MEGA PROJECTS AND MEGA RISKS:

Lessons for Decision-makers through a Comparative Analysis of Selected Large-scale Transport Infrastructure Projects in Europe, USA and Asia Pacific

VOLUME 4: OMEGA RESEARCH PROGRAMME INTERNATIONAL CASE STUDIES: PROJECT AND COUNTRY FINDINGS

Findings of a five year international research programme funded by the Volvo Research and Education Foundations (VREF)

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Centre for Mega Projects in Transport and Development

A global Centre of Excellence in Future Urban Transport sponsored by Volvo Research and Educational Foundations (VREF)

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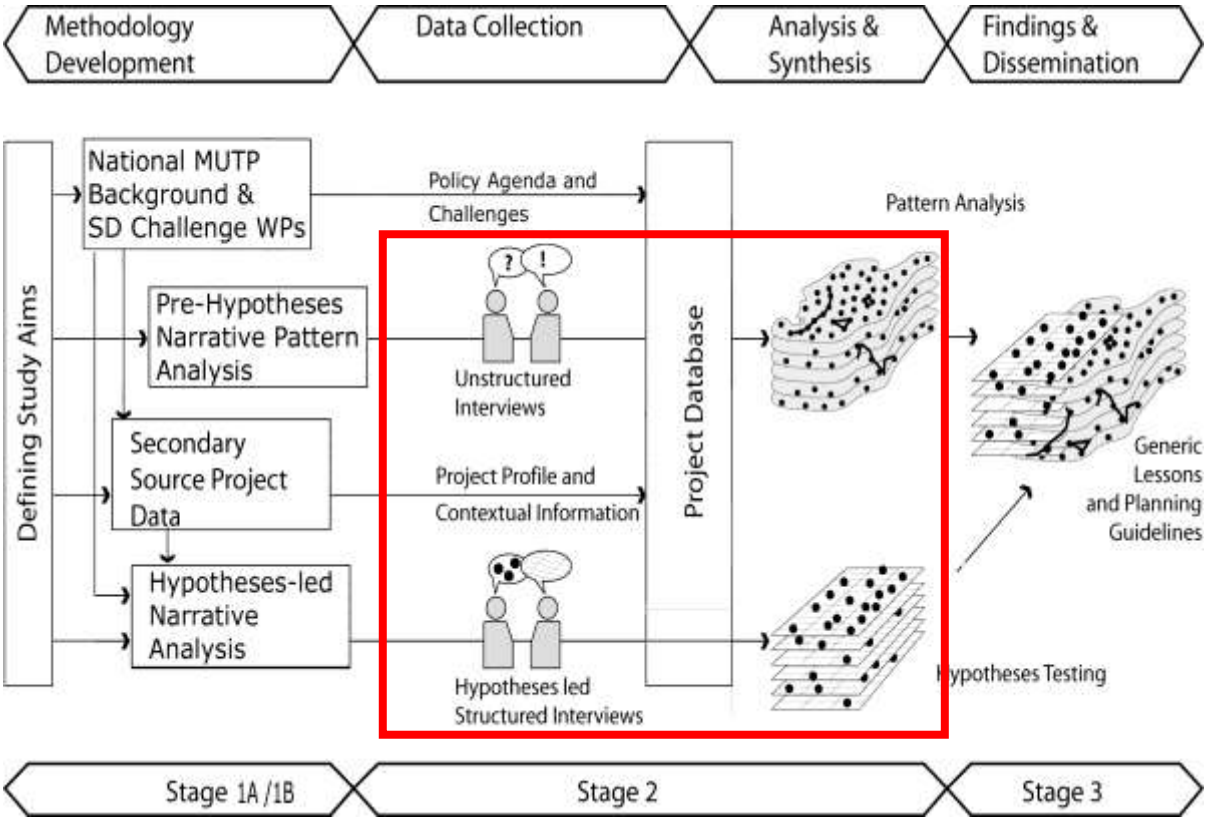
The figure directly below offers an overview of the overall OMEGA research programme Study Methodology. The area highlighted in red is dealt with by this volume of the report.

The OMEGA Study Methodology



1. Introduction

Volume 4 presents consolidated results from the 27 international case studies of mega-urban transport projects undertaken by the OMEGA Centre's nine Country Partners between 2007 and 2011. The purpose of this volume is to present the key findings of the research on a project-by-project basis, and also a synthesis of conclusions and findings on a country-by-country basis.

The 27 case studies from the nine countries are listed in Table 1 on the next page. They consisted of:

4 High speed rail projects;
5 Other rail projects (including several airport links and a freight rail line);
5 Metros / subways;
6 Urban road (motorway) tunnels;
2 Inter-urban motorways;
3 Major bridges (plus numerous smaller bridges and elevated sections in the other projects);
2 Light rail systems.

1.1 Rationale for the choice of case studies

The case studies were selected by the Country Partners in consultation with the OMEGA Centre, and the selection criteria were similar to those adopted for the UK case studies, namely:

- Meeting the overall definition of a MUTP as set out in the original OMEGA CoE Proposal – i.e. large-scale, complicated land-based transport infrastructure projects, such as: bridges, tunnels, highways, rail links and their related transport terminals plus combinations of such projects with construction costs *in excess* of US$ 1 billion (at 1999 prices) that are located in urban and metropolitan areas or regions;
- Representing a degree of variety (and uniqueness) in regard to their principal functions, characteristics and attributes so as to enhance the spectrum of potential findings and enable a degree of useful compare and contrast analysis;
- Allowing inside-stories and narratives to be obtained from persons intimately involved in key aspects of the project decision-making, so as to provide unique insights into responses to the research programme's Overall Research Questions and Overall Research Hypotheses.

Table 1.1: The 27 OMEGA International case studies

Country	Mega-Transport Project	Project Type
France	Météor Rail: Saint Lazare – Olympiades, Paris	Metro rail (subway)
	TGV Med: Valence – Marseille	High speed rail
	Millau Viaduct: Millau, South France	Road bridge (on motorway)
Germany	ICE: Cologne – Frankfurt/Main	High speed rail
	Tiergarten Tunnel: Berlin	Urban road and rail tunnel
	BAB20 Motorway: Schleswig-Holstein - Brandenburg	Inter-urban motorway
Greece	Rion-Antirion Bridge: Rion – Antirion	Road bridge
	Athens Metro: Sepolia – Dafni & Monastiraki – Ethniki Amyna, Athens	Metro rail (subway)
	Attiki Odos, Athens	Inter-urban toll motorway
Netherlands	HSL Zuid	High speed rail
	Randstadrail	Light rail and bus
	Beneluxlijn	Metro rail (subway)
Sweden	Oresund Road, Rail, Bridge/Tunnel Link: Malmo-Copenhagen	Road and rail, bridge and tunnel
	Sodra Lanken Road Tunnel: Stockholm	Urban motorway tunnel
	Arlanda Rail Link: Stockholm Airport to Stockholm	Airport express rail link
USA	Airtrain: JFK Airport: New York City	Light rail airport link
	Alameda Rail Link: Los Angeles (Port – downtown)	Freight rail line
	Big Dig Road and Tunnel Links: Boston	Urban road tunnel and bridges
Australia	City Link, Melbourne	Urban toll motorway (with tunnels and elevated sections)
	Metro Rail, Perth	Inter-urban rail line
	Cross City Tunnel, Sydney	Tolled urban road tunnel
Hong Kong	Western Harbour Crossing: Hong Kong Island – Kowloon	Tolled urban road tunnel
	Airport Rail Links: HK Central – Chek Lap Kok Airport	Airport express rail link
	KCRC West Rail Link: Tsuen Wan – Yeung Long	Urban rail line
Japan	Metropolitan Expressway: Nishishinjuku Junction – Kumanocho Junction, Tokyo	Tolled urban road tunnel
	Shinkansen High Speed Rail Link: Kagoshima - Chuo – Nakata	High speed rail
	Oedo Metro: Hokomae – Hikarigaoka, Tokyo	Metro rail (subway)

1.2 Study methodology

The case study methodology adopted for the international case studies was discussed and agreed with Partners at several Workshops and via Moodle. The methodology was the subject of several Guidance Notes issued by the CoE (see Appendix 9) with a view to achieving consistency in relation to data collection and analysis. The Guidance notes focused in particular on the use of secondary data sources, pre-hypothesis research, hypothesis-led research and the identification of responses to the overall research questions and hypotheses.

From the Partners' submissions, it is clear that a high level of consistency was achieved in the approach to data collection. In terms of analytical work, there was some variation both in terms of breadth and depth of investigation, driven primarily by the specialisms and interests of the teams concerned. This is considered to be a strength of the research in that individual teams were able to use their expertise to focus on some unique aspects of MUTP planning and delivery, while also reflecting on the contextual environment in which they were working. However this variation in focus created some challenges during the comparison of the partners' results, especially during quantification.

1.3 Main project outputs, and organisation of this volume

With the large quantity of information obtained by Country Partners during the course of their studies, the challenge has been to organise and present this in an effective and meaningful way. A balance has to be achieved between the quantity of information (to adequately represent the case studies), and succinctness (to highlight the key lessons).

The approach adopted for this research is to present the findings in TWO volumes. Volume 4 (this volume) presents a summarised version of the Partners' main reports, on a country-by-country basis. Volume 5 presents an overall synthesis of all 30 OMEGA case studies (including the three UK case studies), comparing and contrasting the various studies and identifying overall lessons and conclusions from the research.

To recap (see also Volume 1), the main study outputs from the international case studies were:[1]

- The **Working Paper 1** series on national planning, funding and appraisal frameworks (see Volume 2);
- The **Working Paper 2** series on sustainable development challenges of MUTP's (see Volume 2);
- **Project Profiles** prepared for each case study, setting out the main factual details and case histories of each project. (Short summaries of each project are included in this volume, and web-links to the full Project Profiles are provided in Table 2 below);
- The **'4 Tests Report':** As with the CoE, each Partner was required to prepare a '4 Tests Report' for each of the case study projects. As explained in Volume 3 (section 3.4), the four tests examined project achievements relative to:
    - Test 1: Project Objectives – those originally established for the project and those that emerged during project planning and delivery;
    - Test 2: Sustainable Development Visions and Challenges – as reflected in prevailing policy at the time the project was originally planned and delivered and in relation to current policy;
    - Test 3: Treatment of Risk, Uncertainty, Complexity and Context – with particular reference to normative statements established against the background of the OMEGA 1 Project;

[1] Other partner outputs are described in Volume 1, and include the OMEGA workshops and various other supporting papers.

- Test 4; Synthesis of Tests 1-3 – in relation to responses to the OMEGA Research Questions and Hypotheses, the identification of project 'winners and losers' and provisional lessons.
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- Following the 4-Tests report, each Country Partner prepared a **Country Synthesis Report**, which combined the findings from the three case studies in a single report. These Country Syntheses are presented in full (with editing) in this volume.

The following pages now present, on a country-by-country basis, the findings from each of the nine Country Partner of: (i) the individual project case histories (summaries of the project profiles); and (ii) the full country synthesis reports.

2. Country findings: France

Météor Rail
Paris

TGV Mediterranée
Valence-Marseille

Millau Viaduct
South France

2.1 France: The project profiles

Project Profiles were prepared by the Country Partners[2] for each of the study projects, to provide a consolidated source of secondary information to support all phases of data collection, analysis and synthesis. The profiles covered such matters as: project cost, duration and quality information; principle and secondary project objectives; key project stakeholders; sources of finance; key events and processes. (See also Volume 1, Section 3.4).

The full Project Profiles can be accessed via the following hyperlinks:

Météor Rail, Paris:
http://www.omegacentre.bartlett.ucl.ac.uk/studies/cases/pdf/FRANCE_METEOR_PROFILE_120511.pdf

TGV Med:
http://www.omegacentre.bartlett.ucl.ac.uk/studies/cases/pdf/FRANCE_TGVMED_PROFILE_190411.pdf

Millau Viaduct
http://www.omegacentre.bartlett.ucl.ac.uk/studies/cases/pdf/FRANCE_MILLAU_PROFILE_201210.pdf

Summaries of the Project Profiles are presented on the following pages.

[2] In France, the Country Partners were Laboratoire Technique Territoires et Societes (LATTS), Ecole Nationales Ponts et Chaussees and UFR Lettres et Sciences Humaines, Université de Cergy-Pontoise - directed by **Prof. Elisabeth Campagnac.**

MÉTÉOR, PARIS, FRANCE

OVERVIEW

LOCATION: PARIS
SCOPE: INTRA-URBAN
TRANSPORT MODE: SUBWAY
PRINCIPAL CONSTRUCTION: TUNNEL
NEW LINK: YES

PRINCIPAL OBJECTIVES

CONGESTION RELIEF
LOCAL ECONOMIC DEVELOPMENT REGENERATION
LOCAL TRANSPORT LINK
UTILISE NEW TECHNOLOGY

PRINCIPAL STAKEHOLDERS

PROJECT PROMOTER/CLIENT: RATP
FUNDERS:
REGIONAL GOVERNMENT
NATIONAL GOVERNMENT
CITY GOVERNMENT

PLANNING AND IMPLEMENTATION

APPROX. PLANNING START DATE: 1987
CONSTRUCTION START DATE: 1993/98/00
OPERATION START DATE: 1998/03/07
MONTHS IN PLANNING: 72/132/156
MONTHS IN CONSTRUCTION: 60/60/84
PROJECT COMPLETED: 60 MONTHS BEHIND SCHEDULE (SECTION 2)

COSTS (IN 2010 USD) (SECTIONS 1 & 2)

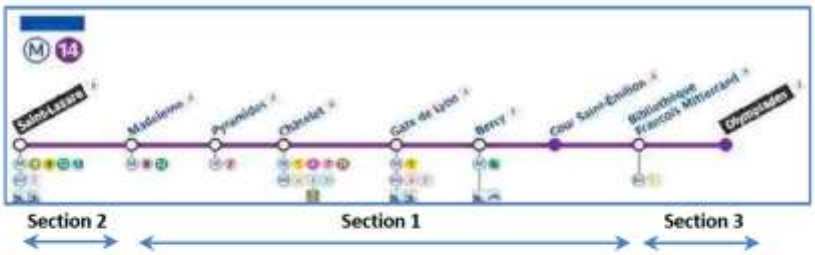
PREDICTED COST: 1.66BN
ACTUAL COST: 1.79BN
PROJECT COMPLETED: 8% OVER BUDGET
FUNDING: 100% PUBLIC

INFRASTRUCTURE QUANTITIES

LENGTH: 12KM
COST PER KM (2010 USD): 0.15BN

PATRONAGE

FORECAST TRAFFIC (1990 for 1992) 250,000 PPD
ACTUAL TRAFFIC (2007) 450,000 PPD



INTRODUCTION

Météor is a 12km metro line running from the northwest to the south of Paris, with two terminals and seven intermediate stations (of which six connect to other metro lines or the national and regional railway network). It operates without drivers. It was built in three sections, the last opening in 2007.

Météor is associated with three urban development zones in the city – Paris Rive Gauche, Chalon and Corbineau-Lachambeaudie to Bercy – and with the regeneration of the 13th *arrondissement*.

BACKGROUND

The main objective of the city transport provider, RATP, was to offer alternative routes for suburban passengers and commuters, in response to increasing passenger numbers on the existing network. The aim of building the region's first automatic metro was also a motivating factor. The city government wanted to serve planned new developments and increase access to areas with only bus links, and the regional government to create jobs in suburban areas.

The project was proposed by RATP in 1987. A competing project was proposed by the national rail operator, SNCF, at the same time and the decision to build both was made by the Prime Minister in 1989. The project was unusual in that the decision to proceed predated the normal regional masterplanning process. The three sections of the project were then included in successive State-region planning contracts, setting out agreed infrastructure investments.

As usual for French infrastructure projects, planning approval was then given, also in three sections, through the *déclaration d'utilite publique* (*DUP*) mechanism. Public consultation formed part of the *DUP* procedure, and was generally favourable to the project.

The project is thought to have accelerated regeneration of the 13th *arrondissement*. An estimated 15,000 jobs have been created at Paris Rive Gauche, and 1,495,800m^2 and 733,000m^2 of commercial and residential space respectively have been delivered throughout the three development zones.

MÉTÉOR, PARIS, FRANCE

TIMELINE

CONCEPTION: 1987: PROJECT PROPOSED BY RATP

CONCEPTION: 1987: NATIONAL RAIL OPERATOR SNCF PROPOSES COMPETING PROJECT

INCEPTION: 1989: PRIME MINISTER APPROVES PROJECT. SECTION 1 IN STATE-REGION PLANNING CONTRACT

INCEPTION: 1990: APPROVAL BY REGIONAL TRANSPORT AUTHORITY

INCEPTION: 1990: PUBLIC INQUIRY, SECTION 1

INCEPTION: 1991: *DÉCLARATION D'UTILITE PUBLIQUE* FOR SECTION 1

INCEPTION: 1993: PUBLIC INQUIRY AND *DÉCLARATION D'UTILITE PUBLIQUE* FOR SECTION 2

CONSTRUCTION: 1993: CONSTRUCTION STARTS, SECTION 1

DELAY: 1993: SECTIONS 2 & 3 DELAYED BY FIVE YEARS DUE TO FUNDING DIFFICULTIES

INCEPTION: 1994: SECTION 2 IN STATE-REGION PLANNING CONTRACT. PROJECT INCLUDED IN REGIONAL MASTERPLAN

INCEPTION: 1997: PUBLIC INQUIRY, SECTION 3

INCEPTION: 1998: *DÉCLARATION D'UTILITE PUBLIQUE* FOR SECTION 3

CONSTRUCTION: 1998: CONSTRUCTION STARTS, SECTION 2

DELIVERY: 1998: SECTION 1 OPENS

INCEPTION: 2000: SECTION 3 IN STATE-REGION PLANNING CONTRACT

CONSTRUCTION: 2000: CONSTRUCTION STARTS, SECTION 3

CONSTRUCTION: 2003: SECTION 1 CONNECTED TO REGIONAL EXPRESS RAIL NETWORK

DELIVERY: 2003: SECTION 2 OPENS

DELAY: 2003: CONSTRUCTION OF SECTION 3 STOPS FOR SIX MONTHS FOLLOWING TUNNEL COLLAPSE

DELIVERY: 2007: SECTION 3 OPENS

CHARACTERISTICS

The project cost (sections 1 and 2) was estimated at EUR 1.121bn (2004 prices) in 1992, equivalent to USD 1.66bn (2010 prices)[i]. The final project cost was slightly higher: EUR 1.211bn (2004 prices) or USD 1.79bn (2010 prices).

The initial framework scheme of 1989 estimated a cost of only EUR 0.72bn (2004 prices) but changes to the scheme, particularly those requested by the regional transport authority, increased costs.

RATP is the main stakeholder, responsible for the conception of the project, supervision of construction, and operation of the line.

TIMELINE ISSUES

The provision of funding by the City of Paris helped to accelerate progress on the project, and the planning and construction process was fast in comparison to other French transport projects. However, sections 2 and 3 were delayed by five years due to funding problems. A tunnel collapsed during work on section 3; construction was halted for six months to investigate the accident and the construction of a replacement tunnel caused a further three-month delay.

FUNDING

RATP financed the project partly through public loans but primarily through public subsidies from the national and regional government. The city government also provided subsidies, uniquely for an infrastructure construction project, to help accelerate construction in the south of the city and thus to contribute to its regeneration aims.

The framework scheme of 1990 included revenue forecasts for 1996 and 2001, and predicted that RATP would be in deficit. The regional transport authority was to provide a subsidy to cover the deficit. Although it is not possible to distinguish the revenue of this specific line within the overall revenue of RATP, traffic volumes have increased steadily.

[i] Costs have been converted to USD at 2010 prices, using historic inflation rates and current exchange rates, to allow comparison between projects.

MILLAU VIADUCT, MILLAU, FRANCE

OVERVIEW

LOCATION: SOUTHWEST FRANCE
SCOPE: INTER-REGIONAL
TRANSPORT MODE: ROAD
PRINCIPAL CONSTRUCTION: BRIDGE
NEW LINK: YES

PRINCIPAL OBJECTIVES

LOCAL ECONOMIC DEVELOPMENT
(INTER)NATIONAL LINK
ACCESSIBILITY
EMERGENT OBJECTIVES:
LOCAL TRANSPORT LINK
NO COST TO PUBLIC SECTOR

PRINCIPAL STAKEHOLDERS

CLIENT: AIOA (STATE ROAD AGENCY)
DESIGNERS: VIRLOGEUX/FOSTER & PTNRS
CONCESSIONAIRE:
EIFFAGE (CEVM/EIFFAGE TP/SETEC)

PLANNING AND IMPLEMENTATION

APPROX. PLANNING START DATE: 1987
CONSTRUCTION START DATE: 10/2001
OPERATION START DATE: 12/2004
MONTHS IN PLANNING: 84
MONTHS IN CONSTRUCTION: 38
PROJECT COMPLETED: THREE MONTHS AHEAD OF SCHEDULE

COST (IN 2010 USD)

PREDICTED COST: 0.66BN
ACTUAL COST: 0.51BN
PROJECT COMPLETED:
22% UNDER BUDGET
FUNDING: 22% PUBLIC: 78% PRIVATE

INFRASTRUCTURE QUANTITIES

LENGTH: 2.46KM
COST PER KM (IN 2010 USD): 0.21BN

PATRONAGE

FORECAST TRAFFIC
10,046 VPD
ACTUAL TRAFFIC
12,055 VPD

INTRODUCTION

The Millau Viaduct is part of the A75 motorway, a 2.46km tolled bridge across the Tarn River valley in southern France. It opened in 2004 and is the world's longest cable-stayed bridge.

BACKGROUND

The main objectives of the project were to provide a link in the national and international road network, and to promote economic development and tourism locally by improving access to the area. It was also intended to relieve local bottlenecks in the town of Millau.

Crossing the valley presented a technical challenge and the state roads directorate, *Arrondissement Interdepartemental des Ouvrages d'Art* (*AIOA*), was involved in preparatory research, feasibility studies and evaluation of options over a period of ten years. In 1989, a route providing access to the town of Millau found local public support and was chosen over three alternatives. Technical solutions were developed, with new concepts and detailed designs invited through two design competitions in 1993 and 1994/96). The decision to supplement the state's expertise with external design inputs was unprecedented at that time.

Planning approval was given (in 1994) through the *déclaration d'utilite publique* (*DUP*) mechanism, preceded by a public inquiry. In 1998, a change in government and shortage of public sector funding led to a decision to adopt a private sector 'build-finance-operate-transfer' scheme. Although this decision reflected the national and European context, the introduction of a toll payment caused some political concern and so led to a second public inquiry and *DUP*.

The project was the first motorway scheme to benefit from two government policies, requiring 1% of the project budget to be allocated to regional economic development and encouraging motorway drivers to stop at nearby *villages étapes*. The viaduct has become a tourist attraction in its own right, and industrial development in the area has benefited from the 1% policy.

CHARACTERISTICS

The cost was estimated at EUR 0.4bn in 1998 (USD 0.66bn in 2010 prices[i]). The final project cost was substantially less: EUR 0.345bn in 2004 (USD 0.51bn in 2010 prices), including EUR 0.025bn in state-funded preliminary design and site works.

MILLAU VIADUCT, MILLAU, FRANCE

TIMELINE

CONCEPTION: 1987: FEASIBILITY STUDIES BEGIN

CONCEPTION: 1988: EXPERT COMMITTEE ESTABLISHED

CONTEXT: 1989: *AIOA* ESTABLISHED

INCEPTION: 1990: FOUR ROUTE OPTIONS EVALUATED. ROUTE SELECTED

INCEPTION: 1991: DETAILED ROUTE SELECTION

INCEPTION: 1993: CALL FOR DESIGN PROPOSALS, ADVISED BY INTERNATIONAL COMMITTEE OF ARCHITECTS AND ENGINEERS. DESIGN APPROVED

INCEPTION: 1994: DETAILED DESIGN COMPETITION ANNOUNCED. FIRST *DÉCLARATION D'UTILITE PUBLIQUE*

INCEPTION: 1994-96: FIVE ARCHITECT/ENGINEER GROUPS PREPARE DETAILED DESIGN PROPOSALS

INCEPTION: 1994-96: FIVE ARCHITECT/ENGINEER GROUPS PREPARE DETAILED DESIGN PROPOSALS

INCEPTION: 1996: FOSTER/SEGELERG-EEG-SERF DESIGN CHOSEN

CONTEXT: 1998: CHANGE IN GOVERNMENT, PUBLIC SECTOR FUNDING CONSTRAINTS

CONCEPTION: 1998: BFOT ROUTE ADOPTED

INCEPTION: 1999: SECOND *DÉCLARATION D'UTILITE PUBLIQUE* ALLOWS FOR TOLL SYSTEM AND CONCESSION CONDITIONS

INCEPTION: 1999-2000: TENDERS INVITED FOR BFOT CONCESSION

INCEPTION: 2001: EIFFAGE WIN CONTRACT

CONCEPTION: 2001: EIFFAGE DECIDE TO BUILD IN STEEL NOT CONCRETE

CONSTRUCTION: 2001 (OCT): CONSTRUCTION BEGINS

CONSTRUCTION: 2002: EXPERT COMMITTEE ESTABLISHED TO CONTROL CONSTRUCTION

DELIVERY: 2004 (DEC): CONSTRUCTION COMPLETED. VIADUCT OPENED TO TRAFFIC

The Viaduct is a multiple cable-stayed span bridge, based on the competition-winning design by Norman Foster & Partners and Segelerg-EEG-SERF, which itself derives from an initial concept by French engineer Michel Virlogeux.

Compagnie Eiffage du Viaduc Millau is the concessionaire: the concession period is 78 years (including 36 months construction and three months without penalties), although the structure is guaranteed to last 120 years. Fosters and Segelerg were retained as architect and engineer respectively.

The concession contract required the concessionaire to structure its organisation along the traditional French MOA/MOE lines, with the 'client' or *maitrise d'ouvrage* (the body operating the completed infrastructure) separate from the 'contractor' or *maitrise d'oeuvre*; the role of the state was reduced to that of overall control, with advice provided by an expert committee.

Environmental mitigation measures included landscape design, restitution and reforestation of access roads and restoration of traditional farmhouses.

TIMELINE ISSUES

The concessionaire's decision to use prefabricated steel construction rather than concrete helped to improve the speed, and also the safety, of the construction process by reducing the amount of time spent in high-altitude work on-site. The project was completed three months ahead of schedule.

FUNDING

The main funding source was Eiffage's equity contribution of EUR 270m, with a loan of EUR 50m from the European Investment Bank providing the balance of the EUR 320m construction costs. The state funded preparatory works to the value of EUR 25m and the remaining works on the A75.

There are no data on forecast and actual revenue available in the public domain. However, toll charges (the main source of income for Eiffage) are regulated by the concession agreement and linked to inflation. The concession period can be reduced to a minimum of 44 years if the revenue generated exceeds EUR 375m during that time.

Eiffage refinanced the project once construction was complete.

[i] Costs have been converted to USD at 2010 prices, using historic inflation rates and current exchange rates, to allow comparison between projects.

TGV MED, VALENCE-MARSEILLE, FRANCE

OVERVIEW

LOCATION: VALENCE-MARSEILLE
SCOPE: INTER-URBAN
TRANSPORT MODE: RAIL
PRINCIPAL CONSTRUCTION: GRADE
NEW LINK: YES

PRINCIPAL OBJECTIVES

TRANS EUROPEAN NETWORK
REGIONAL & INTERNATIONAL LINK
REDUCE TRAVEL TIME
ALTERNATIVE TO AIR AND CAR TRAVEL
EMERGENT OBJECTIVE: STRATEGIC LINK

PRINCIPAL STAKEHOLDERS

CLIENT/FUNDER:
SNCF (TO 1997); RFF (FROM 1997)
PROJECT MANAGER:
SNCF
ADDITIONAL FUNDING:
NATIONAL GOVERNMENT

PLANNING AND IMPLEMENTATION

PLANNING START DATE: 02/1989
CONSTRUCTION START DATE: 02/1995
OPERATION START DATE: 06/2001
MONTHS IN PLANNING: 72
MONTHS IN CONSTRUCTION: 76
PROJECT COMPLETED: 12 MONTHS BEHIND SCHEDULE

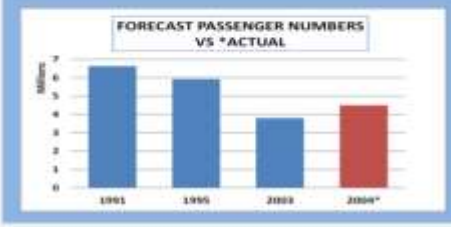
COSTS (IN 2010 USD)

PREDICTED COST: 6.84BN
ACTUAL COST: 6.61BN
PROJECT COMPLETED:
3% UNDER BUDGET
FUNDING: 100% PUBLIC (10% STATE)

INFRASTRUCTURE QUANTITIES

LENGTH: 295KM
NUMBER OF TUNNELS: 9
LENGTH IN TUNNEL: 13KM
NUMBER OF BRIDGES: 23
COST PER KM (IN 2010 USD): 0.02BN

PATRONAGE



INTRODUCTION

TGV Med is part of the TGV Network of high speed rail lines linking major cities in France. It opened in 2001.

The project includes new stations at Valence, Avignon and Aix-en-Provence, six station refurbishments and increasing the speed standard on the Paris-Lyon line to 300km/hr. It is also associated with the *Euroméditerranée* regeneration project in Marseille.

BACKGROUND

The main objective of the project was to provide a high speed rail link in the south of France, linking to the wider high speed network of routes through the country and across Europe. More specifically, the objective of reducing journey times between Marseille and Paris to three hours was, for the national rail operator SNCF, part of a wider strategy of gaining market share from air travel.

SNCF discussed the project at an early stage with regional politicians, who were generally supportive as it was seen as a catalyst for economic revival in the region. However, when details leaked out into the public domain, widespread public opposition began. Although planning approval was finally given, as usual for French infrastructure projects through the *déclaration d'utilite publique* (*DUP*) mechanism, this was preceded by two unique mechanisms introduced by the government to resolve conflicts and develop a consensus around the route.

The Querrien Mission created a degree of agreement around a selected route, but did not consider protest groups' calls to use existing railway corridors and pendular technology, and did not fully resolve the conflict. Protestors were critical of SNCF's power to judge its own proposal and a College of Experts was established, with members nominated by government, SNCF and protest groups. The College used independent experts to conduct an evaluation of SNCF's proposals, directed by a committee of all stakeholders.

Some groups, including the government's environment ministry, remained opposed on the basis of environmental and risk issues. The route crossed designated ecological zones and 138km of floodplains, and passed near to a nuclear site. These concerns were reiterated in the official public survey report to government.

TIMELINE

- INCEPTION: 1989: GOVERNMENT ASKS SNCF TO PREPARE PLAN AND ROUTE STUDIES. PROPOSALS ANNOUNCED TO SUPPORTIVE REGIONAL POLITICIANS
- CONTROVERSY: 1990: PROPOSALS LEAKED, CAUSING PROTEST MOVEMENT
- INCEPTION: 1990: QUERRIEN MISSION APPOINTED TO RESOLVE CONFLICTS
- INCEPTION: 1990: SNCF APPOINTS LOCAL PROJECT MANAGER
- CONTROVERSY: 1991: QUERRIEN MISSION REPORT FAILS TO FULLY RESOLVE CONFLICTS
- CONTEXT: 1991: GRESSIER CIRCULAR REGULATES MANAGEMENT OF TGV PROJECTS
- INCEPTION: 1992: COLLEGE OF EXPERTS SET UP TO DEVELOP CONSENSUS
- CONTEXT: 1992: BIANCO CIRCULAR INTRODUCES NEW CONSULTATION PROCEDURE
- DELAY: 1993: ELECTION OF UNSUPPORTIVE GOVERNMENT, INTER-MINISTRY CONFLICT, PUBLIC SURVEY REPORT CRITICAL OF PROJECT
- INCEPTION: 1994: *DÉCLARATION D'UTILITE PUBLIQUE*
- CONTEXT: 1994: WATER CIRCULAR ISSUED, PROHIBITING CONSTRUCTION IN FLOODPLAINS
- CONSTRUCTION: 1995 (FEB): WORK BEGINS. INVITATIONS TO TENDER FOR CONTRACTS
- CONSTRUCTION: 1995 (SEPT): CIVIL ENGINEERING WORKS BEGIN
- CONTEXT: 1995: BARNIER LAW REINFORCES ENVIRONMENTAL PROTECTION
- CONTROVERSY: 1996: FORMAL INTER-MINISTRY CONSULTATION LEADS TO OPPOSITION FROM ENVIRONMENT MINISTER
- INCEPTION: 1997: RFF ASSUMES OWNERSHIP OF RAIL NETWORK
- INCEPTION: 1999: STATION STAKEHOLDERS GROUP FORMED. RFF/SNCF AGREE DIVISION OF RESPONSIBILITIES
- CONSTRUCTION: 1999: FIRST RAILS JOINTED
- CONSTRUCTION: 2000: FIRST RAILS JOINTED
- CONTEXT: 2000: NEW DECISION-MAKING PROCESS INTRODUCED FOR RAIL PROJECTS
- CONSTRUCTION: 2001: TRIAL RUNS BEGIN
- DELIVERY: 2001 (JUN): LINE OPENS
- DELIVERY: 2004: LOW INTERNET-ONLY FARES INCREASE PATRONAGE

The extent of the protest movement helped to trigger several pieces of new legislation affecting the decision-making procedure for major transport projects.

CHARACTERISTICS

The cost was estimated at EUR 4.51bn in 1994 (2003 prices) but fell when part of the route was cut, and the final project cost was only EUR 4.36bn in 2003 (USD 6.61bn at 2010 prices)[i]. However, the cost of station construction was 26% above the estimate.

SNCF was both client and project manager, contracting separately with a large number of companies for the construction of the line. In contrast to its customary integrated heirarchical structure, and in response to the strength of opposition, it established a project manager in the local area at an early stage. When construction started, the local team had grown to 500 people.

In 1997, the organisational structure of the French rail network changed to reflect changes in European law. A new body, *Réseau Ferré de France* (*RFF*), assumed responsibility for rail infrastructure and construction of new lines, while SNCF remained the main service operator and owner of stations. Although no longer officially the main client, SNCF remained project manager for the line on behalf of RFF. Station construction was more problematic, with responsibility shared between SNCF, RFF and the local authorities, and a stakeholders group was convened to resolve disagreements.

TIMELINE ISSUES

The task of developing a consensus around the project and the detailed route caused substantial delays. In 1991, an opening in 1998 was envisaged, but when the project was finally approved in 1994, the opening date had slipped to 2000. A further 18 month delay was then caused by budgetary constraints imposed on SNCF.

FUNDING

The project was funded mainly by SNCF by recourse to a loan, with the debt transferred to RFF on its formation. A national government subsidy of 10% guaranteed SNCF a profitable rate of return of 8%. Small subsidies were provided by local authorities, for station buildings, and the European Union. Passenger numbers (4.5m in 2004) were initially lower than predicted due to the unfavourable economic climate.

[i] Costs have been converted to USD at 2010 prices, using historic inflation rates and current exchange rates, to allow comparison between projects.

2.2 France: The 4 Tests reports

For each of the projects, the Country Partners prepared the '4 Tests Report' which – as described in Section 1.3 above – examined project achievements according to: (i) objectives (both original and emergent); (ii) sustainability; (iiii) treatment of risk, uncertainty and complexity; (iv) a synthesis of the three tests, focusing on responses to the original research questions and hypotheses, the project winners and losers, and provisional lessons.

The full 4 Tests reports can be accessed via the following hyperlinks:

Météor Rail, Paris
CD ROM: OMEGA Partner 4 Tests\France 4 Tests.docx

TGV Med
CD ROM: OMEGA Partner 4 Tests\France 4 Tests.docx

Millau Viaduct
CD ROM: OMEGA Partner 4 Tests\France 4 Tests.docx

The Partners' overall synthesis of the project findings is now presented in the following pages.

2.3 France: Synthesis of country findings

2.3.1 Main project objectives: relationships between MUTPs and the areas they serve/impact

2.3.1.1 Introduction

The three French case studies concern two public MUTP's (managed by RATP in the case of Météor and SNCF in the case of TGV Mediterranée), and the Millau Viaduct which started as a totally public-managed project but was subsequently implemented as a PPP under a concession regime.

A common concern for all three projects was their relationship with the territories they serve/impact upon. For all of them the relationship between transport and territories is placed in a context where different levels and scales are considered together. Another common characteristic of these MUTPs is that they are considered as instruments of both transport and urban planning. Thus, all of the case study projects had to respond to several 'agent of change' objectives.

2.3.1.2 Potential generic lessons regarding project objectives

Increasing attention was paid to the areas served/impacted by the projects – none of the case study projects could ignore the issue of their relationship with the territories that they either served or impacted upon. These territorial relationship issues related to a series of different dimensions, as follows:

- socio-political dimension – in particular, opposition to the projects;
- economic dimension – the challenges associated with the impact of an MUTP on the local economy (does it contribute to development it or is it a threat?);
- environmental dimension – increasing concerns for the respect for nature and environment protection;

- institutional dimension – especially the involvement of many different institutions, the non-systematic approach to the treatment of the areas influenced by each MUTP and the lack of co-ordination between the multiplicity of these institutions (e.g. the different 'scales' at which each local authority operates).

Socio-political dimension

From the socio-political point of view, in all of the case studies the definition of the route was a delicate and often controversial matter for the local population and for different social groups. However, standpoints varied between stakeholders:

- the Millau project was welcomed, the TGV Mediterranée was controversial and Météor was essentially non-controversial;
- attitudes varied according to the decision-making process. There was a significant contrast between attitudes associated with the decision to implement a project that was the result of a *top down process* (notably when there are *strong public operators* like SNCF and Météor) with those projects characterised by a *bottom up* approach (e.g. when the decision originated from an influential political representative who was supported by local elected representatives (as in the case of Millau).

One of the main lessons emanating from the case studies is the increasing need for *negotiation.* The 'top-down' scenario has become increasingly less politically sustainable while the 'bottom-up' scenario requires the intervention of an intermediary with central government/central administration (or actors able to wear two hats). The negotiation process has also become more institutionalised.

Economic dimension

From an economic viewpoint, the acceptability of a MUTP depends also on the way it is viewed - either as a factor of economic development of the territory or as a factor of economic damage. Different elements have to be taken in consideration, for example:

- the economic, demographic and urban context - a MUTP is more likely to be welcomed when the territory it impacts upon is deprived or disadvantaged;
- the manner and the intensity of the connections with the impacted territories - the welcome accorded to A75 in the Massif Central, and in particular in the Millau area, is due to both of these factors as the project is seen to be an instrument of town and country planning (*autoroute d'amenagement du territoire*);
- the infrastructure type relative to the nature of local economic activity: one of the reasons for the success of Météor is due to its location in an area (13th arrondissement) which was relatively deprived of public transport and the fact that it served and legitimized the development of new activity districts. By contrast, the TGV Mediterrannee is viewed as creating economic damage in a wine-based agriculture region.

Environmental dimension

The case studies illustrate three kinds of positions regarding the environment:

- *a defensive position* – this position is typical of MUTPs in the 1980s and 1990s whereby the environment as a new exigency has not been necessarily taken into account in project planning and delivery and the project may thus meet with new and unexpected kinds of objections. The TGV Mediterranée was, in the beginning, typical of this although the opposition to the project was also due to other considerations;
- a*n offensive position* - in this case, the promoters claim environmental quality as a main feature of the infrastructure. This was the case in Millau which inaugurated the

"landscape motorways". However, in this case the term covers only some aspects of the environment;

- *a negotiating position* - is becoming the most 'normal' situation and requires the use of specific procedures.

Institutional dimension

The relationship of a MUTP with the territory it traverses/impacts upon also requires consideration of the institutional framework and its impact on governance. This often leads to the need for more complex governance approaches/mechanisms.

All of the cases studies demonstrate the gap between the project 'boundary' and the institutions that were in place. The project territory often involves at the same time some organisations associated with central government and local authorities, or a grouping of several of them. This gap encouraged different kinds of grouping of local authorities, leading to the famous "*institutionnel millefeuille*" (many layered). The impact of this is greater as MUTP funding depends very often on contributions from central government, regions or departments. This "*institutionnel millefeuille*" is very often a cause of delay and controversy in MUTPs, especially when the project is not managed at the relevant hierarchical level to achieve all of its objectives.

Transport network and territories network - new issues for MUTPs

Another potential *generic* lesson is that with MUTPs the relationship between transport infrastructure and territory can no longer be treated in a simple manner.

One of the objectives common to all of the case studies was to promote different types of transport infrastructure and so impact on different levels/types of territory. The advantage of this argument is that it responds to the expectations of different authorities (which could potentially participate in funding), but it could also indicate a real change in the flux and mobility characteristics and contribute to integration - one potential impact of MUTPs is to integrate spaces and territories at different scales (local, national, international). Conversely, MUTPs also have the potential to break-up the hierarchical spatial organization networks inherited from the centralised institutional framework. The use of different transport infrastructure types may also seek to integrate different scales of territories (mainly local, inter-regional, national and international), which is a real issue associated with MUTPs.

MUTPs are often justified as being a possible alternative to existing infrastructure that is presently over capacity - for example: one of the first Météor ambitions was to ease pressure on the RER A (Réseau Express Regional); one of the arguments for the A75 and Millau viaduct was that it could function as an alternative to the A6 and A7.

To summarise, it is noted that there is a focus placed on the capacity of MUTPs to be part of a larger transport infrastructure network and on the strategies that may form the connection between them. Time saving is also a main issue and a strong argument to justify the launching of a MUTP. It plays an important role in the competition between different types of transport.

2.3.2 Cost and programme issues

2.3.2.1 Context-specific findings

Of the three case study projects, only one – the Millau Viaduct – met all the cost and programme criteria. Neither TGV Mediterranée nor Météor achieved all of them – according to available data, these two projects failed to be completed on time and on budget.

Proposed by the RATP to the region and to the City of Paris in 1987, the third and last phase of the Météor project was delivered in June 2007 (i.e. the project needed 20 years). Objectively it has been delivered with a delay of 15 months for the first stage (for example). It ended with a cost increase of 68% compared with the forecast initial costs - the forecast construction cost for the 2 first stages was €1,109 billion compared with the initial objective of €719 milllions.

The total cost of TGV Mediterranée has been evaluated at €5.6 billions by the Cour des Comptes, but is estimated elsewhere at between €3.8 and 4.2 billions. Launched in January 1989, the line opened in 2001 with a project duration of 12 years. The opening was forecast to be at the beginning in 1998 but this was revised later to be 2000 - the project had a delay of one year and a half compared with the forecasting undertaken in 1994.

The studies for the Millau Viaduct project started in 1987 and the viaduct was delivered in December 2004 (a 17 year period). The project was completed on-cost (€320 millions, totally paid by the concessionary), on time and even with a month in advance. The works started on 14th December 2001, and the opening of the Viaduct by the President of the Republique (Jacques Chirac) occurred on 14th December 2004. The works lasted 38 months, while the contract stipulates that the viaduct had to be brought into service 39 months after the date of the official publication of the concession contract (10th October 2001), that means on 10thJanuary 2005.

Thus, it may be concluded that the two public projects failed while the public private one (Millau) was a success from this (time and cost) perspective.

2.3.2.2 Potential generic findings

One of the main lessons from our case studies is that project outcomes are not always straightforward and thus there is a need to be very cautious when analysing data.

MUTPs as incremental projects and the impact on analysis of costs

It is illusory to believe that MUTPs are clearly defined from the beginning and do not change. Among the 3 case studies, only the Millau Viaduct succeeded in retaining the (quasi) same project, despite several amendments. For the other case studies, the project that was finally delivered is significantly different from that which was originally conceived. This is clear for both Météor and TGV Mediterrannee.

TGV Mediterranée is a good example of how the costs evolve during the project process: for example, there were three main phases in the evolution of costs:

- 1991 - 1994: there was a modification of the route and some additional measures concerning integration into the environment and protection against natural risks;
- 1994 - 1995: cost evolution was due to the decision to abandon the Nimes-Montpellier branch;
- 2003: the real investments were evaluated by the Cour des Comptes at €4.402 billions, which represented a variation of 4.8% compared with the Ministerial approval file in 1995 (it concluded that the cost of the new line was correctly estimated, but the cost of the new station was less accurately estimated).

The sources of cost and time overrun in public sector projects and their different meanings

Analysis of the sources of cost and time overruns suggests three types of conclusion. **Firstly**, **the specific constraints of public MUTPs and their impact on economic performance**: this relates to the notion that public sector projects are slowed down by budget constraints (especially their subdivision into different sections to meet financing capabilities).

Secondly, the influence of new requirements and their impact on costs and delay: this concerns the notion that public sector projects have been slowed down by the emergence of new expectations/ new requirements and that the resultant cost overruns reflect a change in the project quality. This aspect can be illustrated by the Météor - the project was realised in 3 steps for financing reasons. The first step was affected by a 15 month delay due to an appeal by a resident and the need to undertake another public enquiry (*Declaration d'utilite publique*). This event was pivotal in two ways - on the one hand it represents a penalty of the lack of consultation and on the other hand, it played in favour of new investments to improve the service quality (or some functionalities like automation and safety). Thus, the cost increase reflected this evolution in the project. Some similar results could be seen on TGV Mediterranée - delays and cost overruns were due not only to the objections but also to the integration of new considerations into the project (e.g. environmental statements). Hence, there is a difficulty in evaluating the final costs compared to the forecast costs as a result of this evolutionary process. This limits the ability to judge the limitations of the public sector procurement performance in delivering projects on time and cost and their inadequacy to accommodate the new exigencies concerning such matters as public consultation and the need for environmental statements. One of the lessons drawn from these case studies is therefore the way in which they contribute to changing procurement approaches

Thirdly, limitations of the appraisal and evaluation methods: the methods used to appraise or evaluate the success or failure of a MUTPs are limited or inadequate for different reasons, as follows:

- the reliability of forecasts - as the Conseil General des Ponts et Chaussees observed for Eole and Météor (provisional) through the "*Bilan LOTI*", there is firstly a question of reliability of the economic calculations. For instance, it is quite surprising that the ex-ante evaluation and the TRI (*Taux de Rentabilite Interne*) is higher for Eole than for Météor, while the values are very similar at the end. The main reason is that the investments costs were underestimated for Eole, but correctly estimated for Météor;
- the socio–economic context was, in reality, very different from the assumptions made at the outset, and the situation of reference is rarely the same to the final situation;
- there is a great heterogeneity in the methods used. For example, time saving is not calculated in the same way in the ex-ante evaluation and in ex-post evaluation.

Thus, in many cases the exercise to compare the actual outcomes with the forecasts is rendered inaccurate by the fact that (i) often it is not the same project that is being evaluated (projects evolved greatly over time), (ii) the context in which the project operates is different, and (iii) different methods/assumptions are used.

Similarly, some important elements are not taken fully into account – for example, the increasing complexity of the project; the operating costs and conditions of operating in the long-term; lack of information concerning the impact of service quality on resources (for instance the forecasts of RER D were greatly affected by the non-regularity of the service operating and the quite frequent delays, but this was not considered in the previous stages; and so the RER D was forecast with the best rate of profitability – compared to Eole and Météor – while it is actually the worst).

Other methods remain very weak – e.g. impact on environment, impact on town planning and urban development. As a result there are many reasons to argue in favour of using the economic and socio-economic calculation with great caution. Such caution is also very useful regarding the final decision. For instance, as the Conseil General des Ponts et Chaussees noted for Eole et Météor, the choice in 1989 to simultaneously realise both of these infrastructures was made with the main objective to reduce pressure on the RER Line A. But this objective has not been achieved. In the case of Millau, the result of the decision was the opposite (the forecast for the traffic made by the administration was quite underestimated).

For TGV Mediterranée, even if the economic and socio economic rates of return had been defined and included, it can be questioned how the socio-economic rate of return was calculated (and how social and environmental criteria given a monetary value in the decision process). In fact, the TGV Mediterranée's economic profitability (for the SNCF) was estimated differently according to the time in which such estimates were made and by which institution. For instance:

- in the Public Survey File in 1991, the economic TRI was estimated at 8%;.
- in the Ministerial Approval File in 1994, the economic TRI was revised downwards to around 6.8%, that is to say largely under the rate of 8% which is the profitability threshold for a project likely to be self-financing (this evolution is explained by the modifications made to the project, in particular related to the environmental constraints). At that time, the SNCF appealed to the State to obtain a subsidy of €729 M (€2003), in order to keep an economic TRI at 8%;
- after the SNCF request for subsidy, the State appointed a CGPC/IGF Mission in 1995, to evaluate the right amount of the subsidy to be granted. The mission did not call into question the figures provided by the SNCF, which appeared correct. But the Mission recommended to limit the project to Nîmes instead of Montpellier, in order to reduce the amount of subsidy necessary. With the abandonment of the Nîmes-Montpellier branch, SNCF therefore revised its propositions. With the abandonment of the Nîmes-Montpellier branch, the economic TRI passed to 7.3%. With the State subsidy, estimated at €417.1 mill. (€2003), the economic TRI was estimated at 8%;
- a posteriori, the SNCF evaluated the economic TRI at 4.1% (or 3.4% except subsidy) in the *Bilan LOTI* of 2007. This rate is doubly lower than the previous estimate of 1995. The deviation is explained by the revenue decrease and the construction and operating overrun. These evaluations relate to an operating period of 20 years, and take account of several hypotheses on the operating and investment costs, on traffic and prices, the infrastructure charges, the eluded investments;
- based only on this *economic profitability*, can we say that a private partner would have done the TGV Med? With a TRI at 4% we are quite close to the interest rate, meaning that the project would not lose or make money.

In order to calculate socio-economic profitability (for society), the TGV Mediterranée analysis took into account:

- the project impact on the economic results of the other agents (administrator of infrastructures), in particular the concessionary companies of highways whose income drops because of the traffic transfer to the train;
- operators of transport, in particular the airline companies whose traffic also decreases;
- the State with losses of incomes); and
- the surplus of the users (time-saver, effects on the environment and safety).

It is expressed by a socioeconomic rate of profitability or socio-economic TRI. The reason for the decrease was related to a lower gain of traffic than expected and a rise in the railway fares.

In both cases, (economic and socio-economic profitability), the rates were largely overestimated. The main bias comes from the project revenue forecasts. The conclusion is that in the two cases, the economic and socio–economic profitability of the projects have been deeply overestimated. Conversely, project costs have been under-estimated.

Could we conclude that the calculations are often wrong? Or that the contemporaneous projects call for other methods with a more qualitative aspect? As Pr J.P Orfeuil underlined in his interview for the ICE OMEGA RAMP programme: "The cost–benefit analysis is very useful, even if it doesn't have to be exclusive to other approaches like the multi-criteria one. In general we value gains and losses in the following fields: time of the course, noise, pollution, CO2, insecurity . But there are other subjects for which the monetary valuation is not done: severance effects , for instance. Based on rationales of collective surplus and general interest, these appraisals don't succeed in integrating social and territorial dimensions (who wins? who loses?): that is the main problem in scientific terms; and in more political terms, their main problem is that neither the population nor the elected representative believe in them."

Therefore, concerning cost and time, we would support the normative statement concerning MUTPs as agents of change and the consequent necessity to integrate criteria other than solely those related to economic values - in particular complexity, risk and uncertainty, the long-term project lifecycle, environmental concerns and town planning impact. This is being increasingly recognized – for instance, a new multi-criteria evaluation grid is currently being developed for interurban projects. The aim is to have other forms of evaluation, whether or not quantified, but excluding monetary evaluations, in addition to the socio-economic evaluation that incorporates the cost of CO2. The new evaluation methods can concern biodiversity, the effect of traffic barriers and environmental impact. However, these criteria are difficult to quantify or monetise. This grid will be applied within the framework of the next French national transport infrastructure master plan. The limited capacity of public financing is not integrated into this evaluation.

2.3.3 Treatment of risk, uncertainty and complexity

2.3.3.1 Météor

Concepts of uncertainty and risk in evaluation methods were introduced nationally *after* the completion of Météor. The framework directive dated 3rd October 1995 defined the general approach and methods to be used to evaluate large inter-urban transport infrastructure projects, no matter what mode of transport was concerned. This directive did not apply to Météor. The framework directive concerning economic evaluation methods for large transport infrastructure projects dated 25th March 2004 and updated on 27th May 2005 integrated risk and uncertainty concepts.

Risk evaluation is carried out as follows (source: Framework Directive dated 27 May 2005, p. 31 and p. 57):

- the evaluation needs to include an awareness study covering parameters such as GDP growth, investment and operational costs (especially for innovative products), traffic, cost of energy (including taxes), changes in the prices of the concerned mode and competing modes (fare rates and commercial reactivity of other modes);
- there is a separation between the uncertainties linked to the environment outside the project (global evolution of the French economy, cost of energy) and uncertainties linked to the project itself (investment and operational costs, traffic-linked advantages). Each parameter is given the most realistic value, and the most favourable or unfavourable upper and lower values that might be attained. This is followed by calculating the socio-economic assessment indicators in the three following cases: (i)

basic estimate using the most realistic value for each variable; (ii) lower variant incorporating the most unfavourable hypotheses for each variable; and (iii) upper variant incorporating the most favourable hypotheses for each variable.

Outside of the question of evaluation, all the case studies faced different types of risk (technical, natural, environmental, economic, financial, social), as well as uncertainty and complexity.

The configuration of the different kinds of risk varies according to the case studies, and their appreciation can vary within the same case study according to different actors. The actors do not support exactly the same kind of risks. The projects' history shows the treatment of RUC applied by the actors and the different moments when it was at the heart of pivotal decisions. As has been observed on the Millau Viaduct case study, the risks and the treatment of the risks are not the same at the design stage as at the implementation stage.

One common point between all the studies concerns the attention paid to complexity, which is definitely at the heart of MUTPs. Complexity could be analysed through different aspects:

- it can be seen in a project which involves several public decision-making levels (State, Region, City of Paris) – e.g. Météor – and because it used an innovative driverless system;
- it can also appear when a decision is the result of the convergence between different actors with different rationales;
- it is also linked with the necessary interfaces between different knowledge bases which are essential to solve the questions and problems faced by MUTPs.

Uncertainty enters into the planning and delivery process between the moment when the first ideas are proposed and when the project is launched. Other sources of uncertainty are the way in which projects evolve and the lack of regulation.

The treatment of risk, complexity and uncertainty is based on different meanings. It is noted, for instance, that recourse to the evaluation team or control team is a means to reduce risk in a lot of projects. One of the characteristics of the risks associated with MUTPs is that they are often produced at the interface between different specialities - for instance, structure, geology, meteorology etc.. In other words, the risk tends to be "systemic" and the composition of the team reflects the different types of expertise needed.

The way to treat uncertainty is to manage the project as an incremental process using organisations developed by the project management team especially for the project (*gestion par projet* and *gestion de projet*). A common point of this is that to treat technical complexity and risk, most of the operators, public as well as private, prefer to internalise risk and not to disperse it to other actors. That is one of the characteristics of the construction sector in France - integration is seen as a guarantee against risk. In Millau, this observation was also true for the financial risk management by the Eiffage Company.

2.3.3.2 From the awareness of context to the change of context – Millau

If an MUTP is undertaken as an incremental process, one of the factors of success is the awareness of context. As we pointed out in the Millau Project Profile report, three main decisions represented turning points for the development of the project:

- the first was the choice by the Public administration (Direction des routes, Jean Berthier) of the "*solution haute*" which was the most technically risky decision. But the actors – acting at that time in what we could consider as a 'closed system' – accepted the risk because they were very confident in their skills and competencies. Nevertheless, risk taking relies heavily on background preparatory studies, and to

promote the collaboration between different technical public administrations. This first decision was in favour of *innovation;*

- the second was the decision to conduct *a consultation during feasibility studies* with a large board of architects and civil engineering offices, outside of the administration. It was an *opening to the external environment.* The decision was taken also to change the representation of the motorway A75, to make it rather a "*landscape motorway"* and to integrate this for the Millau Viaduct. This decision expressed: (i) awareness of the external environment with the new aesthetic and environmental expectations; (ii) the necessity to link the project to its territory , and; (iii) the changing of the organisation as well as its environment. It was the source of a new regulation with the contribution of the motorway to the "1% for landscape improvement";
- the third turning point was the decision, faced with budgetary constraints, to manage the project as a concession instead of as a free, publicly-managed MUTP. This opened the project to other stakeholders, in particular private concessionaires and enterprises and expressed an awareness of the change of context.

The main lesson here is that every turning point played a role in helping the project to succeed – such turning points not only contributed to saving the project but also helped it to achieve its objectives in respect of costs, delays and specification. So we could point out that *the awareness of context* is quite decisive in the MUTP. An MUTP is a project which includes significant turning points.

Context impacts on the capacity of the administration and public sector to break with the traditional organisation structure and to share the management of the project, including its relationship with the environment. Therefore, Millau went from a closed system to an open one as a result of two main movements:

- the increasing public sensitivity to sustainability issues;
- globalization, in particular through the impact of EU regulation on the trend towards open competition.

Strategy and risk – Millau

We define strategy here as a double movement of risk taking and risk reducing.

MUTPs stakeholders are not always (and everywhere) typically risk averse. An 'entrepreneur is not necessarily risk averse – he may be both a risk taker and a risk reducing agent' (Emmanuel Chadeau: "*Economie du risque: les entrepreneurs 1850-1980* " Editions orban 1988").

In the case of Millau, both the public administration and Eiffage were at the same time risk-taking and risk-reducing agents - this is a large part of the innovation process. There may be two explanatory elements here: the importance of the engineers on both sides and their common technical culture, with a common value about the 'technical adventure'; the strong state presence and influence which both stimulates risk taking by innovation and at the same time cushions the consequences by introducing legal guarantees. In Millau, this taste for risk taking and risk reducing is evident also in the Eiffage attitude towards financial risk (the decision to self-finance the construction as a basis for later negotiations with the bank).

Tools and techniques for coping with risk, uncertainty and complexity

It is interesting to compare tools and techniques used through the two faces of the state: as 'producer' (designer and project manager as in the first step of the project) and as 'regulator':

- as producer, it faces major project complexity and needs the expertise of numerous scientific and technical partnerships;

- as regulator, the tools concern the way in which to keep the concession contract under control and all the means to be assured that the project will be delivered to the specifications required.

2.3.4 Responses to OMEGA overall research questions and hypotheses

What constitutes a 'successful mega urban transport project (MUTP) in the 21st Century? (ORQ#1)

Clear visions and objectives at the outset?

Millau Viaduct: A successful MUTP lays more on a good understanding of the context than on a clear initial vision of what the project will be exactly. A successful MUTP supposes to conciliate several objectives in a context where different levels and scales are considered together. Clear vision is the result of a social process of interactions between different actors. The success of a MUTP supposes both the capacity to adapt to changing contextual elements and, to the capacity to keep at the same time, some continuity in the project .The success of MUTPs depends on their capacity to achieve their core/essential objectives but also to deliver desirable project outcomes for inhabitants, users and citizens. Example: "Millau viaduct is a project where when we started, we were not sure of anything. If you imagine that the success of these projects is due to responses that you bring to questions asked a priori, you are very far from the reality" (HR 1); "To appreciate if a MUTP is successful or not, it is decisive to remind how was the context of decision making but also the imbrication of the game between the different actors in project design and in definition of the objectives" (HR 1); "The viaduct is such a success than as concessionary we had to response to the users demand and we have been more involved in tourist visits for the bridge and commercial business associated. Our job is changing." (PR 10).

TGV Med: Context-specific response (CS) - TGV Med benefits from a clear and strong objective (based on previous successful high-speed lines). However this objective had to be explained to convince all the stakeholders and to create a consensus on the project necessity. Potentially generic response (PG) - clear visions and objectives are the departure point of the decision-making process and above all of the negotiation process. Clearly define the objectives at the outset is a good way to put the right actors and stakeholders around the table and to start negotiations. At the end each one is able to appreciate the concessions made by the others, by comparing the initial vision to the definitive vision. Notice: clear visions and objectives don't mind that it can't change or evolve. Visions and objectives need to be adjusted to fit the negotiation process and the contextual evolutions.

Potentially generic lesson: MUTPs which are accompanied by clear visions and objectives are more likely to be judged 'successful' by stakeholders. Nevertheless, flexibility is sometimes necessary to adapt the project to a changing context, as public participation, as changing elective representatives, and so on. Flexibility has its limits because it can modify the project too much. Maintaining the principal objectives (general interest) on the long time is important to make the project successful.

Perceptions of 'success'

Paris Meteor: A successful project is one that respects the budget, completion times and quality levels programmed during the earlier studies (nine answers from the public sector). It attains the traffic objectives (six answers from the public sector and two other answers). A project that improves the service quality and provides network effects. It is a project that improves a network's service quality (travel time, travel ease, etc.). (four answers from the

public sector and one from a consultant). The project also improves regularity, comfort, safety, etc. (two answers from the public sector). To a lesser degree, the project also has network effects and reinforces the network's connectivity (one answer, public sector). It meets the needs of users, including the night-time demand. The latter has increased over the last few years with the development of staggered leisure and working hours. The project also enlarges the choice of user destinations. The project reduces disturbances (strikes). It provides a different image of public transport, making it attractive when compared with the use of private cars, and is a technologically and architecturally innovative project. It provides technical innovation, such as automation (three answers from the public sector). The project is characterised by an innovative, aesthetic and comfortable architecture (three answers from the public sector). It ages well (two answers from the public sector).

TGV Med: The project success is relative to the type of stakeholders. "It depends for whom, the TGV Med could be considered as a success for the local associations because they succeed to structure and organize themselves and to federate all their objectives. And we learnt a lot of things. But for the SNCF it is also a failure in terms of cost overruns and delays.(…). For people who lived just in front on the line, it's still a failure because it's obviously a nuisance and they don't take any profit of this infrastructure." (HR10).

Potentially generic lesson: Criteria used by stakeholders to appreciate the success of a project are different, various and can depend on the time of their assessment. The criteria are shared between two main axis: - new relationship between the infrastructure and the "territory". - The MUTP project management (financial, technical, quality of service and so on aspects).

Visions/objectives and politics/political cycles

Millau Bridge: A MUTP, in a disadvantaged region supposes, to be launched and implemented, a strong political support, at different levels, national and local. But to acquire its legitimacy near the engineers and the technical administration – here the Direction des routes, dominated by the Corps des Ponts et Chausses - the project needs to prove its utility by its position in the national motorways network. So, the success of the global project (A 75 and Millau viaduct) is due to joint efforts between a political will (plan of Giscard in favor of a disadvantaged region in 1975), the central government's transport infrastructure planning for development of the regions (CIAT 1987). "At the origin of the project, there was the decision by Valery Giscard d'Estaing, when he was President of Republic, to finance a road to open up the Massif Central, an area where he used to be elected. But in 1986, he was no more President of Republic. Francois Mitterrand was the President, and to be pleasant with Giscard d'Estaing organised a meeting of transport and territorial development in Clermont Ferrand. The decision was taken to finance an express way, not a motorway, since the RN 90. But some politicians didn't understand the difference and speak about the "motorway Clermont –Ferrand –Beziers". And we have to do It but we knew than the central government didn't have money for a motorway". HR2"We thought that the consultation with local authorities was crucial to get a successful project". (HR 1). The success of MUTPs depends also of the quality of local governance : The viaduct is something fantastic, a great intelligence has been put in it, there has been an exceptional operator, which managed the site perfectly, without fatality but we can't say that the local acompaniment can be seen as a good practice. There has been a local authorities associations (*syndicat mixte*) which has been a good tool to coordinate the efforts; but it has been marginalised by the political games: "There has been a political magma between the local politic actors. I would say in retrospect that it's a great failure. We missed the opportunity to develop an action on the scale of this event : the viaduct . We have to recognize that at the local level there has been a total absence of vision and of anticipation from some politicians, at the Department or at the region level. Everybody has to run after the success afterwards". (HR 9).

Potentially generic lesson: Political influence of elective representatives is important to guarantee the respect of principle objectives and to guarantee the availability of the public funds in the case of a public project. The risk is the change of elective representatives. The political power is different among the project is managed by local authorities or by the State.

MUTPs as 'agents of change'

Paris Meteor: The relationship between MUTPs and land planning has not been completely exploited in terms of coherent land use-transport strategies (for example the issue of disequilibrium of houses and offices between the western and the eastern suburbs of Ile-de-France region, which generates the congestion on the east-west line A of the regional express railway network (whose decrease was one of objective of Météor), has not been treated with the Météor project planning).

Millau Bridge: One of the main objectives of an MUTP in a disadvantaged region is to act as an agent of change not only for traffic movements but also for local development through accessibility improvement.But there is not necessarily any clarity of thinking about the nature and impact of forces of change that the project could have a beneficial growth impact in some way. MUTP as an agent of change is supposed to be accompanied by thinking about the resources which can play in favour of attractiveness of the region. Millau viaduct is narrowly linked with a parent project. So it takes place in a complex set: the public motorway A75 and a public private viaduct Millau. As a piece of the motorway A75 shows that the first and main objectives at the beginning was clearly a Town and country planning one. « A successful MUTP is a project which associates cities development and large transport links. That means accessibility and opening up for territories . A MUTP has to be a changing agent for an economic, local and regional restructuring ». (HR 4) To acquire its legitimacy near the engineers and the technical administration of the Direction des routes, dominated by the corps des Ponts et Chausses, the project needs to prove its utility by its position in the national motorways network. So, it has to offer:

- an alternative route compared to the Rhone Valley corridor (quite saturated), by Paris-Clermont-Ferrand- Beziers;
- an international axis from the North –West of Europe to Spain and Mediterranee.

