

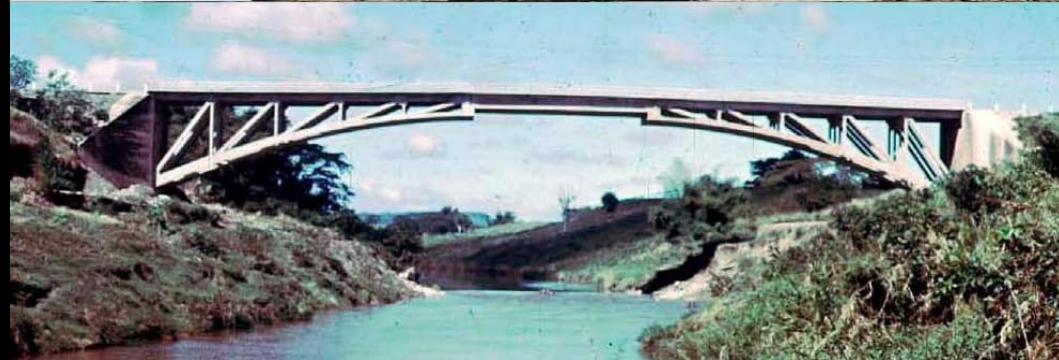
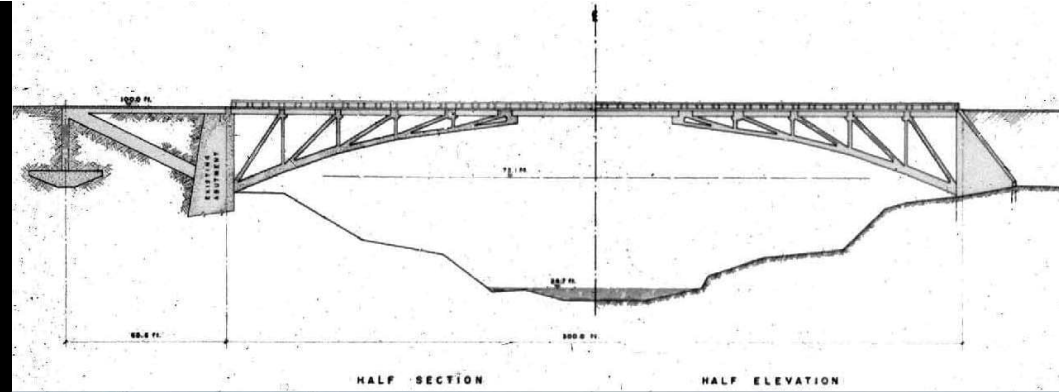


DESIGN & CONSTRUCTION OF THE ZAZA RIVER BRIDGE IN CUBA



ASBI WEBINAR

Presented by Jorge M. Suarez, P.E., F.ASCE | August 2026





Purpose and Learning Objectives

Purpose

This ASBI Webinar provides an educational forum to learn new techniques used in successful projects; lessons learned from design and construction and showcases a case study allowing for discussion of the project.

At the end of this presentation, you will be able to understand:

- Unique design-build delivery methods
- How to design bridge components with challenges of limited crane lift capacities available
- Design simple concrete pinned truss connections for erection ease
- Clever member 'stacked' cast-in-place concrete formwork to ensure precise geometry for all truss members
- Use of final deck slab post-tensioning bars tendons for temporary truss erection 'stays'
- Strut and tie methods to repurpose existing gravity concrete abutments to support cantilevered construction erection methods with dead-man soil anchors

Topics



01

**Mario G
Suarez, P.E.**



02

**Bridge
Location**



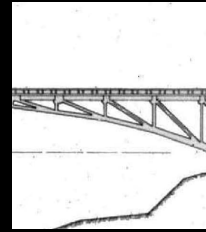
03

**Existing
Bridge –
Before and
After**



04

**Design Build
Bridge
Replacement
Competition**



05

**Bridge
Design and
Details**



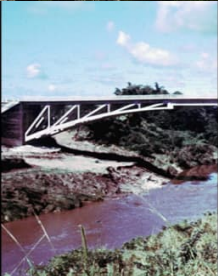
06

Construction



07

**Bridge
Legacy**



Mario G. Suarez, P.E.

Education

University of Havana, 1948
University of Illinois, 1950



Professor

Head of Structural Dept
Univ of Santo Tomas de Villanueva,
Cuba (1954-1958)



Chief Engineer

Stressteel Corporation
(1963-1978)



Award

PTI Legend of Post Tensioning
(2009)



US Patent

Electrically Isolated Post-Tensioning Tendons



Consulting Engineer

Cuba (1948-1960)



Senior Engineer

Ammann & Whitney
(1961-1963)



Owner

Schupack Suarez
Engineers, Inc.
(1978-2008)



Professional Organizations

PTI, ACI & PCI
Technical
Committees, ASCE





Bridge Legacy

1951

The Walnut Lane Bridge, a 160-foot simple span, was built in Philadelphia. It was the first prestressed concrete highway bridge in America.

