Striking a Balance Between Innovation, Constructability and Maintenance Across the San Diego River

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Rail Conference

Presentation Outline

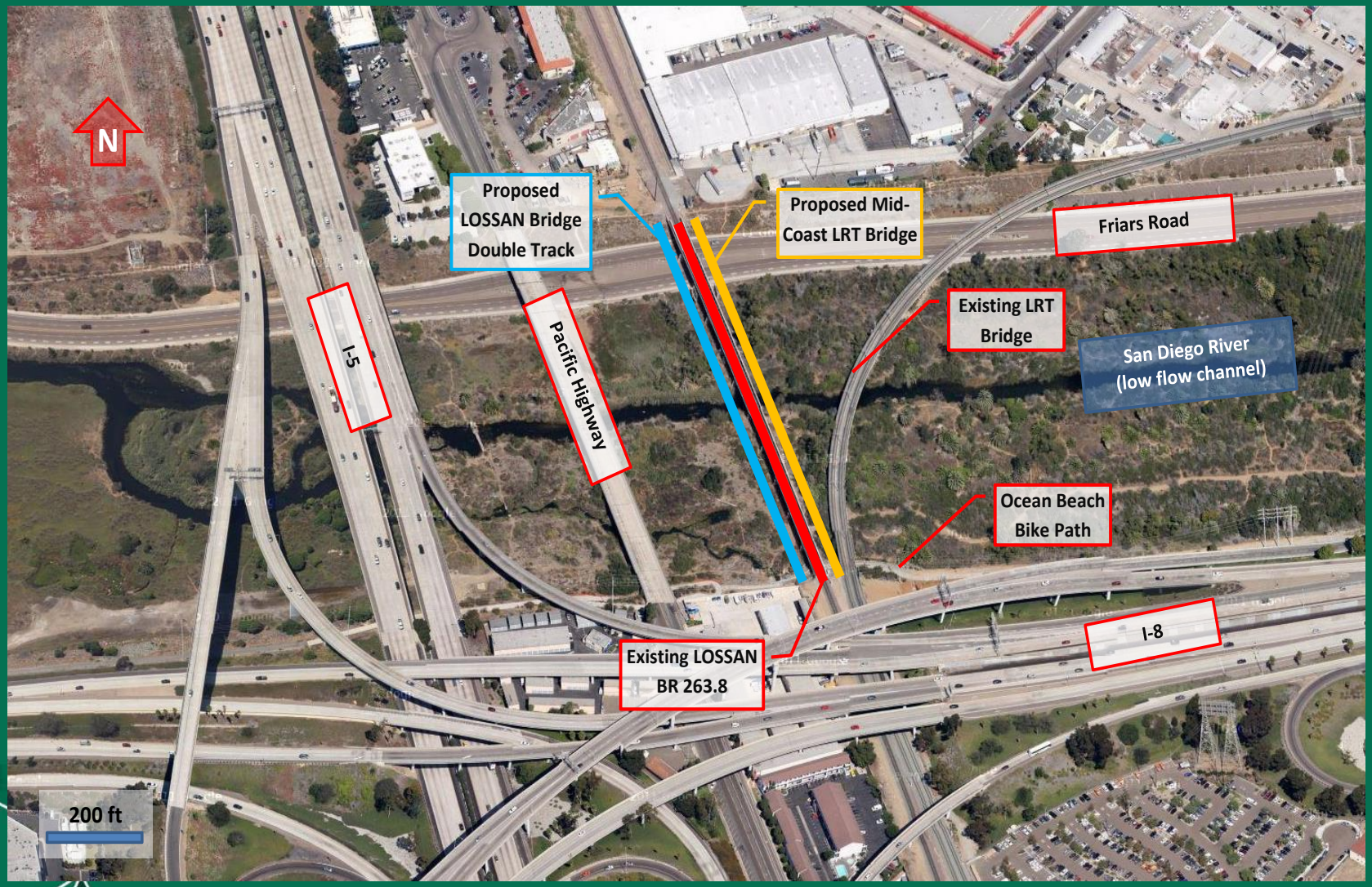
- Project Background
- Constraints and Technical Challenges
- Stakeholders and Delivery Method
- Innovative Approach & Solutions
- Construction
- Lessons Learned

