PN-ABS-580
ISN 90237

CONSTRUCTION CONTROL SERVICES CORPORATION

PESHAWAR

EVALUATION OF BAILEY BRIDGE
AT
ARUNDU

FINAL REPORT (PHASE-1)

PROJECT REPORT/DOCUMENT VOL.III

SEPTEMBER, 1990.

ASSOCIATED CONSULTING ENGINEERS ACE (PVT) LTD.

HIGHWAY & STRUCTURE DIVISION: 22-C/L, GULBERG-III LAHORE.11
1-C/2, M.M.ALAM ROAD GULBERG-III,LAHORE 11. PAKISTAN
10-BANGLORE TOWN SHAHREA FAISAL KARACHI 8.
ISLAMABAD-MAKKAH-RIYADH-ABUDHABI-TRIPOLI-KANO-TEHRAN-KUALALUMPUR

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REF. NO. H&S/295/706

DATE September 27, 1990

The Chief of Party,
Construction Control Services
Corporation (CCSC),
Peshawar.

Subject: EVALUATION OF BAILEY BRIDGE AT ARUNDU
FINAL REPORT (PHASE - I)

Reference: Your letter dated September 25, 1990

Dear Sir,

Thank you very much for according approval to the subject report through your letter under reference.

As desired, we are enclosing herewith Seven (7) copies of the **Final Report** (Phase-I) after incorporating the "Summary Report" on the ACE stationery as required by CCSC.

This completes all our assignment which is limited upto Phase-I only of the Agreement.

Thanking you and assuring you of our best professional services,

Yours faithfully,

(Sh. Shahid Iqbal)
Project Manager

Encl: As above

SMH/SSI/sf

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REF. NO. ....

DATE July 15, 1990

STATEMENT *

I, S. Manzer Husain, Senior Technical Director, state that the contents of this report are true and accurate, and has been accomplished in accordance with the applicable, recognized standards and methods. I accept professional responsibility therefore.

(S. MANZER HUSAIN)
SENIOR TECHNICAL DIRECTOR
For and on behalf of
Associated Consulting Engineers ACE (Pvt) Ltd. Lahore

* This statement is furnished under Clause V-h of Section A-III of the Contract Agreement

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PART - 1

MAIN REPORT

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SUMMARY REPORT

1.0 GENERAL

i) The structure under evaluation is a 180 feet span, Double-Double Chord M1 reinforced Model Bailey Bridge, erected at Arundu in September 1989. The claimed load rating of the bridge - stated by the supplier is HS 20.

ii) The year of manufacture of the main bridge truss panels is reported to be 1951.

iii) Pre-shipment inspection of the consignment or "an adequate evaluation of the Bridge" was not accomplished prior to the procurement.

iv) Corrosion on various main bridge truss panels was noted which raised doubts about the adequacy of the entire structure.

v) Considerable discussion and thinking was done on this subject. It took time to convince the GOP personnel that the bridge - delivered (in that condition) is "buildable". However, in the absence of hard evidence suggesting that the bridge was unsafe, the erection was carried out, - probably based on the supplier's warranties.

vi) After the erection of the bridge at site, CCSC arranged for "Strength Evaluation of Existing Structure" about which this report provide the details.

vii) The present report caters for the Phase-I studies, comprising the following:

a) Analyses of the entire structure based on the Finite Element Method using a standard package computer programme (details in Chapter-2).

b) Load testing of three representative panels from the launch nose assembly panels - available in the CCSC godown, Peshawar. (details in Chapter-3).

c) Visit to the existing bridge site at Arundu, to perform "Condition Survey" of the structure and collect Coupons for physical and chemical testing (details in Chapter-4).

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d) Physical and chemical test on about 30 coupons performed in laboratories at Lahore (details in Chapter-5).

e) Evanation of the safe/permissible vehicle load class on the bridge (details in Chapter 6&7).

2.0 STRUCTURE ANALYSES

i) Analyses was carried out for entire structure based on the Finite Element Method. Various vehicle load class was studied (HS 20, H 15 etc.) to find the dead and live load forces caused in different members.

ii) Structure Analyses for AASHTO H 20 vehicle load class - the heaviest vehicle, has shown that the deflection of the as-built structure, under the dead and live load remains within permissible limits and that the dead load force in the chords are a major component of the total (= 60.5 K).

3.0 PANEL LOAD TESTING

i) Two panel load tests were conducted at the University of Engineering and technology Laboratories Lahore as under:

- Test No.1: Single panel loaded at the top chord as shown in Figure 3.8. The test was terminated at 23,000 Kgf load due to excessive out of plane movement of the panel frame at this load.

- Test No.2: Two panels tested simultaneously in compound form as shown in Figure 3.10. The system stopped resisting further loading at 40,500 Kgf indicating failure. However, the failure was initiated at a load of 19,500 Kgf.

ii) Absence of linear elastic behaviour in panel test No.2 since the early stages of loading, indicates that the panels were subjected to the bottom chord loading previously.

4.0 CONDITION SURVEY AND SITE VISIT

i) The Average Annual Daily Traffic (AADT) on the Bridge is considered to be fairly less.

ii) Condition Survey of the Existing Structure, carried out by the Consultant's team, has indicated considerable corrosion and evidence of fatigue/use of panel members previously as explained hereunder. Other superstructure components and masonry abutments are in good condition.

iii) Cracks in the welding and/or repairs to the existing welding was noted on some panels - especially at the transom seat. This is considered to be an evidence of fatigue or use of the members previously in a Bridge structure.

iv) Excessive pitting/severe corrosion on transom seat of various panels as witnessed during examination of Bridge at the site is considered to have been caused by the ingress of water into the small interface gap between the transom and the seat in an earlier bridge structure, viz. evidence of previous use.

v) Protective paint and absence of corrosive environment on the Existing structure shall however, limit the corrosion fatigue effects on the Existing Structure.

5.0 CHEMICAL AND PHYSICAL TESTING

i) One panel was weighed at UET Laboratories Lahore. The weight of the panel was about 261.0 Kg = 575 lbs. No deduction is made for any coating/film of enamal paint applied recently. This is considered to be in agreement with [1].

ii) Chemical and physical testing of the coupon material - carried out in Laboratories at Lahore comprised the following:

- Chemical testing;
- Tension testing;
- Magnaflux testing;
- Macroscopic examination;
- Shaping operation;
- Boring operation; and
- Ultrasonic testing

besides, tension test was conducted on 3 pins.

//

iii) Chemical and physical testing of the material coupons has indicated that the material complies with ASTM A 572 and A 588. However, as neither of these standards was in force in 1951 - the year of manufacture of the panels, the material may be said to be near to these standards. Overall, the material is high strength, low alloy steel having necessary notch toughness and recommended for use in Bridge Structures.

iv) Three panels transported to Lahore were got examined by a Corrosion Expert has confirmed the findings listed in para 5-iii above. However, severe corrosion of transom seat and bolt head is considered to have been caused due to the ingress of water as explained above.

6.0 FATIGUE STRENGTH OF THE MEMBERS

i) The condition of panel No.9 and 18 in the top storey of truss No.III (ref. Figure 2.2) is considered to be the worst. The "fatigue strength" of members is based on the condition of these panels.

ii) On the basis of physical and chemical testing and other test results the fatigue limit of the member is calculated on the assumption of 500,000 to 750,000 stress cycles completed by the structure members.

7.0 FINDINGS

i) Based on the findings/results of the above tests and studies, the Existing Structure configuration is considered incapable of withstanding AASHTO HS 20 Loading. The analyses suggests that the bridge can be subjected to a maximum wheel load class equivalent to H 15 Truck loading as shown in Figure 2.9 or H 18 with caution, viz. maintaining near zero speed.

ii) Even with the panels available in the present number (including those used in the launch nose assembly) and condition, the Bridge strength could be improved by better planning/management viz. best chosen panels w.r.t. chord condition, used in bay 5 to 12 (inclusive).

CHAPTER - 1

INTRODUCTION

CHAPTER - 1

INTRODUCTION

1.1 BACKGROUND

A steel "Bailey Bridge" was procured by AID in mid 1989. It was erected over the Kunar River at Arundu, in the south of Chitral district. The clear span of the bridge is 180 ft from abutment to abutment. The bridge is a double-double chord M-I reinforced model. The design loading as reported by the supplier is HS 20. Some of the bridge structural members supposedly had been in storage for many years, and corrosion of various structural members was noted which resulted in the adequacy of the as-built bridge being suspect.

This raised questions about the bridge's material properties and safe loading, which required thorough investigations.

1.2 CONSULTANCY AGREEMENT

In Dec. 1989, CCSC, issued a request for quotation (RFQ), seeking technical and financial proposal for the evaluation of the existing structure. In the response a comprehensive proposal was submitted by ACE, which was accepted by the CCSC. In March 1990, the CCSC entered into an agreement with ACE for the evaluation work, following which a "Notice to Proceed" was issued by CCSC, allowing ACE specific time period to complete the job.

1.3 SCOPE OF SERVICES

The work is envisaged to be accomplished in two phases, as follows:

- Phase-I: To determine mathematically and analytically the load carrying capacity of the Bridge now in-place.

- Phase-II: Load testing of the bridge in-place if considered necessary.

As indicated in the title cover, this report relates to the phase-1 of the contract and discuss/explains the approach and method adopted and/or various operations done, procedures/measures adopted in the following:

a) Structural analysis of the entire bridge structure in the design office.

b) Load testing of 3 representative samples from the launch nose assembly in laboratory at Lahore

c) Visual inspection and condition survey of the existing structure and collection of coupons from the existing structure, during the site visit.

d) Chemical and physical testing of coupons in laboratory

The "Consultant's Report" summarises the findings of all the above studies.

1.4 PANEL OF EXPERTS

In order to strengthen their capabilities to deal with the various studies and involved testing the Consultants associated two professors from the University of Engineering and Technology Lahore and a professor from the Punjab University, Lahore which comprised the Consultants "Panel of Experts" for this study. The contributions of the members of the POE - in the form of suggestions and review comments has rendered invaluable assitance in the compilation of this report and drawing the conclusions of the various studies and testings undertaken by the Consultants.

1.5 FORMAT OF THE REPORT

The following two documents have been submitted earlier by the Consultants:

1. Report on Computer Analyses - Project Report/ Document Volume-1

2. Interim Report on Panel testing - Project Report/ Document Volume-11

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The report is written in a form and style so as to be self consistent, viz. reference to other project report/documents submitted earlier and superceded by this document is not required.

1.6 REFERENCES

In Appendix-1 various Standards/Books and other documents have been listed which were referred by the Consultants. Reference to any document, in this report is mentioned in a box [] bracket, with only the Sr. No. mentioned there against that document/reference.

CHAPTER - 2

COMPUTER ANALYSIS

CHAPTER - 2

COMPUTER ANALYSES

2.1 PREAMBLE

As envisaged in the Technical Proposal, analyses of the entire Bailey Bridge Structure were carried out on computer using a package program SAP - developed by the University of California Berkeley. Details of the analyses are given below.

2.1.1 Description of the Structure

The structure comprises of 18 double-double M-1 Truss Panels on each side, as shown in the Key Elevation (Figure 2.1) and Section (Figure 2.2). Panels 2-17 (inclusive) are reinforced at top and bottom chords by an additional channel (Figure 2.1).

2.1.2 Modelling of the Structure

The structure is modeled as shown in figure 2.3. In the true sense of the words, the program distinguishes a 'Frame Element' from 'Truss Element' only from the fixity conditions which is given to be those, applicable for 'frame Elements' (except for the 'Pin Joints').

2.1.3 Input Parameters

The salient input parameters is given in Section 2.3. For HS 20 truck configuration refer Figure 2.6

2.1.4 Output and Forces

In the input 2 loading conditions have been given:

Condition 1: Dead load of the structure
Condition 2: Live load from HS 20 truck (except Case C)

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The output accordingly provides the results for each of the two loading conditions separately. The total force (in kips) in any member in the service condition of the structure, is the sum of both the forces, (in kips).

Three more analyses were carried out after the submission of the "Report on computer analyses" - May 1990", as follows.

A) Ideal structure in which the member properties correspond to that of ideal/new bridge panels viz without loss of cross sectional area of any member. But loading points is only one in each panel near the female end, as shown in construction drawing.

B) Actual structure wherein the area and moment of inertia of chord members reduced to 0.75 of the ideal structure to account for corrosion.

C) Member properties same as B, but H 15 Loading (Refer Figure 2.9 for H 15 Loading) applied instead of HS 20.

The total forces for the ideal structure (case A) are shown in Figure 2.8 in red in paranthesis. Numbers below shows values in case B.

2.2 KEY ELEVATION OF BRIDGE

The following 3 figures are provided to show the structure configuration:

Figure 2.1: Key elevation of Bailey Bridge Structure as given in the Construction Drawing No. 890606 of July 1989

Figure 2.2: Cross-section of Structure/End Elevation

Figure 2.3: Half Computer Model showing nodes and element numbers, (given in circle)

Figure 2.4: The reference axes is shown in this figure

2.3 INPUT PARAMETERS

2.3.1 Programme

SAP - University of California - Berkeley.

2.3.2 Output File

STRUCTI : F3F (for case - A).

2.3.3 Plane of Analysis

X-Y (Refer Figure 2.4).

2.3.4 Loading Conditions: DL & LL

1. DL = Self wt.of Truss + Dead Load from other bridge components (runners, transom, bracings etc.)

2. LL = One HS 20 Truck (Ref. Figure 2.6) considered in the centre of the bridge (i.e. C.G. of Load System nearly coincides with the centre of the span refer Figure 2.7).

Impact considered 20 percent of the axle load and added into LL

2.3.5 Fixity Conditions

- All panels have been considered as individual frames and their joints as rigid joints.

- The "Panel Connecting Joints" (Pin Joints) treated as Truss Joints with rotational restraint:

Fixity Conditions

Desc.	Translation X	Translation Y	Translation Z	Rotations X	Rotations Y	Rotations Z
Panel Joints	0	0	1	1	1	0
Pin Joints	0	0	1	1	1	1

2.3.8 Member Properties

Member Type	Example (ref. fig. 2.3)	Moment of Inertia (in 4)	Area (in Sq.)	Weight (Kip/in)	Mod. of elasticity (Kip/in. Sq.)
1.	1,2,103 & Like + (chord of truss in bay 1 & 18)	9.18	4.26	0.001208	30,000
2.	49,50,51 & like * (chord of truss in other bays)	52.44	8.52	0.002417	30,000
3.	342,343,445,515 & like * (bracing members)	0.197	1.21	0.000333	30,000
4.	47,48,53 & like * (male/female members)	14.03	10.52	0.002983	30,000

\+ Top/bottom chords of panel 1 and 18
* Also refer Figure 2.8

2.4 REFERENCE FIGURES

The following figures are presented to clarify the structure model:

Figure 2.5: Elevation of typical panel truss. This shows a typical truss panel, as manufactured/assembled by the Bailey Bridge Co. The dimensions of different members is also given. Reinforcing to the top/bottom chord - as provided in panels 2-17 (inclusive), has therefore not been shown.

Figure 2.6: Standard HS 20 Truck

Figure shows configuration of HS 20 truck V' as shown is taken to be 14 feet.

Figure 2.7: Magnitude and Distribution of the HS 20 truck axle loads.

Figure 2.8: Total Member Forces (in kips) for Panel 9 and 10. Values in red shows the sum of forces arrived in 2 loading conditions, (Dead and Live) viz. the total force in member in kips (Ref. Section 2.3)

Figure 2.9: Standard H 15 Truck

Figure shows configuration of Standard H 15 truck.

Table 2.1 provides comparison of total (vehicle) loads for different AASHTO Standard trucks.

Table - 2.1

Truck Loads
(as given in [3])

S.No.	Desgn.	No. of Axles	Total Load (K)	Ref. Figure
1.	H 15	2	30	2.9
2.	H 20	2	40	-
3.	HS 15	3	54	-
4.	HS 20	3	72	2.8

2.5 DEFLECTIONS

The observed deflections at the central critical points are given in Table 2.2 below:

Table - 2.2

A. Ideal Structure (Refer 2.1.4 A)

Sr. No.	Nodes No.	Deflection (inches) D.L.	L.L.	Total
1.	47	2.06	1.25	3.31
2.	53	2.09	1.30	3.39
3.	59	2.06	1.29	3.35

B. Actual Structure (Refer 2.1.4 B)

4.	47	2.67	1.67	4.34
5.	53	2.71	1.69	4.40
6.	59	2.67	1.64	4.31

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The complete output of the displacements and rotations at each joint, (for the ideal structure) is given in Appendix-II. The values on Page 1 to 8 inclusive, correspond to the Dead Load case and on Page 9 to 16 inclusive, correspond to the Live Load case. The total deflection is the sum of the two.

2.6 MEMBER FORCES

An output of file F3F viz. Member Forces, of the ideal structure as given by the Program in the end is provided in Appendix-II page 17 to 115 - inclusive. The output should be read with reference to figure no. 2.8 (for node and element members):

-ve = compressive force
+ve = tensile force

The results of 2 critical panels no. 9 and 10 is shown in Figure 2.8. The corresponding values for the actual structure is given in paranthesis. Deflection/y-translations of critical nodes is provided in Section 2.5 above.

A resume of forces in critical members for case B&C is provided in Table 2.3 for ready comparison of HS 20 and H 15 Loading.

2.7 DISCUSSIONS

2.7.1 Observed Deflections

For the result of the analyses to be acceptable, it is necessary to check the "Translations" in each loading case - especially the "Y-translations/deflections". In Section 2.5, observed deflections for the critical points is shown for both cases (A & B), and is found to be within acceptable limits viz. not exceeding span/300 (= 7.2 inches). Deflections in case C is lesser.

2.7.2 Limitations of Computer Analyses

Fact remains, however, that a computer model is based on the idealization of the structure system. Various options were tried on different models to simulate the conditions. It is especially for the "reinforced chord panels" (reinforcement held by collar chord bolts) not provided in the program to truly model that arrangement. Therefore the actual prevailing forces in the members can differ, somewhat, from those calculated by the program.

TABLE 2.3

Summary of Approximate Forces on Critical Chord Members

Sr. No.	Member No.	Panel No.	Location	Forces (Kips)					
				Case B			Case C		
				DL	LL	Total	DL	LL	Total
1.	50	9	Bottom Chord	59.0	45.5	104.5	59.0	19.3	78.3
2.	51	9	-do-	59.0	45.5	104.5	59.0	19.3	78.3
3.	52	9	-do-	60.5	47.7	108.2	60.5	21.0	81.5
4.	262	9	Top Chord	- 59.0	- 45.5	- 104.5	- 59.0	- 19.6	- 78.6
5.	263	9	-do-	- 59.0	- 45.5	- 104.5	- 59.0	- 19.6	- 78.6
6.	264	9	-do-	- 60.5	- 47.7	- 108.2	- 60.5	- 21.0	- 81.5

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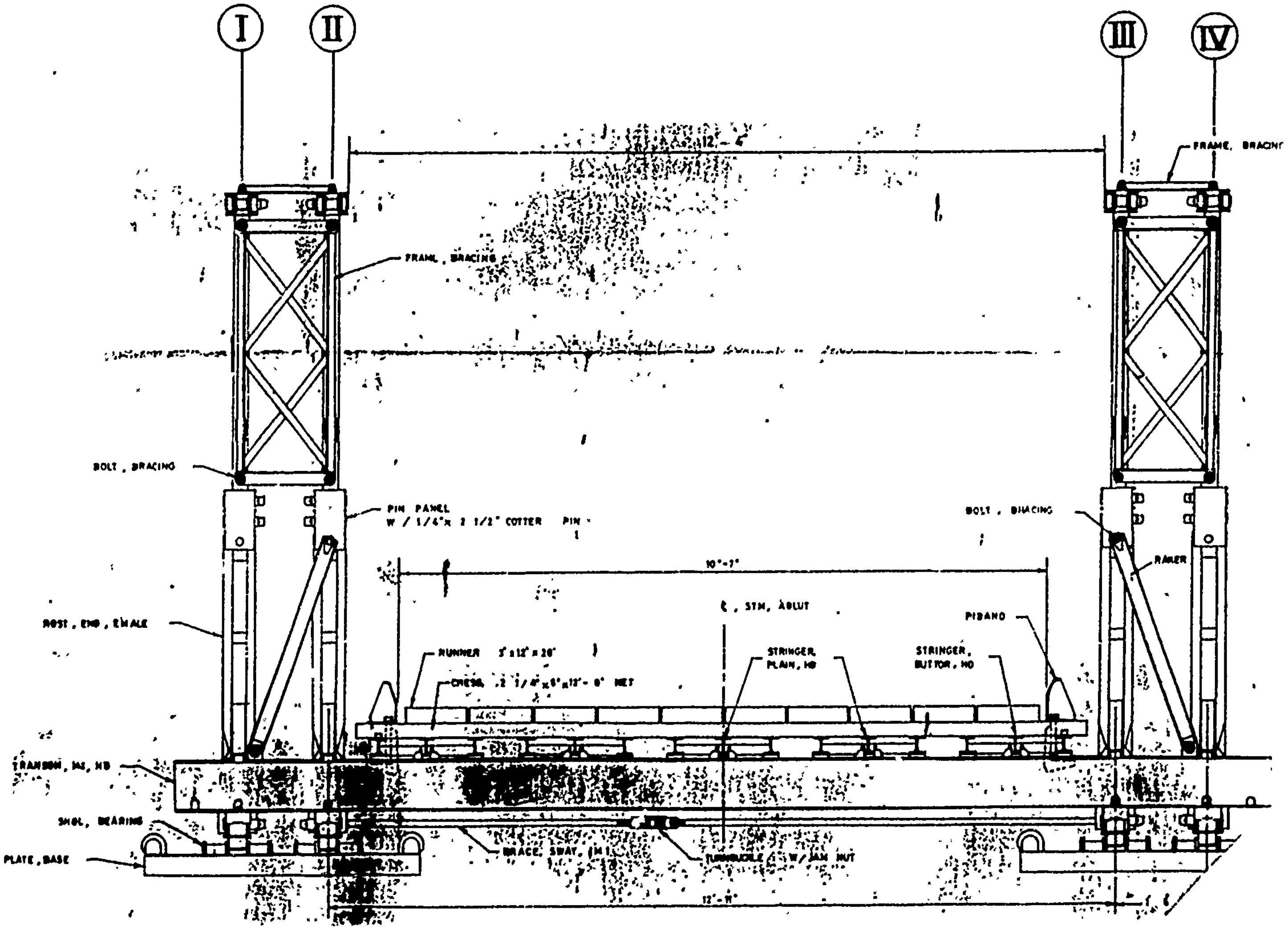
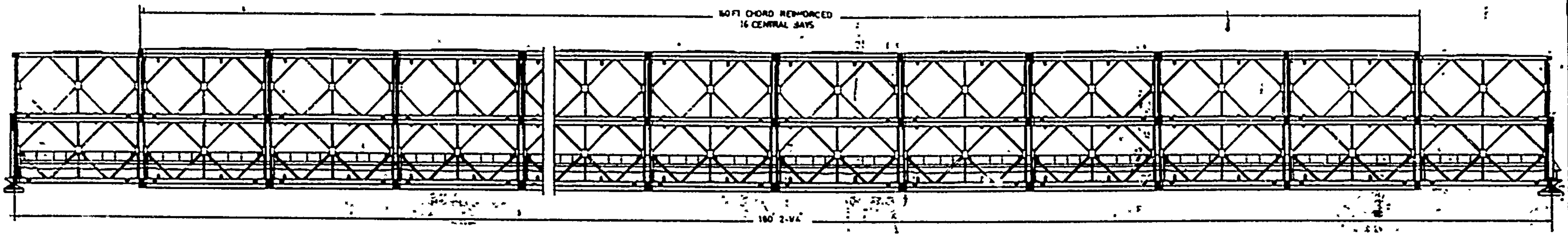
FIG. 2.2



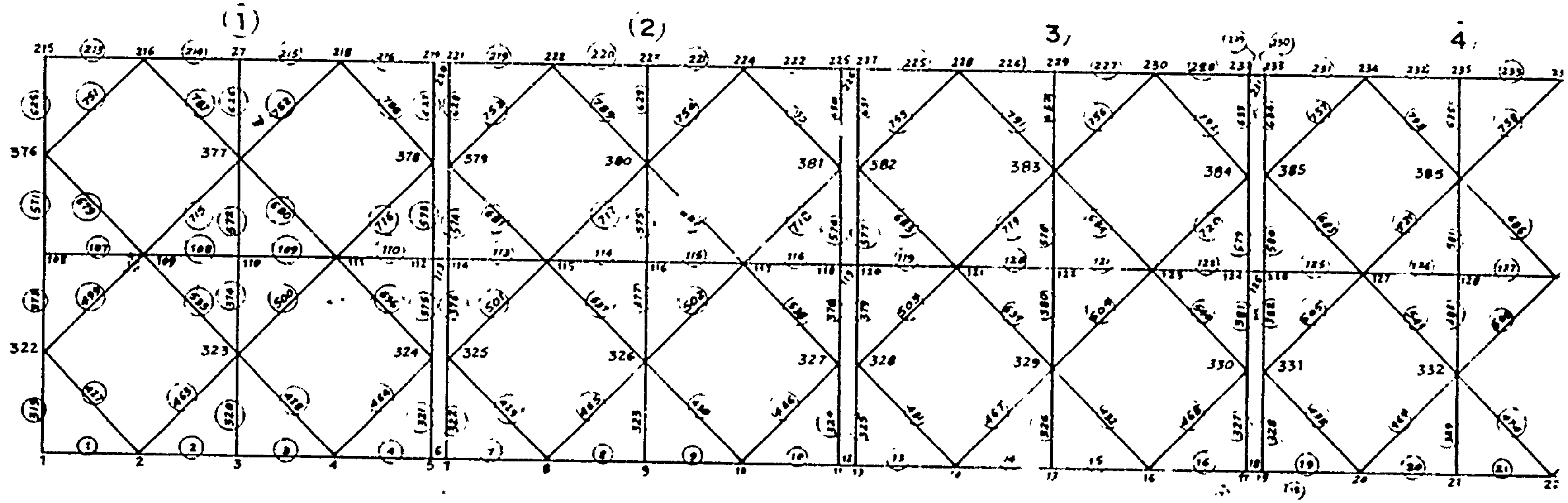
END ELEVATION
X-SECTION

FIG. 2·1



KEY ELEVATION OF BRIDGE STRUCTURE

26


(1)
(2)
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4
376
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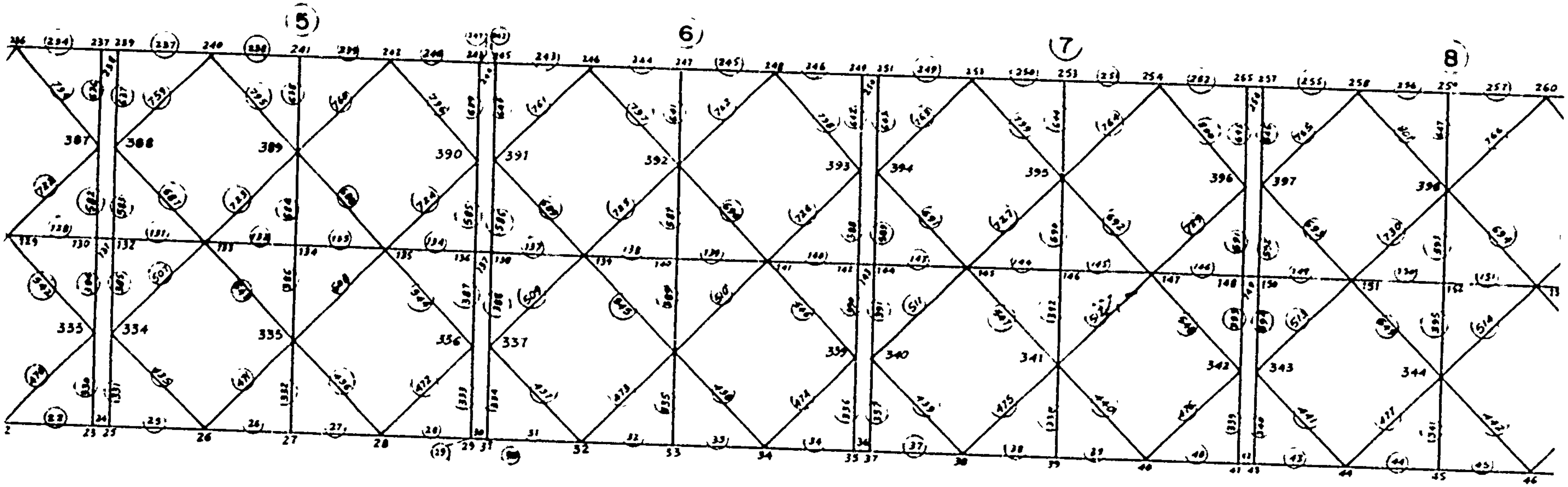
332

HALF COMP



UTER MODEL FOR ANALYSES ON SAP

FIG. 2-3

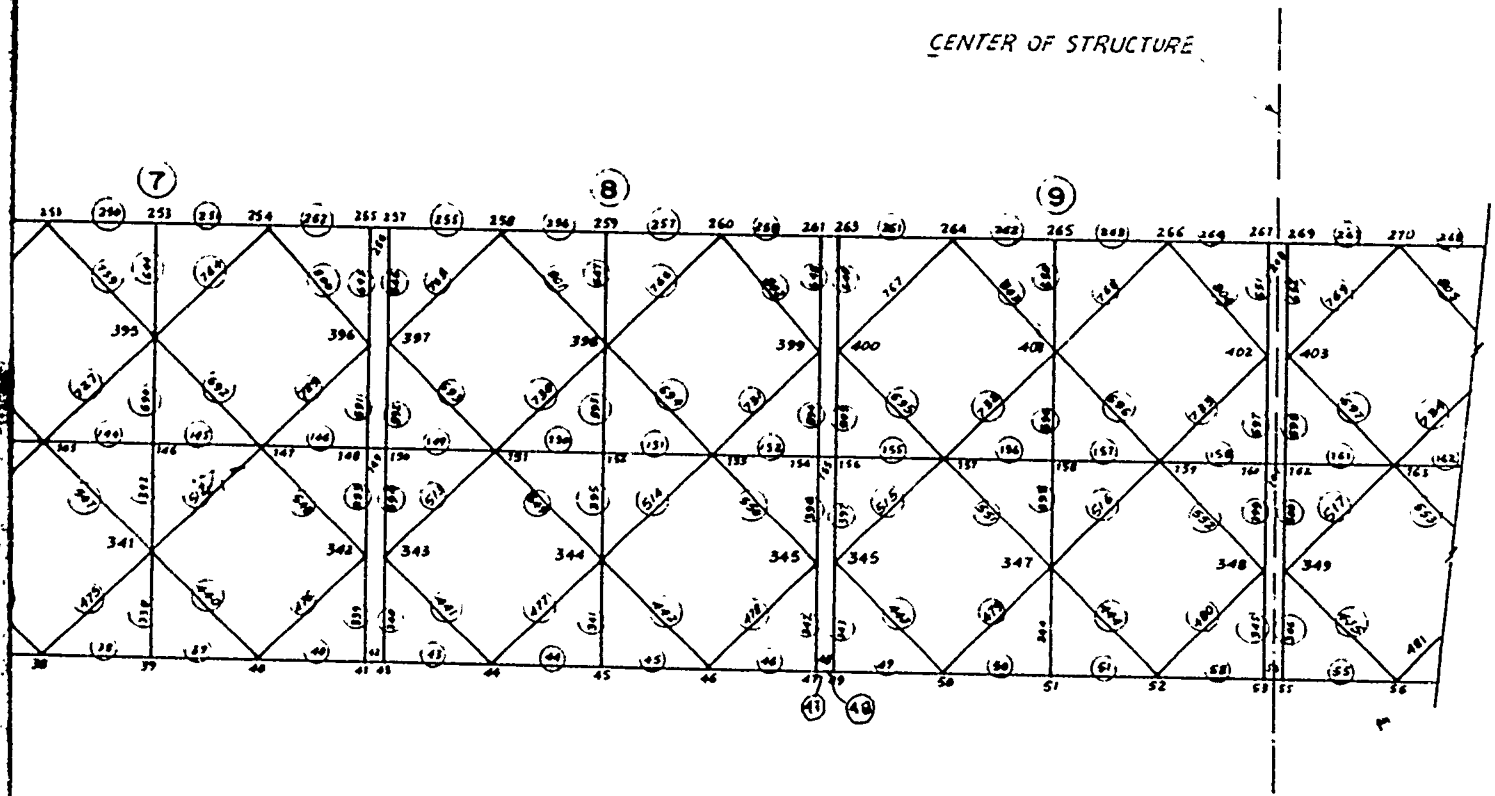
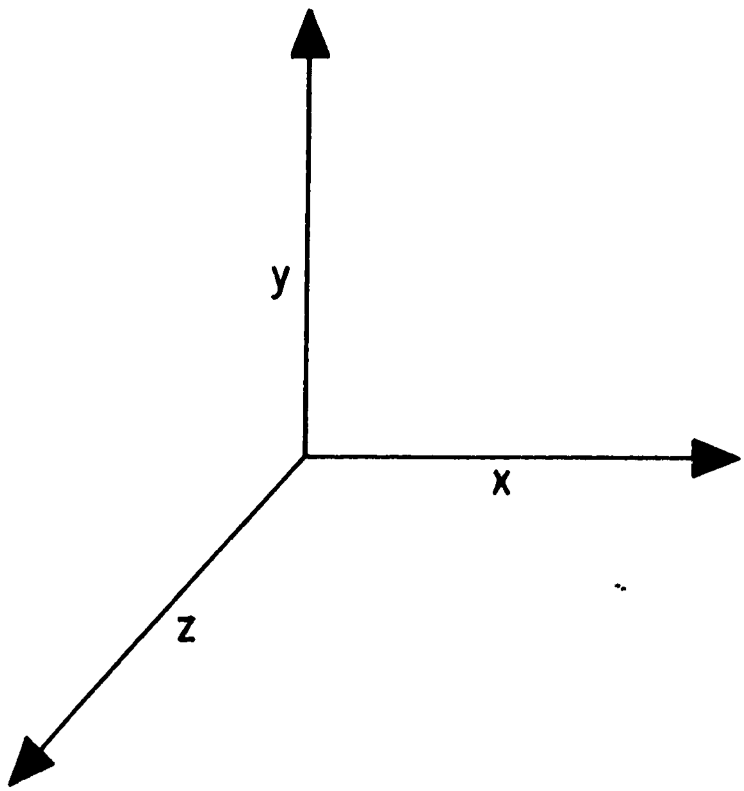
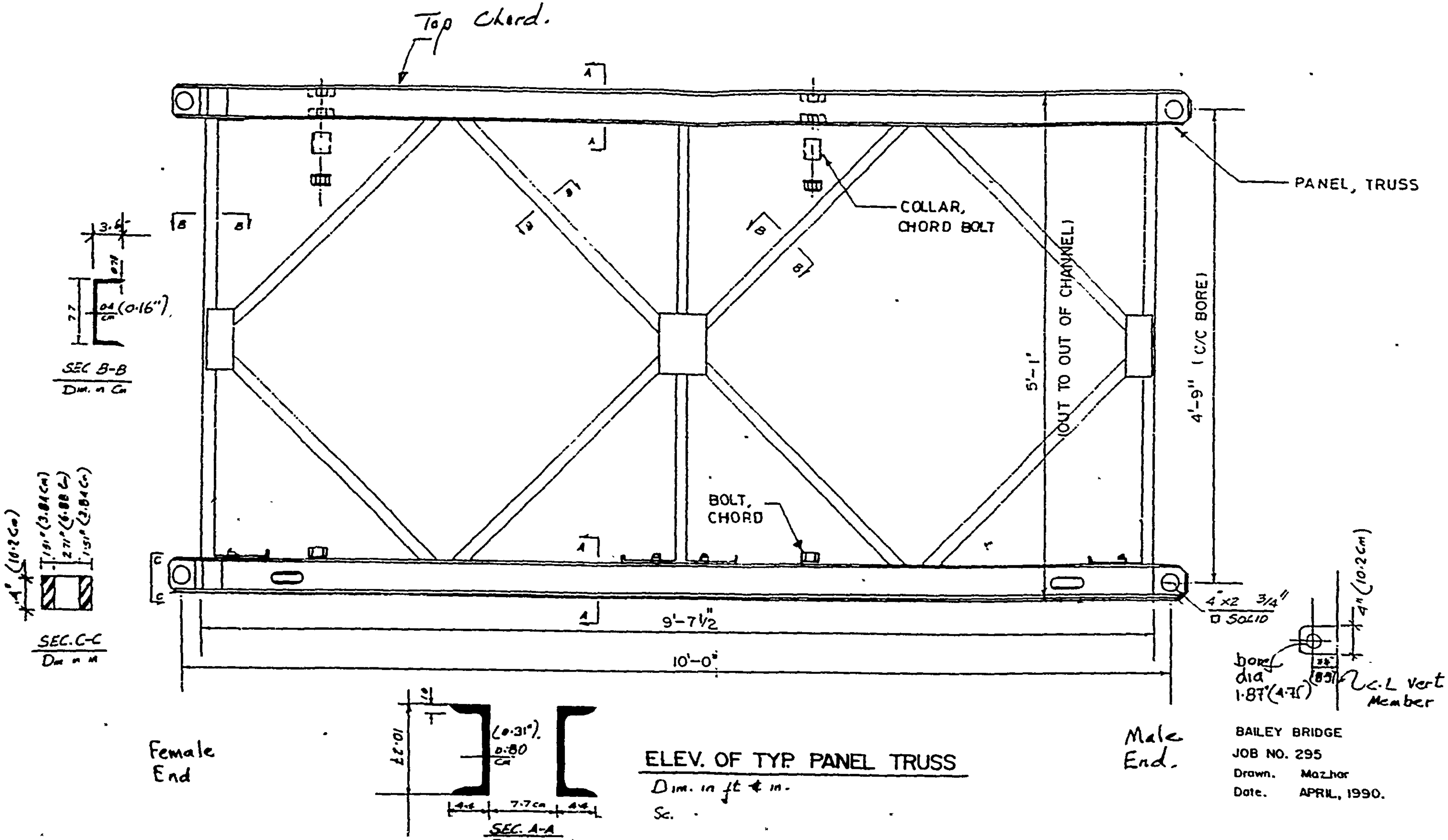


FIG. 2.4



REFERNCE AXES

FIG. 2.5



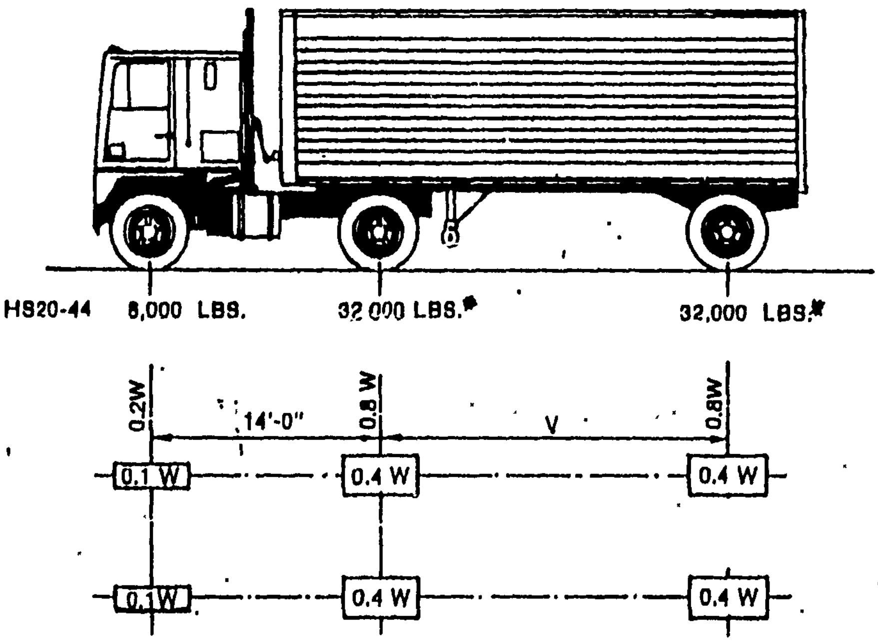
ELEV. OF TYP. PANEL TRUSS

Dim. in ft & in.

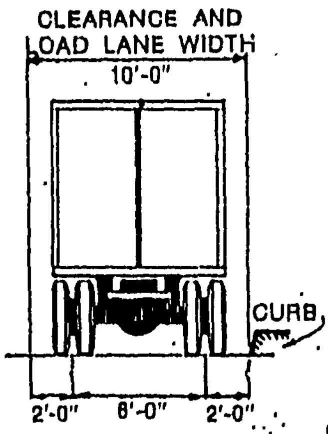
Sc.

BAILEY BRIDGE
JOB NO. 295
Drawn. Mazhar
Date. APRIL, 1990.

FIG. 2.6



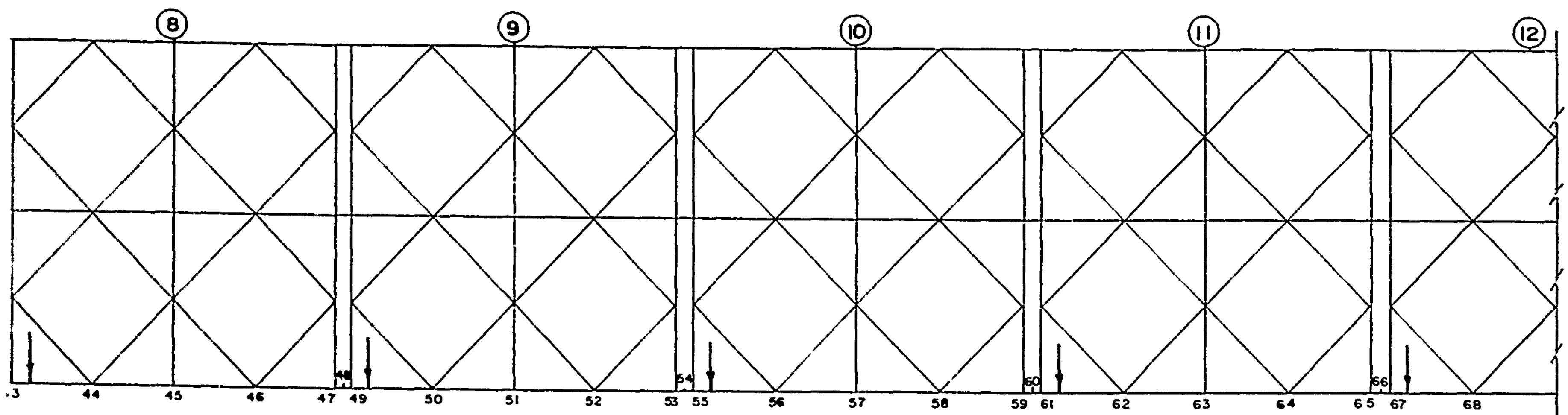
W = COMBINED WEIGHT ON THE FIRST TWO AXLES WHICH IS THE SAME AS FOR THE CORRESPONDING H (M) TRUCK.
V = VARIABLE SPACING — 14 FEET TO 30 FEET INCLUSIVE, SPACING TO BE USED IS THAT WHICH PRODUCES MAXIMUM STRESSES.



Figure

Standard HS Truck
(HS-20)

FIG. 2.7



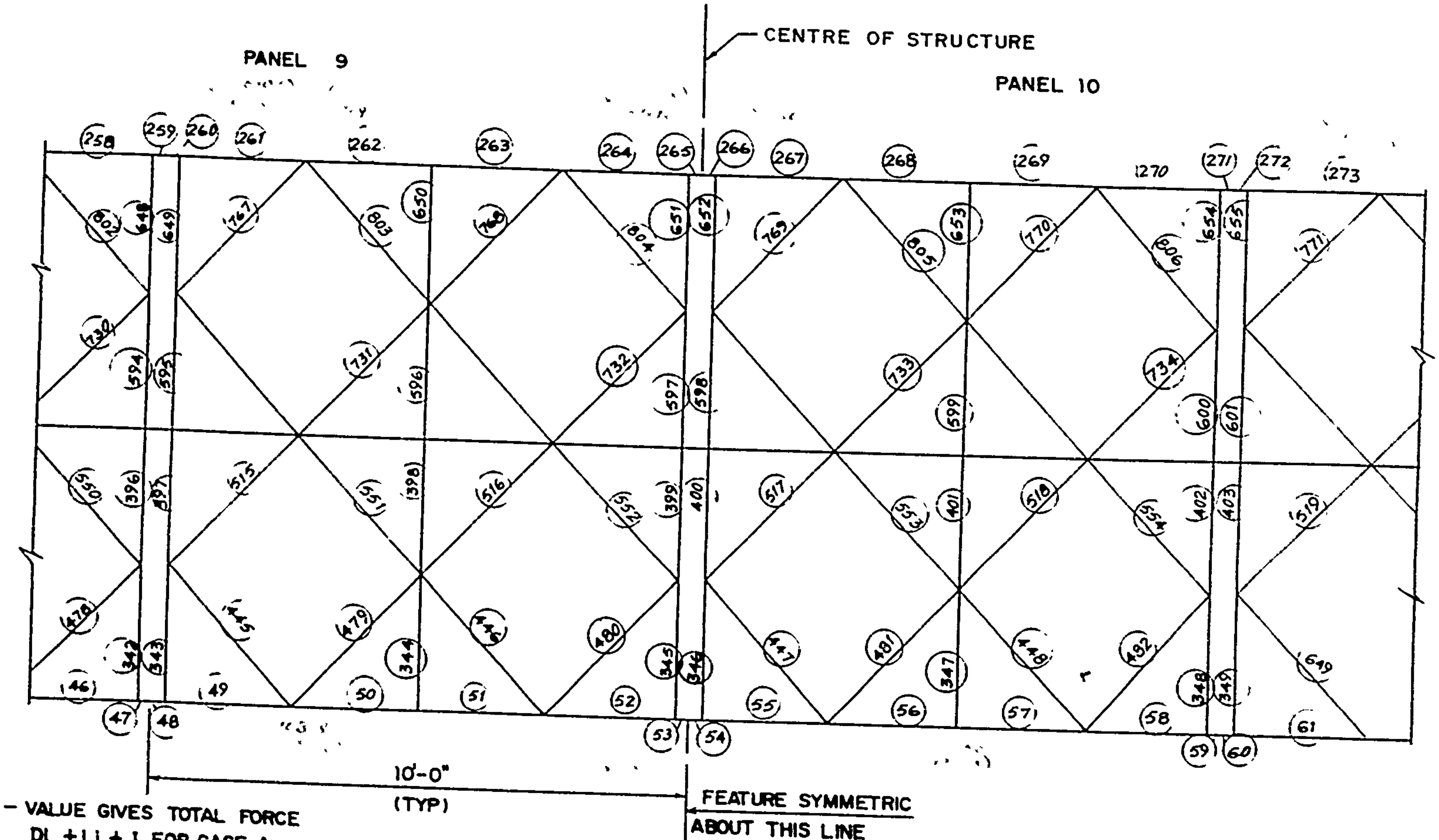
LOADING POINTS. MAGNITUDE AND DISTRIBUTION OF THE HS - 20 TRUCK

PANEL NO.	8	9	10	11	12
LOAD AT 6" FROM NODE No.	43	49	55	61	67
D. L.	1.85	1.85	1.85	1.85	1.85
L. L.	3.20	4.80	8.00	1.20	0.80
L. I.	0.64	0.96	1.60	0.24	0.16
L.T.	3.84	5.76	9.60	1.44	0.96

NOTES

- D.L. Dead Loads, excluding self wt. of truss members
- L.L. Live load due to HS-20 Truck
- L.I. Impact Load
- L.T. Total of D.L. + L.L. + L.I. (given in the input)
- All loads in Kips.

FIG. 2.8



- VALUE GIVES TOTAL FORCE DL + LL + I FOR CASE A
- VALUES IN PARENTHESIS GIVES TOTAL FORCE FOR CASE B
- FIGURES ENCIRCLED INDICATES THE MEMBER NUMBER.

BAILEY BRIDGE PANEL 9 & 10
TOTAL MEMBER FORCES IN KIPS
NAME OF FILE STRUCTI/J
DESIGNED. SMW
DATE. SEPTEMBER 1990.

FIG. 2·9

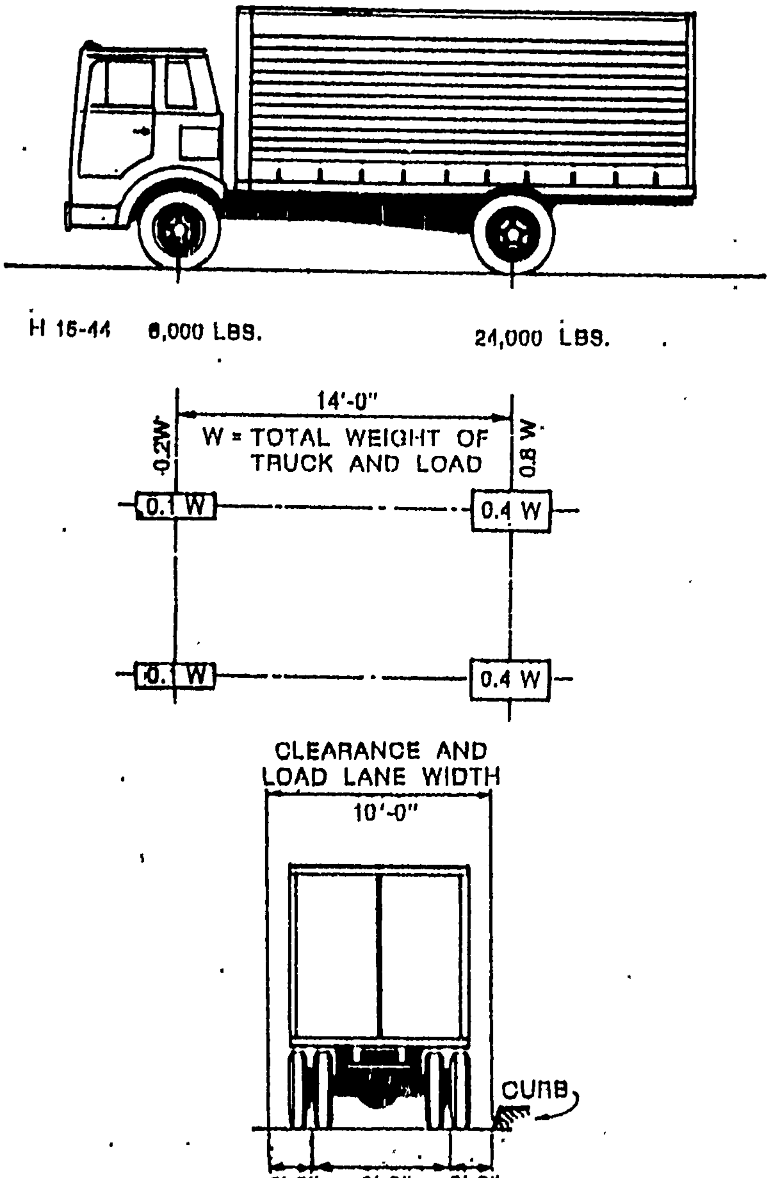


FIGURE H15 TRUCK

CHAPTER - 3

LOAD TESTING OF BRIDGE PANELS

CHAPTER - 3

LOAD TESTING OF BRIDGE PANELS

3.1 PREAMBLE

As required in the Agreement, three representative panels, used in the construction of the structure, were obtained from the launch nose assembly, from Pewshawar and transported to Lahore for load testing.

Testing of these panels was entrusted to the Test Floor of Civil Engineering Department Laboratory University of Engineering and Technology, Lahore. Two tests were conducted:

A. Single panel loaded at the top chord as shown in Figure 3.8 (Test No.1)

B. Two panels tested simultaneously in compound form as shown in Figure 3.10 (Test No.2).

The entire process of preparation of panels and performance of testing was conducted under the supervision of Chief Testing Engineer. Further, Project Advisor, Project Manager and Material Expert witnessed the testing.

Prior to the undertaking of the actual testing, analyses of an isolated panel were performed in the office for each case. The modelling was done in the manner and style, in which the actual testing was done in each case. This enabled to anticipate the memebrs strains and stresses and deflected shapes of the panels.

This chapter explains, the intent/purpose of the study, describes approach and method adopted in performance of each test, explains various operations done, precautionary measures adopted, procedure of testing and includes the comparison of the theoretical and experimental strains produced in the components under the panel loading. In the end, a detailed "Discussion of the Results" is presented.

3.2 INTENT/PURPOSE OF THE STUDY

The panel load testing was carried out with a view to investigate:

- Members strains and stresses together with nodal deflections in test panels, when subjected to loading; and
- Compare the same with those in the panel members of a bridge in service conditions.

3.3 PANEL TESTING

Three panels were tested in the following 2 tests:

- Test No. 1 - Single Panel
- Test No. 2 - Two Panels in compound form

In Test No.1 a single panel subjected to two point unsymmetrical loading and test No.2 two panels put to a single point loading simultaneously in compound form.

Various features of these tests are described in the following sections.

3.4 TEST NO. 1 - SINGLE PANEL TESTING

3.4.1 Testing Arrangements

Figure 3.1 shows the overall view of the panel load testing arrangements. The reaction frame and a general view of the laboratory is also visible. The reaction frame is bolted to a specially designed, 27 inch thick, reinforced concrete floor, by means of eight high strength bolts, to transfer the reaction of the load, without causing secondary deflection/deformations in the holding down arrangement.

