EVALUATION OF VARIOUS TYPES OF RAILROAD CROSSINGS

Fifth Progress Report

MICHIGAN DEPARTMENT OF TRANSPORTATION

TESTING AND RESEARCH DIVISION
RESEARCH LABORATORY SECTION

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OF RAILROAD CROSSINGS

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TABLE 1
SUMMARY OF DATA ON EXPERIMENTAL CROSSINGS IN SERVICE
(All crossings single tracks except as noted.)

Year	Type of Crossing	Railroad	Type of Line	Crossing Length, ft	Route Location	Roadway Surface	No. of Lanes	Average Daily Traffic*
1976	T-Core	A.A.R.R.	Main	36	Kress Rd	Bituminous	2	1,800
1976	T-Core[1]	D & M R.R.	Main	60	US 23, Omer	Bituminous	4	7,800
1976	T-Core[1]	D & M R.R.	Main	111	M 65, Twining	Concrete	2	3,500
1976	T-Core[1]	D & M R.R.	Industrial	60	US 23, Alabaster	Bituminous	2	5,300
1976	Fab-Ra-Cast[1]	C&O R.R.	Industrial	56	Wixom Rd	Concrete	4	11,500
1976	Fab-Ra-Cast[1]	C&O R.R.	Main	56	Seven Mile Rd	Concrete	4	8,300
1976	Steel Plank	D & T S.L.	Main	32	Hurd Rd	Bituminous	2	1,200
1976	Steel Plank	D & T S.L.	Main	39	Nadeau Rd	Bituminous	2	2,000
1976	Track-Span	C&O R.R.	Industrial	52	M 46, St. Louis	Concrete	4	8,800
1977	T-Core[2]	G.T.W. R.R.	Main	48	34th St	Bituminous	2	400
1977	Saf and Dri	Con Rail	Industrial	67	Oakland Ave	Concrete	5	25,000
1977	Steel Plank	D & T S.L.	Industrial	110	M 50, Monroe	Bituminous	4	10,100
1978	Saf and Dri	G.T.W. R.R.	Main	63	US 131, Schoolcraft	Concrete	4	11,100
1978	Steel Plank	D & M R.R.	Main	111	M 65, Twining	Concrete	2	3,500
1978	Steel Plank	D & M R.R.	Main	45	US 23, Rogers City	Concrete	2	1,750
1978	Steel Plank	D & M R.R.	Main	52	M 33, Aloha	Bituminous	2	1,400
1978	Steel Plank	M.I.R.C.	Main	55	M 115, Cadillac	Bituminous	2	3,800
1978	Parkco	D & M R.R.	Main	48	US 23, Omer.	Bituminous	4	7,800
1978	Parkco	D & M R.R.	Industrial	78	US 23, Alabaster	Bituminous	2	5,300
1978	Gen-Trac	D & M R.R.	Main	52	US 23, Alpena	Bituminous	2	9,700
1978	Gen-Trac	D & M R.R.	Industrial	60	US 23, Cheboygan	Concrete	4	7,900
1978	Gen-Trac	D & M R.R.	Main	52	F 41, Oscoda	Bituminous	4	11,500
1978	Gen-Trac	G.T.W. R.R.	Main	30	Niagara St, Saginaw	Concrete	2	11,000
1979	Saf and Dri	C&O R.R.	Industrial	80	US 10, Ludington	Bituminous	5	14,000
1979	Saf and Dri	G.T.W. R.R.	Main	66	M 21, Owosso	Bituminous	4	17,900
1979	Steel Plank[2]	C&O R.R.		45	M 100, Grand Ledge	Bituminous	4	5,100
1979	Steel Plank[3]	D & T S.L.	Main	52	Northline Rd, Wyandotte	Bituminous	4	9,000
1979	Steel Plank	D & T S.L.	Main	42	Goddard Rd, Wyandotte	Bituminous	2	
1979	Parkco	C&O R.R.	Main	45	M 100, Grand Ledge	Bituminous	4	5,100
1979	Parkco	G.T.W. R.R.	Industrial	60	US 131 BR, Grand Rapids	Bituminous	4	28,000
1979	Parkco	D.T.&I. R.R.	Industrial	60	King Rd, Trenton	Concrete	4	
1979	Parkco[4]	D.T.&I. R.R., Con Rail, D & T S.L.		54	Oak St, Wyandotte	Bituminous	3	
1979	Parkco	C&O R.R.	Industrial	60	I 196 BR, Wyoming	Bituminous	2	11,400
1979	Parkco[5]	D.T.&I. R.R., Con Rail		48	Goddard Rd, Wyandotte	Bituminous	2	
