

Session 54

Peter Rogas

Reynolds, Smith and Hills, Inc

Orange County Pedestrian Bridge Project

Topic Description

The Cady Way Trail bridge over SR 436 is the gateway representation of the Orange County Cady Way Trail. The bridge type was chosen to present a highly aesthetic bridge crossing meeting the demands of the trail traffic. The structure type constructed was the result of much coordination between the County and the consultant, with a goal to develop an aesthetically pleasing structure without architectural attachments.

Speaker Biography

Peter Rogas graduated with a BS in civil engineering from Louisiana State University in 1980. I have worked on bridges since my graduation. My long standing partnership with the Department extends to 1988. Past projects include prestress beam bridges, generally developed as phased construction, steel plate and box girders and curved flyover structures within interchanges. Currently, I spend most of my free time with my wife Leslie and my two beautiful daughters, Amanda and Andrea

Cady Way Trail over SR 436



GENERAL INFORMATION

- Cady Way Trail
- Shared-use Trail from Ward Park to Hall Road
- Owner: Orange County Parks and Recreation
- Designer: Reynolds, Smith and Hills, Inc.
- Geotechnical: Geotechnical & Environmental Consultants, Inc.



- Project Details:
 - ✓ 3000 Linear Feet of Trail
 - ✓ 685 Feet of Bridge Structure
- Project Cost:
 - ✓ Overall - \$5,921,000
 - ✓ Bridge - \$5,000,000



Cady Way Trail over SR 436



PROJECT TEAM

Orange County Public Works

- ✓ Julie Naditz, PE – Construction PM
- ✓ Bill Totten – County Senior Field Inspector
- ✓ Steve Stokes – County Field Inspector

Orange County Capital Projects

- ✓ Tony Aguerrevere – Interim Project Manager
- ✓ Joel Baugh – Asst. Project Manager

Orange County Parks & Recreation

- ✓ Robert Goff – Project Manager
- ✓ Bill Thomas – Design Liaison
- ✓ Cliff Torres – Construction Liaison

Reynolds, Smith and Hills, Inc.

Design Team

- ✓ James Avitabile, PE – Project Manager
- ✓ Peter Rogas, PE – Responsible Engineer
- ✓ James Beverly – Asst. Project Manager
- ✓ Jeff Glenn, PE
- ✓ Jack Haynes, PE
- ✓ Ben Lehr, PE
- ✓ Bryan Sturm, PE
- ✓ Anthony Firriolo, EI



Cady Way Trail over SR 436



CONTRACTOR TEAM

- American Bridge
 - ✓ Prime Contractor
 - ✓ Matthew Pershing, EI
 - ✓ Kenneth Wooten

- Hayward Baker, Inc.
 - ✓ Foundations
 - ✓ Vince Hull, PE – Lead Design Engineer



Cady Way Trail over SR 436



PROJECT INCEPTION

- Rails-to-Trails Project
- Funding Source
 - ✓ FDOT LAP / County Funding for Trail
 - ✓ County Funding for SR 436 Bridge
- Right-of-Way
 - ✓ Former CSX Railroad ROW
 - ✓ Purchased by Orange County
- Project Mission Statement:
Develop an aesthetically pleasing structure spanning SR 436 that utilizes the structure as the aesthetic element.



Trail Looking East From Bridge Deck



Cady Way Trail over SR 436



DESIGN CHARRETTES

- Two Design Charrettes
- Team - County and RS&H Associates
- Several Alternatives Developed



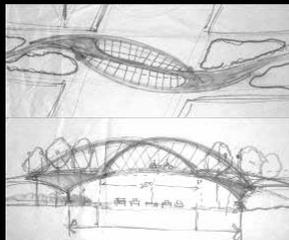
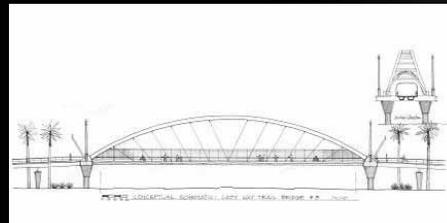
Cady Way Trail over SR 436