But specific objectives have been expected from the viaduct by itself, in particular to end the summer traffic jam and the infamous Millau “bottleneck,” and be a positive element for local development. The passage from a technical and functional vision of a bridge designed to adapt to natural and physical constraints of the area to an aesthetic vision designed to valourize the landscape multiplied the bridge attractiveness near the population. “When the last junctions of A75 will be finished, this viaduct will manage very important flux of cars because it has many qualities : it’s the shortest, the fastest and the most beautiful way to go from Paris to Perpignan. It’s a free motorway except at the viaduct. The landscapes are splendid." (PR 9).

TGV Med: (CS+PG) Success is synonymous with multi-dimensional effects. The project benefits are materialized on short and long term. The main problem consists in a lack of visibility of the relation between MUTPs and the multiple effects or changes related to them. The project should not focus only on transport but also on the other dimensions, especially spatial development. The integration of territorial issues with project of urban development is also a solution to reduce the oppositions. These changes are needed for complementary policies and partnerships, ex for the urban revitalization around the train stations.

Potentially generic lesson: Projects cannot be conceived without taking into account the territorial issues like local economic development, new urbanization, equilibrium between homes and jobs to limit mobility, and so on.

Emergent objectives

Millau Bridge: The final success of this project is due to three major turning points in the decision making. Each of them contributes to integrate new objectives, for instance: (a) improve the quality of architectural design associated to the initial engineering project, and with it; (b) widened the outcomes of the bridge. Co-design allows achieving the structural stability and resistance to wind objective, with something more: aesthetic – harmony, safety and comfort for the driver. To quote HR 6b: "A successful MUTP is an innovative project both in terms of architecture and engineering, and a project on which architects and engineers succeed to work together and to keep the most influence in term of engineering and design until the end. A "Grand Ouvrage d'Art" like this one is primarily proven by engineering constraints and there is still more than one way you can do it. Something was significant: the introduction of the curve with something which allows you to see a ray of structures. Making this curved, there, it makes you feel some continuity between the approaches and the bridge, it makes it a bit more harmonious within the complete, for the driver experience you get, it is better for appreciation of the structure you supporting that it is quite nice that it struck you to appreciate some structure above the level of the deck, it was probably more sense of reassuring in a sense, because some people suffer from vertigo and psychologically to be aware of something holding you up, psychologically all you mean, subliminally. I think that helps with a sense of reinsurance and it is an equilibrium." (HR 6.-b).

Change the nature of the motorway with the new concept of landscape motorways (as a response to ecologist pressure). "Quickly the environment has been seen as a major issue in Millau; the idea was this one: face to thousands of opponents it's not the engineers 'consideration which can operate to choose a route; you need other arguments than the curve ray. So the idea in Millau was to remove the roads far away from the technical field and to say that they are not an 'engineering' object, but rather a cultural object. So, together with the landscape architect, we imagined the idea of "the motorway as inventor of landscape." What surprised people at this time was that this idea came from the Department of roads and not from the Department of Culture and Arts. In fact this last department at that time didn't worry about landscape. But at the same time, this concern about landscape made us very sensitive to other considerations; for instance, on this free motorway, there were many interchanges; so, I thought that every mayor, at each interchange, will want to have a business park and all these things will destroy the landscape. These business parks will not be used and in ten years, there will be industrial wastelands. So it was quite necessary to have a dialogue about the economic development with the local authorities." (HR 10-c).

The proposal to give up the initial idea of public procurement for a private one through concession with the objective of accelerating the delivery of the viaduct and to secure its financing, as a response of budgetary constraint and to secure of concession procurement - for the viaduct – that meant implementation of tolls for the bridge car users. Conflicting visions about that decision were strong among the local political actors. "Nothing let us think at the beginning that this project will would be realised as a concession PPP, even in the time of the choice of the design and engineering team by the jury in 1996. The decision of PPP has been taken suddenly in 1998 by the Minister of Transport, J.C.Gayssot (PC)". (HR1)

Functional objectives v broader agglomeration objectives

Potentially generic lesson: Time and budget is regarded by many as the fundamental basis for judging project success/failure.

Objectives and related criteria as appraisal/evaluation measures

TGV Med: (CS) Traditional criteria remain the most important according to the stakeholders: time, cost, and above all traffic results (compare to the traffic forecasts) and the quality of service. "I would say that there is several elements to take into consideration, but the most important seems to be the traffic and the fact that people answer present and use the new infrastructure. It means that we won!" (HR1)

Objective setting for PPP/PFI projects

Millau Bridge: The Millau case study demonstrated that private partners can be involved in long term objectives and contribute to general interest goals (like high quality or sustainable development) as long as the granting authority is strong and competent enough to control this achievement. The know-how brought by the central administration and its technical experts, in design and control, the know-how brought by the private concessionary in charge of financing, building and operating.

Potentially generic lesson: Certain case studies demonstrated that private partners can be involved in long term objectives and contribute to general interest goals (like high quality or sustainable development) as long as the granting authority is strong and competent enough to control this achievement.

Stakeholder involvement in objective-setting

Paris Météor: A project accepted by the public - the acceptability of the project by the public avoids any claims or complaints during the works. This reduces delays and additional costs. RATP regretted the lack of communication with the public, because Météor was delayed of 15 months because of the cancellation of the public utility statement. (one answer, public sector).

TGV Med: (CS) the limited number of stakeholders involved in objective setting was the main difficulty in the TGV Med project. The top-down decision was criticized and seen as non-democratic. (PG). Stakeholders' involvement is crucial to define the project objective and also to participate to its achievement, especially the public acceptability of the project. In MUTPs the scale of the project induces a specific approach in terms of public consultation. The traditional role played by representatives is inefficient face to the extent of the project impacts. A more large and direct dialogue should be introduced with the public. Technical innovations can be useful to involve stakeholders: For the SNCF engineers, the technical innovations were a way to involve the residents in the project by interesting them in the project implementation. "The technical innovation was not so problematical, on the contrary it allowed to federate people around the project, especially when we started to build the famous exceptional structures. (…) I remember the construction of the Ventarain Viaduct, it was a real technical exploit, so we had a communication unit with a journalist and he suggested we should organize a visit on the site (…) we were waiting for 500 people but finally 3,500 people came, it was crazy, a huge success! (…) People were very impressed by what we done." (HR9)

Context specific lesson: Stakeholders (inhabitants, local elective representatives, etc) – their involvement is crucial to define the project objective and also to participate in its achievement and to make the project acceptable. The public debate procedure can help to make a project more acceptable.

Acknowledging the importance of key contextual factors/influences

TGV Med: A high level of commitment and belief in project success and its necessity is a strong factor of success, especially for the project manager. (PG). Success is a sort of self-fulfilling prophecy. The belief in the project success is the main argument to convince.

2.3.4.1 Risk, Uncertainty, complexity, and context

ORQ#2 – How well has risk, uncertainty and complexity been treated in the planning, appraisal and evaluation of such projects? and…

ORH#3 – The level of competence in decision-making and planning in today's fast-changing world is best assessed by the adequacy of the treatment of risk, uncertainty and complexity and sensitivity to context – all of which are important demands on Strategic Planning.

External v internal sources of RUC

Millau Bridge: Risks concerning the core of the project (feasibility, construction, financing, control) have been treated more easily than uncertainty concerning the different outcomes and "impacts" of the project. There is a gap between the good appraisal and the noteworthy management of technical risks, both from the public and the private side, and the Under-estimation of the potential success of this MUTP and future traffic, in particular by central government and some local politicians. "Once the viaduct was operated, we observed some uncertainty about the viaduct's effects ; but we got a shake up by the events . So that's true, we got some delay to realize the opportunity it gave us. And there have been delay also for all the equipment we could have launched in the program of measures to accompany the viaduct .We have to analyse this situation with objectivity and a critical mind"' (HR9).

TGV Med: We can identify several key risks and most of them are related to a specific context, not to a kind of transport project. Global risks considerations are clearly neglected. The potentially generic risk sources are still available: construction risk, financial and commercial risk, political risk etc.

Context specific lesson: The traditional sources of risks (traffic forecasts, revenue, construction, technical risks, financial risks) are taken into account, but not with success. The external risks (public opposition, the lack of local economic development, change of laws …) are taken into account but are not easily controlled.

RUC and the pace of change in the 21st Century as context for MUTP planning and delivery

Millau Bridge: A MUTP, when due to a link with a parent project, increases the project complexity, by the multiplicity of scales, the diversity of goals, the plurality of actors, visions and objectives. The change in the nature of risks implies a change in the actors' coalitions. Increasing knowledge in the core matter of the project could lead to take major risks. So knowledge can be both a new source of risk and a new solution to treat it. "A mega project is a project which tries and succeeds to push away the borders of risks mastery and control in the civil engineering structures, thanks to technical, technological or even cognitive revolutions. They could go with some giant scale, with as counterpart, the fact that their design and build is no more accessible to small and medium enterprises" (HR 2). It was noted that contextual change is often highly unpredictable and therefore extremely difficult to accommodate in MUTP planning and delivery processes.

Tools and techniques for risk management

Paris Météor: Risk evaluation in the pre-project and post-project stages: The evaluation method used is a classic method employed by RATP. It measures future traffic levels (on the basis of hypotheses such as modal transfer, transfer of traffic from line A and other metro lines, general growth in traffic levels) and the time saved by passengers using public transport lines linked to Météor . It also uses sustainability criteria such as the time saved by passengers having left their cars at home to use Météor. The evaluation method works well (provisional traffic forecasts have been met), even though a number of limitations can be noted, such as the need to review journey time estimations given that these have remained unchanged for the past 30 years. The method can also be enriched by economic criteria, such as the effect of Météor on the economy of the Ile-de-France region, alongside an analysis of changes in ways of living and the choice universes and lifestyles opened up to passengers by the construction of a new infrastructure. The network allows passengers to reach a wider range of destinations and improves their access to employment zones, etc. These criteria can be analysed before and after the construction of the project.

Traffic levels can be increased, especially by providing good connections between the project and the rest of the network as from the project planning stage. This creates a network effect and makes the project more attractive by capturing a higher traffic level and providing a wider range of destinations. The construction of the programmed town planning projects is also important because, if there are cutbacks, traffic levels might decrease. If there is more traffic than forecast, the project will not have a sufficient carrying capacity and this could have an incidence on profitability, travel time saved and the comfort of passengers. (2 responses, public sector).

Financial risk management through the use of a (public) multi-partnership (1 answer, public sector): . Financial risks were covered by demonstrating that Météor, although only a short line with nine stations in Paris, is in fact a regional project. This meant that its financing could be provided by the State and the Region as well as by the City of Paris authority. This was achieved by proving that one of the objectives of the Météor line was to relieve the overcrowding of line A of the regional express train network and allow those living in the suburbs to travel more easily through Paris by providing a connection between the new line, the two regional railway station and the three regional express train network stations. One of the advantages of this public financing provided by several players is that it becomes easier to mobilise large sums of money for the construction of the project as the players are contractually tied to one another. A single financier would have been insufficient. The inconvenience is that there are a considerable number of players, certain of whom do not want to spend large amounts. It is therefore necessary for these bodies to find a consensus and this can delay completion times. The risk of cost overruns (1 answer, public sector). An in-depth and detailed cost analysis during the design phase will prevent any major cost overruns. Cost overruns can also be avoided by a preliminary analysis of the project's function and main objectives, and by carrying out a second cost assessment.

Anticipation-based risk management (1 answer, public sector): Anticipation is a key factor in the success of a project. It was important to pick out and define the constraints from the outset – prior to the design of the project – to avoid any later malfunctions. These constraints concerned costs, geological problems, etc.

Financial agreements and specifications (one answer from the public sector): To avoid delays and additional costs, as was the case for Météor, the public authorities decided to set up financial agreements with the subcontractors (civil engineering, etc.) for other projects. The agreement includes the specifications and a financial schedule. The specifications incorporate obligations and objectives applicable to the subcontractors. The client for the

Météor project regretted not having introduced penalties and tighter completion times on the Météor subcontractors.

Programming and planning subcontractor skills (one answer, public sector): To avoid overly long delays, RATP (which is also the client) set up a subcontractor skills programming and planning procedure. The programming, planning and coordination director plays a vital role in the client's performance. This person coordinates the works progress, the methodology and the organisation of the various contractors. He is also the link between the players intervening on the project. For the passage of trains, RATP worked with the operator, the central control station controlling the train sets, the maintenance manager responsible for the new workshop, the project managers (belonging to the various RATP departments) and the RATP railway engineering department having drafted the operational programme. All these persons and bodies consulted with one another and passed on the required solutions to the project contractors (one answer from the public sector).

Penalties: The delay that took place in the construction of the Olympiades station by the client (RATP) saw the latter opt for modifications to be made in the way that sub-contractors were managed: penalties, tighter schedules for the performance of contracts, and an additional effort being made to manage the planning and programming of the works (one answer from the public sector).

Millau Bridge: Integration and risks reduction: A common approach characterized the public and private partners' attitude to facing risk: it consisted of integrating then reducing the risk either by an internal management, or by a collaborative interface. Thus tools and techniques for risk management depended on this strategic approach of risk management. Risk integration and risk reduction in an entrepreneurial approach can be a factor of success:
(a) integrating the risk by central administration in the civil engineering design. This behaviour could be observed in the public sector at the preliminary studies stage, when the technical and technological risk has been accepted by central government if it allows improving the choice of the route;
(b) self-financing and integration of risk construction as a major risk: one of the specificities of the Eiffage's bid was the choice of self-financing and the integration of the construction risk. The company didn't have recourse neither to government subsidies nor to bank loans. This last aspect was quite new in comparison with the traditional way of proceeding in classical concessions.

Treatment in-house: A more general principle retained in the decision making was to do everything in-house as far as possible – (here in-house meant the contractor company (Eiffage) and all its subsidiaries – Eiffage TP for concrete; Forclum for electricity; Eiffel for the metal structure and the welding; Apia for coating). The only part of the viaduct which was sub-contracted was the stays; they were subcontracted to Freyssinet.Incremental appraisal and competencies. Sources of the success in associating private actors to long-term objectives and general interest goals were:

- a strong and competent granting authority;
- a good and stabilized design;
- a fair balance in the concession tract;
- a competent concessionary company.

"On a MUTP like Millau, the project couldn't go straight immediately, but step by step, in an incremental way, because the calculations have to be made on materials, geology, stability, etc., and it is necessary to put them together. You can get studies, but they are statistical ones, based on normal rules. These rules can't work when there are some external elements like wind. Nobody knows how to combine all that, and if you make a mistake, you

miss the real danger. in cases like this, a constant presence of a quite competent people Is quite essential." (HR 1)

Context specific lessons: The issue is to integrate risks in the project management. The cost benefit analysis is not sufficient.

Risk evaluation in the pre-project and post-project stages: The evaluation method used is a classic and measures future traffic levels (on the basis of hypotheses such as modal transfer, transfer of traffic, general growth in traffic levels) and the time saved by passengers using other modes. It also uses sustainability criteria such as the time saved by passengers having left their cars at home to use a public transport. The evaluation method works well even though a number of limitations can be noted, such as the need to review journey time estimations given that these have remained unchanged for the past 30 years. The method can also be enriched by economic criteria, such as the effect of Météor on the economy of the Ile-de-France region, alongside an analysis of changes in ways of living and the choice universes and lifestyles opened up to passengers by the construction of a new infrastructure. The network allows passengers to reach a wider range of destinations and improves their access to employment zones, etc. These criteria can be analysed before and after the construction of the project. (Météor)

Traffic levels: Traffic levels can be increased, especially by providing good connections between the project and the rest of the network as from the project planning stage. This creates a network effect and makes the project more attractive by capturing a higher traffic level and providing a wider range of destinations. The construction of the programmed town planning projects is also important because, if there are cutbacks, traffic levels might decrease. If there is more traffic than forecast, the project will not have a sufficient carrying capacity and this could have an incidence on profitability, travel time saved and the comfort of passengers. (Météor)

Financial risk management through the use of a (public) multi-partnership: One of the advantages of this public financing provided by several players is that it becomes easier to mobilise large sums of money for the construction of the project as the players are contractually tied to one another. A single financier would have been insufficient. The inconvenience is that there are a considerable number of players, certain of whom do not want to spend large amounts. It is therefore necessary for these bodies to find a consensus and this can delay completion times. (Météor)

The risk of cost overruns: An in-depth and detailed cost analysis during the design phase will prevent any major cost overruns. Cost overruns can also be avoided by a preliminary analysis of the project's function and main objectives, and by carrying out a second cost assessment. (Météor).

Anticipation-based risk management : Anticipation is a key factor in the success of a project. It was important to pick out and define the constraints from the outset – prior to the design of the project – to avoid any later malfunctions. These constraints concerned costs, geological problems , etc. (Météor)

Financial agreements and specifications: To avoid delays and additional costs, the public authorities decided to set up financial agreements with the subcontractors (civil engineering, etc.) for other projects. The agreement includes the specifications and a financial schedule. The specifications incorporate obligations and objectives applicable to the subcontractors. The client for the Météor project regretted not having introduced penalties and tighter completion times on the Météor subcontractors. In the French case, a general strategy is used by the different public or private actors which consists to integrate then to reduce the risk either an internal management or by a collaborative interface. The trend is to treatment

in house with a incremental appraisal. Such an approach supposes some kinds of competencies. (Météor)

Lengthy planning and implementation period as the major source of risk, uncertainty and complexity

Paris Meteor: It would be worthwhile providing a margin to provide a degree of flexibility covering the length of time required for the engineering and construction works during the programming and to have a realistic schedule. The management of the project was accompanied by the supervision of a large number of commissions and the application of a considerable number of regulations to reduce the technical risks (civil engineering, automated systems, operation, etc.). These factors had the effect of slowing down the construction of the project. Completion times - design and construction completion times must be defined from the outset. It is necessary to integrate the risks of unsuccessful calls for bids and the delays suffered by subcontractors whose works are complex and depend on the completion of works by other trade sections. Critical paths in the process must be noted alongside the key dates to be respected in the design and construction phases. Where required, safety margins must be incorporated.

Project interfaces and risk, uncertainty and complexity

Millau Bridge: Nature of risk is changing because MUTPs supposes more relationships between these different sources (technical, financial, environmental, social and political risks). "MUTPs like Millau Viaduct or Normandy bridge don't look like a bed of roses. Much often, there are cabals against such projects. Let's just think of the huge economic issues around them and the competition that they aroused. And sometimes those cabals have some effect. On Normandy bridge, the banks took fright and they increased the interest rate of the loans of 1%. In the case of Millau, it was the same. There are rumours even inside the profession to tell that this project was too risky. The Direction of Road wanted to check this point. But we were quiet because we did all the calculations and technical studies properly with the best experts in the field of wind studies." (HR2) "There were two advantages to take in charge, internally, all the financing. The first is that the decision making was really internal in the group. The second advantage is that if we wanted to find a bank, this one would argue for the huge construction risk on such an *ouvrage d'art*, never realised like that before. And because there was also a risk on the receipts. They would speak to us about the Channel Tunnel or other MUTPs where reality was very different from forecastings. They would insist on all these sources of uncertainty. In this case they used to ask for very important margins for credit. So we decided to build the whole project on our own equity ; the amount was €400 millions, and it was important to get them back just after the construction; but at this step, we went to see the bank and said : "Now there is no more construction risk, the risk on receipts is weak because we got 20% more than the forecast receipts in the first year and so we got a financial cost more reduced compared to this with a bank loan." " (HR 7).

Politics and risk, uncertainty and complexity

Paris Meteor: Segmentation: Météor's construction was segmented into three phases to spread the financing over time. Although segmentation can be of interest for the construction of a very expensive project with financing problems, it also has the inconvenience of creating additional costs. Segmentation also permits the construction of a disputed project more rapidly than if it were constructed in a single phase, with the project carried out in short sections just a few kilometres long there where there was no opposition. The disputed sections were subject to negotiations, some of which took a considerable amount of time. It was also necessary to provide the political monitoring of the project to ensure the financing

of the subsequent phases (two answers from the public sector). “There is another decision which is very expensive – it’s segmentation”.

Trust, transparency and risk

Paris Meteor: The social risk: the risk of objections to a project being raised by civil society is high. It is therefore necessary to clearly and extensively communicate with local residents, unions, the population and locally elected representatives to explain the project prior to the public decision being taken and before the beginning of works. This subsequently saves time and avoids problems during the construction phase (complaints, delays, additional costs, etc.). The aim is to ensure that the highest possible proportion of people accept the project and are convinced by its desirability. Political consensus is also important as it can form the basis for the financing. The population’s approval is also needed. The difficulties in the construction of a project can require occasional adaptation of methods or phasing. “We have to communicate about the project with local residents, unions, the population and locally elected representatives ….internal and external communications are necessary”.

Risk share & PPP/PFI

Millau Bridge: An appropriate degree of risk sharing could be achieved under those following conditions:

- the recourse to the private sector through PPP/PFI has not to occur too early in the project, but rather when the design is stabilized;
- when the political risk is mitigated;
- when the principle of concession and tolls is accepted and transparent;
- a well-balanced contract is a contract where, at the one hand, a precise specification of obligations are made to the concessionary. These obligations can concern a large scope of tasks and duties (including in matter of public services, tariffs regulation and new fields like respects of the environment etc.);
- however, a large potentiality for profitability has to be let to the private sector but under public and transparent control.

"Sometimes there are problems, of course. Everything is not idyllic. For instance, road hauliers claimed for a free access to the viaduct as residents and workers of the department; of course the claims came from the unions of carriers. But we can’t ignore them. We asked them and Eiffage to negotiate. As local authority we are concerned also by a local road, the route de la Cavalerie, between Millau and the motorway. For different reasons, we have been obliged to close it during 3 or 4 months on last year. That means than everybody from Millau has to drive by the viaduct. I put together the concessionary, the representatives of central government, the local authority (conseil general), the union carriers etc.. It‘s important to put everybody around the table. We have to find an acceptable solution for all the stakeholders". HR 4

Robustness and adaptability

TGV Med: The planning process is supposed to associate a flexible and evolving approach and at the same time a robust response to keep the project entire..

Example of adaptability on the project objectives: the construction of the TGV Mediterranean was also supposed to release on the existing lines some new capacities of regional traffic and freight. This objective was not presented in the first version of the project proposed by the SNCF, nevertheless it appeared rather quickly because of the protestations from residents.

Skills, competencies and relationships

Paris Meteor: Personality and personal relationships are vitally important at all levels, within and between organisations. Indeed, MUTP planning and delivery is fundamentally impacted by stakeholder personalities and personal relationships. Météor is a complex project as it involves several public decision-making levels (State, Region, City of Paris) and because it uses an innovative driverless system. The complex management of the planning and construction of the project took place within RATP and was carried out by a project team (cross-disciplinary team grouped together the functions of client and project manager). It was under the responsibility of senior management and had considerable internal powers. The project team had authority over those responsible for the various project components who remained accountable for their particular sectors: project leader, coordinators, engineers, design and construction teams. The reduction in the number of hierarchical levels within the company's new organisation favoured the decentralisation of decision-making and resulted in the sharing of responsibilities. Strong leadership can reduce uncertainty - "I think that Météor has been managed with a project team by RATP, as it is done in other companies".

TGV Med: PG) "There is a need for managers and decision-makers who are able to see projects in their entirety (holistically) over the entire lifecycle." We can talk about systemic vision or approach: "In these kinds of mega projects, I think that we can get out only if we try to develop a systemic thought; we need to forget our own interest and try to take the position of someone else, we need to be open-minded to see what's happened in the other points of the system. It means that the planner should be able to admit that his project is not necessarily the best one and he could accept to adapt his proposals". (HR10). The respondent developed the idea that a project is a success if people involved succeed to develop a systemic approach and are capable to get out their own interest and to think what would be the best solution for each point of view.

Potentially generic lesson: A systemic approach to the project is necessary, with for example with a project team associating all the competencies.

Best practice & institutional learning as a means to mitigate RUC

Millau Bridge: Risk can be a factor of innovation, and innovation a factor of risks. This double dynamic was present in Millau, opening a field of new questions and new cooperation between the actors. The treatment of this new risks combines two main trends: the first is the trend of integration of risk "in-house", as seen above The second trend is the necessity to combine different kinds of expertises. One of the biggest risks in Millau was the construction one; it's mainly linked with the innovating structure (multi-span bridge) and the choice of the route. In the construction field the major problem was the strength of the wind, (in addition to height of the piers) which needed international experts' knowledge. Nobody could claim a monopoly of knowledge or expertise. "When the project was initiated in the late eighties, it was decided to constitute an international panel of experts for project evaluation. This panel has been settled in 1993 and later met at each major step of the project development. Chaired by Jean Francois Coste, it comprises several structural engineers, a wind expert, geotechnicians as well as architects, landscape architects and specialists of bridge aesthetic." The discussion and debates with peers is essential but less and less sufficient because of the interdependence towards a multiplicity of knowledge.

TGV Med: (CS) Best practice is considered as frequently being contextually insensitive. That was the main issue with the TGV Med at the outset: the project management was based on the experience of the previous line. The confrontation with the Mediterranean specific context led to a strong opposition to the project. The main lessons learned from the TGV Med resulted from an immediate reactivity in the decision-making process and the project management, and not really from a post-project evaluation.

2.3.4.2 Importance of context

ORQ#3 - How important is context in making judgements regarding Overall Research Questions 1 and 2?

Contextual forces influence pivotal decisions

Paris Meteor: The appreciation of the context varied enormously according to the experience of each interviewed person. The main contextual elements considered as important concerned the financing, the institutional and political context, consultations and the role played by engineers with regards the elected representatives. The financing context Difficult contexts had an influence on the construction of the project, such as the 1992 economic crisis that reduced the earnings of the Ile-de-France region as a result of falling sales of offices. In parallel, the cost of Météor increased by 68%. The Region also had to finance another project, Eole. The circumstances represented a major handicap and extended the works completion dates. Météor was constructed in three phases spread over 19 years. However, the public financing system of this project allowed the client to obtain the necessary financing (following considerable efforts made to persuade the Region that it would cost more to stop the project than to continue it, and that an incomplete project was a waste of public money). This system is now criticised as it does not allow the forecast costs to be respected. The institutional and political context: the particular case of a regional capital with 1,281 local authorities. The institutional and political context is considered as very important. The large number of administrative levels in the Ile-de-France region (1,281 local authorities, a regional authority, the fairly strong role played by the State when compared with other regions due to the international importance of the Ile-de-France) made the decision more complex than it might have been elsewhere. Consultation with local residents is a fundamental key to the success of a project. There was no consultation with neighbours and local residents for the construction of Météor as this approach was not necessary at the time. RATP regrets that there had been no consultation as this would have developed local enthusiasm for the project and avoided additional delays and costs linked to objections to the public utility declaration. A real consultation procedure has since been developed that encourages people to express themselves as to the relevance of a project. To this end, it is necessary to have a political decision-maker and someone to support the project. The role of the political decision-maker can be increased. The State remains a powerful authority in the taking of decisions, especially when the concerned project is of national interest or if large amounts are concerned.

Millau Bridge: The success of MUTPs depends on their capacity to lay on a strategic vision allowing margins for possible changes and bifurcations. It supposes strategic but also flexible and adaptable planning according to the context. Turning points could be quite beneficial for the project. (Fr) "The studies also knew various episodes, between the moment when they have been drawn up in the framework of public administration, and the moment when they have been continued as competitive tenders in 1994; and then since 1996 in the development of the winner project." (HR1)

TGV Med: Key contextual influences interfere on the decision-making process. The financing context with the pre-eminent role played by the State and by the SNCF in the TGV Med project.

Context specific lesson: The three main contextual forces are:

- financing context;
- institutional context (change of ministries and change of public policies). (Millau);

Perception of context and responses to context

Millau Bridge: The project highlights the relationships between:-central government, technical central a stration and private sector. These relationships are more relevant for the project than the relationships with the local ones.-the local authority, have little influence directly on the project, despite the strategic character of their political support. For a large part, this smaller influence is due to the difficulty that they had to cooperate together - the effect of "French *millefeuilles.*"

Potentially generic lesson: Monitoring committees, public consultation procedure are important to adapt the project to change.

Political influence/support as a key contextual element

Millau Bridge: The political risk was lower in Millau as it was 'absorbed' by various local and national authorities. Social acceptability seems easier in a disadvantaged region, like Millau especially when the project is free of charge for the users and when hopes are put in economic development.

Discerning and understanding context is critical

TGV Med: In general terms, one of the most important factors is the coordination between all the actors involved in the decision-making process. The creation of follow-up committee is a decisive element. For example the coordination between the SNCF and the teams of architects and landscape designers appeared as an important factor in the project process. ""The appeal to architects and landscape designers was an important factor in the decision-making process. They contributed to explain the project (…) and to keep the contact with people on the ground. It became more peaceful…" (HR5).

2.3.4.3 Responses to overall research hypotheses

ORH#1 - Traditional criteria relating to cost overruns, completion dates, generation of travel time savings for users and rates of returns to investors are inadequate measures of success in the 21st Century as sustainable development concerns become increasingly critical both globally and locally.

Projects may be treated as both open and closed at different times and for different reasons

TGV Med: The main issue is to succeed the transformation from a closed to an open system. The project is necessarily conceived as a closed system, based on the economic appraisal (produced by the main contractor). Concerning the TGV Med, the main difficulties provided from the lack of legitimacy of the SNCF. The SNCF was also the only expert on the project: the company had already constructed several high-speed lines alone, without any interventions of the State. So the people opposed to the project blamed the SNCF for being judge and part at the same time and for proposing the most direct route without taking account ofthe planning stakes, in a strictly closed system.

Context specific lesson: For 30 years, projects have been opened to new ideas (environment, local development, and so on) and to new stakeholders (inhabitants, local electives representatives, local economic actors, etc). Nevertheless, the transformation from a closed to an open system is not ended. Projects may be treated as both open and closed at different times and for different reasons.

Political will/ influence

TGV Med: These kinds of interventions can be seen positively or negatively. For example the discourse made by Mitterrand in 1990 in order to exclude the reference route was perceived as a manipulation by all the stakeholders. For the associations of residents and public opinion in general, this declaration was the reaction of the wine lobby intervention and the President's friends. At the opposite, the political intervention was also a good thing for several interviewees: "With the TGV Med there was a sort of swing in the decision-making process because the State took back the project in its hands and it was absolutely necessary to make the project accept by the population." (HR4).

Appraisal processes and criteria

Paris Meteor: "The ex-ante evaluation can concern the cost or be a more general evaluation. The ex post evaluation incorporates an evaluation of the service provided. It is necessary to integrate qualitative elements linked to the environment, to political decisions, to energy consumption but it is difficult to cost them and then compare each variant". "The 60 major transport projects resulting from the Grenelle round table need to be incorporated into a national planning programme and be based on criteria that take into consideration the clientele, economic profitability and sustainable development".

Millau Bridge: (a) Success of a MUTP can't be appraised or evaluated through traditional criteria. It is supposed to take in account other dimensions (like for instance the environmental, social, economic and institutional impact as components of sustainability); but it needs also to be not reduced at a list of prescriptions with a lot of indicators to measure and to cost, but rather as a project to manage with its uncertainty; (b) the appraisal and evaluation suppose different procurement and criteria , changing at the different steps of the project . In the case of Millau viaduct, the criteria were both technical and territorial at the stage of the choice of the route. Two families of technical solutions have been studied. At this time, consultation with local authorities was seen as essential for the success of the project, and the appraisal criteria focused on feasibility .Then for the selection of the project the list of criteria widened and focused on project quality (engineering and architecture), costs and time. Before launching the concession procurement, there has been an economic appraisal based on a traffic studies. The technical and economic calculations have been checked by each partner with their own experts, even by using different software.

Context specific lesson: Traditional criteria associated with (especially) time, cost, value for money and quality remain of critical importance. Broader criteria such as the fostering of economic growth, sustainable development, environmental concerns and other 'social' matters in appraising MUTP achievements are of critical importance. However, such matters are seen to be rather difficult to operationalise and 'measure' successfully using 'traditional' methods.

Techniques, tools and models

Paris Meteor: It would be better to complete the method of standard socio-economic profitability criteria using sustainable development criteria which could be as follows:

- accurately measure the impact of the generalised move from car transport to public transport (optimised travel time, traffic volume, carbon balance, etc.) (four answers from the public sector). The level of CO2 discharges should be fine-tuned (one answer). This would provide an understanding of the project's forecast traffic levels and permit CO2 discharges to be calculated;
- integrate the problems of urban development (urban spread –two answers-role played by transport in the restructuring of districts undergoing change- one answer).

- integrate the limited capacity of public financing into the methods and better study financial risks (two answers from the public sector). This would reinforce the financial transparency of the project.

It is also necessary to underline that the inclusion of environmental criteria into the standard evaluation is more adapted to road projects than it is to public transport projects which, by definition, are more ecological (one answer). On the other hand, social and economic criteria are valid for the two modes of transport.

It is also recommended that political decision be once again given its role with relation to calculations (one answer). The complexity of the evaluations and the number of criteria taken into consideration make it difficult to provide a rational estimation of the relevance of projects with reference to environmental, economic, social, etc. challenges. Consequently, it may well be that the political decision-maker should have a more important role to play in the choice of transport systems and development schemes, as well as in the final decision. This raises the problem of the decision-maker's responsibility and the accuracy of the evaluations that he may use as a basis for the legitimacy of his decisions.

Millau Bridge: Context specificity: appraisal and ex-post evaluation in the case of Millau have to take in account two specific factors:

- the first one is that the evaluation has to treat how the objectives have been achieve both on A 75 and on Millau Viaduct (allowing the ring road);
- the second one is that the budgetary constraint pushed the central government to choose in favor of the concession with the aim to get this infrastructure in the best time and to end the totality of the route in a very much faster way.

The law about the orientation of the internal transport infrastructure (LOTI) has spread the field and criteria for evaluation ex post, in a socio economic assessment. Such an assessment has been established for Millau and published in February 2011;it is managed by the central department of infrastructure, transport and the institution of corps of engineers .

TGV Med: Current project appraisal and evaluation tools are positively perceived by interviewees. The main issue is to complete them with new criteria, such as sustainable development criteria.

ORH#2 - The new emerging international and local agenda related to vision(s) of sustainable development is multi-dimensional and goes beyond notions of environmental sustainability, as critical as this may be, in that it also concerns inter-related concepts of economic sustainability, social sustainability and institutional sustainability.

Issues associated with use of SDVs as appraisal frameworks

Paris Meteor: Operationalising SDVs in a meaningful way is extremely difficult, and certainly not yet sufficiently developed. Sustainability, as well as its component elements, is a concept in a state of change. It is defined by policies which, depending on their contexts, may have different ambitions. Because it is surrounded by a large number of uncertainties, it needs to be defined in a realistic manner. It is more applicable to road transport than public transport which, by its very nature, is sustainable. The sustainability of a project can vary according to the value given to the criteria used, such as the profit resulting from no CO2 emissions. However, there are limits to sustainability. It is difficult to set up complementary strategies to make existing infrastructures more sustainable. An ecological choice can also have non-sustainable consequences.

Millau Bridge: Multi dimensions of sustainability – the environmental dimension:

The environmental dimension has been integrated though:

- integration in landscape as criteria of project quality (and in addition to technical ones);
- requirements for the treatment of site pollutions and restoration of the vegetation afterwards.

An environmental appraisal (with Loti) has been made only on the viaduct (not on the public part); it concerns more the site effects and the actions launched. During the operating phase the main incidence are linked with underground water pollutions with the wastes of pluvial water of the platform of the viaduct and those of the toll barrier. But there are basins with settling tanks; the wastes are checked twice a year by an independent organism. Regular checking is made too of the evolution of plan; as well as on the occasional incidence of the viaduct on fauna, in particular birds and bats. Acoustic measures made in 2004 and 2006 show use of 1% landscape: the amount paid by the concessionary was €3.049 milliion; and it has been used though about 50 actions (leisure development, riverbank development, business activities, buildings regeneration, etc.) To quote: "this 1% has been used in different ways: for instance to bury electric lines, to improve the discovery of very nice villages, somewhere it could go far in the action."

Social dimension: Regarding sustainability overall during the site works, attention was paid to safety on site and prevention of technical and human risks (appraisal of geological and geotechnical risks, feasibility of the solutions from the point of view of stability regarding wind).

Economic and social effects led by the A75 and the Viaduct: an approach in three points has been used:

- a quantitative one (on statistic data);
- a qualitative one (blending bibliographic analysis and interviews near the main economic actors of the viaduct area);
- a geographic approach.

The main results were:

- There has been a demographic revival, with a growth of population between 1999 and 2008, though less on Millau itself (where population growth is weak), but in the bordering local authorities through a urban sprawl (but it is difficult to identify the specific role of the motorway on this phenomenon). It was a mix of many things such as: (i) the accessibility improvement; (ii) the population growth; (iii) the population wish to become a home owner.
- Impact on business activity: the main effects on enterprises: have been the improvement of accessibility with an evolution of the work of road haulier carrier towards logistic ones. We can observe too since 2004 a growth of craft industry. Regarding tourism, there has been clearly a "viaduct effect" with a touristic boom, in particular in 2005 and 2006 , due to the exceptional nature of this "*ouvrage d'art*" and to the media coverage. This effect decreased a little afterwards but remains significant. The main lesson of Millau in this field is that the development of a touristic offer around the viaduct is not the consequence of a strategy, but of a response to the tourists' demand; for instance the accommodation supply remained lower than the increase of tourists. So the appraisal highlights the need for the area to rethinking its tourist supply.

The Millau 'image': this public and media craze changed deeply the Millau image

Business parks: it was forecast that the last link in the chain of A75 will have an impact on business parks, through a strategy of development of future area. Since 1994-1995 about 100hectares have been reserved on the north and south of Millau viaduct. There was an anticipation of this future development by an association of local authorities of A75; the business parks have been filled up quickly, the main criteria for the enterprises to come there was:

- the land price (around €9 per m2);
- proximity with motorway and the markets of south Europe;
- the image of the region;
- quality of life, and safety, country atmosphere-quality of reception (by inhabitants and institutions).

Employment: during the construction stage(3 years), there have been around 3300 jobs a year including 1400 jobs occupied by local inhabitants; of this, 1200 are direct jobs and 2100 indirect jobs. .The specificity of this project is the creation of 50 jobs created thanks to the tourist interest of the viaduct. During the operating stage, there are 245 jobs a year ,including 166 at the local level. Among them 90 jobs are direct ones and 155 indirect ones. In addition the jobs created by new enterprises coming in business parks are appraised at about 200.

Economic and institutional sustainability through local development objectives-tolls : the tariff at the beginning was- 6,5 € during summer and 4.9% during the rest of the year for cars- 24,3€ for trucks Then they increased by about 21%; more precisely the receipts were 25,5 M€ at the beginning and increased on average of 7.3% a year between 2005 and 2008. They have been clearly higher than originally forecast by the concessionaire.

In conclusion, it is difficult to separate the impact and effects due to the viaduct and those associated with the total set of infrastructure.

TGV Med: Sustainability vision is clearly confined to the environmental question. In the TGV Med project, a lot of efforts have been made to limit the project impact on the environment and to protect the environment: in particular the hydraulic measures to limit the floods, the phonic protections against the TGV noise, etc. An important fact is that most of the engagements made by the SNCF to protect the environment were mentioned in the State engagements file, produced by the SNCF. A specific budget was unfrozen to keep these engagements. The environmental measures were also used by the SNCF team in a way to construct the project acceptability: "That's true that we made a lot of efforts concerning the line insertion and the environment. And in a way it led people to understand what we did and it showed them that we were doing good thing. We developed a specific architectural process." (HR7).

At the opposite, the social aspect of SDV is left behind (accessibility, social cohesion, equity, accessibility). The main argument against the project was the focus of the economic gain for the SNCF. In order to answer to the general interest, the socio-economic rate of profitability has been defined and included in the project. It's quite interesting that the economic and socio-economic rates of returns are both useful in the project decision-making process. The economic rate of returns indicates the economic gain for the company (private or public) supporting and funding the project. This rate has to been compared with the socio-economic rate, including the gains made by the project for the entire society. The good question to raise is how we calculate this socio-economic rate of return. We need to include social and environmental criteria, so it implies to give a monetary value to these criteria in order to add

them in the calculation.

Context specific lesson: The sustainability is reduced to the environmental dimension, which is taken into account in the multi criteria analysis. The economic criteria is taken into account in the multi criteria analysis with the asset of forecasts of jobs linked to the infrastructure (construction and exploitation).

Need for revision of sustainable development visions as frameworks for planning and appraisal

Paris Meteor: The hypothesis of a multi-dimensional approach to sustainable development is applicable to transport infrastructure. Most of the persons questioned underlined the need to analyse the sustainability of a project. The following points were specifically raised:

- the project needs to be designed to meet an existing and long term travel requirement to be sustainable. This can have an impact on the operating and maintenance methods (one answer).
- energy consumption (one answer);
- the urban insertion of projects to ensure they are accepted by the public (one answer);
- the project needs to be well incorporated if it is to respect its traffic objectives (one answer).

However, it is difficult to place a financial value on congestion. All of these criteria should be quantified to simplify the choice of projects.

MUTPs and retrofitting

Millau Bridge: Responses suggest that retrofitting is rarely considered in relation to MUTPs.

2.4 Conclusion: France

This section presented a summary and synthesis of the French Country Partner's research on the three case studies of Météor, TGV Mediterranée and the Millau Viaduct.

A summary profile of each project (with hyperlinks to the full Project Profiles) described the project's history and main characteristics, features, issues and timelines.

The Country Partner's own synthesis of their research findings in relation to the '4 Tests' was then given, presenting findings from the overall country perspective (i.e. combining the three case studies). Hyperlinks to the more detailed '4 Tests Reports' for each project were also given.

The next Section now presents the German Country Partner's findings from three mega-urban transport projects, while Volume 5 contains detailed analyses and comparisons of all 30 mega-urban transport projects, together with the overall findings and lessons of the research.

3. Country findings: Germany

ICE
Cologne

Tiergarten Tunnel
Berlin

BAB20
Motorway

3.1 Germany: The project profiles

Project Profiles were prepared by the Country Partner[3] for each of the study projects, to provide a consolidated source of secondary information to support all phases of data collection, analysis and synthesis. The profiles covered such matters as: project cost, duration and quality information; principle and secondary project objectives; key project stakeholders; sources of finance; key events and processes. (See also Volume 1, Section 3.4).

The full Project Profiles can be accessed via the following hyperlinks:

ICE Cologne
http://www.omegacentre.bartlett.ucl.ac.uk/studies/cases/pdf/GERMANY_NBS_COLOGNE_PROFILE_021110.pdf

Tiergarten Tunnel, Berlin
http://www.omegacentre.bartlett.ucl.ac.uk/studies/cases/pdf/GERMANY_TIERGARTENTUNNEL_PROFILE_120411.pdf

BAB20 Motorway
http://www.omegacentre.bartlett.ucl.ac.uk/studies/cases/pdf/GERMANY_BAB20_PROFILE_120411.pdf

Summaries of the Project Profiles are presented on the following pages.

[3] In Germany, the Country Partner was Institute for Geographical Studies, Urban Studies, Free University of Berlin, Berlin, - directed by **Prof. Gerhard Braun**.

NEUBAUSTRECKE (NBS) KÖLN-RHEIN/MAIN, COLOGNE-FRANKFURT, GERMANY

OVERVIEW

LOCATION: FRANKFURT-COLOGNE
SCOPE: INTER-URBAN
TRANSPORT MODE: RAIL
PRINCIPAL CONSTRUCTION: GRADE
NEW LINK: YES

PRINCIPAL OBJECTIVES

NATIONAL/REGIONAL COMPETITIVENESS
NATIONAL/REGIONAL TRANSPORT LINK
PART OF EU TEN NETWORK
TRAVEL TIME SAVINGS
ALTERNATIVE TO CAR/AIR
EMERGENT OBJECTIVES:
- LOCAL ECONOMIC DEVELOPMENT
- LOCAL ACCESSIBILITY
- STRATEGIC TRANSPORT LINK

PRINCIPAL STAKEHOLDERS

CLIENT: GFR/DB AG
PRINCIPAL FUNDER:
NATIONAL GOVERNMENT
ADDITIONAL FUNDING:
DB AG/EU/AIRPORT OPERATORS/REGION
PRINCIPAL CONSULTANT: DE CONSULT
REGULATOR: FEDERAL RAILWAY AGENCY

PLANNING AND IMPLEMENTATION

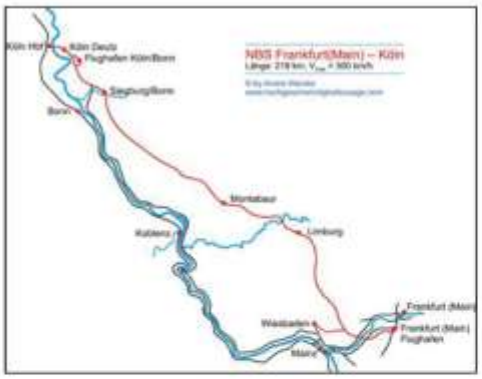
PLANNING START DATE: 09/1985
CONSTRUCTION START DATE: 12/1995 (SOUTH); 02/1997 (CENTRAL); 12/2000 (AIRPORT LOOP)
OPERATION START DATE: 05/1999 (SOUTH); 08/2002 (CENTRAL); 06/2004 (AIRPORT LOOP)
MONTHS IN PLANNING: 123; 137; 183
MONTHS IN CONSTRUCTION: 41; 66; 42
PROJECT COMPLETED:
12-36 MONTHS BEHIND SCHEDULE

COSTS (IN 2010 USD)

PREDICTED COST: 8.21BN (6.57+1.64)
ACTUAL COST: 8.57BN
PROJECT COMPLETED:
4% OVER BUDGET
FUNDING: 100% PUBLIC

INFRASTRUCTURE QUANTITIES

LENGTH (ROUTE): 177KM
LENGTH (TOTAL TRACK): 219KM
LENGTH IN TUNNEL: 47KM
LENGTH OF VIADUCTS: 6KM
NUMBER OF STATIONS: SIX
COST PER KM (USD 2010): 0.04BN



INTRODUCTION

The 177km NBS Cologne-Rhine/Main line is the first rail track in Germany to be built exclusively for high-speed passenger trains. It has reduced the journey time between the two cities by half.

The line serves eight stations, including Frankfurt and Cologne/ Bonn Airports (the latter via a loop), of which five were built as part of the project. It also includes a branch line to Wiesbaden and Mainz. It is part of the European high-speed rail network linking Paris, Brussels, Cologne/Frankfurt, Amsterdam and London.

BACKGROUND

The main objective of the project was to aid national and regional economic development and attract passengers from air and road travel, by reducing journey times between Cologne and Frankfurt.

German Federal Railways (GFR) began planning a new line between Cologne and the Rhine/Main region in 1965. It was included in the 1973 Federal Transport Infrastructure Plan (FTIP), but the plan is not legally binding and the line was abandoned in 1976 due to a lack of consensus about the route.

A new proposal appeared in the 1985 FTIP, and GFR began comparing five route options. A cost-benefit analysis at the time gave a ratio of 4.0, making it a high priority project. An early decision was to contain costs by catering only for passenger traffic.

The national government decided on the route in broad terms, and detailed route plans were considered through the spatial planning procedures of the three regional governments involved. The procedures included environmental impact assessments and public consultation and in this case led to about 100, mostly unsuccessful, legal disputes and numerous detailed changes to the project. Although originally planned with only one intermediate stop, extra stops were required to secure regional government funding. This affected the cost of the project and also the extent to which it could meet its original objective of reducing travel time.

The Cologne/Bonn Airport loop, abandoned in 1991 for economic reasons, was reinstated in 1994 as compensation to Bonn for moving the federal government to Berlin, under the 'Berlin-Bonn' law.

TIMELINE

CONCEPTION: 1965: EARLIER PROPOSAL STUDIED

CONCEPTION: 1973: EARLIER PROPOSAL IN FEDERAL TRANSPORT PLAN

DELAY: 1976: EARLIER PROPOSAL ABANDONED

CONCEPTION: 1985: PROJECT IN FEDERAL TRANSPORT INFRASTRUCTURE PLAN (FTIP), ROUTE OPTIONS STUDIED

CONCEPTION: 1986: MIXED OPERATION (PASSENGER & FREIGHT) RULED OUT DUE TO HIGH COST

INCEPTION: 1989: GOVERNMENT DECIDES ON ROUTE

INCEPTION: 1990: PLANNING PROCEDURES BEGIN

CONTEXT: 1990: REUNIFICATION OF EAST AND WEST GERMANY

DELAY: 1991: COLOGNE/BONN AIRPORT LOOP POSTPONED FOR ECONOMIC REASONS

CONCEPTION: 1992: PROJECT UPDATED TO 'BACKLOG' STATUS IN FIRST ALL-GERMAN FTIP

CONTEXT: 1993: GOVERNMENT PASSES LAW ON FUNDING EXTENSION OF FEDERAL RAILWAYS

CONTEXT: 1994: LINE IDENTIFIED AS PART OF EU TEN NETWORK

CONCEPTION: 1994: COLOGNE/BONN AIRPORT LOOP REINSTATED UNDER 'BERLIN-BONN LAW'

INCEPTION: 1995: PLANNING APPROVAL (SOUTH SECTION)

CONSTRUCTION: 1995 (DEC): CONSTRUCTION BEGINS (SOUTH SECTION)

INCEPTION: 1998: FINAL PLANNING APPROVAL FOR CENTRAL SECTION

CONSTRUCTION: 1998: CONSTRUCTION BEGINS IN CENTRAL SECTION

DELIVERY: 1999: SOUTH SECTION OPENED

DELAY: 1999: OPENING OF FULL LINE DELAYED TO 2002

CONSTRUCTION: 2000: CONSTRUCTION BEGINS, BEHIND SCHEDULE (AIRPORT LOOP)

DELIVERY: 2002: FULL LINE OPEN TO THE PUBLIC

DELIVERY: 2004: AIRPORT LOOP AND COLOGNE/ BONN AIRPORT STATION OPEN

CHARACTERISTICS

The cost was estimated at EUR 2.3bn in 1985 (USD 4.85bn at 2010 prices)[1] and EUR 3.96bn (USD 6.57bn at 2010 prices) when construction began in 1995. An additional EUR 1.04bn (USD 1.64bn at 2010 prices) was agreed for the airport loop in 2000. The final project cost in 2004 was EUR 6bn (USD 8.57bn at 2010 prices).

GFR (DB AG from 1992) acted as commissioning client and project manager, and DE Consult was responsible for design. The Federal Railways Agency, established in 1994, took over supervisory and approval roles. Construction contracts were let in three sections, each subdivided into separate lots. The contract for the central section was awarded to a group of bidders based on a 'functional tendering' system.

The line runs mostly parallel to a motorway, reducing environmental impacts. It required 30 tunnels (22 constructed by mining) and passes under motorways 15 times. Slab tracks and linear eddy current brakes are innovative technical features.

TIMELINE ISSUES

The planning procedures involved complex negotiations with regional and local stakeholders, lasting eight years in total. Although the south section around Frankfurt opened on schedule, the central and north sections and Wiesbaden branch did not: tunnelling problems and delays in plan approvals led to intense negotiations between DB AG and the federal government in 1999, after which delivery of these sections was postponed by a year to 2001. The extended construction time also increased costs.

The construction of the Cologne/Bonn Airport loop was initially abandoned for economic reasons, until given legal backing by the 1994 Berlin/Bonn law.

FUNDING

The national government has a legal obligation to provide railway infrastructure and was the principal source of finance. Under a 1995 agreement, it agreed to pay up to EUR 3.96bn (including land acquisition, equipment, structures and planning costs), with EUR 0.15bn in subsidies from the EU. DB AG were to pay EUR 0.41bn and most extra costs. However, cost overruns were such that DB AG actually paid about a third of the total.

[1] Costs have been converted to USD at 2010 prices, using historic inflation rates and current exchange rates, to allow comparison between projects.

TIERGARTEN TUNNEL, BERLIN, GERMANY

OVERVIEW

LOCATION: BERLIN, GERMANY
SCOPE: INTRA-URBAN
TRANSPORT MODE: ROAD/RAIL
PRINCIPAL CONSTRUCTION: TUNNEL
NEW LINK: YES

PRINCIPAL OBJECTIVES

LOCAL/REGIONAL TRANSPORT LINK
INCREASED CAPACITY
TRAVEL TIME SAVINGS
RAILWAY MODERNISATION
CITY CENTRE REDEVELOPMENT
PART OF EU TEN-T NETWORK

PRINCIPAL STAKEHOLDERS

CLIENT/FUNDERS: NATIONAL GOVT/CITY GOVT/ DEUTSCHE BAHN AG
'PLANNING TEAM': EMCH + BERGER INGENIEURE UND PLANER, SCHÜßLER-PLAN INGENIEURBERATUNG, DE-CONSULT

PLANNING AND IMPLEMENTATION

PLANNING START DATE: 07/1992
CONSTRUCTION START DATE: 12/1995
OPERATION START DATE: 05/2006
MONTHS IN PLANNING: 41
MONTHS IN CONSTRUCTION: 125
PROJECT COMPLETED: 48 MONTHS BEHIND SCHEDULE

COSTS (IN 2010 USD)

PREDICTED COST: 9.73BN (RAIL)
ACTUAL COST: 9.04BN (RAIL)

PROJECT COMPLETED:
7% UNDER BUDGET
FUNDING: 100% PUBLIC

INFRASTRUCTURE QUANTITIES:

LENGTH: 6.4KM (TOTAL)
LENGTH: 2.9KM (ROAD)
LENGTH: 3.5KM (RAIL)
COST PER KM (2010 USD): 2.58BN (RAIL)

PATRONAGE

FORECAST TRAFFIC:
251 TRAINS PER DAY (1992 FOR 2010)
60,000 VPD (1994) – 50,000 VPD (2006)
ACTUAL TRAFFIC:
288 TRAINS PER DAY (2007)
44,000 VPD (2007)

INTRODUCTION

The Tiergarten Tunnel provides a road and rail link through central Berlin. The road is part of a federal long distance road and the rail link is part of the EU TEN-T Network, connecting long distance lines via the new *Hauptbahnhof* (Central Station).

The project originally included a city railway line (still in planning) and the U55 metro line (which opened in 2009). It was conceived in response to the reunification of Germany and the choice of Berlin as capital city, and is associated with subsequent redevelopment of city centre sites around the *Hauptbahnhof* and Potsdamer Platz.

BACKGROUND

The main objective of the project was to improve the city's transport infrastructure to cope with expected increases in traffic volumes, and to integrate the railway into the national and European network. For the city government, it also provided an opportunity to reduce traffic and improve the urban environment in the city centre. Deutsche Bahn aimed to improve journey times and reliability.

Reflecting Berlin's new status as the German capital, the city government and Deutsche Reisebahn (the East German rail provider, later absorbed into Deutsche Bahn AG (DB AG)) were asked by the transport ministry to submit a joint plan for transport facilities in the central area. A team representing all three bodies was set up to develop the plan. The plan is based around a 'mushroom railway' concept in which services converge at the *Hauptbahnhof*.

The federal railway authority, *Eisenbahn-Bundesamt* (EBA), was made responsible for planning approval for the entire project, a controversial decision intended to ensure the different elements were integrated. However, the city rail and metro lines were subsequently postponed due to funding constraints.

Public consultation was a feature of both early land use plans and the formal planning approval procedure. However, the project was subject to substantial public opposition: an alliance of 50 protest groups, concerned about the general approach to transport planning and adverse environmental impacts, appealed to the Federal Administrative Court. Its appeal was dismissed for formal reasons.

TIERGARTEN TUNNEL, BERLIN, GERMANY

TIMELINE

CONTEXT: 1990: REUNIFICATION OF GERMANY

CONTEXT: 1991: BERLIN *HAUPTBAHNHOF* INCLUDED IN LIST OF GERMAN UNITY TRANSPORT PROJECTS

CONTEXT: 1991: BERLIN BECOMES CAPITAL CITY

CONCEPTION: 1992 (JUL): FEDERAL TRANSPORT INFRASTRUCTURE PLAN: GOVERNMENT ASKS CITY GOVERNMENT AND DEUTSCHE REISEBAHN TO SUBMIT JOINT TRANSPORT PLAN

CONTROVERSY: 1992: CONSULTATION ON LAND USE PLAN: 1,300 OBJECTIONS TO ROAD TUNNEL

INCEPTION: 1993: JOINT PLANNING TEAM SET UP

DELAY: 1993: FUNDING SHORTAGE: CITY GOVERNMENT POSTPONES CITY RAILWAY LINE

CONTROVERSY: 1993: ALLIANCE OF PROTEST GROUPS, ANTI-TUNNEL GMBH, FORMED: 19,000 OBJECTIONS TO TRAFFIC PLANS

INCEPTION: 1994: EBA SET UP, MADE RESPONSIBLE FOR PLAN APPROVALS

CONTROVERSY: 1994: ANTI-TUNNEL GMBH ISSUE STATEMENT

INCEPTION: 1995: PLAN APPROVAL DECISION

CONSTRUCTION: 1995 (DEC): CONSTRUCTION STARTS (ROAD AND RAIL TUNNELS)

CONTROVERSY: 1996: ANTI-TUNNEL GMBH LEGAL ACTION DISMISSED

CONSTRUCTION: 1996: SECTION OF RIVERBED DIVERTED

DELAY: 1997: SECTION OF TUNNEL FLOODS

INCEPTION: 1997: FEDERAL GOVERNMENT & DB AG AGREE FUNDING FOR RAIL TUNNEL

INCEPTION: 1998: EU PROVIDES EUR 0.075BN FOR RAIL TUNNEL

CONSTRUCTION: 2000: CONSTRUCTION STARTS (RAILWAY FLYOVER)

DELIVERY: 2002: FORECAST OPENING (ROAD AND RAIL TUNNELS)

INCEPTION: 2005: CITY GOVERNMENT AGREES TO FUND CITY RAIL LINE

DELIVERY: 2006 (MAY): ROAD AND RAIL TUNNELS OPENED

DELIVERY: 2009: FIRST SECTION OF U55 METRO LINE OPENS

CHARACTERISTICS

The cost of the *Knoten Berlin* section ('transport node Berlin') was estimated at EUR 5.113bn in 1991 (USD 9.73bn at 2010 prices)[i]. The final cost of the *Knoten Berlin* was EUR 6.33bn in 2006 (slightly lower when adjusted for inflation, USD 9.04bn at 2009 prices).

This figure is believed to represent the majority of the costs, but excludes the road tunnel, for which estimated costs are not available (the final cost was EUR 0.39bn in 2006). It includes the north-south railway connection (a final cost of EUR 3.1bn in 2006, against an estimate of EUR 2bn in 1995).

Although the inter-agency planning team was responsible for co-ordinating the project as a whole, the city government oversaw the construction of the road tunnel and DB AG the rail connection and stations. There was no main contractor, with separate contracts let for specific parts of the project. In total, 43 contractors worked on the rail project, 27 on the road. The road and rail tunnels were both built in five sections.

TIMELINE ISSUES

The relatively short inception phase reflects the mood of political and economic optimism surrounding Berlin and its potential development at the time. However, funding constraints delayed progress on the city rail and metro lines for many years.

The project was technically very complex, involving a range of tunnelling methods, some used under urban conditions for the first time. Diversion of the Spree River bed and groundwater monitoring was required because of high groundwater levels, and one section of tunnel flooded, causing further delays.

FUNDING

Federal government funding for a rail connection was committed in the 1992 Federal Transport Infrastructure Plan and guaranteed by a law obliging the government to finance the expansion of the rail network. In 1997, the federal government agreed to provide EUR 1.7bn and DB AG provided EUR 0.5bn from its own resources. In 1998, the EU agreed a grant of EUR 0.075bn for the rail tunnel.

The financing of the road tunnel, city rail and metro links was shared by the federal and city governments.

[i] Costs have been converted to USD at 2010 prices, using historic inflation rates and current exchange rates, to allow comparison between projects.

BUNDESAUTOBAHN 20, BALTIC SEA COAST, GERMANY

OVERVIEW

LOCATION: SCHLESWIG-HOLSTEIN - BRANDENBURG, GERMANY
SCOPE: INTERURBAN
TRANSPORT MODE: ROAD
PRINCIPAL CONSTRUCTION: GRADE
NEW LINK: YES

PRINCIPAL OBJECTIVES

REGIONAL ECONOMIC DEVELOPMENT
REGIONAL TRANSPORT LINK
TRANS-EUROPEAN ROAD NETWORK
LOCAL TRANSPORT LINK
CONGESTION RELIEF

PRINCIPAL STAKEHOLDERS

DESIGN & CONSTRUCTION: FEDERAL ROAD AGENCY
FUNDING: NATIONAL GOVERNMENT
PLANNING APPROVAL: BRANDENBURG, MECKLENBURG-WESTERN POMMERANIA & SCHLESWIG-HOLSTEIN

PLANNING AND IMPLEMENTATION

PLANNING START DATE: 03/1991
CONSTRUCTION START DATE: 12/1992
OPERATION START DATE: 12/2005
MONTHS IN PLANNING: 21
MONTHS IN CONSTRUCTION: 156
PROJECT COMPLETED: ON SCHEDULE

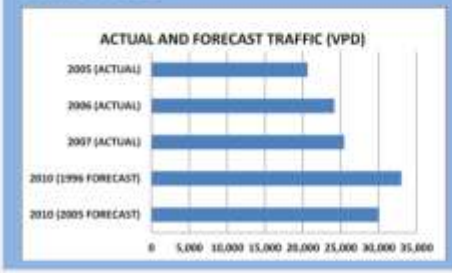
COST (IN 2010 USD)

PREDICTED COST: USD 3.10BN
ACTUAL COST: USD 2.74BN
PROJECT COMPLETED: 11% UNDER BUDGET
FUNDING: 100% PUBLIC

INFRASTRUCTURE QUANTITIES

LENGTH: 323 KM
NUMBER OF BRIDGES / VIADUCTS: 105
COMBINED LENGTH OF FIVE LONGEST VIADUCTS: 3.9KM
COST PER KM (2010 USD): 0.008BN

PATRONAGE



INTRODUCTION

The Bundesautobahn 20 (A20) is a 323km dual two-lane motorway linking the hinterland of the Baltic Sea coast to the western German and European motorway network, completed in 2005.

It terminates at the A1 motorway in the west and at the A11 motorway in the east, with three major junctions providing connections to three cities, two other motorways and a new highway. A further connection to Hamburg in the west is planned.

BACKGROUND

The A20 is one of a programme of 17 post-Reunification German Unity Transport Projects (*Verkehrsprojekte Deutsche Einheit, VDE*), the objectives of which include improving transport infrastructure in the new Federal states and encouraging economic development by linking them to centres in the old states. Its specific objectives include improving access to ports, the coast and Mecklenburg-Western Pommerania, and relieving congestion locally.

Approval of this and the other *VDE* projects was by the Federal Government in an 'enactment of the status of acuteness' (*vordringlicher Bedarf*) in 1991. The three states traversed (Brandenburg, Mecklenburg-Western Pommerania and Schleswig-Holstein) conducted regional planning procedures, involving detailed route selection within their region (taking account of specific land use objectives and local impacts), environmental impact assessments and traffic load estimates. The route was then ratified by Federal law.

The road was intended to be built and opened in stages, to provide connections in specific areas at an early stage, and was split into 26 sections for detailed plan approval procedures (which also included

TIMELINE

CONTEXT: 1990: REUNIFICATION OF GERMANY

INCEPTION: 1991: *VORDRINGLICHER BEDARF* FOR *VDE* PROJECTS AND ACT OF THE ACCELERATION OF TRANSPORT AND INFRASTRUCTURE PLANNING (*VERKPGB)*

INCEPTION: 1991: PLANNING PROCESS BEGINS IN SCHLESWIG-HOLSTEIN, WITH SUPPORT OF REGIONAL ROAD AGENCY

INCEPTION: 1992: *VDE* PROJECTS INCLUDED IN GERMAN FEDERAL TRANSPORT PLAN. *DEGES* TAKES OVER PROJECT

CONSTRUCTION: 1992 (DEC): CONSTRUCTION STARTS AT WISMAR

INCEPTION: 1992: *DEGES* RESPONSIBLE FOR MECKLENBURG-WESTERN POMMERANIA AND BRANDENBURG SECTIONS

INCEPTION: 1994: END OF REGIONAL PLANNING PROCEDURE IN MECKLENBURG-WESTERN POMMERANIA. ROUTE FINALISED (PART)

INCEPTION: 1995: END OF REGIONAL PLANNING PROCEDURE IN BRANDENBURG. ROUTE FINALISED (PART)

CONSTRUCTION: 1995 (DEC): CONSTRUCTION STARTS IN WESTERN POMMERANIA

DELIVERY: 1997: FIRST SECTION OPENS (GREVESMÜHLEN-WISMAR)

CONSTRUCTION: 1997: CONSTRUCTION STARTS (VIADUCT WARNOW)

CONSTRUCTION: 1998: CONSTRUCTION STARTS (FINAL SECTIONS)

CONSTRUCTION: 2000: CONSTRUCTION COMPLETE (VIADUCT WARNOW)

DELIVERY: 2000: SCHÖNBERG - ROSTOCK SECTION (92KM) OPENED

DELIVERY: 2001: PASEWALK-NORD – KREUZ UCKERMARK & LÜBECK - GENIN SECTIONS (31KM & 4.8KM) OPENED

DELIVERY: 2002-2004: THREE MORE SECTIONS OPENED

DELIVERY: 2005 (DEC): REMAINING SECTIONS OPENED. OPENING CEREMONY FOR COMPLETE MOTORWAY

local public consultation). Environmental groups criticised the choice of route through a protected area, but their claims were dismissed. Environmental compensation areas of about 5,600 hectares were provided (compared to about 2,000 hectares used for the actual motorway).

