

Modular Bridge Workshop KCHA Spring Conference



Norm Bowers, Local Road Engineer

AGENDA

- Norm-Engineering, bidding, and legal issues
- Product Availability and Options-15 minutes
- Bob Meinzer, Contech Engineered Solutions
- Bill Keithley, Oldcastle Precast
- Mert Oden, Oden Enterprises
- Rod Nicholson, Newton Prestressed
- Terry Fleck, Coreslab Structures
- Mike Rowe, Jr., Husker Steel
- Aaron Clausson, Big R
- Michel Pollaro, The Railroad Yard
- Marty Hon, E & H Bridge & Grating-illness
- David Clemens, Wheeler Lumber

Modular Bridge Characteristics

Assembled on site

- Pre-cast concrete
- Steel beam & substructure
- Large pipes and multi-plates

Short construction period

Minimal cast in place concrete

Structure may be designed by vendor

May not meet all AASHTO bridge standards

Modular Bridges

Where should we consider them?

Any road depending on structure type, bridge rail, and approach guardrail.

Paved Roads:

- Paved roads typically have higher speeds, higher traffic count and salt.
- Steel bridges will have corrosion issues
- Salt can leak through deck joints and cause issues.
- Handrail and approach guardrail are more likely to be hit.

Modular Bridges

Where should we consider them?

Paved Roads:

- Structure type should not be susceptible to salt damage.
- Bridge rail and guardrail should probably meet AASHTO standards.

These considerations make all steel bridges problematic on paved roads.

Bridge Width

Bridge Width KSA 68-1109

- Minimum width on county major and minor collectors 24 ft.
- Minimum width on township roads 20 feet.

Note: For bridges over 100 ft. in length County Engineer can approve width less than above.

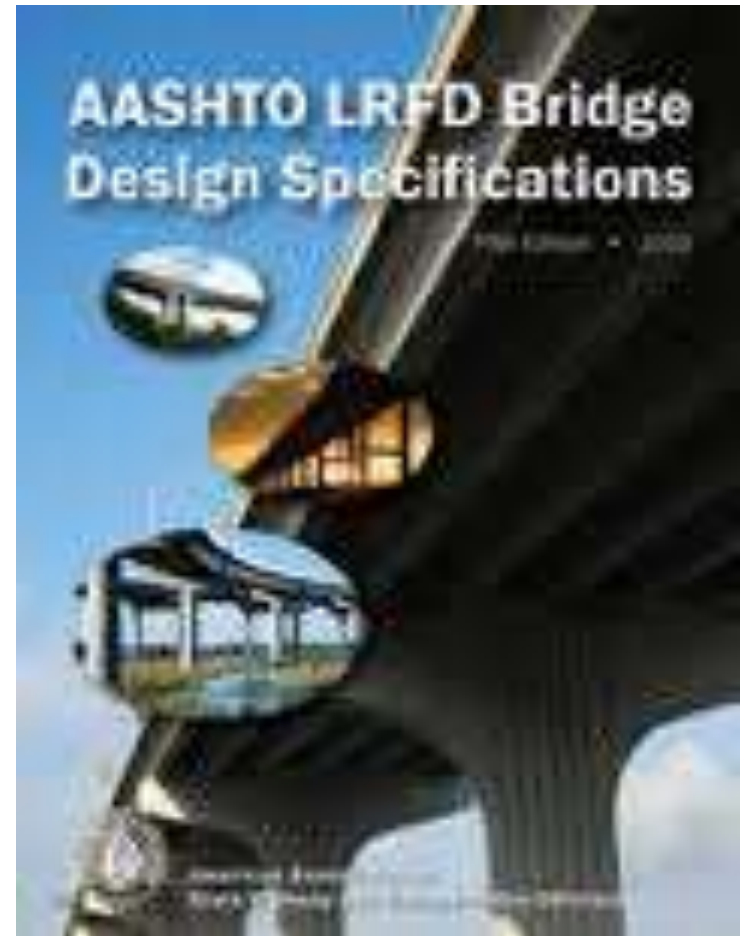
Bridge Design Standards

KSA 68-1111 requires state transportation engineer approval of plans if estimated cost exceeds \$200,000.(probably bridge only cost)

Not sure what the state transportation engineer will require, likely AAHSTO standards-similar to federal aid bridge.

