1359

BITUMINOUS PAVEMENT RESURFACING AT SNOWMOBILE CROSSINGS FIRST YEAR REVIEW

MDOT
Michigan Department of Transportation

CONSTRUCTION AND TECHNOLOGY DIVISION

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16. Abstract

This report details the installation of experimental coatings over bituminous concrete at snowmobile trail crossings. It also contains data gathered during the first year of a five year research project. This report also offers methods of installation of the coating materials and also application procedures.

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MICHIGAN DEPARTMENT OF TRANSPORTATION
MDOT

Bituminous Pavement Resurfacing at Snowmobile Crossings
First Year Review

Thomas D. Miller

Testing and Research Section
Construction and Technology Division
Research Project 97 D-0065
Research Report No. R-1359

Lansing, March 1998

Project Overview

In January 1997, a meeting was held at the Michigan Department of Transportation (MDOT) Cadillac district office to discuss the premature deterioration of bituminous pavements caused by traction control devices on snowmobiles. The traction control devices on the sleds consist of studded tracks and carbide runners mounted on the skis. These traction control devices are *milling* away the bituminous surface of the roads at snowmobile trail crossings (Figure 1).

Figure 1. Deteriorated pavement at a snowmobile trail crossing

A test section located on M-55 near Wellston, Michigan was established to study several experimental protective coatings for the road surface. This location was chosen because of the high number of snowmobilers that are attracted to this area during the winter months, and also because that section of M-55 had been resurfaced two years prior and was in relatively good condition. Four individual crossings were chosen to be included in the test section. Each crossing was divided into two subsections, each section being a 3.7 meter lane and 0.9 meter shoulder wide by 7.3 lineal meters in length (Figure 2).

Figure 2. Each trail crossing was divided into two sections

Eight material manufacturers were chosen to apply their respective products to a crossing location specified by MDOT personnel. Each manufacturer was required to have a representative on site to assist with the installation of their product and to make sure it was installed to their specifications and satisfaction. All traffic control and test section preparation work was performed by MDOT personnel. Each location was thoroughly sandblasted and blown clean with oil-free compressed air. The perimeter of each test location was established and laid out with duct tape (Figure 3).

Figure 3. Typical preparation of the test sites

Methods for installing the coating materials varied from *spray-on* to *broom and seed* to *trowel applied*. Several different types of aggregates were used as part of the coating systems as well. The aggregate types ranged from silica sand to aluminum oxide to chipped flint, depending on the recommendation of the manufacturer. Only one coating was applied as a one coat system. The spray-on applications applied as many coats as the representatives deemed necessary. The most common method of application involved applying two coats of material to the crossings. This was accomplished by applying the first coat of material to the road surface, allowing it to cure sufficiently, and then applying the second coat in the same manner as the first. The second coat was then permitted to cure, the excess aggregate blown off with compressed air and the roadway was re-opened to traffic (Figure 4).

Figure 4. The most common application was the two coat system

After application of the first six coating products, it was noted that cracking developed around the entire perimeter of each coated area within twenty four hours of application of each material (Figure 5). This cracking was likely due to stresses as a result of thermal incompatibilities between the coating and the bituminous concrete, or possibly tensile stresses from curing shrinkage of the coating materials. The perimeter cracking problem was solved by sawing 25mm deep by 3mm wide relief cuts at the interface of the coating and the pavement (Figure 6). This saw cut was then cleaned and sealed with silicone sealant.

