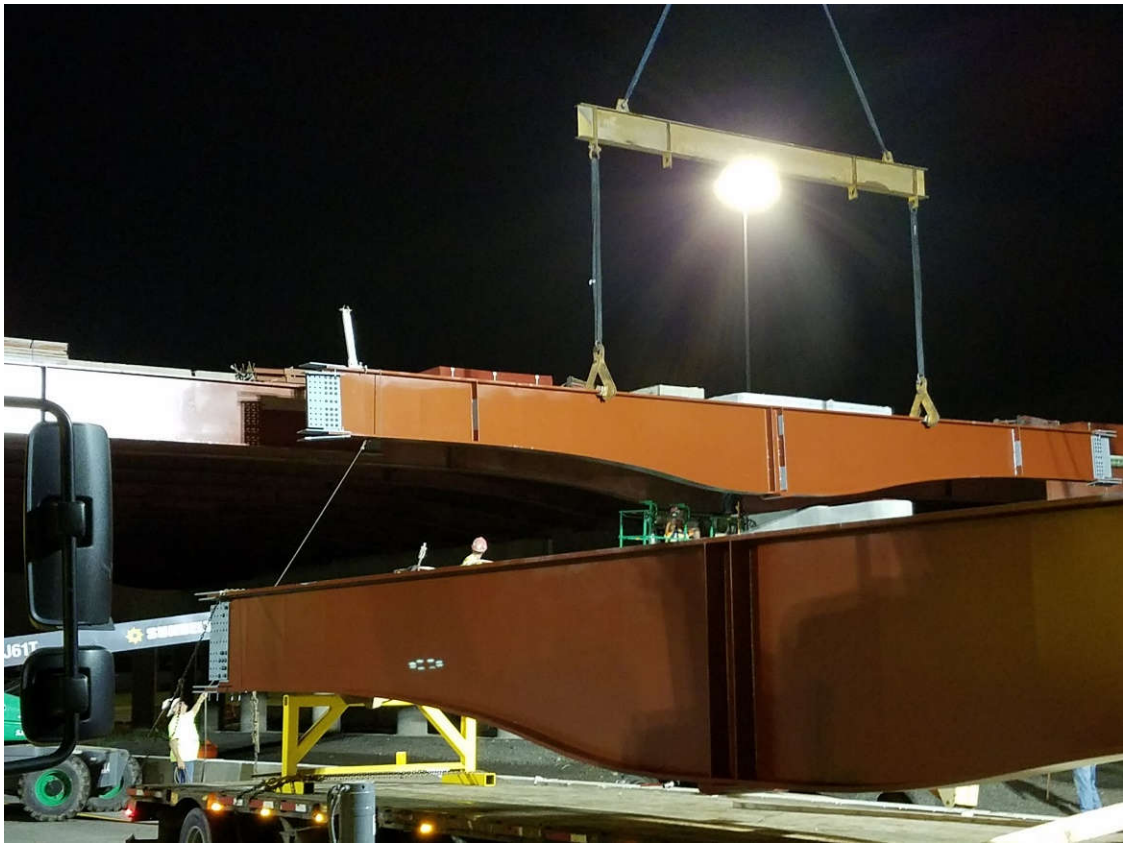
Steel Bridge Fabrication

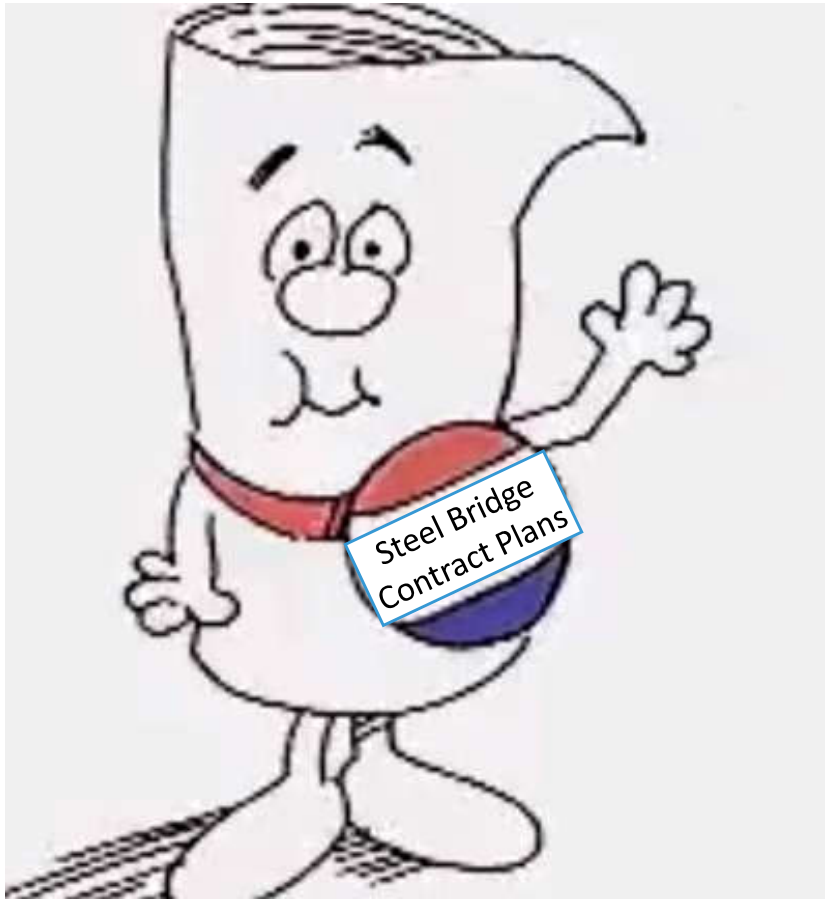
Overview & Roundtable Discussion



Smarter. Stronger. Steel.

North Dakota Steel Bridge Forum – April 2025

I'm just a set of contract plans…..



