HR-531

Condition and Performance Report

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Thin Bonded Concrete Overlay With Fast Track Concrete

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Disclaimer

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INTRODUCTION

This report is a supplement to one issued in late summer 1986 which covered construction on U.S. 71, in Buena Vista County Iowa. The work involved rehabilitation of an older 20 feet wide pavement by placing a four inch thick bonded concrete overlay monolithically with two feet of widening on each side. The work was performed on one lane at a time while construction traffic and limited public traffic used the adjacent traffic lane. When work on the first lane was complete traffic was moved onto it and rehabilitation was completed on the second lane.

This report covers the condition of the rehabilitated roadway in May 1987 after the first winter. The condition is described by visual observations, core conditions, and various test results including core compressive strength, direct shear tests on cores for bond strength, profilometer results and delamtect test results.

VISUAL APPEARANCE

In general terms the pavement appears the same as it did when it was completed last summer. There is no apparent distress related to traffic usage or to the severe winter conditions.

A close examination reveals a small amount of additional transverse cracking which has appeared since last summer. This additional cracking is associated with the reflective cracking at mid panel in the old pavement and apparently was not visible last summer when the majority of reflective cracks was sawed with a crack saw and sealed with regular sof seal hot pour joint seal material.

An estimated 3500 feet of additional crack sawing and sealing is needed and will be accomplished in conjunction with another nearby project this summer.

At isolated locations a multiple transverse crack pattern has developed in the vicinity of the mid panel cracks in the old pavement and there is also a tendency for minor debonding to occur at the mid panel cracks. The delamtect report is attached and shows delamination in the direct vicinity of the transverse reflective cracks. Debonding is very minor and based on past experience is not considered a serious threat to long term performance.

The cause of the debonding is thought to be related to the slight crack closure in the old pavement after overlay placement and during the time of maximum temperature while the insulated covers were in place. Even though crack closure was restricted by incompressibles in the crack it appears there was enough minor closure to cause a tendency for debonding. This same condition appears to have caused the minor amount of multiple transverse cracks in these same areas.

CORE TESTS

Compressive strength of the concrete as shown by the strength of cores is very high and shows normal continued strength gain since last summer. On average the concrete containing calcium chloride is a little higher than concrete without calcium chloride.

The average strength of age 295 days is as follows:

Noncalcium Chloride	1% Calcium Chloride
Avg. of 3 - 6160 PSI ,	Avg. of 3 - 6690 PSI

Direct shear strength at the bond line shows the bond strength on average has decreased slightly. The decrease is considered minor and not significant. The bond strength is a little lower than anticipated but is in a comfortable range and well above the minimum considered necessary to cause the old pavement and the new overlay to work together as a structural unit.

Surface Treatment	Shear Strength (PSI)	Avg. Shear Strength (PSI)
Type I Grout	338	
	294	316
Type III Grout	358	
	318	
	294	
	411	345
Non Grouted	223	
	207	215
Type I Grout & Double Shot Blast	139	
	219	
	398	252

DELAMTECT

Three 1000 feet long test sections were selected for this study. The delamtect tested along centerline in each direction within one or two feet of centerline. Results are shown in the attached Delamtect Survey Tabulations. The abbreviations LT and RT represent left and right wheel tracks respectively. It is noted nearly all delamination occurs in the left track near centerline.

Based on these results delamination percentage could be calculated as follows:

10-28-86

$$\frac{\text{3 linear feet of delamination}}{6000 \times 100} = 0.05\%$$

4-14-87

$$\frac{\text{41 linear feet of delamination}}{6000 \times 100} = 0.68\%$$

Although delamination has increased since last summer it is considered minor and is not cause for concern.

ROAD RATER DEFLECTION

Road rater deflection testing was completed June 23, 1986, just prior to overlay construction. It was repeated April 4, 1987. The average structural rating (SR) at mid panel in 1986 prior to overlay was 3.49 and at the joints was 3.27. The average soil K values in 1986 were 58 at mid panel and 76 at the joints. In 1987 the average SR at mid panel is 6.04 and at the joints is 4.21. The average soil K values in 1987 are 144 at mid panel and 175 at the joints.

These test results show significant improvement in the pavement structural system, which is thought to result from several beneficial features: additional composite pavement thickness, relocating the outside wheel track to a position where the pavement thickness is at a maximum, improved subgrade conditions resulting from longituding drains and surface joint sealing, and improved structural capacity because of the tied and monolithic widening.

Road rater test results show the new composite unit is structurally adequate to carry current and projected traffic.

