Concrete Durability Issues

By
Vijay Chandra P.E.
PB Americas Inc.

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What is Durability?

- Durability of hydraulic-cement concrete is defined as its ability to resist weathering action, chemical attack, abrasion, or any other process of deterioration. Durable concrete will retain its original form, quality, and serviceability when exposed to its environment.

  (*Guide to Durable Concrete, Reported by ACI Committee 201)*

Durability

"Durability of Highways taken for Granted."
- The Oakland Tribune

"Why do you doubt your senses?"
"Because," said Scrooge, "every little thing affects them."
- Charles Dickens

Factors affecting Durability

- Proximity to sea water
- Ice/Snow removal agents
- Leaking expansion joints
- Aggressive chemical exposure
- Freezing & Thawing

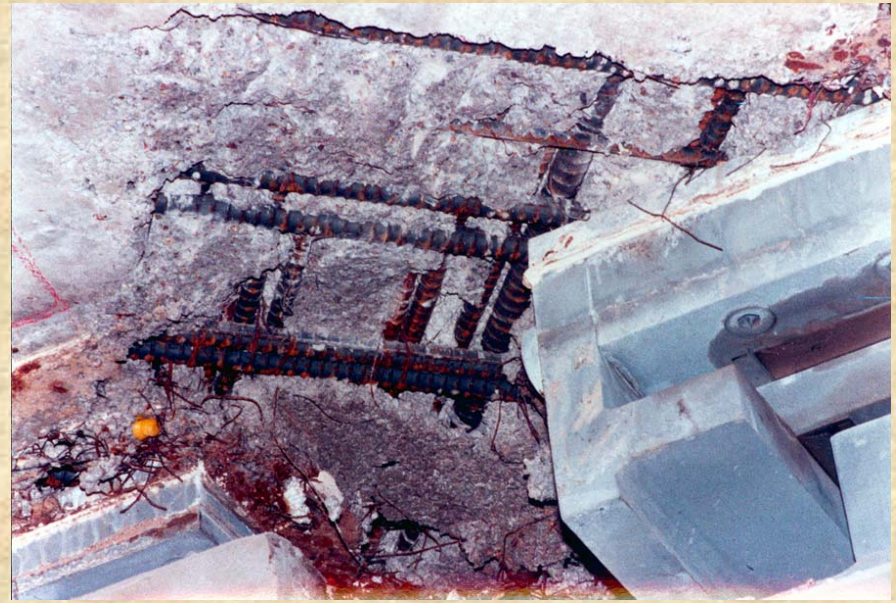
Factors affecting Durability (Cont'd)

- Design & Detailing defects
- Construction defects
- Material types, incl. admixtures
- Post-tensioning grout filler
- Post-tensioning anchorage protection

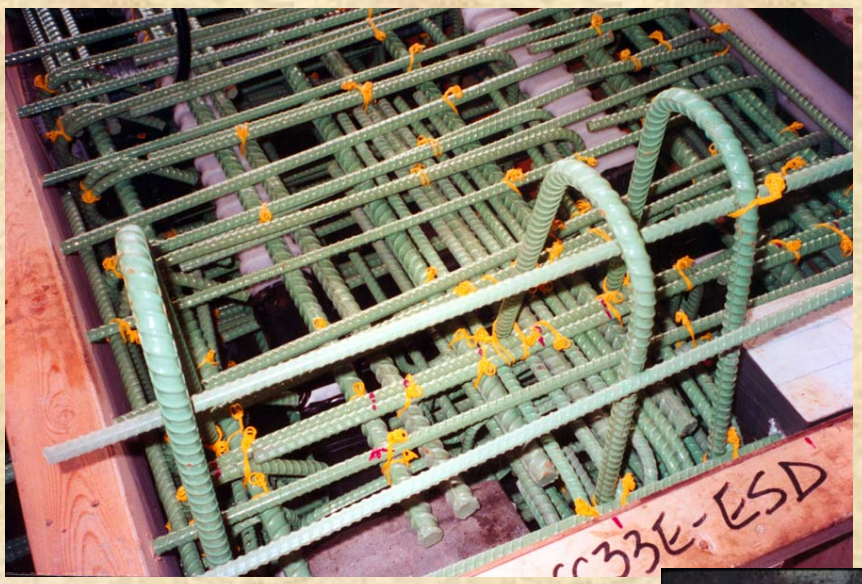
What does Durability depend on?

- Proper selection and correct use of materials
- Proper design and constructible detailing
- Attention to method of construction
- Addressing inspection access and maintenance
- Good specifications / special provisions
- Good inspection and records during construction
- Vigilant quality control during construction
- Qualified personnel to supervise and direct construction activities

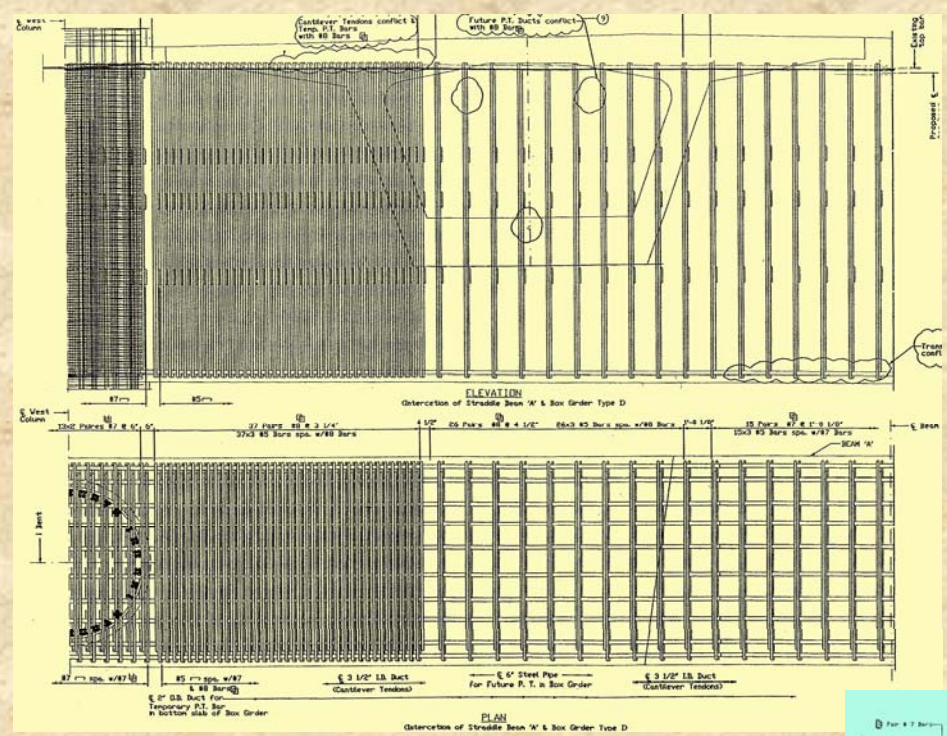
Lessons Learnt in Both Design & Construction