DESIGN CHARRETTES

Charrette Team – Meeting 1

- ✓ Bill Thomas – OC Parks & Rec
- ✓ Jim Hanis, RA – OC Capital Projects
- ✓ Shane Hill – OC Parks & Rec
- ✓ Audra Davis – OC Parks & Rec
- ✓ Mark Black – ZHA (Charrette Consultant)
- ✓ Jim Avitabile, PE – RS&H
- ✓ John Quattrone, AIA – RS&H
- ✓ Peter Rogas, PE – RS&H
- ✓ James Beverly – RS&H
- ✓ Ron Sill – RS&H



Charrette Team – Meeting 2

- ✓ Bill Thomas – OC Parks & Rec
- ✓ Jim Hanis, RA – OC Capital Projects
- ✓ Ken Pelham – OC Parks & Rec
- ✓ Mark Black – ZHA (Charrette Consultant)
- ✓ Jim Avitabile, PE – RS&H
- ✓ John Quattrone, AIA – RS&H
- ✓ Peter Rogas, PE – RS&H
- ✓ James Beverly – RS&H

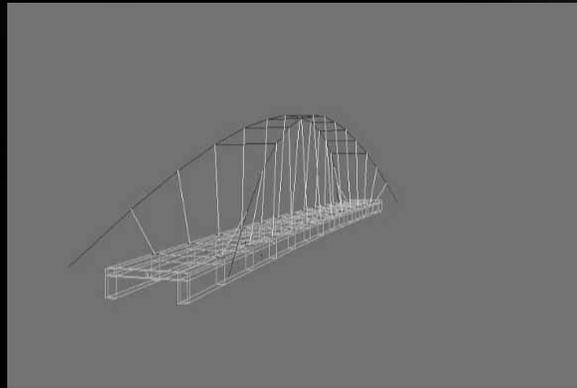


Cady Way Trail over SR 436

RS&H

DESIGN CHARRETTES

- Final Choice: Basket Handle Tied-Arch
- Steel Tube Arches
- Post-Tensioned Concrete Deck / Tension Tie

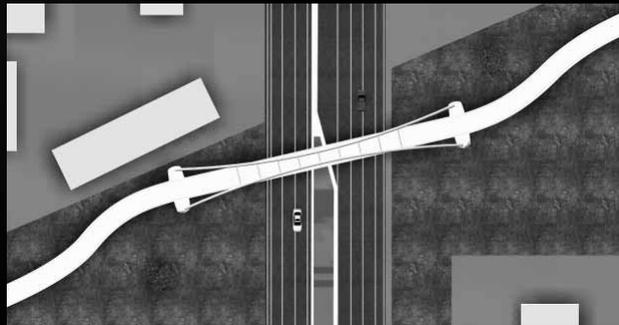


Cady Way Trail over SR 436

RS&H

ADDITIONAL AESTHETICS CRITERIA

- Serpentine Alignment



- Benefits:
 - ✓ Reduces Skew
 - ✓ Crossing More Towards 90 Degrees



Cady Way Trail over SR 436



ADDITIONAL AESTHETICS CRITERIA

- Aesthetically Pleasing Approach Spans
- Inverted Tapered Columns
- Prism Capitals on Columns



Approach Columns



Artist Rendering



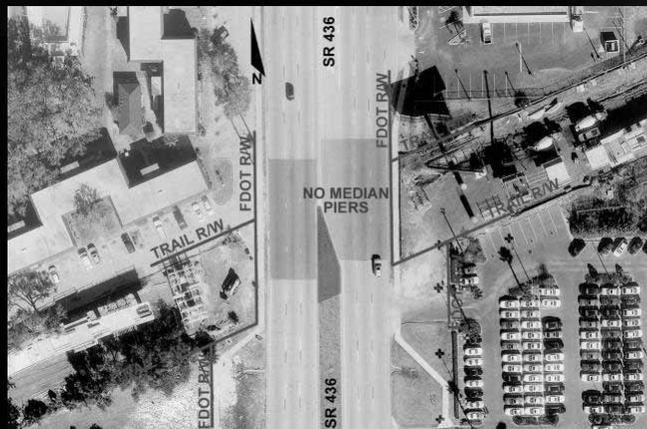
Cady Way Trail over SR 436



BRIDGE LAYOUT

Geometric Controls

- Offset FDOT Right-of-Way Lines
- No Piers Allowed in SR 436 Median



Cady Way Trail over SR 436



BRIDGE LAYOUT

Geometric Controls

- Required FDOT Aerial Right-of-Way Permit
- Projected Widest R/W Line Boundaries



