SPS®

SPS Bridge Decks

SPS Technology
Terminology and History

SPS structure

Conventional stiffened steel structure

Conventional concrete-steel composite structure

Structural Composite

- two steel plates bonded to a solid elastomer core
- continuous elastomer support to steel precludes local buckling
- SPS 8-25-8: expresses the sandwich elements thickness in mm

History

- developed in 1993
- over 450 projects & 3 million ft^2 in service in 30 countries
- used in ships, bridges, stadium and buildings
- approved by major global regulators

SPS Technology

Civil Engineering, Offshore & Marine Applications

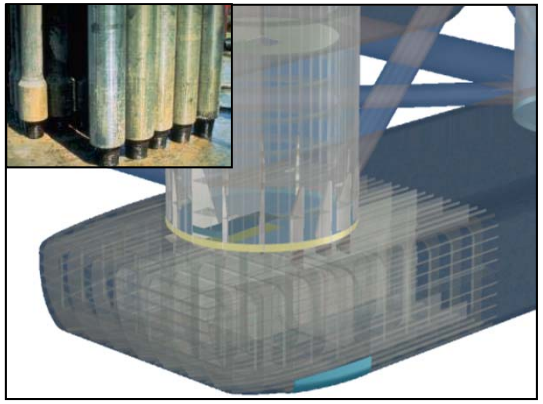
Carnegie Hall - Floors

Martin Branch Bridge - Deck

Georgia Tech - Terraces

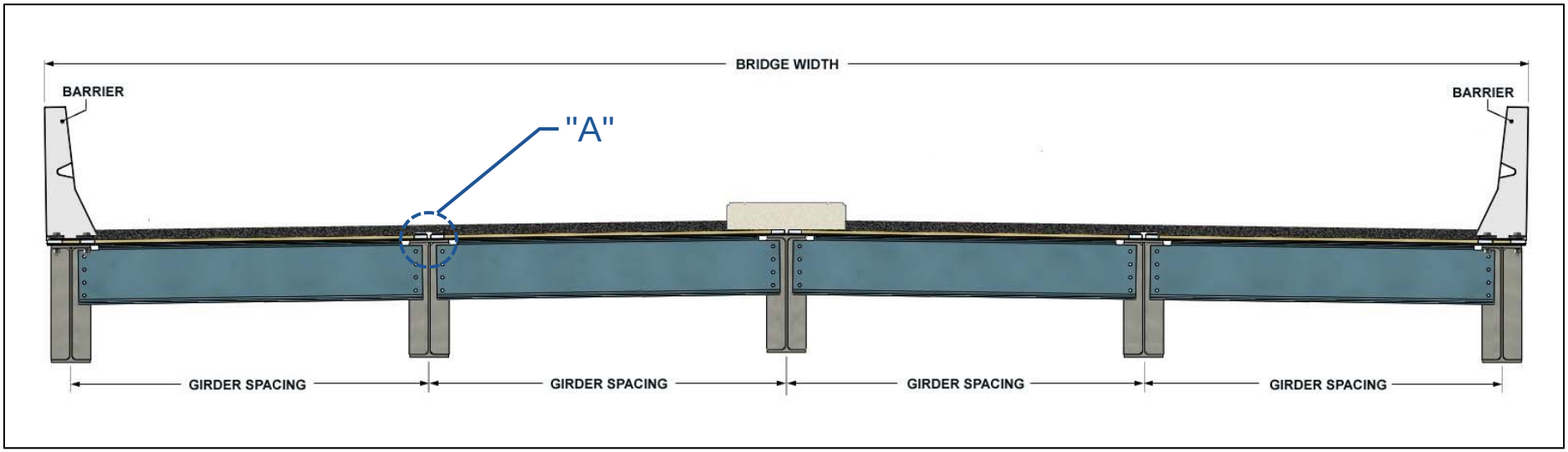
Side Shell Protection - Offshore

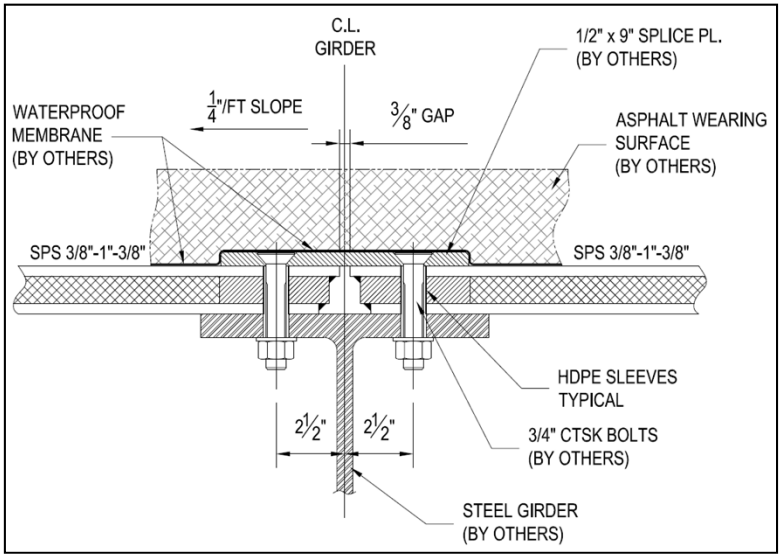
Pontoon Protection - Offshore



Hull Structures - Marine

What are SPS Bridge Decks?





