Guardian Bridge
RAPID CONSTRUCTION

Bridge Panel One

Bridge Panel Two

Fiberglass Composite Products

Bridge decks
- Transverse
- Longitudinal

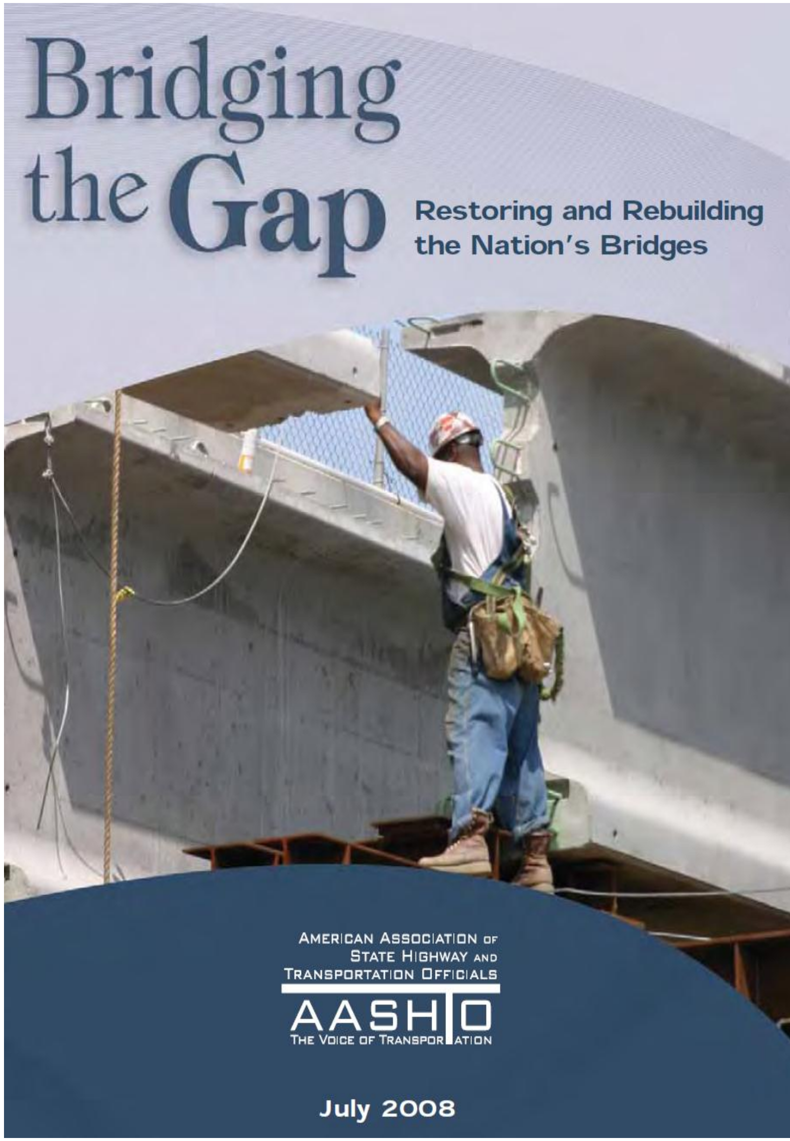
Bridge superstructure
- Largest structure to date 90m span

Rigid Span Bridges

Abutments

Wing walls

Approach slabs



140 BILLION (24%)

The U.S. Department of Transportation's 2006 *Conditions and Performance Report* notes that $8.7 billion in capital investment annually is needed to maintain bridge conditions at current levels and $12.4 billion would be needed to actually improve "conditions" to a level that would help relieve congestion and reduce accidents.

According to data from the FHWA, it would cost $140 billion in 2006 dollars to immediately repair every bridge that is deficient in the country. This estimate is based upon the amount of bridge area considered deficient as of December, 2007, multiplied by the cost per square meter for bridge replacement, estimated at $1,550 per square meter.

Quote from page 30 of AASHTO 2008 REPORT BRIDGING THE GAP

Guardian Bridge
RAPID CONSTRUCTION

Innovation and Technology Are Adding to Bridge Safety

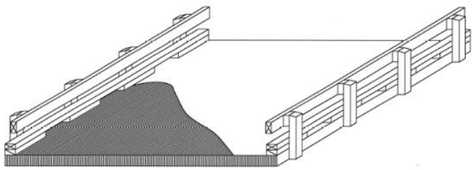
To ensure the safety of the nation's bridges, every state conducts a thorough and continual bridge inspection and rehabilitation program. Federal regulations require that, with some exceptions, bridges over 20 feet in length be inspected every 24 months by trained and qualified bridge inspectors. States often develop more detailed programs appropriate to unique circumstances.

Advances in technology such as electronic gauges are also enhancing the ability of inspectors to assess bridge conditions. New materials are now available for bridge building such as high-strength steel, high-performance concrete, rustproof components, and fiber-reinforced polymer composites.

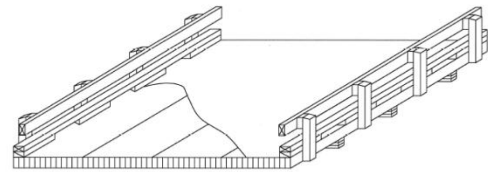
The nation's departments of transportation face a frustrating contradiction. They have better engineering, materials, and construction techniques than ever before, ensuring that a new generation of safe and longer-lasting bridges can be built for the future. Without a national commitment to bridge investment, however, states will face painful trade offs to keep the nation's bridges safe and the American public moving.

Quote from page 7 of AASHTO 2008 REPORT BRIDGING THE GAP

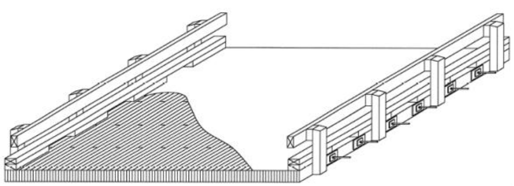
Longitudinal Deck Systems: Nail-Laminated Decks

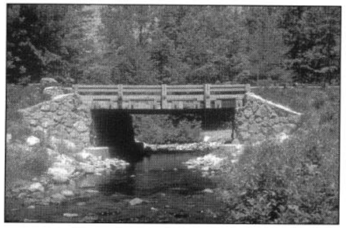


Longitudinal Deck Systems: Spike-Laminated Decks

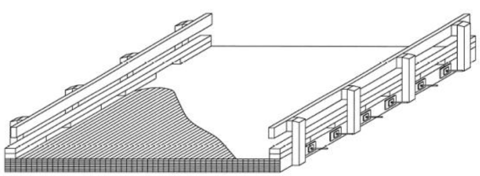


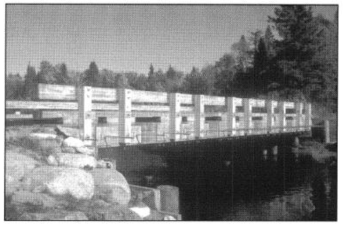
Longitudinal Deck Systems: Stress-Laminated Sawn Lumber Decks



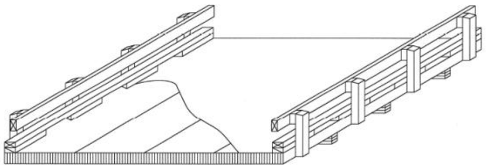


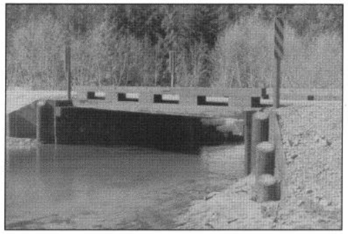
Longitudinal Deck Systems: Stress-Laminated Glulam Decks