CHARACTERISTICS

The cost of the project was estimated at EUR 1.63bn in 1991 (USD 3.10bn at 2010 prices)[i]. The final project cost was EUR 1.89bn (USD 2.74bn at 2010 prices) in 2005.

The Federal/state road agency, *DEGES*, undertook many planning tasks that were traditionally the responsibility of regional planning authorities, and was also responsible for design and construction of the project.

TIMELINE ISSUES

DEGES' involvement in the planning approvals procedure reduced the time involved in this stage considerably, although it also resulted in some complaints that public consultation had been curtailed.

The 1991 Act of the Acceleration of Transport Infrastructure Planning (*VerkPBG*) was intended to ensure efficient planning and approval timelines, specifically by: reducing the time limits for action by public authorities; designating the Federal Administrative Court as the first and last level of jurisdiction; allowing for the immediate implementation of plan-approval orders; and allowing the instruction of representatives on behalf of unknown landowners.

FUNDING

As with all German motorways, the A20 is owned by the Federal government and operated by the states. Funding was provided primarily by the Federal government (to a maximum of EUR 1.9bn), with EUR 0.026bn provided by the European Regional Development Fund.

There is no revenue other than from leases of service stations and the toll on heavy goods vehicles charged throughout Germany (used to fund trunk road improvements). However, in 1996, DEGES estimated the positive regional effects of the road to be in the region of EUR 0.11bn per year.

[i] Costs have been converted to USD at 2010 prices, using historic inflation rates and current exchange rates, to allow comparison between projects.

3.2 Germany: 4 tests report

Report not submitted by German Team

3.3 Germany: Country synthesis report

Report not submitted by German Team

4. Country findings: Greece

Rion-Antirion Bridge Gulf of Corinth

Athens Metro

Attiki Odos Athens

4.1 Greece: The project profiles

Project Profiles were prepared by the Country Partner[4] for each of the study projects, to provide a consolidated source of secondary information to support all phases of data collection, analysis and synthesis. The profiles covered such matters as: project cost, duration and quality information; principle and secondary project objectives; key project stakeholders; sources of finance; key events and processes. (See also Volume 1, Section 3.4).

The full Project Profiles can be accessed via the following hyperlinks:

Rion-Antirion Bridge
http://www.omegacentre.bartlett.ucl.ac.uk/studies/cases/pdf/GREECE_RIONANTIRION_PROFILE_230511.pdf

Athens Metro
http://www.omegacentre.bartlett.ucl.ac.uk/studies/cases/pdf/GREECE_ATHENSMETRO_PROFILE_130111.pdf

Attiki Odos: Athens
http://www.omegacentre.bartlett.ucl.ac.uk/studies/cases/pdf/GREECE_ATTIKI_ODOS_PROFILE_180711.pdf

Summaries of the Project Profiles are presented on the following pages.

[4] In Greece, the Country Partner was the Department of Urban and Regional Development, University of Thessaly - directed by **Prof. Pantelis Skayannis.**

RION-ANTIRION BRIDGE (HARILAOS TRIKOUPIS BRIDGE), GULF OF CORINTH, GREECE

OVERVIEW

LOCATION: GULF OF CORINTH, GREECE
SCOPE: INTER-URBAN
TRANSPORT MODE: ROAD
PRINCIPAL CONSTRUCTION: BRIDGE
NEW LINK: YES

PRINCIPAL OBJECTIVES

LOCAL & REGIONAL TRANSPORT LINK
REDUCE TRAVEL TIMES
PART OF EU TEN-T NETWORK
REGIONAL ECONOMIC DEVELOPMENT
CONGESTION & POLLUTION RELIEF

PRINCIPAL STAKEHOLDERS

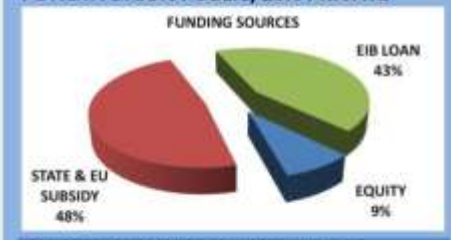
PROMOTER: GREEK STATE
FINANCIER: EU/EIB/STATE
GUARANTORS: BANKS OF TOKYO-MITSUBISHI & AMERICA ETC
CONCESSIONAIRE: GEFYRA SA

PLANNING AND IMPLEMENTATION

APPROX. PLANNING START DATE: 1986
CONSTRUCTION START DATE: 1998
OPERATION START DATE: 08/2004
MONTHS IN PLANNING: 144
MONTHS IN CONSTRUCTION: 74
PROJECT COMPLETED: FIVE MONTHS AHEAD OF SCHEDULE

COSTS (IN 2010 USD)

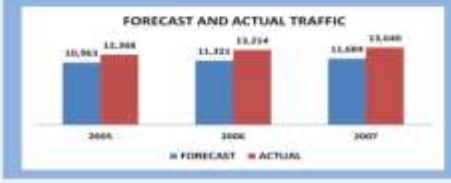
PREDICTED COST: 1.50N
ACTUAL COST: 1.31BN
PROJECT COMPLETED:
13% UNDER BUDGET
FUNDING: 90% PUBLIC/10% PRIVATE

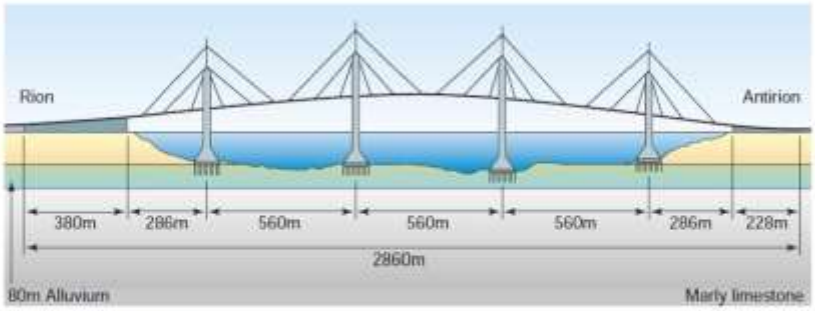


INFRASTRUCTURE QUANTITIES

LENGTH (TOTAL): 2.86KM
LENGTH (CABLE-STAYED): 2.25KM
COST PER KM (2010 USD): 0.46BN

PATRONAGE





INTRODUCTION

The Rion-Antirion Bridge is the longest multi-span cable-stayed bridge in the world. It was designed and built to cope with exceptionally difficult physical conditions in the straits between Rion and Antirion, including high water depths, strong winds, seismic activity and weak soil. It opened in 2004 and was part of the Olympic Torch route for the 2004 Games.

The bridge crosses the Gulf of Corinth near to the port of Patras, links two major national road axes, and is part of the EU TEN-T priority network of transport infrastructure.

BACKGROUND

The main objectives of the project were: to provide an alternative to the ferry boat service between Rion and Antirion, reducing the cost and time of crossing and so encouraging economic and cultural development in the region; to enhance road connections to Western Europe; and to form a basis for local regeneration plans.

The need for a fixed link across the Gulf has been recognised since 1889, when Prime Minister Harilaos Trikoupis proposed a rail link. In 1980 the Greek State invited tenders for the construction of a road bridge but the project stalled due to a lack of interest from the construction industry; a second attempt in 1987 was cancelled as none of the bidding consortia submitted acceptable bids. The third call for tenders in 1991 specified a privately financed solution funded by road tolls. Of seven consortia, Gefyra was the only one to submit a bid that could be considered, and this later led to legal disputes.

The EU was also influential in the evolution of the project, designating the bridge as part of the priority network, promoting the use of private finance, and providing use of the Structural Funds. A 1992 environmental impact assessment by the University of Patras was issued for local public consultation. The project went ahead despite appeals to the Supreme Administrative Court because the it was deemed to be of national importance and so the contract was ratified by law. This has caused debates in the juridicial community.

RION-ANTIRION BRIDGE (HARILAOS TRIKOUPIS BRIDGE), GULF OF CORINTH, GREECE

TIMELINE

- CONCEPTION: 1964: GEOTECHNICAL SURVEYS
- CONCEPTION: 1974-77: EXPERT CONFERENCES
- CONCEPTION: 1980: INTERNATIONAL CALL FOR PROPOSALS BUT NO INTEREST FROM CONSTRUCTION COMPANIES
- CONTEXT: 1981-85: CENTRE-LEFT GOVT, ANTI-MEGA PROJECT PERIOD
- PLANNING: 1986/87: EFPALINOS/RPT HIRED AS TECHNICAL ADVISOR, CALL FOR PROPOSALS
- PLANNING: 1988: FIVE CONSORTIA SUBMIT PROPOSALS, THREE ASKED TO CONTINUE
- CONTEXT: 1989: POLITICAL UNREST DELAYS GOVT DECISION ON PPP
- CONTEXT: 1990: PORT TRAFFIC INCREASING AS YUGOSLAV WARS CUT OFF LAND ROUTES
- PLANNING: 1992: ENVIRONMENTAL IMPACT ASSESSMENT LEADS TO APPEALS TO SAC
- PLANNING: 1993: NEW TENDER PROCESS LAUNCHED – GEFYRA PREFERRED BIDDER
- CONCEPTION: 1994: BRIDGE IDENTIFIED AS PART OF EC TEN-T PRIORITY NETWORK
- DELAY: 1995: EC EXAMINES LAWFULNESS OF GEFYRA'S TENDER FOLLOWING APPEALS FROM COMPETITORS
- PLANNING: 1996: CONCESSION CONTRACT SIGNED WITH GEFYRA & RATIFIED BY PARLIAMENT, EIB APPROVES LOANS
- PLANNING: 1997: GEFYRA & EIB SIGN LOAN AGREEMENT
- CONSTRUCTION: 1998: PRE-CONSTRUCTION
- CONSTRUCTION: 2000 (SEPT): CONSTRUCTION STARTS
- CONSTRUCTION: 2001: FIRST FOUNDATION COMPLETED
- CONSTRUCTION: 2004 (AUG): CONSTRUCTION COMPLETED
- DELIVERY: 2004 (AUG): OLYMPIC FLAME PASSES OVER BRIDGE
- DELIVERY: 2004: BRIDGE OPENED TO TRAFFIC
- ACCIDENT: CABLE CATCHES FIRE, BRIDGE CLOSED FOR A WEEK, EXPERT INVESTIGATION BUT NO LEGAL MEASURES
- DELIVERY: 2039: END OF CONCESSION

CHARACTERISTICS

The cost was estimated at ECU 0.69bn in 1996 (USD 1.50bn at 2010 prices)[1]. The final project cost was EUR 0.8bn (slightly lower when adjusted for inflation, at USD 1.31bn in 2010 prices) including supervisors' and checkers' fees, operating and financial costs.

The State signed a DBFO concession contract with Gefyra SA in 1996 for 42 years. Gefyra was formed by the French firm GTM (later acquired by Vinci Concessions), with a 57% share, and three smaller Greek firms. It consists of a construction joint venture, Kinopraxia Gefyra, and an operator, Gefyra Litourgia. Construction costs accounted for 83% of the total, based on a fixed lump sum contract and additional works costing about 6-7%, and Kinopraxia Gefyra also received bonuses from the State for delivering the bridge in time for the 2004 Olympics, almost five months ahead of schedule.

The seven year construction period included two years for preparatory works and final design, and five years for construction. The site presented challenging physical conditions including deep water and weak soil, and the project pioneered the use of a custom-made tension-leg barge to perform marine works.

TIMELINE ISSUES

During the long gestation period of the project, delays were caused by the initial lack of interest from construction companies and political events. Appeals to the EC by competitors caused a further delay before contracts were signed.

FUNDING

The project was funded mainly from public sector sources: State and EU subsidies (48%) and European Investment Bank loans (43%). The concessionaire provided 9% equity funding. As the EIB was unwilling to accept construction risk, the loans were guaranteed during construction by a consortium of 31 banks led by the Banks of Tokyo-Mitsubishi and America. The concession contract can be terminated early if Gefyra achieves a predetermined return on its equity.

A 1992 study by Efpalinos /RPT predicted traffic volumes of 10,612 vehicles per day by 2005, increasing by over 3% per year. Actual traffic volumes have been 12-17% higher than forecast.

[1] The ECU (European Currency Unit), 1979-99, is assumed to be equivalent to the EUR for conversion purposes. Costs have been converted to USD at 2010 prices, using historic inflation rates and current exchange rates, to allow comparison between projects.

ATTIKO METRO (ATHENS METRO BASE PROJECT), ATTIKI, GREECE

OVERVIEW

LOCATION: ATTIKI REGION, GREECE
SCOPE: INTRA-URBAN
TRANSPORT MODE: METRO
PRINCIPAL CONSTRUCTION: TUNNEL
NEW LINK: YES

PRINCIPAL OBJECTIVES

MODERNISE TRANSPORT NETWORK
TRAVEL TIME SAVINGS
REDUCED POLLUTION
ALTERNATIVE TO CAR TRAVEL
CONGESTION RELIEF
URBAN REGENERATION
ECONOMIC DEVELOPMENT

PRINCIPAL STAKEHOLDERS

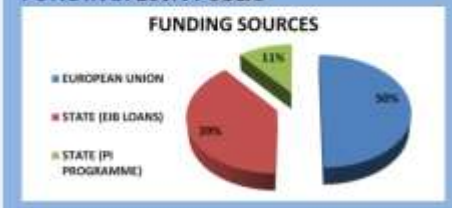
CLIENT/PROJECT MANAGER:
ATTIKO METRO SA
DESIGN/CONSTRUCTION:
OLYMPIAKO METRO
PROJECT CONSULTANT:
BECHTEL INTERNATIONAL
FUNDER: EUROPEAN UNION/EIB

PLANNING AND IMPLEMENTATION

PLANNING START DATE: 03/1985
CONSTRUCTION START DATE: 11/1992
OPERATION START DATE:
01/2000; 11/2000; 04/2003
MONTHS IN PLANNING: 92
MONTHS IN CONSTRUCTION:
86; 96; 125
PROJECT COMPLETED: 28; 38; 65
MONTHS BEHIND SCHEDULE

COSTS (IN 2010 USD)

PREDICTED COST: 3.10BN
ACTUAL COST: 4.61BN
PROJECT COMPLETED:
49% OVER BUDGET
FUNDING: 100% PUBLIC



INFRASTRUCTURE QUANTITIES:

LENGTH: 17.6KM
COST PER KM (2010 USD): 0.26BN

INTRODUCTION

The Athens Metro Base Project is a 17.6km underground rapid transit network in metropolitan Athens. Its two lines serve 20 stations and opened in three stages in 2000 and 2003.

The two lines connect at Syntagma station, and three other stations provide connections to the pre-existing metropolitan railway line.

The Metro network has since been extended five times and is now 51km long with 32 stations. Four further extensions are in progress.

BACKGROUND

The main objective of the project was to modernise the transport network in Athens, providing an alternative to car travel and so reducing congestion, pollution and travel times. It was also intended to act as a catalyst for urban renewal in the vicinity of the stations, and to increase employment opportunities.

At the time of planning the project, although proposals for an underground system had been studied on several occasions, the city's public transport network consisted of one rail line and bus, trolley bus and tram routes. Wilbur Smith & Associates' 1963/4 Smith Study had proved influential, but the *coup d'etat* by a military junta in 1967 impeded progress. In 1971 however, the government invited Smith to submit a new proposal. Feasibility and preparatory studies by a Greek-French consortium, SOFRETU, followed. The project was approved by government in 1978 and included in the general strategic principles of the 1979 Athens Regulatory Plan.

During this time, high levels of car ownership were making urban public transport services unprofitable and causing traffic congestion. More detailed technical studies were began, under the supervision of Athens-Piraeus Electric Railways (ISAP), but a change in government in 1981 led to the suspension of the project until its adoption as a conscious policy in the new Regulatory Plan of 1985.

International protests led to some route modifications to avoid important archaeological sites, and plans to extend the line to Kerameikos were abandoned as a result. The location of stations was, in many cases, influenced by public consultation.

TIMELINE

CONCEPTION: 1963: SMITH STUDY PROPOSES TWO-LINE NETWORK

DELAY: 1967-1974: GREECE RULED BY MILITARY JUNTA

CONCEPTION: 1971: GOVERNMENT INVITES NEW SMITH PROPOSAL

CONCEPTION: 1974: NEW SMITH PROPOSAL ALSO RECOMMENDS TWO-LINE NETWORK

INCEPTION: 1977/78: GOVERNMENT ORDERS FEASIBILITY STUDY OF SMITH PROPOSAL & PRELIMINARY STUDY, APPROVES PROJECT

INCEPTION: 1979: PROJECT INCLUDED IN ATHENS REGULATORY PLAN

DELAY: 1981: NEW GOVERNMENT SUSPENDS PROJECT

INCEPTION: 1985 (MAR): PROJECT ADOPTED IN NEW ATHENS REGULATORY PLAN

INCEPTION: 1987: CONSTRUCTION CONTRACT TENDERED

INCEPTION: 1988: THREE COMPANIES SHORTLISTED AND SUBMIT TENDERS

INCEPTION: 1991: ATTIKO METRO SET UP, CONTRACT AGREED WITH OLYMPIC METRO

CONSTRUCTION: 1992 (NOV): CONSTRUCTION BEGINS

CONSTRUCTION: 1993: TUNNEL BORING MACHINES DELIVERED

CONTROVERSY: 1994: ATTIKO METRO/OLYMPIC METRO CONTRACT RENEGOTIATED TO RESOLVE DELAYS

ACCIDENT: 1994: TUNNEL COLLAPSE CAUSED BY USE OF UNSUITABLE MACHINERY

CONSTRUCTION: 1996: CONSTRUCTION BECOMES VISIBLE WITH ARRIVAL OF TBM2 AT SYNTAGMA SQUARE

CONCEPTION: 1997: GOVERNMENT DEMANDS ROUTE CHANGE TO AVOID KERAMEIKOS CEMETERY

DELIVERY: 2000 (JAN): PARTIAL OPENING (14 STATIONS)

DELIVERY: 2000 (NOV): PARTIAL OPENING (FIVE STATIONS)

DELIVERY: 2003 (APR): PARTIAL OPENING (MONASTIRAKI STATION)

Urban renewal initiatives, increased land values and demand for property development have also occurred around stations.

CHARACTERISTICS

Attiko Metro SA, a government-owned company, was set up in 1991 to act as client and project manager, although Bechtel International also provided some project management services in a consultancy role. The government also signed a lump sum construction contract with Olympic Metro (a consortium of 23 Greek, French and German firms), for EUR 0.83bn (USD 3.10bn at 2010 prices)[i], with a delivery date of September 1997. Construction began in 1992 but, due to client-contractor conflicts and contractual vagueness, the contract was renegotiated in 1994, with additional funding[ii] and a new delivery date of October 1998.

The final project cost was EUR 2.76bn (2003 prices) (equivalent to USD 4.61bn at 2010 prices) including construction costs (EUR 2.1bn), VAT, tax, loan interests and disbursals. The impact of archaeological investigations was partly responsible for cost overruns, in one case requiring a redesign of the route to avoid the Kerameikos cemetery.

Various combinations of tunnelling techniques were used in the construction, including Tunnel Boring Machines, Open Face Shield, NATM and Cut & Cover. Attiko Metro is also developing bus transfer stations and park-and-ride facilities at Metro stations, with the aim of linking the network to remoter areas and discouraging cars from entering the city centre.

TIMELINE ISSUES

Delays were evident soon after the start of construction and were attributed to relations between Attiko Metro and Olympic Metro and differing interpretations of contracts. Extensive archaeological investigations also contributed to delays.

FUNDING

Construction costs were funded by the European Union Community Support Framework (50%) and the Greek State, through its Public Investment Programme (11%) and loans from the European Investment Bank (39%). Attiko Metro SA is responsible for repaying the loans, although they are guaranteed by the State.

[i] Costs have been converted to USD at 2010 prices, using historic inflation rates and current exchange rates, to allow comparison between projects.

[ii] The increase in funding is balanced out by inflation when converting to current prices.

ATTIKI ODOS, ATTIKI, GREECE

OVERVIEW

LOCATION: ATTIKI, GREECE
SCOPE: INTER-URBAN
TRANSPORT MODE: ROAD
PRINCIPAL CONSTRUCTION: AT GRADE
NEW LINK: YES

PRINCIPAL OBJECTIVES

LOCAL TRANSPORT LINK
CONGESTION RELIEF
PART OF EU TEN-T NETWORK
ACCESSIBILITY
REGIONAL DEVELOPMENT

PRINCIPAL STAKEHOLDERS

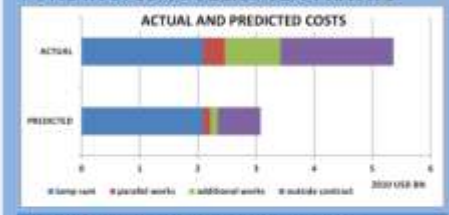
CLIENT: GREEK STATE
CONCESSIONAIRE: ATTIKI ODOS
MAIN CONTRACTOR: ATTIKI ODOS JV
FUNDERS: EIB/ERDF/GREEK STATE

PLANNING AND IMPLEMENTATION

PLANNING START DATE: 03/1985
CONSTRUCTION START DATE: 06/1997
OPERATION START DATE: 08/2004
MONTHS IN PLANNING: 147
MONTHS IN CONSTRUCTION: 86
PROJECT COMPLETED:
10 MONTHS BEHIND SCHEDULE

COSTS (IN 2010 USD)

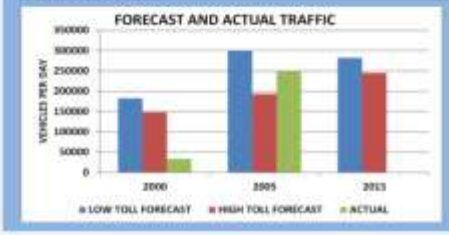
PREDICTED COST: 3.08BN
ACTUAL COST: 5.37BN
PROJECT COMPLETED:
74% OVER BUDGET
FUNDING: 39% PUBLIC : 61% PRIVATE



INFRASTRUCTURE QUANTITIES:

LENGTH: 65KM
NUMBER OF JUNCTIONS: 29
COST PER KM (2010 USD): 0.08BN

PATRONAGE



INTRODUCTION

Attiki Odos, a closed toll motorway 65km in length, was the first public-private partnership project in Greece. It opened in three sections, in 2001, 2003 and 2004.

The road connects with several stations on the Athens Metro and suburban railways lines: an interchange with D.Plakentias station was included in the project. Athens International Airport was built at the same time: the government signed an agreement with its joint venture partner to provide road access to the airport. The New Attika Urban Highways Project, a 55km extension to Attiki Odos using a distance-based electronic toll system, and five other PPP concession projects in Greece, are due to be completed by 2013.

BACKGROUND

The main objectives of the project were to reduce traffic (and hence air and noise pollution) within Athens by providing a new orbital link, to contribute to regional urban development by increasing accessibility to isolated areas and to airport and port facilities, and to provide a link in the EU TEN-T network.

The main section (52km) was first proposed in a 1963 study, with airport access suggested later in the 1960s and the perpendicular Immitos section (13km) in the 1970s. The project received official ratification through inclusion in the 1985 Regulatory Plan of Athens.

Preliminary works on the Immitos section began in 1991, but were stopped following appeals to the Supreme Administrative Court. The Court found the Environmental Impact Assessment was inadequate given the environmental sensitivity of the Immitos area. The American College of Greece appealed successfully against expropriation of its property. These events led to a two-year evaluation of alternative routes and extensive redesign of the route.

The restoration and reforestation of several old quarries, to provide areas for leisure and sport, was undertaken as part of the project.

TIMELINE

- CONCEPTION: 1963: ROAD PROPOSED IN STUDY BY WILBUR SMITH & ASSOCIATES
- CONCEPTION: 1973: ROAD PROPOSED IN SECOND STUDY BY WILBUR SMITH & ASSOCIATES
- INCEPTION: 1985: RATIFICATION BY REGULATORY PLAN OF ATHENS
- INCEPTION: 1991: DETAILED DESIGN AND TRAFFIC FORECASTING
- CONSTRUCTION: 1991: PRELIMINARY WORKS BEGIN ON IMMITOS SECTION
- INCEPTION: 1992: PROJECT TENDERED AS DBFOM SCHEME
- INCEPTION: 1993: THREE CONSORTIA PRE-SELECTED
- DELAY: 1993: TENDER CANCELLED, PRELIMINARY WORKS AT IMMITOS STOPPED DUE TO INADEQUATE EIA
- INCEPTION: 1995: ATTIKI ODOS WINS CONCESSION CONTRACT. FINAL EIA RATIFIED
- INCEPTION: 1996: CONCESSION CONTRACT SIGNED AND RATIFIED
- CONCEPTION: 1996: PART OF ROUTE INCLUDED IN TEN-T NETWORK
- INCEPTION: 1997: ATTIKI ODOS SIGNS LENDING AGREEMENT WITH EIB
- CONSTRUCTION: 1997: START OF PREPARATORY WORKS
- INCEPTION: 1998: COMMERCIAL BANKS AND STATE SIGN LOAN GUARANTEE AGREEMENT.
- INCEPTION: 1999: CONCESSION CONTRACT AMENDED, AGAIN, TO ALLOW FOR MORE STATE FUNDING
- DELAY: 1999: ROUTE CHANGED FOLLOWING SUCCESSFUL APPEAL
- INCEPTION: 2000: OFFICIAL START OF CONCESSION CONTRACT
- DELIVERY: 2001: AIRPORT SECTON DELIVERED ON TIME
- DELIVERY: 2003: DELIVERY OF FINAL SECTION FORECAST
- DELIVERY: 2004: FINAL SECTION DELIVERED

An estimated 5,000 jobs per year were created during construction, with an additional 1,000 per year during the remaining 18 years of the concession contract and 2,000 through multiplier effects.

CHARACTERISTICS

The cost was estimated at USD 3.08bn (2010 prices[1]) in 1996, of which 8% was for parallel and additional works, and 24% for works outside the contract. These costs, mostly State-funded, escalated in comparison to the main lump sum contract, representing 25% and 36% respectively of the final project cost of USD 5.37bn.

Attiki Odos (a consortium involving most large Greek construction companies) is the concessionaire, with a 23 year concession. The main contractor was a subsidiary company, Attiki Odos JV, working under a design and construct contract. There were 23 principal engineering contracts. The French toll-road operator Transroute International is the only other shareholder in its operations and maintenance subsidiary, with a 20% share.

TIMELINE ISSUES

Several appeals to the Supreme Administrative Court caused delays, and some also resulted in increased costs. The concession agreement was amended in 1998 and 1999 to allow increased state funding for preparatory works so that these could proceed before financial close. However, progress was affected by the need to negotiate various permits with 33 local, municipal and regional authorities representing diverse agendas and often conflicting concerns. The project was delivered in six sections, of which three were ahead of schedule, two behind schedule and one (the link to the Airport) on time.

FUNDING

Attiki Odos' funding is mostly from European Investment Bank (EIB) lending (EUR 0.645bn), with EUR 0.162bn of private equity. However, EIB's policy is not to accept construction risk, so the loan was guaranteed by a consortium of (mainly European) commercial banks during construction. The Bank of Tokyo-Mitsubishi was the inter-creditor agent representing the banks and, with HypoVereinsbank, lead arranger. A grant from the European Regional Development Fund, initially EUR 0.476bn, was later reduced to EUR 0.322bn due to eligibility issues.

[1] Costs have been converted to USD at 2010 prices, using historic inflation rates and current exchange rates, to allow comparison between projects.

4.2 Greece: The 4 tests reports

For each of the projects, the Country Partner prepared the '4 Tests Report' which – as described in Section 1.3 above – examined project achievements according to: (i) objectives (both original and emergent); (ii) sustainability; (iiii) treatment of risk, uncertainty and complexity; (iv) a synthesis of the three tests, focusing on responses to the original research questions and hypotheses, the project winners and losers, and provisional lessons.

The full 4 Tests reports can be accessed via the following hyperlinks:

Rion-Antirion Bridge
CD ROM: OMEGA Partner 4 Tests\Greece 4 Tests.docx

Athens Metro
CD ROM: OMEGA Partner 4 Tests\Greece 4 Tests.docx

Attiki Odos: Athens
CD ROM: OMEGA Partner 4 Tests\Greece 4 Tests.docx

The Partner's overall synthesis of the project findings is now presented in the following pages.

4.3 Greece: Synthesis of country findings

4.3.1 Responses to overall research questions and overall research hypotheses (ORQ's and ORH's)

ORQ #1: What constitutes a successful MUTP?

Context-specific responses

The road to the realization of the three projects has been described as so hard and treacherous that achieving their construction and operation is regarded as a success in itself. We consider this to be context-specific since those three projects constituted the first generation of MUTPs to be implemented in Greece (in the last 30 years) in an institutional and economic context that exposed the projects to serious hurdles and risks. Congestion and car-generated pollution, before the realization of Athens Metro and Attiki Odos, were seen as major threats to the quality of life in Athens. The city was in a kind of imperative need for projects that would alleviate congestion from the centre. These two projects' success is judged through those lenses.

Apart from the above basic consideration, the quality in construction and particularly operation arises as a dominant criterion of success along with attractiveness to users and the fulfilment of users' needs. Success is judged by the number of people that use the infrastructure and the convenience they feel it provides them. The cost overruns or the problematic processes (that projects went through in order to be implemented) are all forgotten in the course of time, and projects are regarded as successful when of good quality and offering convenience to a great number of users.

Particularly, for the two PPP concession projects (Attiki Odos and Rion–Antirion Bridge), we find that return on equity for the sponsors and the project's economic viability also appear as important success criteria. Sustainability and treatment of RUC are not explicitly related to

success. However, the degree of integration of the projects into wider, more comprehensive and strategic plans appears as a success criterion. The latter can be recognized to be specific to context since the practice of planning in Greece is generally perceived to be very problematic as both a process and an outcome.

Generic responses

In any context, what seems rational and, also discussed by the Greek projects' stakeholders, is that a successful project is one that has fulfilled its predefined objectives; also, however, that it is rather unrealistic to expect 100% success of all targets set in the frame of a complex MUTP.

Apart from that, generic responses include those that link success with holistic criteria such as the existence of good planning and programming, the project's contribution to social and economic development, and the social benefit for the wider society with minimum environmental impacts. Certainly, we have to add all those responses that highlight the traditional criteria of travel-time savings and budget/delivery-time economies but also refer again to the set of context–specific responses that ought not to be excluded from the current discussion.

ORQ #2: How well has risk, uncertainty and complexity (RUC) been treated in the planning, appraisal and evaluation of the projects?

Context–specific responses

Athens Metro and Attiki Odos are overall viewed by respondents as not successful in their treatment of RUC whilst the Rion–Antirion Bridge is viewed as rather successful. However, there are common contextual aspects of planning, appraisal and evaluation that seem to have affected RUC treatment in all three projects.

The limited competence of the state institutions to adequately treat RUC appears as a dominant negative factor. This lack of competence is attributed to the lack of experience and capability of the public sector to cope with large and complex projects of this kind, and moreover to arrange PPPs with the private sector. However, it is also the historically established modus operandi and decision-making practice of the public sector that remained centralised, politicised and lacking of transparent and constructive stakeholders' involvement. It may also be added that archaeology is a common contextual RUC source (not related to Rion–Antirion Bridge however), together with the lack of wider planning in the spatial and temporal dimension. Another common conclusion is that there is a substantial RUC element that can be avoided if projects are studied thoroughly.

The knowledge that could enhance the treatment of RUC could be acquired early enough if the major RUC challenges were well known before the projects' initiation (difficulties in tendering, contracting, PPP structuring, financing, inadequate EIAs, long and costly expropriation procedures, poorly appraised soil and archaeology conditions, etc) but those challenges were not always adequately studied to allow the appropriate measures to be pro-actively taken. Such challenges were left to be treated at the time when they were acutely affecting the projects. As a final remark, we need to stress that the Rion–Antirion Bridge, in contrast to the other two projects, had some distinctive characteristics that made the treatment of RUC more successful in the Greek context, for example:

- the main element of RUC (technical/construction) was managed by an experienced agent (contractor);

- the project's service was simple (not many landed interests, not many stations/interchanges, it's progress was not very contingent to the efficiency and co-ordination of the public sector).

Generic responses

MUTPs are, very commonly, treated in a regime of exceptionality and uniqueness. This is apparent in Greek projects where their main contracts (either concession ones or Design-Build) were ratified as laws of the state, their EIA terms and other project related issues were also incorporated into laws, they were linked to an exceptionally important event as the Olympic Games and exceptionally large funds were allocated to them. These "exceptionality" approaches were largely guided by a RUC management rationale of the project promoters (primarily the state) who wanted to avoid risks deriving from "harmful" forces against the projects (legal etc.) and generally various events that could delay or even halt the projects. Reality, however, seems to prove that this approach, apart from being autocratic in various instances, treats projects as rigid closed systems and generates new risks that may prove to be higher. In this sense, the projects' resilience has a much higher price.

There is a trade-off between a project's RUC and a project's potential to achieve significant positive outcomes. The integration, for example, of a project into a wider urban development plan increases the societal value of the project, but the project and the plan become more uncertain and complex since their realization will require the resolution of many conflicting interests and probably a re-engineering of the planning, institutional and legal regime covering MUTPs. So, the value that project promoters may intend to attach to the project has an impact on the project's RUC. This thesis stresses the particular importance of self-evaluation of the entities/actors responsible of aspects of RUC management, the ex-post evaluation of a project's RUC treatment as a whole, and the importance of RUC ex-ante appraisal as an initial stage in the RUC management process. There is always some substantial available knowledge about the projects which, if exploited, RUC treatment has more chance of being successful.

ORQ #3: How important is context in making judgments regarding the above questions (on RUC and success)?

Context-specific responses

The perceptions of success and RUC have been two major considerations of this research and play an important role in MUTPs.

It seems that most respondents considered that context was taken into account in making judgements (and decisions) on key planning issues in the case of Athens Metro, such as how to (not) handle the issue of surrounding spaces. On top of this, most thought that decisions were adapted to the Greek context, though it is not obvious whether they refer to context-influenced decisions related to RUC, or success. Some have argued that the dimensions of sustainability were given different importance according to the context – for example, the potential archaeological workload and the potential expropriation costs which were clearly context-related RUC factors that should have been dealt with in a more comprehensive way during planning and appraisal.

In the case of Attiki Odos, all respondents discuss contextual issues when discussing the treatment of RUC and project success and are quite critical as to how much context was practically taken into account when making decisions and important steps for the project. For instance, some consider that context sense-making would require stakeholders to

engage earlier, or that the state had not adequately appraised its own capabilities and competencies.

In the case of the Rion-Antirion Bridge, which has by and large been a technological project, the technology and physical geography context played an important role. While the institutional and financial regimes (including the EC's role) were key enabling contextual factors, meaning that difficulties initially impeding the projects progress were overcome, the respondents have practically argued that each one of these facets of reality represented a RUC challenge and its successful facing was a step towards the success of the whole project.

In Greece, context was to a considerable degree taken into account, but certain aspects of the context were either overestimated or underestimated (potential of engineers, political interventions, reaction of inhabitants to traffic anomalies during construction, etc).

It has to be stressed at this point that RUC is related to context. In the case of Athens Metro there was a risk with archaeology. In the case of Attiki Odos there was risk with environmental issues, and in the case of Rion-Antirion Bridge there was risk with technology and physical geography.

Risk was also influenced by context in the sense that the cultural and social context in Greece – not allowing for findings to be overlooked – made it compulsory to carry out archaeological research, thus delaying the Athens Metro project. Similarly, the sensitisation of the environmental issue in combination with the activities of local communities, bravado of mayors and the pro-environment stance of the High Administrative Court increased complexity in the case of Attiki Odos. With the Rion-Antirion bridge, (historical) delays were due to anticipation of technology improvements. It is possible that under different contextual circumstances (societies more indifferent to archaeological findings, or environmental issues, accelerated technological advances) projects might have taken a somewhat different route.

Similarly, political intervention which is contextual in Greece causes uncertainty; hence risk as in many cases is heavily dependent on particular persons (who may change). The selections and interventions of these persons cannot be predicted, as they are themselves dependent on electioneering and personalized pursuits.

Generic responses

Understanding context is essential in order to really appreciate and face the RUC factors and the notion of success - it is all about cultural (including political), historical (including institutional) realities of societies that pursue the construction of mega projects (not just MUTPs).

Most respondents believe that context is important in decision making judgements regarding RUC and success. This is basically derived from the interpretation of how they responded to questions rather than from their direct answers which were mainly focused on particular projects (context-specific).

Taking context in to account might seem a simple exercise, yet it is a very difficult one, since context is very complex. In fact context is so complex that it is impossible to really take it fully into account. This is a major factor of uncertainty, leading to risk. The objective reality that context represents is composed by a series of parameters and factors that have to be taken into account in various fields of reality. It is therefore useful to deconstruct the contextual world into its facets in order to better understand context. In this sense what is revealed from this research is that important facets of reality constituting the concept of

context are (besides the self-understood but general term of socio-economic concept in any historical conjuncture):

- technology (readiness to face challenges, level of development, adaptability, etc);
- geography (importance of location), institutions, culture and political culture (including conceptions of the state, political behaviour, etc); and
- specific economic and financial regimes.

What is also important is the particular perception of a project and its symbolic value for a society, the psychological and political investment made in a project.

In this sense, though respondents referred to these challenges and were firm that context has to be taken into account in the decision making processes for MUTPs, they were not that sure that in the case of Greek projects everything was taken into account to the desired degree in facing the RUC challenges.

ORH #1: Traditional criteria relating to cost overruns, completion dates, generation of travel time savings for users and rates of returns to investors are inadequate measures of success in the 21st Century as sustainable development concerns become increasingly critical both globally and locally.

It is widely acknowledged by respondents that sustainable development concerns have to be taken into account in project planning and project success evaluation. However, they rarely include the term sustainability in their responses to the initial "what is success" question. Moreover, it seems that either the notion of sustainable development is not entirely clear to the respondents or it is such a flexible catch-all term that gives them room for various interpretations. In this sense, the substantiation of their arguments (and especially the cases/examples they refer to) is different in the various cases.

For example, Attiki Odos is judged by some respondents as sustainable because it has contributed (temporarily) to the lessening of congestion and travel-time economy in central Athens (despite the urban sprawl effect and the overall increase in car-use in the Attiki region). The Athens Metro is regarded as sustainable "by default" as a public transport mean. Rion–Antirion is regarded as sustainable for lessening congestion in the ports of Rion and Antirion. Interviewees tend to stick to an aspect of sustainability, attach special value to it and present it as an achievement (or even measure of success) despite the fact that the project was not planned and implemented on the basis of the sustainability vision.

Regarding the emerging character of sustainability in the hypothesis statement, respondents generally argue that the "sensitivity" to sustainability issues seem now higher than when the projects were planned and implemented. This refers primarily to the civil society's sensitivity, and possibly secondarily to the high level decision-makers'.

Additionally, one could point out that traditional measures of success (cost overruns, completion dates, and generation of travel time savings for users and rates of return to investors) together with the other criteria described in ORQ1 are still considered by a majority of respondents as major criteria of success.

Generic responses

Sustainability cannot be used as a measure of success or driver of planning decisions as long as its notion remains flexible and as long as different stakeholders perceive it very different ways. Interviewees tend to identify an aspect of sustainability, attach special value to it and present it as a post rational achievement (or measure of success) of the project despite the fact that the project was not planned and implemented on the basis of the

sustainability vision. No doubt that sustainable development concerns become increasingly critical both globally and locally. This thesis, however, is affecting MUTPs in rather "soft" ways like through policies related to their operation and has to do with the operator's CSR (Corporate Social Responsibility) image.

ORH #2: The new emerging international and local agenda related to vision(s) of sustainable development is multi-dimensional and goes beyond notions of environmental sustainability, as critical as this may be, in that it also concerns inter-related concepts of economic sustainability, social sustainability and institutional sustainability.

Context-specific responses

Big projects (and MUTPs) in Greece have been designed and implemented as being almost detached from spatial planning. Of course, there is a question whether it is the MUTPs which are out of context, or the spatial and regulatory master plans. In any case, MUTPs are supposed to respond to societal needs. The question is the nature of this response. Is it a response that will last and that will not consume from the future, that will be sustainable and will save recourses for the coming generations or will it only be to satisfy short term needs in the logic that "in the long run we are all dead"? In addition, are the eco-resources the only ones that we should be concerned with? In this research, the responses to these questions were very revealing of the fact that in the Greek context the various dimensions of sustainability did concern the respondents on an individual basis but not all of them, and not the system as a whole. In addition, the respondents were not too familiar with the dimensions of sustainability besides eco-sustainability. If we put dimensions of sustainability in a descending awareness order, the economic dimension would come first, the social second and the institutional third.

In Greece (judging from the three MUTP cases), most perceive economic sustainability as closely related to economic viability, social sustainability as related to quality of life and to the fulfilment of social needs (but very few implied social equity, or the role of MUTPs in society), and institutional sustainability as an effort to maintain a good modus operandi (or to maintain a good quality of personnel in the future and protect the institution from inappropriate political interventions), or as the existence of institutions to effectively produce and enforce development control and implement proper planning. The institutional dimension of sustainability, in particular, is mostly discussed in a very generic and implicit way by pointing out the structural inefficiencies and the lack of capacity of the institutions responsible for planning and governing projects and the limited public participation procedures. However, there was not a comprehensive vision of a learning organisation that could be developed in competencies and that would maintain operational and internal qualities.

In this sense almost all respondents, through an evaluative approach about the project, pointed out major concerns belonging to all four dimensions of sustainability.

Generic responses

The lack of adequate theorisation did not allow the respondents to articulate direct universal and generic responses related to sustainability. Almost none of the respondents made any clear and explicit reference to sustainability as being multi-dimensional or consisting of the above four discrete dimensions.

Interviewees refer to success criteria separately, not always realizing that a major part of them could be grouped under different subcategories of sustainability such as social. Yet

though this could be just a methodological issue not expected to be dealt with by practitioners at this point, it plays a role since a deep understanding of concepts helps in facing the emerging problems. When specifically asked, respondents tended to agree that in today's complex world all four aspects of sustainability are very crucial to observe in the case of MUTPs.

ORH #3: The level of competence in decision-making and planning in today's fast-changing world is best assessed by the adequacy of the treatment of risk, uncertainty and complexity and sensitivity to context – all of which are important demands on Strategic Planning.

Context-specific responses

It is largely acknowledged among respondents that the adequacy of the treatment of RUC and sensitivity to context are crucial for sound decision-making. Moreover, respondents generally agree that the lack of strategic planning negatively challenges the RUC and context treatment. This emerges as a particularly important finding in all three cases, as analysed in their third tests. In all three cases, the main factors that hindered or induced the RUC and context treatment can also be regarded as determinants of competent decision-making in the Greek context. Indicative examples include the practice of public participation and the transparent absorption of feedback from all stakeholders, the strategic approach to planning, the capacity of the institutions that are responsible for planning and the constructive evaluation (ex-post) of projects and plans.

Generic responses

The degree of competence of decision making seems to be determined by the competence of the directly involved institutions / companies / stakeholders, but also by the communication between decision-makers and by the existence (or not) of formal (contractual or institutional) and informal mechanisms that assist the converging to wise decisions at times of changing circumstances and challenges. The existence of one of the two determinants (the competence of actors/entities and their interplay/interaction) cannot guarantee successful RUC and context treatment. However, it is apparent that each determinant reinforces the other. In any case, RUC and context treatment in MUTPs should be a collective task.

What is widely accepted by all respondents is that the involvement of experienced and competent partners in decision making is something that enhances a RUC and context-sensitive decision making approach.

4.3.2 Potential generic and context-specific lessons

4.3.2.1 Sustainable development lessons

Context-specific lessons

Sustainability challenges are multiple yet can be perceived according to major presuppositions of this research as belonging to four general categories: (i) environmental (eco) sustainability, (ii) economic, (iii) social, and (iv) institutional. It has to be stressed that despite the obvious differences between them all four categories are interrelated. Although this is a well-known fact, it could be considered to be a lesson from this research too. Each of the three distinct projects has yielded lessons for each of the four categories/aspects of sustainable development which at the same time constitute major challenges. In this country summary, the aspects of sustainability will be presented on a cross-project basis.

Before summarising by sustainability category, it is vital to point out that most respondents emphasised that good studies, appropriate consultations and participatory processes can to a large extent secure a sustainable result. This is important because of the interrelated nature of many of the desired aspects of project sustainability. This is because sustainable projects are parts of sustainable plans in a context of sustainable institutions.

Additional lessons by sustainability category are as follows:

Environmental (eco) sustainability

Good planning is vital: the lack of clear sustainable vision and strategy is reflected in a comprehensive plan in which land use policies secure a more sustainable result.

Plans should be made before projects. Environmental Impact Assessment of projects should be made properly and ample time should be provided for social actors to scrutinize it. Stakeholders should be consulted beforehand and agreements should be reached before the construction starts.

As MUTPs are spatial chirurgical (surgical) interventions that restructure space, environmental sustainability concerns not only the project per se but the surrounding areas too, and planning and measures for them should be undertaken from the outset

Economic sustainability

The emphasis was put on long term planning which is required and to the fact that projects should be attractive to the private sector (which should be involved from the early stages to save time and resources from the project) in order for investments to take place and secure the economic sustainability of the project. However, it was stressed by many that the involvement of the private sector should not be at the expense of eco-sustainability. Yet, respondents at this point did not put an emphasis on the relation between private sector's involvement and social sustainability, though some commented that the satisfaction of users of projects is more important than revenue per se.

Good appraisal, best "calculation" of RUC (see relevant section) and proper pricing of the services were also considered to be important factors for economic sustainability.

Social sustainability

Social sustainability was not very well known as a term to the respondents, though for some it was a real concern though expressed in different wording. Satisfaction of social needs and respect to the user were more or less common denominators, yet there was little reference to issues such as social equity.

Towards social aspects of projects it was emphasised that the role of the planners is to secure a balance of interests and at the same time sustainable development is crucial.

Good information to the public and reasonable explanations for the details of the project and its progress are important, as well as communication of construction schedules and an aim to reduce problems with citizens.

Projects have positive and negative social impacts. There must be regulations to help the mitigation of negative impacts and to spread the project benefits on an equitable basis.

Institutional sustainability

Institutional sustainability was a tricky concept in this research. This is because, as in the case of social sustainability, respondents were not very familiar with the concept, but also because their references to notions close institutional sustainability were on the verge of its theoretical construct. Lessons as in the previous cases are inseparable from recommendations as a recommendation reflects a lesson learned incorporating the healing method. Some of the most important points made are listed below.

One of the main lessons is that institutional sustainability is not being built after the completion of the project, but it is founded together with it and is being built alongside the physical construction of the project. Institutional sustainability is not just about some new state agency or the perpetuation of the good operation but should be considered as a wider issue.

Keeping this in mind, in order to implement a good plan, institutional capacity is required. Good planning and appraisal (a requirement stressed by all respondents) as well as transparency are necessary and are institutional aspects of projects. To these ends public participation and stakeholder engagement is important to secure sound decisions when facing sustainability challenges. This entails a great effort in informing, educating and sharing with the public and other stakeholders the necessity to participate and engage with the decision making process, the ways that secure a formal and effective participation and engagement, the details of the project itself and its wider spatial impacts. In this context, mechanisms should be established in the frame of the relevant ministries which should be capable of securing the public participation and stakeholders' engagement and the appropriate facing of all sustainability challenges in the context of comprehensive planning. This involves the creation of think-tanks of competent personnel.

Finally, planning should be participatory to secure most efficient treatment of the sustainability challenges, and political interventions for electioneering purposes should be terminated.

Such mechanisms should be learning ones, i.e. have the competencies to reflect on mistakes (e.g. not planning for the environmental aspects from the very initial stages of the project) and incorporate knowledge deriving from the experiences and the effective communication with stakeholders.

A further institutional lesson derived from the Greek experience is that the establishment of intermediate state-owned companies to construct and operate projects, being the legal owners of projects, is a fundamentally wise project governance approach. Yet there should be effective mechanisms to prevent or rationalize the political influence upon the decisions made within them, such as the very simple issue of securing staff efficiency by judging staff on a merit basis.

Generic responses

The difference between context-specific and generic issues of sustainability matters is not easily discernible. The context-specific lessons presented above are easily generalised, while respondents did not feel at ease to respond at both the context-specific and generic/universal levels. In this sense, some of the notions presented above are repeated here in different ways.

A general set of lessons regarding sustainability (all aspects of it) is related to planning. All respondents stress the necessity of good planning, good appraisal and transparency before making decisions for important projects. They also stress that a widely communicated project

has much better chances to be a good project in terms of sustainability. MUTPs are political projects and are confined to a political appraisal where the political gain is the first priority. However, political gain is not always related to the long-term benefit of a country. At the same time, the best possible appraisal and quality of design and construction are vital for economic sustainability (avoidance of future problems). To this end, trust between partners along with keeping a very good control over the contracts of the contractors is very important.

Sustainability should be perceived in a comprehensive way i.e. including social sustainability parameters such as equity, as well as other parameters such as efficiency (relation of resources consumed for the project and the delivered product), in addition to the environmental aspects (e.g. air pollution, noise, ecology, sustainable energy usage).

As implied, social sustainability is closely related to public consultation in planning processes, to securing real information opportunities and to adopting a decent stance towards the public sector vs. the citizens. The voice of the several social actors and stakeholders, if heard and discussed seriously, is for the benefit of the goals of the projects provided the ultimate goal of the project is to be socially useful.

It is important to focus more on the usefulness of a project, and on timely delivery, and not so much on the cost. The ultimate goal of a public transport project is to serve the user on the basis of affordability and social equity. Useful to this end is the respect of the views of specialists, such as transport engineers, who make suggestions regarding the attractiveness of systems (functionality, affordability, credibility, aesthetics, safety, etc).

Social actors and local communities have divergent interests. Often, there is an objective contradiction between local and broader interests. Planners and those responsible for the projects should on the one hand try by consultation and transparent methods to bring a balance and, on the other, scrutinize the reactions of local communities to projects, in order to prevent electioneering practices.

Projects because of their magnitude and visibility establish a psychological relation with the general public based upon feelings such as love, respect, admiration, etc. a fact which should be taken into account in all phases of the development and marketing of projects.
On the institutional sustainability level, it is crucial to secure the placement of projects (after decided and after general political guidelines are given) under the central administration and not under the political influences, so that full transparency is secured, that there is no space for favouritism of any kind.

There should be governance mechanisms to acknowledge and promote project champions/ heroes and to make inspired teams around them widely identifiable, to entrust decision-making power to the critical non-political actors and to protect the critical political ones from intra-polity antagonism.

4.3.2.2 Lessons concerning the treatment of risk, uncertainty and complexity

Context-specific lessons

There is a need for a metropolitan planning authority (in Athens) (or the autonomisation and strengthening of the existing organisation of the Athens master plan) that would engage all stakeholders (municipalities, ministries, civil society, technical chambers etc) in the planning of the city and establish procedures of participatory decision – making. Such a planning authority should have the capacity to plan, rather than outsource all plans/studies/assessments to external practitioners/offices (like it is done now) and, thus, the

capacity to cultivate strategic intelligence over the years. Hiring competent personnel, detached from the ministerial and governmental linkages, and delegating power to them is a prerequisite in order to: de-politicise the critical decisions of short-term reference and the same time re-politicise the long-term decisions according to widely-agreed visions to be implemented by robust strategies. The establishment of such an authority may sound romantic but it is rather unfeasible in a different way to widen the scope and practice of planning so as to successfully incorporate RUC and context concerns.

In Greece, more control (stronger regulation and law enforcement) on spatial development is required. RUC treatment is accomplished through the enforcement of shared plans and regulation of space.

The contractualisation of risks in a PPP deal may prove beneficial for the overall risk management of the project, as long as the parties assuming the risks have adequately assessed them and have done all the needed preparation to be able to efficiently confront them. The relevant context–specific lesson has to do with the fact that the Greek state (as a first-timer in PPPs) had not adequately appraised the risks and complexities that its involvement in a PPP would entail. The state's poor "RUC homework", as illustrated in the Attiki Odos and Rion–Antirion reports, affected very negatively the projects progress and costs.

The complexity of service may challenge the project's success more than the complexity of construction. In projects that have high service complexity (i.e. metros, urban highways etc), there are many agents involved and the institutional and legal context may prove a serious blocking factor to their timely and economical delivery. This seems to be the case in Greece, where the inefficiency of the public sector and the lack of planning capacity has been a central threat to the projects' success. In projects that the service is simple as the Rion-Antirion Bridge, the job of a competent constructor may be expensive, if the construction is complex, but success is not very contingent to the efficiency and co-ordination of the public sector.

There are projects whose method of procurement and financing may play a positive role in risk treatment. A concession type PPP seems a more advisable method for technically complex projects where the project country is in need of a foreign contractor's expertise. On the other hand, in the context of Greece, if the service of the project is complex (urban, multi-hub etc) it is doubtful if a PPP is the advisable procurement method.

Generic lessons

RUC management should be undertaken for strategies and plans, not projects. Otherwise RUC treatment will be always incomplete and ineffective. This is very important especially when we need to manage wider risks related to the impacts of projects on sustainability. It is also because when we do not plan for wider spatial and temporal range, the societal value and even the financial viability of projects may be challenged.

The very long time periods from the projects' first conception until their initiation, increase the risk for poor sense-making of the changing contexts. The context of a) increasing environmental sensitivity, b) increasing environmental threats to projects, c) emerging global financial circumstances, d) emerging underlying factors that formulate the city's form and function, e) the civil society's changing ways of intervening to decisions, and f) the changing rationalities and dominant aspirations regarding society can all be sources of serious risks that tend to be neglected when decisions are made in a closed/centralised manner.

There are many factors and actors in the MUTP planning practice that/who tend to sustain the rationale that MUTPs' exclusive raison d'être is to fulfil any kind of rising transport needs

and to enhance construction activity by adding any kind of concrete structures to space. We consider that this is not a risk-averse and context-aware rationale in the 21st century. A way to combat this rationale is to balance the power of those social actors such with the construction and, banking industries and the narrow–thinking opportunistic politicians. Any attempt, towards achieving this balance, would be rather beneficial.

Projects should turn into learning projects in order for the treatment of RUC and context to be successful. This is fundamental for a "better prevent than cure" approach which is a crucial aspect of decision-making with risk and context in mind.

The cultivation of trust and good faith between partners in a PPP, which is essential to successful RUC and context treatment, requires a long time during which the parties get to know the project in depth, as well as each other's strong and weak aspects and each other's key persons. This is not always the case in PPPs but it is rather much more difficult to happen in MUTPs that are procured on a traditional Design-Build basis.

Key persons are important not only because of their professional and leadership skills but also because they may comprise a communication and cultural conduit between parties. This is extremely important in MUTPs where parties of different cultures and rationalities have to constructively co-operate in order to cope with RUC.

4.4 Conclusion: Greece

This section presented a summary and synthesis of the Greek Country Partner's research on the three case studies of Rion–Antirion Bridge, Athens Metro and Attiki Odos motorway.

A summary profile of each project (with hyperlinks to the full Project Profiles) described the project's history and main characteristics, features, issues and timelines.

The Country Partner's own synthesis of their research findings in relation to the '4 Tests' was then given, presenting findings from the overall country perspective (i.e. combining the three case studies). Hyperlinks to the more detailed '4 Tests Reports' for each project were also given.

The next Section now presents the Netherlands Country Partner's findings from three mega-urban transport projects, while Volume 5 contains detailed analyses and comparisons of all 30 mega-urban transport projects, together with the overall findings and lessons of the research.

5. Country findings: Netherlands

HSL Zuid

Randstadrail

Beneluxlijn

5.1 Netherlands: The project profiles

Project Profiles were prepared by the Country Partner[5] for each of the study projects, to provide a consolidated source of secondary information to support all phases of data collection, analysis and synthesis. The profiles covered such matters as: project cost, duration and quality information; principle and secondary project objectives; key project stakeholders; sources of finance; key events and processes. (See also Volume 1, Section 3.4).

The full Project Profiles can be accessed via the following hyperlinks:

HSL Zuid
http://www.omegacentre.bartlett.ucl.ac.uk/studies/cases/pdf/NETHERLANDS_HSL_ZUID_PROFILE_040311.pdf

Randstadrail
http://www.omegacentre.bartlett.ucl.ac.uk/studies/cases/pdf/NETHERLANDS_RANDSTADRAIL_PROFILE_270611.pdf

Beneluxlijn
http://www.omegacentre.bartlett.ucl.ac.uk/studies/cases/pdf/NETHERLANDS_BENELUXLIJN_PROFILE_070411.pdf

Summaries of the Project Profiles are presented on the following pages.

[5] In the Netherlands, the Country Partner was the Institute for Metropolitan Studies, University of Amsterdam, directed by **Prof. Willem Salet**.

HSL ZUID, AMSTERDAM-ROTTERDAM(-ANTWERP), THE NETHERLANDS(-BELGIUM)

OVERVIEW

LOCATION: AMSTERDAM-ROTTERDAM -ANTWERP
SCOPE: TRANSNATIONAL
TRANSPORT MODE: RAIL
PRINCIPAL CONSTRUCTION: GRADE
NEW LINK: YES

PRINCIPAL OBJECTIVES

NATIONAL/INTERNATIONAL LINK
ALTERNATIVE TO AIR TRAVEL
ECONOMIC DEVELOPMENT

PRINCIPAL STAKEHOLDERS

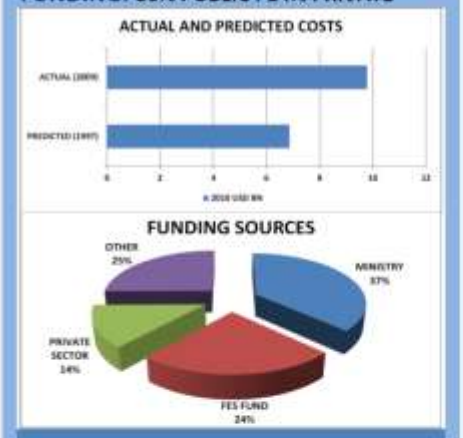
CLIENT: NATIONAL TRANSPORT MINISTRY
FUNDER: NATIONAL GOVERNMENT
MAIN CONTRACTOR: INFRASPEED
OPERATOR: NS HISPEED

PLANNING AND IMPLEMENTATION

APPROX. PLANNING START DATE: 1987
CONSTRUCTION START DATE: 03/2000
OPERATION START DATE: 09/2009
MONTHS IN PLANNING: 153
MONTHS IN CONSTRUCTION: 114
PROJECT COMPLETED:
48 MONTHS BEHIND SCHEDULE

COSTS (IN 2010 USD)

PREDICTED COST: 6.87BN
ACTUAL COST: 9.79BN
PROJECT COMPLETED:
42% OVER BUDGET
FUNDING: 86% PUBLIC : 14% PRIVATE



INFRASTRUCTURE QUANTITIES

LENGTH OF TRACK: 125KM
COST PER KM (2010 USD): 0.078BN

PATRONAGE

FORECAST (1997): 14M PASSENGERS
ACTUAL (2010): 23-24M PASSENGERS

INTRODUCTION

HSL Zuid is a high speed rail line, 125km long, stopping at three stations: Amsterdam Zuid, Amsterdam Schiphol Airport and Rotterdam, before continuing to the Dutch/Belgian border to connect with services to Antwerp, Brussels and Paris. The Hague and Breda are linked to the high speed network by shuttle trains.

Amsterdam Zuid has been the site of major redevelopment and is now a prominent business district. HSL-Zuid has also been a catalyst for the ongoing extensive redevelopment of Amsterdam Central (where the line originally terminated, before Zuid station opened), Rotterdam Central, The Hague Central and Breda stations.

BACKGROUND

The principal objectives of the project were to connect Rotterdam, Schiphol and Amsterdam to the European High Speed Network, to encourage economic development, and to provide an alternative to air travel to European destinations. It was anticipated in the government's 1979 structure scheme and a 1986 feasibility study, although the formal planning process started only in 1987.

The initial proposal was withdrawn as it was felt to be weak, but the revised version already included environmental impact assessments and public consultation from the first. A major concern was the impact on the rural Green Heart area, and other proposals based on adjusting and upgrading the existing infrastructure won widespread support both outside and within government.

To reach agreement with the Belgian government on the route to Antwerp, the environmental impacts of several alternatives were assessed. The preferred Dutch route, although the best environmental option with the highest transport value, traversed the Peerdsbos forest near Antwerp and its viability depended on finding a solution that minimised the impact.

CHARACTERISTICS

HSL Zuid is a dedicated double track infrastructure project, designed for a maximum speed of 300km/hour. The Tunnel Green Heart was one of the first tunnels drilled in the soft Dutch soil: the drilling machine was built specially.

TIMELINE

- CONCEPTION: 1977: AMROBEL STUDY ON HIGH SPEED ROUTE TO BELGIUM
- CONCEPTION: 1979: GOVERNMENT STRUCTURE SCHEME ANTICIPATES HSL
- INCEPTION: 1987: BEGINNING OF PLANNING PROCEDURE TO ESTABLISH HSL
- INCEPTION: 1991: FIRST PROPOSAL SUBMITTED TO PARLIAMENT
- INCEPTION: 1993: CABINET COMMITMENT TO HIGH SPEED LINK WITH EUROPE
- INCEPTION: 1994: SECOND PROPOSAL SUBMITTED
- CONTROVERSY: 1994-96: PUBLIC OPPOSITION TO BUILDING THROUGH GREEN HEART
- CONCEPTION: 1996: GOVERNMENT DECIDES ON TUNNEL UNDER GREEN HEART.
- INCEPTION: 1996: PROPOSAL APPROVED BY PARLIAMENT
- INCEPTION: 1996: AGREEMENT REACHED WITH BELGIAN GOVERNMENT
- INCEPTION: 1997: DECISION TO PROCEED. AGREEMENT WITH BELGIAN GOVERNMENT RATIFIED BY PARLIAMENT
- INCEPTION: 1998: ROUTE FINALISED. TENDER STRATEGY DETERMINED
- CONSTRUCTION: 1999: CONSTRUCTION FORECAST TO START. TENDERING BEGINS
- CONSTRUCTION: 2000: CONSTRUCTION STARTS
- INCEPTION: 2001: CONTRACTS WITH SERVICE AND INFRASTRUCTURE PROVIDERS SIGNED
- CONSTRUCTION: 2004: CONSTRUCTION OF RAIL SYSTEMS BEGINS. TRAINS ORDERED
- CONSTRUCTION: 2005: CIVIL ENGINEERING WORK COMPLETE
- CONSTRUCTION: 2006: CONSTRUCTION OF SOUTHERN SECTION COMPLETE. TESTING OF SYSTEMS BEGINS
- CONSTRUCTION: 2007: CONSTRUCTION COMPLETE
- DELIVERY: 2009: OPERATION STARTS

The transport ministry remained initiator, client and main financier throughout the project, and owns the line. The project team worked under its supervision and included employees of its implementation agency, Rijkswaterstaat, and external consultants. Construction was divided into several contracts, each worth about EUR 0.4bn, awarded to different consortia. The track and signaling systems were developed by Infraspeed (a consortium of Fluor Infrastructure, Siemens Nederland, Koninklijke BAM Groep, Innisfree and HSBC Infrastructure), under a DBFM contract with a requirement that for 25 years the track must be available 99% of the time. This contract runs from 2006 till 2031, with the state paying Infraspeed for availability, depending on whether the 99% target is achieved.

Following privatisation of Dutch railways, HSL Zuid was the first rail project developed with minimal influence from the national rail operator, NS. A public tender was issued for exploitation of the track, won by Hispeed Alliance (a consortium of NS and the national airline, KLM). Since merging with Air-France, KLM has a very strong position in the travel market between Amsterdam and Paris.

