

FINIDINGS AND RECOMMENDATIONS OF THE USA RESEARCH TEAM

EXECUTIVE SUMMARY

December 10 to 22, 2006

Respectfully submitted by

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EXECUTIVE SUMMARY

The Higher Education Commission (HEC) and the USAID have funded a research project entitled “Development of Guidelines for Asphalt Pavement Recycling in Pakistan”. The research is being conducted jointly by staff from the National Institute of Transportation (NIT) of the National University of Sciences and Technologies (NUST) under the direction of Dr. Tayyeb Akram, Director NIT and faculty from the Department of Civil and Environmental Engineering at Michigan State University (MSU) under the direction of Professor Gilbert Baladi. The primary objectives of the project are:

1. Enhance the capabilities of the National Highway Authority (NHA), the Academia and the Private Sector in Pakistan to recycle asphalt pavements in a cost effective manner.
2. Develop guidelines for recycling asphalt pavements in Pakistan using the state-of-the-practice and the state-of-the-art technologies and methodologies.

During August 2006, a four-member team from Pakistan visited USA. The objectives of the visit were to discuss research progress with their USA counterpart, to finalize the research plan and to attend training sessions at the National Center for Asphalt Technology (NCAT). In addition, the team also visited the facilities at MSU, one of the largest asphalt mixing plant in the USA, and the asphalt laboratories at the Michigan Department of Transportation (MDOT).

Between the 10th and the 22nd of December 2006, the USA research team visited Pakistan. The following objectives were accomplished during the visit:

1. Met with members of the National Academy of Sciences and of the Higher Education Commission (HEC).
2. Met and discussed research accomplishments with the NIT research team.
3. Cold recycling pavement project was visited and discussion with the contractor was held.
4. The Attock Oil Refinery Limited at Rawalpindi was visited along with the NIT team and representative from NHA. During the visit, the refinery production of asphalt binder was discussed. Also, the potential for the refinery to produce performance (PG) grade asphalt binder in accordance with specifications compatible with the environmental conditions in Pakistan was explored. Results of the discussion precipitated cooperation between NHA, NIT and the oil refinery personnel and managers. The PG grade will be produced by the refinery and will be tested by NIT, NHA and in the USA by NCAT to assure high quality products.
5. A three-day short course was conducted as a part of technology transfer. The course was attended by more than 150 people from the Road Authorities, the Private Sector and Academia.
6. Pavement sites along M-2 motorway that were recycled or selected for recycling were examined.
7. Several pavement construction, rehabilitation and maintenance projects were visited including the M-1 motorway near Risalpur, the N-5 cold recycling project, the N-5 concrete pavement construction project and the N-5 concrete pavement patching project.

During the pavement project visits, pavement construction and quality control issues were discussed with the contractors. The observations of the USA team include:

1. The asphalt pavement sections along the Lahore-Islamabad Motorway (M-2) that were subjected to hot-in-place recycling exhibited high surface roughness (poor ride quality).
2. The cold milling and cold in-place asphalt pavement recycling operation along the Lahore-Islamabad National Highway (N-5) employed state-of-the-art equipment and procedures.
3. The process used for selecting pavement sections for maintenance is not balanced or appropriate. The 13-years old asphalt pavement section along the truck lane on the north bound N-5 near the town of Sohawa is in good to excellent conditions. However, it was ripped out and replaced by concrete pavement.
4. The equipment and practices used in the construction of new asphalt and concrete pavements are inferior and will cause early failure of the pavement structures. For example, a three years old concrete pavement section along N-5 (near the town of Sohawa) that was supposed to last 15 to 20 years has severely deteriorated and was being patched.
5. The ride quality (roughness) of the as constructed asphalt and concrete pavements is very poor (IRI of 2.5 to 4.5 m/km).
6. The batch mixing plants used throughout Pakistan to produce asphalt concrete mixes have inadequate production capacity for road construction and are not environment-friendly. Drum mixing plants have higher production capacity, better quality control, better pollution control devices and are more cost-effective.

Based on the various meetings and discussions held between the USA research team and many personnel from the road community, and on the team observations of the conditions of the pavement network in Pakistan, the team draws several recommendations, which can be divided into various categories as stated below.

I – GUIDELINES

It is highly recommended that comprehensive guidelines regarding pavement design, construction, rehabilitation, maintenance, quality control and quality assurance be developed. Such guidelines should be based on exhaustive research studies regarding the physical and engineering characteristics of the materials used in road building, traffic load spectrum, and the climatic conditions of Pakistan. It should be noted that guidelines for hot and cold in place asphalt pavement recycling and central plant recycling are being developed as a part of the deliverables of the USAID-HEC sponsored research project.