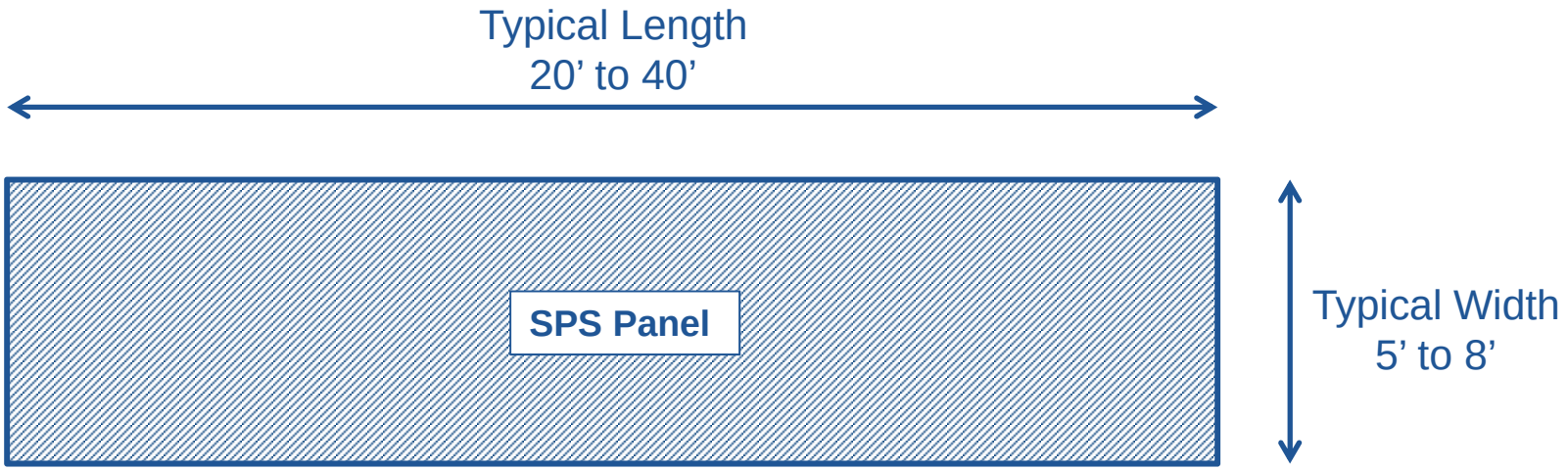
Detail "A"

SPS Bridge Deck

- composite deck
- asphalt, thin overlay & gravel wearing surfaces
- TL-4 crash tested barrier
- AASHTO Innovation Initiative – TxDOT Experience

AASHTO Innovation Initiative

SPS Bridge Decks
Typical Panel Dimensions and Weight

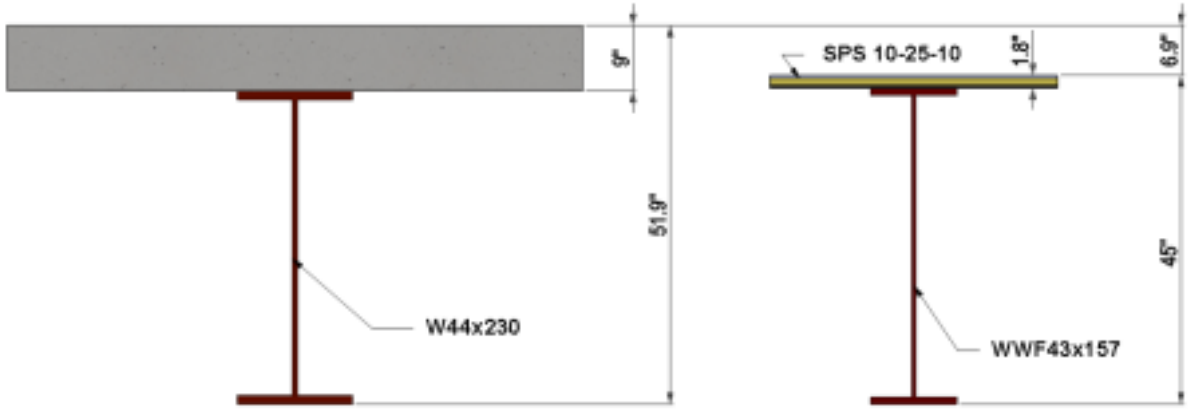


Deck Type		Girder Spacing	Weight[1] (psf)
Imperial	Metric (Approximate)		
SPS 5/16”-1”-5/16”	SPS 8-25-8	5’ to 6’	37
SPS 3/8”-1”-3/8”	SPS 10-25-10	6’ to 7’	41
SPS 1/2”-1”-1/2”	SPS 13-25-13	7’ to 8’	51

[1]Based on the smaller girder spacing and a panel length of 30’ with 1” x 4” perimeter bars

SPS Bridge Decks
Comparison with Concrete Bridge Decks

Attribute	Concrete Deck	SPS Deck
Weight	100 to 113 psf	37 to 51 psf
Deck Thickness	8" to 9"	1-5/8" to 2"
Weather Sensitivity During Installation	Weather dependant	Less weather dependant
Deck Durability	Deck may need to be replaced during its service life due to shrinkage cracking, reinforcement corrosion	Minimum deck life of 100+ years achieved by panel metallization. Protected against de-icing salts and chemicals



