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CONSTRUCTION AND PERFORMANCE MONITORING OF VARIOUS ASPHALT MIXES IN ILLINOIS: 2015 INTERIM REPORT

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**CONSTRUCTION AND PERFORMANCE
MONITORING OF VARIOUS ASPHALT MIXES**

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| 16. Abstract A series of five experimental projects were constructed to better determine the life-cycle cost and performance of pavement overlays using various types and combinations of recycled materials—namely, reclaimed asphalt pavement (RAP), recycled asphalt shingles (RAS) and crushed concrete. The asphalt binder replacement (ABR) varied from 15% to 48% in the experimental sections. The study of these projects prior to construction, during construction, and for a short monitoring period after construction is intended to determine the impact of various pavement conditions, pavement cross-sections, mix designs, and material properties on the ultimate performance of the hot-mix asphalt (HMA) overlay. This interim report documents the construction and testing to date on two of the five projects in the study—Crawford Avenue/Pulaski Road and US 52 (IL 52 to Laraway Road)—that were constructed in 2014. Distress and profile surveys were conducted before and after construction. Samples were obtained of the HMA surface and binder courses and were tested for basic properties, plus Cantabro, stability/flow, Texas overlay cracking potential, fracture energy, flexibility index, fatigue, modulus, creep, and Hamburg rutting. Presented are early performance trends and baseline conditions that future performance can be compared against. Also included in this report is an update of performance on three total recycle asphalt (TRA) sections and a comparison section constructed in 2013 with ABR's ranging from 20% to 60%. | | | | | |
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EXECUTIVE SUMMARY

Recent efforts to increase recycling raised questions about the durability and cracking potential of hot-mix asphalt (HMA) being constructed in Illinois. Mixes using reclaimed asphalt pavement (RAP) and recycled asphalt shingles (RAS) can replace a substantial part of virgin asphalt binder in new HMA, the main cost component of the mix. To be truly sustainable and to reduce life-cycle cost, mixes with high asphalt binder replacement (ABR) must perform equivalent to virgin or low recycle HMA.

To better determine the life-cycle cost and performance of pavement overlays using higher amounts of RAP and RAS, a series of five experimental projects were constructed. The ABR level in the experiment varied from a low of 15% to a high of 48%. The study of these projects prior to construction, during construction, and for a short monitoring period after construction is intended to determine the impact of various pavement conditions, pavement cross-sections, mix designs, and material properties on the ultimate performance of the HMA overlay. This interim report documents the construction and testing to date on the two projects constructed in 2014—namely, Crawford Avenue/Pulaski Road and US 52 (IL 52 to Laraway Road). Distress and profile surveys were conducted, and mix samples were obtained of HMA surface and binder courses, which were tested for basic properties, plus Cantabro, stability/flow, Texas overlay cracking potential, fracture energy, flexibility index (FI), fatigue, modulus, creep and Hamburg rutting.

The self-propelled cold milling (milling) specifications (1101.16) remain essentially unchanged since the practice was adopted in the 1980s. Highly variable milled cross-sections were witnessed on the projects observed in this study. The variability was caused when worn/lost teeth were replaced in the milling head, but it can be prevented with specification changes and enforcement to address the issue.

Crawford Avenue/Pulaski Road is showing much more reflective cracking than US 52 thus far. Initial reviews indicate that some of the longitudinal cracking distress can be related back to cross-section details of how the level binder edge is constructed.

The mixes in this project were tested in accordance with the newly developed Illinois semi-circular bending test (IL-SCB). The results of this test are then used to determine the flexibility index (FI). A high FI value indicates less cracking potential, and a low FI value indicates higher cracking potential. Because there are several variations of SCB test procedures being explored across the country, IDOT has named the IL-SCB test and FI calculation process the Illinois Flexibility Index Test (I-FIT) to indicate a distinctively different test procedure.

For Crawford Avenue/Pulaski Road, the FI values were 4.9 for the PG 64-22 surface mix with 15% ABR from both RAP and RAS and 3.5 for the PG 58-28 surface mix using 30% ABR from both RAP and RAS. The FI values for surface mixes on US 52 were 5.1 for the RAP + RAS mix and 10.5 for the RAP-only mix. Both US 52 mixes used a PG 58-28 with 30% ABR. Thus far, US 52 shows an insignificant level of transverse cracking distress, which correlates well to the higher FI values.

Aside from the various mixes used in this study, different cross-sections are present on a given project and may impact study results. The main differences in cross-sections are overlays of bare concrete pavement or second-generation (or older) overlay that is a mill-and-fill-type HMA pavement rehabilitation. Data by cross-section are presented as well as by surface mix for the study. US 52 was a mill and fill of an existing HMA overlay resulting in little transverse cracking, while a majority of Crawford Avenue/Pulaski Road was bare concrete with higher levels of transverse cracking. Performance by cross-section will be documented during the study on these and other sections in the study.

Also included in this report is an update of performance of the three total recycle asphalt (TRA) sections and a comparison section constructed in 2013. The ABR on these sections varied from 20% to 60%. The 26th Street section required centerline joint patching for approximately 20% of the project length. A section on Wolf Road that used typical District 1 and standard specifications with a 20% ABR mix using RAP only and a PG 58-28 asphalt binder has less distress and at lower levels than any of the TRA sections. It has to be noted that the underlying pavement of the TRA sections paved in 2013 was distressed prior to overlay and the condition of the supporting pavement may contribute to the distresses seen in the TRA overlays. Another factor for consideration is that Wolf Road was previously patched and fairly sound at the time of overlay.

Pre-existing pavement distresses and repairs aside, many of the distresses in the 2013 TRA sections are related strictly to the surface mix. The distresses and levels of distress suggest the 2013 TRA mixes are “dry” compared with conventional mixes such as that used on Wolf Road. The use of high-absorption aggregates such as recycled concrete and slags increase the risk of “dry” mixes.

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CHAPTER 1: INTRODUCTION

According to the National Weather Service, the winter of 2013–2014 was the coldest on record in the Chicago area. After a welcomed spring thaw, the amount of pavement cracking on newly constructed pavements became a concern. Questions were raised as to whether the resulting cracking was related to the harsh winter or whether performance was being impacted by specifications allowing increased use of recycled materials containing aged and brittle asphalt.

The use of reclaimed asphalt pavement (RAP) in Illinois' hot-mix asphalt (HMA) is not new and dates back to the early 1980s. Use of RAP was relatively unchanged until the late 2000s, when allowable percentages of RAP could be increased if materials were sized or fractionated similar to virgin aggregates. In 2010, the Illinois Department of Transportation (IDOT) followed the Illinois Tollway in adopting the use of recycled asphalt shingles (RAS) in HMA. Because of the cost reductions for construction, the percentage of allowable asphalt binder replacement (ABR) was increased year to year from 2010 to 2013. To show that very high levels of ABR were possible, IDOT in 2013 demonstrated the use of total recycle asphalt (TRA), which allowed up to 60% ABR with only recycled materials for aggregate.

Upfront costs are important, but so are annual maintenance costs, traffic interruptions for repairs, safety of the motoring public, and pavement longevity. Another way to look at this is that every year of pavement life is worth 5% to 7% of the upfront construction cost, based on typical HMA pavement life of 15 to 16 years (Wolters et al. 2008). High-recycle mixes can reduce construction cost 10% to 20%, but if early repairs are needed and the overall life is reduced, the savings may not be realized.

This study was designed to follow the laydown and early-life performance of five construction projects using eight different surface mix designs, including TRA. Two of the projects were completed in 2014; the remaining three projects were under construction in 2015. Material sampling and testing will establish material properties of the mixes at the time of construction. Annual coring and distress surveys will be used to document the changes the pavement experiences with time. The mixes are also being examined under the Illinois semi-circular bending (IL-SCB) test method developed in ICT project R27-128, "Testing Protocols to Ensure Performance of High Asphalt Binder Replacement Mixes Using RAP and RAS" (Al-Qadi et al. 2015) to determine the flexibility index (FI). Because there are several variations of SCB test procedures being explored across the country, the Illinois Department of Transportation (IDOT) has named the IL-SCB test and FI calculation process the Illinois Flexibility Index Test with the acronym "I-FIT" to indicate a distinctively different SCB test and analysis. The FI is expected to provide the much-needed prediction link between mix properties at production and long-term performance. This test may be performed during the mix design and production stages (phases) of work.

This interim report documents the construction and early baseline performance of the two projects constructed in 2014—namely, Crawford Avenue/Pulaski Road and US 52 from IL 52 (Chicago Street) to Laraway Road. Basic information for the original 2013 TRA projects is recapped, and short-term performance is documented along with performance trends to date in an effort to continue to monitor the TRA sections constructed prior to this study (Lippert et al. 2014).

CHAPTER 2: RESEARCH PROJECT DESCRIPTION

2.1 STUDY GOAL

The goal of this study is to document the testing, construction, and performance of surface mixes with a variety with ABR levels, ABR types, and different asphalt binder grades to allow the evaluation and comparison of the impact of recycled materials on pavement performance. Five projects will be closely documented in this study. The work includes two projects with TRA mixes and three projects having mixes with various ABR levels.

2.2 SECTION PARAMETERS

The study matrix is presented in Table 1. The last three projects listed are not presented in this report because they are under construction as of this writing. The study evaluates a variety of mixes with different ABR levels and types (RAS and RAP). Virgin asphalt binder grades are also varied to determine the ability of softer asphalt grades to counter aged asphalt from recycled materials. The 2013 TRA projects had limited documentation during construction; what data are available were presented previously (Lippert et al. 2014).

Table 1. Project and Parameter Summary

| April 26, 2013 Letting Projects | | | | | | | | | | | | | |
|---------------------------------|--|---------------------------|----------|------------------|---------------------|----------------------|-------|--------------------|--------------------|-----------|--------------|-------------|--------------|
| Construction Year | Project | Letting Item ¹ | Contract | Net Length (mi.) | Surface Mix Details | | | | | | | Mix Designs | |
| | | | | | Dir. | Mix | ABR % | RAS ³ % | RAP ³ % | Virgin PG | Surface Tons | Surface | Level Binder |
| 2013 | 26th Street (Chicago Heights) from Western Ave to East End Ave | 4 | 60L62 | 2.0 | Both | N50 TRA ² | 60 | 4.6 | 51 | 52-28 | 3,060 | 81BIT137M | 81BIT121M |
| 2013 | Harrison Street (Hillside) from IL 38/Roosevelt Rd. to Wolf Rd. | 28 | 60N67 | 1.1 | Both | N50 TRA ² | 56 | 5.0 | 53 | 52-28 | 2,131 | 81BIT338K | 81BIT300K |
| 2013 | Richards Street (Joliet) from 5th Ave to Manhattan Road | 31 | 60P70 | 0.9 | Both | N50 TRA | 37 | None | 27 | 58-28 | 2,223 | 81BIT138Z | 81BIT137Z |
| 2013 | Wolf Road (Hillside) from IL 38/Roosevelt Rd. to Harrison Street | 9 | 60M30 | 0.5 | Both | N70 Mix D | 20 | None | 30 | 58-28 | 1,382 | 81BIT306K | 81BIT300K |
| June 13, 2014 Letting Projects | | | | | | | | | | | | | |
| Construction Year | Project | Letting Item ¹ | Contract | Net Length (mi.) | Surface Mix Details | | | | | | | Mix Designs | |
| | | | | | Dir. | Mix | ABR % | RAS ³ % | RAP ³ % | Virgin PG | Surface Tons | Surface | Level Binder |
| 2014 | Crawford Ave/Pulaski Rd from 172nd to US Rt. 6 | 30 | 60Y03 | 1.5 | S | N70-30% ABR | 30 | 5.0 | 10 | 58-28 | 2,150 | 81BIT157M | 81BIT147M |
| | | | | | N | N70-15% ABR | 15 | 2.5 | 5 | 64-22 | 2,150 | 81BIT156M | |
| 2014 | US 52 From Chicago St. (IL 53) to Laraway Road | 29 | 60Y02 | 3.3 | E | N70-30% ABR | 30 | 3.1 | 20 | 58-28 | 2,320 | 81BIT140M | 81BIT141M |
| | | | | | W | N70-30% ABR | 30 | None | 34 | 58-28 | 2,320 | 81BIT159M | |
| 2015 | US 52 from Laraway Road to Gouger Road | 16 | 60N08 | 3.3 | Both | N70 TRA ² | 48 | 5.0 | 39 | 52-34 | 5,236 | 81BIT185M | 81BIT163M |
| 2015 | US 52 from Gouger Road to Second Street | 15 | 60N07 | 1.5 | Both | N70 TRA ² | 48 | 5.0 | 39 | 58-28 | 3,014 | 81BIT185M | 81BIT163M |
| 2015 | Washington Street from Bridggs Street to US 30 | 31 | 60Y04 | 1.9 | W | N70-30% ABR | 30 | 3.1 | 20 | 58-34 | 1,580 | 81BIT177M | 81BIT163M |
| | | | | | E | N70-30% ABR | 30 | None | 34 | 58-34 | 1,580 | 81BIT159M | |

¹April 26, 2013, or June 13, 2014, Letting Item Number.