Regional AISC Certified Steel Bridge Fabricators

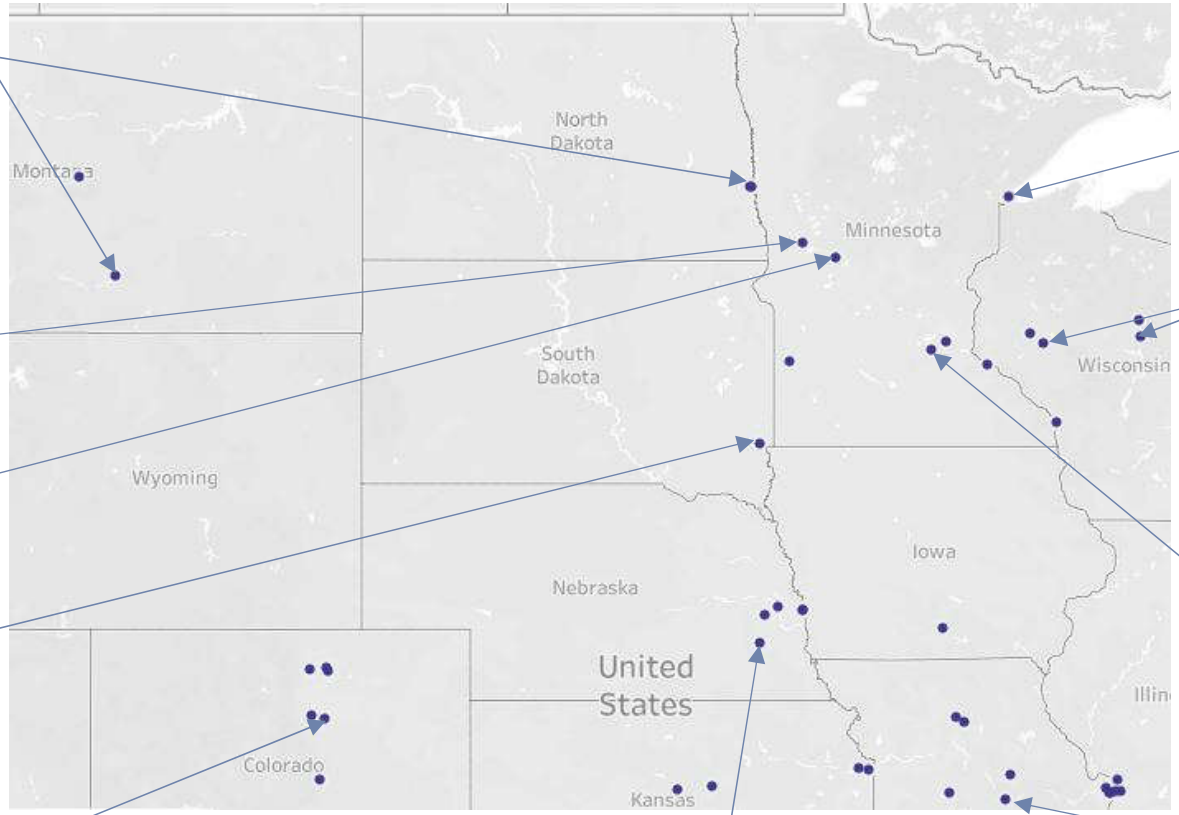
TrueNorth Steel
Nick Zacher

Aura Fabricators Inc.
Jasmine Sonmor

CONTECH ENGINEERED SOLUTIONS
A QUIKRETE® COMPANY

Egger Steel Co.
Brad Harris

Sean Peterson
W&W | AFCO STEEL



CAPITAL CONTRACTORS INC.
Chuck Sidles

Tony Peterson
NATIONAL STEEL BRIDGE ALLIANCE NSBA FOUNDED 1995

Veritas STEEL
Building Tomorrow's Infrastructure
Mark Garrison

Wheeler
Matt Gregg

DeLong's INC.
Gary Wisch

Today's Session

Steel Bridge Fabrication Overview – Nick Zacher, True North Steel

- Bidding a bridge project
- Shop Drawings
- Fabrication
- Delivery and erection support

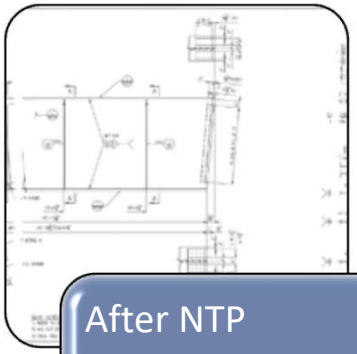
Roundtable Discussion - AUDIENCE INTERACTION (Ask Questions)

- Nick Zacher, True North
- Mark Garrison, Veritas
- Gary Wisch, DeLong's
- Chuck Sidles, Capital Contractors
- Jeff Greene, LeJeune Bolt
- Jasmine Sonmor, Aura
- Matt Gregg, Wheeler

General Steel Bridge Fabrication Schedule

Prebid

- Contract Documents
- Develop Bid

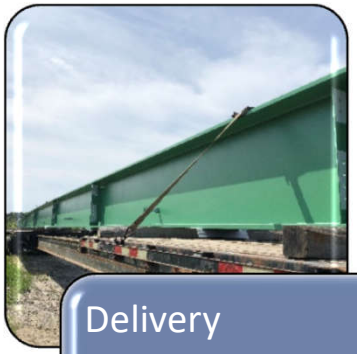


After NTP

- Shop Drawings & Approval
- Material Procurement
- Weld Procedures

Fabrication

- Planning & Programming
- Material Preparation
- Main Fabrication
- Blast clean / Coating



Delivery

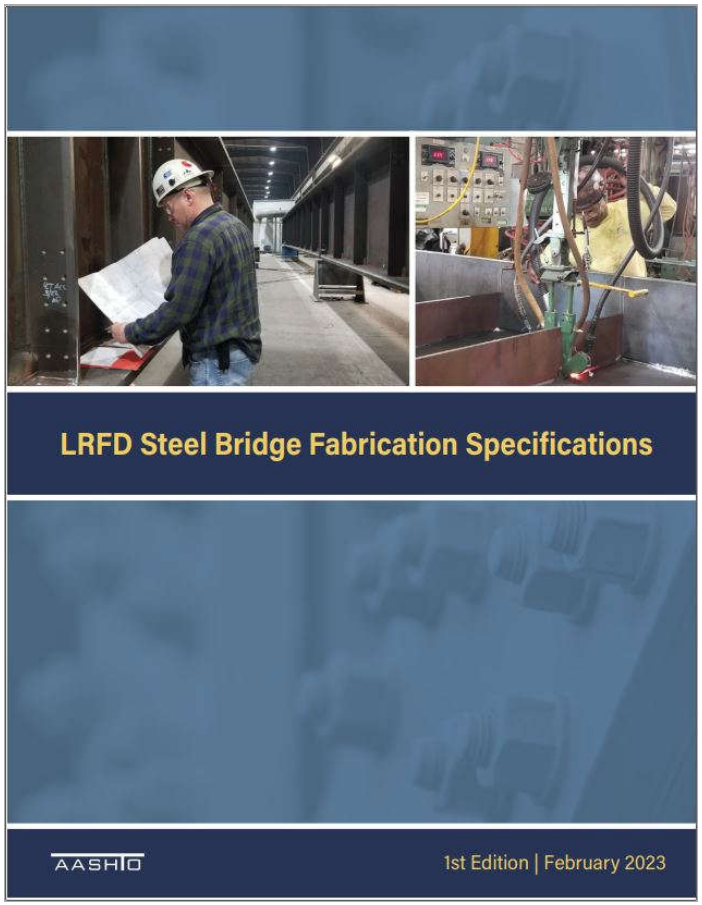
- Load & ship to jobsite

- ***Learning Outcome:***
  - **Better understanding of the steel bridge fabrication process**