1952

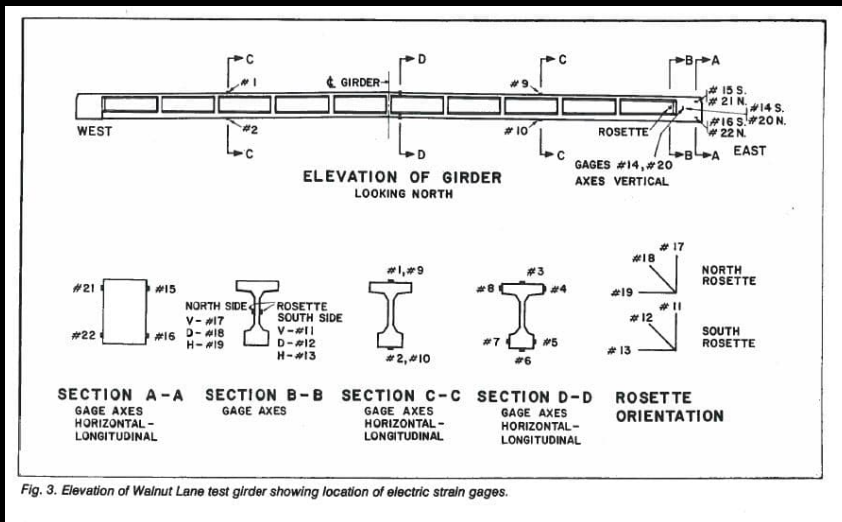
Mario Suarez, 26, designed and built a 250-foot main span, cast-in-place box girder, prestressed concrete highway bridge over the Canas River in Cuba. It was the longest span prestressed bridge in the Western Hemisphere at the time.

1959

Considered the first of its kind, when the Zaza River Bridge was built, it predated all other major precast segmental bridges in the world.

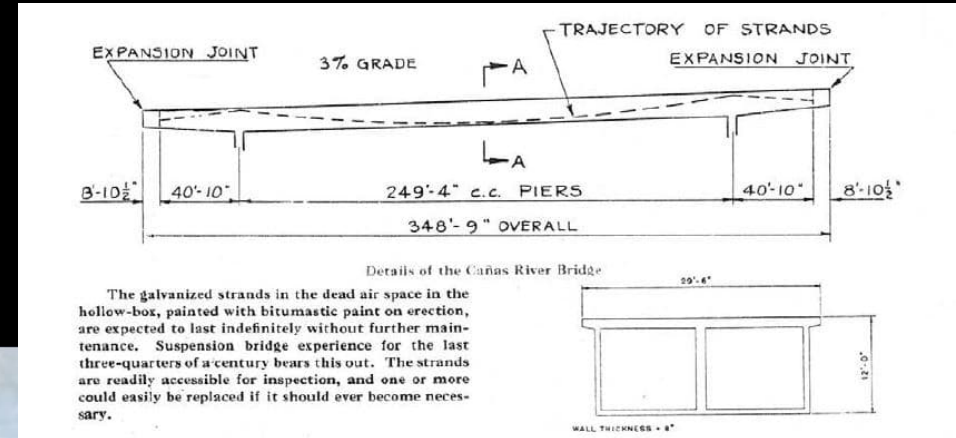
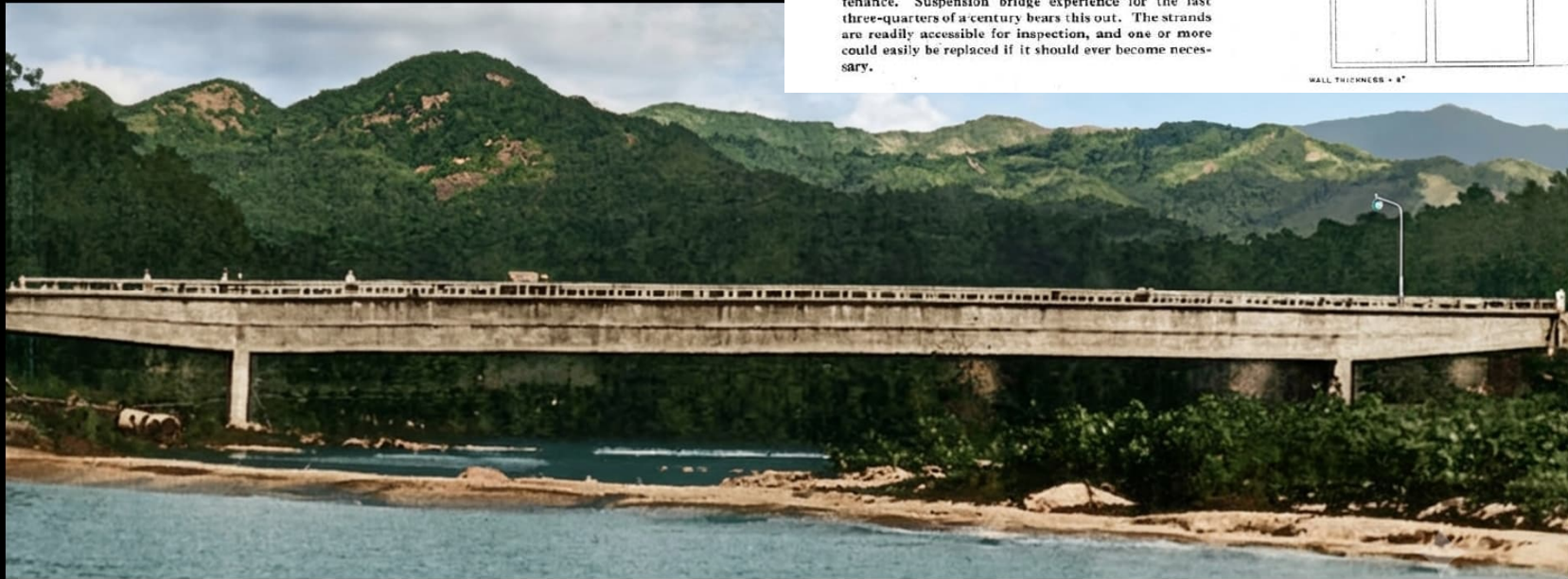


