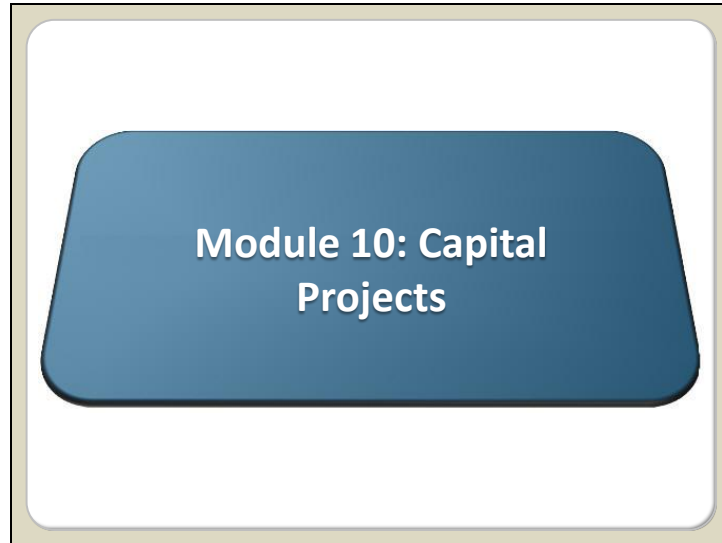


## **TFLEx Guide for Transit Newbies**

### **Module 10**

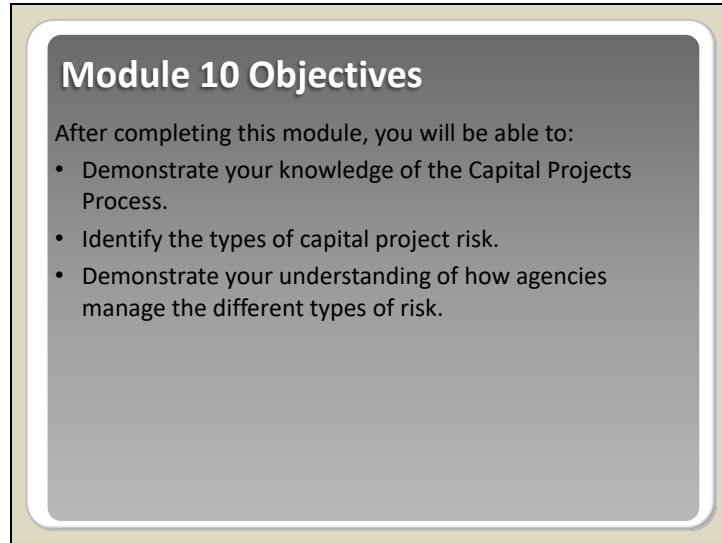
#### **Capital Projects**



Welcome to the Capital Projects module in the TFLEx Guide for Transit Newbies. This module addresses your role in capital projects.

### Module 10

#### Capital Projects



#### Learning Objectives

After completing this module, you will be able to:

- Demonstrate your knowledge of the Capital Projects Process,
- Identify the types of capital project risk, and
- Demonstrate your understanding of how agencies manage the different types of risk.

## TFLEx Guide for Transit Newbies

### Module 10

#### Capital Projects



#### Capital Projects Process Overview

How would you get started on a capital project? Where does the “ball get rolling?” To get a better idea of this, let’s take a look at some of the typical major capital project duties.

##### *Board of Directors and the regulatory agencies*

The duty or role of the Board of Directors and the regulatory agencies is to approve the plan that is brought before them. This includes everything from a TIP [*pronounce as “Tip”*] to a Capital Improvement Program, to a plethora of other capital projects brought to them.

## **TFLEx Guide for Transit Newbies**

### **Module 10**

#### **Capital Projects**

#### **Capital Projects Process Overview (cont.)**

##### *Planning Department*

- Does preliminary studies.
- Holds public meetings.
- Drafts environmental impact statements.
- Does preliminary engineering work, determines route.
- Hands project over to Project Management Department.

The Planning department has several duties that it needs to attend to after the plan has been approved by the Board of Directors and regulatory agencies. This department does the preliminary studies, holds public meetings, and drafts the environmental statements. They also do the preliminary engineering work and determine the route. When this department finishes their duties, the capital project is then handed over to the Project Management department.

