CRSS

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STRUCTURE INVESTIGATION REPORT

SOUTHERN PACIFIC BRIDGE NO. 726.25

OVER THE SALT RIVER

TEMPE, ARIZONA

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For
City of Tempe
Tempe, Arizona

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REMARKS

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June 1990

A126.951

Stabilization of Piers
Southern Pacific Bridge No. 726.25
Over the Salt River
Tempe, Arizona

SCOPE

As a result of the proposed channelization of the Salt River, the ability of the piers of the Southern Pacific's bridge to withstand the increased scour was investigated. The hydraulic investigations indicate that scour to bedrock should be the design condition.

FINDINGS

It was determined that six piers of the bridge were within the limits of potential scour. Counting from the south end of the bridge, Piers 3 through 8 are affected. These are twin-steel cylinder piers filled with concrete.

Piers 3, 4, and 5 are supported on timber piling that extends into the cylinder. Records show that the timber piling in Pier No. 3 does not extend to bedrock, whereas those in Piers No. 4 and 5 do. In either case, scour to bedrock would cause settlement or failure of the pier.

Piers 6, 7, and 8 are also twin-cylinder piers; however, the steel cylinders rest directly on bedrock with no piles. They are also filled with concrete. While the plans indicate that these piers rest directly on bedrock, there is no indication of any anchorage to the rock for lateral resistance.

In 1983, Pier No. 2 settled two to three inches due to heavy scour from floods. The Southern Pacific stabilized the pier by driving H-piles to refusal on the bedrock and pouring a reinforced concrete collar encasing both cylinders and the tops of the H-piles. Studs were welded to the steel cylinders to provide anchorage for the concrete.

The piers were analyzed for stability during flood conditions, assuming that scour to bedrock had occurred. Under the combined wind, dead and stream flow forces, the piers were found to be unstable. In addition, the bracing between the cylinders would be overstressed for this condition. The smoothness of the rock surface was unknown, but the sliding of the piers along the rock was also a concern.

The following assumptions and methods of the structure retrofit were used to determine the estimated construction cost. Final cost of construction will be derived from the approved design concept.

INITIAL COST ESTIMATE

Assumptions:

Pier No. 2 is outside the area of potential heavy scour and no further action is proposed.

No remedial measures are recommended for Pier Nos. 1, 9 and 10 for the same reason.

For the piers within the channel and subject to scour and stream forces, reinforcement is recommended to:

> Provide positive anchorage to the rock against sliding. This is recommended to be accomplished by means of steel reinforcing or piles doweled into the rock.
>
> Provide additional shear capacity between the cylinders of a pier to ensure that they work together. This is provided by additional steel bracing on Piers 6, 7, and 8 and by the concrete encasement of Piers 3, 4, and 5.

Provide positive load transfer from the steel cylinders to the rock. At piers 3, 4, and 5 where timber piles may not bear entirely on bedrock, this is accomplished by steel piles connected through the concrete encasement to the steel cylinders. At Piers 6, 7, and 8 where the steel cylinders are assumed to bear on the rock, this is accomplished by grouting the area at the base of the cylinders.

Methods of Retrofit:

The following procedure is recommended for Pier Nos. 3, 4, and 5. This is similar to the repairs made to Pier No. 2 by the Southern Pacific.

1. Bore holes through the overburden and about five feet into the bedrock around and between the two cylinders as shown on Sketch No. 1.

2. Place 14-inch H-piles into the holes, grouted into bedrock and extended into the concrete collar described in Items 5 and 6.

3. Pressure grout area below the cylinder to encase the timber piles and extend the grout outward to encase the H-piles by two to three feet.

4. Excavate overburden to below the bottom of steel cylinders (about ten feet deep) at Piers 3, 4, and 5.

5. Weld studs to the steel cylinders as shown on Sketch No. 1.

6. Form and pour a reinforced concrete collar, ten feet thick, around both cylinders and the H-piles at each pier.

For Pier Nos. 6, 7 and 8, the recommended repairs consist of the following procedure:

1. Core holes through the overburden to about five feet into bedrock around and between the cylinders in each pier as shown on Sketch No. 2.

