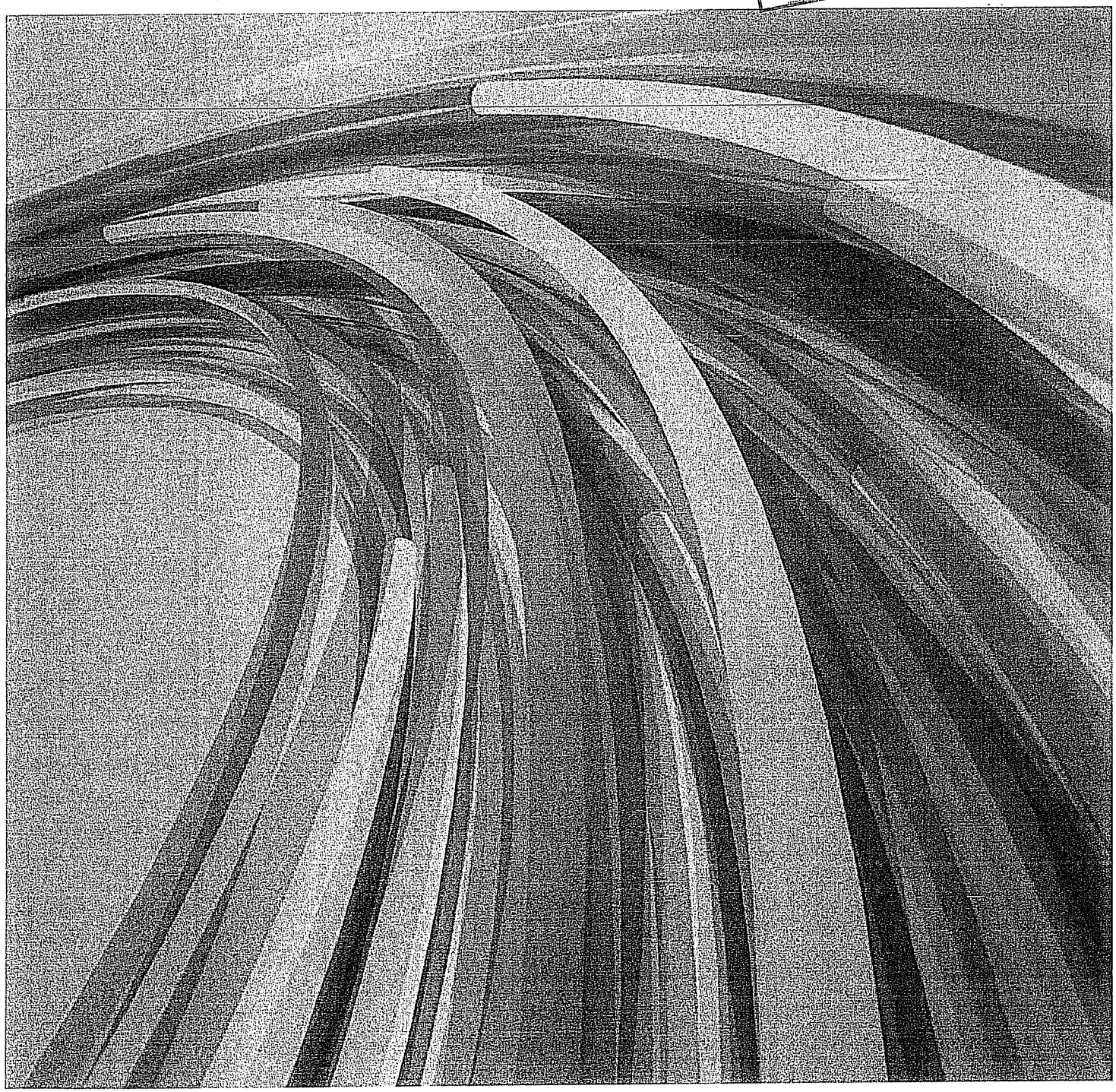
Parkes Way Bridge Widening

Roads ACT

15 September 2010

Load Rating of the Clunies Ross and Sullivans Creek Bridges



Load Rating of the Clunies Ross and Sullivans Creek Bridges

Prepared for

Roads ACT

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Quality Information

Document Load Rating of the Clunies Ross and Sullivans Creek Bridges

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Prepared by Meg Baldo

Reviewed by Darrel Meyers

Revision History

Revision	Revision Date	Details	Authorised	
			Name/Position	Signature
Draft	05-Aug-2010		Darrel Meyers Associate Director - Highways & Structures	
Final	15-Sep-2010		Jane Peters Principal Engineer - Civil Infrastructure	

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1.0 INTRODUCTION

1.1 Background

Parkes Way is an existing road in Canberra that suffers from congestion problems. Roads ACT has engaged AECOM to investigate upgrade works involving the widening of Parkes Way.

The proposed road widening will provide an additional lane each way on Parkes Way between Glenlock Interchange and the ACTON tunnel and will include the widening of the Clunies Ross Street and Sullivans Creek bridges.

The existing bridges were designed and built about 30 years and a description of each bridge is provided below:

Clunies Ross Street Bridge –The existing Clunies Ross Street bridge consists of a set of twin bridges each with a shoulder and two lanes of traffic. Each bridge has three spans and are of post-tensioned twin box girder construction. The spans are supported by abutments at each end and rectangular reinforced concrete piers at intermediate locations. Footings for both the concrete piers and abutments consist of two or three rows of raked and vertically driven steel H piles.

Sullivan's Creek Bridge – The existing Sullivans Creek bridge consists of a set of twin bridges, one for eastbound traffic and one for the westbound traffic. Each bridge has three spans and are of post-tensioned segmental trough girder construction, with six girders for the eastbound carriageway and five girders for the westbound direction. The bridges are supported by concrete abutments founded with driven steel H piles and by two tapered reinforced concrete piers at each end. The tapered piers come down onto a common pile cap which is supported by steel piles driven into the creek bed below.

The General Arrangement of the two bridges as shown in the Work-as-Executed Drawings are presented in Appendix A.

Concept designs of the widening of the two bridges have been developed. The new bridge widening structure for Clunies Ross Street Bridge is proposed to be constructed in between the two existing twin box girder bridges. Each bridge is to be widened by between 1.8 m and 2 m on the median side.

The proposed widening for Clunies Ross Bridge consists of adding a single 1500 deep RTA standard super tee girder and concrete deck slab. The substructure consists of new abutments and concrete piers adjacent to the existing substructure location.

Pilecaps will be constructed parallel along the edges of Clunies Ross Street to pick up both the eastbound and westbound piers. The top level of the pilecap will match the existing pilecap and each pilecap will be founded on rock via four bored concrete piles. Piling will be installed from the existing bridge deck due to easier accessibility.

The new bridge widening structure for Sullivans Creek Bridge is proposed to be constructed in between the two existing twin bridges. Each bridge is to be widened by between 3.1 m and 3.3 m on the median side.

The proposed structure for each widening consists of adding 1200 deep RTA standard super tee girders and concrete deck slab. The substructure consists of new abutments and concrete piers adjacent to the existing substructure location.

One pilecap will be constructed below each of these new piers adjacent to the existing pilecaps. The existing pilecap may need to be cut back to make room for the new structure. Each pilecap will be founded on rock via four bored concrete piles. Piling will be installed from the existing bridge deck due to easier accessibility.

As the existing bridges were designed and built 30 years ago, a load rating analysis was deemed necessary to determine whether the existing bridges will need to be upgraded to comply with the current bridge design code AS5100. Clunies Ross St bridge was designed according to NAASRA Bridge Specification Code 1976 with a design loading of the T44 vehicles.

While the Sullivan's Creek Bridge drawings did not specify the design code it was designed for, it was assumed that it was also designed according to the NAASRA 1976 as it was built around that time. (*The design criteria for this bridge was not shown in the drawings, but its title block showed that its design started in 1975 and construction was completed by 1979. Hence for the purpose of this analysis, it has been assumed that the bridge was also designed in accordance with the NAASRA 1976 Bridge Code)*

The load capacities of the major elements of the bridges needed to be assessed under the current bridge design code using SM1600 as its vehicle loads. This was undertaken in two work components: a desktop assessment generally comprising of a grillage analysis of both bridges using the SM1600 vehicles and (b) a bridge inspection of both bridges to assess the structural condition of the existing bridges.

This report presents the findings of the load rating analysis of the two bridges against the SM1600 vehicle loading as well as the bridge inspection results.

1.2 Information

The information and assumptions used in this report are derived from the following sources:

Design Reference and Standards

AUSTRALIAN STANDARDS

AS5100.1	Bridge Design – Scope and General Principles
AS5100.2	Bridge Design – Design Loads
AS 5100.3	Bridge Design – Foundations and Soil Supporting Structures
AS 5100.4	Bridge Design – Bearings and Deck Joints
AS 5100.5	Bridge Design – Concrete
AS 1170	Loading Code
AS 1302	Steel Reinforcing Bars for Concrete
AS 1310	Steel Wire for Tendons in Prestressed Concrete
AS 1311	Steel Tendons for Prestressed Concrete – 7 Wire Stress-Relieved Steel Strand for Tendons in Prestressed Concrete
AS 1313	Steel Tendons for Prestressed Concrete – Cold-worked High Tensile Alloy Steel Bars for
AS 1314	Prestressing Anchorages
AS 2159	Piling – Design and Installation

NAASRA BRIDGE DESIGN SPECIFICATION

SECTION 2	Design Loads
SECTION 5	Reinforced Concrete Design
SECTION 6	Prestressed Concrete Design

RTA STANDARDS

RTA BRIDGE INSPECTION MANUAL

Design inputs

- Work-As-Executed (WAE) drawings for Clunies Ross Street Bridge
- Work-As-Executed (WAE) drawings for Sullivans Creek Bridge

2.0 METHODOLOGY

The load rating assessment of the two bridges comprised of the following components: (a) a desktop assessment involving a grillage analysis of both bridges using theSM1600 vehicles and (b) a bridge inspection to assess the structural condition of the two bridges. The Clunies Ross St bridge was also further analysed using the T44 vehicle loads as detailed in Section 2.1 below.

2.1 Desktop Analysis

The desktop analysis involved the conduct of the following:

(a) grillage analysis of the two bridges based on the Work as Executed Drawings, and
(b) determining the member capacities based on the NAASRA 76 and AS5100 design standards.

2.2 Analysis Approach

The twin bridges at Clunies Ross Road is comprised of a three span continuous superstructure supported on a single pier. Each of the twin bridges have span lengths of 13m, 27m and 13m. As the elements of both bridges were generally the same and had similar reinforcement details, only one grillage model to represent the two bridges was used and one grillage analysis was undertaken.

The Sullivans Creek bridges consist of a pair of bridges providing for the eastbound and westbound carriageway. Their superstructures are three span post-tensioned segmental trough girders with span lengths of 21.5, 24.5 and 21.5m. The girders are initially simply supported during construction and made continuous for live load with a reinforced concrete plug at the piers. The superstructure is supported on tapered reinforced concrete piers and concrete abutments. Both the abutments and piers are supported by driven steel H piles. The eastbound carriageway has six girders while the westbound carriageway has five girders. Both bridges was modelled and analysed as they differed in the number of girders and piers.

A load rating analysis involves determining the available live load capacity of the bridge compared with the effects of the nominated rating vehicle which in this instance is the SM1600 of AS5100.

