

Mega Project: Lessons from the Big Dig

**2015 OMEGA Seminar Programme
OMEGA Centre
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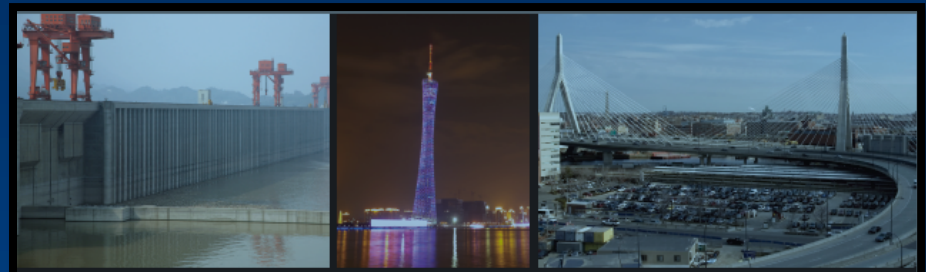
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RESEARCH METHODOLOGIES

1. Combined Theory and Practice – 10 prepublication reviews and comments including PMI
2. More than 600 references (275 Scholarly) and source documents, data, government reports, policies, 9000 procedures, feasibility studies and benefit analysis
3. 58 semi-structured interviews – perceptions of risk, cost, schedule, financing, benefit realization, quality assurance, leadership, governance integration, sustainability, project success and failure
4. Interviewees – Master Designer, 12 Engineers, 2 Members of the MTA Board, Director of Executive Oversight Coordination Commission, 2 Governors, 2 Project Directors, Utility Task Force Chair, 2 MTA Chairs, 9 Contractors, 2 Attorneys, 3 Safety Reps, 1 Broker, 2 Insurance Reps. Senior Affirmative Market Inspector, Human Resources Director and Assistant Director, Claims and Changes Director, Director, Office of Public Affairs, Director, Save the Harbor, Assistant Attorney General, Budget Director, 2 Program Managers, FHWA Project Auditor and Quality Control, project managers – Heathrow Terminal 5, Crossrail, Boston Harbor, Hong Kong Airport, Euro Tunnel, New Haven Crossing, Route 3 North, Denver Airport
5. Themes – focus on schedule, cost, team effort, inherent internal and external uncertainties, changing nature of political environment, continuous design development, evolutionary and constant change, need for flexibility to reach goals, project employees inward looking, government outward looking toward benefits realization



MEGA PROJECT MANAGEMENT

*Lessons on Risk and Project
Management from the Big Dig*

Virginia A. Greiman



WILEY

What is a Megaproject?

Any project of \$1 billion or more in size, or projects of a significant cost that attract a high level of public attention or political interest because of substantial direct and indirect impacts on the community, environment, and state budgets.

(Federal Highway Administration)

“Initiatives that are physical, very expensive, and public” (Altshuler 2003).

Megaprojects are Agents of Social Transformation

The Planning of a Megaproject must be different if a highway agency expects to achieve success. Project leaders and the management team must do more than just manage a project; they must manage a “public journey.”

**Richard Capka, former federal highway administrator and CEO/
executive director of the Massachusetts Turnpike Authority
(Capka 2004)**

