12/08/06

Cost Estimate

of

Structural Support Systems

for

JPods, LLC

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1. Purpose

The objective of this project is to develop an accurate cost estimate of the structural components necessary to construct both a 96'-0 suspension bridge J-Pod rail support system, including the foundations and a 42'-0 J-Pod rail support system, assuming an available existing structure to carry the end reactions and requires no modifications.

This calculation was prepared according to Dynamic Power Technologies, LLC, Project-Specific Quality Plan, DPT Project No. 06-055. Document: DPT – PQP – BI1, Dated; September 2005.

2. Methodology

To prepare a cost estimate, it is necessary to determine accurate quantities of materials, such as Structural Aluminum, Cables and Foundation size and type. To aid in the analysis and design of the structures to be estimated, analyses were performed utilizing Strudl, a structural analysis computer program. For the 96'-0 suspension bridge analysis, two (2) 96'-0 spans were modeled to accurately reflect not only the loads within the members of a single span, but also the common column and foundation between the spans. The 42'-0 span is analyzed as a rigid truss frame supported at each end.

For the 96'-0 suspension bridge span, two(2) types of foundations were evaluated for the pole column supports. The two(2) foundation types will be "Drilled Shaft" and "Spread Footer". Each foundation type will be evaluated for both a poor and good soil condition.

There are no foundations for the 42'-0 span. The structure spanning 42'-0 feet is assumed to be supported from an existing structure of adequate strength and configuration.

Approximate wind loading (35psf) was determined by BOCA.

Cost estimating is aided by utilization of RSMeans, Construction Cost Data, along with access to additional resources such as existing projects and the Internet.

Member Selection: Member selection based on the following; Stress Ratio (Actual Stress vs. Allowable Stress), unbraced length requirements and/or geometry associated with member connections. Minor member optimization can be performed during the final design considering site-specific conditions.

3. Assumptions

96‘-0 Span

1. Maximum eight(8) J-Pods per span, four(4) J-Pods per side, two(2) sides.
2. Minimum J-Pod to J-Pod spacing is 24‘-0.
3. J-Pod dimension between rails is 7‘-6.
4. Total J-Pod weight (DL + LL) = 1750lb.
5. An equivalent wind force of 35 psf will be applied in any direction on the surface area of all members and J-Pod.
6. An equivalend snow load of 50 psf will be applied in the vertical direction of all horizontal surfaces on the structure and J-Pod.
7. An increase in allowable stresses is applied when wind is included in combination.

42‘-0 Span

1. Maximum four(4) J-Pods per span, two(2) J-Pods per side, two(2) sides.
2. Minimum J-Pod to J-Pod spacing is 24‘-0
3. J-Pod dimension between rails is 7‘-6.
4. Total J-Pod weight (DL + LL) = 1750lb.
5. An equivalent wind force of 35 psf will be applied in any direction on the surface area of all members and J-Pod.
6. An equivalent snow load of 50 psf will be applied in the vertical direction of all horizontal surfaces on the structure and J-Pod.
7. An increase in allowable stresses is applied when wind is included in combination.

4. Input Data

Material used for Structural Members is Aluminum 6061-T6

Tab.4.1: Material properties used in analysis

Structural Aluminum	Young's modulus E [ksi]	Poisson's ratio μ [1]	Density ρ [lb/cuin]	Tensile Yield strength Sy [psi]
6061-T6	**10000**	**0.33**	**0.0975**	**35000**

- Ground snow load = 50psf (From IT Corp)
- Basic Wind Speed = 90mph (From IT Corp)
- Uniform Building Code(UBC) 1999
- American Institute of Steel Construction (AISC) 9th Edition

5. Loading Combinations

96'-0 Span

LOAD CASE 1: DL + LL (max number of J-Pods in both spans)

LOAD CASE 2: DL + WL (max number of J-Pods in both spans)

LOAD CASE 3: DL + LL + WL (max number of J-Pods in both spans)

LOAD CASE 4: DL + LL (max number of J-Pods in one span)

LOAD CASE 5: DL + LL + WL (max number of J-Pods in one span)

