COMPOSITE BEHAVIOR OF PRECAST BRIDGE DECK PANEL SYSTEMS

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Objectives of Research Program

- Examine the creep and shrinkage behavior of deck panel systems.
- Look at construction practices and structural details that promote rapid construction.
- Examine horizontal shear behavior in deck panel systems to recommend.

Description of Lab Mockup

- 39.5 ft. simple span with 2 AASHTO Type II Girders, 8 ft spa. C.L. to C.L.
- 5 deck panels – 8’-0” x 12’-0” x 0’-8”
- 4 transverse joints – 2 MF joints and 2 FF joints
- 2 ft pocket spacing – live end
  4 ft pocket spacing – dead end

Description of Lab Mockup (Cont.)

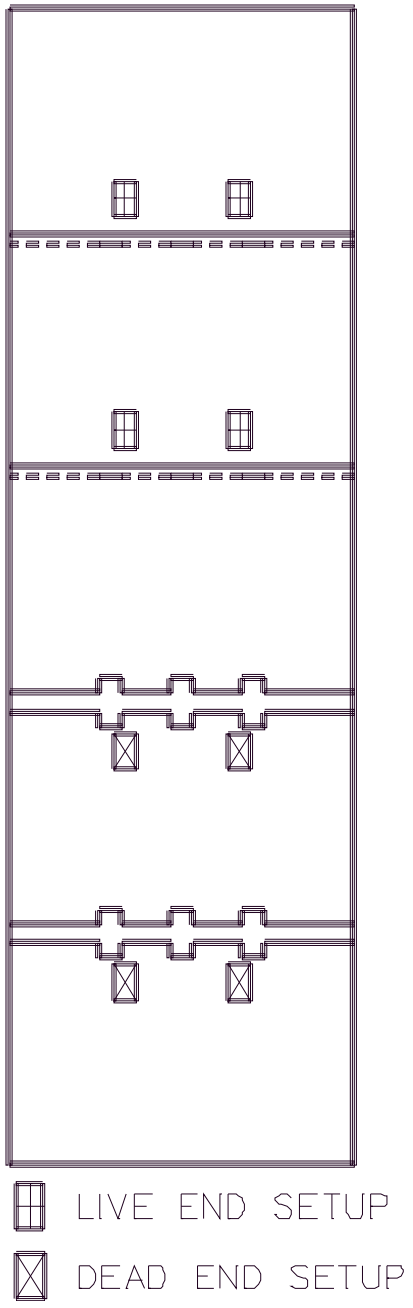
- 2 shear connector types
  - Hooked Reinforcing Bars – girder 1
  - New Shear Stud Detail – girder 2
- Combinations
  - 4 ft pocket spacing with Hooked Reinf. Bars
  - 2 ft pocket spacing with Hooked Reinf. Bars
  - 4 ft pocket spacing with Shear Studs
  - 2 ft pocket spacing with Shear Studs

Constructability Study

- Document all parts of fabrication and construction
  - Construction of the transverse joints
  - Post-tensioning operation and grouting the ducts
  - Forming and pouring the haunch
- Duration of each stage, problems encountered, and ease of construction of structural details was well documented

Live Load Testing

- 2 Test Setups
  - Dead End – 4 ft pocket spacing
  - Live End – 2 ft pocket spacing
  - Axle loads adjacent to transverse joints
- Cyclic Testing



Live Load Testing (cont.)

- Static Tests
  - Failure mode(s)
  - Cracking patterns
  - Strain levels in connectors
- Durability Testing - Ponding water at transverse joints

Live Load Testing (cont.)

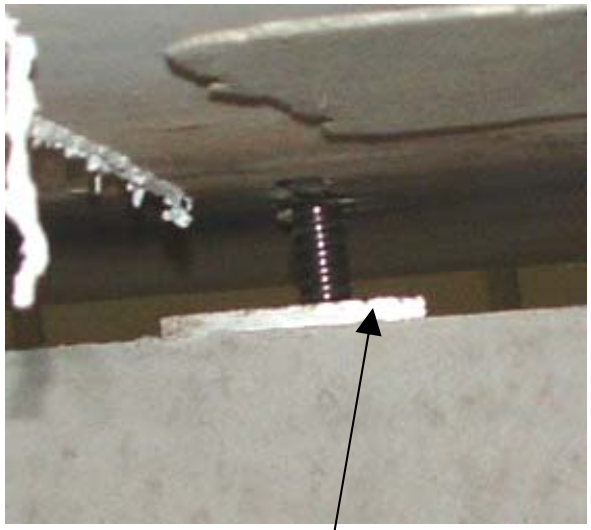
- Finite Element Study
  - Parameters varied:
    - # connectors,
    - type of connectors,
    - pocket spacing, and
    - distribution among pockets
  - Assesment of the AASHTO LRFD design provisions for horizontal shear transfer.

