

# SCHLEEDE HAMPTON ASSOCIATES INC

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## CONSULTING ENGINEERS

April 25, 2008

City of Rochester Hills  
1000 Rochester Hills Drive  
Rochester Hills, Michigan 48309

Attention: Paul Shumejko, PE, PTOE  
Transportation Engineer

Regarding: Recommended Aggregate Base Course Materials  
For City Engineering Standard Specifications  
City of Rochester Hills, Michigan

Dear Mr. Shumejko:

Schleede-Hampton Associates, Inc. (SHA) understands that The City of Rochester Hills is considering several alternatives for allowable aggregate base course materials in the updated Engineering Standard Specifications. We offer comments regarding each of the options that are under consideration.

### **Options Under Consideration**

#### *21AA Crushed Limestone*

The current City standard dense graded aggregate base course is MDOT 21AA crushed limestone. Crushed limestone is produced by crushing, screening and washing high calcium or dolomitic limestone blasted from a rock quarry. The crushing process produces a very angular, dense graded material with extensive point-to-point aggregate contact. When installed and compacted, the 21AA crushed limestone weighs approximately 140 pounds per cubic foot, or 3800 pounds per cubic yard in place (total weight including moisture content). Since the crushed limestone is processed by crushing quarried bedrock free of foreign or deleterious materials, the quantity of deleterious or foreign undesirable materials is minimized. As a result of the relatively high unit weight, relative lack of deleterious components and extensive point-to-point aggregate interlock, the crushed limestone provides a stable roadbed that is able to "bridge" over marginally soft subgrade soils. The main disadvantage of 21AA crushed limestone is cost. The cost of the 21AA limestone is typically greater than the other alternatives, primarily due to the increased trucking cost to / from the local quarries or docks.

### *21AA Crushed Concrete*

Crushed concrete is produced by crushing, screening and washing concrete that is recycled from roadway rehabilitation, building demolition and other sources. After crushing, the concrete materials are somewhat less angular and more rounded than those of the crushed limestone. The total unit weight of 21AA crushed concrete, when installed and compacted, is approximately 130 pounds per cubic foot, or 3500 pounds per cubic yard (total unit weight including moisture content). The crushed concrete typically contains some deleterious materials that are not removed during the screening process such as: broken bricks; pieces of reinforcing steel; hot mix asphalt, miscellaneous construction debris such as glass; and natural sand, gravel and clay. As a result of the above-described properties, 21AA crushed concrete typically does not “bridge” over marginal subgrade soils as effectively as 21AA crushed limestone. The main advantage associated with the use of 21AA Crushed Concrete is proximity to the City of Rochester Hills and cost. The raw material cost for crushed concrete is slightly less than that of limestone, and the trucking costs associated with crushed concrete are less than that of crushed limestone.

### *Milled / Pulverized Asphalt*

When in-place asphalt is milled, the milling process typically transforms the pavement into a relatively coarse and relatively open graded aggregate mixture. Asphalt millings are typically collected and reused as Reclaimed Asphalt Pavement (RAP), a component of many hot mix asphalt (HMA) mixes.

When in-place asphalt is pulverized, the pulverization process typically transforms the pavement into a relatively dense graded mixture, similar to the dense graded crushed aggregate used as roadway bases. Asphalt pulverization is commonly used as part of the crush-and-shape pavement rehabilitation methodology, where in-place asphalt is pulverized, re-shaped and re-compacted, which therefore becomes a base course for a rehabilitated HMA pavement.

Milled or pulverized asphalt is not screened and sized at a manufacturing facility, they are processes which take place on a jobsite on existing pavements. As such, wide variations in the uniformity of the materials are to be expected. Deleterious materials such as roadway debris, concrete pieces and subgrade soils such as clay balls are expected to be contained in milled or pulverized asphalt.

The use of pulverized asphalt is an effective tool for in-place recycling or reuse of existing public roadways and for maintenance aggregate in the City of Rochester Hills. The City of Rochester Hills has successfully utilized pulverized asphalt on several roadway maintenance / rehabilitation projects through the years. The material is best suited for an in-place roadway rehabilitation, however, not for a new construction.

### **Recommended Option**

SHA recommends that the City Engineering Standards continue to specify the use of MDOT 21AA crushed limestone as aggregate base course as part of the standard hot mix asphalt paving section within roads that are to be dedicated within the Public Right-of-Way. The benefits associated with the use of crushed limestone are numerous, and the only negative aspect of the use of crushed limestone is the cost compared with the other choices. On projects built by private developers, the cost will be the responsibility of the developer and the benefits will be provided to the City.

## Closure

SHA appreciates this opportunity to continue professional services for the City of Rochester Hills. If you have any questions regarding this information, please contact us at your convenience.

Very Truly Yours,  
Schleede-Hampton Associates, Inc.

A handwritten signature in blue ink that reads "William West". The signature is written in a cursive style with a large, sweeping 'W' and a distinct 'West'.

William J. West, PE  
Project Engineer