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2024 SPRING CONVENTION

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The Challenges and Opportunities of Utility Tunnels

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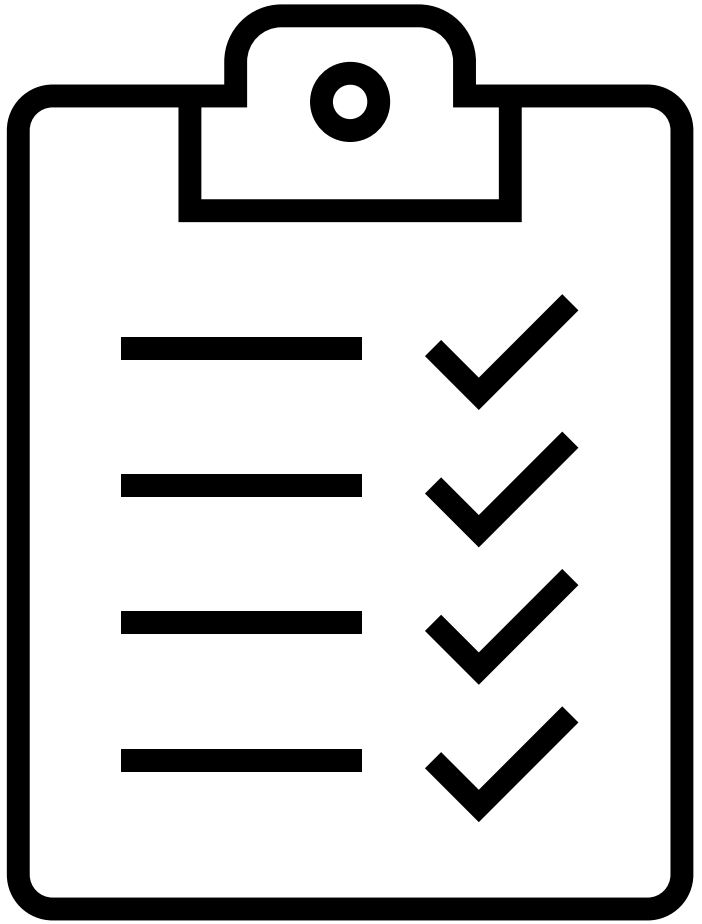
Safety Minute

- Utility Tunnels “check all the boxes” for hazards
- Confined spaces
- Hazardous materials
- Hot/Cold
- Water/flooding
- Electrocution/Arc Flash
- Stored energy (steam)

Agenda

- Objectives
- Typical Conditions
- Evaluation and Design
- Repair Process
- Examples
- Conclusions



Learning Objectives

- Identify the challenges presented by the utility tunnel environment.
- Discuss the maintenance and funding challenges of these tunnels from an Owner's perspective.
- Explore methods for inspection and repair.
- Provide examples of how specific project challenges were approached and solved.

Agenda

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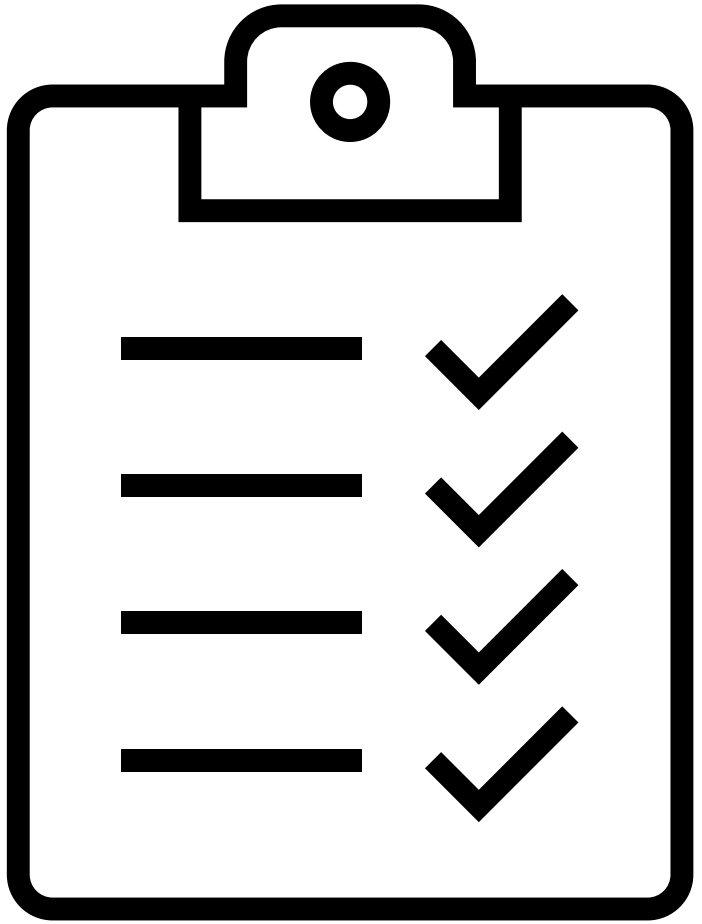
- Typical Conditions



What are these tunnels?