3.4.2 Supports and Lateral Bracing Provided in the Process of Testing

The panel was mounted on two rigid RCC blocks placed at 10 feet on centres. The panel was simply supported. On one end roller support was provided. The other end was hinged (Figures 3.2 & 3.3). The frame was laterally braced against lateral movement to meet the requirements of two dimensional single panel analyses. The arrangement is shown in Figure 3.4.

3.4.3 Loading

Two point loading was applied through hydraulic jack as appears in Figures 3.5 and 3.6. Hydraulic jack was placed upside down against the reaction frame which was rigidly connected to the thick reinforced concrete floor. In view of the practical difficulties involved in the application of loads at the bottom chord of a single panel, two point loading was applied on the top chord of the test panel. The two point loads were applied at 4'-9" centre to centre, the first point being at 6" from edge of the vertical member on female end as shown in figure 3.8. The load at the hydraulic jack was measured with the help of a calibrated pressure cell. The loading was applied in equal increments of 200 psi (= 1785 Kgf) pressure upto a maximum of 2,580 psi (23,000 kgf). This load was enough to produce strains more than the maximum values obtained from the analytical results of the main bridge structure model.

3.4.4 Strain and Deflection Measurement

Twenty SR4 type electrical resistance strain gauges were fixed on fourteen different members of the panel as shown in figures 3.6 and 3.9 together with "Hugenberger Strain Indicator". Since top and bottom chords of the isolated panel resist axial and bending stresses, two strain gauges were provided on opposite sides of the channels to measure the combined axial and bending effects. At these points, the axial strains were calculated by taking the average of the two values given by strain gauges and bending strains as average of their difference. At all other points, i.e. upon each of the selected web and vertical members only one strain gauge was pasted as these members were likely to resist axial strains only.

Analysis of the complete bridge indicated mainly the axial strains and stresses in all the members. Further it showed that the forces in the top and bottom chord members are comparatively larger than in the web members. This, however, was not true in the case of single panel as observed from the theoretical as well as experimental results presented in Tables 3.1 and 3.5 a. The apparent reason for this is the orientation of say a central (bay 9 or 10) panel which receives stresses both from dead load (in the actual orientation) and live load, from transom, while the test panel receive all load from imposition.

Strains were monitored and recorded on all loading increments of 17 strain gauges (out of 20) as three gauges were damaged during the erection process and, no reading was available from there. For deflection measurements, six gauges were used out of which one was required to check the lateral out of plane movement of the panel. This gauge helped the engineer to keep the panel exactly in vertical position during testing (figure 3.4). The other five gauges were used to record the horizontal and vertical deflections at different points as shown in figure 3.8. The gauges were marked as A to E in the figure. A and B gauges were used to record horizontal deflections at the supports whereas gauges C to E indicated vertical deflections at the marked points. Gauge C was placed under the bottom chord of the panel (fig. 3.7) and gauge D and E at quarter points of the panel length.

Electronic distance meter (EDM) was also employed to counter-check the deflection gauges.

3.5 TEST NO. 2 - COMPOUND TESTING OF TWO PANELS

3.5.1 Testing Arrangements

Figure 3.12 shows the overall view of the two panels marked as A and B together with its lateral bracing system. The reaction frame, hydraulic jack, pump and the loading girder is also visible.

3.5.2 Supports and Lateral Bracing

The panels were supported in a manner similar to the single panel. The panels were laterally braced with the help of 8 studs and 2 channels sections, with the reaction frame (Figures 3.12, 3.14 and 3.15). Studs

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were fastened on one end with the reaction frame and on the other with the channel sections outside of the panels with double nuts. Hence, restraining out of plane movement, to meet the requirements of two dimensional analysis.

3.5.3 Loading Process and Panel Behaviour

In view of the practical difficulties involved in the application of loads at the bottom chord of a single panel, it was decided to test the remaining two panels in compound form. It follows that the single point loading was possible to be applied simultaneously on bottom chords of the two panels, 6" from the mid span (Figures 3.10 and 3.11). This loading pattern also gave a closer simulation to actual loading conditions of the panel in the bridge.

Figures 3.12, 3.13 a and b shows that the hydraulic jack load was transfered to a rigid girder, which was simply supported on the bottom chord of each panel (A & B) at centre to centre span of 5'-6". The reactions of the girder were the single point loading on each panel. The loading was applied in the increments of 400 psi, i.e. 200 psi on each of the panels, upto 3200 psi (26,600 kgf). At this load, initially buckled bracing member (shown in Figure 3.11) indicated marked increase in buckling. The study of Tables 3.4 a and 3.4 b reveals that almost all the members of the panels had gone through excessive strains and stresses just at or before this load. Consequently, the onward loading increments were decreased to 100 psi. The panels stopped resisting further strains at a total pressure of 4750 psi (40,500 kgf).

3.5.4 Strain and Deflection Measurement

Strains and deflections were measured and determined as explained in 3.4.4. In this test, EA type electrical strain gauges were used instead of SR4 ones. The former gauges are more sensitive and accurate than the latter ones. Seven gauges were fixed on five different members of each of the two panels. The gauges were installed in such a way that strains at almost all the important points were recorded. Figures 3.10 and 3.11 shows the arrangmeent of strain and deflection gauges of panels A and B, respectively.

3.6 DISCUSSION

3.6.1 Tables 3.1 - 3.4b show experimental results of strains and deflections measured during loading operations for both the tests on panels. A comparison of experimental results with the theoretical values obtained for a simply supported isolated panel is available from Tables 3.5a and 3.5b for the two tests, according to the corresponding loading conditions. Moreover, theoretical strains obtained from full bridge analysis are also given.

3.6.2 The computer analyses results in the form of forces and moments of the isolated panels were converted into strains by dividing the values with EA and ES of the members, respectively.

Where:

E = Young's modulus of elasticity of the material
= 30,000 Ksi (obtained from coupon testing)

A = Cross-sectional area of the section (sq.in)

S = Section modulus of the member (in. cube)

Both A & S are obtained from measured dimensions of the panel members.

3.6.3 The dominance of axial forces in the top and bottom chords of the bridge obtained from the analysis is due to the presence of pin joints used for connection of panels. The web members of the bridge are found to have considerably smaller forces than those in the isolated panel members. This is due to the shear forces combination of members in double M form in the bridge compared with the resistance of single panel.

3.6.4 The presence of bending strains and stresses in the top and bottom chord members of the test panels is due to loading applied at 6" away from the nodal points.

3.6.5 Termination of panel load test No.1 at 23,000 Kgf load was done due to excessive out of plane movement of the Panel Frame at this load. The actual capacity was not exceeded.

3.6.6 The applied loading gave rise to considerably larger strains in some of the panel members, than is likely to be produced in the panel members of the structure (Tables 3.5a and 5b)

3.6.7 Loading pattern in Test No. 2 simulates the actual loading conditions in a closer manner (than Test No.1).

3.6.8 Members of panels A & B (Test No.2) showed signs of abrupt changes and redistribution of strains at a total load of only 19,500 Kgf i.e. 9750 Kgf for one panel (Tables 3.3a and b and 3.5b). This is not true in case of single panel testing (Test No.1). The behaviour of the isolated panel was well within elastic limit even upto a load of 23,000 Kgf (Tables 3.1-2 and 3.5a). It follows that one of the two point loads i.e. 11,500 Kgf was transfered about directly to the supports through vertical members of the panel (Figure 3.8).

3.6.9 The experimental and theoretical strains generally did not show agreement with each other for the case of compound panel test as against a reasonable agreement for the single panel test (Table 3.5a and 3.5b).

3.6.10 The application of bottom chord single point loading in case of compound panel testing not only caused relatively greater bending but also aggravated the behaviour due to bottom chord loadings local effects.

3.6.11 Figures 3.14a and b show the buckling of a bracing member of panel B. The deflected shape of the compound panel system is evident from Figures 3.15 and 3.16. Figure 3.16 also displays vertical buckled member of panel A together with rotated hinge support.

3.6.12 Marked buckling of the above mentioned members in Test No.2 contributed towards the failure of compound panel system.

3.6.13 It is obvious from the permanent set of nodal deflections and member strains observed after complete unloading from the two panels that the panels had gone beyond their elastic limits (Tables 3.3a - 3.4b).

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3.6.14 The compound panel system stopped resisting further loading at 40,500 Kgf indicating failure. However, the failure was initiated at a load of 19,5000 Kgf (Tables 3.3a and 3.3b) in probably panel B.Further, the behaviour was not linear elastic, since the early stages of loading.

3.6.15 As the panels of two (double) trusses on each side of the actual Bridge structure are firmly held by the panel Braces and turn buckles and transoms under the wooden deck, considerable third dimension rigidity is imparted to the actual structure. The individual panels are held in position and restrained in X-Y plane. Hence as explained in Section 7.2.3, the failure of panels at a load of about 20 T in the compound panel test - Test No. 2, probably, is not a serious cause of alarm.

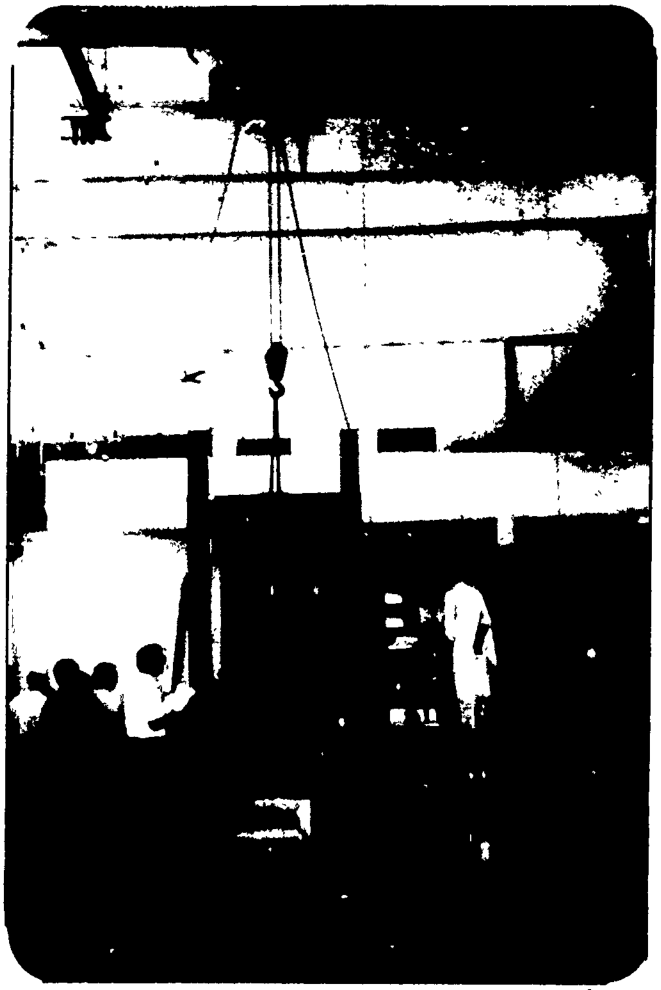

Figure 3.1: Overall view of the Panel Load Testing Arrangements (Test No.1)

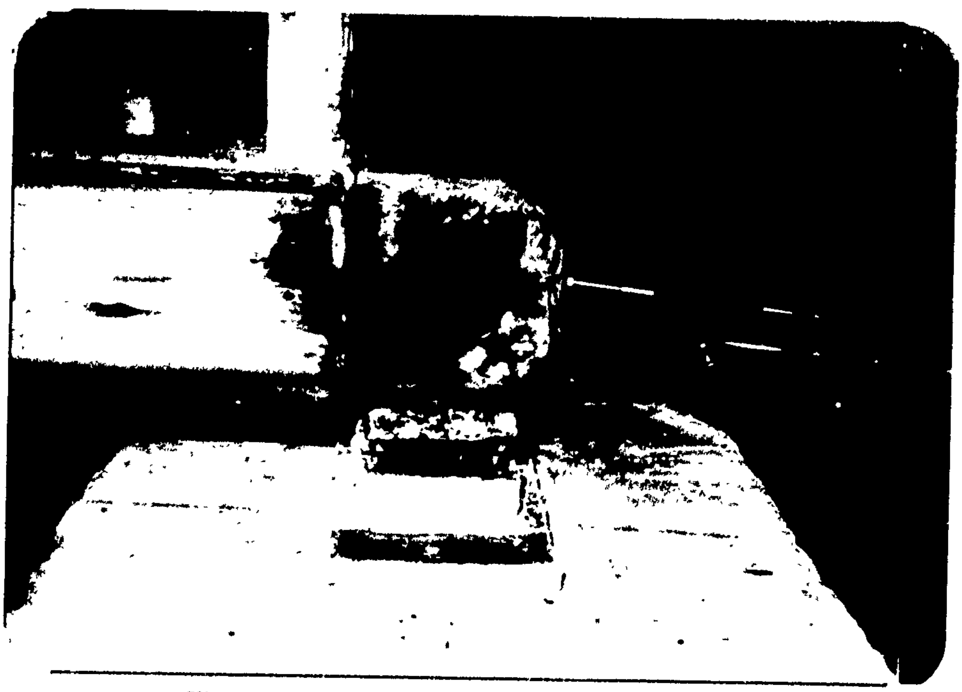

Figure 3.2: Roller Support (Test No.1)

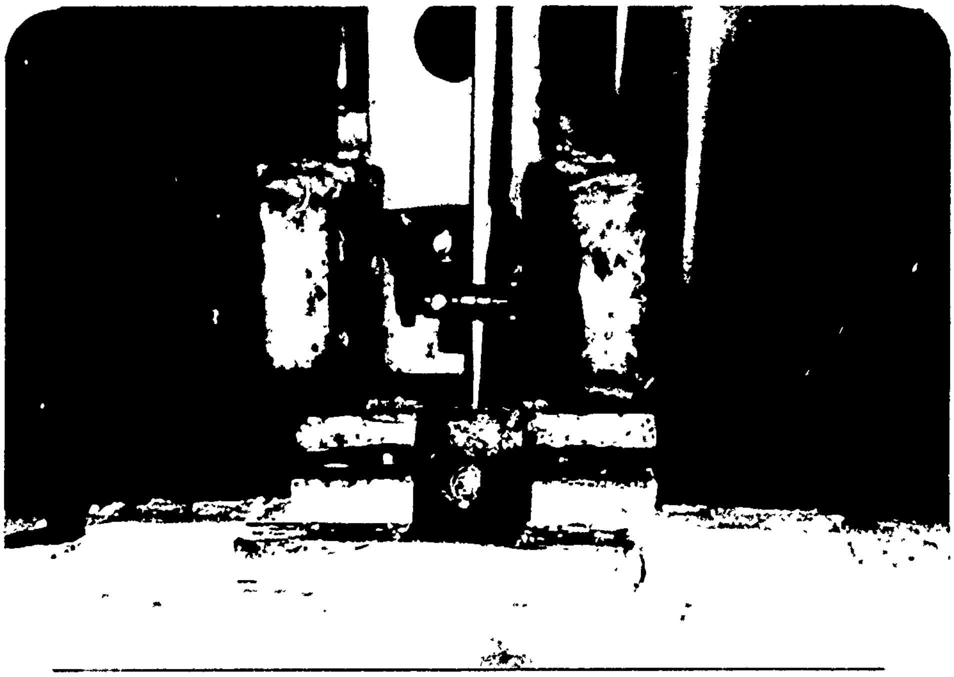

Figure 3.3: Hinged Support (Test No.1)

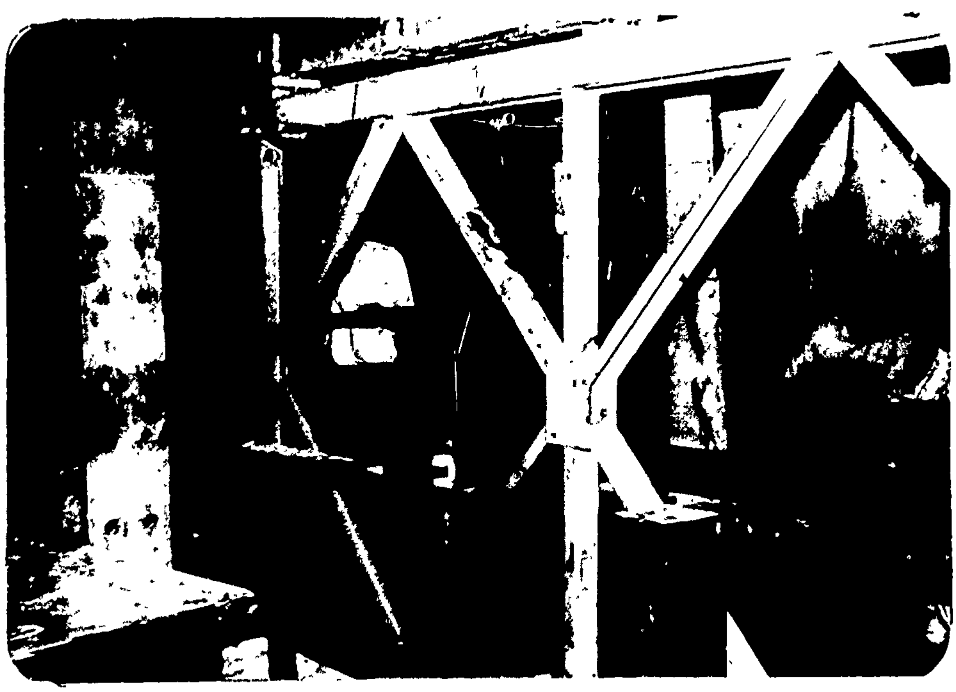

Figure 3.4: Lateral Bracing together with Gauge to record Lateral Movement (Test No.1)

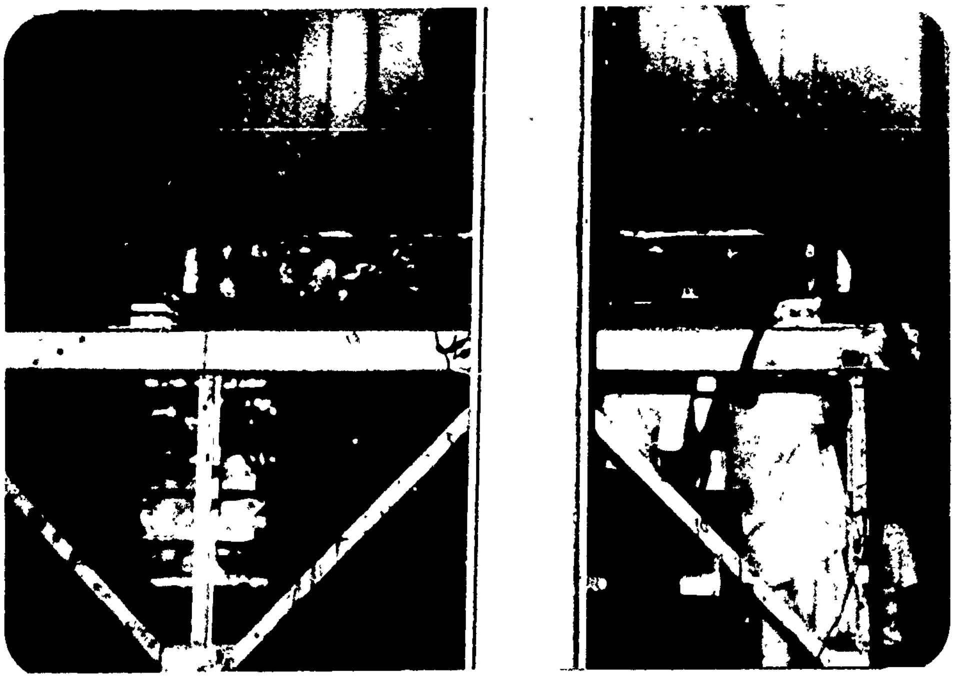

Figure 3.5(a): Two Point Loading (Test No.1)

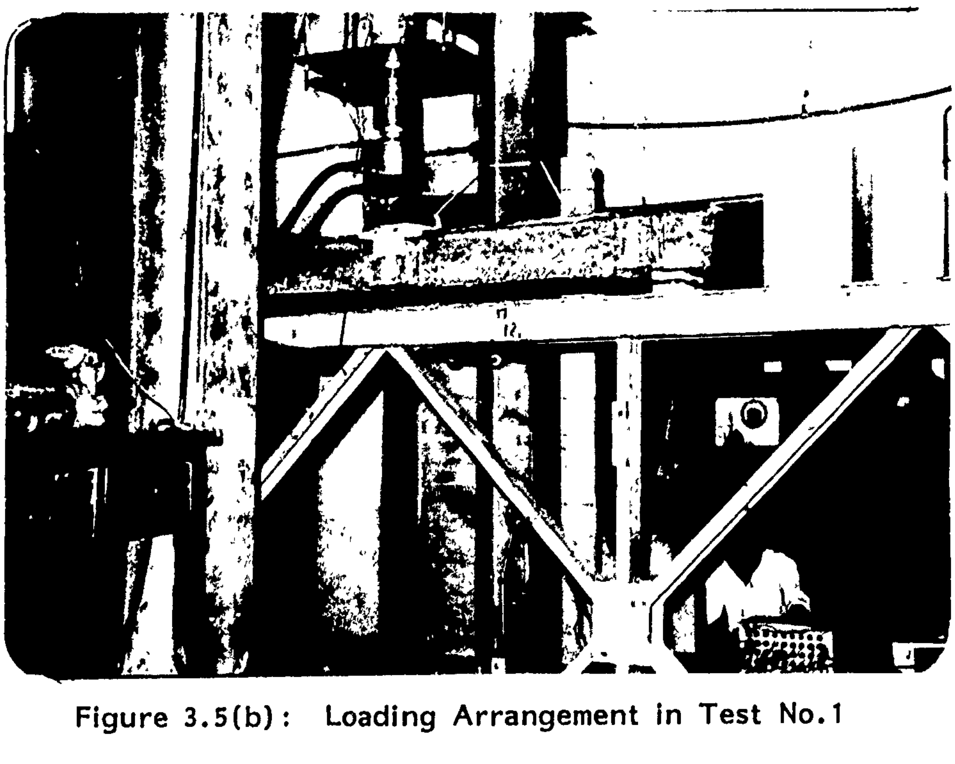

Figure 3.5(b): Loading Arrangement in Test No.1

Figure 3.6: Strain Gauge and Strain Indicator

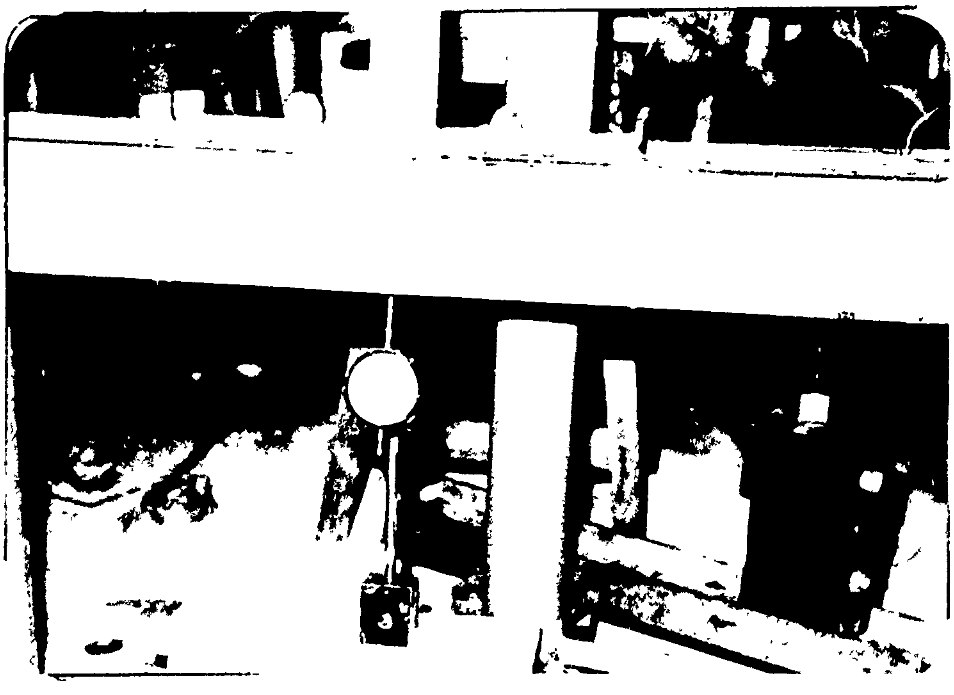

Figure 3.7: Deflection Gauage 'C' at Mid Span

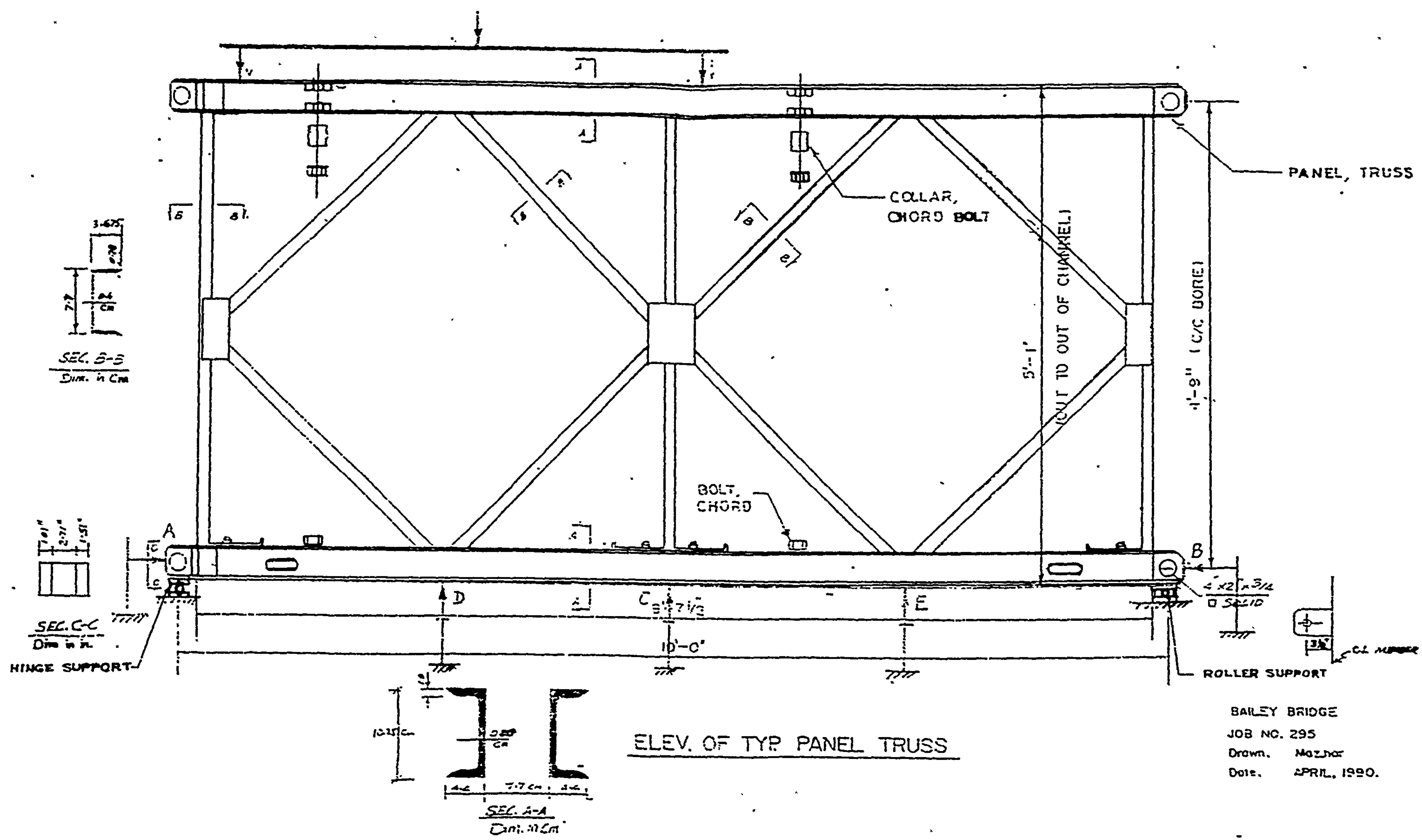

Fig.3.8 : LOADING AND DEFLECTION GAUGES ARRANGEMENT

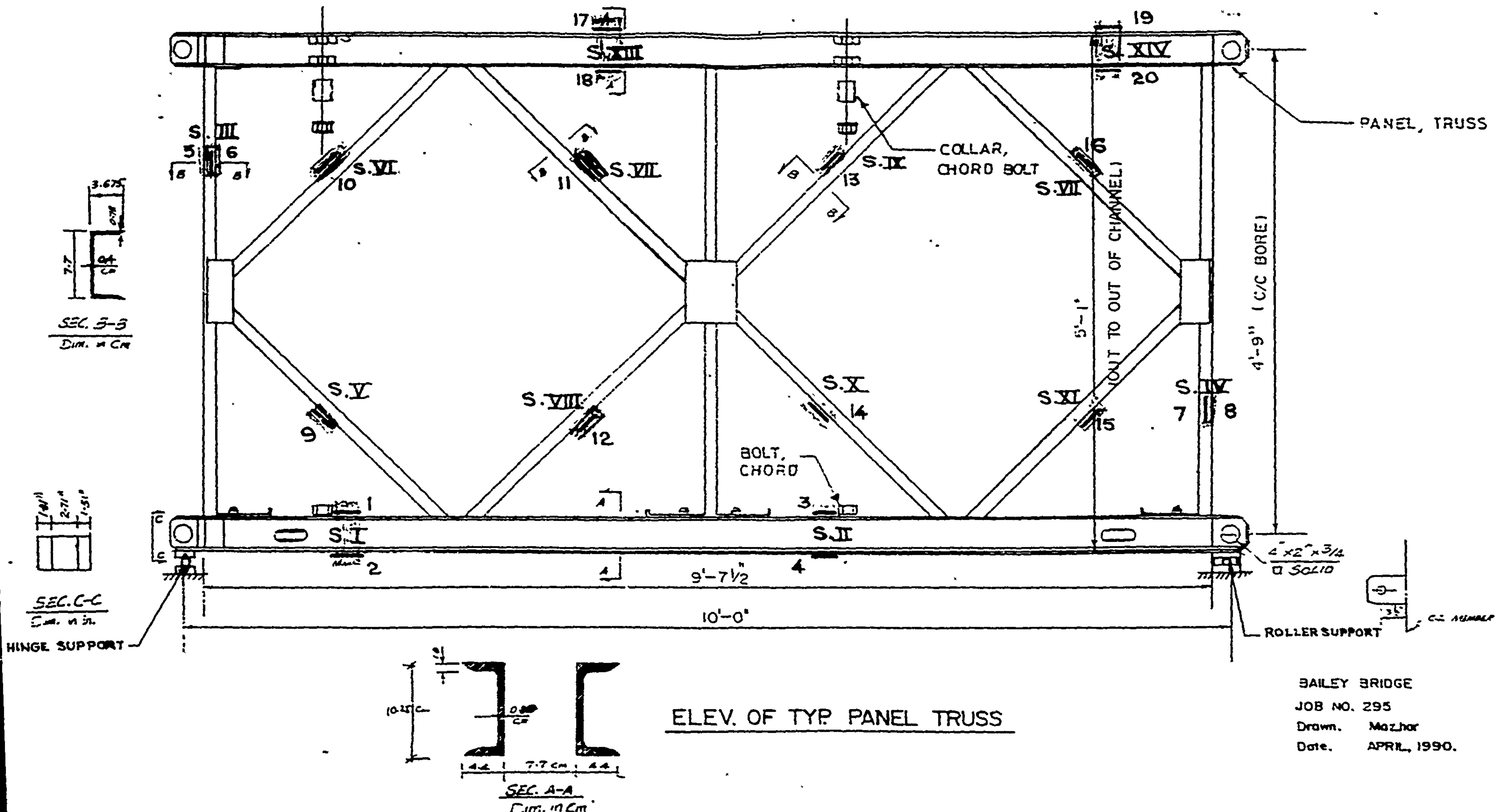

Fig.3.9: Strain gauges arrangement.

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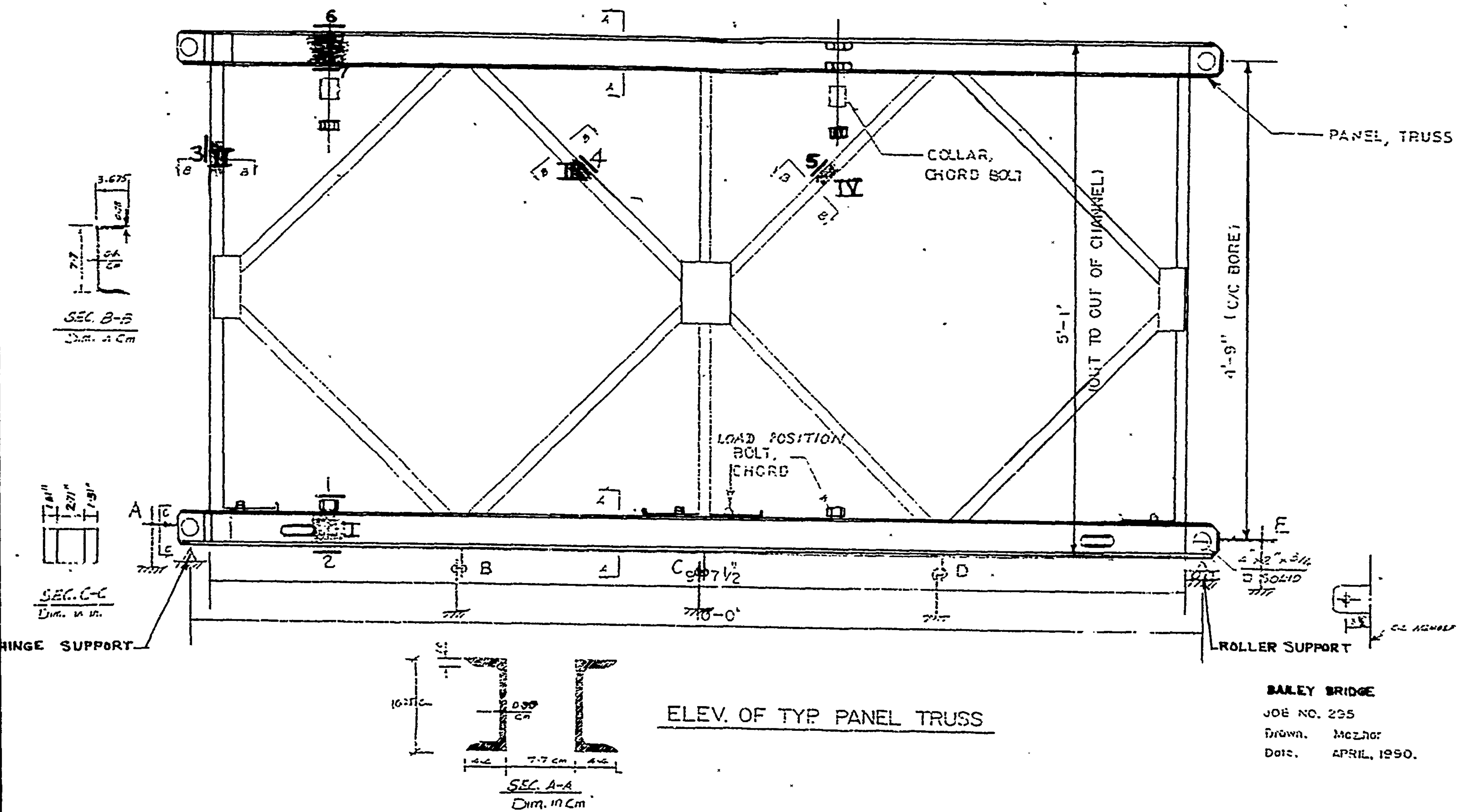


Fig.3·10: STRAIN AND DEFLECTION ...

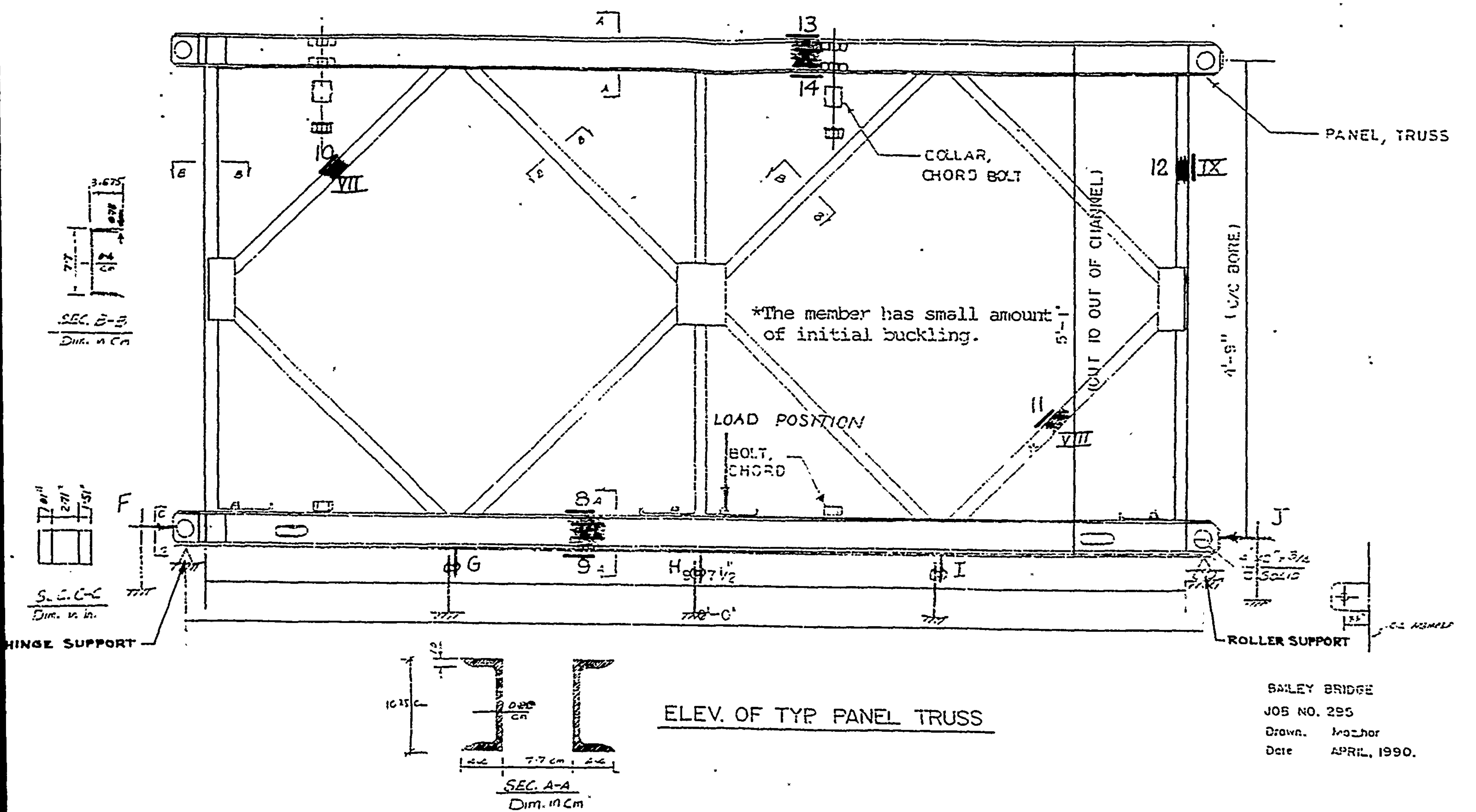


Fig.3·11 STRAIN AND DEFLECTION GAUGES ARRANGEMENT FOR PANEL 'B' (TEST NO.2)

Figure 3.12: Overall view of the two Panels tested in Compund Form (Test No.2)

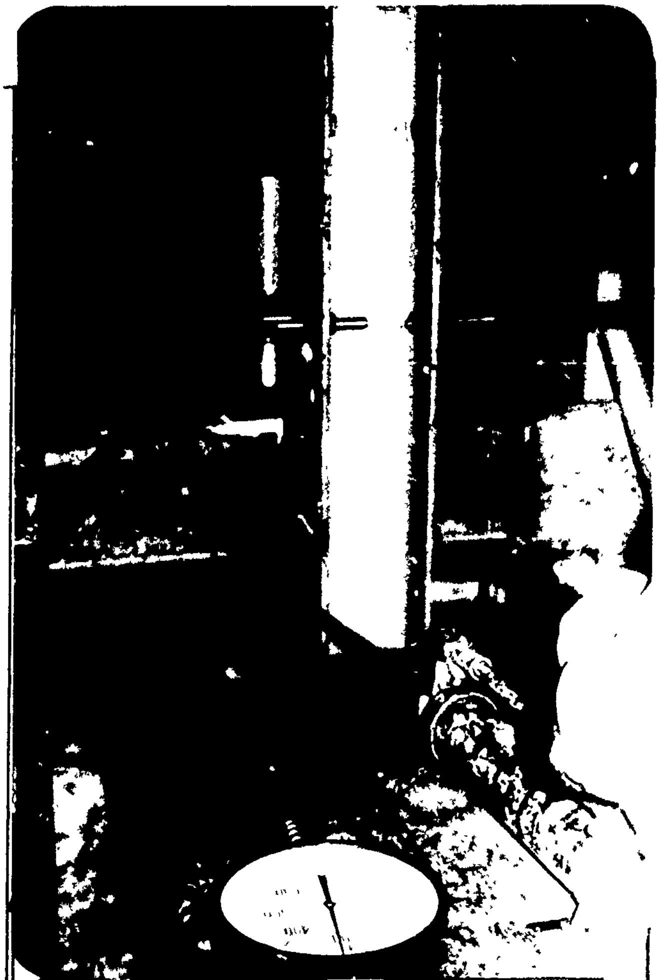


Figure 3.13(a):

Loading Arrangement note the reading on pressure gauage (Test No.2)

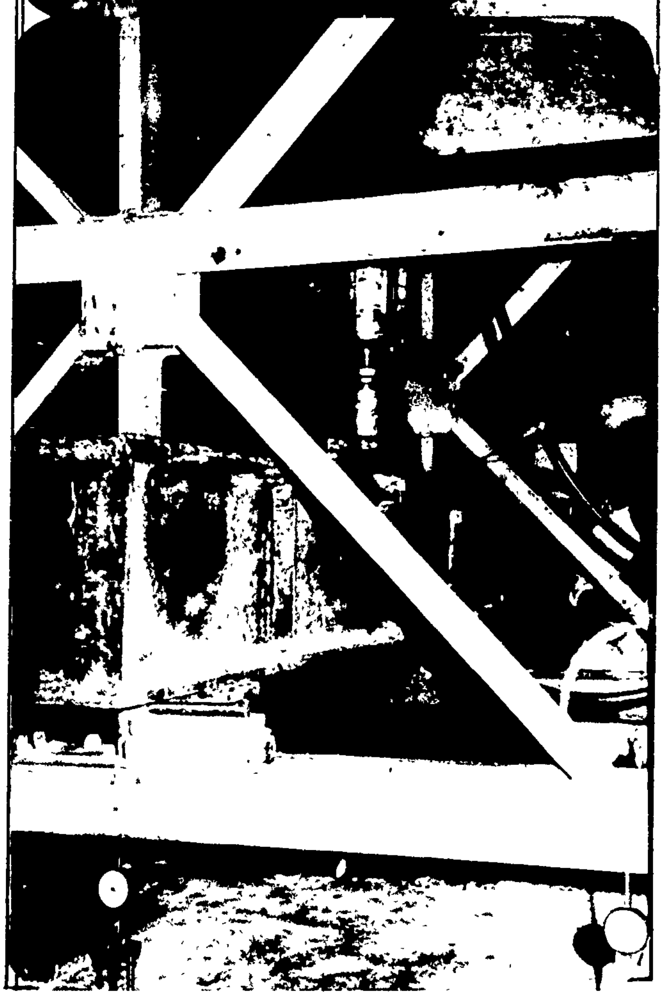
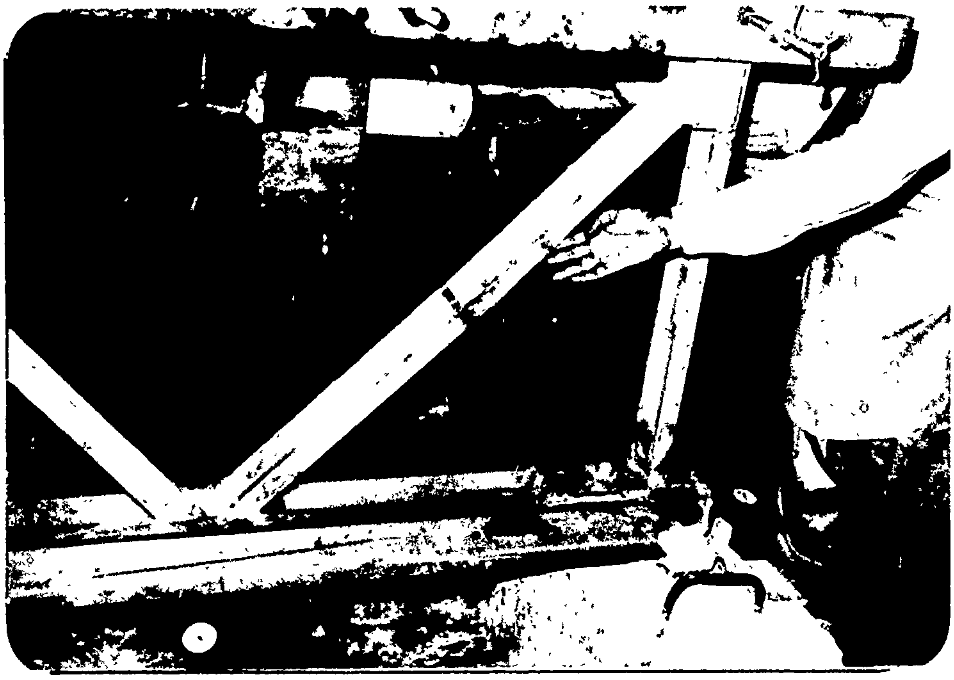


Figure 3.13(b):

Single Point Loading on each Panel centre (Test No.2). Note the deflection in the bottom chord



Figrue 3.14(a): Buckling of a Bracing Member of Panel B (Test No.2)

Figure 3.14(b): Buckling of a Bracing Member of Panel B (Test No.2)

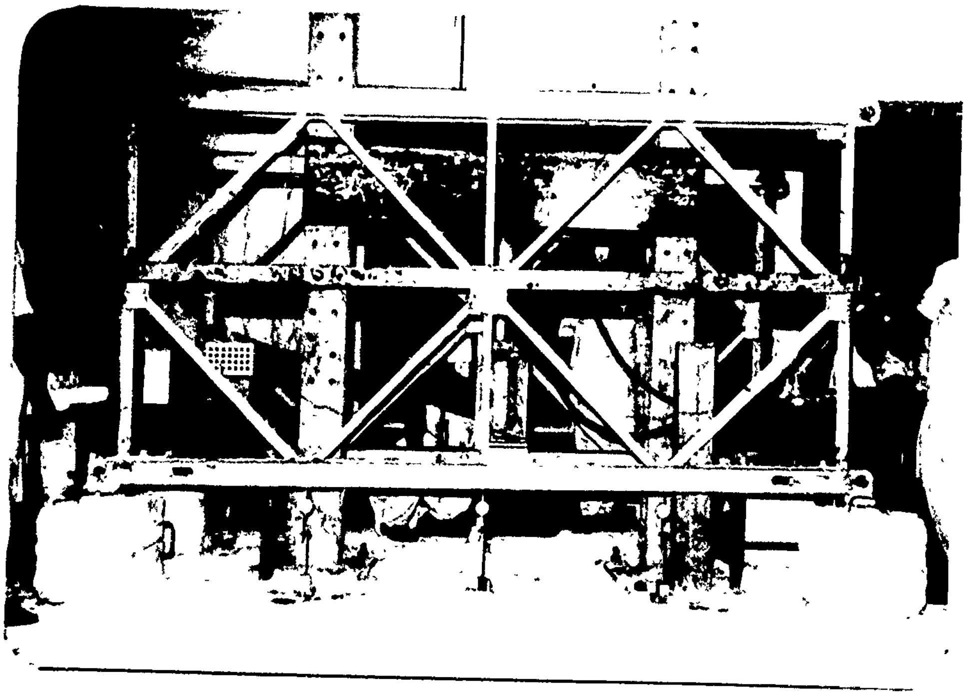


Figure 3.15: Deflected Panel B (Test No.2)

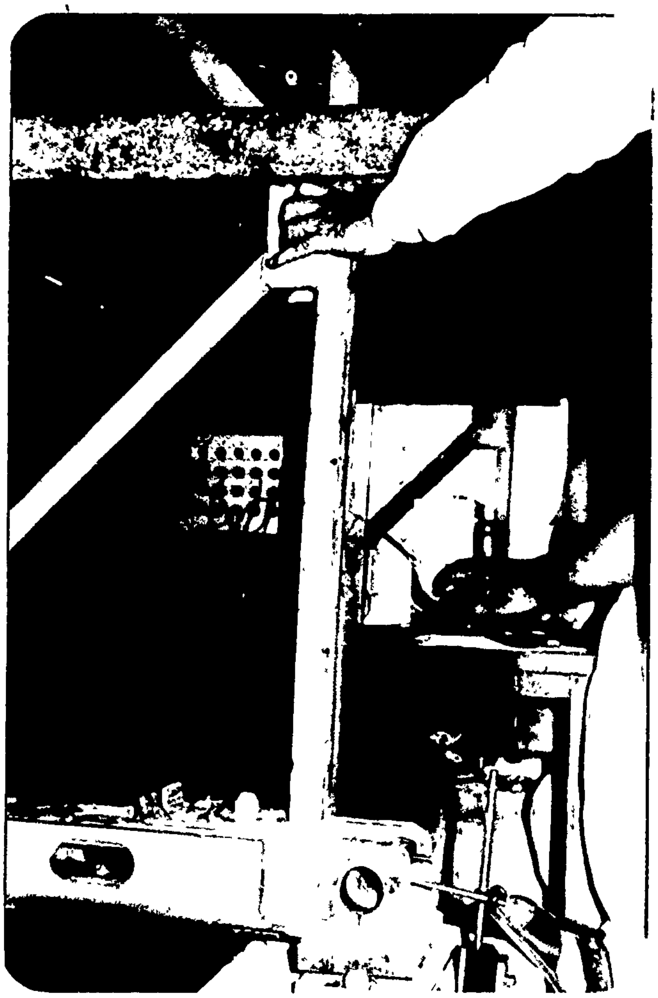


Figure 3.16:

Buckled Vertical Member & Rotated Hinged Support of Penal A (Test No.2)

TABLE - 3.1

EXPERIMENTAL STRAINS IN BAILEY BRIDGE PANEL TEST NO.1

S.No.	Load kgf	STATION - I (S.G. 1&2)		STATION - II (S.G. 3, 4)		STATION-III (S.G.5)	STN.-IV (S.G.7)	STN.-V (S.G.9)	STATION-VI (S.G.10)	STN.-VII (S.G.11)	STN.-VIII (S.G.12)
		Axial $\times 10^{-6}$	Bending $\times 10^{-6}$	Axial $\times 10^{-6}$	Bending $\times 10^{-6}$	Axial $\times 10^{-6}$	Axial $\times 10^{-6}$	Axial $\times 10^{-6}$	Axial $\times 10^{-6}$	Axial $\times 10^{-6}$	Axial $\times 10^{-6}$
1	0	0	0	0	0	0	0	0	0	0	0
2	1800	-2.44	±2.44	-	-	-53.66	-9.76	-9.76	-14.63	4.88	-14.63
3	3500	-9.76	±19.51	21.96	±12.20	-78.05	-14.63	-	-24.39	9.76	-19.51
4	5500	-60.98	±90.25	39.02	±24.39	-107.31	-34.15	-19.51	-48.78	-	-48.90
5	7000	-56.09	±109.76	41.46	±26.83	-117.07	-48.78	-	-73.17	19.51	-53.66
6	9000	-51.22	±118.72	-	-	-	-68.29	-29.27	-97.56	-	-68.29
7	11000	-34.15	±131.71	53.66	±24.39	-131.71	-	-29.27	-107.32	29.27	-73.17
8	12500	-19.51	±102.44	60.71	±28.11	-200.00	-141.46	-34.15	-136.58	48 78	-
9	14300	-19.51	±136.58	69.93	±30.07	-234.15	-162.04	-53.66	-170.73	55.08	-112.20
10	16000	-17.08	±129.27	77.93	±34.15	-258.54	-180.94	-61.46	-185.36	63.04	-136.58
11	18000	-19.52	±156.10	88.02	±26.03	-286.06	-204.68	-68.29	-209.75	75.49	-151.22
12	19600	-19.52	±175.61	95.11	±20.72	-314.78	-220.97	-70.48	-234.10	69.89	-170.73
13	21500	-26.84	±207.32	105.22	±17.08	-341.96	-244.08	-73.17	-258.54	82.69	-180.49
14	23000	-29.27	±209.75	112.20	±30.08	-368.00	-260.69	-78.29	-276.58	89.76	-195.12

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TABLE-3.1 (cont'd)

STATION-IX (S.G.13) Axial $\times 10^{-6}$	STATION-X (S.G.14) Axial $\times 10^{-6}$	STATION-XI (S.G.15) Axial $\times 10^{-6}$	STATION-XII (S.G.16) Axial $\times 10^{-6}$	STATION - XIII (S.G. 17 & 18) Axial $\times 10^{-6}$	STATION - XIII (S.G. 17 & 18) Bending $\times 10^{-6}$	STATION - XIV (S.G. 19&20) Axial $\times 10^{-6}$	STATION - XIV (S.G. 19&20) Bending $\times 10^{-6}$
0	0	0		0	0	0	0
–	-14.63	14.63	STOPPED WORKING	-2.44	±2.44	-4.88	±9.76
–	-19.51	19.51		-2.44	±17.07	-7.32	±12.20
9.76	-39.02	39.02		-4.88	±24.39	-17.07	±21.95
14.63	-63.41	53.66		-26.83	±51.22	–	–
–	-73.17	78.05		-31.71	±56.10	–	±29.27
29.27	-76.00	92.68		–	–	–	–
34.15	-87.80	112.19		-34.15	±78.05	–	–
48.78	-126.83	128.34		-46.34	±90.24	-19.52	±34.15
54.06	-146.34	141.92		-48.78	±102.44	–	±41.47
62.21	-165.85	161.08		-58.54	±112.20	-39.03	±53.66
66.46	-185.36	176.64		-63.19	±134.15	–	±70.74
74.01	-190.24	193.19		-70.22	±143.91	–	±70.74
78.46	-204.88	206.43		-74.88	±160.98	-51.22	±100.00

TABLE - 3.2

EXPERIMENTAL DEFLECTIONS AT VARIOUS POINTS OF BAILEY BRIDGE PANEL TEST NO. 1

Load Kgf	Horizontal Deflections		Vertical Deflections		
	Dial Gauge A (in)	Dial Gauge B (in)	Dial Gauge C (in)	Dial Gauge D (in)	Dial Gauge E (in)
0	0	0	0	0	0
1800	0.001	0.00025	0.005	0.006	0.004
3500	0.00125	0.00075	0.0075	0.007	0.00525
5500	0.002	0.001	0.013	0.013	0.0085
7000	0.00275	0.00275	0.019	0.018	0.0115
9000	0.0035	0.0035	0.023	0.022	0.013
11000	0.00425	0.00425	0.0027	0.026	0.016
12500	0.005	0.005	0.032	0.031	0.019
14300	0.006	0.006	0.036	0.0335	0.022
16000	0.0065	0.0065	0.042	0.036	0.0245
18000	0.007	0.007	0.048	0.043	0.027
19600	0.008	0.008	0.054	0.049	0.031
21500	0.009	0.009	0.06	0.055	0.031
23000	0.01	0.01	0.064	0.059	0.041
0	0.00025	0.00025	0.0005	0.0007	0.0005
Remarks:	on hinge support.	On Roller support.	At mid span under bottom chord	At quarter span under bottom chord on loaded side.	At quarter span under bottom chord on unloaded side.