Bridge Design Standards

- AASHTO LRFD Bridge Design Specifications
- Roadside Design Guide
- Crash tested bridge rail
- Crash tested approach guardrail



Bridge Design Standards

On county funded projects are we required to use AASHTO standards?

NO- but

1. For bridge inspection superstructure will be load rated based on AASHTO standards, so yes use AASHTO standards.

Bridge Design Standards

AASHTO continued

2. Understand there is some risk in not following standards. There are no other standards so we may give up design immunity in tort.
3. Consultant may insist on liability disclaimer in agreement if not following AASHTO standards.

Approach Guardrail

The issues with approach guardrail

1. Due to grading behind the rail additional r/w is usually needed.
2. Adds at least \$25,000 to cost.
3. Maintaining proper height is long term issue.
4. Repairs are expensive.
5. In 25 years wood posts need to be replaced.

Bridge Rail

The issues with bridge rail.

1. Few crash tested bridge rails are compatible with modular bridges.
2. Significant cost involved.

Bridge Rail & Approach Guardrail

When do we consider not following AASHTO?

Where risk of vehicle hitting rail is low.

1. Straight horizontal alignment
2. Bridge is as wide as the approach roadway
3. Traffic count is low
4. Speeds are lower-gravel and dirt
5. Rural area with predominantly local traffic
6. Shorter and shallower structures

Design Load Options

HS-20-44 2-32,000 lb. axles and one 8,000 lb. axle.

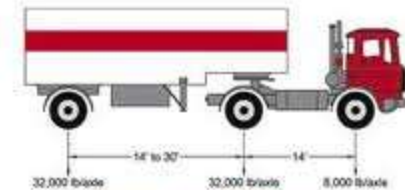
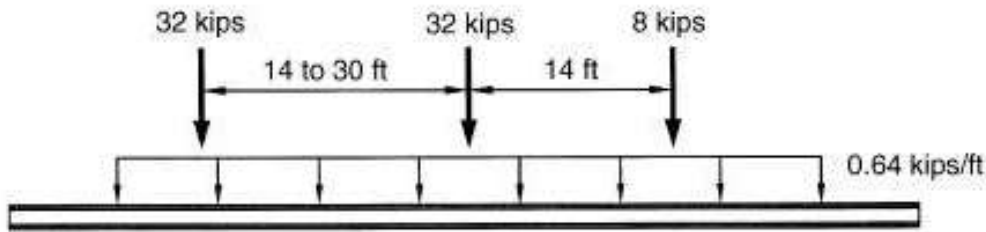
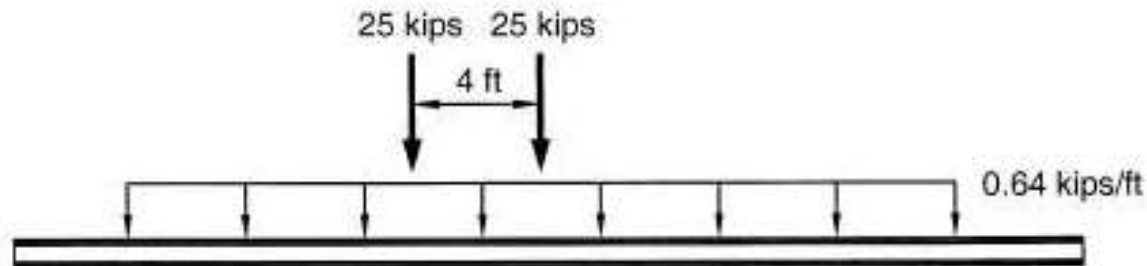


FIGURE 2: HS20 TRUCK

HL-93 50,000 lb. tandem axle



Design Load Options

When considering design loading check with your engineer or supplier on availability with particular span length of the bridge.

HS-20

HL-93

Environmental Permits for construction projects

Working around water requires permits. The bigger the drainage the more likely that a permit will be needed.

