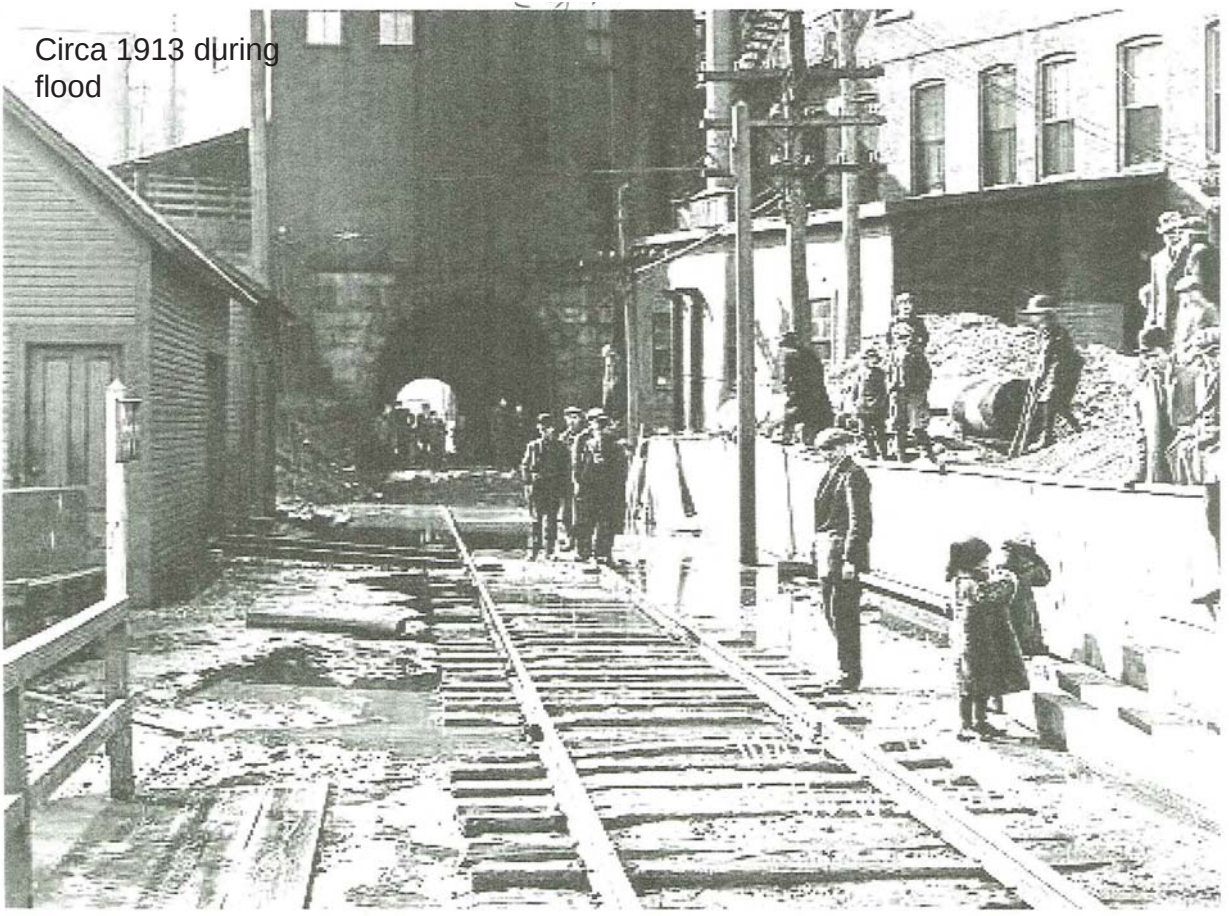
# Bellows Falls Tunnel

Track Lowering Project for Modified Double Stack
Container Cars and Auto-Racks

ECI Rail Constructors, Inc.
Kenneth A Pidgeon, PE

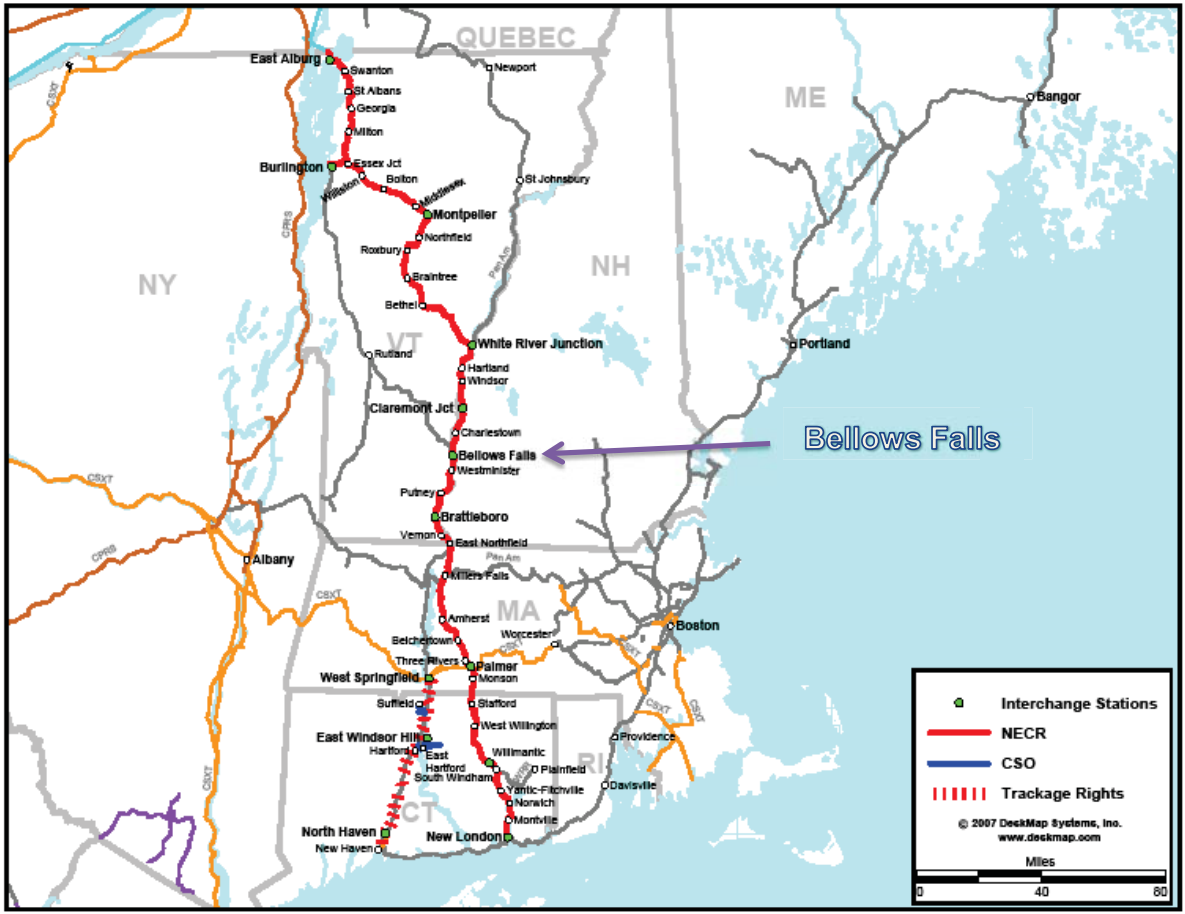

Circa 1913 during
flood

# Project Background

- Project Costs:
  - $2.5M Construction
  - Funded by VTrans/FHWA/Rail America
- Objectives for State/Fed:
  - Reduce I-89 and I-91 Heavy Truck Traffic
  - Enhance VT's Transportation System

# Project Team

- Owner: New England Central Railroad - Rail America
- Engineer: VTrans (Rail & Structures Divisions)
  Parsons Brinckerhoff
- Contractor: ECI Rail Constructors, Inc.
  - Thomas Drilling & Blasting (Rock Removal)
  - Acme Waterproofing (Shotcrete)
  - Bazin Brothers (Local Excavation Company)