TABLE - 3.3(a)

EXPERIMENTAL STRAINS IN PANEL 'A' (BAILEY BRIDGE) TESTED IN COMPOUND FORM

(TEST NO.2)

S.No.	Load kgf	STATION - I (S.G. 1&2)		STN - II (S.G. 3)	STN - III (S.G. 4)	STATION-IV (S.G. 5)	STATION - V (S.G. 6 & 7)		REMARKS
		Axial $\times 10^{-6}$	Bending $\times 10^{-6}$	Axial $\times 10^{-6}$	Axial $\times 10^{-6}$	Axial $\times 10^{-6}$	Axial $\times 10^{-6}$	Bending $\times 10^{-6}$	
1	0	0	0	0	0	0	0	.0	Initial reading
2	2000	4.88	±4.00	-4.88	WORKING STOPPED	2.44	-7.32	±2.44	
3	5400	9.75	±7.00	-9.00		4.88	-9.78	±4.88	
4	9000	10.50	±8.00	-14.63		9.63	-9.78	±7.24	
5	12300	4.88	0	-18.90		14.63	-9.78	±9.76	
6	16000	2.44	±2.44	-24.53		19.51	-9.78	±12.45	
7	19500	0	±9.76	-36.53		24.39	-9.76	±14.69	
8	23000	-107.32	±34.15	-66.83		-73.17	-95.13	±12.20	Already buckled member (STN-VIII) of Panel B is further deteriorated and hence sudden change of strains and stresses in all members of both the panels are observed.
9	26600	-112.20	±29.27	-87.80		-59.54	-96.13	±21.95	
10	28400	- 95.13	±12.20	-92.68		-58.54	-96.13	±21.95	
11	30020	- 97.56	±19.51	-98.93		-53.66	-98.68	±24.39	
12	32000	- 97.56	±19.51	-102.44		-49.85	-100.00	±26.83	
13	33800	-102.44	±24.39	- 87.80		-48.78	-103.50	±27.20	
14	35500	-102.44	±19.51	- 97.56		-53.66	-105.63	±24.39	
15	37500	-124.39	±26.83	-102.44		-68.29	-112.20	±29.27	Other bracing members of Panels A&B also seemed to have buckled which is obvious from considerable amount of change of strain.

Cont'd...p/

TABLE - 3.3(a) ... cont'd

S.No.	Load kgf	STATION - I (S.G. 1,2)		STN - II (S.G. 3)	STN - III (S.G. 4)	STATION - IV (S.G. 5)	STATION - V (S.G. 6,7)		REMARKS
		Axial $\times10^{-6}$	Bending $\times10^{-6}$	Axial $\times10^{-6}$	Axial $\times10^{-6}$	Axial $\times10^{-6}$	Axial $\times10^{-6}$	Bending $\times10^{-6}$	
16	38300	-143.91	±31.71	-131.71	STOPPED WORKING	-87.80	-139.03	±26.83	
17	39200	-175.61	±39.02	-160.98		-117.07	-124.39	±31.71	
18	40000	-124.39	±31.71	-112.20		- 73.17	-112.20	±29.27	Vertical members on hinged support side of both the panels have shown considerable buckling.
19	40500	-119.51	±31.71	- 78.05		- 58.56	-100.00	±26.83	The panels stopped resisting further strains and hence loading was removed. (Final Load)
20	0	-90.25	±7.32	-82.93		-146.34	-104.88	± 2.44	The permanent set at unloading indicates that the panels have crossed their elastic limit together with permanent buckling of some of the members.

TABLE - 3·3(b)

EXPERIMENTAL STRAINS IN PANEL 'B' (BAILEY BRIDGE) TESTED IN COMPOUND FORM

(TEST NO. 2)

S.No.	Load kgf	STATION - VI (S.G. 8,9)		STN - VII (S.G.10)	STN - VIII (S.G.11)	STN - IX (S.G.12)	STATION - X (S.G.13-14)		REMARKS
		Axial $x10^{-6}$	Bending $x10^{-6}$	Axial $x10^{-6}$	Axial $x10^{-6}$	Axial $x10^{-6}$	Axial $x10^{-6}$	Bending $x10^{-6}$	
1	0	0	0	0	0	0	0	0	Initial reading.
2	2000	2.44	0	-19.51	39.02	-14.68	-9.77	0	
3	5400	4.88	±4.88	-53.66	48.78	-24.39	-21.96	±12.20	
4.	9000	6.76	±9.76	-102.44	82.93	-24.39	-39.03	± 9.76	
5.	12300	9.76	±17.07	-131.71	107.32	- 9.76	-41.47	±12.20	
6	16000	12.20	±19.56	-170.73	131.71	0	-58.54	± 9.76	
7	19500	12.20	±21.96	-214.63	160.98	19.51	-68.30	± 9.76	
8	23000	-46.34	±70.73	-253.64	185.37	29.27	-90.25	±12.20	Already buckled member (STN-VIII) of the panel is further deteriorated and hence sudden change of strains and stresses in all members of both the panels are observed.
9	26600	-63.41	±24.39	-346.34	141.46	- 9.76	-170.74	±14.64	
10	28400	-70.73	±31.71	-380.49	160.98	- 9.76	-192.69	±12.20	
11	30020	-70.73	±31.71	-400.00	175.61	- 9.76	-197.57	±17.08	
12	32000	-65.86	±31.71	-429.27	204.88	-14.63	-212.20	±12.20	
13	33800	-70.74	±41.47	-443.90	204.88	19.51	-209.76	±14.64	
14	35500	-65.86	±36.59	-458.54	224.39	24.39	-224.39	±14.64	
15	37500	-80.49	±41.47	-478.05	214.63	19.51	-236.59	±12.20	Other bracing members of both the panels also seemed to have buckled which is obvious from considerable amount of change of strain.

Cont'd....p/

TABLE - 3·3(b) ... cont'd.

S.No.	Load kgf	STATION - VI (S.G. 8,9)		STN-VII (S.G.10)	STN-VIII (S.G. 11)	STN-IX (S.G.12)	STATION - X (S.G.13,14)		REMARKS
		Axial $\times10^{-6}$	Bending $\times10^{-6}$	Axial $\times10^{-6}$	Axial $\times10^{-6}$	Axial $\times10^{-6}$	Axial $\times10^{-6}$	Bending $\times10^{-6}$	
16	38300	-92.69	±39.03	-521.95	219.51	4.88	-280.49	±17.08	
17	39200	-87.81	±43.91	-521.95	239.02	29.27	-253.66	±14.64	
18	40000	-82.93	±39.03	-526.83	253.66	58.54	-268.30	± 9.76	Vertical members on hinged support side of both the panels have shown conisderable buckling.
19	40500	-73.17	±43.90	-526.83	268.29	60.56	-248.78	± 9.76	The panels stopped resisting further strains and hence loading was removed. (Final Load).
20	0	-148.78	±51.22	-107.32	-78.05	43.90	- 68.30	±39.03	The permanent set at unloading indicates that the panels have crossed their elastic limit together with permanent buckling of some of the members.

TABLE - 3·4(a)

EXPERIMENTAL DEFLECTIONS OF PANEL 'A' (BAILEY BRIDGE) TESTED IN COMPOUND FORM (TEST NO.2)

Load kgf	Horizontal Deflections		Vertical Deflections		
	Dial Gauge A (in)	Dial Gauge E (in)	Dial Gauge B (in)	Dial Gauge C (in)	Dial Gauge D (in)
0	0	0	0	0	0
2000	0.005	0.0015	0.009	0.012	0.0095
5400	0.0035	0.0020	0.020	0.030	0.023
9000	0.004	0.004	0.028	0.046	0.034
12300	0.0035	0.008	0.034	0.059	0.044
16000	0.003	0.0125	0.040	0.073	0.054
19500	0.002	0.018	0.047	0.087	0.065
23000	0.0015	0.023	0.052	0.099	0.074
26600	0.0000	0.028	0.058	0.112	0.085
28400	0.000	0.030	0.061	0.121	0.091
30020	-0.001	0.032	0.064	0.128	0.096
32000	-0.001	0.034	0.068	0.135	0.1015
33800	-0.002	0.036	0.070	0.142	0.106
35500	-0.002	0.037	0.073	0.149	0.111
37500	-0.003	0.039	0.077	0.156	0.116
38300	-0.003	0.040	0.079	0.162	0.120
39200	-0.0035	0.041	0.081	0.166	0.123
40000	-0.005	0.042	0.082	0.170	0.126
40500	-0.005	0.042	0.084	0.173	0.129
0	0	0.022	0.0035	0.115	0.012
Remarks:	on hinge support	On roller support	At quarter span towards the hinged side	At mid span	At quarter span towards the roller support

All the gauges indicated permanent set on release of loading.

TABLE - 3·4(b)

EXPERIMENTAL DEFLECTIONS OF PANEL 'B' (BAILEY BRIDGE) TESTED IN COMPOUND FORM (TEST NO. 2)

Load	Horizontal Deflections		Vertical Deflections		
kgf	Dial Gauge F (in)	Dial Gauge J" (in)	Dial Gauge G (in)	Dial Gauge H (in)	Dial Gauge I (in)
0	0	0	0	0	0
2000	0	0.005	0.008	0.011	0.011
5400	0	0.0035	0.016	0.025	0.024
9000	0	0.008	0.021	0.038	0.035
12300	0	0.013	0.027	0.050	0.047
16000	0	0.017	0.032	0.0625	0.058
19500	0	0.021	0.037	0.075	0.070
23000	0	0.024	0.042	0.0855	0.079
26600	0	0.028	0.0475	0.098	0.090
28400	0	0.030	0.0515	0.1055	0.097
30020	0	0.0315	0.054	0.112	0.102
32000	0	0.033	0.056	0.117	0.108
33800	0	0.035	0.059	0.1225	0.112
35500	0	0.0365	0.061	0.129	0.118
37500	0	0.0385	0.063	0.134	0.123
38300	0	0.0395	0.066	0.140	0.129
39200	0	0.0405	0.067	0.144	0.1325
40000	-0.001	0.04175	0.069	0.1475	0.1365
40500	-0.00125	0.0425	0.070	0.149	0.139
0	0.00675	0.0185	0.0145	0.024	0.030
Remarks:	On hinge support	On roller support	At quarter span towards the hinged side.	At mid span	At quarter span towards the roller support.

All the gauges indicated permanent set on release of loading.

/

Comparison of Experimental & Theoretical Strains of a Single Bailey Bridge Panel (Test No. 1)

Member	Experimental Strain ($X10^{-6}$) 1	Treoretical Strain ($X10^{-6}$) Single Panel analysis 2a	Complete Bridge analysis 2b	Ratio 1/2a	Remarks
I	-	1.13	180.86	-	Bottom chord member
II	112.20	98.21	172.36	1.143	"
III	-368.00	-486.71	-70.86	0.756	Vertical web member
IV	-260.69	-474.05	2.60	0.550	"
V	-	361.99	26.97	-	Inclined web members
VI	-276.58	-365.67	32.00	0.756	"
VII	89.76	104.21	67.96	0.861	"
VIII	-195.12	-198.93	-55.63	0.980	"
IX	78.46	104.08	45.38	0.752	"
X	-204.88	-223.66	-25.33	0.916	"
XI	206.43	339.45	22.50	0.608	"
XII	-	-340.78	-22.43	-	"
XIII	-74.88	-77.22	-179.80	0.970	Top chord members
XIV	-	0.28	-177.09	-	"

Table-3·5(b)

Comparison of Experimental & Threotical Strains of two Bailey Bridge Panels tested in compound form (Test No. 2).

Member/ Station	Strains ($X10^{-6}$) at 9750 Kgf		Strains ($X10^{-6}$) at 18750 Kgf		Theortical Strain ($X10^{-6}$) from complete Bridge analysis	Remarks
	Experimental	Theoretical (isolated panel)	Experimental	Theoretical (isolated panel)		
I	0.00	0.00	-124.39	0.00	178.00	Refer Figs. 3 & 4.
II	-36.53	-16.00	-102.44	-30.77	70.80	
III	-	224.90	-	432.40	203.90	
IV	24.39	169.20	-68.29	325.30	90.80	
V	-9.76	0.00	-112.20	0.00	-177.10	
VI	12.20	27.20	-80.49	51.80	172.30	
VII	-214.63	-197.40	-478.05	-379.50	-32.00	
VIII	160.98	256.80	224.39	493.85	27.00	
IX	19.51	22.80	19.51	43.85	70.80	
X	-68.30	-37.60	-236.59	-72.20	-173.80	

CHAPTER - 4

SITE VISIT REPORT

CHAPTER - 4

SITE VISIT REPORT

4.1 VISIT TO THE SITE

ACE team comprised of two engineers, the Project Manager and Chief Testing Engineer. The team visited the Bailey Bridge site to collect the coupons, conduct the inspection survey and check the general conditions of the structure.

Earlier the team held a meeting with the CCSC Chief of Party in Peshawar office, to acquire GOP Clearance regarding security and arrangements for collection of the samples/coupons.

The ACE team conducted the inspection and supervised the collection and repair of coupons in the presence of CCSC/ACLU and GOP representatives. The team had taken with them 16 replacement coupons obtained from the tested panel (test No.1).

4.2 COUPON REMOVAL

The coupon removal and repair was carried out in accordance with ASTM A-6 and A-370 [2]. The selection of the coupons was based on the following considerations.

- Panel location w.r.t. moment & shear forces
- Accessibility
- Member condition

Standing on the left abutment the trusses were numbered I,II on left side and III, IV on right side (ref. fig. 2.2). Each truss has 18 bays. All the bays were assigned serial numbers 1 to 18 from left to right abutment.

Twenty coupons - ten each from chord and bracing members were collected/extracted from the different panels of the existing structures mentioned in table 4.1. Based on the tension test requirements the length of coupon was maintained equal to 18 inches.

The chord members samples were taken, from only the intermediate chord viz either top chords of bottom storey panels or from bottom chords of top storey panels. This area being at the neutral axis of the double M1 structure and subjected to relatively lesser bending moments is almost stress free. Similarly, the bracing members specimens were collected in the zone of relatively lesser shear forces. As a precaution, coupons were taken out from alternate panels only. Further (as shown in col 3 of table 4.1) coupons were not extracted from chord members from panels in bay 5 to 14 (inclusive) and bracing members from bay 1 to 5 and 14 to 18 (inclusive). These, and other measures, made the operation of removal of coupons fool-proof against the possibility of any damage to the structure. No traffic was allowed on the bridge during this operation. Collection of the samples from relatively lesser critical area means that the material of these coupons may be corroded, but has neither yielded nor buckled. All the samples collected were properly marked/numbered at site. The data in appendix-V indicates these marks/numbers.

4.3 REPAIRS OF PANELS

The removal of test coupons from panels and their repair with the already prepared strips/replacement coupons was carried out in-turn and one at a time, in conformity with the recommended procedures i.e., the affected panel was first repaired before the next coupon was cutout.

4.4 CONDITION SURVEY

ACE team inspected the bridge and its components in detail studying all the members and joints visually. The bridge panel members were classified into three groups as under :

S.No.	Dsgn	Category	Lost area* as %
1.	A	Good	0-10
2.	B	Fair	Upto 20
3.	C	Unsatisfactory	Upto 33.3

* It is difficult to quantify the residual area of a pitted member. The figure provides a cautious estimate.

The details of the observations is given in Appendix-IV.

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4.5 OBSERVATIONS DURING INSPECTION

The following important points were noted by the inspection team.

4.5.1 No component part/member such as panels, truss, transom raker, sway / other bracing, chord bolts etc was found missing.

4.5.2 Generally, transom girders and fasteners were found to be in good conditions. However, the pins were not properly oiled as required for a Bailey Bridge used as a permanent structure [1].

4.5.3 Some of the cotter pins were not fanned out properly.

4.5.4 The bridge equipment other than various panels seemed to be unused. The criterion for this categorization was based on the condition of transom seat and bolt. (Ref. Chapter-5).

4.5.5 Almost all the reinforcing chords provided in bays 2-17 (inclusive) can only be categorized as B or C. One of the members has a hole through the web (fig. 4.6) which is attributed to severe corrosion attack. The surrounding area is also found pitted there.

4.5.6 Chord members of panels were fairly corroded or damaged (Refer figures 4-1-4.10). Corrosion is generally severe around the transom seat area. Figure 4.4 shows damaged transom seat. The crack observed in the welding between the transom seat and bottom chord seems to be caused by Fatigue.

4.5.7 Slight buckling and non alignment of some of the chord members was also noted which may have resulted during handling, or probable previous use. (Refer figs. 4.9 and 4.10).

4.5.8 The bracing members are generally in good conditions. However, a buckled bracing member shown in fig 4.9 suggests that probably the panels remained in improper storage (since its manufacture in 1951), or improperly handled sometimes or, probably put to structural use.

4.5.9 Some of the panels have chord members marked C. USA and bracing members G. USA or John and Bethlehem Carnagie. This raises doubt whether any original member was replaced.

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4.5.10 The condition of panel in the top storey of bay No. 18 and 9 of truss III is probably the worst both these panels exist at critical locations.

4.5.11 The condition of the reinforcing chords is especially unsatisfactory.

4.5.12 Cracks in the welding and/or repairs to the existing welding noted on some panels - especially at the transom seat, is considered as an evidence of fatigue or use of the members previously in a Bridge structure.

4.5.13 The sag/vertical deflection of the structure was estimated to be about 3 inches, in the unloaded state of the structure.

4.5.14 The abutments are in good condition.

4.6 COMMENTS ON OBSERVATIONS

Even with the panels available in the present number (including those used in the launch nose assembly) and condition the bridge strength could be improved by better planning/management viz. best chosen panels, w.r.t. chord condition, used in bays 5 to 12. In fact the condition of the two critical Panels (ref. 4.5.10) alone warrant imposing restrictions on the use of this structure.

Figure 4.1:

Pitted Top Chord of the Top Storey Panel in Bay 18 Truss III

Figure 4.2: Panel repair by means of "Prepared Replacement Coupons" in progress. The corrosion is visible on the web member of the next panel

Figure 4.3: The Top Chord of a bottom storey panel indicating reduced thickness of the flange, note also the corrosion visible around the pins

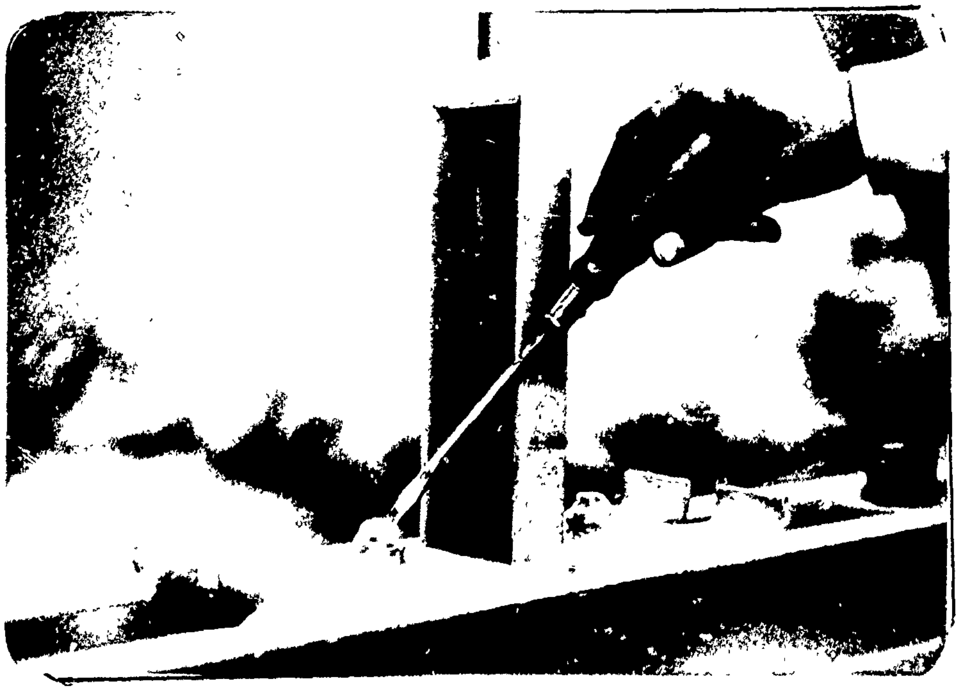

Figure 4.4: Pitted Transom seats & corroded surrounding area at bottom chord of a top storey panel, all such panels are considered "Used"

Figure 4.5: Another damaged Transom seat of bottom chord top storey panel. Note the condition of the bolt head and weld with the chord, considered an evidence of fatigue

Figure 4.6: Pit Hole formed due to corrosion in the top reinforcing & chord, indicated blue mark

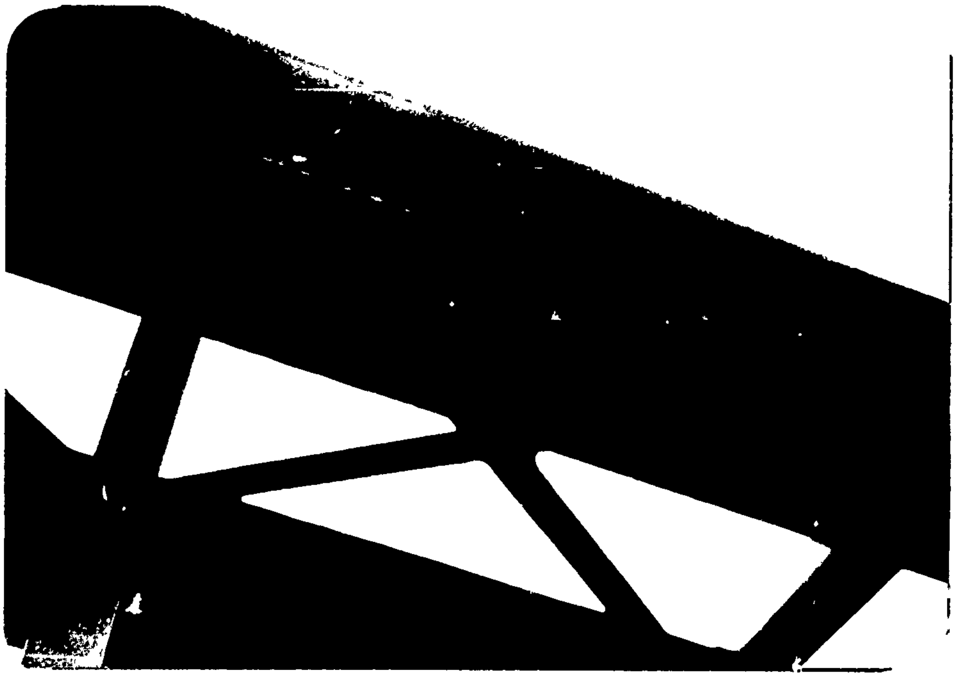

Figure 4.7: A view of damaged top chord channels of a top storey panel

Figure 4.8: A buckled diagonal bracing member of top storey panel

Figure 4.9:

Buckled and corroded bottom chord member of a top storey panel

Figure 4.10:

a buckled bottom chord member of a top storey panel

CHAPTER - 5

CHEMICAL AND TENSION TESTING

CHAPTER - 5

CHEMICAL AND TENSION TESTING

5.1 CHEMICAL TESTING

Chemical testing of the coupons was entrusted to the Metal Industry Research and Development Center (MIRDC) Lahore. Four samples - extracted from test panel No.1 were sent to MIRDC Laboratories on 28th May and other four samples brought from the site on 19th June. The result of analyses are given in table 5.1 and actual report in Appendix-V.

The chemical testing indicates that the material complies with ASTM A 588. However, the year of original adoption of this standard being 1968 (refer table 5.2) the material can be stated to be near to that standard (refer also Sec. 5.4.1).

5.2 COUPON TESTING

30 coupons were prepared in a workshop at Lahore from the Single panel tested (test No.1) within elastic limit. It follows that neither the material of this panel yielded nor members were buckled. 16 coupons were used to repair Bridge panel members at site while removing coupons. The coupons were collected and repaired in accordance with the standard practice of ASTM A-6 and A-370. The selection of coupons was carried out as explained in Chapter-4.

Out of the 20 coupons collected, 5 were obtained by the GOP Representative for their testing. Despite their best efforts, the Consultants did not receive them back. Consequently, 29 coupons i.e. 15 from the site and 14 from tested panel were put to physical and chemical testing. Out of which, 4 specimens were tested both physically and chemically. Physical testing was carried out in the Civil Engineering Department, U.E.T.

5.3 PHYSICAL TESTING

Physical testing - besides other tests listed in 5.4 involved hardness and Tension testing of 25 coupons and 3 pins. 200 Ton Shimadzu Universal Testing Machine, with Automatic Load versus extension testing facility, was employed for tension test on both coupons and pins. Six coupons were subjected to detailed testing including plotting of load extension curves in order to determine Modulus of Elasticity of the material. Due to lesser percentage of carbon in Bridge steel, all the coupons displayed marked and well defined yielding plateau. 3 pins were tested by making special holding facility and reducing their diameters on the same machine as per ASTM A-325 section 5-4 of [6].

Hardness tests on 10 coupons and 3 pins were performed on Rockwell hardness testing machine using diamond penetrator and 150 kg of load in order to confirm the tension and chemical testing resuls. Results of tension tests on coupons and pins and of hardness tests are provided in Tables 5.3 to 5.6 inclusive. The Hardness test results are given in Standard Hardness Numbers. H stands for Hardness Number, R for Rockwell testing machine and C for type of scale.

One truss panel was weighed at the UET Laboratories Lahore. The weight of the panel was about 261.0 Kg = 575 lbs. No deduction is made for any coating/film of enamal paint. This is considered to be in agreement with [1].

5.4 OTHER TESTS

Besides the, tension and hardness tests, some other tests were also performed on the material and discussed below.

5.4.1 Magnaflux Test

This is a non-destructive type of test which is performed for the detection of surface cracks. The (corroded) sample is prepared by hand-filing operation, and current is passed through the material and fine red-oxide powder sprinkled. The cracks of any are then visible by microscopic examination. Mangnaflux test was performed on four coupons and none revealed any surface crack.

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5.4.2 Macroscopic Examination

Visual examination by the help of magnifying glass was carried out on all the eight samples sent to the MIRDC. This examination has shown "small" pitting in all of them. Coupon No.2 (from site) is badly pitted.

5.4.3 Shaping Operation

In the process of sample preparation, 30 coupons were "shaped" in shaping machine. The operation shows that the material is high strength, and of good quality.

5.4.4 Boring operation

3 bores on each of the four samples was conducted which showed that corrosion is limited to surface pitting.

5.4.5 Ultrasonic testing

This test was planned but could not be performed due to considerable (corrosion) pitting.

5.5 DISCUSSIONS

The important points concerning the physical and chemical testing of the coupons are noted hereunder.

5.5.1 Tension and hardness test results of coupons indicate that the steel is generally nearer to ASTM A-572 with the exception of a couple of samples which are closer to A-588 steel. Most of the tested samples have yield and ultimate strength in excess of 55 Ksi and 80 Ksi respectively, (refer table 5.3) which is the requirement of A 572 steel. Also the Hardness value is nearer to A 572 steel, for most of the coupon.

5.5.2 Chemical testing confirms that the steel conforms to ASTM A-588. However, tension tests indicates A-572 steel due to strength obtained from present (reduced) X-sectional area.

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5.5.3 The steel showed well defined and marked yield plateau and plastic range. This is due to approximately 0.2% carbon content of the steel.

5.5.4 The steel is low carbon alloy and its high strength is attributed to presence of Magnese, Nickel and Chromium.

5.5.5 Overall, the material is of genuine quality.

TABLE 5.1
Chemical Analysis Results
(Percentage Composition of other Elements)

	Specimen Numbers							
	1	2	3	4	5	6	7	8
Carbon	0.17	0.22	0.22	0.13	0.16	0.22	0.17	0.22
Silicon	0.15	0.22	0.10	0.12	0.18	0.14	0.17	0.15
Chromium	0.11	0.11	0.11	0.21	-	-	-	-
Manganese	1.14	0.74	1.16	1.15	0.86	1.10	1.12	1.18
Nickel	0.58	0.64	0.91	0.58	-	-	-	-
Molybdenum	Traces	0.098	0.075	Traces	-	-	-	-
Sulphur	-	-	-	-	0.034	0.026	0.037	0.031
Phosphorous	-	-	-	-	0.018	0.016	0.016	0.014

\- Not checked

TABLE 5.2

Year of Original adoption of the various relevant ASTM Standards*.

Sr. No.	ASTM Designation Number	Year of Original adoption	Remarks
1.	A - 36	1960	-
2.	A - 242	1941	-
3.	A - 441	1970	-
4.	A - 572	1966	-
5.	A - 588	1968	-

*Reference [2]

*As mentioned in drawing No. 890607 High Strength, low Alloy Steel used in panels, Transoms, Strength, End posts and ramps correspond to ASTM A-242, A-441, A-572 or A-588 Grade 50.

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Table- 5.3

Coupon Tension Test Results

S.No	Mark	Wt. Rft. Lbs.	Area in^2	Yield Load Kgf	Ultimate Load Kgf	Yield Stress Psi	Ultimate Stress Psi	Elongation in	Percentage Elongation	M.O.E Psi	Remarks
1.	5/II	1.1356	0.334	8300	11,200	54,650	73,750	1.30	16.25	34.15×10^6	Chord Member
2.	7/III	1.1490	0.337	8700	12,400	56,800	80,950	1.20	15.00	32.05X"	"
3.	-	1.459	0.429	10600	15,380	54,350	78,850	1.75	21.87	27.74X"	"
4.	18	0.810	0.238	6540	8,800	60,450	81,350	1.25	15.62	32.47X"	Bracing Member
5.	19	0.949	0.279	7600	10,100	59,950	79,650	1.50	18.75	32.19X"	"
6.	-	0.819	0.241	7500	9,000	68,450	82,150	1.10	13.75	28.81X"	"
7.	6/III	1.1630	0.342	9400	12,120	60,450	77,950	1.50	18.75	-	Chord Member
8.	9/III	1.244	0.365	9320	12,660	56,200	76,300	1.40	17.50	-	"
9.	8	1.148	0.337	8720	12,500	56,950	81,600	1.60	20.00	-	"
10.	-	1.003	0.295	8120	11,600	60,550	86,500	1.60	20.00	-	Bracing Member
11.	3/II	0.962	0.283	7800	10,500	60,650	81,650	1.20	15.00	-	"
12.	15	1.004	0.295	7080	9,600	52,800	71,600	1.20	15.00	-	"
13.	17	0.731	0.215	5800	7,740	59,350	79,200	1.30	16.25	-	"
14.	-	1.451	0.426	10800	15,400	55,750	79,550	1.40	17.50	-	Chord member
15.	-	0.789	0.232	6300	8,300	59,750	78,700	1.40	17.50	-	Bracing Member

Cont'd...p/

Table - 5.3 ... cont'd

Coupon Tension Test Result

S.No	Mark	Wt. Rft. Lbs.	Area in^2	Yield Load Kgf	Ultimate Load Kgf	Yield Stress Psi	Ultimate Stress Psi	Elongation in	Percentage Elongation	M.O.E Psi	Remarks
16.	-	0.797	0.234	6440	8,600	60,550	80,850	1.40	17.50	-	Bracing Memb
17.	-	0.797	0.234	6600	8400	62,050	78,950	1.30	16.25	-	"
18.	-	0.785	0.231	6400	8,280	60,950	78,800	1.20	15.00	-	"

Notes :

1. Modulus of Elasticity of specimen at Sr. No. 1 to 6 are determined from the graphs.
2. The percentage elongations have been determined on a gauge length of 8" (200mm).

Table- 5.4

Hardness Test Results of Pins

S.No.	Mark		Remarks
1.	A	HR 61C	
2.	B	HR 57C	
3.	C	HR 59C	

Table- 5.5

Hardness Value Test Results of Coupons on Steel Paltes

S.No.	Mark		Remarks
1.	15/2	HR-61C	Bracing member
2.	17	HR-59C	"
3.	18	HR-62C	"
4.	19	HR-59C	"
5.	Nil	HR-65C	"
6.	3/III	HR-62C	Chord member
7.	6/III	HR-60C	"
8.	7/III	HR-61C	"
9.	8/III	HR-60C	"
10.	9/III	HR-60C	"

Table-5.6

Tension Test Results of Pins

S.No.	Mark	Dia in.	Area in^2	Yield Load Kgf	Ultimate Load Kgf	Yield Stress Psi	Ultimate Stress Psi	Elongation in	Percentage Elongation	Remarks
1.	A	1.25	1.230	-	67,000	-	1,19,850	-	-	Arrangement failed
2.	B	1.25	1.230	-	87,600	-	1,56,700	0.47	23.50	-
3.	C	1.25	1.230	-	78,000	-	1,39,500	-	-	Arrangement failed

Note:-

The percentage elongations have been worked on a gauge length of 2" (50 mm).

CHAPTER - 6

CORROSION AND FATIGUE

CHAPTER - 6

CORROSION AND FATIGUE

6.1 CORROSION

Probably the main reason of initiating this study/evaluation exercise is the corrosion of the panel members noticed before the launching of the bridge in place. The Consultants, therefore attached due importance to corrosion and endeavoured to verify/study this aspect from more than one approach as discussed below.

- Examination of the 3 panels, and 15 coupons from site, transported to Lahore by a Corrosion Expert.
- Examination of 8 coupons at the MIRDC Laboratory.
- Magnaflux and ultrasonic testing of four coupons brought from the site (2, 11, 14 and 16)at MIRDC Laboratories.
- Examination of bridge structure at site by ACE team.
- Examination of the panels and/or coupons in the ACE office.

6.2 OBSERVATIONS ON CORROSION

6.2.1 Views of Corrosion Expert

The panels and coupons were got examined from the Director Institute of Chemical Engineering and Technology, University of the Punjab, Lahore. His comments are summarized below.

A. The steel quality appears to be nearer to A-572 and A-588. (Refer table 5.2 for reference to the year of original adoption) as neither of these standards was inforce at the time of manufacture (stated 1951). the matter can only be considered near to these standards.

B. The material is High Strength low alloy steel as determined by the Chemical analysis.

C. Material is recommended by ASTM for use in bridges.

D. The quality of welding on the panels is good, indicating that proper welding procedures have been followed.

E. Presence of minimum 0.75 percent Mangnese in all the samples (refer Chemical Analysis report) provides the material necessary "notch toughness" - an important requirement for welded Bridges.

F. Out of the three panels inspected, two had undergone mild corrosion. The third panels has suffered moderate overall corrosion. Localized attack (pitting) is severe on transom seat, seat bolt, near female joint groove and some members, of this panel.

G. The severe corrosion of transom seat and bolt head suggest that a transom has, remained in-place (over the seat) in a previous bridge structure, and water - probably mixed with de-icing salts, ingressed into the small interface gap, between the transom and the seat. Water was held there due to capillary tension, and could not drain-out or readily evaporate, and caused considerable corrosion there. By this criterion all such panels may be considered to have been subjected to use in previous structures.

6.3 FATIGUE

Failure of a component - at a stress level, well below the material strength, which is subjected to a number of varying stress cycles, is known as Fatigue, especially when, magnitude of the upper and lower limits of (stress) cycles vary considerably. A great deal of research has been devoted to the study of the mechanism of fatigue, yet there is not a complete understanding of the phenomenon. Hence it is not an easy problem to handle theoretically or experimentally [5].

6.4 MECHANISM OF FATIGUE

The fatigue mechanism has two distinct phases, initiation of a crack, and propagation of this crack to final rupture of the material. An increase in the tensile mean stress (in the stress cycle) reduces the allowable range of stress for a particular endurance. This applies similarly to direct stress or shear stress (torsional) fatigue [5].

6.5 CORROSION AND FATIGUE COMBINED

Corrosion is essentially a process of oxidation and under static conditions a protective oxide film is formed which tends to retard further corrosion attack. In the presence of cyclic stress the situation is very different, since the partly protective Oxide film is ruptured in every cycle allowing further attack. A rather simplified explanation of the corrosion fatigue mechanism is that the microstructure at the surface of the metal is attacked by the corrosive, causing easier and more rapid initiation of cracks. The stress concentration at the tips of fissures breaks the oxide film and the corrosive in the crack acts as a form of electrolyte with the tip of the crack becoming an anode from which material is removed, thus assisting the propagation under fatigue action. The separate effects of corrosion and fatigue when added do not cause as serious a reduction in strength as the two conditions acting simultaneously, and fractures can be obtained at very low stress after hundreds of millions of cycles [5].

6.6 PROTECTIVE FILM/COATING

While the existing corrosion on the Bridge is a cause of concern, the protective coating by enamel paint and absence of corrosive environment at the Bridge location, however, are two factors, which limit corrosion fatigue effects on the existing Bailey Bridge structure.

6.7 Strength of the structural members

On the basis of physical and chemical testing and other test results the fatigue limit of the member is calculated on the assumption of 500,000 to 750,000 stress cycles completed by the structure.

As mentioned in Section 4.5.10, the condition of panel in the top storey of bay No. 18 and 9 of truss III is probably the worst. Both these panels are situated at critical location w.r.t. shear and BM respectively. "The two main girders of a bridge are independent of each other and each must be capable of taking atleast half the total bridge loads. If one girder is damaged it cannot be replaced by any reserve capacity of the other" [1]. Besides "only chords of central bays and vertical and diagonal members of the end bays are fully stressed. Any damage to these members decrease the bridge class in direct proportion" [1]. In view of the critical position of top storey panel in Bay 9, of truss III, the Existing Bridge Capacity is based on the residual capacity of this panel and reinforcing chords.

It is difficult to quantify the residual area of a pitted member. However for the purpose of evaluation of this structure the net/effective/residual X-section area is considered as 0.75 x a, where a = actual X-section area.

The fatigue strength of the chord member is worked out to be about 70 K (32 T). Details of calculations is given in Appendix-VI.

6.8 STRESS REDISTRIBUTIONS

In a double storey Bailey Bridge structure, only one chord of a particular member is stressed at a time. Viz either the top chord of top storey or the bottom chord of the bottom storey panels. Besides either the bracing members are stressed (bays near to the abutments) or the chord members (in middle of the structure). In this state of stress some redistribution of the stresses may occur, resulting in release of stress in the more stressed member. However in the absence of references providing definite procedures to quantify this reduction, for a Bailey Bridge, likely advantage of this aspect is ignored.

6.7 DISCUSSION OF FACTOR OF SAFETY (FOS)

The Manual [7] provides a safe working stress against a range of stress cycles undergone by the structure. In calculating the strength of structural members (ref. Section 6.7) the working stress have been considered corresponding to 500,000 to 750,000 stress cycles completed by the structure.

The panels are supposed to have been designed for a maximum allowable stress of 0.55 x yield strength. It follows that FOS of 1/0.55 = 1.82 was used. However, due to fatigue of the member, the allowable stress as specifid in the Manual [7] = 0.17 fy. Hence as per this procedure:

–	Fatigue Limit 0.17 x 1.25 x Fy	= 10.625 ksi
–	Reduced capacity of the chord member due to corrosion 10.625 (0.75x8.52)	= 67.89 kip
–	Total force in the member due to H 15 truck (from table 2.3)	= 81.5 kip*
–	Hence FOS 67.89/73.67 x 1.82	= 1.68

* the actual force is however = 73.67 K as shown on P-6/6 of calculations in Appendix VI.

From the above presents we infer that the FOS in the real terms has somewhat reduced (from 1.82 in immaculate condition to 1.68 in the present condition, after allowing for the corrosion and fatigue effects).

In the calculations for Dead Load Pages 1/6 to 6/6, provided in Appendix-VI, it would be observed that the available margin/cushion in the Dead Load is used up later when 81.5 K (or minimum 73.67 K) force is allowed in lieu of 67.89 K "Fatigue Strength" as calculated on Page 3/3 in the same Appendix. This available cushion has not, therefore, affected any of the Consultants finding and hence not further considered in the report.

CHAPTER - 7

CONSULTANTS REPORT

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CHAPTER - 7

CONSULTANTS FINDINGS

7.1 FINDINGS OF THE MEETINGS

In order to fulfil the requirements of the assignment all the available data and information of the bridge were procured through CCSC and their allied offices. For better understandings of the problem, the Consultant had three meetings with CCSC personnel - one at ACE Office Lahore, two in the CCSC Office Peshawar and third with GOP personnel at the site. The data received were also thoroughly processed and studied. As a result of the above efforts, the following points have emerged for consideration.

- The original invoice indicate the year of manufacture of the panel trusses, as 1951.

- Pre-shipment inspection of the consignment or "an adequate evaluation of the Bridge" was not accomplished prior to the procurement.

- Bailey Bridge delivered on 10 and 11th July (1989) is probably "a non-standard design utilizing both M1 and M2 Bailey Bridge parts".

- It probably took time to convince the GOP personnel that the Bridge - delivered (in that condition) is "buildable", as they pointed out "numerous faults" in the consignment delivered.

- "Despite the above, it was decided by CCSC that in the absence of hard evidence that the bridge was unsafe, the erection was carried out, based on the supplier's warranties", probably to avoid "further delay".

7.2 SUMMARY OF THE STUDIES AND TESTS

7.2.1 From the computer analyses we infer that the deflection of this (moderately corroded) structure remain within permissible limits (refer table 2.1) and that the "Forces" on members do not increase in magnitude - as compared to an immaculate structure (refer Fig. 2.8)

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7.2.2 The first panel load test conducted, (Test No.1) has shown that the behaviour of a single panel tested in that conditions, was okay, upto about 23 tons load.

7.2.3 The failure of panels at a load of about 40 tons in the compound panel test - Test No.2, is not a serious cause of alarm, in view of the load applied at the center. The application of load at a point near to the female end - instead at the center, would have resulted in less than half the stresses (in the components) than otherwise caused (refer Fig. 7.1). The absence of the linear elastic behaviour of panels since the initial stages of loading test however suggest, that the panels have, probably been used earlier.

7.2.4 In their visit to the site, the Consultants have noted the following.

A. Except, for the corrosion noted on various panels and reinforcing chords, and other problems discussed in Chapter 4 and 6 and elsewhere, the other components of the structure are alright.

B. CCSC seems to be maintaining a proper maintenance staff and equipments at the site.

C. The Bridge structure is fairly well maintained.

D. The passing traffic is :

- Upto 100 vehicles/day during summer.
- Upto 400 vehicles/day during winter

and comprise mostly of loaded pick-ups. However upto about 15 percent of the traffic - especially in winter comprise of heavily loaded trucks/oil tankers

E. The traffic generally passes (from over the Bridge) slowly.

7.2.5 The chemical and tension test results has indicated that the material properties are :

- E = Modulus of Elasticity = 30,000 Ksi
- Fy = Yield stress = 50 Ksi

also the material is low alloy, high strength, having necessary notch toughness.

7.2.6 Various reports/views obtained, suggest probable previous use of the panels, and the "fatigue limit" of the material has reduced, due to the corrosion fatigue effects.

7.2.7 One representative panel was weighed at the UET Laboratories, Lahore. The weight was about 261 Kg = 575 lbs. - in agreement with that given in [1].

7.3 <u>CONCLUSIONS</u>

The conclusions arrived by these studies, tests, examinations and discussions are provided in the answers to the following questions.

7.3.1 Is the design configuration capable of meeting the claimed load standards?

Ans. The design configuration could meet the claimed load standards only in the original condition of the M2 panels and reinforcing chords. Refer table 14.2 [1]. The table "gives the maximum safe class of Bridge reinforced with supplementary chords". Based on:

- the span of structure; and
- no. of bays reinforced

the table enlists the permissible wheel load class and track load class on the structure.

For a 180 feet span, Double-Double M2, Chord Reinforced Model, the table mentions the allowable wheel load class as follows:

- 8 T for no reinforcing of chords;
- 35 T (HS 20) for 12 bays reinforced

(1 T = 2,000 lbs.)

The existing structure has reinforcement chords in 16 bays. However, as the critical design factor in most fixed panel bridges is Bending Moment - which varies from a maximum at the centre of the span to zero at the support, the reinforcing in the four additional panel does not help in increasing the moment capacity of central bays (9&10).

The existing structure is a "M1 Reinforced Chord" model. Considering the M2 Panels (for which table 14-2 provides information) equivalent to M1 Panels, the existing Bridge Configuration (Doubel-Double, M1 Chord Reinforced) cannot be considered "capable of meeting the claimed load standards" (HS 20), in view of the following:

- known deficinencies/corrosion problem
- permanent use of the structure

7.3.2 Does the steel used to fabricate the component parts meet the standards?

Ans. The materials comply with ASTM A-572 and A-588 as mentioned in the construction drawings, and established by the chemical and physical tests. However as neither of these standards was in force in 1951 (refer table 5.2) the materials are in fact only near to the above standards.

7.3.3 Is there measurable corrosion on the structure? If so, does this corrosion weaken the Bridge below claimed design load capacity?

Ans. This is the most important question. Discussions on this aspect is provided / available in different chapters - especially Chapter No.6. It is inferred that considerable corrosion is present on various panels and reinforcing chords. In view of their conditions, all the reinforcing chord have been rated in category B (Refer Appendix-4). Evidence of fatigue, was also noted, as mentioned in Section 4.5.12 and elsewhere. This inter-alia other reasons, has resulted in reduced fatigue strength of the members. The structure is inadequate to withstand AASHTO HS 20 or equivalent loading (Refer Appendix-VI and Sections 4.4 and 7.3.4.).

7.3.4 If it is determined that the Bridge is substandard what is the load capacity of the structure in its present condition.

Ans. The computer analyses results provide the forces in members in 2 conditions :

1. Dead loads only
2. Live loads corresponding to HS 20 & H 15

The discussions in Section 6.7 (strength of the structural members) has concluded that the "fatigue strength" of chord members in the present conditions is about 70 K (32 T) - as per the safe stress allowed by the Manual [7]. However, the total force produced in the chord member of central bay panels is about 80 K, which is allowed due to the "cushion" available in the dead load from transom (refer calculations in Appendix-VI).

The Dead load forces on the members forms a major component of the total and cannot be reduced. Hence to limit the total force on the chord member to about 80 K, the loading on the Bridge should be restricted to AASHTO H 15, as shown in Figure 2.9. With caution, the allowable loading class can be increased by 25% [1]. It follows that a maximum of 18 T loading may be recommended with caution, viz. maintaining near zero speed.

7.4 DISCUSSIONS

The following points are worth considering.

7.4.1 The Bridge is in service since about last one year and have catered for the winter traffic during the closure of the Lowari Top.

7.4.3 As mentioned in Section 6.6 the existing film of enamel and absence of corrosive environment at the Bridge location, limits corrosion fatigue effects, and probably further deterioration - with proper maintenance.

7.4.4 The traffic intensity or the AADT (Average Annual Daily Traffic) on the structure is low - especially the loaded trucks.

7.4.5 The material of the structure is high strength, low alloy having necessary notch toughness, and recommended for use in the given conditions.

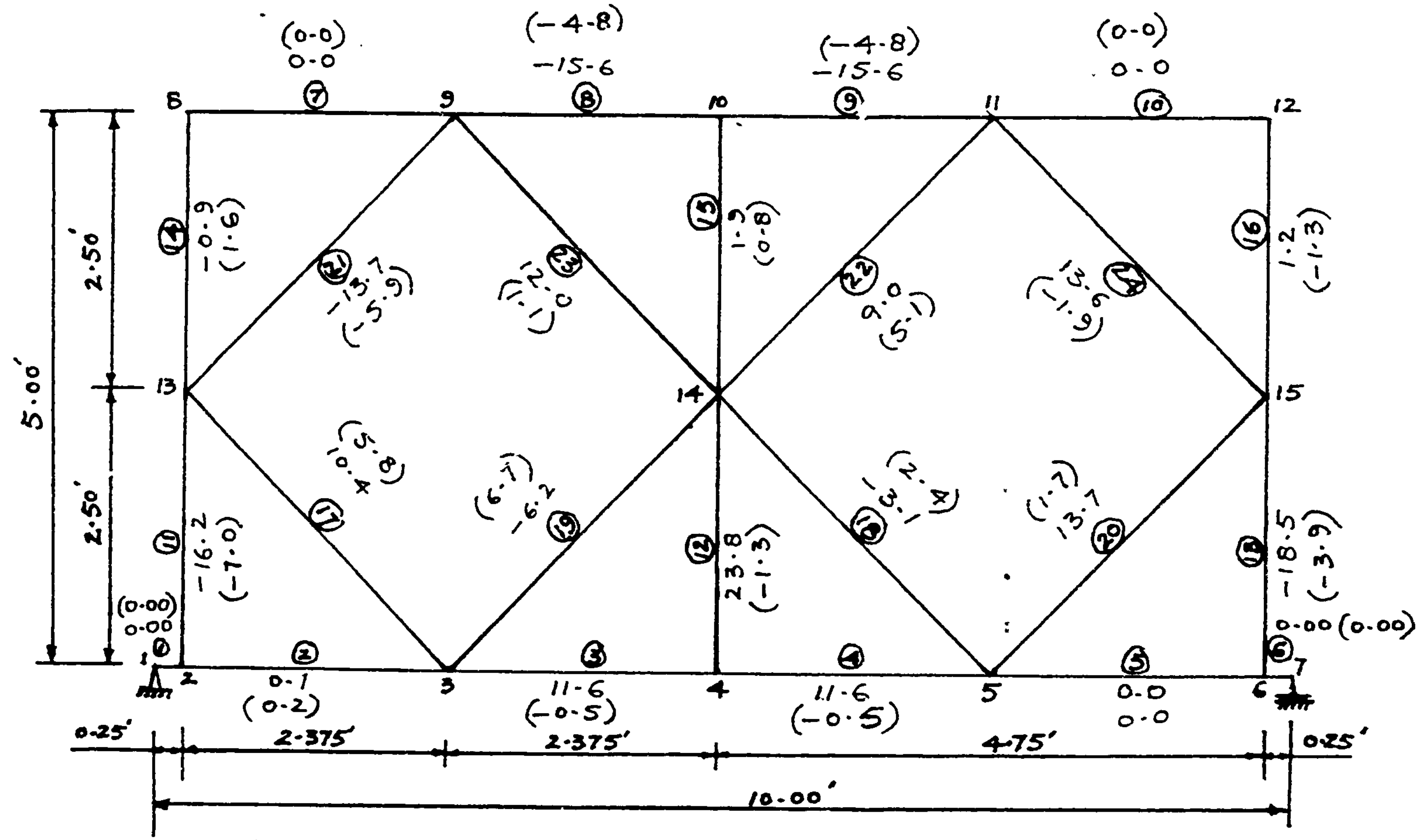
7.4.6 The apparent condition of abutments and all other components (except the main panels) is okay.

7.4.7 It implies from the above that with live load restrictions (mentioned in 7.3.4) observed, the structure can remain in service. It is difficult to answer at this stage the period of satisfactory service. This definitely requires periodic inspection from competent personnel.

7.4.8 Regarding the replacement of panels, the site inspection survey tables provided in Appendix iv clearly indicates the conditions of various panels and their components Method of replacing unsatisfactory/ damaged panels is explained in maintenance schedule (VIII.9b).