Walnut Lane Bridge – 160 ft (1951)





Canas River Bridge – 250 ft (1952)





Project Location





Existing Bridge Before

WSP | Footer goes here | Date





Existing Bridge After

WSP | Footer goes here | Date





Problem for New Castro Government

- Five steel bridges on central highway destroyed
- Hastily organized Cuban Public Works calls for International Design-Build Competition
- Engineering firm and contractor submit bridge design without identification
- Contractor guarantee by bond a lump sum price



Design Criteria (1959)

- Design load: AASHTO H20-16 truck loading
- Two 12-foot-wide traffic lanes, 1'-7" curbs, 4'-11" sidewalks
- The clear span of the bridge must be maintained (300 feet)
- Speed of construction critical requirement in the bridge replacement - led to precast in lieu of CIP
- Equipment available - crawler cranes with maximum 19-ton lift capacity
- Eliminated possibility of using full section precast elements

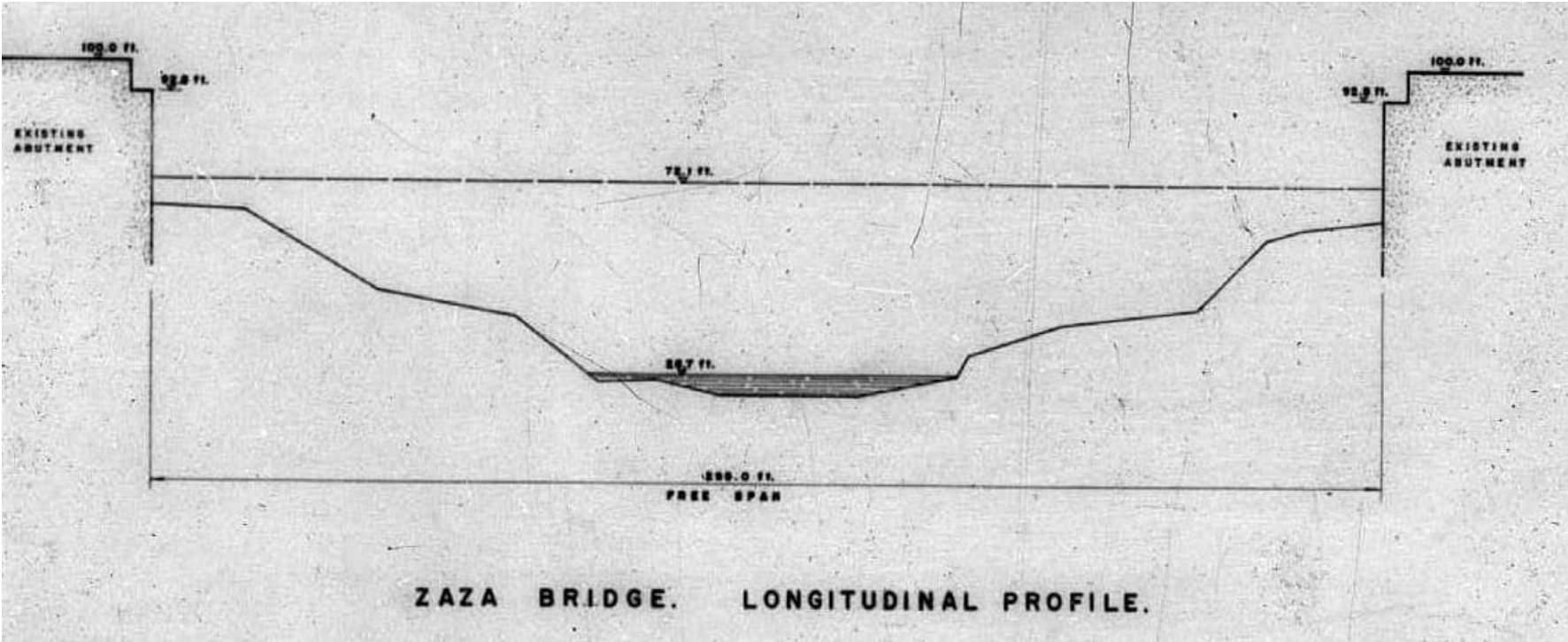


Bridge Type Solution

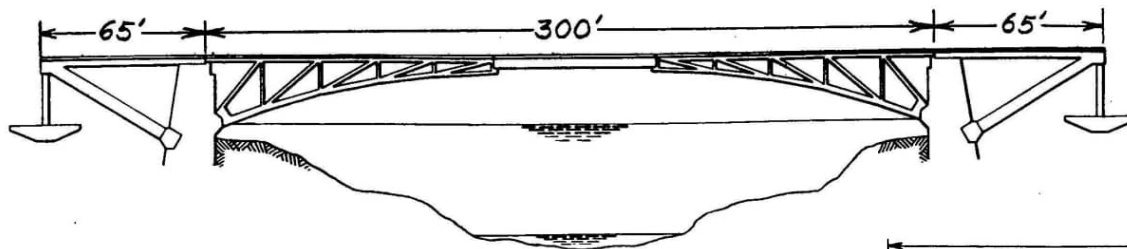
- 4 Parallel Concrete Segmental Trusses with Drop in Beams at Midspan
- No Falsework
- Post-Tensioned Truss / Beam Elements
- Erected by Progressive Cantilever Method
- Inverted Umbrella Earth Tiedown behind Existing Abutments
- Tension Approach Slab
- Compression Strut behind Abutment



