Dogwood Road Bridge

COUNTY OF IMPERIAL

INTRODUCTION


STOP
STOP

DOGWOOD ROAD BRIDGE OVER IID CENTRAL MAIN CANAL:

- Dogwood Road is one of the main north-south corridors of Imperial County.
- The bridge crosses over the IID Central Main Canal
- The Central Main Canal is one of the four major canals in the Imperial Valley
- Three out of four major north-south road corridors that connect interstate to Mexican Border closed due to critical bridge findings

ISSUES:

- Ongoing Subsidence. State of Emergency Declared
- Significant erosion at abutment.
- Proximity with all surrounding utilities which would conflict with construction and final improvements. (Gas line, overhead power lines, telecommunications, drains, and canals)
- Closure of Dogwood at the bridge would cause a large detour that would impact agricultural production, local businesses, and residents.
- No intermediate support was to be placed in IID canal.

PROJECT GOALS

- Design a single span bridge
- Selected a lightweight superstructure
- Minimize bridge depth
- Reduce construction time
- Restore eroded areas adjacent abutments
- Provide future erosion control

PROJECT CHALLENGES

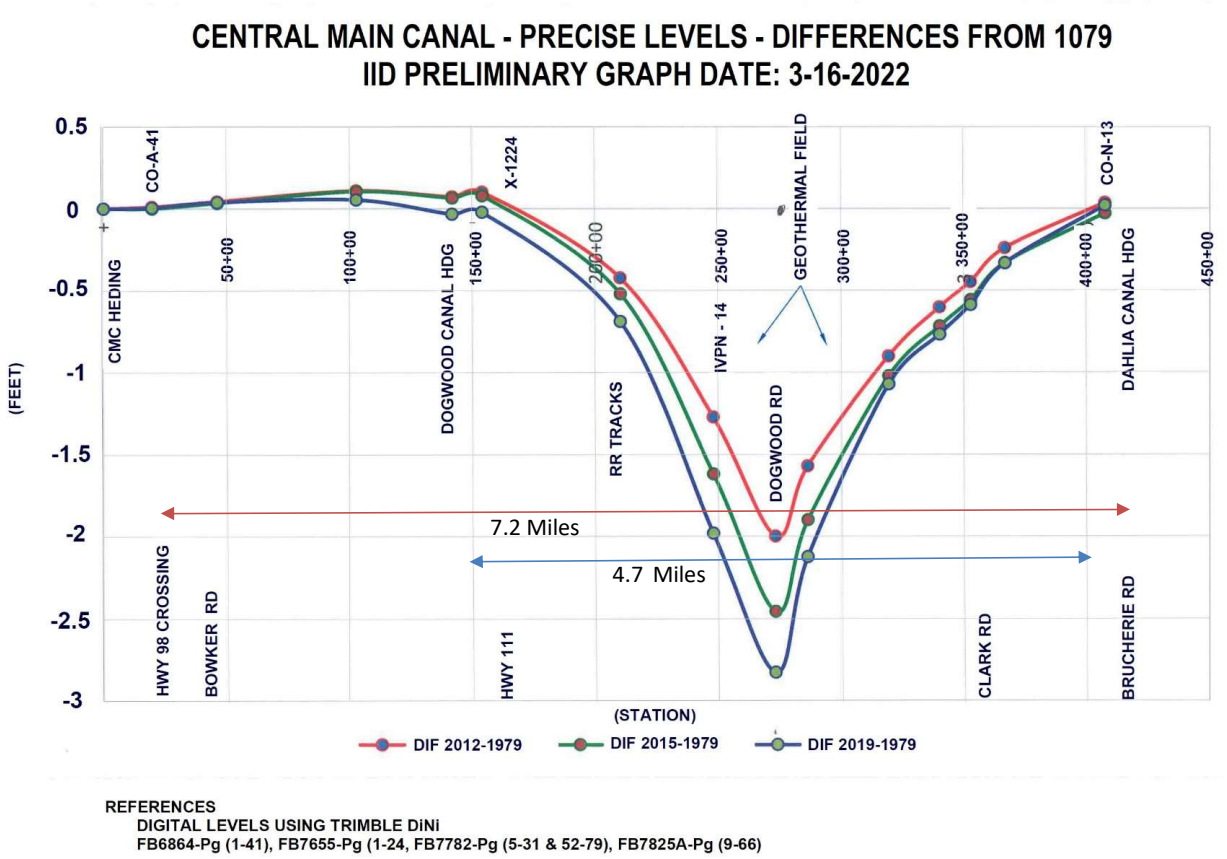
UTILITIES:

- SoCal Gas Pipeline attached to the bridge soffit (eastside)
- Over Head 92kv IID Transmission Line
- AT&T Fiber Optics Telecommunication Line

PROJECT CHALLENGES

Subsidence: Bridge had settled along with the surrounding area at an approximate average rate of 1-in/year!