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Technical Challenges

- Modified over the ages with poor record-keeping
- Multiple co-located utilities that cannot be interrupted
- Challenging environment for evaluation, repair, and long-term durability

Owner/Operation Challenges

- Critical to infrastructure
- Low perceived value – these aren't "signature" structures
- Difficult funding sources

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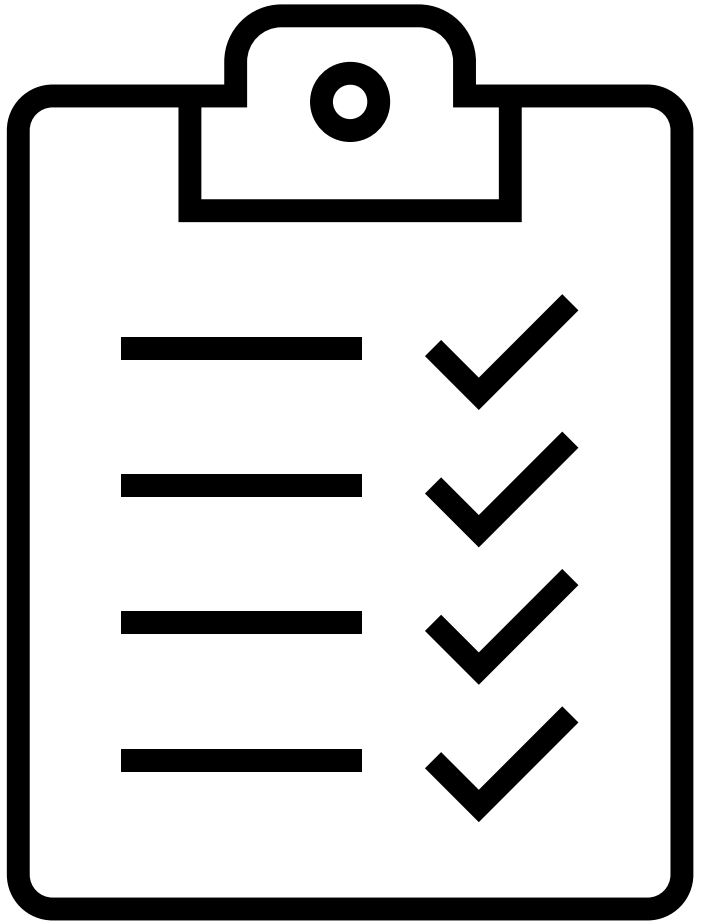

Evaluation

- Typically include
  - Visual
  - Sounding
  - Limited NDT
  - Sampling

Evaluation

- Typically include
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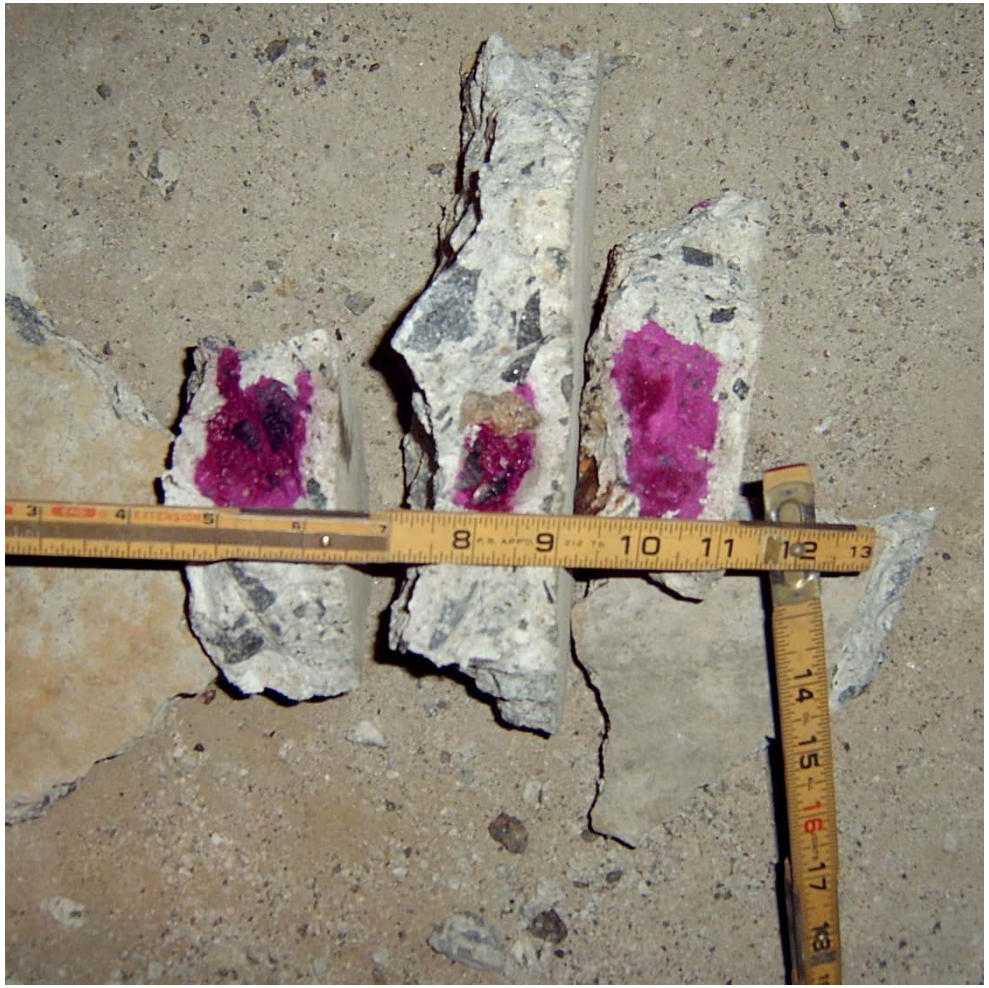
  - Sounding
  - Limited NDT
  - Sampling
- Identification of hazardous materials
- Analysis of loads
- Coordination with owner and utility owners
- Access and extent limited



Structural Challenges

- Surcharge loadings
- Unclear code applicability
- Limited design basis

Waterproofing Challenges

- Blind side waterproofing is very difficult to repair
- Excavation is costly and disruptive
- Transitions between components are challenging
- Difficult to evaluate