Boston's Big Dig



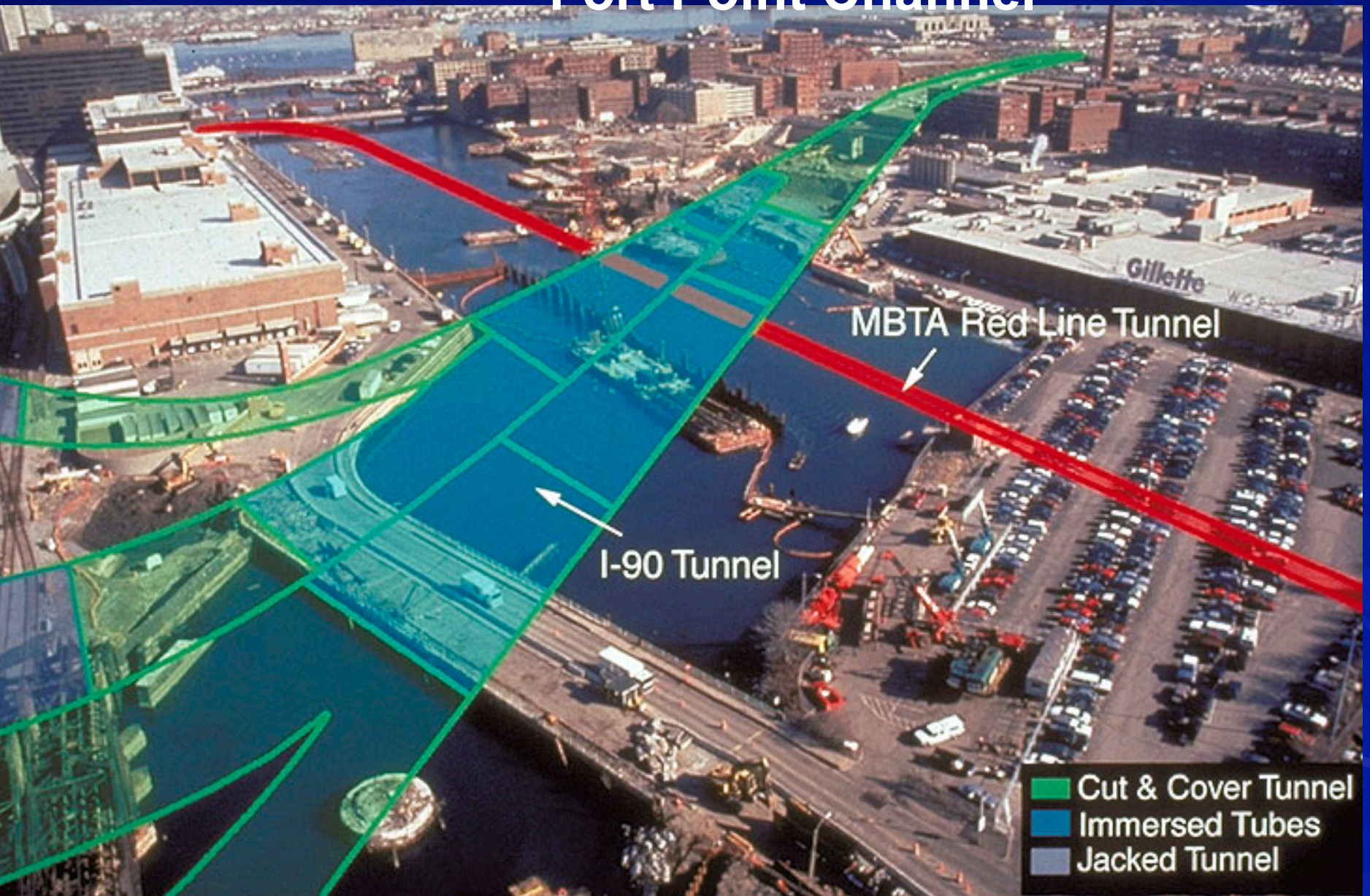
- 54 Designs
- 132 Construction Packages
- 161 Lane Miles
- 5 Major Interchanges
- Landmark Cable-stay Bridge
- Jacked Tunnels
- Immersed Tubes
- Soil Freezing
- Deep Soil Mixing
- 8 miles of Slurry Wall
- Jet Grouting
- Excavation and Parks

Boston's Central Artery



Fig. 9.5

Fort Point Channel



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Megaproject Management, John Wiley & Sons Copyright © 2013

Megaproject Success Sustainability!

- **Realizing the holistic benefits of a project and the anticipated return on this investment that demonstrates the value added in the long term.**

