2015 FRA
Rail Program Delivery

Risk-Based Project Management

Presenters: **Susan Herre, *FRA***
William Thomsen, *Urban Engineers*
Marian Rule, *TranSystems*
Will Willson, *Gardiner & Theobald*
John Lehman, *Hill International*
John Holak, *Urban Engineers*
Thomas Mitchell, *Urban Engineers*

Introduction to Risk-Based Project Management

- Morning Session -

Session Lead:
William T. Thomsen, PE, *Urban Engineers, Inc.*
Co-Lead:
Susan M. Herre, AIA, AICP, *FRA*

Introduction to Risk Based Project Management

Risk assessment and transportation projects

Program evolution

→ FRA use of Risk Assess

Steps / Processes

1) Builds on scope, schedule, cost, tech. capacity reviews
2) Identifies uncertainties and risks -- risk register
3) Develops mitigations (3 types)
4) Forecasts cost and schedule (2 methods)
5) Contingency
6) Risk and Contingency Management Plan

Risk Assessment

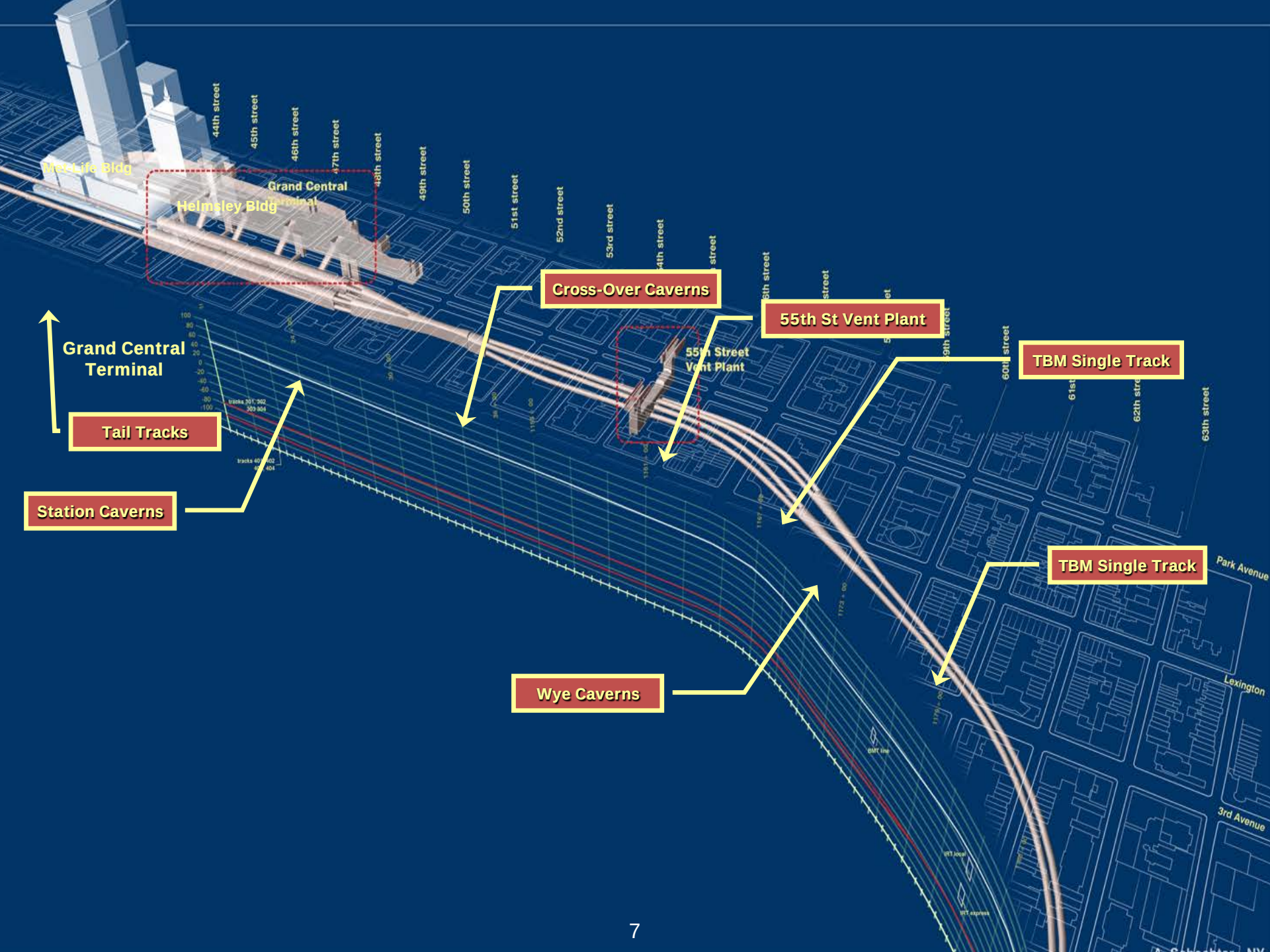
- Each topic described
- Illustrated in case studies
- Focus on Railroad Project SCOPE and potential impacts to Cost, Schedule, Risk

