STRUCTURAL DEVELOPMENT STUDY NUMBER 11

CONCRETE VERSUS FIREPROOFED STRUCTURAL STEEL

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1.0 Introduction

The purpose of this study was to determine the type of pipe support system to be used per specific plant location. Four types of pipe support systems were evaluated; cast-in-place concrete, precast concrete, steel without fireproofing, and steel with various fireproofings.

2.0 Summary

It was determined that the precast concrete pipe support system is the most economical system for all areas of the plant. Where structural steel is used and is required to be fireproofed, shotcrete shall be used for fireproofing.

3.0 Design Basis

A cost comparison was made between concrete and steel pipe supports on the assumption that the only variable was the pipe support frames themselves; all else being equal. The foundations and struts were assumed identical for the concrete and steel pipe supports, and were therefore not included in the cost comparison. The pipe support used for this study was a rigid frame bent with two pipe decks. The lower deck is 18 feet above grade and the upper deck is 23 feet above grade. The columns are 28 feet apart and support 6 foot cantilevers on both ends of each pipe deck. For additional information see Appendix 1.

4.0 Cost Estimate

A cost comparison between precast concrete, cast-in-place concrete, steel without fireproofing, and steel with various fireproofings is presented in Table I. Note that the precast concrete is less than steel without fireproofing.

5.0 Recommendations

It was determined that the in-place cost of the precast concrete pipe support was $6,130. The in-place cost of the cast-in-place concrete pipe support was $13,650. The erected cost of the steel pipe support with Thermolag fireproofing (three hour rating) was $15,610. On the basis of relative cost, Fluor recommends the use of precast concrete pipe supports for all areas of the plant.

Where structural steel is used and is required to be fireproofed, Fluor recommends shotcrete. For a three hour fire rating shotcrete was found to cost $7.75 per square foot. The cost of Thermolag was found to be $7.50 per square foot for a three hour rating. Shotcrete, however, is very durable, more readily available and quickly applied.

TABLE I

COMPARISON OF COST

TYPE OF PIPE SUPPORT	HOUR RATING	ESTIMATED CONSTRUCTION COST		ESTIMATED UNIT COST
		ACTUAL	RELATIVE	
PRECAST CONCRETE	1,2,3	6,130	1.00	398 $/CY
CAST-IN-PLACE CONCRETE	1,2,3	13,650	2.23	886 $/CY
STEEL WITHOUT FIREPROOFING	0	9,010	1.46	1477 $/TON
STEEL WITH ALBI-CLAD	1	12,530	2.04	4.4 $/FT^2
INTUMESCENT MASTIC	2	17,370	2.53	9.5 $/FT^2
	3	19,570	3.19	12.0 $/FT^2
STEEL WITH ALBI-DURASPRAY	1	11,650	1.90	3.0 $/FT^2
LT. WT. CEMENTITIOUS	2	14,290	2.33	6.0 $/FT^2
	3	16,930	2.76	9.0 $/FT^2
STEEL WITH PYROCRETE	1	14,290	2.33	6.0 $/FT^2
MAGNESIUM OXYCHLORIDE	2	16,050	2.62	8.0 $/FT^2
CEMENTITIOUS	3	17,370	2.83	9.5 $/FT^2
STEEL WITH CHARTEK 59	1	-	-	-
INTUMESCENT EPOXY	2	19,042	3.11	11.4 $/FT^2
	3	-	-	-
STEEL WITH THERMOLAG	1	12,530	2.04	4.0 $/FT^2
SUBLIMING COATING	2	14,290	2.33	6.0 $/FT^2
	3	15,610	2.55	7.5 $/FT^2
STEEL WITH SHOTCRETE	1	11,826	1.93	3.2 $/FT^2
(LT. WT. AGGREGATE)	2	14,070	2.29	5.75 $/FT^2
	3	15,830	2.58	7.55 $/FT^2
STEEL ENCASED IN CONCRETE SOLID WITH 2" COVER (CAST IN PLACE)	1,2,3	15,910	2.60	1000 $/CY

1. All Fireproofing cost are within a probable accuracy range of ± 20%.

2. Prices for zonolite not available "contact would not quote".

APPENDIX I

SCOPE OF STRUCTURAL ENGINEERING STUDY

CONCRETE VERSUS FIREPROOFED STRUCTURAL STEEL

STRUCTURAL ENGINEERING STUDY

CONCRETE VERSUS FIREPROOFED STRUCTURAL STEEL

1.0 General

This study will provide a comparison/evaluation of concrete structures versus fireproofed structural steel. Actual comparisons will be made using reinforced concrete pipe support and an equivalent structural steel pipe support.

2.0 Work Definition

2.1 A capital cost estimate will be determined for a representative reinforced concrete pipe support structure (one bent).

2.2 A capital cost estimate will be determined for an equivalent (items 2.1 above) structural steel pipe support structure without fireproofing.

2.3 A capital cost estimate will be determined for, but not limited to, the following fireproofing systems as applied to the structural steel pipe support (item 2.2 above).

2.3.1 Gunite

2.3.2 Zonolite

2.3.3 Shotcrete

2.3.4 Encased in concrete

2.3.5 Albyclad

2.3.6 Thermolag

All fireproofing systems shall be evaluated for both 2 hour and 3 hour rated fireproofing.

3.0 Deliverable to Tri-State

A formal report that contains the following

3.1 Capital cost estimates for all systems defined in section 2.0.

3.2 Matrix of capital cost estimates for various hour rated fireproofing.

3.3 Final recommendations for type of system (concrete, steel or fireproofed steel) to be used per specific plant location.

STRUCTURAL ENGINEERING STUDY

CONCRETE VERSUS FIREPROOFED STRUCTURAL STEEL

4.0 Schedule

It is estimated that the above work will be completed 3 months after authorization to proceed.