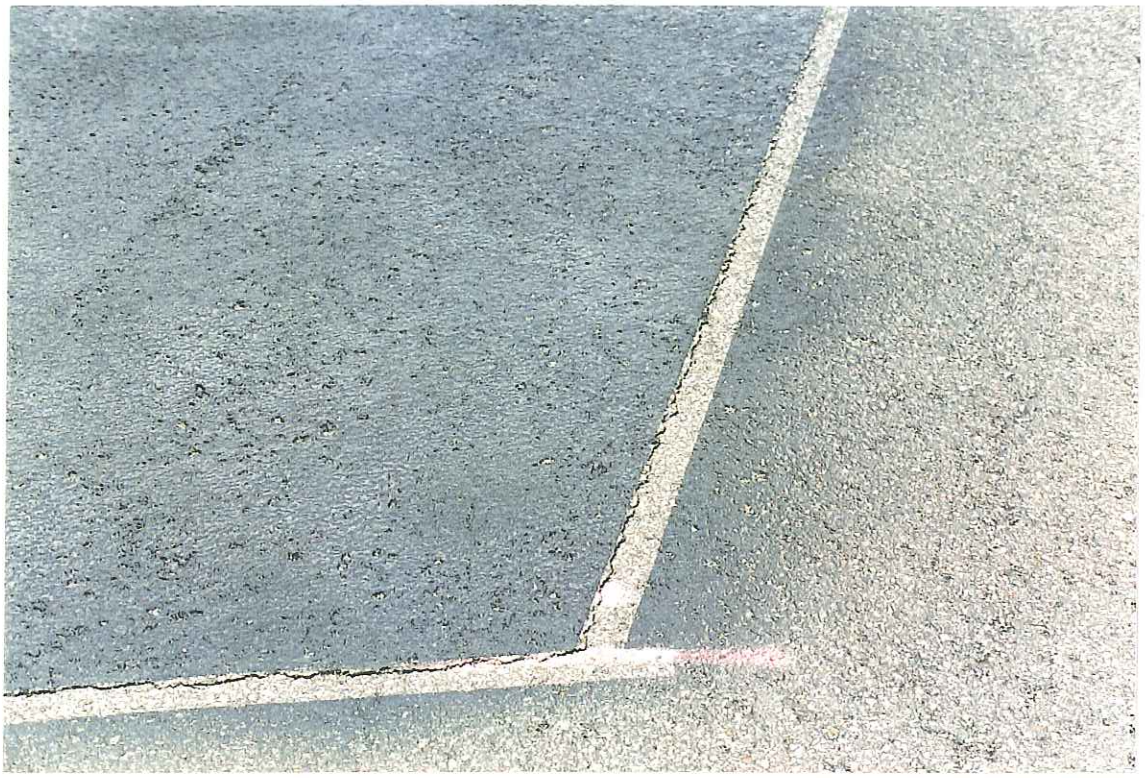


Figure 5. Perimeter cracking occurred after 24 hours

Figure 6. A relief cut was sawn and sealed to control the perimeter cracking

In conjunction with the test section in Wellston, two crossings were coated in the Grayling area in July, 1997. These crossings, (one on M-72 and the other on M-93) both used the same two coat product that was applied to crossing 3B (see appendix) in Wellston. Construction of both crossings was completed in one day, and the perimeter saw cuts were used to control any cracking that may occur.

In September 1997, four products were used to coat two crossings on US-41 near Mohawk, Michigan in the Keweenaw Peninsula. Once again, each crossing was divided into two test areas to accommodate the four materials. The purpose of this test section was to apply some of the same products used in Wellston, using one-coat systems, instead of the previously applied two-coat method. The objective was to compare the effectiveness of one-coat versus two-coat systems, so that a correlation could be made between the cost of the two methods, their effective performance, and their anticipated service life.

In order to correlate the effectiveness of the coatings to actual use of the crossings, snowmobile traffic counters were developed specifically for this project (Figure 7). These counters were installed at selected crossings in the Wellston test section, and also on M-41 near Mohawk, to document the number of sleds using the crossings.

Figure 7. Snowmobile traffic counters

In September 1997, friction tests were conducted on each coating in the Wellston test section. This testing was performed to determine the friction resistance of each material. Friction test results are included in the appendix.

Each material was rated using the evaluation sheet included in the appendix. Evaluation of the materials was done as each one was installed. Formal evaluation of the Wellston coatings were conducted in December, with subsequent inspections planned for the spring and fall, for a period of five years. Friction testing will also be performed once a year during this five year period. It is anticipated that a Qualified Products List of coating products will be developed from these data.