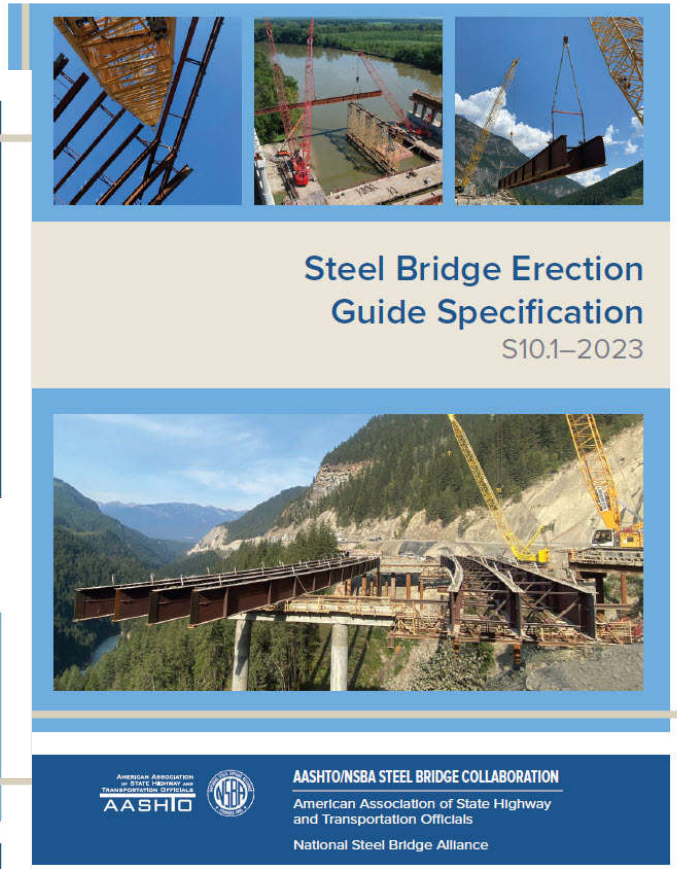
AASHTO Resources

AASHTO Fabrication Specification

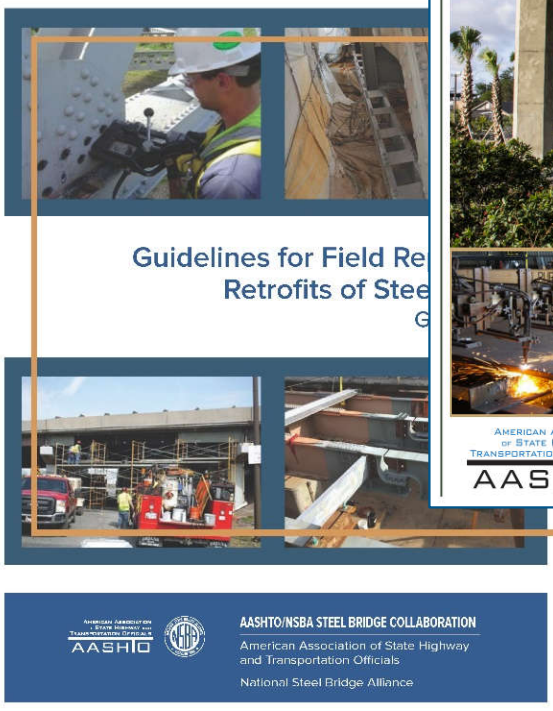
1st Edition

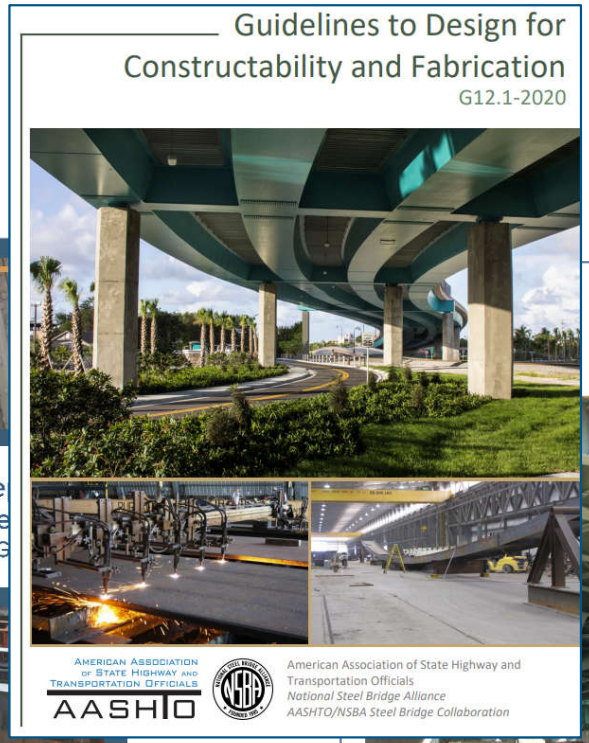


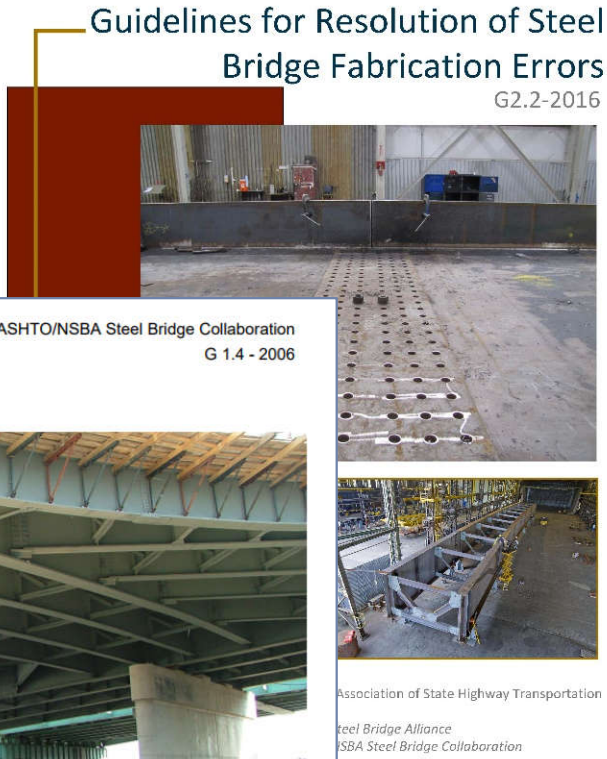
NSBA Resources - Specifications



NSBA Resources - Guidelines



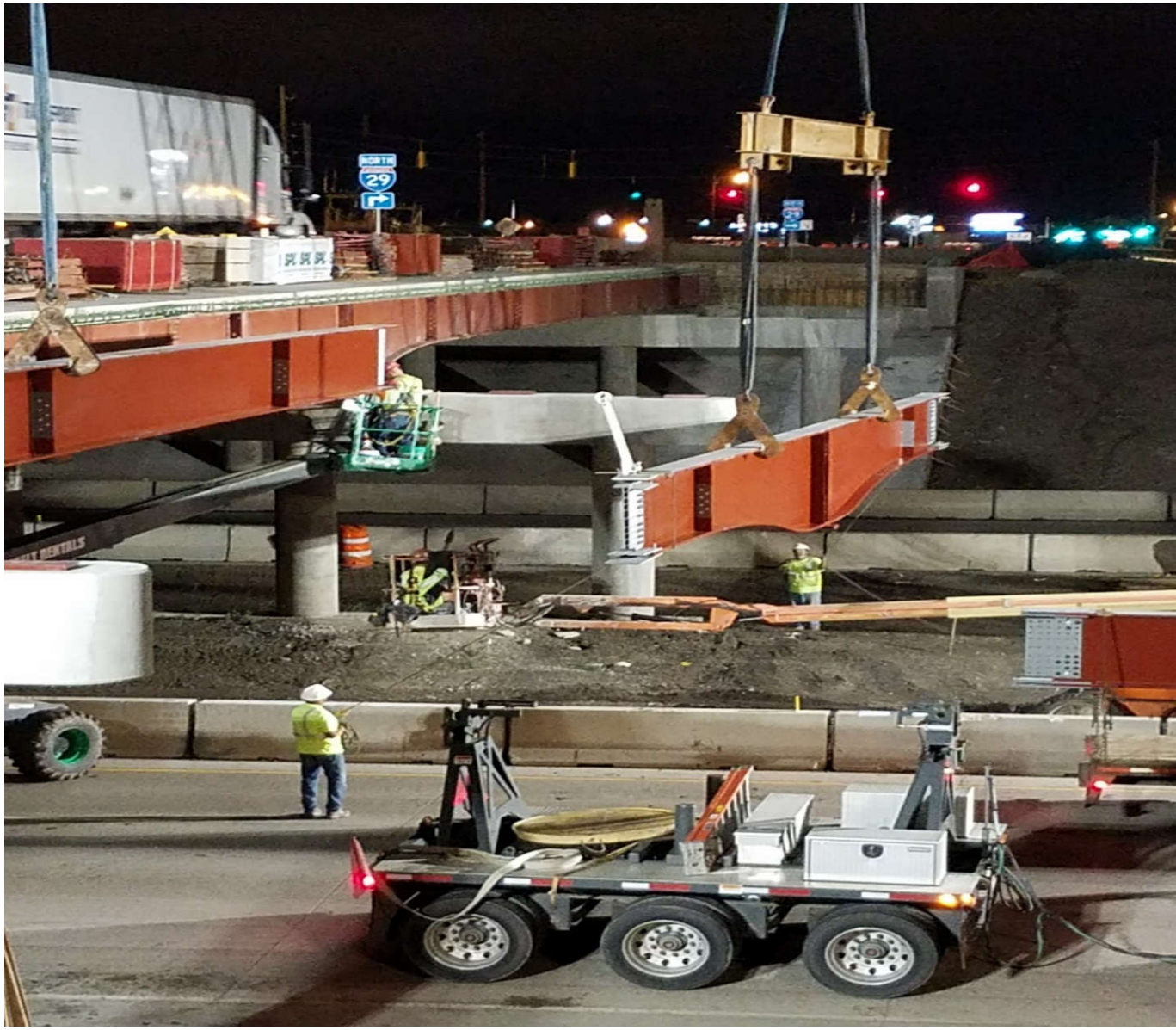




Steel Plate Girder fabrication

