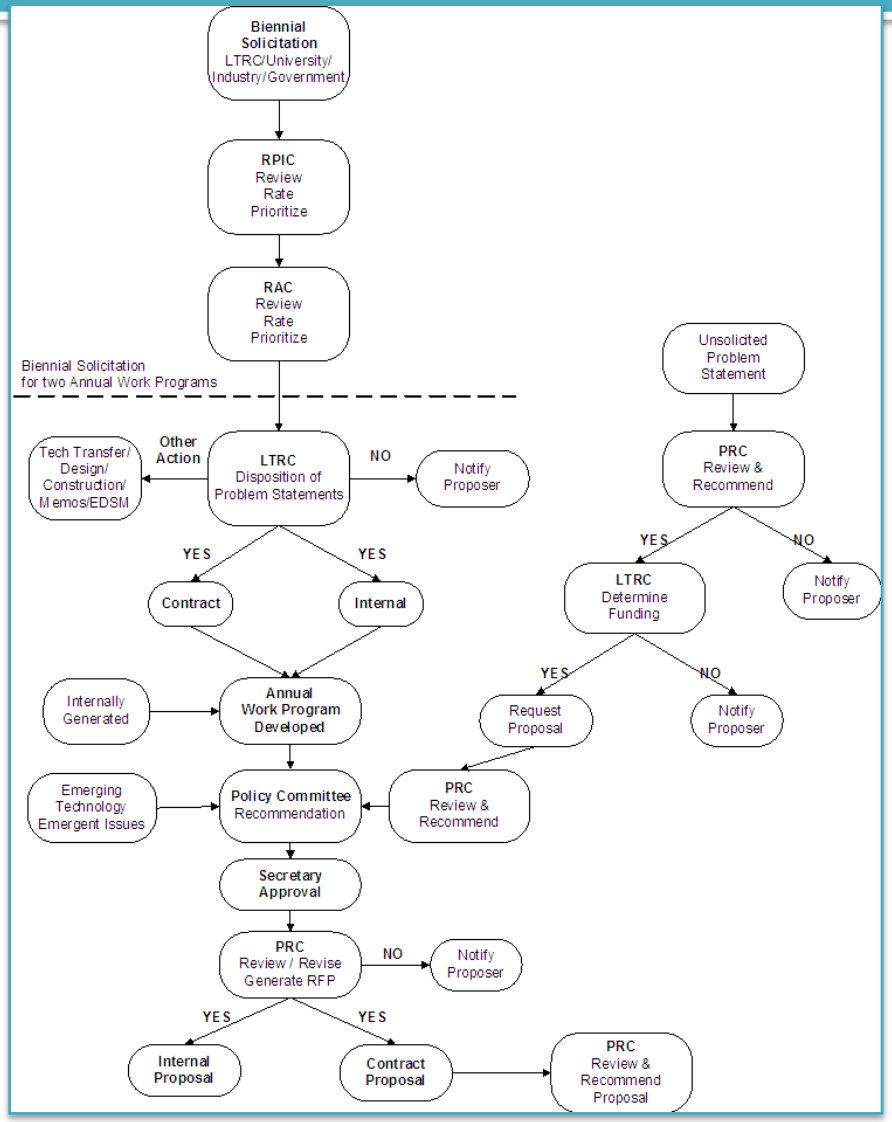
Louisiana Transportation Research Center

2008 Seminar Series
Bridge Structures

Session 5
Innovative Bridge Research Projects

at
LTRC / LA DOTD

In The Beginning…



Here They Come…

1. LTRC 01-1ST

P.I. Dr. Aziz Saber

LA Tech University.

Continuity Diaphragm for Skewed Continuous Span Prestressed Concrete Girder Bridges

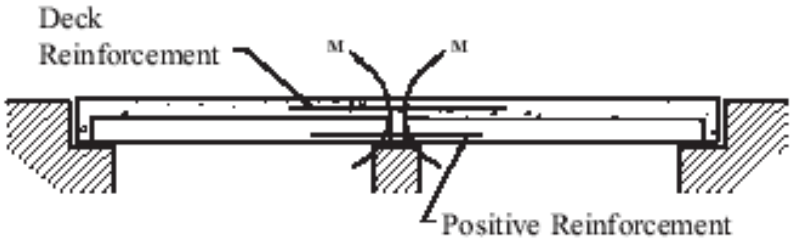
(RPIC Award)

