CURRENT RESEARCH LABORATORY PROGRAM

MICHIGAN DEPARTMENT OF STATE HIGHWAYS

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Research Laboratory Section
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Our research project program has developed over the years to meet the requirements of the Michigan Department of State Highways and Transportation needs. It consists basically of four types of studies as follows:

1. Highway Planning and Research Projects - These are projects generally initiated by laboratory personnel. Prior to commencing, however, they receive Departmental and Federal Highway Administration review, criticism, and approval. These studies, conducted in cooperation with the Federal Highway Administration, are largely Federally financed. They also generally represent our major research efforts in areas that are more complex and of a broader scope than other research studies. There are currently 19 active projects under study or proposed for study in this category.

2. Department Research Projects - These are generally initiated by requests from other Divisions of the Department. They provide information for making decisions and will vary in magnitude and scope from very complex studies to quite simple evaluations. These studies have three general types:

A. Specific Assignments - the study may be terminated upon completion of testing, analysis, and the writing of a report. An example of this might be the testing and developmental work leading to the use of a new material or new procedure and which may eventually be utilized in terms of a Departmental specification for the new material or procedure.

B. Continuing Performance Studies - the study may continue for up to 15 years until definite results are obtained in the evaluation of the performance of materials or methods.

C. Continuing Operational Studies - these projects started as research assignments, for example, roughness and skid resistance measurement programs, but after a number of years become primarily operationally oriented and conducted for the informational benefit of other Divisions to enable them to make decisions on operational betterment programs such as resurfacing, correcting accident prone intersections, etc.

There is currently a total of 94 Department projects under study.

3. New Materials Investigations - These involve materials or methods for laboratory and/or field evaluations referred to the Laboratory by the Department's Committee on Investigation of New Materials. The Committee screens them in a preliminary review to determine whether they are of sufficient interest to operating Divisions to warrant testing and evaluation. Depending on the nature of the new material or method, these evaluations can be simple or quite complex. Since the beginning of this activity in 1959, the Research Laboratory has evaluated 373 specific new materials or new methods.

4. Technical Investigations - This type of project was started in 1969 to cover a great number of assignments which are of shorter duration, generally a 6 month task or less, and are not as time consuming nor require as long a period for evaluating performance. Since 1969 there have been 167 of these studies.

In addition to looking at the type of research projects we should review the scope or nature of the studies. To facilitate analysis of the subject of these studies we have designated eight major study areas. These are as follows:

1. Preservation and Rehabilitation of Bridges
2. Rehabilitation and Improved Service of Existing Pavements
3. Flexible Pavement Design Studies
4. Rigid Pavement Design Studies
5. Environmental Impact Studies (Noise, Air, and Water Quality)
6. Materials or Methods Studies for Improving Performance
7. Studies for Improving Highway Safety
8. Studies for Improving Product Reliability and Quality Control

All current projects are listed under these 8 major areas as follows:

RESEARCH PROJECTS ASSOCIATED WITH PRESERVATION AND REHABILITATION OF BRIDGES

Project Number	Title
70 B-89	Linseed Oil for Curing and Sealing Concrete
59 F-53(1)	Deck Repairs, B01 of 59022 (M 57 over Flat River, Greenville) (Sealant Coatings for Bridge Decks)
59 F-53(2)	Epoxy Coating on the Deck of the Sault Ste. Marie International Bridge (Sealant Coatings for Bridge Decks)
68 F-103*	Galvanized Reinforcing Steel in Concrete Bridge Decks
73 F-131*	Epoxy Coated Rebars for Bridge Decks
49 G-50(4)	Bridges and Bridge Railing Construction and Maintenance (Study of Protective Coatings for Structural Steel)
49 G-50(5)*	Protective Coatings for Highway Metal (Study of Protective Coatings for Structural Steel)
57 G-87(1)	Structural Steel Cleaning and Painting (Revision of Existing Paint Specifications)
62 G-122	Use of Low-Alloy Steels in Highway End-Uses
72 G-188	Experimental Preformed Waterproofing Membranes for Concrete Bridge Decks
73 G-197	Evaluation of Galvanized Structural Steel Protection of Bridges
63 NM-83	Bridge Deck Sealing with Penetrating Epoxy (Protective Products Corp.)
63 NM-92	"Koppers" Concrete Sealer (Koppers Co.)
63 NM-96	"Parlon" Curing Compounds (Hercules Powder Co.)
65 NM-136	"Rub-R-Road" Sealing Compound
65 NM-137	"Iso-Flex" B10 (Harry S. Peterson Co.)
65 NM-144	"Quaker-Koat" (Quaker State Oil Refining Co.)
66 NM-162	Electrostatic Paint Spray Equipment
67 NM-171	"Cybond" Protective Polyester Coating for Concrete
68 NM-190	"Cital Aquacoat 2805" Epoxy from Citrex Corp.
68 NM-192	Resilient-Epoxy Matrix for Thin Surfacing (U.S. Plastics Co.)
68 NM-200	"Carbo-Zinc No. 1" for Protection at Steel Surfaces (Carboline Co.)
68 NM-210	Bridge Deck Seal Membrane (DuPont) Nordel
68 NM-214	Dow-Corning Silicone Curing and Sealing Compound
68 NM-217	"Magic-Kote" for Sealing and Preserving Concrete
68 NM-219	"PRC 440-445" Thin Polyurethane Coating for Bridge Decks
69 NM-226	"Fast-Krete" for Patching Concrete Surfaces
69 NM-229	"Epi-Top 100" Epoxy Binder for Bridge Concrete

*Asterisk denotes FHWA HPR project.

69 NM-232	"Pliolite S-5E" Concrete Curing Compound (Goodyear)
69 NM-239	"Mari-Crete" Fast-Setting Patching Mix
69 NM-240	"Rev-Crete" Patching Compound (Revere Chemical Co.)
69 NM-251	"Regulated Set" Cement for Paving and Patching (Huron Cement Co.)
69 NM-252	"Insuro" Liquid Cement Admixture
70 NM-259	"Sylvatal-40" Distilled Tall Oil for Protecting Concrete Against Scaling
70 NM-266	Uniroyal Hot-Applied Flexible Membrane
70 NM-271	"Thiokol 411" Waterproofing Membrane
71 NM-282	"Hydrozo" Water Repellent Cement Coating for Concrete
71 NM-288	"Bonding Blend" for Repair of Concrete (Resource Designs, Inc.)
71 NM-290	"Duracal" for Patching Concrete and Macadam Roads
71 NM-292	Barrier Formula 1287-Type B Coating for Sealing Bridge Decks (Roylite Co.)
71 NM-297	"Supa Seal" and "Supa Prime" for Sealing Concrete and Preventing Corrosion
71 NM-299	PC-10 Epoxy Admixture for Portland Cement Mortar (Celanese Coatings)
71 NM-300	"Polytok" Membrane 165 for Bridge Decks
71 NM-303	"Supercrete" Curing and Sealing Compound for Concrete
71 NM-306	Republic Steel Co. Concrete Patching Material
72 NM-309	Royston Bridge Membrane No. 10 (Royston Laboratories, Inc.)
72 NM-310	Polymer "Rhoplex E-330" for Modifying Portland Cement Concrete (Rohm & Haas Co.)
72 NM-314	"Protecto-Wrap M-400" Bridge Membrane (Protecto-Wrap Co.)
72 NM-317	"Leepoxy Formula 75" Penetrating Sealer for Bridge Deck Surfaces (Leepoxy Plastics, Inc.)
72 NM-321	"Tech-Epoxy TE-2001 and TE-2501" Penetrant Sealer for Concrete
72 NM-323	"Bituthene HR" Bridge Deck Membrane (W. R. Grace Co.)
72 NM-325	"Ipanex" Concrete Additive for Waterproofing and Sealing Concrete
73 NM-354	Acton Rust Passivator (Troy Chemicals Co.)
73 NM-356	Uretar Membrane Coating (Steelcote Mfg. Co.)
73 NM-358	"Radgrout-H" for Concrete Bridge Deck Patching (Radiation Technology Div.)
73 NM-359	Darex In-Pakt Grout for Non-Shrinking Grout
73 NM-360	"Octocrete" for Patching Spalled and Broken Concrete (Penn Crete Products Co.)
73 NM-361	Liquid Applied Polyurethane Deck Membrane (Chemalur WP-1000)
73 NM-366	Promulsion 50 - Protec Industries, Naperville, Illinois
73 NM-369	"Pliopave MS Film" for Waterproofing Bridge Decks
73 NM-370	"Nexdeck" Waterproofing Membrane System for Bridge Decks (U.S. Steel Corp.)

