Risk Management and Independent Project Oversight

Two key components of a third crossing's project planning and development are the governance structure overseeing the project and the way it is funded and financed. The success of these components depends on the development of an effective and thorough risk management plan and project oversight. Given the many complexities of megaprojects, we find from our review of the literature and analysis of recent federal and state legislation, that it is critical that a new crossing governance structure incorporate robust risk management into project development and oversight.

A risk management program is a systematic process of identifying, assessing, analyzing, and responding to risks.[218] The literature agrees that a risk management plan should be developed at project initiation.[219] For the purposes of our study, we focus on the early stages of where risk management should be incorporated into a third crossing – during the development and establishment of the project's governance structure and funding and financing.

This section contains analysis on the following:

- Megaprojects and risk management in practice: Boston's Central Artery/Tunnel ("Big Dig") project
- Recent legislative efforts regarding megaproject risk management plan requirements at the California state and federal level
- Concluding thoughts on risk identification: major risks from the literature and particular risks existing in the Bay Area context

Each section contains lessons and recommendations for a third crossing.

Megaprojects and Risk Management in Practice

In this section, we discuss risk management plans for the Boston Central Artery/Tunnel project (otherwise known as the Big Dig). State officials adjusted risk management during the course of implementing this megaproject.

Boston's Big Dig project

The Big Dig project is one of the largest infrastructure projects in the U.S. Initially, the Massachusetts Highway Department (MHD, formerly the Massachusetts Department of Public Works) was responsible for the project's overall plan and construction.[220] The Massachusetts Turnpike Authority (MTA) later was assigned to be both owner and operator for the project and its management.[221] Under the MTA's guidance, the management functions are handled by an

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[218] "A Guide to the Project Management Body of Knowledge (PMBOK® GUIDE)."
[219] Greiman, *Megaproject Management*; "Risk Management Guide for Project Development"; "A Guide to the Project Management Body of Knowledge (PMBOK® GUIDE)."
[220] Board, Council, and Engineering, *Completing the "Big Dig."*
[221] Ibid.

integrated project organization (IPO) of MTA staff and B/PB staff.[222] As its official name – the Central Artery/Tunnel project – describes, the project included: 1) replacing the elevated central artery in Boston (I-93) with an underground modern highway, 2) building two major bridges over the Charles River, and 3) extending I-90 to Logan Airport.

The Big Dig project resulted in the replacement of a congested elevated freeway with a technologically advanced tunnel and bridge. The project achieved some of its targeted benefits such as reducing traffic congestion for users, increasing property value that generates new property tax revenue, and making new development possible. The project was scheduled to start in 1982 and be completed in 1998; however, due to delays, the project was not completed until 2007.[223] The original budget for the project was $2.6 billion in 1982, but the final cost was estimated at $14.8 billion in 2007, which, even when accounting for inflation, had more than a $9.28 billion cost overrun.[224] Further, recent reports show $9 billion in financing and interest costs.[225] In the end, the State has been left to carry a huge debt - $9.3 billion – without any revenue to service it, which required them to pay over $100 million a year in state transportation funds.[226]

Risk Management Program in the Big Dig

The Big Dig risk management team consisted of international risk professionals, brokers, and insurers as shown in Figure 34 below.[227] It had a clear goal from the early planning stages of maintaining a zero-accident philosophy and holding safety as the most important value.[228] With this shared value, different principles were set at the various phases of the project; but, risk was regarded as a primary attention of the project from every perspective.[229]

Although there was a collaborative, integrated project management team in decision making, it was seen as a reason for the significant cost increases. In particular, project sponsors did not fully integrate risk management into project organization until the construction was about 50 percent complete and design of the project was 99 percent complete.[230] To be specific, there were more than 100 major contracts involved in complex technical, legal, and economic issues and many processes and procedures, but at the early stage, there was little communication between and among many of the internal and external stakeholders.[231] Also, the government's role as both regulator and owner of the Big Dig discouraged efficient communication between project managers and decreased the project's accountability and transparency.[232] Moreover, cost overruns were