Constructability Study

- Rapid placement of panels possible with use of
  - F-F transverse joint configuration
  - Shear studs for shear connectors
- Problems with bowing of formwork for panels
  - Gaps along M-F joints
  - Additional epoxy injected to joints after p.t. operation

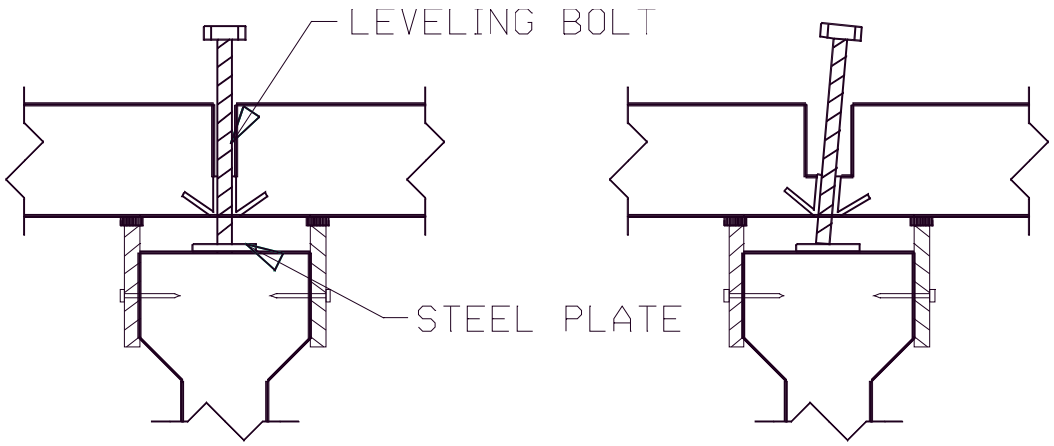
Constructability Study (cont.)

- Provide small steel plates for leveling bolts to bear on.
  - Avoid transferring load from deck to the girders through frictional forces at leveling bolt/girder interface.
- Providing uniform pocket spacing allows a single transverse strand pattern to be used in the panels.
  - Less strand used
  - Reduced material cost



Constructability Study (cont.)

