
# BrR FOR BRIDGE MAINTENANCE & REHABILITATION

**Larry Evans, PE**

**Ryan Sherman, PE, SE**

# FORSGREN ASSOCIATES, INC.

- Founded in Eastern Idaho in 1962
- Primary Clients are State and Local Government Entities
- Began Bridge Load Rating in 1995

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# PRESENTERS

LARRY EVANS, PE – 33 YEARS EXPERIENCE
RYAN SHERMAN, PE, SE – 14 YEARS EXPERIENCE

Began working together on Bridge Load Ratings using BrR in 2009

Load Rated 1,700 Bridges using BrR

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# TYPICAL LOAD RATING PROCESS

- Assigned Bridge to Load Rate
- Develop Load Rating
  - Follow MBE and State Guidelines
  - Assign Conservative Assumptions
- Present Load Rating Results
- DONE!

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# WHAT ABOUT THE IMPACT OF LOAD RATING RESULTS?

- Bridge Closures
- Bridge Posting
- Is there Significant Negative Impact to Owner/Traveling Public?

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# LAFARGEHOLCIM CEMENT PLANT, MORGAN COUNTY, UT


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# USE BrR TO MANAGE THE LOAD POSTING IMPACTS

- Goal is to remove/increase load posting
- Refine load rating model (when possible)
  - Review assumptions (material properties, supplemental loads, etc.)
  - Compare LRFR and LFR results
  - Use 3D FEM
  - Can impact be lowered?
  - Live Load Placement
- Quickly look at multiple strengthening options
- Utilize existing BrR model for rehab designs

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# ROCKVILLE TRUSS, ROCKVILLE, UT

- 220 ft Steel through truss bridge built in 1924
- Only access from Rockville to farms and residences south of the Virgin River
- Detour Length of over 40 miles
- Bridge Closure would have a severe impact
- Initial rating of 0


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# ROCKVILLE TRUSS, ROCKVILLE, UT

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# ROCKVILLE TRUSS, ROCKVILLE, UT

- Looked for alternatives to refine the load rating
- Obtained additional field measurements allowed a reduction in the wearing surface thickness
- Analyzed vehicles in the middle 12 ft
- Low ratings from multiple bridge components = strengthening would be a major task
- Model revisions allowed the bridge to remain open with load posting


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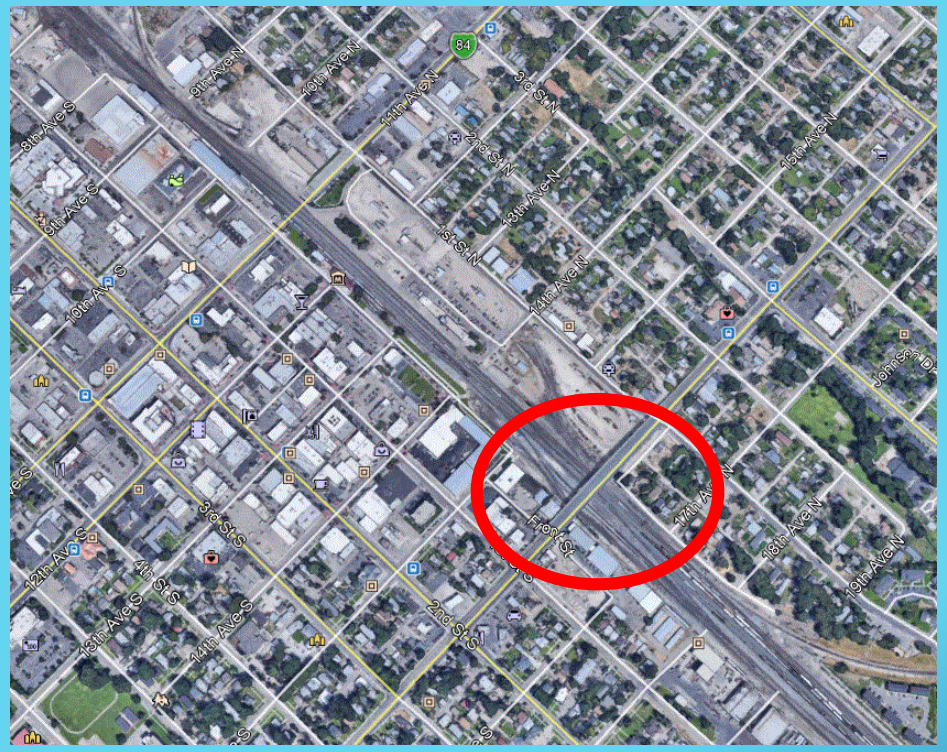
# 16TH AVENUE OVERPASS, NAMPA, ID

