Recycled Glass in Asphalt

Material: Recycled Glass

Issue: *Asphalt containing glass cullet as an aggregate is called "glassphalt," and has been widely tried as a means to dispose of surplus waste glass since the 1960's. Glassphalt is basically the same as conventional hot-mix asphalt, except that 5% to 40% of the rock and/or sand aggregate is replaced by crushed glass. The cost-effectiveness of substituting glass for conventional aggregate is highly dependent on the location, the quality and cost of local aggregates, and any credits available for using recycled materials in beneficial re-use applications.*

Best Practice: This Best Practice discusses the benefits and applicability of glassphalt. For details on the preparation and installation of glassphalt, refer to the *Preparation and Placement of Glassphalt* Best Practice. For a complete discussion of the history of glassphalt also refer to the *Glasphalt Paving Handbook* [(2)].

Glassphalt was originally developed as an alternative to landfill disposal of mixed color waste glass. Mixed color glass, which is unsuitable for recycling into new containers, is generated by most recycling programs. If there are no alternative local markets for mixed color glass and the only other option is disposal with landfill tip fees, using processed glass as a substitute for natural aggregate in asphalt may be an option to be considered.

A great number of glassphalt demonstration projects have been performed in cities around the country. Most of these projects have not progressed past the pilot stage because of economics. It is not economical in most parts of the United States to collect glass, process it to a specification aggregate, blend the glass with natural aggregate, add the batch modifiers needed to meet specifications, and deal with the operational changes required for glassphalt. The best possibility for sustained production of glassphalt is in communities with municipal asphalt plants, because the community can make a direct correlation between the extra costs incurred in glassphalt installation and the savings from diverted solid waste tip fees. The best possibility for sustained use of glassphalt by private sector asphalt manufacturers and contractors is through the creation of ongoing financial incentives to use the glass.

Once in place, glassphalt is difficult to recognize by the ordinary person unless large glass particles are present in the surface layer. When properly installed, glassphalt presents no danger to humans, nor does it damage vehicle tires. Due to its glass content, glassphalt will hold heat longer than conventional asphalt. This characteristic could prove useful in situations where roadwork is conducted in cold weather, or when long periods of post-mix transportation are necessary. In addition, glassphalt surfaces appear to dry faster than traditional paving after rain because the glass particles do not absorb water. Glassphalt surfaces are also more reflective than conventional asphalt, and may improve nighttime road visibility.

Use Limitations Most installations of glassphalt have been designed to meet the standards of The Asphalt Institute for **medium traffic asphalt**, which specify a maximum speed limit of 40 mph. These standards include requirements for stability, flow, voids in mineral aggregate, percentage of air voids in the mix, and unit weight. The most common applications are as surface pavement (surface coarse) for residential streets, secondary roads, parking lots, sidewalks, and curbing.

When glassphalt is placed and compacted, larger glass particles will align themselves parallel to the road surface. This can cause the skid resistance of glassphalt to be slightly lower than that of conventional asphalt. Consequently, glassphalt is not recommended for surface pavement on highways. However, the skid resistance of glassphalt containing less than 10% glass by weight, with cullet particles smaller than ¼-inch in size, shows no appreciable difference from asphalt containing 100% natural aggregate. If the glass aggregate is used as part of the base, or lower, asphalt course, then the size of the glass particles and the skid resistance of the material are not a concern.

All types of asphalt paving face the possibility that the bonding of the asphalt to the aggregate will deteriorate under adverse conditions, particularly water exposure. Weakening this bond will cause the asphalt to "strip" from the aggregate, increasing the potential for premature failure. The smooth surfaces of glass result in a higher stripping potential than that of rougher natural aggregate. Consequently, an anti-stripping agent such as hydrated lime or calcium hydroxide should be used as an additive in glassphalt, especially in surface coarse glassphalt.

Implementation: Glassphalt has probably received more national publicity than any other alternative use for recycled glass. The technical basis for substituting processed glass for a portion of the natural aggregate in asphalt has been well established. However, before committing resources to pilot projects or demonstration sites, recyclers and communities should consider this Best Practice and the *Preparation and Installation of Glassphalt* Best Practice, and study the references below to determine whether the application is sustainable under local conditions. It may be economically more practical to use glass as an unbound construction aggregate. See the *Developing Specifications for Recycled Glass Aggregate* Best Practice.

Benefits: For over twenty years, recycled glass has been used as an aggregate supplement in hot-mix bituminous asphalt pavement. The material has both benefits and limitations, which should be considered before use. Understanding these factors will help producers and end users to decide whether glassphalt is a viable alternative to conventional asphalt.

Application Sites: Glass suppliers, asphalt plants, construction sites, and testing laboratories.

Contact: For more information about this Best Practice, contact CWC, (206) 443-7746, e-mail info@cwc.org.

References:

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