LTRC 01-1ST

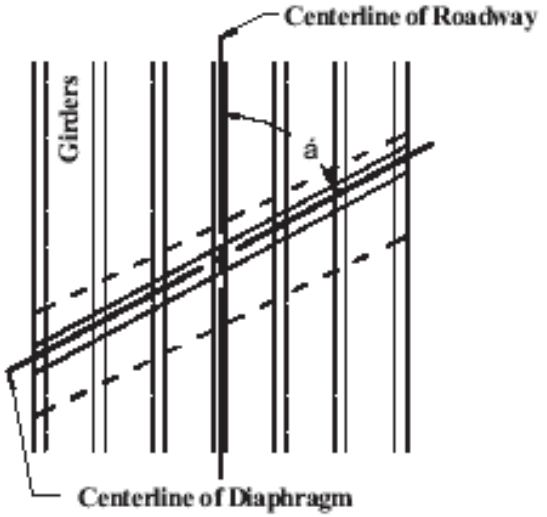
- Problem
- Continuity diaphragms used in prestressed girder bridges on skewed bents cause difficulties in detailing and construction.
- Details for small skewed bridges (30°from perpendicular) have not been a problem.
- However, the problem is when skew angle increases or when and the girder spacing decreases, the connection and the construction become more difficult.
- Even the effectiveness of the diaphragm is questionable at these high skews.

LTRC 01-1ST

Simply supported girders: stage one of construction.



Casting of deck slab and diaphragm for continuity: stage two of construction.



The skew angle of the diaphragm is the angle between the centerline of the diaphragm and the roadway centerline.

LTRC 01-1ST

- The objective of the proposal is to (1) determine the need of continuity diaphragms, (2) study the load transferred through the diaphragms, (3) determine when a full depth diaphragm is required, and (4) to determine the minimum skew angle at which a diaphragm becomes ineffective.

LTRC 01-1ST

- This study answered the first and second parts of the objective. The third and the fourth part of the objective were not carried out since the results from this study did not warrant that. Furthermore, the results may not be conclusive and implementable since the study encompassed the theoretical aspect only.

2. LTRC 03-4ST

P.I. Drs. Paul Ziehl, Tony Lamanna, and V.J. Gopu

Tulane University

Strengthening of Bridge Beams Using Fiber Reinforced Polymers (FRP)

(IBRC Award)

2. LTRC 03-4ST

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- Project Status:
- Final Report is being reviewed before publication.

3. LTRC 05-3ST

P.I. Dr. Guoqiang Li

Louisiana State

Development of Advance Grid Stiffened (AGS) FRP Tube Encased Concrete Columns

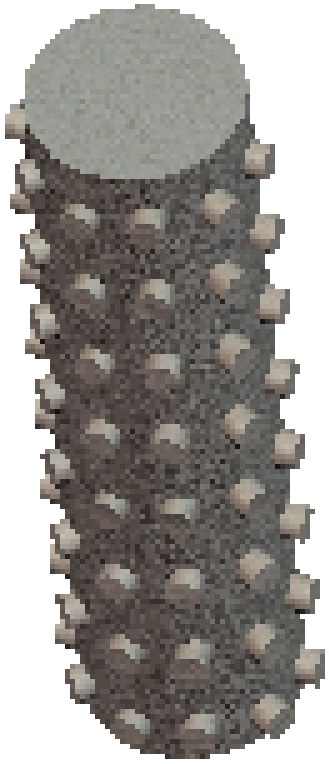
(IBRC Award)

3. LTRC 05-3ST

- The study's objective is to develop:

  A formwork-free, steel-free, maintenance-free, high compressive strength, high bending strength, and high ductility AGS ECCs for bridge pier/pile construction in corrosive environments

3. LTRC 05-3ST



3. LTRC 05-3ST

- **Implementation Potential**

  Once this project proves successful, a new generation of durable, reliable, and long-term

  cost-effective hybrid FRP/concrete columns will be available for design engineers to consider in the construction of bridge piers/piles.

4. LTRC 05-5ST

P.I. Dr. Steve Cai
Louisiana State University

Development and Performance Evaluation of Fiber Reinforced Polymer Bridge

(IBRC Award)

