Managing your Bridge and Culvert Infrastructure

Best Practices for Maintenance, Design, Procurement, and Construction

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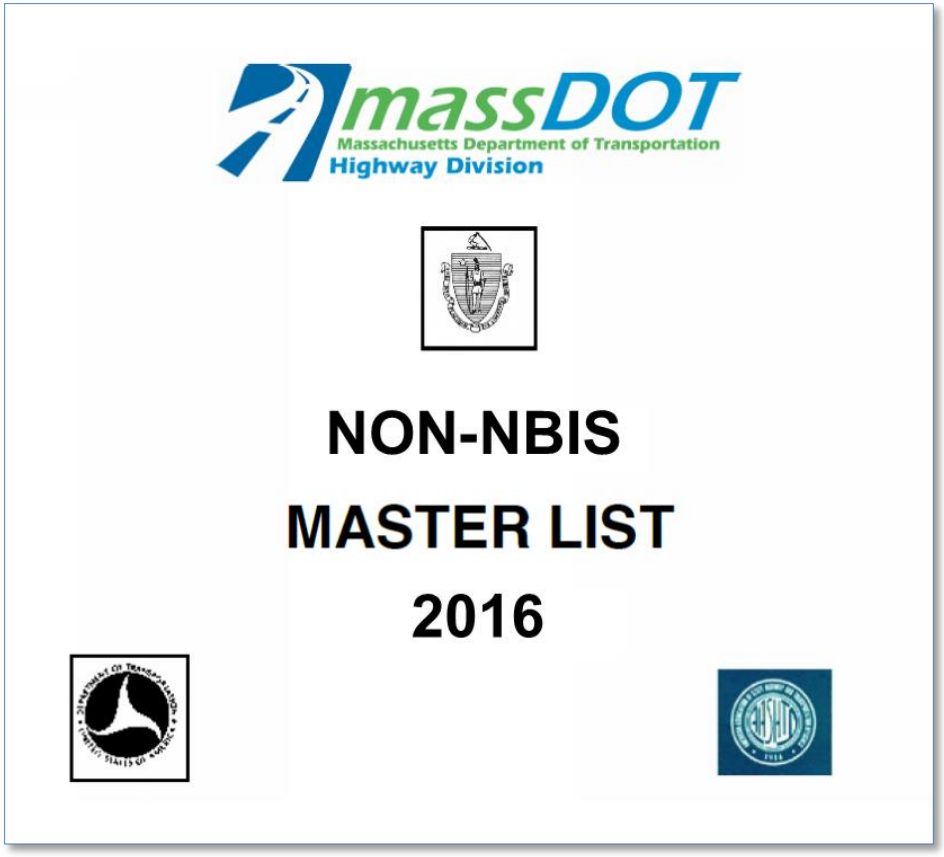
Presentation Goals

- Better understanding of existing bridge and culvert infrastructure
- Importance of maintenance and short-term action items
- Planning, designing, and constructing new bridges and culverts

Step 1: Your Existing Bridge and Culvert Infrastructure

- *What bridge and culvert infrastructure??*
- Current "Non-NBIS" bridge list
  - MassDOT District Office
- What about culverts?
- Other sources of information
  - Your DPW's co-op program…
  - Consultants



