EXTENDING THE USEFUL LIFE OF PARKING STRUCTURES

Transportation Commission meeting.
February 27, 2019

City of Madison Parking Utility

Parking Garage useful life is influenced by:

- Design and Construction
- Use/exposure to weather and salt
- Maintenance and Repair

Age of Parking Structures

- Government East: 1958
- State Street Capitol: 1963, major addition 1995
- State Street Campus Lake: 1964
- Capitol Square North: 1971
- State Street Campus Frances: 1982
- Overture Center: 1982
- South Livingston Street: 2018
- Judge Doyle Garage: 2019

“Rule of thumb” for life of City garages is 60 years for older garages and 70 years for newer garages

Primary Causes of Deterioration

- Sun exposure limits life of joint sealers, expansion joints, and traffic coatings.
- Chlorides (salts) from snow laden vehicles penetrate the concrete.
- Once the chlorides reach steel reinforcing in the concrete, they undermine the ferric oxide layer on the steel surface, promoting corrosion of the steel.
- As corrosion occurs, the products of corrosion expand, causing fractures in the concrete.
- The fractures provide additional routes for water and chlorides to penetrate the concrete, resulting in an accelerated rate of deterioration and freeze-thaw damage.
- Salts can penetrate the sheathing or ends of post tensioned tendons resulting in corrosion and eventual failure of the tendons.

Maintenance procedures to Extend Garage Life

- Wash down garage decks twice per year
- Maintain membrane where present
- Apply penetrating sealer on a routine basis
- Replace caulking that has failed
- Replace expansion joints as needed
- Annual inspection and repairs as needed