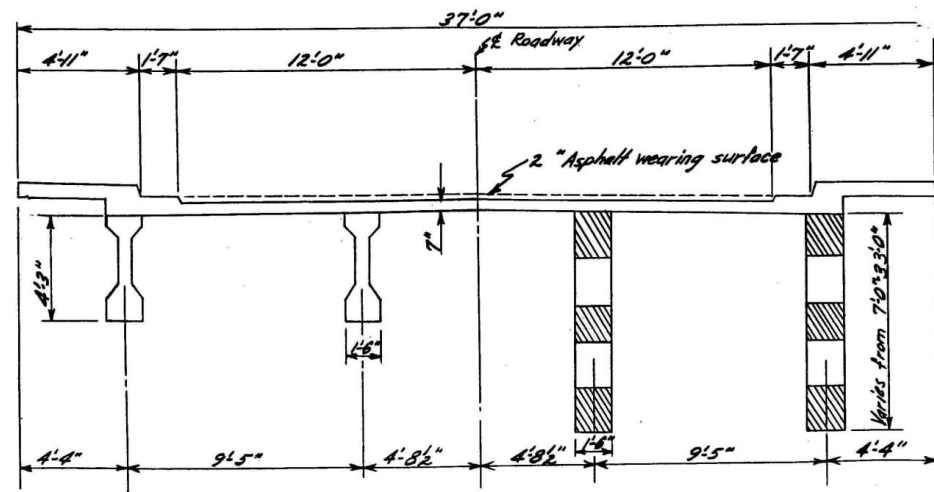
Existing Bridge Abutments - To Remain



Elevation & Section of Bridge



Elevation

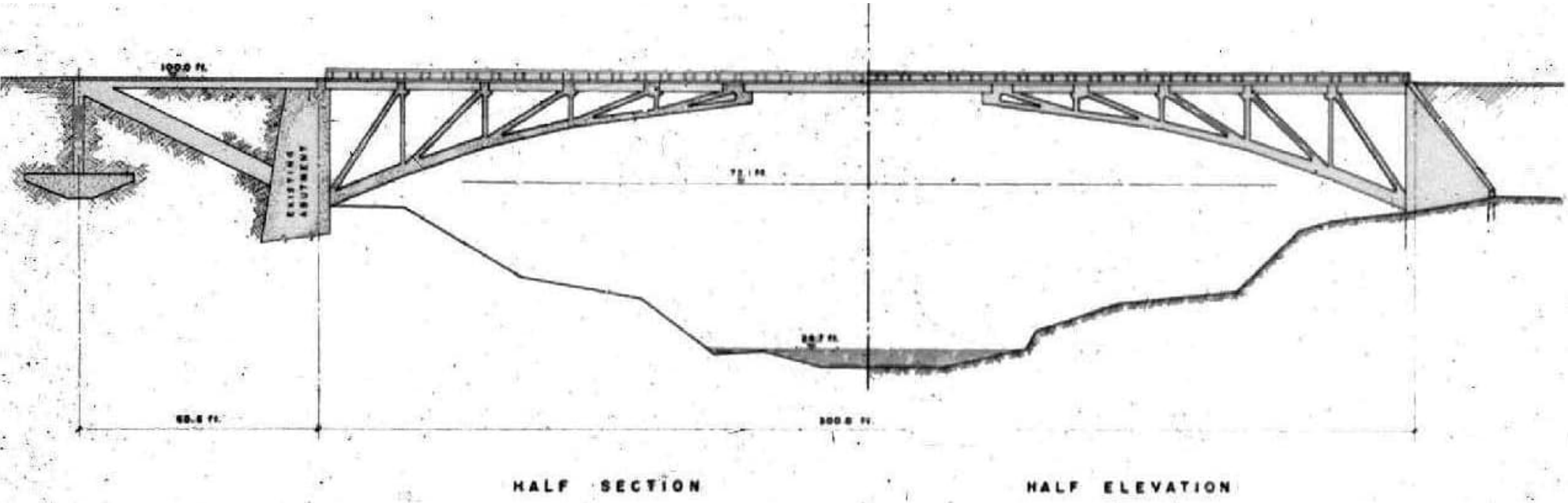