Capital Cost Guidance

- …coming soon to Federal Register

Introductions

- Bill Thomsen, Urban Engineers
- Marian Rule, TranSystems
- John Lehman, Hill International
- Will Willson, Gardiner & Theobald
- John Holak, Urban Engineers
- Tom Mitchell, Urban Engineers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Grand Central Terminal
Helmsley Bldg
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45th street
46th street
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50th street
51st street
52nd street
53rd street
Cross-Over Caverns
55th St Vent Plant
55th Street Vent Plant
TBM Single Track
TBM Single Track
Grand Central Terminal
Tail Tracks
Station Caverns
Wye Caverns
60th street
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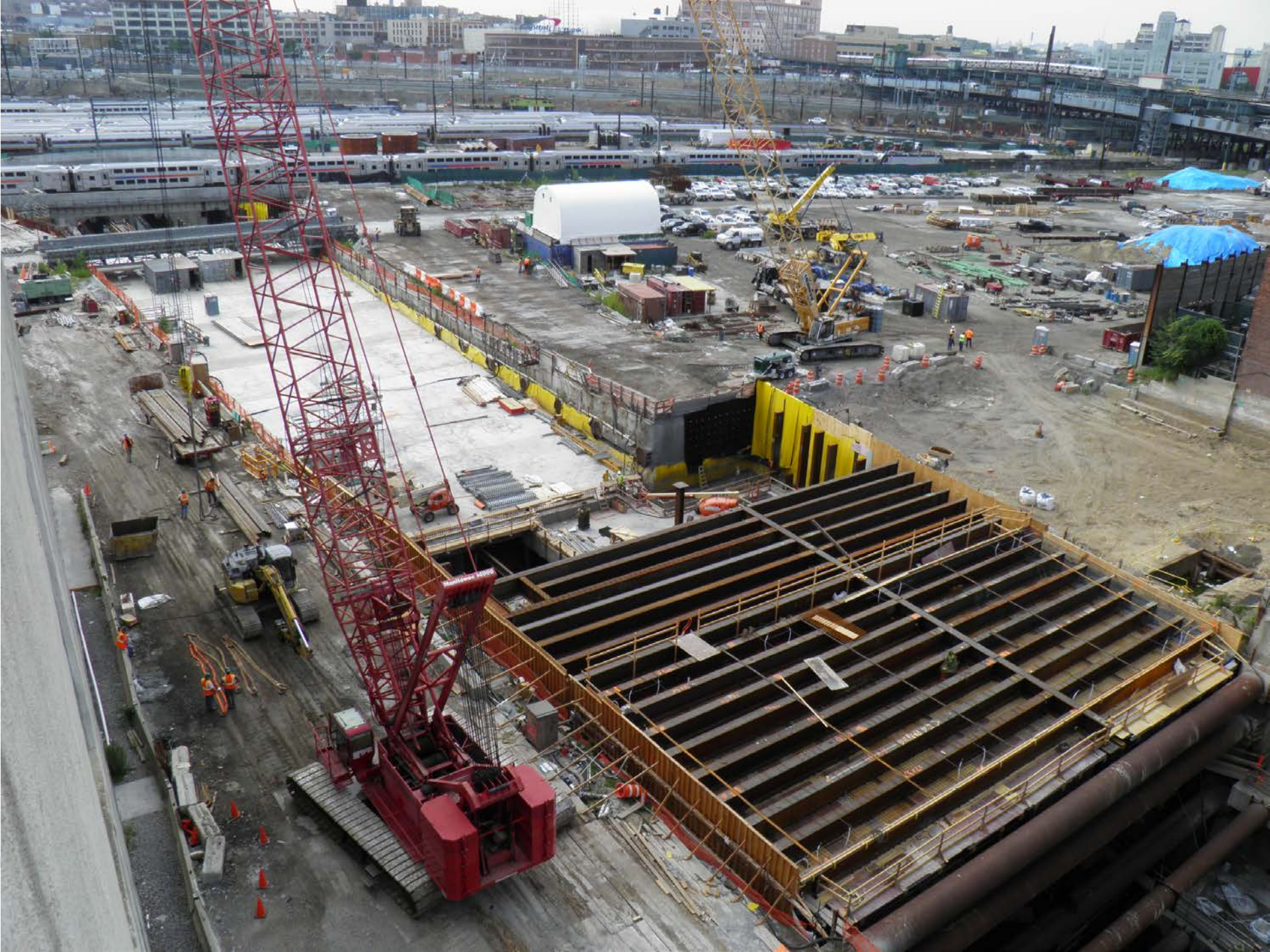
63th street
Park Avenue
Lexington
3rd Avenue