42'-0 Span

LOAD CASE 1: DL + LL (1 pair - JPod at Center)

LOAD CASE 2: DL + LL (2 pair - JPods Centered)

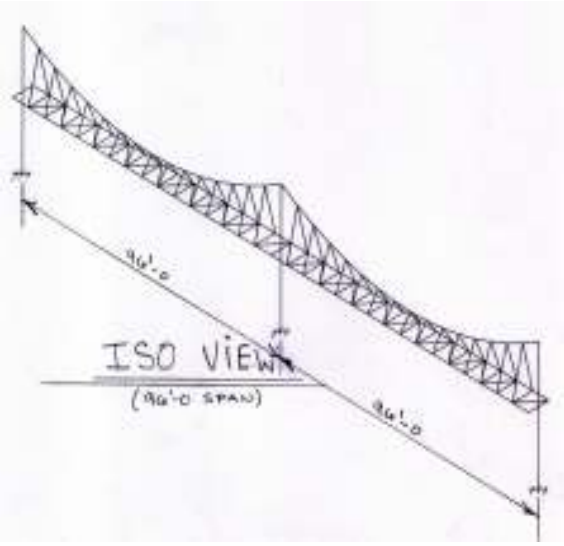
LOAD CASE 3: DL + LL + WL (1 pair - JPod at Center)

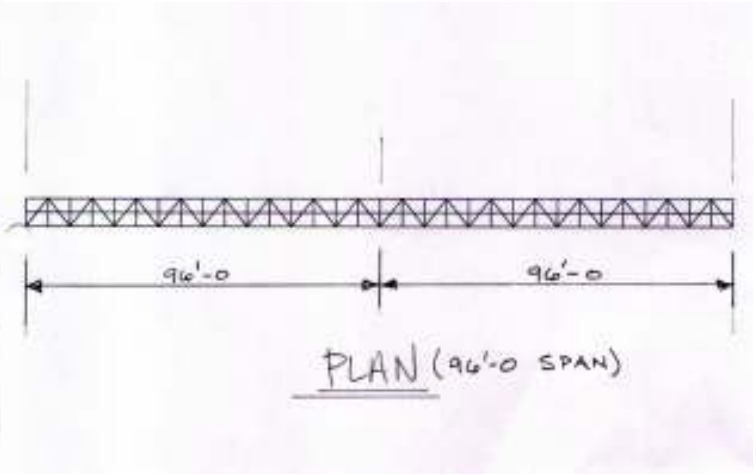
LOAD CASE 4: DL + LL + WL (2 pair - JPods Centered)