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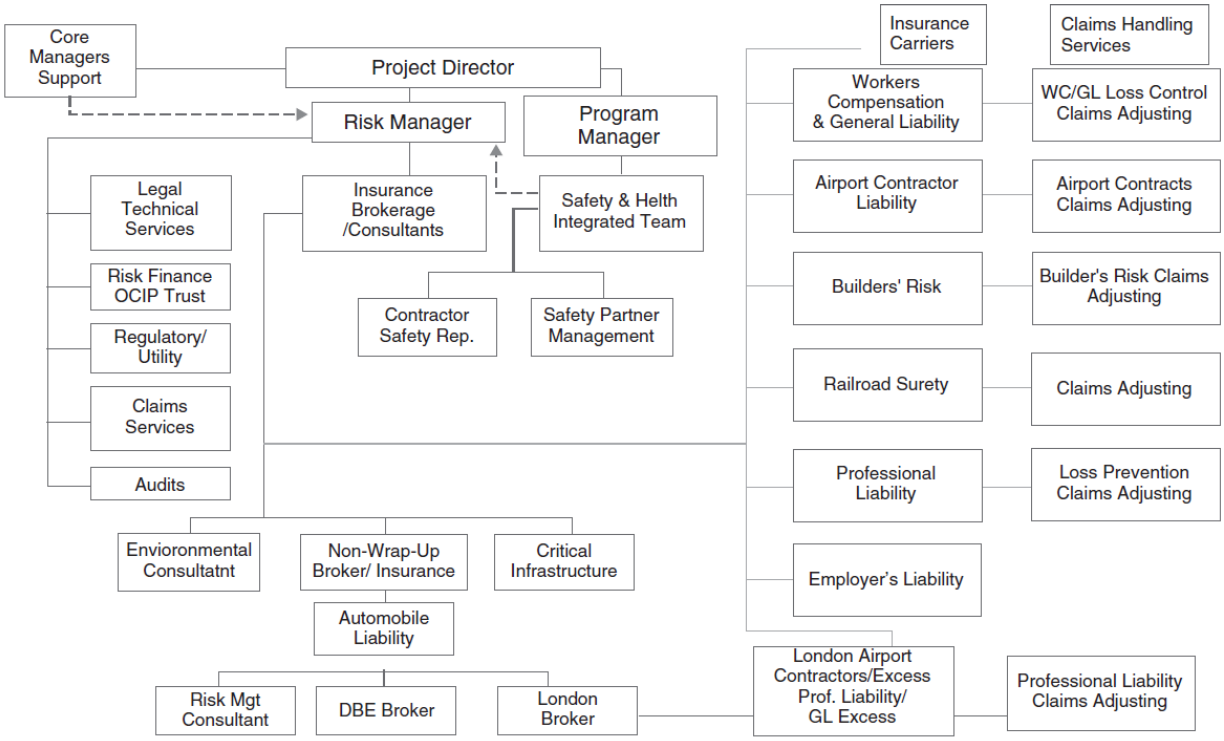
[222] Ibid.
[223] Greiman, *Megaproject Management*.
[224] Poole and Samuel, "Transportation Mega-Projects and Risk."
[225] Flint, "10 Years Later, Did the Big Dig Deliver?"; Moskowitz, "True Cost of Big Dig Exceeds $24 Billion with Interest, Officials Determine."
[226] Poole and Samuel, "Transportation Mega-Projects and Risk"; Flint, "10 Years Later, Did the Big Dig Deliver?"
[227] Greiman, *Megaproject Management*.
[228] Ibid.
[229] Ibid.
[230] Greiman, "The Big Dig."
[231] Ibid.
[232] Greiman, *Megaproject Management*.

mainly caused by unexpected challenges related to subsurface conditions, utilities, archeological discoveries and others.[233]

Figure 34: Risk management organization



Source: Central Artery/Tunnel Project, Integrated Project Organization.[234]