PROFILOMETER

Profilometer testing was accomplished by the contractor in 1986 following overlay placement. Profilometer testing was accomplished by the Iowa Department of Transportation April 10, 1987.

Results for representative sections are as follows:

	Profile Index (in./mi.)	
	1986	1987
Station 498+96 to 502+26 SB	13.50	11.50
521+41 to 526+69 NB	8.00	7.50
576+00 to 581+28 NB	18.50	20.50
628+60 to 633+88 NB	16.50	13.00
719+64 to 724+92 NB	9.50	8.50

These results are interpreted to show there is no perceptible deterioration of the ride quality since rehabilitation construction in 1986.

DEBONDING TAPE AT TRANSVERSE CRACKS

Debonding tape was placed over three transverse cracks in the old pavement just prior to overlay placement. The tape was 4 mil plastic by 4 inches wide with adhesive on one side. It was placed transversely across the driving lane and about 8 inches wide (two widths alongside each other) so that the total tape width covered the old transverse crack. The overlay was then placed and of the overlay inside the bounds of the debonding tape. The goal was to control reflective cracking in the overlay and transform a crack in the old pavement into a straight sawed joint in the overlay.

Results to date are very encouraging. Three cracks full width of the old pavement were treated with debonding tape. This made a total of 6 separate one lane applications (separate NB and SB lane construction). Five of the six one lane applications are blemish free. One of the six has a small scallop shaped crack deviating from the saw cut about three inches. These results certainly warrant additional trials of this localized debonding procedure so that reflective transverse cracking is minimized.

REFLECTIVE CRACKING AT LONGITUDINAL CRACKS

Reflective cracking over longitudinal cracks in the old pavement has been completely controlled by using #5 x 30 inch tie bars placed across the crack at about two feet intervals. The tie bars are held in place by clamps attached to the old pavement with powder nails. To date none of the longitudinal cracks have reflected through the overlay.

LONGITUDINAL WIDENING JOINT

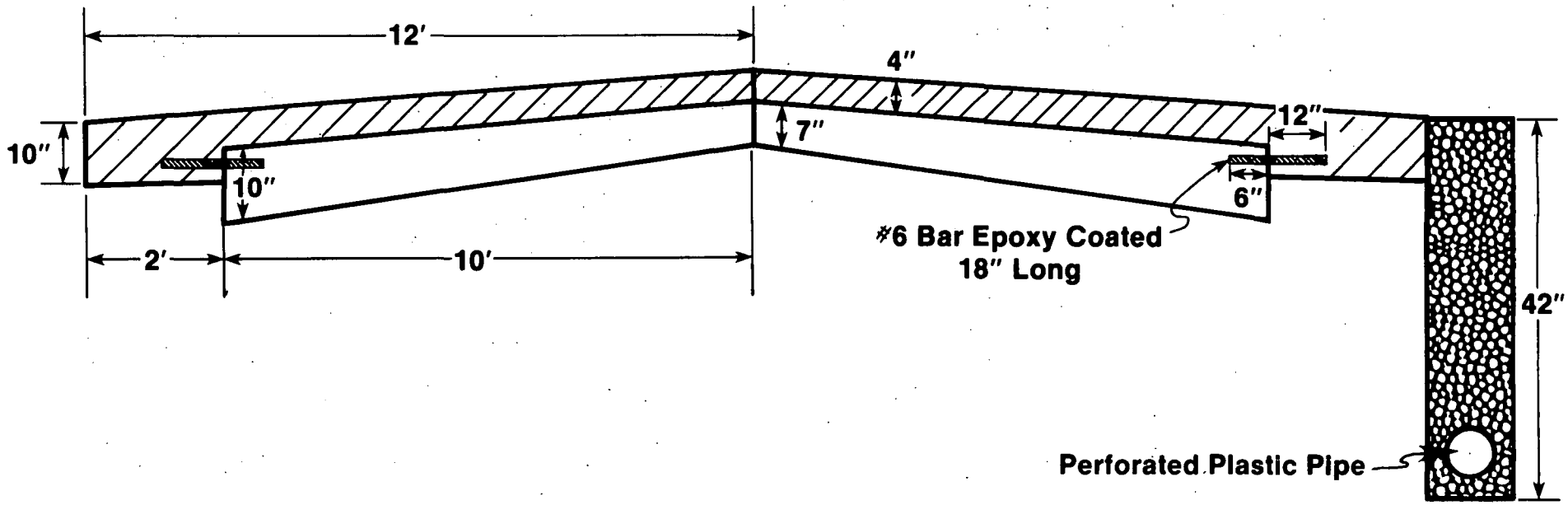
The joint between the widening and old pavement has been examined in some detail. There is a very limited amount of reflective cracking over the widening joint. One area is at the extreme south end NB where filling station and restaurant traffic enter and leave. The other area is at the extreme north end SB where equipment trouble occurred during concrete placement. Except for these two areas which are each less than 100 feet long no other cracking over the longitudinal widening has been observed.