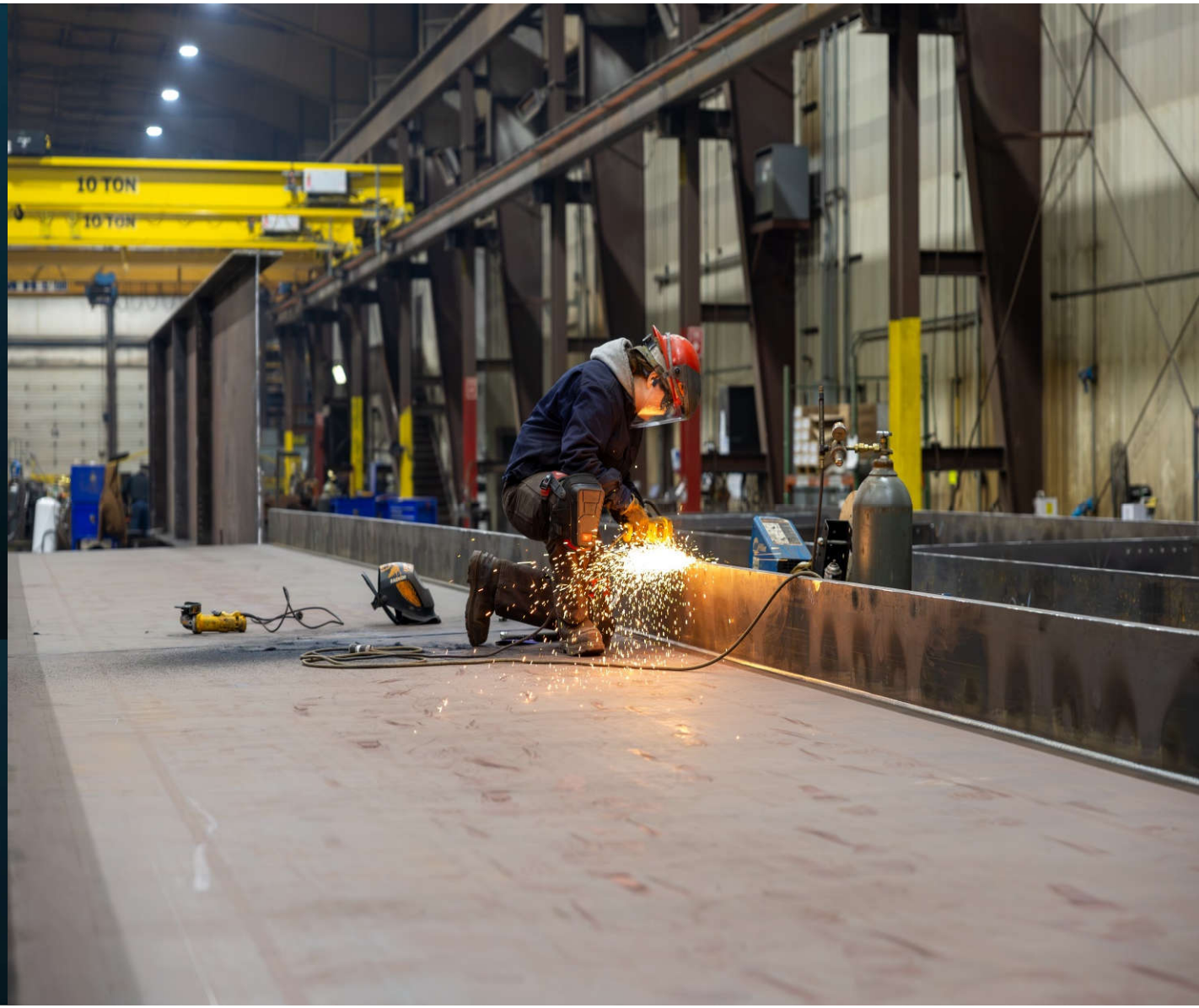
Nicholas Zacher
TrueNorth Steel

special content credit to
Chuck Sidles Capital Contractors
Sean Peterson
W&W affco steel



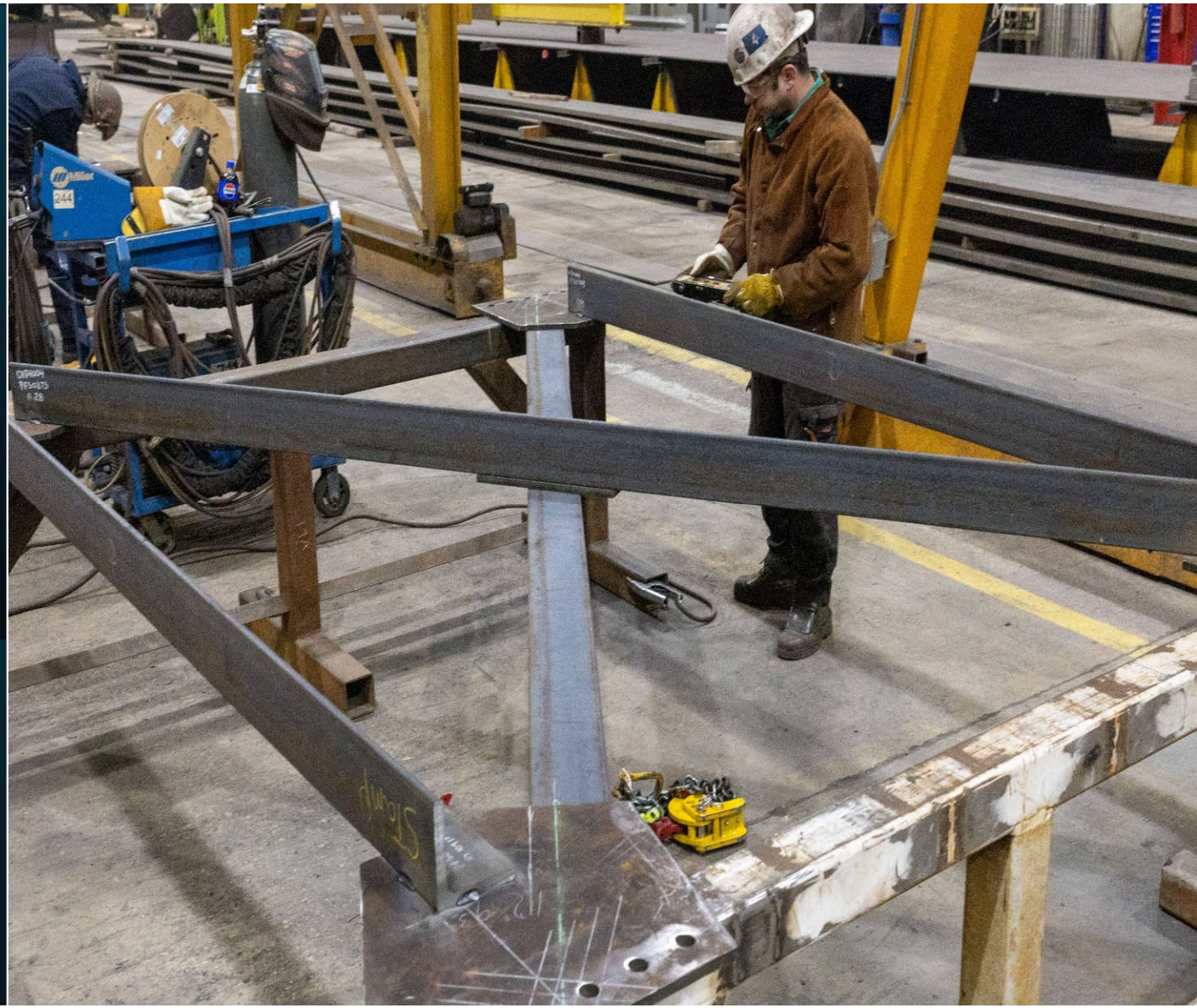
Agenda

1. Design Drawings and what Fabricators need from Designers
2. Material Procurement
3. Girder Fabrication
4. Cross Frame Fabrication
5. Blasting and Surface Prep
6. Shipping and Logistics.