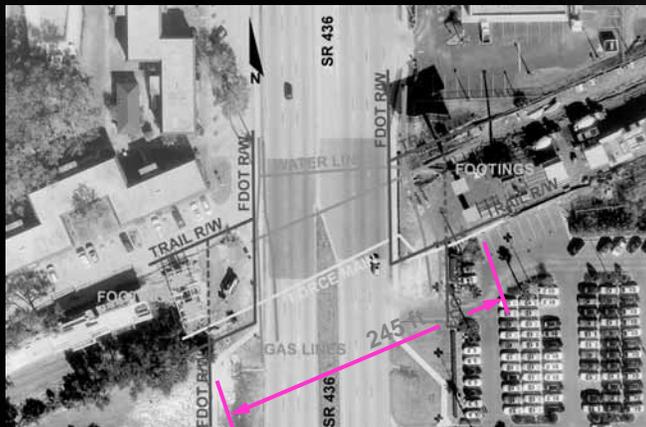
Cady Way Trail over SR 436



BRIDGE LAYOUT

Geometric Controls

- Set Span Length = 245'-0"
- Utilities on East Side Not Impacted



Cady Way Trail over SR 436



BRIDGE LAYOUT

Geometric Controls

- Required Vertical Clearance: 17'-6" Minimum to Structure
- Temporary Vertical Clearance: 16'-6" Minimum to Shoring and Falsework
- Final Vertical Clearance: 19'-3" Provides 2'-9" of Falsework Depth
- Profile Set by Temporary Clearance Requirement

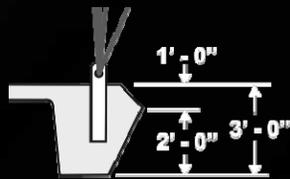


Cady Way Trail over SR 436

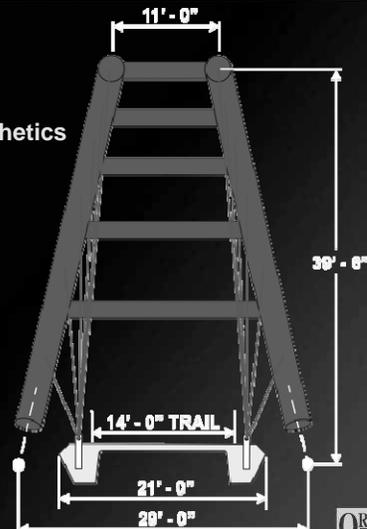


SUPERSTRUCTURE DESIGN

- Main Span Length = 245 ft
- Trail Width 14'-0"
- Angled Shape for Wind Deflection / Aesthetics
- Arch Angle Set Based on Fence Height



Edge Beam Detail



Main Span Typical Section

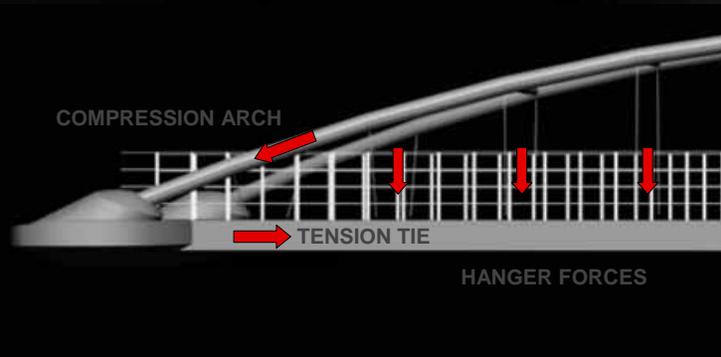


Cady Way Trail over SR 436



SUPERSTRUCTURE DESIGN

- Arch Tubes are Compression Members
- Post-Tensioned Bridge Deck Edge Beams are the Tension Tie