## **TFLEx Guide for Transit Newbies**

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#### **Capital Projects**

#### **Capital Projects Process Overview (cont.)**

##### *Project Management Department*

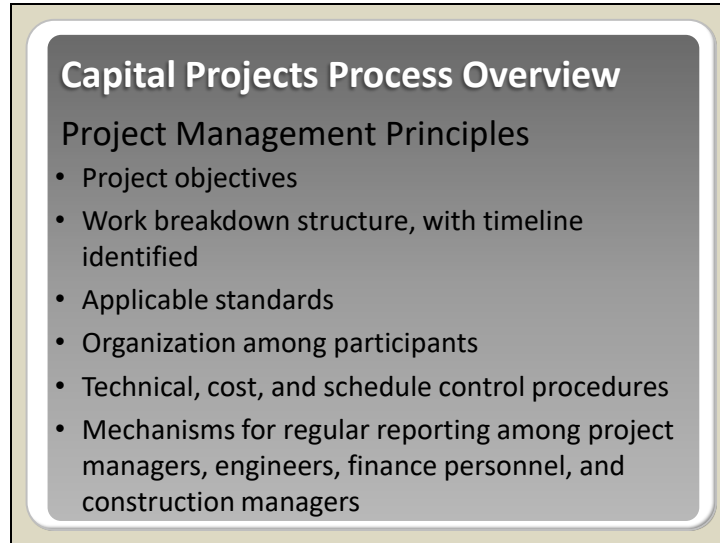
- Completes engineering and design.
- Finalizes locations, initiates real estate acquisition.
- Oversees design and engineering consultants.

The Project Management department completes the engineering and design, and finalizes the location, including initiating the real estate acquisition. This department also oversees the General Engineering Consultant (GEC) and the Systems Design Consultant (SDC) in the final design and contracting.

Next, we'll talk about the project management principles.

### Module 10

#### Capital Projects



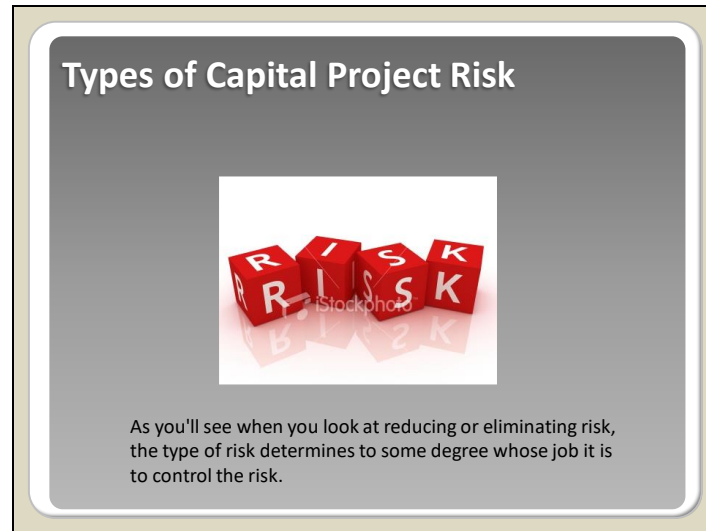
#### Project Management Principles

Effective management of any project depends upon these elements:

- Project objectives,
- Work breakdown structure, with timeline identified,
- Applicable standards,
- Organization among participants,
- Technical, cost, and schedule control procedures, and
- Mechanisms for regular reporting among project managers, engineers, finance personnel, and construction managers

### Module 10

#### Capital Projects



#### Types of Capital Project Risk

As you'll see when you look at reducing or eliminating risk, the type of risk determines to some degree whose job it is to control the risk.

- **Design risks:** Design risks include those related to project scope, schedule, construction plans, materials supplies, cost estimating, constructability, and real estate acquisition. Knowing site conditions is another example.
- **Construction Risks:** Construction risks can include defective design, faulty workmanship, unforeseen site conditions, accidents, unidentified utilities, endangered species on the site, delays related to real estate or right of way acquisitions, floods, weather, fire, hazardous materials, and permitting delays- among others!

### **Module 10**

#### **Capital Projects**

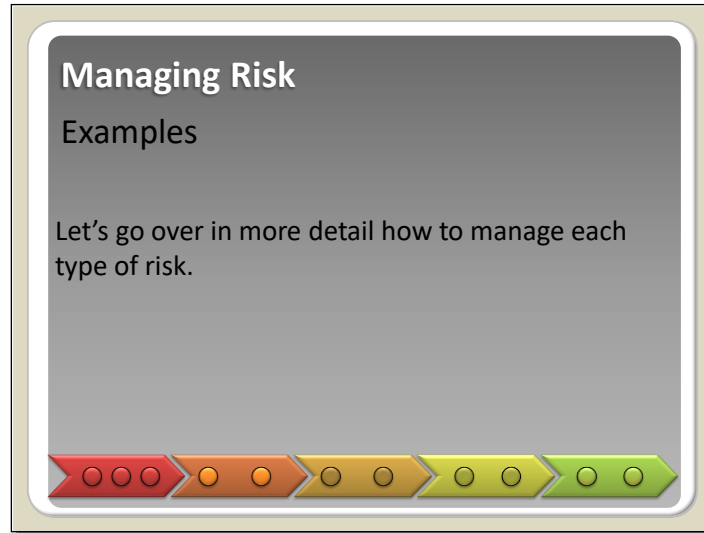
##### **Types of Capital Project Risk (cont.)**

- **Financing Risks:** Financing risks might be shortfalls in funding because of reduction in tax revenue or FTA funding, or increased cost because of inefficiencies, project delays, or scope changes.
- **Economic Risks:** Economic risks could be associated with external conditions that could lower tax revenues, and/or increase costs by bringing about contractor bankruptcies, or increasing costs of labor, material, or equipment.
- **External Political and Social Risks:** External political and social risks are numerous and could stem from relationships with public utilities, residents of the cities and towns affected by the project, public response to accidents on the project, or changing environmental regulations.