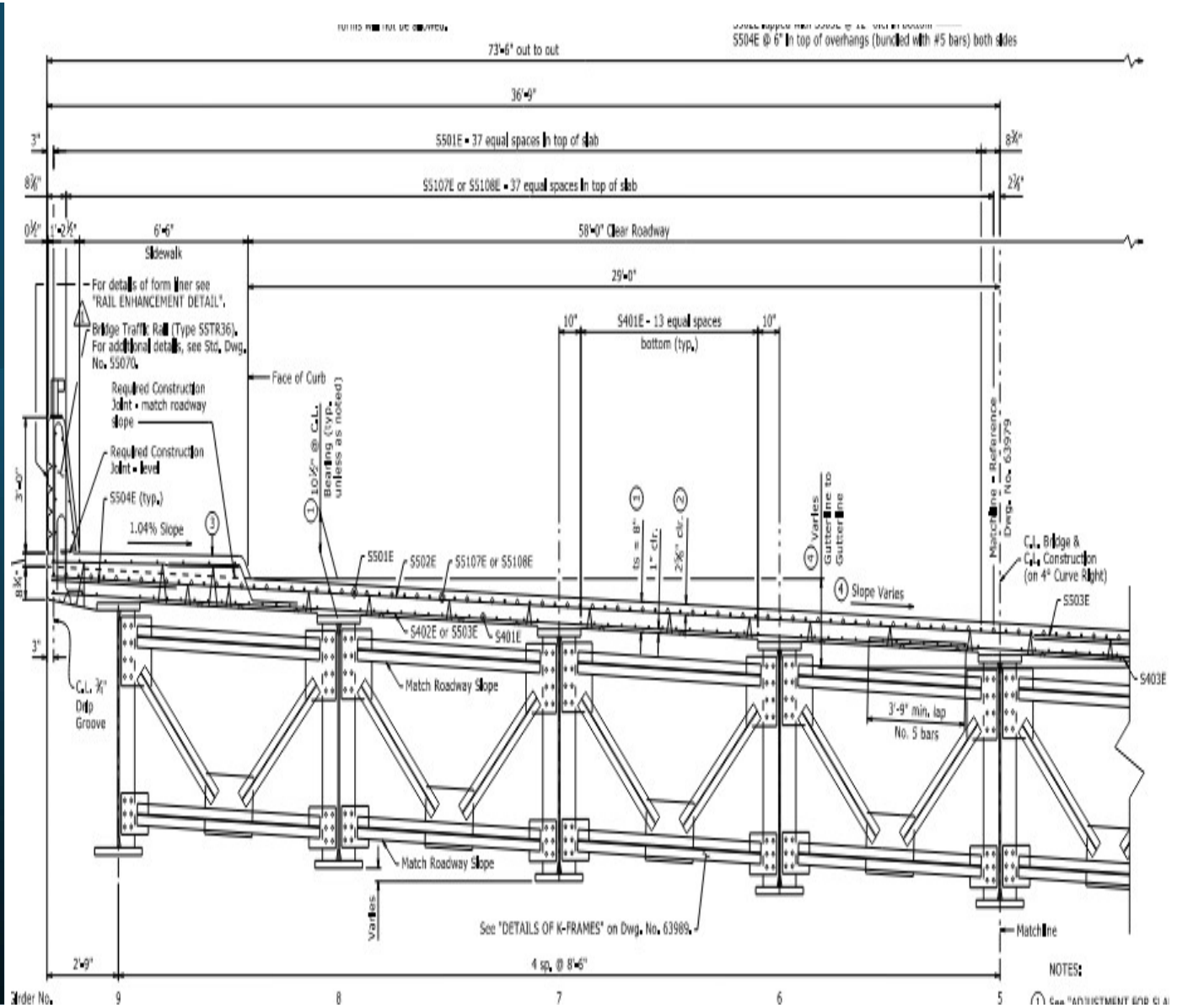


Design Drawing Requests and Considerations

- As fabricators we layout our radius from the centerline of the roadway, avoid northings and eastings for defining the radius.
- Be sure to include vertical curve in the camber tables, this allows a common place for all involved to back check.
- Work points should always be given at the center of the web for cross frame drafting, this allows for more accurate cross frames and less room for error on hole edge distances.
- Avoid skewing each individual stiffener to a girder radius during cross frame design. This creates too many different cross frame types which add cost.

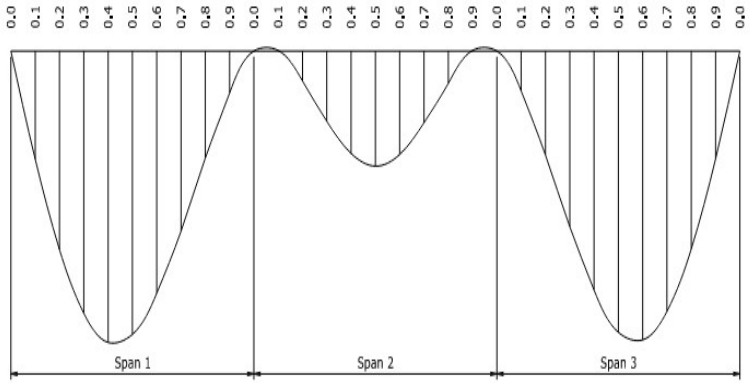


Center line of web example.