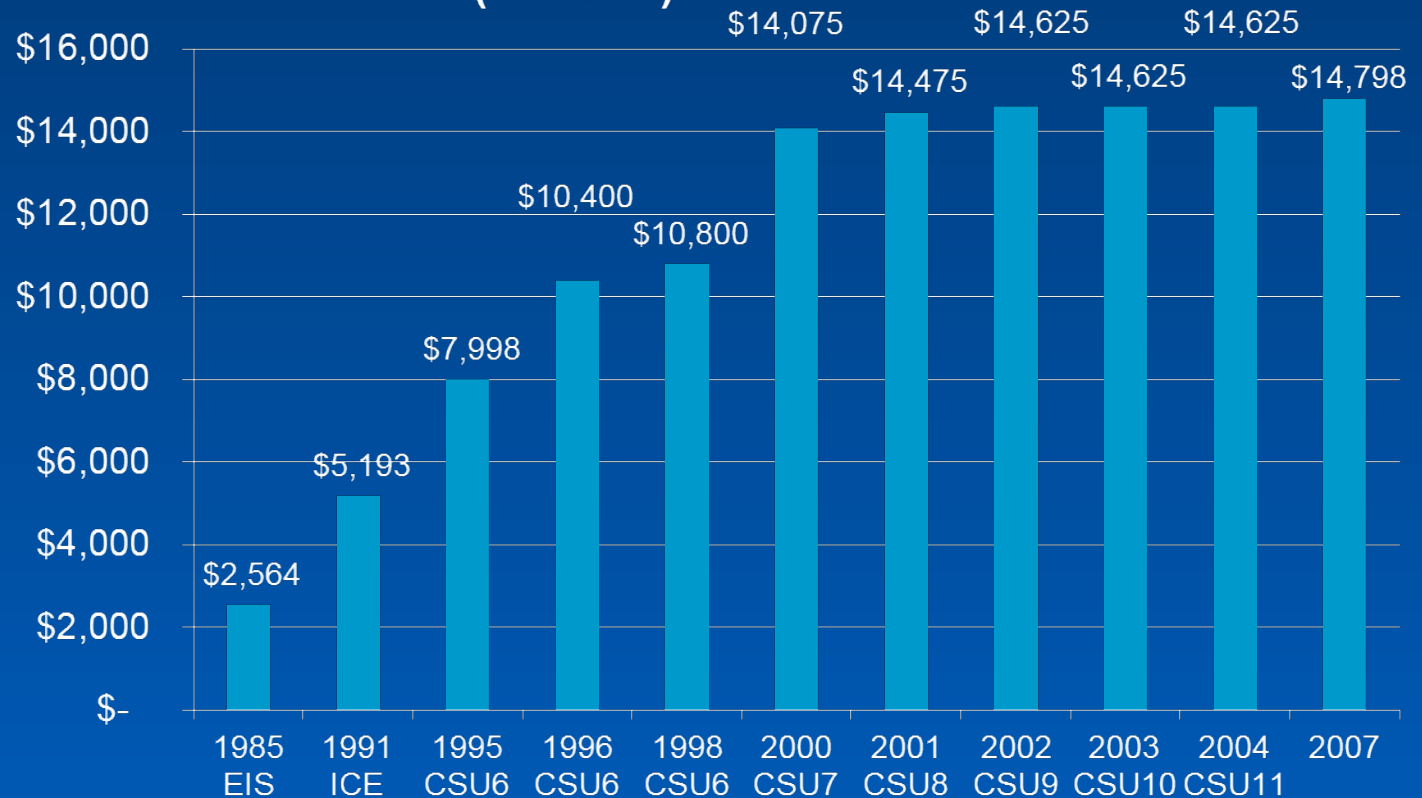
ARE MEGAPROJECTS REALLY AS BAD AS EVERYONE SAYS?

“Measuring the success of a megaproject is not linear. There are twists and turns not only in terms of engineering and the emergence of new technology, ... but in the moving target of public expectations.”

Anthony Flint, Atlantic Cities.com, September 18, 2013

Cost of Boston's Big Dig

**Central Artery/Tunnel Project Cost History
(billions)**



EIS - Environmental Impact Statement

ICE - Interstate Cost Estimate

CSU – Cost and Schedule Update

Greiman, V. (2013) Megaproject Management,
John Wiley & Sons, Inc., New York, London, Hoboken