## TFLEx Guide for Transit Newbies

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#### Capital Projects

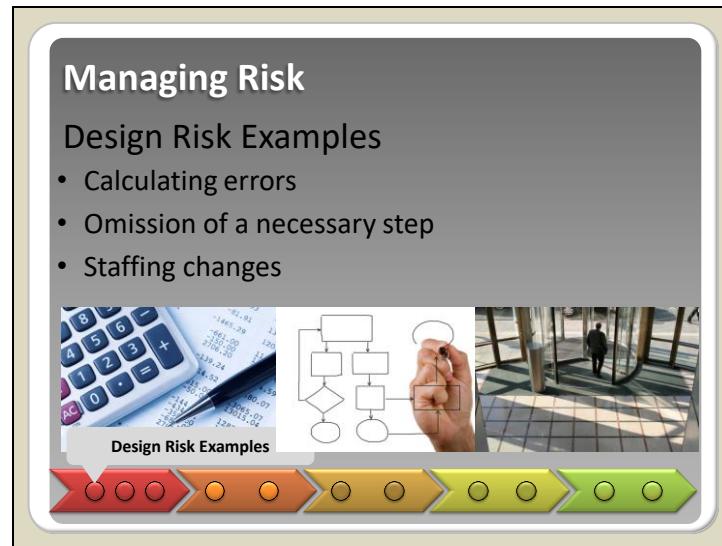


#### Managing Risk

Let's go over in more detail how to manage each type of risk.

### Module 10

#### Capital Projects



#### *Design Risk*

Reviews performed during the design process help to prevent or minimize errors and omissions. The reviews try to surface all uncertainties for risk potential, to determine contingency factors and establish contingency reserves. Still, errors or omissions can occur. Examples:

- Estimators could make errors in calculating the amount of material or labor needed to do an aspect of the work. For instance, a paid holiday could fail to be taken into account during design.
- There could be an omission of a step needed; for example, the design could fail to consider the negative impact of a pre-existing legal impediment.
- The engineering competence needed to do the project could be suddenly unavailable, in the event of a staffing change at the agency or one of its contractors.

However, if the allocation of the risk is perceived to be unfair, it might cause bids to increase, or even discourage qualified contractors from bidding. There could also be an increase in disputes on a project, leading to litigation and delays.

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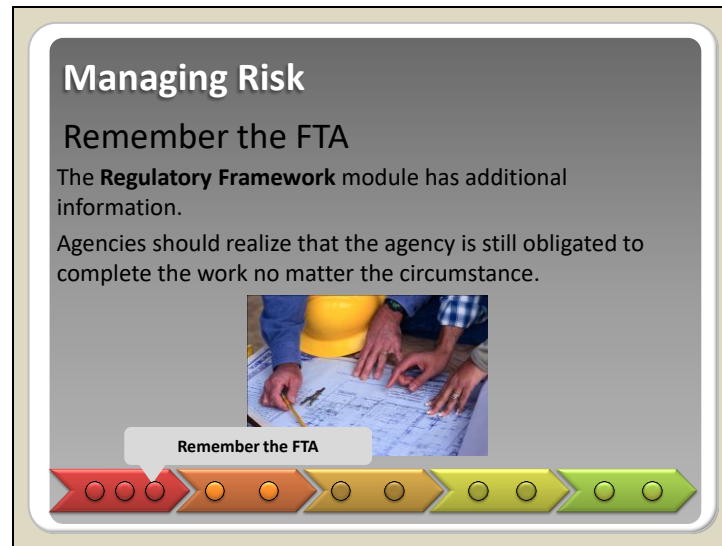
Prior to awarding construction contracts, Project Management personnel review the design and establish contract terms and conditions. At that time, insurance strategies are formed to reduce the risk, or transfer it to other parties, such as contractors. Here are some examples:

- To reduce the risk of inaccurate cost estimates, the estimates should be published in detail at the time of bid opening.
- Scope-change risk can be reduced by employing a sound management plan that uses accepted Project Management steps.

Allocating project risks in this way can help to reduce cost and schedule overruns; the strategy means that either an agency or its contractors, or both, could carry insurance policies to cover identified risks. For example, some engineering firms that perform design work deal with risk on a project by purchasing professional liability insurance specifically for a project.

### Module 10

#### Capital Projects



**Managing Risk**

**Remember the FTA**

The **Regulatory Framework** module has additional information.