AREA SUBSIDENCE



REFERENCES
DIGITAL LEVELS USING TRIMBLE DiNi
FB6864-Pg (1-41), FB7655-Pg (1-24, FB7782-Pg (5-31 & 52-79), FB7825A-Pg (9-66)

Bridge Options

- Pre-Cast Prestress Concrete I-Girder Bridge
- Pre-Fabricated Steel Tub Girder Bridge
- Post Tension Superstructure

Selected Option

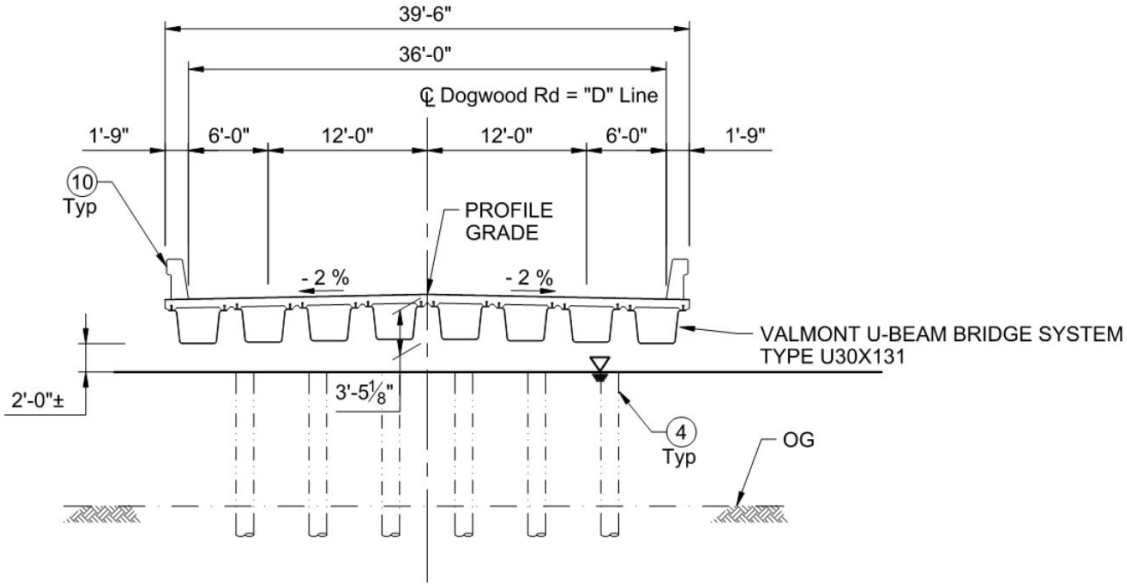
- Steel Tub Girder Bridge

Design Criteria

- AASHTO LRFD Specification 8th Edition.
- HL-93 Live Load
- CALTRANS PL-50 Permit Design Load
- CALTRANS Seismic Design Criteria Ver. 2.0

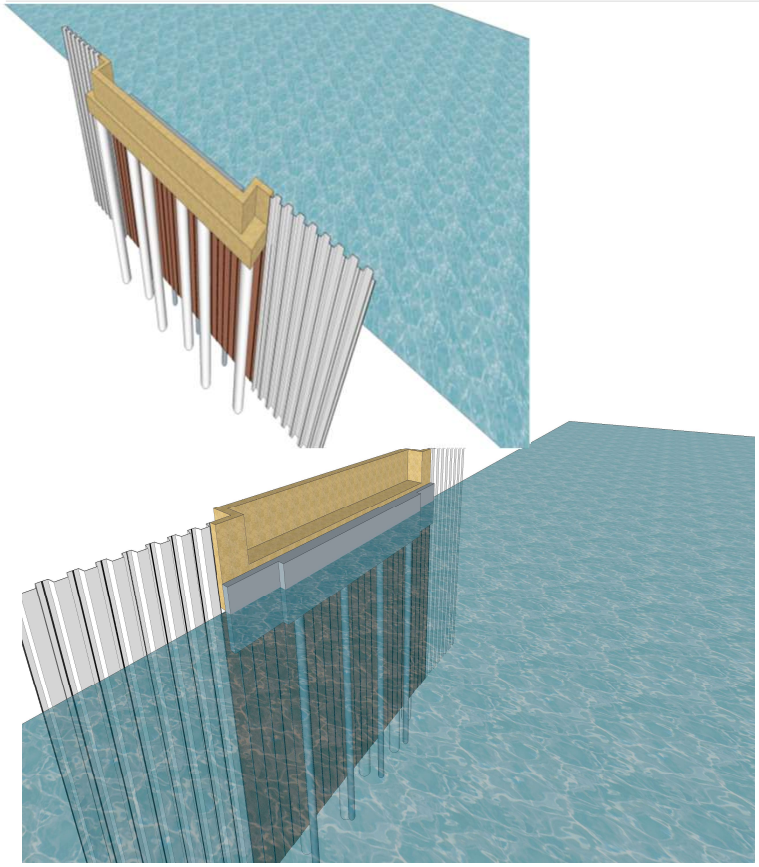
Bridge Facts

- 91’-6” Bridge Length
- 87’-6” Clear Span (CL BRG to CL BRG)
- 36’-0” Cub-to-Curb & 39’-6” Out-to-Out
- 8” Concrete Deck
- 2’-6” Girder Depth
- Two 12’-0” lanes & two 6’ shoulders
- Concrete Barrier (Type 836)
- Elastomeric Bearings
- Six - 30” Diameter CISS Piles at each abutment