Project Location and Corridor

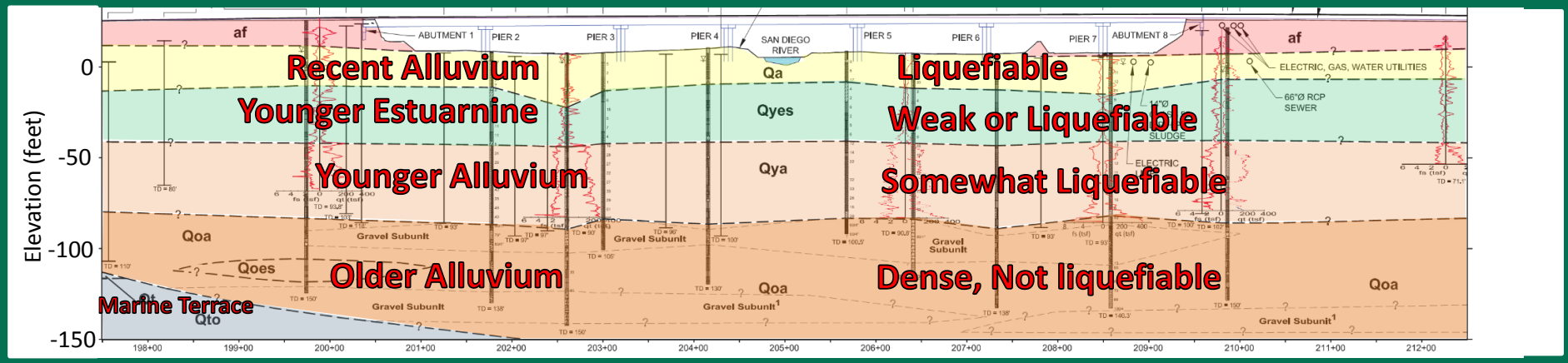
Project Scope

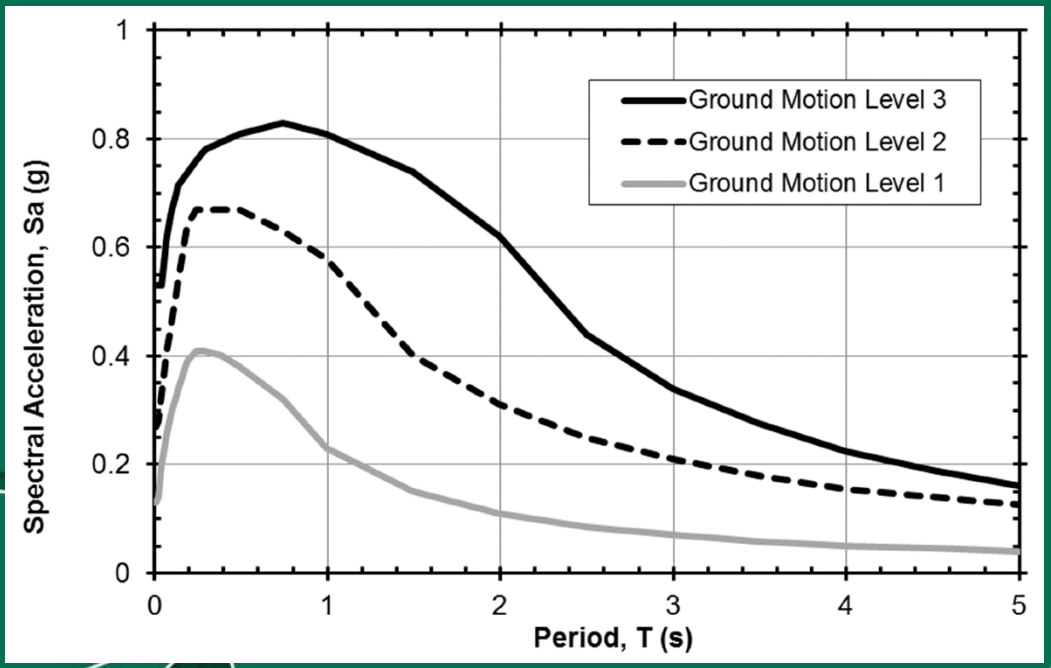
- $100M delivered with $2.0B
- 1000 foot SD River crossing
- Parallel to proposed Mid-Coast LRT
- Design Components:
  - Track Alignment
  - Railroad Systems & Signals
  - Collision & Retaining Walls
  - City Facilities
  - Drainage
  - Utilities, ROW
- Construction 2016-2019

River Construction

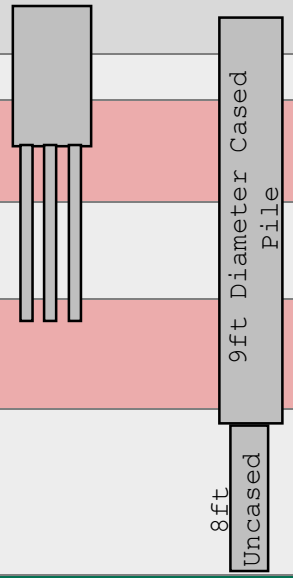


Site Conditions

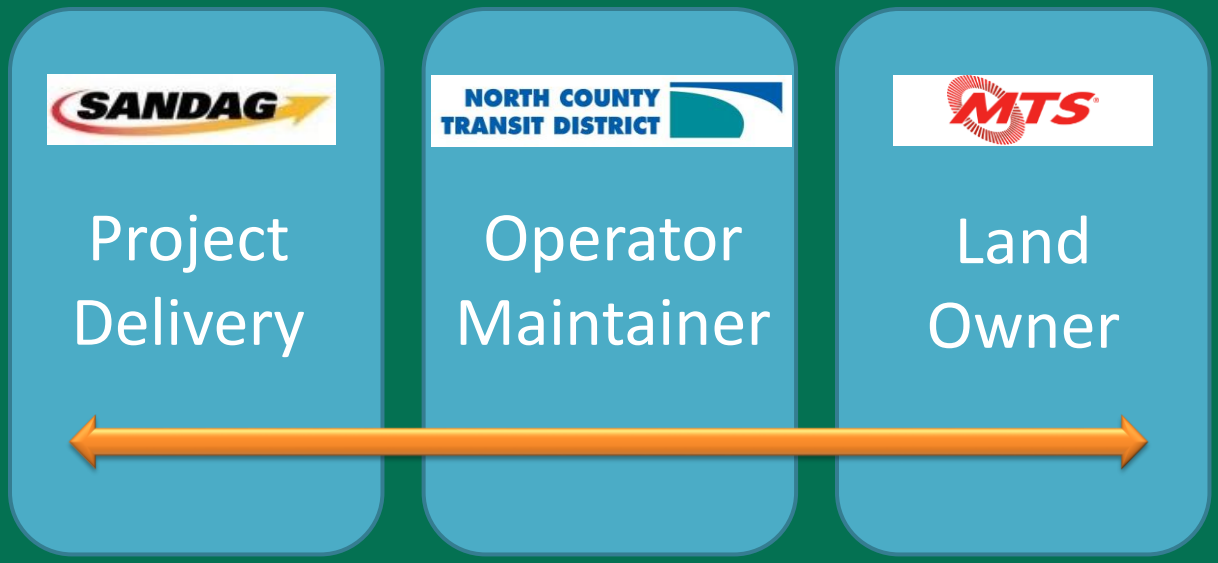




Soil Properties	Layer Depth
Sand	**5 ft**
Liquefiable Soft Clay	23 ft
Stiff Clay	15 ft
Liquefiable Soft Clay	28 ft
Sand	69 ft