The two bridge structures were analysed using grillage models based on WAE drawings to determine the design actions from the vehicle loads. The bridges were analysed using the design loading of the SM1600 vehicle loads AS 5100.

In addition to the AS5100 loads, the Clunies Ross St Bridge was also further analysed using the T44 vehicle loads to determine the design actions the elements were designed for. This was necessary for this bridge since the prestressing reinforcement details in the WAE drawings were incomplete. The determination of the maximum design actions on the girders served as a check on the assumptions made in the assessment of its available live load capacity.

The design traffic loads are positioned on the bridge deck in accordance with the design codes. The SM1600 vehicle loads are positioned within the 3.2m design traffic lane to obtain the maximum design action on the different elements. The T44 standard loadings are positioned within the 3m design traffic lane to obtain the maximum design action in the different elements

2.3 Load factors for the Design vehicles

The following tables show in summary of the load factors for Ultimate Limit State (ULS) and Serviceability Limit State (SLS) as well as the Dynamic Load Allowance (DLA) for the two design codes:

2004 AS 5100 with SM1600	DLA	SLS	ULS
W 80 (wheel)	0.4	1.0	1.8
A 160 (axle)	0.4	1.0	1.8

SM 1600	0.35	1.0	1.8

NAASRA 76	DLA	SLS	ULS
A7 (wheel)	0.4	1.0	2.25
T44 truck (standard loading)	0.3	1.0	2.25

The load effects and design actions on the major structural elements including axial loads, bending moment and shear and torsion due to these vehicle loads were determined from the grillage analysis. These major elements include: (a) abutments, (b) piers, (c) piles, (d) girders and (e) bridge deck. The design capacities of these different members were then determined using the work as executed drawings and applying the AS5100 standards. The available live load capacity of the bridge is calculated by deducting the design permanent effects from the design capacity of the member. The load rating is then calculated by dividing the available live load capacity of the member with the live load effects of the SM1600 vehicle.

The material properties as shown in the drawings and used in the calculation of the element capacities are listed below:

Material Properties for Sullivan's Creek Bridge	
Concrete	Minimum 28 day compressive strength were: a) 25 MPa for abutments and pile caps b) 30 MPa for approach slabs, columns, and deck c) 40 MPa for precast girder segments
Reinforcement bar:	Grade C = 410 MPa
Prestressing t -	12.5mm Diameter Low Relaxation Strands

Material Properties for Clunies Ross Bridge	
Concrete	Minimum 28 day compressive strength were: a) 25MPa for footings, abutments piers and approach slab b) 30 MPa for the deck and girders Concrete compressive strength at transfer = 30MPa
Reinforcement bar:	Grade C = 410 MPa
Prestressing	no details

2.4 Limitation of Existing Information

Some of the WAE drawings were missing information and some assumptions had to be made in order to undertake the analysis. There were some instances though where assumptions couldn't be made, thus no rating was made for the particular element. Missing information include the following:

- Borehole log data for the Sullivan's Creek Bridge
- Incomplete borehole log data for the Clunies Ross St Bridge

- Reinforcement drawings for the abutment of Clunies Ross St Bridge
- Shear reinforcement drawings for the girders of the Clunies Ross St Bridge
- Prestressing details for the Clunies Ross St Bridge

As a result, the following design actions and corresponding load rating for said elements were not undertaken:

- Piles at the abutment and piers for both bridges
- Abutment for the Clunies Ross St Bridge
- Shear capacity of the box girders for the Clunies Ross St Bridge
- Shear capacity of the transverse prestressing pier at the Clunies Ross St Bridge

The tendon properties and prestressing reinforcement details were not completely documented in the drawings and assumptions were made in order to determine the element bending moment capacity. The assumed bending moment capacity was then compared against the design actions of the ULS load combination of the T44 and permanent load effects. It is presumed that since the design capacity is to serve as a check The calculated capacities of the element using these assumptions were compared against the design actions of the T44 and permanent loading (ULS) to confirm that the actions are less than the capacity. It is presumed that since the design capacities are greater than the design actions, the assumed values were valid.

The following prestressing reinforcement properties were assumed for the Clunies Ross Bridge:

- Tendon reinforcement in the girders were assumed to be of 7-wire super Standard, area = 143mm^2 and with minimum tensile strength, fp = 1750Mpa; and
- A total number of 36 strands was used for the external webs and a total number of 34 strands was used for the central web estimated by back calculating the number of strands from the tendon breaking load shown on the drawings.

2.5 Bridge Inspection

An inspection of the bridges was undertaken on 21 July 2010 to assess the current condition to ensure that the calculated capacities based on the design drawings and its original constructed condition still apply. The bridge condition assessment involved a visual inspection of the major elements of the bridges.

Included in this assessment were:

- Extent of any loss of section, for example, as a result of corrosion or accidental damage;
- Eccentricities of loads in members and details, for example by bends, kinks or incorrect alignment;
- Extent of any exposed reinforcement and corrosion;
- Foundation and ground movements or changes to earth loads on the structure;
- Scour of the foundation or of any adjacent river banks; and
- Evidence of any repairs or modifications of the structures.

The condition of the major elements of the bridges was assessed based on the condition rating specified in the RTA Bridge Inspection Manual. The manual provides a guide on determining the rating of the different elements and these varied depending on the material of the structural element being considered and the structural element itself. The elements are rated between the condition ratings of 1 to 4. The condition rating 1 signifies the elements are in good condition and exhibit no or minimal signs of deterioration whilst the condition rating 4, signifies the elements show signs of extensive deterioration and that its structural capacity is compromised.

As an example, below is a table showing the typical condition rating of a prestressed concrete girder:

Condition Rating	Description

1	The element shows no deterioration. There may be discolouration, efflorescence, and/or superficial cracking.
2	Minor cracks and spalls may be present but there is no evidence of corrosion of the non-prestressed reinforcement or deterioration of the prestress system.
3	Some delaminations, significant spalls or cracks may be present. There is no evidence of deterioration of the prestress system. Corrosion of non-prestressed reinforcement may be present but loss of section is minor. There is not sufficient concern to warrant an analysis to ascertain the impact on the strength and/or serviceability of either the element or the bridge.
4	Delaminations or spalls or cracks or corrosion of non-prestressed reinforcement are prevalent. There may also be exposure and deterioration of the prestress system (manifested by loss of bond, broken strands or wire, corrosion or failed anchorages, etc.). There is sufficient concern to warrant an analysis to ascertain the impact on the strength and/or serviceability of either the element or the bridge.

The Manual provides typical condition ratings for the different elements and material of the bridge. Whilst the description of the condition equivalent to the rating varies from element to element, they generally have the following characteristics:

Condition Rating	Description
1	The element shows no signs of deterioration.
2	Minor deterioration occurs
3	Some deterioration occurs but there is not sufficient concern to warrant an analysis to ascertain the impact on the strength and/or serviceability of either the element or the bridge.
4	Significant or major deterioration occurs and there is sufficient concern to warrant an analysis to ascertain the impact on the strength and/or serviceability of either the element or the bridge.

3.0 RESULTS

3.1 Grillage Analysis and Load Rating Results

The design actions for the main structural elements of the two bridges have been calculated using grillage models. The models have been created in ACES version 6.1 structural analysis software package. The section properties for the grillage models have been calculated using Hambly's "Bridge Deck Behaviour".

The following table summarises the results of the load rating analysis of the main elements for both bridges

Table 1 – Load Rating Analysis for Sullivans Creek Bridges

Abutment	Design action	Element capacity	Design action due to DL and SDL	Available capacity for Live load effects	Design action due to SM1600	RF
Abutment	Axial (kN per m width)	10200	500	9700	1700	5.7
	Moment (kNm per m width)	360	20	340	260	1.3
	Approach Slab Moment (kNm per m width)	200	30	170	220	0.77
Piles	Axial					
	Moment					
Pier						

Piles	Axial					
	Moment					
Columns	Axial (kN)	12000	1200	10800	3680	2.9
	Moment (kNm)	1500	20	1480	400	3.7
Girders						
Girder (end span)	Hogging Moment (kNm)	4700	0	4700	7700	0.61
	Sagging Moment (kNm)	5600	2900	2700	6400	0.42
	Shear + Torsion Ratio ($V^*/\phi V_s+T^*/\phi T_s$)	1.0	0.17	0.83	1.28	0.65
Girder (central span)	Hogging Moment (kNm)	4700	0	4700	7700	0.61
	Sagging Moment (kNm)	5800	3600	2200	5837	0.38
	Shear + Torsion Ratio ($V^*/\phi V_s+T^*/\phi T_s$)	1.0	0.24	0.76	1.23	0.62
Bridge Deck						
	Slab Moment (kNm)	80.0	8	72	80	0.90
	Slab Shear (kN)	260.0	1	259	202	1.28

Assumptions used:

Seismic, wind, and flood load cases have not been included in the load rating.

Geotechnical information not available for evaluation of piles.

Table 2 – Load Rating Analysis for Clunies Ross St Bridges

Abutment	Design action	Element capacity	Design action due to DL and SDL (ultimate load using AS 5100 load factors)	Secondary moments due to prestress	Available capacity for Live load effects (considering secondary moments)	Design action due to SM1600	RF
Abutment	Hogging Moment						
	Sagging Moment						
	Shear + Torsion Ratio ($V^*/\phi V_s+T^*/\phi T_s$)						
Piles	Axial						
	Moment						
Pier							
Piles	Axial						
	Moment						
Columns	Axial	12500	5800		6700	3800	1.8
	Moment	7800	600		7200	6045	1.2
Box Girders							
longitudinal prestressing							
Girder (external web)	Hogging Moment	-6600	-4300	2100	-4400	-6700	0.6
	Sagging Moment	8100	3100	2100	2900	4700	0.6
	Shear + Torsion Ratio ($V^*/\phi V_s+T^*/\phi T_s$)						
Girder (internal web)	Hogging Moment	-7100	-3700	2000	-5500	-3600	1.5
	Sagging Moment	7900	3000	2000	2800	2200	1.2
	Shear + Torsion Ratio ($V^*/\phi V_s+T^*/\phi T_s$)						
transverse prestressing							
Piers supports	Hogging Moment	-6000	3700		-2300	-2900	0.8
	Shear + Torsion Ratio ($V^*/\phi V_s+T^*/\phi T_s$)						

Assumptions used:

Seismic and wind load cases were not included in this analysis

Geotechnical information not available for the pier piles (evaluation of longitudinal model not undertaken)

Notes:

Load rating were not undertaken on some elements due to missing drawings or the lack of information on drawings

3.2 Bridge Inspection Summary Results

The results of the inspection are documented through the Bridge Inspection Sheets presented in the tables in Appendix B. Photos referred to in the table are presented in Appendix C**Error! Reference source not found.**.

The inspection summary shows that the bridges are generally in good condition and that the capacities of the members based on the desktop analysis do not require modifications for deterioration.

The only element that requires further investigation and monitoring is the diaphragm near the abutment of the Clunies Ross Bridges. While both bridges exhibited similar cracks near the diaphragms at the abutments and showed signs of previous repair, there was evidence of further cracking at the two bridges in Clunies Ross St.

Whilst this was given a condition rating of 2 due to lack of evidence of moisture ingress or corrosion of the existing reinforcement, further investigation is deemed necessary since these could potentially affect the strength or serviceability of the element.