TIMELINE ISSUES

The ministry's withdrawal of its first proposal, subsequent public opposition to the route through the Green Heart and disagreements in government prolonged the decision-making process. Negotiations with the Belgian state over the route crossing the border were also problematic and the Dutch state eventually paid financial compensation to Belgium to break the deadlock. The choice of security system also caused delays: the specifications of the standard were confirmed late, which also delayed ordering and supply of trains. The line's opening was subject to a four year delay overall.

FUNDING

Of the EUR 7bn (USD 9.79bn in 2010 prices)[1] total cost, EUR 2.6bn (37%) is from the transport ministry's *SVV*-budget. Slightly over EUR 1.7bn (24%) is from the *FES* fund (based on revenues from gas exports, dedicated to economic development). Private funding amounted to EUR 0.94bn (14%), considered to be a high proportion for a Dutch infrastructure project. However, NS overbid in an effort to keep the train line in Dutch ownership.

The ministry also pays EUR 3bn to Infraspeed for track availability, and the government paid EUR 0.4bn to the Belgian government in compensation over the route.

[1] Costs have been converted to USD at 2010 prices, using historic inflation rates and current exchange rates, to allow comparison between projects.

RANDSTADRAIL, THE HAGUE-ROTTERDAM, NETHERLANDS

OVERVIEW

LOCATION: THE HAGUE-ROTTERDAM, THE NETHERLANDS
SCOPE: INTER-REGIONAL
TRANSPORT MODE: LIGHT RAIL
PRINCIPAL CONSTRUCTION: AT GRADE
NEW LINK: PART

PRINCIPAL OBJECTIVES

ALTERNATIVE TO CAR TRAVEL
TRAVEL TIME SAVINGS
ACCESSIBILITY
REGIONAL DEVELOPMENT

PRINCIPAL STAKEHOLDERS

CLIENTS: HAAGLANDEN/ROTTERDAM CITY REGIONS
MAIN CONTRACTORS: HTM/PRORAIL
SERVICE PROVIDERS: HTM/RET
PRINCIPAL FUNDER: NATIONAL GOVERNMENT

PLANNING AND IMPLEMENTATION

APPROX. PLANNING START DATE: 1995
CONSTRUCTION START DATE: 06/2003
OPERATION START DATE: 10/2007
MONTHS IN PLANNING: 96
MONTHS IN CONSTRUCTION: 52
PROJECT COMPLETED: 12 MONTHS BEHIND SCHEDULE (LINE 4)

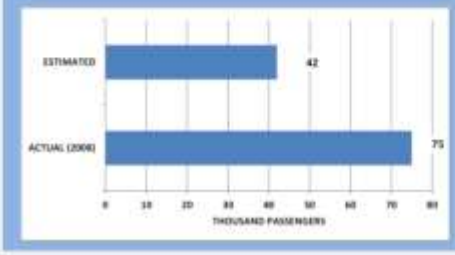
COSTS (IN 2010 USD)

PREDICTED COST: 1.20BN
ACTUAL COST: 1.56BN
PROJECT COMPLETED:
30% OVER BUDGET
FUNDING: 100% PUBLIC

INFRASTRUCTURE QUANTITIES:

LENGTH: 68KM (EXCLUDING BUS LINE)
NUMBER OF STATIONS: 23
NUMBER OF ADDITIONAL STOPS: 48
COST PER KM (2010 USD): 0.023BN

PATRONAGE



INTRODUCTION

A light rail and bus service connecting the centres of The Hague, Rotterdam and the new growth town of Zoetermeer, and their commercial and residential areas, RandstadRail serves one of the most densely populated regions in the world.

RandstadRail includes three light rail lines, used by both tram and metro vehicles, and a dedicated bus route. It opened in stages during 2006 and 2007. It is associated with the *Beatrixkwartier* business district development around Beatrixlaan station, the ongoing redevelopment of The Hague and Rotterdam central stations and city centres, and several new residential neighbourhoods.

BACKGROUND

The origin of the project is rooted in the informal collaboration between local authorities in the Zuidvleugel (southwest of the Randstad) conurbation, principally the Rotterdam and Haaglanden regions. It began with a proposal, published jointly by the two regional transport operators and national rail and bus operators, in 1995. The involvement of the national rail operator provided an opportunity to convert existing underused heavy rail tracks rather than build new infrastructure.

The scope of the project was discussed by local, regional and national operators and governments over the next few years, and an application for funding from the national government's multi-year plan for infrastructure and transport (MIT) was submitted and approved in 2002.

TIMELINE

CONCEPTION: 1989: FIRST PLANS FOR REGIONAL PUBLIC TRANSPORT NETWORK

CONCEPTION: 1995: REGIONAL AND NATIONAL TRANSPORT OPERATORS PROPOSE PROJECT

DELAY: 1996: GOVERNMENT DECIDES REGIONAL PROPOSAL FOR LIGHT RAIL SYSTEM (EUR 1.3-2.7BN) TOO EXPENSIVE

CONCEPTION: 1998: GOVERNMENT RESERVES FUNDING FOR LESS AMBITIOUS PROPOSAL (EUR 0.58BN)

CONCEPTION: 1999: SCOPE EXPANDED, LINKS TO EXISTING NETWORKS PLANNED, COST ESTIMATED AT EUR 0.84BN

CONCEPTION: 2000: MINISTER AGREES TO CONSIDER APPLICATION FOR NATIONAL FUNDING

INCEPTION: 2002: FUNDING APPLICATION SUBMITTED TO NATIONAL GOVERNMENT

CONSTRUCTION: 2002 (DEC): FUNDING APPLICATION APPROVED BY NATIONAL GOVERNMENT, CONSTRUCTION START

INCEPTION: 2002-2004: PUBLIC CONSULTATION FOR SPECIFIC PARTS OF PROJECT

CONSTRUCTION: 2003 (JUN): CONSTRUCTION STARTS (ROTTERDAM)

CONSTRUCTION: 2004: CONSTRUCTION OF ZOO STATION STARTS

CONSTRUCTION: 2005: CONSTRUCTION OF ROTTERDAM CENTRAL METRO STATION STARTS

CONSTRUCTION: 2006: TESTING PERIOD

DELIVERY: 2006: ROTTERDAM HOFPLEIN-NOOTDORP SECTION & LINE 4 OPENED

ACCIDENT/DELAY: 2006: LINE 4 SUSPENDED FOLLOWING SEVERAL DERAILMENTS

DELIVERY: 2007: LINE 3 OPENED (LOOSDUINEN-THE HAGUE SECTION)

DELIVERY: 2007: LINE 4 OPENED (TRAM SECTION: DE UITHOF-THE HAGUE)

DELIVERY: 2007: LINE 4 (ROTTERDAM HOFPLEIN-NOOTDORP SECTION) RE-OPENED. FULL LINE OPEN

As heavy rail, tram and metro are all subject to different legislative requirements and regulatory frameworks, planning the project was highly complex from a technical perspective. However, as it primarily involved the transformation of heavy rail into light rail and linking the tracks to the existing tram and metro network, it did not require a comprehensive environmental impact assessment (although the impact of some components, such as the larger rail stations, was assessed).

Public consultation was carried out by the local governments affected, in relation to changes to land use plans, but did not result in any significant impacts on the project.

CHARACTERISTICS

The cost at the time of approval was EUR 0.761bn (2001 prices, equivalent to USD 1.20bn at 2010 prices[1]). The final cost of the project in 2007 was EUR 1.14bn (USD 1.56bn at 2010 prices), split almost equally between Rotterdam (EUR 0.58bn) and The Hague (EUR 0.56bn). The cost overrun (30%) is believed to be primarily due to the increased scope of the project.

Management of the project was shared between the two regional governments, their transport operators, and the local governments concerned, and a project management team representing the various organisations was set up to co-ordinate construction. The regional transport provider, RET, was responsible for construction of the Rotterdam sections, and the city of The Hague for the sections under its ownership (as the transport provider, HTM, had been privatised). Lump sum contracts were let to private sector companies.

TIMELINE ISSUES

The successive derailments on Line 4 caused this line to be suspended for nearly a year, at an estimated cost of EUR 150,000-200,000 per week.

FUNDING

National government was the primary source of funding, with some funding provided by local and regional governments. National funding was provided through lump sum agreements with the two regional governments, devolving the risk of cost overruns down to the project owners.

[1] Costs have been converted to USD at 2010 prices, using historic inflation rates and current exchange rates, to allow comparison between projects.

BENELUXLIJN, ROTTERDAM-SCHIEDAM-SPIJKENISSE, THE NETHERLANDS

OVERVIEW

LOCATION: ROTTERDAM REGION, THE NETHERLANDS
SCOPE: INTRA-URBAN
TRANSPORT MODE: METRO
PRINCIPAL CONSTRUCTION: VIADUCT/TUNNEL
NEW LINK: YES

PRINCIPAL OBJECTIVES

LOCAL TRANSPORT LINK
ACCESSIBILITY
ALTERNATIVE TO CAR
ARCHITECTURAL QUALITY

PRINCIPAL STAKEHOLDERS

CLIENT: REGIONAL GOVT./ROTTERDAMSE ELEKTRISCHE TRAM (RET)
CONSTRUCTION: GEMEENTEWERKEN (RAIL); RIJKSWATERSTAAT (TUNNEL)
FUNDING: MINISTRY OF TRANSPORT

PLANNING AND IMPLEMENTATION

APPROX. PLANNING START DATE: 1993
CONSTRUCTION START DATE: 1997
OPERATION START DATE: 11/2002
MONTHS IN PLANNING: 53
MONTHS IN CONSTRUCTION: 60
PROJECT COMPLETED: ON SCHEDULE

COSTS (IN 2010 USD)

PREDICTED COST: 1.27BN
ACTUAL COST: 0.97BN
PROJECT COMPLETED: 24% UNDER BUDGET
FUNDING: 100% PUBLIC

INFRASTRUCTURE QUANTITIES

LENGTH: 11.5KM
LENGTH IN VIADUCT: 6.6KM
LENGTH IN LAND TUNNEL: 3.2KM
LENGTH IN RIVER TUNNEL: 1.7KM
COST PER KM (2010 USD): 0.08BN

INTRODUCTION

Beneluxlijn is an 11.5km extension of the Rotterdam metro network, connecting the two existing metro lines and providing a transport link between Rotterdam and the bordering municipalities of Schiedam and Spijkenisse. It opened in 2002 and now forms part of the Calandlijn on the metro network. Through the related Beneluxtunnel, the project provides an additional crossing of the River Nieuwe Maas.

The line has six stations, each designed by a different architect. Schiedam Centrum station connects to the railway line, Vijfsluizen to bus and park-and-ride services, and Tussenwater to the Erasmuslijn. From Tussenwater, the two lines continue on the same route.

BACKGROUND

Plans to extend the metro network in Rotterdam were made soon after the opening of the east-west Calandlijn in 1982. At the end of the 1980s a feasibility study was conducted, assessing three proposed extension projects. This (3M) report proposed a south-eastern line in the direction of Ridderkerk, a line to the north, which has now been completed as the RandstadRail project, and the Beneluxlijn, extending the metro network to the east. The lines were perceived to be in this order of importance. However, although the Beneluxlijn was perceived as the least important, it was the first to be built.

Two contextual events influenced the development of the project. The first was the decision to build a second river crossing to relieve severe road congestion on the Beneluxtunnel connecting the area north of the river with the harbour to the south. The state government decided to build a second tunnel at the beginning of the 1990s. The municipality of Rotterdam supported the proposal, but the neighbouring municipalities of Schiedam and Vlaardingen were strongly opposed to it, fearing that it would attract extra traffic through their cities. The deadlock was resolved by the inclusion of a metro tunnel and a bicycle tunnel in addition to the road tunnel. This compromise made the provision of a metro connection through the tunnel inevitable.

The second event was the municipality's 'Tour de Force' programme, which aimed at maximizing Rotterdam's influence upon central government's annual budgeting for major infrastructure projects, by planning projects ahead of the budgeting process.

TIMELINE

CONTEXT: 1967: FIRST BENELUXTUNNEL OPENS

CONTEXT: 1982: CALANDLIJN OPENS

CONCEPTION: 1992: 3M FEASIBILITY STUDY PROPOSES THREE EXTENSIONS TO METRO NETWORK

CONTEXT: 1993: GOVERNMENT DECIDES TO BUILD SECOND BENELUXTUNNEL

INCEPTION: 1993: DECISION MAKING PROCEDURE BEGINS FOR BENELUXLIJN

CONSTRUCTION: 1996: GROUND PREPARATION STARTS

INCEPTION: 1997: TRANSPORT MINISTRY GIVES FUNDING DEGREE OF NLG 1.4BN (EXCLUDING BENELUXTUNNEL)

CONSTRUCTION: 1997: CONSTRUCTION OF CIVIL STRUCTURES AND STATIONS BEGINS

CONSTRUCTION: 1999: GROUND RESTORATION BEGINS. ELECTRICAL WIRING AND RAILS PUT IN PLACE

DELIVERY: 2002: BENELUXLIJN AND BENELUXTUNNEL COMPLETED AND OPENED

CHARACTERISTICS

The estimated cost (in Dutch guilders, at 1998 price levels) was NLG 1.645bn (USD 1.27bn at 2010 prices[i]), of which 40% was for civil engineering works, 11% for rail engineering, 8% for ground preparation and 5% for restoring ground following construction. Other costs, including additional engineering features and a risk reservation, accounted for 36% of the total. The final cost was only NLG 1.25bn (USD 0.97bn at 2010 prices), 24% less than the estimate.

Two public sector organisations were responsible for construction: *Gemeentewerken* for the rail track, and *Rijkswaterstaat* for the tunnel section.

Specific measures were adopted to mitigate the impact of noise from the metro line, including the use of noise-absorbing materials on adjacent footpaths, noise-absorbing plates between the tracks and, on some sections of the route, sound screens.

TIMELINE ISSUES

The project experienced no significant delays or problems and was delivered on schedule.

FUNDING

As with most infrastructure projects in the Netherlands, the project was financed primarily (95%) by central government funding, through its Infrastructure Fund (*Meerjarenprogramma Infrastructuur en Transport (MIT)*). The Fund is financed primarily from the budget of the Ministry of Transport and Water Management and the Fund for Economic Structure Enhancement (FES), which derives from the profits from the sale of natural gas and shares owned by the state. The Infrastructure Fund had a planned budget in 2007 of about EUR 7bn.

The funding was based on a lump sum agreement in which any unspent funds could be kept by the municipality and invested in other infrastructure projects. (In this case, the unspent funds were used as a contribution to the financing of the RandstadRail). The remaining funding (5%) for the Beneluxlijn came from local public sources.

[i] Costs have been converted to USD at 2010 prices, using historic inflation rates and current exchange rates, to allow comparison between projects.

5.2 Netherlands: The 4 Tests reports

For each of the projects, the Country Partner prepared the '4 Tests Report' which – as described in Section 1.3 above – examined project achievements according to: (i) objectives (both original and emergent); (ii) sustainability; (iiii) treatment of risk, uncertainty and complexity; (iv) a synthesis of the three tests, focusing on responses to the original research questions and hypotheses, the project winners and losers, and provisional lessons.

The full 4 Tests reports can be accessed via the following hyperlinks:

HSL Zuid
CD ROM: OMEGA Partner 4 Tests\Netherlands 4 Tests.docx

Randstadrail
CD ROM: OMEGA Partner 4 Tests\Netherlands 4 Tests.docx

Beneluxlijn
CD ROM: OMEGA Partner 4 Tests\Netherlands 4 Tests.docx

The Partner's overall synthesis of the project findings is now presented in the following pages.

5.3 Netherlands: Synthesis of country findings

5.3.1 Context specific responses to the overall research questions and overall research hypotheses

ORQ #1: What constitutes a successful mega urban transport project in the 21st Century?

Specific to the Dutch context is the fact that sustainability seems to play a very limited role in determining the success of a MUTP. Most important as factors for the success of a project are quality and social value. In particular, directly involved constructors find it extremely important that the quality is high - they have to be proud of what is built and then the expectation is that the population will also be satisfied with the project. Other key factors, perceived to be slightly less important, are time and budget.

In the case of the HSL the financing was done by the same organization that was the owner and project leader - the budget was thus less of a problem. There are two camps in this project when it comes to judging whether this project is a success or not. The first group, that looks at the budget and time management, will view the HSL as a complete disaster. The other camp looks more at the quality of the end product, and are quite happy with the result. However, they are still also somewhat disappointed that the project has not been able to stay within the project budget. All respondents feel you have to judge a project by its objectives and on the criteria of budget, time and quality. The respondents make no indication of this changing in the future. Sustainability will become more important but will not play such a big role in judging success unless it is clearly stated in the objectives in such a way that it is measurable.

The other case study projects were characterised by much stricter budget control – possibly because they shouldered much of the risk and were not in control of the financing of the project. From the perspective of the Beneluxlijn, a successful project in the 21st Century is

the same as it was in the previous century – i.e. a project that is reasonably within budget and time and that has a societal value. Of course, the issue of sustainability is important but of tertiary order in this project. A project has to have a clear transport function and has create a situation that was better than before. It thus has to contribute to a higher quality of the system, in this case the transport system.

ORQ #2: How well has risk, uncertainty, and complexity been treated in the planning, appraisal, and evaluation of such projects?

It is difficult to say how well risk, uncertainty and complexity have been treated in the planning, appraisal and evaluation of these MUTPs. Looking at the data, it seems that the HSL is different in the sense that the estimations were apparently inaccurate and the cost and time overruns were a lot higher than in the other projects. Thus it might be argued that risk has been dealt with better in the other two cases. Specific to these other cases was, however, that they kept the complexity low - they were in some sense simpler projects. The HSL was a pioneering project using technology that had not been used before in the Netherlands. It was the first high speed train line in the country and had the first drilled tunnel in soft soil. Thus a lot of risks were inherent in the chosen technological path. The same is true for the choice of the safety system in the HSL. The choice was made to use a system for which the specifics were unknown at that time because it was still being developed. Retrospectively, this was a wrong decision because it caused a delay in the ordering and construction of the trains. The treatment by the HSL project of the issues of RUC can be considered as good, or very bad, depending on the viewpoint one takes.

With regards the Beneluxlijn, the issues of risk, uncertainty and complexity were treated in a very pragmatic manner. There was a sort of low risk policy by using only techniques that had been used before by the project team and by building above ground where possible. The uncertainty and complexity had thus been strongly reduced, leading in a way to a lower risk project. Perhaps this is how extensions of existing systems projects should be treated unless the context demands another approach.

ORQ #3: How important is context in making judgements regarding the above questions?

Context of course matters when dealing with issues of success or with issues of risk, uncertainty and complexity. When talking about success, the context largely determines whether a project is successful or not. As mentioned above, societal relevance is the most prominently named criterion for success. Ultimately this means that the societal context is key in making a project a success. The people have to appreciate the project and use it.

As for the treatment of risk, uncertainty and complexity, context matters because to a large extent it determines the required level of technological complexity used in the project. Complexity by and large creates these issues of risk and uncertainty. Moreover, it is the context that should determine which techniques should be used or not – e.g. is it necessary to drill a tunnel, when it is also possible to use more traditional types of tunnel building? These decisions should be made on the basis of the contextual factors. However, as we for instance have seen in the HSL case, it was not the natural/urban context that determined that a drilled tunnel was necessary, it was the political context along with the attractiveness of pioneering a new technique that led to the decision for such a tunnel.

Thus context is crucial, although there are many types of context that form a project. For example with the Beneluxlijn, the context was important because the project went through an area where it was possible and acceptable to put the metro on a viaduct. Elsewhere, for example in the historic centre of Amsterdam, this would not have been possible. For the

Beneluxlijn this meant a major reduction in the project complexity. Thus the physical context in which the project is built is very important.

ORH #1: Traditional criteria relating to cost overruns, completion dates, generation of travel time savings for users and rates of returns to investors are inadequate measures of success in the 21st Century as sustainable development concerns become increasingly critical both globally and locally.

The case study projects' aspirations in regard to sustainability were implicit rather than explicit. It seems that public transport projects are automatically seen as sustainable as they aim to cause a modal shift by providing an alternative to the airplane or automobile. Public transport projects are also not evaluated in terms of whether or not people actually leave their car in favour of public transport. Other sustainability issues such as energy are usually not taken into consideration. Sound nuisance is however a very important criterion in the Dutch context, especially when building urban projects - this is very important as it is the main criterion by which the project is judged by the affected population living in the surrounding areas.

With regards the Beneluxlijn, sustainability issues were not very critical – only in the sense of needing to be long-lasting, low on sound nuisance and vandal-proof. Keeping within budget and the time schedule remained the most important measures of success in this project.

Overall, most respondents felt that the traditional criteria of budget, time and quality will remain the most important criteria to judge a project. Sustainability issues will become more prominent but not critical (especially not supported by a strong policy agenda). Indeed, some respondents noted that a continued population decline and an electrical revolution in car transport would solve some of the problems. Moreover, it is debatable whether the measures taken to make infrastructure more sustainable in the short term will prove to be very expensive failures in the long term. It is thus very important to take a lot of developments into consideration and not just limit yourself to the direct impacts of purely transport developments.

ORH #2: The new emerging international and local agenda related to vision(s) of sustainable development is multidimensional and goes beyond notions of environmental sustainability as critical as this may be, in that it also concerns inter-related concepts of economic sustainability, social sustainability and institutional sustainability.

In these types of projects, it seems that most respondents consider sustainability as building something that will last for a hundred years. Taken holistically, it should incorporate all dimensions of sustainability. However, environmental sustainability is probably the least considered of them. Economic sustainability is also taken into consideration in a limited fashion. The three projects do not have a model of return on investment and most likely the will have to be subsidized, thus it will be very unrealistic to think that the cost of the infrastructure will be earned back.

With regards the HSL, economic sustainability was the most important. It was considered crucial that the Netherlands became connected to the European High Speed Network. There was also an element of environmental sustainability in the sense that the train would compete with the airplane. Now we know that it has been only limitedly successful in this respect. Economic sustainability is thus the most important type of sustainability for the HSLs project, and it remains to be seen how economically sustainable it will ultimately be.

ORH #3: The level of competence in decision-making and planning in today's fast-changing world is best assessed by the adequacy of the treatment of risk, uncertainty and complexity and sensitivity to context - all of which are important demands on Strategic Planning

If decision-making and planning is judged in these projects in terms of the adequacy of the treatment of risk, uncertainty and complexity and sensitivity to context, the local and regional cases of the Beneluxlijn and Randstadrail have a higher competence. They have less cost and time overruns because they kept the uncertainty and complexity at bay and thus reduced the risk. Both projects had also stronger context participation programmes running in parallel to not only the planning and decision-making but also the construction period. This is extremely important in preventing opposition to the projects – i.e. the context has to be 'managed'.

With the Beneluxlijn a great amount of effort was put into managing the context of the project, ensuring public support, or at least minimizing public opposition. However, the high level of competence in treating risk, uncertainty and complexity was perhaps at the cost of (insufficiently considering) the strategic capacity.

5.3.2 Possible generic responses (to ORQ's and ORH's)

ORQ #1: What constitutes a successful mega urban transport project in the 21st Century?

Key to what makes a successful project in the 21st century is that it has to prove its success in practice. This is the social value that is mentioned above. Projects have to prove their value to society, which can only be seen after completion. However, the question during decision-making is thus whether a project improves the quality of life of citizens and whether this added value weighs up against the cost. Transport projects have to prove their value generally in the number of passengers that make use of the project. Other large projects, such as dykes for instance, prove their value because they make the country safer. However, a successful project brings about something that was not there before and which proves to be desirable by many.

ORQ #2 How well has risk, uncertainty, and complexity been treated in the planning, appraisal, and evaluation of such projects?

Crucial to the management of risk, uncertainty and complexity is to keep such large projects as simple as possible – in particular, new technologies should only be used when absolutely necessary. In essence, MUTPs are too large and too expensive to be a basis for experimenting with technologies or safety systems. New technologies should first be applied to smaller projects to develop experience.

To ensure that no unnecessary risks are taken it is important to have good checks and balance mechanisms in place that reduce the chance of taking unnecessary risks by creating a lot of uncertainty and complexity. It is thus better if the main project owner is not the main financier of the project. It is also important that the responsible administrator has enough opposition from the parliament/council and from his civil servants and engineers. This, combined with second opinions from foreign departments/companies should ensure that the political opportunism does not take over from realism.

ORH #1 Traditional criteria relating to cost overruns, completion dates, generation of travel time savings for users and rates of returns to investors are inadequate measures of success in the 21st Century as sustainable development concerns become increasingly critical both globally and locally.

The generic response to this overall research hypothesis is that although sustainability issues are definitely becoming more important, they will not push the other criteria into the background. The traditional criteria remain very important in determining whether a project is a success or not.

In particular, the usage levels and appreciation by the population is a strong determinant of whether a project is a success. Respondents suggest that a project can have large cost and time overruns, contribute very little to a sustainable future and still be very successful if the people appreciate the project and use it. This leads to the idea that quality goes above everything else, because in time it is the only thing people will have to judge the project on - time and cost overruns will have been forgotten. Thus, although sustainability is becoming more important, more traditional criteria remain dominant and there is no indication that this will change during the 21st century

ORH #1 The new emerging international and local agenda related to vision(s) of sustainable development is multidimensional and goes beyond notions of environmental sustainability as critical as this may be, in that it also concerns inter-related concepts of economic sustainability, social sustainability and institutional sustainability.

In general, sustainability is an umbrella concept that can encompass many things and definitely moves beyond the issue of environmental sustainability. However, the most important thing to interviewees is that a project is built of good quality that is also appreciated by the population (as above). A project has to be socially and institutionally sustainable such that it becomes an integral part of the urban system and part of the urban transport network. It has to be incorporated into the fabric of the city, region or country. For MUTPs this is seen as more important than environmental sustainability. The importance of economic sustainability is of course different dependent of the type of financing of the project.

ORH #2 The level of competence in decision-making and planning in today's fast-changing world is best assessed by the adequacy of the treatment of risk, uncertainty and complexity and sensitivity to context - all of which are important demands on Strategic Planning

In parallel with the reduction of complexity and uncertainty, risk avoidance is frequently necessary – e.g. if the desire is to keep cost and time under control, it is best to use simple techniques. This might preclude the use of innovations in MUTP infrastructure construction, development and exploitation. However, perhaps such large and costly projects are not the right place to experiment with new technologies. These projects use a large amount of public money and to take risk may be considered unacceptable. Interestingly, many would not appreciate their government investing hundreds of millions in a very risky capital investment, but this often seems acceptable for MUTPs.

5.3.3 Netherlands: Potential generic and context specific lessons

5.3.3.1 Lessons relative to project objectives

In dealing with issues of risk, uncertainty and complexity, the concepts of strategic framing, and robustness / flexibility seem to be a key - as strategic framing of the mission is a crucial tool to create the desired robustness and flexibility. The mission should provide a strong and shared sense of direction (i.e. be robust) but not eliminate or block the dilemmas brought forward by different rationalities and interests (i.e. be flexible). It should intelligently guide the process of deliberation. This will enable the decision-making process to reach different operational solutions as required by upcoming circumstances and at the same time enable parties to deal with conflicts and deadlocks in a constructive way because they still share the same sense of direction. It will, however, also provide a way to incorporate emerging values and interests during the long process of decision-making and implementation.

Related to the mission are the goals of the project. These should also be strategically chosen as guiding principles rather than specific end terms to enable robustness and flexibility in the decision-making process. The emphasis should be on goals that are overarching and uncontested (or 'robust') – e.g. goals such as 'achieving modal shift' or 'stimulating the economy'. More specific goals that are contestable (that are not robust), such as 'achieving 300 km/hour', should be avoided because they lead to strong opposition on the one hand and reduce creativity in the decision-making process on the other. In addition, the framing of the policy network configuration needs some redundancy in order to meet changing conditions and unforeseen processes. It is essential to mobilize the institutional capital of different interests and rationalities within the network of active stakeholders. This means advisory boards, participatory processes and generally opening up the network to participants with different knowledge and standpoints.

5.3.3.2 Context-specific lessons dealing with Sustainable Development Visions

Perhaps most specific to the Dutch context is the fact that sustainability issues play a very limited role in the planning and appraisal of MUTPs. And although SDV's are seen as to become more prominent in the future, it does not seem that they play or will a crucial role in the decision-making process. The crucial criterion remains what a project costs and what the benefits will be.

Issues of sustainability that are important in the Dutch context are landscape and noise pollution. The protection of the landscape and the way the project is fitted into the landscape is an important issue in the Dutch decision-making process for large transport projects. This of course immediately brings issues of taste into the debate. What an engineer finds aesthetically acceptable is not necessarily shared by the persons using the area through which the infrastructure passes. Often, projects turn out more expensive than before because of the adjustments required to fit the project into the landscape.

The HSL had quite a few of these adjustments, including the large tunnel under the Green Heart. RandstadRail had more micro adaptations on the streets of The Hague. The Rotterdam section was more limited in its necessity to make adaptations because it was either using existing tracks or was underground. Of course, the decision to go underground came from strong public opposition to the previous design that had the trains running at ground level through the city (including the historic area of the city).

One very important issue is noise nuisance. This was mentioned often by interviewees when discussing sustainability. Crucial to conquering the minds and hearts of people is to limit the nuisance they are exposed to, which means that noise has to be taken into consideration during the decision-making and designing processes. In particular, buildings like schools

have to be taken into consideration because they have different sound norms. During construction there is a lot of improvement that can be done – including pre-fabrication and cloaks for piles. Keeping a continuous eye one the sound aspects of a project can prevent a lot of opposition to it.

5.3.3.3 Context-specific lessons for dealing with RUCC

Robustness and Flexibility

As the projects have shown, the need to learn from internal and external emerging knowledge require that the project remains flexible. This flexibility will assure a more robust project that can be sustainable over decades as it can cope with changing circumstances. This means that not only does the decision-making process need to be responsive and willing to adapt, but also that the project itself should be constructed in such a way that it can still be adapted to changes in the context.

One way to create this natural process of robustness and flexibility is the incorporation of checks and balances in power if used correctly, with a clear mission which is supported by all key stakeholders. This does not mean that projects should be undertaken only by public private partnerships, but more that projects should be developed by partnerships (even just public-public) in which the partners have a balanced power relation. A power relation that is supplemented by adequate knowledge and discussion will create a more robust decision that has had an appropriate appraisal of interests, ideas and possibilities. It is important that the organizations and decision-makers are adequately equipped in both technical, process and political knowledge to estimate risks and create a structure that is financially able to bear these risks.

Related to this is the distribution of responsibility and accountability. Responsibility should be placed where the competencies are the highest. This is the best way that a project and its emerging problems can be managed and solved. In addition, accountability should be placed on the level where the risks can be managed best. Leadership, or the responsibility for coordination and communication, should be placed on the level where the stakes are the highest. This is the party that risks the most. Furthermore, in order to make an appropriate estimation of risks and responsibilities there should be a form of independent risk assessment throughout the whole process.

Technological Considerations

The complexity of MUTPs lies not so much in their technical aspects but rather in the need to share complex technical knowledge among a variety of stakeholders and affected interests that often have little expert knowledge. Readiness and the ability of the project team to communicate and interact with a broad, diverse public are therefore essential in the reduction of risk and uncertainty.

This means that the identification and the application of best practices is desirable, but it is the ability to learn and act accordingly that is crucial. In this respect, third party monitoring of project progress, upcoming risks, and context developments is necessary. But it will be impossible to monitor all risks and developments of and within the context. Therefore the focus should be on key risks and uncertainties. It is increasingly important to decide upon which risks should at all costs be controlled because of the damage they can inflict on the surroundings, the time and financial budget, and the public image of the project. It is therefore crucial that a proactive/adaptive management strategy is developed during the construction of the project.

Another important technical consideration is that the decision to use technical methods or systems that have not been developed or properly tested at the time of the final decision, means that the project will run great risks in time, and thus cost. Although the chosen system should mean a very substantial increase in the quality of the project, it is not sure it is always worth the gigantic risks involved. A better solution might be to use a proven and simple system as a final solution or as a stepping stone towards a more advanced one. In the construction should then be included the necessary preconditions for the possibility of updating the system later.

When the aim is to make a project manageable it is important not make them more technically complex than necessary. Sometimes proven techniques are just as adequate for achieving the project goals while reducing a lot of uncertainty, risk and complexity. Experimenting with new building techniques should perhaps not be done with public money. New techniques should be applied when there are no proven technologies available to achieve the goals.

It is also crucial to have technically knowledgeable people within the project organization that can act as a counterweight to contractors. Preferably these people are part of the project organization and not brought in as consultants. This means that the necessary competencies are in place for the great responsibilities the project organization has. They have to know at least as much as the contractors in order to keep control over the project. They will also be better able to inform the decision-makers about the risks involved in choosing for one technique or another.

Key stakeholders should be involved and committed at the early phases of the decision-making process. This will create a sense of common responsibility for the project. In addition, it is important to share information with the general public, to take them along in the whole process. A project will be better accepted if citizens and community organizations feel they are listened to and respected.

5.3.3.4 Potential generic lessons

Since sustainability plays such a limited role in the planning appraisal and evaluation of MUTPs in the Netherlands, it is difficult to reach more generic conclusions. However an important lesson, which is most likely applicable to all kind of contexts, is that the sustainability aspects of a project are very dependent on surrounding policies. For instance, it is difficult for high speed trains to compete with airplanes when their energy supply is taxed while the kerosene that airplanes use is not. The same holds for the light/ urban rail projects. These are dependent on the road policies. If there are many congestion problems this provides opportunities to public transport. It is thus important to make clear choices in the Transport and Traffic sector for either public transport or individual road transport.

Another more interesting generic conclusion is that we should be careful in the measures we take in order to fulfill modern notions of sustainability. Some issues might resolve themselves in large part without taken expensive measures. For instance, in general in western European countries, there is a general expectancy that without a strong increase in migration there will be a population decline. This means that the pressure on the transport network will be somewhat relieved. In the general discourse about these types of projects, it has been stressed that there will be a continuing increase of demand for transport. However, it could well be that we are getting close to the maximum need for mobility and that it will actually decline. For instance, it is not an unreasonable assumption that as the population will decline, the pressure on the housing market will also be reduced, meaning that it will be more affordable for people to find adequate housing closer to their work. Another measure is that cars tend to become cleaner and more silent as time goes on. This means that the same amount of cars will produce less exhaust fumes and create less sound nuisance. This

is something that is again related to the point made in the paragraph above that it is important for the sustainability of MUTPs to a strong sustainability-oriented policy context.

5.3.3.5 Generic lessons for risk, uncertainty, complexity and context

In all but the most simple projects there are a number of trade-offs to be made. This research identifies two. The first concerns winners and losers and the second deals with the choice between one versus multiple dimensions.

Trade-Off 1: Winners and losers

There are different approaches to stakeholder interests when developing MUTPs. There are those who believe in developing a project that is beneficial for the maximum number of stakeholders and those who believe that a project should be the best solution from one particular perspective - regardless of other stakeholder interests. A situation where a maximum number of stakeholders 'win', requires all of them to accept a compromise. This is often a second best solution. In contrast, the best solution approach will lead to zero sum games where there are some big winners and big losers. Of course, the winners may well be those that decided on this solution as being the best.

Trade-Off 2: One versus multiple dimensions

MUTPs can be strategically framed in many different ways. Will the project be one dimensional and thus only focus on transport? Or will it incorporate multiple other dimensions such as spatial or economic developments?

The first option will reduce the level of complexity because there are fewer goals and stakeholders to take into consideration in the decision-making process. The trade-off is, however, a loss of opportunities for synergy with (for instance) urban development. The second option introduces more complexity - because introducing more dimensions will also mean introducing more stakeholder interests into the decision-making process.

A potential way out of this dilemma is to break up the project and the decision making-process and to proceed in a more incremental manner. This does not mean renouncing the long-term vision or mission but simply implementing it in smaller steps. The HSL and the Beneluxlijn are both cases of an unresolved trade-off as they could have included 'agent of change' roles but they remained mono-dimensional. In the case of the HSL, adding other dimensions might have reduced complexity considering the strong opposition to the preferred route. RandstadRail moved somewhat in a more comprehensive direction by affirming the desire for a light rail system that connects growth towns (the long-term vision or mission) without completely specifying the type or mode of the project (leaving implementation options open). This, for example, led to the decision to change the planned rail connection between Zoetermeer and Rotterdam to a more feasible dedicated bus route.

5.4 Conclusion: Netherlands

This section presented a summary and synthesis of the Netherlands Country Partner's research on the three case studies of HSL Zuid, Randstadrail and Beneluxlijn.

A summary profile of each project (with hyperlinks to the full Project Profiles) described the project's history and main characteristics, features, issues and timelines.

The Country Partner's own synthesis of their research findings in relation to the '4 Tests' was then given, presenting findings from the overall country perspective (i.e. combining the three

case studies). Hyperlinks to the more detailed '4 Tests Reports' for each project were also given.

The next Section now presents the Sweden Country Partner's findings from three mega-urban transport projects, while Volume 5 contains detailed analyses and comparisons of all 30 mega-urban transport projects, together with the overall findings and lessons of the research.

6. Country findings: Sweden

Öresund Bridge/Tunnel
Malmö - Copenhagen

Southern Link
Stockholm

Arlanda Express
Airport Rail Link

6.1 Sweden: The project profiles

Project Profiles were prepared by the Country Partner[6] for each of the study projects, to provide a consolidated source of secondary information to support all phases of data collection, analysis and synthesis. The profiles covered such matters as: project cost, duration and quality information; principle and secondary project objectives; key project stakeholders; sources of finance; key events and processes. (See also Volume 1, Section 3.4).

The full Project Profiles can be accessed via the following hyperlinks:

Oresund Bridge/Tunnel
http://www.omegacentre.bartlett.ucl.ac.uk/studies/cases/pdf/SWEDEN_ORESUND_PROFILE_090511.pdf

Sodra Lankan Road Tunnel, Stockholm
http://www.omegacentre.bartlett.ucl.ac.uk/studies/cases/pdf/SWEDEN_SODRALANKEN_PROFILE_050511.pdf

Arlanda Airport Rail Link
http://www.omegacentre.bartlett.ucl.ac.uk/studies/cases/pdf/SWEDEN_SODRALANKEN_PROFILE_050511.pdf

Summaries of the Project Profiles are presented on the following pages.

[6] In Sweden, the Country Partner was the Department of Technology and Society, Lund University - directed by **Prof. Bengt Holmberg.**

ORESUND LINK, COPENHAGEN-MALMÖ, DENMARK-SWEDEN

OVERVIEW

LOCATION: COPENHAGEN-MALMÖ
SCOPE: TRANSNATIONAL
TRANSPORT MODE: ROAD/RAIL
PRINCIPAL CONSTRUCTION: BRIDGE/TUNNEL
NEW LINK: YES

PRINCIPAL OBJECTIVES

INTERNATIONAL TRANSPORT LINK
TRANS-EUROPEAN NETWORK
CROSS-BORDER REGIONAL DEVELOPMENT
LOCAL AIRPORT LINK

PLANNING AND IMPLEMENTATION

APPROX. PLANNING START DATE: 1984
CONSTRUCTION START DATE: 10/1993
OPERATION START DATE: 07/2000
MONTHS IN PLANNING: 112
MONTHS IN CONSTRUCTION: 81
PROJECT COMPLETED: ON SCHEDULE

COST (IN 2010 USD)

PREDICTED COST: 2.96BN
ACTUAL COST: 4.10BN (TUNNELS: 0.9BN; MARINE: 0.33BN; BRIDGES: 1.5BN)
PROJECT COMPLETED: 39% OVER BUDGET
FUNDING: 100% PRIVATE

INFRASTRUCTURE QUANTITIES

TOTAL LENGTH: 74KM
RAIL: 42KM
ROAD: 32KM
BRIDGE: 7.8KM
TUNNEL: 4KM
ARTIFICIAL ISLAND: 1.3KM^2
COST PER KM (2010 USD): 0.06BN

PATRONAGE

FORECAST TRAFFIC (2007): 15,732 VPD (ROAD); 28,000 PPD (RAIL)
ACTUAL TRAFFIC (2007): 18,432 VPD (ROAD); 26,600 PPD (RAIL)

INTRODUCTION

A road and rail link across the Oresund[i] between Sweden and Denmark, consisting of a bridge 7.8km long and a tunnel 4km long.

In addition to improvements to connecting transport infrastructure, associated hub development is taking place at Bridge City in Malmö and Ørestad in Copenhagen.

BACKGROUND

Proposals for a fixed link date back to the mid-19th century although technical and political feasibility was often an issue. The Swedish and Danish governments agreed to build a link in 1973, but the energy and economy crisis, Denmark's decision to join the EU and increasing environmental awareness blocked progress.

The European Roundtable of Industrialists lobbied for a link in 1984 but their proposal was perceived as a road project facilitating 'just-in-time' production and so threatening jobs at the local and national level, and met with widespread scepticism. The objective of promoting cross-border regional development emerged in the late 1980s, in the context of economic difficulties facing both cities and Sweden's decision to join the EU.

Representatives of the two governments formed the Oresund delegation in 1984. Over seven years the delegation studied and reported on options for a link and their environmental impacts (primarily effects on water flow, increased traffic and land use issues). The option of a combined road/rail bridge gained the support of Swedish and Danish parliaments in 1990.

The two governments signed an agreement in 1991, committing them both to form state-owned stock companies. The companies would form a consortium responsible for the financing, design, construction and operation of the link, with loans raised on the international finance market, repaid by revenues from user fees and guaranteed by the two states.

The project remained controversial in Sweden, particularly as the environmental impact assessment took place only after the agreement to build the link was signed. The Swedish National Board for Environmental Protection refused planning permission, but its competence was questioned and the government referred the

TIMELINE

CONCEPTION: 1973: SWEDISH-DANISH GOVERNMENTS AGREE TO BUILD FIXED LINK

CONTEXT: 1984 EUROPEAN ROUND TABLE PERCEIVED AS LOBBYING FOR ROAD LINK

INCEPTION: 1984: ORESUND DELEGATION APPOINTED

CONCEPTION: 1985: DELEGATION PROPOSES HELSINGBORG-HELSINGØR RAILWAY TUNNEL & MALMÖ-COPENHAGEN ROAD BRIDGE. STATE FUNDING RULED OUT

CONTEXT: 1986: GREAT BELT BRIDGE DECISION BREAKS DANISH DOMESTIC POLICY BLOCK ON OTHER FIXED LINKS

CONCEPTION: 1987: DELEGATION RECOMMENDS COMBINED ROAD/RAIL BRIDGE BUT CONTINUES TO CONSIDER RAIL TUNNEL OPTION

INCEPTION: 1990: SWEDISH PARLIAMENT SUPPORTS COMBINED BRIDGE OPTION, DANISH LEADERS FOLLOW SUIT

INCEPTION: 1990: NEGOTIATIONS ON FUNDING STRUCTURE

INCEPTION: 1991: TWO GOVERNMENTS SIGN BINDING AGREEMENT. CONSTRUCTION TO START IN 1993 AND FINISH IN 2000

INCEPTION: 1992: ORESUNDBRO CONSORTIUM FORMED, APPLIES FOR PLANNING PERMISSION

CONSTRUCTION: 1993 (OCT): DANISH LAND INFRASTRUCTURE WORKS IN PREPARATION

CONTROVERSY/DELAY: 1993: PERMISSION REFUSED BY SWEDISH NATIONAL BOARD, FINALLY GRANTED BY WATER RIGHTS COURT BUT CONDITIONAL ON REDESIGN

INCEPTION: 1994: REDESIGN APPROVED BY SWEDISH GOVERNMENT

CONSTRUCTION: 1995: CONSTRUCTION STARTS. OC CONTRACTS WITH THREE CONSORTIA

CONSTRUCTION: 1997: FIRST TUNNEL SECTION IN PLACE

CONSTRUCTION: 1998: FIRST BRIDGE SECTION IN PLACE

DELIVERY: 1999: FIRST CAR DRIVES THROUGH TUNNEL

DELIVERY: 2000 (JUL): HANDOVER AND INAUGURATION

Decision to the Water Rights Court instead. The WRC granted permission, on condition that the project had no impact on water flow: this necessitated a redesign and further approvals.

CHARACTERISTICS

The components of the link were defined in the 1991 agreement: a four lane road and double track railway, starting from an artificial peninsula at Kastrup airport, Copenhagen, crossing in a tunnel to an artificial island and continuing to Limhamn, Malmö by bridge.

The Oresundbro Consortium (AS Oresund, Denmark and Svedab AB, Sweden) signed contracts with three consortia: Oresund Tunnel Contractors; Oresund Marine Joint Venture, for construction of the artificial island and dredging; and Sundlink Contractors, for bridges.

The cost was estimated at USD 2.96bn in 1991 (2010 prices[ii]). Maritime safety efforts, environmental protection and 'other' were amongst the reasons cited for escalating cost estimates. The final project cost was estimated at USD 4.10bn, a cost overrun of 39%.

TIMELINE ISSUES

Wider political issues influenced the timing of the project, such as the Danish policy not to allow a link across the Oresund before one had been built across the Great Belt. The controversy over environmental impacts delayed the approval process in Sweden.

FUNDING

The Oresund delegation's 1985 recommendation to fund the project entirely outside of public sector budgets was of fundamental importance to the funding structure. The use of surpluses from road tolls to finance land-based connecting infrastructure, and the payment of fixed fees by the national rail agencies to use the rail tracks, were amongst the issues covered in negotiations between the two governments.

As a result of the decision to rely on private funding, the project was appraised on the basis of economic profitability, rather than socio-economic cost-benefit analysis. However, road user fees were reduced when initial traffic was lower than expected, and the Consortium ran at a loss until 2009, despite increasing traffic.

[i] The spelling 'Oresund' reflects a compromise between the Danish *Øresund* and Swedish *Öresund*

[ii] Costs have been converted to USD at 2010 prices, using historic inflation rates and current exchange rates, to allow comparison between projects.

SÖDRA LÄNKEN (THE SOUTHERN LINK), STOCKHOLM, SWEDEN

OVERVIEW

LOCATION: STOCKHOLM, SWEDEN
SCOPE: INTRA-URBAN
TRANSPORT MODE: ROAD
PRINCIPAL CONSTRUCTION: TUNNEL
NEW LINK: YES

PRINCIPAL OBJECTIVES

LOCAL TRANSPORT LINK
CONGESTION RELIEF
SAFETY REDUCTION
SUSTAINABILITY

PRINCIPAL STAKEHOLDERS

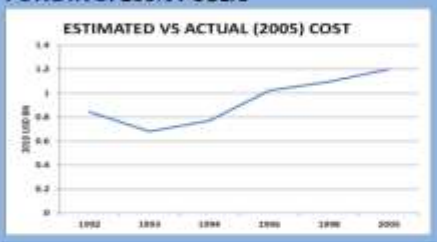
MAIN FUNDER:
NATIONAL GOVERNMENT
PROJECT MANAGER:
STOCKHOLMSLEDER AB (SLAB)/SWEDISH ROAD ADMINISTRATION
PRINCIPAL CONSULTANT:
SÖDRA LÄNKEN KONSULTERNA

PLANNING AND IMPLEMENTATION

PLANNING START DATE: 12/1989
CONSTRUCTION START DATE: 11/1997
OPERATION START DATE: 10/2004
MONTHS IN PLANNING: 95
MONTHS IN CONSTRUCTION: 83
PROJECT COMPLETED: 72 MONTHS BEHIND SCHEDULE

COSTS (IN 2010 USD)

PREDICTED COST: 0.98BN
ACTUAL COST: 1.33BN
PROJECT COMPLETED:
36% OVER PREDICTION
FUNDING: 100% PUBLIC



INFRASTRUCTURE QUANTITIES:

LENGTH: 17KM (TOTAL)
DISTANCE IN TUNNEL: 4.5KM
COST PER KM (USD 2010): 0.08BN

PATRONAGE

FORECAST TRAFFIC (2005)
70,000-90,000 VPD
ACTUAL TRAFFIC (2005)
86,000 VPD

INTRODUCTION

Södra Länken (the Southern Link) is an urban motorway tunnel linking major roads in the south of Stockholm. It is associated with the nearby *Hammarby Sjöstad* waterfront regeneration area and *Årsta fältet* development (the latter on the site of a section of road made redundant by the Link).

BACKGROUND

The main objective of the project was to link Stockholm's major roads, relieving traffic congestion in the south of the city and consequently reducing air pollution and traffic accidents. The concept of a southern ring road was first discussed in the 1930s and included in the 1952 Stockholm plan and 1960 traffic plan. In the 1970s and 1980s, increasing environmental awareness and low rates of economic growth led to a hiatus in road construction, despite an increase in road traffic and concerns about congestion constraining economic development. The ring road concept developed as part of a wider vision of improving the transport network.

The idea of building part of the ring road as a toll-financed tunnel emerged during the mid 1980s and was formally proposed in 1989. This solution would avoid the complex process of gaining permission to build a motorway through a densely populated area and would limit the impact of increasing traffic volumes.

To resolve the lack of consensus between stakeholder groups, Bengt Dennis was appointed as state negotiator and an agreement on a package of transport infrastructure investment was signed in 1991. A revised version was negotiated in 1992, resolving outstanding differences preserved in the original agreement.

The agreement remained controversial during the following years. Although Environmental Impact Assessments and cost-benefit analyses were conducted, public opposition and the lack of approved designs for toll stations delayed progress.

SÖDRA LÄNKEN (THE SOUTHERN LINK), STOCKHOLM, SWEDEN

TIMELINE

CONTEXT: 1952: STOCKHOLM GENERAL PLAN

CONTEXT: 1960: STOCKHOLM TRAFFIC PLAN

CONCEPTION: 1989: SOUTHERN LINK TUNNEL PROPOSED

INCEPTION: 1990: BENGT DENNIS APPOINTED AS NEGOTIATOR

INCEPTION: 1991: DENNIS AGREEMENT SIGNED BY THREE MAIN POLITICAL PARTIES

INCEPTION: 1991: *SLAB* SET UP (STATE-OWNED ROAD CONSTRUCTION COMPANY)

DELAY: 1991-92: CONTINUING DISAGREEMENT BETWEEN POLITICIANS

INCEPTION: 1992: SECOND DENNIS AGREEMENT SIGNED

INCEPTION: 1993: FIRST ENVIRONMENTAL IMPACT ASSESSMENT PUBLISHED

CONTROVERSY: 1993: PUBLIC DEMONSTRATION AGAINST PROPOSALS

INCEPTION: 1994: CITY APPROVES DETAILED PLANS

DELAY: 1994: TACIT OPPOSITION FROM LOCAL AUTHORITIES DELAYS PLANNING PERMISSION

DELAY: 1995 (JUN) – 1996 (MAY): PROJECT HALTED DUE TO LACK OF APPROVAL FOR NORTHERN LINK AND TOLL STATIONS

INCEPTION: 1996: GOVERNMENT PROPOSES ADDITIONAL FUNDING, TENDER INVITATIONS SENT OUT

INCEPTION: 1997: INES DEAL ANNOUNCED, REPLACING DENNIS AGREEMENT, NEW FINANCIAL AGREEMENT

CONSTRUCTION: 1997: CONSTRUCTION STARTS

INCEPTION: 1998: FINANCIAL DEAL APPROVED BY PARLIAMENT

CONSTRUCTION: 2001: TUNNELS COMPLETED, WORK ON INSTALLATIONS STARTS

DELIVERY: 2004: LINK INAUGURATED

CHARACTERISTICS

The cost was estimated at SEK 4.77bn in 1992 (USD 0.98bn in 2010 prices)[i]. The scope of the project was reduced in 1993, reducing the estimated cost, but cost estimates increased subsequently, perhaps partly due to rising wages in the construction industry in the late 1990s. However, the final project cost in 2005, SEK 8.2bn (USD 1.33bn in 2010 prices), was close to that envisaged in the financing structure agreed in 1998.

Stockholmsleder AB (SLAB) was set up in 1991 to be responsible for financing, implementation and operation of road projects in the Dennis Agreement, but was absorbed into the Swedish Road Administration in 1993. The main design contract, for tunnels and connections to the existing road network, was let to a consortium, *Södra länken konsulterna*. There were five smaller design contracts, three for construction management, twelve for construction and ten for installation and fixtures.

TIMELINE ISSUES

The project timeline was affected by initial public and political opposition to the Dennis Agreement. Tacit opposition from local authorities led to delays in planning permissions, and all the projects in the Agreement were frozen for a year due to the lack of approved plans for the Northern Link and road toll stations.

Opposition to the project culminated in a successful appeal to the Supreme Administrative Court and ultimately to the government's abolition of the Agreement and proposal of the less controversial 'Ines deal' in 1997. In this deal, the more controversial road schemes and plans for road tolls were dropped.

FUNDING

Funding came mostly (87.5%) from the national government, with the remainder from the city government; the 1997 agreement stipulated that any cost overruns should be shared between the two in a 3:1 ratio. Land acquisition costs were not included in the agreement but were estimated to add another 15% to the total cost. The project was financed by commercial loans organised through SLAB. The debt is being repaid by the Swedish Road Administration, using grants from the national government, and is expected to be repaid in full by 2025. The city government used the proceeds from the sale of its municipal energy company to fund its share.

[i] Costs have been converted to USD at 2010 prices, using historic inflation rates and current exchange rates, to allow comparison between projects.

ARLANDA RAIL LINK, STOCKHOLM, SWEDEN

OVERVIEW

LOCATION: STOCKHOLM, SWEDEN
SCOPE: INTER-REGIONAL
TRANSPORT MODE: RAIL
PRINCIPAL CONSTRUCTION: AT GRADE
NEW LINK: YES

PRINCIPAL OBJECTIVES

STRATEGIC TRANSPORT LINK
REDUCED EMISSIONS
PRIVATE SECTOR INVOLVEMENT
LOCAL TRANSPORT LINK
REGIONAL TRANSPORT LINK

PRINCIPAL STAKEHOLDERS

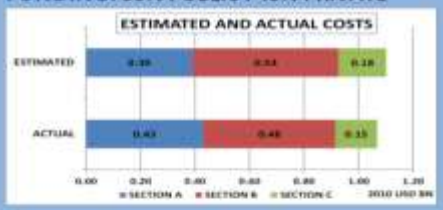
CLIENT: ARLANDA RIGHTS CO (NRA/CAA) A-BANAN PROJEKT AB
CONCESSIONAIRE: ARLANDA LINK CONSORTIUM (LATER MACQUARIE)
OPERATOR: A TRAIN AB

PLANNING AND IMPLEMENTATION

PLANNING START DATE: 01/1988
CONSTRUCTION START DATE: 11/1995
OPERATION START DATE: 11/1999
MONTHS IN PLANNING: 94
MONTHS IN CONSTRUCTION: 48
PROJECT COMPLETED: 13 MONTHS AHEAD OF SCHEDULE

COSTS (IN 2010 USD)

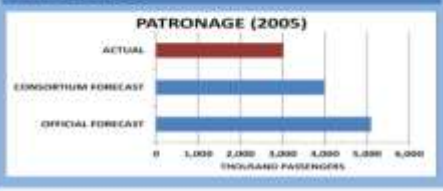
PREDICTED COST: 1.10BN
ACTUAL COST: 1.07BN
PROJECT COMPLETED: 3% UNDER BUDGET
FUNDING: 55% PUBLIC : 45% PRIVATE



INFRASTRUCTURE QUANTITIES:

LENGTH: 20KM
LENGTH IN TUNNEL: 7KM
NUMBER OF STATIONS: THREE
COST PER KM (2010 USD): 0.05BN

PATRONAGE



INTRODUCTION

A two-track railway from Stockholm Central station to Arlanda Airport, the Arlanda Rail Link opened in 1999, with the aim of allowing expansion of the airport whilst reducing emissions.

The Link was the first public-private partnership project in Sweden; a concessionaire operates the Arlanda Express service to Stockholm. The project also includes works to Stockholm Central Station, connections to the existing rail network between Stockholm and Uppsala, and three new stations at the Airport (one for existing regional rail services and two for the Arlanda Express).

BACKGROUND

The main driving forces behind the project were the increased demand for flights from Arlanda Airport during the 1980s and early 1990s, coupled with the aim of relieving the impact on the road network in response to environmental concerns. At the same time, a gradual process of opening up the rail network to private sector competition was given new impetus by an economic crisis and the election, early in 1991, of a conservative-liberal government.

Permission for a third runway at the Airport was granted in 1991 but only on the basis of a cap on emissions (including from ground transport) and the provision of a rail link to Stockholm. The initial planning stages for the Link, including consultation with the local authority concerned, were carried out by the national rail administration (NRA). However, it was seen as suitable pilot project to encourage private sector involvement in infrastructure provision, and a group headed by senior industrialists was set up to manage the procurement process. This group later became the state-owned client company A-Banan Projekt AB.

The project appraisal in 1990 concluded that the project would only be viable with state subsidies, and the government later decided to fund two of the three sections (Section A: upgrading the line haul from Stockholm to Rosersberg from dual-track to four-track; and Section C, the North Bend: providing a connection from Arlanda back to the main line at Odensala) as public sector projects.

Private sector bids were invited for section B: building a branch line from Rosersberg to the Airport and three underground stations, and operating an express service between Stockholm and the Airport.

ARLANDA RAIL LINK, STOCKHOLM, SWEDEN

TIMELINE

CONTEXT: 1962: ALL SCHEDULED FLIGHTS MOVED FROM BROMMA TO ARLANDA

CONCEPTION: 1980s (EARLY): CONCEPT OF RAIL LINK TO AIRPORT DISCUSSED

CONTEXT: 1988: SWEDISH STATE RAILWAYS SEPARATED

CONCEPTION: 1988: GOVERNMENT ASKS NRA TO STUDY ALTERNATIVES TO PUBLIC FUNDING, TO START CONSTRUCTION IN 1991

INCEPTION: 1989: NRA PRESENTS PROPOSAL FOR SCHEME

CONTEXT: 1990-94: ECONOMIC CRISIS IN SWEDEN

INCEPTION: 1990: PROJECT APPRAISAL IDENTIFIES NEED FOR PUBLIC FUNDING

INCEPTION: 1991: GOVERNMENT ESTABLISHES DELEGATION TO MANAGE PROCUREMENT, APPROVES THIRD RUNWAY AT ARLANDA CONDITIONAL ON RAIL LINK

INCEPTION: 1991/92: GOVERNMENT ALLOCATES PUBLIC FUNDING FOR LINE HAUL UPGRADE

CONTEXT: 1991: GENERAL ELECTION, CHANGE OF GOVERNMENT

CONCEPTION: 1992: PROJECT SPLIT INTO THREE SECTIONS: PRIVATE FUNDING ONLY VIABLE FOR SECTION B

INCEPTION: 1993: APPROVAL BY GOVERNMENT. INVITATIONS TO TENDER

INCEPTION: 1994: GOVERNMENT SPECIFIES RIGHTS AND DUTIES OF CONTRACT. A-BANAN PROJEKT AB TAKES OVER FROM DELEGATION

INCEPTION: 1994: TWO TENDERS RECEIVED, NEITHER MEETS TECHNICAL REQUIREMENTS, REVISED BIDS RECEIVED

INCEPTION: 1994: CONCESSION AWARDED TO ARLANDA LINK CONSORTIUM

CONSTRUCTION: 1995 (NOV): CONSTRUCTION STARTS

DELIVERY: 1999: CONSTRUCTION COMPLETE, LINK READY TO OPERATE

DELIVERY: 2003: NATIONAL AUDIT OFFICE EVALUATES PROJECT

DELIVERY: 2004: A TRAIN AB BOUGHT BY MACQUARIE GROUP

CHARACTERISTICS

The concession was awarded to the Arlanda Link Consortium (four construction companies – three Swedish and one British – and the rolling stock supplier GEC Alsthom), under a Build Operate Transfer agreement. The operating company A-Train AB was set up as a subsidiary of ALC. The physical infrastructure is owned by A-Banan Projekt AB but leased on a 45-year concession to A-Train AB, which is obliged to allow access to other rail companies for a 'non-discriminatory' fee.

The cost was estimated at SEK 5.2bn in 1990, and at SEK 5.35bn (excluding rolling stock) in 1992 (USD 1.10bn at 2010 prices[1]). The final cost in 1999 (excluding rolling stock) was SEK 5.95bn (USD 1.04bn at 2010 prices). This included a significant overrun on Section A, which has been linked to a lack of clarity over whether connection to the main line was included in the original estimates. Changes in the project scope, in particular the number and type of stations to be built at the airport, and the inclusion of upgrading works benefiting other routes, also complicate the issue of costs.

TIMELINE ISSUES

Construction was originally envisaged by the government as starting in 1991 but the procurement process was complex and the scope for private funding was revised significantly before approval in 1993, when a completion date of December 2000 was set. The Link opened a year earlier than required.

FUNDING

ALC funded the SEK 2.7bn cost of Section B through bank loans of SEK 1.1bn, a stipulated loan from the government of SEK 1bn, equity of SEK 0.4bn and loans from its partners of SEK 0.2bn. The total private sector funding was thus SEK 1.7bn, or 45% of the total.

The stipulated loan entitles the government to receive a share of the company's returns (rather than a fixed interest rate) but patronage has been lower than anticipated, due to an over-estimation of the growth in flight passengers and high train fares (revenue forecasts had assumed fares would be the same as for airport buses).

ALC was believed to have made a loss of SEK 200m when A-Train AB was sold to the Macquarie Group in 2004. All shares in A-Train and the debt of SEK 400m were included in the deal.

[1] Costs have been converted to USD at 2010 prices, using historic inflation rates and current exchange rates, to allow comparison between projects.

6.2 Sweden: The 4 Tests reports

For each of the projects, the Country Partner prepared the '4 Tests Report' which – as described in Section 1.3 above – examined project achievements according to: (i) objectives (both original and emergent); (ii) sustainability; (iiii) treatment of risk, uncertainty and complexity; (iv) a synthesis of the three tests, focusing on responses to the original research questions and hypotheses, the project winners and losers, and provisional lessons.

The full 4 Tests reports can be accessed via the following hyperlinks:

Oresund Bridge/Tunnel
CD ROM: OMEGA Partner 4 Tests\Sweden_4 Tests.doc

Sodra Lankan Road Tunnel, Stockholm
CD ROM: OMEGA Partner 4 Tests\Sweden_4 Tests.doc

Arlanda Airport Rail Link
CD ROM: OMEGA Partner 4 Tests\Sweden_4 Tests.doc

The Partner's overall synthesis of the project findings is now presented in the following pages.

6.3 Sweden: Synthesis of country findings

6.3.1 General lessons from the three cases

Before discussing general lessons we should note that the three cases are in a sense very different from each other:

- The Öresund Link is an example of a transport infrastructure project that is more than just transport and bears symbolic meanings of regional integration and urban renewal. It is also a complex co-operation between two countries;
- The Arlanda Rail Link was less complicated technically and environmentally but became organisationally complex since it was the first example of a public-private partnership in transport infrastructure in Sweden;
- The Southern Link is an example of a controversial road project in an urban planning context where debate over transport has existed for decades.

There are also many things that the three cases have in common, not least that they were planned and implemented in the same time period when transport infrastructure planning was going through some important changes.

6.3.1.1 "The decade of infrastructure"

It is interesting to note that three of the largest transport infrastructure projects in Sweden were planned in the same time period. Crucial decisions for all three projects were made in the early 1990s and additionally many other major projects were planned and implemented over the course of the decade. One interviewee labelled the 1990s as the "decade of infrastructure".

Interestingly, this was also a politically and economically turbulent time. During most of the 1980s the Social Democrats formed a minority government. Between 1991 and 1994 a coalition of four conservative and liberal parties formed government, and in 1994 the Social

Democrats came back to power (where they would stay until 2006). The power shifts in 1991 and 1994 were of crucial importance for the development of all three projects, albeit in different ways.

Regarding the economy, Sweden was facing one of its worst recessions in modern times. Unemployment was rising drastically, state finances were weak and cutbacks in public spending were introduced. The economic recession can itself be an explanation for the interest in large scale infrastructure investments, signalling a traditional Keynesian approach to tackle the effects of a recession. A novel element to this approach was however to introduce new financing models, exemplified by the projects under study, to allow for maximum labour market effects while simultaneously minimising the burden on the strained state budget.

Another important factor explaining the strong interest in infrastructure was the application for membership, and the subsequent entrance into the European Community in the mid-1990s. This implied that the vision of a common European market and increasing mobility for people, goods and ideas had to be physically fulfilled by improving the communications possibilities between Sweden and other member states.

Another interesting insight that emerged as the case studies were carried out is that the key decision makers constitute a limited number of people, some of which have played important roles in several of the projects. This points to the centralised nature of the planning and delivery mechanisms for large scale projects of this kind in the Swedish context. It also indicates that individual opinions, rationalities and political views can assert considerable influence during the planning and decision making phases of projects.

6.3.1.2 New financing forms in the Swedish context

All three cases exemplify the more general trend in Sweden towards alternative ways of financing large infrastructure projects. From the 1980s onwards there has been a wave of liberalisation in Swedish politics. Traditional public monopolies have been opened up for competition and public companies have been privatised. This development has continued irrespective of the political majority in government. In transport infrastructure one way the liberalisation has been illustrated is a willingness to find alternatives to financing through the state budget. This development was accentuated by the recession of the 1990s, when as the demand for public money increased the economic space for investing in infrastructure shrank. But it is also clear that the size of the investments associated with the projects under study required an alternative to budget funding. The cost for the Öresund link alone would have used up the budget for infrastructure for several years and delayed investments elsewhere for a long time.