Repair Design

- The “right” way to do these repair is very expensive
- Repairs need flexibility in scope and application
- Required unit pricing creates owner angst
- Integrated waterproofing design is often required

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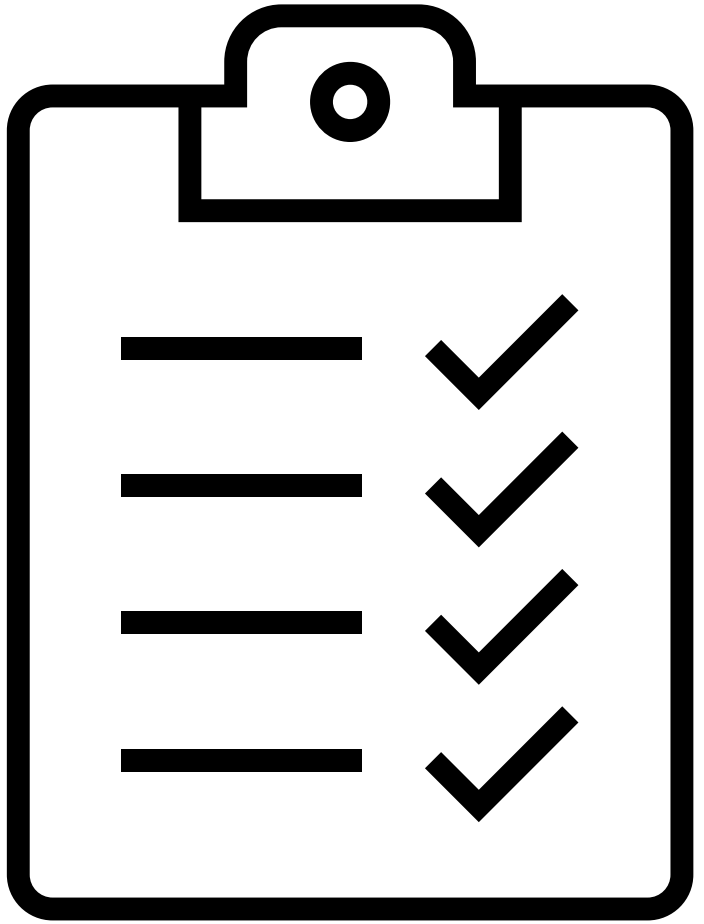


Challenges - Contractor

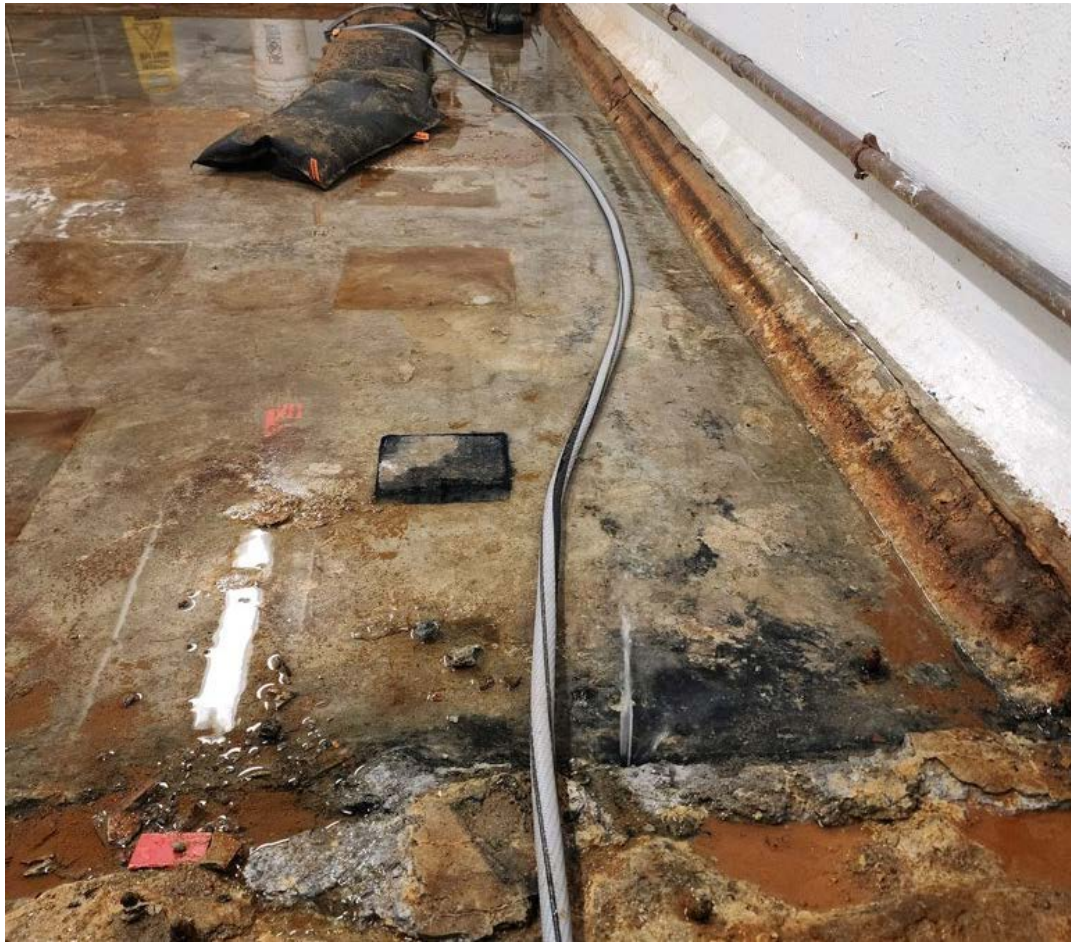
- More planning/coordination
- Workforce and executing the work
- Safety and Logistics
- All of these present atypical costs

