Development of Guidelines for Asphalt Recycling in Pakistan

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Pakistan-U.S. S&T Cooperative Program Symposium
Islamabad, Pakistan, January 31-February 1, 2013
Presentation Overview

- Introduction
- Research objectives
- Background
- Research approach
- Accomplishments
- Research outcomes
- Research Impacts
Role of Roads in Economic Development

- Move goods and people in timely fashion
- Provide access to farms and rural areas
- Create jobs
- Generate investment opportunities
- Improve standard of living
Transportation Modes in Pakistan

- **Passenger**: 90% of total traffic
- **Freight**: 10% of total traffic

National Highways only contribute 4.2% (11,000 km) of the total road network, they carry 90% of total traffic.

**Source:** Economic Survey 2007-08

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[USAID Logo]
Overall Goals of the Research

• Introduce asphalt pavement recycling methodologies
• Positive socio-economic and environmental impacts
• Technology transfer - Training local professionals through short courses
• Capacity building of academic institutions
Research Objectives

Develop guidelines for asphalt pavement recycling in Pakistan within the given constraints and environmental conditions

1. Develop guidelines for pavement evaluation
2. Investigate the state-of-the-practice for pavement recycling
3. Develop procedure for material characterization for recycling
Research Tasks

Development of Guidelines for Asphalt Pavement Recycling in Pakistan

Pavement Evaluation Guidelines
- Site selection
  - Field investigation

State-of-the-Practice in Pavement Recycling
- Case studies
  - HIR - M-2 sections
  - CIR - N-5 sections

Material Characterization Guidelines
- Characterizing asphalt binders
- Characterizing asphalt mixes

Goals
- Guidelines for pavement evaluation and selecting recycling method
- Learn about the existing practices (field performance, construction and technology) and customize guidelines to local constraints (climate and loading)
- Guidelines for HMA mix design with RAP
Pavement Distress — Rutting

N-5, Lahore - Islamabad
Pavement Distress — Cracking

N-5, Lahore - Islamabad
Causes of Distress — Excessive truck loads
Causes of Distress — Climatic factors
Needs for Pavement Preservation

• In 1998, network analysis using the HDM-III computer program showed that an annual budget of PKR 6.0 billions per year is required over 10 years period to improve the average network conditions to an acceptable level.

Source: (NHA 2005), and (Rodrigo and Haider 1998)

• In 2005, the annual needs increased from PKR 6.0 to 10.5 billions after adjusting for inflation.
The Problem

• Funding for preventive maintenance, preservation, rehabilitation, and reconstruction of roadways compete with other demands on the limited public funds and resources.

• Innovation is required in order to do more with less.

• **Asphalt pavement recycling** is one way to stretch existing budgets to maintain, preserve, rehabilitate and reconstruct more kilometers of roadways.
Advantages

• The advantages of asphalt pavement surface recycling (hot or cold in-place and in-plant recycling) include:
  ✓ Conservation of natural resources
  ✓ Better pavement performance
  ✓ Reduced traffic disruption, maintained pavement geometry and thicknesses
Existing Practice — Wasted resources & environmental hazards
Existing Practice — Wasted resources & environmental hazards
Hot-in-place Recycling (HIR)

Wirtgen’s recycling train

Pre-heating unit

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HIR

Remixing unit

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HIR

Scarifying / Heating unit

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HIR

New HMA placed in remixing unit

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Cold Milling
Cold-in-place Recycling (CIR)

CIR train working on N-5
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CIR

View of milled recycled material

Initial compaction by screed

Milled recycled material near screed

Compaction of CIR layer
In-plant Recycling in USA
In-plant Recycling in USA
In-plant Recycling in USA
Technology Transfer

Pakistan team visit to USA—August 16-25, 2006
- Revised research plan
- Visit to cold-in-place recycled road project
- Visit to the state-of-the-art asphalt mixing plant
- One week training course at NCAT, Auburn

USA team visit to Pakistan—December 10-22, 2006
- Three-day short course “Infrastructure asset management systems and asphalt recycling practices and technologies”, more than 200 people attending from the road authorities, private sector and academia.
- Several recycling projects site visits and meetings with HEC, NUST and NHA officials

USA team visit to Pakistan—March 1-9, 2008
- Two-day short course “State-of-the-art in road construction and quality control assurance issues”, more than 120 people attending from the road authorities, private sector and academia.
- Several meetings with contractors, consultants, the World Bank, NHA and NUST officials.
Technical Publications


• Two journal papers presented at the Annual Meeting of Transportation Research Board, 2008 and 2009.

• Nine conference papers published and presented at following conferences:
  • 6th International Conference MAIREPAV6, Torino, Italy, July 8-10, 2009
  • 6th RILEM International Conference on Cracking in Pavements, Chicago, USA, June 8-11, 2008.
  • 6th International Conference on Road and Airfield Pavement Technology (ICPT) Conference, Japan, July 2008.
Masters Thesis

• Introduction of performance-based specification for Asphalt binders in Pakistan, by Mr. Qazi Aurangzeb, 2007.

• Characterization of RAP and asphalt binders for their potential use in CIR with foamed asphalt through conventional and performance testing, by Mr. Khurram Malik, 2008.

• Hot-in-place recycling experience on motorway (M-2) in Pakistan, by Mr. Nadeem A. Qureshi, 2008.

• Developing pavement evaluation guidelines for selection of flexible pavement recycling strategies in Pakistan, by Mr. Arshad Hussain, 2008.

• Characterization of binder blends for asphalt mixtures containing reclaimed asphalt pavements, by Mr. Mudissar, 2009.

Training Components

- More than 300 highway related professionals from public, private and academic sectors were trained during short courses.
- The academic/research/supporting staff at NIT working on the research were trained for using the state-of-the-art material testing using new laboratory equipment procured through the research grant.
Outcome of the Research

• Guidelines for the evaluation of existing pavements
• Pavement structure assessment criteria for selecting asphalt recycling method
• Guidelines for construction processes which includes detailed procedures and methods
• Guidelines for material evaluation and characterization for asphalt recycling
• Guidelines for asphalt mixture design involving RAP by highway class
• A process for evaluating and upgrading the guidelines
Research Impact

Benefits of the research will be for entire highway sector in Pakistan. The beneficiaries include:

Universities and Institutions

- National University of Sciences and Technology (NUST)
- National Institute of Transportation (NIT)
- University of Engineering and Technology (UETs) at Lahore, Taxila, Karachi, and Peshawar

Organizations and Agencies

- National Highway Authority (NHA)
- Provincial Highway Authorities (Punjab, Sindh, NWFP, and Baluchistan)
- Provincial Communications & Works (C&W) Departments
- District and City Governments
- Highway Construction Industry
- Design and Supervision Consultants
Research Impact
Acknowledgements

Pakistan-US Science and Technology Cooperative Program

This research is a part of the 4-years study (2006-2009) entitled:

*Development of Guidelines for Asphalt Recycling in Pakistan*
Thank You