- The Öresund Link was financed by state guaranteed loans that will be paid back from toll fees from car and train traffic;
- The Arlanda Rail Link is a BOT-project and is the only example in Sweden with private involvement in the financing of transport infrastructure;
- The Southern Link was originally planned to be financed by toll fees just like the Öresund Link. However, this idea was later dropped and the project was financed by public money.

Have there been any long term institutional effects of these alternative finance models in Swedish transport infrastructure planning or were they only a temporal product of the economic crisis in the 1990s? We would argue that there has been institutional change and that the option of financing outside the state budget and bringing in private capital is highly present when new infrastructure projects are being planned. Still, after the Arlanda Rail Link no infrastructure projects have been implemented through public private partnerships. The experience with the Arlanda Rail Link has not been unequivocally positive and even the

present conservative-liberal government is not discussing such models in new transport infrastructure planning. Though alternative financing is still an option there is a common feeling that the government needs to have strict control over these projects. In the large infrastructure projects that are now being built public authorities are responsible for planning and finance comes from the state, county councils, municipalities and user fees. The City Tunnel in Malmö (train tunnel) is co-financed by the state, the region of Scania and the city of Malmö. The City Link in Stockholm (train tunnel) is co-financed by the state, municipalities and the County council. The Stockolm Bypass (Förbifart Stockholm, urban motorway) will be financed by the state and by fees from future congestion charges on sections of the ring road around the Stockholm inner city.

An interesting question is if there are any effects on sustainability and environmental outcomes by the use of alternative financing forms. On a general level financing through user fees, or congestion charging will always imply a social dimension that has to be considered carefully so as not to create transport inequalities. Regarding the Öresund Link we also argue that there are other sustainability implications from the implemented financing model. The main problem from a sustainability perspective is the reliance on strong increases in traffic volumes during the next two decades in order to meet liabilities toward creditors. This development sits uneasy with nationally established transport sector related goals of decreasing greenhouse gas emissions during the same time frame. Additionally the reliance on traffic increases also assumes stable transport energy prices and in light of emerging issues such as the effects of peak oil, this may also pose a challenge for the economic stability of the project. On the other hand there are also mechanisms in the financing model that are favourable for public transport and encourage regional cooperation and integration of the railway systems in Scania and Zeeland. As such there are also elements of the financing model that can be viewed as positive from a sustainability perspective.

The main problem with the financing model of the Arlanda Rail Link from a sustainability perspective is that the ticket price for using the link is based on strict business rationality. One consequence of this is that the railway has had a negligible effect on modal shifts from car traffic to public transport. This is problematic in the light of the emission cap in place at the airport and provides an interesting example of how the business rationality of the private actor in a PPP clashes with public interests, such as steering towards sustainable development goals as well as the possibilities to expand activities at the airport. On a more general level the project can also be criticised on the grounds that the financing model resulted in a solution that prioritised the protection of the private actor's interests over integration with the national and regional railway system. The limited regional integration of the project is not helpful in terms of sustainability of the transport system.

The financing model of the Southern Link also has problematic aspects from a sustainability perspective. The most important is the long term lock-in of funds. It is estimated that the Southern Link will cost the Swedish tax payers around SEK 1 million per day for 25 years since the repayment of loans go through the state budget grants allocated to the Swedish Road Administration. This means that the scope for action in terms of emerging challenges will be limited by a significant sum of money being locked in.

6.3.1.3 Environmental issues and the emerging agenda of climate change

The three infrastructure projects were built at a time when neither sustainability nor climate change had entered the core of political decision making, rather they were emerging issues that were well-known but were not integrated in project planning. Still, environmental issues were important in all projects although the environment played out differently in the three cases:

- In the two projects that involved road building (Öresund Link and Southern Link), environmental issues were forced upon the project from actors outside the planning process;
- The environment was definitely not a central part of internal project planning. In the Southern Link case - the planning of the whole Dennis Agreement (with many roads around Stockholm) had come very far before environmental issues were discussed publicly, at which time some political parties and engaged citizens started writing articles criticising the lack of environmental assessments of the projects;
- In the Öresund Link, environmental issues were present in the early internal Social Democratic planning process as a discussion whether rail or road was the most appropriate solution. It was, however, not until the formal environmental assessment was held that a real debate of environmental impacts came about. This was after a binding agreement to build the link had been signed between the governments of Sweden and Denmark.

It is also interesting to observe which type of environmental issues that came into focus in the projects. The opponents of both the Southern Link (and the Dennis Agreement) and the Öresund Link focused much of their critique on the wider transport effects of building new motorways. Long-term lock-in effects towards increased transportation and climate change were issues they brought up. However, the concrete environmental debate instead came to focus on more local and short-term issues. In the Southern Link it was about inner city congestion, local emissions and noise. In the Öresund Link the main issues were the effects on the water flow to the Baltic Sea and on fishing in the Öresund Strait.

Important as they may be, the focus on local impacts came to overshadow a more general debate on the role of transport infrastructure. The regulations on the environmental permit process reinforced this since local issues are prioritised.

Interestingly, this situation can be contrasted to the Arlanda Rail Link. This project was not controversial from an environmental point of view and did not generate any local or general protests. On the contrary the rail link was seen by all as an important improvement in the transportation to Arlanda airport replacing car traffic with train. In fact, a significant rationale for the whole project was to lower CO2 emissions from ground traffic. The railway was a precondition for building a third runway at the airport and it was an important part of the airport's goal towards keeping within its cap on emissions.

Thus, while the issue of climate change was downplayed by project proponents in the Southern Link and the Öresund Link, it was used as a strong argument by project proponents for the Arlanda Rail Link. The interesting thing is that the three projects were planned around the same time and by the same group of people. Climate change was thus already then an important issue but it was only brought into project planning when it suited the aims of the project.

6.3.1.4 Increase in transport as a basic rationality of transport infrastructure planning

Irrespective of the type of project a fundamental rationality that has guided all three transport infrastructure investments is that they contribute to an increase in transport volumes. For the Öresund Link and the Arlanda Rail Link these were more or less outspoken aims of the projects. The Öresund Link was framed as a vital infrastructure to integrate southern Sweden and the Copenhagen area in Denmark. Within this vision there was a clear idea on increased movement between the two regions. The result almost ten years after opening has been a marked increase in transport in the whole region. The Arlanda Rail Link was closely connected to a third runway at the airport and expectations of a sharp rise in flights. Thus, the railway was an important part of the strategy to increase ground traffic capacity (and to

make it more environmentally friendly). The Southern Link and the whole Dennis Agreement embodied capacity increases as the main solution to the problems of the urban transport system in Stockholm. It has, however, been shown that capacity increase in road infrastructure tends to generate new traffic and not only accommodate existing traffic.

Now it may not come as a surprise that mega projects in transport infrastructure have as a basic rationale that they aim at accommodating an increase in transport or even generating new transport. However, it is interesting to compare this finding with the sustainability goals discussed in research and in transport policy documents. A strong argument can be made that a reduction in climate change impact from the transport sector needs to include a combination of more efficient vehicles, cleaner fuels and a reduction in transport volumes. Sustainable mobility should not be conceptualised as an absolute level but rather as incremental movements towards more or less sustainable. To be able to qualify as sustainable a transport measure should therefore fulfil the two goals of reduced pressures on the environment (including climate change) and increased well-being of present generations (including equity issues). None of the three projects studied here contribute to reducing pressures on the environment (even if attempts are made to minimize pressures). Comparing with Swedish transport policy there is more accordance between the infrastructure projects and sustainability goals. In the government's transport policy declaration from 2009 it was stated that an important goal is combating climate change and reducing greenhouse gas emissions. But this is to be done with higher efficiency and development of vehicles that are climate neutral. By 2030 the Swedish car fleet is to be free from fossil fuels. There are no goals regarding the reduction of transport volumes and no concrete goals on changes in modes of transport. This is true also for earlier transport policy goals.

Transport policy measures that aim to reduce traffic growth do exist. The congestion charges that were introduced in Stockholm in 2005, for example, represented a clear break with the focus on capacity increases, and instead aimed at curbing traffic growth in the city centre while strengthening public transport. Similar measures have been introduced in other cities in Sweden and internationally. However, an irony of the story is that now the congestion charges have become permanent, part of the revenues are used to build new roads in the Stockholm area.

6.3.1.5 Are large infrastructure projects inherently controversial?

One clear result from the cases is that large infrastructure projects are controversial, something that has been shown in many studies. The complexity of the projects and their far-reaching effects, both environmentally, economically and socially mean that many actors are involved and that there are many possible issues of contention. For two of the projects, the Öresund Link and the Southern Link, it was mainly environmental issues that generated conflict, and in these cases the debate became highly public. For the Arlanda Rail Link there was also controversy but mainly about the organisational and financing form. In this case the debate mainly involved the political parties and state agencies, while the public did not become involved.

A general conclusion is that debate and openness tends to contribute to better informed and more legitimate decisions, even if it is not always in the interest of decision makers.

For these large projects there is always a long planning phase before the projects go entirely public. This phase is relatively closed and involves a limited set of actors. Still it can involve lot of debate. It is also in this phase that important decisions are made. For the Öresund Link this phase lasted during most of the 1980s when the project was discussed within the Social Democratic party, in government reports, in negotiations between the Swedish and Danish governments and by industry representatives. During this phase it was decided that it would

be a combined road and rail bridge (instead of a rail tunnel or only road bridge). With the agreement between the Swedish and Danish governments in 1991 and the environmental assessment the project went highly public. In the following years there was a fierce public debate that forced the environmental assessment to be very thorough. In the Southern Link case the Dennis Agreement was initially discussed mainly by politicians, civil servants, and representatives from business and trade unions. In these discussions a general agreement was made on how to implement the different projects in the Dennis Agreement. In the mid-1990s the plans started to be criticised in newspaper articles and the project went public. This resulted in a break-up of the whole agreement and each project was planned separately.

Both cases can thus be criticised for being too closed in their early stages when important decisions were made. For the Öresund Link this meant that the debate became highly polarised when it went public. It also created a lot of mistrust from the environmental movement since the feeling was that the environmental process was merely symbolic, something that was exacerbated by the fact that an agreement had already been made by the two states. Still the environmental process and the open debate had some important effects and probably made the project more environmentally stringent. Also for the Southern Link the debate became polarised and in this case it contributed to the abolishment of the Dennis Agreement.

The controversy surrounding the two projects was to a large degree based on ideological views on how the transport system should ideally be designed. Opponents saw the projects as a part of a larger development towards increased transport and increased reliance on car traffic, something which they saw as inherently unsustainable. Proponents highlighted the necessity of good transportation for regional development and growth and believed that the environmental problems of the transport system can be solved by cleaner and more efficient technology. This kind of fundamental controversy can probably not be solved by more transparency or increased participation. However, including differing perspectives at the early stages of the planning process both increases the democratic legitimacy of projects and improves the decision-making quality.

6.3.1.6 Evaluation is not a priority

A problem connected to the usually long planning processes is that the final construction is not comparable to the initial plan. The preparation studies are not designed to be evaluated and evaluation is thought about only after the project is implemented, on the initiative of politicians and researchers. The three case studies provide many examples of the problems of assessing the goal achievements of the projects. Goals are often vaguely formulated or even stated implicitly, and evaluation is thus made difficult. It is also clear that evaluation is not a priority. Evaluations are made by transport research institutes, independent researchers and academics, or by public agencies such as the County Administrative Board and the National Audit Office. But no formal requirements on evaluation of projects exist, and a general impression is that politicians and other key actors involved in transport planning are not that interested in the issue.

6.3.2 Sweden: Context specific responses to the overall research questions and overall research hypotheses (ORQ's and ORH's)

ORQ #1: What constitutes a 'successful mega urban transport project (MUTP) in the 21st Century?

For each of the three cases there are context-specific factors that contributed to the relative success of the projects.

The Öresund Link

The fact that the Öresund Link crossed the sea as well as the border between Sweden and Denmark was context-specific factors that affected perception of its success. This reinforced the view of the project as something more than just a piece of transport infrastructure.

The project was planned and built during a recession that was tough for the two involved cities, Copenhagen and Malmö. Especially for Malmö the Öresund Link took on a powerful symbolic meaning in the transition of the city from a worker's city to a city of knowledge. The bridge physically replaced the Kockums crane (for ship building) as the main symbol of the city.

An unexpected outcome for the Öresund Link was that train travel has increased much more than expected - something that has contributed to the view of success. It has meant an upswing for public rail transport in the whole region.

The Southern Link

An important contextual factor was that the Southern Link was originally part of the wider Dennis package which included several major road projects in the Stockholm area. When the Dennis package collapsed, each project has been handled separately, with the Southern Link being the first project to be implemented. The dropping of the Dennis package changed the contextual preconditions for the Southern Link, something that was not always taken into account in the further planning of the project.

The Arlanda Rail Link

The Arlanda Rail Link was the first example of a public-private partnership for a transport infrastructure project in Sweden - this has conditioned the view of its success both by proponents and critics.

All observers agree on the need for a rail link to the Arlanda airport outside Stockholm and there is also a consensus that the project technically has been successful. The main controversy lies in the financing form and the way the contract was written between the government side and the private operator. Critics argue that the contract has meant that the state had to pay more for the project than intended and that there has been a loss of public control over the project. Thus it has not achieved the goals of reducing car traffic to and from Arlanda because of high ticket prices and a private monopoly on the rail track. Proponents argue that a high-quality rail has been built at a low cost for the public, thanks to the innovative financial model.

ORQ #2: How well has risk, uncertainty and complexity been treated in the planning, appraisal and evaluation of such projects?

The Öresund Link

A contextual factor that made the planning and delivery process more complex was that it involved two governments. In the early planning phase, no one actor had control over the decision process and planning was conducted in a more chaotic way, as a mix of bargaining and co-operation between actors. Although strategic considerations were important these were not treated in a systematic way.

In the implementation phase, the project management organisation had main control over the process. They managed to handle questions of RUC in a competent way.

The Southern Link

Interviewees voiced very different opinions regarding how well risk, uncertainty and complexity was treated in the planning, appraisal and evaluation of the project.

There was a broad consensus among the interviewees that the technical risks associated with the project during the implementation phase were dealt with in a competent way.

Regarding complexity, several interviewees mentioned that the Dennis agreement contained many projects and the financing of several of the individual (road) projects was conditioned on the implementation of the ring road projects and the extraction of road tolls. The latter proved to be a hotly contested part of the Southern Link deal. Several interviewees pointed to the inflexibility of the Dennis agreement as a critical reason for its ultimate political failure. The collapse of the Dennis agreement and the juridical problems encountered by the Northern Link project (see project profile template, section 2.2.1) meant that a new financing model was struck between the state, the region of Stockholm and the City of Stockholm which included only a few projects (the most important being the Southern Link).

The problems associated with the Southern Link can be partly explained by several very important appraisal parameters being radically altered (e.g. the omission and delay of other key projects; the omission of road tolls on the proposed ring road and the introduction of a congestion charging system for the inner city). As such it could be argued that factors external to the project have fundamentally changed the appraisal conditions and that the problems haunting the project today indicate that the handling of uncertainties and complexities was insufficient.

The Arlanda Rail Link

The main contextual aspect of RUC was that it was a PPP model. Views are highly polarised on whether RUC surrounding the financing model was handled well or badly.

ORQ #3: How important is context in making judgments regarding the above questions?

All three cases have been shaped by the unique contexts in which they were developed. The actual development of a project can never be determined by generic factors but will always depend on the specific context.

Öresund Link

A main context-specific factor is that it was a link between two countries and functioned as a way to increase regional integration. The planning of the link was made in the early 1990s with economic difficulties in Malmo and Copenhagen playing an important role for judgements about the success of the project. The role played by the Öresund Link in boosting the economies of both Malmo and Copenhagen is a recurring theme and in this respect the increasing commuting from Malmo to Copenhagen and the increasing integration of the housing and labour markets is often forwarded as an important contextual dimension explaining the success of the project.

Another contextual factor greatly influencing judgements regarding ORQ 1 & ORQ 2 is how the issue of handling the effects on the marine environment in the Öresund and the Baltic Sea became a central topic in the controversy surrounding the project.

Southern Link

The main context-specific factor was the unexpected stopping of the Northern Link project and the subsequent collapse of the Dennis agreement, which meant that the Southern link became the first of the ring road projects in the Dennis agreement to be implemented. As stated in the response to ORQ 2, the current problems of the Southern Link (which clearly affect judgements of success) are mainly the result of changing contextual parameters.

Arlanda Rail Link

Context has been important both because the PPP-model was the first in Sweden and because of the political disagreements between the main parties, which forced a speedy decision in the critical stages of contract negotiation between the government and the private party.

ORH #1: Traditional criteria relating to cost overruns, completion dates, generation of travel time savings for users and rates of returns to investors are inadequate measures of success in the 21st Century as sustainable development concerns become increasingly critical both globally and locally.

The Öresund Link

The focus on regional integration meant that other criteria apart from the traditional ones have been important. The environmental opposition to the project meant that environmental questions became an important part of the appraisal process.

The Southern Link

Cost benefit analysis was carried out but the results were not decisive for the decision. The environmental opposition to the project meant that environmental questions became an important part of the appraisal process.

The Arlanda Rail Link

From the Arlanda Rail Link a number of context-specific criteria emerged as important, such as the quality of the framework contract and the roles of public and private actors.

ORH #2: The new emerging international and local agenda related to vision(s) of sustainable development is multi-dimensional and goes beyond notions of environmental sustainability, as critical as this may be, in that it also concerns inter-related concepts of economic sustainability, social sustainability and institutional sustainability.

The Öresund Link and the Southern Link

Environmental concerns were a fairly new aspect of the decision process and became important because of environmental opposition. Economic and social aspects were a core part of the project from the start of the planning process.

The Arlanda Rail Link

Social aspects took on a special meaning in this case because of high ticket prices which has meant that the rail service is mostly used by business travellers.

ORH #3: The level of competence in decision-making and planning in today's fast-changing world is best assessed by the adequacy of the treatment of risk, uncertainty and complexity and sensitivity to context – all of which are important demands on Strategic Planning.

The Öresund Link

Agree with the statement. The project management team was competent.

The Arlanda Rail Link

Competence with PPP-arrangement was lacking in the public sector so specialist advice was obtained from private companies who had longer experience of the kind of contracts used.

6.3.3 Possible generic responses (to ORQ's and ORH's)

ORQ #1: What constitutes a 'successful mega urban transport project (MUTP) in the 21st Century?

First, it seems important to differentiate between project implementation and function when assessing 'success' - many of the respondents viewed the question of success in this way:

- Project implementation covers questions such as organisation and management, delivery on time and keeping within budget;
- The function of the project relates both to specific questions of travel volumes and environmental effects, but also to the wider effects of the transport infrastructure;

While both aspects are important in evaluating the success of a project it is perfectly possible that implementation is problematic while the performance of the project turns out to be a success from many observers' point of view. In the three projects, implementation went fairly smoothly (even though the decision processes prior to the final decision were troubled and fraught with controversy), while success regarding the function of the projects has varied.

Another generic outcome is that it is not enough to judge the success of a project based on economic and technical criteria only (e.g. economic performance, keeping budget, traffic volumes, meeting environmental requirements). This is a conclusion based both on views from respondents, the interviews and from an observation of the effects of the projects. In order to get a full picture of success it is essential also to consider the wider and long-term effects of mega projects:

- The Southern Link (together with other road projects in Stockholm), for example, probably will have wider effects in the form of an increase in car travel and a lock-in into further dependence on cars;
- The Arlanda Rail Link has the potential to change travel habits to and from the airport, but this is currently not materialising because of high ticket prices on the air shuttle. Mega projects can also in themselves shape the development of a region going beyond mere transport effects;
- The most obvious example is the Öresund Link. Although some of the economic indicators for the project were not met, the main success factor for the Öresund Link is that it has increased the travelling between the Denmark and Sweden and led to increased regional integration. The Öresund link has become more than just a

transport infrastructure; it has also started and spurred other processes in the region. Some examples include an increased integration between the employment markets on the Danish and Swedish sides, an increased number of Danes living in Malmo and an increased cultural exchange.

Third, mega projects tend to be controversial, and this was the case for all three Swedish projects. The controversies are often based on different views of what the project function should be; boiling down to different ideological views on what an effective and sustainable transport system should look like. This was the case both for the Öresund Link and the Southern Link, where a main issue of debate was the role of car traffic and the general increase in transport volumes. In the Arlanda Link the main controversy was how the project should be financed (through public money or a public private partnership?). The controversial nature of the projects means that the perceptions and judgements on project success also tend to be highly polarised. People can agree on how the project performs and its effects, but still disagree on whether or not it is a successful project. Thus it is important to ask successful for whom and on which grounds? Still, the Öresund Link shows that the performance of a project can help to overcome a polarised controversial situation. Today (almost) all observers view it as a successful project because of its positive integration effects, even though the problems of increasing transport and car traffic still exist. The Arlanda Rail Link might be perceived as more successful in the future if it manages to increase its travel share compared to car traffic.

Fourth, many respondents mentioned broad political support as important in order to achieve a successful project. However, the view of what broad political support means can differ. To some it can mean that the main political parties and major stakeholders support the project. To others, such support is not enough if the project is contested by other parties and stakeholders that are excluded from the formal decision process.

To conclude, we note that there is no straightforward connection between the performance on official project goals and the perceptions on whether the project is successful or not. While project goals are in some cases important (e.g. if they are clearly not met this will have a negative effect) other factors and effects can be just as important. This has partly to do with the fact that goals are often not specified clearly and are sometimes difficult to evaluate. But it is also because goals are connected to economic and technical issues while wider impacts are not covered.

ORQ #2: How well has risk, uncertainty and complexity been treated in the planning, appraisal and evaluation of such projects?

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n order to discuss the treatment of risk, uncertainty and complexity in the planning process a few distinctions have to be made. First, the planning process can be divided into (i) planning prior to the final decision to build the project and (ii) implementation and delivery of the project. Second, risks can be divided into (at least) technical, economic and political risks.

For all three projects the planning process prior to decision has been very complex and fraught with controversy:

- The main risk and uncertainty has thus been political;
- However, technical and economic considerations and disagreements have been an important part of the political debate and the fact that the projects implied great technical and economic risks has increased the complexity of the political process;
- Risk, uncertainty and complexity have been treated differently in the three cases;
- An important conclusion is that in the early planning phase no one actor has control of the planning process and the decision process moves forward through a mix of

bargaining, confrontation and co-operation between a multitude of actors with different agendas. These processes are thus highly chaotic;

- In the Öresund Link, for example, one important decision process took place within the Swedish Social Democratic party. Another important actor in the early phase was an industrial lobbying group lead by the chairman of Volvo, Pehr G Gyllenhammar;
- In the Southern Link the early planning process was equally chaotic involving political parties, local environmental groups and government administrations. As the final decision approached, the decision process tended to become more closed and the main actors took more control (e.g. the governments of Sweden and Denmark in the Öresund Link).

In the implementation process it is much clearer that one actor has control over the situation, namely the project management organisation. In this phase the main risks seem to be technical and economic while the political controversies (in these three cases) did not influence the implementation process.

In all three cases, implementation went smoothly with no large technical surprises that jeopardized the project. All projects were delivered on time and according to budget (except the Öresund Link which had some budget overrun). This seems to imply that technical and economic risks were handled well, and this could also be a general conclusion from the three cases.

However, a closer look reveals some oddities. In the Southern Link, a major problem for the finished project has been congestion in the tunnels and high levels of pollution. These problems can in part be explained by several very important appraisal parameters that were used in the early phases being radically altered (e.g. the omission and delay of other key projects; the omission of road tolls on the proposed ring road and the introduction of a congestion charging system for the inner city). The altering of parameters did not lead to a change in the project plans. So even though the project was implemented smoothly the problems haunting the project today indicate that the handling of uncertainties and complexities were insufficient.

Both the Öresund Link and the Southern Link had lengthy and thorough environmental processes which proponents of the projects saw as evidence that (environmental) risk and uncertainty were handled in a competent way. However, stakeholders' views also diverge on this issue. Opponents mainly saw this as mock processes that could not alter the outcome of the projects. They argued that strategic decisions were made at an early stage where environmental considerations were treated in a very rudimentary way. Our conclusion is that both perspectives contain some truth. While the environmental assessment did improve the projects considerably they did not address strategic questions (e.g. should the Öresund Link be only road; road and rail; or only rail?). The exclusion of strategic issues meant that environmental stakeholders became disillusioned by the process.

Reducing economic risks for the public sectors has been an important objective in all three cases. Traditionally, larger infrastructure projects have been financed by the state from the existing budget. The three cases show that this is changing in Sweden and that there is an increased interest in finding alternative ways of financing. A main rationale behind this is to put less strain on the public budget and reduce economic risks:

- The Öresund Link was financed by state guaranteed loans that will be paid back by user fees from car traffic and rail. In this way the financial commitment of the state was reduced. On the other hand, the financial design has had effects on the performance of the Öresund Link, with a main effect being that the consortium is dependent on a long term increase in car traffic volumes;
- The Southern Link was mainly financed by state money with some contribution from the City of Stockholm (and indirectly the county council). In this case the public side

managed to reduce risks by shifting them to the private contractors through the way the contract was written. So while the project was officially completed on budget it was in reality much more expensive and the private contractors had to pay the bill (the exact numbers are not possible to get);

- The Arlanda Rail Link is the first (and so far only) example of a PPP in Sweden where the idea was to attract private capital. However, in this case the private partner managed to get a good deal which meant that in reality a high proportion of the investments were made by the state (for adjoining infrastructure investments that were not part of the core project).

ORQ 3: How important is context in making judgments regarding the above questions?

For ORQ 1 and 2 we have discussed a number of generic lessons that could be drawn from the three case studies. It should, however, be clear that all three cases have been shaped by the unique contexts in which they were developed. The actual development of a project can never be determined by generic factors but will always depend on the context-specific.

Öresund Link

A main context-specific factor was that it was a link between two countries and functioned as a way to increase regional integration. The planning of the link was made in the early 1990s and the context with economic difficulties in Malmo and Copenhagen plays an important role for judgements about the success of the project. The role played by the Öresund Link in boosting the economies of both Malmo and Copenhagen is a recurring theme and in this respect the increasing commuting from Malmo to Copenhagen and the increasing integration of the housing and labour markets is often put forward as an important contextual dimension explaining the success of the project. Another contextual factor greatly influencing judgements regarding ORQ 1 & ORQ 2 is how the issue of handling the effects on the marine environment in the Öresund and the Baltic Sea became a central topic in the controversy surrounding the project. That the project was implemented without any major detrimental effect on the marine environment in the Öresund and without any negative impact on the water flow between the North Sea and the Baltic Sea was mentioned by almost all respondents.

Southern Link

The main context-specific factors was the unexpected stopping of the Northern Link project and the subsequent collapse of the Dennis agreement that meant that the Southern link became the first of the ring road projects in the Dennis agreement to be implemented. As stated in the response to ORQ 2, the current problems of the Southern Link (which clearly affect judgements of success) are mainly results of changing contextual parameters.

Arlanda Rail Link

Context has been important both because the PPP-model was the first in Sweden and because of the political disagreements between the main parties which forced a speedy decision process in the critical stages of making a contract between the government and the private party.

ORH #1: Traditional criteria relating to cost overruns, completion dates, generation of travel time savings for users and rates of returns to investors are inadequate measures of success in the 21st Century as sustainable development concerns become increasingly critical both globally and locally.

Based on both interviews and our own observations of the three cases we conclude that traditional criteria are still an important part of the evaluation of projects and that they should remain so. However, they need to be complemented by other criteria concerning sustainability measures.

That said, our cases also confirm that sustainability is a fuzzy concept that can be interpreted differently by different actors. One contrast (that was clearest in the Southern Link) was that between a focus on local or global issues of sustainability. From a local point of view the Southern Link might be regarded as a success since it contributed to alleviating pollution, noise and congestion problems in the city centre (although critics would say that it is not successful from this point of view either) and the area where it was built. From a global point of view it is much more problematic since it contributes to an increase in car traffic and CO2 emissions. If sustainability concerns should become part of project evaluation and appraisal then there is a need to find ways to make it more concrete and break it down into more specific criteria.

Traditional cost-benefit analysis does not always play a great role in decision making even it is regarded as an established decision tool. The Southern Link was implemented despite the project being subject to two separate Cost-Benefit-Analyses showing that the project had a negative cost-benefit ratio. Proponents of the projects argued that the tools available to measure traditional criteria, most notably Cost-Benefit Analysis (CBA) are inadequate for properly measuring the benefits of projects of this magnitude. A central part of the critique is the inadequacy of existing CBA models to capture all the benefits of motorway tunnels in a densely populated urban area, particularly the inability to capture the long term dynamic (economic) effects of new development made possible by transferring traffic underground. A parallel can be made with the Öresund Link where the main positive effects highlighted by respondents are about regional integration, something that a traditional CBA cannot easily capture.

From the Arlanda Rail Link a number of other criteria emerged as important, such as the quality of the framework contract and the roles of public and private actors.

ORH #2: The new emerging international and local agenda related to vision(s) of sustainable development is multi-dimensional and goes beyond notions of environmental sustainability, as critical as this may be, in that it also concerns inter-related concepts of economic sustainability, social sustainability and institutional sustainability.

We cannot agree fully with the above statement. ORH #2 seems to imply that economic and social sustainability are new concerns that are increasingly being taken into account.

Our interview results rather show that economic and social aspects have been at the core of infrastructure planning for a long time, and that the terms economic sustainability and social sustainability are merely new names for things that have always existed.

Instead, our interpretation of the views of the respondents is that the main novelty brought about by the emerging sustainability agenda is the increasing importance awarded to environmental concerns. In the case studies, (especially the Öresund Link and the Southern Link), environmental concerns were not at the core of planning from the start but later

became major concerns partly because of pressure from external stakeholders. The understanding of the concept of sustainability as described by our respondents seems to imply that the emerging sustainability agenda incorporates the environmental dimension as well as more traditional economic and social concerns.

Based on the case studies we suggest an alternative phrasing of the hypothesis which in our view corresponds better to the opinions expressed by the interviewees: "The new emerging international and local agenda related to vision(s) of sustainable development is multi-dimensional and goes beyond notions of economic growth and social considerations, as critical as this may be, *in that it also concerns environmental considerations." [Emphasis added].*

Additionally we believe that it is incorrect to say that the sustainable development agenda goes beyond environmental sustainability since this indicates that other aspects are more important or can weigh up for negative environmental effects. It is better to say that sustainability also embraces other aspects besides environmental effects.

While looking at a multitude of aspects of sustainability a key question remains whether negative effects on environmental sustainability can be justified if other aspects are fulfilled? In the Öresund link, for example, this seems to have been the outcome. The positive aspects are regional integration, economic growth (possibly), increased travelling and exchange, while the main negative effect is increased emissions from transport. A similar outcome can be seen for the Southern Link. Herein lies the main paradox of new infrastructure projects, especially those that are about building roads. We argue that environmental concerns (as well as economic and social) should be viewed in their own light and that they should not directly be compared to other effects (as is often done in cost-benefit analysis).

Regarding institutional sustainability we have not found much evidence about this since it seems to be a quite unfamiliar concept in the Swedish context.

Finally our cases indicate that there is not a single 'new emerging agenda' on sustainable development. On the contrary, sustainable development is an inherently fuzzy concept that is interpreted differently by different actors (e.g. putting different weight on social, economic and environmental concerns). Thus, it will be necessary to discuss and define what is meant by sustainability in each new context.

ORH #3: The level of competence in decision-making and planning in today's fast-changing world is best assessed by the adequacy of the treatment of risk, uncertainty and complexity and sensitivity to context – all of which are important demands on Strategic Planning.

All three cases give support to the statement in ORH #3. The level of risk, uncertainty and complexity was high in all three cases (as discussed under ORQ 2) and the way these challenges were treated was essential to the success of the projects.

With the Öresund Link, the project management displayed a high degree of competence to handle both the technical and economic risks. They also managed the potential political risks of the project with a strong focus on image building, commitment to environmental effects and a high degree of transparency.

The question of competence was particularly difficult in the Arlanda Link case since it was the first PPP for an infrastructure project. The responsible politicians and civil servants were aware of the lack of competence and brought in special competence from the private sector to develop the project. Still, the complexities of the project (together with a rushed planning

process) meant that an ideal contract (from the public point of view) was not established with the private partner.

The Southern Link showed that there was a lack of competence in handling issues of RUC and adapting to contextual factors. The analysis revealed that many of the problems linked to the project when it was completed are consequences of the (inadequate) treatment of risk, uncertainty and complexity in the decision and planning process.

6.3.4 Sweden: Potential generic and context specific lessons

6.3.4.1 Context-specific lessons

Lessons for sustainable development challenges

Sustainable development is a fuzzy concept and its meaning partly depends on contextual factors. It therefore has to be discussed and defined in every new contextual setting.

Lessons for the treatment of risk, uncertainty, complexity and context

While large transport infrastructure projects are inherently risky, uncertain and complex these challenges are often increased by the specific contextual setting, creating unique problems and challenges for each new project. Examples (of context-specific factors) from the three cases were:

- A polemic and contested political situation (the Öresund Link, the Southern Link and the Arlanda Rail Link);
- The importance of economic recession (the Öresund Link, the Southern Link);
- The use of a new financing model (the Arlanda Rail Link, the Öresund Link);
- The collapse of a wider transport package (the Southern Link).

Planning can therefore never be done by following a handbook. Instead it has to be reflexive and flexible in order to adjust to new situations. If planning is not adaptive there is an increased risk of negative effects on project performance.

Lessons according to project typology

[See next section, 'lessons of a generic nature'. No difference in the conclusions in this case].

6.3.4.2 Potential generic lessons

Lessons for sustainable development challenges

Sustainable development encompasses environmental, economic, social (and institutional) concerns which should all be part of a comprehensive assessment and evaluation of a transport infrastructure project. However, these concerns should not be directly weighed against each other (as, for example, in a cost-benefit analysis). Environmental concerns have to be judged in their own right. It may, of course, be decided that some negative environmental effects can be accepted if other positive effects are achieved. This should not, however, be an inherent outcome of the decision tool (or criteria) that is used.

Sustainable development is a fuzzy concept that can be interpreted differently by different actors. For example different weights can be put on the dimensions of environmental, economic and social sustainability, or on local versus global environmental effects. This

means that for each specific project it has to be decided what is meant by sustainability and how this will be measured.

There is often (but not always) a dilemma/trade-off between different aspects of sustainability; therefore there has to be a transparent and thorough assessment of how these trade-offs should be handled.

Large transport infrastructure projects are inherently problematic from (at least) an environmental sustainability point of view, since an underlying rationale of these projects is that they will contribute to, and accommodate, an increase in transport volumes. Road projects are especially problematic since they contribute to a lock-in into car as the dominant mode of transport. Therefore there is a need to bring in strategic and long-term thinking regarding environmental sustainability into transport infrastructure planning, not only at the project level but on a more nation-wide (or global) level. One way to address the sustainability challenge is to assume that technology will solve the problem (e.g. C02-neutral vehicles), an approach that is often implicit in the thinking of decision makers. Another approach is to rethink the role of large scale infrastructure and start considering how the goals of reduction in transport volumes can be achieved without negative economic and social effects.

Lessons for the treatment of risk, uncertainty, complexity and context

RUC varies in the different phases of project planning. The early planning phase (prior to the political decision to go ahead with the project) is often chaotic and involves a number of different actors and stakeholders with different motives. It is difficult for one actor to control this process and RUC therefore cannot be handled in a rational and well-organized way. While technical and economic assessments are part of the early process it is often political complexity and uncertainty that is the most challenging. In the implementation phase it is the project management that has main control over the process. In this phase RUC related to technical, economic and environmental issues dominate, even if political complexities enter the planning process.

Large transport infrastructure projects are often controversial and affect a large number of stakeholders. This adds to the complexities of the process and it is common that different stakeholders conduct their own assessments (of environmental or economic effects, for example) as an input to the decision process.

Discussion and debate should not be stifled or avoided. A transparent and inclusive decision process is important both for the legitimacy of projects and to improve decision making by bringing in many perspectives. The temptation to narrow down the group of involved stakeholders will always be great in order to have a smooth decision process. It is therefore important to have institutionalised rules and procedures for transparency and inclusiveness. It is also important to have an active civil society that critically reviews new projects.

Large transport infrastructure projects have wider effects that go beyond the transport effects. This adds to the complexity and should be taken into account in decision making.

Economic risks for the public sector can be reduced by an increased involvement of private actors in financing and project implementation. However, government will always have an important role, including financially, as guarantor of the project or with additional investments. Also, it should be noted that the use of new financing models can have effects on other aspects of project performance and this should be taken into account (e.g. environmental performance, transparency, public goals).

Lessons according to project typology

Roads: A key question is whether increased road building is the solution to the urban transport problems of the 21st century? Can such a project be considered a success even if it meets its official goals? Our answer to ORQ #1 seems to indicate that this is not the case even if sustainability concerns are disregarded. It is possible to identify a conflict between local concerns and regional/global ones. Local concerns can be improved environmental conditions in the inner city (as a result of decreasing through traffic) and less noise and traffic related emissions. From a regional or global perspective, major road projects will worsen problems through increased road traffic and may relocate local pollution problems while simultaneously contributing to more energy use.

A clear trend in the Stockholm area is that urban roads are increasingly being built in tunnels. This was the case for the Southern Link and this is also happening for the new projects that are being planned. While this increases the costs it avoids conflicts with other interests and opens up the possibility for new land uses.

Bridges: The Öresund Link case clearly shows that a bridge can take on a more symbolic meaning and embody the image of city and regional transformation. The Link also had wider effects beyond transport effects, on regional integration (e.g. job market and housing).

Rail: An important lesson from the Arlanda Rail Link is the importance of integrating a new rail infrastructure to the existing rail network. This was not done in this case which has contributed to the relatively low passenger volumes and to the fact that car travel to and from the airport has not been reduced. The rail link is both physically disconnected (with different rail tracks, different height of the platforms and the construction of end stations instead of run-through stations) and legally disconnected with monopoly given to the private operator. The reason for this is the way the PPP-contract was written.

6.4 Conclusion, Sweden

This section presented a summary and synthesis of the Sweden Country Partner's research on the three case studies of Öresund Link, Sodra Lankan Road Tunnel, and Arlanda Rail Link.

A summary profile of each project (with hyperlinks to the full Project Profiles) described the project's history and main characteristics, features, issues and timelines.

The Country Partner's own synthesis of their research findings in relation to the '4 Tests' was then given, presenting findings from the overall country perspective (i.e. combining the three case studies). Hyperlinks to the more detailed '4 Tests Reports' for each project were also given.

The next Section now presents the USA Country Partner's findings from three mega-urban transport projects, while Volume 5 contains detailed analyses and comparisons of all 30 mega-urban transport projects, together with the overall findings and lessons of the research.

7. Country Findings – USA

Air Train JKF Airport

Alameda Freight Rail Link, Los Angeles

The Big Dig Boston

7.1 USA: The project profiles

Project Profiles were prepared by the Country Partner[7] for each of the study projects, to provide a consolidated source of secondary information to support all phases of data collection, analysis and synthesis. The profiles covered such matters as: project cost, duration and quality information; principle and secondary project objectives; key project stakeholders; sources of finance; key events and processes. (See also Volume 1, Section 3.4).

The full Project Profiles can be accessed via the following hyperlinks:

Airtrain, JFK Airport
http://www.omegacentre.bartlett.ucl.ac.uk/studies/cases/pdf/USA_AIRTRAIN_PROFILE_060911.pdf

Alameda Freight Rail Link, LA
http://www.omegacentre.bartlett.ucl.ac.uk/studies/cases/pdf/USA_ALAMEDA_PROFILE_110307.pdf

Big Dig Road and Tunnel Link, Boston
http://www.omegacentre.bartlett.ucl.ac.uk/studies/cases/pdf/USA_BIGDIG_PROFILE_291010.pdf

Summaries of the Project Profiles are presented on the following pages.

[7] In the USA, the Country Partner was the Rudin Centre for Transportation Policy and Management, New York University, New York City - directed by **Prof. Charles Brecher.**

AIRTRAIN, NEW YORK, USA

OVERVIEW

LOCATION: JFK AIRPORT, NEW YORK
SCOPE: INTRA-URBAN
TRANSPORT MODE: LIGHT RAIL
PRINCIPAL CONSTRUCTION: GRADE
NEW LINK: YES

PRINCIPAL OBJECTIVES

STRATEGIC TRANSPORT LINK
INCREASED CAPACITY
ALTERNATIVE TO CAR
REDUCED TRAVEL TIMES
REGENERATION (EMERGENT OBJECTIVE)

PRINCIPAL STAKEHOLDERS

CLIENT: PORT AUTHORITY OF NY & NJ
CONTRACTOR:
AIR RAIL TRANSIT CONSORTIUM
FUNDER: PORT AUTHORITY OF NY & NJ
REGULATOR: FEDERAL AVIATION ADMIN.

PLANNING AND IMPLEMENTATION

PLANNING START DATE: 08/1995
CONSTRUCTION START DATE: 05/1998
OPERATION START DATE: 12/2003
MONTHS IN PLANNING: 33
MONTHS IN CONSTRUCTION: 67
PROJECT COMPLETED: 12 MONTHS BEHIND SCHEDULE

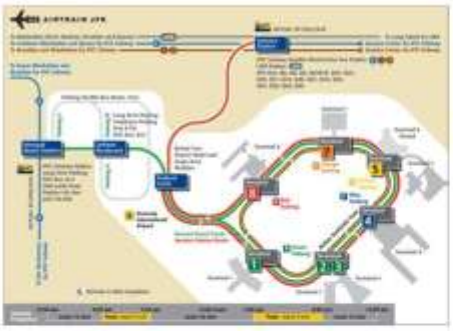
COSTS (IN 2010 USD)

PREDICTED COST: 2.14BN
ACTUAL COST: 2.22BN
PROJECT COMPLETED:
4% OVER BUDGET
FUNDING: 100% PRIVATE

INFRASTRUCTURE QUANTITIES

LENGTH: 13.5KM
NUMBER OF STATIONS: 10
COST PER KM (2010 USD): 0.17BN

PATRONAGE



INTRODUCTION

The Airtrain is a double-track light rail service linking the terminals in JFK Airport via a 2.9km loop, with two spurs of 4.8km and 5.3km to regional transport hubs. It opened in 2003.

The Airtrain serves ten stations: six within the central terminal area of the airport; three in the car rental and long-term parking areas (of which one is an existing station on the city subway network); and one existing station for rail, subway and bus services.

The project included extensive development at the latter two stations. It is part of the Port Authority of New York & New Jersey's term Airport Improvement Program and is associated with a broader vision for the economic regeneration of the Jamaica area in Queens.

BACKGROUND

The main objective of the project was to improve access to, from and within JFK Airport, facilitating the forecast substantial growth in passenger numbers following airline deregulation, whilst providing an alternative to access by car and improving journey times. The objective of regeneration around Jamaica Station emerged during the process of building support amongst local communities.

The Port Authority was first mandated to provide a rail link to the airport in 1962. Despite successive reports and proposals, obstacles including funding issues, a lengthy regulatory process and local opposition blocked progress. In 1978, the Metropolitan Transport Authority introduced a 'train to the plane' service to Howard Beach Station, with a bus shuttle link to the airport, but this was discontinued in 1990. In the same year, a Federal Act allowed airport operators to fund eligible airport improvements through a Passenger Facility Charge (PFC) levied on airline passengers.

The Port Authority began planning an ambitious Automated Guided Transitway (AGT), a 35km direct link to the city centre, in 1992/93, but opted instead for the smaller Airtrain proposal in 1995. Opposition continued from the Mayor of New York (who supported the original aim of providing a 'one seat ride' to the city centre), the Air Transport Association and local communities. However, the PFC funding mechanism allowed the Airtrain to proceed without state or city funding, resolving much of the political opposition to the project. Its use required Federal Aviation Administration approval.

TIMELINE

CONCEPTION: 1962: PORT AUTHORITY (PA) HAS MANDATE FOR AIRPORT LINK

CONCEPTION: 1968: MTA RECOMMENDS RAIL LINK TO CITY CENTRE

PRECURSOR: 1978: 'TRAIN TO THE PLANE' SERVICE INTRODUCED

INCEPTION: 1990: FEDERAL ACT INTRODUCES PASSENGER FACILITY CHARGE

PRECURSOR: 1990: 'TRAIN TO THE PLANE' SERVICE DISCONTINUED

CONCEPTION: 1993: PA SCOPING AUTOMATED GUIDED TRANSITWAY (AGT) SYSTEM

INCEPTION: 1995: DRAFT ENVIRONMENTAL IMPACT STATEMENT (EIS) ON AGT SYSTEM SUBMITTED

INCEPTION: 1995 (AUG): FAA AGREES TO USE OF PFC FOR AIRTRAIN SCHEME

CONTROVERSY/DELAY: 1996: ATA OPPOSITION - FAA APPROVAL ON HOLD

INCEPTION: 1997: FINAL EIS ON AIRTRAIN SCHEME, INCLUDES APPRAISAL OF ALTERNATIVE OPTIONS

CONTEXT: 1997: PA BEGINS CONSTRUCTION OF AIRTRAIN AT NEWARK AIRPORT

INCEPTION: 1998: FAA APPROVAL

CONSTRUCTION: 1998 (MAY): CONSTRUCTION BEGINS (DBOM CONTRACT)

INCEPTION: 1999: CITY COUNCIL APPROVAL. FINAL FAA APPROVAL INCLUDES PLANS FOR JAMAICA STATION

CONSTRUCTION: 2001: CONSTRUCTION BEGINS AT JAMAICA STATION

ACCIDENT/DELAY: 2002: FATAL ACCIDENT DURING TEST RUN

CONSTRUCTION: 2003: CONSTRUCTION COMPLETE

DELIVERY: 2003 (DEC): LINE OPENS

FAA approval was dependent on eligibility criteria and came in several stages. Another crucial element was the city council's permission for the Port Authority to use the right of way on the Van Wyck highway, thus minimising the impact on local residential communities and remaining within the FAA's eligibility criteria.

The 1997 Environmental Impact Statement included an appraisal of alternative options for improving access to the airport. During construction, a community outreach program was set up, delivering local area improvements and awarding contracts to local businesses.

CHARACTERISTICS

The Port Authority was the client, awarding a Design, Build, Operate and Maintain contract to the Air Rail Transit Consortium (a joint venture of Bombardier Transportation, Skanska USA, STV Inc., Alcatel Canada, and Perini Corp). The estimated cost increased from USD 1.1bn in 1996, to USD 1.6bn in 1998 (USD 2.14bn in 2010 prices), including the DBOM contract of USD 1.2bn. The final cost was USD 1.88bn (USD 2.22bn in 2010 prices), 4% over budget.

Trains have been designed to also operate on the rail and subway tracks, allowing a 'one seat ride' to be developed in the longer term. The need to maintain normal traffic conditions on the heavily congested highway network was a constraining factor in construction.

TIMELINE ISSUES

The Port Authority's decision to proceed with the Airtrain, instead of the more ambitious AGT project, and the introduction of the PFC funding mechanism were the key events enabling progress.

The use of a DBOM contract allowed simultaneous design and construction, reducing construction time. However, a fatal accident during a test run caused a one-year delay to the opening.

FUNDING

The PFC was the main source of funding (70% or USD 1.4bn), the Port Authority's capital funds providing the remainder (30% or USD 0.6bn). Operating costs are covered by fare revenues and the avoided costs of bus shuttle services.

Actual ridership numbers have been lower than forecast but have increased steadily since the project's opening. Intra-airport and staff trips are free, and their inclusion in traffic forecasts has made comparisons between forecast and actual traffic difficult.

ALAMEDA CORRIDOR, LOS ANGELES COUNTY, USA

OVERVIEW

LOCATION: LOS ANGELES COUNTY, CA.
SCOPE: INTRA-URBAN
TRANSPORT MODE: RAIL
PRINCIPAL CONSTRUCTION: TRENCH
NEW LINK: YES

PRINCIPAL OBJECTIVES

STRATEGIC TRANSPORT LINK
CONGESTION RELIEF
REDUCED POLLUTION & ACCIDENTS
TRAVEL TIME SAVINGS
REGIONAL ECONOMIC COMPETITIVENESS
SUSTAINABILITY
EMERGENT OBJECTIVES:
LOCAL ACCESSIBILITY/REGENERATION

PRINCIPAL STAKEHOLDERS

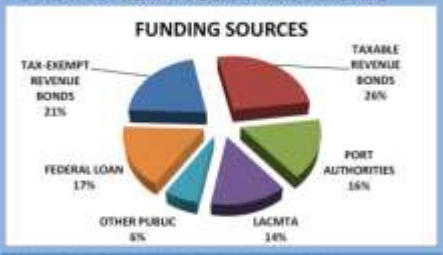
SPONSOR: ACTA
FUNDER: FEDERAL GOVT, PORTS, PRIVATE INVESTORS
PROJECT MANAGER: ACET
MAIN CONTRACTOR: TUTOR-SALIBA

PLANNING AND IMPLEMENTATION

PLANNING START DATE: 12/1984
CONSTRUCTION START DATE: 04/1997
OPERATION START DATE: 04/2002
MONTHS IN PLANNING: 148
MONTHS IN CONSTRUCTION: 60
PROJECT COMPLETED: 13 MONTHS BEHIND SCHEDULE (MID-CORR. TRENCH)

COSTS (IN 2010 USD)

PREDICTED COST: 2.50BN
ACTUAL COST: 2.88BN
PROJECT COMPLETED:
15% OVER BUDGET
FUNDING: 52% PUBLIC : 48% PRIVATE



INFRASTRUCTURE QUANTITIES

LENGTH: 32KM
COST PER KM (2010 USD): 0.09BN

PATRONAGE

FORECAST TRAFFIC:
100 TRAINS PER DAY BY 2020 (1991)
ACTUAL TRAFFIC:
44 TRAINS PER DAY (2008)

INTRODUCTION

The Alameda Corridor, a 32km express freight rail line, links the ports of Los Angeles and Long Beach to the national rail network and railyards of Los Angeles. It opened in 2002.

The line is owned by the Alameda Corridor Transportation Authority, and is funded through user fees paid by private railroads.

BACKGROUND

The main objective of the project was to serve increasing levels of activity at one of the world's busiest port complexes, relieving congestion on the surrounding road and rail network and in the ports and nearby areas. It also enabled the elimination of 200 at-grade rail crossings, improving accessibility for local traffic and the local urban environment, and helping stimulate economic development in the area.

The Southern California Association of Governments was the initiator of the project, forming a Ports Advisory Committee which recommended consolidating the four existing rail lines into one grade-separated route, and subsequently setting up the Alameda Corridor Task Force.

The Alameda Corridor Transportation Authority, a joint powers agency, was formed in 1989 by the two city governments, and also represented other bodies including the port authorities, and federal road and rail administrations. The three private railroads operating in the area sold their rights-of-way to the port authorities and now share rights of way on the Corridor.

Three successive pieces of legislation on multi-modal transport planning strengthened the role of metropolitan planning organisations, increased funding flexibility and eligibility, and promoted the inclusion of freight interests in the process.

Governments of the eight 'Corridor Cities' through which the Corridor passes were also represented on ACTA's governing board, although some opposed the project. ACTA negotiated separate agreements with them, providing funds for specific mitigation measures. The governing board was restructured in 1996 to reduce the influence of the Corridor Cities.

TIMELINE

CONCEPTION: 1970S: PORTS CONSIDER RAIL AND HIGHWAY IMPROVEMENTS IN RESPONSE TO INCREASES IN CARGO CROSSINGS

CONCEPTION: 1981: PORTS ADVISORY COMMITTEE ESTABLISHED

CONCEPTION: 1984 (DEC)/85: PAC PLAN ADOPTED. ALAMEDA CORRIDOR TASK FORCE ESTABLISHED

INCEPTION: 1989: CITY GOVERMENTS FORM ALAMEDA CORRIDOR TRANSPORTATION AUTHORITY (ACTA)

CONTEXT: 1991: INTERMODAL SURFACE TRANSPORT EFFICIENCY ACT AUTHORIZES FUNDING FOR HIGH PRIORITY CORRIDORS

CONTROVERSY: 1993: FOUR CORRIDOR CITIES SUE PORT OF LONG BEACH AGAINST EXPANDING

INCEPTION: 1993: ACTA ISSUES (STATE) ENVIRONMENTAL IMPACT REPORT

INCEPTION: 1994: RAILROADS AGREE TO SELL RIGHTS OF WAY TO PORTS

INCEPTION: 1995: CORRIDOR NAMED NATIONAL HIGH PRIORITY CORRIDOR – ELIGIBLE FOR FEDERAL LOAN

INCEPTION: 1996: ACTA ISSUES FINAL (FEDERAL) ENVIRONMENTAL IMPACT STATEMENT. FEDERAL APPROVAL FOR PROJECT

CONTROVERSY: 1996: LEGAL CHALLENGE BY FOUR CORRIDOR CITIES REJECTED

CONSTRUCTION: 1997 (APR): CONSTRUCTION BEGINS – BRIDGE ACROSS LOS ANGELES RIVER

INCEPTION: 1997: DESIGN-BUILD APPROACH AUTHORIZED FOR MID-CORRIDOR TRENCH, SAVING 14-18 MONTHS

INCEPTION: 1998: RAILROADS AGREE TO PAY USER FEES, CREATING REVENUE STREAM FOR LOAN REPAYMENTS AND BOND ISSUE

CONSTRUCTION: 1998: TUTOR-SALIBA AWARDED CONTRACT FOR MID-CORRIDOR TRENCH, CONSTRUCTION BEGINS

INCEPTION: 1999: PRIVATE INVESTORS PURCHASE LAST OF REVENUE BONDS

CONSTRUCTION: 2001: EXCAVATION OF MID-CORRIDOR TRENCH COMPLETED

DELIVERY: 2002 (APR): OPERATION BEGINS

DELIVERY: 2004: ACTA REPAYS FEDERAL LOAN 28 YEARS AHEAD OF SCHEDULE

ACTA also introduced a range of community outreach measures. Environmental impact assessments were required under both federal and state law (the former only after federal funding was identified), and involved public hearings and community meetings.

CHARACTERISTICS

The project cost was estimated at USD 1.8bn in 1996 (USD 2.50bn in 2010 prices)[i]. The final cost was USD 2.4bn in 2003 (USD 2.88bn in 2010 prices). Construction, design and engineering accounted for 70% of the total, acquiring rights-of-way from the railroad companies 16%, and financial and legal costs 14%.

The project was managed by the Alameda Corridor Engineering Team, a joint venture between DMJM Harris, Moffatt & Nichol, Jenkins/Gales & Martinez, and TELACU, on behalf of ACTA. It consists of three sections: North End Project, Mid-Corridor Trench and South End Project.

The Mid-Corridor, the largest part of the project, was built through one of the country's largest Design-Build contracts, let to the Tutor-Saliba Corporation. It is a below-ground, triple-tracked rail line, 16km long, 10m deep and 15m wide, and allows trains to bypass 145 km of early 20th century branch lines.

FUNDING

In 1998, the railroads agreed to pay ACTA a container-based user fee for access to the Corridor. The projected revenue stream allowed ACTA to finance a revenue bonds issue for USD 1.1bn and helped secure a federal loan for USD 0.4bn. The project's eligibility for federal funding rests on the 1991 Act ('ISTEA') and its designation as a national high priority corridor. Other public bodies provided additional grant funding, including the port authorities and the Los Angeles County Metropolitan Transport Authority.

In the year of opening, 2002, an average of 39 trains per day used the Corridor. Numbers peaked at 55 in 2008, falling to 44 in 2008. This represents approximately a third of the freight traffic from the two ports. The share is lower than initial expectations, as road freight has remained extremely competitive. However, a general increase in port activities and the empty container discount have maintained performance levels and ACTA repaid its federal loan 28 years ahead of schedule, in 2004.

[i] Costs have been converted to USD at 2010 prices, using historic inflation rates and current exchange rates, to allow comparison between projects.

CENTRAL ARTERY/TUNNEL PROJECT ('THE BIG DIG'), BOSTON, USA

OVERVIEW

LOCATION: BOSTON, USA
SCOPE: INTRA-URBAN
TRANSPORT MODE: ROAD
PRINCIPAL CONSTRUCTION: TUNNEL/BRIDGE
NEW LINK: YES

PRINCIPAL OBJECTIVES

CONGESTION RELIEF
STRATEGIC TRANSPORT LINK
ACCIDENT REDUCTION

PRINCIPAL STAKEHOLDERS

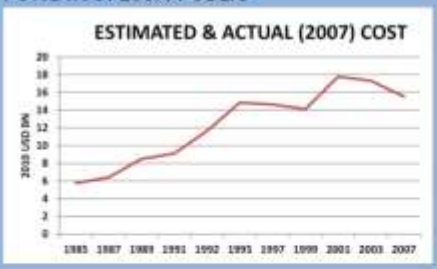
CLIENT: MHD/MTA
PROJECT MANAGER: BECHTEL/PARSONS BRINCKERHOFF JV
CONTRACTORS: MODERN CONTINENTAL & OTHERS
FUNDER: FEDERAL/STATE GOVERNMENTS

PLANNING AND IMPLEMENTATION

APPROX. PLANNING START DATE: 1982
CONSTRUCTION START DATE: 05/1991
OPERATION START DATE: 12/2007
MONTHS IN PLANNING: 108
MONTHS IN CONSTRUCTION: 199
PROJECT COMPLETED: 36 MONTHS BEHIND SCHEDULE

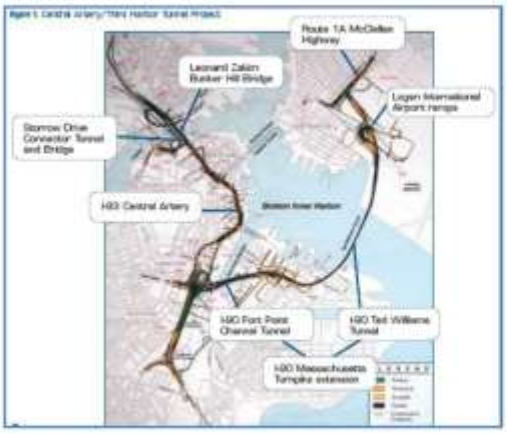
COSTS (IN 2010 USD)

PREDICTED COST: 6.08BN
ACTUAL COST: 15.53BN
PROJECT COMPLETED: 155% OVER BUDGET
FUNDING: 100% PUBLIC



INFRASTRUCTURE QUANTITIES:

LENGTH OF CORRIDOR: 12.9KM
TOTAL INFRASTRUCTURE: 258KM
TUNNELS: THREE
BRIDGES: TWO
COST PER KM (2010 USD): 1.20BN (TOTAL LENGTH); 2.2BN (CORRIDOR)



INTRODUCTION

Boston's Central Artery/ Tunnel Project ('The Big Dig') combines the undergrounding of the Interstate 93 elevated highway, a third tunnel under Boston Harbor to Logan Airport, and two bridges across the Charles River.

It also includes pedestrian facilities, most notably the 27-acre (11 hectare) Rose Kennedy Greenway. However, a rail connection between two major terminals was dropped from the initial plans. The project opened in stages and was fully open by December 2007.

BACKGROUND

The objectives of the project were to relieve highway traffic congestion, to reduce bottlenecks by providing additional crossings over the River and Harbor, and to reduce the accident rate. Congestion had been a problem for many years and accident rates were four times the national average, but community opposition had prevented the building of more highways in the city centre.

The idea of burying the Central Artery (Interstate 93) underground dates from a 1971 meeting between the mayor's transport advisor, Fred Salvucci, and a highway contractor. Meanwhile, the business community was pushing for another harbor crossing to improve access to the airport. Salvucci was to become a key figure in the project's evolution: as the Governor's transport secretary in the 1980s he was involved in bringing the two projects together, providing a sufficiently broad base of support to proceed.

Official planning began in 1982, and environmental impact studies in 1983, with the Environmental Impact Statement/Report published in 1986. US Congress passed a public works bill securing funding for the project in 1987 and, although the bill was then vetoed by the US President, Congress eventually overrode the President's veto.

Controversy began in 1988, when Salvucci's choice of the 'Scheme Z' crossing of Charles River met with widespread criticism and opposition. A new 'amputated' version of Scheme Z was presented in 1990 and quickly incorporated into the Final Supplemental Environmental Impact Statement. A package of mitigation measures was announced and the main opposition group conceded.

TIMELINE

CONCEPTION: 1971: SALVUCCI MEETS HIGHWAY CONTRACTOR, DISCUSS BURYING ROAD

INCEPTION: 1982: OFFICIAL START OF PROJECT

INCEPTION: 1983: ENVIRONMENTAL IMPACT STUDIES BEGIN

INCEPTION: 1986: BECHTEL/PARSONS BRINCKHERHOFF JV APPOINTED

INCEPTION: 1987: US CONGRESS PASSES FUNDING BILL

DELAY: 1987: US PRESIDENT VETOES BILL

INCEPTION: 1987: CONGRESS OVERTURNS PRESIDENT'S VETO, PROJECT PROCEEDS

INCEPTION: 1988: SALVUCCI CHOOSES SCHEME Z ROUTE ACROSS CHARLES RIVER

CONTROVERSY: 1989: OPPOSITION TO SCHEME Z

INCEPTION: 1990: 'AMPUTATED' SCHEME Z INCORPORATED INTO FINAL EIS, MITIGATION MEASURES ANNOUNCED

DELAY: 1991: NEW STATE GOVERNMENT SETS UP BRIDGE DESIGN REVIEW COMMITTEE TO FIND ALTERNATIVE TO SCHEME Z

CONSTRUCTION: 1991 (MAY): FORMAL APPROVAL, CONTRACTS ADVERTISED

INCEPTION: 1992: SCHEME Z REPLACED BY SCHEME 8.1.D. NEW EIS NEEDED

INCEPTION: 1994: STATE HIGHWAYS DEPARTMENT APPROVES ROUTE ACROSS RIVER

DELIVERY: 1995: TED WILLIAMS TUNNEL OPEN

CONSTRUCTION: 1999: PROJECT 50% COMPLETE

DELIVERY: 1999: LEVERETT CIRCLE BRIDGE OPEN

DELIVERY: 2003: I-93 NORTH OPEN

CONSTRUCTION: 2001: PROJECT 70% COMPLETE

CONSTRUCTION: 2005: ELEVATED HIGHWAY DISMANTLED

DELIVERY: 2005: I-93 SOUTH OPEN

CONTROVERSY: 2006: CEILING COLLAPSE CAUSES FATAL ACCIDENT IN TUNNEL

DELIVERY: 2007: SURFACE ROADS COMPLETE

DELIVERY: 2007 (DEC): CENTRAL ARTERY AND TUNNEL OPEN. END OF PARTNERSHIP BETWEEN B/PBJV AND MTA

DELIVERY: 2008 (OCT): ROSE KENNEDY GREENWAY OPENS

CONTROVERSY: 2008: B/PB SETTLE CLAIMS AGAINST THEM

However, following a change in the state leadership in 1991, the Bridge Design Review Committee (representing 42 community, environmental and other stakeholders) was set up to find an alternative to Scheme Z. Construction had already begun on other elements of the project. Various options were proposed, and the state highways department finally approved one in 1994.

CHARACTERISTICS

In 1985 the cost was estimated at USD 2.8bn (1982 prices) (USD 6.08bn at 2010 prices). The final cost was USD 14.8bn in 2007 (USD 15.53bn at 2010 prices), an increase of 155%, making the Big Dig the most expensive highway project in the USA. However, *The Boston Globe* argues that the true final cost including interest will be in the region of USD 22bn. Delays, increased scope and mitigation measures were amongst the reasons given for cost increases.

The client organisation was the Massachusetts Highway Department (MHD) (later Massachusetts Turnpike Authority (MTA). Bechtel/ Parsons Brinckerhoff Joint Venture were appointed as project managers in 1986. MHD/MTA selected and awarded contracts, but B/PB was responsible for monitoring compliance. In 1999, MTA combined some of its team with B/PB's in an 'integrated project organization' intended to make management more efficient.

The project was the first in the USA to use slurry wall construction to build a tunnel, allowing construction without disrupting traffic. However, allegations of corruption and poor workmanship continued throughout the project, with some suppliers prosecuted for providing substandard materials or fraud. After opening, leaking tunnels continued to cause concern and the collapse of a ceiling in 2006 caused the death of a car passenger.

TIMELINE ISSUES

The first official project schedule, produced in 1989, anticipated completion of the project by 1998. Poor design and workmanship were amongst the many factors leading to a delay of nine years.

FUNDING

The federal government provided part funding, but this was capped at USD 8.5bn (48% of the final cost). State sources, including transportation infrastructure funds and the MTA's own resources, provided the remainder. In 2008, with the costs of servicing the project debt rising, MTA increased toll fees on parts of the Big Dig and other sections of the network. In 2009, it faced an unsuccessful lawsuit brought by a group of disgruntled motorists.