- **Corps of Engineers-404 Permit**
- **DWR-Water structures & floodplain fills**
- **KDHE-Construction Stormwater**
- **County-Flood plain development**
- **Wildlife & Parks-Threatened or Endangered Species Permit**

Environmental Permits for construction projects

Bridges will normally require:

- **Corps of Engineers-404 Permit**
- **DWR-Water structures & floodplain fills**

If more than 1 acre of disturbed area:

- **KDHE-Construction Stormwater**

If you have FEMA flood plains in rural area

- **County-Flood plain development from flood plain administrator**

Kansas Historic Bridges



National Register
Truss Bridges – 44
Arch Bridges – 36
Marsh Arch – 11
Concrete – 2

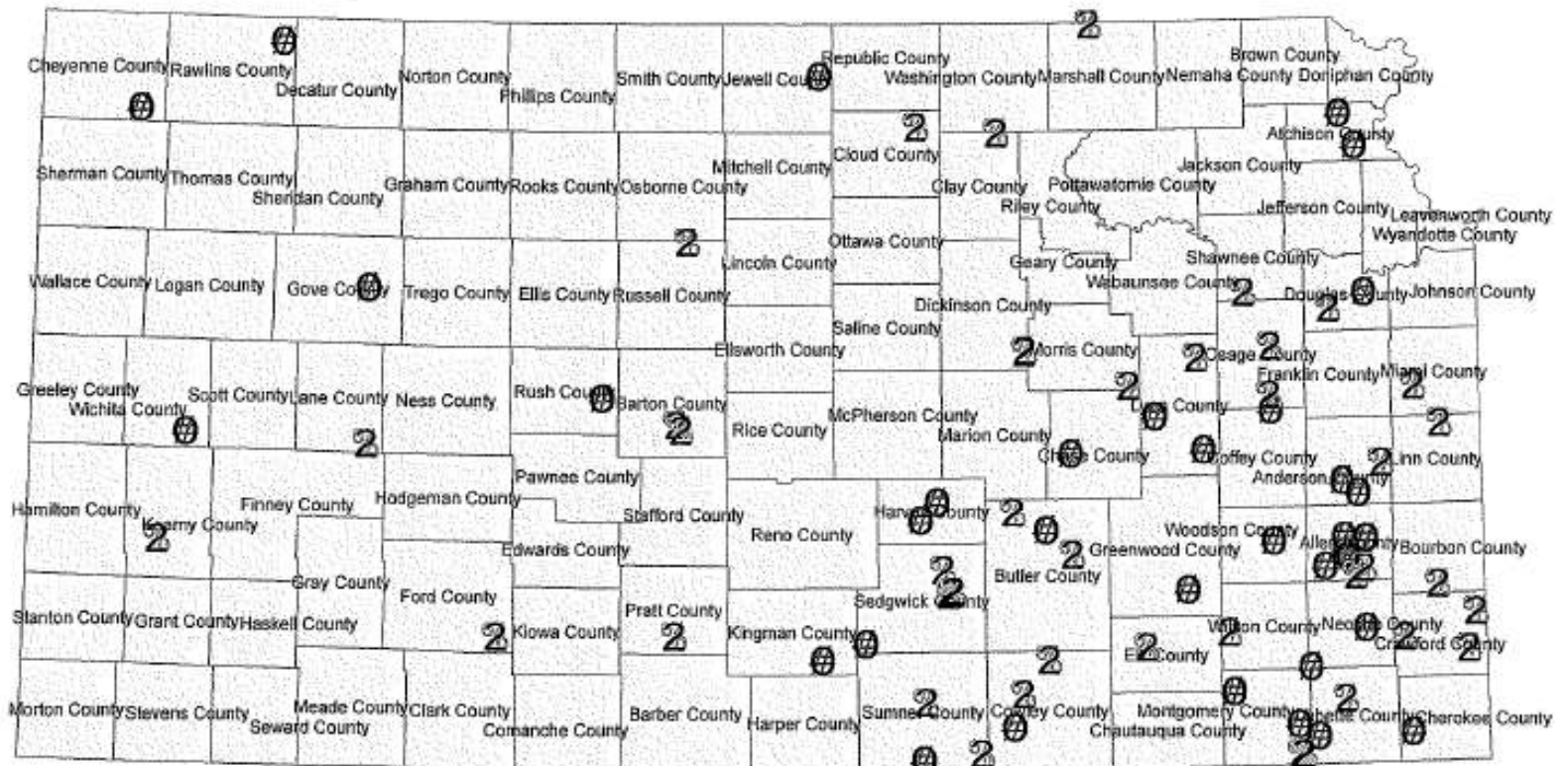
Historic Bridges

In order to obtain a Corps permit you have to have clearance from Kansas State Historical Society.

