

Evaluation & Assessment of Concrete Structures Prior to Rehabilitation

ACI Committee 364

David A. VanOcker, PE, FACI
CVM Professional



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Fall 2019 Convention
Cincinnati, Ohio

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Concrete Evaluation & Assessment



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Concrete Evaluation & Assessment

- Use of NDE Techniques

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Concrete Evaluation & Assessment

- Use of NDE Techniques
- **Proper diagnosis informing rehabilitation measures**

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- **Deterioration or distress**
- **Accident or fire**
- **Natural disaster**
- **Change in Use or Planned Renovation**
- **Sale of Property**

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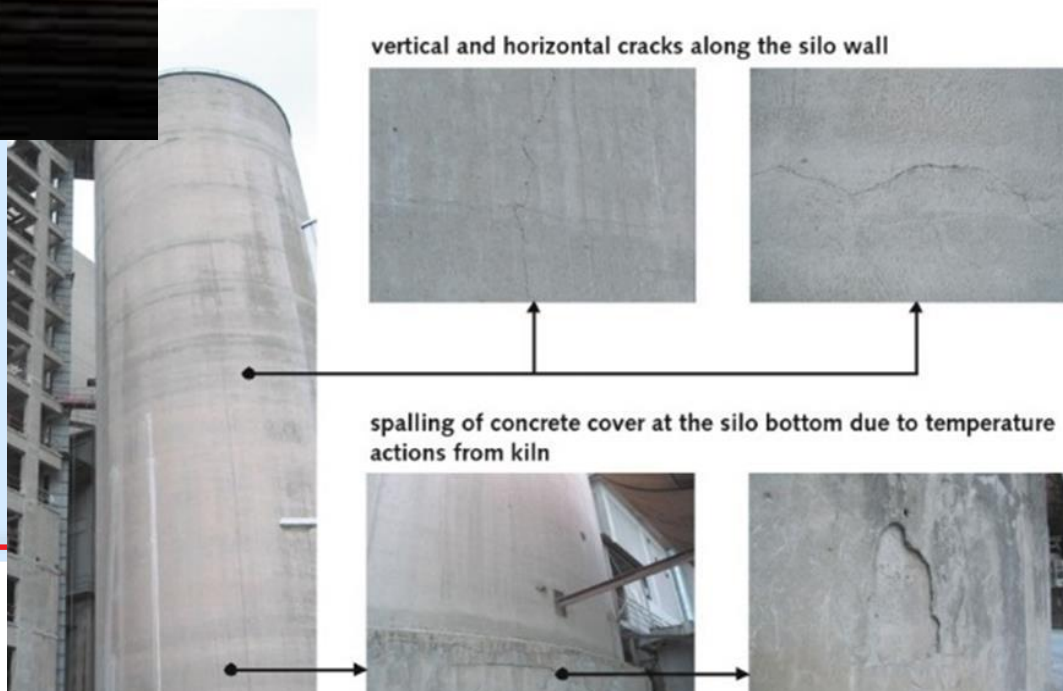
Understanding structural behavior

- **Enclosed structures**
- **Exposed structures:**
 - > environmental factors
 - > process-related
- **Extreme loading:** > accidents, natural disasters
- **Distress & deterioration:**
 - > interaction between systems
 - > original design / construction deficiencies

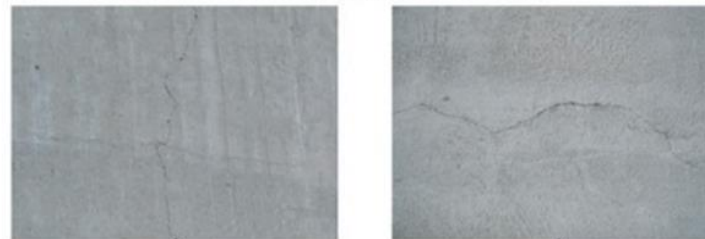
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Exposures



vertical and horizontal cracks along the silo wall



spalling of concrete cover at the silo bottom due to temperature actions from kiln



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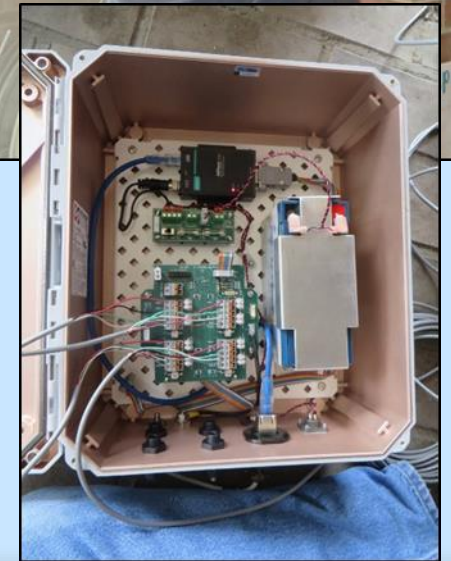
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Table 3-1. Typical Pulse Velocity Values Related to Concrete Damage

Ultrasonic Pulse Velocity (m/sec.)	Decrease from Solid Value (%)	Concrete Condition
4,500 to 4,800	-	Normal
4,200 to 4,500	~7%	Some damage
3,900 to 4,200	~13%	Substantial damage
Less than 3,900	More than 15%	Severe damage