1979	Gen-Trac	G.T.W. R.R.	Main	51	M 66, Ionia	Bituminous	4	12,000
1979	Gen-Trac	C&O R.R.	Industrial	48	M 66, Ionia	Bituminous	4	12,000
1979	Gen-Trac	C&O R.R.	Main	63	US 131, Reed City	Bituminous	4	9,300
1979	Gen-Trac	C&O R.R.	Main	45	M 37, White Cloud	Bituminous	2	3,800
1979	Gen-Trac	G.T.W. R.R.		63	M 13, Bay City	Bituminous	2	14,400
1979	Gen-Trac	G.T.W. R.R.		30	Kolton St, Bay City	Bituminous	2	
1979	Gen-Trac	G.T.W. R.R.		73	State St, Bay City	Bituminous	2	
1979	Gen-Trac	G.T.W. R.R.		45	Backus St, Bay City	Concrete	2	
1979	Gen-Trac	G.T.W. R.R.		94	Wenona Ave, Bay City	Bituminous	2	
1979	Gen-Trac	G.T.W. R.R.		121	Marquette St, Bay City	Bituminous	2	
1979	Gen-Trac	G.T.W. R.R.		78	Henery St, Bay City	Bituminous	2	
1979	Gen-Trac	G.T.W. R.R.		36	North Union St, Bay City	Bituminous	2	
1979	Gen-Trac[5]	Con Rail		54	Northline Rd, Wyandotte	Bituminous	4	9,000
1979	Track-Span	C&O R.R.	Main	80	US 31, Manistee	Bituminous	4	16,000
1979	Track-Span	C&O R.R.	Industrial	115	US 31, Manistee	Bituminous	4	12,100
1980	Steel Plank[3]	D & T S.L.	Main	45	Pennsylvania Rd, Wyandotte	Bituminous	2	9,600
1980	Steel Plank[2,3]	D & T S.L.	Main	52	East Elm St, Monroe	Bituminous	2	2,000
1980	Track-Span	D & T S.L.	Main	25	East First St, Monroe	Concrete	2	2,000
1980	Track-Span	Con Rail	Industrial	60	East First St, Monroe	Concrete	2	2,000
1980	Saf and Dri	C&O R.R.	Main	72	M 57, Clio	Bituminous	2	10,000
1980	Saf and Dri	C&O R.R.	Main	40	M 83, Gera	Bituminous	2	5,000
1980	Parkco	Con Rail	Main	66	I 96 BL, Lansing	Concrete	4	14,300
1980	Parkco	Con Rail	Industrial	42	East Elm St, Monroe	Bituminous	2	2,000
1980	Parkco	D.T.&I. R.R., Con Rail	Main	42	Pennsylvania Rd, Wyandotte	Bituminous	2	9,600
1980	Parkco	D & M R.R.	Main	42	M 72, Grayling	Bituminous	2	9,000
1980	Parkco[3]	C&O R.R.	Industrial	72	M 13, Saginaw	Bituminous	4	11,000
1980	Gen-Trac	G.T.W. R.R.	Industrial	40	Auburn Rd, Auburn Heights	Bituminous	2	9,300
1980	Cobra - X[2]	G.T.W. R.R.	Main	54	M 40, Marcellus	Bituminous	2	2,500
1980	Cobra - X[4]	G.T.W. R.R.	Main	93	M 216, Marcellus	Bituminous	4	2,300
1981	Saf and Dri	C&O R.R.	Main	48	M 15, Arthur	Bituminous	2	3,400
1981	Saf and Dri[2,3]	C&O R.R.	Main	108	M 54 BR, Flint	Bituminous	4	
1981	Gen-Trac	C&O R.R.	Main	84	US 31, Grand Haven	Bituminous	6	14,400
1981	Cobra - X	C&O R.R.	Main	42	M 15, Vassar	Bituminous	2	4,600
1981	Cobra - X	Con Rail	Industrial	72	M 89, Plainwell	Bituminous	2	2,500
1981	Parkco[3]	Con Rail	Main	42	M 89, Plainwell	Bituminous	2	2,500
1981	Parkco	C&O R.R.	Main	60	Seven Mile Rd, Northville	Concrete	4	8,300
1981	Parkco[3]	L. C. R.R.	Main	90	M 52, Adrian	Concrete	4	6,900
1981	Parkco[3]	L. C. R.R.	Main	72	US 223, Palmyra	Bituminous	2	6,800
1981	Parkco	G.T.W. R.R.	Main	54	M 24, Oxford	Bituminous	4	28,800
1981	Parkco[3]	C&O R.R.	Main	162	M 46, Merrill	Bituminous	4	5,100
1981	Parkco[3]	M. I. R.	Main	66	M 71, Owosso	Bituminous	4	16,000
1981	Parkco[3]	M. I. R.	Main	60	M 71, Owosso	Bituminous	4	12,500