SUMMARY

In summary the pavement condition and performance is considered very satisfactory and is expected to give good service for an extended number of years. The concept of single lane construction to permit usage of the adjacent lane for public and construction traffic is considered viable.

Additional information and experience is needed on future projects to explore controlling reflective transverse crack by using debonding tape. If this is successful debonding near the transverse cracks and associated multiple cracking because of elevated curing temperature will be eliminated or minimized.

An Iowa Department of Transportation review panel of design, construction and materials pavement specialists viewed this project along with 8 other bonded overlay projects in April 1987 and based on their judgment projected a service life for this project of 20 to 30 years.



Gra. 096
5193 1 29/86

FIGURE I

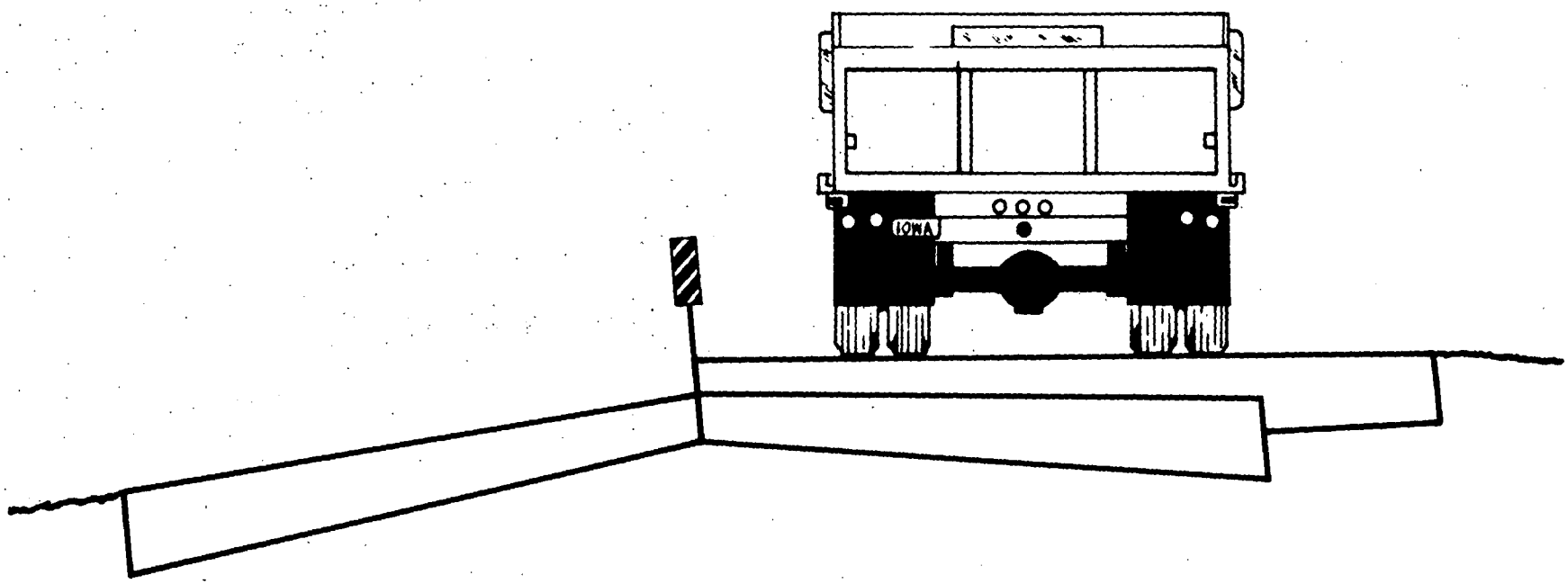
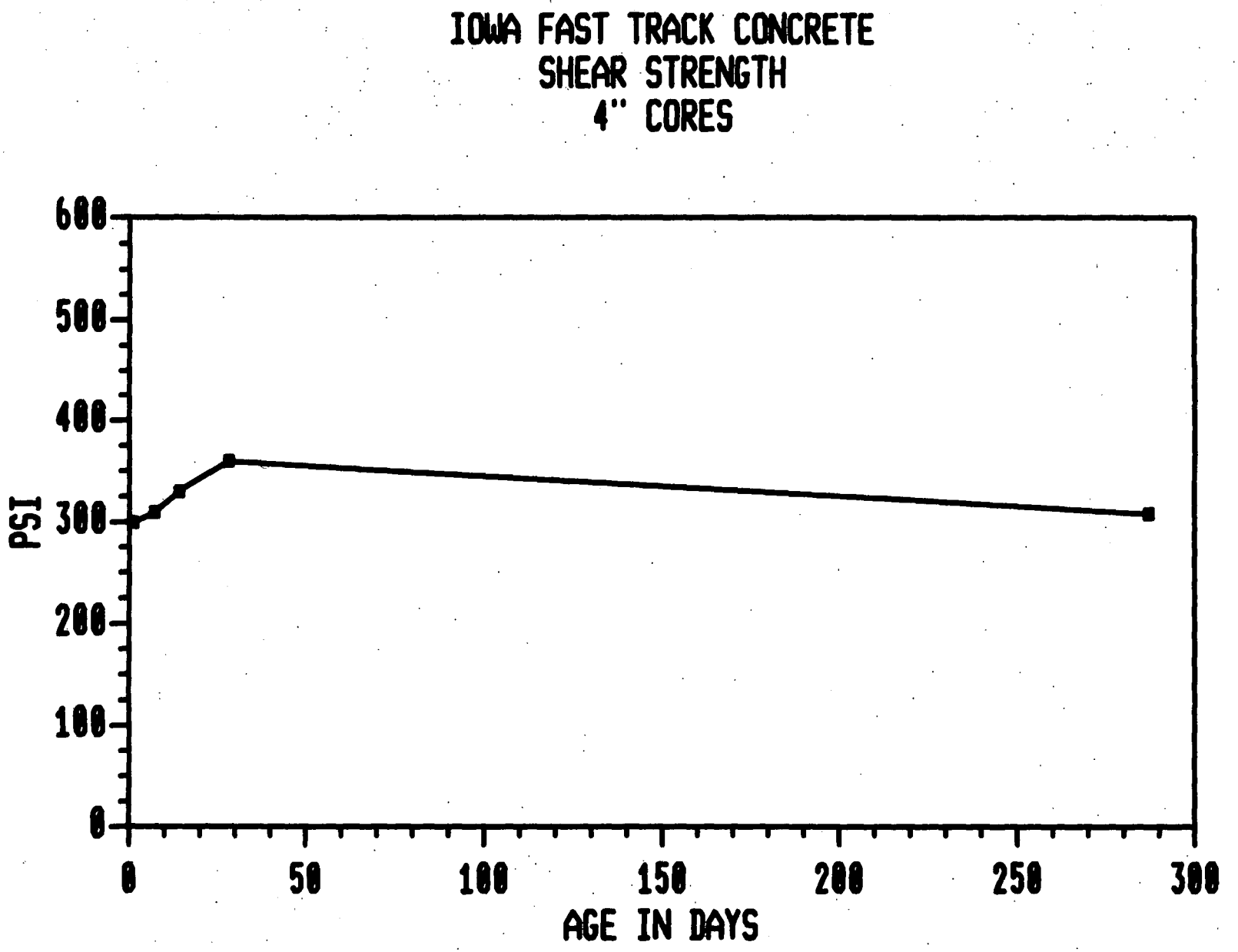
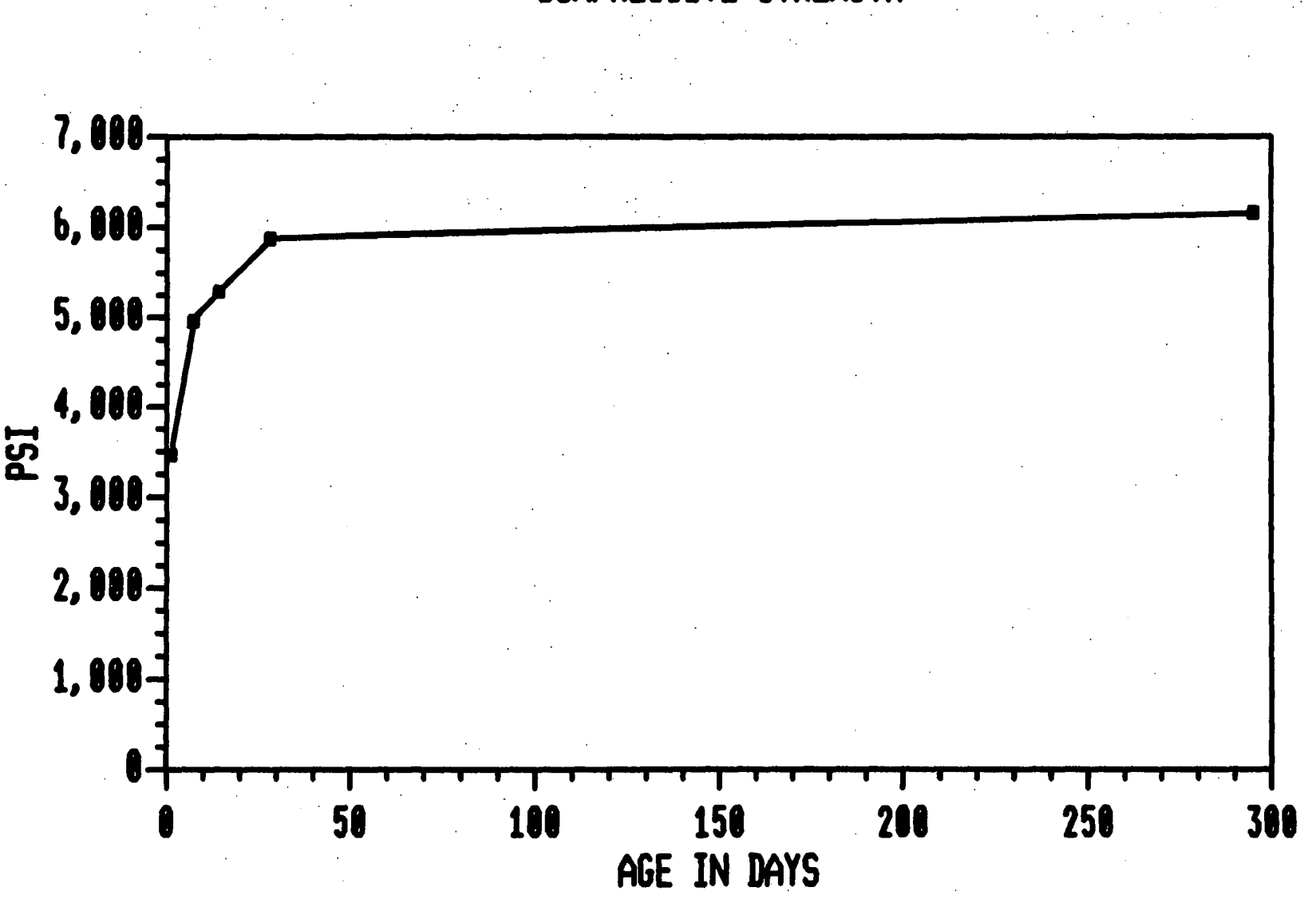
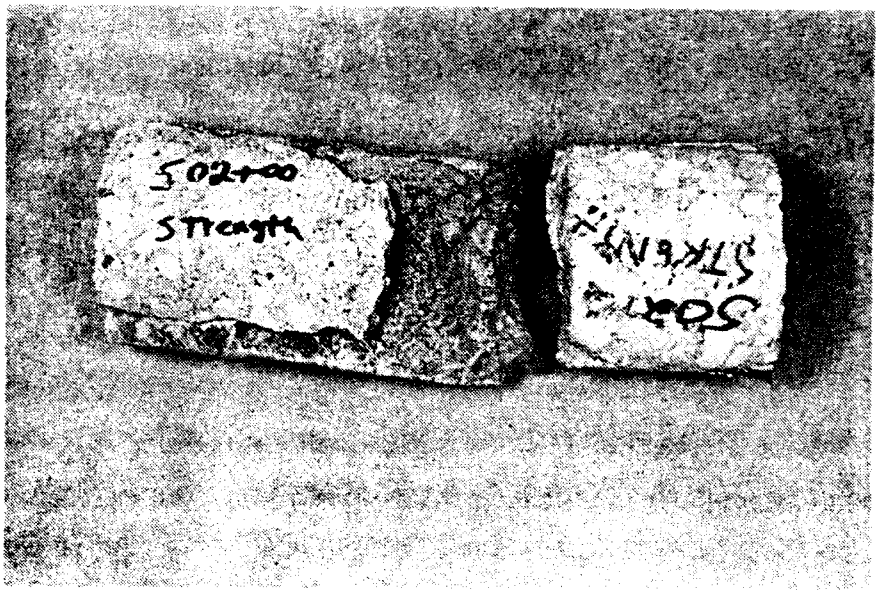