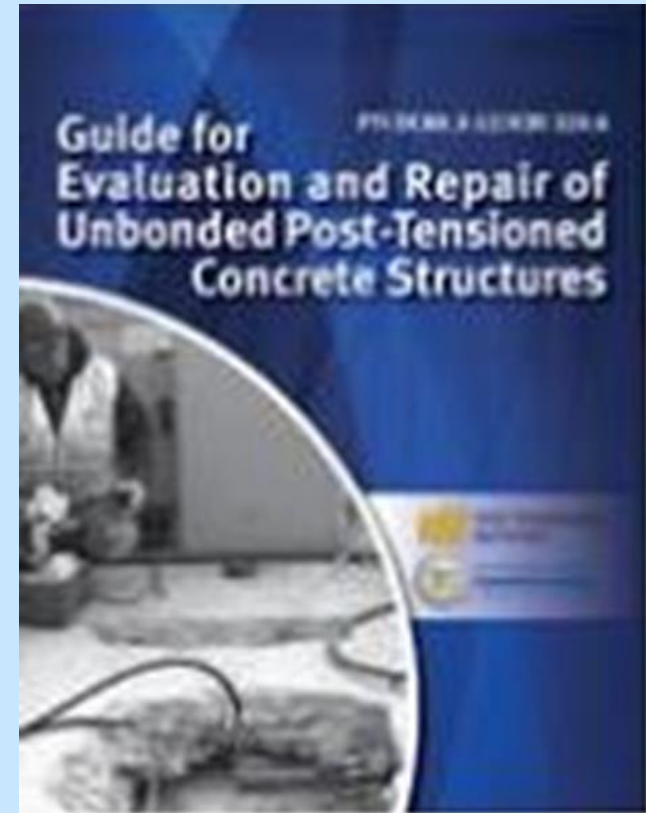
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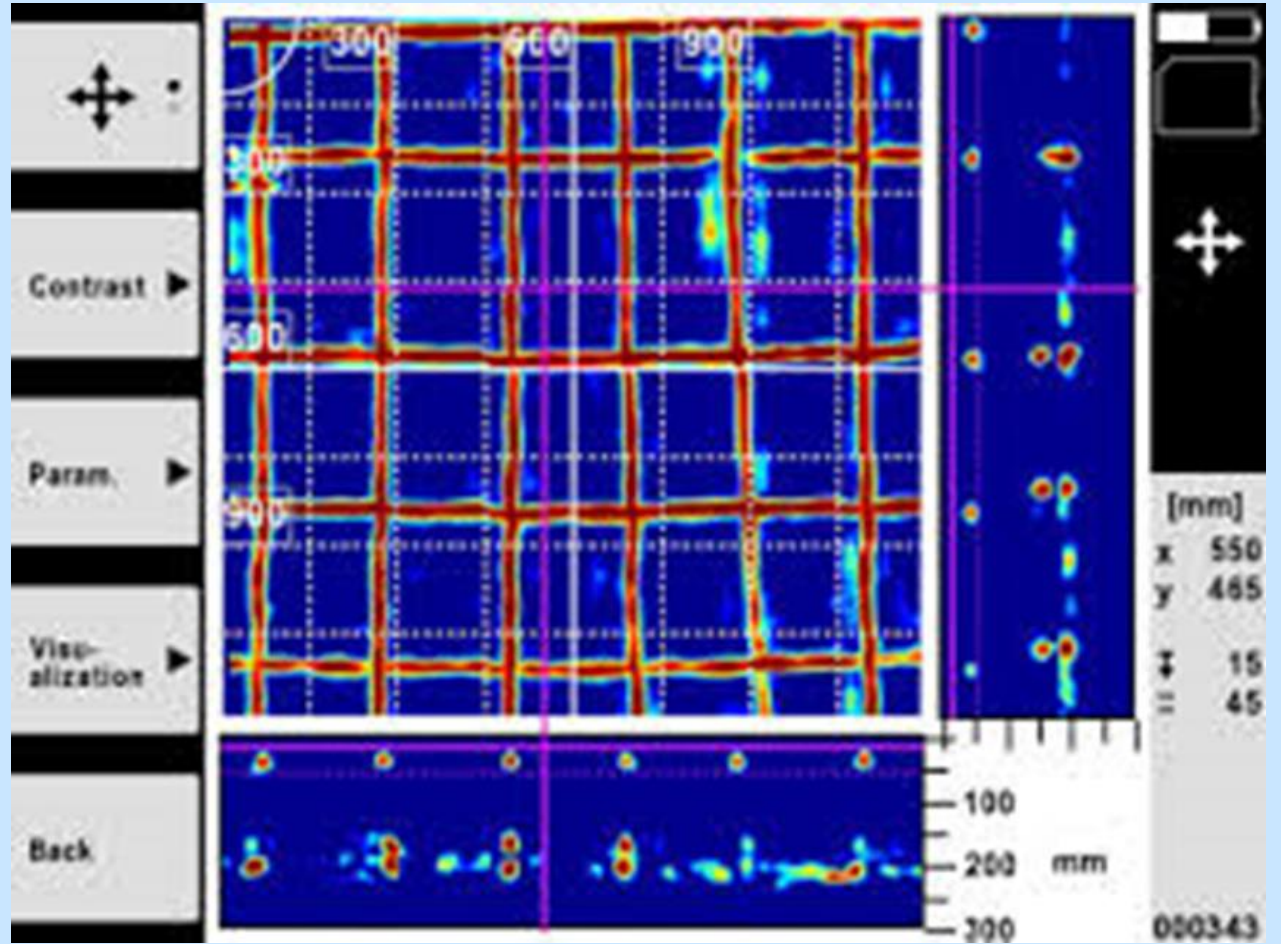
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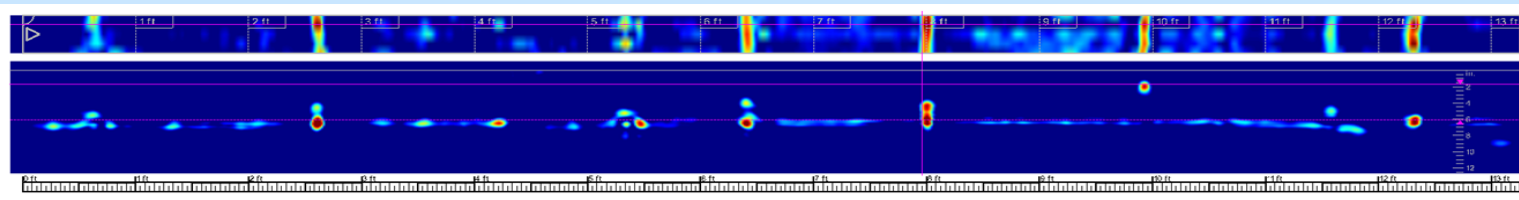
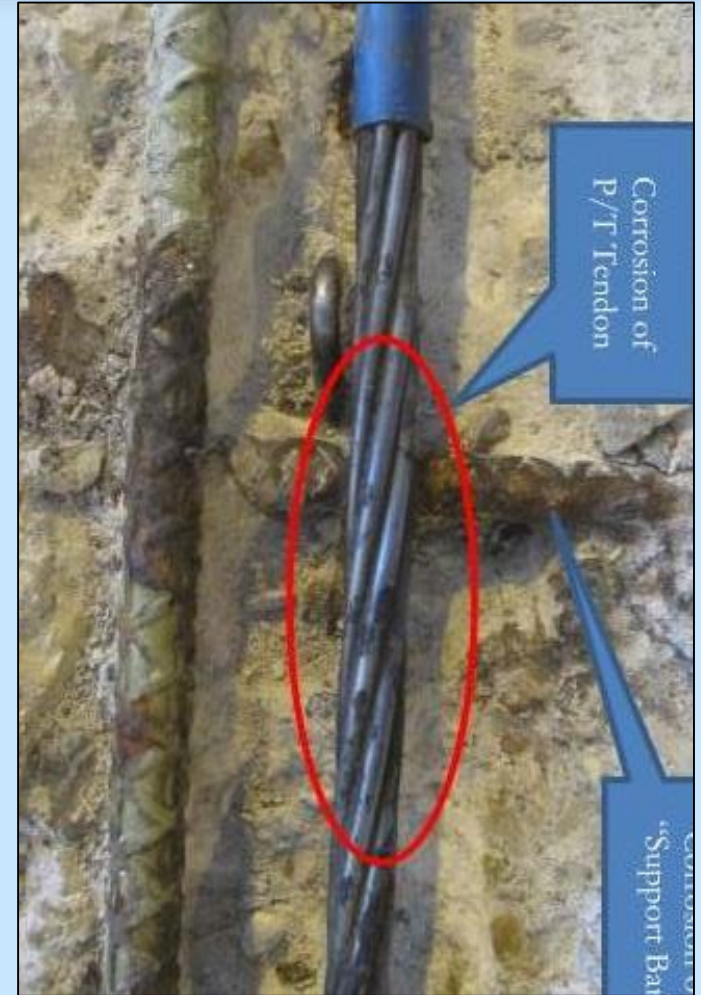
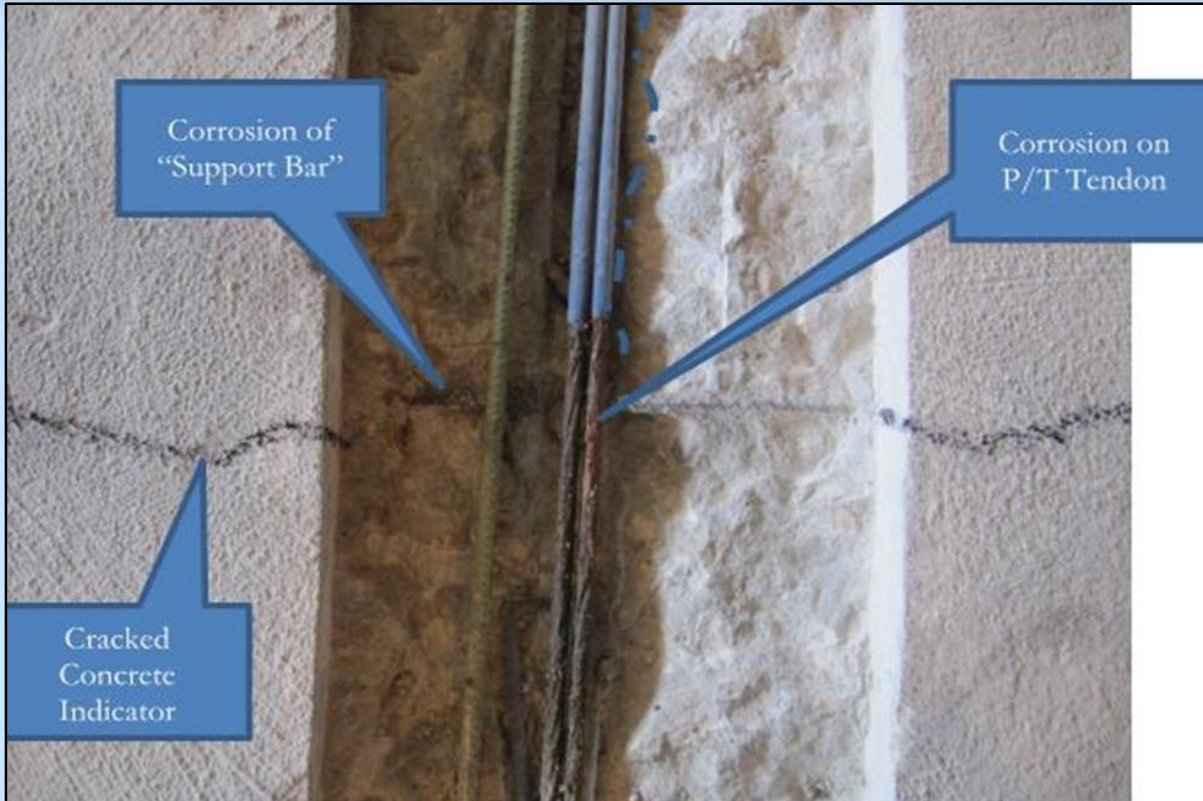