- Decorative concrete bridges
- Stone arches
- Fancy truss bridges

Concrete Historic Bridges

NRHP RECOMMENDED AND ALTERNATIVE CONCRETE BRIDGES



2 Recommended Bridge
 ⊕ Alternate Bridge
 Prepared by KDOT: 5/18/2007

Purchasing

- State law requires bidding for carload lots of lumber and for construction exceeding \$25,000.
- Purchase of materials, equipment, professional services is per county policy usually set by the county commissioners.
- Design build for bridges is not legal in Kansas

Bidding Options

1. Standard: Grading and bridge designed by engineer and sealed bids.
2. Grading designed by engineer, spec bridge options and contractor furnishes sealed plans for bridge.
3. Material furnished by county and take bids on labor and equipment-maybe under \$25,000
4. County do some of the work-removal of structure, backfilling and only contract bridge.

Minimum Engineering

- Plan-profile sheet for environmental permits.
- Hydrology
- Permit submittals
- Load rating if designed bridge
- Preliminary scour analysis for bridges.
- Bidding, specifications, and contract documents
- Some inspection-especially documentation of pile driving. (the rest you can see)

Structural Design

- Consultant or county detailed structural design, but could allow alternates.
- No detail bridge structure and spec:
 - Type of allowable structure-span bridge or concrete box
 - Design Loading HS-20 or HL-43
 - Bridge dimensions: Roadway width, span length, square feet of waterway opening, and low steel elevation.
 - Bridge details: Type of deck, bridge rail, approach guardrail, piling type, sheeting type, painting

Minimum Geotec

Contractor needs some estimate of pile length to order.

- Unless you are pretty sure of pile depth at least one test hole will be needed, and probably not going to cost much more for two holes.
- Test piling when contractor moves in, then order piling-price of piling may change from bid to start of construction or delay getting piling.

Consultant Contracts Bridge Inspection Items

- Include load ratings to comply with bridge inspection manual.
 - If custom design then by consultant
 - If contractor furnished design then by vendor or contractor.
- If not a box or pipe include preliminary scour analysis for bridge inspection folder.

Bridge Tour

Steel Bridge Options and Issues



- Bridge Rail Posts
- Guardrail ends
- Decking
- Wing design
- Wing stability
- stability
- Corrosion

Bridge Rail Posts

Bolted to web



Welded to web



Bridge Rail Posts

Welded to flange-angle



Welded to flange-guardrail post and blockout.



Bridge Rail Posts

Welded to something



Welded to flange-channel



Bridge Rail Posts

H beam welded to flange.

What looks good.

- H beam welded to flange. Stan Rolfe says fatigue cracking not an issue.
- Standard guardrail post is a W 6 x 8.5, don't use anything smaller.



Guardrail Ends

Lower OM-3



OM-3



Guardrail Ends

No Signing

Used delineators in guardrail rather than object marker



Most are just putting an end section at the end.

Design Issues



Put post at the end,
don't leave a section of
guardrail just sticking
out.

Decking Options



6x2 12 ga. decking
with beams at 24"

9x3 7 ga. decking with
beams at 48"

Stay in place forms
with concrete deck

6 x 2 decking with a lot of gravel cover.

6 x 2 Decking

Concrete surface



Asphalt surface



Most are just putting an end section at the end.

9 x 3 Decking

7 ga. Will span 48"

Asphalt surface



Stay in place forms

- Black steel form for concrete deck



Wing Design

Sloped wing



Exposed sheeting at top



Wing Design

Wing angled to stay in r/w



Note dead man cable



Wing Design

Broken supports on tall wing



Be careful on tall wings



Wing recommendations

- Be careful about the joint between abutment and wing.
- On taller structures use deadman cable to other piling to keep wing straight.

Sheeting

Black Steel



Black Steel



Black steel seems to work fine, needs to be heavier gauge than galvanized.

Barn Tin

Barn tin bowing



Barn tin



Discourage the use of barn tin.

Abutment Options

Galvanized sheet pile



Decking for backwall



Most were using sheet piling, but decking seems to work fine.

How long will steel bridges last?

30 year old steel bridge

eastern Kansas



In the right spot a long time-more than 60 years.

Corrosion

Sheeting in contact with water



Piling in contact with water



Corrosion

H piling in contact with water



Galvanized sheeting and piling in water



Keep steel out of standing water-make bridge longer, use different material.

No standing water

Concrete to protect steel.



Rip rap to protect steel

