3.7 Bridge Detailed Investigation

The bridge detailed investigation carried out on the site from October to November, 1995 was as shown in photos of subsequent pages.

Tools used in detailed investigation on 10 bridges are shown below:

(1) Measuring equipment: 50 m steel tape, slide calipers, convex tape, ribbon rod, plumb bob, folding measure, calipers, ultrasonic thickness meter, metal measure, Schmidt hammer, etc.

(2) Recording tools : White board, camera, chalk, damage drawing (draft drawing to record damages), plastic board, etc.

(3) Access tools : Ladder (aluminum-made two-step ladder (7 m), 2 pieces; aluminum-made single-step ladder, 1 piece) (for making access)

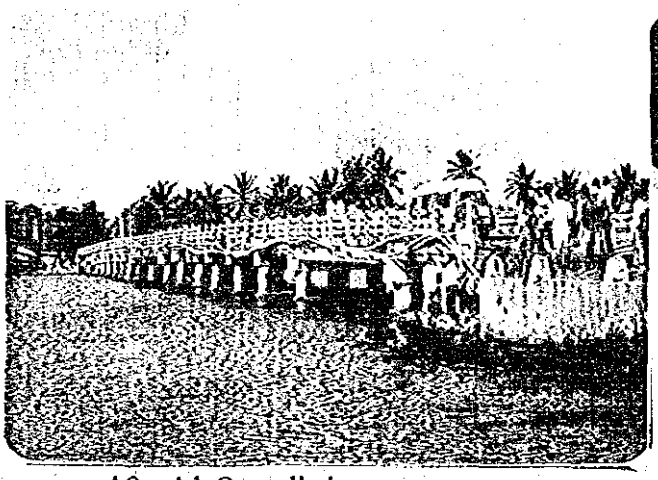
(4) Survey tools : Binoculars, hammer, chisel, wire brush, electric grinder (portable), flashlight, paint brush, etc.

(5) Safety tools : Safety belt, goggles (necessary when peeling the paint), working gloves, boots, etc.