CMGC Delivery & Stakeholders

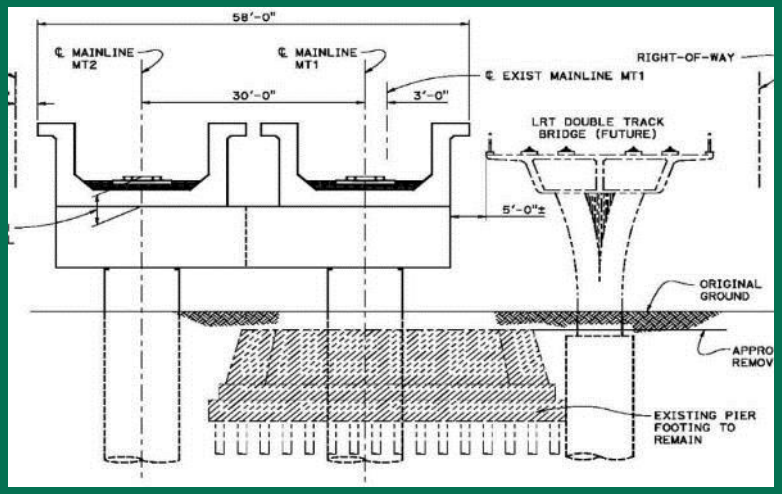


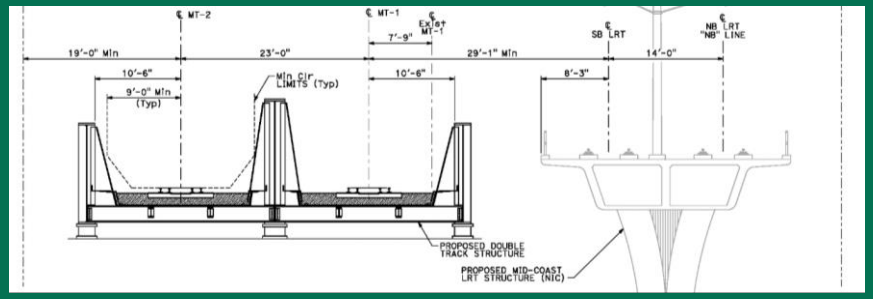
- CMGC Delivery
  - Optimize $1.5B Construction Schedule
  - Gain Cost Efficiencies
  - Cost/Constructability Input

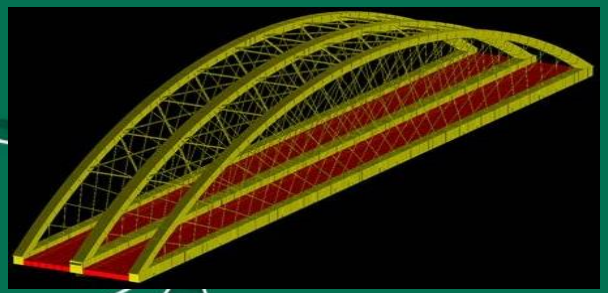
Existing River Crossing

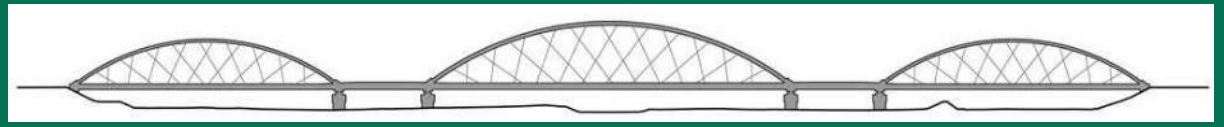
- Nearly Centered within ROW
- Girders stamped 1914, 1927, and 1950
- Location, age, seismicity → Replace Bridge