Cady Way Trail over SR 436



SUPERSTRUCTURE DESIGN

- Preliminary Design
- Bridge Dimension Variables Input
- Output PRN File is STAAD Input File
- Allowed Numerous Iterations
- Iterations = Ecomonization

Microsoft Excel - Cady Way 1 final parab.xls

	A	B	C	D
1	SR 436 Pedestrian Overpass			
2	Arch Geometry			
3	Node Coordinates & Member Incidences			
4				
5	Span Length =		245.00 ft	
6	Center Height =		39.50 ft	
7	Portal Height =		40.3267 ft	
8	Portal Bay Location =		2 bay	
9				
10	No. of Bays =		14	
11	Bay Length =		17.50 ft	
12	Segments per Bay =		8	
13	Segment Length =		2.1875 ft	
14				
15	Bottom Truss Width =		29.00 ft	
16	Top Truss Width =		11.00 ft	
17	Trail Width (out-to-out) =		19.00 ft	
18	Trail Width =		16.00 ft	
19	CL Edge Bm to CL Edge Bm			

Microsoft Excel - Cady Way 1 final parab.xls

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
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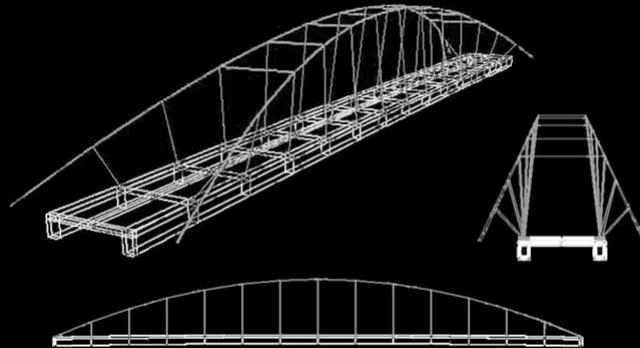


Cady Way Trail over SR 436



SUPERSTRUCTURE DESIGN

- Preliminary and Final Design
- Camber
- Hanger Stressing Sequence
- Check of Contractor's Erection Sequence
- All Developed in STAAD

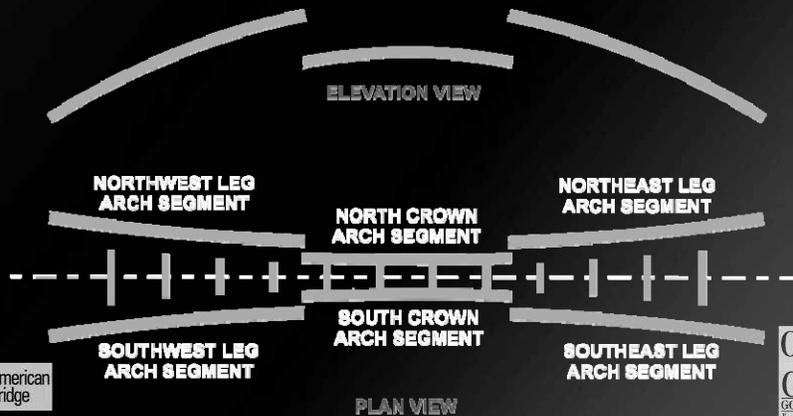


Cady Way Trail over SR 436



SUPERSTRUCTURE FABRICATION

- Steel Tube Parabolic Arch
- Main Arch Fabricated in Three Sections
- Facilitate Shipping / Field Erection
- Minimize Detour Durations



Cady Way Trail over SR 436

RS&H

SUPERSTRUCTURE FABRICATION

- Connections In Field



19 American Bridge

ORANGE COUNTY GOVERNMENT FLORIDA

Cady Way Trail over SR 436

RS&H

SUPERSTRUCTURE FABRICATION

- Parabolic Arch Fabrication Not Practical
- Steel Arch has 14 Circular Segments
- Each Segment has Different Radius
- Center Segment has Tightest Radius
- End Segment has Flatest Radius