²Total recycle asphalt (100% recycled aggregate with high ABR).

³Percentage of mixture that contributes to the indicated ABR%—maximum 5% of RAS allowed in total mix by specification.

The main tasks in this study are as follows:

- Document in detail the pavement condition prior to construction.
- Monitor construction work for issues (cross-sectional or installation) that may present performance problems later.
- Collect quality assurance information for the record.
- Sample mixes and pavement for laboratory material characterization with time.
- Monitor pavement performance with time and present performance trends.
- Provide reporting of data available during the study period.

In the chapters that follow, documentation to date is presented for the 2014 projects constructed. Because of the length of some test procedures, future reports will present test results that could not be completed at this time.

CHAPTER 3: PRE-EXISTING CONDITIONS AND PROPOSED IMPROVEMENTS

This chapter provides project location, pre-existing conditions, and proposed improvements for the two projects constructed in 2014. For projects let and constructed in 2013, available information is provided in a previous report (Lippert et al. 2014).

3.1 CRAWFORD AVENUE/PULASKI ROAD

This project begins approximately 60 ft south of 172nd Street and extends in a northerly direction for a distance of 9,909 ft (1.88 mi) to US 6 (159th Street) through the City of Country Club Hills and the City of Markham in Cook County, as shown in Figure 1.

Two resurfacing omissions for bridges and their approaches are within the project located as follows:

I-80 approaches and bridge: Sta. 18+88 to Sta. 28+30

I-57 approaches and bridge: Sta. 84+18 to Sta. 96+05

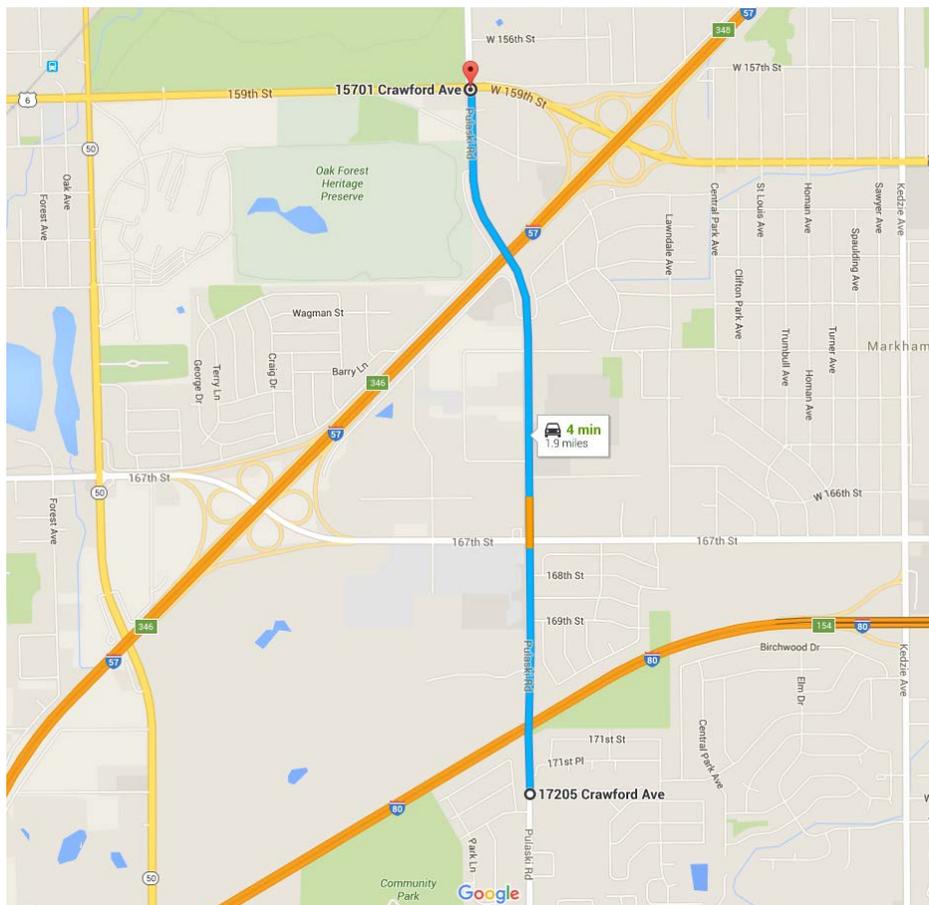


Figure 1. Improvement on Crawford Avenue/Pulaski Road (map data: Google).

3.1.1 Traffic Characteristics

The posted speed limits on the project are 40 and 45 mph. Traffic along the section varies. From the 2010 traffic information, the peak traffic along the project is located just north of I-80, with a two-way average daily traffic (ADT) of 22,400. Truck counts are not available for the section.

3.1.2 Existing Pavement Cross-Section

Existing cross-section details can be found in Appendix A. Because of changing pavement cross-sections along the improvement, there were three distinct sections at the time of construction, as follows.

Segment 1. Southernmost two-lane segment. The south end of the project consists of the original bare 10-in PCC two-lane pavement with aggregate shoulders. Figure 2 shows the condition of the southern segment in 2012.



Figure 2. Crawford Avenue/Pulaski Road looking north at start of improvement (image: Google).

Segment 2. Between I-80 and I-57. North of I-80, the section widens to a five-lane section: two lanes in each direction, with turn lanes on a mountable median. The pavement in this segment consists of the original bare 10-in PCC pavement with a curb and gutter. Figure 3 shows the condition of the center segment in 2012.



**Figure 3. Segment 2 of Crawford Avenue/
Pulaski Road looking north to 169th Street (image: Google).**

Segment 3. North of I-57. This segment cross-section has five lanes, with the center lane for turning movements. The pavement consists of a 2.5-in HMA overlay over a 10-in PCC pavement with a curb and gutter. Figure 4 shows the condition of the north segment in 2012.



**Figure 4. North segment of Crawford Avenue/
Pulaski Road looking north to US 6 (image: Google).**

3.1.3 Pre-Construction Distress Survey

On September 29, 2014, prior to the improvement, the project was surveyed and distresses mapped by the Bureau of Materials and Physical Research (BMPR). The survey consisted of walking the sections with field sheets representing the pavement and related stationing. Data were recorded by mapping and coding the distress as outlined in the BMPR Pavement Distress Manual (IDOT 2012a). The survey will provide a record of cracks and joints that can be compared with reflective distress over the evaluation period.

A survey summary by station is provided in Appendix B. For the purpose of clearly monitoring distress over time, the taper areas were omitted from the summaries. Turn lanes and median lanes were not surveyed.

No record of coring of these projects in advance was presented. Pavement coring may provide additional details to designers when selecting milling depth of the cross-section (i.e., cold-milling depth to remove damaged asphalt and minimize scabbing/potholes caused by too shallow a depth). Proper milling depth results in a surface that will hold up better under traffic during construction and reduce the risk of quantity overruns of level binder.

3.1.4 Pre-Construction Rutting and Ride Quality

For pre-construction rutting and ride quality, BMPR arranged for a data collection run by IDOT's video survey vendor. The data were collected in each lane and direction of the project on August 12 and 15, 2014. Values of international roughness index (IRI) and rutting were determined every 0.1 mi. Areas of paving omissions for bridges were removed from the data, as were tapers, so that only uniform cross-sections of pavement were represented. For the project, the data were summarized for the three uniform segments as noted above for each direction, lane, and wheel path. The data are presented in Appendix C.

3.1.5 Proposed Improvement Work

The improvement was let as Item 30, Contract 60Y03, on IDOT's June 13, 2014, letting bulletin. Electronic plans and specifications are available on IDOT's website (IDOT 2014b). The letting documents indicate that the surface mix was to be TRA; however, the surface mixes were changed as indicated in Table 1 to provide specific ABR, RAP/RAS, and PG binder combinations for this study.

Each segment improvement was different, as follows:

Segment 1. Southernmost two-lane segment. This segment was cold-milled at the edge of the pavement at a nominal depth of 1.5 in, which tapered to zero at a distance of 6 ft from the pavement edge. After tacking, an IL 4.75-mm level binder was placed at a thickness of 1 in for a width of 11 ft of the 12-ft lane, leaving the outside foot of milled PCC pavement exposed. The level binder was tacked and the 1.5 in of surface course placed on the full 12-ft width of the pavement. This resulted in the outside foot of the pavement being a nominal 2.5 in of surface mix and a 1-in "step" from level binder to non-level binder in the surface at the pavement edge. As part of the improvement, asphalt shoulders were added.

Segment 2. Between I-80 and I-57. The two-lane and taper area were improved similar to Segment 1 above. In the five-lane section, the mountable median (shown in Figure 3 above) was removed by cold-milling. In the outside lane, the pavement edge was milled to remove 1.5 in of pavement adjacent to the gutter, which was tapered to zero at the center of the outside lane. After tacking, an IL 4.75-mm level binder was placed 1 in thick

up to 6 ft from the pavement edge, thus not covering the milled taper from the center of the lane to the gutter. After tacking, the nominal 1.5 in of surface mix was placed over the level binder, and a 1-in “step” resulted in the cross-section where the level binder ends such that the surface mix is 2.5 in thick at the edge of the level binder, tapering to 1.5 in at the gutter.

Segment 3. North of I-57. The existing overlay was cold-milled 2.5 in, the full width of the segment. After tacking, an IL 4.75-mm level binder was placed at a thickness of 1 in gutter to gutter, followed by a tack coat and the 1.5 in of surface mix.

Details of the various proposed cross-sections are shown on the plans (IDOT 2014b). Key cross-sections are presented in Appendix A.

3.2 US 52 – IL 53 TO LARAWAY ROAD

This improvement on US 52 (FAP 852) begins approximately 53 ft east of the centerline of IL 53 (Chicago Street) and extends in a southeasterly direction for a total distance of 17,465 ft (3.31 mi) to a point approximately 104 ft east of the centerline of Laraway Road. The project is located within the City of Joliet and unincorporated Will County, as shown in Figure 5.

Three resurfacing omissions for box culverts are within the project located as follows:

- Sta. 81+74 to Sta. 82+03 Box Culvert
- Sta. 112+19 to Sta. 112+60 Box Culvert
- Sta. 158+46 to Sta. 158+85 Box Culvert

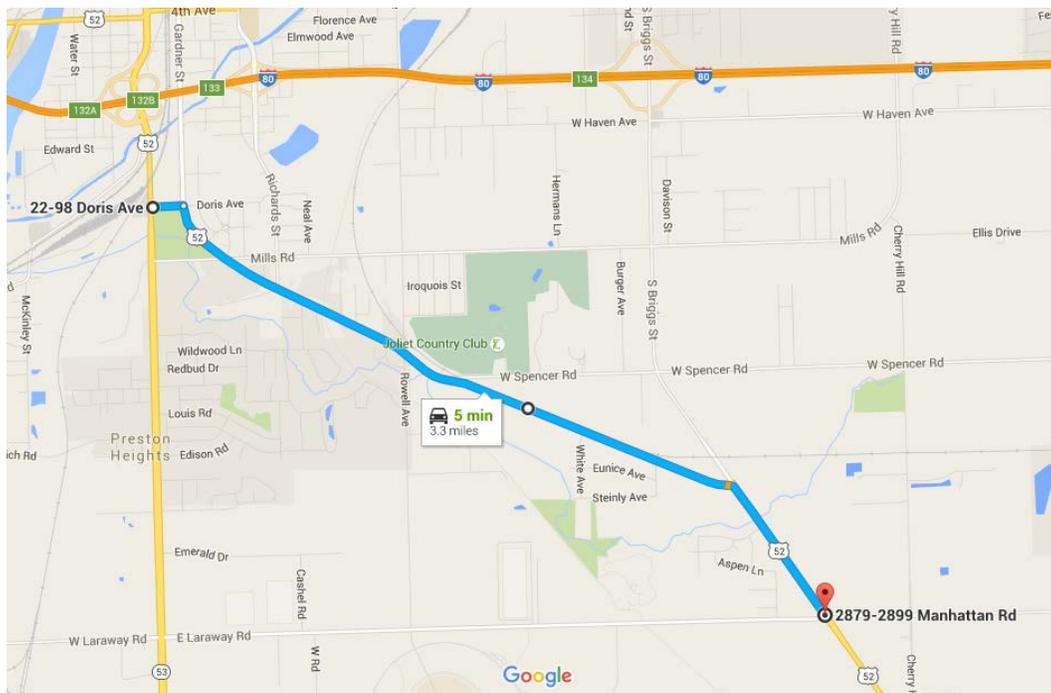


Figure 5. Improvement on US 52 – IL 53 (Chicago Street) to Laraway Road (map data: Google).

