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Workshop Topic 3
AGGREGATES AND OTHER MATERIALS

The 3 sessions concerning the use and purpose of aggregates and other materials consumed or exceeded the allotted time in each case without completely covering the field of aggregate design, production, and use. From the beginning, a need was felt for defining the use and purpose of aggregates to provide a guideline for the discussion. The definition accepted for the purpose of this workshop is as follows:

> Aggregate is a processed and graded material providing bulk and strength in transportation structures.

Although the title of this discussion refers to aggregates and other materials, because of time limitations, the other materials considered during the discussion were restricted to mineral fillers and materials closely related to aggregates. It was also agreed that the full life cycle of the system would be considered and the discussion should not be allowed to become locked into initial costs only.

An attempt was made to follow step by step the design, production, and use of aggregate materials and to evaluate the energy inputs involved along the way. It was decided at the beginning that any reasonable assessment of those inputs could be made only by considering an energy and cost analysis of each item to see what trade-offs might be possible.

The first consideration—and as it turned out, one of the most important—was the optimization of design for aggregates to make the best use of local materials. It was felt that, with regard to aggregates, the most effective way to reduce construction costs and in effect to conserve energy is to use local aggregates wherever possible. This use may well be limited to the lower levels of subbase, base, or surfacing where substandard materials are involved. Or it may be some measure of upgrading such aggregates by blending with other aggregates or perhaps the use of some type of additive for beneficiation. Standard quality aggregates locally available may also be upgraded reasonably and economically as a trade-off for the additional quantity that would otherwise be required. Because transporting materials plays such an enormous role in energy consumption, the location of a material source in proximity to the project is of prime importance. The cost incurred, whether by the contractor or by the contracting agency, in investigating all possible sources of material within reasonable limits of the project will usually yield big dividends. In many cases this will mean assessing the operational costs involved in opening up a new source and those involved in hauling longer distances from an established source.

Another important consideration is the effort necessary to produce a specified material from a particular source. Here the acceptance of a gradation allowing a somewhat larger size aggregate will in many cases reduce crushing costs and yield additional benefits such as lower binder requirements. Many contracting agencies are inclined to establish a grading requirement for a particular source and hold firm to the specification even though it might impose unduly high production costs. In most instances a slight modification of the gradation to more nearly fit a realistic production of the pit material can be effected without adversely affecting the quality of the product.

There are many situations in which "staged construction" or larger aggregate production contracts may well fit into the scheme of costs and energy conservation. For example, if a single source of supply must necessarily serve 2 or more projects, a single crushing operation in the pit should be considered. Planning and scheduling large movements of aggregates possibly by rail or waterway may also be considered.

Recycling aggregates to make use of existing materials that have often been entirely wasted is another consideration that will continue to demand more attention. Although these materials should be considered under the original design requirement to make use of local material, specific mention is made here since the use of these sources are rather new and innovative.

Other measures that may be of benefit in conserving materials and energy include, but are not limited to, the following:

1. Have uniform specifications for an area, i.e., do not require a material supplier operating from a single source to produce to meet the varying specifications of the several agencies who may be in the area (a more general use of existing AASHTO and ASTM specifications would be one means of accomplishing this);
2. Use lightweight aggregate, particularly those from natural extractions;
3. Place base and surfacing courses in lifts greater than conventionally used;
4. Have density requirements for base and surfacing courses rather than a prescribed rolling sequence; and
5. Provide for payment by plans quantity (volume basis) for base materials to reduce aggregate waste, which often is due to the inattention of the inspector.

In view of the foregoing possibilities, the following are some of the innovations that might be considered.

1. If recycling of existing asphalt pavement is possible, to what extent and how effectively can this be achieved in place? Is there equipment now available that can scarify, pick up this material, sufficiently reduce it to approximately its original particle size by means of traveling mixers or pulverizers or both, and remix it with an additional quantity of binder and perhaps flux oils to provide a recompacted base or surfacing course that will satisfy traffic needs for a reasonable period?
2. Can existing portland cement concrete be salvaged, crushed, and reused as aggregates for either flexible or rigid pavement construction? Recent reports point to the judicious use of materials that are usually considered substandard in certain elements of a composite pavement structure where less strength can be tolerated.
3. Will end-product specifications including statistical acceptance provide benefits? This type of specification has had some use, but have the benefits in measures of savings really been defined?

Research needs in the area of aggregate production and control include the following:

1. Improvements in methods of upgrading and using local aggregates ("sprinkle treatment" or blending of polish-resistant aggregates with local materials offers an alternative approach to maximizing the use of local materials); and
2. Examination of all quality test procedures and requirements currently being used for aggregates to determine whether the measured properties really relate to performance (new or modified testing procedures may be in order to prevent rejection of usable materials).