2010

OBSI Testing of Iowa US 30 Diamond Ground Surfaces 9-29-10

Preliminary Report—

On September 29, 2010 the ACPA conducted OBSI testing of three diamond ground surfaces constructed by Manatts Incorporated for the IGGA. Three diamond ground surfaces were constructed, a flush ground surface with ¾ c-c- longitudinal grooving, a conventional diamond ground surface (CDG) with 1/8' grooves spaced at ¾" c-c, and a CDG section. Each section was approximately 600 ft long. The OBSI testing indicated the flush ground and grooved surface produced an OBSI Level of 99.1 dBA, the CDG with grooving 100.6 dBA, and the CDG 100.4 dBA.

ACPA
AMERICAN CONCRETE PAVEMENT ASSOCIATION

ACPA
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10/19/2010

Introduction

On August 16, 2010, Manatts Incorporated constructed three diamond ground test sections on the eastbound roadway of US30 beginning at approximate milepost 194 and proceeding in an easterly direction as indicated in Figure 1. Each of the three sections was approximately 600 ft in length (e.g. 200m) as the project is stationed in meters. The three test sections consisted of a flush grind and grooved section (1/8" grooves ¾" oc), a conventional diamond ground (CDG) section with grooves spaced on ¾" centers and a CDG only section. To produce the flush grind and grooved section, the 110 spacers normally used between the cutting blades were removed so that the segments were flush with each other. The flush ground surface was then grooved with 1/8" wide blades spaced on ¾" centers. The same grooving equipment was used to groove sections TS-1 and TS-2. The CDG performed on sections TS-2 and TS-3 used 125 blades with 110 spacers.

The three test sections were constructed just west of an earlier experiment constructed by CP Tech Center in 2005[1]. The earlier project consisted of placing 18 test sections of various forms of tined and drag surface textures. One short (approximately 170 ft) diamond grind texture was also incorporated in that experiment.

The current test sections were placed to provide linkage between the earlier work on tined textures and diamond ground surfaces. Since there was insufficient area to place the three new sections within the 2005 as-built project, the three sections were located on a 2001 as-built project that was constructed from material from the same pit and used the same joint spacing and dimensions as the 2005 as-built project.

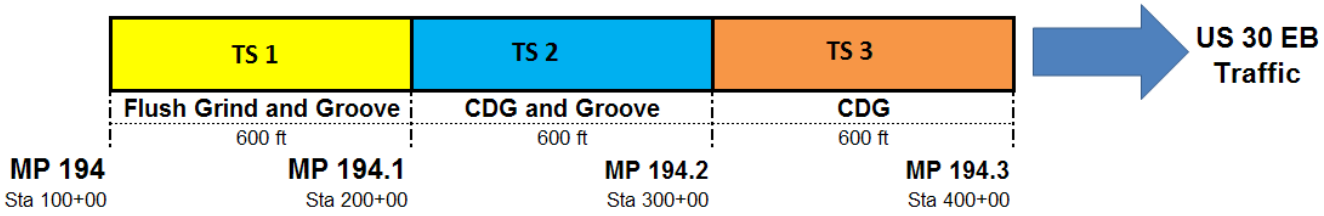
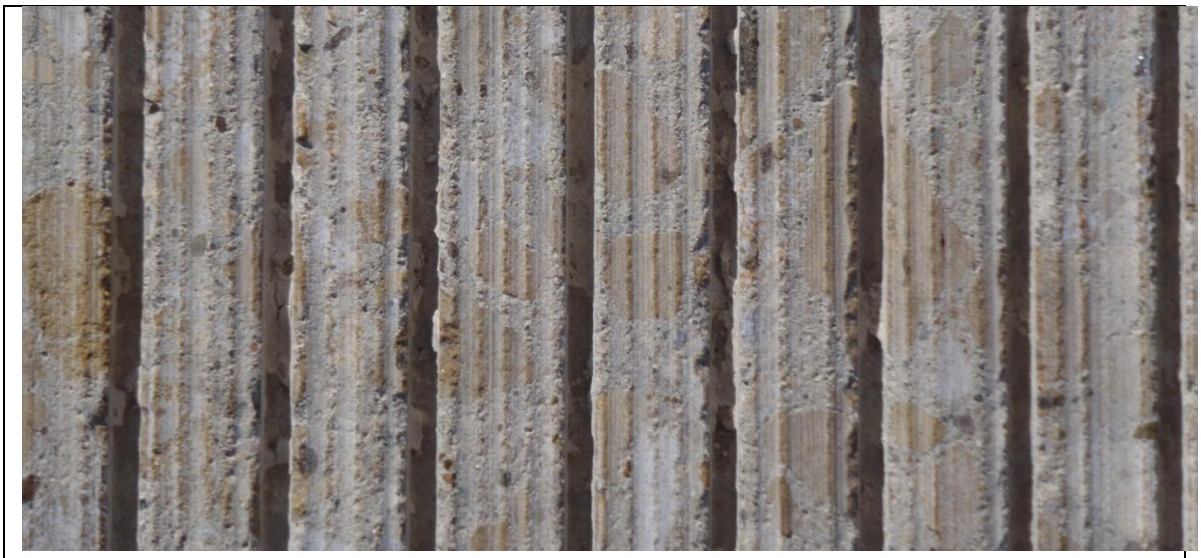