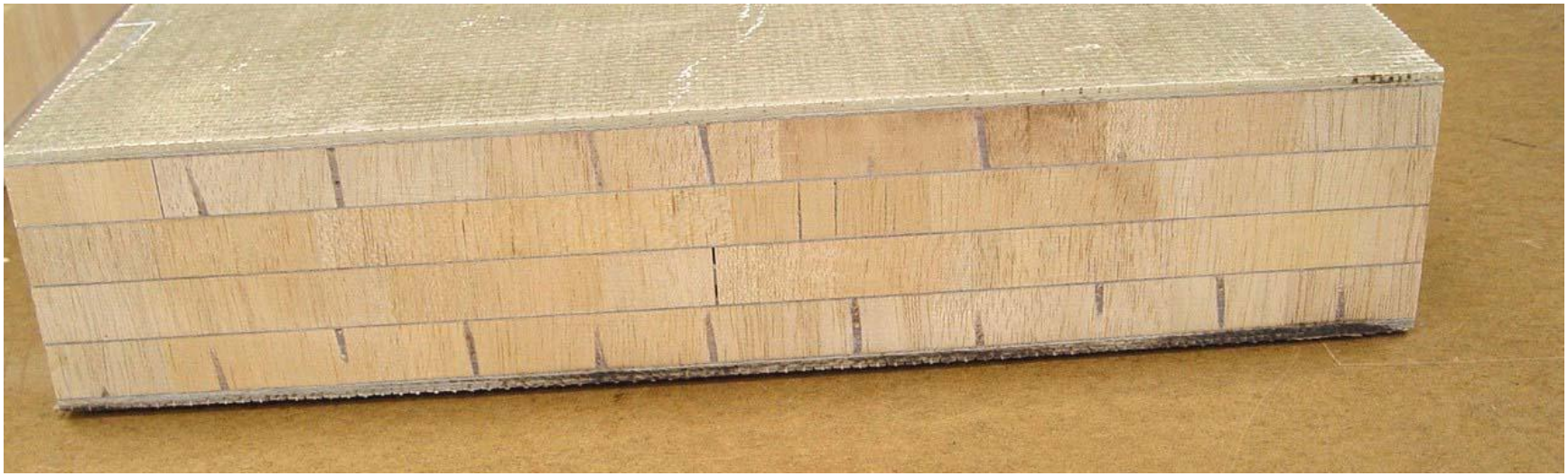
4. LTRC 05-5ST

What is wrong with this picture?

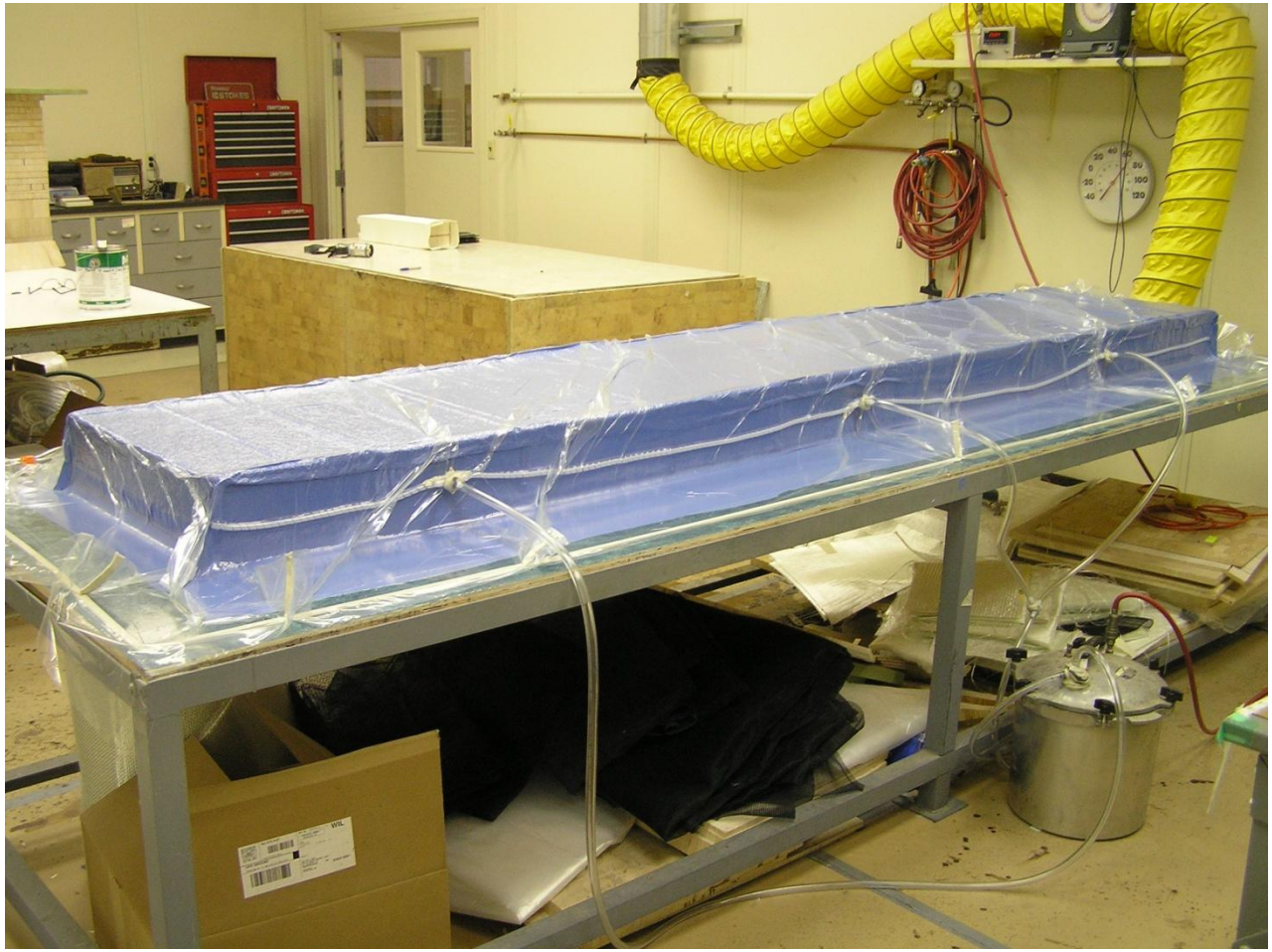
4. LTRC 05-5ST

- This proposed study will be develop an FRP bridge deck to replace the damaged existing one.
- The long-term performance of the bridge will then be monitored throughout its service. Taking advantages of the new development in FRP materials, this demonstration project will potentially provide a new approach to enhancing the transportation infrastructure in Louisiana.