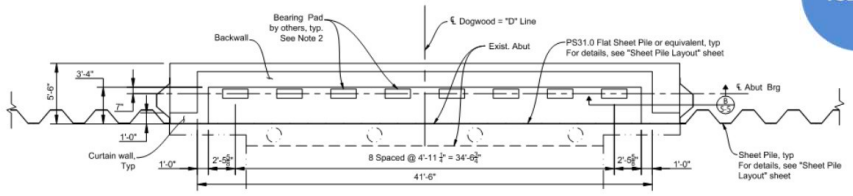


TYPICALL SECTION

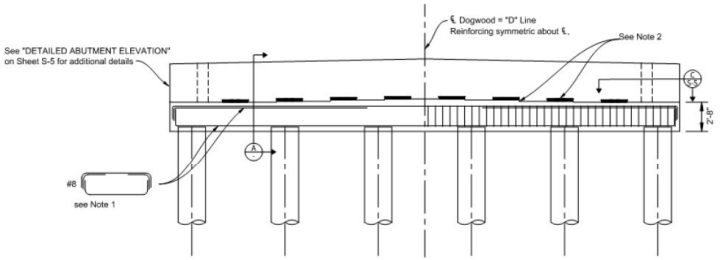
ABUTMENT DESIGN



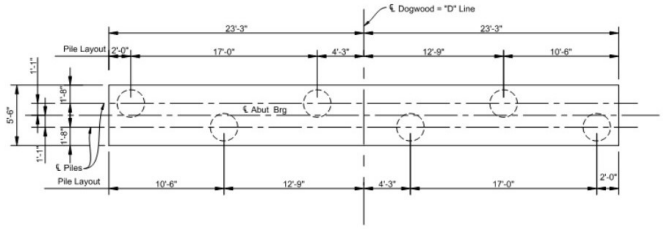
Future Abut. DL was added in pile design



ABUTMENT PLAN
SCALE 1/4" = 1'-0"



ABUTMENT ELEVATION
SCALE 1/4" = 1'-0"



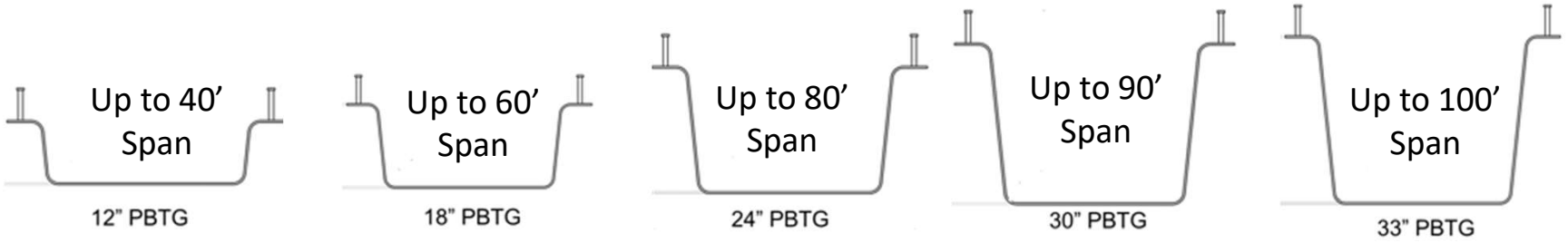
ABUTMENT FOOTING PLAN
SCALE 1/4" = 1'-0"

CONSTRUCTION SEQUENCE

- Removed the old bridge deck
- Kept the old abutment & pier caps
- Constructed the new abutments
- Moved the Prefabricated Steel Tub Girder with Pre-Cast Deck
- Completed the deck closure pours
- Constructed bridge railings, abutment backwall, and the roadways

DESIGN – FABRICATION - COATING

FOR 80 YEARS, VALMONT® HAS BEEN A GLOBAL LEADER IN CREATING VITAL INFRASTRUCTURE AND ADVANCING AGRICULTURAL PRODUCTIVITY. TODAY, WE REMAIN COMMITTED TO DOING MORE WITH LESS BY TAKING THE PROMISE OF TECHNOLOGY AND MAKING IT USEFUL IN EVERYDAY LIFE.