Benefits of SPS Bridge Decks

Prefabrication and Modular Construction

Accelerated Bridge Construction

Staged Construction - Single Lane

Prefabricated Deck-to-Girder

Full-Span Bridge Module

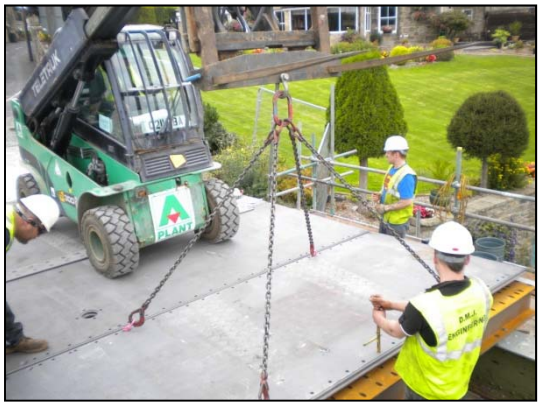
Integrated Deck-to-Tub Girder

Prefabricated Sidewalk Panels

Benefits of SPS Bridge Decks
Construction

Efficient Transportation

Lightweight Equipment



Reduced Site Congestion

Immediate Load Carrying Capacity

Single Trade

All Steel Construction

Benefits of SPS Bridge Decks
Typical Bridge Details

Asphalt Wearing Surface

Lightweight Wearing Surface

Deck Mounted TL-4 Guardrail Post

Steel Curb

Drain Insert

Standard Expansion Joint Seal

Benefits of SPS Bridge Decks

Typical Bridge Details Continued

Longitudinal Camber

Crossfall - Crowned SPS Panels

Crossfall - Sloped Bearing Plates

Weathering Steel

Factory Applied Paint

Metallized Panels

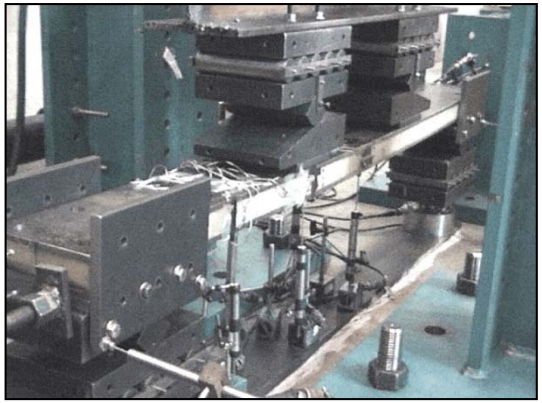
Benefits of SPS Bridge Decks
Design

AASHTO Approved

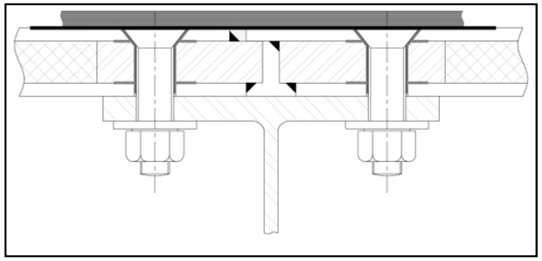
AASHTO Innovation Initiative

Crash Tested TL-4 Barrier

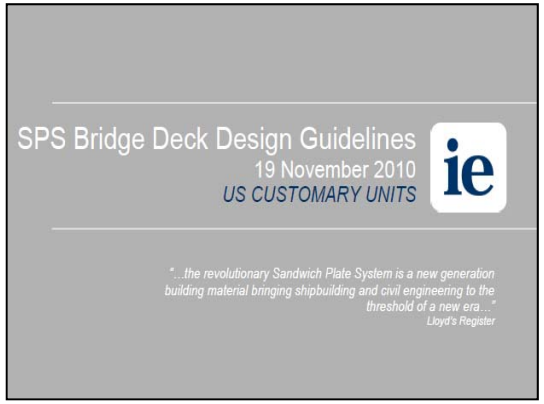
Fatigue Insensitive Bond and Core



Composite Action



Design Guidelines

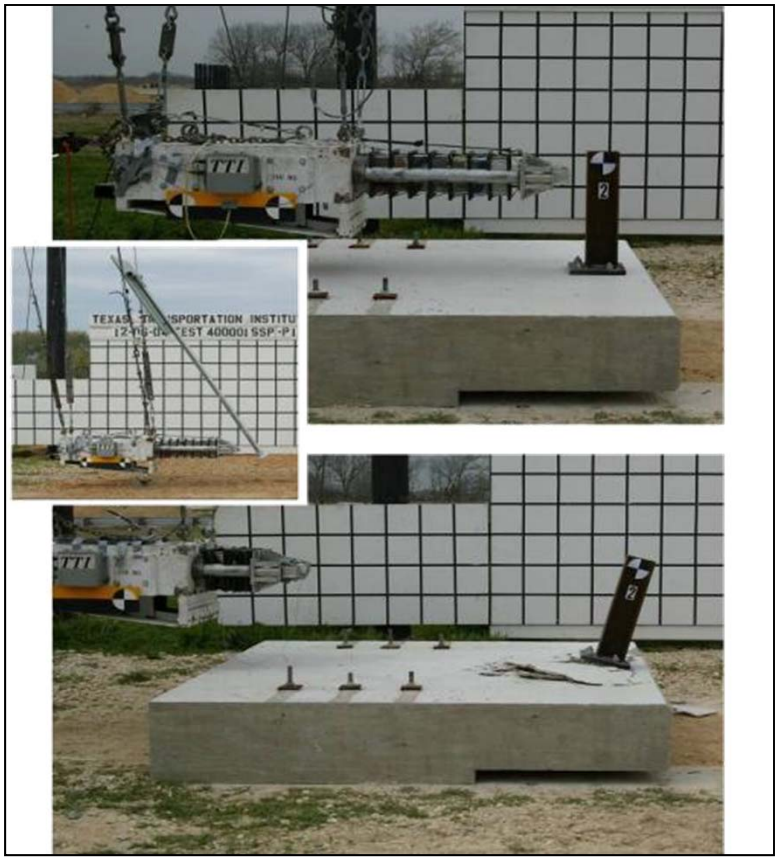


IE Technical Support

CSi COMPUTERS & STRUCTURES, INC.
ABAQUS
ANSYS®

Crash Barrier Performance
Pendulum Tests

- pendulum tests by Texas Transportation Institute (TTI) 2005
- crash barriers on SPS achieved TL-4 performance level
- SPS deck undamaged



SPS Bridge Deck for ABC Application
Tub Girder Bridge

Project Description

- ODOT and Muskingum County awarded an AID Demonstration grant in 2016
- replace existing bridge with steel tub girders with SPS deck

