DE-Consult

TRACECA - Project
Rail Maintenance Central Asia:
Infrastructure (TNREG 9310)

Chapter 2.1.3.

Traffic Census on the Pontoon Bridge near Chardzhev (Turkmenistan) July and August 1996

Report about the Results

- DRAFT -

Deutsche Eisenbahn-Consulting GmbH
Regional Department Europe/ CIS/Mediterranean

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2.1.3 Traffic via the Pontoon Road Bridge over the Amudarya river near Chardzhev

2.1.3.1 Used Methodology and Approach of Data Collection

The available data about the traffic over the pontoon bridge of different sources have different levels. This data was not suitable for the analysis and the forecast.
There is no information about the structure of the road traffic by types, origin/destination etc.
Therefore two types have been prepared and carried out in order to get data concerning the present road traffic via the pontoon bridge.

The counting includes information about all vehicles using the pontoon bridge. The interview survey of selected vehicles should give special information about the structure of the road traffic.

The counting and survey were realised within three days during July and August 1996 (29th - 31st July and 7th - 9th August). In result of the counting it was found out, that the 29th July was not representative, because the traffic on this day was lower than the traffic on all following days. The reason is not known, therefore the counting results of this day had to be eliminated.

The counting of vehicles using the bridge was carried out from 6 to 20 hours. All vehicles crossing the bridge were counted by types and by direction. The total number of vehicles in 24 hours was estimated based on results of 14 hours counting.

The variations of the daily traffic over the bridge in the counting period was normal, the variations are between +2.9 % in maximum and -1.0 % in minimum concerning an average day.

The interview survey of selected vehicles was carried out on the base of the following key points:

- Use of a questionnaire (see annex 1)
- Survey of a selected number of vehicles (each fifth vehicle in general)

The counting and survey were realised with the support of two local subcontractors: the Lebapskoye Road Operation Authority and the Turkmendorproject Institute, Chardzhev branch office.

Altogether the interview survey of vehicles using the pontoon bridge have been concentrated to 1769 vehicles (on six days in total), of them:

-vehicles of freight traffic 984, of them:

236	2-axle vehicles
138	3-axle vehicles
620	>3 axle vehicles

-vehicles of passenger traffic 785, of them:

658	passenger cars
127	buses

This means, 18.9 % of all vehicles crossing the pontoon bridge in the a.m. period have been surveyed.

2.1.3.2 Total Road Traffic Volume via the Pontoon Bridge

Volume by Number of Vehicles

The road traffic via the pontoon bridge amounts to 2,023 vehicles on an average day in both directions (24 hours). The variation of the observed traffic volume by directions Chardzhev-Farap and Farap-Chardzhev is approximately the same.

Passenger cars have the biggest proportion in the number of vehicles using the bridge, their proportion is 54 % in average. The proportion of freight traffic vehicles amounts to 34 %, among them trucks >3 axles to 15 %.
The traffic flows by passenger cars, busses and 3-axle trucks had the same volume in both directions approximately. Concerning the trucks having >3 axles it was observed a bigger volume in the direction to North than to South.

Table 2-14: Average Daily Traffic by Vehicle Type (ADT) via the Pontoon Bridge

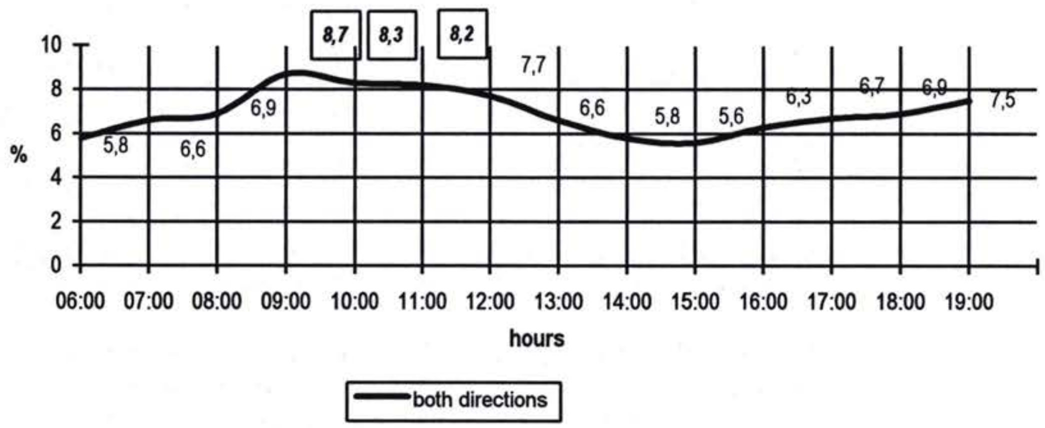
Vehicle Type		ADT by Direction		ADT total	Structure of Traffic Volume by Vehicle Type (in %)
		Chardzhev-Farap	Farap-Chardzhev	*Both directions*	
Utility (2-axle)	< 2 tonne payload 1.9-2.6 tonne GVW*)	119	146	***265***	13
Truck (3 -axle)	2 - < 8 tonne payload 5.8 - < 8 tonne GVW	57	61	***115***	6
Truck (>3 axle)	> 8 tonne payload 17.8 - 38.0 tonne GVW	184	116	***300***	15
Passenger car		568	536	***1,105***	54
Bus		39	40	***79***	4
Other vehicles types		87	69	***156***	8
Total		1,055	969	***2,023***	100

*)GVW Gross vehicle weight

Source: Survey by DE-Consult in co-operation with Lebapskoye Road Operation Authority and Turkmendorproject Institute, Chardzhev branch office

The variation of the number of vehicles is not so high during the day between 6 and 20.00 hours. There is a peak between 9 and 12 a.m., but the variation is not so high in general. In the night the traffic volume is obviously lower than by day.

The following diagram shows the variation in the traffic volume per day on average:



Volume of Traffic by Axles
The number and the structure of vehicles do not characterise the loading of the bridge exactly. Therefore the number of axles per average day was calculated.

Table 2-15: Average Daily Traffic by Axles and Standard-Axle Vehicles via the Pontoon Bridge

Vehicle Type	Number of Axles (in general)	Number of Axles by Direction		Number of Axles in Total	Structure of Traffic Volume by Axles (in %)
		Chardzhev-Farap	Farap-Chardzhev	*Both directions*	
Utility (2-axle)	2	238	292	***530***	11
Truck (3 -axle)	3	171	183	***354***	7
Truck (>3 axle)	5	921	580	***1,501***	31
Passenger car	2	1,137	1,072	***2,209***	46
Bus	2	78	80	***158***	3
Other vehicles types	2	174	138	***312***	6
Total		2,719	2,346	***5,066***	100

Source: Calculation by DE-Consult

Referring to the number of axles it has to be mentioned that the proportion of freight traffic vehicles amounts to 49 % and is little higher than the proportion of passenger cars.

The modal split between freight and passenger traffic by axles sums up to 49 % freight traffic: 49 % passenger traffic (including busses).

2.1.3.3 Structure of the Traffic via the Pontoon Bridge [1]

Freight Traffic
The international traffic amounted to two third of the total road freight traffic via the bridge (68 %) , of them 24 % export and import of Turkmenistan and 76 % transit from/to other countries through Turkmenistan.

The proportion of the domestic traffic via the pontoon bridge amounted to 32 %, of them 89 % traffic within the Velayat Lebap and 11 % of traffic between Velayat Lebap and other regions in Turkmenistan.

This basic structure shows, that the pontoon bridge has an enormous importance for the international traffic especially for the transit traffic through Turkmenistan.

The transit traffic has the following main connections:

Iran - Uzbekistan both directions 34.6 % proportion of the total transit traffic

Turkey - Uzbekistan both directions 32.5 % proportion of the total transit traffic

Iran - Kazakstan both directions 16.0 % proportion of the total transit traffic

Two third of the vehicles running over the bridge have their origin or destination in Uzbekistan.

[1] The source of this data is the survey by DE-Consult in co-operation with Lebapskoye Road Operation Authority and Turkmendorproject Institute, Chardzhev branch office.

Table 2-16 provides an overview about the main regional structure of the freight road traffic via the pontoon bridge.

Table 2-16: Structure of Road Freight Traffic via the Pontoon Bridge

Connection	Proportion of the total road freight traffic (%)	
Domestic traffic	***32.1***	***100.0***
of them:		
within the Velayat Lebap		88.8
with other regions in Turkmenistan		11.2
External trade of Turkmenistan (export/import)	***16.1***	
Transit traffic	***51.8***	***100.0***
among them:		
Iran - Uzbekistan		19.3
Uzbekistan - Iran		15.3
Turkey - Uzbekistan		13.1
Uzbekistan - Turkey		19.4
Iran - Kazakstan		7.8
Kazakstan - Iran		6.2
Kazakstan - Afghanistan		2.0
Uzbekistan - Afghanistan		2.4
Turkey - Afghanistan		2.4
Total	100.0	

Source: Survey by DE-Consult in co-operation with Lebapskoye Road Operation Authority and Turkmendorproject Institute, Chardzhev branch office

The above mentioned main transit connections amounted to 90 % of the total transit via the bridge.

The description of the structure by commodity on the base of the results of the survey is difficult, because not all data is representative. Therefore the conclusion is concentrated on relevant and representative data.

Domestic Traffic
Regarding the number of vehicles via the bridge the structure by commodity in the domestic freight traffic shows the following situation:
The traffic within the Velayat Lebap includes distribution transports with small vehicles in general. Transported main commodities were building materials, food and beverages as well as other consumer goods. The same situation is existing in the domestic traffic between all other Turkmenian Velayats (without Velayat Lebap).

External Trade of Turkmenistan by Road via the Border Crossing Farap
This assessment is based on the customs statistics of 1995 and 1996 (January-June), because the results of the survey are not representative.

The volume transported via Farap border crossing and via the pontoon bridge is very low. The proportion of external trade traffic by road via Farap amounted to 0.4 % in the total export and 0.3 % in the total import. In the first six months of 1996 there was an enormous decline in external trade transports by road via Farap.

The international traffic between Turkmenistan and other countries by car and by bus is characterised by a relevant proportion of traffic between Turkmenistan and its neighbouring country Uzbekistan. The reasons are strong relations between the people on both sides of the Turkmenian-Uzbek border. In the Velayat Lebap there live about 106,000 Uzbek, this means 11.6 % of the population live in the Velayat Lebap[2].
Therefore, there are a important traffic between Turkmenistan and Uzbekistan, especially from/to the region of Bukhara (see table 2-20).

Table 2-20: Passenger Traffic between Turkmenistan and Uzbekistan by Road via the Pontoon Bridge

Kind of traffic	Proportion of the total passenger traffic (in %)		International traffic = 100 %	
	Traffic by car	Traffic by bus	Traffic by car	Traffic by bus
International traffic from/to Turkmenistan abroad	23.0	53.0	100.0	100.0
among them:				
from/to Uzbekistan, region of Bukhara			64.8	51.5
from/to other regions of Uzbekistan			28.5	32.2

Source: Survey by DE-Consult in co-operation with Lebapskoye Road Operation Authority and Turkmendorproject Institute, Chardzhev branch office

The average occupancy rate in the passenger traffic by car amounted to 1.17 persons per car, but various figures in the different kinds of passenger traffic have been observed:

Table 2-21: Occupancy Rates in the Passenger Traffic by Car via the Pontoon Bridge

Kind of traffic		Occupancy rate (persons / passenger car)
Total		***1.17***
of them:		
Domestic traffic	Domestic traffic within the Velayat Lebap	1.13
	Domestic traffic between Velayat Lebap and other Velayats	1.12
	Domestic traffic between other Velayats via the bridge	1.0
International traffic	**Total**	**1.44**
of them:	Traffic with origin or destination in Turkmenistan	1.16
	Transit traffic	2.0

Source: Survey by DE-Consult in co-operation with Lebapskoye Road Operation Authority and Turkmendorproject Institute, Chardzhev branch office

The structure of the passenger car traffic via the bridge by travel purposes shows the following situation:

- The domestic traffic within the Velayat Lebap is characterised by the fact that the proportion of the travel purpose „holidays and visit of relatives“ amounts to one third approximately.
  The travel purpose „business“ has a proportion of 20 % only.
- The domestic traffic between the Velayat Lebap and other Turkmen regions as well as between other Turkmenian regions themselves shows a high proportion of business trips.
- Business trips made by car are the main purpose in all parts of the international traffic.

[2] Source: Results of the Population Counting in Turkmenistan, Goskomstat Ashgabat 1996

Table 2-17: Export and Import Traffic by Road via Farap Border Crossing

	Volume (in 1000 t)	among them:
Export 1995	14,300	9,020 tons cotton to Pakistan
Export Jan-June of 1996	480	
Import 1995	6,350	2,260 tons from Uzbekistan 1,910 tons from Israel 1,380 tons from Russia
Import Jan-June of 1996	950	

Source: Customs Statistic of Turkmenistan 1995 and 1996

The results of the survey in the field of transit traffic are not completely representative, but the following structure could be assumed:
- The main commodities were food and agricultural products (about one third).
- The transport of high-value goods like equipment's, machines etc. has an enormous importance in the transit traffic by road via the pontoon bridge.
- Thirdly there the transport of various consumer goods is of some importance.

The structure by vehicle types shows a high proportion of small vehicles in the domestic traffic and a high proportion of trucks in the international traffic. In the transit traffic the proportion of trucks 17.8 - 39.0 t GVW sum up to over 90 % (table 2-18).

Table 2-18: Structure of Road Freight Traffic via the Pontoon Bridge by Vehicle Type

Kind of traffic	Structure by vehicle type in %			
	Utility 2 axles	Truck 3 axles	Truck > 3 axles	Total
Domestic traffic within the Velayat Lebap	70.1	19.1	10.8	100
Domestic traffic between other Turkmen regions	45.7	40.0	14.3	100
Export/ import traffic	21.5	20.3	58.2	100
Transit traffic	0.8	7.8	91.4	100

Source: Survey by DE-Consult in co-operation with Lebapskoye Road Operation Authority and Turkmendorproject Institute, Chardzhev branch office

The structure of the vehicles by country of the registration shows a high proportion of vehicles registered in Turkmenistan (38 %), in Iran (32 %) and in Turkey (19 %).
Vehicles registered in Kazakstan had a proportion of 3.5 %. The proportion of vehicles with registration in Uzbekistan amounted to 5.5 %.

Passenger Traffic

The passenger traffic via the bridge includes traffic by car and by bus. There is not a public short-distance traffic between Farap and Chardzhev. Therefore the bus traffic running via the bridge is private traffic over short distances (traffic of enterprises etc.)as well as private and public traffic via long distances.

The following table gives an overview the regional structure of the passenger traffic.

Table 2-19: Regional Structure of Passenger Traffic by Car and by Bus via the Pontoon Bridge

Kind of traffic		Structure (in %)	
		Traffic by car	Traffic by bus
Total		*100.0*	*100.0*
of them:			
Domestic traffic	**Total**	**77.0**	**47.0**
	of them:		
	Domestic traffic within the Velayat Lebap	69.5	40.9
	Domestic traffic between Velayat Lebap and other Velayats	6.6	6.1
	Domestic traffic between other Velayats via the bridge	0.9	-
International traffic	**Total**	**23.0**	**53.0**
	of them:		
	Traffic with origin in Turkmenistan	13.1	9.6
	Traffic with destination in Turkmenistan	6.2	17.4
	Transit traffic	3.7	26.1
	among them:		
	Uzbekistan - Iran	*1.1*	*10.5*
	Iran - Uzbekistan	*0.6*	*5.2*

Source: Survey by DE-Consult in co-operation with Lebapskoye Road Operation Authority and Turkmendorproject Institute, Chardzhev branch office

In comparison with the freight traffic the passenger traffic via the bridge has another regional structure. The regional structure of passenger traffic by car is characterised by the following situation:

- The modal split between domestic and international traffic amounted to 77.0 % : 23.0 %.
- 90.3 % of the domestic traffic is traffic within the Velayat Lebap, especially traffic between Chardzhev on the one hand and Farap Etrap res. Pristan one the other hand and 8.7 % domestic traffic between other Turkmenian Velayat via the bridge.
- 83.9 % of international passenger traffic by road is traffic from/to Turkmenistan; 16.1 % transit traffic through Turkmenistan.

The bus traffic shows another regional structure:

- The modal split between domestic and international traffic amounted to 47.0 % : 53.0 %.
- 87.0 % of the domestic traffic is traffic within the Velayat Lebap, especially traffic between Chardzhev on the one hand and Farap Etrap res. Pristan one the other hand, and 13 % are domestic traffic between other Turkmenian Velayats via the bridge.
- The international traffic by bus has the following structure:
  50.9 % traffic from/to Turkmenistan abroad
  49.9 % transit traffic
- More than 60 % of the transit traffic by bus are traffic flows between Iran and Uzbekistan.

Table 2-22: Structure of Passenger Car Traffic by Travel Purposes via the Pontoon Bridge

Kind of traffic		Structure by travel purposes (in %)			
		Business	Holidays, visit of relatives	Private	Other
Domestic traffic	Domestic traffic within the Velayat Lebap	20.2	34.1	24.1	21.6
	Domestic traffic between Velayat Lebap and other Velayats	49.0	34.0	10.6	6.4
	Domestic traffic between other Velayats via the bridge	66.7	22.2	-	11.1
International traffic	Traffic with origin or destination in Turkmenistan	48.7	26.0	20.9	4.4
	Transit traffic	61.7	20.0	8.3	10.0

Source: Survey by DE-Consult in co-operation with Lebapskoye Road Operation Authority and Turkmendorproject Institute, Chardzhev branch office

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Questionnaire for Survey of Users of the Pontoon Bridge near Chardzhev

date of the count	day	time	sheet No:	name of the interviewer	

Question 1: direction (to be crossed where applicable)

11 Chardzhev - Farap		*12 Farap - Chardzhev*	

Question 2: type of vehicle (to be crossed where applicable):

21 heavy goods vehicles/ four-wheelers	22 heavy goods vehicles/ six-wheelers	23 heavy goods vehicles/ with more than six wheels and semi-trailer units	24 passenger cars	25 busses	26 other vehicles

Question 3: country of registration of the vehicle (to be crossed where applicable: country/area):

31 Turkmenistan	32 Kazakhstan	33 Uzbekistan	34 other countries of CIS
35 Iran	36 Afghanistan	37 Turkey	38 other countries

Question 4: origin and destination of the transport (to be crossed where applicable: country/area):

41	Origin/ country of origin		43	Destination/country of destination	
411	Iran		431	Iran	
412	Afghanistan		432	Afghanistan	
413	Turkey		433	Turkey	
414	Kazakhstan		434	Kazakhstan	
415	Uzbekistan, Oblast Bukhara		435	Uzbekistan, Oblast Bukhara	
416	Uzbekistan, other regions		436	Uzbekistan, other regions	
417	Turkmenistan, city of Ashgabat		437	Turkmenistan, city of Ashgabat	
418	Turkmenistan, Velayat Achalskij		438	Turkmenistan, Velayat Achalskij	
419	Turkmenistan, Velayat Balkanskij (e.g. Turkmenbashi, Nebit-Dag)		439	Turkmenistan, Velayat Balkanskij (e.g. Turkmenbashi, Nebit-Dag)	
420	Turkmenistan, Velayat Maryiskij (e.g. Mary, Bajramali)		440	Turkmenistan, Velayat Maryiskij (e.g. Mary, Bajramali)	
421	Turkmenistan, Velayat Dashkhovuskij		441	Turkmenistan, Velayat Dashkhovuskij	
422	Turkmenistan, Velayat Lebapskij (Chardzhev)		442	Turkmenistan, Velayat Lebapskij (Chardzhev)	
423	other countries of CIS		443	other countries of CIS	
424	other countries		444	other countries	

Question 5 with goods transports: Which kind of good is carried? (to be crossed where applicable)

Food, agricultural products 51	Mineral oil products, petrol, paraffin etc. 52	Building material (stones, cement, building equipment etc.) 53	Chemical products, fertilizer 54	Machines, vehicles, industrial semi-finished and finished products 55
Iron and steel products 56	Consumer goods, textile products 57	other products 58		

Question 6

61	weight of the load (in t)	

Question 7 with passenger transports: purpose of travelling (to be crossed where applicable)

Business 71	Holiday, visit to relatives 72	Private reasons (shopping, visit of authorities etc.) 73	others 74

Question 8

81	number of persons per vehicle	

3. INSPECTION REPORT ON BRIDGE AND POTENTIAL FOR REFURBISHMENT

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3 INSPECTION REPORT ON BRIDGE AND POTENTIAL FOR REFURBISHMENT

3.1 GENERAL

3.1.1 Situation and Technical Characteristic of the Bridge

The bridge across the Amu-Darya River was built in the years 1898 to 1901 to connect the town of Chardzhev on the western with Farab on the eastern bank.
25 truss girder bridges (numbered 1 to 25) with span of 66,136 m are situated on double concrete filled tube piers. All truss spans are of the same type: straight lower chords, upper chords with variable system height, so the axis of the upper chord is between 7,506 and 9,144 m above the lower chord axis. The ascending and descending diagonals and verticals connect the gusset plates in distance of 4,724 m. The axis of the main girders have a distance of 5,537 m. Between the main girder lower chords cross girders are arranged every 4,724 m which carry longitudinal girders 1,829 m distant. Upper and lower wind bracings made of angles and also lurch bracing grant horizontal stiffness (photo F2-13 to -15, F6-18).
All connections are riveted except such parts which are added later to replace damaged parts and which are bolted (photo F1-23).
The upper chord is built up by double wall riveted hat plate profile and the lower chord by a reversed hat profile like the upper chord. The diagonals and verticals are either formed as a double-T-section laced by flat iron or as laced plate+angle section. The end frame diagonals are of a hat section. See photo F1-31 to -37, F6-20 to -24.
Cross girders and longitudinal girders are made as riveted plate girders with angle flanges, the end cross girders strengthened by additional cover plates.
The bearings are of cast iron. The fixed bearings are on the western pier whereas the movable bearings are on the eastern pier of each span. See photo F1-17 to -20.
A runway with rails to push a little lorry is arranged outside the main girders on upstream side (photo F1-30, F6-21, -26 and -29).
The bridge deck between the rails is covered with a wooden floor, partly of corrugated iron.
An inspection car is intended to run on I-beam rails below the lower flange but the resistance due to friction is heavy enough to baffle movement other than by force of ten workers.

Some of the spans carry high voltage current masts on their upper flange (see photo F1-08 and F6-33).

The spans are resting on piers made of concrete filled double tubes with boxes between (photo F2-20, -24, F4-34 to -37).

On both banks of the river access spans of plate girders of 11,89 m length are situated.

Schematic drawings with numbering are following in the Annex A.

3.1.2 Visit of Expert

The expert who was concerned to give a comprehensive judgement of the bridge state is an experienced specialist on steel bridges with long time residence in foreign countries. He has documented the general and detail state by written and spoken reports, by sketches and photographs. The summary of his report is given below.

3.1.3 Investigation programme

It was intended to select the spans which are evidently in the worst state. Such spans should be investigated thoroughly, but the remaining only if conspicuous.
The spans which are therefore selected are

- span 0
- span 3
- span 13
- span 15
- span 23

  Some other spans also were checked.

The expert also directed a proof loading of one bridge span and documented the deflection of the structure. The measurement results are checked with program and hand computation.

3.1.4 List of Abbreviations

The following abbreviations are introduced to simplify the report text:

Abbr.	Full text	Abbr.	Full text
MG	Main girder	UC	Upper chord
CG	Cross girder	LC	Lower chord
LG	Longitudinal girder	UF	Upper flange
US	Upstream	LF	Lower flange
DS	Downstream	HV	High voltage

3.2 PRESENT BRIDGE SITUATION

3.2.1 State of the Steel Structure

(See also Annex B and D)
The steel structure was designed with enough safety to sustain the design lodas during a long time period (surely more than 100 years). But the material quality (which could not be judged by the expert) is probably and the workmanship of the execution and the corrosion damages are surely causing reasons for the present state documented in the following description and in the Annexes B and D.

Some particular problems are stated by the expert:
The structure shows some weakness if a train passes the bridge which is caused by weak connections (loose rivets, rust swelling etc.). This weakness produces movement in the connections of the elements which will cause further defects as new cracks.
Many of rivets which are found defective were replaced by bolts which are probably high strength friction grip (HSFG) bolts. In normal riveted structures the plate surfaces in the connection itself are coated with minimum 1 layer of painting. If a HSFG bolt is applied on a structure painted between the force bearing surfaces the friction coefficient is not more than 0,20 instead of 0,40 to 0,45 on normal raw (sandblasted) surface. Therefor it is very probably that these replacing HSFG bolts can not take over the full load of the former rivets if they are not executed as fitting HSFG bolts which are machined and brought into a carefully reamed hole (tolerance hole to shaft 0,01 to 0,02 mm). If not so which can be assumed the remaining rivets have to take over a considerable overload or the whole joint is very weak if load passes over. This can again produce new cracks.
A certain form of strengthening shown on photo F1-13 with round bar welded to a strengthening plate. Such elements are extremely fatigue crack endangered as abrupt cross section changes and poor welding (executed on site) provoke damage especially if they situated near the load carrying track. Strengthening in such form should be avoided.
A very serious problem is the corrosion on the structure and the corrosion protection as executed at present. It is described below that the special cement used for this purpose is not suited. Correct sandblasting and 4 paint coatings of an approved quality should be applied if further defects should be avoided.

3.2.2 State Description of the Piers

The piers are made of steel plate tubes which are riveted together and stiffened by bracings. The inside is filled with non-reinforced concrete.
Generally the piers show signs of heavy corrosion outside as well as inside the plate shell. One pier was hit by a ship and the cladding is deformed. Other piers have large leaks where water can intrude into the inside. It is impossible to say how the state of the piers is below the water level or inside the steel tube. The report of the local experts refer that a large amount of stone packing was brought in at some piers but the stones are now swept away and can be found scattered in the river bed downstream.
There is a great danger that during high water period erosion and deepening of the bottom of river occurs as the protecting stone packing does not exist.

3.3 DOCUMENTATION

3.3.1 Photo Documentation

The photograph documentation is appended to the report in Annex B.

3.3.2 Recordings of Expert

3.3.2.1 General

The general state of the bridge steel structure can be expressed by the following:
A lot of defects have been detected by the expert but are also documented by inspection reports handed over to the expert.
Apart from this the structure is designed save and its stress level would be low enough to carry also heavier loads if there were not the defects and detail faults which are described in the following. These faults can cause fatigue cracks which cannot be detected due to the special cement coating which is applied at present.
The following report does not give a complete enumeration of all defects but shows characteristic features of the structure.

3.3.2.2 Concerning all Spans

In all spans the edge stiffening angles of cross frame connecting main girders and upper bracing are cut off to give more clearance for bigger lorries (photo F6-18, -19). Not in all cases this angle is built in again, and where so, there are considerable excentricities in the connections.

Many of the connecting angles between cross girder and LC are cracked and therefor strengthened by additional angles, where the rivets are replaced by bolts.

The connection between cross girder and longitudinal girder is strengthened in a more modern way by (indeed bad) welding with round bars going through holes in the cross girder web (photo F1-12, -13).

80% of the bolts to fasten the rails are loose.

3.3.2.3 Bearings

The bearings are made of grey cast iron and are in good state. The movable bearing is situated on the Farab side of every span except the acces spans (see below). It consists of an upper part which rests on a round steel whipper. This is embedded in a central body with flat lower plane running over 6 rollers. The rollers go over a lower plate which is situated on the piers header stone. The fixed bearings (on the Chardzhou side) are rocker bearings. The upper part of every bearing is fixed with 4 bolts on the LC of the MG, the lower plate is secured against shearing with 4 vertical round bars (recorded by the local experts, but not visible).
The 2 mm thick lead inlay between upper plate and LC of MG is squeezed out (which is a common and well known fact of lead inlay) - see photo F1-17.
The lower plates of the bearings are resting on 8 mm thick lead which below is lined with a special concrete under pressure which was executed newly (photo F1-20).

3.3.2.4 High Voltage Cantilevers

These cantilevers are connected to the UC in span 1 between 2' and 3', in the other spans between 12' and 13' by replacing the rivets with bolts, but some of the bolts are missing and not again replaced (photo F1-23).

3.3.2.5 Spans

Span 0 (photo F8-24)

This span is a plate girder as described above. The main girder are in good condition (except the painting). The legs of the LC bracing angles are deformed and bent (photo F2-13 to -15).
Bearings:
All 4 bearings are defective (photo F2-10). This is perhaps a consequence of the situation of the bearings: the fixed bearings are arranged diagonally - at Chardzhou end DS and on Farab side US, the movable bearings accordingly opposite. The subsequent constraint could have caused the damages.
A2: Concrete block with cracks and chipping. Vertical gab 4 mm.
A1: (photo F8-26, -33, -34). Concrete block is loose on the stone. No cracks.
B2: (photo F2-10, F9-05, -06). Lower plate deviates 5 mm from bridge axis direction. Vertical movement 2 mm.The lower bearing plate has a crack with 13 mm gap throughout. The concrete base is not fixed on the stone.
B1: (photo F8-25, -27 to -31). The concrete below the bearings sounds to be hollow if hit by hammer (photo F8-31, HOHL = hollow). Cracks in the header stone of the piers are filled up with grout but not treated further (photo F2-12). Lower bearing plate deviates 5 mm from bridge axis direction. Concrete base not fixed on the stone.

Span 3

This span is over land. The general aspect shows a well designed bridge with the characteristics of a riveted structure.
The piers are riveted double steel tubes with angle bracings between the shafts. They are filled with concrete, but at the surface there seems to be poor cement portion. No signs of reinforcement. The bracing and the tube walls are heavily corroded - estimated 1 mm thickness loss. The box between the tube piles is full with water and also heavily corroded (see example on photo F2-24).
The lower plates of the bearings are inserted in the stone of the pile heads and grouted (photo F1-20). No shear connectors are visible and it is not known by the local experts if there are any. The lead inlay is sqeezed out (photo F1-17, F2-05).
At the end nodes of the main girder there are some bad formed rivet heads. At the verticals and diagonals some rivets were removed and replaced with bolts. No loose rivets or bolts could be detected but in some cases the rivet holes are not filled again (photo F1-10). A similar method was used to fix the HV cantilever at the UC. There are also holes which are not filled (photo F1-23).
Strengthening of some structure elements (as the connection longitudinal to cross girder) is executed with angles which are bolted or with welded bars and gussets (photo F1-11 to -13). Such action evidently should improve defects as warping or torsion of angles or plates (photo F1-11).
Some deformations (curvature) of bracings between LC elements seem to come from the erection time (photo F1.15, -16).
On DS side angle cantilevers which carried the footway are cut off and replaced with bolted and welded consoles (photo F1-14).
In many cases the angle which carries the inspection car rails are cracked or deformed heavily (photo F2-07, F6-13, -14 of other span). The supporting angle of the telephone console is loose also.
Very frequent signs of corrosion can be seen (except of the UC which is in good state but coating is full of cracks): photo F1-09, -10, -26 to -29, F2-01. The present painting consists of a special grout of unknown consistency and is full of cracks and not very resistible. Behind this coating very often the steel is rusty. Sometimes the special grout or cement is used to fill wide gaps (photo F1-22).

Span 13

This span shows similar characteristics as the other spans.
Some loose and outstanding rivets have been detected (photo F6-04, -16).
At some diagonals deformation of bracing flats can be seen (photo F6-21, -22).
LC heavy pitting (localized corrosion) due to acid influence is shown on photo F6-11, -12. The suspension angle of the inspection rail is broken (photo F6-13, -14).

Corrosion is visible at various locations especially below rail level (photo F6-01, -02, -03, -05, -06, -07, -09, -11, -12, -15, -17, -32), but also at the diagonals where narrow gaps filled with special cement exist (photo F6-20, -24, -27, -30, -37). Rust has puffed up the angle legs due to volume extension and effects proceeding of corrosion (photo F6-32, -34, -35).

Span 15

Every gusset plate of LC shows signs of rust wherever the above mentioned special grout was applied. At LC gusset plate of vertical 11-11' a plate was riveted in which is to 60% bitten away probably due to attack of (battery?)acid or similar. Also from one rivet only remained 14 mm of the shaft and the lower head. The verticals and diagonals do not have loose rivets as some of them were replaced by bolts. The total span is just in state of unrusting but only the surface of the coating is treated as no proper tools are available (no sandblasting, no wire brushes - only little pick axe). Lower bracing near movable bearing has 3 mm deep rust flaw. The end cross girder at the fixed bearing is not strengthened and is deformed.

Span 23

The inspection car cannot be used as the rails (U 200) are bent due to ships collisions but not repaired (in the spans 22, 23, 24 and 25). The support angles of the inspection rails are deformed (photo F4-16). As the rope winch cannot be used up to ten workmen have to move the car.
The cross girder connection to LC DS and also US shows warping (photo F4-07 to -09, -11, -12). The bracing between the longitudinal girders has loose connections, corroded, some of the rivets are missing (photo F4-10). Rivets are also missing at the end girder (photo F4-12, -23).
The LC is totally spoiled with birds excrements and other waste (photo F4-15, -26, -27).
Corrosion exists at every vertical to LC connection and at cross girders and diaphragms (photo F4-24, -25).
Strengthening of various elements of the structure is made similar to other spans (photo F4-05, -06, -08, -11, -12, -14, -28, -29, -31).
The structure above the rail level is in good condition, no loose rivets detected, riveting was executed very well.

Span 26 (short span on FARAB side, photo F7-25 to -27, F8-22)

No faults on steel structure are visible, all rivets are firm. Painting is thin, some minor rust spots.
Bearings:
B2: (photo F7-12, -13, -14, -17, -18, -20). The concrete block has cracks and chippings. Between upper and lower bearing plate a 7 mm lining plate is inserted, which can be easily moved. Vertical free motion is possible (photo F7-20). The concrete base has no connection to the stone below.
B1: (photo F7-22, -24). Lower plate is cracked. Vertical free motion together with concrete base 1,5 mm. Water channel behind the bearings has to be cleaned. Distortion of upper bearing plate is evident.
A1: (photo F7-30, -32, F8-00). Should be fixed bearing but concrete base moves on the stone (vertical movement 2 mm). Concrete base shows chippings and cracks so that the reinforcement is visible.
A2: (photo F7-31). Vertical movement is 4 mm if train passes by. Cracks in the stone.

3.3.2.6 Piers

It is reported that the real state of the piers deviates from the state documented in the original design drawings. Some reinforcing plates or bars could be arranged inside the steel tubes which are not drawn. It is also unknown if the damages and holes which are now strengthened and closed by plates have caused some deterioration inside the piers.
It was also reported that a great amount of rubble stone was brought at the foot of some piers in the main stream which has to be renewed again as it was swept away. The present state is not known exactly. The water depth diagramm over the years shows very much changes which indicates enduring changes of the situation. Also the main stream changes between the piers.
Plate cladding of the piers 15 mm thick is on some spots totally bitten due to corrosion and there strengthened with plates (photo F4-32 to -34). Pier 24 was hit by a ship which damaged and bent the cladding (photo F4-36, -37).
Where not otherwise stated the following can be said:
All piers are of the same construction type: Riveted steel tubes with bracings, filled with concrete, no reinforcement. Correct position of the bearings is centric on the top of the pier, grouting in good state. Stone good, no cracks.

Pier 1:
Bottom: Rests on land, made of concrete with stone cladding.
Pier 2:
Bottom: Rests in stagnant water. Corrosion signs inside and outside.
Pier 3 (photo F8-35, -36):
Same as for pier 2.
Pier 4 (photo F10-03, -04:
Bottom: Access from Ind possible, with water ditch 2 m. Corrosion signs inside and outside. Inside water filled.
Pier 5 (photo F10-06):
Bottom: Staircase to land, sand surrounding (no water ditch). Heavy corrosion signs inside and outside.
Pier 6 (photo F9-01):
Same as for pier 5.
Pier 7 (photo F10-09, -10, -12, -13):
Bottom: Access possible, water ditch. Heavy corrosion signs inside and outside. Concrete filling defective.
Pier 8 (photo F10-14, -15):
Bottom: Access possible, water ditch. Heavy corrosion signs inside and outside.
Pier 9:
Bottom: Access possible, dry ditch. Heavy corrosion signs inside and outside.
Pier 10:
Bottom: Access possible, sand surrounding. Heavy corrosion signs inside and outside.
Pier 11:
Same as for pier 10.
Pier 12 (photo F10-17, -18):
Bottom: Access possible, sand surrounding. On Chardzhev side a 2,5 m buckling approx. 120 mm deep. Heavy corrosion signs inside and outside.
Pier 13 (photo F10-21):
Bottom: Access possible, water ditch. Heavy corrosion signs inside and outside.
Pier 14:

Same as for pier 13.

Pier 15:
Same as for pier 13.

Pier 16:
Same as for pier 13.

Pier 17:
Same as for pier 13.

Pier 18:
Bottom: Access possible, sand surrounding. Heavy corrosion signs inside and outside.

Pier 19:
Top: Bearing for 320 mm excentric from pier center. Grouting renewed and in good state. No defects of stone.
Bottom: Access possible, water ditch. Very heavy corrosion inside and outside. Hole at water level 2,5 m long (photo F10-22, -23).

Pier 20:
Same as for pier 13.

Pier 21 (photo F10-24):
Same as for pier 13.

Pier 22:
Bottom: Access not possible, pier rests in running water. Heavy corrosion signs inside and outside.

Pier 23 (photo F8-11 to -13):
Bottom: Acces with boat, corrosion defects.

Pier 24 (photo F4-36, -37, F8-06 to -09, F8-15, -16):
Bottom: Access with boat, pier rests in running water. Pier was hit by ship, heavy defects with buckling and bent parts. Corrosion inside and outside.

Pier 25 (photo F4-32 to -34, F8-01 to -03):
Bottom: Access with boat. Corrosion signs. Welded patches on various places. As plates are not weldable the welding is faulty.

Pier 26:
Pier on land, made of stone.

3.3.3 Proof Load Measurement

The proof loading was arranged at span No. 1 on 1996-09-11 at 09:30.
Length of the span 66,1 m.

Initial measurement	at point 0	1399 mm
	at point 7	1350 mm
	at point 14	1384 mm
Temperature:	air	36° C
	structure	27° C

***Loading*:**

1. Two locomotives: length 33 m, total mass 276 metric tons in centric position of span 1
2. Four locomotives: length 66 m, total mass 552 metric tons over total span 1

***Measurement*:**

1.	without locomotives:	left MG	1987 mm
		right MG	1987 mm
	with 2 locomotives	left MG	2015 mm
		right MG	2015 mm
		Deflection therefor 28 mm	
2.	without locomotives	right MG	1971 mm
	with 4 locomotives	right MG	2009 mm
		Deflection therefor 38 mm	

***Longitudinal movement of the bridge end*:**
Measured between movable bearing of the span 1 to fixed bearing of span 2:

Distance	without load	1063 mm	
	1. With 2 loc.	1058 mm	movement 5 mm
	2. With 4 loc.	1054 mm	movement 9 mm

A comparing computation is appended in Annex C.

3.3.4 Statical Computation of the Bridge Main Structure

See Annex C.

3.4 FORMER INSPECTIONS

3.4.1 Results of Inspection of Bridge

It can be stated that the bridge is under permanent supervision as it was reported to the expert and can be read also in the translated report.
This report refers in part I chapter 1.1 of the design and erection of the bridge, in chapter 1.2 of previous inspections which happened in 1928, 1947, 1952, 1959, 1966, 1980, 1984.
Part II refers of the results of the last very thorough inspection at 1990-91 by the experts of „Bridges and laboratory of bridges construction of MIIT".
In general the results of that inspection are similar with these obtained in the present time but are more extensive.
In Annex D some of the results of that investigation are summarised to have a quick overview for decisions.

3.5 FEASIBILITY OF LIFE EXTENSION

3.5.1 Short time activities

Within the remaining years but starting immediately the following actions should be executed:
The piers should be checked regularly at least after each high water situation. Especially the state of the piers which are situated in the main water flow have to be kept under supervision regarding inclination and vibration signs. The heavy leaks at water level should be repaired to prevent sudden break down in a low water level periode.
The structure should be checked regularly, as a minimum every 6 months to detect new cracks, loose bolts and rivets. Such checks should be concentrated to the connection longitudinal girders to cross girders, cross girders to main girder lower chord. The rivets and the straightness of horizontal bracing between the longitudinal girders should be observed. The rivets of lower chord in the region of point 5 to 9 and also the connection of diagonals 0 - 1' and 1' - 2 should be checked.
The axle loads should not be increased but better decreased as the number of cracks and loose rivets detected during previous inspection is a caution signal. As the expert stated at site the trains should be divided in parts with less loading of each span - this has the same background.
The corrosion situation of the bridge is also alarming. Corrosion flaws are serious starting points of fatigue cracks, and as the structure is very carefully enwrapped in the above mentioned special cement envelope which is absolutely intransparent there is a high grade of danger of undetected cracks. A thorough protective treatment is anavoidable and should be done as soon as possible: total removing of the existing coating by means of carefully sandblasting (all other means are unsufficient) and subsequent within 24 hours applying of the first painting. Then three further paintings (including edge protection) should be brought up. Airless spray method has to be used as the design details of some elements show very narrow gaps which could not be protected otherways. Where some pocket holes or boxes exist dewatering borings should be executed to enable water flow.

3.5.2 Long time activities

Lifetime of bridge structures similarly designed could be more than 100 years as examples from Germany or other countries show but very carefully corrosion protection and regular inspection (which is done in this case) is postulated.
It cannot be said how the results are when the bridge is sandblasted and the exact state ot the structure is visible.
In knowledge of the above investigations the bridge should be replaced within the next 10 years if not renewed in a high degree. As it is known from similar structures renewing of riveted structures is very complicated and costly so in this case a total new structure would be cheaper. The renewing should enclose all connections between longitudinal and cross girders and to the main girder lower chord and the lower chord itself (due to its very heavy corrosion damages). This is the judgement without knowledge of the result of evidence after sandblasting of the structure.
It is not recommended to use the existing piers to place a new structure on them without thorough investigations of the river bottom and of the state of steel plate tubes and inside concrete. There are strong suspicions that the load carrying capacity is very low due to water intrusions and corrosion effects.

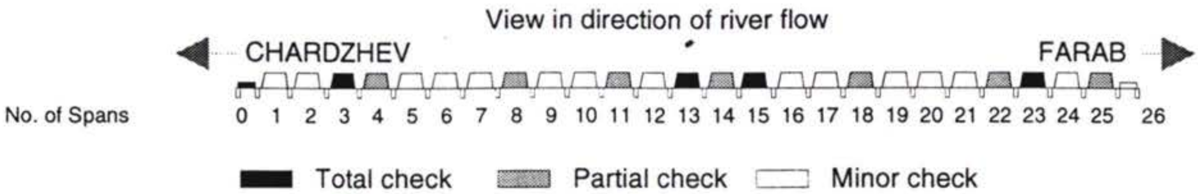
3.6 APPENDICES

APPENDIX A - BRIDGE SYSTEM AND NOTATIONS
APPENDIX B - PHOTGRAPH DOCUMENTATION
APPENDIX C - CHECK COMPUTATION
APPENDIX D - SUMMARY OF FORMER INSPECTIONS

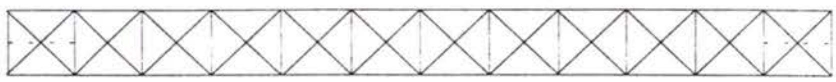
TRACECA - MODULE C - WS 3200 CHARDZHEV BRIDGE

APPENDIX A
BRIDGE SYSTEM AND NOTATIONS

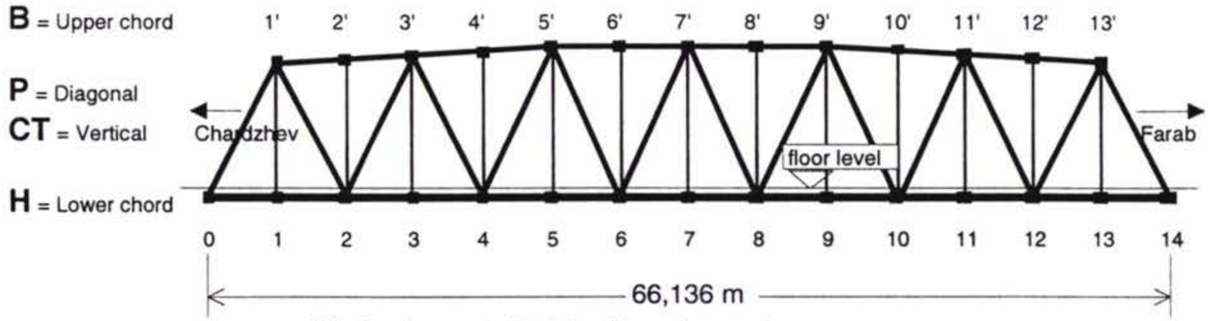
BRIDGE SYSTEM AND NOTATIONS



Upper Bracing - Plan

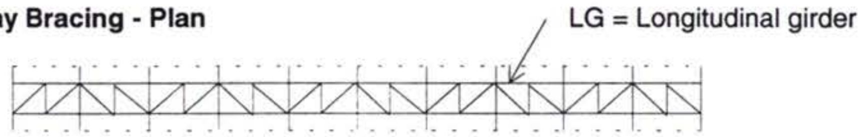


Main Girder - View

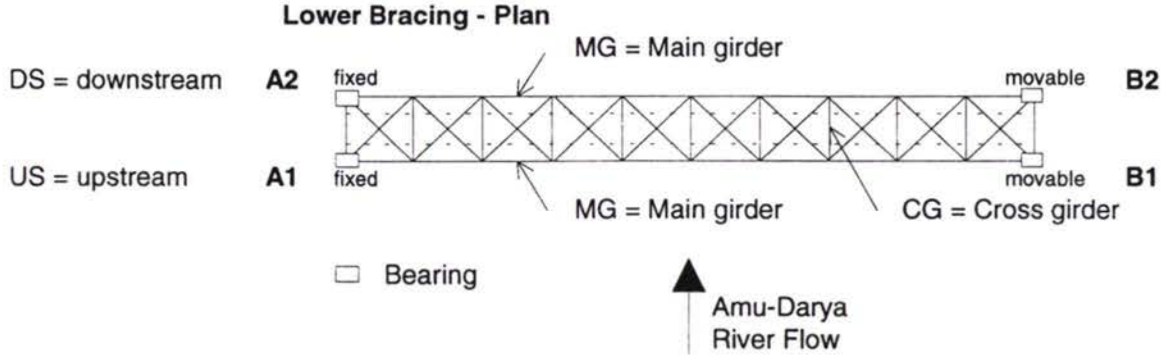


▪ Nodes (gusset plates) with node numbers

Sway Bracing - Plan



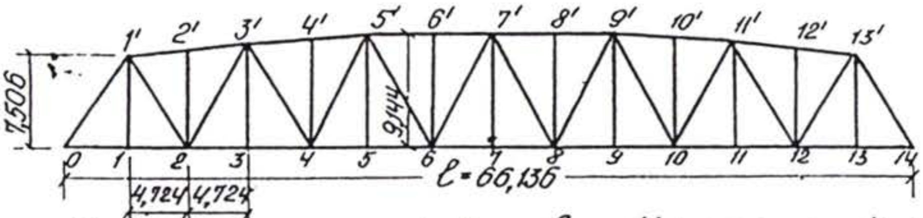
Lower Bracing - Plan



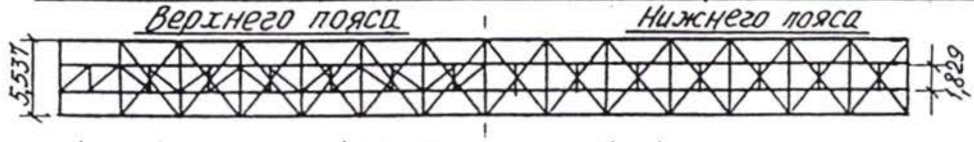
A/2

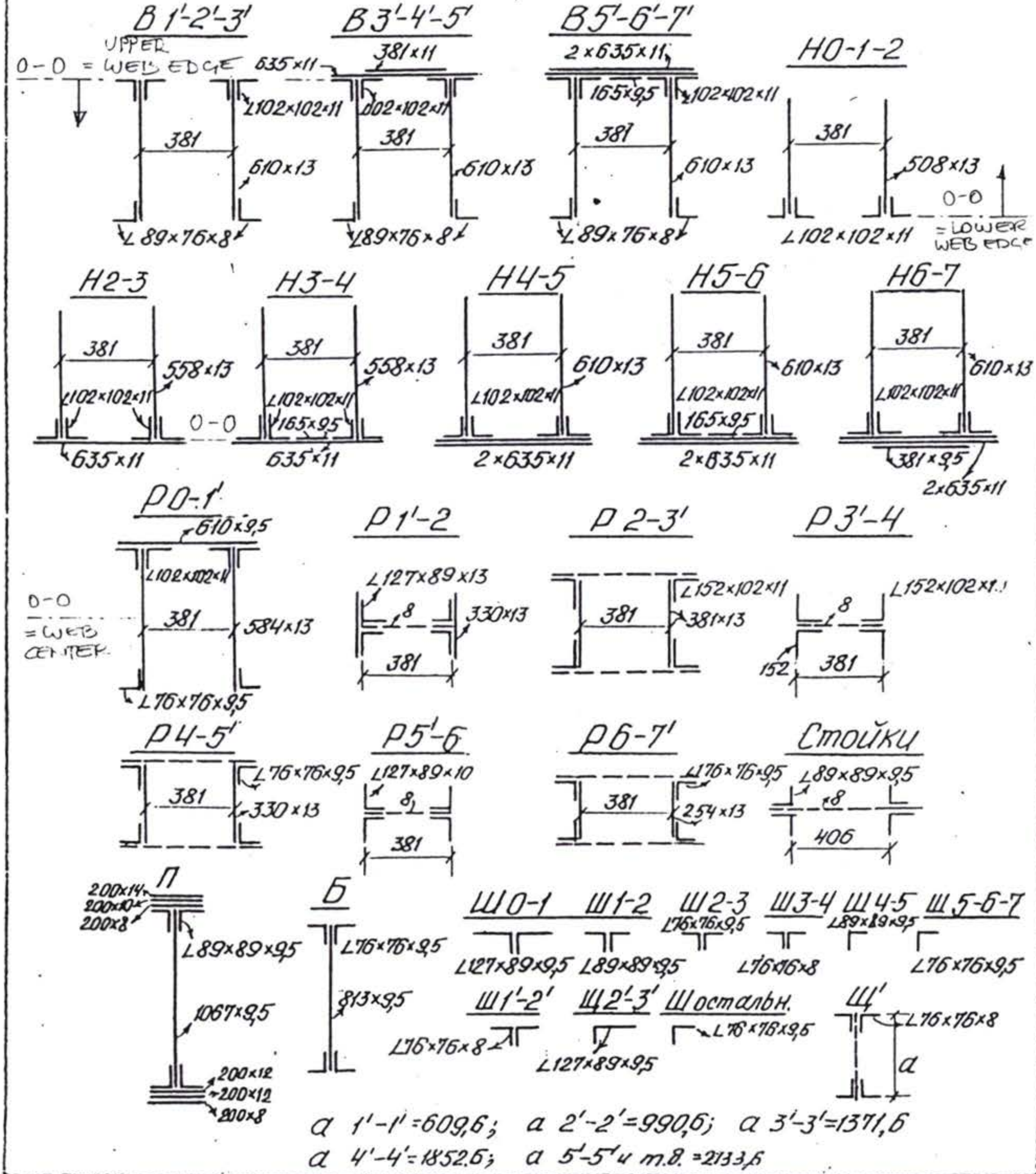
SYSTEM, NOTATIONS, CROSS SECTION DIMENSIONS

Схема главных ферм и связей речных пролетов



План горизонтальных связей и проезжей части

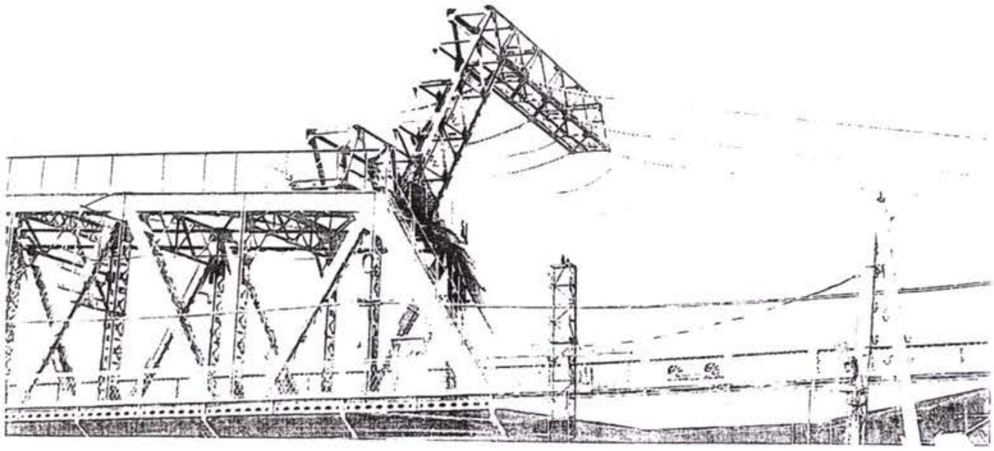




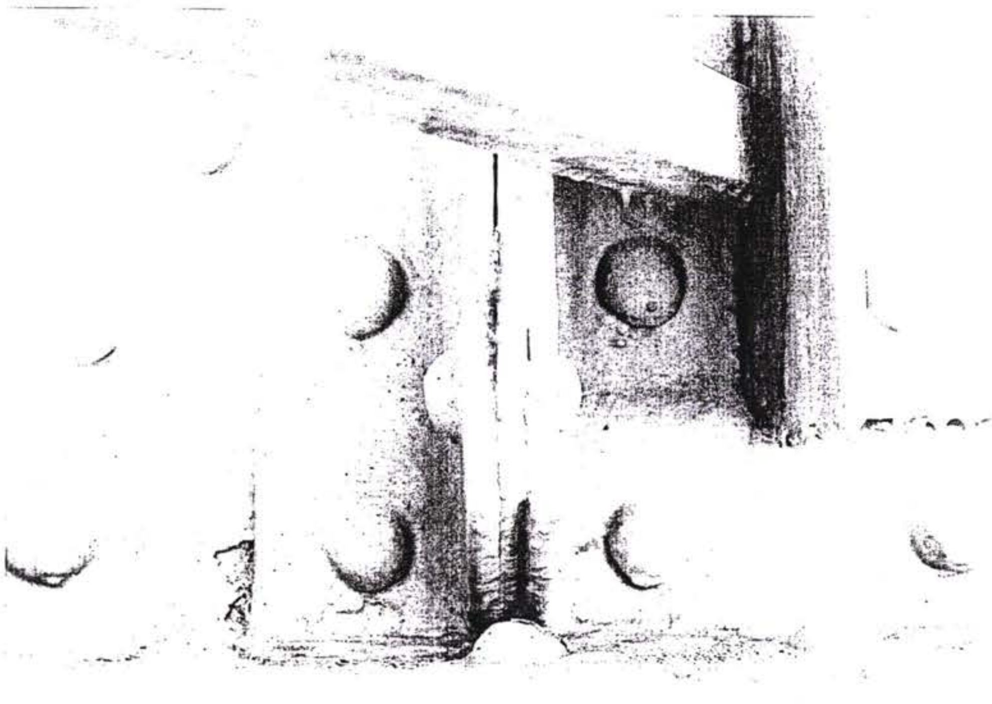
a 1'-1' = 609,6; a 2'-2' = 990,6; a 3'-3' = 1371,6
a 4'-4' = 1852,6; a 5'-5' и т.д. = 2133,6

TRACECA - MODULE C - WS 3200 **CHARDZHEV BRIDGE**

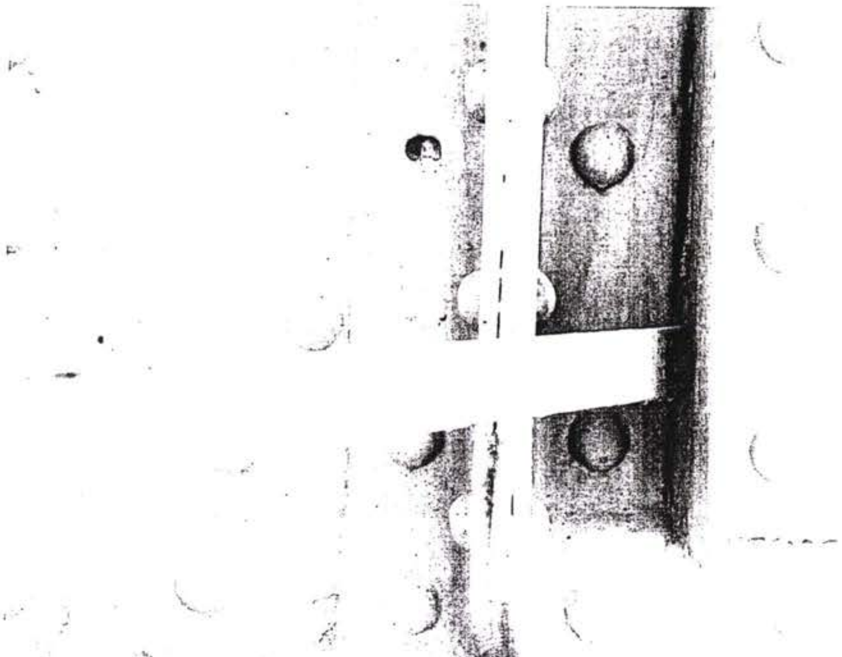
APPENDIX B
PHOTOGRAPH DOCUMENTATION



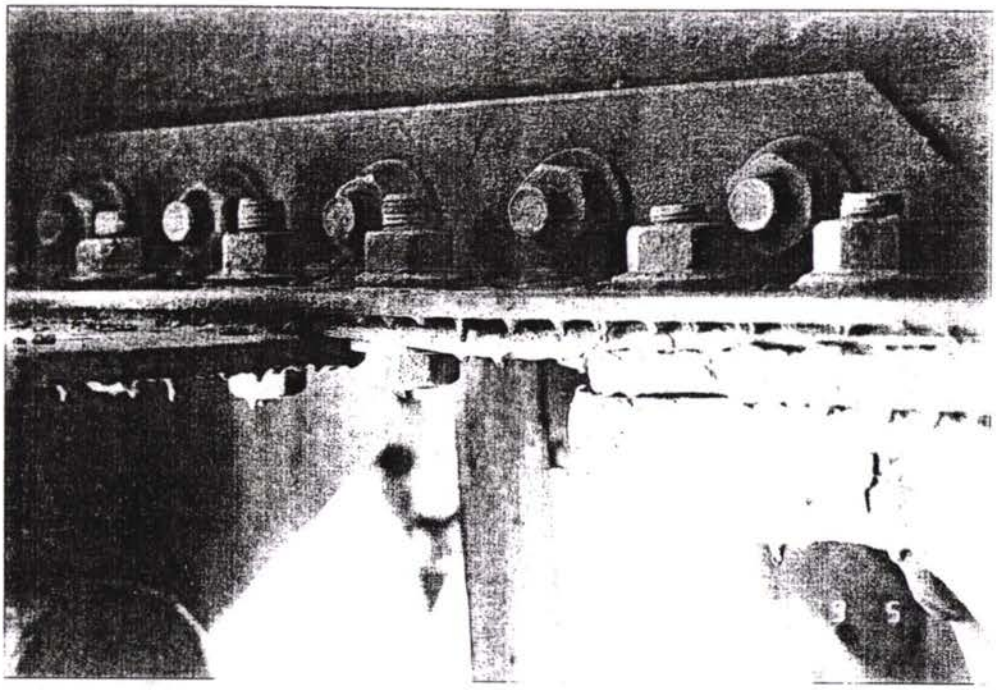
F1-08 Span 3
HV cantilever



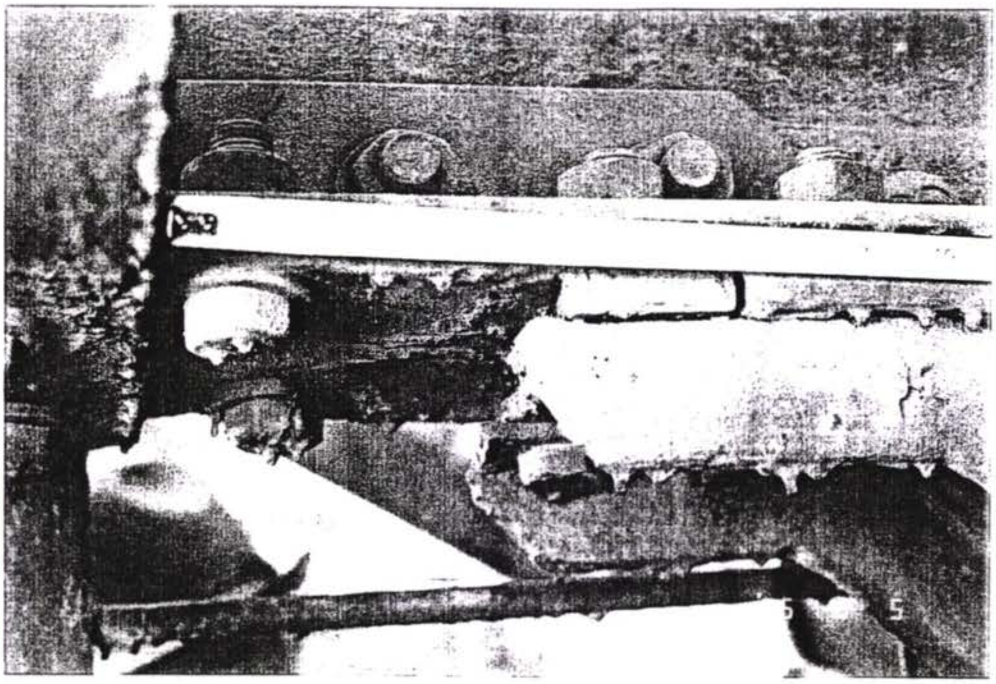
F1-09 Span 3
Cross girder corros.



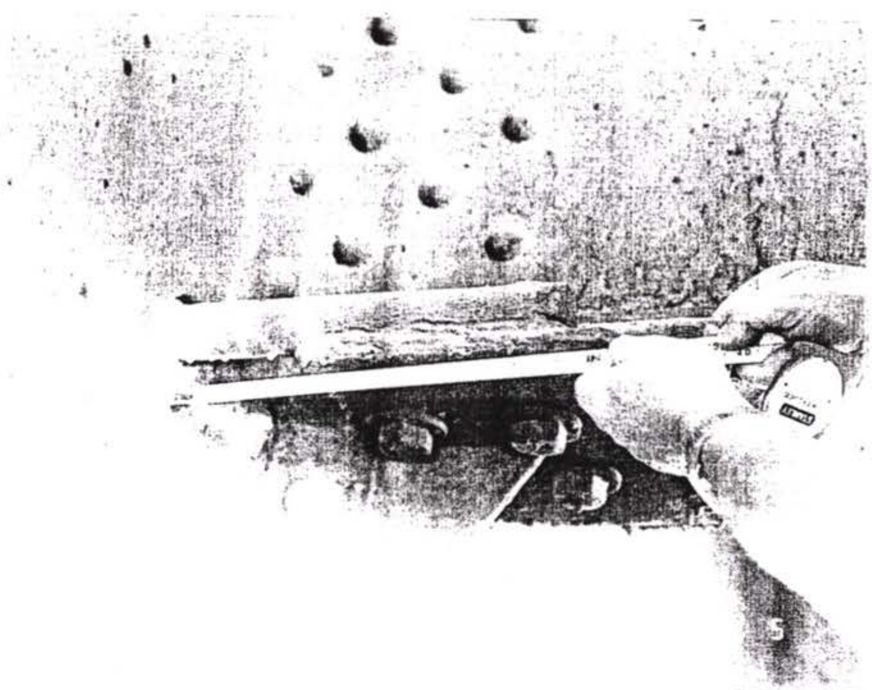
F1-10 Span 3
Cross girder
missing rivet



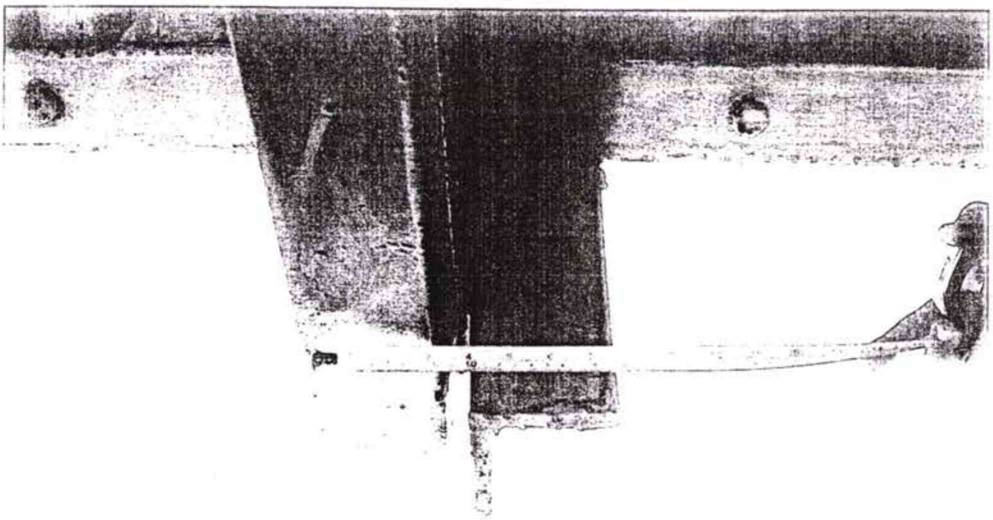
F1-11 Span 3
Cross girder streng-thening, as per 80% of all cross girders



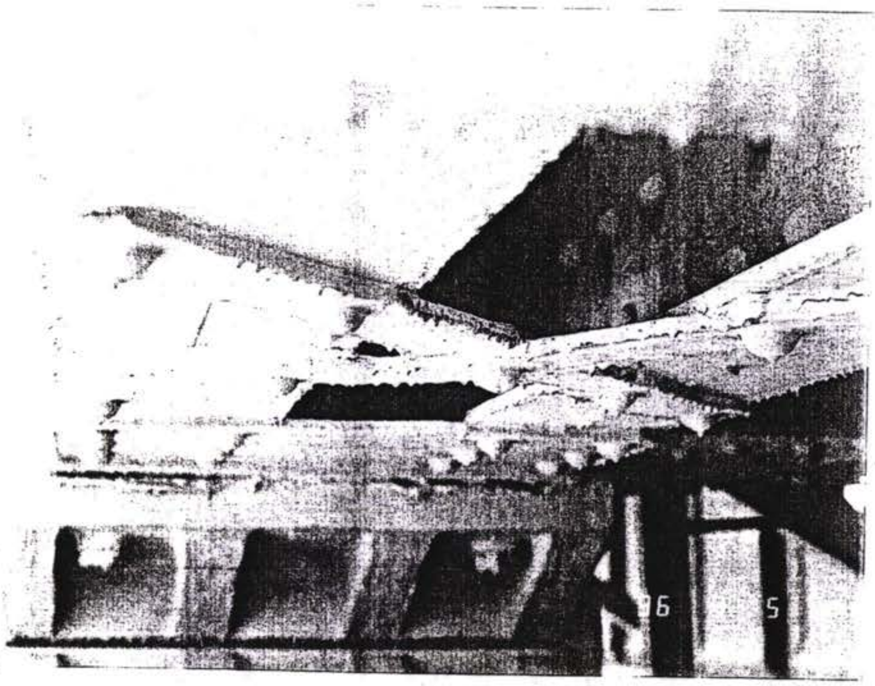
F1-12 Span 3
As F1-11, from below



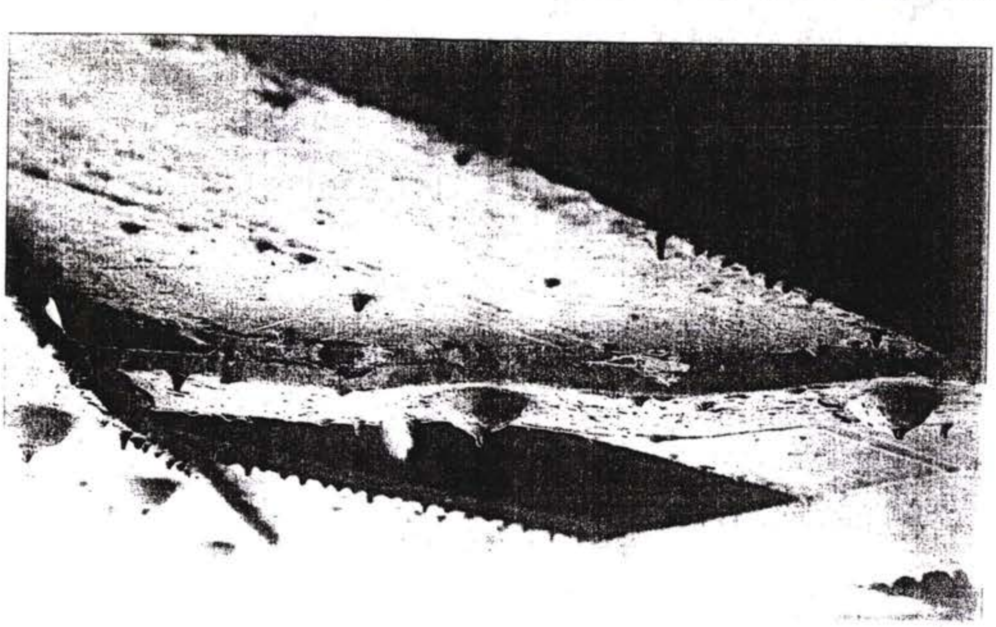
F1-13 Span 3
Longitudinal girder strengthening, cross girder perforated



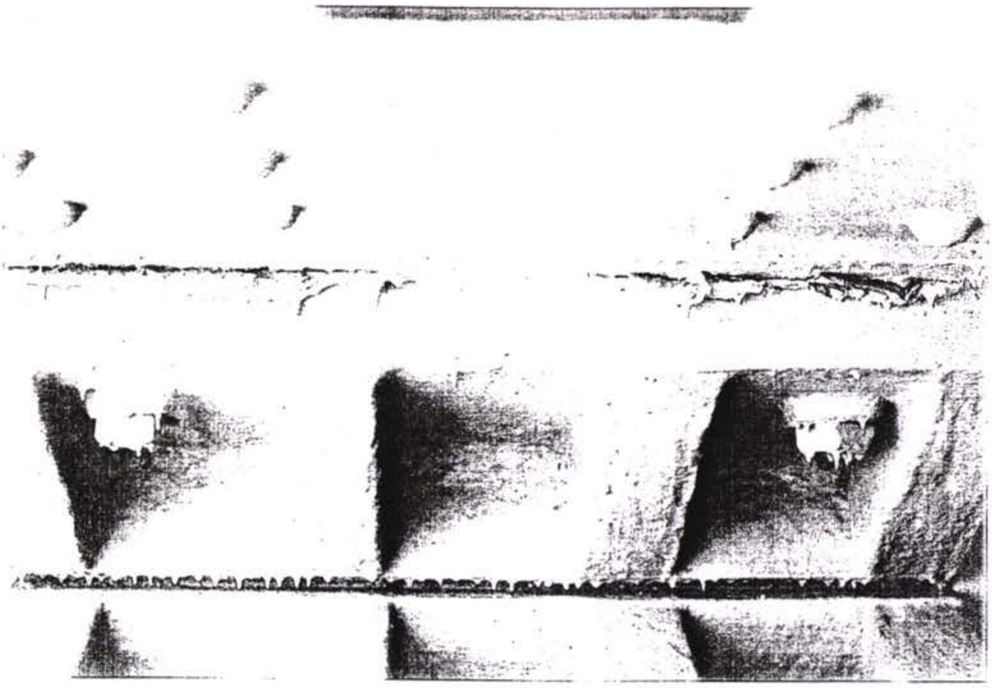
F1-14 Span 3
New runway canti-lever girder bolted, otherwise welded



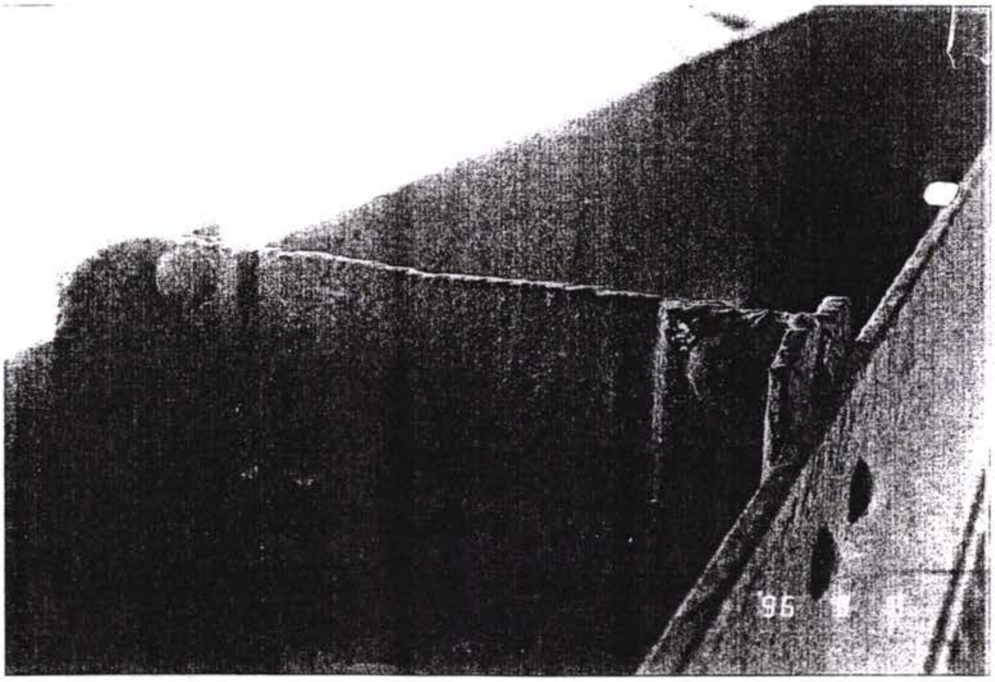
F1-15 Span 3
Deformed LC brackets



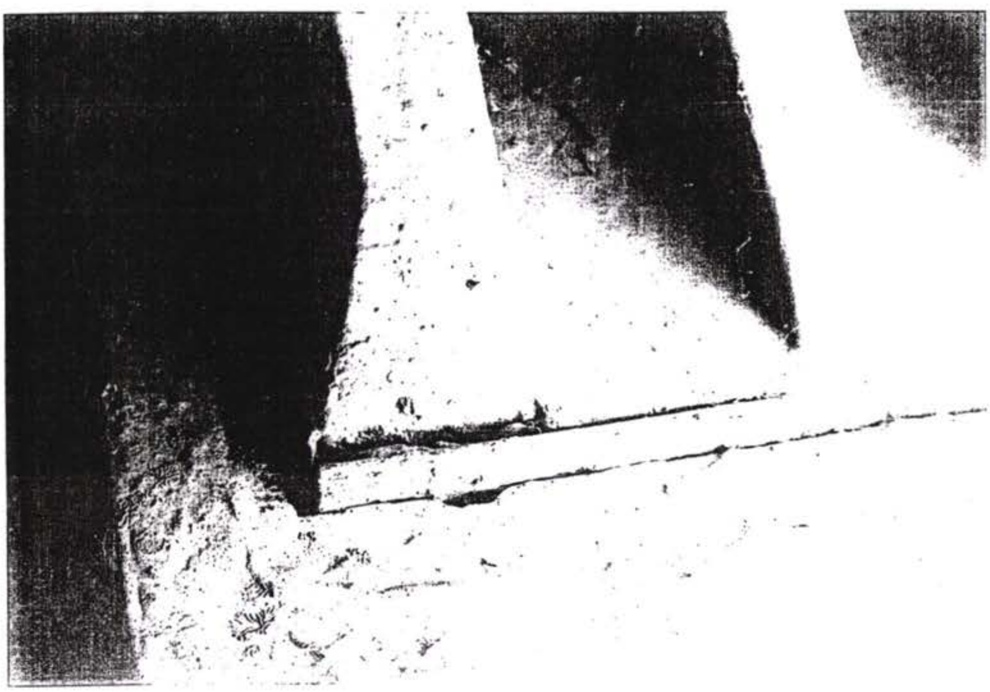
F1-16 Span 3
As F1-15, side view



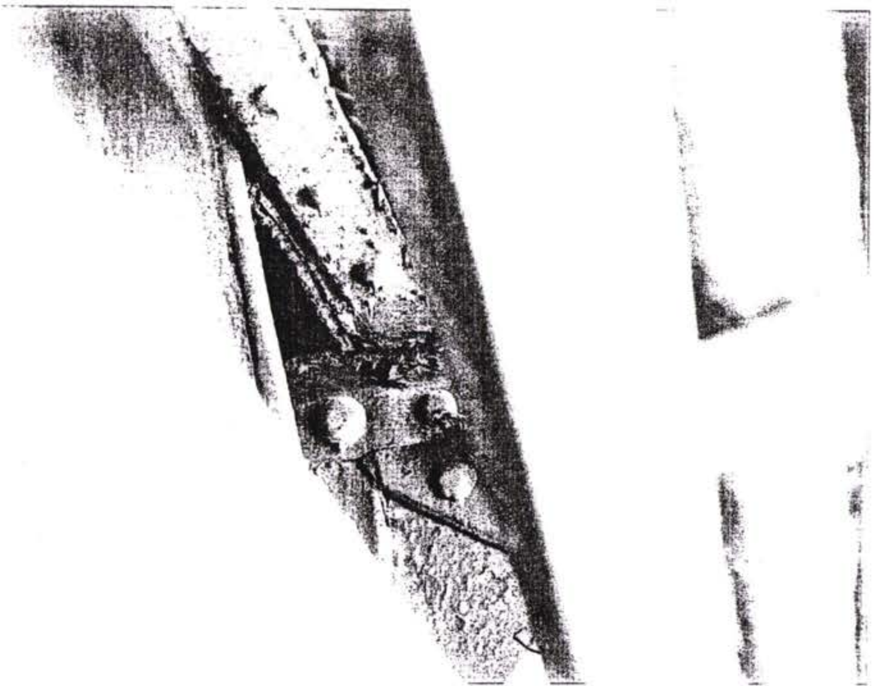
F1-17 Span 3
Fixed bearing with lead inlay, sqeezed



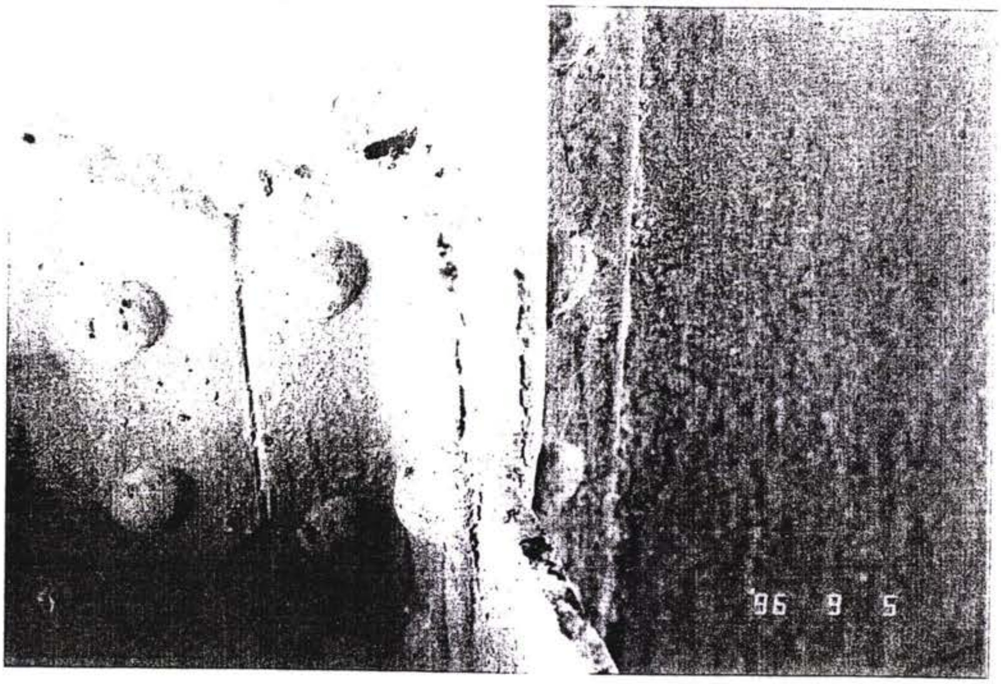
F1-18 Span 3
All runway canti-levers DS are cut off



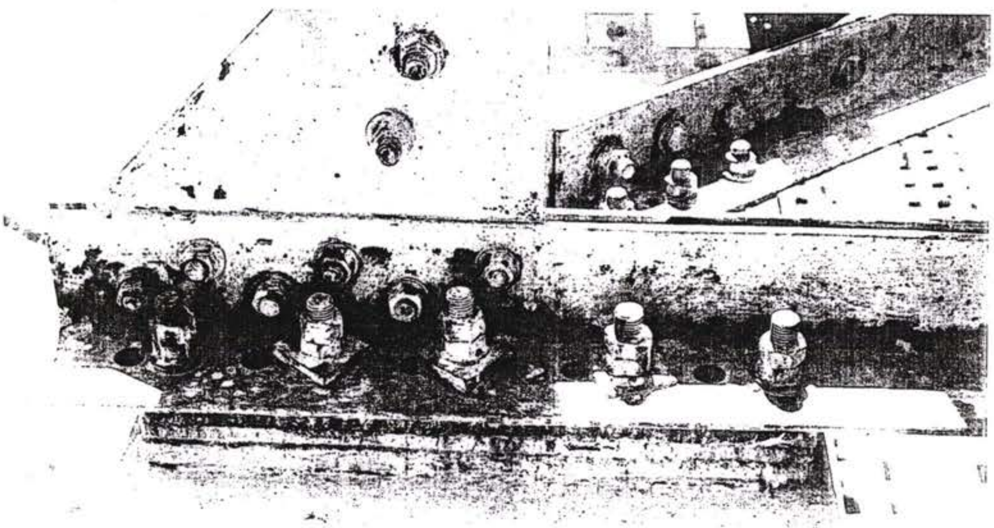
F1-20 Span 3
Fixed bearing lower part with fixing wedge



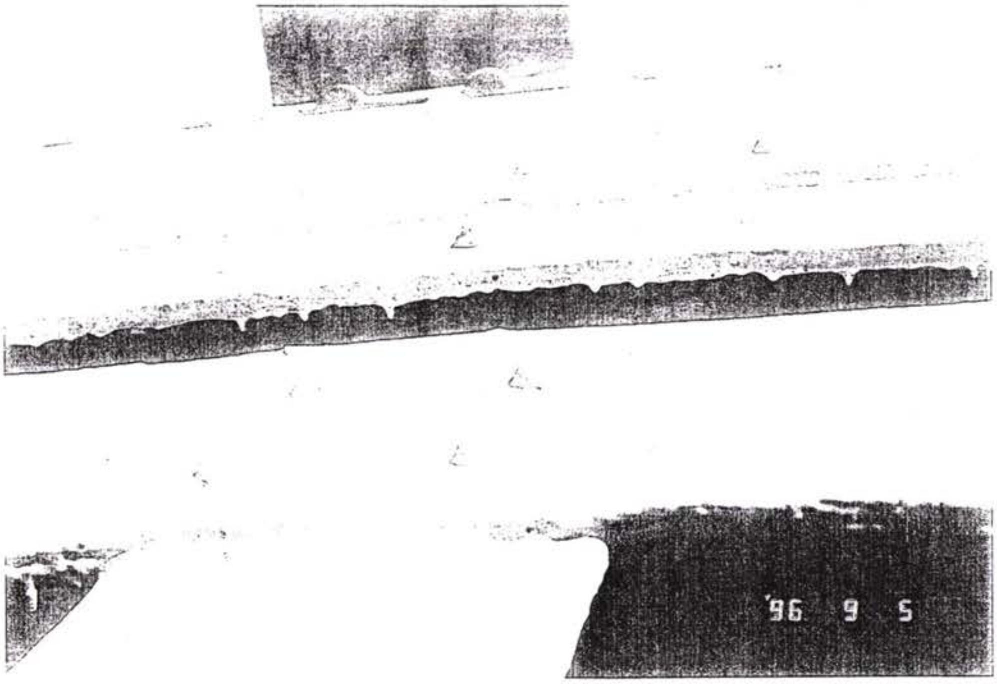
F1-21 Span 3
Corroded longitud. girder



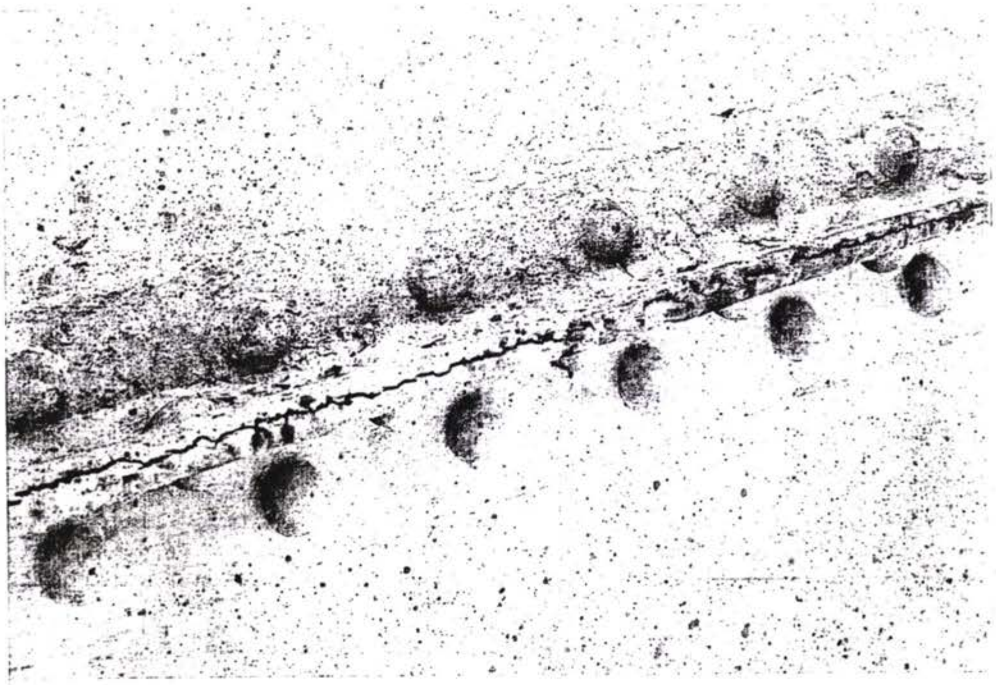
F1-22 Span 3
LC angle joint to cross girder filled up with spec.cement



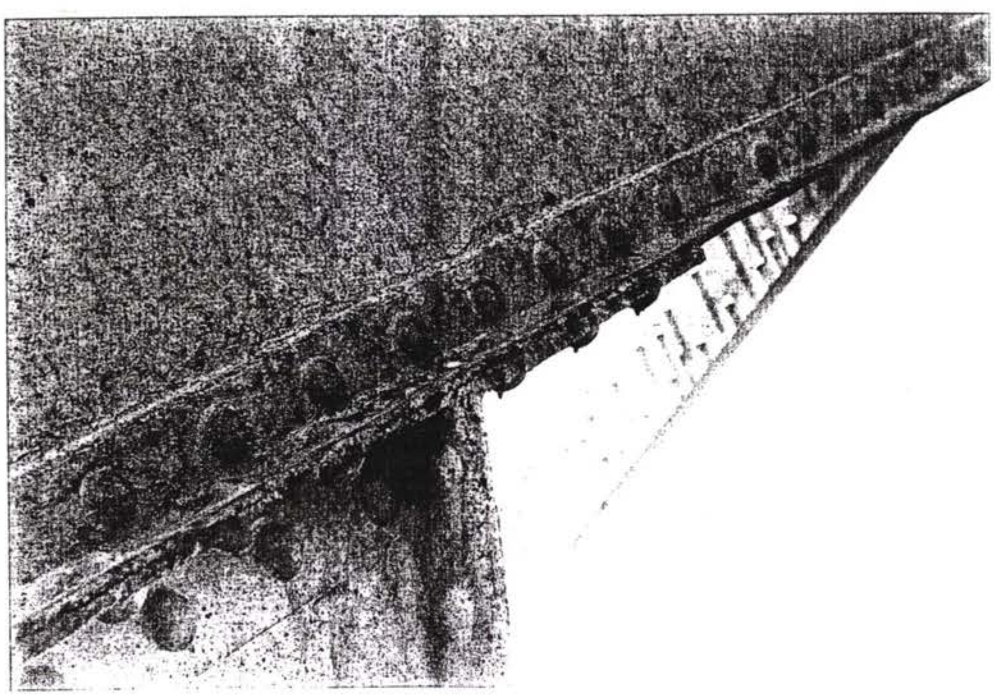
F1-23 Span [illegible]
Fixing [illegible] canti-lever arms



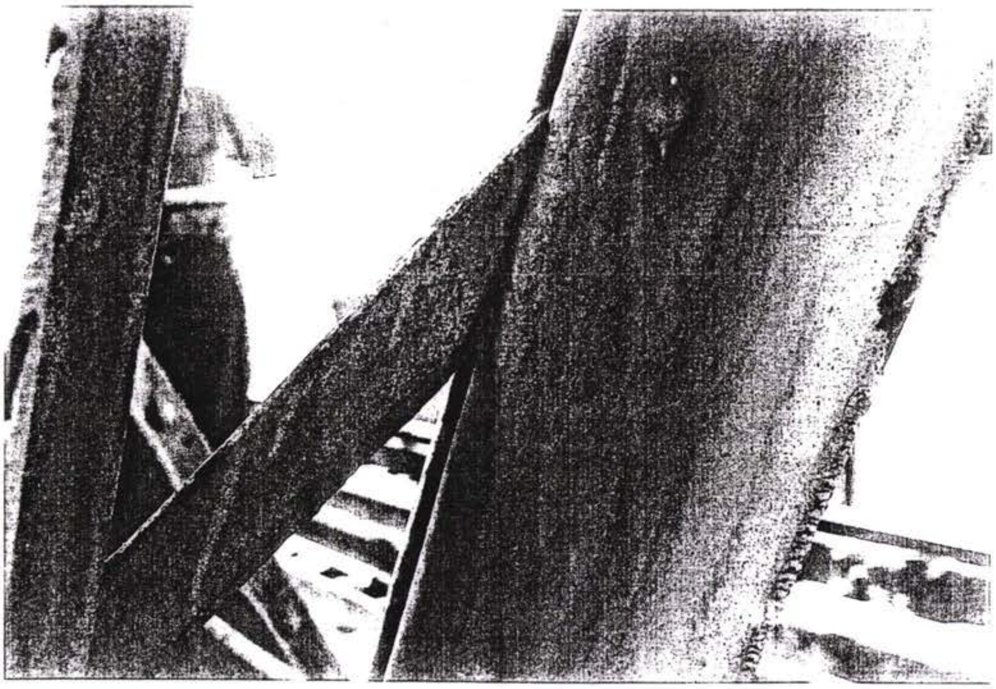
F1-25 Span 3
UC joint to cross bracing



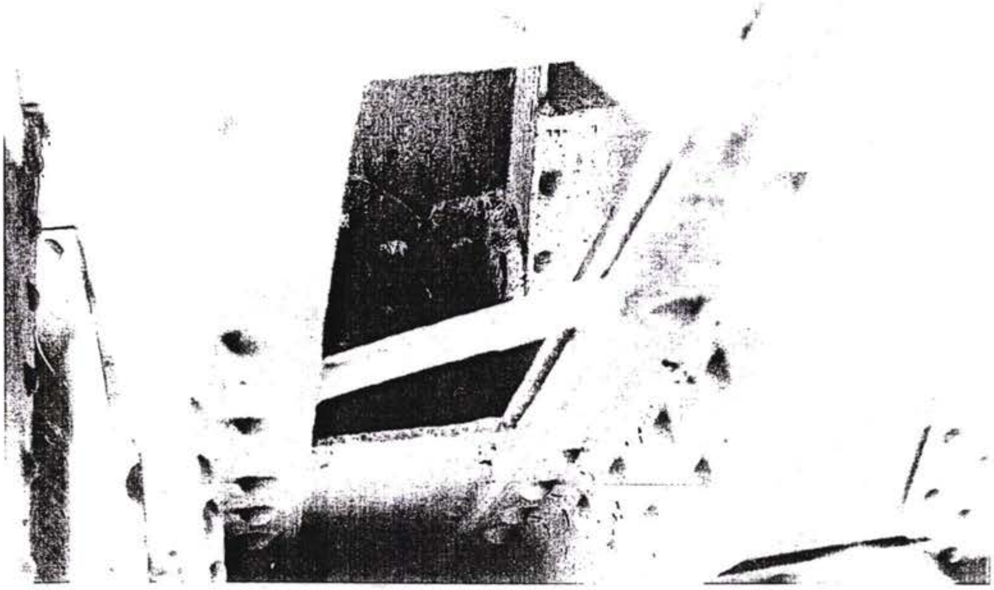
F1-26 Span 3
UC strengthening angle corrosion



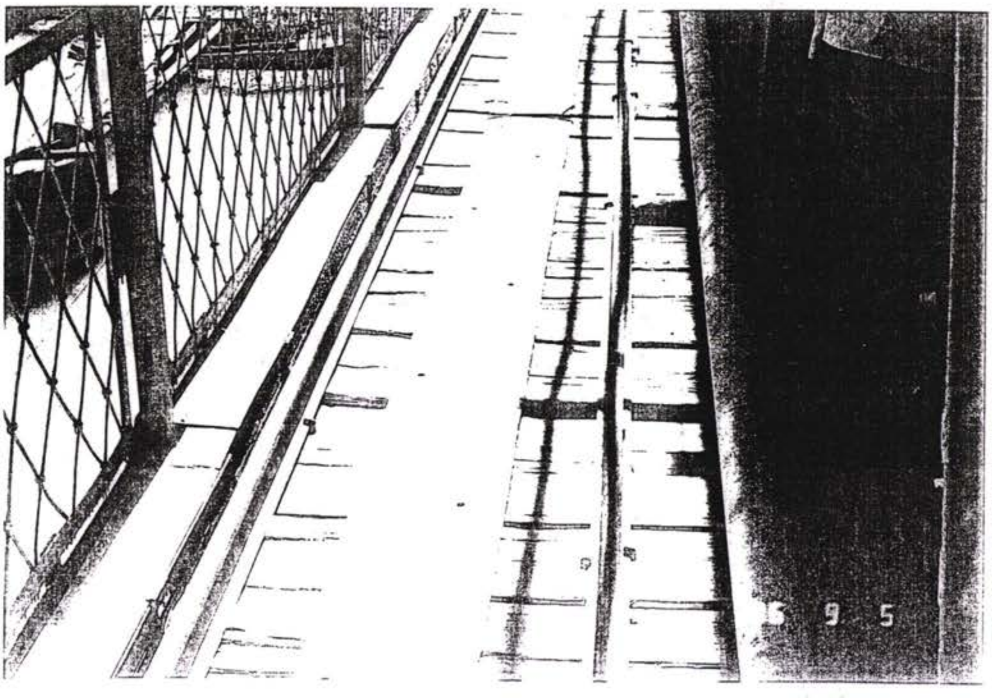
F1-27 Span 3
UC strengthening angle corrosion



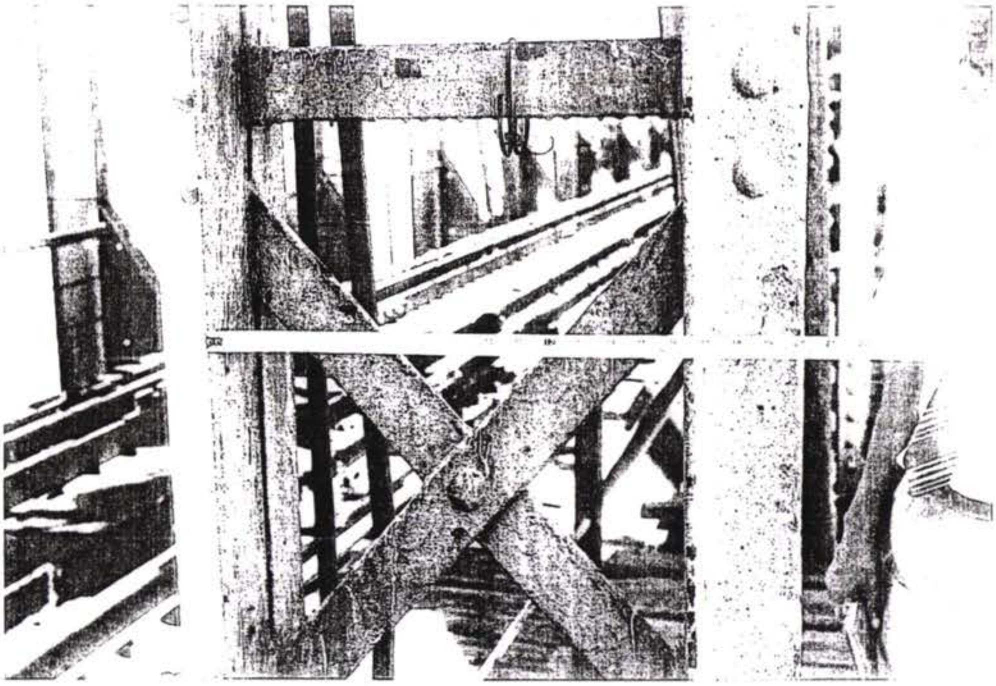
F1-28 Span 3
Corrosin at diagon.