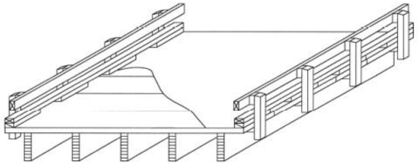


Longitudinal Deck Systems:
Longitudinal Glulam Panel Decks

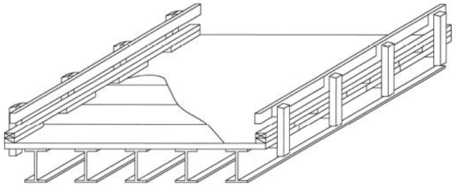


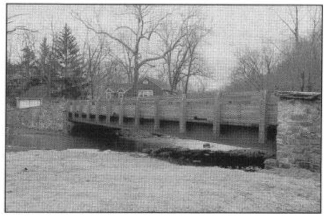


Beam Systems:
Glulam Stringer and Transverse Glulam Deck



Beam Systems:
Transverse Glulam Decks for Steel Beam Bridges

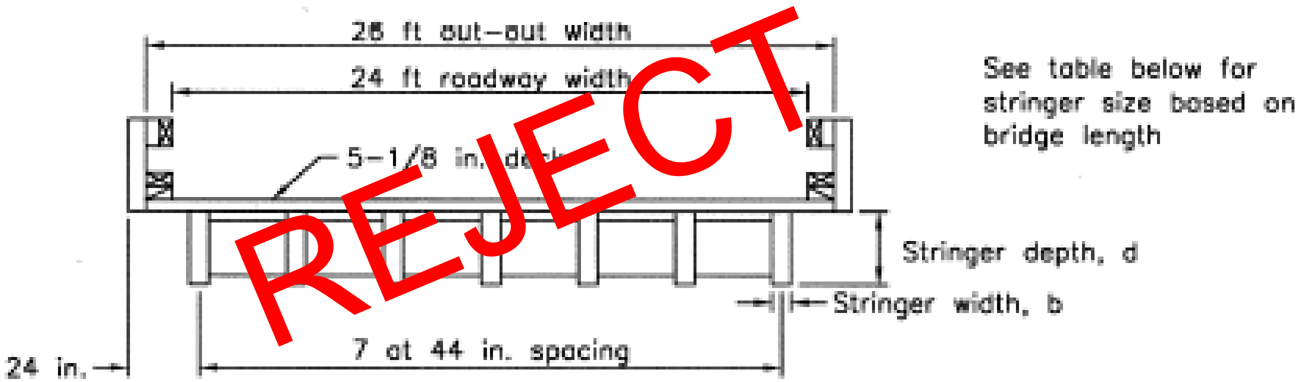




Stringer Configuration and Size - 24-ft Roadway Width

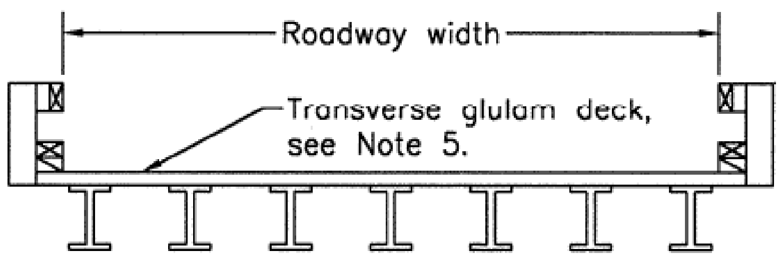
Glulam beams

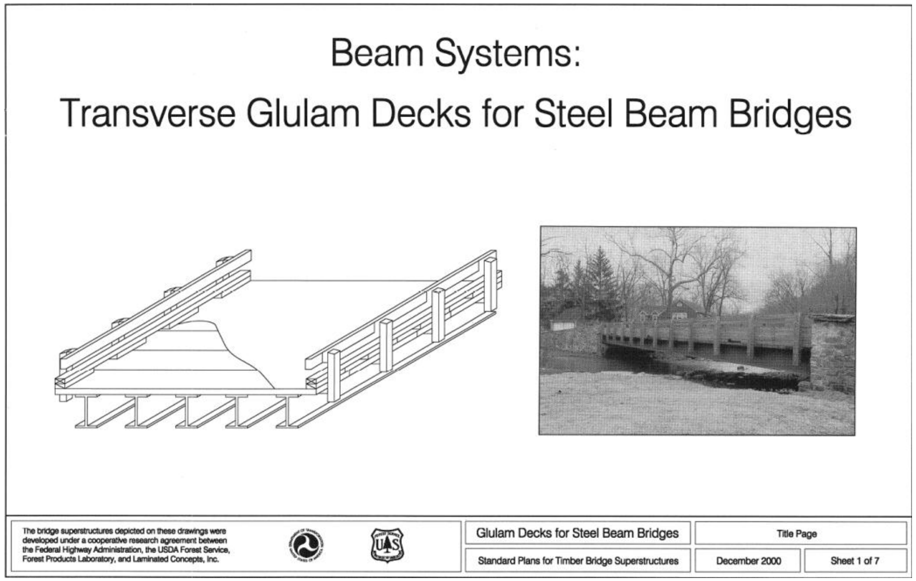
37” H



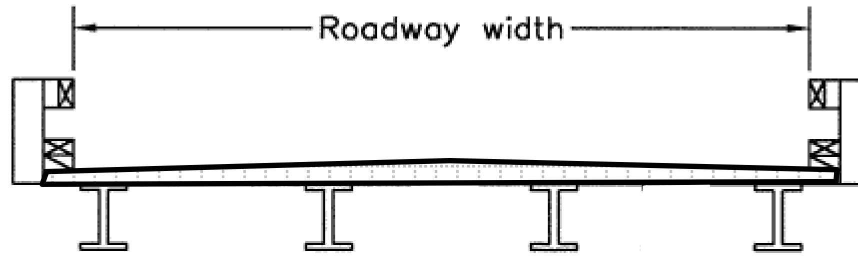
Steel beams

24” H

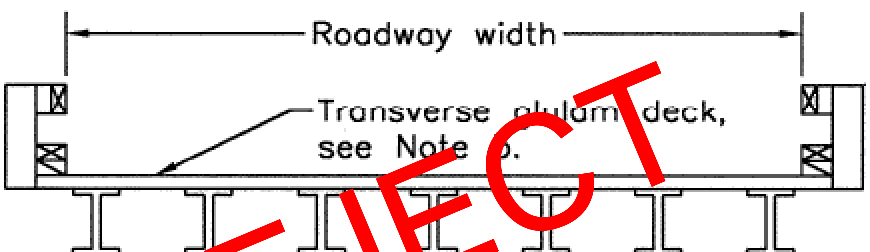




Fiberglass Composite deck

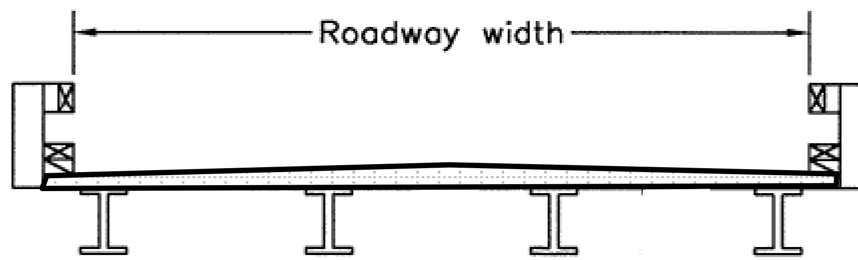


Wood deck



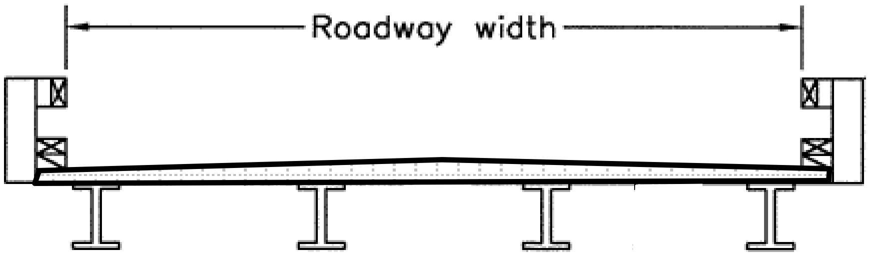
Durability issues
Not compositely acting
No 2% cross slope
More steel superstructure costs (2xmore)
Design Service Life 5 years then penalized