Risk Assessment – A Proactive Approach – A Way to Forecast

Presented by

William T. Thomsen, PE, *Urban Engineers, Inc.*

Risk Considerations on Major Capital Projects

- What is Risk?
- Identifications of Risks
- Types of Risks – Known vs. Unknown
- How we got to where we are today
- Historical Perspective – Qualitative
- Design/Build Demonstration Program

Oversight of Grants

- Steward of Public Transportation funds
- Key Metrics: Time, Cost, and Quality
- Forecast Known and Unknown Risks
- An Independent Look – “Can’t see the forest for the trees”
- Forecasting issues and problems
- Prepare solutions in advance

Qualitative Versus Quantitative

- Initial efforts were qualitative – “Gut Reactions”
- Assign risks and categories where and with whom they can be best resolved
- Terms like small, medium and large (Green, Yellow, Red)
- Assign magnitude and probability

Codifying the Approach

- Developing a consistent process
- Collecting data and sampling
- Using information to develop a model
- Making adjustments based upon data
- Developing procedures and updating them as needed
- Program Guidance PG-22
- Oversight Procedures OP-40
- Monitoring Procedures MP-40

Exploring Common Risks on Common Projects

- Right of Way and Real Estate
- Tunnels
- Elevated Structures and Bridges
- Environmental Risks and Waterways
- Unforeseen Conditions (i.e. Utilities)
- Systems Integration and Vehicles
- Third-Party Coordination
- Startup Testing and Operations

Adjusting the Distribution of Risk Occurrence by Phase

- Requirements
- Design
- Market
- Construction
- Startup and operation

Evolution of Risk Assessments Toward Trending

- Cost trends and ranges
- Schedule trends and ranges
- Impacts on quality and corrective action reporting trending
- Impacts on testing startup and operations

Risk Assessment Introduction

Presented by

Marian L. Rule, PE, *TranSystems*

FRA Philosophy/Approach

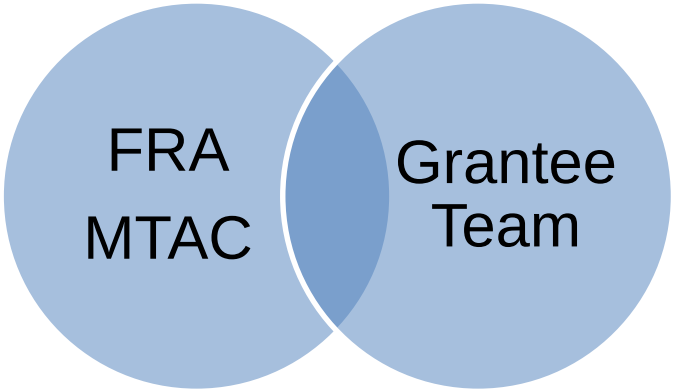
- Goal: Partnering with the Grantee for project success
- Rely on the Grantee to manage their program/project based on a sound cost estimate and schedule
- Use a risk-based approach to manage the program/ project and implement mitigations when needed
- Collaborate and participate with Grantee, to take advantage of lessons learned from other Grantees
- Provide Technical Assistance, when beneficial

FRA Monitoring Procedures (MP)

- MP21 – Technical Capacity/ Capability
- MP32c – Project Scope Review
- MP33 – Cost Estimate
- MP34 – Schedule
- MP40a & MP40c – Risk and Contingency Review

Organization of the MPs

- Purpose: For use by Grantee and MTAC
- Developed based on proven methods
- Organization:
  - Purpose
  - Key Principles
  - Required Documents
  - Methodology/process
  - Tips and reminders
- Concise and comprehensive