Expansion Joint Replacement

Extending the useful life of Parking Structures

Expansion Joint Detail

Tendon and Slab Repair

Tendon and Slab Repair

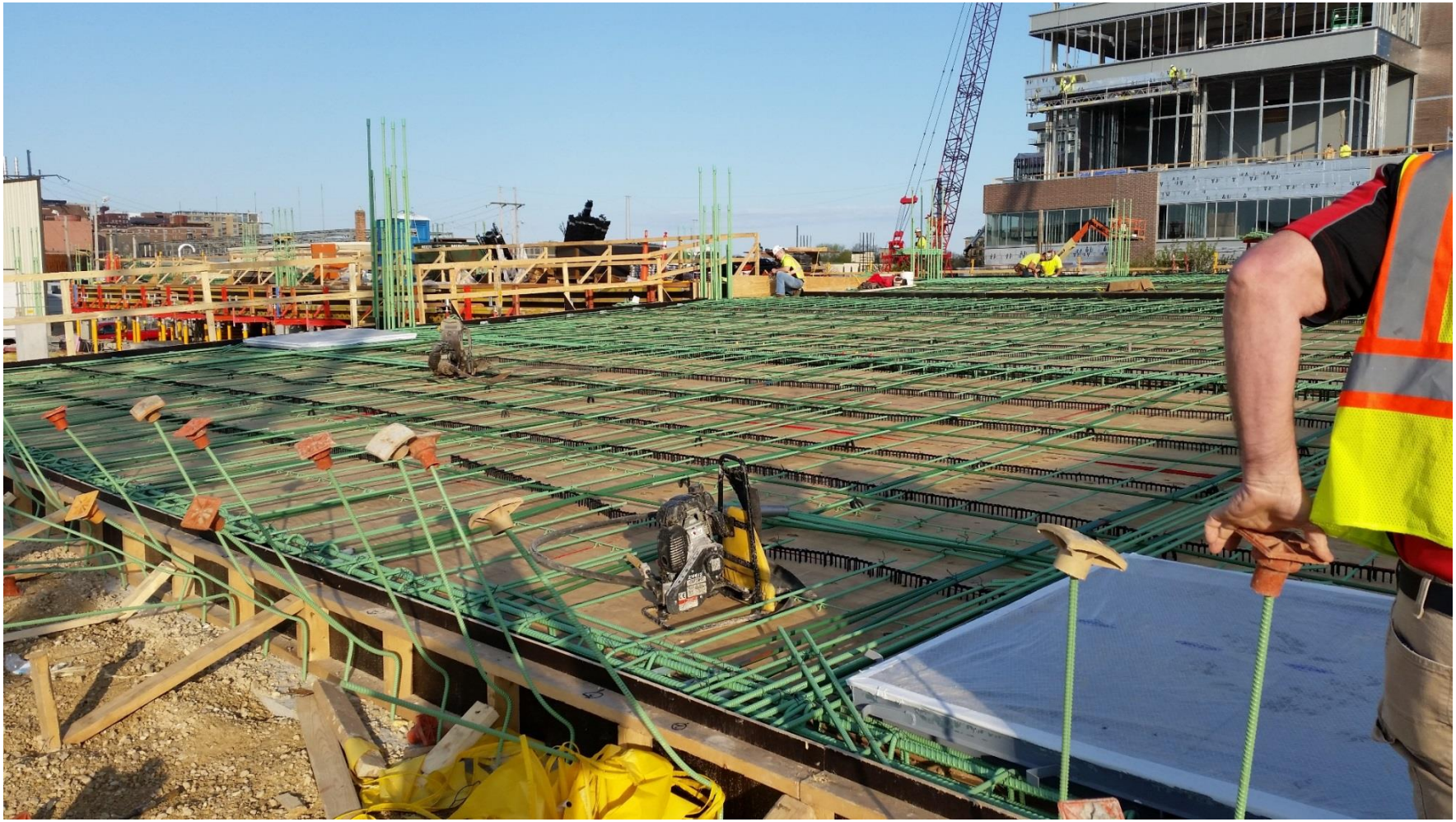
Tendon and Slab Repair

Slab Repair

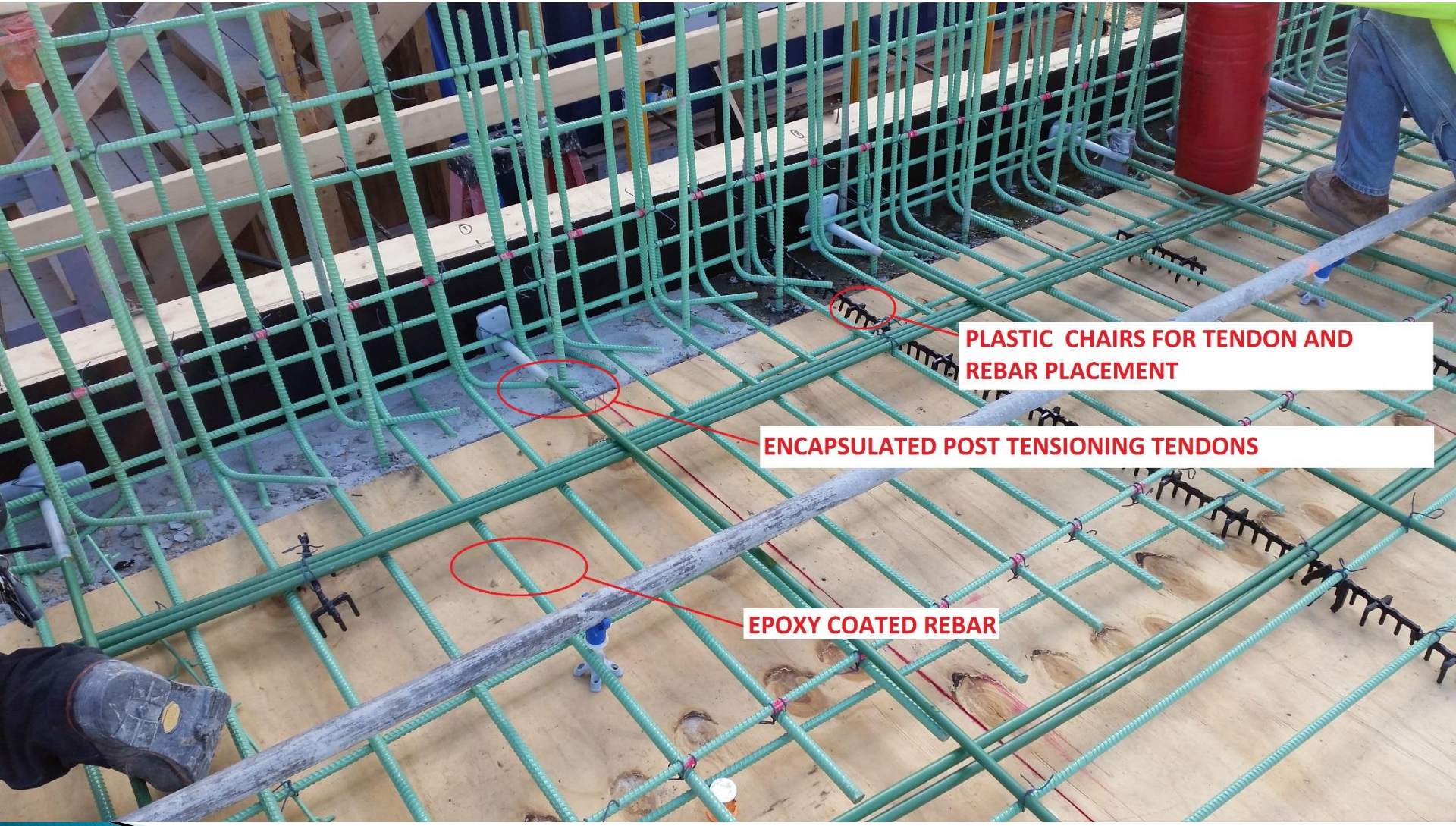
Construction techniques to Extend Garage Life

- Epoxy coating on reinforcing steel
- Encapsulate post tensioning tendons in plastic sheathing
- Crystalline waterproofing admixture to assist in self-sealing small cracks
- Concrete with air entraining admixture to resist freeze-thaw cycles
- Slag and Fly Ash in concrete mix to decrease permeability and increase wear resistance
- Corrosion inhibitor added to concrete mix

South Livingston Street Garage Construction



Design Features at South Livingston Street Garage



Design Features of new South Livingston Street Garage

- Stainless or galvanized steel hardware to reduce maintenance and extend life.

- On site water retention tank to reduce stormwater surcharge and allow solids to settle before water is discharged into the city storm sewer.

- Permeable pavers used to reduce stormwater runoff.

- Provision to accommodate future solar panels above garage.

- Commercial Building incorporated into project to enhance pedestrian experience along East Main Street and make site a destination.

- Open structure, eliminating need for active ventilation.

Design Features at South Livingston Street Garage

Design Features at South Livingston Street Garage
Stormwater Tank reduces peak flows and suspended solids entering stormwater system

Design Features at South Livingston Street Garage
Aluminum Screening for long life and low maintenance

Questions?