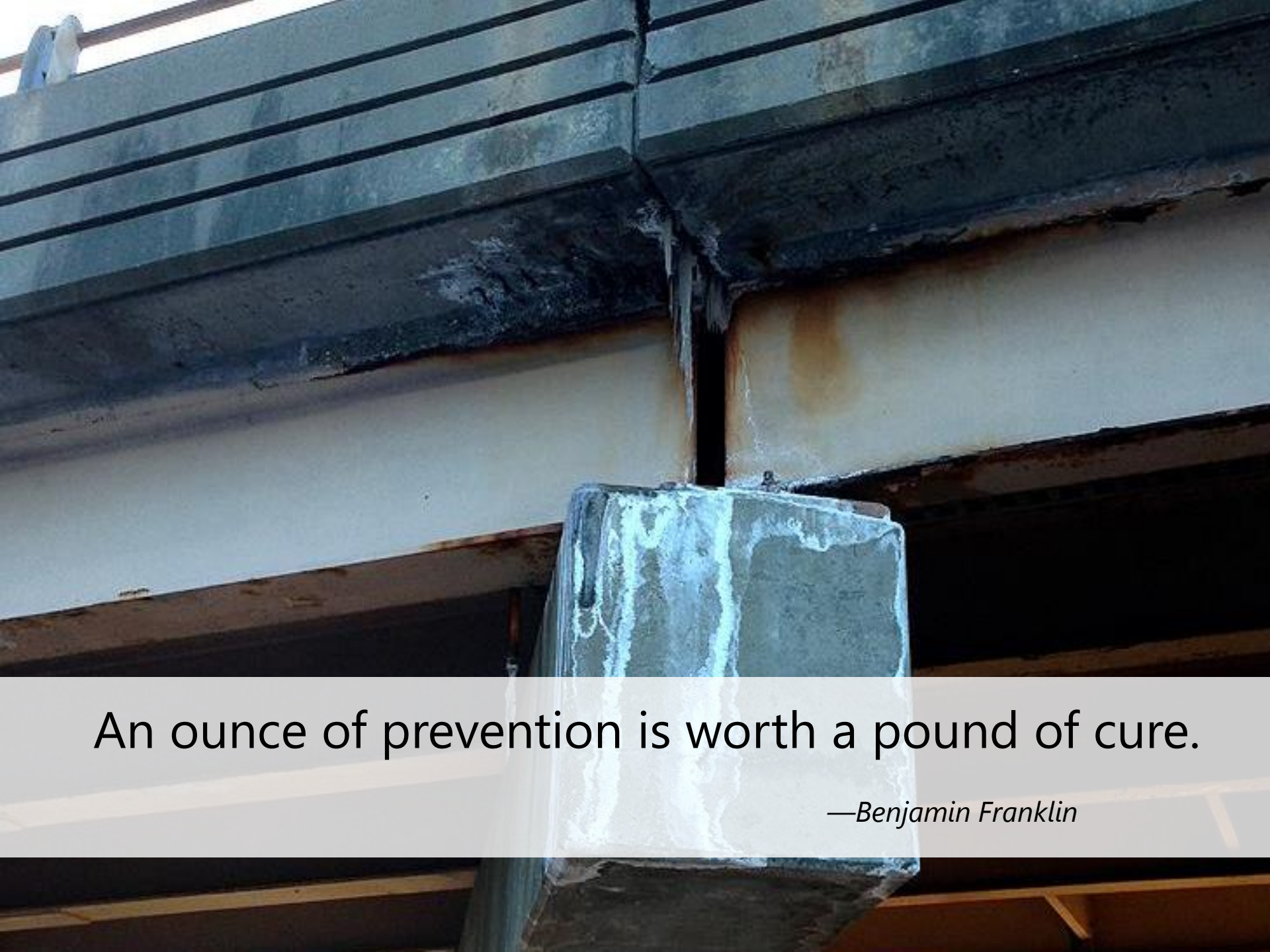
Your Existing Bridge and Culvert Infrastructure

- Owner code
  - DOT = MassDOT
  - MUN = Municipality
- Bridge Type Code
  - BRI = Bridge (10–20ft)
  - CUL = Bridge/Culvert < 10ft
- Very comprehensive list, but not perfect.

BIN	Owner Code	Bridge Type	Other (Facility Carried)	Under (Facility Intersected)	Item 22	Item 21	Item 43	Item 26	Item 41	Year Built	Year Rebuilt	Oper. Rat.	Inv. Rat.	Item 58	Item 59	Item 60	Item 62	Item 67	Item 68	Item 69	Item 70	Item 71	Item 72	AASHTO Rating
istrict 2 (Continued)																								
1AV	DOT	REM	OTHER REMOVED	OTHER REPLACED BY AYG	01	01	910	17	K	1898		0.0	0.0	5	2	7	N	0	0	4	0	N	4	8.2
6MB	RRY	RRO	RR BMRR	ST 68 GARDNER ST	27	27	302	16	A	1919		0.0	0.0	N	6	6	N	2	N	2	0	N	N	22.0
6MA	RRY	REM	OTHER REMOVED	OTHER PCRR/CENTRAL ST	27	27	202	16	A	1915		0.0	0.0					0	N	2	0			30.0
69C	DOT	BRI	US202 /ST68/KG PHL	WATER TROUT BROOK	01	01	111	16	A	1945		0.0	0.0					0	N	N	0			18.4
1AC	DOT	REM	OTHER REMOVED	OTHER REPLACED BY ANT	01	01	302	16	A	1938		53.5	36.5	8	8	8	N	8	6	N	5	4	6	93.4
6KC	DOT	REM	OTHER REMOVED	OTHER ST 2A/PCRR @ STN			???		A	1850	1900	0.0	0.0	?	?	?	?	2	N	N	0			28.0
6KD	MUN	REM	OTHER REMOVED	OTHER FCTRY RD/OTTER RIV			8??		A	19	19	0.0	0.0	?	?	?	?	2	N	N	0			28.0
17T	MUN	BRI	HWY PARTRDGVL RD	WATER PARTRIDGE PND OTLT	03	03	101	19	A	1938		32.7	0.0	N	8	7	N	3	4	N	5	8	7	22.1
69J	MUN	BRI	HWY ORCHARD LN	WATER E TEMPLTN PND OTLT	03	03	101	19	A	1939		0.0	0.0					0	N	N	0			30.1
6KE	PRI	DUM	OTHER PRI317020000	OTHER T02020=G01028			???		A	1850	1900	0.0	0.0	?	?	?	?	2	N	N	0			28.0
6E6	DOT	CUL	HWY FERNALD SC R	WATER BEAVER BROOK	21	21	819	09	A	1850		0.0	0.0	N	N	N	6	3	3	N	0	6	7	29.3
69D	DOT	BRI	ST 2 @ STA 107	WATER TROUT BROOK	01	01	111	02	A	1970		0.0	0.0					0	N	N	0			2.0
6E7	DOT	CUL	ST 2 EB @ STA 238	WATER E TEMPLETON POND	01	01	119	12	A	1969		0.0	0.0	N	N	N		0	N	N	0			18.0
6E8	DOT	CUL	ST 2 WB @ STA 238	WATER E TEMPLETON POND	01	01	119	12	A	1969		0.0	0.0	N	N	N		0	N	N	0			18.0
6EM	MUN	CUL	HWY UNK RD	HWY OLD CEMETARY RD	03	03	819	09	A	1850		0.0	0.0	N	N	N		0	N	N	0			30.9
6EP	MUN	CUL	HWY OTTER RIV RD	WATER OTTER RIVER TRIB	03	03	319	19	A	1950		0.0	0.0	N	N	N		0	N	N	0			30.8
6EQ	MUN	CUL	HWY LORD RD	WATER RIDGELY POND INLT	03	03	319	19	A	1960		0.0	0.0	N	N	N		0	N	N	0			30.9