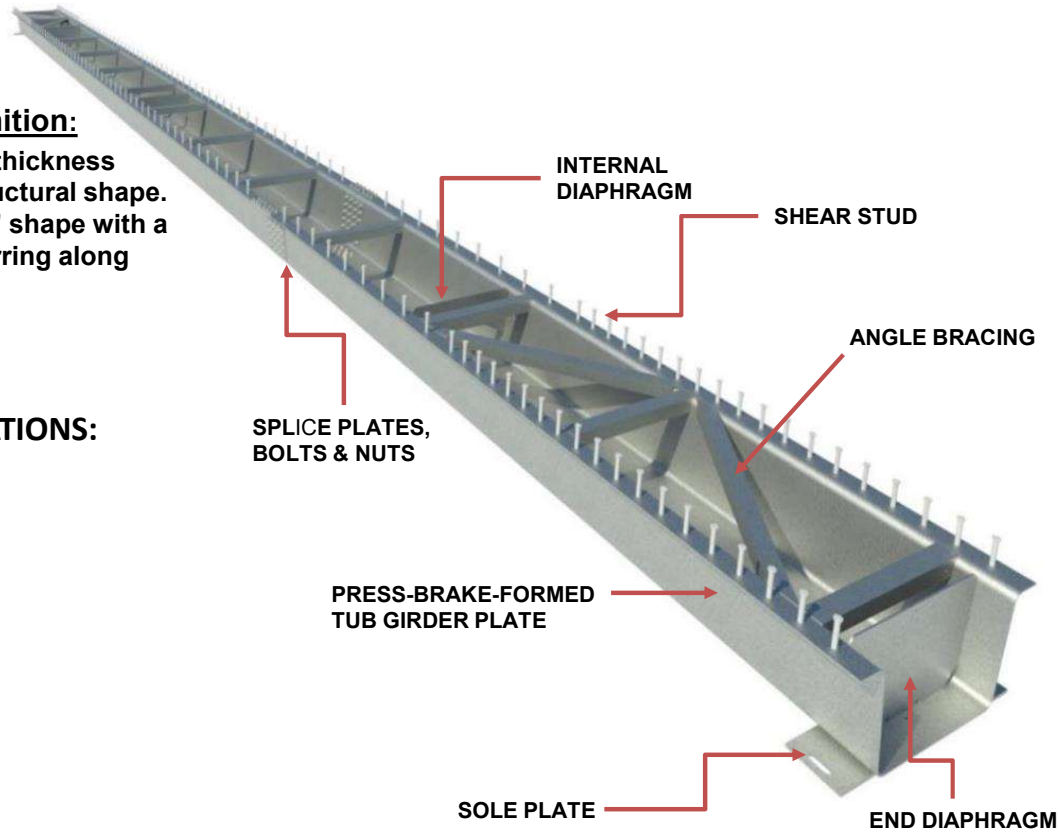
WHAT IS A PRESS BRAKE TUB GIRDER?

Iowa State University Definition:

A single steel plate of the desired thickness that is strategically bent into a structural shape. The plate is cold formed into a "U" shape with a press-brake, with each bend occurring along the plate's longitudinal axis.

PROCEDURES FOLLOW AASHTO DESIGN & CONSTRUCTION SPECIFICATIONS:

1. AASHTO M270 Material
2. Press-Brake Forming
3. Camber
4. Stud Welding
5. Protective Coating
6. Design
7. Shop Drawings
8. Inspection



ADVANTAGES

- 100 Year Service Life
- Follows AASHTO Design
- Follows AASHTO Fabrication
- Simple Standard Details
- Easy Installation

NATIONAL RECOGNITION WITH THE AASHTO INNOVATION INITIATIVE AWARD

2020 Press-Brake Tub Girders receive the “2020 Innovation Award” as **a ready-to-implement technology** that offers improved performance/effectiveness and have been demonstrated in "real world" applications.

2021 Press-Brake Tub Girders become a 2021 AASHTO Focus Technology.

2024 Press-Brake Tub Girders to be included in revisions to the 10th Edition of the AASHTO LRFD Bridge Design Specifications. The revisions apply to Specification Equation 6.11.2.2-3, allowing DOTs, Counties and other entities to utilize AASHTO design guidelines instead of rewriting specifications to include U-BEAMs

“This is great news for state and local Departments of Transportation that are looking for economical, sustainable and accelerated construction solutions for short span bridges, which make up over half of the U.S. bridge inventory.”

- Karl Barth, Ph.D., Associate Professor of Civil and Environmental Engineering at West Virginia University in a recent SSSBA article about the revisions

visit **aii.transportation.org** for more information

HOW DO I DESIGN A PRESS BRAKE TUB GIRDER WITH AASHTO?

