Strain Gauge Balancing of the "Lea Joyner"
Double Leaf Bascule Span Bridge
Louisville Ave. Across the Ouachita River
Monroe, Louisiana

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What is Strain Gauge Balancing?
What is Strain Gauge Balancing?

- A method of determining the balance of a movable bridge by using strain gauges to measure the torque in the span drive pinion shaft.
When Can This Method Be Used?
When Can This Method Be Used?

- Can only be used on spans where the imbalance of the span is resisted by the span drive pinion shaft.
When Can This Method Be Used?

- Can only be used on spans where the imbalance of the span is resisted by the span drive pinion shaft.

Such As...
When Can This Method Be Used?

- Can only be used on spans where the imbalance of the span is resisted by the span drive pinion shaft.

Such As...

- Rack and Pinion Bascule Spans
When Can This Method Be Used?

- Can only be used on spans where the imbalance of the span is resisted by the span drive pinion shaft.

Such As...

- Rack and Pinion Bascule Spans
- Rack and Pinion Vertical Lift Spans
When Can’t This Method Be Used?
When Can’t This Method Be Used?

- Spans that do not have a rack and pinion drive system
When Can’t This Method Be Used?

- Spans that do not have a rack and pinion drive system

Such As...
When Can’t This Method Be Used?

- Spans that do not have a rack and pinion drive system.

Such As...

- Spans driven by hydraulic cylinders
When Can’t This Method Be Used?

- Spans that have a rack and pinion drive system, but the imbalance of the span is not resisted by the rack and pinion drive system.
When Can’t This Method Be Used?

- Spans that have a rack and pinion drive system, but the imbalance of the span is not resisted by the rack and pinion

Such As...
When Can’t This Method Be Used?

- Spans that have a rack and pinion drive system, but the imbalance of the span is not resisted by the rack and pinion. Such As...
  - Rack and pinion swing spans
Lea Joyner Bridge

Monroe, Louisiana
Lea Joyner Bridge
Bridge Information

- Double leaf bascule
Bridge Information

- Double leaf bascule
- Four lanes
Bridge Information

- Double leaf bascule
- Four lanes
- No shoulders
Bridge Information

- Double leaf bascule
- Four lanes
- No shoulders
- Pedestrian sidewalks on both sides
Bridge Information

- Double leaf bascule
- Four lanes
- No shoulders
- Pedestrian sidewalks on both sides
- 39,000 ADT
Bridge Information

- Double leaf bascule
- Four lanes
- No shoulders
- Pedestrian sidewalks on both sides
- 39,000 ADT
- About six openings a week
Bridge History
Bridge History

- Built in 1936
Bridge History

- Built in 1936
- Originally had a timber deck with asphalt planks
Bridge History

- Built in 1936
- Originally had a timber deck with asphalt planks
- 1950, timber deck replaced by lighter grid deck
Bridge History

- Built in 1936
- Originally had a timber deck with asphalt planks
- 1950, timber deck replaced by lighter grid deck
- Plans instructed Contractor to adjust concrete fill in grid deck to balance span
Bridge History

- Counterweight compartments added to the span
Bridge History

- Counterweight compartments added to the span
- 2007, rehabilitation project
Bridge History

- Counterweight compartments added to the span
- 2007, rehabilitation project
- Span was determined to be very “span light”
Bridge History

- Counterweight compartments added to the span
- 2007, rehabilitation project
- Span was determined to be very “span light”
- Repairs added heavier structural members and additional counterweight to the span
Bridge History

After repairs were completed...
Bridge History

After repairs were completed...

- Contractor used motor amperage to determine the span balance
Bridge History

After repairs were completed...

- Contractor used motor amperage to determine the span balance
- Estimated that the spans were between 500 and 1,000 pounds “span heavy” at the tip of the span
Bridge History

• Had another rehabilitation project coming up to replace the grid deck
Bridge History

- Had another rehabilitation project coming up to replace the grid deck
- Decided we needed a more accurate measurement of the imbalance
Bridge History

• Had another rehabilitation project coming up to replace the grid deck

• Decided we needed a more accurate measurement of the imbalance

• Brought in a Consultant to perform this strain gauge balancing
Drive System

FIRST OPEN REDUCTION

RACK GEAR

PINION GEAR

LOCATION OF STRAIN GAUGES

SECOND OPEN REDUCTION

ELEC. MOTOR

MAIN GEAR-BOX

SPAN DRIVE SYSTEM
Strain Gauge Process
Strain Gauge Process
Strain Gauge Process
Strain Gauge Process
Strain Gauge Process
Strain Gauge Process
Strain Gauge Results

Monroe, Louisiana  Louisville Avenue Bridge  
Opening #1  East Leaf  1/19/2010  
Total Strain Gage Data

Screw Torque (x1000 ft-lbs.)

- Start to Raise
- Opening
- 50 degrees open
- Closing
- 0 degrees (leaf fully closed)

Data Point

North Shaft  South Shaft  Clinometer
Strain Gauge Results

Table 2 – Final Balance Condition of the Louisville Avenue Bridge
As Tested January 19, 2010

<table>
<thead>
<tr>
<th>LEAF</th>
<th>OPENING NUMBER</th>
<th>TOE REACTION WHEN THE LEAF IS FULLY CLOSED</th>
<th>LEAF IMBALANCE (MASS OF LEAF TIMES RADIAL DISTANCE (WR))</th>
<th>ANGLE OF IMBALANCE FROM HORIZONTAL ON SPAN SIDE FOR THE CENTER OF GRAVITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>EAST</td>
<td>1</td>
<td>530 LBS.</td>
<td>43,000 FT-LBS</td>
<td>-12 DEGREES</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>530 LBS.</td>
<td>43,700 FT-LBS</td>
<td>-14 DEGREES</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>420 LBS.</td>
<td>36,000 FT-LBS</td>
<td>-20 DEGREES</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>490 LBS</td>
<td>40,900 FT-LBS</td>
<td>-16 DEGREES</td>
</tr>
<tr>
<td>WEST</td>
<td>1</td>
<td>610 LBS.</td>
<td>58,000 FT-LBS</td>
<td>-32 DEGREES</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>670 LBS.</td>
<td>66,600 FT-LBS</td>
<td>-36 DEGREES</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>700 LBS.</td>
<td>65,300 FT-LBS</td>
<td>-30 DEGREES</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>660 LBS</td>
<td>63,300 FT-LBS</td>
<td>-33 DEGREES</td>
</tr>
</tbody>
</table>
Thank You!