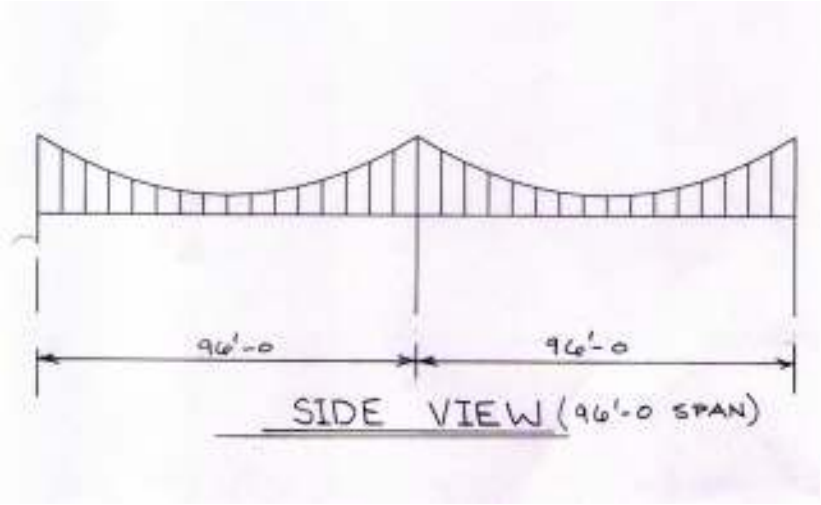
6. Results

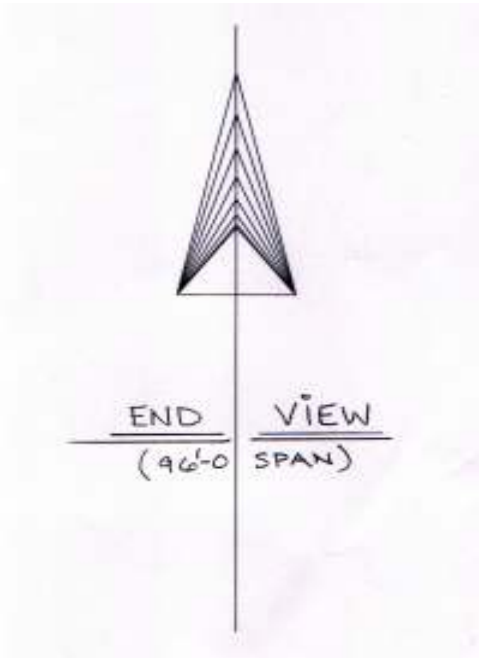
TOTAL POUNDS OF STRUCTURAL ALUMINUM: 3600 lb (per 96'-0 Span)
LENGTH of 1" Diameter Cable: 107 ft (per 96'-0 Span)
LENGTH of 1/2" Diameter Cable: 321 ft (per 96'-0 Span)

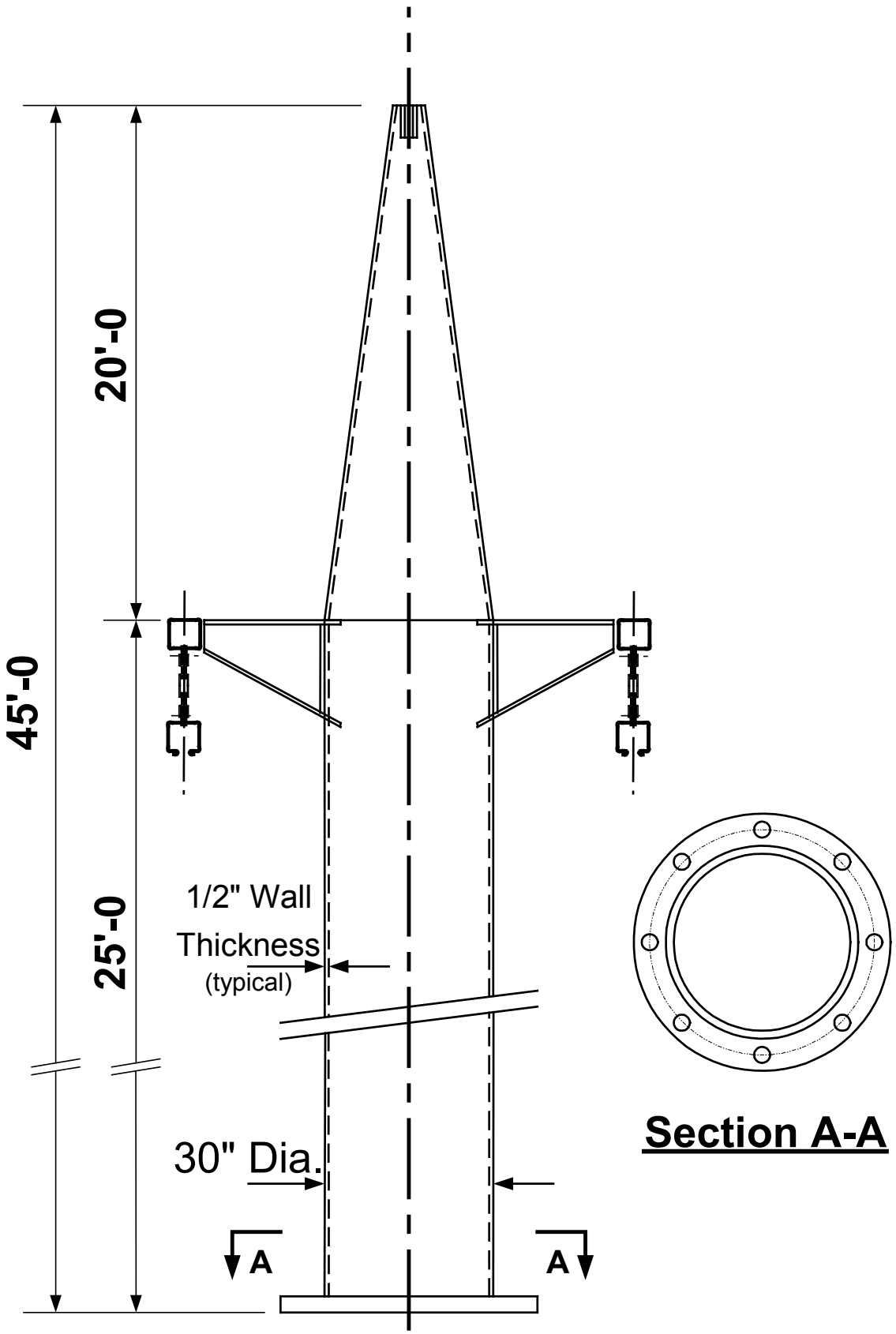
96'-0 SPAN (COMPUTER FILE: STRUDL Output, dated 7/29/06)