B/PB December 1994 Forecast

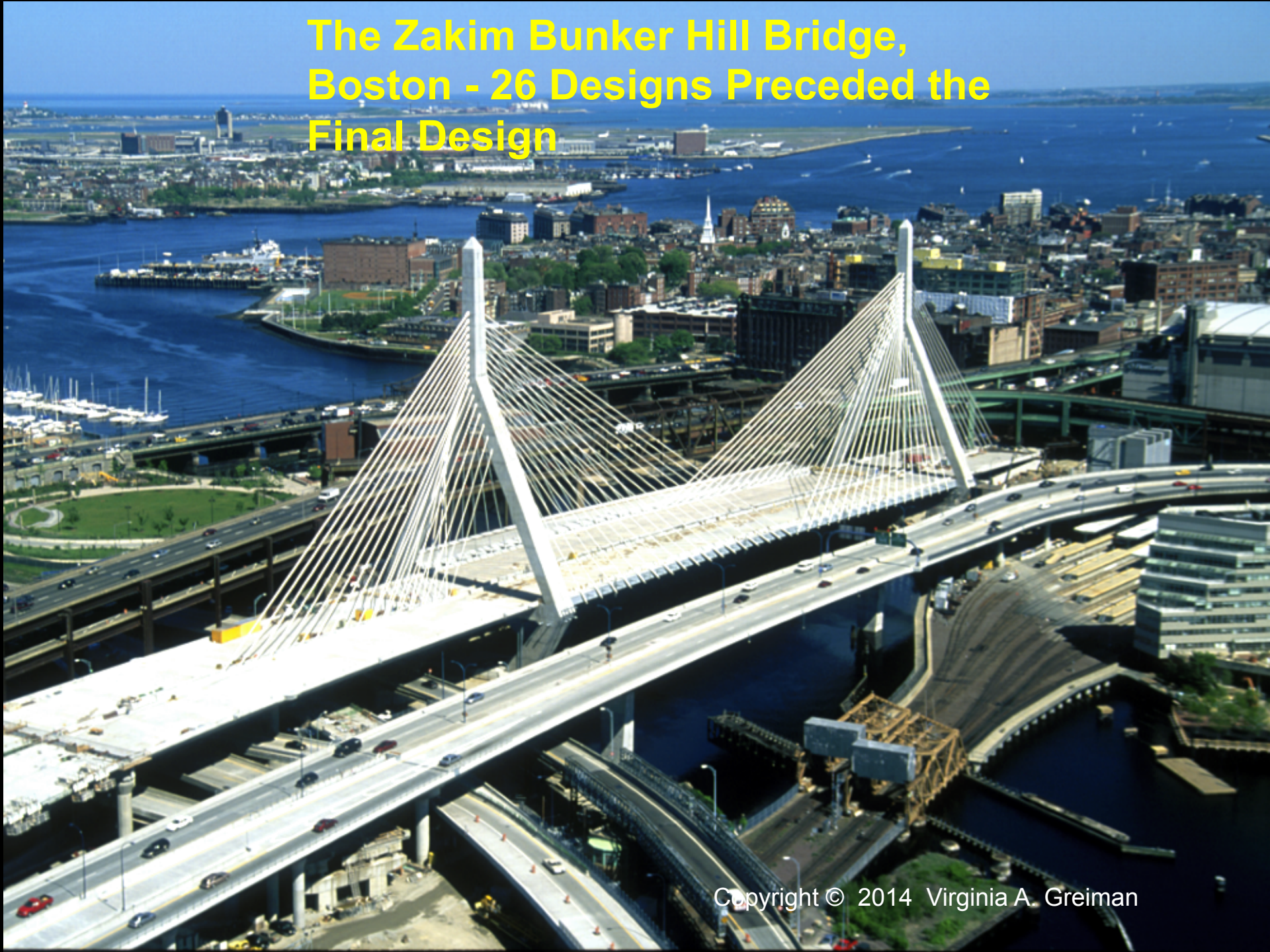
 **\$13,791,000,000.00**

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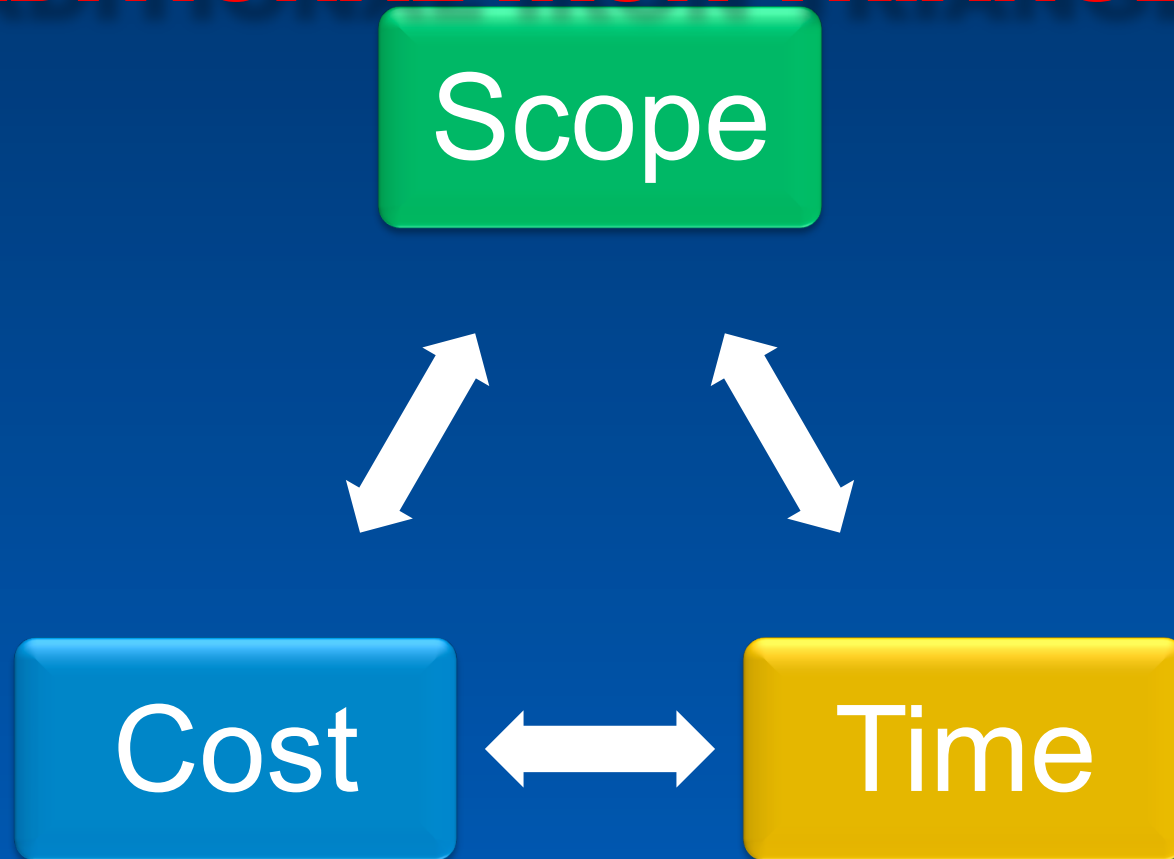
Major Impact on Project Cost and Schedule

- **Changing Stakeholder Expectations**
- **Continuous Design Development and Unforeseen Subsurface Conditions**
- **Complex Governance Structures and Integration**
- **Federal Rules and Requirements**
 - **No Inflation and Low Change Allowance in early years**
 - **Low Bid Contracts**
 - **Design Bid Build Delivery Approach**
 - **Use the Money or Lose it**