Benefits

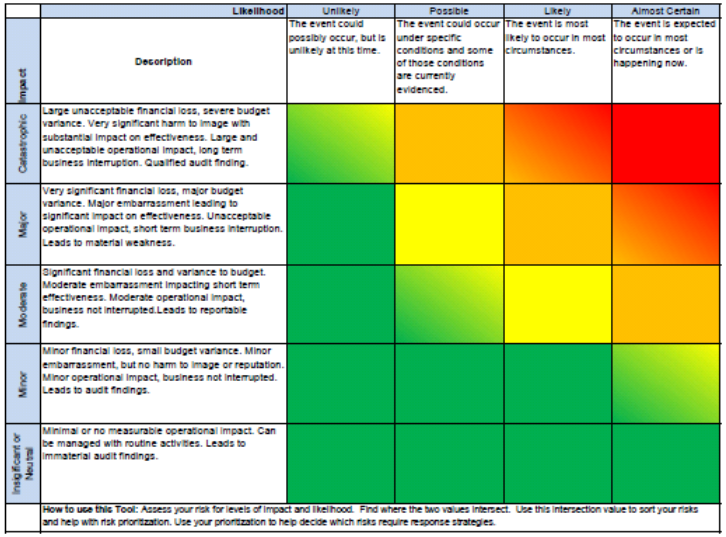
- Develop consensus on **Scope, Schedule** and **Cost Estimate**
- Confirm ability to **spend ARRA funds before 9/30/17 (or non-ARRA funds by end of Period of Performance),** considering project risks
- Assess project **budget and schedule and contingencies**, considering project risks
- Provide a means of **on-going monitoring** of schedule and budget
- Be ready with mitigations when course corrections needed

- **No surprises → effective project execution and delivery**

Risk Review Process:

Collaborating in Risk Assessment

- MP40a: Review of / engaging in the Grantee's Risk Process
  - Review of Grantee's organization & process
  - Review of Project Management Plan (PMP) and Risk and Contingency Management Plan (RCMP)
  - Participation and Assessment



	Likelihood	Unlikely	Possible	Likely	Almost Certain
Impact	Description	The event could possibly occur, but is unlikely at this time.	The event could occur under specific conditions and some of those conditions are currently evidenced.	The event is most likely to occur in most circumstances.	The event is expected to occur in most circumstances or is happening now.
Catastrophic	Large unacceptable financial loss, severe budget variance. Very significant harm to image with substantial impact on effectiveness. Large and unacceptable operational impact, long term business interruption. Qualified audit finding.				
Major	Very significant financial loss, major budget variance. Major embarrassment leading to significant impact on effectiveness. Unacceptable operational impact, short term business interruption. Leads to material weakness.				
Moderate	Significant financial loss and variance to budget. Moderate embarrassment impacting short term effectiveness. Moderate operational impact, business not interrupted.Leads to reportable findings.				
Minor	Minor financial loss, small budget variance. Minor embarrassment, but no harm to image or reputation. Minor operational impact, business not interrupted. Leads to audit findings.				
Insignificant or Neutral	Minimal or no measurable operational impact. Can be managed with routine activities. Leads to immaterial audit findings.				
	How to use this Tool: Assess your risk for levels of impact and likelihood. Find where the two values intersect. Use this intersection value to sort your risks and help with risk prioritization. Use your prioritization to help decide which risks require response strategies.				

Independent Risk Assessment

- MP40c: MTAC Independent Risk Assessment
  - MTAC performs full scope, cost, schedule review.
  - In-depth assessment of PMP, risk register and contingency and management plans.
  - Involve the Grantee through MTAC-led risk session
  - Assess and agree on path forward for project execution

Low (1)	Med (2)	High (3)	Very High (4)	Significant (5)	Legend
<10%	<> 10%-50%	<> 50%-75%	<> 75%-90%	> 90%	< 3
< $3M	<> $3M-$15M	<> $15M-$30M	<> $30M-$50M	>$50M	3-9
< 1 Mths	<> 1-3 Mths	<> 3-6 Mths	<> 6-9 Mths	> 9 Mths	> 10

Characterizing the Project Scope (& Schedule & Budget)

Presented by

John Lehman, *Hill International*

What is a Risk Review?