Step 2: Capital Planning

- What is the extent of your bridge and culvert infrastructure?
- General conditions?
- Identify your “problem” structures
- Identify what will need help over the next 5–10 years
- Prioritize bridges or prioritize work activities?
- Can be done in-house or with the help of a Consultant
- Engage in preventative maintenance!

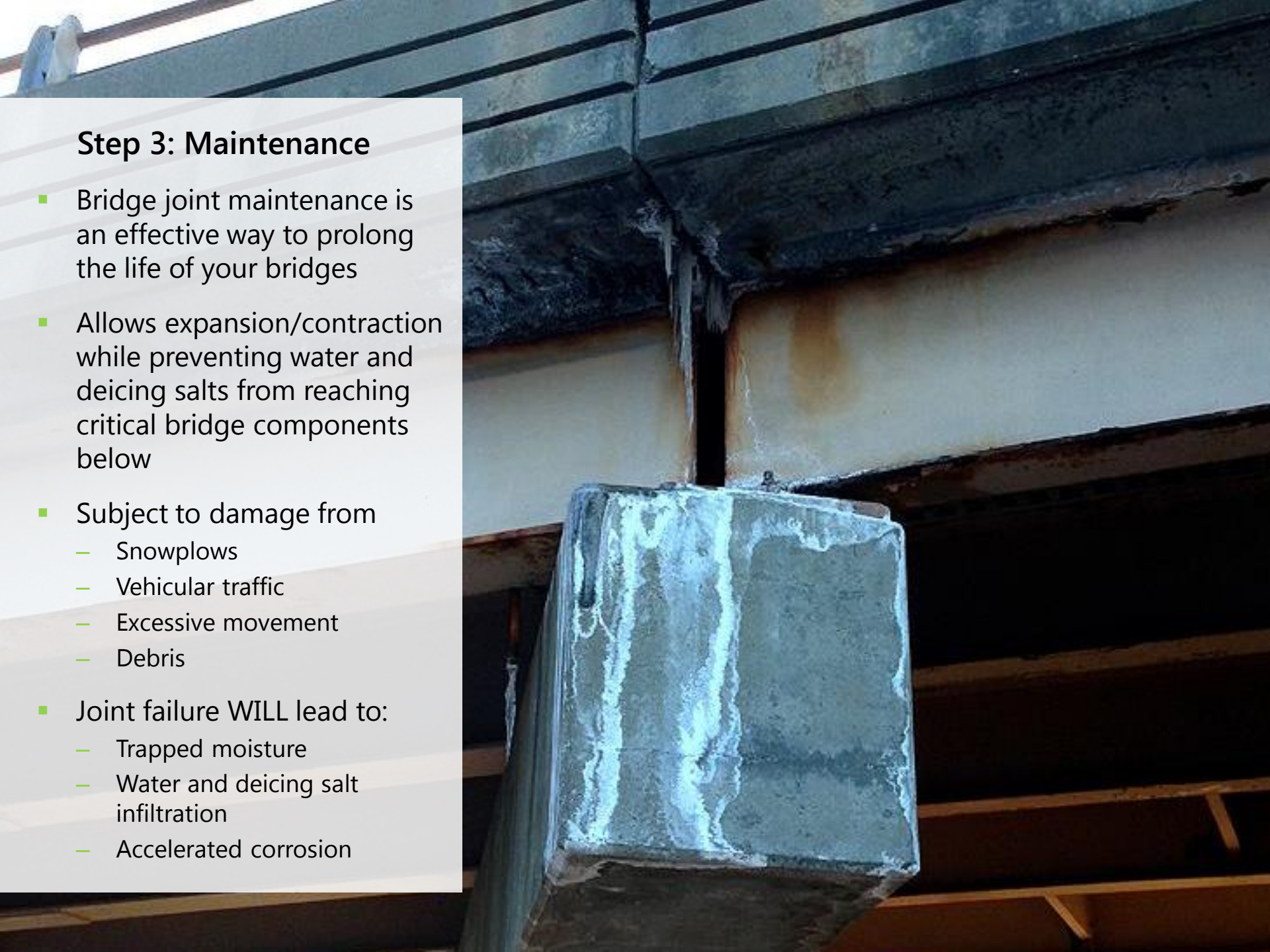


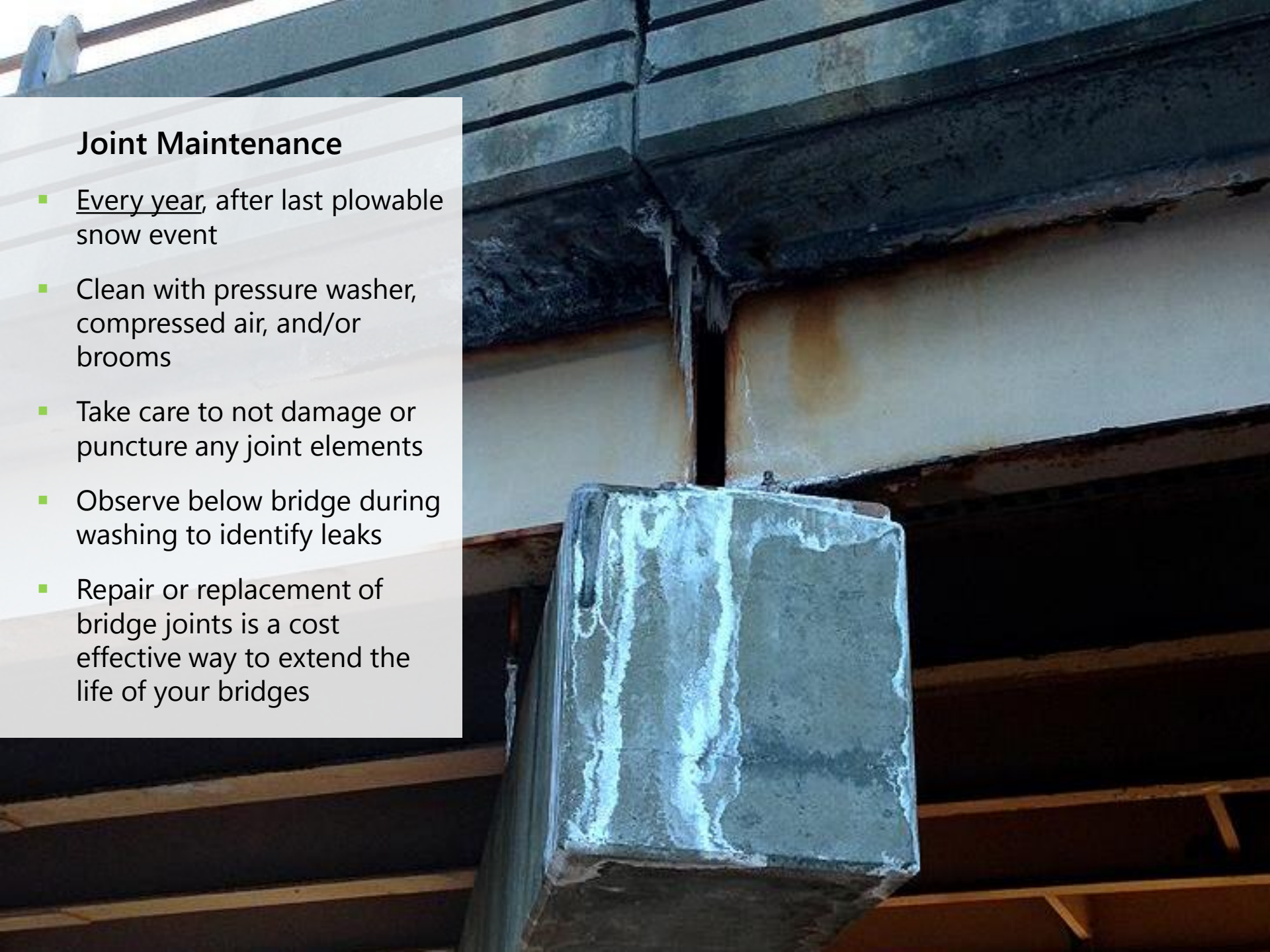
An ounce of prevention is worth a pound of cure.