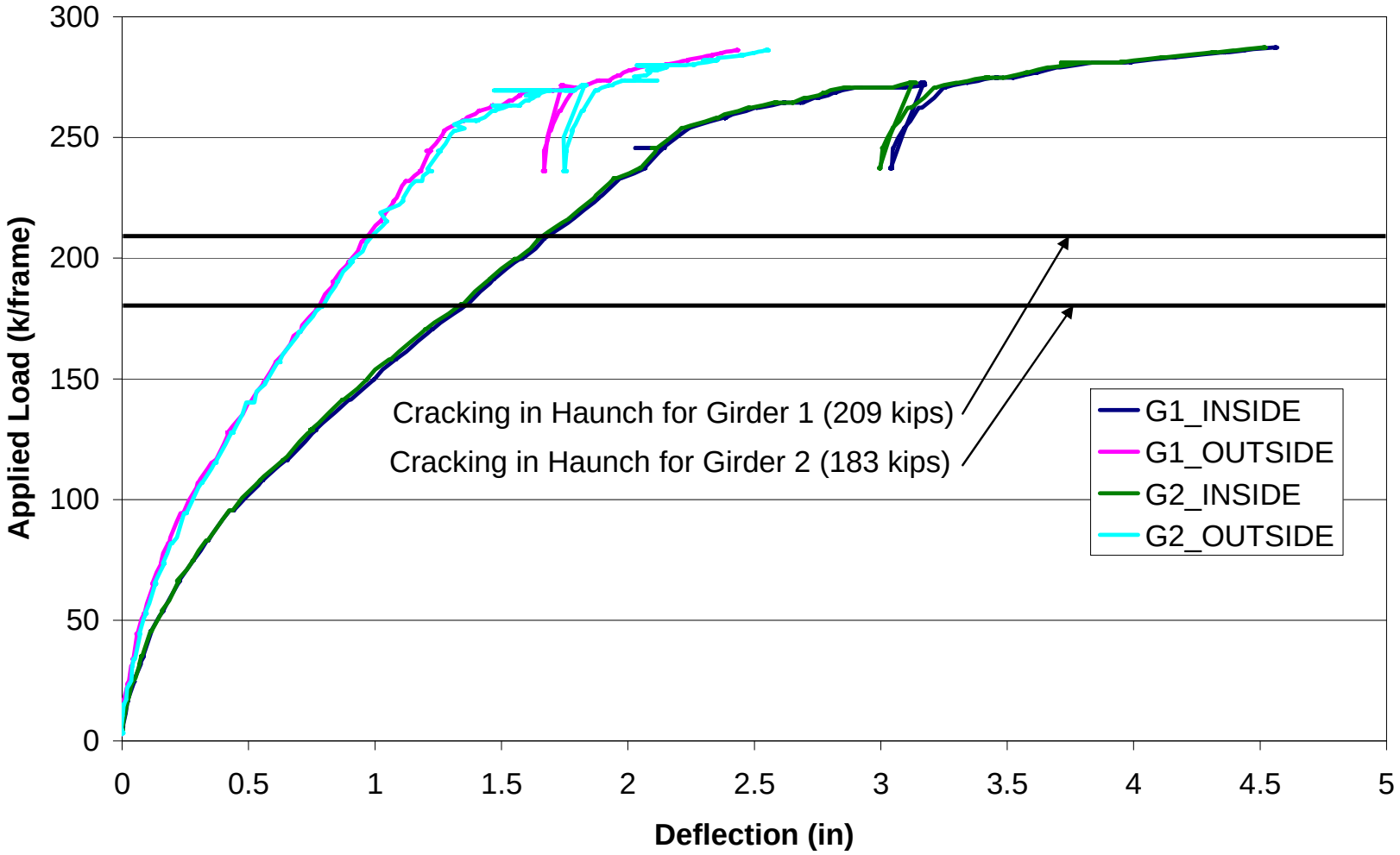
- Dayton Richmond Leveling bolt system recommended.
  - Need larger blockouts.



- Width of steel plate for new shear stud system should be detailed to be ½ in. less than the width of the top flange.

