

ARCHITECTURE
ENGINEERING
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PLANNING

KZFD=SIGN 



Big 4 Pedestrian Bridge Conversion

by

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2006 OTEC Conference

Columbus, Ohio

Contract: KZF Design was commissioned by USACOE Louisville District to provide the following services:

- Roadway Approach
- Utilities
- River Bank Erosion Control
- Geotechnical
- Structural

- Big 4 Railroad Companies (Cleveland, Cincinnati, Chicago, and St. Louis)
- 1889 originally construction (E-30)
- 1929 major rehabilitation and strength upgrade (E-65 chords & E-70 floor & webs)
- 1968 bridge was officially out of service
- 2005 Louisville Waterfront Development Corporation acquires Big 4 Bridge

- Locate existing bridge plans
- Inventory existing bridge members
- Bridge inspection
- Bridge analysis (existing)
- Bridge design (proposed)
- Load rating
- Bridge rehabilitation/repair

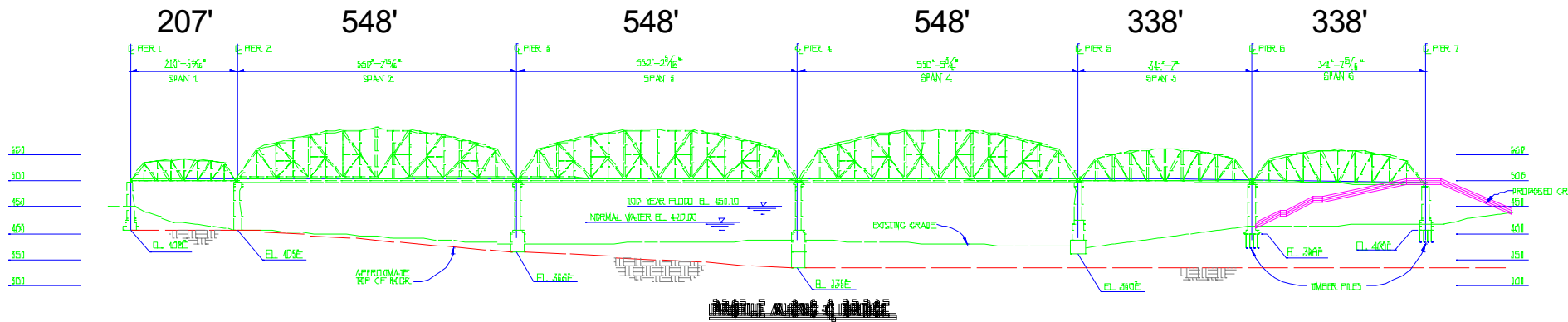
Purpose:

Provide a baseline and inventory of existing bridge members

Importance:

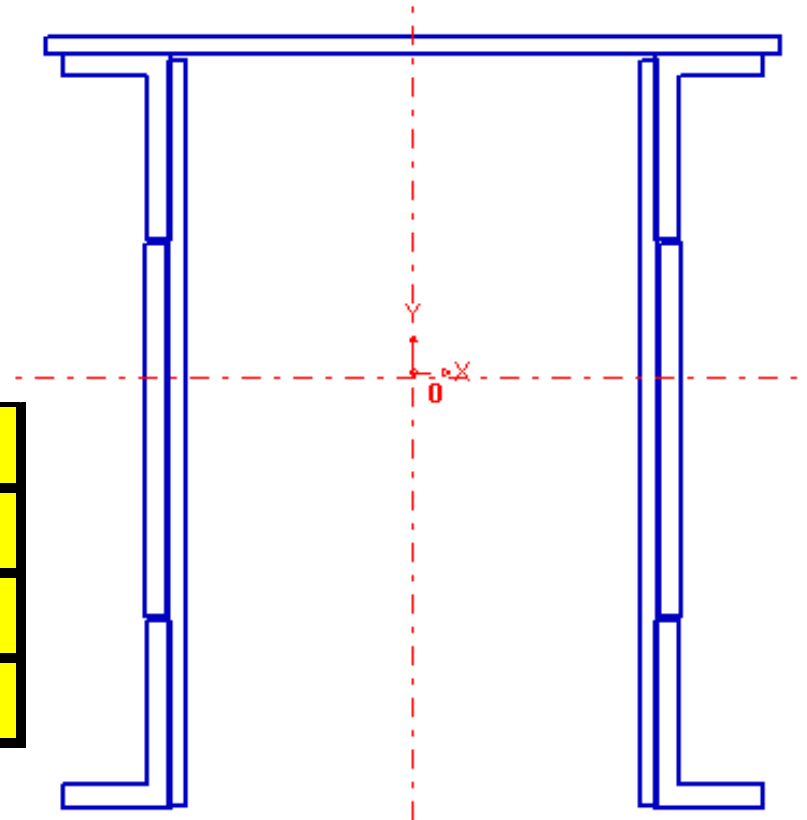
The scope assumed that the plans would be available.

Bridge Length = 2527 ft.



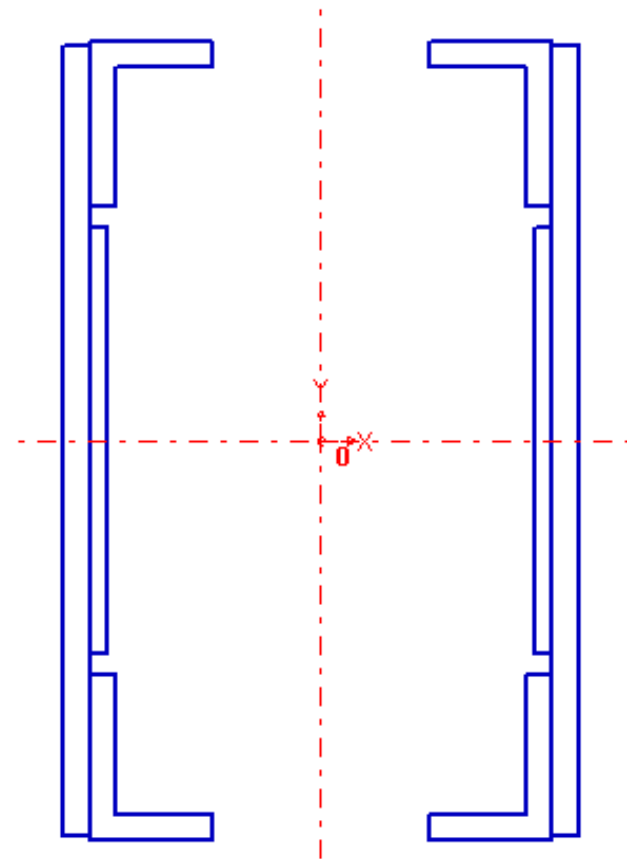
- Chords (top & bottom)
 - Up river side
 - Down river side
- Section Properties