SPS Bridge Deck for ABC Application
FHWA AID Program

AID Program Objective

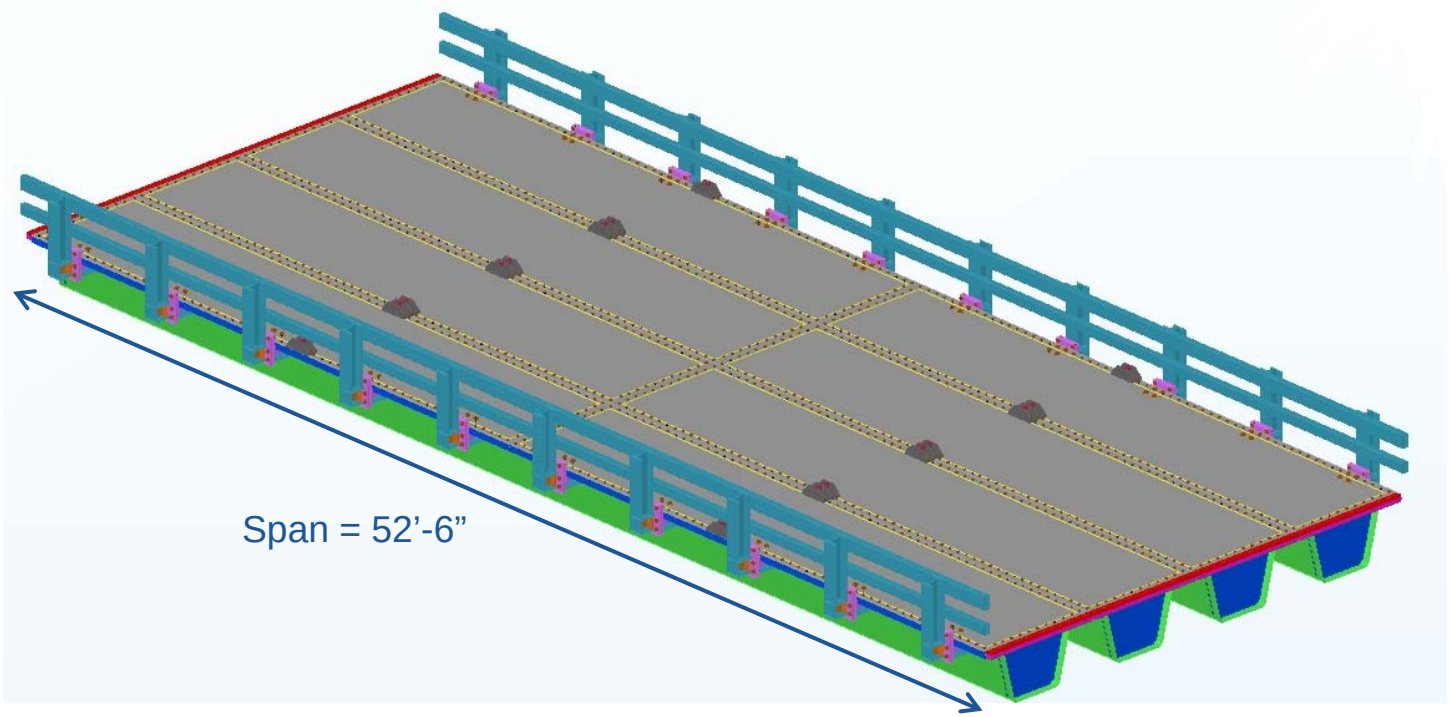
- advancement of SPS throughout the country
- funding used to demonstrate ABC attributes of SPS
- 30 day maximum road closure

Superstructure

- SPS 8-28-8 deck composite with press-braked tub girder
- 100 year service life (galvanization and metallization)

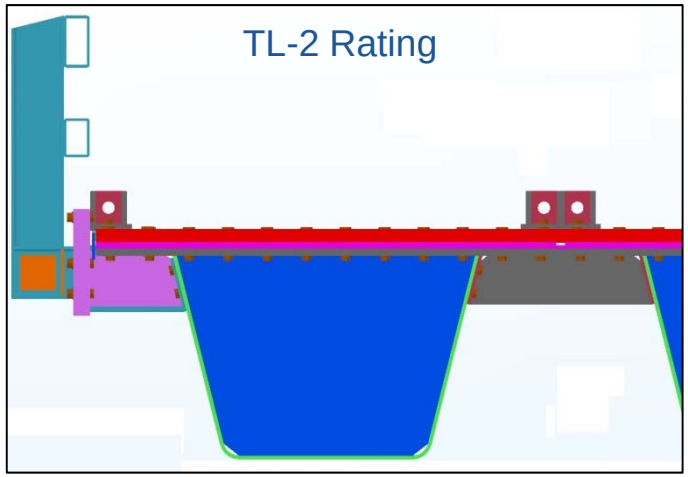
SPS Bridge Deck for ABC Application

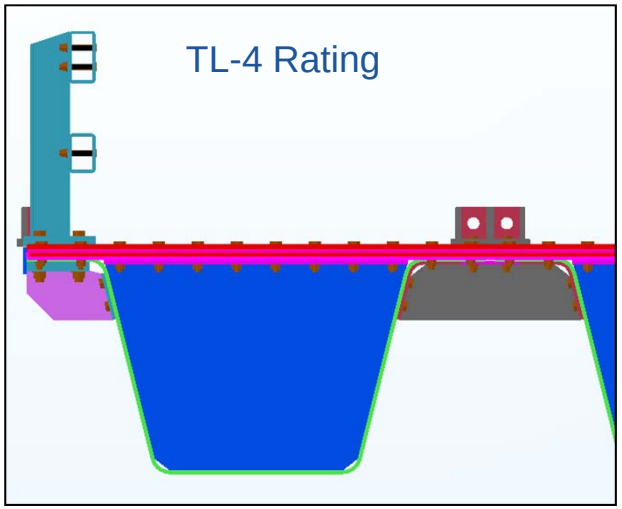
Tub Girder Bridge



SPS Bridge Deck for ABC Application
Crash Barriers

- standard DOT guardrails are easily accommodated
- deck- or side- mounted guardrails are available
- plastic deformations are limited to the crash barriers with supporting structure undamaged