7.2 USA: The 4 Tests reports

For each of the projects, the Country Partner prepared the '4 Tests Report' which – as described in Section 1.3 above – examined project achievements according to: (i) objectives (both original and emergent); (ii) sustainability; (iiii) treatment of risk, uncertainty and complexity; (iv) a synthesis of the three tests, focusing on responses to the original research questions and hypotheses, the project winners and losers, and provisional lessons.

The full 4 Tests reports can be accessed via the following hyperlinks:

Airtrain, JFK Airport
CD ROM: OMEGA Partner 4 Tests\USA_4 Tests.docx

Alameda Freight Rail Link, LA
CD ROM: OMEGA Partner 4 Tests\USA_4 Tests.docx

Big Dig Road and Tunnel Link, Boston
CD ROM: OMEGA Partner 4 Tests\USA_4 Tests.docx

The Partner's overall synthesis of the project findings is now presented in the following pages.

7.3 USA: Synthesis of country findings

7.3.1 Project success

By *conventional* criteria two of the three projects can be judged successful - the JFK AirTrain and the Alameda Corridor were completed close to their initial schedules and near their initially approved budgets, and they achieved the traffic volumes and user fee revenues initially anticipated in approximately the planned time frame. Moreover, a variety of environmental issues identified in the required Environmental Impact Statements were addressed and mitigated by actions developed as part of this planning process.

By contrast, the Big Dig failed to meet certain basic criteria. It was completed more than seven years behind the initial schedule at a cost far in excess of initial budgets. Its original design required substantial changes during the course of the project because of key stakeholder objections, and commitments made by the project sponsors for environmental mitigation due to expanded auto traffic volume have not all been implemented. In addition, the quality of construction work has proved low, leading to leaks, tunnel roof collapses and associated fatalities after the project was completed.

7.3.2 Dealing with organizational and political complexity.

In the United States transportation planning and operations are characterized by political and organizational complexity in the form of multiple **"modal silos."**

At the federal, state and local levels, **separate agencies** are responsible for air, rail, road and mass transit; the agencies have few incentives for cooperation and little is done in the form of multi-modal planning. However, megaprojects typically involve more than one mode of transportation, and strategies must be developed to deal with this organizational fragmentation and political complexity.

In the case of the **JFK AirTrain** the project sponsor, the Port Authority of New York and New Jersey (hereafter, the PA), operated the airport, and its project required cooperation with the Metropolitan Transportation Authority (MTA), which operated subways and commuter rail trains, the State Department of Transportation, which owned and operated the highway whose median was to become the right of way for much of the AirTrain route, and the local New York City Department of Transportation which was responsible for the streets in the area of the terminals and crossing the State highway at multiple points. In addition, the Federal Aviation Administration controlled the funding source, an air passenger fee, that was chosen to fund most of the project.

The **Alameda Corridor** required cooperation among multiple public and private entities. Railroad corporations had to agree to the planned new operation, the port authorities operating the two sets of ship docks sought to promote the project, eight different local governments had property in the route of the Corridor, the State transportation agency had oversight responsibilities, and funding was required from the federal transportation agency.

The **Big Dig** required cooperation among the turnpike authority operating the toll road known as the Massachusetts Turnpike, the State transportation department operating other non-tolled roads, the agency operating the airport to which the tunnel connected, and City of Boston and other local governments affected by the street route changes. In addition, the federal government was the major source of funding, involving the federal highway administration and key members of Congress.

Each megaproject developed a **different strategy** for dealing with this complexity, with varying degrees of success, as follows.

Alameda Corridor

A new entity was created to finance and manage the project. The governance of this entity underwent a significant change during the course of project planning, eventually eliminating several local governments that did not have a direct financial stake in the project. The revised authority proved a viable mechanism for dealing with the complex negotiations and financial arrangements.

JFK AirTrain

No new entity was created; instead, project sponsors relied on the leadership of the governor and his designated representative to facilitate resolution of inter-organizational conflict. One governor was in office for 12 years spanning much of the life of the project, and he attached much political importance to having the project built. He had sufficient clout through budget and appointment powers to strongly influence the leadership of the PA and the MTA as well as the State transportation department. His leadership provided the key mechanism for bridging the organizational conflicts and complexity.

Big Dig

No successful mechanism was developed. No new entity was created, and the implicit strategy was to rely on the political clout of the governor, who oversaw the major organizations involved. However, unlike the AirTrain, there were multiple governors and transportation secretaries over the life of the project including changes in party affiliation of the governor. While the project was never dropped, it was periodically reconsidered and redesigned. Perhaps equally important, the federal official with the greatest influence over the project's federal funding was House Speaker Tip O'Neal. Incumbent from 1977 until his retirement in 1987 when the project was still ongoing, his leaving office during the course of the project left that aspect of the political complexity in jeopardy.

Successful megaprojects require viable strategies for overcoming organizational and political complexity. In some cases, the commitment of a high level elected official such as a state governor may be a sufficient mechanism, but the possibility that election cycles may lead to changes in the officeholder make this a risky strategy. The creation of new special purpose entities for megaprojects may, in some cases, prove an effective strategy for dealing with organizational complexity.

7.3.3 The key role of financing arrangements

By definition, megaprojects require large sums for construction and additional ongoing operational support. The three case study projects vary notably in their sources of funding for construction, and the nature of the financing arrangements appear to have significantly influenced project outcomes.

Air Train

AirTrain - relied primarily on funds accumulated via a federally authorized Passenger Facility Charge (PFC) of $3 on each airline passenger at the JFK facility. These funds allowed the project to be built with limited debt, meaning there would be no significant future debt service obligation from the project. Ongoing operating and maintenance expenses were to be covered via fares, with the service being self-supporting. This financial model had three important implications:

- the PFC has strings attached, and they affected the project design. The funds were intended for use for airport facility improvements, and airlines fought to narrow the definition of such improvements so that airline passenger fees would not be diverted to mass transit facilities. The limits were arguably stretched in the case of AirTrain, but the Federal Aviation Agency's rules affected the extent to which the PA was able to integrate the AirTrain with the MTA's mass transit services;
- the reliance on PFC revenues set a budget constraint for the project cost, and this influenced the overall scale of the project and created incentives to keep within budget. The PA did not want to borrow or draw on other funding sources for the AirTrain, so it kept costs within the sums reasonably projected from the PFC;
- the desire to keep the project within the budget derived from the PFC also was a factor in opting for a DBOM contract; as discussed below this procurement mechanism provided some protection against risks of cost escalation.

Alameda Corridor

The Alameda Corridor was built with a mix of capital contributions from the federal government and from the two participating ports and from borrowing via long-term bonds. The borrowing was the single largest source of capital, accounting for about half the funding. The bonds were revenue bonds to be repaid from fees charged to the railroads for using the Corridor, not general obligation bonds of any state or local government. This financial model, relying heavily on user-fee supported revenue bonds, contributed to the success of the project. The railroads, who would be paying the future fees to repay the debt, were also major stakeholders in the project governance and had incentives to control costs. They knew cost overruns and delays would translate into higher fees for them in the future. They also sought reasonable and reliable volume and revenue projections from the fees, because they would be at risk for elevated fees if there were a shortfall from the projections.

Big Dig

The financial model for the Big Dig was to maximize federal assistance and minimize state or Turnpike Authority obligations. This strategy was supported by the early (1983) federal

approval of the project as a part of completion of the interstate highway system, which permitted more generous federal funding than was available for other highway projects, and the powerful role of the state's Congressional delegation including the Speaker of the House. However, this strategy eventually faltered, with the federal government capping its contribution as costs escalated rapidly. By the time of project completion, federal funding comprised less than half the total costs (compared with initial estimates of about 90 percent) with state and related entity contributions and borrowings filling the sizeable gap. This unsuccessful financial model had at least two effects on the project's outcomes. First, the heavy reliance on anticipated federal funds created little incentive, especially in the early stages, for project sponsors to be concerned with cost escalation. The ability repeatedly to turn to Congress for increased appropriations created a sense of limited concern with rising costs. Second, the state and the turnpike authority currently face sharp fiscal pressures to raise the revenue necessary to cover the debt service on borrowings they issued to raise necessary capital when federal aid was no longer available.

Financing arrangements have important implications for project design and implementation. Projects which depend heavily on user fees (and include the potential users as active stakeholders) are more likely to assign priority to keeping design constraints within a predetermined budget and to sustain pressure to keep project costs within budget during construction. Projects relying heavily on external funding are more likely to suffer cost escalation, especially when the outside funders are subject to political pressures from local constituencies.

7.3.4 Techniques for risk management

The multiple uncertainties related to megaprojects create significant risks that projects will suffer delays and cost increases and may fail to achieve the volume and revenue targets set for the projects. In each of the three cases different techniques were used to cope with these risks, and they had varying degrees of success.

Air Train

AirTain sponsors had two strategies for curtailing risk:

- they opted for established technology in the design for the project, seeking to avoid risks related to newer, unproven, technology;
- they used a DBOM contract for procurement, passing much of the cost related risk onto the private partner;
- the contract also included a contingency fund with an agreement that unused funds would be divided 60/40 between the PA and the private partner, creating further incentives for cost control as well as a speedy process for resolving unexpected developments. This mechanism worked well.

Alameda Corridor

The sponsors also used procurement techniques to curtail risks. Large segments of the project were built using Design-Build (DB) contracts. This differs from conventional U.S. public sector procurement in which public agencies do the design work and then put out a fully designed project for bid for construction. The DB mechanism allows private partners to take responsibility for design and construction, often speeding work, eliminating conflicts over design feasibility and creating incentives for a design that is easily built.

Big Dig

The project sponsors relied on a partnership with private partners in which they took responsibility for overseeing work, but did not assume major cost risks. This joint venture model did not work to share risks, and, in fact, created incentives for cost escalation since the private partners were paid fees based on total project cost.

A common element of the projects is the limited ability to share revenue risks with a private partner. The PA's DBOM contract did not include giving the private partner responsibility for collecting fares and taking any revenue risk. The PA guaranteed payments for maintenance and operation, and it assumed all revenue risk for the new service. In the case of the Alameda Corridor, the revenue bonds helping to finance the project were backed by user fees, and the railroads were at some risk for higher fees – but the bonds were issued by a public entity and that authority carried the ultimate risk for the bonds. In the case of the Big Dig, little attention was paid to future user charges, particularly any future toll increases on the turnpike portion of the project. Public entities issued bonds for the project after federal funds were capped, and they assumed the risk for sufficient revenues from taxes or tolls to repay the bonds.

7.3.5 Sustainability – the adequacy of environmental reviews

Each of the case study megaprojects were subject to state and federal legal requirements that their planning include preparation of an Environmental Impact Statement (EIS), and that harmful environmental impacts be subject to appropriate mitigation efforts as part of the plan. The experiences with these EIS requirements point to three generalizations about the ways in which sustainability criteria are addressed in U.S. megaprojects:

- the EIS criteria do not directly include greenhouse gas emissions, notably CO2, and contemporary concerns for global warming. Each of the projects was reviewed before this issue of global warming attained its current prominence. However, the review did consider other types of emissions and issues relating to forms of air pollution, and these concerns overlap in some ways with the issue of CO2 emissions. In the case of the AirTrain, the project was justified in part by its diversion of auto trips to the airport to a rail mode, in the case of the Alameda Corridor, the review identified positive impacts due to diversion of freight transport from trucks to a rail mode and due to less traffic congestion and delays on the roads for which rail crossings would be eliminated due to the tunnel under road crossings, in the case of the Big Dig, it was recognized that the new airport tunnel and the expanded highway route would increase auto volume and air pollution. This led to mitigation actions including plans for expanded mass transit as an alternative. While these a examples of ways in which current concerns for environmental sustainability were addressed in the project planning process, it also should be noted that the broader issue of the relationship between economic growth and environmental sustainability were not explicitly addressed. Each of the projects was justified to some degree by its contribution to regional economic growth, and thus to more intensive energy consumption and greenhouse gas emissions. The AirTrain was intended to facilitate expanded passenger and flight volumes at the regional airports; the Alameda Corridor was intended to capture a growing volume of freight imports at the regional ports; and the Big Dig sought to stimulate job growth in downtown Boston and to increase volume at the local airport. The positive environmental impacts were framed as making some increased level of economic activity more environmentally sustainable, but the projects were intended to promote growth;
- the EIS requirements and procedures were effective in identifying and mitigating many conventionally defined adverse environmental impacts. Potential damage to wetlands near JFK airport, for example, was identified in the EIS for the AirTrain, and appropriate mitigation actions were incorporated in the plans. Similarly, the plans included

environmentally friendly ways to handle to disposal of much of the dirt and debris generated by project construction including creation of parks in Boston;

- the Big Dig project illustrated one shortcoming with current environmental review procedures that may be of broad concern – monitoring and enforcement of mitigation commitments made in the planning stage can be lax in subsequent years. Extensive mitigation commitments were made by the Big Dig sponsors, and many of these actions were implemented. However, some of the mass transit improvements identified as mitigation steps have not yet been fully implemented. Federal agencies have not taken strict enforcement actions, and local private parties have been reluctant to initiate litigation. This suggests that enforcement of mitigation measures can be a problem under the current system.

7.3.6 Suggested criteria for future assessment of sustainability

An important normative task of the Omega Project is to recommend criteria for use in the future for assessment of transportation megaprojects. The preparation of the three U.S. case studies combined with interaction with Omega partners provides a basis for suggesting such criteria. In particular, a draft report by Omega partner Nick Low circulated in August 2009 provided insight and stimulus for our suggestions presented below.

Two types of criteria ought to be employed in assessing megaprojects: the first are minimal necessary conditions for project approval; they are either met or not met. Only projects meeting these criteria should be moved to a second stage evaluation and subject to review under the second type of criteria. These criteria can be assessed in a relative and more quantitative fashion, permitting a comparison of projects and alternatives among common criteria. We suggest two types of minimal necessary standards and six criteria for relative assessment.

Minimal necessary standards: The two necessary conditions relate to the process for conducting assessment and the avoidance of harm:

- Projects should be reviewed by a public agency accountable to elected officials, and staffed with professionals given significant political independence. They should follow procedures established in law, open to public input and fully disclosed and transparent. They should be subject to the ethical standards of sound public administration.
- The project's construction and operation should do no significant harm to the public health of humans nor significantly harm the natural environment. Analogous to the principle of medical ethics, "Do no harm," this standard requires that projects do not create public health hazards nor do they irreparably harm aspects of the natural environment including animal species. Any temporary harm during construction should be repaired and restored, and ongoing adverse impacts should be subject to substantial mitigation.

Positive criteria for relative assessment: Megaprojects should do more than, "Do no harm." They also should contribute positively to a society's well-being. We suggest six ways in which the positive contributions of transportation megaprojects should be assessed:

- Improve economic efficiency by lowering the cost of moving goods. The relevant costs are those borne by producers (and eventually passed on to consumers) and the social costs of moving goods.
- Improve the efficiency of labor markets. Transportation projects should improve the functioning of labor markets by reducing the costs and time required for travel to work (thereby lowering labor costs and/or increasing real wages). Labor market efficiency can also be improved for employers by expanding the scale of the pool of labor available and can be improved for workers by giving them access to a larger number and type of jobs.

- Enhance the equity of labour markets. Projects can have disproportionately large labor market benefits for vulnerable and/or previously discriminated against subgroups of the population. They can disproportionately increase their access to more jobs or to a greater variety of jobs. Elected officials should be responsible for identifying subgroups of the population for whom equity concerns are most relevant.
- Improve the safety of transportation systems. New or altered transportation facilities can reduce hazards of travel. Investments should be assessed in terms of reductions in accidents and morbidity and mortality associated with use of transportation facilities.
- Improve the security of transportation systems and the communities they serve. In the United States and elsewhere transportation investments have been motivated by security concerns; for example, the Eisenhower Administration's proposal for a national highway trust fund was motivated by concerns for a national highway system that could serve defense needs in times of emergency. Current concerns with vulnerability to terrorist attacks suggest improvement in security should be a relevant criterion for assessing megaprojects.
- Reduce the negative externalities affecting the natural environment caused by use of transportation systems. The most relevant externalities are various forms of air pollution and the emission of greenhouse gases associated with global warming. Investments should make transportation systems more environmentally sustainable by reducing negative emissions per trip or mile travelled.

In using these criteria for assessment, analysts should compare proposed projects with current facilities and with other available viable options. The comparisons should be made based on common assumptions regarding levels of economic activity and growth. That is, options should be compared based on how well they perform at an assumed level of economic activity. Assessments of megaprojects should not determine planned or socially desirable levels of economic activity; they should consider the impact of a project as an alternative to other transportation options to meet planned levels of economic activity.

These suggestions for future assessment criteria are intended as a contribution of the U.S. team to an on-going process for refining these recommendations as a part of the Omega Project activities. We submit this report with the hope it will contribute to a constructive dialogue among all partners that helps improve the final recommendations of the Project.

7.4 Conclusion: USA

This section presented a summary and synthesis of the USA Country Partner's research on the three case studies of JFK AirTrain, Alameda Freight Rail Link and the Big Dig, Boston.

A summary profile of each project (with hyperlinks to the full Project Profiles) described the project's history and main characteristics, features, issues and timelines.

The Country Partner's own synthesis of their research findings in relation to the '4 Tests' was then given, presenting findings from the overall country perspective (i.e. combining the three case studies). Hyperlinks to the more detailed '4 Tests Reports' for each project were also given.

The next Section now presents the Australia Country Partner's findings from three mega-urban transport projects, while Volume 5 contains detailed analyses and comparisons of all 30 mega-urban transport projects, together with the overall findings and lessons of the research.

8. Country findings: Australia

City Link
Melbourne

Perth-Mandurah
Railway

Cross City Tunnel
Sydney

8.1 Australia: The project profiles

Project Profiles were prepared by the Country Partners[8] for each of the study projects, to provide a consolidated source of secondary information to support all phases of data collection, analysis and synthesis. The profiles covered such matters as: project cost, duration and quality information; principle and secondary project objectives; key project stakeholders; sources of finance; key events and processes. (See also Volume 1, Section 3.4).

The full Project Profiles can be accessed via the following hyperlinks:

City Link, Melbourne
http://www.omegacentre.bartlett.ucl.ac.uk/studies/cases/pdf/AUS_CITYLINK_PROFILE_260311.pdf

Metro Rail, Perth
http://www.omegacentre.bartlett.ucl.ac.uk/studies/cases/pdf/AUS_PERTH_PROFILE_020611.pdf

Cross City Tunnel, Sydney
http://www.omegacentre.bartlett.ucl.ac.uk/studies/cases/pdf/AUS_SYDNEY_PROFILE_260311.pdf

Summaries of the Project Profiles are presented on the following pages.

[8] In Australia, the Country Partners were the Australasian Centre for the Governance and Management of Urban Transport (GAMUT), Faculty of Architecture, The University of Melbourne and Department of Urban and Regional Planning, Curtin University of Technology, Perth - directed **Prof. Nicholas Low.**

CITYLINK, MELBOURNE, AUSTRALIA

OVERVIEW

LOCATION: MELBOURNE, AUSTRALIA
SCOPE: INTRA-URBAN
TRANSPORT MODE: ROAD
PRINCIPAL CONSTRUCTION: GRADE/TUNNEL/ELEVATED
NEW LINK: PARTIALLY

PRINCIPAL OBJECTIVES

CONGESTION RELIEF
LOCAL & STRATEGIC TRANSPORT LINK ACCESSIBILITY
LOCAL AREA IMPROVEMENTS

PLANNING AND IMPLEMENTATION

PLANNING START DATE: 03/1992
CONSTRUCTION START DATE: 05/1996
OPERATION START DATE: 12/2000
MONTHS IN PLANNING: 38
MONTHS IN CONSTRUCTION: 55
PROJECT COMPLETED: IN 8 SECTIONS, ON AVERAGE 2.5 MONTHS BEHIND SCHEDULE (MAXIMUM 12 MONTHS)

COSTS (IN 2010 USD)

PREDICTED COST: 2.80BN
ACTUAL COST: 2.46BN
PROJECT COMPLETED: 12% UNDER BUDGET
FUNDING: 100% PRIVATE

INFRASTRUCTURE QUANTITIES

LENGTH: 22KM
NUMBER OF JUNCTIONS: 10
BRIDGE: 4.2KM
TUNNELS: 5KM
ROAD IMPROVED: 8KM
ELEVATED ROAD IMPROVED: 5KM
COST PER KM (IN 2010 USD): 0.11BN

PATRONAGE

FORECAST TRAFFIC (1996)
662,000 VPD IN 2001
731,000 VPD IN 2011
ACTUAL TRAFFIC
621,019 VPD IN 2001
751,494 VPD IN 2008

INTRODUCTION

CityLink is a 22km road scheme in two sections. The Western Link upgrades an existing freeway to eight lanes and adds a six-lane elevated road and bridge crossing over the River Yarra. The Southern Link upgrades an arterial roadway to five and six lanes, and provides two three-lane tunnels (of 3.4km and 1.6 km in length) under the Yarra. It opened in 2000. Toll charges are collected through an electronic system developed as part of the project.

The project is associated with the redevelopment of unused docklands between the central business district and the Yarra, and the expansion of container traffic through the port.

BACKGROUND

The primary objective of the project was to relieve congestion in the city centre, by linking the existing radial highways and bypassing the centre's urban and residential streets. This in turn would improve the urban environment and provide better access for industry to port, rail and airport facilities.

The project was supported by a variety of national and state government policy statements relating to transport and urban development between 1987 and 1992. The decision to seek private sector involvement was announcd in 1992, based on guidelines issued by the State government in 1991.

The scheme was initially developed by the state road agency, VicRoads, but in 1995 the core team from VicRoads was transferred to the newly established Melbourne City Link Authority.

Public consultation took place in 1992, highlighting issues about potential economic, social and environmental impacts, and leading to the publication of an environmental effects statement in 1994.

CITYLINK, MELBOURNE, AUSTRALIA

TIMELINE

CONCEPTION: 1929: FIRST PROPOSAL FOR SOUTHERN BYPASS OF CBD

CONCEPTION: 1989: ENVIRONMENTAL EFFECTS STATEMENT (EES) FOR PART OF WESTERN BYPASS. SCHEME ABANDONED

CONTEXT: 1991: STATE GOVERNMENT GUIDELINES ON PRIVATE INVESTMENT IN INFRASTRUCTURE

CONCEPTION: 1992: NATIONAL GOVERNMENT POLICY SUPPORTS LINKING MELBOURNE'S FREEWAYS THROUGH PRIVATE FUNDING

INCEPTION: 1992: PRIVATE SECTOR INVITED TO SUBMIT EXPRESSIONS OF INTEREST. CONSULTATION ON EES

DELAY: 1992/93: NEW GOVERNMENT REVIEWS FINANCIAL ASPECTS OF SCHEME

INCEPTION: 1994: SHORTLISTED CONSORTIA INVITED TO SUBMIT BIDS. EES PRODUCED

INCEPTION: 1995: TRANSURBAN BID WINS, CONCESSION AGREEMENT SIGNED & RATIFIED BY PARLIAMENT

IMPLEMENTATION: 1995: VICROADS CORE TEAM TRANSFERS TO MELBOURNE CITY LINK AUTHORITY (MCLA)

IMPLEMENTATION: 1996: INDEPENDENT REVIEWER APPOINTED. CONSTRUCTION STARTS

DELIVERY: 1998: TOLL PRODUCTS AVAILABLE

DELIVERY: 1999: TOLL ACCOUNTS OPENED. WESTERN LINK OPENED, WITHOUT TOLLS. STATE LEGISLATION PROTECTS USERS AGAINST TOLLING ERRORS AND MISUSE OF PRIVATE INFORMATION

DELIVERY: 2000: CONSTRUCTION COMPLETE, FULL OPENING

DELIVERY: 2001: TRANSURBAN RESTRUCTURES FROM SINGLE PURPOSE ENTITY

DELIVERY: 2002: MCLA REPLACED BY OFFICE OF DIRECTOR AS PUBLIC SECTOR CONTRACT MANAGER

DELIVERY: 2004: OFFICE OF DIRECTOR DISBANDED

DELIVERY: 2034: CITYLINK REVERTS TO STATE OWNERSHIP

CHARACTERISTICS

The cost was estimated at AUD 1.776bn (at 1993 prices) (USD 2.80bn at 2010 prices[i]) in Transurban's 1996 prospectus. The design and construct contract accounted for 65% of the estimated cost. The final project cost in 2006 was slightly lower, at AUD 2.2bn (USD 2.46bn at 2010 prices). The state government also incurred costs of AUD 0.34bn (twice the original estimate) for land acquisition and works to the connecting road network.

The Transurban Consortium (Transfield Holdings of Australia and Obayashi Corporation of Japan) was awarded the concession to design, build, finance, operate, levy tolls and maintain the infrastructure for 34 years, when it will transfer to the state.

A subsidiary of Transurban, the Transfield Obayashi Joint Venture, was responsible for design and construction. Melbourne City Link Authority acted as the client and performed various functions including land acquisition, liaison and negotiation with other public authorities (it has since been disbanded). Sinclair Knight Merz was appointed by the state as independent reviewer.

The development of an electronic toll system presented the greatest risk for Transurban, as no revenue could be collected unless it functioned to a high degree of accuracy.

FUNDING

Transurban is a sub-lessee of the unit trust, City Link Management Ltd, a wholly owned subsidiary of Macquarie Bank Ltd. Its prospectus was underwritten by JB Were, Macquarie Underwriting Ltd and SBC Warburg Australia Ltd.

The project was financed by 59% debt (provided by a syndicate of banks) and 23% equity (raised from a variety of sources including public and institutional bond issues). Additional funding came from CPI bonds underwritten by ANZ, Bankers Trust Australia, CBA, Macquarie Bank, MLC and Westpac, and subordinated debt underwritten by National Australia Bank.

Transurban pays concession fee payments to the state every year. The state can terminate the concession deed after 25 years in the event of high rates of return and repayment of the initial loan.

[i] Costs have been converted to USD at 2010 prices, using historic inflation rates and current exchange rates, to allow comparison between projects.

OVERVIEW

LOCATION: PERTH, AUSTRALIA
SCOPE: INTER-URBAN
TRANSPORT MODE: RAIL
PRINCIPAL CONSTRUCTION: GRADE
NEW LINK: PARTIALLY (SOME USE OF EXISTING TRACKS)

PRINCIPAL OBJECTIVES

LOCAL TRANSPORT LINK
ALTERNATIVE TO CAR
TRAVEL TIME SAVINGS
IMPROVED AIR QUALITY
CITY CENTRE REGENERATION

PRINCIPAL STAKEHOLDERS

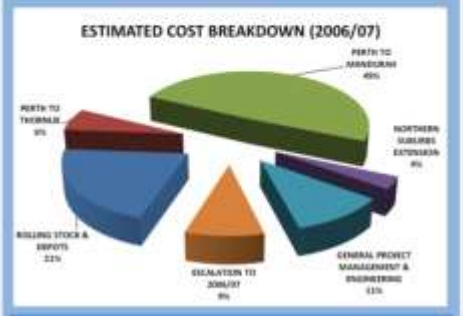
CLIENT/FUNDER: PUBLIC TRANSPORT AUTHORITY/NEW METRORAIL
DESIGN: MAUNSELL ETC
CONTRACTORS: LEIGHTON KUMAGAI ETC

PLANNING AND IMPLEMENTATION

APPROX. PLANNING START DATE: 1990
CONSTRUCTION START DATE: 2004
OPERATION START DATE: 2007
MONTHS IN PLANNING: 168
MONTHS IN CONSTRUCTION: 36
PROJECT COMPLETED: ON SCHEDULE (TUNNELS 39 MONTHS BEHIND SCHEDULE)

COSTS (IN 2010USD)

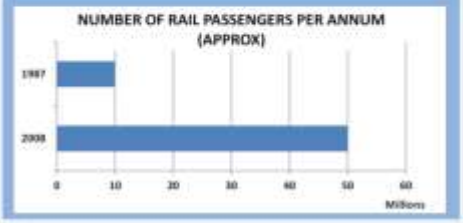
PREDICTED COST: 1.57BN
ACTUAL COST: 1.75BN
PROJECT COMPLETED:
12% OVER BUDGET
FUNDING: 100% PUBLIC



INFRASTRUCTURE QUANTITIES

LENGTH: 70.1KM
NUMBER OF STATIONS: 9
NUMBER OF BRIDGES: 31
SETS OF TUNNELS: 2
COST PER KM (IN 2010 USD): 0.025BN

PATRONAGE



INTRODUCTION

An inter-urban railway line of 70.1km length, running from Perth, the capital of Western Australia, to the town of Mandurah.

There are nine stations on the line, with associated bus and/or park-and-ride facilities and some transit-oriented developments. The project also included revisions to bus routes, to provide feeder services into rail stations.

BACKGROUND

The project originated in a long-term aspiration to resurrect the passenger rail network in the Perth region, reflecting a gradual evolution of transport and land use policy. The Metropolitan Region Planning Authority, established in 1960, adopted a Corridor Plan for Perth in 1970, which aimed to deal with urban sprawl by focusing development around transport corridors. In 1989, 1993 and 1995, successive transport strategies were produced: emphasising the role of public transport in providing an alternative to car use; separating strategic and operational responsibility; and prioritising accessibility over mobility, with an aim of increasing the modal share of public transport.

The government decided in principle to extend commuter rail services in 1992. The Department of Transport favoured a light rail scheme, and established the South West Area Transit (SWAT) project to develop an option supported by the local community. The SWAT report was never published, however, and the state rail operator Westrail began developing a heavy rail scheme. A masterplan was published in 2000, and revised in 2001 when the incoming government changed the route. A supplementary masterplan detailed the final section of the route through Perth's central business district: this caused considerable debate locally and led to the establishment of an advisory committee to examine the options.

An environmental impact assessment was carried out as part of the masterplanning process, and an environmental management plan was prepared, although not released for public comment. The project involved a range of mitigation measures in response to high levels of biodiversity, heritage issues, and fragile land and water resources, including species restoration and land swaps.

An economic analysis conducted in 2004 suggested the project generated a benefit-cost ratio of 3.3:1 (at 7%) and substantial non-economic benefits including increased 'liveability' and encouraging a shift from car to rail travel, particularly if transit-oriented development were also encouraged.

TIMELINE

CONTEXT: 1970: METROPOLITAN REGION PLANNING AUTHORITY FOUNDED

CONTEXT: 1970: METROPOLITAN REGION PLANNING AUTHORITY ESTABLISHES CORRIDOR PLAN FOR PERTH

CONTEXT: 1979: CLOSURE OF PERTH-FREMANTLE RAIL SERVICE

CONTEXT: 1982: NEW TRANSPORT POLICY IMPLIES EVENTUAL CLOSURE OF RAILWAYS

CONTEXT: 1983: RAIL SERVICE REINSTATED BY NEW GOVERNMENT

CONTEXT: 1985: INQUIRY RECOMMENDS RAIL SERVICE ELECTRIFICATION

CONCEPTION: 1990: SOUTH WEST RAPID TRANSIT STUDY INTO OPTIONS FOR NEW LINE

CONCEPTION: 1992: GOVERNMENT ANNOUNCES 'IN PRINCIPLE' DECISION TO BUILD LINE, ESTABLISHES SWAT

CONCEPTION: 1992: WESTRAIL IN FAVOUR OF HEAVY RAIL LINE

INCEPTION: 1994: ROUTE RESERVED

CONTEXT: 1995: EXTENSION OF EXISTING NETWORK FROM KENWICK TO FREMANTLE ANNOUNCED

INCEPTION: 1997: PREPARATION OF MASTERPLAN BEGINS

INCEPTION: 2000: INITIAL MASTERPLAN ISSUED

DELAY: 2001: NEW GOVERNMENT, NEW ROUTE, REVISED MASTERPLAN

INCEPTION: 2001: PUBLIC ENVIRONMENTAL REVIEW CONSULTATION

INCEPTION: 2002: SUPPLEMENTARY MASTERPLAN ON ROUTE THROUGH PERTH CBD

CONSTRUCTION: 2003: FORECAST CONSTRUCTION START (CITY TUNNELS)

CONSTRUCTION: 2003: CONTRACT AWARDED (CONTROL SYSTEM)

CONSTRUCTION: 2004: CONTRACTS AWARDED (CIVIL ENGINEERING WORKS)

CONSTRUCTION: 2004: ACTUAL CONSTRUCTION START (CITY TUNNELS & MAIN TRACK)

CONSTRUCTION: 2004: CONTRACTS AWARDED (RAIL AND BUS STATIONS)

DELIVERY: 2007: CONSTRUCTION COMPLETION, OPEN TO TRAFFIC

CHARACTERISTICS

A project budget of AUD 1.217bn (USD 1.57bn in 2010 prices[i]) was approved in 2001, although by 2002 this had been revised to AUD 1.419bn, of which 9% represented a cost escalation. The actual cost (in 2007) was AUD 1.6bn (USD 1.75bn in 2010 prices, an increase of 12% on the original budget). Labour and materials shortages and the loss of over 70 days due to industrial action were amongst the reasons for rising costs.

The state's Public Transport Authority acted as the client, letting eight Design & Build contracts with private sector consultant-contractor joint ventures (the largest to Leighton-Kumagai JV). Its subsidiary, New MetroRail, was responsible for contract management (except on one contract involving associated roadworks, managed by the state roads agency on behalf of New MetroRail). Maunsell was the only international company involved, acting as principal design consultant on two contracts delivering the infrastructure. Three contracts involved design and construction of stations, and were led by architects as principal design consultants.

Tunnelling under Perth City was highly complex due to the soft ground conditions and high risk of subsidence, and involved the use of 5,000 seismic sensors.

TIMELINE ISSUES

The initial masterplan envisaged the staged development of the project as funds became available. The final project, however, involved a much compressed schedule, with services to Rockingham and Waikiki commencing at the end of 2006 and to Mandurah by the end of 2007.

Complex ground conditions delayed the start of construction in the city centre by about a year, and industrial action also caused delays. The design of Murdoch station was amended to save a colony of Giant Spider Orchids growing there, leading to an additional six months in the planning process.

Overall the project finished on schedule, although the tunnels through Perth were subject to over three years delay.

FUNDING

The project was funded entirely by the Government from existing resources and is therefore debt-free. The use of private funding had been considered, but a review by Deutsche Bank, Booz Allen & Hamilton, Blake Dawson Waldron and Skea Nelson Hager concluded public funding was more cost effective. The choice to fully fund the project reflects the availability of funds during an economic boom, the relatively low cost of finance and a reduction in overall risk.

[i] Costs have been converted to USD at 2010 prices, using historic inflation rates and current exchange rates, to allow comparison between projects.

CROSS CITY TUNNEL, SYDNEY, AUSTRALIA

OVERVIEW

LOCATION: SYDNEY, AUSTRALIA
SCOPE: INTRA-URBAN
TRANSPORT MODE: ROAD
PRINCIPAL CONSTRUCTION: TUNNEL
NEW LINK: YES

PRINCIPAL OBJECTIVES

CONGESTION RELIEF
LOCAL AREA REGENERATION
TRAVEL TIME SAVINGS
IMPROVED AIR QUALITY
ACCESSIBILITY
'NO COST TO PUBLIC SECTOR'

PRINCIPAL STAKEHOLDERS

CLIENT: ROADS & TRAFFIC AUTHORITY
CONCESSIONAIRE:
CROSS CITY MOTORWAYS
CONTRACTOR: BILFINGER BERGER AKTIENGESELLSCHAFT/BAULDERSTONE HORNIBROOK JV
NEW OWNER: LEIGHTON/ABN AMRO

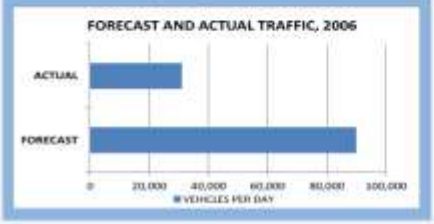
PLANNING AND IMPLEMENTATION

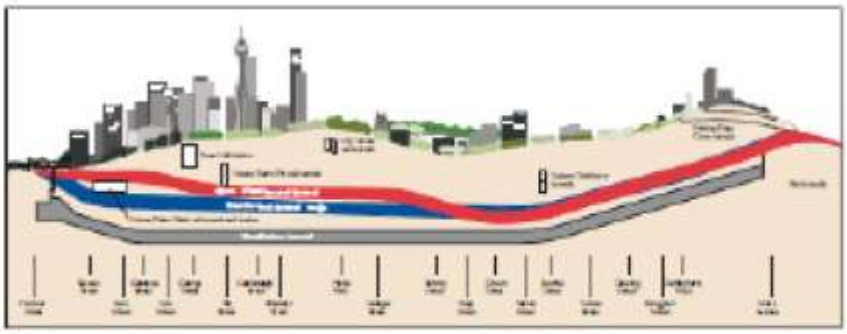
APPROX. PLANNING START DATE: 1990
CONSTRUCTION START DATE: 01/2003
OPERATION START DATE: 07/2005
MONTHS IN PLANNING: 150
MONTHS IN CONSTRUCTION: 30
PROJECT COMPLETED: 2 MONTHS AHEAD OF SCHEDULE

COSTS (IN 2010 USD)

PREDICTED COST: USD 0.80BN
ACTUAL COST: USD 1.12BN
COMPLETED: 40% OVER BUDGET
FUNDING: 100% PRIVATE (85% DEBT : 15% EQUITY)
COST PER KM: USD 0.27BN

PATRONAGE (2006)





INTRODUCTION

An urban road tunnel providing a new link within the city, consisting of two tunnels of 2.1km length, opened to traffic in 2005. Associated surface street works were completed in December 2006.

The tunnel has four entrances and four exits.

BACKGROUND

The main objective of the project was to relieve congestion in the city centre, thus enhancing the urban environment, improving air quality and accessibility, and delivering travel time savings.

Procurement was by the state road agency (RTA); a private concessionaire (CCM) owns, operates and maintains the tunnel, financed through toll charges. Planning approval was given by the state planning minister.

State planning policies and local plans have legal status governing land use and development. For privately financed projects, the state planning department has no power to suggest alternative means of meeting the project's objectives, although the minister can (and did, in this case) impose conditions when planning permission is granted.

Environmental impact assessments (EIS) were carried out on the initial proposal, on the revised proposal and on the final proposal, the latter two involving public consultation. There was also limited local consulation on changes to surface streets.

The initial EIS included a cost-benefit analysis (showing a benefit/cost ratio of 3.1 at 7%) and comparison with other means of responding to travel demand.

An estimated 1,600 direct and 3,600 indirect jobs were created during construction, and 30 jobs following construction. One industrial fatality was recorded.

CROSS CITY TUNNEL, SYDNEY, AUSTRALIA

TIMELINE

CONTEXT: 1988: LEGISLATION PASSED ENABLING TOLLED ROADS

CONCEPTION: 1990, 1995: CITY CENTRE TUNNEL SUGGESTED

CONCEPTION: 1998: PUBLIC SECTOR FUNDING RULED OUT

CONCEPTION: 1998: INITIAL TUNNEL CONCEPT RELEASED FOR COMMENT: 2 DOLLAR TOLL SUGGESTED

INCEPTION: 1999: INITIAL PROPOSAL. REVISED PROPOSAL BASED ON ENVIRONMENTAL ASSESSMENT

INCEPTION: 2000: EIS ISSUED FOR PUBLIC COMMENT

INCEPTION: 2000: REGISTRATIONS OF INTEREST INVITED FROM PRIVATE CONSORTIA

INCEPTION: 2001: PLANNING APPROVAL GRANTED INCLUDING 240 CONDITIONS

INCEPTION: 2001: DETAILED PROPOSALS FROM THREE SHORTLISTED CONSORTIA

INCEPTION: 2002: CCM PROPOSAL CHOSEN

DELAY: 2002: CCM PROPOSAL NON-COMPLIANT, REQUIRES SECOND EIS AND APPROVAL FOR AMENDED PROJECT

INCEPTION: 2002: CONTRACT SIGNED WITH CCM

INCEPTION: 2001: PLANNING APPROVAL GRANTED INCLUDING 292 CONDITIONS

CONSTRUCTION: 2003 (JAN): CONSTRUCTION STARTS

CONTROVERSY: 2003: LEGISLATIVE COUNCIL BEGINS INVESTIGATING PROJECT

INCEPTION: 2004: AGREEMENT ON INCREASED TOLLS TO FUND EXTRA WORKS

DELIVERY: 2005 (AUG): CONSTRUCTION COMPLETE, OPEN TO TRAFFIC

CONSTRUCTION: 2005 (OCT): FORECAST CONSTRUCTION COMPLETION

CONTROVERSY: 2006: FIRST REPORT OF PARLIAMENTARY INQUIRY

CONTROVERSY: 2006/07: CCM DECLARED INSOLVENT AND BOUGHT OUT

CHARACTERISTICS

The cost was estimated at AUD 0.62bn in 2001 (USD 0.80bn in 2010 prices[1]). The final project cost was slightly over AUD 1bn (2006 prices) (USD 1.12bn, 2010 prices), including the concession bid of AUD 0.68bn (USD 0.79bn) (covering development, design, construction, fit out and commissioning costs).

Earlier, less ambitious, proposals were estimated to cost AUD 0.27bn (1998) (USD 0.39bn, 2010 prices) and AUD 0.4bn (2001) (USD 0.51bn, 2010 prices).

Engineering and construction are considered exemplary, with 92% of excavated material reused on other projects.

TIMELINE ISSUES

RTA awarded the concession to a non-compliant bid, which caused delay by necessitating a further Environmental Impact Statement and ministerial approval before construction could start. However, construction finished two months ahead of schedule.

FUNDING

Public funding was ruled out in 1998 and private consortia were invited to bid for the project. Three detailed bids were received in 2001; the winning concession bid of AUD 0.68bn included a 'business consideration fee' to the state of AUD 0.097bn, to cover preparation costs.

Additional works to the value of AUD 0.075bn and AUD 0.035bn were approved in 2002 and 2004 respectively. CCM was authorised to increase toll levels in order to fund these.

CCM was declared insolvent in 2006, with accrued debts of AUD 0.56bn, and the tunnel was bought by Leighton Contractors/ABN Amro in 2007 for AUD 0.7bn.

CCM's business case assumed traffic volumes of 90,000 vehicles per day in 2006. Actual traffic in 2006 was only 26,000-31,000. No data are given on forecast and actual revenue, but inflated traffic forecasts have been cited as a reason for the collapse of CCM. Funding additional conditions and state costs may also have contributed to an unsustainable business case. A "concerted public campaign to demonise the project" is also cited as a possible reason for low traffic volumes.

The project was financed by AUD 0.58bn debt and AUD 0.1bn equity, by national and international (including Malaysian and German) investors, from initial capital of AUD 0.846bn (including AUD 0.3435bn equity).

[1] Costs have been converted to USD at 2010 prices, using historic inflation rates and current exchange rates, to allow comparison between projects.

8.2 Australia: The 4 Tests reports

For each of the projects, the Country Partners prepared the '4 Tests Report' which – as described in Section 1.3 above – examined project achievements according to: (i) objectives (both original and emergent); (ii) sustainability; (iiii) treatment of risk, uncertainty and complexity; (iv) a synthesis of the three tests, focusing on responses to the original research questions and hypotheses, the project winners and losers, and provisional lessons.

The full 4 Tests reports can be accessed via the following hyperlinks:

City Link, Melbourne
CD ROM: OMEGA Partner 4 Tests\Aust 4 Tests.docx

Metro Rail, Perth
CD ROM: OMEGA Partner 4 Tests\Aust 4 Tests.docx

Cross City Tunnel, Sydney
CD ROM: OMEGA Partner 4 Tests\Aust 4 Tests.docx

The Partner's overall synthesis of the project findings is now presented in the following pages.

8.3 Australia: Synthesis of country findings

8.3.1 Responses to the overall research questions and overall research hypotheses (ORQ's and ORH's)

ORQ 1: What constitutes a 'successful mega urban transport project (MUTP) in the 21st Century?

The City Link motorways and the Perth-Mandurah railway are both widely regarded as successes, whereas the Sydney Cross City Tunnel is regarded as a failure. The key question is: what was the reason for the above judgements?

City Link - Melbourne

In the case of City Link there was a clear and uncomplicated rationale for the motorway project that the large majority of the public and policy makers came to believe in. This is in spite of the prior existence of an earlier rationality that held that building motorways was environmentally unsound and socially undesirable. The motorways were simply justified by 'strong need', a supposedly self-evident rationality that held that previously unconnected sections of motorway should be connected. The 'connectivity' rationale came to prevail over the social and environmental rationale. There was a sort of inevitability about the definition of the problem and its solution. The solution in fact came to influence the definition of the problem. The connectivity rationale did not come 'out of the blue'. The Labor Government had quietly substituted it for the environmental rationale in transport infrastructure over a period of nearly ten years from 1992.

The CBD and an extensive penumbra of inner and middle suburbs was the location of much of the service sector employment growth which had dominated the Melbourne economy in the 1980s and '90s. City Link provided access to those employment opportunities for people

living in the more affordable outer suburbs. Although in Melbourne most people live near their work in locations dispersed throughout the city, this central employment area is a major attractor and generates radial pulses of traffic at peak times causing congestion.

The connectivity rationality was supercharged, so to speak, in the early 1990s by the recession of that time, and the need to 'get Victoria moving again'. So the project became the signature project of the Kennett government to get investment flowing again in Victoria, which had come to be regarded as a 'rust bucket State'. The project, its vision and the rationality of connectivity were highly integrated. City Link's internal objectives were consistent with a dominant narrative and vision and were achieved. Perhaps too the overcoming of major engineering and technical challenges which had impeded the development of the linkages in the past, provided the impetus for the creation of this internal consistency between the solution and the problem, and the mitigation of minor negative social effects also contributed to its success.

Perth-Mandurah Railway

The Perth-Mandurah railway was likewise propelled by an integrated vision and rationality, one that similarly arose seemingly organically from a pre-existing narrative about the need for an effective, connected heavy rail system for the city. The railway built on the prior success of the Northern Suburbs railway project. In terms of its internal objectives the project was successful. Like the City Link project, even though its rationale was different, the objective was quite simple and directly related to the infrastructure to be built: to build a railway that would be well used and liked.

The project was not in fact exclusively about building a new railway line - it was embedded within a program that used model of management of public transport new to Australia. The essential ingredients of this model are: a single central agency planning the routes and timetables of both trains and buses, and feeder buses with timetables integrated with train timetables. This is a European/Canadian model of governance and management, and unique in Australia where the norm is fragmented management of different modes. The perception of success may have benefited from this program.

City Link and the Perth-Mandurah Railway

Both achieved a token of success in the simple fact that they were used. That fact came to symbolize the success of the projects after the event. In both cases the retrospective judgement tended to be along the lines: 'imagine Melbourne without City Link!', 'Imagine Perth without the railways!'

Sydney Cross City Tunnel

By contrast this project became detached from its original narrative, which was one of improving the deteriorated environment of the Sydney CBD.

Looked at dispassionately the tunnel, delivered on time and on budget, should be regarded as a modest success. The fact is that 40,000 cars per day which would otherwise be using the surface streets are using the tunnel. However these achievements did not save the tunnel from a widespread perception of failure. There are unfortunate negatives. The tunnel has limited exits and entrances, is placed as part of a very complex set of streets. it is poorly understood, illegible, and difficult to navigate once you are in it. It doesn't physically take people where they want to go, nor let them get off where they want to get off. The tunnel is too long and tried to do too much. A shorter tunnel would have gathered more traffic from the wider points of origin in the eastern suburbs.

Paradoxically, compared with Melbourne and Perth, the history of success of the narrative, in this case the success of PPP motorway building in Sydney, seduced the government into believing that private investment in motorway building could generate a useful cash flow for the government. This internal objective came to be confused with the narrative of environmental improvement in the CBD in a particular way. First, it seems that the need to boost the projected revenue from the motorway to cover the State government's tax on the proponent required unrealistic traffic forecasts and high tolls. Second, the road closures necessary to achieve the environmental improvement could be, and were, portrayed as a conspiracy to force commuters from Eastern Sydney to use the tunnel and pay the toll. Lacking its environmental rationale, the motorway came to be seen as just another road increasing the city's car dependence and the greenhouse gas load from traffic.

ORQ 2: How well has risk, uncertainty and complexity been treated in the planning, appraisal and evaluation of such projects?

The greatest non-technical risk to projects is that they will not be used, or not sufficiently to justify the expenditure and other costs:

- **City Link** - the private consortium bore most of the costs and thus the financial risk on non-use. The greatest risk for the project resulted from the residual uncertainty about the acceptance by the public of pricing road space. Apart from an aborted attempt to charge tolls on the Westgate Bridge, the use of Melbourne's motorways had hitherto been without charge: 'freeways' to the users in a financial sense. This caused the concessionaire Transurban to take care both to consult with the public and monitor public reaction, and to design an exceptionally user-friendly and flexible system for toll collection. The allocation of other project risks was handled successfully via the contracts, and key construction risks were shifted to the private sector (Transurban and the engineering contractor). The means of managing risks was also effective.
- **Perth-Mandurah railway** - Perth is a highly car-dependent city and the coupling of commuter journeys with car use required a change of behaviour. Fortunately the proponent of the railway could point to changed behaviour in the Northern corridor. Here, though, there was mainly a shift from bus to rail for longer journeys. The risk of non-use was also mitigated by the physical restrictions to southern entrances to the central business district due to the location of the Swan River. So any high capacity mode was likely to make some improvement to the situation, and represent a good option for especially commuter.
- **Sydney Cross City Tunnel** - the primary risk in Sydney was that people would not use the infrastructure. The eastern suburbs within which the project is located had until that time been toll free. There is a sense from many interviewed that the overall number of tolls, and the complexity of the toll network in Sydney may be reaching saturation point. Although this was a PPP and the consortium bore the financial risk, ultimately going into receivership, the government was left with the political odium of perceived failure.

There were construction risks in all three projects, but especially the Perth and Melbourne projects. In Melbourne these resulted from tunneling in highly unstable mud under and around the Yarra River. These risks were clearly allocated away from the State government. There were major engineering risks in tunneling under central Perth. The tunnel was through soft ground under the city. The construction risks associated with the tunnel were high. For the Sydney project the construction risks, which were generally handled successfully, were also considerable - the tunnel had to weave its way over, under and around a number of already existing tunnels, including the heavy railways, and make provision for a proposed railway tunnel. The entire construction program was conducted in a highly concentrated urban area, without significant disruption to surface streets.

In Sydney there is a sense that the early projects such as the Sydney Harbour Tunnel were not satisfactory for the government, which took all the risk concerning traffic forecasts and guaranteed a minimum income for the tunnel operators. The uptake of the PPP option had changed this allocation of financial risk but more than one PPP project have been a failure for the private companies that constructed them, all risk other than political risk being allocated to the private sector. The Cross City Tunnel however raises questions about the validity of arguments which suggest that so long as government isn't exposed to financial loss, then a project is valid. The failure of the tunnel, and in particular the resultant inability to realise benefits in terms of changes on the surface, has brought to the fore notions of opportunity cost. In related commentary interviewees also noted that the success of the project in the wider sense was highly dependent on a number of risk factors such as the global financial crisis, oil prices and climate change which were largely neglected in the selection of the tunnel project over other possible projects, such as public transport.

One other risk, illustrated by the Sydney case, is that projects which are unsuccessful, damage community willingness to support the future projects and undermine faith in the government and government processes. This is a form of political risk which is perhaps at times insufficiently managed.

ORQ 3: How important is context in making judgments regarding the above questions?

As discussed in 'Test 4' the context of each of the project case studies was important, not only in influencing the genesis of the project but also whether its was ultimately perceived as a success or a failure.

The City Link project was based on a strong logic of 'clear need'. The anti-motorway sentiment that prevailed following the attempt to introduce a grid of urban freeways in the early 1970s was overcome by a strategy of connecting and enlarging existing freeways. City Link continued that logic. The economic downturn in the early 1990s gave added reason for the project under the logic of economic stimulus to get Victoria 'on the move' again. The politics of the time emphasized the need for strong and decisive leadership from Cabinet level, and opposition within the State bureaucracy and local government was cowed by 'reform' measures. The local environment through which the new section of ground level motorway passed was of little natural environmental value, being mostly old industrial areas.

Western Australia is a unique environment. It has very high levels of biodiversity, large numbers of unique species, and fragile water and land resources in many places. This sets the context for environmental issues, with sensitivity to such matters high. The need to protect the areas between corridors of development over the 'water mounds' (underground aquifers) was in the end the decisive factor in the decision to proceed with a fast rail solution to transport in the corridors. Also important was the linking of the environmental debates with improved public transport and the discourse of land use transport integration (or LUTI). Finally, since Western Australia received royalties from the immense mining industry in that State, the State was able to provide finance to build the railway without having to rely on partnership with the private sector.

Sydney Cross City tunnel was the apparent success of several other tollway projects in Sydney. This success tempted the Government try to recover all the public sector costs in designing and implementing the project. The other contextual factor was the conflict over motorway building in Sydney between the road lobby and its supporters, and those who wanted to see more sustainable environmental outcomes.. The road was meant to resolve the conflict by the improvements to the urban environment of central Sydney. But the conflict was not successfully managed and the environmental improvements were abandoned,

The global context played a limited role. Undoubtedly the world-wide thrust of neo-liberalism helped justify the involvement of the private sector in infrastructure projects that had formerly been the preserve of the public sector. Likewise the on-going concern to reduce public sector debt also played a significant role. In both Victoria and New South Wales governments could claim significant additions to infrastructure without adding much to government borrowing. In Western Australia also the availability cash flow from the mining industry made the public investment more justifiable. While the rhetoric of sustainability played into the arguments over the projects in various ways, in no case was 'sustainability' operationalised (that is with reference to targets leading to real outcomes) as a criterion for decision or evaluation.

Political leadership

City Link - it is clear that strong political leadership was critically important to the project's successful implementation in terms of its internal objectives. It is significant that benefit-cost analysis was only carried out after the decision to proceed. Once that decision was taken the possibility of abandoning the project was removed. As one interviewee conceded, the project took on a life of its own. Strong leadership does not mean a stubborn refusal to listen to counter-arguments within the frame given by the decision to proceed. There was no going back on that decision. And there were moments of adamantine firmness on the part of the Premier (chief minister of the State of Victoria) in dealing with the bidders for the concession, as evidenced in the stories told, but there is also evidence that flexibility was later shown in dealing with conflicts over the contract, and innovative thinking attentive to public needs about mitigation of negative social effects and in the design of the tolling system.

Perth - there was strong emphasis on the role of political leadership, with its connotations of power, success, and reputations on the line. As mentioned above, political leadership was linked in both the Melbourne and Perth cases with strong and consistent supporting narratives. In Perth there was much discussion about the actors involved and their roles, and lobby groups. The politics of the distribution of transport opportunities was a significant factor from the start. Once the Northern Suburbs line had been built, people started looking to the suburbs sprawling along the Perth coastline to the South of the CBD. At first this 'look' was no more than a rhetorical sop to that particular public. Then it was perceived by the government and Perth City Council, that the people of the South West were significant to the economy of the whole city. Many interviewees mentioned the critical role of the Minister and the top leadership in promoting and 'championing' the project. The Minister adopted a consensus-building style, but was prepared to take strong action and be very firm when the occasion demanded. The Minister was only one of a series of people who stood up to be counted in this project.

Sydney - the Minister in charge at times exhibited determined leadership to the point of being overbearing. But this minister was not there at the end of the construction phase having resigned along with the Premier who started the project. But in contrast with both City Link and the Perth-Mandurah railway, the Sydney Cross City Tunnel was not given undivided and unequivocal political support. The leader of the project in the public service lost his job. And there was reportedly conflict and rivalry between Ministers. A view was expressed that the bureaucracy in NSW has been highly politicised in recent years, with bureaucrats increasingly unwilling to question projects. As noted above, the supporting narrative for the project was fatally confused in the public mind.

ORH #3 – Managerial competence

City Link - competence in decision-making for MUTPs has to do with the effective (rather than merely adequate) treatment of RUC and sensitivity to context. These are ever present variables in almost any public sector management task in today's world. Effective management would not be able to compensate for a lack of the 'success characteristics' of the project. Successful management followed from:

- strong political leadership and governmental support
- strong team work and management structure
- effective project planning.

Managerial competence that was demonstrated in the City Link case study was shown in the ability of team leaders to negotiate outcomes and arrive at compromises satisfactory to all sides thus minimising the need for court action. The absence of seriously conflicting objectives – for instance between financial and service goals, certainly helped the project. The management of the objectives of the parties so that alignment was retained was one of the key demonstrations of managerial competence in the project. Non-stop multilane electronic tolling, incident detection and response systems have consistently exceeded all targets. The entire Concession Deed was a model for East Link (a later PPP).

Perth - discussions about management competence in the Perth-Mandurah railway case study often returned to leadership. On the more technical aspects interviewees pointed to integrated planning of the project (including city planning), financial management and planning, the contracts, project planning, and team work and skills. Strong leadership with 'vision' was necessary to get the transport network to work irrespective of the formal bureaucratic structure. The project was run to a proper budget that was adhered to. Despite comment to the contrary by interviewees, the contractor could not be held to a fixed price because the contract was not a fixed price contract in the beginning. This brought about the conflict over the indexing which was really started by the ATO stopping management of the index. . The project was carefully scrutinized by the Treasury Department and subjected to cost-benefit analysis. The timely delivery of the project became an issue and was driven by political needs. There was a feeling that the team was not working harmoniously in the implementation phase. On the other hand strong leadership from the government was critical in getting the project to completion.

Sydney - a major competence failure was the incorrect traffic projections for the project. However there were other significant issues. One is that in Sydney there is a large number of agencies involved in the decision process and they are poorly coordinated. In contrast with the Melbourne City Link Project, the Sydney project was given to an already existing agency, the RTA, which then had to try to coordinate with the Department of Planning and other agencies to get approval. In Melbourne and Perth planning approval was handled through special legislation for the projects. This task was complicated because of rivalries at the political level between ministers. Initially the project was well supported by the City Council and the community. The EIS led to a number of requests for changes to suburban surface streets by residents. 'Ownership' of the project was difficult to determine. The City Council were very vocal in lobbying for a tunnel, however the Council needed the State to put together the financial package. Certainly the decision to go ahead was the State government's and the Minister for Roads at the time was a vocal supporter of the project. Like previous projects, such as the Eastern Distributor, the decision making process might be categorised as one interviewee put it a "DAD approach to projects, the Decide, Announce and Defend process". This is supported by the nature of the consultation, which was generally restricted to those living on the proposed route of the tunnel, and those directly affected. A broader consultation process concerning the effect on the city was not conducted publicly. The major problem with this approach was that the 'Defend' part didn't happen.

When it came time to defend, the new government members simply ran for cover suggesting that the project perhaps should not have been built.

ORH 1 and ORH 2 – sustainability

City Link project - identified 'sustainability' with long term planning of broad scope, protecting the global and local environments, enhancing the quality of life, taking account of externalities, sustaining the economy and creating a better road network that would save travel time. Having so many things with no operational definition in which the achievement of targets could actually be measured meant that 'sustainability' became a fairly meaningless concept. The potential for conflicts among the sustainability values is substantial and was never clarified or resolved. At the time City Link was being proposed sustainability was an important issue but probably not the highest priority.

Perth-Mandurah railway project - there was a strong narrative of sustainability not so very different from that used in the City Link project. This narrative linked improvement to public transport, and especially electric rail-based public transport with values such as global environmental sustainability, preserving the quality of local environments, fairness and equity in providing transport services to the community, sustaining economic growth in the long term, improving the quality of the urban environment, and improving the transport service. However the focus came down to the three aspects of the 'triple bottom line': 'sustainability' in the broad *economic* sense of enhancing social welfare or benefit, an *environmental* sense of protecting the global commons – the atmosphere, climate and resource base, and a *social* sense of contributing to fairness, or social justice.

Sydney Cross City tunnel - was justified in part by the promise to make central Sydney a more liveable environment, to divert traffic and make more space for pedestrians, cyclists and public transport. This objective comes under the 'sustainability' objective of enhancing 'urbanity'. However, as with the other two projects sustainability was related to economic indicators, especially appropriate pricing signals. Sustainability was associated with wealth generation and good management of the economy, factors which were considered under threat by the failure of this project, and projects more generally. Equity was seen as part of generating a safe society, and one with reasonable levels of cohesion. The Environmental Impact Statement presented an assessment of the project against a different set of principles of sustainable development, namely the precautionary principle, intergenerational equity and conservation of biological diversity. This was unusually explicit about the conditions for sustainability. Greenhouse gas reductions were expected to diminish as a result of improvements to public transport.

In all cases the rhetoric of sustainability was unmatched by any capacity or desire to set specific benchmarks or targets against which either the projected or the actual performance could be measured. Nor were potential conflicts between the environmental, social and economic dimensions of the sustainability rhetoric discussed, let alone resolved.

Success in terms of the needs of the twenty first century?

Viewed in terms of their own frameworks of thought and value, both the City Link and the Perth-Mandurah projects were successful. The failure of the Sydney Cross City tunnel owed more to unresolved conflicts in the framework of justification than to objective failure.

In terms of the needs of the twenty first century, none of the projects can be regarded as proved successes. This is hardly surprising because ten years into the present century the internal conflicts within the concept of sustainability have not been confronted or resolved, and operational targets have not been set or agreed upon.

If economic, social and environmental goals are part of the paradigm of sustainability there remains the question of which should have priority if, in particular cases, they are in conflict. Yet the conflicts emerge in the projects themselves.

The City Link motorways boosted the economy of Victoria and temporarily reduced traffic congestion. Yet less than ten years later congestion on the motorways had built up again, requiring another massive enlargement of the motorway system. The perpetuation of a road-based solution to mobility, with continuing growth of greenhouse emissions from transport, is hardly conducive to global environmental sustainability. Exactly which sections of the population have benefited has never been established, and the opportunity cost of massive continued investment in roads as against rail based public transport, has left large areas of the outer suburban population without access to high quality networked public transport.

The Perth-Mandurah railway sustains a highly dispersed city form, and the projected savings of greenhouse gas emissions is based on a comparison with the same form served by private vehicle use, and not through change to urban form. While the potential for transit-oriented development exists, the space around rail stations has been occupied by car parking to sustain the 'park and ride' philosophy of the railway. However, the railway does mark a shift of infrastructure philosophy from road-based to integrated public transport. In this respect, even though Perth remains heavily car dependent, the path of development of transport has diverged significantly from that of Sydney and Melbourne. Of course the question of whether anything other than a highly dispersed form is possible for Perth given the geographic configuration of its water supply provides an interesting conundrum to the way urban form is generally held to be sustainable. The latest thinking in Perth around developing higher density, but also highly dispersed nodes at the rail stations which have been built seems to mark a way forward, but one which diverges from much of the traditional urban densification literature.

While the Sydney Cross City tunnel was evaluated against ambitious concepts in the environmental effects assessment process, these concepts were not formulated as measurable benchmarks or targets. The particular objective of improved urban environment in central Sydney was eventually dropped leaving the road project exposed as the not particularly effective continuation of the road-based transport solution which is the dominant paradigm is both Sydney and Melbourne.

An important finding from these case studies is therefore that if sustainability is to be a meaningful concept to guide investment in infrastructure projects, the concept must be given much greater precision by confronting internal conflicts, making decisions about priorities, and setting benchmarks and targets based on these priorities. Otherwise the concept will remain a politically useful but ultimately empty rhetoric with little reference to reality.

8.4 Conclusion: Australia

This section presented a summary and synthesis of the Australia Country Partner's research on the three case studies of City Link, Melbourne; Perth-Mandurah railway and the Sydney Cross City tunnel.

A summary profile of each project (with hyperlinks to the full Project Profiles) described the project's history and main characteristics, features, issues and timelines.

The Country Partner's own synthesis of their research findings in relation to the '4 Tests' was then given, presenting findings from the overall country perspective (i.e. combining the three

case studies). Hyperlinks to the more detailed '4 Tests Reports' for each project were also given.

8.5 Additional material[9] supplied by the Australia country partners (23rd Sept. 2011)

Introduction

There is no international body such as the EU that affects Australian MUTPs. The primary influences on MUTP development are funding for projects from the federal level and development and planning of projects at State level. The federal program of MUTPs (for instance AusLink 1 and 2) has been developed from 'wish lists' submitted by the States and local governments rather than comprehensively planned on the basis of national need. The balance of influence has changed somewhat in recent years with the election of the Rudd Government. A new national authority, *Infrastructure Australia* has been created to evaluate MUTP proposals on a more rational basis. None of the case studies were carried out under this new regime.

We make a distinction between project and program. Programs (for instance strategic metropolitan development plans) must be wide ranging, meet multiple objectives, involve public consultation about these objectives, and give rise to projects to meet these objectives. Projects need to be carefully circumscribed and designed to meet a set of limited and non-conflicting objectives. This distinction emerged strongly from the case studies and has to be kept in mind in reading the 'lessons'

8.5.1 Test 1 project objectives

8.5.1.1 Melbourne city link

Context-specific lessons

- The project was judged a success because it met a strongly felt and widely agreed need.
- The necessary financial support could be found through a public-private partnership and a toll road. Toll collection at the volume required to make the road viable could only be achieved through innovative electronic means.
- Multiple goals relating to passenger and freight transport serving the airport and port, and a major urban development could be simultaneously met. Economic stimulus was also an important goal.
- The project was judged a success because no alternative and competing vision of the problem was allowed to emerge which might reveal conflicts amongst goals.
- The success of the project could be said to have occurred because of strenuous efforts made to limit (or place boundaries around) the objectives of the project to those that were directly attributable to the project. That is, the project was not allowed to become part of wider or other objectives.