—Benjamin Franklin

Step 3: Maintenance

- Bridge joint maintenance is an effective way to prolong the life of your bridges
- Allows expansion/contraction while preventing water and deicing salts from reaching critical bridge components below
- Subject to damage from
  - Snowplows
  - Vehicular traffic
  - Excessive movement
  - Debris
- Joint failure WILL lead to:
  - Trapped moisture
  - Water and deicing salt infiltration
  - Accelerated corrosion





Joint Maintenance

- Every year, after last plowable snow event
- Clean with pressure washer, compressed air, and/or brooms
- Take care to not damage or puncture any joint elements
- Observe below bridge during washing to identify leaks
- Repair or replacement of bridge joints is a cost effective way to extend the life of your bridges

Step 4: Repair vs Replace

- Key questions
  - Is it repairable?
  - Lack of sidewalks, shoulders, bike accommodations?
  - Scour issues?
  - Future utility work?
- Additional guidance
  - MassDOT District office
  - Consultant

Repairs—Best ROI

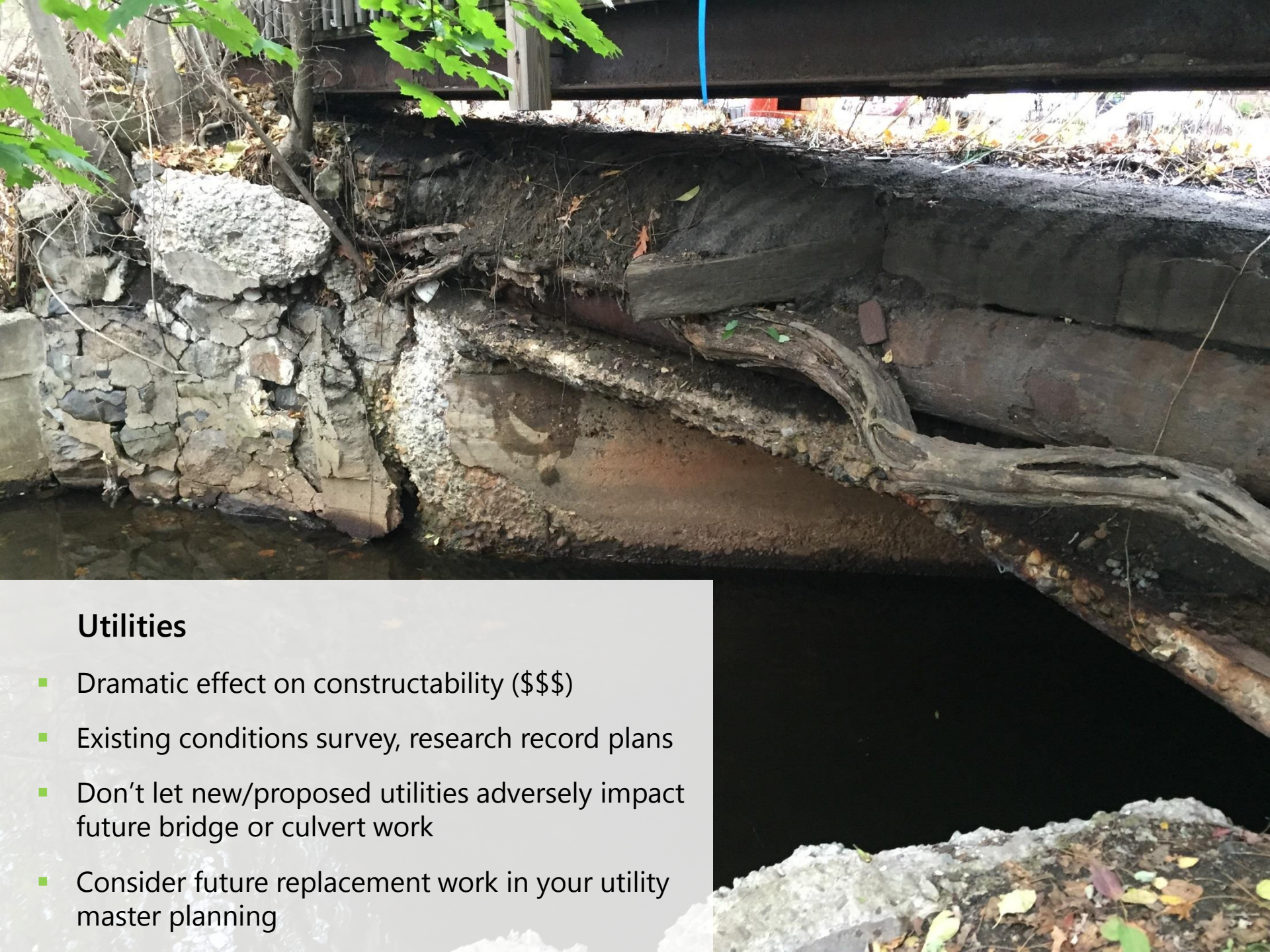
- Reseal, repair, or replace bridge joints
- New waterproofing and repaving
- Scour mitigation and repairs
- Cleaning and painting structural steel
- Concrete patching
- Replacement or jacketing of timber piles