Section A-A

Typical Suspension Column (96'-0 Span)

MAXIMUM VERTICAL DEFLECTION AT MID-SPAN: **3.90”**

Table 6.1.1: 1” Diameter Main Suspension Cables
Members (1001 to 1016) and (1101 to 1116)

Load Case	TENSION LOAD (KIPS)
MAXIMUM ALLOWABLE LOAD: 89.8 kips	
MAXIMUM STRESS RATIO*(Combination 1): 0.26	
1. 1.00(DL + LL,1JPod)	**23.51**
2. 0.75(DL + WL,1JPod)	11.66
3. 0.75(DL + LL + WL,1JPod)	17.63
4. 1.00(DL + LL,2JPods)	22.96
5. 0.75(DL + LL + WL,2JPods)	17.22

Table 6.1.2: 1/2” Diameter Main Suspension Cables
Members (2502 to 2516) and (2601 to 2616)

Load Case	TENSION LOAD (KIPS)
MAXIMUM ALLOWABLE LOAD: 23.0 kips	
MAXIMUM STRESS RATIO*(Combination 1): 0.04	
1. 1.00(DL + LL,1JPod)	**0.99**
2. 0.75(DL + WL,1JPod)	0.51
3. 0.75(DL + LL + WL,1JPod)	0.76
4. 1.00(DL + LL,2JPods)	0.96
5. 0.75(DL + LL + WL,2JPods)	0.74

Table 6.1.3: Main Longitudinal Members
Members (2101 to 2116),(2201 to 2216),(3101 to 3116),(3201 to 3216)

Load Case	AXIAL LOAD (KIPS)	SHEAR LOAD (KIPS)	MOMENT (KIP-FT)
MEMBER: TUBE 8x8x3/8			
MAXIMUM STRESS RATIO*(Combination 4): 0.80			
1. 1.00(DL + LL,1JPod)	0.01	0.16	30.85
2. 0.75(DL + WL,1JPod)	24.41	2.71	17.02
3. 0.75(DL + LL + WL,1JPod)	24.41	2.75	25.07
4. 1.00(DL + LL,2JPods)	**8.45**	**6.15**	**30.68**
5. 0.75(DL + LL + WL,2JPods)	22.18	3.07	25.55

* - Stress Ratio = (Actual Stress / Allowable Stress)

Table 6.1.4: Perpendicular Horizontal Cross Members (Top and Bottom Chords) Members (2302 to 2316) and (3302 to 3316)

Load Case	AXIAL LOAD (KIPS)	SHEAR LOAD (KIPS)	MOMENT (KIP-FT)
MEMBER: TUBE 4x2x3/16			
MAXIMUM STRESS RATIO*(Combination 4): 0.21			
1. 1.00(DL + LL,1JPod)	0.52	0.00	0.00
2. 0.75(DL + WL,1JPod)	1.22	0.00	0.00
3. 0.75(DL + LL + WL,1JPod)	1.29	0.00	0.00
4. 1.00(DL + LL,2JPods)	**1.71**	**0.00**	**0.00**
5. 0.75(DL + LL + WL,2JPods)	1.25	0.00	0.00

