Environmental benefits of Warm Mix Asphalt (WMA)

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WMA is a relatively new technology that allows significant lowering of the production and pavement temperature of conventional hot mix asphalt (HMA). It promises various benefits, but probably the most significant is the possibility to reduce carbon footprint of asphalt thus supporting the demands of Kyoto protocol for lowering greenhouse gas emissions in the atmosphere. The environmental benefits could be divided into two subcategories — direct and indirect emission reduction.

The direct improvement, in lowering the emissions, comes from reduction in energy usage in asphalt plants and paving sites because of significantly lower WMA production temperatures comparing to HMA. (D'Angelo et al., 2008) reports plant stack emission reduction of CO_2 in the range of 15% to 40%, SO_2 – 20% to 35%; volatile organic compounds (VOC) up to 50%, carbon monoxide (CO) – 10% to 30% and nitrous oxides (NO_X) – 60% to 70%. The reduction of aerosols, fumes, noise and dust is also beneficial to worker health and to the people situated in surrounding territories of production and paving sites. The actual reduction in each specific case depends primarily on the temperature reduction rate and according to (Brosseaud and Saint Jacques, 2008) greenhouse gases (CO_2, N_2O, and CH_4) are reduced in the same proportion as energy gain, which is illustrated in Figure 1. Reduction of fuel used for asphalt production results also in reducing the demand of non-renewable fuel extraction and dropping the carbon footprint of fuel production and transportation.

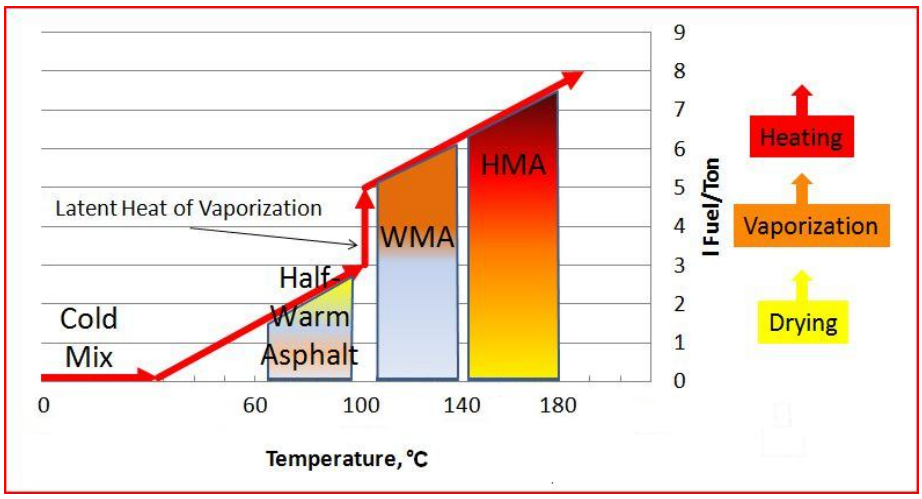

Figure 1: Fuel savings depending on mix technology (1)

Because of the different production technology for WMA, it promises several benefits that are indirectly related to reduction of atmospheric pollution. Lower mixing temperatures and modification of bitumen results in different visco-elastic behaviour of binder in the WMA technology pavements. Less aging during production and paving process tends to improve pavements flexibility, which reduces susceptibility to fatigue and temperature cracking. This results in improvement of pavements longevity (life cycle), further reducing the potential costs for restoring the asphalt overlay

(Perkins, 2009). The lowering of bitumen viscosity in the production process allows incorporating a higher percentage of reclaimed asphalt pavement (RAP). Even up to 90% of RAP is reported by (Drüschner, 2009) and WMA still results in less effort needed for compaction, which means an additional energy saving realised in the paving process. The overall benefit of RAP usage is the resolving of the problem of RAP utilisation, saving of landfill space, reduction of virgin aggregates and energy used for mining.

It must be noted that some of the environmental benefits may be offset with the carbon footprint embodied for producing additives and/or any additional equipment supporting the production of WMA.

The degree of emission reductions, of course, depends on the technology used for producing WMA and the fuel used in the process therefore life cycle assessment tool to calculate environmental effects is vital in proving the environmental benefits gained from WMA.

References

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