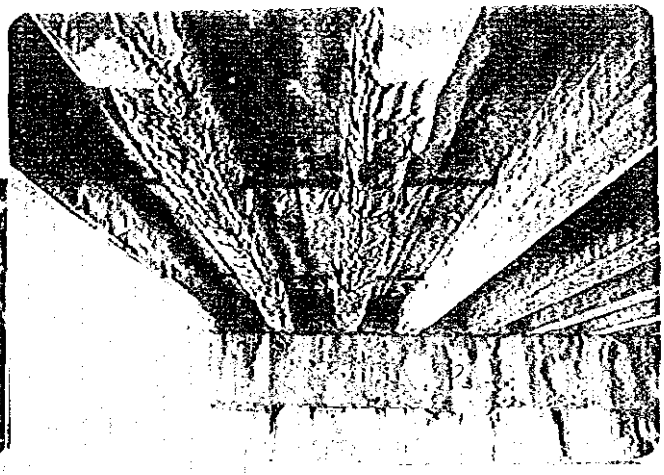
(6) Others : Scaffolding

Detailed Investigation

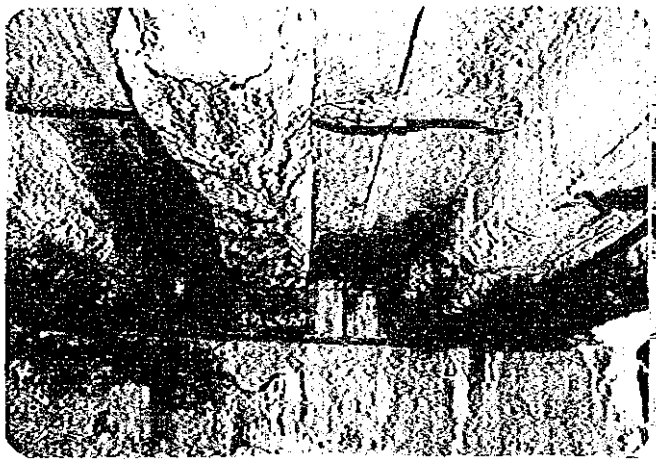
Ser No. 7 B425 20/4 km



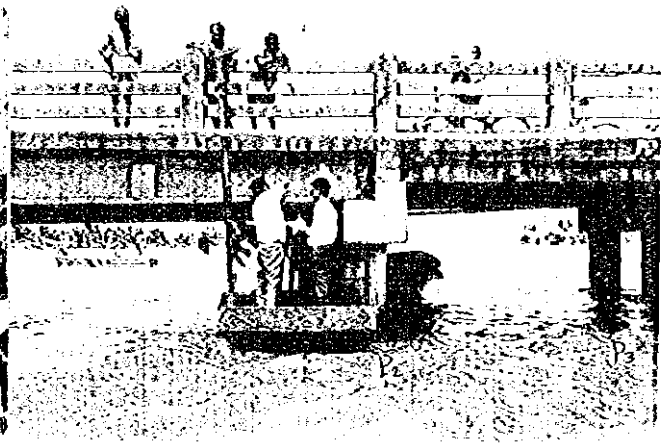
A2 - A1 Overall view



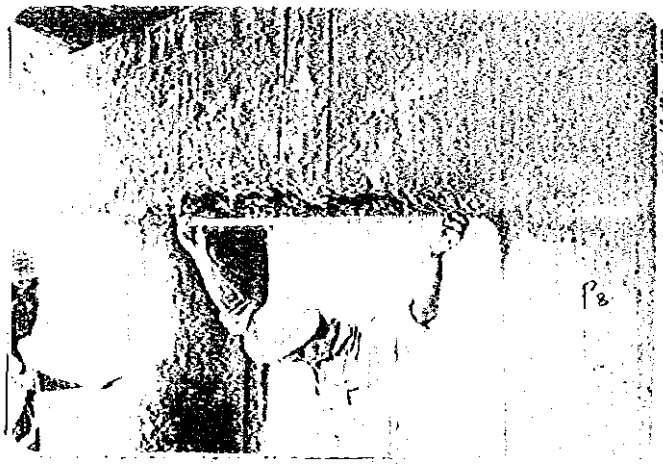
P7 - P8

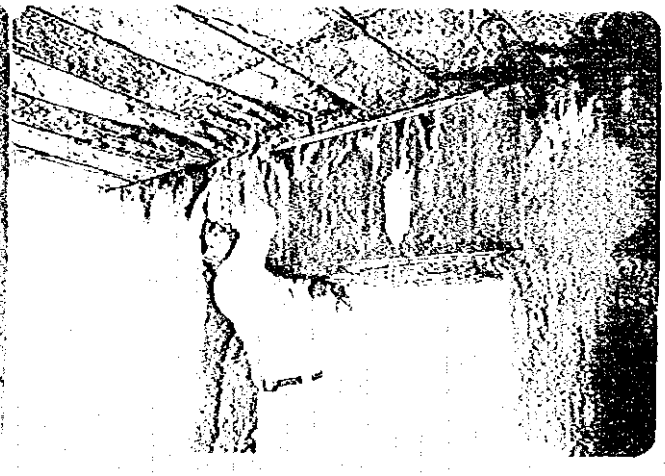


P7 - P8



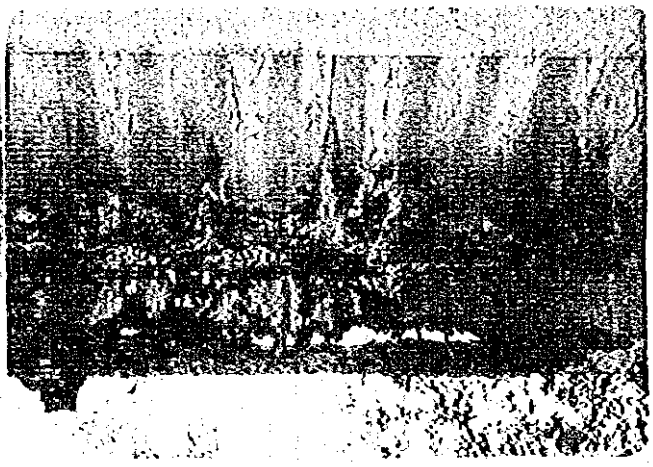
P17 - A2 Schmidt hammer test



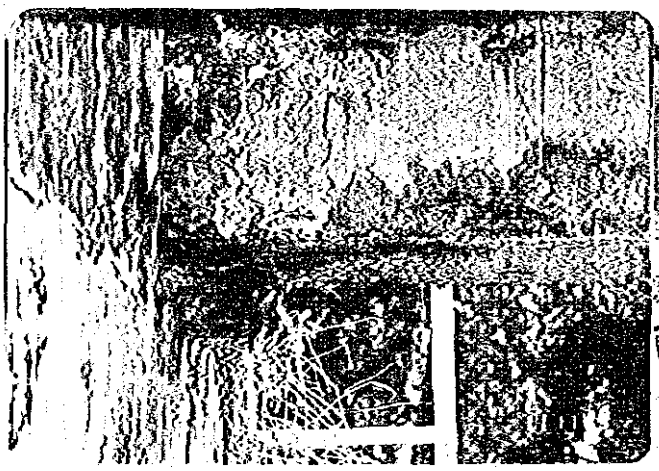


Ser No. 20 B264 25/7 km

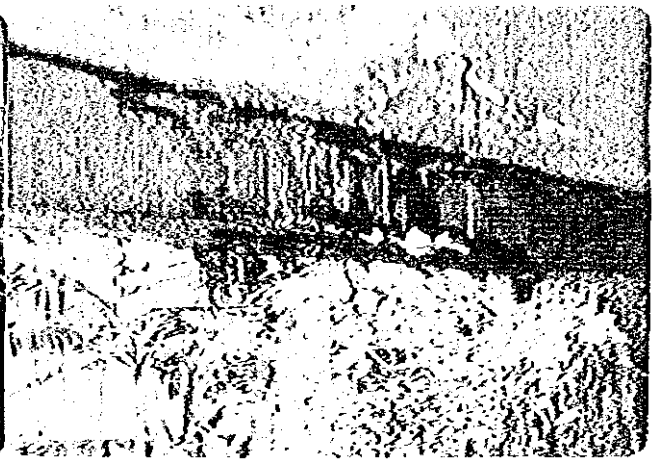
P1 - A2 Main girder G1



P1 - A2 Main girder G1

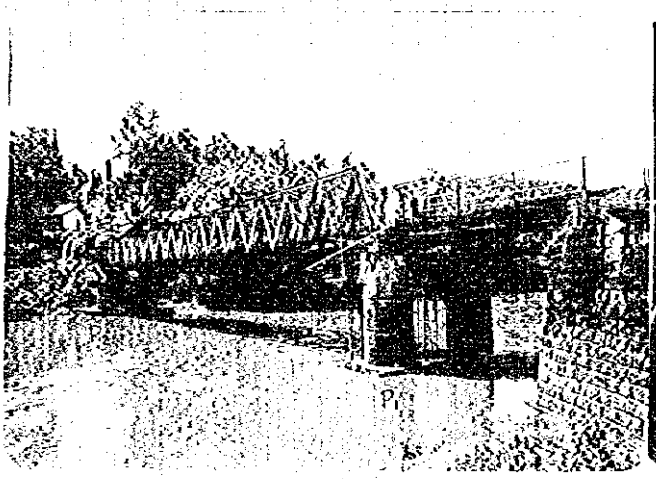


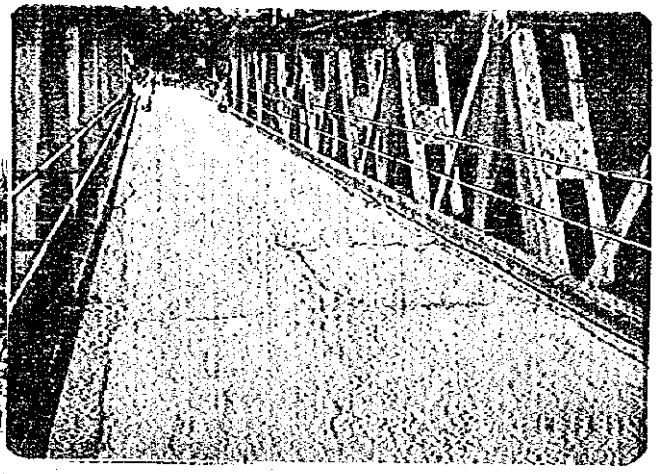
P1 G1 Bearing



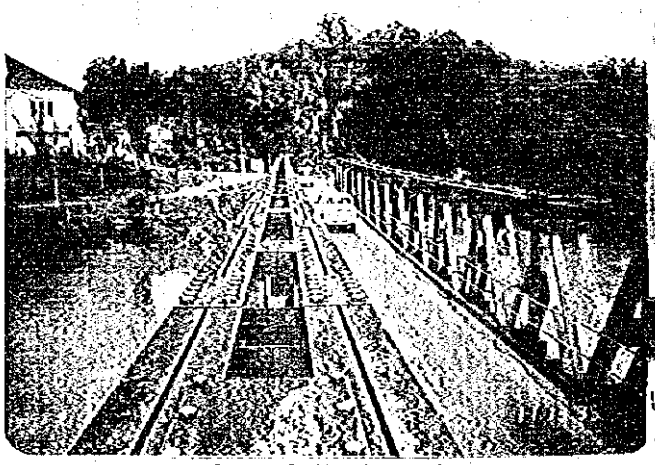
P1 Downstream side

Ser No.33 B157 12/3 km

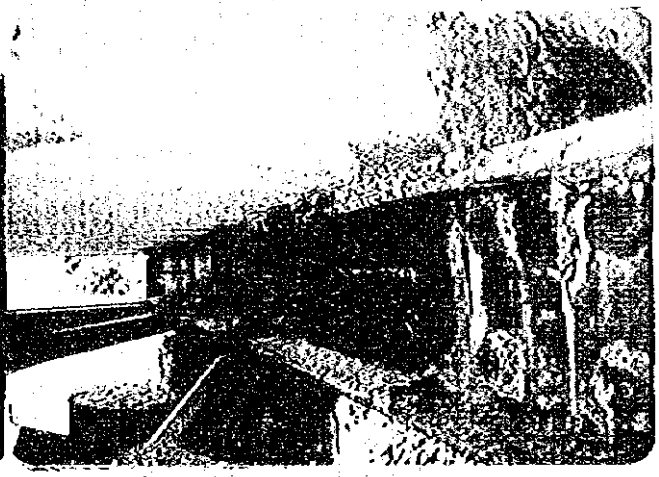




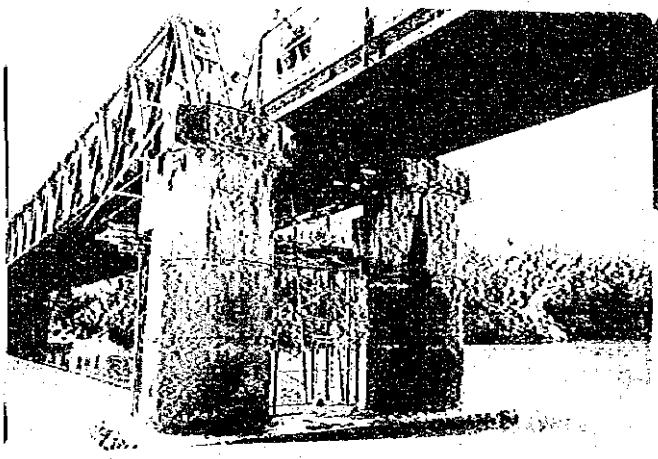
Slab

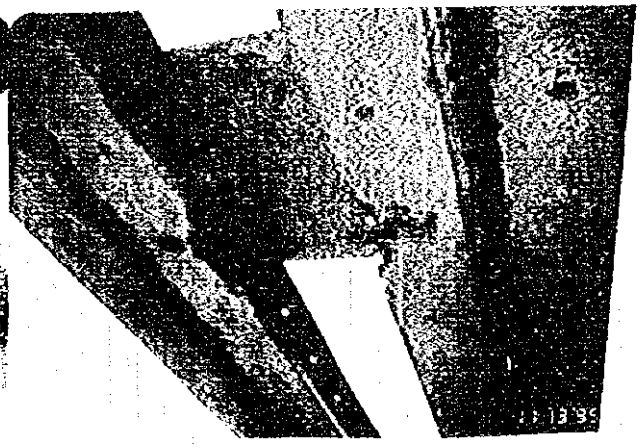


Top surface of chord members



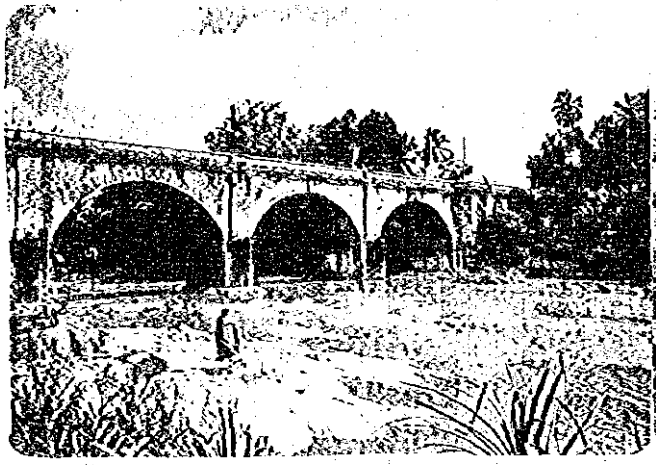
Cross beam to carry slabs



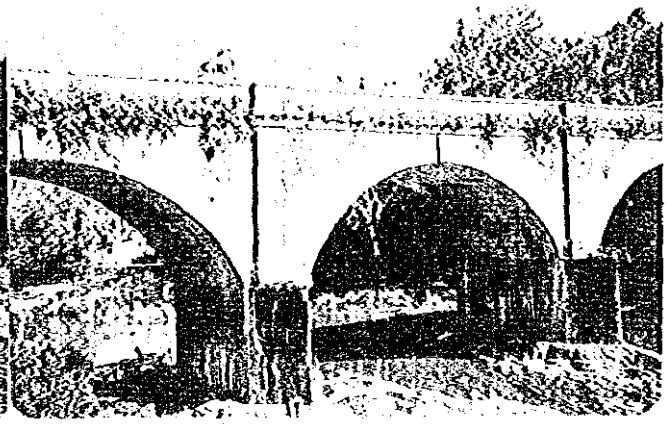


P1 Pier A1 - P1

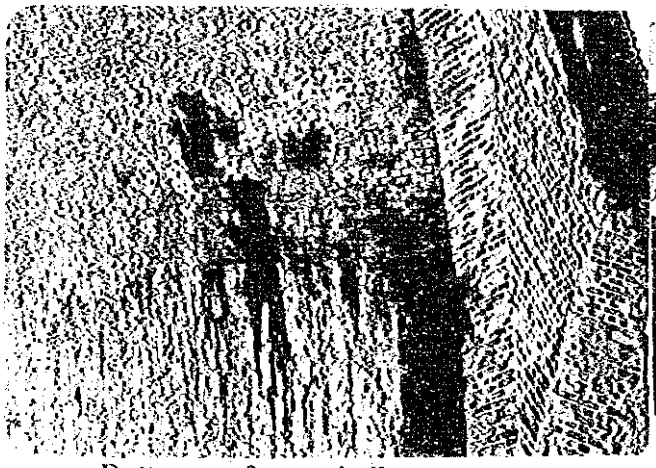
Ser No. 85 AA001 91/2 km



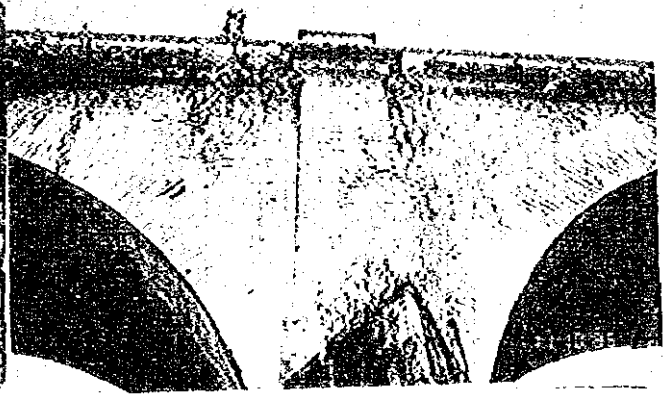
P1 - P2 - P3 - A2



A1 - P1 Arch



Bottom surface arch rib



P1 Arch Arc base

CHAPTER4 BRIDGE ASSESSMENT PROCEDURE

4.1 General

There is no method established yet for overall judgment or monitoring of the soundness of existing bridges. Many studies are currently under way by various institutes and universities.

