BARTLETT SCHOOL OF PLANNING

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PROJECT PROFILE

Greece

Athens Metro

(Attiko Metro)

omega centre
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)

UNIVERSITY OF THESSALY
SCHOOL OF ENGINEERING
DEPARTMENT OF PLANNING

This report was compiled by the Greek OMEGA Team, Research Unit of Infrastructure Technology Policy and Development, Department of Planning and Regional Development, University of Thessaly, Greece.

Please Note: This Project Profile has been prepared as part of the ongoing OMEGA Centre of Excellence work on Mega Urban Transport Projects. The information presented in the Profile is essentially a 'work in progress' and will be updated/amended as necessary as work proceeds. Readers are therefore advised to periodically check for any updates or revisions.

The Centre and its collaborators/partners have obtained data from sources believed to be reliable and have made every reasonable effort to ensure its accuracy. However, the Centre and its collaborators/partners cannot assume responsibility for errors and omissions in the data nor in the documentation accompanying them.

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Details of Project Team

Principal Investigator	Pantoleon Skayannis
VREF PhD Scholar (Basic Researcher)	George Kaparos
Researchers	Petros Rodakinias Sofia Kessopoulou, Anna Zygoura, Sotiris Pavleas
Support Team	Ioanna Nasiopoulou, Marina Makri, Alexis Alexiou, Marilena Venetsanou, Alexandra Koukidou Danae Karamitsiou

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Abbreviations

AIA: Athens International Airport
AMDP: Athens Metro Development Plan
AMEL SA: Attiko Metro Operation Company SA
ARP: Athens Regulatory Plan
ATIM: Automatic Ticket Issuing Machines
CCTV: Closed Circuit Television
CSF: Community Support Framework
DM: Deutche Mark
EC: European Commission
ECU: European Currency Unit
EIB: European Investment Bank
ERDF: European Regional Development Fund
ETHEL SA: Thermal Buses SA
ECU: European Currency Unit
EU: European Union
FEK: Official Government Gazette
GAA: Greater Athens Area
GRD: Greek Drachma
ILPAP SA: Athens Electric Buses SA
ISAP: Athens-Piraeus Electric Railways
KTEL: Common Treasury for Buses
MEF: Ministry of Economy and Finance
MEPPW: Ministry of Environment, Planning and Public Works
MoC: Ministry of Culture
MTC: Ministry of Transportation and Communications
MTS: Metro Transfer Stations
NATM: New Austrian Tunnelling Method
OAS: Urban Transport Organization
OCC: Operation Control Centre
OMC: Olympic Metro Consortium
OSE: Hellenic Railways Organization
O.A.S.A S.A: Organization of Urban Transport of Athens
PAS: Public Address System
PPP: Public Private Partnership
PSN: Persons with Special Needs
PT: Public Transportation

SOP: Standard Operation Procedures

TBM: Tunnel Boring Machine

TVC: Ticket Validator / Cancellers

VAT: Value Added Tax

VOC: Vehicle Operating Cost

A INTRODUCTION

Type of project

Athens Metro, or Attiko Metro which is the most commonly used name of this project, is one of the major infrastructure projects presently implemented in Greece and the most complex one in the transport field in both technical and planning terms. Moreover, it is ranked as one of the most important projects in Europe. It comprises an underground rapid transit system serving the metropolitan Athens area. The design and construction of the project were awarded to a consortium of French, German and Greek companies, while the management of the project and the supervision of the works is performed by ATTIKO METRO SA[1], a legal entity of private law exclusively owned by the Greek State, a subsidiary of which, ATTIKO METRO OPERATION COMPANY SA (AMEL SA)[2], is responsible for the operation, exploitation and development of the system, following the completion of construction works (www.minenv.gr).

The scope of this report is to provide a comprehensive analysis of the main planning, funding, construction and operation aspects of the Athens Metro Base Project along with a timeline of the key enabling mechanisms and decisions in the project's history (Figure 1). The Athens Metro Base project had been the most important transport work carried out during the 1990s in the greater area of Attiki. The project consisted of Lines 2 and 3 as shown in Figure 1. Line 2 is the Sepolia – Dafni section (9.2km and 12 stations) and Line 3 the Monastiraki – Ethniki Amyna section (8.4km and eight stations), in total, 17.6km and 20 stations. The original plan for the Base Project was to construct a network approximately 20km long with 21 stations in two Lines (i.e it included the next station after Monastiraki, called Kerameikos, which was ultimately not built as part of this project due to a decision in March 1997 on the grounds of archeological risk).

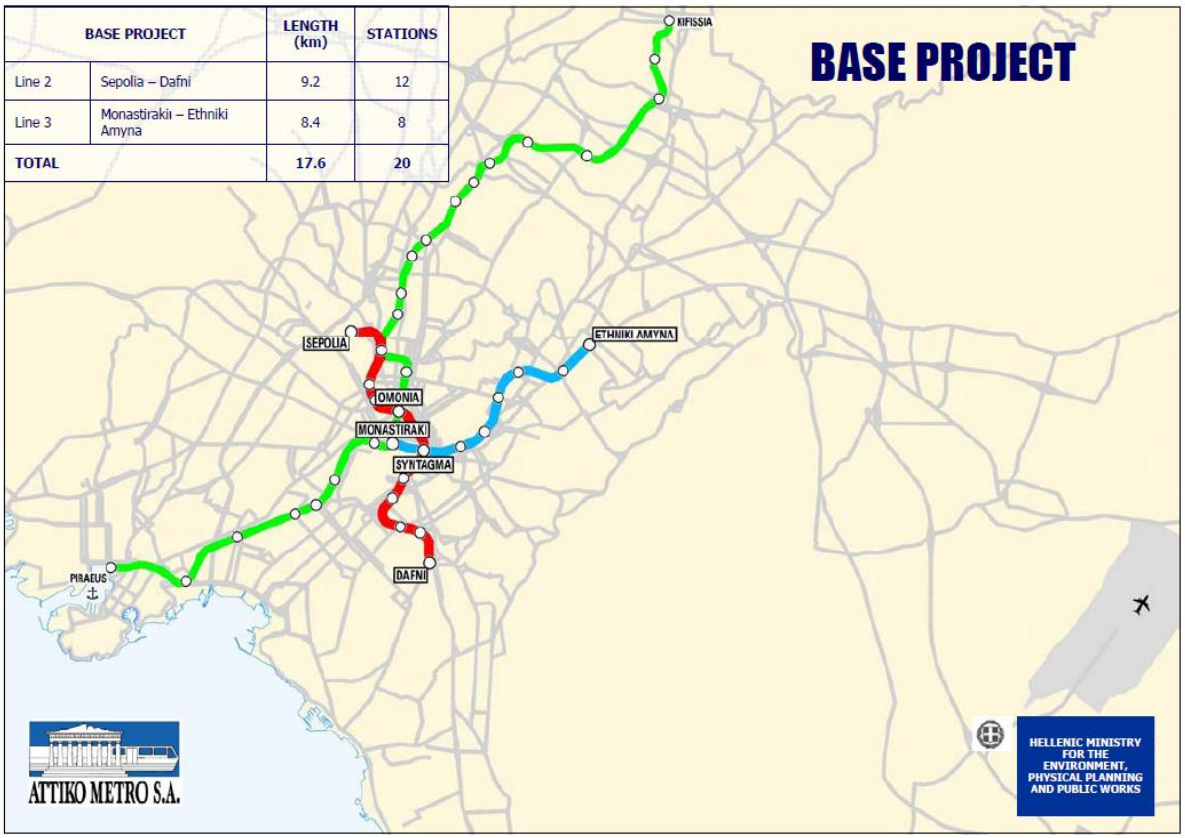
The construction of the Athens Metro Base Project commenced in November 1992.

The first part of Line 3 (Syntagma - Ethniki Amyna) and of Line 2 (Sepolia – Syntagma) started operating in January 2000, while an additional 5km with five stations (Syntagma – Dafni) began operation in November 2000. The missing Syntagma-Monastirali (1.5km) part of Line 3 was finally brought into operation in April 2003.

[1] In summer 1991, based on Law 1955, ATTIKO METRO SA was established. Its scope is the design, construction, organization, administration, operation, running and development of the Metro network in the area of Attiki Prefecture and, thus, at the end of 1992 the construction of two new Metro Lines initiated (www.ametro.gr).

[2] The *Societe Anonyme* styled ATTIKO METPO OPERATION COMPANY SA (AMEL) is a subsidiary company of ATTIKO METRO SA. It was founded in 1998 and was registered in the Register of Limited Companies of Athens Prefecture on 15 February 2001. The Company operates based on the rules of private economy, is a Public Utility Company and is supervised by the Minister of Transport and Communications (www.amel.gr).

Figure 1: The Athens Metro Base Project



Source: Leoutsakos, G., 2007 (Attiko Metro SA)

From that time, the following extensions to Lines 2 and 3 have been built:

Line 2:

- In August 2004, the Sepolia - Agios Antonios section (1.4km extension from Sepolia west) started operation (Figure 2);
- In June 2004, the Dafni - Agios Dimitrios/ Alexandros Panagoulis section (1.2km extension from Dafni east) started operation (Figure 3).

Line 3:

- In July 2004, the Ethniki Amyna – Doukissis Plakentias – Athens Airport section (5.9km extension from Ethniki Amyna north to D.Plakentias and another 20.7km to the El. Venizelos Athens International Airport) started operation (Figures 1 and 4). In D.Plakentias station the Metro trains emerge at the surface level and cover the distance to the airport using the Suburban Railways;
- In May 2007, the Monastiraki - Aigaleo section (4.2km extension from Kerameikos west) started operation, including the Kerameikos station (Figure 7). The location of this station was initially planned to be at a nearby road junction but because the alignment was underneath the famous classical Athens cemetery and would probably cause archaeological damage it was relocated a few hundred metres away in the safer Gazi area;
- The Nomismatikopeio station opened in September 2009 (Figure 5).

Both Lines have now (2010) a total length of 51.1km and 32 stations (including four that are in combined use with the Suburban Railway). These Lines serve daily more than 650,000 passengers (year 2009) (www.ametro.gr / the company).

Extensions in progress

At present (2010), the construction of the following extensions is in progress:

- From Aigaleo to Haidari: 1.5km including one new station (expected delivery: 2010);
- From Agios Dimitrios to Elliniko (old Athens airport) (Figures 3, 9): 5.5km including four new stations (expected delivery: 2010);
- From Ag. Antonios to Anthoupolis (Figures 2, 8): 1.5km including two new stations (expected delivery: 2010);
- Full development of Line 3 with the addition of Holargos and Agia Paraskevi stations (expected delivery: 2010).

New Lines planned

ATTIKO METRO SA is considering (or is currently preparing studies for) the construction of a new Line 4. It will be of a U shape and will be 20.9km long with 20 stations. It will serve the most densely populated areas of Athens, and the estimated number of possible users is 400,000 a day.

In addition, in November 2008, ATTIKO METRO SA proceeded to the re-procurement of the project related to Line 3 Metro extension to the western suburbs, terminating in Piraeus (underground tunnel, 7.6km long, with six stations: Agia Varvara, Korydallos, Nikaia, Maniatika, Piraeus, Dimotiko Theatro). The budget for this project amounts to EUR 515m (www.ametro.gr).

Figure 2: Athens Metro Extension to Anthoupolis

Source: ametro.gr

Figure 3: Athens Metro Extension to Elliniko

Source: ametro.gr

Figure 4: Athens Metro Extension to Piraeus

Source: ametro.gr

Figure 5: Athens Metro Extension Line 4

Source: ametro.gr

Figure 6: Athens Metro Extension Sepolia – Agios Antonios, inside view of Agios Antonios station

Source: ametro.gr

Figure 7: Athens Metro Extension Monastiraki - Aigaleo, inside view of Monastiraki station

Source: ametro.gr

Figure 8: Athens Metro Extension Agios Antonios to Anthoupolis, view of construction site

Source: ametro.gr

Figure 9: Athens Metro Extension Agios Dimitrios to Elliniko, view of construction site

Source: ametro.gr

Country/location

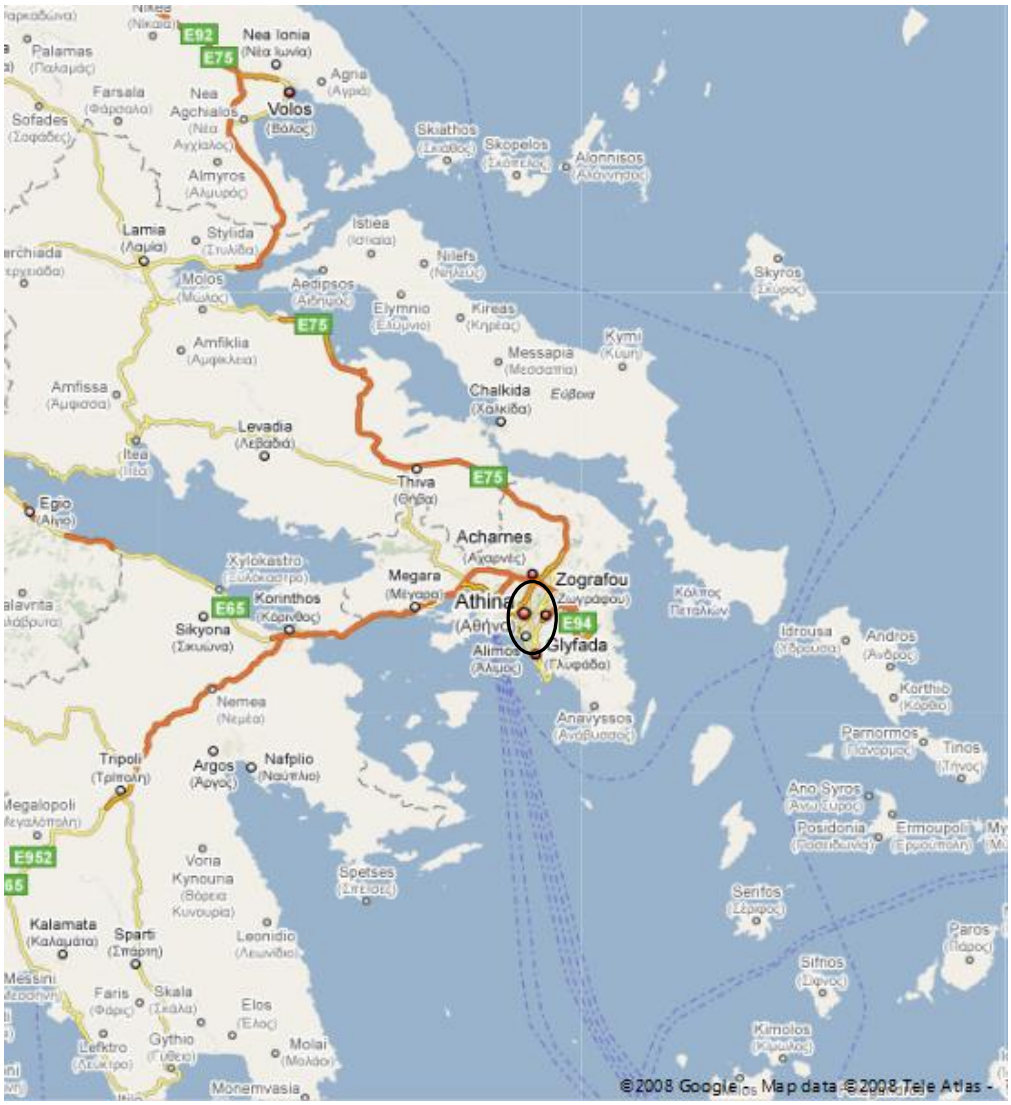
The Athens Metro is located in Attiki Region (the region to which Athens, Greece belongs) (Figure 10). The region of Attiki is one of the 13 Regions of Greece. As it includes both Athens and the main Greek port city Piraeus, Attiki is the most densely populated region of Greece. The wider area of Athens has a population of 3,172,000 (census 2001).

The region comprises mainly the peninsula jutting into the Aegean Sea and, besides the entire metropolitan area of Athens, includes other smaller towns as well as islands in the gulf of Saronikos. Administratively, the region of Attiki is divided into the prefectures of Athens, Piraeus, East Attiki and West Attiki. Geographically the Attiki Region is divided into two major sections: the capital region (consisting of the entire metropolitan region of Athens including Piraeus) and the rest of Attiki.

The capital region is bounded by the Saronikos Gulf and the mountains of Parnitha, Hymettus (Imittos) and Penteli, defining the Athens basin. The area of the capital region is 427km^2, covering 11.2% of the total area of the Attiki region. The rest of Attiki covers most of the area of the Region of Attiki which is an area of 3,381km^2 covering 88.8% of the total area of the Region.

The Athens Metro Base Project (which is the object of this study) is located within the Athens basin servicing the City of Athens and a few of the neighbouring municipalities, while the extensions in operation or under construction and the sections planned serve additional municipalities and the City of Piraeus.

Figure 10: Athens Metro project location within Greece and Attiki Region



Source: Google maps and own elaboration

Current status

The Athens Metro Base Project, the object of this study, consists of parts of Lines 2 and 3, although it operates as a whole with the other parts of Lines 2 and 3, as well as with Line 1 (belonging to ISAP[3]).

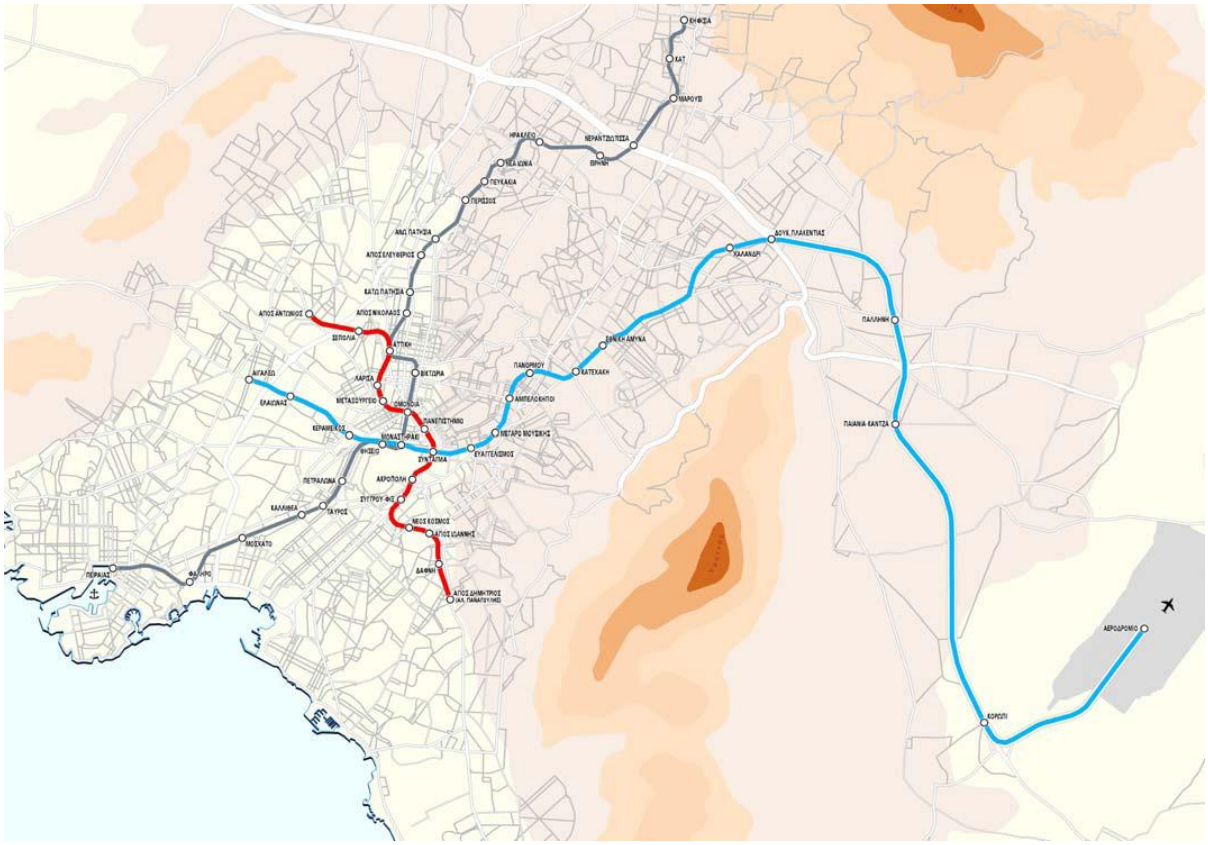
The Athens Metro as a whole operates under the ATTIKO METRO OPERATION COMPANY SA (AMEL SA) which is a subsidiary of ATTIKO METRO SA. AMEL, as an operator, co-operates with OASA[4] (Organization of Urban Transport of Athens) to which belong the buses, electric buses (trolley buses), suburban railway and tram.