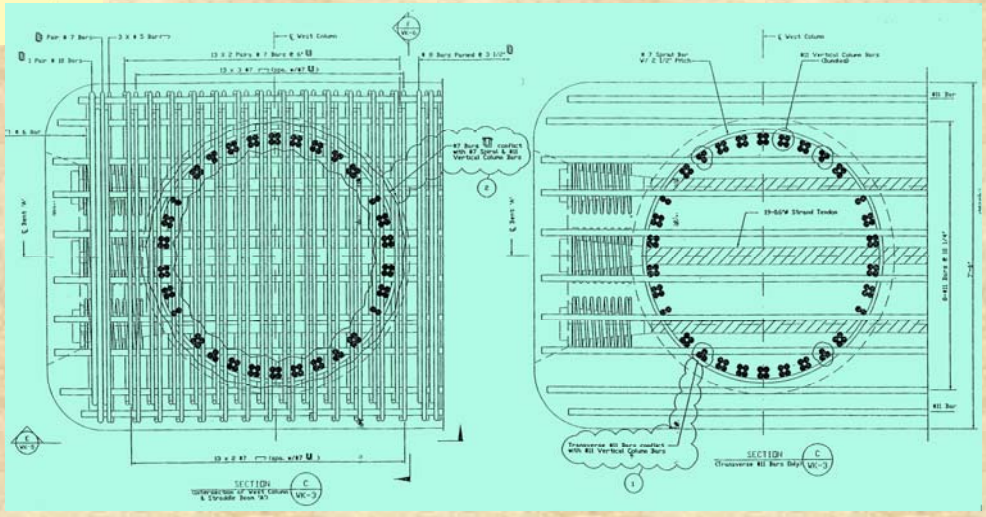


Deck Rebar and Piling



Straddle Beam Rebar Congestion





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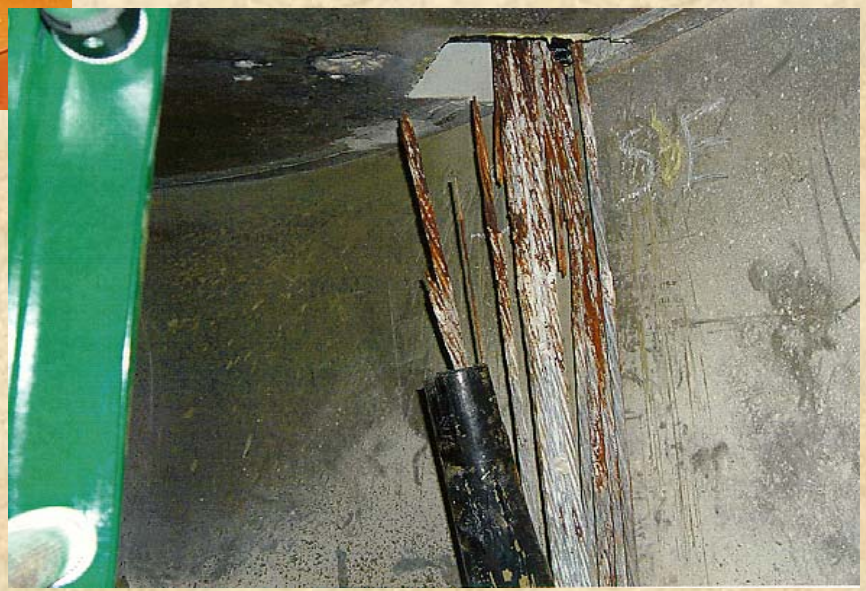
Scour Damage

Girder Collapse – Lack of Bracing

Freeze-Thaw Effect

Epoxy Application

Internal Corrosion



PE Pipe Cracking

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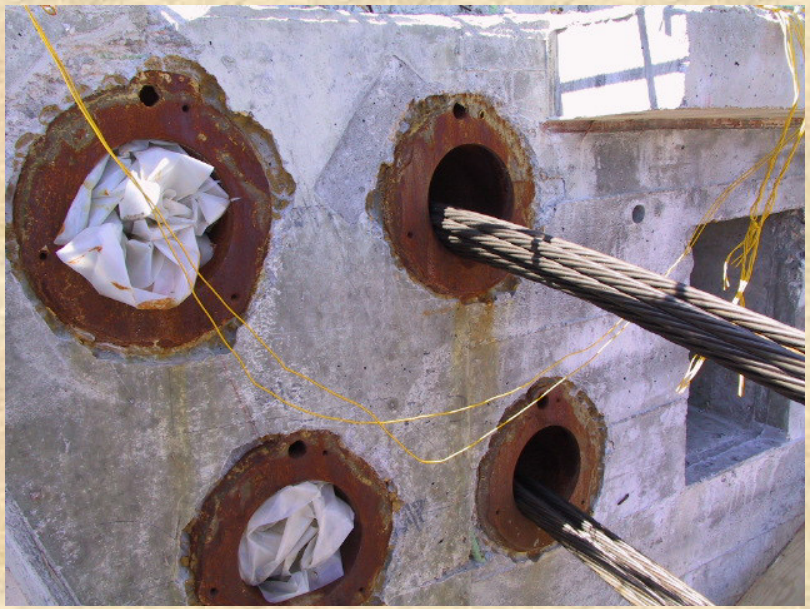
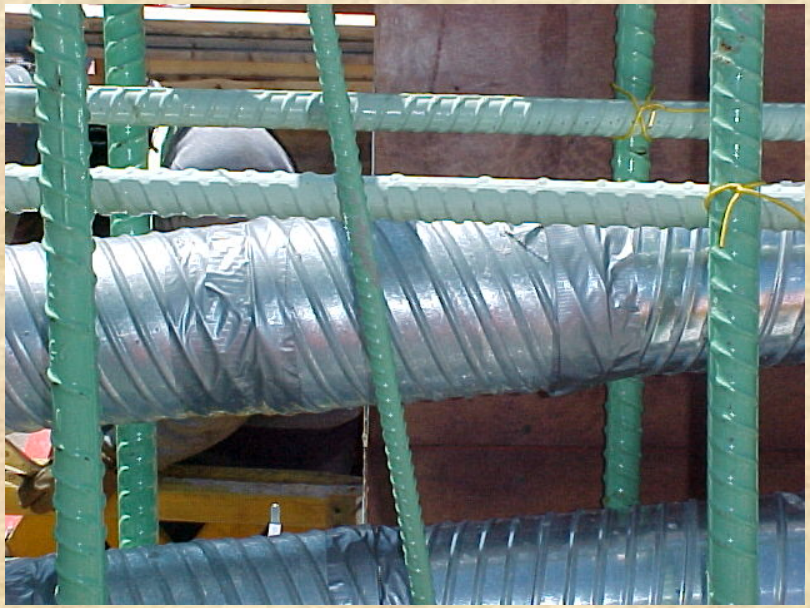
P0001407.JPG

PT Hardware Condition





Visual Observation

Duct w/ Void

Duct w/ Water

Grouted Ducts !!!