DEVELOPMENT AND EXPERIMENTAL TESTING OF PRESS-BRAKE-FORMED STEEL TUB GIRDERS FOR SHORT SPAN BRIDGE APPLICATIONS

Karl E. Barth, Ph.D.
Gregory K. Michaelson, Ph.D.
Cory L. Gibbs

Submitted to the AISI Steel Market Development Institute Short Span Steel Bridge Alliance

Table 2.2: Equation Legend (AASHTO, 2014)

Chapter 2	AASHTO 7th Edition	Chapter 2	AASHTO 7th Edition
Equation 2.1	Equation 6.11.2.1.2-1	Equation 2.39	Equation 6.11.8.2.2-4
Equation 2.2	Equation 6.11.2.1.3-1	Equation 2.40	Equation 6.11.8.2.2-5
Equation 2.3	Equation 6.11.2.2-1	Equation 2.41	Equation 6.11.8.2.2-6
Equation 2.4	Equation 6.11.2.2-2	Equation 2.42	Equation 6.11.8.2.2-7
Equation 2.5	Equation 6.11.2.2-3	Equation 2.43	Equation 6.11.8.2.2-8
Equation 2.6	Equation 6.10.3.2.1-1	Equation 2.44	Equation 6.11.8.2.2-9
Equation 2.7	Equation 6.10.3.2.1-2	Equation 2.45	Equation 6.11.8.2.2-10
Equation 2.8	Equation 6.10.3.2.1-3	Equation 2.46	Equation 6.11.8.2.2-11
Equation 2.9	Equation 6.10.3.2.2-1	Equation 2.47	Equation 6.11.8.2.2-12
Equation 2.10	Equation 6.10.3.2.3-1	Equation 2.48	Equation 6.11.8.2.3-1
Equation 2.11	Equation 6.11.3.2-1	Equation 2.49	Equation 6.11.8.2.3-2
Equation 2.12	Equation 6.11.3.2-2	Equation 2.50	Equation 6.11.8.2.3-3
Equation 2.13	Equation 6.11.3.2-3	Equation 2.51	Equation 6.11.8.3-1
Equation 2.14	Equation 6.11.3.2-4	Equation 2.52	Equation 6.10.9.1-1
Equation 2.15	Equation 6.11.3.2-5	Equation 2.53	Equation 6.10.9.2-1
Equation 2.16	Equation 6.10.3.3-1	Equation 2.54	Equation 6.10.9.2-2
Equation 2.17	Equation 6.11.9-1	Equation 2.55	Equation 6.10.9.3.2-1
Equation 2.18	Equation 6.10.4.2.2-1	Equation 2.56	Equation 6.10.9.3.2-2
Equation 2.19	Equation 6.10.4.2.2-2	Equation 2.57	Equation 6.10.9.3.2-3
Equation 2.2	Equation 6.10.4.2.2-3	Equation 2.58	Equation 6.10.9.3.2-4
Equation 2.21	Equation 6.10.4.2.2-4	Equation 2.59	Equation 6.10.9.3.2-5
Equation 2.22	Equation 6.6.1.2.2-1	Equation 2.60	Equation 6.10.9.3.2-6
Equation 2.23	Equation 6.6.1.2.5-1	Equation 2.61	Equation 6.10.9.3.2-7
Equation 2.24	Equation 6.6.1.2.5-2	Equation 2.62	Equation 6.10.9.3.2-8
Equation 2.25	Equation 6.6.1.2.5-3	Equation 2.63	Equation 6.10.9.3.3-1
Equation 2.26	Equation 6.11.6.2.2-1	Equation 2.64	Equation 6.10.9.3.3-2
Equation 2.27	Equation 6.10.7.3-1		
Equation 2.28	Equation 6.11.7.1.1-1		

ARE THERE REFFERNCES FOR THE I DESIGN A PRESS BRAKE TUB GIRDER?

NSBA DESIGN MANUAL

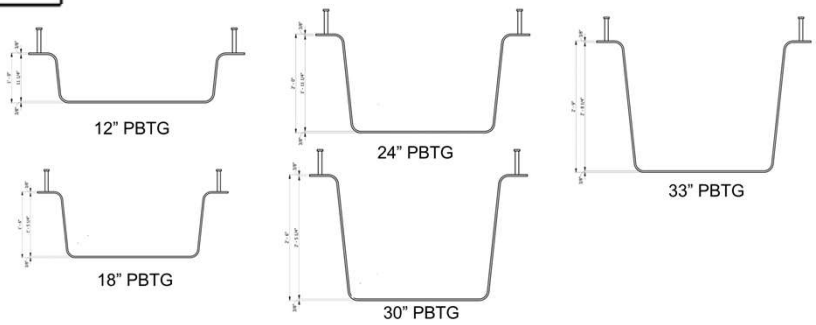
TABLE OF CONTENTS

COMING SOON FROM NSBA

3.1.2 NSBA PBTG Standard Sections

In the effort to optimize PBTG design and fabrication, five standard heights are defined here as shown in figure 3.1 through figure 3.5. These heights account for the recommended steel plate thickness, required 5t bend radius and standard plate widths of 72”, 84”, 96”, 108” and 120”. Specific top and bottom flange dimensions should be coordinated with the capabilities of your local fabricator. Final shapes should meet AASHTO LRFD article 6.7.3 Minimum Thickness of Steel requirements and AASHTO LRFD article 6.11.2 Cross Section Proportion Limits requirements for a compact section.