Additional crossings will be coated as part of this ongoing research project. Regions wishing to participate in this field research project are encouraged to contact Tom Miller at the Construction and Technology Division by calling 517-322-1070, or E-mail at millerth@mdot.state.mi.us.

Conclusions

Several conclusions have been ascertained regarding this research project in the first year of evaluations:

- Saw cuts are required at the leading and trailing edges of the coated area to prevent uncontrolled cracking of the road surface at this interface. These saw cuts must be cleaned and sealed with a silicone sealant to prevent the intrusion of incompressible materials.

- The liquid binder must be allowed to run onto the gravel shoulder slightly to protect the exposed edge of the paved road surface. Aggregate must be broadcast onto this overflow in the same manner as the rest of the coated area.

- Two-coat systems appear to be more durable than the same material applied in one coat. One-coat systems may be a viable alternative at less heavily traveled crossings, and more importantly, where the road surface is not showing much deterioration. Test sections indicate that severe snowplow damage may occur to one-coat systems that have been applied to deteriorated and severely rutted roadways.

- Aggregates used in conjunction with the liquid binders must be angular to sub-rounded with a minimum MOHS scratch hardness of 7. Aggregates types used in this test section included silicon dioxide, Washington stone, aluminum oxide, and chipped chert.

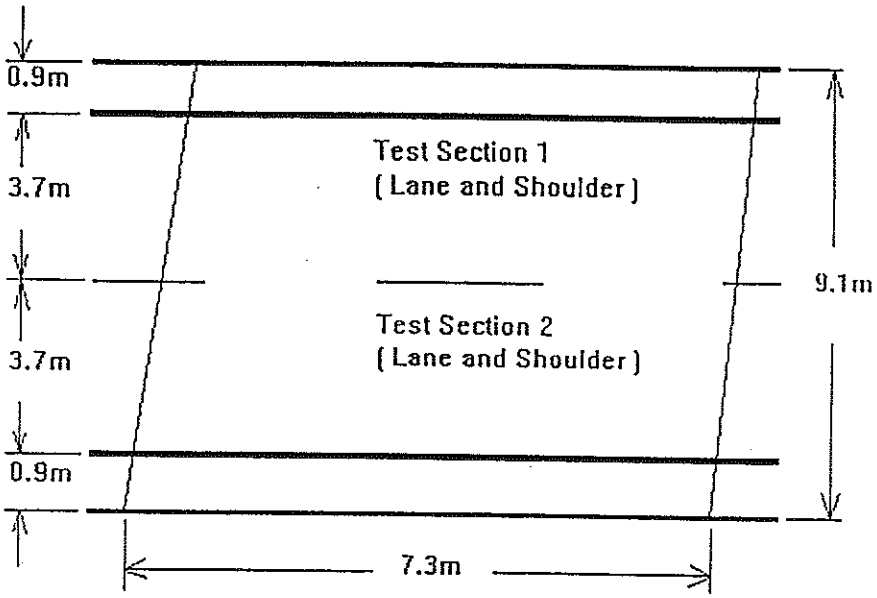
- Care must be taken during preparation of the area to be coated. The bituminous surface must be thoroughly sandblasted and blown clean with oil-free compressed air prior to application of the liquid binder. The leading and trailing edges of the area to be coated must be defined by laying several widths of duct tape on the road surface to ensure a straight transition edge. This will also prevent excess material from running onto the road surface outside the coating area. This method will provide a well-defined edge for the saw cut.

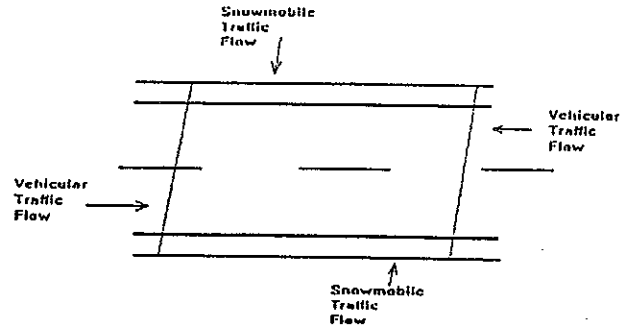
- The coated area should be no wider than necessary for economical reasons; however, it will be determined by the limits of deterioration of the road surface. Generally, the width of a crossing will be 3.7 to 4.6 meters.