- 766- foot, 11-span steel girder bridge over UPRR
- 4 different bridge segments
- Near downtown and important truck routes
- Rated low requiring load posting

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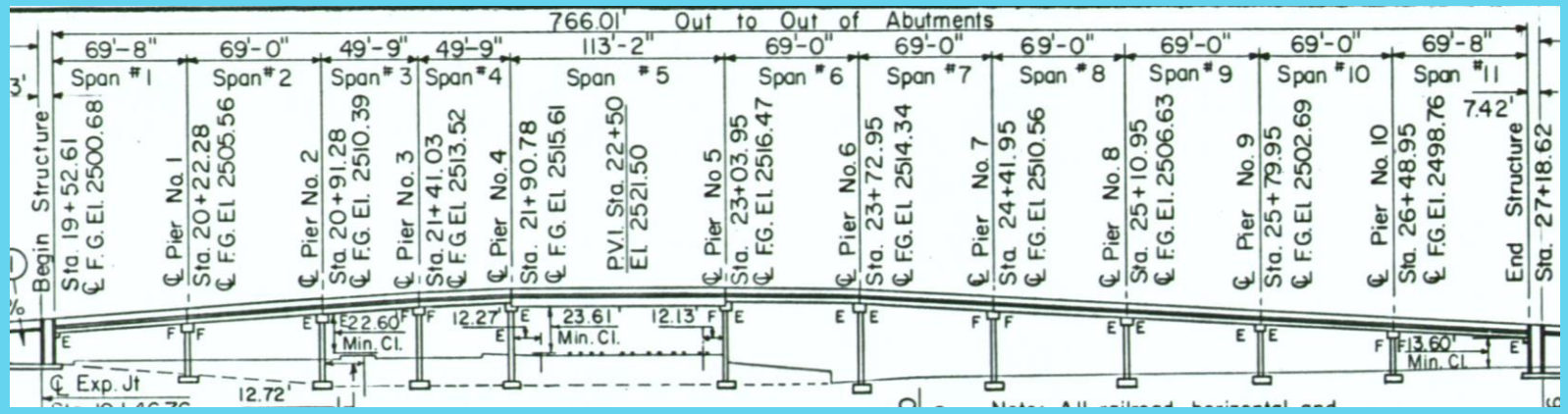
# 16TH AVENUE OVERPASS, NAMPA, ID

- Low rating was only in spans 7 and 10
- Controlling point was at a dramatic flange change
- No other low ratings
- Refining load rating didn't increase load posting

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# 16TH AVENUE OVERPASS, NAMPA, ID

- BrR Spec Check showed the bottom flange in compression after the transition to the 8"x1/2" flange
- With the current diaphragm spacing of 22.75 ft the unbraced length was too long
- Looked at several options including
  - Cover plate
  - Longitudinal stiffener near bottom flange
  - Additional diaphragms near flange transitions


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# 16TH AVENUE OVERPASS, NAMPA, ID

- Chose to add diaphragms near each flange transitions
- This option was the least expensive and easiest to construct in the field
- The City was able to remove the posting and open the bridge to full legal loads

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# 2100 S RD BRIDGE OVER I-84

- Low volume 3-span continuous steel girder bridge over I-84 in agricultural area
- Rated low during initial BrR load rating requiring load posting
- Low rating was only in span 2 near the bottom flange transitions
- Looked to refine analysis


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# 2100 S RD BRIDGE OVER I-84

| 2100 S Bridge over I-84 | | | | | |
|---|---|---|---|---|---|
| | Operating Rating Factors | | | | |
| **Rating Vehicle** | **Original Analysis** | **3D FEM** | **3D FEM w/ 25 mph Impact** | **Add Cover Plate at Bottom Flange to Diaphragm** | **Additional Diaphragm (between support & first diaphragm)** |
| HS-20 | 0.608 | 0.756 | 0.769 | 1.157 | 1.203 |
| Idaho - Type 3 | 1.016 | 1.243 | 1.261 | 1.976 | 2.041 |
| Idaho - Type 3S2 | 0.773 | 0.936 | 0.950 | 1.369 | 1.414 |
| Idaho - Type 3-3 | 0.767 | 0.928 | 0.942 | 1.353 | 1.398 |
| Idaho - 121k | 0.585 | 0.701 | 0.711 | 0.938 | 0.97 |
| NRL | 0.735 | 0.887 | 0.900 | 1.278 | 1.320 |
| Posting Requirement | 9.5 Ton Max Axle Weight | 10 Ton Max Axle Weight | 10 Ton Max Axle Weight | N/A | N/A |

