SKID TESTING OF PAVEMENT MARKINGS

Final Report TSD-277-75

TRAFFIC and
SAFETY
DIVISION

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
AND TRANSPORTATION

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By

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MICHIGAN DEPARTMENT OF STATE HIGHWAYS AND TRANSPORTATION

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INTRODUCTION

In response to a request from a District Traffic and Safety Engineer, the Research Unit proposed a two-phase project to study the skid coefficient of pavement markings. The phases were: Phase I - supply small pavement marking samples to the Testing and Research Division to test using the British Portable Skid Tester, and Phase II - apply certain pavement marking materials at a field test site and evaluate using Testing and Research Division skid test vehicle.

OBJECTIVES

It is assumed that pavement markings have a lower skid coefficient than the surrounding road surface. Therefore, the objectives are (1) to measure skid coefficients of existing pavement marking (both in the laboratory and field), (2) determine if any pavement markings have skid coefficient values that could contribute to a vehicle skidding out of control, and (3) if necessary, change Department specifications for use of certain pavement markings and/or develop new materials or additives to improve pavement marking skid coefficients.

PHASE I

Fourteen different types of pavement marking materials were applied to three-inch by five-inch aluminum rectangles and supplied to the Testing and Research Division for laboratory testing using the British Portable Skid Tester. Values obtained by this method are called British Pendulum Numbers (BPN) and are basically equivalent to coefficients of friction x 100. These values have been shown to represent the wet skid resistance performance of a patterned tire at approximately 30 mph. However, the values do not necessarily correlate with the Department's skid tester at the 40 mph speed.

The British Pendulum Numbers provided in the following table give a reliable comparison among the fourteen pavement marking materials tested.

TABLE I

PAVEMENT MARKING SKID RESISTANCE
AS MEASURED BY THE B.P.S.T.

Sample Number	Description	*Average B.P.N. Skid Value
1.	Simco - white cold plastic	38
2.	Simco - yellow cold plastic	28
3.	Chemetron - white cold plastic (rough)	28
4.	Chemetron - white cold plastic (smooth)	14
5.	3M-Temptape - yellow with beads	38
6.	Baltimore - fast dry yellow - no beads	38
7.	Baltimore - fast dry white - no beads	45
8.	3M-Temptape - white with beads	36
9.	Baltimore - fast dry white with beads	32
10.	Baltimore - fast dry yellow with beads	32
11.	Baltimore - fast dry white with beads	30
12.	Baltimore - fast dry yellow with beads	30
13.	Permaline - extruded hot plastic - light beads	30
14.	Permaline - extruded hot plastic - heavy beads	35

*Average BPN taken from three readings per sample, two longitudinally and one transverse.

PHASE II

Due to the relatively low readings obtained in the Laboratory, three pavement marking materials were installed in twenty-inch by fifty-foot strips on an unopened portion of US-127 freeway near Lansing. Skid testing was performed by the Testing and Research Division using their skid testing vehicle with results as follows:

TABLE II
FIELD TEST DATA

Surface	SN(40)(Field) Average	BPN (Lab) Average
1. Department fast dry white paint - with beads	37[1]	31
2. Permaline-Extruded yellow hot plastic - with beads	23	35
3. Simco - smooth white cold plastic - no beads	4	14[2]
4. Concrete surface at test site	67	-

1. The Department fast dry paint is applied in a thin coat and therefore assumes some of the road-surface texture, which explains the increase in the Field SN(40) value.

2. The Simco material used in the Laboratory was a rough-textured material with a 38 BPN value, and not directly comparable to the sample tested in the field. The BPN value of 14 is for a smooth Chemetron product.

Several District Traffic and Safety Engineers were contacted requesting their experience with slippery pavement markings causing accidents and/or complaints from motorists about markings being slippery. All contacted stated they had knowledge of the markings being slippery but the roadway area covered by special markings (such as railroad crossing) is small and had not, to their knowledge, caused any accidents due to slippery pavement markings.

In further discussions with the District Traffic and Safety Engineers, an unrelated problem with special pavement markings became apparent. Special hot and cold pavement markings, such as arrows, are being damaged and/or destroyed by snowplowing, especially on the concrete surface, requiring replacement within one or two years. Inlaid special markings usually hold up under snowplowing with little damage. Since these markings are cost-justified, due to their long life, consideration should be given to future use.

The Department of Aeronautics previously used two-foot longitudinal pavement markings on airport runways. However, they experienced serious problems with landing aircraft due to slipperiness of the markings. They changed their standards and now apply four-inch longitudinal "zebra" pattern pavement markings which eliminated the problem since aircraft tires are always in simultaneous contact with both the runway and the pavement markings.

Thermoplastic vendors responded positively to the idea of dropping abrasives on their material at the same time reflective beads are applied. This could reduce reflectivity some, but they would cooperate with the Department in such an experiment.

CONCLUSIONS

1. Pavement markings generally have a lower coefficient of

friction than the surrounding road surface.

2. Hot and cold plastic pavement markings have SN(40) values that could cause vehicles to skid out of control if enough road surface area is covered. However, when used for lane lines and special pavement markings, the area covered is too small to cause a vehicle to skid out of control. The safety features pavement markings provide to the motoring public far exceed the possibility of their causing an accident, and continued use of the material is encouraged.
3. Accident data is not available to correlate skidding accidents and pavement markings.
4. Most District Traffic and Safety Engineers acknowledge pavement markings have a lower skid number than the road surface but have had no serious problems or complaints in this area.
5. Damage to plastic pavement markings due to snowplowing appears to be a serious problem, especially when used on concrete.

RECOMMENDATIONS

1. The Department should continue using hot plastic for lane lines and use both hot and cold plastic for special pavement markings on bituminous. Special markings should be inlaid when possible.
2. A development project should be instigated with hot and cold plastic vendors to study abrasive materials that could be added at the same time reflective beads are applied.

15/20

3. The use of four-inch "zebra" patterns for special markings should be investigated for (a) installation problems and (b) legibility and readability to motorists, both in transverse and longitudinal directions. Previous studies have shown the road surface SN and the pavement marking SN can be averaged when applied in the "zebra" pattern, increasing the average coefficient of friction.

4. Since the question of snowplowing and special pavement marking life has been raised, a separate study might be started to investigate types of material used, installation on bituminous and concrete, and the requirement for inlaid special marking, where possible.

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Traffic Research Unit
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