A risk review really is a
Scope/Schedule/Cost/Risk Review:

- You can't assess risks until you know the scope, the schedule, the cost.
- To review risk it is essential to understand:
  - Project scope
  - Who are the stakeholders
  - Stage of project development
  - The project phase where the risk appears

    Requirements > Design > Market > Construction > Start-up

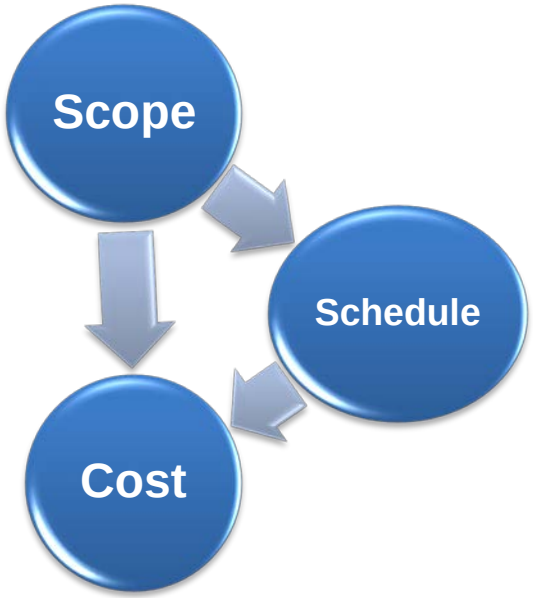
Why Review Scope/Schedule/Cost?

- Scope/Schedule/Cost Reviews are the systematic review of the three basic elements affecting the end results of a project

- If any of these are off track, they can potentially jeopardize the completion/success of the project

Why is it Scope/Schedule/Cost?

- Scope is what will be built
- Building that scope takes time (schedule) and money (cost)
- Schedule affects cost
- Cost is the result of scope and schedule



“Requirements”

Scope Items are the Project “Requirements”

All activities that will be needed to complete the grant scope of work

- Project Management
- Planning/Environmental
- Agreements/ROW
- Engineering
- Procurement
- Construction
- Testing and Start-up

Stakeholders’ specific requirements

<u>Scope items need to be identified before “Design”</u>

Stakeholders

- Stakeholder identification may be the most important single activity for the Project Grantee
- Include a stakeholder list in your PMP

The impact on scope is that stakeholder requirements discovered late in the project are costly and impact schedule.

Typical Stakeholders

Public / Interest Groups – Community Groups, Individuals

Governmental Bodies – Sponsors, Elected Officials

Financing Partners – Governments, Bondholders, Pvt. Investors

Regulatory Agencies – FRA, Federal Agencies, State DOTs, SHPO, local governments, ….

Landowners – Governmental, Private, Relocations

Utilities – Water, Sewer, Telephone, Gas, Electric, Pipeline, Gas or Elec. Transmission, Fiber-optic, ….

Existing Transportation Systems – Host Railroad, Amtrak, ….

Properties affected by construction – Businesses, ….

Construction Industry – Contractors, Unions, Material Supply ….

Project Delivery Method

Look at

How will the Project Delivery Method affect cost and schedule? (DBB, D-B, CM/GC, etc.)

Who will bear the project risk?

Engineers estimate risk;
Contractors **price** risk

– Does contract really transfer risk?

– What did the risk transfer cost you?

How much control is given away by “alternative” project delivery methods?

What work needs to be done by Railroad forces?

Scope Questions

- What is being built? What does it take to build it?
  - Program management capacity & capability
  - Third-party agreements
  - Real estate
  - Utilities and utility relocations
- Important to know the risks up front
  - Know every stakeholder's requirements.
  - By the time design is underway, new risks/show stoppers should not be discovered.
  - If there are show stoppers, they need to be resolved before project can successfully progress.
- If you need help – ask FRA for Technical Assistance.

Scope Issues for Railroad Projects

- Project Management
- Project Delivery Method
- Construction Support
- Right-of-Way
- Stations
- Track Design / Features
- Signals
- Systems
- Start-up

Scope: Project Management

Management team: Appropriate skills, experience, staffing

- Working with a railroad? Get an experienced railroader on staff
- Sponsor employed staff for overall decision making
- Supervise your Program Management Contractor; don't leave them unsupervised

Coordinate early with Utilities, Local Governments, Regulators, and other Third Parties

- Who pays for Utility relocation?
- Can you compel schedule?
- Utility relocation needs to comply with Buy-America provisions!
- Which regulators need to review designs?
  - Don't forget FRA, DEQ, PUC, local jurisdictions, and others

Scope: Delivery Method

- Who are the stakeholders?
- Contracting Method with contractors:
  - Affects amount of detail in design, affects control, affects cost
- Contracting Method with Railroads:
  - Scope of Force Account work
  - Time and material
  - Other services provided
  - Who supervises contractors on their property

Scope: Construction Support

- Planning outages:
  - Types of outages available and the cost of each outage:
    - Some projects use bid options for outages. The bid documents describe the type of outages available, the cost for each, and the estimated number. The Contractor can bid more or less.
- Flagging costs:
  - How many flaggers will be needed?
    - How many can be available?
    - What happens if not enough show up for the work?
- Phasing and constructability are major cost and schedule drivers:
  - These need to be worked out among the costed options early in the project.
  - Value engineering would be well applied here.