QUEBEC
ME
NY
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Waterbury
Montpelier
Northfield
Roxbury
Braintree
Bethel
White River Junction
Rutland
Hartland
Windsor
Claremont Jct
Charlestown
Bellows Falls
Westminster
Putney
Brattleboro
Vernon
East Northfield
Millers Falls
Amherst
Belchertown
Three Rivers
Palmer
Monson
West Springfield
Suffield
Stafford
West Willington
East Windsor Hill
Hartford
East Hartford
South Windsor
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Miles
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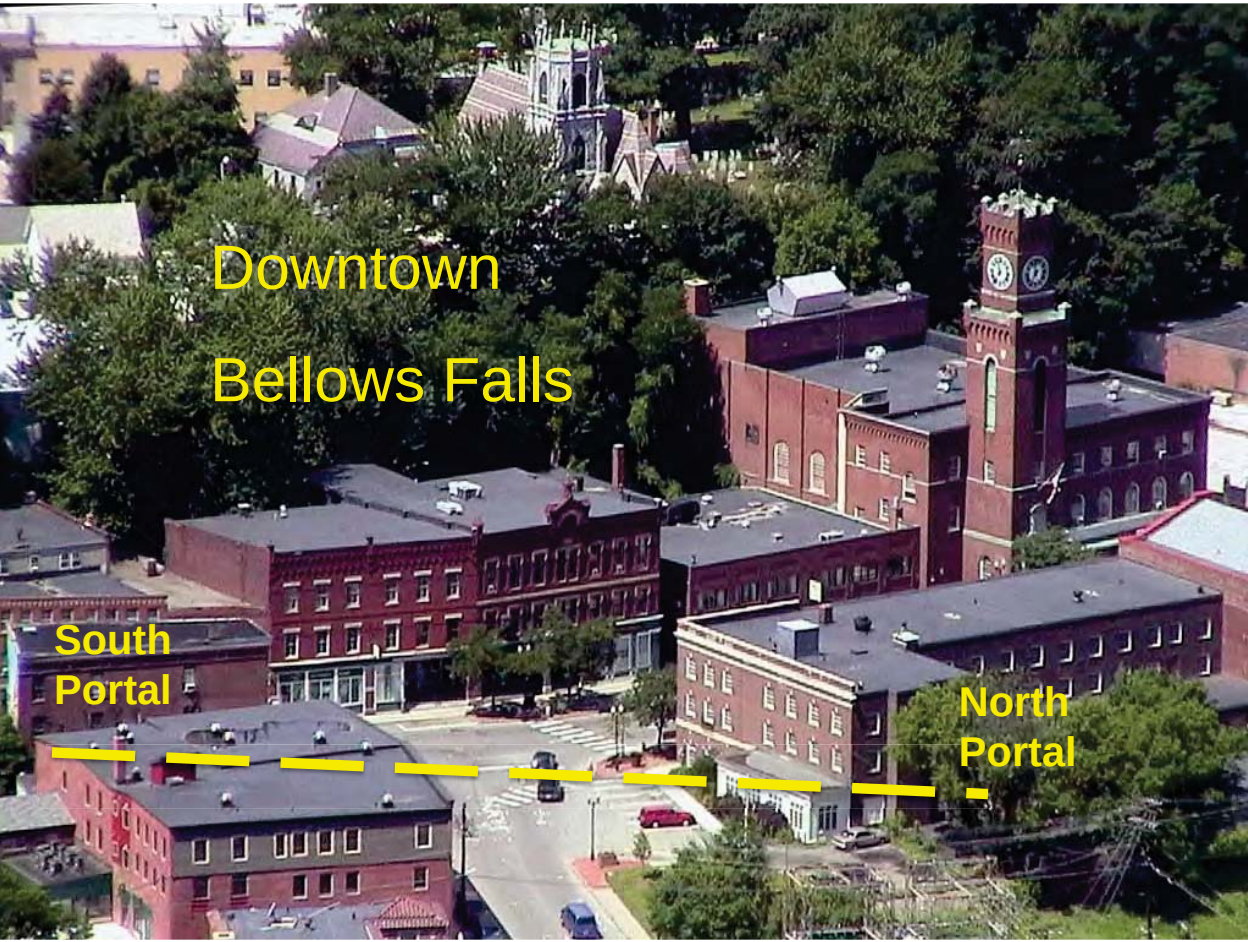
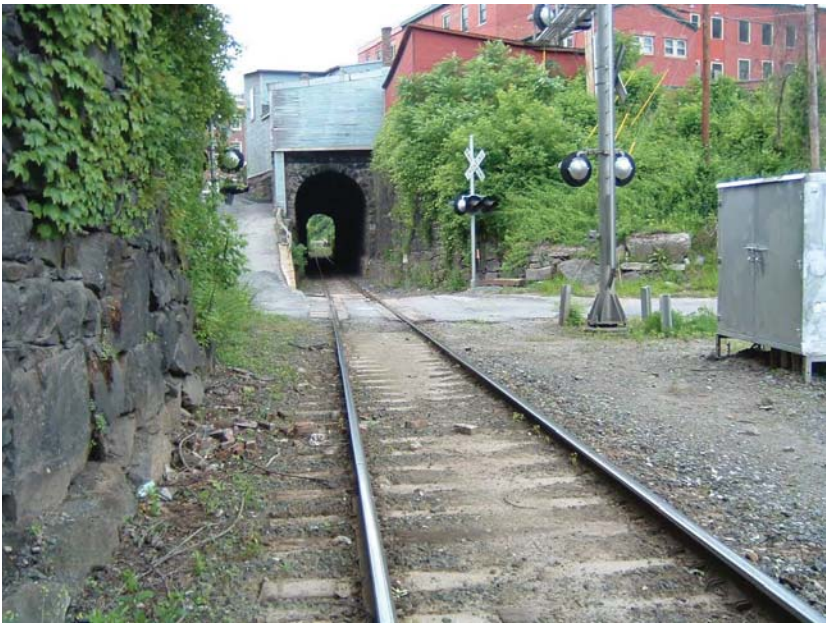
40
80