3.2.1 Traffic Characteristics

The posted speed limit on the project is 35 mph (Doris Avenue) and 55 mph (Manhattan Road). Traffic along the section varies. From the 2013 traffic information, the peak traffic along the project is located just off IL 53, with a two-way ADT of 9,350. The two-way truck ADT was 240 vehicles at the same location.

3.2.2 Existing Pavement Cross-Section

Because of changing pavement cross-sections along the improvement, there were three distinct sections at the time of construction, as follows.

Segment 1. Doris Avenue four-lane segment. The west end of the project consists of a four-lane HMA overlay section. Lane 1 in each direction (passing lane) was originally a 9 in \pm PCC pavement. The section was widened with a bituminous base course to add Lane 2 in each direction (driving lane), at which time the entire cross-section was overlaid. Figure 6 shows the condition of this segment in 2013.



Figure 6. Doris Avenue looking east (image: Google).

Segment 2. Doris Avenue to Laraway Road. The bulk of US 52 consists of a two-lane highway that is an overlay of a 9-in \pm thick PCC pavement widened with a bituminous base course on each side. The result is a 12-ft lane with a 19-in-wide HMA safety shoulder on each side. Within this main segment is an intersection area that differs and has been broken out as Segment 3 described below. Figure 7 shows the condition of Segment 2.



Figure 7. US 52 looking southeast near Laraway Road (image: Google).

Segment 3. Central intersection segment. This part of US 52 consists of a two-lane section that is an overlay of a 9-in \pm thick PCC pavement widened with a bituminous base course on each side. A 4 ft, 10-in bituminous shoulder, tapers, and turn lanes are the main differences between this segment and Segment 2 above. Figure 8 shows the condition of the intersection area in 2013.



Figure 8. Intersection segment of US 52 looking southeast (image: Google).

Details of the various existing cross-sections are shown on the plans. Key cross-sections are presented in Appendix A.

3.2.3. Pre-Construction Distress Survey

Prior to construction on September 9 and 25, 2014, the project was surveyed and distresses mapped by BMPR. The survey consisted of walking the sections with field sheets representing the pavement and related pavement stationing. Data were recorded by mapping and coding the distress as outlined in the BMPR Pavement Distress Manual (IDOT 2012a). The survey will provide a record of cracks and joints that can be compared with reflective distress over the evaluation period.

A distress survey summary is provided in Appendix B. For the purpose of clearly monitoring pavement distress over time, different cross-sections were broken out into separate segments and directions. This was done to associate performance with unique underlying pavement conditions and the experimental surface mix. Turn lanes were not surveyed.

No record of coring of these projects in advance was presented. Pavement coring may provide additional details to designers when selecting milling depth of the cross-section (i.e., cold-milling depth to remove damaged asphalt and minimize scabbing/potholes caused by too shallow a depth). Proper milling depth results in a surface that will hold up better under construction traffic and reduce the risk of quantity overruns of level binder.

3.2.4 Pre-Construction Rutting and Ride Quality

For pre-construction rutting and ride quality, BMPR arranged for a data collection run by IDOT's video survey vendor. The data were collected in each lane and direction of the project on August 12 and 15, 2014. The data were analyzed by 0.1-mi segments, with paving omissions and bridges removed from the data so that only the pavement was represented. For the project, the data were summarized for the three segments as noted above for each direction, lane, and wheel path. The data are presented in Appendix C.

3.2.5 Proposed Improvement Work

The project was let as Item 29, Contract 60Y02, on IDOT's June 13, 2014, letting. Electronic plans and specifications are available online on IDOT's website (IDOT 2014a). The work consisted primarily of HMA surface removal, variable-depth PCC removal, pavement patching, frame and lid adjustment, resurfacing with leveling binder and HMA surface course, grading and shaping shoulders, placement of thermoplastic pavement markings, raised reflective pavement markers, detector loop replacement, and all incidental and collateral work necessary to complete the project. The letting documents indicate that the surface mix was to be TRA; however, the surface mixes were changed as indicated in Table 1 to provide specific ABR, RAP/RAS, and PG binder combinations for this study.

Each of the sections was treated differently. The three sections had improvements, as follows:

Segment 1. Doris Avenue four-lane segment. The segment was milled to a depth 2.25 in shoulder to shoulder. After tacking, a 0.75-in thick IL 4.75-mm level binder was placed except for the outer 12 in of the pavement, leaving the outside foot of the milled PCC pavement exposed. After tacking the level binder, 1.5 in of surface was placed the full width of the pavement. This resulted in the outside foot of the pavement being a nominal 2.25 in of surface mix and a 0.75-in "step" from level binder to non-level binder in the surface at the pavement edge. Additional aggregate was added to the shoulder to complete the cross-section.

Segment 2. Doris Avenue to Laraway Road. Excluding the intersection segment noted below, the bulk of the US 52 improvement consisted of milling the surface to a depth of 2.25 in edge to edge of the safety shoulder. After tacking, a 0.75-in thick IL 4.75-mm level binder was placed except for the outer 12 in of the safety shoulder, leaving the outside foot of the milled HMA shoulder exposed. After tacking the level binder, 1.5 in of surface was placed on the full width of the pavement and shoulder. This resulted in the outside foot of the pavement being a nominal 2.25 in of surface mix and a 0.75-in “step” from level binder to non-level binder in the surface at the pavement edge. Additional aggregate was added to the shoulder to complete the cross-section.

Segment 3. Central intersection segment. This area of the improvement consisted of milling the surface to a depth of 2.5 in edge to edge of the safety shoulder. After tacking, a 1-in thick IL 4.75-mm level binder was placed except for the outer 12 in of the safety shoulder, leaving the outside foot of the milled HMA shoulder exposed. After tacking the level binder, 1.5 in of surface was placed the full width of the pavement and shoulder. This resulted in the outside 12 in of the safety shoulder being a nominal 2.5 in of surface mix and a 0.75-in “step” from level binder to non-level binder in the surface at the safety shoulder edge.

Details of the various proposed cross-sections are shown on the plans. Key cross-sections are presented in Appendix A.

CHAPTER 4: PROJECT CONSTRUCTION

This chapter presents information pertaining to the HMA overlay construction in 2014. The general sequence of construction operations for the projects was to mill the concrete and HMA overlay as shown on the plans; adjust frames and grates; perform patching and filling of cracks, joints, and flangeways with HMA; apply tack coat; place 4.75-mm level binder; tack coat the level binder, place a 9.5-mm surface course; construct shoulders; establish pavement markings; install raised pavement reflectors; and install detector loops for traffic signals. For all 2014 let projects in this study effort, D Construction, Inc. of Coal City, Illinois, was the successful bidder and prime contractor.

4.1 CRAWFORD AVENUE/PULASKI ROAD

4.1.1 Pavement Cold-Milling

Each of the segments contained different pavement cold-milling details as described above and shown in Appendix A. In general, milling per Article 440 and 1101.16 of the Standard Specifications for Road and Bridge Construction (IDOT 2012b) was used at the pavement edges to retain the curb and gutter function and taper the new surface into the existing gutter elevation. The result was that the bare concrete sections were milled down 1.5 in at the pavement edge and curb line. In Segment 3, the HMA was milled curb to curb so that the new surface elevation would remain the same as the existing elevation, once complete.

Figures 9 through 16 show the resulting milling at various areas. From the resulting texture of the milled surface on both the PCC and HMA segments, it was evident that the milling machine's teeth were being partly replaced with new teeth upon being lost or worn. This resulted in uneven depth of milling across the pavement section. The milling operation also exposed areas of marginal concrete quality at joints and cracks, resulting in spalling and material loss in those areas that required patching or filling by hand.

4.1.2 Patching, Filling of Cracks, Joints, and Flangeways

Prior to overlay, the section was patched using Class D patches (full-depth HMA), and any wide cracks and joints were cleaned and filled with an IL 4.75-mm HMA level binder sand mix. Appendix D provides the patching schedule for Class D patches. The total plan quantity for patching was 1,515 yd². Patching totaled 891.92 yd² for the project, which represents 59% of the plan patching quantity.

Filling of cracks, joints, and flangeways with IL 4.75-mm HMA level binder required 73.06 t of material. This equates to an average of 0.25 t for every 100 lane-ft of the project.

4.1.3 Tack Coat

After repairs were complete, the pavement was cleaned then tacked. Figure 16 provides an indication of the tack on Segment 2 in the milled area. Between the level binder and surface course, a tack coat was also placed. Figure 17 shows the resulting tack coat on the level binder. In both cases, some wide "zebra striping" was evident.

4.1.4 Level Binder

The mix used for level binder was an IL 4.75-mm sand mix, which was used on the entire project. The level binder used an asphalt binder of PG 70-28 with an ABR of 35% from both RAP and RAS. For the level binder, RAS was used at a rate of 4.9% of total mix, with 54% of the ABR coming from RAP and 46% from RAS. Details of the mix design can be found in Appendix E.

It should be noted that the level binder was placed full width from 159th Street to the I-57 bridge (Segment 3). The remaining segments had the level binder placed partial width of the cross-section. On Segment 1, the outside foot was without level binder, and on Segment 2 the outside 6 ft of the pavement was without level binder. See Appendix A for cross-sectional details of how the level binder was placed. Figures 14 through 16 also illustrate this detail. As shown on the plan, the level binder was placed 1 in thick, with the machine edge forming the longitudinal edge of the level binder. No attempt was made to taper the level binder edge.

Appendix F contains the paving sequence map for the level binder. Paving sequence can be important in determining long-term performance related to compaction conditions of the mat near joints (i.e., confined or unconfined edge).

Two static three-wheel rollers were used as breakdown and intermediate rollers, as shown in Figure 14. A vibratory roller in static mode was used as a finish roller.

4.1.5 Surface Course

The surface course mixes are the main experimental feature on this project. Two mixes typical of PG grade selection policies/specifications are featured. Surface mixes on this project as well as all the projects within the 2014 let projects use an N70 mix design. All mix criteria (aggregate and volumetrics) are according to standard specifications and job special provisions; however, RAP and RAS percentages for the surface course were changed as follows:

The northbound lanes used a mix with 15% ABR split equally between RAP and RAS with a PG 64-22 asphalt binder. This mix represents a typical “unbumped” mix as a result of being under 20% ABR in statewide specifications (15% ABR per District 1 Special Provision)—that is to say, if the plans were showing a PG 64-22 for asphalt binder, the specification controls would allow an ABR up to 20% (15% ABR per District 1 Special Provision) before “bumping” the grade down to a softer asphalt binder.

The southbound lanes used a mix with 30% ABR, also split equally between RAP and RAS. Because of exceeding 20% ABR, statewide specifications (15% ABR per District 1 Special Provision) would require the contractor to “double bump” down the asphalt binder, resulting in a PG 58-28 asphalt binder that was used with this mix.

Appendix F contains the paving sequence map for the surface course. Paving sequence can be important in determining long-term performance related to confined or unconfined compaction edge conditions of the joint.

