

# **Gandy Bridge Tours Fall 2005**

## **Things to Notice**

### Three Bridges

1950's (North side)

1970's (South side)

1990's (Middle)

### Grade of Bridges

### Length of Vertical Curve

### Elevation of Approaching Roadway Surface

### Pier Types (also called Bents)

Girder Supports

Column Types

Foundation Types

### Girders and Configuration

1950's 3 Span Continuous

1970's 5 or 6 Span Continuous

1990's 3 Span Continuous

### Bearing Supports

### Railings / Barrier Walls

### Provisions for Future Expansion

### Corrosion Damage

### Vessel Collision Resistance

## Maximum Grade

Design Speed (mph)	Maximum Grade, % (e.g. ft of rise per 100 ft of horizontal)	
	Flat Terrain	Mountainous Terrain
30	6	9
40	5	8
50	4	7
60	3	6
70	3	5
80	3	4

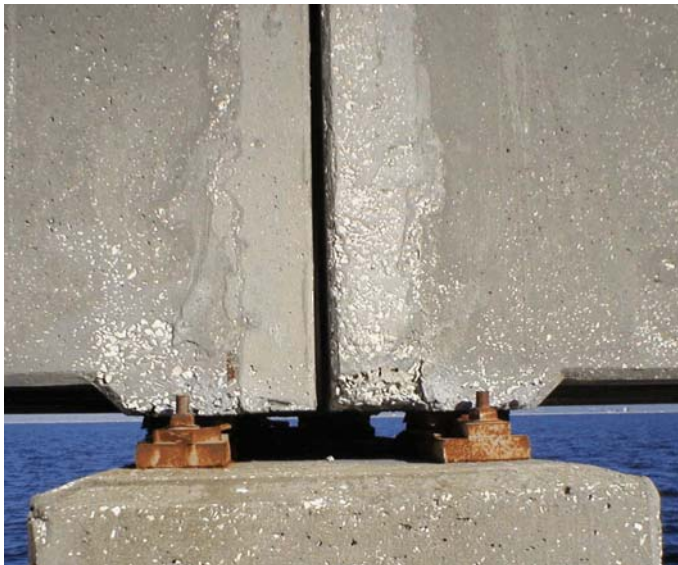
## Length of Vertical Curve

$$L = K A$$

- L** = Length of Vertical Curve (stations)  
**K** = Stopping Site Coefficient (dimensionless)  
**A** = Algebraic Difference in Grade throughout the curve (%)

Design Speed (mph)	Stopping Site Coefficient, K	
	Sag Curve	Crest Curve
30	35	28
40	55	55
50	75	85
60	100	150
65	130	215
70	145	255
75	160	325
80	185	400

## Bearings and Expansion Joints





## Approach Span Piers



*1950's Approach Spans  
Girder on Pile Cap-Type Pier*

*Reinforced Concrete Girders  
4-5 ft above MHT  
50 ft span*

*4 - 20 in Square Piles  
Reinforce Concrete  
8 - No. 9 Bars  
percent steel, 2.0%*



*1970's Approach Spans  
Girder on Pile Cap-Type Pier*

*Prestressed Concrete Girders  
5-7 ft above MHT  
50 ft span*

*5 - 20 in Square Piles  
Prestressed Concrete  
20 - 1/2" Grade 270 Strands  
percent steel, 0.8%*



*1990's Approach Spans  
Hammerhead-Type Pier  
Column on Pile Cap*

*Prestressed Concrete Girders  
15 - 18 ft above MHT  
150 ft span*

*4-48" diam. drilled shafts  
Reinforced Concrete  
18 - 20 No. 9 Bar  
percent steel, 1.0%*

## Main Span Piers



*1950's Main Span  
Two Column-Type Pier  
on Two Footings*

*Reinforced Concrete Girders  
40 ft above MHT  
75 ft span*

*5 - 20 in Square Piles  
Reinforce Concrete  
8 - No. 9 Bars  
percent steel, 2.0%*



*1970's Main Span  
Two Column Pier  
w/Cantilevers  
Two Pile Caps Tied*

*Prestressed Concrete Girders  
45 ft above MHT  
75 ft span*

*5 - 24 in Square Piles  
Prestressed Concrete  
24 - 1/2" Grade 270 Strands  
percent steel, 0.8%*