4. LTRC 05-5ST



4. LTRC 05-5ST



4. LTRC 05-5ST

5. LTRC 06-1ST

P.I. Dr. George Voyiadjis
Louisiana State University

Feasibility of Tubular Fender Units for Pier Protection against Vessel Collision

(RPIC Award)

5. LTRC 06-1ST

- The objective of this study was:
- identify existing protective systems
- propose new systems that can be used to mitigate the effects of bridge/vessel collisions.

5. LTRC 06-1ST

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5. LTRC 06-1ST

.6. UHMW Marine Plastic Material Panel

5. LTRC 06-1ST

Figure A15. Schuyler Rubber's Laminated Rubber Fenders

5. LTRC 06-1ST

Seapile and SeaTimber Marine Composite (SEAWORD, Trelleborg Group)

5. LTRC 06-1ST

Conclusion:

Several fender system configurations were submitted to the PRC when a presentation of the findings of the study was given to the PRC.

6. LTRC 06-2ST

P.I. Dr. Guoqiang Li
Southern University
Co-P.I. Dr. Aziz Saber
Louisiana Tech University

Elimination of Deck Joint Using a Corrosion-Resistant FRP Approach (RPIC Award)

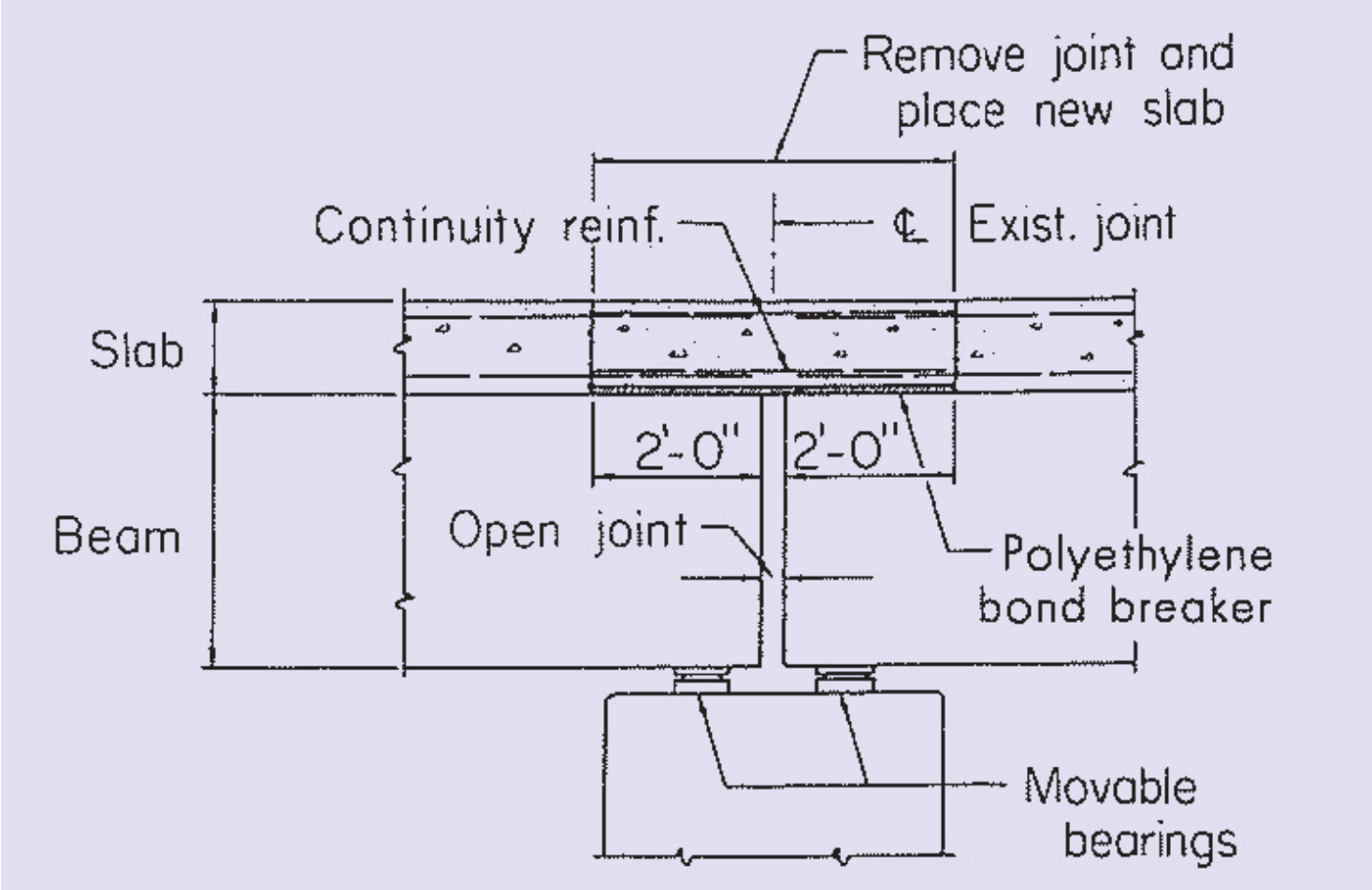
6. LTRC 06-2ST

- The objective of this research is to develop and evaluate a new technique using the advancements in materials and current technology.
- This new technique will eliminate joints in bridge decks without changing the design of the bridge.