Truss (ft)	A (in ²)	I _{xx} (in ⁴)
207	86	5947
338	120	15800
547	231	33500



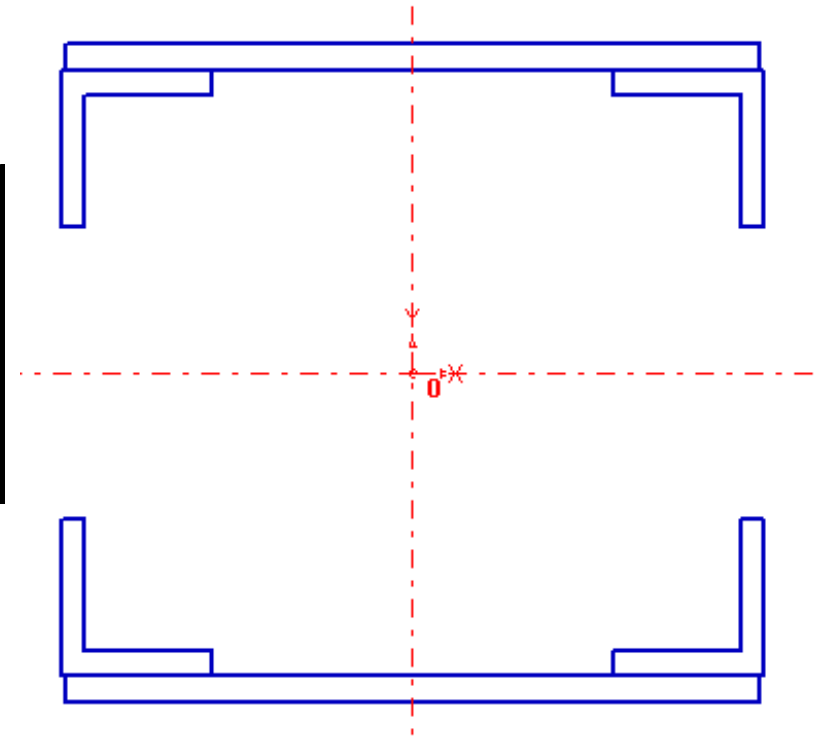
- Verticals
- Section Properties

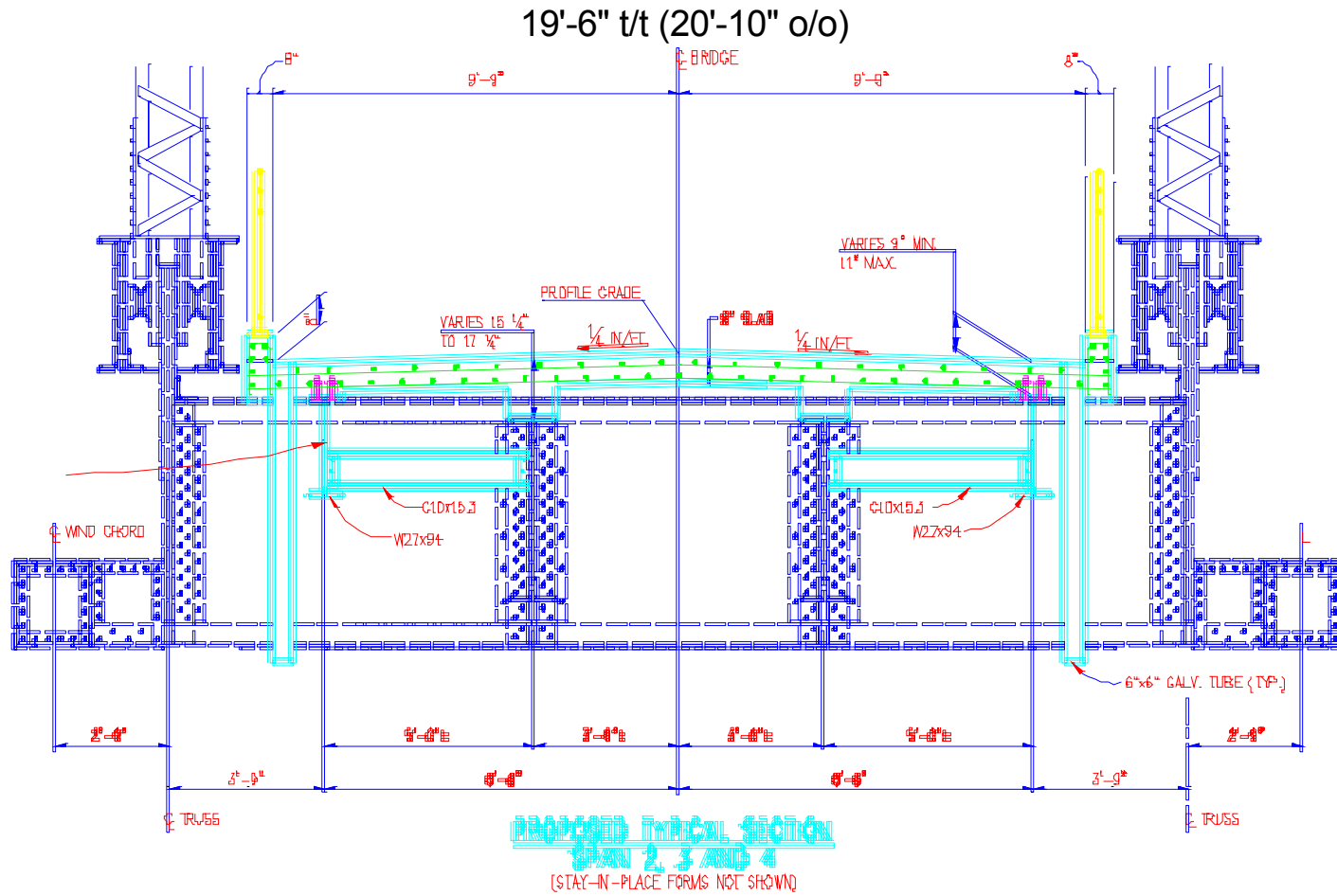
Truss	A (in ²)	Ixx (in ⁴)
207	36	1561
338	53	4000
547	64	8465