Figure 1 Test Section Layout for Diamond Ground Surfaces

Manatts used a PC6000 diamond grinder with a 4 ft head to CDG all three test areas first[2]. Then, for the flush grind and grooved surface, they used a PC-150 with the head staked to 19 inches in width[2]. They eliminated the spacers for this pass so that the blade segments were flush to each other enabling a smooth, flush ground texture. Older blades (123) were used to produce the texture on the lands. Upon completion of the flush grinding, the PC-150 head was restacked to a grooving head to groove TS-1 and TS-2 at the same time. The grooving head was 32 inches in width and stacked with 125 blades set at ¾" centers[2]. All three test sections in the EB roadway were constructed in one day. The eastbound roadway consisted of a 14ft travel lane and a 12 ft passing lane. Both EB lanes were ground in all three test sections. The CP Tech Center observed construction of the sections and prepared a construction report—see reference 1 for construction details.

Figure 2 indicates close up photos of each of the textures. Additional texture photos are included in Appendix 1 thru 3 which contain photos of Test Sections 1 thru 3, respectively. As indicated in Figure 2, the flush ground and grooved pavement exhibits approximately 5 ridges



Test Section 1 Flush Grind and Groove

Test Section 2 CDG and Groove

Test Section 3 CDG

Figure 2 Close Up Views of Test Section Textures

on the land area, where the CDG with grooves exhibits three ridges per land area. The CDG texture also exhibits three ridges in the same distance since it was constructed with the same conventional grinding head as section 2.

Figure 3 indicates the location of the sections east of Marshalltown, Iowa.

