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WHY DO RAIL TRANSIT PROJECTS COST SO MUCH?

Causes & Consequences

Impacts

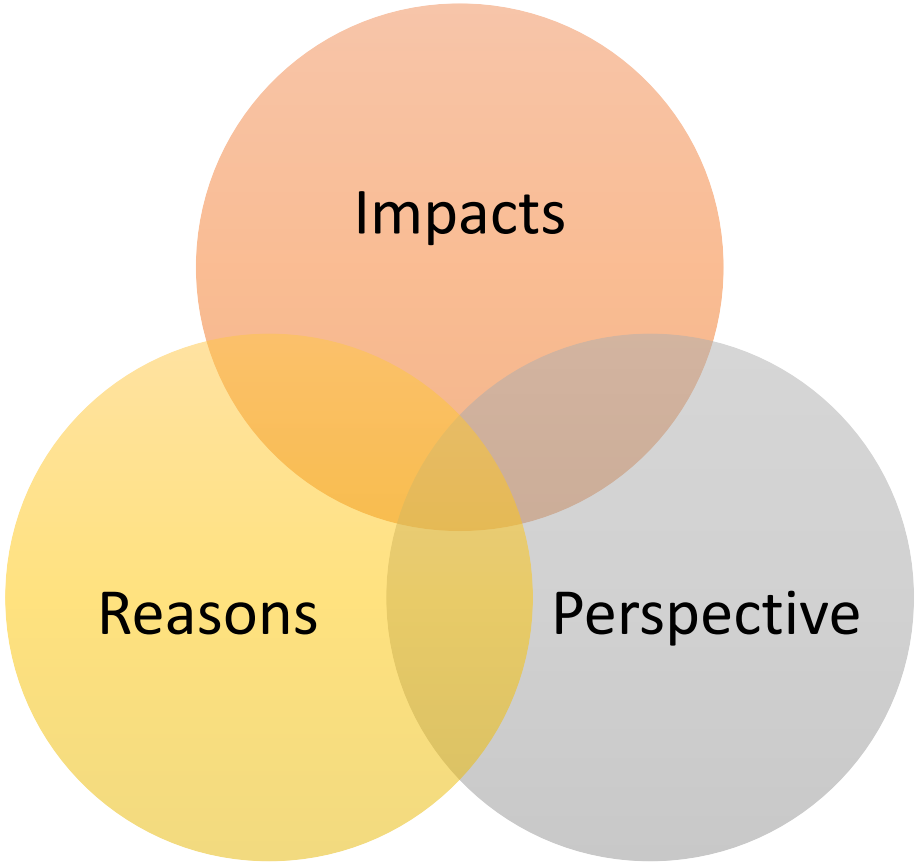
- ➢ Limited resources will reduce the number and extent of new rail projects
- ➢ Will limit the ability for cities to address congestion, climate change and pollution
- ➢ Projects that are built can squeeze out funding for other desirable public goals

Reasons

- ❖ Projects have become all things to all people
- ❖ Rail projects are usually located in the heart of the communities they serve
- ❖ More and more new requirements
- ❖ Provide maximum mobility benefits while enhancing communities, minimizing impacts and satisfying numerous regulatory requirements
- ❖ The reasons are not ranked, and vary by project type and location
- ❖ There is not one reason, but many
- ❖ There is no (simple) solution