Crosssection at Center Line

Crosssection at Truss



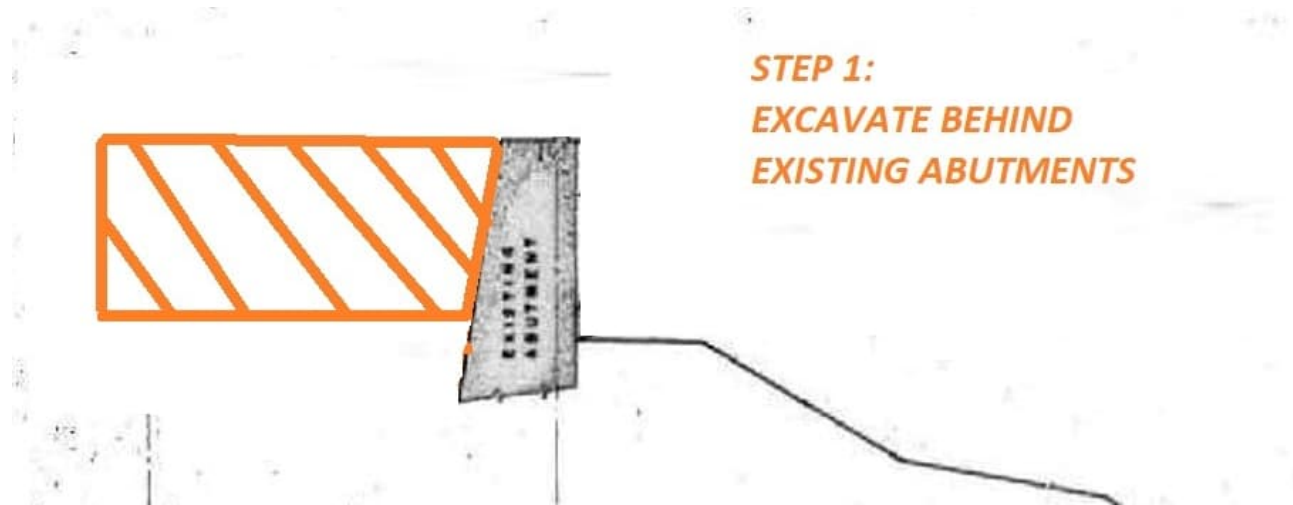
Elevation (117-foot Truss Cantilevers, 66-foot Midspan Beams)