The Zakim Bunker Hill Bridge, Boston - 26 Designs Preceded the Final Design



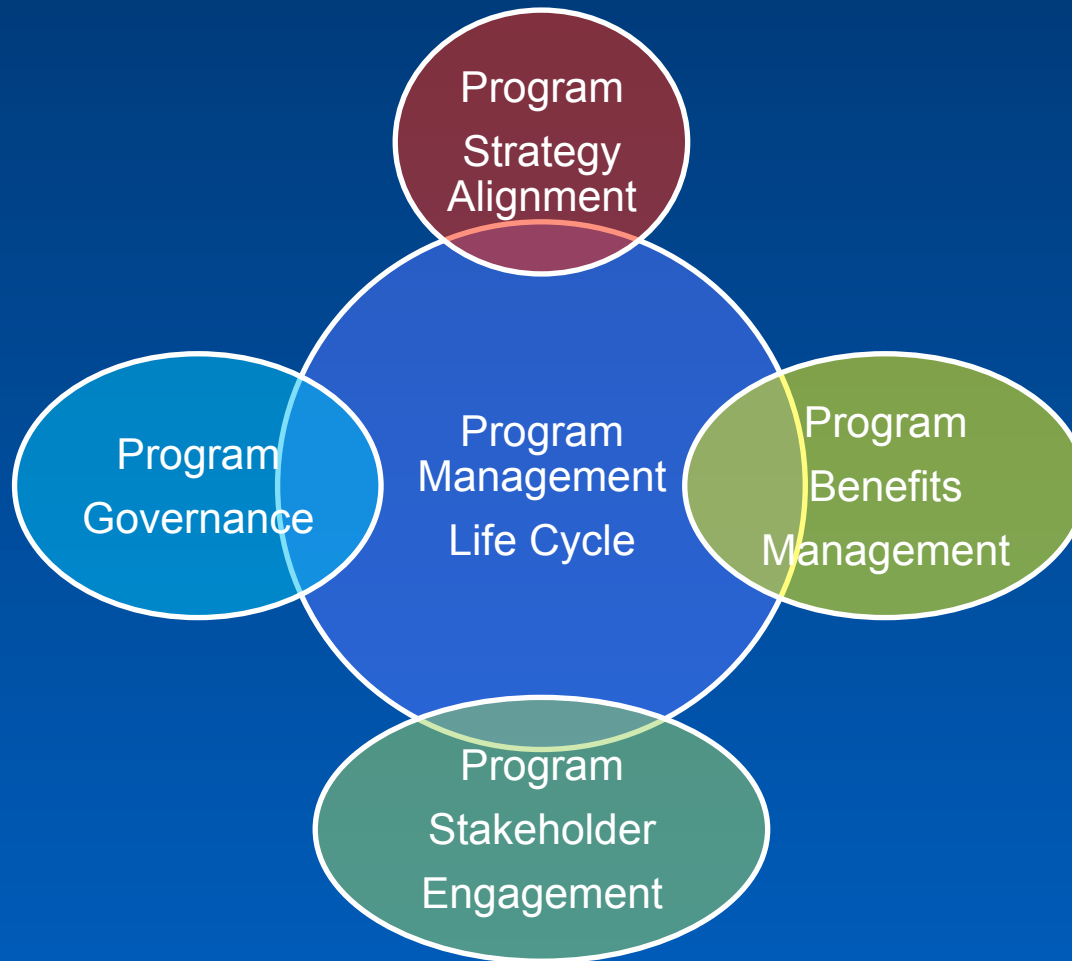
PROJECT MANAGEMENT: TRADITIONAL IRON TRIANGLE



Design, Risk, Safety and Quality Decisions!!

Program Performance Domains

PMI The Program Management Standard, 3rd ed. 2013



Benefits Management

The Business Case

- **The objective of a benefit-cost analysis is to create a business case and translate the effects of an investment into monetary terms and to account for the fact that benefits generally accrue over a long period of time while capital costs are incurred primarily in the initial years.**

The Big Dig

Methodology for Measuring Economic Benefits

- **Identify the nature of highway system changes (that affect travel times and trip distances)**
- **Measure actual changes occurring in travel times**
- **Identify expected benefits associated with soon to be completed projects**
- **Calculate Annual Dollar Value of Benefits**

Real Estate and Air Rights Impacts

- **Air Rights measured by development opportunities**
- **Access improvements**
- **Removal of real and psychological barriers created by existing infrastructures**
- **Targeting of new or unmet market niches**

Public Debate on Benefits

- California has evaluated the potential for high-speed rail for several decades, but the project's cost and scope continue to be a source of controversy. Failing to engage in a vigorous public discussion of potential benefits on huge megaprojects can ultimately lead to failed projects despite the ability to build these projects on schedule and budget.

Stakeholder Engagement

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Program Management Stakeholders