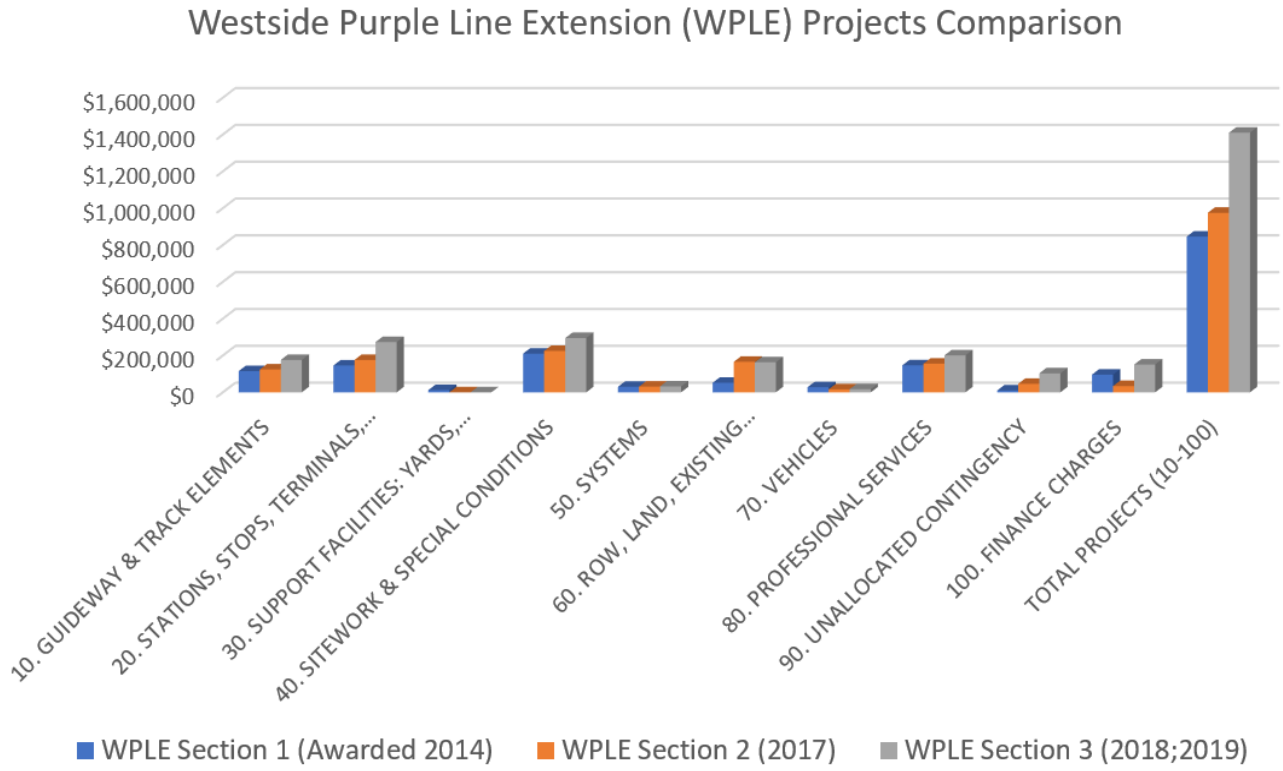
Perspective

- ✓ All the reasons listed have benefits and make positive contributions to society
- ✓ However, the costs for each add up and result in more expensive projects
- ✓ Project managers must balance conflicting and ever-changing requirements while still meeting project goals



Los Angeles (LA) Underground Cost Experience

Cost per route mile (in thousands), September 2020

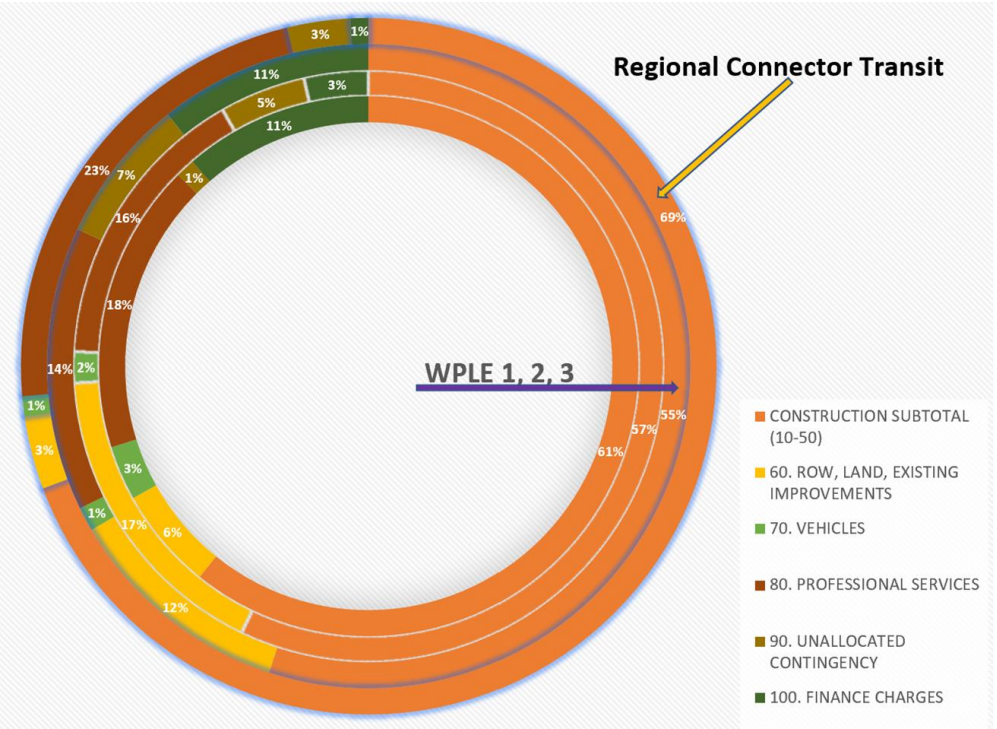


OBSERVATION OF MAJOR COST DRIVERS:

Project total costs (10-100) have increased over the years. Significant increases are:

- 10-50: Construction costs have overall trended upward from WPLE1.
- 60: ROW costs have increased 3X from WPLE1 to WPLE 2&3 (location factor and especially the rise in real estate costs in recent years)
- 80: Professional Services cost has trended higher since WPLE1 was awarded (fixed staffing costs are possibly saved on longer alignment projects)

Cost Percentages of Total Project Comparison

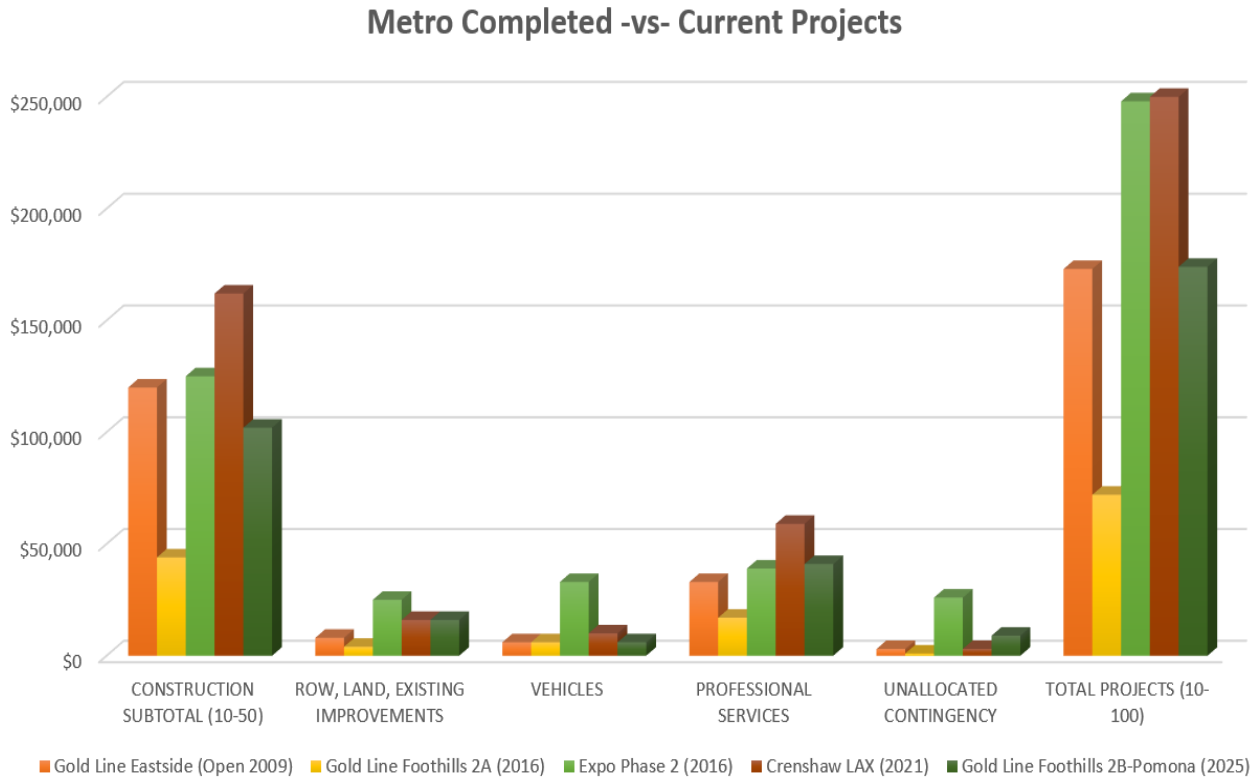


Metro vs Other Agencies Underground Cost Experience

PROJECT	YEAR OPEN	COST $M**	LENGTH (Miles)	COST PER MILE ($M)
Red Line Segment 1	1993	$1,439.00	4.4	$ 327.05
Red Line Segment 2	1996-1999	1,739.00	6.7	259.55
Red Line Segment 3	2000	1,313.00	6.3	208.41
WPLE-1	2023	2,979.00	3.92	759.95
WPLE-2	2025	2,441.00	2.59	942.47
WPLE-3	2027	3,224.00	2.56	1,259.38
Regional Connector	2022	1,756.00	1.9	924.21
BART San Jose Extension	2029	6,728.00	6	1,121.33
NY Second Ave Subway - 1	2016	4,450.00	1.68	2,648.81
NY Second Ave Subway - 2	2029	6,000.00	1.61	3,726.71
*Includes tunnel				
**Costs exclude finance charges				