All the other elements generally showed no signs of deterioration while some showed minor localised deterioration.

4.0 CONCLUSION AND RECOMMENDATION

4.1 Analysis Results

The assessment indicates that some of the major elements that were load rated would need to be strengthened to have sufficient capacity to support SM1600 vehicle loads.

The elements that would require strengthening to resist SM1600 loading are:

Sullivans Creek Bridge:

- Approach slab
- Girders (for bending moment and shear)
- Bridge deck (for bending moment)

Clunies Ross St Bridge:

- Girders (for bending moment)
- Diaphragm at piers (for bending moment)

The elements that were not load rated include:

Sullivans Creek Bridge:

- Piles at the piers and the abutments

Clunies Ross St Bridge:

- Abutments
- Piles at the piers and the abutments
- Girders (shear capacity)
- Diaphragms at pier supports (shear capacity)
- Bridge deck
- Approach slab

The results of the bridge inspection showed that the load rating assessment results based on the desktop analysis are still applicable since the bridge inspection assessed the elements to generally have condition ratings of 1 to 2 and with only one element requiring further investigation.

The cracks in the diaphragms of the box girders at the Clunies Ross Bridge require monitoring since there is concern that the cracks could lead to the onset of corrosion in the reinforcement.

The analysis of the other elements that were not load rated due to missing information can be undertaken as part of the future widening works as outlined in Section 4.2.

4.2 Future Work

As a result of missing information in the drawings as well as the lack of geotechnical data, not all of the elements of the two bridges were load rated.

To address these constraints, the following activities are proposed to be undertaken in order to come up with a load rating on the missing elements:

Lack of geotechnical data:

It was not possible to provide a load rating of the piles due to lack of geotechnical data. Geotechnical surveys to establish the soil conditions at the bridge sites can be undertaken as part of the bridge widening works.

Missing information in drawings:

The load rating and strengthening of the elements with missing information in the drawings can be obtained with the following options:

- Where the reinforcement detail is not shown in the drawings - Break out the cover concrete from a portion of the elements to establish the cover and calibrate the cover meter. The reinforcement bar sizes and its spacing can then be determined for the surface reinforcement. With this information the capacity of the element can be calculated.
- Based on the assumption that the bridge was designed correctly, it can be conservatively assumed that the elements have been designed to T44 and permanent effects (ULS), and that the design capacity of the elements is equal to this. The amount of strengthening required on the element will be the equal to its design capacity reduced by the design action of SM1600 and permanent effects (ULS).

Appendix A

General Arrangement Drawings

Appendix A General Arrangement Drawings

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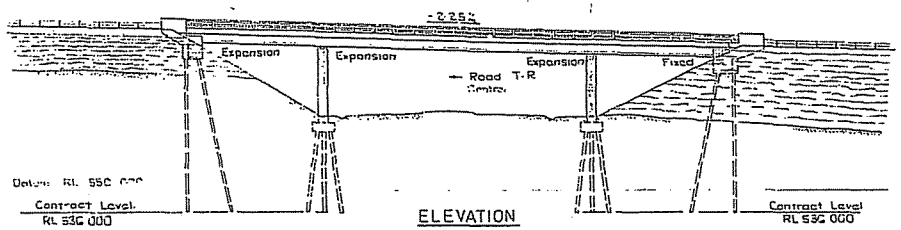

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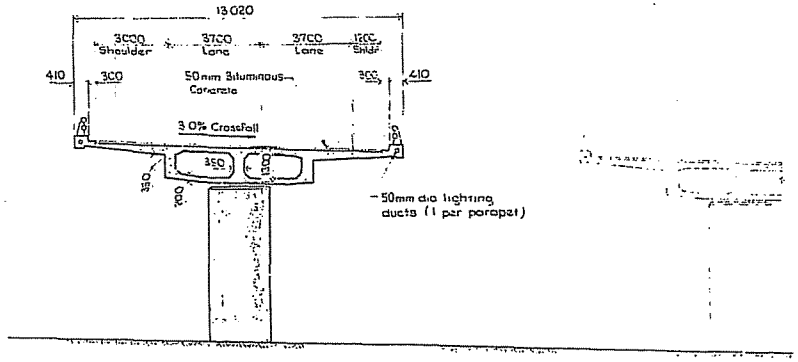

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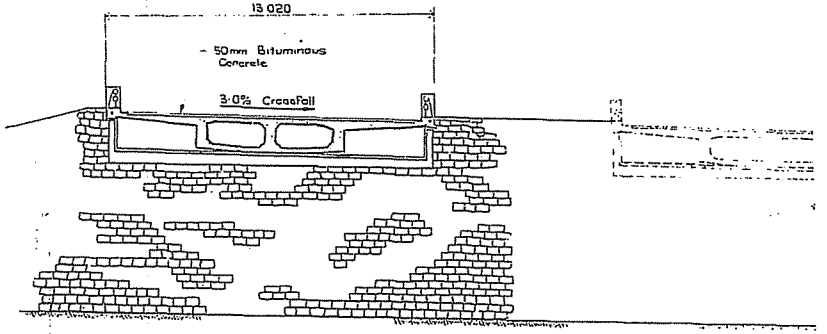

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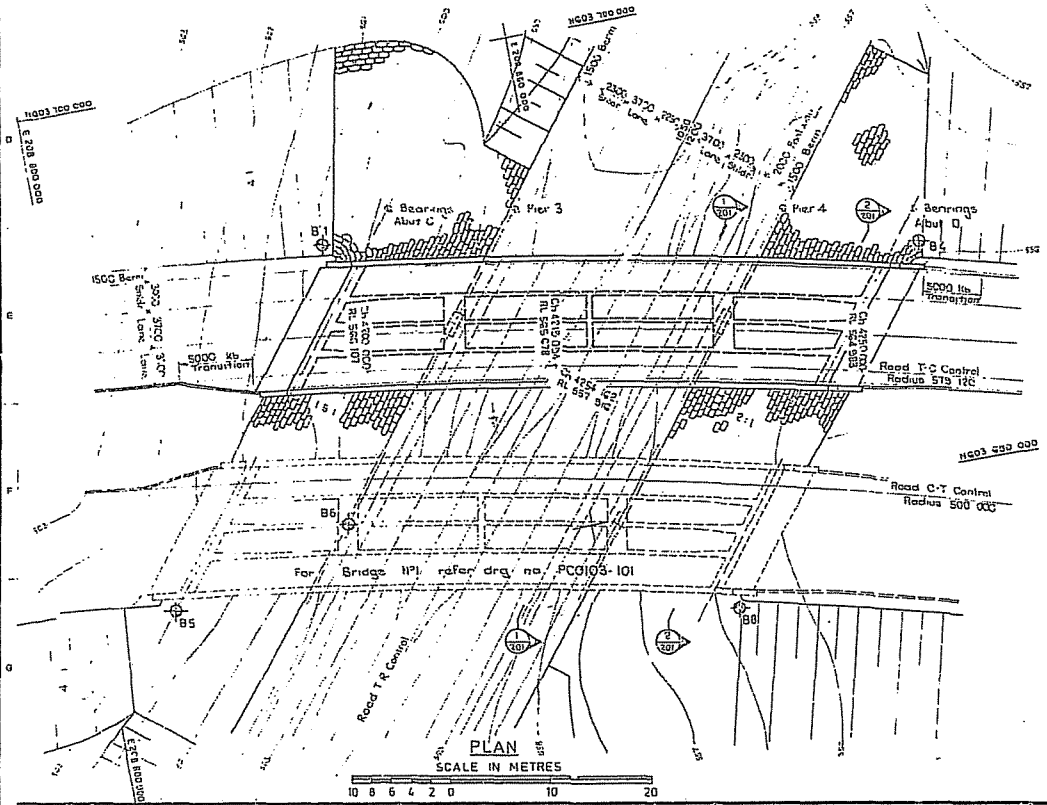
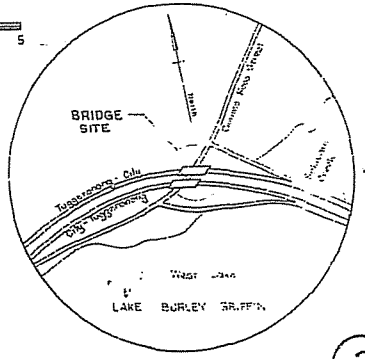


REFERENCE DRAWINGS

PC0103-201	GENERAL ARRANGEMENT
202	BOREHOLE LOG
203	SETTING OUT PLAN
204	ABUTMENT C CONCRETE
205	ABUTMENT D CONCRETE
206	ABUTMENT BEARINGS
207	PIERS 3 & 4 CONCRETE
208	PIER BEARINGS
209	DECK CONCRETE Sheet No.1
210	DECK CONCRETE Sheet No.2
211	LONGITUDINAL PRESTRESSING
212	TRANSVERSE PRESTRESSING
213	APPROACH SLABS C&D CONCRETE
214	EXPANSION JOINT
215	FIXED JOINT
216	CRASHRAILING Sheet No.1
217	CRASHRAILING Sheet No.2



80-11723 LOCALITY PLAN N.T.S

2114

WORK AS EXECUTED

(2)

DIMENSIONS IN MILLIMETRES
DRAWING PRACTICE TO AS1100

BRIDGE DESIGN CONSULTANTS PTY. LTD
CITY MUTUAL BUILDING, HOBART PLACE
CANBERRA 2600
TELEPHONE — 49 6311 8449039-2

DRAWN	T C H	DATE	JAN. 1977
SCALE	AS SHOWN		
DESIGNED	R.A.S	CHECKED	
APPROVED			

No.	DATE	APP'D	AMENDMENT
A	5-5-77		Longitudinal grade added to elevation
A	5-5-77		additional piles at each pier
A	5-5-77		kb transition added

NATIONAL CAPITAL DEVELOPMENT COMMISSION
CANBERRA A.C.T.