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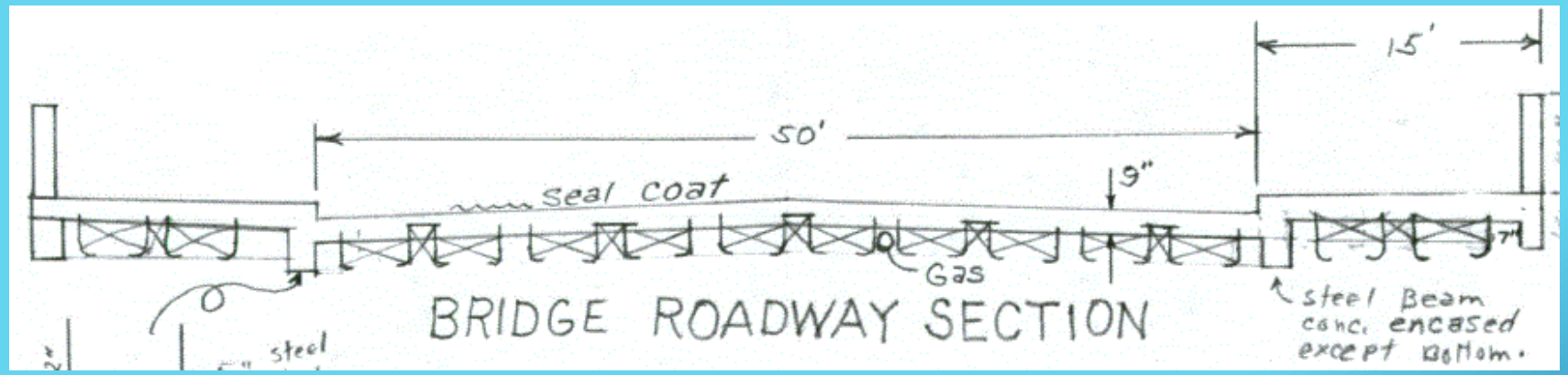
# 4TH STREET BRIDGE, CALDWELL, ID

- 34-foot single span bridge constructed in 1935
- 5 salvaged railroad cars with 4 members per car
- 9" concrete deck with steel channel members embedded 3" into deck
- Initially rated as non-composite girders
- Ratings of 0 for exterior channels of each frame

