

July 28, 2010

To: James Pappas  
Chief Materials and Research Engineer  
Delaware Department of Transportation

RE: Li ion penetration in the Rt 113 treatment site

Jim:

I have received the results from TCG on Li ion content for the cores you had sent to them. Since the FHWA is also supposed to be measuring Li ion penetration, this limited study was designed to see if there were significant differences between the surface blasted versus unblasted areas.

As you may recall from the sampling plan sent to you on March 26, there were 7 cores representing 4 different surface conditions. Two were from a 'typical' surface (cores 1A and B), two were from a 'typical, but blasted' surface (2A and B), two were from a blasted diamond ground surface (3A and B), and the last was from an unblasted, but diamond ground surface (4).

All of the 'A' cores were taken from the right-wheel-path, and all of the 'B' cores were from the center of the lane. (Core 4 was from the left-wheel-path. This was the nearest area that had a surface of the type needed to complete this matrix. By having all the cores nearby, the area to be temporarily closed to traffic was minimized.) Pictures of these core locations were included in the March 26 sampling plan. TCG was unaware of the sampling plan, or what the cores represented.

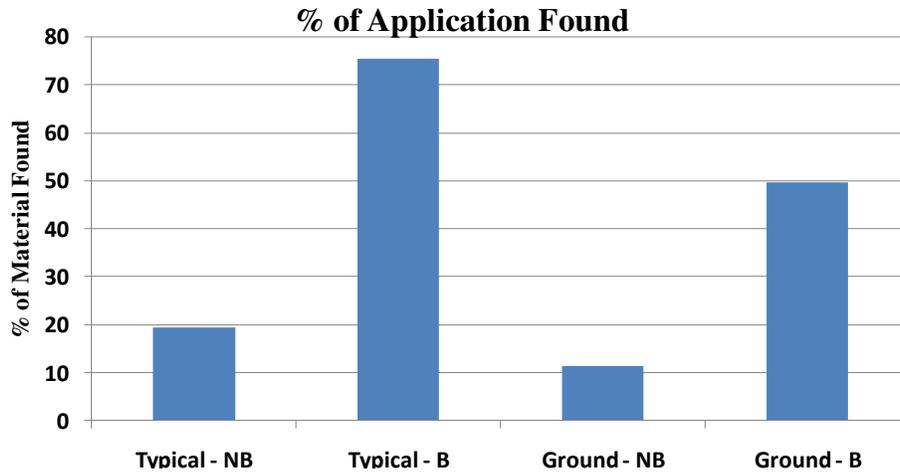
The cores were received by TCG, who then performed the following: two one-half inch slices were cut from the cores (to a total depth of one inch), and then each slice was pulverized to pass a #100 sieve. These were then acid-extracted, and the Li ion measured. I told them to select a core at random, take a one-half inch slice from near the bottom, and to use that for the background Li ion level measurement. They selected 2A for the background determination. Their report is included as an appendix to this letter, by separate email.

The results showed a marked increase in penetration in the blasted areas compared with the non-blasted areas. Also, the diamond ground areas were less than the non-ground areas, but again, the surface blasting significantly increased the penetration. In addition, it can be seen that the right-wheel-path cores had consistently higher penetrations than the center of the lane. Whether this is from the right-wheel-path being more penetrable, or because there was minor rutting in that area, or if simply the residence time was longer due to the slope of the pavement, or some other reason, is not something we tried to determine. It simply is a fact in the data.

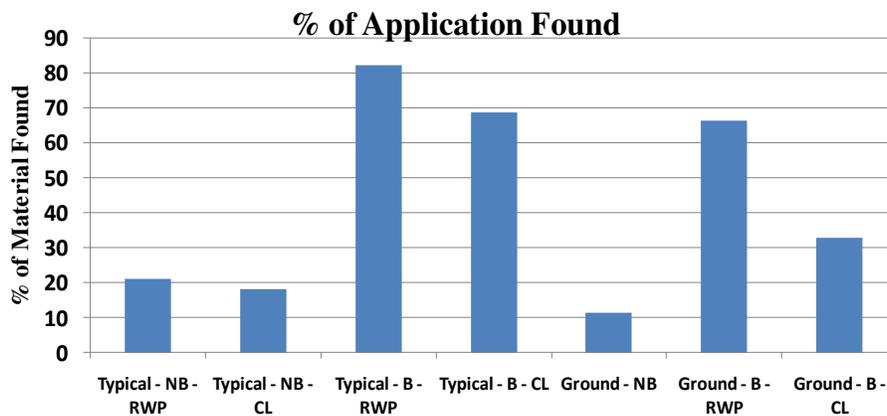
I performed calculations to determine what percentage of the material that was applied was recovered in these cores. To do this, since we had two points of depth at each location, I fitted the two points with a straight line, which yielded a surface concentration and a depth at which the concentration would be equal to the background. The area under this line, multiplied by a length, then yields an amount of lithium in a volume of pavement for a given area. Since we know the amount of lithium applied as a function of surface area, we can thus estimate the amount of lithium ion recovered by this process.

The figure on the next page shows the average recovered lithium for the four surface types:

(Note that NB and B stand for not blasted and blasted, respectively.)



The figure below shows all the individual cores, to highlight the difference between the right-wheel-path and the center of the lane:



Note that the pavement was not sampled until about 9 months after the application of the lithium treatment.

Although only one sample was taken of the 'typical' area, extrapolation from this single result suggests that at present there is on the order of 20 % of the material found remaining in the pavement (except for the blasted areas, from which most of the applied material was recovered). The actual amount remaining, overall, will be somewhat higher considering the higher penetrations that would be expected at the joints, as well as any more heavily cracked areas (although these latter represent a fairly minor percentage of the overall pavement).

I look forward to seeing how the penetration results from the FHWA compare with these.

Best Regards,



David Stokes  
 Manager, Concrete Technology