Paving was typical; however, the paver did use a 24-ft reference rather than a 30 ft. In each case of asphalt placement (all lanes, all mixtures), the grade reference was on the left side of the paver. The right side of the paver was adjusted from time to time to control material yield. The surface was paved a thickness of 1.5 in and compacted with two dual-drum vibratory rollers followed by a dual-drum vibratory roller operated in static mode as the finish roller. As noted, the partial-width level binder in the cross-section resulted in a stepped cross-section in the outer lane. The surface lift thickness varies from 1.5 in over the 6-ft width of level binder to 2.5 in tapering to 1.5 in over the outer 6 ft on the milled surface in Segment 2. The lighter area in Figures 18 through 20 define the location of the level binder, and the darker area of the surface near the curb line/pavement edge defines the single lift of surface that was placed on the milled concrete surface. Some early distress was noted at the edge of the level binder where hairline cracks formed intermittently at this “step” location. It may be possible to reduce the impacts of this transition by reducing the level binder thickness to 0.75 in and hand-luting the level

binder edge to form a tapered edge to zero rather than a dropped-off edge. Placing the level course only on the inner lane with a tapered edge may be another alternative.



Figure 9. Segment 3 (159th Street to I-57) cold-milled pavement.



Figure 10. Segment 2 (between I-57 and I-80) cold-milled pavement.



Figure 11. Segment 3 (159th Street to I-57) cold-milled pavement.



Figure 12. Segment 3 (159th Street to I-57) cold-milled pavement.



Figure 13. Segment 2 (between I-57 and I-80) cold-milled pavement.



Figure 14. Segment 2 (between I-57 and I-80) level binder placed at start of cold-milled taper.



Figure 15. Segment 2 (between I-57 and I-80). Placing 4.75-mm level course from approximately 6 ft off of curb line and 6 ft from center median.



Figure 16. Segment 2 (between I-57 and I-80). Placing 4.75-mm level binder course from approximately 6 ft off of curb line. Level binder course is 1 in thick at 6 ft off of curb line, not tapered to zero.



Figure 17. Segment 2 (between I-57 and I-80). Placing surface in turn lane. Typical zebra-striped tack coat on level binder.



Figure 18. Segment 2 (between I-57 and I-80). Placing surface course installation on Pulaski. Primary straight section with cold-milling from curb to 6 ft from curb. A 24-ft longitudinal grade reference was used in lieu of the 30 ft required.



Figure 19. Segment 2 (between I-57 and I-80). Slightly cracked surface in center of photo defines edge of level binder and cold-milling taper to curb line.



Figure 20. Segment 2 (between I-57 and I-80). Slightly cracked surface (lighter surface area) defines location of level binder. Right 6 ft of lane (darker area next to curb) is cold-milling taper where the surface is 2.5 in at center of lane tapering to 1.5 in at curb.

4.2 US 52–IL 53 TO LARAWAY ROAD

4.2.1 Pavement Cold-Milling

Each of the segments contained different pavement milling details, as shown in Appendix A. In general, milling was used to retain the existing cross-section and profile. The result was that the existing HMA was milled 2.25 or 2.5 in in depth. The width of the milling varied but was edge to edge of pavement, including the safety shoulder. Figures 21 through 23 present the results.

From the resulting texture of the milled surface on both the PCC and HMA segments, it was evident that the milling machine's teeth were being partly replaced upon being lost or worn. This resulted in uneven depth of milling across the pavement section. The milling operation also exposed numerous previously installed pavement patches, as shown in Figure 21.

4.2.2 Patching, Filling of Cracks, Joints, and Flangeways

Prior to overlay, the section was patched using Class D patches (full-depth HMA), and any wide cracks and joints were cleaned and filled with an IL 4.75-mm HMA sand mix level binder. Appendix D provides the patching schedule for Class D patches. Note that the patching is located in intersection Segment 3. The total plan quantity for patching was 510 yd². The actual patching totaled 387.78 yd² for the project, which represents 76% of plan quantity.

The plan quantity for filling of cracks, joints, and flangeways with an IL 4.75-mm HMA level binder was 84 t. The project used all the plan quantity by placing 84.41 t of HMA for this operation, which equates to an average of 0.31 t for every 100 lane-ft of the project.

4.2.3 Tack Coat

The pavement was cleaned then tacked. Figure 25 shows the tack coat on the level binder lift in Segment 2, where some wide “zebra striping” was evident.

4.2.4 Level Binder

As is typical for the district, the mix used for level binder was an IL 4.75-mm sand mix, which was used on the entire project. The level binder uses an asphalt binder of PG 70-28 with an asphalt binder replacement of 32% from both RAP and RAS. For the level binder, RAS was used at a rate of 4.9% of total mix, with 51% of the ABR coming from RAP and 49% from RAS. Details of the mix design can be found in Appendix E.

Level binder was placed narrower than the pavement area to be resurfaced. The outside 12 in of the pavement or safety shoulder were not covered with the level binder. See Appendix A for cross-sectional details of how the level binder was placed. Figures 24 and 26 also show this detail. As shown on the plan, the level binder was placed at 0.75 in thick, with the machine edge forming the longitudinal joint edge of the level binder in Segments 1 and 2. Segment 3 received a 1-in.-thick level binder. Appendix F contains the paving sequence map for the level binder.

The same rolling sequence was used on this project as was used on Crawford Avenue/Pulaski Road, with two static three-wheel rollers for breakdown and intermediate rolling followed by a dual-drum vibratory roller operated in static mode.



Figure 21. Segment 2 cold-milling of roadway exposed numerous previously installed pavement patches.



Figure 22. Existing cold-milling specifications do not address variability between adjacent teeth; newer teeth result in deep grooves of 0.5 in or more across the pavement section (Segment 1 shown).



Figure 23. In Segment 2, the milling resulted in loss of material at numerous cracks and joints that had reflected through the previous HMA overlay.



Figure 24. Level course installed 1 ft narrower than cold-milling operation.



Figure 25. Typical tack coat installation; note zebra pattern.

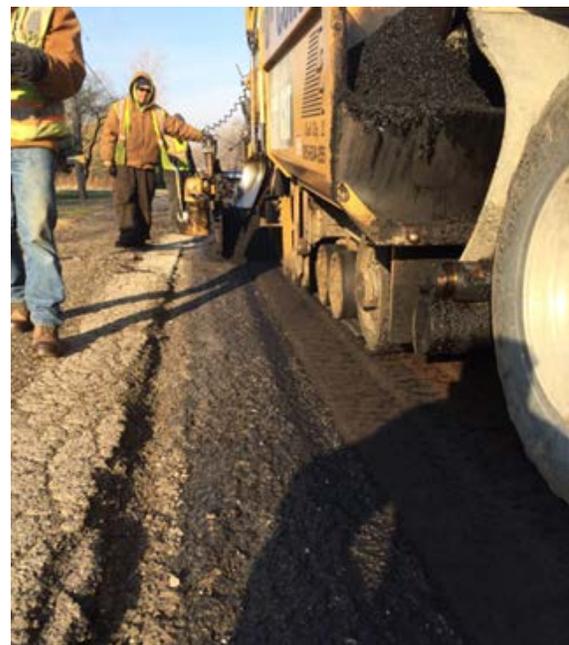


Figure 26. Surface course installation showing leveling course, lip between level and cold-milled surface, and surface course installation.

4.2.5 Surface Course

The surface course mix experiments on this project featured the use of the same basic components overall, with and without RAS. The mix is an N70 gyratory mix using PG 58-28 for the liquid binder. Both mixes used 30% ABR. All mix criteria (aggregate and volumetrics) are according to standard

specifications and job special provisions; however, RAP and RAS used for the surface course were specified as follows:

The mix in the westbound lanes used only RAP to obtain the 30% ABR.

The mix in the eastbound lanes used both RAP and RAS to achieve the 30% ABR, with each material equally contributing to the ABR.

The plans would normally specify the asphalt binder as a PG 64-22, leaving the ABR content to the contractor. The statewide standard specifications would allow up to 20% ABR (15% ABR per District 1 Special Provision) before the asphalt binder grade would have to be “double bumped” to a lower PG grade. In this case, with 30% ABR, a “double bump” down to a PG 58-28 asphalt binder is required. Both mixes are in accordance with normal and common practice and represent the possible choices of different recycle levels that a contractor could choose under current specifications. The adjustment in PG grades required at higher levels of ABR is intended to result in equal or better cracking performance of mixes at lower ABR levels that do not require a grade bump. The mix details can be found in Appendix E.

Appendix F contains the paving sequence map for the surface course. Paving sequence can be important in determining long-term performance related to compaction conditions of the mat near joints (i.e., confined or unconfined edge). However, it should be noted that Segment 1 was a turnaround point in paving the project. In that area, all the lanes were laid in a short time period with limited cooling of the previous lane when the next lane was placed. The result is that the lane joints are “hot” joints and are likely to perform better over the life of the project than typical cold joints on the remainder of the project.

Paving was typical; however, the paver used a 24-ft reference rather than a 30 ft. In each case of asphalt placement (all lanes, all mixtures), the grade reference was on the left side of the paver. The right side of the paver was adjusted from time to time to control material yield. The surface was paved at a thickness of 1.5 in and compacted with two dual-drum vibratory rollers followed by a dual-drum vibratory roller operated in static mode as the finish roller. As noted, the partial use of level binder in the cross-section resulted in stepped cross-section at the outer foot of the pavement. During paving, there was some obvious distress (longitudinal cracking) when using the “step” paving detail, as shown in Figure 26. The distress is in the form of an intermittent hairline longitudinal crack, as seen in Figure 27. The outer surface lift thickness was 2.25 in in Segments 1 and 2. In Segment 3, the outer surface lift thickness was 2.5 in because of the increased level binder thickness in this segment. There is also some slight segregation along the pavement edge longitudinally.



Figure 27. Evidence of hairline crack at underlying transition from level binder to no level binder. Level binder (4.75 mm) to left of crack and milled surface to right of crack. Increased segregation also at pavement edge (right side of photo).

CHAPTER 5: POST-CONSTRUCTION SURFACE CONDITIONS

5.1 PAVEMENT PROFILE

As part of the evaluation of the projects, international roughness index (IRI) and rutting data were collected using noncontact profile equipment. Prior to construction, IDOT’s profile vendor collected the profile data. After construction, ERI Inc. of Savoy, Illinois collected profile and rutting data for the study. The same equipment and data collection techniques will be used throughout the post-construction evaluation to reduce device-to-device variations in measurement technology. For IRI, all data presented are quarter-car simulations.

Post-construction IRI and rutting data were obtained on December 17, 2014, for Crawford Avenue/Pulaski Road. Although winter was quickly closing in, the data were collected prior to the winter freeze of the subgrade. Appendix C presents the dataset of IRI and rutting by study segment, lane, direction, and wheel path. Post-construction profiles are not considered smooth and are well above the historical average of Illinois interstate pavements as indicated from the cumulative frequency curve of 2014. Interstate data are shown in Figure 28 with the overall IRI for the projects. High-quality two-lift interstate pavement overlay construction typically has an IRI of approximately 50 to 60 in/mi. Urban sections tend to have higher IRI values and rural sections tend to be smoother. The data from Crawford Avenue/Pulaski Road (urban) and US 52 segments 2 and 3 (rural) follow this general trend.

Additional IRI and rutting data were collected on March 10, 2015. This data collection run was conducted while the pavement subgrade was frozen. Just prior to the data collection, the pavement surface was starting to experience freeze–thaw conditions. The data represent the worst-case condition for ride from frost-heave conditions. These data are also presented in Appendix C. In general, the frozen profile conditions were the same as immediately after construction for Crawford Avenue/Pulaski Road. For US 52, the section saw a 15 to 20 in/mi rise in IRI for the frozen conditions from post-construction. The main differences in the sections are urban with curb and gutter for Crawford Avenue/Pulaski Road versus rural for US 52.

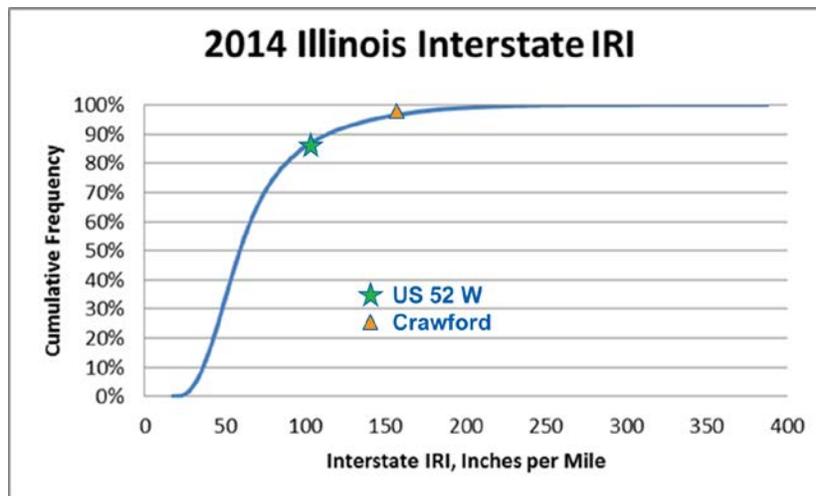


Figure 28. 2014 cumulative frequency curve of Illinois interstate IRI with average project IRI.