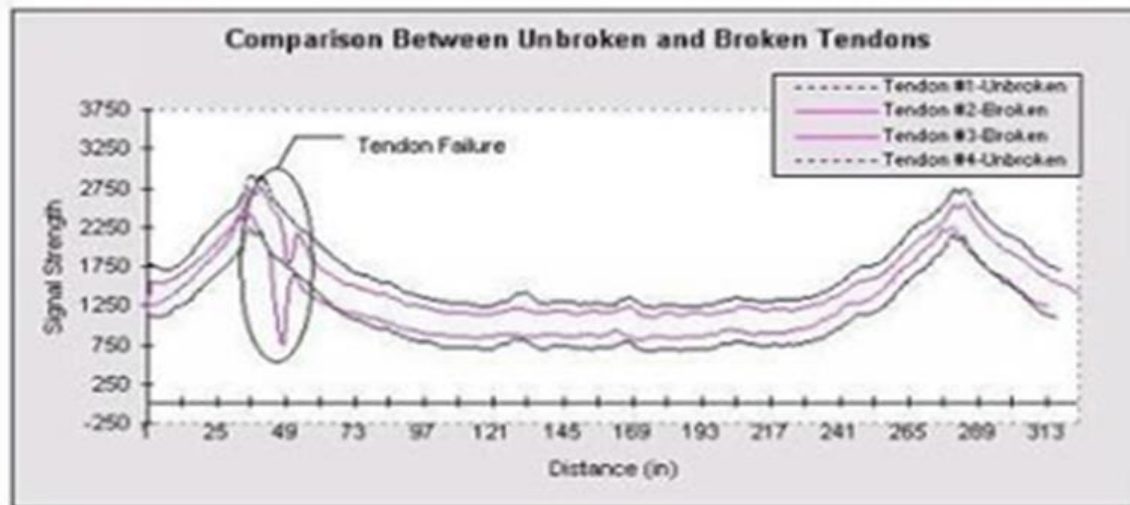
Figure 8. Unstressed strand at location shown in Figure 7 (note wedges were loosely placed grout pocket was removed).



Figure 9. Two possible locations with unstressed strands (118th Street side).

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This graph indicates failures at two of the four tendons. The main peaks of the graph indicate concrete beams.

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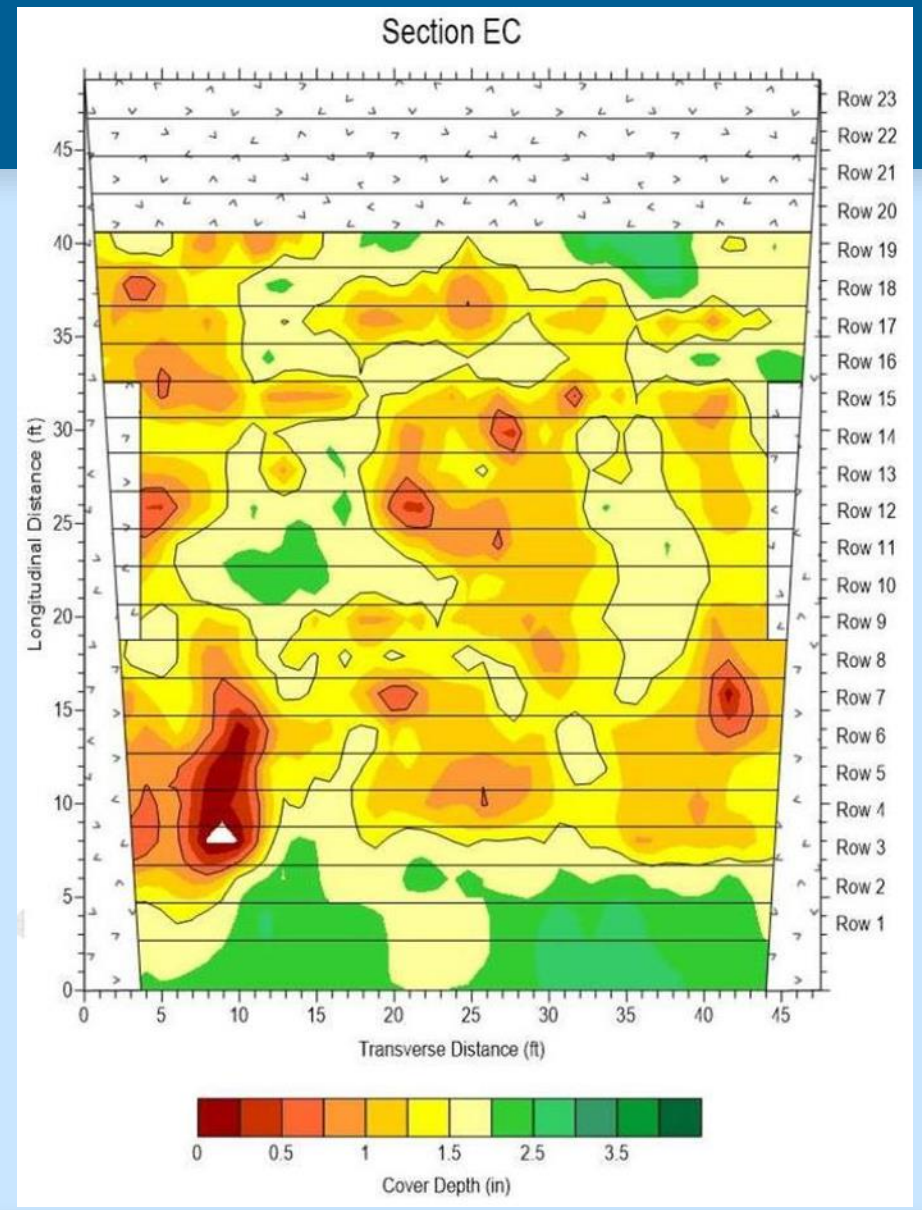
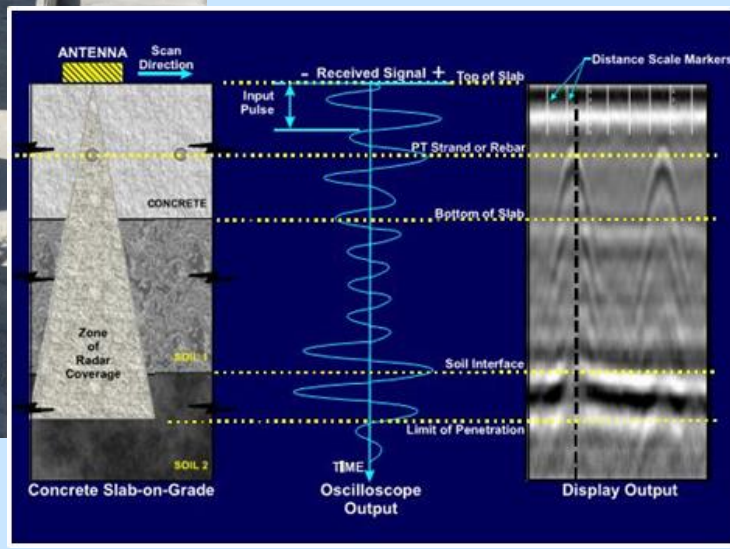
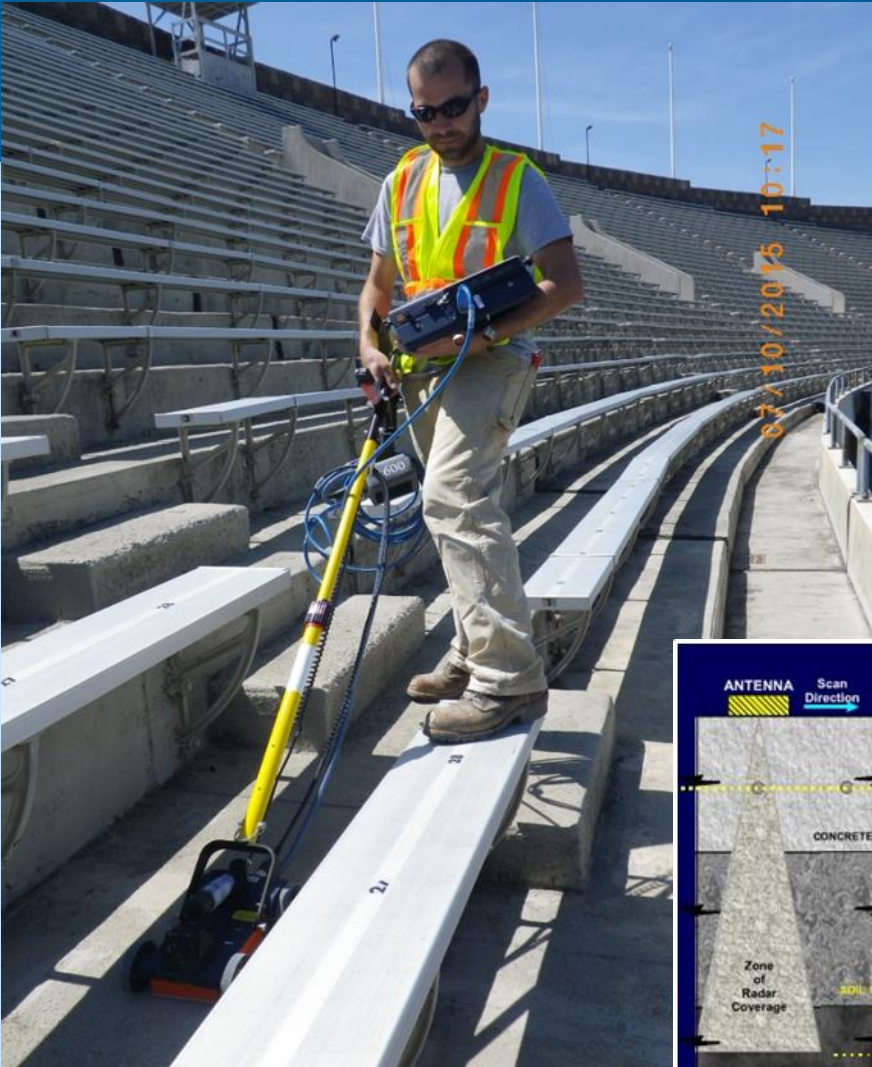
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Table A-1. Guidelines for Assessment of Corrosion Potential Test Results per ASTM C876