Load Deflection Table

Span	Point of Deflection	Structural Steel									Structural Steel + Slab									Structural Steel + Slab + Parapet + Sidewalk								
		Girder 1	Girder 2	Girder 3	Girder 4	Girder 5	Girder 6	Girder 7	Girder 8	Girder 9	Girder 1	Girder 2	Girder 3	Girder 4	Girder 5	Girder 6	Girder 7	Girder 8	Girder 9	Girder 1	Girder 2	Girder 3	Girder 4	Girder 5	Girder 6	Girder 7	Girder 8	Girder 9
1	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0.1	0.21	0.223	0.235	0.245	0.253	0.258	0.265	0.278	0.295	0.766	0.851	0.916	0.965	1.002	1.014	1.026	1.05	1.084	0.938	0.978	1.018	1.055	1.091	1.112	1.15	1.224	1.325
	0.2	0.384	0.413	0.433	0.448	0.459	0.474	0.49	0.513	0.54	1.408	1.572	1.691	1.767	1.819	1.864	1.899	1.942	1.99	1.723	1.81	1.879	1.931	1.979	2.043	2.128	2.262	2.431
	0.3	0.506	0.542	0.568	0.592	0.608	0.623	0.645	0.674	0.712	1.859	2.066	2.221	2.34	2.41	2.457	2.505	2.555	2.628	2.274	2.382	2.47	2.557	2.621	2.692	2.805	2.973	3.211
	0.4	0.56	0.6	0.631	0.652	0.671	0.69	0.713	0.745	0.79	2.059	2.292	2.471	2.584	2.666	2.725	2.777	2.835	2.921	2.518	2.645	2.749	2.823	2.899	2.984	3.106	3.295	3.568
	0.5	0.544	0.579	0.608	0.63	0.649	0.67	0.693	0.724	0.766	2.009	2.217	2.389	2.507	2.592	2.657	2.709	2.762	2.842	2.456	2.56	2.658	2.738	2.817	2.907	3.026	3.205	3.47
	0.6	0.463	0.491	0.516	0.537	0.556	0.571	0.593	0.619	0.652	1.72	1.889	2.036	2.152	2.232	2.279	2.329	2.376	2.432	2.098	2.181	2.264	2.349	2.424	2.491	2.597	2.751	2.967
	0.7	0.337	0.355	0.376	0.394	0.404	0.418	0.432	0.453	0.482	1.265	1.381	1.5	1.592	1.642	1.683	1.711	1.755	1.812	1.538	1.592	1.667	1.736	1.781	1.837	1.904	2.026	2.206
	0.8	0.195	0.208	0.219	0.227	0.236	0.242	0.253	0.268	0.283	0.744	0.82	0.888	0.936	0.979	0.989	1.016	1.055	1.081	0.898	0.943	0.985	1.019	1.06	1.077	1.126	1.212	1.311
	0.9	0.071	0.076	0.08	0.085	0.086	0.089	0.097	0.095	0.108	0.282	0.312	0.337	0.361	0.374	0.377	0.4	0.386	0.427	0.335	0.356	0.372	0.392	0.403	0.409	0.441	0.438	0.514
2	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0.1	0.02	0.019	0.02	0.02	0.017	0.017	0.015	0.013	0.01	0.023	0.02	0.022	0.022	0.014	0.018	0.004	-0.014	-0.037	0.056	0.034	0.031	0.029	0.019	0.024	0.014	0.005	-0.008
	0.2	0.106	0.11	0.115	0.116	0.114	0.114	0.113	0.113	0.109	0.273	0.303	0.323	0.327	0.329	0.339	0.318	0.281	0.235	0.394	0.376	0.372	0.366	0.366	0.38	0.374	0.37	0.367
	0.3	0.209	0.221	0.229	0.232	0.234	0.24	0.236	0.236	0.236	0.592	0.663	0.705	0.72	0.735	0.758	0.718	0.667	0.607	0.813	0.808	0.805	0.8	0.81	0.844	0.831	0.838	0.86
	0.4	0.29	0.307	0.318	0.325	0.33	0.334	0.335	0.336	0.336	0.849	0.947	1.013	1.048	1.069	1.075	1.042	0.983	0.906	1.145	1.15	1.154	1.161	1.175	1.194	1.199	1.218	1.253
	0.5	0.32	0.338	0.351	0.361	0.368	0.371	0.373	0.374	0.377	0.947	1.056	1.135	1.182	1.203	1.198	1.164	1.101	1.026	1.27	1.282	1.293	1.308	1.321	1.329	1.336	1.358	1.41
	0.6	0.291	0.305	0.318	0.328	0.335	0.338	0.339	0.339	0.342	0.855	0.95	1.029	1.077	1.092	1.08	1.043	0.983	0.915	1.151	1.158	1.175	1.193	1.2	1.198	1.197	1.214	1.267
	0.7	0.21	0.22	0.23	0.237	0.243	0.245	0.244	0.243	0.244	0.6	0.672	0.734	0.765	0.778	0.758	0.72	0.674	0.617	0.82	0.826	0.842	0.849	0.856	0.843	0.829	0.839	0.878
	0.8	0.107	0.113	0.117	0.119	0.123	0.123	0.122	0.123	0.12	0.283	0.324	0.354	0.371	0.378	0.347	0.32	0.3	0.254	0.403	0.408	0.411	0.414	0.418	0.389	0.373	0.385	0.396
	0.9	0.021	0.023	0.022	0.026	0.024	0.021	0.024	0.024	0.012	0.029	0.041	0.046	0.062	0.05	0.023	0.019	0.012	-0.038	0.061	0.063	0.059	0.072	0.058	0.03	0.029	0.03	-0.008
3	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0.1	0.068	0.075	0.077	0.078	0.082	0.083	0.086	0.092	0.1	0.265	0.3	0.314	0.326	0.35	0.363	0.376	0.391	0.412	0.318	0.339	0.344	0.353	0.378	0.394	0.416	0.447	0.488
	0.2	0.196	0.206	0.215	0.221	0.226	0.231	0.239	0.252	0.268	0.734	0.8	0.853	0.892	0.927	0.965	0.991	1.022	1.059	0.895	0.914	0.942	0.971	1.004	1.052	1.103	1.179	1.274
	0.3	0.336	0.356	0.373	0.383	0.392	0.407	0.417	0.437	0.46	1.236	1.363	1.461	1.525	1.583	1.66	1.688	1.734	1.776	1.513	1.565	1.619	1.662	1.718	1.813	1.883	2.009	2.152
	0.4	0.462	0.489	0.51	0.531	0.545	0.557	0.576	0.6	0.631	1.689	1.856	1.982	2.099	2.178	2.238	2.299	2.349	2.405	2.07	2.139	2.201	2.29	2.366	2.448	2.568	2.725	2.926
	0.5	0.54	0.574	0.605	0.623	0.639	0.656	0.675	0.704	0.748	1.971	2.169	2.343	2.452	2.541	2.617	2.675	2.732	2.825	2.417	2.505	2.606	2.677	2.762	2.864	2.99	3.171	3.445
	0.6	0.561	0.597	0.623	0.643	0.66	0.676	0.701	0.731	0.771	2.044	2.249	2.407	2.527	2.615	2.685	2.762	2.822	2.898	2.507	2.603	2.68	2.761	2.843	2.94	3.087	3.275	3.537
	0.7	0.506	0.538	0.563	0.582	0.598	0.615	0.633	0.66	0.697	1.842	2.024	2.173	2.284	2.366	2.432	2.487	2.541	2.611	2.259	2.345	2.422	2.497	2.574	2.663	2.779	2.947	3.189
	0.8	0.385	0.408	0.429	0.445	0.456	0.468	0.481	0.501	0.531	1.399	1.532	1.654	1.743	1.802	1.847	1.884	1.924	1.984	1.716	1.777	1.844	1.906	1.961	2.023	2.104	2.229	2.425
	0.9	0.209	0.221	0.234	0.243	0.249	0.254	0.26	0.272	0.29	0.758	0.829	0.903	0.952	0.981	1.003	1.017	1.045	1.08	0.93	0.963	1.007	1.042	1.068	1.098	1.135	1.209	1.32
	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

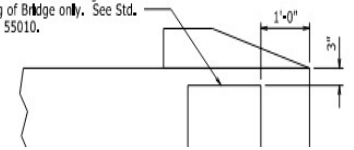


DEAD LOAD DEFLECTION DIAGRAM

Note:
Camber for Dead Load Deflection +/- Inch tolerance. Deflections shown are along centerline of beam/girder from the plane perpendicular to the web extending from C.L. Bearing to C.L. Bearing. Negative sign (-) indicates point above plane. Vertical curve corrections not included. Superelevation transition corrections not included.

Dead load deflections shown include an assumed loading of 18 psf to account for stay-in-place metal deck forms. Revisions to the deflection table may be necessary upon review of the Contractor's submitted forming details or any approved changes to the pouring sequence shown in "REINFORCING PLAN & DECK POURING SEQUENCE" on Dwg. Nos. 63991 & 63992.

Place Type D Bridge Name Plate on front face of span rail approximately 1'-0" from end of rail on right side Beginning of Bridge only. See Std. Dwg. No. 55010.