Concrete deck



Durability issues
Compositely acting
2% cross slope, super elevate, longitudinal slope
Effective steel design
Design Service Life 75 years then penalized

Fiberglass Composite deck



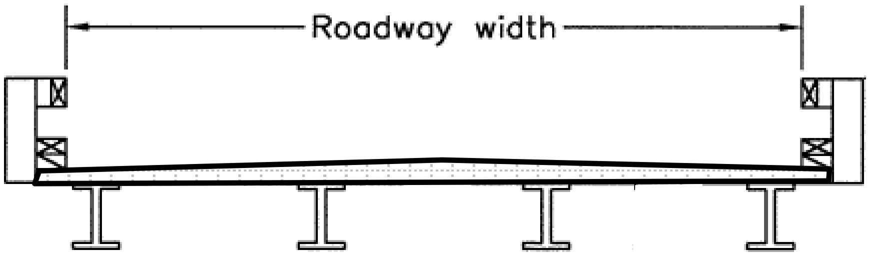
Span 15m

Depth of Section

Girders	610
Deck	205
Asphalt	55
	870

70mm less

Concrete deck



Span 15m

Depth of Section

Girders	660
Deck	225
Asphalt	55
	940

REJECT

Guardian Bridge
RAPID CONSTRUCTION

Bridge applications comparison…

Concrete Bridge Deck

Design not good

- Internally reinforce

Durability and capacity

Glue Laminated Timber Bridge

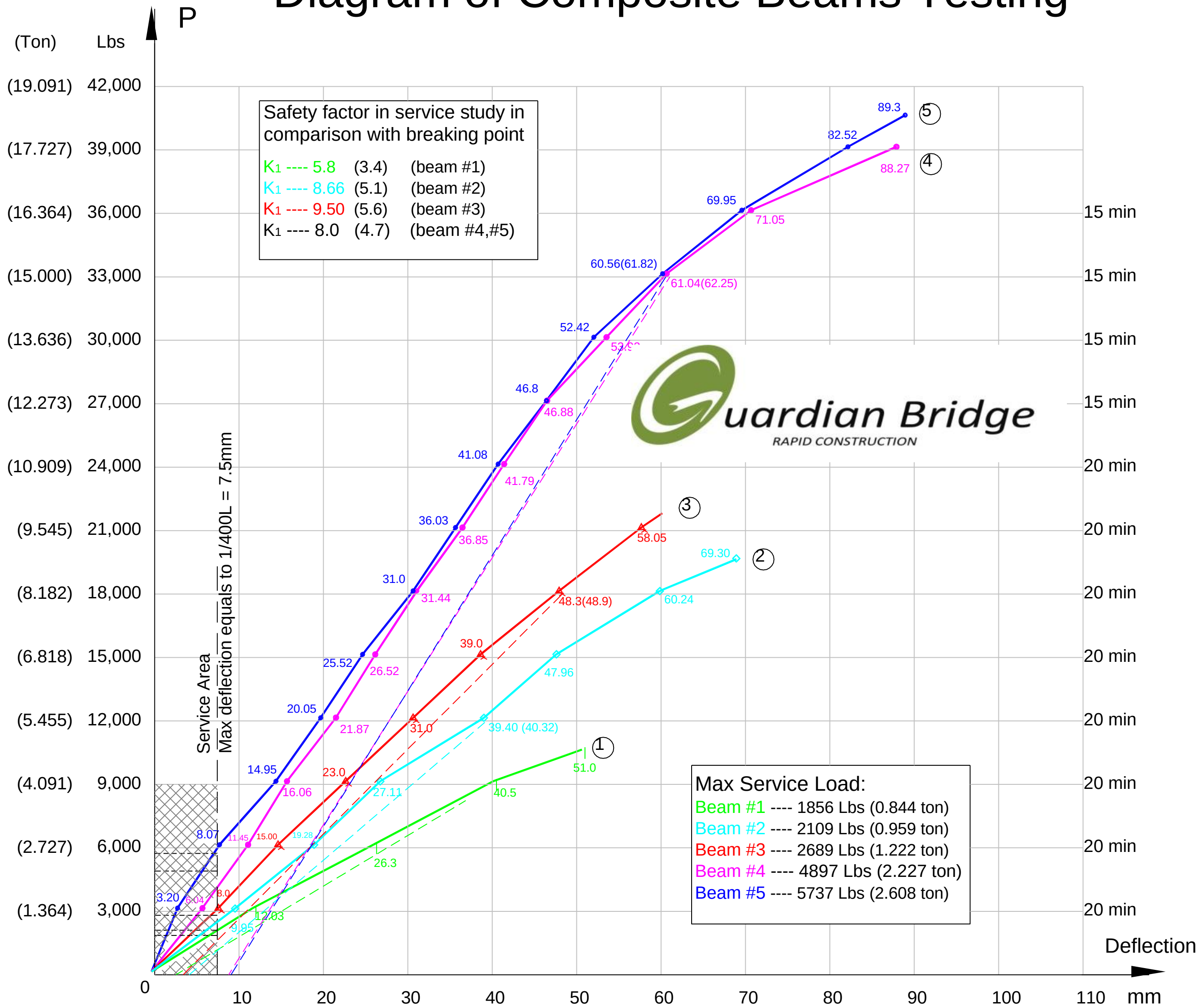
Design not good

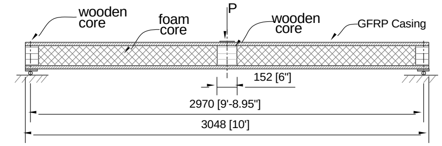
- Externally reinforce

Durability and capacity

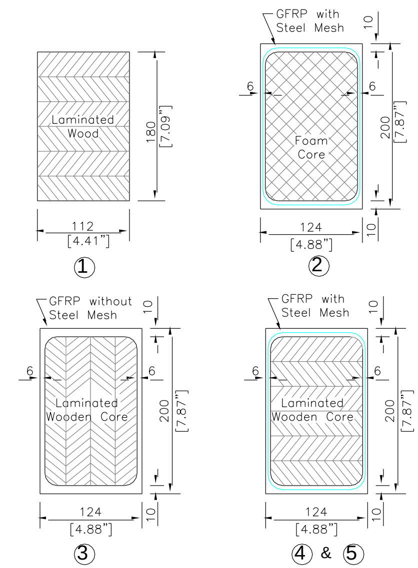
Guardian Bridge
RAPID CONSTRUCTION

Diagram of Composite Beams Testing





Testing Scheme



Beam Sections

Legend:

Beam #1 ------- Laminated wooden beam
Beam #2 ------- GFRP beam with foam core (GFRP casing reinforced with steel mesh)
Beam #3 ------- Composite beam with laminated wooden core (GFRP casing without reinforced steel mesh) (Shear parpandicular to wooden grains)
Beam #4, #5 -- Composite beams (GFRP casing with steel mesh and wooden core)

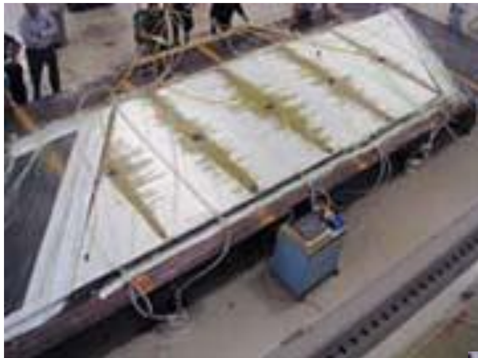
Note:

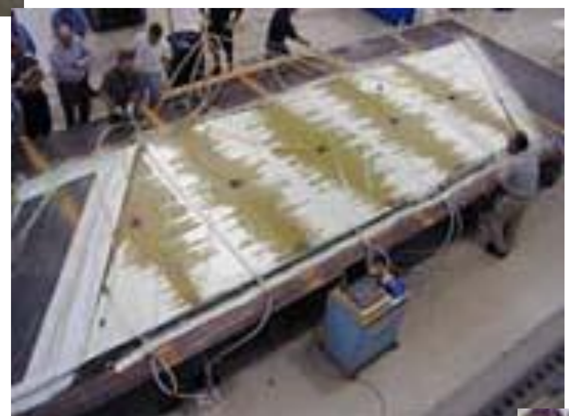
Values in diagram are deflections of testing beams

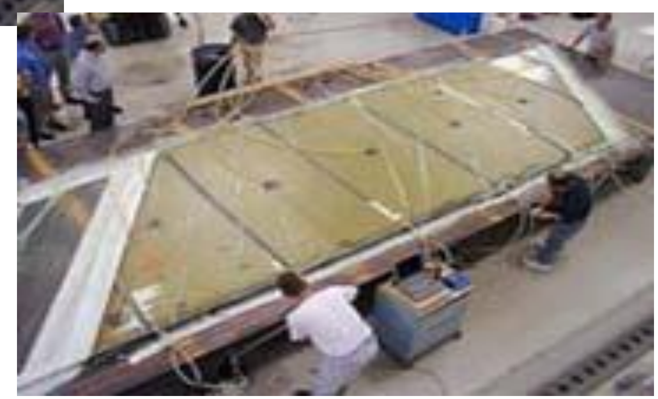
13m long x 3m wide x .495mm deep

Guardian Bridge

RAPID CONSTRUCTION





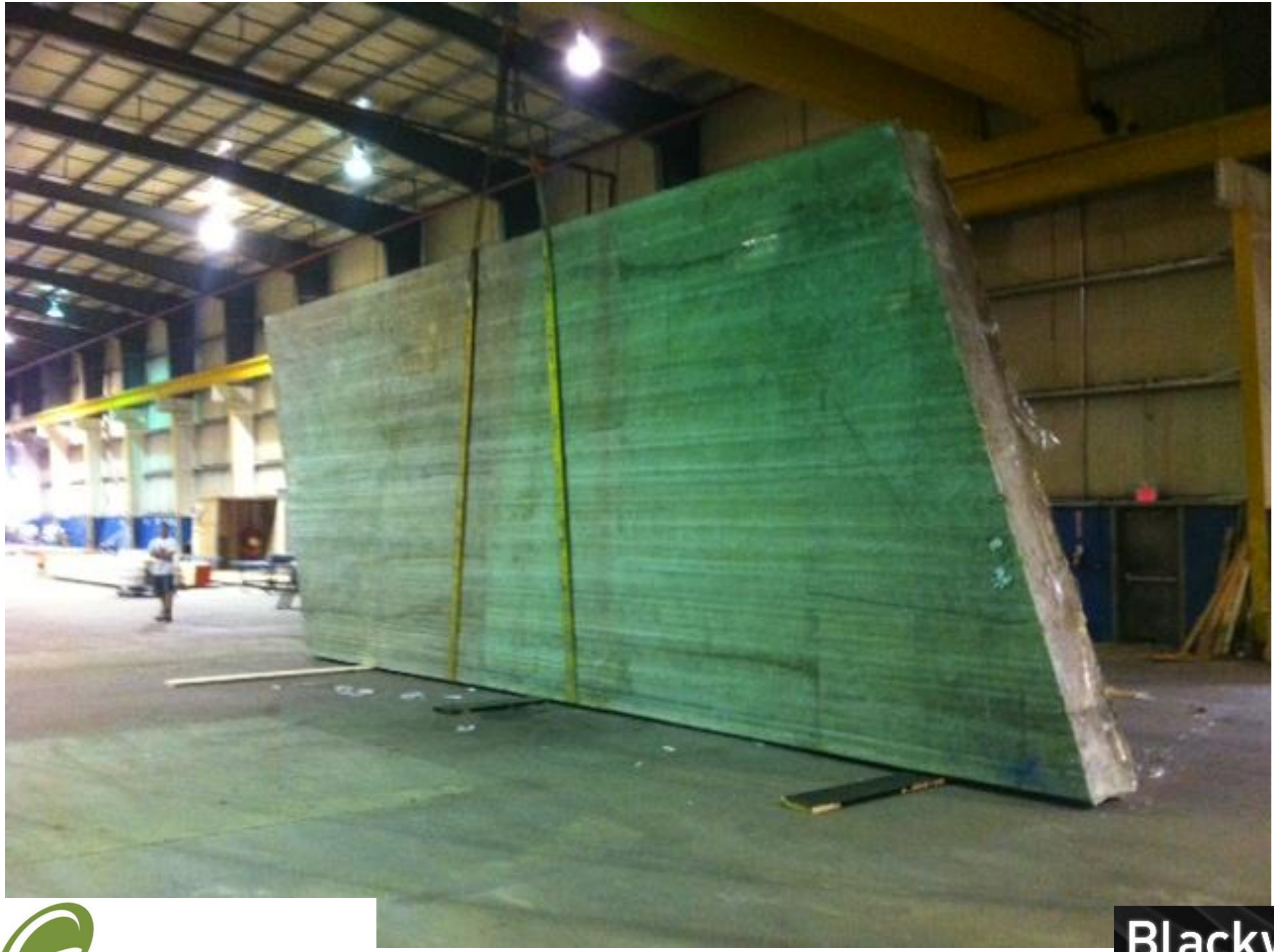


Engineered Wood core

Encapsulated with Epoxy Fiberglass reinforcement

Canadian , U.S., International Patents


11.86m long x 5.5m wide x 508mm deep
92mm less than concrete rigid span
Guardian Bridge
RAPID CONSTRUCTION INC.
Blackwell



Guardian Bridge
RAPID CONSTRUCTION INC.