SPS Bridge Deck for ABC Application

Bridge Demolition

- bridge closed and demolished on 1 May 2017

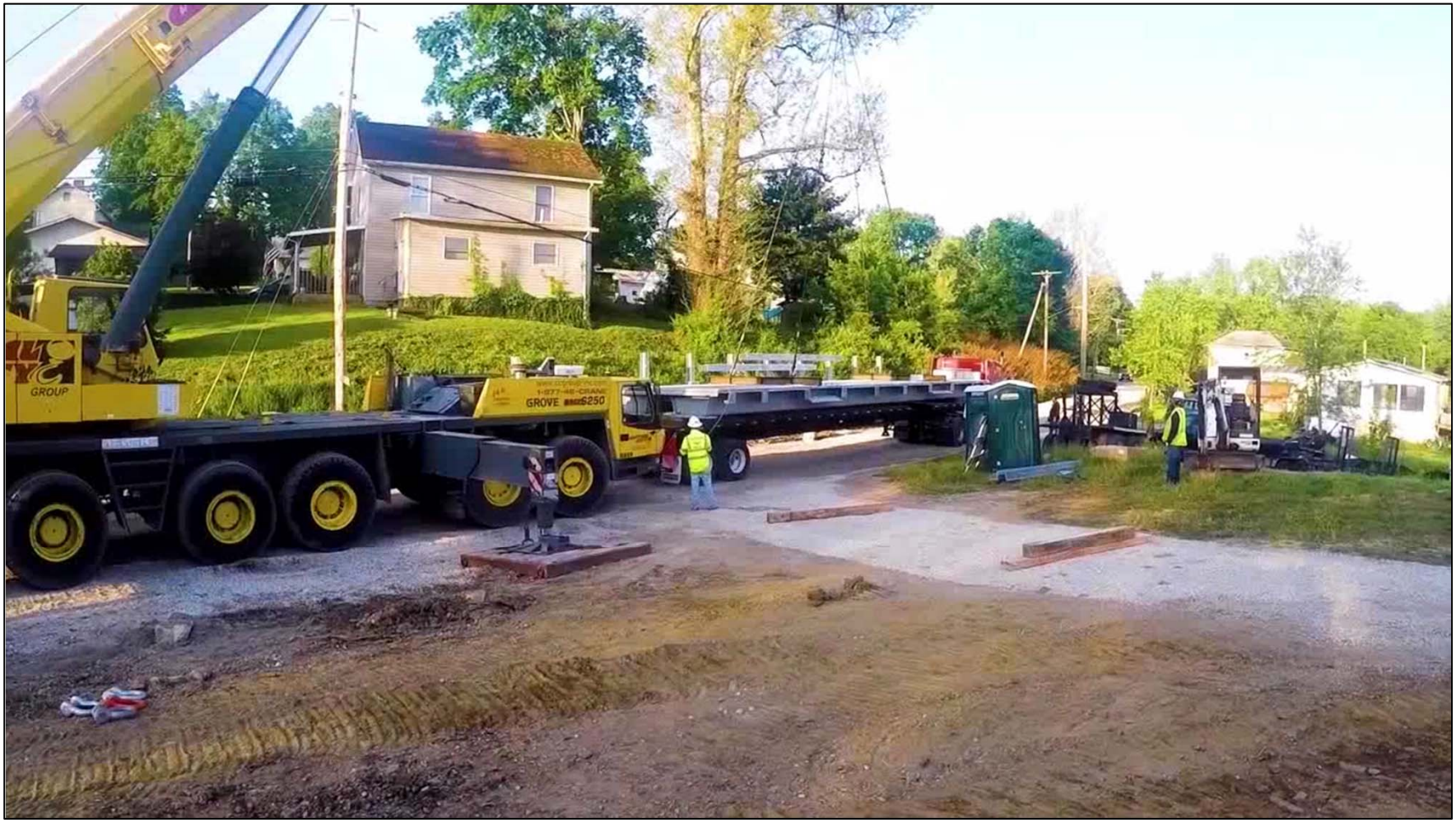
SPS Bridge Deck for ABC Application
New Abutments

- abutments completed by 12 May 2017

SPS Bridge Deck for ABC Application

Erection and Placement of Modules (Total Time = 20 minutes)