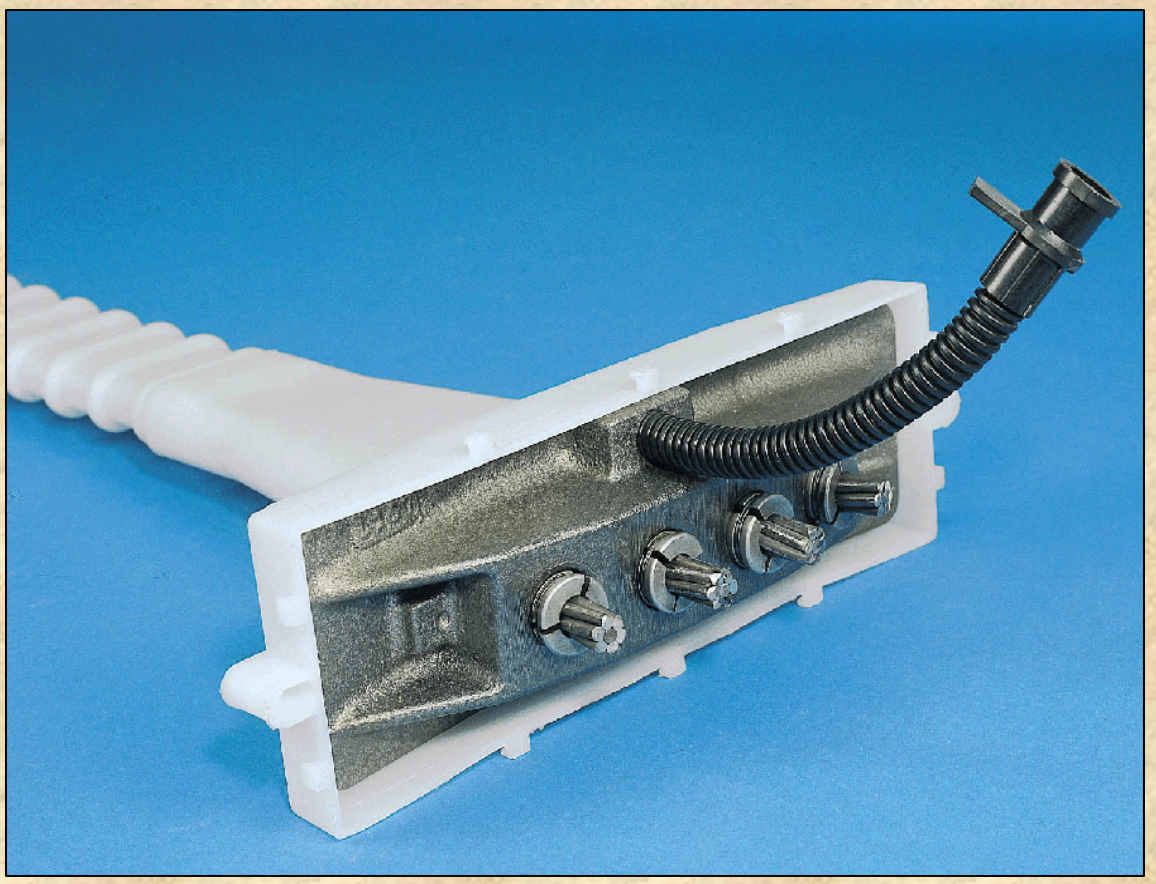
Deck Rebar Positioning

Concrete Honeycombing

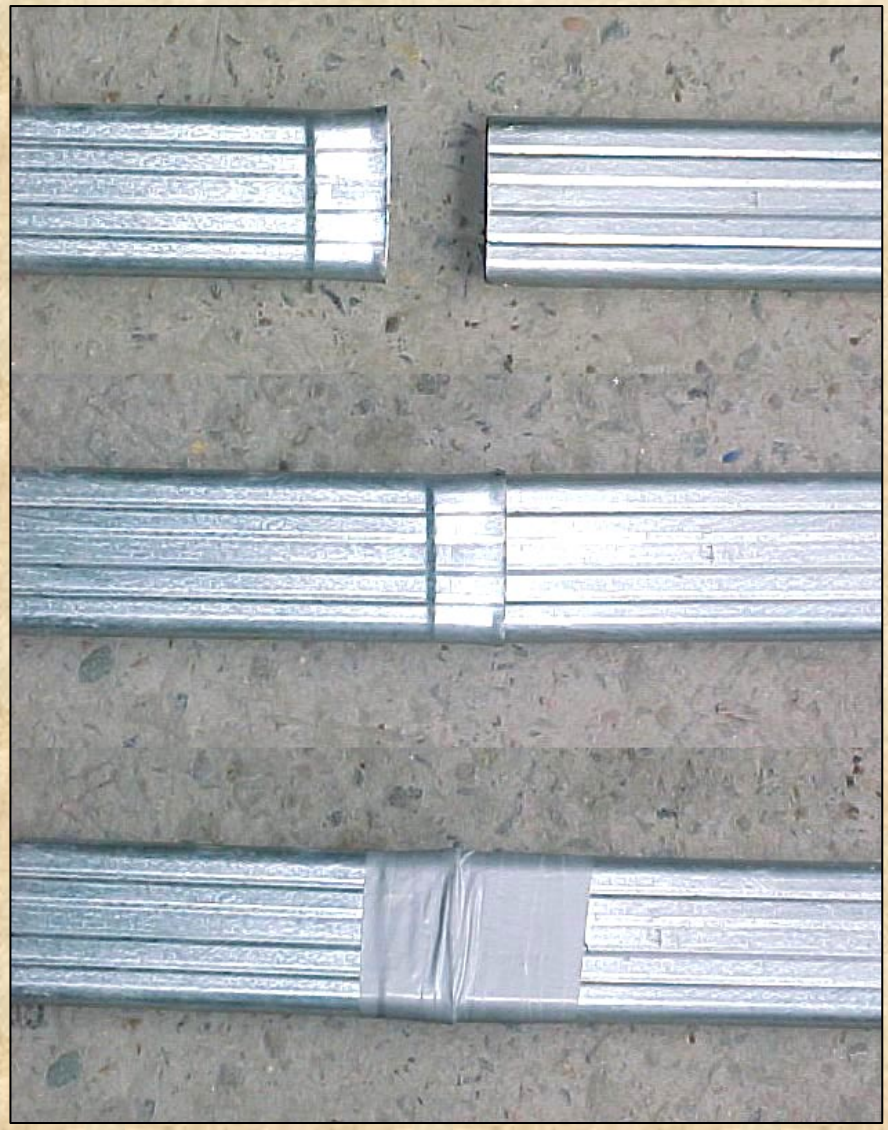
New Direction

Self Consolidating Concrete

PT System



Smooth Steel Sheath