6. LTRC 06-2ST

- Expansion joints will be replaced by a link slab that joins decks of adjacent spans without imposing any continuity in the bridge girders.

6. LTRC 06-2ST


Remove joint and place new slab
Continuity reinf.
℄
Exist. joint
Slab
2'-0"
2'-0"
Beam
Open joint
Polyethylene bond breaker
Movable bearings

5. LTRC 06-2ST

- Implementation potential
- The results from this research will be implemented in the design and construction of bridge decks built in Louisiana, with implementation possible in other states as well.
- Bridge construction and maintenance costs would be reduced.

7. LTRC 06-3ST

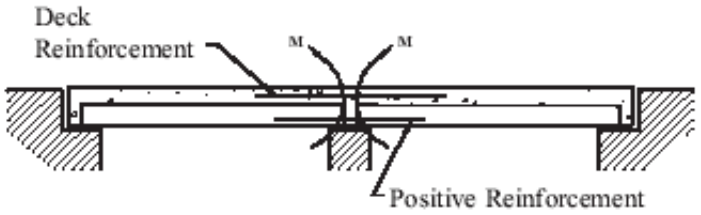
- P.I. Dr. Aziz Saber
- Louisiana Tech University

Field verification for Continuity Diaphragm for Skewed Continuous Span P/S P/C Bridges

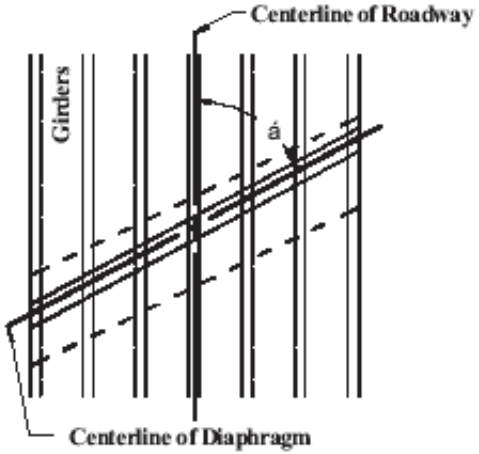
(RPIC Award)

7. LTRC 06-3ST

Simply supported girders: stage one of construction.



Casting of deck slab and diaphragm for continuity: stage two of construction.



The skew angle of the diaphragm is the angle between the centerline of the diaphragm and the roadway centerline.

7. LTRC 06-3ST

- This study is a field verification of finding of LTRC 01-1ST

8. LTRC 07-1ST

P.I. Dr. Murad Abu-Farsakh

LTRC / LSU

Structure Health Monitoring of I-10 Twin Span Bridge

(IBRD Award)

8. LTRC 07-1ST

- The main objective of this research project is to establish a bridge substructure health monitoring system for use in the short-term and long-term monitoring purposes:

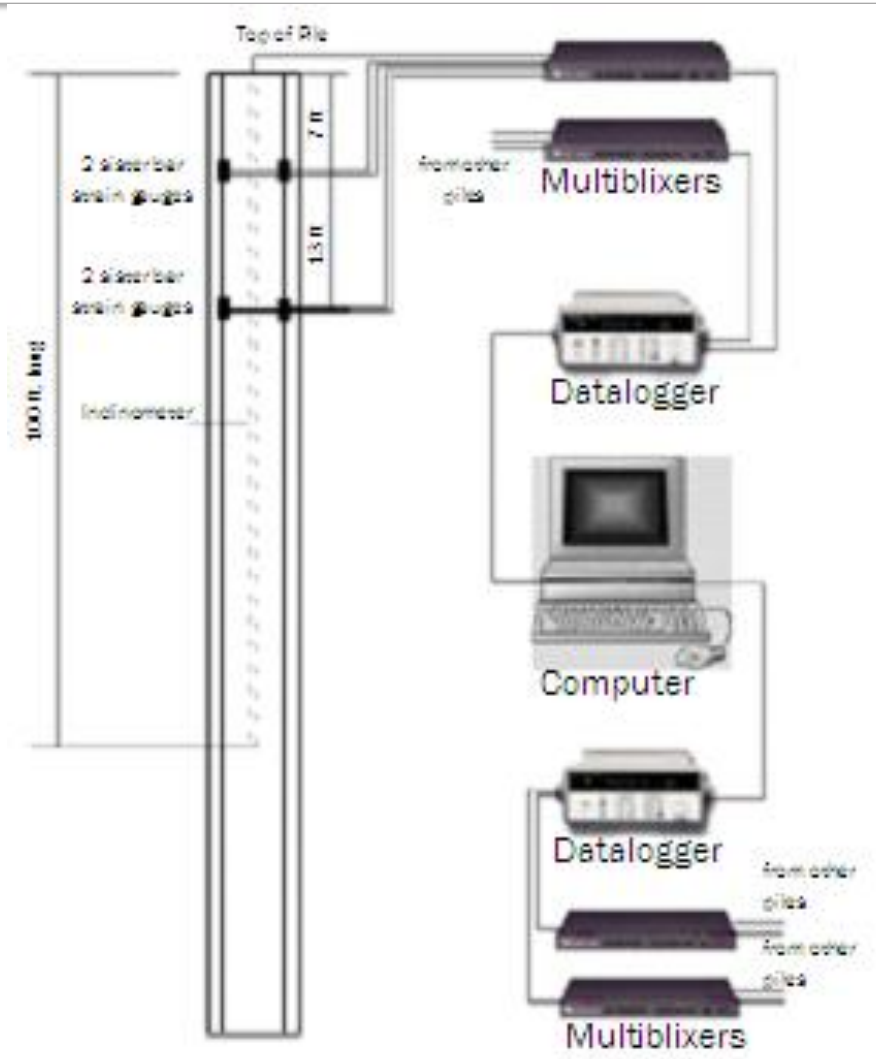
8. LTRC 07-1ST

- Short-term monitoring: to validate the applicability of the FB-MultiPier analysis for predicting the performance of battered pile group system under lateral loading, and to develop (or back-calculate) the p-y multipliers for battered pile groups in similar soil conditions by conducting lateral static load test.

8. LTRC 07-1ST

- Long-term monitoring: to evaluate the behavior of pile group structure under dynamic loads caused by selected events (winds, waves and vessel collision).
- Provide data developing a better rational approach in the design process of battered pile group.

8. LTRC 07-1ST


Top of Pile
7 m
13 m
Multiblixers
Datalogger
Computer
Datalogger
Multiblixers

8. LTRC 07-1ST

- The results of the proposed research will be implemented in the design and construction of bridge foundations that are built every year in the State of Louisiana and could be extended to other states. The outcome of this research will reduce the construction and maintenance cost of bridges in the state of Louisiana and the Nation.

9. LTRC 07-3ST

P.I. Dr. Steve Cai
Louisiana State University

Repairing / Strengthening of Bridges with post-Tensioned FRP strands and Performance Evaluation

(IBRD Award)

9. LTRC 07-3ST

- The proposed project is to take advantages of some new development in bridge engineering to apply FRP post-tensioning strands on a selected structure.

9. LTRC 07-3ST

Strengthening with External Post-Tensioning

9. LTRC 07-3ST

- This study will assess the performance of externally post-tensioned strands used to strengthen/repair a concrete and/or steel bridge selected by LA DOTD.

9. LTRC 07-3ST

- The long-term performance of the bridge will then be monitored during their service. Taking advantages of the new development in FRP materials, this study will potentially provide a new approach to enhancing the transportation infrastructure in Louisiana.

10. LTRC 07-4ST

P.I. Dr. George Voyiadjis
Co-P.I.s Dr. Steve Cai
Dr. Rahdi Sharma
Louisiana State University

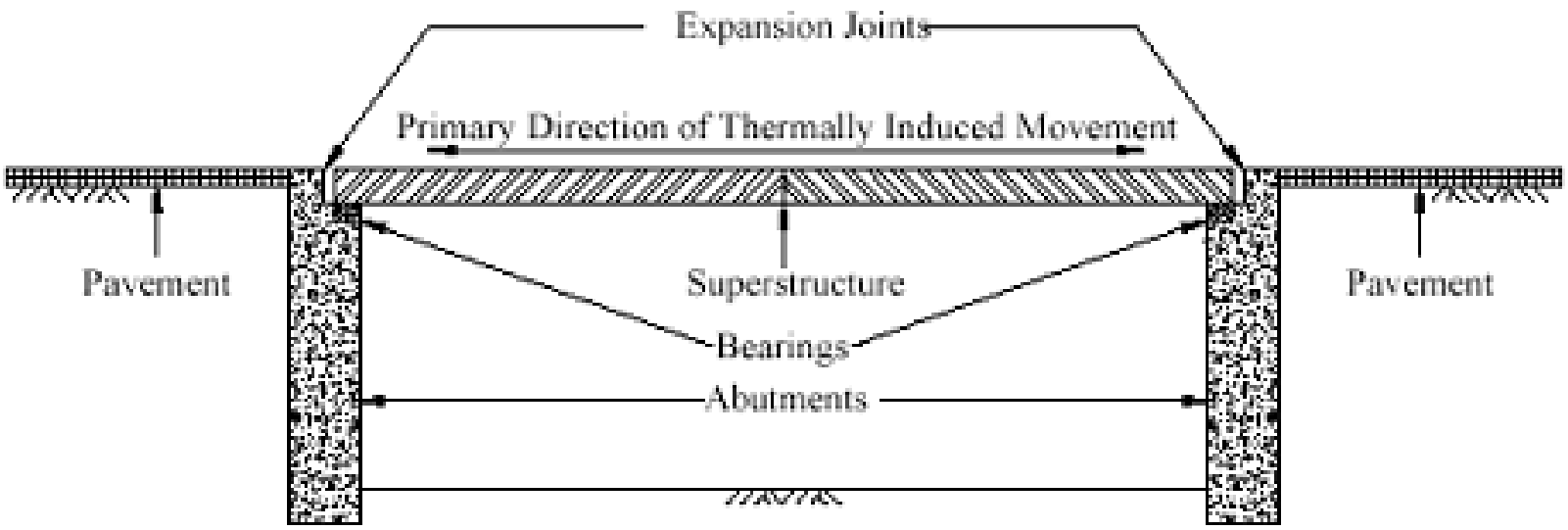
Integral Abutment Bridge for Louisiana's Soft and Stiff Soils