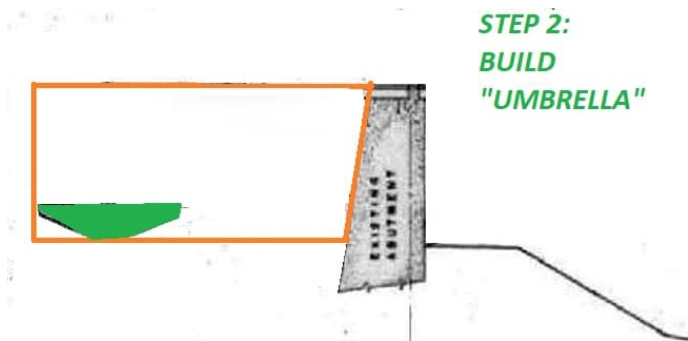


Substructure Construction Sequence





Inverted Umbrella Tie Down

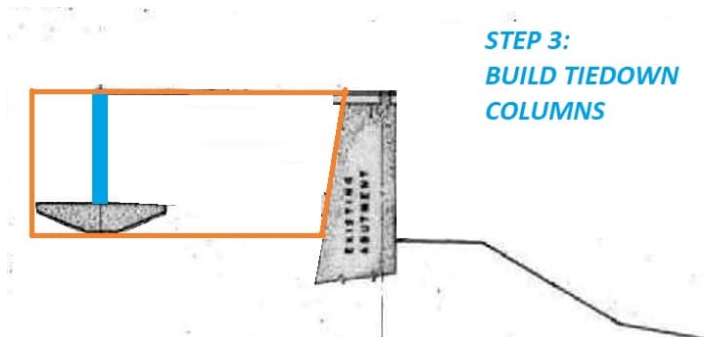


STEP 2:
BUILD
"UMBRELLA"



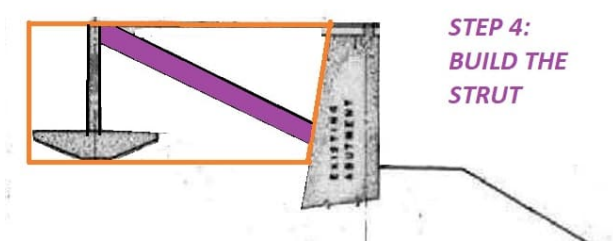


PT Bar Tie Down Hangers





Diagonal Compression Element behind Abutment





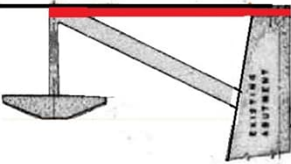
Top Connection of Diagonal and Hanger



Post Tensioning of Hanger Bars (Note Longit Slab PT)



STEP 5:
BACKFILL AND BUILD
TENSION APPROACH
SLAB





Tension Slab Tendon behind Abutment





Front Face of Abutment – Reinf & Pin Connection





Cast Anchor with Pin Connection





Formwork for Stacked 4 Trusses (each side of river)





Pin Connector @ Truss Bottom Chord





Rebar at Joints around Pin Connection





Extreme End of Cantilever w Beam Seat





Cast Concrete Trusses (Stacked)