2. Place heavy rebars (#12) into holes and extend three to four feet above the rock line.

3. Grout holes to anchor rebars and pressure grout surrounding overburden to a height of five feet ± extending outward from the steel cylinders about five feet ± all around.

4. Excavate top ten feet ± to a level surface at each pier.

5. Install an additional level of steel bracing between the cylinders below the existing bracing as shown on Sketch No. 2. This bracing and its connections should be coated with a protective abrasion coating such as an epoxy paint.

COST ESTIMATE
SOUTHERN PACIFIC BRIDGE NO. 726.25
OVER THE SALT RIVER
TEMPE, ARIZONA

ITEM	UNIT	QUANTITY	ESTIMATED UNIT PRICE	ESTIMATED COST
MOBILIZATION	L.S.	1	$150,000	$150,000
CONCRETE	C.Y.	515	$180	$92,700
REINFORCING	LB.	136000	$0.40	$54,400
PILING	L.F.	1452	$70	$101,640
STRUCTURAL STEEL	LB.	9500	$5	$47,500
WELDED STUDS	EACH	288	$150	$43,200
GROUTED DOWELS	EACH	51	$400	$20,400
STRUCTURE EXCAVATION	C.Y.	1431	$25	$35,775
EARTH EXCAVATION	C.Y.	1300	$15	$19,500
PRESSURE GROUTING	L.S.	1	$37,000	$37,000
		TOTAL		$602,115
		15% CONTINGENCY		$90,317
		TOTAL		**$692,432**
		SAY		**$700,000**

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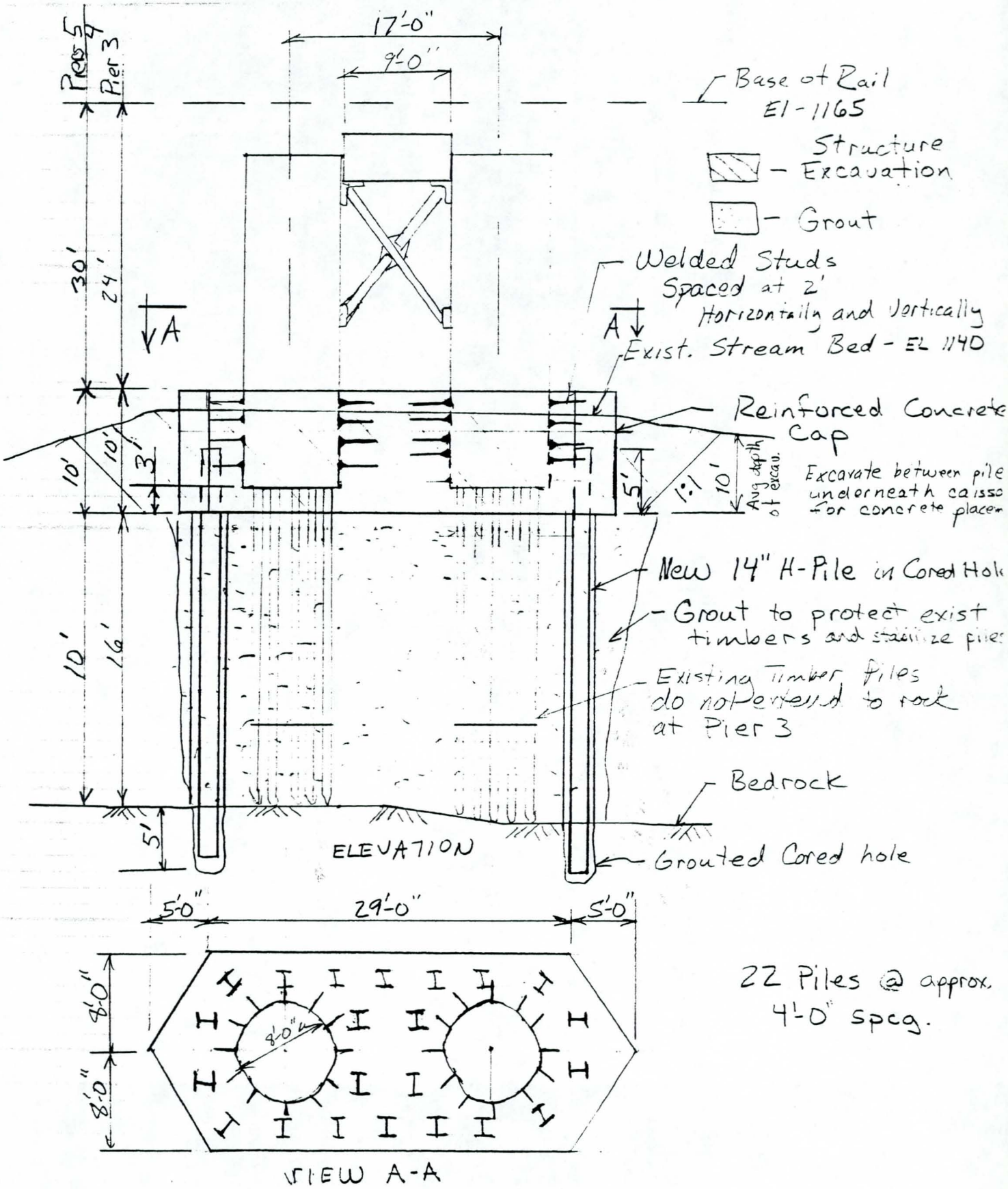
SOUTHERN PACIFIC BRIDGE NO. 726.25
OVER THE SALT RIVER
TEMPE, ARIZONA
STABILIZATION OF PIERS 3, 4 & 5
SKETCH NO. 1