- bridge modules erected on 16 May 2017

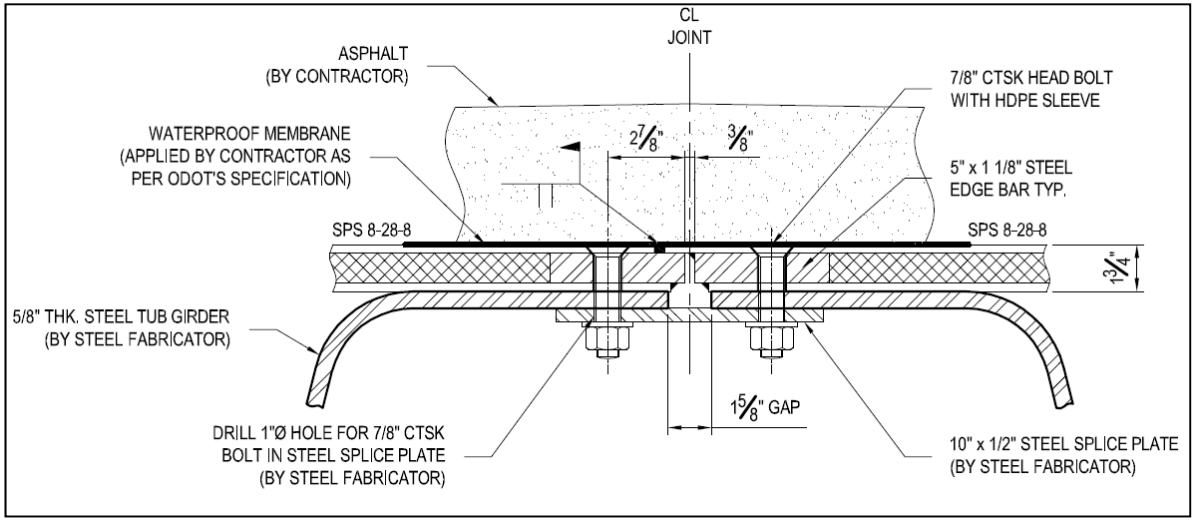


SPS Bridge Deck for ABC Application

Girder Module Components

SPS Bridge Deck for ABC Application

Centerline Connection



SPS Bridge Deck for ABC Application

Centerline Connection

SPS Bridge Deck for ABC Application

Guardrail and Bearing Connection

SPS Bridge Deck for ABC Application
Waterproofing Membrane

- waterproofing membrane placed on 22 May 2017

ODOT Type III
Waterproofing Membrane

SPS Bridge Deck for ABC Application

Asphalt Wearing Surface and PMA Expansion Joint System

SPS Bridge Deck for ABC Application

Completed Structure


MAXIMUM
WEIGHT
5
tonnes

SPS Bridge Decks - Water Street Bridge
Background

Bridge History

- built in 1898; steel Pratt through-truss bridge spanning 103`
- located in the town of St. Marys ,Ontario Canada

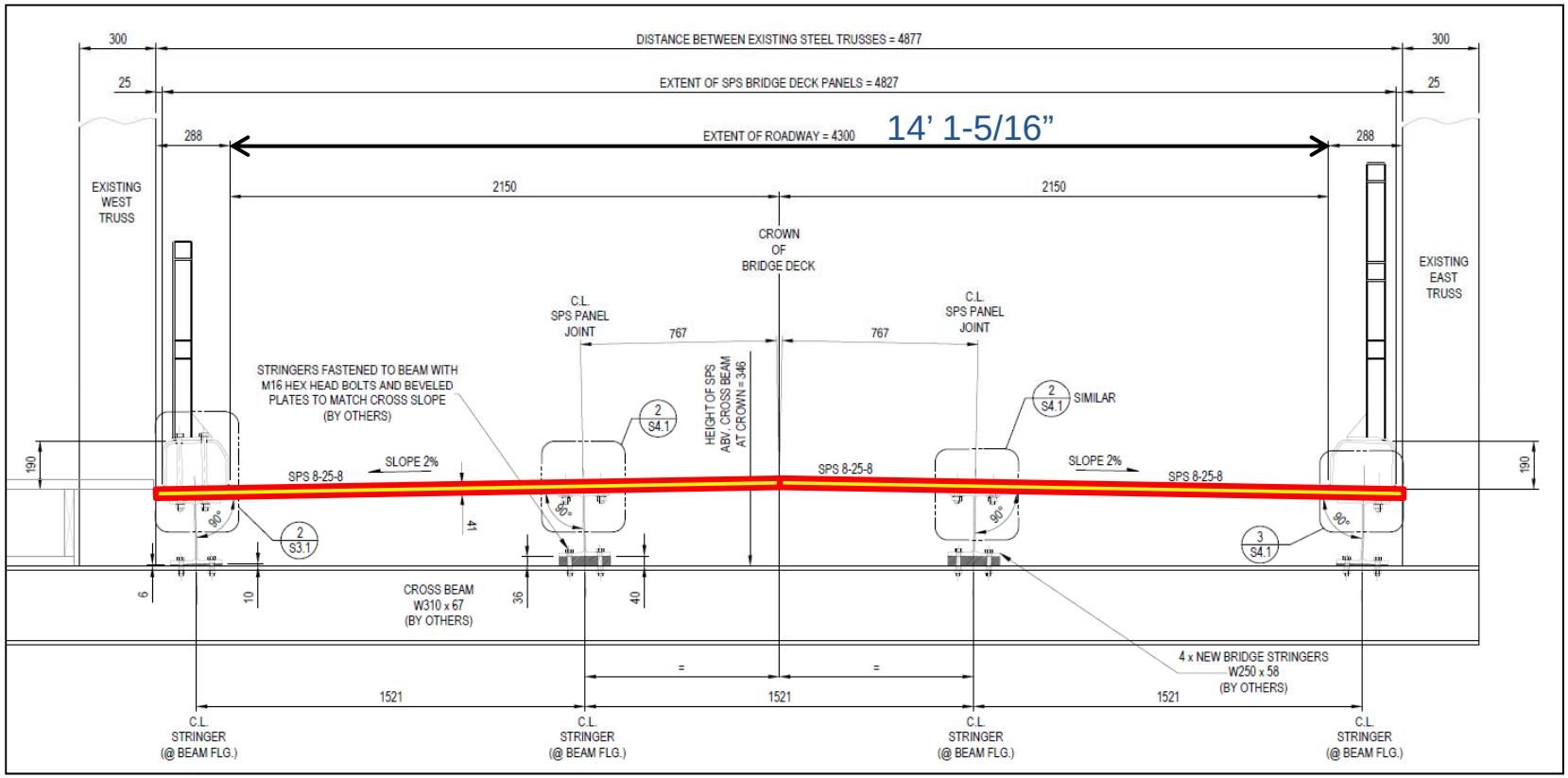
Bridge Prior to Rehabilitation

- salt water ingress due to winter salting was corroding the superstructure
- load limit of 5tonnes was imposed

SPS Bridge Decks - Water Street Bridge

Reasons for SPS Deck

Why SPS Bridge Decks?