(IBRD Award)

10. LTRC 07-4ST

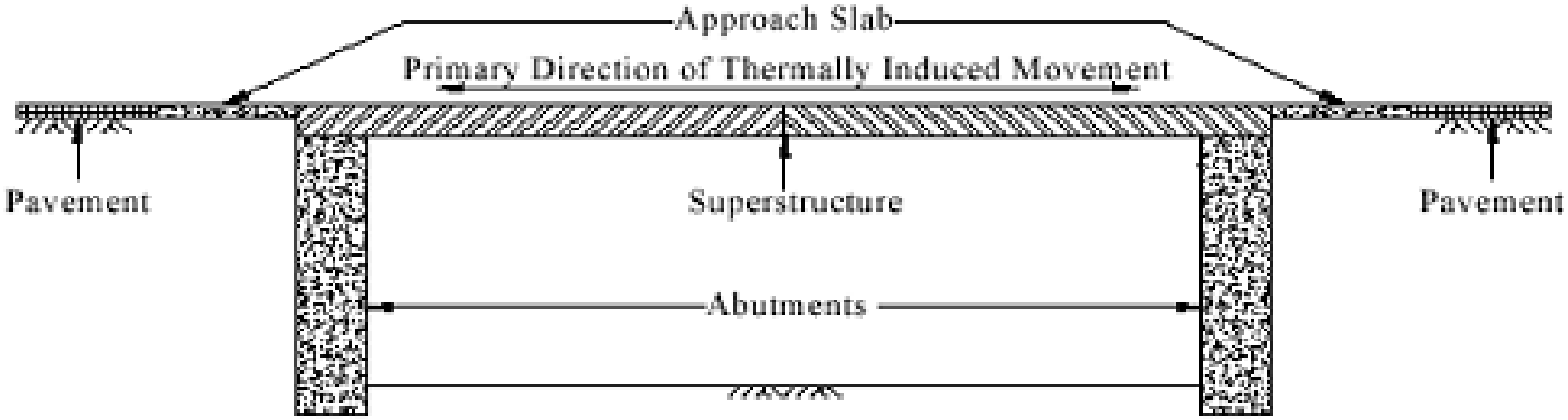
- Problem Statement
- An integral abutment bridge (IAB) system is constructed without deck joints, particularly at the abutments. The design of IAB in stiff soil has become a well established practice. However, Due to our state's unique soft soil condition and the complexity of the pile and soil interaction in the Integral Abutment Bridges, no full integral bridge has ever been explored in Louisiana.

10. LTRC 07-4ST



Typical Conventional Abutment Concept (after Horvath, 2000)

10. LTRC 07-4ST



Typical Integral Abutment Concept (after Horvath, 2000)

10. LTRC 07-4ST

- The objective of the study will be to field-instrument, monitor, and analyze the design and construction of full integral abutment bridges for Louisiana's soft and stiff soil conditions by addressing the following:

10. LTRC 07-4ST

- Behavior of the backfill material and surrounding soil under the cyclic abutment displacement
- Behavior of the pavement and approach slab near the abutment
- Pile and soil interaction
- Abutment wall and soil interaction
- Approach slab and soil interaction
- Effects of temperature and longitudinal movement
-

11. LTRC 08-1ST

P.I. Dr. Ayman O'keil
Co-PI Dr. Steve Cai

Louisiana State University

Evaluation of Continuity Detail for Precast Prestressed Girders
(RPIC Award)