7.4.9 Nothing is mentioned in the Bailey Bridge Manual regarding M1 type Bailey Bridge. However, memorandum for the Director, office of AID Rep. dated 16.07.1989, mentioned that the bridge is neither exclusively an M1 or M2. This bridge is a combination of the two types with some specialized pieces. Hence the values given in the table for M2 type had been taken as a guide.

FIG. 7·1



(Note: The values in parantheses correspond to Load applied near the female end)

BAILEY BRIDGE
SINGLE PANEL
FILE: STRUCTM/N
DSGN:SMW
DATE: JULY 1990.

PART - II

APPENDICES

APPENDIX - 1

LIST OF REFERENCES

APPENDIX - 1

LIST OF REFERENCES

This Section provides supporting reference for Chapter-1.

Various standards/Books and other documents have been consulted in the compilation of this document and listed in this Appendix. Reference to any such document in this report/document is mentioned in a box [] bracket, with only the serial number mentioned there against that document (listed in table 1.1) without repeating the full name.

TABLE - I.1

List of References used in the Report

Ref. No.	Compiling Agency/Writer	Description
1.	Headquarters Department of the Army - Washington	Bailey Bridge Field Manual 5-277 Edition 1986
2.	American Society for Testing and Materials	ASTM Standards Volume 4
3.	American Association of State Highway and Transportation Officials (AASHTO)	Standard Specifications for Highway Bridges 1983
4.	American Concrete Institute	ACI 318-83
5.	Warnock F.V. & Benham P.P.	Mechanics of Solids and Strength of Materials
6.	AASHTO	Manual for Maintenance - Inspection of Bridges 1983
7.	American Institute of Steel Construction	AISC Manual 8th Edition
8.	Heins C.P & Firmage O.A	Design of Modern Steel Highway Bridges

APPENDIX - II

COMPUTER ANALYSES RESULTS

APPENDIX - II

COMPUTER ANALYSES RESULTS

This section provides supporting reference for Chapter-2.

A complete print-out of the following two files is presented in this Appendix, for Analysis-A reported in Section 2.2.4.

1 SOL Deflections (Pages 1-16)

2 F3F Member forces (Pages 17-115)

BAILEY BRIDGE TRUSS ANALYSIS (CASE 1)
SAP80 V85.02

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* * * *     J O I N T   D I S P L A C E M E N T S       * * * *
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
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LOAD CONDITION 1 - DISPLACEMENTS "U" AND ROTATIONS "R"

JOINT	U(X)	U(Y)	R(Z)
1	.000000	.000000	-.004798
2	.000014	-.129228	-.004112
3	.003383	-.238679	-.003438
4	.006768	-.341534	-.004197
5	.011886	-.439272	-.000526
6	.012041	-.439854	.000000
7	.012203	-.441317	-.001268
8	.014748	-.518093	-.003424
9	.017741	-.619453	-.003536
10	.020747	-.719440	-.003359
11	.024355	-.794601	-.001191
12	.024573	-.795901	.000000
13	.024803	-.797245	-.001165
14	.028403	-.867593	-.003140
15	.032361	-.960362	-.003218
16	.036335	-1.050803	-.003033
17	.040852	-1.118779	-.001078
18	.041125	-1.119955	.000000
19	.041413	-1.121144	-.001030
20	.045922	-1.183275	-.002777
21	.050687	-1.265254	-.002827
22	.055474	-1.344223	-.002646
23	.060736	-1.403648	-.000943
24	.061054	-1.404677	.000000
25	.061390	-1.405688	-.000876
26	.066645	-1.458402	-.002360
27	.072062	-1.527975	-.002381
28	.077503	-1.593979	-.002208
29	.083355	-1.643734	-.000792
30	.083709	-1.644598	.000000
31	.084082	-1.645414	-.000707
32	.089929	-1.687769	-.001899
33	.095850	-1.743657	-.001893
34	.101798	-1.795528	-.001732
35	.108094	-1.834749	-.000626
36	.108475	-1.835433	.000000
37	.108877	-1.836042	-.000527
38	.115169	-1.867327	-.001406
39	.121459	-1.908560	-.001371
40	.127775	-1.945430	-.001227
41	.134381	-1.973476	-.000451
42	.134781	-1.973968	.000000
43	.135202	-1.974361	-.000339
44	.141806	-1.994075	-.000889
45	.148335	-2.019965	-.000828
46	.154893	-2.041243	-.000704
47	.161681	-2.057674	-.000268
48	162092	-2.057967	.000000
49	.162525	-2.058138	-.000146

50	.169312	-2.065976	-.000358
51	.175960	-2.076101	-.000271
52	.182636	-2.081455	-.000169
53	.189485	-2.086024	-.000082
54	.189899	-2.086114	.000000
55	.190337	-2.086062	.000048
56	.197185	-2.081903	.000179
57	.203833	-2.076093	.000291
58	.210508	-2.065444	.000368
59	.217296	-2.058088	.000106
60	.217707	-2.057974	.000000
61	.218140	-2.057699	.000241
62	.224929	-2.041608	.000713
63	.231458	-2.019942	.000848
64	.238013	-1.993461	.000899
65	.244618	-1.974298	.000291
66	.245018	-1.973982	.000000
67	.245439	-1.973489	.000430
68	.252047	-1.945715	.001237
69	.258335	-1.908522	.001391
70	.264648	-1.866633	.001415
71	.270942	-1.835969	.000473
72	.271323	-1.835455	.000000
73	.271725	-1.834753	.000612
74	.278024	-1.795737	.001742
75	.283943	-1.743608	.001913
76	.289886	-1.687001	.001908
77	.295735	-1.645334	.000646
78	.296089	-1.644630	.000000
79	.296463	-1.643730	.000784
80	.302318	-1.594119	.002218
81	.307731	-1.527917	.002401
82	.313167	-1.457567	.002369
83	.318426	-1.405604	.000809
84	.318744	-1.404723	.000000
85	.319080	-1.403641	.000941
86	.324346	-1.344304	.002655
87	.329107	-1.265192	.002847
88	.333887	-1.182383	.002786
89	.338400	-1.121060	.000958
90	.338673	-1.120017	.000000
91	.338961	-1.118775	.001080
92	.343482	-1.050836	.003043
93	.347434	-.960301	.003238
94	.351402	-.866657	.003148
95	.355006	-.797168	.001088
96	.355225	-.795982	.000000
97	.355455	-.794605	.001197
98	.359068	-.719442	.003369
99	.362055	-.619402	.003556
100	.365053	-.517130	.003433
101	.367604	-.441246	.001188
102	.367758	-.439952	.000000
103	.367921	-.439367	.000502
104	.373050	-.342478	.004222
105	.376429	-.238920	.003482
106	.379821	-.127364	.004198
107	.379833	.000000	.004481
108	.192196	-.030637	-.003592
109	.192199	-.134911	-.003629

///

111	.191677	-.347577	-.003808
112	.191365	-.436488	-.001462
113	.191346	-.438090	.000000
114	.191326	-.439902	-.001566
115	.191015	-.528451	-.003536
116	.190816	-.619837	-.002983
117	.190616	-.710033	-.003405
118	.190502	-.793674	-.001419
119	.190496	-.795225	.000000
120	.190488	-.796875	-.001429
121	.190375	-.877817	-.003229
122	.190299	-.961078	-.002712
123	.190222	-1.042826	-.003071
124	.190179	-1.117994	-.001272
125	.190176	-1.119383	.000000
126	.190174	-1.120848	-.001270
127	.190130	-1.192717	-.002861
128	.190098	-1.266205	-.002387
129	.190065	-1.337826	-.002674
130	.190047	-1.402980	-.001098
131	.190046	-1.404178	.000000
132	.190045	-1.405431	-.001086
133	.190027	-1.466836	-.002437
134	.190010	-1.529102	-.002014
135	.189994	-1.589204	-.002227
136	.189985	-1.643161	-.000906
137	.189985	-1.644149	.000000
138	.189984	-1.645169	-.000884
139	.189975	-1.695012	-.001968
140	.189964	-1.744916	-.001604
141	.189953	-1.792411	-.001740
142	.189948	-1.834258	-.000699
143	.189948	-1.835020	.000000
144	.189948	-1.835790	-.000667
145	.189942	-1.873232	-.001466
146	.189933	-1.909913	-.001166
147	.189925	-1.943991	-.001225
148	.189920	-1.973055	-.000480
149	.189920	-1.973579	.000000
150	.189920	-1.974087	-.000440
151	.189916	-1.998525	-.000941
152	.189908	-2.021381	-.000708
153	.189900	-2.041483	-.000691
154	.189896	-2.057314	-.000255
155	.189896	-2.057592	.000000
156	.189896	-2.057830	-.000206
157	.189892	-2.068883	-.000400
158	.189884	-2.077549	-.000240
159	.189876	-2.083353	-.000145
160	.189873	-2.085715	-.000026
161	.189872	-2.085743	.000000
162	.189872	-2.085709	.000031
163	.189869	-2.083203	.000147
164	.189861	-2.077543	.000233
165	.189853	-2.068960	.000402
166	.189849	-2.057820	.000203
167	.189849	-2.057598	.000000
168	.189849	-2.057291	.000267
169	.189845	-2.041259	.000691

171	.189829	-1.998530	.000943
172	.189825	-1.974060	.000429
173	.189825	-1.973591	.000000
174	.189824	-1.973016	.000500
175	.189820	-1.943697	.001225
176	.189811	-1.909888	.001159
177	.189803	-1.873168	.001470
178	.189797	-1.835749	.000649
179	.189797	-1.835041	.000000
180	.189797	-1.834205	.000726
181	.189791	-1.792049	.001740
182	.189780	-1.744882	.001596
183	.189769	-1.694885	.001972
184	.189761	-1.645117	.000858
185	.189760	-1.644180	.000000
186	.189760	-1.643097	.000940
187	.189751	-1.588780	.002225
188	.189734	-1.529064	.002006
189	.189718	-1.466653	.002441
190	.189700	-1.405372	.001054
191	.189699	-1.404221	.000000
192	.189697	-1.402908	.001139
193	.189680	-1.337349	.002672
194	.189647	-1.266167	.002379
195	.189614	-1.192487	.002865
196	.189571	-1.120787	.001231
197	.189568	-1.119442	.000000
198	.189565	-1.117922	.001318
199	.189522	-1.042306	.003069
200	.189445	-.961045	.002705
201	.189368	-.877553	.003234
202	.189255	-.796818	.001385
203	.189248	-.795304	.000000
204	.189241	-.793607	.001471
205	.189127	-.709479	.003402
206	.188927	-.619814	.002975
207	.188726	-.528170	.003540
208	.188413	-.439879	.001517
209	.188394	-.438218	.000000
210	.188374	-.436453	.001525
211	.188060	-.346710	.003805
212	.187809	-.240348	.003632
213	.187557	-.135418	.003627
214	.187560	-.030510	.003625
215	.376056	-.039559	-.003679
216	.376054	-.144435	-.003513
217	.373763	-.240209	-.003120
218	.371459	-.338695	-.004188
219	.366964	-.437531	-.000536
220	.366828	-.438124	.000000
221	.366685	-.439573	-.001256
222	.364452	-.516874	-.003460
223	.361620	-.618868	-.003541
224	.358774	-.718614	-.003343
225	.355279	-.793370	-.001182
226	.355068	-.794660	.000000
227	.354845	-.795980	-.001145
228	.351358	-.866599	-.003169
229	.347443	-.959955	-.003224

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231	.339036	-1.117637	-.001066
232	.338766	-1.118799	.000000
233	.338481	-1.119962	-.001009
234	.334015	-1.182317	-.002806
235	.329248	-1.264903	-.002835
236	.324461	-1.343677	-.002627
237	.319216	-1.402539	-.000931
238	.318899	-1.403553	.000000
239	.318564	-1.404538	-.000854
240	.313327	-1.457458	-.002389
241	.307892	-1.527644	-.002390
242	.302435	-1.593460	-.002189
243	.296591	-1.642638	-.000779
244	.296238	-1.643486	.000000
245	.295865	-1.644275	-.000685
246	.290027	-1.686830	-.001928
247	.284083	-1.743333	-.001901
248	.278113	-1.795019	-.001713
249	.271822	-1.833657	-.000613
250	.271441	-1.834325	.000000
251	.271040	-1.834907	-.000505
252	.264753	-1.866390	-.001435
253	.258438	-1.908239	-.001380
254	.252097	-1.944925	-.001209
255	.245495	-1.972385	-.000437
256	.245096	-1.972861	.000000
257	.244674	-1.973227	-.000317
258	.238075	-1.993138	-.000918
259	.231520	-2.019645	-.000837
260	.224937	-2.040739	-.000685
261	.218152	-2.056584	-.000255
262	.217742	-2.056861	.000000
263	.217308	-2.057006	-.000124
264	.210525	-2.065039	-.000387
265	.203851	-2.075781	-.000280
266	.197150	-2.080952	-.000150
267	.190304	-2.084934	-.000069
268	.189890	-2.085009	.000000
269	.189453	-2.084929	.000070
270	.182608	-2.080966	.000150
271	.175935	-2.075773	.000282
272	.169234	-2.064941	.000387
273	.162449	-2.056998	.000119
274	.162039	-2.056868	.000000
275	.161606	-2.056566	.000263
276	.154820	-2.040671	.000685
277	.148266	-2.019621	.000839
278	.141685	-1.992957	.000918
279	.135084	-1.973208	.000305
280	.134685	-1.972875	.000000
281	.134263	-1.972355	.000452
282	.127660	-1.944777	.001209
283	.121347	-1.908201	.001382
284	.115009	-1.866129	.001434
285	.108720	-1.834877	.000486
286	.108339	-1.834347	.000000
287	.107938	-1.833618	.000634
288	.101644	-1.794795	.001713
289	.095703	-1.743284	.001904

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291	.083896	-1.644238	.000660
292	.083543	-1.643518	.000000
293	.083170	-1.642591	.000806
294	.077323	-1.593167	.002189
295	.071893	-1.527586	.002392
296	.066441	-1.457057	.002388
297	.061199	-1.404497	.000823
298	.060882	-1.403599	.000000
299	.060547	-1.402490	.000964
300	.055299	-1.343324	.002627
301	.050537	-1.264840	.002837
302	.045756	-1.181859	.002805
303	.041286	-1.119922	.000972
304	.041015	-1.118861	.000000
305	.040730	-1.117590	.001104
306	.036253	-1.049779	.003016
307	.032342	-.959893	.003227
308	.028417	-.866096	.003168
309	.024926	-.795947	.001103
310	.024714	-.794743	.000000
311	.024491	-.793332	.001224
312	.020992	-.718181	.003344
313	.018165	-.618813	.003544
314	.015328	-.516328	.003460
315	.013091	-.439522	.001211
316	.012955	-.438200	.000000
317	.012812	-.437545	.000561
318	.008309	-.339080	.004177
319	.006013	-.240490	.003151
320	.003710	-.143740	.003513
321	.003708	-.039423	.003650
322	.093249	-.021881	-.002984
323	.097578	-.239582	-.003054
324	.102308	-.436756	-.003425
325	.097533	-.439984	-.003315
326	.109403	-.619948	-.002831
327	.100843	-.794825	-.003062
328	.104107	-.796400	-.003066
329	.116052	-.961068	-.002584
330	.109181	-1.119107	-.002756
331	.113144	-1.120314	-.002753
332	.124504	-1.266134	-.002282
333	.119488	-1.404028	-.002390
334	.123972	-1.404906	-.002380
335	.134468	-1.528994	-.001932
336	.131305	-1.644101	-.001974
337	.136200	-1.644716	-.001959
338	.145602	-1.744783	-.001542
339	.144289	-1.835046	-.001517
340	.149492	-1.835463	-.001499
341	.157610	-1.909764	-.001122
342	.158129	-1.973655	-.001030
343	.163546	-1.973925	-.001010
344	.170224	-2.021221	-.000682
345	.172541	-2.057704	-.000524
346	.178083	-2.057861	-.000504
347	.183195	-2.077382	-.000228
348	.187257	-2.085883	-.000008
349	.192836	-2.085945	.000012

351	.202015	-2.057767	.000509
352	.207547	-2.057733	.000526
353	.209255	-2.021201	.000682
354	.216556	-1.973800	.001017
355	.221954	-1.973655	.001031
356	.221868	-1.909733	.001123
357	.230614	-1.835309	.001507
358	.235790	-1.835017	.001516
359	.233874	-1.744743	.001542
360	.243911	-1.644537	.001969
361	.248769	-1.644048	.001971
362	.245006	-1.528947	.001932
363	.256143	-1.404706	.002392
364	.260582	-1.403956	.002387
365	.254966	-1.266086	.002283
366	.266974	-1.120101	.002765
367	.270886	-1.119022	.002751
368	.263414	-.961023	.002585
369	.276015	-.796180	.003079
370	.279223	-.794736	.003056
371	.270055	-.619914	.002831
372	.282591	-.439772	.003329
373	.278405	-.436799	.003418
374	.281134	-.239788	.003051
375	.287781	-.021639	.003013
376	.279227	-.039442	-.002938
377	.287614	-.241017	-.002944
378	.277022	-.435065	-.003337
379	.283710	-.439554	-.003241
380	.270990	-.619446	-.002789
381	.279109	-.794040	-.003032
382	.276661	-.795934	-.003041
383	.264052	-.960738	-.002570
384	.270644	-1.118528	-.002747
385	.267448	-1.119796	-.002745
386	.255454	-1.265839	-.002278
387	.260264	-1.403525	-.002389
388	.256527	-1.404369	-.002379
389	.245409	-1.528739	-.001931
390	.248391	-1.643625	-.001975
391	.244237	-1.644173	-.001959
392	.234217	-1.744535	-.001542
393	.235360	-1.834580	-.001519
394	.230893	-1.834917	-.001500
395	.222160	-1.909519	-.001123
396	.221473	-1.973193	-.001033
397	.216792	-1.973379	-.001012
398	.209499	-2.020977	-.000682
399	.207015	-2.057242	-.000527
400	.202210	-2.057314	-.000505
401	.196482	-2.077139	-.000229
402	.192255	-2.085422	-.000010
403	.187412	-2.085398	.000010
404	.183347	-2.077132	.000228
405	.177451	-2.057306	.000506
406	.172656	-2.057186	.000524
407	.170331	-2.020957	.000681
408	.162864	-1.973340	.001014
409	.158203	-1.973106	.001029

411	.148759	-1.834850	.001504
412	.144321	-1.834464	.001513
413	.145615	-1.744495	.001541
414	.135411	-1.644080	.001965
415	.131293	-1.643486	.001968
416	.134426	-1.528693	.001930
417	.123116	-1.404256	.002385
418	.119424	-1.403366	.002380
419	.124384	-1.265811	.002277
420	.112192	-1.119669	.002753
421	.109047	-1.118357	.002737
422	.115790	-.960693	.002569
423	.102975	-.795801	.003050
424	.100583	-.793864	.003021
425	.108862	-.619409	.002788
426	.095914	-.439420	.003251
427	.102085	-.434988	.003327
428	.092776	-.241293	.002944
429	.099912	-.039321	.002938

LOAD CONDITION 2 - DISPLACEMENTS "U" AND ROTATIONS "R"

JOINT	U(X)	U(Y)	R(Z)
1	.000000	.000000	-.002376
2	.000005	-.067599	-.002236
3	.001467	-.127216	-.001888
4	.002937	-.183932	-.002302
5	.005057	-.237181	-.000281
6	.005121	-.237491	.000000
7	.005188	-.238293	-.000698
8	.006240	-.281546	-.001944
9	.007474	-.339213	-.002017
10	.008713	-.396280	-.001912
11	.010193	-.438890	-.000671
12	.010282	-.439621	.000000
13	.010377	-.440391	-.000668
14	.011852	-.481717	-.001857
15	.013533	-.536663	-.001913
16	.015222	-.590567	-.001805
17	.017190	-.630872	-.000636
18	.017309	-.631566	.000000
19	.017435	-.632284	-.000623
20	.019398	-.670770	-.001730
21	.021587	-.721880	-.001770
22	.023785	-.771536	-.001663
23	.026303	-.808778	-.000590
24	.026455	-.809422	.000000
25	.026616	-.810072	-.000564
26	.029130	-.844885	-.001567
27	.031890	-.891041	-.001587
28	.034662	-.935282	-.001482
29	.037801	-.968603	-.000530
30	.037991	-.969182	.000000
31	.038191	-.969748	-.000490
32	.041327	-.999957	-.001361
33	.044733	-1.039904	-.001358
34	.048153	-1.077405	-.001256
35	.051996	-1.105836	-.000455
36	.052228	-1.106334	.000000
37	.052474	-1.106793	-.000397
38	.056314	-1.131280	-.001109
39	.060451	-1.163802	-.001092
40	.064607	-1.193699	-.001009
41	.069277	-1.216921	-.000381
42	.069560	-1.217341	.000000
43	.069858	-1.217702	-.000307
44	.074527	-1.233430	-.000676
45	.079322	-1.253233	-.000649
46	.084138	-1.270742	-.000607
47	.089377	-1.285307	-.000248
48	.089694	-1.285583	.000000
49	.090029	-1.285769	-.000155
50	.095268	-1.290687	-.000178
51	.100395	-1.296041	-.000149
52	.105544	-1.299546	-.000146
53	.110944	-1.304015	-.000093
54	.111271	-1.304123	.000000
55	.111616	-1.304128	.000003
56	.117017	-1.296150	.000445
57	.121896	-1.282986	.000501
58	.126795	-1.267878	.000490

59	.131491	-1.257830	.000150
60	.131775	-1.257665	.000000
61	.132075	-1.257369	.000256
62	.136772	-1.240958	.000722
63	.141007	-1.219499	.000804
64	.145258	-1.195028	.000833
65	.149262	-1.176875	.000284
66	.149504	-1.176564	.000000
67	.149760	-1.176135	.000371
68	.153764	-1.152932	.001025
69	.157329	-1.122462	.001116
70	.160907	-1.089293	.001125
71	.164219	-1.064549	.000389
72	.164419	-1.064123	.000000
73	.164631	-1.063584	.000468
74	.167946	-1.035155	.001252
75	.170884	-.997919	.001349
76	.173833	-.958268	.001343
77	.176545	-.928636	.000465
78	.176709	-.928127	.000000
79	.176882	-.927511	.000535
80	.179597	-.894838	.001447
81	.181985	-.851809	.001546
82	.184381	-.806767	.001520
83	.186565	-.773178	.000527
84	.186697	-.772603	.000000
85	.186837	-.771925	.000588
86	.189024	-.735835	.001604
87	.190926	-.688131	.001705
88	.192835	-.638768	.001662
89	.194553	-.602009	.000577
90	.194657	-.601381	.000000
91	.194766	-.600655	.000630
92	.196488	-.561880	.001728
93	.197961	-.510486	.001830
94	.199439	-.457754	.001773
95	.200745	-.418528	.000615
96	.200824	-.417858	.000000
97	.200907	-.417096	.000662
98	.202217	-.376280	.001822
99	.203314	-.322113	.001922
100	.204415	-.266962	.001850
101	.205366	-.226039	.000640
102	.205424	-.225342	.000000
103	.205485	-.225016	.000280
104	.207405	-.174445	.002185
105	.208738	-.120651	.001799
106	.210076	-.063813	.002116
107	.210081	.000000	.002241
108	.108480	-.012978	-.001972
109	.108482	-.070200	-.001990
110	.108379	-.127913	-.002015
111	.108275	-.187103	-.002100
112	.108146	-.236139	-.000804
113	.108139	-.237017	.000000
114	.108130	-.238023	-.000872
115	.108002	-.287652	-.001991
116	.107923	-.339453	-.001700
117	.107843	-.390977	-.001948
118	.107798	-.438825	-.000811

119	.107795	-.439710	.000000
120	.107792	-.440668	-.000831
121	.107746	-.487968	-.001894
122	.107718	-.537050	-.001607
123	.107690	-.585722	-.001839
124	.107674	-.630868	-.000766
125	.107673	-.631704	.000000
126	.107672	-.632606	-.000781
127	.107656	-.676890	-.001766
128	.107647	-.722407	-.001484
129	.107637	-.767306	-.001693
130	.107633	-.808838	-.000705
131	.107633	-.809609	.000000
132	.107632	-.810436	-.000716
133	.107628	-.850795	-.001600
134	.107627	-.891717	-.001327
135	.107626	-.931787	-.001507
136	.107629	-.968732	-.000629
137	.107629	-.969420	.000000
138	.107629	-.970154	-.000633
139	.107632	-1.005571	-.001392
140	.107639	-1.040748	-.001132
141	.107646	-1.074806	-.001277
142	.107659	-1.106068	-.000534
143	.107659	-1.106654	.000000
144	.107660	-1.107274	-.000533
145	.107673	-1.136659	-.001137
146	.107673	-1.164733	-.000888
147	.107672	-1.191293	-.000988
148	.107653	-1.215407	-.000412
149	.107652	-1.215860	.000000
150	.107651	-1.216285	-.000364
151	.107633	-1.236012	-.000750
152	.107605	-1.254013	-.000553
153	.107578	-1.269910	-.000560
154	.107555	-1.283054	-.000219
155	.107554	-1.283295	.000000
156	.107552	-1.283467	-.000147
157	.107530	-1.291065	-.000269
158	.107477	-1.296670	-.000146
159	.107424	-1.299773	-.000052
160	.107359	-1.299957	.000012
161	.107355	-1.299942	.000000
162	.107351	-1.299788	.000132
163	.107285	-1.292193	.000313
164	.107238	-1.283502	.000308
165	.107192	-1.272278	.000522
166	.107216	-1.257783	.000270
167	.107218	-1.257483	.000000
168	.107219	-1.257122	.000308
169	.107244	-1.239704	.000712
170	.107255	-1.220447	.000652
171	.107266	-1.199405	.000866
172	.107273	-1.176868	.000401
173	.107273	-1.176426	.000000
174	.107274	-1.175909	.000445
175	.107281	-1.150666	.001026
176	.107285	-1.123291	.000917
177	.107289	-1.094395	.001154
178	.107297	-1.064957	.000515

179	.107298	-1.064392	.000000
180	.107298	-1.063756	.000549
181	.107307	-1.032455	.001272
182	.107311	-.998657	.001127
183	.107315	-.963610	.001374
184	.107316	-.928987	.000599
185	.107316	-.928332	.000000
186	.107316	-.927599	.000634
187	.107317	-.891374	.001471
188	.107316	-.852406	.001296
189	.107314	-.812374	.001554
190	.107310	-.773494	.000668
191	.107310	-.772764	.000000
192	.107309	-.771953	.000702
193	.107305	-.731739	.001631
194	.107296	-.688603	.001432
195	.107287	-.644568	.001698
196	.107273	-.602289	.000723
197	.107272	-.601500	.000000
198	.107271	-.600627	.000757
199	.107256	-.557253	.001758
200	.107230	-.510840	.001539
201	.107204	-.463678	.001810
202	.107163	-.418768	.000765
203	.107161	-.417933	.000000
204	.107158	-.417014	.000797
205	.107116	-.371256	.001854
206	.107044	-.322341	.001621
207	.106971	-.272766	.001897
208	.106855	-.225801	.000800
209	.106848	-.224928	.000000
210	.106840	-.224017	.000790
211	.106723	-.177220	.001993
212	.106629	-.121291	.001912
213	.106535	-.066253	.001892
214	.106536	-.011823	.001876
215	.213453	-.016804	-.002018
216	.213452	-.074514	-.001945
217	.212462	-.127934	-.001753
218	.211466	-.182909	-.002308
219	.209602	-.236922	-.000289
220	.209546	-.237241	.000000
221	.209487	-.238048	-.000702
222	.208563	-.281433	-.001947
223	.207406	-.339104	-.002016
224	.206245	-.396146	-.001913
225	.204810	-.438831	-.000674
226	.204724	-.439565	.000000
227	.204632	-.440336	-.000669
228	.203203	-.481693	-.001857
229	.201549	-.536627	-.001912
230	.199888	-.590518	-.001806
231	.197936	-.630851	-.000637
232	.197818	-.631546	.000000
233	.197694	-.632264	-.000623
234	.195746	-.670763	-.001731
235	.193567	-.721868	-.001770
236	.191378	-.771518	-.001663
237	.188864	-.808772	-.000590
238	.188712	-.809416	.000000

239	.188551	-.810067	-.000564
240	.186041	-.844887	-.001567
241	.183282	-.891040	-.001587
242	.180511	-.935277	-.001482
243	.177370	-.968606	-.000530
244	.177180	-.969185	.000000
245	.176979	-.969751	-.000490
246	.173841	-.999969	-.001362
247	.170429	-1.039916	-.001358
248	.167001	-1.077425	-.001257
249	.163146	-1.105879	-.000456
250	.162913	-1.106378	.000000
251	.162666	-1.106840	-.000399
252	.158814	-1.131388	-.001108
253	.154651	-1.163596	-.001070
254	.150471	-1.192521	-.000966
255	.145819	-1.214609	-.000357
256	.145538	-1.214999	.000000
257	.145241	-1.215306	-.000264
258	.140590	-1.231505	-.000735
259	.135740	-1.252450	-.000657
260	.130869	-1.269104	-.000547
261	.125651	-1.281903	-.000209
262	.125336	-1.282132	.000000
263	.125003	-1.282237	-.000089
264	.119786	-1.287829	-.000265
265	.114581	-1.294794	-.000155
266	.109354	-1.296733	-.000043
267	.104017	-1.298192	-.000026
268	.103695	-1.298219	.000000
269	.103354	-1.298080	.000120
270	.098018	-1.291036	.000292
271	.093065	-1.281752	.000407
272	.088092	-1.267765	.000495
273	.083371	-1.257120	.000167
274	.083085	-1.256935	.000000
275	.082783	-1.256616	.000275
276	.078062	-1.240279	.000702
277	.073795	-1.219305	.000795
278	.069511	-1.194807	.000843
279	.065500	-1.176319	.000291
280	.065257	-1.175999	.000000
281	.065001	-1.175555	.000384
282	.060989	-1.152429	.001010
283	.057410	-1.122358	.001105
284	.053816	-1.089341	.001124
285	.050496	-1.064572	000390
286	.050295	-1.064145	.000000
287	.050083	-1.063605	.000468
288	.046760	-1.035164	.001253
289	.043818	-.997926	.001349
290	.040865	-.958276	.001343
291	.038152	-.928637	.000466
292	.037988	-.928128	.000000
293	.037814	-.927512	.000535
294	.035098	-.894834	.001447
295	.032713	-.851807	.001546
296	.030317	-.806767	.001520
297	.028138	-.773173	.000527
298	.028006	-.772597	.000000

299	.027867	-.771919	.000588
300	.025684	-.735819	.001604
301	.023790	-.688120	.001705
302	.021890	-.638761	.001663
303	.020187	-.601992	.000577
304	.020084	-.601362	.000000
305	.019975	-.600636	.000631
306	.018268	-.561834	.001729
307	.016821	-.510454	.001829
308	.015368	-.457733	.001773
309	.014104	-.418478	.000616
310	.014027	-.417807	.000000
311	.013947	-.417043	.000664
312	.012678	-.376157	.001824
313	.011652	-.322013	.001921
314	.010622	-.266858	.001853
315	.009787	-.225816	.000644
316	.009736	-.225115	.000000
317	.009682	-.224780	.000288
318	.007996	-.173514	.002190
319	.007092	-.121303	.001675
320	.006185	-.070129	.001851
321	.006184	-.015306	.001916
322	.052929	-.009241	-.001715
323	.054780	-.127680	-.001738
324	.057222	-.236565	-.001985
325	.053970	-.237445	-.001901
326	.060656	-.339459	-.001647
327	.055548	-.439555	-.001817
328	.056572	-.440006	-.001795
329	.063503	-.537005	-.001542
330	.058964	-.631375	-.001684
331	.060366	-.632127	-.001657
332	.067302	-.722330	-.001407
333	.063538	-.809091	-.001512
334	.065325	-.810182	-.001480
335	.072200	-.891611	-.001235
336	.069352	-.968680	-.001297
337	.071575	-.970179	-.001258
338	.078320	-1.040610	-.001022
339	.076571	-1.105636	-.001032
340	.079209	-1.107623	-.000986
341	.086086	-1.164649	-.000761
342	.084915	-1.215375	-.000706
343	.089734	-1.217473	-.000662
344	.094356	-1.254129	-.000455
345	.095448	-1.283487	-.000339
346	.101187	-1.284712	-.000295
347	.103984	-1.296953	-.000114
348	.106624	-1.301600	.000054
349	.114173	-1.301117	.000088
350	.112410	-1.283793	.000227
351	.119277	-1.258572	.000413
352	.122641	-1.256518	.000459
353	.122679	-1.220352	.000542
354	.128531	-1.177421	.000746
355	.131679	-1.175530	.000785
356	.130404	-1.123187	.000810
357	.136739	-1.065089	.001028
358	.139009	-1.063499	.001061

359	.137019	-.998535	.001035
360	.143336	-.928826	.001264
361	.145235	-.927664	.001290
362	.142304	-.852310	.001220
363	.148745	-.773084	.001456
364	.150270	-.772279	.001476
365	.146551	-.688530	.001369
366	.153057	-.601679	.001610
367	.154253	-.601171	.001624
368	.149865	-.510795	.001487
369	.156380	-.417994	.001732
370	.157254	-.417753	.001742
371	.152376	-.322340	.001579
372	.158688	-.225094	.001827
373	.155652	-.224480	.001896
374	.157772	-.121086	.001661
375	.159539	-.008416	.001641
376	.158747	-.016758	-.001685
377	.162622	-.128377	-.001693
378	.157728	-.236051	-.001948
379	.161492	-.237498	-.001870
380	.154712	-.339352	-.001629
381	.159705	-.439420	-.001804
382	.158714	-.440041	-.001783
383	.151763	-.536970	-.001536
384	.156256	-.631326	-.001679
385	.154866	-.632141	-.001652
386	.147924	-.722318	-.001404
387	.151672	-.809072	-.001510
388	.149888	-.810192	-.001478
389	.143015	-.891610	-.001234
390	.145859	-.968670	-.001295
391	.143634	-.970195	-.001256
392	.136898	-1.040621	-.001020
393	.138662	-1.105637	-.001028
394	.135972	-1.107684	-.000982
395	.129471	-1.164481	-.000758
396	.129692	-1.214338	-.000705
397	.126448	-1.216358	-.000660
398	.120705	-1.253524	-.000452
399	.118793	-1.282005	-.000342
400	.115341	-1.283038	-.000297
401	.110968	-1.295985	-.000115
402	.106807	-1.299104	.000041
403	.103262	-1.298159	.000077
404	.101012	-1.282875	.000220
405	.095301	-1.258364	.000402
406	.092370	-1.256106	.000449
407	.091857	-1.220211	.000537
408	.086005	-1.177220	.000740
409	.083238	-1.175225	.000780
410	.084107	-1.123114	.000808
411	.077937	-1.065123	.001025
412	.075647	-1.063496	.001058
413	.077643	-.998541	.001034
414	.071331	-.928836	.001263
415	.069432	-.927656	.001288
416	.072359	-.852308	.001219
417	.065919	-.773091	.001454
418	.064397	-.772262	.001474

419	.068101	-.688519	.001366
420	.061590	-.601691	.001606
421	.060405	-.601126	.001620
422	.064750	-.510763	.001481
423	.058217	-.418026	.001721
424	.057374	-.417630	.001729
425	.062146	-.322243	.001563
426	.055747	-.225142	.001798
427	.059251	-.224011	.001862
428	.054895	-.121719	.001620
429	.058354	-.015265	.001614

BAILEY BRIDGE TRUSS ANALYSIS (CASE 1)
SAP80 V85.02

* *
* * * * * F R A M E M E M B E R F O R C E S * * * * *
* *

LOAD COMBINATION MULTIPLIERS

NEW LOAD COMB.	OLD LOAD CONDITION 1	2
1	1.000	.000
2	.000	1.000

MEMBERS WITH NUMBERS BETWEEN 1 & 32000

MEM #	LOAD #	AXIAL FORCE	DIST I	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT
1							
	1	.06					
			.0	1.71	-1.28		
			6.0	1.71	8.98		
				-.14		.00	
			28.9	-.17	5.39		
	2	.02					
			.0	.12	-.46		
			28.9	.12	3.13		
103							
	1	22.67					
			.0	-2.24	84.83		
			6.0	-2.25	71.35		
				-4.10		.00	
			28.9	-4.13	-22.95		
	2	8.48					
			.0	-2.04	47.63		
			28.9	-2.04	-11.34		
2							
	1	14.95					
			.0	.12	4.91		
			28.8	.08	7.81		
	2	6.49					
			.0	.03	2.87		
			28.8	.03	3.78		
104							
	1	14.99					
			.0	1.04	-21.86		
			28.8	1.00	7.54		
	2	5.92					
			.0	.49	-10.81		
			28.8	.49	3.42		
3							
	1	14.96					
			.0	-1.01	7.61		
			28.9	-1.05	-22.23		
	2	6.49					
			.0	-.53	3.71		
			28.9	-.53	-11.59		

105					
	1	14.99			
			.0	-.05	7.73
			28.9	-.09	5.73
	2	5.91			
			.0	-.03	3.48
			28.9	-.03	2.57
4					
	1	22.62			
			.0	4.04	-23.30
			28.9	4.01	93.05
	2	9.37			
			.0	2.17	-12.16
			28.9	2.17	50.64
106					
	1	.05			
			.0	-.24	6.31
			28.9	-.27	-1.09
	2	.02			
			.0	-.11	2.79
			28.9	-.11	-.42
5					
	1	22.54			
			.0	7.05	94.84
			2.2	7.05	110.07
	2	9.32			
			.0	2.92	51.69
			2.2	2.92	57.99
11					
	1	31.86			
			.0	7.01	224.41
			2.2	7.01	239.55
	2	13.06			
			.0	3.28	127.30
			2.2	3.28	134.39
17					
	1	39.89			
			.0	6.25	203.24
			2.2	6.24	216.72
	2	17.38			
			.0	3.29	120.47
			2.2	3.29	127.58
23					
	1	46.48			
			.0	5.34	178.06
			2.2	5.34	189.59
	2	22.24			
			.0	3.28	111.41
			2.2	3.28	118.50
29					
	1	51.70			
			.0	4.47	149.42
			2.2	4.46	159.06
	2	27.73			
			.0	3.21	99.83
			2.2	3.21	106.77
35					
	1	55.64			
			.0	3.60	118.13
			2.2	3.59	125.90

127

	2	33.96			
			.0	3.11	85.36
			2.2	3.11	92.08
41					
	1	58.38			
			.0	2.69	84.92
			2.2	2.68	90.72
	2	41.28			
			.0	4.34	69.50
			2.2	4.34	78.88
47					
	1	60.00			
			.0	1.77	50.37
			2.2	1.76	54.18
	2	46.32			
			.0	3.95	44.14
			2.2	3.95	52.68
53					
	1	60.54			
			.0	.84	15.06
			2.2	.83	16.86
	2	47.74			
			.0	3.74	14.08
			2.2	3.74	22.16
59					
	1	60.01			
			.0	-.09	-20.48
			2.2	-.09	-20.67
	2	41.52			
			.0	-1.47	-27.70
			2.2	-1.47	-30.87
65					
	1	58.40			
			.0	-.97	-55.72
			2.2	-.98	-57.83
	2	35.40			
			.0	-2.23	-52.84
			2.2	-2.23	-57.66
71					
	1	55.66			
			.0	-1.82	-90.12
			2.2	-1.82	-94.06
	2	29.29			
			.0	-2.87	-72.63
			2.2	-2.87	-78.83
77					
	1	51.73			
			.0	-2.75	-122.96
			2.2	-2.76	-128.91
	2	23.98			
			.0	-2.95	-87.51
			2.2	-2.95	-93.88
83					
	1	46.52			
			.0	-3.60	-153.78
			2.2	-3.61	-161.57
	2	19.32			
			.0	-3.01	-99.46
			2.2	-3.01	-105.97
89					

	1	39.93			
			.0	-4.53	-181.72
			2.2	-4.54	-191.51
	2	15.20			
			.0	-3.02	-109.08
			2.2	-3.02	-115.61
95					
	1	31.90			
			.0	-5.26	-206.27
			2.2	-5.27	-217.64
	2	11.56			
			.0	-3.02	-116.58
			2.2	-3.02	-123.10
101					
	1	22.58			
			.0	-5.33	-225.72
			2.2	-5.33	-237.23
	2	8.44			
			.0	-2.68	-121.86
			2.2	-2.68	-127.66
6					
	1	22.54			
			.0	7.04	-242.17
			2.3	7.03	-226.13
	2	9.32			
			.0	2.92	-132.11
			2.3	2.92	-125.46
12					
	1	31.86			
			.0	7.00	-223.00
			2.3	7.00	-207.04
	2	13.06			
			.0	3.29	-127.10
			2.3	3.29	-119.59
18					
	1	39.89			
			.0	6.21	-197.20
			2.3	6.20	-183.05
	2	17.38			
			.0	3.30	-118.69
			2.3	3.30	-111.16
24					
	1	46.49			
			.0	5.38	-167.83
			2.3	5.38	-155.56
	2	22.24			
			.0	3.27	-107.76
			2.3	3.27	-100.31
30					
	1	51.70			
			.0	4.52	-135.67
			2.3	4.52	-125.36
	2	27.73			
			.0	3.23	-94.06
			2.3	3.23	-86.70
36					
	1	55.64			
			.0	3.60	-101.38
			2.3	3.59	-93.18
	2	33.96			

			.0	3.14	-76.82
			2.3	3.14	-69.66
42					
	1	58.38			
			.0	2.67	-65.63
			2.3	2.66	-59.56
	2	41.28			
			.0	4.31	-61.67
			2.3	4.31	-51.84
48					
	1	60.00			
			.0	1.80	-29.08
			2.3	1.79	-25.00
	2	46.32			
			.0	3.89	-33.13
			2.3	3.89	-24.25
54					
	1	60.54			
			.0	.91	7.80
			2.3	.90	9.87
	2	47.74			
			.0	3.73	-3.76
			2.3	3.73	4.74
60					
	1	60.01			
			.0	-.03	44.54
			2.3	-.04	44.46
	2	41.52			
			.0	-1.56	49.02
			2.3	-1.56	45.47
66					
	1	58.40			
			.0	-.93	80.47
			2.3	-.94	78.34
	2	35.39			
			.0	-2.22	71.08
			2.3	-2.22	66.03
72					
	1	55.66			
			.0	-1.92	115.18
			2.3	-1.93	110.80
	2	29.29			
			.0	-2.88	89.62
			2.3	-2.88	83.05
78					
	1	51.73			
			.0	-2.80	147.84
			2.3	-2.81	141.44
	2	23.98			
			.0	-2.95	102.03
			2.3	-2.95	95.31
84					
	1	46.52			
			.0	-3.66	177.87
			2.3	-3.67	169.51
	2	19.32			
			.0	-3.00	112.00
			2.3	-3.00	105.17
90					
	1	39.93			

130

			.0	-4.50	204.51	
			2.3	-4.51	194.24	
	2	15.20				
			.0	-3.02	119.79	
			2.3	-3.02	112.91	
96						
	1	31.90				
			.0	-5.30	227.03	
			2.3	-5.30	214.94	
	2	11.56				
			.0	-3.02	125.68	
			2.3	-3.02	118.79	
102						
	1	22.59				
			.0	-5.34	98.80	
			2.3	-5.35	86.61	
	2	8.44				
			.0	-2.69	54.76	
			2.3	-2.69	48.62	
7						
	1	22.49				
			.0	8.64	-225.08	
			6.0	8.62	-173.28	
				6.77		.00
			28.9	6.72	-18.64	
	2	9.30				
			.0	3.94	-124.83	
			28.9	3.94	-10.79	
13						
	1	31.82				
			.0	8.01	-206.05	
			6.0	7.99	-158.06	
				6.14		.00
			28.9	6.09	-17.94	
	2	13.04				
			.0	3.76	-119.00	
			28.9	3.76	-10.33	
19						
	1	39.85				
			.0	7.21	-182.11	
			6.0	7.19	-138.92	
				5.34		.00
			28.9	5.29	-17.12	
	2	17.36				
			.0	3.48	-110.63	
			28.9	3.48	-9.91	
25						
	1	46.45				
			.0	6.30	-154.74	
			6.0	6.29	-116.96	
				4.44		.00
			28.9	4.38	-15.84	
	2	22.22				
			.0	3.13	-99.82	
			28.9	3.13	-9.33	
31						
	1	51.67				
			.0	5.32	-124.68	
			6.0	5.31	-92.79	
				3.46		.00

			28.9	3.40	-14.18	
	2	27.71				
			.0	2.69	-86.29	
			28.9	2.69	-8.56	
37						
	1	55.61				
			.0	4.28	-92.59	
			6.0	4.27	-66.95	
				2.42		.00
			28.9	2.36	-12.19	
	2	33.94				
			.0	2.11	-69.33	
			28.9	2.11	-8.19	
8						
	1	26.56				
			.0	.93	-19.10	
			28.8	.86	6.58	
	2	10.95				
			.0	.49	-11.06	
			28.8	.49	3.07	
14						
	1	35.12				
			.0	1.00	-18.37	
			28.8	.93	9.52	
	2	14.92				
			.0	.52	-10.58	
			28.8	.52	4.45	
20						
	1	42.29				
			.0	1.05	-17.48	
			28.8	.98	11.72	
	2	19.42				
			.0	.55	-10.15	
			28.8	.55	5.82	
26						
	1	48.08				
			.0	1.06	-16.14	
			28.8	.99	13.47	
	2	24.49				
			.0	.59	-9.56	
			28.8	.59	7.36	
32						
	1	52.56				
			.0	1.05	-14.41	
			28.8	.98	14.81	
	2	30.23				
			.0	.62	-8.76	
			28.8	.62	9.10	
38						
	1	55.82				
			.0	1.01	-12.34	
			28.8	.94	15.79	
	2	36.72				
			.0	.64	-8.36	
			28.8	.64	10.20	
44						
	1	57.95				
			.0	.95	-10.01	
			28.8	.88	16.42	
	2	42.56				

			.0	.58	-6.82
			28.8	.58	9.74
50					
	1	59.00			
			.0	.88	-7.48
			28.8	.81	16.73
	2	45.50			
			.0	.51	-5.74
			28.8	.51	8.85
56					
	1	59.00			
			.0	.78	-4.80
			28.8	.71	16.72
	2	43.30			
			.0	.36	-2.14
			28.8	.36	8.21
62					
	1	57.94			
			.0	.68	-2.04
			28.8	.61	16.40
	2	37.58			
			.0	.41	-1.46
			28.8	.41	10.41
68					
	1	55.80			
			.0	.56	.76
			28.8	.49	15.76
	2	31.63			
			.0	.28	.87
			28.8	.28	9.01
74					
	1	52.53			
			.0	.42	3.56
			28.8	.35	14.77
	2	26.07			
			.0	.17	2.76
			28.8	.17	7.79
80					
	1	48.05			
			.0	.28	6.29
			28.8	.21	13.41
	2	21.19			
			.0	.06	4.53
			28.8	.06	6.32
86					
	1	42.25			
			.0	.13	8.92
			28.8	.06	11.65
	2	16.88			
			.0	-.03	6.02
			28.8	-.03	5.02
92					
	1	35.08			
			.0	-.04	11.45
			28.8	-.10	9.43
	2	13.07			
			.0	-.12	7.28
			28.8	-.12	3.86
98					
	1	26.51			

			.0	-.21	13.61
			28.8	-.28	6.47
	2	9.73			
			.0	-.19	8.21
			28.8	-.19	2.70
9					
	1	26.57			
			.0	.25	6.29
			28.9	.18	12.60
	2	10.95			
			.0	.19	2.93
			28.9	.19	8.52
15					
	1	35.13			
			.0	.07	9.27
			28.9	.00	10.42
	2	14.93			
			.0	.11	4.30
			28.9	.11	7.43
21					
	1	42.30			
			.0	-.09	11.50
			28.9	-.16	7.88
	2	19.43			
			.0	.01	5.68
			28.9	.01	5.98
27					
	1	48.08			
			.0	-.24	13.29
			28.9	-.31	5.22
	2	24.50			
			.0	-.10	7.21
			28.9	-.10	4.25
33					
	1	52.56			
			.0	-.39	14.67
			28.9	-.46	2.46
	2	30.23			
			.0	-.23	8.95
			28.9	-.23	2.18
39					
	1	55.82			
			.0	-.52	15.69
			28.9	-.59	-.35
	2	36.73			
			.0	-.38	10.05
			28.9	-.38	-.94
45					
	1	57.95			
			.0	-.64	16.36
			28.9	-.71	-3.18
	2	42.56			
			.0	-.51	9.64
			28.9	-.51	-5.08
51					
	1	59.00			
			.0	-.75	16.71
			28.9	-.82	-5.98
	2	45.50			
			.0	-.60	8.83

			28.9	-.60	-8.45
57					
	1	59.00			
			.0	-.84	16.75
			28.9	-.91	-8.69
	2	43.30			
			.0	-.62	8.32
			28.9	-.62	-9.53
63					
	1	57.94			
			.0	-.92	16.46
			28.9	-.99	-11.25
	2	37.58			
			.0	-.62	10.54
			28.9	-.62	-7.38
69					
	1	55.80			
			.0	-.98	15.86
			28.9	-1.05	-13.61
	2	31.63			
			.0	-.60	9.15
			28.9	-.60	-8.08
75					
	1	52.53			
			.0	-1.02	14.91
			28.9	-1.09	-15.70
	2	26.07			
			.0	-.57	7.92
			28.9	-.57	-8.58
81					
	1	48.04			
			.0	-1.04	13.59
			28.9	-1.11	-17.47
	2	21.18			
			.0	-.54	6.45
			28.9	-.54	-9.29
87					
	1	42.25			
			.0	-1.03	11.87
			28.9	-1.10	-18.83
	2	16.87			
			.0	-.52	5.15
			28.9	-.52	-9.83
93					
	1	35.07			
			.0	-.98	9.69
			28.9	-1.05	-19.75
	2	13.07			
			.0	-.49	3.99
			28.9	-.49	-10.23
99					
	1	26.50			
			.0	-.91	6.76
			28.9	-.98	-20.48
	2	9.73			
			.0	-.47	2.83
			28.9	-.47	-10.67
10					
	1	31.89			
			.0	7.35	12.07

135

			28.9	7.28	223.56
	2	13.08			
			.0	4.10	8.23
			28.9	4.10	126.75
16					
	1	39.92			
			.0	6.69	9.95
			28.9	6.62	202.50
	2	17.40			
			.0	3.90	7.16
			28.9	3.90	119.99
22					
	1	46.51			
			.0	5.91	7.46
			28.9	5.84	177.39
	2	22.26			
			.0	3.64	5.72
			28.9	3.64	111.02
28					
	1	51.72			
			.0	5.02	4.87
			28.9	4.95	148.90
	2	27.74			
			.0	3.30	4.00
			28.9	3.30	99.52
34					
	1	55.65			
			.0	4.03	2.18
			28.9	3.96	117.79
	2	33.96			
			.0	2.88	1.96
			28.9	2.88	85.15
40					
	1	58.39			
			.0	2.98	-.57
			28.9	2.91	84.74
	2	41.28			
			.0	2.44	-1.17
			28.9	2.44	69.49
46					
	1	60.00			
			.0	1.89	-3.32
			28.9	1.82	50.34
	2	46.31			
			.0	1.71	-5.26
			28.9	1.71	44.27
52					
	1	60.53			
			.0	.77	-6.04
			28.9	.70	15.18
	2	47.73			
			.0	.79	-8.57
			28.9	.79	14.33
58					
	1	59.99			
			.0	-.36	-8.67
			28.9	-.43	-20.20
	2	41.51			
			.0	-.62	-9.47
			28.9	-.62	-27.44

64						
	1	58.37				
			.0	-1.49	-11.16	
			28.9	-1.56	-55.26	
	2	35.38				
			.0	-1.57	-7.26	
			28.9	-1.57	-52.54	
70						
	1	55.63				
			.0	-2.59	-13.44	
			28.9	-2.66	-89.45	
	2	29.27				
			.0	-2.22	-7.91	
			28.9	-2.22	-72.25	
76						
	1	51.70				
			.0	-3.66	-15.46	
			28.9	-3.73	-122.18	
	2	23.97				
			.0	-2.72	-8.39	
			28.9	-2.72	-87.06	
82						
	1	46.48				
			.0	-4.66	-17.16	
			28.9	-4.73	-152.86	
	2	19.30				
			.0	-3.11	-9.08	
			28.9	-3.11	-98.98	
88						
	1	39.88				
			.0	-5.58	-18.45	
			28.9	-5.65	-180.79	
	2	15.18				
			.0	-3.42	-9.60	
			28.9	-3.42	-108.54	
94						
	1	31.86				
			.0	-6.39	-19.31	
			28.9	-6.46	-205.21	
	2	11.54				
			.0	-3.67	-9.98	
			28.9	-3.67	-116.00	
100						
	1	22.54				
			.0	-7.04	-20.00	
			28.9	-7.11	-224.61	
	2	8.41				
			.0	-3.83	-10.42	
			28.9	-3.83	-121.24	
43						
	1	58.36				
			.0	3.20	-59.09	
			6.0	3.19	-39.92	
				1.34		.00
			28.9	1.28	-9.93	
	2	41.27				
			.0	4.59	-51.56	
			6.0	4.59	-24.01	
				.75		.00
			28.9	.75	-6.77	