Measured Half-Cell Corrosion Potential	Assessment
More negative than -350 mV	90% probability of active corrosion
-200 mV to -350 mV	Uncertain corrosion activity
More positive than +200 mV	90% probability of no active corrosion

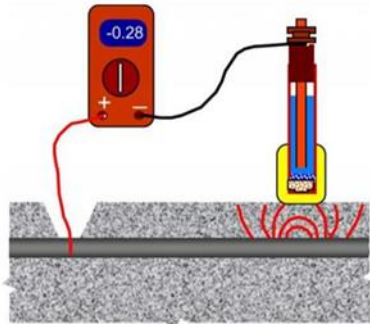
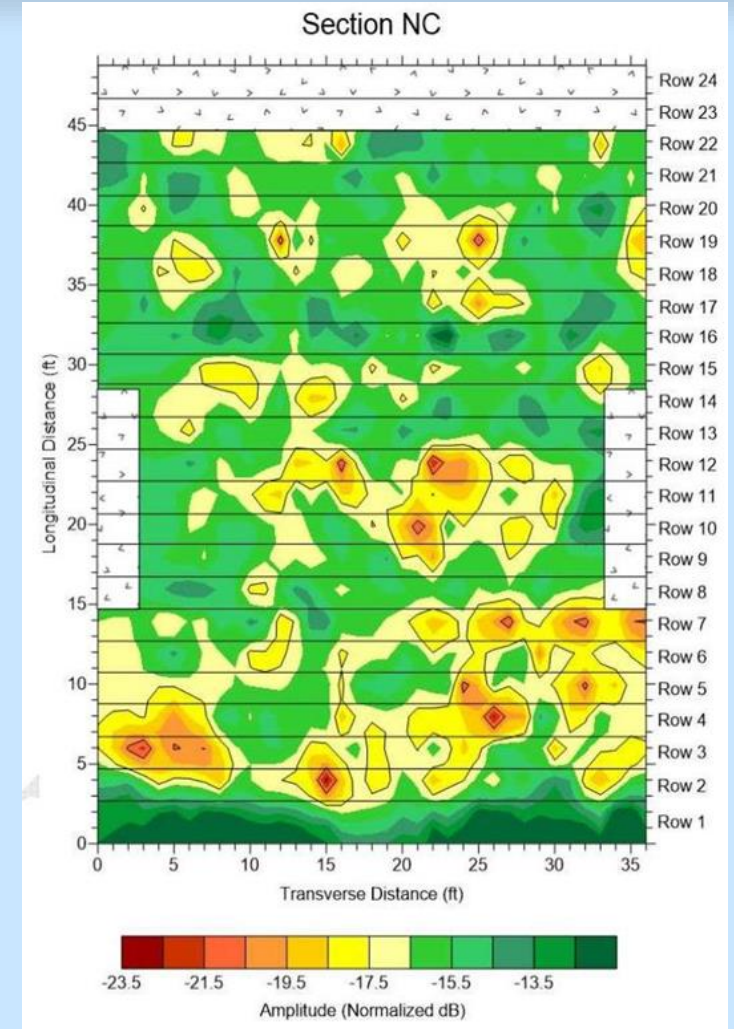
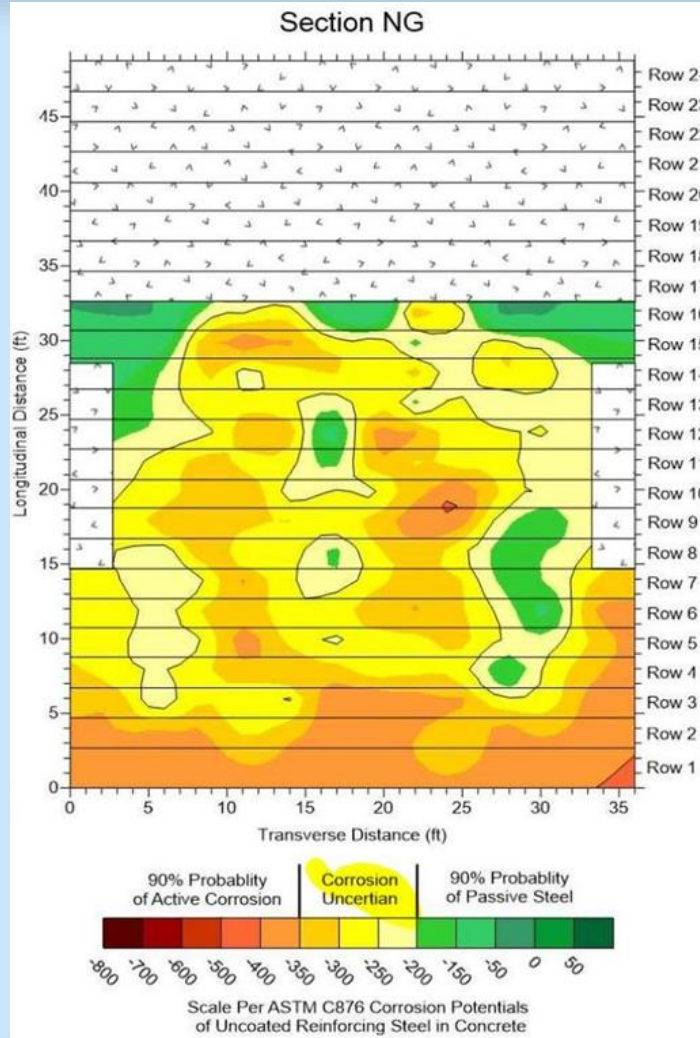


Figure A-2. Schematic of half-cell potential measurement (figure courtesy of N. Carino).