For the promotion and establishment of the system of bridge maintenance and management and rehabilitation (repair, strengthening and functional improvement) however, it is absolutely necessary to find out the method to understand the degree of damages to bridges and to assess these damages.

In these circumstances the Study Team proposed the method readily applicable in Sri Lanka while referring to the assessment methods in Japan.

4.2 Damage Assessment Criteria

An important item of visual inspection is to observe the current condition of bridges. RDA has performed assessment in four ranks of "Good", "Fair", "Poor" and "Very Poor." The Study Team followed this RDA's practice, conducting assessment in the field while discussing the judgment criteria to the released engineers, and agreed to use ratings 1 to 4 as shown below:

(1) Damage Assessment by Structural Members

Rating	Rating Criteria
1	No damage detected on the basis of inspection results.
2	Damage has been detected. Follow-up survey is required.
3	There is significant damage and a detailed survey needs to be carried out to establish whether repair work is to be carried out or not.
4	There is very critical damage and urgent repair or rehabilitation is required or the bridge has to be closed to traffic or restriction on vehicle weight to be imposed.

(2) Overall Assessment of Bridges

In view of the importance of each member the weighted factor was taken into account during evaluation . This is to achieve overall assessment on the basis of numerical judgment of the degree of members. The overall assessment will provide data essential for determination of the rehabilitation priority among bridges in the future.

In consideration of following reasons only principal members were selected for assessment.

- Pavement should be rehabilitated during periodical maintenance and management in the future and studied separately from priority determination of this rehabilitation plan.

- The expansion joint is of a buried type, with bearings and girder ends buried also in the top of abutments or piers, making visual inspection impossible. In addition the importance of expansion joints and bearings is not so high because the temperature does not fluctuates much here.

- There are many bridges whose length were made shorter, with abutments extending into the river stream forward in this country. They are intended to cut down the construction cost. For these bridges the wing wall is important, therefore, has been chosen as vital member.

Weighted factor of each member used in this investigation is shown below:

Structural Members		Weighted Factor
Superstructure,	Deck slab	0.8
	Main girder, main truss	1.0
Paint		0.5
Substructure,	Abutment (including foundation)	1.0
	Pier (including foundation)	1.0
	Wing wall	0.5

Assessment points determined for each member in superstructure and substructure were multiplied by a respective weighted factor. Among assessment points thus obtained with members, the higher score was used as the assessment point for superstructure and substructure respectively. For overall assessment the assessment point of superstructure or substructure, whichever was higher, was used as an overall assessment point.

In certain bridge types the bearings may become a vital member. In this case, the weight factor is 0.5.

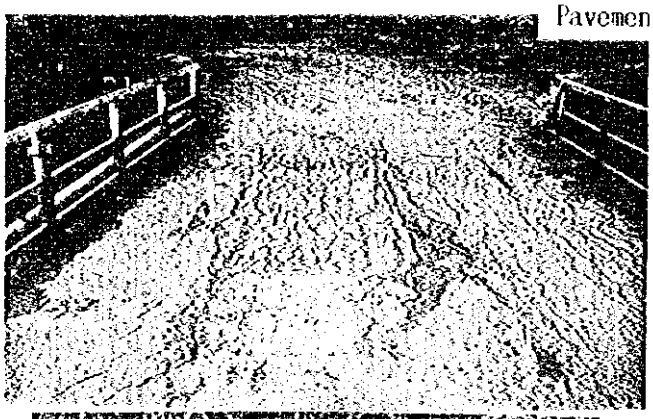
4.3 Damage Assessment Method

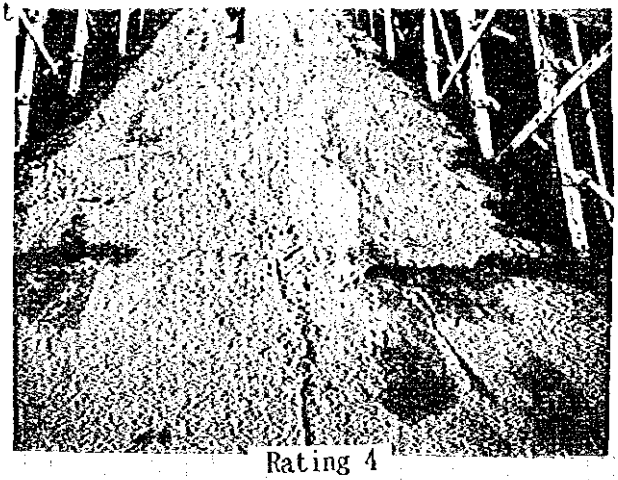
As examples of the damage assessment of each bridge member of bridges Table 4-1 and photos in subsequent pages are given.

Table 4-1 Degree of Defects of Each Rating

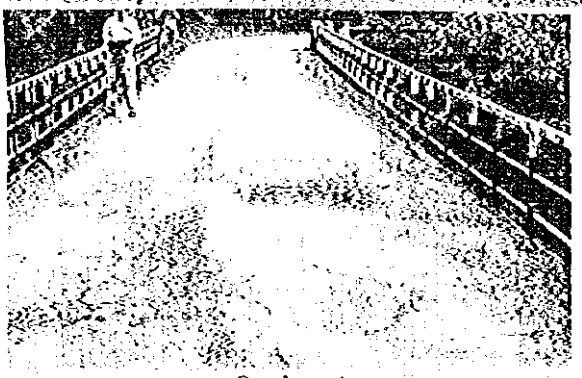
Members	Rating 4	Rating 3	Rating 2	Rating 1
Pavement	• Severe damage, (big crack uneven surface, pot hole and opening)	• Uneven surface big settlement at bridge approach	Damage needing further inspection	Minor damage
Curb Railing	• Long length of damaged portion • No curb/railing at all	• Medium length of damaged portion	"	"
Deck Slab	• Very corroded corrugated/buckle plates • Severe damage on concrete (crack, scaling, etc.) • Opening on slab • Free lime at crack • Reinforcing bar exposed	• Medium damage • Medium crack, scaling, free lime • Crack on pavement resulting from deck slab damage	"	"
Arch/Stone or Concrete	• Major crack • Void on stone/ concrete • Severe weathering through full thickness	• Free lime etc. • Heavy vegetation on members	"	"
RCB/RCS	• Severe crack scaling flaking • Reinforcing bar exposed • PC tendon exposed, cut apart • Big displacement	• Severe damage on pavement resulting from concrete slab	"	"
RSJ	• Severe corrosion • Void/opening of steel member	• Severe rust	"	"
Bearing	• Covered completely by abutment concrete	• Vegetation/debris abound	"	"
Expansion Joint	• Severe damage (cut and moving steel) • Big gap at joint	• Dangerous damages	"	"
Drainage	• Plugged completely due to small size	• Plugged severely	"	"
Piers	• Severe settlement • Very corroded steel member	• Crack	"	"
Abutment	• Severe scouring • Major crack • Severe settlement	• Crack	"	"
Wingwall	• Severe scouring • Major crack • Severe settlement • Major void and crack	• Crack	"	"
Revetment	Washed out revetment	• Severe damage	"	"
Steel through Truss	• Remarkable deflection	• Water stagnation on lower chord	"	"