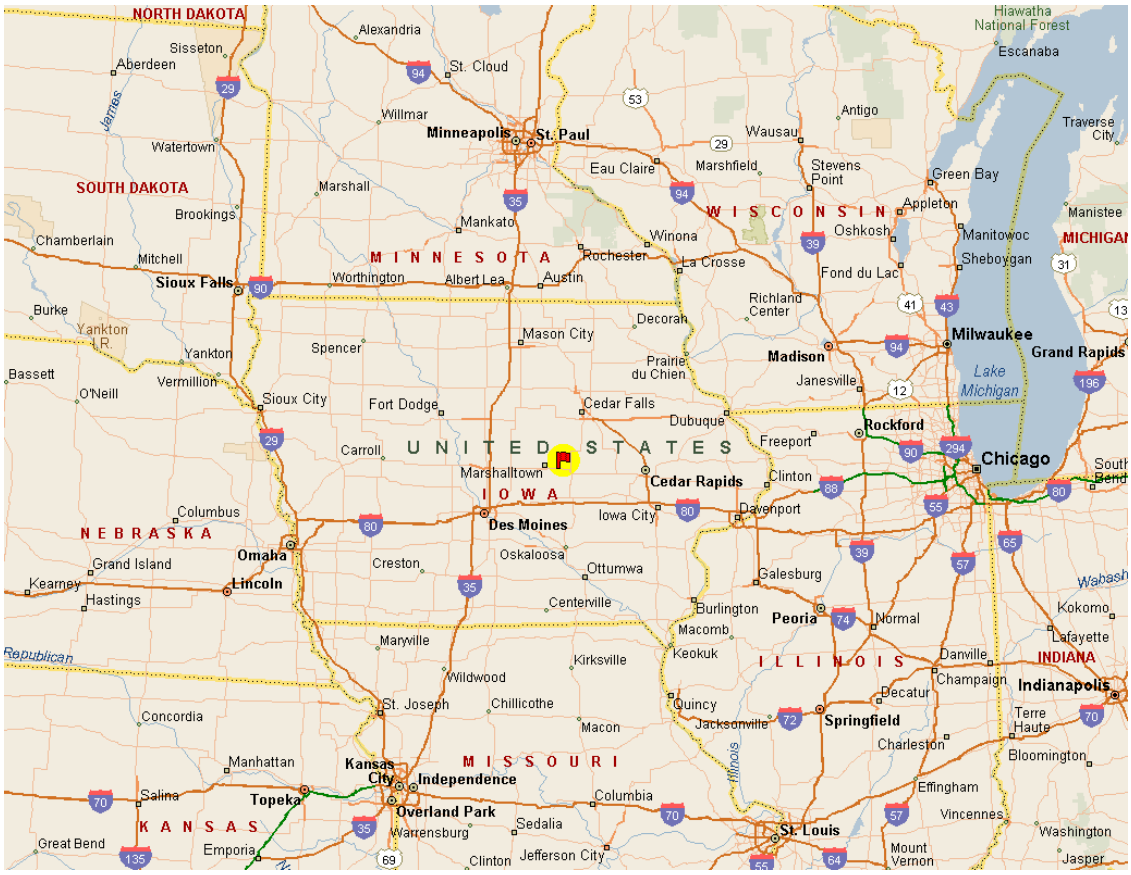


Figure 3 Location of Test Sections Indicated by Red Flag Near Marshalltown, Iowa

OBSI Test Results

On September 29, 2010 the ACPA conducted OBSI testing of these sections using the ACPA dual probe OBSI system, ACPA 2009 SRTT tire, and a 2010 Chevy Malibu. Testing was conducted at 60 mph using the vehicle cruise control. Due to the rolling terrain, it was difficult to maintain speed without driver input to the vehicle speed. Test section 1 (e.g. flush grind and groove) was located at the bottom of a sag curve on the uphill side of the sag. Test sections 2 and 3 continued on the same uphill grade. This roadway geometry would tend to accelerate the vehicle into the sag and then reduce the speed on the uphill grade.

Testing was conducted between 4 and 6 PM and temperatures ranged between 78 and 81^{o} F with most of the testing conducted between 80 to 81^{o} F. Three repeat runs were made for each section by testing all three textures in sequence before conducting the next set of replicate runs. Five second OBSI tests were conducted for each test and analyzed between 500 Hz to 5000 Hz.

Figure 4 indicates the overall A-weighed OBSI level for each texture. As indicated, the flush ground with grooved section (TS-1) was the quietest section by approximately 1.5 dBA. The sections had received approximately six weeks of traffic at the time of OBSI testing so there may be additional reduction of texture on the CDG sections in the future.

Figure 5 indicates the one-third octave spectra for each of the center band frequencies between 500 Hz and 5000 Hz. As indicated, the flush ground and grooved texture was the quietest of the textures below 1000 Hz and between 1000 Hz and 1600 Hz. Future additional fin breakage on the CDG sections may reduce the frequency levels below 1000 HZ.