# About the Tunnel

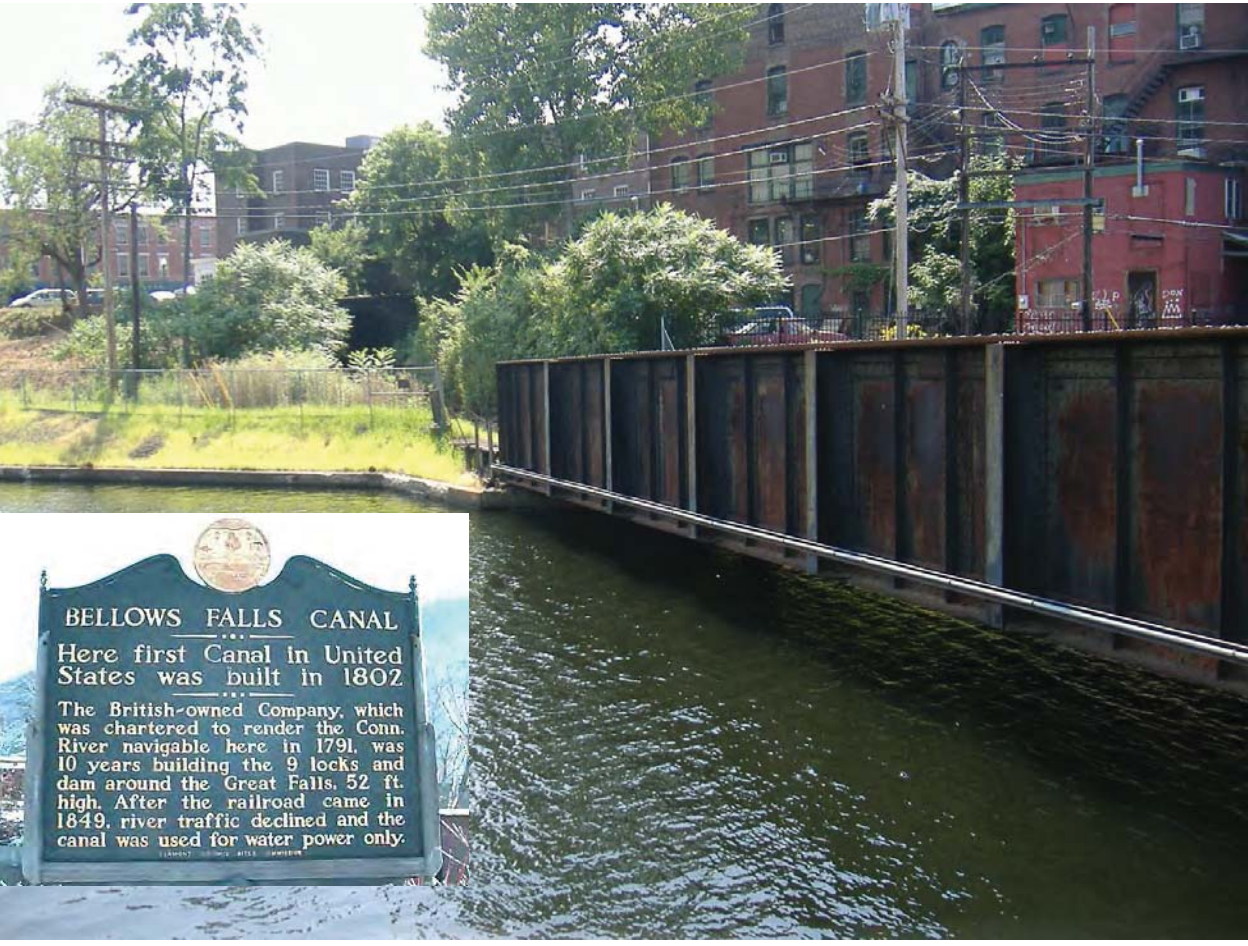
- Stone Arch – Cut & Cover Construction
- 280 ft long x 12 ft narrow
- Constructed in 1850s
- Invert Lowered Twice Previously (1950s and 1970s)
- Overlying Hotel & City Street
- Crossing at South Portal is only access to Municipal Sewer Treatment Plant


Downtown
Bellows Falls
South
Portal
North
Portal

# South Portal – June 2006



# North Portal – August 2005


BELLOWS FALLS CANAL
Here first Canal in United States was built in 1802
The British-owned Company, which was chartered to render the Conn. River navigable here in 1791, was 10 years building the 9 locks and dam around the Great Falls, 52 ft. high. After the railroad came in 1849, river traffic declined and the canal was used for water power only.

