

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

RESEARCH NEEDS WORKSHOP

DECEMBER 2006

On December 6-7, 2006, the Research Division of the Mississippi Department of Transportation hosted a “Research Needs Workshop” to assist in the identification and development of future potential research topics that ultimately, if researched, would provide the highest benefit to all transportation stakeholders in the State of Mississippi. Over 120 participants from MDOT, FHWA, Industry and Academia attended the Workshop to assist in the prioritization of Departmental research needs. The participants divided up into the following six (6) focus groups based on their experience and expertise:

- Traffic, Safety, and ITS
- Structures and Hydraulics
- Maintenance
- Materials and Geotechnical
- Construction
- Intermodal Planning

The remainder of this document gives the prioritized results for each focus group.

# **TRAFFIC, SAFETY, & ITS**

| <b><u>Priority</u></b> | <b><u>Research Need</u></b>                                                                                        |
|------------------------|--------------------------------------------------------------------------------------------------------------------|
| 1                      | Cost/Benefit of Types of Striping Under Various Conditions                                                         |
| 2                      | Controlling Speeding in Work Zones                                                                                 |
| 3                      | Establishing Minimum Values of Retroreflectivity for Sign Sheeting                                                 |
| 4                      | Consolidation of Traffic Data Collection Across Departments, Divisions and Agencies                                |
| 5                      | Strategy for Driver Usage of Cellular Telephone Legislation                                                        |
| 6                      | Effectiveness of Various Traffic Signal Timing Software                                                            |
| 7                      | Effect of Information Overload and Oversaturation of Warning Signs (Review and Remove Unnecessary Signs)           |
| 8                      | Evaluation of Statewide Communication and Reliability of Applications                                              |
| 9                      | Costs/Resources for Maintaining 4-Lane Roads                                                                       |
| 10                     | Types of Traveler Information Needed for Evacuation                                                                |
| 11                     | Warrants for Left Turn Protective and Permitted Phasing                                                            |
| 12                     | Predictive Module for Hazard Indices in SAMS                                                                       |
| 13                     | Predicting Queue Length in Work Zones                                                                              |
| 14                     | Statewide Safety Study (Reason for Nationwide Ranking)                                                             |
| 15                     | Feasibility for Establishment of Statewide Motorist Assistance Patrol                                              |
| 16                     | Cost Effectiveness of Planning and Safety Activities                                                               |
| 17                     | Strategy for Legislation Regarding Moving Vehicles Out of Road to Minimize Incident Impact to the Traveling Public |
| 18                     | Investigate Enforcement Presence vs Severity of Work Zone Incidents                                                |
| 19                     | Establish an Access Management Policy                                                                              |
| 20                     | Establish Warrants or Guidelines for "Smart Zone"                                                                  |
| 21                     | Establishment of Comprehensive Work Zone Plan                                                                      |
| 22                     | Guidelines to Determine When and Where to Utilize Rural ITS                                                        |
| 23                     | Investigate Market Readiness of Low Cost Highway-Rail Grade Crossing Technology (Minnesota)                        |
| 24                     | Synthesis of Red Light Running Video Enforcement Legislation, Effectiveness, and Public Reaction                   |
| 25                     | Development of a Statewide Mobility Strategy                                                                       |
| 26                     | Guidelines/Warrants for Placement of Sheeting/Striping on Concrete Barriers                                        |
| 27                     | Benefits of Cable Barriers vs Concrete Barriers for Medians & Shoulders                                            |
| 28                     | Effectiveness of Overhead Signal Flashers (Strobes)                                                                |
| 29                     | Evaluate use of Overhead Lane Assignment Signals During Evacuation or Peak Flow                                    |
| 30                     | Feasibility Study for Establishing Limited Access on US49                                                          |
| 31                     | Establishing Guidelines for Impact Studies                                                                         |
| 32                     | Development of Emergency Traffic Management Policy and Procedures                                                  |
| 33                     | Development of Training Program for Traffic Signal Construction Inspectors                                         |
| 34                     | Comparison of Mast Arm vs Span Wire for Signal Installation (Where and When to Utilize Each)                       |
| 35                     | Identification of Security Issues on Transportation Facilities                                                     |
| 36                     | Synthesis of Cost Effectiveness of LED Signals vs Incandescent                                                     |