LA Light Rail Transit (LRT) Cost Experience

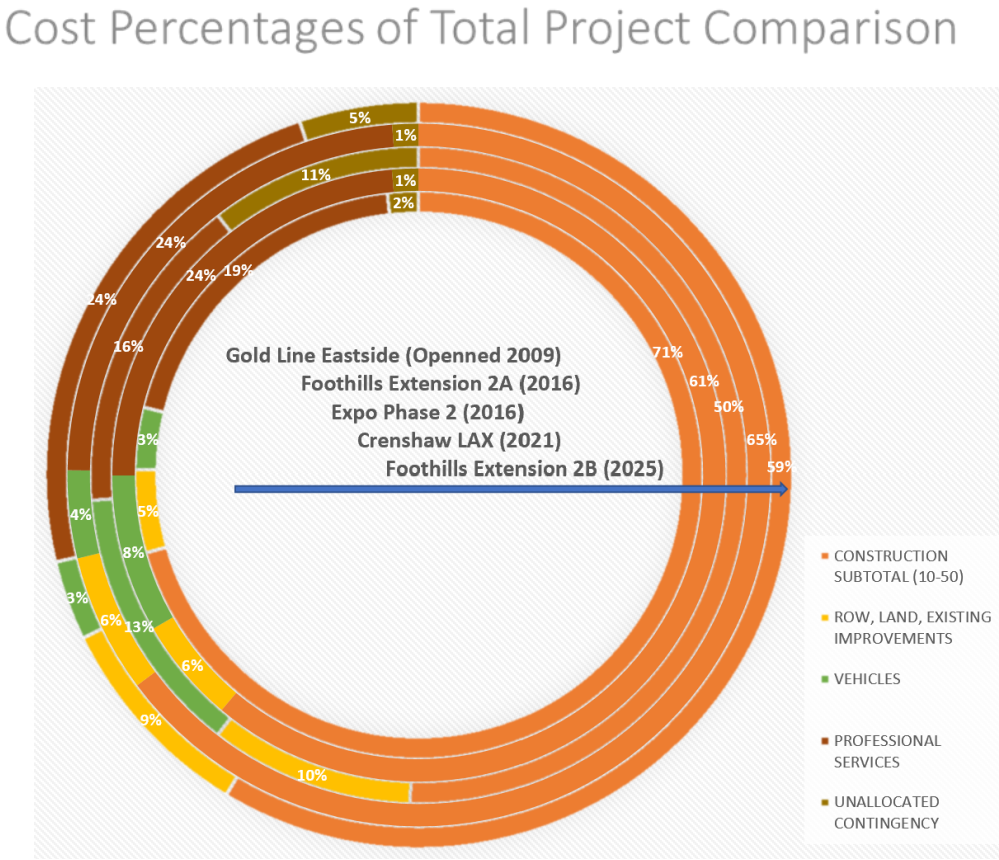
Cost per route mile (in thousands), September 2020



MAJOR COST DRIVERS:

Similar to HRT-Tunnel trends, these costs broadly increased over the years due to changes in market conditions:

- Construction
- ROW, Land, Existing Improvements
- Professional Services
- Project Total Costs



Metro vs Other Agencies LRT Cost Experience

PROJECT	YEAR OPEN	COST $M	LENGTH (Miles)	COST PER MILE ($M)
Blue Line	1990	$877	22	$39.86
Green Line	1995	712	20	35.60
Gold Line Pasadena	2003	735	13.7	53.65
Gold Line Eastside*	2009	899	6	149.83
Gold Line Foothill 2A	2016	769	11.5	66.87
Gold Line Foothill 2B	2026	1,583	9.1	173.96
Expo 1	2012	979	8.6	113.84
Expo 2	2016	1,511	6.6	228.94
Crenshaw*	2021	2,148	8.5	252.71
Denver T-REX	2006	879	19	46.26
Boston Green Line	2021	2,300	4.7	489.36
Portland Southwest	2027	2,800	11	254.55
West Seattle & Ballard Lines*	2031	12,600	11.8	1,067.8
*Includes tunnel				

T-REX EXAMPLE:

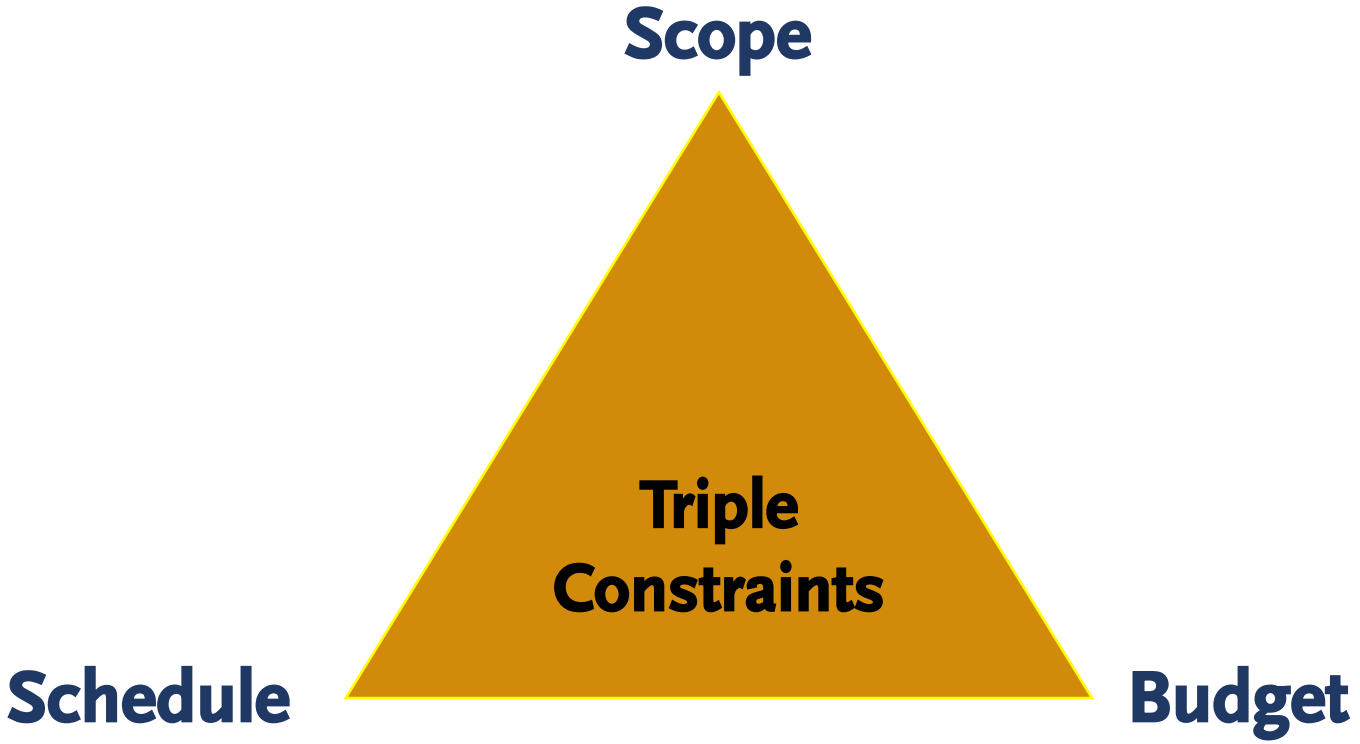
- Completed in 2006 for $879 million (19 miles) - $46 million per mile
- Fully grade separated
- New, large maintenance facility
- New SCADA system; new control center
- Includes signal upgrades to existing system
- Would cost $150 - $200 million per mile today

Potential Cost Drivers

1. Unfunded Mandates	8. Communities	15. Alignments
2. Technical Requirements	9. Real Estate Costs	16. Regulatory Oversight
3. Environmental Ground Conditions and Cleanup	10. Fire/Life Safety	17. Security Requirements
4. Third Party Stakeholders	11. Operational Requirements	18. Project Management and Soft Costs
5. Contractual	12. Business/Workforce Goals	19. Utilities
6. Technical Complexity	13. Federal Requirements	20. Turnover, Acceptance and Warranties
7. Environmental Clearance	14. Railroad Interface	21. Project Changes

Project Management

One side of the triangle cannot be changed without affecting the other sides:



Recommendations

Contractual

- ✓ Thoroughly review all contract terms including “boilerplate”
- ✓ Engage in extensive and open industry (owner/contractor) discussions
- ✓ Hold one on one meetings with proposers during procurement
- ✓ Spend more effort researching past performance of bidders
- ✓ Focus on risk allocation
- ✓ Consider standard contracts throughout the industry
- ✓ Emphasize best value versus low bid selections

Technical

- Make projects simpler, less complex
- Frequently review agency design criteria
- Where possible, design to budget
- Take advantage of new technologies
- Get involved in the development of new standards
- More emphasis on low-cost traffic engineering solutions – study European concepts of urban insertion

Management

- ❖ Maintain a core of experienced project management personnel
- ❖ Focus on technical capacity
- ❖ Consultant support but not consultant driven projects
- ❖ Value engineering
- ❖ Peer reviews
- ❖ Public private partnerships do a better job of analyzing the need for project elements – thorough life cycle cost analyses – minimizes gold plating

Community

- Allow projects to be self-permitting
- Shorten the time or eliminate the need for environment impact studies for transit project – they are by definition, good for the environment
- Allow for more consideration of cost in environmental process
- Consider joint management of projects with Cities, DOTs, etc.
- De-emphasize focus on minimizing traffic impacts – we are building transit for a reason

Political

- ➢ It is seldom that fundamental laws, regulations and policy goals will change
- ➢ Acknowledge urban design goals early and incorporate adequate budget for these goals
- ➢ Projects are reflective of societal and community goals
- ➢ However, hold open discussions with policy makers, they may not understand the cost impacts of certain approaches