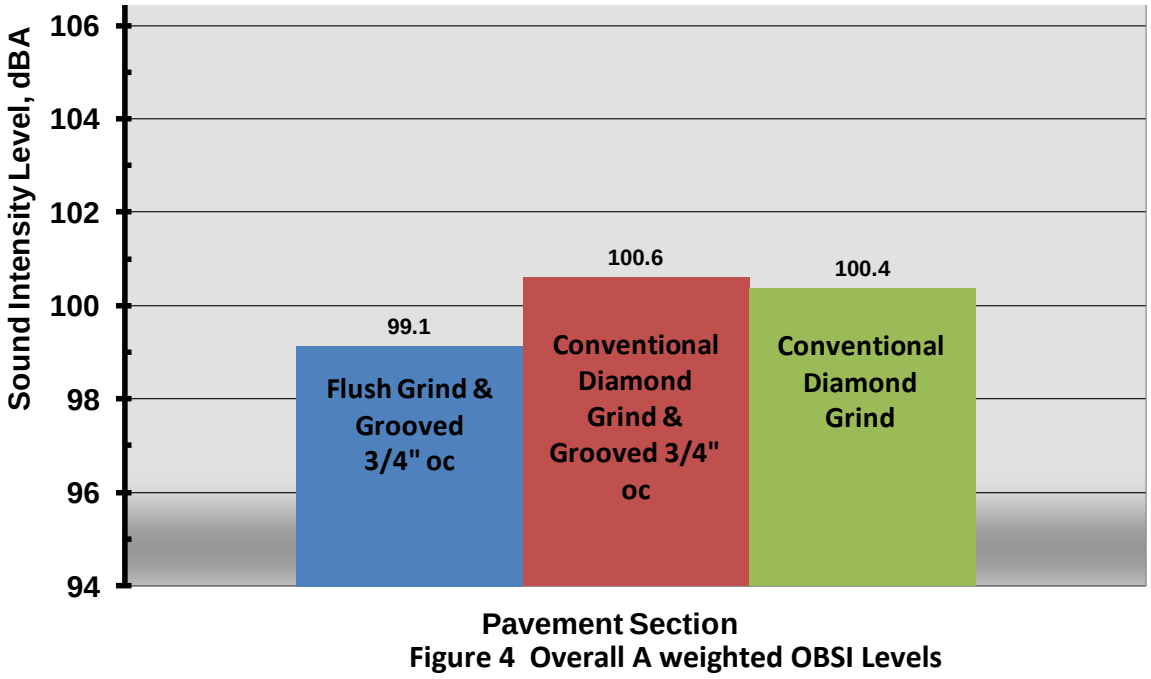


Figure 4 Overall A weighted OBSI Levels

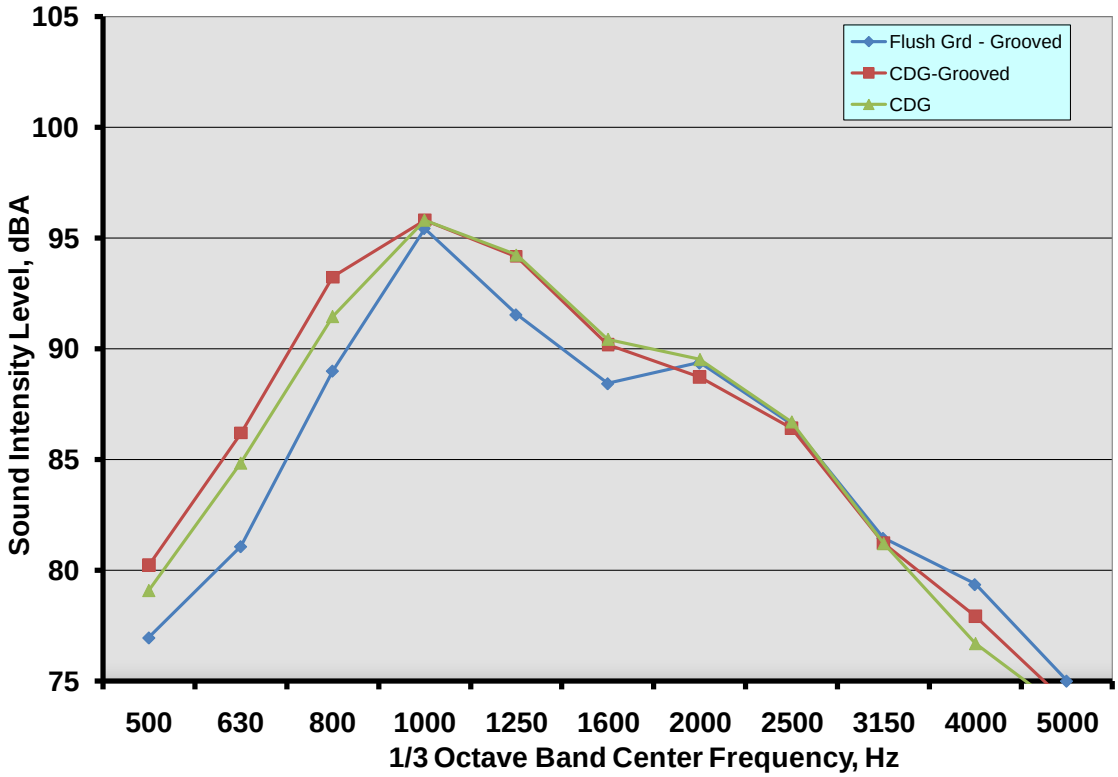


Figure 5 One-Third Octave Spectra for Each Texture Type

Friction Test Results

On September 26, 2010 the Iowa DOT conducted ASTM E-274 testing using both the ribbed tire (E-501) and the smooth tire (E-524). Testing was conducted at 40 mph approximately three weeks after construction. The results of that testing are indicated in Table 1. As indicated, the flush grind and groove has the lowest friction for both the ribbed and smooth tire results. However, as the textures age and the CDG fins are reduced under traffic the three textures may become more similar in friction levels. It should be noted that only the CDG texture with grooves exhibited the higher smooth tire than rib tire friction result.