*Total traffic in both directions.
[1] Experimental surface material replaced.
[2] Two tracks.
[3] Modified design.
[4] Five tracks.
[5] Three tracks.

Surface Materials

All crossing surface materials are proprietary products. Eight materials have been installed for evaluation purposes. Two of these—T-Core and Fab-Ra-Cast—were found to give unsatisfactory performance and are no longer accepted as a crossing material. It should be noted that the Fab-Ra-Cast crossing included in this evaluation was of an older design than that currently available. The new design has been approved by the Department for evaluation under this project.

Of the remaining six materials, three consist of steel reinforced rubber panels, one is made of steel plates, one is cast-in-place utilizing a mixture of ground tires and epoxy, and one consists of expanded linear high-density polyethylene. A brief description of the six crossings, based on the manufacturer's literature, follows. Modifications made to the original design are noted.

Saf and Dri (75 NM-428)

This type of crossing consists of modular units made of structural steel tubes enclosed in an elastomer. The tubes are filled with grout to increase their rigidity. The center units are 26 in. wide and 6 ft 8 in. long and two units are used to span the distance between rails. The side units are of the same length and are 20-7/8 in. wide. The surface pattern consists of 1/4-in. wide by 5/16-in. deep grooves spaced 1 in. apart and running perpendicular to the rails. The tie spacing is 20 in. on centers and wood shims are required to obtain proper surface elevation. Twelve 3/4-in. drive spikes with shock absorbing rubber washers are used to fasten each center unit, and four are used to fasten each side unit. The spike holes can be closed with a rubber plug if desired.

A new design of the Saf and Dri crossing is now available. The panels consist of corrugated steel plates enclosed in an elastomer. The panel length is 36 in. The side panel width is 19-53/64 in. and the gage panels are 56-1/2 in. wide plus a lip that extends under each rail ball. Their thickness is 2-13/16 in. The surface pattern consists of 1/4 in. by 15/16-in. grooves perpendicular to the rails and spaced 1 in. apart. Longitudinal grooves are spaced 6 in. apart and are 1-13/16 in. deep with a top width of 1-9/16 in. tapering to a bottom width of 13/16 in. The required tie spacing is 18 in. on centers and tie lengths should be 8 ft 6 in. Wood shims are placed on the ties to obtain correct elevation. The units are fastened by bolting through the shims and the ties. Eight bolts are required on ties where two units are joined and four bolts on intermediate ties. A steel splice plate fitting in the bottom of the longitudinal grooves and locking the units together is used under the bolt heads when joining two units. A wood header is needed.

Steel Plank (74 NM-404)

The steel crossing consists of modular units fabricated from No. 3 gage hot-rolled steel. The center units are 50-1/2 in. wide and 6 ft 6 in. long and are fastened to the ties with 15 lag bolts. The side units are 20 in. wide and 6 ft 6 in. long, with six lag bolts used to fasten each unit to the ties. A tie spacing of 19-1/2 in. on centers is required. A steel washer and a rubber washer are used under the head of each lag bolt. The top surface of the units is coated with epoxy containing sand to increase surface friction, and the interiors of the units are epoxy coated to resist corrosion.

The manufacturer of the Steel Plank crossing has modified the design described above. The modification basically consists of the surface supports running perpendicular to the ties rather than parallel; the lag bolts used for fastening are installed in dimpled holes in the surface rather than through holes in the supports; each side unit is fastened with 10 bolts rather than 6; and the center units are fastened with 6 bolts rather than 15. No header is required.