[3] ISAP stands for Athens Piraeus Electric Railways. It was built between 1869 and 1957 and has undergone a major renovation in view of the 2004 Olympics. It is an urban rail line of 24 stations within Athens' fringe, extending from Piraeus to Kifissia.

[4] At the end of 1993 the *Societe Anonyme* entitled 'Organization of Urban Transport of Athens (OASA SA)' was established as a Legal Entity of Private Law; OASA became the general successor of OAS (Organization of Urban Transport) along with its responsibilities. In 1996, OASA statutes were

The total of 650,000 passengers a day (year 2009) mentioned earlier includes 350,000 using Line 2 and 300,000 using Line 3. In addition, the pre-existing Line 1 (grey line) of ISAP serves more than 415,000 passengers. Thus, the number of passengers using the interlinked metro system comes to more than a million a day.

Figure 11: Athens Metro current status

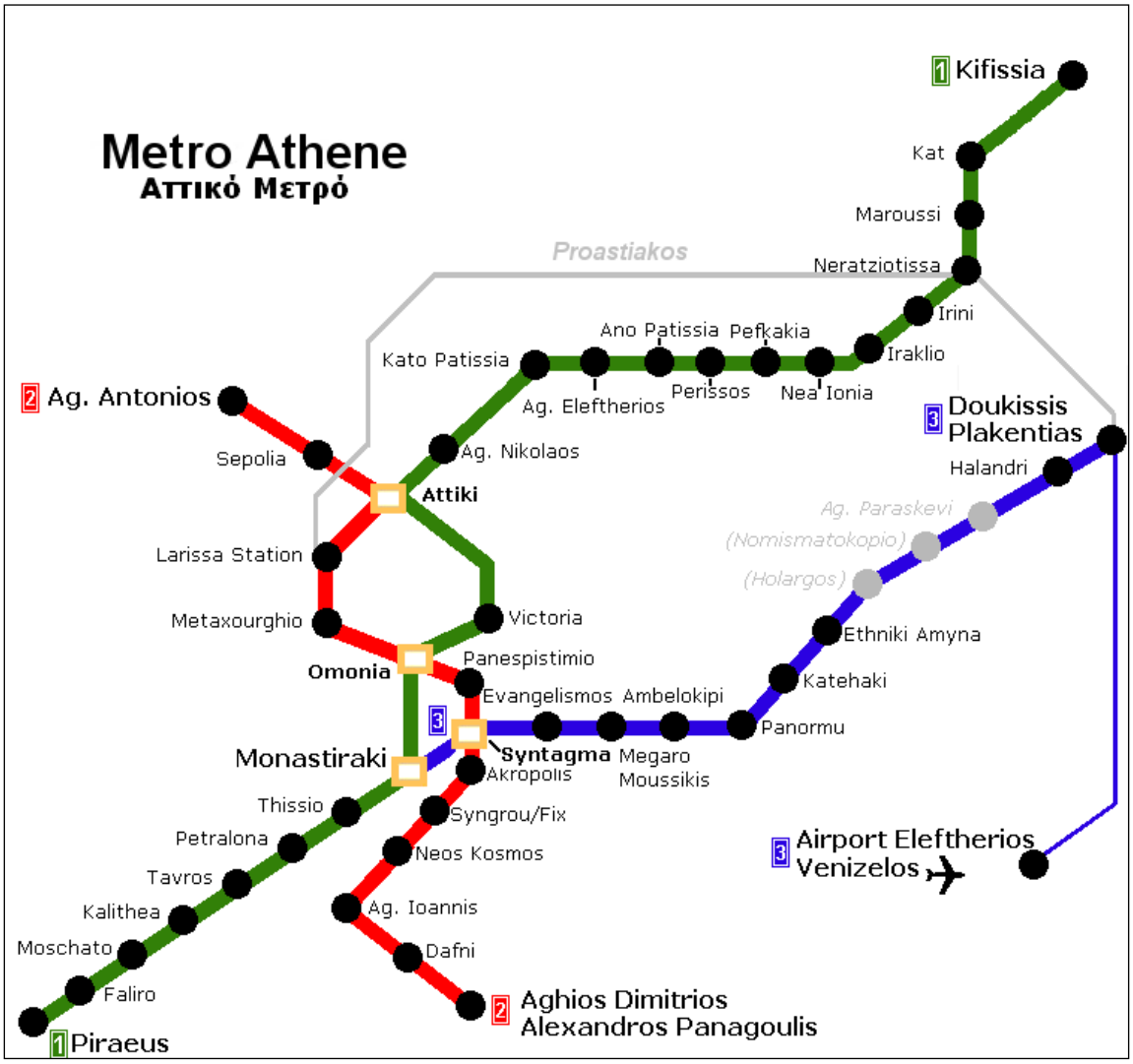


Source: ametro.gr

amended and are adapted to the provisions of Law 2414 about the modernization of urban transport (www.ametro.gr).

As of December 1998, along with the publication of Law 2669, Athens – Piraeus Urban Transport has entered a new phase. The planning, programming, organization, coordination, control and transport related services offered by all transportation modes belong to OASA, while the transport services, through buses, trolley-buses and electric railway in the area of OASA's responsibilities are provided by the Executive Agencies of Transport Services (ETHEL SA [buses], ILPAP SA [electric buses], ISAP SA [Line 1]), which are contracted with OASA and constitute its subsidiaries (www.ametro.gr).

Figure 12: Athens Metro current status



Source: www.mlahanas.de

Figure 13: Athens Metro Network with planned extensions, 2007

Source: www.UrbanRail.Net

B BACKGROUND TO THE PROJECT

Principal project objectives

According to the official announcements of the Ministry of Environment, Planning, and Public Works (MEPPW) (www.minenv.gr), the planning and construction of Athens Metro in the district of the capital city was based on the following principal objectives:

- Modernization and enhancement of the public transportation system;
- Providing a fast, comfortable and reliable mode of transport;
- Reducing private car trips in metropolitan Athens;
- Contributing to the reduction of pollution;
- Alleviation of the acute parking problem;
- Upgrading the areas around the Metro stations through organized urban renewal;
- Improving traffic conditions;
- Saving money and time for the citizens of Athens;
- Enhancing employment during and after the completion of the project;
- Obtaining additional funding from the European Union.

As a result, citizens will enjoy better services and the city will function more efficiently, influencing positively the quality of life and improving the urban environment.

Based on the views of Golias (2002), Athens, like many cities of a similar size around the world, was "suffering from traffic congestion and related problems such as a low quality of life, environmental degradation, etc. As a means toward dealing with many of these problems, a decision was made to build a new subway system to act as a complement to the existing urban rail line and the urban transport system. The new Metro system constitutes a new mode, which is a well-organized, fast and effective urban transport network". The decrease in private car trips, as well as the reorganization of city buses to feed the metro lines but not to access the city centre, constituted the premises on which the improvement of traffic and a cleaner atmosphere would be achieved in the greater Athens area. "One of the additional objectives of the project was to encourage the public to increase the use of public transportation services, shifting to the Metro system and to coordinated surface lines (like ISAP, bus lines and tram lines), choosing that as the preferred alternative to driving their automobiles through the streets of a congested city", Athens (Golias, 2002: 93).

Finally, Kostas Laliotis, the Greek Minister of Environment, Planning and Public Works in 2000, apart from the objectives mentioned above, mentioned the need for the Region of Attiki to obtain a polycentric structure and balanced development and simultaneously to enhance the role of peripheral and degraded municipalities of the metropolitan area, especially in the western part of the city (Laliotis, 2000).

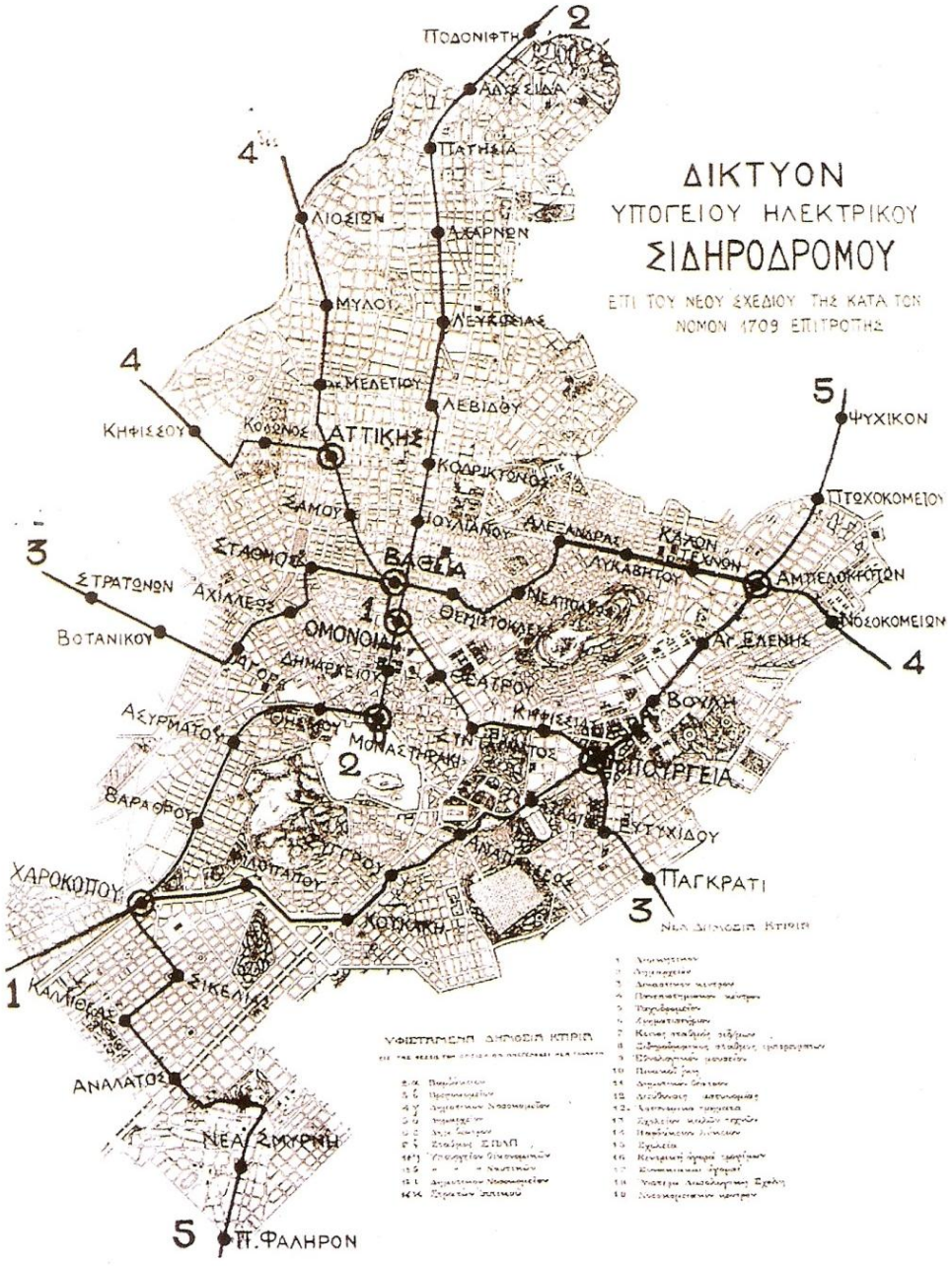
Key enabling mechanisms and decisions to proceed

The history of the proposed plans for the creation of a metropolitan railway network in Athens began in the 1920s and 1930s. The older known plan was introduced in 1925 by the engineer Alexandros Verdelis, on behalf of the Greek Engineer Association of the time, in the framework of a conference about the Athens New Plan of the time (Figure 14). This specific plan consisted of five basic metro lines (Nathenas et al, 2007).

According to the timeline illustrated in the website of Attiko Metro ('Transit in Athens', in www.ametro.gr), "at the end of World War II, as was the case in most of Europe, the public

transportation system of Athens was in ruins. The central area of Athens was served by the remnants of a worn out tramway system that was sorely in need of rehabilitation or replacement. A single Metro line extended from the port of Piraeus north through Omonoia Square - the heart of the central business district of Athens - to Attiki Square. … Bus lines and taxi services that operated before the war were virtually non-existent, most of their vehicles having been confiscated by the occupying forces or destroyed. … Faced with this situation, the Greek Government invited interested individuals to invest in acquiring buses and, alone or with partners, provide public transportation services on lines of their choice. The owner of a bus, who very often also was its driver, was responsible for its operation and maintenance on a day-to-day basis. Entrepreneurs responded and, in those early post-war days, the investment in a bus had a high rate of return" ('Transit in Athens', in www.ametro.gr).

Figure 14: The oldest metro development plan by Alexandros Verdelis, 1925



Source: Nathenas et al, 2007

"This 'simple' style of transportation in the city could not and did not last very long. As people were flocking to Athens looking for better employment opportunities than those that existed in their villages, the demand for public transportation services started to increase sharply. … The problems associated with unrestricted free enterprise led to the formation of the 'KTEL' system for managing and coordinating bus services. This acronym is made up of the initials of the words in the Greek language for 'Common Treasury for Buses'. The KTEL system, though a little cumbersome, worked well and provided reasonable bus services in the 1950s and 1960s. In 1965, public transportation usage in Athens hit its all-time high of 973m passengers on all modes" ('Transit in Athens', in www.ametro.gr).

Figure 15: Monastiraki station 1895 – ISAP Railway

Source: www.ametro.gr

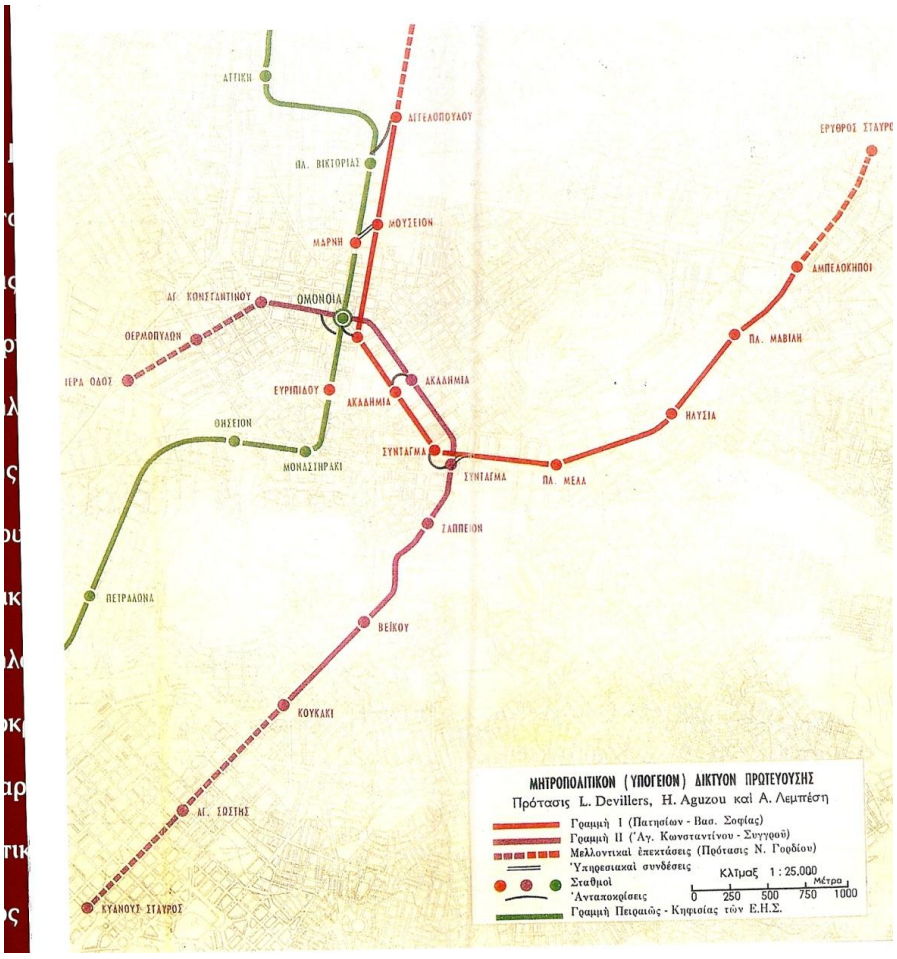
According to www/ametro.gr, "other significant changes in the urban transport network occurred during this period. Electric trolley buses were introduced in Piraeus in 1949 and in Athens in 1953. By 1961, all local tram lines in Athens and Piraeus had been replaced by electric or internal combustion powered buses; suburban trams connecting Piraeus with Perama continued to operate until 1977 when they too were replaced by diesel buses. In the meantime, a start on urban rail line was made on developing urban rail system for the Greater Athens Area. The existing line connecting Piraeus with Athens had its origins in Greece's first steam railway, placed in service in 1869. This line was extended from Thissio through Monastiraki to Omonoia in 1894 (Figure 15), electrified and converted into one of Europe's first metropolitan railways in 1904, and extended from Omonoia through Victoria to Attiki Square in 1926. Three decades later, the Metro was extended via the right-of-way of an abandoned one-meter gauge steam railway, reaching Nea Ionia in 1956 and its present

northern terminal in Kifissia in 1957. Although ambitious proposals were announced for additional Metro lines, the funds needed to construct them were not available" ('Transit in Athens', in www.ametro.gr).

The next complete proposal about the development of a metro network came from Kostas Biris in 1953, the director of the Athens Planning Organization at the time. It constituted a supplementary study of the Athens underground metro network. This specific proposal, in combination with the abruptly rising car ownership, contributed to the serious consideration, on behalf of the formal authorities, of the initiation of a metro project (Nathenas et al, 2007).

In 1957, the Minister of Transport at the time, George Rallis, invited two French transport engineers, L.Devillers and H.Aguzou from the Urban Transport Organization of Paris. With the cooperation of A. Lampesis, the Director of Ministry's Railway Department, they conducted a new study, proposing two additional lines to the existing ISAP Line 1, with further expansions (Figure 16). The same directions were also given by the well-known Greek transport engineer of the time, N.Gordios (Nathenas et al, 2007).

Figure 16: Athens Metro Development proposal from L.Devillers, H.Aguzou and A.Lampesis, 1957



Source: Nathenas et al, 2007

In the 1960s efforts to plan the underground metropolitan railway system in Athens were intensified. In 1963, a study on the Athens public transportation system, which became known as the 'Smith study' was conducted by the American consultant firm Wilbur Smith and

Associates, under the supervision of the Ministry of Public Works. Galis states that "…the goal of this study was to analyse and map transportation patterns in Athens and to develop an integrated plan for public transport. This study (Figure 17), which was presented in 1964, outlined concretely the construction plan for a metro network which would solve the emerging traffic problems of the city of Athens. The Smith study initially specified a metro 'network distributed along the axes of Patission-Lenorman-Panepistimiou-Syngrou, branching into Vouliagmenis Avenue and Vass. Sophias in the centre of Athens. This recommended network consisted of two lines. The first line was a route from Attiki through the city centre to Dafni (on the so-called Ellinikon branch), as well as to Pantios (on the so-called Faliron branch). The second line extended from the port of Piraeus to Agia Paraskeui, at the northeast side of Athens basin and through the city centre, towards the western suburb of Peristeri. … This study raised once again the issue of the metro and provided a preliminary design" (Galis, 2006).