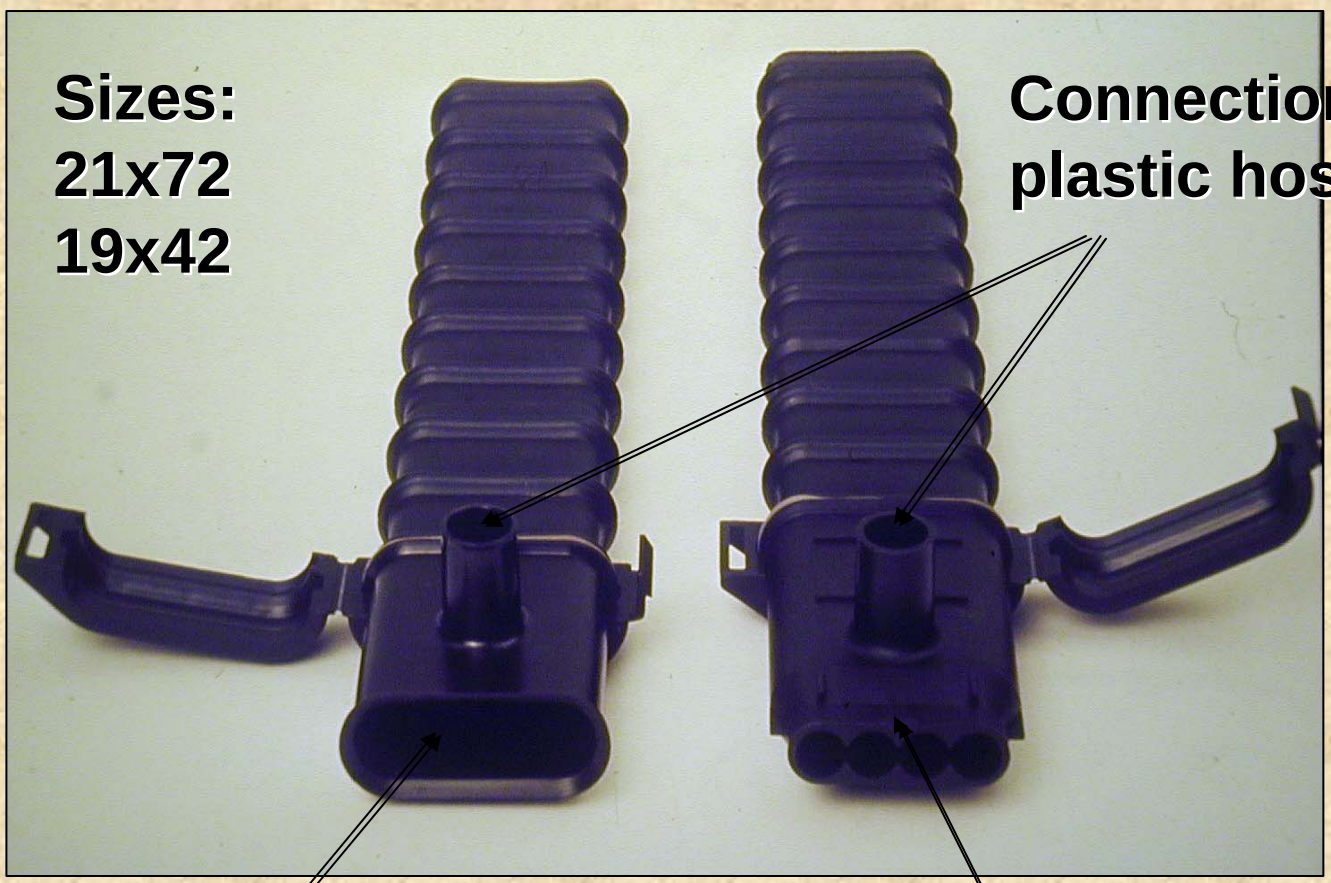


Individual duct sections

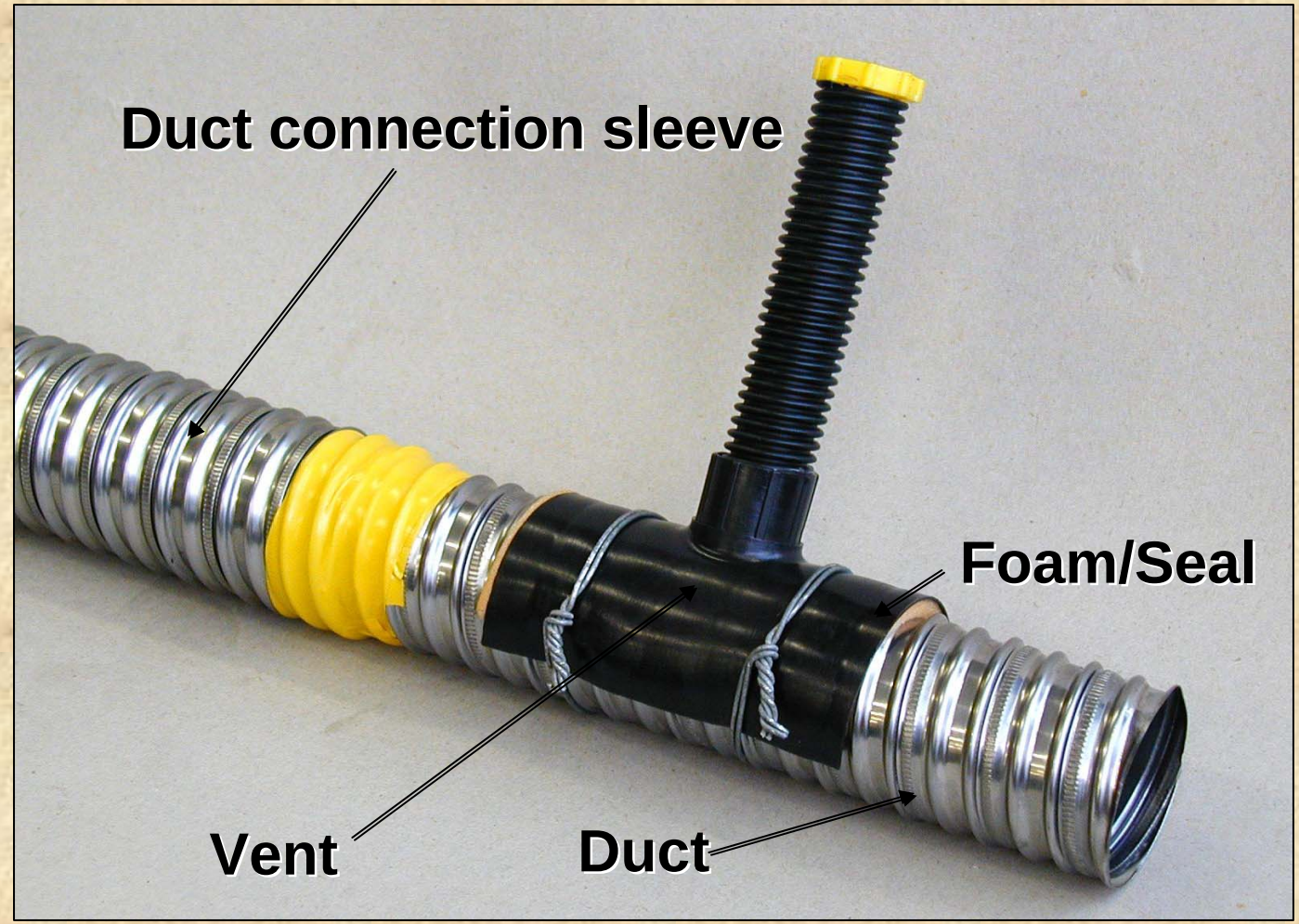
Joined duct sections

Sealing of joint by tape

PT- PLUS Duct: Flat



Corrugated Steel Duct: Round



Vent made of corrugated hose:

Closing by Outside Screw Cap

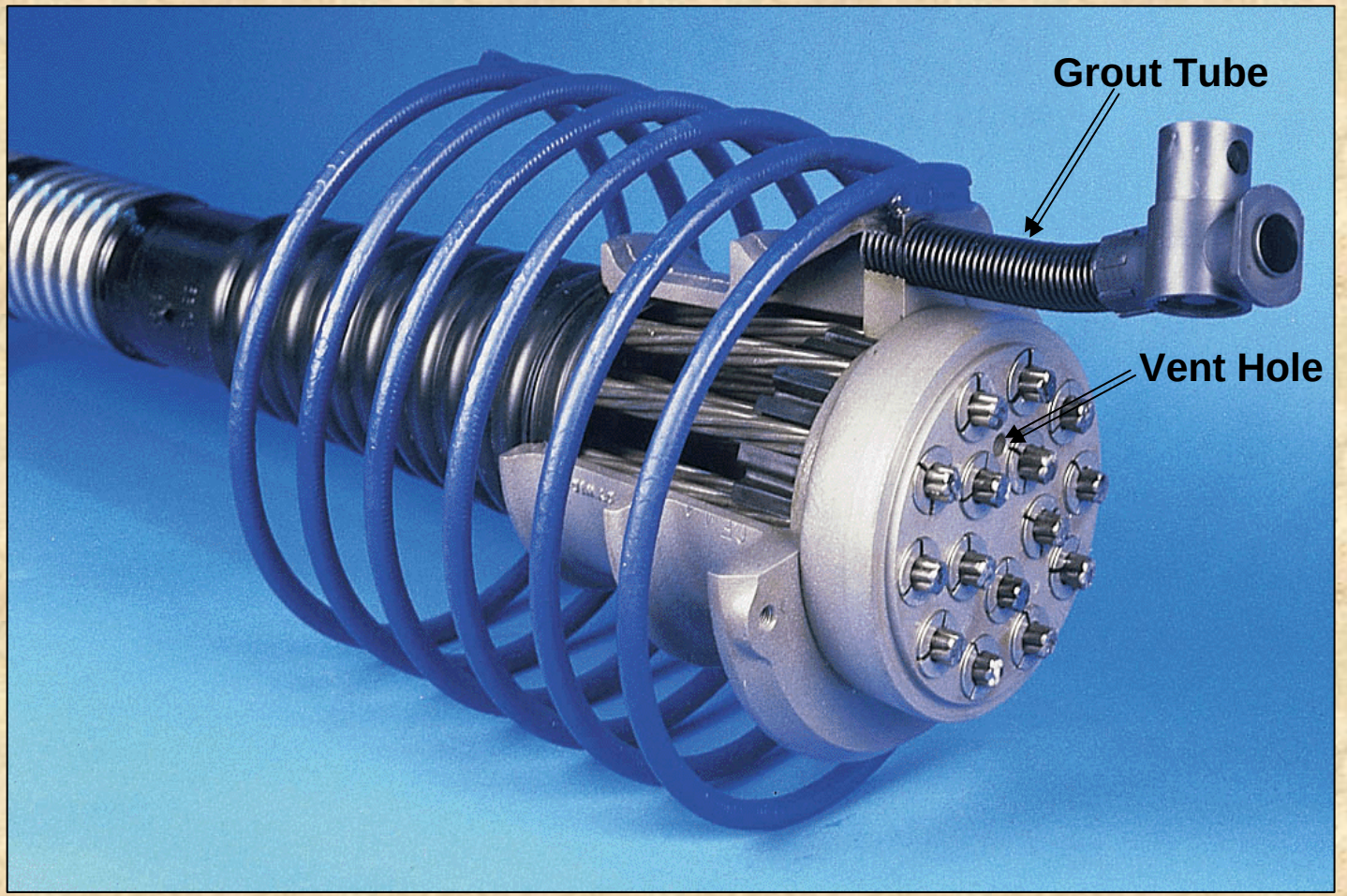
Closing by Inside Screw Cap

Closing by Valve

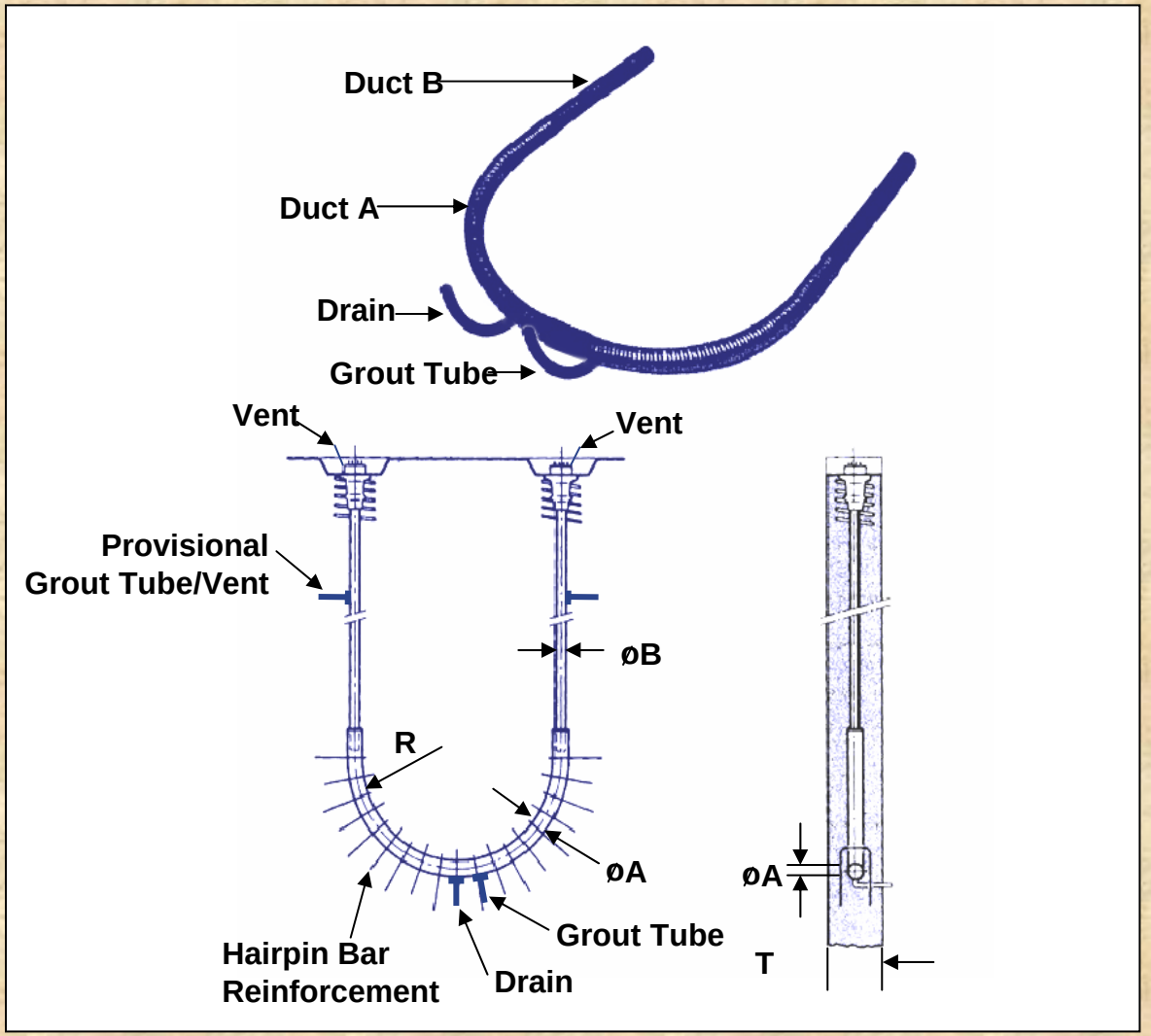

pb
Change tomorrow today™

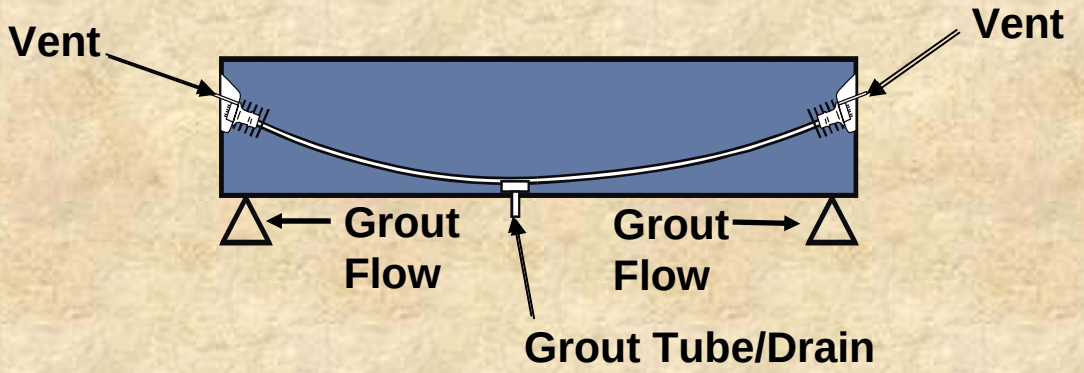
HDPE Pipe

Anchorage

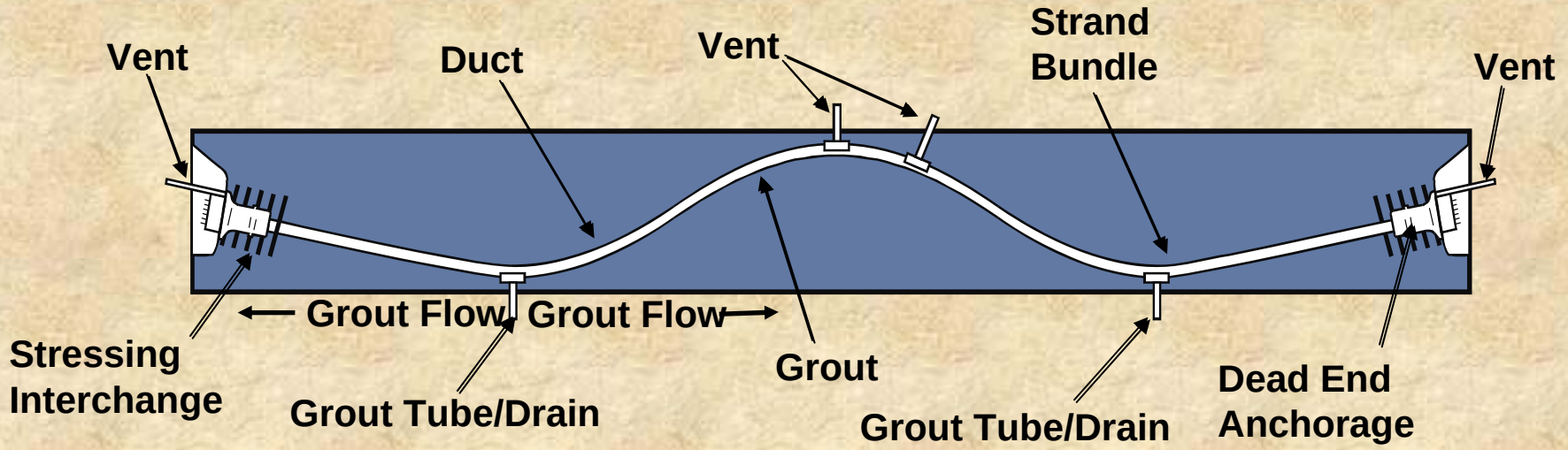


Loop Tendon


Duct B
Duct A
Drain
Grout Tube
Vent
Vent
Provisional
Grout Tube/Vent
øB
R
øA
Hairpin Bar
Reinforcement
Drain
Grout Tube
øA
T