RESEARCH PROJECTS ASSOCIATED WITH REHABILITATION AND IMPROVED SERVICE OF EXISTING PAVEMENTS

Project Number	Title
68 F-102	Repair at Concrete Pavement Joints by Pre-Cast Slabs
69 F-105	Effects of Transverse Sawcutting PCCP on Reflection Cracking
70 F-118*	Development of Procedures for Replacing Joints in Concrete Pavements
71 F-122	Experimental Pressure Relief Joints, US 23 North of M 36
72 F-123	Comparative Field Study of Joint Repair Techniques
73 F-132	Rehabilitation of Continuously Reinforced Concrete Pavement (HP&R Tentative)
71 NM-286	"Petro-Mat" Fabric Asphalt Membrane for Bridge Decks and Prevention of Reflection Cracking
71 NM-287	"Petro-Set" Emulsion for Preserving Bituminous Surfaces
72 NM-318	"Cerex" Spunbound Nylon for Retarding Reflection Cracking in Overlay (Chemstrand Research Center, Inc.)

RESEARCH PROJECTS ASSOCIATED WITH FLEXIBLE PAVEMENT DESIGN STUDIES

Project Number	Title
64 E-31	Styrofoam Insulation Test Installation on Project 73031A, C8, C9 (M 47 from St. Charles north to Junction with M 46)
68 E-42	Evaluation of Component Layers in Bituminous Pavement Design
69 E-45	Frost Insulating Properties of Asphalt-Treated Bases
71 E-47	Review and Evaluation of Soil Stabilization Methods
71 E-49	Development of Soil Support Values and Coefficients of Relative Strengths of Michigan Highway Soils
73 E-51	Transverse Cracking of Flexible Pavements
62 F-66	Performance of Bituminous Expressway Pavements
62 F-70	Investigation of the Use of a Soil Cushion as a Means of Preventing Reflection Cracking of Reinforced Pavement (M 60 from Leonidas to St. Joseph-Branch County Line) Proj. F 78042, C3

RESEARCH PROJECT ASSOCIATED WITH RIGID PAVEMENT DESIGN STUDIES

Project Number	Title
39 F-7(14)	Performance of Postwar Pavements (Concrete Pavement Design)
52 F-26*	Automatic Weighing of Vehicles in Motion and Collection of Traffic Data by Electronic Methods

55 F-42*	A Study of Dynamic Load Aspects of Truck Size and Weight
57 F-46	Continuously Reinforced Test Project, I 96, M 66 to Portland
61 F-64	Continuously Reinforced Test Project No. 2, I 96 to Phillips Road to Meridian Road (EBACI 33084B, C3)
61 F-64(1)	Continuously Reinforced Pavement (Seaway Freeway-Fisher Freeway)
63 F-74*	Statewide Determination of Highway Loading and Conversion to 18-Kip Single-Axle Load Equivalents
69 F-110*	General Evaluation of Current Concrete Pavement Performance in Michigan
70 F-113	Non-Reinforced Concrete Pavement Ramps
70 F-116	Experimental Joint Spacing Project
70 F-117	Bulkhead Joints for Concrete Base Shoulders
71 F-121	Investigation of Narrow Width Reinforcing Mats with Slip-Form Paving
72 F-127	Fiber Reinforced Concrete Overlay

RESEARCH PROJECTS ASSOCIATED WITH ENVIRONMENTAL IMPACT STUDIES (NOISE, AIR AND WATER QUALITY)