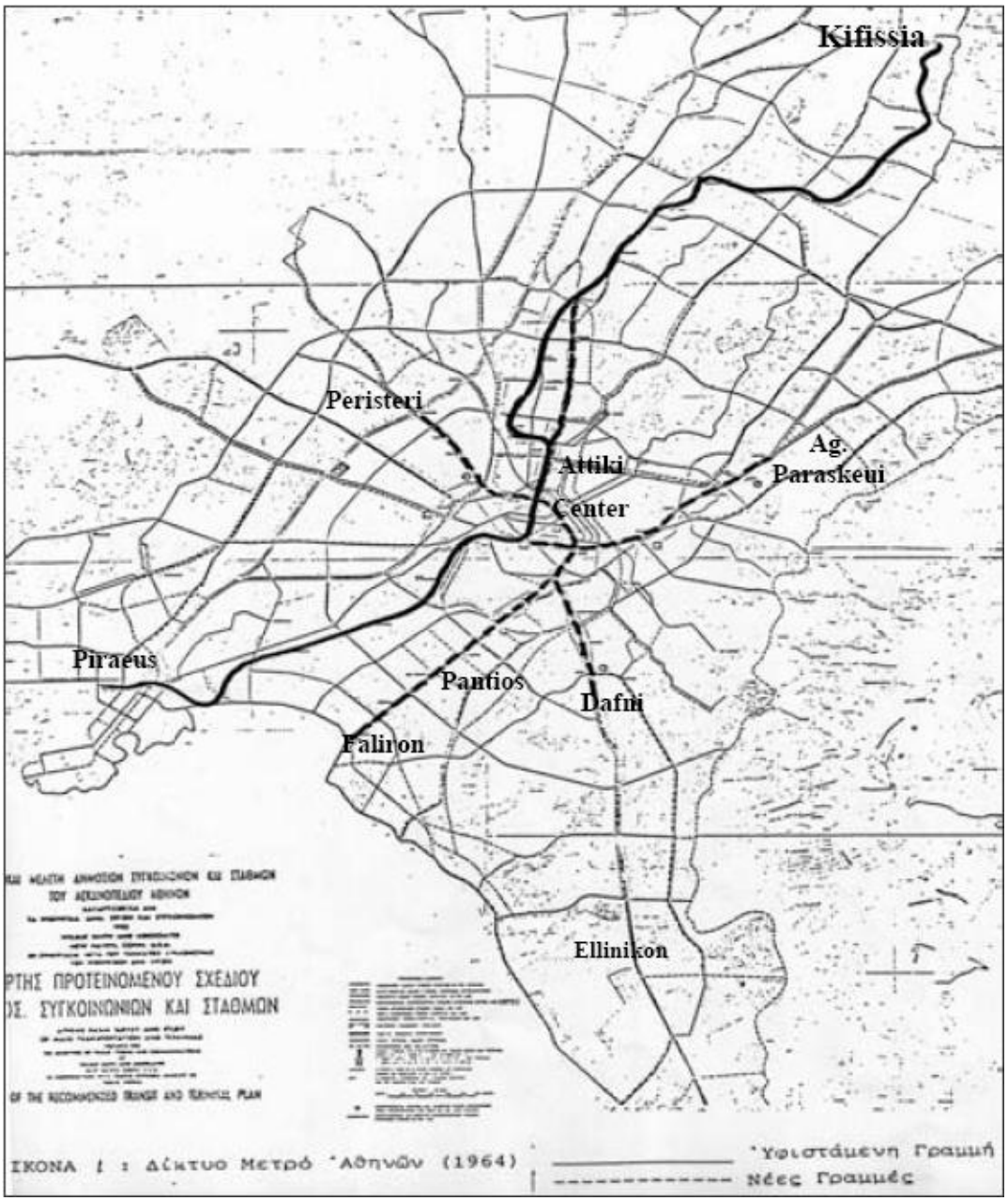
One factor contributing to the failure to realise the Smith study was the establishment of the Greek military junta on 21 April 1967. The debate and all efforts concerning the prospect of a metro system in Athens were halted and no significant action was taken on this issue for several years (Strimmenou, 2000). During the 1970s, the rate of private automobile ownership in Greece increased at a dramatic rate with the ratio of automobiles per 1,000 inhabitants rising from 15 in 1960 to 60 in 1970. Despite the increase in population, the much greater rate of increase in private automobile ownership became the most significant factor affecting usage of public transportation services. In 1971, seven years after the first Smith study, the Greek government assigned a new preliminary investigation to Wilbur Smith and Associates with the aim of providing a concrete and functional proposal for urban transport networks in Athens and the Attiki Region. The timeline of the new study extends to the year 2000. The second Smith study comprised two volumes, the first issued in 1973 and the second in 1974 (Galis, 2006 and Transit in Athens in www.ametro.gr).

The Smith study was followed by the so-called Regulatory Plan[5] of Athens conducted by the Ministry of Public Works in 1965 and Athens Master Plan in 1972 by Doxiadis. These efforts, however, had a legal standing, and the suggested plans did not contribute to mitigating the problems. The 1972 Athens Master Plan had also recommended the construction of a metro system, but the idea was met with indifference and lack of political will. Reflecting the second Smith study of 1974 (Figure 18), the authors of the study recognized that an extensive enlargement of the existing railway system and the development of a new metro would be a major improvement of public transportation within the Athens Basin. The second Smith study's recommendations for the creation of the new metro system largely duplicated the plans that had been included in the first Smith study from 1964 (Galis, 2006).

After the fall of the junta in August 1974, the new government, under the pressures of increasing traffic and pollution problems in the capital (the number of privately owned cars in 1975 reaching 200,000), took up the Smith study's proposals, which resulted in a new initiative consisting of preparing a new preliminary study in the form of a new Master Plan for the construction of the metro lines (Figure 19). According to Galis "it is somewhat unclear what the exact content of the new initiative was. There are indications, however, that the new administration reached a decision in May 1976 about the overall traffic and transport system of the capital, which also promoted the solution of constructing a metro system" (Galis, 2006).

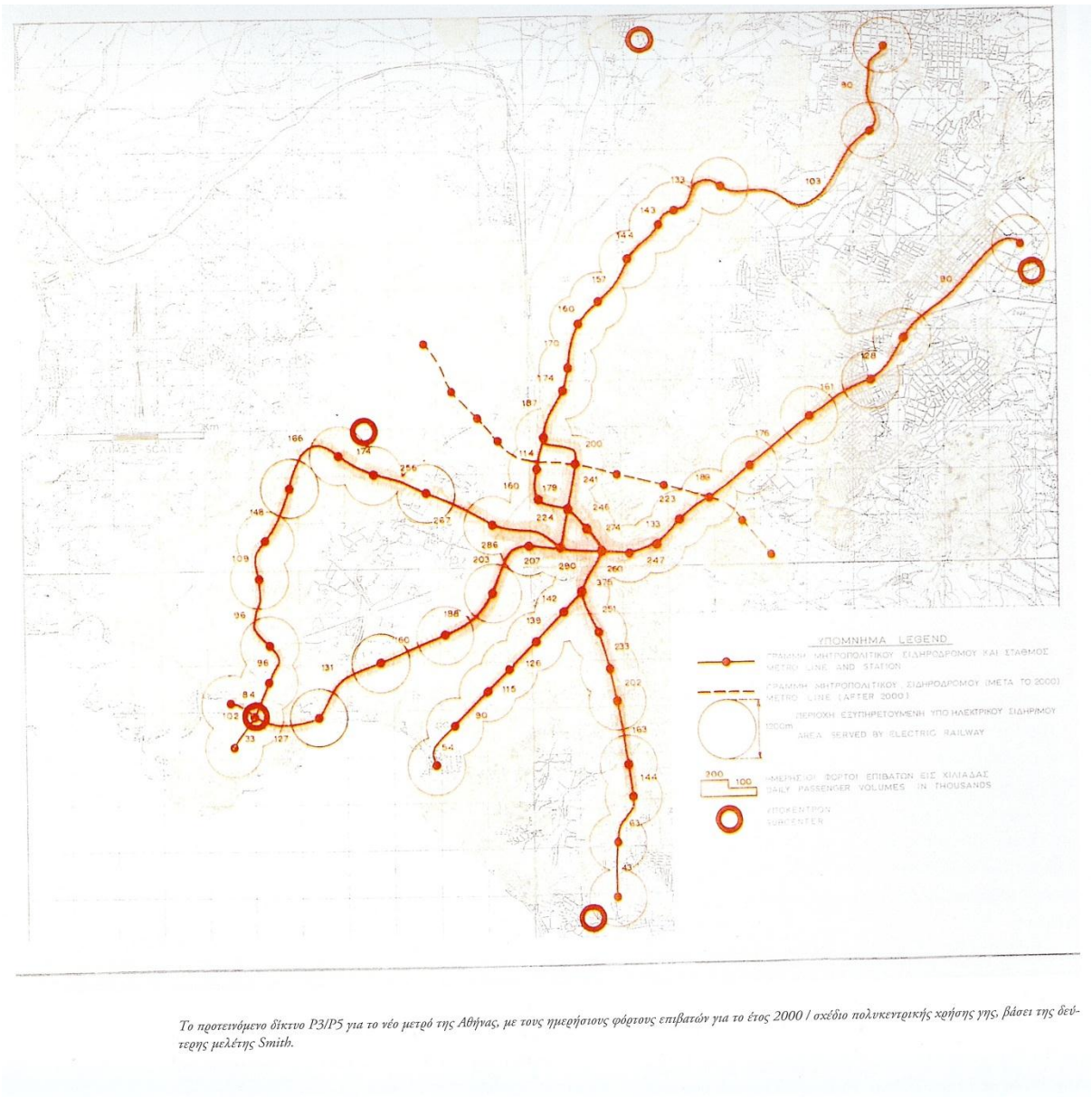
[5] Diamantopoulos, 1990: 28. "Για ποιό Ρυθμιστικό;" (For Which Regulatory Plan?).

Figure 17: Athens Basic Survey and Study of Mass Transportation and Stations (Smith Study) – recommended lines, 1964



Source: Galis, 2006

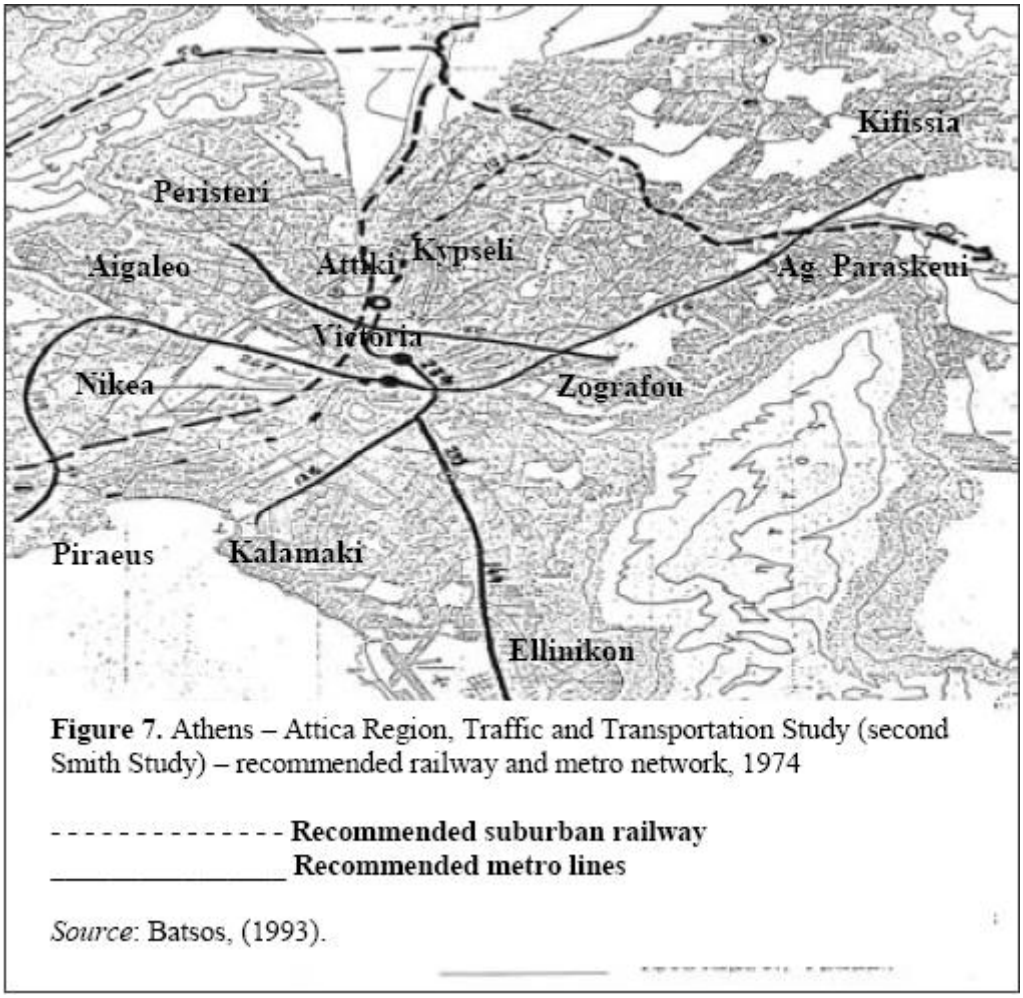
Figure 18: Second Smith Study – 1974



Το προτεινόμενο δίκτυο P3/P5 για το νέο μετρό της Αθήνας, με τους ημερήσιους φόρτους επιβατών για το έτος 2000 / σχέδιο πολυκεντρικής χρήσης γης, βάσει της δεύτερης μελέτης Smith.

Source: Nathenas et al, 2007

Figure 19: Athens – Attiki Region, Traffic and Transportation study (second Smith study) - recommended railway and metro network, 1974



Source: Batsos, 1993

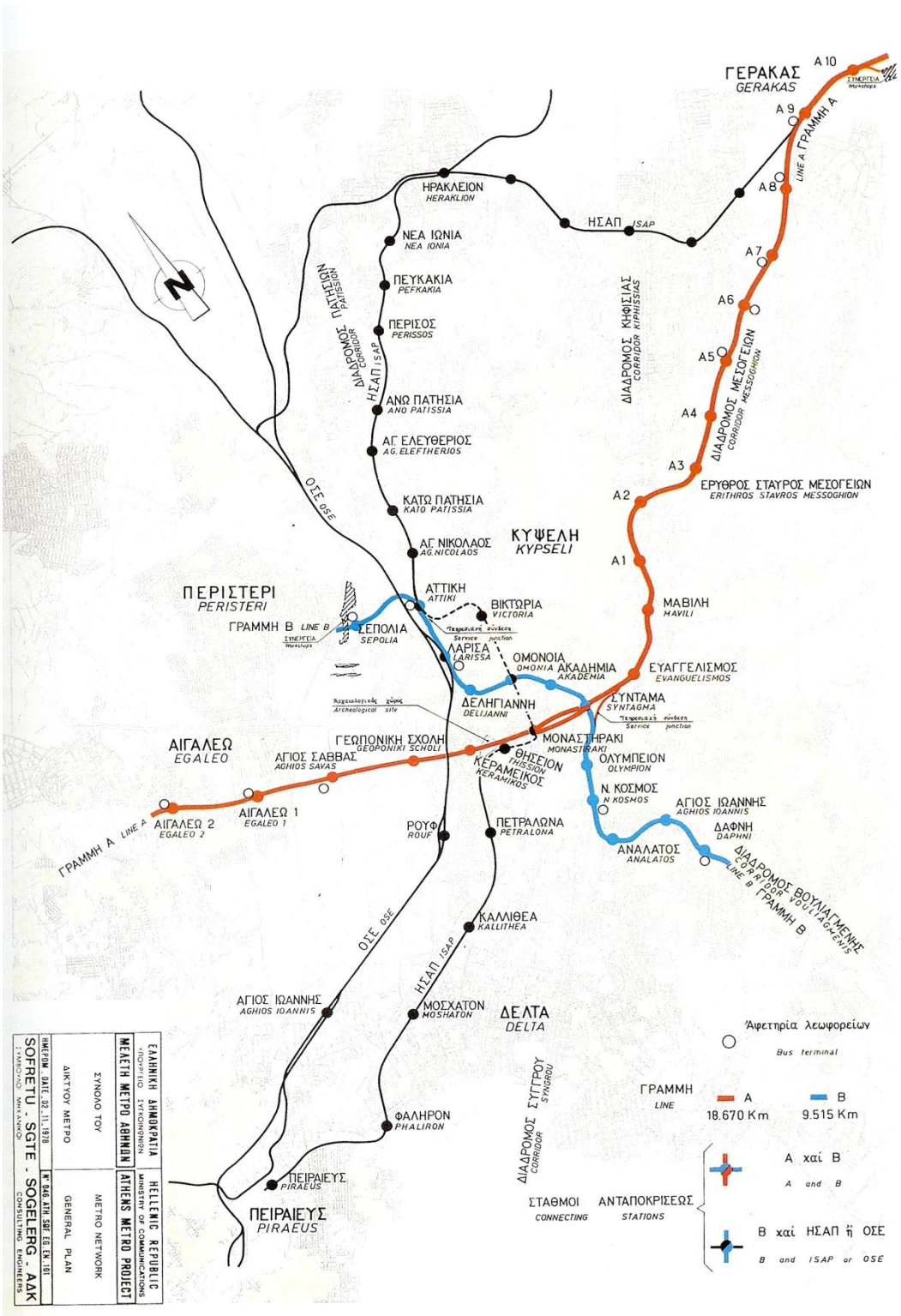
A year later, in 1977, the government decided to order a feasibility study and in 1978 a preliminary study for the actual construction of two metro lines proposed by the feasibility study. After an international competition, the government commissioned a feasibility study followed by a preliminary study from the French and Greek research consortium SOFRETU-SGTE-SOGELERG-ADK. The two lines, from Gerakas to Aigaleo (line A) and from Dafni to Sepolia (line B), proposed by the SOFRETU consortium, were in contrast to the complicated networks previously proposed by the two Smith studies. It is worth noting that, while this study was left unused for more than seven years, it eventually became the basis for the actual design and construction of the Athens Metro in the 1990s (Galis, 2006).

As described by Galis "in the late 1970s, the government nevertheless implemented a number of concrete policy measures that proved essential for the realization of the metro project. The government had the will to proceed to the construction of the metro. After a governmental meeting in July 1978 under the supervision of the Prime Minister, the administration decided to approve lines A and B as specified by the SOFRETU study (Figure 20) and to appoint the Urban Transport Organization (OAS) as the supervising authority" (Galis, 2006).
In September 1979, the National Council of Country Planning and Environment approved a new Athens Regulatory Plan (ARP). Within the framework of the new plan, which had been issued by the Ministry of Public Works under the title 'Athens 2000', architects, engineers

and town planners were invited to evaluate the role of a metro network in the Greek capital. This signified another additionally important policy initiative towards the realization of the metro that was taken by the government. State officials, city planners, and engineers engaged with the metro issue perceived the project as a concrete means for improving planning and transport structures in Athens. City planner Kloutsinioti[6] notes that all researchers, State officials, and experts who participated in the planning processes of 'Athens 2000' responded positively to the prospect of building a metro in Athens. The implementation of the metro was perceived as a stimulus for the gradual transformation of land use and town planning in the capital towards the desirable goal, namely the improvement of Athens' spatial quality. Although the metro project thus began to gather support from the public planning community, many things still remained to be done in order for a realistic procurement and implementation of the project to become reality. The 1970s ended promisingly for the metro: two preliminary studies had been completed (the Smith study and the SOFRETU study) and the project had gained increasing attention from government officials, city planners, and engineers in relevant companies.

[6] Kloutsinioti, 1990: 27. 'Athens metro as an element of Athens' spatial improvement'.

Figure 20: General Plan of Metro Network – SOFRETU Study 1978



Source: Nathenas et al, 2007

While the population of the Greater Athens Area was increasing at a significant rate (3.5% per annum in the 1961-1971 period and 1.75% per annum in the 1971-1981 period), the much greater rate of increase in private automobile ownership became the most significant factor affecting usage of public transportation services. In 1961, 39,000 automobiles were in circulation. By 1971 this number had grown to 170,000, representing a phenomenal rate of

growth of 15.8% per annum. Although the growth rate declined gradually to 11.2% per annum in the 1972-1981 decade and to 6.7% in the 1982-91 decade, the number of automobiles in use in Athens increased to 492,000 in 1981 and to 943,000 in 1991. In addition, over 16,000 taxis had been licensed by 1991. The very high ownership and usage of automobiles and taxis had a significant depressing effect on the ridership of urban transit services. Public transportation trips per year dropped from the record figure of 973m passengers in 1965 to a spiraling 510m passengers in 1983. The attendant loss of revenue, coupled with spiraling operating costs, made urban transit services unprofitable (www.ametro.gr).