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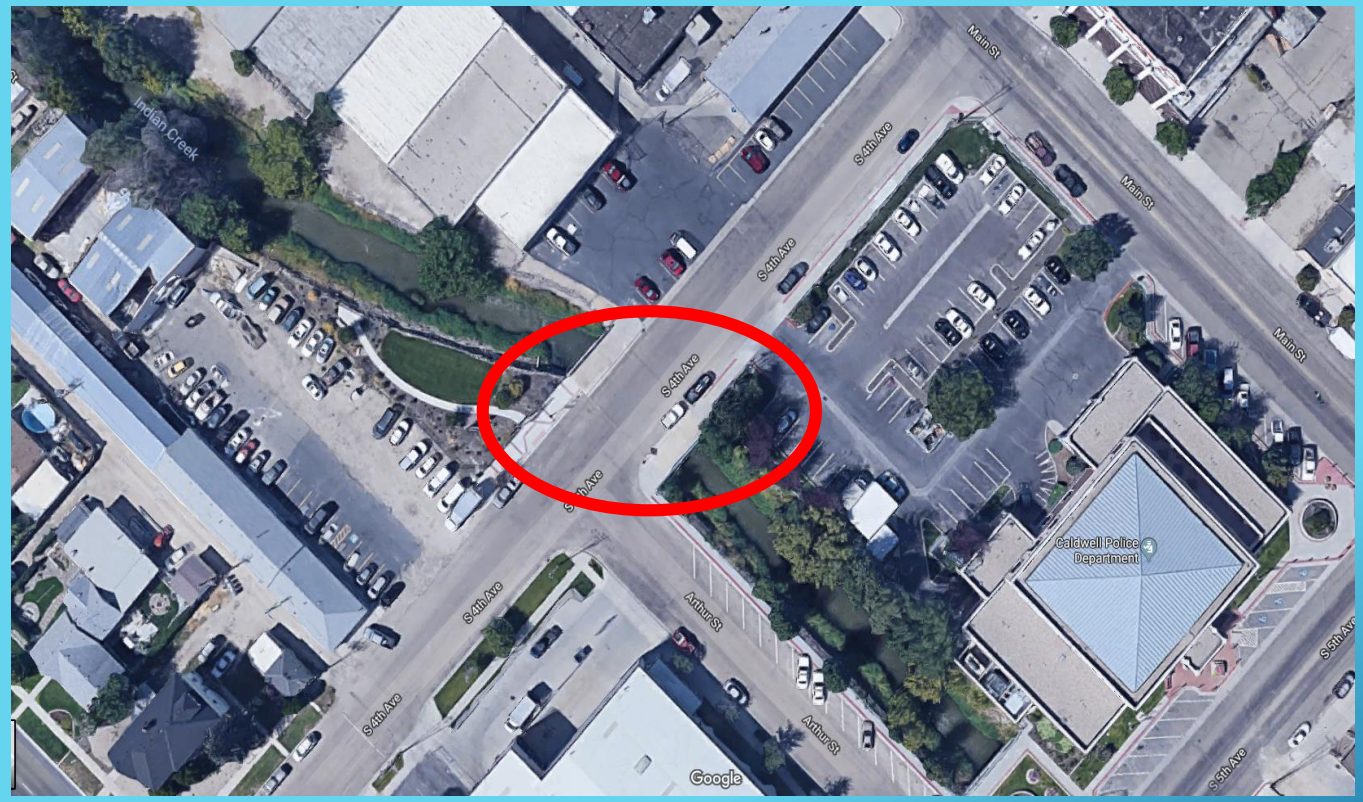
# 4TH STREET BRIDGE, CALDWELL, ID

- Closing the bridge would have significant impact
- Adjacent to the City Police Station
- Truck Route for adjacent businesses
- No change in structure condition from inspection reports over past 10 years

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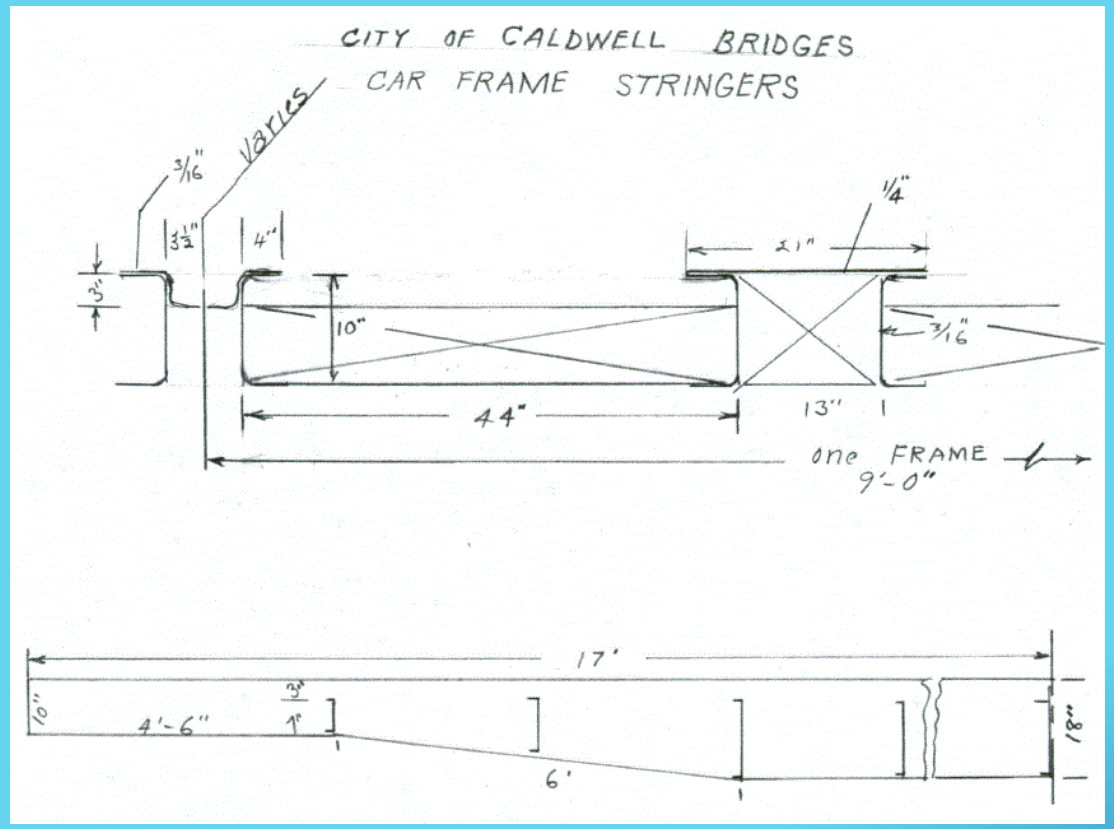
# 4TH STREET BRIDGE, CALDWELL, ID