Blackwell

Robust & Durable

Blackwell


Guardian Bridge
RAPID CONSTRUCTION INC.
Blackwell

Guardian Bridge
RAPID CONSTRUCTION INC.

Blackwell

Guardian Bridge
RAPID CONSTRUCTION INC.

Blackwell


Guardian Bridge
RAPID CONSTRUCTION INC.
Blackwell

Modular Panel 40 feet long x 18 feet wide

Guardian Bridge
RAPID CONSTRUCTION INC.

Blackwell

Modular Panel 40 feet long x 18 feet wide

Panel Two

Panel One


Longitudinal Joint
Panel one
Panel two
DEERE
Guardian Bridge
RAPID CONSTRUCTION INC.
Blackwell

Guardian Bridge
RAPID CONSTRUCTION INC.

Blackwell

New prefab bridge panel 50 feet long x 20 feet wide

New prefab deck

Guardian Bridge
RAPID CONSTRUCTION INC.

Blackwell

Delcan 60th

Guardian Bridge
RAPID CONSTRUCTION INC.

Blackwell

Delcan

Guardian Bridge
RAPID CONSTRUCTION INC.

Blackwell

Delcan

Guardian Bridge
RAPID CONSTRUCTION INC.

Blackwell

Delcan

Guardian Bridge
RAPID CONSTRUCTION INC.

Blackwell

Delcan 60th

Lowest concrete bid 566,000.00

Guardian bid 294,000.00

Savings over 200,000.00

Plus dead load savings of 190,000 pounds

Plus time from concrete at 90 days reduced to 10 days on site.

Guardian Bridge
RAPID CONSTRUCTION


Concrete deck and steel floor beams removed
Bridge painted before deck removed
And after
Guardian Bridge
RAPID CONSTRUCTION


3 Prefabricated bridge decks
delivered on one truck to site
31,00 pounds total
Guardian Bridge
RAPID CONSTRUCTION

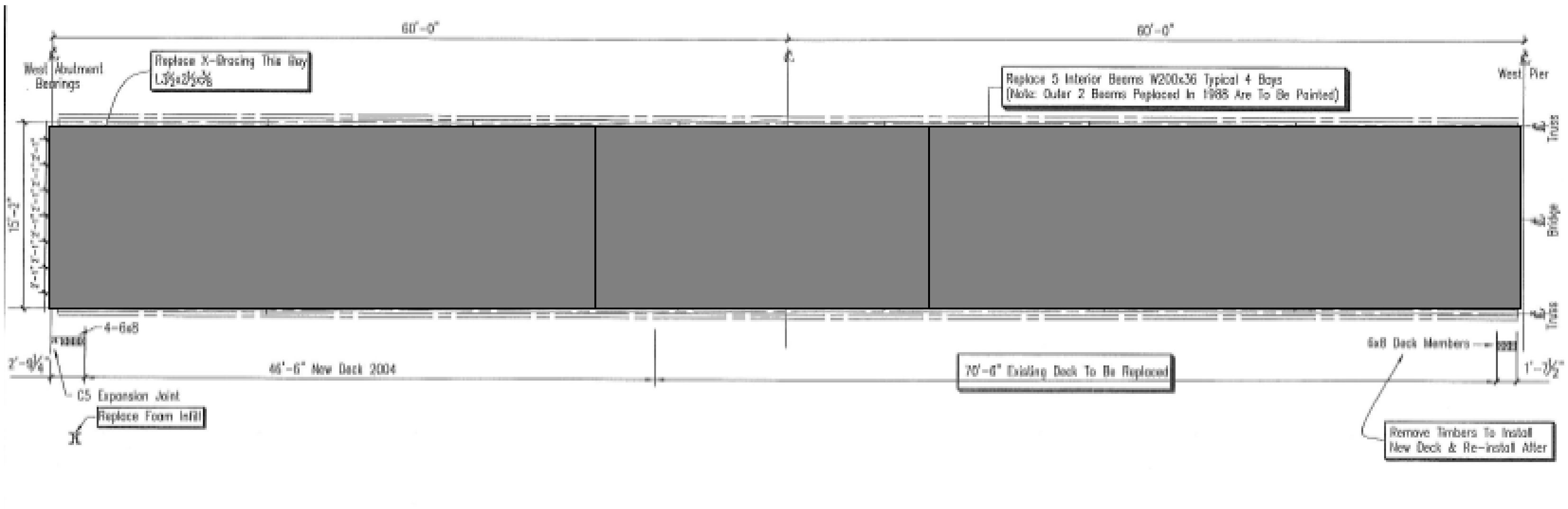
3 Prefabricated bridge decks

Removed by crane

Guardian Bridge
RAPID CONSTRUCTION


Guardian Bridge
RAPID CONSTRUCTION

Launching three bridge deck panels



Guardian Bridge
RAPID CONSTRUCTION


Guardian Bridge
RAPID CONSTRUCTION


Guardian Bridge
RAPID CONSTRUCTION

Guardian Bridge
RAPID CONSTRUCTION


Guardian Bridge
RAPID CONSTRUCTION

Increased live load

from 4 t to 22 t

Bridge was proof loaded using
Tri-axle loaded dump truck, weighed at scale with load ticket.

Pulled middle axle, loaded section by section with back two axles.

Deflection measured using digital indicators.

Result posted 22 tonne limit.

Guardian Bridge
RAPID CONSTRUCTION

Tweed

Double lane bridge delivered in two panels

Guardian Bridge RAPID CONSTRUCTION INC.

10m long x 8m wide

Centre Hastings

Callander

Guardian Bridge
RAPID CONSTRUCTION INC.