Replacement Options

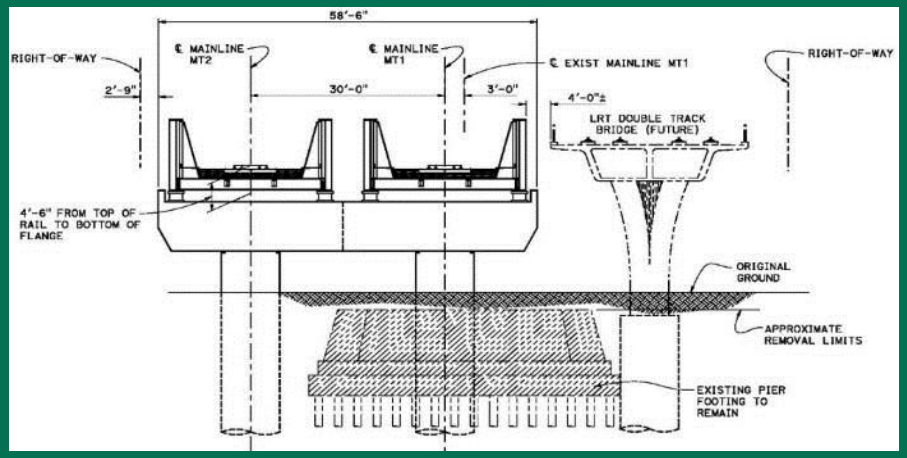


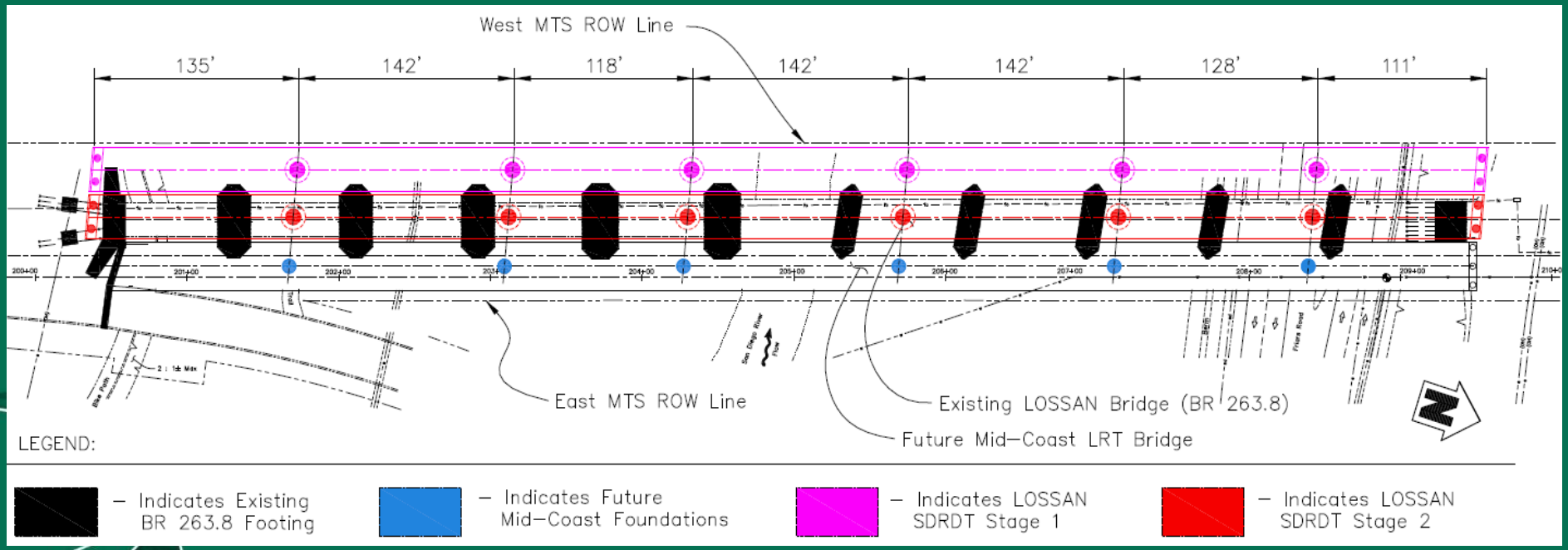




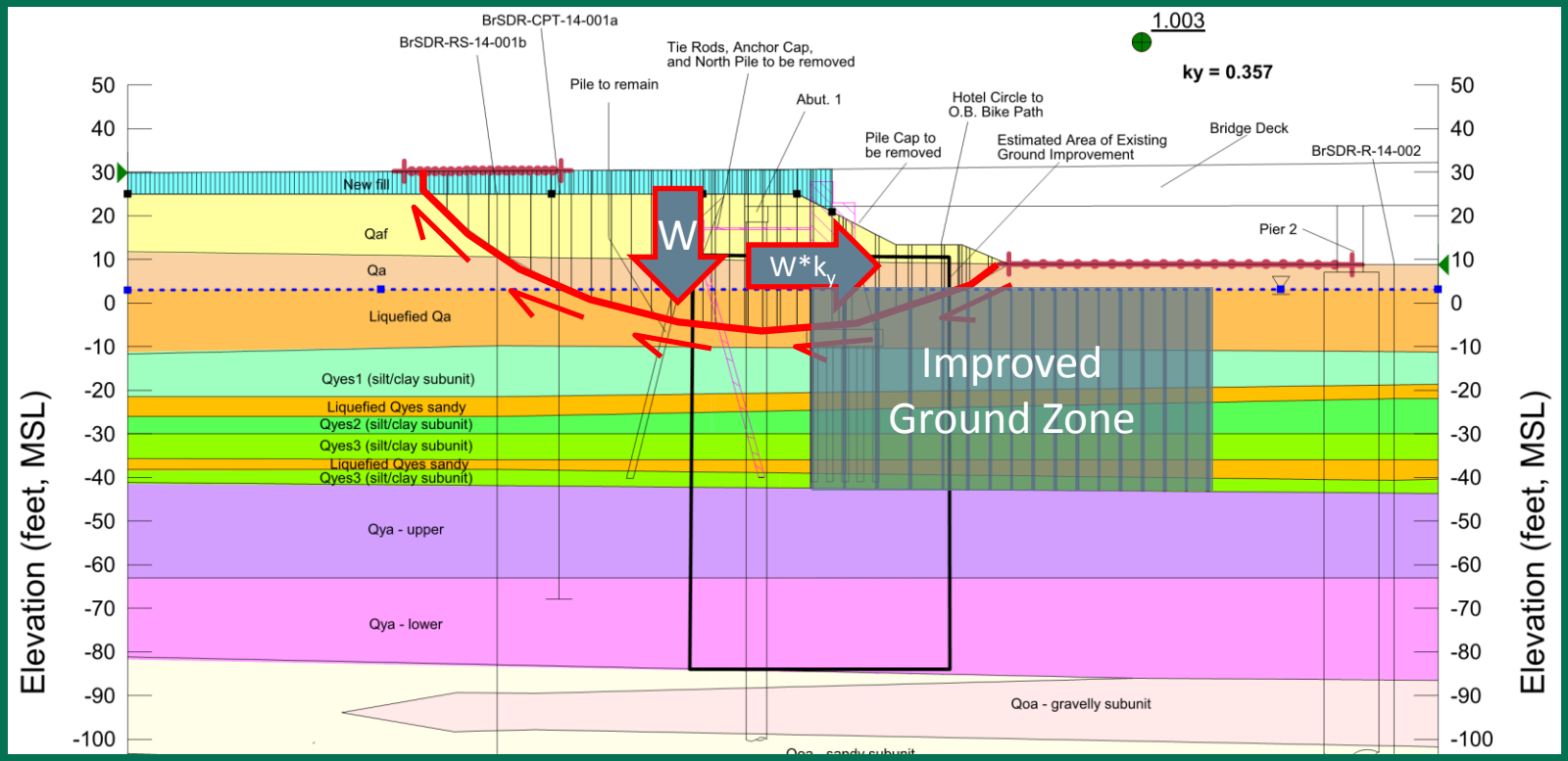


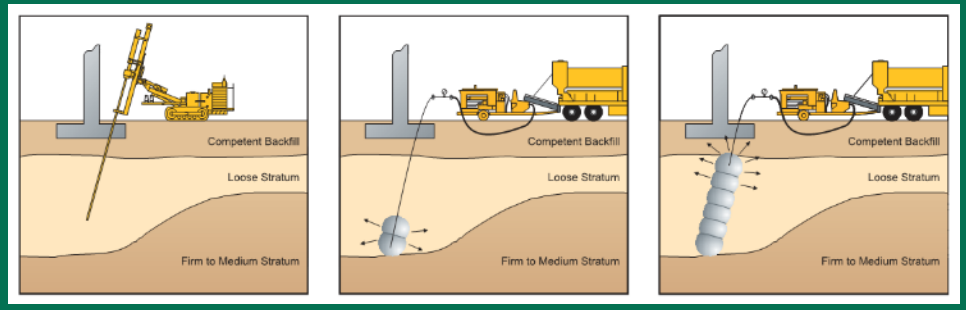
Replacement Structure





Slope Stability



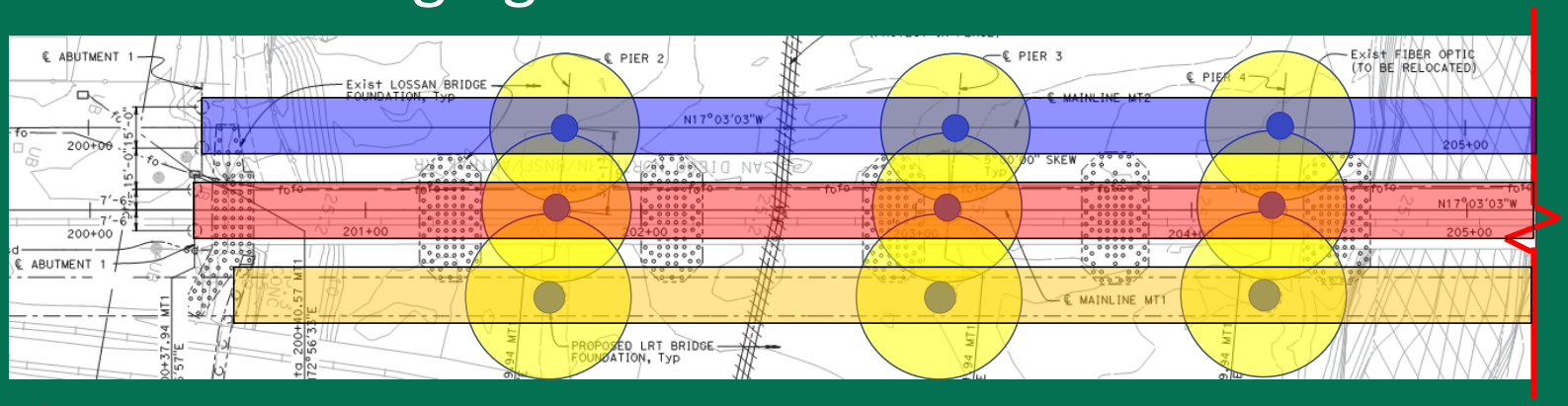


