



## Asphalt Pavements: Versatile, Durable, Safe and Economical

The final session of a recent asphalt pavement seminar prompted the following question: "You have instructed me how to design, construct and maintain an asphalt pavement. Why should I choose asphalt in the first place?" This question is not unique; it must be answered each time a new pavement is constructed or an existing one overlaid. Ninety-four times out of one hundred, the person making that decision, after considering all the facts, chooses to build an asphalt pavement. Anytime a product can claim ninety-four percent of its market, it says something about the quality of that product. There are many reasons for this overwhelming choice. A state asphalt pavement association recently published forty reasons for choosing asphalt pavements. If those forty reasons were grouped under four general headings, they would be VERSATILITY, DURABILITY, ECONOMY, and SAFETY. These four reasons are inter-related and can be seen in every stage of an asphalt pavement from the beginning (the design and construction) to the maintenance of that pavement, and finally back to the beginning.

### DESIGN AND CONSTRUCTION

The designer of an asphalt pavement has the VERSATILITY to choose from the following:

Hot-mix - those pavements mixed and placed in the range of 265F to 325F, providing the stability and DURABILITY for heavy, moderate and low volume roads.

Cold-mix - those pavements that can be mixed and placed at atmospheric temperature, particularly applicable to low traffic volumes and those areas not readily accessible to hot-mix.

Full-Depth - a pavement in which asphalt mixtures are used for all courses above the subgrade.

Deep-Strength - a pavement constructed with an asphalt surface on an asphalt base.

DURABLE asphalt pavements can be designed to suit any conditions of traffic and soil using these materials and methods. Generally, these options also afford the luxury of using locally available materials, resulting in an ECONOMICAL pavement. There will be those quick to single out a specific road which did not perform as expected and I could counter with the two-mile section of the New Jersey Turnpike with an asphalt overlay, which after twenty-seven years without major maintenance, is still in service. Both our examples would represent the extremes rather than the mean. The fact is that full-depth asphalt pavements have been shown to meet or exceed design life.

The designer's tool box is also equipped to provide SAFETY. Consider if you will the different aggregates provide

varying degrees of skid resistance and by selecting his aggregate to meet the anticipated traffic conditions, the designer can reduce the possibility of skid related accidents. Another problem related to skidding accidents is hydroplaning. The use of open graded friction course, a high void asphalt plant mix, promotes the drainage of water through the friction course and out onto the shoulder, reducing the chances of hydroplaning and at the same time eliminating the water spray onto windshields of trailing vehicles. The elimination of the water spray means better visibility-SAFETY.

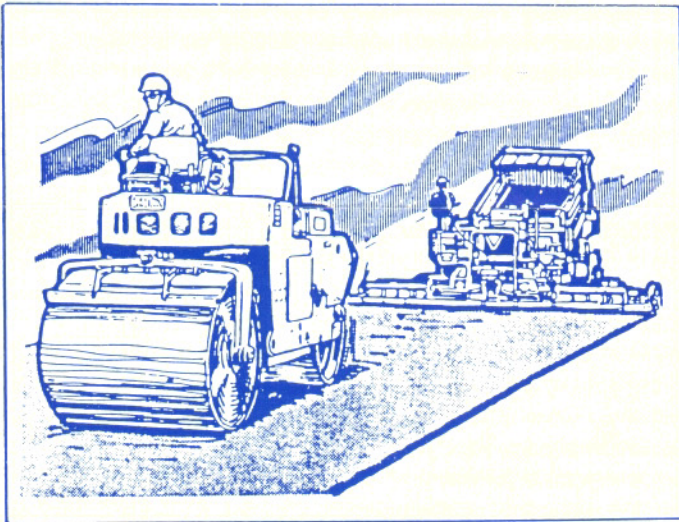
New roads are constructed to move people and goods efficiently and ECONOMICALLY. The nature of asphalt pavements and their construction is such that they can be built quickly and opened to traffic immediately. Rapid construction is particularly critical when overlaying an existing pavement. Delaying the motoring public means the loss of productive manhours and excessive fuel consumption, both of which equal wasted dollars. Asphalt pavements, with their lack of a required curing period, mean minimal delays to the traveling public. Asphalt overlays can be scheduled for off peak hours and re-opened in time for the rush hour. A perfect example of this is Interstate-495, the beltway around Washington, D.C. Sections of the beltway were overlaid at night, while the daily commuters slept, and then opened each morning for use. The result was minimal delays, fewer lost working hours to traffic jams, efficient use of fuel and the award for the BEST asphalt pavement in 1984.