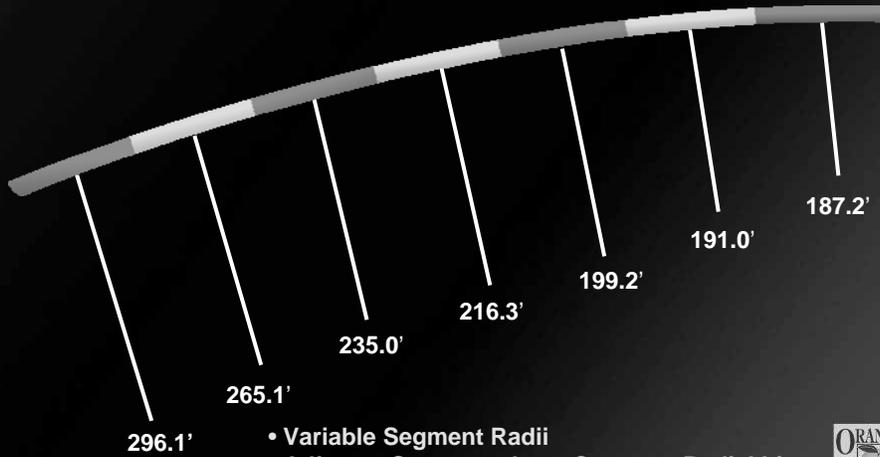
20 American Bridge

ORANGE COUNTY GOVERNMENT FLORIDA

Cady Way Trail over SR 436



SUPERSTRUCTURE FABRICATION

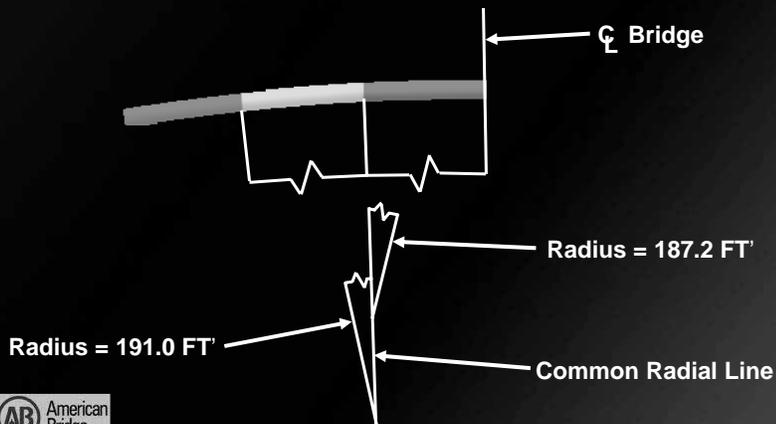


Cady Way Trail over SR 436



SUPERSTRUCTURE FABRICATION

- Adjacent Segments
- Common Radius Shown
- Adjacent Segments Perpendicular to Common Radial Line



Cady Way Trail over SR 436



SUPERSTRUCTURE FABRICATION

- Fabricator: BendTec, Inc.
- Duluth, Minnesota
- Specializes in Bending Tubes



Leg Segment Ready for Transport



Arch in Laydown



Cady Way Trail over SR 436



SUPERSTRUCTURE FABRICATION

- Critical Geometry
- All Pieces Held into Place
- Field Erection Completed without Difficulties



Crown Segments Held In Place By Jigs



Cady Way Trail over SR 436



SUBSTRUCTURE DESIGN

- Arch Thrust Components Parallel & Perpendicular
- Parallel Arch Thrust Resisted by Edge Beam Tie
- Pier Platform Transverse Post-Tension



Cady Way Trail over SR 436



FOUNDATIONS

- Site is Near Apartment Complex
- Proximity to Pressurized Utilities
- Piles with Controlled Vibration