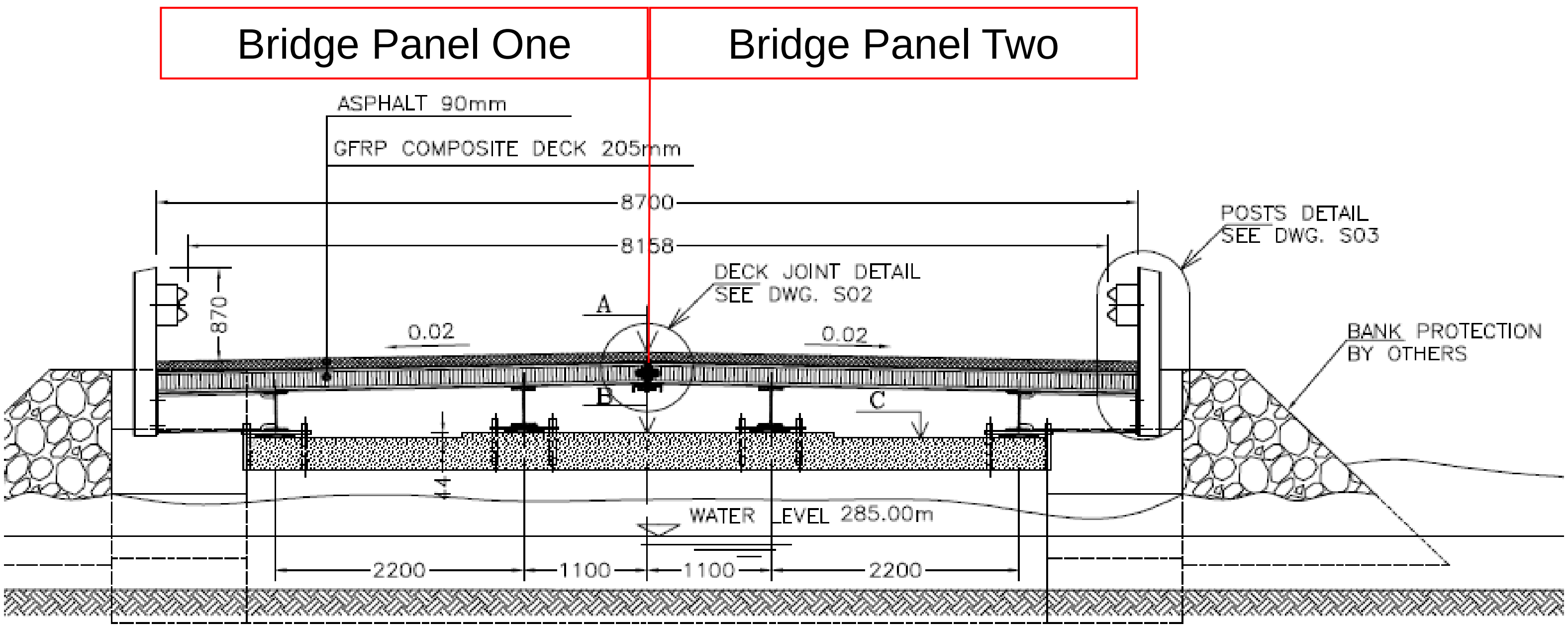
Double lane bridge

Guardian Bridge
RAPID CONSTRUCTION INC.

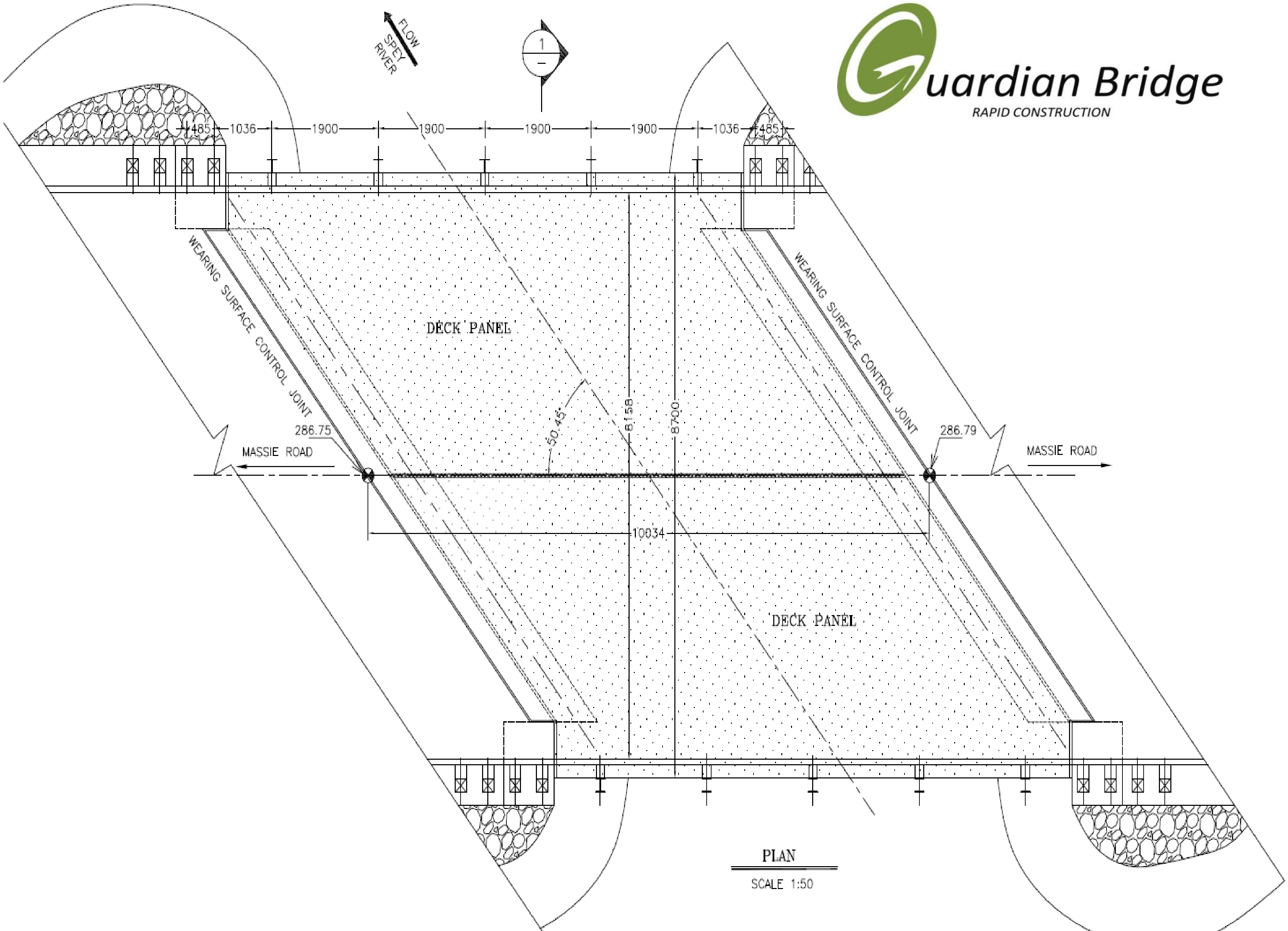
Prefitted at shop before shipping to site

Guardian Bridge
RAPID CONSTRUCTION INC.