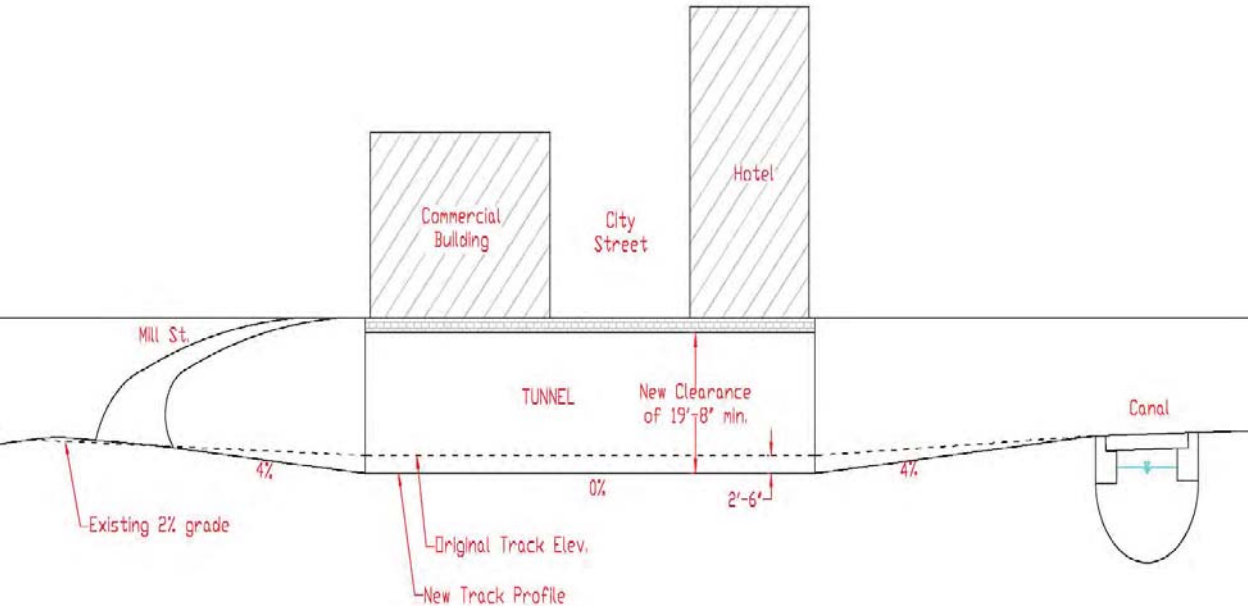
# Stone Arch Construction
# Built in 1850s

# Historic Hotel and City Street above the Tunnel

# Project Criteria

- Lower Track about 2.5 feet to provide a minimum 19’8” clearance
- Maintain a horizontal clearance envelope of 11’8”
- Maintain Train Traffic with an allowance for:
  - A 1-day shutdown for the grade crossing work
  - A 3-day shut down for final profiling
- Minimize Closure of Mill Street

# Illustrative Profile



# Railroad Coordination

- ECI Served as RR Flagger
- ECI Set out Derails & Removed
- Amtrak Passed through at 12:00 and 5:30
- Freight Traffic at Night
- ECI work Windows:
    - 4:00 am to 11:45 am
    - 12:00 noon to 5:30 pm

# ECI's Foreman Strobel Sets out the Derail

# Construction Hardships

- Restricted Working Times & Long Days
- Poor Lighting: Better Light = Better Work Quality
- Unexpected Subsurface Conditions
- Limited Access: Tunnel work is a linear chain process (no equipment movements around internal activities)
- Limited number of activities could occur at once

# Early 4:30 am Shift Starts Required Working in Dark Conditions

# Working Room Was Limited, Operations are Linear, & Poor Lighting

# Obstructions & Unexpected Conditions

# Construction Phases

1. Mobilize: Tunnel Lighting, Office Trailer, Security Cam, Staging Areas, Access (9/06)

2. Relocate Sprint & RR Comm Lines

3. Relocate UG Utilities at Crossing

4. Rebuild Crossing Area (Tracks & Street)

# Construction Phases (cont.)

6. Shotcrete Work: Crash Wall Repairs, Ceiling Joints, New Retaining Wall (NW)

7. Dap Bridge Ties

8. Cut rail in 13 ft sections, drill, add joint bars

9. Line Drill Rock Areas

10. Rock Removal (2,077 cubic feet)

# Construction Phases (cont.)

11. Underpinning (551 linear ft)
12. Cast-in-Place Retaining Wall (NE)
13. Lower Track to New Profile about 2 ½ ft (8/07)
14. Install Continuous Welded Rail
15. Final Paving/Reset Communication Lines/Demobilization (9/07)