From the data, it can be seen that the right wheel path near the pavement edge or curb is the roughest. However, the data trend of higher right wheel path roughness is a phenomenon of all IRI data collected, even in the passing lane of sections and with different data collection devices. The paving grade

reference being placed on the left side of the paver with the operator adjusting the right side for material yield may explain the difference in left and right wheel path smoothness. The statewide interstate data also show a bias of the right lane being rougher. A limited investigation found this to be a common trend in many datasets and not considered an error. Using two longitudinal grade references (one on each side) would likely produce better uniformity between the wheel paths. If using the single reference (one side), maintaining a uniform cross-slope would improve the far wheel path (right wheel path in this case) smoothness. It is important to perform a pre-pave meeting and discuss equipment requirements and use prior to paving.

The outer or right wheel path typically has more distress than the interior left. To improve smoothness, proper repairs of the pavement edge, selecting a proper milling depth to reduce scabbing, using a milling specification to improve teeth milling depth, and adopting similar milling features as the paver with respect to longitudinal smoothness and uniform cross-slope will all lead to an improved ride.

CHAPTER 6: MATERIALS TESTING

6.1 SAMPLING OF MATERIALS

As the projects were constructed, component and mix materials were collected for testing. The components included samples of the neat liquid asphalt binder, virgin aggregates, RAP, and RAS for each mixture being produced. Component aggregate, asphalt binder, and mixture sampling were all done at the HMA plant. All samples were taken jointly from the same sampling area by Illinois Center for Transportation (ICT) and IDOT Bureau of Materials and Physical Research (BMPR) teams. This was done to reduce variability of production throughout the day and to have as nearly identical materials as possible for the battery of test.

6.2 TESTING AND RESULTS

A suite of tests were chosen that would provide the most useful information for the study. The tests were then assigned to the BMPR and ICT laboratories best suited to perform the work. Table 2 presents the suite of tests, specification used, and laboratory performing the work. Note that Illinois has made a number of modifications to standardized tests to better differentiate material test results (IDOT 2015).

Tests were conducted on level binders, each of the surface mixes, and the neat liquid asphalt binder used on the projects. Results of the various tests are presented in Appendix G for Crawford Avenue/Pulaski Road and US 52 projects. Owing to the length of time for testing fatigue, these results are not presented in this report.

Table 2. HMA Mix Test Specifications with Performing Laboratory

| Test | Specification | Laboratory |
|---|---|------------|
| Quantitative extraction of bitumen from bituminous paving mixtures | AASHTO T 164-13 (Illinois Modified 01/01/15) | BMPR |
| Maximum specific gravity of bituminous paving mixtures | AASHTO T 209-12 (Illinois Modified 01/01/15) | BMPR |
| Stability and flow, 150-mm gyratory | ASTM D 1559 (Illinois Modified w/150-mm fixture) | BMPR |
| Marshall stability and flow of asphalt concrete, 4-in sample | ASTM D 1559 | BMPR |
| Cantabro loss | TxDOT Test: Tex-245-F | BMPR |
| Resistance of compacted bituminous mixture to moisture induced damage | AASHTO T 283-07 (2011) (Illinois Modified 01/01/15) | BMPR |
| Texas overlay test | TxDOT Test: Tex-248-F | BMPR |
| Hamburg wheel-track testing of compacted hot-mix asphalt (HMA) | AASHTO T 324-11 (Illinois Modified 01/01/15) | ICT |
| Creep compliance/IDT strength | AASHTO T-322-07 (2011) | ICT |
| Fatigue | AASHTO T-321-14 | ICT |
| Semi-circular bending with flexibility index (I-FIT) | Draft AASHTO TP 105-13 Modified for Intermediate Temperatures | ICT |
| Flow | AASHTO TP 79-13 | ICT |
| Complex modulus | AASHTO T 342-11 | ICT |
| Performance-graded asphalt binder | AASHTO M 320 (Illinois Modified/AASHTO M 332) | BMPR |

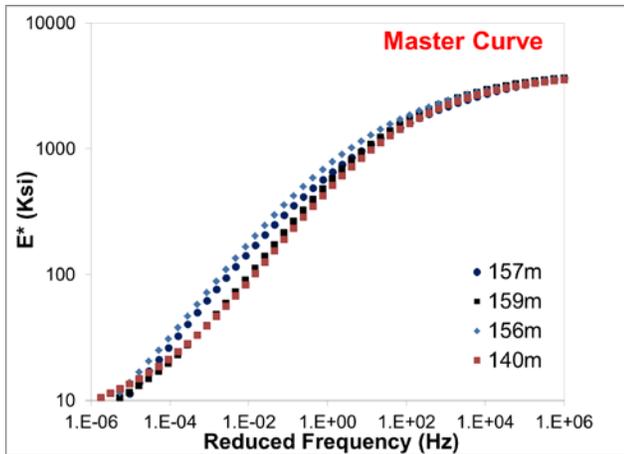
BMPR = Bureau of Materials and Physical Research Laboratory

ICT= Illinois Center for Transportation

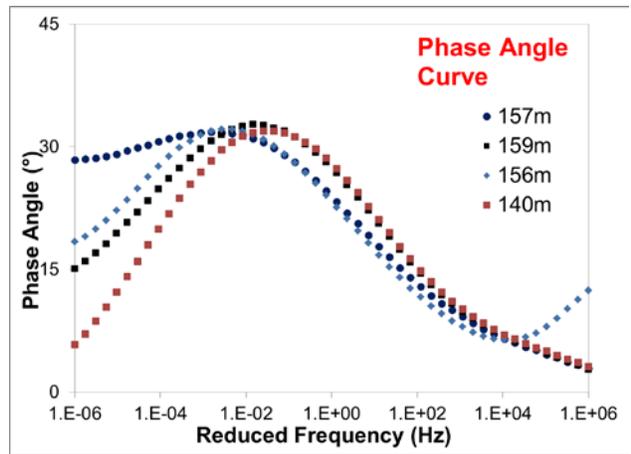
6.2.1 Complex Modulus Test Results

The results of the complex modulus tests for the experimental surface mixes are presented in Figure 29. The legend provides mix details and location. Viscoelastic characteristics of the mixes were investigated using the following plots:

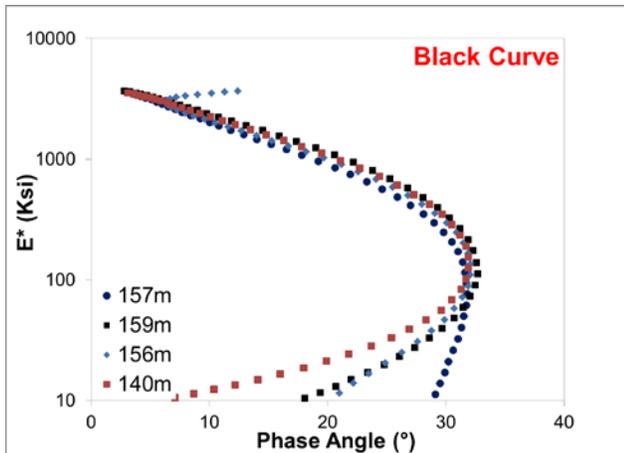
- Complex modulus vs. frequency (master curve): The master curve provides linear viscoelastic characterization of asphalt mixes over a wide range of temperatures and frequencies. Complex modulus values contain elastic and viscous phases of asphalt mixes.
- Phase angle vs. frequency (phase curve): The phase angle curve indicates how the viscous phase of asphalt mixes is evolving with temperature and loading frequency (i.e., 0 degrees—very stiff or rigid; 90 degrees—very fluid or water like).
- Complex modulus vs. phase angle (black curve): The Black curve indicates how complex modulus and phase angle are correlated to each other. These curves are often used to seek fingerprints of modification of asphalt binders, such as polymer modification.
- Storage modulus (elastic part) vs. loss modulus (viscous part) (Cole–Cole curve): Cole–Cole plots are also commonly used in research to study the interaction of complex modulus components (elastic and viscous parts) of the viscoelastic materials.



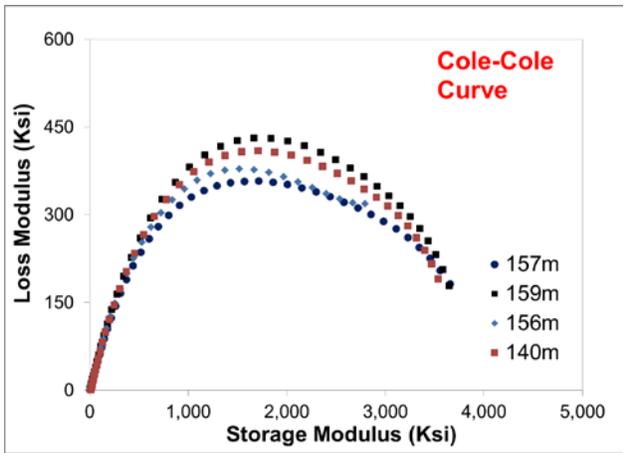
(a)



(b)



(c)



(d)

Figure 29. Viscoelastic characterization of the N70 surface mixes:
 (a) master curve, (b) phase angle, (c) Black curve, (d) Cole–Cole plots.

CHAPTER 7: TOTAL RECYCLE ASPHALT PERFORMANCE

In 2012, IDOT developed the concept of total recycle asphalt (TRA), where up to 60% asphalt binder replacement (ABR) would be allowed and all aggregates would be recycled materials such as reclaimed asphalt pavement (RAP), recycled concrete, or slag by-product. In 2013, the concept had progressed to the point of building three demonstration projects to determine the performance of the mix on low-volume sections. Construction and early performance details have been previously reported, along with performance after the first winter (Lippert et al. 2014). This chapter provides a brief overview of the sections constructed, an update on performance, and data trends of the sections to date.

Three projects using the TRA specification were constructed as part of the 2013 demonstration. The TRA projects are located as follows:

1. 26th Street in Park Forest/Chicago Heights
2. Harrison Street in Hillside
3. Richards Street in Joliet

In addition, a nearby section of Wolf Road constructed during the same period was selected as a comparison section. All projects were on the April 26, 2013, IDOT letting (IDOT 2013). These projects were surveyed for distress before and after construction and annually by BMPR following the bureau's Pavement Distress Manual (IDOT 2012a), with the exception of Wolf Road. Wolf Road was selected as a comparison section after construction of the overlay was complete. For this reason, a "in-person" pre-construction distress survey was not conducted on this segment. Google Street View photo records of 2011 were used to conduct the pre-construction distress survey.

Although the demonstration projects were constructed under similar specifications, the contractor was given a number of recycling options for aggregate. The result was that two projects had similar mixes using recycled concrete and steel slag as raw feedstock aggregate, and one used only steel slag. Table 3 provides the resulting mixes, asphalt binder selection, and ABR.

Table 3. 2013 TRA Project Mix Summary

| | 26th Street | Harrison Street | Richards Street | Wolf Road |
|---|--------------------|------------------------|------------------------|------------------|
| Material | Percent | Percent | Percent | Percent |
| Crushed Stone (Coarse) | Not Used | Not Used | Not Used | 51.3 |
| Stone Sand | Not Used | Not Used | Not Used | 8.0 |
| Natural Sand | Not Used | Not Used | Not Used | 10.0 |
| Fine FRAP | 51.5 | 26.0 | 24.0 | 5.0 |
| Coarse FRAP | Not Used | 27.0 | 6.0 | 25.0 |
| Crushed Concrete | 30.0 | 27.0 | Not Used | Not Used |
| Steel Slag (Fine) | Not Used | Not Used | 24.0 | Not Used |
| Steel Slag (Coarse) | 15.0 | 15.0 | 45.5 | Not Used |
| Mineral Filler | Not Used | Not Used | 0.5 | 0.7 |
| Reclaimed Asphalt Shingles (RAS) | 3.5 | 5.0 | Not Used | Not Used |
| Added Asphalt Grade | PG 52-28 | PG 52-28 | PG 58-28 | PG 58-28 |
| Added Asphalt Content (PG XX-28) | 2.7 | 2.7 | 3.4 | 4.7 |
| Total AC Content | 6.7 | 6.5 | 5.4 | 5.9 |
| Total ABR | 60 | 56 | 37 | 20 |
| Minimum Air Voids | 3.0 | 3.0 | 3.0 | 4.0 |
| Voids in Mineral Aggregate (VMA) | 15.1 | 14.9 | 14.7 | 14.9 |
| N-Design | 50 | 50 | 50 | 70 |

Richards Street did not use RAS as part of the ABR, and steel slag was the feedstock aggregate. The result was that Richards Street had significantly less ABR (37%) than Harrison Street or 26th Street at 56% and 60%, respectively.