Agencies should realize that the agency is still obligated to complete the work no matter the circumstance.

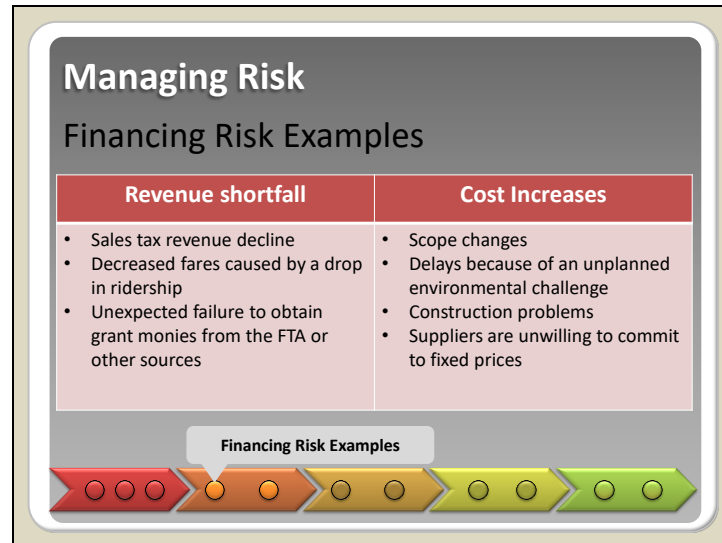
Remember the FTA

The slide features a background image of two people in hard hats reviewing blueprints. At the bottom, there is a progress bar with ten colored circles (red, orange, yellow, green) and a speech bubble pointing to the second circle with the text 'Remember the FTA'.

- The Regulatory Framework module has additional information on the contracting requirements that apply if your capital project is partially funded by the Federal government. These include Buy America, Davis-Bacon Wage Rates, and more.
- Also, remember as a public entity, agencies should realize that even if risk is shared with or shifted to contractors, if the contractor goes out of business, the agency is still obligated to complete the work.

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#### Capital Projects



Both sides of the construction profitability equation can be the cause of financing risk. Revenue shortfall could occur because of sales tax revenue decline, or decreased fares caused by a drop in ridership, or an unexpected failure to obtain grant monies from the FTA or from other sources.

Cost increases might be attributable to scope changes, delays because of an unplanned-for environmental challenge, or any number of construction problems. For a long project, it might be that suppliers are unwilling to commit to fixed prices for the materials being provided.

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#### Capital Projects

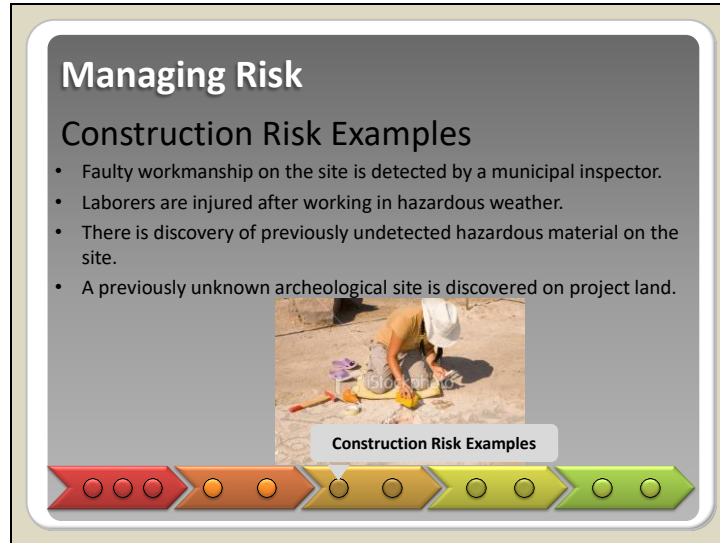


So how is the financing risk managed?

- The Finance Department should make the review and revision of revenue projections an ongoing part of its regular work.
- Contingency funds needed for the project should be developed in the design phases.
- The Finance Department can make changes in project financing, but only by cooperating closely with Project Management staff when construction actually begins, to get progress reports and the latest projected costs for the project.

### Module 10

#### Capital Projects



Safety, quality, and security issues are the primary examples of construction risk. These issues include:

- Faulty workmanship on the site is detected by a municipal inspector; the project is delayed while the work is undone and re-done.
- A construction supervisor makes the decision to work during hazardous weather conditions, and two laborers are injured as a result.
- There is discovery of previously undetected hazardous material on the site.
- A previously unknown but nationally important archeological site is discovered on project land.

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Anticipating construction problems is the first step in managing construction risk, before contracts are negotiated and long before construction is started. In some cases, anticipated construction risks can be addressed by incorporating proper terms and conditions in contracts.