- Diagonals
- Section Properties

Truss	A (in ²)	Ixx (in ⁴)
207	42	1798
338	53	4000
547	81	10400





Purpose:

- Document extent of section loss & member deterioration
- Verification of existing bridge member inventory
- Burgess & Niple (Lexington Office) performed inspection as subconsultant



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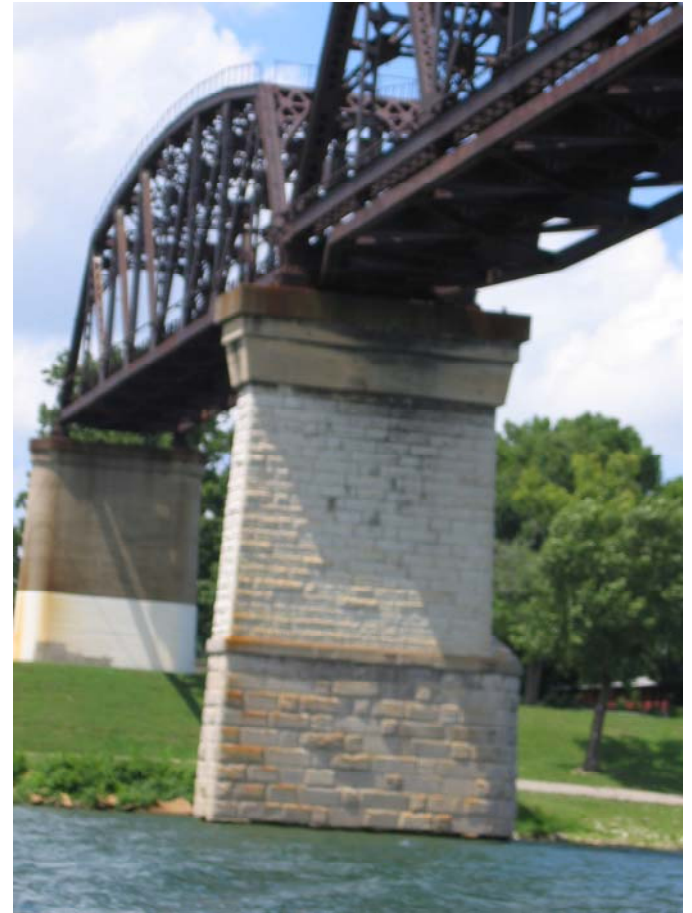
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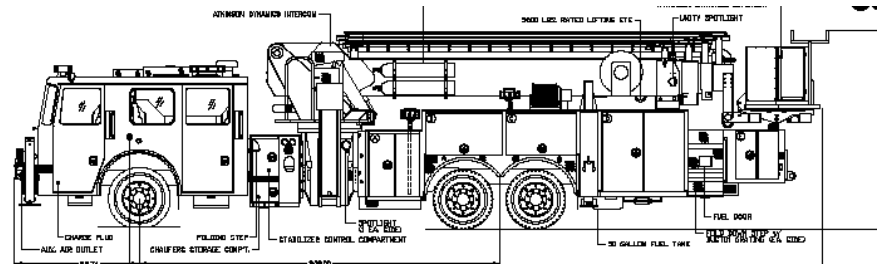


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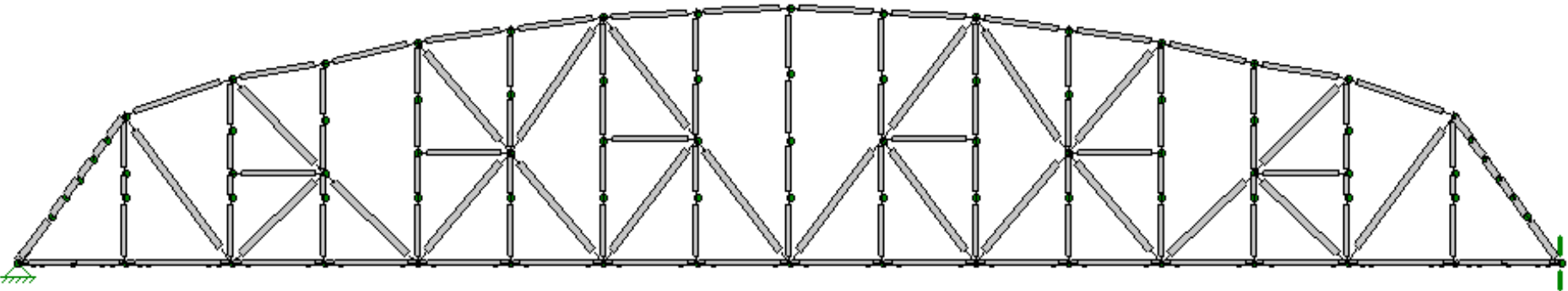
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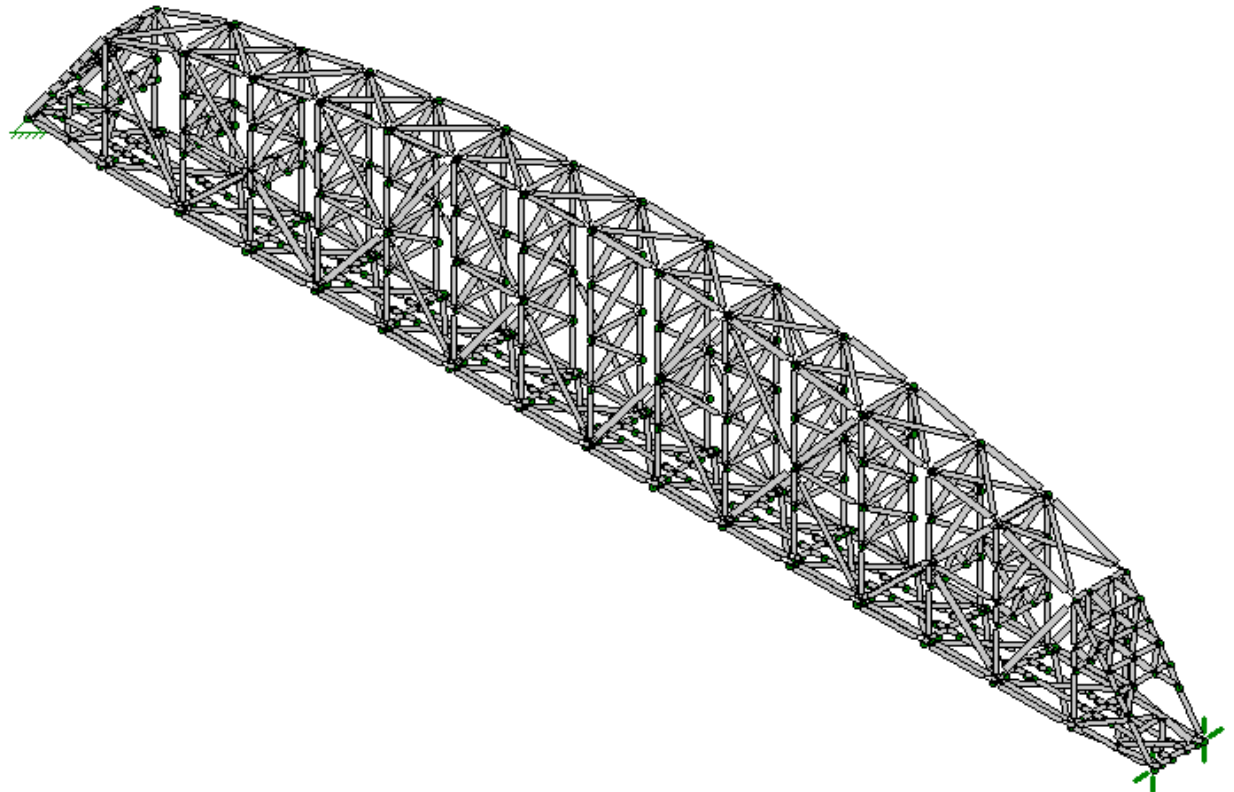
- Loads
 - Dead Load
 - Wind Load
 - Existing vs. Proposed
 - Seismic
 - Live Load
 - Existing (Cooper E-loadings)
 - Proposed (Pedestrian Load = 100 psf & H15 truck)