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Evaluation

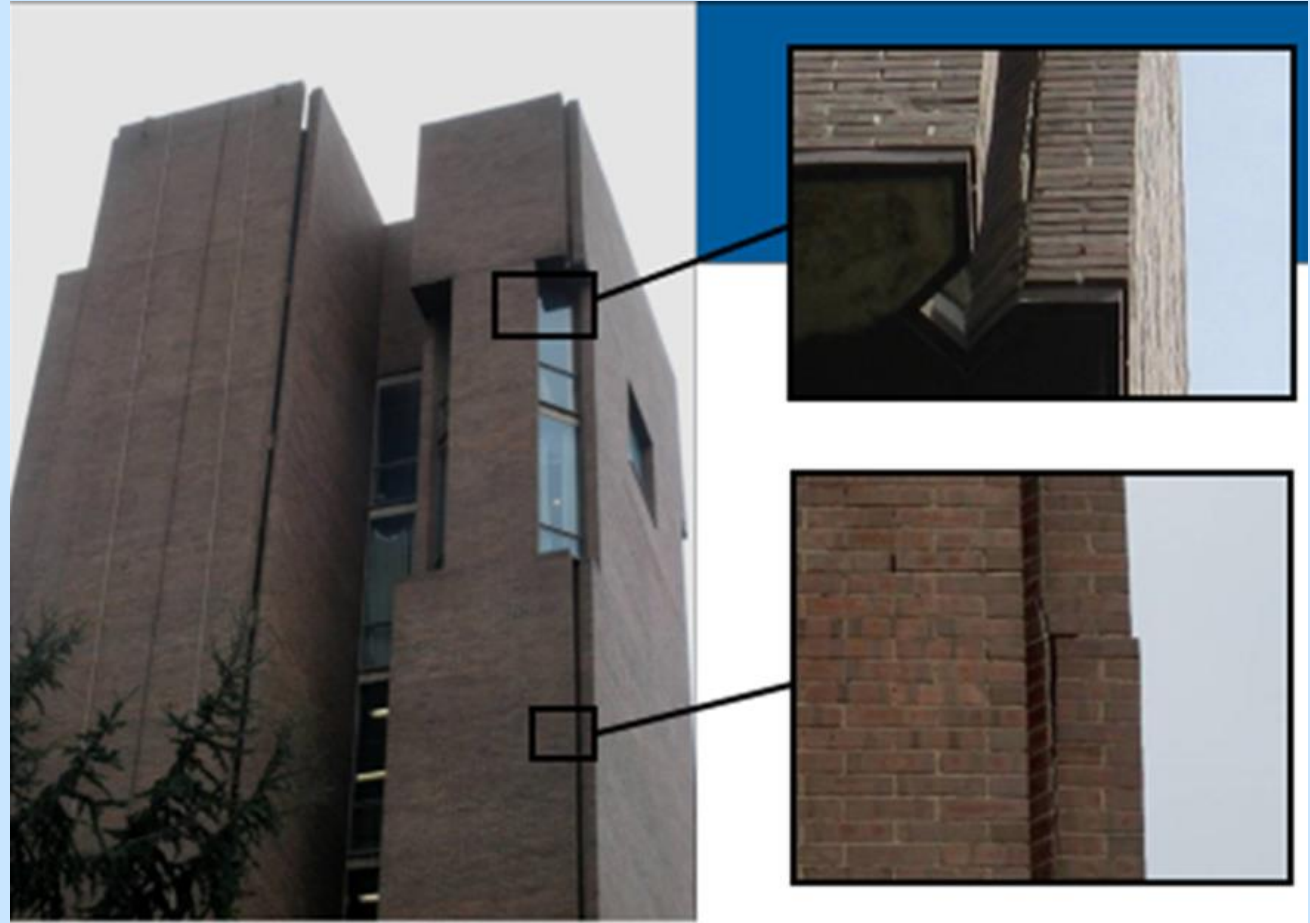


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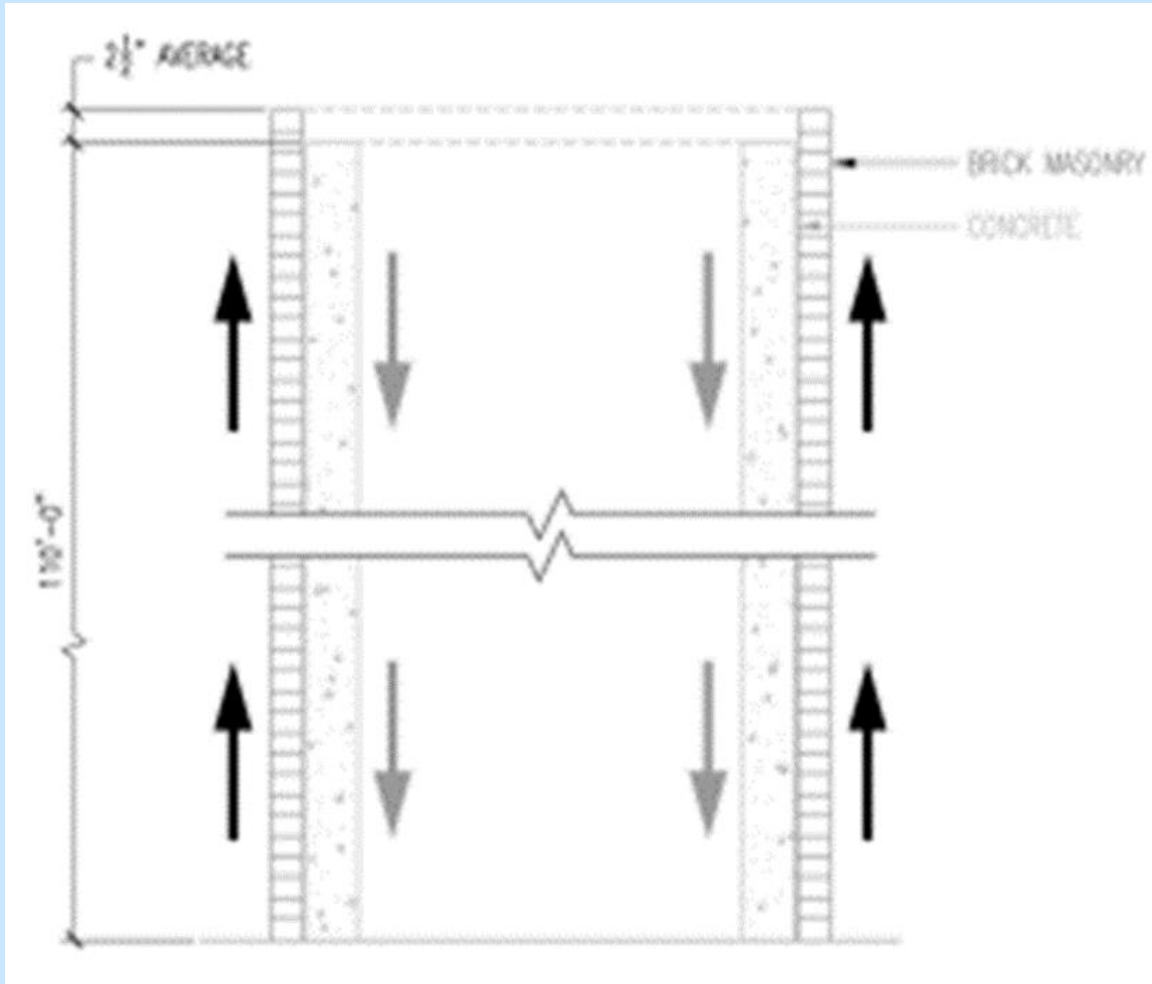
Structural behavior

- **Creep, long-term deformation**
 - Shortening of columns, walls
 - Deflection in thin slabs, cantilevered beams
- **Volume change effects**
 - Thermal
 - Internal prestress forces