# **STRUCTURES AND HYDRAULICS**

## **Priority**

## **Research Need**

- 1 Develop Strategies to Incorporate "Smart" Structure Technology Into Bridge Structures
- 2 Evaluate Structure Survivability Due to Natural Disasters and Acts of Terrorism
- 3 Evaluation of Current Deck Design Procedures as it Relates to Pre-Cast Deck Panels, Stay in Place Forms and Deck Pouring Schedules
- 4 Refinement of PCI Deflection Multipliers for Use in Prestressed Concrete Design
- 5 Determine the Crash Test Rating of Existing "Obsolete" In-Service Bridge Rails/Guardrail Bridge Rail Transition Designs
- 6 Accurate Determination of Driven Pile Bearing Capacity
- 7 Assessment and Refinement of Bridge Inspection Techniques
- 8 Analysis of Existing Structures for Weight Posting (Refinement of Procedures)
- 9 Inspection/Inventory of Overhead Sign Trusses and High Mast Lights
- 10 Bridge Scour in Cohesive Soils
- 11 Investigate the Feasibility of Using High Performance Concrete (HPC) & High Performance Steel (HPS)
- 12 Update Rainfall Intensity Duration and Frequency Curves
- 13 Evaluation of Current Bridge Deck Construction for Long-term Durability and Serviceability (Deck Grinding Effects)
- 14 Explore Cost Effective Ways to Paint Existing Steel Structures Containing Lead Paint
- 15 Mechanically Stabilized Earth (MSE) Wall Design Optimization
- 16 Develop Specification for Using Spliced Bulb-T Girders
- 17 Evaluate the Use of Post Grouted Drilled Shafts
- 18 Protection Measures for Truss Structures Against Vehicle Impact
- 19 Feasibility Study for Developing Pay Item for Diamond Grinding and Grooving Bridge Decks
- 20 Research Abutment Design Options to Eliminate Approach Slab Settlement
- 21 Improvement of Curb Inlet Design
- 22 Study of Multi-Cell Box Siltation
- 23 Crash Test Rating of New Aesthetic Barrier Types/Transitions
- 24 Evaluation of Pipe Culvert Options
- 25 Determination of Sound Wall Requirements in Areas with Post Construction Growth
- 26 Study of Possible Uses for Composites as it Relates to Structures
- 27 Evaluation of Maintenance Measures to Counter De-Icing Agents

# MAINTENANCE

## Priority

## Research Need

- 1 Pavement Preservation - Treatments, Decision Trees , Service Life CRC and Bridge Deck, Cost-Benefit
- 2 Chip Seals/Fog Seals on High ADT Routes
- 3 Reclamation of Asphalt Pavement With Cement or Emulsion
- 4 Fog Seal Advantages
- 5 Concrete Patching Materials
- 6 Pavement Drainage - Are Edge Drains the Best Option?
- 7 Optimal Maintenance Employee Composition of Field Crews, Salaries, and Training
- 8 Rut Filling Techniques That Will Work
- 9 Raised Pavement Markings (RPM) Versus Stripe on Edge Line - Wet-Night Reflectivity
- 10 Warm Mix Technology
- 11 Better Materials and Techniques for Restriping Pavements
- 12 Median Inlets/ Paved Ditches Improve Construction/Design Alternatives
- 13 Deer Prevention
- 14 Encroachment and Outdoor Advertising Permit Fees
- 15 Cold-in-Place Recycling/ Hot-in-Place Recycling - Successes in Other States
- 16 Density Requirements for Ultra Thin Overlays (4.75 mm)
- 17 Multi-Spectral Camera for Pavement Distress Determination
- 18 Repair/ Prevention Techniques for Longitudinal Joints
- 19 Rutting at Intersections - Prevention and Repair
- 20 Aggregate Durability - Using Correct Aggregate and Gradation
- 21 Subgrade Treatments - Alternate to Lime and Fly-Ash Treatments - Do we need this on every project?
- 22 Pavement Maintenance to Decrease Traffic Delays - Scheduling Work Night Versus Day Urban Versus Rural
- 23 Ultra Thin Bonded Wearing Course
- 24 Chemical Mowing Vegetation Retarding
- 25 Timber Management Best Practices on Right-Of-Way
- 26 Snow and Ice Treatment Effects on Bridges - Look at Other States and Alternates to Salt
- 27 Interstate Fencing
- 28 Pavement Markings in Lieu of Signs
- 29 Better and Longer Lasting Retroreflectivity of Signs