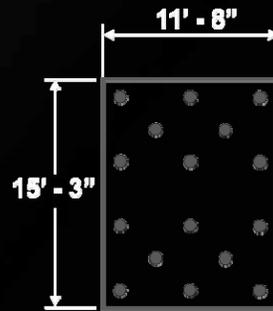


Cady Way Trail over SR 436

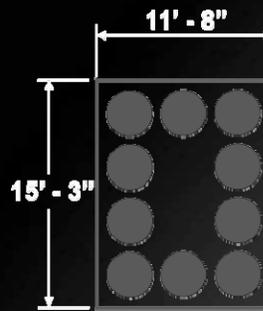


FOUNDATIONS

- Two Alternative Foundation Types
- 10" Diameter Pressure-Grouted Mini Piles
- 3-ft Diameter Press-In Tubular Piles
- Test Pile Program for Each Alternative
- Minipiles Chosen by Contractor



Mini Piles
Main Piers



Press-In Tubular Piles
Main Piers



Cady Way Trail over SR 436



FOUNDATIONS

- Pressure-Grouted Mini Pile is Final Alternative
- Soils: Firm Sand



Cady Way Trail over SR 436



FOUNDATIONS

- Test Pile Program
- Tested 4 Permanent Piles
- 1 per Approach Structure – 216 kips
- 1 per Main Pier – 261 kips
- Maximum Deflection = 1/4"
- Permanent Set = 1/8"



Cady Way Trail over SR 436



CONSTRUCTION Foundations



Mini Pile Installation

Mini Piles in Approach Footing



Cady Way Trail over SR 436



CONSTRUCTION

Foundations – Approach Spans



Cady Way Trail over SR 436



CONSTRUCTION

Approach Spans



- Capitals Poured
- Closure Pour Between Capitals



Approach Column With Capital



Cady Way Trail over SR 436



CONSTRUCTION



- Capitals Poured
- Closure Pour Between Capitals



Approach Columns With Capitals



Cady Way Trail over SR 436



CONSTRUCTION

Main Piers



Inverted Taper Columns
Pier 7 Looking East



Cady Way Trail over SR 436



CONSTRUCTION

Main Piers



Pier with Column & Cap



Cady Way Trail over SR 436



CONSTRUCTION

Main Piers



Main Pier with Platform



Cady Way Trail over SR 436

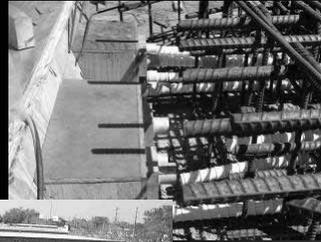


CONSTRUCTION

Main Pier



Main Pier Pour



Transverse PT In Main Pier



Main Pier Reinforcement



Cady Way Trail over SR 436



CONSTRUCTION

Main Pier



Edge Beam Post-Tensioning in Main Pier



Cady Way Trail over SR 436



CONSTRUCTION

Main Pier



- Anchor Bolt Jig
- Sets Transverse And Longitudinal Angles
- Fabricated by BendTec
- Anchor Block Placed as Secondary Pour