Table 6.1.5: Diagonal Horizontal Members (Top and Bottom Chords) Members (2401 to 2416) and (3401 to 3416)

Load Case	AXIAL LOAD (KIPS)	SHEAR LOAD (KIPS)	MOMENT (KIP-FT)
MEMBER: TUBE 4x4x3/16			
MAXIMUM STRESS RATIO*(Combination 2): 0.43			
1. 1.00(DL + LL,1JPod)	0.07	0.00	0.00
2. 0.75(DL + WL,1JPod)	**10.84**	**0.00**	**0.00**
3. 0.75(DL + LL + WL,1JPod)	10.84	0.00	0.00
4. 1.00(DL + LL,2JPods)	0.33	0.00	0.00
5. 0.75(DL + LL + WL,2JPods)	10.63	0.00	0.00

* - Stress Ratio = (Actual Stress / Allowable Stress)

42'- 0 SPAN

TOTAL POUNDS OF STRUCTURAL ALUMINUM: 2700 lb (per 42'-0 Span)

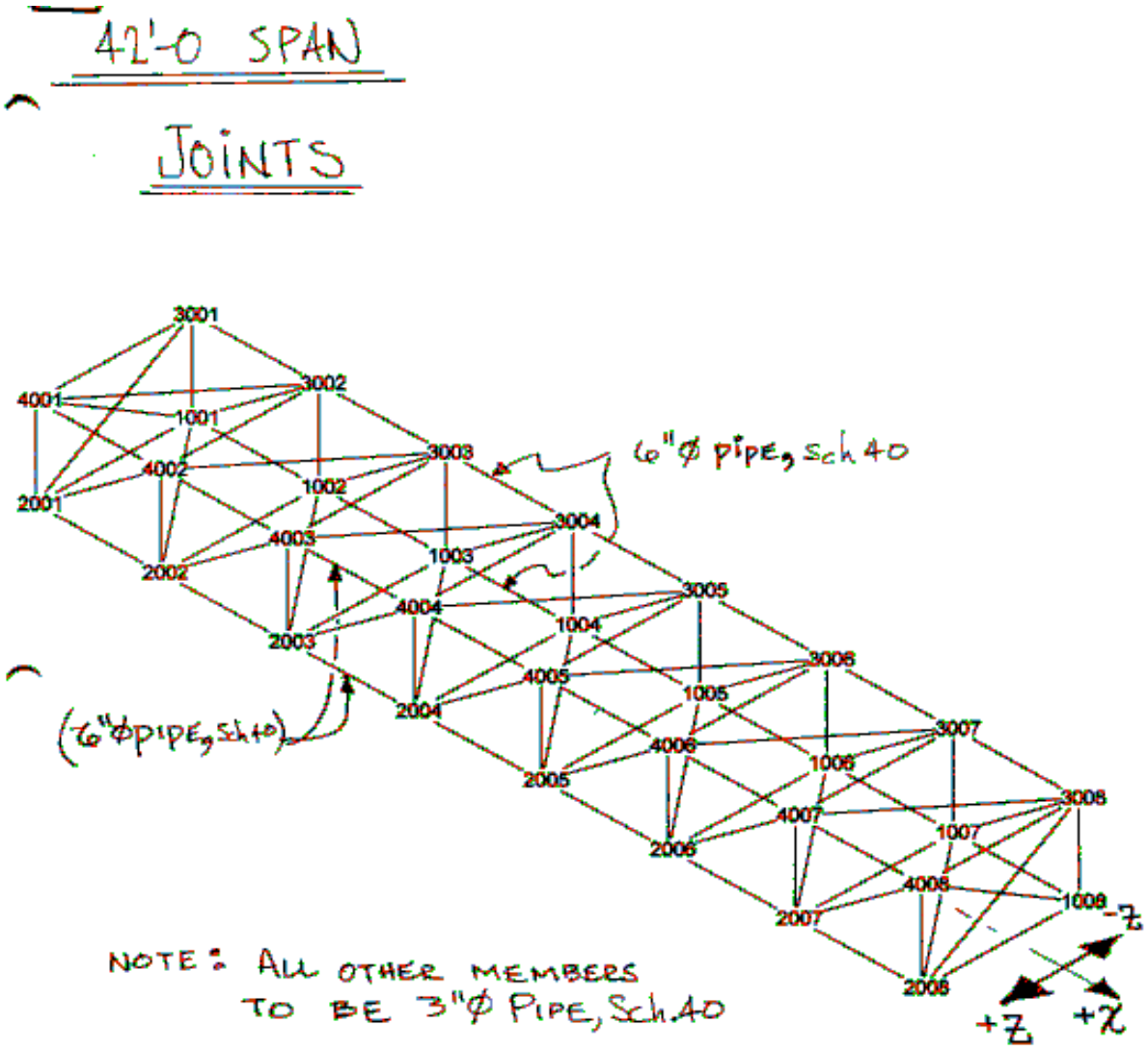


Table 6.2.1: Bottom Chord – Main Longitudinal Members
Members (1001 to 1007) and (2001 to 2007)

Load Case	(- Z)		(+ Z)	
	AXIAL LOAD (KIPS)	MOMENT (KIP-FT)	AXIAL LOAD (KIPS)	MOMENT (KIP-FT)
MEMBER: Pipe 6" Diameter, Schedule 40				
MAXIMUM STRESS RATIO*(Combination 2): 0.15				
1. 1.00(DL + LL, 1-JPod)	15.59	0.32	13.75	0.30
2. 1.00(DL + LL, 2-JPods)	**15.75**	**0.26**	13.70	0.18
3. 0.75(DL + LL + WL,1-JPod)	14.81	0.26	8.91	0.23
4. 0.75(DL + LL + WL,2-JPods)	14.73	0.16	9.42	0.21

Table 6.2.2: Top Chord – Main Longitudinal Members
Members (3001 to 3007) and (3001 to 3007)

Load Case	(- Z)		(+ Z)	
	AXIAL LOAD (KIPS)	MOMENT (KIP-FT)	AXIAL LOAD (KIPS)	MOMENT (KIP-FT)