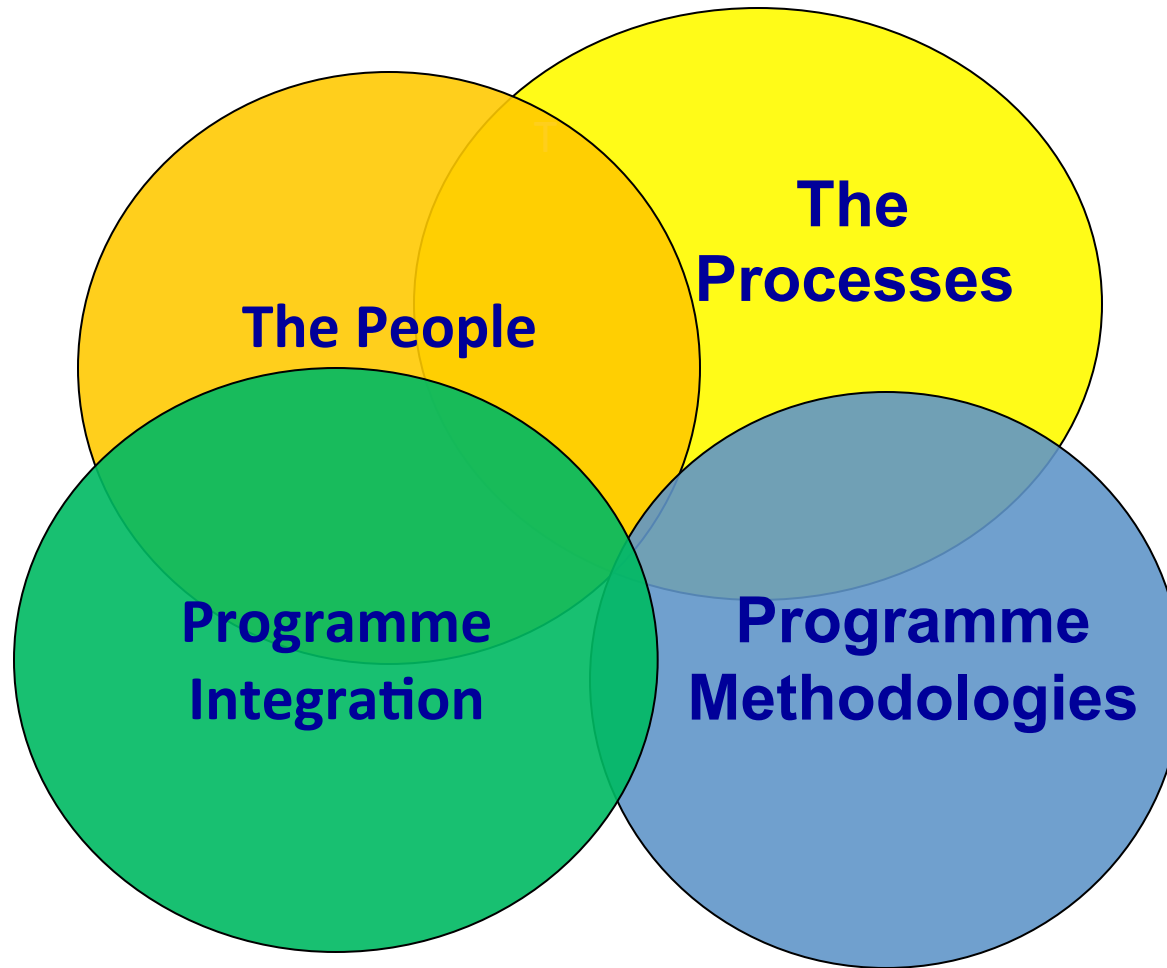
Integration: The Fifth Domain

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Integration: Key Questions

- **What types of functions or activities require coordination in the projects?**
- **What is the best way to achieve this integration?**
- **How may these needs change over time?**