TABLE 1 FRICTION TEST RESULTS

Test Section Description	Ribbed Tire Result	Smooth Tire Result
Flush Grind and Groove (TS-1)	48.0	46.6
CDG and Groove (TS-2)	49.4	49.9
CDG (TS-3)	50.4	47.2

References

1. **Cable, Jim, "Final Report-Surface Characteristics Next Generation Grooving and Grinding Test Site- Construction Report", July 16-17, 2010.**
2. **Frentress, Dan, "Iowa Trip Report", August 26, 2010**

Appendix 1 Flush Ground and Grooved Test Section 1

Figure 1-1 Overview Photo of Flush Ground and Grooved Test Section 1

Figure 1-2 Close Up of Flush Ground and Grooved Texture in Test Section 1

Appendix 1 Flush Ground and Grooved Test Section 1

Figure 1-3 View of Flush Ground and Grooved Texture Across Lane in Test Section 1

Figure 1-4 Close Up of Flush Ground and Grooved Texture on Section 1

Appendix 1 Flush Ground and Grooved Test Section 1

Figure 1-5 Ground Level View of Flush Ground and Grooved Texture on Section 1

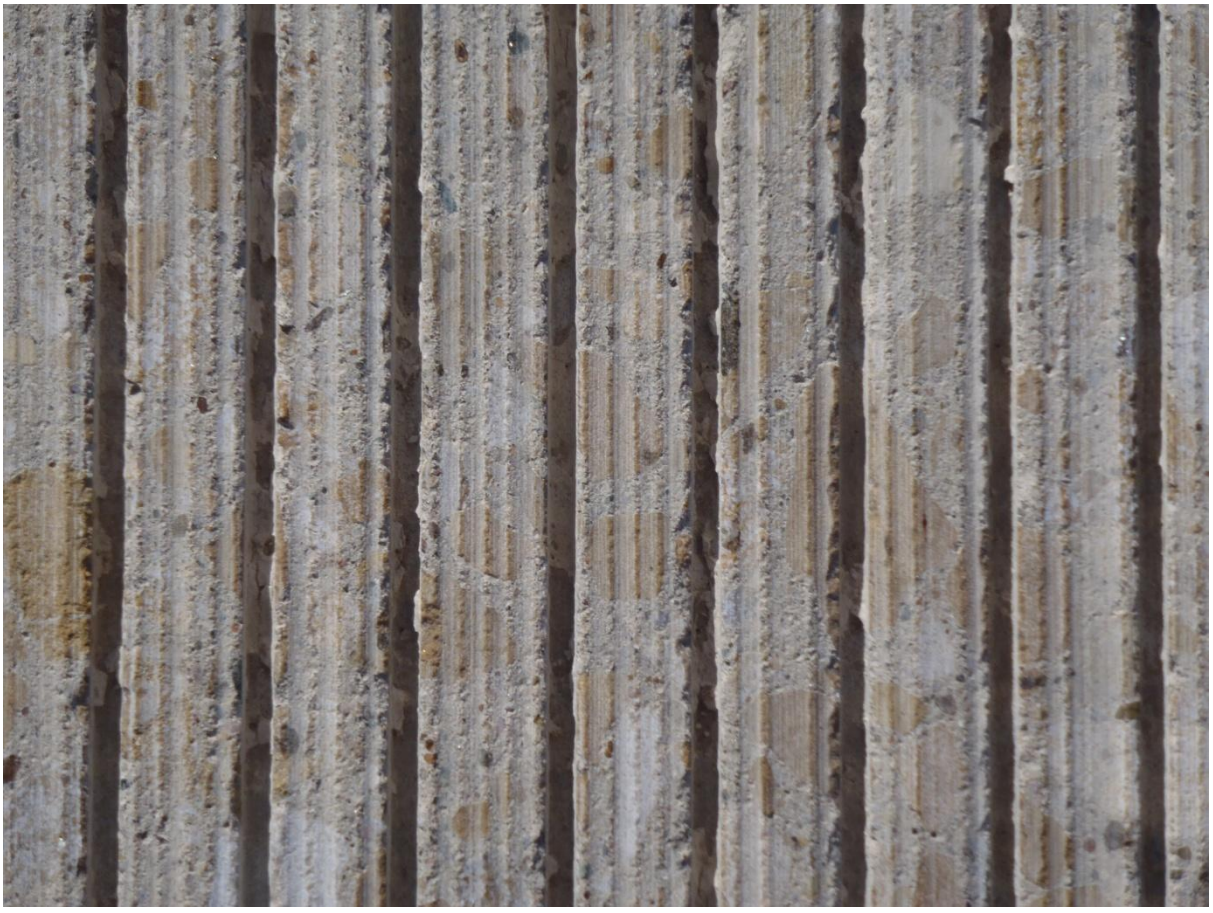


Figure 1-6 Close Up of Texture in Flush Ground and Grooved (3/4”) Texture on Section 1

Appendix 1 Flush Ground and Grooved Test Section 1

Figure 1-7 Stationing 100 Indicating Beginning of Flush Ground and Grooved Section 1