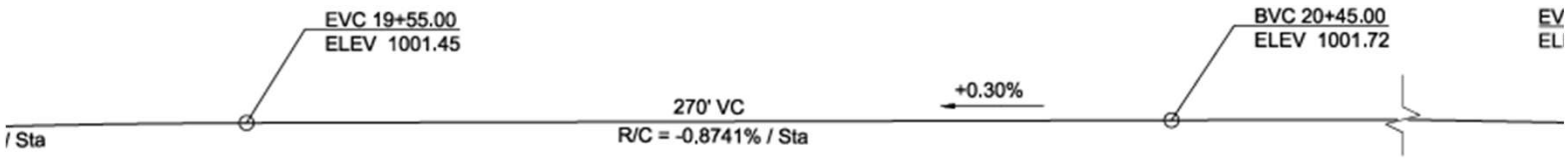
U-BEAM™ SPACING	BRIDGE LENGTH (ft)															
	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
4' - 6"	U12	U12	U12	U12	U12	U18	U18	U18	U24	U24	U24	U30	U30	U33	U33	S.D.
5' - 0"	U12	U12	U12	U12	U12	U18	U18	U18	U24	U24	U30	U30	U33	U33	S.D.	S.D.
5' - 6"	U12	U12	U12	U12	U18	U18	U18	U24	U24	U24	U30	U30	U33	U33	S.D.	
6' - 0"	U12	U12	U12	U12	U18	U18	U18	U24	U24	U30	U30	U30	U33	S.D.	S.D.	
6' - 6"	U12	U12	U12	U12	U18	U18	U18	U24	U24	U30	U30	U33	U33	S.D.		
7' - 0"	U12	U12	U12	U12	U18	U18	U24	U24	U24	U30	U30	U33	S.D.	S.D.		
7' - 6"	U12	U12	U12	U12	U18	U18	U24	U24	U30	U30	U33	U33	S.D.			
8' - 0"	U12	U12	U12	U18	U18	U18	U24	U24	U30	U30	U33	S.D.	S.D.			



5 STANDARD TUB SHAPES

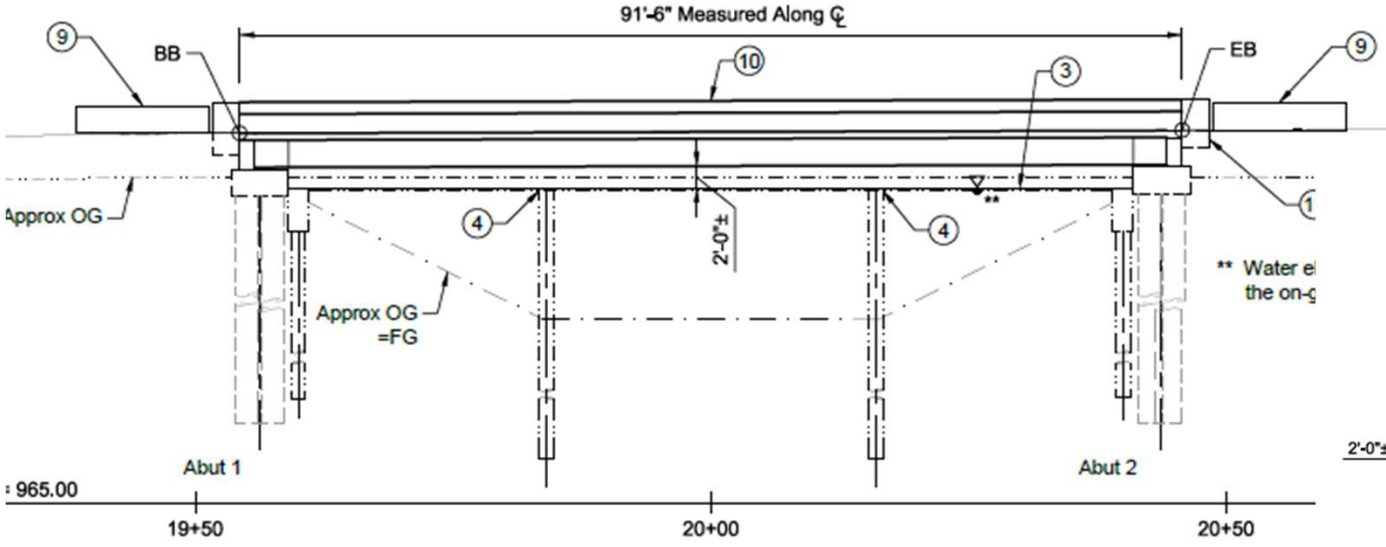
(BASED ON MILL FLAT PLATE STANDARD WIDTHS)