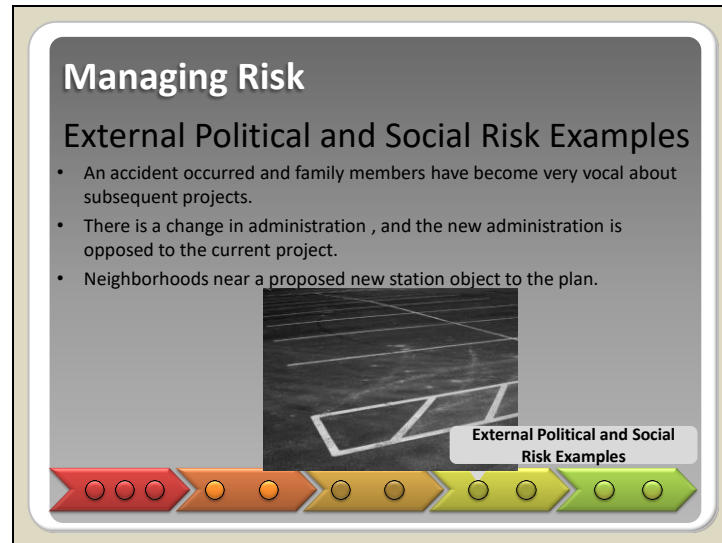
For this reason, every agency should make a focused effort to learn lessons about capital projects from its own and other transit properties' experiences.

Managing construction risk should be a team effort, with some key players:

- Contracting officers with specific knowledge of construction management
- Risk management personnel, who identify insurance strategies.
- Cost estimators, who continually revisit projected costs for the project, taking into consideration actual occurrences and planned events.
- Finance personnel, who obtain financing for estimated costs and ongoing revisions.
- Construction managers, who oversee safety of site operations.

### Module 10

#### Capital Projects



Primary risk drivers in this category are relationships with cities, towns, utilities, railroads, government transit authorities, and environmental agencies. Unforeseen changes in laws and regulations that have a bearing on an agency's projects are also a possibility. Here are some examples:

- Despite our best efforts, an accident occurred on a previous project site, and several laborers were seriously injured. Their families have become very vocal about subsequent projects, claiming that the agency's response to the accident was unsatisfactory.
- There is a change in administration in one of the outlying cities through which a project passes. The new administration is opposed to the current project.
- Neighborhoods near a proposed new station object to the plan because the needed parking lot will displace some low-income housing.

### Module 10

#### Capital Projects

### Managing Risk

#### Managing External Political and Social Risk

- Political and social risk identification is done by the project management department.
- Mitigation of the risk is managed by personnel assigned to handle external and public affairs.



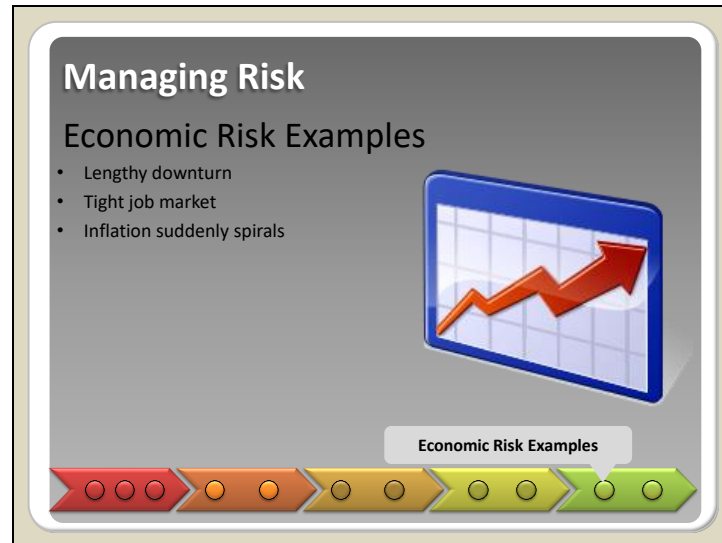
Managing External Political and Social Risk



Political and social risk identification is done by the project management department, as early as possible during project planning and design. Mitigation of the risk is usually managed by personnel assigned to handle external and public affairs.

### Module 10

#### Capital Projects

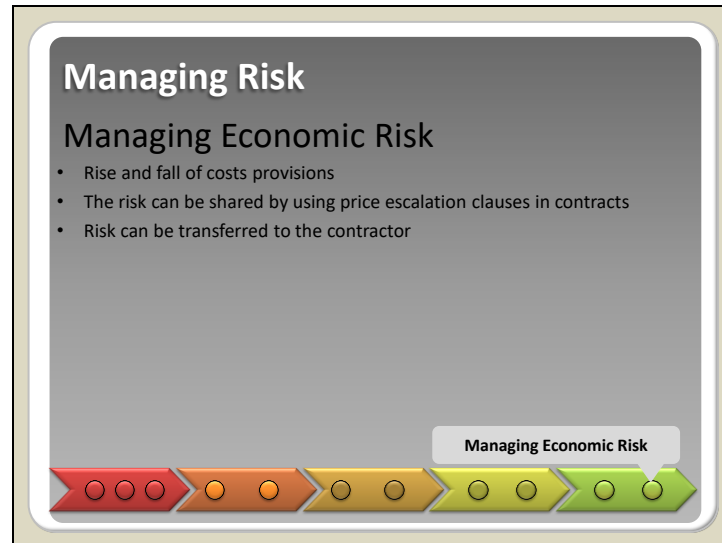


Projects can go awry because of external conditions that are not social or political, but linked to inflation, the job market, unemployment rates, and the like. As the economic downturn that began in 2007 showed, projects may be of vital importance to a community, but are unable to be completed due to economic conditions. Let's look at some examples:

- An unexpectedly lengthy downturn brings about a 25% decrease in sales tax revenue compared with the prior year. Models used to forecast construction progress were dependent on greater revenue levels.
- A very tight job market reduces the number of bidders on projects, resulting in higher material and labor costs than anticipated.
- Inflation suddenly spirals, contributing to higher-than-expected material and labor prices.

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#### Capital Projects



Capital cost estimates consider economic risks, during design. During contracting, when bids are received and evaluated, contract clauses and insurance programs also reflect awareness of economic risk. Here are some examples:

- If inflation rates are expected to be high, and the project will last longer than 24 months, an agency can insert "rise and fall of costs" provisions.
- If inflation is expected to be high and the project is shorter than 18 months, the risk can be shared by using price escalation clauses in contracts. This action can encourage contractors to keep costs low.
- If the project is short, the risk can be transferred to the contractor by means of contract terms-in general, the contractor can control short-term costs.

Module 10

Capital Projects

## Managing Risk

### Knowledge Check

|                                            |                                                              |
|--------------------------------------------|--------------------------------------------------------------|
| <b>Design Risk</b>                         | Workers are injured because they worked in hazardous weather |
| <b>Financing Risk</b>                      | A new administration opposes the project                     |
| <b>Construction Risk</b>                   | Sales tax revenue decline                                    |
| <b>External Political and Social Risks</b> | Staffing change                                              |
| <b>Economic Risk</b>                       | An unexpected lengthy downturn                               |

Let's check your knowledge. Match each risk on the left to its specific example on the right.

Answer on the next page.

## Managing Risk

### Knowledge Check

|                                            |                                                              |
|--------------------------------------------|--------------------------------------------------------------|
| <b>Design Risk</b>                         | Workers are injured because they worked in hazardous weather |
| <b>Financing Risk</b>                      | A new administration opposes the project                     |
| <b>Construction Risk</b>                   | Sales tax revenue decline                                    |
| <b>External Political and Social Risks</b> | Staffing change                                              |
| <b>Economic Risk</b>                       | An unexpected lengthy downturn                               |

Each risk, on the left, is matched to its specific example on the right.

## TFLEx Guide for Transit Newbies

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#### Capital Projects

*Ten more questions to test your knowledge.*

1. Which category best describes the risk example of tax revenue declines?
  - Design
  - Construction
  - Financing
  - Economic
  - External political/social
2. Which category best describes the risk example of residents of local towns protesting right of way acquisition?
  - Design
  - Construction
  - Financing
  - Economic
  - External political/social
3. Which category best describes the risk example of inflation driving up material costs?
  - Design
  - Construction
  - Financing
  - Economic
  - External political/social
4. Which category best describes the risk example of bad contractor workmanship?
  - Design
  - Construction
  - Financing
  - Economic
  - External political/social
5. Which category best describes the risk example of cost estimating error?
  - Design
  - Construction
  - Financing
  - Economic
  - External political/social

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#### Capital Projects

6. True or false: Design reviews are the primary vehicle for mitigating design risk.
  - True
  - False
7. True or false: The Finance Department is expected to anticipate revenue shortfalls attributable to sales tax declines.
  - True
  - False
8. True or false: One way to reduce construction contract risk is to evaluate the risk before contracts are awarded.
  - True
  - False
9. Here is a scenario. There is a construction site in the middle of the city taking place in January. A water main has broken, which is causing construction delays. Is this considered a construction risk?
  - Yes
  - No
10. True or false: External political and social risks can be addressed entirely in contract terms and conditions.
  - True
  - False

