

Recycling Hot Mix Asphalt

Hot-mix recycling is a proven process that may be used to upgrade worn-out pavements.¹ On the basis of cost-effectiveness alone, hot-mix recycling of existing pavements should be a major consideration in planning road rehabilitation. An important reason for recycling is the need to conserve natural resources. Economy, ecology, and energy conservation are all served when asphalt and aggregate – the two most frequently used pavement construction materials – are reused to provide a strengthened and improved roadway.



Prior to the 1970's, when HMA was removed from a roadway it was considered waste and usually went to a land fill. In the late 1970's, the Maplewood **heat transfer process** was a breakthrough for coupling **recycled asphalt pavement (RAP)** with virgin material to produce quality hot-mix asphalt (HMA).



Spurred by the energy crisis, innovative engineers saved fuel costs as the price of many roadway materials rose by requiring the crushing of the material to specific sizes and stockpiling what is commonly referred to as RAP. The heat transfer process involves superheating the aggregates in the plant, adding RAP, then adding asphalt cement. The finished product is an HMA wear or non-wear pavement layer that has a specific mix design and **quality control process** followed to ensure quality. The heat transfer method proved to be pollution free and still provides excellent HMA mixes.

A recent article described the evolution of recycling materials as it “always seemed like a good idea, but as the number of people supporting this concept has increased, it has become more of an expectation or even a demand of consumers that products be recycled and reused whenever possible.”² The article describes how a Newport, Oregon based contractor incorporated 20 percent RAP into the HMA mix produced. The contractor noted that the use of RAP was a “win-win” situation because a lot of dump sites don't want old asphalt as fill material, whereas they now have a use for it.

The benefits outlined in the next section are very significant for RAP usage as a “permissive” opportunity in Mn/DOT's Combined 2360/2350 (Gyratory/Marshall Design) Specification.



Benefits to the user/agency/owner and to the contractor include the following items:

User/Agency/Owner Benefits

1. Competitive bidding process to obtain the HMA material alternative at the least cost.
2. Rules out possible situations where hot-mix recycling may cost more than conventional mixtures.
3. For pavement design, recycled hot-mix can be assigned the same structural equivalence factor as a conventional mixture.
4. Reduce consumption of our natural resource supply.
5. Less dependence on foreign oil because of energy savings in haul, mining, etc. and less new asphalt cement (binder) is required.
6. The potential to reuse in-place materials to obtain a pavement with more load carrying capacity.
7. Reduction of haul road damage associated with transportation of new material to job sites.
8. Eliminates decisions of logistics of the salvage material: processing form, use of excess materials, and how to incorporate materials into future contracts.
9. Acceptability of the recycled material and proportions can be determined through mix design prior to allowing the use provided that the recycled product meets minimum criteria for all layers.
10. Provides a means where pavement material removal is economically justified, thus, stretching available funds to meet current needs.
11. Increases pavement performance capability without increasing its total thickness through an increased asphalt treated base.
12. Gives one the opportunity to correct existing deficiencies in the old pavement structure and/or base.

Contractor Benefits

1. Agency possession or ownership of removed materials is discouraged so that private enterprise is not restricted for the most effective utilization of these materials.
2. Allows inventorying material until such time sufficient quantity is available to economically hot-mix recycle.
3. Allows fair advantage to all bidders for future use as salvage material. If the contract agency/owner retained ownership, depending upon stockpile site location, one bidder may have an advantage over another.
4. Allows the contractor to back haul, reduces handling, reprocessing costs, energy, aggregate and environmental problems associated with mining, etc.
5. Specialized equipment is not required.
6. Allows for contractor ingenuity because the specifications are oriented toward the control and acceptance of the end products rather than the specifics of the process or method.
7. Hot-mix recycling can be successfully performed in batch, continuous and dryer drum mix plants.
8. Allows for a combination of hot-mix recycled mixture or conventional mixture on a specific project.
9. Allows the contractor to amortize any additional costs that he/she may have for hot-mix recycling over a number of tons produced rather than on the tonnage of *one* specific project.
10. Allows the contractor to operate at a recycle percentage that suits his/her operation.

In conclusion, Minnesota has changed with the demands of the era to promote and stimulate the reuse of the best quality materials used initially. Efforts are directed toward full optimization of cost savings potential. It is also felt that the highest return of a recycled product is through hot-mix recycling. A contract agency can no longer afford the “cook book” procedures and practices of design or construction. Every project should be a unique package in itself to economize on dollars. To fully capitalize savings in the state, permissible recycling, especially hot-mix recycling, should be included in all public and private contracts that require HMA mixtures.

References

1. The Asphalt Institute, “Asphalt Hot-Mix Recycling,” Manual Series No. 20 (MS-20), August 1981.
2. www.aggregateresearch.com “Asphalt Plant Now Using Recycled Material.” June 15, 2005.