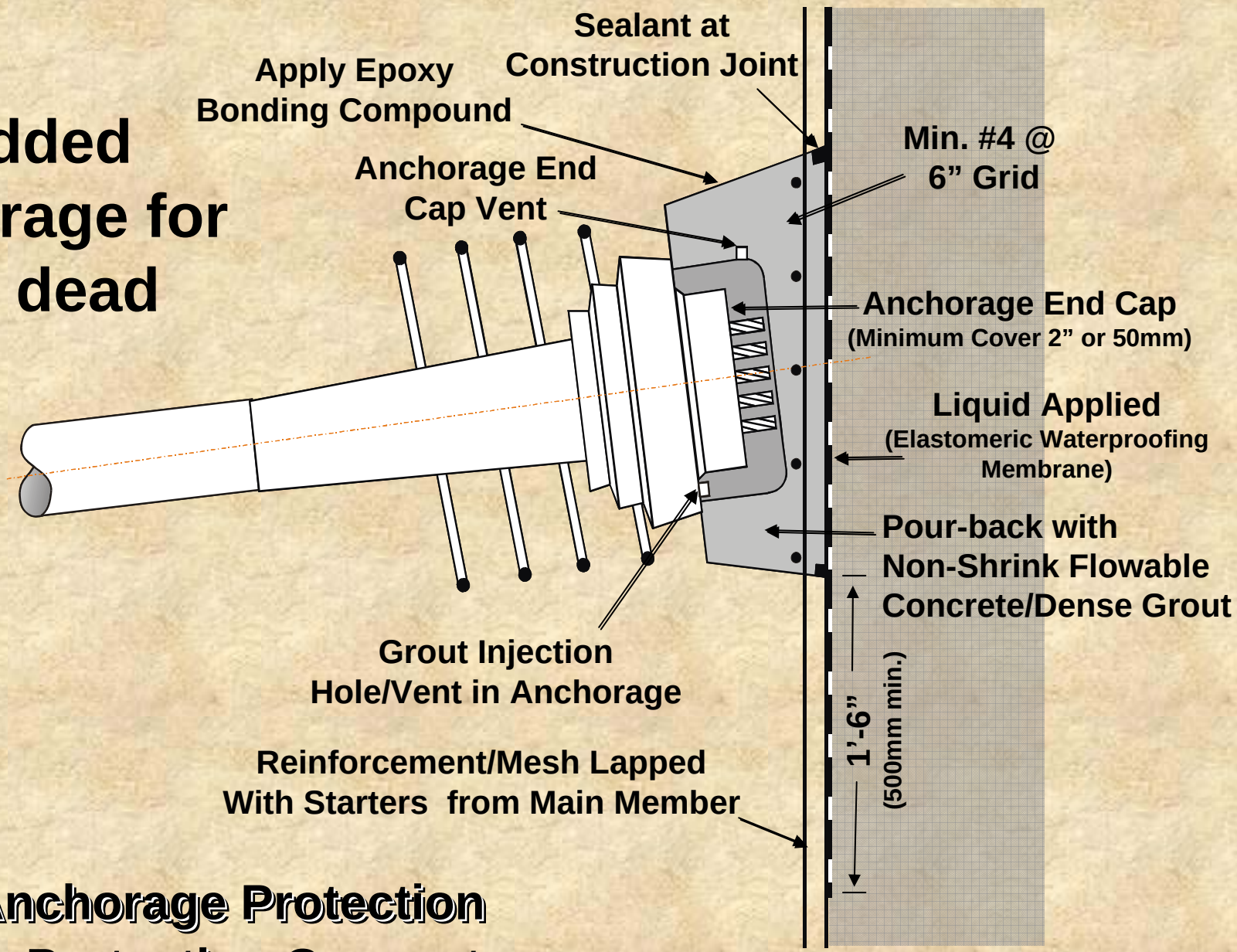


Simply Supported Beam



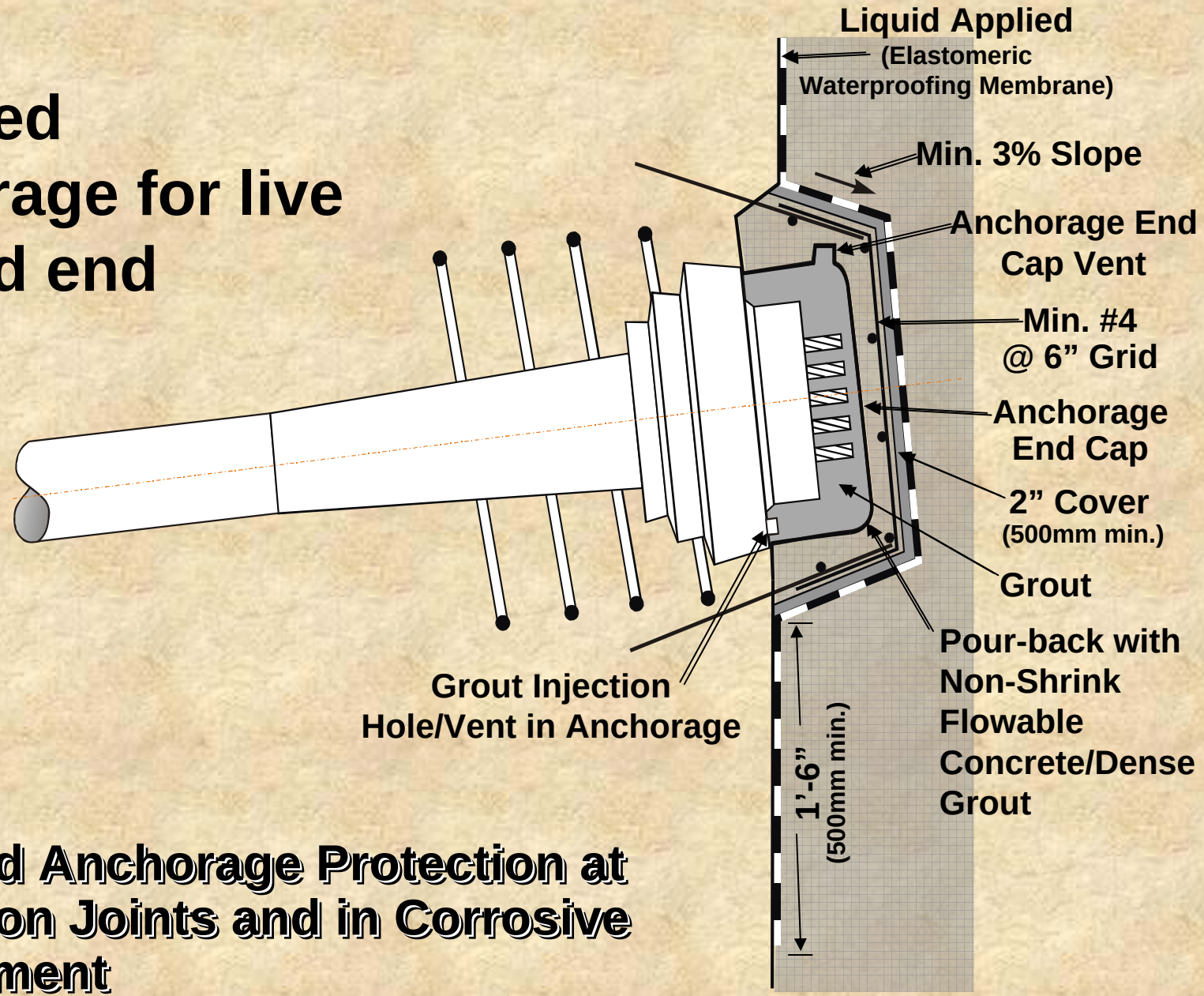
Continuous Beam

Embedded anchorage for live or dead end



TR 47 Anchorage Protection
Multiple Protection Concept

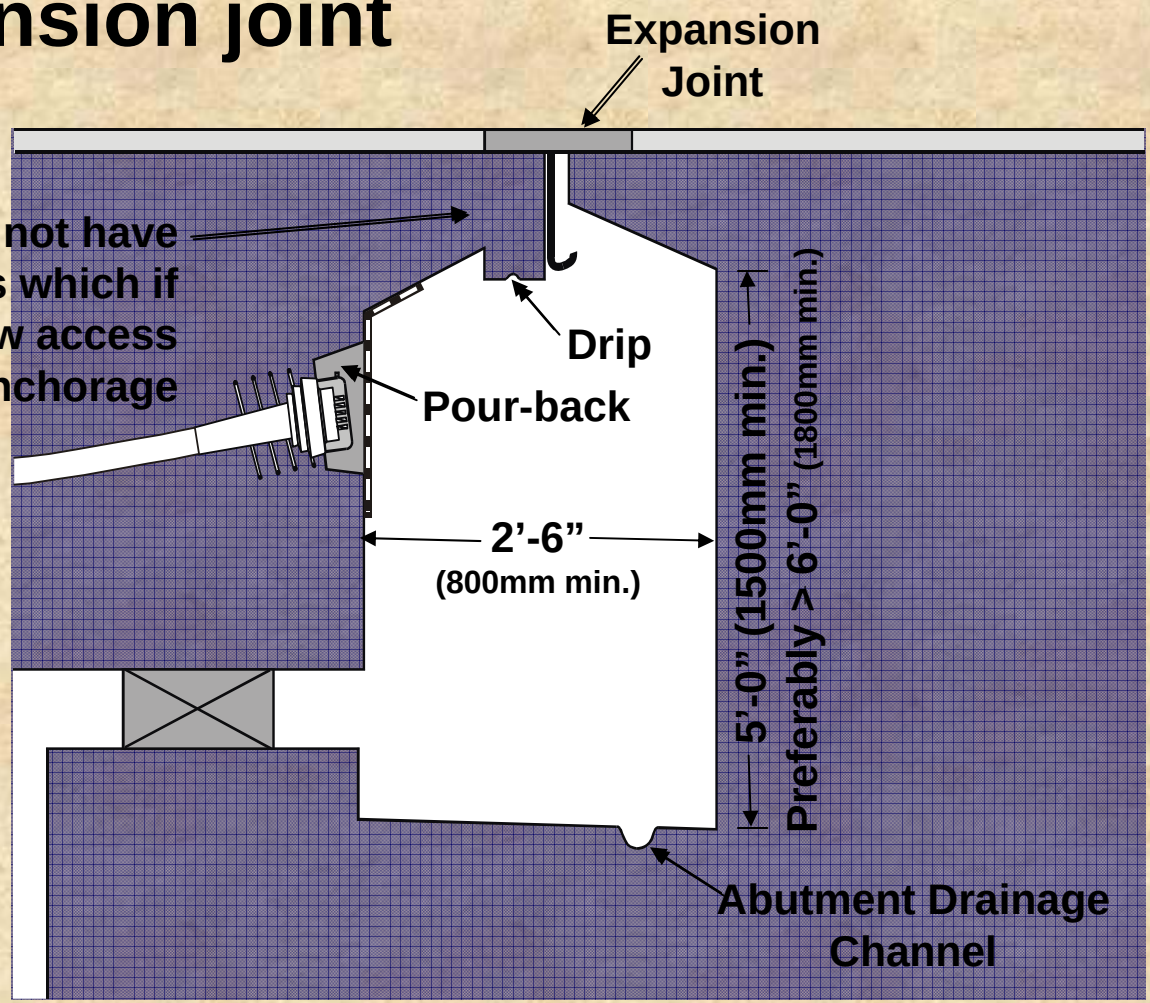
Exposed anchorage for live or dead end



Preferred Anchorage Protection at Expansion Joints and in Corrosive Environment

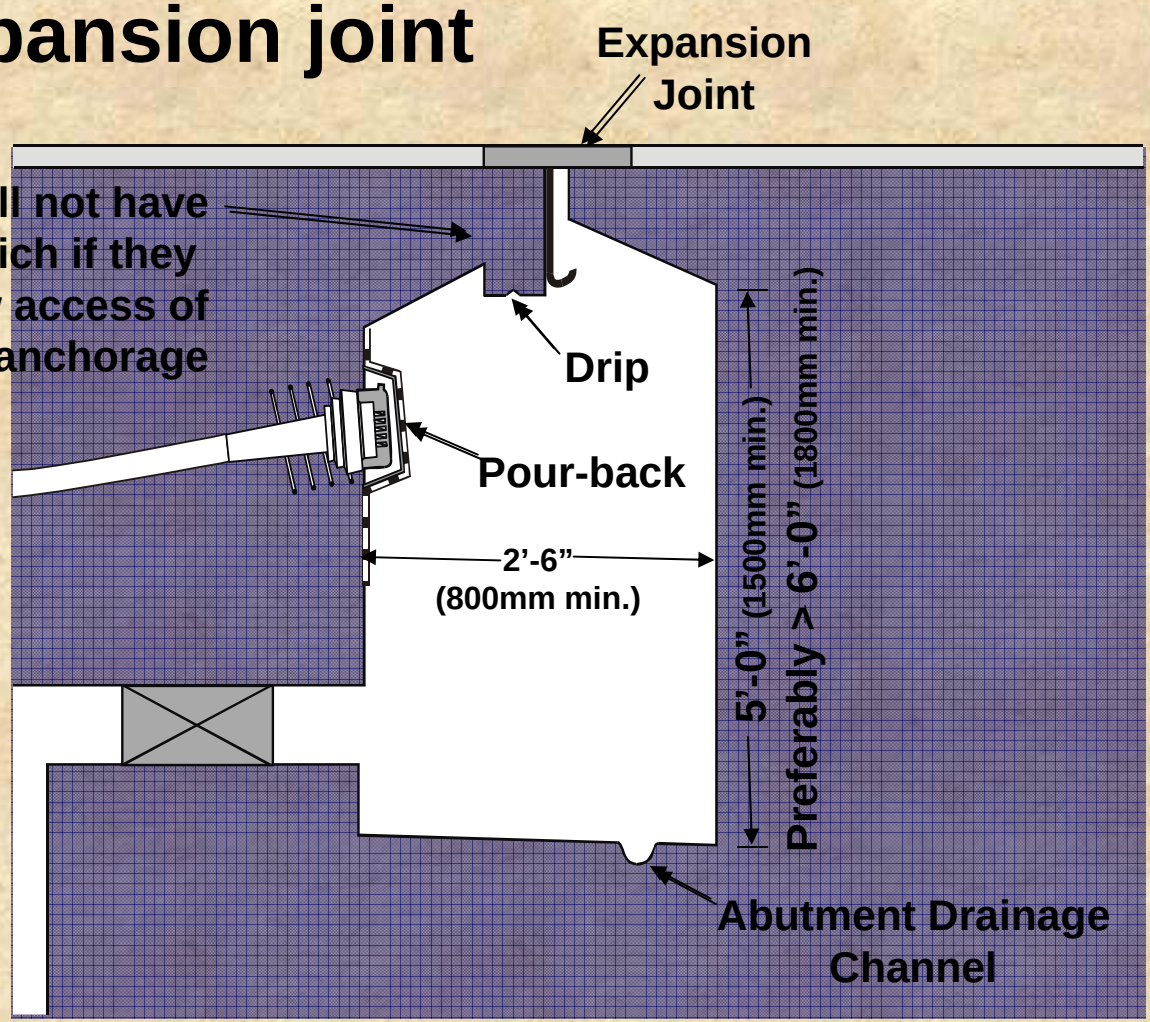
Multiple Protection Concept

Embedded anchorage for live or dead end at abutment expansion joint