Appendix 2 CDG with ¾” Grooved Test Section 2

Figure 2-1 Overview of Test Section 2 for CDG with ¾” Groove Spacing

Figure 2-2 Overview of CDG with ¾” Grooving on Section 2

Appendix 2 CDG with ¾” Grooved Test Section 2

Figure 2-3 Close Up of CDG Texture with ¾ Groove Spacing on Section 2

Figure 2-4 Close Up of CDG Texture with ¾” Groove Spacing on Section 2

Appendix 2 CDG with ¾” Grooved Test Section 2

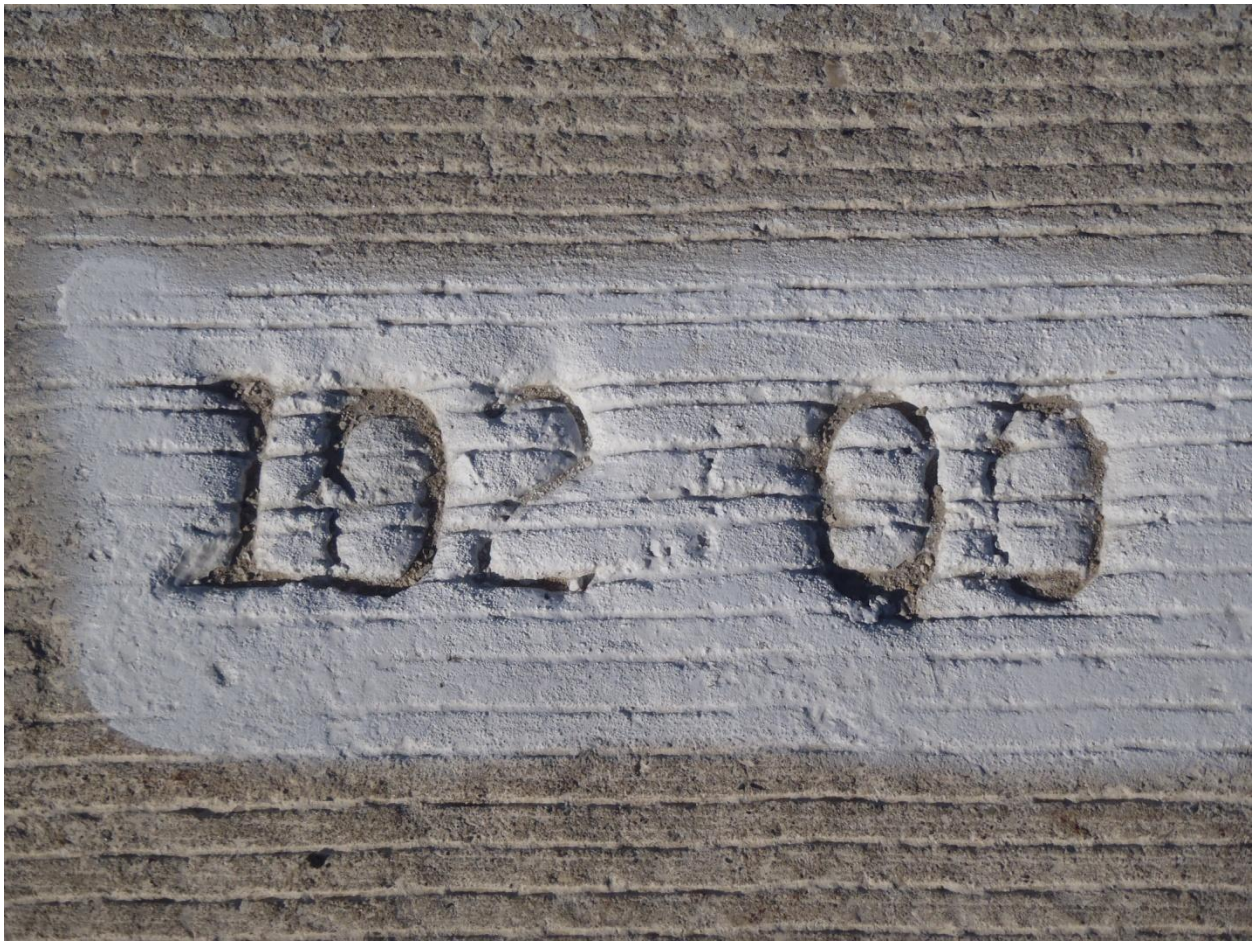


