DISPELLING THE MYTH ABOUT UNBONDED PT BUILDINGS

Christopher Fulton, B.Sc.(Eng.)

Lindsey Tourand, P.Eng.

Parsons Brinkerhoff Halsall Inc.

Reference: Seinfeld, Keith 2011, *Demolition of a Nearly-New Seattle Tower*, photograph, viewed 28 April 2014 <http://www.kplu.org/post/demolition-nearly-new-seattle-tower>

Deterioration of Unbonded PT

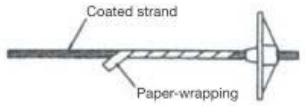
Moisture during construction

Moisture during service

Mechanical damage

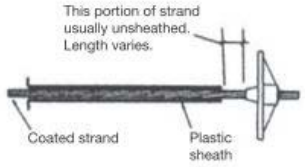
The Evolution of Unbonded PT

Paper-wrapped
1955 – 1975+

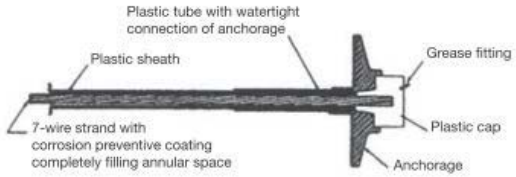


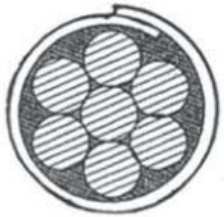
Push-Through Preformed Tube
Strand pushed through as grease is applied.

Plastic Sheath
1960 – Present



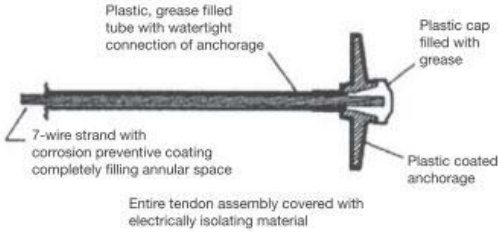
1985 PTI Recommended System

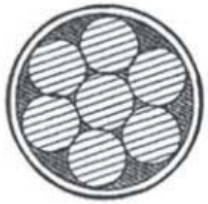




Heat-Sealed
Formed from flat strip as grease is applied.

Electrically Isolated Tendon





Extruded
Formed by extruding over strand as grease is applied.

Reference: Schupack, M., "Corrosion Protection for Unbonded Tendons," *Concrete International*, February 1991

The Study

Goal of the study was to answer:

What is Tendon Failure Rate?

What is the Cause of Failure?

The Study

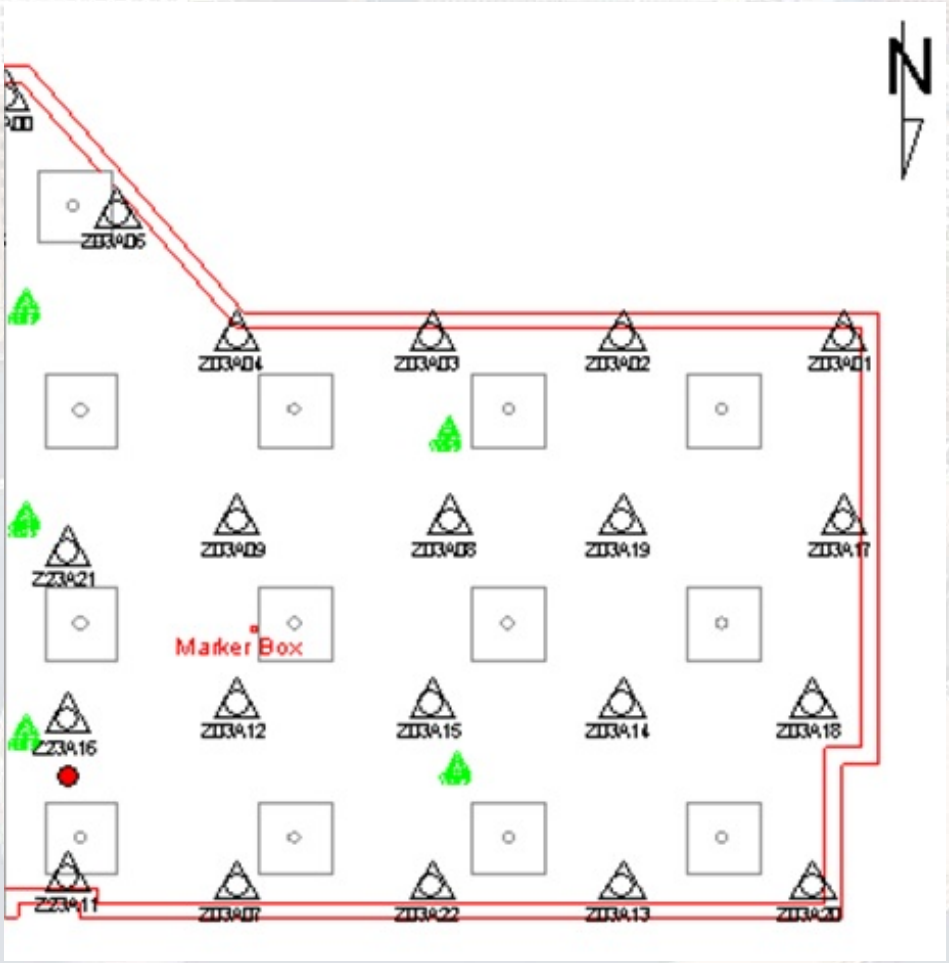
Data Collected:

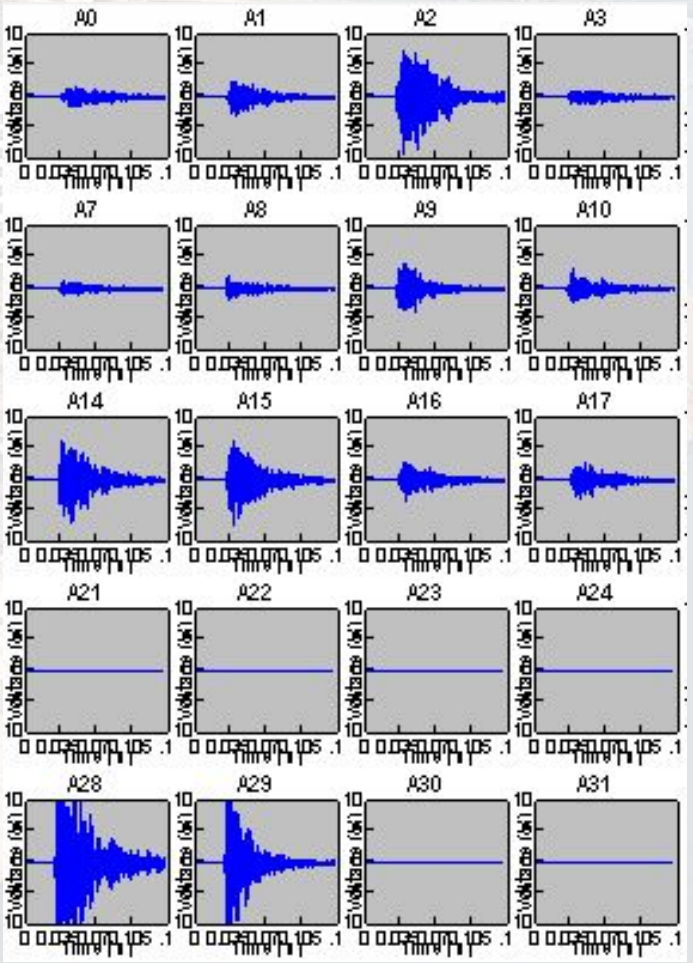
Acoustic Monitoring Records for 26 Structures