Massie Road Bridge 9.0m span x 8.158m wide



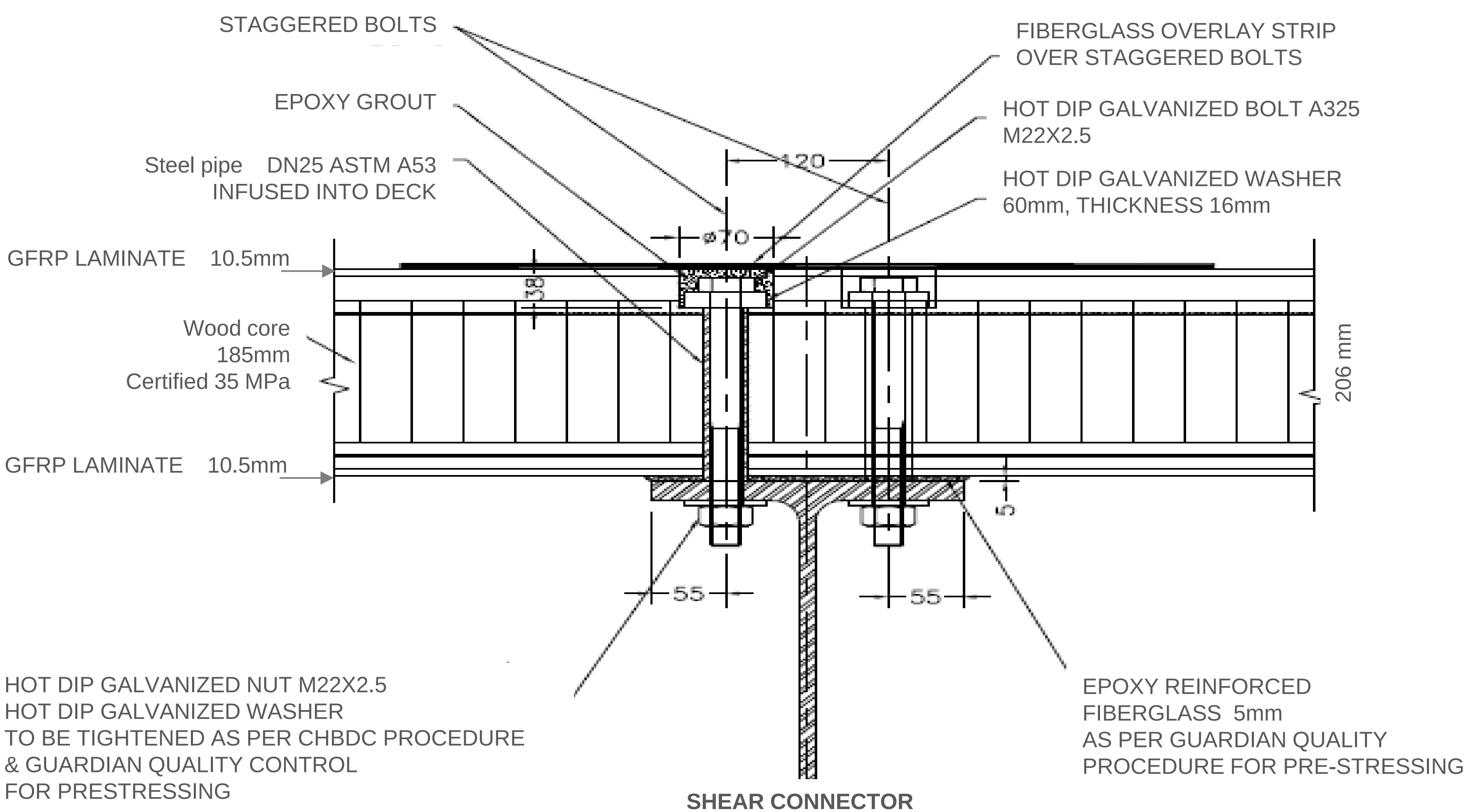
Guardian Bridge
RAPID CONSTRUCTION



PLAN

SCALE 1:50

Typical Deck to steel girder connection



SHEAR CONNECTOR

DETAIL

PATENT PENDING

Guardian Bridge
RAPID CONSTRUCTION

U.S. PATENT IN PROCESS, MATERIALS, APPLICATION

Bridge

Delivered by truck

8:30am

Guardian Bridge

RAPID CONSTRUCTION

Bridge Panel One

Rigging completed

9:00am

Guardian Bridge


Bridge Panel One
Rigging completed
9:00am
Guardian Bridge
RAPID CONSTRUCTION

Panel One

Set in place

9:09am

Panel Two

Rigged

9:19am

Guardian Bridge

Panel Two

Rigged

Lifted into place

9:20am

Guardian Bridge
RAPID CONSTRUCTION

Panel Two

Set in place

9:25am

Weight of each GFRP bridge panel 17,700 pounds

Old concrete bridge was 167,700 pounds- single lane

Reduced dead load on rehab abutments

Increases capacity and longevity.

Guardian Bridge
RAPID CONSTRUCTION

Panel Two

Secure in place

9:43am

Guardian Bridge

RAPID CONSTRUCTION


Guardian Bridge
RAPID CONSTRUCTION

Semi Integral

Protection Board installed

10 days on site from mobilization to completion

- Removed single lane bridge
- Rehab existing abutments and re-certified
- New double lane bridge
- PL1 Rails
- Approach's Granular B & A
- Asphalt

Guardian Bridge
RAPID CONSTRUCTION


OVERSIZE LOAD

Guardian Bridge
RAPID CONSTRUCTION INC.


Guardian Bridge
RAPID CONSTRUCTION INC.

Guardian Bridge
RAPID CONSTRUCTION INC.

Blackwell

Guardian Bridge
RAPID CONSTRUCTION INC.

Guardian Bridge
RAPID CONSTRUCTION INC.

44 meters long x 10.86 meters wide (two lanes+sidewalk)

CHBDC CL625

5 steel girders 1.7m high

10 GFRP bridge decks transverse to be field installed

Guardian Bridge
RAPID CONSTRUCTION INC.


Guardian Bridge
RAPID CONSTRUCTION INC.


Guardian Bridge
RAPID CONSTRUCTION INC.


Guardian Bridge
RAPID CONSTRUCTION INC.


Guardian Bridge
RAPID CONSTRUCTION INC.
ROOTS


Guardian Bridge
RAPID CONSTRUCTION INC.


Guardian Bridge
RAPID CONSTRUCTION INC.


Guardian Bridge
RAPID CONSTRUCTION INC.

Panel to Panel Connection

Guardian Bridge
RAPID CONSTRUCTION INC.


Guardian Bridge
RAPID CONSTRUCTION INC.