Pavement



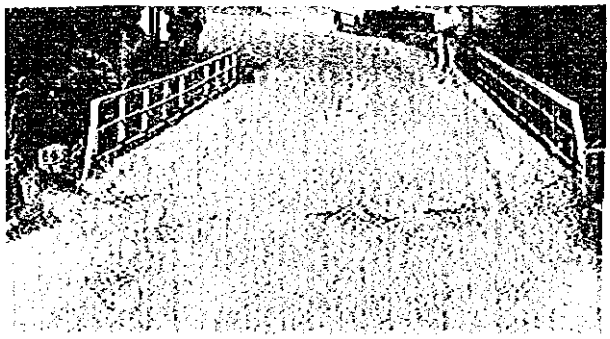


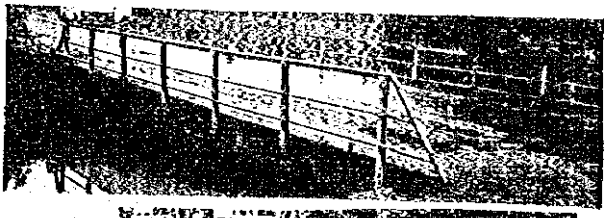
Rating 4

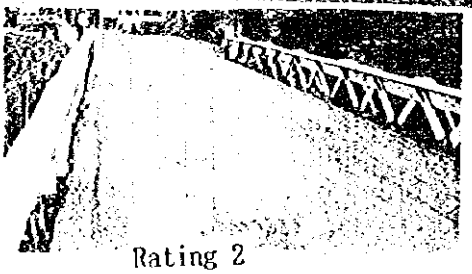


Rating 4

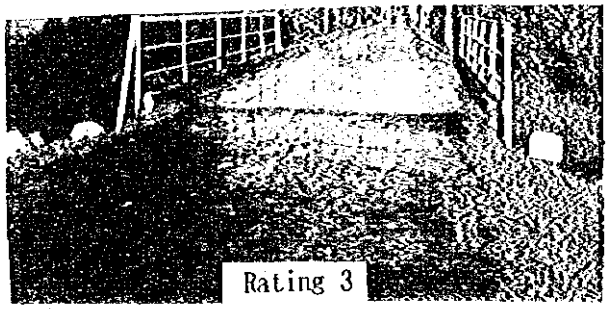
Rating 3





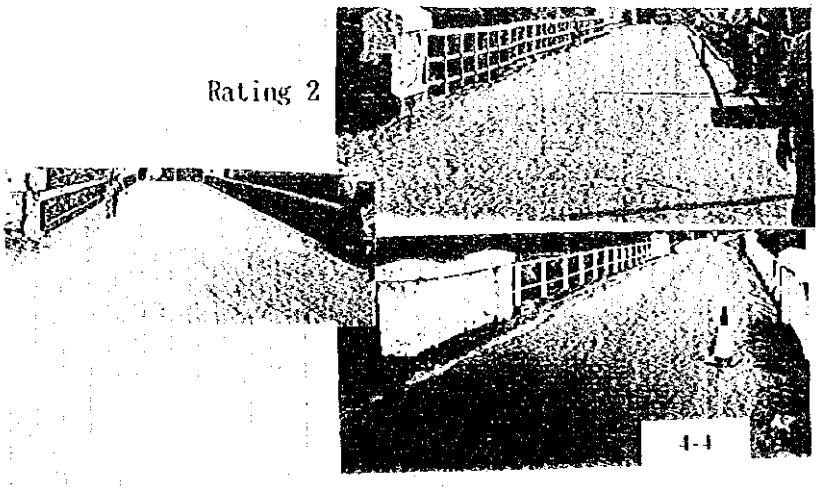


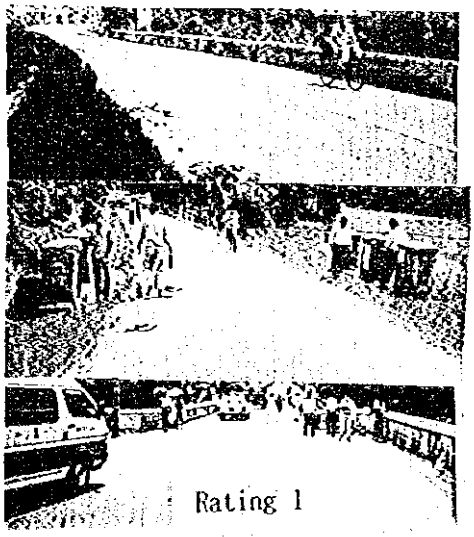
Rating 2



Rating 3

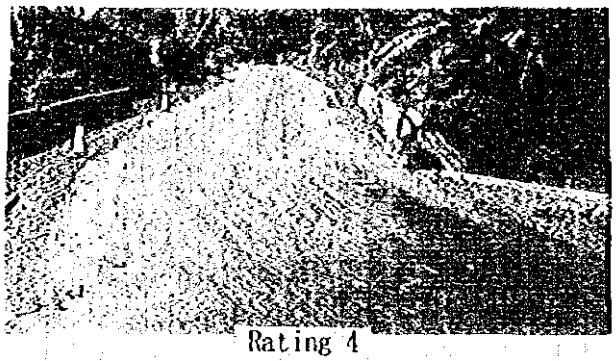
Rating 2



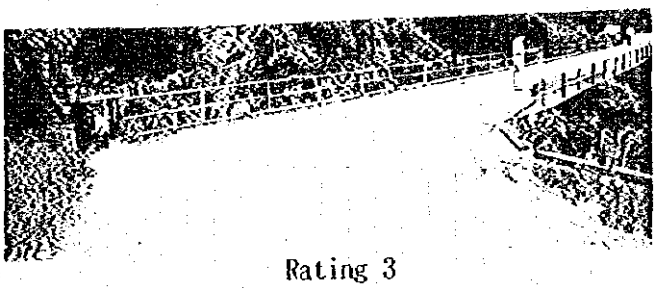


Rating 1

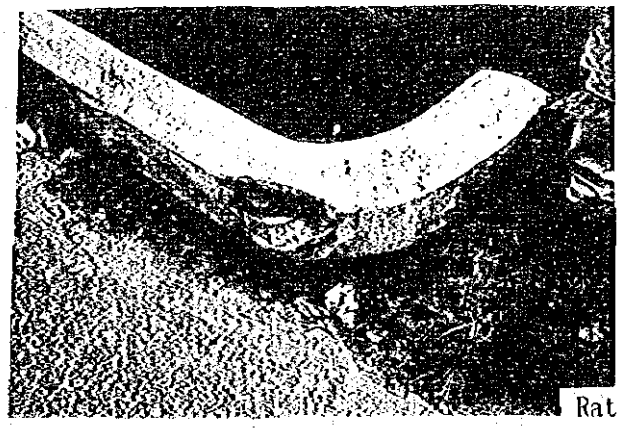
Curb



Rating 4

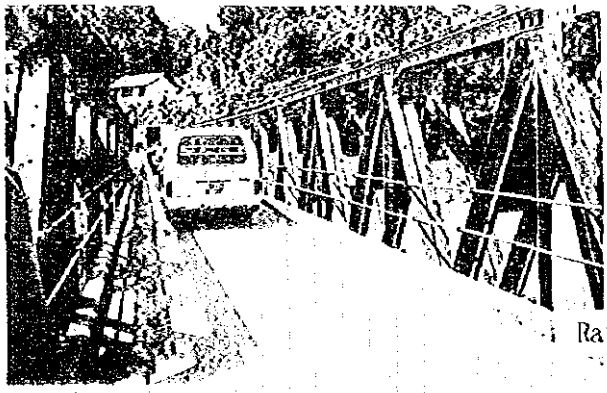


Rating 3



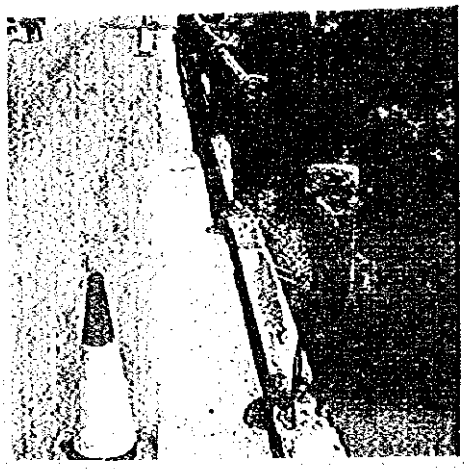
Rating 2

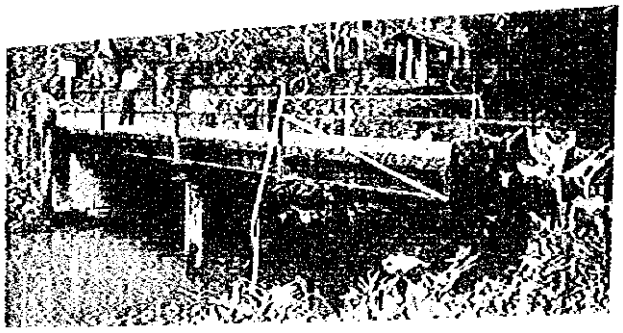
Damaged partly



Rating 1