Visual Review of 246 Tendon Failures from 7 Structures

Background on Acoustic Monitoring

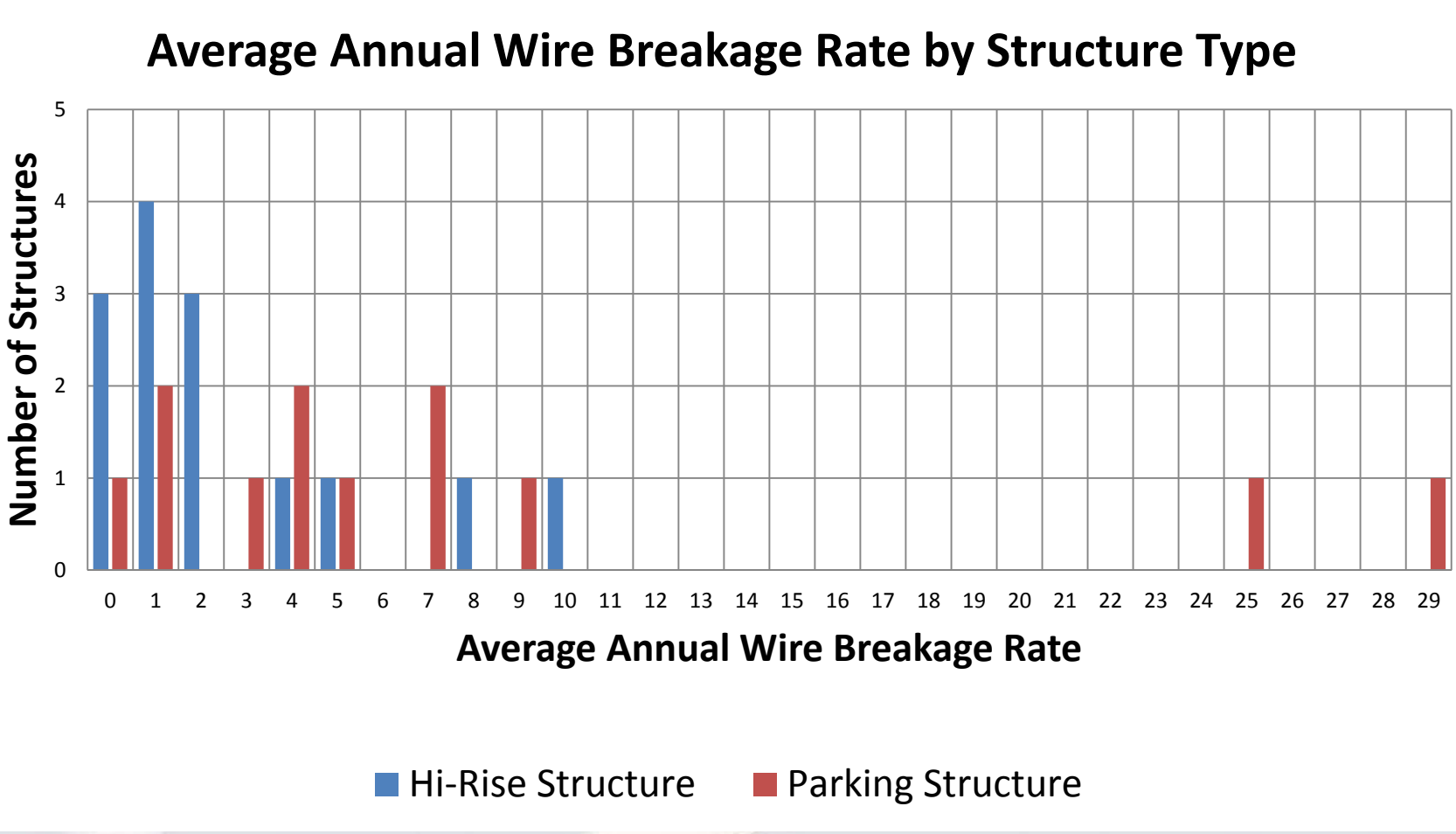
Background on Acoustic Monitoring



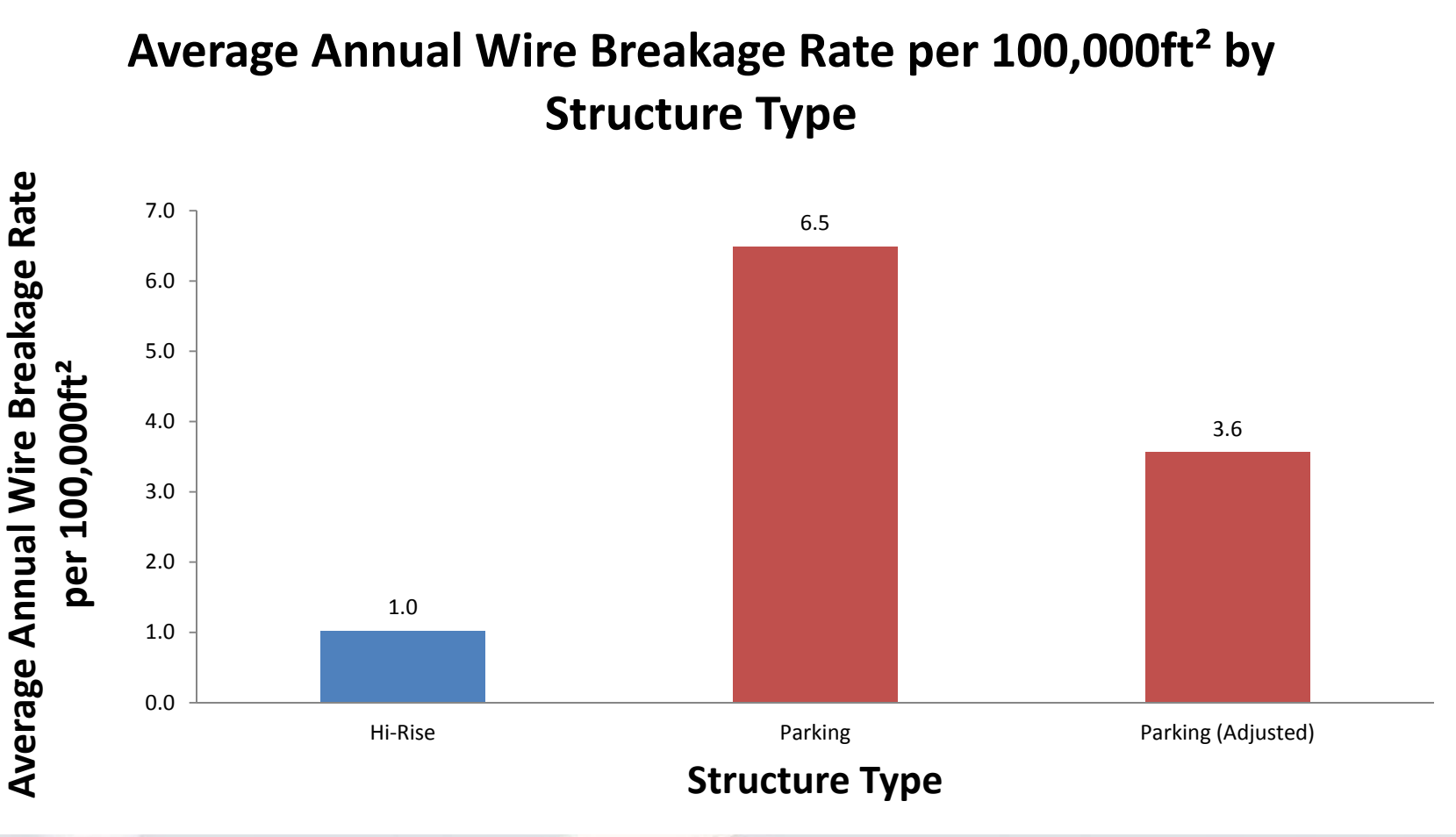