Recognizing the importance to public welfare of public transportation services, the Government began to supplement the revenues collected by operators with subsidies to offset their losses. Concerned about the decreasing level and quality of service being provided by the urban public transport system, the Government made several attempts to reorganize it. After considerable study and debate, the following major changes in its organizational structure took place in the 1970s (www.ametro.gr):

- The privately owned Electric Transport Company, operator of the trolley bus lines in Athens and Piraeus, was dissolved in 1971 and replaced by the Government-owned Athens-Piraeus and Suburbs Electric Bus Company;
- The privately-owned Hellenic Electric Railway Company, operator of the Metro line and the Piraeus-Perama tram line, was dissolved in 1976 and replaced by the Government-owned Athens-Piraeus Electric Railway;
- The diesel bus lines operated by the Common Treasury for Buses were taken over by the Government-owned Urban Transport Company in 1978.

In the spring of 1980, the government signed a supplementary contract with the French consortium SOFRETU. The new contract concerned "the extensions and certain arrangements on difficulties that emerged as a result of the application of the initial contract". In September 1980, the government commissioned SOFRETU to study exactly where exploratory underground boreholes for the metro should be located. On 27 September 1980 the Athens-Piraeus Electric Railways (ISAP) took over the metro project's supervision from OAS through the enactment of Law 1074/80, which superseded the previous Law 588/77. The new law stipulated that ISAP was assigned responsibility for conducting all studies and investigations concerning the metro, as well as for construction[7]. The rationale behind this decision was the fact that ISAP was regarded by the government as the appropriate organization for implementing the metro project since it had accumulated relevant experience and competence from the operation and supervision of the Athens-Piraeus railway. Under clause 6 of the new law, a new metro department within ISAP was established with the task to supervise and coordinate the metro study (Galis, 2006).

In October 1981, a new government was elected. According to Pagoulatos (2002), who was a member of the government's Council of Economic Advisors, the new government's economic strategy focused mainly on redistributive policies that aimed at social and economic inclusion of marginalized citizens, such as left-of-centre citizens, rather than on investment in major infrastructure. As a result, significant funds were relocated away from infrastructure plans and the metro project was suspended. Moreover, major bureaucratic, economic and political obstacles prevented an immediate procurement process. As maintained by Balourdos et al (2001), the most important barrier to the progress of the project was the decision by the newly elected government in December 1981 to put off all major infrastructure projects and to withdraw resources from the capital.

[7] Official Government Gazette (FEK), 1980: 2653. Law 1074. 'About the assignment of the Underground Railway of the Capital (Metro) to ISAP S.A'.

In 1985 the government made the decision to raise the metro idea again in order to address Athens' traffic and environmental problems. The project became part of a conscious policy reflected in a new Regulatory Plan, the 1985 Regulatory Plan for Athens as enacted by Law 1515/85[8]. This new law aimed at structuring and planning the Greater Athens area (GAA) within the framework of limiting the city's growth, structural zoning, public transport systems, technological and social infrastructure, land-use and housing policy. In particular, the new plan proposed two previously suggested metro lines, the A and B lines: the Piraeus-Aigaleo-Gerakas line (line A) and the Peristeri-Glyfada (line B). The metro division within ISAP submitted a final proposal for the underground network compatible with the new plan. The lines described by the SOFRETU plan as A and B were renamed lines 2 and 3 (Galis, 2006).

Recognizing the need for proper planning, programming and budgeting of urban transit services, the Government had established the Urban Transport Organization in 1978 as an independent publicly-owned company with the mandate to co-ordinate and assist the three operating companies. In summer 1991, based on Law 1955, ATTIKO METRO SA was established. Its scope is the design, construction, organization, administration, operation, running and development of the Metro network in the area of Attiki Prefecture and, thus, at the end of 1992 the construction of two new Metro Lines was initiated. At the end of 1993 the *Societe Anonyme* entitled 'Organization of Urban Transport of Athens (O.A.S.A SA)' was established as a Legal Entity of Private Law; O.A.SA became the general successor of O.A.S. along with its responsibilities. In 1996, O.A.SA statutes were amended and adapted to the provisions of Law 2414/1996 on the modernization of urban transport (www.ametro.gr).

As of December 1998, along with the publication of Law 2669/1998, Athens–Piraeus urban transport entered a new phase. The planning, programming, organization, coordination, control and transport related services offered by all transportation modes belong to O.A.S.A, while the transport services, through buses, trolley-buses, electrical railway in the area of O.A.SA's responsibilities, are provided by the Executive Agencies of Transport Services (E.THE.L. SA, I.L.P.A.P. SA, I.SAP. SA), which are contracted with O.A.SA and constitute its subsidiaries. In the meantime, the construction of Lines 2 and 3 of the Athens Metro progressed and in January 2000 the first section of the Project Line 2 'Syntagma–Sepolia' and Line 3 'Ethniki Amyna–Syntagma, 13km long with 14 stations, was commissioned. In November 2000, Line 2 section SYNTAGMA DAFNI, 5km long with five new stations, is added to the network, while in the same year the Company 'ATTIKO METRO OPERATION COMPANY SA (AMEL SA)' is established, its purpose being the management of the system's operation (www.ametro.gr).

It has to be mentioned that the station of Kerameikos had already been excluded from the Metro basic project in 1997. Serious objections had been stated by several members of the council of Municipality of Athens, by geologists and by the archaeological agency of the Ministry of Culture, in terms of the danger and damage that the ancient cemetery of Kerameikos could possibly suffer, because of the planned construction works. As a result, the length of the basic Metro project was reduced by one station and 0.7km tunnel route (www.tee.gr).

In April 2003, Line 3 section SYNTAGMA-MONASTIRAKI, 1.5km long with one new station (Monastiraki Station), was added to the network and consequently the last remaining part of the Athens Metro basic project was set in operation (Nathenas et al, 2007).

[8] Official Government Gazette (FEK), 1985. Law 1515. 'Regulatory Plan and Environment Protection Programme of the Greater Athens Area (GAA)'.

Main organizations involved

Government

European Union (EU): Subsidized the project through the European Regional Development Fund (ERDF). It also had responsibility for supervision of the process of the project's progress and implementation.

The Greek Parliament: The parliament has the legislative duties of the Greek state. The contracts of 1991 and 1994 were ratified by the parliament as Laws of the Greek state.

The Ministry of Environment, Planning and Public Works (MEPPW): Responsible for the supervision of the project. It is also responsible for finding additional funding mechanisms for the upcoming expansions of the Athens Metro. The ministry is the sole shareholder of ATTIKO METRO SA.

Ministry of Transportation and Communications (MTC): Responsible for the control and the supervision of the operation of Athens Metro, after the completion of each part of the project. The Ministry is also responsible for the supervision of Attiko Metro Operation Company.

Ministry of Economy and Finance (MEF): Responsible for allocating the national budget to MEPPW. In collaboration with MEPPW and other ministries, it conducts the National Development Plan submitted to the EU. When approved it becomes the Community Support Framework that co-finances the Plan through the Structural Funds (ERDF, European Social Fund, etc).

Ministry of Culture (MoC): Responsible for all archaeological activities and the management of the findings, according to Greek legislation.

Banks

European Investment Bank (EIB): Responsible for providing the loans for the completion of the project.

Companies

ATTIKO METRO SA: "The State company responsible for the implementation and the development of Attiko Metro network" ('ATTIKO METRO SA', in www.ametro.gr). It was "established by Law 1955/1991 as a legal entity of private law in the form of a *societe anonyme*, the Greek State being its sole shareholder. Up to 49% of the shares are transferable to natural or legal entities of the private sector and can be introduced in the Athens Stock Exchange. Furthermore, ATTIKO METRO SA can merge with other mass transit organizations, either public or private, operating within the area of the Attiki Prefecture, provided that at least 51% of all the shares of the merged company remain with the Greek State. The purpose of this company is the design, construction, organization, administration, operation, running and development of the urban railway network and, in general, of the electrical railway network in Attiki Prefecture, except for the OSE railway network" ('Establishing Role of AM', in www.ametro.gr).

Olympiako Metro: The joint venture, a consortium of 23 companies, responsible for the construction of the basic part of the project after signing a contract with ATTIKO METRO SA (Law 2274/1994 - see below, section 'Main Contracts and Contractors').

BECHTEL International Inc.: The project consultant of ATTIKO METRO SA and Olympiako Metro consortium from 1992 to 2003. By the provision of Law 1955, ATTIKO METRO SA

could engage Greek and foreign technical and specialized administration personnel necessary for its operations and retain domestic or foreign entities as consultants. On this basis, BECHTEL Inc. was responsible for providing the necessary technical and specialized personnel, consulting and 'know how' services to ATTIKO METRO SA., also for providing services to perform all the activities and obligations of Attiko Metro S.A with regards to the interaction with Olympiako Metro joint venture (www.BECHTEL.com). In addition, based on the information provided by the interview with INT9, BECHTEL International assisted significantly in reporting to the EIB and EU which were the major funders of the project.

ISAP (Athens – Piraeus Electrical Rail): On 27 September 1980, the Athens-Piraeus Electric Railways (ISAP) took over supervision of the Metro project from OAS through the enactment of Law 1074/80, until 1985. From 1985, the Ministry of Environment, Planning and Public Works took over this responsibility until the establishment of ATTIKO METRO SA in 1991 (Wickham and Battaglini, 2001).

Committees

Steering Committee for Metro Development Study: A joint committee set up in view of the future extensions of the underground. In 2000, it delivered a voluminous Metro Development Plan, conducted by the consultancies Hellenic Consultancy Tech SA, Dromos, OMEP and Papageorgiou.

Planning and environmental regime

The Greek legislation covering transport infrastructure planning and development comprises a magnitude of legal documents with often conflicting provisions (Zografos et al, 2004). It is a complex legal framework consisting of laws and other legal acts which have been, in many cases, amended through subsequent legal acts, while the same time there is also substantial relevant EC legislation with statutory standing. Below is provided a list of the legislation that is most important and relevant to the Athens Metro project:

- Law 1418/84 and the Presidential Decree 609/85 covering the legislation on public works contracting;
- Law 1515/85: Regulatory Plan and Environmental Protection Programme for the wider Athens Area;
- Law 1650/86: On the protection of the Environment and the Environmental Impact Assessment of projects (amended in 1990 by joint ministerial acts 69269/5387/90 and 75308/5512/90 and in 2000 by Presidential Decree 334/00 to incorporate all relevant EU Directives);
- Law 2338/95 for the ratification of the Public Private Partnership between the Greek State and the private concessionaire 'Athens International Airport SA'.

Regarding the general planning policy adopted during the construction of the project, referring to the information provided by the interview with INT9, planning should have an overall aspect; however the State decisions did not adopt this precondition at a high level. INT9 argues that the Metro is not only for people who walk to the stations. One has to feed the system with bus lines. There was no overall thinking and it was very hard to change the minds of people. For example, there is no other city in the world with a company like ATTIKO METRO SA, which is totally separate from the operation of the Metro, and a line like ISAP, which is totally separate administratively and operationally from the Athens Metro.

Environmental statements

According to Axarlis (1999), at that time a concern was expressed by Greek archaeologists and scholars, who were worried that ancient remains in the centre of classical and modern Athens could be damaged or destroyed by a new subway tunnel under Ermou Street linking Syntagma Square with the Monistiraki district. Originally the tunnel, part of the Athens Metro's Line 3, was to pass underneath Mitropoleos Street where the Athens cathedral of the Greek Orthodox Church stands. Protests by church authorities led to the new route under Ermou Street. But the new tunnel was supposed to pass underneath the eleventh-century church of Kapnikarea, a significant monument of Byzantine Athens, and Panagia Pantanassa, a seventeenth-century church that had already suffered extensive structural damage from subway work below it. In addition, in 1997 the Greek government, following international protests, intervened and forced cancellation of a tunnel being dug by Attiko Metro, also part of the Line 3, that was to pass underneath the archaeological site of Kerameikos, the most important cemetery of ancient Athens. More than 1,000 ancient tombs were destroyed during the construction and as a result there was a change to the tunnel construction route, in the pattern that is shaped and completed today. In general, it can be supported that because of the high necessity of the Athens Metro project, to upgrade the quality of everyday life in the broader area of the capital city, a dominant mentality prevailed during the completion of the project, on behalf of the official State, regarding a loose treatment of deriving environmental issues, which could be delaying obstacles in the process.

Overview of public consultation

According to INT9, the decision on location of the stations was affected many times by the pressure of the people. There were conflicting opinions, on the part of the citizens, as to whether they wanted a station near or far from their homes. As INT9 states, this is a risk in every city and requires handling in a fair but firm way, looking for the best interest not only for the hundreds of local people, but also for the benefit of hundreds of thousands of people over the years. For example, the decision on the location of the station entrance in the Mesogeion area was strongly influenced by local reactions. Also, in the case of Megaro Mousikis (Music Hall) station, the tunnel route was changed, because of the reaction of the administration of the Megaro Mousikis organisation.

According to INT1, there were reactions from citizens, even concerning the name of the Metro stations, as in the case of Agios Dimitrios (named also as Alexandros Panagoulis) station. In some other cases, there were pressures from local authorities for the Metro network to reach their municipality, when this was absolutely not feasible and there was not even a relative perspective in the Metro development studies.

Regarding accessibility for disabled people, research by Galis (2006) suggests that the Metro was not initially designed to integrate facilities and provisions for people with special needs, neither in stations nor in trains, which reflected the stance of Greek society towards disability in the beginning of the 1990s. It has also been noted that “the Metro was not originally designed as an accessible system (for disabled people). It required an additional contract that included elevators and all the necessary elements for an accessible system” (Galis, 2006). The process of designing, constructing and implementing an accessible Metro was thus far from self-evident or linear. Instead, it entailed complex interactions among groups with divergent interests, expectations and goals, as well as struggles and conflicts between representatives of disability organizations, politicians, engineers, public administrators, architects and managers of the project. These interactions concerned negotiations about whether and how accessibility provisions would be applied in the project and how technical problems were to be solved (Galis, 2006).

During the 1990s and in parallel with the start of construction work for the Metro, disability organizations had increasingly claimed extensive participation in policy and decision-making processes. As the Metro project unfolded, disability organizations were involved in different phases of its development and with varying results. Despite their increasing political influence, it was not clear, however, to what extent the Metro would be accessible or what role disability organizations would play in shaping the project. The initial neglect of accessibility provisions by the government and protests by disability organizations were successively replaced by the formal involvement and engagement of Greek disabled people in the design process. After these interventions, the final version of the Metro system indeed included facilities and services for people with disabilities. Today the Athens Metro symbolizes not only a landmark for accessible systems in an otherwise inaccessible city, but also a distinct socio-technical controversy between the Greek government and disability organizations, as well as between Metro engineers and disabled people (Galis, 2006).

In the framework of the services provided by ATTIKO METRO SA, it has to be noted that there were serious restrictions about the boarding of bicycles in the Metro coaches, a policy that is in opposition to the general 'mentality' of other European metro networks. In September 2007, the Mayor of Athens Nikitas Kaklamanis submitted the following statement to the Ministry of Transportation and Communications, which was responsible for the operation of the Athens Metro:

> "Tomorrow I intend to send a letter to new Transport and Communications Minister Costis Hatzidakis, in which I will request his assistance and consent in fulfilling two demands put forward by the Athens City Council, namely:
>
> - The extension of Athens Metro underground operating hours until 2am, at least on Fridays and Saturdays;
> - Allowing the transfer of bicycles via the Athens Metro for all individuals, who wish to use this environmentally-friendly mode of transport in our car-clogged city.
>
> I hope that, this time, the government, via the competent Minister, will show understanding with regards to an issue that affects mostly young people and low-income citizens"
> (www.CityofAthens.gr).

The official request presented above, contributed to a decision on the extension of the Athens Metro operating hours after a few months, with a relatively successful result. However, there were serious objections by the Company's staff, regarding the extension of working hours and the respective overloading of working shifts. No actual results were obtained concerning the requests and needs of the cyclists' community.

In terms of specific complaints on behalf of the Greek scientific community, it is worth reporting a complaint that was published in the Newsletter of the Hellenic Institute of Transport Engineers. A brief note was published in the no.159 issue (Hellenic Institute of Transport Engineers, 2007) of the journal and concerned the statement of serious objections about the level of accessibility for pedestrians at the Metro station of Agios Dimitrios. The response came from the Communication department of ATTIKO METRO SA, on 28 March 2008, explaining that the existing four station entrances/exits sufficiently cover pedestrians' needs for accessibility (Department of Communication of ATTIKO METRO SA, 2008).

Ecological mitigation

According to the official announcements of the Hellenic Ministry of the Environment and Public Works (www.minenv.gr), the adaptation and construction of Attiko Metro in the district of the capital city has produced numerous benefits for the city of Athens, the environment and its citizens. Indicatively, there was a modernization and enhancement of the public transportation system, so trips became faster and more comfortable. The number of private cars in the streets of the capital has diminished; as a result, the levels of pollution deriving from vehicles have decreased by about 8%. The acute parking problem has been rather alleviated and an upgrading of the areas around the Metro stations occurred, through organized urban renewal. A number of open areas and squares have been created at the sites of the Metro stations. In general, traffic conditions have improved, citizens enjoy better services and the city functions more efficiently, positively influencing the quality of life and improving the urban and physical environment.

INT1 pointed out that in the framework of the research conducted for the Athens Metro Development Study, environmental measurements of air pollution were undertaken in 1999 (before the launch of the Metro operation) and in 2000 (after the launch of the Metro operation). The results showed that the levels of air pollution had diminished by 4% to 8%. Regarding the social appraisal of the project, INT1 argued that an investment like Athens Metro is very valuable, since it provides the opportunity for people without means of private transportation to travel. Specifically, the Athens Metro Development Study suggested that for every Euro invested by the State in road infrastructure, 3 Euros should be invested in public infrastructure programmes.

Regeneration related impacts

Archaeological findings

"The construction of the Athens Metro, one of the largest public works projects in Europe, took place among the greatest sites of classical archaeology; five of the new Metro stations are located within ancient Athens, in the shadow of the Acropolis.

The archaeological programme is a joint effort of ATTIKO METRO SA, the owner of the project, Olympic Metro Consortium (the contractor) and the Ministry of Culture (MoC), which is charged under Greek law with the responsibility of supervising all archaeological activity. The role of the MoC is to plan and supervise the excavations, safeguard artifacts and to educate the public through museum exhibits. ATTIKO METRO SA provides funding and coordinates the interface of MoC activities with other parties. The Olympic Metro Consortium mobilizes resources and provides logistical support required by the MoC to perform excavations, curation and storage. This sport includes specially trained labor, supplies, tools, equipment and new laboratories located in the renovated buildings.

Prior to the start of the project, OMC together with MoC verified with investigation trench and other methods, expected archaeological high risk areas as they were described in the preliminary design. These are based on the results of careful mapping of previous subsurface investigations, research of ancient literature and records such as the travelogue of Pausanias, test trenches, and modern techniques such as ground penetrating radar. This analysis highlighted five stations (Syntagma, Monastiraki, Kerameikos, Olympion and Academia), where major excavations are also being performed at ventilation shafts, mainly in the centre of the city (Mitropoleos, Assomaton, Ermou and Arionos, Iakhou, Amalias, National Garden, Amerikis and Petmeza), where significant archaeological findings were and are anticipated. The excavations uncovered material from all periods, from the Neolithic to the modern era (Figures 21 & 22). Discoveries include a bathhouse, metal working shops,

aqueducts, and cisterns, ancient roads and city walls, drains, cemeteries and random burial, and an enigmatic room filled with oil lamps decorated with erotic scenes".

(Source: Cyber Thesis. Daily On-line Journal, Ministry of Foreign Affairs, Greece, available in http://www.hri.org/cthesis/special/metro/page8.html lastly accessed on Febrouary 14, 2010)

Figure 21: Stratigraphy of the antiquities wall of Athens Metro Syntagma station

Source: www.savingantiquities.org

"At work sites, for which non-important antiquities were expected, MoC archaeologists are 'on-call' and respond as soon as construction workers encounter antiquities. Construction resources are diverted elsewhere, until archaeologists clear the site. Surprise discoveries to date include a totally unexpected sarcophagus at Ethniki Amyna station and a large Roman-period drain at Larissa station. A major factor in the decision to use tunnel-boring machines to bore 12km of train tunnels through solid rock was to eliminate the possibility of encountering cultural resources. Several stations such as Olympion, Monastiraki and Academia have been built by underground tunneling techniques, rather than the surface excavation technique, in order to minimize the disturbance of known sites."