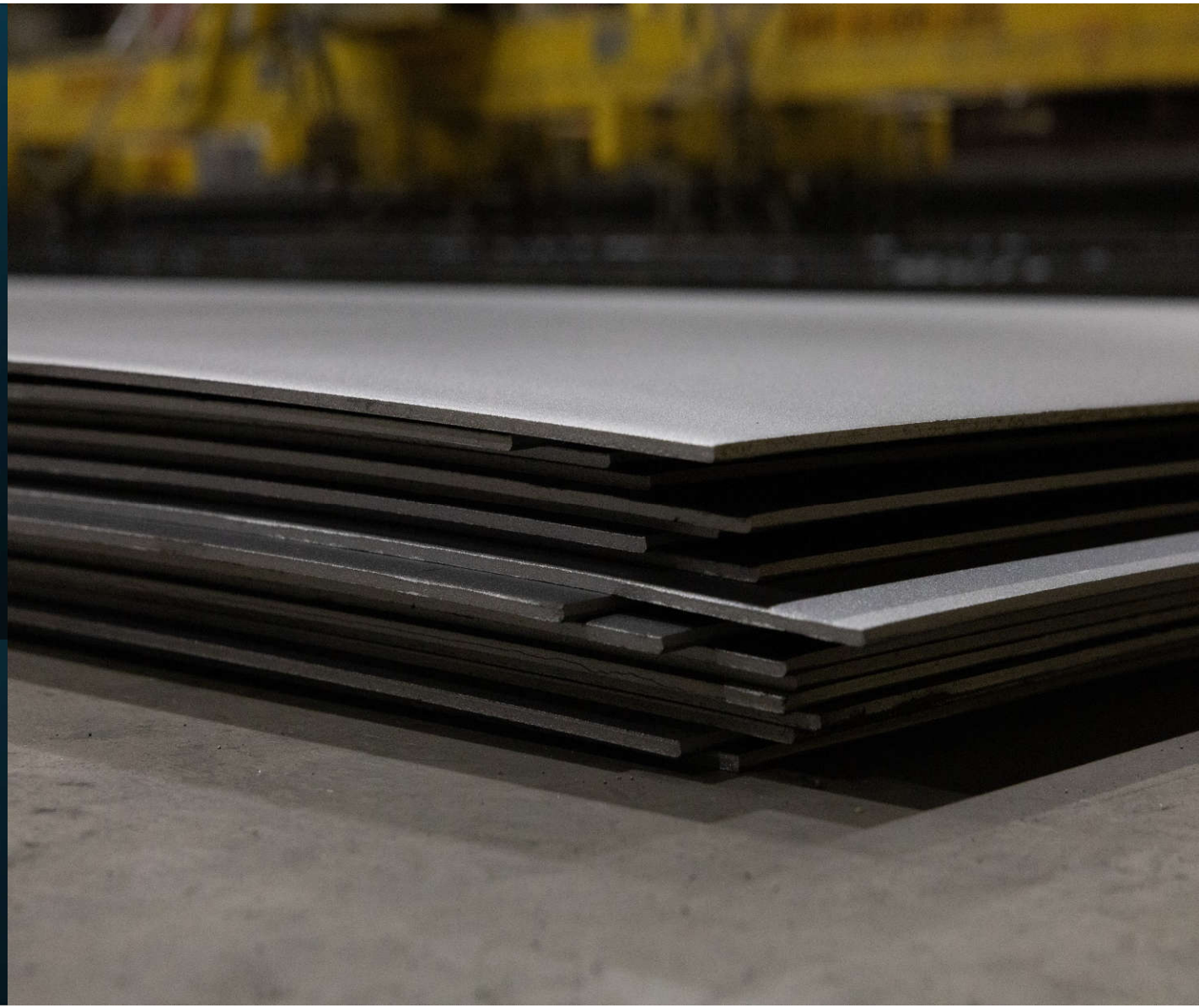


OF VARIABLES
h Std. Dwg. No. 55070)

ied Rail Panels		
ength	A	R4XXE
¼"	23	R404E
)"	23	R405E

Material Procurement

- Maximizing the plate Mult
- Web depths DO NOT have to be specified in 3” increments
- Flange widths DO NOT have to be specified in even number intervals
- Plate thicknesses are available in 1/16” increments between ¼” to 4” thick
- Maintain constant flange width within a given field section
- Length constraints typically occur beyond 130’
- Lead times are 8 to 10 weeks in a typical market
- Weathering steel is an excellent cost effective solution for most applications.
- Weathering steel can be purchased in all typical thickness’



Credit: Sean Peterson W&W AFCO STEEL.

Girder Fabrication Basics

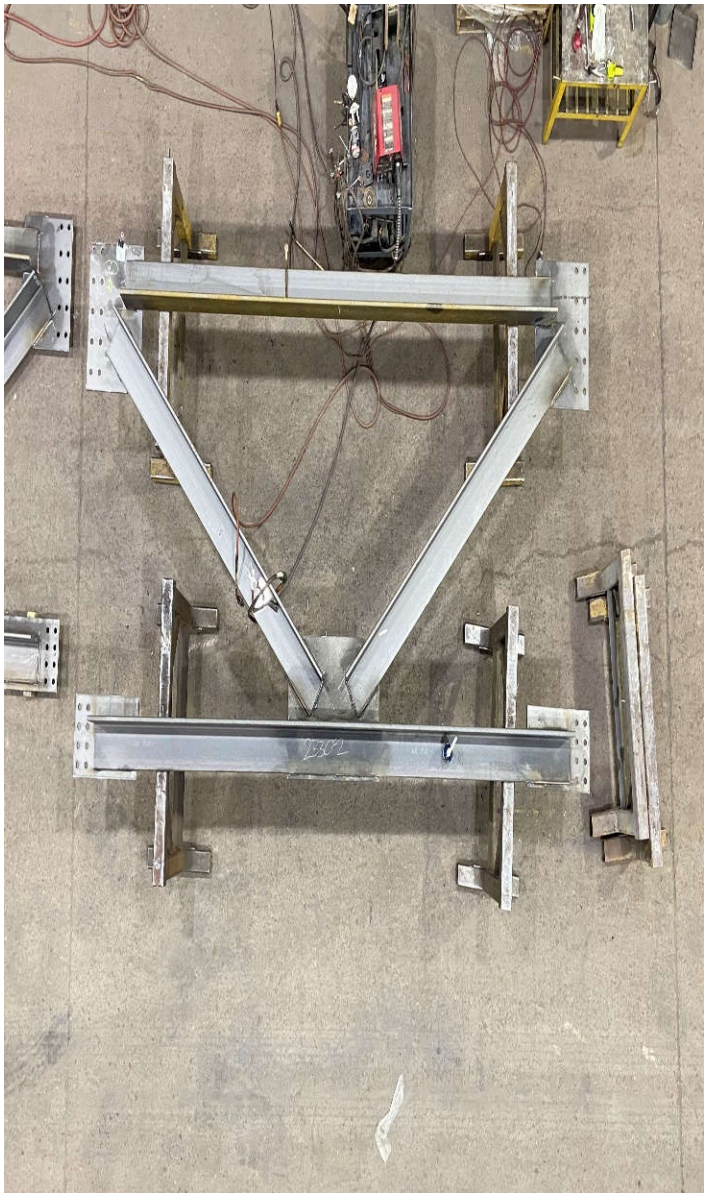
1. Receive raw material
2. Strip flanges to manageable sizes
3. Process webs and flanges
4. Tack up webs to flanges
5. Weld webs and flanges
6. Install stiffeners
7. Block and fit splices
8. Blast
9. Paint
10. Ship