- Refined analysis
  - Analyzed as composite superstructure: Rating = 0
  - Modeled each frame as 1 and 2 composite girders
  - Max Axle Weight of 2.2 Tons
- Looked at adding cover plates
- Concluded that it is time to replace this structure

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# USING BrR FOR BRIDGE REPAIRS

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# MOODY RD BRIDGE, MADISON COUNTY, ID

- RCT bridge built in 1959
- Severe concrete deterioration at edge of deck and curb
- Used BrR to verify bridge capacity warranted repair

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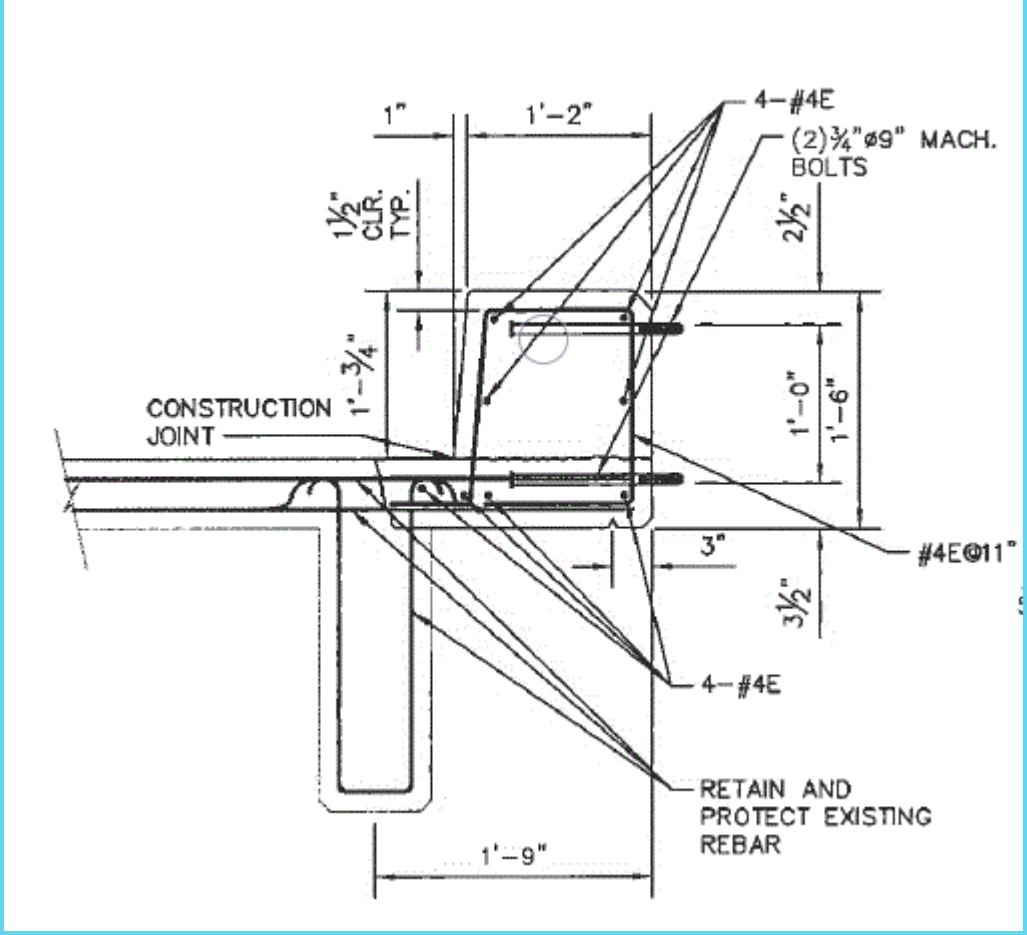
# MOODY RD BRIDGE, MADISON COUNTY, ID