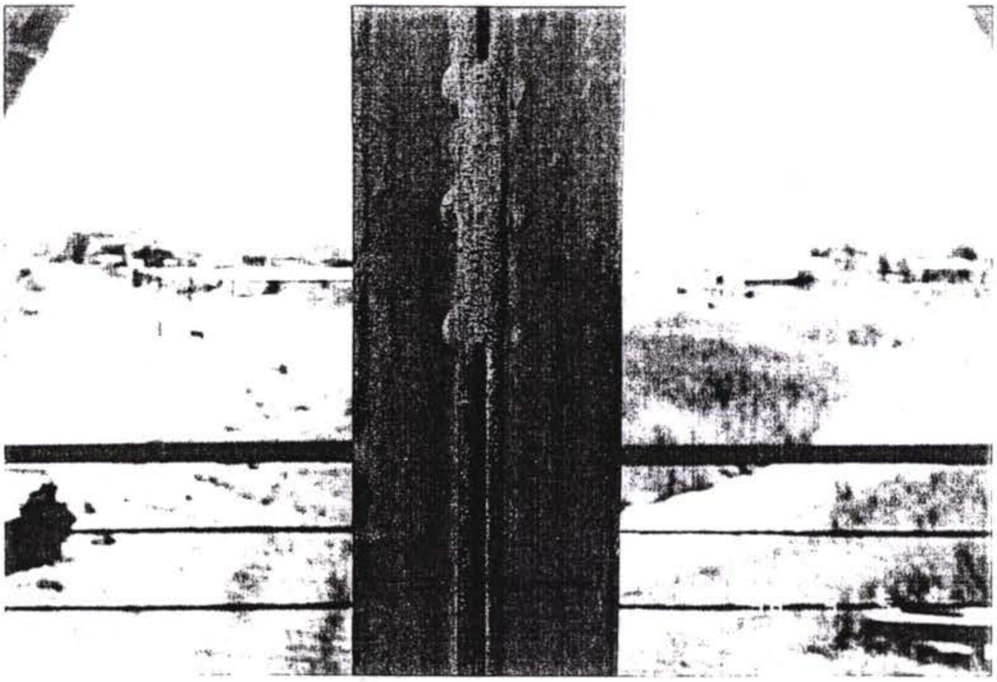
F1-29 Span 3
As F1-28



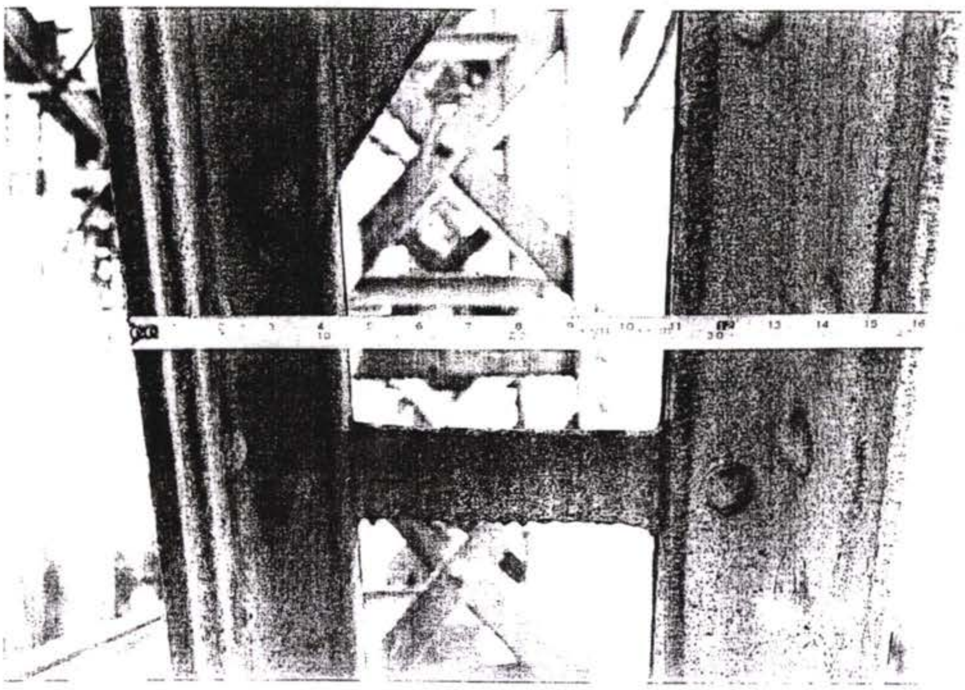
F1-30 Span 3
Runway with rails
for transport lorry



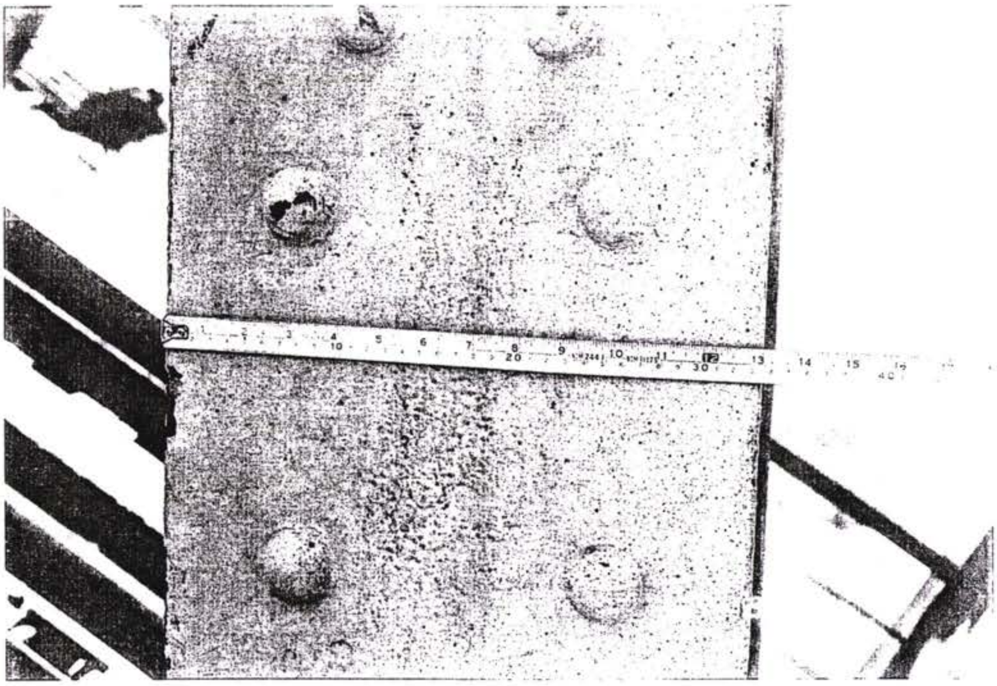
F1-31 Span 3
Vertical with bracing



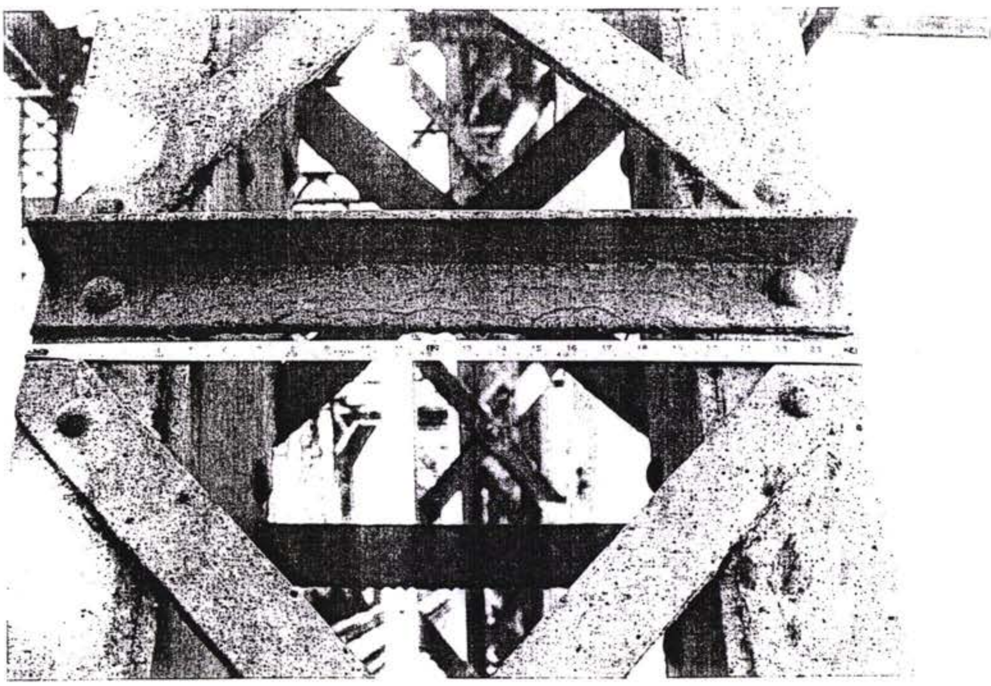
F1-32 Span 3
Vertical with cut off railing cantilever



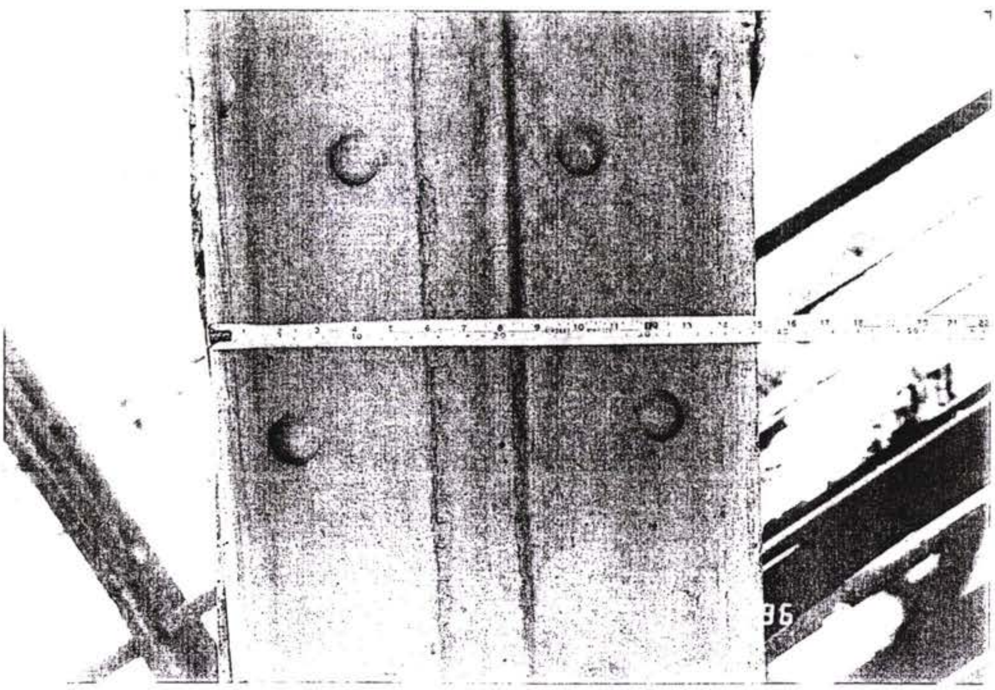
F1-33 Span 3
Diagonal



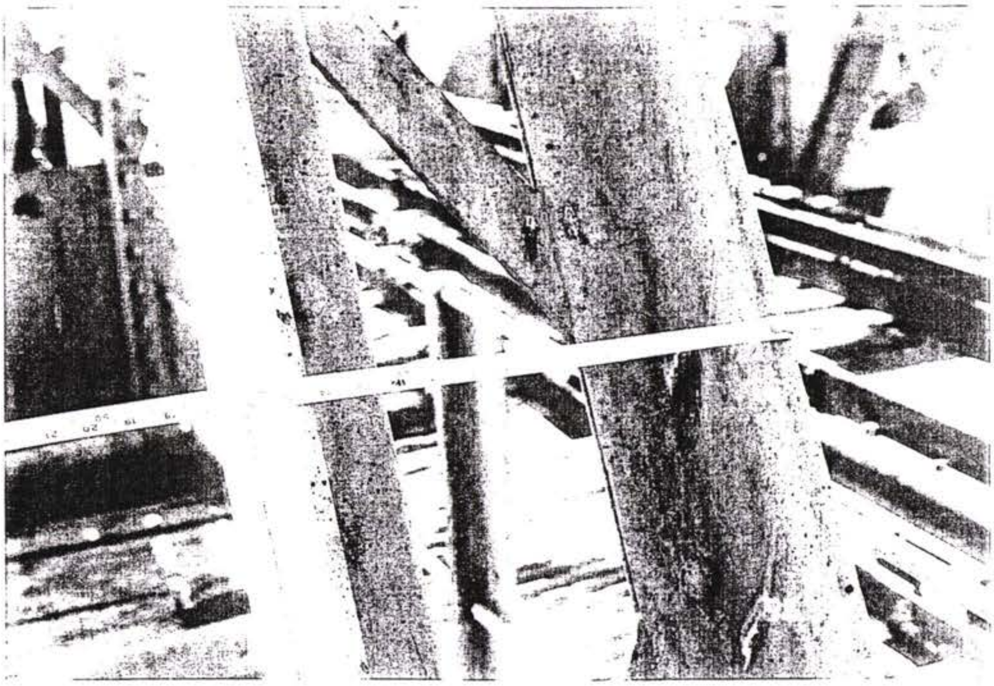
F1-34 Span3
As F1-33



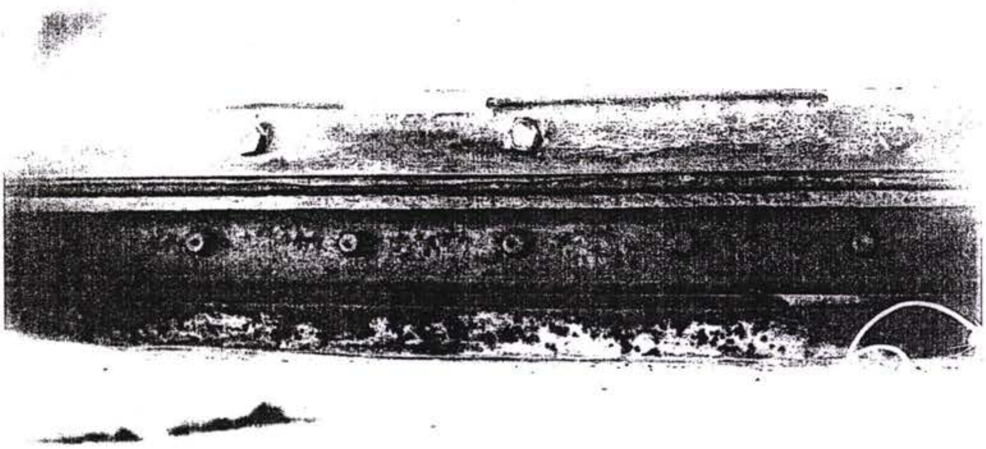
F1-35 Span 3
Diagonal



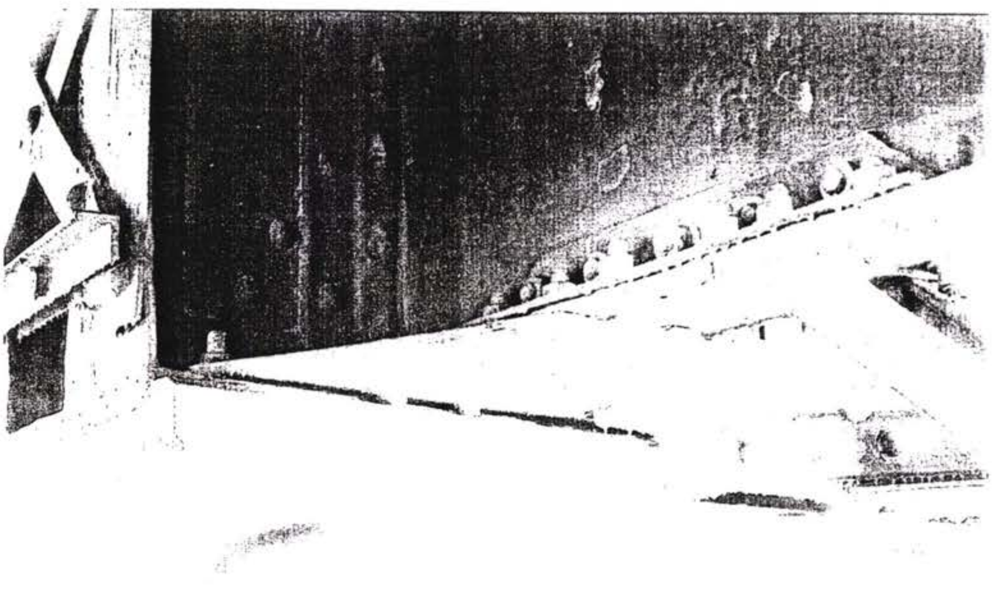
[illegible]



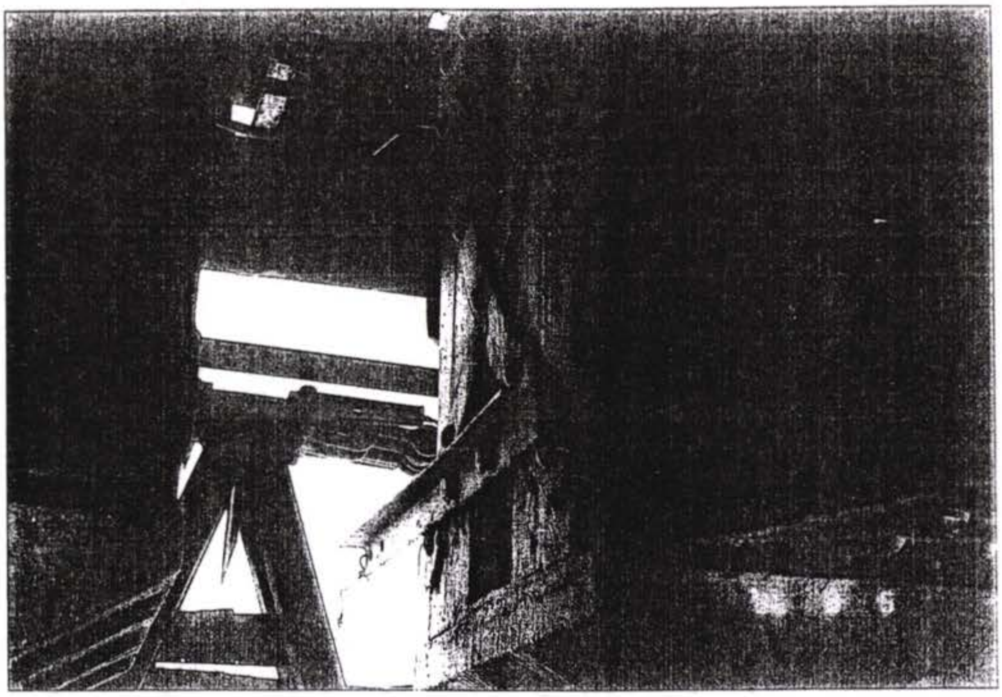
F1-37 Span 3
Diagonal



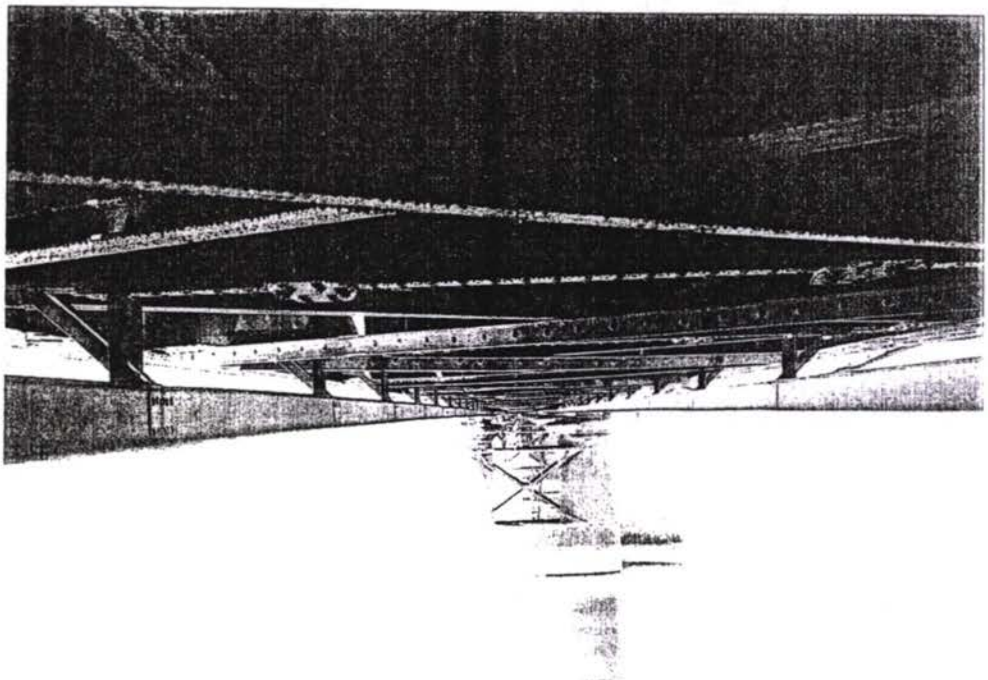
F2-01 Span 3
Movable bearing
Lower part



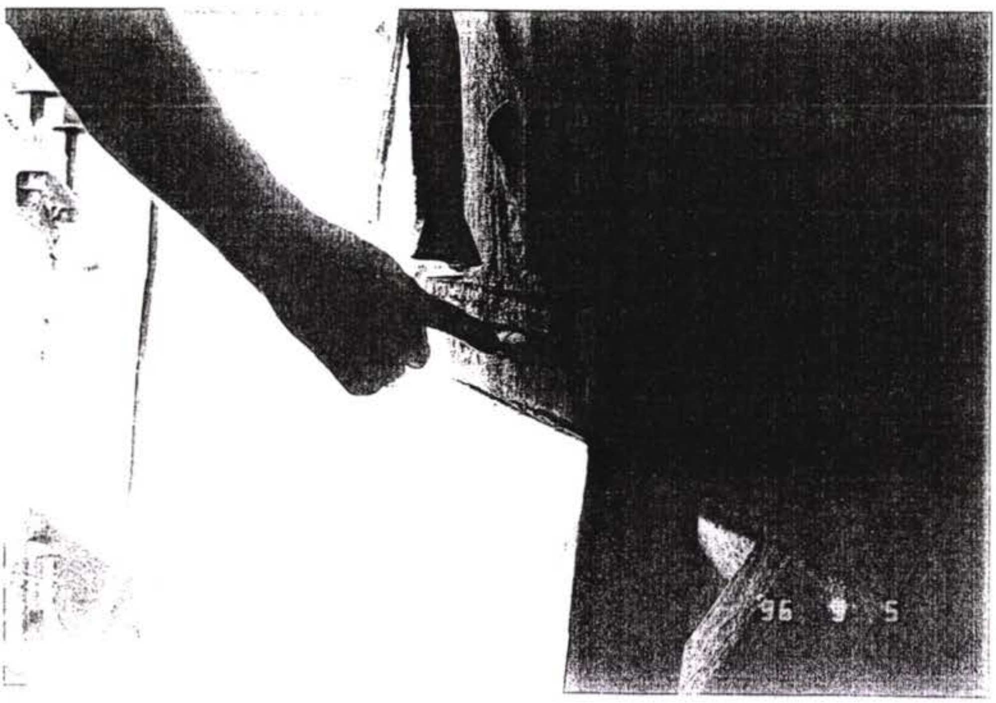
F2-02 Span 3
End cross girder
at movable bearing



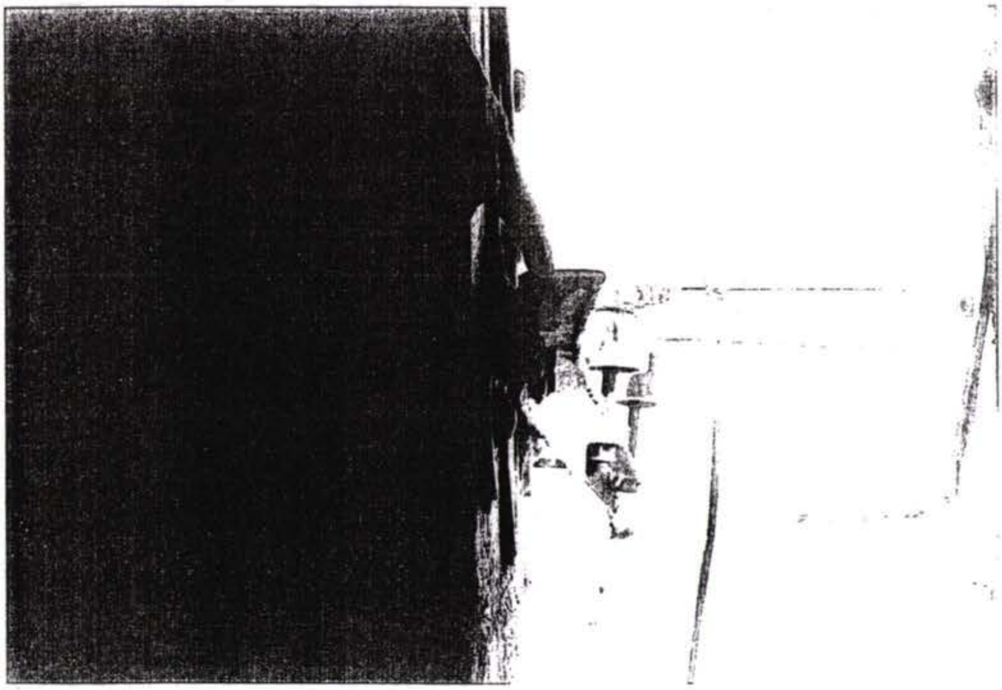
F2-03 Span 3
Bearing
(flashlight defect)



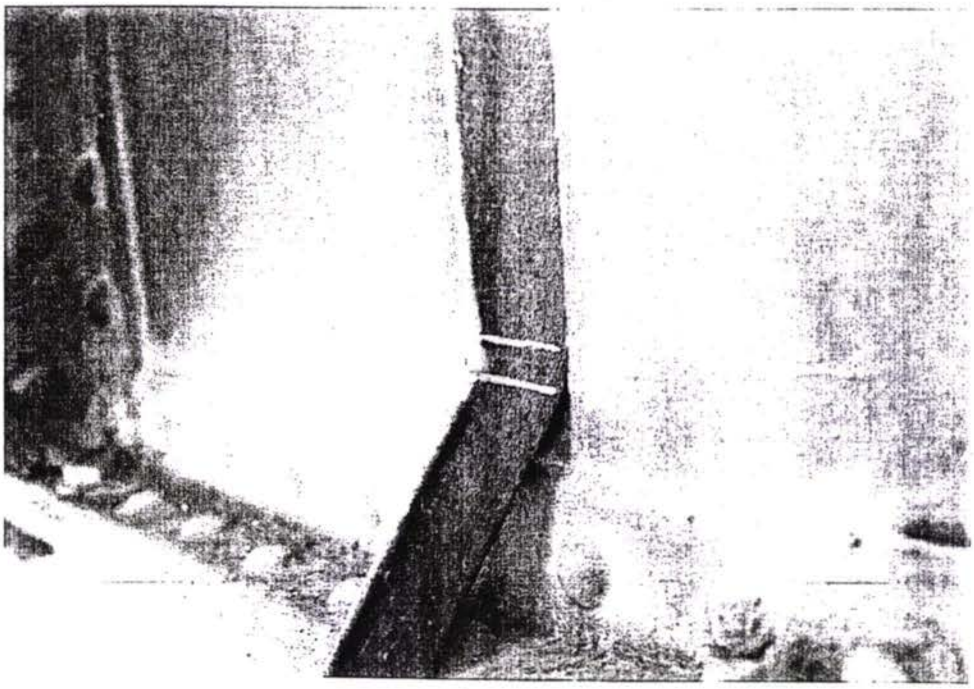
F2-04 Span 3
View from pier
with rails for
inspection car



F2-05 Span 3
Bearing with
squeezed lead inlay

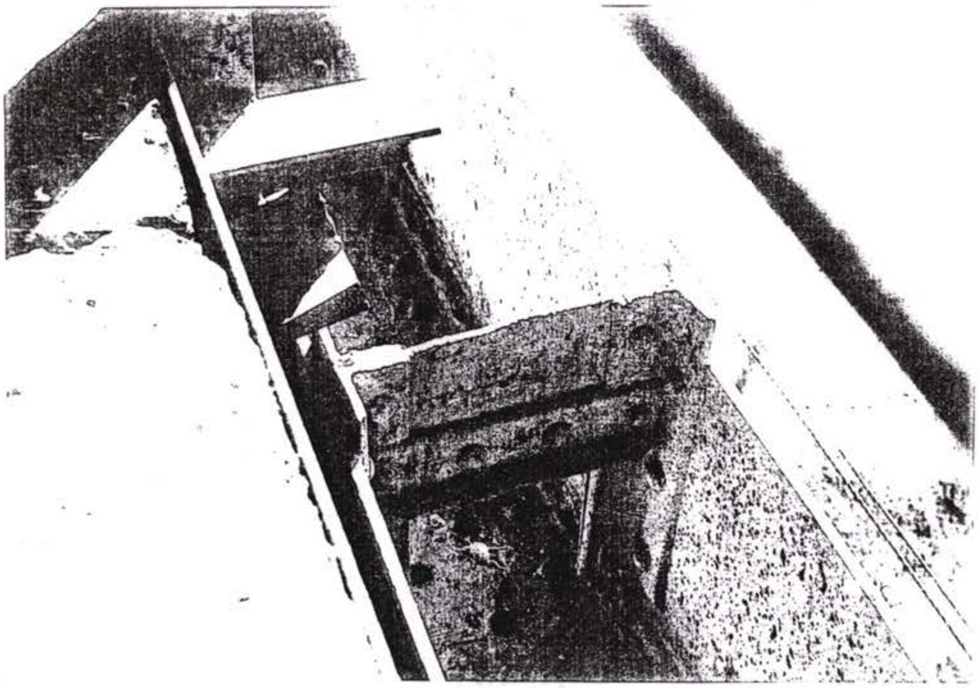


F2-06 Span 3
Angle for current conductors for ship signals

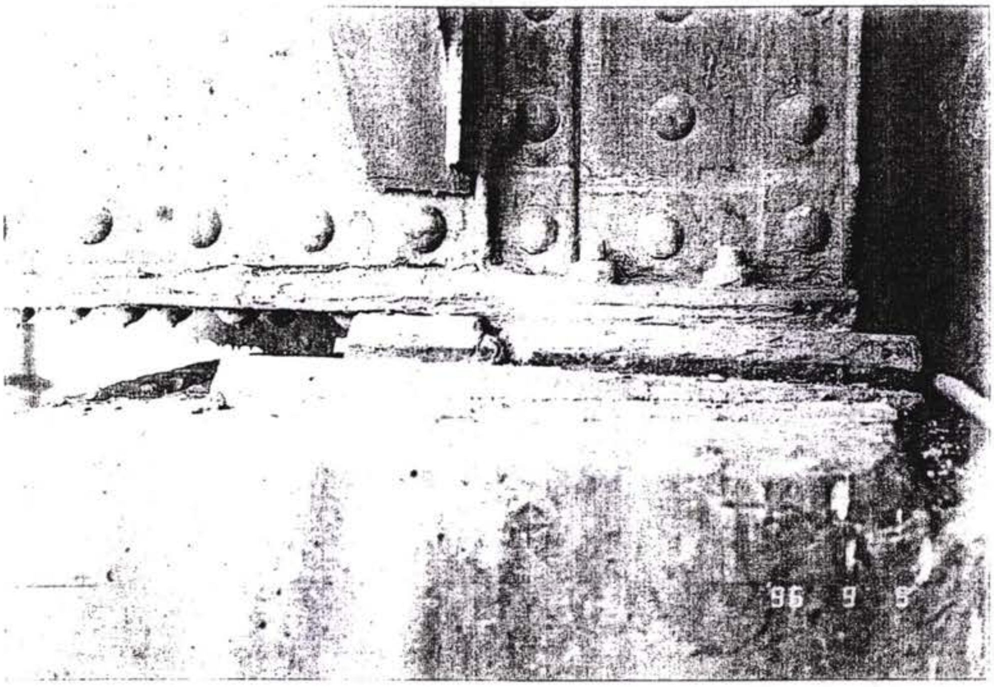


F2-07 Span 3
Cracked angle of inspection car rail

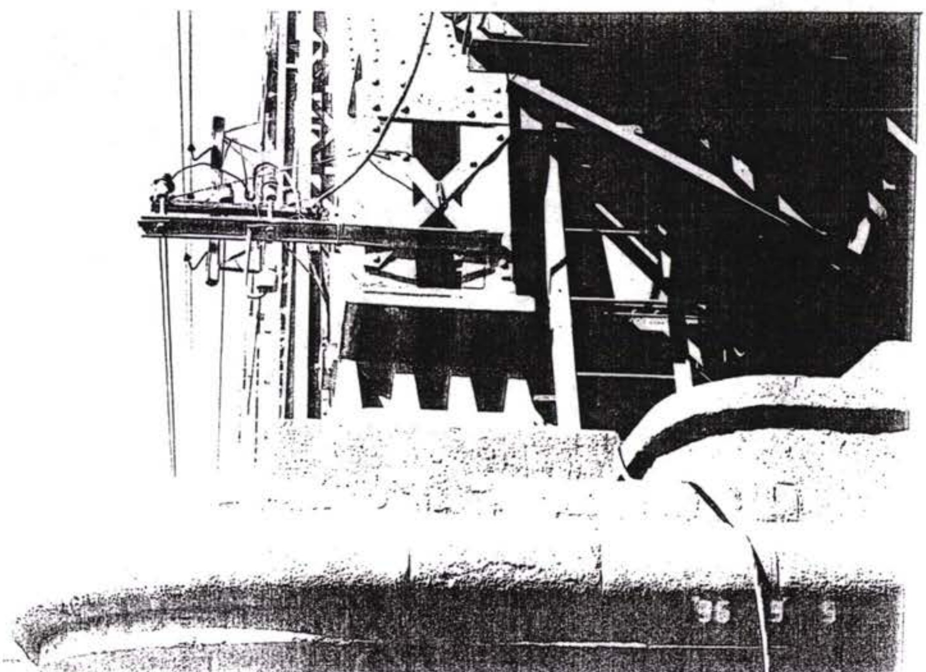
F2-08 Span 3
Loose support of telephone brackel. [illegible]



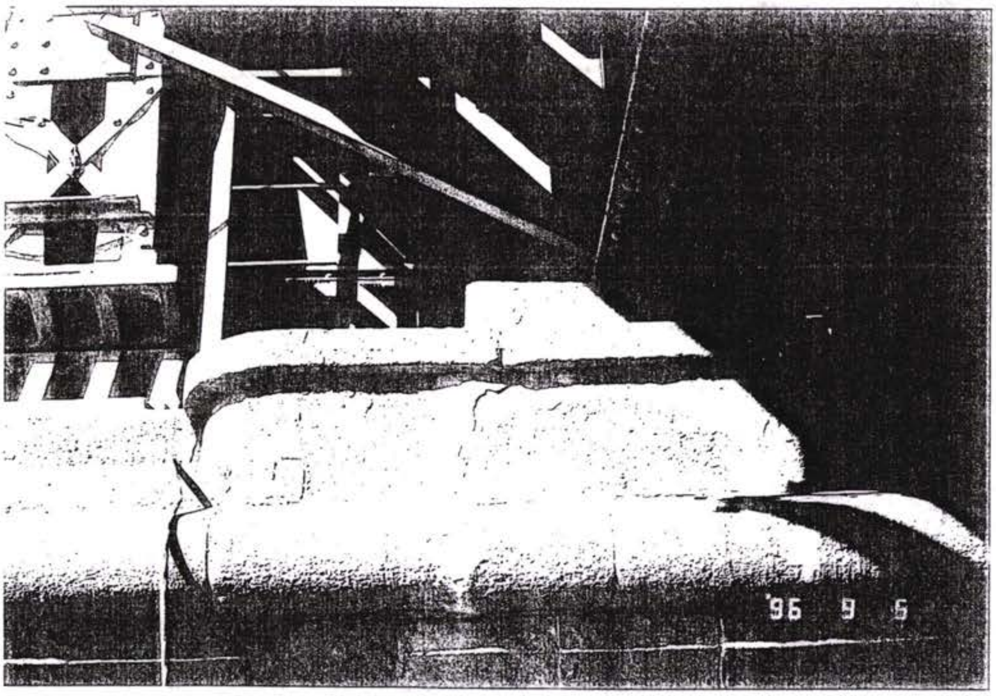
F2-09 Span 3
LC DS cut off
footway cantilever



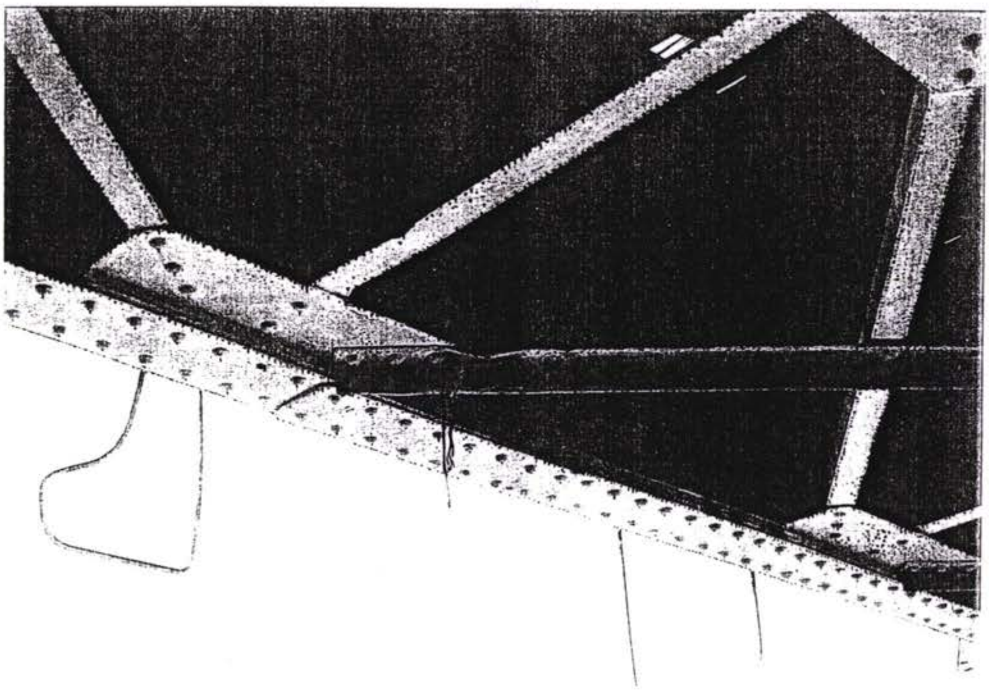
F2-10 Span 0
Bearing of plate
girder 0 (land)



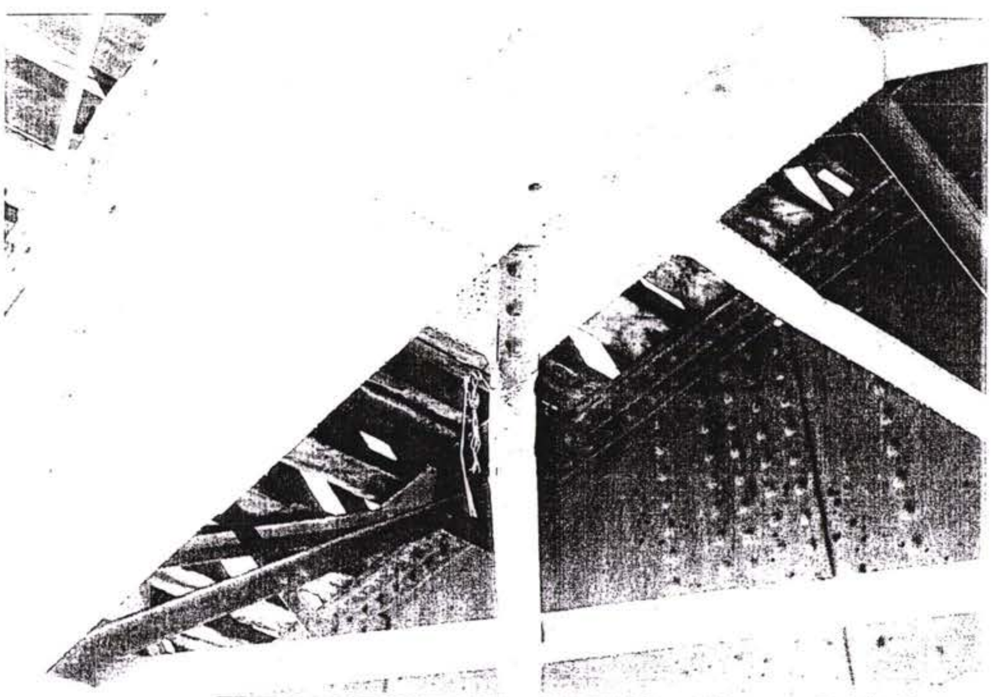
F2-11 Span 1
Fixed bearing of
span 1 DS



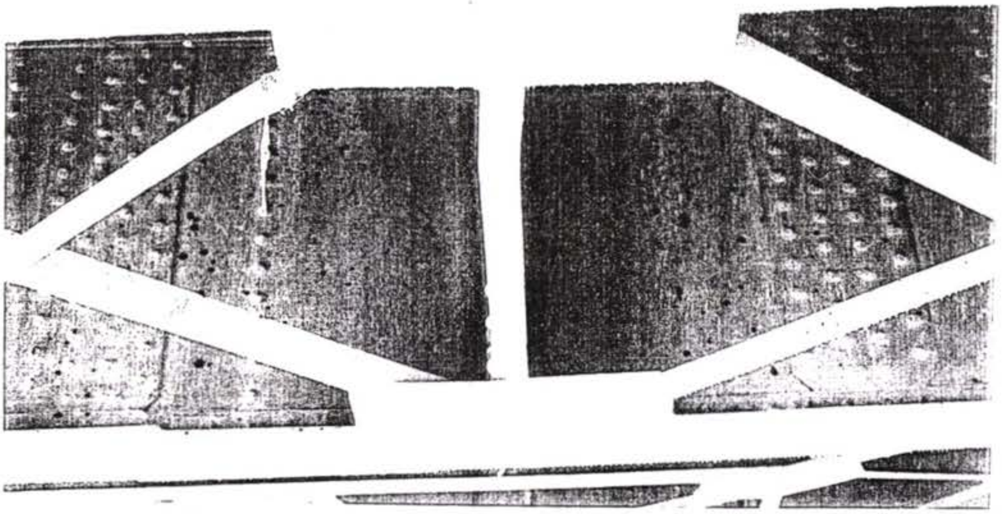
F2-12 Span 0
Bearing DS of span 0, crack in the stone



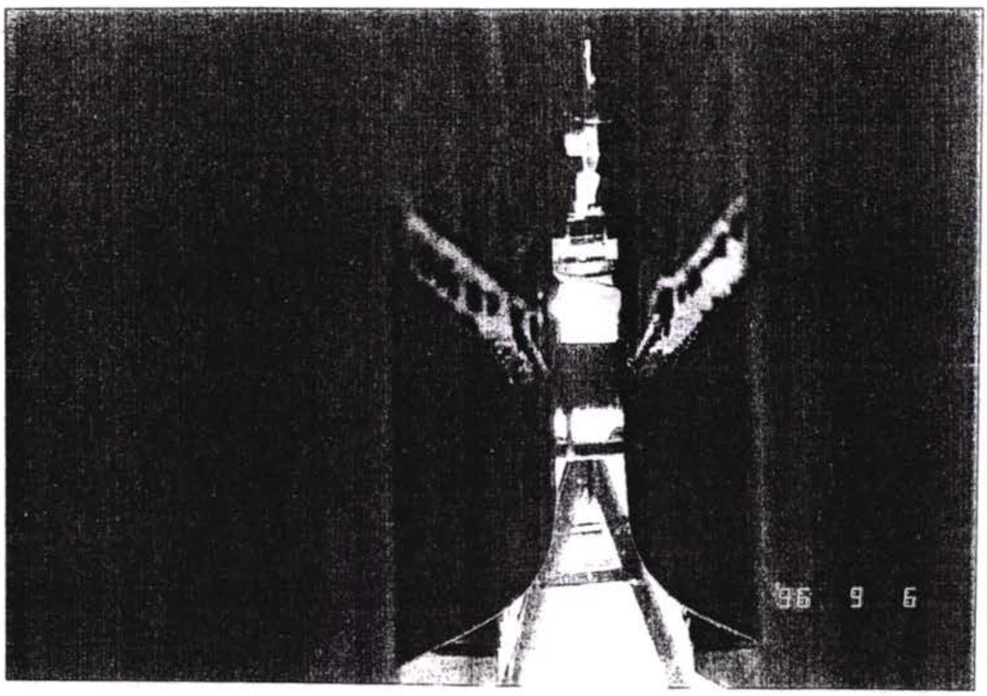
F2-13 Span 0
Deformed LC bracing angle



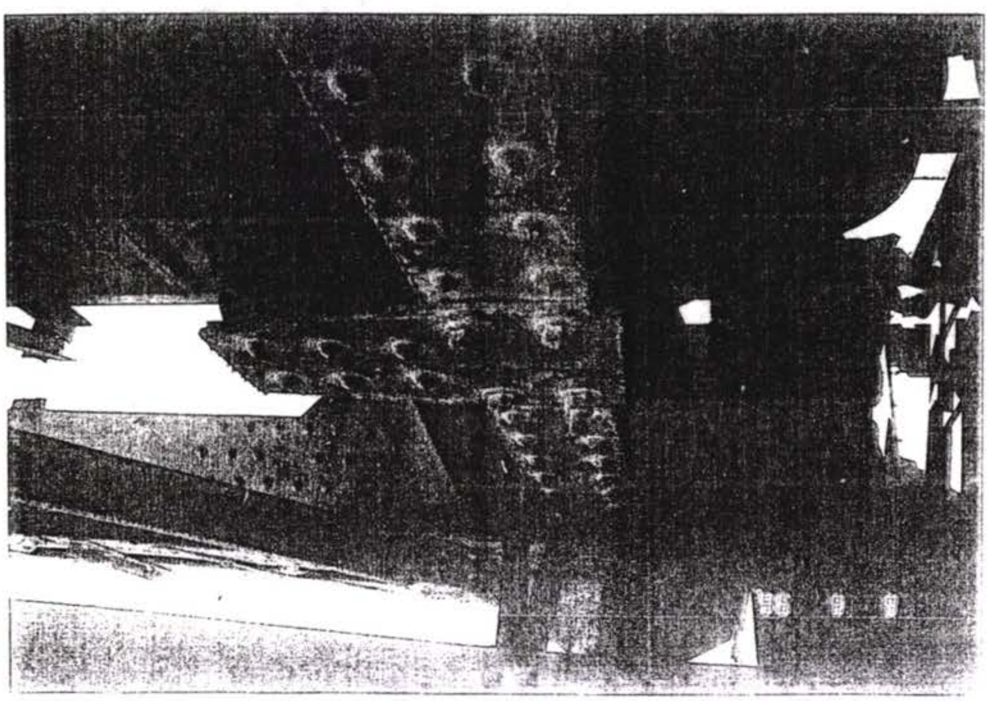
F2-14 Span 0
Deformed LC bracing angle

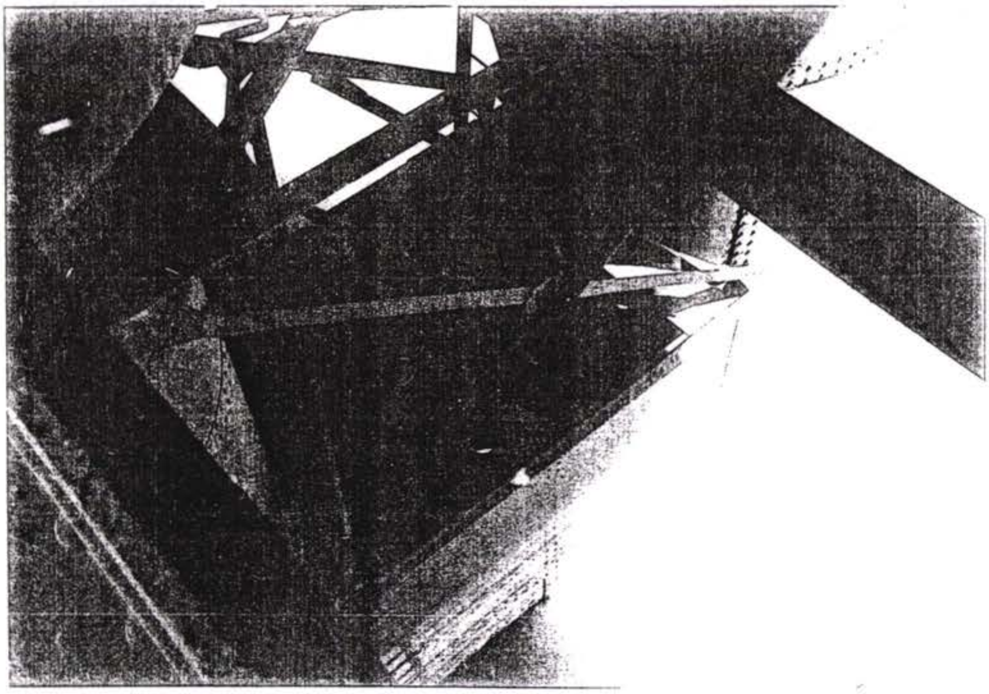


F2-15 Span 0
Deformed LC bracing angle

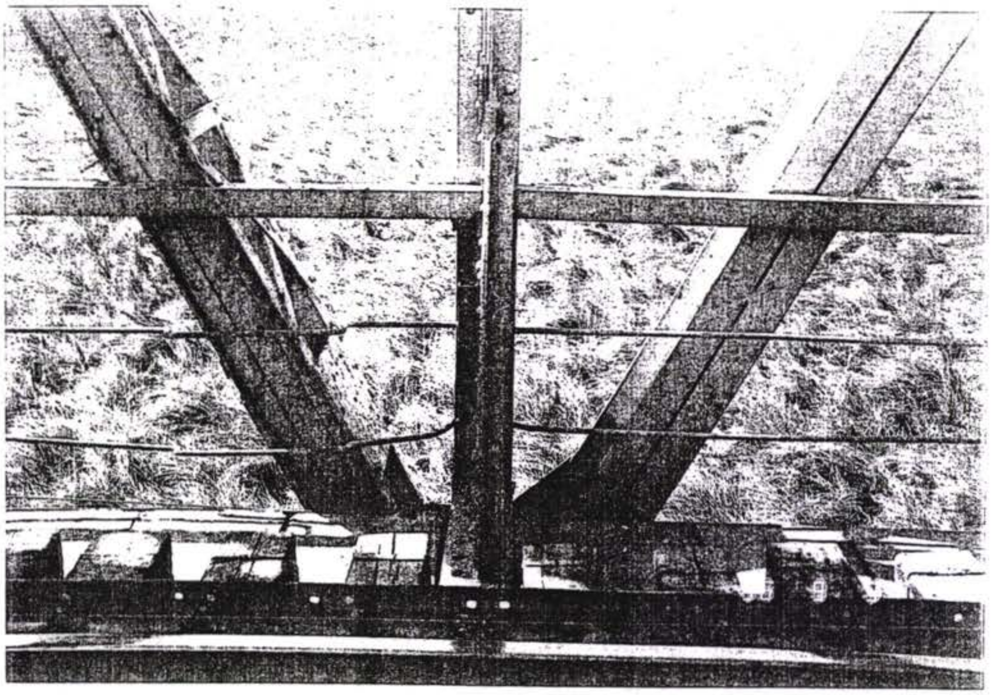


F2-16 Span 2 and 3
Gap between Span 2 and 3

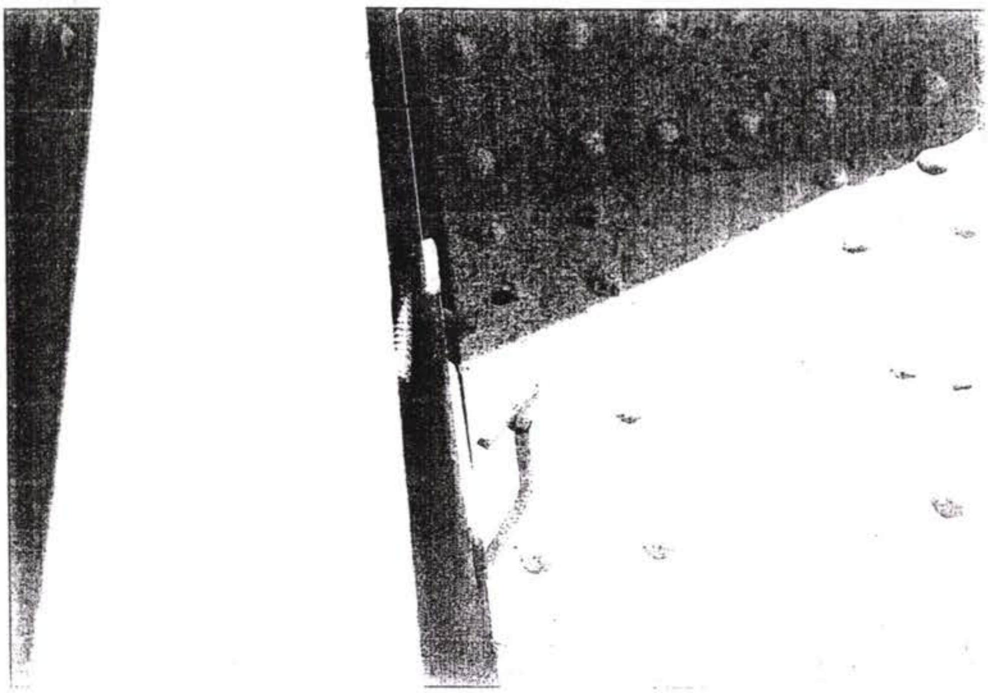


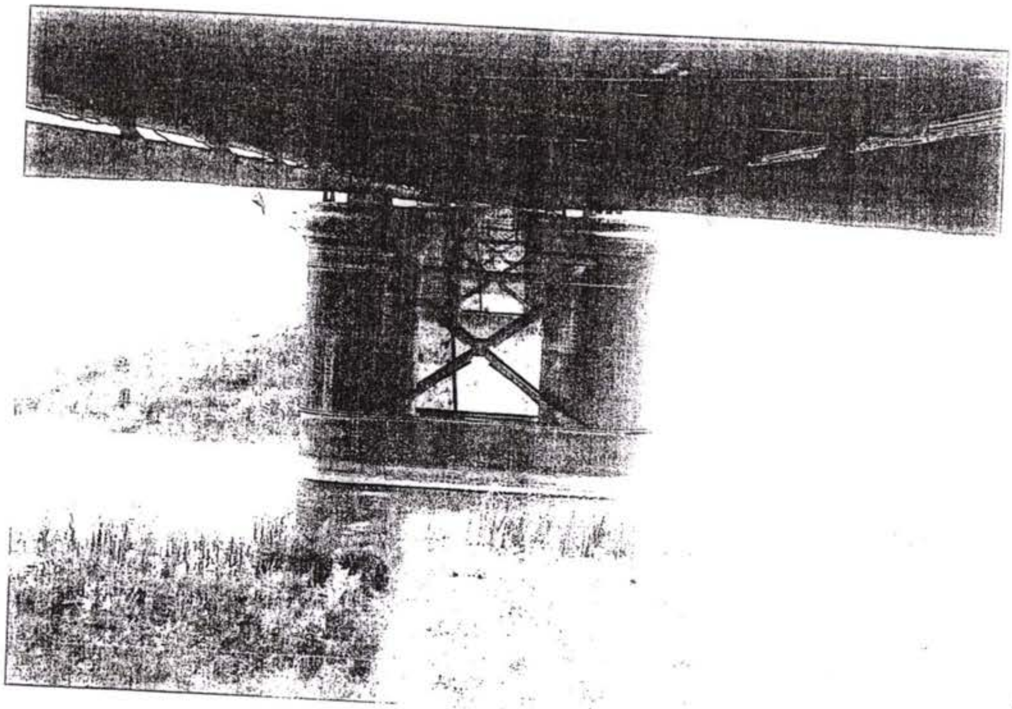


F2-24

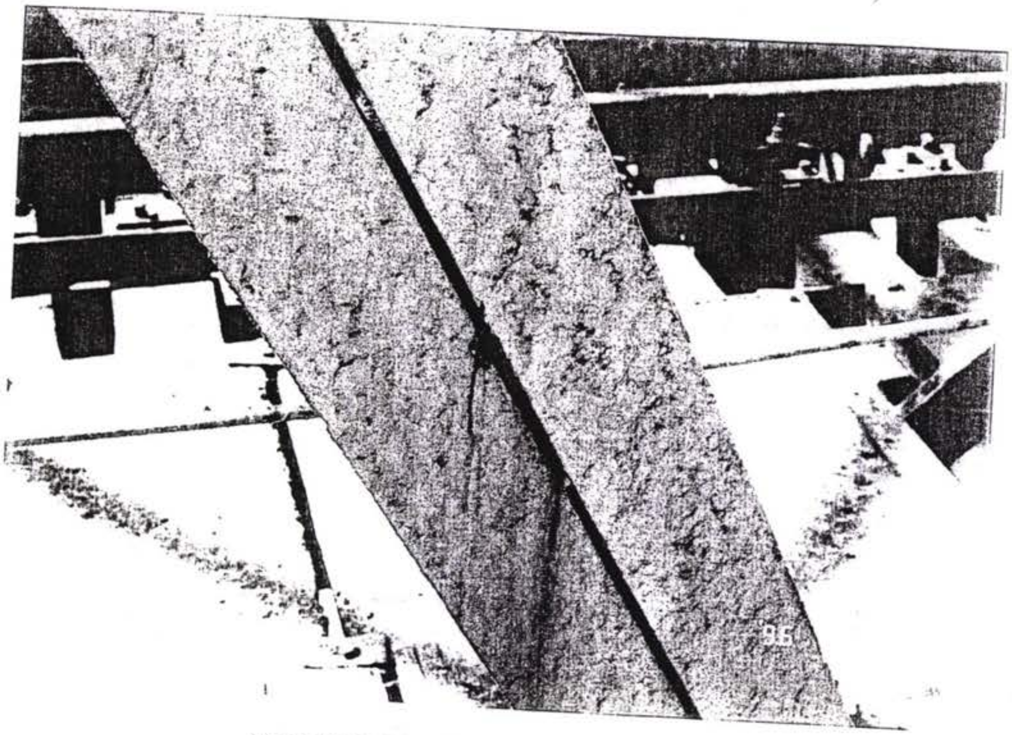


F2-25

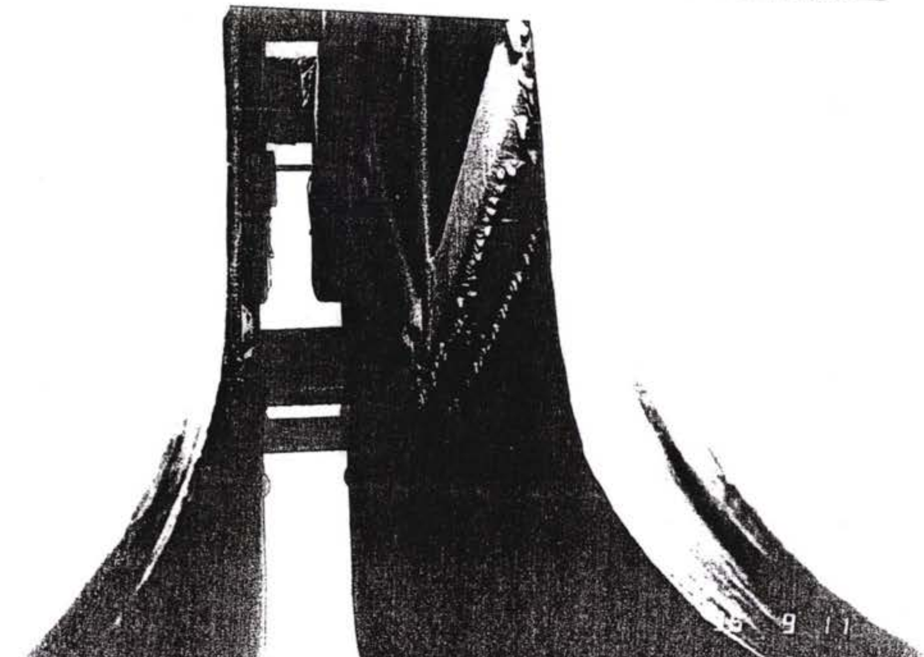




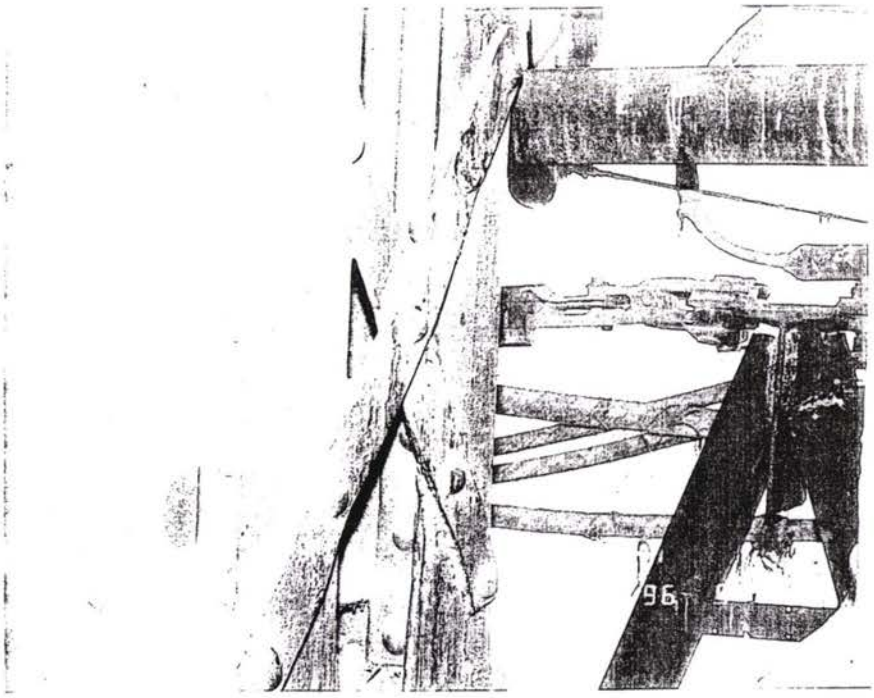
F2-27



F3-01 Span 15
Corrosion signs

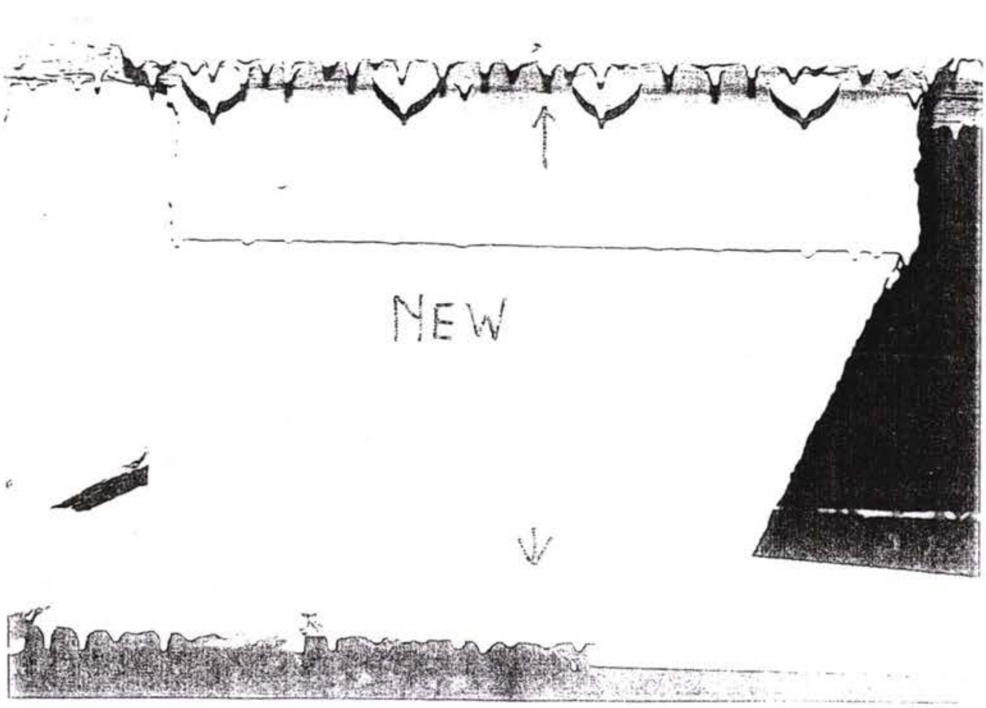


F4-01 Span 23
Expansion gap
with deformed
[illegible]

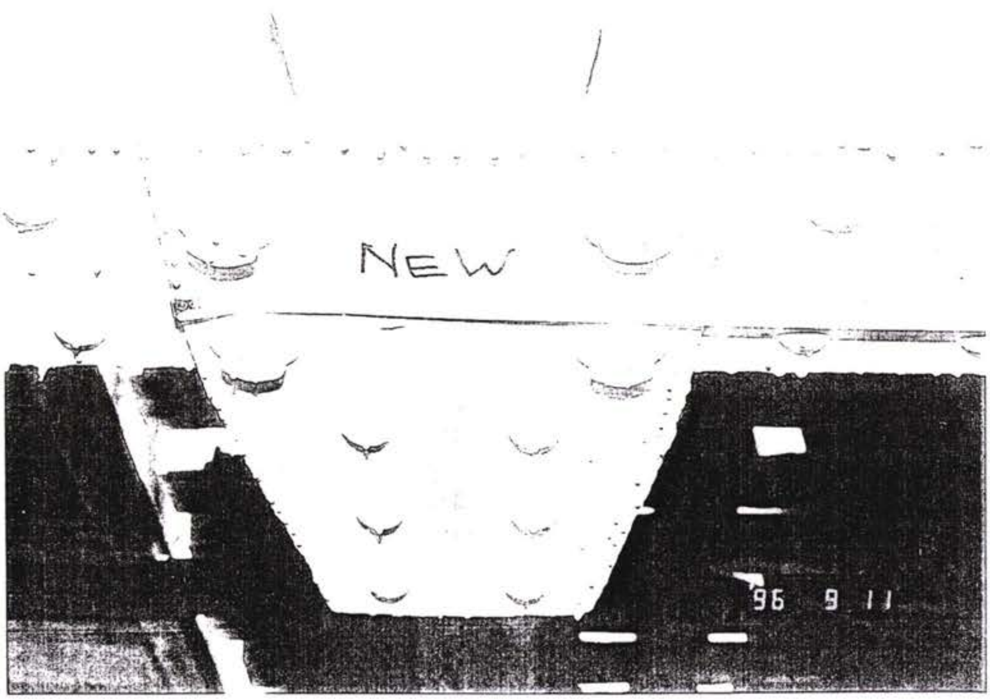


F4-02 Span 23
Deformed diagonal bracing

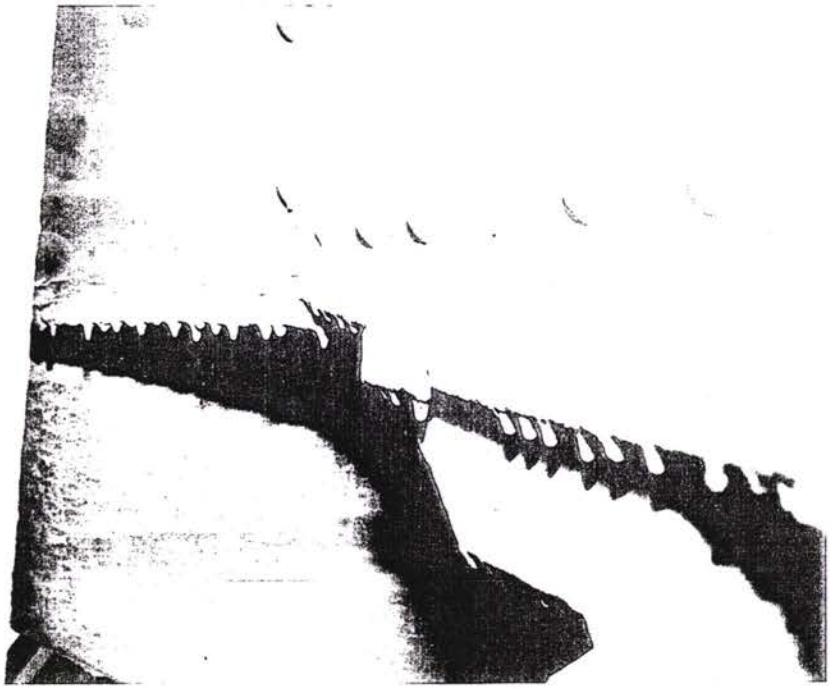
F4-03 Span 23
Bolt replaces rivet



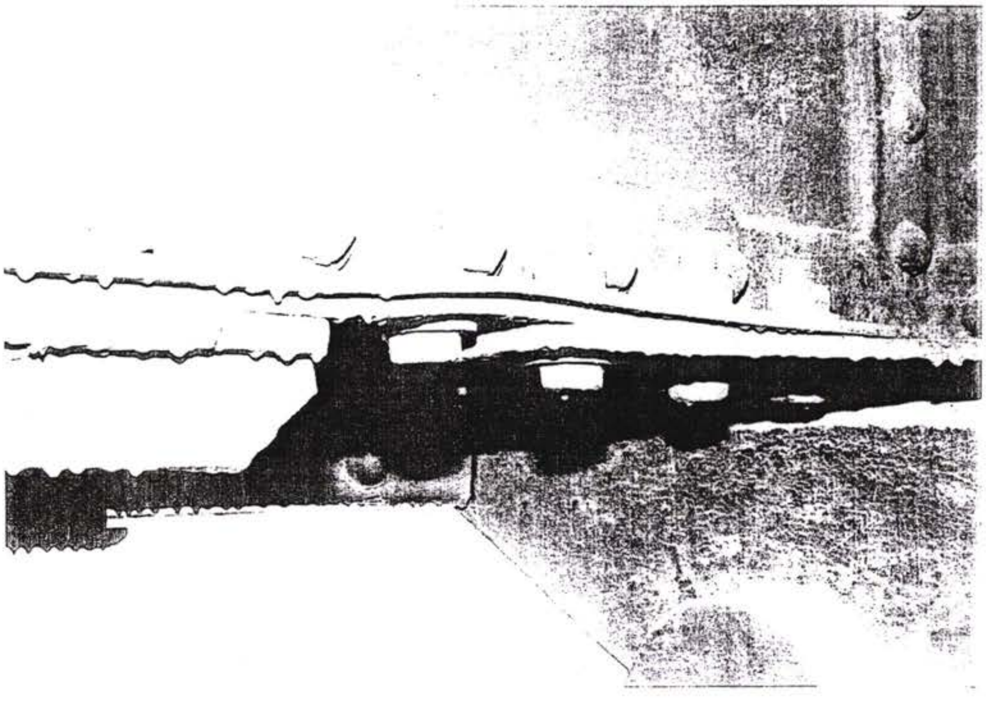
F4-05 Span 23
New angles at longitudinal girder to cross diaphragm



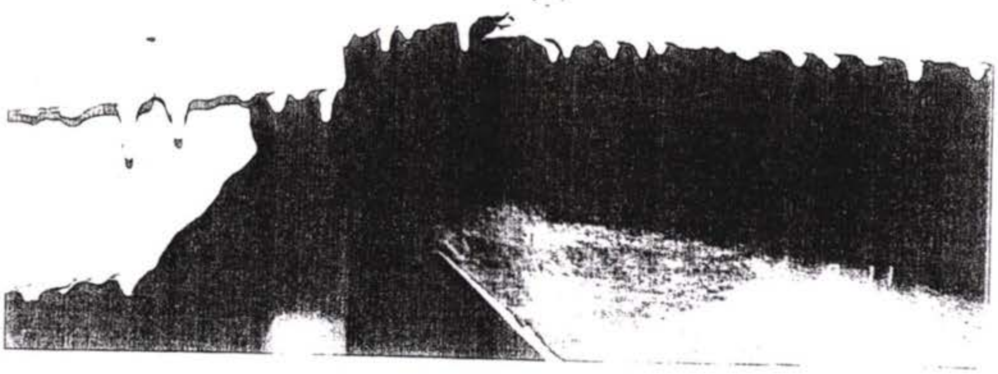
F4-06 Span 23
As F4-06, from below



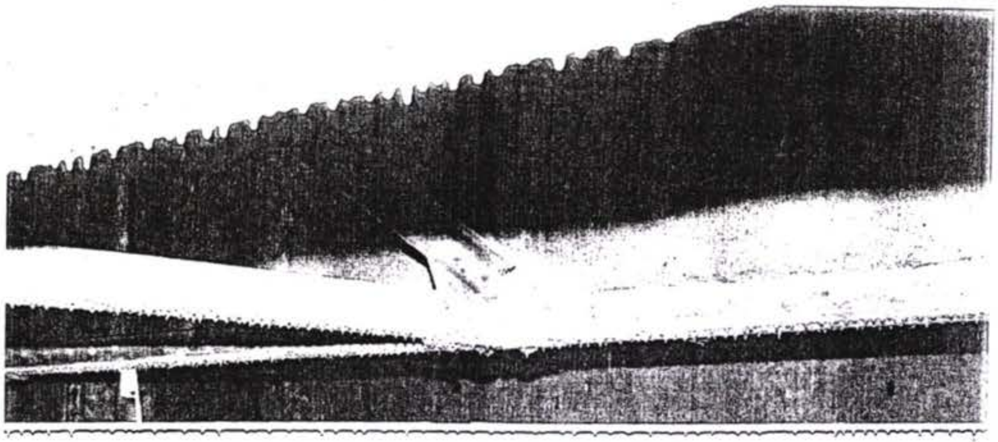
F4-07 Span 23
Cross diaphragm warping of lower flange



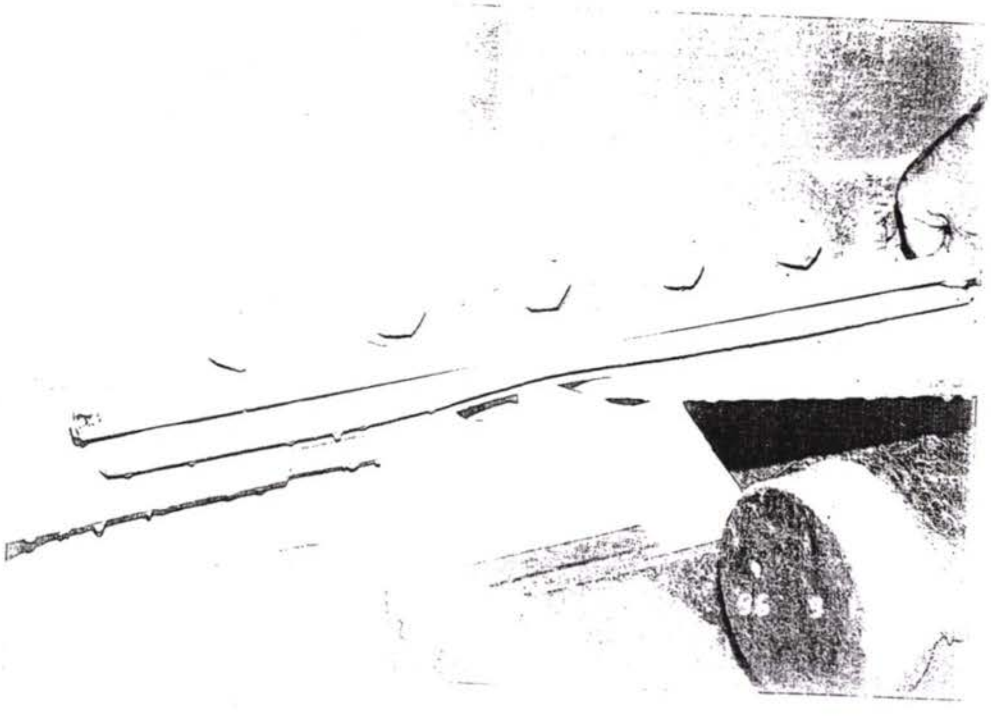
F4-08 Span 23
As F4-[illegible]



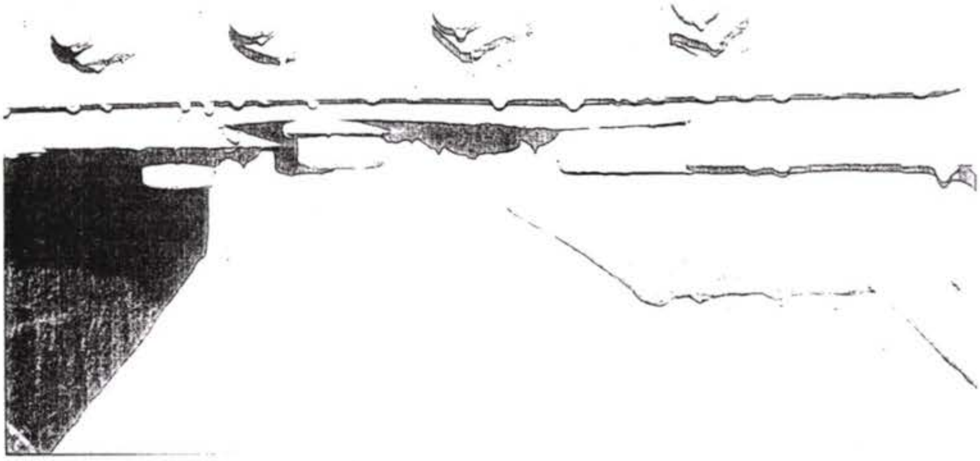
F4-09 Span 23
As F4-07



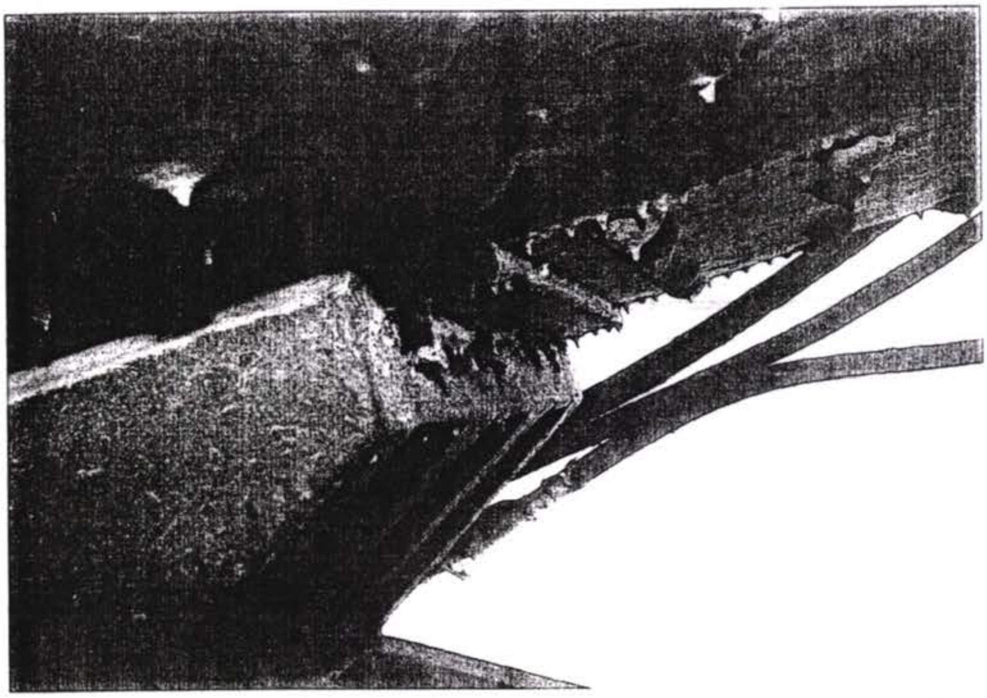
F4-10 Span 23
Bracing between longitudinal girders



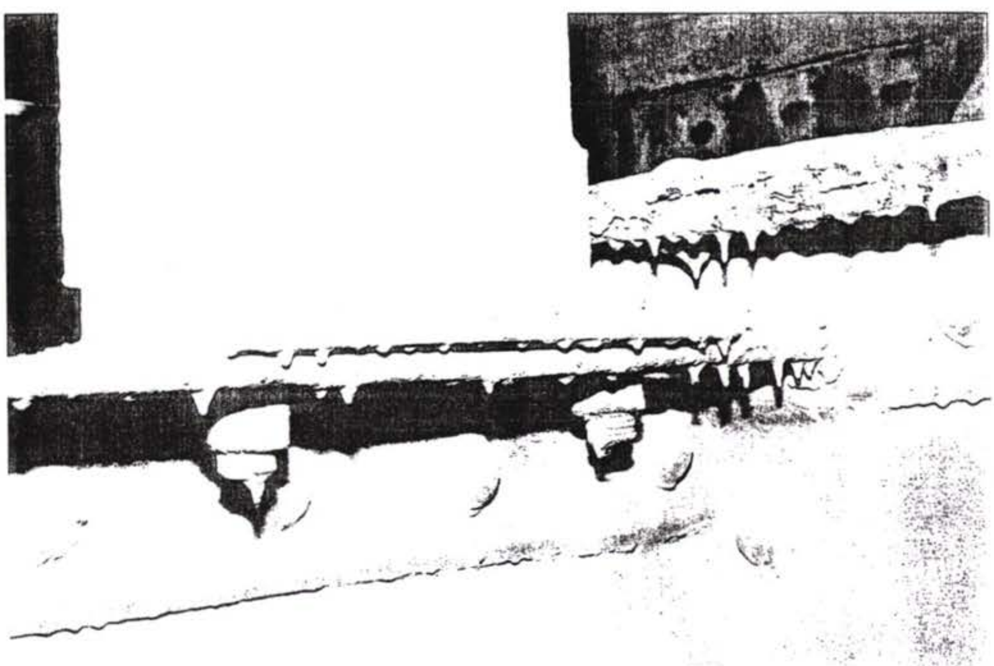
F4-11 Span 23
Cross diaphragm warping despite of strengthening



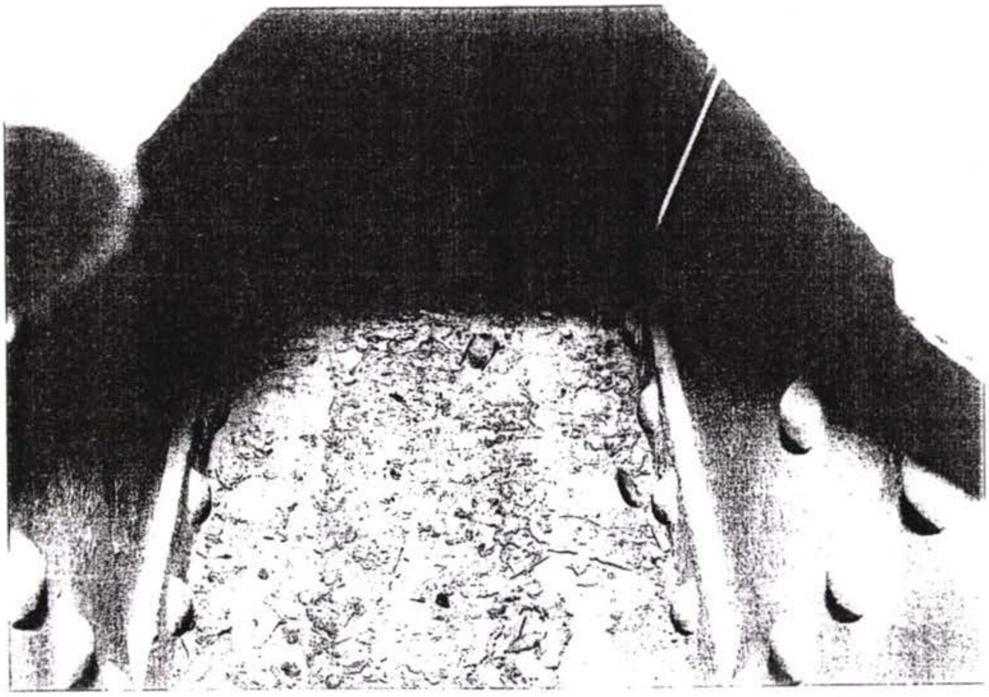
F4-12 Span 23
Strengthening of cross girder



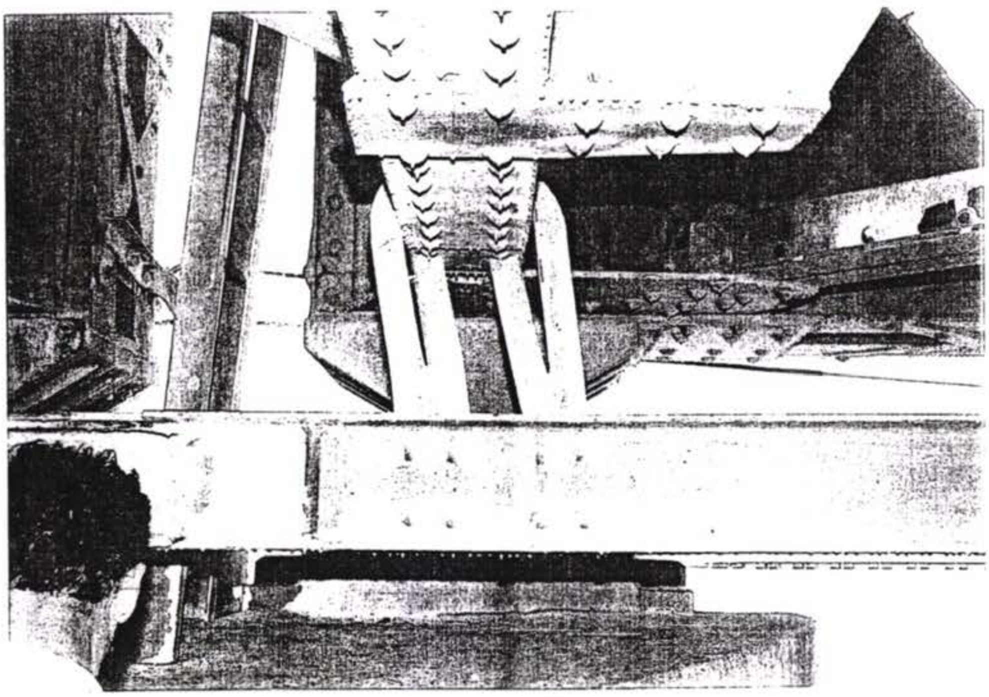
F4-13 Span 23



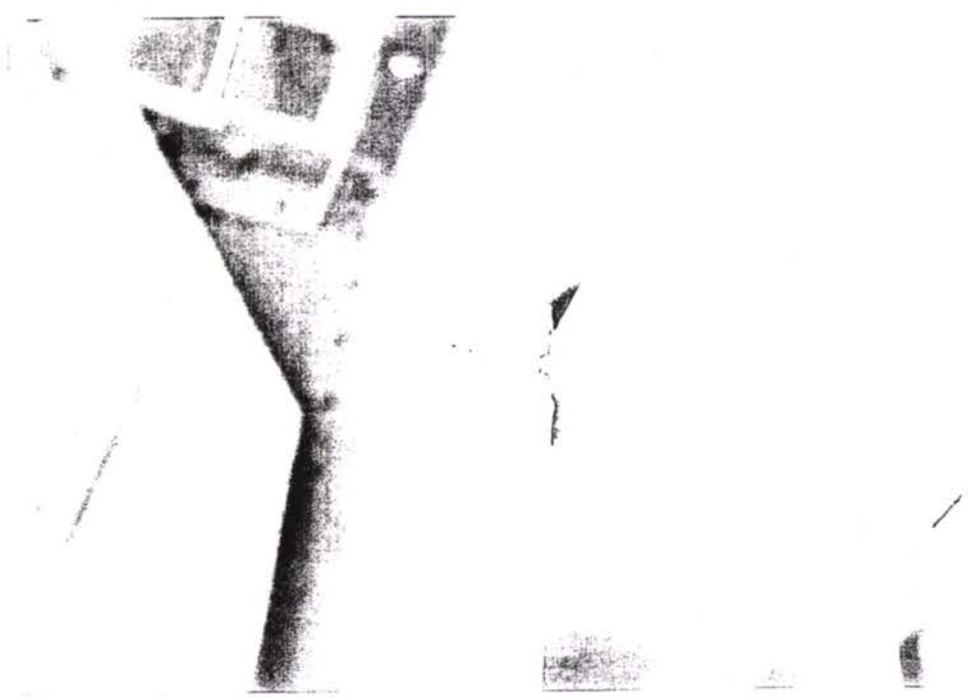
F4-14 Span 23
Corrosion of longit. girder [illegible] cross girder



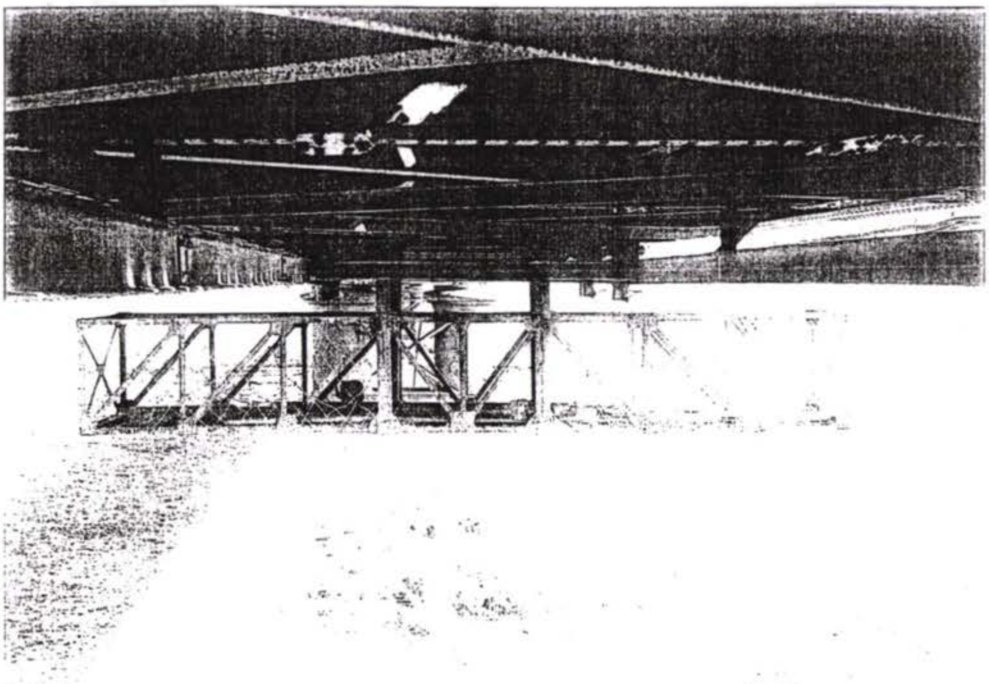
F4-15 Span 23
Corrosion of LC



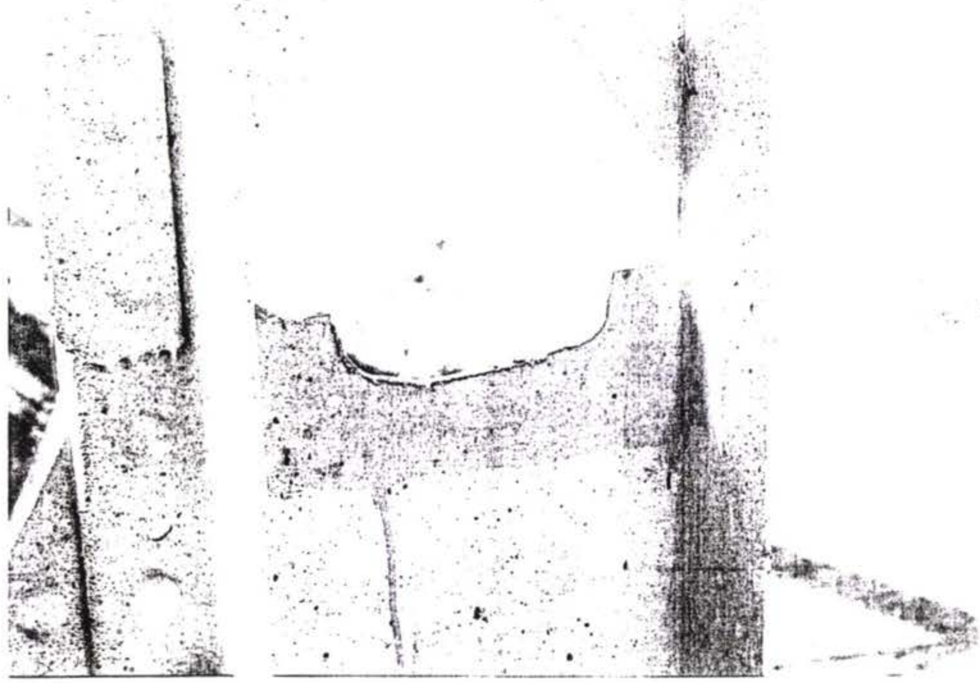
F4-16 Span 23
Deformed support
of inspection car
track



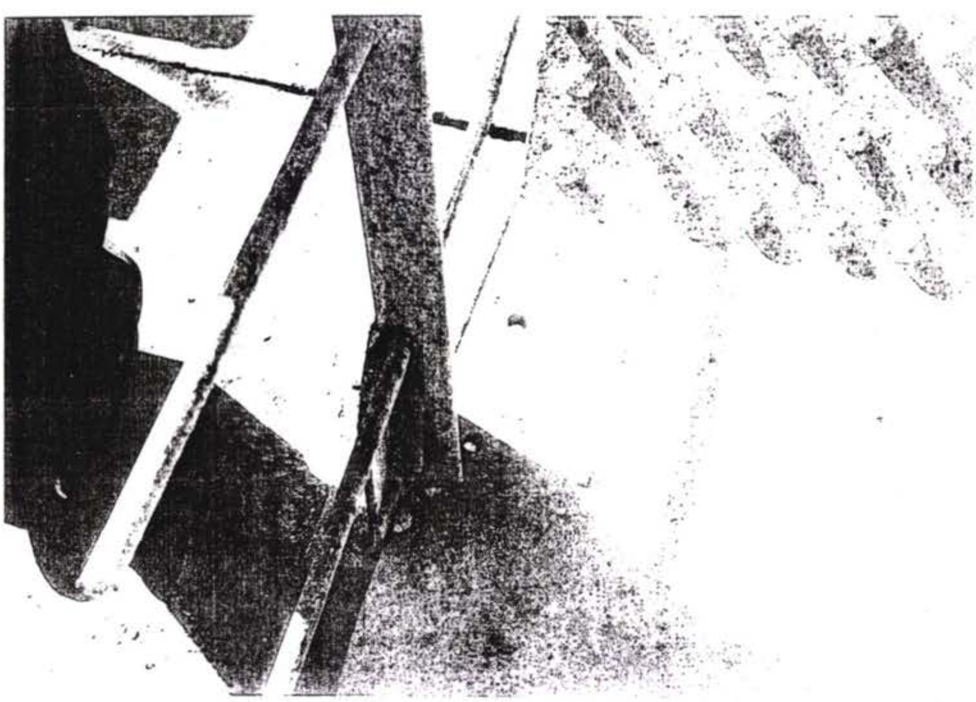
F4-17 Span 23
Inspection car
support



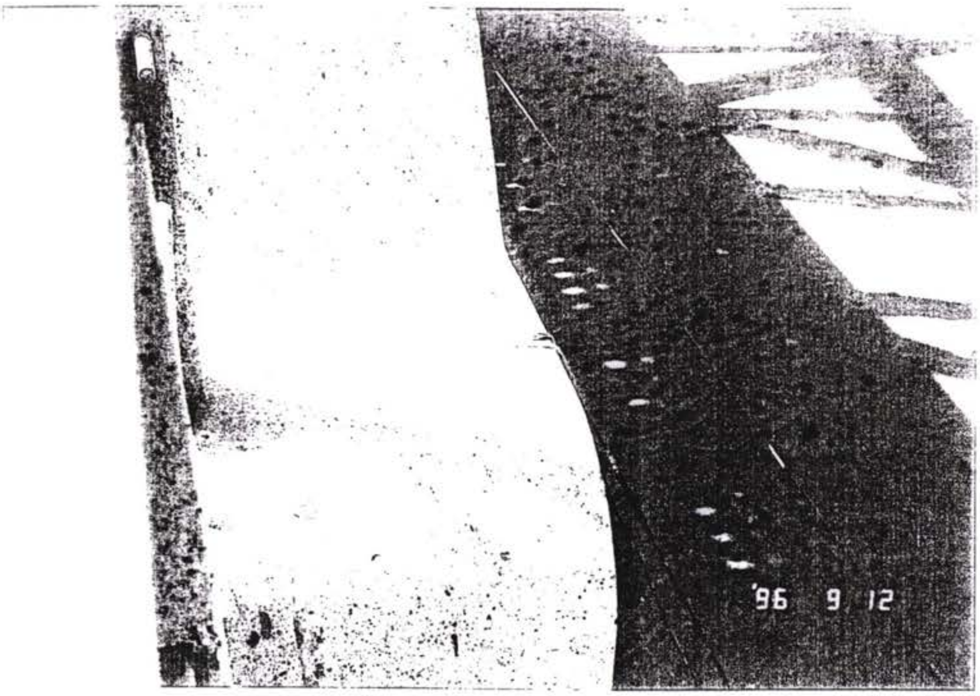
F4-19 Span 23
Inspection car only to be moved by hand of 12 men



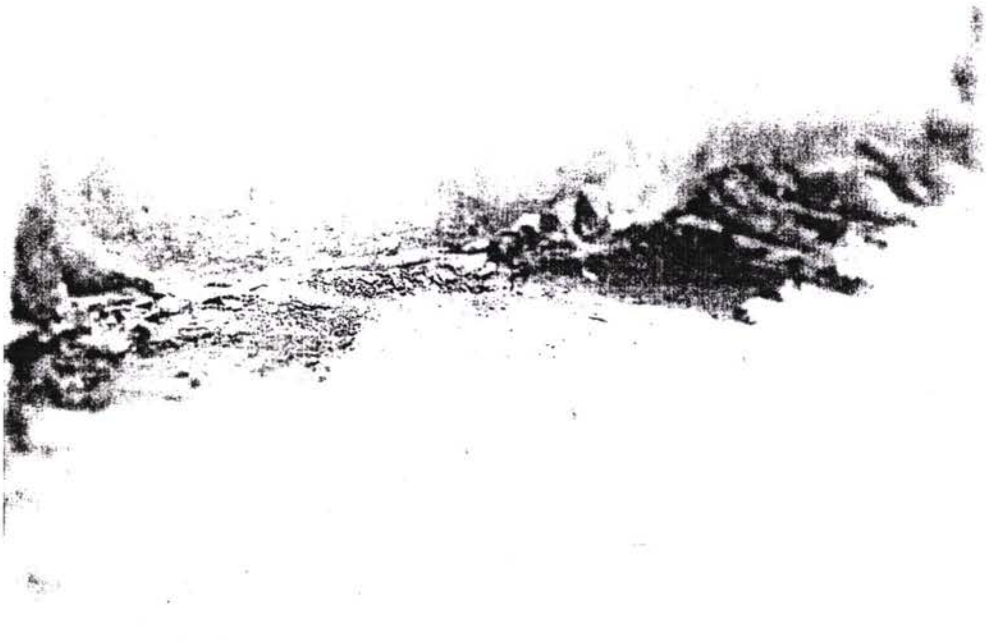
F4-20 Span 23
Cut off railing support



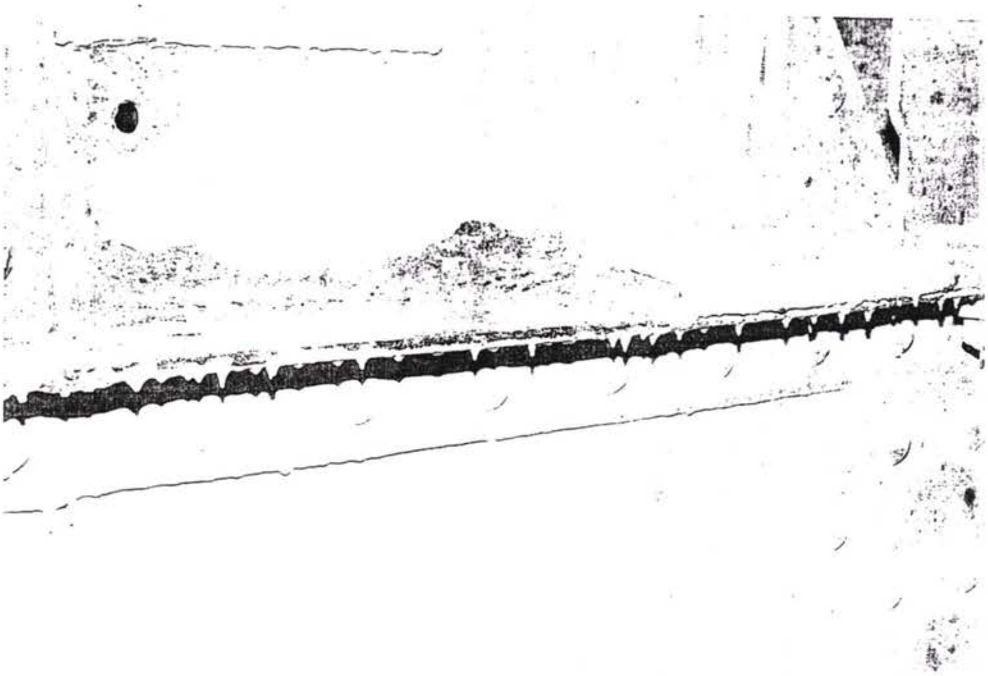
F4-21 Span 23
Missing rivet at end street