Planning and Pricing

- Need to work with designer
- Don’t expect drawings to show everything
- Be flexible
- Prime vs Sub
- Overhead is high and logistics need to be planned
- Bids have to be balanced

Executing the work

- Need the right craftspeople
- Production rates are generally slower - inefficient repairs
- Coordination of active utilities - (steam, data, gas, etc.)
- Access and staging, safety equipment



Safety and Logistics

- Workforce Training
- Physically able to work in these spaces
- If excavating – spoils, restoration, paving, permitting
- Injection/solvents/etc. in confined areas
- Staging area?
- Material into work area – lots of stick-built things

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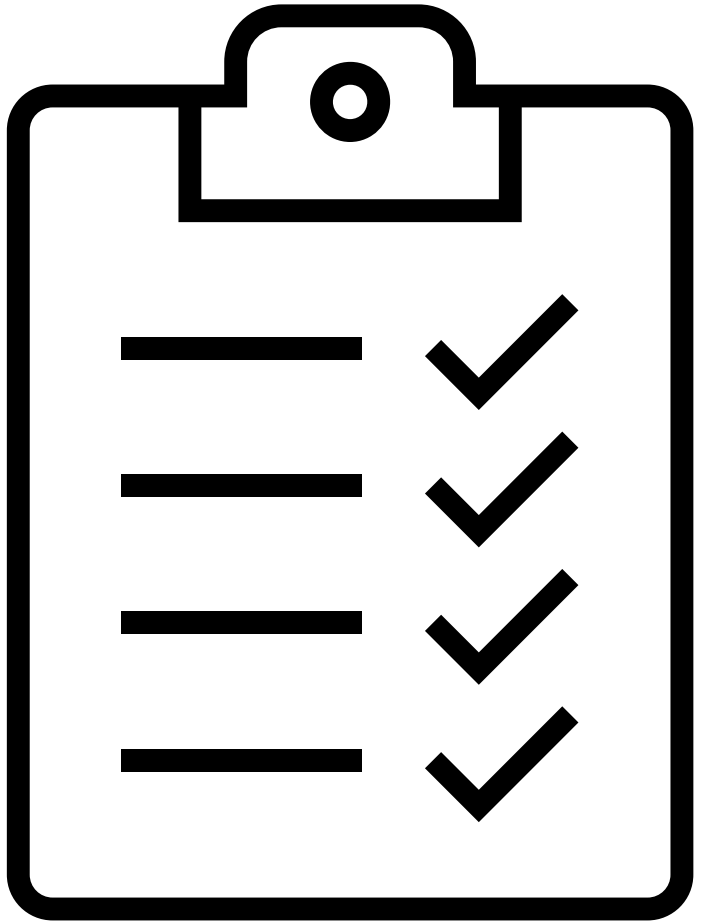
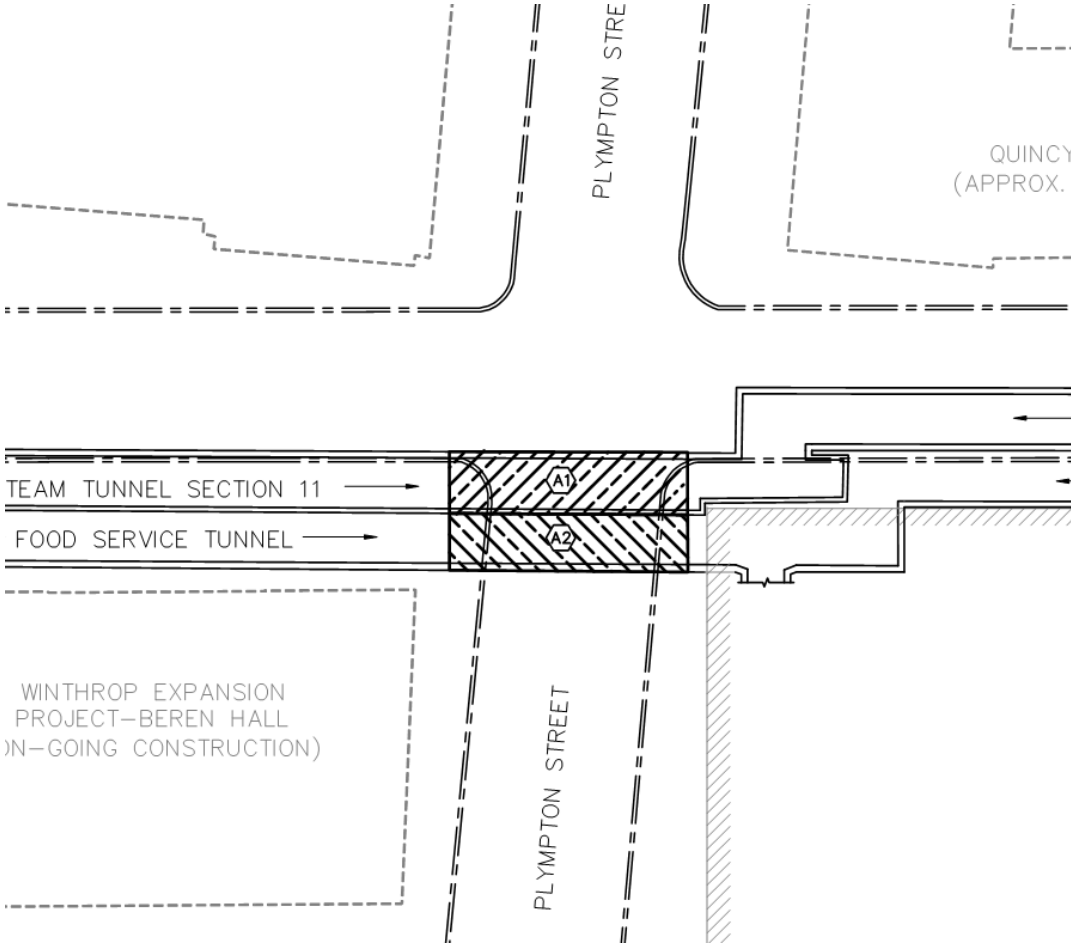
- Example - 1