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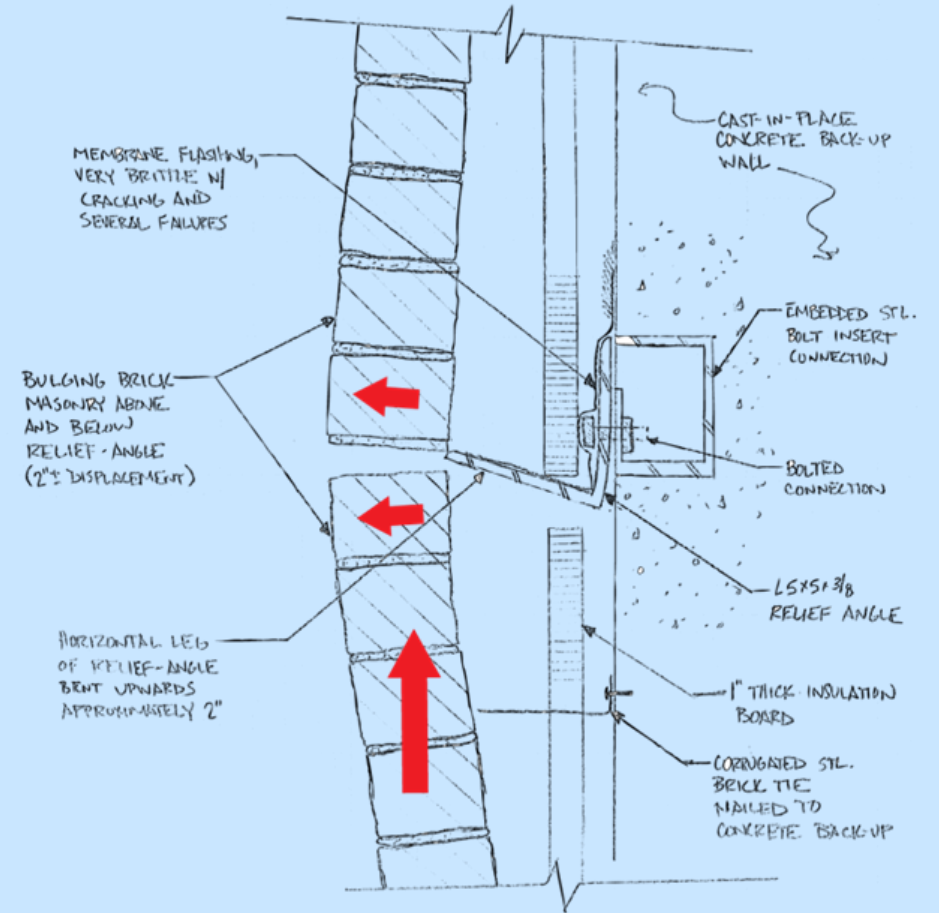
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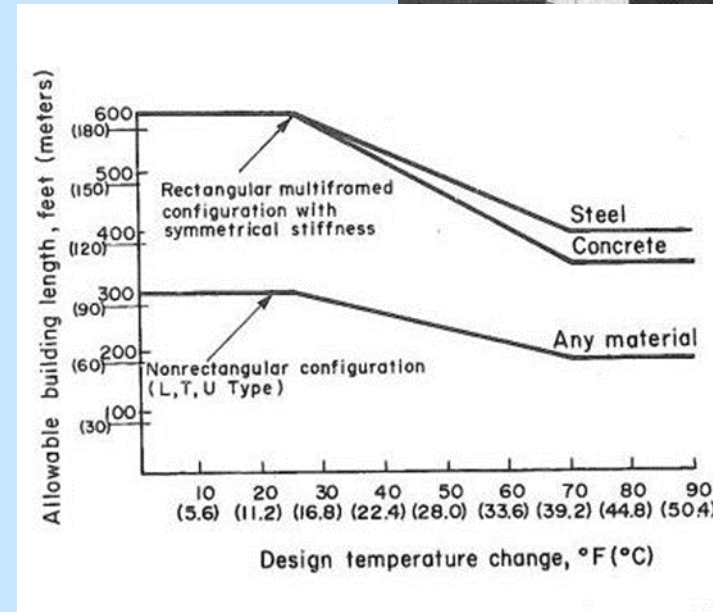
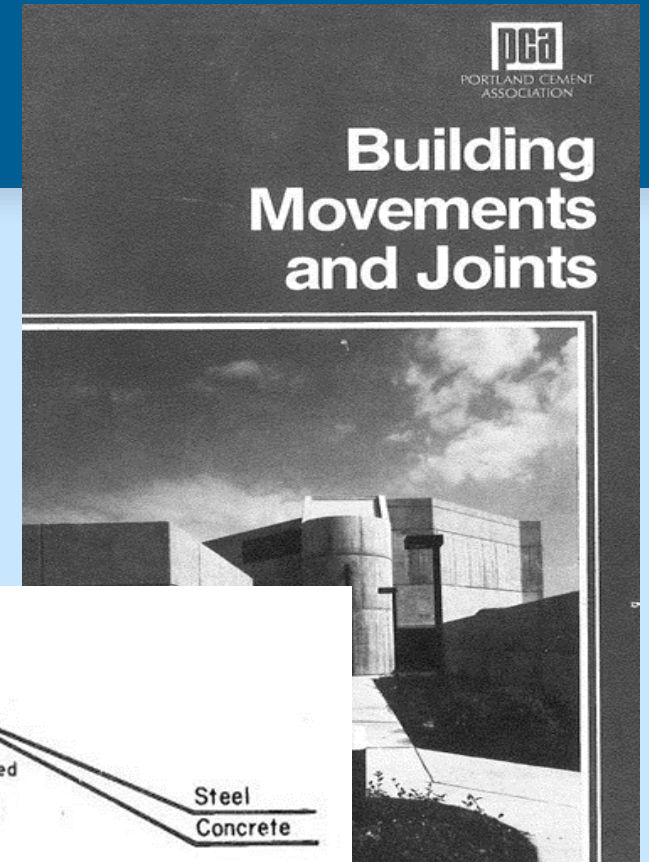
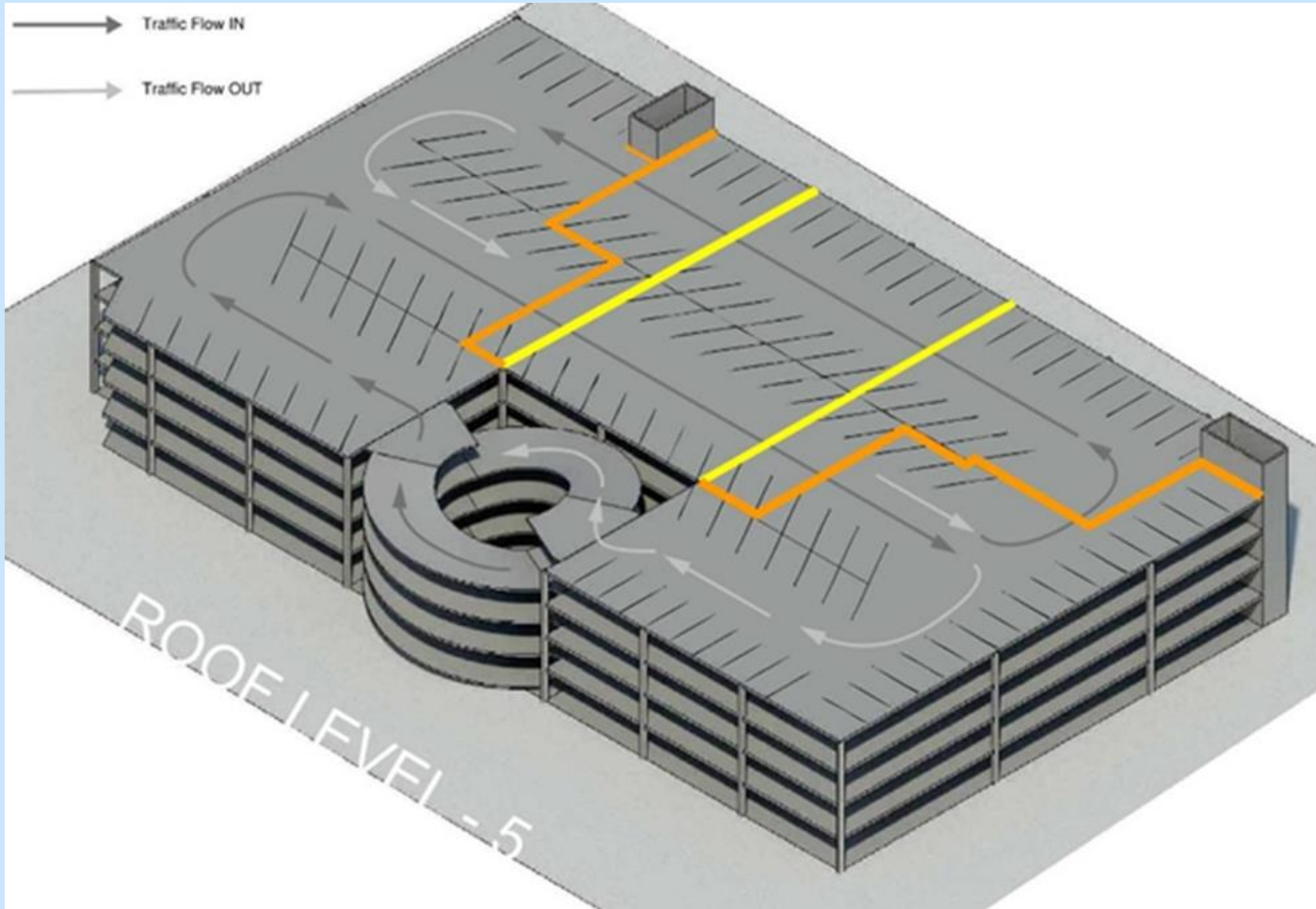