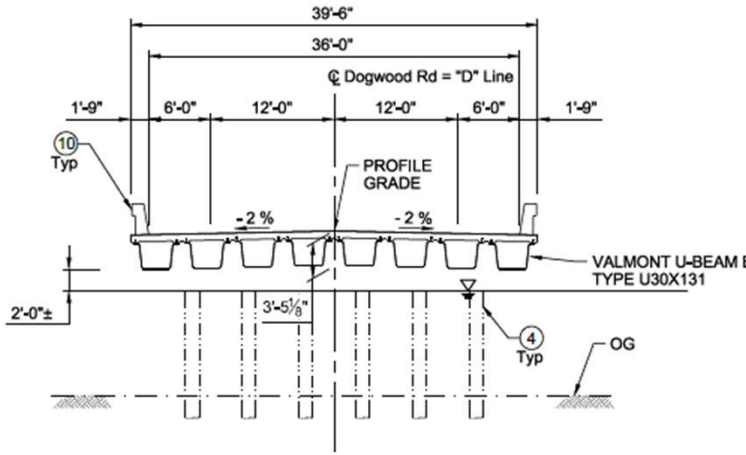
WHY WAS A PBTG USED ON THIS PROJECT– LOW COST, SHALLOW DEPTH, LIGHT WEIGHT AND NO MAINTENANCE



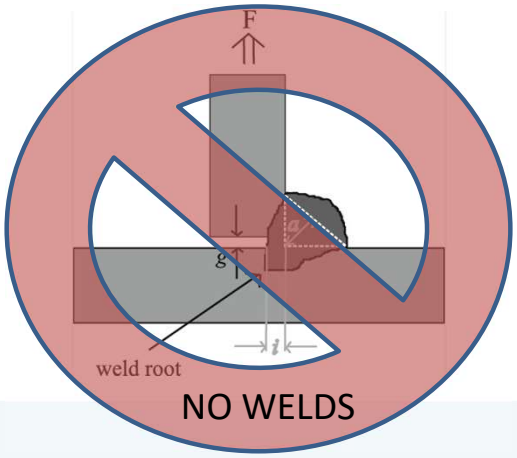
PROFILE GRADE

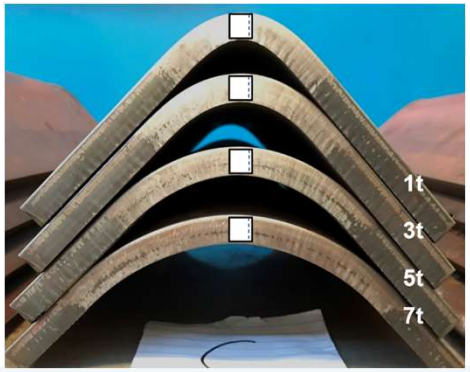
NO SCALE





WHY WAS A PBTG USED ON THIS PROJECT– LOW COST, SHALLOW DEPTH, LIGHT WEIGHT AND NO MAINTENANCE

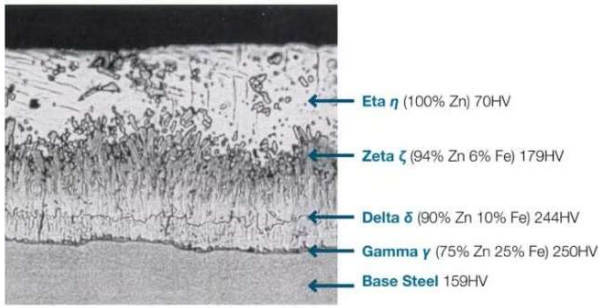




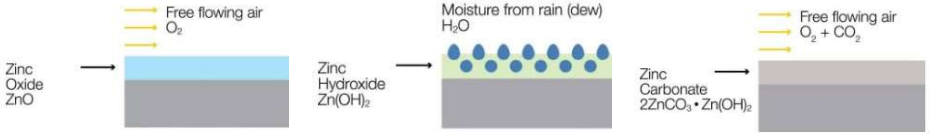
- Met All CALTRANs Design Requirements
- Low Underclearance Requirements
- Low Weight
- Low Cost
- Low Maintenance
- Easy Visual Inspection of Interior

WHY WAS A PBTG USED ON THIS PROJECT– LOW COST, SHALLOW DEPTH, LIGHT WEIGHT AND NO MAINTENANCE

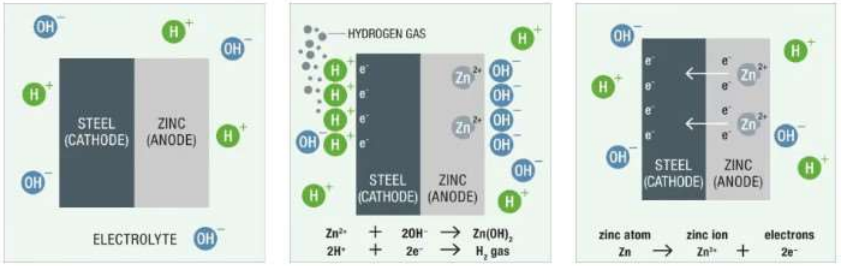
3 FORMS OF PROTECTION



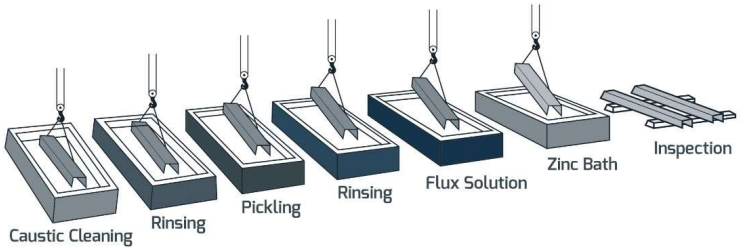
ZINC BARRIER (PHYSICAL)