161 feet long x 26 feet wide

10,000 vehicles per day

83’ long x 28’ wide

221’ long x 32’ wide

182’ long x 28’ wide

241’ long x 32’ wide

125’ long x 25’ wide

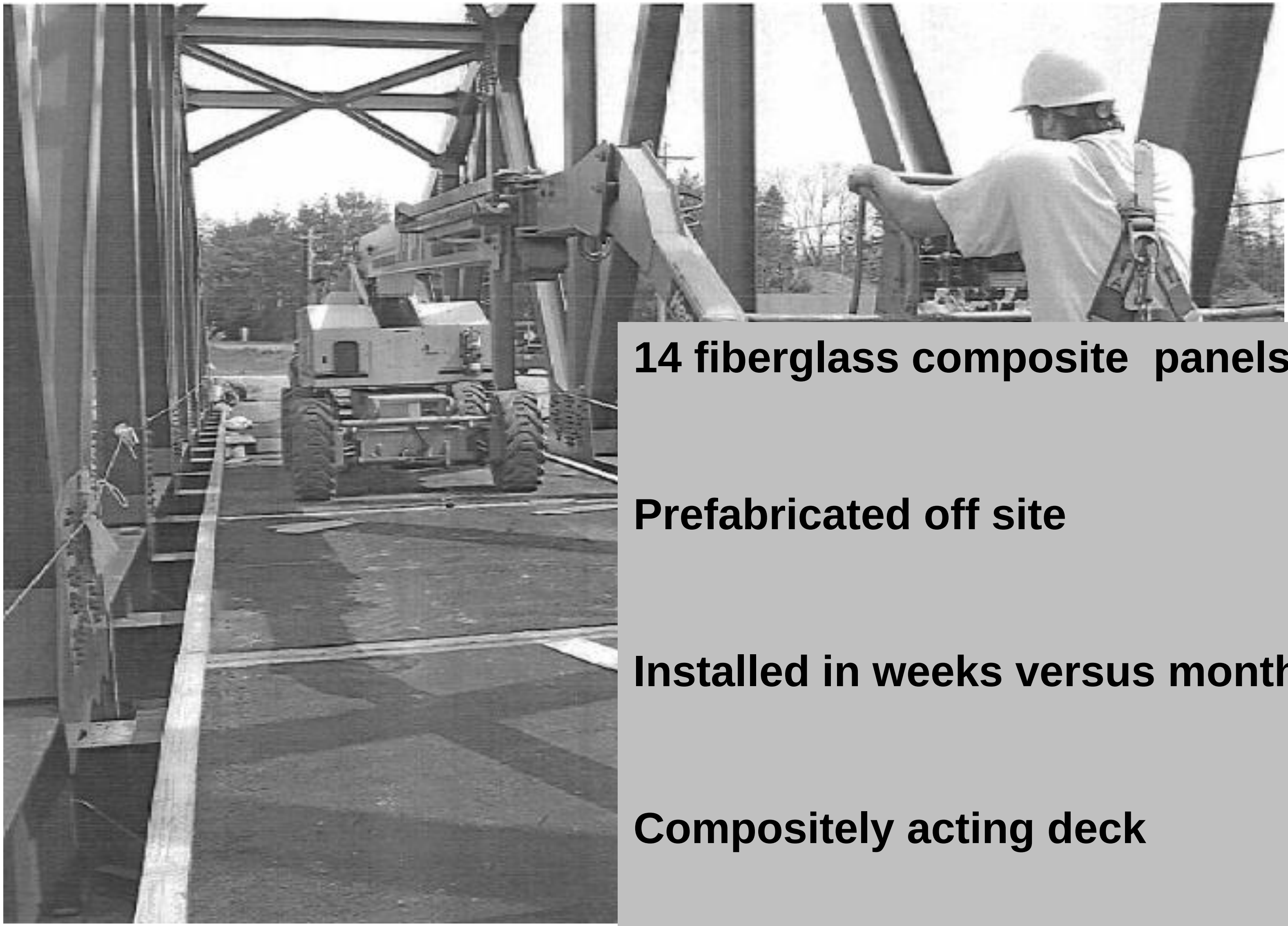
10,000 vehicles per day

Port Clyde

90 m long x 5.5 m wide

CHIEF ENGINEER JIM FRANCIS

DEPARTMENT OF NOVA SCOTIA TRANSPORTATION



14 fiberglass composite panels

Prefabricated off site

Installed in weeks versus months

Compositely acting deck

Cheaper, faster, longer lasting…what's not to like?

Innovative Approach to Port Clyde Bridge

Transportation and Public Works
May 31, 2005 15:35

Residents of the Port Clyde area on the Lighthouse Route (Route 309) will have their new bridge in place sooner than anticipated.

"The Port Clyde bridge will have an innovative decking system that will reduce construction costs and even more importantly for residents, reduce the amount of time a detour will be in place," said Ron Russell, Minister of Transportation and Public Works. "Cheaper, faster, longer lasting -- what's not to like?"

The new bridge will span the river without the need for in-water piers. This reduces environmental concerns. The bridge's fibreglass wrapped deck will provide added protection against road salt and require less maintenance than a traditional bridge. Cost of the replacement will be $2.1 million as opposed to the cost of a traditional bridge, estimated at more than $3 million.

Traditional bridge construction would require the immediate placement of the panel bridge with a permanent bridge to be built in 2006, taking five months to complete.

Mr. Russell said his department will be consulting with the local community, including organizations like the fire department, about the best time to schedule a two-month closure while the new bridge is constructed on site.

CLYDESDALE

CHIEF ENGINEER JIM FRANCIS
DEPARTMENT OF NOVA SCOTIA TRANSPORTATION

BRIDGE PANEL NUMBER ONE

27 m long x 4.75m wide

CLYDESDALE

CHIEF ENGINEER JIM FRANCIS
DEPARTMENT OF NOVA SCOTIA TRANSPORTATION

BRIDGE PANEL NUMBER ONE

27 m long x 4.75m wide

CLYDESDALE

CHIEF ENGINEER JIM FRANCIS
DEPARTMENT OF NOVA SCOTIA TRANSPORTATION

BRIDGE PANEL NUMBER ONE

27 m long x 4.75m wide

CLYDESDALE

CHIEF ENGINEER JIM FRANCIS
DEPARTMENT OF NOVA SCOTIA TRANSPORTATION

TWO BRIDGE PANELS INSTALLED

BRIDGE 9.5M WIDE

CLYDESDALE

CHIEF ENGINEER JIM FRANCIS
DEPARTMENT OF NOVA SCOTIA TRANSPORTATION

27 m long x 9.5 m wide bridge

Delivered in two panels

Installed in weeks versus months

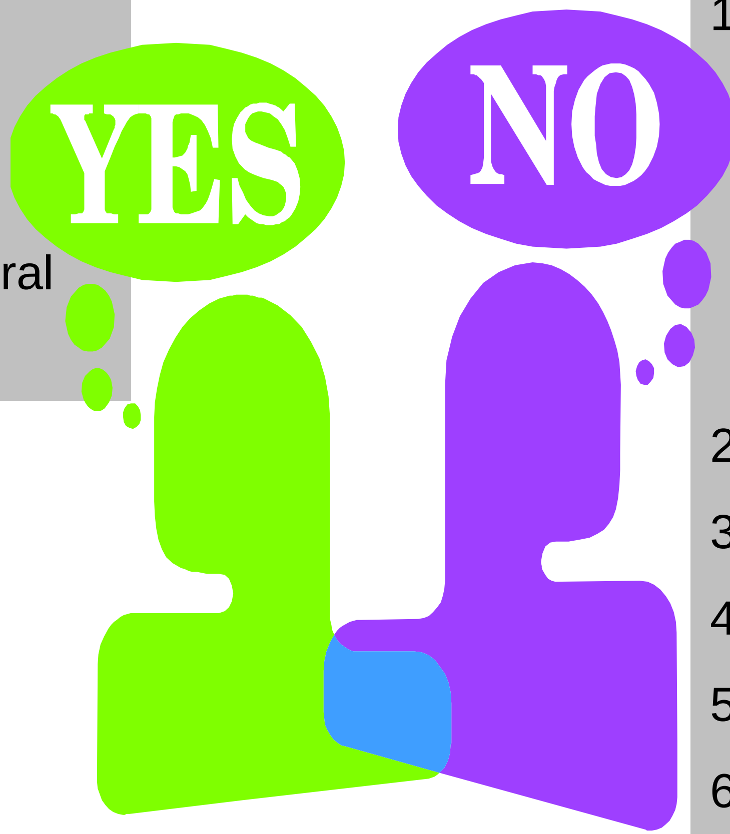
790K Project costs

Compare Superstructure Timelines

25 meters long x 9.5 meters wide

Guardian

1. New bridge panels
   A. First panel
   B. Second Panel
2. Semi Integral or Integral
3. Asphalt HL3 90mm



Concrete

1. New concrete beams
   A. First Beam
   B. Second Beam
   C. Third Beam
   D. Fourth Beam
2. Install forming
3. Install Rebar
4. Pour Concrete Deck
5. Wait 28 days
6. Waterproofing
7. Asphalt HL3 90mm

5 days

60 days


11/28/06 9:25 am

Recognize

Nancy Dewar

Joshua Dewar, Ben Dewar, Natascha Dewar

International Timber Bridge Conference Scientific Committee

International Timber Bridge Conference Planning Committee

USDA Forestry Lab

Wood Works

Canadian Highway Bridge Design Code

Canadian Wood Council Jasmine Wang Ph.D P.Eng

Blackwell – Cory Zurell Ph.D P.Eng

Delcan – Sylvain Montminy P.Eng & Patrick Mergel P.Eng

Stantec – Reed Ellis Ph.D P.Eng & Jim Francis P.Eng

ISIS Canada – Dr. Mufti, Dr. Baidar Bakht

MTO – Bala Tharmabala Ph.D P.Eng

Guardian Bridge
RAPID CONSTRUCTION