49						
	1	59.99				
			.0	2.10	-24.72	
			6.0	2.08	-12.18	
				.23		.00
			28.9	.18	-7.48	
	2	46.30				
			.0	5.20	-24.03	
			6.0	5.20	7.14	
				-.56		.00
			28.9	-.56	-5.81	
55						
	1	60.53				
			.0	.99	9.95	
			6.0	.97	15.84	
				-.88		.00
			28.9	-.93	-4.88	
	2	47.73				
			.0	7.36	4.86	
			6.0	7.36	49.01	
				-2.24		.00
			28.9	-2.24	-2.38	
61						
	1	60.01				
			.0	-.11	44.42	
			6.0	-.12	43.71	
				-1.97		.00
			28.9	-2.03	-2.19	
	2	41.51				
			.0	-.49	45.52	
			6.0	-.49	42.59	
				-1.93		.00
			28.9	-1.93	-1.63	
67						
	1	58.40				
			.0	-1.18	78.12	
			6.0	-1.20	70.99	
				-3.05		.00
			28.9	-3.10	.54	
	2	35.40				
			.0	-1.50	65.91	
			6.0	-1.50	56.94	
				-2.46		.00
			28.9	-2.46	.66	
73						
	1	55.67				
			.0	-2.21	110.51	
			6.0	-2.22	97.22	
				-4.07		.00
			28.9	-4.13	3.26	
	2	29.30				
			.0	-2.78	82.83	
			28.9	-2.78	2.54	
79						
	1	51.75				
			.0	-3.17	140.99	
			6.0	-3.18	121.93	
				-5.03		.00
			28.9	-5.09	5.93	
	2	24.00				

			.0	-3.14	94.99	
			28.9	-3.14	4.30	
85	----------					
	1	46.54				
			.0	-4.05	168.90	
			6.0	-4.06	144.59	
				-5.91		.00
			28.9	-5.97	8.50	
	2	19.34				
			.0	-3.42	104.77	
			28.9	-3.42	5.78	
91	----------					
	1	39.95				
			.0	-4.81	193.50	
			6.0	-4.82	164.59	
				-6.67		.00
			28.9	-6.73	10.97	
	2	15.22				
			.0	-3.65	112.44	
			28.9	-3.65	7.02	
97	----------					
	1	31.93				
			.0	-5.45	214.11	
			6.0	-5.46	181.36	
				-7.31		.00
			28.9	-7.37	13.09	
	2	11.58				
			.0	-3.81	118.28	
			28.9	-3.81	7.95	
107	----------					
	1	.03				
			.0	-.07	-.67	
			28.9	-.14	-3.69	
	2	.01				
			.0	-.05	-.28	
			28.9	-.05	-1.76	
209	----------					
	1	-2.77				
			.0	-9.86	266.88	
			28.9	-9.93	-19.18	
	2	-1.03				
			.0	-5.12	139.49	
			28.9	-5.12	-8.56	
108	----------					
	1	-2.31				
			.0	.15	-3.82	
			28.8	.08	-.58	
	2	-.92				
			.0	.03	-1.81	
			28.8	.03	-.85	
210	----------					
	1	-2.24				
			.0	.60	-17.84	
			28.8	.54	-1.43	
	2	-.84				
			.0	.24	-7.89	
			28.8	.24	-.96	
109	----------					
	1	-2.31				
			.0	-.43	-1.23	

			28.9	-.50	-14.58
	2	-.92			
			.0	-.24	-1.13
			28.9	-.24	-8.21
211					
	1	-2.23			
			.0	.06	-.76
			25.0	.00	-.01
			28.9	-.01	-.03
	2	-.83			
			.0	-.03	-.70
			28.9	-.03	-1.50
110					
	1	-2.76			
			.0	9.95	-15.93
			28.9	9.88	270.83
	2	-1.13			
			.0	5.50	-8.93
			28.9	5.50	150.00
212					
	1	.03			
			.0	.01	.11
			3.6	.00	.12
			28.9	-.06	-.66
	2	.01			
			.0	.04	-1.46
			28.9	.04	-.25
111					
	1	-2.75			
			.0	11.27	272.74
			2.2	11.26	297.07
	2	-1.13			
			.0	5.09	151.14
			2.2	5.09	162.13
117					
	1	-1.00			
			.0	8.94	266.91
			2.2	8.93	286.20
	2	-.40			
			.0	4.60	153.04
			2.2	4.60	162.97
123					
	1	-.38			
			.0	7.61	239.56
			2.2	7.60	255.99
	2	-.14			
			.0	4.69	144.15
			2.2	4.69	154.28
129					
	1	-.16			
			.0	6.30	207.20
			2.2	6.30	220.80
	2	-.04			
			.0	4.77	132.27
			2.2	4.77	142.57
135					
	1	-.08			
			.0	5.02	171.08
			2.2	5.01	181.92
	2	.02			

			.0	4.87	117.22
			2.2	4.87	127.74
141					
	1	-.05			
			.0	3.74	132.08
			2.2	3.73	140.15
	2	.11			
			.0	5.06	98.54
			2.2	5.06	109.46
147					
	1	-.03			
			.0	2.53	90.89
			2.2	2.53	96.35
	2	-.16			
			.0	4.35	75.56
			2.2	4.35	84.95
153					
	1	-.03			
			.0	1.32	48.31
			2.2	1.31	51.15
	2	-.20			
			.0	2.22	40.19
			2.2	2.22	44.98
159					
	1	-.03			
			.0	.01	5.10
			2.2	.01	5.12
	2	-.57			
			.0	-1.26	-.94
			2.2	-1.26	-3.66
165					
	1	-.03			
			.0	-1.24	-38.21
			2.2	-1.25	-40.90
	2	.22			
			.0	-4.02	-48.28
			2.2	-4.02	-56.97
171					
	1	-.03			
			.0	-2.48	-80.95
			2.2	-2.49	-86.32
	2	.07			
			.0	-4.39	-73.37
			2.2	-4.39	-82.85
177					
	1	-.05			
			.0	-3.71	-122.43
			2.2	-3.72	-130.46
	2	.07			
			.0	-4.52	-95.40
			2.2	-4.52	-105.16
183					
	1	-.08			
			.0	-4.99	-161.89
			2.2	-5.00	-172.68
	2	.01			
			.0	-4.39	-111.89
			2.2	-4.39	-121.37
189					
	1	-.16			

			.0	-6.28	-198.60
			2.2	-6.29	-212.17
	2	-.04			
			.0	-4.29	-125.48
			2.2	-4.29	-134.74
195					
	1	-.38			
			.0	-7.62	-231.69
			2.2	-7.63	-248.15
	2	-.13			
			.0	-4.20	-136.32
			2.2	-4.20	-145.39
201					
	1	-1.00			
			.0	-8.93	-260.29
			2.2	-8.93	-279.58
	2	-.37			
			.0	-4.16	-144.66
			2.2	-4.16	-153.63
207					
	1	-2.77			
			.0	-11.19	-283.61
			2.2	-11.20	-307.79
	2	-1.03			
			.0	-4.57	-150.96
			2.2	-4.57	-160.83
112					
	1	-2.75			
			.0	11.27	-302.00
			2.3	11.26	-276.32
	2	-1.13			
			.0	5.09	-166.74
			2.3	5.09	-155.14
118					
	1	-1.00			
			.0	8.95	-273.99
			2.3	8.94	-253.59
	2	-.40			
			.0	4.61	-158.73
			2.3	4.61	-148.22
124					
	1	-.38			
			.0	7.62	-243.06
			2.3	7.62	-225.68
	2	-.14			
			.0	4.67	-149.55
			2.3	4.67	-138.89
130					
	1	-.16			
			.0	6.29	-207.71
			2.3	6.29	-193.37
	2	-.04			
			.0	4.75	-137.55
			2.3	4.75	-126.72
136					
	1	-.07			
			.0	5.00	-168.91
			2.3	4.99	-157.51
	2	.02			
			.0	4.87	-122.45

			2.3	4.87	-111.35
142					
	1	-.05			
			.0	3.79	-127.52
			2.3	3.78	-118.90
	2	.11			
			.0	4.99	-104.06
			2.3	4.99	-92.68
148					
	1	-.04			
			.0	2.47	-84.09
			2.3	2.47	-78.46
	2	-.16			
			.0	4.35	-72.12
			2.3	4.35	-62.21
154					
	1	-.03			
			.0	1.22	-39.50
			2.3	1.21	-36.72
	2	-.20			
			.0	2.25	-29.68
			2.3	2.25	-24.56
160					
	1	-.03			
			.0	.03	5.62
			2.3	.02	5.67
	2	-.57			
			.0	-1.29	25.92
			2.3	-1.29	22.98
166					
	1	-.03			
			.0	-1.22	50.74
			2.3	-1.23	47.94
	2	.22			
			.0	-4.02	61.51
			2.3	-4.02	52.34
172					
	1	-.04			
			.0	-2.45	95.12
			2.3	-2.45	89.53
	2	.06			
			.0	-4.41	87.11
			2.3	-4.41	77.05
178					
	1	-.05			
			.0	-3.71	138.18
			2.3	-3.71	129.72
	2	.07			
			.0	-4.49	106.48
			2.3	-4.49	96.24
184					
	1	-.07			
			.0	-5.02	179.23
			2.3	-5.03	167.78
	2	.01			
			.0	-4.38	121.95
			2.3	-4.38	111.96
190					
	1	-.16			
			.0	-6.29	217.41

			2.3	-6.29	203.07
	2	-.04			
			.0	-4.30	134.51
			2.3	-4.30	124.72
196					
	1	-.38			
			.0	-7.56	251.95
			2.3	-7.56	234.71
	2	-.13			
			.0	-4.21	144.46
			2.3	-4.21	134.86
202					
	1	-1.00			
			.0	-8.93	281.74
			2.3	-8.94	261.36
	2	-.37			
			.0	-4.15	151.94
			2.3	-4.15	142.48
208					
	1	-2.77			
			.0	-11.19	294.29
			2.3	-11.20	268.77
	2	-1.03			
			.0	-4.57	150.98
			2.3	-4.57	140.56
113					
	1	-2.75			
			.0	11.57	-274.04
			28.9	11.50	59.46
	2	-1.13			
			.0	6.42	-153.76
			28.9	6.42	31.96
119					
	1	-1.00			
			.0	10.64	-251.46
			28.9	10.57	55.28
	2	-.40			
			.0	6.16	-146.92
			28.9	6.16	31.36
125					
	1	-.38			
			.0	9.51	-223.78
			28.9	9.44	50.33
	2	-.14			
			.0	5.82	-137.70
			28.9	5.82	30.60
131					
	1	-.16			
			.0	8.20	-191.72
			28.9	8.13	44.48
	2	-.04			
			.0	5.36	-125.67
			28.9	5.36	29.48
137					
	1	-.08			
			.0	6.75	-156.18
			28.9	6.68	37.89
	2	.02			
			.0	4.79	-110.50
			28.9	4.79	27.96

143					
	1	-.05			
			.0	5.18	-117.97
			28.9	5.11	30.71
	2	.11			
			.0	4.09	-92.03
			28.9	4.09	26.35
149					
	1	-.04			
			.0	3.52	-77.84
			28.9	3.45	23.06
	2	-.16			
			.0	2.82	-61.86
			28.9	2.82	19.83
155					
	1	-.03			
			.0	1.82	-36.47
			28.9	1.75	15.06
	2	-.20			
			.0	1.23	-24.49
			28.9	1.23	11.18
161					
	1	-.03			
			.0	.08	5.49
			28.9	.01	6.81
	2	-.58			
			.0	-.90	22.85
			28.9	-.90	-3.22
167					
	1	-.03			
			.0	-1.66	47.39
			28.9	-1.73	-1.59
	2	.22			
			.0	-2.07	51.98
			28.9	-2.07	-8.01
173					
	1	-.04			
			.0	-3.38	88.59
			28.9	-3.44	-10.03
	2	.06			
			.0	-3.10	76.49
			28.9	-3.10	-13.21
179					
	1	-.05			
			.0	-5.04	128.43
			28.9	-5.11	-18.43
	2	.07			
			.0	-3.88	95.43
			28.9	-3.88	-16.80
185					
	1	-.08			
			.0	-6.63	166.21
			28.9	-6.70	-26.68
	2	.01			
			.0	-4.53	110.99
			28.9	-4.53	-19.93
191					
	1	-.16			
			.0	-8.12	201.19
			28.9	-8.19	-34.71

	2	-.04			
			.0	-5.05	123.61
			28.9	-5.05	-22.53
197					
	1	-.38			
			.0	-9.47	232.53
			28.9	-9.54	-42.39
	2	-.13			
			.0	-5.47	133.63
			28.9	-5.47	-24.66
203					
	1	-1.01			
			.0	-10.63	259.04
			28.9	-10.70	-49.25
	2	-.37			
			.0	-5.79	141.17
			28.9	-5.79	-26.19
114					
	1	-1.77			
			.0	-1.92	58.20
			28.8	-1.99	1.89
	2	-.71			
			.0	-1.07	31.30
			28.8	-1.07	.55
120					
	1	-.68			
			.0	-1.78	54.15
			28.8	-1.85	1.99
	2	-.25			
			.0	-1.05	30.72
			28.8	-1.05	.60
126					
	1	-.29			
			.0	-1.60	49.33
			28.8	-1.67	2.14
	2	-.08			
			.0	-1.02	29.99
			28.8	-1.02	.73
132					
	1	-.15			
			.0	-1.40	43.61
			28.8	-1.47	2.25
	2	-.01			
			.0	-.97	28.90
			28.8	-.97	.86
138					
	1	-.10			
			.0	-1.18	37.18
			28.8	-1.24	2.33
	2	.06			
			.0	-.92	27.43
			28.8	-.92	1.02
144					
	1	-.08			
			.0	-.93	30.15
			28.8	-1.00	2.36
	2	.00			
			.0	-.85	25.87
			28.8	-.85	1.29
150					

	1	-.07			
			.0	-.67	22.67
			28.8	-.74	2.37
	2	-.24			
			.0	-.61	19.47
			28.8	-.61	2.05
156					
	1	-.07			
			.0	-.40	14.84
			28.8	-.47	2.34
	2.	-.47			
			.0	-.30	11.01
			28.8	-.30	2.44
162					
	1	-.07			
			.0	-.12	6.77
			28.8	-.19	2.29
	2	-.42			
			.0	.20	-3.13
			28.8	.20	2.63
168					
	1	-.07			
			.0	.16	-1.45
			28.8	.09	2.21
	2	.10			
			.0	.31	-7.75
			28.8	.31	1.15
174					
	1	-.08			
			.0	.44	-9.72
			28.8	.38	2.09
	2	.04			
			.0	.48	-12.85
			28.8	.48	.87
180					
	1	-.10			
			.0	.73	-17.95
			28.8	.66	1.95
	2	.04			
			.0	.59	-16.37
			28.8	.59	.55
186					
	1	-.15			
			.0	1.00	-26.04
			28.8	.93	1.77
	2	-.01			
			.0	.69	-19.46
			28.8	.69	.41
192					
	1	-.29			
			.0	1.27	-33.90
			28.8	1.20	1.56
	2	-.08			
			.0	.77	-22.01
			28.8	.77	.29
198					
	1	-.68			
			.0	1.52	-41.44
			28.8	1.45	1.30
	2	-.23			

			.0	.84	-24.10
			28.8	.84	.18
204					
	1	-1.77			
			.0	1.75	-48.17
			28.8	1.68	1.11
	2	-.64			
			.0	.89	-25.61
			28.8	.89	.13
115					
	1	-1.77			
			.0	-1.66	1.34
			28.9	-1.73	-47.67
	2	-.71			
			.0	-.95	.29
			28.9	-.95	-27.30
121					
	1	-.68			
			.0	-1.43	1.51
			28.9	-1.50	-40.92
	2	-.25			
			.0	-.90	.34
			28.9	-.90	-25.55
127					
	1	-.29			
			.0	-1.18	1.74
			28.9	-1.25	-33.35
	2	-.08			
			.0	-.82	.46
			28.9	-.82	-23.12
133					
	1	-.15			
			.0	-.91	1.93
			28.9	-.98	-25.44
	2	-.01			
			.0	-.72	.59
			28.9	-.72	-20.13
139					
	1	-.10			
			.0	-.63	2.07
			28.9	-.70	-17.28
	2	.06			
			.0	-.60	.74
			28.9	-.60	-16.52
145					
	1	-.08			
			.0	-.35	2.19
			28.9	-.42	-9.00
	2	-.01			
			.0	-.45	1.00
			28.9	-.45	-11.92
151					
	1	-.07			
			.0	-.07	2.26
			28.9	-.14	-.66
	2	-.24			
			.0	-.15	1.86
			28.9	-.15	-2.58
157					
	1	-.07			

			.0	.22	2.31
			28.9	.15	7.62
	2	-.47			
			.0	.19	2.40
			28.9	.19	7.86
163					
	1	-.07			
			.0	.50	2.33
			28.9	.43	15.77
	2	-.41			
			.0	.61	2.84
			28.9	.61	20.38
169					
	1	-.07			
			.0	.77	2.31
			28.9	.70	23.67
	2	.10			
			.0	.71	1.38
			28.9	.71	21.90
175					
	1	-.08			
			.0	1.04	2.27
			28.9	.97	31.22
	2	.04			
			.0	.82	1.12
			28.9	.82	24.70
181					
	1	-.10			
			.0	1.28	2.20
			28.9	1.21	38.31
	2	.04			
			.0	.87	.81
			28.9	.87	26.09
187					
	1	-.15			
			.0	1.51	2.10
			28.9	1.44	44.82
	2	-.01			
			.0	.92	.66
			28.9	.92	27.41
193					
	1	-.29			
			.0	1.72	1.96
			28.9	1.65	50.59
	2	-.08			
			.0	.96	.53
			28.9	.96	28.40
199					
	1	-.68			
			.0	1.89	1.78
			28.9	1.82	55.46
	2	-.23			
			.0	.99	.42
			28.9	.99	29.08
205					
	1	-1.78			
			.0	2.04	1.66
			28.9	1.97	59.54
	2	-.64			
			.0	1.01	.37

			28.9	1.01	29.63
116					
	1	-1.00			
			.0	10.87	-48.77
			28.9	10.80	264.51
	2	-.40			
			.0	6.21	-27.92
			28.9	6.21	151.64
122					
	1	-.38			
			.0	9.69	-41.89
			28.9	9.62	237.36
	2	-.14			
			.0	5.84	-26.15
			28.9	5.84	142.86
128					
	1	-.16			
			.0	8.31	-34.16
			28.9	8.24	205.26
	2	-.04			
			.0	5.35	-23.67
			28.9	5.35	131.11
134					
	1	-.08			
			.0	6.80	-26.09
			28.9	6.73	169.45
	2	.02			
			.0	4.73	-20.64
			28.9	4.73	116.22
140					
	1	-.05			
			.0	5.17	-17.77
			28.9	5.10	130.78
	2	.11			
			.0	3.97	-16.97
			28.9	3.97	97.79
146					
	1	-.04			
			.0	3.47	-9.31
			28.9	3.40	90.00
	2	-.16			
			.0	3.02	-12.27
			28.9	3.02	75.00
152					
	1	-.03			
			.0	1.72	-.80
			28.9	1.65	47.83
	2	-.20			
			.0	1.47	-2.75
			28.9	1.47	39.88
158					
	1	-.03			
			.0	-.06	7.67
			28.9	-.13	4.96
	2	-.58			
			.0	-.31	7.92
			28.9	-.31	-1.00
164					
	1	-.03			
			.0	-1.83	15.99

			28.9	-1.90	-37.98
	2	.22			
			.0	-2.38	20.70
			28.9	-2.38	-48.07
170					
	1	-.04			
			.0	-3.57	24.06
			28.9	-3.64	-80.33
	2	.06			
			.0	-3.29	22.30
			28.9	-3.29	-72.91
176					
	1	-.05			
			.0	-5.26	31.79
			28.9	-5.33	-121.41
	2	.07			
			.0	-4.15	25.16
			28.9	-4.15	-94.72
182					
	1	-.08			
			.0	-6.87	39.04
			28.9	-6.94	-160.52
	2	.01			
			.0	-4.76	26.61
			28.9	-4.76	-111.00
188					
	1	-.16			
			.0	-8.35	45.70
			28.9	-8.42	-196.90
	2	-.04			
			.0	-5.27	27.96
			28.9	-5.27	-124.42
194					
	1	-.38			
			.0	-9.69	51.61
			28.9	-9.76	-229.73
	2	-.13			
			.0	-5.67	28.98
			28.9	-5.67	-135.11
200					
	1	-1.00			
			.0	-10.85	56.62
			28.9	-10.92	-258.07
	2	-.37			
			.0	-5.98	29.69
			28.9	-5.98	-143.36
206					
	1	-2.77			
			.0	-11.79	60.82
			28.9	-11.86	-281.24
	2	-1.03			
			.0	-6.22	30.26
			28.9	-6.22	-149.59
213					
	1	-.01			
			.0	.14	-.24
			28.9	.10	3.23
	2	.00			
			.0	.06	-.10
			28.9	.06	1.51

315					
	1	-19.90			
			.0	-4.08	93.55
			28.9	-4.11	-24.84
	2	-7.45			
			.0	-2.11	48.62
			28.9	-2.11	-12.38
214					
	1	-10.17			
			.0	.05	3.16
			28.8	.02	4.18
	2	-4.39			
			.0	.02	1.48
			28.8	.02	2.19
316					
	1	-10.19			
			.0	.98	-23.70
			28.8	.94	3.91
	2	-4.01			
			.0	.48	-11.80
			28.8	.48	1.96
215					
	1	-10.18			
			.0	-.96	3.95
			28.9	-1.00	-24.46
	2	-4.40			
			.0	-.51	2.11
			28.9	-.51	-12.68
317					
	1	-10.18			
			.0	-.04	4.13
			28.9	-.07	2.61
	2	-4.01			
			.0	-.03	2.03
			28.9	-.03	1.30
216					
	1	-19.87			
			.0	4.19	-25.62
			28.9	4.15	95.00
	2	-8.24			
			.0	2.25	-13.29
			28.9	2.25	51.74
318					
	1	-.01			
			.0	-.08	2.67
			28.9	-.12	-.24
	2	.00			
			.0	-.05	1.33
			28.9	-.05	-.09
217					
	1	-19.78			
			.0	7.13	96.80
			2.2	7.13	112.20
	2	-8.19			
			.0	3.31	52.79
			2.2	3.31	59.93
223					
	1	-30.86			
			.0	6.40	223.44
			2.2	6.40	237.26

	2	-12.66			
			.0	3.41	127.56
			2.2	3.41	134.93
229					
	1	-39.51			
			.0	5.50	201.81
			2.2	5.50	213.69
	2	-17.24			
			.0	3.32	120.59
			2.2	3.32	127.76
235					
	1	-46.33			
			.0	4.58	176.43
			2.2	4.57	186.31
	2	-22.21			
			.0	3.26	111.50
			2.2	3.26	118.54
241					
	1	-51.63			
			.0	3.70	147.71
			2.2	3.69	155.69
	2	-27.75			
			.0	3.22	99.86
			2.2	3.22	106.82
247					
	1	-55.59			
			.0	2.79	116.43
			2.2	2.78	122.45
	2	-34.07			
			.0	3.13	85.46
			2.2	3.13	92.22
253					
	1	-58.35			
			.0	1.85	83.24
			2.2	1.85	87.24
	2	-41.12			
			.0	2.64	66.66
			2.2	2.64	72.36
259					
	1	-59.97			
			.0	.94	48.68
			2.2	.94	50.70
	2	-46.12			
			.0	1.34	39.35
			2.2	1.34	42.24
265					
	1	-60.51			
			.0	.02	13.36
			2.2	.01	13.39
	2	-47.17			
			.0	-.73	5.93
			2.2	-.73	4.36
271					
	1	-59.98			
			.0	-.90	-22.18
			2.2	-.91	-24.14
	2	-41.74			
			.0	-2.30	-30.1[illegible]
			2.2	-2.30	-35.08
277					

	1	-58.36			
			.0	-1.78	-57.44
			2.2	-1.79	-61.30
	2	-35.46			
			.0	-2.71	-53.84
			2.2	-2.71	-59.70
283					
	1	-55.61			
			.0	-2.73	-91.73
			2.2	-2.74	-97.64
	2	-29.36			
			.0	-2.91	-72.79
			2.2	-2.91	-79.07
289					
	1	-51.65			
			.0	-3.63	-124.62
			2.2	-3.63	-132.46
	2	-23.99			
			.0	-2.94	-87.55
			2.2	-2.94	-93.91
295					
	1	-46.36			
			.0	-4.55	-155.41
			2.2	-4.55	-165.24
	2	-19.28			
			.0	-3.01	-99.50
			2.2	-3.01	-106.00
301					
	1	-39.54			
			.0	-5.41	-183.53
			2.2	-5.41	-195.22
	2	-15.07			
			.0	-3.07	-109.10
			2.2	-3.07	-115.73
307					
	1	-30.90			
			.0	-6.39	-208.11
			2.2	-6.40	-221.92
	2	-11.19			
			.0	-3.12	-116.65
			2.2	-3.12	-123.39
313					
	1	-19.82			
			.0	-7.16	-228.18
			2.2	-7.16	-243.64
	2	-7.41			
			.0	-3.04	-122.14
			2.2	-3.04	-128.71
218					
	1	-19.78			
			.0	7.12	-240.01
			2.3	7.12	-223.77
	2	-8.19			
			.0	3.30	-133.28
			2.3	3.30	-125.75
224					
	1	-30.86			
			.0	6.41	-218.74
			2.3	6.41	-204.13
	2	-12.66			

154

			.0	3.41	-127.42
			2.3	3.41	-119.66
230					
	1	-39.51			
			.0	5.46	-192.46
			2.3	5.45	-180.02
	2	-17.24			
			.0	3.35	-118.83
			2.3	3.35	-111.18
236					
	1	-46.33			
			.0	4.57	-162.90
			2.3	4.56	-152.49
	2	-22.21			
			.0	3.29	-107.82
			2.3	3.29	-100.33
242					
	1	-51.63			
			.0	3.61	-130.59
			2.3	3.60	-122.37
	2	-27.75			
			.0	3.23	-94.11
			2.3	3.23	-86.75
248					
	1	-55.60			
			.0	2.73	-96.33
			2.3	2.72	-90.12
	2	-34.07			
			.0	3.19	-77.31
			2.3	3.19	-70.03
254					
	1	-58.35			
			.0	1.81	-60.60
			2.3	1.80	-56.48
	2	-41.12			
			.0	2.63	-51.71
			2.3	2.63	-45.71
260					
	1	-59.97			
			.0	.99	-24.11
			2.3	.98	-21.86
	2	-46.12			
			.0	1.33	-18.01
			2.3	1.33	-14.99
266					
	1	-60.51			
			.0	.01	12.89
			2.3	.00	12.90
	2	-47.17			
			.0	-.75	23.08
			2.3	-.75	21.37
272					
	1	-59.98			
			.0	-.93	49.62
			2.3	-.93	47.50
	2	-41.74			
			.0	-2.34	53.46
			2.3	-2.34	48.12
278					
	1	-58.36			

155

			.0	-1.87	85.61
			2.3	-1.88	81.33
	2	-35.46			
			.0	-2.74	73.95
			2.3	-2.74	67.70
284					
	1	-55.61			
			.0	-2.73	120.18
			2.3	-2.73	113.95
	2	-29.36			
			.0	-2.91	89.72
			2.3	-2.91	83.09
290					
	1	-51.65			
			.0	-3.63	152.89
			2.3	-3.64	144.60
	2	-23.99			
			.0	-2.97	102.09
			2.3	-2.97	95.32
296					
	1	-46.36			
			.0	-4.53	183.05
			2.3	-4.54	172.71
	2	-19.28			
			.0	-3.01	112.07
			2.3	-3.01	105.21
302					
	1	-39.54			
			.0	-5.48	210.04
			2.3	-5.49	197.54
	2	-15.07			
			.0	-3.07	119.98
			2.3	-3.07	112.99
308					
	1	-30.90			
			.0	-6.42	233.32
			2.3	-6.43	218.66
	2	-11.19			
			.0	-3.13	126.16
			2.3	-3.13	119.03
314					
	1	-19.82			
			.0	-7.16	111.64
			2.3	-7.17	95.31
	2	-7.41			
			.0	-3.04	56.54
			2.3	-3.04	49.62
219					
	1	-19.74			
			.0	7.14	-222.77
			28.9	7.07	-17.38
		8.17			
			.0	3.97	-125.15
			28.9	3.97	-10.37
225					
	1	-30.82			
			.0	6.46	-203.15
			28.9	6.39	-17.38
	2	-12.63			
			.0	3.77	-119.08

			28.9	3.77	-10.18
231					
	1	-39.47			
			.0	5.65	-179.10
			28.9	5.58	-16.77
	2	-17.21			
			.0	3.49	-110.66
			28.9	3.49	-9.85
237					
	1	-46.29			
			.0	4.74	-151.68
			28.9	4.67	-15.58
	2	-22.18			
			.0	3.13	-99.84
			28.9	3.13	-9.30
243					
	1	-51.60			
			.0	3.76	-121.61
			28.9	3.69	-13.94
	2	-27.74			
			.0	2.69	-86.32
			28.9	2.69	-8.52
249					
	1	-55.57			
			.0	2.72	-89.51
			28.9	2.65	-11.96
	2	-34.05			
			.0	2.15	-69.70
			28.9	2.15	-7.40
255					
	1	-58.33			
			.0	1.64	-56.01
			28.9	1.57	-9.71
	2	-41.10			
			.0	1.37	-45.43
			28.9	1.37	-5.85
261					
	1	-59.96			
			.0	.53	-21.64
			28.9	.46	-7.26
	2	-46.11			
			.0	.36	-14.79
			28.9	.36	-4.35
267					
	1	-60.50			
			.0	-.58	13.03
			28.9	-.65	-4.66
	2	-47.16			
			.0	-.84	21.50
			28.9	-.84	-2.80
273					
	1	-59.98			
			.0	-1.68	47.49
			28.9	-1.75	-1.96
	2	-41.73			
			.0	-1.72	48.14
			28.9	-1.72	-1.69
279					
	1	-58.37			
			.0	-2.75	81.20

			28.9	-2.82	.76
	2	-35.46			
			.0	-2.32	67.62
			28.9	-2.32	.54
285					
	1	-55.62			
			.0	-3.77	113.60
			28.9	-3.84	3.47
	2	-29.37			
			.0	-2.78	82.86
			28.9	-2.78	2.51
291					
	1	-51.67			
			.0	-4.74	144.10
			28.9	-4.81	6.10
	2	-24.01			
			.0	-3.14	95.01
			28.9	-3.14	4.27
297					
	1	-46.38			
			.0	-5.62	172.07
			28.9	-5.69	8.59
	2	-19.30			
			.0	-3.43	104.81
			28.9	-3.43	5.73
303					
	1	-39.57			
			.0	-6.40	196.83
			28.9	-6.47	10.84
	2	-15.09			
			.0	-3.65	112.54
			28.9	-3.65	6.89
309					
	1	-30.93			
			.0	-7.07	217.83
			28.9	-7.14	12.42
	2	-11.21			
			.0	-3.84	118.53
			28.9	-3.84	7.61
220					
	1	-25.13			
			.0	.96	-17.90
			28.8	.89	8.73
	2	-10.26			
			.0	.48	-10.64
			28.8	.48	3.15
226					
	1	-34.75			
			.0	1.05	-17.85
			28.8	.98	11.50
	2	-14.67			
			.0	.52	-10.44
			28.8	.52	4.45
232					
	1	-42.30			
			.0	1.11	-17.17
			28.8	1.04	13.69
	2	-19.34			
			.0	.55	-10.10
			28.8	.55	5.83

238					
	1	-48.23			
			.0	1.12	-15.91
			28.8	1.05	15.43
	2	-24.49			
			.0	.59	-9.52
			28.8	.59	7.36
244					
	1	-52.76			
			.0	1.11	-14.20
			28.8	1.04	16.77
	2	-30.29			
			.0	.62	-8.72
			28.8	.62	9.08
250					
	1	-56.04			
			.0	1.07	-12.15
			28.8	1.00	17.74
	2	-36.94			
			.0	.67	-7.57
			28.8	.67	11.66
256					
	1	-58.18			
			.0	1.01	-9.82
			28.8	.94	18.38
	2	-43.04			
			.0	.71	-5.97
			28.8	.71	14.55
262					
	1	-59.23			
			.0	.94	-7.29
			28.8	.87	18.69
	2	-46.20			
			.0	.72	-4.39
			28.8	.72	16.47
268					
	1	-59.22			
			.0	.84	-4.61
			28.8	.77	18.68
	2	-43.96			
			.0	.63	-2.72
			28.8	.63	15.29
274					
	1	-58.16			
			.0	.74	-1.85
			28.8	.67	18.36
	2	-37.87			
			.0	.46	-1.54
			28.8	.46	11.69
280					
	1	-56.02			
			.0	.62	.95
			28.8	.55	17.71
	2	-31.76			
			.0	.31	.73
			28.8	.31	9.65
286					
	1	-52.73			
			.0	.49	3.73
			28.8	.42	16.73

	2	-26.11			
			.0	.18	2.72
			28.8	.18	7.78
292					
	1	-48.19			
			.0	.35	6.43
			28.8	.28	15.37
	2	-21.17			
			.0	.06	4.51
			28.8	.06	6.31
298					
	1	-42.26			
			.0	.20	8.98
			28.8	.13	13.61
	2	-16.80			
			.0	-.03	5.97
			28.8	-.03	5.02
304					
	1	-34.70			
			.0	.04	11.29
			16.0	.00	11.60
			28.8	-.03	11.40
	2	-12.85			
			.0	-.11	7.14
			28.8	-.11	3.86
310					
	1	-25.08			
			.0	-.11	12.92
			28.8	-.18	8.62
	2	-9.11			
			.0	-.18	7.87
			28.8	-.18	2.76
221					
	1	-25.15			
			.0	.19	8.41
			28.9	.12	12.77
	2	-10.27			
			.0	.18	2.99
			28.9	.18	8.14
227					
	1	-34.76			
			.0	.03	11.23
			13.1	.00	11.44
			28.9	-.04	11.14
	2	-14.68			
			.0	.10	4.30
			28.9	.10	7.29
233					
	1	-42.31			
			.0	-.13	13.46
			28.9	-.20	8.81
	2	-19.35			
			.0	.01	5.68
			28.9	.01	5.92
239					
	1	-48.23			
			.0	-.28	15.25
			28.9	-.35	6.23
	2	-24.49			
			.0	-.10	7.21

			28.9	-.10	4.21
245					
	1	-52.76			
			.0	-.42	16.63
			28.9	-.49	3.51
	2	-30.29			
			.0	-.24	8.93
			28.9	-.24	2.12
251					
	1	-56.04			
			.0	-.55	17.64
			28.9	-.62	.70
	2	-36.94			
			.0	-.40	11.51
			28.9	-.40	-.14
257					
	1	-58.18			
			.0	-.67	18.32
			28.9	-.74	-2.13
	2	-43.05			
			.0	-.59	14.45
			28.9	-.59	-2.53
263					
	1	-59.23			
			.0	-.78	18.67
			28.9	-.85	-4.92
	2	-46.20			
			.0	-.72	16.44
			28.9	-.72	-4.27
269					
	1	-59.22			
			.0	-.88	18.70
			28.9	-.95	-7.63
	2	-43.95			
			.0	-.73	15.38
			28.9	-.73	-5.85
275					
	1	-58.16			
			.0	-.95	18.42
			28.9	-1.02	-10.19
	2	-37.86			
			.0	-.64	11.82
			28.9	-.64	-6.59
281					
	1	-56.02			
			.0	-1.01	17.81
			28.9	-1.08	-12.55
	2	-31.76			
			.0	-.60	9.79
			28.9	-.60	-7.70
287					
	1	-52.73			
			.0	-1.05	16.87
			28.9	-1.12	-14.63
	2	-26.10			
			.0	-.57	7.92
			28.9	-.57	-8.55
293					
	1	-48.19			
			.0	-1.07	15.55

161

			28.9	-1.14	-16.37
	2	-21.17			
			.0	-.54	6.45
			28.9	-.54	-9.27
299					
	1	-42.26			
			.0	-1.05	13.83
			28.9	-1.12	-17.66
	2	-16.80			
			.0	-.52	5.16
			28.9	-.52	-9.78
305					
	1	-34.69			
			.0	-1.00	11.67
			28.9	-1.07	-18.36
	2	-12.84			
			.0	-.49	4.00
			28.9	-.49	-10.10
311					
	1	-25.07			
			.0	-.91	8.94
			28.9	-.98	-18.41
	2	-9.10			
			.0	-.46	2.90
			28.9	-.46	-10.29
222					
	1	-30.89			
			.0	7.31	12.26
			28.9	7.24	222.55
	2	-12.68			
			.0	4.12	7.86
			28.9	4.12	127.03
228					
	1	-39.54			
			.0	6.62	10.68
			28.9	6.55	201.08
	2	-17.26			
			.0	3.91	7.01
			28.9	3.91	120.10
234					
	1	-46.35			
			.0	5.82	8.41
			28.9	5.75	175.80
	2	-22.22			
			.0	3.64	5.66
			28.9	3.64	111.07
240					
	1	-51.65			
			.0	4.92	5.90
			28.9	4.85	147.25
	2	-27.77			
			.0	3.30	3.97
			28.9	3.30	99.54
246					
	1	-55.60			
			.0	3.94	3.24
			28.9	3.87	116.12
	2	-34.07			
			.0	2.88	1.90
			28.9	2.88	85.22

252					
	1	-58.35			
			.0	2.89	.51
			28.9	2.82	83.06
	2	-41.12			
			.0	2.31	-.33
			28.9	2.31	66.58
258					
	1	-59.97			
			.0	1.80	-2.24
			28.9	1.73	48.66
	2	-46.12			
			.0	1.45	-2.64
			28.9	1.45	39.39
264					
	1	-60.50			
			.0	.67	-4.96
			28.9	.60	13.50
	2	-47.16			
			.0	.36	-4.28
			28.9	.36	6.06
270					
	1	-59.96			
			.0	-.46	-7.59
			28.9	-.53	-21.88
	2	-41.73			
			.0	-.83	-5.76
			28.9	-.83	-29.89
276					
	1	-58.34			
			.0	-1.59	-10.07
			28.9	-1.66	-56.94
	2	-35.45			
			.0	-1.63	-6.46
			28.9	-1.63	-53.55
282					
	1	-55.59			
			.0	-2.69	-12.36
			28.9	-2.76	-91.13
	2	-29.34			
			.0	-2.24	-7.53
			28.9	-2.24	-72.42
288					
	1	-51.62			
			.0	-3.75	-14.37
			28.9	-3.82	-123.88
	2	-23.98			
			.0	-2.72	-8.36
			28.9	-2.72	-87.09
294					
	1	-46.32			
			.0	-4.76	-16.03
			28.9	-4.83	-154.57
	2	-19.26			
			.0	-3.11	-9.05
			28.9	-3.11	-99.00
300					
	1	-39.50			
			.0	-5.68	-17.25
			28.9	-5.75	-182.54

	2	-15.05			
			.0	-3.42	-9.55
			28.9	-3.42	-108.57
306					
	1	-30.86			
			.0	-6.51	-17.89
			28.9	-6.58	-207.09
	2	-11.17			
			.0	-3.67	-9.85
			28.9	-3.67	-116.07
312					
	1	-19.78			
			.0	-7.20	-17.88
			28.9	-7.27	-227.15
	2	-7.38			
			.0	-3.86	-10.03
			28.9	-3.86	-121.54
319					
	1	-26.48			
			.0	-.06	1.28
			30.0	-.06	-.57
	2	-11.18			
			.0	-.02	.46
			30.0	-.02	-.20
320					
	1	-1.09			
			.0	-.01	.20
			30.0	-.01	-.05
	2	-.56			
			.0	.00	.07
			30.0	.00	-.01
321					
	1	3.04			
			.0	.08	-1.80
			30.0	.08	.66
	2	.75			
			.0	.05	-1.05
			30.0	.05	.38
322					
	1	1.61			
			.0	.04	-1.06
			30.0	.04	.25
	2	1.03			
			.0	.03	-.62
			30.0	.03	.15
323					
	1	-.60			
			.0	-.01	.29
			30.0	-.01	-.01
	2	-.30			
			.0	.00	.14
			30.0	.00	.00
324					
	1	-.27			
			.0	.03	-.87
			30.0	.03	.13
	2	-.81			
			.0	.02	-.54
			30.0	.02	.09
325					

	1	1.02			
			.0	.04	-1.00
			30.0	.04	.25
	2	.47			
			.0	.02	-.59
			30.0	.02	.14
326					
	1	-.85			
			.0	-.01	.26
			30.0	-.01	-.01
	2	-.41			
			.0	.00	.15
			30.0	.00	.00
327					
	1	-.40			
			.0	.03	-.76
			30.0	.03	.10
	2	-.61			
			.0	.02	-.48
			30.0	.02	.07
328					
	1	1.00			
			.0	.04	-.93
			30.0	.04	.25
	2	.19			
			.0	.02	-.55
			30.0	.02	.14
329					
	1	-1.06			
			.0	-.01	.22
			30.0	-.01	.00
	2	-.54			
			.0	-.01	.15
			30.0	-.01	.00
330					
	1	-.46			
			.0	.02	-.63
			30.0	.02	.06
	2	-.38			
			.0	.01	-.41
			30.0	.01	.04
331					
	1	.95			
			.0	.04	-.84
			30.0	.04	.24
	2	-.13			
			.0	.02	-.50
			30.0	.02	.14
332					
	1	-1.23			
			.0	-.01	.18
			30.0	-.01	.00
	2	-.69			
			.0	-.01	.15
			30.0	-.01	-.01
333					
	1	-.44			
			.0	.02	-.49
			30.0	.02	.02
	2	-.09			

			.0	.01	-.31
			30.0	.01	.01
334					
	1	.84			
			.0	.03	-.72
			30.0	.03	.23
	2	-.52			
			.0	.02	-.43
			30.0	.02	.13
335					
	1	-1.36			
			.0	.00	.14
			30.0	.00	.00
	2	-.85			
			.0	-.01	.15
			30.0	-.01	-.02
336					
	1	-.36			
			.0	.01	-.33
			30.0	.01	-.02
	2	.24			
			.0	.01	-.20
			30.0	.01	-.02
337					
	1	.70			
			.0	.03	-.59
			30.0	.03	.21
	2	-1.00			
			.0	.02	-.35
			30.0	.02	.12
338					
	1	-1.46			
			.0	.00	.10
			30.0	.00	.00
	2	-1.02			
			.0	-.01	.15
			30.0	-.01	-.02
339					
	1	-.22			
			.0	.00	-.17
			30.0	.00	-.05
	2	1.87			
			.0	.00	-.04
			30.0	.00	-.09
340					
	1	.53			
			.0	.02	-.45
			30.0	.02	.19
	2	.28			
			.0	.01	-.28
			30.0	.01	.14
341					
	1	-1.52			
			.0	.00	.06
			30.0	.00	.00
	2	-1.08			
			.0	.00	.10
			30.0	.00	-.02
342					
	1	-.04			

			.0	.00	-.01
			30.0	.00	-.09
	2	2.20			
			.0	-.01	.09
			30.0	-.01	-.13
343					
	1	.34			
			.0	.02	-.30
			30.0	.02	.16
	2	1.28			
			.0	.01	-.20
			30.0	.01	.15
344					
	1	-1.55			
			.0	.00	.02
			30.0	.00	.00
	2	-1.10			
			.0	.00	.02
			30.0	.00	-.01
345					
	1	.17			
			.0	-.01	.16
			30.0	-.01	-.13
	2	2.92			
			.0	-.01	.22
			30.0	-.01	-.16
346					
	1	.14			
			.0	.01	-.14
			30.0	.01	.13
	2	3.64			
			.0	.01	-.14
			30.0	.01	.17
347					
	1	-1.55			
			.0	.00	-.02
			30.0	.00	.00
	2	-.98			
			.0	.00	-.11
			30.0	.00	.00
348					
	1	.39			
			.0	-.02	.32
			30.0	-.02	-.16
	2	-.90			
			.0	-.01	.20
			30.0	-.01	-.10
349					
	1	-.04			
			.0	.00	.02
			30.0	.00	.09
	2	1.03			
			.0	.00	-.01
			30.0	.00	.09
350					
	1	-1.52			
			.0	.00	-.06
			30.0	.00	.00
	2	-1.03			
			.0	.00	-.13

167

			30.0	.00	.02
351					
	1	.60			
			.0	-.02	.48
			30.0	-.02	-.19
	2	-.66			
			.0	-.01	.30
			30.0	-.01	-.12
352					
	1	-.20			
			.0	.00	.18
			30.0	.00	.06
	2	.73			
			.0	.00	.11
			30.0	.00	.05
353					
	1	-1.46			
			.0	.00	-.10
			30.0	.00	.00
	2	-.88			
			.0	.01	-.14
			30.0	.01	.02
354					
	1	.80			
			.0	-.03	.62
			30.0	-.03	-.22
	2	-.65			
			.0	-.02	.37
			30.0	-.02	-.12
355					
	1	-.32			
			.0	-.01	.34
			30.0	-.01	.02
	2	.10			
			.0	-.01	.22
			30.0	-.01	.01
356					
	1	-1.37			
			.0	.00	-.14
			30.0	.00	.00
	2	-.75			
			.0	.00	-.14
			30.0	.00	.01
357					
	1	.96			
			.0	-.03	.76
			30.0	-.03	-.24
	2	-.23			
			.0	-.02	.44
			30.0	-.02	-.13
358					
	1	-.38			
			.0	-.02	.48
			30.0	-.02	-.02
	2	-.19			
			.0	-.01	.32
			30.0	-.01	-.02
359					
	1	-1.25			
			.0	.01	-.18

166

			30.0	.01	.00
	2	-.61			
			.0	.00	-.14
			30.0	.00	.01
360					
	1	1.09			
			.0	-.04	.87
			30.0	-.04	-.25
	2	.11			
			.0	-.02	.50
			30.0	-.02	-.13
361					
	1	-.38			
			.0	-.02	.62
			30.0	-.02	-.05
	2	-.43			
			.0	-.01	.40
			30.0	-.01	-.05
362					
	1	-1.08			
			.0	.01	-.22
			30.0	.01	.00
	2	-.48			
			.0	.00	-.13
			30.0	.00	.00
363					
	1	1.16			
			.0	-.04	.97
			30.0	-.04	-.26
	2	.40			
			.0	-.02	.55
			30.0	-.02	-.14
364					
	1	-.30			
			.0	-.03	.75
			30.0	-.03	-.09
	2	-.62			
			.0	-.02	.46
			30.0	-.02	-.07
365					
	1	-.87			
			.0	.01	-.26
			30.0	.01	.00
	2	-.37			
			.0	.00	-.13
			30.0	.00	.00
366					
	1	1.20			
			.0	-.04	1.04
			30.0	-.04	-.26
	2	.65			
			.0	-.02	.58
			30.0	-.02	-.14
367					
	1	-.16			
			.0	-.03	.86
			30.0	-.03	-.12
	2	-.79			
			.0	-.02	.51
			30.0	-.02	-.09

368					
	1	-.62			
			.0	.01	-.29
			30.0	.01	.01
	2	-.28			
			.0	.00	-.13
			30.0	.00	-.01
369					
	1	1.78			
			.0	-.05	1.10
			30.0	-.05	-.26
	2	1.14			
			.0	-.03	.61
			30.0	-.03	-.15
370					
	1	3.11			
			.0	-.08	1.78
			30.0	-.08	-.64
	2	.65			
			.0	-.05	1.00
			30.0	-.05	-.36
371					
	1	-1.05			
			.0	.01	-.19
			30.0	.01	.02
	2	-.53			
			.0	.00	-.06
			30.0	.00	.01
372					
	1	-26.18			
			.0	.05	-1.09
			30.0	.05	.51
	2	-10.18			
			.0	.02	-.42
			30.0	.02	.18
373					
	1	-10.59			
			.0	.00	-.13
			30.0	.00	-.11
	2	-4.52			
			.0	.00	-.06
			30.0	.00	-.04
374					
	1	-.62			
			.0	-.02	.13
			30.0	-.02	-.37
	2	-.28			
			.0	-.01	.05
			30.0	-.01	-.16
375					
	1	.32			
			.0	.04	-.23
			30.0	.04	1.01
	2	.52			
			.0	.02	-.13
			30.0	.02	.59
376					
	1	.10			
			.0	.05	-.47
			30.0	.05	1.16

	2	-.70			
			.0	.03	-.29
			30.0	.03	.70
377					
	1	.13			
			.0	-.02	.20
			30.0	-.02	-.26
	2	.01			
			.0	-.01	.10
			30.0	-.01	-.13
378					
	1	1.39			
			.0	.06	-.56
			30.0	.06	1.21
	2	.88			
			.0	.03	-.31
			30.0	.03	.70
379					
	1	-.57			
			.0	.05	-.42
			30.0	.05	1.07
	2	-.80			
			.0	.03	-.28
			30.0	.03	.66
380					
	1	-.01			
			.0	-.01	.18
			30.0	-.01	-.23
	2	-.05			
			.0	-.01	.11
			30.0	-.01	-.13
381					
	1	1.35			
			.0	.05	-.52
			30.0	.05	1.10
	2	.61			
			.0	.03	-.29
			30.0	.03	.65
382					
	1	-.65			
			.0	.04	-.37
			30.0	.04	.95
	2	-.58			
			.0	.03	-.25
			30.0	.03	.60
383					
	1	-.09			
			.0	-.01	.15
			30.0	-.01	-.20
	2	-.09			
			.0	-.01	.10
			30.0	-.01	-.13
384					
	1	1.27			
			.0	.05	-.46
			30.0	.05	.97
	2	.31			
			.0	.03	-.27
			30.0	.03	.59
385					

171

	1	-.64			
			.0	.04	-.30
			30.0	.04	.81
	2	-.31			
			.0	.02	-.22
			30.0	.02	.52
386					
	1	-.13			
			.0	-.01	.13
			30.0	-.01	-.16
	2	-.13			
			.0	-.01	.10
			30.0	-.01	-.14
387					
	1	1.14			
			.0	.04	-.40
			30.0	.04	.82
	2	-.06			
			.0	.02	-.24
			30.0	.02	.50
388					
	1	-.55			
			.0	.03	-.23
			30.0	.03	.65
	2	.03			
			.0	.02	-.18
			30.0	.02	.43
389					
	1	-.16			
			.0	-.01	.10
			30.0	-.01	-.12
	2	-.17			
			.0	-.01	.10
			30.0	-.01	-.14
390					
	1	.95			
			.0	.03	-.33
			30.0	.03	.65
	2	-.52			
			.0	.02	-.20
			30.0	.02	.40
391					
	1	-.40			
			.0	.02	-.15
			30.0	.02	.48
	2	.42			
			.0	.01	-.13
			30.0	.01	.31
392					
	1	-.18			
			.0	-.01	.07
			30.0	-.01	-.09
	2	-.10			
			.0	-.01	.10
			30.0	-.01	-.15
393					
	1	.73			
			.0	.02	-.25
			30.0	.02	.47
	2	-.04			

17

			.0	.02	-.18
			30.0	.02	.29
394					
	1	-.19			
			.0	.01	-.07
			30.0	.01	.29
	2	1.44			
			.0	.01	-.04
			30.0	.01	.16
395					
	1	-.19			
			.0	.00	.04
			30.0	.00	-.05
	2	.14			
			.0	.00	.05
			30.0	.00	-.09
396					
	1	.47			
			.0	.01	-.17
			30.0	.01	.28
	2	.52			
			.0	.01	-.12
			30.0	.01	.17
397					
	1	.04			
			.0	.00	.01
			30.0	.00	.10
	2	1.51			
			.0	.00	.04
			30.0	.00	.02
398					
	1	-.20			
			.0	.00	.01
			30.0	.00	-.02
	2	.34			
			.0	.00	.01
			30.0	.00	-.02
399					
	1	.20			
			.0	.01	-.09
			30.0	.01	.08
	2	1.99			
			.0	.00	-.08
			30.0	.00	.06
400					
	1	.29			
			.0	-.01	.10
			30.0	-.01	-.09
	2	1.61			
			.0	-.01	.15
			30.0	-.01	-.13
401					
	1	-.20			
			.0	.00	-.02
			30.0	.00	.02
	2	.35			
			.0	.01	-.10
			30.0	.01	.13
402					
	1	-.06			

		.0	.00	.00
		30.0	.00	-.12
2	.95			
		.0	.00	.04
		30.0	.00	-.10
403				
1	.54			
		.0	-.02	.18
		30.0	-.02	-.28
2	-.73			
		.0	-.01	.12
		30.0	-.01	-.18
404				
1	-.20			
		.0	.00	-.05
		30.0	.00	.06
2	-.12			
		.0	.01	-.08
		30.0	.01	.12
405				
1	-.31			
		.0	-.01	.08
		30.0	-.01	-.31
2	.67			
		.0	-.01	.09
		30.0	-.01	-.23
406				
1	.77			
		.0	-.02	.26
		30.0	-.02	-.47
2	-.46			
		.0	-.02	.17
		30.0	-.02	-.30
407				
1	-.19			
		.0	.01	-.08
		30.0	.01	.09
2	-.12			
		.0	.01	-.09
		30.0	.01	.13
408				
1	-.53			
		.0	-.02	.17
		30.0	-.02	-.50
2	.16			
		.0	-.02	.15
		30.0	-.02	-.35
409				
1	.98			
		.0	-.03	.33
		30.0	-.03	-.64
2	-.31			
		.0	-.02	.20
		30.0	-.02	-.40
410				
1	-.17			
		.0	.01	-.11
		30.0	.01	.13
2	-.15			
		.0	.01	-.09