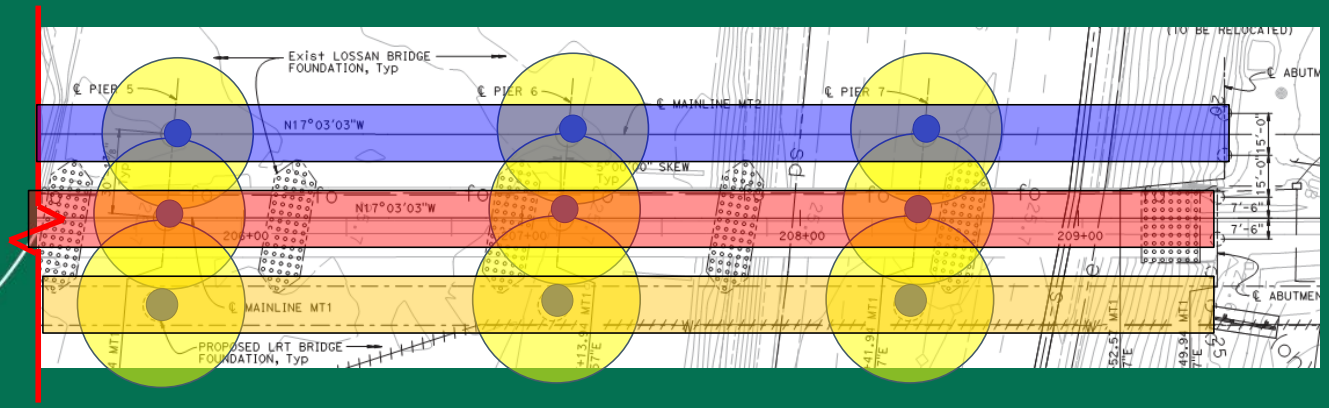
Foundation Construction

- Foundations often highest cost / risk
- How did the team mitigate this risk?

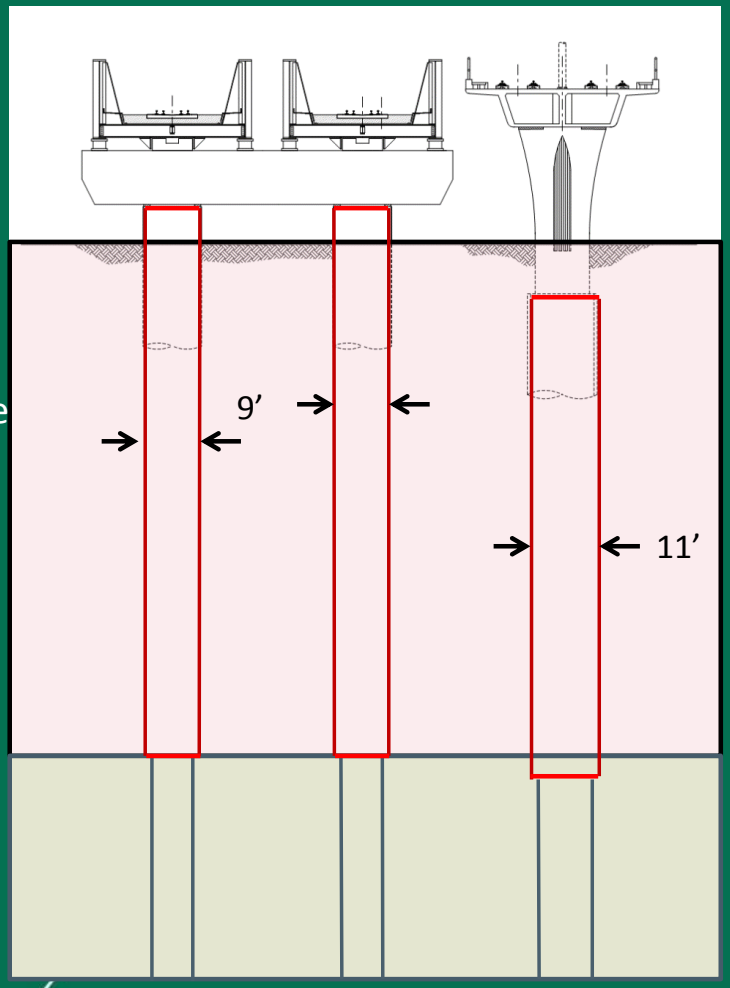
Pier Construction & Stability

- Original Approach – Ground Improvement
  - 90 feet deep
  - Conflicts & Staging