This summary includes conclusions based on evaluations and data collected during the first year of service for the crossing materials. Due to the mild conditions that Michigan has experienced this winter, these results may not be indicative of the actual performance of the coatings. Continued performance evaluations will be conducted twice yearly for a five year period, and any changes will be documented in future progress reports.

APPENDIX

Typical Snowmobile Crossing Test Section





Each manufacturer or manufacturers representative will provide all materials including, but not limited to, liquid binders, aggregates, mixing and application equipment, including trowels, squeegies, mixing paddles, etc. MDOT will provide all traffic control. MDOT will also provide an air compressor and sandblasting equipment, and the personel to operate this equipment. MDOT will also provide a generator to run hand tools. Each manufacturer or manufacturers representative will be responsible for installation of their product. Any specialized preparation equipment will be provided by the manufacturer or manufacturers representative. Each manufacturer will be required to apply their product on an area as shown above, to include the traffic lane from the centerline, and the 0.9m paved shoulder. Each test section will be 7.3 meters long. The manufacturer will ensure a skid resistant surface for their respective products.

Snowmobile Crossing Evaluation

Manufacturer/Material :

Date :

Date of Installation :

Crossing Number :

Weather :

Ease of Installation

Very Difficult 1 2 3 4 Very Easy 5

* Only Rated On Day Of Installation

Comments : _____

_____

_____

_____

Adhesion To Pavement

Total Loss Of Adhesion 1 2 3 4 100% Adhesion 5

Comments : _____

_____

_____

_____

Surface Wear of Crossing Material

Severely Abraded 1 2 3 4 No Abrasion 5

Comments : _____

_____

_____

Overall Appearance Of Crossing Material

Unsatisfactory 1 2 3 4 Very Good 5

Comments : _____

_____

_____

_____

Overall Effectiveness Of Crossing Material

Unsatisfactory 1 2 3 4 Very Effective 5

Comments : _____

_____

_____

_____

Additional Comments

_____

_____

_____

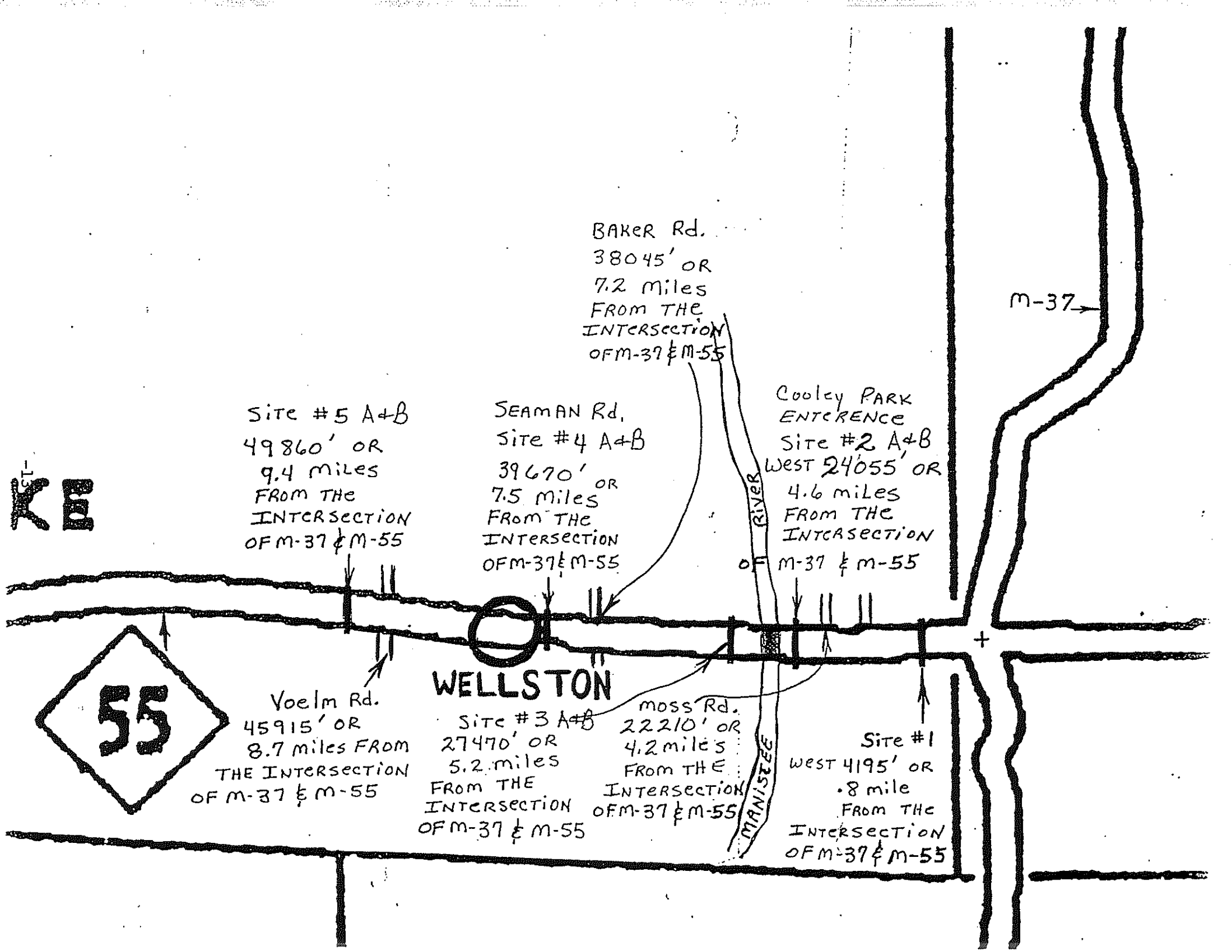
_____

_____

_____

Signed : _____

Snowmobile Crossing Coatings, M-55, Wellston, Michigan		
Crossing Number	**Product Name**	**Manufacturer**
2A	Propoxy Type III DOT	Unitex
2B	Polymer Road System	PolyCarb
3A	Polyarmor	Visuron Technologies
3B	Flexogrid	PolyCarb
4A	CB 700	Axson Akemi
4B	Concrete Welder	Percol
5A	Delcrete	The D.S. Brown Co.
5B	PNS 900	SSI Silspec