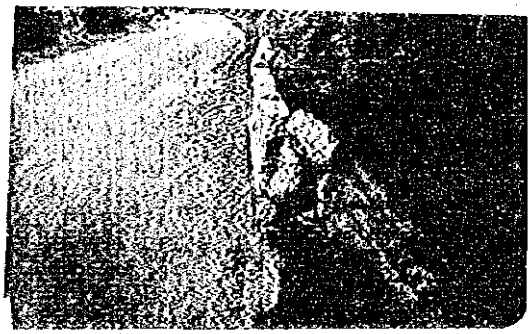
Railing



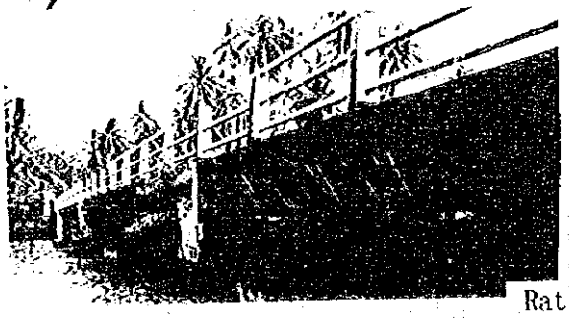


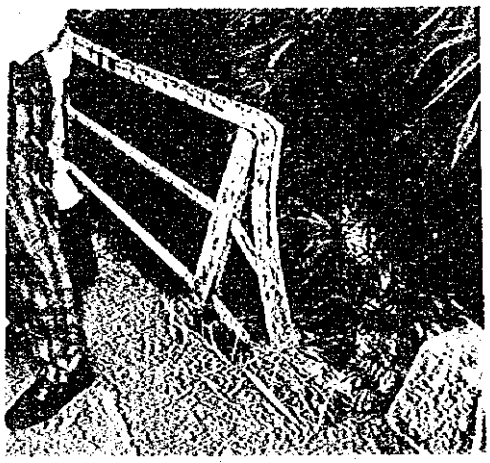
Rating 4

No railing

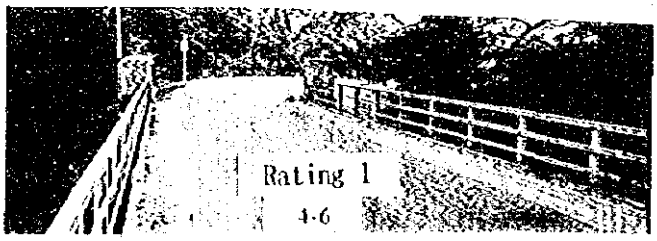


Rating 3



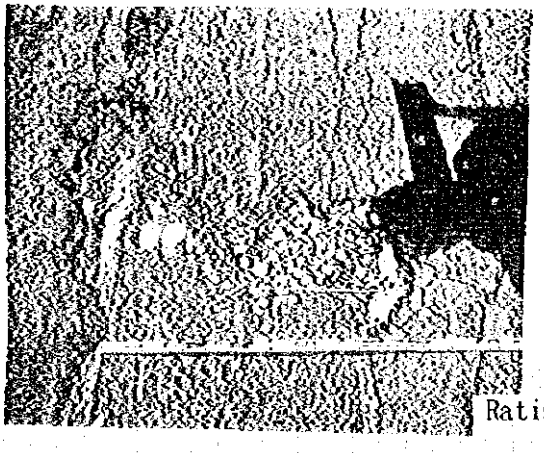


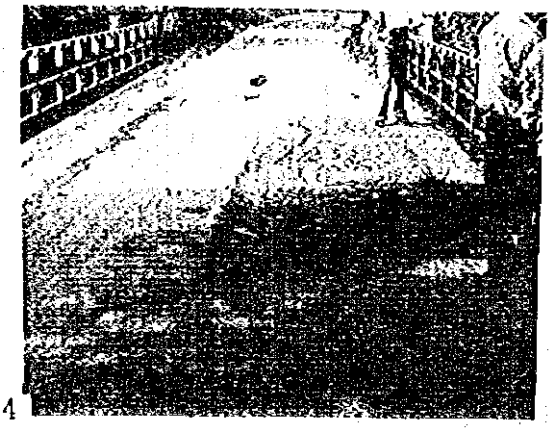
Rating 2



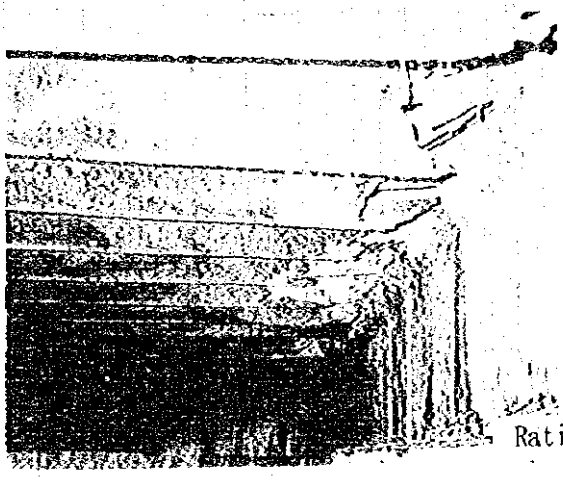
Rating 1

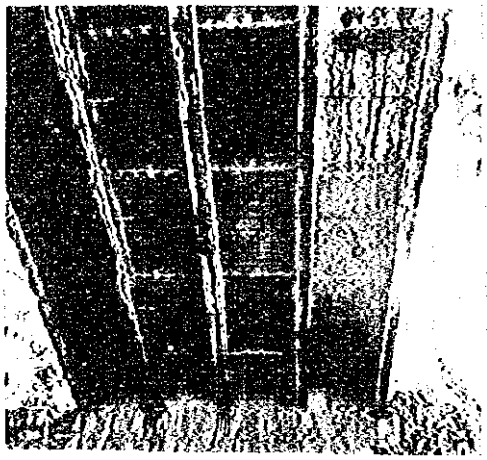
Deck slab



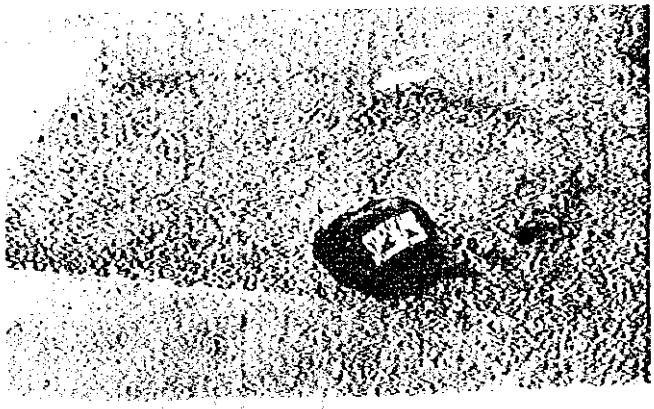


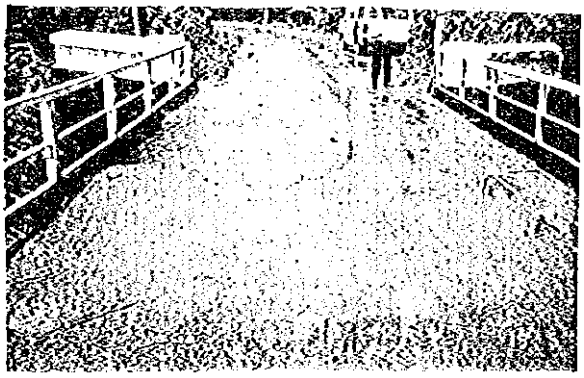
Rating 4

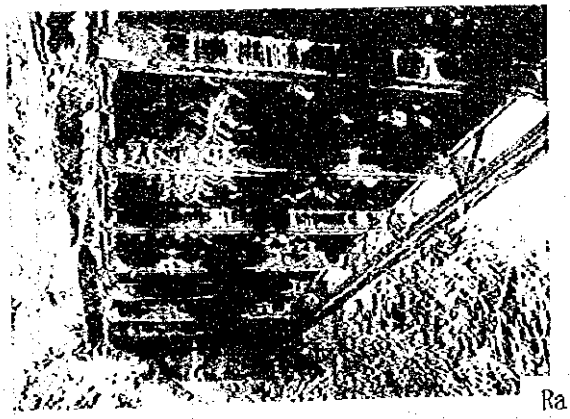


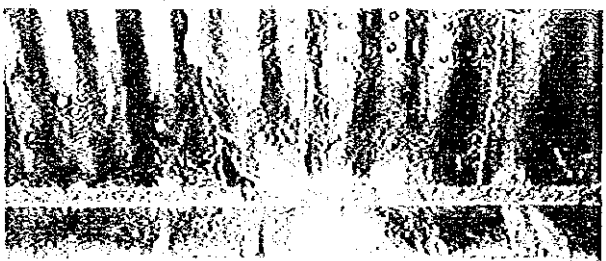


Rating 4



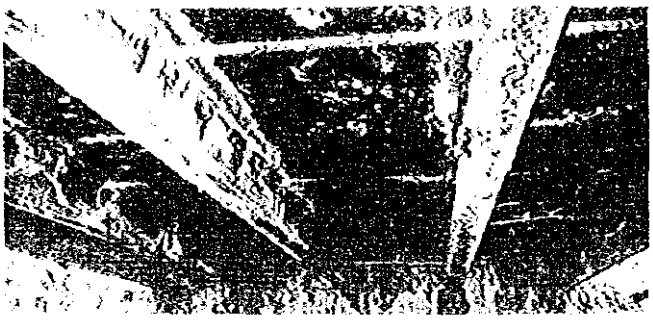


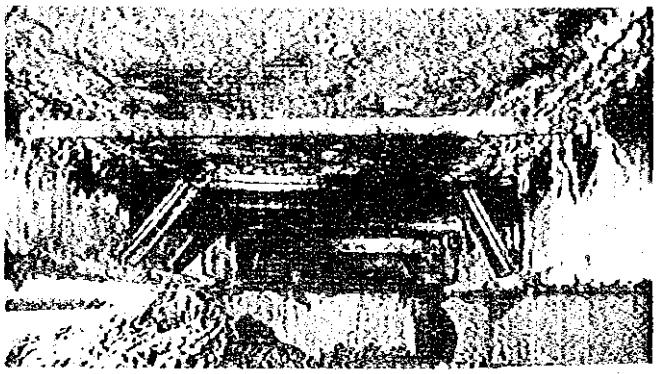