Appendix

- 21 Potential Cost Drivers

1. Unfunded Mandates

- New requirements without any new funding
- Many of the items described in this presentation can be classified as unfunded mandates
- Example is American with Disabilities Act (ADA)

2. Technical Requirements

- Constantly evolving to reflect lessons learned, new technology, and more developed information
- Water quality – National Pollutant Discharge Elimination System
- Water detention – Urban Drainage and Flood Control
- Seismic requirements
- Tunneling methodologies
- Prevalence of litigation leads to conservative (expensive) design solutions
- Gold plating

3. Environmental Ground Conditions and Cleanup

- Classifications of contaminated materials has become more strict
- More soil that cannot be re-used on a project and must be hauled away
- Reduction in nearby landfills that accept contaminated material
- Awareness of potential hazards – e.g. aerial deposited lead

4. Third Party Stakeholders

- Cost of reviews
- Schedule impact of review process
- Betterment requests
- Schedule pressures result in little leverage for the project
- Many European projects are not subject to external approvals. The project becomes the permitting authority

5. Contractual

- Contractor claims are increasing
- Size and complexity of mega projects lead to more risk
- Risk is priced into the contract
- Contractor losses lead to claims and disputes, which can be expensive to resolve
- Onerous contract provisions result in risk being priced into the project regardless of whether it occurs

6. Technical Complexity

- SCADA systems, control center interface, networked communications systems, extensive CCTV, intrusion systems, fire/smoke detection, complex software driven systems, etc.
- Any one item is not expensive, but the need to manufacture, program, install, test and integrate these thousands of communications items is very complex and time consuming
- LA Metro Crenshaw/LAX project has over 9,000 communications devices that are monitored, controlled or report
- Often not enough schedule built in for systems integration
- Expertise to perform and manage is in short supply

7. Environmental Clearance

- Time and cost to perform and secure clearance for environmental documents has increased
- Longer time period has lengthened projects with resultant inflationary costs
- Extensive and expensive mitigations must be incorporated to secure approvals
- Threat of lawsuits against rail transit projects is a major risk

8. Communities

- Communities are becoming less tolerant of disruptions to their businesses and residents
- Business interruption programs
- Restrictions on work hours
- Construction moratoriums
- Community amenities
- Community outreach programs

9. Real Estate Costs

- Cost of real estate in most cities has outpaced general inflation
- Time to acquire a critical property can be up to 18 months, lengthening the project schedule
- United States is unique in its requirement for underground easements for tunneling projects

10. Fire/Life Safety

- Safety has become a paramount objective, often with little analysis of risk vs. cost tradeoffs
- Specific requirements related to tunnel ventilation, barriers and fencing, extensive use of CCTV, emergency communications systems, etc.
- NFPA 130 is constantly evolving. European systems (and legacy US systems) generally do not have NFPA 130 tunnel ventilation requirements
- Authority having jurisdiction (AHJ) can lead to additional safety requirements

11. Operational Requirements

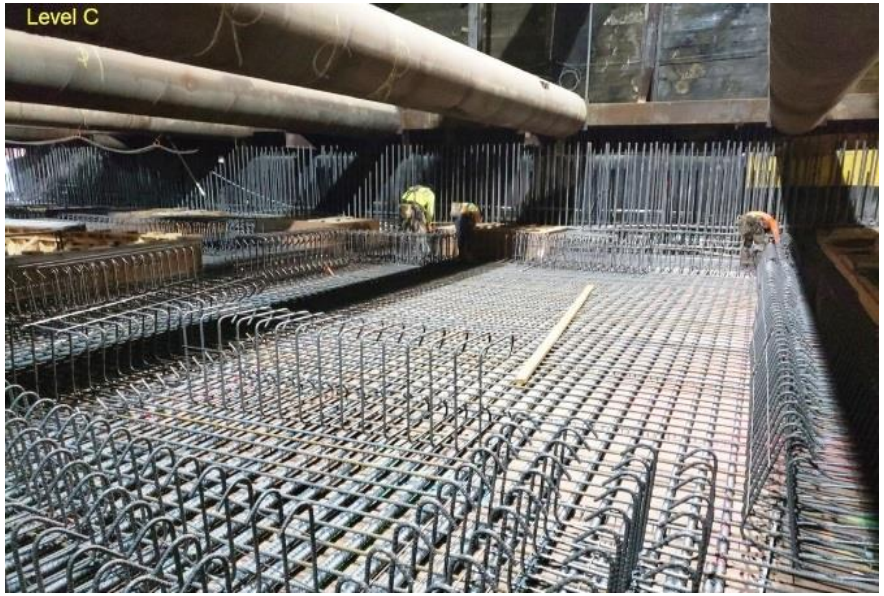
- As rail systems expand, they become interconnected with the larger network, increasing the importance of reliability of the operation along with new systems needed to achieve that reliability
- Results can be more interlockings (crossovers), sidings and pocket tracks, more extensive signaling to accommodate shorter headways, reverse signaling, more robust power systems, larger maintenance facilities, additional elevators for redundancy, hardened rail, etc.
- Changes as operational standards and personnel evolve through long running capital projects