Figure 2-5 Beginning Station for CDG with ¾” Groove Spacing on Section 2

Appendix 3 CDG Test Section 3

Figure 3-1 Overview Photo of CDG Test Section 3

Figure 3-2 Ground Level View of CDG Texture in Section 3

Appendix 3 CDG Test Section 3

Figure 3-3 Ground Level View of CDG Texture in Section 3

Figure 3-4 Close Up of CDG Texture in Section 3

Appendix 3 CDG Test Section 3

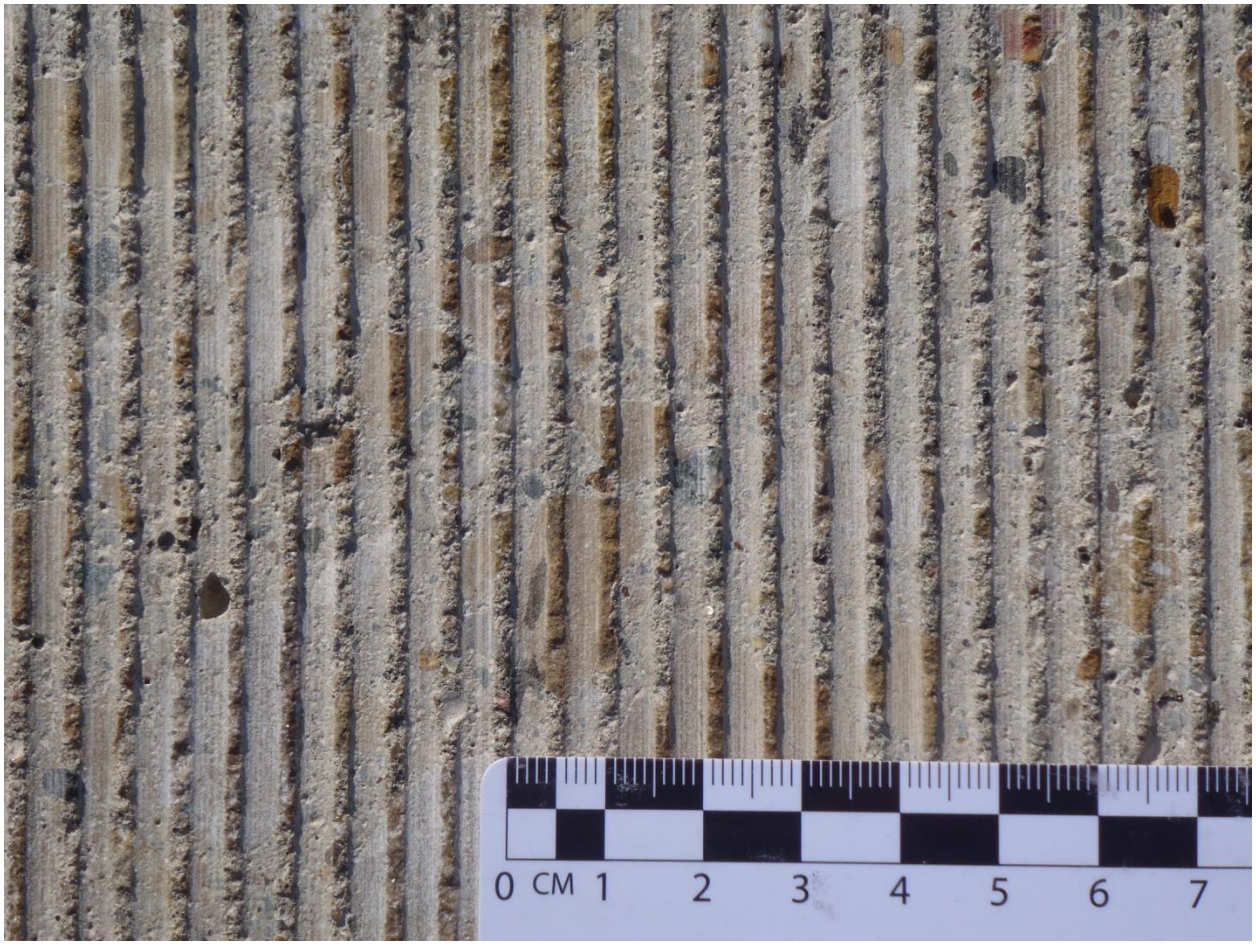


Figure 3-5 Very Close Up View of CDG Texture in Section 3