Superstructure

Transportation

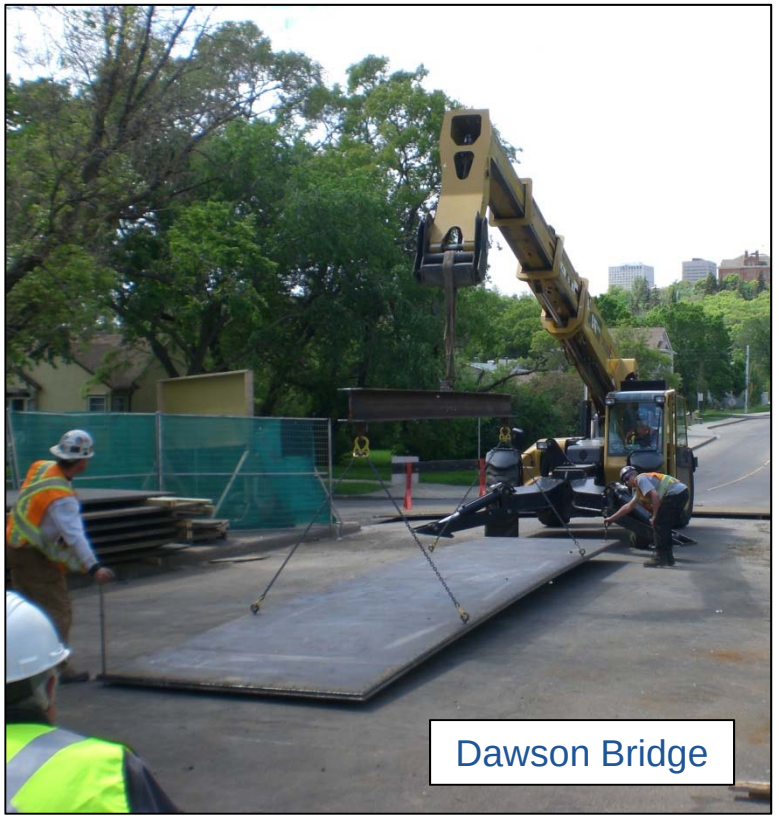
- entire bridge deck delivered in one truck load (~ 30tons)

SPS Bridge Decks - Water Street Bridge

SPS Panel Off-Loading

SPS Panel

- one operator and two ground personnel used to off-load
- panel weight = 3.5tons



Dawson Bridge

SPS Bridge Decks - Water Street Bridge

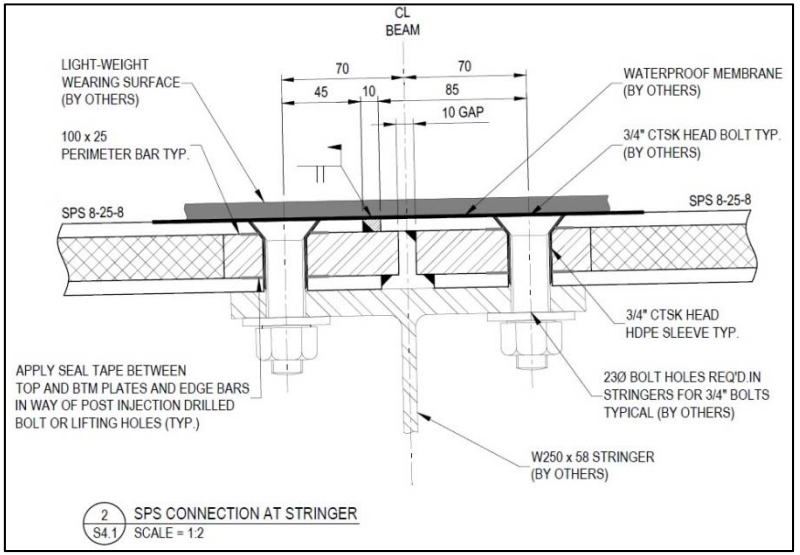
SPS Installation

Panel Installation

- one operator and four ground crew
- cumulative time for panel placement was 1 day

Panel Bolting

- bolting completed in 3-1/4 days working 8 hour days
- crew: 2 pairs of workers (one above and below) and one foreman