7.1 TOTAL RECYCLE ASPHALT DEMONSTRATION PROJECT DETAILS

Cross-sections of the existing and proposed improvement are located in Appendix A. In the following subsections, location maps and project descriptions are provided for each project.

7.1.1 26th Street in Chicago Heights, Illinois

This project is located on 26th Street (FAU 1633) and begins approximately 230 ft east of the centerline of Western Avenue and extends easterly to a point approximately 80 ft west of the centerline of East End Avenue, for a total distance of 10,640 ft (2.02 mi). Let as Contract 60L62, the project is located in the Village of Park Forest and the City of Chicago Heights in Cook County. Figure 30 presents the location of the section.

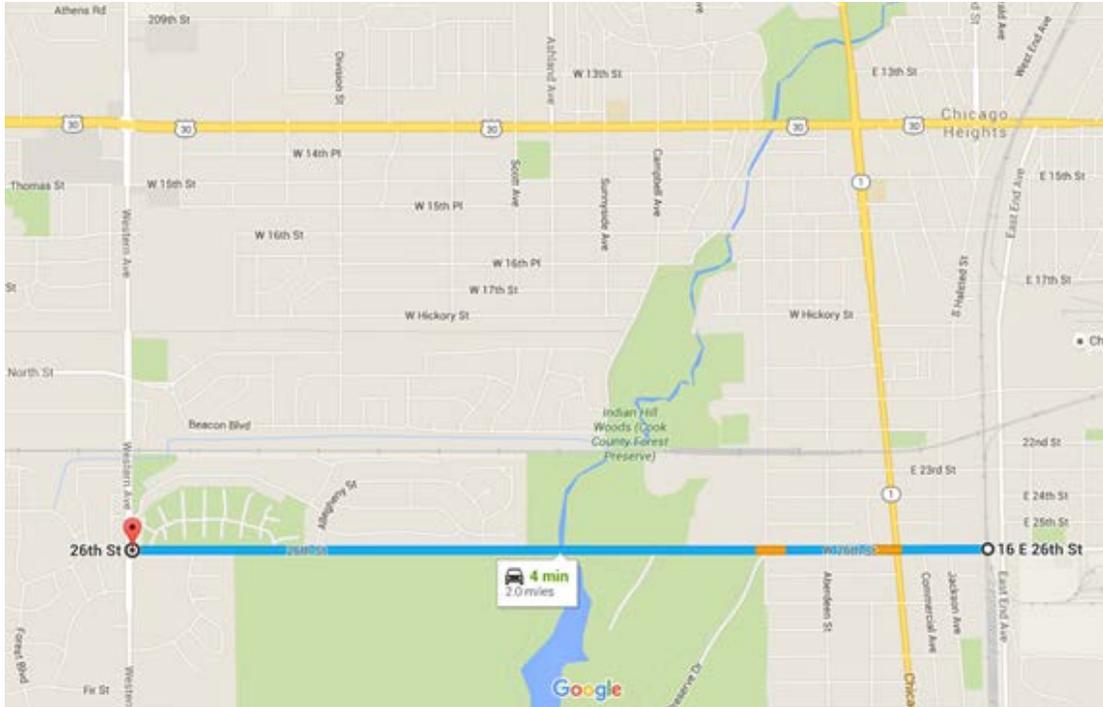


Figure 30. Improvement on 26th Street (map data: Google).

7.1.2 Harrison Street in Hillside, Illinois

This project begins at a point on the centerline of Harrison Street (FAU 1427) approximately 77 ft north of IL 38 (Roosevelt Road) and extends north and then east to approximately 59 ft west of Wolf Road. Let as Contract 60N67, the project is located within the Village of Hillside in Cook County. This project has a gross and net length of 5,927.6 ft (1.12 mi). Figure 31 presents the location of the section.

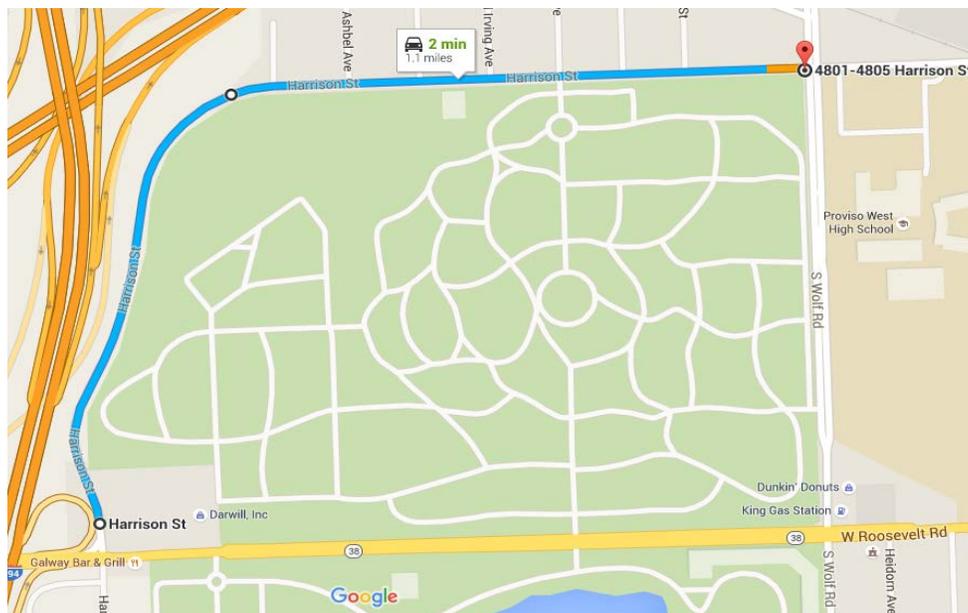


Figure 31. Improvement on Harrison Street (map data: Google).

7.1.3 Richards Street in Joliet, Illinois

The resurfacing improvement of Richards Street begins at 5th Avenue and extends in a southerly direction approximately 5,364 ft (1.015 mi) to Manhattan Road. Let as Contract 60P70, the improvement is located in the City of Joliet and Lockport Township, Will County. Figure 32 presents the location of the section.

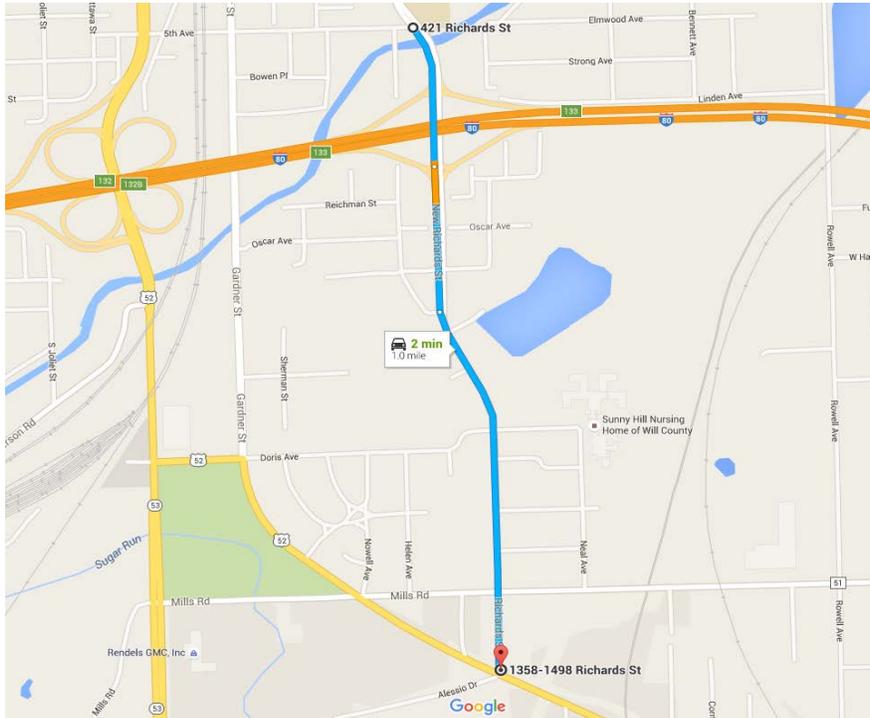


Figure 32. Improvement on Richards Street (map data: Google).

7.1.4 Wolf Road in Hillside, Illinois (Comparison Section)

The resurfacing improvement of this project begins at a point on the centerline of Wolf Road at IL 38 (Roosevelt Road) and extends in a northerly direction to 135 ft north of Harrison Street. Let as Contract 60M30, the project is within the Village of Hillside in Cook County. This project has a gross and net length of 2,638 ft (0.50 mi). Figure 33 presents the location of the section.

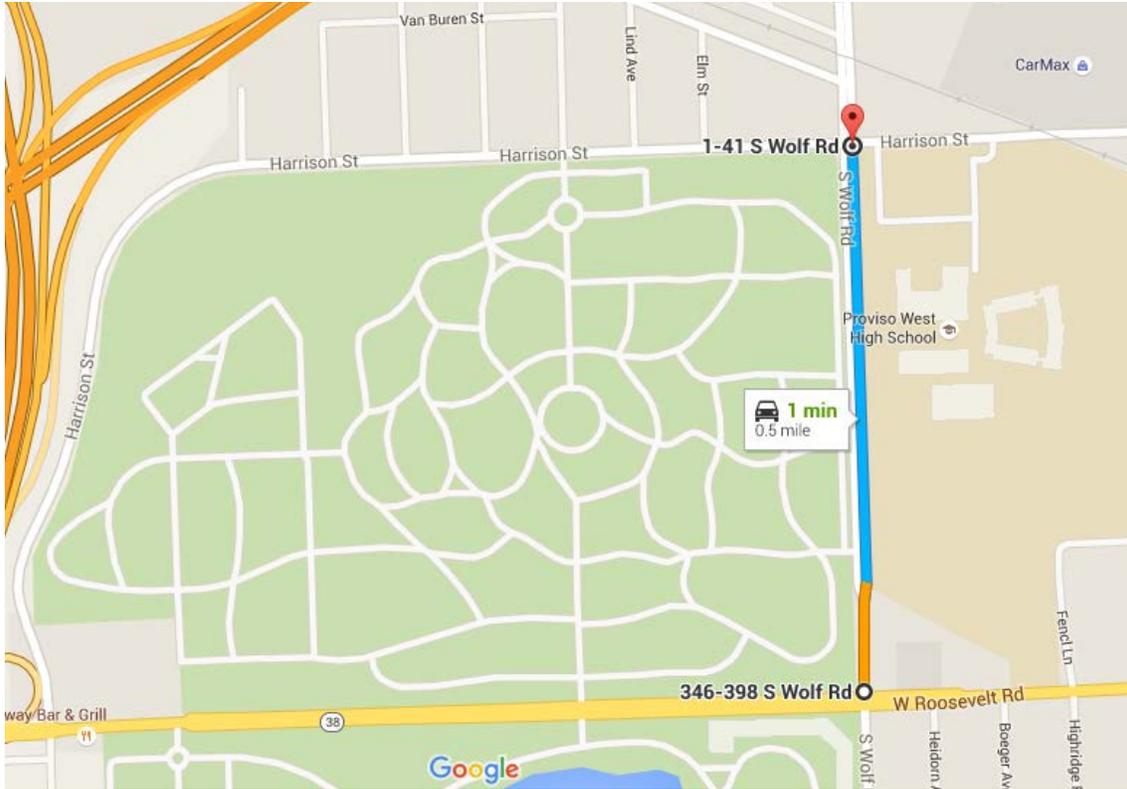


Figure 33. Improvement on Wolf Road (map data: Google).