Asphalt pavements also afford the opportunity to use Planned Stage Construction. Planned stage construction in depth means building the pavement by applying successive layers of asphalt concrete according to design and a predetermined time schedule. Stage construction is a way of providing fully adequate pavements when current levels of funding are limited. An important point of stage construction is that the succeeding layers must be placed at the scheduled times.

### MAINTENANCE

Properly designed and constructed asphalt pavements, as stated previously, can be expected to meet or exceed their designed life. Maintenance is a key factor in achieving that total life expectancy. If we were to look at a life-cycle curve for an asphalt pavement we would see that we lose forty percent of the quality of an asphalt pavement over seventy-five percent of the life of the pavement and the next forty percent over the next twelve percent of the life-cycle. Where the pavement is on that life-cycle curve is proportional to the degree of maintenance required. Any maintenance which may be required during that first seventy-five percent of pavement life should be minimal and routine in nature with rou-

tine defined as crack sealing, seal coating or slurry sealing. These three are **ECONOMICAL** and cause little disruption to the daily highway user. As the pavement reaches the latter stages of its design life and more extensive repairs become necessary, the rapid construction and absence of a cure period discussed earlier mean that defective areas can be cut out, if necessary, and repaired and opened to traffic within the same day. The result is that traffic does not have to be channeled into a reduced number of lanes for any extended period of time while traffic control is minimized, both of which are contributory factors in keeping life-cycle cost of asphalt pavements competitive.



## RECYCLING

As an asphalt pavement approaches the end of its life cycle, that point when individual repairs are no longer cost effective, it really isn't the end, it's the **BEGINNING!** Asphalt pavements are totally recyclable. Those pavements which reach the end can be milled and reused either as a component of hot-mix or cold-mix. Again, in recycling we see **VERSATILITY** (hot and cold recycling), **DURABILITY** and **ECONOMY**. Either recycling process begins with the milling of the distressed asphalt pavement. Following milling, the two processes can take separate paths, Hot-mix recycling requires that the milled materials be returned to the hot-mix plant where it is combined with virgin materials to produce a mix equal in performance to an all virgin mixture. Hot-mix recycling is particularly well suited to urban areas where curb reveals and other drainage features must be maintained and where the number of plants does not require long hauls of the milled material. Cold-mix recycling does not require the milled

material be hauled to a plant for mixing. Instead, the milled material may be mixed in-place with an asphalt cement, or emulsified asphalt to produce a base course. The base course material must then be covered with either a double seal coat or an asphalt overlay.

Since asphalt pavements are totally recyclable that means we can take advantage of the salvage value of the aggregate and asphalt content which can reflect in lower cost, more **ECONOMY**.

So from the beginning we can see **DURABILITY**, **ECONOMY**, **VERSATILITY**, and **SAFETY** of asphalt pavements and along the way we pick up some additional benefits:

Asphalt pavements have shown to be quieter for the motorist and those people living along the highway.

Quality construction and the absence of paving joints equal a smooth ride. Consider the article which appeared in ENR/Jan. 5, 1984 entitled **Rough Ride for Concrete** which chronicled a state Dept. of Transportation deciding to use asphalt for **all** new highway paving. Their decision was in response to complaints from motorists objecting to the condition of the state's concrete highways, saying they preferred the **SMOOTH** ride they get on asphalt.

That same article pointed to an anticipated reduction in winter maintenance cost because the dark asphalt pavement will heat up more quickly during the day melting the snow and ice. When de-icing chemicals are required, asphalt pavement is not effective.

The dark surface which reduces winter maintenance cost is also responsible for the high visibility of pavement markings another **SAFETY** factor.

As you can see, the advantages of asphalt pavement are numerous and together they account for asphalt pavements being less expensive over the life of the pavement. Federal Highway Administration published figures show that a dollar spent on asphalt pavements goes 26.9 percent further than a dollar spent on concrete pavements.

The key to maximizing all these advantages requires

1. Proper design procedures
  - (a) thickness
  - (b) mix composition
2. Proper placing techniques to achieve uniformity
3. Proper compaction
4. Providing timely routine maintenance

This is the first of a series of articles concentrating on asphalt pavements. Succeeding articles will look at specific areas discussed in this article, such as thickness design, mix composition, placement, compaction, pavement management, routine maintenance and finally recycling.