The deployment of earlier centripetal motorways that terminated at the edge of the city core was seen to be creating congestion at the city ends of the motorways and within the core itself. The wider question of what caused traffic congestion was not publicly considered, nor was any non-motorway solution to congestion – for instance through improved public

[9] These 'lessons' should be read in conjunction with the fuller discussion of the case studies in the 'Four Tests' section of the main report (above).

transport – seriously considered. Whether motorways create induced traffic was a question that did not emerge to threaten the policy logic.

Generic lessons

- A project will only take place if an appropriate funding package can be found for it.
- Projects are judged a success if they have clear and internally non-conflicting goals.
- Projects are judged a success if their goals are consistent with an established policy logic.
- Projects are judged a success if people use them.
- Traffic on the roads creates its own perception of success, understanding of the problem and appropriate solution.

The City Link project followed the policy logic of motorway building to serve Melbourne's transportation needs, and the project provided a logical way of connecting up existing motorways to form a more integrated motorway system. The ultimate confirmation of success came when the traffic forecasts on the motorway came up to and exceeded projections: people were using the motorway and, moreover, were prepared to pay for its use. Paradoxically, success in getting people to use the project resulted in congestion on the motorway itself. Time spent in travel on the whole road system increased, and by 2008 congestion forced the roads authority to implement a massive enlargement program on the City Link motorways.

8.5.1.2 Perth: Mandurah railway

Context-specific lessons

- The need to find a public transport solution to the city's transport problems came from longstanding advocacy by respected academics, in parallel with strong community activism.
- The decision to pursue a public transport solution was assisted by prior positive experience with public transport.
- A wealthy government (as is the State of Western Australia) can afford to undertake infrastructure projects without having to rely on public-private partnerships. This means that public transport alternatives can be considered
- The project succeeded when backed by a stronger case than the alternative.
- Successful implementation depended on firm and unwavering political commitment following the decision to proceed.
- The success of the public transport solution depended on effective competition on journey time with the car.

Unlike the City Link case, the underlying rationale for the railway was in question for a considerable time before the decision to proceed. The alternative proposition was a more compact city form growing out from the existing urban periphery, rather than a 'string of beads' development along the coast. The former was proposed to be serviced by bus transport. The argument against this option that proved decisive was the need to prevent development over the sub-surface aquifers known as 'water mounds'. Protection of the water mounds meant that urban development could not be allowed to sprawl out from the edge but would have to be located in existing coastal settlements to the south. Rapid public transport access to the central core from these settlements could only be achieved by a fast rail service.

Although in Perth, five options were considered for funding packages for the railway, in practice investment in rail infrastructure is only likely to take place with near 100% public funding. The State of Western Australia was rich enough to undertake the investment without relying on federal funds, which at the time were unavailable. No doubt the rail option was also assisted by the earlier reinstatement of the City to Fremantle railway and the success of the Northern Suburbs rail line. These successes added to the credibility of the highly competent railway planning staff and the long term support by an eminent planning scholar for public transport in general and rail in particular. The ultimate judgement of success, as in the City Link case, came with strong use of the new rail line. Once the decision was taken to proceed, the project had the undivided commitment of the Minister responsible. It should also be noted that Perth is already well supplied with high quality roads of motorway standard, but the centripetal journeys create congestion. The railway system is less extensive (still) than that of Sydney and Melbourne.

Generic lessons

- When alternative solutions are considered, a project can succeed over alternatives if a stronger argument can be advanced to support it.
- The public transport option (for major investment in infrastructure) will only be considered if 100% public funding is available. A project will only take place if an appropriate funding package can be found for it.
- Projects are judged a success if they have clear and internally un-conflicted goals.
- Projects are judged a success if their goals are consistent with an established policy logic.
- Projects are judged a success if people use them.

In Australia, the consideration of public transport as an option for investment in infrastructure only takes place if either the State Government is rich enough to finance the project itself, or if central funding from the (federal) Commonwealth Government is available. We do not know if this is more widely true, but it seems likely that major public transport investments require national level funding.

8.5.1.3 Sydney: Cross city tunnel

Context-specific lessons

- Conflicting goals held by government for the project led to its failure. Saving money for the State Government led to a level of toll beyond what some people were prepared to pay to avoid city centre roads. Thus *saving money* conflicted in practice with *environmental improvement*. So road closures were abandoned and use of the road fell below forecasts.
- Overestimating demand led to the financial failure of the private owner of the tunnel. Note that inaccurate forecasting is not by itself a reason for perceived failure. If demand exceeds forecasts that may be regarded as an indicator of success – but there is congestion.
- Despite the general perception of failure, some of the project's goals were met. For instance, for those prepared to pay, trips across the city were substantially reduced in time by avoiding 18 sets of traffic lights.

Traffic forecasts for the Cross City Tunnel were grossly inflated over the real number using the tunnel. This was inaccurate forecasting in the wrong direction: too few users rather than too many. This led to the financial collapse of the initial owner of the tunnel Cross City Motorways Pty Ltd. The main reason for the project, namely to channel through traffic under

the city and thereby improve the environment of Sydney's central area, was not achieved. The necessary central area road closures were widely perceived by the public as a means of funnelling traffic into the tunnel to the benefit of the private consortium operating the tunnel. Unlike the City Link case study, the travelling public was not prepared to pay the toll, boycotted the tunnel, and demanded that roads that were closed be re-opened. The State Government viewed the private-public partnership as a means of obtaining a better through route, and completion of their orbital freeway network, without cost to the government. The State government demanded a 'business consideration fee' from those tendering for the project in order to ensure the project resulted in zero cost to government. This resulted in high toll fees for use of the tunnel. The Local Council viewed it as a means to obtain environmental improvements.

There was, thus, an unresolved conflict between the local environmental improvement undertaken as part of the project and the transport objectives of connecting a motorway system. The transport network effects and conflicts were left unresolved.

Generic lessons

- A mega-transport project fails if there is internal goal conflict, if the project goals are not consistent with established policy logic, and if use falls below expectations.
- A project will fail unless there is community support from key groups.

The above is the negative side (failure) of the positive generic lesson (success) from City Link. In the Sydney case, the key groups were the potential users of the tunnel. The project was planned and directed by the State roads authority. This is in contrast with City Link where a special purpose authority was created somewhat distanced from the government.

8.5.2 Test 2 Sustainable development visions and challenges

8.5.2.1 Melbourne city link

Context-specific lessons

- Project leaders who wish a project to be implemented will build a rhetoric of sustainability around it as part of its justification. But sustainability is probably best applied to programs.
- Project leaders who wish a project to be judged a success will exclude criteria of sustainability that the project cannot meet.

'Sustainable development' became part of the rhetorical discourse around City Link. But the meaning given to the term within this discourse was such as would not threaten the implementation of the project. Other meanings were excluded.

Generic lessons

- For 'sustainability' to guide project development, the term must be specified in measurable terms external to the project, otherwise 'sustainability' becomes a *post-hoc* rationalisation of the project. Specification of the sustainability definition, criteria and indicators must be by an authority independent of the project proponents.
- For sustainability to be meaningful, the limits of the system to which the term applies must be specified, for instance the economy, the environmental system, society etc. and at what scale: national, regional global.

- Conflicts amongst different sustainability criteria must be acknowledged, for instance between advancing economic growth and climate stability, or between economic growth and public health.
- Considering the history of the concept, sustainability has a distinctively global connotation because the ultimate limits of the closed system in which projects occur is the planet. Therefore for sustainability to be meaningful, the term must refer at some level to the planetary system and its interconnected economic, social and environmental aspects. In a narrow sense, sustainability of a sub-system may be contrary to the sustainability of the whole system, but since all subsystems are dependent on the whole, the impact on the whole must be considered.
- Assessment of the project against sustainability criteria should be conducted by an authority independent from the project proponents.

'Sustainability' has many different definitions. Different definitions serve different interests. The City Link project can be assessed against the OMEGA criteria of sustainability which can stand as an attempt to create a set of external criteria. The conclusions of such an assessment are detailed in the main report. Public participation was helpful in identifying negative effects of the project and then finding solutions, but such participation was not allowed to question the project logic or the need for the project. The option of stopping the project was excluded.

8.5.2.2 Perth: Mandurah railway

Context-specific lessons

- Project leaders who wish to promote mega-projects should embed them in a discourse of sustainability that resonates with the local public.
- The integrated land use and transport approach which is necessary to further the aim of sustainability is facilitated by the existence of a planning agency (WAPC) distanced from day to day politics.
- Sustainability is enhanced where there is public participation at the formation stage of project plans, before the project has been decided – participation in program development and not just project development.
- The Perth case study shows the importance of including enhanced urbanity, or quality of the urban environment as an aim of transport mega projects.
- Sustainability was not well defined in the Perth case, but played an important role in the strategic thinking for the project. As with City Link, criteria of sustainability must be defined in order to become a management tool and go beyond rhetoric. These criteria should include enhancing human health and fair distribution of social opportunities.

The narrative of sustainability became a cultural variable as it was absorbed into the political discourse. There was a fairly widespread view that people ought to be given alternatives to the car. Possibly this occurred in Perth because the other State capital cities already had well developed rail or bus way systems. There was constant reiteration of the theme that civilized and liveable cities require rail based transit. In Perth the discourse was turned towards building cities, not just building transport infrastructure. Here 'sustainability' is coupled with 'good cities that work well'. The Mandurah railway was not just a railway project, but an integrated bus, car and rail project. In some places land use was integrated into the plan, but in many cases where transport nodes had the potential to be places for future commercial growth, this has not yet taken place, and in some places is inhibited because of the hectares of car parking around the suburban stations. In other places subdivisions have taken place and are in the process of being developed.

Generic lessons

- Mega-projects should be connected to a strong and well argued discourse of sustainability. That discourse itself poses the question of how sustainability criteria can be derived in such a way as to become a management tool.
- The same generic lessons can be derived from the Perth study as from the City Link study. In the case of Perth the discourse of sustainability was much more influential in guiding the project towards a public transport solution and away from the entrenched car-based motorway solution.

8.5.2.3 Sydney: Cross city tunnel

Context-specific lessons

- Some features of governance for the project were inadequate: a lack of transparency, too close a relationship of the project planning authority to the political tier, lack of attention to the impact of tolls, lack of clarity about the role of the environmental planning and assessment process, the ineffectiveness of the 'right to operate' financial charge on a private partner, and inadequate community consultation.
- The improvements to Sydney's central urban environment were not met because of the goal conflict within the project and the failure to gain the consent of key groups in the community.
- Despite assessment of the project against explicit environmental criteria, some of the criteria were not expressed in operational terms which could be used in the design and monitoring of the project. However the impact of construction was closely monitored and was reduced by the use of intelligent construction techniques
- The project was intended to reduce traffic accidents but no post-implementation monitoring of this aspect was carried out.

A review of the Cross City Tunnel drew a number of specific lessons from the project regarding governance. These are detailed in the Four Tests section of the Australia Report (Volume 4).

Generic lessons

The Sydney case study tends to support the lessons derived from the City Link case, namely:

- The Sydney case demonstrates even more clearly the limits of post-hoc environmental assessment. Sustainability criteria should be applied in the design of the project but for this to occur, criteria must be specified in measurable terms. Specification of the sustainability definition, criteria and indicators should be by an authority independent of the project proponents.
- For sustainability to be meaningful, the limits of the system to which the term applies must be specified, for instance the economy, the environmental system, society etc. and at what scale: national, regional global.
- Conflicts amongst different sustainability criteria must be acknowledged, for instance between advancing economic growth and climate stability, or between economic growth and public health.

In some ways environmental sustainability was taken more seriously, and the project assessed in greater depth, than either City Link or the Mandurah railway. But it was a *post ho*c process, and the idea of sustainability did not figure strongly in the public discourse prior to and in the design of the project. The road was conceived by a road building authority within a rather traditional road building policy logic. The road proposal did not emerge from a

strongly articulated metropolitan strategy. Like City Link, motorways in Sydney tend historically to be absorbed into metropolitan plans rather than emerge from an integrated strategy for land use and transport.

8.5.3 Test 3 Treatment of risk, uncertainty, complexity and context

8.5.3.1 Melbourne City Link

Context-specific lessons

- The City Link project shows that careful attention to the detail of the political as well as the engineering context led to continuing support and success.
- No project is risk free and City Link risk appears to have been successfully managed by i) pre-planning, ii) careful monitoring, scrutiny of key documents, and problem-solving on the job, iii) manageable risk *taking* rather than just risk avoidance, iv) public consultation, v) the private sector agents staying in close touch with government, and vi) sticking to decisions once taken

Risks were sensibly allocated amongst the parties, and an important strategic task was the creation of a single purpose authority to manage the road. The boundaries of the City Link project were carefully defined. They extended to the wider community, the stakeholders and the potential users and the local economy, but were not drawn so wide as to include review of the transportation system as a whole or the future direction of development of the city. Traffic forecasts did not play a major role in decision-making for City Link. Forecasts were inaccurate but in the right way: more traffic occurred than predicted resulting in a benign problem for the project: increased congestion.

Generic lessons

- Project leaders need to be very aware of the political and strategic context of the project. Context includes the political background of the project, community support for the project, any potentially conflicting expectations of it, and the logic supporting it (including any flaws in the logic).
- Effective management of risk needs to be thought of not so much in terms of a 'toolbox' but a process that includes three stages:
    i. assessing risk,
    ii. allocating risk fairly among the parties,
    iii. managing the risks that have been accepted.

- Projects should be derived from wider programs or strategies (for transport, the urban future, the environment).
- Forecasting traffic demand should be carried out by an independent authority.
- Engineering innovation is often a major element is success.

Projects should not attempt to become programs or strategies, and they are not substitutes for program and strategy. Since ultimate use of the project by people is a mark of success, accurate forecasting of travel demand is crucial to reduction of risk. Forecasting should never become part of 'making the case' for the project. The success of a project may conflict with the success of a program. For instance a successful project may attract large numbers of users causing congestion. If the strategic aim is to reduce congestion, the project may well not contribute to this aim. Unfortunately politicians and the public regularly conflate the two: program and project. Engineers are by training innovative problem solvers. In this case the problem was how to apply tolls with sufficient speed to move traffic fast without the need for

vast toll payment plazas (at booths). The solution was electronic tolling with allowance for exceptional circumstances in which occasional journeys could be made with pre or post-payment.

8.5.3.2 Perth: Mandurah railway

Context-specific lessons

- As with City Link, careful attention to the detail of the political as well as the engineering context led to continuing support and success.
- Unlike City Link, part of the context for the Mandurah railway was an ongoing debate about the future urban form of the city, therefore project leaders must be aware of the connections between land use and transport planning.
- Project leaders should be aware of the sequence of events in which the project is embedded and be prepared to take advantage of opportunities to advance the project as they emerge.
- The project succeeded because it had both strong political leadership and a strong narrative, and strong community support.

The Perth project entailed a number of risks. The first was the risk of non-use of the railway by the public. This risk was somewhat mitigated by the real experience of the precursor Northern Suburbs railway that could be used to calibrate modelling of passenger use. There was an irreducible engineering risk in the boring of the tunnels, with considerable risk to the city buildings, in part because ground conditions were extremely difficult (so difficult in fact that tunnel boring had never been attempted in Perth before). There was also funding risk. The original Master Plan considered 5 options to fund, from government fully funded and operated through to private sector fully BOOT (build-own-operate-transfer). In practice private participation was always very unlikely..

Three main groups of contextual variables were relevant to the question of ‘context’:
- The physical, geographical and economic facts of Perth in Western Australia: the layout of the city and its geography, the wealth accruing from the mining boom;
- the cultural and social variables that included the ‘car culture’ and the discourse of sustainability;
- the actors and the timing of events.

The political geography of the Perth region was an important contextual variable: the location of marginal seats and equity in the distribution of transport opportunities. The physical context included the fact that the freeways to the North and South contained in effect land reservations that could be used to locate railway lines. The economic context of a rich State enjoying the fruits of a sustained mining boom was significant. The lowest cost was provided by full public funding due to low cost of finance. The choice to fully fund the project was therefore made because of the availability of funds, the relative cost of the funds and a sense that public funding would reduce risk to the project. The contractor was required to take the risk for somewhat unknown ground conditions and to price on the basis of assumptions.

As to political strategy, the project had ‘three legs of a supporting tripod: strong community support (people taking ownership of the project), active political leadership with a strong supporting narrative, and competent and skilled technical design and implementation

Generic lessons

- Project leaders need to be very aware of the political and strategic context of the project. Context includes the political background of the project, community support for the project, any potentially conflicting expectations of it, and the logic supporting it (including any flaws in the logic).
- Effective management of risk needs to be thought of not so much in terms of a 'toolbox' but a process that includes three stages:
    - assessing risk,
    - allocating risk fairly among the parties,
    - managing the risks that have been accepted.
- Projects should be derived from wider programs or strategies (for transport, the urban future, the environment).
- Forecasting traffic demand should be carried out by an independent authority.
- Engineering innovation is often a major element is success.

The generic lessons that can be derived from the Perth study are no different from the City Link study. With City Link the future form of development of the city was already decided and the motorway enlargement had been part of metropolitan planning policy since 1996 (in a document titled *Transporting Melbourne* issued by the Department of Infrastructure). However in Melbourne motorway planning had proceeded more or less independently from land use planning, with the results being subsequently embedded within land use plans. In Perth land use and transport planning were conducted as a much more integrated process with urban form and transport infrastructure being considered together.

8.5.3.3 Sydney: Cross City Tunnel

Context-specific lessons

- There seems to have been little reflective awareness of the contextual variables and marked absence of consensus around a broader vision for the project. The 'big picture' vision seems to have become lost. Instead key actors were closely involved in political manoeuvring (specific contextual variables in Sydney are described in the Four Tests section of the main report Volume 4)
- Conflict over projects can be considered normal. But unlike in the other two case studies, there was no authority strong enough or determined enough to resolve the conflicts constructively, Conflicts between bureaucrats tended to become conflicts between Ministers. However the key conflict could probably not be resolved, namely between having a tunnel that would be used and having a tunnel at no cost to the public purse.
- The original planners of the Cross City Tunnel clearly viewed the project in the wider systemic context of the city and its global environment. This was very much an open systems perspective. However the problem was that the system wasn't adequately closed by the project – the objectives were not encircled by the logic of the project and thus they could be abandoned even after the project was delivered.
- Evaluation was not done very often or very well. A number of interviewees felt that it was too early to tell if the project had been a success. This is in part to do with not having well developed methods for measuring the effect of these projects on the broader network, or land use changes.
- A key criticism of the way assessment for mega projects is conducted (in both NSW and Victoria) was that it is often limited to consideration of a very limited set of options. Usually both the EIS and CBA are restricted to a comparison of the suggested project with a 'do nothing' scenario, or at best with variants of the suggested project. As one interviewee put it 'it is quite common that *the project precedes the appraisal*, rather than

the appraisal identifying the candidate projects. This leads to the result in Cross City Tunnel where the project that was built was not the project that was needed.
- The construction risks were generally handled successfully. Even though the base rock was easy to tunnel through, the tunnel had to weave its way over, under and around a number of existing tunnels, including the heavy railways, and make provision for a proposed railway tunnel. The entire construction program was conducted in a highly concentrated urban area, without significant disruption to surface streets.
- As with the other two case studies, the primary risk was that people would not use the infrastructure. The eastern suburbs within which the project is located had until that time been toll free. There is a sense from many interviewed that the overall number of tolls, and the complexity of the toll network in Sydney may be reaching saturation point.

The above lessons are self-explanatory and need no further elucidation.

Generic lessons

- It is important to define what 'project' is in a generic sense, in contradistinction to 'program'. Projects require well specified criteria against which to evaluate them. For instance 'sustainability' is a useful device to focus attention on desirable attributes of *programs*. But to be useful in *project* the term must be specified in measurable, operational terms, becoming both guiding criteria in project design and benchmarks against which to assess the project once completed.
- The overall sense from the community was that consultation on road closures was not productive and that information was deliberately withheld (Kalowski, 2008). Consultation was considered tokenistic at best (Joint Select Committee on the Cross City Tunnel, 2006a). Further consultation was held with the local community on changes to the surface streets. There is indication that these consultations were conducted in response to directions in the Conditions of Approval. Despite all this consultation there was clearly considerable frustration and anger generated in the community from the project, and particularly the road closures which limited access to the harbour crossings from eastern Sydney.
- A general point is that post-implementation evaluation is important and almost never done. So we never find out if a project met its objectives. Partly this is because the criteria are not specified at the start in a way that can be measured.

As has emerged elsewhere in the three case studies, there is often confusion of project with program. There is an unfortunate tendency to create programs as bundles of projects, rather than projects flowing from well considered and widely debated programs.

8.5.4 Australia country summary

Context-specific lessons

- In Australia toll road projects can be successfully funded by private-public partnerships if they respond to a clear need, are well liked and are well used. But these criteria are dependent on others:
    - Clear need means that there is a widespread consensus that the project is needed, and there is no underlying conflict within the project's goal set.
    - Being well liked means that there is a widely known supporting narrative whether of sustainability, urbanity, transport need or economic growth.
    - Being well used depends on demand being correctly assessed so that actual use matches or exceeds prior projections.

- In Australia rail projects (at least up to the present) depend on government funding either by States (with the required financial strength) or with central government assistance. Partnership is likely to mean State-Commonwealth partnership.

Generic lessons

- It seems likely that the above lesson particular to Australia may also be generic and widely applicable, so projects succeed if they respond to a clear need, are well liked and are well used.
    - Clear need means that there is a widespread consensus that the project is needed, and there is no underlying conflict within the project's goal set.
    - Being well liked means that there is a widely known supporting narrative whether of sustainability, urbanity, transport need or economic growth.
    - Being well used depends on demand being correctly assessed so that actual use matches or exceeds prior projections.

- Context is important, so what worked in one urban context, or for one project, does not necessarily work in another. The problem here is transferring the technology of project without a deeper understanding of what made a successful project work in a particular context. The engineering and management technologies can be transferred but the more subtle political and strategic contextual factors may vary widely (for instance if the government introduces goal conflicts into the project planning as appears to have happened in Sydney).
- Projects should be set within, or emerge from planning strategies for the urban area they serve. This is more likely to ensure that the project is supported by a wider planning (rather than just transport) logic
- Effective implementation of the project demands strong and continuous political commitment and leadership as well as competent management.
- In addition to political leadership in a general sense, there is also a need for *championship* of the project: someone to take personal responsibility for seeing the project to a successful conclusion, such a person may be in the bureaucracy or in the political sphere but must command respect and power.
- Effective implementation demands appropriate assessment, allocation, and management of risk agreed by the parties concerned.
- Effective implementation demands flexibility of response to emergent problems and a preparedness and capacity to find innovative solutions.
- Effective project management demands integrated planning (over various bureaucratic silos), financial skill in running the project to a well prepared budget, negotiating and managing the contract, and a capacity for teamwork.
- Leadership requires a convincing narrative to support a project. This narrative cannot be just a story, however compelling, it must ultimately be based on fact. Evidence has to be adduced in support of the narrative, and embedded within the narrative.
- If 'sustainability' is to become a management tool there need to be clear and measurable criteria of sustainability. An alternative approach would be to define indicators of 'un-sustainability' and seek to reduce them. These may well define the meaning of sustainability for the project. However the project sustainability must be reconciled with the wider global discourse of sustainability.

A personal postscript by Nick Low

As the world heads deeper into recession, there may, and probably should, be a renewed call for government investment in infrastructure projects to help prevent the economy from stagnating. But we need first to think more deeply about the causes of the recession (or depression).

We face a failure of economic sustainability which results both from a failure of social sustainability (growing inequality and some absolute poverty in the developed world) and of environmental sustainability (evidenced by climate change). Figure 8.1 below produced by the Australian economist Alan Kohler shows that from 1950 to the mid-1980s labour income as a percentage of GDP in the USA grew faster than consumer outlays which meant that people spent and also saved. From the mid-sixties consumer spending began to surge but labour income plateaued. The mid 1980s was the moment which saw the formation of the 'Washington consensus' politically implemented by Reagan and Thatcher. Thereafter labour income trended downward (with a spike between 1998 and 2002) while consumer outlays (spending) continued to grow strongly. Wealth was increasingly concentrated in fewer and fewer hands – quite deliberately and by policy – in the belief that this would restart and then encourage investment. This meant, however, that consumer spending that maintained growth, even up to 2010, was fuelled by debt – which covered the gap between income and expenditure. Now people have started to save again because the markets have determined that debt is bad, even for governments.

Figure 8.1: Consumer spending and labour payments 1950 - 2010

Chart developed by Alan Kohler

The conclusion must be that, since growth can no longer be driven by debt, economic growth will only start again when there is redistribution of wealth to enable consumption to be driven by payments to labour. There is no longer a crisis of investment but a crisis of consumption. Investment will not resume until consumption resumes.

So where does this leave infrastructure investment, including transport mega-projects? Their immediate Keynesian purpose will be to relieve unemployment, so there should be a large expansion of such projects financed by government. But, while capital markets are free, governments cannot finance these projects by incurring more debt, so they must be financed by a substantial increase in a highly progressive regime of taxation. The wealth of the rich has to be redistributed. Even billionaires like Warren Buffett are in effect saying just that. Of course such a move will be resisted until unemployment reaches crisis dimensions in the US and Europe, or until there is a social revolution (euphemistically termed 'unrest'). The latter will have highly unpredictable results but social conflict could easily be harnessed to fascist

or otherwise totalitarian purposes. That is what happened in Germany in 1933 with initially good economic results.

Unlike in 1933 there is today an environmental crisis called global warming, or climate change. This will also independently cause intense and prolonged social disruption worldwide. So infrastructure projects must have the dual purpose of relieving social inequality and restoring climate stability. The world economy is at present absolutely predicated on mobility of goods and people at every level from local to global, and the source of this mobility is at least 90% fossil fuel. The infrastructure projects that are promoted must be directed to maintaining mobility without harming the environment. It is pure fantasy to imagine that people are going to have all their needs met locally, without mobility, as well as being disastrous for the less developed world. This means of course replacing carbon fuels with other sources of energy stored and distributed through electricity (whether batteries or direct current). The remaining carbon fuel will have to be reserved for uses where no substitute is available – mainly air transport. The question is what can transport mega-projects do to towards that end?

9. Country findings: Hong Kong

Western Harbour Crossing

Airport Rail Link

KCRC West Rail Link

9.1 Hong Kong: The project profiles

Project Profiles were prepared by the Country Partner[10] for each of the study projects, to provide a consolidated source of secondary information to support all phases of data collection, analysis and synthesis. The profiles covered such matters as: project cost, duration and quality information; principle and secondary project objectives; key project stakeholders; sources of finance; key events and processes. (See also Volume 1, Section 3.4).

The full Project Profiles can be accessed via the following hyperlinks:

Western Harbour Crossing
http://www.omegacentre.bartlett.ucl.ac.uk/studies/cases/pdf/HK_WESTHARBOUR_PROFILE_250711.pdf

Airport Rail Links
http://www.omegacentre.bartlett.ucl.ac.uk/studies/cases/pdf/HK_AIRTRAIN_PROFILE_180511.pdf

KCRC West Rail Link
http://www.omegacentre.bartlett.ucl.ac.uk/studies/cases/pdf/HK_WESTRAIL_PROFILE_180111.pdf

Summaries of the Project Profiles are presented on the following pages.

[10] In Hong Kong, the Country Partner was the Department of Real Estate and Construction, University of Hong Kong - directed by **Prof. Frederik Pretorius.**

WESTERN HARBOUR CROSSING, HONG KONG, HONG KONG

OVERVIEW

LOCATION:
WESTERN HARBOUR, HONG KONG
SCOPE: INTRA-URBAN
TRANSPORT MODE: ROAD
PRINCIPAL CONSTRUCTION: TUNNEL
NEW LINK: YES

PRINCIPAL OBJECTIVES

STRATEGIC TRANSPORT LINK
CONGESTION RELIEF

PRINCIPAL STAKEHOLDERS

CLIENT/PROJECT MANAGER:
HK GOVERNMENT
CONCESSIONAIRE:
WESTERN HARBOUR TUNNEL CO LTD
MAIN CONTRACTOR:
NISHIMATSU KUMAGAI JV
DESIGNER:
MAUNSELL-ACER-PARSONS BRINCKERHOFF
LOAN ARRANGER: HSBC

PLANNING AND IMPLEMENTATION

PLANNING START DATE: 05/1989
CONSTRUCTION START DATE: 08/1993
OPERATION START DATE: 04/1997
MONTHS IN PLANNING: 51
MONTHS IN CONSTRUCTION: 44
PROJECT COMPLETED: 3 MONTHS AHEAD OF SCHEDULE

COSTS (IN 2010 USD)

PREDICTED COST: 0.83BN
ACTUAL COST: 0.90BN
PROJECT COMPLETED: 8% OVER BUDGET
FUNDING: 100% PRIVATE (69:31 DEBT:EQUITY)

INFRASTRUCTURE QUANTITIES

LENGTH (IN TUNNEL): 2KM
LENGTH (CONNECTING ROADS): 10KM
NUMBER OF BRIDGES: 17
COST PER KM (2010 USD): 0.07BN

PATRONAGE (1997) & REVENUE

FORECAST TRAFFIC: 50-70,000 VPD
ACTUAL TRAFFIC: 20,000 VPD

INTRODUCTION

Western Harbour Crossing was Southeast Asia's first dual three-lane immersed tunnel when it opened in 1997. It is a build-operate-transfer project funded through tolls.

The tunnel is 2km long and has 10km of associated roads. It connects Hong Kong Island and the West Kowloon Reclamation, and forms part of Hong Kong's Airport Core Program.

BACKGROUND

The main objectives of the project were to relieve growing traffic congestion on the two existing harbour crossings and to contribute to the transport infrastructure links planned to support the new airport due to open in 1997.

The government decided at an early stage that the Tunnel should be funded by the private sector. In 1991 a study by the Western Harbour Crossing Consultants of the project's engineering, financial and environmental feasibility suggested a build-operate-transfer model.

The government's advisory committee on the environment rejected the environmental impact assessment report, as measures to reduce the impact of traffic noise upon residents were considered inadequate. The government later agreed a compensation package for those affected.

The formal enabling mechanism for the project was a government ordinance enacted in 1993. However, the impending transfer of sovereignty to China formed an influential backdrop to the project's progress. The agreement between British and Chinese governments on financing for the Airport Core Program was the subject of intensive negotiations leading up to the transfer in 1997. The full Program would be a significant drain on government reserves and the operation of its facilities would continue beyond the transfer. However, the WHC project was also considered justifiable on a stand-alone basis even without other elements of the Program.

Following the invitation of tenders, the Western Harbour Tunnel Company Ltd (WHTCL) was appointed by the Hong Kong government to finance, design, build, maintain and operate the WHC for 30 years, until August 2023. No other bids had been received: the two leading bidders had joined forces shortly before submitting their bid.

TIMELINE

CONCEPTION: 1981: SHORTLISTED OPTIONS FOR NEW TUNNEL CROSSING

CONCEPTION: 1989: NEED FOR TUNNEL CONFIRMED IN COMPREHENSIVE TRANSPORT STUDY. FEASIBILITY STUDY BEGINS

CONTEXT: 1989: NEW AIRPORT ANNOUNCED

CONCEPTION: 1990: GOVERNMENT ANNOUNCES PROJECT WILL BE BUILT AS B-O-T SCHEME

DELAY: 1991-2: ADVISORY COMMITTEE REJECTS EIA REPORT, GOVERNMENT AGREES COMPENSATION PACKAGE

CONTEXT: 1991: BRITISH/CHINESE AGREEMENT ON SUPPORT FOR AIRPORT CORE PROGRAM

INCEPTION: 1992: CALL FOR TENDERS FOR B-O-T SCHEME

INCEPTION: 1992: THE TWO LEADING BIDDERS JOIN FORCES AS WHTCL AND SUBMIT ONLY BID

INCEPTION: 1992: WHTCL AWARDED FRANCHISE

INCEPTION: 1993: FORMAL PROJECT APPROVAL BY GOVERNMENT ORDINANCE

INCEPTION: 1993: WHTCL AND GOVERNMENT AGREE TOLL ADJUSTMENT MECHANISM

INCEPTION: 1993: WHTCL/BANKS LOAN AGREEMENT

CONSTRUCTION: 1993: CONSTRUCTION BEGINS

CONSTRUCTION: 1995 (SEPT): FIRST FOUR SECTIONS OF IMMERSED TUBE IN POSITION, WHC 48% COMPLETE

CONSTRUCTION: 1996 (APR): FINAL UNIT SUNK INTO PLACE, WHC 71% COMPLETE

CONSTRUCTION: 1996 (SEPT): IMMERSED TUNNEL SECTION COMPLETE

CONSTRUCTION: 1996 (DEC): WHC 95% COMPLETE

DELAY: 1996: TAXI DRIVERS DISPUTE TOLL LEVEL

DELIVERY: 1997 (APR): WHC OPENED TO TRAFFIC

CONTEXT: 1997 (JUL): HONG KONG SOVEREIGNTY TRANSFERRED TO CHINA

DELIVERY: 2001: TOLL RISES HAVE REDUCED TRAFFIC, CONGESTION ON OTHER HARBOUR CROSSINGS INCREASED

DELIVERY: 2023: END OF CONCESSION

CHARACTERISTICS

The project cost was estimated in 1992 as HKD 6.5bn (at 1997 prices) (USD 0.83bn at 2010 prices)[i]. The final cost in 1997 was HKD 7bn (USD 0.90bn at 2010 prices), although WHTCL raised HKD 7.5bn in finance. The government also spent HKD 2.8bn on associated roadworks.

Shares in WHTCL are held by Cross Harbour Tunnel (37%), China Merchants (Hong Kong) (13%), the Adwood Consortium (CITIC Pacific, 10%, and CITIC Hong Kong, 25%) and Kerry Group (15%). WHTCL appointed the Nishimatsu Kumagai JV as main contractor, with sub-contracts for design, reclamation works, construction of the immersed tunnel, and mechanical, electrical and electronic works. They also appointed Scott Wilson Kirkpatrick as an independent checker and Ove Arup & Partners as project co-ordinator.

TIMELINE ISSUES

Despite initial uncertainties about Chinese government support, there were no major delays and the project was completed ahead of schedule.

FUNDING

WHTCL was required to maintain a debt: equity ratio of 69:31. It provided HKD 2.4bn equity for the project, and borrowed HKD 5.1bn in a syndicated bank loan involving 22 banks (60-70% from Japanese banks). Its agreement with the government involved an automatic toll adjustment mechanism that guaranteed the concessionaire a target rate of return. This caused controversy amongst legislators, who argued that the rate of return was too high, but the government refused to jeopardise the project by re-opening negotiations.

According to government estimates, WHTCL was expected to earn net revenue of HKD 60-83.7bn during the concession period. However, its performance has been disappointing to date: both traffic volumes and revenue have been consistently well below estimates. WHTCL has responded by increasing toll levels (four times to 2008), but this has only resulted in further reductions in traffic volumes and queues at the two other harbour crossings, which have lower tolls. The project has thus been criticised for not meeting its original objective of relieving congestion on the other crossings.

[i] Costs have been converted to USD at 2010 prices, using historic inflation rates and current exchange rates, to allow comparison between projects.

HONG KONG AIRPORT RAILWAY, WESTERN HONG KONG, HONG KONG

OVERVIEW

LOCATION: WESTERN HONG KONG
SCOPE: INTER-URBAN
TRANSPORT MODE: RAIL
PRINCIPAL CONSTRUCTION: AT-GRADE
NEW LINK: YES

PRINCIPAL OBJECTIVES

STRATEGIC TRANSPORT LINK
CONGESTION RELIEF
LOCAL TRANSPORT LINK

PRINCIPAL STAKEHOLDERS

CLIENT/PROJECT MANAGER:
MASS TRANSIT RAILWAY CORPORATION
FUNDER: HONG KONG GOVERNMENT
PRINCIPAL CONTRACTOR (TUNNEL):
KUMAGAI TARMAC JV
PRINCIPAL CONTRACTOR (TRACK):
GAMMON/BALFOUR BEATTY JV

PLANNING AND IMPLEMENTATION

PLANNING START DATE: 11/1989
CONSTRUCTION START DATE: 07/1994
OPERATION START DATE: 06/1998
MONTHS IN PLANNING: 56
MONTHS IN CONSTRUCTION: 48
PROJECT COMPLETED: 12 MONTHS BEHIND SCHEDULE

COSTS (IN 2010 USD)

PREDICTED COST: 4.29BN
ACTUAL COST: 4.37BN
PROJECT COMPLETED:
2% OVER BUDGET
FUNDING: 68% PUBLIC/33% PRIVATE

INFRASTRUCTURE QUANTITIES:

LENGTH: 34KM
LENGTH IN TUNNEL: 8KM
LENGTH (ELEVATED STRUCTURES): 6KM
COST PER KM (2010 USD): 0.13BN

PATRONAGE

INTRODUCTION

The Hong Kong Airport Railway is the first world's first railway built specifically as a dedicated express service between city centre and airport, but also serves the new town of Tung Chung in Lantau. It has two lines, Tung Chung (TCL, 31.1km) and Airport Express (AEL, 34.8km). It opened in 1998 with six stations. Nam Chung station opened in 2003, and Sunny Bay station and the extension to AsiaWorld Expo opened in 2005.

BACKGROUND

The project was conceived by the Government and the Government-owned Mass Transit Railway Corporation (MTRC), and was designed to be built in conjunction with other components of the Airport Core Programme (ACP), including government highways, reclamation works and bridge construction. Early feasibility studies suggested combining an express service without intermediate stops and a slower stopping service on the same alignment could be viable. The latter became the Tung Chung Line and was intended to relieve congestion on the existing mass transit system. The two lines would also serve the new developments on the West Kowloon Reclamation and provide a third cross harbour rail link.

A feasibility study, environmental impact assessment and financial appraisal were conducted. Although initial ridership was predicted not to meet original expectations, the project was considered viable based on assumptions about road bridge tolls and growth in air passenger traffic. A final environmental impact report recommended measures to reduce air and noise pollution during construction, although some residents complained about the noise.

The project was built mostly on newly reclaimed land, granted to MTRC by the government. It is associated with major property developments at five sites, totalling nearly 3.5million m^2 of floor area. MTRC has consent to develop the airspace above or adjacent to stations and has aimed to provide integrated developments, self-sufficient in social, recreational, retail and employment terms.

TIMELINE

CONCEPTION: 1989: GOVERNMENT ANNOUNCES NEW AIRPORT LOCATION AND AIRPORT RAILWAY FEASIBILITY STUDY

CONCEPTION: 1990: PLANNED COMPLETION DATE 1997 BUT CONCERNS ABOUT COST

CONTEXT: 1991: BRITISH-CHINESE GOVERNMENTS SIGN MEMORANDUM OF UNDERSTANDING

INCEPTION: 1991: FEASIBILITY STUDY FINAL REPORT PUBLISHED

INCEPTION: 1992: GOVERNMENT SIGNS DEAL WITH MRTC TO BUILD RAILWAY

INCEPTION: 1992/94: FOUR SUCCESSIVE FINANCIAL PACKAGES PROPOSED

INCEPTION: 1994: ENVIRONMENTAL IMPACT FINAL REPORT

CONSTRUCTION: 1994: TUNNEL CONTRACT AWARDED, FIRST SECTION TOWED INTO HARBOUR

INCEPTION: 1994 (NOV): BRITISH-CHINESE GOVERNMENTS AGREE FINANCIAL PACKAGE, SINO-BRITISH LAND COMMISSION AGREES TO ALLOCATION OF LAND

CONSTRUCTION: 1994: 16 CONTRACTS LET, CONSTRUCTION 42% COMPLETE

INCEPTION: 1994: MRTC INVITES TENDERS FOR FIRST PHASE OF PROPERTY DEVELOPMENT

INCEPTION: 1995: LEGISLATIVE COUNCIL AGREES TO EQUITY INJECTION

INCEPTION: 1995: GOVERNMENT/MRTC SIGN DBFO AGREEMENT FOR HKD 35.1BN

CONSTRUCTION: 1995: LAST CIVILS CONTRACT AWARDED (HONG KONG STATION)

DELAY: 1996: SIX WORKERS KILLED IN ACCIDENT ON RAMBLER CHANNEL BRIDGE

DELAY: 1996: WORKERS IMPORTED IN RESPONSE TO LABOUR SHORTAGE

CONTEXT: 1997 (JUL): HONG KONG TRANSFERS TO CHINESE RULE

DELIVERY: 1998 (JUL): AIRPORT AND RAILWAY OPENED

DELIVERY: 2005: ASIAWORLD EXPO STATION OPENS

CHARACTERISTICS

The cost of the project was estimated in 1989 at HKD 8.98bn, less than the combined cost of building the AEL and TCL separately (HKD 5.75bn and HKD 7.96bn respectively). In 1991, the estimated cost had risen to HKD 22.1bn, due to modifications to the scheme and the addition of other ACP components. This figure was expected to increase to HKD 33.5bn (at 1997 prices; USD 4.29bn at 2010 prices)[i] once construction was complete. In 1995 the cost was agreed at HKD 35.1bn. The project was at an advanced stage by this time and was completed within budget; the final cost at 2010 prices was USD 4.37bn.

MRTC managed the design and construction process, letting 18 separate main contracts and entrusting some aspects to the government. The two lines run in parallel but with separate platforms, crossing the harbour via the Western Immersed Tube Tunnel and Rambler Channel via the 1km Rambler Channel Bridge.

TIMELINE ISSUES

Government support for the project was reaffirmed in 1990, when completion was planned to coincide with the new airport's opening in 1997. However, early progress was affected by concerns about the cost of the project, particularly within the Chinese government.

The 1991 memorandum of understanding between British and Chinese governments guaranteed the latter's support for the Airport Core Program before the handover of Hong Kong in 1997. However, negotiations about financing and the allocation of land for property development continued, with the fourth proposed financing package finally agreed in 1994. The uncertainty over funding restricted MRTC's ability to raise capital and to let construction contracts.

FUNDING

In the financial package agreed in 1994, the Government agreed to inject HKD 23.7bn of equity into MTRC and to grant it 62 hectares of adjacent land for property development. MTRC raised HKD 11.4bn in loans from more than 170 financial institutions (to be repaid in 1997).

Although passenger numbers have been below forecasts, MTRC has shared in the profits from associated property developments.

[i] Costs have been converted to USD at 2010 prices, using historic inflation rates and current exchange rates, to allow comparison between projects.

WEST RAIL, KOWLOON, HONG KONG

OVERVIEW

LOCATION: KOWLOON/NEW TERR.
SCOPE: INTER-URBAN
TRANSPORT MODE: RAIL
PRINCIPAL CONSTRUCTION: VIADUCT/TUNNEL
NEW LINK: YES

PRINCIPAL OBJECTIVES

REGIONAL TRANSPORT LINK
ACCESSIBILITY
REGIONAL DEVELOPMENT

PRINCIPAL STAKEHOLDERS

CLIENT:
KOWLOON-CANTON RAIL COMPANY
FUNDER: HONG KONG GOVERNMENT
PROJECT MANAGEMENT:
KCRC/PACIFIC BECHTEL

PLANNING AND IMPLEMENTATION

PLANNING START DATE: 05/1989
CONSTRUCTION START DATE: 10/1998
OPERATION START DATE: 12/2003
MONTHS IN PLANNING: 113
MONTHS IN CONSTRUCTION: 62
PROJECT COMPLETED: ON SCHEDULE

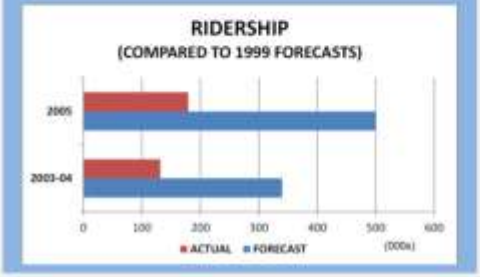
COST (IN 2010 USD)

PREDICTED COST: 7.97BN
ACTUAL COST: 5.85BN
PROJECT COMPLETED:
27% UNDER BUDGET
FUNDING: 100% PUBLIC

INFRASTRUCTURE QUANTITIES (KM)

COST PER KM (2010 USD): 0.19BN

PATRONAGE



INTRODUCTION

West Rail is a passenger railway line, 30.5km in length, linking Kowloon to the new towns of Hong Kong's Northwest New Territories. It opened in December 2003.

West Rail forms Phase 1 of the Western Corridor scheme: Phase 2, consisting of a freight line and a cross-border line, is yet to be built.

Of nine stations on the line, two are interchanges with the Hong Kong metro and four with light rail services in the New Territories. Nine sites have been identified for associated developments, with completion of the first expected in 2013. These represent a total floor area of 1.5m square metres including 18,000 housing units.

BACKGROUND

The main objective of the project was to cater for projected population growth and travel demand, improving transport links to the New Territories and facilitating further development in the region in the longer term.

Based on an initial concept proposed in the 1989 Comprehensive Transport Study, the project was recommended in Hong Kong's first Railway Development Strategy of 1994. It was promoted by the government-owned operator, Kowloon-Canton Rail Company (KCRC). The Legislative Council played a key role in assessing the project on behalf of the government. A series of ordinances passed by the government gave KCRC powers of land acquisition and the power to construct and operate new railways, and enabled the government to inject equity funding into KCRC.

ERM conducted an environmental impact assessment, and the report was endorsed by the Advisory Council on the Environment in 1998. Mitigation measures included noise barriers and replacement of wetland habitat. Local community interests were represented by district councils, although these had limited power. A community liaison office was opened in 1999, and community outreach programmes were introduced shortly before opening in 2003.

CHARACTERISTICS

Earlier proposals including Phases 1 and 2 were the subject of escalating cost estimates. The 1998 project agreement for Phase 1

TIMELINE

CONCEPTION: 1989: INITIAL CONCEPT IN COMPREHENSIVE TRANSPORT STUDY

CONCEPTION: 1994: WESTERN CORRIDOR RECOMMENDED IN RAILWAY DEVELOPMENT STUDY

INCEPTION: 1995: KCRC SUBMITS PROPOSAL TO GOVERNMENT

CONTROVERSY: 1996: GOVERNMENT INVESTIGATES KCRC'S PROCUREMENT PRACTICE. CONTRACTS RE-TENDERED

DELAY: 1996: GOVERNMENT ANNOUNCES FREEZE ON PHASE TWO

INCEPTION: 1997: ORDINANCE PASSED, GIVING KCRC AND GOVERNMENT LAND ACQUISITION POWERS

CONTEXT: 1997: SOVEREIGNTY TRANSFERS TO CHINA. GOVERNMENT APPROVAL OF PROJECT EXPECTED

INCEPTION: 1998: AGREEMENT BETWEEN KCRC AND GOVERNMENT. ORDINANCES PASSED, EMPOWERING KCRC TO CONSTRUCT AND OPERATE NEW RAILWAYS, AND GOVERNMENT TO INJECT EQUITY OF HKD 29BN

INCEPTION: 1998: ENVIRONMENTAL IMPACT ASSESSMENT REPORT ENDORSED BY ADVISORY COUNCIL

INCEPTION: 1998: DETAILED DESIGN CONTRACTS AWARDED

CONSTRUCTION: 1998: FIRST CONSTRUCTION CONTRACT AWARDED – TAI LAM TUNNEL. CONSTRUCTION STARTS

CONSTRUCTION: 1999: CONTRACTS AWARDED FOR TSUEN WAN RECLAMATION, TRAINS AND SIGNALING, CIVIL WORKS

FUNDING: 1999: SECOND GOVERNMENT EQUITY INJECTION. KCRC LAUNCHES NOTES ISSUANCE PROGRAMME

CONSTRUCTION: 2000: CONTRACT AWARDED FOR VENTILATION SYSTEM

CONTROVERSY: 2002: INDEPENDENT INVESTIGATION INTO CONTRACT OVERRUNS

DELIVERY: 2003: CONSTRUCTION COMPLETE. OPERATION BEGINS

estimated the cost at HKD 64bn (USD 7.97bn in 2010 prices[1]), although both capital and financing costs were substantially reduced in later estimates (the latter from 8% of total costs in 1998 to 1% in 2001). The final project cost, at HKD 40.4bn (USD 5.85bn), was substantially lower again.

Somewhat controversially, KCRC employed large numbers of consultants, mainly from Pacific Bechtel, to supplement its own project management staff. Many other consultancies were involved in line alignment and detailed design, including Parsons Brinckerhoff, Atkins China, Maunsell, Ove Arup and Halcrow. Construction contracts went to Amec, Balfour Beatty and 13 other contractors. Hong Kong Shanghai Banking Corporation provided financial advice.

In 1996 concerns arose over KCRC's practice of awarding contracts without an open tender process. After a government report recommending some changes to procurement processes, and reflecting the progression from technical studies to detailed design, contracts were re-tendered. KCRC's management of the contract with Siemens, the telecommunications contractor, also caused public concern and was investigated by KPMG and Ernst & Young.

The government carried out related works including provision of feeder roads and public transport interchanges, and reclamation.

TIMELINE ISSUES

Despite delays in land acquisition and the telecommunications contract, construction was completed several months before the forecast date of September 2003 and operation began as scheduled in December.

FUNDING

The government injected HKD 29bn of equity into KCRC, in return for new shares. KCRC's two notes issuance programmes raised HKD 11.9bn, and its internal funds from property development and interest income provided the balance.

Shortly before the service opened, KCRC responded to the economic downturn of the time by announcing discounts on fares. No data on actual or forecast revenue are available, although actual ridership numbers have been significantly below forecasts.

KCRC merged with the Mass Transit Railway Corporation Ltd in 2007.

[1] Costs have been converted to USD at 2010 prices, using historic inflation rates and current exchange rates, to allow comparison between projects.

9.2 Hong Kong: The 4 Tests Reports

For each of the projects, the Country Partner prepared the '4 Tests Report' which – as described in Section 1.3 above – examined project achievements according to: (i) objectives (both original and emergent); (ii) sustainability; (iiii) treatment of risk, uncertainty and complexity; (iv) a synthesis of the three tests, focusing on responses to the original research questions and hypotheses, the project winners and losers, and provisional lessons.

The full 4 Tests reports can be accessed via the following hyperlinks:

Western Harbour Crossing
CD ROM: OMEGA Partner 4 Tests\HK 4 Tests.docx

Airport Rail Links
CD ROM: OMEGA Partner 4 Tests\HK 4 Tests.docx

KCRC West Rail Link
CD ROM: OMEGA Partner 4 Tests\HK 4 Tests.docx

The Partner's overall synthesis of the project findings is now presented in the following pages.

9.3 Hong Kong: Synthesis of country findings

9.3.1 Context-specific and possible generic responses to the overall research questions and overall research hypotheses (ORQ's and ORH's)

9.3.1.1 ORQ #1: What constitutes a 'successful' MUTP in the 21st Century?

Context-specific responses - characteristics that constitute or contribute to success

Some of the key context-specific characteristics that contribute to project 'success' include:

- projects that 'lead the way' and represent the first of their kind (a 'showcase' project);
- projects that function as 'agents of change' through their contribution to regeneration and/or territorial restructuring (e.g. building new towns), and allow all possible opportunities to be captured (as opposed to single function projects that are not well-integrated);
- those that integrate remote communities into the urban network, reducing the psychological distance of residents in marginalised communities;
- those that provide an alternative, environmentally friendly mode of transport;
- those that fulfil their function as public infrastructure despite institutional arrangements surrounding their ownership, fare/fee structure and operational control;
- those that allow all possible opportunities to be captured, rather than single-function, optimized projects within urban areas with no thought about integration.

The Airport Railway, for example, fulfilled many of these context-specific criteria, being the first dedicated, integrated and purpose-designed direct airport-downtown railway connection with in-town check-in facilities. It created a generic model which is now being copied worldwide.

Conventional measures of defining project success against functional objectives remain important, and for transport projects this represents primarily the movement of people and goods, conveniently and efficiently, and saving time for the public. Further considerations include that they should do so with minimized social and environmental impacts and are acceptable to the community;

Possible generic responses - characteristics that constitute or contribute to success

For generic characteristics of project 'success', traditional criteria remain critical – for example, relating to functional objectives, budgets, delivery, patronage, financial viability and value for money, etc.. Successful MUTPs are seen to be economically sustainable, meaning that they should at least be self-financing and not require long-term subsidies by public funding; should have significant beneficial impacts on the urban and regional economy; and should have flexible institutional and regulatory arrangements that allow options for owners, stakeholders and Governments in the event of economic, political or social change.

However, wider criteria also have to be considered, including:

- capturing the needs of the community by providing an efficient, affordable and reliable means of transport;
- providing a focal point for urban development, facilitating urban regeneration and creating economic opportunities;
- satisfying the strategic needs of a city through integrating urban planning and development horizontally and vertically into its regional context;
- owned by the government who can carry out overarching policies with leadership and political will;
- an inclusive planning process that allows different stakeholders to weigh the pros and cons of the various options;
- compatibility with broader climate change policies.

To a large extent, these 'generic' success criteria overlap with 'context-specific' factors.

In summary, projects can only be considered to be 'successful' when measured against multiple criteria, including economic impacts, social impacts, impacts on the environment, and many more. Further, part of the project conception and the political process surrounding it may be about deciding on the weights allocated to these various criteria.

ORQ #2: How well has risk, uncertainty and complexity (RUC) been treated in the planning, appraisal and evaluation of such projects?

Context-specific and generic responses

Risk, uncertainty and complexity in the three Hong Kong case studies occurred in many different ways throughout the different stages of the project process. Both context-specific and generic RUC factors arising in the three projects are summarised in the following table:

Table 9.1: Types of context-specific and generic risk identified in the three Hong Kong case studies

Types of RUC	Context-Specific Risks	Generic Risks
Planning risks	The need for overarching strategies to guide MUTPs (for example, the Port and Airport Development Strategy for the Airport Railway and West Harbour Crossing, and Railway Development Strategy for West Rail). However, it is difficult to judge whether the Hong Kong case study projects represented the prevailing social values at that time and whether they are capable of integrating with the urban fabric and addressing climate change and environmental issues according to current standards and norms.	MUTPs may not be part of a macro-strategic plan that represents social values or serves to integrate the urban fabric and address climate change and environmental sustainability issues
Demand risks	The projects clearly overestimated ridership and capacity.	Demand risk and over-optimistic or manipulated assumptions in appraisal exercises.
Political risks	High politics between two countries (China and Britain); politicisation of contract management issues in the case of West Rail (Phase I).	Political will.
Economic risks	West Rail (Phase I) failed to adopt the appropriate project sizing (phased development led to wasted resources, an unconnected railway network and low patronage levels).	Appropriate project 'sizing' (scale, scope and impacts) is of crucial importance. However, there are great uncertainties about the future physical environment that directly affect longer-run economic forecasts.
Uncertainty	The risk that MUTPs with lives of 50-100 years will be required to function in completely different social / economic / environmental / climate circumstances and fulfil different functions.	
External events	Property developments along West Rail and Airport Railway were delayed because of the Asian Financial Crisis and the consequent property slump in Hong Kong.	External events: currency fluctuations, availability of labour, materials, etc.;
Financial risks	Dependence upon the property market for funding support (in the case of Airport Railway) and patronage. Risks associated with investing large amounts of capital in MUTPs for reasons of political or economic expediency, and thus tying up irreversibility scarce resources in underperforming assets or sites with possibly better alternative uses.	Sunk investment: comparative advantage of capital deployment needs to be considered carefully; Modes of funding may create further risks.

	The financial risk of decisions to proceed with MUTPs as network components is greater when such networks are complex and approaching full maturity (marginal returns are high with initial investments and reduce with additional network development). risks of irreparably damaging frail ecosystems.	
Project management risks	Use of proven technologies and proven operators (helped to minimise project management risks).	Clear project objectives, experienced designers and managers, proven technologies, and clear management lines of authority; Large projects with multiple interfaces require a co-ordinating body such as NAPCO.
Project design and contract management risks	The need to appoint the lowest bidders may lead to defaulting contractors and project disruptions; The ability, in the case of Airport Railway, to retain appointed contractors while the project was on hold; KCRC, who delivered West Rail, managed to set up its own project management team to cut costs; The use of a funnelling process to procure the latest signalling system which allowed a 25% reduction of station size and costs; West Rail Management Team were appointed to manage the contract interface thus saving costs and minimising risks; Bi-weekly Senior Management Group meetings to detect project risks via a 'green, red and amber' alarm system; The setting-up of a Change Control Committee to expedite change approvals.	Project design: project management expertise is crucial; Contract management: risks include cost escalation: better management of contracts; proper bidding strategies; well specified contracts with clear instructions, reputable construction companies.
Unintended consequences	The risk of unintended consequences: MUTPs may generate unwanted impacts, or may become obsolete as regional economic development patterns change along with the location of critical economic activity.	Smaller-scale, more flexible MUTPs, with flexible institutional arrangements that allow options to reconfigure systems or networks to respond to changing circumstances.

ORQ #3: How important is context in making judgements regarding Overall Research Questions 1 and 2?

Context-specific responses

Regarding the **political context**, the Airport Railway and West Harbour Crossing were planned as part of the 10 Airport Core Projects to boost public confidence after the 1989 Tiananmen incident in China and to create employment and generate economic activity. The whole 1997 question about the transition of Hong Kong as a British colony to a Special Administrative Region under China created a lot of uncertainties when MUTPs were planned, appraised and built. The political context also led to project delay for one year as China and Britain debated on the financing mode of the Airport Railway. In addition, the container trucks, logistics and port business interests worked through the Chinese authorities to block the development of the freight railway line portion of the Western Corridor Railway project.

More recently, public acceptance has become to be seen as a key factor in the political context of Hong Kong's MUTP planning and delivery.

Regarding **socio-economic matters**, Hong Kong comprises a population that is willing to tolerate short-term problems in order to achieve long-term benefits. Hong Kong as a pragmatic city has always emphasised economic and financial matters above all else. In addition, (and partly as a result), Hong Kong has been blessed with availability of public capital for delivering MUTPs. Political stability also allowed implementation agents to borrow in the market with confidence.

However, Hong Kong's role as a 'gateway' to China suffered a blow in the 1990s as no one had anticipated the rapid economic growth of China. This impacted on West Rail (Phase I) as the border link was deferred. Today, how MUTPs are supposed to fit strategically with regional economic context is seen as key to decision-making;

Regarding **stakeholder issues**, the Airport Railway and West Harbour Crossing were built on reclaimed land and hence were free of stakeholder problems. However, green groups were instrumental in raising environmental sustainability concerns in the development of West Rail (Phase I). The context of urban district land use planning and its integration with MUTP decisions is also seen as an increasingly important factor, as local communities become better organized and desire to influence decisions about their physical environment.

Regarding **Government policy and institutions,** three key contextual factors were:

- the lack of a coordinated transport policy to favour environmentally-friendly modes of transport;
- planning institutional arrangements surrounding MUTPs had to give consideration to the scenario where a BOT is not financially sustainable;
- compartmentalisation of the government means that integrated thinking is still a remote dream.

Possible generic responses - key contextual influences and/or requirements

Regarding generic responses to the Overall Research Questions 1 and 2, the responses emerging from the three Hong Kong case studies indicated the following factors were crucial for overall project 'success' (ORQ1) and the handling of risk, uncertainty and complexity (ORQ2):

- a Government with political resolve and commitment;

- a large amount of public capital;
- good connections to the global economy;
- good connections to the areas served by a MUTP;
- availability of project management experts in the required areas;
- a pragmatic culture that is concerned about planning, appraisal and delivery;
- sincere, thorough and meaningful engagement of representative stakeholders in conceiving MUTPs;
- a platform for the government and citizens to discuss various issues surrounding MUTPs to foster understanding and build consensus
- greater selectivity about the choice of MUTPs to be procured with Public-Private-Partnership arrangements;
- the need to retain public control of key strategic MUTPs.

Conversely, negative generic factors included:
- a rapidly developing political context, including the rise of a civil society, potentially introducing more uncertainty for the conception and delivery of MUTPs;
- inter-sectoral competition potentially blocking the implementation of a MUTP project.

ORH #1: Traditional criteria relating to cost overruns, completion dates, generation of travel time savings for users and rates of returns to investors are inadequate measures of success in the 21st Century as sustainable development concerns become increasingly critical both globally and locally.

Context-specific responses:

Sustainable development concerns were simply not considered at the time of project appraisal, although environmental impact assessments were undertaken to mitigate negative environmental impacts. In fact, all three projects in Hong Kong were appraised by conventional financial criteria as stand-alone projects, and not for their potential impacts on urban development. With Airport Rail especially, the appraisal was based on the economic needs of Hong Kong as a logistics, trade and financial centre, and this approach was generally supported by the community despite the politics surrounding the other Airport Core projects.

Regarding conventional economic 'success', the revenue projections of all three projects turned out to be wrong and the pricing policy (except WHC which is a BOT project) was undermined as a consequence of road transport competition. However, although all three projects appear as 'failures', when measured by traditional financial criteria, they are nonetheless all admirable infrastructure built to a very high standard.

If we use 'little or no complaints' as an indicator of success for MUTPs in Hong Kong, the Airport Railway is actually a resounding success. This is less so for West Rail (Phase I), and West Harbour Crossing is a dismal failure due to its escalating fares over the years.

With the political support of Tuen Mun residents, West Rail (Phase I) succeeded in overcoming the problems of building the railway in the nullah thanks to technical solutions.

Regarding stakeholder participation, Hong Kong still lacks a process for different stakeholders to engage in meaningful debate of sustainability issues.
In conclusion, Hong Kong excels in delivering complex, capital expensive projects successfully within conventional time, cost, and quality criteria, but when more abstract criteria are considered, success becomes more problematic.

Possible generic responses

At the project conception stage, MUTPs cannot be considered without a concerted effort to appraise alternatives approaches. However, the three case studies demonstrated that conventional transport economic appraisal methods are relevant but too narrow and too easily manipulated. There was broad recognition of the importance and necessity of including social and environmental criteria in appraisal and evaluation. However, there is currently an inability in appraisal techniques to incorporate meaningful economic, social and environmental impacts (basic and secondary, direct or indirect).

While traditional evaluation criteria such as meeting project deadlines, quality concerns and budget mechanisms are absolutely important, and financial and economic criteria are important for determining effective resources application, using these measures in isolation could present only a partial, simplistic and often distorted view of reality. The case studies underlined that it is critical to distinguish between social and/or economic benefits assessment and financial return on investment. The quality of mitigation measures is also important to gauge the success of MUTPs.

MUTP assessment criteria require a vision of what future is being sought, and the role the project is expected to fulfill in that vision. If the vision relates to the promotion of economic development, then such criteria have to form part of both the appraisal and evaluation criteria. Economic criteria are important also for intergenerational distribution reasons – as transferring negative impacts and costs to future generations in an irresponsible way should be avoided – it is important to transfer future positive economic benefits when possible. These matters should form part of the appraisal and evaluation criteria.

An engaging process for stakeholders' participation and transparency of information to equip informed deliberation are important criteria for success. Community support is critical, and without public participation and political debate, the techniques used to appraise economically justified projects may be just measuring 'only a small part of the story'.

Overall, the benefits of MUTP appraisal was seen mostly to reside in two factors: firstly to eliminate wasteful practices in the operation of the projects; secondly, and probably more importantly, it is an important depositary of accumulated experience and learning about MUTPs for future reference.

ORH #2: The new emerging international and local agenda related to vision(s) of sustainable development is multi-dimensional and goes beyond notions of environmental sustainability, as critical as this may be, in that it also concerns interrelated concepts of economic sustainability, social sustainability and institutional sustainability.

Context-specific responses

Sustainability considerations did not play a major part in the planning and delivery processes of the three Hong Kong projects - efforts simply focused on environmental issues governed by the EIA Ordinance and/or concerns about spacing between buildings, acoustic and noise factors. High density developments around mass transit stations along Airport Railway and West Rail (Phase I) are somewhat sustainable, but climate change and carbon footprints concerns were not addressed.

Regarding post-construction operation, the capacities of Airport Rail and West Rail have not been utilised due to the lack of coordinated transport policy by the Government to minimise the use of buses or minibuses.

From respondents, there seemed to be greater agreement over what might not be sustainable as opposed to what might be sustainable. It was also considered possible to retrofit virtually any technological/physical component of MUTPs, to improve efficiency, performance or other objectives. Interviewees suggested that it is possible to retrofit *anything*, if society is willing to pay the price.

Possible generic responses

Projects should not proceed unless there is a clear idea about long-term sustainability implications. However, there is a clear problem in *operationalising* sustainable development, and an urgent need to generate operational criteria to guide sustainability thinking and planning. The sooner these are developed, the sooner society can start to learn and accumulate knowledge about sustainability and sustainable development in practice. Specifically, strategic environmental assessment was seen as more useful than EIA.