(Source: Cyber Thesis. Daily On-line Journal, Ministry of Foreign Affairs, Greece, available in http://www.hri.org/cthesis/special/metro/page8.html lastly accessed on Febrouary 14, 2010)

Figure 22: Antiquities found near Syntagma station

Source: http://www.ametro.gr/page/default.asp?la=1&id=2375 - #

As INT9 notes, the interventions from the archaeological agency have probably delayed the project by about two to three years and increased the cost by about 15-20%. However, the display of the findings has made the Metro project unique. In Kerameikos, an important ancient cemetery was discovered and the entire Metro route had to be changed; INT31 commented that relative interventions, although necessary, hurt the overall project both economically and in terms of reputation.

Areas surrounding stations

In the areas surrounding the Metro stations, a number of organized open urban areas and squares were created, through urban renewal initiatives. In a few cases, as in the case of Katechaki station, architectural design of the area was adopted (Figure 23). It is worth mentioning the case of Kerameikos Metro station, where a relatively large square has been developed, accompanied by the ongoing creation and function of various bars and

restaurants. The existence of the Metro station, thus the high level of accessibility to the area, has attributed many gentrification features to the area and at the current period it constitutes one of the most famous recreation sites in Athens. However, as INT9 points out, the intervention and the regeneration of areas surrounding stations took place at a very restrained level, because the complaints of the inhabitants in every area were very intense, and the political influence very restrictive.

Figure 23: Katechaki station with Bridge Designed by Santiago Calatrava

Source: www.ametro.gr

Parking facilities

Two organised parking facilities are available to Metro users: at Syngrou-Fix Station a controlled underground parking facility and a bus transfer station operating on a 24-hour basis, and at Halandri Station (not a base project station) a controlled open-air parking facility. According to Karadimas (2006), civil transportation engineer, Syngrou-Fix Station consists of six underground parking levels and 640 parking spaces. It also has a direct connection with the Metro station and a bus terminal. Halandri Station includes 280 parking spaces and a bus terminal.

The parking rates render the Metro parking facilities particularly attractive to Metro users, since high quality services are provided at a relatively low cost, while long-term parking is discouraged, and, thus, parking places are utilised in the best possible way. Finally, non-controlled parking facilities are available in Katechaki, Ethniki Amyna and D.Plakentias (not a base project station) stations with 630 parking places specifically. More stations are now constructed, planned or already delivered in stations not located in the core of Athens and not belonging to the Base project (e.g. Nomismatokopeio station on Line 3).

INT1 stated that one of the main goals of the project was to create as many parking places as possible, in order to promote the Park and Ride mode. However, as he admits, this part of the programme has not exhibited great progress over the years. Since there are few parking options, only 6-7% of passengers can choose the Park and Ride mode. Most passengers – 57% - walk to the Metro stations and about 25% reach the stations by bus (which is in compliance with the idea of feed-in lines). Enhancing the bus terminals next to stations is another policy that should be adopted, although there are significant delays in this aspect too.

(Source: www.amel.gr)

Restructuring of the bus transportation system (www.amel.gr)

Approximately 650,000 passengers use the two Metro Lines 2 and 3 on a daily basis (base project plus extensions). It has been estimated that the Metro's operation reduced by 70,000 the number of cars entering the city centre or, in other words, it reduced the vehicular traffic by 335,000 vehicular kilometres on a daily basis. At the same time, the Metro operation was combined with the restructuring of other public transportation modes; the creation of new bus terminal stations close to the Athens Metro Stations led to an overall reduction in the number of bus terminal stations in the city centre. Therefore, the Metro's operation significantly reduced not only the number of private cars, but also the number of buses in the centre of Athens.

Increase in land prices near Metro stations

According to the estimations of Revithis (2000), President of Real Estate agents in Greece at the time, real estate products in the area adjacent to Athens Metro Stations exhibit high demand, especially in the cases of purchase of land, apartments and business offices. The areas around new Metro stations have set off a new wave of investment interest in land and buildings that for many decades were indifferent to buyers and real estate agents. The Metro project has altered the transport profile of the capital city of Athens and as a result it has changed the general preferences for land purchase and the development of business projects and initiatives.

In particular, increased demand has emerged, and is expected to emerge, for the purchase of land for construction of buildings, parking places, offices, stores and houses. Undoubtedly, stores in the area near Monastiraki and Omonoia stations have particularly

benefited, in terms of consumption levels, because of large numbers of passengers and people passing by. The area around Dafni station benefits from proximity to the commercial Vouliagmenis Avenue nearby. Rents and sale prices of offices, stores and apartments have shown an increasing tendency, which is expected to continue, in the areas around Panormou, Katechaki and Ethniki Amyna stations. It is also worth mentioning that the real estate units visible from the older or newer Metro stations have or will enclose an increase of 10-20% of their values, if they present positive features for further development or utilisation.

Appraisal methods and approaches

Economic benefits of the project

The 'Athens Metro Development Study' (2000), in the framework of the quantification of economic benefits, reported that the economic benefits of the Athens Metro project include:

- Time savings for passengers switching from other public transport modes (such as bus or trolley bus) to the Metro;
- Reduced road congestion caused by car users switching to the Metro and hence freeing road space for remaining road users;
- Vehicle operating cost savings resulting from reduced use of cars, buses and taxis;
- Reduction in road accidents resulting from transfers from road to rail transit;
- Reduction in road infrastructure investments (car parking requirements) as a result of car users switching to rail;
- Environmental benefits, including reduced air pollution; and
- A residual value indicating the net value of the project at the end of the evaluation period.

Based on the information provided by the Economic Study Update of ATTIKO METRO SA, conducted by Booz-Allen & Hamilton Ltd. and Planning SA (March 1998), because of uncertainty in relation to both underlying assumptions and modelling procedures, a range of scenarios were developed for testing. The Central Case scenario included the following key assumptions:

- Per capita income growth of 3% per year;
- Increasing peak period road traffic congestion at a rate of some 3% per annum;
- Underlying growth in demand for the Metro of 2.2% per annum.

Under these assumptions transportation benefits were calculated at 77.153bn Drachmas in 2002 (or EUR 226.421bn), rising to 336.006bn Drachmas by 2026 (or EUR 986.078bn). Benefits by category are summarised in Table 1. The greatest benefits are generated through time savings for existing public transport users. These make up 40% of all benefits in 2002, increasing to 42% by 2026. The other major contribution comes from 'non user' benefits. These are expressed in the form of lower accident costs (brought about by people transferring from relatively dangerous private vehicles to the relatively safe Metro), lower pollution, lower vehicle operating costs and lower road user times (through taking cars off the road and hence alleviating congestion for remaining road users). Benefits from these sources make up 60% of benefits in 2002 and 58% by 2026.

Car park benefits accrue through diverting people who previously parked their car in central Athens to the Metro. This acts to release relatively expensive city centre land for other uses. Benefits from this source are assumed to only make a significant impact in 2001. They have little impact on overall project viability.

An additional residual benefit is calculated at the end of the evaluation period. This is simply the estimated value of capital works and goods at the end of the project's evaluation period. For example, civil engineering works such as cuttings and tunnels are often assumed to have an economic life of 100 years or more. The evaluation period is only some 30 years. This means that the works still have 70 years of useful economic life at the end of the period. To cater for this, a residual value of 70% of the capital cost is allocated as a benefit at the end of the project. Though large in absolute terms (337,815bn Drachmas or EUR 991.38bn), the value is only relevant in the final year of the project and, as prices are discounted into the future, the benefit only has a marginal impact on project performance.

Benefits generally increase in value through time; this is a function of:

- Increasing demand for the Metro;
- Increasing per capita incomes leading to ever higher valuations of time and accident related benefits;
- Increasing congestion on the road network, which acts to increase the marginal benefits associated with the removal of any one vehicle off the road.

Table 1: Transport benefits streamed through time

	1996 prices (EUR m)			
Year	2001	2002	2026	2027
Benefits				
Residual benefit				991,386
Pollution etc.	4,202	4,423	14,976	15,756
PT user time	85,925	91,504	415,786	442,926
Private car user time	55,486	59,800	365,423	394,277
Accident benefits	32,625	34,327	116,267	122,330
VOC benefits	32,525	33,555	70,990	73,241
Car park benefits	109,88	2,81	2,81	2,81
Total	**320,65**	**226,42**	**986,25**	**2.042,73**

Source: Booz-Allen & Hamilton, 2008

According to INT1, the Athens Metro is a relatively cheap project, in terms of the economic resources spent, to obtain and create ground space that was used to construct and organise the Metro stations. Based on the views of INT14, this project is of high significance, mainly because of the environmental benefits anticipated. In addition, fewer cars in the streets means not only less air pollution, but also fewer car accidents and less energy consumed.

Land acquisition

"As with the construction of any major urban mass transportation project in an area as decently developed as Athens, the expropriation of private property is unavoidable. In the process of developing the system alignments and sitting of stations, the designers have, as a prime consideration, optimized the use of public space wherever possible. This effort has resulted in a minimum requirement to expropriate private property.

Expropriation of private property required, as estimated in 1999:

- Sepal Depot
  - Number of properties: 89
  - Total estimated cost: 3.6bn Drachmas (GRD) or 13.6m ECU

- Remainder of system
  - Number of properties: 47
  - Total estimated cost: 3.1bn Drachmas (GRD) or 11.3m ECU"

(Source: Cyber Thesis. Daily On-line Journal, Ministry of Foreign Affairs, Greece, available in http://www.hri.org/cthesis/special/metro/page8.html accessed on 14 February 2010)

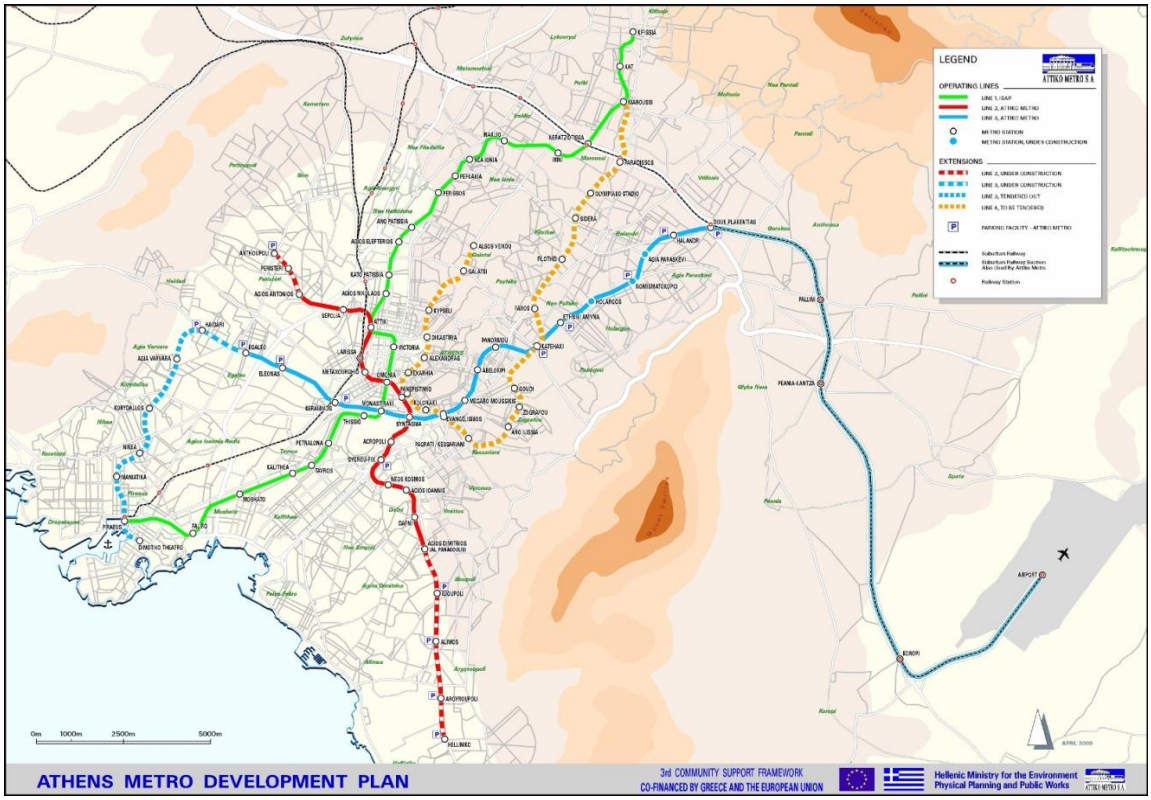
In the same framework, according to INT9, during the construction of a metro in any city, one should basically ensure and design a considerable amount of land around the stations. Unfortunately, the political pressures in Greece and the direction of the board of directors of ATTIKO METRO SA were generally negative. As a result, it was decided to acquire the least amount of land necessary, in order to prevent complaints from neighbouring citizens about the expropriation of their property. In some specific cases, as INT31 commented, objections from citizens were extremely strong, as in the case of an inhabitant of the area around Neos Kosmos station, who preferred to stay in his house and commit suicide rather than let his property be expropriated.

C PRINCIPAL PROJECT CHARACTERISTICS

Principal transport nodes

It has already been mentioned that the 'operation of the system' of the Athens Metro project has been assigned to a subsidiary company called 'Attiko Metro Operation Company SA'. According to Karadimas (2006), the limited size of the Metro network contributes to the necessity of 'inter-modal trips'. Inter-modality is identified with 'passenger transferability' between the Metro system and other modes of public or private transport. The transfer must be implemented in a way that enhances speed, accuracy, safety and credibility.

Figure 24: Athens Metro Network (including future extensions, ISAP and Suburban Railway)



Source: MEPPW/ ATTIKO METRO SA, 2000

Crucial transport nodes are primarily those connecting the lines with each other, i.e. those of Omonoia (connection between Lines 1 and 2), Syntagma (connection between Lines 2 and 3), Attiki (connection between Lines 1 and 2), Monastiraki (connection between Lines 1 and 3) and D.Plakentias (not in the Base Project) (connection between Line 3 and the Suburban Railway).

Figure 25: Syntagma Square station

Source: www.ametro.gr

In the framework of the Athens Metro project, the company ATTIKO METRO SA has aimed to develop bus transfer stations and private car parking infrastructure (Park and Ride) in organized patterns, located next to critical Metro stations and called 'Metro Transfer Stations (MTS)'. The MTS aim to:

- Encourage the use of the Metro system by linking it to remote areas;
- Avoid negative consequences due to illegal parking (near Metro stations or in the city centre);
- Prevent car users entering the city centre;
- Improve travelers' safety conditions;
- Improve traffic and environmental conditions in general.

Figure 26: Doukissis Plakentias station

Source: www.ametro.gr

It is worth noting that it is difficult to find urban land to develop MTS. Strong objections from local communities usually lead to underground solutions, especially in urban areas. It is easier to develop MTS closer to the suburbs. The major existing Transfer Stations can be found in a) Ethniki Amyna, Katechaki and Sygrou-Fix (stations belonging to the base project); b) Halandri and D.Plakentias (extension stations). These stations are linked to a significant number of bus lines, either terminating there or having bus stops, and a total of 2,100 parking spaces. New Transfer Stations, under construction or tendering, are at Haidari, Kerameikos and Nomismatikopeio stations (the last operating since 10 February 2010), providing a potential additional 1,120 parking places.

Outline of technical specifications

Tunnel construction

In the Athens Metro tunneling, five basic methods were used. According to www.ametro.gr, the construction methods were used separately or in combination, as deemed applicable, always in relation to the geological conditions and in-situ conditions of the surrounding area.

The basic tunnel boring methods used in the Base Project were as follows:[9]

[9] Non specialist level information on these methods and their particular use in Athens Metro construction can be found in www.a.metro.gr and in Cyber Thesis, Daily On-line Journal, Ministry of Foreign Affairs, Greece, available in http://www.hri.org/cthesis/special/metro/page8.html (accessed on 14 Febrouary 2010).

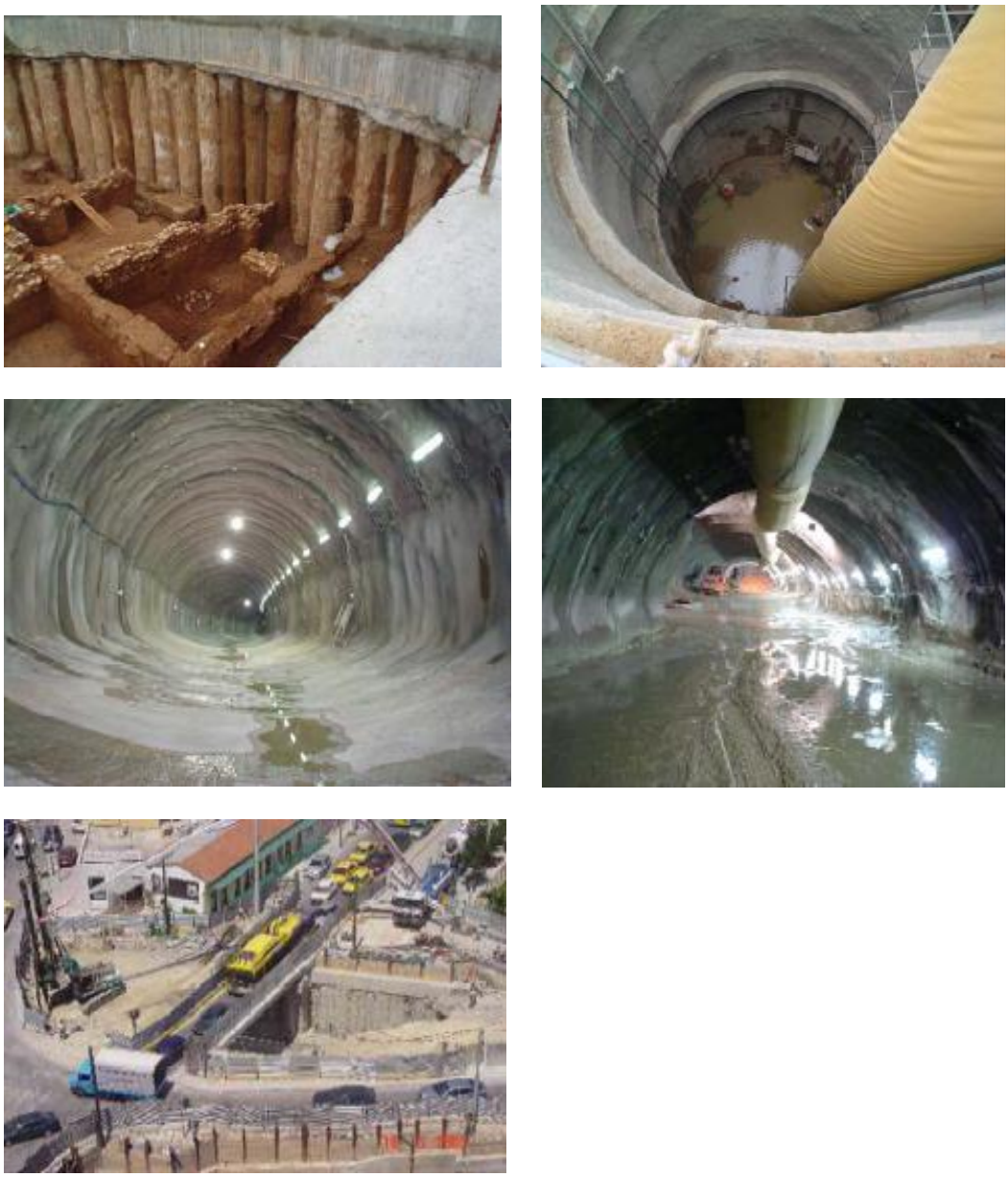
Table 2: Tunnel Boring Methods

Tunnel boring methods	Where it was used	Special comments
1. Excavation with the use of Tunnel Boring Machines (TBM)	TBM1 in Line 2 section from Larissa to Agios Ioannis stations TBM2 in Line 3 section from Katechaki to Syntagma Square stations	Two TBMs specifically designed for the particular conditions in Athens were employed for the boring of tunnels
2. Excavation with the use of the Open Face Shield (OFS)	Dafni – Agios Dimitrios section of Line 2	
3. Excavation with the use of the New Austrian Tunneling Method (NATM)	Panepistimio, Akropoli, Ambelokipi, Monastiraki, Omonoia and the deepest section of Syntagma (both Lines)	Soils with poor mechanical characteristics and excavation of some stations
4. Excavation with the use of the Cut and Cover method	Sepolia, Attiki, Larissa, Metaxourghio, Syngrou-Fix, N.Kosmos, Agios Ioannis, Dafni, Syntagma Square (Line 2) Ethniki Amyna, Katechaki, Panormou, Megaro Moussikis, Evangelismos, (Line 3) Attiki-Larissa (Line 2) and Katehaki-Ethniki Amyna (Line 3) tunnel sections	Most stations of the project, and in a few cases, for the excavation of tunnels at locations where problems were encountered due to poor mechanical characteristics of the soil
5. Excavation with the use of the Cover and Cut method (variation cut & cover)	Syntagma (Line 2)	

Source: codified information from www.ametro.gr

These methods have also been used for the later extensions along with a sixth method, ‘Excavation with the use of Earth Pressure Balance Machine’.