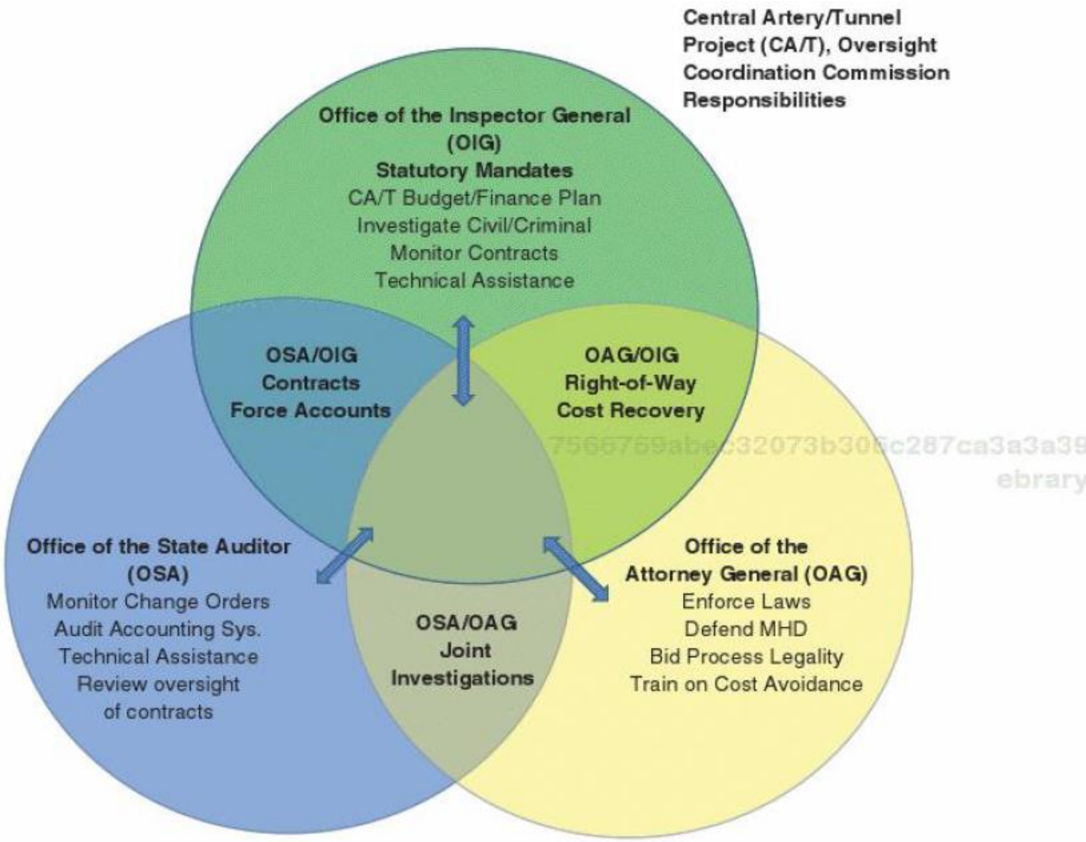
External Independent Oversight in the Big Dig

Due to the many challenges of the Big Dig, Massachusetts instituted a strong independent oversight body that consists of more than 33 local, state, and federal audit agencies, including the Central Artery/Third Harbor Tunnel Oversight Coordination Commission (OCC).[235] Under the guidance of OCC's Executive Director, member agencies were able to understand each other's responsibilities and functions and to share expertise.[236] The OCC also was responsible for combining the expertise and statutory authority of three offices that are composed of the State Auditor, the State Attorney General and the State Inspector General to investigate various aspects of the Big Dig project.[237] Figure 35 shows the three major investigating offices and activities of the oversight commission. In addition to the OCC, the Big Dig had external audit agencies and outside organizations that consisted of specialists in construction contract financial reviews.[238] Their post audits contained assertions of unreasonable or undocumented damages caused by a contractor or subcontractor,

[233] Greiman, "The Big Dig."
[234] Greiman, *Megaproject Management*.
[235] Ibid.
[236] Sloan, "Managing the Central Artery/Tunnel Project."
[237] Ibid.
[238] Greiman, *Megaproject Management*.

associated changes or claims, technical assistance, cost recovery assistance, cost overrun assistance, and review of schedules and contingency budgets.[239]

Figure 35: Central Artery/Third Harbor Tunnel (CA/T) Project Oversight Coordination Commission responsibilities diagram



Source: Commonwealth of Massachusetts. Central Artery/Third Harbor Tunnel Project Oversight Coordination Commission. Summary Report (July 1998)

The case of the Big Dig reveals the difficulty of encompassing the needs of many stakeholders and the importance of the government's role for the communication between internal and external stakeholders. Additionally, the case shows that robust risk management organization and external independent oversight should be formed from an early stage to minimize unexpected risks, such as those caused by poor communication.

Recent California State and Federal Legislation on Megaproject Risk Management

Recent megaprojects have demonstrated the need for upfront risk management, and the failures of certain megaprojects have led to new legislation in California as well as proposed federal legislation.

[239] Ibid.