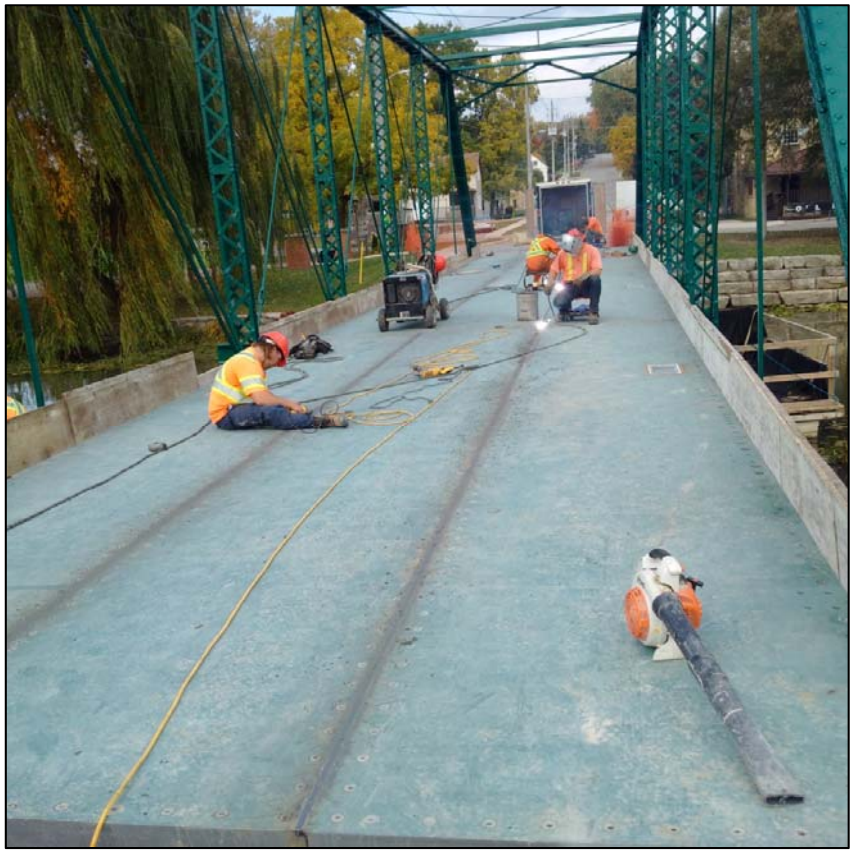


SPS Bridge Decks - Water Street Bridge

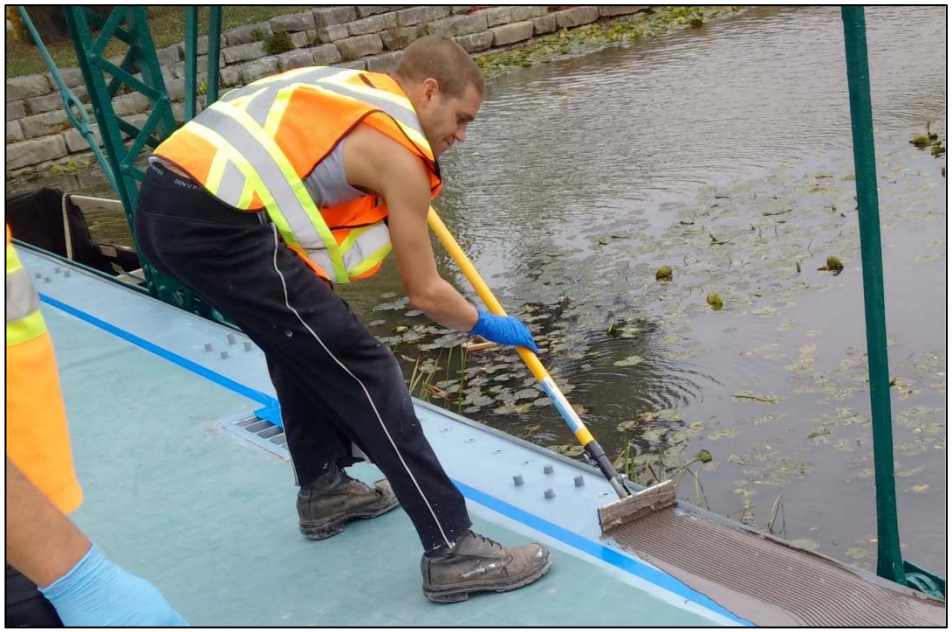
SPS Panel Seam Welding

Panel Welding

- deck can be track welded for faster installation
- GC chose to weld by hand (2 welders, 2 days)

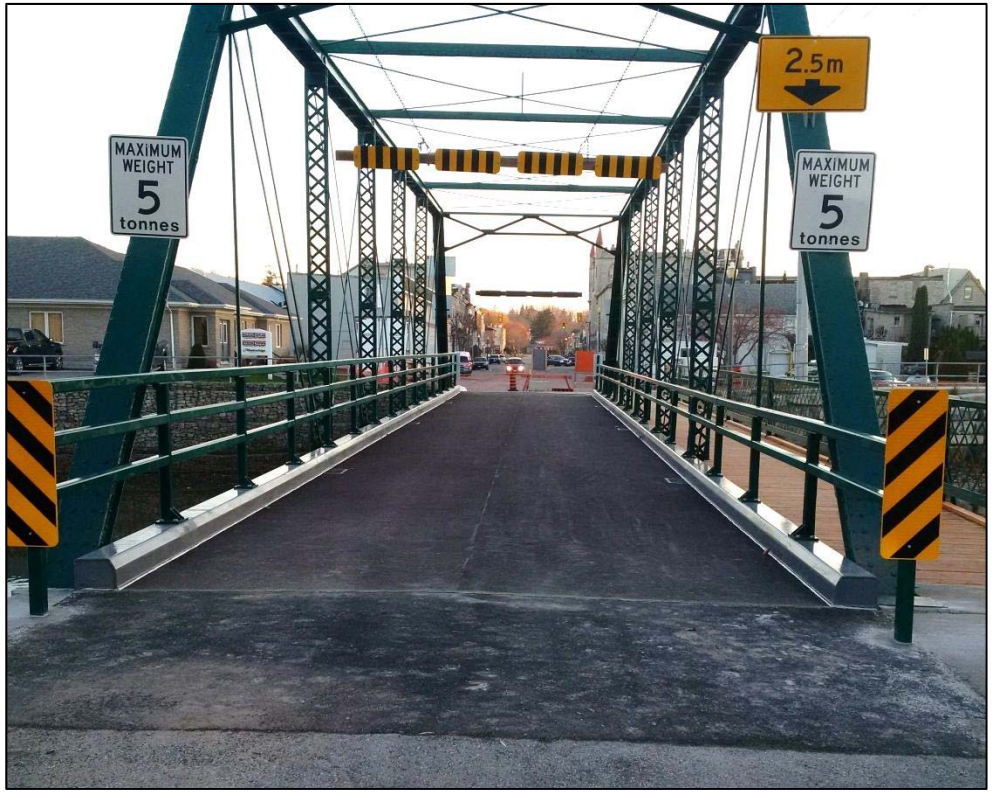


Curb Installation



Wearing Surface

- light-weight wearing surface with nominal thickness of ~ 3/8"



SPS Bridge Decks - Water Street Bridge

Completed Structure

SPS Bridge Decks

Proven Performance, Schedule/Constructability Benefits, Longevity, Quality

Characteristic	Attributes / Benefits / Reduced Risk
Schedule (ABC)	• shorter and predictable schedule • weather independent • traffic disruption, site congestion and environmental contamination are minimized • staged construction readily accommodated
Constructability	• lifting locations built into panels • light-weight equipment (telehandler) can be used to move plates • plates are easily stackable -> increases site safety and reduces staging area • single trade for deck and superstructure • immediate load-carrying capacity (construction loads, light-weight lifting equipment)
Durability	• designed for 100+ year design life • infinite fatigue resistance • watertight deck • water management details incorporated • industry standard coatings provide a protective barrier
Maintenance	• weathering steel can be specified eliminating the need for coating maintenance • topside of bridge deck is coated using industry standard methods to provide a protective barrier against standing water as required for weathering steel • in case of accidental or extreme load events, damaged panel can be easily removed and replaced
Rideability	• solid deck provides smooth riding surface • asphalt and light-weight wearing surfaces readily accommodated
Quality Assurance	• factory quality construction production (independent of weather conditions) • excellent dimensional accuracy • high quality finishes

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