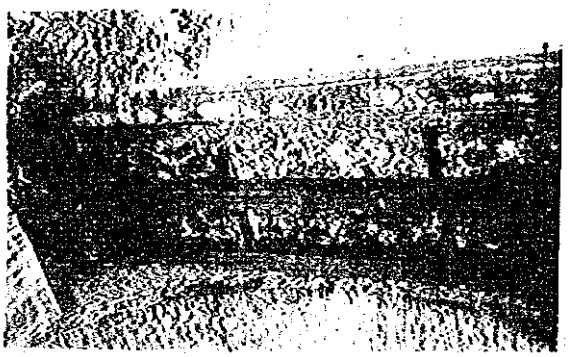


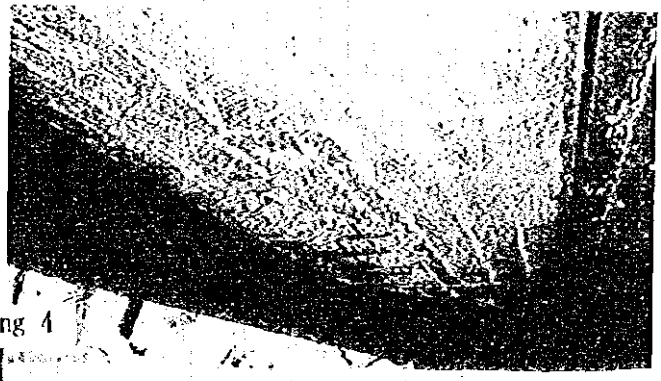
Rating 4

Deck slab

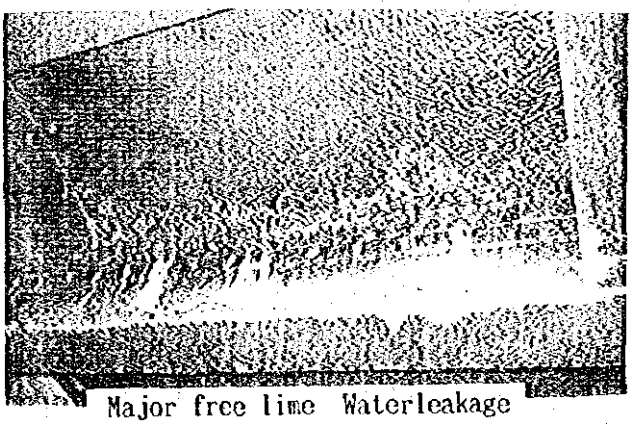




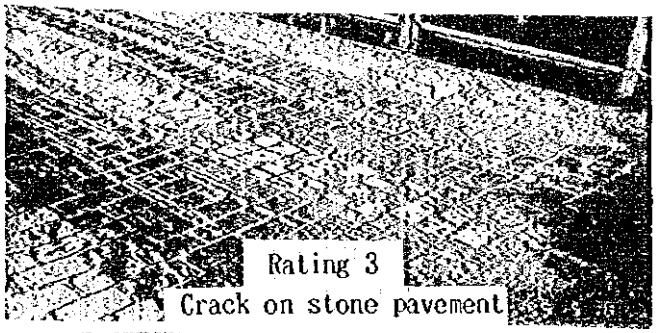




Rating 4

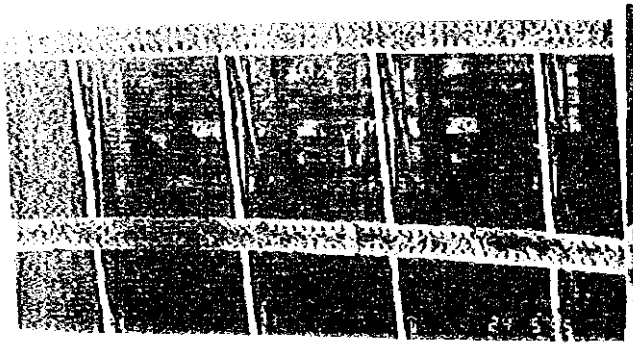


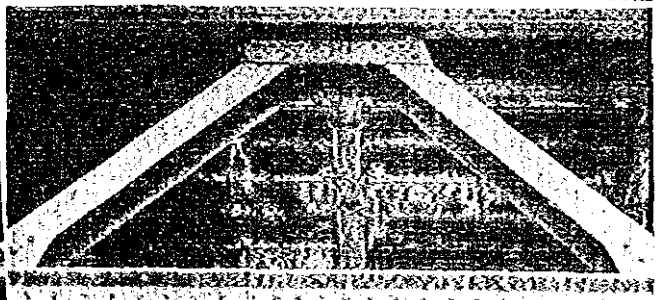
Major free lime Waterleakage

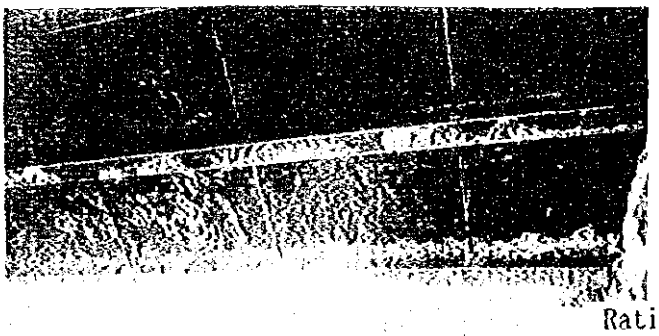


Rating 3

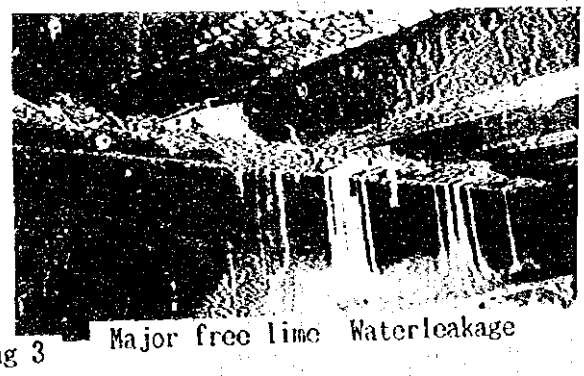
Crack on stone pavement





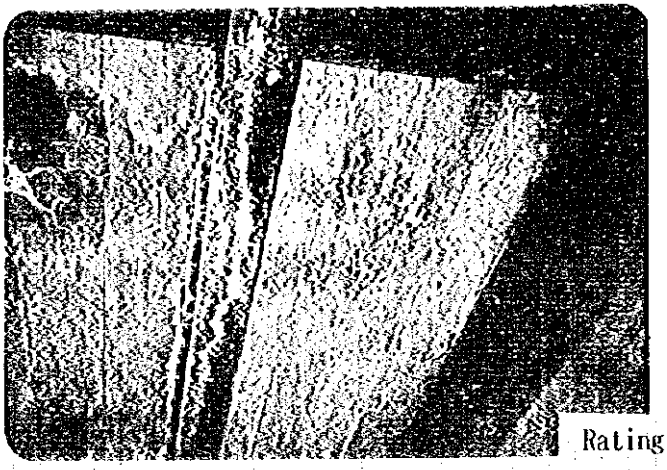


Rating 3

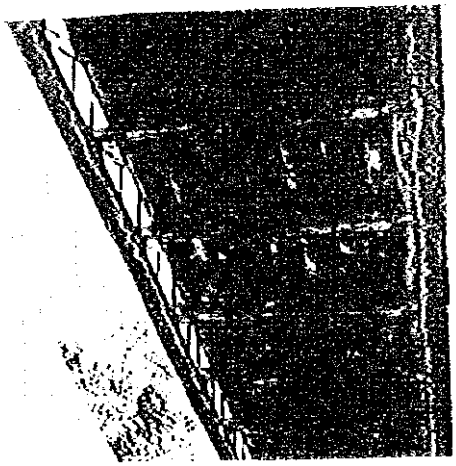


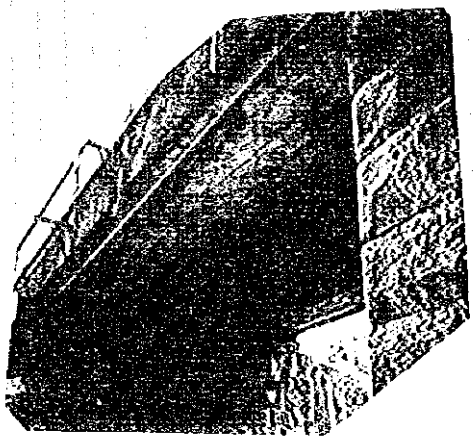
Major free lime Waterleakage

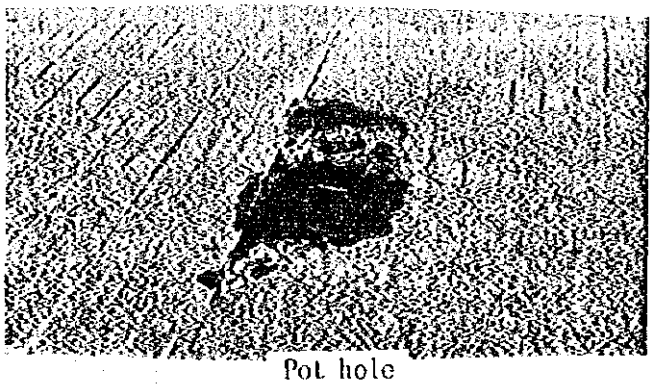