Plate Girder Assembly

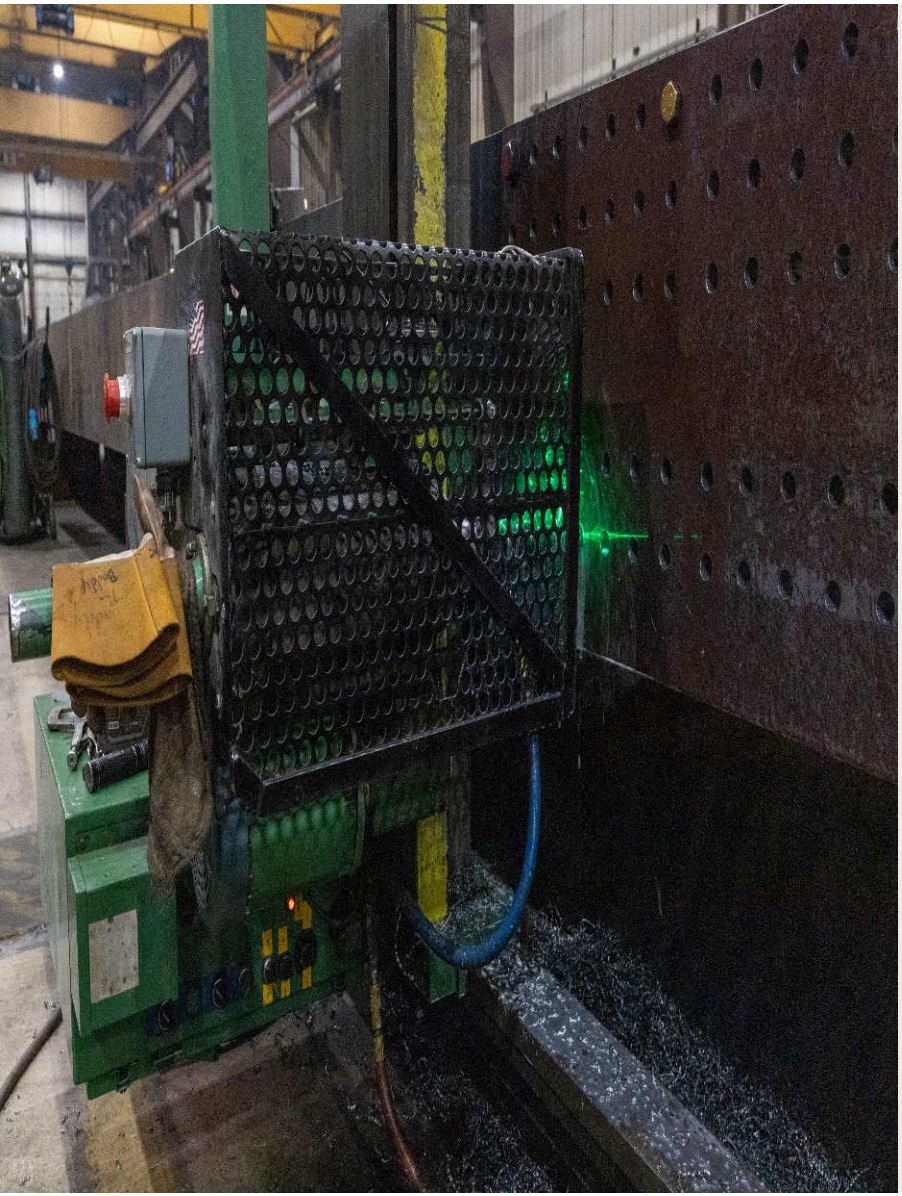
1. Lay out web
2. Squeeze flanges to web
3. Tack flanges
4. Sub-arc weld webs to flanges
5. Install stiffeners
6. We can typically complete 1 “girder blank”, start to finish in a 10 hour shift without stiffeners.

Cross Frame Preferences

- Standardize size as much as possible
- Consider shop bolted cross frames
- General Practices to save Money
- Material
  - Angle, Channel, beams, Plate
  - T's add to costs – Splitting, Heat Correcting
- Design
  - No backside welds – significant relative costs
  - No wrap welds (around back side)
  - Angle always the same direction
- Avoid large bent plate applications, C's or large angles are often a cheaper option



Example of an economic cross frame

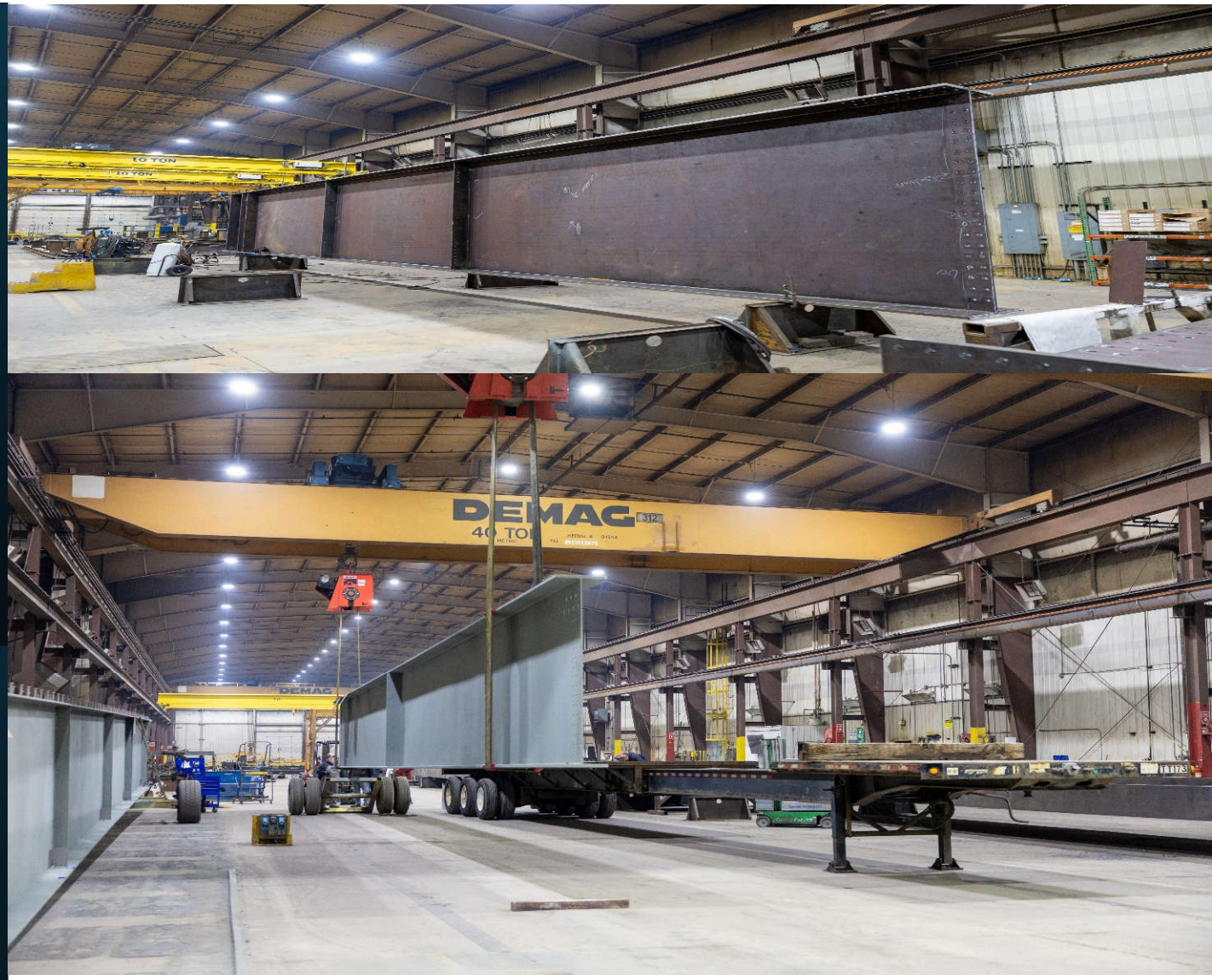


Fabricating Splices

- Splices
  - Splices are typically shop assembled and match drilled
  - Shop Girder Blockings are typically done in 2 and 3 girder runs to ensure splice elevation, location and camber values are accurate
  - Girder blanks are typically left long and shop cut after assembly during the splicing process to ensure accurate lengths.

Blast & Surface Preparation

- Weathering Steel applications typically require a SSPC-SP7 “brush off blast” at all main girders and cross frames to create a “uniform rusting condition.” This approach is very economical
- Painted Girders typically require a minimum of SSPC-SP6 Commercial blast clean and often require SSPC-SP10 near white blast prior to coatings. This process typically adds 50% more surface prep time than an SSPC-SP7.
- Blasting can be completed in a cabinet blaster, by hand or a combination of the 2
- Connection surfaces are prepared to Class A or Class B surface profile depending on the AHJ specification.



Transportation

- Girders are typically shipped in the vertical orientation
- Girders with webs deeper than 8’ typically require special equipment and permitting to ship
- Steerable dollys, stretch trailers and bolsters are the industry standard for shipping.

QUESTIONS?

Audience Questions

Questions (if none from audience)

Panel Discussion:

- When the owner/engineer reviews shop drawings, how much detail should they go into? What are some items that engineers do not need to comment on?
- Does steel typically have to be ordered from the mill prior to shop drawings being fully approved?
- Are you using robotics in fabrication? If so, how? Is a 3d structural model needed?
- When is shop assembly needed? What load condition is it completed in?

Thank you!

LeJEUNE BOLT COMPANY

NATIONAL STEEL BRIDGE ALLIANCE NSBA FOUNDED 1995

DeLong's INC.

Wheeler

TrueNorth Steel®

CAPITAL CONTRACTORS INC.

Veritas STEEL
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Aura Fabricators Inc.