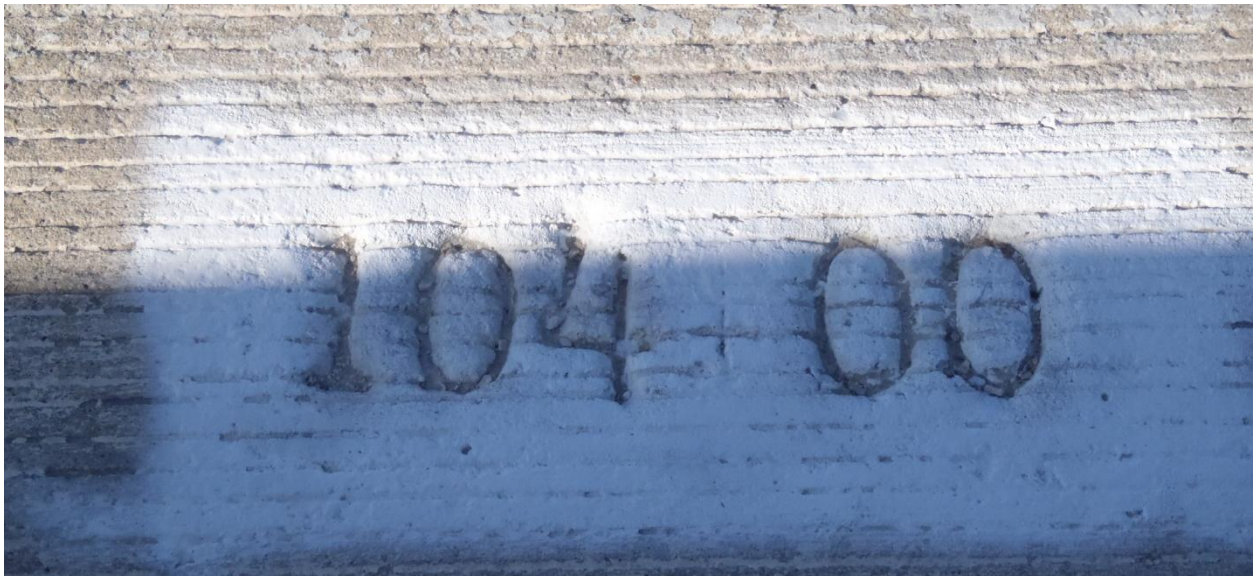


Figure 3-6 Photo of Station at the Beginning of CDG Section 3

Appendix 4 Miscellaneous Project Photos

Figure 4-1 Photo of Transverse Joint Sealant on Existing US 30 EB Pavement

Figure 4-2 Photo of Transverse Joint Sealant Condition and Width

Appendix 4 Miscellaneous Project Photos

Figure 4-3 View of Aggregate Size Evident in Original Pavement

Figure 4-4 Photo of Original Asbuilt Construction Data for Existing Pavement Construction