Figure 27: Aspects of metro tunnel construction



Source: www.ametro.gr

Table 3: Technical information for Athens Metro basic project

Technical information	Line 2	Line 3
Terminal elevation difference	42.6m	152.3
Total line length	9.22km	8.38 km
Total number of curves	23	22
Total length of curves	6.62km	4.34km

Source: www.hri.org

Facilities for persons with special needs

The new Athens Metro is equipped with facilities and vehicles to accommodate Persons with Special Needs (PSN). Statistics show that one third of people over the age of 65 have some

kind of physical disability. Moreover, Persons with Special Needs are considered to comprise 8-10% of the overall population.

The Athens Metro steps towards facilitation of PSN concern Station Provisions for Ambulatory Users and for Wheelchair Users as well as Seating, Handhold and Standing Improvements (for more details see Cyber Thesis, Daily On-line Journal, Ministry of Foreign Affairs, Greece, available in http://www.hri.org/cthesis/special/metro/page8.html (accessed on 14 February 2010).

Station features

- Number of stations: 21;
- Type of stations: all below ground;
- Construction methods: underground mined (six stations); cut-and-cover (15 stations);
- Station configuration: surface entrances and station access;
- Intermediate: concourse and transfer levels; lower platform levels; two side platforms at all stations except Ethniki Amyna; one centre platform at Ethniki Amyna;
- Length of platforms: 110m;
- Revenue collection: barrier free proof-of-payment system; paid/unpaid areas clearly defined; validated tickets required; ticket sales offices; automatic ticket issuing machines (ATIMs); ticket validator/cancelers (TVCs);
- Station supervision: concourse station master;
- Police office: at selected stations;
- Closed circuit television (CCTV);
- Public address system (PAS);
- Emergency telephones: on platforms;
- Environmental control: forced air mechanical ventilation system;
- Provisions for future air-conditioning;
- Vertical circulation: stairs; escalators; elevators from street to concourse and concourse to platform for persons with special needs;
- Passenger amenities: platform seating; public telephones, concourse and platforms; ash and trash bins; signs and graphics; neighbourhood and system maps; public lavatories; first aid rooms and facilities; central lost and found office at Syntagma station;
- Archaeological displays and exhibition areas.

(see Cyber Thesis, Daily On-line Journal, Ministry of Foreign Affairs, Greece, available in http://www.hri.org/cthesis/special/metro/page8.html, accessed on 14 February 2010).

Policies for stations

In order to maintain a safe, clean and pleasant environment in the Metro system, the following activities are not allowed:

- Smoking;
- Carrying flammable or dangerous substances, materials and objects;
- Carrying inconvenient items (bulky or oversized items etc.), bicycles only sometimes;
- Drinking or eating;
- Travelling drunk or under the influence of drugs;
- Selling or distributing goods or services;
- Using musical instruments;
- Begging or troubling other passengers;

- Littering;
- Walking on the tracks or in the tunnel;
- Pets can be transported only inside special boxes.

(Source: www.amel.gr)

Special preparation for Olympic Games 2004

Within the framework of security and protection measures for passengers from fires and possible terrorist acts involving deadly gases in the Metro's tunnels, the ATTIKO METRO SA purchased detectors of chemical substances and explosives and 24,000 gas masks. In particular, 175 gas masks covering the entire head were packed in special airtight boxes and placed in a specially designated area of each train car. The masks could be used in the event of a chemical or biological attack or a fire or smoke in the train tunnels, in order to prevent unnecessary loss of life or asphyxiation. The gas mask installation on the Athens Metro was a global first.

(Source: www.greeknewsonline.com)

Major associated developments

The Athens Metro is one of a series of interlinked transport infrastructure projects that changed the urban transport profile of Athens. The major steps were taken between about 1991 and the 2004 Olympics. Greece was also a candidate for the 1996 Olympics, which means that several projects were already part of Greek planning and on track (at various stages and phases) before the award of the 2004 Olympics. It is certain that all major urban transport infrastructure projects were influenced either directly or indirectly by the upcoming event of the Olympics, with the practical result for some of them of being accelerated.

Excluding the Athens Metro Base Project and its parallel works, the major associated urban transport infrastructure projects are:

Athens Metro Extensions of Lines 2 and 3 (see 'Introduction' section of this report)

ISAP

The Athens-Piraeus Electric Railways (ISAP) is Line 1 of the overall Metro system in Athens and the oldest line, built in 1869 and electrified in 1904. It reached its full length to Kifissia in 1957 and has undergone various renovations, the major one in view of the Olympics. It has links to both Athens Metro Lines 2 and 3 (in Attiki and Omonoia with Line 2 and in Monastiraki with Line 3). It is also connected with the Suburban Railway at Piraeus, Larissa, and Neratziotissa stations.

Suburban railway

The suburban railway is a modern, electrified and frequent itinerary part of the Hellenic Railways Oganization (OSE) network, operated by TRAINOSE SA (initially a subsidiary of OSE and now independent), currently linking the airport with northern Peloponnese and Piraeus via the centre of Athens (Larissa station). The part from Athens to the airport via Neratziotissa station was delivered in view of the Olympics.

Line 3 of the Athens Metro has a connection with the suburban railway at D.Plakentias station. From this station to the Athens International Airport, Athens Metro and the Suburban Railway share railway tracks (20.7km).

Tramway

The Athens and Piraeus tramway started operation in July 2004, a month before the Olympics. It is run by TRAM SA (a subsidiary of ATTIKO METRO SA), is structured in three lines-branches (routes 3, 4 and 5, running on standard gauge track). One runs along the seashore of the Athens basin connecting Piraeus with the southern suburb of Voula, one from Voula to Athens and one from Piraeus to Athens. The latter two have a terminal station at Syntagma where they connect with Lines 2 and 3 of the Athens Metro (the tram also connects to Line 1 of ISAP at the coastal stadium of Peace and Friendship. In the future it will also connect to the Argyroupolis station of the extension of Line 2 of the Athens Metro, under construction in 2010). The current development is considered to be the first phase of a wider network operating as a feeding system to the overall Athens Metro system. The next phase will be materialised in Piraeus where it will connects with Line 1 of ISAP and the suburban railway. The tram now attracts 65,000 passengers per day, operating on 27km of tramway with 48 stops along the routes (see www.tramsa.gr).

Attiki Odos

Attiki Odos is a major urban motorway linking the western with the eastern part of Attiki, bypassing the centre of Athens. A crucial part of it, the Pallini–Airport section, had to be delivered by 28 February 2001, when the Athens airport was brought into operation (Law 2338/1995).

None of the Athens Metro Base Project stations are located along Attiki Odos or combined with interchanges of the highway. However, several stations belonging to the extensions are directly linked with Attiki Odos. These are Halandri and D.Plakentias stations of Line 3, and Neratziotissa station (one of the two fixed track transport hubs serving the main Olympic complex) of Line 1 of ISAP.

Athens International Airport (AIA 'EL.Venizelos'[10])

The AIA was completed in 2001. It was built by Hochtief (awarded in July 1995) in a joint venture with the Greek state. AIA was formally introduced into the planning of the city by Law 1955/91 which amended the 1985 Regulatory Plan. The concession contract between the Greek State and the German PPP partner led by Hochtief was ratified in 1995 by Law 2338/95. With the opening of AIA the previous Athens airport at Ellinkion was made redundant. The Athens Metro Line 3 and the suburban railway terminate at AIA. The extension to the airport was not included in the base project.

Predicted costs and project delivery

The estimated budget of the Athens Metro Base Project is actually the lump sum announced in the publication of Law 1955/91, establishing ATIKO METRO SA and ratifying the contract of ATTIKO METRO SA with OLYMPIC METRO Consortium. This budget amounts to GRD 46,234,416,690 (EUR 135,684,275) plus DEM 1,357,506,860 (EUR 694,081,825.57) in 1991 prices. At that time no information was available on the sources of funding. Project delivery was determined at six years after the commencement of works with the final delivery date set at 15 September 1997.

[10] After the name of one of the most important Greek politicians (Liberal), and Prime Minister for several periods during the first two thirds of the 20th century (Eleftherios Venizelos).

However, due to the complexity of the project and significant vagueness in specific points of the contract between the State and the consortium, and after two years of escalated problems, the progress of the project reached a dead end in the summer of 1993. The general progress of the works that had to be completed had already delayed substantially. These new unpleasant developments threatened the general execution and completion of the Metro project. This interruption was also confirmed by the information received from the interview with INT9. To be more specific, he attributed the problems in the evolution of the project to the conflicts between the construction consortium and ATTIKO METRO SA. Thus, the new administration of ATTIKO METRO SA took the initiative of approaching the contractor, establishing a friendly environment and discussing the crucial points of the disagreement. This initiative resulted in a mutual agreement and the signing of a new modified contract in October 1994 (Amendment of Law 1955/91). According to this contract, the additional amount in the initial lump sum was GRD 11,368,036,709 (or EUR 33,361,809.9) plus DEM 173,541,475 (or (EUR 88,730,294.73) in 1994 prices. Consequently, the total amount agreed for the cost of Athens Metro Base Project in 1994 was GRD 57,602,453,399 (or EUR 169,046,084.8) plus DEM 1,531,048,335 (or EUR 782,812,120.3). There was also an extension of 11.5 months for the delivery of the project, setting a new final delivery date for the project at 31 October 1998. The initial and amended predicted costs, and the initial and amended project delivery dates are presented in table 4.

Table 4: Predicted Base Project Costs and Delivery Dates

Relevant official document	**Base project cost**		**Project delivery date**
	Greek Drachmas & German Marks	**Euros**	
Law 1955/91	GRD 46,234,416,690 + DEM 1,357,506,860	829,766,100.57	15 September 1997
Law 2274/94	GRD 57.602.453.399 + DEM 1,531,048,335	951,858,205.10	21 October 1998

Source: Codified from Law 1955/91 and Law 2274/94

For the final actual cost of the Base Project see ‘Background to funding’ section.

Main contracts and contractors

Main Contractors (www.hri.org)

The contractor of the project, OLYMPIC METRO Consortium (OMC), signed a contract on 19 June 1991 with the Greek State, represented by the Ministry of the Environment, Planning and Public Works. This consortium consists of twenty-three Greek, French and German firms. The scope of work of OLYMPIC METRO is “the design, construction and commissioning of the extension of the Athens Metro network”. The contract was assigned by the Greek State to ATTIKO METRO SA on 7 February 1992. The members of the consortium are listed below:

1. Engineering Works SOGELERG INGENERIE, France
2. DE-CONSULT, Frankfurt, Germany
3. ADK, Athens, Greece
4. HAMBURG CONSULT, Hamburg, Germany
5. SOCIETE GENERALE DE TECHNIQUE ET D'ETUDES, France

6. BERLINER VERKEHRS CONSULTING, Berlin, Germany
7. LAHMEYER INTERNATIONAL, Frankfurt, Germany
8. Civil Works and Track Works SOGEA, France
9. HOCHTIEF AG, Essen, Germany
10. SPIE-BATIGNOLLES, France
11. METON SA, Athens, Greece
12. AEGEK SA, Athens, Greece
13. DOMIKA ERGA, Athens, Greece
14. DUMEZ INTERNATIONAL, France
15. CEGELEC, France
16. Electromechanical Works SIEMENS AKTIENGESELLSHAFT BERLIN-MUENCHEN, Erlangen, Germany
17. GEC-ALSTHOM, Paris, France
18. CEGELEC, France
19. AEG SHIENENFAHRZEUGE GMBH, Berlin, Germany
20. SPIE-BATIGNOLLES, France
21. SIEMENS S.A, Athens, Greece
22. CGA-HBS, France
23. JS TELECOM, Louveciennes, France

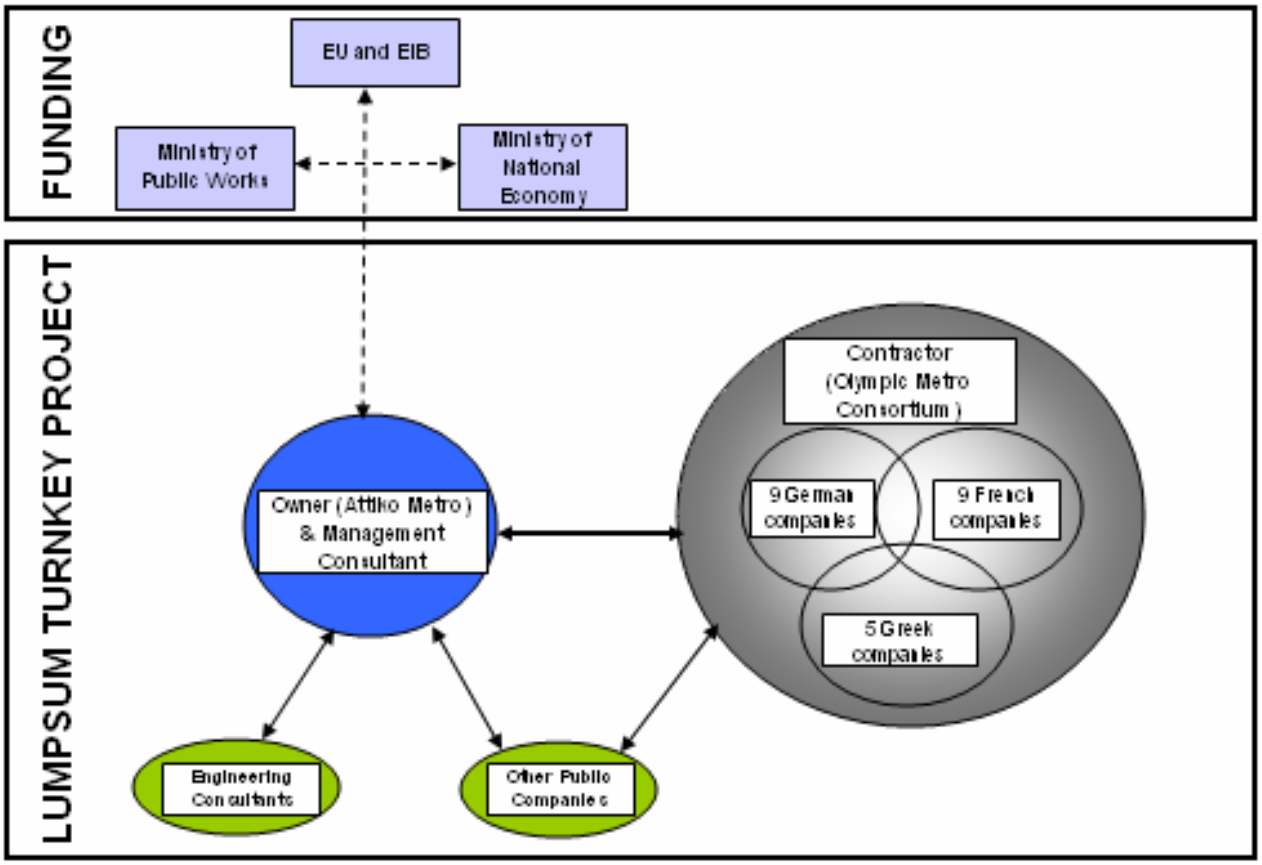
(Source: Cyber Thesis, Daily On-line Journal, Ministry of Foreign Affairs, Greece, available in http://www.hri.org/cthesis/special/metro/page8.html, accessed on Febrouary 14, 2010).

Management structure

The Base Project was a design and construct lump sum turnkey project. The project owner (ATTIKO METRO), assisted by a management consultant, supervised the contractor (OLYMPIC METRO) who constructed the project. The process was monitored by a special committee with officials from the Ministry of Public Works, the Ministry of National Economy, the European Investment Bank (EIB) and the European Union (EU). The figure below indicates the project structure in aschematic form (Leoutsakos, 2007).

According to Leoutsakos, “the Consortium was divided into a centralized management group and seven other sub-groups covering Engineering, Civil Works, Power Supply, Low Voltage, Rolling Stock, Trackwork and the Depot. Several internal relationships were set up at various levels between the above companies and subgroups, each one being a different profit centre” (Leoutsakos, 2007). The managerial and funding structure is shown in Figure 28.