Scope: Right-of-Way

Recognize complex real estate transactions

- Storage Locker Facilities, Cemeteries, etc.
- Environmental remediation needed
- Sliver acquisitions and easements (by the 100s – not expensive… but oh so many)

Plan adequate real estate specialists to support schedule

Identify Hazards early in design phase and mitigate

- Access: pedestrian, vehicle intrusion
- Security issues: bollard placement, hiding places

Constructability

- Construction Phasing
- Coordination of Contracts
- Maintenance of Traffic – Highway, Railroad

These can become quite costly

Scope: Stations

- Interface with local interests
- ADA accessible station and platforms
- Amtrak requirements for intercity trains:
  - Ticketing and waiting areas (generally attended)
  - Baggage handling
- Commuter Rail:
  - Public Address Systems
  - Security Systems
  - Ticket Vending Machines
- Intermodal interfaces (taxi, motor coach, city bus)
- Local Transport Adequate Parking
  - Long-term parking for Amtrak
  - Available parking limits commuter ridership

Scope: Track Design

- Track that is to be used primarily in passenger service is configured differently from freight:
  - Curvature
  - Curve superelevation
  - Spiral length
  - Gradient
  - Signal spacing
- Track and signal modifications need to be approved by FRA, Railroads, and railroad users

Scope: Track Features

- Additional features such as fencing and pedestrian crossing gates may be needed due to the higher speeds.
  - Do a Hazard analysis!
- Provide adequate laydown areas for fabrication of turnouts or storage of track materials:
  - When new turnouts are to be installed, a large laydown area is needed to prefabricate the turnouts.
  - If additional track is being installed queueing of track materials, especially crossties require space.
- Scrap Credits:
  - Get credits for materials removed, particularly rail

Scope: Signals

- Signals at one location are linked into signals at several adjacent locations:

  Signal systems are not spot controls but are always linked into the adjacent signal locations in both directions, often for 3 or 4 miles.

- Only new signals are installed:

  Signals are installed new, tested, and then “cut-over”. Only then are the old signals removed.

- All newly installed or modified signals will need to have PTC installed and software prepared:

  Installing actual PTC hardware with new signals is not difficult. However, the new track and turnouts need to be surveyed, a database created, and the data tested on site. Allow time in the schedule.

Scope: Systems

- Fiber-optic Backbone
- SCADA
- Public Address Communications
- Security Systems
- Other systems
  - Weather monitoring
  - High water
  - Slides
  - Ticketing

Scope: Start-up

Formulate the Roadmap to Revenue Service including the Systems Integration Test Plan in the early stages of construction

- Easy to forget or to wait too long
- Result – expensive change orders; schedule delays

Conduct Scope/Schedule/Cost/Risk refresh workshop at least one year before Pre-Revenue Service to address:

- Hazard mitigation – final hazard review
- System Integration Test planning – contractor/designer/operator
- Safety and Security Certification elements
- Staff Hiring and Training

Scope Summary

- Seek / find all stakeholder requirements
- Include all findings and risks in the Risk Register
- Develop and execute mitigation strategies
- Make sure that the design team and the procurement team address all of these issues.

Animation Scope Case Study – Construction of Grade Separation: Road Under Double Track Railroad

