MATES

MICHIGAN DEPARTMENT OF TRANSPORTATION

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HERE TODAY, GONE TOMORROW
THE CASE OF THE VANISHING RESOURCES

People have a tendency to take things for granted. Such things as health and freedom are generally not appreciated until they are gone. Several years ago there seemed to be an unlimited, inexhaustible supply of oil until the petroleum exporting countries generated a great oil shortage in the early seventies and American domestic oil supplies were inadequate to support the demand. This was accompanied by long lines at the gas pumps and sharp increases in price. Today, that situation is just an unpleasant memory which seems to have been forgotten by the general public, in spite of continued warnings from knowledgeable people. There is no question that oil is a finite resource. There are limited numbers of natural oil deposits on this earth, only part of which can be recovered. Once they are gone, alternate kinds of fuels and materials will have to be developed.

There is another finite resource, although much more plentiful than oil, the depletion of which would have a very great impact on our society, and transportation in particular. This resource is sand and gravel. The average person comes in contact daily with many types of sand and gravel without even realizing it. Portland cement concrete is about 85 percent sand and gravel while bituminous mixes for blacktopping are about 95 percent sand and gravel. The average person arises in the morning in a house that is resting on concrete footings with a concrete basement floor. The basement walls are poured concrete or concrete block. Water that flows from the house runs through concrete sewer pipe.

One goes out to the garage with a concrete floor and backs out on a gravel, concrete, or blacktopped driveway, past a concrete sidewalk onto a gravelled, concrete, or blacktopped street, perhaps with concrete curb and gutter. We drive to work on concrete or blacktopped roads over concrete bridges, and park the car in a concrete parking structure or gravel, concrete, or blacktopped parking lot. The workplace may be partially or almost entirely constructed of concrete. During this time, one probably doesn't think of, or realize the role that ordinary sand and gravel play in daily life.

Year after year, decade after decade, sand and gravel continue to be the construction material used in greatest quantity throughout the nation. The Michigan Department of Transportation specifications list 26 different classes of gravel and 12 different classes of sand which are used in building roads, bridges, docks, airports, railroads, and other structures. The physical requirements for the aggregates are constantly being changed, refined, and fine-tuned to meet today's transportation needs. And yet, sand and gravel, like oil, are finite resources. Michigan owes much of its surface configuration to continental glaciation. The last glaciers started melting about 17,000 years ago in the southern part of the State, receding northward until they disappeared around 10,000 years ago. The aftermath of the glaciers' initial southward movement, coupled with the enormous quantity of meltwater, was the deposition of many sand and gravel deposits which are located in various parts of the State in a variety of different geological formations.

One example of such a geological formation is the Mason Esker. The surface appearance of an esker is that of a long, winding hogback ridge. Eskers are elongated hills characteristically formed in stagnant ice by rivers which flowed in tunnels under the ice. Surface meltwaters flowing on top of the ice found its way to the bottom of the ice through crevasses and cracks. Once on the glacial drift floor beneath the ice, they began to erode downward until they were impeded by the underlying bedrock. Eventually these channels began to fill with sand, gravel, and cobblestones. They actually filled the eroded drift channel and continued to fill above the drift floor, the water and deposited granular materials being confined by the surrounding ice. When the ice melted, the sand and gravel deposited above the drift floor collapsed into a hogback ridge. The Mason Esker can be traced from north of Lansing, through Holt, and ends just south of Mason. Its length of 22 miles makes it one of the longest eskers in the United States.

The first settlers coming into the Lansing area began to dig into the Mason Esker as a source of sand and gravel for building materials. Over the decades, the Lansing, Holt, and Mason areas have largely been built from the sand and gravel in the esker. Today the esker is almost entirely gone and although some minor excavation is still going on, it is no longer a viable source of sand and gravel. It is now a long, winding, water-filled excavation. Parts which were not disturbed because they contain cemeteries, or a few fragments existing in farmer's fields, remain as mementoes of its original form. Sand and gravel to supply the area now are hauled by truck from sources many miles distant. All over the State, the major sand and gravel deposits continue to be mined to supply the never-ending construction demands. All of the existing deposits are finite and many have future lifetimes measured in years, not decades.

What is then to take their place? There are still many untapped deposits around the State, but the majority are becoming untouchable. Many have been built upon by suburban sprawl, shopping malls, golf courses, and industrial expansion. Sand and gravel pits are not the most popular venture in the eyes of the surrounding community. They are generally rated alongside sanitary landfills, and yet their product is part of the life blood of the community.

The age in which we now live may become known as the NIMBY (not in my back yard) era. Organizations and groups emerge like mayflies to oppose almost everything from wars, pollution, economic or industrial expansion, incinerators, atomic plants, landfills, military exercises, to, yes--sand and gravel pits.

It is interesting to observe that land use studies and committees which generate elaborate colored maps outlining grand land-use plans for the following 20 to 50 years rarely, if ever, take into account the utilization of local sand and gravel deposits as sources of the material that is one of the most basic building blocks of the master plan. Some township zoning boards and commissions have made an exercise of generating complicated requirements and restrictions as prerequisites for opening or enlarging a sand and gravel operation. These are basically formulated not to achieve an operation more sensitive to environmental and personal needs, but to discourage its operation at all.

Modern coarse and fine aggregates (processed gravel and sand) are designed to include specific quantities of different sized particles. Specific quantities of certain

sizes are required to be fractured to form sharp-edged pieces in order to produce bituminous concrete that will support heavy loads. Restrictions are placed on certain rock types that have proven to cause problems in portland cement concrete or asphalt pavements. A modern sand and gravel operation that produces a variety of fine and coarse aggregates requires complicated, expensive equipment, along with considerable knowledge to operate and maintain it. It produces as sophisticated a line and variety of products as many manufacturing operations considered more desirable, and even sought after, by communities. Further, if properly controlled, the end result of a long-term mining operation may be a beautiful lake that is a significant asset to a community.