179

			30.0	.01	.13
411					
	1	-.70			
			.0	-.03	.24
			30.0	-.03	-.68
	2	-.20			
			.0	-.02	.19
			30.0	-.02	-.45
412					
	1	1.15			
			.0	-.04	.40
			30.0	-.04	-.81
	2	.08			
			.0	-.02	.23
			30.0	-.02	-.49
413					
	1	-.14			
			.0	.01	-.14
			30.0	.01	.16
	2	-.12			
			.0	.01	-.09
			30.0	.01	.12
414					
	1	-.81			
			.0	-.04	.32
			30.0	-.04	-.85
	2	-.50			
			.0	-.03	.22
			30.0	-.03	-.53
415					
	1	1.27			
			.0	-.05	.46
			30.0	-.05	-.96
	2	.39			
			.0	-.03	.25
			30.0	-.03	-.56
416					
	1	-.10			
			.0	.01	-.16
			30.0	.01	.20
	2	-.09			
			.0	.01	-.10
			30.0	.01	.12
417					
	1	-.83			
			.0	-.05	.39
			30.0	-.05	-.99
	2	-.74			
			.0	-.03	.25
			30.0	-.03	-.60
418					
	1	1.33			
			.0	-.05	.52
			30.0	-.05	-1.08
	2	.66			
			.0	-.03	.27
			30.0	-.03	-.61
419					
	1	-.03			
			.0	.01	-.19

			30.0	.01	.24
	2	-.05			
			.0	.01	-.10
			30.0	.01	.12
420					
	1	-.77			
			.0	-.05	.45
			30.0	-.05	-1.11
	2	-.94			
			.0	-.03	.27
			30.0	-.03	-.65
421					
	1	1.37			
			.0	-.06	.56
			30.0	-.06	-1.18
	2	.89			
			.0	-.03	.29
			30.0	-.03	-.66
422					
	1	.12			
			.0	.02	-.21
			30.0	.02	.26
	2	.00			
			.0	.01	-.10
			30.0	.01	.11
423					
	1	-.13			
			.0	-.06	.49
			30.0	-.06	-1.20
	2	-.86			
			.0	-.03	.29
			30.0	-.03	-.69
424					
	1	.42			
			.0	-.04	.25
			30.0	-.04	-1.00
	2	.56			
			.0	-.02	.12
			30.0	-.02	-.55
425					
	1	-.68			
			.0	.02	-.16
			30.0	.02	.39
	2	-.25			
			.0	.01	-.05
			30.0	.01	.15
426					
	1	-10.73			
			.0	.00	.15
			30.0	.00	.10
	2	-4.12			
			.0	.00	.06
			30.0	.00	.04
427					
	1	10.96			
			.0	.00	-.07
			41.7	-.01	-.32
	2	4.60			
			.0	.00	.00
			41.7	.00	-.15

429					
	1	-1.06			
			.0	-.02	.49
			41.7	-.03	-.59
	2	-1.20			
			.0	-.01	.30
			41.7	-.01	-.32
431					
	1	-1.12			
			.0	-.02	.47
			41.7	-.03	-.56
	2	-.88			
			.0	-.01	.30
			41.7	-.01	-.31
433					
	1	-1.15			
			.0	-.02	.44
			41.7	-.03	-.51
	2	-.53			
			.0	-.01	.28
			41.7	-.01	-.30
435					
	1	-1.11			
			.0	-.02	.39
			41.7	-.02	-.45
	2	-.12			
			.0	-.01	.26
			41.7	-.01	-.28
437					
	1	-.97			
			.0	-.01	.33
			41.7	-.02	-.38
	2	.39			
			.0	-.01	.23
			41.7	-.01	-.26
439					
	1	-.77			
			.0	-.01	.26
			41.7	-.02	-.30
	2	.99			
			.0	-.01	.20
			41.7	-.01	-.24
441					
	1	-.51			
			.0	.00	.19
			41.7	-.01	-.22
	2	.81			
			.0	-.01	.12
			41.7	-.01	-.12
443					
	1	-.21			
			.0	.00	.11
			41.7	-.01	-.14
	2	.17			
			.0	.00	.05
			41.7	.00	-.01
445					
	1	.09			
			.0	.00	.03
			12.5	.00	.05

			41.7	-.01	-.05
	2	-1.40			
			.0	.01	-.06
			41.7	.01	.17
447					
	1	.40			
			.0	.01	-.05
			29.8	.00	.05
			41.7	.00	.04
	2	-1.21			
			.0	.00	-.04
			41.7	.00	.11
449					
	1	.67			
			.0	.01	-.13
			41.7	.00	.12
	2	-.82			
			.0	.01	-.09
			41.7	.01	.16
451					
	1	.90			
			.0	.01	-.21
			41.7	.01	.21
	2	-.28			
			.0	.01	-.13
			41.7	.01	.18
453					
	1	1.06			
			.0	.02	-.29
			41.7	.01	.29
	2	.19			
			.0	.01	-.17
			41.7	.01	.22
455					
	1	1.14			
			.0	.02	-.36
			41.7	.01	.37
	2	.57			
			.0	.01	-.21
			41.7	.01	.24
457					
	1	1.13			
			.0	.03	-.42
			41.7	.02	.44
	2	.89			
			.0	.01	-.23
			41.7	.01	.26
459					
	1	1.05			
			.0	.03	-.48
			41.7	.02	.50
	2	1.17			
			.0	.01	-.26
			41.7	.01	.28
461					
	1	-1.93			
			.0	.03	-.44
			41.7	.02	.60
	2	-.09			
			.0	.01	-.23

			41.7	.01	.31
428					
	1	9.04			
			.0	-.01	.11
			41.7	-.02	-.50
	2	3.94			
			.0	-.01	.08
			41.7	-.01	-.24
430					
	1	8.80			
			.0	.01	-.19
			37.4	.00	-.03
			41.7	.00	-.03
	2	4.23			
			.0	.00	-.09
			41.7	.00	.02
432					
	1	8.08			
			.0	.01	-.15
			32.0	.00	-.03
			41.7	.00	-.04
	2	4.40			
			.0	.00	-.08
			41.7	.00	.01
434					
	1	7.24			
			.0	.01	-.11
			26.0	.00	-.03
			41.7	.00	-.06
	2	4.55			
			.0	.00	-.07
			41.7	.00	-.01
436					
	1	6.32			
			.0	.00	-.07
			20.2	.00	-.02
			41.7	.00	-.08
	2	4.69			
			.0	.00	-.05
			41.7	.00	-.02
438					
	1	5.34			
			.0	.00	-.03
			14.6	.00	-.01
			41.7	-.01	-.09
	2	4.84			
			.0	.00	-.03
			41.7	.00	-.04
440					
	1	4.33			
			.0	.00	.01
			9.3	.00	.02
			41.7	-.01	-.10
	2	5.23			
			.0	.00	-.01
			41.7	.00	-.06
442					
	1	3.29			
			.0	.00	.04
			4.2	.00	.05

179

			41.7	-.01	-.12
	2	4.24			
			.0	.00	.04
			41.7	.00	-.09
444					
	1	2.22			
			.0	.00	.08
			41.7	-.01	-.13
	2	2.57			
			.0	.00	.09
			41.7	.00	-.10
446					
	1	1.12			
			.0	.00	.11
			41.7	-.01	-.14
	2	-1.28			
			.0	-.01	.17
			41.7	-.01	-.10
448					
	1	-.01			
			.0	.00	.14
			41.7	-.01	-.15
	2	-2.23			
			.0	-.01	.15
			41.7	-.01	-.06
450					
	1	-1.17			
			.0	.00	.17
			41.7	-.01	-.15
	2	-2.82			
			.0	-.01	.15
			41.7	-.01	-.06
452					
	1	-2.35			
			.0	.00	.19
			41.7	-.01	-.16
	2	-3.00			
			.0	.00	.14
			41.7	.00	-.06
454					
	1	-3.56			
			.0	.00	.21
			41.7	-.01	-.16
	2	-3.12			
			.0	.00	.14
			41.7	.00	-.06
456					
	1	-4.78			
			.0	.00	.23
			41.7	-.01	-.15
	2	-3.23			
			.0	.00	.14
			41.7	.00	-.05
458					
	1	-5.99			
			.0	.00	.24
			41.7	-.01	-.15
	2	-3.29			
			.0	.00	.13
			41.7	.00	-.05

460					
	1	-7.03			
			.0	.00	.24
			41.7	-.01	-.14
	2	-3.27			
			.0	.00	.13
			41.7	.00	-.05
462					
	1	-10.84			
			.0	.01	.09
			29.1	.00	.19
			41.7	.00	.17
	2	-4.30			
			.0	.00	.04
			41.7	.00	.09
463					
	1	-10.51			
			.0	.00	.16
			11.4	.00	.18
			41.6	-.01	.07
	2	-4.72			
			.0	.00	.10
			41.6	.00	.04
465					
	1	-6.92			
			.0	.01	-.13
			41.6	.00	.23
	2	-3.57			
			.0	.00	-.05
			41.6	.00	.14
467					
	1	-5.88			
			.0	.01	-.14
			41.6	.00	.23
	2	-3.59			
			.0	.00	-.06
			41.6	.00	.14
469					
	1	-4.67			
			.0	.01	-.14
			41.6	.00	.22
	2	-3.51			
			.0	.00	-.06
			41.6	.00	.15
471					
	1	-3.45			
			.0	.01	-.15
			41.6	.00	.20
	2	-3.39			
			.0	.01	-.06
			41.6	.01	.15
473					
	1	-2.25			
			.0	.01	-.15
			41.6	.00	.18
	2	-3.24			
			.0	.01	-.06
			41.6	.01	.16
475					
	1	-1.07			

			.0	.01	-.15
			41.6	.00	.16
	2	-3.01			
			.0	.01	-.07
			41.6	.01	.17
477					
	1	.09			
			.0	.01	-.14
			41.6	.00	.13
	2	-1.05			
			.0	.01	-.07
			41.6	.01	.14
479					
	1	1.21			
			.0	.01	-.13
			41.6	.00	.10
	2	1.32			
			.0	.00	-.08
			41.6	.00	.10
481					
	1	2.31			
			.0	.01	-.12
			40.8	.00	.07
			41.6	.00	.07
	2	5.00			
			.0	.00	-.07
			41.6	.00	.01
483					
	1	3.37			
			.0	.01	-.11
			36.0	.00	.04
			41.6	.00	.04
	2	4.46			
			.0	.00	-.06
			41.6	.00	.01
485					
	1	4.41			
			.0	.01	-.10
			31.0	.00	.01
			41.6	.00	.00
	2	4.61			
			.0	.00	-.05
			41.6	.00	-.02
487					
	1	5.42			
			.0	.01	-.08
			25.6	.00	-.01
			41.6	.00	-.04
	2	4.36			
			.0	.00	-.03
			41.6	.00	-.03
489					
	1	6.39			
			.0	.00	-.07
			20.0	.00	-.02
			41.6	.00	-.08
	2	4.24			
			.0	.00	-.01
			41.6	.00	-.05
491					

	1	7.31			
			.0	.00	-.05
			14.2	.00	-.03
			41.6	-.01	-.12
	2	4.11			
			.0	.00	.00
			41.6	.00	-.07
493					
	1	8.15			
			.0	.00	-.04
			8.3	.00	-.03
			41.6	-.01	-.16
	2	3.98			
			.0	.00	.01
			41.6	.00	-.08
495					
	1	8.86			
			.0	.00	-.02
			2.8	.00	-.02
			41.6	-.01	-.20
	2	3.84			
			.0	.00	.02
			41.6	.00	-.09
497					
	1	9.10			
			.0	.02	-.48
			41.6	.01	.08
	2	3.60			
			.0	.01	-.22
			41.6	.01	.07
464					
	1	-1.96			
			.0	-.02	.56
			41.7	-.03	-.41
	2	-.19			
			.0	-.01	.32
			41.7	-.01	-.24
466					
	1	1.15			
			.0	-.02	.49
			41.7	-.03	-.48
	2	1.18			
			.0	-.01	.30
			41.7	-.01	-.27
468					
	1	1.20			
			.0	-.02	.43
			41.7	-.03	-.42
	2	.85			
			.0	-.01	.28
			41.7	-.01	-.25
470					
	1	1.19			
			.0	- .1	.36
			41.7	-.02	-.35
	2	.48			
			.0	-.01	.26
			41.7	-.01	-.21
472					
	1	1.09			

18

			.0	-.01	.28
			41.7	-.02	-.28
	2	.03			
			.0	-.01	.23
			41.7	-.01	-.17
474					
	1	.91			
			.0	.00	.19
			41.7	-.01	-.20
	2	-.52			
			.0	-.01	.19
			41.7	-.01	-.12
476					
	1	.65			
			.0	.00	.11
			41.7	-.01	-.12
	2	-1.32			
			.0	-.01	.17
			41.7	-.01	-.08
478					
	1	.35			
			.0	.00	.02
			14.7	.00	.05
			41.7	-.01	-.04
	2	-1.15			
			.0	.00	.09
			41.7	.00	-.02
480					
	1	.02			
			.0	.01	-.07
			32.3	.00	.05
			41.7	.00	.04
	2	-.63			
			.0	.00	.02
			41.7	.00	.03
482					
	1	-.32			
			.0	.01	-.15
			41.7	.00	.13
	2	1.29			
			.0	.01	-.15
			41.7	.01	.13
484					
	1	-.64			
			.0	.02	-.24
			41.7	.01	.20
	2	.93			
			.0	.01	-.19
			41.7	.01	.16
486					
	1	-.93			
			.0	.02	-.32
			41.7	.01	.28
	2	.57			
			.0	.01	-.23
			41.7	.01	.20
488					
	1	-1.16			
			.0	.02	-.40
			41.7	.01	.35

	2	.03			
			.0	.01	-.25
			41.7	.01	.23
490					
	1	-1.32			
			.0	.03	-.47
			41.7	.02	.41
	2	-.42			
			.0	.01	-.27
			41.7	.01	.26
492					
	1	-1.39			
			.0	.03	-.53
			41.7	.02	.46
	2	-.79			
			.0	.01	-.29
			41.7	.01	.27
494					
	1	-1.38			
			.0	.03	-.59
			41.7	.02	.50
	2	-1.10			
			.0	.01	-.30
			41.7	.01	.29
496					
	1	-1.34			
			.0	.03	-.62
			41.7	.02	.52
	2	-1.39			
			.0	.01	-.30
			41.7	.01	.30
498					
	1	10.66			
			.0	.02	-.42
			41.7	.01	.01
	2	4.19			
			.0	.00	-.14
			41.7	.00	.00
499					
	1	-11.06			
			.0	.02	-.37
			41.7	.01	.12
	2	-4.65			
			.0	.01	-.14
			41.7	.01	.07
501					
	1	1.03			
			.0	-.01	.22
			41.7	-.02	-.35
	2	1.18			
			.0	-.01	.14
			41.7	-.01	-.16
503					
	1	1.09			
			.0	-.01	.20
			41.7	-.02	-.31
	2	.86			
			.0	-.01	.12
			41.7	-.01	-.15
505					

	1	1.14			
			.0	-.01	.18
			41.7	-.02	-.28
	2	.52			
			.0	-.01	.11
			41.7	-.01	-.14
507					
	1	1.10			
			.0	.00	.16
			41.7	-.01	-.24
	2	.11			
			.0	-.01	.10
			41.7	-.01	-.13
509					
	1	.97			
			.0	.00	.13
			41.7	-.01	-.20
	2	-.40			
			.0	.00	.08
			41.7	.00	-.11
511					
	1	.77			
			.0	.00	.10
			41.7	-.01	-.16
	2	-1.00			
			.0	.00	.05
			41.7	.00	-.09
513					
	1	.51			
			.0	.00	.07
			1.4	.00	.07
			41.7	-.01	-.12
	2	-.81			
			.0	.00	.06
			41.7	.00	-.09
515					
	1	.23			
			.0	.00	.04
			9.5	.00	.05
			41.7	-.01	-.07
	2	-.15			
			.0	.00	.06
			41.7	.00	-.05
517					
	1	-.07			
			.0	.00	.00
			17.7	.00	.04
			41.7	-.01	-.03
	2	1.43			
			.0	.00	.09
			41.7	.00	-.03
519					
	1	-.37			
			.0	.01	-.03
			25.9	.00	.04
			41.7	.00	.01
	2	1.24			
			.0	.00	.00
			41.7	.00	.07
521					

	1	-.64			
			.0	.01	-.07
			33.9	.00	.06
			41.7	.00	.06
	2	.84			
			.0	.00	-.03
			41.7	.00	.09
523					
	1	-.86			
			.0	.01	-.10
			41.6	.00	.10
			41.7	.00	.10
	2	.30			
			.0	.00	-.06
			41.7	.00	.12
525					
	1	-1.02			
			.0	.01	-.13
			41.7	.00	.14
	2	-.16			
			.0	.00	-.08
			41.7	.00	.13
527					
	1	-1.09			
			.0	.01	-.16
			41.7	.00	.17
	2	-.55			
			.0	.01	-.09
			41.7	.01	.14
529					
	1	-1.08			
			.0	.01	-.18
			41.7	.00	.20
	2	-.87			
			.0	.01	-.11
			41.7	.01	.14
531					
	1	-1.00			
			.0	.02	-.20
			41.7	.01	.23
	2	-1.15			
			.0	.01	-.12
			41.7	.01	.15
533					
	1	1.88			
			.0	.03	-.45
			41.7	.02	.49
	2	.06			
			.0	.01	-.25
			41.7	.01	.28
500					
	1	-10.84			
			.0	.00	-.13
			19.7	.00	-.09
			41.7	-.01	-.15
	2	-4.93			
			.0	.00	-.05
			41.7	.00	-.06
502					
	1	-7.40			

15

			.0	.00	.07
			41.7	-.01	-.30
	2	-3.78			
			.0	-.01	.06
			41.7	-.01	-.15
504					
	1	-6.43			
			.0	.00	.05
			41.7	-.01	-.26
	2	-3.84			
			.0	.00	.06
			41.7	.00	-.14
506					
	1	-5.33			
			.0	.00	.04
			41.7	-.01	-.22
	2	-3.82			
			.0	.00	.05
			41.7	.00	-.13
508					
	1	-4.19			
			.0	.00	.02
			.2	.00	.02
			41.7	-.01	-.17
	2	-3.78			
			.0	.00	.04
			41.7	.00	-.12
510					
	1	-3.06			
			.0	.00	.01
			6.4	.00	.01
			41.7	-.01	-.13
	2	-3.72			
			.0	.00	.03
			41.7	.00	-.10
512					
	1	-1.93			
			.0	.00	-.01
			12.8	.00	.01
			41.7	-.01	-.09
	2	-3.66			
			.0	.00	.02
			41.7	.00	-.08
514					
	1	-.81			
			.0	.00	-.03
			19.3	.00	.02
			41.7	-.01	-.04
	2	-1.90			
			.0	.00	.00
			41.7	.00	-.03
516					
	1	.29			
			.0	.01	-.05
			25.8	.00	.03
			41.7	.00	.00
	2	.31			
			.0	.00	-.01
			41.7	.00	.03
518					

16

	1	1.39			
			.0	.01	-.06
			32.2	.00	.06
			41.7	.00	.05
	2	4.07			
			.0	.00	-.04
			41.7	.00	.12
520					
	1	2.47			
			.0	.01	-.08
			38.4	.00	.09
			41.7	.00	.09
	2	3.82			
			.0	.00	-.03
			41.7	.00	.12
522					
	1	3.55			
			.0	.01	-.10
			41.7	.00	.13
	2	4.08			
			.0	.00	-.04
			41.7	.00	.14
524					
	1	4.60			
			.0	.01	-.11
			41.7	.00	.17
	2	3.95			
			.0	.00	-.05
			41.7	.00	.14
526					
	1	5.64			
			.0	.01	-.13
			41.7	.00	.20
	2	3.89			
			.0	.00	-.05
			41.7	.00	.15
528					
	1	6.65			
			.0	.01	-.14
			41.7	.00	.24
	2	3.83			
			.0	.01	-.06
			41.7	.01	.15
530					
	1	7.58			
			.0	.01	-.15
			41.7	.00	.26
	2	3.76			
			.0	.01	-.06
			41.7	.01	.15
532					
	1	8.37			
			.0	.02	-.15
			41.7	.01	.28
	2	3.64			
			.0	.01	-.06
			41.7	.01	.15
534					
	1	8.88			
			.0	.00	.06

			18.0	.00	.10
			41.7	.01	.03
	2	3.41			
			.0	.00	.05
			41.7	.00	.01
535					
	1	8.71			
			.0	.01	.01
			28.5	.00	.11
			41.6	.00	.09
	2	3.73			
			.0	.00	.01
			41.6	.00	.06
537					
	1	8.28			
			.0	-.01	.27
			41.6	-.01	-.14
	2	4.00			
			.0	-.01	.16
			41.6	-.01	-.07
539					
	1	7.49			
			.0	.00	.26
			41.6	-.01	-.14
	2	4.13			
			.0	-.01	.16
			41.6	-.01	-.06
541					
	1	6.56			
			.0	.00	.23
			41.6	-.01	-.13
	2	4.22			
			.0	-.01	.16
			41.6	-.01	-.06
543					
	1	5.55			
			.0	.00	.20
			41.6	-.01	-.12
	2	4.29			
			.0	-.01	.16
			41.6	-.01	-.05
545					
	1	4.52			
			.0	.00	.16
			41.6	-.01	-.11
	2	4.34			
			.0	.00	.15
			41.6	.00	-.05
547					
	1	3.46			
			.0	.00	.12
			41.6	-.01	-.09
	2	4.58			
			.0	.00	.15
			41.6	.00	-.04
549					
	1	2.39			
			.0	.00	.08
			4.5	.00	.08
			41.6	-.01	-.07

	2	3.38			
			.0	.00	.10
			41.6	.00	-.02
551					
	1	1.30			
			.0	.00	.04
			10.7	.00	.05
			41.6	-.01	-.06
	2	1.56			
			.0	.00	.05
			41.6	.00	-.01
553					
	1	.21			
			.0	.00	.00
			17.1	.00	.03
			41.6	-.01	-.04
	2	-2.19			
			.0	.00	-.05
			41.6	.00	.02
555					
	1	-.90			
			.0	.01	-.05
			23.6	.00	.02
			41.6	.00	-.02
	2	-2.86			
			.0	.00	-.06
			41.6	.00	.01
557					
	1	-2.01			
			.0	.01	-.09
			30.1	.00	.01
			41.6	.00	.00
	2	-3.32			
			.0	.00	-.08
			41.6	.00	.02
559					
	1	-3.14			
			.0	.01	-.14
			36.5	.00	.02
			41.6	.00	.01
	2	-3.40			
			.0	.00	-.10
			41.6	.00	.03
561					
	1	-4.27			
			.0	.01	-.18
			41.6	.00	.03
	2	-3.45			
			.0	.00	-.11
			41.6	.00	.04
563					
	1	-5.41			
			.0	.01	-.22
			41.6	.00	.05
	2	-3.48			
			.0	.00	-.12
			41.6	.00	.05
565					
	1	-6.52			
			.0	.01	-.27

			41.6	.00	.06
	2	-3.50			
			.0	.00	-.13
			41.6	.00	.05
567					
	1	-7.48			
			.0	.01	-.30
			41.6	.00	.07
	2	-3.44			
			.0	.00	-.14
			41.6	.00	.06
569					
	1	-11.06			
			.0	.01	-.17
			26.6	.00	-.09
			41.6	.00	-.11
	2	-4.49			
			.0	.00	-.05
			41.6	.00	-.04
536					
	1	1.90			
			.0	-.02	.52
			41.7	-.03	-.48
	2	.16			
			.0	-.01	.30
			41.7	-.01	-.27
538					
	1	-1.10			
			.0	-.01	.25
			41.7	-.02	-.21
	2	-1.15			
			.0	-.01	.16
			41.7	-.01	-.13
540					
	1	-1:16			
			.0	-.01	.22
			41.7	-.01	-.20
	2	-.83			
			.0	-.01	.16
			41.7	-.01	-.11
542					
	1	-1.15			
			.0	.00	.19
			41.7	-.01	-.17
	2	-.46			
			.0	-.01	.15
			41.7	-.01	-.10
544					
	1	-1.05			
			.0	.00	.15
			41.7	-.01	-.14
	2	.00			
			.0	-.01	.14
			41.7	-.01	-.08
546					
	1	-.87			
			.0	.00	.11
			41.7	-.01	-.11
	2	.55			
			.0	.00	.12

			41.7	.00	-.05
548					
	1	-.62			
			.0	.00	.07
			5.9	.00	.07
			41.7	-.01	-.08
	2	1.34			
			.0	.00	.09
			41.7	.00	-.01
550					
	1	-.32			
			.0	.00	.02
			14.2	.00	.05
			41.7	-.01	-.04
	2	1.18			
			.0	.00	.04
			41.7	.00	.02
552					
	1	.00			
			.0	.01	-.02
			22.7	.00	.04
			41.7	.00	.00
	2	.66			
			.0	.00	-.02
			41.7	.00	.05
554					
	1	.33			
			.0	.01	-.07
			31.2	.00	.04
			41.7	.00	.03
	2	-1.29			
			.0	.00	-.04
			41.7	.00	.01
556					
	1	.65			
			.0	.01	-.11
			39.6	.00	.07
			41.7	.00	.07
	2	-.93			
			.0	.00	-.08
			41.7	.00	.04
558					
	1	.93			
			.0	.01	-.16
			41.7	.00	.10
	2	-.58			
			.0	.00	-.10
			41.7	.00	.06
560					
	1	1.16			
			.0	.01	-.20
			41.7	.00	.13
	2	-.04			
			.0	.00	-.12
			41.7	.00	.08
562					
	1	1.31			
			.0	.01	-.24
			41.7	.00	.16
	2	.41			

			.0	.01	-.13
			41.7	.01	.10
564					
	1	1.37			
			.0	.02	-.28
			41.7	.01	.18
	2	.77			
			.0	.01	-.14
			41.7	.01	.11
566					
	1	1.35			
			.0	.02	-.31
			41.7	.01	.20
	2	1.08			
			.0	.01	-.15
			41.7	.01	.13
568					
	1	1.31			
			.0	.02	-.35
			41.7	.01	.23
	2	1.37			
			.0	.01	-.16
			41.7	.01	.14
570					
	1	-10.76			
			.0	-.01	.14
			41.7	-.02	-.38
	2	-4.23			
			.0	.00	.06
			41.7	.00	-.13
571					
	1	-10.65			
			.0	-.03	.56
			30.0	-.03	-.30
	2	-4.57			
			.0	-.01	.24
			30.0	-.01	-.12
572					
	1	-1.12			
			.0	-.01	.28
			30.0	-.01	.01
	2	-.56			
			.0	.00	.12
			30.0	.00	.01
573					
	1	1.72			
			.0	.04	-.91
			30.0	.04	.17
	2	.11			
			.0	.02	-.55
			30.0	.02	.10
574					
	1	.42			
			.0	.05	-1.13
			30.0	.05	.47
	2	.64			
			.0	.03	-.68
			30.0	.03	.29
575					
	1	.47			

			.0	-.02	.29
			30.0	-.02	-.21
	2	.12			
			.0	-.01	.14
			30.0	-.01	-.11
576					
	1	-.44			
			.0	.06	-1.18
			30.0	.06	.54
	2	-.72			
			.0	.03	-.70
			30.0	.03	.30
577					
	1	1.14			
			.0	.05	-1.07
			30.0	.05	.44
	2	.76			
			.0	.03	-.65
			30.0	.03	.27
578					
	1	.41			
			.0	-.01	.24
			30.0	-.01	-.19
	2	.10			
			.0	-.01	.14
			30.0	-.01	-.11
579					
	1	-.65			
			.0	.05	-1.09
			30.0	.05	.50
	2	-.55			
			.0	.03	-.65
			30.0	.03	.29
580					
	1	1.27			
			.0	.04	-.96
			30.0	.04	.38
	2	.56			
			.0	.03	-.59
			30.0	.03	.25
581					
	1	.42			
			.0	-.01	.20
			30.0	-.01	-.16
	2	.11			
			.0	-.01	.14
			30.0	-.01	-.10
582					
	1	-.66			
			.0	.05	-.96
			30.0	.05	.45
	2	-.28			
			.0	.03	-.58
			30.0	.03	.27
583					
	1	1.29			
			.0	.04	-.83
			30.0	.04	.32
	2	.30			
			.0	.02	-.52

			30.0	.02	.22
584					
	1	.44			
			.0	-.01	.16
			30.0	-.01	-.13
	2	.13			
			.0	-.01	.14
			30.0	-.01	-.10
585					
	1	-.56			
			.0	.04	-.81
			30.0	.04	.39
	2	.07			
			.0	.02	-.50
			30.0	.02	.24
586					
	1	1.20			
			.0	.03	-.67
			30.0	.03	.25
	2	-.05			
			.0	.02	-.42
			30.0	.02	.18
587					
	1	.46			
			.0	-.01	.13
			30.0	-.01	-.10
	2	.15			
			.0	-.01	.14
			30.0	-.01	-.10
588					
	1	-.39			
			.0	.03	-.64
			30.0	.03	.32
	2	.52			
			.0	.02	-.40
			30.0	.02	.20
589					
	1	1.06			
			.0	.02	-.50
			30.0	.02	.17
	2	-.50			
			.0	.01	-.31
			30.0	.01	.13
590					
	1	.48			
			.0	-.01	.09
			30.0	-.01	-.07
	2	.31			
			.0	-.01	.14
			30.0	-.01	-.09
591					
	1	-.17			
			.0	.02	-.46
			30.0	.02	.24
	2	1.29			
			.0	.01	-.27
			30.0	.01	.15
592					
	1	.86			
			.0	.01	-.31

196

			30.0	.01	.09
	2	-.09			
			.0	.01	-.19
			30.0	.01	.08
593					
	1	.49			
			.0	.00	.06
			30.0	.00	-.04
	2	.59			
			.0	-.01	.10
			30.0	-.01	-.06
594					
	1	.09			
			.0	.01	-.27
			30.0	.01	.16
	2	1.27			
			.0	.01	-.14
			30.0	.01	.09
595					
	1	.62			
			.0	.00	-.12
			30.0	.00	.01
	2	.52			
			.0	.00	-.07
			30.0	.00	.02
596					
	1	.50			
			.0	.00	.02
			30.0	.00	-.02
	2	.83			
			.0	.00	.02
			30.0	.00	-.01
597					
	1	.35			
			.0	.00	-.07
			30.0	.00	.08
	2	1.03			
			.0	.00	.00
			30.0	.00	.02
598					
	1	.38			
			.0	.00	.07
			30.0	.00	-.08
	2	1.97			
			.0	.00	.03
			30.0	.00	-.05
599					
	1	.50			
			.0	.00	-.02
			30.0	.00	.01
	2	.76			
			.0	.00	-.08
			30.0	.00	.05
600					
	1	.62			
			.0	.00	.13
			30.0	.00	-.01
	2	-.70			
			.0	.00	.10
			30.0	.00	-.05

197

601					
	1	.13			
			.0	-.01	.26
			30.0	-.01	-.16
	2	1.23			
			.0	-.01	.17
			30.0	-.01	-.11
602					
	1	.49			
			.0	.00	-.05
			30.0	.00	.04
	2	.29			
			.0	.01	-.12
			30.0	.01	.07
603					
	1	.87			
			.0	-.01	.32
			30.0	-.01	-.09
	2	-.43			
			.0	-.01	.23
			30.0	-.01	-.10
604					
	1	-.11			
			.0	-.02	.45
			30.0	-.02	-.24
	2	.83			
			.0	-.01	.29
			30.0	-.01	-.16
605					
	1	.48			
			.0	.01	-.09
			30.0	.01	.07
	2	.21			
			.0	.01	-.13
			30.0	.01	.08
606					
	1	1.09			
			.0	-.02	.51
			30.0	-.02	-.18
	2	-.20			
			.0	-.02	.35
			30.0	-.02	-.15
607					
	1	-.31			
			.0	-.03	.62
			30.0	-.03	-.31
	2	.31			
			.0	-.02	.40
			30.0	-.02	-.20
608					
	1	.47			
			.0	.01	-.13
			30.0	.01	.10
	2	.14			
			.0	.01	-.13
			30.0	.01	.09
609					
	1	1.25			
			.0	-.03	.69
			30.0	-.03	-.25

198

	2	.18			
			.0	-.02	.45
			30.0	-.02	-.19
610					
	1	-.47			
			.0	-.04	.79
			30.0	-.04	-.38
	2	-.07			
			.0	-.02	.49
			30.0	-.02	-.23
611					
	1	.45			
			.0	.01	-.16
			30.0	.01	.13
	2	.12			
			.0	.01	-.12
			30.0	.01	.09
612					
	1	1.35			
			.0	-.04	.85
			30.0	-.04	-.33
	2	.49			
			.0	-.03	.53
			30.0	-.03	-.22
613					
	1	-.55			
			.0	-.05	.93
			30.0	-.05	-.44
	2	-.37			
			.0	-.03	.56
			30.0	-.03	-.25
614					
	1	.43			
			.0	.01	-.20
			30.0	.01	.16
	2	.10			
			.0	.01	-.12
			30.0	.01	.10
615					
	1	1.35			
			.0	-.05	.99
			30.0	-.05	-.39
	2	.72			
			.0	-.03	.60
			30.0	-.03	-.25
616					
	1	-.53			
			.0	-.05	1.06
			30.0	-.05	-.50
	2	-.60			
			.0	-.03	.61
			30.0	-.03	-.27
617					
	1	.43			
			.0	.01	-.24
			30.0	.01	.19
	2	.09			
			.0	.01	-.12
			30.0	.01	.10
618					

199

	1	1.23			
			.0	-.05	1.11
			30.0	-.05	-.45
	2	.90			
			.0	-.03	.65
			30.0	-.03	-.27
619					
	1	-.31			
			.0	-.06	1.14
			30.0	-.06	-.53
	2	-.74			
			.0	-.03	.65
			30.0	-.03	-.28
620					
	1	.49			
			.0	.02	-.29
			30.0	.02	.21
	2	.12			
			.0	.01	-.12
			30.0	.01	.10
621					
	1	.56			
			.0	-.06	1.17
			30.0	-.06	-.49
	2	.80			
			.0	-.03	.67
			30.0	-.03	-.28
622					
	1	1.77			
			.0	-.04	.89
			30.0	-.04	-.18
	2	.01			
			.0	-.02	.52
			30.0	-.02	-.10
623					
	1	-1.14			
			.0	.01	-.28
			30.0	.01	.01
	2	-.52			
			.0	.00	-.11
			30.0	.00	-.01
624					
	1	-10.66			
			.0	.03	-.56
			30.0	.03	.29
	2	-4.16			
			.0	.01	-.22
			30.0	.01	.11
625					
	1	-.14			
			.0	-.01	-.05
			30.0	-.01	-.24
	2	-.06			
			.0	.00	-.03
			30.0	.00	-.10
626					
	1	.98			
			.0	-.01	.16
			30.0	-.01	-.22
	2	.54			

200

			.0	.00	.06
			30.0	.00	-.08
627					
	1	-2.98			
			.0	.08	-.70
			30.0	.08	1.81
	2	-1.05			
			.0	.05	-.39
			30.0	.05	1.05
628					
	1	-.02			
			.0	.04	-.22
			30.0	.04	1.00
	2	-.67			
			.0	.02	-.14
			30.0	.02	.60
629					
	1	.70			
			.0	-.01	.02
			30.0	-.01	-.32
	2	.30			
			.0	-.01	.00
			30.0	-.01	-.15
630					
	1	.81			
			.0	.03	-.15
			30.0	.03	.88
	2	.71			
			.0	.02	-.09
			30.0	.02	.54
631					
	1	-.06			
			.0	.04	-.23
			30.0	.04	.98
	2	-.36			
			.0	.02	-.14
			30.0	.02	.58
632					
	1	.95			
			.0	-.01	.01
			30.0	-.01	-.27
	2	.41			
			.0	-.01	.00
			30.0	-.01	-.15
633					
	1	1.08			
			.0	.03	-.11
			30.0	.03	.77
	2	.57			
			.0	.02	-.07
			30.0	.02	.48
634					
	1	-.20			
			.0	.04	-.24
			30.0	.04	.92
	2	-.15			
			.0	.02	-.14
			30.0	.02	.55
635					
	1	1.16			

			.0	-.01	.00
			30.0	-.01	-.22
	2	.54			
			.0	-.01	.01
			30.0	-.01	-.15
636					
	1	1.19			
			.0	.02	-.07
			30.0	.02	65
	2	.36			
			.0	.01	-.04
			30.0	.01	.41
637					
	1	-.20			
			.0	.04	-.23
			30.0	.04	.83
	2	.15			
			.0	.02	-.14
			30.0	.02	.50
638					
	1	1.33			
			.0	-.01	.00
			30.0	-.01	-.18
	2	.69			
			.0	-.01	.01
			30.0	-.01	-.15
639					
	1	1.20			
			.0	.02	-.04
			30.0	.02	.51
	2	.08			
			.0	.01	-.01
			30.0	.01	.31
640					
	1	-.12			
			.0	.03	-.22
			30.0	.03	.72
	2	.54			
			.0	.02	-.13
			30.0	.02	.43
641					
	1	1.45			
			.0	.00	.00
			30.0	.00	-.14
	2	.85			
			.0	-.01	.02
			30.0	-.01	-.15
642					
	1	1.12			
			.0	.01	.00
			30.0	.01	.36
	2	-.29			
			.0	.01	.03
			30.0	.01	.20
643					
	1	.01			
			.0	.03	-.20
			30.0	.03	.59
	2	1.02			
			.0	.02	-.12

			30.0	.02	.35
644					
	1	1.55			
			.0	.00	.00
			30.0	.00	-.10
	2	1.07			
			.0	-.01	.03
			30.0	-.01	-.15
645					
	1	.98			
			.0	.01	.04
			30.0	.01	.19
	2	-.33			
			.0	.00	.06
			30.0	.00	.08
646					
	1	.18			
			.0	.02	-.18
			30.0	.02	.45
	2	1.27			
			.0	.01	-.12
			30.0	.01	.27
647					
	1	1.61			
			.0	.00	.00
			30.0	.00	-.06
	2	1.30			
			.0	.00	.02
			30.0	.00	-.10
648					
	1	.80			
			.0	.00	.08
			30.0	.00	.03
	2	.12			
			.0	.00	.08
			30.0	.00	-.03
649					
	1	.37			
			.0	.01	-.15
			30.0	.01	.30
	2	.97			
			.0	.01	-.11
			30.0	.01	.19
650					
	1	1.64			
			.0	.00	.00
			30.0	.00	-.02
	2	1.44			
			.0	.00	.01
			30.0	.00	-.02
651					
	1	.59			
			.0	-.01	.11
			30.0	-.01	-.14
	2	1.10			
			.0	-.01	.09
			30.0	-.01	-.11
652					
	1	.57			
			.0	.01	-.12

203

			30.0	.01	.14
	2	.10			
			.0	.01	-.11
			30.0	.01	.13
653					
	1	1.64			
			.0	.00	.00
			30.0	.00	.02
	2	1.36			
			.0	.00	-.02
			30.0	.00	.09
654					
	1	.37			
			.0	-.01	.15
			30.0	-.01	-.30
	2	1.51			
			.0	-.01	.09
			30.0	-.01	-.18
655					
	1	.75			
			.0	.00	-.08
			30.0	.00	-.02
	2	-.62			
			.0	.00	-.08
			30.0	.00	.02
656					
	1	1.62			
			.0	.00	.00
			30.0	.00	.06
	2	1.10			
			.0	.01	-.02
			30.0	.01	.13
657					
	1	.16			
			.0	-.02	.18
			30.0	-.02	-.45
	2	1.09			
			.0	-.01	.11
			30.0	-.01	-.29
658					
	1	.91			
			.0	.00	-.05
			30.0	.00	-.18
	2	-.40			
			.0	.00	-.05
			30.0	.00	-.11
659					
	1	1.56			
			.0	.00	.00
			30.0	.00	.10
	2	.91			
			.0	.01	-.02
			30.0	.01	.14
660					
	1	-.03			
			.0	-.03	.20
			30.0	-.03	-.60
	2	.67			
			.0	-.02	.12
			30.0	-.02	-.37

661					
	1	1.02			
			.0	-.01	-.01
			30.0	-.01	-.34
	2	-.13			
			.0	-.01	-.01
			30.0	-.01	-.22
662					
	1	1.47			
			.0	.00	.00
			30.0	.00	.14
	2	.75			
			.0	.01	-.01
			30.0	.01	.14
663					
	1	-.19			
			.0	-.03	.22
			30.0	-.03	-.74
	2	.24			
			.0	-.02	.13
			30.0	-.02	-.44
664					
	1	1.08			
			.0	-.02	.03
			30.0	-.02	-.49
	2	.17			
			.0	-.01	.02
			30.0	-.01	-.32
665					
	1	1.34			
			.0	.01	.00
			30.0	.01	.18
	2	.61			
			.0	.00	-.01
			30.0	.00	.14
666					
	1	-.29			
			.0	-.04	.24
			30.0	-.04	-.85
	2	-.10			
			.0	-.02	.13
			30.0	-.02	-.50
667					
	1	1.06			
			.0	-.02	.06
			30.0	-.02	-.62
	2	.41			
			.0	-.01	.05
			30.0	-.01	-.39
668					
	1	1.17			
			.0	.01	.00
			30.0	.01	.22
	2	.48			
			.0	.00	.00
			30.0	.00	.14
669					
	1	-.31			
			.0	-.04	.24
			30.0	-.04	-.94

	2	-.36			
			.0	-.02	.14
			30.0	-.02	-.54
670					
	1	.93			
			.0	-.03	.10
			30.0	-.03	-.74
	2	.59			
			.0	-.02	.07
			30.0	-.02	-.46
671					
	1	.97			
			.0	.01	-.01
			30.0	.01	.27
	2	.37			
			.0	.00	.00
			30.0	.00	.14
672					
	1	-.18			
			.0	-.04	.24
			30.0	-.04	-1.00
	2	-.55			
			.0	-.02	.14
			30.0	-.02	-.57
673					
	1	.64			
			.0	-.03	.13
			30.0	-.03	-.84
	2	.71			
			.0	-.02	.09
			30.0	-.02	-.51
674					
	1	.72			
			.0	.01	-.02
			30.0	.01	.32
	2	.28			
			.0	.00	.00
			30.0	.00	.14
675					
	1	-.12			
			.0	-.04	.22
			30.0	-.04	-1.03
	2	-.82			
			.0	-.02	.14
			30.0	-.02	-.60
676					
	1	-3.09			
			.0	-.08	.67
			30.0	-.08	-1.76
	2	-.93			
			.0	-.05	.37
			30.0	-.05	-.99
677					
	1	.97			
			.0	.01	-.14
			30.0	.01	.22
	2	.50			
			.0	.00	-.05
			30.0	.00	.08
678					

	1	-.12			
			.0	.01	.04
			30.0	.01	.24
	2	-.05			
			.0	.00	.03
			30.0	.00	.09
679					
	1	7.26			
			.0	.00	.03
			41.7	-.01	-.29
	2	3.13			
			.0	.00	.02
			41.7	.00	-.11
681					
	1	-.29			
			.0	-.01	.19
			41.7	-.02	-.34
	2	-.88			
			.0	-.01	.13
			41.7	-.01	-.16
683					
	1	-.81			
			.0	-.01	.18
			41.7	-.02	-.30
	2	-.76			
			.0	-.01	.12
			41.7	-.01	-.15
685					
	1	-1.01			
			.0	-.01	.16
			41.7	-.02	-.26
	2	-.48			
			.0	-.01	.11
			41.7	-.01	-.14
687					
	1	-1.03			
			.0	.00	.14
			41.7	-.01	-.23
	2	-.09			
			.0	-.01	.10
			41.7	-.01	-.13
689					
	1	-.92			
			.0	.00	.12
			41.7	-.01	-.19
	2	.42			
			.0	.00	.08
			41.7	.00	-.12
691					
	1	-.73			
			.0	.00	.09
			41.7	-.01	-.15
	2	1.06			
			.0	.00	.05
			41.7	.00	-.10
693					
	1	-.48			
			.0	.00	.06
			4.4	.00	.06
			41.7	-.01	-.10

	2	.95			
			.0	.00	.03
			41.7	.00	-.06
695					
	1	-.19			
			.0	.00	.02
			12.5	.00	.04
			41.7	-.01	-.06
	2	.31			
			.0	.00	.02
			41.7	.00	-.01
697					
	1	.11			
			.0	.00	-.01
			20.7	.00	.04
			41.7	.00	-.01
	2	-1.31			
			.0	.00	.01
			41.7	.00	.06
699					
	1	.40			
			.0	.01	-.05
			28.9	.00	.05
			41.7	.00	.03
	2	-1.29			
			.0	.00	-.01
			41.7	.00	.08
701					
	1	.67			
			.0	.01	-.08
			36.9	.00	.07
			41.7	.00	.07
	2	-.87			
			.0	.00	-.03
			41.7	.00	.10
703					
	1	.89			
			.0	.01	-.12
			41.7	.00	.11
	2	-.33			
			.0	.00	-.06
			41.7	.00	.12
705					
	1	1.03			
			.0	.01	-.15
			41.7	.00	.15
	2	.15			
			.0	.00	-.08
			41.7	.00	.13
707					
	1	1.07			
			.0	.01	-.17
			41.7	.00	.19
	2	.53			
			.0	.01	-.09
			41.7	.01	.14
709					
	1	.96			
			.0	.01	-.20
			41.7	.01	.22

	2	.81			
			.0	.01	-.11
			41.7	.01	.15
711					
	1	.61			
			.0	.02	-.21
			41.7	.01	.26
	2	.99			
			.0	.01	-.12
			41.7	.01	.15
713					
	1	-3.38			
			.0	.03	-.48
			41.7	.02	.55
	2	-.64			
			.0	.01	-.26
			41.7	.01	.30
680					
	1	8.83			
			.0	.01	-.20
			30.8	.00	-.09
			41.7	.00	-.11
	2	3.97			
			.0	.00	-.08
			41.7	.00	-.04
682					
	1	8.22			
			.0	.00	.05
			41.7	-.01	-.29
	2	4.04			
			.0	.00	.06
			41.7	.00	-.15
684					
	1	6.85			
			.0	.00	.05
			41.7	-.01	-.26
	2	3.93			
			.0	.00	.05
			41.7	.00	-.14
686					
	1	5.60			
			.0	.00	.04
			41.7	-.01	-.22
	2	3.86			
			.0	.00	.05
			41.7	.00	-.13
688					
	1	4.42			
			.0	.00	.02
			.7	.00	.02
			41.7	-.01	-.17
	2	3.80			
			.0	.00	.04
			41.7	.00	-.12
690					
	1	3.26			
			.0	.00	.01
			6.9	.00	.01
			41.7	-.01	-.13
	2	3.75			

			.0	.00	.03
			41.7	.00	-.10
692					
	1	2.13			
			.0	.00	-.01
			13.3	.00	.01
			41.7	-.01	-.08
	2	3.64			
			.0	.00	.01
			41.7	.00	-.08
694					
	1	1.01			
			.0	.00	-.03
			19.7	.00	.02
			41.7	-.01	-.04
	2	2.34			
			.0	.00	-.01
			41.7	.00	-.02
696					
	1	-.10			
			.0	.01	-.05
			26.2	.00	.03
			41.7	.00	.00
	2	.23			
			.0	.00	-.03
			41.7	.00	.04
698					
	1	-1.19			
			.0	.01	-.07
			32.6	.00	.06
			41.7	.00	.05
	2	-2.91			
			.0	.00	-.03
			41.7	.00	.12
700					
	1	-2.28			
			.0	.01	-.08
			38.8	.00	.09
			41.7	.00	.09
	2	-3.73			
			.0	.00	-.03
			41.7	.00	.12
702					
	1	-3.35			
			.0	.01	-.10
			41.7	.00	.13
	2	-4.00			
			.0	.00	-.04
			41.7	.00	.14
704					
	1	-4.42			
			.0	.01	-.11
			41.7	.00	.17
	2	-3.97			
			.0	.00	-.04
			41.7	.00	.14
706					
	1	-5.48			
			.0	.01	-.13
			41.7	.00	.21

210

	2	-3.91			
			.0	.00	-.05
			41.7	.00	.15
708					
	1	-6.55			
			.0	.01	-.14
			41.7	.00	.24
	2	-3.87			
			.0	.01	-.06
			41.7	.01	.15
710					
	1	-7.66			
			.0	.01	-.15
			41.7	.01	.27
	2	-3.86			
			.0	.01	-.06
			41.7	.01	.16
712					
	1	-8.94			
			.0	.02	-.15
			41.7	.01	.30
	2	-3.93			
			.0	.01	-.06
			41.7	.01	.16
714					
	1	-9.10			
			.0	.00	.16
			.5	.00	.16
			41.7	-.01	-.03
	2	-3.57			
			.0	.00	.09
			41.7	.00	-.01
715					
	1	-9.14			
			.0	.01	-.05
			41.6	.00	.18
	2	-3.91			
			.0	.00	-.01
			41.6	.00	.10
717					
	1	-8.95			
			.0	-.01	.29
			41.6	-.02	-.15
	2	-4.32			
			.0	-.01	.17
			41.6	-.01	-.07
719					
	1	-7.68			
			.0	-.01	.27
			41.6	-.01	-.14
	2	-4.25			
			.0	-.01	.17
			41.6	-.01	-.06
721					
	1	-6.57			
			.0	.00	.24
			41.6	-.01	-.14
	2	-4.26			
			.0	-.01	.16
			41.6	-.01	-.06

723					
	1	-5.50			
			.0	.00	.20
			41.6	-.01	-.13
	2	-4.31			
			.0	-.01	.16
			41.6	-.01	-.05
725					
	1	-4.44			
			.0	.00	.17
			41.6	-.01	-.11
	2	-4.38			
			.0	.00	.15
			41.6	.00	-.04
727					
	1	-3.37			
			.0	.00	.13
			41.6	-.01	-.10
	2	-4.34			
			.0	.00	.14
			41.6	.00	-.04
729					
	1	-2.30			
			.0	.00	.09
			3.4	.00	.09
			41.6	-.01	-.08
	2	-3.12			
			.0	.00	.11
			41.6	.00	-.03
731					
	1	-1.21			
			.0	.00	.04
			9.6	.00	.06
			41.6	-.01	-.06
	2	-1.02			
			.0	.00	.06
			41.6	.00	-.02
733					
	1	-.12			
			.0	.00	.00
			16.0	.00	.03
			41.6	-.01	-.04
	2	2.07			
			.0	.00	-.02
			41.6	.00	-.01
735					
	1	.99			
			.0	.01	-.04
			22.5	.00	.02
			41.6	.00	-.03
	2	2.97			
			.0	.00	-.05
			41.6	.00	.00
737					
	1	2.11			
			.0	.01	-.09
			29.0	.00	.01
			41.6	.00	-.01
	2	3.34			
			.0	.00	-.08

			41.6	.00	.02
739					
	1	3.24			
			.0	.01	-.13
			35.4	.00	.01
			41.6	.00	.01
	2	3.42			
			.0	.00	-.10
			41.6	.00	.03
741					
	1	4.39			
			.0	.01	-.18
			41.6	.00	.02
	2	3.47			
			.0	.00	-.11
			41.6	.00	.04
743					
	1	5.58			
			.0	.01	-.22
			41.6	.00	.04
	2	3.52			
			.0	.00	-.12
			41.6	.00	.05
745					
	1	6.82			
			.0	.01	-.26
			41.6	.00	.05
	2	3.58			
			.0	.00	-.13
			41.6	.00	.05
747					
	1	8.20			
			.0	.01	-.29
			41.6	.00	.05
	2	3.68			
			.0	.00	-.14
			41.6	.00	.05
749					
	1	8.78			
			.0	.00	-.13
			14.7	.00	-.10
			41.6	-.01	-.18
	2	3.62			
			.0	.00	-.04
			41.6	.00	-.07
716					
	1	-3.27			
			.0	-.02	.58
			41.7	-.03	-.51
	2	-.80			
			.0	-.01	.32
			41.7	-.01	-.28
718					
	1	.82			
			.0	-.01	.27
			41.7	-.02	-.23
	2	.97			
			.0	-.01	.17
			41.7	-.01	-.13
720					

	1	1.14			
			.0	-.01	.23
			41.7	-.02	-.21
	2	.76			
			.0	-.01	.16
			41.7	-.01	-.11
722					
	1	1.24			
			.0	.00	.20
			41.7	-.01	-.18
	2	.43			
			.0	-.01	.15
			41.7	-.01	-.10
724					
	1	1.18			
			.0	.00	.16
			41.7	-.01	-.16
	2	-.02			
			.0	-.01	.14
			41.7	-.01	-.08
726					
	1	1.01			
			.0	.00	.12
			41.7	-.01	-.12
	2	-.58			
			.0	.00	.12
			41.7	.00	-.05
728					
	1	.76			
			.0	.00	.08
			3.6	.00	.08
			41.7	-.01	-.07
	2	-1.14			
			.0	.00	.11
			41.7	.00	-.03
730					
	1	.46			
			.0	.00	.03
			11.9	.00	.05
			41.7	-.01	-.05
	2	-.80			
			.0	.00	.08
			41.7	.00	-.02
732					
	1	.14			
			.0	.00	-.01
			20.4	.00	.04
			41.7	.00	-.02
	2	.05			
			.0	.00	.04
			41.7	.00	-.01
734					
	1	-.19			
			.0	.01	-.06
			28.9	.00	.04
			41.7	.00	.02
	2	1.54			
			.0	.00	-.04
			41.7	.00	.00
736					