Study Part 1 –
Review of Acoustic Monitoring Records

Breakage Rates



Breakage Rates



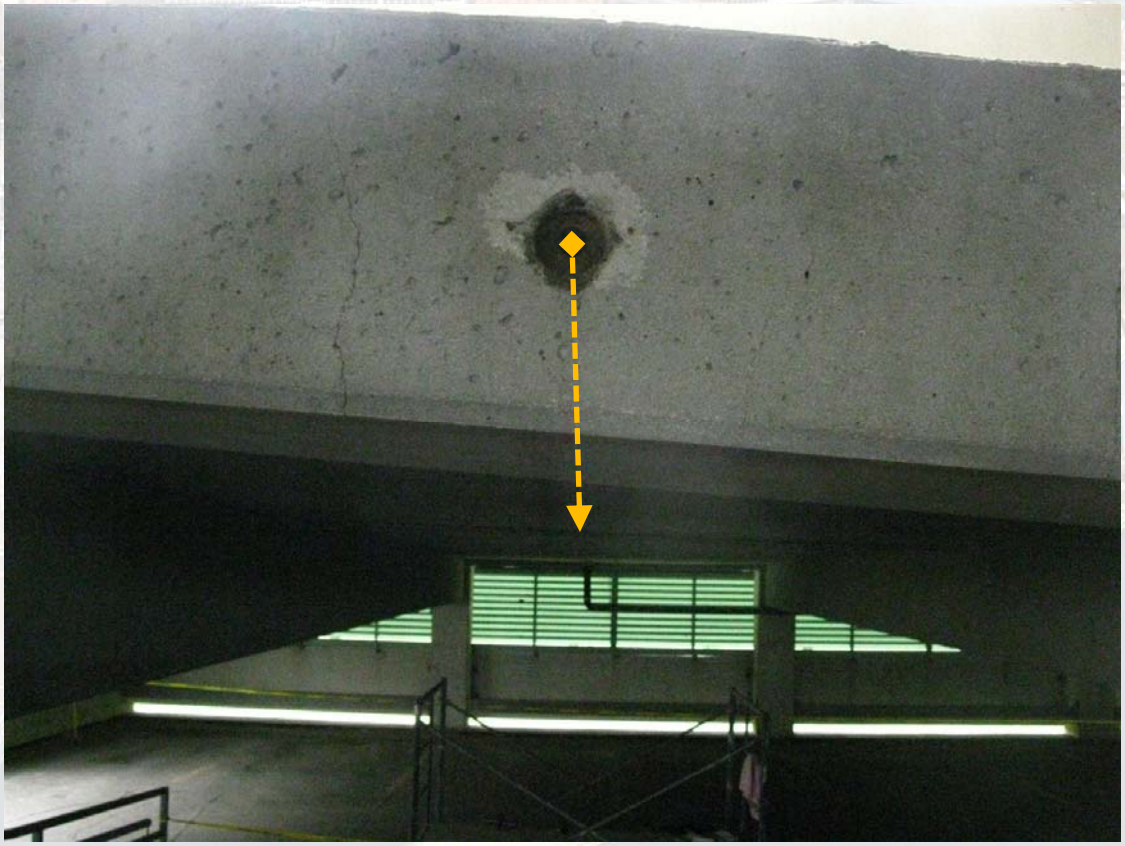
Study Part 2 –
Review of Tendon Failure Causes