Step 5: Replacement

- Engage a Consultant
- Qualitative Bid Selection
  - MassDOT prequalified
  - Strong list of relevant past projects
  - Responsive
- Ask lots of questions
- Typical scope elements:
  - Survey
  - Geotech
  - ENV Permitting
  - Highway, Traffic, Utility design
  - Structural Design

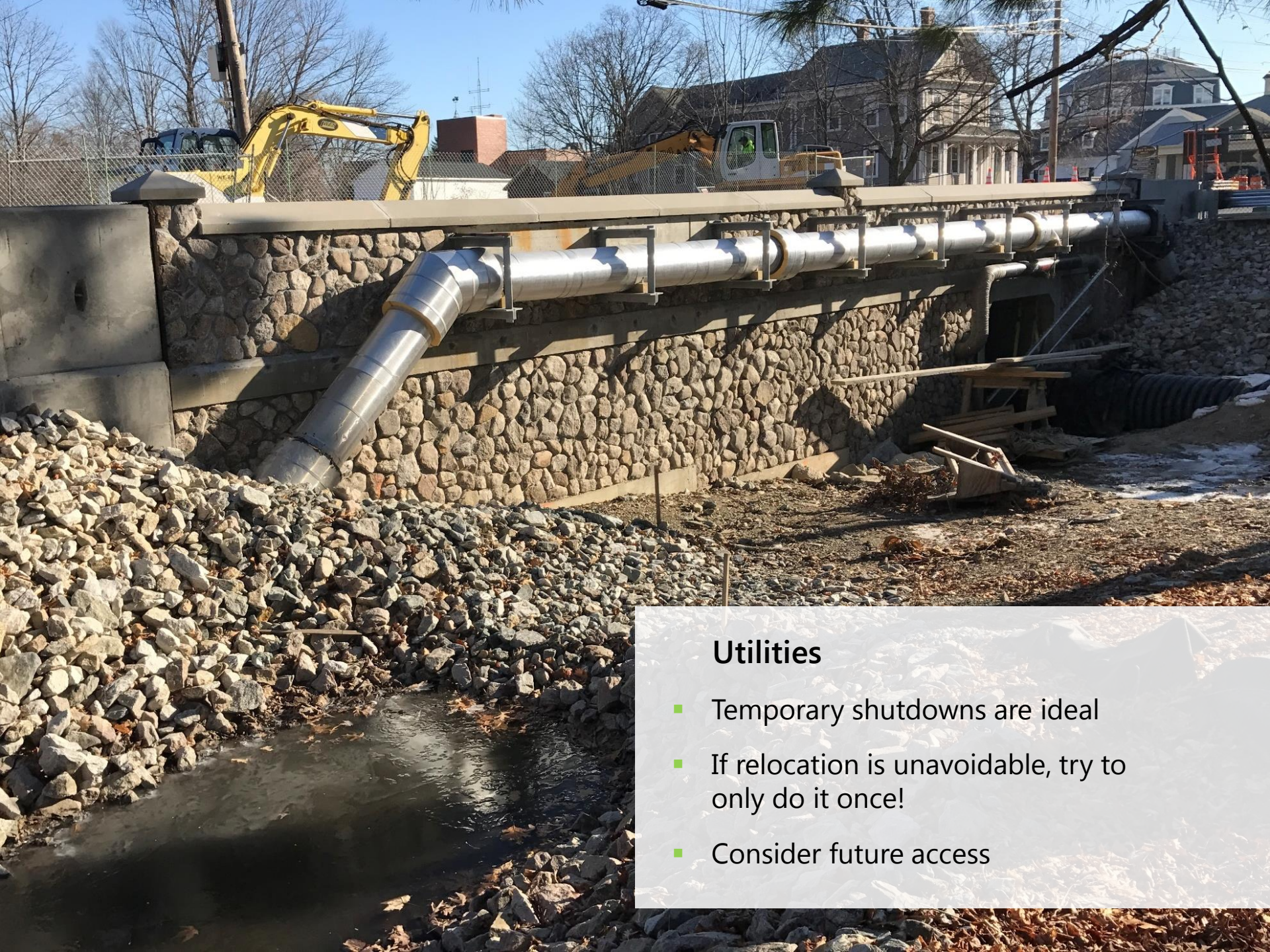
Step 6: Construction—Procurement and Risk Factors

- Contractors don't task risks, they price risk
- Biggest project risks, typically:
  - Utilities
  - Control of water
  - Traffic management