	1	-.50			
			.0	.01	-.10
			37.3	.00	.06
			41.7	.00	.06
	2	1.06			
			.0	.00	-.07
			41.7	.00	.04
738					
	1	-.78			
			.0	.01	-.15
			41.7	.00	.09
	2	.61			
			.0	.00	-.10
			41.7	.00	.06
740					
	1	-1.00			
			.0	.01	-.19
			41.7	.00	.12
	2	.05			
			.0	.00	-.12
			41.7	.00	.08
742					
	1	-1.13			
			.0	.01	-.23
			41.7	.00	.15
	2	-.39			
			.0	.01	-.13
			41.7	.01	.10
744					
	1	-1.14			
			.0	.02	-.27
			41.7	.01	.17
	2	-.74			
			.0	.01	-.14
			41.7	.01	.11
746					
	1	-.96			
			.0	.02	-.30
			41.7	.01	.19
	2	-.99			
			.0	.01	-.15
			41.7	.01	.12
748					
	1	-.45			
			.0	.02	-.34
			41.7	.01	.19
	2	-1.10			
			.0	.01	-.16
			41.7	.01	.13
750					
	1	7.28			
			.0	.01	-.27
			41.7	.00	.01
	2	2.85			
			.0	.00	-.10
			41.7	.00	.02
751					
	1	-7.31			
			.0	.01	-.28
			41.7	.00	.05

	2	-3.15			
			.0	.00	-.12
			41.7	.00	.04
753					
	1	.32			
			.0	-.02	.50
			41.7	-.03	-.63
	2	.90			
			.0	-.01	.30
			41.7	-.01	-.32
755					
	1	.84			
			.0	-.02	.49
			41.7	-.03	-.59
	2	.77			
			.0	-.01	.29
			41.7	-.01	-.32
757					
	1	1.03			
			.0	-.02	.45
			41.7	-.03	-.54
	2	.49			
			.0	-.01	.28
			41.7	-.01	-.30
759					
	1	1.04			
			.0	-.02	.41
			41.7	-.03	-.48
	2	.10			
			.0	-.01	.26
			41.7	-.01	-.28
761					
	1	.93			
			.0	-.01	.35
			41.7	-.02	-.41
	2	-.41			
			.0	-.01	.23
			41.7	-.01	-.26
763					
	1	.73			
			.0	-.01	.28
			41.7	-.02	-.33
	2	-1.06			
			.0	-.01	.20
			41.7	-.01	-.24
765					
	1	.47			
			.0	-.01	.21
			41.7	-.02	-.25
	2	-.95			
			.0	-.01	.16
			41.7	-.01	-.18
767					
	1	.18			
			.0	.00	.13
			41.7	-.01	-.16
	2	-.32			
			.0	-.01	.11
			41.7	-.01	-.10
769					

	1	-.13			
			.0	.00	.05
			7.3	.00	.06
			41.7	-.01	-.08
	2	1.30			
			.0	.00	.05
			41.7	.00	.01
771					
	1	-.43			
			.0	.01	-.03
			24.6	.00	.04
			41.7	.00	.01
	2	1.28			
			.0	.00	-.02
			41.7	.00	.09
773					
	1	-.70			
			.0	.01	-.11
			41.7	.00	.09
	2	.85			
			.0	.01	-.08
			41.7	.01	.14
775					
	1	-.92			
			.0	.01	-.19
			41.7	.00	.18
	2	.30			
			.0	.01	-.13
			41.7	.01	.18
777					
	1	-1.07			
			.0	.02	-.26
			41.7	.01	.26
	2	-.17			
			.0	.01	-.17
			41.7	.01	.22
779					
	1	-1.11			
			.0	.02	-.34
			41.7	.01	.34
	2	-.55			
			.0	.01	-.21
			41.7	.01	.24
781					
	1	-1.00			
			.0	.02	-.40
			41.7	.01	.41
	2	-.83			
			.0	.01	-.23
			41.7	.01	.26
783					
	1	-.65			
			.0	.03	-.45
			41.7	.02	.48
	2	-1.01			
			.0	.01	-.25
			41.7	.01	.28
785					
	1	3.45			
			.0	.03	-.37

			41.7	.02	.54
	2	.68			
			.0	.01	-.21
			41.7	.01	.30
752					
	1	-10.57			
			.0	.02	.21
			41.7	-.02	-.63
	2	-4.67			
			.0	-.01	.12
			41.7	-.01	-.30
754					
	1	-9.12			
			.0	.01	-.20
			38.8	.00	-.02
			41.7	.00	-.03
	2	-4.46			
			.0	.00	-.10
			41.7	.00	.02
756					
	1	-8.06			
			.0	.01	-.16
			33.1	.00	-.03
			41.7	.00	-.04
	2	-4.49			
			.0	.00	-.08
			41.7	.00	.01
758					
	1	-7.08			
			.0	.01	-.11
			27.2	.00	-.03
			41.7	.00	-.05
	2	-4.59			
			.0	.00	-.07
			41.7	.00	-.01
760					
	1	-6.11			
			.0	.00	-.07
			21.4	.00	-.02
			41.7	.00	-.07
	2	-4.72			
			.0	.00	-.05
			41.7	.00	-.02
762					
	1	-5.12			
			.0	.00	-.03
			15.8	.00	.00
			41.7	-.01	-.08
	2	-4.88			
			.0	.00	-.03
			41.7	.00	-.04
764					
	1	-4.11			
			.0	.00	.00
			10.5	.00	.02
			41.7	-.01	-.10
	2	-4.89			
			.0	.00	.00
			41.7	.00	-.06
766					

	1	-3.06			
			.0	.00	.04
			5.4	.00	.04
			41.7	-.01	-.11
	2	-3.63			
			.0	.00	.04
			41.7	.00	-.07
768					
	1	-1.99			
			.0	.00	.08
			.6	.00	.08
			41.7	-.01	-.12
	2	-1.45			
			.0	.00	.09
			41.7	.00	-.07
770					
	1	-.89			
			.0	.00	.11
			41.7	-.01	-.13
	2	1.67			
			.0	.00	.14
			41.7	.00	-.06
772					
	1	.24			
			.0	.00	.14
			41.7	-.01	-.14
	2	2.42			
			.0	.00	.15
			41.7	.00	-.06
774					
	1	1.40			
			.0	.00	.17
			41.7	-.01	-.14
	2	2.87			
			.0	.00	.15
			41.7	.00	-.06
776					
	1	2.59			
			.0	.00	.19
			41.7	-.01	-.15
	2	3.02			
			.0	.00	.14
			41.7	.00	-.06
778					
	1	3.82			
			.0	.00	.21
			41.7	-.01	-.15
	2	3.14			
			.0	.00	.14
			41.7	.00	-.06
780					
	1	5.11			
			.0	.00	.23
			41.7	-.01	-.14
	2	3.27			
			.0	.00	.14
			41.7	.00	-.05
782					
	1	6.50			
			.0	.00	.24

219

			41.7	-.01	-.13
	2	3.40			
			.0	.00	.13
			41.7	.00	-.05
784					
	1	8.10			
			.0	.00	.24
			41.7	-.01	-.12
	2	3.58			
			.0	.00	.13
			41.7	.00	-.05
786					
	1	7.33			
			.0	.01	-.01
			32.3	.00	.11
			41.7	.00	.10
	2	2.91			
			.0	.00	.00
			41.7	.00	.06
787					
	1	7.35			
			.0	.00	.12
			5.5	.00	.12
			41.6	-.01	-.03
	2	3.19			
			.0	.00	.07
			41.6	.00	.00
789					
	1	8.09			
			.0	.01	-.11
			41.6	.00	.24
	2	3.92			
			.0	.00	-.05
			41.6	.00	.14
791					
	1	6.50			
			.0	.01	-.13
			41.6	.00	.23
	2	3.71			
			.0	.00	-.05
			41.6	.00	.14
793					
	1	5.12			
			.0	.01	-.14
			41.6	.00	.22
	2	3.56			
			.0	.00	-.06
			41.6	.00	.15
795					
	1	3.83			
			.0	.01	-.14
			41.6	.00	.21
	2	3.41			
			.0	.01	-.06
			41.6	.01	.15
797					
	1	2.60			
			.0	.01	-.14
			41.6	.00	.19
	2	3.27			

			.0	.01	-.06
			41.6	.01	.16
799					
	1	1.41			
			.0	.01	-.14
			41.6	.00	.16
	2	3.10			
			.0	.01	-.06
			41.6	.01	.16
801					
	1	.26			
			.0	.01	-.14
			41.6	.00	.14
	2	1.84			
			.0	.00	-.06
			41.6	.00	.14
803					
	1	-.87			
			.0	.01	-.13
			41.6	.00	.11
	2	-.19			
			.0	.00	-.06
			41.6	.00	.11
805					
	1	-1.97			
			.0	.01	-.12
			40.7	.00	.07
			41.6	.00	.07
	2	-3.33			
			.0	.00	-.07
			41.6	.00	.05
807					
	1	-3.04			
			.0	.01	-.11
			36.0	.00	.04
			41.6	.00	.04
	2	-4.30			
			.0	.00	-.06
			41.6	.00	.02
809					
	1	-4.08			
			.0	.01	-.09
			30.9	.00	.02
			41.6	.00	.00
	2	-4.48			
			.0	.00	-.05
			41.6	.00	-.01
811					
	1	-5.09			
			.0	.01	.08
			25.5	.00	-.01
			41.6	.00	-.03
	2	-4.39			
			.0	.00	-.03
			41.6	.00	-.03
813					
	1	-6.08			
			.0	.00	-.07
			20.0	.00	-.02
			41.6	.00	-.07

	2	-4.25			
			.0	.00	-.01
			41.6	.00	-.05
815					
	1	-7.05			
			.0	.00	-.05
			14.2	.00	-.03
			41.6	-.01	-.11
	2	-4.14			
			.0	.00	.00
			41.6	.00	-.07
817					
	1	-8.02			
			.0	.00	-.04
			8.2	.00	-.03
			41.6	-.01	-.16
	2	-4.06			
			.0	.00	.01
			41.6	.00	-.08
819					
	1	-9.08			
			.0	.00	-.02
			2.5	.00	-.02
			41.6	-.01	-.20
	2	-4.05			
			.0	.00	.02
			41.6	.00	-.09
821					
	1	-10.52			
			.0	.02	-.61
			41.6	.01	.19
	2	-4.26			
			.0	.01	-.28
			41.6	.01	.11
788					
	1	3.34			
			.0	-.02	.53
			41.7	-.03	-.36
	2	.84			
			.0	-.01	.32
			41.7	-.01	-.22
790					
	1	-.86			
			.0	-.02	.48
			41.7	-.03	-.46
	2	-1.00			
			.0	-.01	.30
			41.7	-.01	-.27
792					
	1	-1.19			
			.0	-.01	.42
			41.7	-.02	-.41
	2	-.79			
			.0	-.01	.28
			41.7	-.01	-.24
794					
	1	-1.28			
			.0	-.01	.34
			41.7	-.02	-.34
	2	-.45			

			.0	-.01	.26
			41.7	-.01	-.21
796					
	1	-1.21			
			.0	-.01	.26
			41.7	-.02	-.27
	2	-.01			
			.0	-.01	.23
			41.7	-.01	-.17
798					
	1	-1.04			
			.0	.00	.18
			41.7	-.01	-.19
	2	.56			
			.0	-.01	.19
			41.7	-.01	-.12
800					
	1	-.79			
			.0	.00	.09
			41.7	-.01	-.11
	2	1.12			
			.0	.00	.13
			41.7	.00	-.06
802					
	1	-.49			
			.0	.00	.01
			17.1	.00	.04
			41.7	-.01	-.03
	2	.79			
			.0	.00	.05
			41.7	.00	.01
804					
	1	-.16			
			.0	.01	-.08
			34.7	.00	.06
			41.7	.00	.05
	2	-.05			
			.0	.00	-.06
			41.7	.00	.08
806					
	1	.18			
			.0	.01	-.17
			41.7	.00	.13
	2	-1.54			
			.0	.01	-.16
			41.7	.01	.13
808					
	1	.50			
			.0	.02	-.25
			41.7	.01	.21
	2	-1.06			
			.0	.01	-.20
			41.7	.01	.17
810					
	1	.79			
			.0	.02	-.33
			41.7	.01	.29
	2	-.61			
			.0	.01	-.23
			41.7	.01	.20

812					
	1	1.01			
			.0	.02	-.41
			41.7	.01	.36
	2	-.04			
			.0	.01	-.25
			41.7	.01	.23
814					
	1	1.15			
			.0	.03	-.48
			41.7	.02	.42
	2	.40			
			.0	.01	-.27
			41.7	.01	.26
816					
	1	1.16			
			.0	.03	-.55
			41.7	.02	.47
	2	.75			
			.0	.01	-.29
			41.7	.01	.27
818					
	1	.99			
			.0	.03	-.60
			41.7	.02	.50
	2	1.00			
			.0	.01	-.30
			41.7	.01	.29
820					
	1	.49			
			.0	.03	-.64
			41.7	.02	.52
	2	1.12			
			.0	.01	-.31
			41.7	.01	.29
822					
	1	-7.33			
			.0	.00	.03
			41.7	-.01	-.26
	2	-2.87			
			.0	.00	.04
			41.7	.00	-.10

APPENDIX - III

PANEL LOAD TESTING RESULTS

APPENDIX - III

PANEL LOAD TESTING RESULTS

This section provides supporting reference for Chapter-3.

Copies of the report on Compound Testing of Panels, received with reference No. CED/TL/1160 dated June 30, 1990 - from the University of Engineering & Technology, Lahore is presented in this Appendix.

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ORE-31 PAKISTAN

شعبہ سول انجینئرنگ
یونیورسٹی آف انجینئرنگ اینڈ ٹیکنالوجی
لاہور - ۳۱ پاکستان

Ref. CED/TL/1160 حوالہ

Date 30 June, 1990 تاریخ

Mr. S. Mazhar Hussain,
Technical Director,
ACE (Pvt) Limited,
Highway & Structure Division,
22-C/L, Gulberg-3,
LAHORE-54660.

Subject: LOAD TESTING OF BAILEY BRIDGE PANELS

Dear Sir;

Further to our letter No.CED/TL/1070, dated 27/28th May,1990 and your letter No.H&S/295/438, dated 21.5.90, on the above subject.

We are pleased to submit the report. This report includes the results of both the single and compound panels. The tension and hardness tests on strips and pins are also enclosed.

Thanking you,

Yours faithfully,

Z.A. Siddiqi

(ZAHID AHMAD SIDDIQI)
Assistant Professor

(DR. MUHAMMAD ASHRAF)
Associate Professor

TESTING OF BAILEY BRIDGE PANELS

Three panels were tested as was required by the Consultants. A Preliminary Report of Test No.1 on a single panel has already been submitted. The remaining two panels were tested in compound form applying load in mid span at the lower chord (Test No.2). In this case, a single point load on a girder was transferred simultaneously into one point loading on each of the two panels equally at 6 inches from their mid-span (Figs-3 & 4). Hence Test No.2 simulates the actual loading on the bottom chord in a relatively closer form.

This report will replace the Preliminary Report (already submitted), which comprises the following:

Loading Arrangement	:	Suggested by the A.C.E.(Pvt) Ltd.Lahore and shown in Figs-1,3 & 4.
Strain Gauges	:	Figs-2,3 & 4.
Deflection Gauges	:	Figs-1,3 & 4.
Strain Results	:	Tables-1,3(a) & 3(b).
Deflection Results	:	Tables-2, 4(a) & 4(b).

REMARKS:

Test No.1: No visible disorder or buckling was noticed in any of the members. Further the joints behaved perfectly with no damage to welding etc.

Test No.2: Due to buckling of one of the bracing members of Panel 'B' (Fig-4), the buckling in the other bracing and vertical members of both the panels was induced. The compound panel system failed on lesser load than that of the single panel. It is obvious from the permanent set of deflections and strains obtained after complete unloading that the panels have gone beyond their elastic limits.

Z. A. Siddiqi

(ZAHID AHMAD SIDDIQI)
ASSISTANT PROFESSOR

(DR. MUHAMMAD ASHRAF)
ASSOCIATE PROFESSOR

DEPARTMENT OF CIVIL ENGINEERING
UNIVERSITY OF ENGINEERING AND TECHNOLOGY, LAHORE.

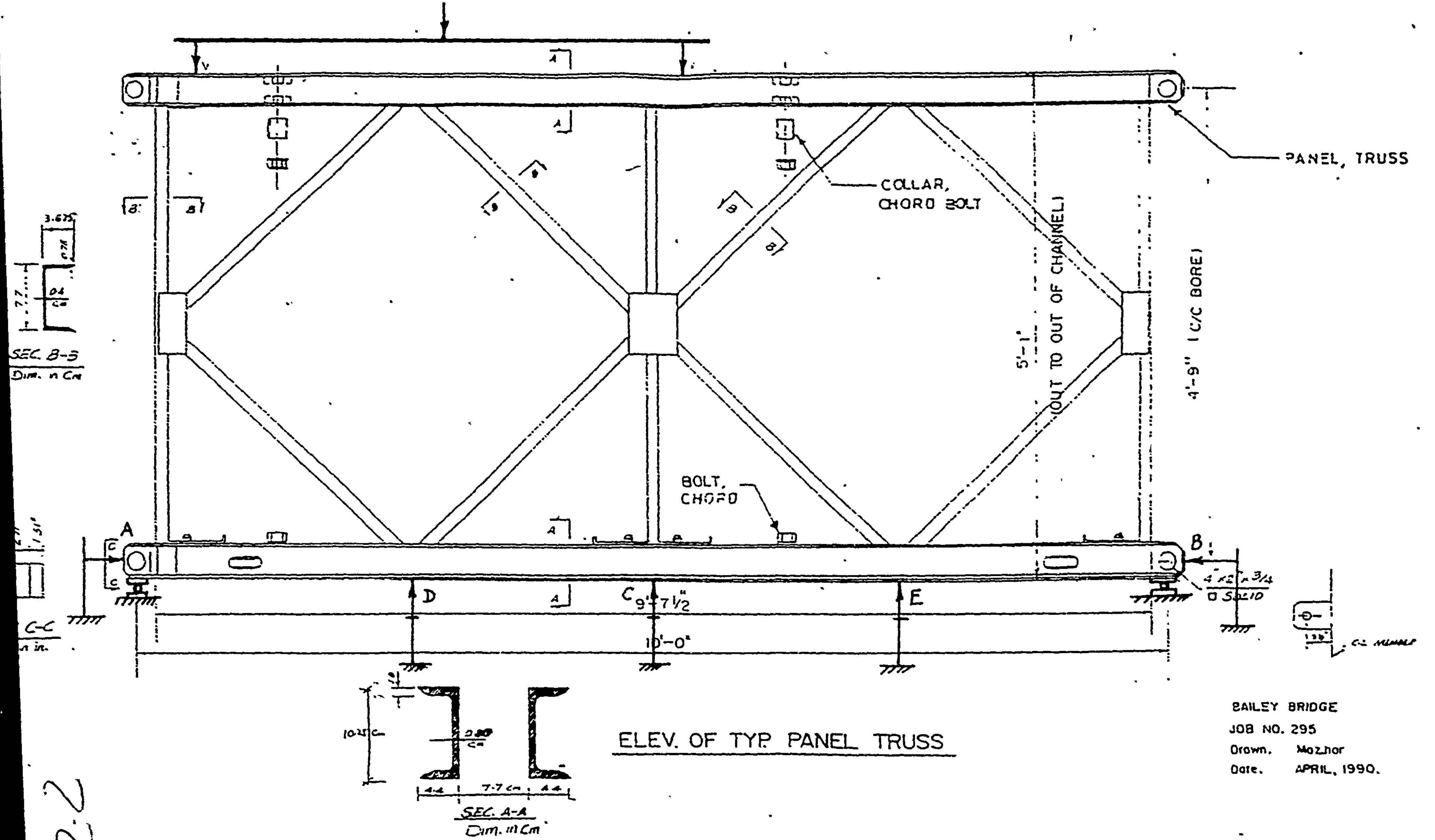

Fig-1 : LOADING AND DEFLECTION GAUGES ARRANGEMENT

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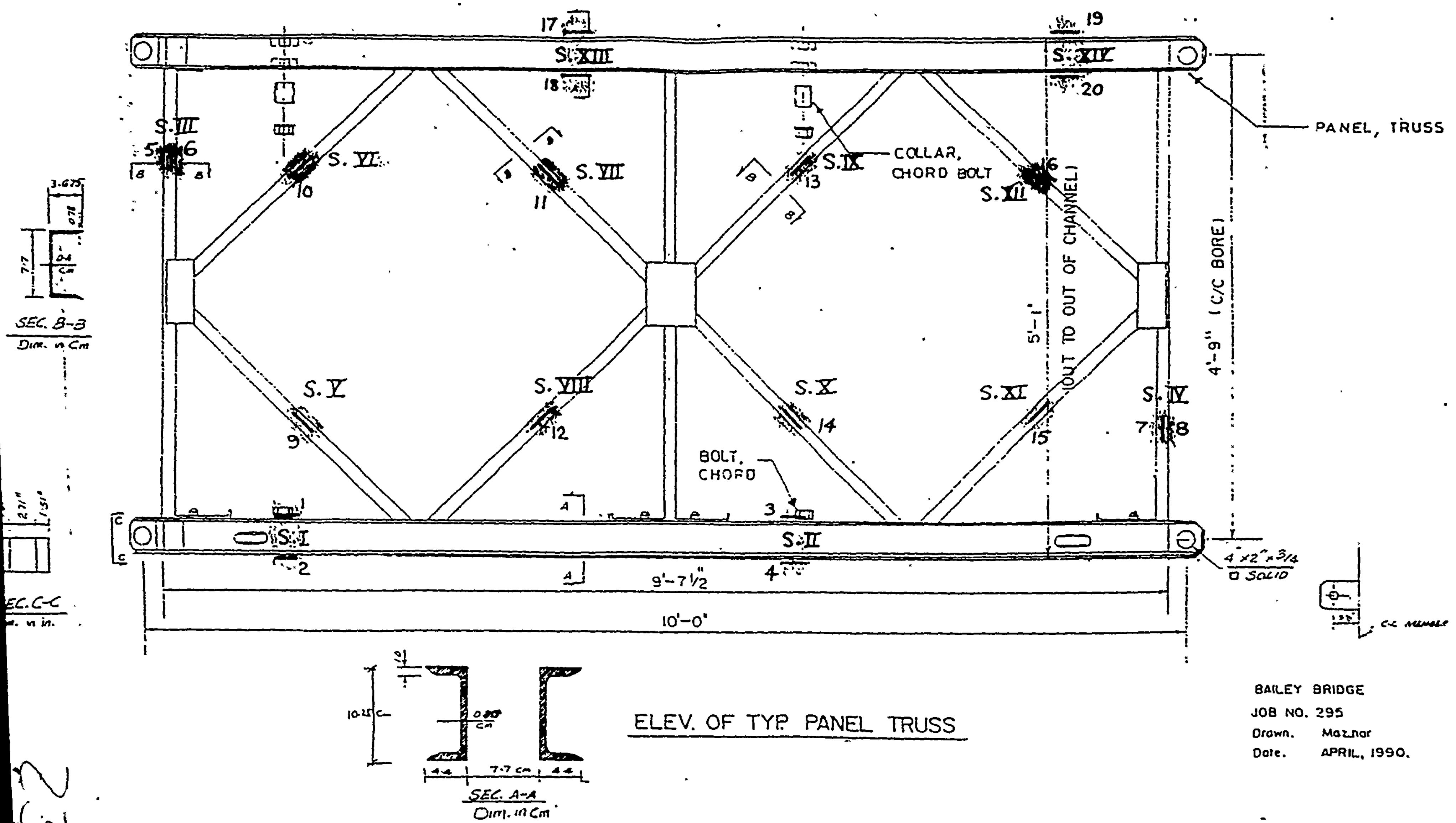


Fig 2 : Strain Gauges Arrangement.

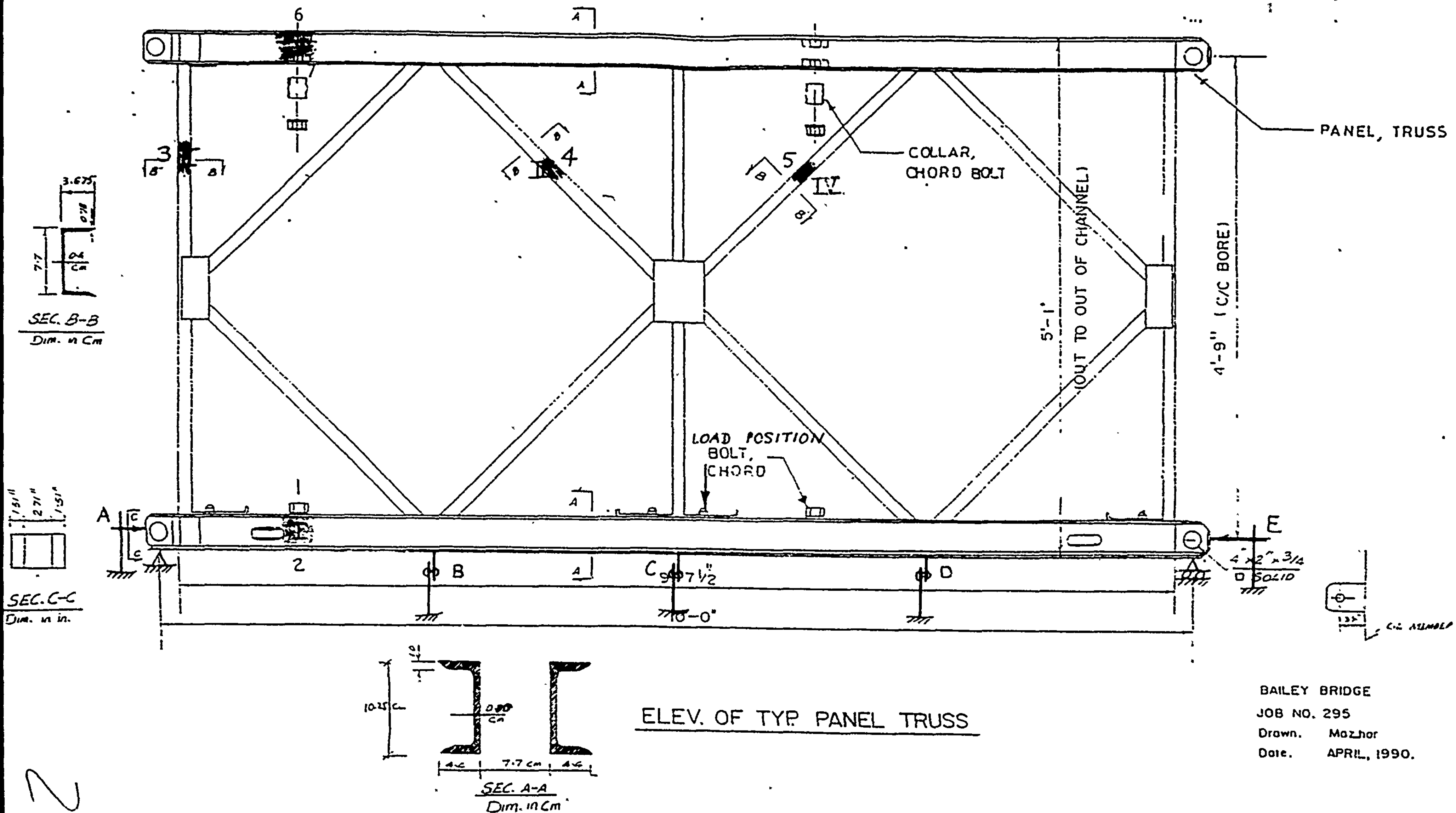
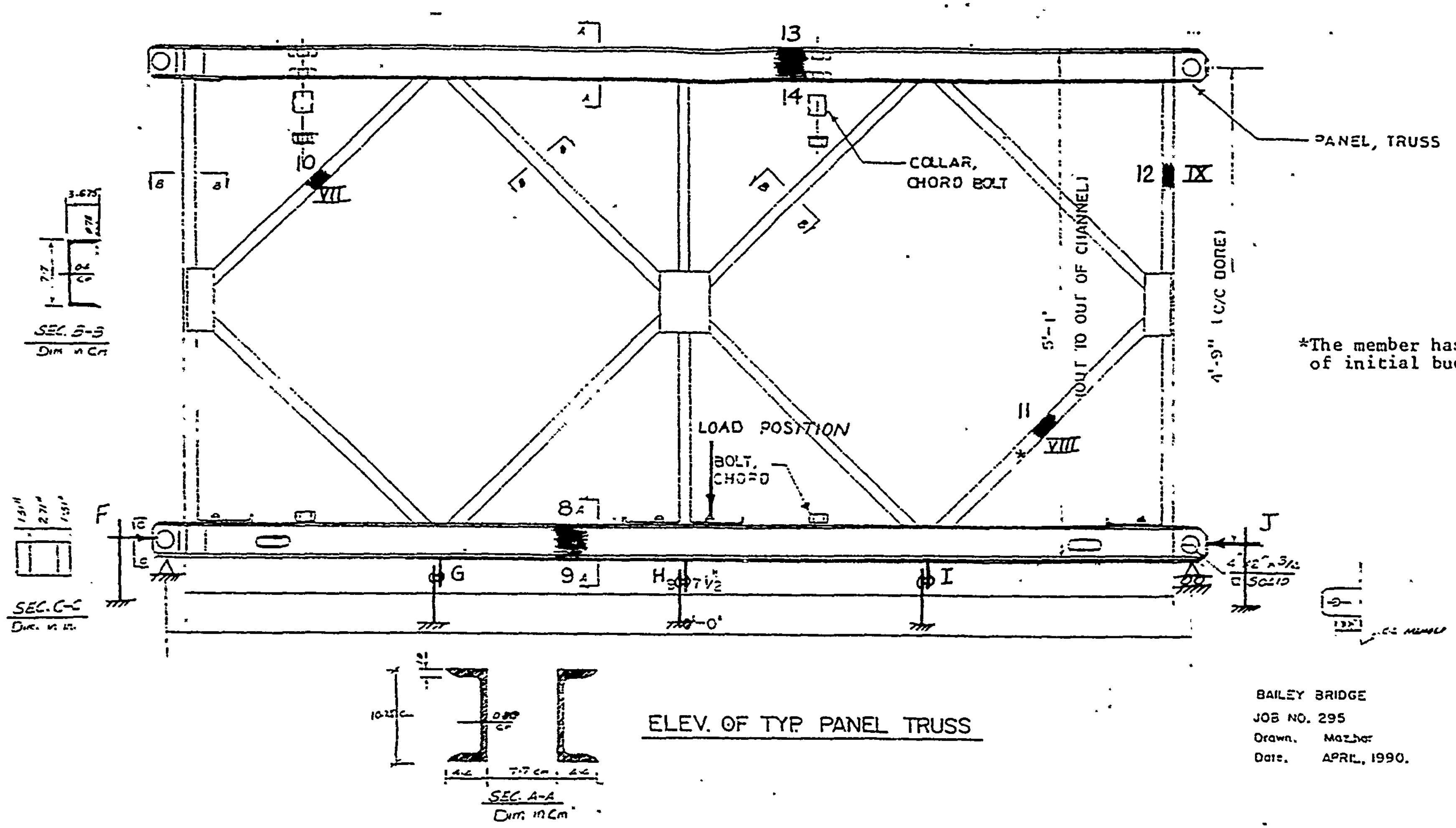


Fig-3 : STRAIN AND DEFLECTION GAUGES ARRANGEMENT FOR PANEL 'A' (TEST NO.2)



*The member has small amount of initial buckling.

Fig-4 : STRAIN AND DEFLECTION GAUGES ARRANGEMENT FOR PANEL 'B' (TEST NO.2)

TABLE - 1

EXPERIMENTAL STRAINS IN BAILEY BRIDGE PANEL TEST NO.1

S.No.	Load kgf	STATION - I (S.G. 1&2) Axial $\times 10^{-6}$	STATION - I (S.G. 1&2) Bending $\times 10^{-6}$	STATION - II (S.G. 3,4) Axial $\times 10^{-6}$	STATION - II (S.G. 3,4) Bending $\times 10^{-6}$	STATION-III (S.G.5) Axial $\times 10^{-6}$	STN.-IV (S.G.7) Axial $\times 10^{-6}$	STN.-V (S.G.9) Axial $\times 10^{-6}$	STATION-VI (S.G.10) Axial $\times 10^{-6}$	STN.-VII (S.G.11) Axial $\times 10^{-6}$	STN.-VIII (S.G.12) Axial $\times 10^{-6}$
1	0	0	0	0	0	0	0	0	0	0	0
2	1800	-2.44	±2.44	-	-	-53.66	-9.76	-9.76	-14.63	4.88	-14.63
3	3500	-9.76	±19.51	21.96	±12.20	-78.05	-14.63	-	-24.39	9.76	-19.51
4	5500	-60.98	±90.25	39.02	±24.39	-107.31	-34.15	-19.51	-48.78	-	-48.90
5	7000	-56.09	±109.76	41.46	±26.83	-117.07	-48.78	-	-73.17	19.51	-53.66
6	9000	-51.22	±118.72	-	-	-	-68.29	-29.27	-97.56	-	-68.29
7	11000	-34.15	±131.71	53.66	±24.39	-131.71	-	-29.27	-107.32	29.27	-73.17
8	12500	-19.51	±102.44	60.71	±28.11	-200.00	-141.46	-34.15	-136.58	48.78	-
9	14300	-19.51	±136.58	69.93	±30.07	-234.15	-162.04	-53.66	-170.73	55.08	-112.20
10	16000	-17.08	±129.27	77.93	±34.15	-258.54	-180.94	-61.46	-185.36	63.04	-136.58
11	18000	-19.52	±156.10	88.02	±26.03	-286.06	-204.68	-68.29	-209.75	75.49	-151.22
12	19600	-19.52	±175.61	95.11	±20.72	-314.78	-220.97	-70.48	-234.10	69.89	-170.73
13	21500	-26.84	±207.32	105.22	±17.08	-341.96	-244.08	-73.17	-258.54	82.69	-180.49
14	23000	-29.27	±209.75	112.20	±30.08	-368.00	-260.69	-78.29	-276.58	89.76	-195.12

Cont'd

TABLE-1 (cont'd)

STATION-IX (S.G.13) Axial $x10^{-6}$	STATION-X (S.G.14) Axial $x10^{-6}$	STATION-XI (S.G.15) Axial $x10^{-6}$	STATION-XII (S.G.16) Axial $x10^{-6}$	STATION - XIII (S.G. 17 & 18) Axial $x10^{-6}$	STATION - XIII (S.G. 17 & 18) Bending $x10^{-6}$	STATION - XIV (S.G. 19&20) Axial $x10^{-6}$	STATION - XIV (S.G. 19&20) Bending $x10^{-6}$
0	0	0		0	0	0	0
–	-14.63	14.63	STOPPED WORKING	-2.44	±2.44	-4.88	±9.76
–	-19.51	19.51		-2.44	±17.07	-7.32	±12.20
9.76	-39.02	39.02		-4.88	±24.39	-17.07	±21.95
14.63	-63.41	53.66		-26.83	±51.22	–	–
–	-73.17	78.05		-31.71	±56.10	–	±29.27
29.27	-76.00	92.68		–	–	–	–
34.15	-87.80	112.19		-34.15	±78.05	–	–
48.78	-126.83	128.34		-46.34	±90.24	-19.52	±34.15
54.06	-146.34	141.92		-48.78	±102.44	–	±41.47
62.21	-165.85	161.08		-58.54	±112.20	-39.03	±53.66
66.46	-185.36	176.64		-63.19	±134.15	–	±70.74
74.01	-190.24	193.19		-70.22	±143.91	–	±70.74
78.46	-204.88	206.43		-74.88	±160.98	-51.22	±100.00

TABLE - 2

EXPERIMENTAL DEFLECTIONS AT VARIOUS POINTS

OF BAILEY BRIDGE PANEL TEST NO. 1

Load Kgf	Horizontal Deflections		Vertical Deflections		
	Dial Gauge A (in)	Dial Gauge B (in)	Dial Gauge C (in)	Dial Gauge D (in)	Dial Gauge E (in)
0	0	0	0	0	0
1800	0.001	0.00025	0.005	0.006	0.004
3500	0.00125	0.00075	0.0075	0.007	0.00525
5500	0.002	0.001	0.013	0.013	0.0085
7000	0.00275	0.00275	0.019	0.018	0.0115
9000	0.0035	0.0035	0.023	0.022	0.013
11000	0.00425	0.00425	0.0027	0.026	0.016
12500	0.005	0.005	0.032	0.031	0.019
14300	0.006	0.006	0.036	0.0335	0.022
16000	0.0065	0.0065	0.042	0.036	0.0245
18000	0.007	0.007	0.048	0.043	0.027
19600	0.008	0.008	0.054	0.049	0.031
21500	0.009	0.009	0.06	0.055	0.031
23000	0.01	0.01	0.064	0.059	0.041
0	0.00025	0.00025	0.0005	0.0007	0.0005
Remarks:	on hinge support.	On Roller support.	At mid span under bottom chord	At quarter span under bottom chord on loaded side.	At quarter span under bottom chord on unloaded side.

EXPERIMENTAL STRAINS IN PANEL 'A' (BAILEY BRIDGE) TESTED IN COMPOUND FORM

(TEST NO.2)

S.No.	Load kgf	STATION - I (S.G. 1&2)		STN - II (S.G. 3)	STN - III (S.G. 4)	STATION-IV (S.G. 5)	STATION - V (S.G. 6 & 7)		REMARKS
		Axial $\times 10^{-6}$	Bending $\times 10^{-6}$	Axial $\times 10^{-6}$	Axial $\times 10^{-6}$	Axial $\times 10^{-6}$	Axial $\times 10^{-6}$	Bending $\times 10^{-6}$	
1	0	0	0	0	0	0	0	.0	Initial reading
2	2000	4.88	±4.00	-4.88	---- WORKING STOPPED ----	2.44	-7.32	±2.44	
3	5400	9.75	±7.00	-9.00		4.88	-9.78	±4.88	
4	9000	10.50	±8.00	-14.63		9.63	-9.78	±7.24	
5	12300	4.88	0	-18.90		14.63	-9.78	±9.76	
6	16000	2.44	±2.44	-24.53		19.51	-9.78	±12.45	
7	19500	0	±9.76	-36.53		24.39	-9.76	±14.69	
8	23000	-107.32	±34.15	-66.83		-73.17	-95.13	±12.20	Already buckled member (STN-VIII) of Panel B is further deteriorated and hence sudden change of strains and stresses in all members of both the panels are observed.
9	26600	-112.20	±29.27	-87.80		-59.54	-96.13	±21.95	
10	28400	- 95.13	±12.20	-92.68		-58.54	-96.13	±21.95	
11	30020	- 97.56	±19.51	-98.93		-53.66	-98.68	±24.39	
12	32000	- 97.56	±19.51	-102.44		-49.85	-100.00	±26.83	
13	33800	-102.44	±24.39	- 87.80		-48.78	-103.50	±27.20	
14	35500	-102.44	±19.51	- 97.56		-53.66	-105.63	±24.39	
15	37500	-124.39	±26.83	-102.44		-68.29	-112.20	±29.27	Other bracing members of Panels A&B also seemed to have buckled which is obvious from considerable amount of change of strain.

Cont'd.

TABLE - 3(a) ... cont'd

S.No.	Load kgf	STATION - I (S.G. 1,2)		STN - II (S.G. 3)	STN - III (S.G. 4)	STATION - IV (S.G. 5)	STATION - V (S.G. 6,7)		REMARKS
		Axial $\times 10^{-6}$	Bending $\times 10^{-6}$	Axial $\times 10^{-6}$	Axial $\times 10^{-6}$	Axial $\times 10^{-6}$	Axial $\times 10^{-6}$	Bending $\times 10^{-6}$	
16	38300	-143.91	±31.71	-131.71	STOPPED WORKING	-87.80	-139.03	±26.83	
17	39200	-175.61	±39.02	-160.98		-117.07	-124.39	±31.71	
18	40000	-124.39	±31.71	-112.20		- 73.17	-112.20	±29.27	Vertical members on hinged support side of both the panels have shown considerable buckling.
19	40500	-119.51	±31.71	- 78.05		- 58.56	-100.00	±26.83	The panels stopped resisting further strains and hence loading was removed. (Final Load)
20	0	-90.25	±7.32	-82.93		-146.34	-104.88	± 2.44	The permanent set at unloading indicates that the panels have crossed their elastic limit together with permanent buckling of some of the members.

TABLE - 3(B)

EXPERIMENTAL STRAINS IN PANEL 'B' (BAILEY BRIDGE) TESTED IN COMPOUND FORM

(TEST NO. 2)

S.No.	Load kgf	STATION - VI (S.G. 8,9) Axial $\times 10^{-6}$	STATION - VI (S.G. 8,9) Bending $\times 10^{-6}$	STN - VII (S.G.10) Axial $\times 10^{-6}$	STN - VIII (S.G.11) Axial $\times 10^{-6}$	STN - IX (S.G.12) Axial $\times 10^{-6}$	STATION - X (S.G.13,14) Axial $\times 10^{-6}$	STATION - X (S.G.13,14) Bending $\times 10^{-6}$	REMARKS
1	0	0	0	0	0	0	0	0	Initial reading.
2	2000	2.44	0	-19.51	39.02	-14.68	-9.77	0	
3	5400	4.88	±4.88	-53.66	48.78	-24.39	-21.96	±12.20	
4.	9000	6.76	±9.76	-102.44	82.93	-24.39	-39.03	± 9.76	
5.	12300	9.76	±17.07	-131.71	107.32	- 9.76	-41.47	±12.20	
6	16000	12.20	±19.56	-170.73	131.71	0	-58.54	± 9.76	
7	19500	12.20	±21.96	-214.63	160.98	19.51	-68.30	± 9.76	
8	23000	-46.34	±70.73	-253.64	185.37	29.27	-90.25	±12.20	Already buckled member (STN-VIII) of the panel is further deteriorated and hence sudden change of strains and stresses in all members of both the panels are observed.
9	26600	-63.41	±24.39	-346.34	141.46	- 9.76	-170.74	±14.64	
10	28400	-70.73	±31.71	-380.49	160.98	- 9.76	-192.69	±12.20	
11	30020	-70.73	±31.71	-400.00	175.61	- 9.76	-197.57	±17.08	
12	32000	-65.86	±31.71	-429.27	204.88	14.63	-212.20	±12.20	
13	33800	-70.74	±41.47	-443.90	204.88	19.51	-209.76	±14.64	
14	35500	-65.86	±36.59	-458.54	224.39	24.39	-224.39	±14.64	
15	37500	-80.49	±41.47	-478.05	214.63	19.51	-236.59	±12.20	Other bracing members of both the panels also seemed to have buckled which is obvious from considerable amount of change of strain.

Cont'd....

S.No.	Load kgf	STATION - VI (S.G. 8,9) Axial $\times 10^{-6}$	STATION - VI (S.G. 8,9) Bending $\times 10^{-6}$	STN-VII (S.G.10) Axial $\times 10^{-6}$	STN-VIII (S.G. 11) Axial $\times 10^{-6}$	STN-IX (S.G.12) Axial $\times 10^{-6}$	STATION - X (S.G.13,14) Axial $\times 10^{-6}$	STATION - X (S.G.13,14) Bending $\times 10^{-6}$	REMARKS
16	38300	−92.69	±39.03	−521.95	219.51	4.88	−280.49	±17.08	
17	39200	−87.81	±43.91	−521.95	239.02	29.27	−253.66	±14.64	
18	40000	−82.93	±39.03	−526.83	253.66	58.54	−268.30	± 9.76	Vertical members on hinged support side of both the panels have shown conisderable buckling.
19	40500	−73.17	±43.90	−526.83	268.29	60.56	−248.78	± 9.76	The panels stopped resisting further strains and hence loading was removed. (Final Load).
20	0	−148.78	±51.22	−107.32	−78.05	43.90	− 68.30	±39.03	The permanent set at unloading indicates that the panels have crossed their elastic limit together with permanent buckling of some of the members.

TABLE - 4(a)

EXPERIMENTAL DEFLECTIONS OF PANEL 'A' (BAILEY BRIDGE) TESTED IN COMPOUND FORM (TEST NO.2)

Load kgf	Horizontal Deflections		Vertical Deflections		
	Dial Gauge A (in)	Dial Gauge E (in)	Dial Gauge B (in)	Dial Gauge C (in)	Dial Gauge D (in)
0	0	0	0	0	0
2000	0.005	0.0015	0.009	0.012	0.0095
5400	0.0035	0.0020	0.020	0.030	0.023
9000	0.004	0.004	0.028	0.046	0.034
12300	0.0035	0.008	0.034	0.059	0.044
16000	0.003	0.0125	0.040	0.073	0.054
19500	0.002	0.018	0.047	0.087	0.065
23000	0.0015	0.023	0.052	0.099	0.074
26600	0.0000	0.028	0.058	0.112	0.085
28400	0.000	0.030	0.061	0.121	0.091
30020	-0.001	0.032	0.064	0.128	0.096
32000	-0.001	0.034	0.068	0.135	0.1015
33800	-0.002	0.036	0.070	0.142	0.106
35500	-0.002	0.037	0.073	0.149	0.111
37500	-0.003	0.039	0.077	0.156	0.116
38300	-0.003	0.040	0.079	0.162	0.120
39200	-0.0035	0.041	0.081	0.166	0.123
40000	-0.005	0.042	0.082	0.170	0.126
40500	-0.005	0.042	0.084	0.173	0.129
0	0	0.022	0.0035	0.115	0.012
Remarks:	on hinge support	On roller support	At quarter span towards the hinged side	At mid span	At quarter span towards the roller support

All the gauges indicated permanent set on release of loading.

TABLE - 4(b)

EXPERIMENTAL DEFLECTIONS OF PANEL 'B' (BAILEY BRIDGE) TESTED IN COMPOUND FORM (TEST NO. 2)

Load kgf	Horizontal Deflections		Vertical Deflections		
	Dial Gauge F (in)	Dial Gauge J (in)	Dial Gauge G (in)	Dial Gauge H (in)	Dial Gauge I (in)
0	0	0	0	0	0
2000	0	0.005	0.008	0.011	0.011
5400	0	0.0035	0.016	0.025	0.024
9000	0	0.008	0.021	0.038	0.035
12300	0	0.013	0.027	0.050	0.047
16000	0	0.017	0.032	0.0625	0.058
19500	0	0.021	0.037	0.075	0.070
23000	0	0.024	0.042	0.0855	0.079
26600	0	0.028	0.0475	0.098	0.090
28400	0	0.030	0.0515	0.1055	0.097
30020	0	0.0315	0.054	0.112	0.102
32000	0	0.033	0.056	0.117	0.108
33800	0	0.035	0.059	0.1225	0.112
35500	0	0.0365	0.061	0.129	0.118
37500	0	0.0385	0.063	0.134	0.123
38300	0	0.0395	0.066	0.140	0.129
39200	0	0.0405	0.067	0.144	0.1325
40000	-0.001	0.04175	0.069	0.1475	0.1365
40500	-0.00125	0.0425	0.070	0.149	0.139
0	0.00675	0.0185	0.0145	0.024	0.030
Remarks:	On hinge support	On roller support	At quarter span towards the hinged side.	At mid span	At quarter span towards the roller support.

All the gauges indicated permanent set on release of loading.

APPENDIX - IV

DATA COLLECTED AT SITE

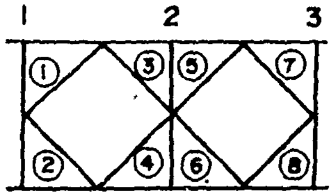
APPENDIX - IV

DATA COLLECTION AT SITE

Site visit was conducted by the ACE Team in June 90. Each panel (no. 1 to 18, inclusive, as shown in Figure 2.3) of each truss (refer Figure 2.2, x-section of bridge) was examined. The data collected is presented in this Section.

For explanation of condition designations A,B,C refer Section 4.4 - Condition Survey.