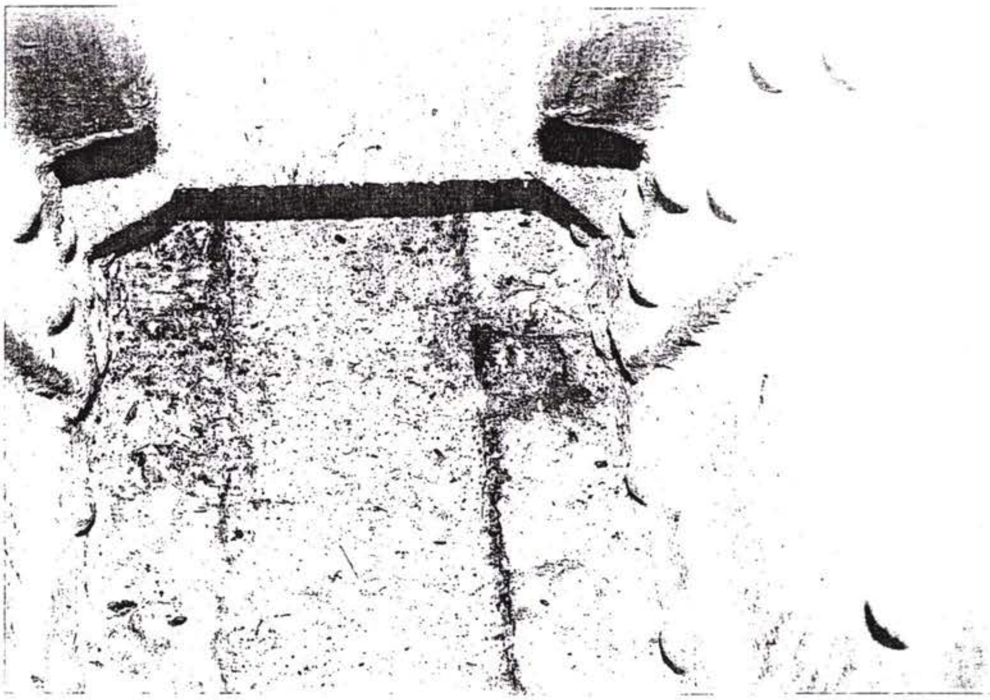
F4-23 Span 23
Missing rivet at end girder



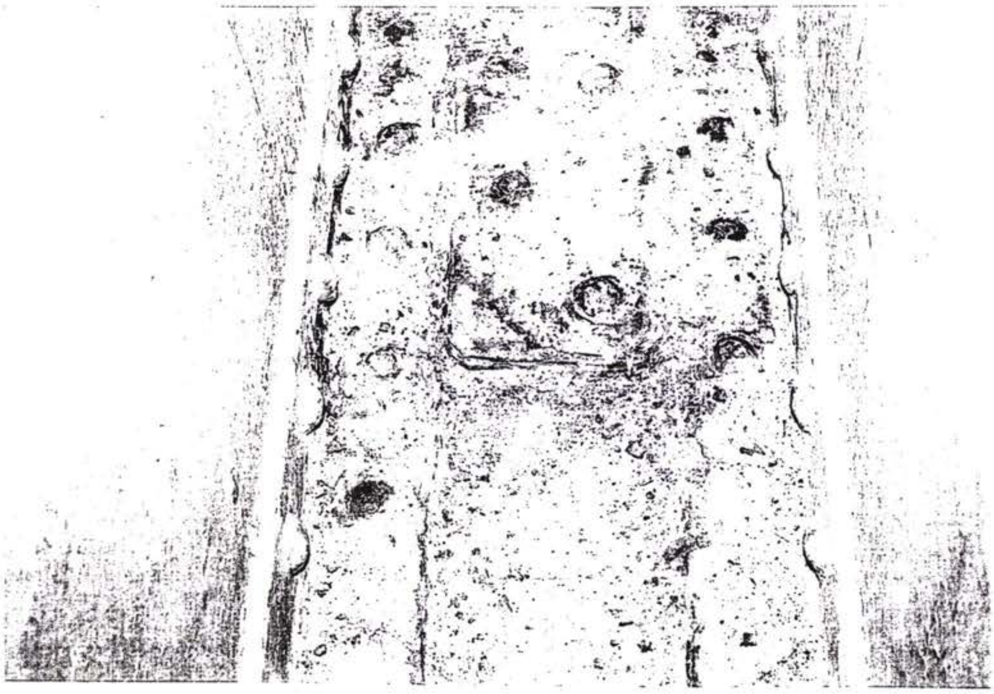
F4-24 Span 23
Corrosion at cross girder



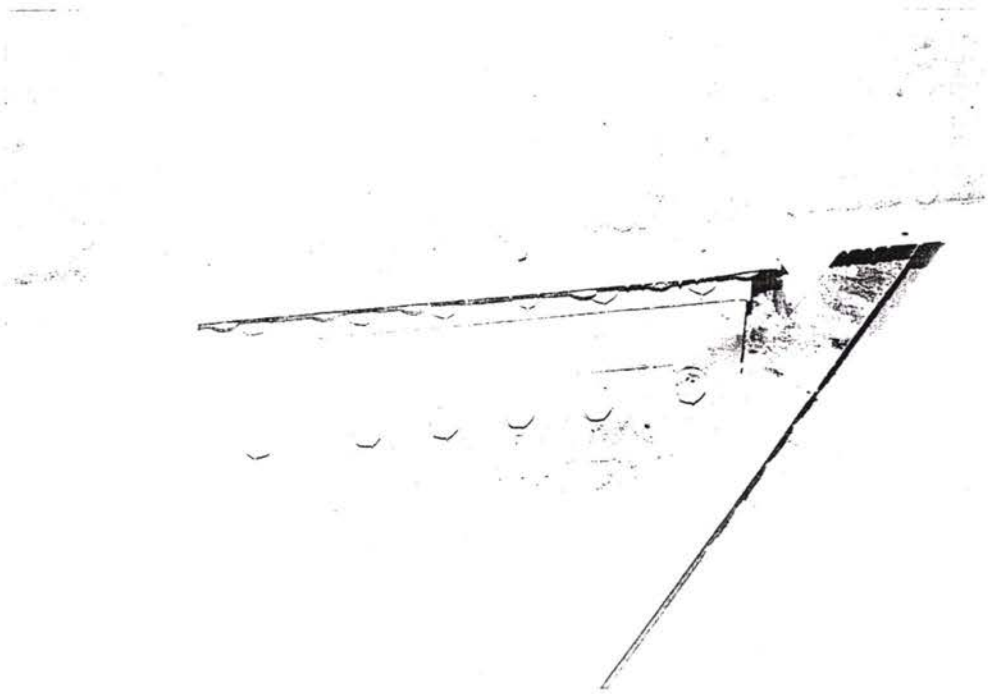
F4-25 Span 23
Missing rivet and corrosion at cross diaphragm



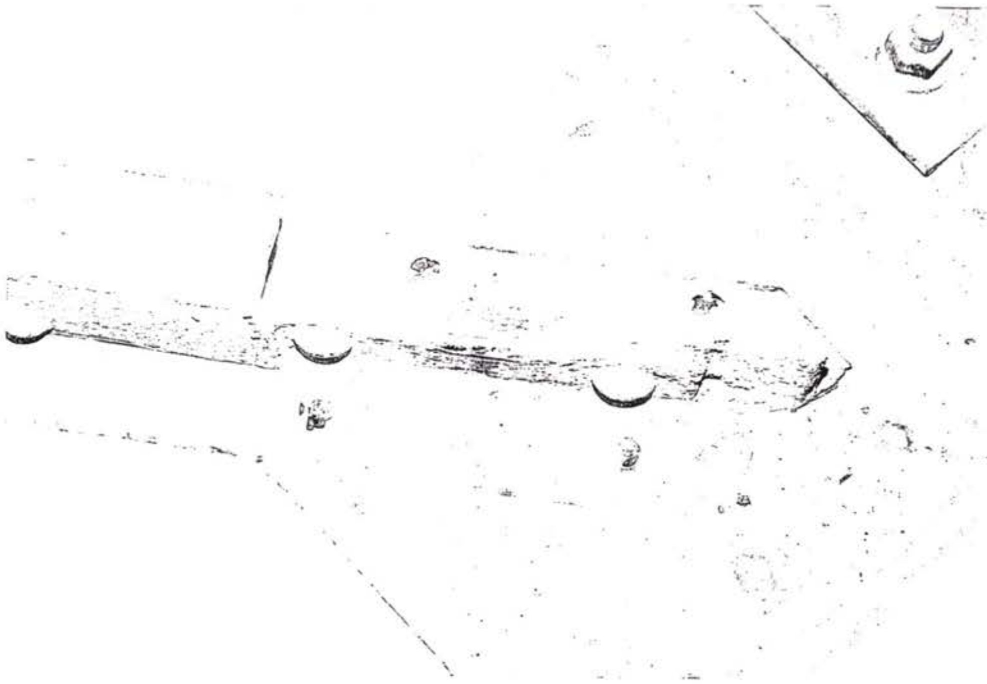
F4-26 Span 23
LC corrosion and warping



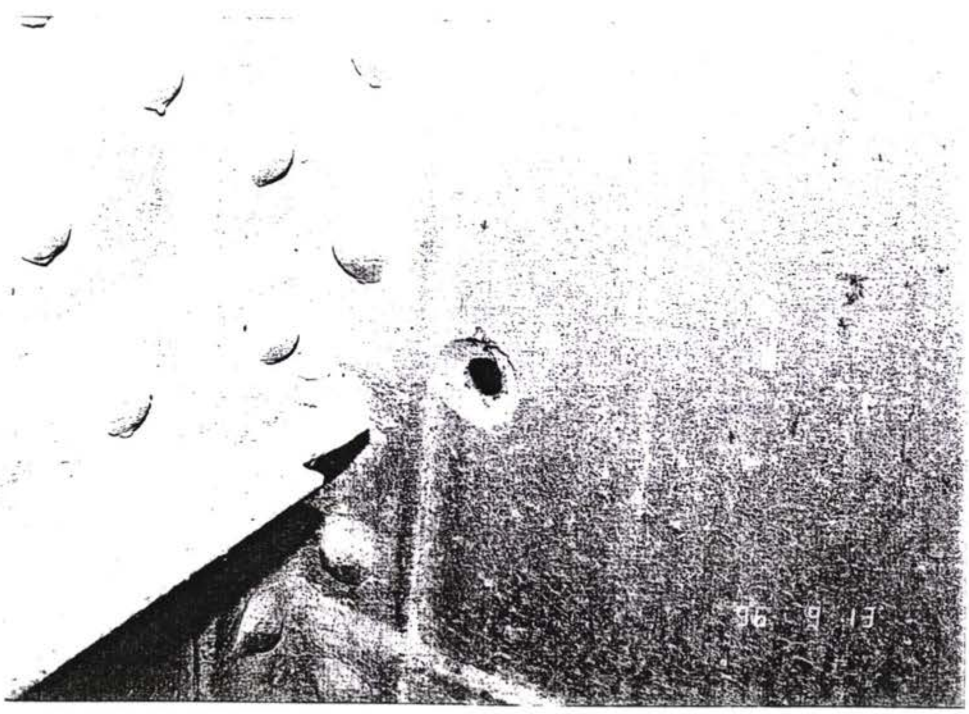
F4-27 Span 23
LC corrosion in the middle of LC node U4 US



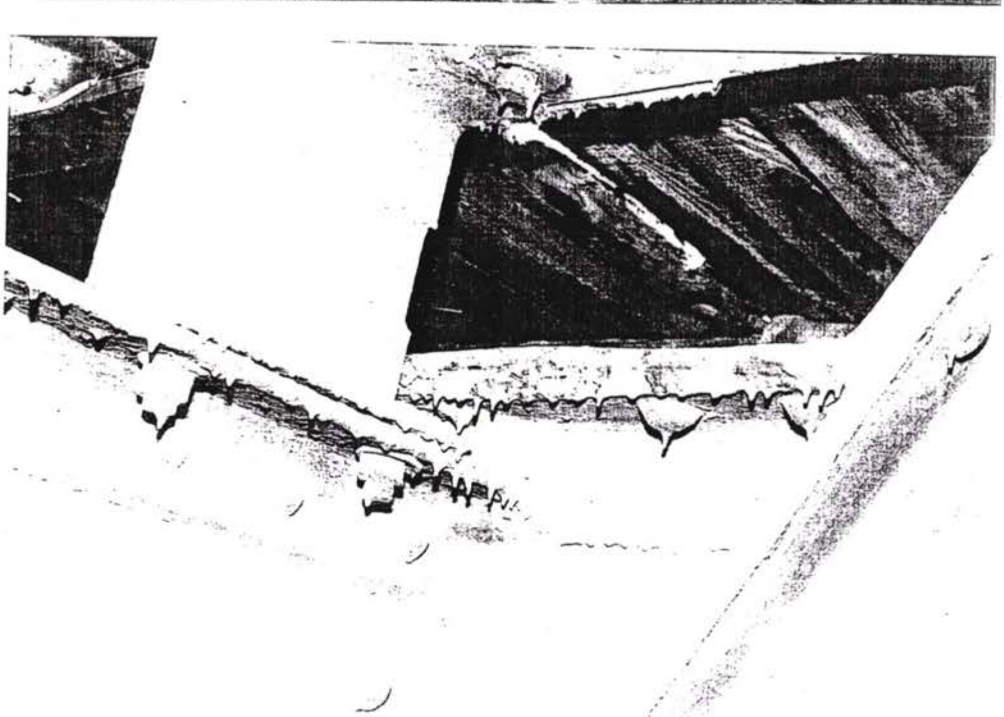
F4-28 Span 23
New strengthening at lower wind bracing



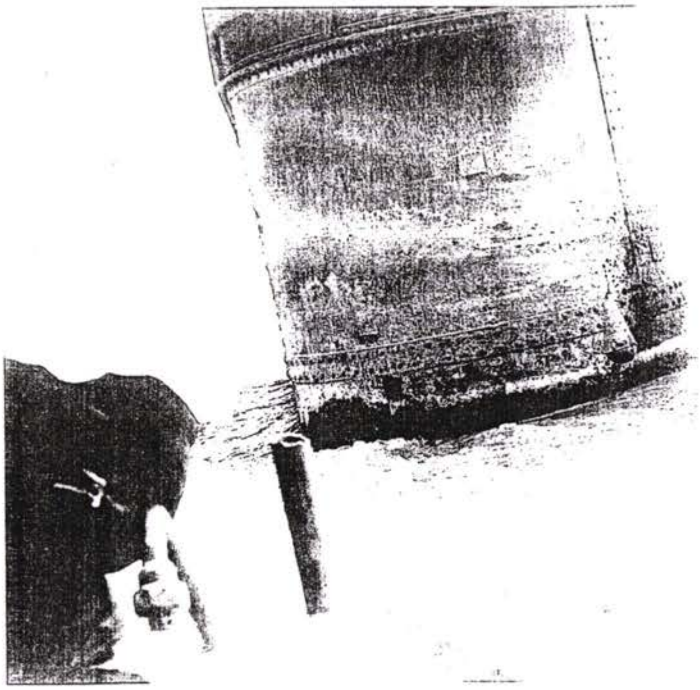
F4-29 Span 23
Lower wind bracing newly strengthened, corrosion



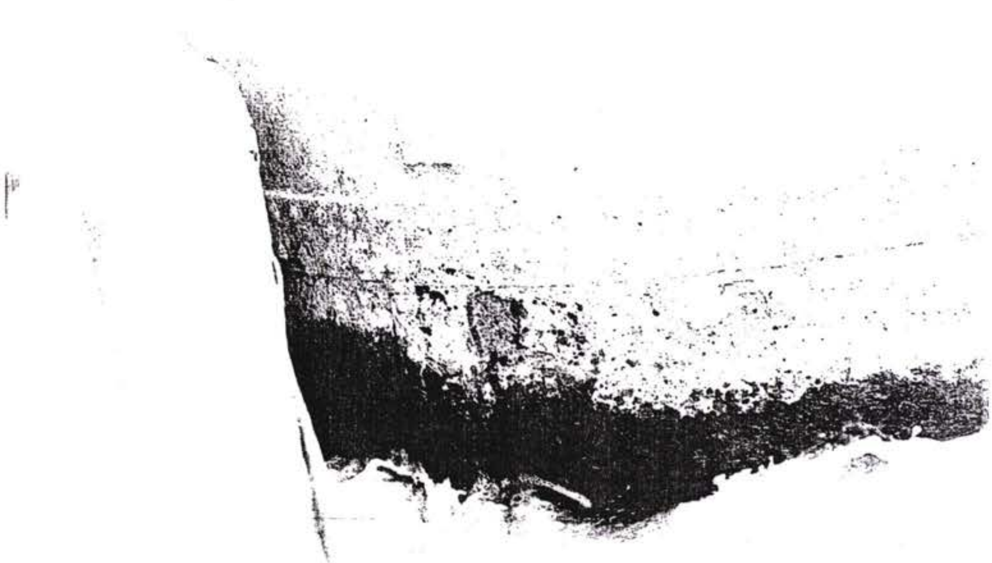
F4-30 Span 23
Cross diaphragm, hole without rivet or bolt



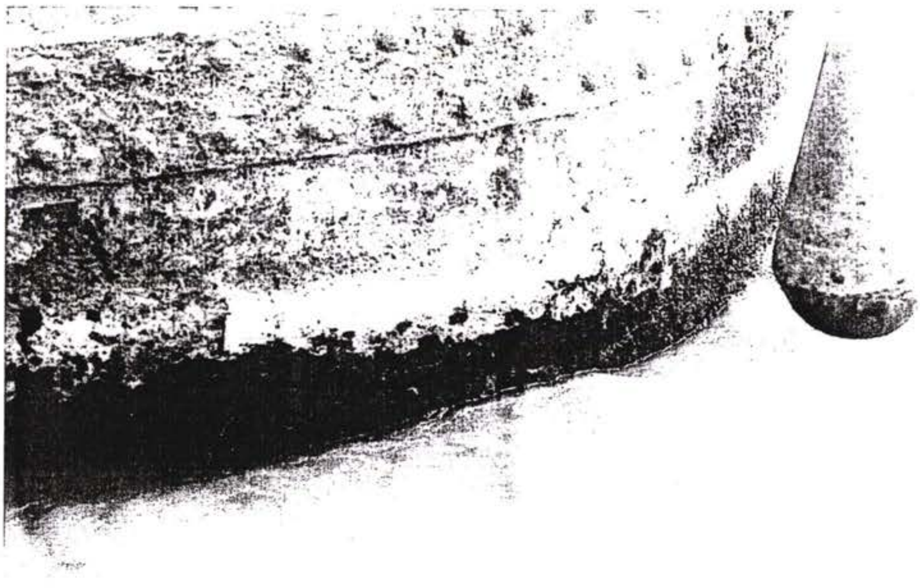
F4-31 Span 23
Corrosion at longit. girder to cross diaph.



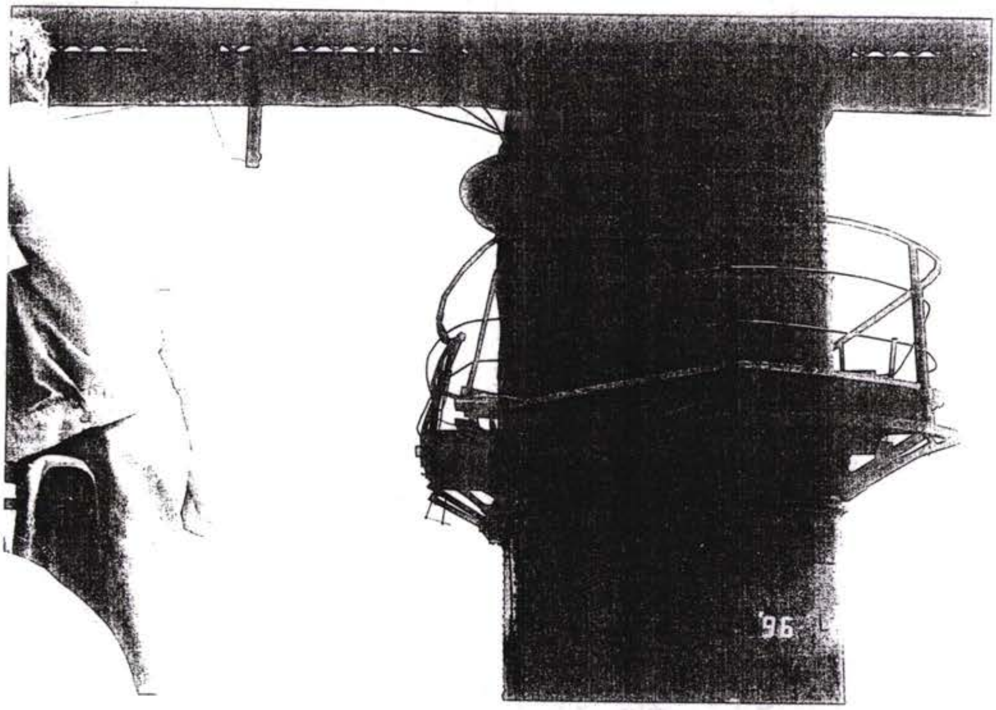
F4-32 Pier 25
Pier 25 from ship



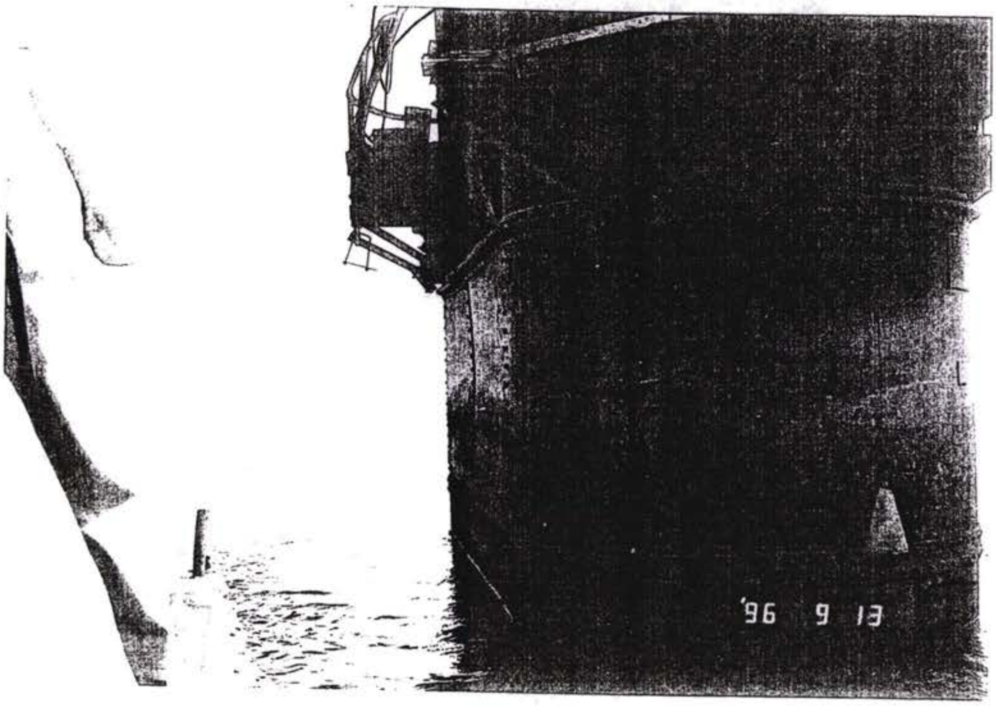
F4-33 Pier 25
Pier 25 from ship
Heavy corrosion
leaks



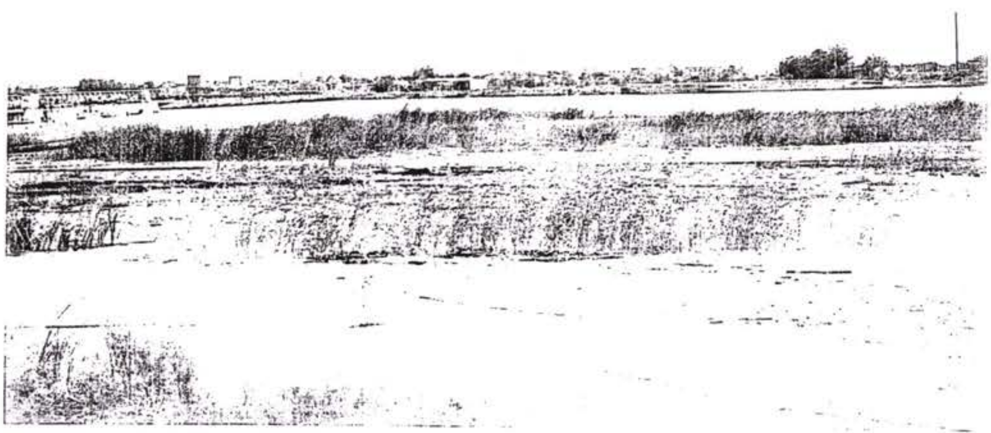
F4-34 Pier 25
Pier 25 corrosion



F4-36 Pier 24
Pier 24 hit by a ship collision

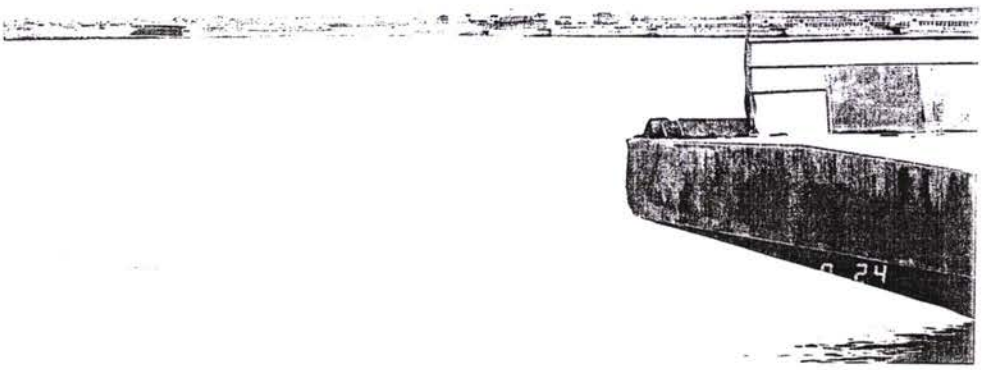


F4-37 Pier 24
As F4-36

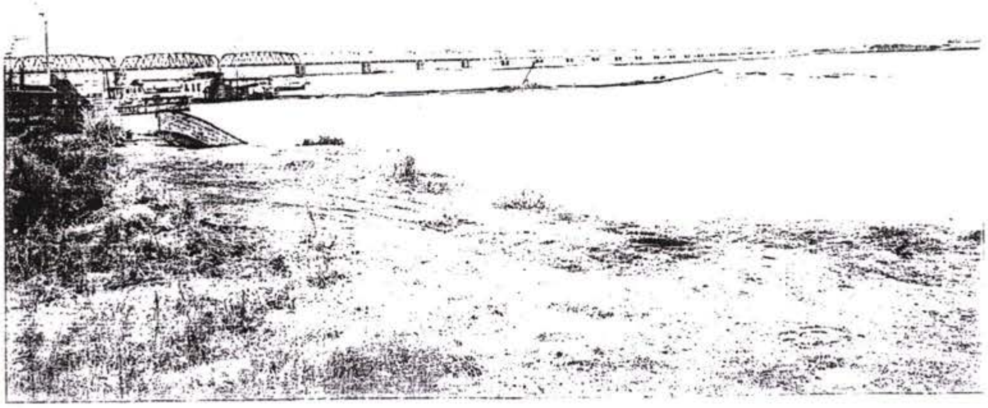


F5-27
Sand banks near the bridge US

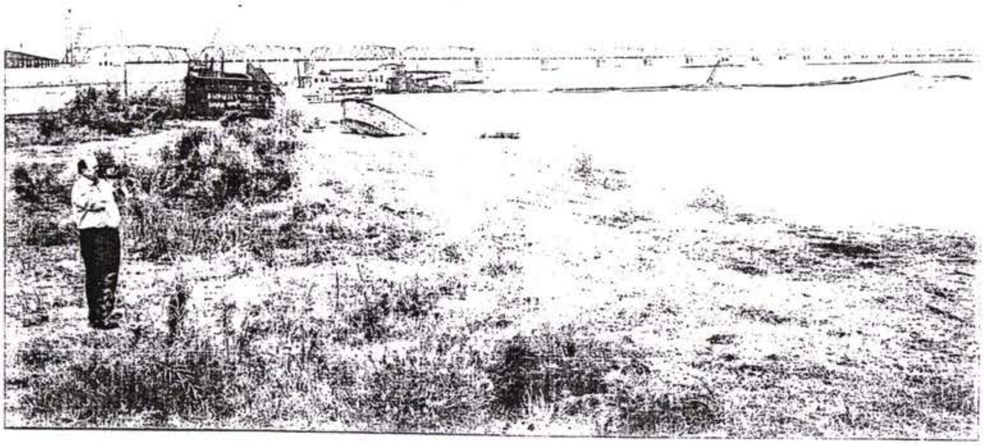
F5-28
Site of the new proposed bridge, DS



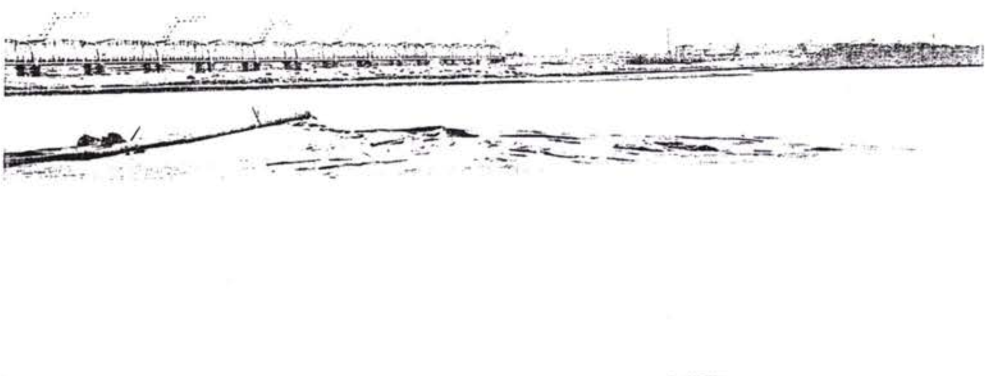
F5-29
As F5-28



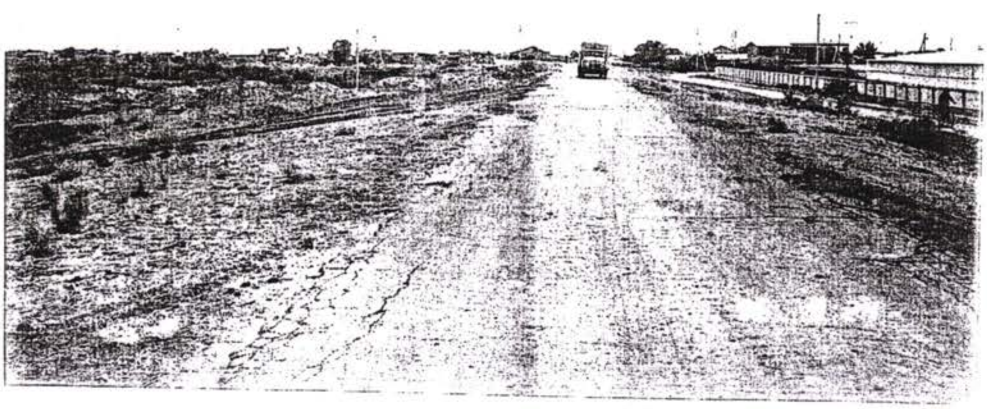
F5-30
View of the existing bridge



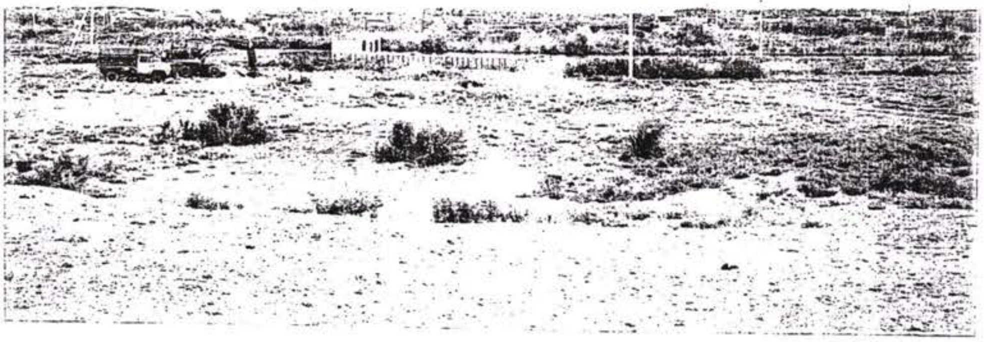
F5-31
As F5-30, with Mr. Fleischmann



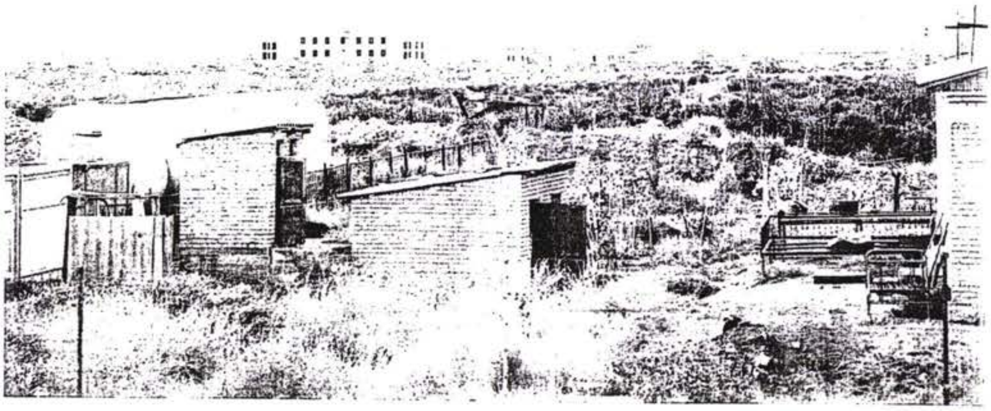
F5-32
As F5-30, with sand bank DS



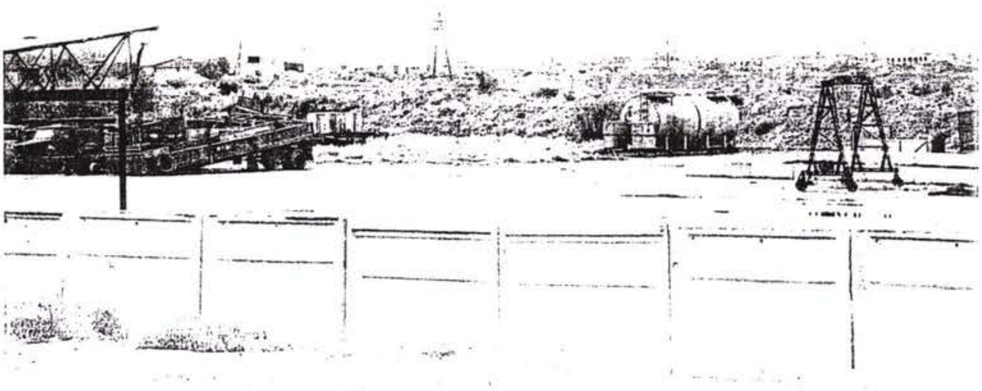
F5-3[illegible]
bypassing road [illegible]
[illegible]



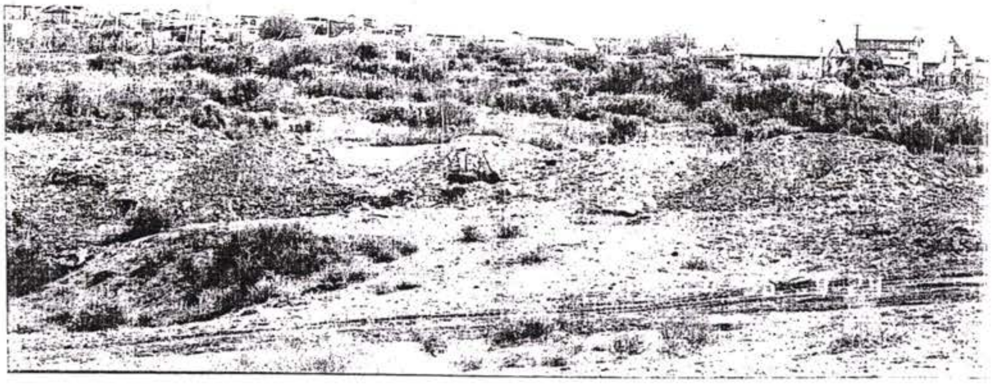
F5-34
Site of new bypass road



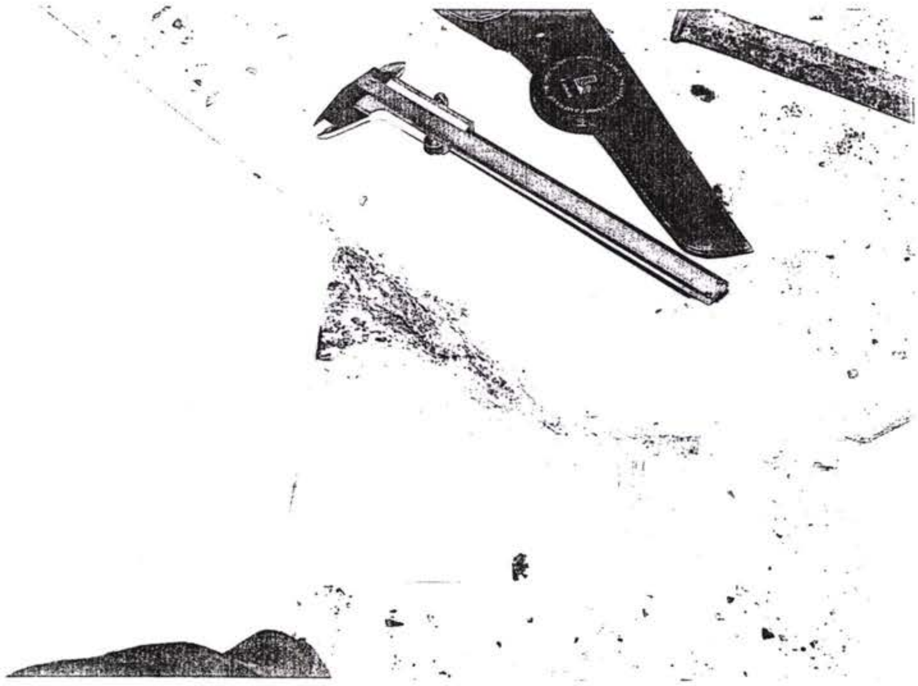
F5-35
As F5-34



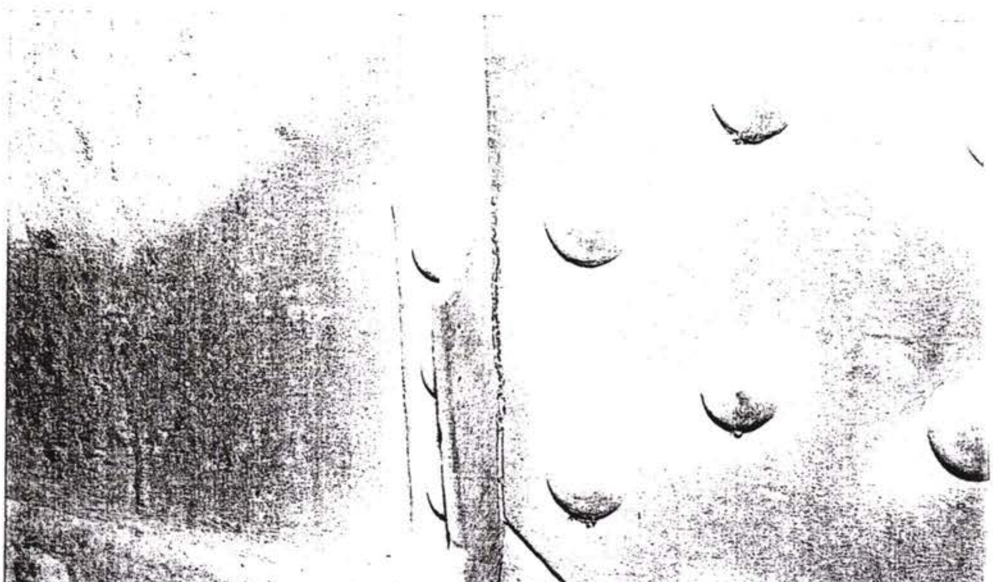
F5-36
As F5-34



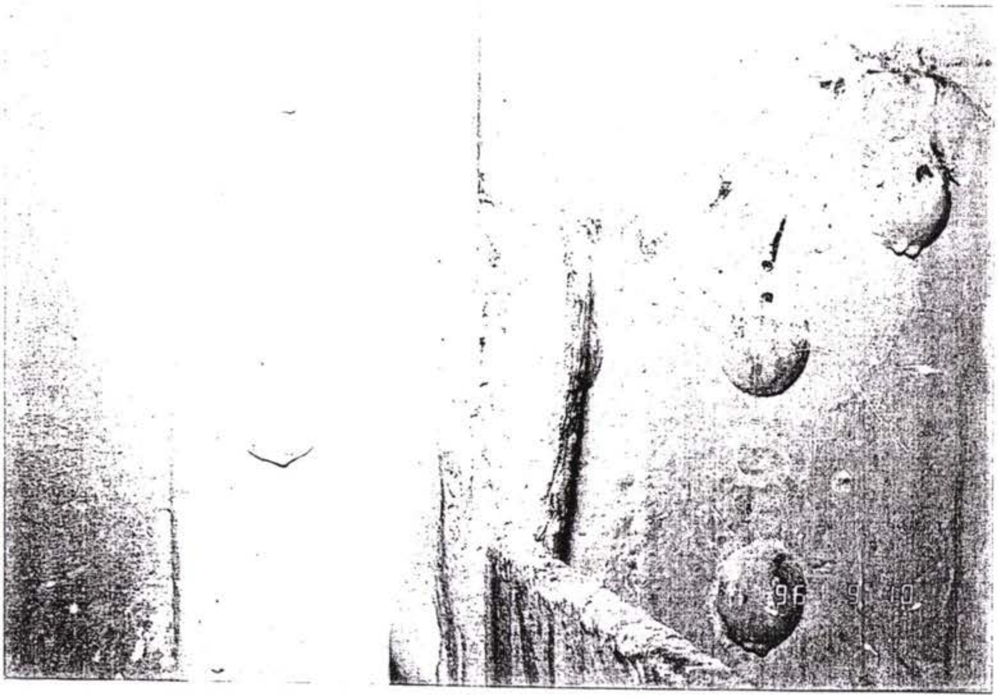
F5-37
As F5-34



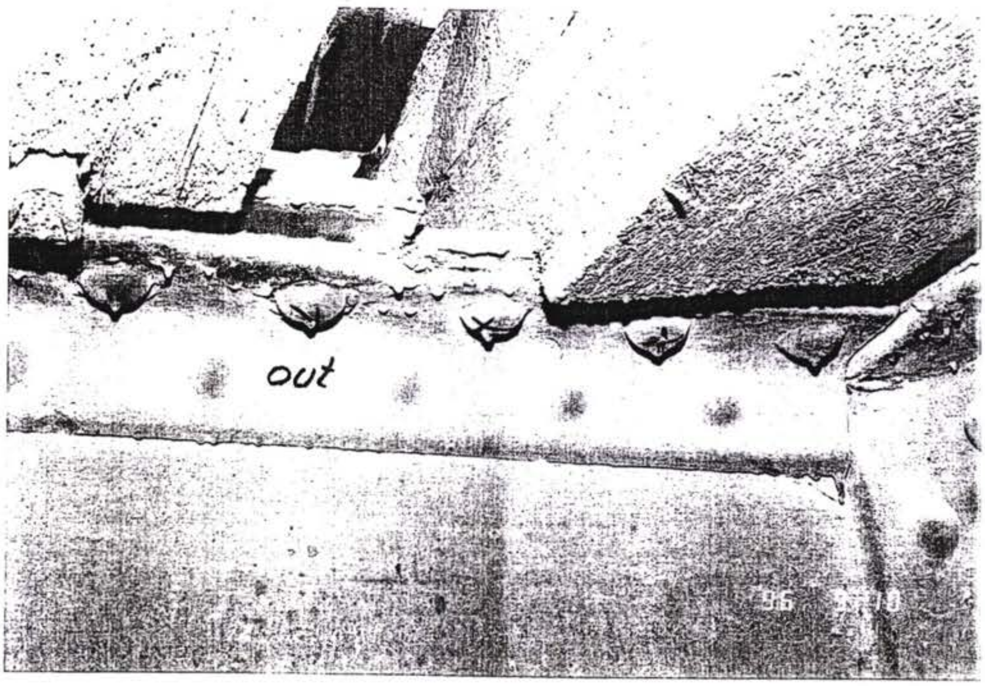
F6-01 Span 13
Corrosion at lower wind bracing, behind special cement



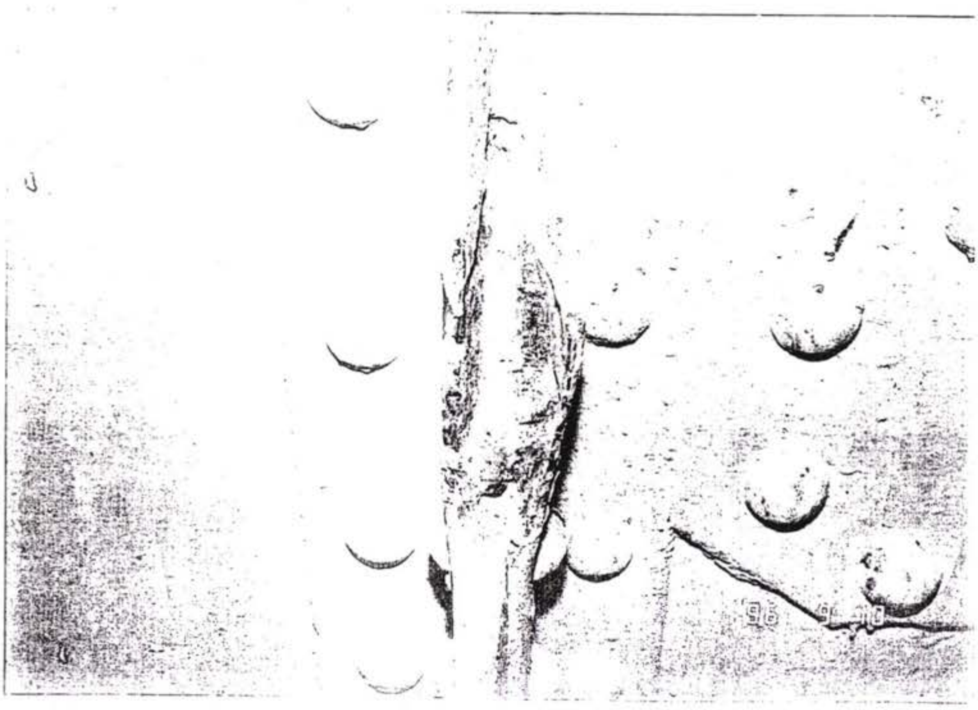
F6-02 Span 13
Corrosion at inspec. rail support



F6-03 Span 13
Special cement at LC node between angles US



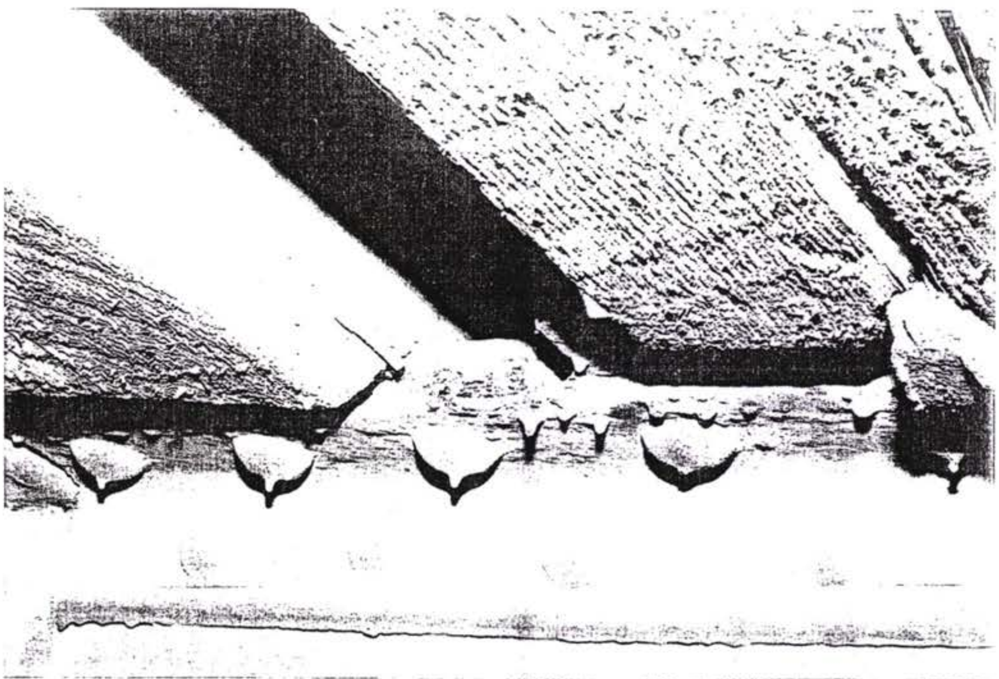
F6-04 Span 13
Lose and outstand. rivets at longitudinal girder



F6-0[illegible] Span 13
LC node at [illegible]

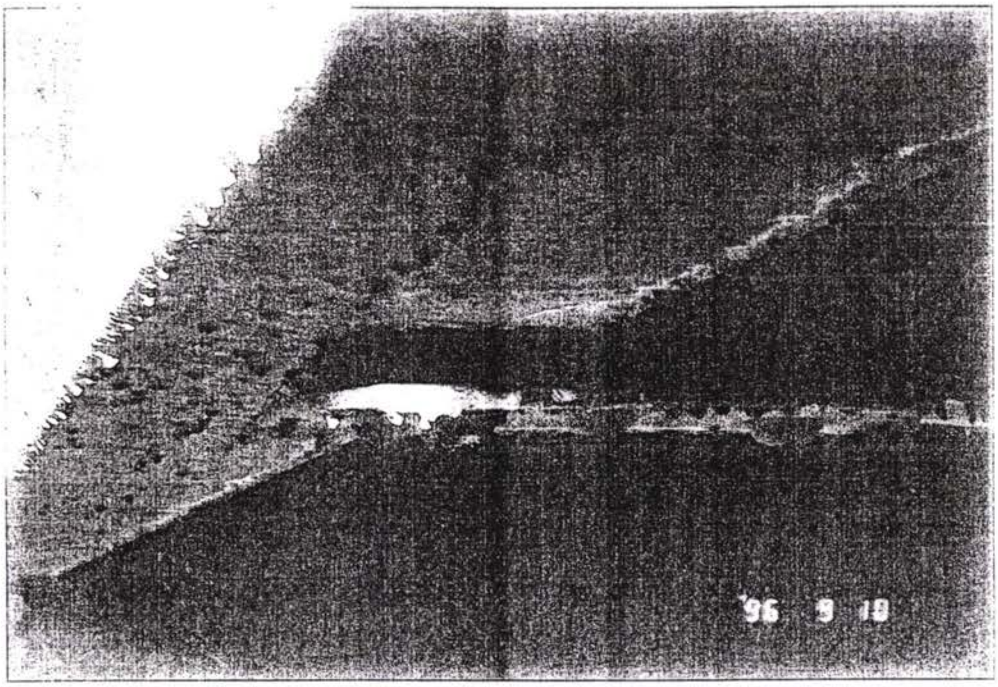
F6-06 Span 13
LC angle corrosion

F6-07 Span 13
LC node corrosion

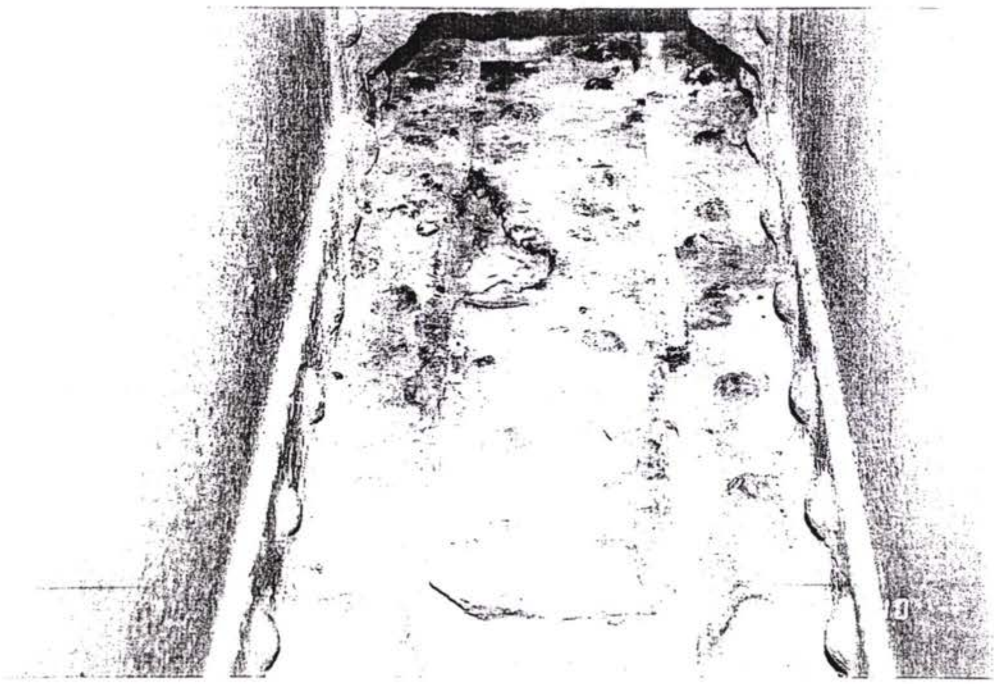


F6-08 Span 13
Longitudinal girder
upper flange corros.

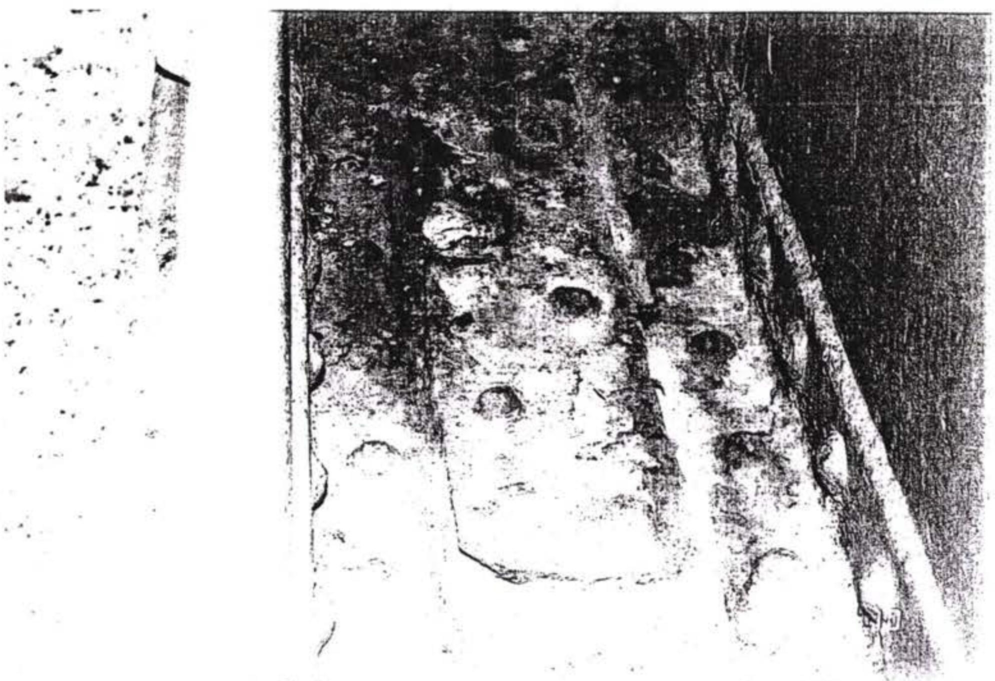
F6-09 Span 13
Longitudinal girder
corrosion in chink to
cross girder



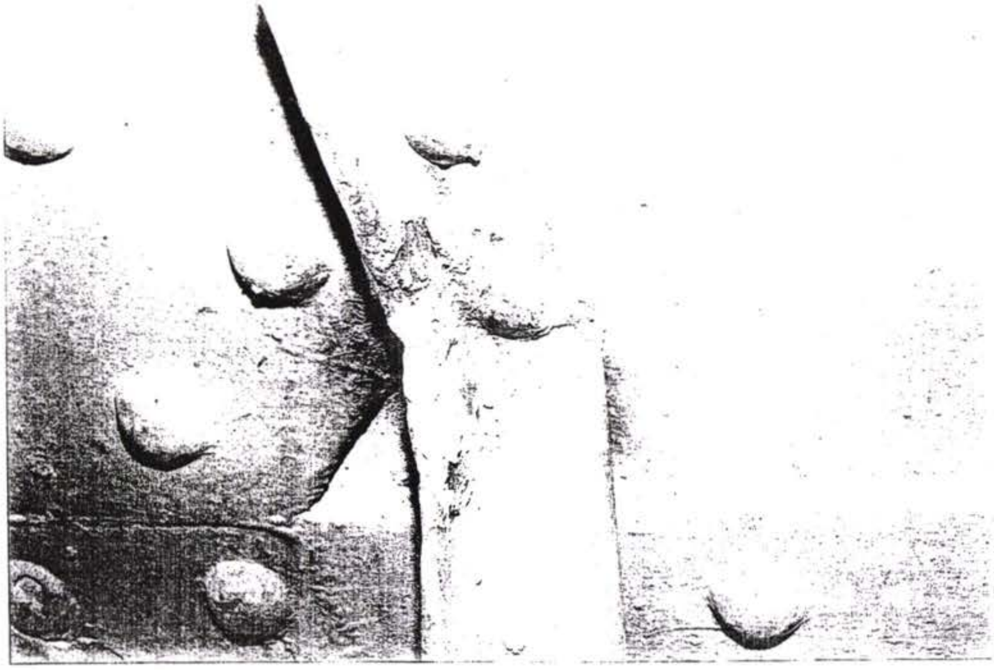
F6-10 Span 13



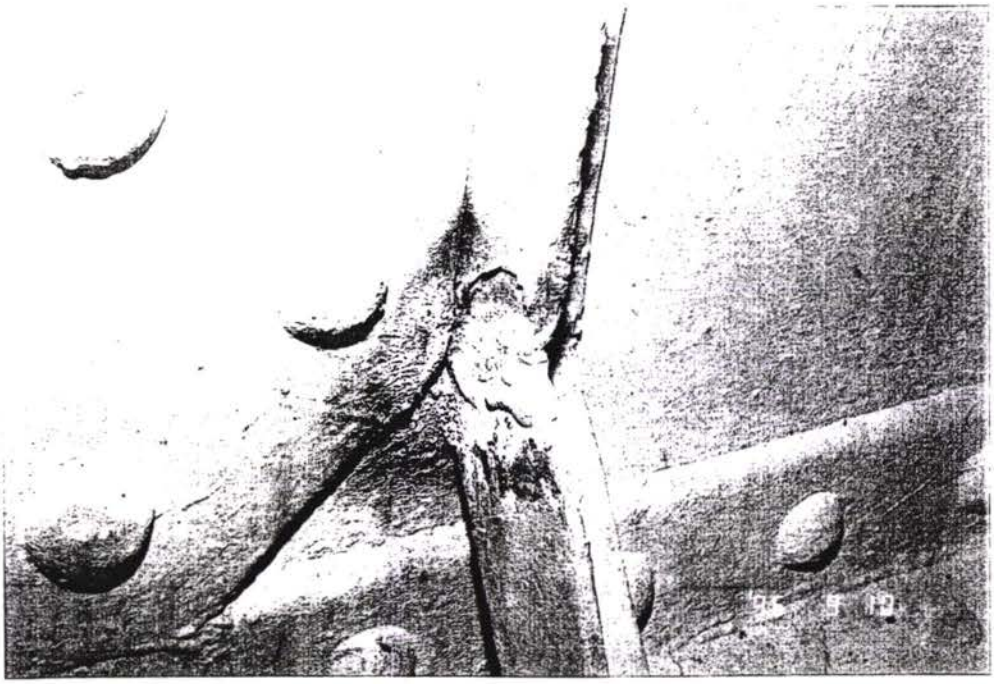
F6-11 Span 13
LC US node, rivet head and plate missing



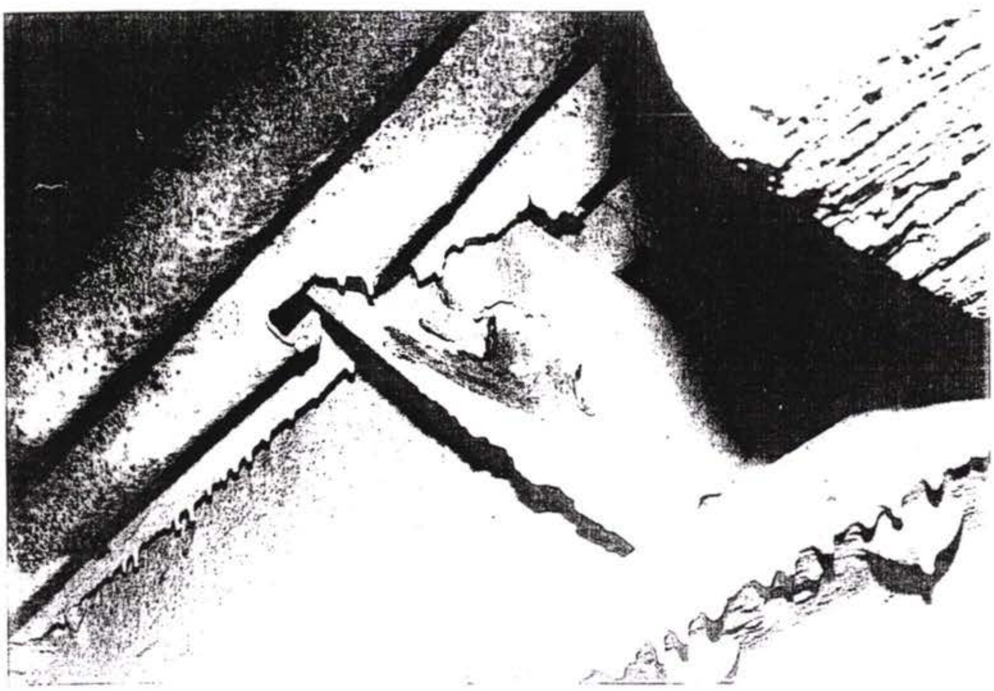
F6-12 Span 13
As F6-11



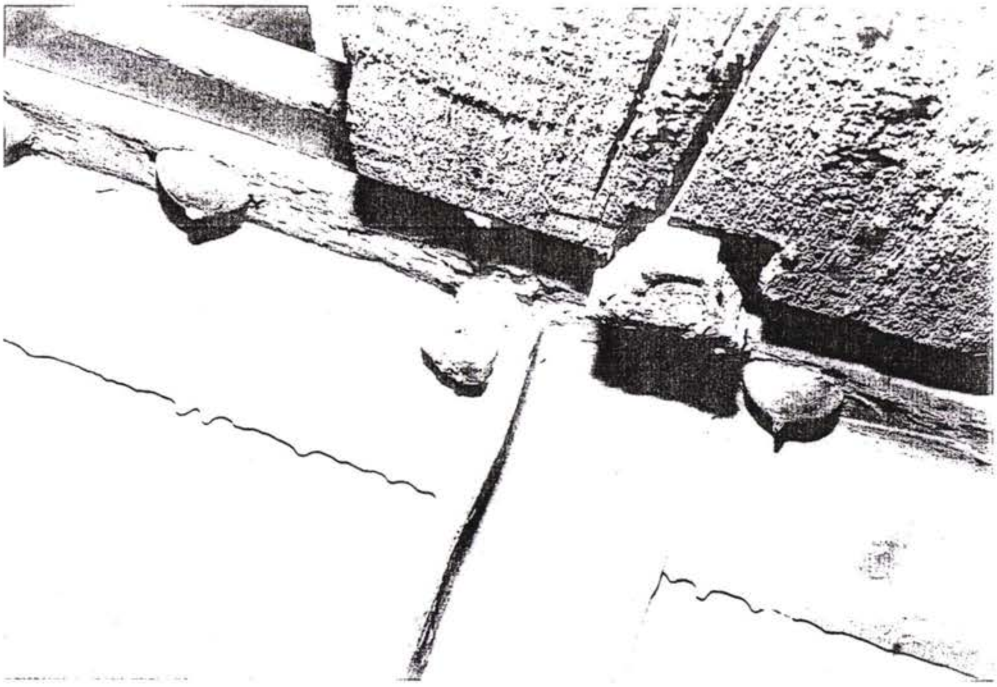
F6-13 Span 13
Broken inspection rail support



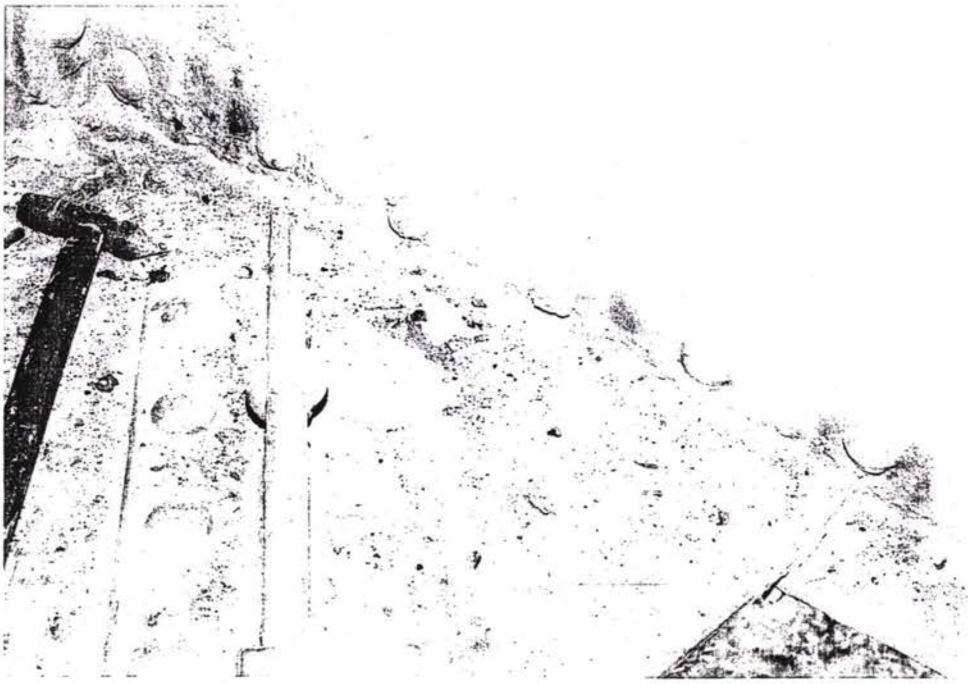
F6-14 Span 13
As F6-13



F6-15 Span 13
Longitudinal girder upper flange corros.

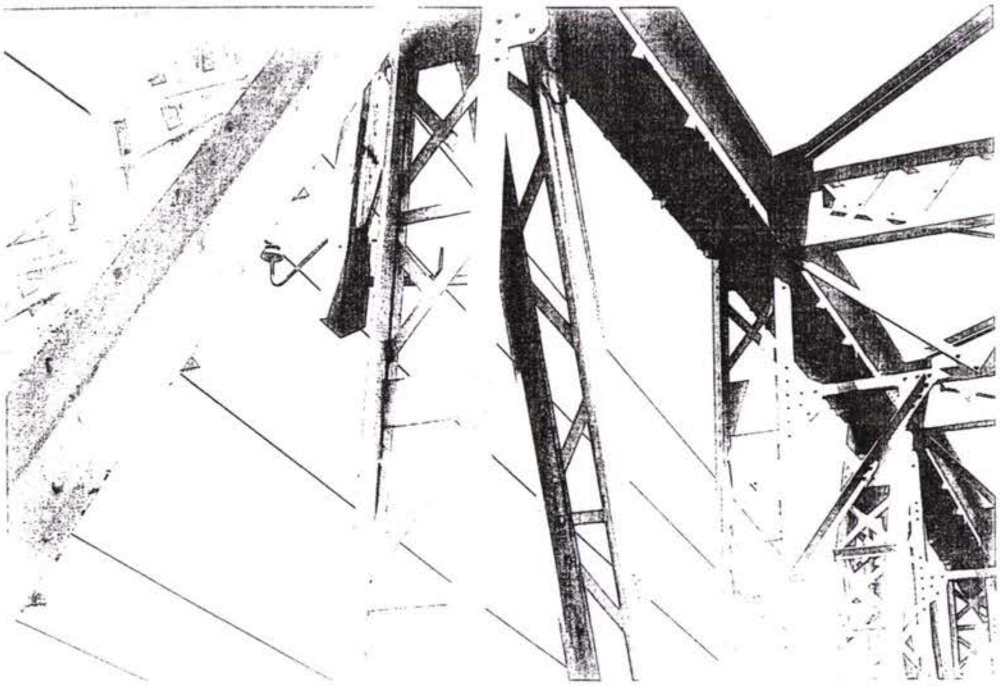


F6-16 Span 13
Longitudinal girder standing off rivet

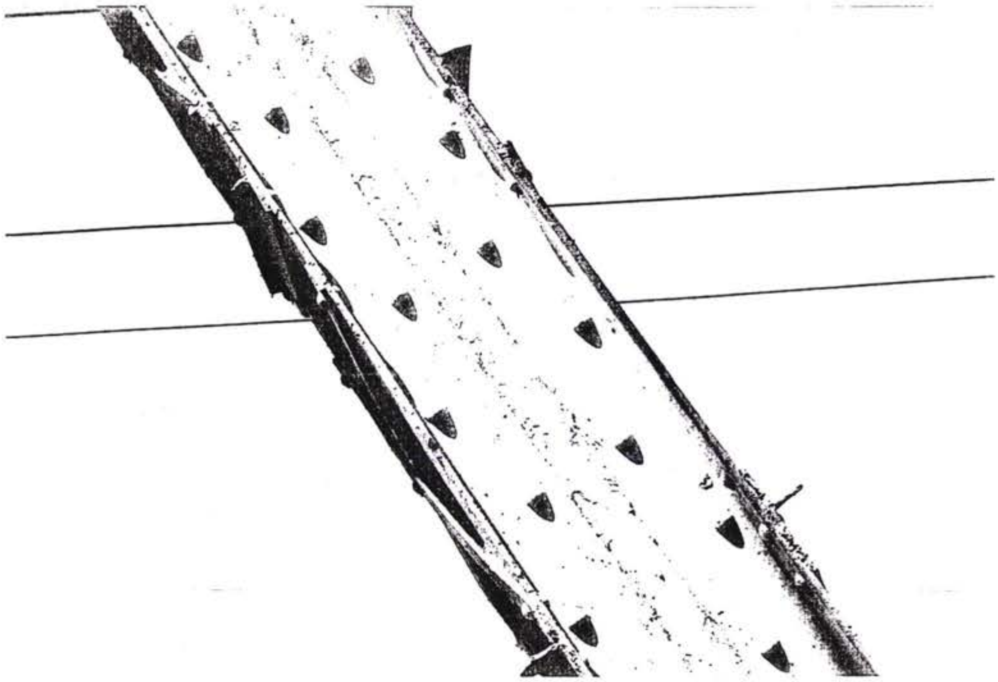


F6-17 Span 13
LC US corrosion

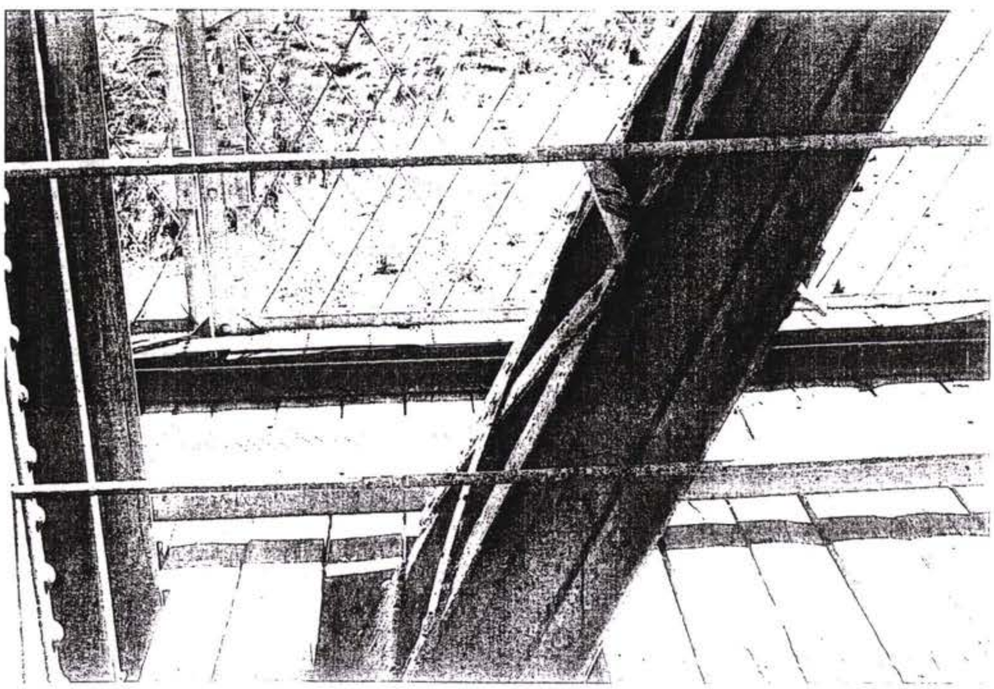
F6-18 Span 13
Bracing angle out of axis



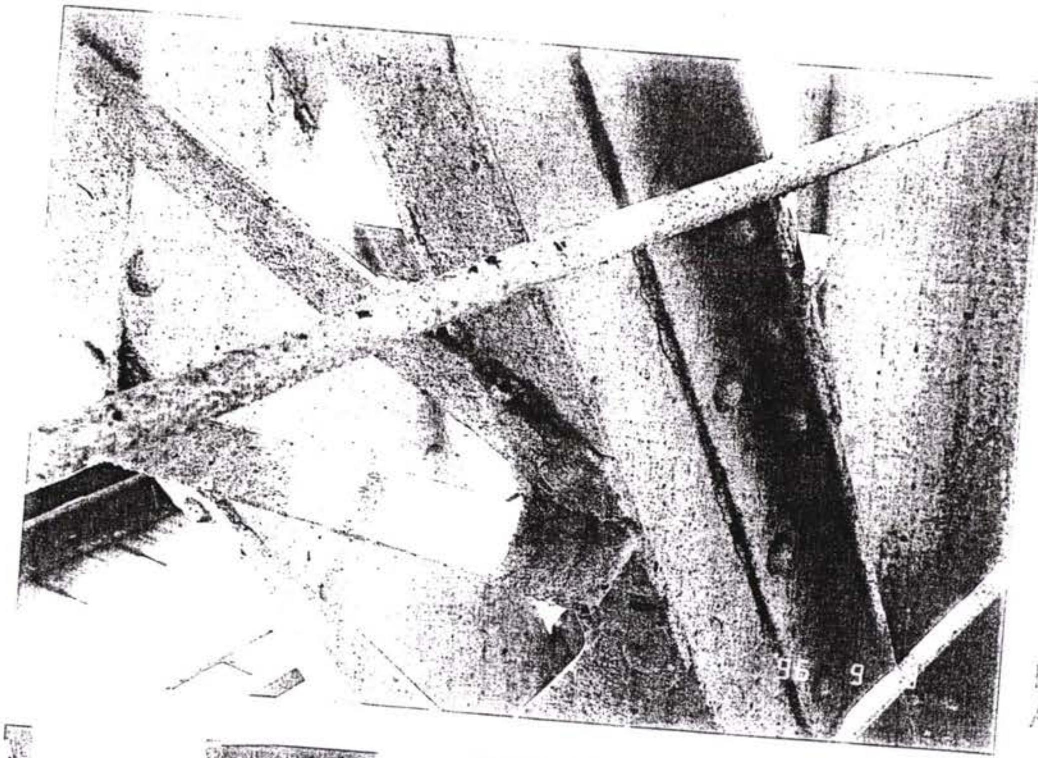
F6-19 Span 13
Bracing angle cut off, not replaced



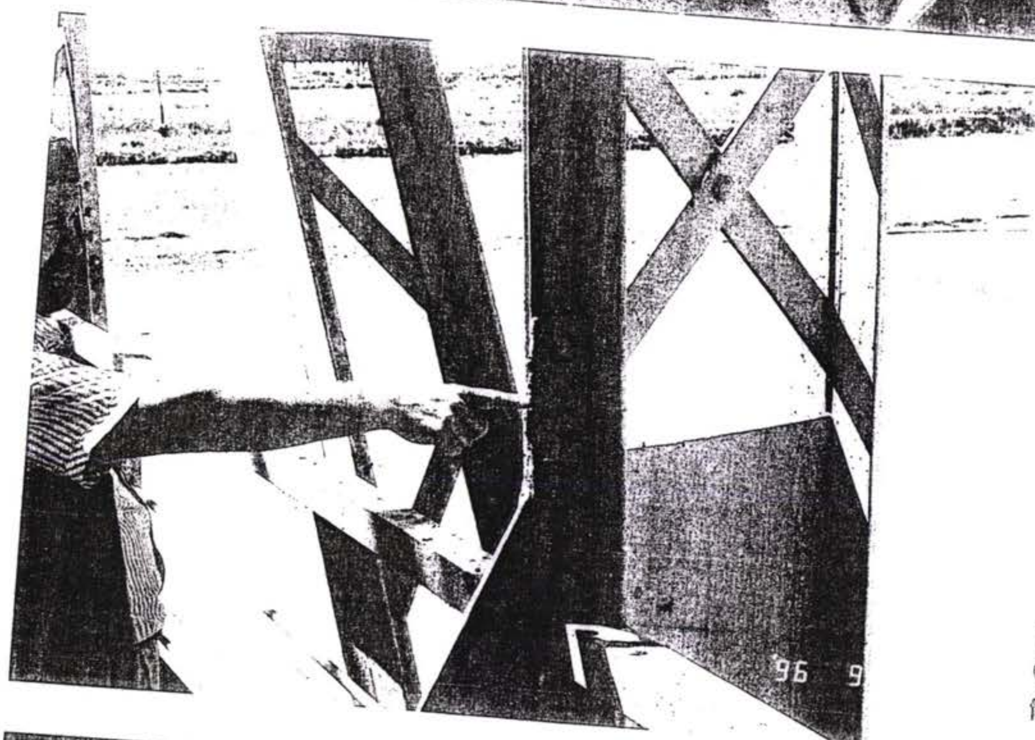
F6-20 Span 13
Corrosion behind special cement of diagonal



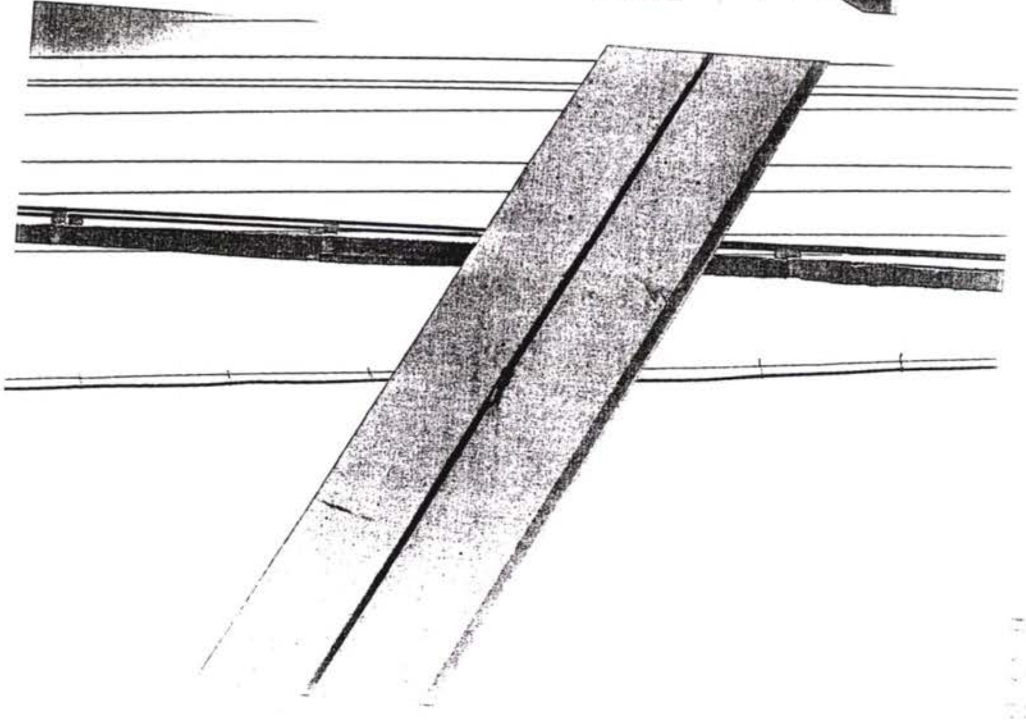
F6-21 Span 13
Deformation of flat plates of diagonal



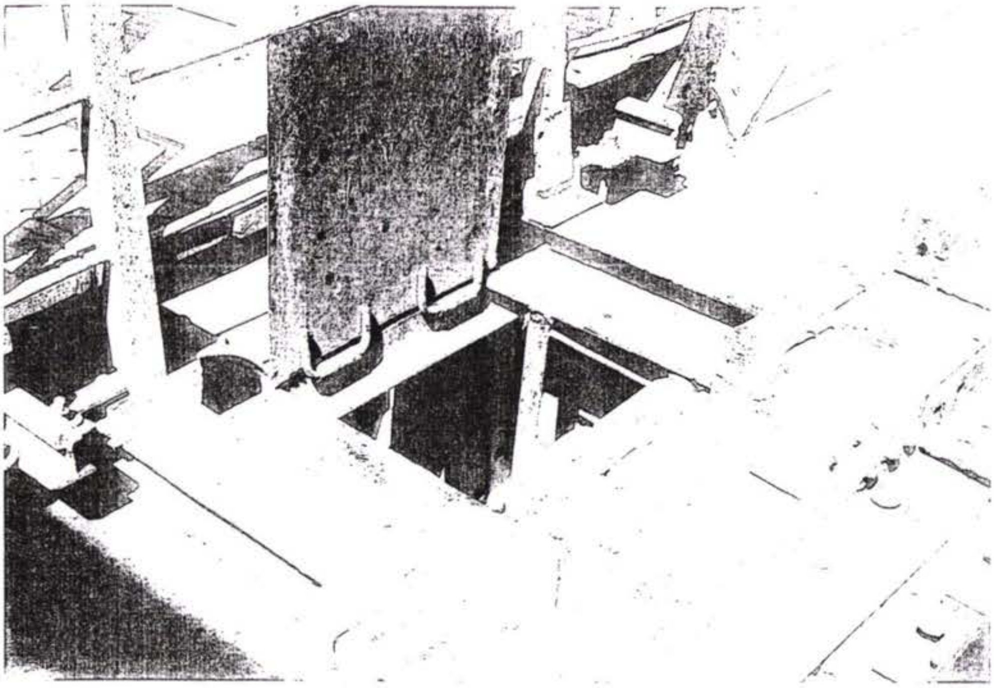
F6-22 Span 13
As F6-21



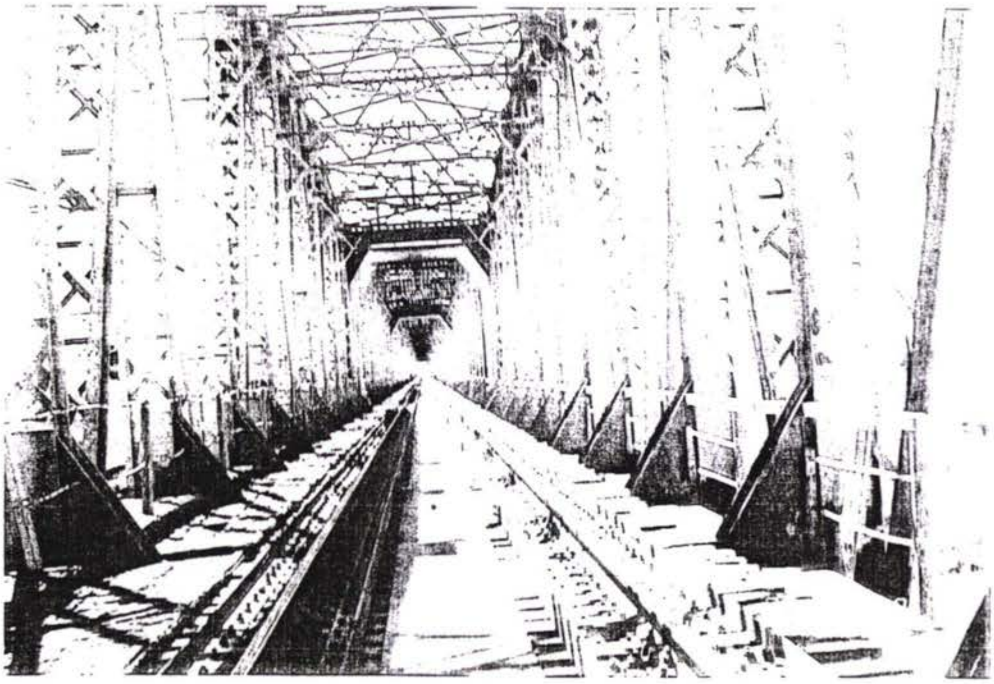
F6-23 Span 13
Cut off cantilever of
former railing



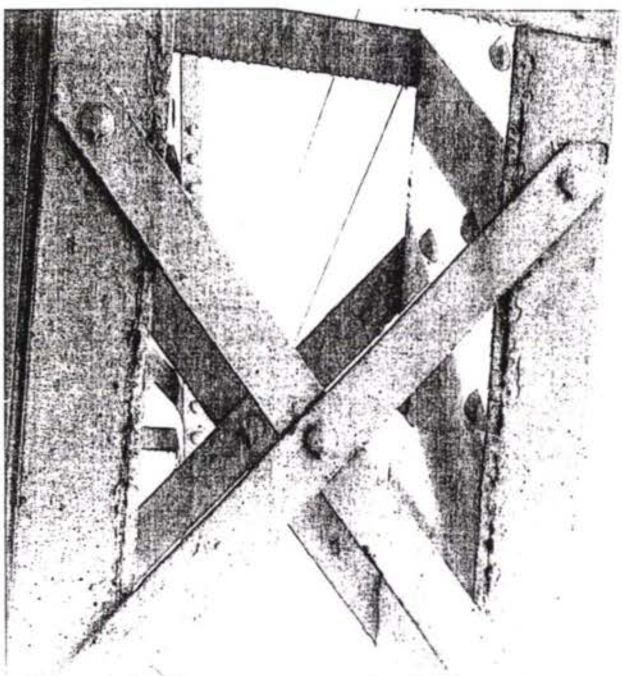
F6-24 Span 13
[illegible] at dia-
[illegible]



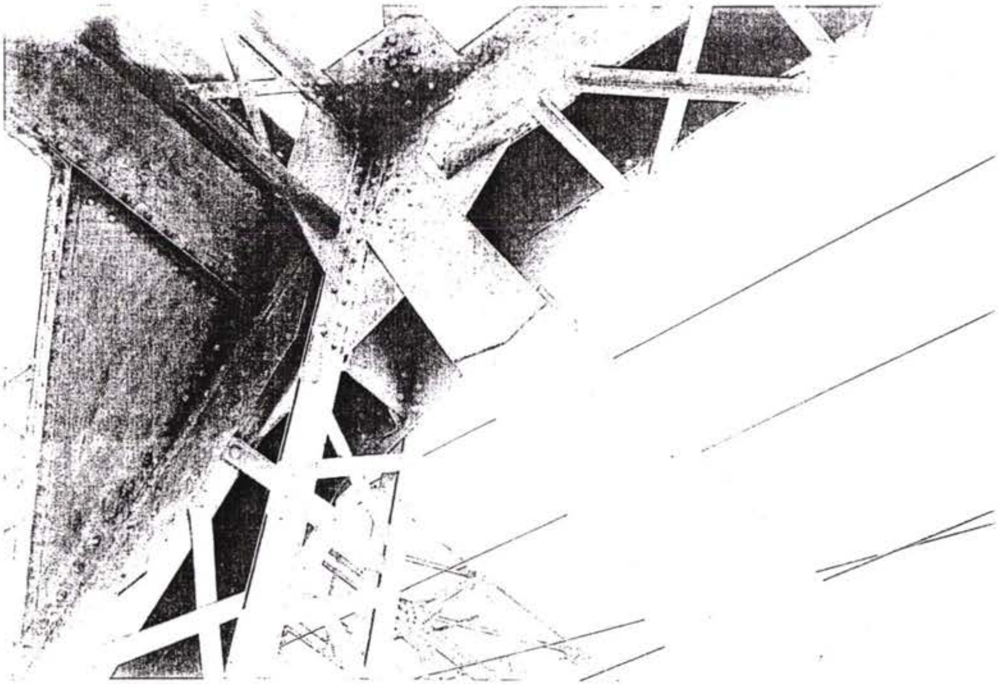
F6-25 Span 13
Trap-door at
descent to bearings,
at each span



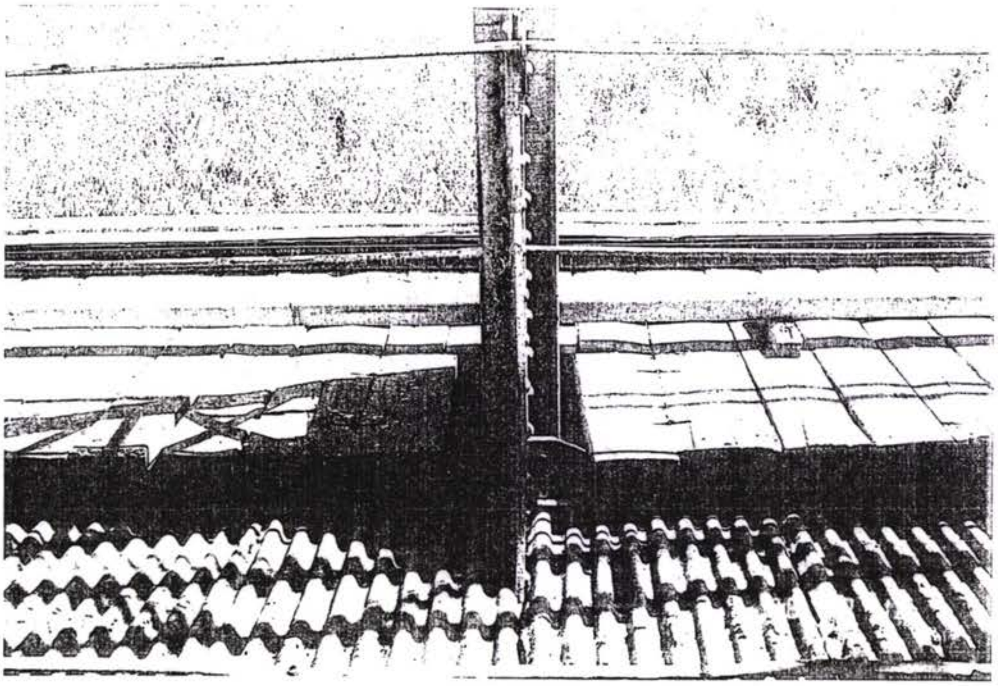
F6-26 Span 13
View along bridge
inside



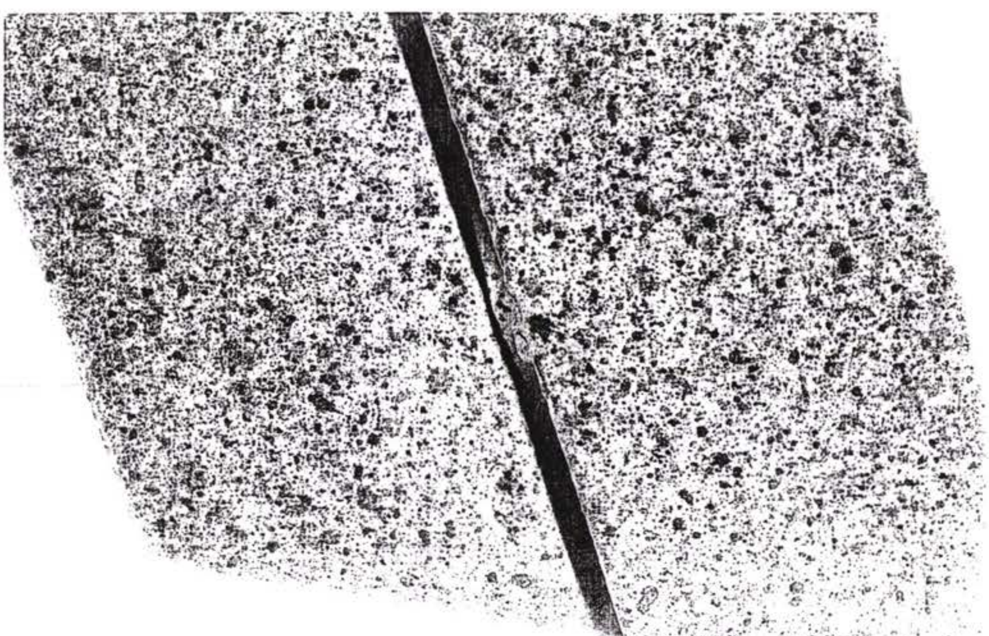
F6-27 Span [illegible]
[illegible]



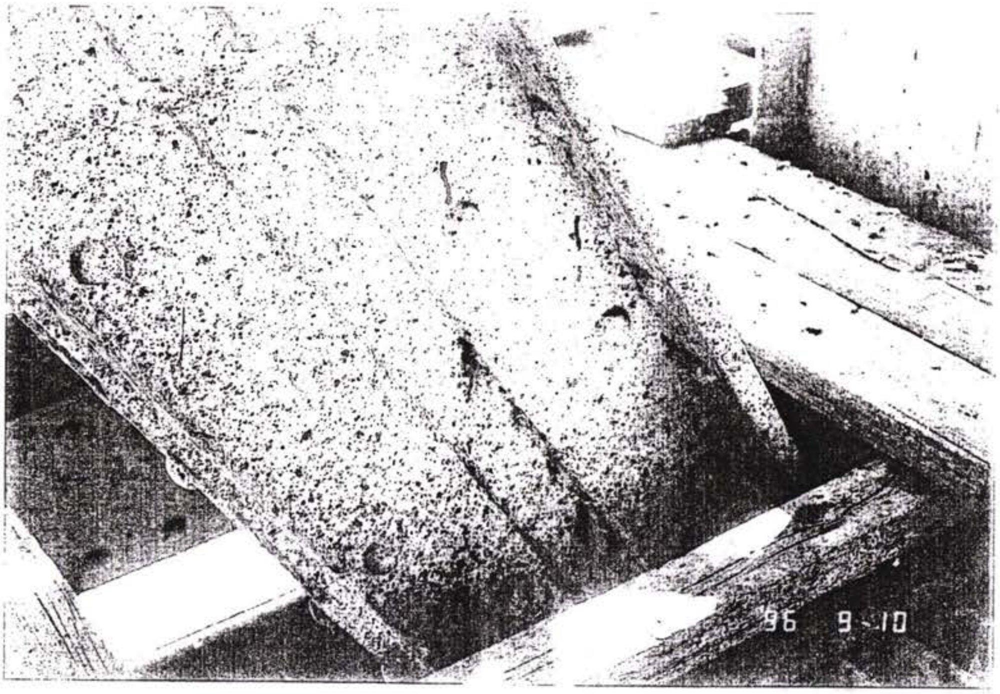
F6-28 Span 13
UC node 1 missing rivet



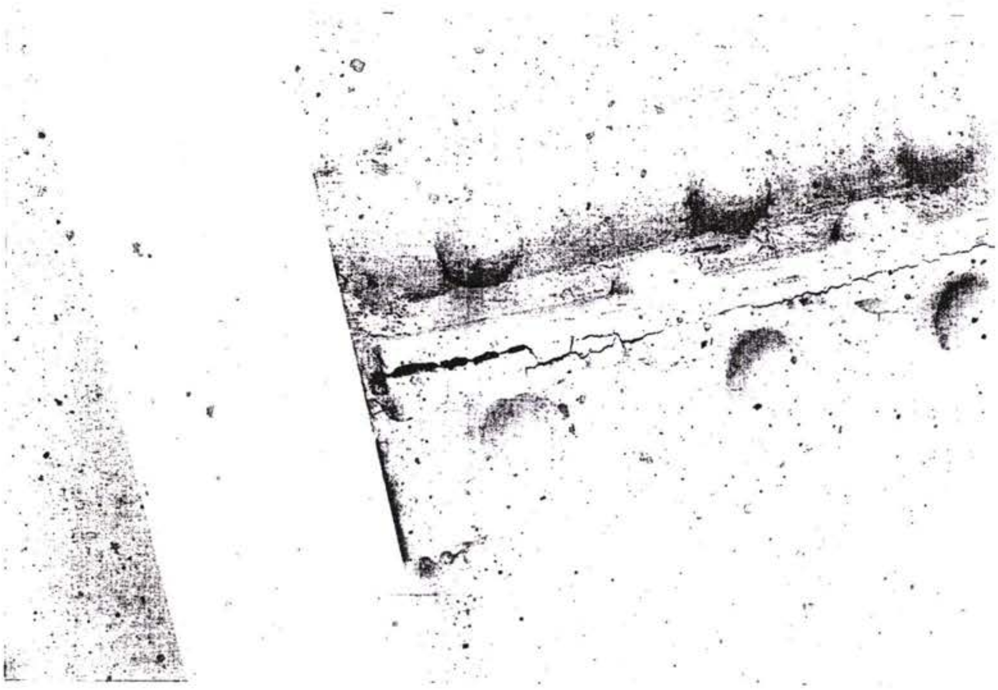
F6-29 Span 13
Deformed stiffener plate between cross girder and vertical



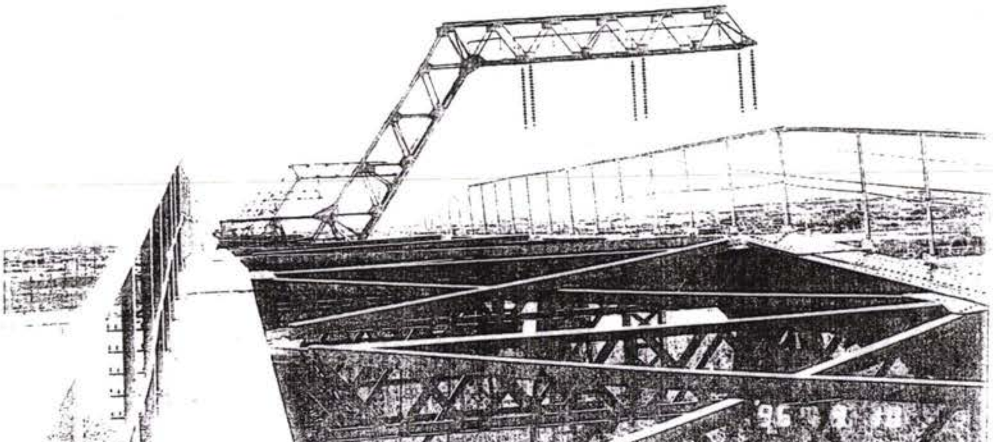
F6-30 Span 13
[illegible]
[illegible]



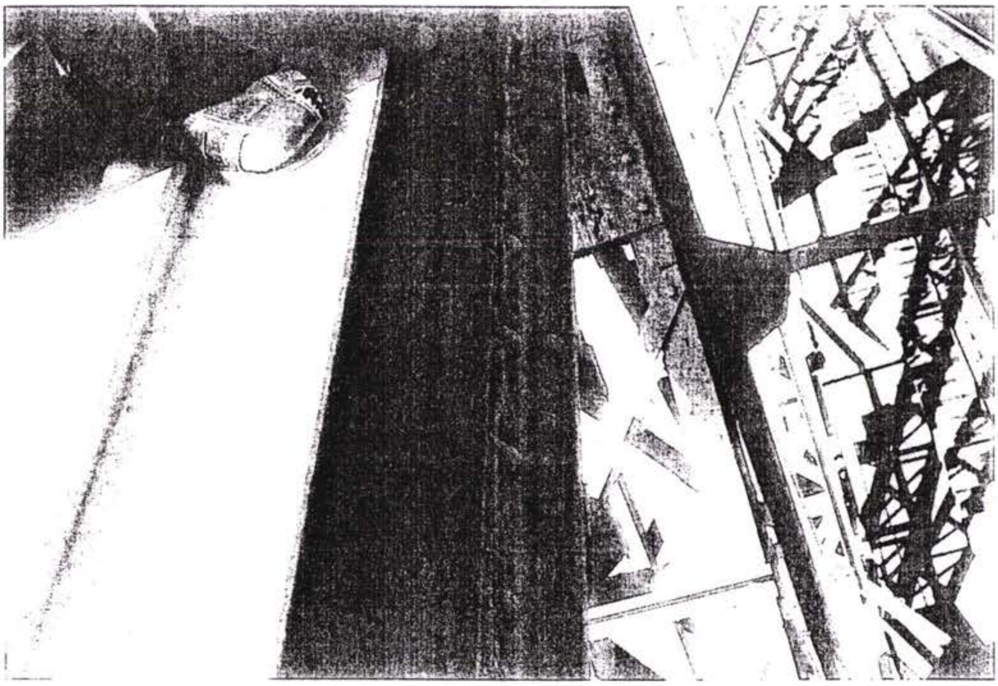
F6-31 Span 13
As F6-30



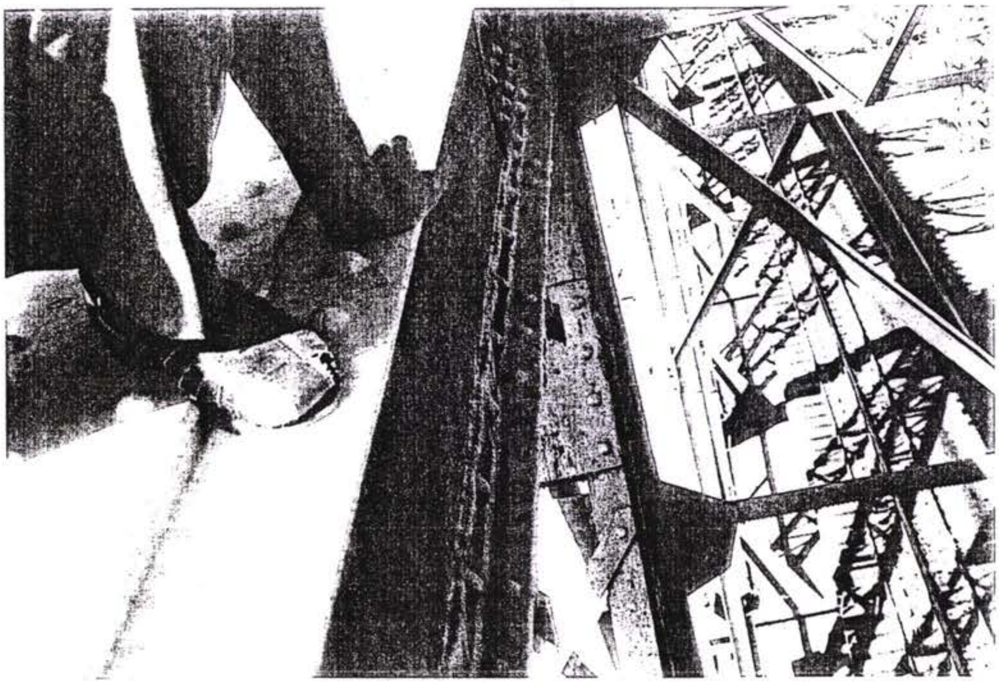
F6-32 Span 13
LC DS angle
puffed up by corros.