RANKINE & HILL
CONSULTING ENGINEERS
CITY MUTUAL BUILDING, HOBART PLACE
CANBERRA — 49 6311

BRIDGE OVER CLUNIES ROSS STREET
TUGGERANONG TO CITY CARRIAGEWAY

MOLONGLO ARTERIAL
BLACK MOUNTAIN SECTION-STAGE 2

GENERAL ARRANGEMENT

No. IN SET 81 | DRAWING No. PC0103-201 | A | A1

FOR MICROFILMING PURPOSES ONLY

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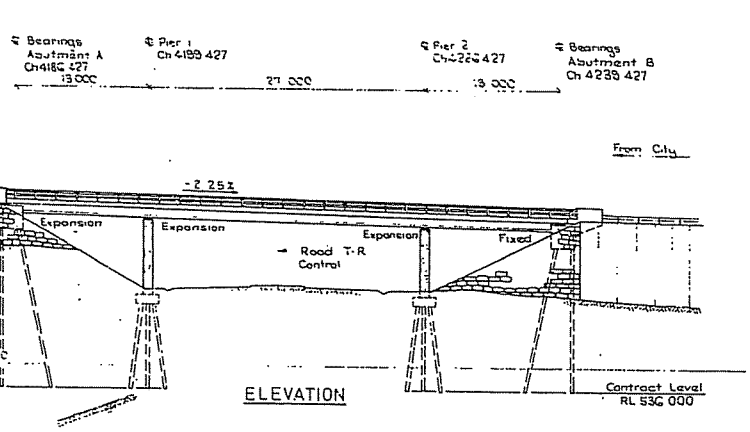

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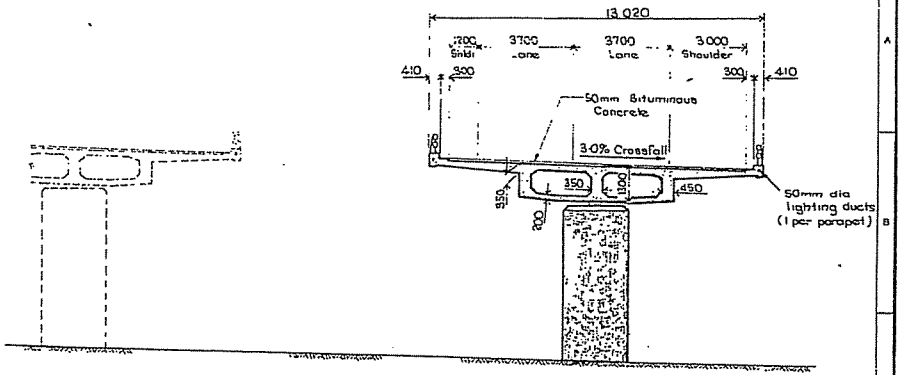

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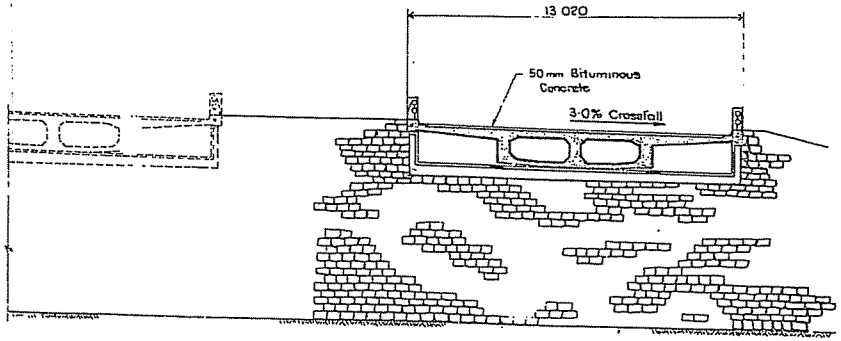

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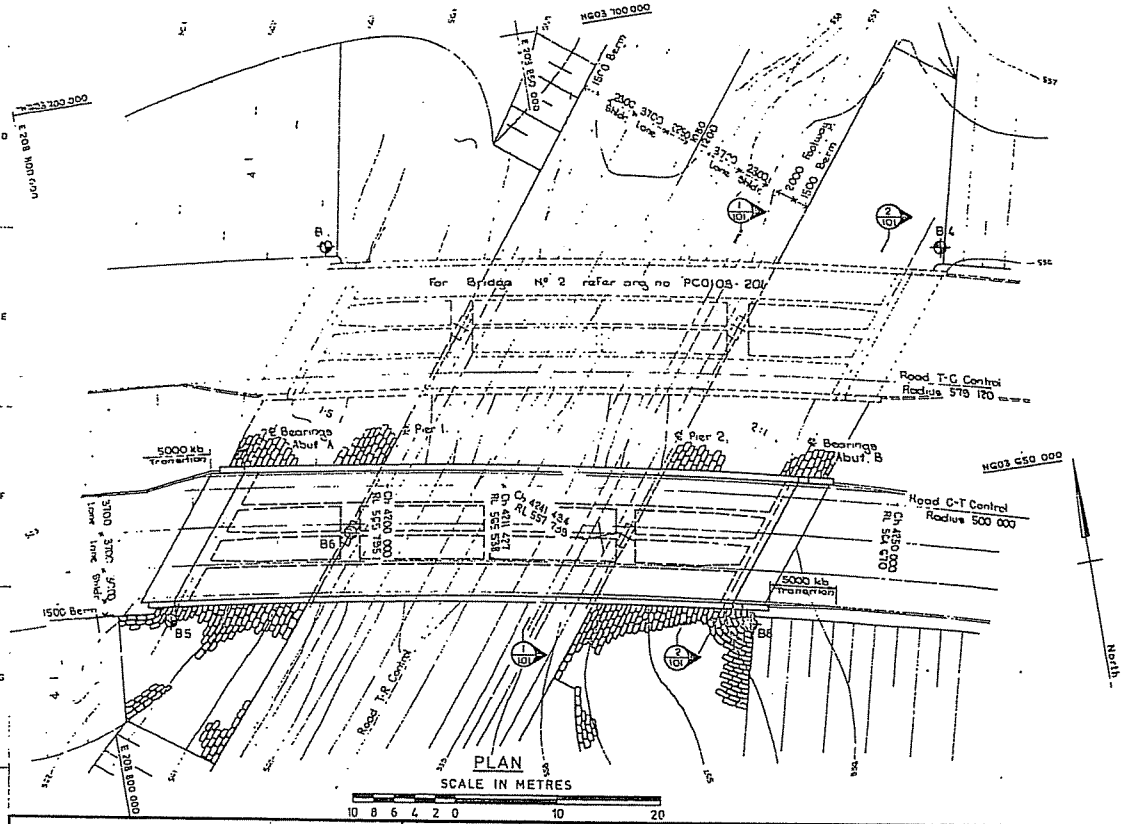


PLAN

SCALE IN METRES

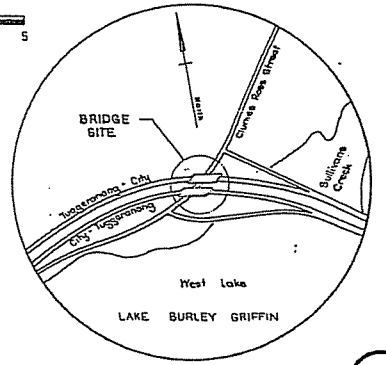
10 8 6 4 2 0 10 20

SCALE IN METRES

5 4 3 2 1 0 5

REFERENCE DRAWINGS

PC0103-101 GENERAL ARRANGEMENT
102 BOREHOLE
103 SETTING OUT PLAN
104 ABUTMENT A CONCRETE
105 ABUTMENT B CONCRETE
106 ABUTMENT BEARINGS
107 PIERS 1 & 2 CONCRETE
108 PIER BEARINGS
109 DECK CONCRETE Sheet No.1
110 DECK CONCRETE Sheet No.2
111 LONGITUDINAL PRESTRESSING
112 TRANSVERSE PRESTRESSING
113 APPROACH SLABS & B CONCRETE
114 EXPANSION JOINT
115 FIXED JOINT
116 CRASHRAILING Sheet No.1
117 CRASHRAILING Sheet No.2



LOCALITY PLAN N.T.S.

1

80-11692

WORK AS EXECUTED

DIMENSIONS IN MILLIMETRES
DRAWING PRACTICE TO AS 1100

BRIDGE DESIGN CONSULTANTS PTY. LTD.
CITY MUTUAL BUILDING, HOBART PLACE
CANBERRA 2600
TELEPHONE 48 8311 BM0038-1

DRAWN T C N | DATE JAN. 1977 | SCALE AS SHOWN
DESIGNED R.A.D. | CHECKED B/C | APPROVED

No.	DATE	APP'D	AMENDMENT
A	6-6-77		Longitudinal grade added to elevation
A	6-6-77		6 additional piles at each pier
A	6-6-77		Kb transition added

NATIONAL CAPITAL DEVELOPMENT COMMISSION CANBERRA A.C.T.

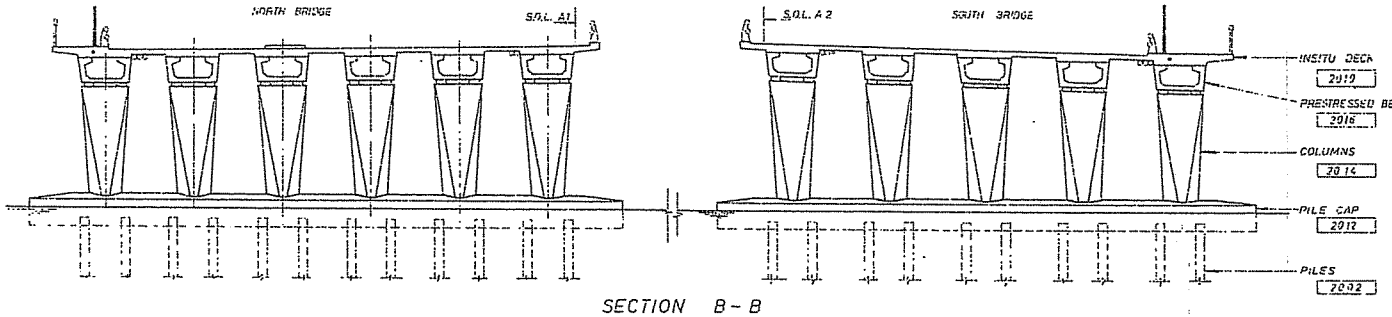
RANKINE & HILL
CONSULTING ENGINEERS
CITY MUTUAL BUILDING, HOBART PLACE
CANBERRA — 48 8311

BRIDGE OVER CLUNIES ROSS STREET
CITY TO TUGGERANONG CARRIAGEWAY

MOLONGLO ARTERIAL
BLACK MOUNTAIN SECTION - STAGE 2
GENERAL ARRANGEMENT
No. on SET 81 | DRAWING No. PC0103-101 | A | A1

FOR MICROFILMING PURPOSES ONLY

DRG. No 8174/2/2000



SECTION B - B
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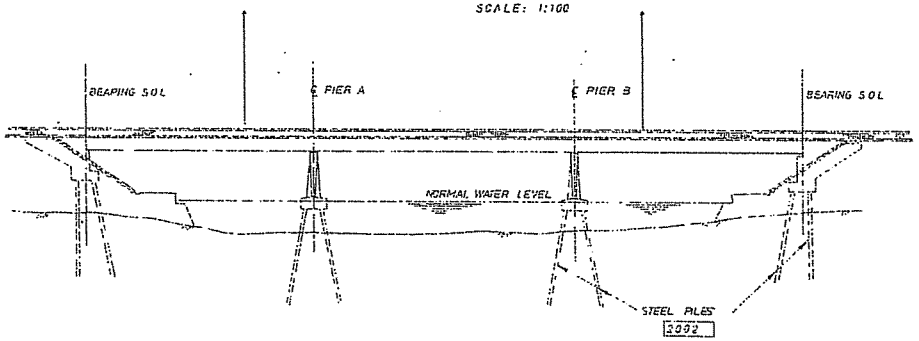
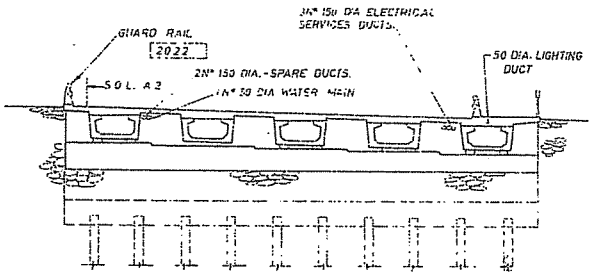
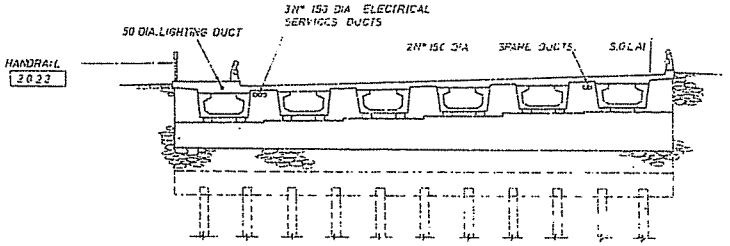