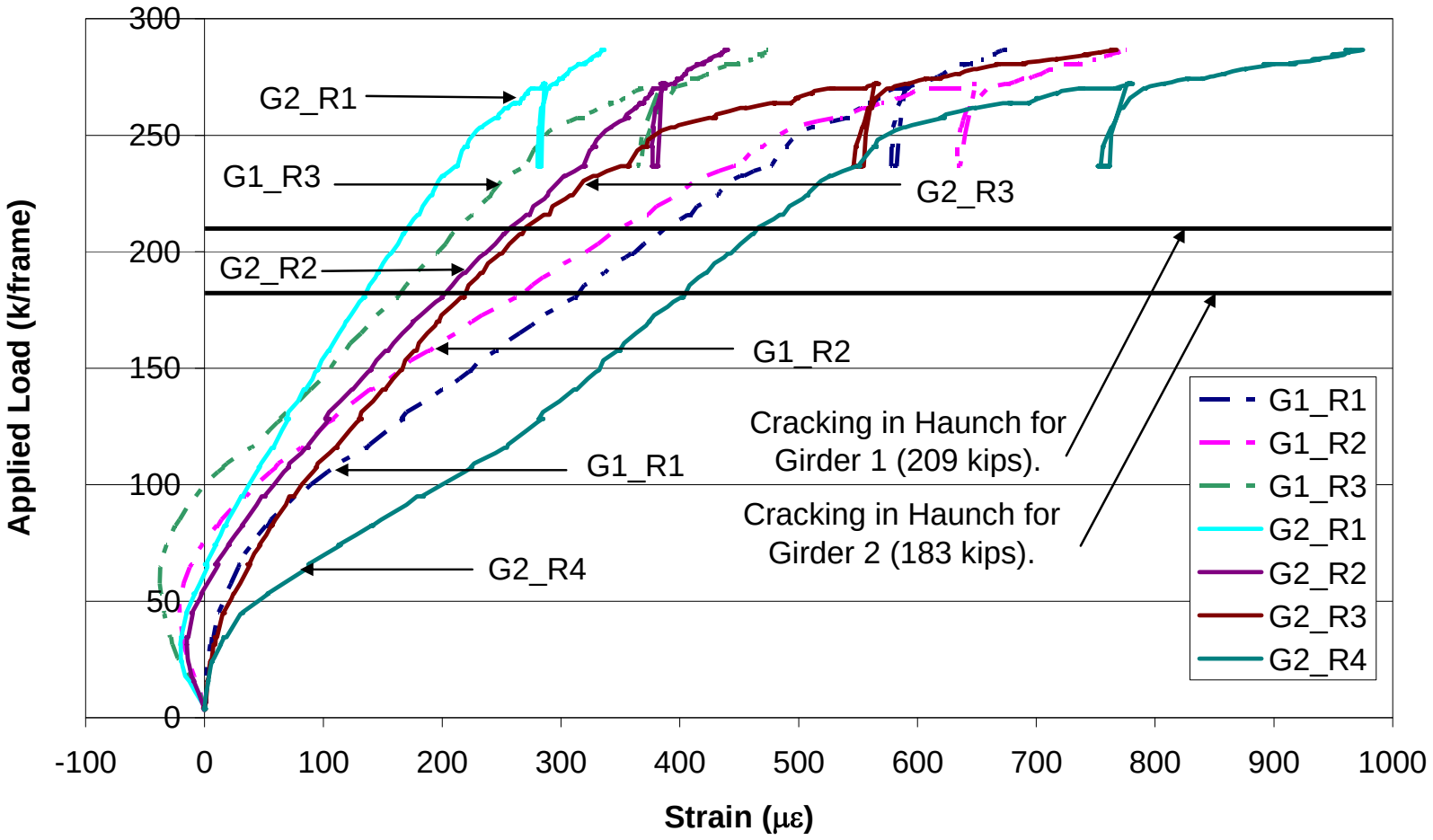
Live Load Testing

Dead End – 4 ft pocket spacing