Causes of Tendon Failure

Corrosion from Moisture

Causes of Tendon Failure

Mechanical Damage

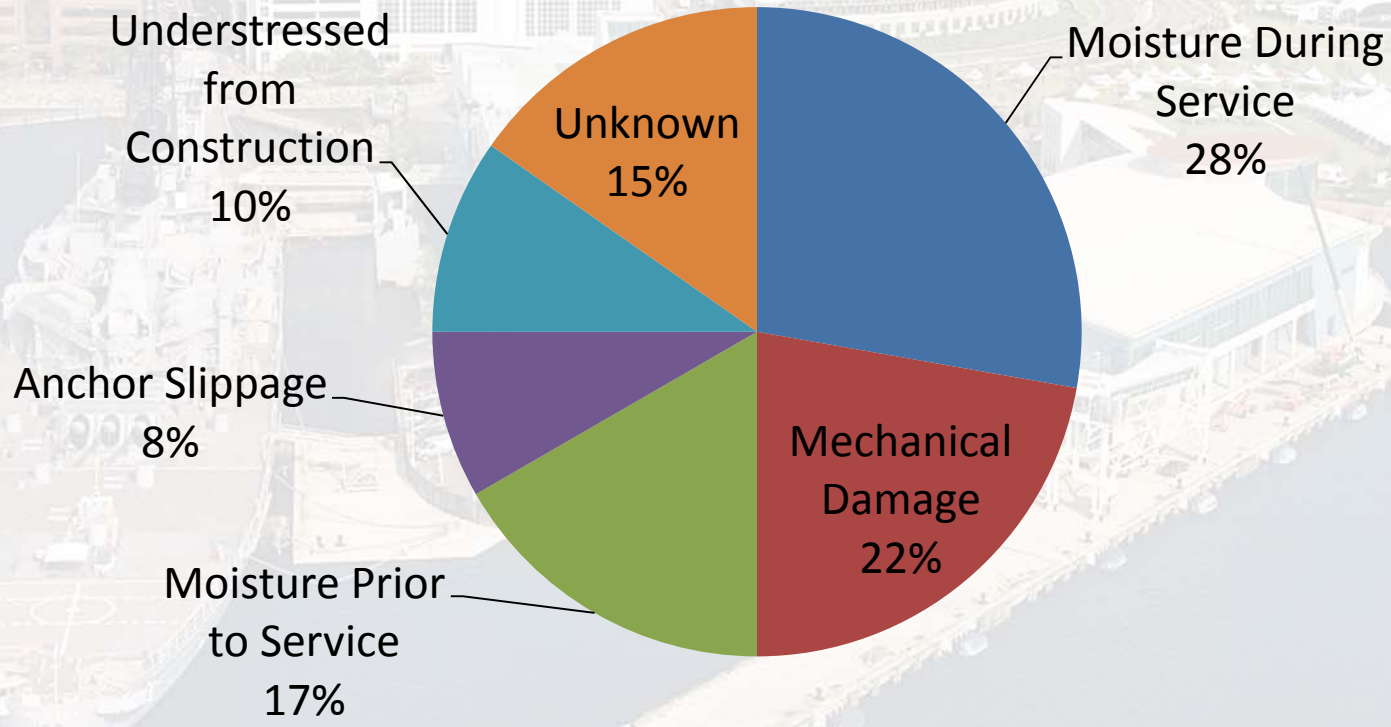


Causes of Tendon Failure

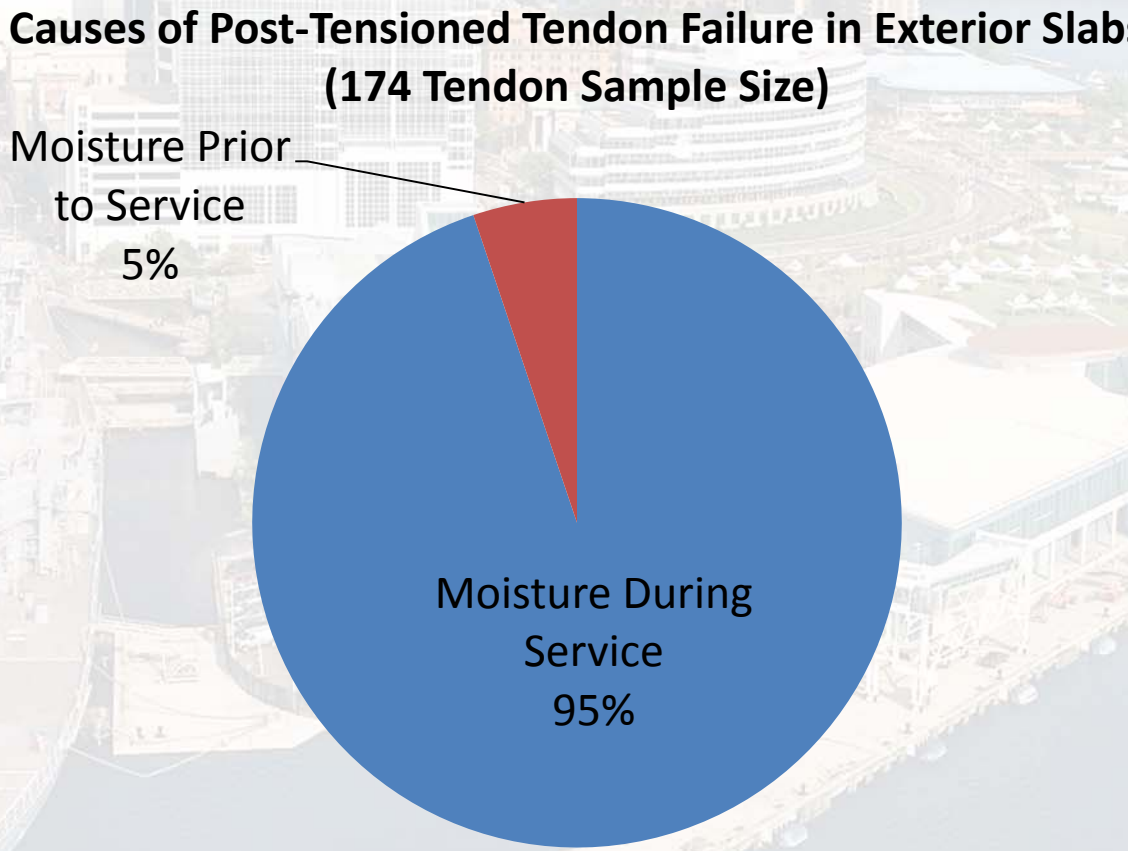
Anchor Slippage

Causes of Tendon Failure

Causes of Post-Tensioned Tendon Failures in Interior Spaces (72 Tendon Sample Size)



Causes of Tendon Failure



What Does It All Mean?

Large percentage of PT tendon failures are the result of moisture entry or mechanical damage during service. These failures can be mitigated through regular preventative maintenance

The stigma that unbonded PT structures are unpredictable and costly to maintain may not be deserved

Special Thanks

Study Co-Authored by Stephan Trepanier, Partner at Edison Engineering

Acoustic Monitoring data provided by Pure Technologies Limited

DISPELLING THE MYTH ABOUT UNBONDED PT BUILDINGS

Questions?

Christopher Fulton, B.Sc.(Eng.)
Lindsey Tourand, P.Eng.
Parsons Brinkerhoff Halsall Inc.