# Sprint & RR Communication Lines Were Relocated and Moved Back After Construction

# Repaired Crash Wall – by Shotcrete

# 13 ft Track Sections Removed in Work Areas Twice Daily


Utility Relocation in Mill Street


Grade Cross Replacement at Mill Street


Amtrak Passes at 12:00 noon
and 5:30 pm

Subcontractor DL Thomas
Drilling & Blasting Rock in Tunnel
Hydraulic Splitting and Hammering also Used


Rock is Removed After Blast

# Hydraulic Rock Splitting Required where Tunnel was Supported on Soil with Shallow Rock

Shotcrete was used for Crash Wall Repairs, Ceiling Joint Fill, and Retaining Walls

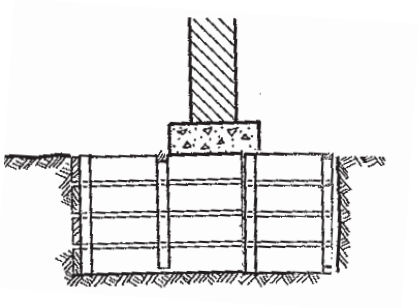
ShotCrete Retaining Wall

# Dapping Bridge Ties to Lower Rail

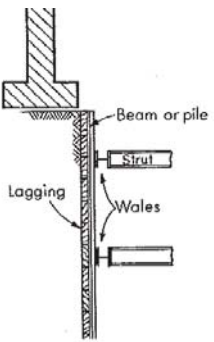
Change to Bridge Profile

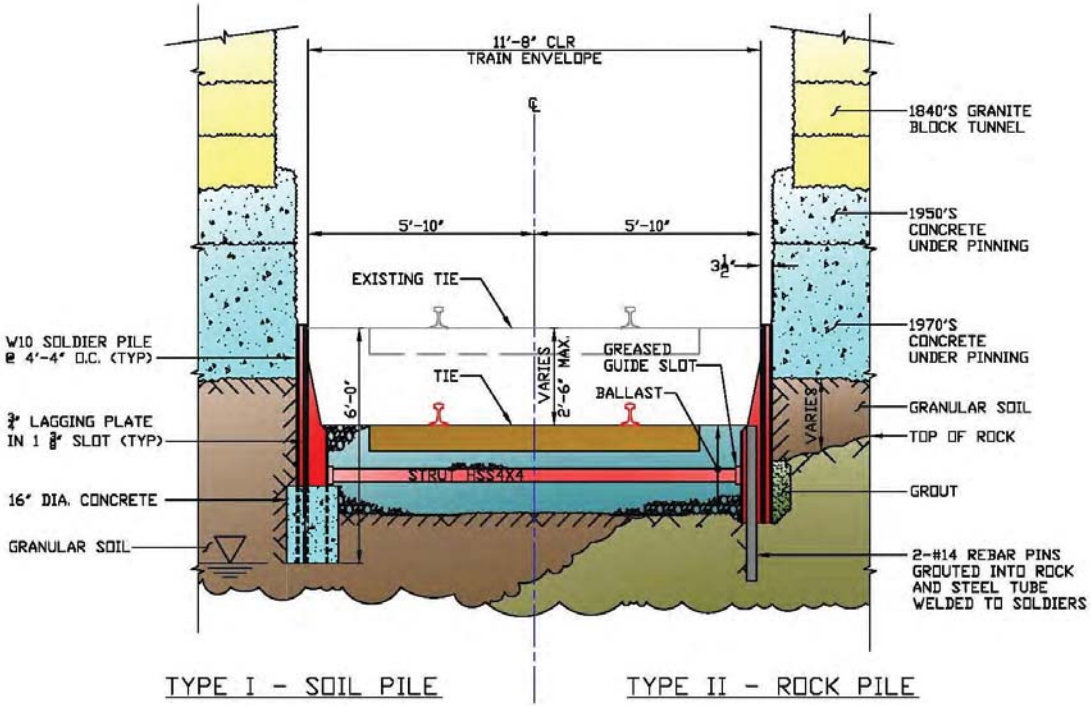
# Underpinning

- Traditional Underpinning:
  - Typically a series cast-in-place concrete units below an existing foundation serving to extend the depth of the footing



- At Bellows Falls Tunnel:
  - Underpinning consist of soldier piles, steel plate lagging, and steel cross bracing
  - More accurately called permanent excavation support