PATINA BARRIER (PHYSICAL)



GALVANIC ACTION (CHEMICAL)



- Hot-dipped galvanizing is not simply a coating but a integral protective system
- Galvanizing alone provides a 70 year life-time to first maintenance
- Hot-dipped galvanizing provides 3 protection methods
  - Zinc barrier protection (eta, zeta, delta, gamma layers)
  - Patina protection (zinc oxide)
  - Cathodic protection (galvanic action)

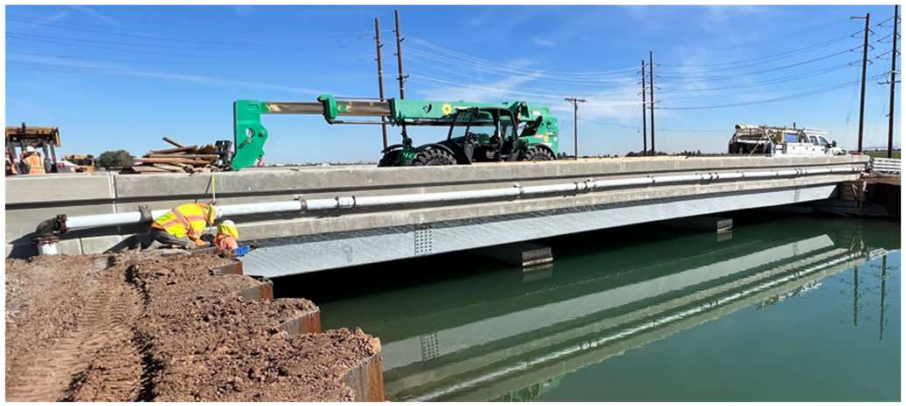
WHY WAS PBTG A BENEFIT – FAST DELIVERY

- Fast Delivery
- Easy Jobsite Storage and Handling
- Delivered Prior to Contractor Mobilization

Fig. 2. Domestic plate mill locations. »

WHY WAS PBTG A BENEFIT – SHALLOW DEPTH

- Shallow L/36 Span to Beam Depth Ratio
- Increased Underclearance to 24”
- Limited Raise in Road Grade



WHY WAS PBTG A BENEFIT – FUTURE JACKING

- Designed for Future Jacking
- Additional Bearing Plates 10’ from End of Beam
- Additional Bearing Diaphragm

WHY WAS PBTG A BENEFIT - VERSATILITY

- Designed as Cast-in-Place Concrete deck
- Redesigned to Precast Concrete Deck During Construction
- Give the Credit to Dugan Construction Co.

WHAT ELSE HAS BEEN DONE WITH PBTG IN CALIFORNIA

- Clark Road Bridge with Cast-in-Place Deck
- Chico Precast Panel Bridge with Full Depth Precast Panels

WHAT THE FUTURE HOLD FOR PBTG IN CALIFORNIA

- CALTRANs Planning 2 Bridge Replacements on CA-99 in 2024 and 2025
- Use New Technologies Learned to Achieve Longer Spans

The Dogwood Road Bridge Replacement Project received the prestigious ASCE 2024 Outstanding Structural Engineering Project Award

Dear John, Jack, and Archie,

On behalf of the ASCE San Diego Section and the ASCE Awards Committee, it brings me immense pleasure to announce that your remarkable project, "Dogwood Road Bridge Replacement Project" has been chosen as the recipient of the prestigious Outstanding Structural Engineering Project award. Your project serves as a shining example of how structural engineering project can significantly impact the San Diego community. We extend our heartfelt congratulations to your entire team for this outstanding achievement.

CLOSING REMARKS

Project Team:
Owner: County of Imperial DPW
Design Team: NV5
Bridge Manufacturer: Valmont
Contractors: Pyramid Construction and Aggregates, Inc.
Construction Manager: The Holt Group, Inc.

Stakeholders:
SoCalGAS
Imperial Irrigation District (IID)
AT&T

Special Thanks to:
LandMark, R Dugan Construction, Foundation Pile, BJ Engineering and Surveying, ACME, and Superior Pavement Markings.

ASCE 2024 Outstanding Structural Engineering Project Award
APWA 2024 Project of the Year Award

TIME-LAPS VIDEO