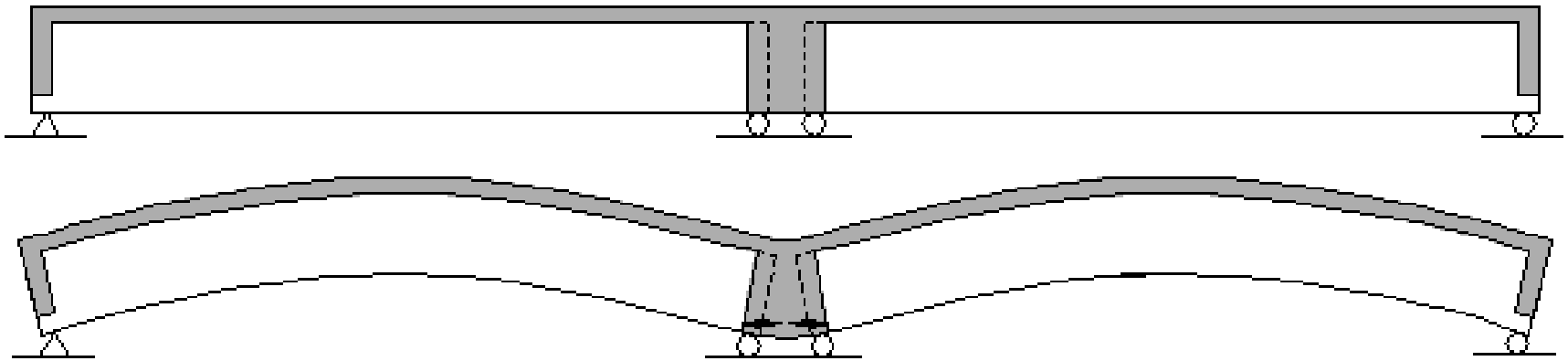
11. LTRC 08-1ST

- OBJECTIVES
- The main objective of this project is to install a monitoring system for the purpose of investigating the performance of the continuity diaphragm detail including the positive moment detail that is employed in Bridge #2 of the James Audubon Bridge Project under long-term effects. The purpose of the monitoring system is to:

11. LTRC 08-1ST

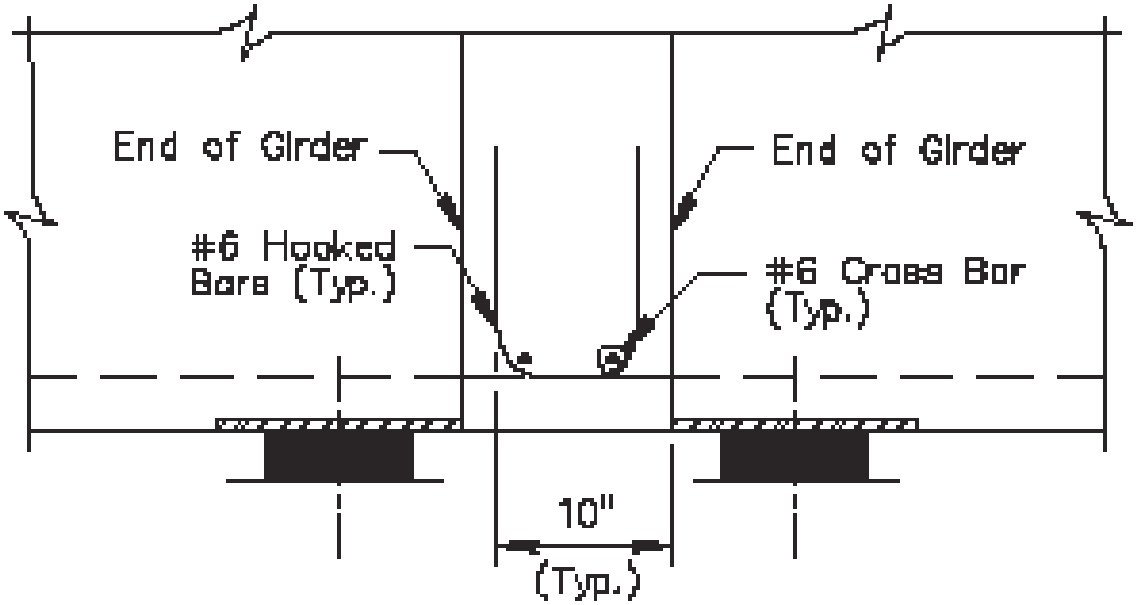
- Validate the performance of the NCHRP 519 continuity detail;
- Assess the effects of differential shrinkage between the girder and the slab;
- Evaluate the performance of the skewed details of the connection, and;
- Evaluate the performance of the detail in bridges with Bulb-T girders.

11. LTRC 08-1ST



Development of positive moment in bridge connections with continuity diaphragm.

11. LTRC 08-1ST



Detail of reinforcement placement at positive moment connection (section view) (NCHRP 519 Report)

12. LTRC 08-2ST

P.I. Dr. Steve Cai

Louisiana State University

Monitoring Bridge Scour Using Fiber Optic Sensors

(IBRD Award)

13. LTRC 08-3ST

Prediction of Reliable Scour Depths for Bridge Structures

Any Question?

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Finally

Thank You!

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- For more information on those projects as well as other ongoing or completed research, please visit our website below

- http://www.ltrc.lsu.edu/publications.html