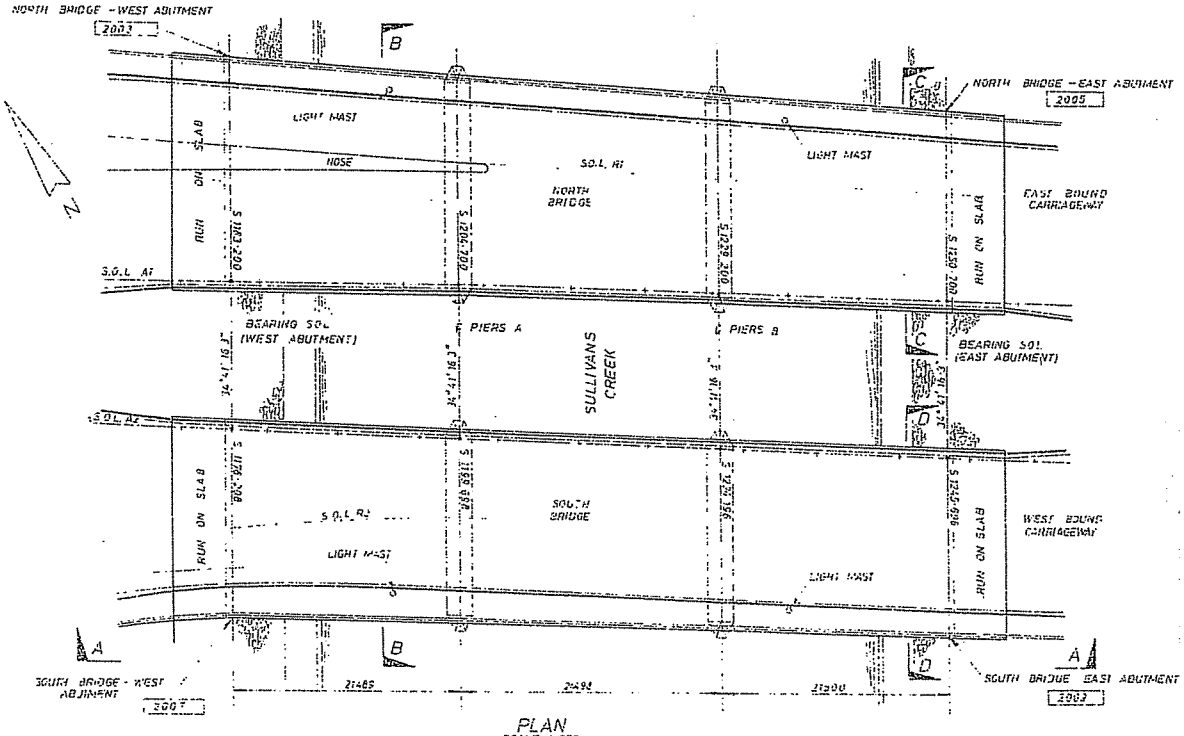
ELEVATION A - A
SCALE: 1:250



SECTION D-D
SCALE 1: 100



SECTION C - C
SCALE: 1:100



PLAN
SCALE: 1:250

GENERAL NOTES

1. UNLESS OTHERWISE SHOWN THESE NOTES APPLY TO ALL SULLIVANS CREEK BRIDGE DRAWINGS
2. FOR DRAWING LIST SEE 1009
3. UNLESS OTHERWISE SHOWN ALL CONCRETE CORNERS HAVE 15x15 CHAMFER
4. BLINDING LAYER 75 THICK. CONCRETE CLASS 10(20)
5. UNLESS OTHERWISE SHOWN ALL KICKERS 150 HIGH.
6. NOTATION OF BAR REINFORCEMENT

27 | C | 20 | 3 | 200 | (NF)

N° OFF BAR
BAR CLASS
DIAMETER
SUFFIX
SPACING
BAR MARK

BAR CLASSES - R = STRUCTURAL GRADE PLAIN ROUND
S = STRUCTURAL GRADE DEFORMED
C = COLD WORKED DEFORMED

SUFFIX T = TOP FACE FF = FAR FACE
B = BOTTOM FACE BF = BOTH FACES
NF = NEAR FACE ABR = ALTERNATIVE BAR REVERSED

7. FOR ROAD SETTING OUT DETAILS SEE ROADWORKS & GENERAL SECTIONS
8. ALL DUCTS GALV STEEL PIPES AS SPECIFIED.
9. FOR LAYOUT OF SPARE DUCTS AT ENDS OF BRIDGE SEE 1101
10. FOR LAYOUT OF A.C.T.E.A. DUCTS AT ENDS OF BRIDGE SEE 1140

GENERAL LEGEND

DRAWING REFERENCES 2010
SETTING OUT LINES
BLINDING
CONSTRUCTION JOINTS C.J.
EXPANSION JOINTS EXP. J.

REV.	DATE	DESCRIPTION	PE.
C	3/4/79	WORK AS EXECUTED.	
B	25/6/131	DUCTS REVISED	
A	5/11/77	WORKING DRAWING MINOR REVISION	

DIMENSIONS IN MILLIMETRES

NATIONAL CAPITAL DEVELOPMENT COMMISSION CANBERRA A.C.T.

MOLONGLO ARTERIAL - SULLIVANS Ck. SECTION

SULLIVANS CREEK - BRIDGE

GENERAL ARRANGEMENT

BRIDGE I.D. 2115 & 2116

DESIGNED
DRAWN
CHECKED
APPROVED

MAUNSELL & PARTNERS PTY LTD
CONSULTING ENGINEERS

SCALE 1:250
DATE MARCH 1979
DATE OF ISSUE 4 JUL 1979

DRG. No. 8174/2/2001

WORKING DRAWING

Appendix B

Bridge Inspection Reports

Appendix B Bridge Inspection Reports

BRIDGE INSPECTION REPORT

Name of Bridge:	Clunies Ross Bridge - B1
Location:	
Photos:	
Date Inspected:	21/7/10
Time:	
Inspecting Officer:	MB/JP
Weather Conditions:	sunny
Temperature (shade):	10° C

CONDITION RATINGS	
4	Refer to RTA Bridge Inspection Procedure Manual
3	
2	
1	
NI	-Not inspected
NA	-Not applicable

Item	Component		Condition	Comments	Repairs Required	Photos
1.	Footings			NI		
2.	Abutment	A	1	ok		
		B	1	minor water stains at the abutment shelf	investigate source of water	Photo 50
3.	Batter Protection	Abut A	1	minor vegetation	remove vegetation	
		Abut B	1	minor vegetation	remove vegetation	
4.	Piers	1	1	ok		
		2	1	ok		
	Pile caps	1		NI		
		2		NI		
5.	Girders	Span 1	1	Deck soffit generally in good condition except for the gridlike pattern of reinforcement noted at the soffit		Photo 51
		Span 2	1	girder soffits are in good condition		Photo 52
		Span 3	2	vertical, horizontal and diagonal cracks at the anchorage zone in Abutment B and box girder and wall interface, with evidence of previous repairs (N/S)	monitor cracks	Photo 53,54,55
			2	transverse/diagonal cracks at the soffit of the flange of the web near Abutment B (N/S)	monitor cracks	Photo 56
			2	similar cracks as noted above that are less extensive appear in the (O/S) of Abutment B	monitor cracks	Photo 57
6.	Parapets/kerbs	N/S	1	Minor vertical cracks near Abutment A		
		O/S	1	ok		
7.	Railings	N/S	1	ok		Photo 58
		O/S	1	generally okay but with graffiti near abutment B		Photo 59-60
8.	Wearing Surface		1	ok		Photo 61
9.	Approach Slabs	Abut A	1	rutting/cracks at approach slab		Photo 62, 63
		Abut B	1	asphalt has spalled off at the start of the approach slab near Abutment B	monitor spall	Photo 64, 65
10.	Drainage/Services			N/I		
11.	Expansion/Fixed Joint	Abut A	1	ok		Photo 66, 67
		Abut B	1	debris built-up at the expansion joint	clear debris	Photo 68
11.	Miscellaneous					

Parkes Way Bridge Inspection

BRIDGE INSPECTION REPORT

Name of Bridge:	Clunies Ross Bridge - B2
Location:	
Photos:	
Date Inspected:	21/7/10
Time:	
Inspecting Officer:	MB/JP
Weather Conditions:	sunny
Temperature (shade):	10° C

CONDITION RATINGS	
4	Refer to RTA Bridge Inspection Procedure Manual
3	
2	
1	
NI	-Not inspected
NA	-Not applicable

Item	Component		Condition	Comments	Repairs Required	Photos
1.	Footings			NI -not visible		
2.	Abutment	C	1	water stains at abutment shelf (possibly water from expansion joint)	investigate source of water	Photo 69
		D	1	ok		
3.	Batter Protection	Abut C	1	generally in good condition		
			1	minor vegetation growth at the abutment	remove vegetation	Photo 70
		Abut D	1	cracks at the side of the batter and wing wall - evidence of minor settlement	monitor cracking	Photo 71, 72
			1	other location generally in good condition (O/S)		Photo 73
4.	Piers/Restraints	3	1	ok		Photo 74
		4	1	ok		Photo 74
	Pile caps	3		NI - not visible		
		4		NI - not visible		
5.	Girders	Span 1	1	girder soffits are in good condition		Photo 75
		Span 2	1	girder soffits are in good condition		Photo 75
		Span 3	1	minor spall at the underside of the flange near abutment C		Photo 76
			2	vertical, horizontal and diagonal cracks at the anchorage zone in Abutment D and box girder and wall interface, with evidence of previous repairs (NS)	monitor cracking	Photo 77, 78
			2	cracks that started from the Abutment D (N/S) in item 2 above propagated transversely/diagonally at the soffit of the flange of the web until about 2 m from the start of the span	monitor cracking	Photo 79, 80
			2	similar cracks that are less extensive appear in the (O/S) of Abutment D, with horizonal cracks at the web and flange junction, minor cracks at soffit of flange of deck extend transversely	monitor cracking	Photo 81, 82, 83
			1	girder soffit in other locations along the span are generally in good condition		Photo 73
6.	Parapets/kerbs	N/S	1	minor vertical shrinkage cracks at parapet near abutment C		
		O/S	1	ok		
7.	Railings	N/S	1	3rd horizontal railing from abutment C is bent out a bit		
			1	other railings are generally in good condition		Photo 84
		O/S	1	ok		
8.	Wearing Surface		1	wearing surface generally in good condition except for rutting at abutment C end	monitor rutting	Photo 85
9.	Approach Slabs	Abut C	1	crack/rutting at approach slab from NS until OS	monitor rutting	Photo 86, 87
		Abut D	1	minor crack at joint of slab extending until the other side	monitor rutting	Photo 88
10.	Drainage/Services			N/I		
11.	Expansion/Fixed Joint	Abut C	1	expansion joint in Abutment C is in good condition		Photo 89
		Abut D	1	rutting of bitumen sealer above the fixed at abutment D	monitor rutting	Photo 90, 91
			1	debris built-up at the expansion joint	remove debris	Photo 92
11.	Miscellaneous					