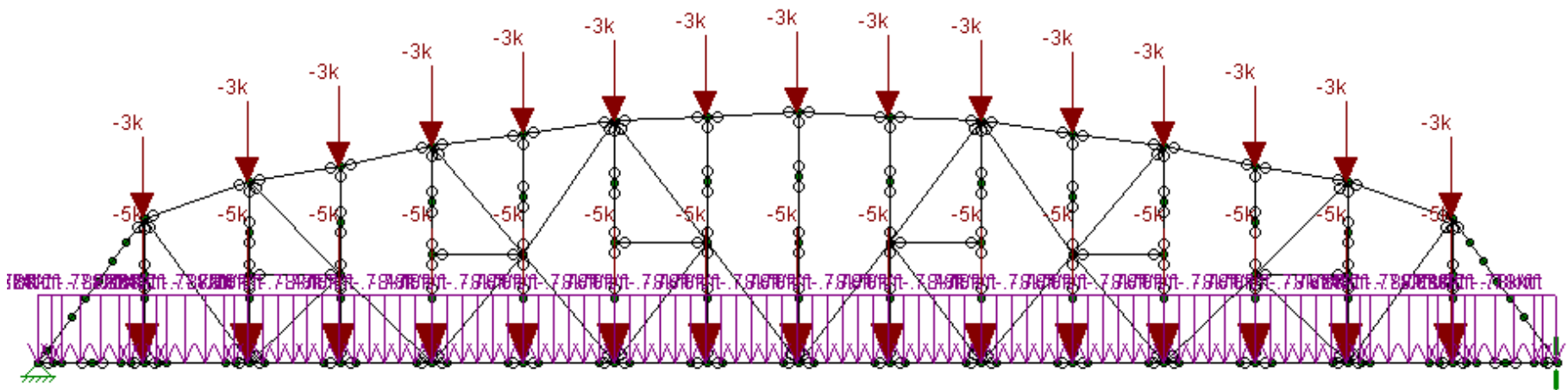
- Span Configurations (548, 338, 207 ft.)
- Geometry & Analysis (2-D and 3-D)
- Baseline Force Analysis
 - Shear (V)
 - Moment (M)
 - Reaction (R)