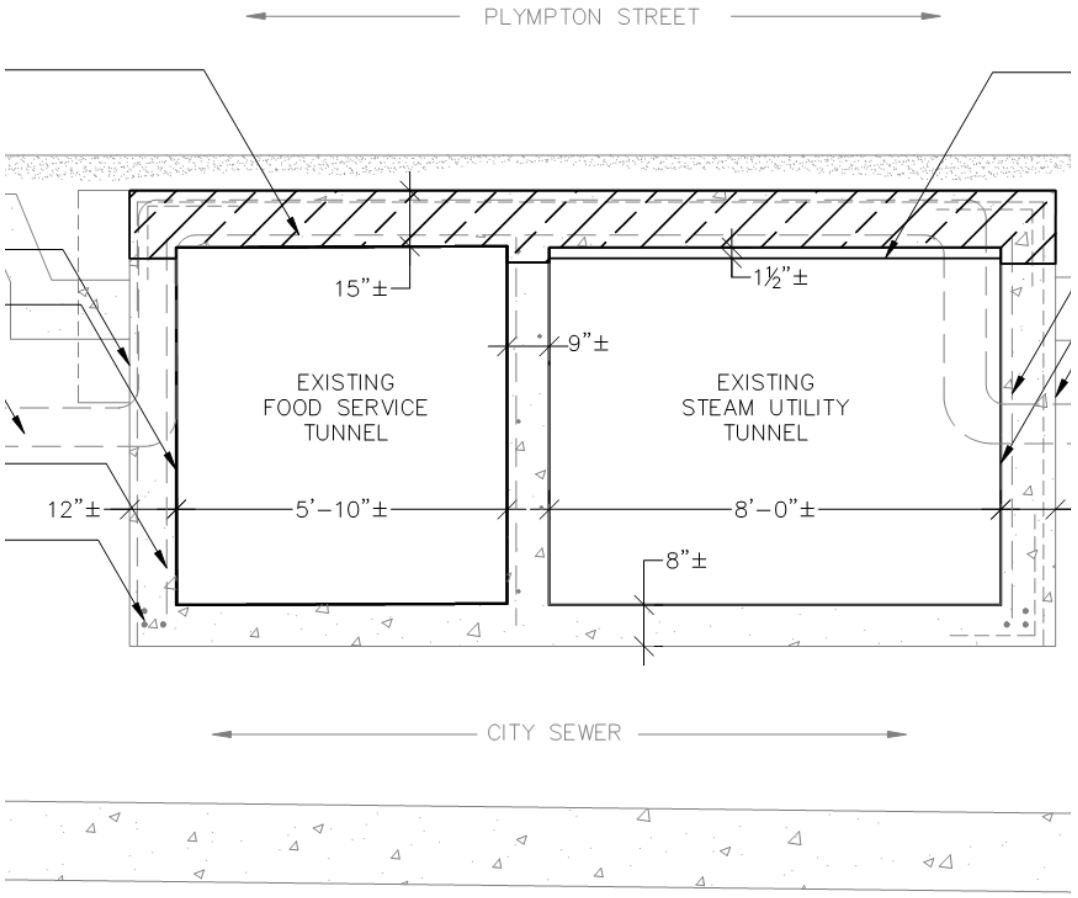
Typical Tunnel

- Food Service and Utility Tunnels – side by side
- Crosses active roadway
- Replace concrete roof
- Waterproof – connect to existing