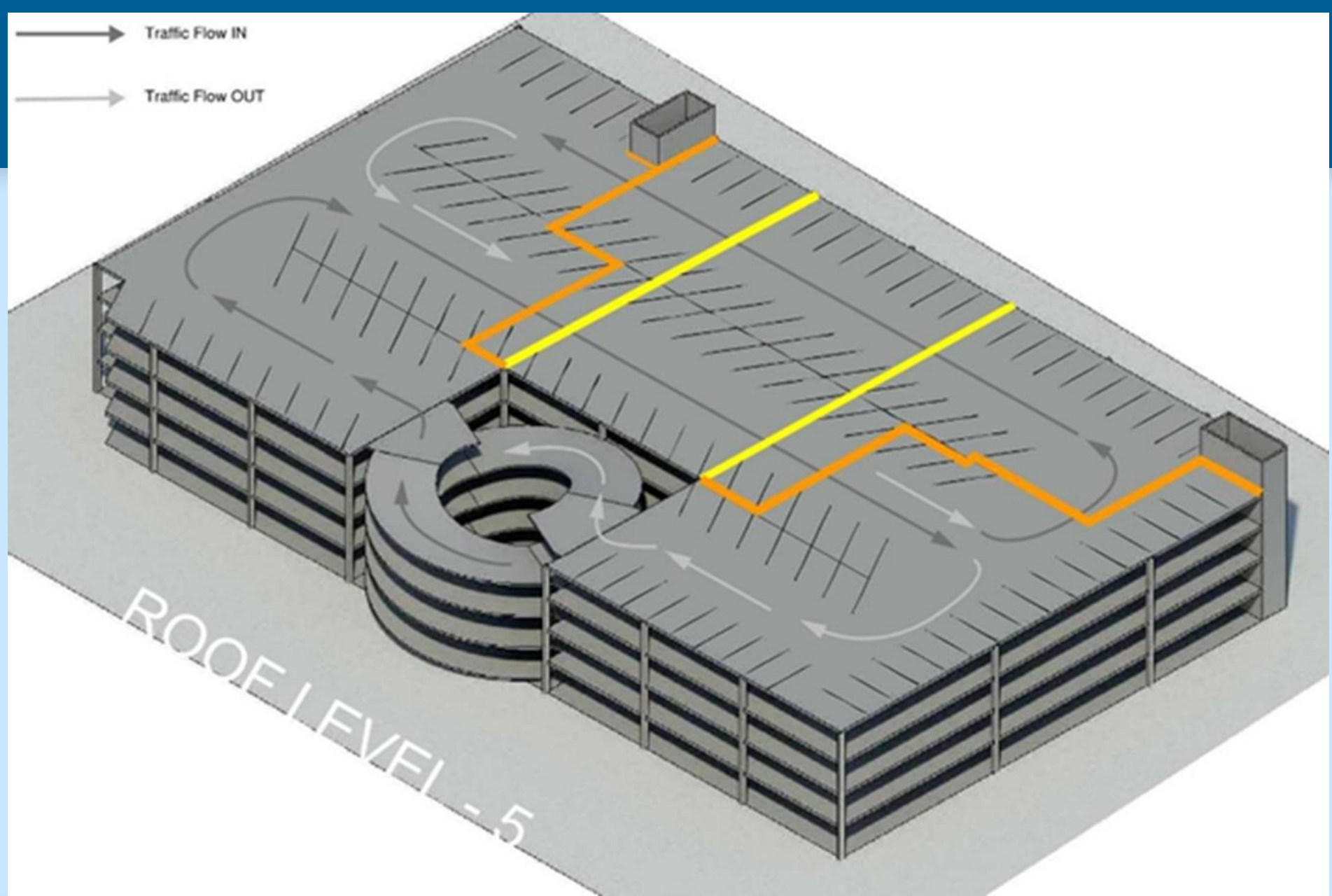
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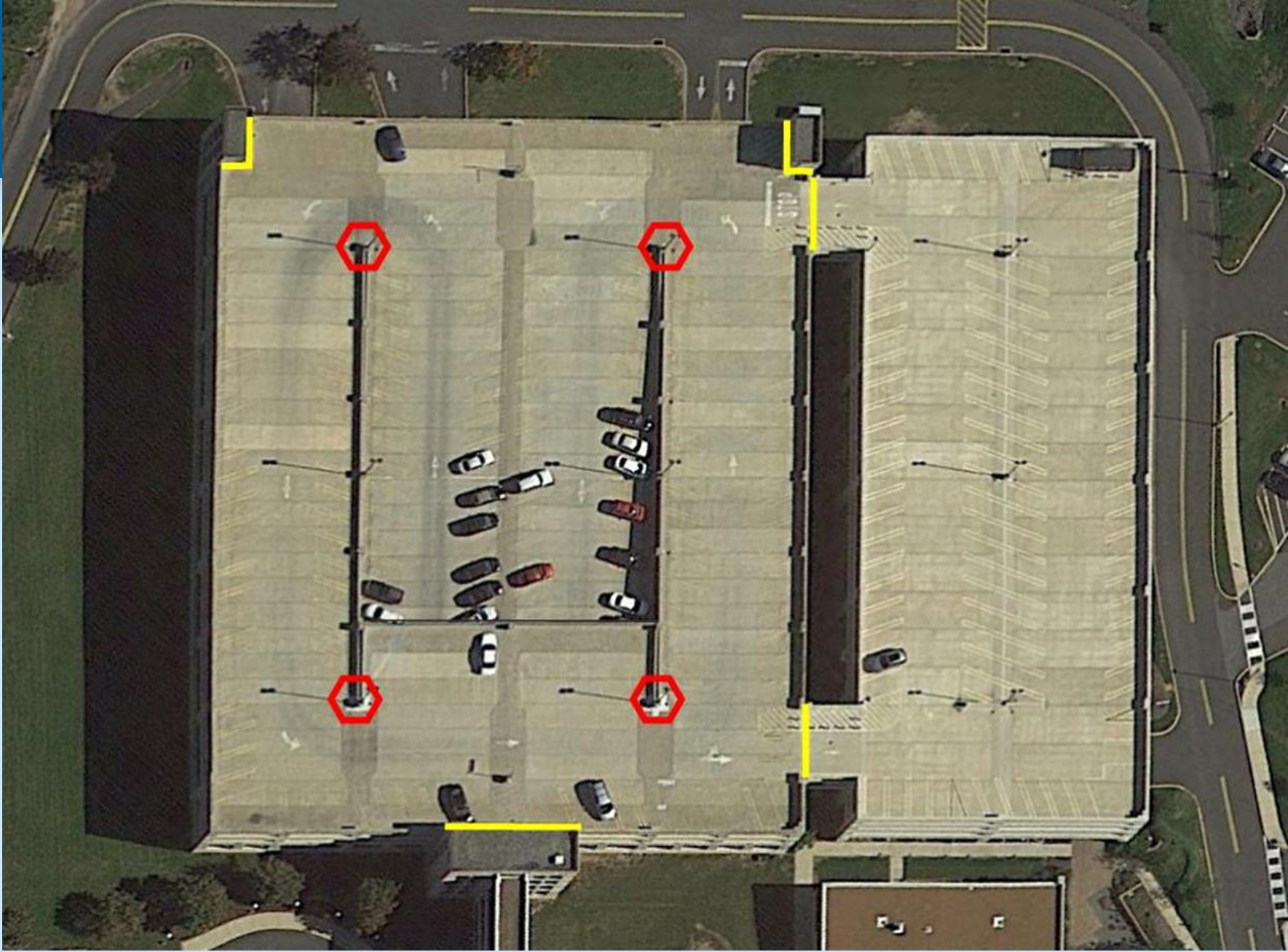