Integration on Large and Complex Projects: Managing the Four Ps



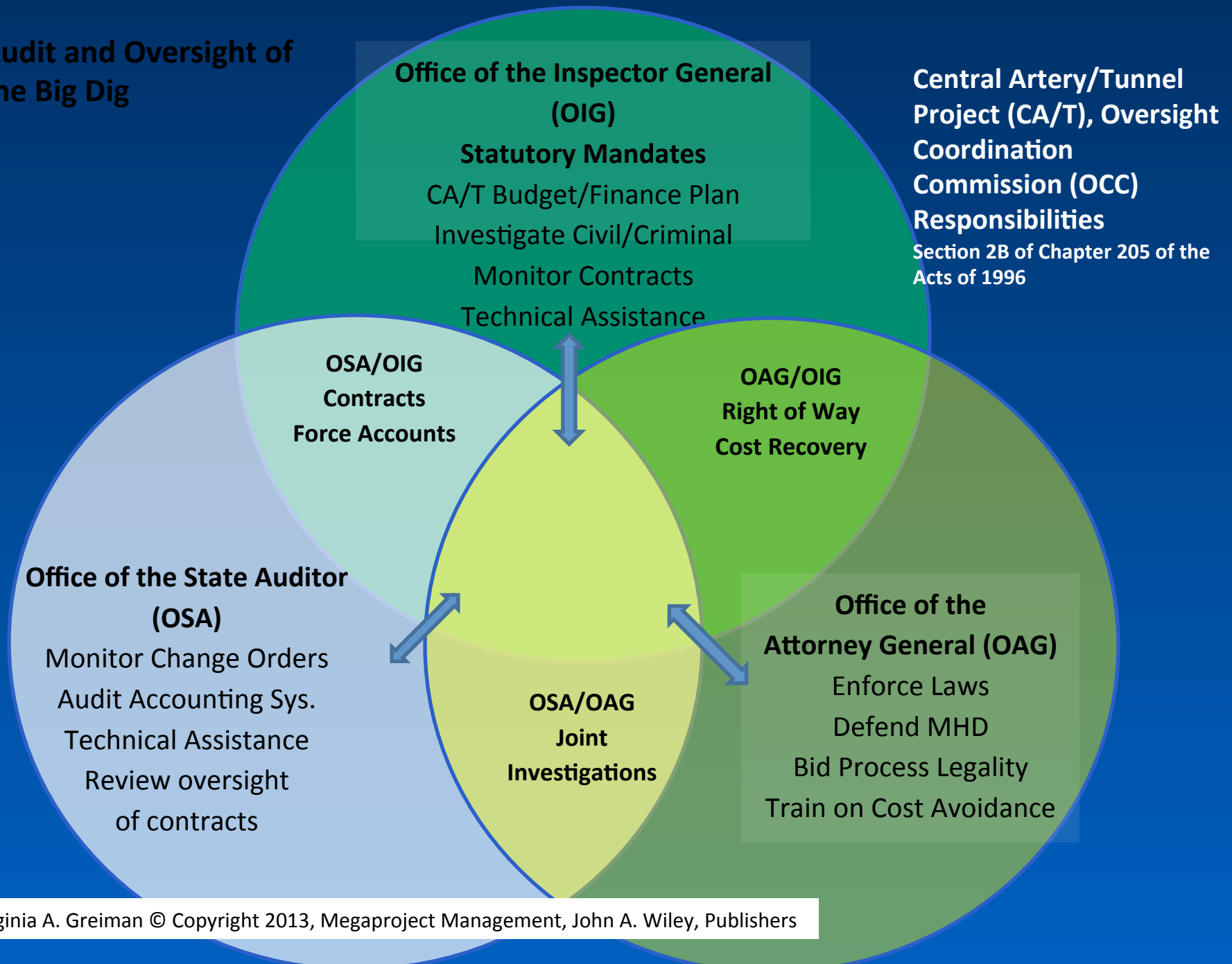
The Big Dig's Risk Management Mission Zero Accident Philosophy

To protect the Commonwealth of Massachusetts, Big Dig contractors, consultants, workers and the general public against catastrophic loss by:

**Operating an integrated world-class
Risk Management Program for:**

- Engineering and Construction**
- Loss Control**
- Safety and Health**

Audit and Oversight of the Big Dig



The Programme Methodologies

- **The Project Management Body of Knowledge (PMBOK) (PMI 2013)**
- **The Standard for Programme Management (PMI 2013)**
- **The Standard for Portfolio Management (PMI 2013)**
- **Systems Engineering**
- **Concurrent Engineering**
- **Agile Project Management**
- **Improvisation**

Integration of Systems Engineering and Programme Management Disciplines

- In 2011 The International Council on Systems Engineering (INCOSE) and the Project Management Institute (PMI®) formed a strategic alliance to advance the integration of the systems engineering and program management disciplines. The Consortium for Engineering Program Excellence (CEPE) at the Massachusetts Institute of Technology (MIT) provided strategic support in analyzing, reviewing and finalizing survey results with INCOSE and PMI.
- The results of the analysis resulted in the development of key requirements in improving the integration of the two Systems which included the following: (1) using standards from both domains; (2) formalizing the definition of integration; (3) developing integrated engineering program assessments; and (4) effectively sharing responsibility for risk management, quality, lifecycle planning and external suppliers (Conforto et al 2013).

Key lessons on Integration

- **Projects are the creature of change**
- **Integration can foster collaboration and change management**
- **Integrated project organizations (IPOs) must be carefully structured and managed**
- **Project integration can encompass many disciplines including claims management, dispute resolution, quality assurance, risk management, and dispute resolution**

What Have We Learned?

- **Megaproject investments are for future generations**
- **Megaprojects should focus on the Program Domains – Governance – Stakeholder Engagement – Organizational Alignment – Benefit Analysis and not just the iron triangle!**
- **Megaprojects require “greater integration” due to their complex, interrelationships with stakeholders and the citizens they serve**
- **Megaprojects can be Transforming – Seize the Moment!!!!**

Thank You!
Questions???

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