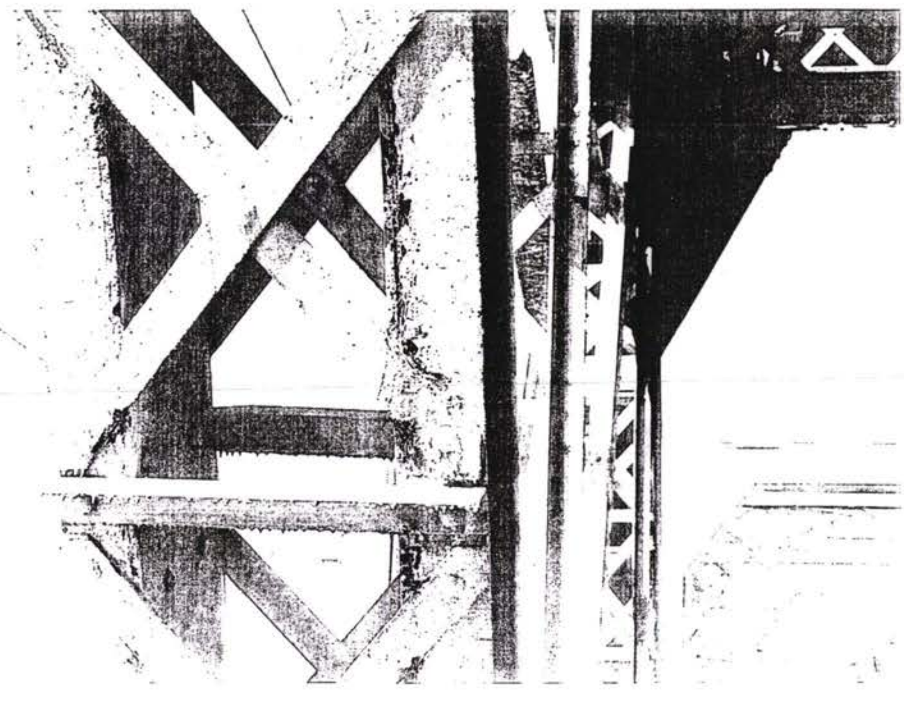
[illegible]



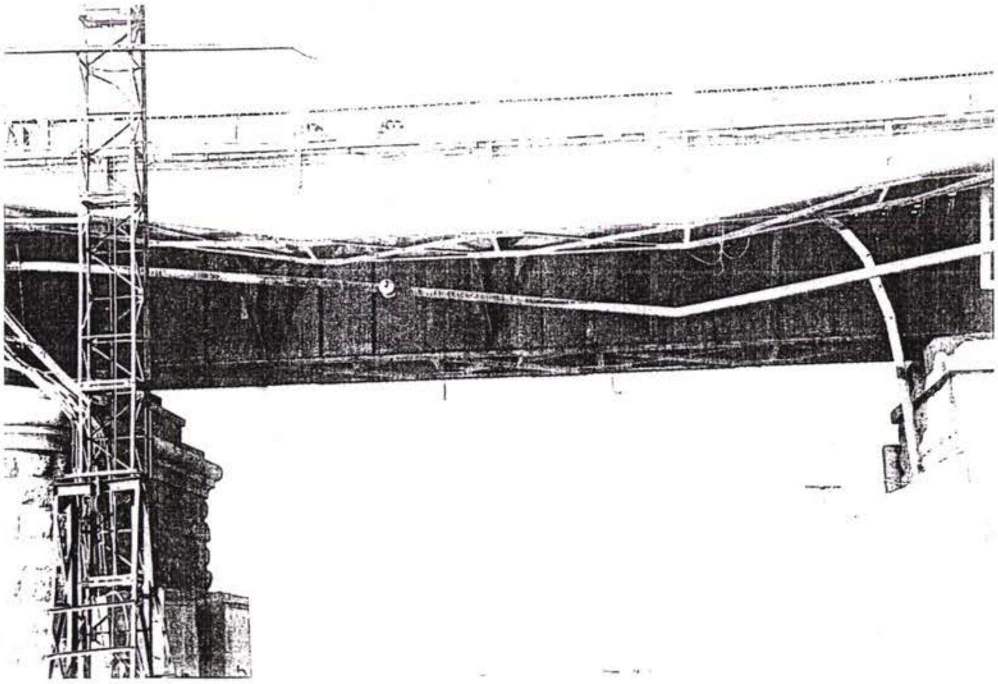
F6-34 Span 13
UC DS puffing up between rivets



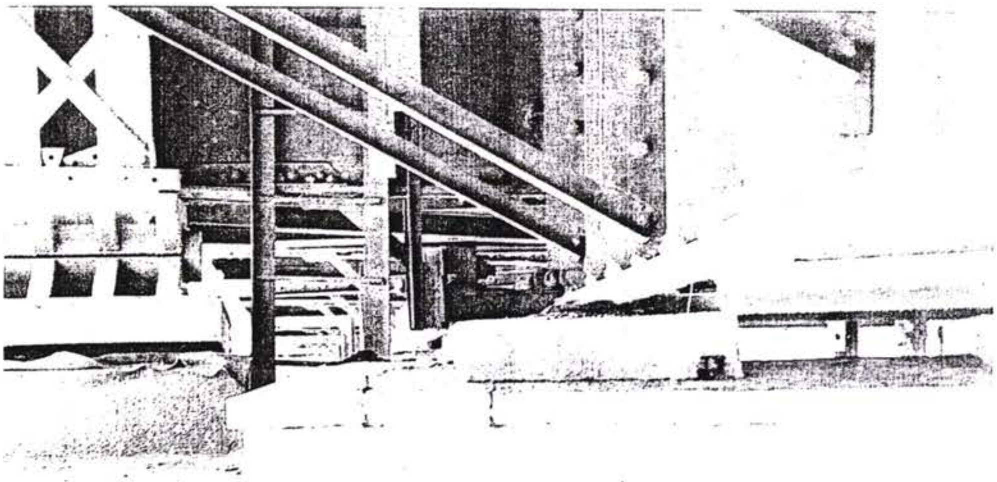
F6-35 Span 13
As F6-34



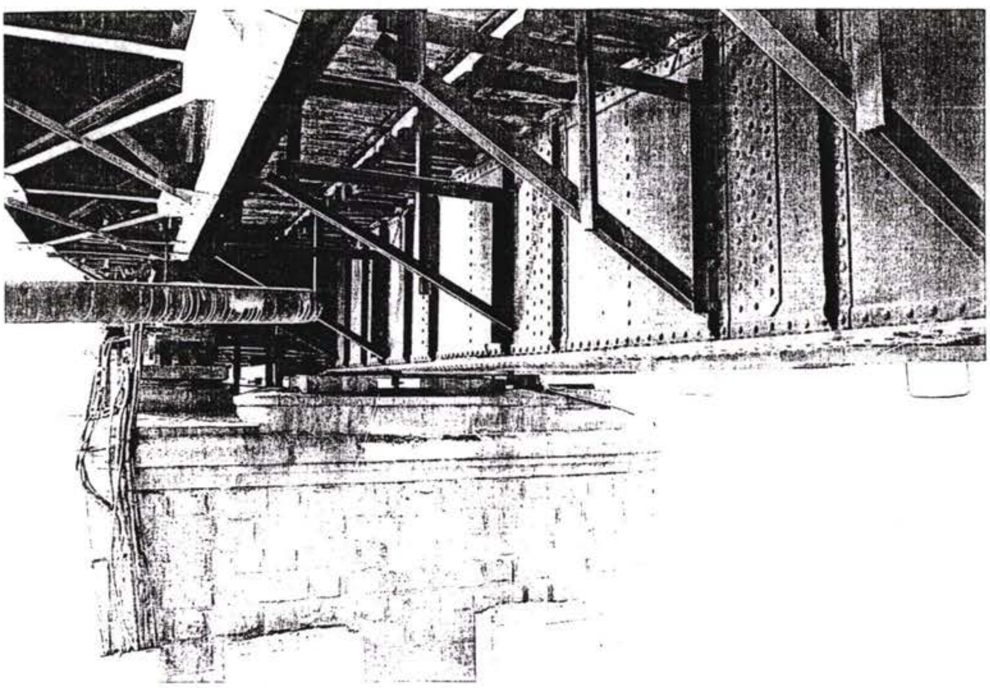
F6-37 Span 13
Corrosion of dia-gonal



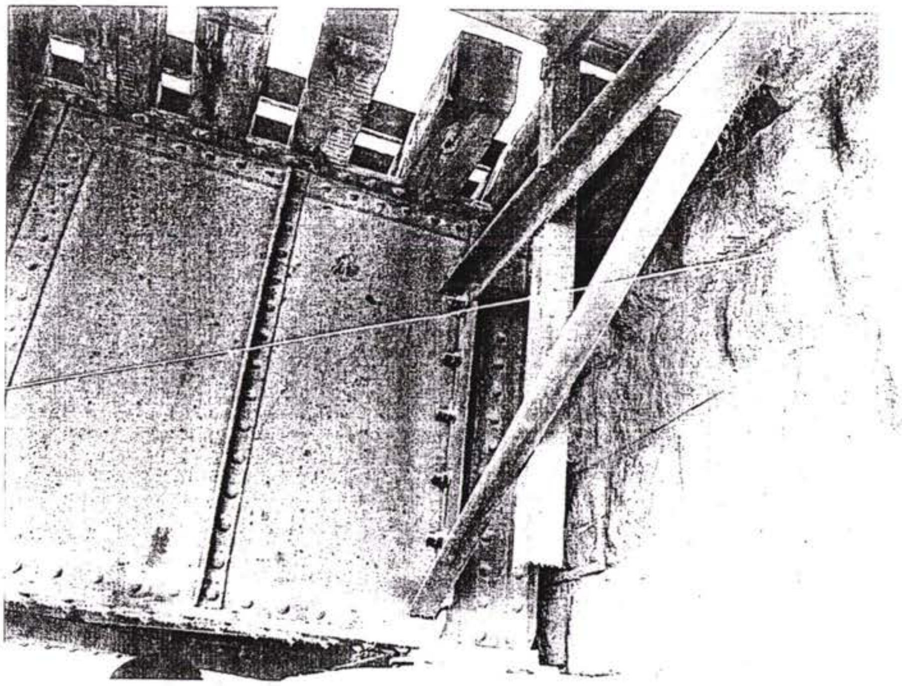
F7-06 Span 26
View of footbridge



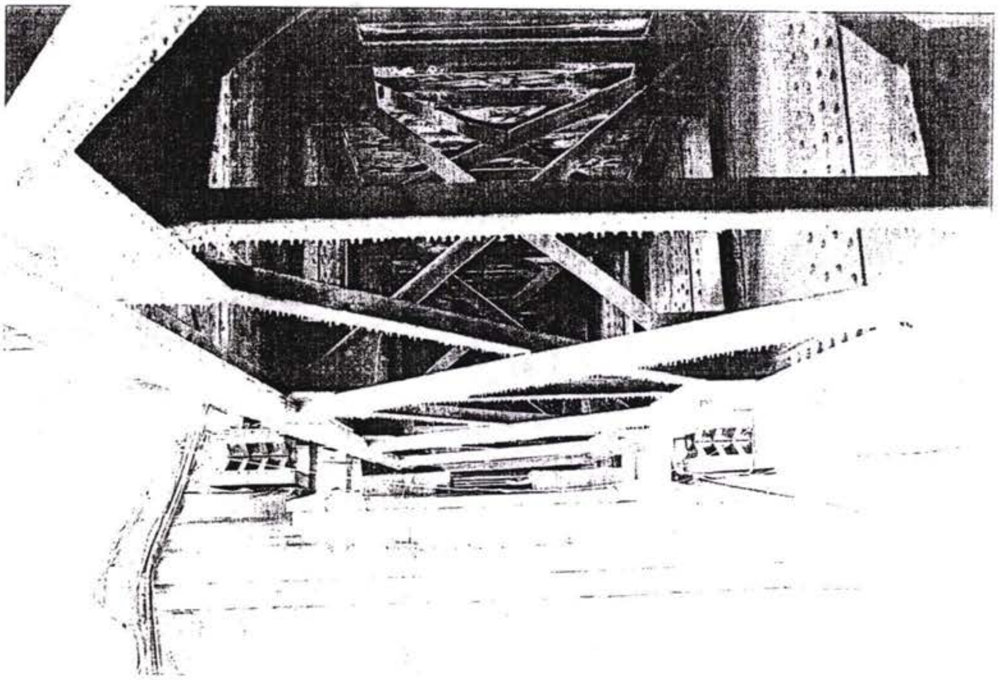
F7-07 Span 26
Bearing A1 with
cracked stone



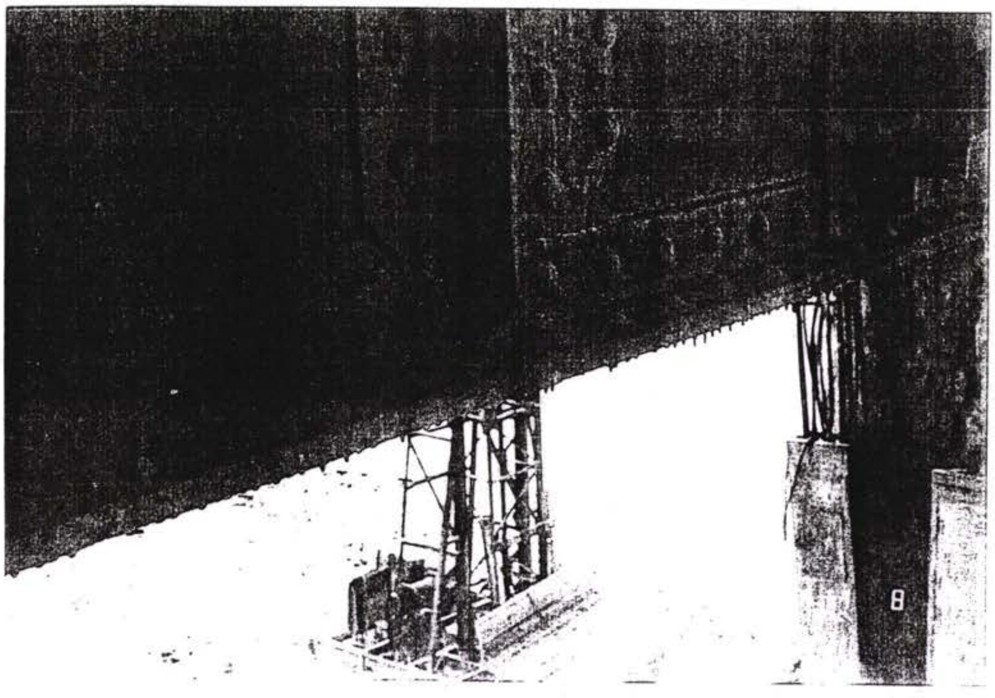
F7-08 Span 26
View from US



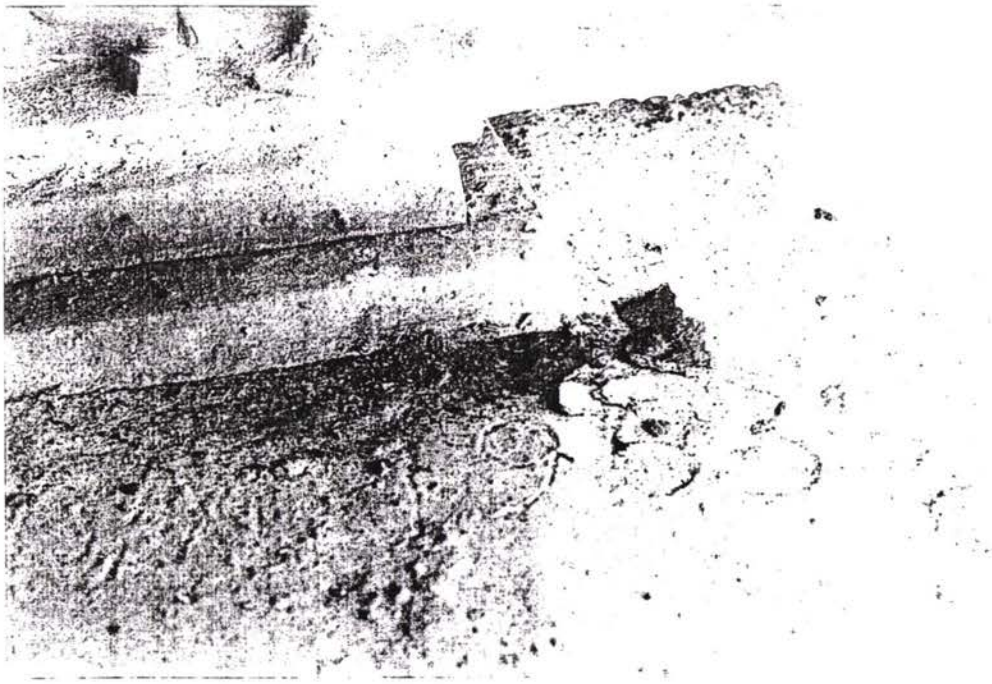
F7-09 Span 26
Footbridge - bolted cantilever



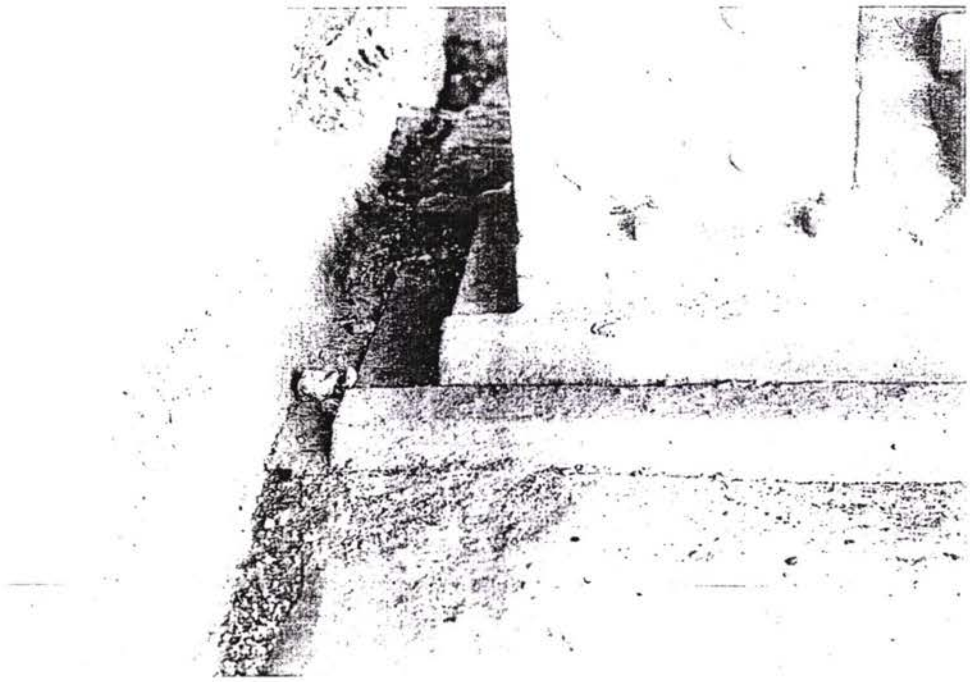
F7-10 Span 26
Bridge - lower side



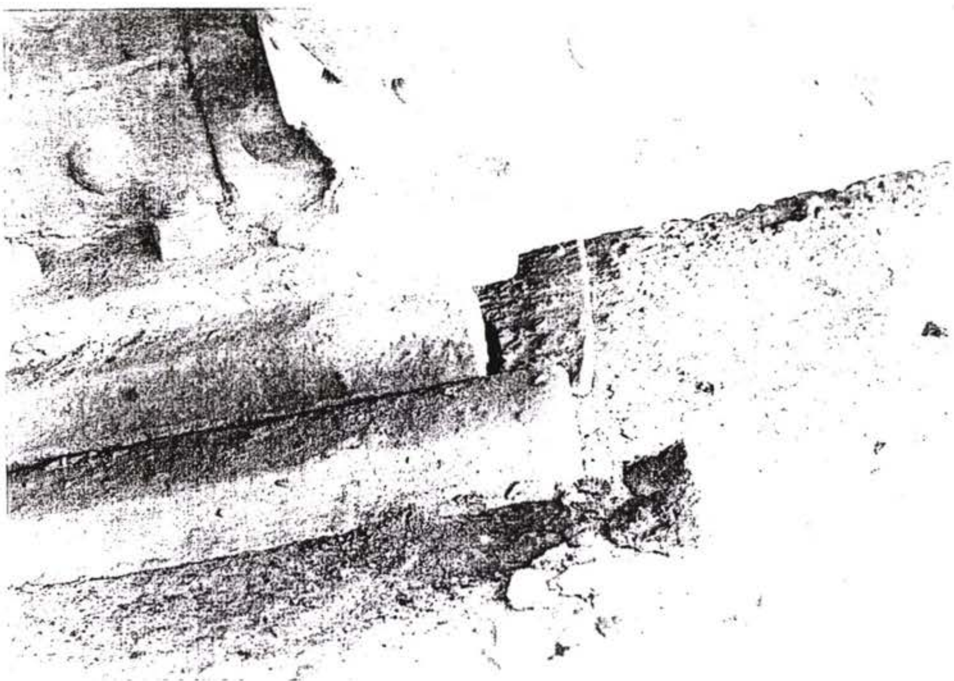
F7-11 Span 26
Main girder from DS



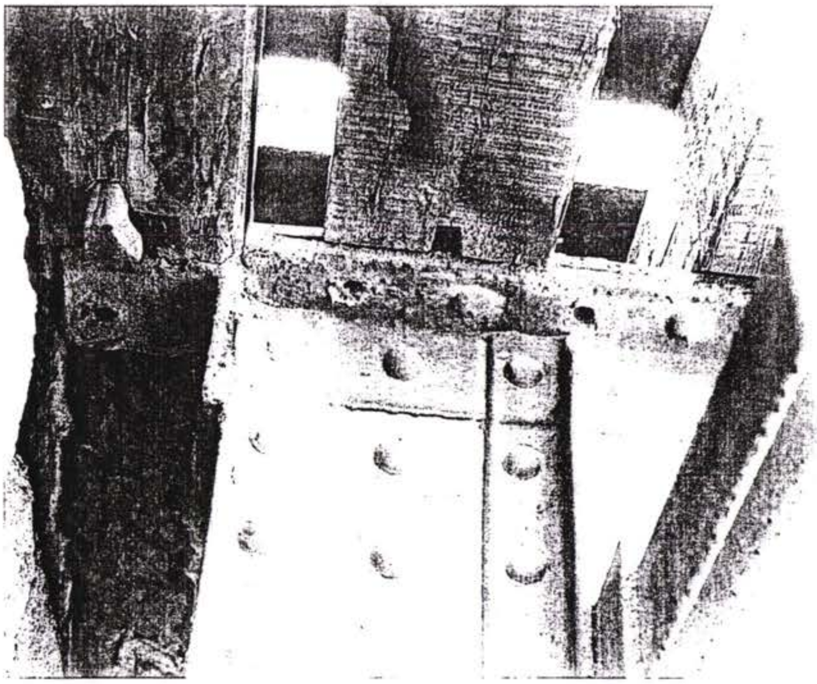
F7-12 Span 26
Bearing B2 -
defective mortar



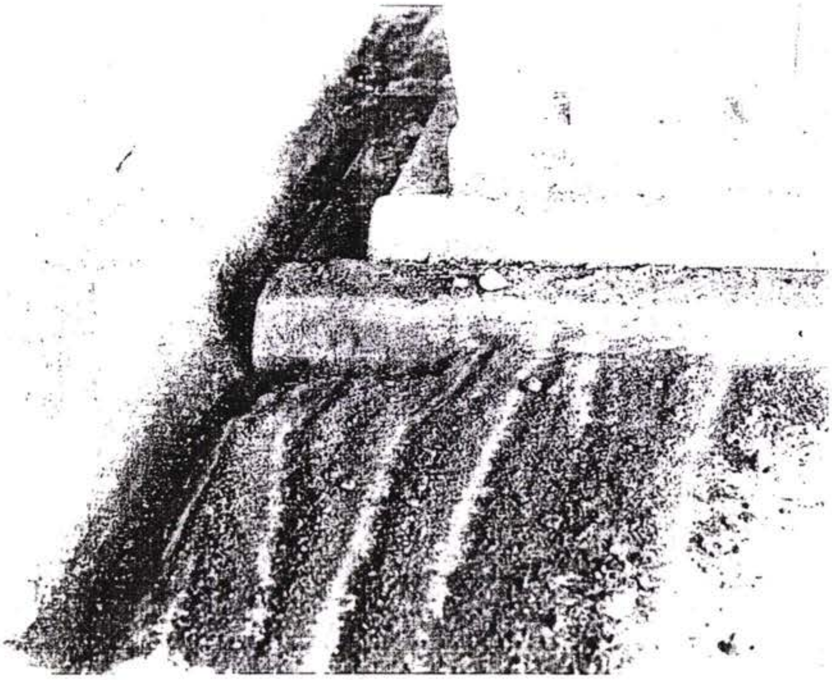
F7-13 Span 26
Bearing B2 -
water channel



F7-14 Span 26
Bearing B2 -
defective mortar

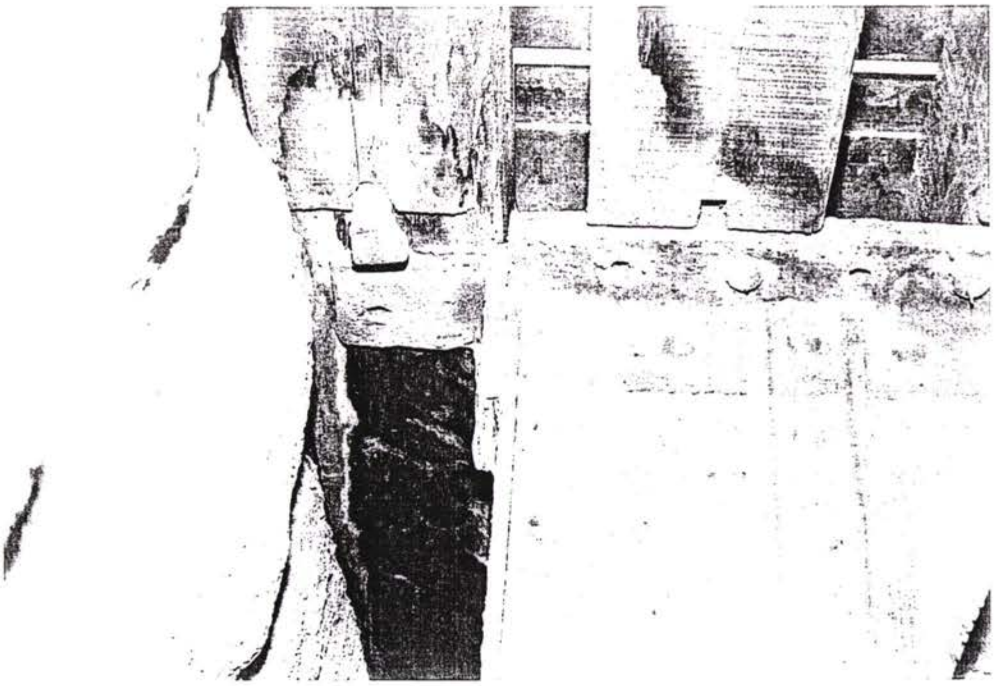


F7-15 Span 26
Angle welded to structure

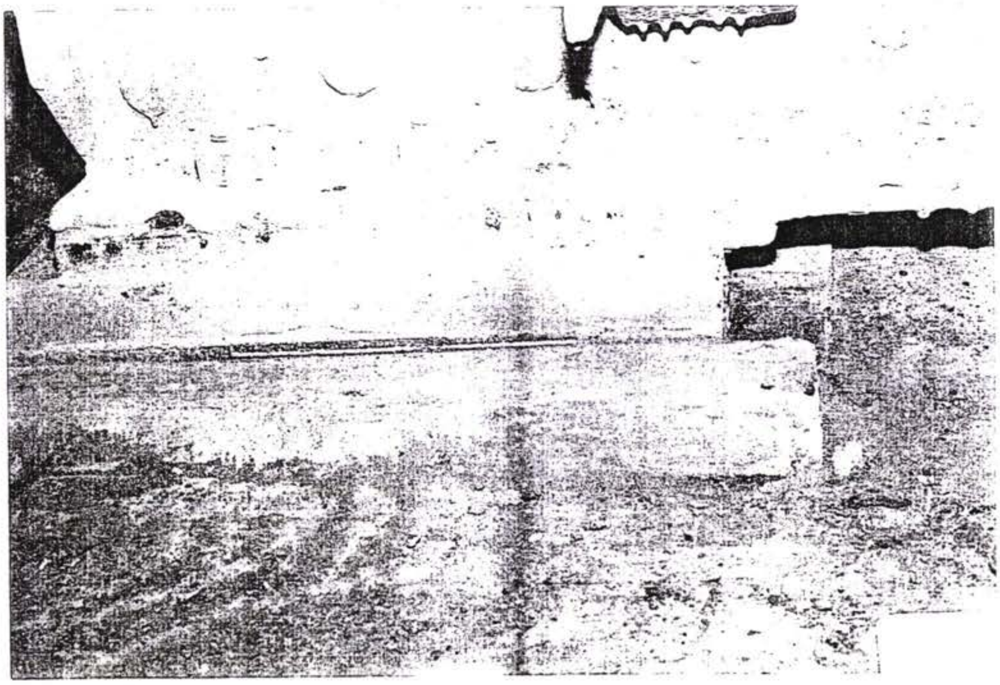


F7-17 Span 26
Bearing B2

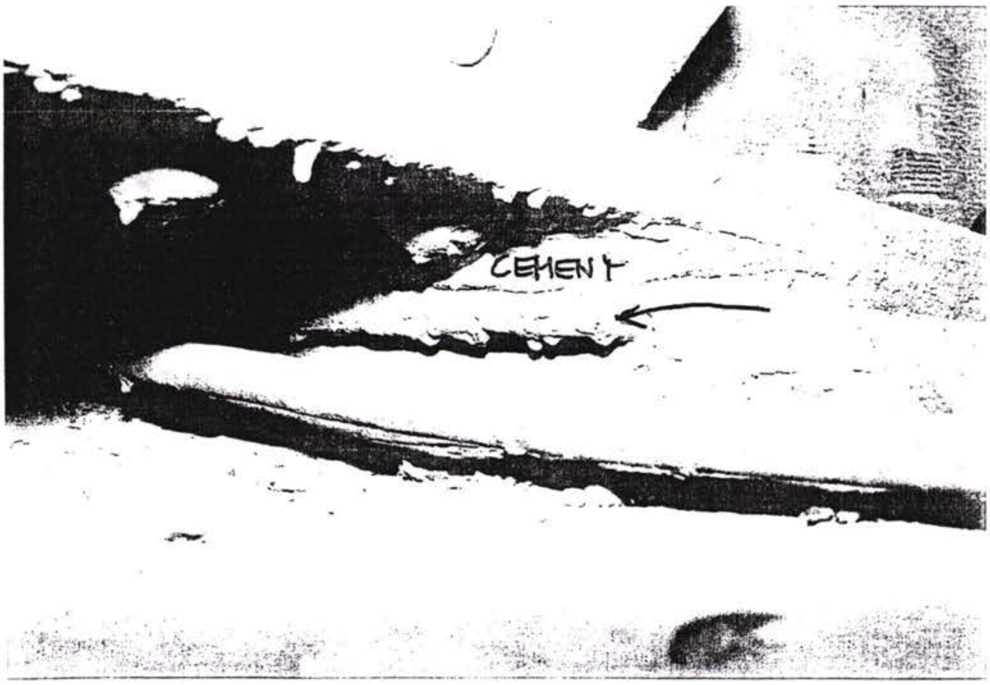
F7-18 Span 26
Bearing B2



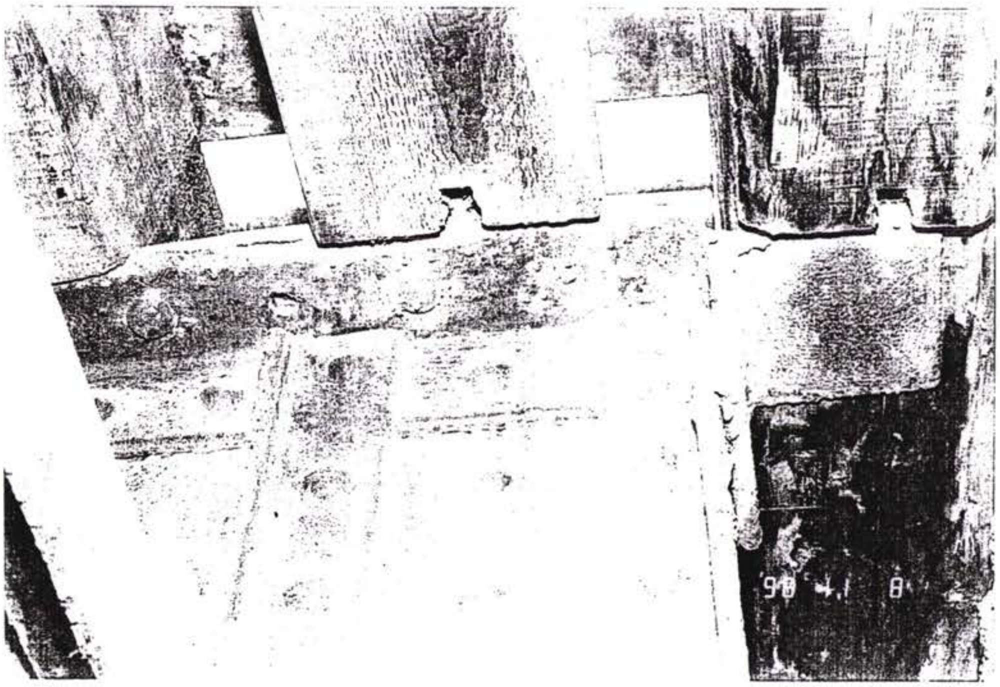
F7-19 Span 26
Angle welded to structure



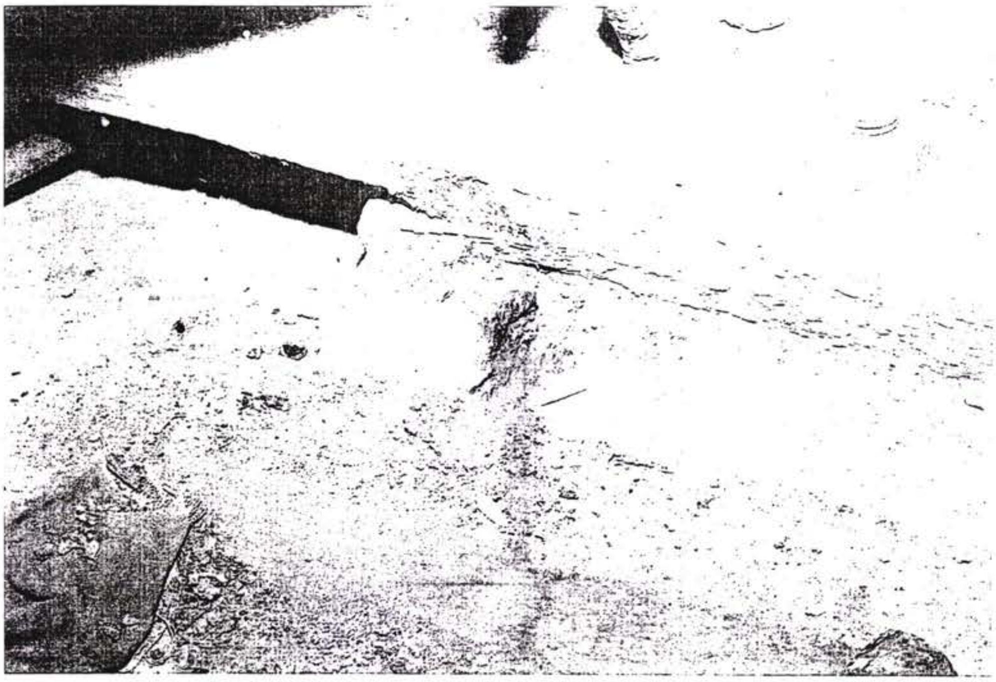
F7-20 Span 26
Bearing B2 - vertical movement



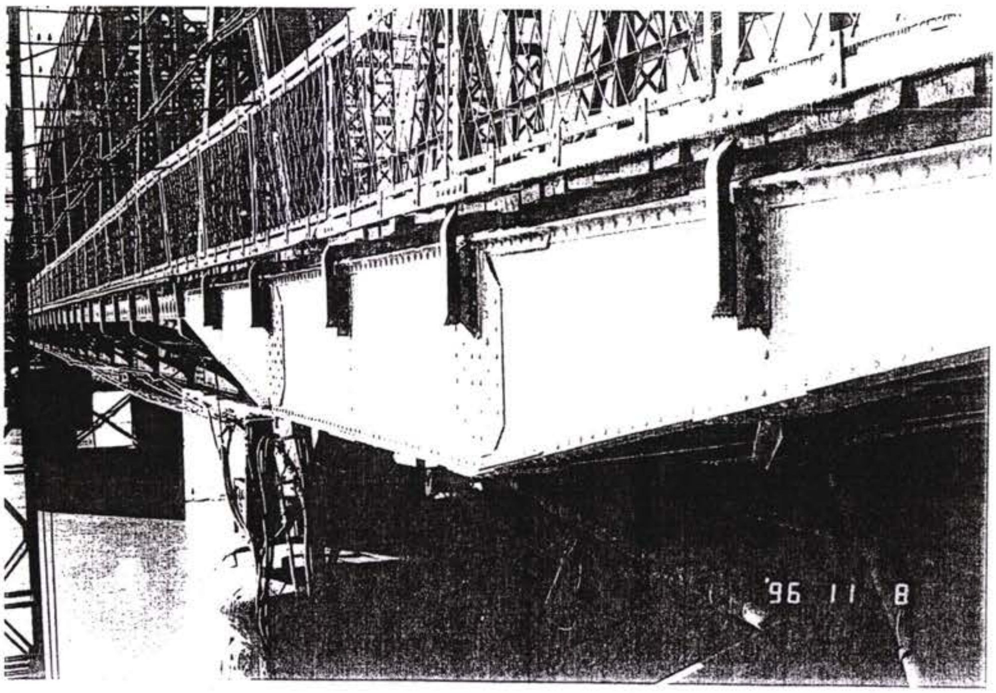
F7-22 Span 26
Bearing B1 - Distortion of upper bearing plate



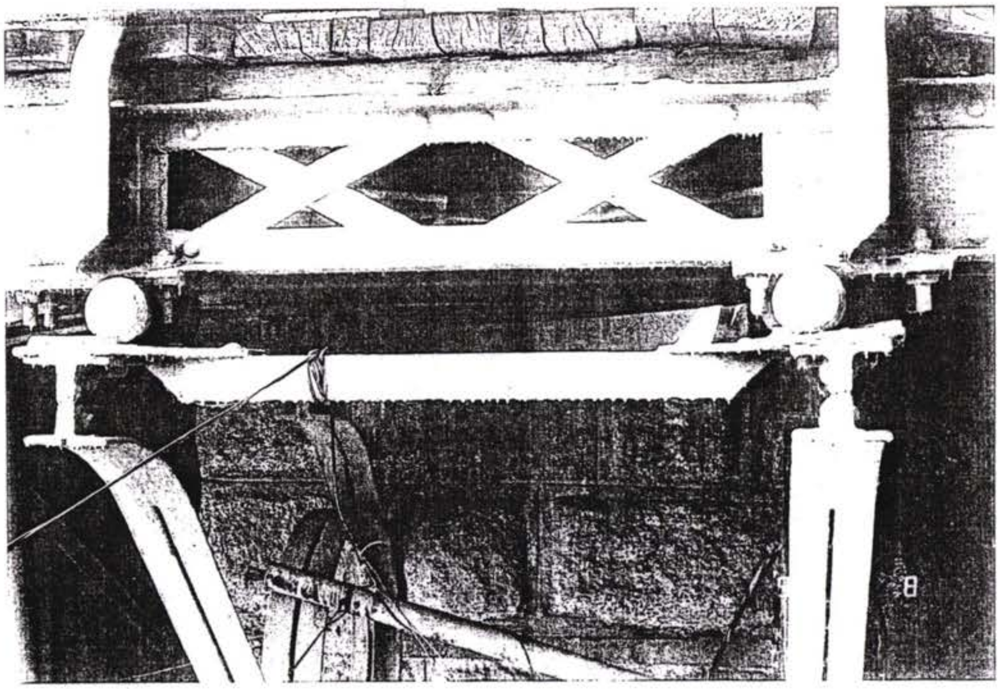
F7-23 Span 26
Welded fixing angle
for sleepers



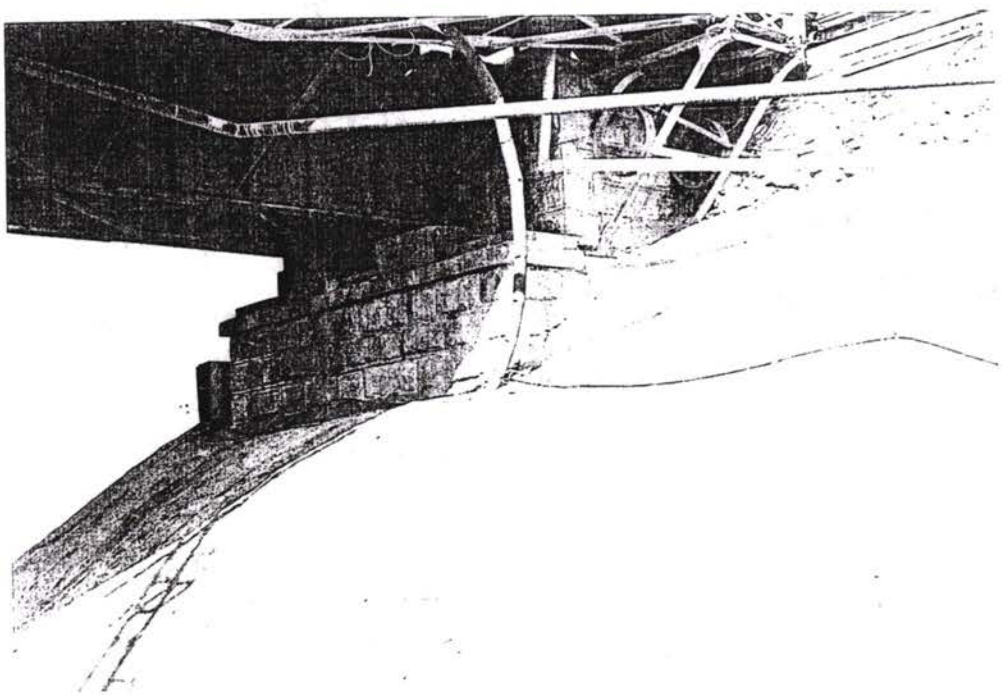
F7-24 Span 26
Bearing B1 -
cracked lower plate



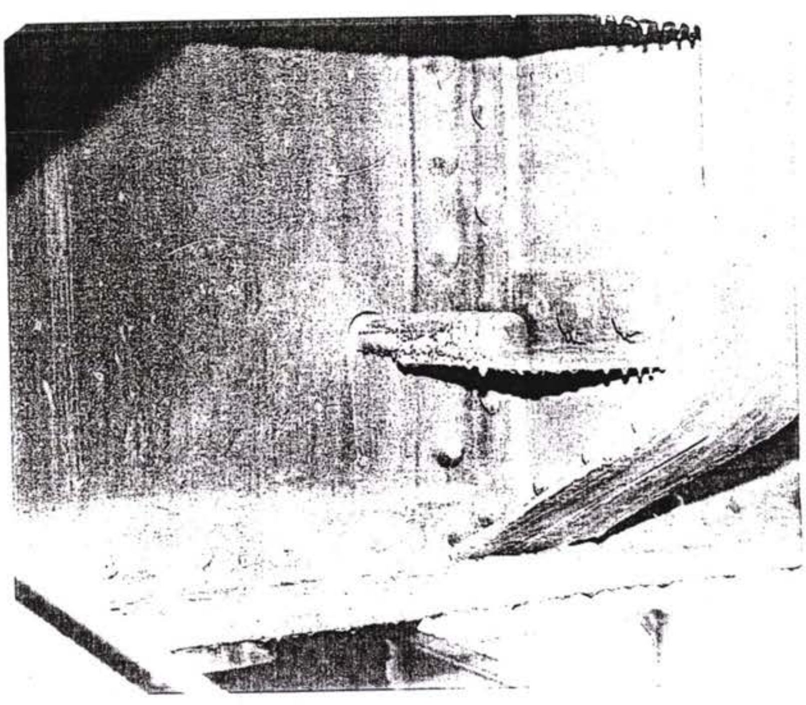
F7-25 Span 26
Footbridge US



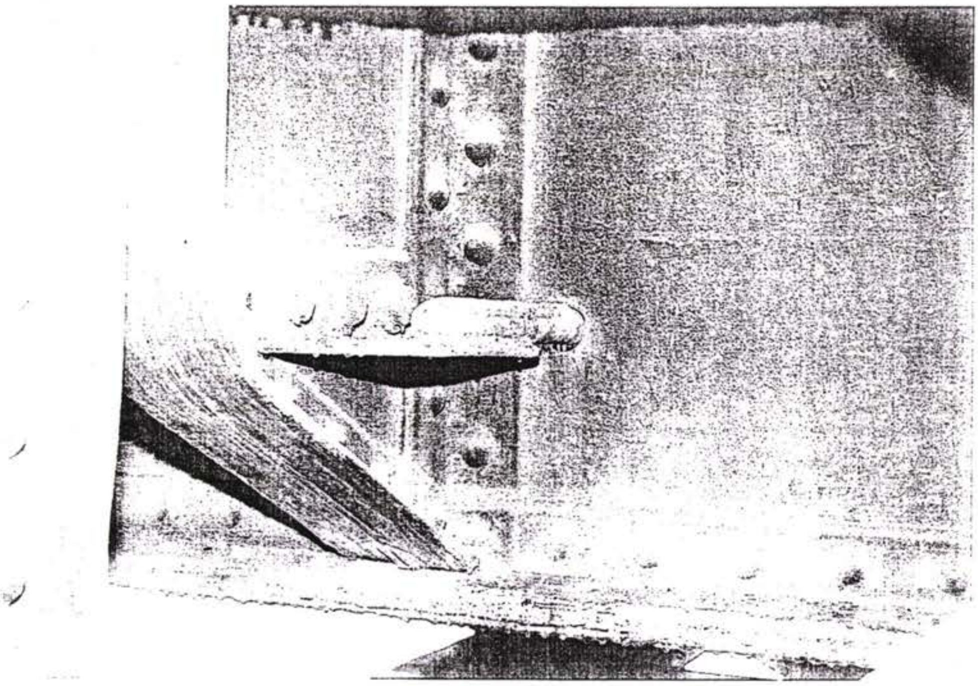
F7-26 Span 26
Roller bearing of footbridge - odd position of rollers



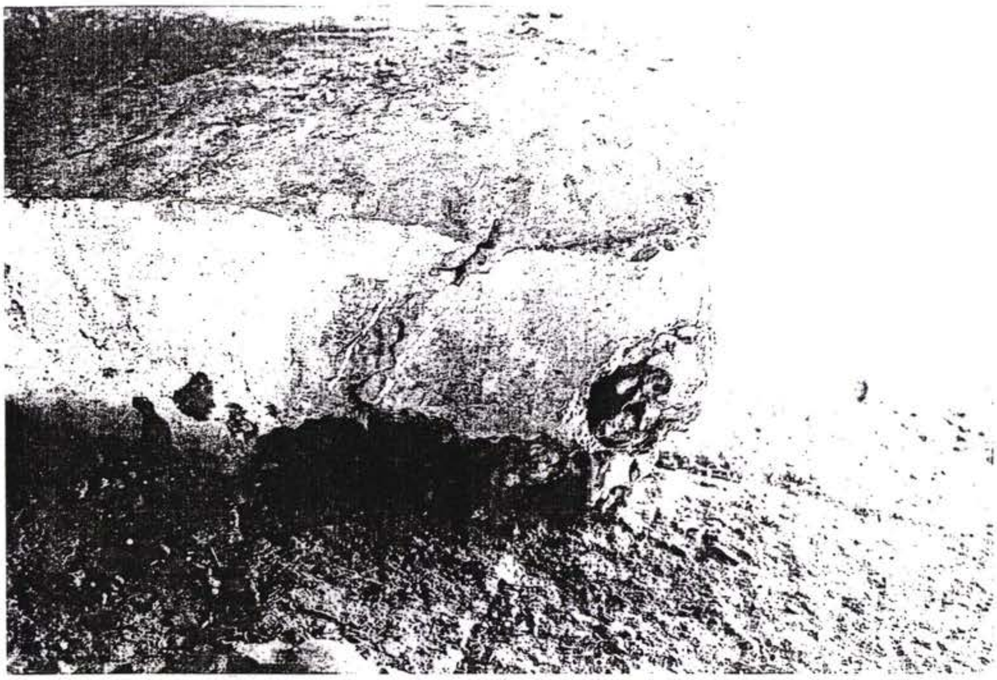
F7-27 Span 26
Farab abutment



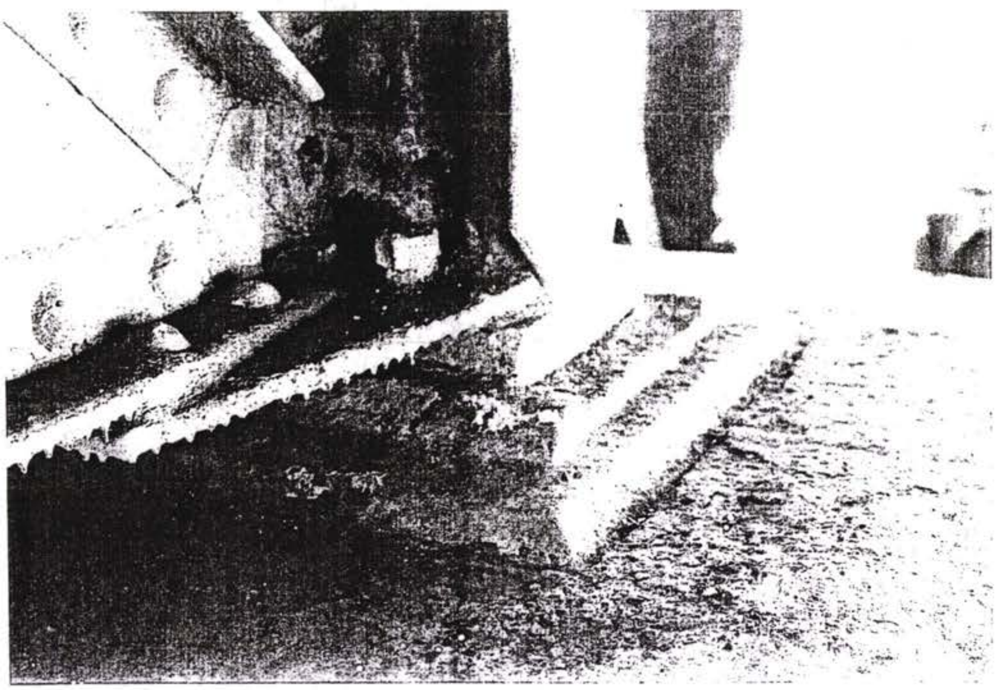
F7-28 Span 25
Reinforcement at end crossgirder, outside



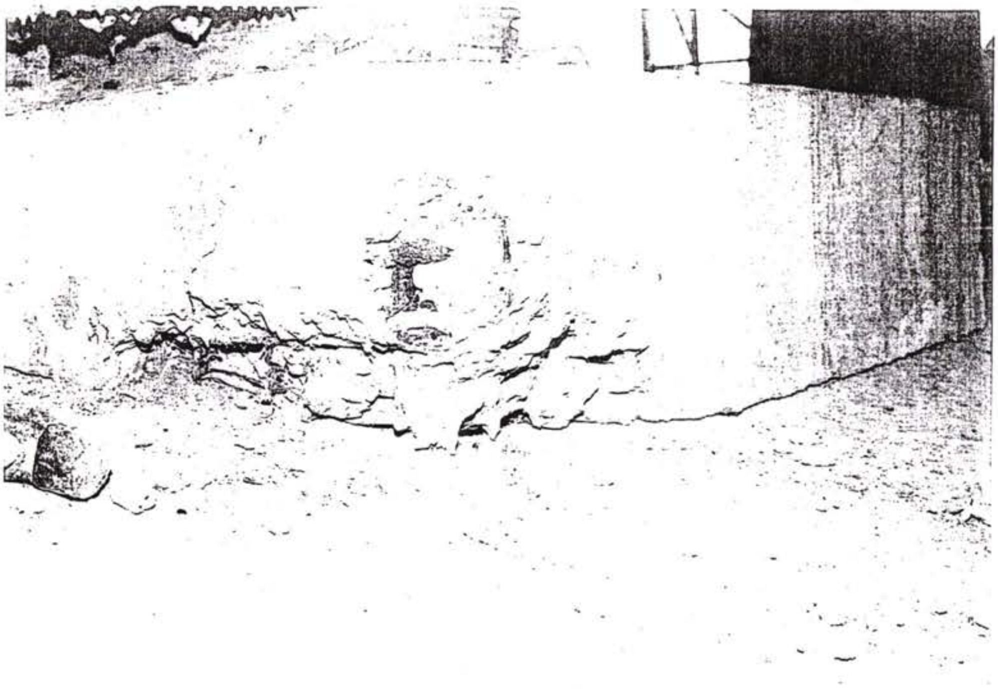
F7-29 Span 25
As F7-28,
other side



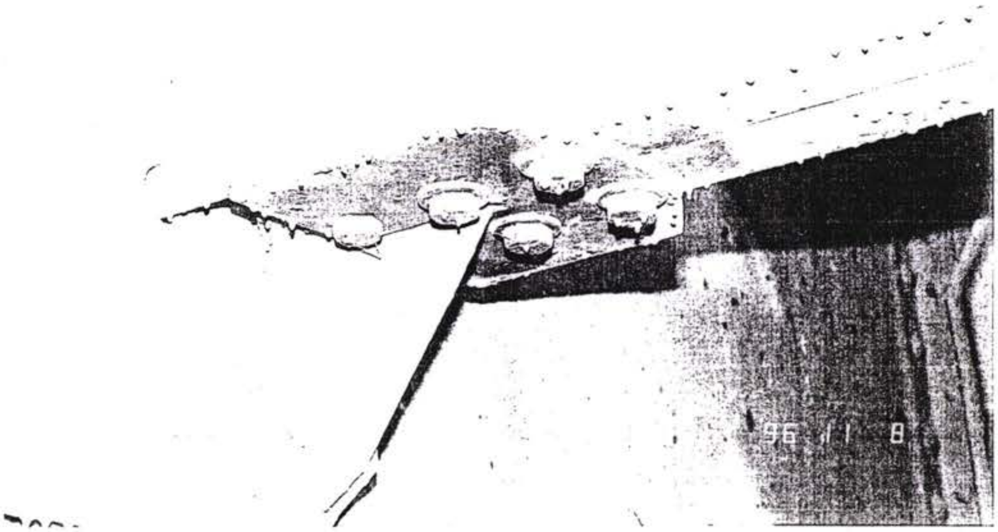
F7-30 Span 26
Bearing A1 - crack



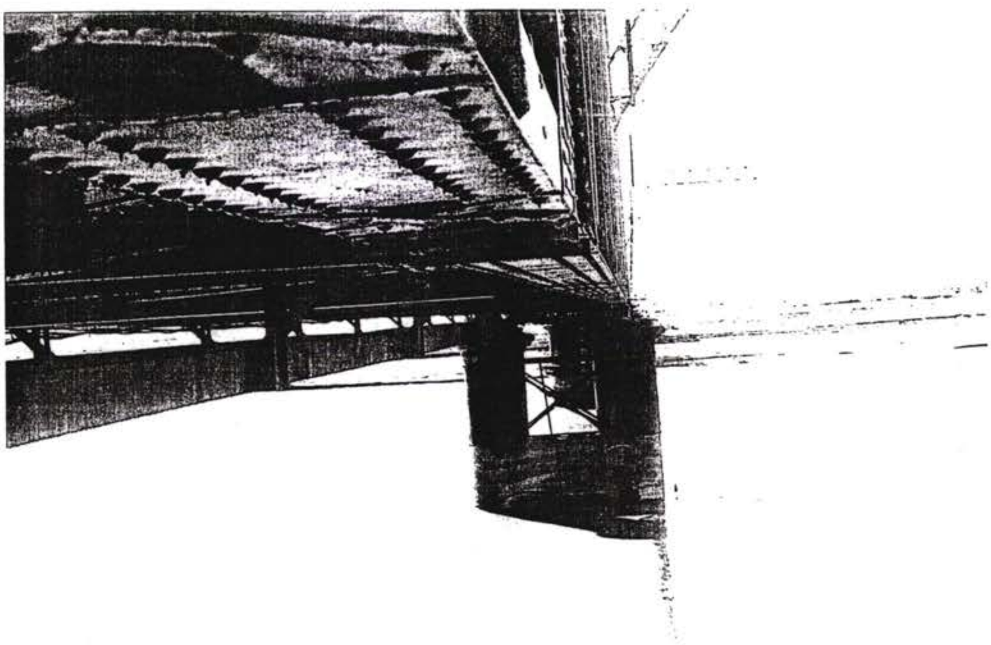
F7-31 Span 26
Bearing A2
Fixed bearing



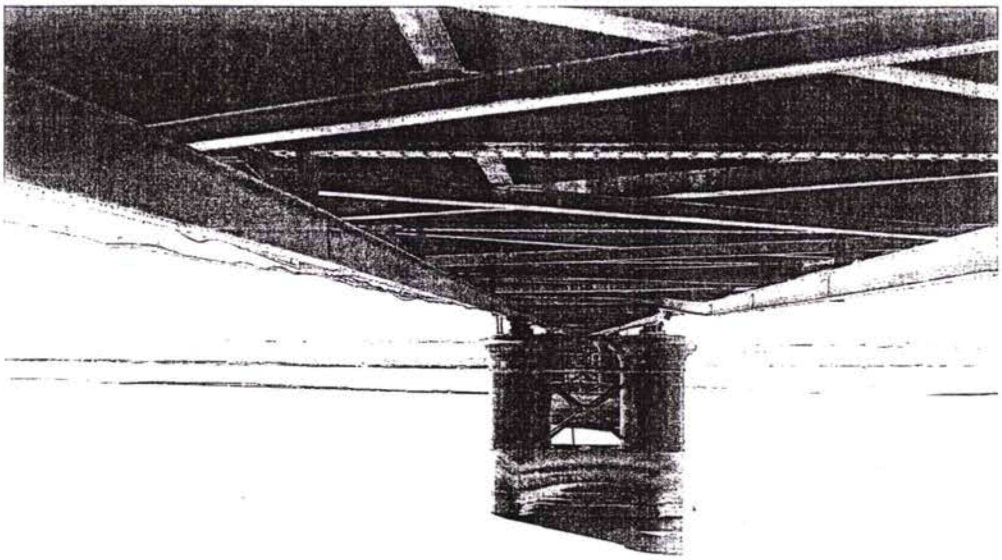
F7-32 Span 26
Bearing A1 -
bearing block



F7-33 Span 25
Reinforcement of
crossgirder

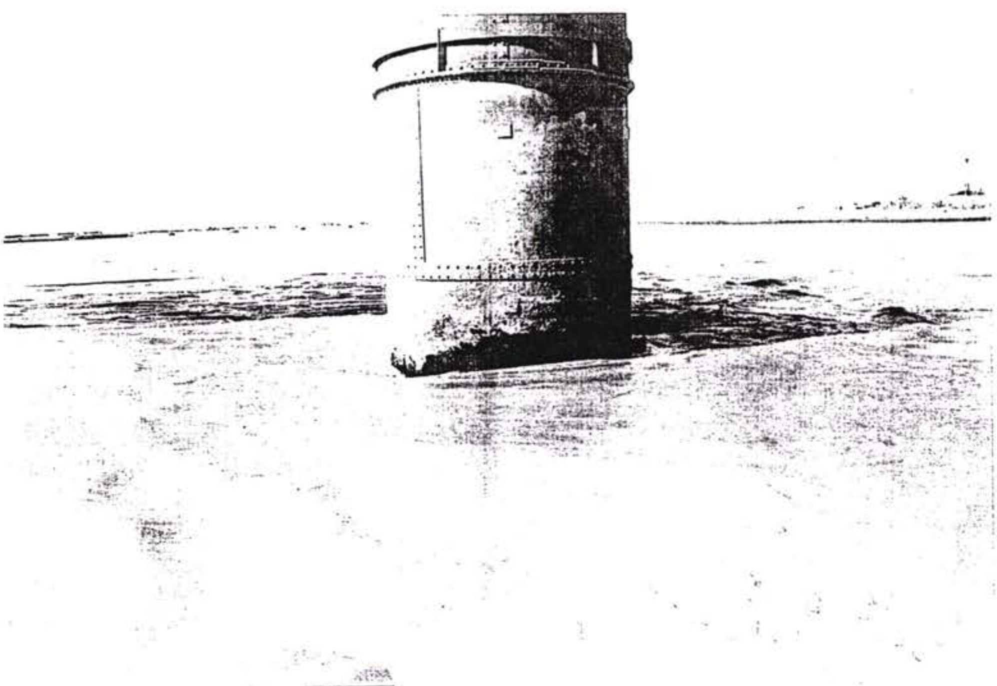


F7-34 Span 25
Lower side of span

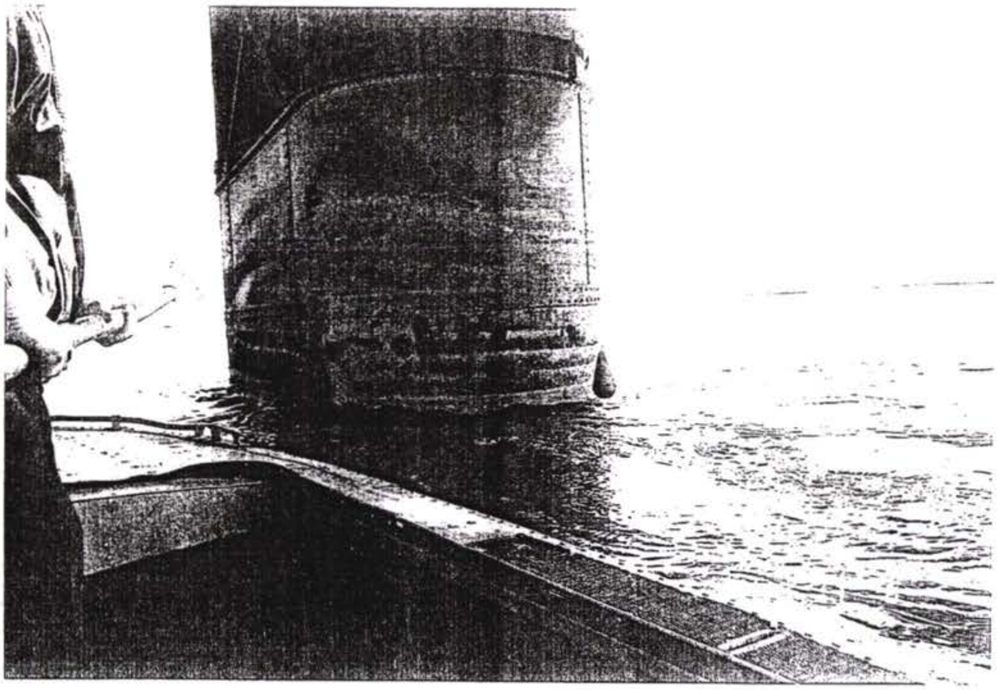


F7-36 Span 25
As F7-35

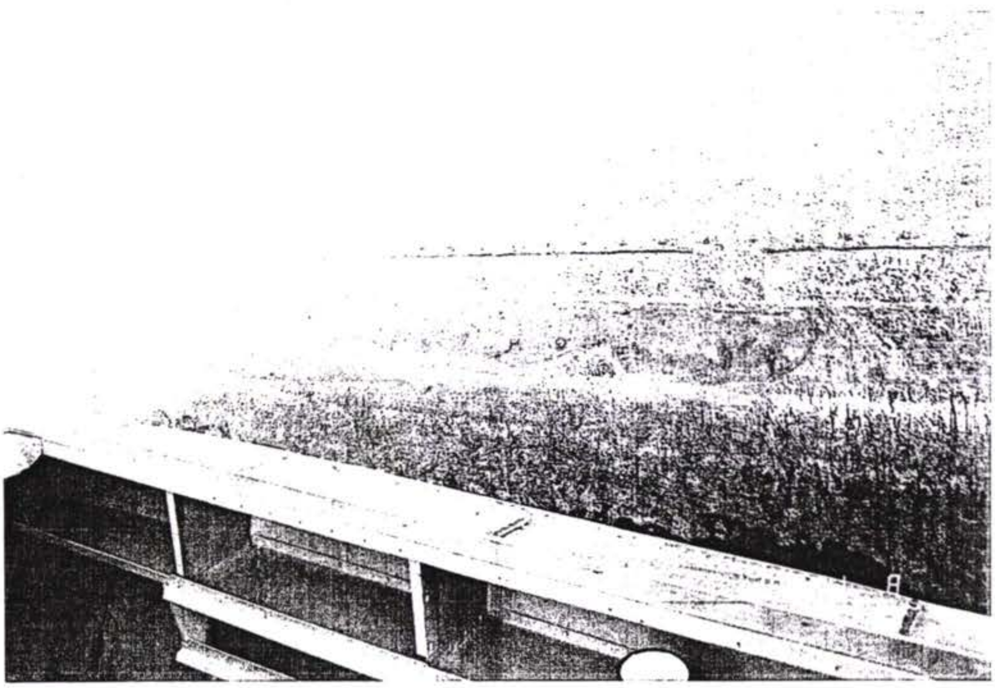
F8-00 Span 25
Bearing A1



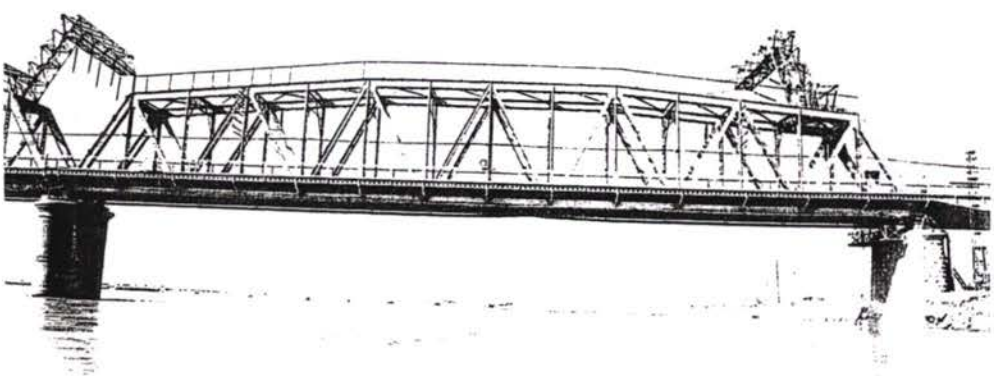
F8-01 Pier 25
View from boat



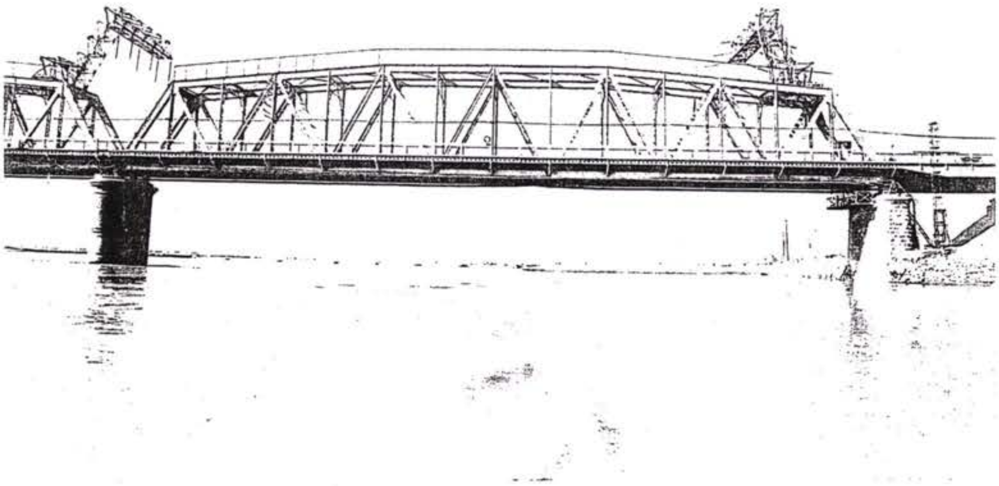
F8-02 Pier 25
As F8-01



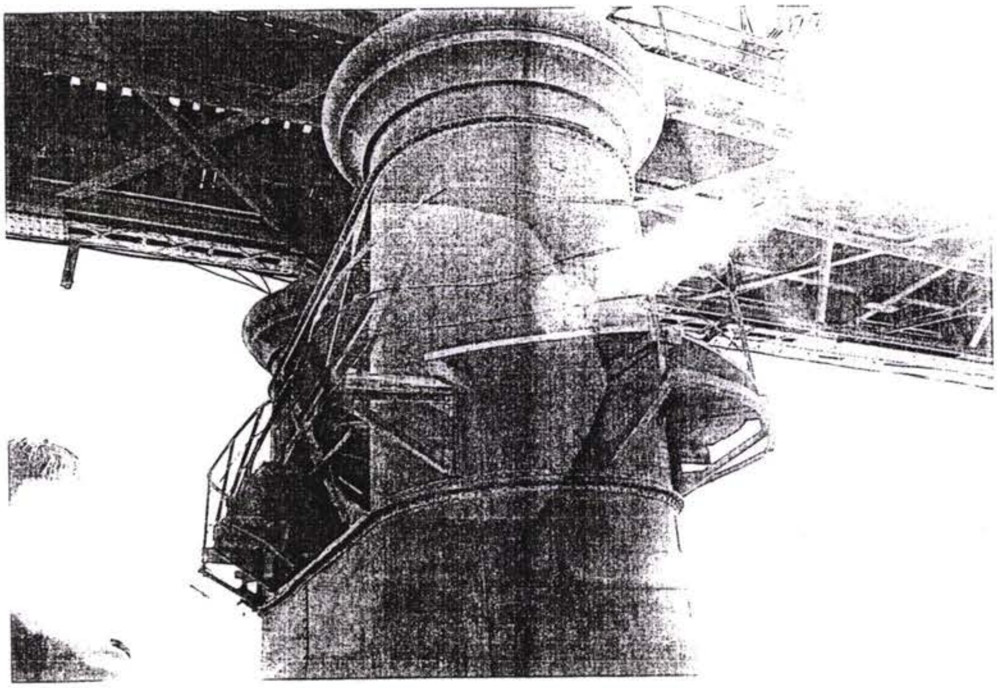
F8-03 Pier 25
As F8-01



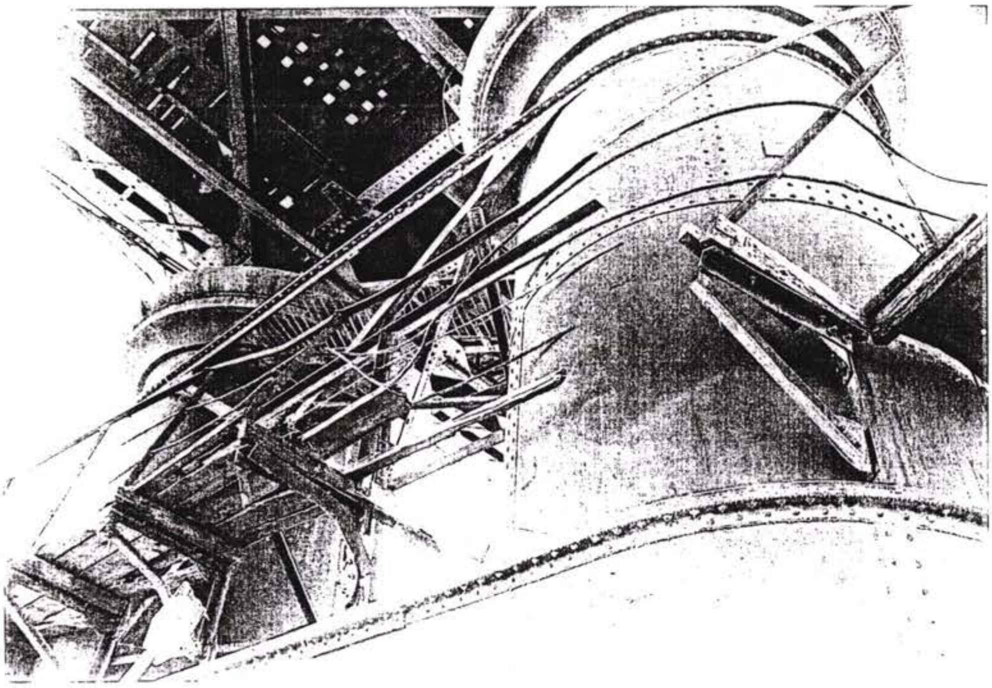
F8-04 Span 25
View from US



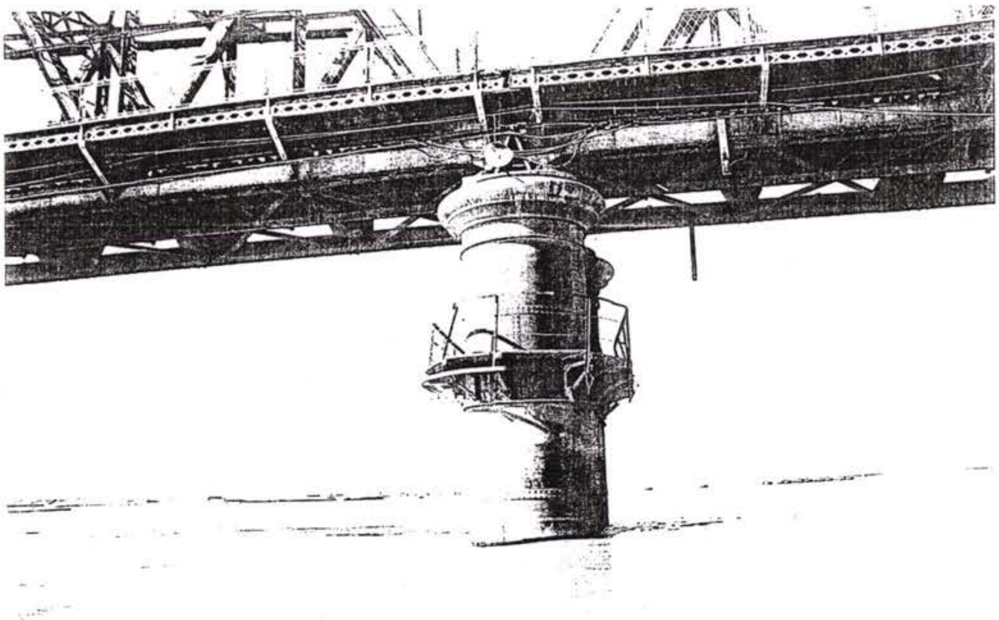
F8-05 Span 25
As F8-04



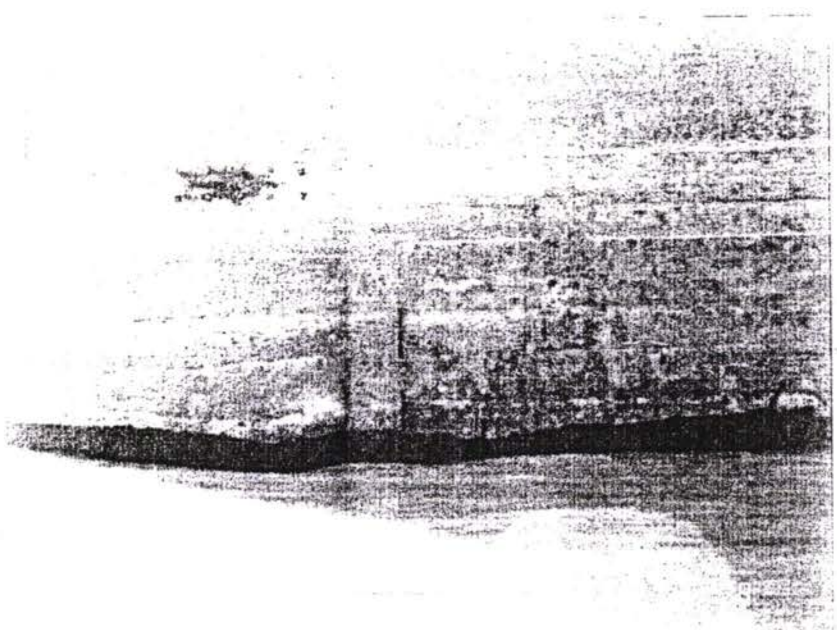
F8-06 Pier 24
Demolished after
ship collision



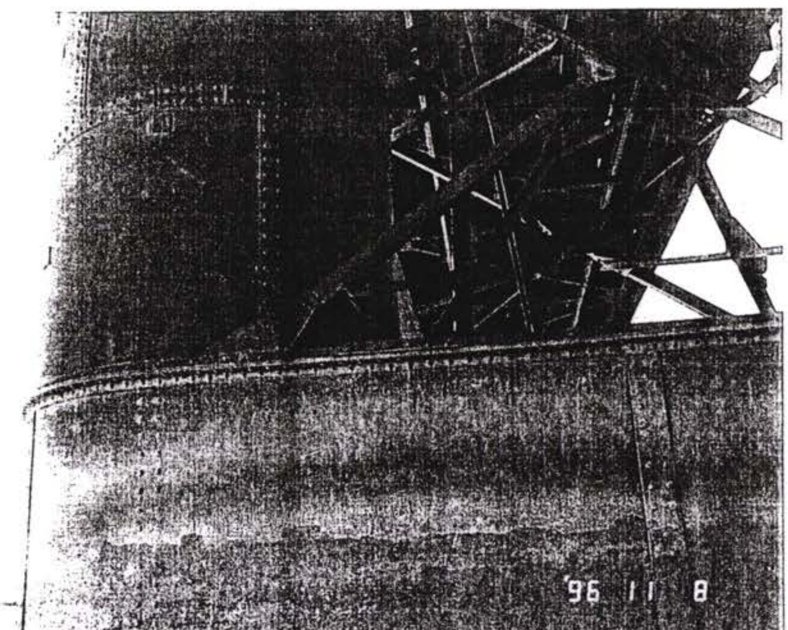
F8-07 Pier 24
As F8-06



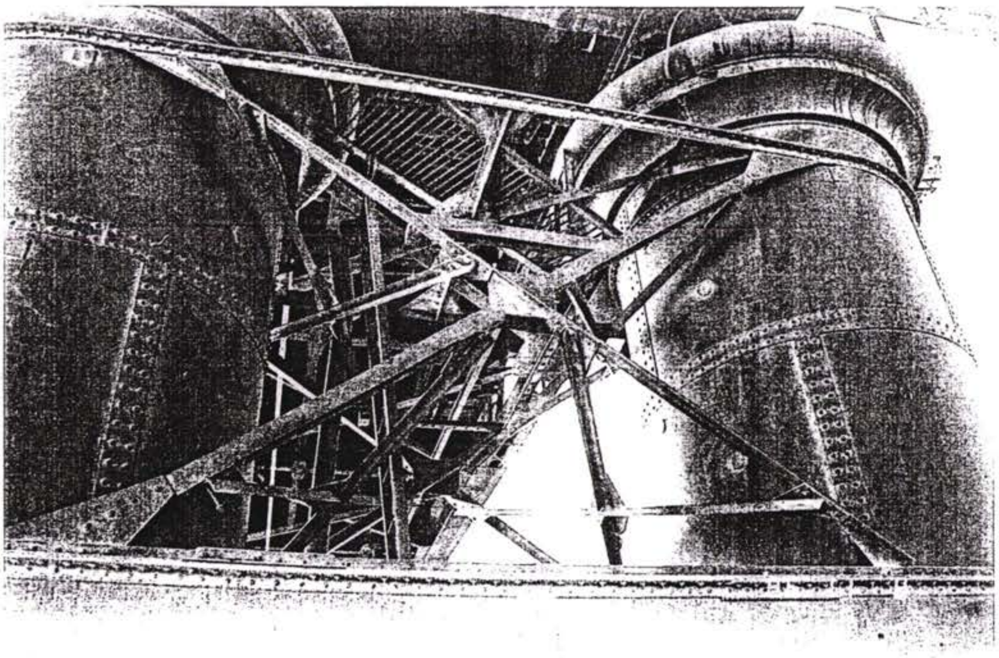
F8-08 Pier 24
As F8-06



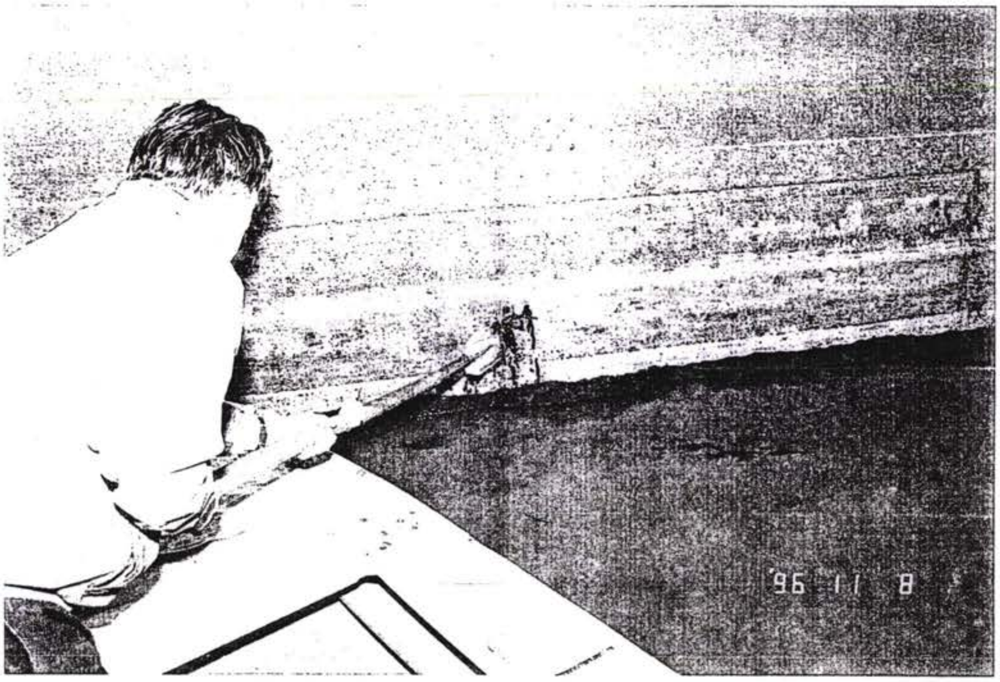
F8-09 Pier 24
As F8-06



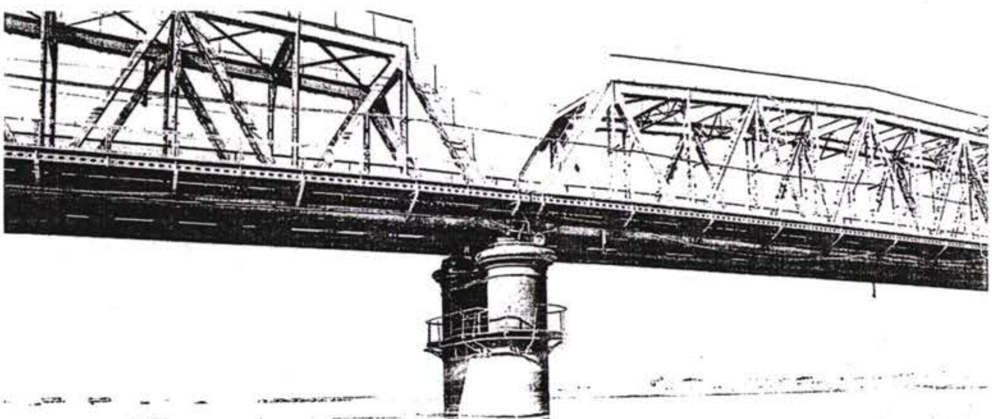
F8-11 Pier 23
Detail



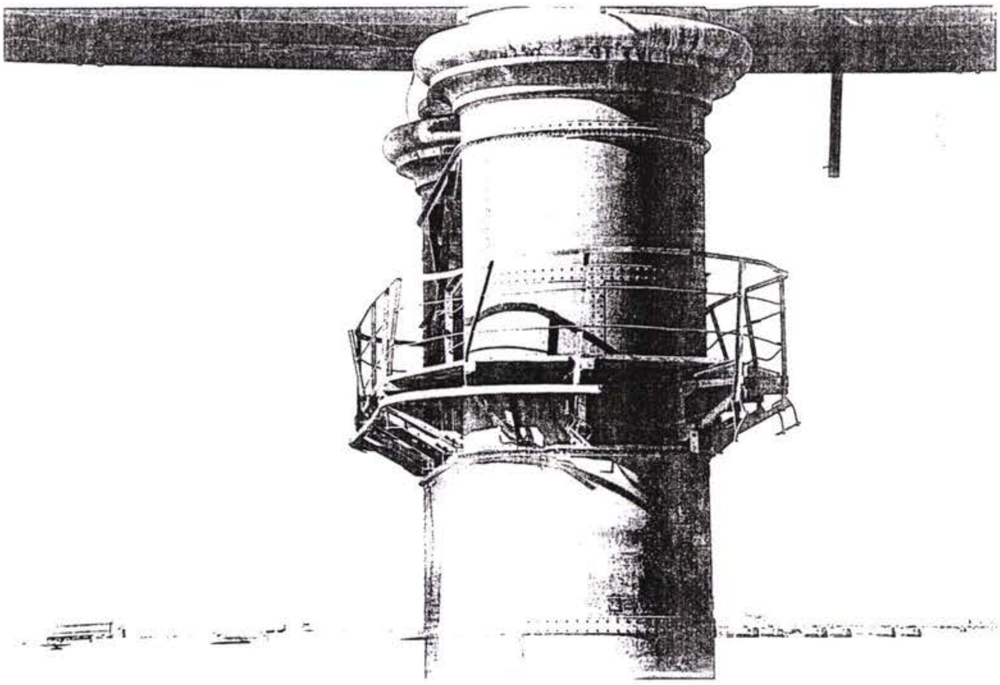
F8-12 Pier 23
Bracing



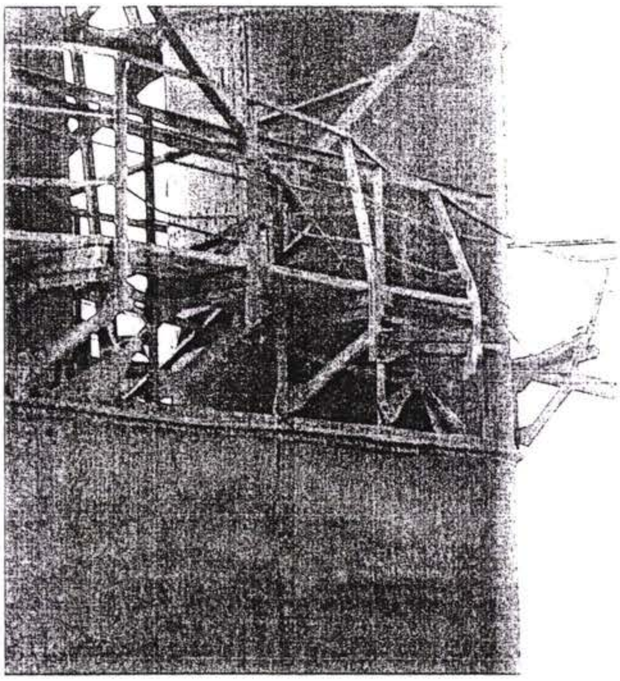
F8-13 Pier 23
Mr. Kazanov,
director



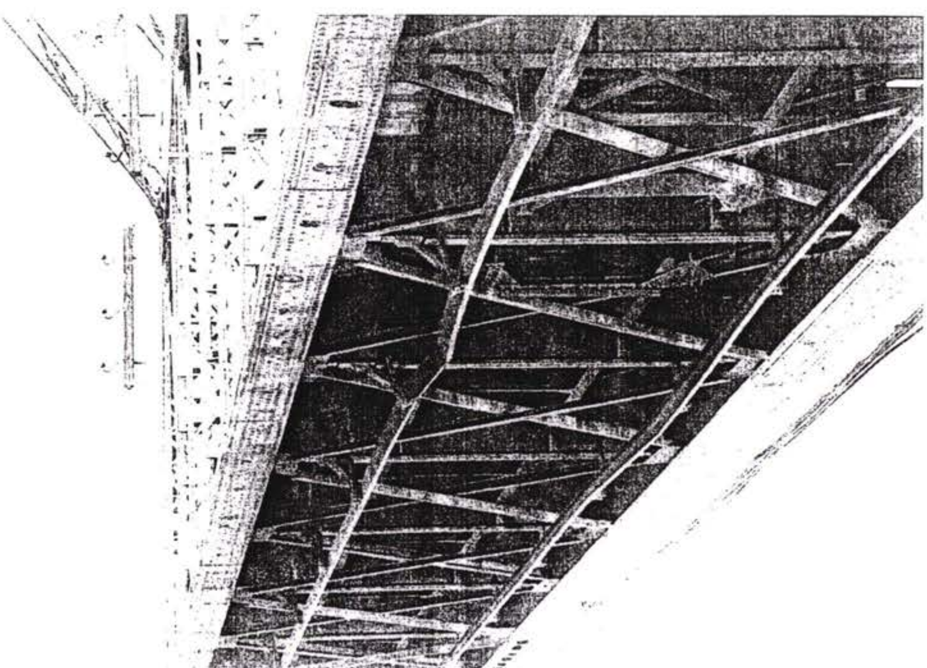
F8-14 Span 23-24



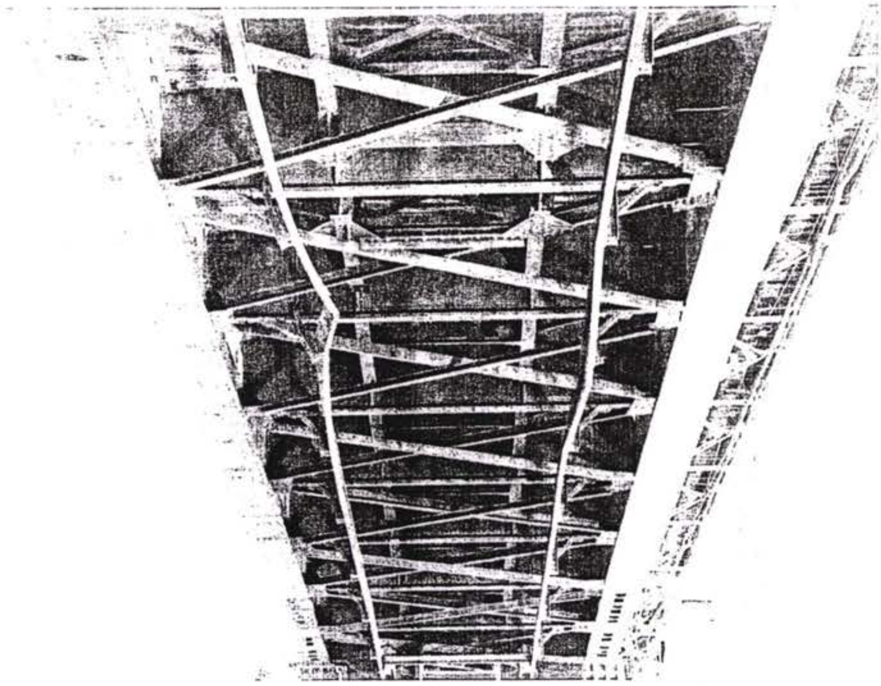
F8-15 Pier 24



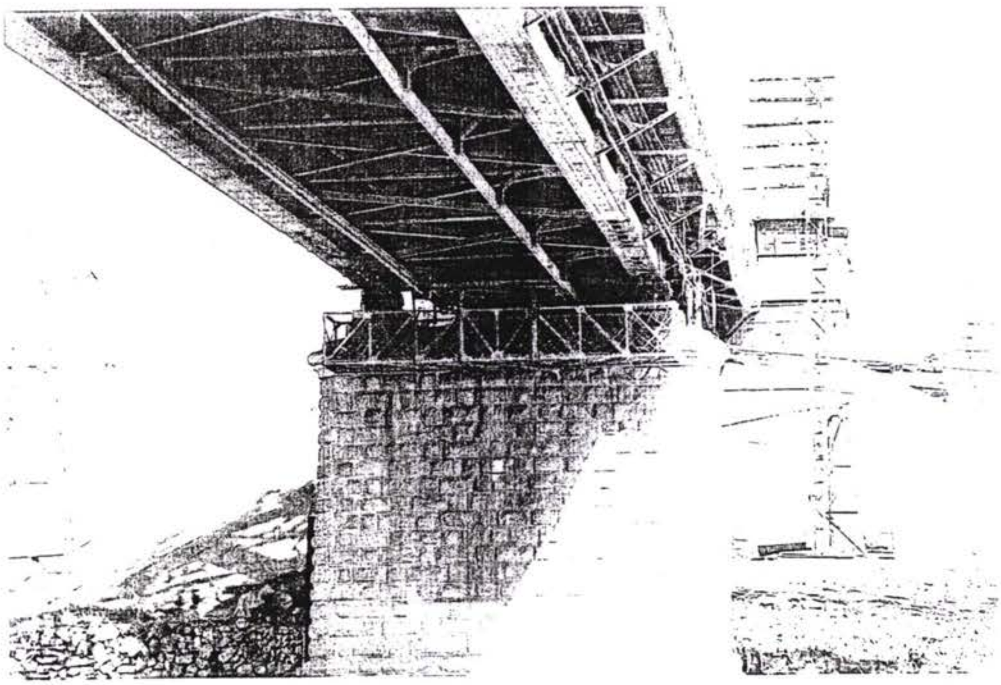
F8-16 Pier 24



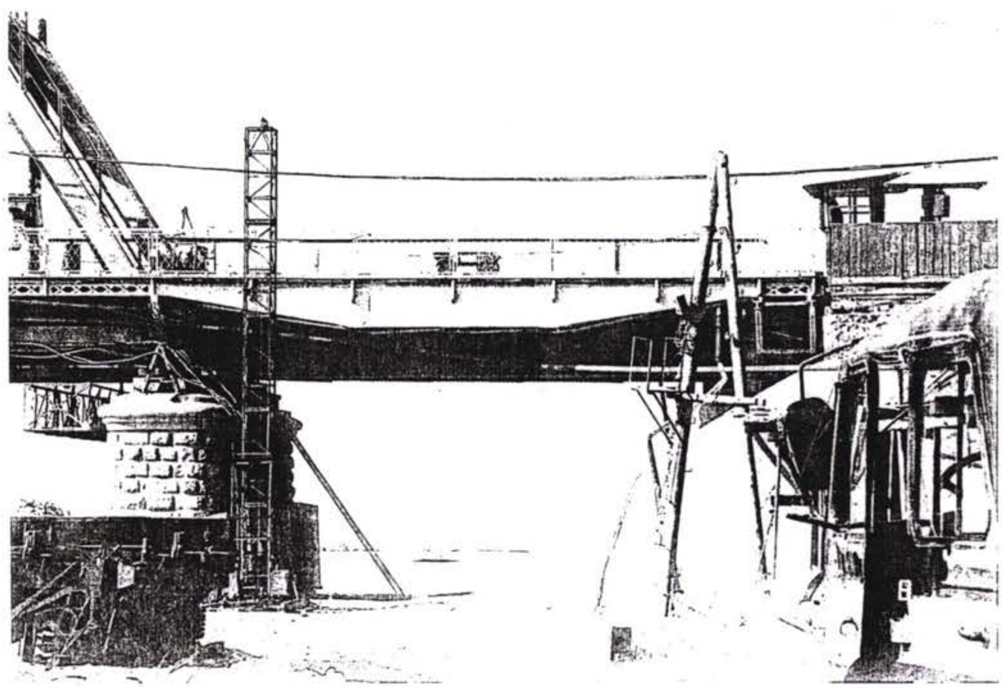
F8-17 Span 25
Bent rail of inspection car