California Legislation

Assembly Bill 144 of 2005, Hancock. Bay Area State-owned Toll Bridges: Financing

Background

In 2004 in response to cost overruns in the Bay Area's state-owned toll bridge program, particularly the Bay Bridge's new East Span, the California State Auditor critiqued Caltrans for its lack of rigorous risk management.[240] Although Caltrans had attempted to perform risk assessment with hired consultants, Caltrans did not have a comprehensive risk management approach, meaning that there was a lack of risk management integration into the development of budget contingencies and construction schedules.[241]

Actions

In response to the Auditor's report, the Legislature passed Assembly Bill 144 of 2005. The bill requires Caltrans to: 1) establish a comprehensive risk management plan for toll bridge seismic retrofit projects that contains clearly defined roles and responsibilities for RM, 2) quantify the impacts of identified risks in financial terms, 3) develop and maintain documents to track identified risks and related mitigation steps, and 4) regularly integrate estimates for capital, capital outlay support costs, and contingency reserves into a program-wide report.[242] After the passage of AB 144, Caltrans implemented a formal risk management program to satisfy the requirement of AB144.[243]

The bill also required the formation of a Toll Bridge Program Oversight Committee (TBPOC) that is composed of the Bay Area Toll Authority (BATA), Caltrans, and California Transportation Commission (CTC) directors. The role of the oversight committee is to: review project status; manage regular cost estimates in excess of $1 million, conduct risk assessments and oversee cash flow; and provide program direction. Also under the bill, Caltrans is required to provide monthly reports to the oversight committee. Initially the oversight's meetings were not open to the public but due to ensuing construction challenges with the new East Span, committee meetings were opened to public and media access.

Lessons

Since the formal oversight committee and risk management program were implemented mid-way through the project, the early phases did not have larger project oversight nor scheduled risk analysis and thorough engineering estimates, and as such did not benefit from the robust oversight and formal risk management plan.[244] Furthermore, of the three members on the oversight committee, one member is a director of an entity that already

[240] "New East Span Project – Lessons Learned Report."
[241] Ibid.
[242] Ibid.
[243] Ibid.
[244] Ibid.

oversees Caltrans (California State Transportation Agency) and does not include additional *external* oversight like that of the Boston Big Dig such as state auditors.

Senate Bill 1029 of 2012, Governor Brown. the Budget Act

Background

The California High-Speed Rail Authority (CHSRA) is the designated agency to plan, design and implement high-speed rail system in the California. The CHSRA reported that risk management documents received from the Authority were in the form of 2007 technical memoranda produced by the private-sector program manager, not the Authority, and appeared to be generic, incomplete, and likely out of date.[245]

Actions

Provision 8 of Item 2665-306-6043 of the Budget Act (SB 1029, Chapter 152, Statutes of 2012) requires the CHSRA provide the Legislature with a Project Update Report that contains extensive discussion of project risks and process taken to minimize those risks. The report requires a comprehensive risk management plan that describes roles and responsibilities for risk management. It addresses how the authority will identify and quantify project risks, implement and track risk response activities, and monitor and control risks throughout the duration of each project.[246] Other requirements are to quantify the impacts of identified risks in financial terms, keep documents tracking recognized risks, form mitigation phases, offer a plan for regularly reevaluating estimates of capital and support costs, provide a plan to reevaluate risks and reserves, and develop a plan for incorporating the estimates for capital, support costs and contingency reserves.[247]

Lessons

According to the California High Speed Rail Authority, the new risk management program, when complying with all of requirements for SB 1029, offers a formal, systematic approach to identifying assessing, evaluating, documenting, and managing risks for the success of a given project.[248]

Senate Bill 425 of 2013, DeSaulnier. Public Works Project Peer Review Act of 2013; Senate Bill 969 of 2014, DeSaulnier. Public Works Project Oversight Improvement Act

Background

In response to the significant cost increases, delays, and construction challenges of the Bay Bridge's new East Span (see Historical Context section), the Senate Transportation and

245 "California High-Speed Rail Authority Organizational Assessment."
246 "Project Risk Management Plan."
247 Ibid.
248 Ibid.

Housing Committee held hearings about these issues and reviewed megaproject literature that included recommendations for comprehensive and rigorous risk analysis and independent external peer review of elemental assumptions and analyses to improve project delivery.[249]

Actions

As an initial response to the Senate Committee's work, the Legislature enacted SB 425 (DeSaulnier), Chapter 252, also known as the Public Works Project Peer Review Act of 2013. The bill established a framework for including the use of peer review on public works projects by requiring a transparent process for selecting peer review group members and requiring a charter describing the group's members, objectives, and aims. The following year, the Legislature passed Senate Bill 969, which changed the name of the Public Works Project Peer Review Act to the Public Works Project Oversight Improvement Act.

