

4. I could quote any of several recommendations of the paper by Hicks and Hatch. Just one is: "Improve construction records to better document the history of each project. A documentation process accessible to the designers would allow analysis of new processes and materials."

Certainly if we can learn lessons such as

INTERNATIONAL VIEW

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Mr. Chairman, ladies and gentlemen: I was supposed to speak on the international viewpoint summary from that angle on the conference but the learned Professor, I think, has preempted everything I wanted to say and I am not sure whether there is anything else left to say after such a brilliant summary of what has transpired for the past three days. However, if you will bear with me for a few minutes I will just present one or two aspects that I think should be looked into.

The Second International Conference on Low-Volume Roads, in my view, has been most successful. The conference has highlighted areas in which developing countries need to focus their attention in their desire to maximize development with limited funds. Low-volume roads constitute the bulk of the roads in these countries and they best serve the immediate and daily needs of the people. I would like to touch on a few of the very many excellent papers that were presented at this conference.

The Use of Local Materials

Many people clearly demonstrated the need to use local materials in the construction of low-volume roads, if minimum costs are to be achieved. One paper dealt with ways and means of turning local soils, either in their natural state or modified by lime, asphalt, or cement into load-bearing bases and sub-bases. It is recognized that low-volume roads carry heavy axle loads with quite destructive capabilities. Only bases and subbases of high enough strengths can adequately distribute loads to the subgrades. These subgrades are usually, in the case of low-volume roads, prepared with minimum efforts. Two papers dealt with the needs to understand local materials, at first sight, without resorting to complex and costly laboratory tests. The tools to use were soil surveys and geotechnical data banks.

The Use of Local Labor

Some papers presented at this conference have touched on this subject. I must caution, however, that we must not let ourselves be carried away with the so-called labor-intensive, labor-based methods which reduce the quality of life in the developing world and dehumanize the people. Any so-called appropriate technology that turns human beings into work horses or seeks to perpetrate underdevelopment by embarking on the construction of jungle trails is best forgotten. Only certain aspects of work in the construction of low-volume roads lend themselves to labor-based methods and only these should be encouraged. For instance, protection of embankments through grassing, turfing, and stone pitching; desilting of culverts and cleaning of blocked drains, and routine pavement maintenance operations such as pothole repairs and patching of distressed pavements with hot or cold mixes, are examples that can be executed by local labor. On the other hand, it would be quite futile to attempt soil-cement stabilization by mixing the soil and cement in head pans, spreading by oxen labor and compacting by the stamping

contained in these single statements, our time has been well spent. I am certain I speak for all of us as I express thanks for this conference to the several agencies that organized it, the committee that set up the program, the individuals that have handled the details, and the persons who have authored and presented the papers.

of feet.

New or Improved Methods

Several papers dealt with recent developments in the use of traditional methods, refinements in existing methods and better utilization of local materials. An interesting paper is the one that dealt with the use of sulphur-treated bamboo in reinforcing concrete and in reinforcing earth. The ideas contained in this paper can be extended to reinforcing walls of traditional houses built of clay or mud in developing countries. The need to provide shelter for the population of the developing countries, at least cost, is a matter that is being urgently considered in these countries. In the same category was a paper that dealt with new efforts at making durable pavements with asphalt emulsions, and with the use of lateritic soils in Thailand's Khorat Plateau. New Zealand's experience in the pavement design and the performance of low-volume roads carries a message that can be explored to the advantage of all developing communities.

Problems of Maintenance

Maintenance, as you all know, is a big problem to many developing countries. Emphasis in development has been on new construction and insufficient funds are allocated for maintenance. Properly organized, equipped, staffed and efficient road maintenance organizations are the exception rather than the rule. It is important, therefore, to always strive to make any construction as durable as possible, and certainly for more than five years of life. Road improvement by new application of surface dressing or the laying of hard asphaltic concrete overlays should be seen as steps in the stages of development of low-volume roads to those of high levels of service and function. When to maintain and what to do were also well illustrated by papers on a program of bridge inventory, inspection, and rating for a local roads system and the evaluation of the structural adequacy of bituminous pavements in Minnesota.

Some interesting papers dealt with the engineering economics of maintaining and paving of low-volume roads. These are useful tools but the immediate needs of developing countries as far as maintenance of low-volume roads is concerned are simple operational manuals that teach basic maintenance procedures.

I would like to comment on the conference session on developing countries' needs for information on low-volume road technology. I was a panelist at that session. What has come out as the prime need from that session is the necessary data for the basic things. Whereas the developed world has computerized data banks, the developing countries are still groping in the dark for such basic data as runoff coefficient for drainage design, rate of asphalt absorption by local aggregates, and, indeed, the required

understanding of the engineering properties, uses and limitations of locally available road building materials. Here I am in complete agreement with the views of Dr. Ray Millard of the World Bank, that engineering training and education should be geared more closely to the practical aspects of the profession and a little less emphasis on the romance of the pure researcher with sophisticated mathematics. What also is needed, at this state, is the knowledge of the basic and practical aspect of building durable bituminous surface dressed pavements. This leads me to some of the new technology we have been introduced to at this conference. I refer to the International Bank for Reconstruction and Development's highway design and maintenance standards model. I believe that it is an excellent research tool. It must be regarded, however, as a means or indeed one of several means available to reach the end. It should not be regarded as the end in itself. I think we should be worried that by plugging a few parameters into a computer we have found the answers to our maintenance problems. One is reminded of the World Bank's transportation planning model. It, too, was a sequential model in that the output from one step became the input to the next step. Final results developed from data inputted by the user nonetheless have been developed without any control by the user of the intermediate steps. The result was that more often than not final recommendations obtained were at odds with the real world. I am informed that this model has now been virtually abandoned and has been replaced by stage planning. What, in effect is seen is that research should be aimed at developing easily

understood rule-of-thumb procedures that would enable the average engineer in Lagos, or Indonesia, to perform effectively with perhaps only a slide rule or electronic calculator. I am in fact, therefore, advocating for a practical mind with field experience.

In concluding my summary of the Second International Conference on Low-Volume Roads from international or foreign viewpoints, I want on behalf of my colleagues from Asia, Latin America, The West Indies, and Africa to say how useful this conference has been. It has stimulated our minds and has given us renewed vigor and impetus to develop our countries so as to improve the quality of life of our citizens. This is what development in life is about. BETTER ROADS MEAN BETTER LIVING. I, therefore, want to thank the organizers and sponsors of this conference, the Transportation Research Board, United States Agency for International Development, the Federal Highway Administration, the American Association of State Highway and Transportation officials, the American Road and Transportation Building Association, the National Bank for Reconstruction and Development, the National Association of County Engineers, National Association of County Officials, National Science Foundation, U.S. Army Engineers, U.S. Forest Service, the Iowa State University, the Iowa Department of Transportation, the Iowa Association of County Engineers and the International Road Federation for a job well done.

I do also want to express my deep appreciation to the Secretariat, the University Staff, and the bus drivers who have all helped to make our stay in Iowa a wonderful and pleasant experience.