Innovative Pier Approach

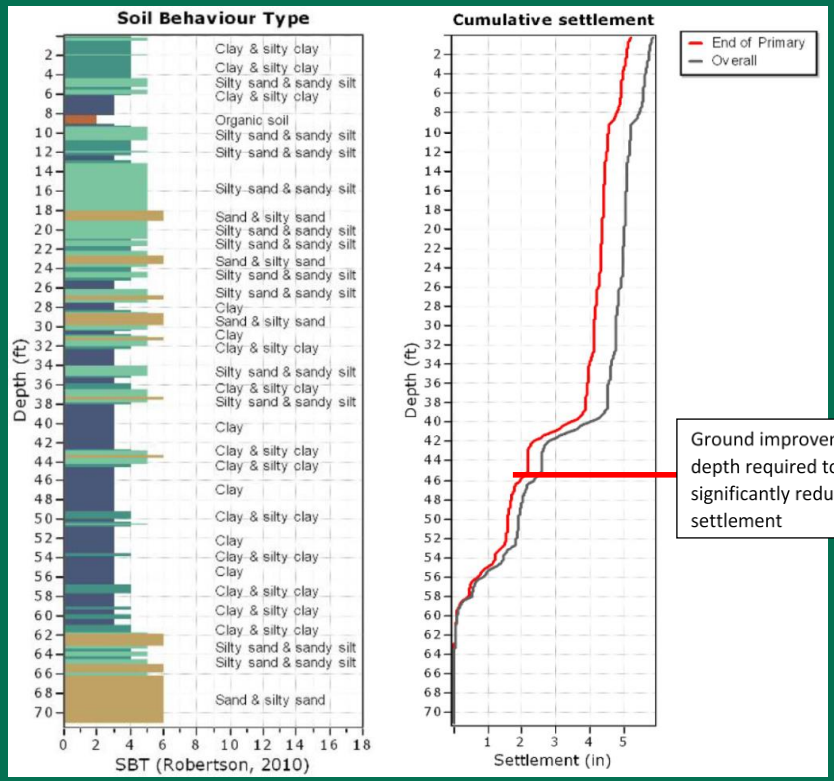


- Constructability
- Capacity
- 5% Cost Savings

Foundation Construction

Foundation Construction

Approach Embankment Challenges

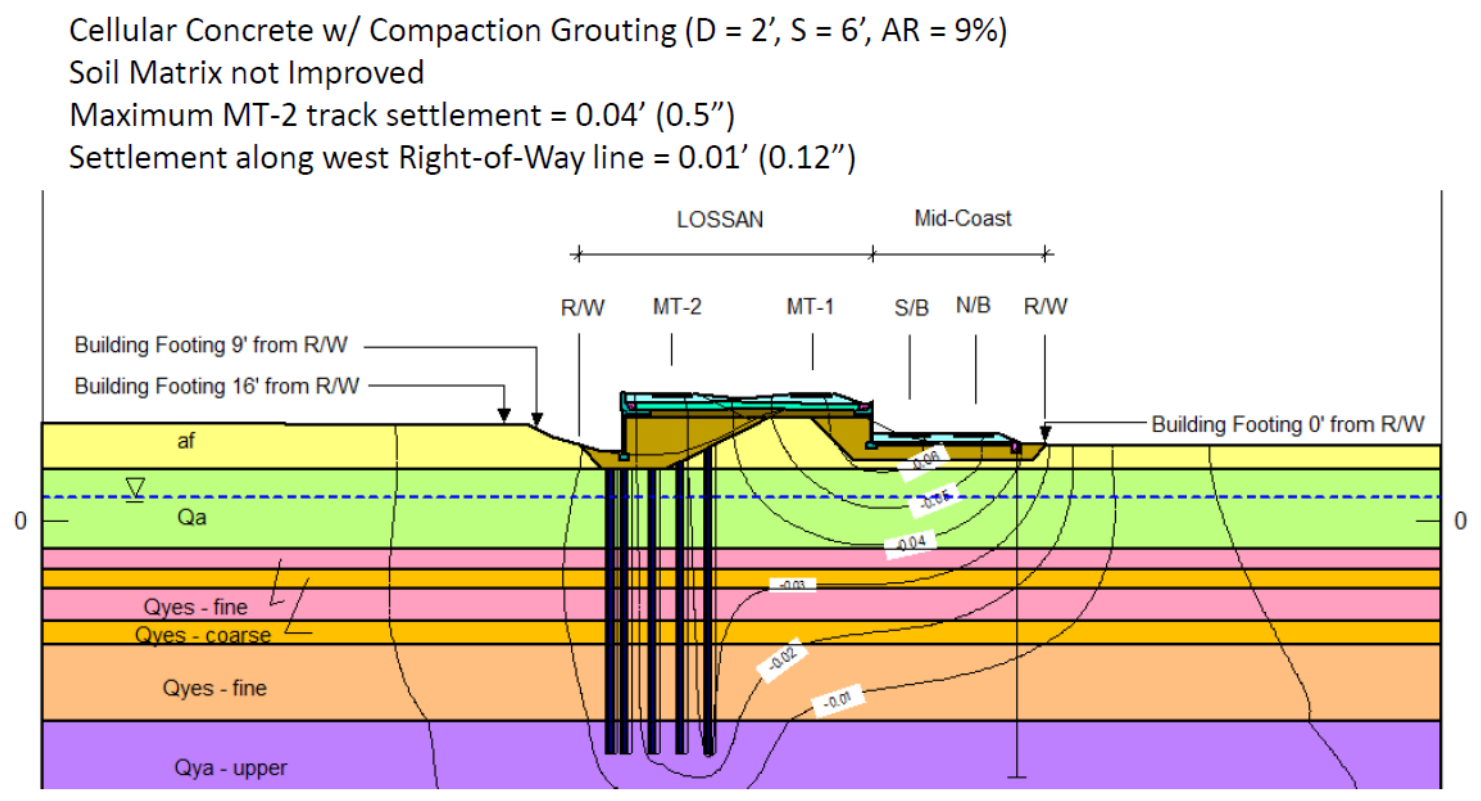


Approach Embankment Challenges

- Building Settlements
- Track Settlements
- Utility Settlements

Approach Embankment Solutions

- Bridge
- Lower Profile
- Cut-off Wall
- Surcharge
- Lightweight Fill
- Ground Improvement