Track-Span (74 NM-416)

This crossing utilizes flexible epoxy and ground automobile tires and is cast-in-place. The rails, ties, and pavement edges or edge forms, are coated with epoxy prior to pouring the crossing. A base layer of flexible epoxy containing ground tire casings is placed first. Then a wearing surface about 2-1/2 in. thick consisting of flexible epoxy with rubber buffings is placed and the surface is finished by tamping. A flange-way is formed on the inside of each rail. Approximately four hours of curing time is needed and installation is limited to dry weather and temperatures above 35 F. No special tie spacing is required, and no header is needed.

Parkco (77 NM-537)

This crossing material is described by the manufacturer as molded rubber modules reinforced with steel flex plates. The slab units are placed on wood shims spiked to the ties. The slab joints are of the tongue-and-groove type and longitudinal channels are cast within the units. The slabs are fastened by tensioning cables passing through the longitudinal channels and through holes in steel plates bolted to the end ties of the crossing. A steel plate protects the fastening rods and plates at each crossing end. The center units are 6 ft long, 29-1/2 in. wide, and 3-1/2 in. thick and two units, placed side by side, are used between the rails. The side units are 6 ft long, 18 in. wide, and 3-1/2 in. thick. A wood header is used to prevent material from entering under the crossing surface. A tie spacing of 18 in. is required. The surface consists of a 1/2-in. raised circle pattern.

The design has been modified by adding a steel bar to the underside of the flex plates. This bar is enclosed in rubber. Bolts are cast into the side units for fastening the header in place.

Gen-Trac (76 NM-484)

The modular units for this crossing consist of a 1/4-in. structural steel arch enclosed in an elastomer. The arch is prevented from spreading at its springing line by 1/2-in. bolts installed perpendicular to the arch. The center units are 52 in. wide and 1 ft 6 in. long. The side units are 23 in. wide and 1 ft 6 in. long. The surface pattern consists of grooves 1/8-in. deep by 1/2-in. wide, spaced 1/2 in. apart, and running perpendicular to the rails. The units are supported directly on the ties. Each center and each side unit is fastened by four 3/4-in. washer-head drive spikes with a rubber washer placed under the spike heads. Spike holes are sealed with a rubber plug. The required center-to-center tie dimension is 18 in. No header is required.

Cobra-X (79 NM-569)

The panel material is a high density linear polyethylene structural foam. The panels are full depth; that is, they are placed directly on the ties which eliminates the need for shims. The center panels are 57 in. wide, the side units 20 in. wide and both are 18 in. long. A tie spacing of 18 in. on centers is required. Each side unit is bolted to the ties with two lag bolts and the center units are bolted with three lag bolts each. The panels feature a tongue-and-groove type joint. Since the field panels have closed ends toward the pavement, no header is required.

CONSTRUCTION PROCEDURES

Construction of the crossings was the responsibility of the railroad agency and was done either by their own forces or by contract. The Department's Research Laboratory has the responsibility of evaluating the various types of crossing material and, as part of the evaluation procedure, construction of the experimental crossings was observed by research personnel as time permitted. Installation of the crossing material was to be done in accordance with the manufacturer's recommended procedure and, generally, their representative was present during placement operations of the first few crossings.

At all crossing sites the existing rails, ties, and ballast were removed and replaced for at least 10 ft beyond each crossing end. The procedures used to replace these materials depended on the requirements for maintaining both rail and highway traffic at the crossing. Basically, the following three methods were employed.

1) The most efficient procedure for replacing an existing crossing was when both the highway and railroad could be closed to traffic or where at least a few hours gap in train traffic existed. The existing crossing, including the ballast, was removed by mechanical equipment. A preassembled track section was positioned on the grade or the crossing assembled in place. The joints between new and old rails were bolted and new ballast added and compacted under the ties. Final adjustment of rail height, compaction of the ballast, and installation of the surface material was done under normal train traffic or completed before train traffic was resumed.

2) Where traffic on the highway was maintained during reconstruction of a crossing, it was necessary to replace half of the crossing at a time. The general procedure employed consisted of first replacing the ties and ballast on half of the crossing and installing a temporary wood crossing. Road traffic was then routed over on the temporary crossing while the other half was replaced. Once the new ballast and ties were in place on the entire crossing, the old rails were removed and new rail sections were placed. Road traffic was stopped during replacement of the rails. The crossing material was installed on half of the crossing, traffic switched over on the completed side, the temporary wood crossing removed, and installation of the new surface material was completed.