Figure 28: Athens Metro base project management structure: lump sum turn key contract



Source: Leoutsakos, G., 2007 (Attiko Metro SA)

D PROJECT TIMELINE

Year	Month	Type	Key Event/Decision
1869		Background development	Commissioning of the first steam-driven railway of Greece (Piraeus–Thissio)
1894		Background development	Extension of the railway line (Thissio–Omonoia)
1904		Background development	Electrification of the railway line
1869-1957		Planning, conception	In 1869, the development of the Metro System for the Greater Athens Area began. The existing line connecting Piraeus with Athens had its origins in Greece's first steam railway, placed in service in 1869. This line was extended from Thissio through Monastiraki to Omonoia in 1894, electrified and converted into one of Europe's first metropolitan railways in 1904, and extended from Omonoia through Victoria to Attiki Square in 1926. Three decades later, the Metro was extended via the right-of-way of an abandoned one-meter gauge steam railway, reaching Nea Ionia in 1956 and its present northern terminal in Kifissia in 1957. Although ambitious proposals were announced for additional Metro lines, the funds needed to construct them were not available.
1925		Planning, conception	The older relative known plan was introduced by the engineer Alexandros Verdelis.
1945		Conception	At the end of World War II, as was the case in most of Europe, the public transportation system of Athens was in ruins. The central area of Athens was served by the remnants of a worn out tramway system that was sorely in need of rehabilitation or replacement. A single metro line extended from the port of Piraeus north through Omonoia Square - the heart of the central business district of Athens - to Attiki Square.
1953		Planning, conception	A complete proposal about the development of a metro network from Kostas Biris, director of the Athens Planning Organization of that period.
1957		Planning, conception	The Minister of Transport, G.Rallis, invited two French transport engineers, L.Devillers and H.Aguzou, from the Urban Transport Organization of Paris. With the cooperation of A.Lampesis, Director of Ministry's Railway Department, they conducted a new study, proposing two additional lines with further expansions, apart from the ISAP Line.
1962		Conception	The famous transportation specialist Smith declares the need for a subway network in the broader area of Athens.
1963		Planning, conception	The government ordered a study on the Athens public transportation system, which became known as the 'Smith study'. The study was conducted by the American consultant firm Wilbur Smith and Associates under the supervision of the Ministry of Public Works. The goal of this

Year	Month	Type	Key Event/Decision
			study was to analyse and map transportation patterns in Athens and to develop an integrated design for public transport.
1964		Planning, conception	Presentation of the first 'Smith Study'.
1965		Background development	Public transportation usage in Athens hit its all-time height of 973 million passengers.
1967	April	Background development	Greek military junta *coup d'etat* on 21 April 1967: suspension of the debate and all investigations concerning the prospect of constructing a metro system.
1971		Planning, conception	Seven years after the Smith Study, the Greek government commissioned a new preliminary investigation that was also conducted by Smith and Associates.
1971		Background development	ILPAP public company replaces the private Company of Electric Transport.
1972		Planning	Introduction of the Athens Master Plan or Regulatory Plan.
1974	May	Planning, conception	Presentation of the second 'Smith Study'.
1974	July	Background development	Fall of the military dictatorship junta on 23 July 1974 and reconstitution of democracy: pressures from increasing traffic problems in Athens.
1976	May	Planning, conception	Decision by the Government for the elaboration of a pre-study for the basic metro network.
1977		Planning	The government made a decision to order a preliminary study for the actual construction of two metro lines. After an international competition, the government commissioned a preliminary study from the French and Greek research consortium SOFRETU-SGTE-SOGELERG-ADK. This study was important because it later became the basis for the actual design and construction of the Athens Metro in the 1990s.
1978		Background development	Establishment of Athens Urban Transport Organization.
1978	July	Background development	After a governmental meeting, under the supervision of the Prime Minister, the administration decided to approve lines A and B as specified by the SOFRETU study and to appoint as supervising authority the Urban Transport Organization (OAS).
1979	September	Planning, conception	The National Council of Country Planning and Environment approved a new Athens Regulatory Plan. Within the framework of the new plan, which had been issued by the Ministry of Public Works under the title 'Athens 2000', architects, engineers and town planners were invited to evaluate the role of a metro network in the Greek capital. Inclusion of the need for the construction of two basic metro lines 2 and 3 in the general strategic principles of Athens Regulatory Plan.
1980		Planning, conception	In the spring of 1980, the government signed a supplementary contract with the French consortium SOFRETU. The new contract

Year	Month	Type	Key Event/Decision
			concerned "the extensions and certain arrangements on difficulties that emerged as a result of the application of the initial contract". In September 1980, the government commissioned SOFRETU to study exactly where exploratory underground boreholes for the metro should be located.
1980	September	Planning/Legal	On 27 September 1980, the Athens-Piraeus Electric Railways (ISAP) took over the Metro project's supervision from OAS through the enactment of Law 1074/80 which superseded the previous Law 588/77.
1981	December	Background development	A major set-back for the realisation of the project was recorded, when the newly elected socialist government decided to suspend all major infrastructure projects and to channel resources away from the overgrown capital until February 1987.
1982	January	Background development	Decision of the Council of Ministers of the first PASOK Government after the Proposal of the EPPW Minister Tritsis that Athens was in no need of a metro system (Manos, 2008).
1982-1985		Background development	Inactivation of the Metro project evolution, mainly because of the indecisive attitude of the Ministry of Environment, Planning and Public Works. In October 1981, a new government was elected. According to Pagoulatos (2002), the new government's economic strategy focused mainly on redistributive policies aimed at social and economic inclusion of marginalised citizens. As maintained by Balourdos et al (2001) the most important barrier to the progress of the project was the decision by the newly elected government in December 1981 to cancel all major infrastructure projects and to withdraw resources from the capital. In 1985, the recall of the Metro idea to address Athens' traffic and environmental problems and EU funding availability.
1985		Planning/Legal	Transfer of responsibility for construction of the project, from ISAP to the Ministry of Environment, Planning and Public Works, through legislative action (1578/85). ISAP was considered to lack the appropriate human resources and organising capacity to complete such a complex project.
1985	March	Background of tender	Three groups of companies were shortlisted and submitted their tenders in March 1988. It took almost a year for the government committee charged with the final selection to reach a neglected periphery. It was only three years later, in early 1985, that a major shift was recorded in government policy in favour of promoting the underground project.
1985	June	Background development	Newly appointed Minister, of the Ministry of Public Works, Planning, Housing, Environment and Transportation, Evaggelos Kouloumbis.

Year	Month	Type	Key Event/Decision
1987	February	Background of tender	Announcement of the Tender for the ATHENS METRO Underground Project: 20km of tunnel, 21 stations, one depot and 28 trains.
1987	August	Background of tender	Nine groups of engineering and construction companies participate in the pre-qualification stage.
1988	March	Background of tender	Three groups of companies were shortlisted and submitted their tenders in March 1988. It took almost a year for the government committee charged with the final selection to reach a neglected periphery. It was only three years earlier, in early 1985, that a major shift was recorded in government policy in favour of promoting the underground project.
1989	February	Background of tender	The government committee responsible for the evaluation of the offers recommends to the Government the award of the project to OLYMPIC METRO consortium, provided the vague points of the offer were clarified.
1989		Background development	A few months later, the country entered a period of political instability, which lasted several months, thus causing further delay to the project.
1989	December	Background of tender	OLYMPIC METRO consortium denied intensively to clarify the vague parts of the offer.
1990	June	Background of tender	The government committee requested a report of the reasons why the consortium did not proceed to clarifications. Afterwards, all the contradictory aspects were gathered by the committee, which composed an additional statement, taking into account the different aspects, and proposed a compromising adjustment report to the consortium, in order to be signed.
1991	June	Contract	OLYMPIC METRO consortium agreed with the adjustment report and signed it.
1991	July	Legal	Publication of Law 1955/91, establishing ATTIKO METRO SA and ratifying the Design and Build contract between ATTIKO METRO SA and OLYMPIC METRO SA consortium. The same Law stipulates that, based on the decision by the Minister of Environment, Planning and Public Works, all rights and obligations of the Greek State deriving from the contract with OLYMPIC METRO SA consortium and from the Project 'Sepolia-Attiki Pilot Tunnel', shall be conceded and transferred to ATTIKO METRO SA at no price.
1991		Background development	Objections and skepticism were stated by the Opposition of the Greek Parliament, whether the administration and management of such an important project should pass to a company with wide and expanded jurisdictions. Concerns were also stated about cases of opacity.
1991	November	Management of project	Beginning of cooperation with BECHTEL International Inc. The framework of the services provided by the company concerned the balanced operation of ATTIKO METRO SA in

Year	Month	Type	Key Event/Decision
			terms of cooperation with other actors and financial, technical and administrative aspects.
1992	February	Funding/Management of project	The European Investment Bank provided a long-term loan to finance the project. The Ministry of the Environment, Planning and Public Works transferred its competencies regarding the project to the newly established private law company ATTIKO METRO SA, which supervised the project.
1992	July	Background development	Commencement of archaeological surveys.
1992	November	Evolution of project	Commencement of main construction activities at Larissa station (Line 2).
1993	June	Evolution of project	Taking delivery of the first Tunnel Boring Machine (TBM).
1993	July	Evolution of project - delays	Two years after the beginning of the project, great delays in the timeline were already obvious and significant disagreements between ATTIKO METRO SA and OLYMPIC METRO SA consortium had already emerged, mainly because of the subjective interpretations of parts or obligations of the contract and claims from OLYMPIC METRO SA for reimbursements outside the contract.
1993	December	Evolution of project	Taking delivery of second Tunnel Boring Machine (TBM).
1994	January	Management of project	The new administration of ATTIKO METRO SA set off initiatives to compromise the disagreements among the involved actors.
1994	April	Evolution of project	Commencement of operation of the first TBM at Larissa station (Line 2).
1994	August	Evolution of project	Commencement of operation of the first TBM at Katechaki station (Line 3).
1994	October	Contract	The negotiations among the involved actors, regarding the disagreements, resulted in a modified contract, which was signed on 18 October 1994.
1994		Accident	A major tunnel collapse took place, because the machines used by the contractors, which were selected by the constructors and approved by ATTIKO METRO SA, were not the proper machines for the ground conditions of Athens.
1994	December	Background development	Objections and concerns stated in the Greek Parliament, by the Opposition, concerning the new modified contract, the evolution of the project, specific construction costs, the quality of the workforce and even the services provided by BECHTEL.
1994	December	Contract/Legal	Publication of the modified contract concerning ATTIKO METRO SA and the Metro project, increasing the total budget, by the Law of 2274/94.
1996	June	Evolution of project	Line 3 - Arrival of TBM 2 at Syntagma Square
1996	June	Evolution of project	The arrival at Syntagma Square was a major

Year	Month	Type	Key Event/Decision
			milestone, because until that time, all the works were executed underground and Athenians were only reading about the project or hearing about it on TV. At that time, they realised that the project was actually in progress.
1997	March	Change of route	The Greek government, following international protests, intervened and forced cancellation of a tunnel being dug by ATTIKO METRO SA, also part of the Line 3, scheduled to pass underneath the archaeological site of Kerameikos, the most important cemetery of ancient Athens, so the programmed tunnel route was changed.
1997	March	Management of project/Budget modification	Due to the non-contractual behavior exhibited by the contractor, which was contrary to the pertinent legislation, a resolution was made to cancel the public works for the tunnel section Syntagma-Kerameikos-Iakchou Shaft, the respective Electromechanical Works, and Kerameikos station from the contract, so that the tunnel passage underneath the Kerameikos archaeological site would result in no risk for the project (www.ametro.gr).
1997	May	Evolution of project	Resuming of TBM 1 operation in the area of Karaiskaki Square (Metaxourgheio - Omonoia tunnel section).
1997	December	Evolution of project	Line 2 - Arrival of TBM 1 at Syntagma Square.
1998	April	Evolution of project	Transfer of TBM 2 from Nikis Street (Syntagma) - without its head - to Dafni Station and placement of an order for the open face shield for the boring of Dafni - Agios Ioannis section.
1998	June	Delivery	Delivery of the first train in Athens.
1998	December	Evolution of project	Arrival of TBM 1 at Agios Ioannis Station (completion of the boring activities using TBM 1).
1999	March	Evolution of project	Completion of the boring activities in Dafni- Agios Ioannis tunnel section using the Open Face Shield. Completion of Line 2 Tunnels' construction. Completion of the boring activities in Dafni - Agios Ioannis tunnel section using the Open Face Shield. Completion of Line 2 tunnels' construction.
1999	April	Evolution of project	Power supply of Line 3 and commencement of tests for the first train.
1999	May	Evolution of project	Commencement of tunnel boring from Syntagma Square towards Monastiraki station using conventional methods.
1999	July	Evolution of project	Completion of the track laying related works for Syntagma Square - Sepolia and Syntagma Square – Ethniki Amyna sections (Partial Opening 1) of the system.
1999	August	Delivery	Taking delivery of the 28th train.
1999	September	Change of route	Greek archaeologists and scholars expressed concerns that ancient remains in the centre of classical and modern Athens could be damaged or destroyed by a new subway tunnel under Ermou street, linking Syntagma Square with the

Year	Month	Type	Key Event/Decision
			Monastiraki district. Originally the tunnel, part of Athens Metro's Line 3, was scheduled to pass underneath Mitropoleos street, where the Athens cathedral of the Greek Orthodox Church stands. Protests by church authorities led to the new route under Ermou street. In this case, also, the new tunnel is supposed to pass underneath the eleventh-century church of Kapnikarea, a significant monument of Byzantine Athens and Panagia Pantanassa, which is a seventeenth-century church.
1999	November	Evolution of project	Completion of the track laying related works for Syntagma Square - DAFNI section (Partial Opening II) of the System.
2000	January	Delivery	Commencement of Metro Operation: Partial Opening I of the system (Syntagma Square - Sepolia and Syntagma Square – Ethniki Amyna sections), commissioning of 14 stations in total, i.e. seven stations in Line 2 and seven stations in Line 3.
2000	May	Evolution of project/Delivery	Tests for the energization of the Line for Syntagma Square - Dafni section (Partial Opening II) of the System
2000	November	Evolution of project/Delivery	Partial Opening II of the system (Syntagma Square - Dafni section): commissioning of five additional stations of Line 2.
2001	September	Evolution of project	Completion of tests in Syntagma Square - Monastiraki tunnel section.
2001	December	Evolution of project	Completion of excavation works in the main Monastiraki station.
2003	April	Evolution of project/Delivery	Partial Opening III of the system (Syntagma Square - Monastiraki): Commencement of operation of Monastiraki station, i.e. the last Station of Line 3 The delivery of this station marked the end of the Base Project with a delay of about five yearsto the Base Project delivery dates, set in Laws 1955/91 and 2274/94.
2004	July	Evolution of project-Delivery	Commencement of operation of the section Ethniki Amyna - D.Plakentias – Airport as part of the extension of Line 3 (**not part of the Base Project**).

E PROJECT FUNDING/ FINANCING

Background to funding/financing and funding sources

The Athens Metro project constitutes a public initiative, including some of the characteristics of a concession contract, but with many differentiations. In general, in concession contracts the private contractor is responsible for the funding of the project, either by own capital or by loans. In the procurement form of concessions (Deloukas, 2003), private investment costs are recovered during the concession period by means of future revenue streams (non-recourse financing of commercially viable projects) and/or public transport to reach financial viability (limited recourse project financing). Public support may take the form of a one–off capital grant, or periodic availability payments, or both. In all types of public-private collaboration, the full ownership of the transport infrastructure project is transferred to the public sector after a fixed period.

In the case of Athens Metro (Fragkomichalou, 2003), the project is based on a public contract and the necessary capital is found and offered exclusively by the state, having at the same time the obligation to repay any loans received for the construction procedure. The study, construction, operation and maintenance of the project are allocated to a contractor for a specific period of time. In this case also, the contractor's costs are covered by the future revenues of the use of the project for the specific time period.

According to data provided by ATTIKO METRO S.A, the total basic project funding reached EUR 2.1bn, covered half by the European Union through grants from the Community Support Framework I & II (about EUR 1.05bn), and half by the Greek State (about EUR 1.05bn) through European Investment Bank loans (39%, about EUR 819m) and funding from the Public Investment Programme (11%, about EUR 231m). The European Investment Bank provided the Greek State with loans, which have a quittance period of 25 years and a 7-10 years period of grace. The interest rate is defined as the rate applied in the banking system (increased by 1%) on the day the loan was assembled. Interest rates are updated every five years. The first loan contract was signed in February 1992, the second in October 1993 and the third in April 1995. One extra loan was agreed in 2001. ATTIKO METRO SA is responsible for repayment of all the loan contracts. The guarantee actor for the loans is the Greek State. Below, several data from ATTIKO METRO S.A (obtained, processed and presented by Fragkomichalou 2003) are presented regarding the cash flows of the project:

- Sources of funds:
  - Funding from European Union 52.4%;
  - Loans from European Investment Bank 33.7%;
  - Tax rebates 6.1%;
  - Revenues from loan interest 7.8%;
  - Total of inflows 100%.

- Uses of funds:
  - Basic cost 68%;
  - Complementary works 22.9%;
  - Administration expenditure of the project 9.1%;
  - Total project cost 100% (EUR 2.066bn);
  - Tax EUR 193m;
  - Project cost and tax EUR 2.259bn;
  - Loan interest from European Investment Bank EUR 195m;
  - Total of outflows EUR 2.454bn.

The Athens Metro Base Project was mainly and substantially funded by the 2nd and 3rd Community Support Framework (1994-1999 and 2000-2006). Based on the information provided by the Ministry of Environment, Regional Planning and Public Works, the Metro project exhibited a total cost of EUR 1.566m in the period 1994-1999. Half of the amount was funded by the European Regional Development Fund (EUR 783m) and half by Greek State expenditure (EUR 783m). The Greek State ensured the largest part by lending from the European Investment Bank (EUR 626m) and by the Greek Public Investment Programme (EUR 157m).

According to the Annual Report of 2003 for the Operational Programme of the Greek State 'Road axes, Ports and Urban Development' (3rd Community Support Framework 2000-2006), the data concerning the structure of the total budget of the Athens Metro Project, referring to the funding received from the 3rd Community Support Framework (CSF), is as follows:

Table 5: Structure of total budget of Athens Metro project

Total Budget (thousand EUR)	1,405,724
Total Public expenditure	1,267,794
Funding from European Commission	633,881
National funding	633,913
Private funding	137,930
Loans from European Investment Bank	409,000

Source: Ministry of National Economy, 2004 (Annual Report of 2003 of Greek Operational Programme)

The inquiry into financing data regarding the Athens Metro Base Project from ATTIKO METRO S.A and from the company's Planning and General Studies Division resulted in Table 6. The data received correspond to the information provided in the Annual Internal Economic report of ATTIKO METRO SA published in December 2007. One can observe that the actual numbers presented are somewhat different to the data received by Fragkomichalou (2003), while the total amounts of the sources and uses of funds seem higher (EUR 2.764bn and EUR 2.7582bn respectively).

The total construction cost of the Base Project, as shown in Table 6, reached approximately EUR 2.025bn, corresponding to the EUR 2.1bn Base Project cost stated in the data from ATTIKO METRO SA (as mentioned above). However, the total project cost, according to Table 6, reached EUR 2.758bn. The total project cost includes VAT, tax, loan interests and disbursals, besides total construction cost. As shown in Table 4 above, the predicted cost was EUR 951,858,205.10 according to Law 2274/94 which means the cost overrun was as much as EUR 1,806,341,795 (or 289.8%) taking EUR 2.758bn as a basis, according to this version of the official data.

Table 6: Funding features of Athens Metro Base Project (EUR bn)

Sources of funds	
Funding from European Union	1.489
Loans from European Investment Bank	0.835
Tax rebates	0.214
Revenues from loans' interest	0.226
Total sources of funds	**2.764**
Uses of funds	
Payment in DM	0.941
Payment in GRD	0.4535
Simultaneous works	0.4703
Administration expenditure	0.1601
Total construction cost	2.0249
VAT	0.2146
Total construction cost + tax	2.2395
Loans' interest	0.4169
Loans disbursal	0.1018
Total uses of funds	**2.7582**

Source: ATTIKO METRO SA

F OPERATIONS

Operating procedures

The company operates using Standard Operation Procedures (SOPs):

- This framework of Standard Operation Procedures (SOPs) is implemented to ensure the synergy of the company's departments in order to achieve the optimum result;
- All employees have been trained extensively on these procedures in order to execute their duties accordingly and to handle any kind of incident successfully;
- Operational incidents are analysed at regular meetings, and the necessary corrective and preventive actions are decided in order to achieve maximum customer satisfaction and optimum passenger and employee safety;
- Simultaneously, a continuous revision system of SOPs is implemented.

Procedures dealing with incidents in stations:

- The Station Master faces the incident directly;
- 1st step: incident assessment;
- 2nd step: Traffic Regulator briefing;
- 3rd step: deals with the incident by following exactly all the steps of the relative procedure dealing with that incident;
- 4th step: informs the Traffic Regulator for every step of the procedure.

Procedures dealing with incidents in stations:

- Traffic Regulator informs the Network Controller, the Train Driver (of the train passing through the incident's location if required);
- The Network Controller informs Station Staff Supervisors and Operations Superintendents depending on the incident;
- The Security Controller informs the police, fire department and calls for an ambulance depending on the incident;
- The Power Controller depending on the incident cuts off the power supply if this is required;
- The Station Staff Supervisor and the Operations Superintendent reach the incident location as soon as possible to assist with its resolution, depending on necessity, and inform the management if required.

Procedures dealing with incidents in trains:

- The Train Driver faces the incident directly;
- 1st step: incident assessment;
- 2nd step: informs the Traffic Regulator;
- 3rd step: deals with the incident by following exactly all the steps of the relative procedure dealing with that incident regarding the Train Drivers.

Procedures dealing with incidents in trains:

- The Traffic Regulator informs Station Masters of the Stations involved and the Network Controller;

- The Network Controller informs Station Staff Supervisors, the Operations Superintendent, the Power Controller, and the Security Controller depending on the incident;
- The Station Master of the Station involved in the incident contributes to the resolution of the incident and assists the Train Driver (when the train reaches the station the Station Master takes over);
- The Security Controller informs the police, the fire department and calls for an ambulance depending on the incident;
- The Power Controller depending on the incident cuts off the power supply if this is required;
- The Station Staff Supervisor and Operations Superintendent reach the incident location as soon as possible to assist with its resolution, depending on necessity, and inform the management if required.

Accident and incident prevention methods:

- Operation Control Centre (OCC), Station Masters, Train Driver announcements;
- Frequent checks from the Station Master and the Train Drivers (for false operation);
- CCTV surveillance from the OCC and Station Masters;
- Implementation of the steps of the SOPs by all staff.

Based on the views of INT14, in terms of the trains' operation framework, in a very short period of time from now, the trains' driving and circulation procedure will be controlled not by train drivers, but by a central computer.