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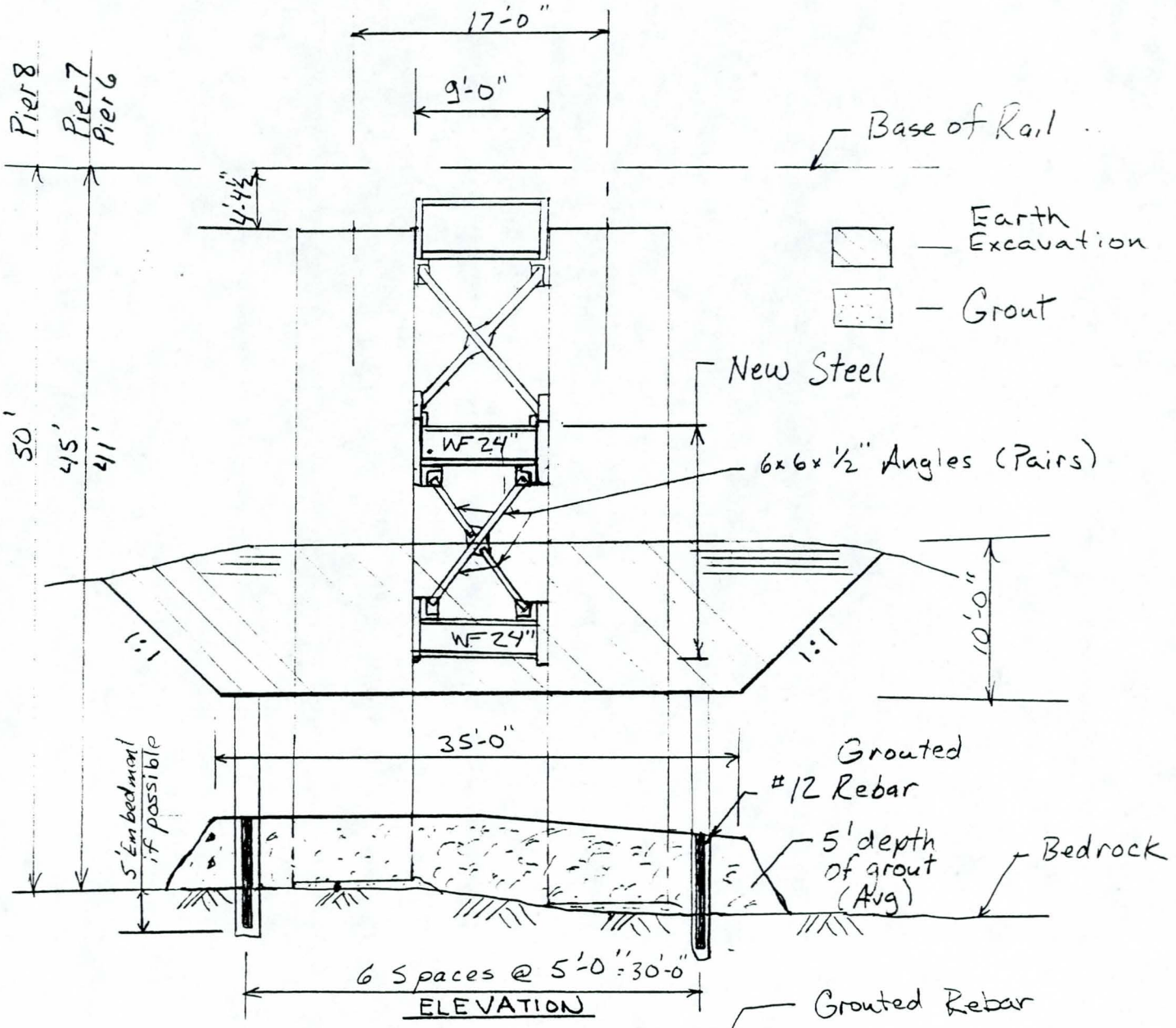
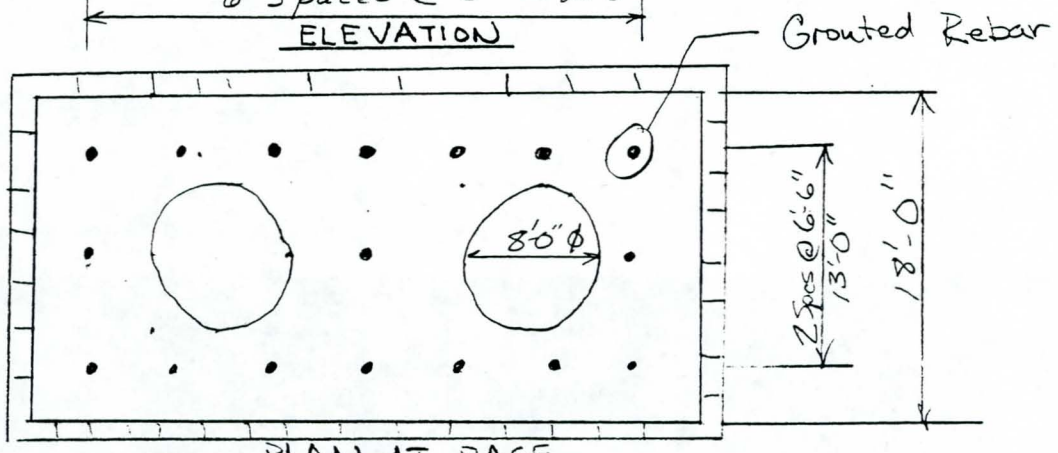