MEMBER: Pipe 6" Diameter, Schedule 40				
MAXIMUM STRESS RATIO*(Combination 2): 0.18				
1. 1.00(DL + LL, 1-JPod)	14.60	0.32	14.54	0.30
2. 1.00(DL + LL, 2-JPods)	**14.65**	**0.24**	14.58	0.24
3. 0.75(DL + LL + WL,1-JPod)	9.52	0.26	12.44	0.21
4. 0.75(DL + LL + WL,2-JPods)	9.56	0.20	12.48	0.14

Table 6.2.3: Top Chord and Bottom Chord Perpendicular Cross Members
Bottom Chord (5001 to 5007) and Top Chord (6001 to 6007)

Load Case	Bottom (5001 to 5007)	Bottom (6001 to 6007)
	AXIAL LOAD (KIPS)	AXIAL LOAD (KIPS)
MEMBER: Pipe 3" Diameter, Schedule 40		
MAXIMUM STRESS RATIO*(Combination 4): 0.14		
1. 1.00(DL + LL, 1-JPod)	0.19	0.14
2. 1.00(DL + LL, 2-JPods)	0.21	0.16
3. 0.75(DL + LL + WL,1-JPod)	2.71	0.88
4. 0.75(DL + LL + WL,2-JPods)	**3.15**	1.05

* - Stress Ratio = (Actual Stress / Allowable Stress)

Table 6.2.4: Vertical Perpendicular Side Truss Members
Bottom Chord (7001 to 7008) and Top Chord (8001 to 8007)

Load Case	Bottom (7001 to 7008, -Z) AXIAL LOAD (KIPS)	Bottom (8001 to 8008, +Z) AXIAL LOAD (KIPS)
MEMBER: Pipe 3" Diameter, Schedule 40		
MAXIMUM STRESS RATIO*(Combination 2): 0.13		
1. 1.00(DL + LL, 1-JPod)	4.65	4.34
2. 1.00(DL + LL, 2-JPods)	**6.05**	5.70
3. 0.75(DL + LL + WL,1-JPod)	3.73	3.17
4. 0.75(DL + LL + WL,2-JPods)	4.74	4.29