Similarly, there is a great need for developing institutional retrofitting strategies, as these are most often easier to effect that changing large, capital –intensive, irreversible MUTPs.

Interviewees expressed concerns about revitalising the economic environment, boosting employment and bringing about cultural change; however, 'people-centred' development should be the norm – with concern more focused on people rather than the economy.

There should also be an effort to consider what might be appropriate across generations, because it is clear that sustainable development thinking continues to evolve. There is always the risk of current decisions not being able to take into account future decision-making contexts that may be different.

There should also be efforts to develop methodologies that are acceptable to different stakeholders to assess intangible factors and sustainability criteria. This could be seen in the light of traditional financial assessment, which is accepted as a methodology by stakeholders.

Overall, the key is to have flexible institutional governance and regulatory systems to commence with, and institutionalising a vigorous and comprehensive process of stakeholder management and engagement, with fully-informed participants, is seen as essential.

ORH #3: The level of competence in decision-making and planning in today's fast changing world is best assessed by the adequacy of the treatment of risk, uncertainty and complexity and sensitivity to context – all of which are important demands on Strategic Planning.

Context specific responses

With regards to **macro-strategic planning**, no platform or participatory process to produce strategic plans exists in Hong Kong, and strategic long-term socio-economic plans do not exist. That said, Airport Railway was part of a massive economic stimulus project to build confidence in Hong Kong in very difficult and uncertain times. The project enhanced Hong Kong's international competitiveness and position as a global transport hub. The symbolic deadline of 1997 for Airport Railway also affected decision making and the work schedule.

While the Airport Railway has played an important role in restructuring Hong Kong's CBD and revitalising a declining industrial area, the role played by West Rail (Phase I) in revitalising communities, enhancing the environment and fostering more cohesive communities is less certain. For West Rail (Phase I), it was not clear how the Railway

Development Strategy related to land use and environmental planning or the city's long-term socio-economic development strategies. Consequently, the phasing of West Rail led to 'truncated' development that did not integrate with the urban fabric and led to low patronage and poor IRR;

With WHC, no amount of macro-planning could have generated the scenario represented by the distress in Hong Kong following the Asian Financial Crisis: the property market collapsed, Government finances collapsed. Sometimes there is a perfect economic and social storm, and it happened in 1997-2003. WHTCL survived, but its future was irreparably undermined.

With regards to **micro-strategic planning**:

- institutionalising a standard set of procedures in planning and delivering MUTPs is important; and likewise for
- Government to engage independent consultants to review the delivering agent's projected figures, assumptions and financial viability, etc..

Possible generic responses

International competitiveness (for the country/region) is an important driving factor in decision-making, and planning and implementation of MUTPs may be undertaken to realise a national or regional development vision which may be affected by RUC outside the control of the project team. Therefore it is important to have transparent and participatory mechanisms to produce long-term strategic socio-economic development plans so that strategic implications of MUTP developments can be identified.

Key 'agent of change' functions for MUTPs include: (i) to integrate transport networks; (ii) to close missing links; and (iii) to serve new development areas. MUTPs may also be used (iv) to counter cyclical economic impacts.

MUTP planning requires visionary, integrated and multidisciplinary planning. It needs to be examined against positive and negative scenarios, and it needs the absolute worst case scenarios to be considered in order to obtain insights into institutional mechanisms that have to be put in place to deal with distress.

9.3.2 Hong Kong: Potential context-specific and generic lessons

9.3.2.1 Context-specific lessons

Table 9.2: Sustainable development visions and challenges (by project type)

Criteria	Lesson	
	Airport Rail Link and West Rail (the railway projects)	**Cross Harbour Tunnel**
1. Governance and process issues: (e.g. sound, ethical principles of public administration, such as legality, transparency, accountability, economy of means, fairness, stakeholder engagement and cooperation, etc).	Built in the late 1990's and early 2000's, both the Airport Railway and West Rail (Phase I) were products of a strong executive-led Government in Hong Kong and hence the ethical principles of public administration were not emphasised. Should a MUTP be built in a similar context, it would be useful to observe the following: o Legality: ensure legislation enables the right to object and appeal o Transparency: information should be available such that stakeholders can participate in informed debates/negotiations o A participatory platform: it would be useful if a platform or an advisory group is formed to facilitate discussions and generation of consensus. This body can also serve as a bridge between the government and different stakeholders. This will contribute to accountability, fairness of outcome, inclusiveness, capacity building and nurturing different stakeholders through engagement and cooperation	"Privatization at any cost" has by now become a severely tainted concept, and demonstrated in this by WHC. At best tunnels that are key strategic facilities in road networks should be retained in public control, without undermining user pays principles. Poorly conceived concession agreements have the potential to throw compact and very busy networks into disarray, but more importantly, limit affordable access. Concession agreements should provide for flexible governance arrangements when assumptions governing planning prove incorrect, and should possibly including "living wills" in the event that they create costs from externalities that are socialized, or not shared equitably. In planning WHC, there was no inclusiveness (stakeholder/ community engagement) in the process, no conception of fairness of outcome, nor any other criteria considered to be important in the more modern conception of sustainable governance and processes towards creating sustainable communities. It was an entirely top-down decision, although the BOT concession was processed through a (nondemocratic) semi-representative legislature.
2. Appropriate institutions: The task of ensuring good governance of MUTPs should rest in a national, regional or metropolitan agency, at 'arm's length' from the political level, created for the purpose. The agency should be	Airport Railway and West Rail (Phase I) were built by publicly-owned private corporations (the two had merged recently and partly privatised) required by law to operate according to prudent commercial principles. They were not directly accountable to the legislature and had no mandate to develop multiple objectives of MUTPs. It is not desirable to have profitability as the primary objective in developing MUTPs. Government	Open and transparent public engagement in setting objectives is essential to set the stage for further good governance. Project objectives should be set collectively by stakeholders and systems should be devised for monitoring, assessing accountability and responsibility if things go wrong. This sustainability challenge effectively disqualifies most private sector interests from participating in MUTPs, without compromising

accountable to the legislature under its own legislation. Should strive for vertical (local-regional) and horizontal (cross-sectoral) integration to achieve multiple objectives of MUTPs.	should be involved: o to provide partial funding o to play a leadership role in setting the objectives of a MUTP o to play a coordinating role in orchestrating different departments or agencies to achieve the multiple objectives of a MUTP Even if the delivering agency is not accountable to the legislature, regular briefing sessions can be organised to update the politicians and hence the community the progress of the project.	private sector objectives. WHCTL is a private sector special purpose project company, created to own and operate WHC as a BOT for 30 years. It is governed by the West Harbour Tunnel Ordinance, which enshrines the concession agreement in law. This is its only regulatory arrangement (apart from corporation legislation and other normal requirements such as OHS).
3. There should be economic gain (e.g. contribution to GDP, employment, investment and diversity)	While the Airport Railway as part of the Airport Core Projects has played a critical role in stabilizing political uncertainty, generating economic activities, revitalising industrial districts and restructure the CBD, West Rail (Phase I) has little economic gain. The 'failure' of West Rail has to do with the delayed implementation of property developments along its route, reducing patronage and potential employment opportunities. It is very important to consider MUTPs as potential economic catalyst in urban development. It is important to integrate railway development with human settlements to maximize patronage. Shoppers and employees should also be encouraged to use railway to reach their destinations.	MUTPs have an important contributory role to play in this matter, but the principal economic gain aimed for should be permanent efficiency gains and social benefits as a result of changed structured, not initial construction employment only. However, it should not be a primary function. As part of the ACP announced in 1989, WHC helped stabilize political uncertainty, and helped generate economic activity and employment in the following years. Despite its relatively poor performance and comparatively high tolls, WHC is an extremely efficient facility, particularly in its functions of providing links to the airport and container port. It is certain to generate significant economic gain through these functions, but could be expected to generate substantial additional efficiency gains if more carefully planned to integrate with surrounding urban areas.
4. An MUTP should respect and enhance the value of urbanity (e.g. land use plans, enhance aesthetic and symbolic qualities of landscape and cultural heritage, no segregation, no increase in aggregated travel, 'surface efficient' and promoting transit-	Both railways have further promoted Hong Kong's success in transit-oriented development Integration with land use plans should be done more carefully so that natural and built heritage can become part and partial of the alignment and network of the railway. The railway lines should be designed to improve the accessibility of these assets to the community. In terms of station design, more thought should be given to enhancing aesthetic and symbolic qualities of landscape and cultural heritage	MUTPs have to de designed to integrate with their urban environments, otherwise great urban development opportunities may be lost. WHC has not been planned with any consideration of the value of urbanity, or any other criteria associated therewith. It was planned entirely (and almost exclusively) as an efficient transport link in a strategic road network. It has also not facilitated transit-oriented development.

oriented development).	Part of West Rail (Phase I) was built on a viaduct which has helped avoid segregating places and in fact, the feature has added aesthetic interest to the rural landscape.	
5. A MUTP should positively assist the achievement of global and local environmental objectives and targets (e.g. safe global per capita GHG emission level; energy efficiency; renewable energy sources; minimise use of resources; use of green products or materials; minimise destruction of fauna and flora, esp. endangered species)	Besides the statutory requirements stipulated in the EIA Ordinance, the two railways studied have not strived to achieve the environmental objectives and targets specified As a naturally environmentally friendly mode of transport, there is certainly scope to improve emission standards, energy efficiency and resource uses. As argued by one of the interviewees with an engineering background, efficient design has always been a key concern for engineers and such an approach will certainly cut costs. Another lesson is that while it is inevitable to bring about some destruction to the environment and also the local community, the goals should always be to recreate something that is even better—a better wetland or a more diverse ecology or a community with their network conserved and enhanced.	MUTPs have to de designed to integrate with their urban environments, otherwise great urban development opportunities may be lost. WHC has not been planned with any consideration of the value of urbanity, or any other criteria associated therewith. It was planned entirely (and almost exclusively) as an efficient transport link in a strategic road network. It has also not facilitated transit-oriented development.
6. Public health: A MUTP project should not, either directly in construction and operation, or indirectly through its system-wide effects, adversely affect public health (minimal nuisances, reduce mortality and morbidity risk to human life from transport).	As a result of the Government's inaction in rationalising the transport system, people continue to patronise cheaper but more polluting buses and hence the total effectiveness of the transport system has not been enhanced with the commencement of the railways An obvious lesson is that the government should play a key role in developing a transport policy that gives priority to the use of the railway mode of transport and to minimize the use of more polluting transportation means	System-wide effects are the province of concept planning and impact appraisal, and should be conducted also with respect to health and these matters at initial concept development, prior to any decisions are taken that may eliminate preferable options. Impact was considered as part of WHC development during planning, development and execution, this was restricted to the statutory Environmental Impact Assessment process. No consideration was given to proactive measures such as the use of renewable energy and the reduction of emission of GHGs. Energy efficiency, green materials, and more current conceptions of sustainability were simply not considered at the time of planning and development of WHC.
7. Social opportunities:	As an infrastructure to bring 'the airport to the CBD', the Airport Rail cannot be described as affordable.	Social and spatial impacts including distribution of social opportunities are the province of concept planning and

A MUTP project should enhance the fair distribution of social opportunities in a city or region (no discrimination, affordable to all; bringing different communities together; not adding vulnerability to sections of the public in terms of fuel scarcity, economic insecurity or climate change).	However, urban development along its alignment has succeeded in bringing different communities together. The introduction of concessionary prices is one way to make the railway line more affordable. The building of a parallel Tung Chung Line to a certain extent ameliorates the affordability issue. For West Rail, it has succeeded in linking marginalised communities with the city core through an efficient mode of transport at an affordable price. Perhaps there should be a differentiation between railway lines that serve only domestic passengers and one that serves a variety of customers.	impact appraisal, and should be conducted at initial concept development, prior to any decisions are taken that may eliminate preferable options. It may in fact be that MUTPs will affect negatively these criteria. WHC's objectives were to increase overall accessibility between Kowloon and Hong Kong Island. If it had achieved its overall objectives, it may have observed this criterion. However, it is certainly not accessible to all price-wise, it does not aim to bring communities together, while it does not endanger any communities in times of scarcity or distress, as itemized. It is also arguable if it functions to enhance the distribution of social opportunities in Hong Kong.

Table 9.3: Risk, uncertainty and complexity (context-specific lessons)

Criteria	**Lesson**	
	Airport Rail Link and West Rail (the railway projects)	**Cross Harbour Tunnel**
1. Planning	The role of the MUTP in city development within the wider regional context needs to be carefully considered and articulated Planning objectives should represent a shared vision of the community The planning process should enable full engagement/ participation Polices should be developed to favour modes of transport that are more environmentally friendly	Poorly conceived concession agreements have the potential to throw compact and very busy networks into disarray, but more importantly, limit affordable access. Concession agreements should provide for flexible governance arrangements when assumptions governing planning prove incorrect, and should possibly including "living wills" in the event that they create costs from externalities that are socialized, or not shared equitably. MUTPs planning as a matter of principle should never be single-objective, "closed system" facilities otherwise urban development potential is lost.
2. Decision making	Bias towards traditional appraisal methods can be moderated by sustainability impact assessment through a vigorous and critical scrutiny of project assumptions Social impact assessment is particularly useful to identify socio-economic costs of various alignments Strong community support is instrumental in the smooth	Traditional appraisal methodology is flawed in application, typically because it is executed poorly. Appraisal teams should be (but typically never are) multi-disciplinary, scenarios are infrequently realistically generated or developed, options are infrequently seriously generated, there is typical bias in execution towards a preferred solution, assumptions are never stress-tested, and more. There is a need for serious rethinking of appraisal methodology and

	implementation of projects	application. Meaningful community engagement is essential in conceiving MUTPs.
3. Implementation	Projects with clear functional objectives and executed with experienced and highly reputable and trustworthy project managers and contractors are mostly likely to achieve conventional time, cost and quality objectives Creation of purpose-specific MUTP coordination/management organisations are likely to facilitate efficient project delivery Community support is very important for MUTP implementation Funding support from the government is also important Urban density has contributed to the success of Airport Railway and to a certain extent West Rail (Phase I). These railway lines in turn enhance urban compactness and sustainability. If government is more committed to a transport policy that rationalise various modes of transport, the whole system can capitalise more on the railways and become more sustainable.	Private participation at any cost, or at least as a priority, is discredited dogma. Implementing WHC with a BOT turned out to be problematic, and even important Hong Kong decision-makers have privately considered this to be the case. Apart from financial pressures, choosing BOT to deliver WHC was probably as a consequence of biased appraisals, but possibly more importantly, an inadequate consideration of the implications on institutional arrangements governing WHC in the event that its financial model was not sustainable. Generally, institutional arrangements surrounding the development of MUTPs deserve far closer attention.
4. Stakeholders:		
Government	Provides strategic guidance and subsidies but may or may not receive applause from the community	Important political and social changes also seemed afoot in Hong Kong society since 1997, and it is not inconceivable that WHC played a role in bringing this about. The lack of political will on the part of the Government to address the huge discrepancy in toll charges between the CHT and WHC is a symptom of the momentum gained by social movements in Hong Kong.
Delivery agent	The two once publicly-owned private corporations operating according to prudent commercial principles could be identified as losers. Although they have developed a functionally efficient and exemplary transport project, they are not financially self-sustaining. The lack of policy support for this sustainable mode of transport from the government is also frustrating to the operators. The government should show more political resolve to encourage the use of environmentally friendly	The design and construct consortium was a major winner with delivery of WHC. It delivered a technically and functionally superior facility in time, on budget and exceeded quality expectations. However, society perhaps obtained a marginal gain on the one hand (somewhat improved traffic and an efficient link to the airport and beyond), lost in another way (externalities for continued congestion); while WHTCL lost financially; and the government lost because it is incapable of addressing the problem without losing face. This could have been avoided with better concept planning, and more importantly, more

	transportation mode	attention to crafting a more flexible concession agreement that recognized the possibility that traffic may have been overestimated as a distinct possibility.
Bus & mini-bus operators	They remain competitive as they provide point to point services at a much more affordable price for the lower-income members of our community	Buses have offered new improved routes using WHC, so in that sense the bus companies have gained, as they have been able to spread the cost of tolls over a large passenger base. In this sense tunnels are able to improve the efficiency of public transport despite other impacts.
Consultants/ contractors/ workers	A lot of employment opportunities, but no evaluation of permanent secondary employment impacts.	Many employment opportunities during construction, but no evaluation of permanent secondary employment impacts.
Politicians (including Legislative Council (LegCo) members and local district councillors)	LegCo often brought West Rail (Phase I) into the limelight through investigation into the various appraisal figures Local district councillors in Tuen Mun were instrumental in changing the alignment of West Rail (Phase I) to suit local needs	WHC has provided politicians with a great opportunity to criticize the Government and make demand that it force WHTCL to revise its tolls downwards based on the social good, knowing well that for contractual and legal reasons this is impossible. It could be said that it has provided legislators with a more cerebral opportunity to point out mistakes and view WHC as a learning exercise, as many legislators that approved WHC are still in LegCo at present.
Environmental groups	Both railways have caused environmental disruptions. The lesson is to pay special attention to the quality of the remedial actions, with a view to enhancing the disturbed environment, beyond basic statutory requirements.	WHC caused no particular reported environmental concerns of note. It must be pointed out, however, that it was constructed in one of the most polluted marine environments in the world. It is likely to have significantly disturbed polluted, possibly toxic, sediments, with effects that were not established.
Affected communities	Provided with an alternative mode of sustainable and reliable transport.	It is difficult to identify any community that has directly benefited from WHC. Island West communities could have benefitted greatly if access roads had been planned with greater attention to integration with urban areas in Sai Ying Pun and Kennedy Town.
Property owners	Depot developments provide property ownership opportunities.	-
Real estate development companies	Green field sites for development associated with the projects represent major development opportunities Partnering with the corporations to provide property units for sale	Real estate developers were potentially winners from the development of WHC, if all had gone according to plan. But the cancellation of Green Island Reclamation, and shelving of Route 7, has meant that there are fewer developments that WHC could have provided access to. Consequently they probably lost together with WHTCL.
Passengers	High quality service in both railway	There is a core of users for WHC that

	lines	has proven to be price-inelastic, probably users with very distinct travelling patterns. These may include wealthy Island West residents and Central business people possibly using personal transport travelling to and from the airport and the New Territories. Airport bus routes also use WHC, with great efficiency. These users are winners, but this hardly suggests access for all.
Mass media	-	WHC has provided the mass-media with populist fodder ever since it opened in 1997. The media never report the contractual realities of the concession agreements, however.

9.3.2.2 Potential generic lessons in the treatment of risk, uncertainty and complexity

With regards to **planning**, the role of the MUTP in city development within the wider regional or even national context should be clarified. The planning objectives should be a shared vision of the community, and the planning process open, transparent and participatory — a learning process for all stakeholders.

The rationales for building the MUTP should be defensible, and there should be integrated policy support to favour modes of transport that are more environmentally friendly.

Successful planning also requires the selection and development of appropriate MUTP governance mechanisms.

In the **decision-making process**, appropriate appraisal criteria are needed to capture positive and negative impacts as well as primary, secondary and tertiary impacts. It may be useful to engage two groups of professionals to verify the appraisal data and figures.

Decision-makers should avoid adopting single target project objectives such as financial viability; assumptions should be scrutinised carefully and vigorously; and positive social, environmental and economic impacts maximised while minimising negative ones.

Careful thought should be given to the social impacts and land resumption implications for various possible alignments, and the appraisal should be conducted by multi-disciplinary teams, and reviewed by independent auditors to identify unrealistic assumptions and scenarios.

In the **implementation phase**, projects with clear functional objectives and executed by experienced and highly reputable and trustworthy project managers and contractors are most likely to achieve conventional time, cost and quality objectives.
The creation of purpose-specific MUTP coordination/ management organisations are likely to facilitate efficient project delivery, and community support is very important for MUTP implementation.

With regards to the various **stakeholders**, the **government's** role should be:

(i) to provide strategic guidance and subsidies;

(ii) to work with different stakeholders in a participatory planning process to develop multiple objectives;
(iii) To orchestrate various government departments and agencies to deliver integrated policies that support the achievement of MUTP objectives.

The **delivery agents** should work in advance with the government to secure policy support for a more sustainable mode of transport (particularly in connection with railway developments).

Politicians (including Legislative Council members and local district councillors) have important but differing roles:

- Legislative councillors provide checks and balances in scrutinising project development (i.e. a 'strategic oversight' role);
- Local district councillors can be instrumental in fine-tuning the alignment of MUTPs and other local improvements (i.e. a 'tactical' role).

Environmental groups should be vigilant to ensure that environmental qualities can be maintained through proper and effective mitigation measures, while the **mass media** plays a potentially crucial role in monitoring project work and disseminating information

9.4 Conclusion: Hong Kong

This section presented a summary and synthesis of the Hong Kong Country Partner's research on the three case studies of the Western Harbour Crossing, Airport Rail Link, and KCRC West Rail Link.

A summary profile of each project (with hyperlinks to the full Project Profiles) described the project's history and main characteristics, features, issues and timelines.

The Country Partner's own synthesis of their research findings in relation to the '4 Tests' was then given, presenting findings from the overall country perspective (i.e. combining the three case studies). Hyperlinks to the more detailed '4 Tests Reports' for each project were also given.

The next Section now presents the Japan Country Partner's findings from three mega-urban transport projects, while Volume 5 contains detailed analyses and comparisons of all 30 mega-urban transport projects, together with the overall findings and lessons of the research.

10. Country findings: Japan

Metropolitan Expressway
Tokyo

Shinkansen
Kyushu

Oedo Metro
Tokyo

10.1 Japan: The project profiles

Project Profiles were prepared by the Country Partners[11] for each of the study projects, to provide a consolidated source of secondary information to support all phases of data collection, analysis and synthesis. The profiles covered such matters as: project cost, duration and quality information; principle and secondary project objectives; key project stakeholders; sources of finance; key events and processes. (See also Volume 1, Section 3.4).

The full Project Profiles can be accessed via the following hyperlinks:

Metropolitan Expressway Tunnel, Tokyo
http://www.omegacentre.bartlett.ucl.ac.uk/studies/cases/pdf/JAPAN_SHINJUKU_PROFILE_120411.pdf

Shinkansen High Speed Rail, Kagoshima-Nakata
http://www.omegacentre.bartlett.ucl.ac.uk/studies/cases/pdf/JAPAN_SHINKANSEN_PROFILE_310511

Oedo Metro, Tokyo
http://www.omegacentre.bartlett.ucl.ac.uk/studies/cases/pdf/JAPAN_OEDO_PROFILE_190111

Summaries of the Project Profiles are presented on the following pages.

[11] In Japan, the Country Partners were the Department of Built Environment, Interdisciplinary Graduate School of Science and Engineering, Tokyo Institute of Technology and School of Regional Development Studies, Toyo University - directed by **Prof. Yasunori Muromachi.**

C2 SHINJUKU ROUTE (YAMATE TUNNEL), NORTH TOKYO, JAPAN

OVERVIEW

LOCATION: NORTH TOKYO, JAPAN
SCOPE: INTRA-URBAN
TRANSPORT MODE: ROAD
PRINCIPAL CONSTRUCTION: TUNNEL
NEW LINK: YES

PRINCIPAL OBJECTIVES

LOCAL TRANSPORT LINK
CONGESTION RELIEF
EMERGENT OBJECTIVE:
LOCAL ECONOMIC DEVELOPMENT

PRINCIPAL STAKEHOLDERS

PLANNING AUTHORITY:
TOKYO METROPOLITAN GOVERNMENT
MAIN CONSTRUCTOR/OPERATOR:
METROPOLITAN EXPRESSWAY PUBLIC CORPORATION (LATER METROPOLITAN EXPRESSWAY CO LTD)
SUPERVISOR:
MINISTRY OF CONSTRUCTION
FUNDING:
METROPOLITAN EXPRESSWAY CO LTD/ JAPAN EXPRESSWAY HOLDINGS & DEBT REPAYMENT AGENCY

PLANNING AND IMPLEMENTATION

PLANNING START DATE: 03/1970
CONSTRUCTION START DATE: 08/1992
OPERATION START DATE: 12/2007
MONTHS IN PLANNING: 269
MONTHS IN CONSTRUCTION: 184
PROJECT COMPLETED:
18 MONTHS BEHIND SCHEDULE

COSTS (IN 2010 USD)

PREDICTED COST: 5.50BN
ACTUAL COST: 5.45BN
PROJECT COMPLETED:
1% UNDER BUDGET
FUNDING: 57% PRIVATE : 43% PUBLIC

INFRASTRUCTURE QUANTITIES

LENGTH (IN TUNNEL): 6.7KM
NUMBER OF JUNCTIONS: 3
COST PER KM (2010 USD): 0.81BN

PATRONAGE & REVENUE

FORECAST TRAFFIC (2005):
49,000-80,000 VPD
ACTUAL TRAFFIC (2008):
34,000 VPD

INTRODUCTION

The C2 Shinjuku Route (known as the Yamate Tunnel), a 6.7km road tunnel from Nishishinjuku Junction to Kumanocho Junction in north Tokyo, opened in December 2007. It is part of the Metropolitan Expressway Network C2 route, the second circular route around the city, which provides connections to inter-urban expressways. The Network is financed by road tolls.

BACKGROUND

The legislative basis for tolled roads in Japan was established in 1952 and the Metropolitan Expressway Public Corporation (MEPC) was established in 1959 to build a tolled road network to relieve congestion in the city.

The main objective of the C2 Shinjuku Route (and of the C2 route as a whole) was to relieve growing congestion on the existing radial expressway, forecast to result from its connection to express inter-urban highways. The need for such a route was recognised soon after the MEPC was established, and it was included in a plan to extend the Network in 1968, and in the national government's development plan in 1970. As regional and local plans are expected to reflect the national plan, the city government has been under pressure to develop the route since then.

Three enabling mechanisms provide the legal authority for the project to proceed: a City Planning Decision by the relevant local authority, giving land acquisition powers and restricting other development in the area; a Basic Plan by the Minister of Construction[i], outlining the project's scope and construction cost; and the Minister's validation of MEPC's construction work plan, which allows construction to begin. The Minister then validates the tolling regime, allowing MEPC to begin collecting tolls. Both validations also require the local authority's consent.

Tokyo Metropolitan Government (TMG) and MEPC were the promoters of the route, but progress was constrained by local concerns about the environmental impacts in the 1970s and 1980s, and opposition to road-building from Tokyo's Governor (1967-79). During the 1980s, TMG advocated the role of the route in promoting the economic development of the subcentres in Ikebukuro, Shinjuku

TIMELINE

- CONTEXT: 1952: ACT ESTABLISHES LEGAL BASIS FOR TOLLED ROADS
- CONCEPTION: 1953: FIRST NATIONAL PLAN FOR EXPRESSWAY NETWORK
- CONCEPTION: 1959: METROPOLITAN EXPRESSWAY PUBLIC CORPORATION FORMED TO BUILD TOLLED ROADS IN TOKYO
- DELAY: 1967-79: TOKYO GOVERNOR ANTI-ROADS, STOPS EXPRESSWAY CONSTRUCTION
- CONCEPTION: 1968: C2 ROUTE INCLUDED IN PLAN TO EXTEND EXPRESSWAY NETWORK
- CONCEPTION: 1970: C2 ROUTE PROMOTED IN NATIONAL DEVELOPMENT PLAN
- CONTEXT: 1979: NEW TOKYO GOVERNOR ELECTED, ROAD BUILDING IS ALLOWED AGAIN
- CONTEXT: 1982: FIRST SECTION OF C2 ROUTE OPENED
- INCEPTION: 1982: C2 ROUTE INCLUDED IN CITY GOVERNMENT LONG-TERM PLAN
- INCEPTION: 1988: LOCAL CONSULTATION ON DETAILED ROUTE PROPOSALS – TUNNEL OPTION CHOSEN
- INCEPTION: 1990: ENVIRONMENTAL IMPACT ASSESSMENT REPORT, CITY PLANNING DECISION & BASIC PLAN
- INCEPTION: 1991: PROJECT VALIDATION BY MINISTRY, LAND ACQUISITION BEGINS
- DELAY: 1991: NEGOTIATIONS WITH LANDOWNERS COMPROMISED BY COLLAPSE OF BUBBLE ECONOMY
- CONSTRUCTION: 1992 (AUG): CEREMONY TO START CONSTRUCTION
- INCEPTION: 1993: CITY PLANNING DECISION (FINAL SECTION)
- INCEPTION: 1994: PROJECT VALIDATION BY MINISTRY (FINAL SECTION)
- CONSTRUCTION: 1999: MEPC ADOPTS SHIELD TUNNELLING METHOD
- CONTEXT: 2005: PRIVATISATION OF MEPC & OTHER HIGHWAY CORPORATIONS
- DELIVERY: 2007 (DEC): ROUTE OPENED TO TRAFFIC

and Shibuya. In 1988, a tunnel solution was adopted in order to resolve environmental concerns.

An Environmental Impact Assessment and local public consultation were incorporated into the City Planning Decision process, the latter leading to re-siting and redesign of ventilation systems.

CHARACTERISTICS

The decision to adopt a tunnel solution increased the cost greatly. Escalating land values during the late 1980s 'bubble economy' also contributed to cost increases as, when the bubble economy collapsed, many landowners insisted on getting the same prices for their land. The actual cost, JPY 460bn in 2006 (USD 5.45bn at 2010 prices)[ii], was in line with the budget of JPY 458bn (USD 5.50bn at 2010 prices) set in 1992.

The widening of the 6th Circular Highway ('Yamate Dori') from 22m to 40m enabled the C2 Shinjuku Route to be built under the road. The tunnel is one of the world's longest in an urban area, runs alongside major utility infrastructure and is crossed by eleven rail lines. The shield tunnelling method was used to minimise noise and other impacts, and a U-turn technique was developed to optimise the use of tunnelling machines and so reduce costs.

The construction was divided into 17 civil engineering components, let in separate contracts primarily to joint ventures of Japanese companies including Kumagai, Nishimatsu and Obayashi.

TIMELINE ISSUES

Public and political opposition during the 1970s and 1980s caused a 20-year delay in securing approval for the project. Construction also progressed slowly, due to the technical complexity of tunnelling in densely populated urban areas and the need to develop new technological solutions such as shield tunnelling.

FUNDING

MEPC was privatised in 2004 and is now known as Metropolitan Expressway Co Ltd. It leases highway assets from the Japan Expressway Holdings & Debt Repayment Agency (JEHDRA) and collects road tolls from users. JEHDRA also accepted USD 2bn of the project debt (approximately 43% of the total cost).

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[i] The Ministry of Construction subsequently became the Ministry of Land, Infrastructure and Transport

[ii] Costs have been converted to USD at 2010 prices, using historic inflation rates and current exchange rates, to allow comparison between projects.

KYUSHU SHINKANSEN KAGOSHIMA ROUTE, KYUSHU, JAPAN

OVERVIEW

LOCATION: KYUSHU, JAPAN
SCOPE: INTER-URBAN
TRANSPORT MODE: RAIL
PRINCIPAL CONSTRUCTION: TUNNEL
NEW LINK: YES

PRINCIPAL OBJECTIVES

REGIONAL DEVELOPMENT
LOCAL ECONOMIC DEVELOPMENT
ACCESSIBILITY
TRAVEL TIME SAVINGS

PRINCIPAL STAKEHOLDERS

MAIN CONTRACTOR:
JAPAN RAILWAY CONSTRUCTION CORP.
FUNDERS: JNR/CENTRAL & LOCAL GOVT

PLANNING AND IMPLEMENTATION

PLANNING START DATE: 06/1972
CONSTRUCTION START DATE: 08/1991
OPERATION STATE DATE: 03/2004
MONTHS IN PLANNING: 230
MONTHS IN CONSTRUCTION: 151
PROJECT COMPLETED:
33 MONTHS BEHIND SCHEDULE

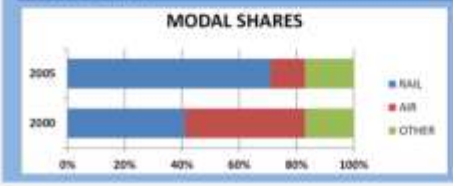
COSTS (IN 2010 USD)

PREDICTED IN 1991: 5.58BN
PREDICTED IN 2001: 7.50BN
ACTUAL IN 2004: 7.45BN
PROJECT COMPLETED:
34% ABOVE ESTIMATE/ON BUDGET
FUNDING: 100% PUBLIC

INFRASTRUCTURE QUANTITIES

TRACK: 127KM, INCLUDING
TUNNEL: 88KM
BRIDGE: 25KM
COST PER KM (2010 USD): 0.06BN

PATRONAGE



INTRODUCTION

A high speed rail line, from Kagoshima to Yatsushiro on the Japanese island of Kyushu, consisting of 127km of track, including 88km in tunnel and 25km of bridge. The line opened in March 2004.

The project includes five stations, in the cities of Yatsushiro, Minamata, Izumi, Sendai and Kagoshima. It is part of the country-wide Shinkansen high speed railway network, the overall aim of which is to encourage decentralisation of population and economic growth. It represents approximately half of the section planned for Kyushu, with the remaining section scheduled for completion at the end of the 2010 financial year.

BACKGROUND

The main objective of the project, as for the Shinkansen network as a whole, was to contribute to economic development, facilitating population dispersal and the growth of regional industry. The concept of the network derives from a comprehensive national development plan agreed in 1969, and the 1970 National Shinkansen Railway Construction Law defines procedures for planning and constructing parts of the network. Routes are decided by the relevant government minister, with advice from the Railway Construction Council.

Progress on this and other sections of the network was suspended in 1982 due to the budget deficit caused by oil shocks. In 1988, the government decided to start construction of this and four other high priority sections, and in 1989 it agreed to share the costs equally with local government bodies and the recently privatised Japan Railways. The opportunity to significantly reduce travel times by providing an alternative to single-track lines was a deciding factor in the prioritisation of this section in the south of Kyushu.

The Japan Railway Construction Corporation was the main contractor for the project and is the owner of the infrastructure, leasing it to the service operator, Japan Railways Kyushu. There was no distinct client organisation.

TIMELINE

CONTEXT: 1964: THE FIRST SHINKANSEN LINE OPENS IN TIME FOR THE TOKYO OLYMPIC GAMES

CONTEXT: 1969: NATIONAL DEVELOPMENT PLAN

CONCEPTION: 1970: NATIONAL SHINKANSEN RAILWAY CONSTRUCTION LAW

CONCEPTION: 1972: KYUSHU SHINKANSEN ROUTE PLANNED

INCEPTION: 1973: KYUSHU SHINKANSEN CONSTRUCTION ORDER ISSUED

CONTEXT: 1973: OIL SHOCK CAUSES FINANCIAL PROBLEMS FOR JAPANESE GOVERNMENT

DELAY: 1982: NATIONAL SHINKANSEN RAILWAY CONSTRUCTION PLAN SUSPENDED

INCEPTION: 1984: DRAFT ENVIRONMENTAL ASSESSMENT REPORT

INCEPTION: 1987: SUSPENSION OF NATIONAL PLAN LIFTED, JAPAN NATIONAL RAILWAYS PRIVATISED, JAPAN RAILWAYS KYUSHU ESTABLISHED

INCEPTION: 1988: GOVERNMENT AGREEMENT TO BUILD SOME SECTIONS OF NETWORK

INCEPTION: 1989: GOVERNMENT AGREES TO SHARE COSTS WITH JNR AND LOCAL GOVERNMENT

INCEPTION: 1990: GOVERNMENT AGREEMENT TO BUILD KAGOSHIMA-YATSUSHIRO LINE

CONSTRUCTION: 1991: CONSTRUCTION AUTHORISED. GROUND-BREAKING CEREMONY

CONSTRUCTION: 1992: CONSTRUCTION OF KAGOSHIMA-CHUO STATION AUTHORISED

DELIVERY: 1996: KAGOSHIMA-CHUO STATION COMPLETED

CONCEPTION: 1998: STARTING POINT CHANGED FROM YATSUSHIRO TO SHIN-YATSUSHIRO

CONCEPTION: 2000: SPECIFICATION CHANGED FROM SUPER EXPRESS TO FULL STANDARD

DELIVERY: 2004: LINE OPENED

Environmental impact assessments and public consultation formed part of the detailed planning and implementation process.

An evaluation report was published in 2009 and included a cost-benefit analysis suggested a benefit/cost ratio of 1.1 over 50 years. Journey times were reduced by up to 63%, with the journey from Kagoshima to Hakata quicker than by air. The modal share of rail increased significantly and passengers are able to spend up to 50% more time in their destination.

CHARACTERISTICS

Although the initial proposal authorised in 1991 was estimated to cost JPY 457bn (USD 5.58bn at 2010 prices), the project cost was estimated at JPY 640bn (USD 7.50bn at 2010 prices[1]) at the second authorisation in 2001. The final cost was lower (JPY 629bn, or USD 7.45bn at 2010 prices), perhaps partly due to negative inflation.

Changes to the project scope, the increased price of goods, adoption of the higher specification 'full standard' and unexpected geological conditions contributed to increasing costs. However, innovative construction techniques also helped reduce costs: for example, four specific innovations saved about JPY 4.5bn.

A special tunnel construction method was required for part of the route, built through *shirasu* volcanic ash. This won an award from the Civil Engineering Society, one of nine for the project overall.

TIMELINE ISSUES

Changing from the 'super express' to the higher specification 'full standard' led to a revision of the estimated completion date, from 2001 to 2003.

FUNDING

From 1989 to 1996, Japan National Railways funded 50% of the construction costs of this and related projects. Central and local government funded 40% and 10% respectively of works related to infrastructure, and 25% each of works related to stations and community facilities. From 1997, funding has been shared between central and local government in a 2:1 ratio. The project was financed entirely by interest-free funds, including revenue from the transfer of the Shinkansen network to privatised rail companies.

[1] Costs have been converted to USD at 2010 prices, using historic inflation rates and current exchange rates, to allow comparison between projects.

OEDO LINE (LOOP SECTION), TOKYO, JAPAN

OVERVIEW

LOCATION: TOKYO
SCOPE: INTER-URBAN
TRANSPORT MODE: SUBWAY
PRINCIPAL CONSTRUCTION: TUNNEL
NEW LINK: YES

PRINCIPAL OBJECTIVES

LOCAL TRANSPORT LINK
ACCESSIBILITY
LOCAL DEVELOPMENT

PLANNING AND IMPLEMENTATION

PLANNING START DATE: 05/1978
CONSTRUCTION START DATE: 02/1992 (LOOP SECTION)
OPERATION START DATE: 12/2000 (LOOP SECTION)
MONTHS IN PLANNING: 239
MONTHS IN CONSTRUCTION: 106
PROJECT COMPLETED: 48 MONTHS BEHIND SCHEDULE

COSTS (IN 2010 USD) (LOOP SECTION)

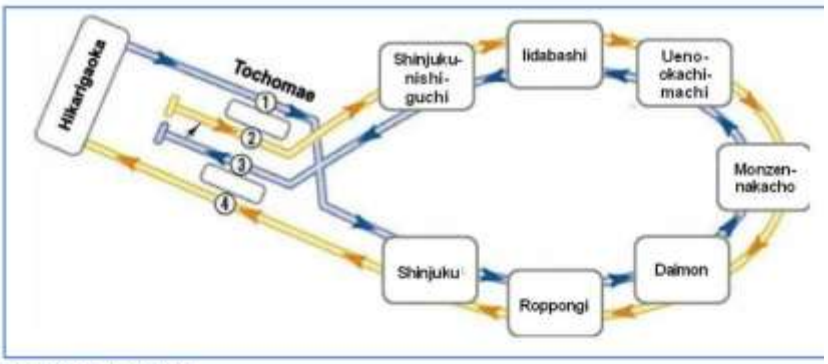
PREDICTED COST: 9.15BN
ACTUAL COST: 11.38BN
PROJECT COMPLETED:
24% OVER BUDGET
FUNDING: 29% PUBLIC : 71% PRIVATE

INFRASTRUCTURE QUANTITIES

LENGTH: 27.8KM (LOOP SECTION)
NUMBER OF STATIONS: 38
COST PER KM (2010 USD): 0.40BN

PATRONAGE

FORECAST TRAFFIC (1987 FOR 1996)
985,000 PPD
FORECAST TRAFFIC (1987 FOR 2006)
1,213,000 PPD
FORECAST TRAFFIC (1998 FOR 2000)
824,000 PPD
ACTUAL TRAFFIC (2000)
219,358 PPD
ACTUAL TRAFFIC (2007)
781,487 PPD



INTRODUCTION

The OEDO line is a 41km subway line. The 12.9km radial section (financed and built by the public sector) opened in two stages, in 1991 and 1997, and the 27.8km loop section in 2000. The line has 38 stations, of which 26 connect to other subway lines.

BACKGROUND

The main objective of the project was to improve the transport network within Tokyo, providing an orbital route linking existing radial routes, improving accessibility to public facilities and other major destinations, and reinforcing the city's redevelopment plans.

The line is one of 13 identified in the 1972 Tokyo Metropolitan High-speed Railway Network Development Plan. However, the project was frozen due to the economic downturn following the first oil shock in 1973. It was reconsidered by an advisory panel to Tokyo's governor in 1978 and a Liaison Council of eleven ward-mayors was established to promote it in 1981.

In 1985 the government decided to relocate its headquarters and this brought more urgency to the objective of improving the transport network. An investigation committee was set up, reporting back to the government in 1987, when the construction of the loop section was authorised with the release of a formal implementation plan.

A 'third sector' construction body, Tokyo Subway, was set up in 1988 to finance and build the loop section, incorporating private sector management practices into a public-private partnership, with the aim of transferring the completed project to the public sector Bureau of Transportation for operation.

A cost-benefit analysis conducted in 1988 estimated that the line would generate benefits of 4.16 times the investment, and create 280,000 jobs. An ex-post evaluation has not yet been carried out.

OEDO LINE (LOOP SECTION), TOKYO, JAPAN

TIMELINE

CONCEPTION: 1972: LINE IDENTIFIED IN NETWORK DEVELOPMENT PLAN

CONTEXT: 1973: FIRST OIL SHOCK

DELAY: 1975: PROJECT TEMPORARILY FROZEN DUE TO ECONOMIC DOWNTURN

CONCEPTION: 1978 (MAY): PROJECT RECONSIDERED. DOWN-SIZING STRATEGY BEGAN

CONCEPTION: 1981: LIAISON COUNCIL OF ELEVEN WARD-MAYORS ESTABLISHED TO PROMOTE PROJECT

INCEPTION: 1982: RADIAL SECTION INCLUDED IN TOKYO LONG-TERM PLAN

CONTEXT: 1985: RELOCATION OF METROPOLITAN GOVERNMENT HQ DECIDED

INCEPTION: 1986: PROTOTYPE OEDO LINE CAR LAUNCHED

INCEPTION: 1986: COMPLETION OF LOOP SECTION BY 2005 A GOAL IN TOKYO'S LONG-TERM PLAN

CONSTRUCTION: 1986: CONSTRUCTION OF RADIAL SECTION (PART ONE) STARTS

INCEPTION: 1987: LOOP SECTION IN OFFICIAL GOVERNMENT IMPLEMENTATION PLAN

INCEPTION: 1988: THIRD SECTOR BODY, 'TOKYO SUBWAY', ESTABLISHED TO BUILD LOOP SECTION

CONSTRUCTION: 1990: CONSTRUCTION OF RADIAL SECTION (PART TWO) STARTS

DELIVERY: 1991: RADIAL SECTION (PART ONE) OPENS

CONSTRUCTION: 1992 (FEB): CONSTRUCTION OF LOOP SECTION STARTS

DELIVERY: 1997: RADIAL SECTION (PART TWO) OPENS

INCEPTION: 1998: FINANCIAL SCHEME REVISED

CONCEPTION: 2000: DECISION ON EXTENSION TO LINE, TO BEGIN CONSTRUCTION IN 2015

DELIVERY: 2000: LOOP SECTION OPENS

DELIVERY: 2001: BUSINESS PROMOTION COUNCIL SET UP TO ATTRACT MORE PASSENGERS

CHARACTERISTICS

The initial financial scheme for the loop section was established in 1987 when the cost was estimated at JPY 682.6bn (USD 9.15bn in 2010 prices)[i]. The final financial scheme agreed in 1998 was for JPY 988.6bn (USD 11.38bn in 2010 prices).

A strategy of down-sizing trains, tunnels and facilities was adopted early in the planning stage to reduce construction and operation costs, in response to the economic downturn caused by the oil shocks. Land acquisition costs were minimised through route selection, refurbishment of existing stations and facilities, and special policies for government land. However, difficult construction conditions, a prolonged construction schedule and the addition of facilities and higher specification features not in the original plan contributed to increasing costs.

The line uses several innovative new technologies: linear motors, lightweight aluminium bodies, and 'one-person-operated-trains'. Open-cut, caisson and underpinning tunnelling methods were used. Stations are decorated with public arts to create amenity space.

TIMELINE ISSUES

The economic crisis caused by the oil shock was estimated to have caused a four-year delay in delivering the project. The process of land acquisition and negotiations with local residents was lengthy, and the complexity of construction in the central business district also caused delays.

FUNDING

The project was financed by a combination of no-interest loans from the metropolitan government and interest-bearing loans from Japan Development Bank and other financial institutions. The financial scheme involves the Bureau of Transportation purchasing the line from Tokyo Subway in installments, and Tokyo Subway using the payments to repay the interest bearing loans over a period of twelve years from FY2001, and no-interest loans over ten years from FY2021, respectively.

The financial scheme was revised in 1998 to reflect higher costs and lower passenger forecasts, with extra funding from sub-leasing bonds. Passenger numbers were initially well below forecasts but have increased dramatically following a publicity campaign.

[i] Costs have been converted to USD at 2010 prices, using historic inflation rates and current exchange rates, to allow comparison between projects.

10.2 Japan: The 4 tests reports

For each of the projects, the Country Partners prepared the '4 Tests Report' which – as described in Section 1.3 above – examined project achievements according to: (i) objectives (both original and emergent); (ii) sustainability; (iiii) treatment of risk, uncertainty and complexity; (iv) a synthesis of the three tests, focusing on responses to the original research questions and hypotheses, the project winners and losers, and provisional lessons.

The full 4 Tests reports can be accessed via the following hyperlinks:

Metropolitan Expressway, Tokyo
CD ROM: OMEGA Partner 4 Tests\Japan 4 Tests.docx

Shinkansen High Speed Rail, Kagoshima-Nakata
CD ROM: OMEGA Partner 4 Tests\Japan 4 Tests.docx

Oedo Metro, Tokyo
CD ROM: OMEGA Partner 4 Tests\Japan 4 Tests.docx

The Partner's overall synthesis of the project findings is now presented in the following pages.

10.3 Japan: Synthesis of country findings

10.3.1 Responses to overall research questions and overall research hypotheses (ORQ's and ORH's)

10.3.1.1 ORQ #1: Project success

In relation to ORQ#1, it is considered that positive contributions to regional economies and development is an important generic response to the question of what constitutes a successful MUTP. This is because it is likely that a plan for a MUTP originates from a viewpoint of economic development, as noted by interviewees. Interviewees also suggested that the following factors are generically important constitutes for 'success':

- consensus amongst the general public in terms of the need for the project;
- contribution to environmental improvement;
- stability of operations.

Notwithstanding the above, it is debatable whether 'environmental improvement' represents a key pre-requisite for an MUTP rather than a factor that *contributes* to success.

We consider that patronage levels represents a context-specific response in relation to the two rail-based case study projects - patronage levels are quite important for rail projects in Japan which are required to be operationally profitable.

10.3.1.2 ORQ #2: Treatment of risk, uncertainty and complexity

Risk

Cost and funding were seen to be key factors in relation to project risk.

In relation to ORQ#2, the interviewees of the Case 2 and 3 considered funding while the interviewees of the Case 1 (Tokyo Metropolitan Express Way) regarded project cost as a

major risk. Because funding schemes were different between the Case 2 (The Kyushu Shinkansen) and 3 (Oedo Line), how the project proponents responded to the risk was also different.

For Case 2, because funding was critically dependent on the national government, they mitigated risk by lobbying for the project through powerful politicians and appealing to the general public.. For Case 3, Tokyo Metropolitan Government, as a project proponent, mitigated risk by:

- the establishment of a public-private institution;
- procedural change of design order;
- introduction of overseas production;
- delegation of administrative work to a third party, and;
- introduction of private funding (Tokyo Metropolitan Government as a local government shared the cost with national government and it could take its own initiatives more flexibly for responding to the risk).

For Case 1, the project cost risk was not well treated, probably because Tokyo Metropolitan Government and the Metropolitan Expressway Public Corporation as project proponents faced two sources of risk:

- the persistent opposition from residents living along the Route (if elevated structure was adopted);
- the considerably higher cost if an underground structure was adopted instead.

Ultimately it was decided to select the second risk partly because they evaluated the benefits of the project even more than the considerably higher cost for underground structure. In order to cover the project cost, the Metropolitan Expressway Corporation needed to increase toll levels. When the proposal for higher toll of the Metropolitan Expressway Public Corporation was approved by the governments, it was not realized because the Corporation was involved in the privatization process soon after the approval. The treatment of the project cost risk by the Corporation was significantly dependent on national and local governments.

We thus consider that for any MUTP like the Cases in Japan, how to cover the project cost is one of the major generic risks.

In Cases 1 and 2, the project proponents considered the residents as a context specific risk. For the Case 1, the risk posed by residents' opposition was well treated by way of the amendments to city planning decisions and other minor modifications in design and construction of the project in response to the demand of the residents as well as adoption of underground structure. Also, distribution of sophisticated periodical papers among the residents along the Route may have worked well for collecting the demands of the residents on a daily basis.

Because of environmental concerns, the proponents of urban expressway projects such as Case 1 cannot avoid the risks caused the residents and must give their first priority to its treatment. For the Case 2, the project proponents needed to manage the risk by showing continuous commitments to the project and appealing to the residents for viewing the project in perspective of Kyushu Region as a whole. The risk of the residents is related with the risk of funding because national funding is dependent on the social consensus in Kyushu Region.

In Cases 1 and 3, the risk of coordination with relevant institutions was considered as another context specific risk. For Case 1, Metropolitan Expressway Corporation must negotiate with many companies in charge of urban utilities and rails crossing the project Route. The adoption of the shield tunnel method considerably reduced risk; however the risk remained around some intersections where the method was not applicable. For the Case 3,

Tokyo Metropolitan Government treated it by negotiation with owners of land or existing facilities along the route, implementation of passages to the ground, and the available space for construction works. Because the Case 1 and 3 are located in urban areas and their routes go in a circular direction from city center, it is natural that the project proponents necessarily face the requirements set by the owners of existing rails and utilities. In addition, for the Case 1 the Corporation as well as Tokyo Metropolitan Government needed to persuade national government to change the project design from elevated to underground structure with considerably higher cost because the national government was concerned that the change would increase the unit cost of constructing expressway considerably in other areas of Japan. They were successful in obtaining the approval from the national government by emphasizing the special characteristics of the location that the project must go through. For the Case 3, Tokyo Metropolitan Government negotiated with national government for funding, however the national government initially opposed to the project since it needed a large amount of national subsidy. Because the Case 1 and 3 are located in Tokyo, it is understandable that national government is so concerned about the effects (In this case the creation of expensive precedents) of the projects on similar projects in other areas of Japan that it becomes conservative.

Uncertainty

In relation to uncertainty, for all Cases in Japan, the project proponents left the uncertainty in relation to the technology with which the project would be realized, even when the construction of the project was started. From a different viewpoint, the project proponents accepted the uncertainty in relation to technological developments in order to proceed with the projects by reducing some relevant risks dramatically:

- Case 1 - the acceptance of uncertainty in relation to technological developments for underground expressway such as the shield tunnel method, low-concentration denitration equipment, ventilation station and other safety and environmental measures decreased the risk from residents significantly;
- Case 3 - the acceptance of uncertainty in relation to relevant technological developments such as smaller cars, smaller tunnel dimensions, and the use of linear motors resulted in reduction in the risk of project cost considerably;
- Case 2 - the proponents made use of the uncertainty of technological developments in a different way from Case 1 and 3. The difficult sections in terms of engineering led to the commencement of the construction works before formal approval of the project, even when the project was given lower priority among the competing projects for national funding, which worked for lowering the risk of national funding.

We consider that the uncertainty of technological developments was accepted generically for reducing major risks in all three Japanese Case studies, and that its acceptance resulted in proceeding with the projects successfully in general. We also think it is likely that the proponents accepted the uncertainty of technological developments, because they make the decisions internally without the commitments of relevant external institutions who might create other sources of risks.

Complexity

In relation to complexity, the interviewees for all Japanese Case studies regarded their respective Cases as rather complex generically. For the Case 1 and Case 3, because the projects adopted underground structures in densely inhabited areas especially in circular directions from the city center, the projects necessarily involved many stakeholders and local community groups living along the routes as well as many companies in charge of urban utilities and rails crossing with the routes. The proponents of the projects also needed to negotiate with national government and other sections of Tokyo Metropolitan Government for getting consensus and funding. For the Case 2, the project is geographically so long that the

project has to face a large group of stakeholders whose roles and levels of the commitments differed considerably from Prefectures to local residents as well as national government for funding. We think that a major generic source of complexity in Japanese Cases is the number of organizations and people who are involved in the projects.

10.3.1.3 ORQ #3: Context

In relation to ORQ#3, firstly, we think that the interviewees of all Japanese Case studies generically regarded the consensus of the general public as the most influential context in the planning and delivery of the case projects.

For the Case 1, the *attitude of the general public* affected the project negatively when it was included in the Plan for Metropolitan Expressway Extensions in 1968 due to the environmental concerns, and positively when the City Planning Decision was made in 1990 due to the serious congestion. For the Case 2, the project was dependent on national funding, which needed the consensus of the general public nationally. For the Case 3, the proponents of the project regarded the willingness of the Governor of Tokyo Metropolitan Government as important probably because it represented the attitude of the general public.

Secondly, we consider the *geographical aspect* as an influential generic context. For the Case 2, the project is located geographically far from the Tokyo Metropolitan Area, which might be directly or indirectly a disadvantage for the project especially for obtaining national funding. For the Case 1 and 3, the projects are located in the Tokyo Metropolitan Area, which might naturally involve national government and incur its commitments. Thirdly, we consider economic aspect as an influential generic context. For the Case 1, the collapse of the Japanese bubble economy in the 1990s affected the process of land taking for the project by worsening the economic situations of some landowners and weakening their willingness to sell their land lots. For Case 2, the chronic deficit of the Japan National Railways lead to the freeze of Shinkansen construction in 1982.

For the Case 3, we think that the *political aspect* was an influential context specific context. The city planning guideline that promoted the shift from one-center to multi-center urban structure supported the project and necessitated the coordination with the relocation of the Tokyo Metropolitan Government building from Marunouchi to Shinjuku, and with other urban development projects such as the Shiodome land readjustment project.

10.3.1.4 ORH #1 - Appraisal criteria & methods

In relation to ORH#1, we consider 'traditional' appraisal and evaluation criteria as still important; however, the criteria should be extended to cover social sustainability such as consensus of the residents and reduction in the gap between areas in terms of their economy and other aspects, environmental sustainability such as local environment, and institutional sustainability such as the continuation of the project operation. The idea is generic to all Case studies of Japan.

10.3.1.5 ORH #2 - Sustainability

In relation to ORH#2, we consider that the vision of sustainable development should be multi-dimensional and go beyond notions of environmental sustainability. We agree with the idea that sustainability considerations are necessary for the MUTP and other transportation infrastructure planning and construction because it requires a long time commitment from planning to operation. We also believe that if one of our social goals is to make our society sustainable, sustainability considerations should necessarily include multi-dimensional aspects and inter-relate concepts. Major categorization of economic, environmental, social and institutional aspects might be useful for understanding the concepts; however, we do not

believe that clear categorization is always possible.

For some examples in the Case 2, establishment of the project operation needs economic and institutional sustainability, support from the general public needs social and environmental sustainability, and reduction in the gap between local areas needs economic and social sustainability considerations. For other examples in the Case 3, because railways have to be operationally profitable in most cases in Japan, institutional sustainability and economic sustainability were inter-related. Also, accessibility improvement to new multi-centers rather than the existing center made by the case project could be evaluated from the viewpoint of both economic and social sustainability. We think the idea is generic to all Case studies of Japan.

10.3.1.6 ORH #3: Adequacy of treatment of risk, uncertainty and complexity

In relation to ORH#3, we agree that the level of competence in decision-making and planning is best assessed by the adequacy of the treatment of risk, uncertainty and complexity and sensitivity to context in general.

We think that some of the treatments might be less than the demands on Strategic Planning; however, they mostly contributed to the implementation of the Japanese Case projects. For the Case 1, the interviewees considered the residents who were concerned about local environment and their consensus as one of the main sources of risk.

The interviewees also regarded the consensus of the general public as the most influential context in the planning and delivery of the case project. When the case project was included in the Plan for Metropolitan Expressway Extensions in 1968, the Metropolitan Expressway Public Corporation experienced many objections from residents living along the western section of the project. We consider that the Corporation did not treat well the risk of the residents and the context of the general public who were concerned about the environment at that time. The lessons cost the Corporation the freezing of the project for around twenty years, and improved the adequacy of the treatment of risk, uncertainty and complexity and sensitivity to context by the Corporation in relation to the residents and the general public.

While some interviewees indicated that the issues on the project cost and delay were not well treated, we considered that the Tokyo Metropolitan Government and the Corporation chose to give more priorities to the risk of the residents. For Case 2, the interviewees considered the social consensus among the residents living in Kyushu region as one of the main sources of risk. Some interviewees pointed out the risk on priority setting of Shinkansen Routes for national fund allocation. Because of other competing Shinkansen projects in other parts of Japan, the proponents of the case project necessarily needed the social consensus that the case project was supported by the general public living in Kyushu Region as a whole. At the same time, we believe that the proponents were concerned that the consensus could be easily broken because of different levels of commitment among the Prefectures in the Kyushu region that the Shinkansen went through partly because it was likely that the project might bring in more benefits in large cities and less in the other areas. We consider that the proponents well treated the risk of the residents by showing continuous commitments to the project, for example, the building of a new pedestrian passage in Kagoshimachuo Station assuming that it would become a new station of the project in advance of the formal start of the construction work for the Shinkansen project. They also kept on appealing to the residents to view the project from the perspective of the Kyushu Region as a whole, for example by making the strategic economic development plan of the Kyushu Region coupled with the development of the Kyushu Shinkansen in perspective with the eastern Asian countries .

For the Case 3, because railways have to be operationally profitable in most cases in Japan, the implementing institutions well treated the risk of the project cost by reducing it considerably especially under the unfavorable context of financial crisis of the Tokyo Metropolitan Government in 1976. They made every effort to minimize the demand for funding, for example, by the establishment of public-private institutions, the procedural change of design order, introduction of overseas production, delegation of administrative work to the third party and introduction of private fund. They also accepted uncertainty of technological developments such as the use of smaller cars, smaller tunnel dimensions, and linear motors for cost minimization. The implementing institutions seemed to concentrate on the risk of the project cost because it was one of the most important factors, and because rail projects were relatively welcomed by the local people who might have otherwise constituted a major risk for other projects.

10.3.2 Japan: Potential generic and context-specific lessons

10.3.2.1 Context-specific lessons

In relation to potential lessons of a context-specific nature, our findings are as follows:

All of the Japanese Case studies experienced the temporary freeze of the project due to unfavorable contexts such as many objections from the general public who were concerned about the environment, the deficit of the Japanese National Railways who where supposed to be the operator of the project, and the energy crisis that worsened financial status of the relevant government. However, even during the freeze period, the stakeholders engaged in project implementation continuously took actions, such as the commencement of construction from the easier section, formulating the regional development plan coupled with the project and making the revisions to the original plan. Interestingly, all of the actions resulted in important steps to the future of the project. Because a MUTP requires a long time commitment from planning to operation, we consider that the risks and uncertainties of the project should be well treated and reduced if possible even during the period of unfavorable context.

As we pointed out in the previous sections, in urban areas with high density populations, objections from the residents might be one of the major sources of risks. In order to respond to this issue, we think that a decisive measure is sometimes necessary such as the adoption of an underground structure in the Case 1. The measure could considerably reduce the risk of the oppositions from the residents living along the Route. The building of a new pedestrian passage in Kagoshimachuo Station in advance of the formal start of the construction work for the Case 2, and reduction in the size of cars and tunnel as well as adoption of linear motor for the Case 3 might be regarded as a sort of decisive measures taken for successful projects.

In all of the Japanese cases, technological development was regarded as a solution. We consider that the proponents of the Japanese Case projects might likely choose uncertainty in relation to technological developments in order to reduce the major risk of the project such as the resident because they could decide and control it internally without the commitments of external relevant institutions. It should be noted that technological development was conducted sometimes after the commencement of construction works. It appears that technological development entails uncertainty on whether suitable technology is successfully developed or not within a certain period of time. However, it might be better from the viewpoint of the people engaged in technological development that the direction or specification of technological development is clearer in the case of a MUTPs, and that the risk of technological development in wrong direction might be lower. We believe it is especially true for the field of civil engineering.

10.3.2.2 Potential generic lessons

In relation to potential lessons of a generic nature, our findings are as follows:

We found some strategic behaviour or statements from the stakeholders such as 'the construction from the easiest to the most difficult section of the whole project', 'commencement of the construction work for the project from the most difficult section in terms of engineering', 'commencement of the construction from the far end of the project instead of the near end which was already connected with the existing network', and 'commitment to the pursuit of early construction and simultaneous full opening of the project', which were all successful in demonstrating the commitments to the project.

We consider that the relationship between the two groups with different responsibilities or motives works as one of the blocking mechanisms for the project. For the Case 1, when the City Planning Decision was made in 1990 with the change from elevated to underground structure with the viewpoint of environmental sustainability, national government was not supportive for the adoption of an underground structure from the viewpoint of social sustainability because it might induce the adoption of underground structures in other parts of Japan, and would increase the unit cost of constructing expressway considerably. For the Case 2, as the implementation of the national Shinkansen railway network plan moves from the section with high benefits located near Tokyo and Osaka to the section with low benefits located far from Tokyo and Osaka such as the Kyushu Region, it is likely that the concerns of the plan by the general public should change from social to economic sustainability of Japan as a whole, which makes a conflict with the people living in Kyushu Region who have waited for the project for a long time. For the Case 3, national government in charge of national fund allocation might be regarded as one of the major blocking mechanisms because funding resources are scarce in general and national government tends to allocate funds evenly among possible projects from the viewpoint of social sustainability, which might be disadvantageous for the projects whose contributions to economic sustainability are higher. The treatment of conflicting aspects of multi-dimensional sustainability visions might remain for future studies.

To consider an option of doing-nothing might often be helpful for understanding the risk structure of the project. In the Case 1, the doing-nothing might be an option by which implementing institutions utilize the opportunity for accumulating empirical knowledge and investigating the possibility of technological development suitable for the project. In the Case 2, the proponents needed to consider that an option of doing-nothing might mean the risk of future declining in economy in the Region, before facing two inter-related risks of national funding priority and the social consensus in Kyushu Region. In the Case 3, the objectives of the city planning guideline that supported multi-centre urban structure and the project were mutually reinforced, and an option of doing-nothing for the project could not exist without the giving-up of the city planning guideline.

10.4 Conclusion: Japan

This section presented a summary and synthesis of the Japan Country Partner's research on the three case studies of C2 Metropolitan Expressway, Tokyo; Shinkansen Kyushu; and Oedo Metro, Tokyo.

It contained a summary profile of each project (with hyperlinks to the full Project Profiles), describing each project's history and main characteristics. The Country Partner's synthesis of findings in relation to the '4 Tests' was then given, presenting their findings from an overall country perspective.

11. Conclusion

This volume (Volume 4) of the research study presented the findings from 27 international case studies undertaken by the OMEGA Centre's Partners in nine countries. The Partners' research output was delivered through numerous reports and working papers (listed in Section 1.3 above), and was summarised[12] in this volume through:

- Summaries of the Project Profiles for each case study *(Note: hyperlinks to the full Project Profiles are given in section);*

- A country-by-country synthesis of the main findings from the '4 Tests Reports'. *(Note: hyperlinks to the 4 Tests Reports for each mega-project are also given in each section).*

The '4 Tests' – as explained in Volume 3 and also Section 1.3 above – provided the main research framework for analysing the mega-projects, focusing on project achievements in relation to:

Test 1: Project objectives, (both original and emergent objectives);

Test 2: Sustainable development visions and challenges;

Test 3: The treatment of risk, uncertainty and complexity, and the importance of context, throughout the project process;

Test 4: A synthesis of the above three tests, particularly in relation to the OMEGA research questions and hypotheses, project 'winners' and 'losers', and overall lessons.

This volume is therefore a compilation of the Country Partners' work and main findings, on a country-by-country basis.

The next volume (Volume 5) presents the overall analysis of all 30 MUTP case studies (including the three UK case studies), to provide overall comparisons, conclusions and lessons from the international research study.

[12] The short summaries of the Project Profiles were prepared by the OMEGA Centre, and the Synthesis of Country Findings by the Country Partners.