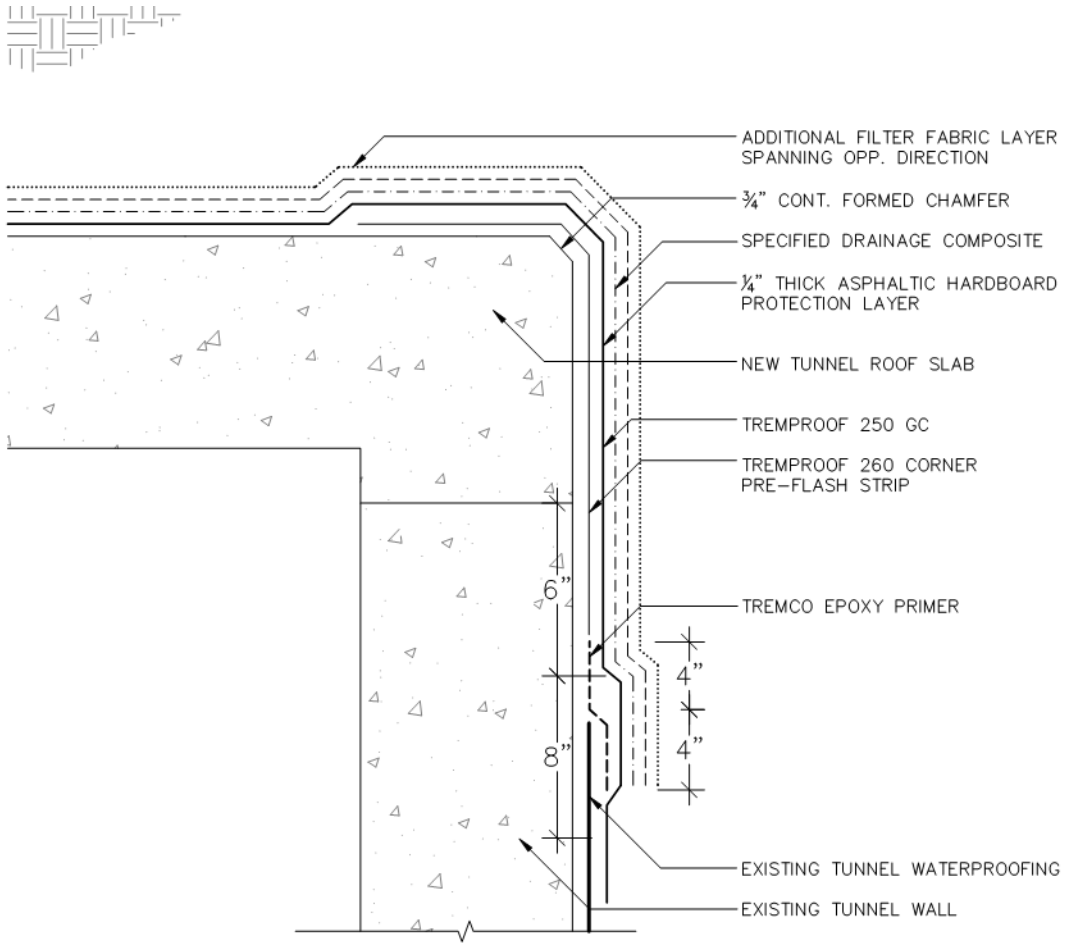
Concrete Repairs

- Divert traffic
- Excavate
- Conventional concrete repair/roof replaced



Waterproofing Repairs

- Details/Spec'd vs. feasible
- Fast turnaround
- Liquid vs. Sheet
- Connection to unknown materials
- Weather



Special/Unusual

- Very shallow cover
- Wet/Winter conditions
- Logistics – utility and traffic

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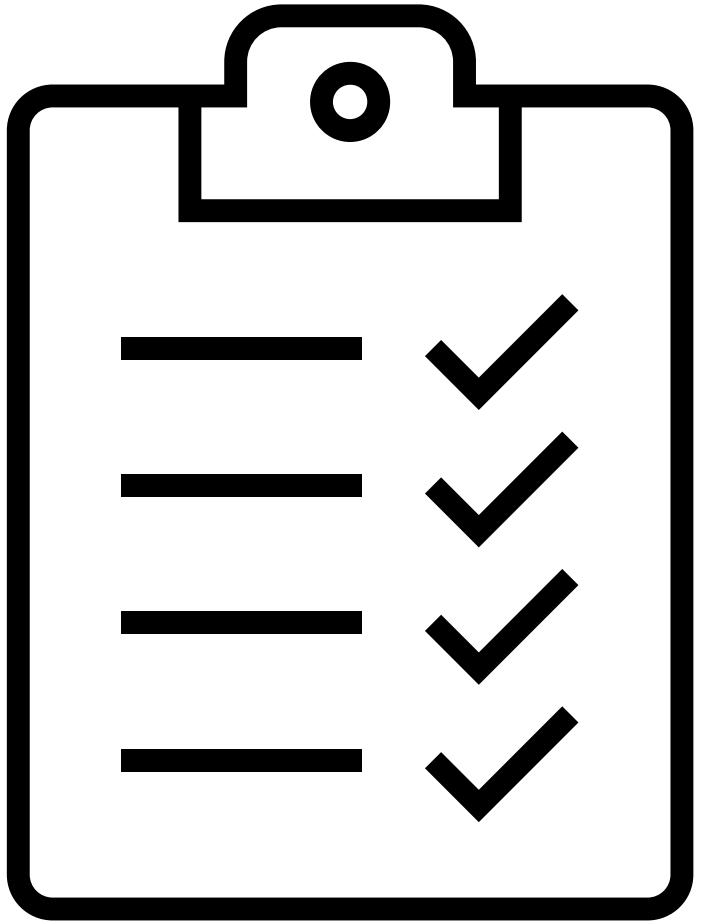

Underwater Tunnel

- Utility tunnel running under river – Weymouth/Quincy
- Leaks noted during bridge rehabilitation
- Access through hatch on 1 side only
- Active utilities

Special Conditions

- Logistics/Access of work area
- Safety
- Communication

Waterproofing Repairs

- Combination of hydraulic cement & injection grouts
- Environment – control waste
- Safety challenges due to limited access