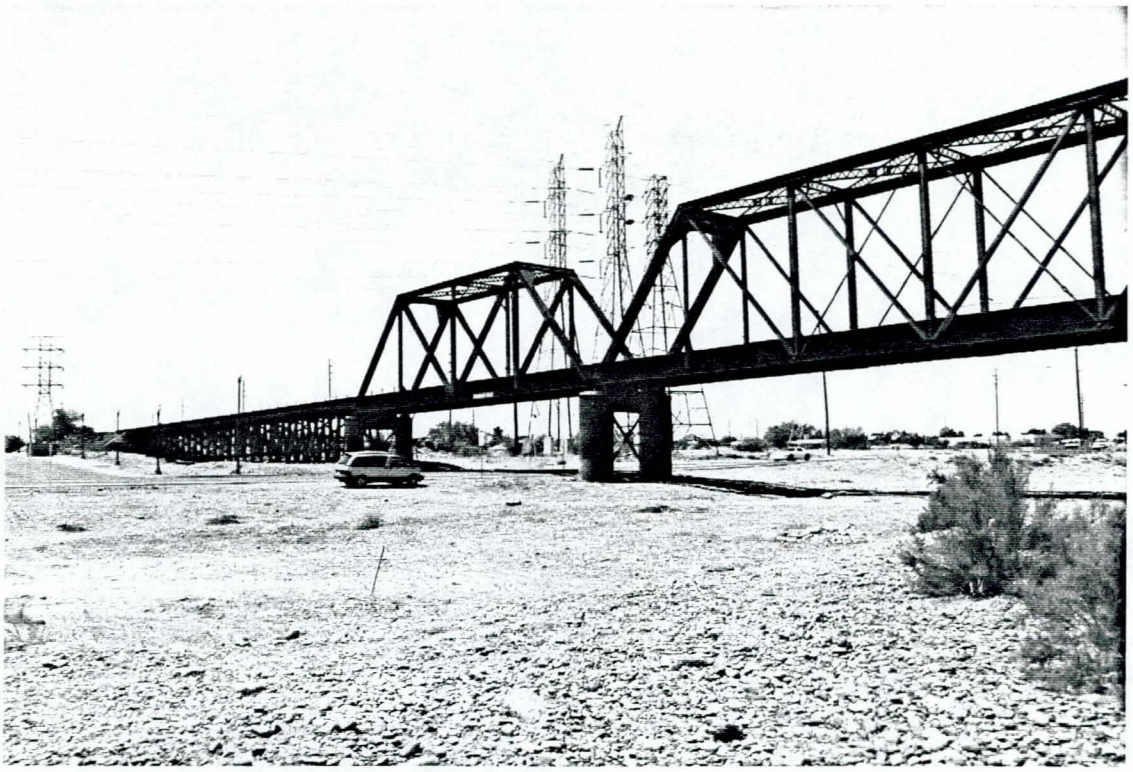
SOUTHERN PACIFIC BRIDGE NO. 726.25
OVER THE SALT RIVER
TEMPE, ARIZONA
STABILIZATION OF PIERS 6, 7 & 8
SKETCH NO. 2