7.2 PAVEMENT PERFORMANCE

7.2.1 Distress Surveys

Distress survey data have been collected on the sections using established distress criteria (IDOT 2012a). The datasets consist of pre-construction (2013), post-construction (2013), spring 2014, and spring 2015. Summaries of the distress surveys by section and date are presented in Appendix H. To present data trends, the data summaries have been plotted on stacked bar charts by distress type, as shown in Figures 34 through 44. As noted above, the preconstruction distress surveys of Wolf Road were conducted via Google Street View. The survey was limited to pavement joints, cracks, and patches. The number of cracks and joints are considered to be accurate; however, the patch area is an estimate based on policy minimum patch lengths and estimated lengths of longer patches. Wolf Road was extensively patched prior to overlay; therefore, Figure 38 was developed to present post-construction patching conditions.

Part of the annual distress survey is to take photos at similar locations with each survey to provide a visual progression of distress with time. Typical photos representing each section are presented in Appendix I.

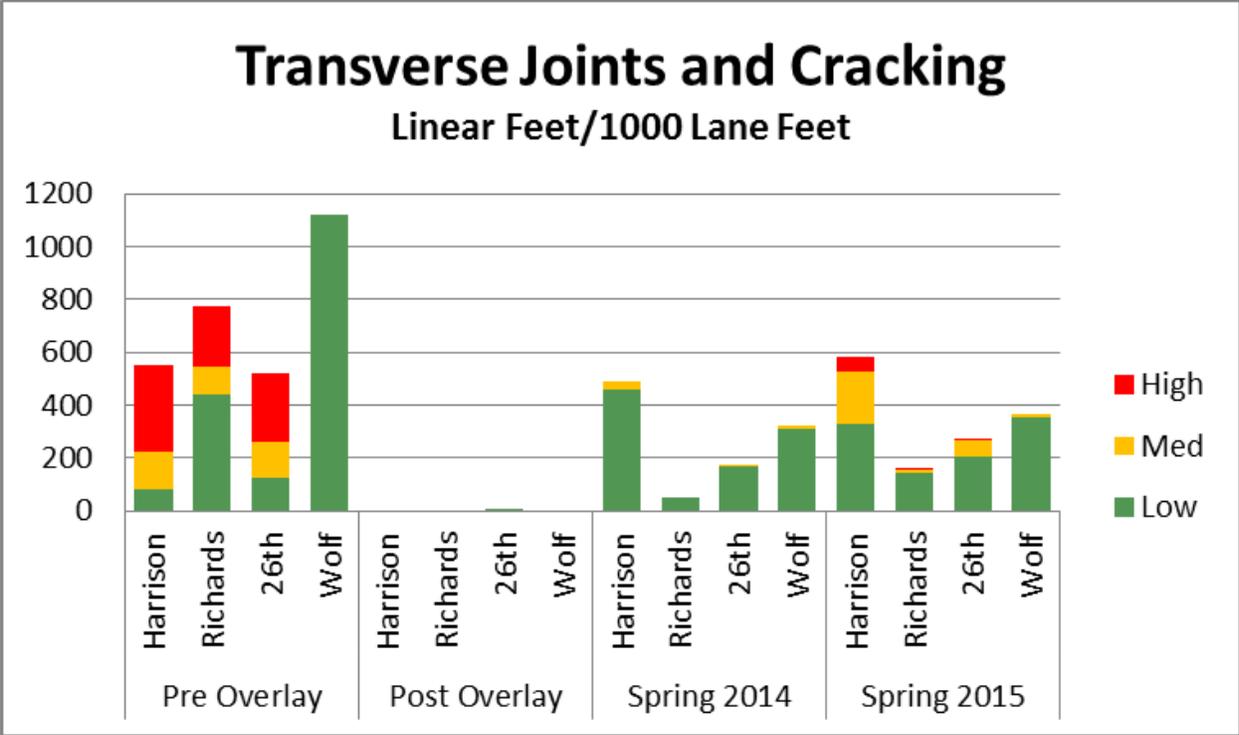


Figure 34. Transverse joints and cracks by distress level for TRA projects.

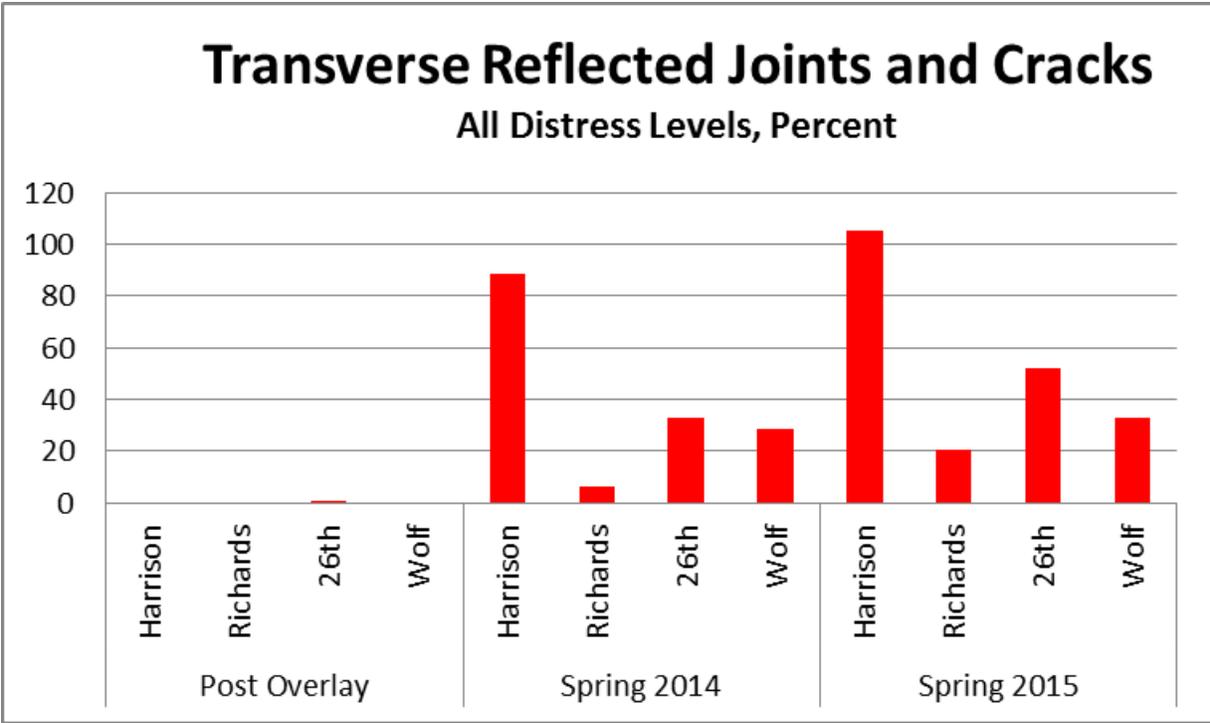


Figure 35. Percentage of crack and joint length reflected through overlay for TRA projects.

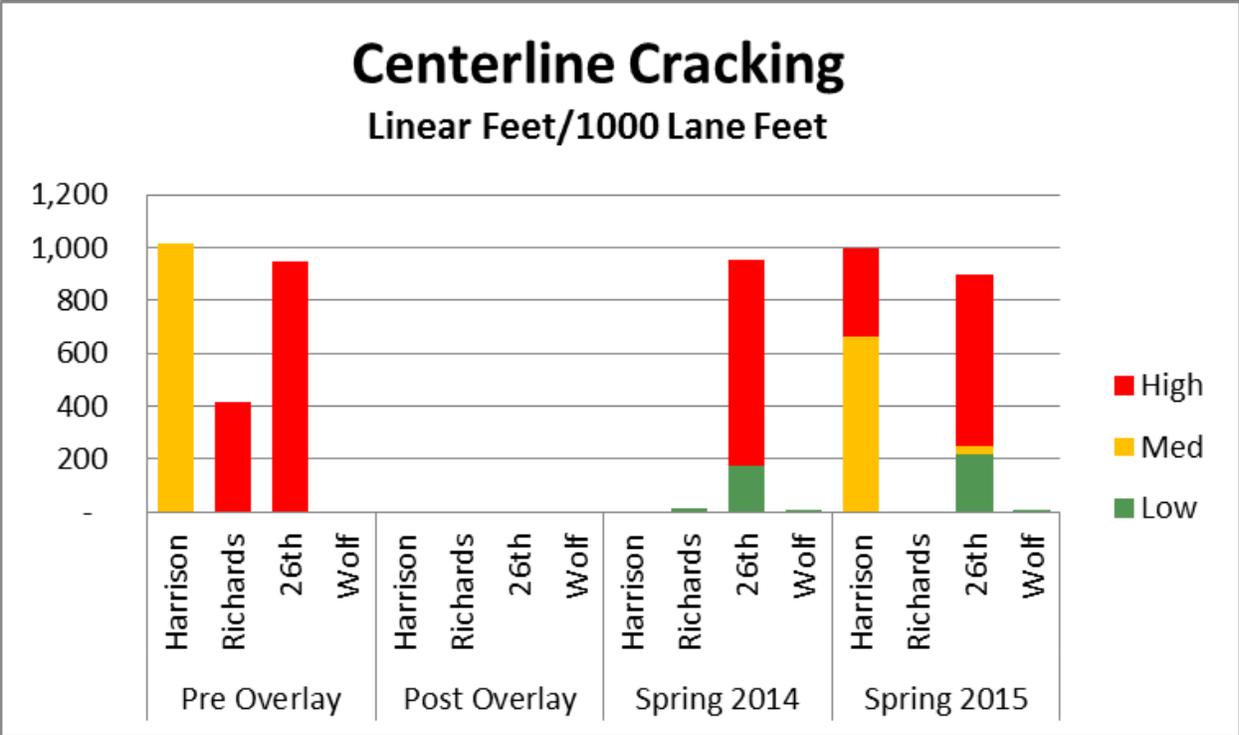


Figure 36. Centerline cracking by distress level for TRA projects.

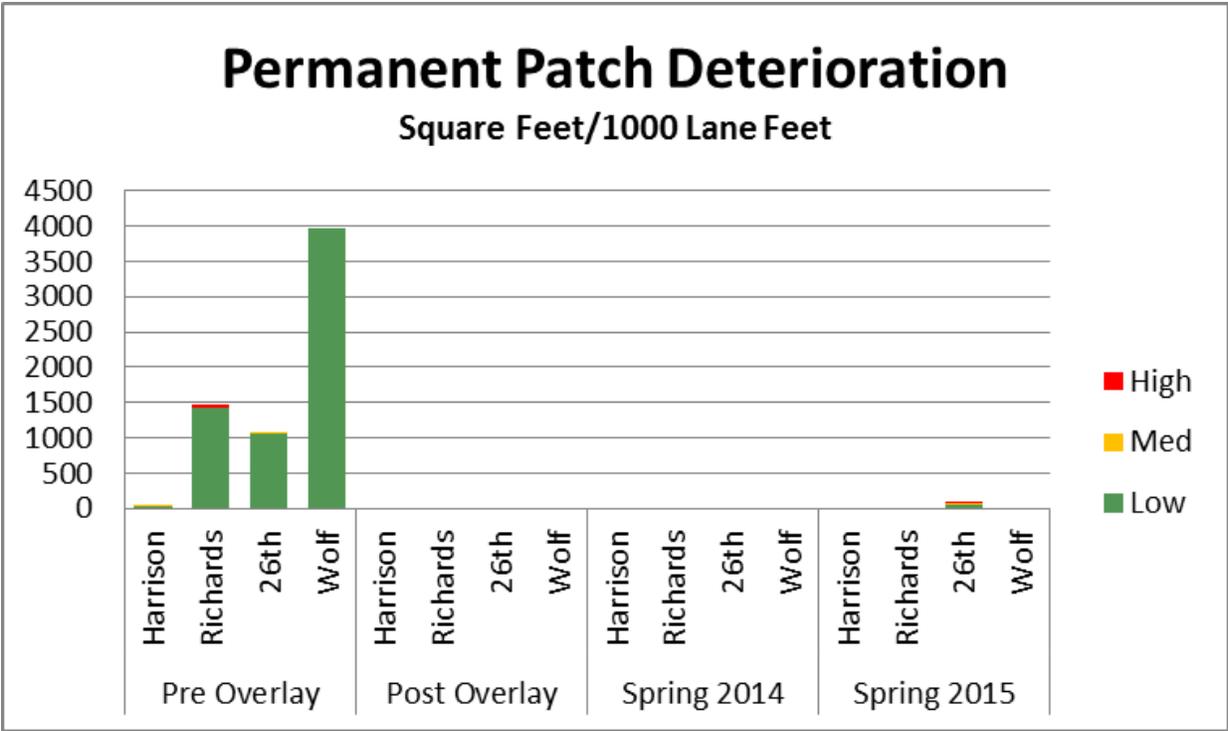


Figure 37. Permanent patching deterioration for TRA projects.