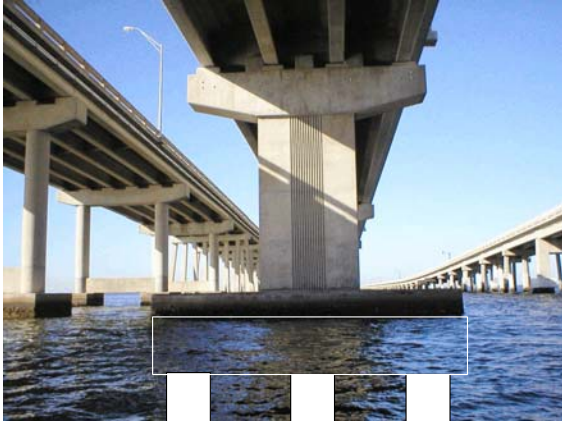


*1990's Main Span  
Hammerhead-Type Pier  
Column on Pile Cap*

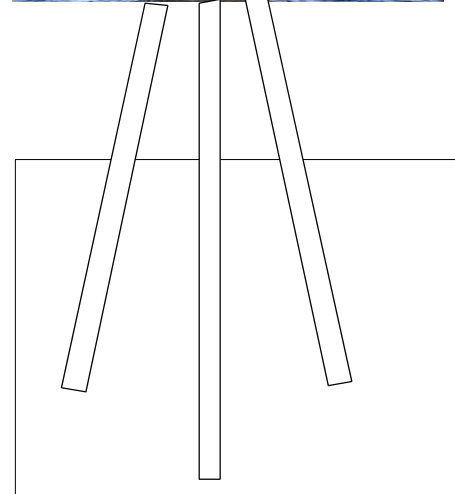
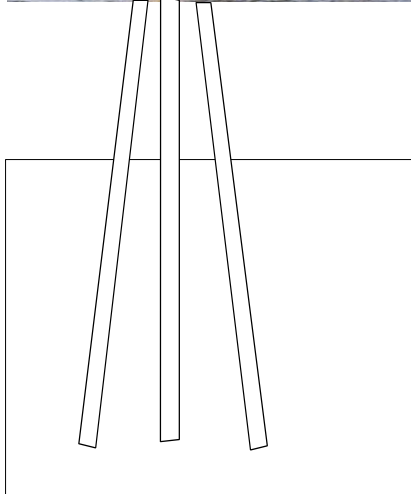
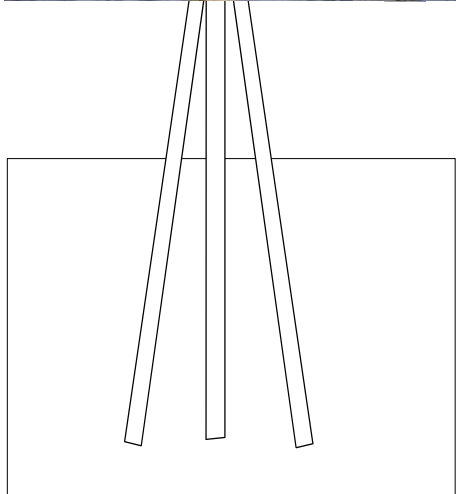
*Prestressed Concrete Girders  
45 ft above MHT  
225 ft span*

*9 - 48" diam. drilled shafts  
Reinforced Concrete  
18 - 20 No. 9 Bars  
1.0% steel*

## Foundation Elements (Piles and Shafts)



*4' Diam Drilled Shafts*



*Battered Piles up to Girders*

*Battered Piles up to Pile Cap*

*Battered Piles up to Pile Cap*



## Battered Piles



*One pier under every continuous span unit has longitudinally batter piles in the center (1950 and 70's); not typical today.*



*All piers have laterally battered piles each end; not typical today.*



*All other piles under continuous span units are vertical except for lateral batter at ends (1950 - 70's)*

**DESIGN CRITERIA**  
**CAPSTONE STRUCTURAL/GEOTECHNICAL/MATERIALS DESIGN**  
**Spring 2004**

1. DESIGN SPECIFICATIONS: American Association of State Highway and Transportation Officials (AASHTO) LRFD Bridge Design Specifications (customary U.S. units), Second Edition 1998, with interim specifications through 2000.

2. DESIGN METHOD: Composite design for superimposed dead loads and live load.

3. LOADING: Live Load = HL93  
Future wearing surface = 20 PSF  
Stay in place steel forms = 16 PSF  
Vessel Impact Load = 1500 Kips

4. TRAFFIC DATA: ADT = 29,000 One direction, year 2020  
T = 10%  
Design Speed = 60 mph  
K=150 (crest), K=100 (sag)  
Maximum Grade = 4%  
Minimum Approach Elevation El. 25.0 msl

5. SITE LOCATION: Tampa, FL.

6. MATERIALS: Structural Steel: ASTM A709 Gr. 50 (50 Ksi)  
Reinforcing Steel : Gr. 60 (60 ksi)  
Concrete : f'c = 5000 psi (prestressed piles)  
f'c = 4000 psi (cast-in-place superstructure)  
f'c = 3400 psi (substructure)  
f'c = 3000 psi (drilled shafts)

7. CONNECTIONS : All steel field connections shall be bolted - no field welding is allowed. Shop connections may be bolted or welded. Bolted connections shall be proportioned for a "Class A Surface" friction type connection, using ASTM A-325 H. S. Bolts.

8. TRANSPORTATION LIMITATIONS : Max. Shipping Length = 150 ft.(barge)  
Max. Shipping Weight = 50 Tons



# Advantages of Continuous Spans ( in terms of moments $\times wl^2$ )