TABLE IV.1



Bailey Bridge on River Arundu

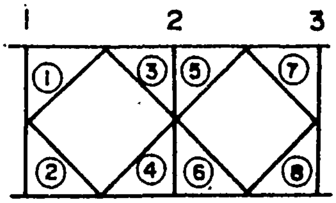
Inspection Survey

Truss No. I, II, III & IV

Storey: Top/Bottom

Surveyed by: DR. M. ASHRAF Dated 15.06.1990

PANEL	Storey	Chord Member			Verticals			Diagonals								Remarks
		Top	Bot.	Rein.	1	2	3	1	2	3	4	5	6	7	8	
1	T.	B	A	–	—	—	—	—	A	—	—	—	—	—	—	
	B.	B	C	–	—	—	—	—	A	—	—	—	—	—	—	
2	T.	B	B	A	A	B	B	—	—	—	A	—	—	—	—	
	B.	B	A	B	—	—	—	—	A	—	—	—	—	—	—	
3	T.	A	B	A	—	—	—	—	A	—	—	—	—	—	—	
	B.	B	A	A	—	—	—	—	A	—	—	—	—	—	—	
4	T.	B	B	B	—	—	—	—	A	—	—	—	—	—	—	
	B.	A	A	C	B	A	B	—	—	—	A	—	—	—	—	
5	T.	A	A	A	B	A	B	—	—	—	A	—	—	—	—	
	B.	B	B	B	B	A	B	A	B	A	B	A	A	A	A	
6	T.	B	B	B	B	—	—	—	—	—	A	—	—	—	—	
	B.	A	A	A	B	—	—	—	—	—	A	—	—	—	—	



Bailey Bridge on River Arundu

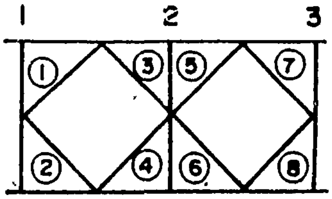
Inspection Survey

Truss No. I, II, III & IV

Storey: Top/Bottom

Surveyed by: DR. M. ASHRAF Dated 15.06.1990

PANEL	STOREY	Chord Member Top	Chord Member Bot.	Chord Member Rein.	Verticals 1	Verticals 2	Verticals 3	Diagonals 1	Diagonals 2	Diagonals 3	Diagonals 4	Diagonals 5	Diagonals 6	Diagonals 7	Diagonals 8	Remarks
7	T.	B	B	A	—	—	—	—	A	—	—	—	—	—	—	
	B.	B	B	B	—	—	—	—	A	—	—	—	—	—	—	
8	T.	B	B	B	—	—	—	—	A	—	—	—	—	—	—	
	B.	B	A	A	—	—	—	—	A	—	—	—	—	—	—	
9	T.	A	B	A	A	A	A	B	A	B	A	A	A	A	A	
	B.	A	A	B	—	—	—	—	A	—	—	—	—	—	—	
10	T.	A	A	B	A	B	—	—	—	A	—	—	—	—	—	
	B.	B	B	A	A	A	A	B	—	—	—	A	—	—	—	
11	T.	A	A	A	A	A	B	—	—	—	—	A	—	—	—	
	B.	A	A	A	—	—	—	—	A	—	—	—	—	—	—	
12	T.	C	B	B	B	A	—	—	—	—	A	—	—	—	—	
	B.	A	A	B	—	—	—	—	A	—	—	—	—	—	—	



Balley Bridge on River Arundu

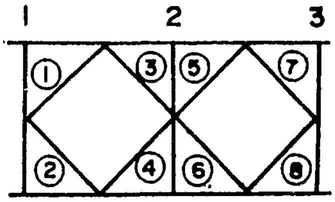
Inspection Survey

Truss No. I II, III & IV

Storey: Top/Bottom

Surveyed by: DR. M. ASHRAF Dated 15.06.1990

PANEL	Storey	Chord Member			Verticals			Diagonals								Remarks
		Top	Bot.	Rein.	1	2	3	1	2	3	4	5	6	7	8	
13	T.	B	B	C	—	—	—	—	—	A	—	—	—	—	—	
	B.	A	A	A	—	—	—	—	—	A	—	—	—	—	—	
14	T.	C	B	B	B	—	—	—	—	A	—	—	—	—	—	
	B.	B	A	B	—	—	—	—	—	A	—	—	—	—	—	
15	T.	B	B	B	—	—	—	—	—	A	—	—	—	—	—	
	B.	B	B	A	A	B	A	—	—	—	A	—	—	—	—	
16	T.	B	B	B	—	—	—	—	—	A	—	—	—	—	—	
	B.	B	B	B	—	—	—	—	—	A	—	—	—	—	—	
17	T.	B	B	C	—	—	—	—	—	A	—	—	—	—	—	
	B.	C	B	B	A	B	A	A	B	B	B	B	A	A	A	
18	T.	B	C	-	B	B	B	B	B	B	B	A	B	B	A	
	B.	B	B	—	—	—	—	—	—	A	—	—	—	—	—	



Bailey Bridge on River Arundu

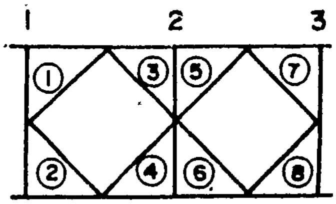
Inspection Survey

Truss No. I, II, III & IV

Storey: Top/Bottom

Surveyed by: DR. M. ASHRAF Dated 15.06.1990

PANEL	STOREY	Chord Member			Verticals			Diagonals								Remarks
		Top	Bot.	Rein.	1	2	3	1	2	3	4	5	6	7	8	
1	T.	B	A	–	—	—	—	—	—	A	—	—	—	—	—	
	B.	A	A	–		—	—			A	—	—	—		—	
2	T.	A	A	B	—	—	—	—	—	A	—	—	—	—	—	
	B.	B	B	B	—	—	—	—	—	A	—	—	—	—	—	
3	T.	A	A	A	—	—	—	—	—	A	—	—	—	—	—	
	B.	A	A	A	A	A	B	—	—	—	A	—	—	—	—	
4	T.	A	A	B	B	A	B	—	—	—	A	—	—	—	—	
	B.	B	B	B	A	A	A	—	—	—	B	—	—	—	—	
5	T.	A	A	B	B	A	B	—	—	—	A	—	—	—	—	
	B.	B	B	B	B	A	B	—	—	—	A	—	—	—	—	
6	T.	A	B	B	B	A	B	—	—	—	A	—	—	—	—	
	B.	B	B	B	B	A	B	—	—	—	A	—	—	—	—	



Bailey Bridge on River Arundu

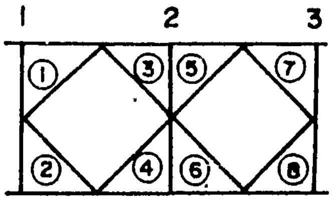
Inspection Survey

Truss No. I, II, III & IV

Storey: Top/Bottom

Surveyed by: DR.M.ASHRAF Dated 15.06.1990

PANEL	Storey	Chord Member			Verticals			Diagonals								Remarks
		Top	Bot.	Rein.	1	2	3	1	2	3	4	5	6	7	8	
7	T.	A	A	B	A	B	A	—	—	—	A	—	—	—	—	
	B.	A	A	B	A	B	A	—	—	—	A	—	—	—	—	
8	T.	A	B	A	—	—	—	—	—	A	—	—	—	—	—	
	B.	A	A	A	—	—	—	—	—	A	—	—	—	—	—	
9	T.	C	B	B	B	A	A	B	A	B	A	A	A	A	A	
	B.	A	A	A	—	—	—	—	—	A	—	—	—	—	—	
10	T.	B	C	B	B	B	B	A	B	B	B	B	B	B	B	
	B.	A	A	B	—	—	—	—	A	—	—	—	—	—	—	
11	T.	C	B	A	B	B	A	—	—	—	A	—	—	—	—	
	B.	A	A	B	—	—	—	—	A	—	—	—	—	—	—	
12	T.	B	C	A	—	—	—	—	A	—	—	—	—	—	—	
	B.	B	A	B	—	—	—	—	A	—	—	—	—	—	—	



Bailey Bridge on River Arundu

Inspection Survey

Truss No. I, (II), III & IV

Storey: Top/Bottom

Surveyed by: DR. M. ASHRAF Dated 15.06.1990

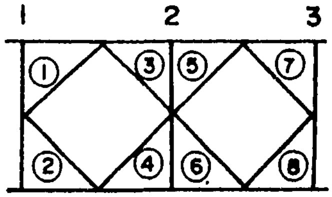
PANEL	Storey	Chord Member			Verticals			Diagonals								Remarks
		Top	Bot.	Rein.	1	2	3	1	2	3	4	5	6	7	8	
13	T.	A	B	B	B	A	A	A	B	A	A	A	A	A	A	
	B.	B	A	B	B	—	—	—	—	A		—	—	—	—	
14	T.	A	B	B	A	A	A	B	B	A	A	A	A	A	A	
	B.	B	A	C	A	—	—	—	—	A						
15	T.	B	A	B	B	B	B	—	—	—	A	—	—	—	—	
	B.	B	B	B	A	B	A	B	A	B	A	A	A	A	A	
16	T.	B	C	C	A	B	B	—	—	—	A	—	—	—	—	
	B.	B	B	B	—	—	—	—	A	—	—	—	—	—	—	
17	T.	C	B	C	B	B	B	B	B	B	B	B	A	B	A	
	B.	B	B	B	—	—	—	—	A	—	—	—	—	—	—	
18	T.	B	B	—	—	—	—	—	A	—	—	—	—	—	—	
	B.	B	B	—	—	—	—	—	A	—	—	—	—	—	—	

Bailey Bridge on River Arundu

Inspection Survey

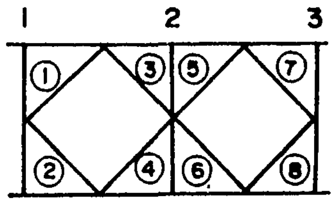
Truss No. I, II, III & IV

Storey: Top/Bottom



Surveyed by: SSI Dated 16.06.1990

PANEL	Storey	Chord Member Top	Chord Member Bot.	Chord Member Rein.	Verticals 1	Verticals 2	Verticals 3	Diagonals 1	Diagonals 2	Diagonals 3	Diagonals 4	Diagonals 5	Diagonals 6	Diagonals 7	Diagonals 8	Remarks
1	T.	B	B	—	—	—	—	—	—	B	—	—	—	—	—	
	B.	A	A	-	—	—		—	—	A	—	—			—	
2	T.	A	B	B	—	—	—	—	—	A	—	—	—	—	—	
	B.	A	B	B	—	—	—	—	—	A	—	—	—		—	
3	T.	A	B	B	—	—	—	A	—	B	—	—		—	—	
	B.	A	B	B	—	—			—	A	—	—	—	—	—	
4	T.	A	B	B	—	—	—	—	—	A	—	—	—	—	—	
	B.	A	B	B	—	—	—	—	—	A	—	—	—	—	—	
5	T.	A	B	B	—	—	—	—	—	A		—	—	—	—	
	B.	A	-	B	—	—	—	—	—	A	—	—	—	—	—	
6	T.	C	C	C	—	—	—	—	—	A	—	—	—	—	—	
	B.	A	-	B	—	—	—	—	—	A	—	—	—	—	—	



Bailey Bridge on River Arundu

Inspection Survey

Truss No. I, II, III & IV

Storey: Top/Bottom

Surveyed by: SSI   Dated 16.06.1990

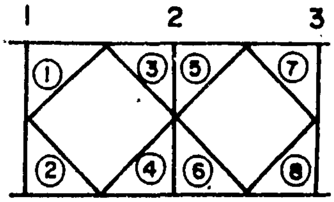
Panel	Storey	Chord Member			Verticals			Diagonals								Remarks
		Top	Bot.	Rein.	1	2	3	1	2	3	4	5	6	7	8	
7	T.	B		C	—	—	—	—	—	A	—	—	—	—	—	
	B.	A		B						A						
8	T.	A	B	B	B	B	B	A	-	B						
	B.	B		B	B	B	B	A								
9	T.	C	C	B	—	—	—			B	—	—	—	—	—	
	B.	B	B	B	B	B	B	-	C	—	—	—	—			
10	T.	A	B	B	A	-	B			A	-	B				
	B.	A	B	C		A	—		B							
11	T.	B	C					A	B							
	B.	C	B					A	B							
12	T.	B		B	—	—	—	—	B	—	—	—	—	—	—	
	B.	C		B	—	—	—	—	B	—	—	—	—	—	—	

Bailey Bridge on River Arundu

Inspection Survey

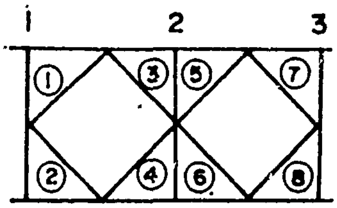
Truss No. I, II, III & IV

Storey: Top/Bottom



Surveyed by: SSI Dated 16.06.1990

PANEL	Storey	Chord Member Top	Chord Member Bot.	Chord Member Rein.	Verticals 1	Verticals 2	Verticals 3	Diagonals 1	Diagonals 2	Diagonals 3	Diagonals 4	Diagonals 5	Diagonals 6	Diagonals 7	Diagonals 8	Remarks
13	T.	B		B	—	—	—			B						
	B.	A		B					A	B						
14	T.	B	B	—	—	—	—	—	—	A	—	—	—	—		
	B.	A	B	—	—	—	—			A						
15	T.	B	C	—	—	—			—	A			—	—		
	B.	B	B	—	—	—	—			A	—	—				
16	T.	A	B	—	—	—	—	—	—	A	—	—	—	—	—	
	B.	A	A	—	—	—				A	—	—	—			
17	T.	A	B	—	—	—	—	—	—	A						
	B.	A	B	—	—					A	—					
18	T.	C	–	—	—	A	–	B	—							
	B.	B	–	—	—	A	–	B	—						—	



Bailey Bridge on River Arundu

Inspection Survey

Truss No. I, II, III & IV

Storcy: Top/Bottom

Surveyed by: SSI Dated 16.06.1990

PANEL	Storey	Chord Member			Verticals			Diagonals								Remarks
		Top	Bot.	Rein.	1	2	3	1	2	3	4	5	6	7	8	
1	T.	B	-	-	—	A	---			A						
	B.	A	-	-	A					A						
2	T.	B		B						A						
	B.	B		B						A						
3	T.	B	B	B	---					B						
	B.	A	B	B	- -					A						
4	T.	A		B	- -					A						
	B.	A	-	B	- -					A						
5	T.	A	B	B						A						
	B.	A		B				A	-	B						
6	T.	B		B	---	---	---			B						
	B.	B	C	B	- -	---	---			A						

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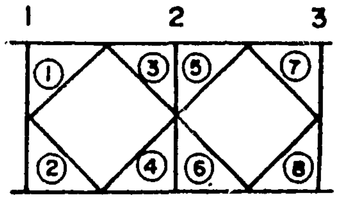


Bailey Bridge on River Arundu

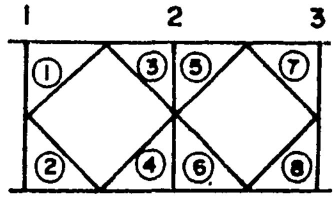
Inspection Survey

Truss No. I, II, III & IV

Storey: Top/Bottom

Surveyed by: SSI Dated 16.06.1990

PANEL	Storey	Chord Member			Verticals			Diagonals								Remarks
		Top	Bot.	Rein.	1	2	3	1	2	3	4	5	6	7	8	
7	T.	B	.	B	-	-	-	-	-	B	-	-	-	-	-	
	B.	B	C	B	-	-	-	-	-	A	-	-	-	-	-	
8	T.	B		B	-	-	-	-	-	B	-	-	-	-	-	
	B.	A		A						A	-	-	-	-	-	
9	T.	B		B				A	-	B						
	B.	A - B		B	-	-	-	-	-	A	-					
10	T.	B	-	-	-	-	-	-		B	-	-	-	-	-	
	B.	B	B				A	-	-	B						
11	T.	A		B	-	-	-	-	-	A	-	-	-	-	-	
	B.	A		B	-	-	-	-		A			-			
12	T.	A -	B	B				A	-	B						
	B.	A -	B	B	-	-		-	-	A						



Balley Bridge on River Arundu

Inspection Survey

Truss No. I, II, III & IV

Storey: Top/Bottom

Surveyed by: SSJ Dated 16.06.1990

PANEL	Storey	Chord Member			Verticals			Diagonals								Remarks
		Top	Bot.	Rein.	1	2	3	1	2	3	4	5	6	7	8	
13	T.	A		B	—	—				A						
	B.	B	-	B						A						
14	T.	A		B	—	—	—	—	—	A	—	—	—	—	—	
	B.	A	B	B	—	—				A						
15	T.	B	B	B	B	B	B	—	—	—	—	A	—	—	—	
	B.	A	B	B	-	A					A					
16	T.	B	B	B			A	—	B							
	B.	A	A	B	A	—		B	—							
17	T.	B	B	B	—	—		B								
	B.	A	B	B			A			B						
18	T.	A	A	—						A						
	B.			—						A						

APPENDIX - V

CHEMICAL AND TENSION TEST RESULTS

APPENDIX - V

CHEMICAL AND PHYSICAL TEST RESULTS

This Section provides supporting reference for Chapter-5.

V-1 The following tests were performed on the coupons and/or pins.

- Chemical Tests
- Tension Test
- hardness Test
- Magnaflux test
- Macroscopic examination
- Shaping operation

In this appendix the originals of the reports is enclosed.

METAL INDUSTRY RESEARCH & DEVELOPMENT CENTRE

J-6489

EVALUATION OF STEEL SAMPLES FROM A BAILEY BRIDGE.

INTRODUCTION

M/s. Associated Consulting Engi neers A.C.E.(pvt)Ltd., 22-C/L, Gulberg-III, Lahore approached MIRDC regarding the evaluation of four steel strips, marked 1,2,3 and 4 from an extra pannel and four other strips from the installed Bridge, marked 11/II, 2,16 and 14/II. First four strips were subjected to chemical analysis whereas all the strips were examined visually.

1. Chemical Analysis:

	Specimen-1	Specimen-2	Specimen-3	Specimen-4
Carbon =	0.17%	0.22%	0.22%	0.13%
Silicon =	0.15%	0.22%	0.10%	0.12%
Chromium =	0.11%	0.11%	0.11%	0.21%
Manganese =	1.14%	0.74%	1.16%	1.15%
Nickel =	0.58%	0.64%	0.91%	0.58%
Molybdenum =	Traces	0.098%	0.075%	Traces

2. Visual Examination of Strips: Each strip provided to the MIRDC Labs. were insperted care-fully with the help of magnifying glass. All the four strips ~~provided~~ marked ~~xxx~~ No.1 to No.4 have small pitting under the coating of paint. Where as among the later four strips No.2 is badly pitted, No.14/II and 11/II have small pitting under the coating. However No.16 has less pitting.

...p/2

Visual Examination of Pannel:

The pannel from the Bailey Bridge was inspected at the office of A.C.E. The pannel from various places is badly pitted, particularly at the joints.

Pitting:

Pitting is a form of extremely localized attack that results in holes in the ~~ax~~ metal. These holes may be small or large in diameter, but in most of the cases they are relatively small. Pits are sometimes isolated or so close together that they look like a rough surface. Generally a pit may be described as a cavity or a hole with surface diameter about the same as or less than the depth.

Pit Shape & Growth:

Pitting is usually a slow process, it may require months or a year to perforate a metal section. Pitting usually requires an extended initiation period before visible pits appear. This period ranges from months to years, depending on both the specific metal and the corrosive After start pit penitrates the metal at an ever increasing rate. In addition pits tend to under mine or under cut the surface as they grow. Pitting may be considered as the intermediate stage between general overall corrosion and complete corrosion resistance.

Effects of Pitting:

Pitting is one of the most destructive and insidious form of corrosion. It causes equipment ~~af~~ to fail because of perforation with only a small percent weight loss of

...p/3

the entire stracture. It is aften difficult to detect pits because of their small size and because ~~of~~ the pits are often covered with corrosion products. In addition it is difficult to measure quantitatively and compare the extent of pitting because of varying depths and numbers of pits that may occure under identical conditions. Pitting being localized and intense form of pitting usually cause to failure with extreme suddenness.

CONCLUSIONS

1. The analysis of the strips(1 to 4) conform to the specification of ASTM. A 588. Its composition is as follows;
   C =0.2%(max), Mn =0.8%, Ni =0.6%.

2. The ASTM A 588 specification is recommended for structural purposes.

3. The visual examination results that the material has started pitting in all of the representative samples, i.e. the material is not free of pits.

4. From the tests and observations conducted at MIRDC Labs, it is envisaged that the pannels have been used for long time.

5. These observations and results pertain to the sample supplied to these labs only.

REFERENCES: - Corrosion Engineering by Fontana & Greene.
- Metallic materials specification Hand Book by Robert B.Ross.

ANIL/MAV/ar
010790

*****

METAL INDUSTRY RESEARCH & DEVELOPMENT CENTRE

J-6561

EVALUATION OF STEEL STRIPS

INTRODUCTION

M/s. Associated Consulting Engineers A.C.E.(Pvt)Ltd., 22-C/L, Gulberg-III, Lahore approached MIRDC regarding the evaluation of four steel strips marked as 2, 11/II, 14/II and 16/III for chemical analysis and N.D. testing i.e. Magnaflux and ultrasonic testing. These are the same strips which were supplied for Macroscopic examinations under the Job No. 6489 at MIRDC. The strips were subjected to chemical analysis and N.D. Testing at MIRDC Labs. The results and observations are tabulated below;

CHEMICAL ANALYSIS

	Spec. 2	Spec. 11/II	Spec. 14/II	Spec. 16/III
Carbon =	0.16%	0.22%	0.17%	0.22%
Silicon =	0.18%	0.14%	0.17%	0.15%
Manganese =	0.86%	1.10%	1.12%	1.18%
Sulphur =	0.034%	0.026%	0.037%	0.031%
Phosphorous =	0.018%	0.016%	0.016%	0.014%

MAGNAFLUX TESTING

The Magnaflux Testing for the detection of surface cracks was performed. After necessary preparation the given samples were tested at a current density of 700 Aperes(DC). Sprinkling of(Fine) Red-oxide powder did not reveal any surface crack.

...p/2

<u>ULTRASONIC TESTING</u>

Ultrasonic testing is not possible on such type of tapered k and badly corroded (pited) specimens. Therefore, the ultrasonic testing was not conducted.

<u>CONCLUSIONS</u>

1. The analysis of the strips 2, 11/II, 14/II and 16/IIIconform to the specification of ASTM A 588. Its composition is as follows;

   C =0.2%max. Mn =0.8%, Ni =0.6%.

2. The ASTM A 588 is a recommended material for structural uses.

3. The Magnaflux testing of the submitted strips did not reveal any surface crack.

4. Such irregularly cut(welded) and corroded specimens are not suitable for ultrasonic testing.

*****

MAV/ANIL/ar
160790

From PROFESSOR OF CIVIL ENGINEERING
UNIVERSITY OF ENGINEERING AND TECHNOLOGY,
LAHORE

To M/S Associated Consulting
Engineers ACE (Pvt)
Ltd. LAHORE.

232 – 248
Z.A. Mr. Ashraf
13-22

Our Ref. No. CED/TL/ 1149 dated 30/6/90.
Your Ref. No. HSS/235/435/ dated 21/6/90.

Page No. 1

TENSION TEST REPORT

ORIGINAL
A CARBON COPY OF THE REPORT HAS BEEN RETAINED IN THE LAB. FOR RECORD

Gauge length 2.0 Date of test 30/6/90.
Description Tensile Test on Pins.

S. No.	Wt. Rft. Lbs.	~~Size of~~ Dia.	Area	Yield Load	Ultimate load	Yield Stress	Ultimate Stress	Elongation	Percentage Elongation	Remarks
	Mark	in.	in²	Kg	Kg	Psi.	Psi	in.		
1	— A	1.25	1.230	—	6700	—	119850	—	—	—
2	— B	1.25	1.230	—	8760	—	156700	0.47	23.50	—
3	— C	1.25	1.230	—	7800	—	139500	—	—	—

Remarks: Pins no A & C Welding for testing arrangement failed. B. Pin safe and tested properly.

Note: The above results pertain to the sample/samples supplied to this Laboratory.

SEAL

CHAIRMAN CIVIL ENGG DEPTT. STRUCTURAL ENGINEERING DIVISION U.E.T. LAHORE

O/I/C. Testing Laboratories
University of Engineering and Technology, Lahore

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From PROFESSOR OF CIVIL ENGINEERING
UNIVERSITY OF ENGINEERING AND TECHNOLOGY,
LAHORE

To M/S Associated Consulting Engineers
ACE (Pvt.) Ltd.
LAHORE

232248
Z. A. Mr. Ashrif

Our Ref. No. CED/TL/ 1149 dated 30/6/90.
Your Ref. No. HES/2957435/ dated 21/6/90

Page No ②

TENSION TEST REPORT

Gauge length 8" Date of test 30/6/90.
Description Tensile Test on Steel Strips

ORIGINAL
A CARBON COPY OF THE REPORT HAS BEEN RETAINED IN THE LAB. FOR RECORD

S. No.	Wt. Rft. Lbs.	~~Size or Dia.~~ MARK	Area in²	Yield Load Kg	Ultimate load Kg	Yield Stress Psi.	Ultimate Stress Psi.	Elongation in	Percentage Elongation	* Remarks M.o.E Psi.
① 5/II	1.1356	Chord Member	0.334	8300	11,200	54,650	73,750	1.30	16.25	34.15×10⁶
② 7/III	1.1490	do	0.337	8700	12,400	56,800	80,950	1.20	15.0	32.05 "
③ —	1.459	do	0.429	10600	15,880	54,350	78,850	1.75	21.87	27.74 "
④ 18	0.810	Bracing member	0.288	6540	8800	60,450	81,350	1.25	15.62	32.47 "
⑤ 19	0.949	do	0.279	7600	10,100	59,950	79,650	1.50	18.75	32.19 "
⑥ —	0.819	do	0.241	7500	9,000	68450	82,150	1.10	13.75	28.81 "
⑦ 6/III	1.163	Chord member	0.342	9400	12120	60,450	77,950	1.50	18.75	—
⑧ 9/III	1.244	do	0.365	9320	12,660	56200	76,800	1.40	17.50	—
⑨ 8	1.148	do	0.337	8720	12,500	56950	81,600	1.60	20.0	—
⑩ —	1.003	Bracing member	0.295	8120	11,600	60,550	86,500	1.60	20.0	—
⑪ 8/II	0.962	do	0.283	7800	10,500	60,650	81,650	1.20	15.0	—
⑫ 15	1.004	do	0.295	7080	9600	52,800	71,600	1.20	15.0	—
⑬ 17	0.731	do	0.215	5800	7740	59,350	79,200	1.30	16.25	—
⑭ —	1.451	Chord member	0.426	10800	15,400	55,750	79,550	1.40	17.50	—
⑮ —	0.789	Bracing member	0.232	6800	8300	59,750	78,700	1.40	17.50	—
⑯ —	0.797	do	0.234	6446	8600	60,550	80,850	1.40	17.50	—
⑰ —	0.797	do	0.234	6600	8400	62,050	78,950	1.30	16.25	—
⑱ —	0.785	do	0.231	6400	8280	60,950	[illegible]	1.20	15.0	—

Note : The above results pertain to the sample/samples supplied to this Laboratory.

* Modulus of Elasticity of specimen at Sr. No 1 to 6 are determined from the graph.

SEAL

Incharge Testing Laboratories
University of Engineering and Technology, Lahore

STRUCTURAL ENGINEERING DIVISION
U. E. T. LAHORE

From PROFESSOR OF CIVIL ENGINEERING
UNIVERSITY OF ENGINEERING AND TECHNOLOGY,
LAHORE

To M/S Associated Consulting Engineering ACE (Pvt), LAHORE.

232-240
ZA DE MA

Our Ref. No. CED/TL/ 1149 dated 30/6/80

Your Ref. No. H88/285/435 dated 21/6/80

page 3

TENSION TEST REPORT

Gauge length .... Date of test 30/6/80.

Description Hardness Test on Pins & Steel Plates.

ORIGINAL

A CARBON COPY OF THE REPORT HAS BEEN RETAINED IN THE LAB. FOR RECORD

S. No.	~~Wt. Rft. Lbs.~~	~~Size or Dia.~~	~~Area~~	Yield Load	Ultimate load	Yield Stress	Ultimate Stress	Elongation	Percentage Elongation	Remarks
	Mark			HARDNESS TEST ON PINS						
				Average						
1.	A			HR 61C						
2.	B			HR 57C						
3.	C			HR 59C						
				HARDNESS TEST ON STEEL PLATES						
1.	15/2	Bracing member		HR-61C						
2.	17	-do-		HR-59C						
3.	18	-do-		HR-62C						
4.	19	-do-		HR-59C						
5.	Nil	-do-		HR-65C						
6.	3/III	Chord member		HR-62C						
7.	6/III	-do-		HR-60C						
8.	7/III	-do-		HR-61C						
9.	8/III	-do-		HR-60C						
10.	9/III	-do-		HR-60C						

Note: The above results pertain to the sample/samples supplied to this Laboratory.

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CHAIRMAN CIVIL ENGG DEPTT. STRUCTURAL ENGINEERING U.E.T. LAHORE

O. I/C. Testing Laboratories
University of Engineering and Technology, Lahore

APPENDIX - VI

OBSERVATIONS ON CORROSION AND FATIGUE

APPENDIX - VI

OBSERVATIONS ON CORROSION AND FATIGUE

This section provides supporting reference for Chapter-6.

A copy of the report from the "Corrosion Expert" and the calculations to arrive at the fatigue limit force of the chord members, is included in this Section. In the end the dead load calculations on a typical tensom is provided.

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SOCEP

**Society of Corrosion Engineers
Pakistan**

Material of Construction and Its Extent of Corrosion

1. Material: It may be inferred from the results of chemical analysis (MIRDC) and tensile strength (UET) that the panels are fabricated from A572 or A588 high strength low-alloy structural steel. ASTM standard A572 was originally published (adopted) in 1966 and A588 in 1968 was adopted. The age of these panels appears to be more than 35 years as indicated. It may be concluded that the steel quality is nearer to these standards and the material may be designated as high strength low-alloy structural steel of good quality standard prevalent in fifties. Thus the material on the basis of chemical analysis and tensile strength conforms with ASTM standard specifications for revited, bolted or welded construction of bridges, buildings and other structures. The condition of welds of these panels was found good. It is

Recd on 14 Jul 90

C/O Institute of Chemical Engineering and Technology University of the Punjab Quaid-I-Azam Campus Lahore - 20 PAKISTAN Ph: 864116

indicative of the facts that the steel is weldable quality and proper welding procedures have been followed during its welding.

For welded bridge construction notch toughness is an important material requirement. These are negotiated at the time of purchase of the steel between the purchaser and the producer of the steel. The manganese level of concentration (greater than 0.75%) by chemical analysis at MIRDC confirms its quality for impact strength (notch toughness). It appears that no lapses have occurred during procurement of steel of requisite quality and its fabrication into panels under investigation.

2. Extent of Corrosion: Three panels were inspected for extent of corrosion on them. Two of them have undergone slight corrosion. The third panel suffered moderate overall corrosion. There was localized attack (pitting) which was severe on some seat bolts head and on adjoining transam seat, female joint groove and partially on bottom chord. The severe corrosion of transam seat and

Society of Corrosion Engineers Pakistan

adjoining bolt head suggests that transam seat has remained in place in a previous bridge structure and water (probably mixed with deicing salt) ingress into the small interface gap. The water had no drain point and caused considerable corrosion in the presence of chloride ions ~~[illegible]~~ ~~[illegible] the presence of water pitting had occurred.~~ ~~The first explanation is more probable one.~~

The overall condition of the panels is satisfactory from corrosion point of view. The damage to the pin joint is more important to be considered. The pin joints of the bridge structure may be examined for safety considerations

Ijaz Hussain Khan
13/7/90

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Associated Consulting Engineers ACE (Pvt.) Ltd.

Project: Bailey Bridge | Job No | Sheet 1 of 3
Feature: Fatigue Limit | Designed: DMA/SMW | Date: July 90
Item | Checked | Date

Fatigue Limit

Residual capacity of Panel & reinforcing chord in the top storey of bay 9, truss III & IV.

Ref. figures

Fig. 2.1, Key Elevation of Bridge structure.
Fig. 2.2, x-Section of Bridge

A Truss III

Member	Condition Symbol*	Resd. area %
top chord	C	66
Reinforcing	B	80

$$av. = \frac{146}{2} = 73$$

*Ref. P-8/12 of Appendix IV.

B Truss IV

Ref. P-11/12 of Appendix IV.

top chord	B	80
Reinforcing	B	80

$$av. = \frac{160}{2} = 80$$

Combined Average = 76.5 %

$$\frac{73 + 80}{2}$$

— Consider Reduction factor = 0.75

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According to reference [7], loading condition of Table B-1 was followed assuming that number of loading cycles to which the structure had gone through ranges between 500,000 to 750,000. Hence the allowable stress F'_{sr} can be determined from the following relationship in conjunction with table B2 & B3.

$$F'_{sr} = \left(\frac{f_t + f_c}{f_t + 0.6 f_c}\right) F_{sr}$$

where $f_t \simeq f_c$ = Stress in the member
= force ÷ X-sectional area

Maximum stress in any structural component (top/bottom chords of Panel in Bay 9 or 10)

$= 108 \div 8.52 = 12.676$ Ksi

108K = max. force in chord members. Ref. table 2.3

$$\therefore F'_{sr} = \left(\frac{12.676 + 12.676}{12.676 + 0.6 \times 12.676}\right) F_{sr}$$

F_{sr} from table B-3 [7], for Category B, table B2

$= 0.17 f_y = 8.50$ Ksi

$f_y = 50$ Ksi for A 588 Steel

Associated Consulting Engineers ACE (Pvt.) Ltd.

Project	Bailey Bridge	Job No		Sheet	3 of 3
Feature	Fatigue Limit	Designed	DMA/SMN	Date	July 90
Item		Checked		Date	

$$F'_{sr} = 1.25 \times F_{sr}$$
$$= 1.25 \times 8.5$$
$$= 10.625 \text{ Ksi}$$

$\therefore$ Fatigue Limit force $= 90.52$ Kips
10.625×8.52

The above member capacity is reduced due to corrosion effect which has reduced the effective X-Sectional area of the member, refer calculations on P 1/3.

$$\therefore a_{net} = 0.75 \times a$$
$$= 6.39 \text{ in}^2$$

hence the available Capacity $= 67.90$ Kip

$$\frac{6.39}{8.52} \times 90.52$$

Say 68 K.

—x—.

Associated Consulting Engineers ACE (Pvt.) Ltd.

Project: Bailey Bridge.	Job No	Sheet 1/6 of
Feature: Dead Loads	Designed	Date
Item: Calculation.	Checked	Date

Estimate/calculation of transom loads.

Data:- Transom are located at each panel viz. at 10 ft c/c..

Reference:- [1] Bailey Bridge M2, FM 5-277

[2] End elevation of Bailey Bridge as shown in the dwg. no 890605

[3] Bailey Bridge parts Catalog

[4] J. E. Lother, Design of Steel Structures

Approach:- It is considered that all the load/weight of Component/parts - including the Self wt. of transom, is transferred at the transom location.

-Firstly all loads in one Bay shall be calculated, Later the value divided by 2 to get weight on one truss (upstream III + IV / downstream I + II truss). Finally again divided by 2 to get value/load on each truss (I & like) for which the computer model is prepared.

- Consider unit wt of timber = 50 pcf. (Ref. table App. B. [1])

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Project: Bailey Bridge Job No: ____ Sheet: 2/6 of ____

Feature: Dead Loads. Designed: S.I. Date: ____

Item: ____ Checked: ____ Date: ____

References used for Calc., appear below Sr. No

Sr No.	Description	No per panel	Total wt (lbs)
1 / [2]	Runners 3" × 12" – 10 ft length Considered per panel $\left[\frac{3}{12} \times \frac{12}{12} \times 10\right] \times (10) \times 50$	10	1250.0
2. / [2]	Chess/transv. planks [2¼" × 6"] – 12 ft length No = 10 $\left[\frac{2.25}{12} \times \frac{6}{12} \times 12\right] \times (10)\, 50$	10	562.25
3 / 44/[3]	Stringers (5) × 260	5	1300.00
4 / 49-1/[3]	Transom	1	433.00
13-1/[3]	& Clamps (2) × 7	2	14.00
5 / 25/[3]	Panel Pins (24) × 6.1	12×2 = 24	146.50
6 / 26[3]	Retainer clip. (24) × 0.13	24	3.12
			3708.62

Associated Consulting Engineers ACE (Pvt.) Ltd.

Project: Bailey Bridge | Job No: | Sheet: 3/6 of
Feature: Dead Loads. | Designed: | Date:
Item: | Checked: | Date:

Sr No	Description	No per panel	Total wt (lbs).
7 / 38[3]	Riband (curb) (2) x 215	2	430.00
	+ Riband J-bolts (4) x 4.5	4	18.00
8 / 34[3]	Raker (2) x 22	2	44.00
9 / 8-1/[3]	Sway Brace (2) x 63.5	1	127.00
10 / 27/[3]	Pin Sway brace (4) x 1.1	4	4.40
11 / 17-1/[3]	Bracing frames (top) (2) x 44.	2	88.00
12 / 5/[3]	Bracing bolts for 11 (8) x 1	4x2 = 8	8.00
13 / 17-1/[3]	Bracing frame (end) (2) x 44	2	88.00
14 / 5/[3]	Br. Bolts for 13 (8) x 1	8	8.00
			815.40

Associated Consulting Engineers ACE (Pvt.) Ltd.

Project: Bailey Bridge | Job No: | Sheet: 4/6 of
Feature: Dead Loads. | Designed: SSF | Date:
Item: | Checked: | Date:

Sr No	Description	No per Panel	Total wt (lbs).
15 / 6 [3].	Chord bolts (24) × 7.5	12 × 2 = 24	180.0
16 / 14 [3]	Collar, chord bolt (24) × 1	24	24.0
17 / 10 [1] & 11-1/[3]	Chess (not used).	13	—
			204.0
18		Σ P-3	815.40
		Σ P-2	3708.62
			4727.12

$\therefore$ Load/panel/truss = 1,182.0

$\frac{1}{2} \times \frac{1}{2} \times 4727$

— Add for deficiency of wt. of truss as calculated by the program, by dividing it equally on all the 18 transom 320.0

$\frac{1}{18} \times [27,044 - 21,300]$

(See P-5 for explanation)

1,502.0 lbs.

Panel truss Loads.

Ref. [3] - Bailey Bridge parts Catalog

item 23, wt of panel truss = 577 lbs
item 37, wt of reinf. Chord = 196 lbs
= 773 lbs

Weight of the truss as calculated by SAP

In the process of analyses, the program calculates "total material weight" - viz. the self wt of the structure configuration, without any (imposed) dead / live load.

In the modelling of the panel truss, as shown in figure 2.3, transom seat, gusset plates & like do not appear in the idealized model, hence the "total weight of materials" as shown is less than the actual & = 21,300 lbs & is less than the actual wt. as shown below.

"Actual total weight of materials"

1) Panels in bay 1 w/o reinf. $1\times(577\times2)$ = 1,154
2) Panels in bays 2-17 inclusive $16\times(773\times2)$ = 24,736
3) Panels in bay 18 w/o reinf $1\times(577\times2)$ = 1,154

= 27,044 lbs

- The dead loads from transom, as applied in the model = 1850 lb

- ie, there is cushion of 1850 − 1502 = 348 lbs in each transom load

- this "cushion" of additional 348 lbs has not however materially affected the findings/inference drawn from the analyses, as illustrated below.

- Total DL per panel (actual) = 2,685 lbs.
  $1502 + (21,300 \div 18)$
- Total DL per panel (in the input) = 3,033 lbs
  $1850 + (21,300 \div 18)$

- DL force calculated by Program = 60.5 K.
- LL force calculated by Program = 21.0 K.
  ≡ H 15 truck load $\qquad \Sigma = 81.5$ K

∴ Actual DL force in the member = 53.55 K.

$$\frac{2685}{3033} \times 60.5$$

LL force min. value ≡ 15% impact = 20.12 K

$$\frac{1.15}{1.20} \times 21$$

= 73.67 K.

73.67 K > 68 K (Fatigue Strength).

APPENDIX - VII

SUPPORTING FIGURES

APPENDIX - VII

SUPPORTING FIGURES

This Section provides supporting reference for Chapter-7.

Some photographs of the panel load testing and relevant views of the existing structure is presented in this Appendix.

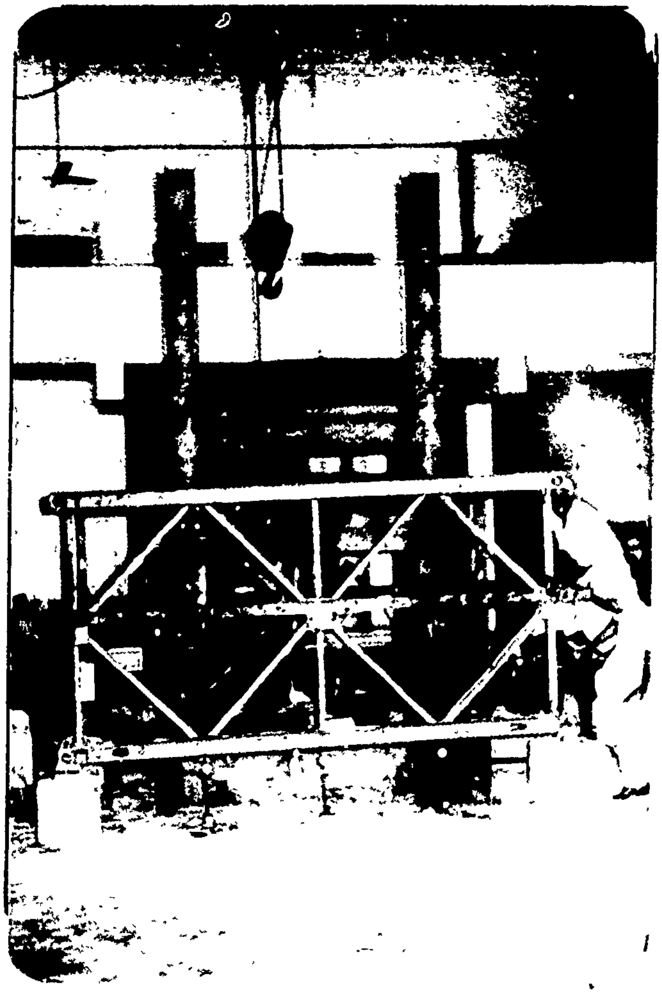

Figure VII.1:

Overall view of Panel Test No.2

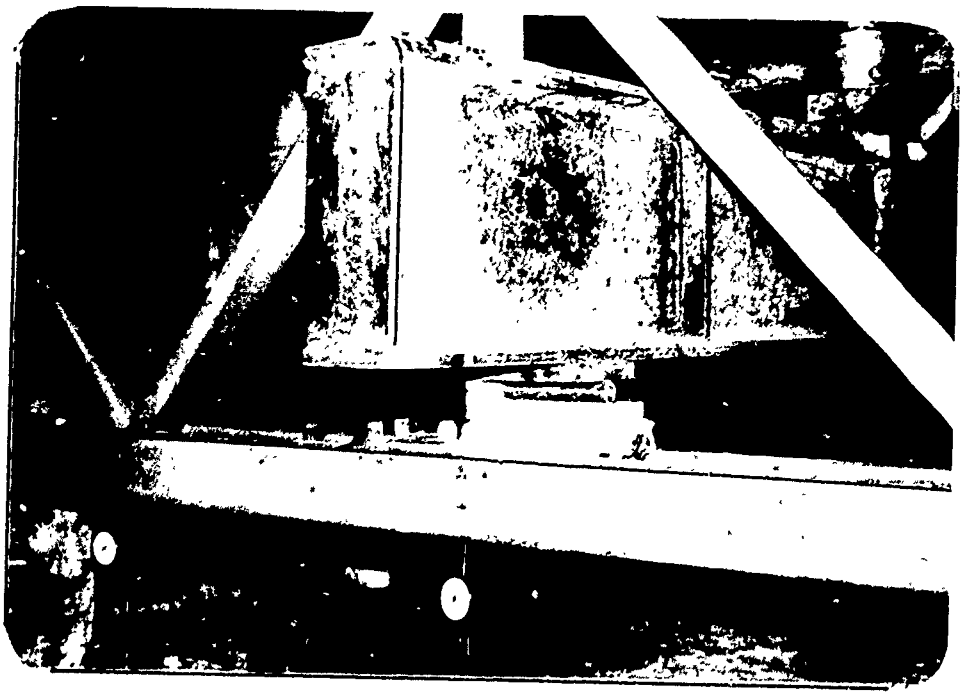

Figure VII.2: Roller support of Main Girder on Panel B (Test No.2)

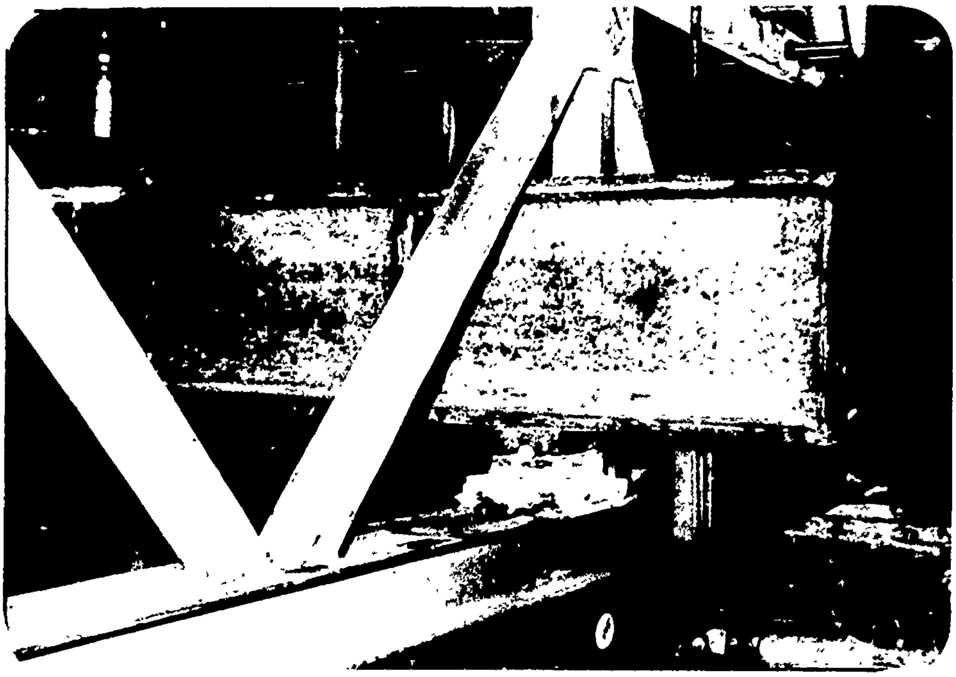

Figure VII.3: Hinge support of main girder on Panel A (Test No.2)

Figure VII.4: Hinge support and one end of each Panel (Test No.2)

Figure VII.5: Deflection gauages under salient joints (Test No.2)

Figure VII.6: Application of Pressure/Force

Figure VII.7: Hydraulic jack transfers the load at the centre of main girder

Figure VII.8: Noting the gauge readings

Figure VII.9: A corroded top chord in the existing structure

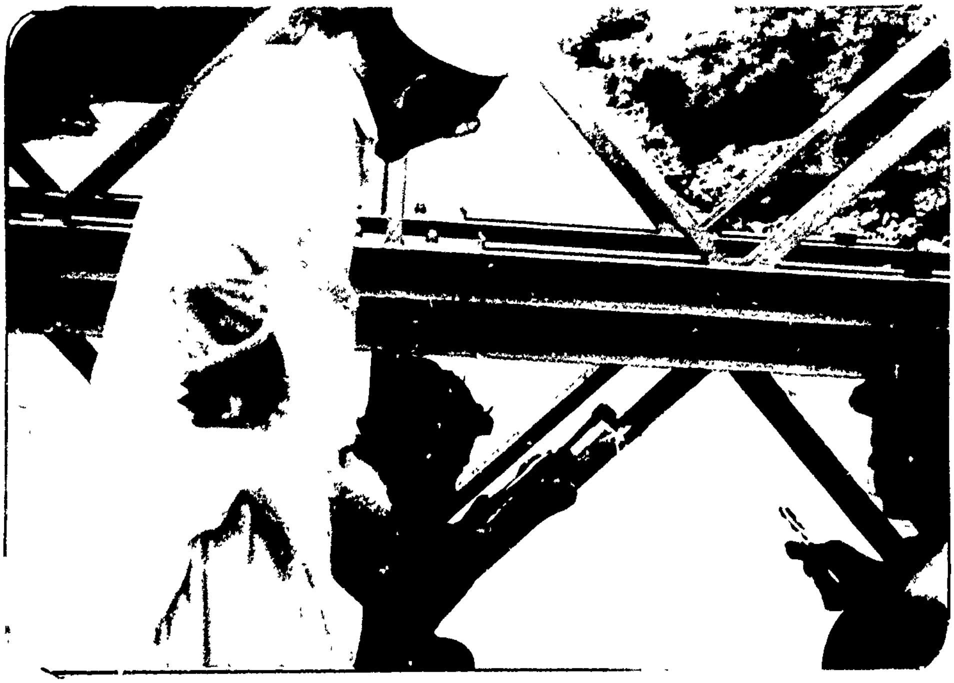

Figure VII.10: Coupons extraction in progress during site visit

Figure VII.11: Vehicles await "opening" during coupon extraction

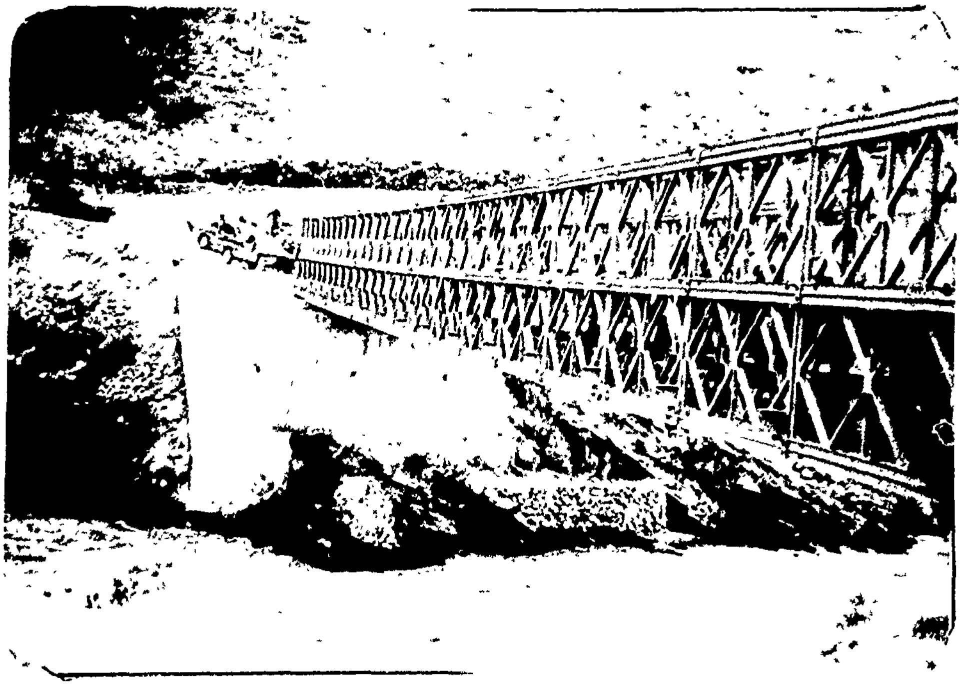

Figure VII.12: A view of the bridge from the left/ Pakistan side abutment. Note the condition of the right/Afghanistan side abutment

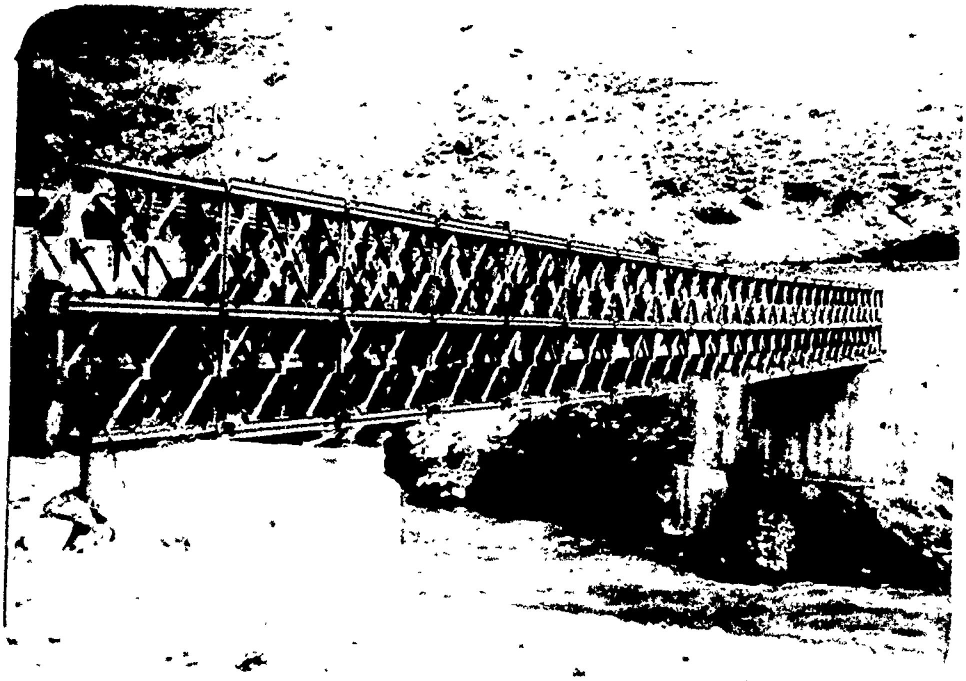

Figure VII.13: Another view of upstream of the structure looking from left abutment to right abutment

APPENDIX - VIII

MAINTENANCE PLAN & SCHEDULE

APPENDIX - VIII

MAINTENANCE PLAN AND SCHEDULE

VIII.1 General [6]

Maintaining the Bridge in a condition to provide safe and uninterrupted traffic flow is the primary function of this Maintenance Plan and Schedule.

VIII.2 Qualification of Inspection Personnel [6]

The Incharge of the Inspection Unit shall posses the following minimum qualifications:

i) Be a registered professional engineer; or

ii) Be qualified for registration as a professional engineering under the law; or

iii) Have a minimum of 10 years experience in Bridge Inspection assignments in a responsible capacity and have completed a comprehensive training course.

He shall be responsible for the thoroughness of the field inspection, analyses of all findings ascertained by the inspection and the subsequent recommendations for correction of defects, posting for restricted loading and/or speed, or any other recommendations deemed necessary.

VIII.3 Frequency of Inspection

The Bridge is to be thoroughly inspected and maintained by a full crew at regular intervals not to exceed six months.

In view of:

- known deficiencies; and
- allowable vehicle loading limit less than that which is legal on the Highways

two interim inspections should be carried out between the above inspection by a full crew.

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VIII.4 Maintenance Crew

It is considerd that a full crew comprise of six personnel as follows:

S.No.	Post	No.	Qualification
1.	Incharge	1	As mentioned in VIII.2
2.	Supervisor	1	Full knowledge of maintenance procedures and minimum one year experience of similar work
3.	Welders	2	Qualified Welder
4.	Labour	2	Full briefing of the job

For daily maintenance a crew of three persons - a Supervisor and 2 Labourers is considered sufficient.

VIII.5 Maintenance Details [1]

1. Check tightness of cribbing under end transoms and ramps.

2. Make sure all panel-bridge pin retainers are in place.

3. Lubricate all exposed threads and occasionally pour a small quantity of oil over each panel joint as the bridge is to remain in place for a long period.

4. Repair wearing surface on deck and ramps, and keep stone and gravel off deck.

5. Maintain immediate approaches and ditches.

6. During heavy rainstorms, check closely for erosion of bank seats, abutments, approaches, and drainage ditches.

7. Replaces damaged end-post guards.

VIII.6 Tools for Routine Bridge Maintenance

The routine maintenance crew should possess the necessary tools as enlisted in table VIII.1.

TABLE - VIII.1

S.No.	Tools	Quantity
1.	Wrench, ratchet (for double and tripple storey bridges only)	1
2.	Wrench, socket, 1-1/8"	2
3.	Wrench, structural, 1-1/8"	2
4.	Wrench, structural, 1-1/8"	1
5.	Wrecking bar	1
6.	Claw hammer	1
7.	Carpenter s level	1
8.	Hand crosscut saw	1
9.	Sledge, 6 lb.	1
10.	Shovel, long-handled	1

VIII.7 Spare Parts for Routine Maintenance

It is considered that the structure is safe from hostilities from enemy and only enough spare deck parts and wear tread planking - to replace those worn or damaged by normal use, shall be sufficient.

VIII.8 Additional Equipment for Periodic Maintenance

The crew for the periodic maintenance should possess the equipment listed in Table VIII.2 in addition to the tools listed in VIII.1.

TABLE - VIII.2

S.No.	Equipment	No.
1.	Diesel Generator & Welding Plant	1
2.	Grinder	1
3.	Gas Cutting Equipment	1
4.	Gas Cylinders	2

VIII.9 Repair Methods

a) Damaged deck and bracing parts can be easily replaced with Spares [1].

b) Panel Damage

Replacing damaged panels is almost impossible without first delaunching the Bridge. All such repairs should be carried out in accordance with the standard procedures laid down in [1] or Bridge Inspectors Training Manual published by the U.S. Department of Transportation [6]. Splices plates secured by fillet welds are more reliable than butt welding alone. Splice material should be mild steel plate about 50 percent greater in cross-sectional area than the damaged section of the member being repaired. Splice plates should be arranged to match as closely as possible the shape and position of the damaged section replaced. The minimum length, in inches, of a 1/4" (.64 centimeters) fillet weld required on each end of a splice plate is 10 times the cross-sectional area of the plate in square inches.

All welding procedures and practices shall comply with the provisions of [1]. Beside the bridge shall be painted after every repairs and fully at the interval of 3 to 4 years.

VIII.10 Involved Costs

The estimate of the direct costs involved in the maintenance works, at the prevailing price index is provided in Table VIII.3 given below:

TABLE - VIII.3

Direct Costs* of Maintenance (Rs./Day/Head)

Designation of Personnel 1	Salary Cost+ 2	Meal Charges 3	Total 2+3 4
Incharge	200	50	250
Supervisor	140	40	180
Welders	100	30	130
Labourers	75	30	105

* the cost does not include the following:

- accommodation if offered free
- travel and transport, if involved
- free medical facility if offered by the Agency
- insurance cost
- Overheads incurred by the Agency
- Rental cost of tools/equipment
- materials and/or consumable items/paints

\+ Salary cost inclusive of allowance/s of remote site location.

- All costs to be considered approximate.