Cady Way Trail over SR 436



CONSTRUCTION

Main Span



Bottom Form and Falsework Beams



Sideform Stripped



Cady Way Trail over SR 436



CONSTRUCTION

Main Span



Edge Beam Adjacent to Main Pier

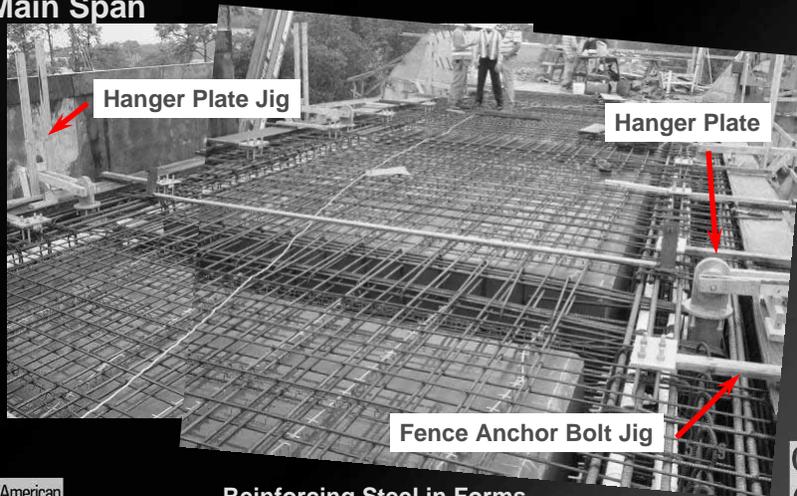


Cady Way Trail over SR 436



CONSTRUCTION

Main Span



Reinforcing Steel in Forms

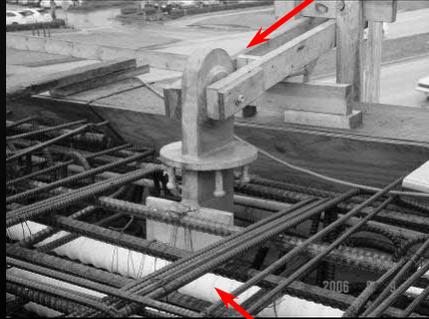


Cady Way Trail over SR 436

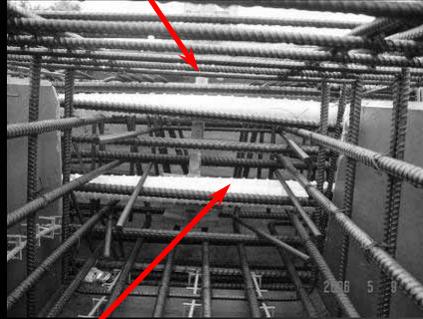


CONSTRUCTION

Main Span



Bridge Deck Above Floor Beam



View Inside Floor Beam No Congestion

Hanger Plate

PT Ducts In Edge Beam



Cady Way Trail over SR 436



CONSTRUCTION

Edge Beam Tendons in Main Piers



Pulling Tendons



Anchorage Blockouts With Tendons



Tendon Stressing



Anchorage Blockouts Ready for Capping



Cady Way Trail over SR 436



CONSTRUCTION

Main Span



Arch Shipment & Storage



Cady Way Trail over SR 436



CONSTRUCTION

Main Span

Main Leg
Saddle
Support



Arch Segment Erection



Cady Way Trail over SR 436



CONSTRUCTION

Main Span



Arch Segment Erection



Cady Way Trail over SR 436



CONSTRUCTION

Main Span



Night Arch Segment Erection
Crown Section Placement

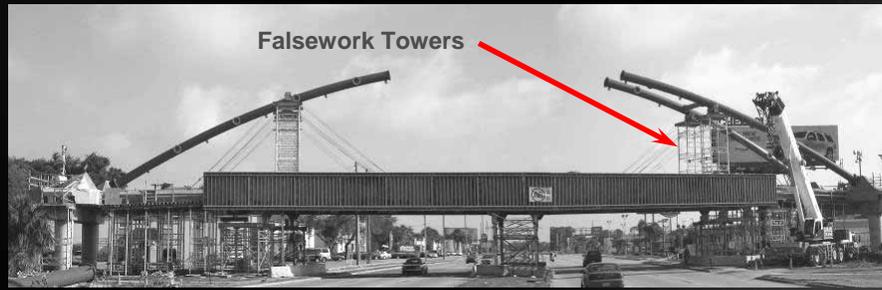


Cady Way Trail over SR 436



CONSTRUCTION

Main Span



Arch Segment Erection



Cady Way Trail over SR 436



CONSTRUCTION

Main Span



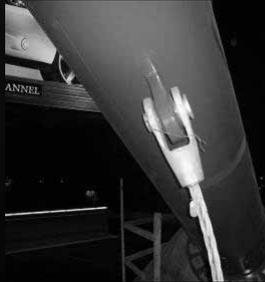
View Looking West



Cady Way Trail over SR 436



CONSTRUCTION Main Span



Hanger Stressing
Stressed in Pairs



Cady Way Trail over SR 436



CONSTRUCTION Main Span



Complete Construction
Hangers Stressed
Bridge Floating Above Formwork



Cady Way Trail over SR 436



Questions & Answers