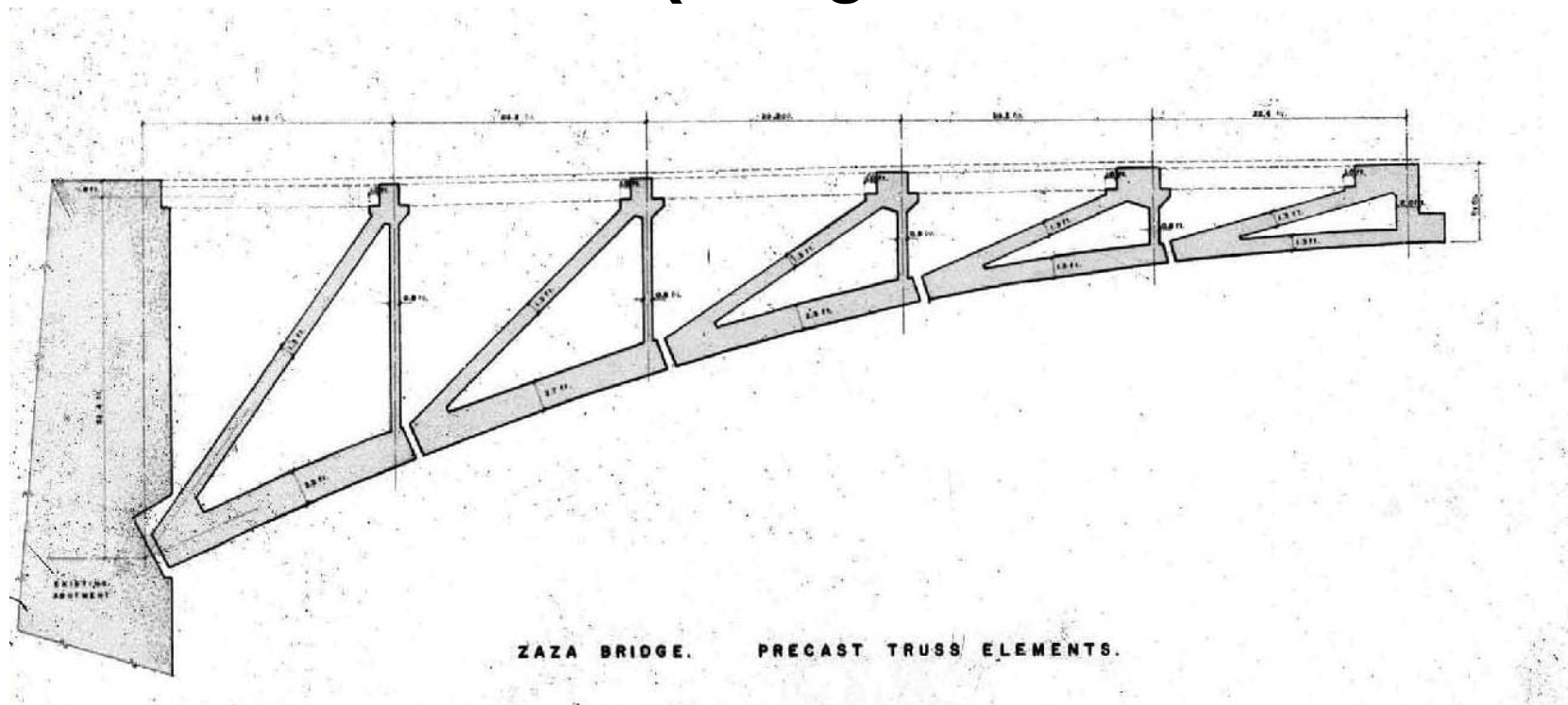




Rebar at Joints Cut and Pin Removed

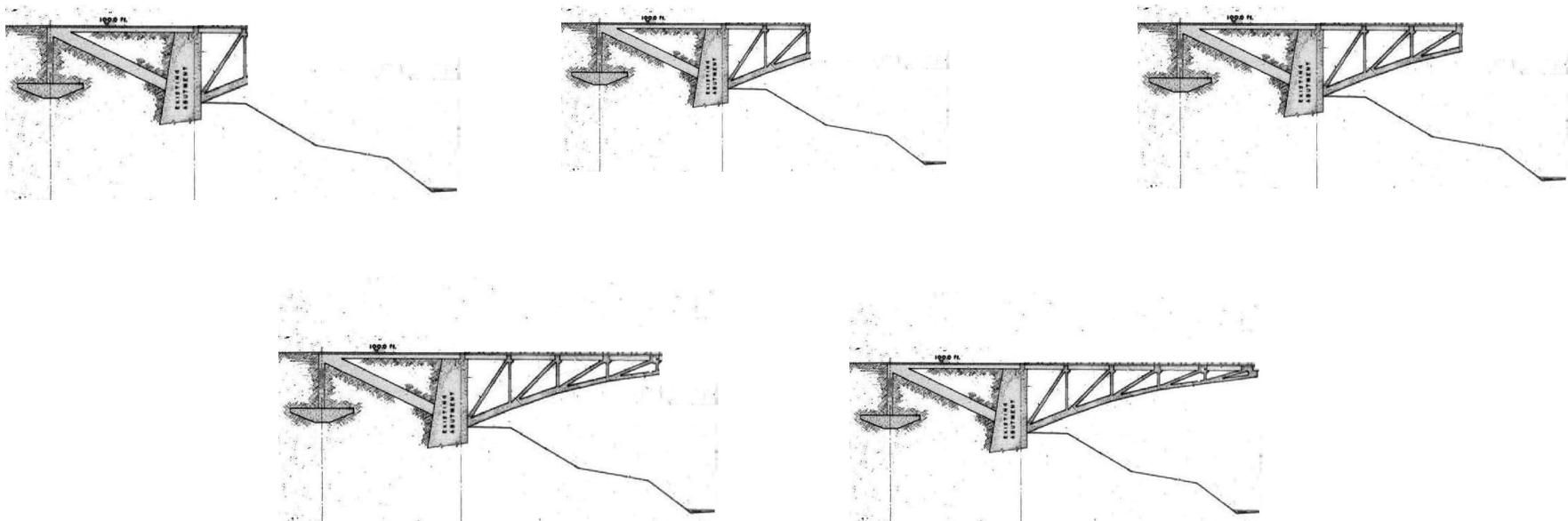


Concrete Truss Details (5 segments @ 23'-4" = 117 ft)