- Updated BrR model to analyze repairs
- New deck overhang, curbs, and rail

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# PACKSADDLE RD BRIDGE, TETON COUNTY, ID

- 3-Span RCT bridge built in 1956
- Scour concerns, concrete deterioration at pier caps and substandard rails
- Currently load restricted
- Developed BrR model to evaluate rehabilitation vs. replacement


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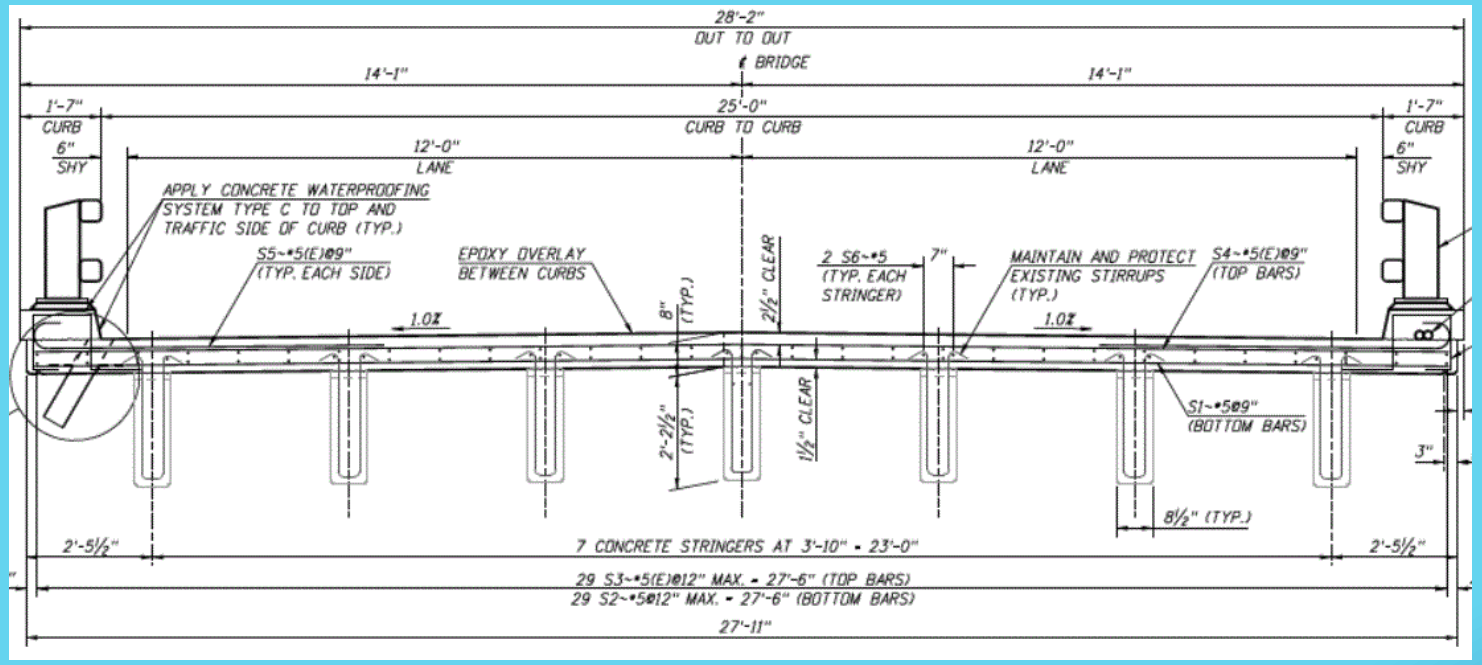
# PACKSADDLE RD BRIDGE, TETON COUNTY, ID

- Used BrR to analyze different deck geometry
- Replaced 5” concrete deck with 8” deck
- Widened the deck 1’-8” and updated curb and rail
- Removed load restrictions without replacing the entire structure

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# CONCLUSION

- Refine the BrR model for low ratings that cause severe impacts
- BrR is an efficient tool for analyzing rehabilitation/strengthening options
- BrR allows the use of existing load rating files to analyze repair/rehabilitation options quickly

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