# **MATERIALS & GEOTECHNICAL**

## **Priority**

## **Research Need**

- 1 Engineering Properties of and Remedial Techniques for High Volume Change Soils
- 2 Design and Construction of Perpetual Pavements with Recycled Materials
- 3 Evaluation of HMA Drainage Layer in MDOT Flexible Pavements
- 4 Open Graded Friction Course
- 5 Characterization of Engineered Emulsions for Base Stabilization and/or Full Depth Reclamation
- 6 Concrete Mix Design Based on Performance Specifications
- 7 Develop Spreadsheet to Determine Safety for Cold Weather Concrete Placement
- 8 Geophysical Characterization of Depth of Existing Foundations
- 9 Increase Percentage of RAP in HMA mixes, Classification of RAP
- 10 Soil Boring and Driven Pile Databases
- 11 Degree of Bonding and Application Rate of Tack Coat
- 12 Evaluate use of 100% RAP HMA on Secondary Roads
- 13 Vibration Transmission Characteristics of Construction Activities in Urban Environments
- 14 Geogrid Reinforcement for Mechanically Stabilized Base Courses
- 15 Evaluate use of Mississippi Limestone and Micro Silicate in Concrete
- 16 Composite Materials for Structural Connections
- 17 QC/QA for Soil Stabilization
- 18 Sulfate Resistant Concrete
- 19 Post-Grouted Drilled Shafts
- 20 Stress Absorbing Interlayer Systems
- 21 Effect of Fillers on HMA
- 22 Correlation between DCP & Strength of Stabilized Base, Evaluate Effect of Moisture Change on Resilient Modulus of Subgrade Soils
- 23 Proper Specification of Air-Entrainment in Ready Mix
- 24 Low Modulus Layer within Structure
- 25 Specifications for Recycled Concrete as Base Course
- 26 QC/QA Concrete Paving, Blending Aggregates for Concrete based on Performance
- 27 Pavement Noise Mitigation (Tire/Road Interaction)
- 28 Spread & Cure Techniques for Soil Cement Stabilization
- 29 Characterization of Erosion Susceptible Embankment Soils and Mitigation Techniques and Materials
- 30 Gradation of Beads in Thermoplastic Stripe, Determining Thickness of Thermoplastic Stripe
- 31 Moisture Content of Stockpiles, Fuel Usage of Plant
- 32 HMA Stripping Due to Like-Charged Aggregate and Binder
- 33 Determining Presence of  $\text{Ca}(\text{OH})_2$  in HMA
- 34 Correlation Factors for Load Resistance Design Factor (LRFD) Foundation Design
- 35 Auger Cast-in-Place Piles for Bridge Foundations
- 36 Evaluation of Dynamic Properties of Geomaterials
- 37 Prestress Bases
- 38 Density Requirements for 4.75 NMS HMA
- 39 Non-Nuclear Density Gauges
- 40 CPT Testing (Deep Foundations)
- 41 Sediment Flocculation for Best Management Practices (BMP) in Field
- 42 Rapid Subgrade Characterization with Mini-Piezocone
- 43 Performance Improvements from Pavement Rejuvenators
- 44 Traffic Projection vs. Real Traffic