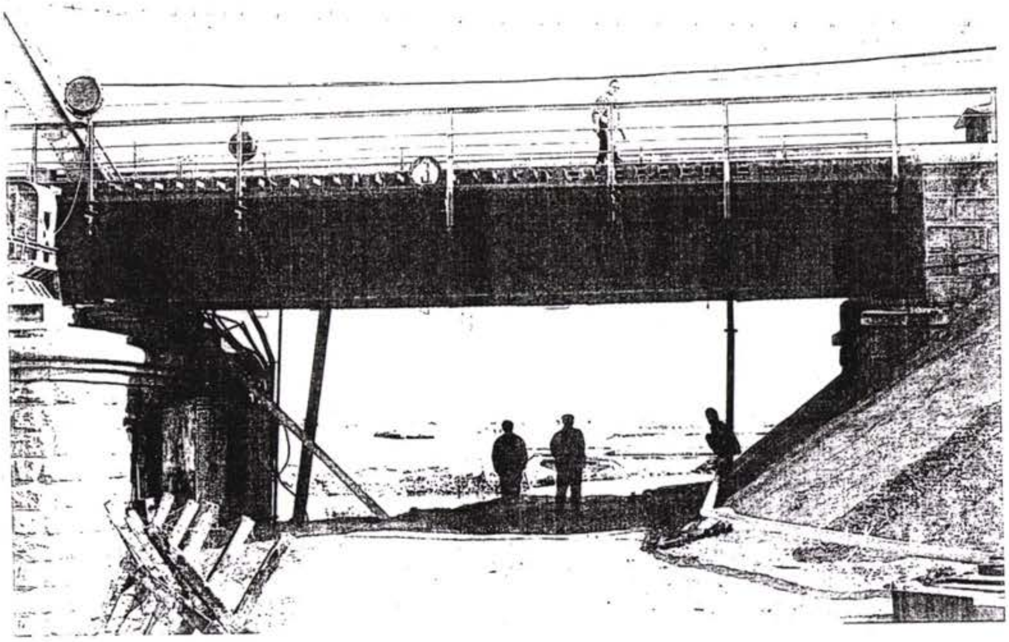
F8-19 Span 25
As F8-17



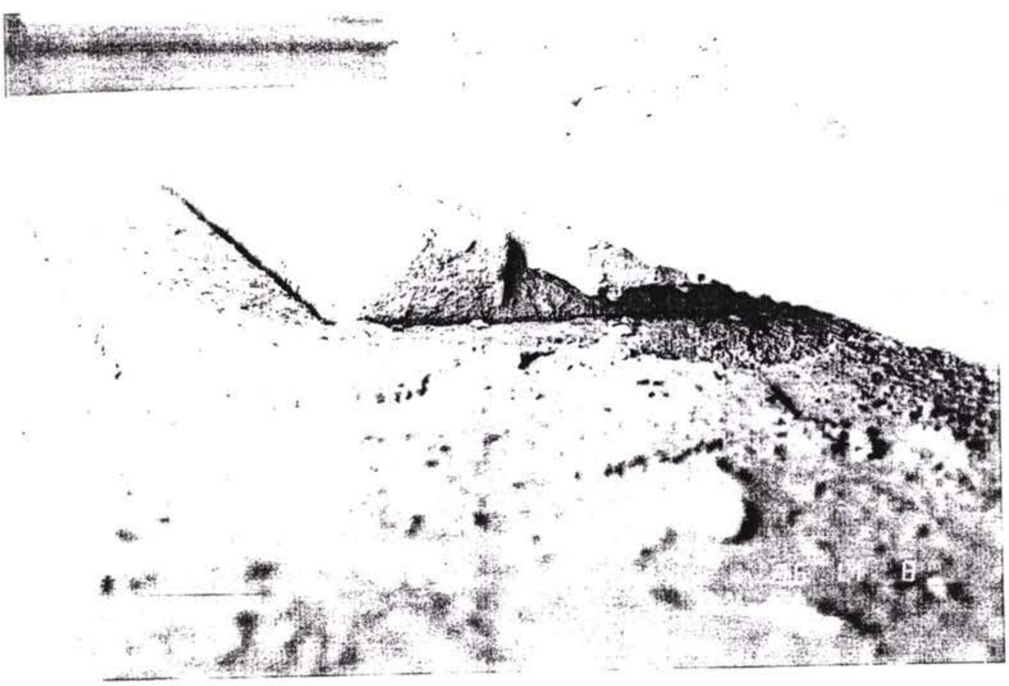
F8-21 Span 25
Bridge with guard room



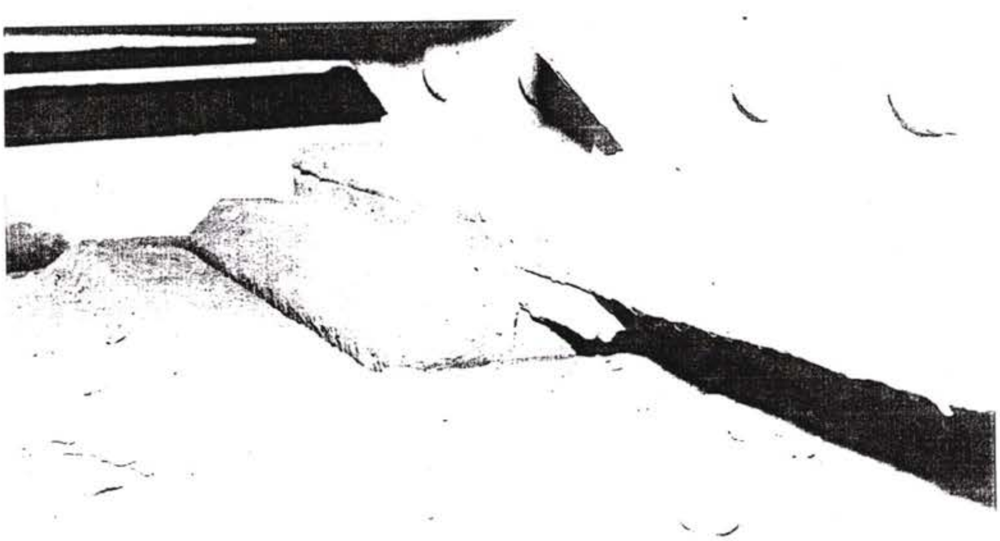
F8-22 Span 26



F8-24 Span 0

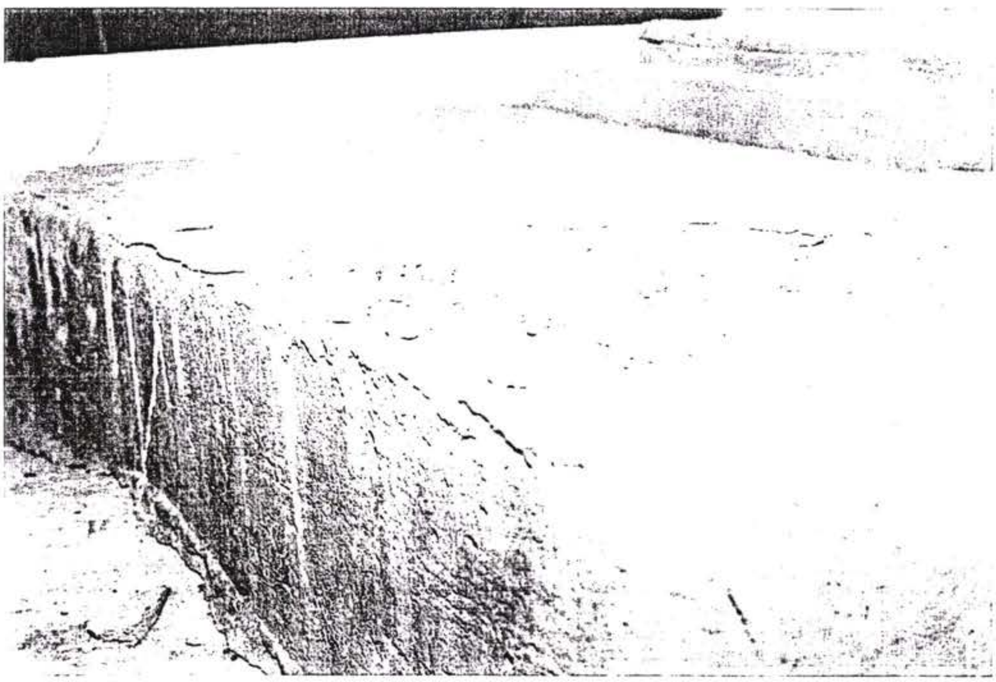


F8-25 Span 0
Bearing B1 -
vertical movement



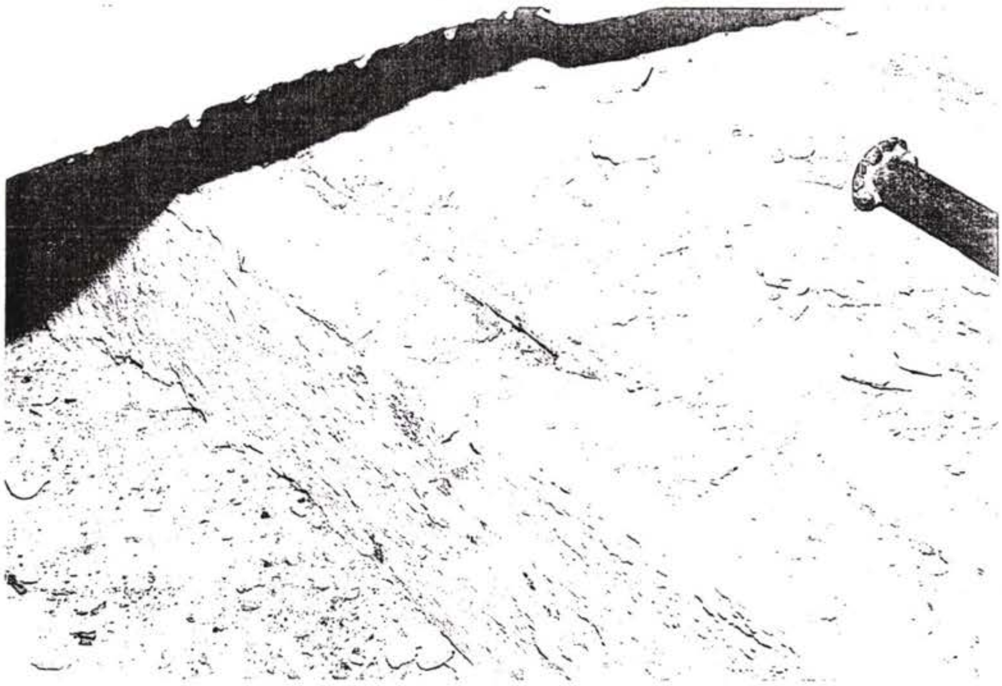
F8-26 Span 0
Bearing A1 -
vertical movement

F8-27 Span 0
Bearing B1 -
concrete block stands loose on stone



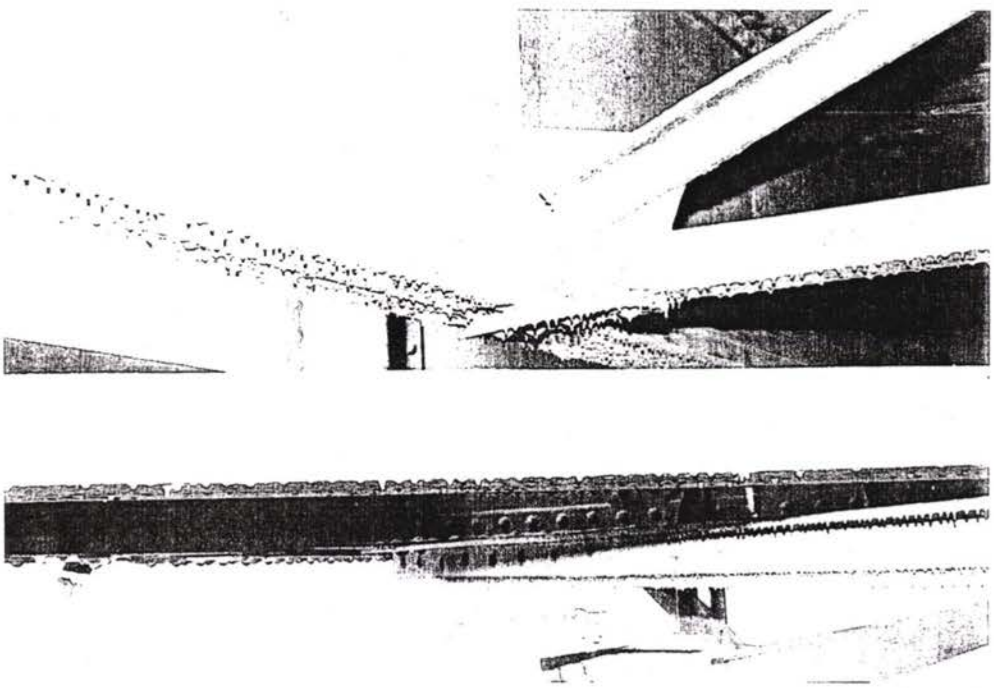
F8-28 Span 0
Bearing B1 -
concrete block

F8-29 Span 0
Bearing B1 -
concrete chipping

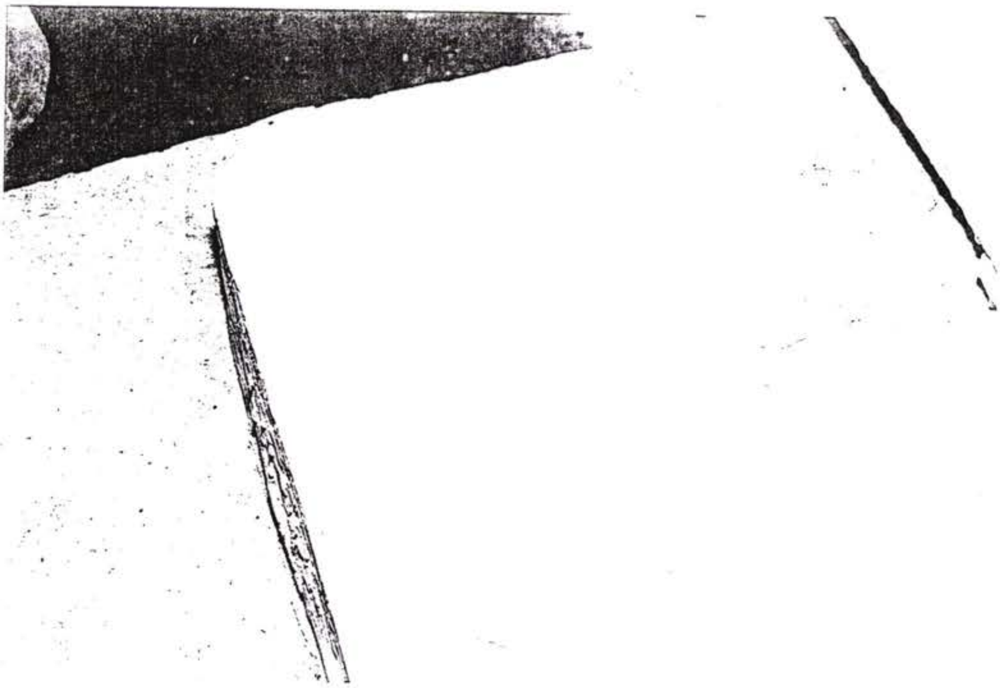


F8-30 Span 0
Bearing B1 - chipping to reinforcement

F8-31 Span 0
As F8-30

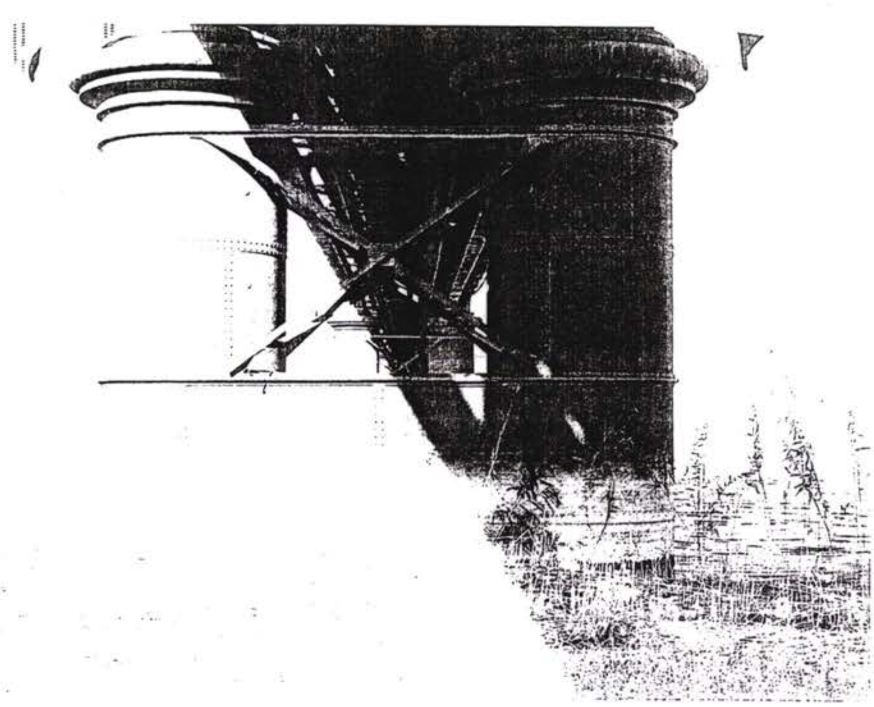


F8-32 Span 0
Gusset plate of longit. girder loose

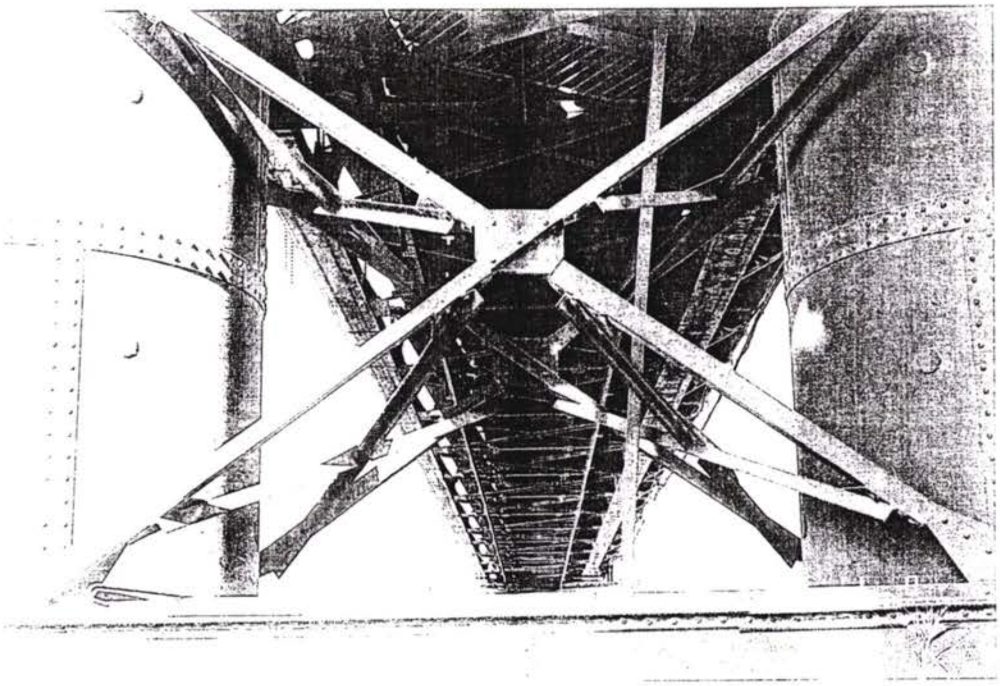


F8-33 Span 0
Bearing A1 -
crack in concrete

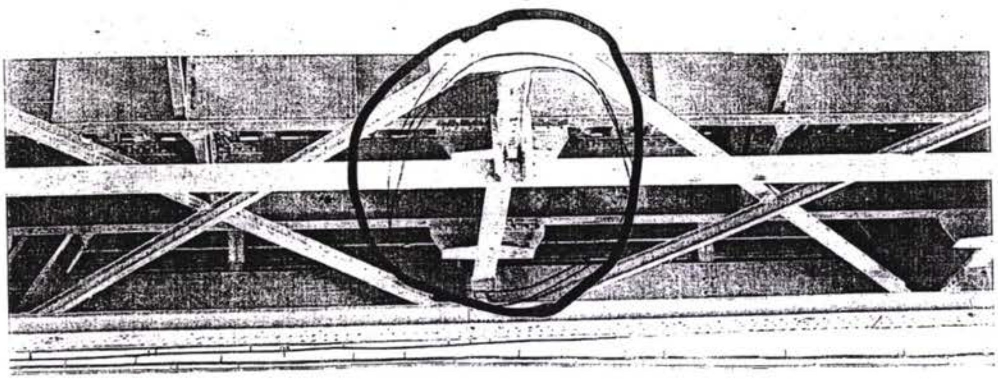
F8-34 Span 0
Bearing A1 -
chipping of concrete



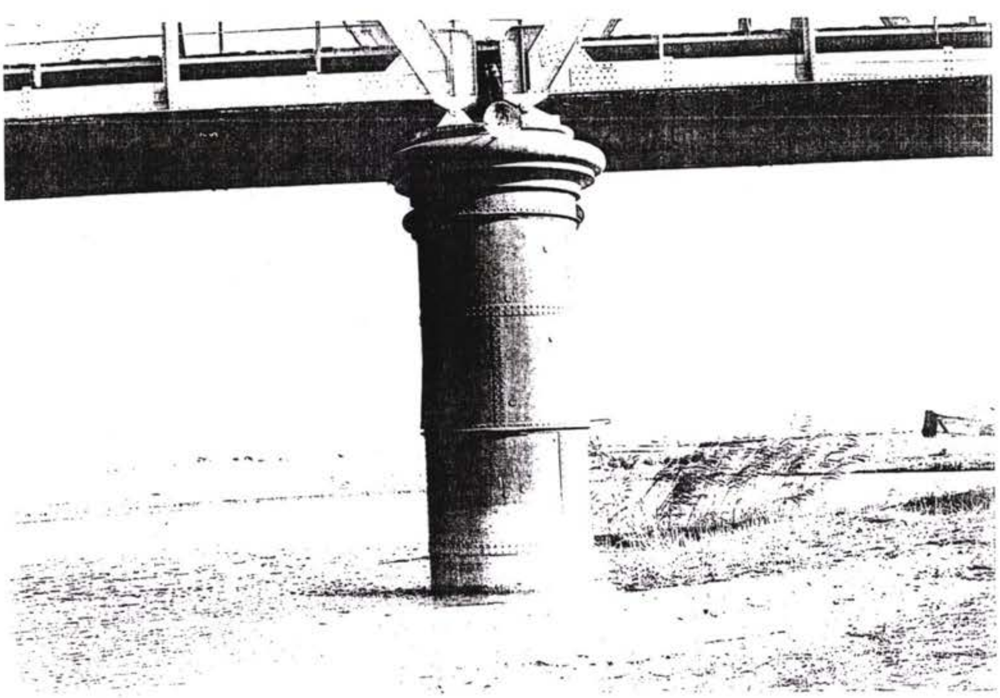
F8-35 Pier 3



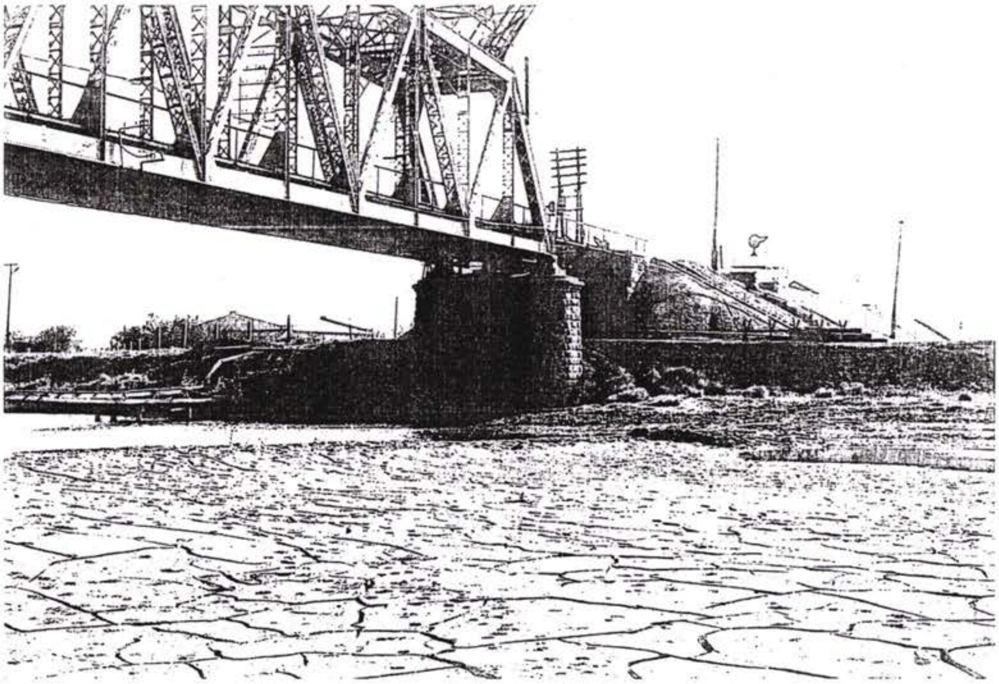
F8-36 Pier 3



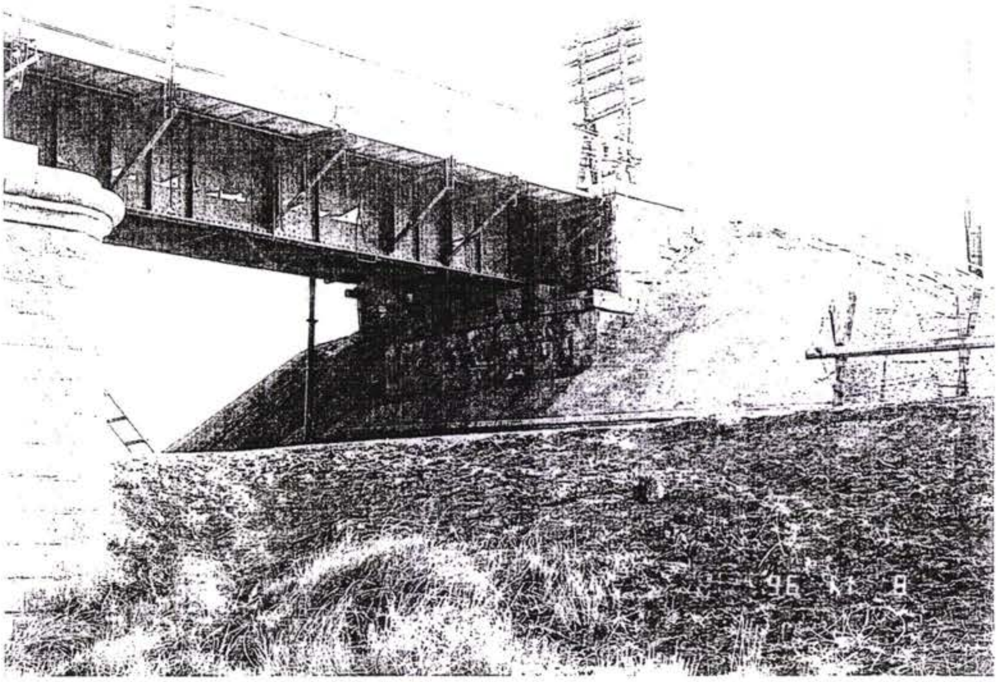
F9-00 Span 9
Reinforcements



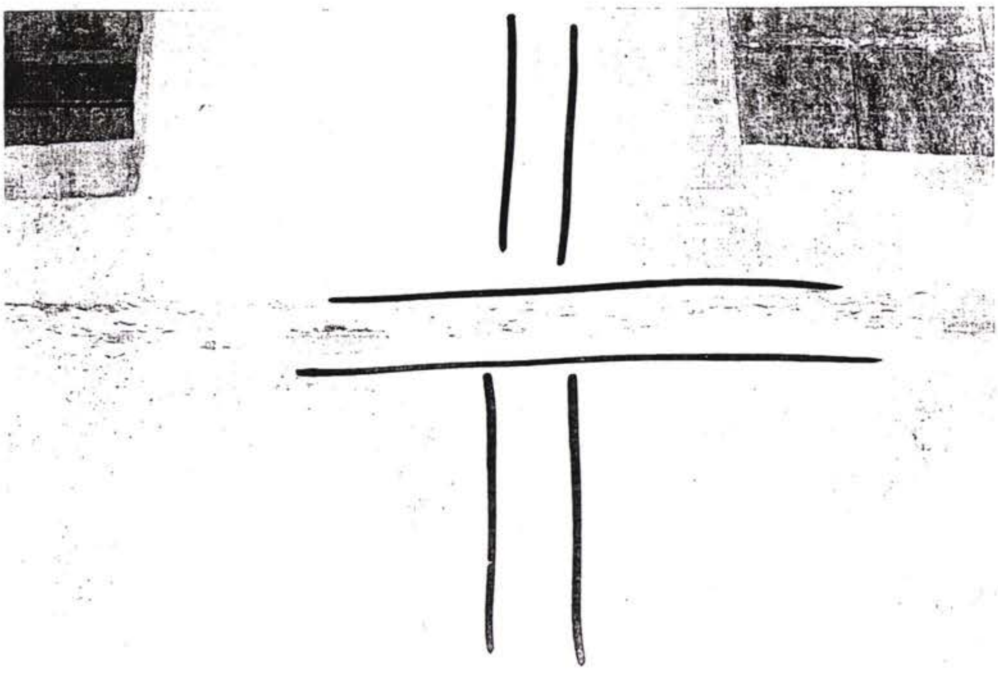
F9-01 Pier 6



F9-02 Span 1
Span 0 behind span 1



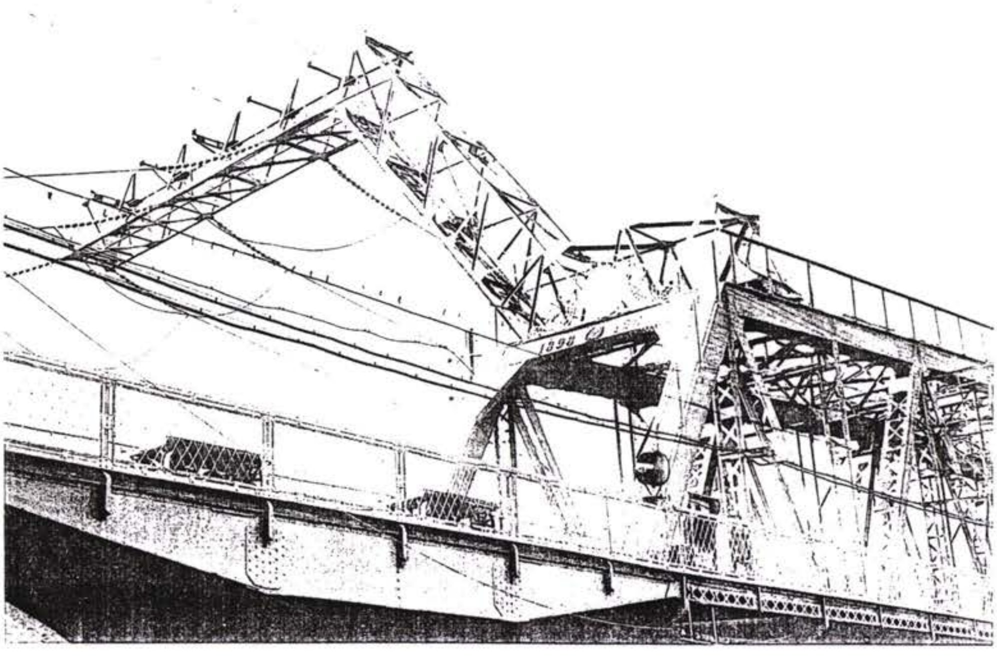
F9-03 Span 0



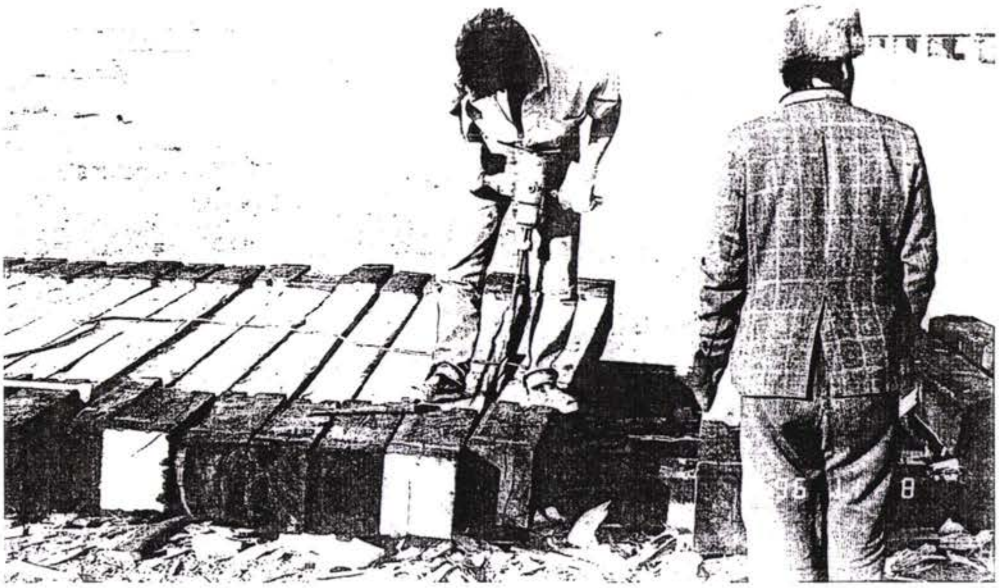
F9-04 Abutment 0
Cracks in the stone

F9-05 Span 0
Bearing B2 -
Broken part of upper bearing plate

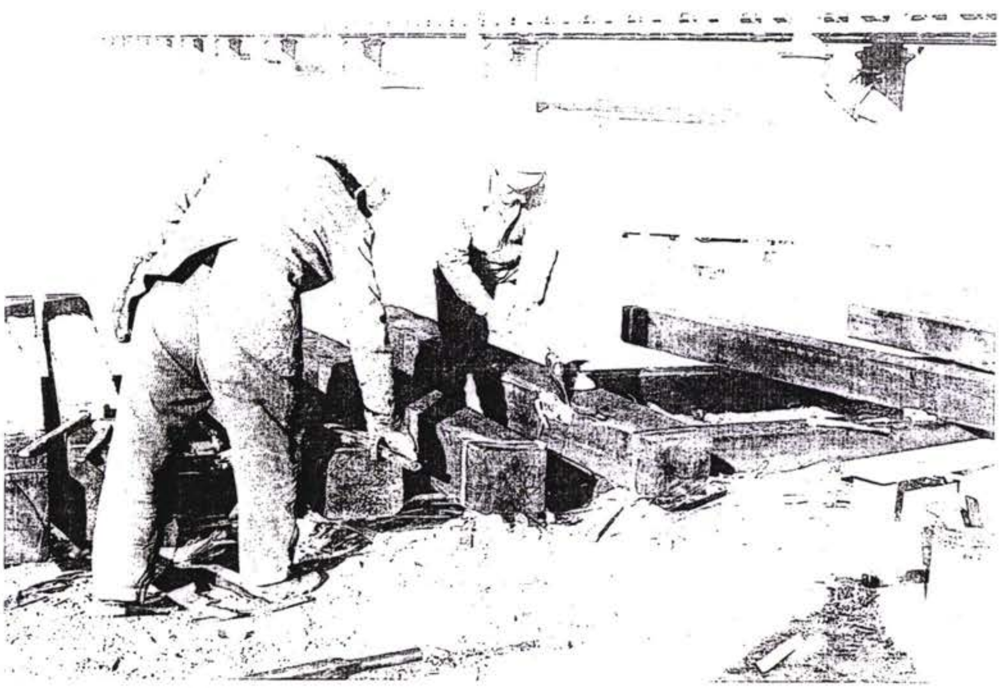
F9-06 Span 0
As F9-05



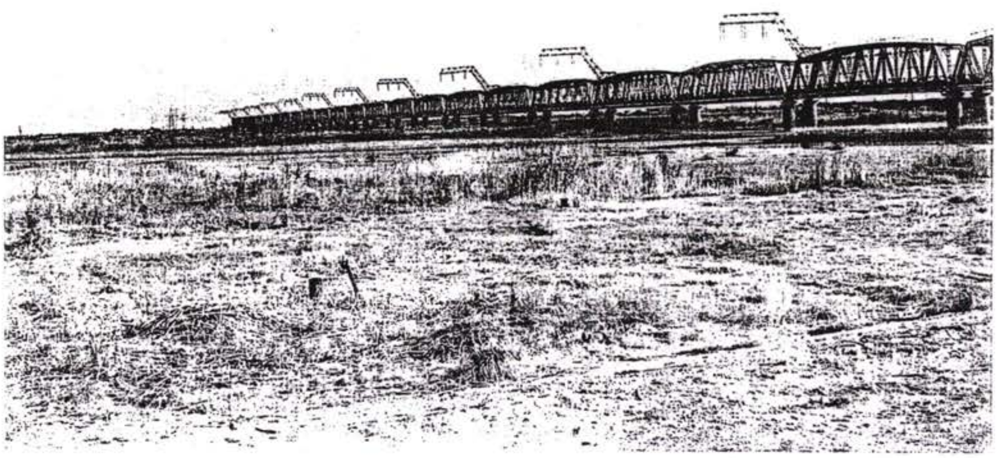
F9-07 Span 1
End frame with high voltage line



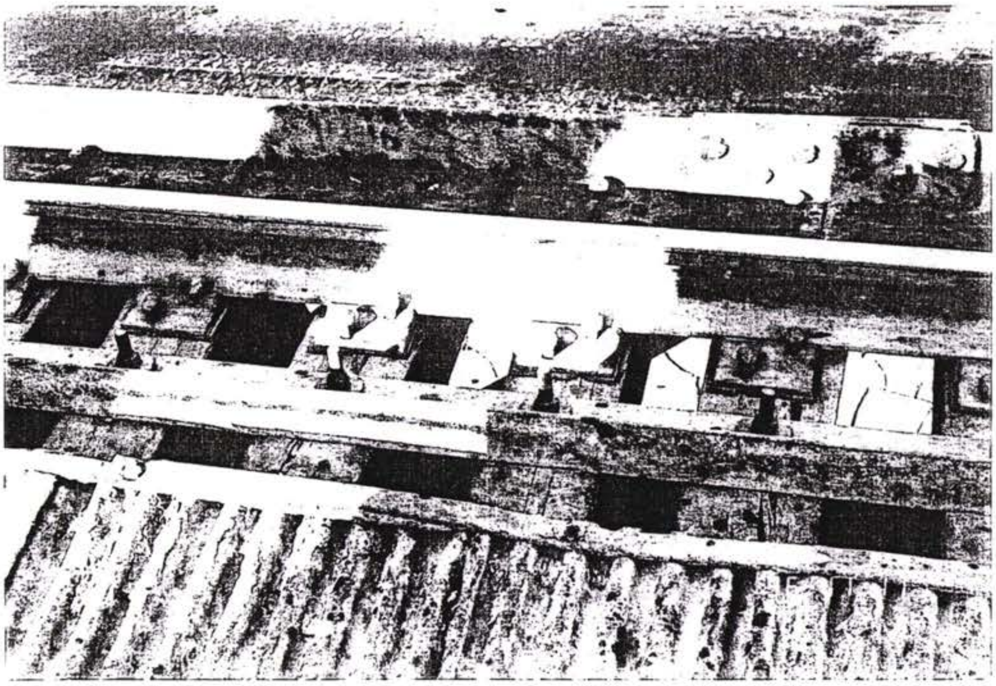
F9-10
Sleeper, no impreg-
nation



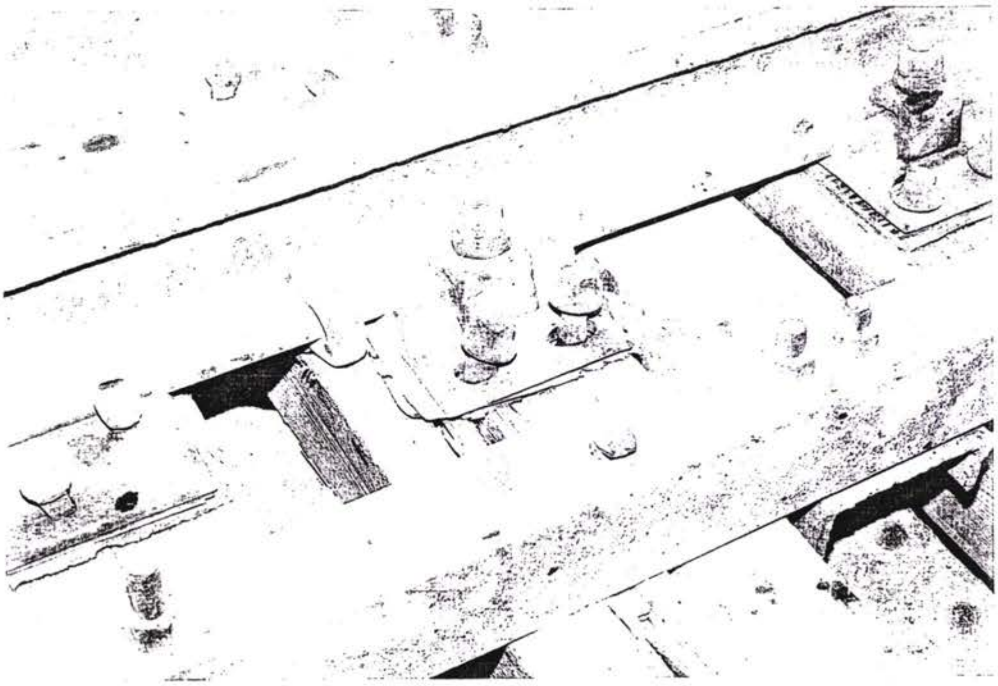
F9-11
As F9-10



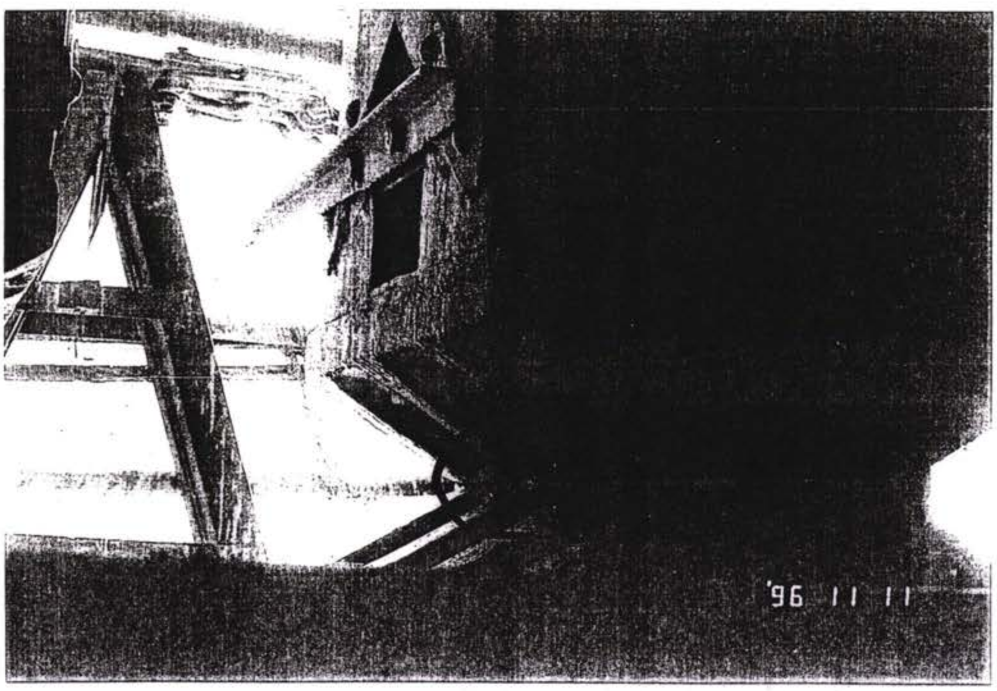
F9-12
Total view



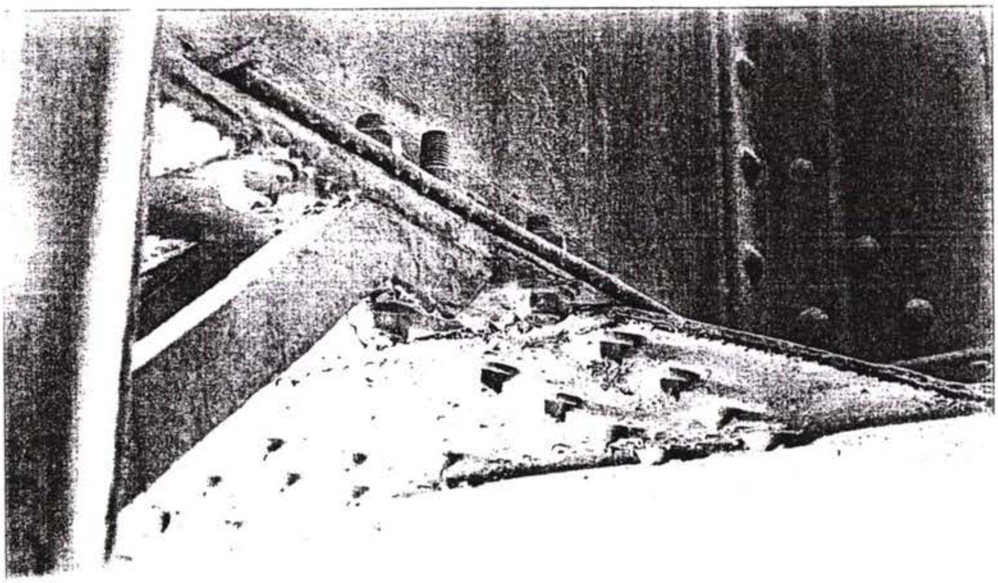
F10-00
Loose rail fasteners (nails)



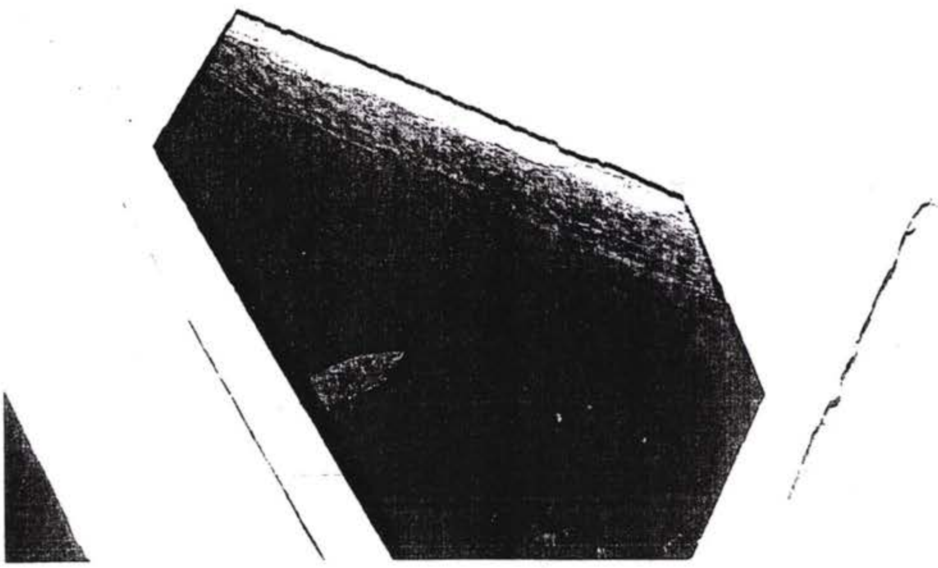
F10-05
As F10-00



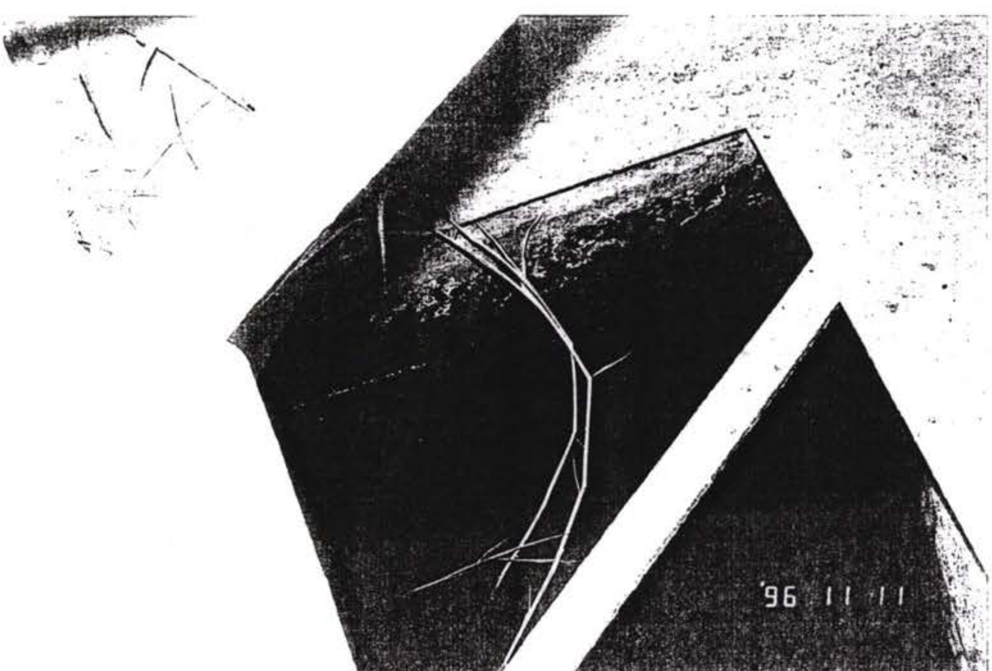
F10-01 Pier 9
Corrosion at bearing



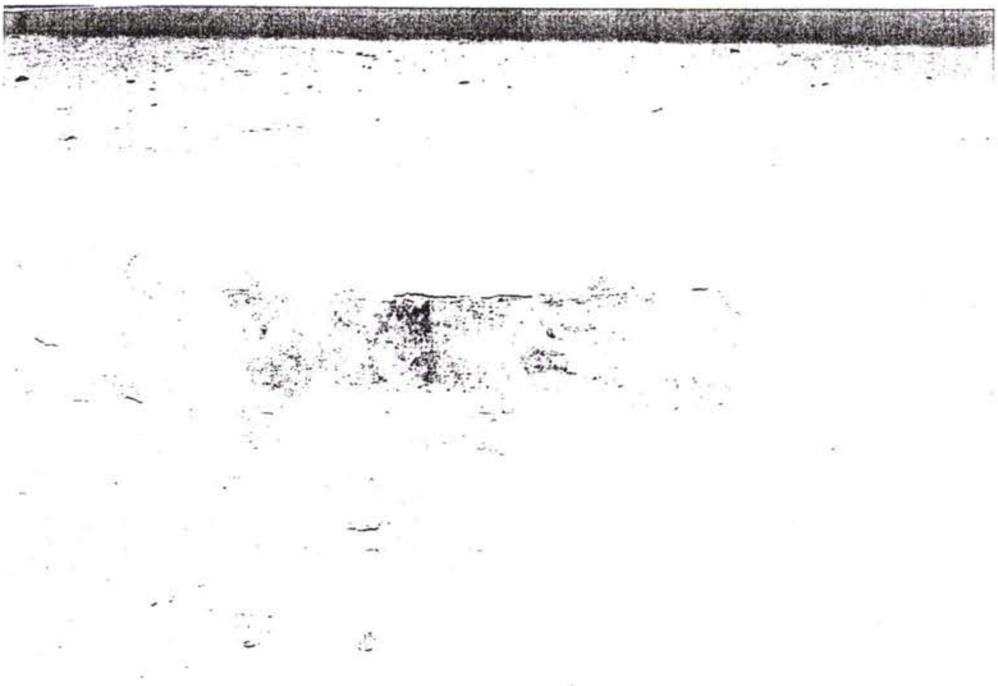
F10-02 Span 1
End crossgirder bent and corroded plate



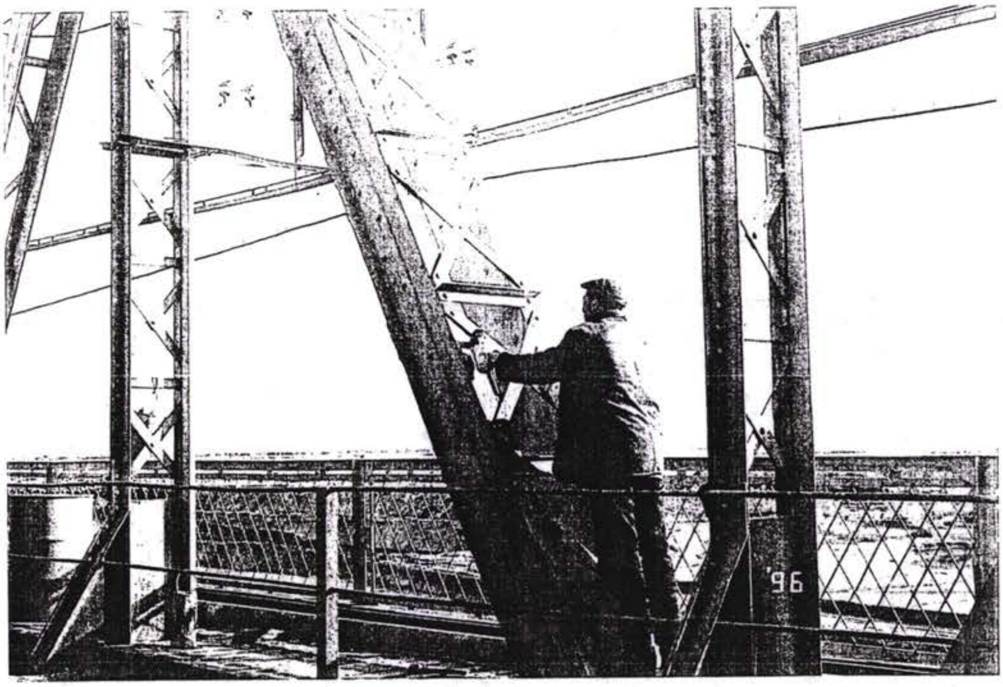
F10-03 Pier 4
Inside view water filled



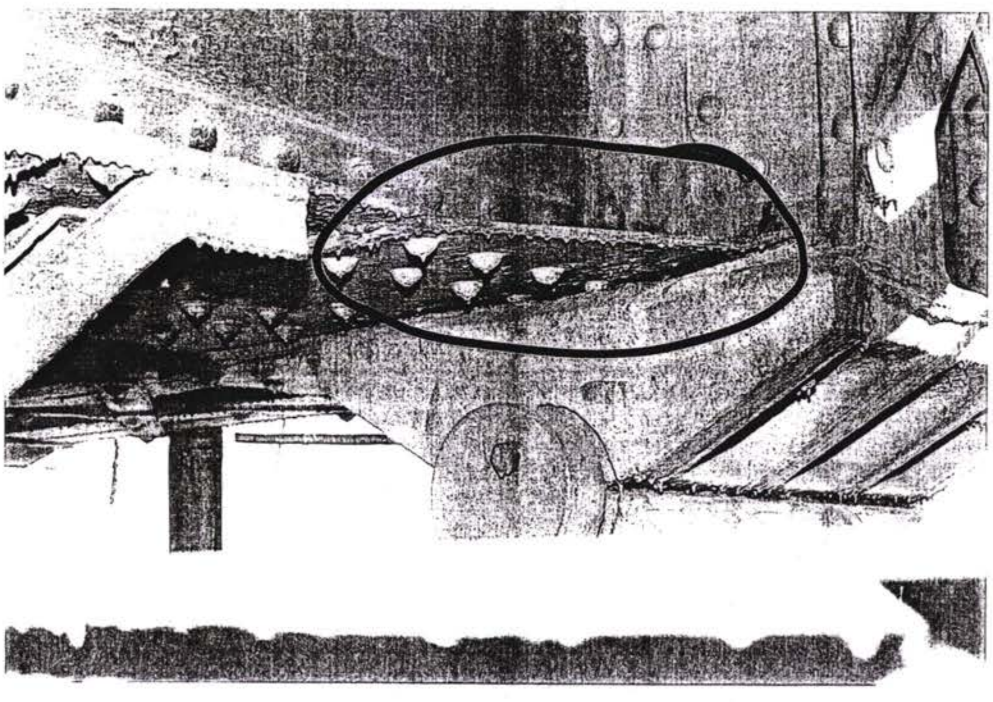
F10-04 Pier 4
As F10-03



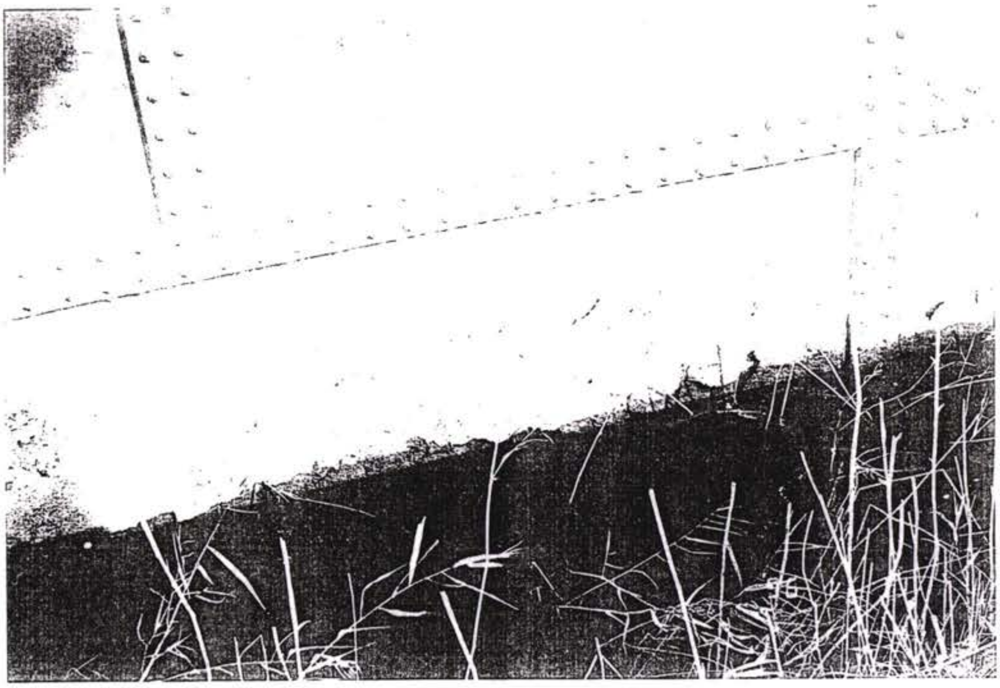
F10-06 Pier 5
Rust spots US



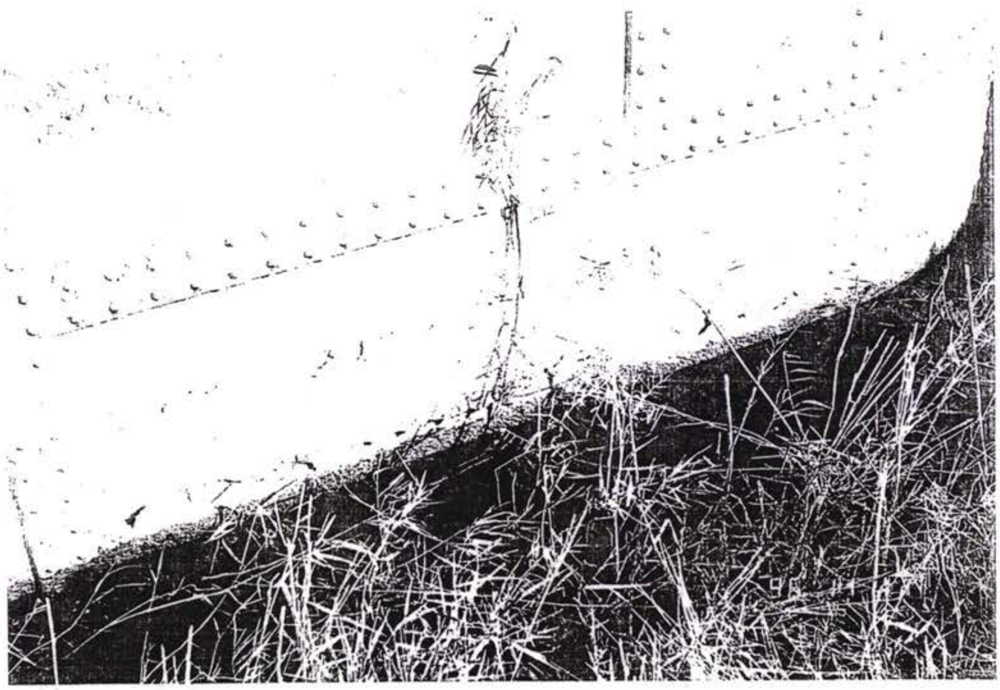
F10-07
Derusting
method with hammer



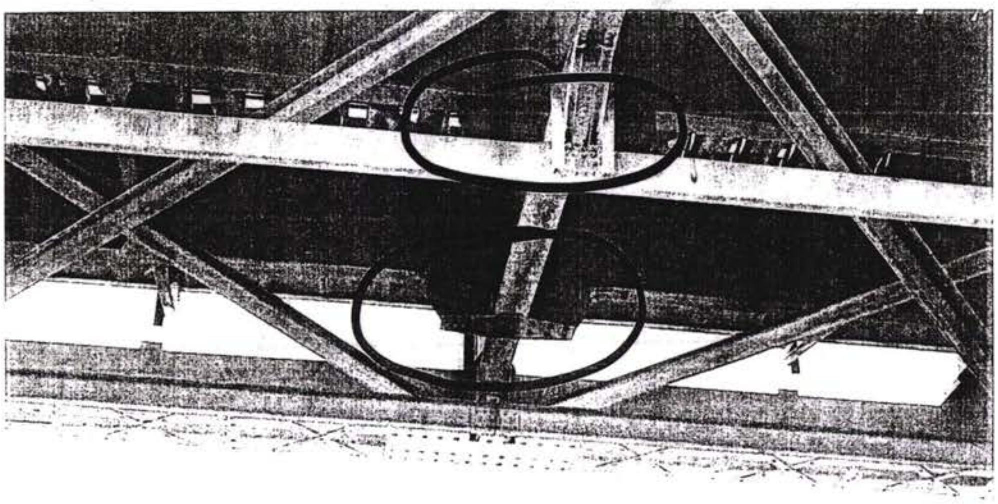
F10-08 Span 7
End crossgirder
bent gussset plate



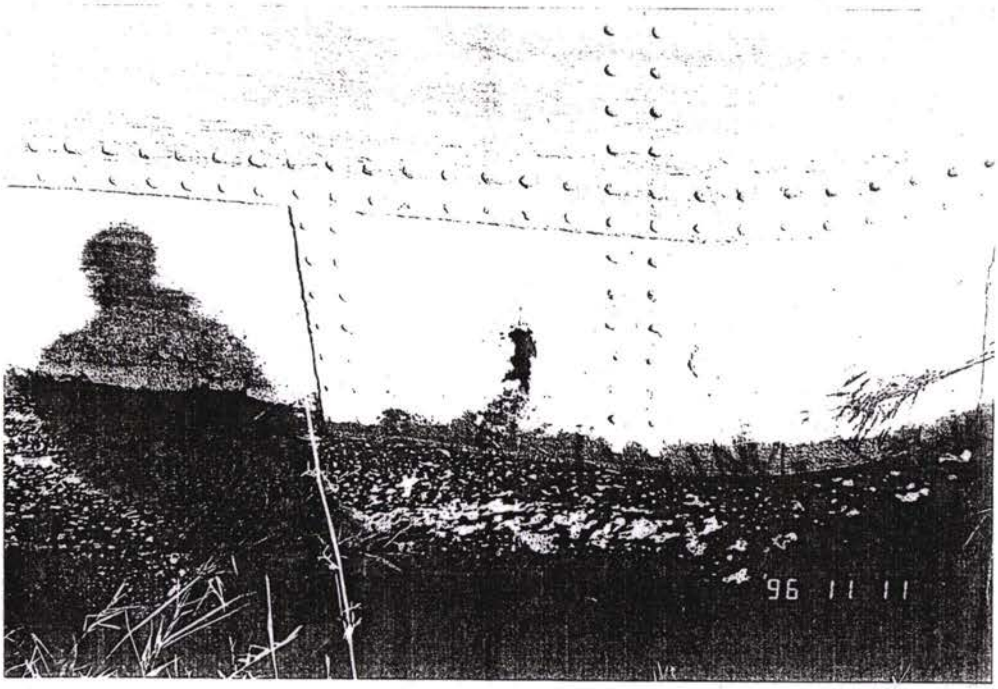
F10-09 Pier 7



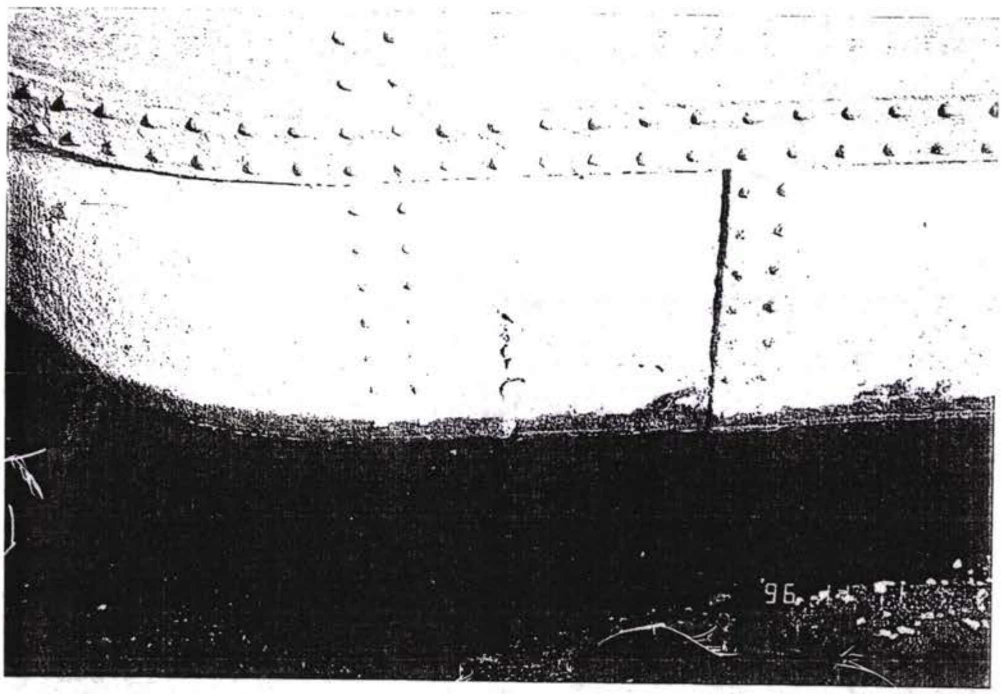
F10-10 Pier 7



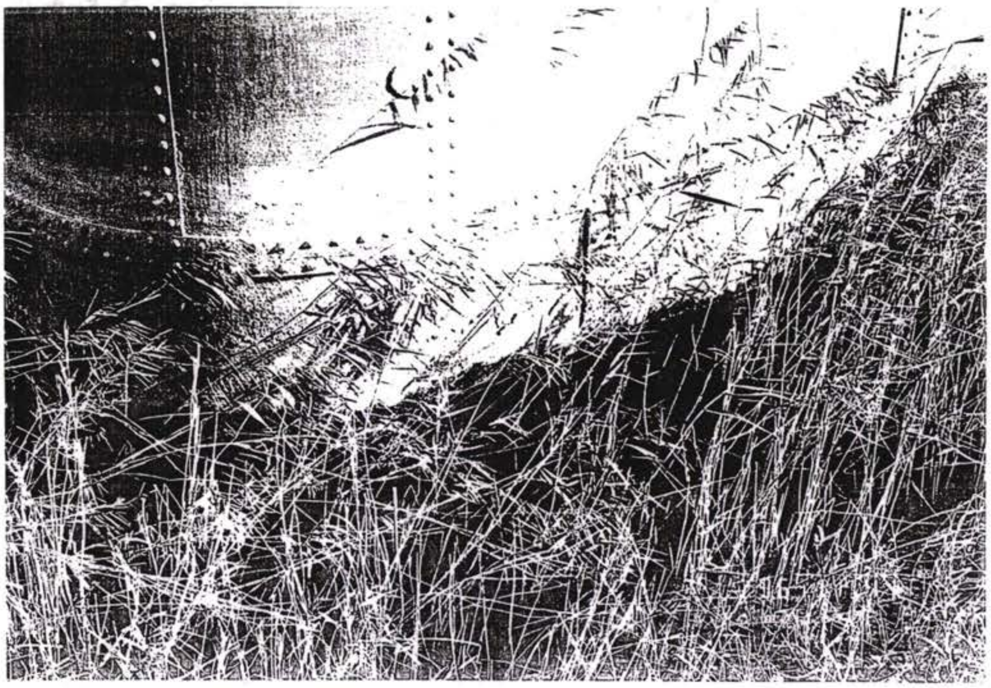
F10-11 Span 5
Strengthening



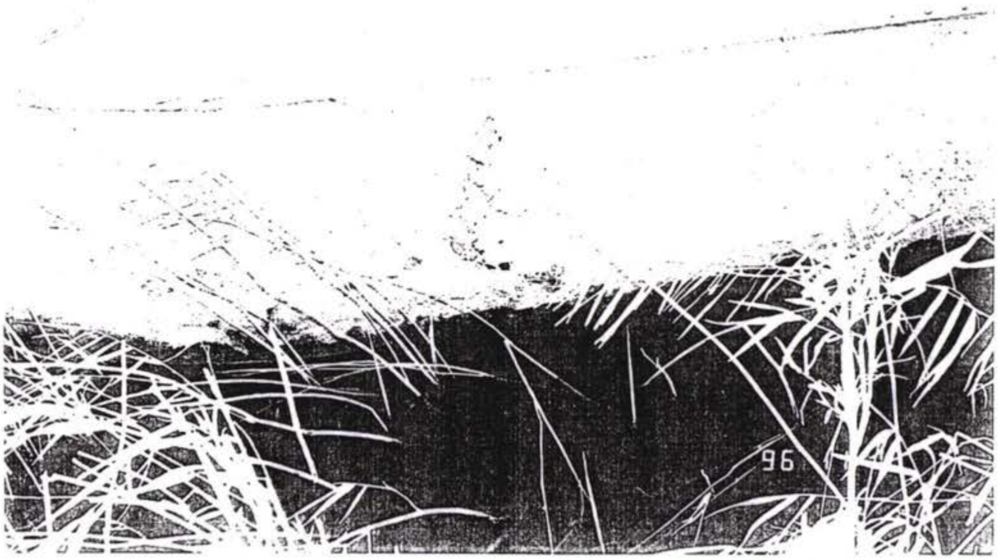
F10-12 Pier 7
Hole in the steel shell US,
300 x 70 mm



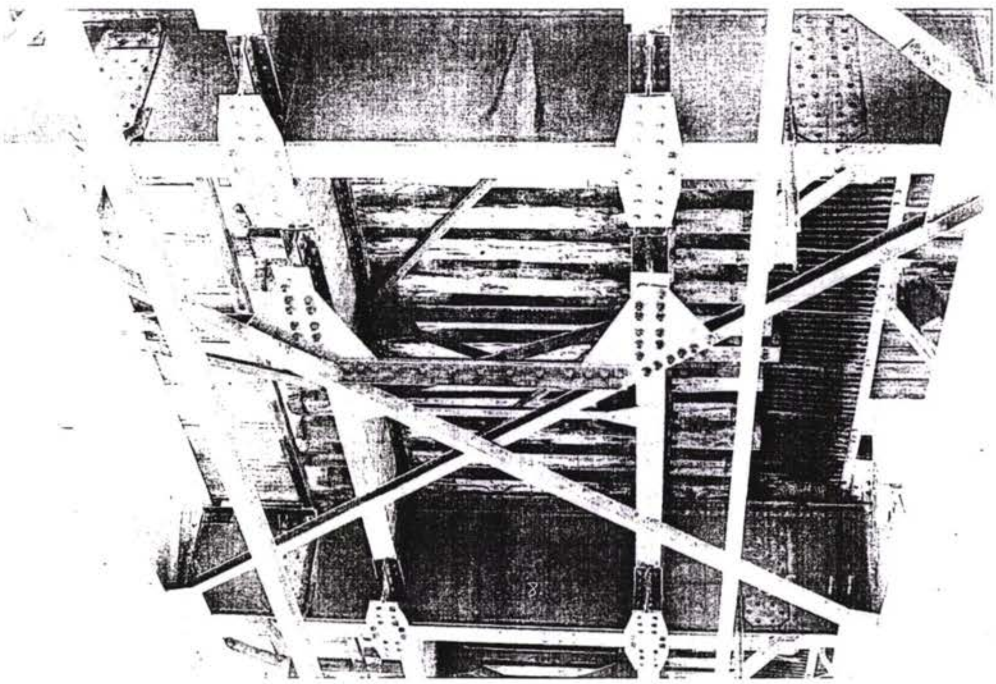
F10-13 Pier 7
Hole in the steel shell DS,
350 x 10 mm



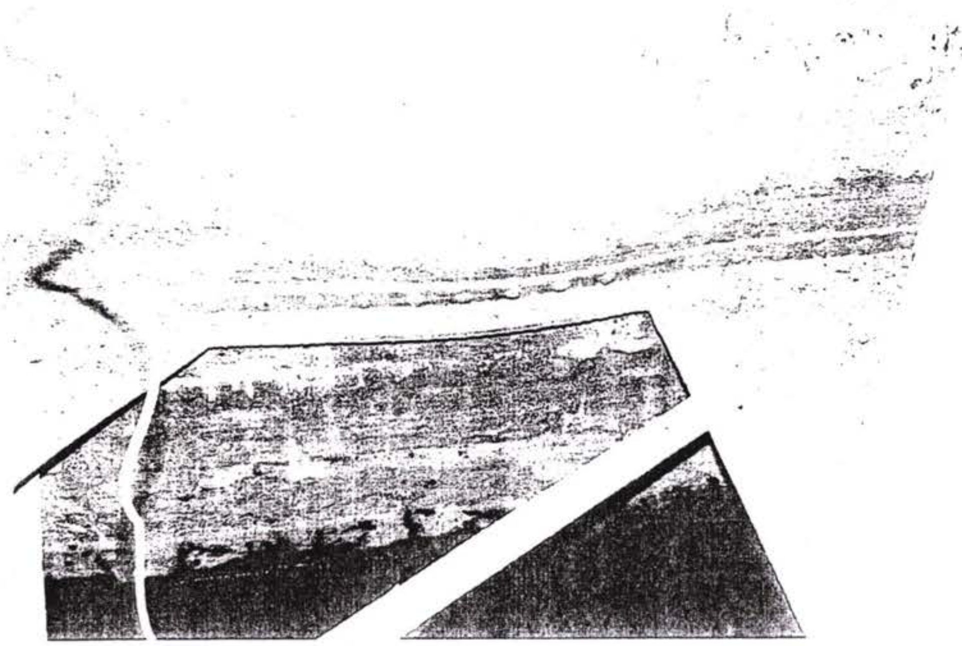
F10-14 Pier 8
US view



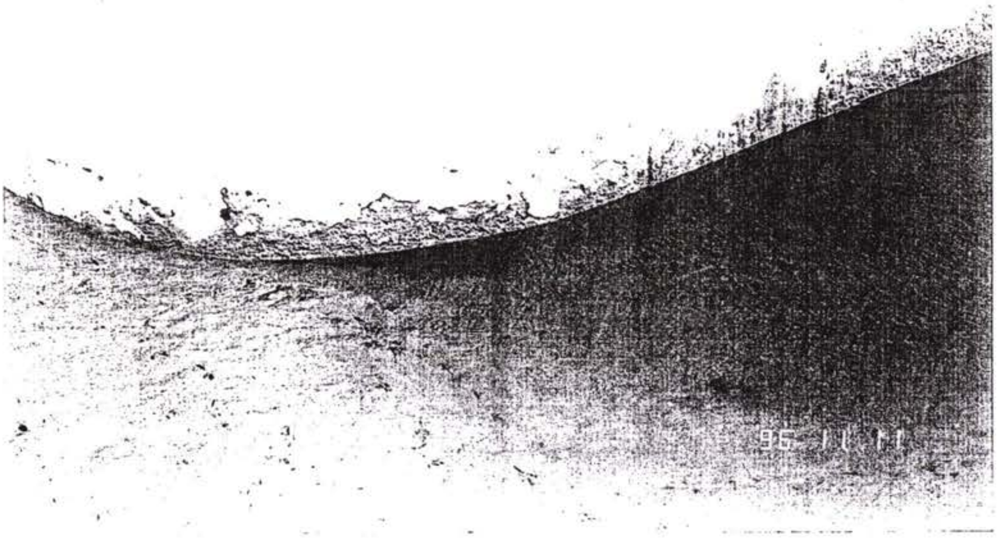
F10-15 Pier 8
DS cracks



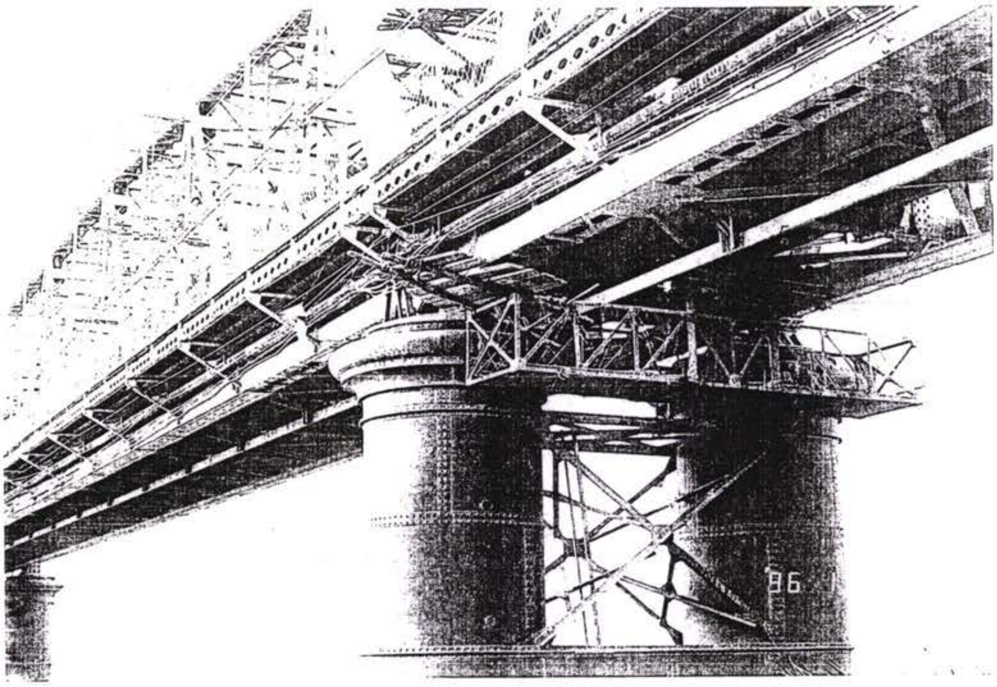
F10-16 Span 9
Strengthening



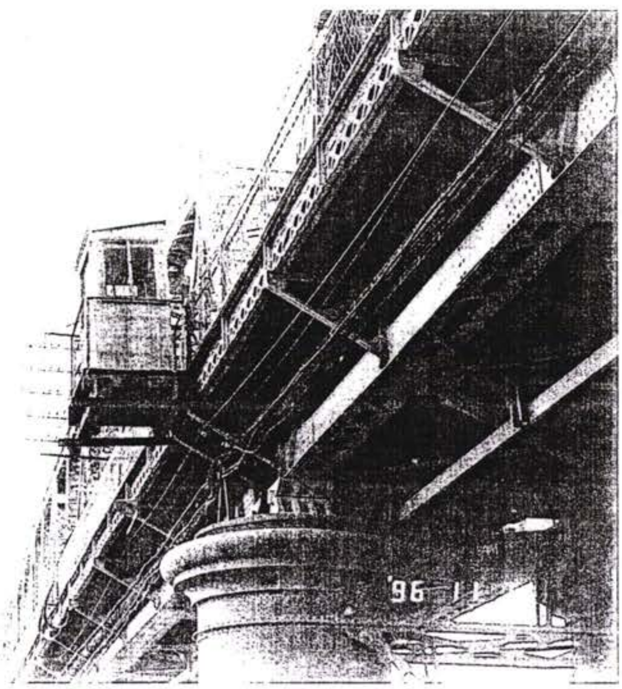
F10-17 Pier 12
Buckling by land car, from inside



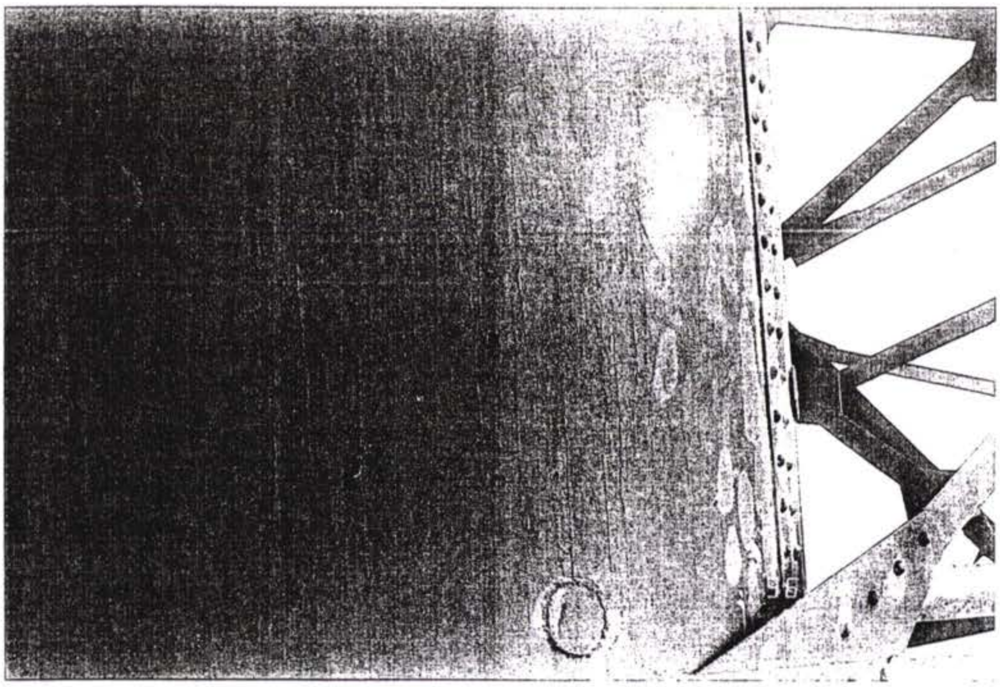
F10-18 Pier 12
View from outside



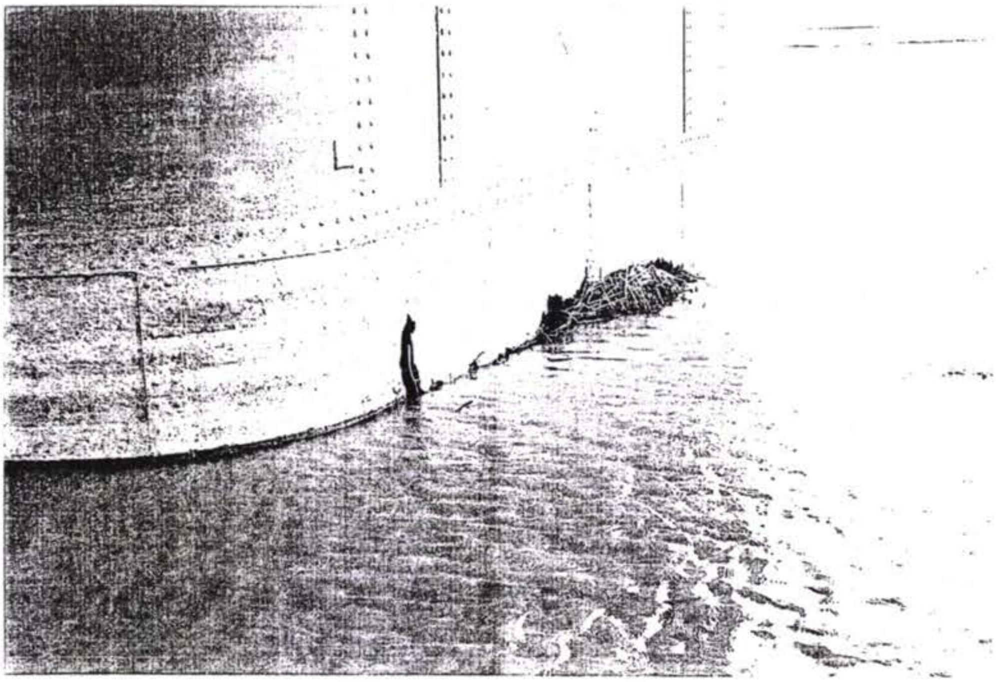
F10-19
Inspection car



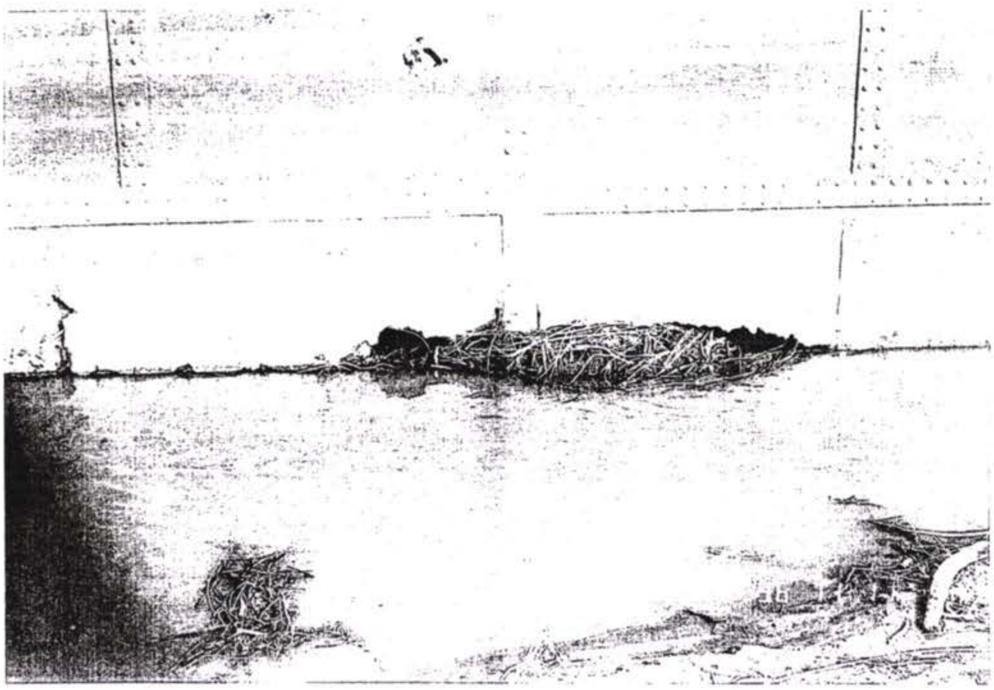
F10-20
Guard room
(middle of bridge)



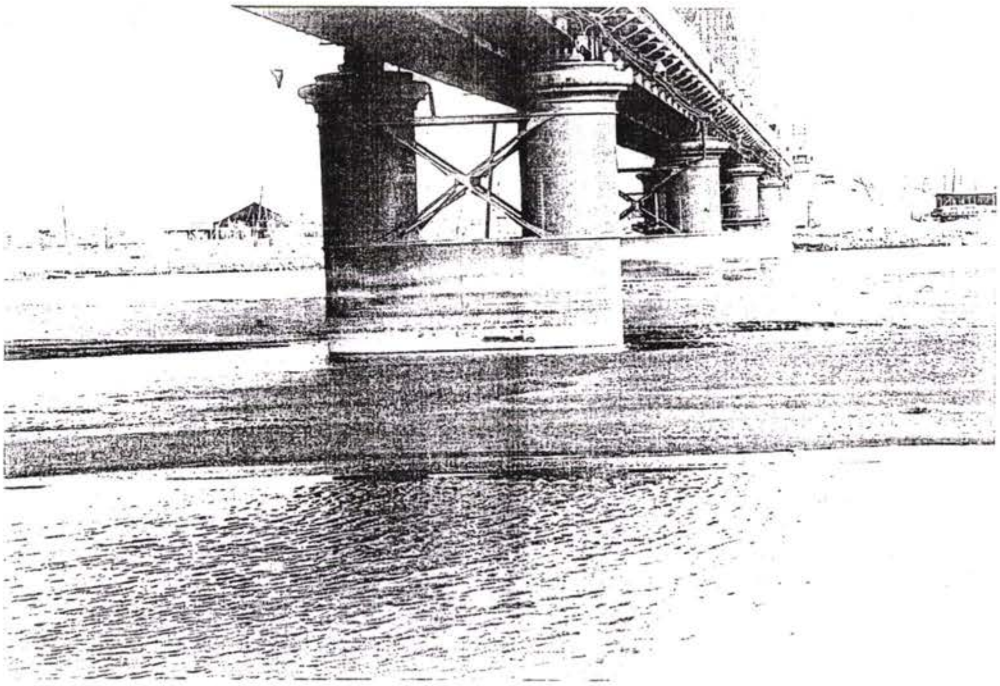
F10-21 Pier 13
Hole (not closed) in the steel shell



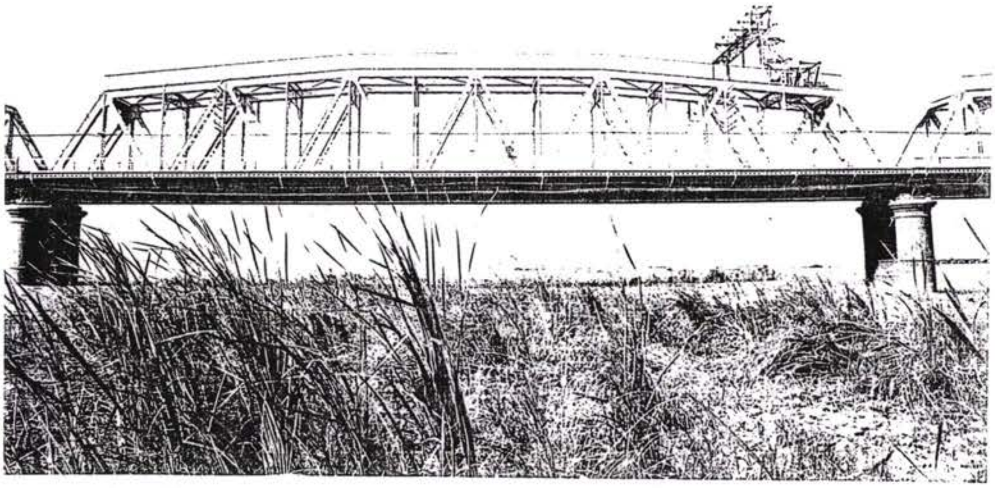
F10-22 Pier 19
Holes due to corrosion



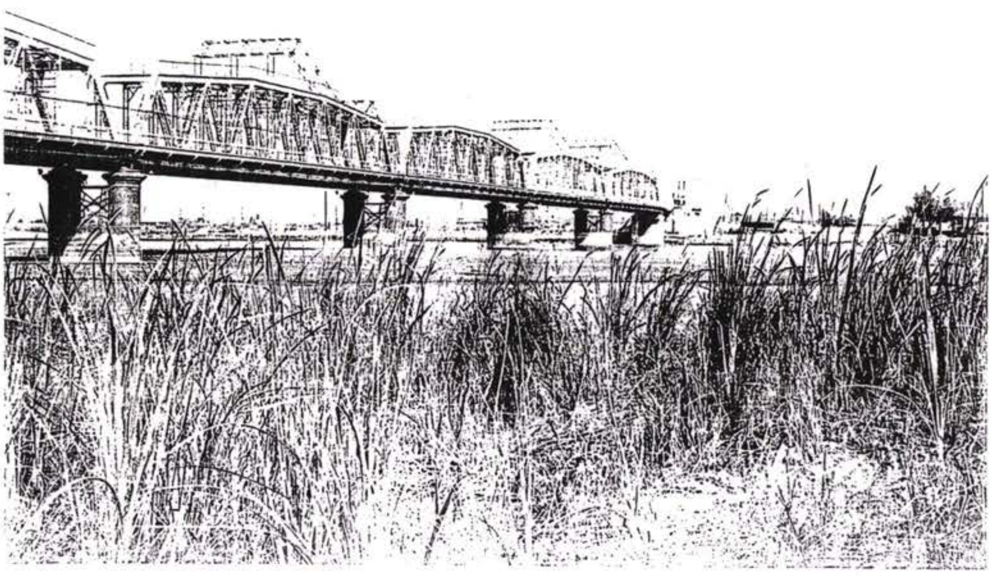
F10-23 Pier 19
As F10-22



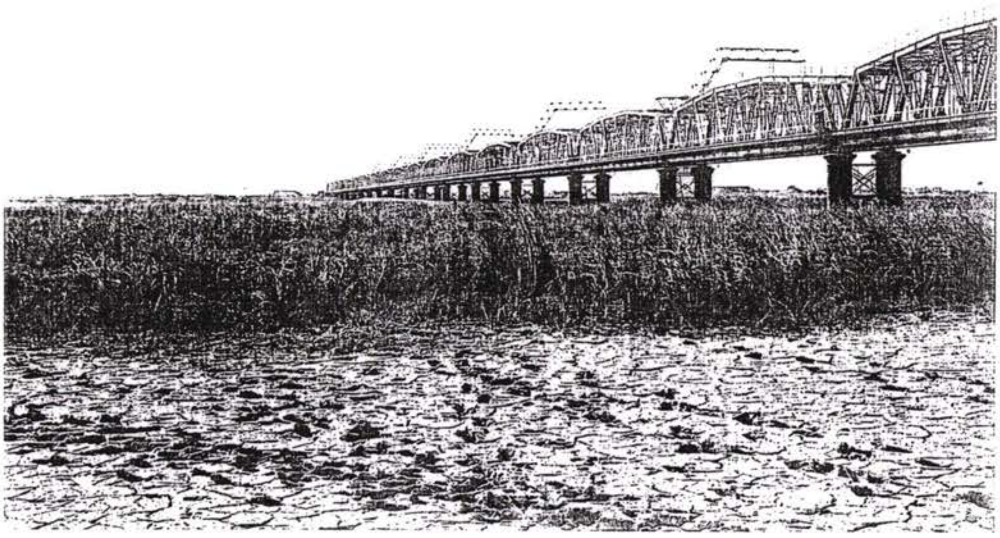
F10-24 Pier 21
Corrosion marks



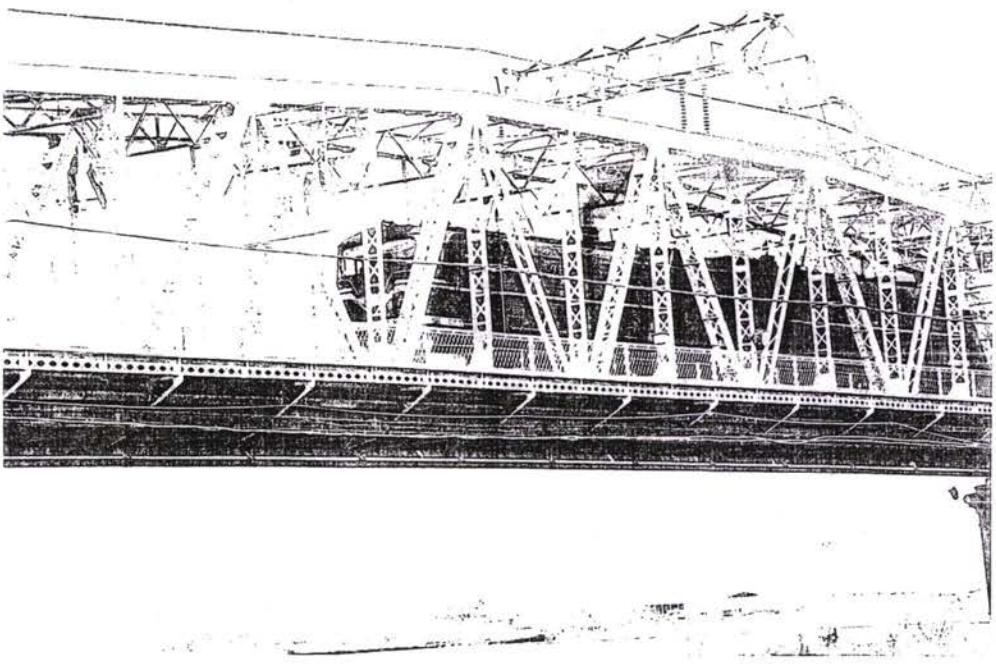
F10-25 Span 13



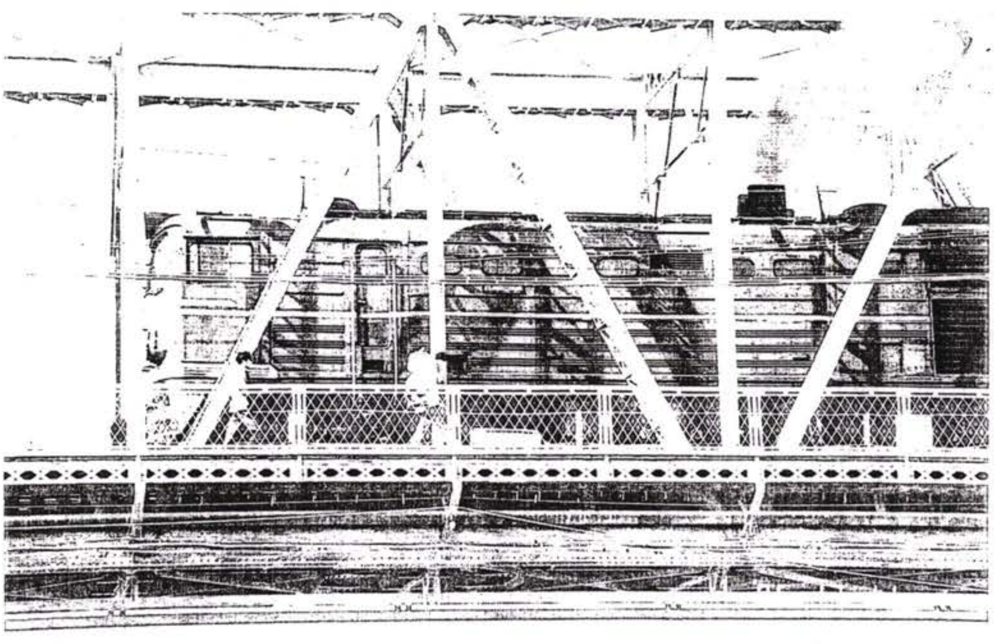
F10-26 Spans 22-25



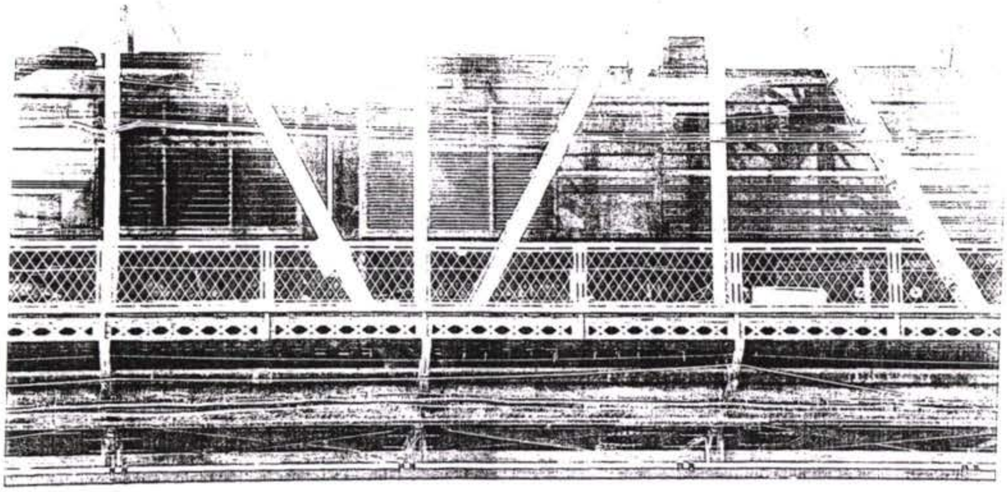
F10-27
View to Farab



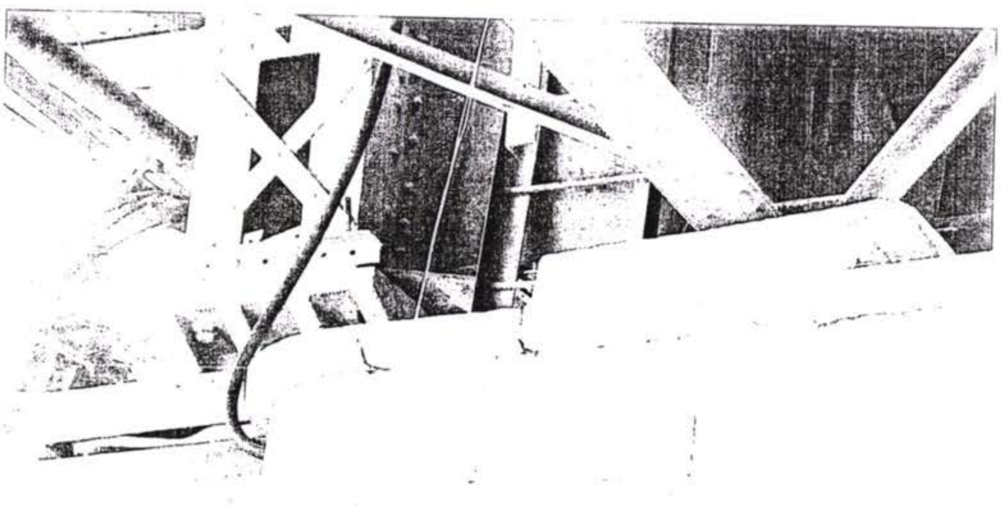
F10-28
Train passing



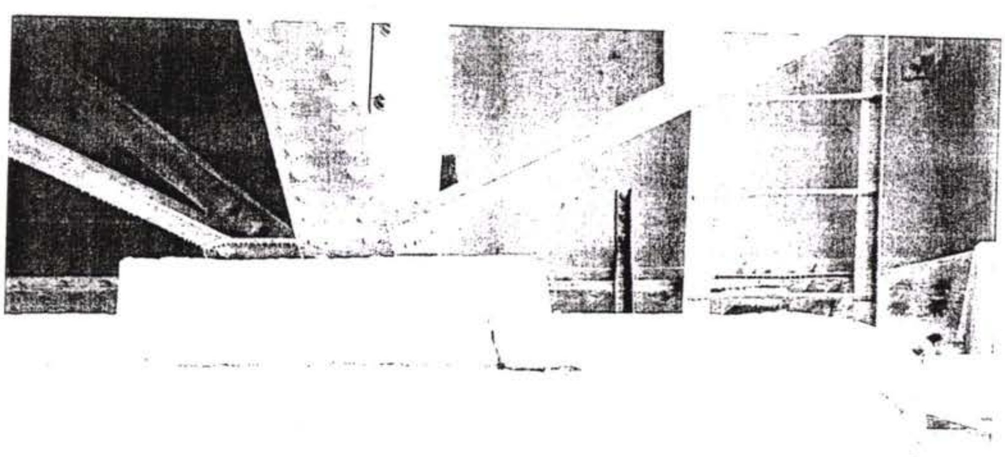
F10-29
As F10-28



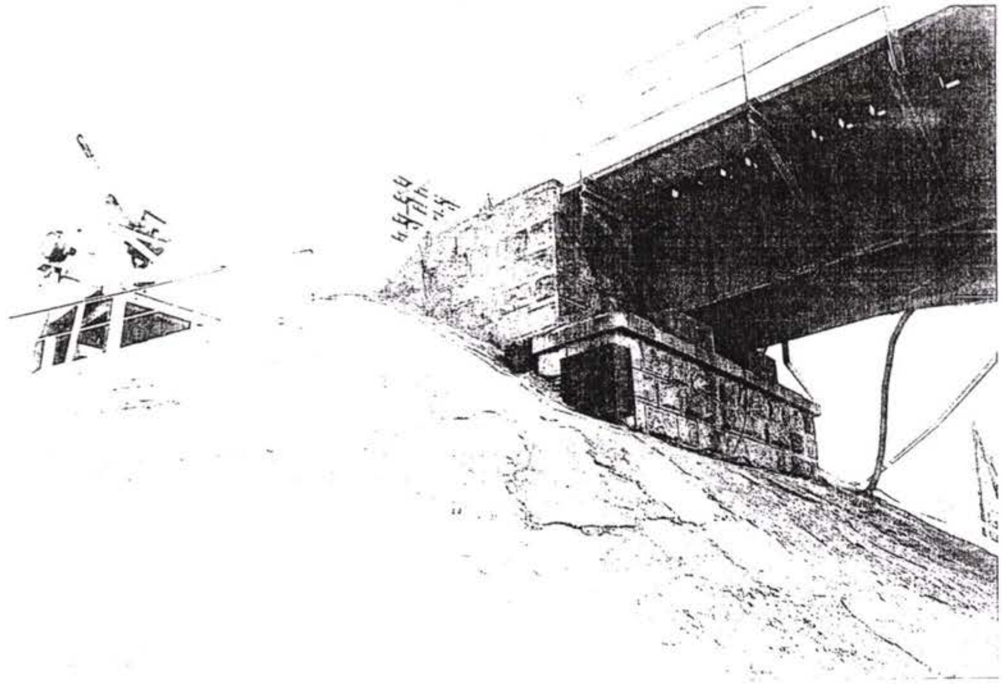
F10-30
As F10-28



F10-33 Abutment
26
DS



F10-34 Abutment
26
US



F10-35 Abutment 26
Total view

TRACECA - MODULE C - WS 3200 CHARDZHEV BRIDGE

APPENDIX C
CHECK COMPUTATION

CHECK COMPUTATION

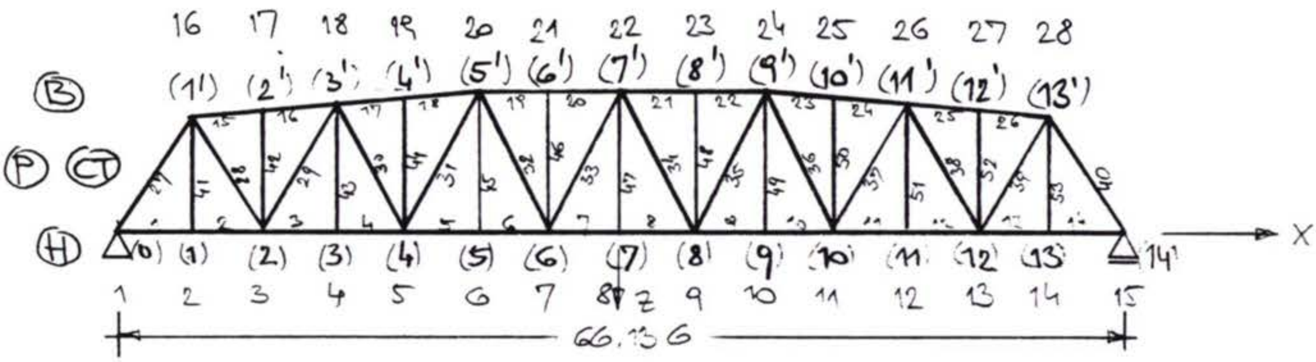
1 ft = 0,3048 m

1 in = 0,0254 m

1. BRIDGE SYSTEM, COORDINATES

Numbers in brackets ... original drawings see Annex A

Numbers: node numbers of electronic calculation



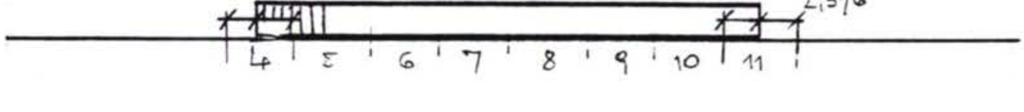
z		-7,506	-7,916	-8,325	-8,735	-9,144	-9,144	-9,144	-9,144	-9,144	-8,735	-8,325	-7,916	-7,506	
X	-33,068	-28,344	-23,620	-18,896	-14,172	-9,448	-4,724	0	4,724	9,448	14,172	18,896	23,620	28,344	33,068

2. LOADS

Locomotive load: 1 engine 2760 kN length 33 m

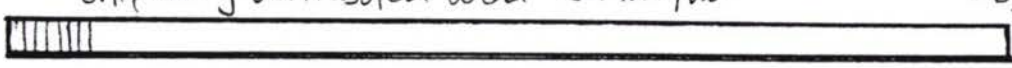
Load case LC2 — unit load 1

uniformly distributed load 2760/33 = 84 kN/m → $\frac{0,84}{2} \cdot 100$ kN/m ← one main girder



load case LC1: — unit load 2

uniformly distributed load 84 kN/m — $=\frac{0,84}{2} \cdot 100$ kN/m



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load case LC3

half loaded bridge excentric: elements 1:7 loaded

loadcase LC4

dead load, estimated:

according Austrian tables with approximated weight assumptions: (see page C/3)

truss span with track in bottom position, single track:

		kg/m'
a) main girder	g = 40 . 66,14 + 400 =	3046
b) wind bracings	g =	360
c) track girders	g = 85,5,54 + 200 =	671
d) other floor elements	g = 200.5,54 + 60 =	1162
e) cantilevers	g =	30
f) footway floor, trolley rails		100
g) inspection car rails		100
		5435

rounded 5500 kg/m'

≙ 55 kN/m'

for 1 main girder:

27,5 kN/m'

MASS ESTIMATION OF RAILWAY BRIDGES

Tafel 1

Näherungswerte für **Gewichte** ein- und zweigleisiger Eisenbahnbrücken aus St 37 und St 52 *) für die Lastenzüge **S, L**, N, E [1])

1	2	3	4	5	6	7	8	9	10	11
TYPE Bauart	SPAN Stützweite l m	ein- oder zweigleisig	Hauptträgerabstand b m	MATER. Baustahl	LOAD Lastenzug	Anteile für 1 m Brückenlänge — Stahlgewicht der Überbauten Hauptträger [2]) kg	Verbände 1 Windverband kg	Verbände 2 Windverbände kg	Fahrbahnträger [3]) kg	übriges Fahrbahngewicht [4]) kg
1. Brücken mit offener Fahrbahn										
Vollwandträger mit unmittelbarer Schwellenauflagerung	10 bis 50	eingl	2,0	St 37	S	57 l	150	200	20	760
					L	48 l				
					N	65 l				
					E	56 l				
				St 52	S	46 l				
					L	39 l				
					N	54 l				
					E	45 l				
Vollwandträger mit versenkter Fahrbahn [5])	10 bis 50	eingl	2,6 bis 4,85	St 37	S	57 l	80 bis 140	—	81 b + 190	200 b + 60
					L	48 l			76 b + 170	
					N	68 l			} 85 b + 200	
					E	56 l				
				St 52	S	46 l			67 b + 160	
					L	39 l			62 b + 145	
					N	54 l			} 70 b + 170	
					E	45 l				
TRUSS GIRDER Fachwerkträger *) a) Fahrbahn unten b) Fahrbahn oben oder etwas versenkt	25 bis 100	SINGLE TRACK eingl	a) 4,8 bis 5,3 b) 2,5 bis 3,2	St 37	S	34 l + 325	200	320	81 b + 190	200 b + 60
					L	27 l + 235			76 b + 170	
					N	40 l + 400	200	320	85 b + 200	
					E	32 l + 300				
				St 52	S	24 l + 305	180	280	67 b + 160	
					L	20 l + 180			62 b + 145	
					N	28 l + 370	180	280	70 b + 170	
					E	23 l + 270				
Fachwerkträger *) Fahrbahn unten	25 bis 100	zweigl	8,5 bis 9,5	St 37	S	46 l + 1080	320	580	115 b + 720	200 b + 120
					L	35 l + 790			115 b + 500	
					N	53 l + 1320	320	580	120 b + 750	
					E	43 l + 1000				
				St 52	S	29 l + 885	280	520	115 b + 460	
					L	22 l + 650			115 b + 270	
					N	36 l + 1070	280	520	120 b + 480	
					E	27 l + 820				
			Main girder distance b[m]		Train type, heaviest=N selected	Mass of main girder	Mass of 1 bracing	Mass of 2 bracings	Floor & track girder mass	Mass of other floor

*) St 52 T und St 55 S. Für Eisenbahnbrucken aus St 44 sind die Mittelwerte der Gewichte für St 37 und St 52 zu nehmen.