Parkes Way Bridge Inspection

BRIDGE INSPECTION REPORT

Name of Bridge: Sullivans Creek - North Bridge
Location: Parkes Way, ACT
Photos:

Date Inspected: 21/7/10
Time: 11:00
Inspecting Officer: JLP / MB
Weather Conditions: Sunny
Temperature (shade): 10° C

CONDITION RATINGS	
4	Refer to RTA Bridge Inspection Procedure Manual
3	
2	
1	
NI	-Not inspected
NA	-Not applicable

Item	Component		Condition	Comments	Repairs Required	Photos
1.	Footings		NI	Pile caps - binocular inspection, OK		Photo 1
			NI	Abutment footings not visible		
2.	Abutment / Restraints	A	1	Minor crack at top of shelf between girders G1 and G2		Photo 2
			1	Vertical cracks between girders G3 and G4 and under g4, full height of abutment		
			1	water stains on face of abutment and down batter slope		Photo 3
		B	1	Repaired vertical cracks at girder G4		Photo 4
			1	minor vertical crack at girder G5		Photo 5
			1	some staining on back wall of abutment; notably at location where drainage/services penetrate wall; possible water penetrating at expansion joint	Investigate source of water	Photo 6
			2	Some leaching through back wall		Photo 7
3.	Batter Protection	Abut A	1	Some vegetation		Photo 8
			1	water stains on face of abutment and down batter slope		Photo 3
		Abut B	1	Ok		
4.	Piers / Restraints	1	1	OK, binocular inspection		
		2	1	OK, binocular inspection		
5.	Girders	S1	1	Grafitti on girders near abutment	Clean grafitti	Photo 9
			2	leachate on girder G3 @ slab/girder joint		Photo 10
						Photo 11
		S2	1	minor cracks in top of footpath slab over Piers 1 and 2		
			2	evidence of crack (leachate) on soffit of girder G1 top flange at Pier 2	monitor cracking	Photo 12
		S3	1	Grafitti on girder G3 at abutment		
			1	efflorescence stains on soffit of girder G1 N/S flange		Photo 13
						Photo 14
						Photo 15
6.	Parapets/kerbs	N/S	2	some rust at joints		Photo 16
			4	crack in steel barrier support in middle of span 3	Replace or strengthen barrier support	Photo 17
						Photo 18
		O/S	1	OK (inspected from walkway below)		
7.	Railings	N/S	2	rust on railings just off bridge at Abutment B		Photo 19
		O/S	N/A	N/A		
9.	Skirts	N/S	N/A	N/A		
		O/S	N/A	N/A		
11.	Wearing Surface		1	Span 3, Grid pattern on footpath		Photo 20
						Photo 21
			3	Span 2, reinforcement exposed at footpath slab	Seal surface locally	Photo 22
12.	Approach Slabs	Abut A	1	debris in expansion joint	Clean out joint	Photo 23
			1	some vegetation growing at slab joint in median	Clean out joint	Photo 24
			2	settlement of slab at on-ramp lane	Monitor settlement	Photo 25
			1	vegetation growing in joint at end of footpath approach slab	Remove vegetation	Photo 26
		Abut B	1	Some cracking in wearing surface at end of approach slab		Photo 27
			1	Some debris in expansion joint; grass growing in expansion joint at footpath		Photo 28
13.	Drainage/Services		1	OK		Photo 6
14.	Light Poles		1	OK		
15.	Miscellaneous		3	Exposed steel reinforcement at drainage intake just off bridge at abutment A	Repair	Photo 29

Parkes Way Bridge Inspection

BRIDGE INSPECTION REPORT

Name of Bridge:	Sullivans Creek - South Bridge
Location:	Parkes Way, ACT
Photos:	
Date Inspected:	21/7/10
Time:	11:00
Inspecting Officer:	JLP / MB
Weather Conditions:	Sunny
Temperature (shade):	10° C

CONDITION RATINGS	
4	Refer to RTA
3	Bridge Inspection
2	Procedure Manual
1	
NI	-Not inspected
NA	-Not applicable

Item	Component		Condition	Comments	Repairs Required	Photos
1.	Footings		NI	Pile caps - binocular inspection, OK		Photo 30
			NI	Abutment footings not visible		
2.	Abutment / Restrai	A	1	Full height vertical crack at girder G3		
			1	Diagonal drack between girders G3 and G4		Photo 31
		B	1	some stained cracking on shelf (plastic shrinkage cracks?)		Photo 32
			2	crack on back wall of abutment with leachate between girders G4 and G5	Monitor cracking	Photo 33
			1	water stains on back wall of abutment (water from expansion joint?)	Investigate source of water	Photo 34
			1	reparied vertical crack at girder G3		
			1	Diagonal crack in wingwall propigating from joint between shelf and back wall		Photo 35
3.	Batter Protection	Abut A	1	Some minor vegegation	remove vegitation	Photo 36
			1	Grafitti on batter slope	Clean Grafitti	
		Abut B	1	Some vegetation growth	remove vegitation	
4.	Piers / Restraints	1	1	Rope around bearing - should be removed	remove rope	Photo 37
			1	OK, binocular inspection		
		2	1	OK, binocular inspection		
5.	Girders	S1	1	grafitti on girders near abutment	Clean Grafitti	Photo 38
						Photo 39
		S2	2	Cracks in top of footpath slab over pier 2; road wearing surface OK	Monitor cracking	Photo 40
			2	evidence of crack (leachate) on soffit of girder G1 top flange at Pier 2	Monitor cracking	Photo 41
		S3	1	grafitti on girders near abutment	Clean Grafitti	
6.	Parapets/kerbs	N/S	1	Some damage to paint	repaint	
			1	some rust at barrier rail expansion joint		Photo 42
		O/S	1	OK (inspected from walkway below)		
7.	Railings	N/S	1	OK		
		O/S	N/A	N/A		
9.	Skirts	N/S	N/A	N/A		
		O/S	N/A	N/A		
11.	Wearing Surface		1	minor crack in top of footpath slab at pier 1		Photo 43
			2	a number of cracks in top of footpath slab have been filled in/repaired at pier 2	Monitor cracking	Photo 40
12.	Approach Slabs	Abut A	1	Some cracking of road surfacing at kerb lane at end of approach slab		Photo 44
			1	Some debris in expansion joint	Clear joint	Photo 45
			1	some damage/degredation of rubber in roadway expansion joint	monitor joint condition	Photo 46
		Abut B	1	some damage/degredation of rubber in footpath expansion joint	monitor joint condition	
			1	Some debris in expansion joint	Clear joint	Photo 47
			1	minor cracking in wearing surface at end of approach slab		Photo 48
13.	Drainage/Services		1	OK		Photo 39
14.	Light Poles		1	OK		Photo 49
15.	Miscellaneous		N/A	N/A		

Appendix C

Site Inspection Photos

Appendix C Site Inspection Photos

Sullivans Creek Bridge (North Bound)

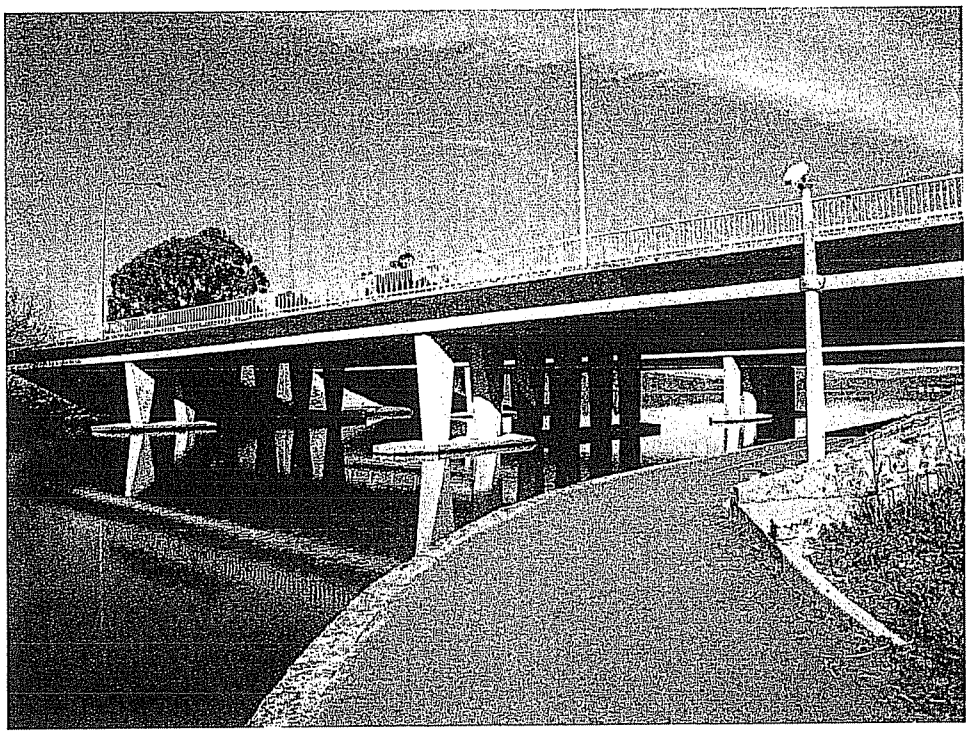
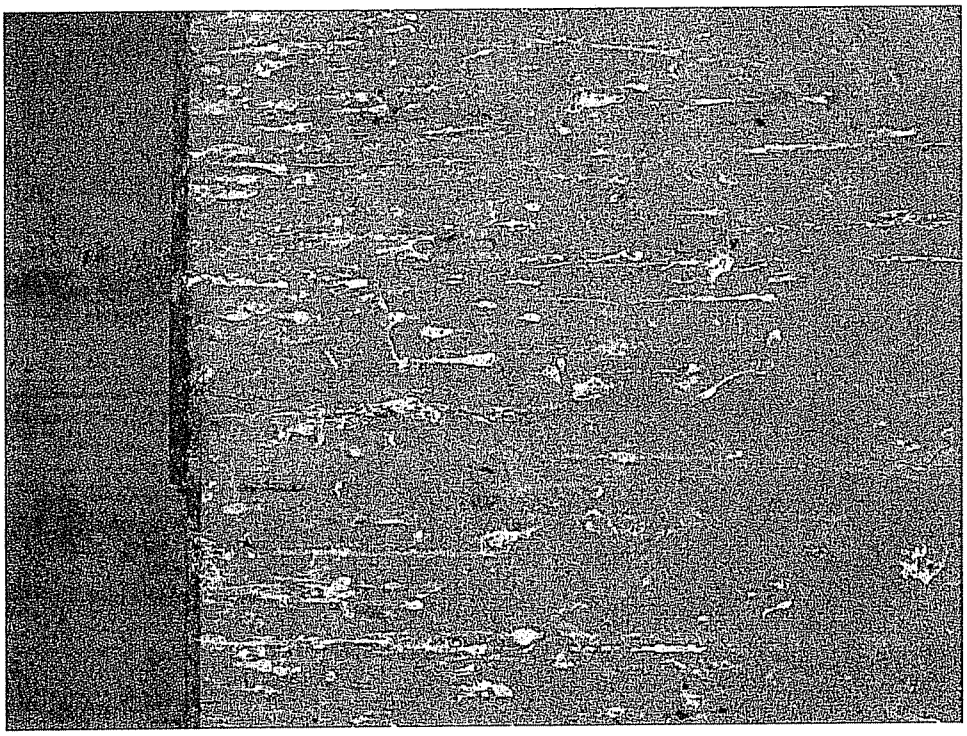