Project Number	Title
71 G-179	Sediment Pollution Related to Highway Construction (US 131)
71 G-180	Effect of De-Icing Salts on the Chloride Levels in Waters Adjacent to Roadways
71 G-182	Investigation of Air Quality Test Equipment and Procedures
72 G-185	Development of Noise Prediction Nomographs for Undeveloped Lands Adjacent to Proposed Project (Transferred to 72 G-189)
72 G-189	Sources and Effects of Environmental Noise
73 G-194	Evaluation of a Traffic Noise Barrier
73 G-200	Evaluation of Water Quality Resulting from I 696 Skimmer Tank
73 G-201	Computer Noise Analysis Program Q12095/QTANDR
72 TI-95	Noise Impact Evaluation - I 475 City of Flint (5th Street to Stewart Avenue)
72 TI-99	Noise Evaluation for Environmental Impact, M 29 through Oakland and Wayne Counties
72 TI-133	Vibration Study and Effect on Adjacent Buildings, I 696 near Merideth and Haverhill Drive (Warren)
72 TI-137	Alleged Structural Damage to Myer's House, 8864 Ashton Avenue, Detroit
73 TI-145	Vehicle Emission Data on Michigan's Highway System
73 TI-146	Air Quality Impact, Northwestern Highway, Oakland County
73 TI-151	Air Pollution Impact - Logan Street, Lansing
73 TI-152	Air Pollution Impact - M 99 Waverly Road to Eaton Rapids City Limits

73 TI-156	Air Pollution Impact - Labo Road, North to Penn Road - I 275
73 TI-160	Mound Road Freeway (10-1/2 to 17-1/2 Mile) Air Quality Impact
73 TI-161	Mound Road Freeway (10-1/2 to 17-1/2 Mile) Noise Impact
73 TI-162	Noise Impact on M 99 Logan Street, City of Lansing, I 496 to Grand River
73 TI-166	Air Quality Investigation Concerning Adjacent Homes, I 696, Warren
73 TI-167	Air Quality Investigation, M 43 at Harrison Road

RESEARCH PROJECTS ASSOCIATED WITH MATERIALS OR METHODS STUDIES FOR IMPROVING PERFORMANCE

Project Number	Title
67 A-25	Aggregate Source Study and Stratigraphic Relationships in the Bayport Limestone and Their Effect on Utilization in Highway Construction
72 B-90	Experimental Use of a Water Reducer in Slip-Form Concrete Pavement
72 B-92	Experimental Bridge Deck Surfacing Methods (1) Revibrated Concrete (2) Bonded Conventional Overlay (3) Bonded Latex Mortar Overlay
72 C-14	Evaluation of Gussasphalt Surfacing Material
73 C-16	Experimental Trinidad Asphalt Resurfacing (US 27 Snowbowl Road, north to M 55)
72 D-27	Evaluation of Cold-Mix Black Base Construction
57 E-15	Sodium Chloride Stabilization, M 46 from Newaygo-Montcalm County Line West (F 62041, C1R)
68 E-43	Feasibility of Open Hearth Slag for Bases
72 E-50	Performance of Drains in Concrete Shoulders - I 69, Butterfield and Ainger Road Interchanges
63 F-75	Chrome-Alloy Steel Dowels, Construction Project 81103A and B
75 F-84	Dampening Bridge Vibration During Construction Widening
69 F-109	Evaluation of Slip-Form Paving Methods
69 F-111	Construction and Performance Evaluation of Mixed-In-Place Bituminous Stabilized Shoulder
72 F-125	Mixed-In-Place Stabilization of Soils with Bituminous Materials
72 F-126	Experimental (Type 1) Concrete and Bituminous Shoulders
72 F-128	Evaluation of Various Bridge Deck Joint Systems
73 F-130	Experimental Pavement Edging (Experimental Work Plan No. 23)
73 F-133	Paved Shoulders - State-of-the-Art (100% Federal Financing)
60 G-102(1)	Evaluation of Aluminum Coatings for Fencing
60 G-102(2)	Aluminum Coatings for Guardrail
62 G-116	Extruded Neoprene Joint Sealer, including I 96 from Waverly Road to M 99 (33083A, C1, C2RN)