A variation of this procedure where train traffic did not need to be maintained was to place a preassembled track section on the ballast in half the crossing, retamp the ballast and then install the new surface material. Road traffic was then rerouted onto the new surface and the other side of the crossing was rebuilt. Using this procedure, the rails were welded in place while road traffic was maintained.

3) The procedure for replacing a crossing where the road traffic was detoured but high-speed frequent train movement prevailed, entailed a good deal of handwork. First, the old crossing surface was removed followed by removal of the ballast between the ties. The ties were then unfastened from under the rails. The ties, up to the center of the crossing, were slid and twisted out and new ties were inserted under the rails. New ballast was placed and compacted and the existing rails spiked to the ties to allow train traffic over the crossing. The ties in the other half of the crossing were replaced in the same manner. The new rail sections were placed and

fastened into position and raised to proper elevation by adding and compacting the ballast. The crossing surface was installed during periods between train movements.

Once the ballast, ties, and rails had been replaced, the installation of the crossing surface generally was completed in a matter of hours. The actual time involved in installing the various types of crossing materials depends upon the equipment, hand tools, and number and experience of the personnel. The installation of all eight experimental crossing types used to date was fairly simple, but careful work is necessary.

In cases where the experimental surface has failed and replacement was made, the new surface material was placed on the existing ties and no rework of the ballast was done, except in one case where the existing tie spacing was adjusted to accommodate the new material.

PERFORMANCE EVALUATION

The procedure set up for evaluating the performance of the crossings called for semi-annual inspections and elevation measurements. However, budget reductions have necessitated that only yearly inspections be made and the time consuming task of measuring elevation changes at the crossing has been eliminated. The inspections consist of visual observation of the following performance factors:

1) Surface Wear - the wearing away of the material's surface as a result of tire contact.

2) Surface Damage - cracking, fracturing, or tearing of the surface resulting from either train or vehicular traffic or from snow clearing equipment.

3) Alignment of Units - the ability of the individual units to maintain both vertical and horizontal position while in service.

4) Fastening of Units - the ability of units to remain securely fastened in position during the life of the crossing material.

5) Fastening of Rails - the securing of the rails to the ties. Loose rails may indicate that settlement of the crossing has occurred.

6) Pavement/Crossing Joint - the distance between the pavement and the crossing edge. The width of the joint may vary considerably from one crossing to another and in bituminous pavement the joint is eliminated entirely. In concrete pavements, the joint is generally filled with bituminous material.

TABLE 2
SUMMARY OF CROSSING PERFORMANCE

Crossing Type and Total Number of Crossings	Number of Crossings With and Without Problems in Each Performance Factor Category														
	Surface Wear		Surface Damage		Poor Alignment		Loose Panels		Loose Rails		Joint Problem		Crossing Smoothness		
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Good	Fair	Poor
Cobra - X (7)	0	7	0	7	0	7	0	7	3	4	3	4	7	0	0
Saf and Dri (9)	0	9	1	8	0	9	1	8	1	8	1	8	9	0	0
Track-Span (5)	0	5	5	0	-	-	-	-	0	5	2	3	5	0	0
Steel Plank (14)	12	2	3	11	1	13	5	9	1	13	3	11	11	3	0
Gen-Track (21)	0	21	9	12	2	19	7	14	3	18	4	17	20	1	0
Parkco (27)	0	27	4	23	0	27	-	-	1	26	8	19	27	0	0

7) Crossing Smoothness - a measure of the discomfort felt by vehicle occupants while passing over the crossing. Generally, most drivers will adjust their speed to hold the discomfort to a tolerable level and on this basis, the smoothness of the crossings is rated as 'Good, Fair, and Poor,' (Good - basically no slowdown in traffic; Fair - some slowdown in traffic; and, Poor - considerable slowdown in traffic).

The results of the 1981 performance inspections have been summarized and are given in Table 2. A brief discussion of the results shown for each performance factor follows:

Surface Wear - As noted in the table, only the Steel Plank crossings were found to have any visible wear. It should be emphasized that the observed wear is the wearing-off of the epoxy coating and not wearing of the steel surface.