# CONSTRUCTION

## Priority

## Research Need

- 1 Evaluate the Use of GPS and Terrain Modeling in Conjunction with Plan Distribution and Construction
- 2 Sub-Grade/Design Soil or Sub-Base Stabilization and Reinforcement Utilizing Geo-Grid, Geo-Fabrics or Other Similar Type Systems
- 3 Evaluation of Wet-Reflective Pavement Marking Performance
- 4 Effect of Contractor Pre-Qualification Requirement on Project Performance and Cost as Compared to Current Bidding Process
- 5 New and Innovative Erosion Control Methods Including an Economical Alternative to Paved Ditch
- 6 Study Cold Weather Concrete Placement in Several Different Types of Concrete Structure Conditions and Make Recommendations for Specification Changes
- 7 Evaluate the Use of 4.75 mm HMA Mix Utilizing Local Aggregates and Make Associated HMA Specification Change Recommendations
- 8 Evaluate the Value of Alternate Bidding on Different Pavement Types or Combinations (Rigid, Flexible or Both) Using Life Cycle Cost
- 9 Evaluate Use of Metal Decking for Forming and Pre-Cast Concrete Slabs for Use in Forming and Pouring Concrete Bridge Slabs
- 10 Evaluate the Use of Non-Nuclear Density Testing
- 11 Study to Evaluate Effects of Temperature on Polymer Modified HMA Mixes and Make Recommendations for Specification Changes
- 12 Determine the Need for Drainage Layers Under Concrete Pavements
- 13 Evaluate the Use of Open Graded Friction Courses as Wearing Courses on HMA Pavements
- 14 Evaluate the Use of Real Time Quality Control Equipment in the Production of HMA and Concrete (Gradation, Moisture Content, etc)
- 15 Evaluate the Overall Value of a Pavement Warranty Project
- 16 Revise Current Pavement Marking Policy and Consider ADT, Pavement Type, etc. Including Temporary Stripe or Stripe in Work Zones
- 17 Determine Standardized Method of Determining Life Cycle Cost for Various Pavements
- 18 Evaluate Performance Related Specifications for the Following:
  - a. Pavement Construction
  - b. Pavement Markings
  - c. Permanent Erosion Control (Grassing)
- 19 Research the Use of Dense Graded Drainage Layers That Will Contribute to the Structural Capacity of the Roadway (Combine Bottom Lift HMA and Drainage Layer)
- 20 Explore Alternate Curing Methods for Minor Structure Concrete Specifically Cast-in-Place Rail
- 21 Evaluation of Rumble Strips (Rumble Stripe) on Low Volume Roads
- 22 Evaluate Expanding the Use of the Maturity Meter to Include Acceptance for Pay
- 23 Evaluate the Use of Different or Shorter Guardrail Systems with Respect to ADT, Speed and Functional Classification
- 24 Evaluate the Effects of Weather (Wind) on the Ability to Achieve Density Requirements on HMA Pavements
- 25 Control of Turbid Run-Off on Construction Projects and the Resulting Effects on the Environment
- 26 Evaluate the Procedure of "Day-Lighting" Drainage Layers to the Outer Slopes
- 27 Evaluate Two-Lift Concrete Construction Technique

# **INTERMODAL PLANNING**

## **Priority**

## **Research Need**

- 1 Use of ITS to Improve Transit
- 2 Utilize Universities as an Information Clearinghouse
- 3 Evaluate the Impacts of Bypasses\Routes on Mississippi Communities
- 4 Successful Rural Transit Providers (What makes them successful) Impacts of Additional Investment
- 5 Identify Fuel Tax Alternatives
- 6 Cost benefits of an Improved Rail Safety Program
- 7 How can Intermodal Resources Aid in Disaster Response and Recovery
- 8 Establishment of an Intermodal Internship Program
- 9 Impacts of Regional Airports to State and Community
- 10 Regional Mobility Study for Transit
- 11 Real time Analysis of Freight Flows to Identify Bottlenecks\Incidents and Use History to Aid in Design
- 12 Mode Neutral Choice Analysis
- 13 Alternative Fuels and Their Impacts on Transit, and Fuel Taxes
- 14 State of Practice of Traffic Data Collection
- 15 Intermodal Project Prioritization Criteria
- 16 Comparison of Traffic Projections to Current Counts
- 17 Impacts of Disasters to Intermodal System and Commerce
- 18 ITS for Freight Monitoring and Analysis
- 19 Quantify Impacts of Intermodal Connector Improvement Program
- 20 Standard Specifications for Transit Vehicles
- 21 IT Opportunities for Traffic Flow Monitoring
- 22 Regional Real Time Freight Movements for Trip Planning and Analysis
- 23 Policy and Regulatory Barriers to Coordinated Transportation
- 24 IT Opportunities for Freight Monitoring and Dissemination To Freight Providers