Recycling of Asphalt Pavements

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ABSTRACT:

The issue of sustainability is a recurring theme in today's society, as such asphalt pavement are particularly well suited for the topic as in some countries they are the most recycled product on a national scale. However, some questions still remain with regards to the suitability and durability of asphalt pavements when reclaimed asphalt pavement (RAP) is used in the mix design.

Generally speaking the three most important requirements that pavements featuring RAP must satisfy are that the RAP pavement must: 1) Be cost effective, 2) be environmentally responsible, and finally3) perform well. The topic of this paper will be to analyze and discuss how pavements featuring RAP contents fare with regards to these criteria and more specifically if there are specific conditions that might provide obstacles with regards to RAP pavements in the Nordic countries.

The cost effectiveness of using RAP in asphalt pavements is one of the primary reasons for which it is used in pavement production. A typical asphalt pavement is generally composed of 96% stone aggregate and 4% asphalt binder. Typically, the asphalt binder constitutes the most expensive component of the asphalt pavement; therefore, by incorporating RAP into the mix a certain amount of binder is reused from the RAP thus resulting in savings for the contractor. However, it must also be stressed that proper fractionation of the RAP material is necessary in order to ensure that the road quality is not compromised. The fractionation process does indeed add an additional step to the production chain, thus potentially increasing expenses associated with the production of RAP pavements. However, it is also necessary to mention that in some countries bonuses can be given based on the use of RAP in a pavement, therefore in many instances incentives are provided to ensure that recycling is adopted by the asphalt producers and contractors.

The environmental benefits of using RAP are numerous and obviously start with the fact that by using recycled materials in the road pavement a significant amount of virgin resources are saved. When these benefits are translated in terms of energy use and emissions, studies have found that an additional benefit of RAP use in pavements lies in the fact that when the RAP is recycled it is in fact removed from the waste stream, and thus does not require additional treatment/energy use. Additionally, research conducted in the US has shown that RAP mixes can be quite compatible with warm mix technologies, in fact quite often it is recommended to use a warm mix technology whenever high RAP contents (>20%) are used. Curiously one of the primary environmental concerns often cited with the use of RAP lies in the leaching behavior of RAP at the production site. Numerous studies have, however, concluded that leachate from asphalt pavements with or without RAP does not exceed European requirements.

Finally, the issue of the performance of pavements with RAP has also received a significant amount of attention and research. Laboratory studies as well as field evaluation confirm that when designed properly, RAP mixes tend to achieve as good a pavement life and quality as pavements utilizing only virgin materials. However, some RAP specific issues need to be taken into consideration to ensure that pavements of the appropriate quality are produced. Specific factors that need to be taken into consideration include the fractionation and proper treatment of the RAP prior to reusing in the asphalt mix, and also the necessity to modify the binder content to take into consideration the binder already present in the RAP. When such practices are employed most agencies conclude that when adequate QC/QA is employed, RAP mixes perform comparably to conventional asphalt mixes.

KEYWORDS: *Asphalt binder, Filler, Dynamic Shear Rheometer, Bending Beam Rheometer*

Author Biographies

Dr. Carl Christian Thodesen has a PhD in Civil Engineering with an emphasis in sustainable construction materials in pavement engineering. He is a researcher at SINTEF in the Infrastructure division where he deals with numerous issues facing sustainable construction materials, specifically the testing and evaluation of such materials to ensure they meet existing standards and specifications. Dr. Thodesen is a work package leader in the FP7 project PANTURA and was previously involved in the ERANET Roads project "Pavement Performance and Remediation Requirements following Climate Change".