Presented by

John Lehman, *Hill International*

Marian L. Rule, PE, *TranSystems*

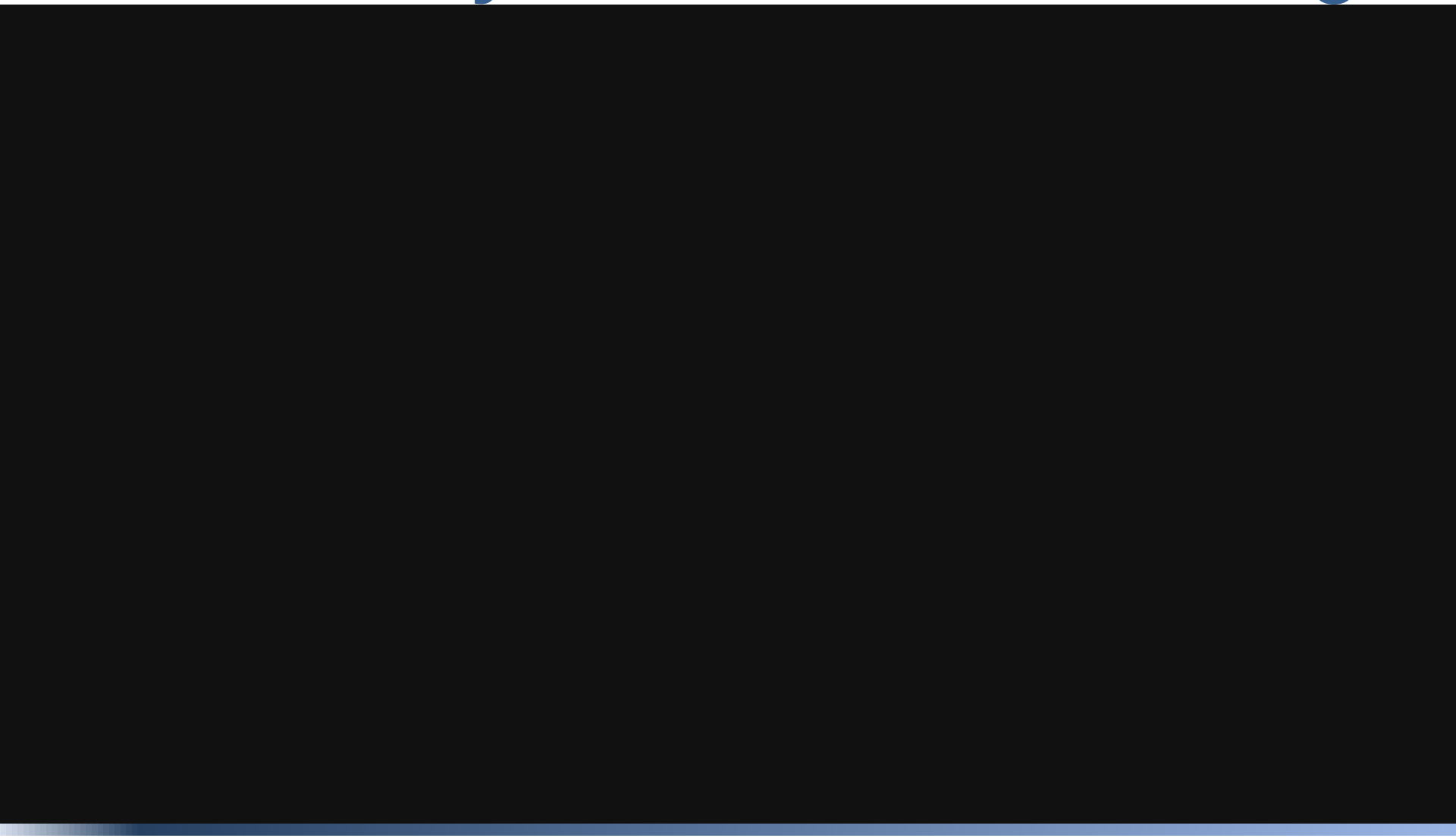
Case Study: Road Undercrossing Project

- New road undercrossing might entail…..
  - Setting road detours
  - Driving piles
  - Excavating
  - Constructing underground utilities
  - Completing substructure
  - Completing superstructure
  - Paving and striping
  - Place fencing, railing & signs
  - Simple.

Case Study: Road Undercrossing Project

- New road undercrossing under live track…..
  - Complex, multi-phase process
  - Close coordination with railroads, operators and flaggers
  - Each phase completed without impact to train frequency / each end state allows safe passage of train
  - Limited /tight time windows need to be respected
  - Focus on safety
  - Need to remain flexible
  - Not so Simple……

Case Study: Road Undercrossing



Understanding Operational Context

- What do you have to know before starting?
- Operational Context
  - On-going operational needs
  - Railroad requirements
  - Rights of entry
  - Operational windows / limitations
  - Railroad ROW utilities
  - Flagging requirements

Understanding Physical Parameters

- What else do you have to know before starting?
- Existing conditions
  - Existing facilities
    - Track
    - Signals
    - Right-of-Way
- Clearances
  - Temporary clearances
  - Permanent clearances
- Space for Construction
  - Lay down areas
  - Construction access
  - Materials / equipment staging and storage

Understanding Scope and End State

- Also, before starting, must have clear understanding of:
  Scope of work to be accomplished
  - Order of construction
  - Start date and duration of each phase of construction
  - Materials and labor needed for each phase
  - Pre-installation meetings to coordinate for executing the work within the windows of construction are critical
  - Established lines of authority and communication
  - Mitigation plans to prepare for the unexpected
    - Hazardous materials
    - Weather conditions
    - Spare parts and extra materials