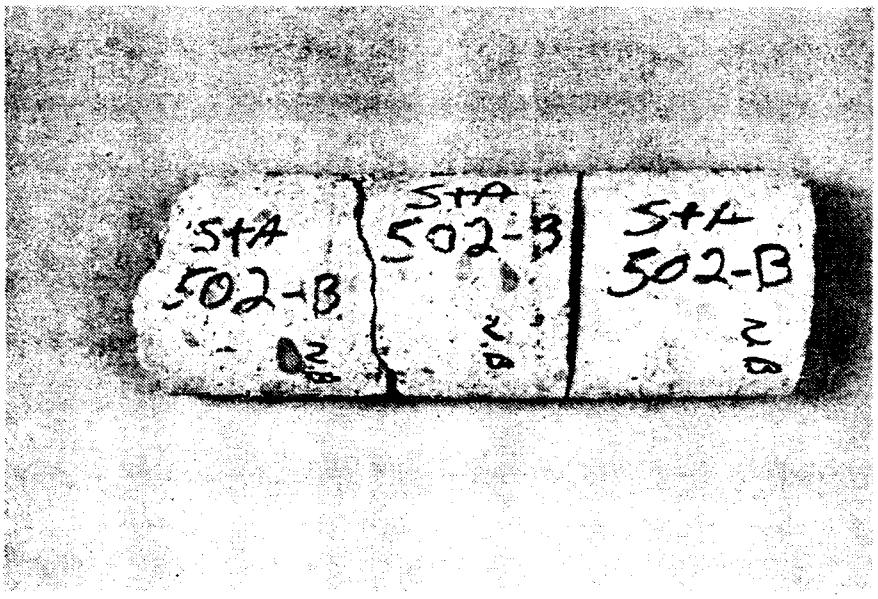
FIGURE II


IOWA FAST TRACK CONCRETE
SHEAR STRENGTH
4" CORES
600
500
400
300
200
100
0
PSI
0
50
100
150
200
250
300
AGE IN DAYS

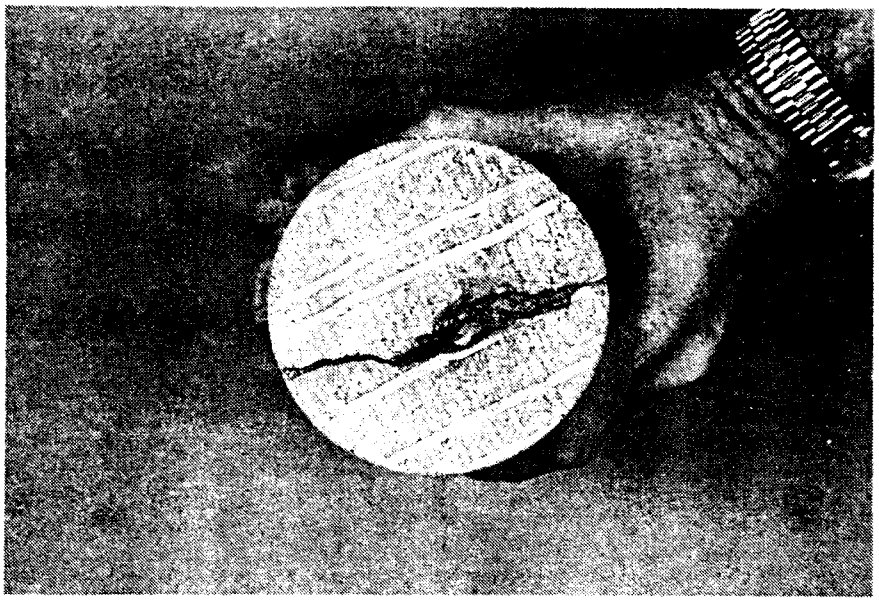

IOWA FAST TRACK CONCRETE
COMPRESSIVE STRENGTH
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
PSI
0
50
100
150
200
250
300
AGE IN DAYS