Photo 1



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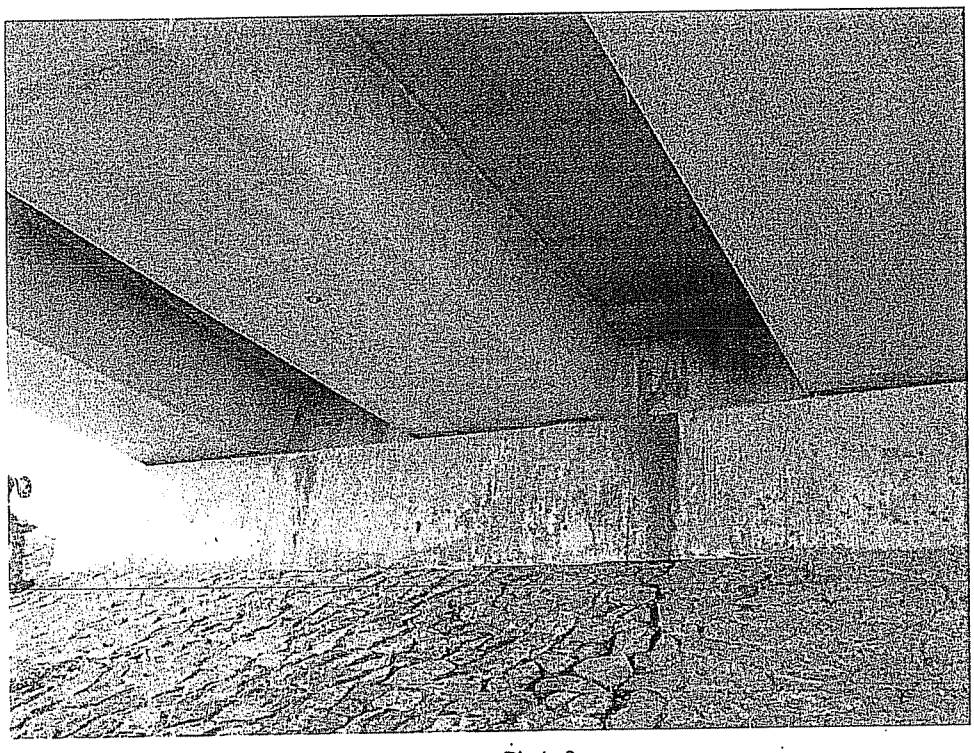

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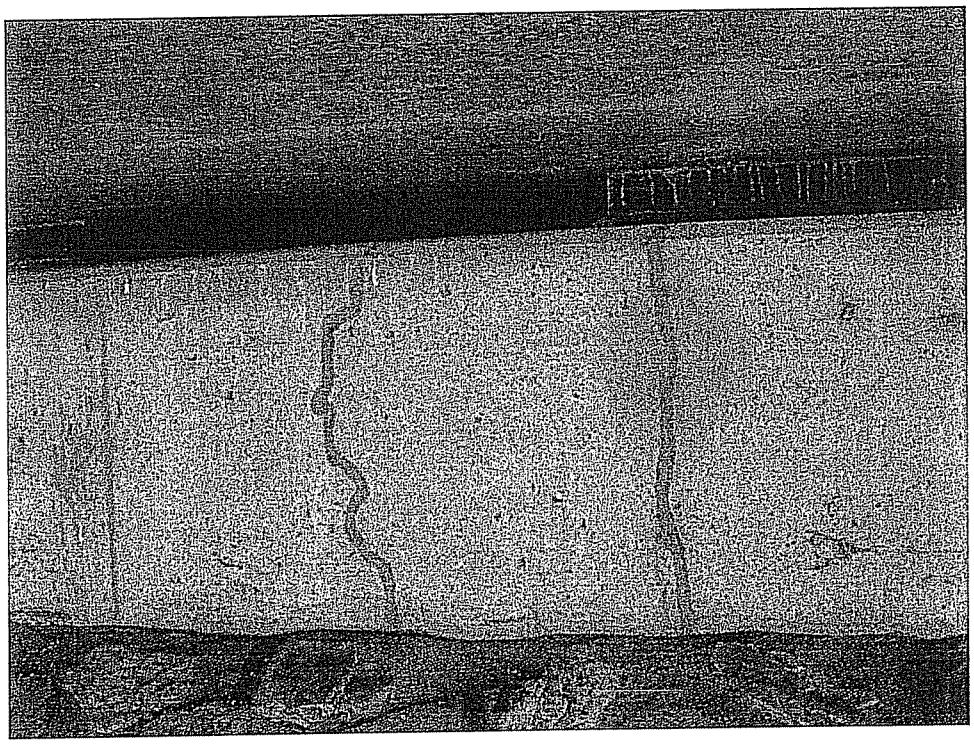