# BELLOWS FALLS TUNNEL
# UNDERPINNING DETAIL

Courtesy of PB

# Soldier Piles: Coped End, Lagging Guide Plate, Stiffeners, Strut Bracket, Innerduct Holes

# Piles = 148
Length = 6'0"
Spacing = 4'4"

# Underpinning

1. Insert Piles (vacuum excav) & Grout
2. Insert Cross Struts
3. Insert ¾" Steel Lagging Plates & Grout

# Grout Plant

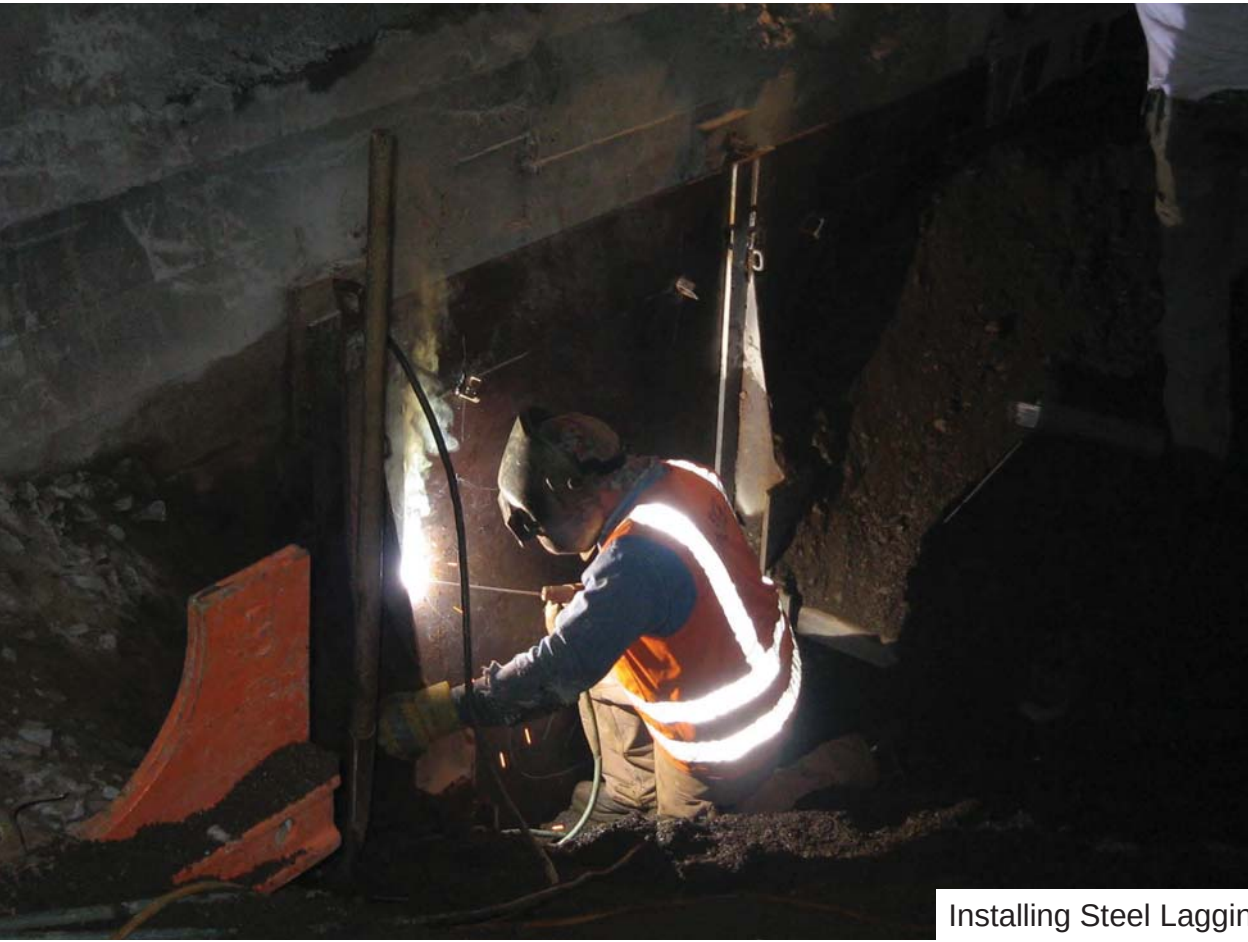

# Installation

Approximately 2,000 bags of grout

# Labor-Intensive Chipping of Existing Granite Blocks Was Required to Maintain Clearances

# Amtrak Passed at Mid-Day Which Interrupted All Tunnel Work

Strut Bearing Against Rock Face