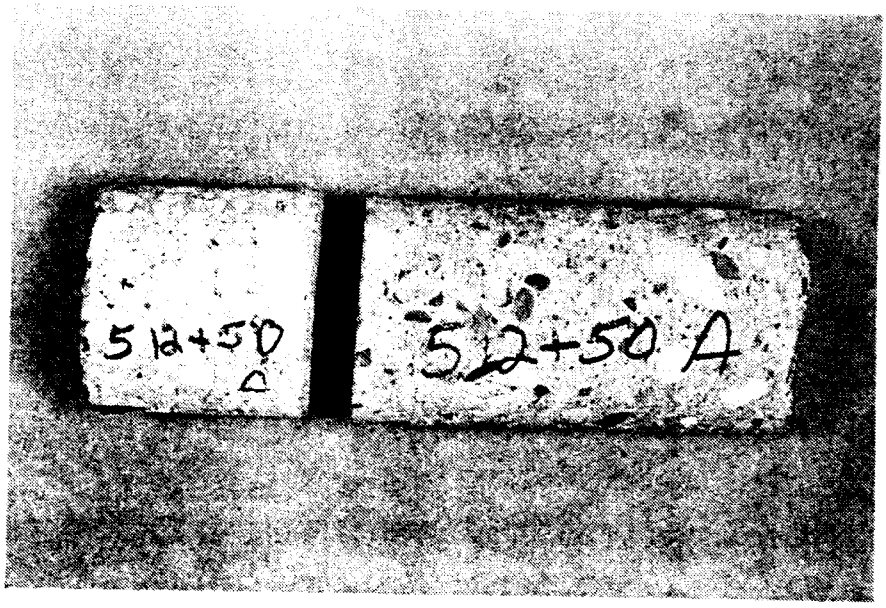
Station 502+00 A.
Crack in overlay matches
crack in old pavement.



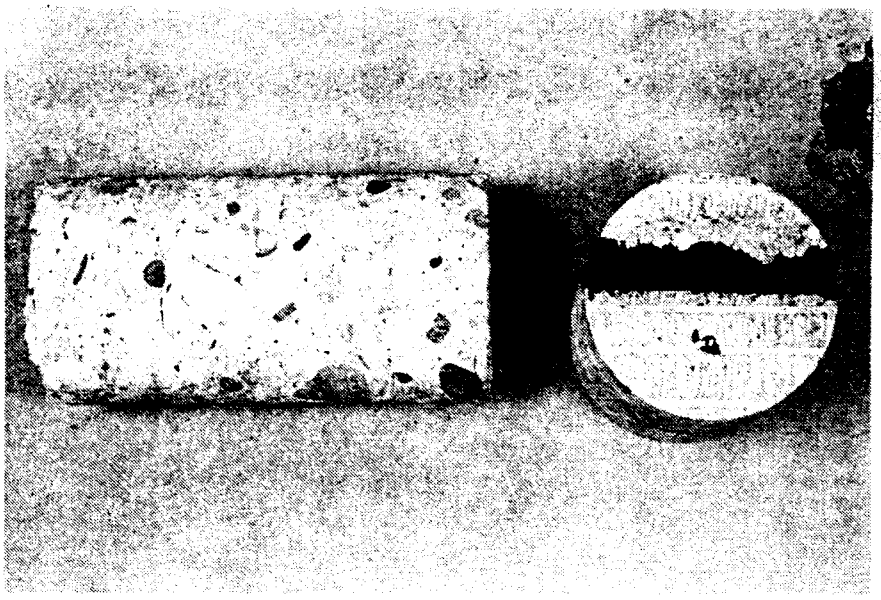


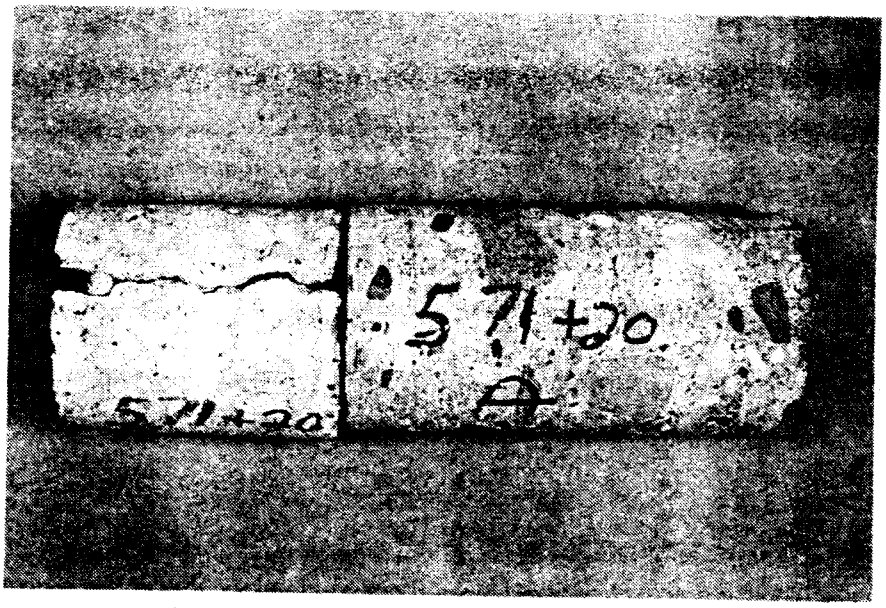
Station 502+00 B.
Crack in overlay does not match crack in old pavement.