II - RESEARCH AND DEVELOPMENT

It is highly recommended that the National Highway Authorities (NHA) in Pakistan establish short- and long-term research and development program. A model for financing and administrating the program is recommended below.

1. NHA designates one percent of its total budget or at least two percent of the toll revenues for establishing Research and Development program. The program should be administered by NHA. In order to assist NHA in managing the program, it is strongly recommended that NHA establish a Research Advisory Council (RAC). The RAC members should consist of three representatives from the Academia, three from NHA, and three from the Private Sector. All members are to serve on a voluntary basis. The functions of the RAC include:
 - Develop short- and long-term research and implementation plans.

- Collect research problem statements from NHA personnel, the Academia and the Private Sector.
 - Prioritize the research problem statements.
 - For each problem statement develop a request for proposal (RFP) that includes the problem statement, the objectives of the research project, the envisioned tasks to be executed by the research agency, the estimated budget, and the deadline for proposal submission.
 - For each funded research project, form a five member Technical Advisory Group (TAG) to monitor the progress of the research team. The pool for the TAG members could be personnel from NHA, the Academia and/or from the Private Sector (Contractors and Consultants). The responsibility of the TAG members includes reviewing relevant research reports and making recommendations to the RAC members regarding the acceptance or rejection of the final report.
 - Develop short- and long-term Continuing Education Program (CEP) based on the need of NHA and Provincial Road Authorities. The CEP typically consists of 2 to 3-day short classes that can be offered by NHA personnel, the Academia, the Private Sector or combination thereof.
2. NHA post on its web site or publish by other means of communication that are available to the Academia, and private consultants, all RFP for the given physical year.
 3. For each proposed research project, the proposed budget and costs shall be based on 75 percent chargeable to NHA and 25 percent fund (matching fund) to be provided by the proposing agency. The matching fund could be in Rupees or in time devoted by project personnel toward the project without charges.
 4. Upon receiving proposals in response to an RFP, NHA shall forward one copy of each proposal to each TAG member.
 5. The TAG members shall meet, elect a chairperson, and review and prioritize the proposals based upon their merits and the qualifications of the research teams. The review process and the selection of the best proposal shall be completed within two months from the published deadline.
 6. The TAG Chairperson shall forward the TAG decision to NHA promptly and NHA shall inform the winning research agency by their decision within 2 weeks from receiving the TAG decision.
 7. All proposals shall include the following sections: technical (details of the research tasks, research plan, implementation plan), qualification of the research team including full resume of each team member, available facilities (laboratories, libraries, etc.), and proposed budget including matching fund that details the costs of each proposed task.

III – ROAD AUTHORITIES

1. Establish quality control/quality assurance (QC/QA) divisions equipped with the state-of-the-practice equipment and state-of-the-art knowledge to check the quality of the as-constructed pavements. Or, NHA adopt the practice of issuing, for each road project, two contracts to two independent contractors; one for construction and quality control and the other for quality assurance. Such practice would precipitate the building of local capacity and experience and improve construction quality and pavement performance and increase the longevity of the pavement network.

2. Establish performance-based specifications regarding the quality of the as-constructed roadways.
3. Design and gradually implement a program for acquiring training and certification of technicians working for the road contractors and consultants.
4. Treat local consultants on equal footing as their foreign counterparts.
5. Establish an incentive/disincentive program. In this program, if the road quality delivered by a construction contractor exceeds the specifications, the contractor is given an award over and above the contract price. Visa versa, the contractor should be penalized by holding certain percentage of the contract price for low quality construction.
6. A team from NHA visits USA and attends two-week training sessions regarding the design and construction of cost effective pavements, visits the facilities of a State Highway Agency and a few pavement construction sites.

IV –THE PRIVATE SECTOR

1. The Private Sector invests in state-of-the-art equipment and methodologies for the construction of cost-effective roadways and for material testing and to take advantages of the existing local expertise, which is currently grossly under utilized.
2. The Private Sector, in cooperation with the various Road Authorities and the Academia sponsor continuing education programs and invest in the education of their engineers and technicians regarding the state-of-the-art and the state-of-the-practice in pavement design, construction, rehabilitation, maintenance and quality control.

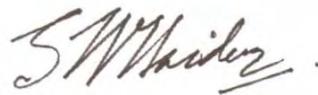
V – THE ACADEMIA

1. Universities and higher education colleges establish uniform technician training program and certification process to train and certify technicians working in road construction, rehabilitation, maintenance and QC/QA.
2. Universities and higher education colleges establish continuing education programs by offering short courses to engineers and technicians working in the transportation infrastructure.
3. Universities establish training and certification centers to train and certify technicians and workers to use state-of-the-art equipment and methodologies in road construction and material testing.

Respectfully submitted



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