Surface Damage - Most of the reported damage on the rubber crossings consists of snowplow cuts in the surface and tearing of the surface along the rails by the flanges of the train wheels. One form of damage observed on two Parkco crossings is the bending or sagging of the field side units located in the wheelpaths of the highway traffic. One crossing was repaired in 1981 and it was found the steel flex plate had broken in one panel and the cables through the broken unit were nearly worn through. This crossing was repaired by replacing the broken and bent panels with panels of the modified design and installing new cables. The panel failures were apparently caused by broken shims and tie settlement. To improve the support condition of the crossing, drain pipes were installed when the crossing was repaired.

The surface damage reported for the Track-Span crossings consists of open transverse cracks in the surface layer. These cracks apparently occur at construction joints between pours. A derailment at one crossing resulted in damage along one of the rails.

The damage observed at three Steel Plank crossings was caused by a derailed car. No surface problems were seen at the Cobra-X crossings.

Poor Alignment - The only observed alignment problems were at two Gen-Trac and one Steel Plank crossing. At the latter crossing, one field unit was tipped about 1/2-in. and at the two Gen-Trac crossings the panels in the wheel tracks had settled below the adjacent ones.

Loose Panels - This performance factor is not applicable to the Track-Span and Parkco crossings because the surface material is not fastened to the ties with bolts. Panels at the Cobra-X crossings were found to be securely fastened but all of these crossings have been in service only one to two years. One panel on a Saf and Dri crossing was noted to be loose.

Seven Gen-Trac crossings had loose side panels and removal of panels at two crossings revealed that the rocking of the panels under traffic had actually worn 1/2 to 3/4 in. deep grooves in the ties. The panels on five Steel Plank crossings had worked loose. The loose panels were all on crossings of the old design where the panels are bolted only through the bottom steel support plate.

Loose Rails - At nine crossings loose rails were noted. Although this may not affect the smoothness of the surface itself it does indicate loss of support under the ties which could influence the service life of the material.

Joint Problem - Twenty-one crossings had distressed joints between the pavement and the crossing. The distress noted consists of cracking in the pavement surface adjacent to the crossing. At this time the distress in all cases is of little consequence. The cracking results from the movement that occurs when traffic passes over the crossing.

Crossing Smoothness - Seventy-nine crossings were rated 'good' which by definition means no slowdown in traffic. Four crossings were rated 'fair'—some slowdown in traffic. The 'fair' ratings resulted from crossing settlement rather than the surface material being the cause. None of the crossings were rated 'poor.'

Elevation Changes of Crossings

At most railroad grade crossings a difference of elevation from the pavement to the crossing surface develops with time. In nearly all cases the crossing elevation decreases with respect to the pavement. This change in elevation results in a bumpy crossing even when the surface material itself remains smooth.

The amount of change occurring across the pavement/crossing joint has been measured at crossings rebuilt prior to 1981. As in most cases with long-term field evaluation projects, problems developed in obtaining the measurements. Derailments and feathering work resulted in readings being discontinued at some crossings, and a faulty level invalidated most of one set of measurements. In spite of these problems, the data should be sufficient to indicate the elevation changes that may be expected at the pavement/crossing joint.

From the reduced elevation readings, it was apparent that crossings with heavy train traffic develop the largest elevation differences. Therefore, the data were divided into two groups: one for heavy mainline train traffic (several train movements per day) and light mainline and spur traffic (one or less train movement per day). Figure 1 shows a plot of the data for these two groups of train traffic for a four-year period.

The plotted lines represent the average settlement of the crossings with respect to the pavement. As can be seen, the settlement for the heavier travelled tracks is about twice as much as that for the lighter traffic tracks. Also, it is apparent that the settlement continues with time but the rate of settlement decreases somewhat. It should be noted that the plotted data were obtained during the summer-fall period to avoid the influence of frost heave.

COST AND SELECTION OF MATERIAL

The average unit bid prices for each of the six types of crossing material, including fastening hardware, are as follows:

Crossing Type	Cost per Track-Foot					
	1976	1977	1978	1979	1980	1981
Steel Plank	$105	$120	$130	$135	$115	--
Track-Span	$212	--	--	$180	--	--
Saf and Dri	--	$210	$230	$230	$225	$265
Parkco	--	--	$220	$234	$220	$253
Gen-Trac	--	--	$240	$249	--	$252
Cobra-X	--	--	--	--	$160	$200

One of the more important factors used to select the type of crossing surface for a particular location is the total Average Daily Traffic (ADT) volume on the roadway. However, with new surface materials their performance under traffic should be known before one can assign the traffic volume range for which the material is suitable. Since no specific criteria with respect to ADT volume were used to select the locations for testing the experimental materials, it was thought to be of interest to study the distribution of each of the six materials with respect to the crossing ADT volume. A distribution plot showed that most rubber crossings were installed at locations with greater than a 5,000 total ADT volume and Steel Plank and Cobra-X crossings were mostly used at crossings with less than a 5,000 total ADT volume.