Lightweight Concrete Fill

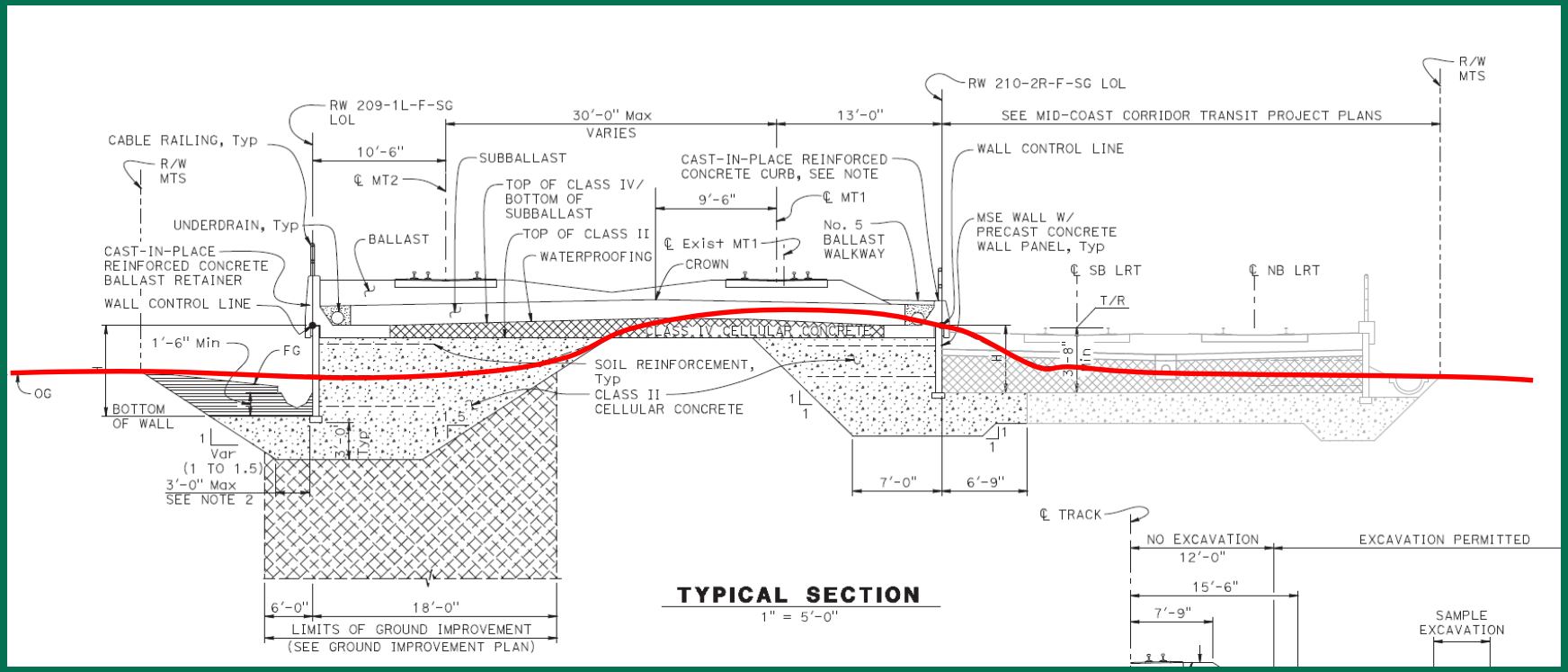
- Site mixed with foaming agent
- 2-3 foot lifts
- Approx. $40-50/cuyd (typical)
- Demonstrated transportation use

Cellular Concrete Class	Cast Density Pcf	Minimum Compressive Strength at 28 days* psi
I	24-29	10
II	30-35	40
III	36-41	80
IV	42-49	120
V	50-79	160
VI	80-90	300