12. Business/Workforce Goals

- Includes DBE/SBE, Project Labor Agreements and workforce development
- Cost to administer these programs
- Potential of penalties for non-attainment
- Risk of non-performance
- Impacts to workflows and assignment of work
- Risk of subcontractor disputes

13. Federal Requirements

- Buy America – challenging in a global economy
- Affects established supply chains, particularly for third parties such as utilities
- Davis-Bacon – labor rates not as critical an influence in a “hot” economy, but job classifications and disputes have an influence
- Cost of federal reporting and administration



14. Railroad Interface

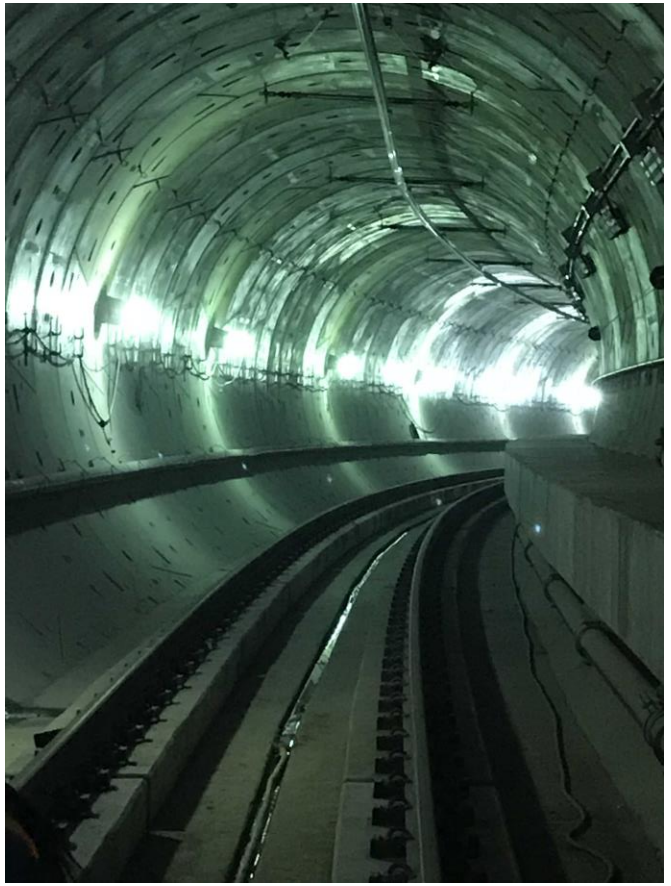
- Railroad alignments often offer the best opportunities to reach destinations
- However, tight railroad capacity, profitability and greater understanding of risks have led railroads to impose stricter requirements for transit projects to share their alignment.
- Results in larger track centers (requiring more right of way), train barriers between the two alignments, intrusion detection barriers, higher insurance premiums related to indemnification, work hour restrictions and higher payments for use of their right of way.
- In some cases, railroad alignments cannot be made available.

15. Alignments

- Increased traffic congestion requires more, expensive grade separations (aerial or tunnel)
- Many communities insist on grade separations for safety or to minimize traffic impacts
- Low cost traffic engineering innovations with signal priority, lane and street closures, parking prohibitions (such as used in Dublin) are often not allowed, resulting in more expensive, separated alignments

16. Regulatory Oversight

- Numerous levels of federal, state and local oversight and regulations are performed to assure the integrity of the project and compliance with regulations
- Administration of the regulatory process
- Schedule impacts of regulatory approvals
- Risk that regulators will not approve opening



17. Security Requirements

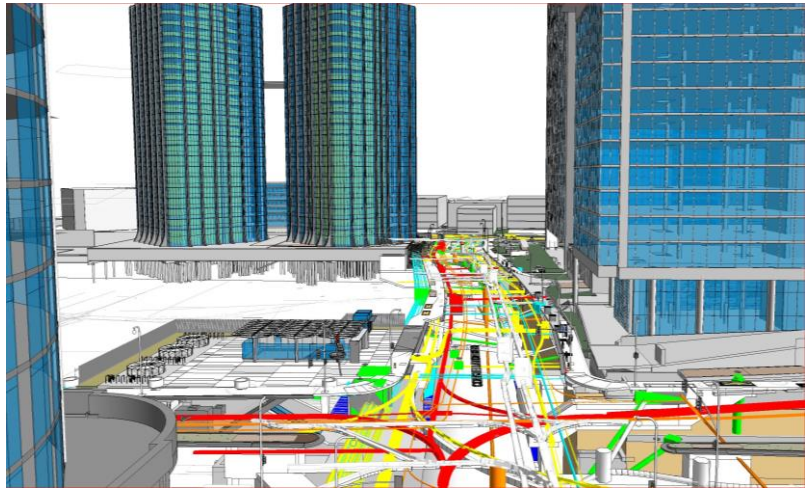
- Increased focus since 9-11
- More security facilities, security control centers, cameras and high-tech equipment