64 G-134	Evaluation of Rubber Pads for Railroad Crossings, M 46 - M 81 in City of Saginaw (G06 of 73063 and G06 of 73073)
68 G-167	Evaluation of Thermal Conductivity of Canvas Covered Insulation
73 G-195*	Effectiveness of Neoprene Seals in Preventing Pavement Joint Deterioration
73 G-199	Investigation of Performance of Neoprene Joint Seals of Several Manufacturers (NCHRP 4-9a)
60 NM-26	Aluminum Culvert Pipes
61 NM-33	Aluminum Coated Steel Chain Link Fence (U.S. Steel)
61 NM-38	Pentachlorophenol Treatment for Timber Piling (Dow Chemical Co.)
61 NM-47	"Boliden" Salt Treatment for Timber Piles (Taco Company)
63 NM-85	Polyurethane Joint Sealer (Dow Chemical Co.)
64 NM-114	Silicone Construction Sealant (General Electric Company)
67 NM-165	Use of "Chem Compt" for Pavement or Bridge Concrete
69 NM-228	PVC Coated Chain Link Fence (Anchor Post Products)
69 NM-230	Low-Density Polyethylene Foam for Pavement Relief Joints (Dow)
69 NM-245	"Resinweld" for Sign Backing Material
69 NM-246	"Poly-Tite" Joint Sealant (Jandell Mfg. Co.)
70 NM-262	"Joy" Highway Lighting Connection
70 NM-276	"Scotch-7700" 3M Arc and Fireproof Tape
70 NM-280	Plastic and Scotch-Koted Jacketed Dowels (U.S. Steel)
70 NM-281	Evaluation of Relative Humidity Meter
70 NM-284	"Pozicon" Refined Fly Ash for Concrete (Michigan Ash Sales)
72 NM-316	Revibratory Furnace Waste Slag (White Pine Copper Co.)
73 NM-355	"Strength" Water Reducing Admixture for Concrete
73 NM-367	Olin PVC Perforated Drain Pipe, Carrollton, Ohio
71 TI-38	Infrared Spectral Analysis for Evaluating 1971 Concrete Curing Compound
71 TI-58	Preparation of Simulation Model for Rest Areas
73 TI-138	Steel Cover Survey of Shored Bridges
73 TI-158	Cement Content-Tunnel Lining I 50062 EMP I-696-8(35)232-01690A
73 TI-165	Investigation of Incompatability of Rubber Calk 7000 (P. R. C.) with Sika-Flex T-68 Bridge Joint Sealer (Two-Component Urethane)

RESEARCH PROJECTS ASSOCIATED WITH STUDIES FOR IMPROVING HIGHWAY SAFETY

Project Number	Title
71 C-13	Study of Aggregate and Mix Requirements for Durable and Skid-Resistant Bituminous Concrete
72 D-28	Experimental Evaluation of Wet Bottom Slag for Bituminous Wearing Course for Shoulders (Const. Projec. 82022-04950C) I 94 in Dearborn Heights

65 F-82	The Effects of Safety Studded Tires on Pavement Surfaces
68 F-101	Concrete Shoulder Construction
70 F-114	Broomed Concrete Pavement Surface
73 F-134	Plant Mix Open Graded Asphalt - FHWA Demonstration Project
73 F-135	Experimental Concrete Glare Screen, I 696
47 G-36(26)	1973 Supplemental Paint Performance Tests (Investigation of Reflectorized Traffic Marking Materials and Methods)
51 G-54	Revision of Standard Specifications for Reflectorized Signs and Reflective Materials
54 G-73(3)	Revision of Specifications (Investigation of Traffic Control Devices)
54 G-74	Survey of Skid Resistance of MDSH Surfaces
54 G-74(5)	High Accident Areas (for Traffic Research) (Survey of Skid Resistance of MDSH Surfaces)
62 G-117*	Lights and Lighting for Hazard Warning and Delination
67 G-157	Evaluation of Bridge Deck Surfacing for Orthotropic Bridge on I 496 over Crietz Road (S05 of 23081A)
68 G-163	Delineator Condition Survey
68 G-164*	Requisite Luminance and Legend Size of Reflectorized Signs
68 G-165	Edge Marking Criteria from Contrast Ratios
69 G-173*	Determination and Improvement of Relevant Pavement Skid Coefficients
72 G-184	Proposed Loop and Detector Test Project
72 G-187	Evaluation of Liquid De-icing Chemicals
73 G-192	Glare Criteria for Advertising Signs
73 G-193	Possible Relationship Between Pavement Skid Resistance and Frequency of Accidents (HP&R Tentative)
73 G-196	Tower Lighting Evaluation I 696 and I 75 Interchange, 63103A, Job No. 0357A (Experimental Work Plan No. 21)
73 G-198	Specification Revision for Street Lighting
73 G-202	Evaluation of Various Reflectorized and Non-Reflectorized Signing, I 96, Eckles Road to I 75
66 NM-158	Non-Reflective Vinyl Film Sheeting
68 NM-212	"Presslabs" for Pavement Marking
69 NM-241	Chain-Link Fencing for Glare Screen Application (B4 82195-29, Part I)
69 NM-243	3M Bi-Symmetry Beads for Paint Marking
70 NM-265	Plastic Rumble Strip (Essex Wire Corp.) (Traffic Div. to follow)
70 NM-267	Wheeling Highway Modular Glare Barrier System
70 NM-270	High-Index Wet Performance Beads (3M and Potter Bros.)
70 NM-273	"Flexpost" Plastic Self-Righting Traffic Post (Dall Industries) (Traffic Division)
71 NM-291	"New Alert" Reflective Liquid (Cataphote) and "Beads-In-Paint" (Flexolite)
71 NM-294	Fosco Fabricators, Inc. Louvered Signs
71 NM-295	"Hydron FX-15" Protective Sealant for Concrete
72 NM-307	"ARD-45" Liquid De-Icing Chemical (Allied Chemical Co.)