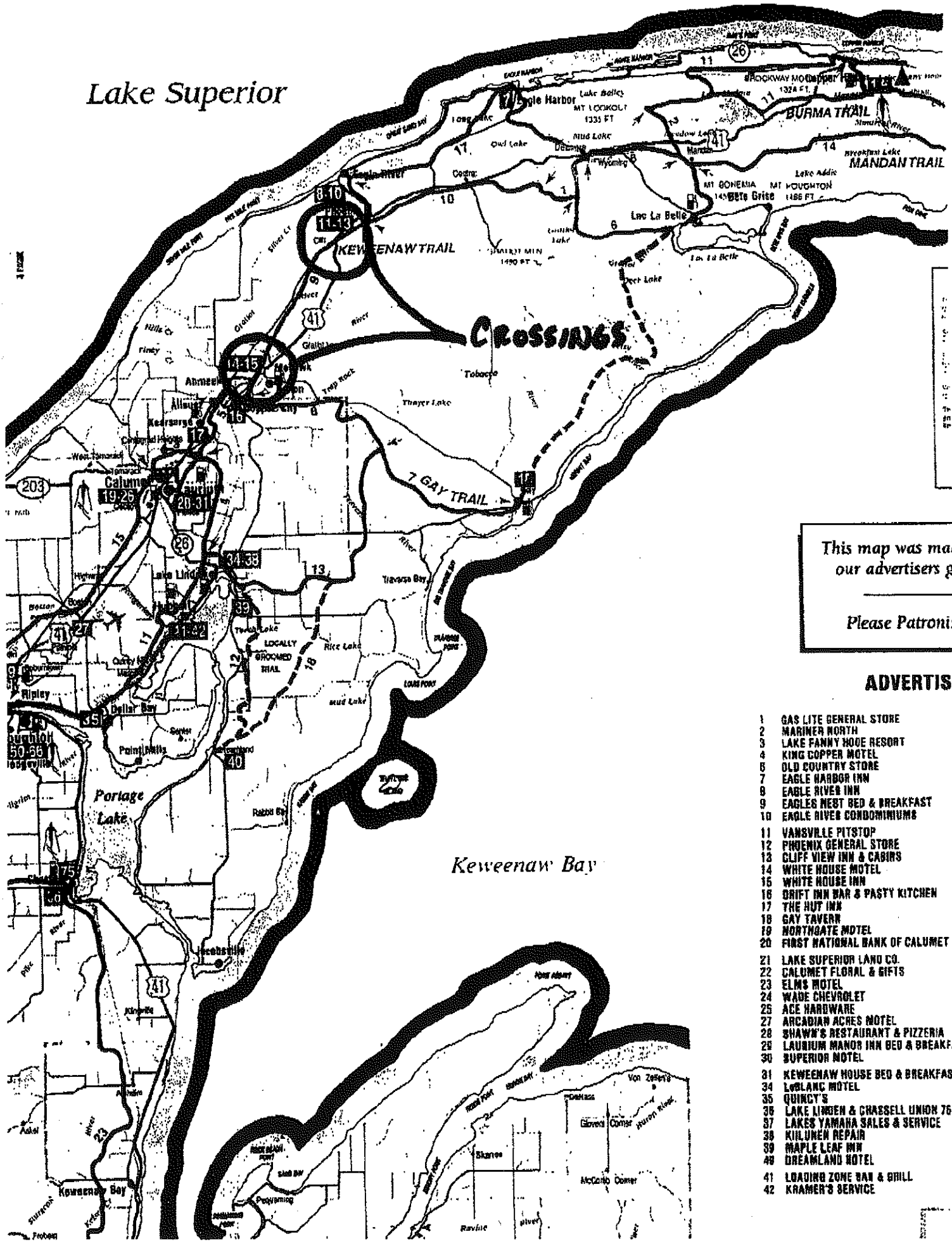

M-37
BAKER Rd.
38045' OR
7.2 Miles
FROM THE
INTERSECTION
OF M-37 & M-55
SEAMAN Rd.
Site #4 A+B
39670' OR
7.5 Miles
FROM THE
INTERSECTION
OF M-37 & M-55
Site #5 A+B
49860' OR
9.4 Miles
FROM THE
INTERSECTION
OF M-37 & M-55
Cooley PARK
ENTERENCE
Site #2 A+B
West 24055' OR
4.6 Miles
FROM THE
INTERSECTION
OF M-37 & M-55
MANISTEE River
WELLSTON
55
Voelm Rd.
45915' OR
8.7 Miles FROM
THE INTERSECTION
OF M-37 & M-55
Site #3 A+B
27470' OR
5.2 Miles
FROM THE
INTERSECTION
OF M-37 & M-55
Moss Rd.
22210' OR
4.2 Miles
FROM THE
INTERSECTION
OF M-37 & M-55
Site #1
West 4195' OR
.8 mile
FROM THE
INTERSECTION
OF M-37 & M-55

Snowmobile Crossing Traffic Count

M-55 Wellston, Michigan

Date and Time Start	*Date and Time End*	*Crossing Number*	*Actual Sled Count*	*Initials*
1-12-98 11:44am		3	34	TDM
1-13-98		3	15	TDM
1-14-98		3	61	TDM
1-15-98		3	188	TDM
	1-16-98 11:15am	3	32	TDM
1-16-98 11:45am		3	366	TDM
	1-17-98 4:26pm	3	655	TDM
3-9-98 3:40pm	3-9-98 9:32pm	5	11	TDM
3-10-98 9:00am	3-10-98 7:10pm	5	38	TDM
3-11-98 10:55am	3-11-98 11:29pm	5	37	TDM
3-12-98 12:49am	3-12-98 10:53pm	5	50	TDM
3-13-98 3:05am	3-13-98 10:00pm	5	152	TDM
3-14-98 7:42am	3-14-98 11:49pm	5	402	TDM
3-15-98 12:43am	3-15-98 10:36pm	5	132	TDM
3-16-98 12:45pm	3-16-98 9:49pm	5	11	TDM
3-17-98 12:42pm	3-17-98 12:42pm	5	3	TDM