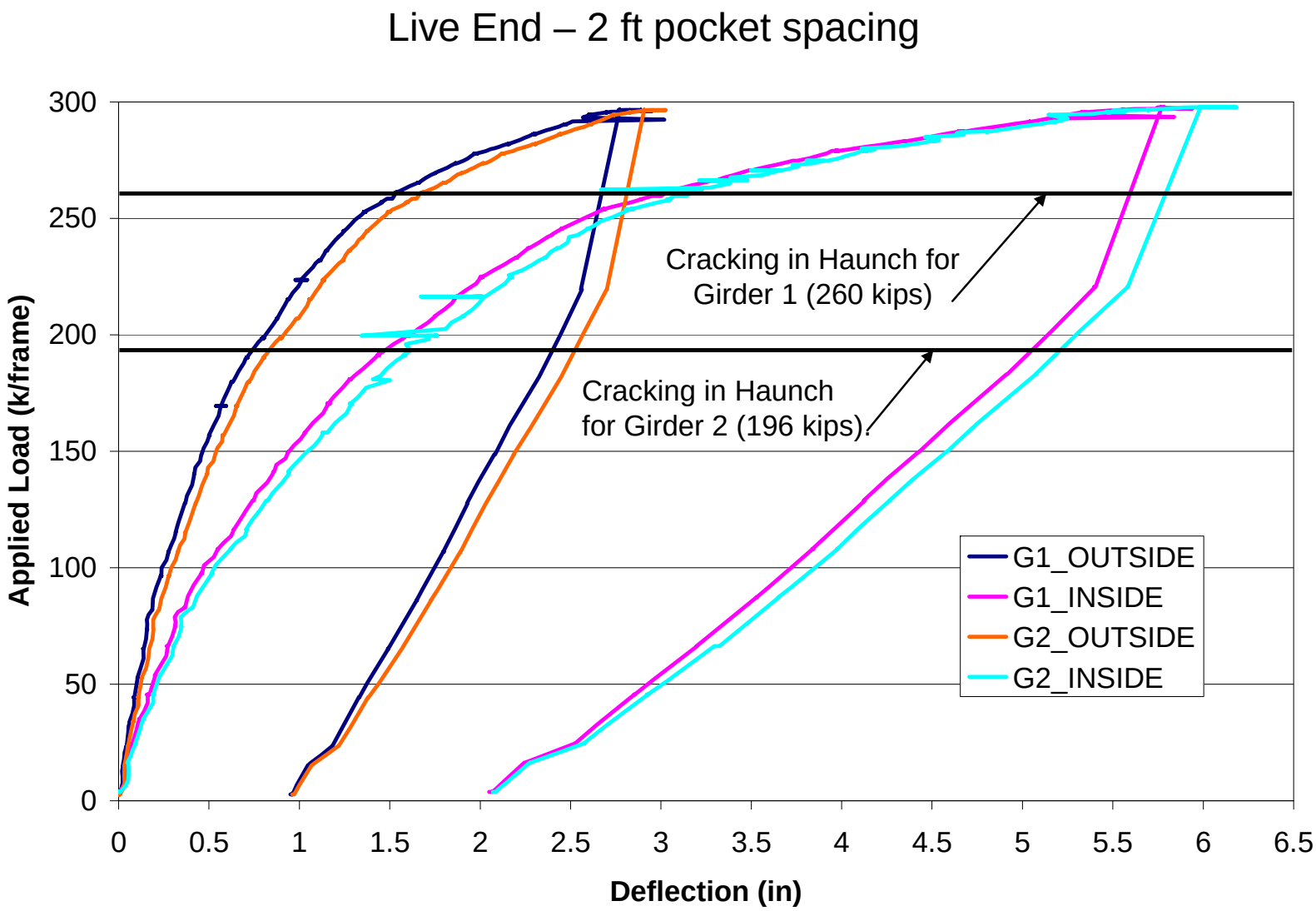


Live Load Testing (cont.)

Dead End – 4 ft pocket spacing



Live Load Testing (cont.)