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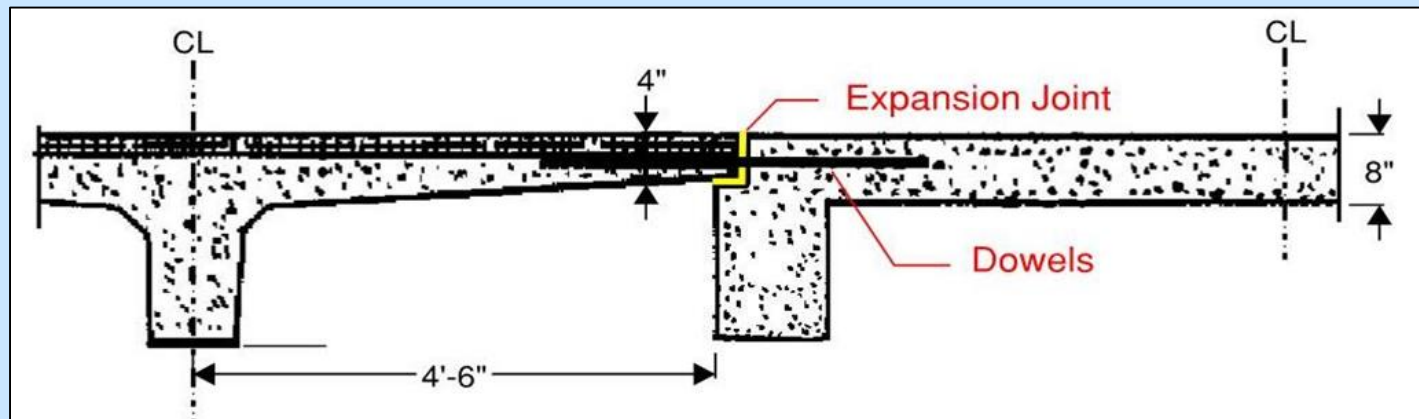
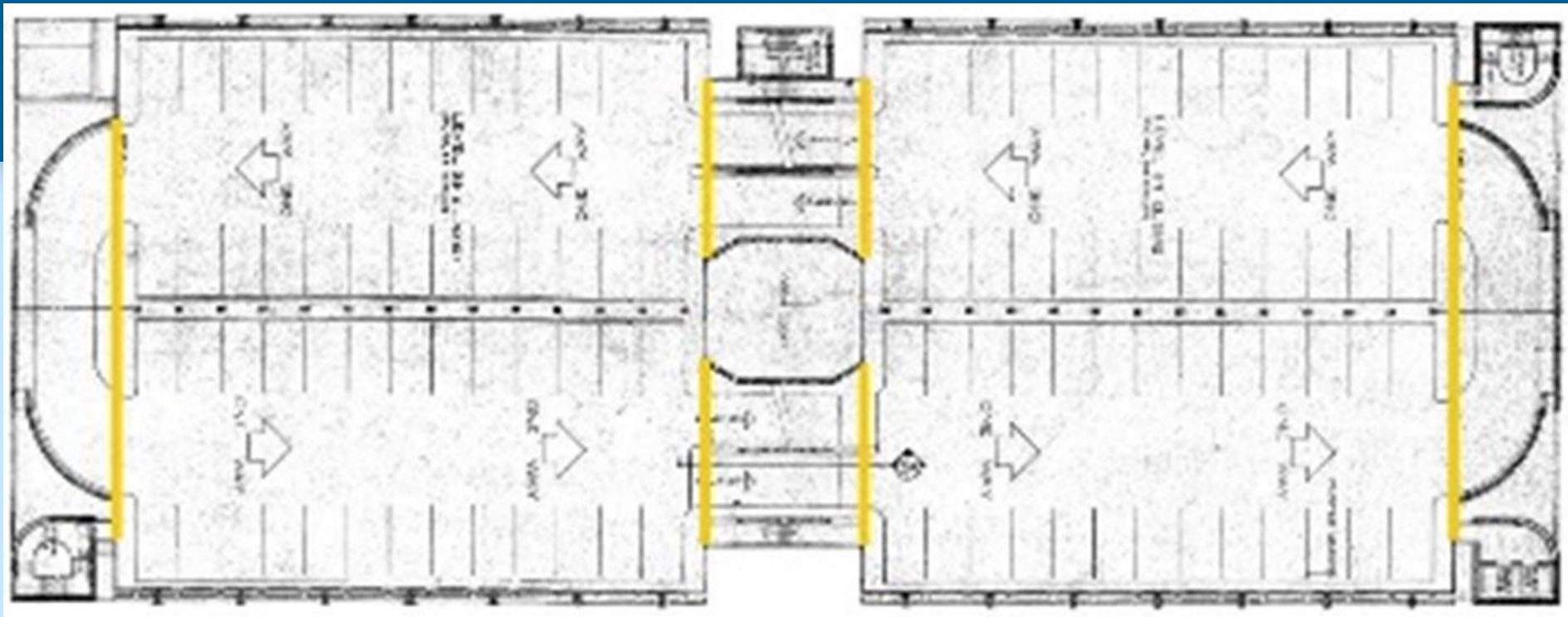




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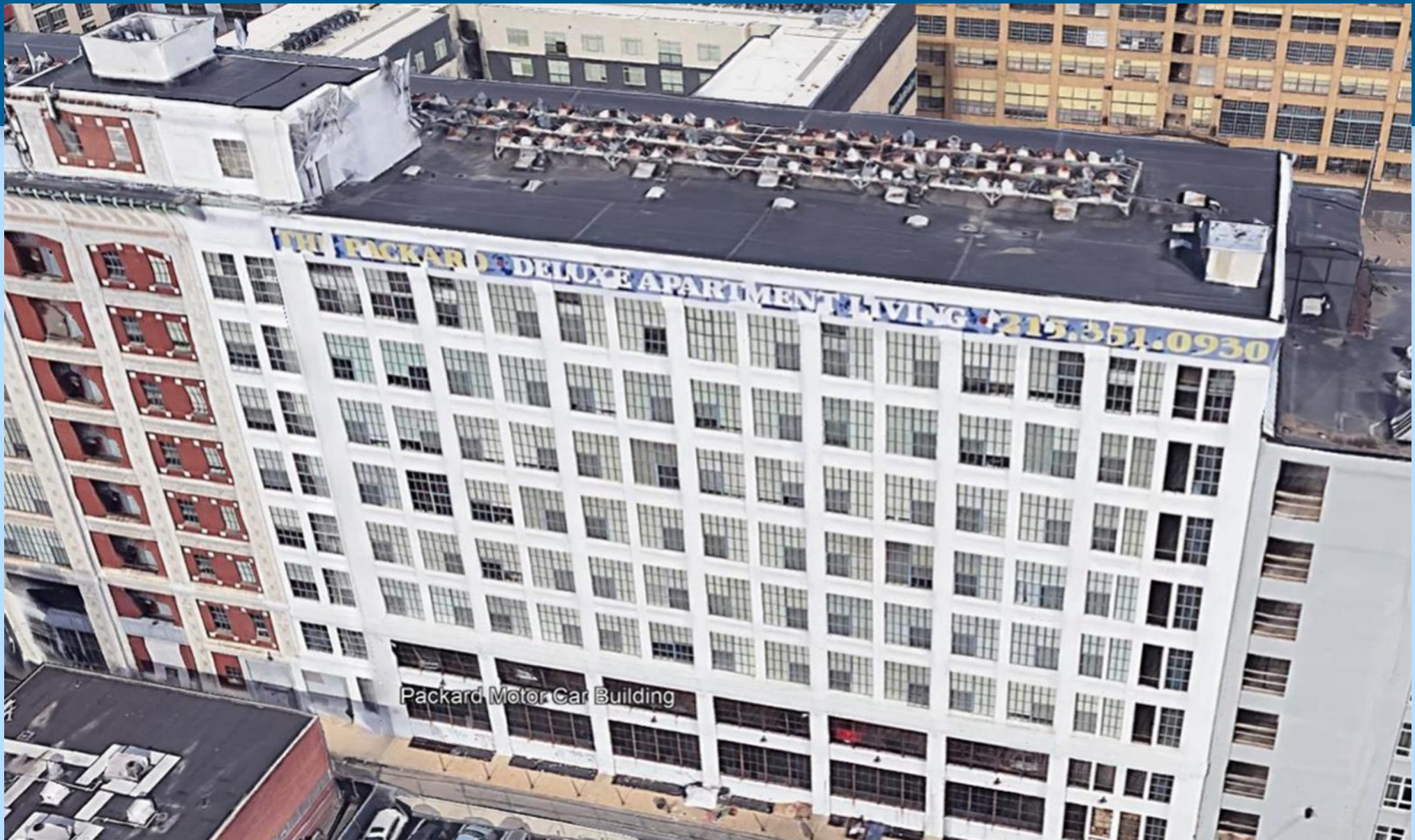
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Thank You



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