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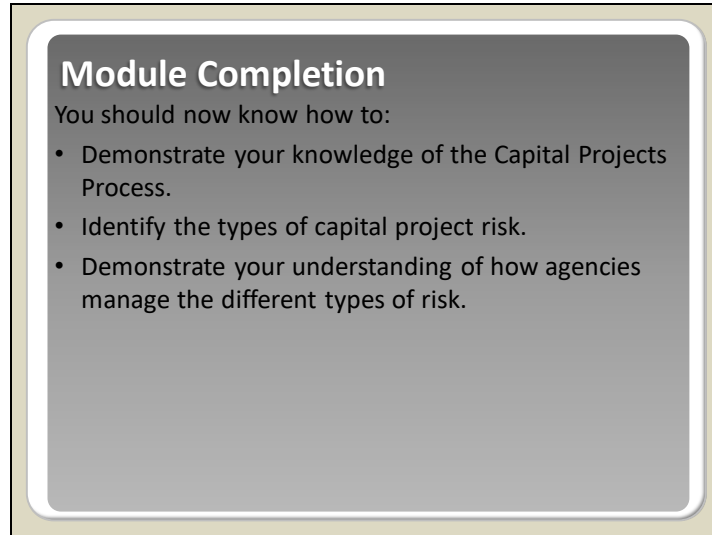
#### Capital Projects

##### *Answers to Quiz*

1. Which category best describes the risk example of tax revenue declines?  
**Financing**
2. Which category best describes the risk example of residents of local towns protesting right of way acquisition?  
**External political/social**
3. Which category best describes the risk example of inflation driving up material costs?  
**Economic**
4. Which category best describes the risk example of bad contractor workmanship?  
**Construction**
5. Which category best describes the risk example of cost estimating error?  
**Design**
6. True or false: Design reviews are the primary vehicle for mitigating design risk.  
**False**
7. True or false: The Finance Department is expected to anticipate revenue shortfalls attributable to sales tax declines.  
**True**
8. True or false: One way to reduce construction contract risk is to evaluate the risk before contracts are awarded.  
**True**
9. Here is a scenario. There is a construction site in the middle of the city taking place in January. A water main has broken, which is causing construction delays. Is this considered a construction risk?  
**Yes**
10. True or false: External political and social risks can be addressed entirely in contract terms and conditions.  
**False**

### Module 10

#### Capital Projects



Congratulations! You have completed the **Capital Projects** module. You should now know how to:

- Demonstrate your knowledge of the Capital Projects Process,
- Identify the types of capital project risk, and
- Demonstrate your understanding of how agencies manage the different types of risk.

## **TFLEx Guide for Transit Newbies**

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#### **Capital Projects**

##### **Capital Projects Glossary**

##### **American Association of State Highway & Transportation Officials (AASHTO)**

A standards setting body which publishes specifications, test protocols, and guidelines that are used in highway design and construction throughout the United States. Despite its name, the association represents not only highways but air, rail, water, and public transportation as well.

##### **Advisory Council on Historic Preservation (ACHP)**

Independent agency charged with coordinating Federal, State, and local and private preservation efforts and advising the President and Congress matters of historic preservation. It acts in an advisory capacity.

##### **Alternative Analysis**

The study of various solutions to a transportation concern.

##### **Best and Final Offer**

For negotiated procurements, a contractor's final offer following the conclusion of discussions.

##### **Capital Program Committee (CPC)**

This committee was established to review and make recommendations concerning all aspects of the Department's Capital program. The committee approves recommendations for the project advancement as presented by the Screening Committee, reviews project advertisement schedule, receive reports on the development of the Capital Program, Statewide Transportation Improvement Program and Study and Development Program, and addresses other issues relating to the

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#### **Capital Projects**

capital programming process. The Deputy Commissioner chairs the committee. Voting members consist of the Chief of Staff and Assistant Commissioners.

#### **Capital Program Screening Committee**

This committee was established by the Capital Program Committee to review in detail projects advancing to feasibility assessment, preliminary design and final design. The committee members assure us the appropriate scope of work is being pursued. The Screening Committee recommends approval of the appropriate action for each project to the Capital Program Committee. The committee also recommends assignment of projects to the appropriate pipeline. The Director, Division of Capital Investment Planning and Development chairs the committee. Voting members are the Directors of Project Management, Design Services, Quality Management Services, Environmental Resources, Operations Support, Systems Planning and Research and Project Planning and Development.

#### **Categorical Exclusions (CE)**

A classification of projects which have been determined not to individually or cumulatively have a significant impact on the human or natural environment and are therefore exempt from the preparation of an Environmental Assessment or Environmental Impact Statement.

#### **Catenary Structure or Tower**

A structure above a railroad that holds electrical power lines.

#### **Constructability review**

Constructability reviews look for answers to these questions:

- Is the design compatible with the proposed construction process?
- Can the design package be built?
- Will the design result in cost-effective construction?

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##### **Critical Path Method (CPM)**

A formal scheduling method used on large complex projects to assure design and construction can be completed in the shortest time frame. The Critical Path Method utilizes network-based logic to identify the interrelationship of design and construction activities and calculates the longest path of interrelated activities (the critical path) through the process which cannot be delayed without causing the entire project to be delayed.

##### **Environmental Assessment (EA)**

Document prepared for projects identified in FHWA regulations as those projects for which it is unclear if there is a potential for significant environmental impacts. Provides information on the alternatives considered and their associated impacts. After the EA is made available and a public comment period held, if the project is determined not to have a significant impact on the environment, then FHWA issues a Finding of No Significant Impact (FONSI). If the project is determined to have a Significant Impact, an EIS must be prepared.