Progressive Cantilever Erection Scheme





Lifting First Truss Segment





Connecting First Truss Line Segment to Abutment Face





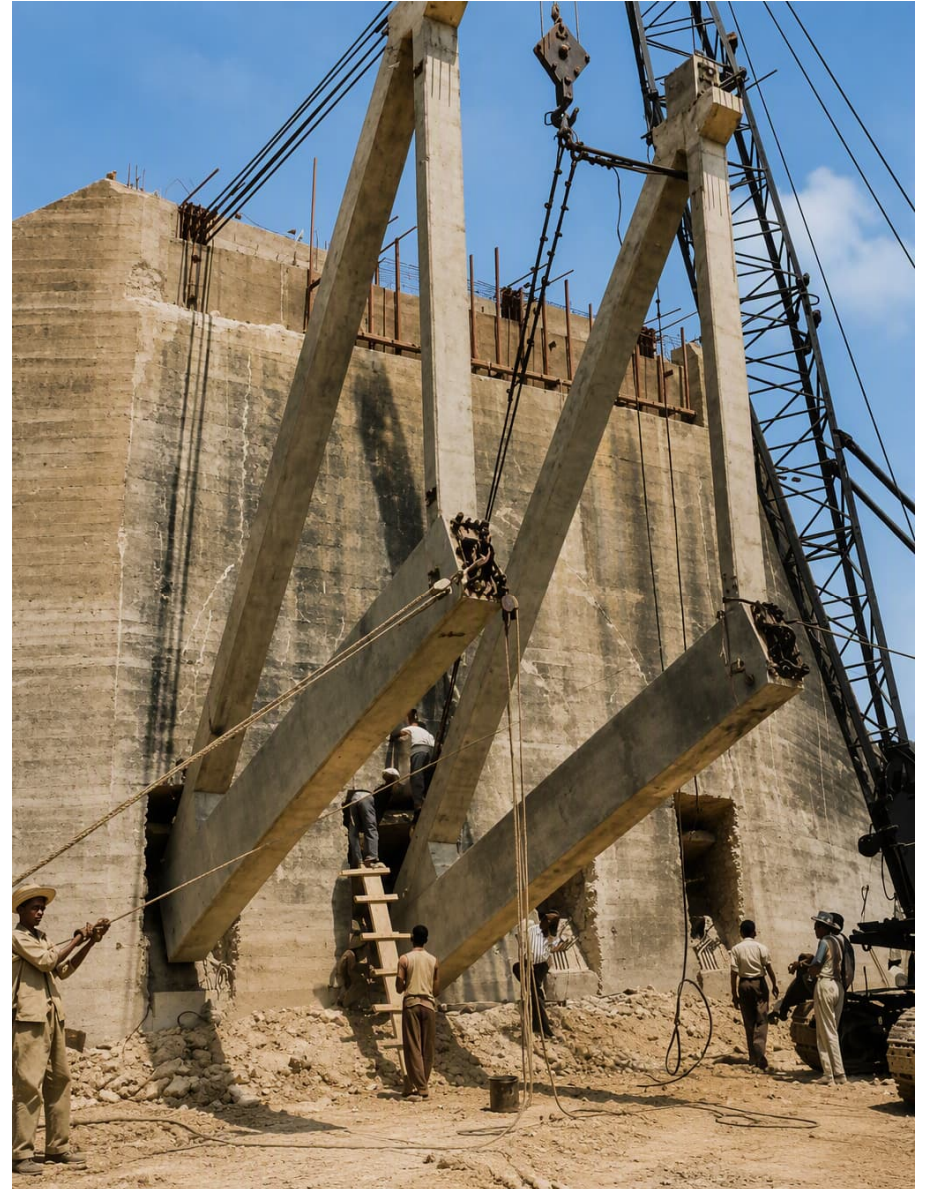
Member Alignment to Insert Pin





Second Truss Line – First Segment Erection

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Erection of the Second Segment – First Truss Line





Second Segments of all 4 Truss Lines in Place





Third Segments of all 4 Truss Lines in Place





Fourth Segments of all 4 Truss Lines in Place





Fifth Segments of all 4 Truss Lines in Place





Deck of Left Cantilever Truss Completed





Second Truss Completed





Drop in Beams Being Fabricated on Deck behind Abutment

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Preparation for Placing Drop In Beams





Crane About to Pick Up First Beam





Crane with First Beam





First Beam at Midspan





Placing the First Beam





Placing the Third Beam





Four Beams in Place – Ready for Deck Formwork





Completed Zaza River Bridge





Unique Bridge Solutions

- Economical design - using 2026 costs - \$165 per SF
- Speed of Construction - erection crew of 9 men took 7 DAYS to erect each of the two cantilever trusses
- Entire structure from date of award to traffic was 6 MONTHS (including 12-day strike and 20 days inclement weather)
- No Falsework required for erection



Zaza River Bridge 2017





Acknowledgements: Frank D. Salas, PE



Mosquito River Bridge, Cuba – predecessor to Zaza Bridge



Presentation Dedication

Mario G. Suarez, PE

(1926-2014)

Raquel Suarez

(1928-2016)



THANK YOU

QUESTIONS?

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