3. CROSS SECTION TYPES

	Elements	Number	J_x [cm⁴]	A [cm²]	A_s [cm²]
Upper chord	B 1'-2'-3'	1	124.200	269	159
	B 3'-4'-5'	2	175.300	380	159
	B 5'-6'-7'	3	187.900	424	159
Lower chord	H 0-1-2	4	54.500	217	132
	H 2-3	5	90.900	300	145
	H 3-4	6	93.700	315	145
	H 4-5	7	134.200	383	159
	H 5-6	8	136.500	399	159
	H 6-7	9	142.200	419	159
Diagonals	P 0-1'	10	140.300	322	152
	P 1'-2	11	13.700	191	26
	P 2-3'	12	38.500	206	29
	P 3'-4	13	8.300	107	50
	P 4-5'	14	19.700	140	25
	P 5'-6	15	4.600	82	40
	P 6-7'	16	19.600	158	66
Verticals	CT	17	2.100	64	30

Assumption: no excentricity due to axis deviation.

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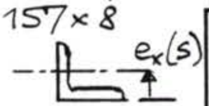
C/5

AMU-DARYA BRIDGE ANGLES Planungsgesellschaft für Stahl- und Maschinenbau Wien

Querschnittswerte von Blechträgern / Cross section values of plate girders A.Nr. 20-007

Querschnitt/cross section:	**L89x76x8**						
Bez.	by[mm]	hx[mm]	ex[mm]	A=b.h[cm2]	A*ex[cm3]	A*ex*ex[cm4]	Jx(o)[cm4]
leg -	89	8	4	7,12	3	1	0
leg I	8	68	42	5,44	23	96	21
				0,00	0	0	0
				0,00	0	0	0
Equivalent		ex(s)[cm]	**2,05**	**12,56**	26	97	21
plate ╪		H(tot)[mn	76,0	A[cm2]	i(x) [cm] 2,29	**Jx(s)[cm4]=**	**66**
157×8		Note:				**Jx(s)[m4]=**	**6,5872E-07**
				x(o) [mm]	76,0	**Wx(o)[cm3]=**	**-11,9**
				x(a) [mm]		**Wx(a)[cm3]=**	**32,2**
				x(b) [mm]		**Wx(b)[cm3]=**	**32,2**
Vers.050894/Piringer				x(u) [mm]	0,0	**Wx(u)[cm3]=**	**32,2**

Querschnitt/cross section:	**L 102x102x11**						
Bez.	by[mm]	hx[mm]	ex[mm]	A=b.h[cm2]	A*ex[cm3]	A*ex*ex[cm4]	Jx(o)[cm4]
leg -	102	11	5,5	11,22	6	3	1
leg I	11	91	56,5	10,01	57	320	69
				0,00	0	0	0
				0,00	0	0	0
		ex(s)[cm]	**2,95**	**21,23**	63	323	70
193×11		H(tot)[mn	102,0	A[cm2]	i(x) [cm] 3,13	**Jx(s)[cm4]=**	**208**
		Note:				**Jx(s)[m4]=**	**2,0781E-06**
				x(o) [mm]	102,0	**Wx(o)[cm3]=**	**-28,7**
				x(a) [mm]		**Wx(a)[cm3]=**	**70,3**
				x(b) [mm]		**Wx(b)[cm3]=**	**70,3**
Vers.050894/Piringer				x(u) [mm]	0,0	**Wx(u)[cm3]=**	**70,3**

Querschnitt/cross section:	**L 76x76x9,5**						
Bez.	by[mm]	hx[mm]	ex[mm]	A=b.h[cm2]	A*ex[cm3]	A*ex*ex[cm4]	Jx(o)[cm4]
leg -	76	9,5	4,75	7,22	3	2	1
leg I	9,5	66,5	42,75	6,32	27	115	23
				0,00	0	0	0
				0,00	0	0	0
		ex(s)[cm]	**2,25**	**13,54**	30	117	24
		H(tot)[mn	76,0	A[cm2]	i(x) [cm] 2,31	**Jx(s)[cm4]=**	**72**
143×9,5		Note:				**Jx(s)[m4]=**	**7,2477E-07**
				x(o) [mm]	76,0	**Wx(o)[cm3]=**	**-13,5**
				x(a) [mm]		**Wx(a)[cm3]=**	**32,2**
				x(b) [mm]		**Wx(b)[cm3]=**	**32,2**
Vers.050894/Piringer				x(u) [mm]	0,0	**Wx(u)[cm3]=**	**32,2**

Querschnitt/cross section:	**L 127x89x13**						
Bez.	by[mm]	hx[mm]	ex[mm]	A=b.h[cm2]	A*ex[cm3]	A*ex*ex[cm4]	Jx(o)[cm4]
leg -	89	13	6,5	11,57	8	5	2
leg I	13	114	70	14,82	104	726	161
				0,00	0	0	0
				0,00	0	0	0
		ex(s)[cm]	**4,22**	**26,39**	111	731	162
		H(tot)[mn	127,0	A[cm2]	i(x) [cm] 4,01	**Jx(s)[cm4]=**	**424**
		Note:				**Jx(s)[m4]=**	**4,2412E-06**
203×13				x(o) [mm]	127,0	**Wx(o)[cm3]=**	**-50,0**
				x(a) [mm]		**Wx(a)[cm3]=**	**100,6**
				x(b) [mm]		**Wx(b)[cm3]=**	**100,6**
Vers.050894/Piringer				x(u) [mm]	0,0	**Wx(u)[cm3]=**	**100,6**

C/6

Querschnitt/cross section:	L 152x102x11						
Bez.	by[mm]	hx[mm]	ex[mm]	A=b.h[cm2]	A*ex[cm3]	A*ex*ex[cm4]	Jx(o)[cm4]
leg -	102	11	5,5	11,22	6	3	1
leg I	11	141	81,5	15,51	126	1030	257
				0,00	0	0	0
				0,00	0	0	0
		ex(s)[cm]	**4,96**	**26,73**	133	1034	258
		H(tot)[mn	152,0	A[cm2]	i(x) [cm] 4,87	**Jx(s)[cm4]=**	**634**
243 x 11		Note:				**Jx(s)[m4]=**	**6,3413E-06**
				x(o) [mm]	152,0	**Wx(o)[cm3]=**	**-61,9**
				x(a) [mm]		**Wx(a)[cm3]=**	**127,9**
				x(b) [mm]		**Wx(b)[cm3]=**	**127,9**
Vers.050894/Piringer				x(u) [mm]	0,0	**Wx(u)[cm3]=**	**127,9**

Querschnitt/cross section:	L 127x89x10						
Bez.	by[mm]	hx[mm]	ex[mm]	A=b.h[cm2]	A*ex[cm3]	A*ex*ex[cm4]	Jx(o)[cm4]
leg -	89	10	5	8,90	4	2	1
leg I	10	117	68,5	11,70	80	549	133
				0,00	0	0	0
				0,00	0	0	0
		ex(s)[cm]	**4,11**	**20,60**	85	551	134
		H(tot)[mn	127,0	A[cm2]	i(x) [cm] 4,05	**Jx(s)[cm4]=**	**338**
206 x 10		Note:				**Jx(s)[m4]=**	**3,3803E-06**
				x(o) [mm]	127,0	**Wx(o)[cm3]=**	**-39,3**
				x(a) [mm]		**Wx(a)[cm3]=**	**82,3**
				x(b) [mm]		**Wx(b)[cm3]=**	**82,3**
Vers.050894/Piringer				x(u) [mm]	0,0	**Wx(u)[cm3]=**	**82,3**

Querschnitt/cross section:	L 176x76x9,5						
Bez.	by[mm]	hx[mm]	ex[mm]	A=b.h[cm2]	A*ex[cm3]	A*ex*ex[cm4]	Jx(o)[cm4]
leg -	176	9,5	4,75	16,72	8	4	1
leg I	9,5	66,5	42,75	6,32	27	115	23
				0,00	0	0	0
				0,00	0	0	0
		ex(s)[cm]	**1,52**	**23,04**	35	119	25
		H(tot)[mn	76,0	A[cm2]	i(x) [cm] 1,98	**Jx(s)[cm4]=**	**91**
243 x 9,5		Note:				**Jx(s)[m4]=**	**9,0747E-07**
				x(o) [mm]	76,0	**Wx(o)[cm3]=**	**-14,9**
				x(a) [mm]		**Wx(a)[cm3]=**	**59,8**
				x(b) [mm]		**Wx(b)[cm3]=**	**59,8**
Vers.050894/Piringer				x(u) [mm]	0,0	**Wx(u)[cm3]=**	**59,8**

Querschnitt/cross section:	L 89x89x9,5						
Bez.	by[mm]	hx[mm]	ex[mm]	A=b.h[cm2]	A*ex[cm3]	A*ex*ex[cm4]	Jx(o)[cm4]
leg -	89	9,5	4,75	8,46	4	2	1
leg I	9,5	79,5	49,25	7,55	37	183	40
				0,00	0	0	0
				0,00	0	0	0
		ex(s)[cm]	**2,57**	**16,01**	41	185	40
		H(tot)[mn	89,0	A[cm2]	i(x) [cm] 2,73	**Jx(s)[cm4]=**	**119**
169 x 9,5		Note:				**Jx(s)[m4]=**	**1,1941E-06**
				x(o) [mm]	89,0	**Wx(o)[cm3]=**	**-18,9**
				x(a) [mm]		**Wx(a)[cm3]=**	**46,4**
				x(b) [mm]		**Wx(b)[cm3]=**	**46,4**
Vers.050894/Piringer				x(u) [mm]	0,0	**Wx(u)[cm3]=**	**46,4**

Datenschutz: psm

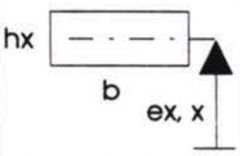
c/7

AMU-DARYA BRIDGE — Planungsgesellschaft für Stahl- und Maschinenbau Wien

Querschnittswerte von Blechträgern / Cross section values of plate girders — A.Nr. 20-007

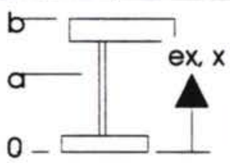
Querschnitt/cross section: **B 1'-2'-3'**

Bez.	by[mm]	hx[mm]	ex[mm]	A=b.h[cm2]	A*ex[cm3]	A*ex*ex[cm4]	Jx(o)[cm4]
webs	26	610	305	158,60	4837	147538	49179
lower L	157	16	590	25,12	1482	87443	5
upper L	193	44	30	84,92	255	764	137
				0,00	0	0	0
				0,00	0	0	0
				0,00	0	0	0
				0,00	0	0	0
	ex(s)[cm]		**24,47**	**268,64**	6574	235745	49322
	H(tot)[mm]		610,0	A[cm2]	i(x) [cm] 21,50	**Jx(s)[cm4]=**	**124.184**
	Note:					**Jx(s)[m4]=**	**0,001241843**
				x(o) [mm]	610,0	**Wx(o)[cm3]=**	**-3.399,7**
				x(a) [mm]	0,0	**Wx(a)[cm3]=**	**5.074,6**
				x(b) [mm]	0,0	**Wx(b)[cm3]=**	**5.074,6**
Vers.050894/Piringer				x(u) [mm]	0,0	**Wx(u)[cm3]=**	**5.074,6**



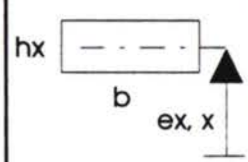
Querschnitt/cross section: **B 3'-4'-5'**

Bez.	by[mm]	hx[mm]	ex[mm]	A=b.h[cm2]	A*ex[cm3]	A*ex*ex[cm4]	Jx(o)[cm4]
webs	26	610	305	158,60	4837	147538	49179
lower L	157	16	590	25,12	1482	87443	5
upper L	193	44	30	84,92	255	764	137
upper pl	635	11	-5,5	69,85	-38	21	7
upper pl	381	11	-16,5	41,91	-69	114	4
				0,00	0	0	0
				0,00	0	0	0
	ex(s)[cm]		**17,00**	**380,40**	6467	235880	49333
	H(tot)[mm]		632,0	A[cm2]	i(x) [cm] 21,47	**Jx(s)[cm4]=**	**175.285**
	Note:					**Jx(s)[m4]=**	**0,001752849**
				x(o) [mm]	610,0	**Wx(o)[cm3]=**	**-3.983,7**
				x(a) [mm]	0,0	**Wx(a)[cm3]=**	**10.311,2**
				x(b) [mm]	0,0	**Wx(b)[cm3]=**	**10.311,2**
Vers.050894/Piringer				x(u) [mm]	-22,0	**Wx(u)[cm3]=**	**9.129,7**



Querschnitt/cross section: **B 5'-6'-7'**

Bez.	by[mm]	hx[mm]	ex[mm]	A=b.h[cm2]	A*ex[cm3]	A*ex*ex[cm4]	Jx(o)[cm4]
webs	26	610	305	158,60	4837	147538	49179
lower L	157	16	590	25,12	1482	87443	5
upper L	193	44	30	84,92	255	764	137
upper pl	165	9,5	4,75	15,68	7	4	1
upper pl	635	22	-11	139,70	-154	169	56
				0,00	0	0	0
				0,00	0	0	0
	ex(s)[cm]		**15,16**	**424,02**	6428	235917	49379
	H(tot)[mm]		632,0	A[cm2]	i(x) [cm] 21,05	**Jx(s)[cm4]=**	**187.851**
	Note:					**Jx(s)[m4]=**	**0,001878514**
				x(o) [mm]	610,0	**Wx(o)[cm3]=**	**-4.097,9**
				x(a) [mm]	0,0	**Wx(a)[cm3]=**	**12.391,5**
				x(b) [mm]	0,0	**Wx(b)[cm3]=**	**12.391,5**
Vers.050894/Piringer				x(u) [mm]	-22,0	**Wx(u)[cm3]=**	**10.821,2**



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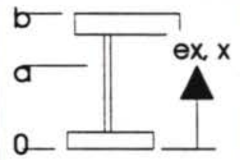
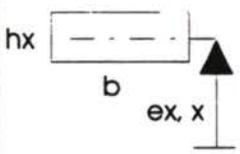
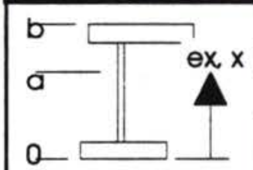
Querschnitt/cross section:	H 0-1-2						
Bez.	by[mm]	hx[mm]	ex[mm]	A=b.h[cm2]	A*ex[cm3]	A*ex*ex[cm4]	Jx(o)[cm4]
webs	26	508	254	132,08	3355	85213	28404
lower L	193	44	30	84,92	255	764	137
				0,00	0	0	0
				0,00	0	0	0
				0,00	0	0	0
				0,00	0	0	0
				0,00	0	0	0
		ex(s)[cm]	16,63	217,00	3610	85977	28541
		H(tot)[mm]	508,0	A[cm2]	i(x) [cm] 15,84	Jx(s)[cm4]=	54.476
		Note:				Jx(s)[m4]=	0,000544761
				x(o) [mm]	508,0	Wx(o)[cm3]=	-1.594,5
				x(a) [mm]	0,0	Wx(a)[cm3]=	3.275,0
				x(b) [mm]	0,0	Wx(b)[cm3]=	3.275,0
Vers.050894/Piringer				x(u) [mm]	0,0	Wx(u)[cm3]=	3.275,0



Querschnitt/cross section:	H 2-3						
Bez.	by[mm]	hx[mm]	ex[mm]	A=b.h[cm2]	A*ex[cm3]	A*ex*ex[cm4]	Jx(o)[cm4]
webs	26	558	279	145,08	4048	112932	37644
lower L	193	44	30	84,92	255	764	137
lower pl	635	11	-5,5	69,85	-38	21	7
				0,00	0	0	0
				0,00	0	0	0
				0,00	0	0	0
				0,00	0	0	0
		ex(s)[cm]	14,22	299,85	4264	113717	37788
		H(tot)[mm]	569,0	A[cm2]	i(x) [cm] 17,41	Jx(s)[cm4]=	90.867
		Note:				Jx(s)[m4]=	0,00090867
				x(o) [mm]	558,0	Wx(o)[cm3]=	-2.185,4
				x(a) [mm]	0,0	Wx(a)[cm3]=	6.389,8
				x(b) [mm]	0,0	Wx(b)[cm3]=	6.389,8
Vers.050894/Piringer				x(u) [mm]	-11,0	Wx(u)[cm3]=	5.931,0

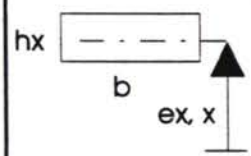


Querschnitt/cross section:	H 3-4						
Bez.	by[mm]	hx[mm]	ex[mm]	A=b.h[cm2]	A*ex[cm3]	A*ex*ex[cm4]	Jx(o)[cm4]
webs	26	558	279	145,08	4048	112932	37644
lower L	193	44	30	84,92	255	764	137
lower pl	165	9,5	4,75	15,68	7	4	1
lower pl	635	11	-5,5	69,85	-38	21	7
				0,00	0	0	0
				0,00	0	0	0
				0,00	0	0	0
		ex(s)[cm]	13,54	315,53	4272	113721	37789
		H(tot)[mm]	569,0	A[cm2]	i(x) [cm] 17,23	Jx(s)[cm4]=	93.683
		Note:				Jx(s)[m4]=	0,000936827
				x(o) [mm]	558,0	Wx(o)[cm3]=	-2.216,7
				x(a) [mm]	0,0	Wx(a)[cm3]=	6.920,1
				x(b) [mm]	0,0	Wx(b)[cm3]=	6.920,1
Vers.050894/Piringer				x(u) [mm]	-11,0	Wx(u)[cm3]=	6.400,0

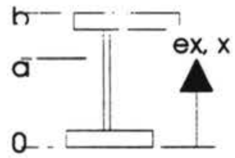


c/9

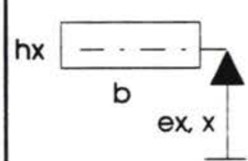
Querschnitt/cross section:	H 4-5						
Bez.	by[mm]	hx[mm]	ex[mm]	A=b.h[cm2]	A*ex[cm3]	A*ex*ex[cm4]	Jx(o)[cm4]
webs	26	610	305	158,60	4837	147538	49179
lower L	193	44	30	84,92	255	764	137
lower pl	635	22	-11	139,70	-154	169	56
				0,00	0	0	0
				0,00	0	0	0
				0,00	0	0	0
				0,00	0	0	0
		ex(s)[cm]	12,89	383,22	4938	148471	49373
		H(tot)[mm	632,0	A[cm2]	i(x) [cm] 18,71	Jx(s)[cm4]=	134.205
		Note:				Jx(s)[m4]=	0,001342046
				x(o) [mm]	610,0	Wx(o)[cm3]=	-2.789,3
				x(a) [mm]	0,0	Wx(a)[cm3]=	10.414,3
				x(b) [mm]	0,0	Wx(b)[cm3]=	10.414,3
Vers.050894/Piringer				x(u) [mm]	-22,0	Wx(u)[cm3]=	8.895,6



Querschnitt/cross section:	H 5-6						
Bez.	by[mm]	hx[mm]	ex[mm]	A=b.h[cm2]	A*ex[cm3]	A*ex*ex[cm4]	Jx(o)[cm4]
webs	26	610	305	158,60	4837	147538	49179
lower L	193	44	30	84,92	255	764	137
lower pl	165	9,5	4,75	15,68	7	4	1
lower pl	635	22	-11	139,70	-154	169	56
				0,00	0	0	0
				0,00	0	0	0
				0,00	0	0	0
		ex(s)[cm]	12,40	398,90	4946	148475	49374
		H(tot)[mm	632,0	A[cm2]	i(x) [cm] 18,50	Jx(s)[cm4]=	136.526
		Note:				Jx(s)[m4]=	0,001365256
				x(o) [mm]	610,0	Wx(o)[cm3]=	-2.809,1
				x(a) [mm]	0,0	Wx(a)[cm3]=	11.011,2
				x(b) [mm]	0,0	Wx(b)[cm3]=	11.011,2
Vers.050894/Piringer				x(u) [mm]	-22,0	Wx(u)[cm3]=	9.351,8

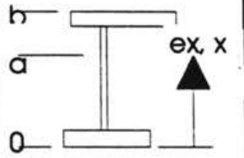


Querschnitt/cross section:	H 6-7						
Bez.	by[mm]	hx[mm]	ex[mm]	A=b.h[cm2]	A*ex[cm3]	A*ex*ex[cm4]	Jx(o)[cm4]
webs	26	610	305	158,60	4837	147538	49179
lower L	193	44	30	84,92	255	764	137
lower pl	635	22	-11	139,70	-154	169	56
lower pl	381	9,5	-26,75	36,20	-97	259	3
				0,00	0	0	0
				0,00	0	0	0
				0,00	0	0	0
		ex(s)[cm]	11,54	419,42	4842	148730	49375
		H(tot)[mm	641,5	A[cm2]	i(x) [cm] 18,41	Jx(s)[cm4]=	142.216
		Note:				Jx(s)[m4]=	0,00142216
				x(o) [mm]	610,0	Wx(o)[cm3]=	-2.875,6
				x(a) [mm]	0,0	Wx(a)[cm3]=	12.319,9
				x(b) [mm]	0,0	Wx(b)[cm3]=	12.319,9
Vers.050894/Piringer				x(u) [mm]	-31,5	Wx(u)[cm3]=	9.678,8

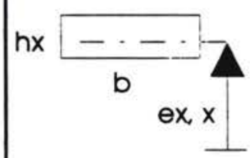


c/10

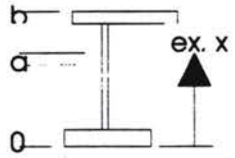
Querschnitt/cross section:		P 0-1'					
Bez.	by[mm]	hx[mm]	ex[mm]	A=b.h[cm2]	A*ex[cm3]	A*ex*ex[cm4]	Jx(o)[cm4]
webs	26	584	0	151,84	0	0	43155
lower L	143	19	-269,5	27,17	-732	19734	8
upper L	193	44	262	84,92	2225	58292	137
upper pl	610	9,5	296,75	57,95	1720	51031	4
				0,00	0	0	0
				0,00	0	0	0
				0,00	0	0	0
		ex(s)[cm]	9,98	321,88	3212	129057	43304
		H(tot)[mm]	593,5	A[cm2]	i(x) [cm] 20,88	Jx(s)[cm4]=	140.303
		Note:				Jx(s)[m4]=	0,001403028
				x(o) [mm]	301,5	Wx(o)[cm3]=	-6.956,0
				x(a) [mm]	0,0	Wx(a)[cm3]=	14.058,5
				x(b) [mm]	0,0	Wx(b)[cm3]=	14.058,5
Vers.050894/Piringer				x(u) [mm]	-292,0	Wx(u)[cm3]=	3.581,0



Querschnitt/cross section:		P 1'-2					
Bez.	by[mm]	hx[mm]	ex[mm]	A=b.h[cm2]	A*ex[cm3]	A*ex*ex[cm4]	Jx(o)[cm4]
webs	26	330	0	85,80	0	0	7786
lower L	26	203	-46,2	52,78	-244	1127	1813
upper L	26	203	46,2	52,78	244	1127	1813
				0,00	0	0	0
				0,00	0	0	0
				0,00	0	0	0
				0,00	0	0	0
		ex(s)[cm]	0,00	191,36	0	2253	11411
		H(tot)[mm]	330,0	A[cm2]	i(x) [cm] 8,45	Jx(s)[cm4]=	13.664
		Note:				Jx(s)[m4]=	0,000136645
				x(o) [mm]	165,0	Wx(o)[cm3]=	-828,2
				x(a) [mm]	165,0	Wx(a)[cm3]=	-828,2
				x(b) [mm]	-165,0	Wx(b)[cm3]=	828,2
Vers.050894/Piringer				x(u) [mm]	-165,0	Wx(u)[cm3]=	828,2

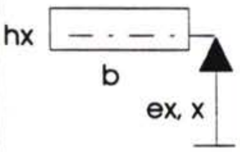


Querschnitt/cross section:		P 2-3'					
Bez.	by[mm]	hx[mm]	ex[mm]	A=b.h[cm2]	A*ex[cm3]	A*ex*ex[cm4]	Jx(o)[cm4]
webs	26	381	0	99,06	0	0	11983
lower L	22	243	-140,9	53,46	-753	10613	2631
upper L	22	243	140,9	53,46	753	10613	2631
				0,00	0	0	0
				0,00	0	0	0
				0,00	0	0	0
				0,00	0	0	0
		ex(s)[cm]	0,00	205,98	0	21227	17244
		H(tot)[mm]	524,8	A[cm2]	i(x) [cm] 13,67	Jx(s)[cm4]=	38.471
		Note:				Jx(s)[m4]=	0,000384709
				x(o) [mm]	262,4	Wx(o)[cm3]=	-1.466,1
				x(a) [mm]	190,5	Wx(a)[cm3]=	-2.019,5
				x(b) [mm]	-190,5	Wx(b)[cm3]=	2.019,5
Vers.050894/Piringer				x(u) [mm]	-262,4	Wx(u)[cm3]=	1.466,1

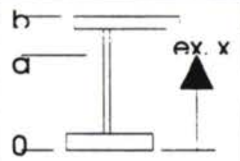


C/11

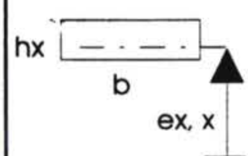
Querschnitt/cross section:	P 3'-4						
Bez.	by[mm]	hx[mm]	ex[mm]	A=b.h[cm2]	A*ex[cm3]	A*ex*ex[cm4]	Jx(o)[cm4]
webs	0	0	0	0,00	0	0	0
lower L	22	243	-53,6	53,46	-287	1536	2631
upper L	22	243	53,6	53,46	287	1536	2631
				0,00	0	0	0
				0,00	0	0	0
				0,00	0	0	0
				0,00	0	0	0
		ex(s)[cm]	**0,00**	**106,92**	0	3072	5261
		H(tot)[mm]	350,2	A[cm2]	i(x) [cm] 8,83	**Jx(s)[cm4]=**	**8.333**
		Note:				**Jx(s)[m4]=**	**8,33303E-05**
				x(o) [mm]	175,1	**Wx(o)[cm3]=**	**-475,9**
				x(a) [mm]	156,0	**Wx(a)[cm3]=**	**-534,2**
				x(b) [mm]	-156,0	**Wx(b)[cm3]=**	**534,2**
Vers.050894/Piringer				x(u) [mm]	-175,1	**Wx(u)[cm3]=**	**475,9**



Querschnitt/cross section:	P 4-5'						
Bez.	by[mm]	hx[mm]	ex[mm]	A=b.h[cm2]	A*ex[cm3]	A*ex*ex[cm4]	Jx(o)[cm4]
webs	26	330	0	85,80	0	0	7786
lower L	19	143	-142,5	27,17	-387	5517	463
upper L	19	143	142,5	27,17	387	5517	463
				0,00	0	0	0
				0,00	0	0	0
				0,00	0	0	0
				0,00	0	0	0
		ex(s)[cm]	**0,00**	**140,14**	0	11034	8712
		H(tot)[mm]	428,0	A[cm2]	i(x) [cm] 11,87	**Jx(s)[cm4]=**	**19.747**
		Note:				**Jx(s)[m4]=**	**0,000197468**
				x(o) [mm]	214,0	**Wx(o)[cm3]=**	**-922,7**
				x(a) [mm]	165,0	**Wx(a)[cm3]=**	**-1.196,8**
				x(b) [mm]	-165,0	**Wx(b)[cm3]=**	**1.196,8**
Vers.050894/Piringer				x(u) [mm]	-214,0	**Wx(u)[cm3]=**	**922,7**



Querschnitt/cross section:	P 5'-6						
Bez.	by[mm]	hx[mm]	ex[mm]	A=b.h[cm2]	A*ex[cm3]	A*ex*ex[cm4]	Jx(o)[cm4]
webs	0	0	0	0,00	0	0	0
lower L	20	206	-45,1	41,20	-186	838	1457
upper L	20	206	45,1	41,20	186	838	1457
				0,00	0	0	0
				0,00	0	0	0
				0,00	0	0	0
				0,00	0	0	0
		ex(s)[cm]	**0,00**	**82,40**	0	1676	2914
		H(tot)[mm]	296,2	A[cm2]	i(x) [cm] 7,46	**Jx(s)[cm4]=**	**4.590**
		Note:				**Jx(s)[m4]=**	**4,58996E-05**
				x(o) [mm]	148,1	**Wx(o)[cm3]=**	**-309,9**
				x(a) [mm]	131,0	**Wx(a)[cm3]=**	**-350,4**
				x(b) [mm]	-131,0	**Wx(b)[cm3]=**	**350,4**
Vers.050894/Piringer				x(u) [mm]	-148,1	**Wx(u)[cm3]=**	**309,9**



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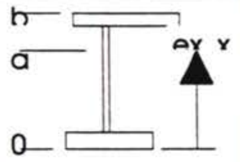
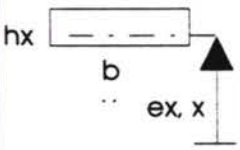
Querschnitt/cross section:	P 6-7'						
Bez.	by[mm]	hx[mm]	ex[mm]	A=b.h[cm2]	A*ex[cm3]	A*ex*ex[cm4]	Jx(o)[cm4]
webs	26	254	0	66,04	0	0	3551
lower L	19	243	-111,8	46,17	-516	5771	2272
upper L	19	243	111,8	46,17	516	5771	2272
				0,00	0	0	0
				0,00	0	0	0
				0,00	0	0	0
				0,00	0	0	0
	ex(s)[cm]		0,00	158,38	0	11542	8094
	H(tot)[mm]		466,6	A[cm2]	i(x) [cm] 11,13	Jx(s)[cm4]=	19.636
	Note:					Jx(s)[m4]=	0,000196361
				x(o) [mm]	233,3	Wx(o)[cm3]=	-841,7
				x(a) [mm]	127,0	Wx(a)[cm3]=	-1.546,2
				x(b) [mm]	-127,0	Wx(b)[cm3]=	1.546,2
Vers.050894/Piringer				x(u) [mm]	-233,3	Wx(u)[cm3]=	841,7



Querschnitt/cross section:	CT						
Bez.	by[mm]	hx[mm]	ex[mm]	A=b.h[cm2]	A*ex[cm3]	A*ex*ex[cm4]	Jx(o)[cm4]
webs	0	0	0	0,00	0	0	0
lower L	19	169	-29,7	32,11	-95	283	764
upper L	19	169	29,7	32,11	95	283	764
				0,00	0	0	0
				0,00	0	0	0
				0,00	0	0	0
				0,00	0	0	0
	ex(s)[cm]		0,00	64,22	0	566	1528
	H(tot)[mm]		228,4	A[cm2]	i(x) [cm] 5,71	Jx(s)[cm4]=	2.095
	Note:					Jx(s)[m4]=	2,09497E-05
				x(o) [mm]	114,2	Wx(o)[cm3]=	-183,4
				x(a) [mm]	93,0	Wx(a)[cm3]=	-225,3
				x(b) [mm]	-93,0	Wx(b)[cm3]=	225,3
Vers.050894/Piringer				x(u) [mm]	-114,2	Wx(u)[cm3]=	183,4



Autor/Author	Datum/Date	Seite/Page No.	Änderung/Revis.	Auftrag/Order No.
VR	22.10.96	C/13		20-007

4. SYSTEM ELEMENTS

Elem.	I	K	Gr Nr	Elem.	I	K	Gr Nr	Elem.	I	K	Gr Nr
1	1	2	4	19	20	21	3	37	11	26	13
2	2	3	4	20	21	22	3	38	26	13	12
3	3	4	5.	21	22	23	3	39	13	28	11
4	4	5	6	22	23	24	3	40	28	15	10
5	5	6	7	23	24	25	2	41	2	16	17
6	6	7	8	24	25	26	2	42	3	17	17
7	7	8	9	25	26	27	1	43	4	18	17
8	8	9	9	26	27	28	1	44	5	19	17
9	9	10	8	27	1	16	10	45	6	20	17
10	10	11	7	28	16	3	11	46	7	21	17
11	11	12	6	29	3	18	12	47	8	22	17
12	12	13	5	30	18	5	13	48	9	23	17
13	13	14	4	31	5	20	14	49	10	24	17
14	14	15	4	32	20	7	15	50	11	25	17
15	16	17	1	33	7	22	16	51	12	26	17
16	17	18	1	34	22	9	16	52	13	27	17
17	18	19	2	35	9	24	15	53	14	28	17
18	19	20	2	36	24	11	14				

5. ELECTRONIC COMPUTATION

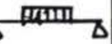
On the following pages C/16 to C/31 the following loadcases are computed:

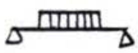
LC1 ... total load: 100 kN/m over full span

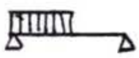
LC2 ... centric load: 100 kN/m length 33 m in middle of span

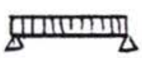
LC3 ... excentric load 100 kN/m on left half of span

On pages C/32 to C/56 load combinations are investigated to get the most unfavourable forces for fatigue check:

COMBINATION 301	Dead load 27,5 kN/m = 1 main girder
COMBINATION 302	Centric traffic load 42 kN/m 
COMBINATION 303	Total traffic load 42 kN/m 
COMBINATION 304	Dead load + either

 traffic load centric

 traffic load excentric

 traffic load total

whatever gives the most influence.

Combination 304 can be used to estimate effect of fatigue loading.

The program used is a German product, distributor and producer: Ing. DLUBAL
Am Zellweg 2
D-93464 Tiefenbach

The program is a finite element framework program (2D and 3D). It is a very common product in Germany and often approved.

The results are demonstrated graphically
on pages C/58, C/59 - deflection under unit loads,
on pages C/60 to C/62 - normal forces max/min values.
On pages C/63 is given the result and comparison.

INHALTSVERZEICHNIS CONTENTS **BLATT**

Strukturdaten . . . . STRUCTURAL DATA **2**
- Struktur-Kenngroessen . . STRUCTURE 2
- Knoten-Koordinaten. . . . COORDINATES 2
- Materialdaten . . . . . . MATERIAL 3
- Traegheitsmomente . . . . MOMENTS / SECOND 3
- Querschnittsflaechen . . CROSS SECTION 3
- Stabdaten . . . . ELEMENT DATA 4
- Auflagerdaten . . . . . . BEARING 5

Belastungsdaten . . . . . . LOAD DATA **5**

Ergebnisse Lastfaelle - Th. I. Ordnung. LOAD CASE. **7**
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Programmsystem RSTAB : Ebene/raeumliche Stabwerke nach FEM Version 4.61

Programm-Entwicklung : Ing.-Software Dlubal GmbH
Am Zellweg 2
D-93464 Tiefenbach
Telefon 09673/1775 o. 1776
Telefax 09673/1770

STRUKTUR-KENNGROESSEN STRUCTURAL DATA

Anzahl der
- Knoten : 28
- Materialien : 1
- Querschnitte : 17
- Stabendgelenktypen : 0
- Stabteilungstypen : 0
- Staebe : 53
- Auflager : 2

Stabwerktyp: 2-Dimensional

Anmerkung:
Main girder / 1 plane

KNOTEN-KOORDINATEN COORDINATES

Knoten-Nr.	Koordinaten-system	Pol-Knoten	Knoten-Koordinaten X (m)	Y (m)	Z (m)
1	Kartesisch	0	-33.068		0.000
2	Kartesisch	0	-28.344		0.000
3	Kartesisch	0	-23.620		0.000
4	Kartesisch	0	-18.896		0.000
5	Kartesisch	0	-14.172		0.000
6	Kartesisch	0	-9.448		0.000
7	Kartesisch	0	-4.724		0.000
8	Kartesisch	0	0.000		0.000
9	Kartesisch	0	4.724		0.000
10	Kartesisch	0	9.448		0.000
11	Kartesisch	0	14.172		0.000
12	Kartesisch	0	18.896		0.000
13	Kartesisch	0	23.620		0.000
14	Kartesisch	0	28.344		0.000
15	Kartesisch	0	33.068		0.000
16	Kartesisch	0	-28.344		-7.506
17	Kartesisch	0	-23.620		-7.916
18	Kartesisch	0	-18.896		-8.325
19	Kartesisch	0	-14.172		-8.735
20	Kartesisch	0	-9.448		-9.144
21	Kartesisch	0	-4.724		-9.144
22	Kartesisch	0	0.000		-9.144
23	Kartesisch	0	4.724		-9.144
24	Kartesisch	0	9.448		-9.144
25	Kartesisch	0	14.172		-8.735
26	Kartesisch	0	18.896		-8.325
27	Kartesisch	0	23.620		-7.916
28	Kartesisch	0	28.344		-7.506

MATERIALDATEN

Materia Nr.	Material-Bezeichnung	E-Modul (kN/cm^2)	G-Modul (kN/cm^2)	Sp.Gewicht (kN/cm^3)	Waermezahl (K^-1)
1	Stahl STEEL	2.100E+04	8.100E+03	7.850E-05	1.200E-05

TRAEGHEITSMOMENTE SECOND MOMENT BENDING

Quers Nr.	Mate Nr.	Querschnitts-Bezeichnung	Torsion I-1 (cm^4)	Biegung I-2 (cm^4)	Biegung I-3 (cm^4)
1	1	B 1'-2'-3'		124200.000	
2	1	B 3'-4'-5'		175300.000	
3	1	B 5'-6'-7'		187900.000	
4	1	H 0-1-2		54500.000	
5	1	H 2-3		90900.000	
6	1	H 3-4		93700.000	
7	1	H 4-5		134200.000	
8	1	H 5-6		136500.000	
9	1	H 6-7		142200.000	
10	1	P 0-1'		140300.000	
11	1	P 1'-2		13700.000	
12	1	P 2-3'		38500.000	
13	1	P 3'-4		8300.000	
14	1	P 4-5'		19700.000	
15	1	P 5'-6		4600.000	
16	1	P 6-7'		19600.000	
17	1	CT		2100.000	

QUERSCHNITTSFLAECHEN AREAS

Quers Nr.	Mate Nr.	Querschnitts-Bezeichnung	Normal A-1 (cm^2)	Schub A-2 (cm^2)	Schub A-3 (cm^2)
1	1	B 1'-2'-3'	269.000		159.000
2	1	B 3'-4'-5'	380.000		159.000
3	1	B 5'-6'-7'	424.000		159.000
4	1	H 0-1-2	217.000		132.000
5	1	H 2-3	300.000		145.000
6	1	H 3-4	315.000		145.000
7	1	H 4-5	383.000		159.000
8	1	H 5-6	399.000		159.000
9	1	H 6-7	419.000		159.000
10	1	P 0-1'	322.000		152.000
11	1	P 1'-2	191.000		86.000
12	1	P 2-3'	206.000		99.000
13	1	P 3'-4	107.000		50.000
14	1	P 4-5'	140.000		86.000
15	1	P 5'-6	82.000		40.000
16	1	P 6-7'	158.000		66.000

POSITION: TRUSS1 - TRUSS1
PROJEKT : TURKMEN - TURKMEN 1996.10.23 **STRUKTURDATEN**

QUERSCHNITTSFLAECHEN

Quers Nr.	Mate Nr.	Querschnitts-Bezeichnung	Normal A-1 (cm^2)	Schub A-2 (cm^2)	Schub A-3 (cm^2)
17	1	CT	64.000		30.000

STABDATEN ELEMENTS DATA

CROSS SECTION LENGTH

Stab- (ELEMENT) Nr.	Stabtyp	Knoten Anf (START)	-	Knoten End (END)	Dreh-Winkel	Quersch Anf	Quersch End	Gelenktyp Anf-End	Stab-Teilung	Laenge (m)	Lage
1	Balken BEAM	1	-	2		4	4			4.724	HORI
2	Balken	2	-	3		4	4			4.724	HORI
3	Balken	3	-	4		5	5			4.724	HORI
4	Balken	4	-	5		6	6			4.724	HORI
5	Balken	5	-	6		7	7			4.724	HORI
6	Balken	6	-	7		8	8			4.724	HORI
7	Balken	7	-	8		9	9			4.724	HORI
8	Balken	8	-	9		9	9			4.724	HORI
9	Balken	9	-	10		8	8			4.724	HORI
10	Balken	10	-	11		7	7			4.724	HORI
11	Balken	11	-	12		6	6			4.724	HORI
12	Balken	12	-	13		5	5			4.724	HORI
13	Balken	13	-	14		4	4			4.724	HORI
14	Balken	14	-	15		4	4			4.724	HORI
15	Balken	16	-	17		1	1			4.742	ALLG
16	Balken	17	-	18		1	1			4.742	ALLG
17	Balken	18	-	19		2	2			4.742	ALLG
18	Balken	19	-	20		2	2			4.742	ALLG
19	Balken	20	-	21		3	3			4.724	HORI
20	Balken	21	-	22		3	3			4.724	HORI
21	Balken	22	-	23		3	3			4.724	HORI
22	Balken	23	-	24		3	3			4.724	HORI
23	Balken	24	-	25		2	2			4.742	ALLG
24	Balken	25	-	26		2	2			4.742	ALLG
25	Balken	26	-	27		1	1			4.742	ALLG
26	Balken	27	-	28		1	1			4.742	ALLG
27	Balken	1	-	16		10	10			8.869	ALLG
28	Balken	16	-	3		11	11			8.869	ALLG
29	Balken	3	-	18		12	12			9.572	ALLG
30	Balken	18	-	5		13	13			9.572	ALLG
31	Balken	5	-	20		14	14			10.292	ALLG
32	Balken	20	-	7		15	15			10.292	ALLG
33	Balken	7	-	22		16	16			10.292	ALLG
34	Balken	22	-	9		16	16			10.292	ALLG
35	Balken	9	-	24		15	15			10.292	ALLG
36	Balken	24	-	11		14	14			10.292	ALLG
37	Balken	11	-	26		13	13			9.572	ALLG
38	Balken	26	-	13		12	12			9.572	ALLG
39	Balken	13	-	28		11	11			8.869	ALLG
40	Balken	28	-	15		10	10			8.869	ALLG
41	Balken	2	-	16		17	17			7.506	VERT

STABDATEN

Stab- Nr.	Stabtyp	Knoten Anf	-	Knoten End	Dreh- Winkel	Quersch Anf	Quersch End	Gelenktyp Anf-End	Stab- Teilung	Laenge (m)	Lage
42	Balken	3	-	17		17	17			7.916	VERT
43	Balken	4	-	18		17	17			8.325	VERT
44	Balken	5	-	19		17	17			8.735	VERT
45	Balken	6	-	20		17	17			9.144	VERT
46	Balken	7	-	21		17	17			9.144	VERT
47	Balken	8	-	22		17	17			9.144	VERT
48	Balken	9	-	23		17	17			9.144	VERT
49	Balken	10	-	24		17	17			9.144	VERT
50	Balken	11	-	25		17	17			8.735	VERT
51	Balken	12	-	26		17	17			8.325	VERT
52	Balken	13	-	27		17	17			7.916	VERT
53	Balken	14	-	28		17	17			7.506	VERT

AUFLAGERDATEN BEARING RESTRAINTS

Lager Nr.	Knoten Nr.	Schieflagerung Alpha	Schieflagerung Beta	Feste Stuetzung in X- Y-	Z-Richtung	Feste Einspannung um X- Y- Z-Achse
1	1			J	J	N
2	15			N	J	N

LASTFALL-VERZEICHNIS - BELASTUNG LOADING

LF- Nr.	Lastfall- Bezeichnung	Multiplikations- Faktor
1	Total loaded	1.000
2	Centric loaded	1.000
3	Excentric loaded	1.000

BELASTUNG LOADCASE 1

LASTFALL 1 : Total loaded

LF- Nr.	Eigengewicht in Richtung X	Y	Z	Anmerkung zum Lastfall
1	-	-	-	Uniformly, total length

STABLASTEN LOAD ON ELEMENT

Nr.	Stab-Nr. von	-	bis	Lastart Nr.	Richtung	P-1	P-2	A	B
1	1	-	14	1	Z	100.000	0.000	0.000	0.000

Lastart-Nr. 1: Linienlast UNIFORM LOAD

Last-Parameter kN/m — P-1: Groesse der Linienlast

Einheit UNIT — (kN/m)

Richtung DIRECTION — Z: Global in Z-Richtung

Bezugslaenge der Stablast LENGTH — Projizierte Stablaenge in X-Y-Ebene

BELASTUNG

LASTFALL 2 : Centric loaded

LF-Nr.	Eigengewicht in Richtung X	Y	Z	Anmerkung zum Lastfall
2	-	-	-	Uniformly, 33 m loaded length

STABLASTEN

Nr.	Stab-Nr. von	-	bis	Lastart Nr.	Richtung	P-1	P-2	A	B
1	4	-	4	4	Z	100.000	100.000	2.396	4.724
2	5	-	10	1	Z	100.000	0.000	0.000	0.000
3	11	-	11	4	Z	100.000	100.000	0.000	2.328

Lastart-Nr.	Last-Parameter	Einheit
1: Linienlast	P-1: Groesse der Linienlast	(kN/m)
4: Trapezlast	P-1: Randlast am Anfangsknoten	(kN/m)
	P-2: Randlast am Endknoten	(kN/m)
	A : Abstand P-1 vom Anfangsknoten	(m)
	B : Abstand P-2 vom Anfangsknoten	(m)

Richtung
Z: Global in Z-Richtung

Bezugslaenge der Stablast
Projizierte Stablaenge in X-Y-Ebene

BELASTUNG

LASTFALL 3 : Excentric loaded

LF-Nr.	Eigengewicht in Richtung X	Y	Z	Anmerkung zum Lastfall
3	-	-	-	Uniformly, 33 m loaded length

STABLASTEN

Nr.	Stab-Nr. von - bis	Lastart Nr.	Richtung	Last-Parameter P-1	P-2	A	B
1	1 - 7	1	Z	100.000	0.000	0.000	0.000

Lastart-Nr. **Last-Parameter** **Einheit**
1: Linienlast P-1: Groesse der Linienlast (kN/m)

Richtung
Z: Global in Z-Richtung

Bezugslaenge der Stablast
Projizierte Stablaenge in X-Y-Ebene

ERGEBNISSE THEORIE I. ORDNUNG

LASTFALL LF 1 2 3

LASTFALL-VERZEICHNIS

LF	Lastfall-Bezeichnung
1	Total loaded
2	Centric loaded
3	Excentric loaded

LF ... LOAD CASE

SCHNITTGROESSEN STABBEZOGEN FORCES ON ELEMENT

Stab (ELEMENT) Nr.	LF	Knot-Nr.	x (m)	Kraefte (kN) N	Q-2	Q-3	Momente (kNm) M-T	M-2	M-3
1	1	1	0.00	1963.30		251.29		-201.18	
		2	4.72	1963.30		-221.11		-129.88	
	2	1	0.00	1043.38		5.40		-26.30	
		2	4.72	1043.38		5.40		-0.81	
	3	1	0.00	1440.53		248.59		-188.00	
		2	4.72	1440.53		-223.81		-129.47	
2	1	2	0.00	1964.21		221.38		-133.68	
		3	4.72	1964.21		-251.02		-203.70	
	2	2	0.00	1044.10		7.80		-3.74	
		3	4.72	1044.10		7.80		33.10	
	3	2	0.00	1441.08		217.47		-131.81	

↓ NORMAL FORCE ↓ SHEAR FORCE ↓ BENDING MOMENT

SCHNITTGROESSEN STABBEZOGEN

Stab-Nr.	LF	Knot-Nr.	x (m)	Kraefte (kN) N	Q-2	Q-3	Momente (kNm) M-T	M-2	M-3
2	3	3	4.72	1441.08		-254.93		-220.27	
3	1	3	0.00	4431.78		277.50		-263.51	
		4	4.72	4431.78		-194.90		-68.42	
	2	3	0.00	2816.32		-3.25		-6.60	
		4	4.72	2816.32		-3.25		-21.97	
	3	3	0.00	3021.28		278.58		-260.34	
		4	4.72	3021.28		-193.82		-60.12	
4	1	4	0.00	4432.72		206.56		-72.47	
		5	4.72	4432.72		-265.84		-212.51	
	2	4	0.00	2817.30		34.60		-26.21	
		5	4.72	2817.30		-198.20		-133.74	
	3	4	0.00	3021.75		197.06		-62.12	
		5	4.72	3021.75		-275.34		-247.03	
5	1	5	0.00	5499.05		278.40		-243.42	
		6	4.72	5499.05		-194.00		-44.04	
	2	5	0.00	3999.44		262.12		-179.30	
		6	4.72	3999.44		-210.28		-56.83	
	3	5	0.00	3353.30		288.96		-257.72	
		6	4.72	3353.30		-183.44		-8.49	
6	1	6	0.00	5499.62		201.85		-46.68	
		7	4.72	5499.62		-270.55		-208.94	
	2	6	0.00	4000.03		202.00		-59.48	
		7	4.72	4000.03		-270.40		-221.04	
	3	6	0.00	3353.25		179.83		-8.28	
		7	4.72	3353.25		-292.57		-274.59	
7	1	7	0.00	5968.71		289.12		-225.38	
		8	4.72	5968.71		-183.28		24.60	
	2	7	0.00	4470.70		289.25		-236.98	
		8	4.72	4470.70		-183.15		13.60	
	3	7	0.00	2984.60		294.66		-265.09	
		8	4.72	2984.60		-177.74		11.09	
8	1	8	0.00	5968.71		183.28		24.60	
		9	4.72	5968.71		-289.12		-225.38	
	2	8	0.00	4470.70		183.15		13.60	
		9	4.72	4470.70		-289.25		-236.98	
	3	8	0.00	2984.11		5.55		13.50	
		9	4.72	2984.11		5.55		39.71	
9	1	9	0.00	5499.62		270.55		-208.94	
		10	4.72	5499.62		-201.85		-46.68	
	2	9	0.00	4000.03		270.40		-221.04	
		10	4.72	4000.03		-202.00		-59.48	
	3	9	0.00	2146.37		-22.03		65.65	
		10	4.72	2146.37		-22.03		-38.40	
10	1	10	0.00	5499.05		194.00		-44.04	
		11	4.72	5499.05		-278.40		-243.42	
	2	10	0.00	3999.44		210.28		-56.83	
		11	4.72	3999.44		-262.12		-179.30	
	3	10	0.00	2145.75		10.56		-35.56	
		11	4.72	2145.75		10.56		14.31	

SCHNITTGROESSEN STABBEZOGEN

Stab- Nr.	LF	Knot- Nr.	x (m)	Kraefte (kN) N	Q-2	Q-3	Momente (kNm) M-T	M-2	M-3
11	1	11	0.00	4432.72		265.84		-212.51	
		12	4.72	4432.72		-206.56		-72.47	
	2	11	0.00	2817.30		198.20		-133.74	
		12	4.72	2817.30		-34.60		-26.21	
	3	11	0.00	1410.97		-9.50		34.53	
		12	4.72	1410.97		-9.50		-10.34	
12	1	12	0.00	4431.78		194.90		-68.42	
		13	4.72	4431.78		-277.50		-263.51	
	2	12	0.00	2816.32		3.25		-21.97	
		13	4.72	2816.32		3.25		-6.60	
	3	12	0.00	1410.50		1.09		-8.30	
		13	4.72	1410.50		1.09		-3.17	
13	1	13	0.00	1964.21		251.02		-203.70	
		14	4.72	1964.21		-221.38		-133.68	
	2	13	0.00	1044.10		-7.80		33.10	
		14	4.72	1044.10		-7.80		-3.74	
	3	13	0.00	523.12		-3.90		16.57	
		14	4.72	523.12		-3.90		-1.87	
14	1	14	0.00	1963.30		221.11		-129.88	
		15	4.72	1963.30		-251.29		-201.18	
	2	14	0.00	1043.38		-5.40		-0.81	
		15	4.72	1043.38		-5.40		-26.30	
	3	14	0.00	522.76		-2.70		-0.40	
		15	4.72	522.76		-2.70		-13.18	
15	1	16	0.00	-3415.17		42.41		-113.33	
		17	4.74	-3415.17		42.41		87.78	
	2	16	0.00	-1970.17		17.35		-45.85	
		17	4.74	-1970.17		17.35		36.41	
	3	16	0.00	-2428.02		33.77		-90.36	
		17	4.74	-2428.02		33.77		69.77	
16	1	17	0.00	-3411.54		-11.30		83.31	
		18	4.74	-3411.54		-11.30		29.73	
	2	17	0.00	-1968.56		-8.77		33.54	
		18	4.74	-1968.56		-8.77		-8.06	
	3	17	0.00	-2425.16		-7.30		66.74	
		18	4.74	-2425.16		-7.30		32.14	
17	1	18	0.00	-5140.79		33.27		-17.77	
		19	4.74	-5140.79		33.27		139.97	
	2	18	0.00	-3558.05		36.22		-55.15	
		19	4.74	-3558.05		36.22		116.61	
	3	18	0.00	-3352.55		19.73		7.01	
		19	4.74	-3352.55		19.73		100.57	
18	1	19	0.00	-5135.76		-31.62		136.98	
		20	4.74	-5135.76		-31.62		-12.92	
	2	19	0.00	-3553.62		-25.17		112.67	
		20	4.74	-3553.62		-25.17		-6.69	
	3	19	0.00	-3349.76		-14.54		99.55	
		20	4.74	-3349.76		-14.54		30.59	
19	1	20	0.00	-5862.03		42.68		-34.20	

SCHNITTGROESSEN STABBEZOGEN

Stab-Nr.	LF	Knot-Nr.	x (m)	Kraefte (kN) N	Q-2	Q-3	Momente (kNm) M-T	M-2	M-3
19	1	21	4.72	-5862.03		42.68		167.44	
	2	20	0.00	-4364.13		39.34		-34.14	
		21	4.72	-4364.13		39.34		151.72	
	3	20	0.00	-3316.17		9.54		31.39	
		21	4.72	-3316.17		9.54		76.47	
20	1	21	0.00	-5862.48		-19.41		165.38	
		22	4.72	-5862.48		-19.41		73.70	
	2	21	0.00	-4364.57		-19.36		149.68	
		22	4.72	-4364.57		-19.36		58.23	
	3	21	0.00	-3315.94		-11.27		77.49	
		22	4.72	-3315.94		-11.27		24.26	
21	1	22	0.00	-5862.48		19.41		73.70	
		23	4.72	-5862.48		19.41		165.38	
	2	22	0.00	-4364.57		19.36		58.23	
		23	4.72	-4364.57		19.36		149.68	
	3	22	0.00	-2546.53		8.14		49.43	
		23	4.72	-2546.53		8.14		87.89	
22	1	23	0.00	-5862.03		-42.68		167.44	
		24	4.72	-5862.03		-42.68		-34.20	
	2	23	0.00	-4364.13		-39.34		151.72	
		24	4.72	-4364.13		-39.34		-34.14	
	3	23	0.00	-2545.86		-33.14		90.97	
		24	4.72	-2545.86		-33.14		-65.59	
23	1	24	0.00	-5135.76		31.62		-12.92	
		25	4.74	-5135.76		31.62		136.98	
	2	24	0.00	-3553.62		25.17		-6.69	
		25	4.74	-3553.62		25.17		112.67	
	3	24	0.00	-1786.00		17.07		-43.52	
		25	4.74	-1786.00		17.07		37.44	
24	1	25	0.00	-5140.79		-33.27		139.97	
		26	4.74	-5140.79		-33.27		-17.77	
	2	25	0.00	-3558.05		-36.22		116.61	
		26	4.74	-3558.05		-36.22		-55.15	
	3	25	0.00	-1788.24		-13.54		39.40	
		26	4.74	-1788.24		-13.54		-24.78	
25	1	26	0.00	-3411.54		11.30		29.73	
		27	4.74	-3411.54		11.30		83.31	
	2	26	0.00	-1968.56		8.77		-8.06	
		27	4.74	-1968.56		8.77		33.54	
	3	26	0.00	-986.38		4.00		-2.40	
		27	4.74	-986.38		4.00		16.57	
26	1	27	0.00	-3415.17		-42.41		87.78	
		28	4.74	-3415.17		-42.41		-113.33	
	2	27	0.00	-1970.17		-17.35		36.41	
		28	4.74	-1970.17		-17.35		-45.85	
	3	27	0.00	-987.14		-8.64		18.01	
		28	4.74	-987.14		-8.64		-22.97	
27	1	1	0.00	-3631.73		-34.09		201.18	
		16	8.87	-3631.73		-34.09		-101.12	

SCHNITTGROESSEN STABBEZOGEN

Stab- Nr.	LF	Knot- Nr.	x (m)	Kraefte (kN) N	Q-2	Q-3	Momente (kNm) M-T	M-2	M-3
27	2	1	0.00	-1947.64		-7.05		26.30	
		16	8.87	-1947.64		-7.05		-36.20	
	3	1	0.00	-2655.91		-30.55		188.00	
		16	8.87	-2655.91		-30.55		-82.99	
28	1	16	0.00	2689.90		-2.03		9.18	
		3	8.87	2689.90		-2.03		-8.85	
	2	16	0.00	1719.60		-1.48		7.19	
		3	8.87	1719.60		-1.48		-5.92	
	3	16	0.00	1828.27		-1.29		5.57	
		3	8.87	1828.27		-1.29		-5.88	
29	1	3	0.00	-2076.13		-8.46		46.80	
		18	9.57	-2076.13		-8.46		-34.22	
	2	3	0.00	-1719.45		-6.61		31.22	
		18	9.57	-1719.45		-6.61		-32.06	
	3	3	0.00	-1215.74		-5.20		31.32	
		18	9.57	-1215.74		-5.20		-18.50	
30	1	18	0.00	1386.90		-1.68		9.51	
		5	9.57	1386.90		-1.68		-6.61	
	2	18	0.00	1463.46		-2.34		11.10	
		5	9.57	1463.46		-2.34		-11.25	
	3	18	0.00	640.06		-0.75		4.76	
		5	9.57	640.06		-0.75		-2.46	
31	1	5	0.00	-820.45		-3.53		21.32	
		20	10.29	-820.45		-3.53		-14.96	
	2	5	0.00	-985.88		-4.94		29.93	
		20	10.29	-985.88		-4.94		-20.94	
	3	5	0.00	-30.85		-0.69		7.16	
		20	10.29	-30.85		-0.69		0.07	
32	1	20	0.00	788.49		-0.57		3.76	
		7	10.29	788.49		-0.57		-2.12	
	2	20	0.00	792.10		-0.61		3.84	
		7	10.29	792.10		-0.61		-2.39	
	3	20	0.00	-80.34		0.23		-0.50	
		7	10.29	-80.34		0.23		1.86	
33	1	7	0.00	-228.84		-1.34		12.33	
		22	10.29	-228.84		-1.34		-1.50	
	2	7	0.00	-228.63		-1.34		11.58	
		22	10.29	-228.63		-1.34		-2.19	
	3	7	0.00	718.64		1.69		-6.55	
		22	10.29	718.64		1.69		10.82	
34	1	22	0.00	-228.84		1.34		-1.50	
		9	10.29	-228.84		1.34		12.33	
	2	22	0.00	-228.63		1.34		-2.19	
		9	10.29	-228.63		1.34		11.58	
	3	22	0.00	-947.48		3.03		-12.32	
		9	10.29	-947.48		3.03		18.88	
35	1	9	0.00	788.49		0.57		-2.12	
		24	10.29	788.49		0.57		3.76	
	2	9	0.00	792.10		0.61		-2.39	

SCHNITTGROESSEN STABBEZOGEN

Stab-Nr.	LF	Knot-Nr.	x (m)	Kraefte (kN) N	Q-2	Q-3	Momente (kNm) M-T	M-2	M-3
35	2	24	10.29	792.10		0.61		3.84	
	3	9	0.00	868.82		0.80		-3.98	
		24	10.29	868.82		0.80		4.27	
36	1	24	0.00	-820.45		3.53		-14.96	
		11	10.29	-820.45		3.53		21.32	
	2	24	0.00	-985.88		4.94		-20.94	
		11	10.29	-985.88		4.94		29.93	
	3	24	0.00	-789.60		2.84		-15.03	
		11	10.29	-789.60		2.84		14.16	
37	1	11	0.00	1386.90		1.68		-6.61	
		26	9.57	1386.90		1.68		9.51	
	2	11	0.00	1463.46		2.34		-11.25	
		26	9.57	1463.46		2.34		11.10	
	3	11	0.00	746.85		0.93		-4.16	
		26	9.57	746.85		0.93		4.75	
38	1	26	0.00	-2076.13		8.46		-34.22	
		13	9.57	-2076.13		8.46		46.80	
	2	26	0.00	-1719.45		6.61		-32.06	
		13	9.57	-1719.45		6.61		31.22	
	3	26	0.00	-860.38		3.26		-15.72	
		13	9.57	-860.38		3.26		15.48	
39	1	13	0.00	2689.90		2.03		-8.85	
		28	8.87	2689.90		2.03		9.18	
	2	13	0.00	1719.60		1.48		-5.92	
		28	8.87	1719.60		1.48		7.19	
	3	13	0.00	861.63		0.74		-2.97	
		28	8.87	861.63		0.74		3.60	
40	1	28	0.00	-3631.73		34.09		-101.12	
		15	8.87	-3631.73		34.09		201.18	
	2	28	0.00	-1947.64		7.05		-36.20	
		15	8.87	-1947.64		7.05		26.30	
	3	28	0.00	-975.83		3.53		-18.13	
		15	8.87	-975.83		3.53		13.18	
41	1	2	0.00	442.49		-0.91		3.81	
		16	7.51	442.49		-0.91		-3.03	
	2	2	0.00	2.40		-0.72		2.94	
		16	7.51	2.40		-0.72		-2.45	
	3	2	0.00	441.28		-0.55		2.34	
		16	7.51	441.28		-0.55		-1.80	
42	1	3	0.00	54.54		-1.09		4.15	
		17	7.92	54.54		-1.09		-4.47	
	2	3	0.00	26.57		-0.69		2.55	
		17	7.92	26.57		-0.69		-2.87	
	3	3	0.00	41.67		-0.75		2.87	
		17	7.92	41.67		-0.75		-3.03	
43	1	4	0.00	401.46		-0.94		4.04	
		18	8.32	401.46		-0.94		-3.78	
	2	4	0.00	37.85		-0.98		4.24	
		18	8.32	37.85		-0.98		-3.92	

SCHNITTGROESSEN STABBEZOGEN

Stab-Nr.	LF	Knot-Nr.	x (m)	Kraefte (kN) N	Q-2	Q-3	Momente (kNm) M-T	M-2	M-3
43	3	4	0.00	390.88		-0.47		2.00	
		18	8.32	390.88		-0.47		-1.87	
44	1	5	0.00	66.15		-0.68		2.98	
		19	8.73	66.15		-0.68		-2.98	
	2	5	0.00	62.29		-0.95		4.38	
		19	8.73	62.29		-0.95		-3.94	
	3	5	0.00	35.09		-0.24		1.08	
		19	8.73	35.09		-0.24		-1.02	
45	1	6	0.00	395.85		-0.57		2.64	
		20	9.14	395.85		-0.57		-2.56	
	2	6	0.00	412.28		-0.58		2.65	
		20	9.14	412.28		-0.58		-2.67	
	3	6	0.00	363.27		0.05		-0.21	
		20	9.14	363.27		0.05		0.22	
46	1	7	0.00	62.09		-0.44		1.99	
		21	9.14	62.09		-0.44		-2.06	
	2	7	0.00	58.70		-0.44		1.97	
		21	9.14	58.70		-0.44		-2.04	
	3	7	0.00	20.81		0.23		-1.09	
		21	9.14	20.81		0.23		1.02	
47	1	8	0.00	366.57		0.00		0.00	
		22	9.14	366.57		0.00		0.00	
	2	8	0.00	366.31		0.00		0.00	
		22	9.14	366.31		0.00		0.00	
	3	8	0.00	183.28		0.48		-2.41	
		22	9.14	183.28		0.48		2.02	
48	1	9	0.00	62.09		0.44		-1.99	
		23	9.14	62.09		0.44		2.06	
	2	9	0.00	58.70		0.44		-1.97	
		23	9.14	58.70		0.44		2.04	
	3	9	0.00	41.28		0.67		-3.08	
		23	9.14	41.28		0.67		3.08	
49	1	10	0.00	395.85		0.57		-2.64	
		24	9.14	395.85		0.57		2.56	
	2	10	0.00	412.28		0.58		-2.65	
		24	9.14	412.28		0.58		2.67	
	3	10	0.00	32.58		0.62		-2.85	
		24	9.14	32.58		0.62		2.78	
50	1	11	0.00	66.15		0.68		-2.98	
		25	8.73	66.15		0.68		2.98	
	2	11	0.00	62.29		0.95		-4.38	
		25	8.73	62.29		0.95		3.94	
	3	11	0.00	31.06		0.44		-1.90	
		25	8.73	31.06		0.44		1.97	
51	1	12	0.00	401.46		0.94		-4.04	
		26	8.32	401.46		0.94		3.78	
	2	12	0.00	37.85		0.98		-4.24	
		26	8.32	37.85		0.98		3.92	
	3	12	0.00	10.58		0.47		-2.04	

SCHNITTGROESSEN STABBEZOGEN

Stab- Nr.	LF	Knot- Nr.	x (m)	Kraefte (kN) N	Q-2	Q-3	Momente (kNm) M-T	M-2	M-3
51	3	26	8.32	10.58		0.47		1.91	
52	1	13	0.00	54.54		1.09		-4.15	
		27	7.92	54.54		1.09		4.47	
	2	13	0.00	26.57		0.69		-2.55	
		27	7.92	26.57		0.69		2.87	
	3	13	0.00	12.87		0.34		-1.28	
		27	7.92	12.87		0.34		1.44	
53	1	14	0.00	442.49		0.91		-3.81	
		28	7.51	442.49		0.91		3.03	
	2	14	0.00	2.40		0.72		-2.94	
		28	7.51	2.40		0.72		2.45	
	3	14	0.00	1.20		0.36		-1.47	
		28	7.51	1.20		0.36		1.23	

AUFLAGERKRAEFTE UND -MOMENTE BEARING FORCES

Knot- Nr.	LF	Auflagerkraefte (kN) P-X	P-Y	P-Z (VERTICAL)	Auflagermomente (kNm) M-X	M-Y	M-Z
1	1	0.000		3306.800		0.000	
	2	0.000		1650.000		0.000	
	3	0.000		2480.100		0.000	
15	1	0.000		3306.800		0.000	
	2	0.000		1650.000		0.000	
	3	0.000		826.700		0.000	

Summen Lagerkraefte/Belastung SUM OF FORCES

Lage	1	0.000		6613.600
Bela		0.000		6613.599
Lage	2	0.000		3300.000
Bela		0.000		3300.000
Lage	3	0.000		3306.800
Bela		0.000		3306.800

KNOTEN-VERFORMUNGEN DEFLECTIONS

Knot- Nr.	LF	Verschiebungen (mm) u-X	u-Y	u-Z	Verdrehungen (mrad) Phi-X	Phi-Y	Phi-Z
1	1	0.00000		0.00000		-6.11581	
	2	0.00000		0.00000		-3.02338	
	3	0.00000		0.00000		-4.37482	
2	1	2.03525		28.12351		-5.27212	
	2	1.08162		16.04209		-3.58288	
	3	1.49332		19.01755		-3.25086	
3	1	4.07144		50.14172		-4.55913	
	2	2.16398		32.16973		-2.97701	

⟶ HORIZONTAL ↓ VERTICAL +) ROTATION

KNOTEN-VERFORMUNGEN

Knot- Nr.	LF	Verschiebungen (mm) u-X	u-Y	u-Z	Verdrehungen (mrad) Phi-X	Phi-Y	Phi-Z
	3	2.98722		31.88672		-2.84116	
4	1	7.39457		72.57640		-4.06411	
	2	4.27577		46.90534		-3.33054	
	3	5.25270		45.92493		-2.20424	
5	1	10.56013		87.86678		-3.02020	
	2	6.28771		61.62553		-3.06650	
	3	7.41064		52.65278		-1.45065	
6	1	13.78996		101.90000		-2.31220	
	2	8.63675		74.32631		-1.92824	
	3	9.38018		59.25085		-0.56454	
7	1	16.89059		109.40000		-1.35377	
	2	10.89193		80.48259		-1.17501	
	3	11.27071		58.24970		0.16938	
8	1	20.09507		114.40000		0.00000	
	2	13.29216		85.01307		0.00000	
	3	12.87307		57.18059		1.10222	
9	1	23.29954		109.40000		1.35377	
	2	15.69238		80.48259		1.17501	
	3	14.47518		51.16304		1.52315	
10	1	26.40018		101.90000		2.31220	
	2	17.94756		74.32631		1.92824	
	3	15.68528		42.68151		1.74766	
11	1	29.63000		87.86678		3.02020	
	2	20.29660		61.62553		3.06650	
	3	16.94557		35.21400		1.56955	
12	1	32.79557		72.57640		4.06411	
	2	22.30854		46.90534		3.33054	
	3	17.95320		26.65147		1.85987	
13	1	36.11870		50.14172		4.55913	
	2	24.42033		32.16973		2.97701	
	3	19.01085		18.25500		1.71797	
14	1	38.15489		28.12351		5.27212	
	2	25.50270		16.04209		3.58288	
	3	19.55315		9.10596		2.02126	
15	1	40.19014		0.00000		6.11581	
	2	26.58431		0.00000		3.02338	
	3	20.09507		0.00000		1.74099	
16	1	31.81660		25.65231		-4.60984	
	2	20.67231		16.02866		-3.17241	
	3	19.76153		16.55305		-2.79425	
17	1	31.03671		49.82050		-4.84210	
	2	20.39964		32.01321		-3.25826	
	3	19.02531		31.64130		-2.98143	
18	1	29.91730		70.08968		-3.81457	
	2	20.01013		46.67087		-3.02669	
	3	18.00910		43.50378		-2.08263	
19	1	28.35671		87.43686		-3.02759	
	2	19.15076		61.22067		-2.63088	
	3	16.78376		52.42474		-1.38983	

KNOTEN-VERFORMUNGEN

Knot-		Verschiebungen (mm)			Verdrehungen (mrad)		
Nr.	LF	u-X	u-Y	u-Z	Phi-X	Phi-Y	Phi-Z
20	1	26.31549		99.23918		-2.22862	
	2	17.92315		71.52135		-1.94834	
	3	15.16293		56.77934		-0.55170	
21	1	23.20540		109.00000		-1.43108	
	2	15.60777		80.08321		-1.24455	
	3	13.40354		58.10811		0.09392	
22	1	20.09507		111.90000		0.00000	
	2	13.29216		82.52085		0.00000	
	3	11.64427		55.93360		0.70300	
23	1	16.98474		109.00000		1.43108	
	2	10.97654		80.08321		1.24455	
	3	10.29321		50.88218		1.52500	
24	1	13.87465		99.23918		2.22862	
	2	8.66116		71.52135		1.94834	
	3	8.94251		42.45984		1.67692	
25	1	11.83343		87.43686		3.02759	
	2	7.43355		61.22067		2.63088	
	3	8.52213		35.01212		1.63777	
26	1	10.27284		70.08968		3.81457	
	2	6.57418		46.67087		3.02669	
	3	8.18687		26.58591		1.73194	
27	1	9.15343		49.82050		4.84210	
	2	6.18467		32.01321		3.25826	
	3	8.08367		18.17920		1.86067	
28	1	8.37354		25.65231		4.60984	
	2	5.91200		16.02866		3.17241	
	3	8.04000		9.09926		1.81559	
Maxi	1	40.19014		114.40000		6.11581	
	2	26.58431		85.01307		3.58288	
	3	20.09507		59.25085		2.02126	
Mini	1	0.00000		0.00000		-6.11581	
	2	0.00000		0.00000		-3.58288	
	3	0.00000		0.00000		-4.37482	

INHALTSVERZEICHNIS **BLATT**

Ergebnisse LF-Kombinationen LOAD COMBINATIONS . . . **2**
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Programmsystem RSTAB : Ebene/raeumliche Stabwerke nach FEM Version 4.61

Programm-Entwicklung : Ing.-Software Dlubal GmbH
Am Zellweg 2
D-93464 Tiefenbach
Telefon 09673/1775 o. 1776
Telefax 09673/1770

ERGEBNISSE LF-UEBERLAGERUNG

LF-KOMBINATION LFK 301 302 303 304

LF-KOMBINATION-VERZEICHNIS

LFK	LF-Kombination-Bezeichnung	Kombinations-Kriterium
301	Dead load	0.275*1/s
302	Single engine load centric	0.42*2/s
303	2 engines (bridge length)	0.42*1/s
304	Max/min combination	0.275*1/s + 0.42*2 oder 0.42*3 oder 0.42* 1

KOMBINATIONSKRITERIEN

LFK		LF	LF-Bezeichnung	Ueber-lagerung	Wichtungs-Faktor
301		1:	Total loaded	Staendig	0.275
302		2:	Centric loaded	Staendig	0.420
303		1:	Total loaded	Staendig	0.420
304		1:	Total loaded	Staendig	0.275
	plus	2:	Centric loaded	Eventuell	0.420
	oder	3:	Excentric loaded	Eventuell	0.420
	oder	1:	Total loaded	Eventuell	0.420

MAX/MIN/ZUG SCHNITTGROESSEN STABBEZOGEN

Selektier-Kriterium: /K

Stab-Nr.	LFK	x (m)		Kraefte (kN) N	Q-2	Q-3	Momente (kNm) M-T	M-2	M-3
1	301	0.00	*MAX	539.91*		69.11		-55.32	
		0.00	*MIN	539.91*		69.11		-55.32	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	438.22*		2.27		-11.05	
		0.00	*MIN	438.22*		2.27		-11.05	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	824.58*		105.54		-84.49	
		0.00	*MIN	824.58*		105.54		-84.49	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	1364.49*		174.65		-139.82	
		0.00	*MIN	539.91*		69.11		-55.32	
			*MAX	LF 1 1					

MAX/MIN/ZUG SCHNITTGROESSEN STABBEZOGEN

Stab- Nr.	LFK	x (m)		Kraefte (kN) N	Q-2	Q-3	Momente (kNm) M-T	M-2	M-3
1	304		*MIN	LF 1					
2	301	0.00	*MAX	540.16*		60.88		-36.76	
		0.00	*MIN	540.16*		60.88		-36.76	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	438.52*		3.28		-1.57	
		0.00	*MIN	438.52*		3.28		-1.57	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	824.97*		92.98		-56.15	
		0.00	*MIN	824.97*		92.98		-56.15	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	1365.12*		153.86		-92.91	
		0.00	*MIN	540.16*		60.88		-36.76	
			*MAX	LF 1	1				
			*MIN	LF 1					
3	301	0.00	*MAX	1218.74*		76.31		-72.46	
		0.00	*MIN	1218.74*		76.31		-72.46	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	1182.86*		-1.37		-2.77	
		0.00	*MIN	1182.86*		-1.37		-2.77	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	1861.35*		116.55		-110.67	
		0.00	*MIN	1861.35*		116.55		-110.67	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	3080.09*		192.86		-183.14	
		0.00	*MIN	1218.74*		76.31		-72.46	
			*MAX	LF 1	1				
			*MIN	LF 1					
4	301	0.00	*MAX	1219.00*		56.80		-19.93	
		0.00	*MIN	1219.00*		56.80		-19.93	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	1183.27*		14.53		-11.01	
		0.00	*MIN	1183.27*		14.53		-11.01	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	1861.74*		86.75		-30.44	
		0.00	*MIN	1861.74*		86.75		-30.44	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	3080.74*		143.56		-50.36	
		0.00	*MIN	1219.00*		56.80		-19.93	
			*MAX	LF 1	1				
			*MIN	LF 1					

MAX/MIN/ZUG SCHNITTGROESSEN STABBEZOGEN

Stab-Nr.	LFK	x (m)		Kraefte (kN) N	Q-2	Q-3	Momente (kNm) M-T	M-2	M-3
5	301	0.00	*MAX	1512.24*		76.56		-66.94	
		0.00	*MIN	1512.24*		76.56		-66.94	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	1679.77*		110.09		-75.30	
		0.00	*MIN	1679.77*		110.09		-75.30	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	2309.60*		116.93		-102.24	
		0.00	*MIN	2309.60*		116.93		-102.24	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	3821.84*		193.49		-169.18	
		0.00	*MIN	1512.24*		76.56		-66.94	
			*MAX	LF 1 1					
			*MIN	LF 1					
6	301	0.00	*MAX	1512.40*		55.51		-12.84	
		0.00	*MIN	1512.40*		55.51		-12.84	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	1680.01*		84.84		-24.98	
		0.00	*MIN	1680.01*		84.84		-24.98	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	2309.84*		84.78		-19.61	
		0.00	*MIN	2309.84*		84.78		-19.61	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	3822.24*		140.29		-32.44	
		0.00	*MIN	1512.40*		55.51		-12.84	
			*MAX	LF 1 1					
			*MIN	LF 1					
7	301	0.00	*MAX	1641.39*		79.51		-61.98	
		0.00	*MIN	1641.39*		79.51		-61.98	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	1877.69*		121.48		-99.53	
		0.00	*MIN	1877.69*		121.48		-99.53	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	2506.86*		121.43		-94.66	
		0.00	*MIN	2506.86*		121.43		-94.66	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	4148.25*		200.94		-156.64	
		0.00	*MIN	1641.39*		79.51		-61.98	
			*MAX	LF 1 1					
			*MIN	LF 1					
8	301	0.00	*MAX	1641.39*		50.40		6.76	

MAX/MIN/ZUG SCHNITTGROESSEN STABBEZOGEN

Stab-		x		Kraefte (kN)			Momente (kNm)		
Nr.	LFK	(m)		N	Q-2	Q-3	M-T	M-2	M-3
8	301	0.00	*MIN	1641.39*		50.40		6.76	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	1877.69*		76.93		5.71	
		0.00	*MIN	1877.69*		76.93		5.71	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	2506.86*		76.98		10.33	
		0.00	*MIN	2506.86*		76.98		10.33	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	4148.25*		127.38		17.09	
		0.00	*MIN	1641.39*		50.40		6.76	
			*MAX	LF 1	1				
			*MIN	LF 1					
9	301	0.00	*MAX	1512.40*		74.40		-57.46	
		0.00	*MIN	1512.40*		74.40		-57.46	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	1680.01*		113.57		-92.84	
		0.00	*MIN	1680.01*		113.57		-92.84	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	2309.84*		113.63		-87.75	
		0.00	*MIN	2309.84*		113.63		-87.75	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	3822.24*		188.03		-145.21	
		0.00	*MIN	1512.40*		74.40		-57.46	
			*MAX	LF 1	1				
			*MIN	LF 1					
10	301	0.00	*MAX	1512.24*		53.35		-12.11	
		0.00	*MIN	1512.24*		53.35		-12.11	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	1679.77*		88.32		-23.87	
		0.00	*MIN	1679.77*		88.32		-23.87	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	2309.60*		81.48		-18.50	
		0.00	*MIN	2309.60*		81.48		-18.50	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	3821.84*		134.83		-30.61	
		0.00	*MIN	1512.24*		53.35		-12.11	
			*MAX	LF 1	1				
			*MIN	LF 1					
11	301	0.00	*MAX	1219.00*		73.11		-58.44	
		0.00	*MIN	1219.00*		73.11		-58.44	

MAX/MIN/ZUG SCHNITTGROESSEN STABBEZOGEN

Stab-Nr.	LFK	x (m)		Kraefte (kN) N	Q-2	Q-3	Momente (kNm) M-T	M-2	M-3
11	301		*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	1183.27*		83.24		-56.17	
		0.00	*MIN	1183.27*		83.24		-56.17	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	1861.74*		111.65		-89.25	
		0.00	*MIN	1861.74*		111.65		-89.25	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	3080.74*		184.76		-147.69	
		0.00	*MIN	1219.00*		73.11		-58.44	
			*MAX	LF 1 1					
			*MIN	LF 1					
12	301	0.00	*MAX	1218.74*		53.60		-18.82	
		0.00	*MIN	1218.74*		53.60		-18.82	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	1182.86*		1.37		-9.23	
		0.00	*MIN	1182.86*		1.37		-9.23	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	1861.35*		81.86		-28.74	
		0.00	*MIN	1861.35*		81.86		-28.74	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	3080.09*		135.46		-47.56	
		0.00	*MIN	1218.74*		53.60		-18.82	
			*MAX	LF 1 1					
			*MIN	LF 1					
13	301	0.00	*MAX	540.16*		69.03		-56.02	
		0.00	*MIN	540.16*		69.03		-56.02	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	438.52*		-3.28		13.90	
		0.00	*MIN	438.52*		-3.28		13.90	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	824.97*		105.43		-85.56	
		0.00	*MIN	824.97*		105.43		-85.56	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	1365.12*		174.46		-141.57	
		0.00	*MIN	540.16*		69.03		-56.02	
			*MAX	LF 1 1					
			*MIN	LF 1					
14	301	0.00	*MAX	539.91*		60.80		-35.72	
		0.00	*MIN	539.91*		60.80		-35.72	
			*MAX	LF 1					

MAX/MIN/ZUG SCHNITTGROESSEN STABBEZOGEN

Stab-Nr.	LFK	x (m)		Kraefte (kN) N	Q-2	Q-3	Momente (kNm) M-T	M-2	M-3
14	301		*MIN	LF 1					
	302	0.00	*MAX	438.22*		-2.27		-0.34	
		0.00	*MIN	438.22*		-2.27		-0.34	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	824.58*		92.86		-54.55	
		0.00	*MIN	824.58*		92.86		-54.55	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	1364.49*		153.67		-90.27	
		0.00	*MIN	539.91*		60.80		-35.72	
			*MAX	LF 1	1				
			*MIN	LF 1					
15	301	0.00	*MAX	-939.17*		11.66		-31.16	
		0.00	*MIN	-939.17*		11.66		-31.16	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	-827.47*		7.29		-19.26	
		0.00	*MIN	-827.47*		7.29		-19.26	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	-1434.37*		17.81		-47.60	
		0.00	*MIN	-1434.37*		17.81		-47.60	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	-939.17*		11.66		-31.16	
		0.00	*MIN	-2373.54*		29.48		-78.76	
			*MAX	LF 1					
			*MIN	LF 1	1				
16	301	0.00	*MAX	-938.17*		-3.11		22.91	
		0.00	*MIN	-938.17*		-3.11		22.91	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	-826.80*		-3.68		14.09	
		0.00	*MIN	-826.80*		-3.68		14.09	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	-1432.85*		-4.75		34.99	
		0.00	*MIN	-1432.85*		-4.75		34.99	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	-938.17*		-3.11		22.91	
		0.00	*MIN	-2371.02*		-7.85		57.90	
			*MAX	LF 1					
			*MIN	LF 1	1				
17	301	0.00	*MAX	-1413.72*		9.15		-4.89	
		0.00	*MIN	-1413.72*		9.15		-4.89	
			*MAX	LF 1					
			*MIN	LF 1					

MAX/MIN/ZUG SCHNITTGROESSEN STABBEZOGEN

Stab-Nr.	LFK	x (m)		Kraefte (kN) N	Q-2	Q-3	Momente (kNm) M-T	M-2	M-3
17	302	0.00	*MAX	-1494.38*		15.21		-23.16	
		0.00	*MIN	-1494.38*		15.21		-23.16	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	-2159.13*		13.97		-7.46	
		0.00	*MIN	-2159.13*		13.97		-7.46	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	-1413.72*		9.15		-4.89	
		0.00	*MIN	-3572.85*		23.12		-12.35	
			*MAX	LF 1					
			*MIN	LF 1	1				
18	301	0.00	*MAX	-1412.33*		-8.69		37.67	
		0.00	*MIN	-1412.33*		-8.69		37.67	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	-1492.52*		-10.57		47.32	
		0.00	*MIN	-1492.52*		-10.57		47.32	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	-2157.02*		-13.28		57.53	
		0.00	*MIN	-2157.02*		-13.28		57.53	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	-1412.33*		-8.69		37.67	
		0.00	*MIN	-3569.35*		-21.97		95.20	
			*MAX	LF 1					
			*MIN	LF 1	1				
19	301	0.00	*MAX	-1612.06*		11.74		-9.41	
		0.00	*MIN	-1612.06*		11.74		-9.41	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	-1832.93*		16.52		-14.34	
		0.00	*MIN	-1832.93*		16.52		-14.34	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	-2462.05*		17.93		-14.37	
		0.00	*MIN	-2462.05*		17.93		-14.37	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	-1612.06*		11.74		-9.41	
		0.00	*MIN	-4074.11*		29.67		-23.77	
			*MAX	LF 1					
			*MIN	LF 1	1				
20	301	0.00	*MAX	-1612.18*		-5.34		45.48	
		0.00	*MIN	-1612.18*		-5.34		45.48	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	-1833.12*		-8.13		62.87	

MAX/MIN/ZUG SCHNITTGROESSEN STABBEZOGEN

Stab-Nr.	LFK	x (m)		Kraefte (kN) N	Q-2	Q-3	Momente (kNm) M-T	M-2	M-3
20	302	0.00	*MIN	-1833.12*		-8.13		62.87	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	-2462.24*		-8.15		69.46	
		0.00	*MIN	-2462.24*		-8.15		69.46	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	-1612.18*		-5.34		45.48	
		0.00	*MIN	-4074.42*		-13.49		114.94	
			*MAX	LF 1					
			*MIN	LF 1	1				
21	301	0.00	*MAX	-1612.18*		5.34		20.27	
		0.00	*MIN	-1612.18*		5.34		20.27	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	-1833.12*		8.13		24.46	
		0.00	*MIN	-1833.12*		8.13		24.46	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	-2462.24*		8.15		30.95	
		0.00	*MIN	-2462.24*		8.15		30.95	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	-1612.18*		5.34		20.27	
		0.00	*MIN	-4074.42*		13.49		51.22	
			*MAX	LF 1					
			*MIN	LF 1	1				
22	301	0.00	*MAX	-1612.06*		-11.74		46.05	
		0.00	*MIN	-1612.06*		-11.74		46.05	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	-1832.93*		-16.52		63.72	
		0.00	*MIN	-1832.93*		-16.52		63.72	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	-2462.05*		-17.93		70.32	
		0.00	*MIN	-2462.05*		-17.93		70.32	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	-1612.06*		-11.74		46.05	
		0.00	*MIN	-4074.11*		-29.67		116.37	
			*MAX	LF 1					
			*MIN	LF 1	1				
23	301	0.00	*MAX	-1412.33*		8.69		-3.55	
		0.00	*MIN	-1412.33*		8.69		-3.55	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	-1492.52*		10.57		-2.81	
		0.00	*MIN	-1492.52*		10.57		-2.81	