Deck slab



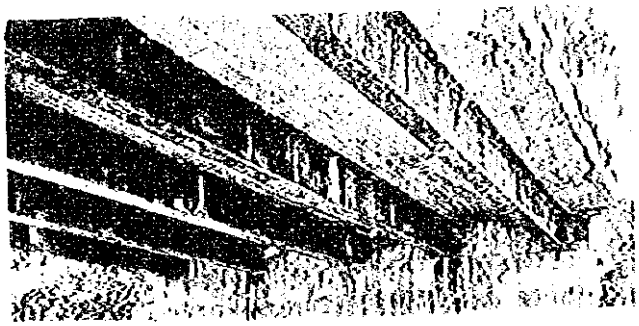
Rating 3

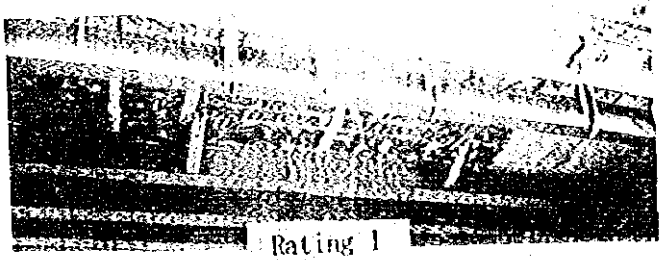






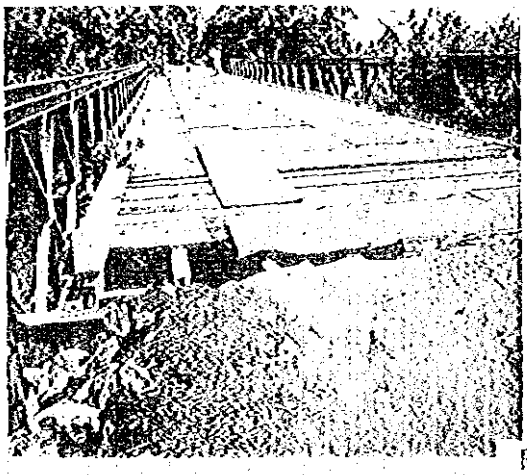
Pot hole

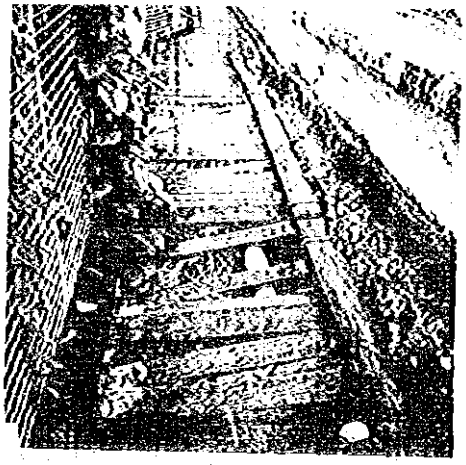




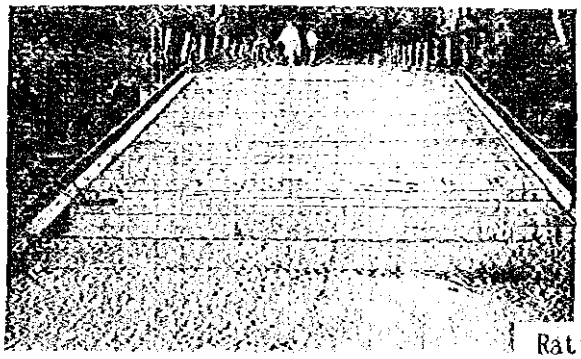
Rating 1

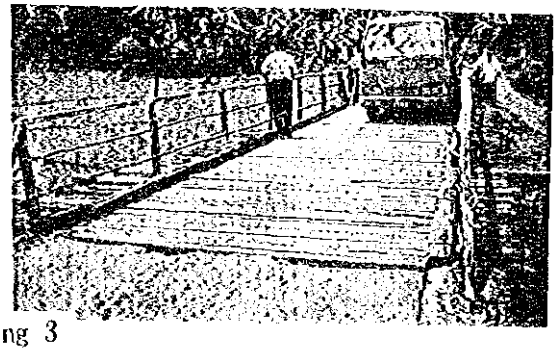
Timber deck





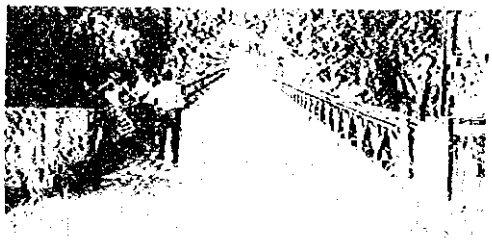
Rating 4

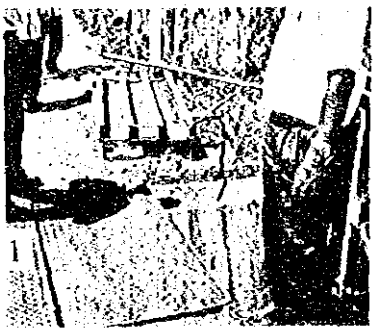




Rating 3

Steel plate deck

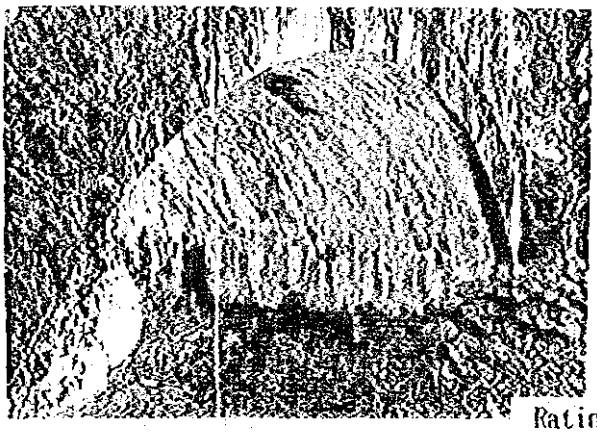


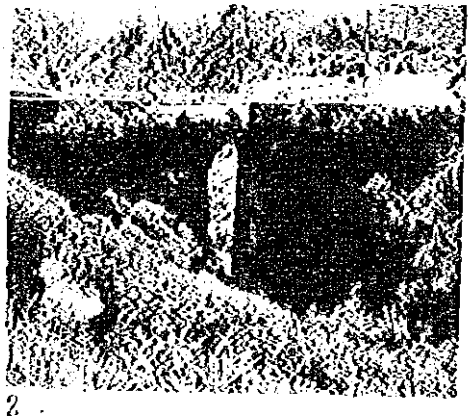


Rating 1

Arch Steel, Concrete

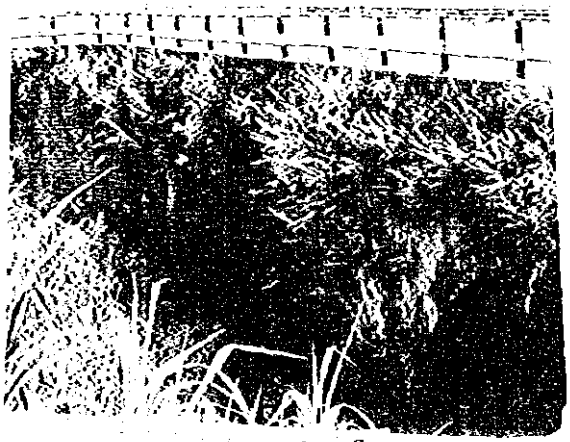
Rating 4





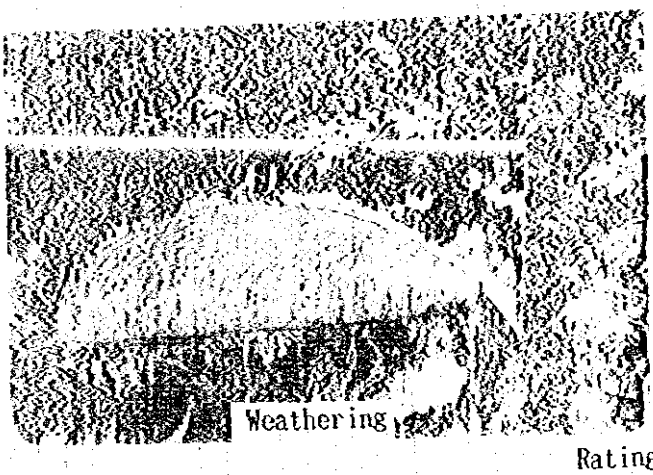
Rating 2

Arch/Concrete