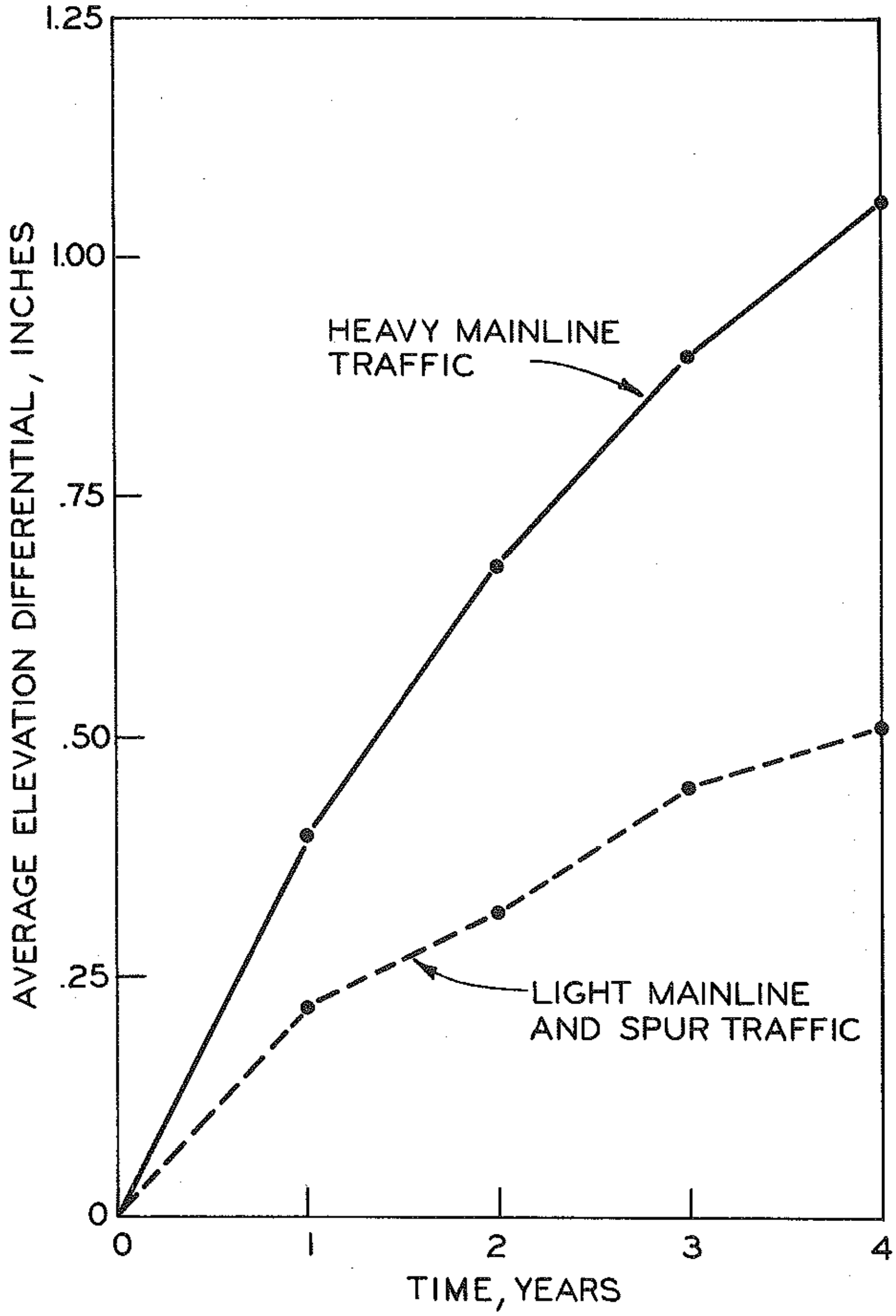

Figure 1. Elevation difference across pavement/crossing joint.