Understanding Scope, Operational Context, and Physical Parameters → Detailed Construction Sequencing → Project Implementation Success

Methods – Cost Estimate as Building Block for Risk Assessment

Presented by

John Lehman, *Hill International*

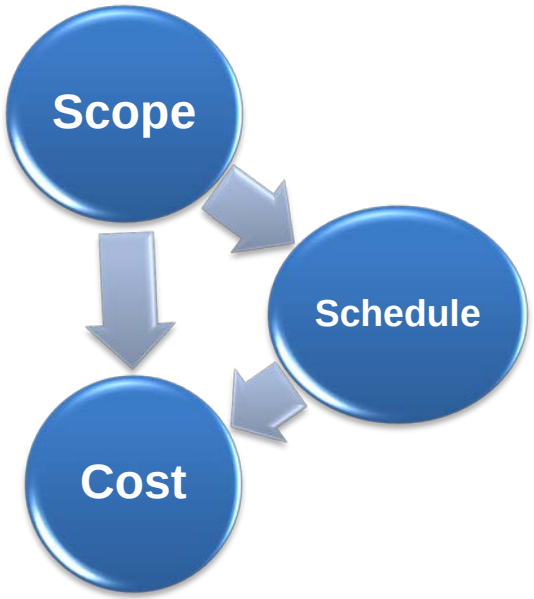
Cost Estimating
Desired Principles

- Proven Methodologies
- The Whole Picture
- Real Reliability

Refer to FRA MP-33 Capital Cost Estimate Review

Why is it Scope/Schedule/Cost?

- Scope is what will be built
- Building that scope takes time (schedule) and money (cost)
- Schedule affects cost



Cost is the result of scope and schedule

Cost Estimating Documents

- Project drawings, specifications, design reports, and project schedule
- The project capital cost estimate in original and SCC format
- Capital cost estimate backup data for the purpose of traceability
  - Take-offs, cut sheets, work breakdown structure, calculations
- Capital cost estimating methodology memo

Why Two Formats?

- **Cost estimate needs to be presented to FRA both in its original format and in SCC format.**
  - The original format is beneficial for the cost estimator since they use their own database and estimating methods.
  - The SCC format lets the FRA, MTAC, and others discuss the estimate by type of work in a more simplified form.

Why Two Formats?

- Cost estimators work from the design documents and therefore are estimating the likely construction contract cost.

- The SCC format is geared towards the whole program cost.

Programmatic Costs

- Programmatic costs can be significant and risky
  - Environmental clearance (can introduce design changes)
  - Real estate procurement (both a cost and schedule risk)
  - Flag protection and effective working time
  - The types of outages needed/available and the cost of each outage to each party
  - Construction management (for contractor work even if contracted by a railroad)
  - Railroad protective insurance
  - Start-up costs (testing, safety certification, training / crew familiarization)

Cost Estimates Lessons Learned

- Capital project estimates are inherently optimistic
  - Engineers tend to underestimate the cost impact of project risks
  - Keep adequate contingency under the Grantee control
- There is a strong correlation among Scope/Schedule/Cost
- Estimates need to become more accurate and precise as the project progresses
- Try to anticipate “unforeseens”
  - Even if the risk is unlikely, the fact that it is possible calls for some consideration on how to mitigate its effects.
- Continually monitor, evaluate, and refine cost estimates
  - Memorialize the reasons for any changes

FRA SCC Estimates

Establish Estimate Allocation Methods

- Contractor / Subcontractor Overhead and Profit
- Contractor general conditions, laydown areas, etc.
- SCC classification of items
  - Work with your MTAC

Include support costs:

- Right-of-Way (SCC 60) – all appraisal and acquisition
- Vehicles (SCC 70) – all engineering and inspection
- Professional Services/Support Costs (SCC 80) – all costs relating to the project as a whole or to the design and management of construction (SCC 10-50)

Key Factors Influencing Cost Increases

- Inadequate planning
- Environmental issues
- Geotechnical (For Projects Underground)
- Safety Issues
- Unrealistic Schedules
- Escalation / Inflation Factors
- Technical Capacity & Capability
- Contract Packaging
- Onerous Terms & Conditions
- Contractor Coordination
- Right-of-Way and Property Acquisitions
- Failure to Evaluate, Adjust for Known Risks
- Market Conditions
- External Stakeholders
- Financing Costs
- Funding Commitments – Timing

Morning Session Close

Afternoon Session Resumes at 12:45 p.m.