Senate Bill 969 defines a megaproject as a transportation project with total estimated development and construction costs exceeding $2.5 billion dollars. It requires an administering agency to establish an independent peer review group to review the planning, engineering, financing, and other aspects.[250] In addition, the bill requires the establishment of a comprehensive risk management plan that will identify and quantify risks to the project, track responses, and control risks throughout the life of the project; the requirements are very similar to those described above in SB 1029.[251]

Lessons

The SB 969 bill analysis by Thronson explained that this bill incorporates recommendations from megaproject scholarship by requiring administering agencies overseeing all future transportation megaprojects to establish adequate comprehensive risk management plans from the outset, and to incorporate independent external peer review into the project development process.[252] This law focuses on stand-alone projects and would not necessarily extend to encompass an overall program of projects like a third crossing that could have a new crossing in tandem with other strategies recommended for consideration herein throughout our report. Further, projects under $2.5 billion are not subject to these requirements but also could experience cost increases and are in need of risk management and peer review.

H.R.4228 (Transportation Megaprojects Accountability and Oversight Act) of 2015, Introduced by Congressman Mark DeSaulnier of California

Background

[249] Flyvbjerg, Buzelius, and Rothengatter, *Megaprojects and Risk: An Anatomy of Ambition*.
[250] Thronson, "SB 969 Senate Bill - Bill Analysis."
[251] Ibid.
[252] Ibid.; Flyvbjerg, Buzelius, and Rothengatter, *Megaprojects and Risk: An Anatomy of Ambition*.

This bill draws from California Senate Bill 425 of 2013 and Senate Bill 969 of 2014 discussed above, which were authored by California Senator Mark DeSaulnier. The bill was introduced because federal rules and regulations lacked significant oversight mechanisms for large, complex megaprojects beyond financial reporting requirement for projects more than $500 million.[253] Although not enacted, the bill is an additional example of increasing efforts to improve oversight and risk management of large scale projects.

Actions

H.R. 4228 requires agencies that receive federal funds for projects over $2.5 billion to submit a comprehensive risk management plan that contains a description of identified risks associated with the project, proposed mechanisms to manage such risks, and updated cost estimates.[254] Moreover, it requires that an independent peer review group be established, avoiding conflict of interest for greater transparency and consisting of a minimum of five individuals tasked with giving expert advice on scientific, technical, and management aspects of the megaproject.[255] The peer review group is formed after the approval of construction for the project, and the group is required to have annual meetings. Also under this bill, the publication of information about the project to increase transparency is required.[256]

Lessons

The presence of a peer review group is useful; however, it would be helpful if it specified exact roles of recipients of annual reports from the peer review group. For a third crossing, these reports from the peer review group should be incorporated into overall project governance risk identification and management. Please also see the Lessons section regarding Senate Bill 969 for additional considerations.

Risk Identification and Application to a Third Crossing

Many scholars identified and classified various types of risk in megaprojects. The process is referred to as "risk identification" and is necessary when deciding which risks can be transferred to stakeholders at each phase. Based on an extensive review of published research on risk management in megaprojects, Irimia-Diéguez, Sanchez-Cazorla, & Alfalla-Luque argue there are nine main megaproject risks: 1) design risks, 2) legal and/or political risks, 3) contractual risks, 4) construction risks, 5) operation and maintenance risks, 6) labor risks, 7) clients/users/society risks, 8) financial and/or economic risks, and 9) force majeure (such as natural disasters, extreme weather conditions, and terrorist acts) (see Table 3).[257]

253 "Congressman DeSaulnier Introduces Bi-Partisan Legislation to Improve Accountability & Oversight of Megaprojects."
254 "Transportation Megaprojects Accountability and Oversight Act of 2015 (H.R. 4228)."
255 Ibid.
256 "Government Relations and Public Affairs Committee Meeting."
257 Irimia-Diéguez, Sanchez-Cazorla, and Alfalla-Luque, "Risk Management in Megaprojects."

Risk Identification for the Third Crossing

From this list, consideration of certain risks needs emphasis if the region and state were to move ahead with a third crossing because of the Bay Area's complex larger political, geographical, and socio-economic context.

