


## StructureTec Group

### Victoria Street Garage Rehabilitation


Presented By:  
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 ROBERT G. MASON, JR., P.E. – STRUCTURETEC





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## Design Team


**OWNER:**  


**LEAD CONSULTANT:**  


**MEP CONSULTANT:**  


**ARCHITECTURAL CONSULTANT:**  


**SPECIALTY STRUCTURAL CONSULTANT:**  




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## Construction Team

**GENERAL CONTRACTOR:**  


**POST-TENSIONED REHABILITATION CONSULTANTS:**  



**PRIME SUBCONTRACTORS:**  





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## Project Site





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## Project History

- 1967
  - Pittsburgh Parking Authority constructed original 4-story parking garage
- 1974
  - Columns were extended to construct the 6-story Pitt School of Nursing building
- 1981
  - Level 5 of the parking garage was constructed
- 2000/2001
  - Partial depth repairs to the original 1967 parking structure were performed
- 2008
  - Façade evaluation was performed
- 2012
  - 2008 evaluation was updated to include garage structural conditions
- 2013
  - Restoration of the garage's brick masonry façade and aluminum screenwall
- 2014
  - Exploratory assessment of the post-tensioned floor slabs
  - Temporary shoring installed
- 2015/2016
  - Full-depth slab replacement for both the 1981 and 1967 structures was undertaken




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## Condition Assessment

- The deterioration of the garage slabs consisted of extensive delamination, spalling, and stress cracking of the slabs
- 70% of the Level 2 thru 4 PT tendons were discovered to be compromised
- 40% of the Level 5 PT tendons were discovered to be compromised
- Temporary shoring installed prior to full repair scope of work




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## Repair Approach

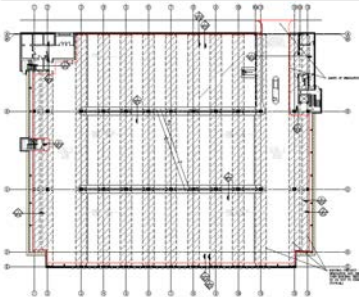
- 3 Different Repair Options presented to UPMC
  - #1 – Extensive partial depth repair and installation of remedial steel beam framing spanning between precast tees
  - #2 – Full-depth strip repairs to replace damaged PT tendons
  - #3 – Full-depth slab replacement on all levels
- Owner chose #3 as the best long-term option for the continued use of the garage facility and above 6-story building




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## Overall Floor Plan





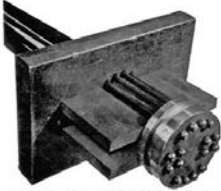
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## Existing Structures

1967

- Paper-wrapped button-head post-tensioned slabs



**Button head BBRV system**



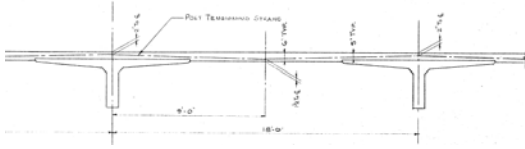
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## Existing Structures

1967

- Slabs supported by precast concrete single-tees and columns





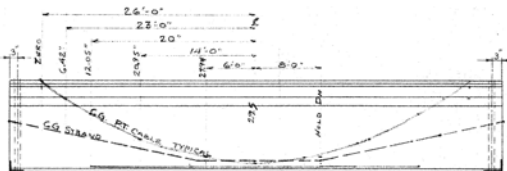
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## Existing Structures

1967

- Precast concrete single tees are both pre-stressed and post-tensioned

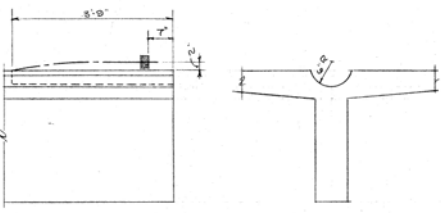





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## Existing Structures



**TYPICAL THRU POST TENSIONED TEE END DETAIL**



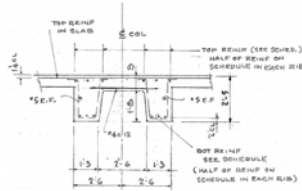
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## Existing Structures

1981

- Conventional un-bonded post-tensioned one-way beam and slab structural system
- Each post-tensioned beam is a double beam supported by the 1967 precast concrete columns on neoprene bearing pads

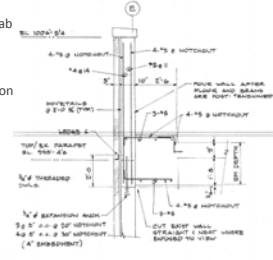


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## Construction Issues

- Determining shoring and bracing requirements
  - Impact from the extent of slab removal allowed
  - How many floors does shoring need to extend?
  - Is any lateral bracing required?
- Sequencing the demolition and re-construction work
  - Top level (Level 5) considerations
  - Lower level (Levels 2 thru 4) consideration
- Interfacing between new and existing post-tensioned construction
  - New construction forces vs. existing forces needed to remain



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## Construction Issues

- Maintaining existing post-tensioned members to remain
  - Avoiding demolition of post-tensioned tendons or anchors to remain
  - Avoiding damage to the exterior façade repairs completed in 2013
- Design forces discussion
  - What happens to the design force of the Level 5 composite H-beams when the top slab is removed?



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## Shoring



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## Shoring



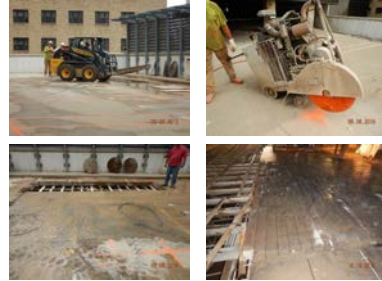
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## Detensoning



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## Sawcutting & Slab Removal



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## Air Hammer & Chipping



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## Post-Tensioning Repairs



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### PT Splicing and Rebar Install



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### PT Stressing after Concrete Placement



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### Existing Shear Dowels Too Low To Engage New Concrete Section in Some Areas



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### Temperature Tendon Intermediate Tensioning



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### Saw Blade Cut into Existing Single Precast Tee Flanges



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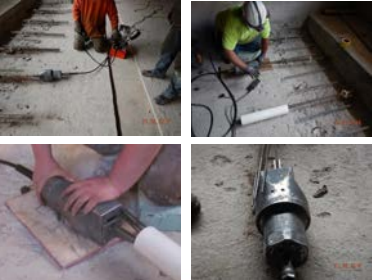
### Single Precast Tee Anchor Points Not Where Shown on Drawings



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### Existing Buttonhead to New Monostrand PT Tendon Splice




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### Existing Buttonhead to New Monostrand PT Tendon Splice




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### Façade Wall Deformation



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### Concrete Repairs at Steam Piping



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### Trench Drain at Victoria St Entrance



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### High Voltage Electrical Conduit Feeding Adjacent Research Lab Building



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### Existing Tendon Failures Popped Out at Existing/New Tendon Splices



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### Before-During

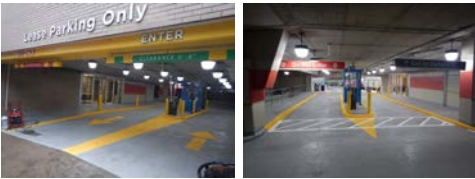
#### Level 3 North "A" Ramp



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### After

#### Level 3 North "A" Ramp



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### Before-During-After

#### Level 5 South "A" Ramp



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## StructureTec, Group

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THANK YOU!

QUESTIONS ???

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