The percentage distribution of materials used at crossings with known ADT volumes is as follows:

Material Type	Percent of Crossings	
	Under 5,000 ADT	Over 5,000 ADT
Gen-Trac	7	93
Parkco	11	87
Saf and Dri	14	86
Track-Span	40*	60
Steel Plank	62	38
Cobra-X	100	0

* These crossings were installed at low ADT volume locations because of the material's ability to fit unique crossing conditions.

On the basis of this distribution and the performance of rubber crossing materials, it appears reasonable to use these materials for crossings with greater than a 5,000 total ADT volume and the Cobra-X and Steel Plank materials to be used at crossings with less than a 5,000 total ADT. Some exceptions may be justified for crossings with high speed but low traffic volumes or where unique track configurations exist in the crossing area.

CONCLUSIONS

In general, the experimental crossing materials continue to perform satisfactorily. Some problems have developed which have resulted in modification of the original designs or the design of new panels. A brief summary of the conditions of each crossing type as of the 1981 inspection follows:

1) Cobra-X - All crossings are performing satisfactorily, but are only one and two years old and serve at locations with less than a 5,000 total ADT.

2) Steel Plank - This crossing was redesigned and three redesigned crossings installed in 1979 and 1980, are giving satisfactory service. Crossings of the older design experience loose panels which may cause breaking of the supports and eventual collapse of the panels.

3) Saf and Dri - All crossings are performing satisfactorily. One loose side panel was found on one crossing, but does not interfere with the crossing's performance. This crossing is now available in a new design

utilizing corrugated steel plates instead of steel tubes. Two single track crossings of this new design were included in this evaluation study.

4) Track-Span - These crossings have served quite well. They do develop surface cracks (apparently at construction joints) which open and are infiltrated with sand. As a result the cracks cause a 'tent' in the surface. The cracks are perpendicular to the rails. On one crossing the surface layer peeled off as a result of poor bonding. After replacement by manufacturer, the crossing has given good service.

5) Parkco - Only one of the 27 crossings in service has experienced problems with the surface material. In this case, loss of support under a field side panel resulted in the steel reinforcing plate breaking and severe fraying of the hold-down cables. The remaining crossings are serving satisfactorily. The panels were redesigned to prevent breaking of the steel reinforcement plate. The manufacturer is currently working on the development of a plastic header to replace the wood header used in the past.

6) Gen-Trac - The performance of these crossings is still good. However, on seven of the 21 crossings inspected, loose side panels were noticed in the wheel tracks of the roadway. Investigation of the problem on two crossings revealed that the rocking of the panels had worn 1/2 to 3/4-in. deep grooves in the tie surface. The manufacturer is developing methods to correct the worn tie problem on existing crossings and on new installations a neoprene pad is furnished for placing between the tie and the panel to prevent tie wear. A new crossing, Gen-Trac II, is now available.

Elevation measurements across the pavement/crossing joints indicate that the crossings settle from 1/2 to 1 in. over a period of four years. This suggests that the crossing elevation should be higher by at least that amount when it is rebuilt. The pavement should then be feathered to meet the crossing height. As the crossing settles, the feathering would need to be removed to maintain a smooth joint.

On the basis of crossing material distribution with respect to ADT volumes, steel reinforced rubber panels and epoxy-rubber material are generally used on crossings having a total ADT volume over 5,000. The steel and polyethylene crossing materials are more often used on crossings with less than a 5,000 total ADT volume.

RECOMMENDATIONS

Because of the severity of the environment in which the surface material must serve manufacturers have had to strengthen original designs or completely redesign the surface panels. Therefore, current designs have only limited performance time and it is suggested that the evaluation study be continued.

With respect to current installations, it is recommended that the level of maintenance effort be increased. Especially, loose panels should be retightened to prevent more serious damage and the roadway-crossing joints should be maintained to ensure a smooth crossing.

Considerable effort has been expended to improve site conditions when reconstructing the crossings. In recent years, drainage pipes and filter blankets have been used extensively to enhance support conditions. Other important factors that influence the service life of the crossings are tie quality and compaction of the ballast. All of the new surface material needs the best quality ties available to remain securely fastened and continued firm support to prevent bending or breaking of the panels. The importance of quality material and workmanship in obtaining a smooth and lasting crossing cannot be overemphasized.