Table 6.2.5: Bottom and Top Horizontal Diagonal Members
Bottom (10001 to 10008) and Top (11001 to 11008)

Load Case	Bottom (10001 to 10008, -Z) AXIAL LOAD (KIPS)	Top (11001 to 11008, +Z) AXIAL LOAD (KIPS)
MEMBER: Pipe 3" Diameter, Schedule 40		
MAXIMUM STRESS RATIO*(Combination 4): 0.38		
1. 1.00(DL + LL, 1-JPod)	0.24	0.18
2. 1.00(DL + LL, 2-JPods)	0.28	0.20
3. 0.75(DL + LL + WL,1-JPod)	3.87	1.20
4. 0.75(DL + LL + WL,2-JPods)	**4.99**	1.22

Table 6.2.6: Vertical Diagonal Members
Bottom (12001 to 12008) and Top (13001 to 13008)

Load Case	Bottom (12001 to 12008, -Z) AXIAL LOAD (KIPS)	Top (13001 to 13008, +Z) AXIAL LOAD (KIPS)
MEMBER: Pipe 3" Diameter, Schedule 40		
MAXIMUM STRESS RATIO*(Combination 2): 0.47		
1. 1.00(DL + LL, 1-JPod)	7.80	7.86
2. 1.00(DL + LL, 2-JPods)	10.25	**10.34**
3. 0.75(DL + LL + WL,1-JPod)	5.85	5.83
4. 0.75(DL + LL + WL,2-JPods)	7.70	7.68

* - Stress Ratio = (Actual Stress / Allowable Stress)