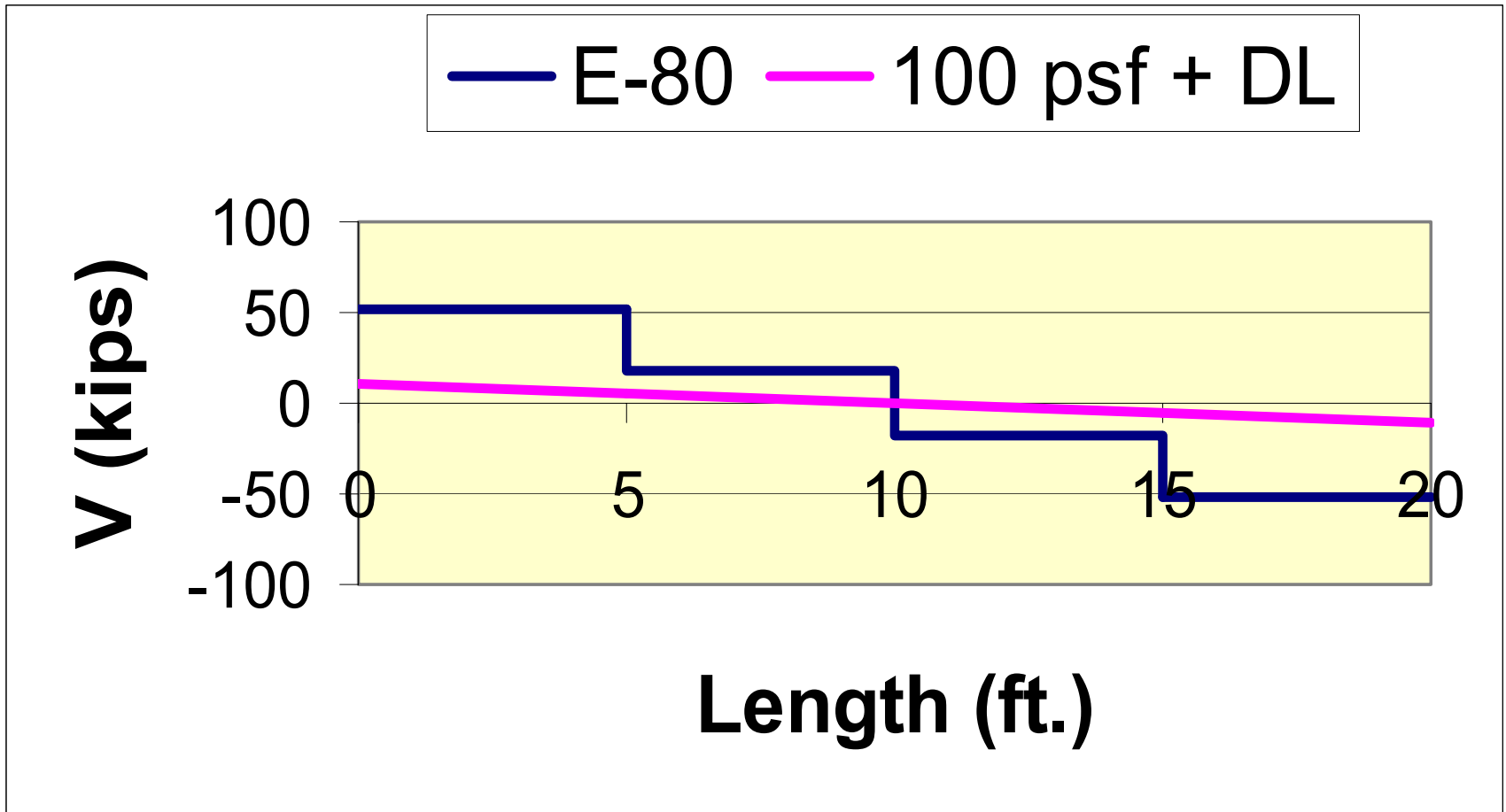


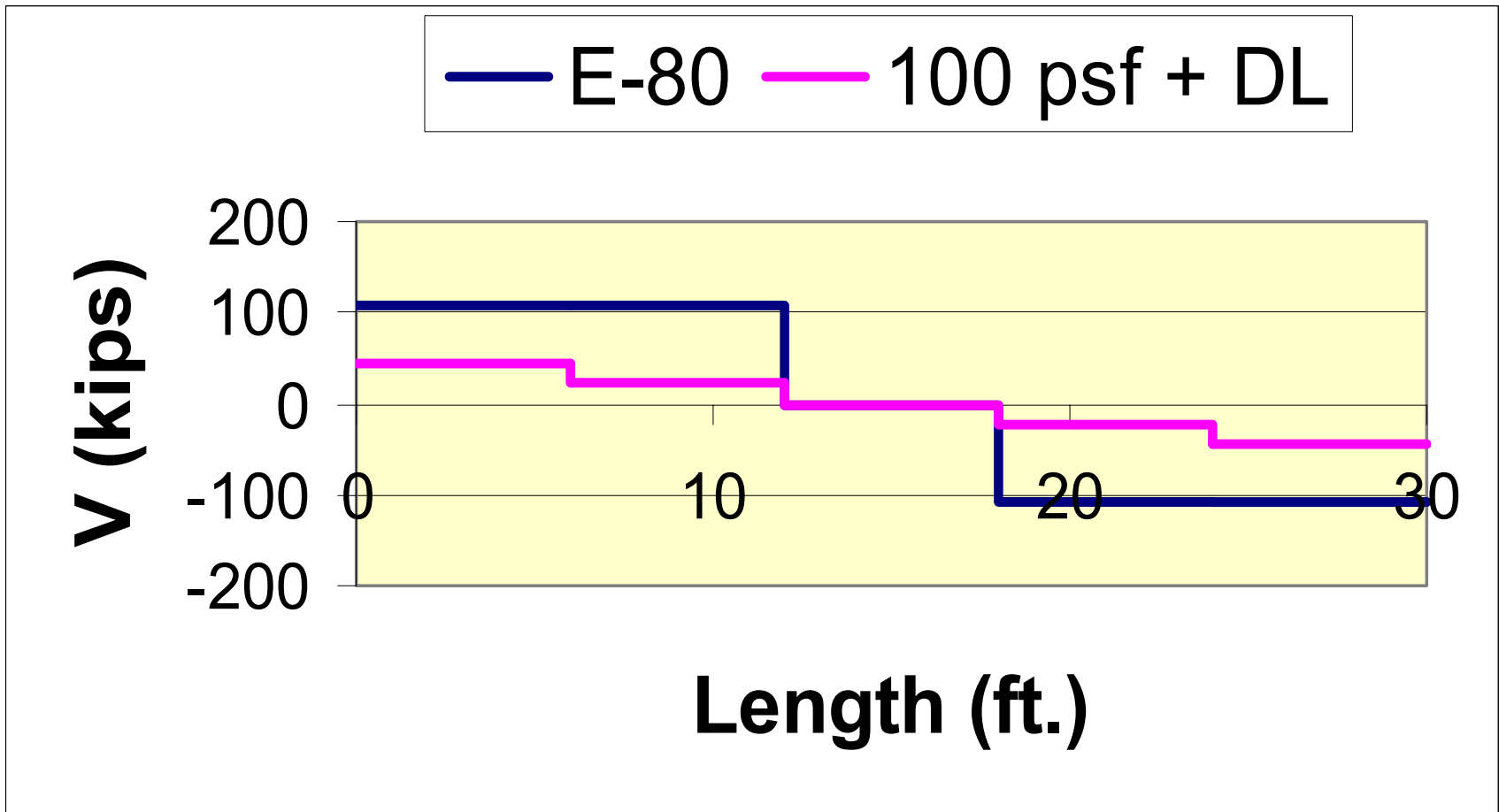
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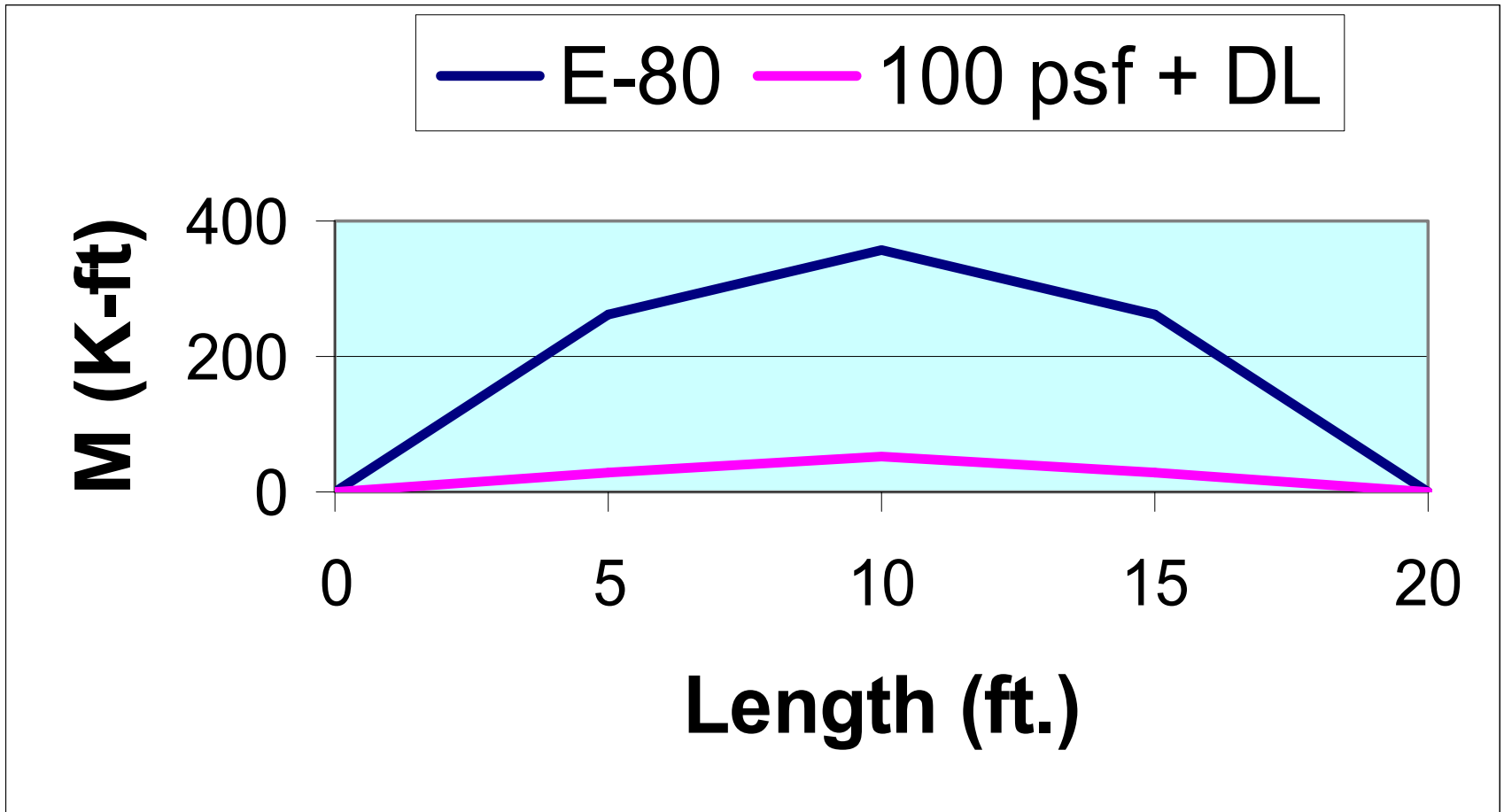