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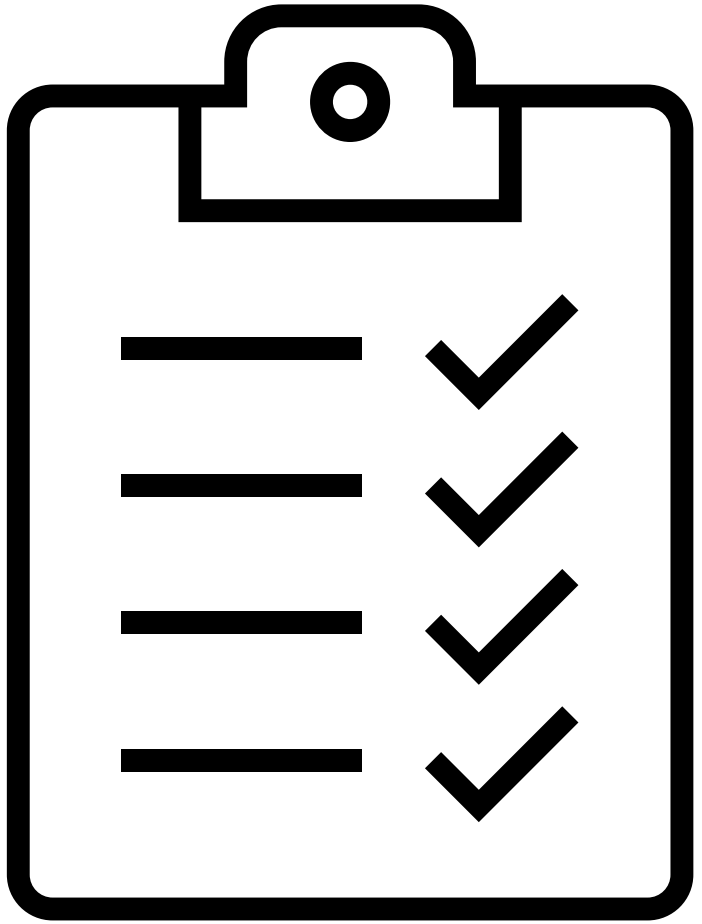
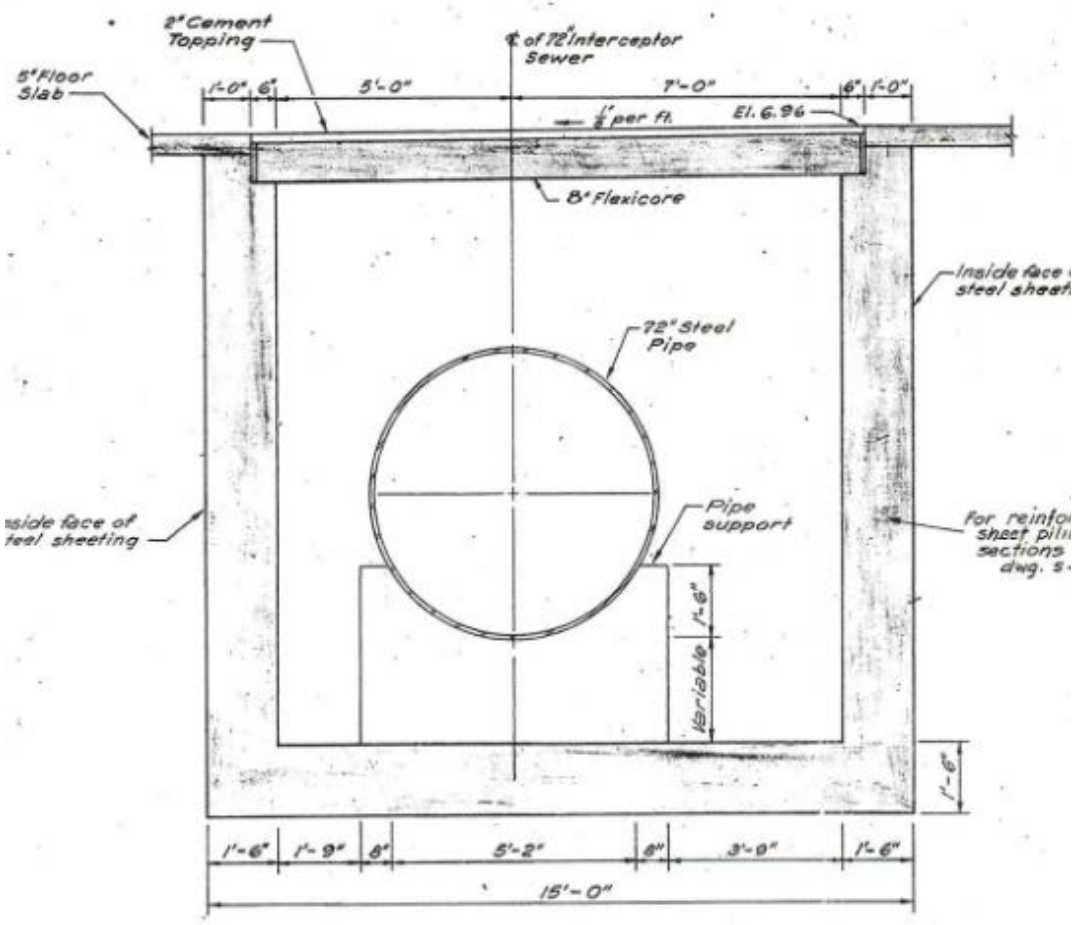


Sewer Tunnel

- Tunnel containing a large sewer interceptor below a garage
- “Roof” comprised of individual prestressed precast concrete planks



Sewer Tunnel

- Tunnel containing a large sewer interceptor below a garage
- “Roof” comprised of individual prestressed precast concrete planks
- Chloride ingress from garage caused corrosion and related spalling in the bearing area
- Corrosion damage to beams

Waterproofing Repairs

- Stabilization used to extend life while a long-term plan was developed
- New traffic-bearing waterproofing system installed to mitigate further ingress

Shoring

- Stabilization used to extend life while a long-term plan was developed
- New traffic-bearing waterproofing system installed to mitigate further ingress
- Shoring installed within tunnel