Approval Process

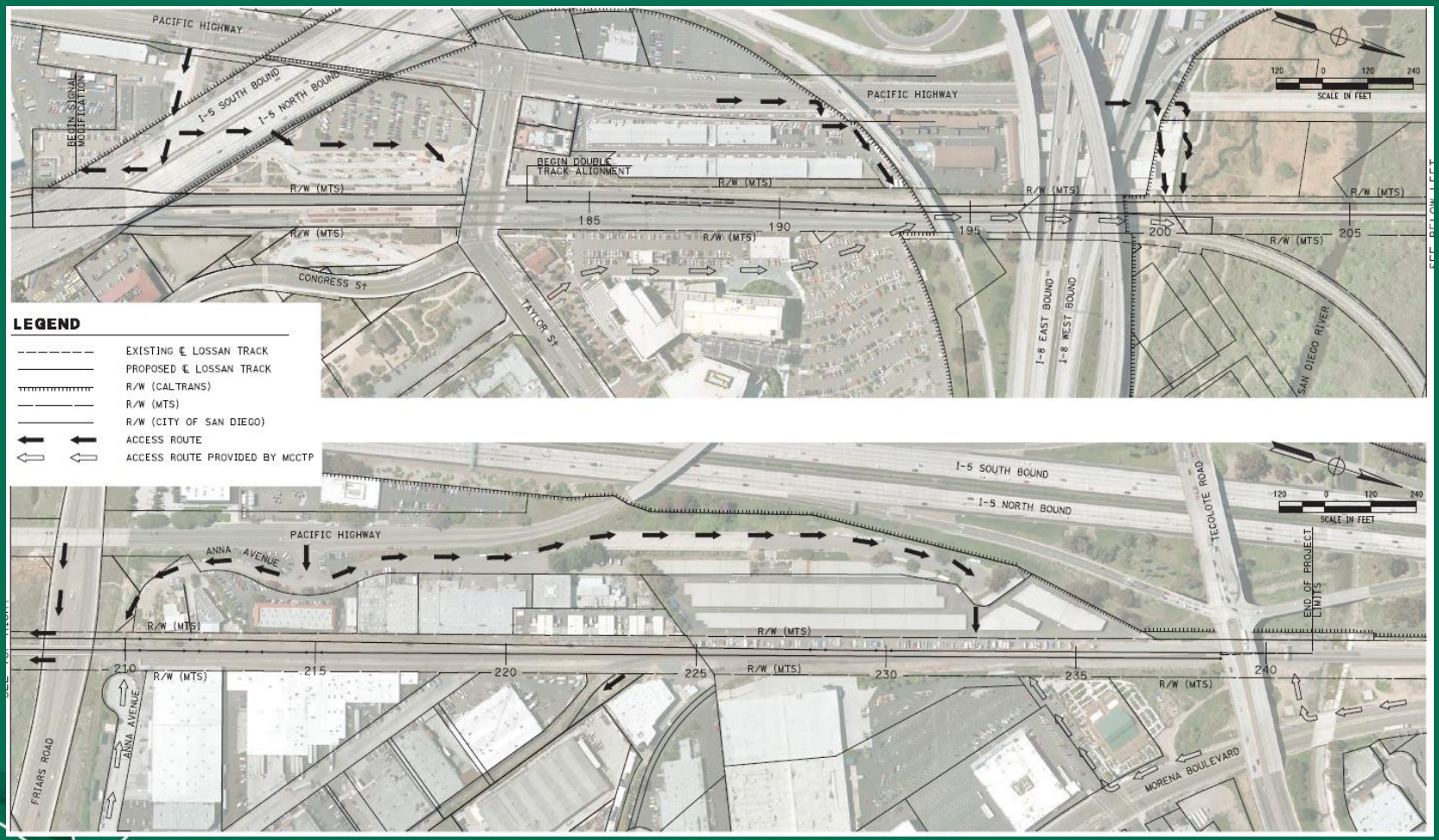
- Not a conventional solution
- What are the stakeholder concerns?
- How can we alleviate concerns?
- Is this really the right solution?

Approach Embankment Solution



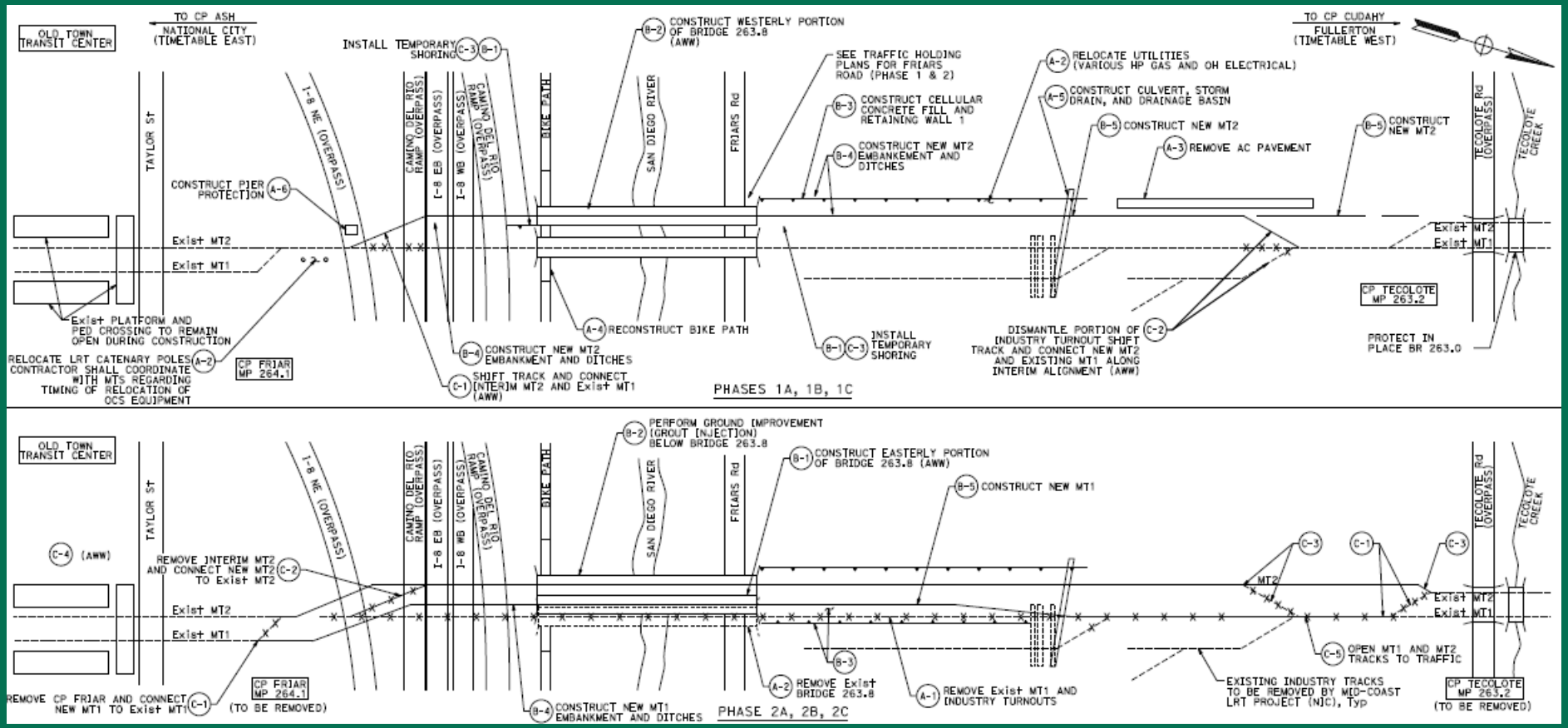
- 2-phase Construction
- Less Surcharge + More Resistance
- Approx. 10% Cost Savings

CMGC Design Input/Optimization



CMGC Design Input/Optimization

Construction



Construction

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Construction

Construction

Construction

Summary

- CMGC River Crossing Case Study
- Costs and Risks Biased toward Structures
- Design and CMGC Team Interaction
- Use of Innovative Design Methods
- Team Engagement in a CMGC Project