Measuring customer satisfaction

In the same survey ATTIKO METRO SA measures customer satisfaction in ten specific transportation characteristics in order to define quality as perceived by passengers. For the year 2005 the results are:

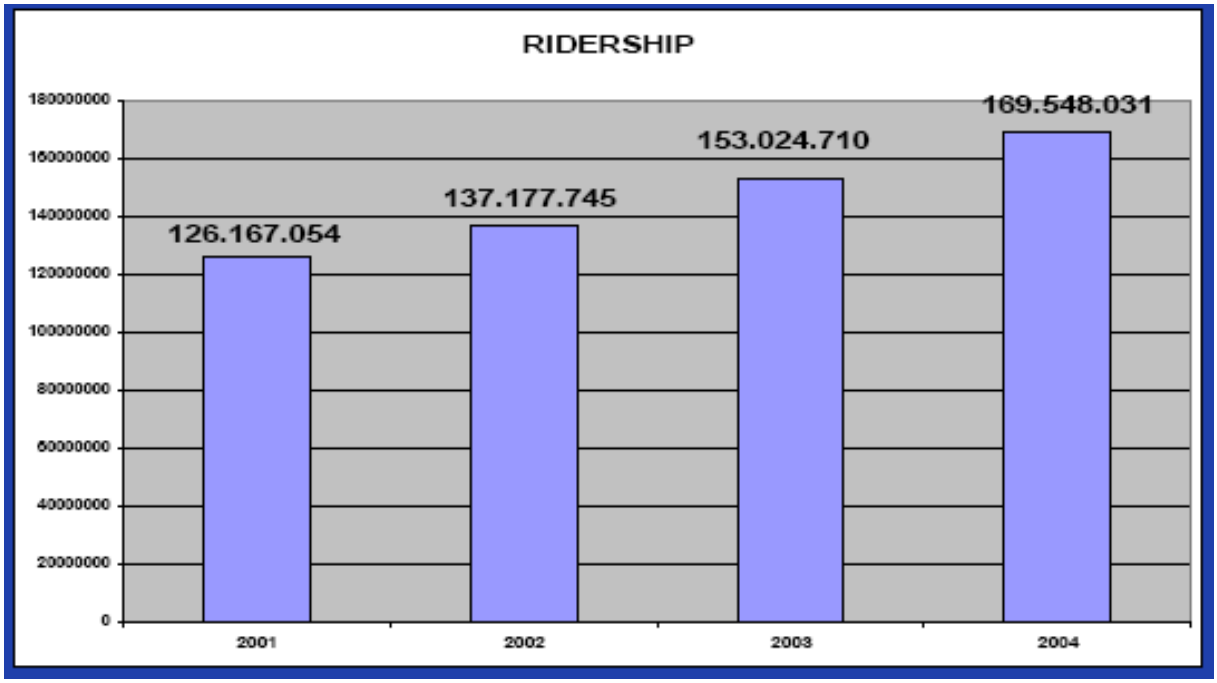
- Reliability of timetable (88%);
- Frequency of timetable (87%);
- Commercial speeding (91%);
- Conditions (87%);
- Cleanliness in stations (92%);
- Cleanliness inside train (92%);
- Personal safety (88%);
- Helpfulness and appearance of staff (90%);
- Signs and other information displays (88%);
- Ease of ticket availability (ticket offices and ticket machines) (90%).

Based on the information provided by the interview with INT9, a significant advantage is the quality of the project finally produced. He declared that he was very proud of the fact he insisted the project should be of very high quality materials, with low maintenance and very clean, and as it was proved from the first day, Greek citizens respected this level of quality. INT9, added that the Athens Metro is very cheap for users compared to the rest of Europe and the world and that is a mistake because it should match the cost of materials, petrol etc. In the same framework, INT31 strongly believes that the outcome of the Athens Metro project can be considered a success, especially compared to other new infrastructure projects in Athens, like the Tram project. He also thinks the key success factor is the respect exhibited to passengers, in terms of operation procedures. Having the same

opinion, INT1 argues that this project can be considered successful, because it is an attractive and extremely useful outcome, with high levels of credibility and organisation, in terms of customer service.

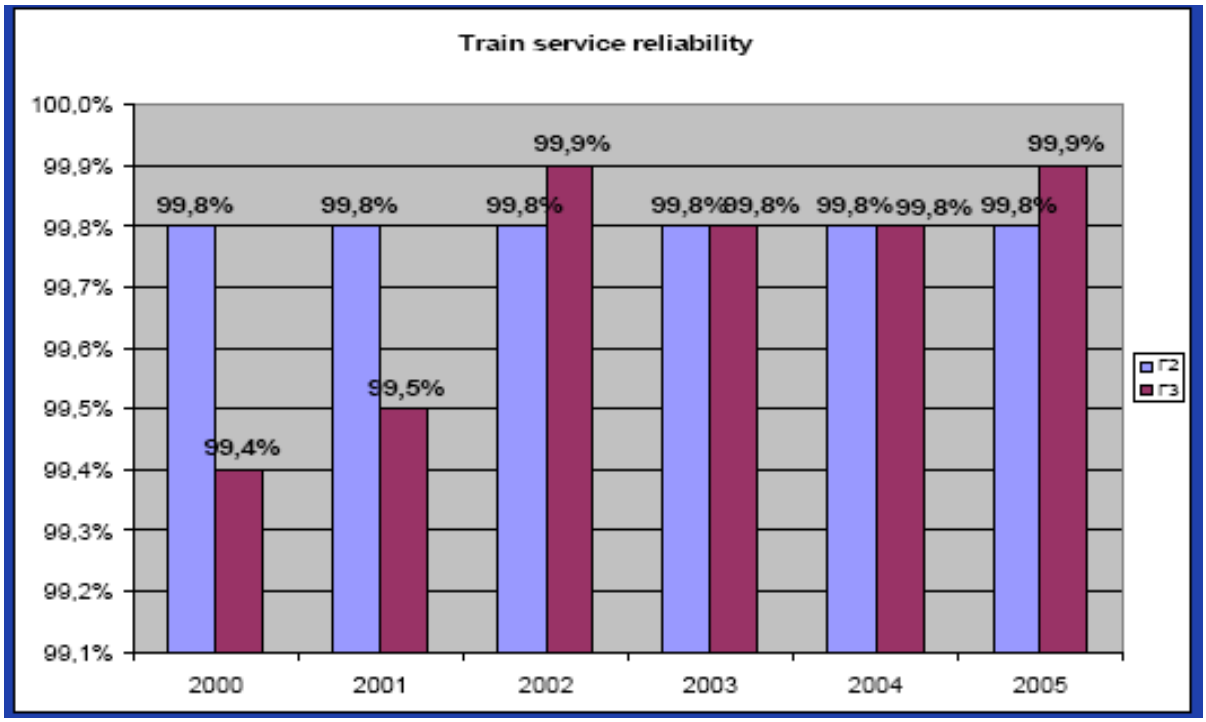
In the diagrams below, one can observe several data from this research of Attiko Metro Operation Company SA, in terms of ridership levels over time, train service reliability and the amount of train kilometres diachronically. In general, an increasing tendency is profound, in all three categories.

Figure 29: Athens Metro ridership over time



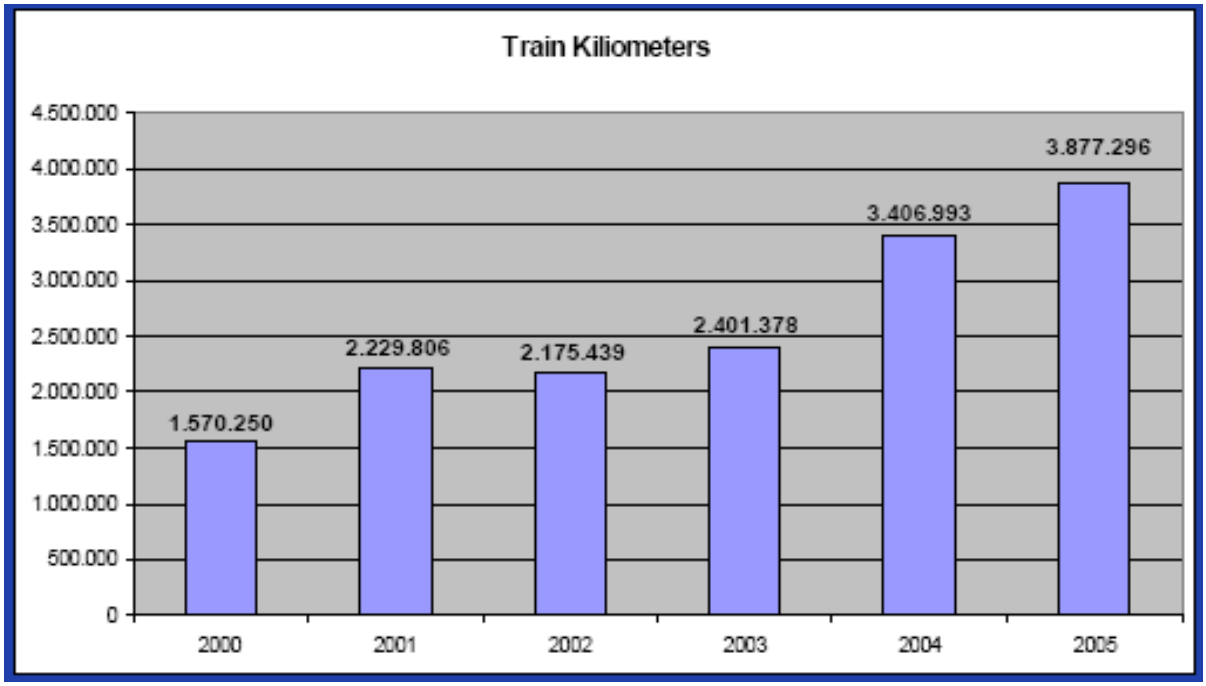
Source: www.amel.gr

Figure 30: Athens Metro Train service reliability over time



Source: www.amel.gr

Figure 31: Athens Metro Train kilometres performance over time



Source: www.amel.gr

Passenger traffic

Based on the data provided by ATTIKO METRO SA - Planning and General Studies Division, in Table 6, one can observe the evolution of the average number of passengers using Athens Metro services per day, monthly and for the time period 2000-2009. For the

year 2009, data until September is available. According also to the graph below, the general trend of passenger traffic through time refers to a general increase in usage of the Metro. To be more specific, the number of passengers seems to increase from year to year and for every month in this time framework. Differentiations from the general tendency are few, and it is worth mentioning that the period with the larger number of passengers for most months is the year 2008.

Table 7: Average Athens Metro passengers traffic evolution 2000-2009

Months / Years	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
2000	102.623	305.128	295.959	294.330	265.606	271.034	210.247	132.423	229.422	286.137	352.797	437.263
2001	402.632	444.176	472.694	425.311	471.363	426.076	334.396	214.582	385.859	440.773	473.460	502.645
2002	442.633	499.127	491.568	499.564	428.887	463.387	336.826	233.289	428.645	473.217	530.301	530.841
2003	516.079	523.780	530.722	560.279	529.413	539.250	435.208	276.782	478.362	532.008	576.557	583.588
2004	555.978	566.824	576.103	560.615	573.985	547.661	472.290	410.935	532.427	618.984	632.941	628.543
2005	603.840	644.450	645.570	651.816	612.530	627.947	528.310	326.732	566.858	653.575	663.375	696.808
2006	617.478	653.035	663.984	623.880	643.547	611.081	524.798	325.990	579.442	629.621	669.216	690.532
2007	598.537	656.802	655.934	644.856	664.235	627.055	536.723	348.784	594.630	653.116	708.775	703.677
2008	651.087	685.212	737.790	673.548	660.317	655.563	542.719	331.535	589.600	691.519	708.974	645.241
2009	607.016	632.243	610.304	584.532	605.523	600.782	488.083	290.083	557.018			

Source: ATTIKO METRO SA

In addition, for all years, a significant decrease in usage of the Metro is exhibited in August, which is clearly attributed to the fact that the majority of the citizens of Athens leave the capital city, to visit other tourism destinations for their summer vacations. However, in August 2004, this number shows a relatively very small decrease compared to the other years. This incongruity derives from the fact that the very important event of Olympic Games took place in the metropolis of Athens in August 2004, attracting a large number of tourists and visitors, who particularly used the facilities and transport services of Athens Metro.

(Attiko Metro Operation Company SA [AMEL] results in 4th Quality Conference 28-9-2006)

G BIBLIOGRAPHY

- Attiko Metro Operation Company SA (2006), Results in 4th Quality Conference, held at 28-9-2006
- Axarlis, N. (1999) article located in www.archaelogy.org (Publication of the Archaeological Institute of America).
- Balourdos, D., Mouriki, A., Sakellaropoulos, K., Theodoropoulos, E., & Tsakiris, K. (2001) "Political sociology of the car system - Athens case study A: The Underground Extension Project". In PROJECT SCENESUSTECH Scenarios for a sustainable society: car transport systems and the sociology of embedded technologies. Edited by Wickham J. & Battaglini E. Deliverable Number: 2.2, Status: Final, Delivery date: 12 October 2001.
- Batsos, D. (1993) "Transport projects and arrangements: the METRO in its implementation course and its intervention in the shape of the city". Paper presented at the two-day conference Major *Projects and Arrangements in Attiki,* organized by the Technical Chamber of Greece, Architects Scientific Committee, Athens 3-4 June.
- Benardos, A.G. and Kaliampakos, D.C. (2004) 'A methodology for assessing geotechnical hazards for TBM tunnelling—illustrated by the Athens Metro, Greece', *International Journal of Rock Mechanics & Mining Sciences* , 41, pp. 987–999.
- Deloukas, A. (2003) 'Innovative financing techniques: European urban rail projects and the case of Athens Metro extensions', *Association for European Transport*.
- Department of Communication of Attiko Metro (2008) "Response to the Hellenic Institute of Transport Enginners" — protoc. No. ALX 33996 – 28/2/2008.
- Diamantopoulos, M. (1990) "Για ποιό Ρυθμιστικό;" (For Which Regulatory Plan?). In *Tehnika Chronika*, July-August 1990, pp. 28-32 (in Greek).
- Booz-Allen & Hamilton Ltd. and Planning SA (1998), "Economic Study Update", Arthens, ATTIKO METRO S.A.
- Fragkomichalou, P. (2003) "New Forms of Public-Private Partnership: the case of Attiko Metro". Study in the framework of seminars of the National School of Public Administration. Athens.
- Galis, V. (2006) "From Shrieks to Technical Reports: technology, disability and political processes in building Athens metro". Ph.D. Thesis, Linköping University, Linköping studies in arts and science, No. 374, Sweden.
- Golias, J.C. (2002) "Analysis of traffic corridor impacts from the introduction of the new Athens Metro system". *Journal of Transport Geography*, 10, pp. 91-97.
- Hellenic Institute of Transport Engineers (2007) *Newsletter*, issue 159 (Oct., Nov., Dec.) Athens.
- Karadimas, C. (2006) Presentation in *Conference: Parking in urban centres; Management Policies and Proposals*', 19th June, Athens.
- Kloutsinioti, R. (1990) "Athens Metro as an element of Athens' spatial improvement''. *Tehnika Chronika*, September-October 1990, pp. 27-29.
- Laliotis, K. [Minister of EPPW] (2000) Speech in Conference *Metro Development Study*, Caravel Hotel, June 2000, Athens.
- Leoutsakos, G. (2007) "Athens Metro Past, Present and Future*"*. In *46th ECCE Meeting*. Athens, 19 October.
- Manos, S. (2008) "Three Decades of Struggle, for the Environment, and the City. Continuities, Ruptures and Restructuring". In *The Mediterranean City Facing Climate Change*. Quality of Life. Athens 9.84 radio Station Auditorium. January 11.
- MEPPW/ ATTIKO METRO SA (2000), "Athens Metro Development Plan, Report 1", Athens: Attiko Metro.
- MEPPW/ ATTIKO METRO SA (2008) "Attiko Metro 2008 Facts of the Project". Athens: Attiko Metro.

- Ministry of National Economy (2004) “Annual Report of 2003 for the Operational Programme of the Greek State ‘Street Corridors, Ports and Urban Development’” (3rd Community Support Framework 2000-2006). Athens.
- Nathenas G., Kourouzidis S, Klonos A, Vlastos T., Kourbelis A., Katsareas V., Karamanis P., Kokkinos N., (Research Team for the History of Athens Transportation) (2007), *From ‘Pamforeia’ to Metro* (2 vols), Athens: Militos.
- Official Government Gazette (FEK) (1980) Law 1074, Vol. 219, “About the assignement of the Underground Railway of the Capital (Metro) to ISAP S.A.”, Athens.
- Official Government Gazette (FEK) (1984) Law 1418, Vol. 1, No. 23, “Public works and the regulation of relevant issues”. Athens.
- Official Government Gazette (FEK) (1985) Law 1515, Vol. A, No. 18, “Regulatory Plan and Environmental Protection Programme”, Athens
- Official Government Gazette (FEK) (1986) Law 1650, Vol. 1, No. 160, “On the protection of the Environment and the Environmental Impact Assessment”, Athens.
- Official Government Gazette (FEK) (1991) Law 1955, Vol. 112, “Establishment of the Company with the name ATTIKO METRO SA”. Athens.
- Official Government Gazette (FEK) (1994) Law 2274, Vol. 237, “For the Validation of the Modal Contract and its Annexes 1,2, and 3, between Attiko Metro S.A. and the Consortium ’Olympic Metro’, regarding the project ‘Underground Railway of the Capitol’ (Athens Metro), Line 2 Sepolia – Dafni, Line 3 Keramikos – Y. ETH. A”, Athens.
- Official Government Gazette (FEK) (1995) Law 2338, Vol. 1, No, 202, “On the ratification of the Public Private Partnership between the Greek State and the private concessionaire “Athens International Airport SA”, Athens.
- Official Government Gazette (FEK) Amendment of the 18-10-1994 modification of Law 1955/18-7-1991, “on the contract between ATTIKO METRO SA and Olympiako Metro consortium”, Athens.
- Pagoulatos, G. (2002) “Greece, the European Union, and the 2003 Presidency”. In Research and European Issues, No. 21, December 2002. (Available at:http://www.notreeurope.asso.fr/IMG/pdf/Etud21-en.pdf).
- Revithis, I. (2000) Article published in newspaper *To Vima – on line*, 23rd January
- Strimmenou, S. (2000) “Underground Rides with Athens Metro”, In *Apodimos*, available at: http://www.apodimos.com/arthra/index_gen15.html.
- Thermal Buses SA (ETHEL) (2002) “1952-2002, Fifty years of public buses in every neighbourhood” vol.16 (in Greek).
- Wickham, J. and Battaglini, E. (2001) ‘Political sociology of the car system’ in the framework of Project SCENESUSTECH, Department of Sociology, Trinity College Dublin, Ireland.
- Zografos, K., May, A., Marsden, G., Kallioinen, Tegner, H., (2004) “Surveys of Transport Institutional Systems in Europe, Report for the European Commission”, 5th Framework Programme – DGTREN, Final Revised Version, 27 April 2004.

Sources in INTERNET

- www.statistics.gr, Census 2001, National Statistical Agency [accessed February 20, 2010]
- www.greeknewsonline.com (Greek American Weekly Newspaper) [accessed February 20, 2010]
- www.ametro.gr (ATTIKO METRO SA) [accessed February 20, 2010]
- www.mlahanas.de (Greek German forum) [accessed February 20, 2010]
- www.UrbanRail.Net (International portal for metros, subways and urban rail transit systems) [accessed February 20, 2010]
- www.minenv.gr (Ministry of Planning, Environment and Public Works) [accessed February 20, 2010]

- www.tee.gr (Greek Association of Engineers) [accessed February 20, 2010]
- www.BECHTEL.com (BECHTEL Corporation) [accessed February 20, 2010]
- www.hri.org (Hellenic Resources Network) [accessed February 20, 2010]
- www.cthesis.com (Cyber Thesis Journal of the Hellenic Ministry of Foreign Affairs) [accessed February 14, 2010]
- www.savingantiquities.org (International Portal on Cultural Heritage) [accessed February 20, 2010]
- www.CityofAthens.gr (Official Portal of Municipality of Athens) [accessed February 20, 2010]
- www.amel.gr (Attiko Metro Operation Company SA) [accessed February 20, 2010]
- www.dgmarket.com (International portal for tenders and procurement opportunities) [accessed February 20, 2010]
- http://nom-athinas.gov.gr (Official Portal of Prefecture of Athens) [accessed February 20, 2010].