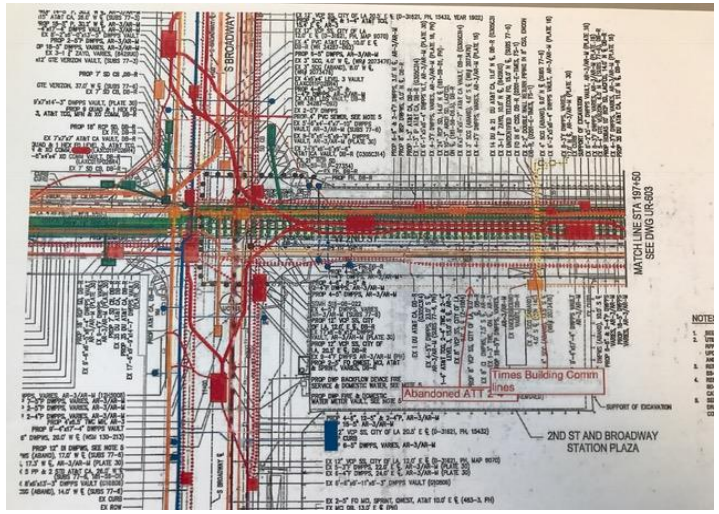
18. Project Management and Soft Costs

- Soft costs average approximately 30% of total project cost
- Challenge of maintaining a sustainable management staff, given the intense, but relatively short-lived timeframe of projects
- Extensive use of consultants
- Longer, more complex projects and the caliber and number of professionals needed to staff
- Technical capacity is critical

19. Utilities

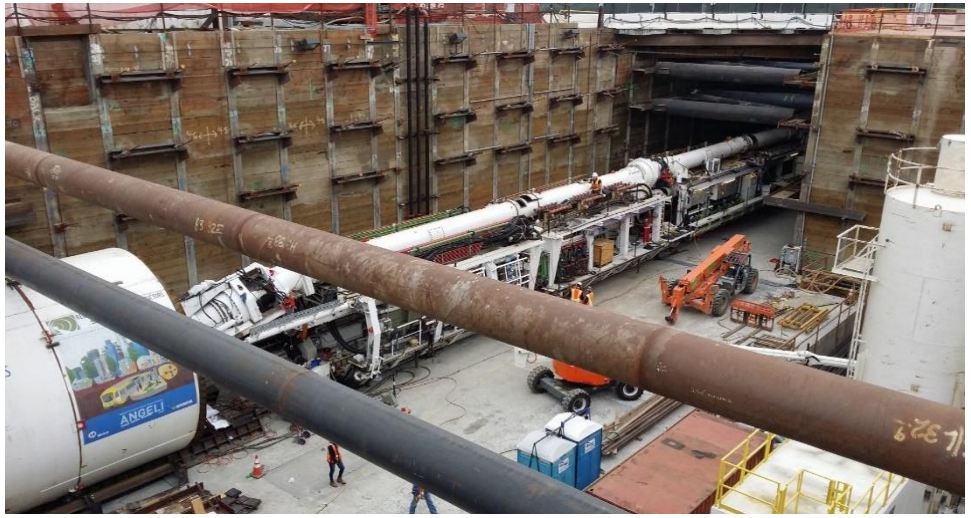
- Rail corridors are congested with underground and overhead utilities
- Cost and schedule impacts of extensive utility relocations
- Schedule risk – work must often be done by the third party utility
- Betterments – new and larger conduits, moving lines from overhead to underground, replacement rather than relocation
- Old utilities not correctly marked on documentation





20. Turnover, Acceptance and Warranties

- Each project element must be formally accepted
- Contractor assigned risk
- Owner delay in acceptance
- Trend toward longer warranties
- Plant establishment periods also being extended for landscaping



21. Project Changes

- Projects lasting 5-6 years lead to inevitable changes, which are expensive and can be disruptive to the project
- New stakeholder personnel and preferences including internal to the agency
- Transit oriented development plans often not defined until later stages of project
- Rapid changes in technology (what was specified can be obsolete when installed)