Photo 4

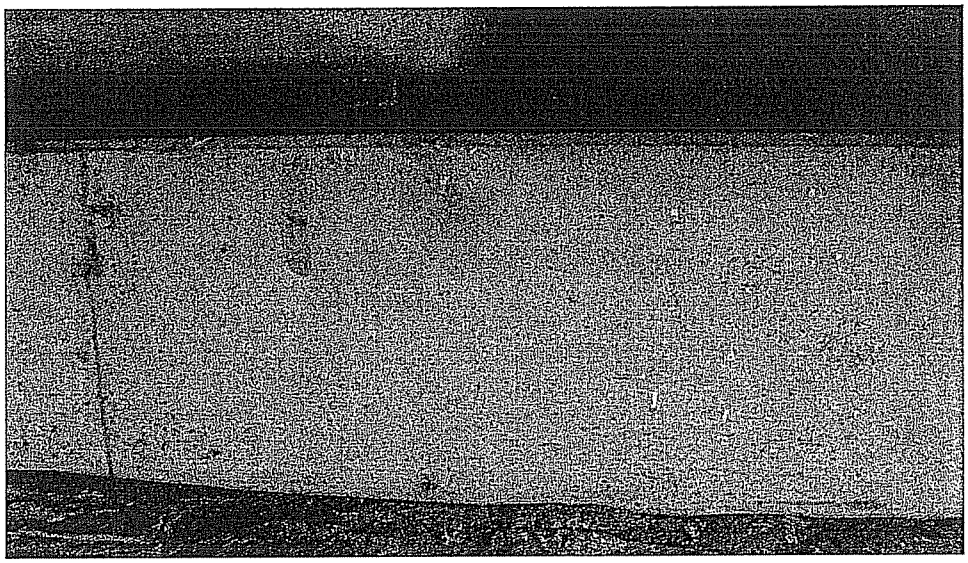


Photo 5

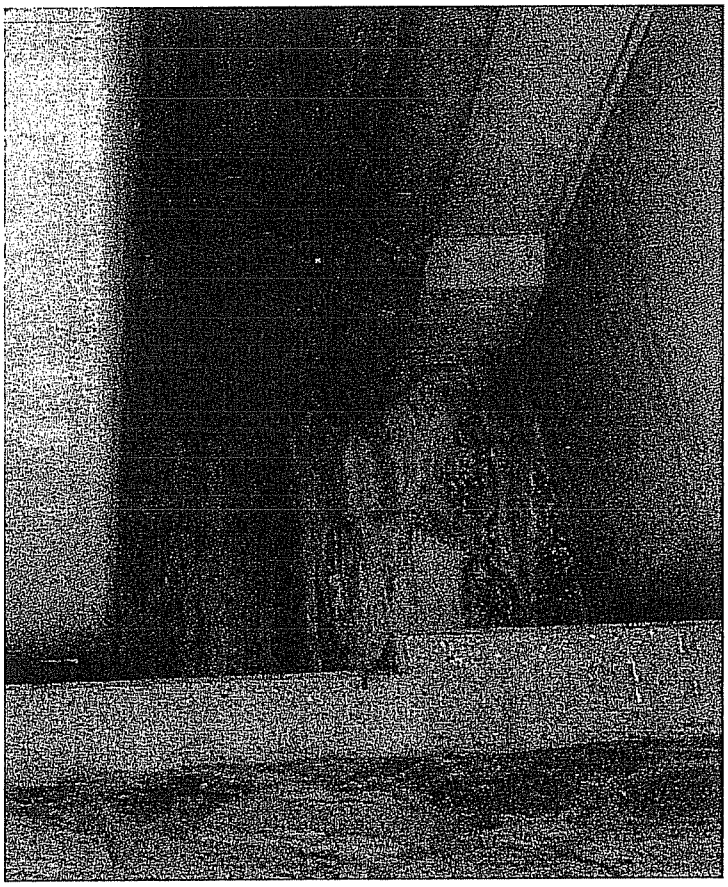


Photo 6

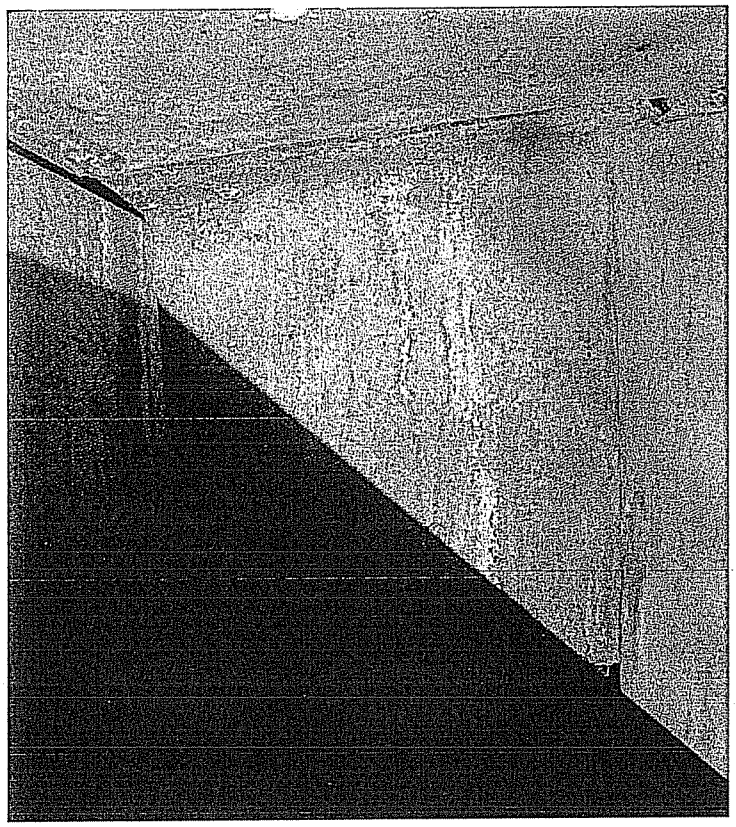


Photo 7

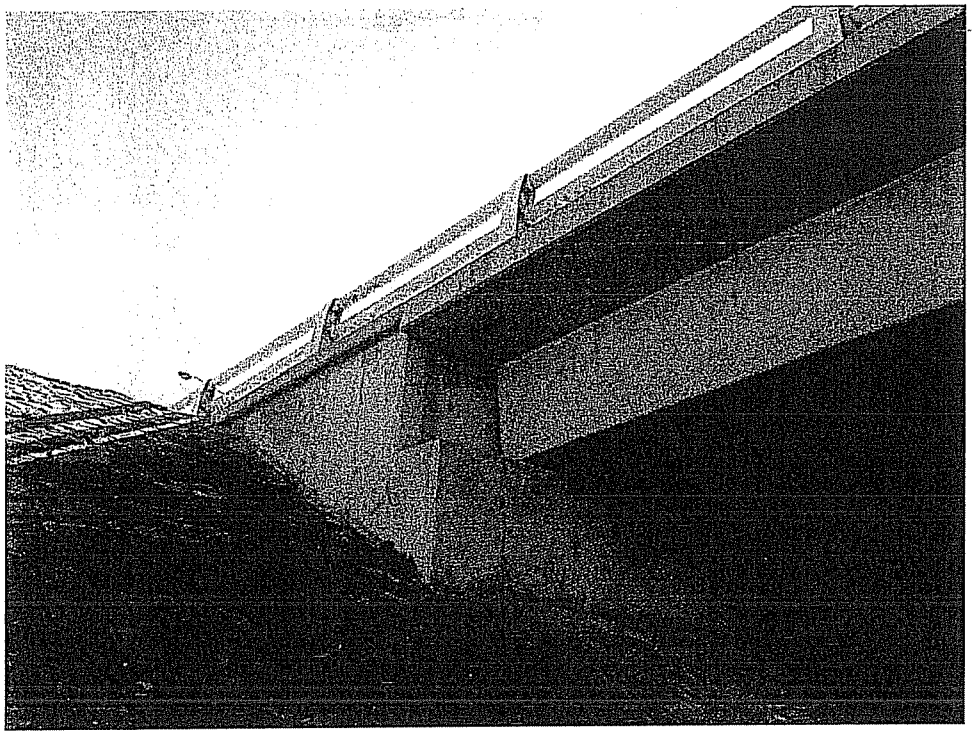
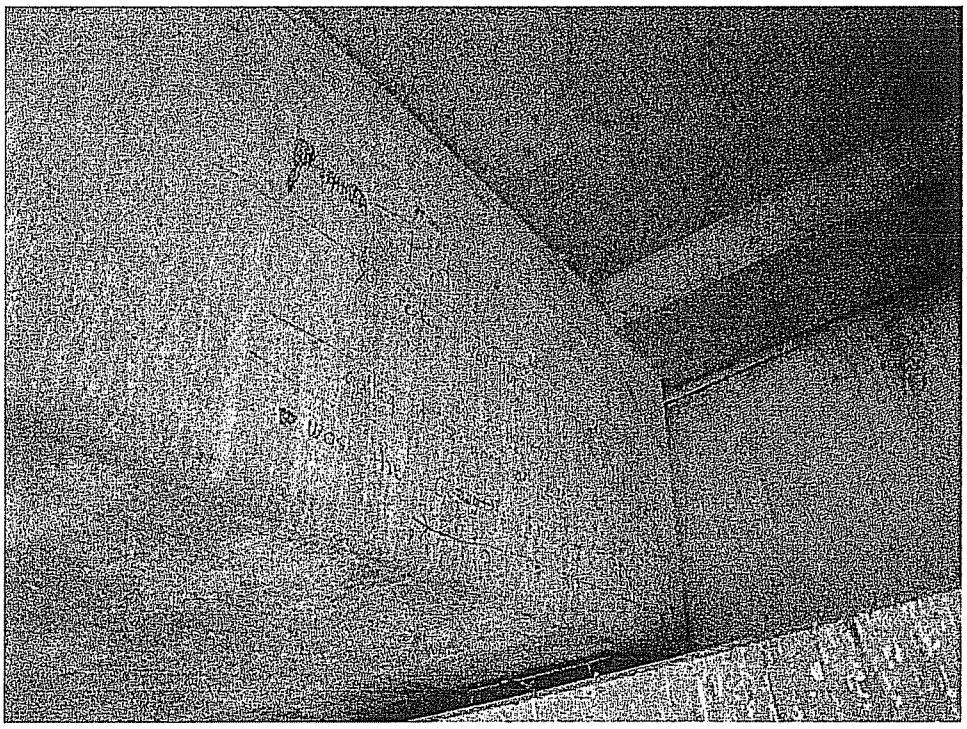


Photo 8



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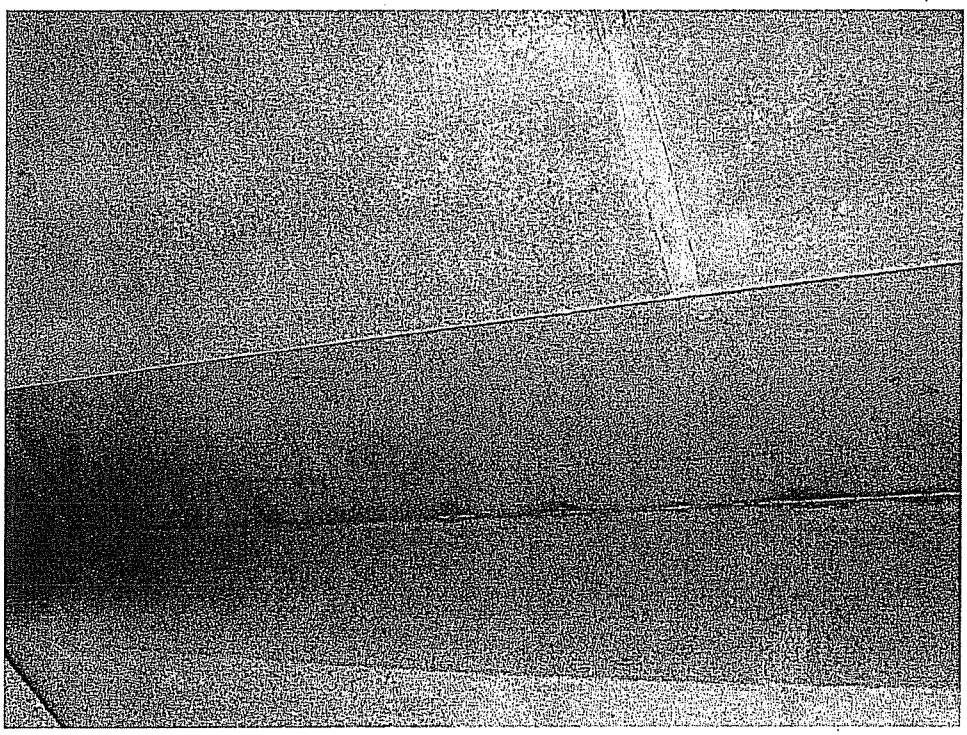

Photo 10

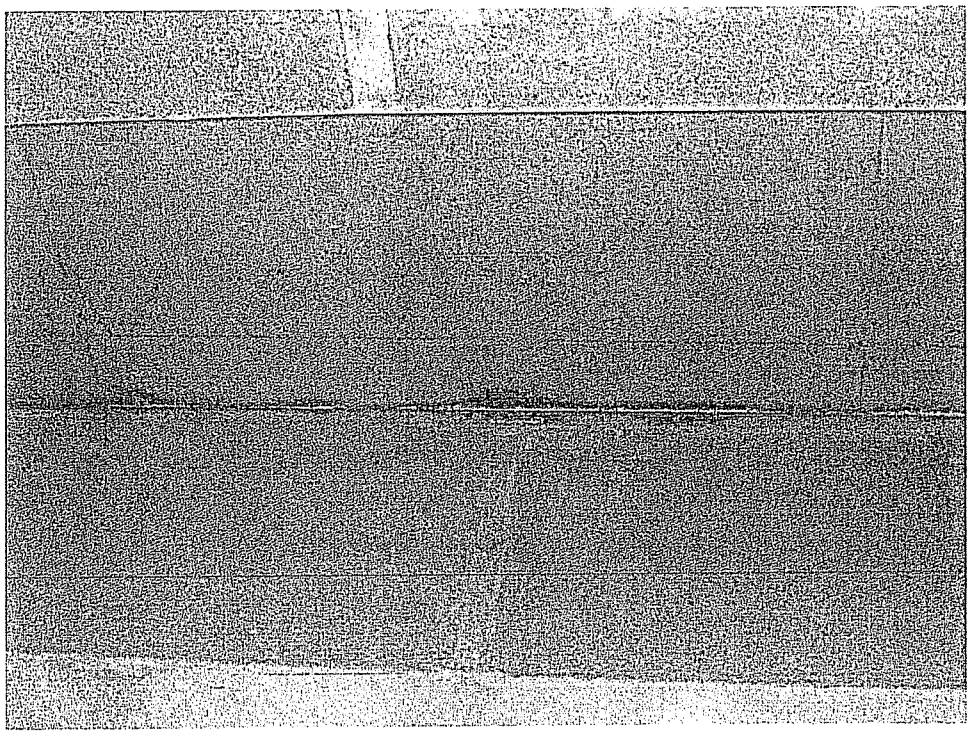

Photo 11

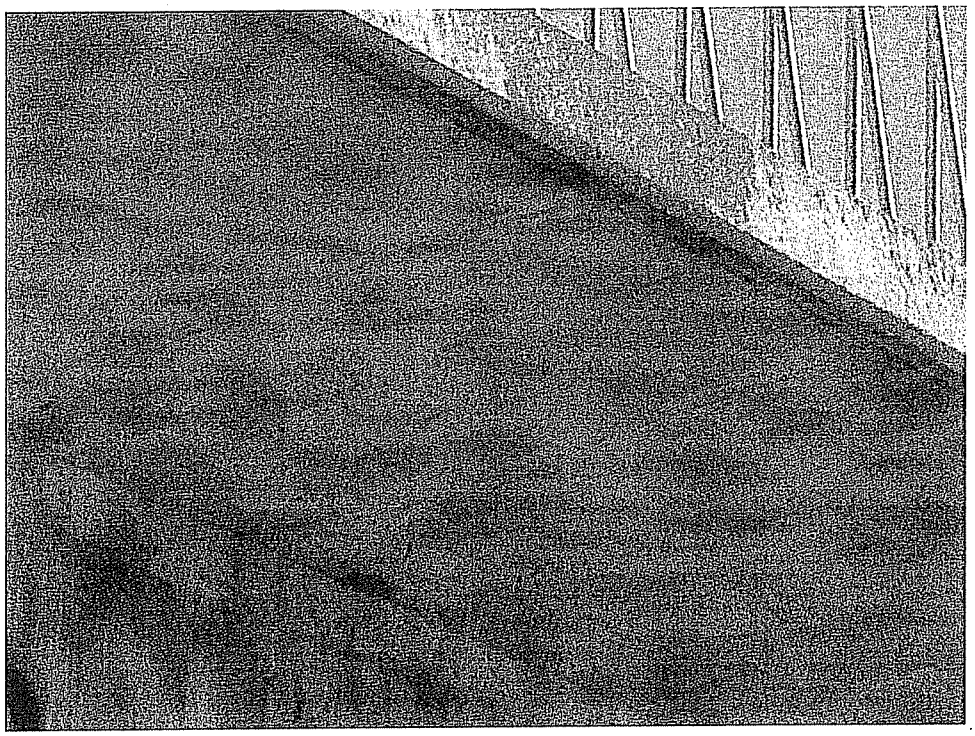

Photo 12