##### **Environmental Impact Statement (EIS)**

Document prepared for projects identified in FHWA's regulations as those projects that have the potential for significant environmental impacts. Provides information on the alternatives considered and their associated impacts. It is circulated to the public and to review agencies for "comments" and is prepared as a draft and final document. Its approval is a Record of Decision prepared by FHWA and published in the Federal Register.

##### **Environmental Justice (EJ)**

The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income regarding the development, implementation, and enforcement

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#### **Capital Projects**

of environmental laws, regulations, and policies. Everyone must enjoy the same degree of protection from environmental and health hazards and equal access to the decision-making process.

#### **Federal Register**

The official publication for Presidential Documents, Executive Orders as well as Notices, Rules, and Proposed Rules from Federal Agencies and organizations; regulations (also known as rules) regarding such laws as Section 106 of the National Historic Preservation Act are published in the Federal Register prior to their codification in the Code of Federal Regulations (CFR).

#### **Federal Highway Administration (FHWA)**

The Federal agency that oversees the disbursement of federal funds for highway projects. Also required to ensure that all applicable federal laws have been met before releasing those funds to the State Department of Transportation.

#### **Federal Transit Administration**

As part of the U.S. Department of Transportation, the Federal Transit Administration (FTA) requires grantees to adhere to the Federal Acquisition Regulations (FAR) for all federally funded projects. See the FTA website for the latest information:

[www.fta.dot.gov](http://www.fta.dot.gov).

#### **Final Environmental Impact Statement (FEIS)**

Final version of an EIS which documents evaluation of the potential environmental impacts of a project and the consideration of comments on the draft EIS and public involvement process, in making the recommendation for the Preferred Alternative to be developed using federal funds or the conclusion that the No Build Alternative will be chosen.

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##### **National Environmental Policy Act (NEPA)**

1969 Act of national legislation requiring the preparation of environmental impact statements for major federal actions.

##### **Project Manager (PM)**

Manages and is accountable for projects from Scope Development through completion of construction.

##### **State Historic Preservation Officer (SHPO)**

State designated official which offers the official opinions of the State Historic Preservation Office in the Section 106 process.

##### **United States Environmental Protection Agency (USEPA)**

An executive agency of the United States Federal Government responsible for managing federal efforts to control air and water pollution, radiation and pesticide hazards, ecological research, and solid waste disposal. It was neither created by, nor is it an immediate part of the National Environmental Policy Act (NEPA), it does not promulgate regulations regarding the preparation of NEPA documents; it does, however, serve as a clearinghouse and commenting agency on all Environmental Impact Statements.

##### **Value engineering**

The FTA defines Value Engineering (VE) as the systematic application of recognized techniques by a multi-disciplined team to identify the function of a product or service, establish a worth for that function, generate alternatives through the use of creative thinking, and provide the needed functions to accomplish the original purpose of the project at the lowest life-cycle cost without sacrificing safety, necessary quality, and or environmental attributes of the project.

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The potential benefits of conducting value engineering or value analysis include:

- Simplified designs
- Lower product life cycle cost
- Improved project schedule performance
- Product standardization
- Increased customer acceptance/improved ridership
- Lower product obsolescence/improved availability of materials and components

#### *VE Implementation Process*

While VE studies are conducted in a variety of ways, the following methodology to implement a VE study is fairly common:

1. Identify products/processes for consideration.
2. Establish cost and schedule targets.
3. Select an independent and technically diverse team(s) to conduct the value engineering analysis or analyses.
4. Analyze product/process features - for products, dimensions, weight, components, materials, reliability, maintainability, functionality, and tolerances for processes, steps/sequence, necessary approvals, schedule, tooling, etc.
5. Develop new and unusual alternatives for required functions.
6. Reengineer/redesign and prototype the product or process, as applicable.
7. Test the new product or process.
8. Provide feedback from the test results to the value engineering team.
9. Repeat steps 5 through 7, as necessary.
10. Make recommendations to management.
11. Implement approved changes.

### Module 10

#### Capital Projects

##### *Value Engineering Results*

- Projects that have already experienced cost, schedule, or scope problems benefit from VE analysis. However, the greatest potential for improvement is in technically and organizationally complex or unusually constrained projects in preliminary design. VE at this point produces maximum benefit because recommendations can be implemented without delaying progress or causing significant rework of completed designs. While the average cost improvement from VE is 6%, cost reduction is not always the most significant benefit. Schedule reductions, environmental requirement modification, and operational procedures can all be improved through the functional cost evaluation used in all VE studies.
- The FTA mandates that value engineering be done on major capital projects prior to them entering final design. For an excellent discussion of value engineering and the FTA's mandates regarding it, visit the FTA website: [www.fta.dot.gov](http://www.fta.dot.gov)