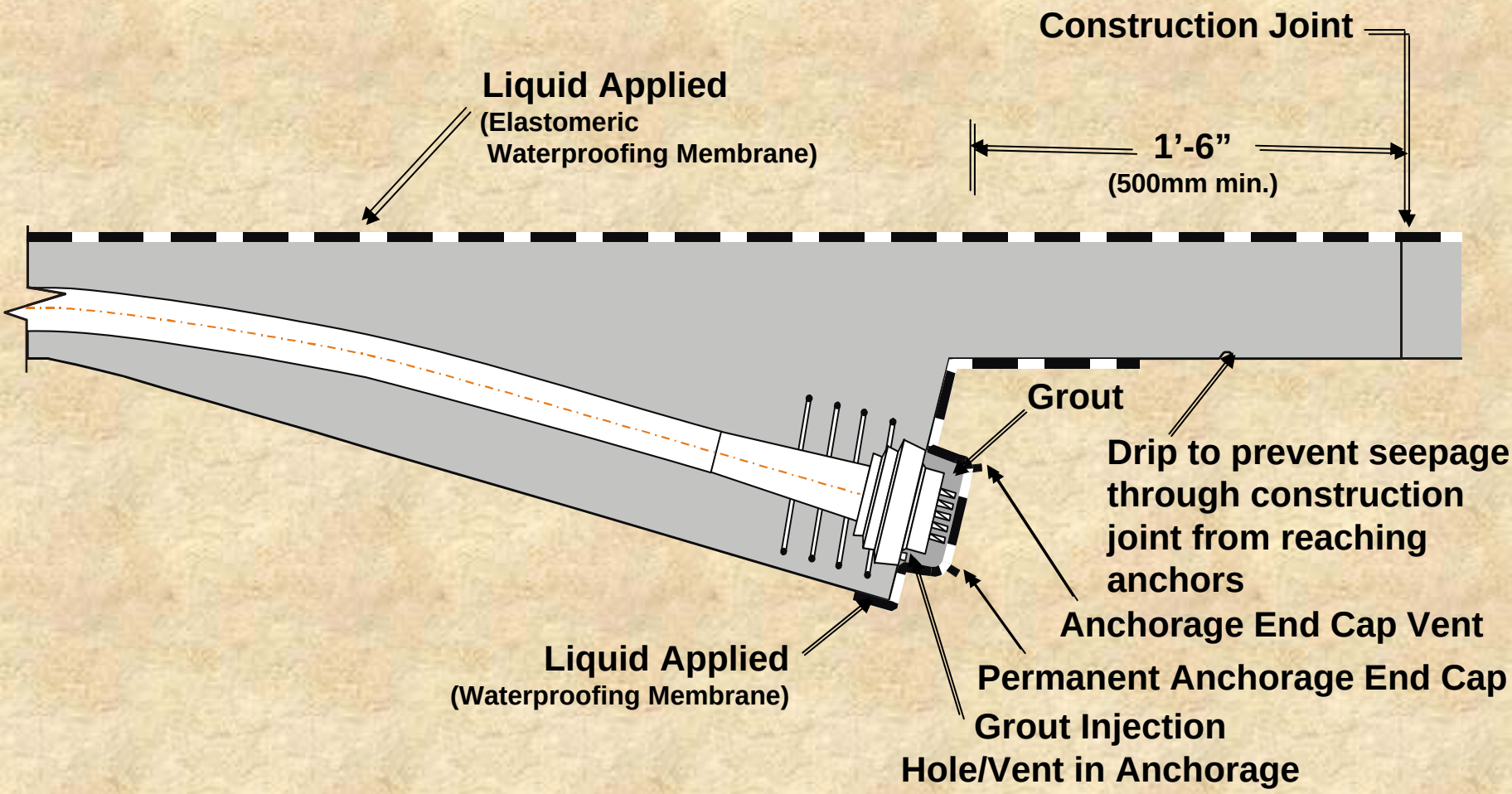


TR 47 Anchorage Protection
Multiple Protection Concept

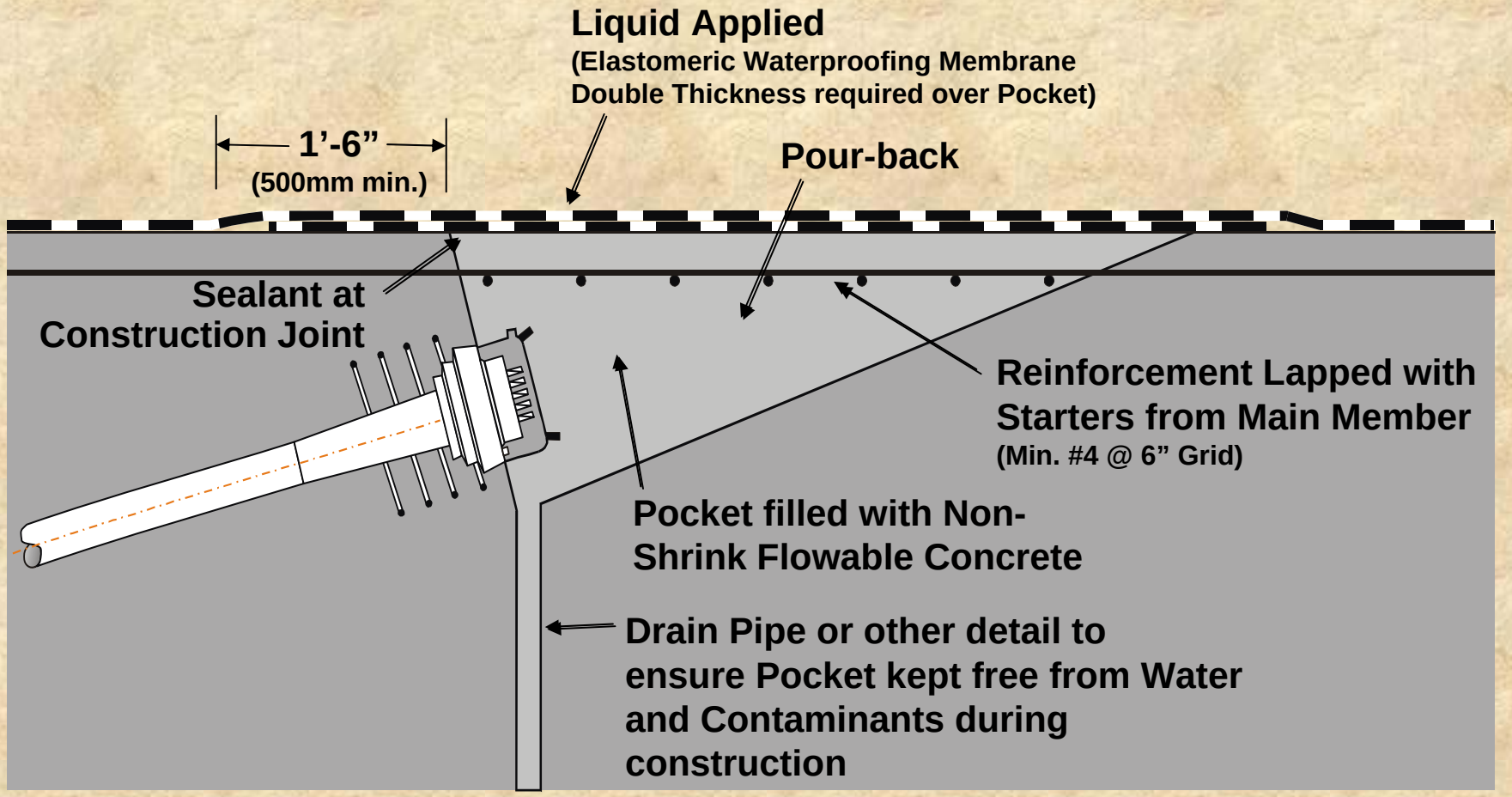
Exposed anchorage for live or dead end at abutment expansion joint



Modified TR 47
Anchorage Protection
Multiple Protection Concept



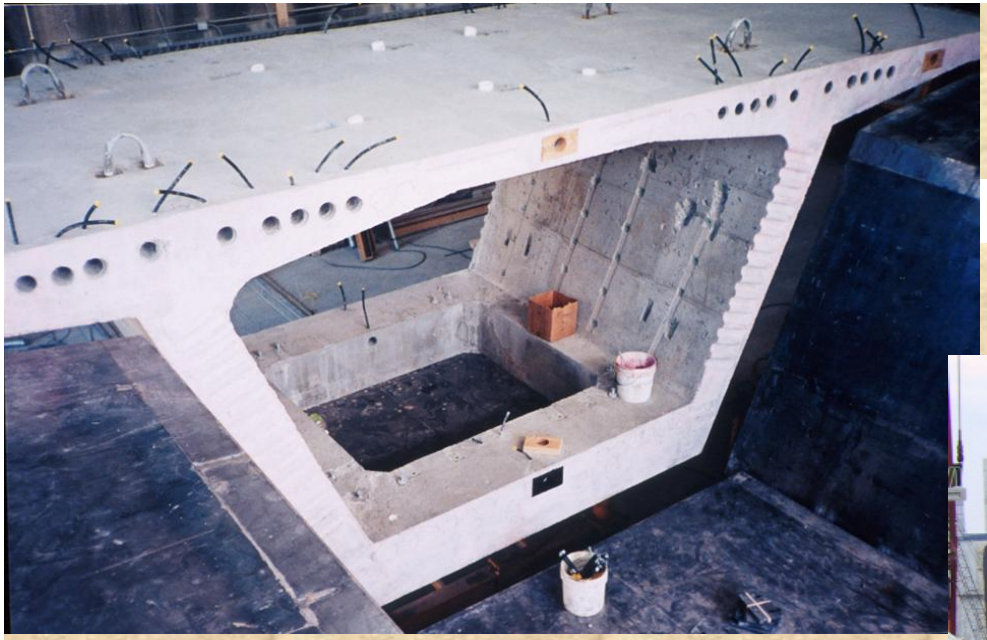
TR 47 Anchorage Protection
Multiple Protection Concept



Note: Not allowed in the state of Florida for segmental bridges, except splice girders with cast-in-place top deck.

Top Pocket Anchorage (not recommended)
Multiple Protection Concept

FIXED BENT SEGMENT– PRECAST DETAILS



SAW CUT STARTER SEGMENTS

STRADDLE BENT – AFTER ERECTION IS COMPLETED






Conclusion

- Durability depends on design, detailing, materials, construction, construction supervision, and quality control at all levels of design and construction.
- Properly designed, detailed and constructed structures enhance structural durability.
- Durable structures are economical, avoid unnecessary repairs and minimize future maintenance costs.

Thank You