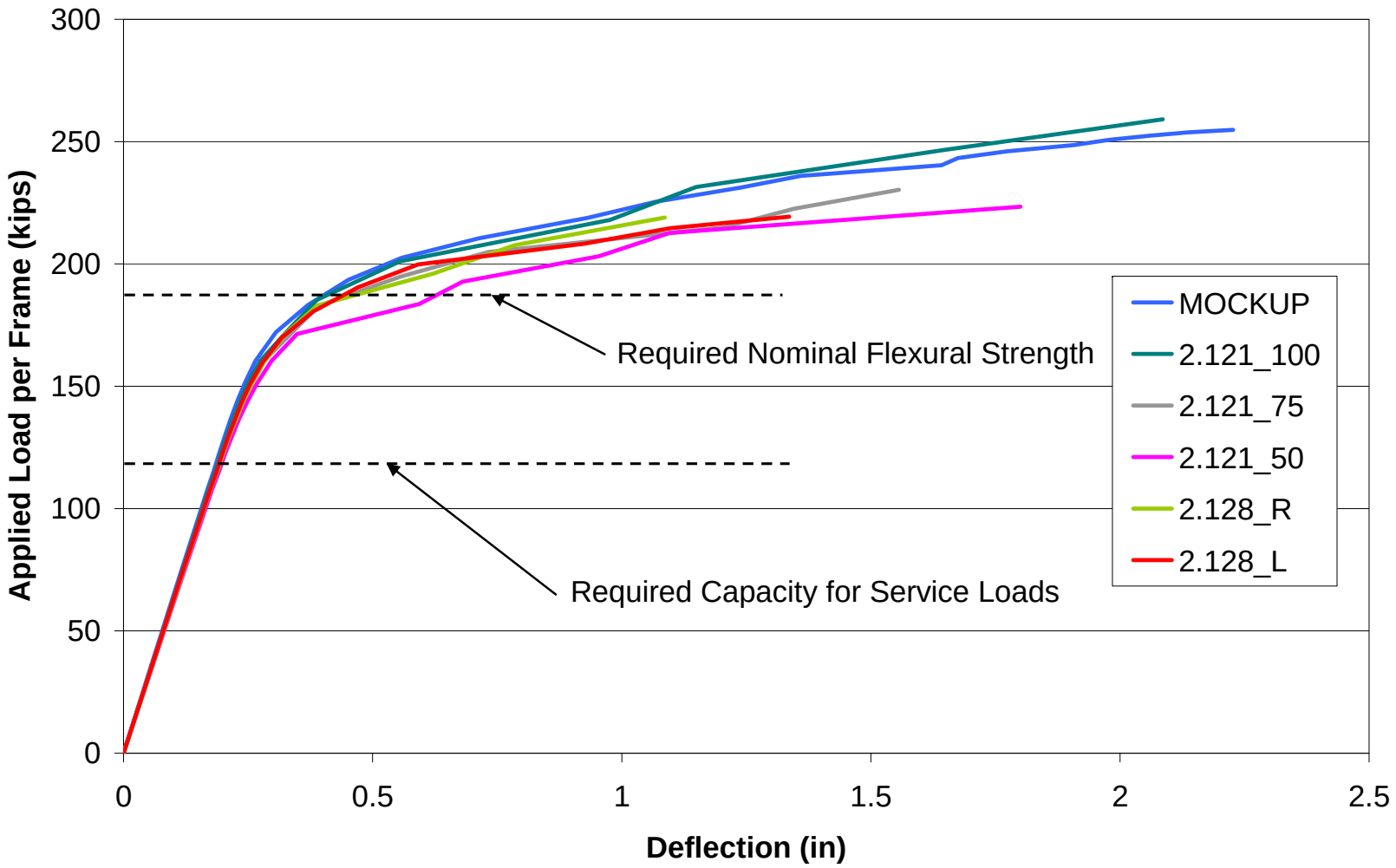


Live Load Testing (cont.)

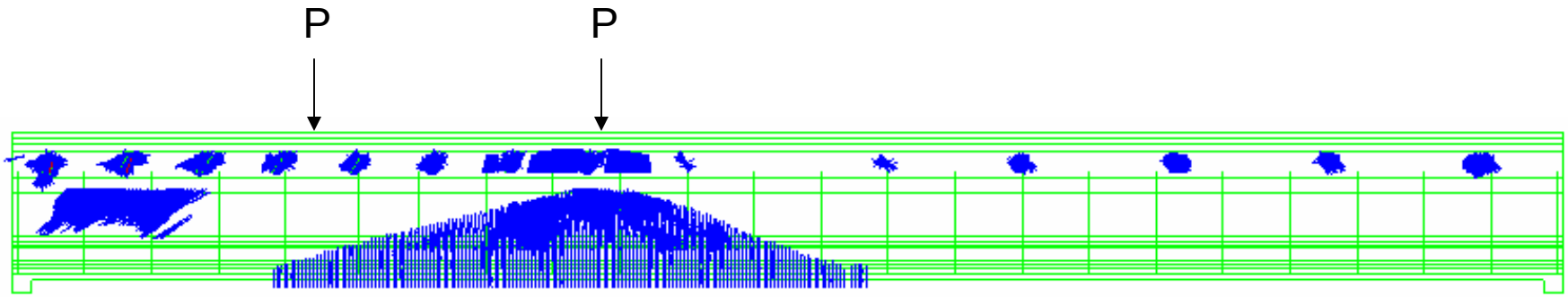
Comparison of Calculated Capacities and Test Values

	Required	Calculated	Dead End	Live End
Flexure (k-in)	15,500	24,800	23,700	24,500
Vertical Shear (k)	152	226	206	213

Live Load Testing (cont.)



Live Load Testing (cont.)



Live Load Testing (cont.)

- Satisfactory performance
  - 2 ft and 4 ft pocket spacing
  - Hooked reinf. bars and new shear stud detail
- Performance of system not affected by cyclic testing.
- Transverse joints – Leaking for epoxied MF joints.

Live Load Testing (cont.)

- Cracking pattern is not dependent on
  - Pocket spacing,
  - Shear connector type,
  - Shear connector distribution among the pockets,
  - Cracks propagated to the load points.

Live Load Testing (cont.)

- Application of shear friction equation to horizontal shear design for deck panel systems:

$$A_{s\_pocket} = \frac{\frac{V_u l_v}{d_e \phi} - b_v l_v c}{\mu} - P_c}{f_y}$$

$V_n \le \min(0.2 f_c' A_{cv}, 5.5 A_{cv})$ where, $A_{cv} = b_v l_v$

QUESTIONS ?