	A	B	C	D	E
1		97SR-18			
2		M-55 SNOWMOBILE CROSSINGS			
3	CONTROL	DIRECTION	SITE	FRICTION	
4			NUMBER	NUMBER	
5	51021	W1	1	45	
6	51021	W1	1	44	SAME
7	51021	W1	1	43	
8		ROAD SURFACE =45 FN IN THIS AREA			
9	51021	E1	1	48	
10	51021	E1	1	45	SAME
11	51021	E1	1	47	
12					
13	51021	W1	2	37	
14	51021	W1	2	36	HIGHER
15	51021	W1	2	36	
16		ROAD SURFACE = 37 FN IN THIS AREA			
17	51021	E1	2	39	
18	51021	E1	2	37	HIGHER
19	51021	E1	2	38	
20					
21					
22	51021	W1	3	42	
23	51021	W1	3	41	LOWER
24	51021	W1	3	40	
25		ROAD SURFACE =43 FN IN THIS AREA			
26	51021	E1	3	43	
27	51021	E1	3	42	HIGHER
28	51021	E1	3	41	
29					
30					
31	51021	E1	4	37	
32	51021	E1	4	39	A LITTLE HIGHER
33	51021	E1	4	38	
34		ROAD SURFACE = 35 FN IN THIS AREA			
35	51021	W1	4	27	
36	51021	W1	4	30	ALOT LOWER
37	51021	W1	4	30	
38					
39					
40	51021	W1	5	39	
41	51021	W1	5	37	SAME
42	51021	W1	5	37	
43		ROAD SURFACE = 39 FN IN THIS AREA			
44	51021	E1	5	39	
45	51021	E1	5	41	SAME
46	51021	E1	5	40	