MAX/MIN/ZUG SCHNITTGROESSEN STABBEZOGEN

Stab-Nr.	LFK	x (m)		Kraefte (kN) N	Q-2	Q-3	Momente (kNm) M-T	M-2	M-3
23	302		*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	-2157.02*		13.28		-5.43	
		0.00	*MIN	-2157.02*		13.28		-5.43	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	-1412.33*		8.69		-3.55	
		0.00	*MIN	-3569.35*		21.97		-8.98	
			*MAX	LF 1					
			*MIN	LF 1	1				
24	301	0.00	*MAX	-1413.72*		-9.15		38.49	
		0.00	*MIN	-1413.72*		-9.15		38.49	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	-1494.38*		-15.21		48.98	
		0.00	*MIN	-1494.38*		-15.21		48.98	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	-2159.13*		-13.97		58.79	
		0.00	*MIN	-2159.13*		-13.97		58.79	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	-1413.72*		-9.15		38.49	
		0.00	*MIN	-3572.85*		-23.12		97.28	
			*MAX	LF 1					
			*MIN	LF 1	1				
25	301	0.00	*MAX	-938.17*		3.11		8.18	
		0.00	*MIN	-938.17*		3.11		8.18	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	-826.80*		3.68		-3.39	
		0.00	*MIN	-826.80*		3.68		-3.39	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	-1432.85*		4.75		12.49	
		0.00	*MIN	-1432.85*		4.75		12.49	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	-938.17*		3.11		8.18	
		0.00	*MIN	-2371.02*		7.85		20.66	
			*MAX	LF 1					
			*MIN	LF 1	1				
26	301	0.00	*MAX	-939.17*		-11.66		24.14	
		0.00	*MIN	-939.17*		-11.66		24.14	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	-827.47*		-7.29		15.29	
		0.00	*MIN	-827.47*		-7.29		15.29	
			*MAX	LF 2					

MAX/MIN/ZUG SCHNITTGROESSEN STABBEZOGEN

Stab-		x		K r a e f t e (kN)			M o m e n t e (kNm)		
Nr.	LFK	(m)		N	Q-2	Q-3	M-T	M-2	M-3
26	302		*MIN	LF 2					
	303	0.00	*MAX	-1434.37*		-17.81		36.87	
		0.00	*MIN	-1434.37*		-17.81		36.87	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	-939.17*		-11.66		24.14	
		0.00	*MIN	-2373.54*		-29.48		61.00	
			*MAX	LF 1					
			*MIN	LF 1	1				
27	301	0.00	*MAX	-998.73*		-9.37		55.32	
		0.00	*MIN	-998.73*		-9.37		55.32	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	-818.01*		-2.96		11.05	
		0.00	*MIN	-818.01*		-2.96		11.05	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	-1525.33*		-14.32		84.49	
		0.00	*MIN	-1525.33*		-14.32		84.49	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	-998.73*		-9.37		55.32	
		0.00	*MIN	-2524.06*		-23.69		139.82	
			*MAX	LF 1					
			*MIN	LF 1	1				
28	301	0.00	*MAX	739.72*		-0.56		2.52	
		0.00	*MIN	739.72*		-0.56		2.52	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	722.23*		-0.62		3.02	
		0.00	*MIN	722.23*		-0.62		3.02	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	1129.76*		-0.85		3.85	
		0.00	*MIN	1129.76*		-0.85		3.85	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	1869.48*		-1.41		6.38	
		0.00	*MIN	739.72*		-0.56		2.52	
			*MAX	LF 1	1				
			*MIN	LF 1					
29	301	0.00	*MAX	-570.93*		-2.33		12.87	
		0.00	*MIN	-570.93*		-2.33		12.87	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	-722.17*		-2.78		13.11	
		0.00	*MIN	-722.17*		-2.78		13.11	
			*MAX	LF 2					
			*MIN	LF 2					

MAX/MIN/ZUG SCHNITTGROESSEN STABBEZOGEN

Stab-Nr.	LFK	x (m)		Kraefte (kN) N	Q-2	Q-3	Momente (kNm) M-T	M-2	M-3
29	303	0.00	*MAX	-871.97*		-3.56		19.66	
		0.00	*MIN	-871.97*		-3.56		19.66	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	-570.93*		-2.33		12.87	
		0.00	*MIN	-1442.91*		-5.88		32.53	
			*MAX	LF 1					
			*MIN	LF 1	1				
30	301	0.00	*MAX	381.40*		-0.46		2.61	
		0.00	*MIN	381.40*		-0.46		2.61	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	614.65*		-0.98		4.66	
		0.00	*MIN	614.65*		-0.98		4.66	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	582.50*		-0.71		3.99	
		0.00	*MIN	582.50*		-0.71		3.99	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	996.05*		-1.44		7.28	
		0.00	*MIN	381.40*		-0.46		2.61	
			*MAX	LF 1	2				
			*MIN	LF 1					
31	301	0.00	*MAX	-225.62*		-0.97		5.86	
		0.00	*MIN	-225.62*		-0.97		5.86	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	-414.07*		-2.08		12.57	
		0.00	*MIN	-414.07*		-2.08		12.57	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	-344.59*		-1.48		8.96	
		0.00	*MIN	-344.59*		-1.48		8.96	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	-225.62*		-0.97		5.86	
		0.00	*MIN	-639.69*		-3.05		18.43	
			*MAX	LF 1					
			*MIN	LF 1	2				
32	301	0.00	*MAX	216.83*		-0.16		1.03	
		0.00	*MIN	216.83*		-0.16		1.03	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	332.68*		-0.25		1.61	
		0.00	*MIN	332.68*		-0.25		1.61	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	331.16*		-0.24		1.58	

MAX/MIN/ZUG SCHNITTGROESSEN STABBEZOGEN

Stab- Nr.	LFK	x (m)		Kraefte (kN) N	Q-2	Q-3	Momente (kNm) M-T	M-2	M-3
32	303	0.00	*MIN	331.16*		-0.24		1.58	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	549.52*		-0.41		2.65	
		0.00	*MIN	183.09*		-0.06		0.82	
			*MAX	LF 1	2				
			*MIN	LF 1	3				
33	301	0.00	*MAX	-62.93*		-0.37		3.39	
		0.00	*MIN	-62.93*		-0.37		3.39	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	-96.03*		-0.56		4.87	
		0.00	*MIN	-96.03*		-0.56		4.87	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	-96.11*		-0.56		5.18	
		0.00	*MIN	-96.11*		-0.56		5.18	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	238.90*		0.34		0.64	
		0.00	*MIN	-159.04*		-0.93		8.57	
			*MAX	LF 1	3				
			*MIN	LF 1	1				
34	301	0.00	*MAX	-62.93*		0.37		-0.41	
		0.00	*MIN	-62.93*		0.37		-0.41	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	-96.03*		0.56		-0.92	
		0.00	*MIN	-96.03*		0.56		-0.92	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	-96.11*		0.56		-0.63	
		0.00	*MIN	-96.11*		0.56		-0.63	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	-62.93*		0.37		-0.41	
		0.00	*MIN	-460.87*		1.64		-5.59	
			*MAX	LF 1					
			*MIN	LF 1	3				
35	301	0.00	*MAX	216.83*		0.16		-0.58	
		0.00	*MIN	216.83*		0.16		-0.58	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	332.68*		0.25		-1.00	
		0.00	*MIN	332.68*		0.25		-1.00	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	331.16*		0.24		-0.89	
		0.00	*MIN	331.16*		0.24		-0.89	

MAX/MIN/ZUG SCHNITTGROESSEN STABBEZOGEN

Stab- Nr.	LFK	x (m)		Kraefte (kN) N	Q-2	Q-3	Momente (kNm) M-T	M-2	M-3
35	303		*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	581.74*		0.49		-2.25	
		0.00	*MIN	216.83*		0.16		-0.58	
			*MAX	LF 1	3				
			*MIN	LF 1					
36	301	0.00	*MAX	-225.62*		0.97		-4.11	
		0.00	*MIN	-225.62*		0.97		-4.11	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	-414.07*		2.08		-8.79	
		0.00	*MIN	-414.07*		2.08		-8.79	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	-344.59*		1.48		-6.28	
		0.00	*MIN	-344.59*		1.48		-6.28	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	-225.62*		0.97		-4.11	
		0.00	*MIN	-639.69*		3.05		-12.91	
			*MAX	LF 1					
			*MIN	LF 1	2				
37	301	0.00	*MAX	381.40*		0.46		-1.82	
		0.00	*MIN	381.40*		0.46		-1.82	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	614.65*		0.98		-4.72	
		0.00	*MIN	614.65*		0.98		-4.72	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	582.50*		0.71		-2.78	
		0.00	*MIN	582.50*		0.71		-2.78	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	996.05*		1.44		-6.54	
		0.00	*MIN	381.40*		0.46		-1.82	
			*MAX	LF 1	2				
			*MIN	LF 1					
38	301	0.00	*MAX	-570.93*		2.33		-9.41	
		0.00	*MIN	-570.93*		2.33		-9.41	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	-722.17*		2.78		-13.47	
		0.00	*MIN	-722.17*		2.78		-13.47	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	-871.97*		3.56		-14.37	
		0.00	*MIN	-871.97*		3.56		-14.37	
			*MAX	LF 1					

MAX/MIN/ZUG SCHNITTGROESSEN STABBEZOGEN

Stab- Nr.	LFK	x (m)		Kraefte (kN) N	Q-2	Q-3	Momente (kNm) M-T	M-2	M-3
38	303		*MIN	LF 1					
	304	0.00	*MAX	-570.93*		2.33		-9.41	
		0.00	*MIN	-1442.91*		5.88		-23.78	
			*MAX	LF 1					
			*MIN	LF 1	1				
39	301	0.00	*MAX	739.72*		0.56		-2.43	
		0.00	*MIN	739.72*		0.56		-2.43	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	722.23*		0.62		-2.49	
		0.00	*MIN	722.23*		0.62		-2.49	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	1129.76*		0.85		-3.72	
		0.00	*MIN	1129.76*		0.85		-3.72	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	1869.48*		1.41		-6.15	
		0.00	*MIN	739.72*		0.56		-2.43	
			*MAX	LF 1	1				
			*MIN	LF 1					
40	301	0.00	*MAX	-998.73*		9.37		-27.81	
		0.00	*MIN	-998.73*		9.37		-27.81	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	-818.01*		2.96		-15.21	
		0.00	*MIN	-818.01*		2.96		-15.21	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	-1525.33*		14.32		-42.47	
		0.00	*MIN	-1525.33*		14.32		-42.47	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	-998.73*		9.37		-27.81	
		0.00	*MIN	-2524.06*		23.69		-70.28	
			*MAX	LF 1					
			*MIN	LF 1	1				
41	301	0.00	*MAX	121.68*		-0.25		1.05	
		0.00	*MIN	121.68*		-0.25		1.05	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	1.01*		-0.30		1.23	
		0.00	*MIN	1.01*		-0.30		1.23	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	185.84*		-0.38		1.60	
		0.00	*MIN	185.84*		-0.38		1.60	
			*MAX	LF 1					
			*MIN	LF 1					

MAX/MIN/ZUG SCHNITTGROESSEN STABBEZOGEN

Stab-Nr.	LFK	x (m)		Kraefte (kN) N	Q-2	Q-3	Momente (kNm) M-T	M-2	M-3
41	304	0.00	*MAX	307.53*		-0.63		2.65	
		0.00	*MIN	121.68*		-0.25		1.05	
			*MAX	LF 1 1					
			*MIN	LF 1					
42	301	0.00	*MAX	15.00*		-0.30		1.14	
		0.00	*MIN	15.00*		-0.30		1.14	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	11.16*		-0.29		1.07	
		0.00	*MIN	11.16*		-0.29		1.07	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	22.91*		-0.46		1.74	
		0.00	*MIN	22.91*		-0.46		1.74	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	37.90*		-0.76		2.89	
		0.00	*MIN	15.00*		-0.30		1.14	
			*MAX	LF 1 1					
			*MIN	LF 1					
43	301	0.00	*MAX	110.40*		-0.26		1.11	
		0.00	*MIN	110.40*		-0.26		1.11	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	15.90*		-0.41		1.78	
		0.00	*MIN	15.90*		-0.41		1.78	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	168.61*		-0.39		1.70	
		0.00	*MIN	168.61*		-0.39		1.70	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	279.01*		-0.65		2.81	
		0.00	*MIN	110.40*		-0.26		1.11	
			*MAX	LF 1 1					
			*MIN	LF 1					
44	301	0.00	*MAX	18.19*		-0.19		0.82	
		0.00	*MIN	18.19*		-0.19		0.82	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	26.16*		-0.40		1.84	
		0.00	*MIN	26.16*		-0.40		1.84	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	27.78*		-0.29		1.25	
		0.00	*MIN	27.78*		-0.29		1.25	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	45.97*		-0.47		2.07	

MAX/MIN/ZUG SCHNITTGROESSEN STABBEZOGEN

Stab- Nr.	LFK	x (m)		Kraefte (kN) N	Q-2	Q-3	Momente (kNm) M-T	M-2	M-3
44	304	0.00	*MIN	18.19*		-0.19		0.82	
			*MAX	LF 1	1				
			*MIN	LF 1					
45	301	0.00	*MAX	108.86*		-0.16		0.73	
		0.00	*MIN	108.86*		-0.16		0.73	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	173.16*		-0.24		1.11	
		0.00	*MIN	173.16*		-0.24		1.11	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	166.26*		-0.24		1.11	
		0.00	*MIN	166.26*		-0.24		1.11	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	282.01*		-0.40		1.84	
		0.00	*MIN	108.86*		-0.16		0.73	
			*MAX	LF 1	2				
			*MIN	LF 1					
46	301	0.00	*MAX	17.08*		-0.12		0.55	
		0.00	*MIN	17.08*		-0.12		0.55	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	24.65*		-0.18		0.83	
		0.00	*MIN	24.65*		-0.18		0.83	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	26.08*		-0.19		0.84	
		0.00	*MIN	26.08*		-0.19		0.84	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	43.15*		-0.31		1.38	
		0.00	*MIN	17.08*		-0.12		0.55	
			*MAX	LF 1	1				
			*MIN	LF 1					
47	301	0.00	*MAX	100.81*		0.00		0.00	
		0.00	*MIN	100.81*		0.00		0.00	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	153.85*		0.00		0.00	
		0.00	*MIN	153.85*		0.00		0.00	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	153.96*		0.00		0.00	
		0.00	*MIN	153.96*		0.00		0.00	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	254.76*		0.00		0.00	
		0.00	*MIN	100.81*		0.00		0.00	

MAX/MIN/ZUG SCHNITTGROESSEN STABBEZOGEN

Stab-Nr.	LFK	x (m)		Kraefte (kN) N	Q-2	Q-3	Momente (kNm) M-T	M-2	M-3
47	304		*MAX	LF 1 1					
			*MIN	LF 1					
48	301	0.00	*MAX	17.08*		0.12		-0.55	
		0.00	*MIN	17.08*		0.12		-0.55	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	24.65*		0.18		-0.83	
		0.00	*MIN	24.65*		0.18		-0.83	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	26.08*		0.19		-0.84	
		0.00	*MIN	26.08*		0.19		-0.84	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	43.15*		0.31		-1.38	
		0.00	*MIN	17.08*		0.12		-0.55	
			*MAX	LF 1 1					
			*MIN	LF 1					
49	301	0.00	*MAX	108.86*		0.16		-0.73	
		0.00	*MIN	108.86*		0.16		-0.73	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	173.16*		0.24		-1.11	
		0.00	*MIN	173.16*		0.24		-1.11	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	166.26*		0.24		-1.11	
		0.00	*MIN	166.26*		0.24		-1.11	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	282.01*		0.40		-1.84	
		0.00	*MIN	108.86*		0.16		-0.73	
			*MAX	LF 1 2					
			*MIN	LF 1					
50	301	0.00	*MAX	18.19*		0.19		-0.82	
		0.00	*MIN	18.19*		0.19		-0.82	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	26.16*		0.40		-1.84	
		0.00	*MIN	26.16*		0.40		-1.84	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	27.78*		0.29		-1.25	
		0.00	*MIN	27.78*		0.29		-1.25	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	45.97*		0.47		-2.07	
		0.00	*MIN	18.19*		0.19		-0.82	
			*MAX	LF 1 1					

MAX/MIN/ZUG SCHNITTGROESSEN STABBEZOGEN

Stab-Nr.	LFK	x (m)		Kraefte (kN) N	Q-2	Q-3	Momente (kNm) M-T	M-2	M-3
50	304		*MIN	LF 1					
51	301	0.00	*MAX	110.40*		0.26		-1.11	
		0.00	*MIN	110.40*		0.26		-1.11	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	15.90*		0.41		-1.78	
		0.00	*MIN	15.90*		0.41		-1.78	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	168.61*		0.39		-1.70	
		0.00	*MIN	168.61*		0.39		-1.70	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	279.01*		0.65		-2.81	
		0.00	*MIN	110.40*		0.26		-1.11	
			*MAX	LF 1 1					
			*MIN	LF 1					
52	301	0.00	*MAX	15.00*		0.30		-1.14	
		0.00	*MIN	15.00*		0.30		-1.14	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	11.16*		0.29		-1.07	
		0.00	*MIN	11.16*		0.29		-1.07	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	22.91*		0.46		-1.74	
		0.00	*MIN	22.91*		0.46		-1.74	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	37.90*		0.76		-2.89	
		0.00	*MIN	15.00*		0.30		-1.14	
			*MAX	LF 1 1					
			*MIN	LF 1					
53	301	0.00	*MAX	121.68*		0.25		-1.05	
		0.00	*MIN	121.68*		0.25		-1.05	
			*MAX	LF 1					
			*MIN	LF 1					
	302	0.00	*MAX	1.01*		0.30		-1.23	
		0.00	*MIN	1.01*		0.30		-1.23	
			*MAX	LF 2					
			*MIN	LF 2					
	303	0.00	*MAX	185.84*		0.38		-1.60	
		0.00	*MIN	185.84*		0.38		-1.60	
			*MAX	LF 1					
			*MIN	LF 1					
	304	0.00	*MAX	307.53*		0.63		-2.65	
		0.00	*MIN	121.68*		0.25		-1.05	
			*MAX	LF 1 1					
			*MIN	LF 1					

MAX/MIN/ZUG AUFLAGERKRAEFTE UND -MOMENTE

Knot-Nr.	LFK		Auflagerkraefte (kN) P-X	P-Y	P-Z	Auflagermomente (kNm) M-X	M-Y	M-Z
1	301	Max P-X	0.00*		909.37		0.00	
		Min P-X	0.00*		909.37		0.00	
		Max P-X LF	1					
		Min P-X LF	1					
	302	Max P-X	0.00*		693.00		0.00	
		Min P-X	0.00*		693.00		0.00	
		Max P-X LF	2					
		Min P-X LF	2					
	303	Max P-X	0.00*		1388.86		0.00	
		Min P-X	0.00*		1388.86		0.00	
		Max P-X LF	1					
		Min P-X LF	1					
	304	Max P-X	0.00*		909.37		0.00	
		Min P-X	0.00*		909.37		0.00	
		Max P-X LF	1					
		Min P-X LF	1					
	301	Max P-Z	0.00		909.37*		0.00	
		Min P-Z	0.00		909.37*		0.00	
		Max P-Z LF	1					
		Min P-Z LF	1					
	302	Max P-Z	0.00		693.00*		0.00	
		Min P-Z	0.00		693.00*		0.00	
		Max P-Z LF	2					
		Min P-Z LF	2					
	303	Max P-Z	0.00		1388.86*		0.00	
		Min P-Z	0.00		1388.86*		0.00	
		Max P-Z LF	1					
		Min P-Z LF	1					
	304	Max P-Z	0.00		2298.23*		0.00	
		Min P-Z	0.00		909.37*		0.00	
		Max P-Z LF	1	1				
		Min P-Z LF	1					
15	301	Max P-Z	0.00		909.37*		0.00	
		Min P-Z	0.00		909.37*		0.00	
		Max P-Z LF	1					
		Min P-Z LF	1					
	302	Max P-Z	0.00		693.00*		0.00	
		Min P-Z	0.00		693.00*		0.00	
		Max P-Z LF	2					
		Min P-Z LF	2					
	303	Max P-Z	0.00		1388.86*		0.00	
		Min P-Z	0.00		1388.86*		0.00	
		Max P-Z LF	1					
		Min P-Z LF	1					
	304	Max P-Z	0.00		2298.23*		0.00	
		Min P-Z	0.00		909.37*		0.00	
		Max P-Z LF	1	1				
		Min P-Z LF	1					

MAX/MIN KNOTEN-VERFORMUNGEN

Knot- Nr.	LFK		Verschiebungen (mm) u-X	u-Y	u-Z	Verdrehungen (mrad) Phi-X	Phi-Y	Phi-Z
1	301	Max	0.0000		0.0000		-1.6819	
		Min	0.0000		0.0000		-1.6819	
	302	Max	0.0000		0.0000		-1.2698	
		Min	0.0000		0.0000		-1.2698	
	303	Max	0.0000		0.0000		-2.5686	
		Min	0.0000		0.0000		-2.5686	
	304	Max	0.0000		0.0000		-1.6819	
		Min	0.0000		0.0000		-4.2505	
2	301	Max	0.5597		7.7340		-1.4498	
		Min	0.5597		7.7340		-1.4498	
	302	Max	0.4543		6.7377		-1.5048	
		Min	0.4543		6.7377		-1.5048	
	303	Max	0.8548		11.8119		-2.2143	
		Min	0.8548		11.8119		-2.2143	
	304	Max	1.4145		19.5458		-1.4498	
		Min	0.5597		7.7340		-3.6641	
3	301	Max	1.1197		13.7890		-1.2538	
		Min	1.1197		13.7890		-1.2538	
	302	Max	0.9089		13.5113		-1.2503	
		Min	0.9089		13.5113		-1.2503	
	303	Max	1.7100		21.0595		-1.9148	
		Min	1.7100		21.0595		-1.9148	
	304	Max	2.8296		34.8485		-1.2538	
		Min	1.1197		13.7890		-3.1686	
4	301	Max	2.0335		19.9585		-1.1176	
		Min	2.0335		19.9585		-1.1176	
	302	Max	1.7958		19.7002		-1.3988	
		Min	1.7958		19.7002		-1.3988	
	303	Max	3.1057		30.4821		-1.7069	
		Min	3.1057		30.4821		-1.7069	
	304	Max	5.1392		50.4406		-1.1176	
		Min	2.0335		19.9585		-2.8246	
5	301	Max	2.9040		24.1634		-0.8306	
		Min	2.9040		24.1634		-0.8306	
	302	Max	2.6408		25.8827		-1.2879	
		Min	2.6408		25.8827		-1.2879	
	303	Max	4.4353		36.9041		-1.2685	
		Min	4.4353		36.9041		-1.2685	
	304	Max	7.3393		61.0674		-0.8306	
		Min	2.9040		24.1634		-2.1185	
6	301	Max	3.7922		28.0225		-0.6359	
		Min	3.7922		28.0225		-0.6359	
	302	Max	3.6274		31.2171		-0.8099	
		Min	3.6274		31.2171		-0.8099	
	303	Max	5.7918		42.7980		-0.9711	
		Min	5.7918		42.7980		-0.9711	
	304	Max	9.5840		70.8205		-0.6359	
		Min	3.7922		28.0225		-1.6070	

MAX/MIN KNOTEN-VERFORMUNGEN

Knot- Nr.	LFK		Verschiebungen (mm) u-X	u-Y	u-Z	Verdrehungen (mrad) Phi-X	Phi-Y	Phi-Z
7	301	Max	4.6449		30.0850		-0.3723	
		Min	4.6449		30.0850		-0.3723	
	302	Max	4.5746		33.8027		-0.4935	
		Min	4.5746		33.8027		-0.4935	
	303	Max	7.0940		45.9480		-0.5686	
		Min	7.0940		45.9480		-0.5686	
	304	Max	11.7390		76.0330		-0.3011	
		Min	4.6449		30.0850		-0.9409	
8	301	Max	5.5261		31.4600		0.0000	
		Min	5.5261		31.4600		0.0000	
	302	Max	5.5827		35.7055		0.0000	
		Min	5.5827		35.7055		0.0000	
	303	Max	8.4399		48.0480		0.0000	
		Min	8.4399		48.0480		0.0000	
	304	Max	13.9661		79.5080		0.4629	
		Min	5.5261		31.4600		0.0000	
9	301	Max	6.4074		30.0850		0.3723	
		Min	6.4074		30.0850		0.3723	
	302	Max	6.5908		33.8027		0.4935	
		Min	6.5908		33.8027		0.4935	
	303	Max	9.7858		45.9480		0.5686	
		Min	9.7858		45.9480		0.5686	
	304	Max	16.1932		76.0330		1.0120	
		Min	6.4074		30.0850		0.3723	
10	301	Max	7.2600		28.0225		0.6359	
		Min	7.2600		28.0225		0.6359	
	302	Max	7.5380		31.2171		0.8099	
		Min	7.5380		31.2171		0.8099	
	303	Max	11.0881		42.7980		0.9711	
		Min	11.0881		42.7980		0.9711	
	304	Max	18.3481		70.8205		1.6070	
		Min	7.2600		28.0225		0.6359	
11	301	Max	8.1482		24.1634		0.8306	
		Min	8.1482		24.1634		0.8306	
	302	Max	8.5246		25.8827		1.2879	
		Min	8.5246		25.8827		1.2879	
	303	Max	12.4446		36.9041		1.2685	
		Min	12.4446		36.9041		1.2685	
	304	Max	20.5928		61.0674		2.1185	
		Min	8.1482		24.1634		0.8306	
12	301	Max	9.0188		19.9585		1.1176	
		Min	9.0188		19.9585		1.1176	
	302	Max	9.3696		19.7002		1.3988	
		Min	9.3696		19.7002		1.3988	
	303	Max	13.7741		30.4821		1.7069	
		Min	13.7741		30.4821		1.7069	
	304	Max	22.7929		50.4406		2.8246	
		Min	9.0188		19.9585		1.1176	
13	301	Max	9.9326		13.7890		1.2538	

MAX/MIN KNOTEN-VERFORMUNGEN

Knot-Nr.	LFK		Verschiebungen (mm) u-X	u-Y	u-Z	Verdrehungen (mrad) Phi-X	Phi-Y	Phi-Z
		Min	9.9326		13.7890		1.2538	
	302	Max	10.2565		13.5113		1.2503	
		Min	10.2565		13.5113		1.2503	
	303	Max	15.1699		21.0595		1.9148	
		Min	15.1699		21.0595		1.9148	
	304	Max	25.1025		34.8485		3.1686	
		Min	9.9326		13.7890		1.2538	
14	301	Max	10.4926		7.7340		1.4498	
		Min	10.4926		7.7340		1.4498	
	302	Max	10.7111		6.7377		1.5048	
		Min	10.7111		6.7377		1.5048	
	303	Max	16.0250		11.8119		2.2143	
		Min	16.0250		11.8119		2.2143	
	304	Max	26.5176		19.5458		3.6641	
		Min	10.4926		7.7340		1.4498	
15	301	Max	11.0523		0.0000		1.6819	
		Min	11.0523		0.0000		1.6819	
	302	Max	11.1654		0.0000		1.2698	
		Min	11.1654		0.0000		1.2698	
	303	Max	16.8799		0.0000		2.5686	
		Min	16.8799		0.0000		2.5686	
	304	Max	27.9322		0.0000		4.2505	
		Min	11.0523		0.0000		1.6819	
16	301	Max	8.7496		7.0544		-1.2677	
		Min	8.7496		7.0544		-1.2677	
	302	Max	8.6824		6.7320		-1.3324	
		Min	8.6824		6.7320		-1.3324	
	303	Max	13.3630		10.7740		-1.9361	
		Min	13.3630		10.7740		-1.9361	
	304	Max	22.1125		17.8283		-1.2677	
		Min	8.7496		7.0544		-3.2038	
17	301	Max	8.5351		13.7006		-1.3316	
		Min	8.5351		13.7006		-1.3316	
	302	Max	8.5679		13.4456		-1.3685	
		Min	8.5679		13.4456		-1.3685	
	303	Max	13.0354		20.9246		-2.0337	
		Min	13.0354		20.9246		-2.0337	
	304	Max	21.5705		34.6252		-1.3316	
		Min	8.5351		13.7006		-3.3653	
18	301	Max	8.2273		19.2747		-1.0490	
		Min	8.2273		19.2747		-1.0490	
	302	Max	8.4043		19.6018		-1.2712	
		Min	8.4043		19.6018		-1.2712	
	303	Max	12.5653		29.4377		-1.6021	
		Min	12.5653		29.4377		-1.6021	
	304	Max	20.7925		48.7123		-1.0490	
		Min	8.2273		19.2747		-2.6511	
19	301	Max	7.7981		24.0451		-0.8326	
		Min	7.7981		24.0451		-0.8326	

MAX/MIN KNOTEN-VERFORMUNGEN

Knot-Nr.	LFK		Verschiebungen (mm) u-X	u-Y	u-Z	Verdrehungen (mrad) Phi-X	Phi-Y	Phi-Z
	302	Max	8.0433		25.7127		-1.1050	
		Min	8.0433		25.7127		-1.1050	
	303	Max	11.9098		36.7235		-1.2716	
		Min	11.9098		36.7235		-1.2716	
	304	Max	19.7079		60.7686		-0.8326	
		Min	7.7981		24.0451		-2.1042	
20	301	Max	7.2368		27.2908		-0.6129	
		Min	7.2368		27.2908		-0.6129	
	302	Max	7.5277		30.0390		-0.8183	
		Min	7.5277		30.0390		-0.8183	
	303	Max	11.0525		41.6804		-0.9360	
		Min	11.0525		41.6804		-0.9360	
	304	Max	18.2893		68.9712		-0.6129	
		Min	7.2368		27.2908		-1.5489	
21	301	Max	6.3815		29.9750		-0.3935	
		Min	6.3815		29.9750		-0.3935	
	302	Max	6.5553		33.6349		-0.5227	
		Min	6.5553		33.6349		-0.5227	
	303	Max	9.7463		45.7800		-0.6011	
		Min	9.7463		45.7800		-0.6011	
	304	Max	16.1278		75.7550		-0.3541	
		Min	6.3815		29.9750		-0.9946	
22	301	Max	5.5261		30.7725		0.0000	
		Min	5.5261		30.7725		0.0000	
	302	Max	5.5827		34.6588		0.0000	
		Min	5.5827		34.6588		0.0000	
	303	Max	8.4399		46.9980		0.0000	
		Min	8.4399		46.9980		0.0000	
	304	Max	13.9661		77.7705		0.2953	
		Min	5.5261		30.7725		0.0000	
23	301	Max	4.6708		29.9750		0.3935	
		Min	4.6708		29.9750		0.3935	
	302	Max	4.6102		33.6349		0.5227	
		Min	4.6102		33.6349		0.5227	
	303	Max	7.1336		45.7800		0.6011	
		Min	7.1336		45.7800		0.6011	
	304	Max	11.8044		75.7550		1.0341	
		Min	4.6708		29.9750		0.3935	
24	301	Max	3.8155		27.2908		0.6129	
		Min	3.8155		27.2908		0.6129	
	302	Max	3.6377		30.0390		0.8183	
		Min	3.6377		30.0390		0.8183	
	303	Max	5.8273		41.6804		0.9360	
		Min	5.8273		41.6804		0.9360	
	304	Max	9.6429		68.9712		1.5489	
		Min	3.8155		27.2908		0.6129	
25	301	Max	3.2542		24.0451		0.8326	
		Min	3.2542		24.0451		0.8326	
	302	Max	3.1221		25.7127		1.1050	

MAX/MIN KNOTEN-VERFORMUNGEN

Knot-Nr.	LFK		Verschiebungen (mm) u-X	u-Y	u-Z	Verdrehungen (mrad) Phi-X	Phi-Y	Phi-Z
		Min	3.1221		25.7127		1.1050	
	303	Max	4.9700		36.7235		1.2716	
		Min	4.9700		36.7235		1.2716	
	304	Max	8.2242		60.7686		2.1042	
		Min	3.2542		24.0451		0.8326	
26	301	Max	2.8250		19.2747		1.0490	
		Min	2.8250		19.2747		1.0490	
	302	Max	2.7612		19.6018		1.2712	
		Min	2.7612		19.6018		1.2712	
	303	Max	4.3146		29.4377		1.6021	
		Min	4.3146		29.4377		1.6021	
	304	Max	7.1396		48.7123		2.6511	
		Min	2.8250		19.2747		1.0490	
27	301	Max	2.5172		13.7006		1.3316	
		Min	2.5172		13.7006		1.3316	
	302	Max	2.5976		13.4456		1.3685	
		Min	2.5976		13.4456		1.3685	
	303	Max	3.8444		20.9246		2.0337	
		Min	3.8444		20.9246		2.0337	
	304	Max	6.3616		34.6252		3.3653	
		Min	2.5172		13.7006		1.3316	
28	301	Max	2.3027		7.0544		1.2677	
		Min	2.3027		7.0544		1.2677	
	302	Max	2.4830		6.7320		1.3324	
		Min	2.4830		6.7320		1.3324	
	303	Max	3.5169		10.7740		1.9361	
		Min	3.5169		10.7740		1.9361	
	304	Max	5.8196		17.8283		3.2038	
		Min	2.3027		7.0544		1.2677	
	301	MAX	11.0523		31.4600		1.6819	
		MIN	0.0000		0.0000		-1.6819	
	302	MAX	11.1654		35.7055		1.5048	
		MIN	0.0000		0.0000		-1.5048	
	303	MAX	16.8799		48.0480		2.5686	
		MIN	0.0000		0.0000		-2.5686	
	304	MAX	27.9322		79.5080		4.2505	
		MIN	0.0000		0.0000		-4.2505	

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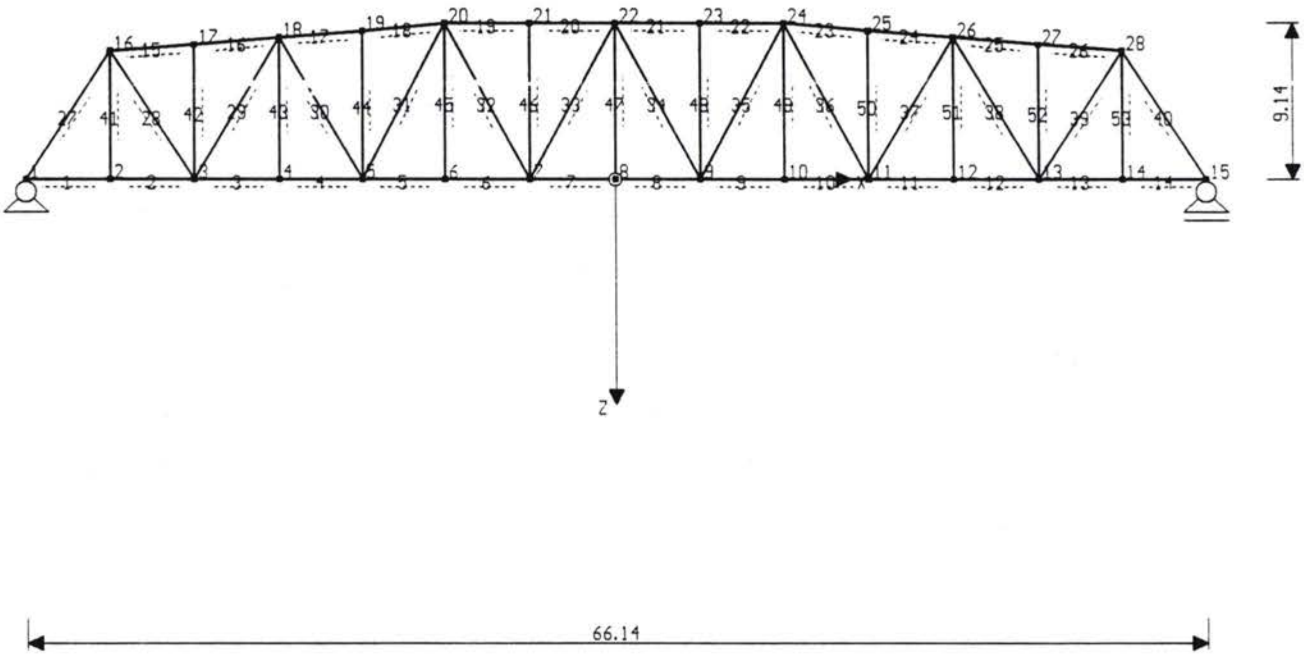
STRUKTUR - TRUSS1

IN Y-RICHTUNG



STÄBE:
/D1,B /D3

WINKEL:		**DARGESTELLTER BEREICH [m]**	KNOTENNUMERIERUNG
ALPHA:	7.0	IN X: -100000. ... 100000.0	STABNUMERIERUNG
BETA :	42.0	IN Y: -100000. ... 100000.0	
GAMMA:	0.0	IN Z: -100000. ... 100000.0	

VERZERRUNG			
IN X:	1.00	ANZAHL DER KNOTEN :	28
IN Y:	1.00	ANZAHL DER STÄBE :	53
IN Z:	1.00	ANZAHL DER AUFLAGER :	2

PROJEKT: TURKMEN
POSITION: TRUSS1

PROJEKT-NAME: TURKMEN
POSITION-NAME: TRUSS1

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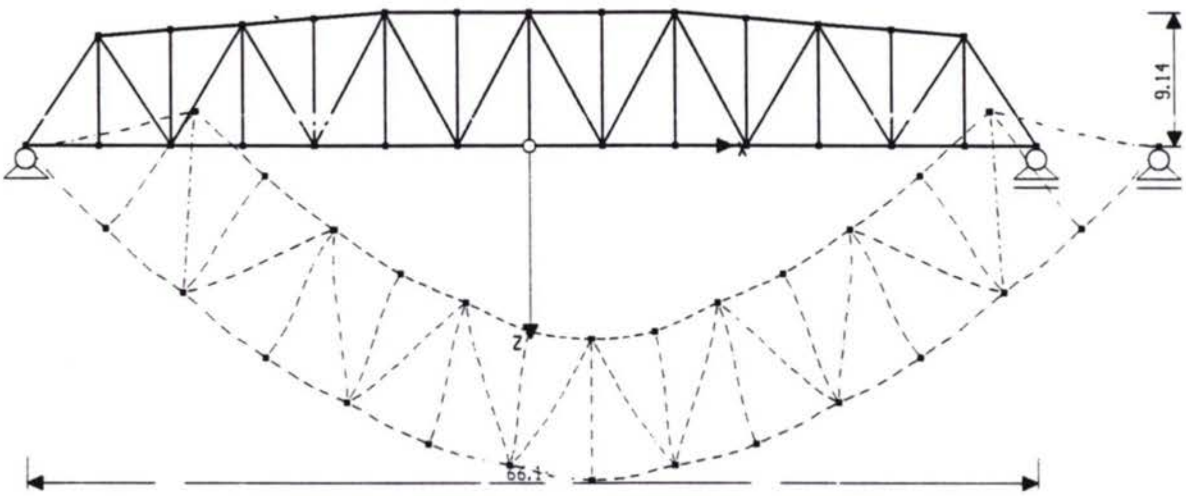
VERFORMUNGEN - TRUSS1 - LF 1

IN Y-RICHTUNG



DEFLECTION
TOTAL UNIT LOAD 100 kN/m

Max = 116.152 mm

5.07 m

STÄBE: /D1,B /D3

LF/LG/LK 200*1 /F15 /T1 /D1

WINKEL:		DARGESTELLTER BEREICH [m]	LF 1 : ---- 200x
ALPHA:	7.0	IN X: -100000. ... 100000.0	
BETA :	42.0	IN Y: -100000. ... 100000.0	
GAMMA:	0.0	IN Z: -100000. ... 100000.0	

VERZERRUNG			
IN X:	1.00	ANZAHL DER KNOTEN :	28
IN Y:	1.00	ANZAHL DER STÄBE :	53
IN Z:	1.00	ANZAHL DER AUFLAGER :	2

PROJEKT: TURKMEN
POSITION: TRUSS1

PROJEKT-NAME: TURKMEN
POSITION-NAME: TRUSS1

Lastfall: 1 200-fach
Total loaded

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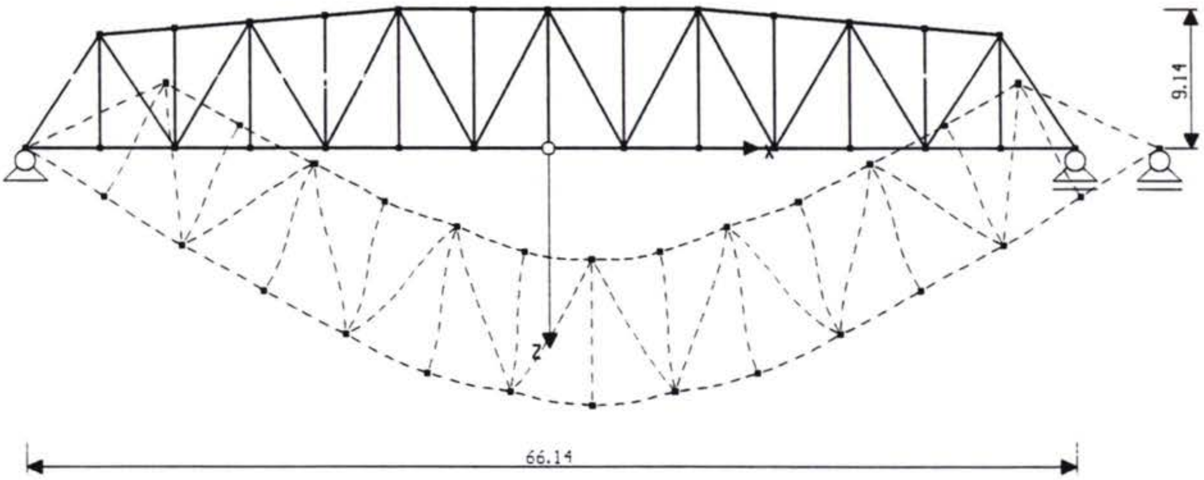
VERFORMUNGEN - TRUSS1 - LF 2

IN Y-RICHTUNG



DEFLECTION
CENTRIC UNIT LOAD 100 kN/m

Max = 86.046 mm

4.89 m

STÄBE: /D1,B /D3

LF/LG/LK 200*2 /F15 /T1 /D1

WINKEL:		**DARGESTELLTER BEREICH [m]**	LF 2 : ---- 200x
ALPHA:	7.0	IN X: -100000. ... 100000.0	
BETA :	42.0	IN Y: -100000. ... 100000.0	
GAMMA:	0.0	IN Z: -100000. ... 100000.0	
VERZERRUNG			
IN X:	1.00	ANZAHL DER KNOTEN :	28
IN Y:	1.00	ANZAHL DER STABE :	53
IN Z:	1.00	ANZAHL DER AUFLAGER :	2

PROJEKT: TURKMEN
POSITION: TRUSS1

Lastfall: 2 200-fach
Centric loaded

PROJEKT-NAME: TURKMEN
POSITION-NAME: TRUSS1

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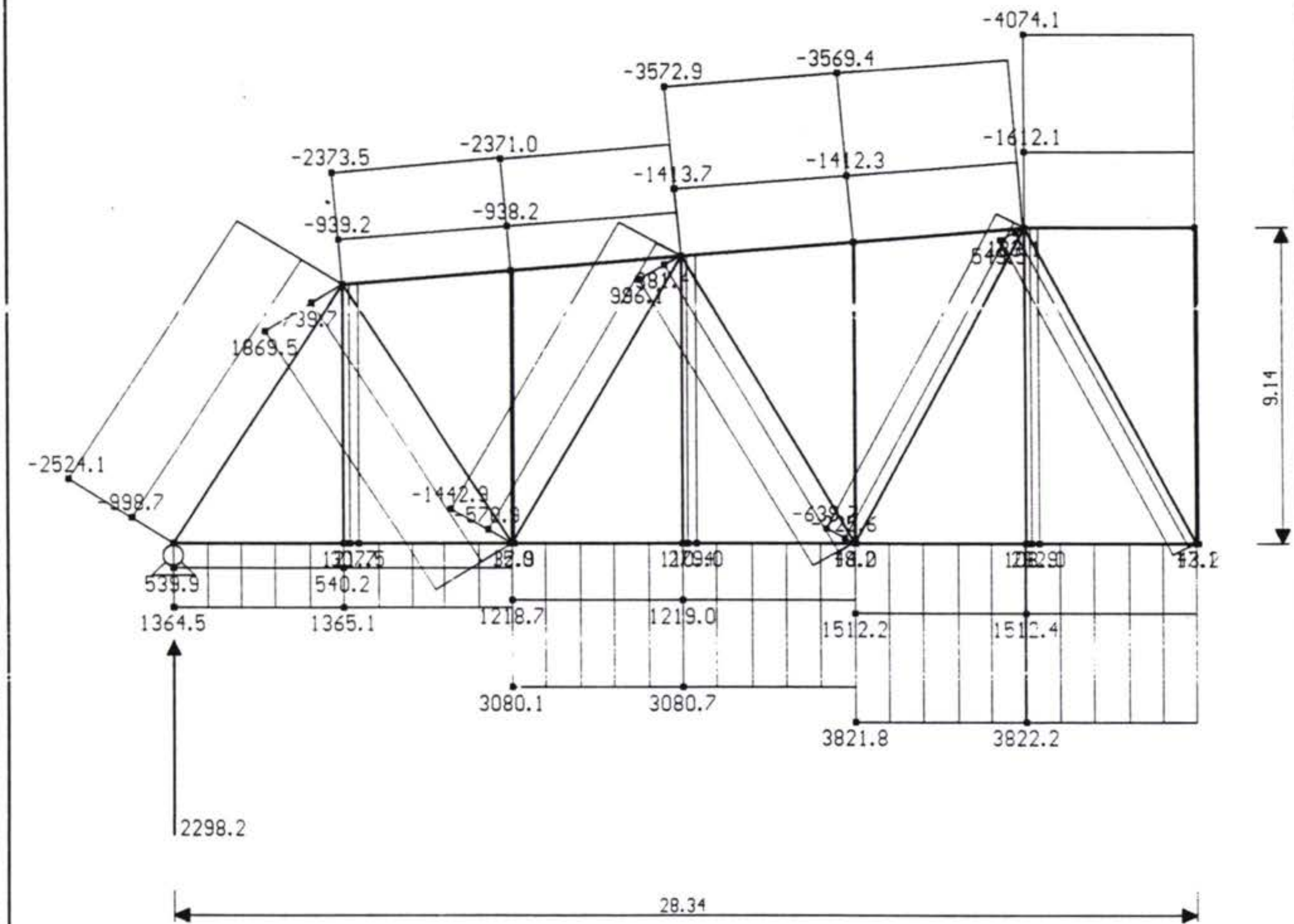
SCHNITTGROSSEN - TRUSS1 - LK 304

N

IN Y-RICHTUNG



LOAD COMBINATION 304
MAX/MIN NORMAL FORCES

1547.27 kN

Max = 3822.24, Min = -4074.11 kN

2.11 m

STÄBE:
/D1,B /D3

WINKEL:		**DARGESTELLTER BEREICH [m]**
ALPHA:	7.0	IN X: -100000. ... 100000.0
BETA :	42.0	IN Y: -100000. ... 100000.0
GAMMA:	0.0	IN Z: -100000. ... 100000.0

VERZERRUNG			
IN X:	1.00	ANZAHL DER KNOTEN :	28
IN Y:	1.00	ANZAHL DER STÄBE :	53
IN Z:	1.00	ANZAHL DER AUFLAGER :	2

PROJEKT:
TURKMEN
POSITION:
TRUSS1

PROJEKT-NAME:
TURKMEN
POSITION-NAME:
TRUSS1

LF-KOMBINATION: 304
Max/min combination

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Normalkräfte N
Max N = 3822.24, Min N = -4074.11 kN

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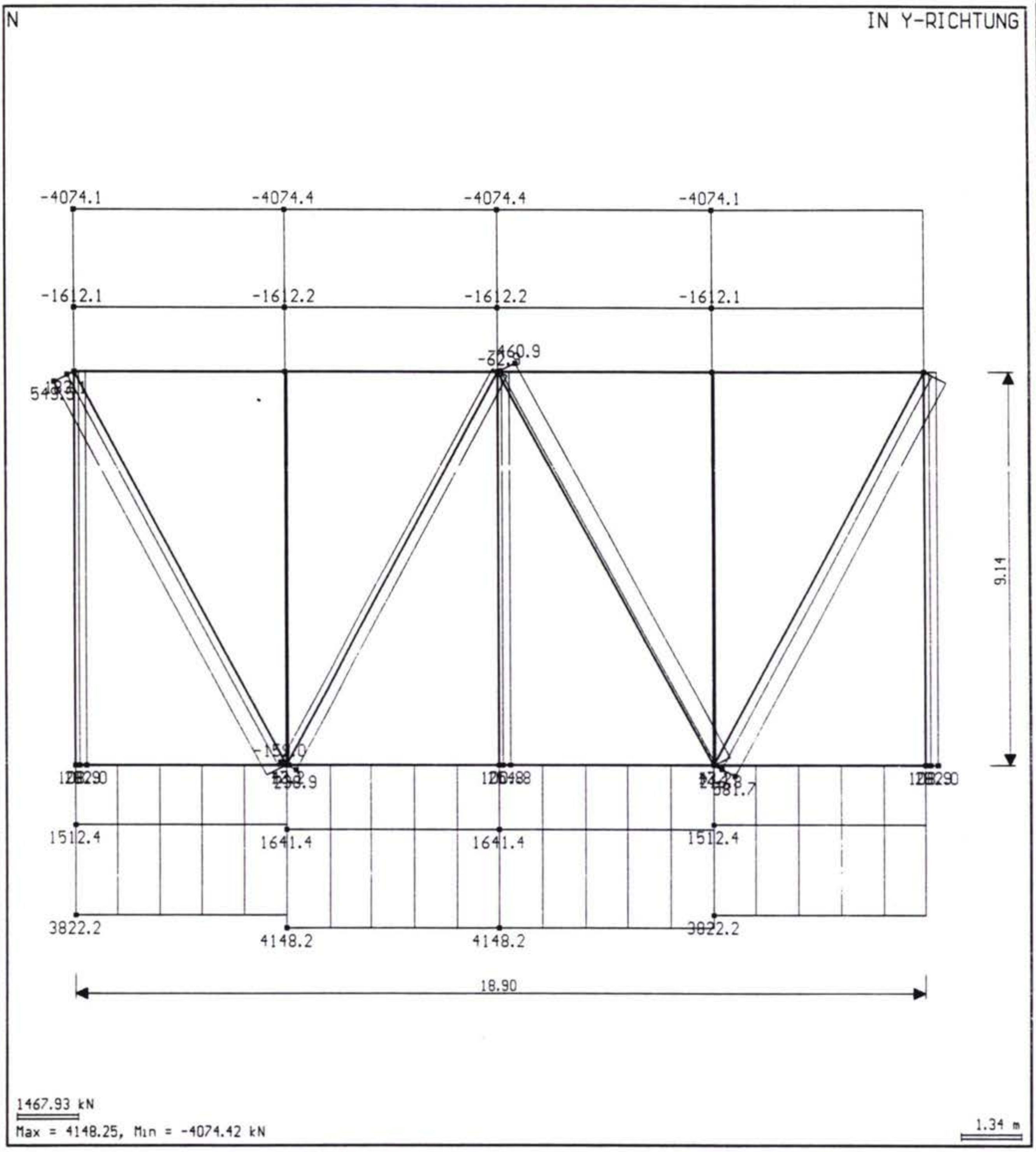
SCHNITTGROSSEN - TRUSS1 - LK 304



STÄBE:
/D1,8 /D3

WINKEL:		**DARGESTELLTER BEREICH [m]**
ALPHA:	7.0	IN X: -100000. ... 100000.0
BETA :	42.0	IN Y: -100000. ... 100000.0
GAMMA:	0.0	IN Z: -100000. ... 100000.0

VERZERRUNG			
IN X:	1.00	ANZAHL DER KNOTEN :	28
IN Y:	1.00	ANZAHL DER STÄBE :	53
IN Z:	1.00	ANZAHL DER AUFLAGER :	2

PROJEKT: TURKMEN
POSITION: TRUSS1

PROJEKT-NAME: TURKMEN
POSITION-NAME: TRUSS1

LF-KOMBINATION: 304
Max/min combination

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Normalkräfte N
Max N = 4148.25, Min N = -4074.42 kN

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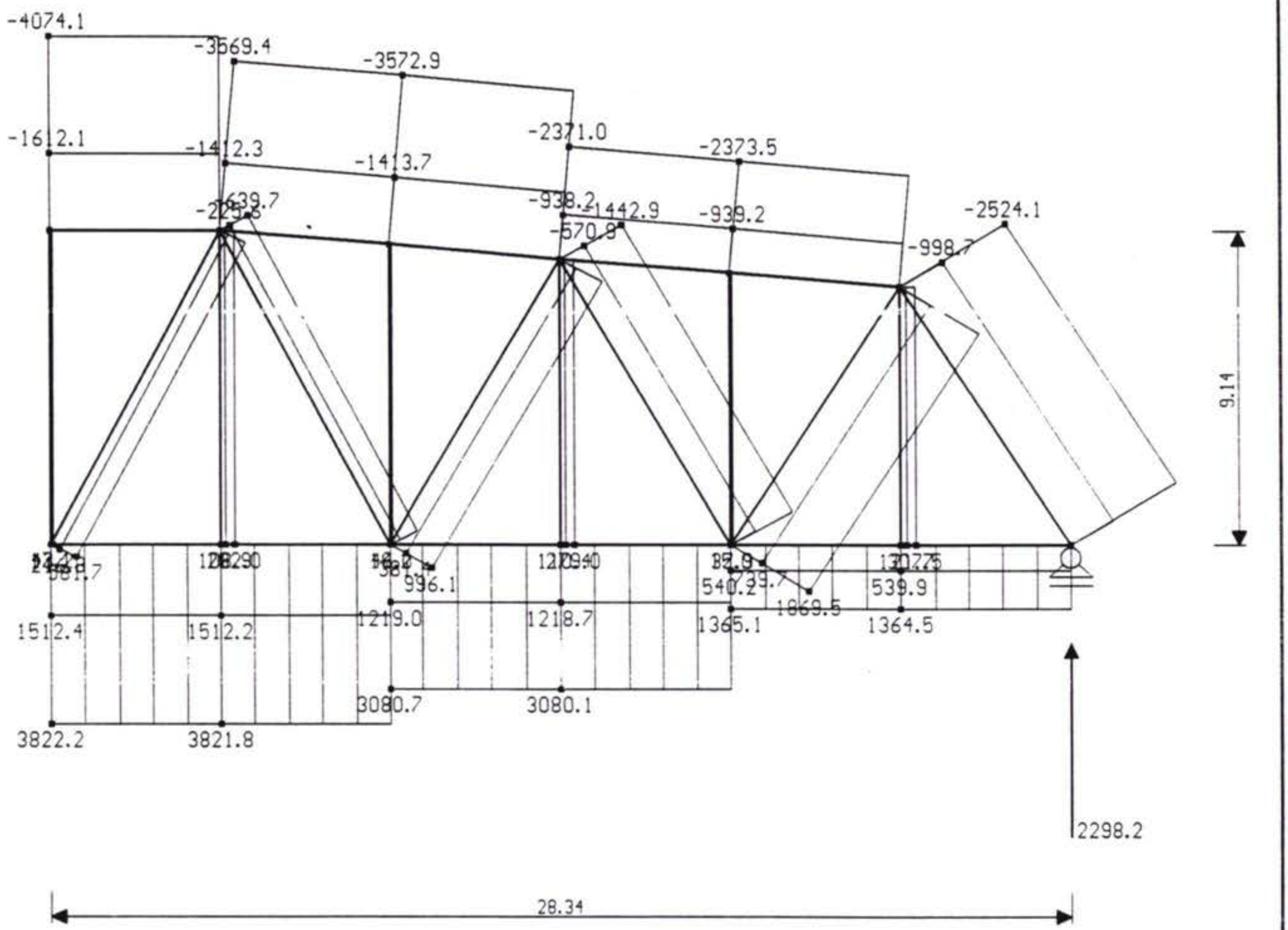
SCHNITTGROSSEN - TRUSS1 - LK 304

N

IN Y-RICHTUNG



1544.39 kN
Max = 3822.24, Min = -4074.11 kN

2.11 m

STÄBE:
/D1,B /D3

WINKEL:		**DARGESTELLTER BEREICH [m]**
ALPHA:	7.0	IN X: -100000. ... 100000.0
BETA :	42.0	IN Y: -100000. ... 100000.0
GAMMA:	0.0	IN Z: -100000. ... 100000.0

VERZERRUNG

IN X:	1.00	ANZAHL DER KNOTEN :	28
IN Y:	1.00	ANZAHL DER STÄBE :	53
IN Z:	1.00	ANZAHL DER AUFLAGER :	2

PROJEKT:
TURKMEN
POSITION:
TRUSS1

PROJEKT-NAME:
TURKMEN
POSITION-NAME:
TRUSS1

LF-KOMBINATION: 304
Max/min combination

Normalkräfte N
Max N = 3822.24, Min N = -4074.11 kN

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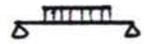
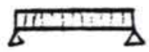
6. CHECK RESULT

6.1 DEFLECTION

As documented in the inspection report paragr. 3.3 „Proof load Measurement"
the deflections of the real structure are:

deflection mm	calcu-lated	mea-sured	%
centric load (2 locomotives) 	36	28	78%
total load (4 locomotives) 	48	38	79%

It is normal that measured deflection are less than calculated due to extra stiffness (gusset plates, bracings, action of cross + longitudinal girders acting with main girders).

In the reverse case this would be an alarming sign.

6.2 FATIGUE CHECK

It is assumed that the load applied (2 and 4 locomotives) is a characteristic load for fatigue check.
Due to rail and track discontinuities an impact factor of $\varphi = 1{,}40$ is applied which is very unfavourable and therefor is on the safe side.

Under these assumptions the fatigue check results as follows.

lower chord H 6-7-8 A = 419 cm² (page C/9)

page C/35 Stab Nr. 7:

$F_{max} = 4148{,}25 \cdot 1{,}40 = 5808$ kN $\sigma = 139$ N/mm²

$F_{min} = 1641{,}39 \cdot 1{,}40 = 2298$ $\sigma = 55$

$\Delta\sigma = 84$ N/mm²

due to tension: hole deduction estimated 20% $\Delta\sigma_{net} = \frac{84}{0{,}8} =$ 105 N/mm²

EUROCODE 3: riveted structure
eventually with fishplates → det. categ.: 112 > 105

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upper chord B 6'-7'-8' $A = 424\ cm^2$ (page C/7)

page C/39 Stab Nr. 19

$F_{max} = -1612{,}06 \cdot 1{,}40 = -2257\ kN$ $\sigma = -53\ N/mm^2$

$F_{min} = -4074{,}11 \cdot 1{,}40 = -5704\ kN$ $\sigma = -135$

no netto-deduction $\Delta\sigma = 82\ N/mm^2$

EUROCODE 3: detail category 112 > 82

diagonal P1'-2 $A = 191\ cm^2$ (page C/10)

page C/42 Stab Nr. 28

$F_{max} = 1869{,}48 \cdot 1{,}40 = 2617\ kN$ $\sigma = 137\ N/mm^2$

$F_{min} = 739{,}72 \cdot 1{,}40 = 1036\ kN$ $\sigma = 54$

$\Delta\sigma = 83\ N/mm^2$

EUROCODE 3: detail category 112 > 83

Vertical CT $A = 64\ cm^2$ (page C/12)

Axle load = $23^t \hat{=} 230\ kN$ page C/48 Stab Nr. 45

Force on vertical $F_{max} = 282{,}01 \cdot 1{,}60 = 451\ kN$

Dynamic factor $\cong 1{,}60$ $F_{min} = 108{,}86 \cdot 1{,}60 = 174$

(Austrian standard)

$\sigma_{max} = 70\ N/mm^2$

$\sigma_{min} = 27$

$\Delta\sigma = 43\ N/mm^2$

hole deduction: 20% $\Delta\sigma_{net} = \frac{43}{0{,}8} = 54\ N/mm^2$

EUROCODE 3 detail category: 112 > 54

WARNING: If welding is applied (also if correctly executed, with smooth

transitions, no start-stop-positions,
correctly tested:
detail category can go down to
det.cat. = 100 for force-parallel throat welds
det.cat. = 80 for force-perpendic. throat welds
det.cat. = 50 for short welds,
assumed that the material is qualified for welding.

Danger of cracks exists if welding is executed on bad material, with no smooth transitions, sharp ending, etc.

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TRACECA - MODULE C - WS 3200 CHARDZHEV BRIDGE

APPENDIX D
SUMMARY OF FORMER INSPECTIONS BY THE LOCAL EXPERTS

SUMMARY OF STEEL QUALITY ASSESSMENT of bridge elements (as described in PART D-2 following):

Chemical analysis of the metal samples as described in chapter 2.6.1 (Most 51):

Carbon	Manganese	Silicon	Phosphorus	Sulphur
C	Mn	Si	P	S
0,051 - 0,13 %	0,33 - 0,54 %	0,0 - 0,05 %	0,058 - 0,12 %	0,051 -0,062 %

Comparison with steel quality Fe 360 = S235JO as defined in European Standard EN 10025 and EN 10027:

Carbon	Manganese	Silicon	Phosphorus	Sulphur	Nitrogene
C	Mn	Si	P	S	N
≤ 0,170	≤ 1,400	---	≤ 0,040	≤ 0,040	≤ 0,009

As there are no more elements checked a simplified Carbon-Equivalent (CEQ) is calculated:
CEQ = C + Mn/6 = (0,051 ... 0,13) + (0,33 ... 0,54)/6 = 0,106 ... 0,220
which were sufficient low values but the contents of Phosphorus and Sulphur are crucial as they indicate that the material is difficult to weld (less toughness, tendency of segregation, embrittlement). Contents of P and S should not be more than 0,045 % respective.

Mechanical characteristics of the samples (see table Most 119 on following page):

Values of yield stress, ultimate stress and strain show that the material are similar to steel quality Fe 360 = S235JO as defined in European Standard EN 10025 and EN 10027.
Only few values are below that standard:
sample 7.1 yield stress = 213,9 N/mm^2, which is below 225 N/mm^2
sample 8.2 yield stress = 222,8 N/mm^2, which is below 225 N/mm^2
sample 3.1 strain = 14,3 %, which is below 25%.

In Most58 (see page 11 in D-2) an allowable stress is calculated assuming normal distribution:
R' = mσ_t - 3.σ_s = 271,5 - 3.32,47 = 174 N/mm^2 (based on 0,14 % fractile).

Calculating according to DIN or similar standards a characteristic value of
R_k = mσ_t - 1,645.σ_s is assumed (which is equivalent to 5 % fractile).
Therefor R_k = 271,5 - 1,645.32,47 = 218,1 N/mm^2.
The allowable stress is then derived to be R_k/safety factor = 218,1 / 1,4 = 156 N/mm^2.
This value is less than the above calculated to 174 N/mm^2. That fact indicates that the standard deviation of the material characteristics is higher than for normal steel according to DIN or European standards. Some caution is also based on this fact.

The following summary gives an overview which defects are detected in various spans if described in the inspection report.

MAIN GIRDER AND BRACING from tables 2.1, 2.2, 2.3

SPAN No.	TYPE OF DEFECT						
	RIVET				CRACK	DEFORMATION	
	loose	deformed	missing	replaced by bolt		main element	bracing element
1	2	1		12			
2	1			13			1
3	2			10		1	
4	2			14			
5	1			15			
6	4			17			1
7	1			22		2	4
8	3			11			
9	2			13			
10	5	7		12			
11	3	2		13			
12	2	4	1	18			
13	3	2		20			
14	4	2		15			
15	2	3		11			
16	5		1	8			
17	3		1	10			
18	4	2		20			
19	2		1	19			
20	4	11		22			1
21	8			22			
22	3	1		26			
23	19			25			
24	1	1		20			
25	9	2		15			

CROSS BEAMS AND LONGITUDINAL BEAMS, FISHPLATES AND GUSSET PLATES "B" TO "P"
from tables 2.4, 2.5, 2.6, 2.7, 2.8

SPAN No.	TYPE OF DEFECT						
	RIVET				CRACK		STRENGTH. (ST) and No. of bolts
	loose	deformed	missing	replaced by bolt	number	length mm	
1		1		56	2	30	ST, 11
2				38			
3				8			ST, 9
4				115			ST, 5
5				34			
6				34			
7		1		34			
8				19	1	NV	ST, 5
9	1			56	2	NV	ST, 20
10				37			
11	3			38	1	NV	
12		1	1	60	1	NV	ST, 5
13				39	1	70	ST, 5
14				474	1	NV	
15				6			
16				15			
17	2			7	1	NV	
18				2	3 5	NV 20 to 60	
19	3			8			
20			1	6	1	NV	
21		1		31	2 1 FP 3	NV 20	
22	1			29			
23	6		3	46	FP 1		
24	1		2	51			
25	1	1	1	53	1 FP 1	NV	

NV ...
not visible due to overlapping by angle iron or fishplate

FP ...
cracks in fishplates

MOST119.PCX

Таблица

МЕХАНИЧЕСКИЕ ХАРАКТЕРИСТИКИ ПРОБ МЕТАЛЛА

# ПС	ЭЛЕ- МЕНТ	МЕСТО ВЫРЕЗКИ	## ОБРАЗ.	σ тек. кг/см²	σ вр. кг/см²	δ %	М.О σ тек СКО σ тек	М.О σ вр СКО σ вр
1	2	3	4	5	6	7	8	9
		ВЕРХНИЙ	1.1	2603	4188	33.3		
		УГОЛОК	1.2	2546	4131			
2	0-1`	ВНЕШНЕЙ	1.3	2490	4131		254.05	409.08
		ВЕТВИ	1.4	2370	3890			
		У НИЖН.	1.5	2688	4138		10.709	10.564
		УЗЛА	1.6	2546	4067			
			2.1	2989	4131			
		ЛИСТ	2.2	3059	4067			
		ДИАФ-	2.3	3183	4279	30.3	305.93	415.83
2	1-2	РАГМЫ	2.4	3006	4191	32.0		
			2.5	3077	4155	30.3	6.884	8.739
			2.6	3042	4050	30.7		
			2.7	****	4208	35.0		
		УГОЛОК	3.1	****	3997	14.3	288.20	412.05
2	1`-2	— ‖ —	3.2	2882	4244	31.3	******	17.465
		УГОЛОК	4.1	****	3784	31.0	******	383.7
2	2-3`	— ‖ —	4.2	****	3890	28.3	******	7.495
			5.1	****	3537	35.0	******	361.93
2	3`-4	УГОЛОК	5.2	****	3890	40.0		
		— ‖ —	5.3	****	3431	40.0	******	24.032
2	4-5`		6.1	2971	4545	33.0	289.55	455.35
		УГОЛОК	6.2	2988	4686	31.0		
		ВНУТР.	6.3	2794	4421	32.0	9.830	10.841
		ВЕТВИ	6.4	2829	4562	26.0		
			7.1	2139	3678	39.3		
		УГОЛКИ	7.2	2476	3855	34.3	242.28	391.68
2	5`-6		7.3	2653	4173	31.7		
			7.4	2440	4138	35.0	14.970	19.617
		2 ПРОБЫ	7.5	2370	3802	40.3		
			7.6	2405	3855	34.3		
		УГОЛОК	8.1	2370	3926	32.0	229.90	376.70
2	6-7`	— ‖ —	8.2	2228	3608	32.0	10.040	22.486
		УГОЛОК	9.1	2653	3890	36.7	282.95	412.90
2	1-1`	— ‖ —	9.2	3006	4368	30.0	24.961	33.800

PART D-1

REPORT OF LOCAL EXPERTS (FIRST PART)

containing pages 1 to 45 (including tables)

1. GENERAL DATA

1.1.TECHNICAL CHARACTERISTIC OF THE BRIDGE

The bridge is located on direct one-track horizontal section of the railway. The bridge openning is blocked by 27 span structures under chain 11,58 + 25x66, 14 + 11,58. The bridge was constructed in period from 1898 on 1901 Designing of the bridge was conducted since March 1895 according to norms of 1896. The engineer of ways of communication Ol'shevsky S.I controlled the construction. Span structures had been made on Bryansk factories. The current of the river in place of bridge of crossing from the right to the left if to look on course of the account of span structures. Supports, span structures and their elements are numbered against course of the account of kilometers, that is from the side of Chardzhou.

1.1.1. DESIGN OF SPAN STRUCTURES.

Span structures № 0 and № 26.

Coastal span structures of a beam type, with two continuous beams with top driving (Bнс.1.1; 1.2) are designed according to the norms of 1896 Calculated length 1-1,582 m..(36 ft). Complete length 11,89 m.. Distance between axes of beams 11,828 m. (6 ft). Height of a wall of a beam 1,52 m.. The wall along the length of a span is made of six sheets, connected by fishplates. Thickness of a wall - 9,5 mm. In near-support sections the top and bottoms chords of beams consist of angle irons 4 " x 4 " x 7/16 " (102x102x11.) and sheet 102x11. In sections located closer to middle of a span, from above and is from below added on one additional horizontal sheet 102x11. Vertical angle irons are the edges of rigidity, divide a beam on 15 sections. The beams in level of chords are connected by ties from angle irons, forming in the plan cross-shaped cross ties. There are also available cross-shaped cross ties. A material of span structures is metal (iron). A diameter of rivets - 22 mm.

Basic parts are flat, each consisting of two plates: top and bottom. The bottom plate from above has a deepening - a bed, which does not permit the top plate to be moved in cross direction. In its turn a bed of the top plate covers a chord of a main beam span structures.

Span structures Nr. 1 - № 25.

Channel span structures with bottom driving, with through trusses by effective span of 66,142 m. (217 ft), are designed according to the norms of 1896 of an Outline of the top chords of trusses is broken with effective heights of 7,874 m. - in section of first unit and 9,398 m. in sections at middle units. A lattice ie triangular with racks and hangers. Quantity of panels - 14 on 4,724 m. each. A material of span structures is metal (iron). All elements of span structures are riveted of rolling grade of metal. Tere are used both equal-side angle irons (3 " x 3 " x 3 " /8; 3"1/2 x 3 " 1/2 x 3 " /8; 4 " x 4 " x7 " /16), and different side angle irons 5 " x 3 " 1/2 x 1 " /2; 6" X 4 " * x 1H/2; 6" x 4 " x 7 /16). Section of elements are enclosed. In attachments of angle braces B1 - 2, B2 - 3 "; B3'- 4 and B5 " - 6 to chords rivets the diameter of 23,8 mm are delivered. (15 " /16). Rivets by a diameter of 22,2 mm. (7 " /8) are applied in all main partsB4 - 5 " and B6 7 ", in separate parts of angle braces and in attachment to chords of racks and supports. Rivets by a diameter 19,0 mm. (3 " /4) are used in attachments of elements of a connecting lattice.

Distance between axes of trusses of 5,537 m. (18 ft of 2 inches). The trusses are connected between themselves by longitudinal top and bottom ties, and as by cross ties, located in planes of racks and supports. Section of longitudinal ties in comparison with initial are changed during repair jobs and strengthening in 1955-58 In their structure is entered on one additional angle iron 100 x 75 x 8. In 1980 at average cross beams there were arranged brakes ties (fig.1.5) Thus longitudinal ties joined longitudinal beams through vertical sheet and between themselves they were joined with spacer.

Longitudinal and cross beams are continuous with arrangement of the top chords in one level. Distance between longitudinal beams 1,829 m. (6 of ft). Originally the joint of longitudinal beams had not the bottom fishes. Now, after strengthening, on all span structures (except span structures24 " " 25) there are installed the bottom fishes with tables. On span structure № 25 connections of longitudinal beams have other design. To bottom chords of longitudinal beams on sites of their joint to cross horizontal fishplates on high-strength bolts as with one, and on the other hand are attached. On horizontal fishplates steels cores of round section, missed through an openning in a wall of a cross beam are welded. The longitudinal beams are connected by cross ties - in middle of the panel and longitudinal ties - in level of the top chord. The cross beams are attached to units of main trusses with help of axes. Section of beams of the bridge road are shown on fig. 1.4.The top horizontal sheet at longitudinal beams are installed for strengthening in 1980. The horizontal sheets (two from above and two from below) on cross beams were delivered in 1937 - 1942.

On the half of span structures in 1965 support of a line of power transmission were installed. The support have a design in kind of console trusses with triangular lattice from angle irons with bolt connections . The supports are located on panels 13 14 (1 - 2) on top chords of main trusses.

Basic parts are hinged-balanced. The mobile basic parts are rolling and located from the side of Farab and have six rolls each wuth a diameter of 114 mm and length of 775 mm.

Bridge floor laid on wooden crosspieces. Rails R50. The levelling devices are not present. Bridge the bars by section 240 x 200 are attached to top chords of main and longitudinal beams with help лапчатых of bolts. КонтВуголки by section 160 x 160 x 20, security angle irons 160 x 100 x 16. Over cross beams there are installed transitive tables.

Main footwalk pass along the bridge is arranged on consoles at the upper (right) side of the bridge outside of span structures. A flooring of the pass is wooden. Along the whole length of the bridge on flooring there are stacked rails of a narrow track for moving of the technological carriage. Within the limits of coastal spans the footwalk the span is passed along span structures, each consisting of two continuous beams with broken outline of the bottom chord. Span structure of sidewalk leans on console, one of which is fixed on abutments, other on basic unit Вуслового span to structures m » 1 or T *? 25). The fastening fotwalk of pass to Вусловым span to structures is made in units of main trusses.

On whole length of the bridge there is the pass inside of span structures. This fotwalk pass is located from the low side from rail track (at the left). Plates of reinforced concrete of a pass are stacked on consoles, attached to vertical edges of rigidity of longitudinal beams. There are the refuges. From the right from rail track the space between bridge floor and main trusses is closed by corrugated steel sheets.

Over main fotwalk pass to elements of main trusses on consoles the power cables are attached.

1.1.2. DESIGN OF SUPPORTS OF THE BRIDGE AND INFORMATION ABOUT THEIR STRUCTURE

During designing of the bridge across Amu-Daria extensive prospecting work, reflected in an Album of the excutive drawings [8) were carried out. In this document the historical and geographical information on river to Amudarya in the region of Chardzhou oasis are shown. There are marked fast current of the river, its extremly turbid water. As in Chardzhou region both coasts are low-lying, and valley of the river consists from weak alluvial soils, the outline of coast has strongly changed, and their destruction occured very quickly. Width of the river during researches and construction on the average made 2 - 3 kms., along the channel there are a lot of sand-banks and islands .

In the [8] there are given maps of the river in region of the bridge crossing at horizon of low water for period of 1888 on 1899 inclusive. Here there are clearly seen formation and erosion of islands and annual changes of channel.

Flood on Amu-Daria during researches and construction occured in June and July, that is connected with melting of glaciers in sources of the river. There was marked also spring flood in April, connected with melting of snow in prehills and долинах. In [8] the diagrams of horizons of water in Amu-Daria with 1886 on 1901 inclusive are shown. The lowest horizons of water were observed from November to April.

In 1887 higher along current from axis of the future bridge the temporary wooden bridge was constructed. Starting with 1888 there began erosion of support of this bridge. For struggle with erosion the bottom of the river was strengthened with stones. Then a work for strenghtening of coast in place bridge of crossing have begun.

During surveys investigation for determination of speeds of current of the river, areas of live section, heaviest charge of water, inclination of the river were lead. The openning of the bridge was nominated equal 11 x 1600 m.. It corresponded to effective average speed of water 2,75 m/sec,, at average depth of water under bridge of 4,0 m..

In design materials data on geological structure of soils in place of the bridge crossing are shown. The bottom of the river was composed by powerful layers running ground and black sand, lower there are layers of clays, clays with sand, yellow sand, cemented grey.

All 24 intermediate support of the bridge have practically identical design. The support consists of two columns variable on height of a diameter. Each column is covered with riveted steel plating. The diameter of the bottom part of columns was chosen from condition of effective dipping of columns, at pressure on ground about 0,62 mPa of 2.5 poods per sq. inch). The bottoms parts of columns are supplied knife by a part with round openning by a diameter 1,58 m. For passing of a grab, having a diameter about 1200 mm.

On top part of knife section in accordance with dipping of columns a rubble masonry was erected, and for protection of fresh solution from erosion during the work of a grab, the masonry was protected inside a well by metal sheets by thickness 1,2 mm. For reduction of friction of the plating about ground of the outside there were done hidden head of rivets of knife section . Above knife section the plating of columns has yet five sections of the same diameter with thickness of sheets of 6,3 mm. (1/4 inch). The following three sections of columns have a smaller diameter, that was done for reduction of friction at dipping of columns. Appropriate ring-shaped step 152 mm in width was formed by angle irons 152 x 102 x 13 and 76 x 76 x 10. Above specified three rows there was arranged one more step of angle irons of the same size. In this part of a column from 6 up to 7 sections depending on depth of dipping. The whole section of a underwater part of columns, except knife one have thickness of sheets of 6,3 mm.

Inside both steps of a underwater part of columns are srtrengthened by six arms of curved angle irons.

The top edge of underwater part of columns after dipping exceeded on 0,25 m. horizon of the lowest waters. This part of a column is finished with ring-shaped platform 483 mm of width. And top head of rivets were here arranged as secret. Ring-shapedые of a platform, surrounded from within by curved angle iron 76 x 76 x 10 are strengthened by six arms from angle irons 51 x 76 x 10. The top part of angle irons of arms is continued up to horizon of the highest waters (up to 1/3 height of the second section of a surface part of a support) and is seized on height by two ring-shaped angle irons 51 x 76 x 10.

On underwater part of each column after its dipping, there were freely installed steel riveted section of the plating of a surface part, than before concreting these parts of columns had not been tied to something. It was done for in case of errors at dipping of columns, their surface parts could be installed in exact design position as lengthways, and across axis of the bridge. At erection of a masonry inside plating angle arms were immersed in concrete massif and rubble masonry and provided additional connection between underwater and surface part of a column.

The surface part of each column of intermediate support has a diameter of 2641 mm and consists of four stages with height of 1829 mm each.

For maintenance of necessary rigidity and stability of support, two of the bottom stages of a surface part have the additional plating by thickness 12 mm. Inside plating horizontal and vertical ties from angle irons were installed. Two top circles of columns, having thickness of sheets 8 mm., are also connected by horizontal, vertical and inclined ties. The horizontal and vertical joints of sheets of the plating of a surface part are blocked by outside fishplates of width 165 mm. All vertical seams of the plating place are tied.

On top parts of columns, is above angle irons surrounding top of columns , there were installed riveted metal headbands (cornices) from curved sheet and angle metal 6 mm. thick (fig. 1.17). The design of a cornice and its interface to column permitted to carry out certain adjustment of top of columns on height. The separate parts of a cornice, consisting of eight sections, incorporated to help of internal fishplates on rivets with outside secret головками. The internal part of cornices was filled by concrete. Complete height of a cornice is equal 1250 mm., height of the bottom part, interfacing a cornice to a column, makes 330 mm. An internal part of a cornice is strengthened by ties of six angle irons and curved anchoring strips.

The internal rubble masonry was erected ring-shaped only in underwater part of columns. After end of dipping of each column and installation of the bottom section of the plating of a surface part, concreting internal wellы and surface part of a column up to level was carried out, on which there was the water in river in operating time. A continuous rubble masonry was further erected, which was finished by two spacer rows with thickness of 0,32 m. each. After stacking of spacer rows they installed cornices and filled by concrete the bottoms emptiness between cornices with spacer rows. On spacer rows (through sauce) there were installed granite support stones. Empty space between under-truss stone and top part of a cornice was filled by concrete up to level of a bottom of the top part of a cornice. On this concrete there were installed overflow stones, having inclination of the top sides across axis of the bridge. In plan under-truss stones have two rectilinear sides, parallel an axis of the bridge, and two sides, cut on arch of a circle and contiguous directly to top part of a metal cornice.

The thickness of a stone ring masonry of columns was chosen from condition of immersing of a column on given depth under action of own weight rubble masonries and metal plating.

After shown account in project a conclusion was made, that immersing of a column up to effective depth cannot be provided only by scooping out ground. For immersing of columns on last 4,25 m. it was necessary to resort to artificial downturn of horizon of water inside well about on 5,3 m. with help pumping by the centrifugal pump, to cause a movement of water along outside surface of a column and to reduce friction of the plating about ground.

In design materials there is also given the effective substantiation of depth of immersing of columns of intermediate support, proceeding from minimum possible erosion . The size (effective) of erosion was accepted basing on the results of observations of maximum erosion at one of columns of a pier Nr. 22, which had been noticed in June 10 1900.

For pier # 22 the following parameters were calculated:

Weight of a underwater masonry of a column is 2387,0 kN (14922 poods)

Weight of a surface masonry is 688,0 kN (4302 poods)

Weight of the metal plating - 285,0 kN (1782 pood)

Gross Weight of a column V = of 3361,0 kN (21006 poods).

During pass of the highest waters in 1901 the depth of the basis relatively the bottom was h_1= 5,33 m.. For this case in design materials there was determined factor equal to:

$$m_1 = h_1 / h_2 = 1{,}91$$

In design materials there is given rather detailed description of manufacture of work for construction of intermediate supports. Their dipping was made from wooden stagings, based on a double piling . The dipping of both columns of one pier was carried out alternately by one excavator. In the beginning of work the dipping of columns was carried out by the steam Kekerill crane. Further on it appeared more conveniently and more safely to work with steam crabs, placed outside of stagings on separate platforms.

For digging out ground when dipping columns there was applied an excavator (two-jaws grab) of the Bull' system manufactured in Pristman factory in England.

When conducting the work the elevating chanes of a grab were some times broken off, that slowed down a course of dipping.

Each column was suspended to stagings with the help of four or six special chains, the regulation of which was carried out by elevating screws. The chains consist of separate demountable parts, length of which was equal to length of the screw.

When dipping of a column they carefully monitored uniform tension of all the chains.

When immersing. columns an excavator made up to 400 rises per day and could return up to 39 m^3 of rocks. The work by an excavator were conducted alternately on two columns. Under normal conditions in a day it was possible to lower both columns up to 1,6 m..

As a ground was excavated from column there was its dipping, and pendant chains stretched. With the help of an elevating screw column was lowered before easing of chains. After each dipping they determined position of a column in plan (with help four plumbs) and its deviation from vertical axis (with help of a level). For correction of columns when dipping they used stone counterbalances, jacks and spacers or regulation of a tension of pendant chains. After dipping of a column on 8 10 m. correction already was not required. The further dipping was carried out without pendant chains.

When the top of a ring masonry of a column reached on 0,4 m. horizon of water, further dipping of a column had been stopped, and excavator was moved for dipping of other column. On first column they put the following part of the steel plating and filled it by ring rubble masonry, which was conducted by 8 Italian masons. From internal side the masonry was limited by iron riveted former, the outside diameter of which was equal to a diameter of a column well. The former was suspended on drafts to runs of stagings at such height, that its bottom always was 1,0 m. below the surface of a ring masonry at the moment of escalating of a new link of the plating. Space from top of a former up to bottom of runs of stagings was covered by roofing iron, that served protection to masons at fulfilment of a ring masonry in operating time of an excavator.

At rise a grab shocked masonry and could destroy it. For protection of a masonry it was protected from within by the plating of sheet iron 1,2 mm thick. At the end of dipping of poles this plating was partially removed and rosen upwards, grasped by excavator. Partially this plating was removed after filling of the well on half of the depth and downturn of water horizon in the well with the help of centrifugal pump. It was done for maintenance of strong tie of a masonry with concrete. At erection of a ring masonry before termination of dipping of columns they used cement solution with ratio of cement. and sand 1:3. In surface part for stone masonry applied a solution with ratio 1:4.

When passing a knife of columns through layers of clays the dipping was much slowed down. In this case they applied a grab with teeth; increased speed of dipping of a grab, previously loosened ground with bit.

At dipping of columns of support ## 13 and 19 when passing f layers of clay they have applied blasting ground with help powder cartridges. Similar work have been carried out at dipping of columns of supports ## 17, 22, 23, 24, with the help of pyroxyline.

In [8] there are given the diagrams of a course of work when dipping piers ## 2 and 20. The columns of a pier # 2 were lowered from November 11 to December 18 1899, column of a pier # 20 from the 6th to 24th of March 1900 .

Simultaneously with dipping of columns separately they carried out assembly and riveting of two bottom parts of a surface part of a pier. After dipping of underwater parts up to necessary marks axial lines of a support were restored and careful measurement of distance up to next support (average effective temperature was accepted as 16 " C). The assembled parts of a surface part were installed on ring platforms of a surface part at first approximately, and then them levelled with help of metal wedges, laid under the bottom shels of the bottom angle irons of a surface part. After dipping of columns up to proper marks wells of columns were filled by concrete. The mix for concrete was prepared separately and in ready form moved to place of work. River grey sand from top part of layers of a ground, lifted by an excavator at dipping of columns was used.The dry mix of cement. and sand relating 1: 4 was mixed with washed out crushed stone and further on moved in so-called concrete mixers, with help of which the concrete was dippen in a well. They applied two kinds of concrete mixers: wooden and rectangular having capacity of 0,3 m^3 with unlockable bottom, and metal overturning ones. The concrete mixers were lowered in well with the help of manual or steam crabs. Unlocking of bottom or overturning of concrete mixers was carried out on given depth automatically with help of a cord. For complete filling of one well it was required 3 days of continuous work.

When constructing piers the following materials were applied. The steels parts of columns for twenty piers were delivered by Bryansk factories, for three piers by a Rudsky&C° factory in Warsaw and for one pier by a Nikopol'-Mariulol factory.

Rubble stone for masonry inside columns was extracted from quarry at Ziadin station in 230 kms. from Chardzhou (towards Samarkand). rock of stone is marble-like limestone. The extraction of stone was carried out by an explosive method. The stone passed test in Mechanical laboratory of Institute of the Engineers of Ways of Communication.

The piece stone for under-trusses and overflows was brought from vicinities of city of Samarkand. The rock of stone is similar to Serdobolsk granite, has large hardness and uniform structure.

The Portland-cement. for rubble and concrete masonry was delivered exclusively by factories of Society of Gluhoozersk factories in Вольске. All parties(sets) of cement. passed tests on rules of Ministry of Ways of the Communication.

The sand for rubble masonries was extracted when removing ground, at dipping of columns of supports.

The abutments of the bridge have a design of a separate type. The top part of abutments leans on common bases, carried out in a kind of so-called cards of caissons. The dipping of caissons of both abutments was carried out with help digging off ground by 8 excavators through eight rectangular well, taking place through ceiling of each caisson.

The internal space of caisson is divided on 8 well with the help of one longitudinal and three cross beams, located above the knife of a caisson on 97 cm . The metal plating of a caisson has thickness 3,2 mm (1/8 of inch) and is strengthened by fishplates.

For dipping of open caissons of the abutments special stagings, consisting of eight double wooden trusses were arranged. After assembly of a caisson it was suspended on 22 chains, attached to the top parts of cross beams and to angular arms of lateral walls. The dipping of a caisson was adjusted by the elevating screw.

Rubble masonry was carried out in space between wells and of them along perimeter of a caisson. They began masonry, when the bottoms edges of ceilings between wells reached water. After certain deepening of caissons in ground further supporting of them on chains was not required, as the dipping proceeded without appreciable deviations from vertical.

In accordance with dipping of caissons, their metal parts were increased; a rubble masonry was erected. Composition of cement solution for masonry had ratio 1:3.

Concreting of wells of open caissons of the abutments was carried out according to the same technology, as for well of piers. The concreting was carried out similtaneously in four wells. Two pairs of extreme wells along axis of the bridge had been concreted up to top, as on them futher on there were erected surface parts of the abutments. Middle wells were filled partially by concrete and partially by sand.

The top part of the abutments consists of two parts: of a supporting wall and pier. Between them a longitudinal wall is arranged, which blocks water flow between pier of the abutments and cone of embankment.

The surface part of the abutments was erected from rubble stone using cement solution with ratio 1:4. From outside side rubble masonry was covered with cut grey granite stone. Seams were pointed with cement. with admixture of dutch soot. The general view of a pier is shown.

On fig. 1.21 the diagram of a structure of intermediate supports and abutments of the bridge across Amu-Daria is shown, where main phases of work are outlined. First columns of a support # 9 were lowered, for that columns of support ## 10, 11, 13 were consistently lowered. Further many columns of support were lowered practically simultaneously the last were lowered in March 1900 - columns of support № № 20 - 24.

1.2. BRIEF INFORMATION ABOUT RESULTS OF PREVIOUS INSPECTIONS OF THE BRIDGE DURING ITS OPERATION

During the whole period of operation the bridge was repeatedly surveyed by various organizations. There are the information, that before Great Patriotic War the bridge was surveyed at least once - in 1928 by Saratov bridge-testing station. It was not possible to find the results of this work.

In post-war period the bridge was surveyed rather regularly. The first of such inspections was lead in 1947 bridge-testing station of Novosibirsk Institute of the Engineers of Railway Transport. The inspection was accompanied by detailed geophysical measurements. There was performed a binding head-bands and under-truss stones of all supports of the bridge in plan and in profile. In the report of NIERT of 1947 the following main damages of span structures and supports were marked:

- Extension of metal in riveted elements of through main trusses;

- Corrosion of elements of the brigge road;

- Curvature of elements of main trusses and connecting lattice;

- Weak top longitudinal ties between main trusses;

- Corrosion of ties between poles of supports in the level of change of horizon of water (reduction of thickness of shelves of separate angle irons of ties up to 60 %).

In 1951 Saratov bridge-testing station has noted the following damages:

- Corrosion of the plating of support: thickness of the plating is δ = 12,7 mm. in some separate sites it has decreased as an average on 3 - 4 mm.;

- Rusting of metal in cracks between separate parts of sections of elements of main trusses in consequence of a large step between binding rivets, but also in attachments of connecting lattice;

- Failures in maintenance of bridge-floor ;

- Frustration of rivets in attachment of longitudinal beams to cross beams.

In 1952 Bridge-investigating Diving Station of the CP MPS has carried out inspection of underwater and surface parts of the bridge supports. In appropriate report it was marked, that the waterway of the river is not constant, in current 8 - 10 years it keeps moving from one coast to other. In 1937 the waterway was at right coast, in 1942 - 45 years - at left-hand. During inspection a waterway passed at the middle of the river.

During underwater inspection support № № 14, 15, 16, 17, 22, 23, 24 were examined. Were revealed leaky tighted rivets in joint fishplates of the plating. It was marked, that rusting of underwater part of support has a kind of sinders, separated by plates 3 4 mm thick. Oxidation occurs mainly in fodder part of columns, where there is the least speed of current of water.

Breaks bridge covers, but also weak rivets in underwater part of support is found out was not.

At inspection of a surface part of support there was carried out knocking of metal covers with sledge hammer. Thus backlog of cover from masonry was found out in 253 places. Maximum backlog by the area of 6,5 mm are revealed on support #24. Was made 14 notches in covers of supports ## 9, and, 13, 16 and 23. The notches were done in all four stages of a surface part of columns in places of backlog of the cover from masonry, in places of occurrence rusty spots and through holes. Opening of columns has shown, that in places leaky пВилегания the backlash reaches 5 mm. It was also revealed, that in first stage of an over-foundation part of masonry is not concrete, but rubble with cement a solution. * Rubble stone of the masonry is marble-like lime-stone of satisfactory durability. Cement solution was crumbling at average impact of a hammer. The masonry was in satisfactory condition, though there were the emptiness of volume up to 2000 cm^3, and a diprod penetrated into emptiness on depth up to 43 cm.

In conclusion upon the results of inspection the Diving Station has given the following recommendations:

- To cut out the plating in zones of emptiness and to clean dust were available;

- To fill with plastic concrete emptiness in rubble masonry;

- To deliver on place of notches metal fishplates on welded seams;

- To paint a surface part of support not less often than once in five years;

- To monitor condition of under-truss platforms;

- To carry out injection of cement solution in emptiness of a masonry;

- To replace all rusty bottom ties between columns.

In 1952 under the orders of MPS there was lead inspection of hydro-geological conditions in place of the bridge crossing. In materials of inspection there is specified, that a zone of possible wandering of channel is about 3 times more than size of an openning of the bridge. Therefore the struggle against opportunity of bypass of the bridge by the river began at once after end of construction.

In materials under review the brief geological characteristic of the region of the crossing is given. Is specified, that долина of the river is formed by alluvial deposits, underlaid by hard tertiary rocks. The hard rocks are exposed on surface only on right side and they are almost not being erosed. On left-hand coast the exposure of hard rocks is is absent. The tertiary deposits are presented by dense sandy clays, and bycemented grey and yellow sands.

In data of 1952 on the regime of the river high rigidity of water in view of presence of sulfuric anhydride and sodium chlorine is marked. The charge of water in 1950 made 2225 5196 m^3 /sec. The process of erosion is as an average compensated by silting of ground.

On same data, maximum erosion under bridge was observed in 1919 at support № 19. The whirlpool with a diameter about 200 m. with centre in support # 19 for one night erosed to depth of 22,4 m., thus only 0,76 m remained up to mark of a support bottom.. In result of erosion the upper column of support # 19 has given a setting of 53 mm and roll of 77 mm. On the under-toss platform the horizontal deviation reached 336 mm. The lower column has received the same roll, but there was not any setting. The movement of trains had been interrupted, the liquidation of erosion was conducted during three days by a continuous load of rubble stone in a volume of 1850 m^3.

The practice of water of struggle during first 50 years of operation has established a compulsory load at eroded supports, when their deepening in ground becomes less than 11,0 meters. The dipping of gabions will be carried out directly from the bridge, as a rule, up to level of lowest waters and is higher on. It was marked, that during 50 years there had been poured a huge amount of a stone, the large part of which is broaught away by flow and is not saved.

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* During construction the concreting of a underwater part of columns was carried out up to level, on which there was the water in river in operating time (see section 1.1 of the present report).

In conclusions on given materials there is specified, that the openning of the bridge does not work on 40 % and can be reduced, and influence of this reduction owes be appreciated experimentally. It is recommended to continue designing and construction of regulating structures and dams for protection of Chardzhou. There also was made as a conclusion that it would be expedient to construct the bridge of the second track at the top side from existing one.

In 1953 Transmostproekt has developed the detailed design for capital reconstruction of crossing bridge across Amu-Daria. In this connection they carried out at support # 11 and 19 drilling by means of a hand- power percussion-rotary complete set with purpose to reveal presence of a rock fill at support. All 12 bore holes (6 for each support) have shown presence of a stone at the depth of 10 meters from the edge of foundation parts of support, that has confirmed preservation rock fills.

In the same 1953 Bridge Design Bureau of CP MPS has developed the detailed design on repair and strengthening of the bridge across Amu-Daria. In appropriate materials there are the results of geodetic surveys of the span structure # 11, building rise at which was 50 mm. for right truss, and 63 mm for left-hand one.

In same design order of the Bridge Design Bureau the data on turning loads н and modes of operation of the bridge had shown, that starting with 1952 traffic along the bridge has sharply increased. In 1953 ther was introduced a load from 2 oil engin locomotives and cars and pressure intensity 7,2 tc/m. In that time there also circulated trains with steam locomotives of the CO serie.

In 1959 the bridge was surveyed by Moscow Bridge-Testing Station of CP MPS. In appropriate report there was indicated that up to the moment there had been conducted strengthening of spacers of a connecting lattice with the help of angle irons,.strengthening of a connecting lattice of the top chords also with the help of angle irons, strengthening of the top longitudinal ties between trusses, reconstruction of portals. It was marked, that to the moment of inspection (1959) repair and painting of all the supports had been completed. The repair consisted of cementation of separate support, repair of cross ties of supports and installation inspection traps between separate poles of supports. In report the recommendation is given to remove rail levelling devices, installed at every other span.

In 1966 the LJBK of MIIT experts surveyed and partially tested span structure of the bridge. In data about history of the bridge (report of MIIT of 1966) there was specified, that to that time span structures had been stregthen 3 times. In 1937 -

1942 cross beams were strengthened by addition of two horizontal sheets, voterens were replaced for bridge bars. In 1955 - 58 a connecting lattice of the top chords and angle braces was strengthened, there was strengthened attachment of elements in 3`- 4` to units 3`, connections between trusses were strengthened, there were performe a work for increase of a dimension under 2-C , plenty of weak rivets in attachments B and P were reriveted. In 1965 when installing consoles of a line of electrotransmission the top chords of main trusses in edge panels were strengthened by two horizontal sheets.

In the report there is marked, that in 1966 during a pass of the train an excavator cantilever had damaged "axes" in attachment of cross beams to units of main trusses.

In report of DZHEK MIIT there was marked, that main damage of main trusses of span structures to 1966 was beginning mass frustration of rivets in attachments of angle braces B5` - 6` and B8` - 9` to top units. During inspection there was found out 169 weak rivets in first lines of attachments. There was marked a beginning of work of separate riveted joints (rivets) in the III stage with substantial growth of factor of concentration of tension at rivet opennings.There were no cracks in these units , but their occurrence was predicted in nearest (after 1966) future. The endurance class of these angle braces was determined equal 4,66 with load class - 4,70 (TEZ + 7,2 ts / m).

Main damage of the bridge road in that time was frustration of rivets in attachment of longitudinal beams to cross beams (in walls P), observed already for a long time. It was marked, that in 1955-57 many weak rivets and 155 high-strength bolts had been reriveted. Cracks in the horizontal shels of the top chord angle irons of longitudinal beams and were found out also in separate profiles of attachment of ties to these beams.

During the tests tensions in angle brace B8 - 9` of a right truss span structure № 1 were measured. At trains taking place they have not exceeded 610 kg/cm^2 from temporary load). According to the MIIT data dynamic factor for main trusses in case of oil engin locomotive traction has made $(1 + \mu) = 1{,}07$.

MIIT had also carried out test of unit of attachment of a longitudinal beam to a cross beam. Axial tensions(efforts) in assembly rivets and high-strength bolts were measured. There was made a conclusion, that mode of operations of bolts with axial tension 15,0 tn was better, than with tension 20,0 tn.. It was recommended in lines 1, 2, 6, 7 and 8 attachments of longitudinal beams to make tightening of bolts to the effort of 15,0 tn , in other lines to 20,0 tn.. In result of work of MIIT in 1966 the conclusions were made that span structures provide the passing of all the loads (trains with oil engin locomotives TEZ, steam engin locomotives E and L), circulating along the bridge in that time , without restriction of speed. The danger of mass frustration of rivets in attachments of angle braces 5 " - 6 was also specified .

It was recommended in nearest years to carry out strengthening of attachments of longitudinal beams to cross beams with maintenance of transfer of bending moment through fishes and other constructive elements, to strengthen longitudinal beams by horizontal sheets, to carry out strengthening of angle braces B5`- 6 and B8- 9` on endurance and durability. As urgent measures it was recommended to replace weak rivets of first two rows of attachment of angle braces B5` - 6 and B8 - 9` by high-strength bolts as in top and in bottom units, but also to replace weak rivets with high-strength bolts in attachment of longitudinal beams to cross beams (1, 2, 6, 7, 8 rows - with tension of 15,0 tn., other - of 20,0 tn.).

In 1980 Kiev Bridge Station of CP MPS had inspected the bridge. In appropriate report when describing of general data there is specified, that after washout in 1919 of support # 19, the basic parts were moved on the distance of displacement of a pier (33 cm) not only on this support but also on support # 18 on distance 11,5 cm.

During inspection of 1980 on the bridge strengthening of longitudinal beams of bridge road was finished. It was marked, that the work of strengthening of longitudinal beams had been performed with law quality, there is the plenty of (weak) rivets, on each span structure (from 30 up to 100 rivets) .

In the results of inspection there were marked cracks in seams between stones of covering of the abutments and corrosion of the plating of piers in level of variable horizon of water.

During 1984 the bridge was jointly inspected by Tashkent Bridge Station and Repair - Investigation Diving Station of CP MPS.

In the conclusion of Tashkent Bridge-Testing Station there is shown the presence of "blind" joints in right rail string at 1=0°C , loosing of leaning of rails on rail chair and pollution of ballast on approaches.