72 NM-326	"Spray Grip" Skid Proofing Application, US 24 at 10 Mile Rd, Southfield
72 NM-329	Dow Aluminum Median Barrier
72 NM-332	Snowglow Beads (Snofast Co., Europe)
72 NM-333	Dow Glycols for Ice and Snow Removers on Bridges
72 NM-334	"Resil-A-Post" Traffic Markers for Gores, etc. (Flexible Highway Products)
73 NM-365	VuControl - Traffic Guide (Weaner Mfg. Dura Corp., Springfield, Illinois)
73 NM-371	"Early Warner III" Sequential Arrow for Traffic Control
73 NM-372	"Forward" Glare Screen -Horizontally Louvered Plastic Glare Screen (Proven Products, Inc.)
73 NM-373	Mitsubishi International Corp. Reflective Sheeting
72 TI-104	Hydroplaning Calculations
72 TI-114	Investigation of Causes of Low Skid Resistance on New Pavements, M 17, U 81081, Job Nos. 01141A and 01142A
72 TI-120	Investigation of Fire Damage to Two Culverts on US 2 near Crystal Falls
72 TI-126	Improving Skid Resistance by Use of Tennant Machine and Pavement Grooving
72 TI-134	Structural Studies on Anderson Guard Rail Corp. Overhead Sign Support Structures
73 TI-143	Materials Specifications for Rumble Strip
73 TI-163	Evaluation of Fiber Optics Sign for Grand River Avenue in Detroit
73 TI-164	Evaluation of Reflectorized Flagmen's Vests

RESEARCH PROJECTS ASSOCIATED WITH STUDIES FOR IMPROVING PRODUCT RELIABILITY AND QUALITY CONTROL

Project Number	Title
73 C-15	Experimental Trinidad Asphalt Resurfacing (US 27, Snowbowl Road north to M 55)
62 E-24	Improving Density Control Methods
66 E-39	Study of Clay Minerals in Base Materials
70 E-46	Effects of Gradation, Density and Admixtures on the Frost Susceptibility of Soil-Aggregate Mixtures
71 E-48	Methods for Preventing Slope Failure
47 F-15	Pavement Roughness Investigation
67 F-95	Evaluation of Acme Load-Transfer Devices
68 F-99	Movement Study of Bridge Piers (Const. Proj. X12-33045E)
68 F-104	Plastic-Coated Dowels for Pavement Joints
72 F-124	Impact and Fatigue Properties of Electroslag Weldments (71 TI-24 and 71 TI-52 Combined and Transferred)

73 F-129	Evaluation of Slip-Form Paving Methods for CRCP
62 G-114	Peeling of Paint on Pressure Tested Posts
63 G-124*	Application of Instrumental Methods for Evaluating Highway Materials
71 G-177	Estimation of Quantites of Bituminous Resurfacing by Computer Simulation
71 G-178	Survey of Wood Guardrail Post Deterioration
72 G-191*	Quality Control for Aggregate Gradation
71 TI-29	Construction of Plastic Concrete Roughness Measuring Device
72 TI-127	Subjective Evaluation of Michigan Roughometer Measurements