Stakeholder Support (2. Legal and/or political risks)

As mentioned in the Policy Context and Current Conditions section, a variety of communities in the Bay Area include historically disadvantaged and low-income communities. When proceeding with the project, issues regarding various neighborhoods may surface. Issues associated with public trust, political advocacy of special interest groups, and managing expectations of key stakeholders in the project process are particularly relevant. Meaningful community involvement and public approval is critically important to its success. Maintaining public support at the local level poses its own risks to the project budget if the project does not meet expectations and mitigation costs are not budgeted for in the cost estimates.[258]

Right-of-way (3. Contractual risks)

Acquiring right-of-way is very important to meet project deadlines, which may be influenced by timing of achievement of environmental milestones, receipt of funding, and completion of multiple levels of governmental review and approval processes.[259] The problems caused by the delay of the acquisition process could affect overall project development and increase project costs.[260]

As a successful example of acquiring right-of-way, the West Rail Line project by the Regional Transportation District (RTD) in Colorado provides several lessons.[261] As one of the rail line planned by the RTD FasTracks projects in the Denver metropolitan area**,** the West Rail line Project is 12 miles from downtown Denver to Jefferson County.[262] Despite its complex right-of-way acquisition process and different schedule for acquiring each parcel, RTD was able to succeed in the acquisition of right-of-way by: 1) communicating early and often with stakeholders, property owners, and residents, 2) establishing processes to deal with contentious or disputed acquisitions, and 3) ensuring a formal, approved schedule for acquisitions that were included in the contract with the contractor.[263]

Environmental Approvals (7. Clients/users/society risks)

One of common risks that megaprojects have in California is the process of obtaining environmental approvals. In addition to National Environmental Policy Act (NEPA) provisions, California has specific environmental requirements through the California Environmental Quality Act (CEQA). This can cause delays in project development schedules.[264] Moreover, interdependencies between

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[258] "Project Update Report to the California State Legislature."
[259] Ibid.
[260] Ibid.
[261] "West Rail Line: Lessons Learned."
[262] Regional Transportation District, "Fastracks Plan"; "West Rail Line: Lessons Learned."
[263] "West Rail Line: Lessons Learned."
[264] "Project Update Report to the California State Legislature."

various agencies granting approvals/permits may generate delays of the entire process.[265] For more details, please see the Funding and Financing section.

Table 3: Identifiable risk types

	Types of Risks	Description
1.	Design risks	Risks related with the planning phase of the megaproject, such as delivery method, contract formation, and scope control
2.	Legal and/or political risks	Risks derived from changes in the governing policy of the country where the megaproject is developed
3.	Contractual risks	Risks derived from the renegotiation of the contract, such as midstream change of project scope, and issues caused by imprecision and vagueness in the contract
4.	Construction risks	most significant risks, including cost overruns (or cost escalation), project schedule, coordination problems, and inappropriate design or accident during the construction
5.	Operation and maintenance risks	Risks related with the operational phase that can affect the operation cost, operation capacity or quality, such as economic viability issues, unnecessarily high operations costs, poor construction quality, and operator incompetence
6.	Labour risks	Risks related with the workers linked to training, language, accident cost, and culture
7.	Clients/users/society risks	Risks affecting revenues, including: 1) demand risks such as inflation, price trends, price range; 2) market risks such as variations in the client's requirement existence of the market;3) social profitability risk which puts into question if the project provides the expected benefits to society; 4) impact on local groups' risk; 5) environmental risks; 6) reputational risks
8.	Financial and/or economic risks	Risks encompassing a variety of events related with the financing and performance of the megaproject
9.	Force majeure	Natural disasters, extreme weather conditions, terrorist act

Source: Risk Management in Megaprojects.[266]

[265] Ibid.
[266] Irimia-Diéguez, Sanchez-Cazorla, and Alfalla-Luque, "Risk Management in Megaprojects."

Incorporation of Risk Management, Oversight and Peer Review

Drawing from risk management and megaprojects literature about the key principles for successful risk management and recent key legislation efforts discussed above, key lessons that are critical for incorporation into a third crossing's governance structure and risk management plan include:

- External independent oversight and peer review are critical and should be incorporated from a project's inception in its governance structure.
- The megaproject should have a robust, high-level management program that covers all aspects and phases of the project and risk such as those discussed in Table 3.
- Risk management should function as a center of the project.
- A risk management plan and overall project should have a clear and shared vision of risk along the planned management aims of the organization.
- The risk management plans and overall project should develop a defined strategy that focuses on continuous improvement with an iterative progression, shared lessons learned, and the implementation of best practices.
- The project should involve the public and stakeholders at every step of the risk management.
- The risk management process should be tied to the development and management of program cost contingencies, which would be determined by the risk assessment documented in the risk register.