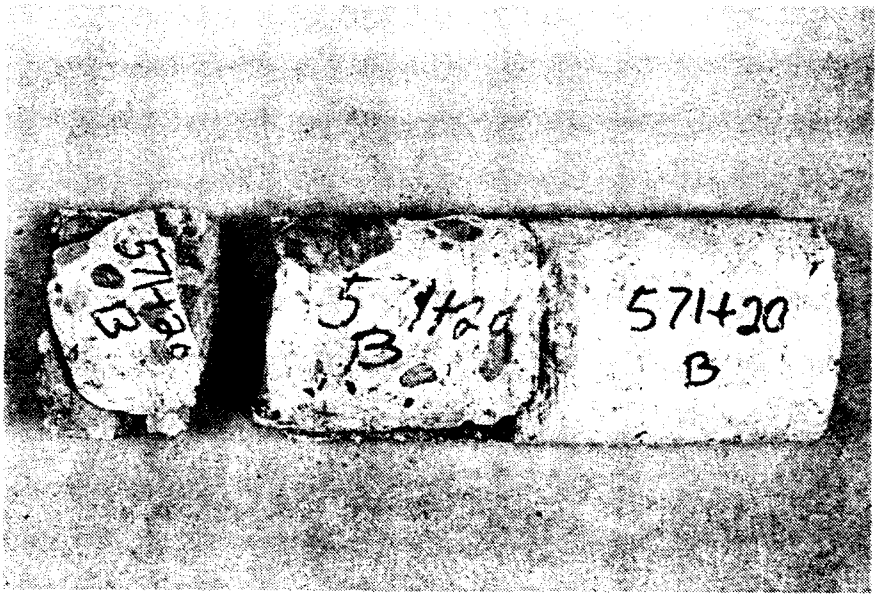


Station 512+50 A.
Crack in overlay does not match crack in old pavement.
Overlay is debonded.

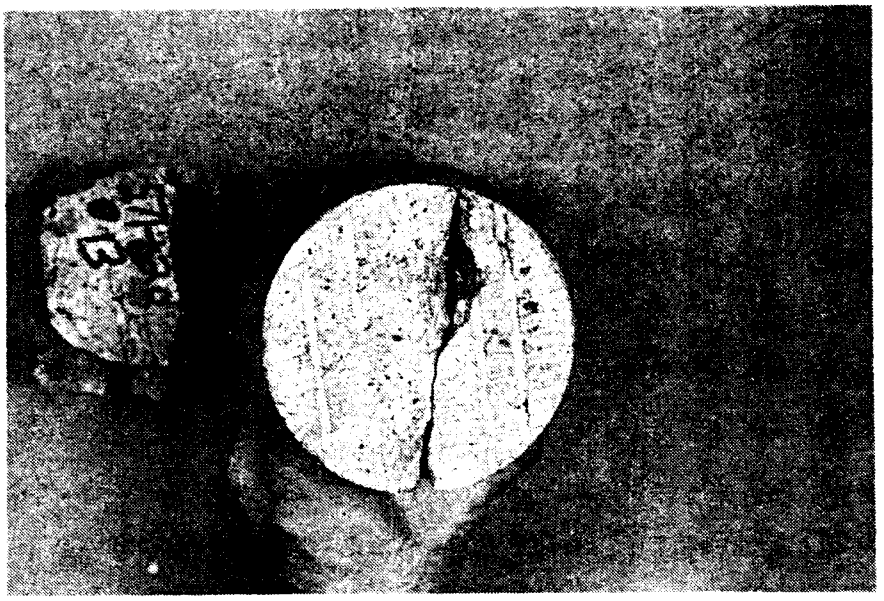




Station 571+20 A.
Crack in overlay does
not match crack in
in old pavement.



Station 571+20 B.
Crack in overlay matches crack in old pavement.



Station 592+50.
One crack in the overlay matches the crack in the old pavement.
One does not.