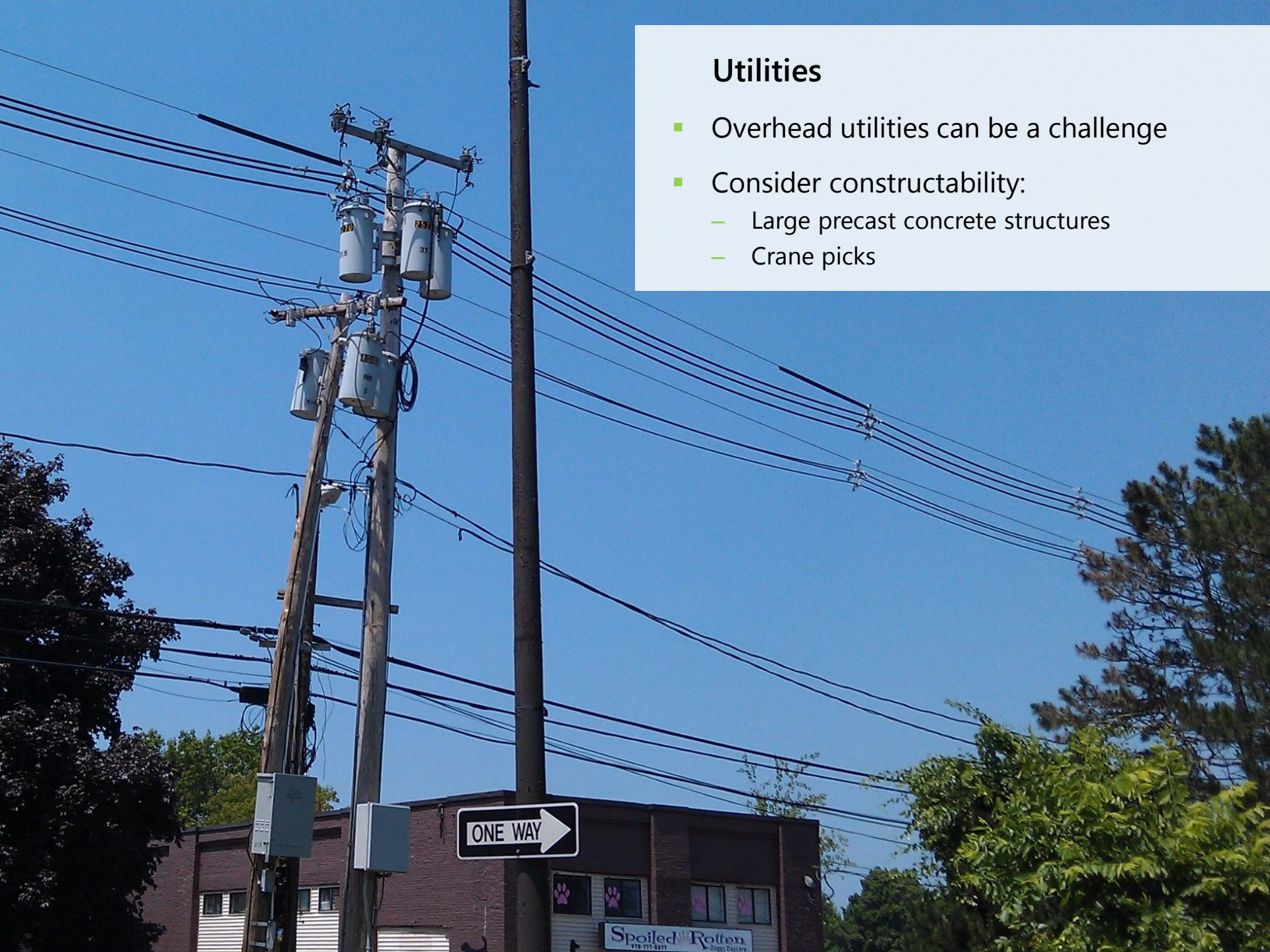
Utilities

- Dramatic effect on constructability ($$$)
- Existing conditions survey, research record plans
- Don’t let new/proposed utilities adversely impact future bridge or culvert work
- Consider future replacement work in your utility master planning



Utilities

- Temporary shutdowns are ideal
- If relocation is unavoidable, try to only do it once!
- Consider future access



Utilities

- Overhead utilities can be a challenge
- Consider constructability:
  - Large precast concrete structures
  - Crane picks

Control of Water

- Significant cost ramifications
- Environmental permitting
- Fish and other aquatic species passage
- Every location is unique

Time of Year is Important!

