Literature Search
Need Statement 556

Prepared for: Nicole Buehne
Prepared by: Jim Byerly, Electronic Resources Librarian
Resources searched: ASCE Library, MnDOT Library Catalog, Transport Database, Research in Progress, Web

Summary: Results are compiled from the databases named above. Links are provided for full-text, if applicable, or to the full record citation. I completed my searches using the following terminology: mix design, low volume roads, best practice, state of the art, state of the practice. The results are divided into most relevant and less relevant.

1. Pavement Asset Design and Management Guide.
   Abstract: This Guide is a consolidation of Canadian pavement design and management practices. It provides a theoretical understanding of issues, a summary of best practices and is intended to be applicable across Canada for varying conditions and jurisdictions. Tools for the management of transportation infrastructure assets are included. The Guide emphasizes routine maintenance and preservation as important aspects of pavement management. Key industry issues such as sustainability, climate change and new innovations are highlighted. Low volume road design and management is addressed. The Guide explicitly highlights provincial practices in addition to municipal practices. State of the art is explored, and future opportunities are identified throughout the Guide. The document is a guide rather than a comprehensive design manual and each of its fifteen chapter provides numerous additional resources for further reference. The Guide is intended for a diverse range of users, practitioners and managers. Academic users will find this Guide a valuable reference. The private and public sector will use the Guide as a design and management tool, particularly when training new technologists, engineers and managers. (A)
   Year: 2013

2. Mix Design for Full-Depth Reclaimed Asphalt Pavement with Cement As Stabilizer
   Advanced Characterization of Asphalt and Concrete Materials
   Source: (1 - 8)
   Abstract: A rational rehabilitation design should be based on the understanding and knowledge of the existing pavement distress or condition. The purpose of this research was to investigate the effects of reclaimed asphalt pavement (RAP) content and cement content on the strength of full-depth reclamation (FDR) base. FDR for asphalt pavement with cement as the stabilizer was used as the base course. The full-factorial experimental design included five RAP contents and five cement contents. To ensure the reproducibility, there were three replicates for each specimen. The 7 days; unconfined compressive strength (UCS) was used as the control parameters. The five RAP contents consisted of 0%, 25%, 50%, 75%, and 100%. The five-cement blending content included 0.5%, 1.0%, 1.5%, 2.0%, and 2.5%. The test results indicate that the optimum design was 50% RAP and 2% cement.

3. Warm-Mix Asphalt for Rural County Roads

   Source: (438 - 454)
   Abstract: Warm-mix asphalt (WMA) is a group of technologies that allow for the placement of asphalt at production temperatures 35°F–100°F lower than traditional Hot-mix asphalt (HMA). Some of the benefits for using WMA are that it lowers fuel consumption, lessens the aging of the asphalt binder, decreases the production of greenhouse gases, allows for the placement of asphalt plants in more restrictive areas, and improves worker conditions. First used in Europe, WMA was introduced to the U.S. with a European scanning tour in 2002. In 2004 the first field tests in the
Literature Search

Need Statement 556

U.S. were constructed, with the first production paving jobs in 2006. Warm Mix Technology is divided into three distinct classifications based on the mechanism used to produce the end product. In one class, foaming, small amounts of water are mixed with the hot asphalt oil. A second process uses organic additives or waxes to decrease the viscosity of the oil. The last class use chemicals or surfactants to aide in the coating of the aggregate at lower temperatures. All three processes have been used in cold weather climates. A surfactant was chosen for Crow Wing County Road 108. Most surfactants require little if any plant modifications when compared to a foaming process in which the modifications could be as simple as adding another bin to a rap feeder or as complicated as adding manifolds and injectors to the plant. The use of a wax was rejected, as one of the ways to get a cost comparable product for this project was to substitute a warm mix product using PG 58-28 oil for a hot mix product using PG 58-34 oil. Research indicated that one of the benefits of warm mix using the foaming or surfactant process is that they generally perform better than the waxes for thermal cracking. On August 19th of 2008 2913 tons of WMA and 272 tons of HMA were placed on Crow Wing County Road 108 by Anderson Brothers Construction Company of Brainerd. A level 2 gyratory mix design was used incorporating Evotherm 3G in the asphalt binder. The additive was added at the Flint Hills refinery in Minneapolis at a rate of 0.5% by the weight of the binder. The product arrived at the paving plant ready to use, requiring no modifications to the plant or the paving equipment. During production the only change made to the normal testing procedure of the mix was the temperature at which the gyratory samples were made. The oil met all the requirements of a PG 58-28 oil and the mix met all of the requirements of a Level 2 gyratory design. The binder was cut 0.1% from the HMA design to bring the production air voids in the WMA up to the desired levels. The densities of the road cores of the WMA (ave. 92.7%) were found to be slightly below that of the HMA (94.1%) but still at a respectable level for a 2-inch lift on a 5-ton road over gravel. Answers that will come over time are whether or not WMA will perform better than HMA for thermal cracking, will it will have a longer life span and will prices become comparable to HMA. Some other countries currently believe the answers are "yes" and are willing to pay a higher price today to realize cost savings in the future.

5. Green Initiatives at MnROAD

6. T&D1 Congress 2011: Integrated Transportation and Development for a Better Tomorrow
Source: (720 - 730)

Abstract: The transportation network and its supporting infrastructure have significant economic, social, and environmental impacts. Using more sustainable methods to design, construct, and preserve our roads will better protect the environment and meet our ongoing transportation needs. The Minnesota Department of Transportation (Mn/DOT) and our partners in government, industry, and academia have been researching and implementing ways to make our roads greener while maintaining and improving roadway quality. The Minnesota Road Research Facility (MnROAD), an accelerated pavement test facility near St. Paul, MN, is conducting research on several "green" pavement technologies that reduce environmental impacts, reuse roadway materials, or use recycled materials in pavement applications. Green pavement technology should maintain or improve the state of the practice of pavement engineering. This ensures the green product will be market-driven, cost-effective, and sustainable.

7. Low Volume Road Asphalt Trial in SA

8. BEST PRACTICES FOR THE DESIGN AND CONSTRUCTION OF LOW VOLUME ROADS REVISED
Source: MnLRRB Report
9. BEST PRACTICES TO SUPPORT AND IMPROVE PAVEMENT MANAGEMENT SYSTEMS FOR LOW-VOLUME PAVED ROADS – PHASE I

10. Benefits of MnROAD: Phase-II Research

11. CONSTRUCTION OF LOW VOLUME SEALED ROADS: GOOD PRACTICE GUIDE TO LABOUR-BASED METHODS