The cumulative effect of depleting aggregate sources, coupled with zoning restrictions that prevent mining, can eventually have a tremendous impact on society. The greatest expense in the supply of quality sand and gravel in many areas of the State is transportation, which can equal several times the cost of the original product. And who will ultimately pay? The one who always does, the consumer, the average person. It is, therefore, of utmost importance in planning for the future development of the State, that aggregate deposits be located, protected from alternate land usage, and harvested in environmentally sound ways, to provide the basic building blocks of future prosperity.

-Don Malott

TECHADVISORIES

The brief information items that follow here are intended to aid MDOT technologists by advising or clarifying, for them, current technical developments, changes or other activities that may affect their technical duties or responsibilities.

MDOT RESEARCH PUBLICATIONS

Freeze-Thaw Evaluation of Selected Rock Types From a Composite Sample of Michigan Gravel, Research Report No. R-1301, by R. W. Muethel. The purpose of this study was to substantiate the Department's classification of deleterious gravel constituents by studying the engineering properties of the lithological constituents of Michigan gravels. In the past, the difference between durable and non-durable (deleterious) rock types was based primarily on visual evidence of distress in the concrete, and this report provides laboratory test documentation to support our classification. Twenty-four rock types sorted from glacial gravel obtained from 49 selected sources were subjected to the standard MDOT laboratory acceptance tests for aggregates, including those for freeze-thaw durability, abrasion loss, and sulfate soundness loss. Additional information was obtained from specific gravity, absorption, and Iowa Pore Index determinations. The test results supported the MDOT classification; i.e., that friable sandstone, siltstone, shale, clay ironstone, and chert are deleterious materials.

Inspection of Sign Support Structures, Research Report No. R-1302, by Sonny Jadun. Over the years the performance of Michigan's cantilever and overhead truss sign supports has been satisfactory. As the majority of these sign support structures are more than 15 years old, this project set out to determine their overall condition before any major problems might be encountered in the field. It was decided to randomly select 10 percent of the sign support structures from various parts of the State, making a total of 82 cantilever and 36 overhead truss supports to be inspected. The selected sample structures were visually inspected and deficiencies such as splitting, bending, and cracking of the tubular members were recorded. Welds were checked for cracking and any crack found was recorded and reported to the Maintenance Division. In addition, the connecting bolts were also thoroughly inspected. After each structure was inspected, its overall condition was determined. Based on visual inspection of these structures it was concluded that the sign supports in this State are in good condition.

Concrete Pavement Restoration: Construction Report, Research Report No. R-1292, by J. E. Simonsen and A. W. Price. The concrete pavement restoration work described in this report uses repair techniques previously developed by the Research Laboratory Section, in addition to new ones, to allow short-term daylight closures to minimize the inconvenience and hazards caused by maintenance patching. The pavement selected for restoration is a 20 year old, 9-in. reinforced concrete slab with 71-ft joint spacings, and joints sealed with preformed neoprene seals. Deteriorated joints were repaired using full-depth repairs having dowelled joints with the dowels grouted-in-place using an epoxy grout. Some mid-slab failures were repaired by tying the new concrete to the existing slab using grouted-in deformed bars. Spalls along the joint grooves were repaired, partial-depth, with fast-set premixed mortar, the neoprene seals were replaced with silicone sealant, and surface popouts were fixed using fast-set premixed mortar. The performance of the various restoration techniques will be evaluated for a five-year period.

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RALPH VOGLER HONORED

We are delighted to announce that our M&T colleague Ralph Vogler, head of Structural Services in our Testing Laboratory Section, is designated to receive (in May) an **Award of Merit** from the American Society for Testing and Materials (ASTM). Ralph was nominated for this esteemed award by the members of one of the four committees on which he serves, the Committee on Metallic-Coated Iron and Steel Products (A-5). In the announcement letter from Albert J. Bartosic, Chairman of the Board of the ASTM, he says, in part: "Your outstanding contribution to the advancement of voluntary standardization is a fine example of the kind of dedication that has helped make ASTM a success." Each recipient of this coveted award becomes a 'Fellow of the Society,' as well.

The ASTM is the world's largest source of voluntary concensus standards, with 30,000 active members, out of which 19,150 serve on the Society's 140 technical committees and 2,040 sub-committees, and to be singled out as an Award of Merit recipient and Fellow of the Society is an achievement indeed. As well as serving on Committee A-5, Ralph has recently been elected chairman of Committee D-4, Road and Paving Materials, and also serves on the Committees for Concrete and Concrete Aggregates (C-9) and Light Metals and Alloys (B-7), as well as numerous sub-committees. These committees are composed of the recognized experts in their particular areas from government, industries, and universities across the nation. Their continuous review of the standards that are assigned to their committees and sub-committees assure that they reflect the very latest research and development technology.

All of us who work with Ralph share the esteem and respect of his ASTM colleagues, and appreciate the incredible amount of his personal time that he has devoted to ASTM and AASHTO activities over the years. Congratulations, Ralph!

This document is disseminated as an element of MDOT's technical transfer program. It is intended primarily as a means for timely transfer of technical information to those MDOT technologists engaged in transportation design, construction, maintenance, operation, and program development. Suggestions or questions from district or central office technologists concerning MATES subjects are invited and should be directed to M&T's Technology Transfer Unit.

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