They has marked in supports of the bridge, in joints between columns and foundation the part formation of a niche, with depth up to 70 cm (on support №

23). During inspection of the bridge in 1984 works on repair of support under project of Giprotransput » were carried out. At the top side of supports # # 18 - 24 under this project there were arranged the chords of reinforced concrete.

At level of variable horizon of water strong corrosion of the plating and angle irons of tie between columns of support was marked.

In span structures Tashkent Bridge Station has revealed the following damages:

- Holes and cracks in top chord angle irons of longitudinal beams (all cracks are blocked by angle fishplates *;

- Cracks in top chord angle irons of longitudinal beams in panel 1-2 span structure № 4, not blocked by fishplates;

- Weak rivets on attachment of chord sheets of longitudinal beams;

- Swelling, corrosion, absence of rivets in profiles of ties of attachment of ties between longitudinal beams;

- The cracks in bottom chord angle irons of extreme cross beams (are blocked by angle fishplates);

- Local corrosion of horizontal sheets of the bottom chords of main trusses;

- Swelling in separate attachments of angle braces and racks to chords of trusses.

In the materials under review there are given the same classes of basic parts according to data of "Giprotransput" of 1974. The least rolls (K=6,1) have the least class. This class is the least for the bridge.

As a result there was made a conclusion about opportunity of passing of all the loads without restriction of speed. There is the list of measures on elimination of damages in span structures.

In conclusion of Diving Station of CP MPS 1984 there is no estimation of a condition of a underwater part of supports itself. The main attention here was paid to a condition of joints of a underwater and surface part. It is specified, that in view of leaky leaning of surface parts of covers (through levelling wedges) there began intensive destruction of concrete in zone of joints.

February 14 1984 there was made a notch in metal cover of a support # 24. It was found out, that inside top cover with diameter of 2,6 m. there is one more cover with diameter of 2,0 m., going in foundation part and densely attached by a horizontal ring sheet to the foundation cover in the cut level. Thickness of a wall of an internal cover is about 5 mm., and behind it there is the dense not destroyed concrete. Between covers (in place of the notch) there was found a dense mix of crushed stone with silty sand and traces of cement.. This layer is 1,0 m high above the edge of foundation parts, and above it there is concrete, passing to rubble masonry .

On the basis of conducted opening of the support # 24 there was made a conclusion that the executive documentation does not correspond to the reality, since the builders, have ostensibly changed a design of a support, without reflecting it in design materials. It is assumed, that due to internal metal cover, the destruction of a masonry on large depth could not take place, and inside support there is the pole of strong concrete with a diameter about 2,0 m.. In the same 1984 Bridge Faculty of Novosibirsk Institute of Engineers of Railway Transport has given the conclusion about condition of joints between surface and underwater parts of supports of the bridge. In this conclusion there was marked that for the first time backlashes in joints were found out in 1951-52 Their width was 1-7 and depth 4 - 10 cm.

During the inspection of joints of supports ## 18 and 19 NIERT experts have found out damages of joints to the depth of more than 30 cm. The assumption was stated, that the depth of destruction of joints is limited basically, by the width of a ring platform on the top side of columns.

Table 1.6

MAXIMAL DEPTHES NEAR SUPPORTS DURING OPERATION PERIOD

Support	3	10	16	17	19	21	24
Year	1908	1911	1934	1934	1919	1969	1973
Depth,m	19.2	18	17	17	22	19	21

Table 1.7

MEASUREMENTS OF DEPTH FOR APRIL 1990

Date	Abutement	24	23	22	21	20	4	3	2	1	Abutement
1.04	0.6	4.1	4.7	4.9	3.8	4.3		0.5			0.5
10.04	0.4	3.5	4.5	4.6	3.6	4		0.3			0.3
17.04	5.3	4	5.7	6.7	6.4	5.3	0.4	1	0.4	0.4	1

II. - RESULTS OF INSPECTION OF BRIDGE

II.1. GENERAL INFORMATION

During 1990 - 91 group of the employees of `Bridges` and laboratory of bridge constructions of MIIT made inspections of all designs of the bridge. Conducting of inspections preceded by detailed study of the engineering specifications for the bridge.

The primary inspection had been carried out in April 1990 and according to its results section of the preliminary conclusion was made. Repeated inspection was carried out in April and October 1991 During the inspection there were in details examined span structures, supports and basic parts, bridge floor of a design of consoles, line of electrotransmission), design of rolloing ways of inspection катания carriage; geodetic shootings of a longitudinal structure of the bridge are lead. For estimation of chemical structure of metal, its mechanical characteristics with the purpose of reception of specified effective parameters from a number of elements of span tests of metal were taken.

During the inspection of support on support 9 and 10 notches in plating of underwater and surface parts were made with the purpose of estimation of quality and durability of a masonry, determination of quality of metal of the plating, degree of its damage by corrosion, specification of the design.

Below in the present chapter results of all inspections are in detail stated, systematized and submitted in form of tables of damages, having large repeatability.

II.2. RESULTS OF INSPECTION OF SPAN STRUCTURES

II.2.1. RESULTS OF INSPECTION OF MAIN TRUSSES OF CHANNEL SPAN STRUCTURES

In result of inspection the following damages were found out:

1. Weak rivets attachment, mainly of long-drawn angle braces and supports to top units of trusses.

2. Frustration of rivets and tear off of their heads in attachments of elements of a connecting lattice between branches of angle braces and racks (suspension) of main trusses - on all without exception span structures. Except clearly expressed easing of rivets, the signs of their frustration are also rust circles, cracks in layer of a paint around of the heads and flows of a rust from under rods. The list of found out frustration of rivets is shown in Table 2.1.; Thus, in the table quantity of weak rivets and rivets with teared off heads in each branch of elements of all span structures are specified separately. Except frustration specified in the table, there was found out, one rivet with teared off head in attachment of a filling lattice of spacer between top units 4` on SS № 19

3. On all the span structures many rivets, the attachment of connecting rods in units between branches mainly of compressed angle braces are replaced with bolts, that testifies to mass frustration of these rivets having place early. The list of elements and quantity of rivets replaced with bolts are shown in Table 2.2.

4. In attachment of separate suspensions and angle braces of the main trusses to top units there are the rivets with defective heads: not formed, moved from their axis, connecting by part of surface of joining places and etc. Defects of heads of rivets - are of building origin, however their presence can promote frustration of attachment (easing of rivets, tears off of heads). The list of places, where defective rivets are found out, is given in Table 2.3..

5. On majority of span structures corrosion damages are as follows:

- Corrosion and extention of separate rods, uniting branches of angle braces;

- Spot corrosion and swelling of connecting rods of the bottom chords (so on SS # 1- at H12 - 13 of the left-hand truss corrosion makes up to 10 % of of a rod section; On SS 4 - at HO1; H12 - 13; H13 - 14 of the left-hand truss);

- The corrosion of heads of connecting rivets of horizontal places inside boxes (headers?) of the bottom chords, caused by stagnation of water due to choking or absence of drainage opennings (so on SS # 2 in panels H 8 - 9 - 10 - of the left-hand truss drainage opennings are absent, water becomes stale, 40 - 70 % of rivets heads have corrosion up to 10 %; on SS № 7 in HZ - 4 of left-hand trusses 50 % of rivets have the corrosion of 5 - 10 %);

- Swelling between connecting shels of angle irons of suspensions near bottom chords of trusses;

- Swelling of central profiles in top units of trusses in places of abutting to them mainly of long-drawn angle braces B 3 ` - 4; B 10 - 11' (so, on the SS № № 1 - 4 this phenomenon is expressed best of all);

- Swelling between bottom chords of cross beams and profiles of longitudinal ties of the main trusses.

6. In some elements of the bottom chords there take place swelling of vertical sheets from their plane. This phenomenon is expressed most of al on the SS # 5 in H8 - 9 of the left-hand trusses, where an outside sheet has a bend with length of 60 cm with arrow of 3 cm.

7. Some elements of main trusses and elements of a connecting lattice have curvatures:

- On the SS # 3 S7` - 7 of right trusses there is curvature (corner 3 - 4 `) near top unit on distance of 1 m. from profile;

- On the SS # 7 two top elements of a connecting lattice B 1` - 2 of right trusses are curved with an arrow of 7 cm, two bottom connecting plates C9 ` - 9 of right trusses are curved downwards;

- Deflection of filling rods in details of cross ties between trusses: on the SS № 2 in unit 7 (fourth cross from above); on the SS # 20 in unit 5 (third cross from above);

- On the SS № 6 the angle brace B2 - 3 ` of a left-hand truss has a curvature towards an axis of span structures with an arrow f_{max} = 19 mm.;

- On the SS # 7 angle braces B6 - 7 ` of a right truss has a curvature towards an axis of span structures with an arrow $f_{max}$ = 19 mm.; and angle brace B9 ` - 10 of left-hand truss with an arrow of f_{max} = 11 mm..

Table 2.1

WEAK RIVETS AND RIVETS WITH TORN OFF HEADS IN ATTACHMENTS OF CONNECTING LATTICE

Span Structure #	Elements and Quantity of Frustrated Rivets			
	Left Truss		Right Truss	
	Internal branch	External branch	Internal branch	External branch
1	2	3	4	5
1	B1`-2-2	B12-13`-1	B10-11`-1 (Head tear-off)	
2	B12-13`-2			
3	B3`-4-1		B10-11`-2	
4		B10`-11-1	B10`-11-1 B12-13`-2	
5	B3`-4-1			
6	B3`-4-1	B10-11`-1 B12-13`-2		B12-13`-1
7	B1`-2-2			
8	B10-11`-1			B1`-2-1 B8-9`-1
9			B3`-4-1 B10-11'-2 B12-13'-1	
10		B8-9'-1 B10-11'-1	B3'-4-1 B5'-6-1	B12-13'-1
11	Bl'-2-1 B8-9'-1	-	-	B12-13'-3
12	B12-13'-1 B2-3`-1(absent)	-	B3'-4-1	-
13	B3'-4-1 (Head tear-off)	Bl'-2-2 B 12-13'-2	B1'-2-1	-
14		B12-13'-1	-	B1'-2-1 B10-11'-1 B12'-13'-1
15	B10-11'-2	-	-	Bl'-2-1
16	Bl'-2-1 B12-13'-1	-	B1'-2-1 B12-13'-1 B9'-10-1(abs.)	B12-13'-1
17	BO-1'-1	B1'-2-1 B9'-10-1(abs)	B3'-4-1	
18	B10-11'-1	B1'-2-1	Bl'-2-1	C11'-11-1
19	C12'-12-1	B1'-2-1	- _	-

1	2	3	4	5
20	Bl'-2-1 B12-13'-1	B1'-2-1 B3'-4-1	-	-
21	. B10-11'-1 B12-13'-1	B1'-2-1 B3'-4-1 B10-11'-1 BO-1'-1	Bl'-2-2	B3'-4-1
22	B1'-2-1	-	-	B10-11-1 B12-13'-1
23	B3'-4-2 B10-11'-1	C1'-1-1 B1'-2-1 B3'-4-1 B12-13'-1	BS'-6-2 B10-11'-1	B1'-2-2 B5'-6-1
24		-	B8-9`-1	.
25	B3'-4-1 B8-9'-1	-	B5'-6-1 B10-11'-1 B12-13'-1	BO-1'-1 Bl'-2-1 B3'-4-1 B5'-6-1

Table 2.2.

INFORMATION ABOUT REPLACEMENT OF WEAK RIVETS BY BOLTS IN ATTACHMENTS OF CONNECTING PLANKS IN ANGLE BRACES OF MAIN TRUSSES

Span Structure ##	Truss	Quantity of replaced rivets in angle braces					
		B2-3'	B4-5'	B6-7'	B7'-8	B9'-10	B11'-12
1	2	3	4	5	8	7	8
1	Left - .		2	2	1	2	
	Right		1	1	1	2	-
2	Left		2	1	2	2	
	Right	-	2	2	1	1	-
3	Left		1	2		1	2
	Right	1	-	-	2	1	
4	Left		2	2	1	2	
	Right	-	2	1	2	2	-
5	Left -		2	1	1	3	
	Right	-	3	1	1	3	-
6	Left -	-	3	3	3		
	Right	-	3	3	2		-
7	Left -		3	2	2	2	1
	Right	-	3	3	2	3	1
8	Left -		2	1	1	1	
	Right		2	1	1	2	
9	Left	-	2	1	1	2	
	Right	1	2	1	1	2	
10	Left		2	1	1		
	Right	-	2	2	2	2	
11	Left		2	2	2	2	_
	Right	-	2	1	1	1	
12	Left		2	2	2	2	1
	Right	-	3	3	2	3	-
13	Left	1	3	1	1	3	1
	Right	1	3	1	2	2	1
14	Left		3	1	1	1	
	Right		3	1	2	3	
15	Left		1	1	1	1	
	Right		3	1	1		2

1	2	3	4	5	8	7	8
16	Left	-	-	1	1	1	-
	Right	1	1	1	-	1	1
17	Left	-	1	1	-	1	1
	Right	-	2	-	1	2	1
18	Left	-	2	2	2	2	1
	Right	-	3	3	2	2	1
19	Left	1	3	-	-	2	1
	Right	1	3	2	2	3	1
20	Left .	1	3	2	2	3	1
	Right	-	3	1	2	3	1
21	Left	1	3	2	2	2	1
	Right	-	3	2	2	3	1
22	Left	1	2	2	2	3	1
	Right	1	4	2	3	3	2
23	Left	2	2	2	2	3	1
	Right	1	4	2	2	3	1
24	Left	1	3	1	1	3	-
	Right	1	3	1	1	3	2
25	Left	1	1	2	1	1	-
	Right	1	1	2	2	2	1

Table 2.3.

RIVETS WITH DEFECTS IN ATTACHMENTS OF MAIN TRUSSES TO TOP UNITS

Span Structure ##	Truss	Element	Branch	Quantity	Outside or inside
1	2	3	4	5	6
10	Left -	C 7' - 7	Internal	2	Inside
	Left -	C 11' -11	Internal	4	Inside
.	Left -	C 3' - 3	Internal	1	Inside
11	Left	C 11' -11	External	1	Inside
	Left	B 5' - 6	External	1	Inside
12	Left	C 7' - 7	Internal	1	
	Left	C 7' - 7	External	1	Inside
	Left	C 9' - 9	Internal	1	and
	Right	C 7' - 7	Internal	1	Outside
13	Left	B 3' - 4	External	2	Inside
14	Left -	C 9' - 4	Internal	1	Inside
	Left -	C 11' -11	Internal	1	Inside
15	Left -	C 9' - 9	External	1	Inside
	Left -	C 9' - 9	Internal	1	Inside
	Left -	C 11' -11	Internal	1	Inside
18	Left -	C 7' - 7	Internal	2	Inside
20	Left -	B 8 - 9`	Internal	4	
	Left	C 9' - 9	Internal	3	
	Left	B 9` - 10	Internal	1	
	Right	C5` - 5	Internal	1	
	Right	C 9' - 9	Internal	2	
22	Right	C 7' - 7	External	1	Inside
24	Left	C5` - 5	External	1	
25	Left	C5` - 5	Internal	1	Inside
	Left	C 9' - 9	Internal	1	

II.2.2. RESULT OF INSPECTION OF BRIDGE ROAD OF CHANNEL SPAN STRUCTURES

Inspection of the bridge road have come to outlight defects and damages of:

- Longitudinal and cross beams;

- Ties between beams and rivets of their attachment;

- "Fishes" and rivets attachment B to P;

- Structures of rolling track for inspection carriage. More over there was fixed quantity and location of elements of strengthening of the bridge road structures, as:

- High-strength bolts in attachments, delivered instead of rivets;

- Presence of overlapping of cracks and holes in beams.

In result of inspection the following damages were found out:

1. Holes under bridge bars in horizontal shelves of the top chord angle irons of longitudinal beams. In total on all the span structures there is found out 13 holes , located mainly outside angle irons beams . 12 of them are overlapped by angle fishplates with atachment of the last by high-strength bolts (in 11 cases) and rivets (in one case), and one - in right B2 - 3 on SS # 16 is not overlapped (Fig.2.1.) evidently all holes had been formed, yet before strengthening of longitudinal beams by the top horizontal sheet. In Table 2.4. Data about the location were available holes and a character of their overlapping are shown.

Table 2.4

INFORMATION ABOUT HOLES IN CHORDE SECTIONS
OF LONGITUDINAL BEAMS

Span Structures ##	Longitudal beam	Panel	Branch	Position along the panel, counting from the beginning	Caracter of the overlapping and number of fixing boltes in B - chorde
1	Right	2 .- 3.	External	1./4	Angle iron
	Left	4.- 5	External	1./2	Angle iron
	Left	5. - 6	External	1./5	Angle iron,6 HSB
	Right	7. - 8	External	1./4	Angle iron,5 HSB
3	Left	2. - 3	External	3./4	Angle iron,9HSB
4	Left	4.- 5	External	1./3	Angle iron,5 rivets
8	Left	10. - 11	Internal	1./4	Angle iron,5 HSB
9	Left	4.- 5	External	1./2	Angle iron,8 HSB
	Left	8. - 9	External	3./4	Angle iron,6 HSB
	Left	9. - 10	External	3./4	Angle iron,6 HSB
12	Right	2 .- 3.	External	near P2	Angle iron,5 HSB
13	Right	0 - 1	Internal	1./3	Angle iron,5HSB
16	Right	2 .- 3.	External	2./3	Not overlapped

2. Cross fatigue cracks in horizontal shelves of the bottom chord angle irons of cross beams near their attachments to main trusses (Fig.2.2.). The cracks arise at edge of a shelf and are distributed to head of an angle iron. All cracks are located at edge of profiles of longitudinal ties of main trusses, where in structure of section of the bottom chord of a cross beam there are only the angle irons, since the horizontal sheet is broken off directly before profile. Thus in this zone the moment of resistance of a chord in horizontal direction appear much less, than on connecting sites. Besides follows to note, that all found out cracks are located only in four cross beams nearest on both ends span structures. Namely in them there are the heaviest deformations (bending moments in horizontal plane) because of inclusion of beams of the bridge road in joint work with main trusses. Set of the specified factors with rather high cyclicity of change of tension results in occurrence of described cracks.

On all the span structures in last four cross beams (П 11, Л 12, Л 13, П 14) zones of formation of cracks notwithstanding of their presence or absence - are attached by angle by fishplates with attachment thereof by high-strength bolts (Fig.2.3.). In initial cross beams such strengthening is not present (at exception of П 1 on SS # 9, near left-hand truss from the side of panels 1 - 2).

Information about found out cracks in angle irons of cross beams is shown in Table 2.5.

Table 2.5

Span Structure ##	## of cross beams	Near which truss	Angle iron P from the side of panel	Lenrth of crack, mm	Mark of overlapping
1	2	3	4	5	6
1	P1	Right	1. -2	30	No
	P2	Right	2. - 3	30	No
8	P13	Right	13 - 14	*	Yes
9	P1	Left	1. - 2	*	Yes
	P12	Left	11. - 12	*	Yes
11	P12	Right	12. - 13	*	Yes
12	P14	Left	13 - 14	*	Yes
13	P0	Right	0 - 1	70	No
13	P1	Right	0 - 1	30(Fig.2.4.)	No
	P13	Right	12. - 13	*	Yes
	P14	Left	Cantilever	*	Yes
14	P11	Right	10. - 11	*	Yes
17	P13	Right	13 - 14	*	Yes
18	P0	Left	0 - 1	25	No
	P1	Left	0 - 1,1-2	60,40(Fig.2.	No
	P2	Right	2` - 3	60	No
	P3	Right	2. - 3	20	No
	P13	Left	13 - 14	*	Yes
	P14	Left,Right	13 - 14	*,*	Yes, yes
20	P13	Left	12. - 13	*	Yes
21	P0	Left	Cantilever	20	No
	P11	Right	10. - 11	*	Yes
	P14	Right	13 - 14	*	Yes
25	P13	Right	13 - 14	*	Yes

* Length of the crack was not measured, because it had been closed from the top by angle iron of oveerlapping

3. Cracks of the top "fishes" of attachments of longitudinal beams to crossbeams. All the cracks are found out in five "fishes" on three span structures they are located, as a rule, along chord of a cross beam from edges of rivet opennings of the first row of the attachment of fishes to chords of longitudinal beams on whole or part of width of a "fish".

On the SS # 21:

- In attachment of right B 11 - 12 to P 12 - the crack begins at the edge of an openning of the first row and leaves on the outside edge of the "fish" » (Fig.2.6.); on internal edge of a "fish" the cracks are not found out. Here has place a tear off of the head of the second rivet of attachment of a "fish" to the top chord B (Fig.2.6.).

- In attachment of the left-hand B 11 - 12 to P 12 - the crack dissects the "fish" along whole its width on the first row of rivet of opennings, in zone of formation of a crack there is also marked a strong corrosion of the "fish".

- In attachment of left-hand B 13 - 14 to Л 13 - crack is similar to the described above (Fig.2.6.) on SS # 23 - in attachment of the right B 1 - 2 to P 1 a crack begins from the edge of an openning of a rivet of the first row, crosses the "fish" along the whole width and leaves on its internal and outside edges. Thus, from internal side the crack leaves at the feather of a chord angle iron B opposite to the of a rivet attachment of the "fish" second from the P, and goes obliquelly under the small corner to feather of an angle iron up to internal edge of the "fish" . From outside side near a feather of the chord angle iron the crack bifurcates: one passes along the feather, other leaves on the edge of the "fish" near chord P.

On the SS # 25:

- In attachment of the right B 10 - 11 to P 11 - from outside side hanging down over the chord angle iron of an edge of the "fish" is cut off (fig.2.7.); from internal side - the crack leaves at the feather of an angle iron along chord P and finishs not reaching 4 cm up to an edge of the "fish".

4. Frustration (easing), tear off of heads, absence of rivets of attachment of "fishes" to the top chords of longitudinal beams:

- On SS № 21 in attachment of the right B 11 - 12 to P 12 - tear off of the head (from below) of a rivet of attachment the second from the P from outside side of B

(Fig.2.6.); precisely such the damage is marked on SS # 25 in attachment of the left-hand B0 - 1 to the P 1;

- On SS # 24 in attachment of the right and left-hand B 13 - 14 to P 14 inside and outsidethere are absent rivets the first from the P (total 4 p.); precisely such a picture has a place on SS № 25 in attachment of both B0 - 1 to P0;
- On SS № 25 in attachment of the left-hand B 11 - 12 to the P 11 from internal side there is weak rivet which is the third from the P and which simultaneously with the fish attaches yet a profile of longitudinal ties between B.

5. In attachments of longitudinal beams to cross beams many rivets both in the wall P, and in the wall B are replaced with high-strength bolts, the separate rivets have easings or tear off of heads.

Below there are shown the information about damaged and replaced rivets; thus the account of rivets begins from the bottom chord P including the rivets in a "table" .

There are the following damages of rivets in the B wall:

- On the SS # 4 in the attachment of the right B to P 6 from inside the fifth rivet the head is torn off (a bridge maintenance team immediately replaced this rivet with high-strength bolt);
- On the SS # 19 in attachments right B to the P12 and P 13 outside there are the sighns of easing of the 2d, 3d, and 4th rivets;
- on the SS # 22 in attachment of the right B to the P 11 outside there are the sighns of easing of the 3d rivet;

- on the SS # 23 in attachments of the right B outside to:

-P 2 - the fifth rivet has signs of easing (the next fourth rivet on HSB);

-P 11 - signs of easing of the 4-th, 5-th, 6-th rivets;

-P 12 - signs of easing of the 2-nd and 3d rivets;

- on the SS # 24 in attachment of the right B to the P 5 outside the third rivet has signs of easing (next from 4-th to 7-th are replaced for HSB).

The list of rivets, in the wall P, replaced for high-strength bolts is given in the Table 2.6.

Table 2.6.

LIST OF RIVETS REPLACED FOR HIGH-STRENTH BOLTS IN THE WALL OF CROSS BEAM

Span Structure ##	Longitud. beam Right Left	Side External Internal	Nr.Nr. of relaced rivets in PNr.Nr (account from below)												
			P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P10	P 11	P 12	P13
1	Left	Internal	-	4,5	-	-	-	-	-	-	-	-	-	6	-
		External	-	5	-	6	2,4,5	4	-	4=8	4=6,8 . .	-	8	4,5	4=6
	Right	Internal	4	4,5	-	-	-	4,5	7,8	4	-	-	-	4,5	-
		External	4: 7	-	-	-	-	4 ,5, 7	-	-	4,5	-	-	-	-
2	Left	Internal	9	4,5	-	-	-	-	-	-	-	-	-	-	4,5
		External	-	4:6,8	-	4	-	4	8,9	6	4,8	4,5	-	-	6,7
	Right	Internal	-	4	-	4,8	-	4	-	-	-	-	-	-	-
		External	4:9	4,5	-	6	4:6	-	-	-	-	-	-	9	-
3	Left	Internal	-	6	4,9	9	-	4,5	-	-	5	-	-	-	-
		External	-	-	-	-	-	-	-	-	-	-	-	-	-
	Right	Internal	-	-	-	-	-	-	-	-	-	-	.	10	-
		External	-	-	-	-	-	-	-	-	-	-	-	-	-
4	Left	Internal	-	4	4,7	-	-	4	4,6=8	-	-	4=9	-	6	4,5,8,9
		External	-	45	5	47	4,5	-	4	5	4	3=9	5	-	4=9
	Right	Internal	59	4:9	4,5,7: 9	5=8	4,5	5	-	4	5=8	6=8	4=7	8=10	4=9
		External	4=6	4:7	4,6	4:6	-	4	-	-	5,6	-	-	4=8	4=6
5	Left	Internal	-	-	-	46	-	-	4	-	-	-	4,7	-	-
		External	-	-	6	4	-	-	-	5	-	-	4	4=7	-
	Right	Internal	8	-	-	4	4=9	-	-	-	-	-	-	-	-
		External	-	4	-	-	-	-	-	-	4	4	-	4	4=9
6	Left	Internal	-	-	-	5=7	4	-	-	4	-	4,7,9,10	-	4	4,5
		External	-	-	-	4,5,8	-	-	-	-	-	-	-	-	-
	Right	Internal	-	-	4	2	4	4	-	4,5	-	4,5	4,5	-	4
		External	-	4	-	4	-	-	4	4	-	-	-	-	-

Span Structure ##	Longitud. beam Right / Left	Side External / Internal	Nr.Nr. of relaced rivets in PNr.Nr (account from below)												
			P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P10	P 11	P 12	P13
7	Left	Internal	-	.	-	-	-	4	45,7,9	-	-	-4	-	6	-
		External	5	4=6	-	5	-	-	-	-	-	-	4	-	-
	Right	Internal	-	-	48	-	-	4	45	45	-	-	-	-	-
		External	4	5 6	45	-	-	45	-	4=6	-	.. -	-	7.8	4.6
8	Left	Internal	-	3	-	5	6	-	5	-	4	-	-	-	-
		External	-	-	-	-	-	-	4,5	4	-	-	-	-	-
	Right	Internal	-	-	-	-	4=6	-	-	-	-	4	-	-	-
		External	-	-	6	5	-	-	4	6	-	45	-	-	4
9	Left	Internal	-	6	6	4	7=9	-	-	45	-	4,9	4.6	4	4.8.9
		External	4.6.9	-	5	4	4	4	-	-	4,5	4	6	4	8.9
	Right	Internal	-	-	-	-	-	-	-	4, 5	4,5	-	-	4	4
		External	4	-	-	4	-	4, 5	-	4	-	4.6.9	4	4=7	8.9
10	Left	Internal	-	49	4	-	4	49	4	4	9	-	8.9	8.9	4
		External	-	-	-	-	-	-	4	4	-	-	-	-	4
	Right	Internal	-	-	-	-	4	8	9	4	9	-	4.9	4	8.9
		External	5	4, 5	-	-	-	4= 6	4	-	-	4	4.5	-	-
11	Left	Internal	-	5	45	4	5	4=6	4	89	-	-	-	9	4
		External	-	4=6	56	4	-	-	6	-	-	5	-	4	4.7=9
	Right	Internal	-	45	4	8	4	-	-	5	-	4	4	-	-
		External	-	-	4	4	4	-	-	-	9	-	-	-	-
12	Left	Internal	4,8,9	4,8,9	4,9	4	4	4	4	4,8,9	4,8=10	4	-	-	8,9
		External	-	-	-	89	-	-	-	8,9	4,8	-	8,9	4	-
	Right	Internal	4	4	4	45	-	4,9	-	9	4,5	4	-	2.7=9	8,9
		External	4	4	-	45	4	-	-	4	4	4	4	4	4
13	Left	Internal	4	4	-	-	-	-	-	-	4	-	8,9	4	-
		External	4=6	-	-	-	-	-	-	-	-	-	4	4	-
	Right	Internal	-	-	-	89	-	45	9	4,8,9	8,9	9	4	5.7=9	-
		External	-	-	4	45	-	-.	4	4	4	-	8	4=6	-

Span Structure ##	Longitud. beam Right Left	Side External Internal	Nr.Nr. of relaced rivets in PNr.Nr (account from below)												
			P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P10	P 11	P 12	P13
14	Left	Internal	9,10	-	8:10	45,8,9	9	9,10	9	-	9,10	-	-	-	4=9
		External	-	-	6= 8	4: 8	4,9	-	-	-	-	-	-	-	-
	Right	Internal	-	-	.	4,8,9	8,9	-	-	-	-	-	-	-	-
		External	10	9,10	-	-	10	-	-	9	-	4	4	-	-
15	Left	Internal	-	5	-	-	-	-	-	-	-	-	-	-	-
		External	-	-	-	-	-	-	-	-	-	-	-	-	-
	Right	Internal	-	-	-	-	4	-	-	-	-	-	4,7	-	-
		External	-	-	-	-	-	-	-	-	-	-	-	-	-
16	Left	Internal	-	-	-	-	-	-	-	-	-	-	-	-	-
		External	-		-	-	-	-	-	-	-	-	4	-	-
	Right	Internal	-	-	-	-	-	-	-	-	-	-	-	-	-
		External	-	-	-	-	-	-	-	-	-	-	-	-	-
17	Left	Internal	-	-	-	-	-	9	-	-	-	-	-	-	-
		External	-	.	-	-	-	-	-	-	-	-	-	-	-
	Right	Internal	-	9,10	-	-	-	-	-	-	-	-	-	-	-
		External	-	-	-	-	-	-	-	-	-	-	-	-	-
18	Left	Internal	-	-	-	-	-	-	-	-	-	-	-	-	-
		External	-	-	-	-	-	-	-	-	-	-	-	-	-
	Right	Internal	-	-	-	-	-	-	-	-	-	-	-	-	-
		External	-	-	-	-	-	-	-	-	-	-	-	-	-
19	Left	Internal	-	-	-	-	-	-	-	-	-	-	-	4,5	-
		External	-	-	-	-	-	-	-	-	-	8	9	4,5	-
	Right	Internal	-	-	-	-	-	-	-	-	-	-	-	-	-
		External	-	-	-	-	-	-	-	-	-	-	-	-	-
20	Left	Internal	-	-	-	-	-	-	-	-	-	-	-	-	-
		External	-	-	-	-	-	-	-	-	-	-	-	-	-
	Right	Internal	-	-	-	-	-	-	-	-	-	-	-	-	-
		External	-	4	-	-	-	-	-	-	-	-	-	-	-

Span Structure ##	Longitud. beam Right Left	Side External Internal	Nr.Nr. of relaced rivets in PNr.Nr (account from below)												
			P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P10	P 11	P 12	P13
21	Left	Internal	-	-	-	4=7	4,5	-	-	-	-	4=8	-	-	-
		External	-	-	-	4=8	4=6,,9	5	-	-	-	-	-	-	4
	Right	Internal	-	-	-	-	-	.	-	-	-	-	4	-	-
		External	-		-	-	-	.	-	4	5	-	-	-	5
22	Left	Internal	-	-	-	-	-	.	-	4	-	-	-	4=9	-
		External	-	-	-	-	-	-	-	-	-	5	-	4=6	5
	Right	Internal	-	-	-	-	-	.	-	.	-	-	4	4,5	-
		External	-	.	-	-	-	.	-	.	-	-	-	5	4
23	Left	Internal	-	4,5	5	-	-	4=9	-	.	-	-	-	4=8	4=6
		External	6	4=7	-	-	-	4,8	-	-	-	6	-	4=6	4
	Right	Internal	-	-	.	-	-	-	4,5		-	-	-	-	-
		External	-	-	7=9	-	-	-	-	4,6,7	4	4=7	-	-	-
24	Left	Internal	-	-	-	45	-	4	-	-	-	-	-	4	-
		External	-	-	4=7	-	-	-	45	-	-	4,6,7,9	4	-	-
	Right	Internal	-	-	5	-	-	.	5	-	-	5,6	6.7	-	4,5
		External	4,5	-	4=6	4 ,5	4=7	.	45	-	4	9-Apr	5,6	6=9	4,5
25	Left	Internal	-	-	-	4	-	-	45	45	4	4=6	5	4,5	-
		External	4=7	-	-	9	4=6	45	-	4		4=7	-	4=6	4=8
	Right	Internal	-	-	-	45	-	-	-	45	-	4=6	-	-	-
		External	-	-	-	-	-	.	-	4, 5	-	-	-	-	4,5

Easing and the defects of rivets in the wall B (incleding the ones of the wall "tables") are found out:

- on the SS # 19 in the wall B 1 - 2 at P 2 - there is no the first rivet (openning is not completely drilled);

- on the SS № 23 in the wall of the right B 1 - 2 at P 1 - there are loosed the rivets (from the fourth to the ninth,) along thr feather of an angle iron of the attachment ^ there are the traces of a rust (in attachment of this B to the P 1); the "fish" is also strongly damaged (See . P.3.);

- on the SS # 23 in the wall of the right B 7 -8 at P 8 there are signs of frustration of fourth, fifth and sixth rivets.

The list of the rivets in the wall 6 replaced for HSB, is given in table 2.7.

Table 2.7.

LIST OF RIVETS REPLACED FOR HIGH-STRENGTH BOLTS
IN THE WALL OF LONGITUDINAL BEAM

Span Structur ##	Longitudin beam (left,right)	Panel	Strengthenin to the P ##	Numbers(from the bottom) of thr opennu\ings with HSB)
2	Left	4=5	B4	1
	Left	7=8	B8	4
4	Left	11=12	B12	4 ; 5
	Right	8=9	B9	3
	Right	9=10	B10	3;4;5
5	Right	4=5	B4	3
	Left	7=8	B8	4
6	Left	11=12	B12	3
9	Right	7=8	B8	4
	Left	10=11	B10	3;4
12	Right	3=4	B4	4
13	Left	9=10	B10	3
15	Left	9=10	B10	4
16	Right	2=3	B3	4;5;6
	Right	11=12	B12	4;5;6;7
17	Right	3=4	B4	4;5.
	Right	5=6	B6	4;5;6
20	Right	11=12	B11	3;4;5

6. Frustration and defects of the top chord rivets and longitudinal beams:

- on the SS # 9 in the left-hand B 4 5 about P 5 there are signs of frustration (flows of a rust from under the chord angle iron) in the three rivets nearest to the P;

- on the SS # 11 in right B 13 - 14 in middle of the panel there is one weak rivet (attaching simultaneously both chord and angle iron of rigidity);

- on the SS # 20 in left-hand B 9 - 10 about P 9 - there is no rivetwhich is the first from the P (there is no openning in vertical sheet of a beam);

- on the SS # 1 in the left-hand B 2 - 3 (second half of panel) nine rivets are replaced for HSB.

7. Weak and absent rivets in "caps " of longitudinal beams (rivets, connecting the top angle irons to a horizontal sheet).

On many span structures there is marked a defect connected with work on strengthening of the top chords of beams - there are missed about two - three rivets of a cap » 6 on every site about edges of rigidity in middle of the panel (fig. 2.8.).

In these places there are the backlashes between angle iron and sheet. So, on the SS № 12 in middle of panels 3 - 4; 4 - 5; 5 - 6 of the left-hand B there is missed on one rivet under edge of rigidity; on the SS # 23 in middle of the panel 2 - 3 of the left-hand B there are missed three rivets см.Fig 2.8).

The list of places, where there are found out weak and replaced for HSB rivets of "caps" of the B, is shown in table 2.8.

Table 2.8.

WEAK AND REPLACED RIVETS IN THE "CAPS" OF B

Span Structures ##	Beam	Panel	Side	Quantity of weak rivets	Position along the panel, counting from the beginning
1	Right	7 .-8.	External,internal	1;1	3./4;3/4
	Left	2.- 3	External	2	1./3
9	Left	8. - 9	External, internal	3;3	3./4;3./4
13	Right	0 - 1	Internal,external	3;2	1./3
15	Left	0 - 1	External	1	1./4
16	Right	5 .- 6.	External,internal	3;3 gaps between angle iron and sheet	2./3;2/3
19	Right	10.-11	External	1	1./2
20	Left Right	12.-13	External	1;1	1./5;1/5
21	Left	7.-8	Internal	1	1./5
	Left	8.-9	External	1	3./4
	Right	8.-9	External	1;1	1./2;3/4
	Left	13-14	External	1	3./4
22	Right	3.-4	External	1	1./4
	Right	4.-5	External	1	3./4
	Left	4.-5	External	1;1	1./2;3/4
	Left	4.-5	Internal	1;1	1./2;3/4
	Left	11.-12	External,internal	3;1	1./2;1/2
	Right	12.-13	External	1	1./2
	Left	13-14	External	1	1./2
23	Left	12.-13	External	1	1./4
25	Left	4.-5	External	1	1./4
	Left	11.-12,12-13	External	2 HSBper each	1./2;1/2
	Right		External	2 HSB	1./2

8. Rivets, frustrated, defective and replaced for HSB of the attachment of elements of the top ties between longitudinal beams to profiles and profiles to chords B are marked:

- on the SS № - there is no head of one rivet of attachment of profile of ties to chord B 8 - 9 at P 8;

- on the SS # 9 - one weak rivet of attachment of the second diagonal of the panel of profile in the middle of length of the left-hand B 4 - 5;

- on the SS # 11 - two weak rivets of the attachment of the profiles of ties to chord of the right B 13 14 in middle of the panel (Fig.2 ..9), profile has significant horizontal movings at passing of a load ; above this place a joint of a working rail is located;

- on the SS # 12 there is one defective (poorly formed) rivet of attachment of the profile of ties to chord of the left-hand B 6 - 7 in middle of the panel;

- on the SS № 17 there are two weak rivets of attachment of profile of ties to chord of the left-hand B 4 - 5 in middle of the panel (Fig.2.10.);

- on the SS # 22 rivets of attachment of profile of ties to chord of the left-hand B 13 - 14 at P 14 are replaced for HSB;

- on the SS # 25 there is one weak rivet of attachment of profile of ties to chord of the left-hand B 11 - 12 at P 11 (simultenoiusly these profile attach the "fish" »);

- on the SS № 7 there is defective (unriveted) rivet of attachment of profile of the top spacer to chords of the left-hand and the right B0 - 1 in middle of the panel.

9. On the row of span structures there are observed a swelling of profiles ofattachment of bottom spacers between B in middle of panels and tear off of heads of rivets of their attachment (fig. 2.11):

- on the SS # 14 to right B 2 - 3;

- on the SS # 15 to right B 3 - 4, 6 8 - 9, to left-hand B 11 - 12, B 12 - 13;

- on the SS # 17 to right B 7 - 8;

- on the SS B # 18 to right B 5 - 6;

- on the SS B #19 to right Б7-8,БИ - 12;

- on the SS # 20 to left-hand B 7 - 8, B 9 - 10;

- on the SS № 24 to left-hand B 4 - 5, B 5 - 6, B 13 - 14, to right B 4 - 5, 6 13 - 14;

- on the SS # 25 to right B 2 - 3, B 6 - 7.

On the SS # 1 - there is no head (from above.) of one rivet of attachment of bottom spacer between B to profile in middle of the panel and the right B 4 - 5.

10. The corrosion damages meet on all the span structures and are expressed in kind of:

- surface and spot (cometimes through) corrosion of elements;

- swelling between elements in compound packages and in places of the attachment.

Everywhere there is marked corrosion of fishes of attachment of longitudinal beams to cross beams to the depth up to 5 mm. (for example, on the SS # 1 the "fishes" of attachment of the right B to P 3, P 4, P 10 have corrosion holes with depth of 4 - 5 mm.; on the SS # 21 "fish" of the attachment of the left-hand B 11 - 12 to P 12 have strong corrosion along chord P and crack on this direction).

In many places there is spot corrosion and swelling of chords of cross beams about their attachment to main trusses (for example, on the SS # 1 - in P 6 at right truss there is corrosion damage with depth of 2 mm. On length about 5 cm, on the SS # 3 in P 10 the left-hand truss has swelling and stratification of the bottom sheet).

The through corrosion of profiles of attachment of longitudinal ties between B in middle of the panel is found out in left-hand B 4 - 5 and B 7 - 8 on the SS # 1

11. Damage of angle irons of suspension of rolling tracks of inspection carriage to cross beams: cracks, complete break, easing of rivets attachment. Cracks and the breaks of angle irons are located, as a rule, in places bending (FIG.2.12, 2.13). Near each cross beam the rolling tracks (each string) is attached by two inclined and two vertical angle irons, connecting accordingly bottom chord and a wall P to a

wall of channel iron of a track. Thus on each span structure there are present 60 inclined and vertical angle irons. Quantity of damaged ones separately for the left-hand and the right sides and the character of damages is specified in table 2.9.

As it is visible from the table, there are damaged 34,8 % from total of angle irons of rolling track suspension and number there of is increasing rapidly.

12. In attachments of the bottom basic "table" to the chord B and connection it with lower "fish" on some span structures rivets are replaced on HSB (fig. 2.14.). The heaviest quantity of HSB is installed on the SS # 14: 207 pieces in attachments to bottom chord B; 224 pieces in connection of the top angle irons and the wall of hte table itself. According to information, received in a distance department, the works on installation of HSB were carried out during strengthening of attachment B to P ("table") in connection with bad quality of the previous riveting.

II.2.3. RESULTS OF INSPECTION OF COASTAL SPAN STRUCTURES

The survey of stationary basic parts has not revealed in them any defects and damages. During the survey of mobile basic parts there were fixed mutual positions of the bottom balance weght, carriage with rolls and bottom basic plate. The gaugings were made in solar windy weather at positive temperature of air about 20^{o} C. Besides they paid much attention to integrity of axial bolts of fastening of ralls in carriage, condition of rolling. The gaugings and survey were made on majority of basic parts, the other parts were not inspected in details due to impossibility of access to the rolls because of design features of casings. So at all basic parts of span structures № № 21 - 25 casings are all-riveted, not demountable, at some other covers of casings cannot be open. By results of measurements of a position of elements of basic parts sizes of mutual displacement of the bottom balance weghts, carriages and basic plates are counted up, which are shown in table 2.10.

Table 2.10

VALUES OF MUTUAL DISPLACEMENTS OF THE BOTTOM BALANCE WEIGHTS AND BASIC PLATES OF MOBILE BASIC PARTS

Span ##	On the support ##	Displacement of balance weight axle in relation to axle of basic plate mm "+" from span,"-" in span		Displacement of rolling carriage axle in relation to axle of basic plate mm "+" from span,"-" in span	
		Left	Right	Left	Right
1	1	+23	+21	+12	+14
2	2	+3	-5	-3	+4
3	3	-6	-22	+1	-2
4	4	+1	+5	-4	+10
5	5	-15	-27	-8	-6
6	6	-14	-13	-7	-3
7	7	-19	-4	-11	-2
8	8	+3	+5	-17	-10
9	9	+21	+28	+12	+12
10	10	-	+20	-	-3
11	11	-	-	-	-
12	12	+15	-	5	-
13	13	-8	-26	0	-2
14	14	+25	27	10	+10
15	15	-6	-6	-4	+1
16	16	+7	-	-8	-
17	17	-33	-9	+3	-7
18	18	-5	-8	+3	-7
19	19	+23/+33	-25/-32	+10/+20	-10/-5
20	20	+31	+21	-11	+6

As shows the analysis of received results all mobile basic parts are in close to normal position, corresponding to temperature of air and metal of span structures. The maximum sizes of displacement of axes of the bottom balance weghts and carriages with ralls in relation to axes of basic plates make 33 and 20 mm. accordingly. On support # 19, which has an inclination to the right side from axis of the bridge, the sizes of displacement were measured twice on each basic part - from internal and outside side. It was found, that there was the heaviest skew of the and balance weghts in relation to basic plates, making up to 10 mm.

On the support # 2 in the right mobile basic part in the extreme span roll from its internal side an axial bolt of fastening of roll in the carriage is cut off. A condition of rolling surfaces are good, meeting the requirements of the "Instruction for Maintenance of Artificial Structures".

PART D-2

REPORT OF LOCAL EXPERTS (SECOND PART)

containing pages 1 to 14
(including headers of tables; the original tables are added on the following pages respective)

Most 12

The data concerning convertible loads and bridge operating conditions are given in the same project specifications of the Bridge Design Bureau. It is noted that since 1952 the traffic on the bridge has greatly increased. In 1953 the load of 2 diesel locomotives and cars was introduced with pressure intensity of 7.2 t/m. Trains with series CO steam locomotives were used at that time.

In 1959, the bridge was inspected by the Moscow Bridge Testing Station (ЦП МПС)[1]. They have described in their report the strengthening of strut joining grid spacers with angles, strengthening of joining grid of upper booms with angles, strengthening of upper longitudinal connections between trusses, reconstruction of portals that had been carried out by that time. It was noted that repair and painting of all piers had been completed by the moment of inspection (1959). The repair included cementation of individual piers, repair of transverse pier connections and installation of inspection ladders between individual pier columns. The recommendation was given in the report to remove rail levelling instruments located on every other span.

In 1966 span structures of the bridge were inspected and partially tested by the experts of ЛЖБК МИИТ[2]. It was shown in the bridge history (report of МИИТ), 1966) that the span structures had been strengthened 3 times by that time. Transverse beams were strengthened in 1937-1942 by adding two horizontal sheets, "voterens" were replaced with bridge beams. In 1956-58, the joining grid of upper booms and struts was strengthened, the connection of elements in 3'-4' to joint 3' was strengthened, intertruss connections bindings were strengthened, clearance was increased in accordance with 2-C, great amount of weak rivets in Б-П connections were replaced. In 1965 in view of installation of power line brackets, upper booms of main trusses were strengthened in end panels with two horizontal sheets.

Most 13

It was noted in the report that the "axes" in connections of transverse beams to main truss joints were damaged by an excavator jib in the result of train passing in 1966.

The table of element classes obtained in 1953 by the Bridge Design Bureau of ЦП МПС is presented in the same report.

[1] ЦП МПС - Central Permanent Way Department of the MPS (Ministry of Rail Transport)

[2] ЛЖБК МИИТ - specialised laboratory of the Moscow Rail Engineer Institute (МИИТ)

Table 1.4

Element	cm^2	Class		Element	cm^2	Cross-section class	Notes
		As to cross-section	As to connection				
							Compression of joint Compression out of joint Tension Compression in joint Compression out of joint Tension Compression in joint Compression out of joint Tension Compression in joint Compression out of joint

Longitudinal beam class according to the same data:
As to bending moment - 7.86
As to lateral force - ~~10.61~~ 10.61
As to connection to П on Б wall - 8,56
As to rivets in П wall - 20,6
It is noted in (ЛЖБК МИИТ) report that the major damage of the main span structure trusses by 1966 was loosening of rivets in the connections of Đ5'-6 and Đ8-9' struts to the upper joints. During the inspection, 169 weak rivets were detected in the first rows of connections.

Most 17

...are situated, as a rule, along the boom of a transverse beam in the direction from rivet hole edges of the first row of "fish" connections to the booms of longitudinal beams over all or a part of a "fish" width.
In position No 21:
- in the connection of the right Б11 to П12 - the crack starts from the edge of the hole in first row and runs to the outer edge of the "fish" (Fig. 2.6); no crack is detected on the inner edge of the "fish". The break of the second rivet head of the "fish" connection to the upper boom Б (Fig. 2.6);
- in the connection of the left Б11 to П12 - the crack crosses the whole "fish" along the first row of rivet holes; strong corrosion of the "fish" is also detected in the area of crack formation;
- in the connection of the left Б13-14 to П13 - the crack similar to the above one (Fig. 2.6).

In position No 23: in the connection of the right Б1-2 to П1 - the crack starts from the hole edge of the first row rivet, crosses the whole "fish" transversely and runs to its inner and outer edges. From the inner side, the crack runs out at the blade of boom angle Б opposite the second from П rivet of "fish" connection and runs diagonally at the small angle with respect to the angle blade to the inner edge of the "fish"; the экскаватора были повреждены "топорики" в прикреплении поперечных балок к узлам главных ферм.

В том же отчете приведена таблица классов элементов, полученных в I963 году мостовым проектным бюро ЦП МПС.

Таблица 1.4

Классы элементов, I963 год

Эл-т ELEMENT	См² cm²	Класс CLASS По сеч. CROSS SECT.	По прикр. CONNECTION	Эл-т ELEMENT	См² cm²	Класс по сечению CROSS SECTION CLASS	Примеч.
В1'-2'	223	8,92	7,8	Р0-1'	268	I0,5	Сж.узла 1)
В2'-3'	223	-"-	-"-	Р0-I'	26I	9,75	Сж.вне узла 2)
В3'-4'	316	8,6		РI'-2	I57,6	7,03	Растяж. 3)
В4'-5'	3I6	8,6	7,8	Р2-3'	I72,3	I0,[illegible]7	Сж.в узле 1)
В5'-7'	355	8,44	7,33	Р2-3'	I47	8,36	Сж.вне узла 2)
Н0-2	I7I	I2,75		Р3'-4	III,3	8,35	Растяж. 3)
Н2-3	242	7,I3		Р4-5'	II6,I	II,50	Сж.в узле 1)
Н3-4	255	7,7		Р4-5'	86	8,I5	Сж.вне узла 2)
Н4-5	3I2	7,75		Р5'-6	72,8	6,03	Растяж. 3)
Н6-7	342	7,79		Р6-7'	95,9	I2,65	Сж.в узле 1)
С	5I,35	8,25		Р6-7'	66,5	8,90	Сж.вне узла 2)

1) COMPRESSION OF JOINT
2) COMPRESSION OUT OF JOINT
3) TENSION

По тем же данным класс продольных балок:

По изгибающему моменту - 7,86

По поперечной силе - I0,6I

По прикреплению к П в стенке Б - 8,56

По заклепкам в стенке П - 20,6

В отчете ЛИИЖТ МИИТа отмечено, что основным повреждением главных ферм пролетных строений к I966 году являлось начавшееся массовое расстройство заклепок в прикреплениях раскосов Р5'-6 и Р8-9' к верхним узлам. При обследовании было обнаружено I69 слабых заклепок в первых рядах прикреплений. Отмечалось начало работы

crack doubles on the outer side near the blade of the boom angle: one runs along the blade, and the other one - reaches the edge of the "fish" near П boom.
In position No 25: in the connection of the right Б1-2 to П1 - from the outer side, edge of the "fish" hanging over the boom angle is chopped off (Fig. 2.7); on the inner side - the crack runs out at the blade of the angle along П boom and comes to an end 4 cm from the edge of the "fish".

Most 19

4. Loosening, head break, lack of rivets joining the "fishes" with the upper booms of longitudinal beams:
- on position No 21 in the connection of the right Б11-12 to П12 - break of head (from below) of the second from П rivet of the connection to the outer side Б (Fig. 2.6.); the same damage is detected on position No 25 in the connection of the left Б0-1 to П1;
- on position No 24 in the connection of the right and left Б13-14 to П 14 the rivets nearest to П are absent from the inner and outer sides (4 pieces); the same is on position No 25 in the connection of both Б0-1 to П0;
- on position No 25 in the connection of the left Б11-12 to П11 on the inner side - the third from П rivet is loosened, which, besides the "fish", fastens shaped element of longitudinal bonds between Б.
5. In the connections of the longitudinal beams to the transverse ones, many rivets both on П and Б walls are replaced with high-strength bolts, some rivets are weakened or have torn off heads.
Data concerning damaged or replaced rivets are shown hereinafter; the numbering of rivets starts from the lower boom П, including the rivets in the "table".
The following damages of rivets on the wall П are detected:
- on position No 4 in the connection of the right Б to П6 on the inside - the head of the fifth rivet is torn off (it was replaced immediately with the high-strength bolt by the bridge repairing team);
- on position No 19 in the connection of the right Б to П11 on the outer side - the signs of the rivets No 2, 3 and 4 loosening;
- on position No 22 in the connection of the right Б to П11 on the outer side - the signs of the rivet No 3 loosening;

- on position No 23 in the connections of the left Б on the outer side to:
- П2 - the fifth rivet has the signs of loosening (the neighbouring rivet is replaced with high-strength bolts);
- П 12 - the signs of the 4th, 5th and 6th rivets loosening;
- П 12 - the signs of the 2nd and 3rd rivets loosening;
- on position No 24 in the connection of the right Б to П5 on the outer side - the third rivet has the signs of loosening (the neighbouring rivets from 4th to 7th are replaced with high-strength bolts).

The list of the rivets on the П wall replaced with high-strength bolts is given in Table 2.6.

The following loosenings and defects of the rivets on Б wall (considering the "table" wall) are detected:
- on position No 19 on the wall of the left Б1-2 near П2 - the first rivet is missed (the hole is not completely drilled);
- on position No 23 on the wall of the right Б1-2 near П1 - The rivets from 4th to 9th are loosened, signs of corrosion along the blade of connection angle (the "fish" in the connection of that Б to П1 is also strongly damaged - refer to p.3);
- on position No 23 on the wall of the right Б7-8 near П8 - the signs of the 4th, 5th and 6th rivets loosening.

The list of the rivets on the Б wall replaced with high-strength bolts is represented in Table 2.7.

6. Loosening and defects of the upper boom rivets of longitudinal beams:
- on position No 9 in the left Б4-5 near П5 - signs of weakening (corrosion sags from the boom angle) of three rivets nearest to П;
- on position No 11 in the right Б13-14 in the middle of the panel - one loosened rivet (fixing both boom and stiffener);

...(individually for left and right sides) and nature of damages are shown in Table 2.9.

As one can see from the Table, 34.8% of total amount of angles of rolling track suspensions are damaged and their number is rapidly increasing.

12. In the connections of the lower bearing "table" to Б boom and its connections to the lower "fish" of some span structures, the rivets are replaced with high-strength bolts (Fig. 2.14). The greatest number of such high-strength bolts are located on position No 14: 207 pcs. in the connection to the lower boom Б; 224 pcs. in the connection of the upper angles to the "table" wall. According to the information obtained from track inspection, strength bolts placing was carried out while strengthening the connection of Б to П ("table") due to low quality of previous riveting.

2.2.3. The results of ground based span structures inspection.

The ground based span structures No 1 and 26 are in satisfactory condition; no essential damage effecting capacity is detected. The corrosion of the upper horizontal sheets of the main beams is of a surface nature, the resulting sheet damage is no more that 10% of their cross-section.
Damage of the upper plates is detected while inspecting supporting elements of span structures. Near the left supporting element of the abutment No 0, the plate is cleaved in two parts by inclined crack (Fig. 2.15); the similar damage is near the supporting element of the abutment No 26, and the elements of the beam lower boom are deflected in the point of resting upon the plate.
The last bridge beam of the left bank span structure (near the cabinet wall) is resting on the short beams made of angle 160 x 160 x 20 which are welded to the butt ends of the main beams with vertical joints. When train is running, these angles are strongly deformed, and this point of resting of the last bridge beam is unreliable.

Most 25

Table 2.9. Damages of angles of rolling track suspensions for inspection trolley.

Span structure No	Side	Number of damaged angles and their connections		Nature of damage
		Inclined	vertical	
		left		cracks
		right		
				cracks
				complete fracture
				cracks
				cracks
				complete fracture

Most 26

				cracks
				one connection rivet is loosened
				complete fracture
				cracks
				complete fracture
				cracks
				one connection rivet is loosened
				cracks
				complete fracture
				cracks
				complete fracture
In all for the whole bridge				cracks
				complete fracture
				loosened connection rivets

Most 28

2.3. The results of inspection of supporting elements of channel span structures.

The inspection of stationary supporting elements has not revealed any defect or damage.
While inspecting movable supporting elements, relative position of the lower balance beam, carriage with rollers, and lower supporting plate was determined. Measurements were carried out in sunny, windy weather, at the temperature about +20°C. Besides that, attention was paid to the integrity of axial bolts connecting rollers and carriage and condition of rolling surface. Measurements and inspection were carried out for the most of supporting elements; the rest were not inspected in details because of inaccessibility of the rollers due to design of their cases. The cases of all supporting elements of span structures No 21-25 are all-riveted, stationary, lids of some other cannot be opened. After the results of the measurements of supporting elements positions, the values of relative displacements of lower balance beams, carriages and supporting plates are calculated, the results are presented in Table 2.10.
According to the analysis of obtained results, all movable supporting elements are in position close to the normal one corresponding to the temperature of air and span

Таблица 2.9

Повреждения уголков подвеса путей катания смотровой тележки

Пролетное строение NN	Сторона	Количество поврежденных уголков и их прикреплений		Характер повреждений
		наклонных	вертикальн.	
1	2	3	4	5
1	левая	11	1	трещины
	правая	6	1	
2	левая	10	—	—"—
	правая	8	—	
3	левая	16	—	—"—
	правая	18	—	
4	левая	16	—	—"—
	правая	10	1	
5	левая	11	—	—"—
	правая	10	—	
6	левая	11	—	—"—
	правая	7	—	
7	левая	11	—	—"—
	правая	8	—	
8	левая	15	—	—"—
	правая	14	—	
9	левая	23	—	—"—
	правая	18	—	
10	левая	19	—	—"—
	правая	23	—	
11	левая	23	1	—"—
	правая	21	—	
12	левая	16	1	трещины
	левая	—	1	полный разрыв
	правая	14	—	трещины
13	левая	21	—	трещины
	правая	19	2	
14	левая	27	—	—"—
	правая	27	—	
	правая	—	2	полный разрыв

Продолжение таблицы 2.9

1	2	3	4	5
15	левая	29	—	трещины
	правая	26	2	
16	левая	25	2	—"—
	правая	24	—	
	правая	—	1	одна слаб. заклепка прикрепления
	левая	—	1	полный разрыв
17	левая	—	1	—"—
	левая	26	—	трещины
	правая	17	1	
18	левая	28	1	—"—
	правая	27	1	
	левая	—	1	полный разрыв
	правая	—	2	
19	левая	21	2	трещины
	правая	26	—	
20	левая	32	1	—"—
	правая	28	—	
21	левая	32	—	—"—
	правая	24	1	
	правая	—	1	одна слаб. заклепка прикрепления
22	левая	26	—	трещины
	правая	24	1	
	левая	—	1	полный разрыв
	правая	1	1	
23	левая	28	1	трещины
	правая	23	—	
24	левая	22	—	—"—
	правая	27	—	
25	левая	33	—	—"—
	правая	27	—	
	правая	—	1	полный разрыв
Итого по всему мосту		1011	20	трещины
		1	11	полный разрыв
		—	2	слабые заклепки прикреплен.

structure metal. The maximum displacement values for axes of lower balance beams and carriages with rollers relative to supporting plates axes are 33 and 20 mm respectively. Displacement values for the pier No 19 inclined to the right with respect to the bridge axis were measures twice for each supporting element - on the inner and outer side.

Most 29

Table 2.10.
Values of relative displacements of lower balance beams and supporting plates of movable supporting elements.

Span No	On the pier No	Balance beam axis displacement relative to supporting plate axis Δ_1, mm; "+" - from the span "-" - into the span		Carriage with rollers displacement relative to supporting plate axis Δ_2, mm; "+" - from the span "-" - into the span	
		left	right	left	right

Most 30

It is determined that there is a small misalignment of rollers and balance beams relative to supporting plates - up to 10 mm.
Axis bolt fixing roller to the carriage of the last roller in the span on the pier No 2 in the right movable supporting element is cut down on the inner side.
The condition of rolling surface is good and meets the requirements of the "Artificial construction maintenance regulations".

Most 31

2.4. The results of piers inspection.

The inspection of bridge piers was carried out by the team of experts of the Chair of Bridges of the МИИТ in April 1990 and October 1991. The inspection of underwater part was carried out by the specialists of (ЦП МПС) divers' station in November 1990 and March 1991.
Layouts of bridge passage as on April 1990 and March 1991 are shown in Fig. 2.16 and 2.17. The results of depth measurements near piers obtained by channel station during the period of fulfilment of the present work are shown in Table .
Stone caps. Each round stone cap is 270 cm in diameter and consists of a plane masonry plate and two draining plates inclined in respect to the truss axis. In the most of the caps (besides the cases noted below), joints between individual blocks are dense by appearance, there are no cracks or gaps in joints, specific "jingling" sound is heard when beating caps with hammer.
The lower supporting plates of supporting elements are mounted in the recesses of stone caps without anchor bolts. The places of contact of supporting plates and granite on all the piers are dense by appearance without any cracks, tear-outs, destructions. On some caps, the places of contact of supporting parts with stone are cemented.

Таблица 2.10

Величины взаимных смещений нижних балансиров и опорных плит подвижных опорных частей

Пролет NN	На опоре NN	Смещение оси балансира относительно оси опорной плиты Δ1, мм „+" из пролета; „–" в пролет		Смещение каретки с катками относительно оси опорной плиты Δ2, мм „+" из пролета; „–" в пролет	
		левая	правая	левая	правая
1	1	+ 23	+ 21	+ 12	+ 14
2	2	+ 3	– 5	– 3	+ 4
3	3	– 6	– 22	+ 1	– 2
4	4	+ 1	+ 5	– 4	+ 10
5	5	– 15	– 27	– 8	– 6
6	6	– 14	– 13	– 7	– 3
7	7	– 19	– 4	– 11	– 2
8	8	+ 3	+ 5	– 17	– 10
9	9	+ 21	+ 28	+ 12	+ 12
10	10	—	+ 20	—	– 3
11	11	—	—	—	—
12	12	+ 15	—	+ 5	—
13	13	– 8	– 26	0	– 2
14	14	+ 25	+ 27	+ 10	+ 10
15	15	– 6	– 6	– 4	+ 1
16	16	+ 7	—	– 8	—
17	17	– 33	– 9	+ 3	– 7
18	18	– 5	– 8	0	+ 3
19	19	+23 / +33	–25 / –32	+10 / +20	–10 / –5
20	20	+ 31	+ 21	– 11	+ 6

The major attention was paid to the condition of stone caps and contact of supporting elements with them on the pier No 19 that was inclined in 1919 due to a disastrous erosion. Supporting elements on that pier are displaced by 35 cm relative to the centres of caps transverse to the axis of a passage in the direction of river flow. Here, the bearing pressure is transferred partially to the blocks of a drainage besides heavy duty blocks of masonry plate. No serious disturbance in resting of supporting elements plates upon pier No 19 caps was detected.

Most 32

Layout of bridge passage according to the data of channel station (April 1990).

Most 33

Layout of bridge passage according to the data of channel station (March 1991).

Most 34

Table 2.11

The results of depth measurements near piers (m)

Year Pier

Month
March
April
may
June
July
August
September
October
November
December
January
February
March
April
may
June
July
August
September
October

Most 45

The inspection of the lateral surface of foundation coating of the same pier using a rigid probing rod has shown that coating metal at the depth of one meter has no considerable corrosion damage. The investigated metal surfaces, always situated below water or flooded soil level, are less corroded comparing with the surfaces situated in the zone of variable water level.
In April 1991 while inspecting piers, the recess was made in the forth (from the top) layer of the pier No 9 top column. The recess 42x42 cm in size was on the transverse axis of the pier, its lower edge was on the level of the midheight of the forth layer of the above-foundation part. The opening was made after water pumping from the pit near the pier, before that the level of water was on the level of the middle of the 4th pier (Fig. 2.27).
Coating surface in the opening zone on the level of variable water level is strongly corroded. Rivet heads of vertical cover-plates near the recess are corroded by approximately 3/4 (Fig. 2.28). The part of the coating, that was cut out, appeared to be dry from within and covered remainders of paint. The thickness of the cut part strongly corroded from the outer side, measured over the whole perimeter, was 10.5 - 11 mm (design thickness is 1/2" or 12.7 mm). Dry, high quality rubble masonry was opened which was hardly effected when using electrical pick-hammer. At the depth of 44.5 cm from the coating surface, vertical angle was opened with the size of the wing 75 mm (Fig. 2.29). The opening of the angle has revealed that the joining

Данные промеров глубин у опор (м)　　　　Таблица 2.11

год	опора / мес	уст	1	2	3	4		10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	уст
	Март	0,9	0.5	0.5	0.9	0.5												5.0	8.0	6.5	5.6	5.3	10.4
	апрель	1,3	0.9	0.9	1.5	0.9												5.8	6.6	7.0	5.9	4.9	5.2
	май	2.3	1.7	1.7	2.3	1.7											9.3	8.7	10.5	10.0	11.8	9.7	4.6
0	июнь	2.0	1.7	1.7	2.3	1.7										9.5	9.1	8.4	9.0	8.7	6.7	10.6	5.1
	июль	2.3	1.7	1.7	2.3	1.7						4.2	10.7	9.1			11.5	9.8	9.2	6.8	6.9	13.0	5.0
9	август	2.0	1.5	1.5	1.9	1.5								4.9	8.8	7.9	7.8	8.5	6.4	6.7	6.6	12.1	3.5
	сент	1.5	0.9	0.9	1.6	1.0						6.3	7.5	8.5	7.6	3.9	2.1	5.8	5.8	6.0	8.5	7.6	1.3
9	окт	0.9	0.6	0.8	1.4	0.8						6.3	7.5	8.2	7.6	4.0	0.5	3.6	3.6	4.9	8.4	5.3	1.1
	ноябрь	0.9	0.3	0.3	0.9	0.3						6.5	6.5	5.3	4.0	4.3	2.6	2.9	2.9	3.5	4.1	7.7	1.4
1	декабрь	1.0	0.2	0.2	0.8	0.3						6.9	7.8	6.2	4.0	2.4	2.6	3.5	3.0	3.0	3.4	7.7	1.3
	январь	0.7	0.2	0.1	0.7	0.2						7.0	7.7	5.8	2.2	0.2	1.3	1.9	1.9	2.7	5.0	5.8	0.6
	февраль	0.8	0.2	0.2	0.8	0.1						4.7	5.8	5.2	2.5	1.7	2.4	1.5	2.3	4.0	5.7	5.7	1.0
1	март	0.6	0.6	0.1	0.1	0.7						7.0	7.4	5.7	2.3	0.7	1.5	1.9	1.9	2.7	5.0	5.9	0.5
	апрель	2.2	2.2	1.6	2.2	1.9						2.6	5.2	6.7	7.9	8.5	7.5	6.0	5.2	7.3	6.8	8.9	2.3
9	май	2.5	1.9	1.9	2.5	1.9						9.3	11.6	8.3	7.5	6.2	5.0	5.8	6.5	6.3	8.8	9.6	1.6
	июнь	2.4	2.4	1.8	2.4	1.8			2.0	2.3	11.1	9.0	8.9	8.0	8.1	5.2	5.0	5.5	5.6	5.8	9.0	13.8	4.9
9	июль	2.1	1.6	2.2	2.2	1.6			9.5	11.0	8.5	7.5	5.6	4.9	4.5	3.7	3.2	4.2	4.2	5.2	9.0	13.6	4.6
	август	2.1	1.5	1.5	2.1	1.5			9.1	7.9	6.8	5.4	4.2	4.0	4.2					6.5	8.2	12.0	4.1
1	сент	1.7	1.2	1.2	1.7	1.2		0.7	8.6	7.8	6.3									3.0	8.5	9.1	3.9
	октябрь	1.2	0.6	1.2	0.6			6.9	6.5	5.0	3.4								5.2	6.1	8.4	8.0	2.4

structure of the above-foundation and foundation parts of the pier, that was built first during construction, corresponds to the design (Fig. 1.17).

Most 49

Inspection of underwater part of the piers was carried out by the specialists of the Repair and Inspection Pilot Station of ЦП МПС. The results of underwater inspection of pier coating and inspection of foundation and above-foundation parts joint at low water level are shown in their report (annex No 4). The results of pier No 24 coating opening carried out in 1984, as well as the ideas concerning the design of that pier coating joint, that differs from the initial design according to the results of the opening, are also shown.
The conclusion was made after the results of pier metal surfaces inspection carried out by divers that coating metal of underwater part of the piers is in good condition; through corrosion of pier coating and other considerable damages in the underwater part were not detected.
The inspection of the bridge abutments has shown that there are cracks between individual stones of the covering masonry. On the right-bank (Farab) abutment, the block of a cordon stone on the front face of the revetment wall lower side has separated from the masonry and is displaced towards the span. This damage is partially eliminated by cementing joints. There are cracks in masonry stones of the same pier revetment wall.

Most 51

2.6. Metal and concrete quality assessment

2.6.1. Span structures metal quality assessment

The most important design parameters in the method of limiting states are design resistances. Both welding iron and ingot steel were in use when the bridge was built, the speed-torque characteristics of which differ considerably. There are no reliable data concerning the metal of span structures and its quality.
Considering the above, as well as taking into account the importance of the construction, the main design resistance of the metal of span structures was obtained basing on the results of detailed material investigations in laboratory conditions. 30 metal samples were taken from unstrained zones of working elements (booms, struts, etc.) of span structures No 2, 4, 5, 10, 24. Metal samples 5x15 cm in size were cut out using cutting torch in accordance with the "Table of sample cutting out" shown in Annex No 1.
The laboratory investigations included:
- chemical analysis;
- structural analysis
- speed-torque characteristics determination.
Basing on the chemical analysis of span structures metal samples, the following percentage composition of main chemical elements is determined (Annex 1):
Carbon - C - 0.051-0.13%
Manganese - Mn - 0.33-0.54%
Silicon - Si - 0-0.05%
Phosphorus - P - 0.058-0.12%
Sulphur - S - 0.051-0.062%.

Most 58

It should be noted that the results of the tests conform with the results obtained previously while investigating ingot steel produced before 1905 and used in other bridges, but there is a great variation of characteristics of the bridge metal.

The main characteristic defining the first limiting state as to metal span structures strength is yield limit.

The main design resistance of metal, when estimating bridge capacity, may be considered $R_0=R'$, where R' - the smallest value of yield limit, the probability of which is no more than 0,0014. In the case of normal distribution σ_t

$$R' = m\sigma_t - 3\sigma_s = 271.5 - 3 \cdot 32.47 = 174 \text{ MPa}$$

Basing on this, the main design resistance of span structure metal in capacity calculations is taken as R = 174 MPa, that is lower than value recommended by "Instructions on Capacity Calculation of Railway Bridge Metal Span Structures", 1987, for that type of metal (ingot steel produced before 1906), according to which R_0 = 185 MPa.

Most 59

2.6.2. Assessment of Intermediate Piers' Rubble and Brick Masonry Quality.

Recesses were made in piers No 9 and 10 in April 1990 and October 1991 in order to assess the quality of rubble and brick masonry of inner filling of piers' covering. The results of the inspection are shown in Section 2.4. of the present Report.

The strength of rubble and brick masonry was defined by non-destructive method using Schmidt sclerometer. Sclerometer readings, as well as the values of cubic strength of rubble and brick masonry obtained using calibration curves, are shown in Tables 2.17, 2.18. Average value (expected value) of cubic strength is 26.8 MPa for rubble masonry and 22.8 MPa for brick masonry. These values correspond to calculated resistance values R_b = 10.0 MPa for rubble masonry and R_b = 8.5 MPa for brick masonry [3].

When specifying design value of concrete strength to calculate joints of foundation and above-foundation parts of intermediate piers, it was taken into account that pier columns masonry operates within metal covering. That effects positively filling material and increases its supporting power. Besides that, joint damages were detected in many piers being the result of concrete quality deterioration in the places of above-foundation coatings resting on ring platforms through levelling pads at the depth no more than the size of ring platform, the inner diameter of which being d = 208 cm.

Considering the above, the design resistance of the material was specified as R_b = $0.9 \cdot 85 = 76.5$ kg/cm^2, where m_{tc} = 0.9 is the factor of operation condition of the pier. m_{tc} factor was specified in accordance with guide draft on determination of pier load-carrying capacity of railway bridges in operation.

Most 60

Strength determination of rubble masonry of pier No 10 3rd layer using Schmidt sclerometer.

Table 2.17

Reading in the moment of impact	
Cubic strength	

Average value (expected value) is 26.8 MPa

Strength Determination of concrete masonry of pier No 10 4th layer using Schmidt sclerometer.

Table 2.18

Reading in the moment of impact	
Cubic strength	

Average value (expected value) is 22.8 MPa.

Most 61

3. Assessment of Bridge Elements Load-carrying Capacity and Reliability

3.1. Load-carrying Capacity of Span Structures.

Most 64

Table 3.1.
Comparison of elements classes of span structures main trusses with load classes.

Element	Element classes			Load classes of II category	Load Classes of III category
	as to strength, stability	as to strength, stability, considering wind brake load	as to durability		

Определение прочности склерометром Шмидта бутовой кладки 3 – го яруса опоры № I0

Таблица 2.17

Отсчет при ударе	29	34	32	34	32	30	24
Кубиковая прочность	230	3I0	280	3I0	280	240	I50
Отсчет при ударе	33	33	32	3I	30	20	38
Кубиковая прочность	290	290	275	260	240	230	380

Среднее значение (математическое ожидание) 26,8 МПа

Определение прочности склерометром Шмидта бетонной кладки 4 –го яруса опоры № I0

Таблица 2.18

Отсчет при ударе	24	25	24	I7	26	22	29
Кубиковая прочность	I55	I70	I55	–	I80	I30	230
Отсчет при ударе	28	24	36	24	29	25	29
Кубиковая прочность	2I0	I55	340	I55	230	I70	230
Отсчет при ударе	27	38	38	34	40	I7	28
Кубиковая прочность	200	380	380	3I0	420	–	2I0
Отсчет при ударе	30	35	3I	29	26	–	–
Кубиковая прочность	240	325	260	225	I80	–	–

Среднее значение (математическое ожидание) 22,8 МПа

Таблица 3.1

Сравнение классов элементов главных ферм пролетных строений с классами нагрузки

Элемент	λ, м	α	Классы элементов: по прочности, устойчивости	Классы элементов: по прочности, устойчивости, в сочетании с ветровой и тормозной нагрузками	Классы элементов: по выносливости	Классы нагрузки II категории	Классы нагрузки III категории
Н 0-2	66,I4	0,07I	I4,I2	I0,88	I0,9I	7,I7	6,53
Н 2-3	66,I4	0,2I4	7,97	6,88	6,55	7,28	6,58
Н 3-4	66,I4	0,2I4	8,58	7,34	7,09	7,28	6,58
Н 4-5	66,I4	0,357	8,52	7,5I	7,06	7,38	6,6I
Н 5-6	66,I4	0,357	9,0I	7,95	7,49	7,38	6,6I
Н 6-7	66,I4	0,500	8,79	7,82	7,3I	7,48	6,65
В I'-2'	66,I4	0,I43	I0,63	II,03	–	7,23	6,55
В 2'-3'	66,I4	0,I43	8,I6	8,25	–	7,23	6,55
В 3'-5'	66,I4	0,286	8,39	8,44	–	7,33	6,59
В 5'-7'	66,I4	0,429	8,58	8,65	–	7,4I	6,63
Р 0-I'	66,I4	0,07I	8,90	7,I6	–	7,I7	6,53
Р I'-2	60,83	0,068	7,39	–	6,28	7,04	6,46
Р 2-3'	55,57	0,065	8,53	–	II,79	6,86	6,37
Р 3'-4	50,36	0,062	7,77	–	5,89	6,78	6,26
Р 4-5'	45,20	0,059	I0,33	–	I2,84	6,70	6,30
Р 5'-6	40,70	0,07I	7,2I	–	2,2I	6,75	6,50
Р 6-7'	35,62	0,07I	I2,67	–	4,26	6,98	6,62
С	9,45	0,500	8,07	–	3,56	6,I9	5,97

Most 85

General information about magnetic records made using strain resistors placed on the elements of span structure No 11.

Table 3.6.
1. Strain resistor No
2. Channel No
3. Strain resistor position
4. Figure No
5. Number of records
6. Full load
7. Mixed
8. Empty
9. Passengers'
10. Passengers', local
11. Individual locomotive
12. In all
13. Including braking on the bridge

Most 87

3.2.3. Analysis of Results of Span Structure Elements Fatigue Life Assessment

Most 88

Table 3.7.
Measure of damages accumulation in the element П13-2 during the whole period of bridge operation.

Most 100

3.3. Load-carrying Capacity of Piers.

Most 117

ANNEX No 1

Results of Laboratory Investigations of Metal Speed-torque Characteristics.

Approved by
Head of Track Service
of Middle Asia Railway

Общие сведения о магнитограммах, записанных с тензорезисторов, установленных на элементах пролетного строения № II

Таблица 3.6

№№ тензорезисторов	№№ каналов	Месторасположение тензорезисторов	№№ рисунка	Количество записанных реализаций							
				Полногрузные	Смешанные	Порожние	Пассажирские	Пассажирск. местные	Отдельный локомотив	Всего	В том ч. с торможением на мосту
I	2.	3	4	5	6	7	8	9	I0	II	I2
I	I	СI -I' внешняя ветвь у I'	3.3	3	36	3	9	II	9	7I	-
2	2	РI'-2 внешняя ветвь у I'	3.3	4	4I	3	II	I2	9	80	-
3		Р3'-4 внешняя ветвь у 3'	3.2	3	36	3	9	II	9	7I	-
4	4	С5-5' внешняя ветвь у 5'		3	36	3	9	II	9	7I	-
5	5	Р5'-6 внешняя ветвь у 5'	3.1	3	37	3	9	I2	9	73	-
6	6	Н6-7 внутр.стенка у 7'	3.4	3	36	3	9	II	9	7I	-
7	I	Р5'-6 внутр.ветвь у6	3.5	-	I	-	-	I	-	2	-
8	6	Р5'-6 наружн.ветвь у6	3.9	-	I	-	-	I	-	2	-
9	2	"Рыбка" П7, В6-7-2	3.6	I	8	I	3	2	-	I5	2
I0	6	Стенка В6-7-2 у П7	3.6	I	8	I	3	2	-	I5	2
II	6	Вертикальная подвеска путей катания смотровой тележки	3.7	I	I3	I	6	2	I	24	-
I2	I	Наклонная подвеска путей катания смотровой тележки	3.7	I	I3	I	6	2	I	24	2

I	2	3	4	5	6	7	8	9	I0	II	I2
I3	4	Горизонт.полка нижнего поясного уголка П6 со стороны 5–6	3.7	I	I4	I	6	3	I	26	2
I4	5	Горизонт.полка нижнего поясного уголка ПI со стороны 0–I	3.8	I	II	I	6	2	I	22	2
I5	3	Горизонет.полка нижнего поясного уголка ПI со стороны I–2	3.8	I	II	I	6	2	I	22	2

ИТОГО: 589 реализаций

MOST86.PCX

MOST88.PCX

Таблица 3.7

Мера накопления повреждений в элементе Р1'-2 за весь период эксплуатации моста

Тип поезда	Этапы эксплуатации, гг.		Макс. напряжения цикла	Кол-во поездов в блоке N тыс.	Мера накопления повреждений от			
					поездов		вагонов	
					100000	N	100000	N
1	2	3	4	5	6	7	8	9
сквозн.	1930-47	2.76	79.81	276.00	0.005066	0.013982	0.001239	0.003420
	1948-64	2.76	82.58	260.60	0.006218	0.016203	0.001701	0.004434
	1965-80	2.76	83.45	306.60	0.006619	0.020295	0.001748	0.005358
	1980-91	2.76	86.84	210.80	0.007809	0.016462	0.002330	0.004911
						0.066941		0.018123
Волгогр.	1930-47	2.76	71.32	13.20	0.004849	0.000640	0.000000	0.000000
	1948-64	2.76	73.81	12.50	0.005715	0.000714	0.000000	0.000000
	1965-80	2.76	74.58	14.70	0.006084	0.000894	0.000000	0.000000
	1980-91	2.76	77.61	10.10	0.007720	0.000780	0.000000	0.000000
						0.003029		0.000000
порожние	1930-47	2.76	71.80	26.20	0.003874	0.001015	0.000000	0.000000
	1948-64	2.76	74.30	24.70	0.004755	0.001174	0.000000	0.000000
	1965-80	2.76	75.08	29.10	0.005062	0.001473	0.000000	0.000000
	1980-91	2.76	78.13	20.00	0.006423	0.001285	0.000000	0.000000
						0.004947		0.000000
пассаж.	1930-47	2.76	55.61	84.10	0.001319	0.001109	0.000000	0.000000
	1948-64	2.76	62.56	79.40	0.002460	0.001953	0.000000	0.000000
	1965-80	2.76	62.56	97.30	0.002460	0.002393	0.000000	0.000000
	1980-91	2.76	69.52	66.90	0.003886	0.002600	0.000000	0.000000
						0.008055		0.000000
местные Чарджоу	1930-47	2.76	38.65	84.10	0.000000	0.000000	0.000000	0.000000
	1948-64	2.76	43.48	79.45	0.000000	0.000000	0.000000	0.000000
	1965-80	2.76	43.48	97.35	0.000000	0.000000	0.000000	0.000000
	1980-91	2.76	48.31	66.95	0.000623	0.000417	0.000000	0.000000
						0.000417		0.000000
местные Фараб	1930-47	2.76	32.84	84.10	0.000000	0.000000	0.000000	0.000000
	1948-64	2.76	36.94	79.45	0.000000	0.000000	0.000000	0.000000
	1965-80	2.76	36.94	97.35	0.000000	0.000000	0.000000	0.000000
	1980-91	2.76	41.05	66.95	0.000000	0.000000	0.000000	0.000000
						0.000000		0.000000
						0.083389		0.018123

Итого : V = 0.101512

Таблица 3.8

Мера накопления повреждений в элементе Р3'-4 за весь период эксплуатации моста

Тип поезда	Этапы эксплу-атации, гг.		Макс. напря-жения цикла	Кол-во поездов в блоке N тыс.	Мера накопления повреждений от			
					поездов		вагонов	
					100000	N	100000	N
1	2	3	4	5	6	7	8	9
смешан.	1930-47	2.88	69.64	276.00	0.003375	0.009315	0.000842	0.002324
	1948-64	2.88	73.56	260.60	0.004491	0.011703	0.001321	0.003441
	1965-80	2.88	73.56	306.60	0.004491	0.013769	0.001321	0.004049
	1980-91	2.88	76.70	210.80	0.005547	0.011693	0.001675	0.003530
						0.046480		0.013345
военгр.	1930-47	2.88	56.66	13.20	0.002171	0.000287	0.000000	0.000000
	1948-64	2.88	59.84	12.50	0.002791	0.000349	0.000000	0.000000
	1965-80	2.88	59.84	14.70	0.002791	0.000410	0.000000	0.000000
	1980-91	2.88	62.40	10.10	0.003566	0.000360	0.000000	0.000000
						0.001406		0.000000
порожние	1930-47	2.88	65.28	26.20	0.002983	0.000781	0.000000	0.000000
	1948-64	2.88	68.94	24.70	0.004107	0.001014	0.000000	0.000000
	1965-80	2.88	68.94	29.10	0.004107	0.001195	0.000000	0.000000
	1980-91	2.88	71.89	20.00	0.005246	0.001049	0.000000	0.000000
						0.004040		0.000000
пассаж. Чарджоу	1930-47	2.88	60.23	42.05	0.002190	0.000921	0.000000	0.000000
	1948-64	2.88	67.76	39.70	0.004362	0.001732	0.000000	0.000000
	1965-80	2.88	67.76	48.65	0.004362	0.002122	0.000000	0.000000
	1980-91	2.88	75.29	33.45	0.007472	0.002499	0.000000	0.000000
						0.007274		0.000000
пассаж. Фараб	1930-47	2.88	63.29	42.05	0.002257	0.000949	0.000000	0.000000
	1948-64	2.88	71.20	39.70	0.004497	0.001785	0.000000	0.000000
	1965-80	2.88	71.20	48.65	0.004497	0.002188	0.000000	0.000000
	1980-91	2.88	79.11	33.45	0.007322	0.002449	0.000000	0.000000
						0.007371		0.000000
местные Чарджоу	1930-47	2.88	36.58	84.10	0.000000	0.000000	0.000000	0.000000
	1948-64	2.88	41.16	79.45	0.000000	0.000000	0.000000	0.000000
	1965-80	2.88	41.16	97.35	0.000000	0.000000	0.000000	0.000000
	1980-91	2.88	45.73	66.95	0.000227	0.000152	0.000000	0.000000
						0.000152		0.000000
местные Фараб	1930-47	2.88	35.40	84.10	0.000000	0.000000	0.000000	0.000000
	1948-64	2.88	39.82	79.45	0.000334	0.000266	0.000000	0.000000
	1965-80	2.88	39.82	97.35	0.000334	0.000325	0.000000	0.000000
	1980-91	2.88	44.25	66.95	0.000518	0.000347	0.000000	0.000000
						0.000938		0.000000
						0.067662		0.013345

ИТОГО : V=0.081006

MOST90.PCX

Таблица 3.9

МЕРА НАКОПЛЕНИЯ ПОВРЕЖДЕНИЙ В ЭЛЕМЕНТЕ Р5'-6
ЗА ВЕСЬ ПЕРИОД ЭКСПЛУАТАЦИИ МОСТА

Тип поезда	Этапы эксплуатации, гг.		Наиб. напряжения цикла	Кол-во поездов в блоке N тыс.	Мера накопления повреждений от			
					поездов		вагонов	
					100000	N	100000	N
1	2	3	4	5	6	7	8	9
смешан. Чарджоу	1930-47	3.10	73.23	138.00	0.003280	0.004526	0.000972	0.001341
	1948-64	3.10	77.61	130.30	0.004560	0.005942	0.001479	0.001927
	1965-80	3.50	78.02	153.30	0.010279	0.015758	0.004565	0.006998
	1980-91	3.97	81.10	105.40	0.026104	0.027513	0.014272	0.015042
						0.053739		0.025308
смешан. Фараб	1930-47	3.10	64.38	138.00	0.003222	0.004447	0.000472	0.000652
	1948-64	3.10	68.23	130.30	0.004485	0.005844	0.000874	0.001138
	1965-80	3.50	68.59	153.30	0.010020	0.015360	0.002871	0.004400
	1980-91	3.97	71.30	105.40	0.025612	0.026995	0.010250	0.010804
						0.052646		0.016994
полногр.	1930-47	3.10	46.50	13.20	0.001175	0.000155	0.000000	0.000000
	1948-64	3.10	49.29	12.50	0.001952	0.000244	0.000000	0.000000
	1965-80	3.50	49.54	14.70	0.004486	0.000659	0.000000	0.000000
	1980-91	3.97	51.50	10.10	0.014101	0.001424	0.000000	0.000000
						0.002483		0.000000
порожние	1930-47	3.10	64.11	26.20	0.002797	0.000733	0.000000	0.000000
	1948-64	3.10	67.95	24.70	0.003877	0.000958	0.000000	0.000000
	1965-80	3.50	68.30	29.10	0.008571	0.002494	0.000000	0.000000
	1980-91	3.97	71.00	20.00	0.022061	0.004412	0.000000	0.000000
						0.008597		0.000000
пассаж. Чарджоу	1930-47	3.10	0.07	126.10	0.000000	0.000000	0.000000	0.000000
	1948-64	3.10	0.07	119.10	0.000000	0.000000	0.000000	0.000000
	1965-80	3.50	63.37	146.00	0.002849	0.004160	0.000000	0.000000
	1980-91	3.97	79.21	100.40	0.020065	0.020145	0.000704	0.000707
						0.024306		0.000707
пассаж. Фараб	1930-47	3.10	0.06	126.10	0.000000	0.000000	0.000000	0.000000
	1948-64	3.10	0.06	119.10	0.000000	0.000000	0.000000	0.000000
	1965-80	3.50	51.29	146.00	0.001753	0.002559	0.000000	0.000000
	1980-91	3.97	64.12	100.40	0.012633	0.012684	0.000000	0.000000
						0.015243		0.000000
						0.157013		0.043009

ИТОГО : V=0.200022

13.5

Таблица 3.10

МЕРА НАКОПЛЕНИЯ ПОВРЕЖДЕНИЙ В ЭЛЕМЕНТЕ С1-1'
ЗА ВЕСЬ ПЕРИОД ЭКСПЛУАТАЦИИ МОСТА

Тип поезда	Этапы эксплу-атации, гг.		Макс. напря-жения цикла	Кол-во поездов в блоке N тыс.	Мера накопления повреждений от			
					поездов		вагонов	
					100000	N	100000	N
1	2	3	4	5	6	7	8	9
смешан. Чарджоу	1930-47	2.83	68.33	138.00	0.005692	0.007856	0.006612	0.009125
	1948-64	3.49	57.62	130.30	0.009335	0.012163	0.013361	0.017409
	1965-80	3.49	54.11	153.30	0.006709	0.010284	0.008649	0.013259
	1980-91	3.49	58.50	105.40	0.010107	0.010653	0.016332	0.017214
						0.040956		0.057007
смешан. Фараб	1930-47	2.83	64.65	138.00	0.003463	0.004778	0.005762	0.007951
	1948-64	3.49	54.52	130.30	0.005199	0.006775	0.010663	0.013894
	1965-80	3.49	51.20	153.30	0.004190	0.006423	0.007654	0.011733
	1980-91	3.49	55.35	105.40	0.005629	0.005933	0.012725	0.013412
						0.023909		0.046991
полногр.	1930-47	2.83	57.12	13.20	0.002638	0.000348	0.000000	0.000000
	1948-64	3.49	48.17	12.50	0.004277	0.000535	0.000456	0.000057
	1965-80	3.49	45.23	14.70	0.003074	0.000452	0.000000	0.000000
	1980-91	3.49	48.90	10.10	0.004631	0.000468	0.000493	0.000050
						0.001802		0.000107
порожние	1930-47	2.83	59.74	26.20	0.002554	0.000669	0.000000	0.000000
	1948-64	3.49	50.38	24.70	0.004473	0.001105	0.000000	0.000000
	1965-80	3.49	47.31	29.10	0.003066	0.000892	0.000000	0.000000
	1980-91	3.49	51.15	20.00	0.004843	0.000969	0.000000	0.000000
						0.003634		0.000000
пассаж. Чарджоу	1930-47	2.83	35.56	42.05	0.000000	0.000000	0.000000	0.000000
	1948-64	3.49	40.01	39.70	0.003247	0.001289	0.000000	0.000000
	1965-80	3.49	40.01	48.65	0.003247	0.001580	0.000000	0.000000
	1980-91	3.49	44.46	33.45	0.004945	0.001654	0.000000	0.000000
						0.004523		0.000000
пассаж. Фараб	1930-47	2.83	43.22	42.05	0.000420	0.000177	0.000000	0.000000
	1948-64	3.49	48.62	39.70	0.004027	0.001599	0.000000	0.000000
	1965-80	3.49	48.62	48.65	0.004027	0.001959	0.000000	0.000000
	1980-91	3.49	54.02	33.45	0.007315	0.002447	0.000000	0.000000
						0.006181		0.000000
местные Чарджоу	1930-47	2.83	39.80	84.10	0.000000	0.000000	0.000000	0.000000
	1948-64	3.49	44.78	79.45	0.001326	0.001053	0.002010	0.001597
	1965-80	3.49	44.78	97.35	0.001326	0.001291	0.002010	0.001957
	1980-91	3.49	49.75	66.95	0.002307	0.001544	0.003497	0.002341
						0.003888		0.005895
местные Чарджоу	1930-47	2.83	39.80	84.10	0.000000	0.000000	0.000000	0.000000
	1948-64	3.49	44.78	79.45	0.000000	0.000000	0.000000	0.000000
	1965-80	3.49	44.78	97.35	0.000000	0.000000	0.000000	0.000000
	1980-91	3.49	49.75	66.95	0.000000	0.000000	0.000000	0.000000
						0.000000		0.000000
						0.084894		0.109999

ИТОГО : V=0.194893

MOST92.PCX

Таблица 3.11

Мера накопления повреждений в элементе С5-5'
за весь период эксплуатации моста

Тип поезда	Этапы эксплуатации, гг.		Макс. напряжения цикла	Кол-во поездов в блоке N тыс.	Мера накопления повреждений от			
					поездов		вагонов	
					100000	N	100000	N
1	2	3	4	5	6	7	8	9
смешан. Чарджоу	1930-47	2.96	66.23	138.00	0.005891	0.008130	0.005891	0.000000
	1948-64	3.78	55.85	130.30	0.020073	0.026155	0.020073	0.000000
	1965-80	3.78	52.45	153.30	0.009643	0.014783	0.009643	0.000000
	1980-91	3.78	56.70	105.40	0.021655	0.022824	0.021655	0.000000
						0.071891		0.000000
смешан. Фараб	1930-47	2.96	54.14	138.00	0.003026	0.004177	0.003026	0.000000
	1948-64	3.78	45.65	130.30	0.009961	0.012979	0.009961	0.000000
	1965-80	3.78	42.87	153.30	0.005680	0.008707	0.005680	0.000000
	1980-91	3.78	46.35	105.40	0.010746	0.011327	0.010746	0.000000
						0.037190		0.000000
воинегр.	1930-47	2.96	47.30	13.20	0.000535	0.000071	0.000000	0.000000
	1948-64	3.78	39.89	12.50	0.001650	0.000206	0.000000	0.000000
	1965-80	3.78	37.46	14.70	0.000981	0.000144	0.000000	0.000000
	1980-91	3.78	40.50	10.10	0.002047	0.000207	0.000535	0.000054
						0.000628		0.000054
порожние	1930-47	2.96	41.87	26.20	0.000305	0.000080	0.000000	0.000000
	1948-64	3.78	35.31	24.70	0.001198	0.000296	0.000000	0.000000
	1965-80	3.78	33.16	29.10	0.000761	0.000221	0.000000	0.000000
	1980-91	3.78	35.85	20.00	0.001532	0.000306	0.000000	0.000000
						0.000904		0.000000
пассаж. Чарджоу	1930-47	2.96	24.40	42.05	0.000000	0.000000	0.000000	0.000000
	1948-64	3.78	27.45	39.70	0.000000	0.000000	0.000000	0.000000
	1965-80	3.78	27.45	48.65	0.000000	0.000000	0.000000	0.000000
	1980-91	3.78	30.50	33.45	0.000644	0.000216	0.000000	0.000000
						0.000216		0.000000
пассаж. Фараб	1930-47	2.96	32.61	42.05	0.000000	0.000000	0.000000	0.000000
	1948-64	3.78	36.68	39.70	0.000671	0.000266	0.000000	0.000000
	1965-80	3.78	36.68	48.65	0.000671	0.000326	0.000000	0.000000
	1980-91	3.78	40.76	33.45	0.001265	0.000423	0.000000	0.000000
						0.001016		0.000000
местные Чарджоу	1930-47	2.96	26.70	84.10	0.000000	0.000000	0.000000	0.000000
	1948-64	3.78	30.03	79.45	0.000000	0.000000	0.000000	0.000000
	1965-80	3.78	30.03	97.35	0.000000	0.000000	0.000000	0.000000
	1980-91	3.78	33.37	66.95	0.000944	0.000632	0.000000	0.000000
						0.000632		0.000000
местные Фараб	1930-47	2.96	31.03	84.10	0.000000	0.000000	0.000000	0.000000
	1948-64	3.78	34.91	79.45	0.000737	0.000586	0.000000	0.000000
	1965-80	3.78	34.91	97.35	0.000737	0.000718	0.000000	0.000000
	1980-91	3.78	38.79	66.95	0.001064	0.000712	0.000000	0.000000
						0.002016		0.000000
						0.114492		0.000054

итого : 0.114546

MOST93.PCX

Таблица 3.12

МЕРА НАКОПЛЕНИЯ ПОВРЕЖДЕНИЙ В ЭЛЕМЕНТЕ Н6-7
ЗА ВЕСЬ ПЕРИОД ЭКСПЛУАТАЦИИ МОСТА

Тип поезда	Этапы эксплуатации, гг.		Макс. напряжения цикла	Кол-во поездов в блоке N тыс.	Мера накопления повреждений от			
					поездов		вагонов	
					100000	N	100000	N
1	2	3	4	5	6	7	8	9
смешан.	1930-47	2.66	39.23	276.00	0.000000	0.000000	0.000000	0.000000
	1948-64	2.86	38.80	260.60	0.000000	0.000000	0.000000	0.000000
	1965-80	2.86	39.50	306.60	0.000000	0.000000	0.000000	0.000000
	1980-91	2.86	38.80	210.80	0.000000	0.000000	0.000000	0.000000
						0.000000		0.000000
полногр.	1930-47	2.66	35.59	13.20	0.000000	0.000000	0.000000	0.000000
	1948-64	2.86	35.20	12.50	0.000000	0.000000	0.000000	0.000000
	1965-80	2.86	35.83	14.70	0.000000	0.000000	0.000000	0.000000
	1980-91	2.86	35.20	10.10	0.000000	0.000000	0.000000	0.000000
						0.000000		0.000000
порожние	1930-47	2.66	32.55	26.20	0.000000	0.000000	0.000000	0.000000
	1948-64	2.86	32.20	24.70	0.000000	0.000000	0.000000	0.000000
	1965-80	2.86	32.78	29.10	0.000000	0.000000	0.000000	0.000000
	1980-91	2.86	32.20	20:00	0.000000	0.000000	0.000000	0.000000
						0.000000		0.000000
пассаж.	1930-47	2.66	27.01	84.10	0.000000	0.000000	0.000000	0.000000
	1948-64	2.86	30.39	79.40	0.000000	0.000000	0.000000	0.000000
	1965-80	2.86	30.39	97.30	0.000000	0.000000	0.000000	0.000000
	1980-91	2.86	33.76	66.90	0.000000	0.000000	0.000000	0.000000
						0.000000		0.000000
местные	1930-47	2.66	14.09	168.20	0.000000	0.000000	0.000000	0.000000
	1948-64	2.86	15.85	158.90	0.000000	0.000000	0.000000	0.000000
	1965-80	2.86	15.85	194.70	0.000000	0.000000	0.000000	0.000000
	1980-91	2.86	17.61	133.90	0.000000	0.000000	0.000000	0.000000
						0.000000		0.000000
						0.000000		0.000000

ИТОГО : V=0.000000

Table of metal sampling from bridge passage across Amudarya river near Chardzhev.

Sample No	Span structure No	Truss left/right	Truss element	Sampling place

Most 119

Speed-torque characteristics of metal samples.

П Р И Л О Ж Е Н И Е I

Результаты лабораторных исследований механических характеристик металла

УТВЕРЖДАЮ:

Начальник службы ПУТИ
Средне-Азиатской Ж.Д.

Таблица вырезки проб металла мостового перехода через реку Аму-Дарью у г. Чарджоу

№№ проб	№ пролтроения	ферма лев/прав	элемент фермы	место вырезки проб
I	2	3	4	5
I	2	лев	0 - I	уголок внешней ветви у нижнего узла
2	2	прав	0 - I	- "" -
3	2	лев	I - 2	- "" -
4	2	лев	2 - 3'	- "" -
5	2	лев	3' - 4	- "" -
6	2	лев	4 - 5'	- "" -
7	2	лев	5' - 6	- "" -
8	2	лев	6 - 7'	- "" -
9	2	лев	5 - 5'	- "" -
I0	2	лев	4 - 5'	нижний уголок внешней ветви
II	2	лев	5' - 6	- "" -
I2	2	лев	прод балка	уголок консоли прод балки
I3	2	прав	- "" -	- "" -
I4	5	лев	I - 2	уголок внешней ветви у нижнего поясф
I5	5	лев	3' - 4	- " -
I6	5	лев	5' - 6	_ "" _
I7	5	лев	6 - 7'	нижний уголок внешн ветви
I8	5	лев	фасонка св	по месту
I9	5	прав	- "" -	- "" -

14.1