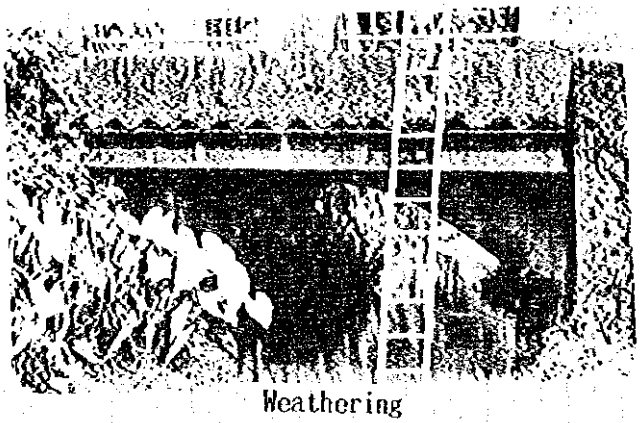


Rating 2

Rating 1

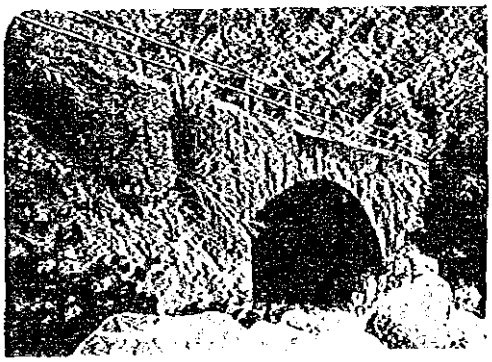


Weathering

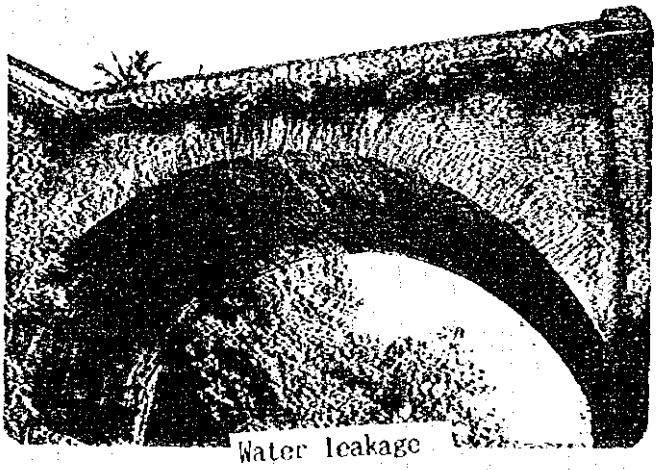


Weathering

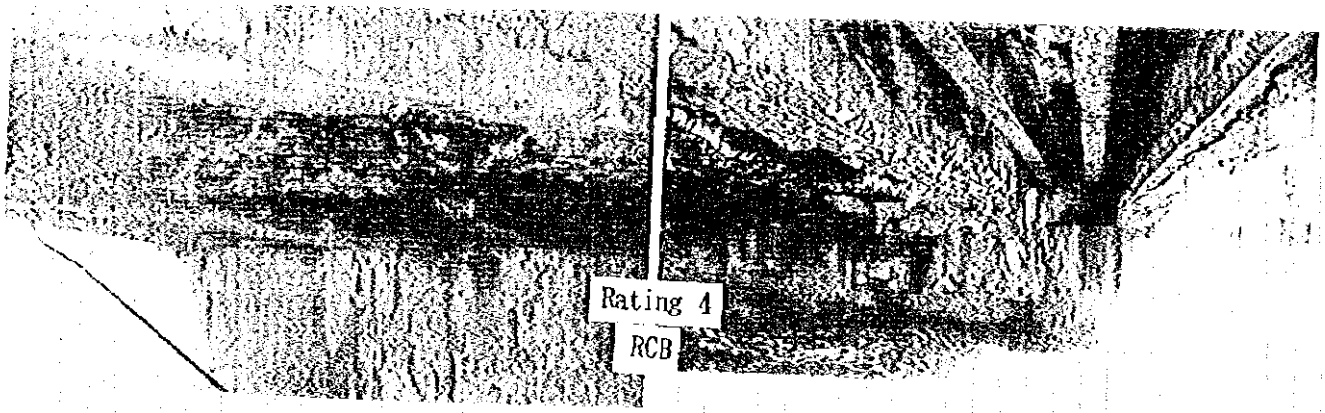
Rating 4



Rating 2

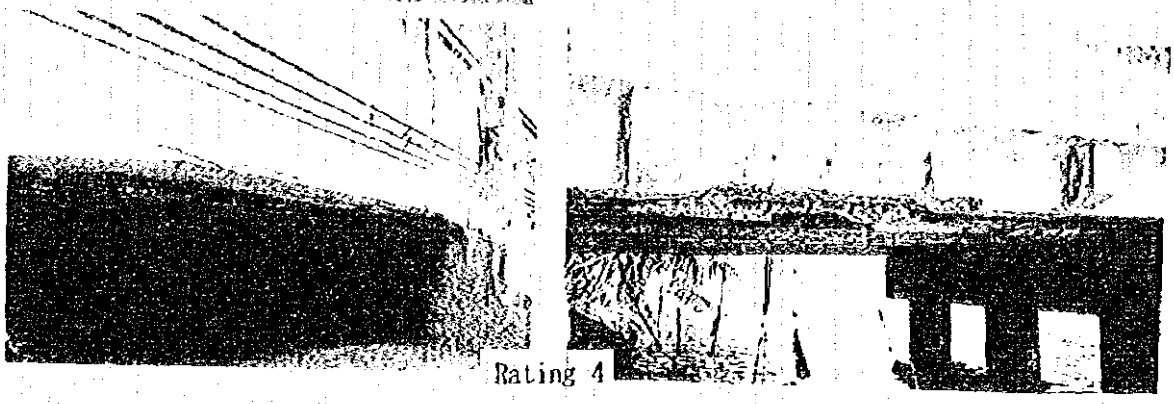


Water leakage

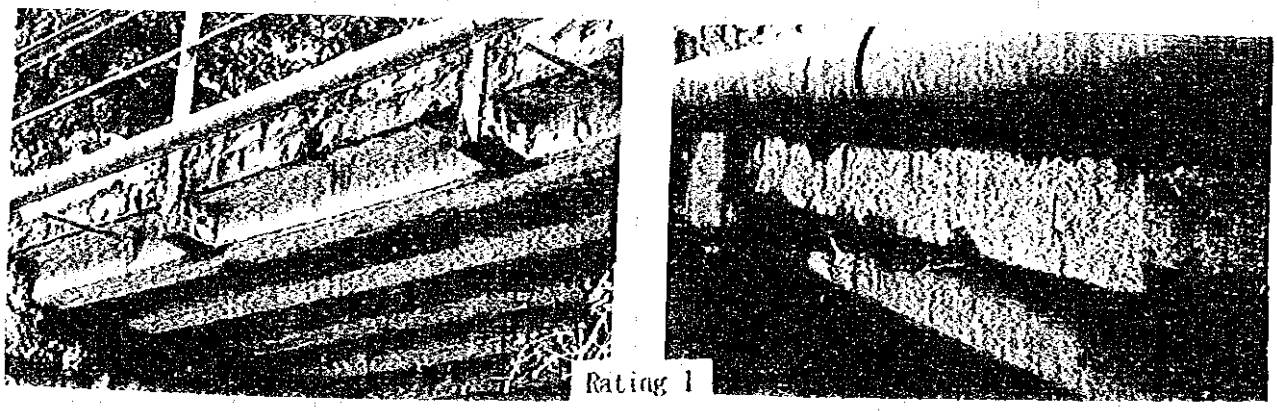


Rating 4

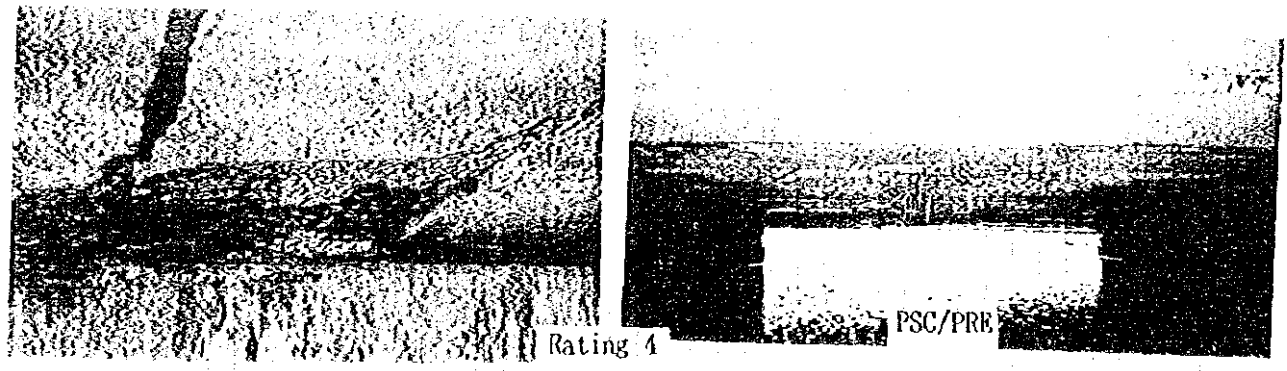
RCB



Rating 4

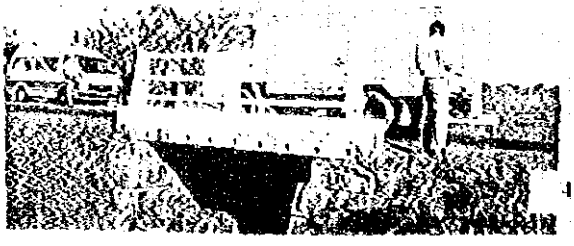


Rating 1



Rating 4

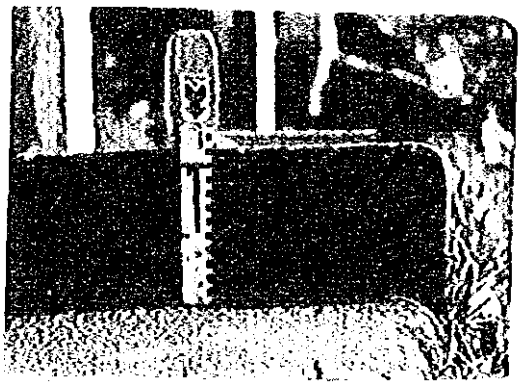
PSC/PRE



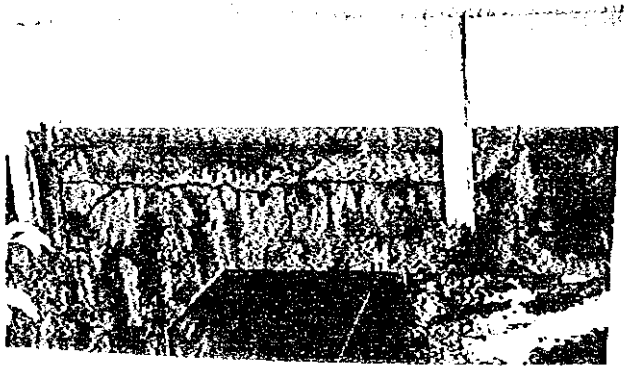
4-13

Rating 1

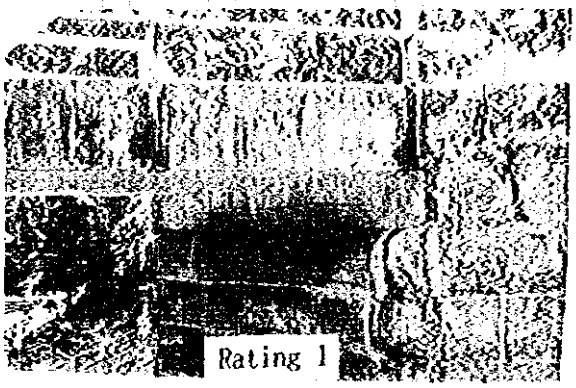
Rating 4



Rating 4



Rating 2



Rating 1