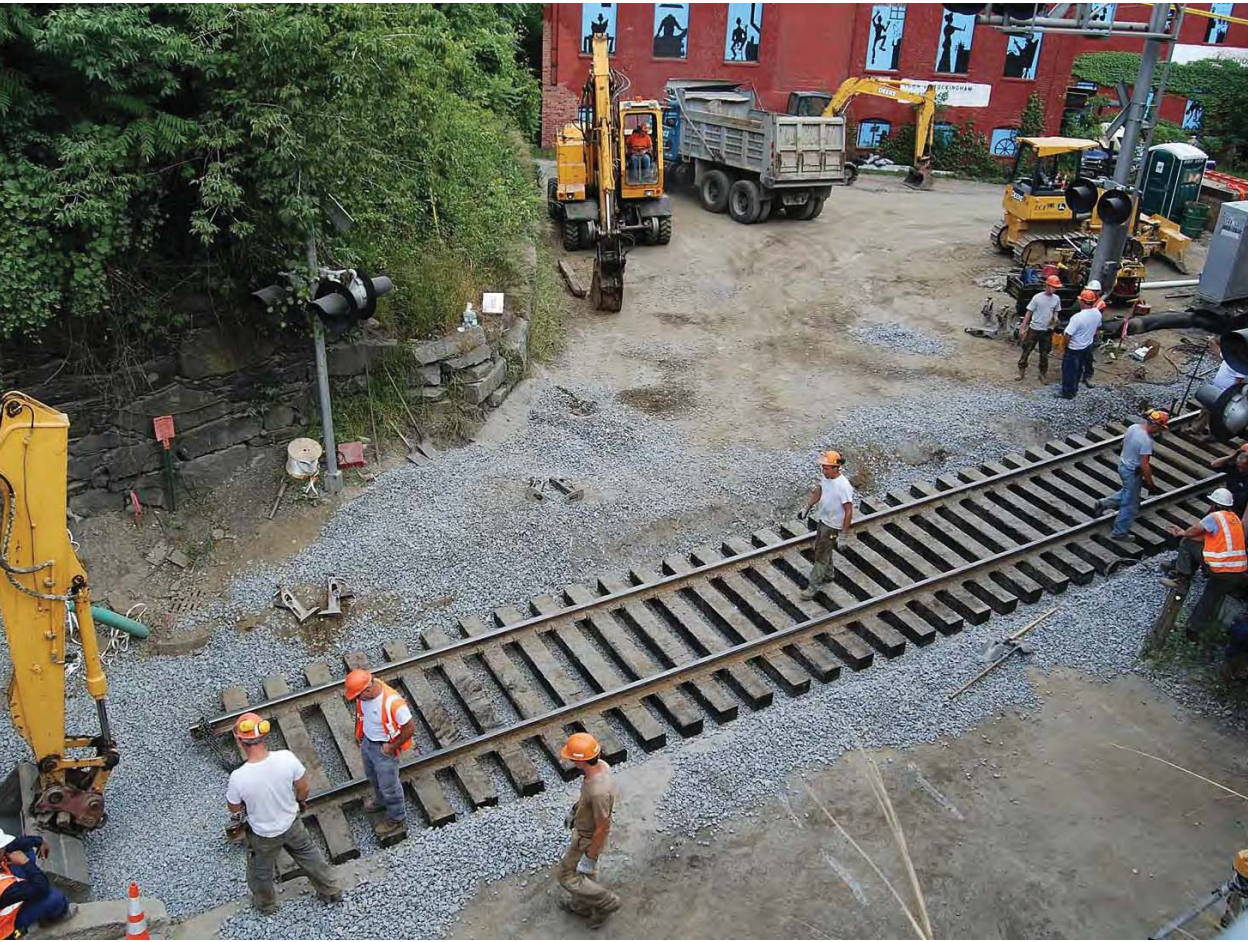


Installing Steel Laggin

# The Blitz

- 3 Days Continuous (Aug 18th – 20th)
  - Removed Track
  - Excavated to new Subgrade
  - Installed conduit
  - Trimmed Rock
  - Installed Ballast Stone
  - Installed Track
  - Surfaced, Aligned, Tamped

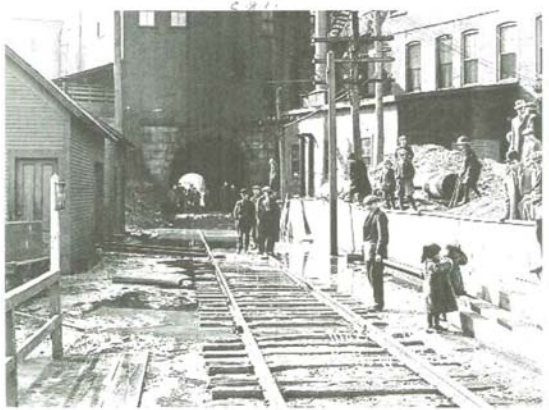

DEERE
ECI
ENGINEERS
CONSTRUCTION



# First Train Passes Through Lowered Tunnel: August 20th

# Installing CWR

# Double Stack Test



Circa 1913,
Flood with Stop Logs in Place
Approx 14 ft vertical clearance

August 29, 2007
After Lowering Track
Min 19’8” Vertical Clearance

# Questions?