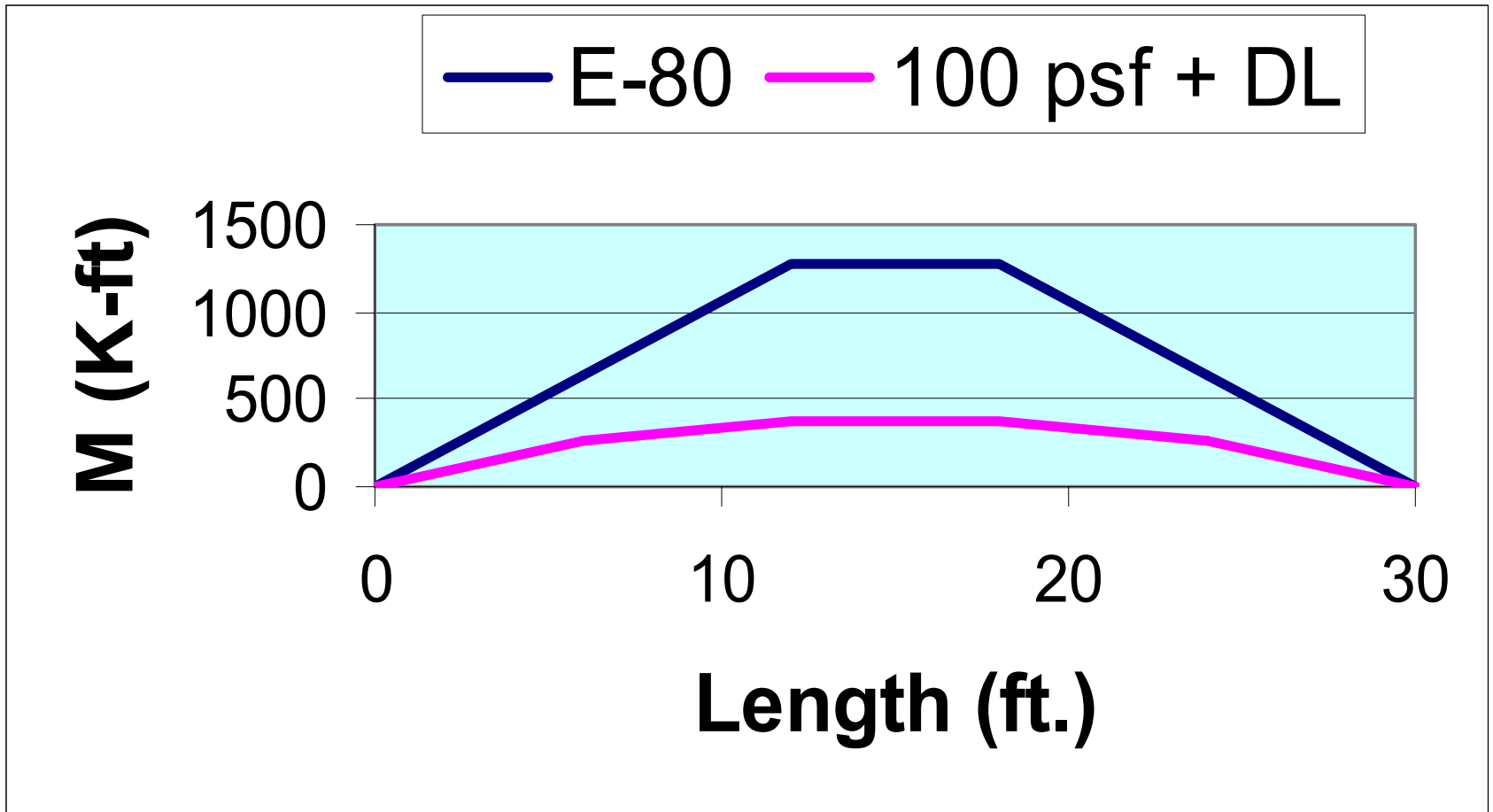
- Rerun baseline existing analysis model to compare load distribution effects
- Larger of 100 psf or H15 truck loading
- Place truck in multiple transverse positions to maximize load effects