ELEVATION

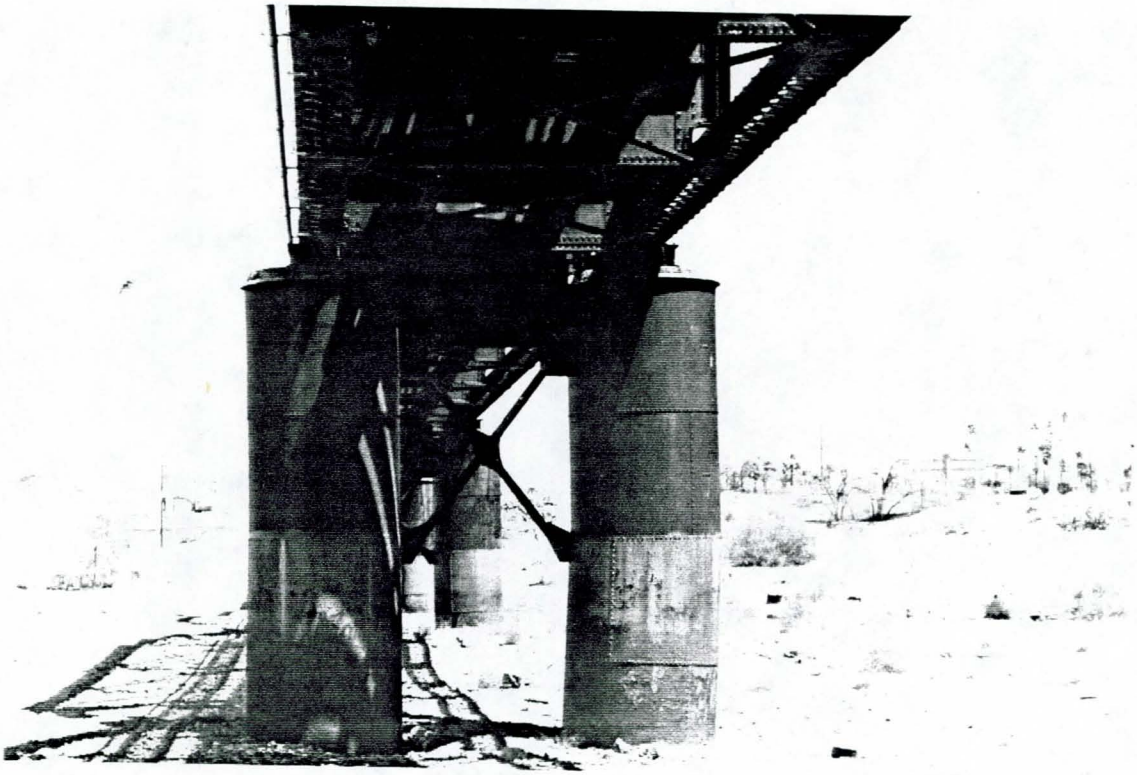


PLAN AT BASE



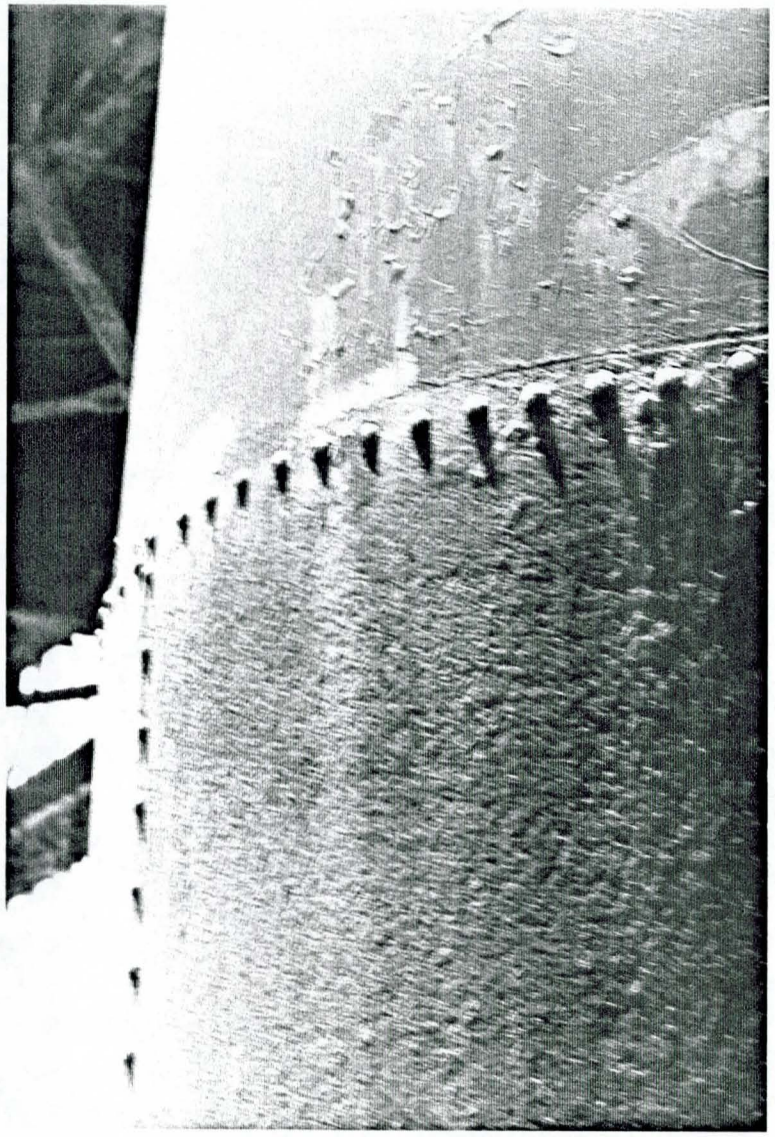
Existing South Abutment, Trestle and Piers 1 and 2

New North Abutment and Approach to Pier 11



Pier #2 - Northern View

Structure Overview



Close-up of Rivet Condition, Pier 3

Close-up of Caison Base, Pier 3