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8 EAGLE RIVER INN
9 EAGLES NEST BED & BREAKFAST
10 EAGLE RIVER CONDOMINIUMS
11 VANSVILLE PITSTOP
12 PHOENIX GENERAL STORE
13 CLIFF VIEW INN & CABINS
14 WHITE HOUSE MOTEL
15 WHITE HOUSE INN
16 DRIFT INN BAR & PASTY KITCHEN
17 THE HUT INN
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30 SUPERIOR MOTEL
31 KEWEENAW HOUSE BED & BREAKFAST
34 LeBLANC MOTEL
35 QUINCY'S
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38 KIILUNEN REPAIR
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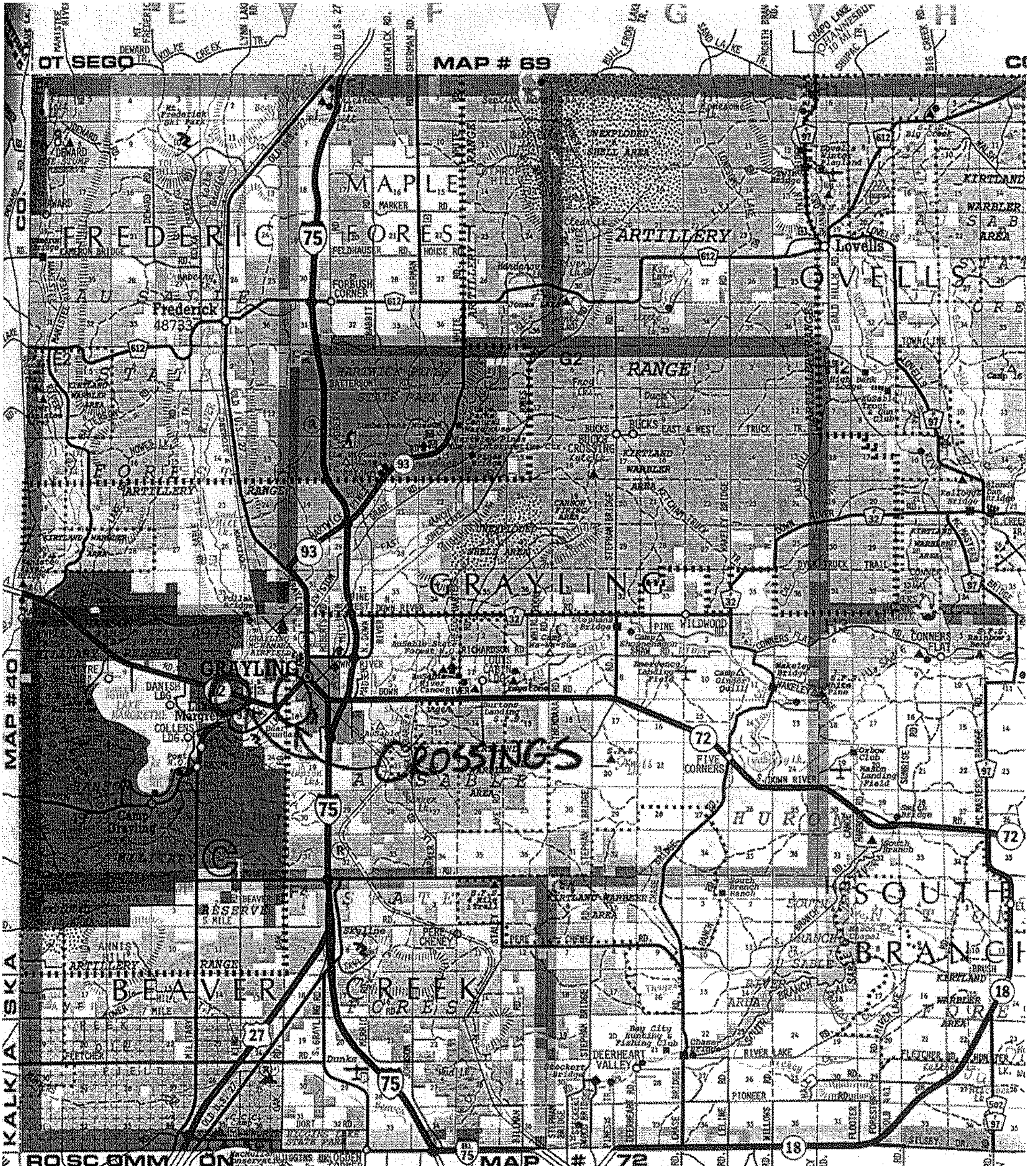
42 KRAMER'S SERVICE

Snowmobile Crossing Traffic Count

Date and Time Start	*Date and Time End*	*Crossing Number*	*Actual Sled Count*	*Initials*
1-23-98 11:42am	1-24-98 10:55am	Cliff Crossing	172	TDM
1-24-98 11:06am	1-24-98 11:12pm	Cliff Crossing	460	TDM
1-25-98 2:41am	1-25-98 11:58pm	Cliff Crossing	217	TDM
1-26-98 12:02am	1-27-98 9:57am	Cliff Crossing	343	TDM
1-27-98 10:18am	1-27-98 11:16pm	Cliff Crossing	489	TDM
1-28-98 8:38am	1-28-98 10:09am	Cliff Crossing	64	TDM



OTSEGO
MAP # 69
MAPLE
FREDERIC
FOREST
ARTILLERY
RANGE
LOVELLS
Lovells
Frederick
48733
Mt. Frederick Ski Park
UNEXPLODED SHELL AREA
HARTWICK PINES STATE PARK
BUCKS CROSSING
GRAYLING
CROSSINGS
Grayling
AU SABLE
Camp Grayling
MILITARY RESERVE
MAP #40
KALKASKA
BEAVER CREEK
SOUTH BRANCH
HURON
FIVE CORNERS
CONNERS FLAT
DEERHEART VALLEY
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