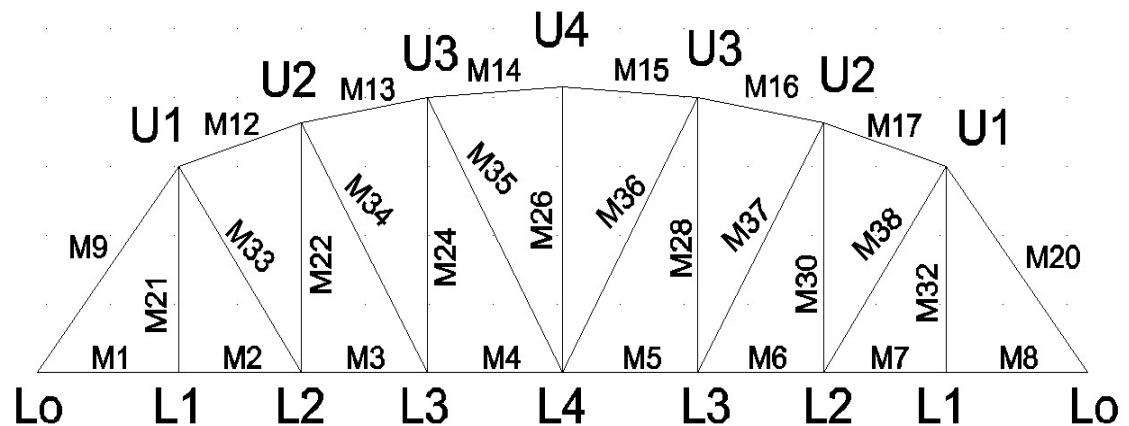








- Stress comparisons
 - Allowable stress
 - Chords
 - Verticals & diagonals
 - Floorbeams & stringers
 - Proposed/Design stresses
 - Chords
 - Verticals & diagonals
 - Floorbeams & stringers



- Overstress Members
 - Chords
 - Verticals & Diagonals

Member :	Model	Member Net Area	E105: 3D Analysis	Total Stress=	*****HAND***** Calculated	1922 Plans Allowable	
Bot Chords:	Member	in ²	Force, K	F/A, ksi	Stress	Stress	
L0-L1	M1, M2	73.56	1116	15.17	19.4	22.5	--O.K.
L1-L2	M3, M4	73.56	884.5	12.02	19.4	22.5	--O.K.
L2-L3	M5, M6	110.12	1592	14.46	20.9	22.5	--O.K.
L3-L4	M7, M8	110.12	1474	13.39	20.9	22.5	--O.K.
L4-L5	M9, M10	132.26	2069.5	15.65	21.9	22.5	--O.K.
L5-L6	M11, M12	132.26	2002	15.14	21.9	22.5	--O.K.
L6-L7	M13, M14	157.85	2256.5	14.30	20.06	22.5	--O.K.
L7-L8	M15, M16	157.85	2260	14.32	20.06	22.5	--O.K.
Top Chords:							
L0-U1	M17, M28	249.02	2450	9.84	9.47	16.18	--O.K.
U1-U2	M29, M30	164	2157	13.15	13.74	17.46	--O.K.
U2-U3	M31, M32	164	2828	17.24	17.45	17.61	--O.K.
U3-U4	M33, M34	164	2826.3	17.23	17.45	17.61	--O.K.
U4-U5	M35, M36	202	3121	15.45	15.37	17.59	--O.K.
U5-U6	M37, M38	202	3116	15.43	15.37	17.59	--O.K.
U6-U7	M39, M40	230.88	3189.5	13.81	13.61	17.57	--O.K.
U7-U8	M41, M42	230.88	3185.5	13.80	13.61	17.57	--O.K.
Verticals:							
U1-L1	M43-M48	29.9	458.5	15.33	12.9	16	--O.K.
U2-L2	M49-M56	67.24	821.2	12.21	11.9	12.4	--O.K.
U4-L4	M65-M72	48.88	599.5	12.26	9.86	12.09	--N.G.
U6-L6	M81-M88	39.25	560	14.27	15.78	16	--O.K.
U8-L8	M97-M100	22.79	247.7	10.87	10.5	16	--O.K.
M3-L3	M57-M60	24.25	401.5	16.56	14.78	16	--N.G.
M5-L5	M77-M80	24.25	402.5	16.60	15	16	--N.G.
M7-L7	M93-M97	24.25	404.2	16.67	15.1	16	--N.G.
U3-M3	M61-M64	14.7	40	2.72	1.66	9.05	--O.K.
U5-M5	M73-M76	14.7	44.3	3.01	2.8	8.18	--O.K.
U7-M7	M89-M92	14.7	45.3	3.08	3.04	7.87	--O.K.