- Autumn vs. spring

Control of Water

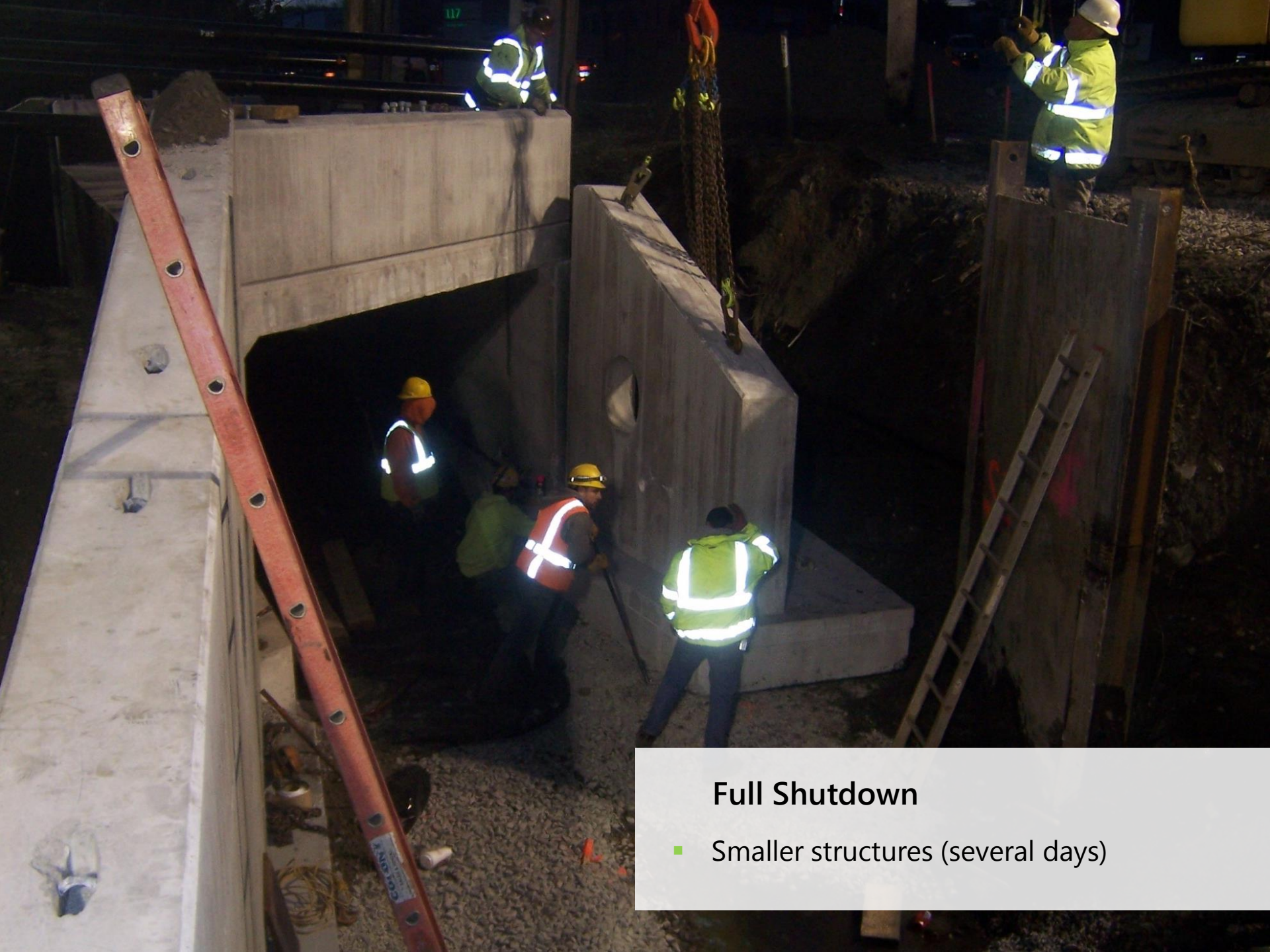
- Allows aquatic species passage
- Plenty of reserve capacity
- Inexpensive solution (vs. pumps)

Traffic Management

- Ensure sufficient traffic counts during design
- Understand the needs of your constituents
- Traditional construction vs. ABC techniques?
- Site-specific solution

Full Shutdown

- Requires substantial planning for long-term detours (schools, life-safety, abutters)
- Most effective way to facilitate construction and utility relocations
- Length of shutdown time is proportional to the complexity and size of the project



Full Shutdown

- Smaller structures (several days)

Staged Construction

- Road can't be closed, even for a short time
- Can be a cost premium
  - Longer construction duration
  - More SOE
  - Temporary utility relocation

Prefabricated Structures

- Typically precast concrete (box culverts, arches, etc.)
- Steel (stringers or truss) or timber (usually for non-vehicular applications)
- Prefabricated structures are acceptable by MassDOT (Ch.85 review)
  - Engage a consultant to prepare submittal package
  - Contractor would engage a subcontractor (Fabricator) to design and construct the prefabricated bridge or culvert
  - Fabricator provides design of the prefabricated elements
  - Consultant reviews and approves the submitted calcs and shop drawings
  - MassDOT will expect to see copies of the approved submittal documents as part of their Ch.85 review

3-Sided Box Culverts

- Preferred over 4-sided box culverts
- Allows for natural stream bottom (retain and reuse existing)
- Slightly more expensive
- Slightly longer construction
- More flexibility
- Consultant designs the footings and determines thrust loads to culvert walls

Thank you!

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Offices located throughout the east coast