New Beams

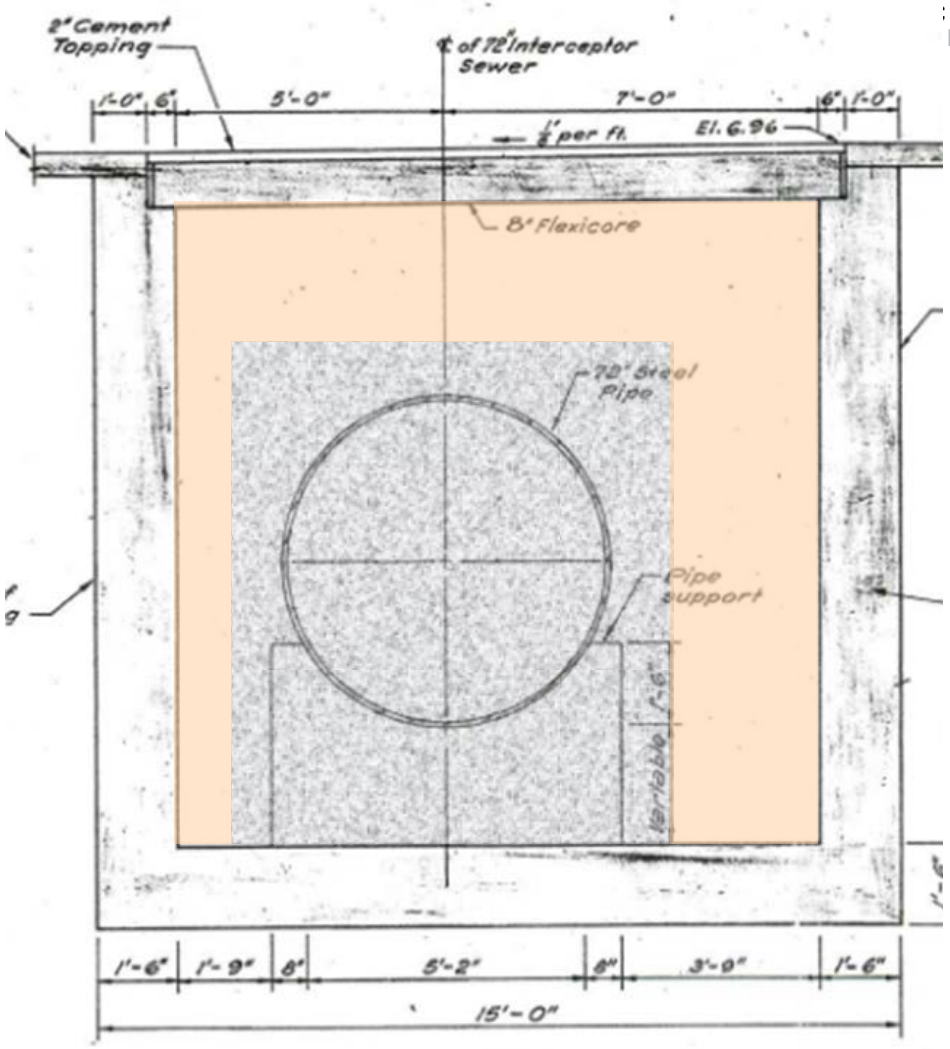
- Stabilization used to extend life while a long-term plan was developed
- New traffic-bearing waterproofing system installed to mitigate further ingress
- Shoring installed within tunnel
- Supplemental steel beams installed

Concrete Repairs

- Limited repairs at garage level and at columns
- Installation of new access

Special/Unusual

- Alternative solution implemented to abandon utilities and fill
- Owner relocated active associated utilities
- Sewer pipe enclosed in normal-weight concrete



Special/Unusual

- Alternative solution implemented to abandon utilities and fill
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- Anchorage to resist buoyancy

Special/Unusual

- Alternative solution to abandon utilities and fill
- Owner relocated active associated utilities
- Sewer pipe enclosed in normalweight concrete
- Anchorage to resist buoyancy
- Lightweight flowable fill throughout tunnel

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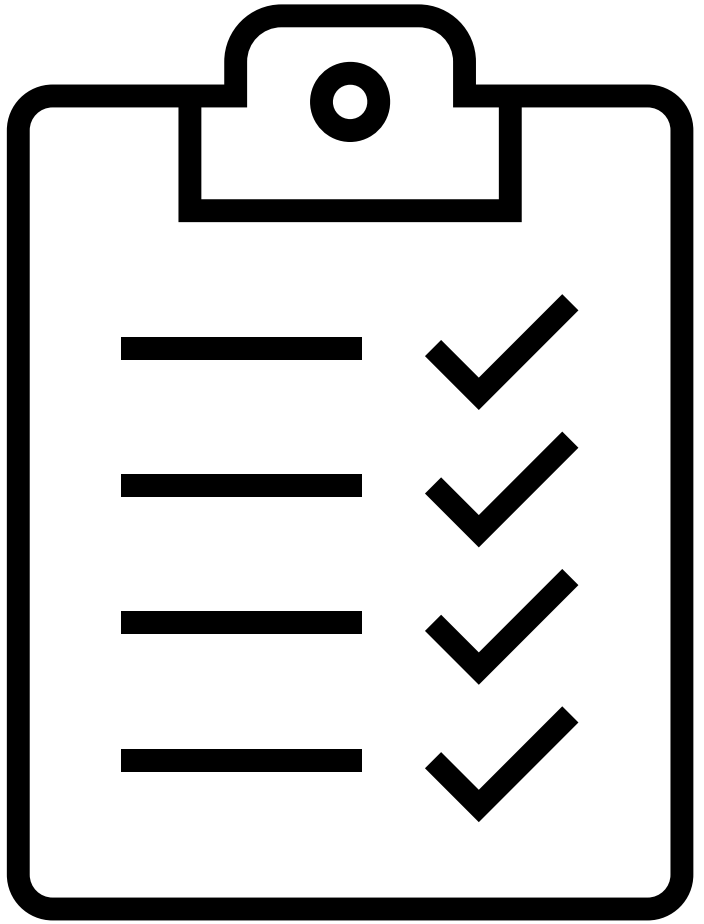

Conclusions

- Utility tunnels comprise significant campus infrastructure, but are underappreciated and undervalued due to their concealed nature.
- They present an aggressive and challenging environment, and many are aging. Damage presents a large risk to campus operations.
- Conventional evaluation and repair approaches won't work due to challenging logistics and complicated constraints.
- Repair requires teamwork, specialized approaches, lots of coordination, "outside the box" thinking, and flexibility.
- They can provide for rewarding projects.

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Questions?

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