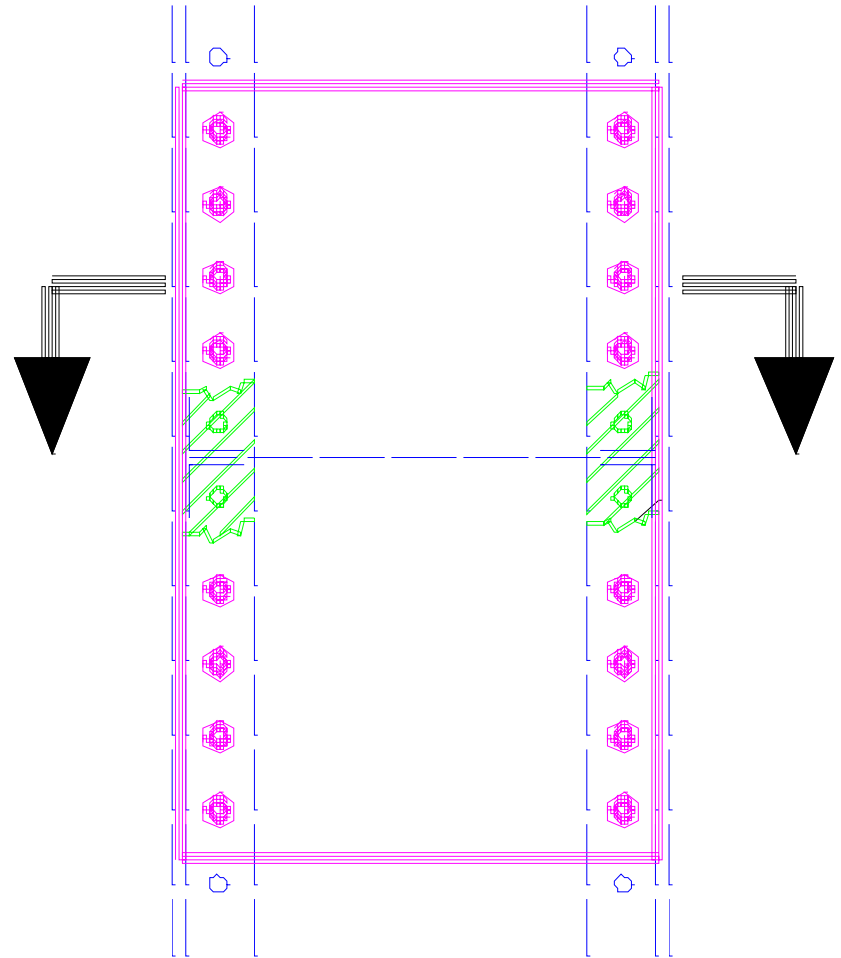
- Vertical & Diagonal members
 - Locations of internal diaphragms
 - Horizontal surfaces provide accelerated debris collection, deterioration, and section loss



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 - Horizontal surfaces provide accelerated debris collection, deterioration, and section loss



- Vertical & Diagonal members
 - Add angle plates via bolted connections to existing members



- Stringers
 - Remove existing top flange plates and add new equal size plates
- 1 or 2 Floorbeams
 - Due to concentrated area of fire damage, remove existing top flange plates and add new equal size plates

Kentucky side:

- Due to the limited roadway access length/area and high 60 ft height of the existing bridge pier, a spiral earth approach was recommended during the conceptual phase of the project.
- Because of settlement impacts & mitigation costs, the spiral mound was eliminated.

Indiana side:

KZF Design submitted several approach concepts to the City of Jeffersonville

1. Hanging walkway
2. Truss Approach span with elevator access

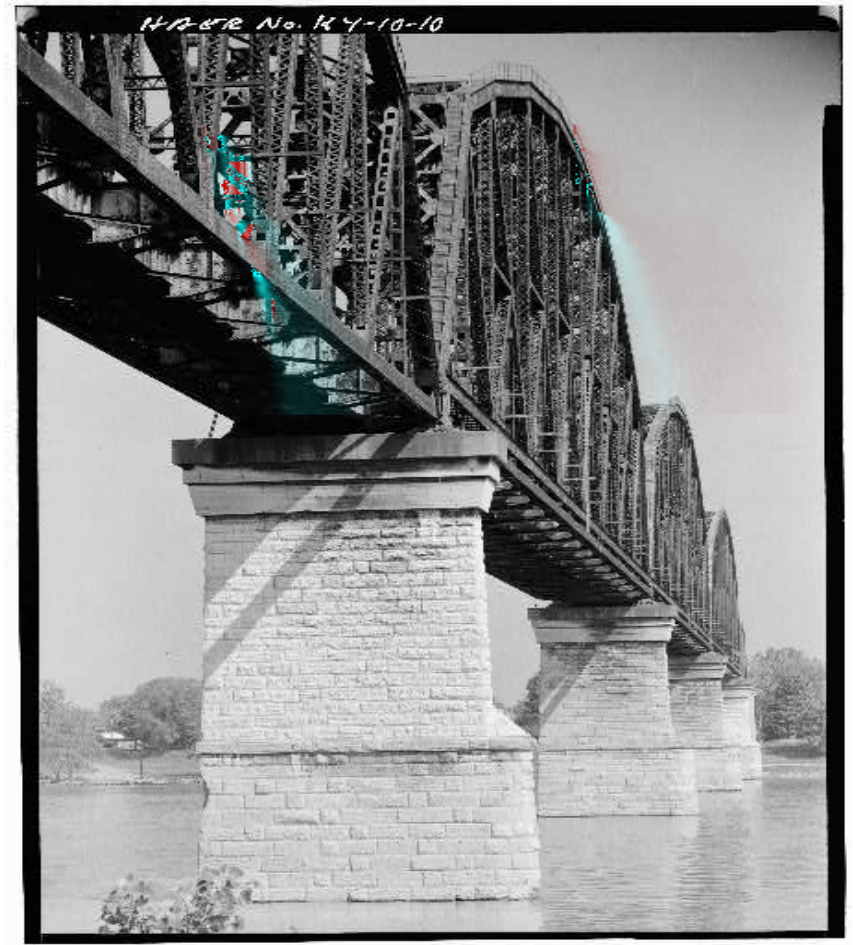




- 207'-3 @ 548'-2 @ 338
(Bridge Length = 2527 ft.)
- Inventory Existing Members
- Bridge Inspection
- 3-D Model/Analysis
- Load Rating & Proposed Design Section
- Rehabilitation/Repair



- Historic American Engineering Record
- Louisville Waterfront Development Corporation (LWDC)
- Engineering News Record Article, 1929



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