7. COST ESTIMATE

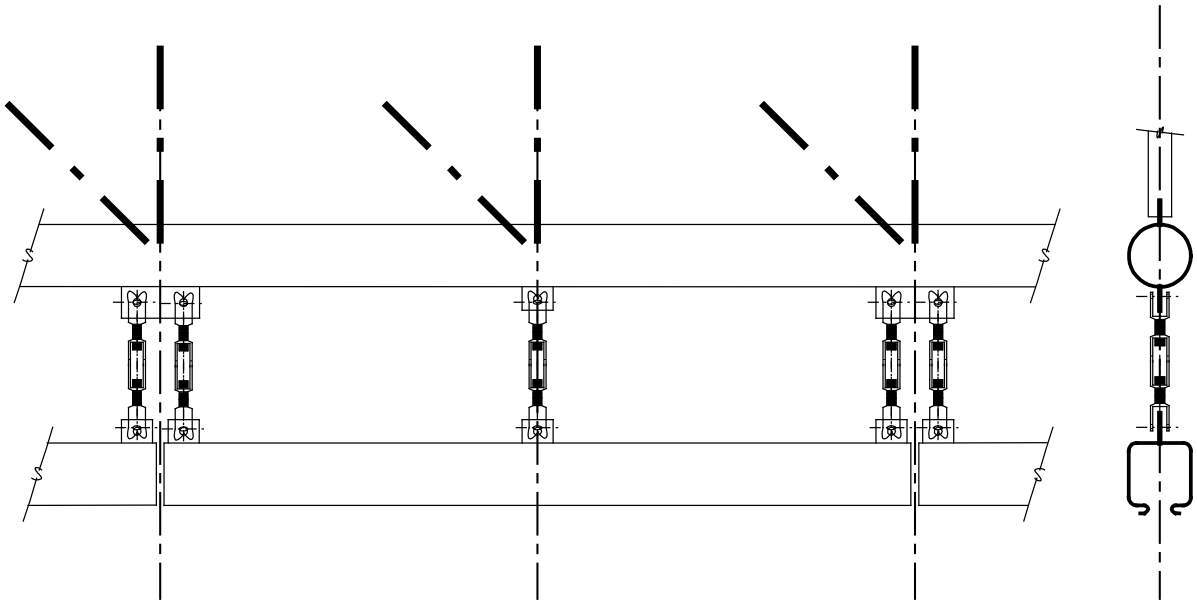
96'-0 SPAN

96'-0 SPAN Cost Estimate						
SUPER-STRUCTURE		Cost/unit	Quantity (96' span)	units	Total Cost	
CABLE						
	1/2" Diameter Wire Rope	$ 2.20	321	foot	$ 706.20	
	Installation 1/2" Diameter Wire Rope	$ 4.00	321	foot	$ 1,284.00	
	1" Diameter Wire Rope	$ 7.41	107	foot	$ 792.87	
	Installation 1" Diameter Wire Rope	$ 12.00	107	foot	$ 1,284.00	
STRUCTURAL (Includes Erection)						
	Structural Aluminum 6061-T6 (Horiz Truss)	$ 7.00	3600	lb	$ 25,200.00	
	Structural Aluminum 6061-T6 (Main Suspension Column)	$ 7.00	1400	lb	$ 9,800.00	
J-POD RAIL (Includes Erection)						
	Structural Aluminum 6061-T6	$ 7.00	1723	lb	$ 12,061.00	
	C.S.Area=7.6in^2, [(7.6/144)x192ft]x170lb/cf=1723lb					
HARDWARE (Rail Expansion, Stainless Steel)						
	Hanging Tie Rod Expansion System	$ 42.84	48	pc	$ 2,056.32	
HARDWARE (Cable)						
	Wire Rope Clip 1" Diameter Cable	$ 4.45	15	pc	$ 66.75	
	Wire Rope Clip 1/2" Diameter Cable	$ 11.00	30	pc	$ 330.00	
	Wire Rope Thimble for 1/2" Diameter Cable	$ 8.00	15	pc	$ 120.00	
	Wire Rope Shackle for 1/2" Diameter Cable	$ 9.00	15	pc	$ 135.00	
INSTALLATION OF MECHANICAL HARDWARE						
	Cable Clips, Thimbles, Shackles, Tie-Rods, Etc	$ 30.00	124	pc	$ 3,720.00	
	(Estimate is $30 per item, 124 items)					
					$ 57,556.14	
FOUNDATIONS						**TOTAL**
	SINGLE CAISSON					
	POOR SOIL				$ 33,500.00	91,056.14
	GOOD SOIL				$ 30,000.00	87,556.14
	DOUBLE CAISSON					
	POOR SOIL				$ 31,500.00	89,056.14
	GOOD SOIL				$ 28,500.00	86,056.14
	SPREAD FOOTING					
	POOR SOIL				$ 24,000.00	81,556.14
	GOOD SOIL				$ 22,000.00	79,556.14

42'- 0 SPAN

42'-0 SPAN Cost Estimate				
TRUSS-STRUCTURE	Cost/unit	Quantity (42' span)	units	Total Cost
STRUCTURAL (Includes Erection)				
Structural Aluminum 6061-T6 (Horiz Truss System)	$ 7.00	2700	lb	$ 18,900.00
J-POD RAIL (Includes Erection)				
Structural Aluminum 6061-T6	$ 7.00	754	lb	$ 5,278.00
C.S.Area=7.6in^2, [(7.6/144)x84ft]x170lb/cf=754lb				
HARDWARE (Rail Expansion, Stainless Steel)				
Hanging Tie Rod Expansion System	$ 42.84	21	pc	$ 899.64
INSTALLATION OF MECHANICAL HARDWARE				
Shackles and Tie-Rods, Etc	$ 40.00	21	pc	$ 840.00
(Estimate is $40 per item, 16 items)				
MOUNTING MODIFICATIONS (Existing Structure)				
(One structural mounting modification at each end)	$ 3,000.00	2	pc	$ 6,000.00
				$ 31,917.64

8. ADDITIONAL SKETCHES, DETAILS and NOTES



ELEVATION (J-Pod Rail Expansion Hanger Rods)

NOTES:

1. **A cost per soil borings can be assumed to be $1500.00 It should be assumed that a soils boring will be required at each foundation location.**

2. **It can be assumed that the associated engineering costs of the foundations and superstructures will be in the range of (5 – 10) % of the construction costs.**

3. **Permitting costs should be estimated on a site specific basis.**