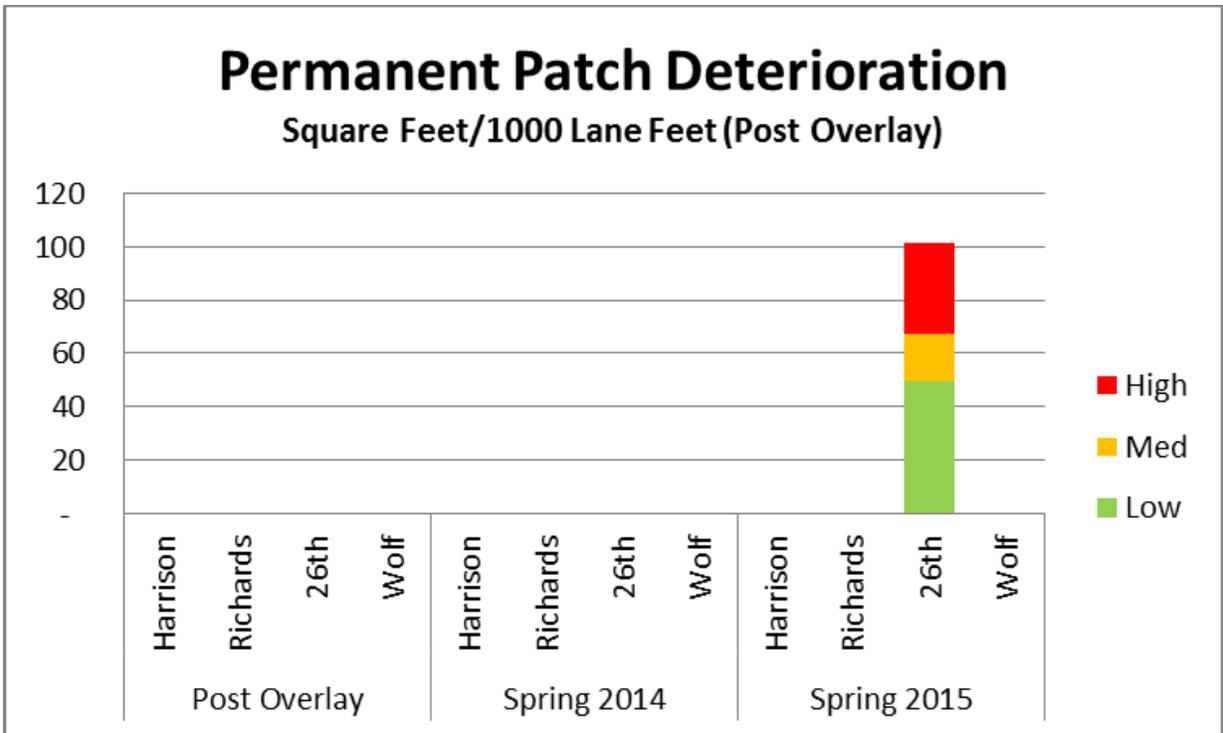


Figure 38. Permanent patching deterioration for TRA projects (post-overlay only).

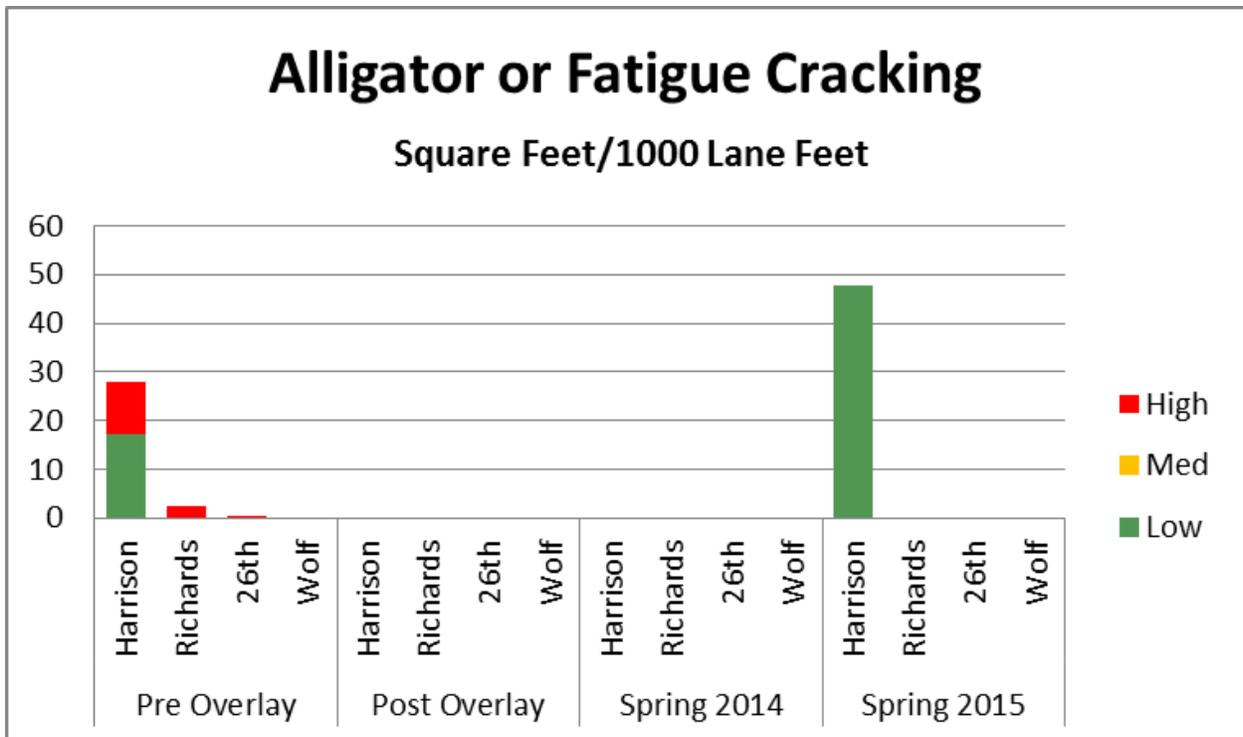


Figure 39. Centerline cracking by distress level for TRA projects.

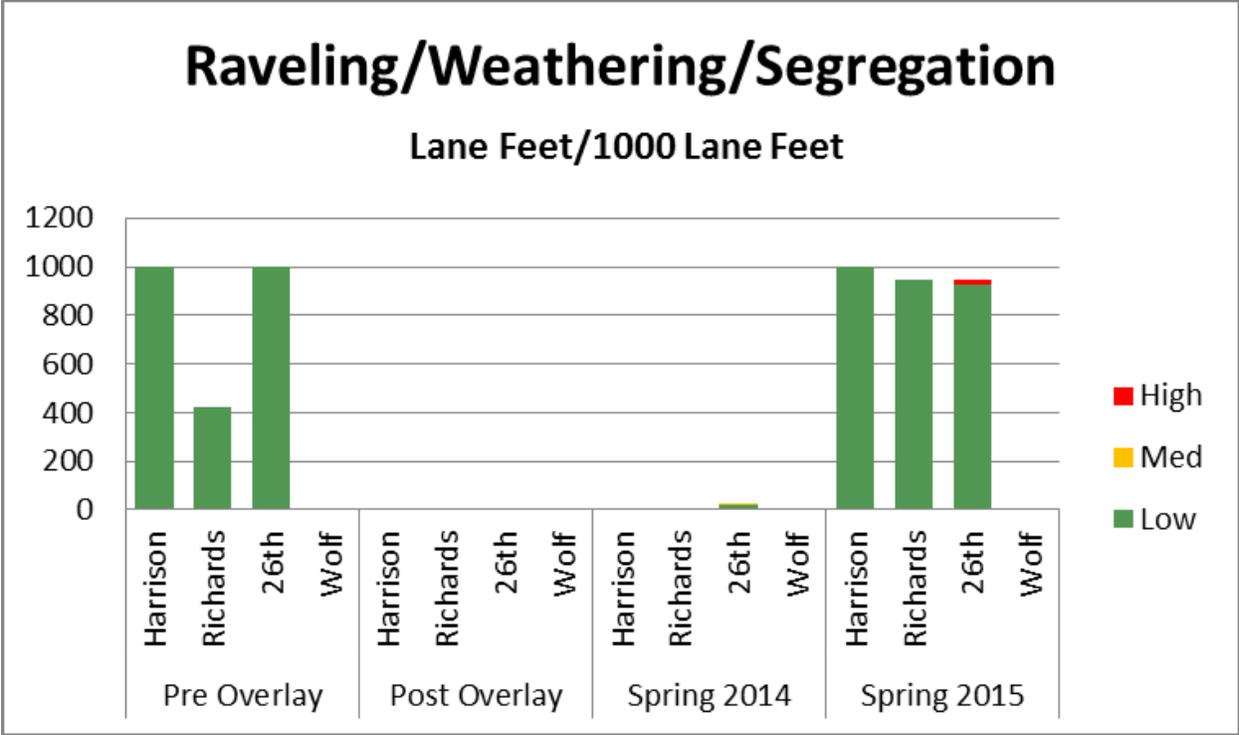


Figure 40. Raveling/weathering/segregation by distress level for TRA projects.

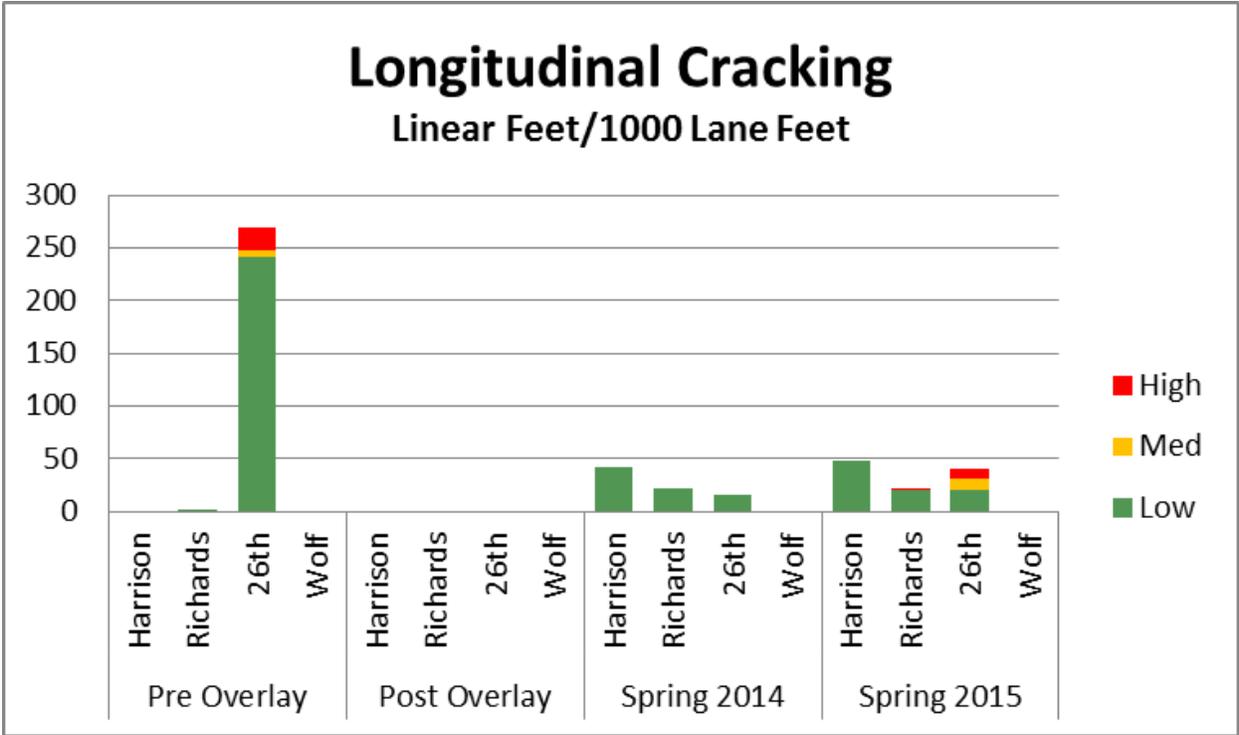


Figure 41. Longitudinal cracking by distress level for TRA projects.

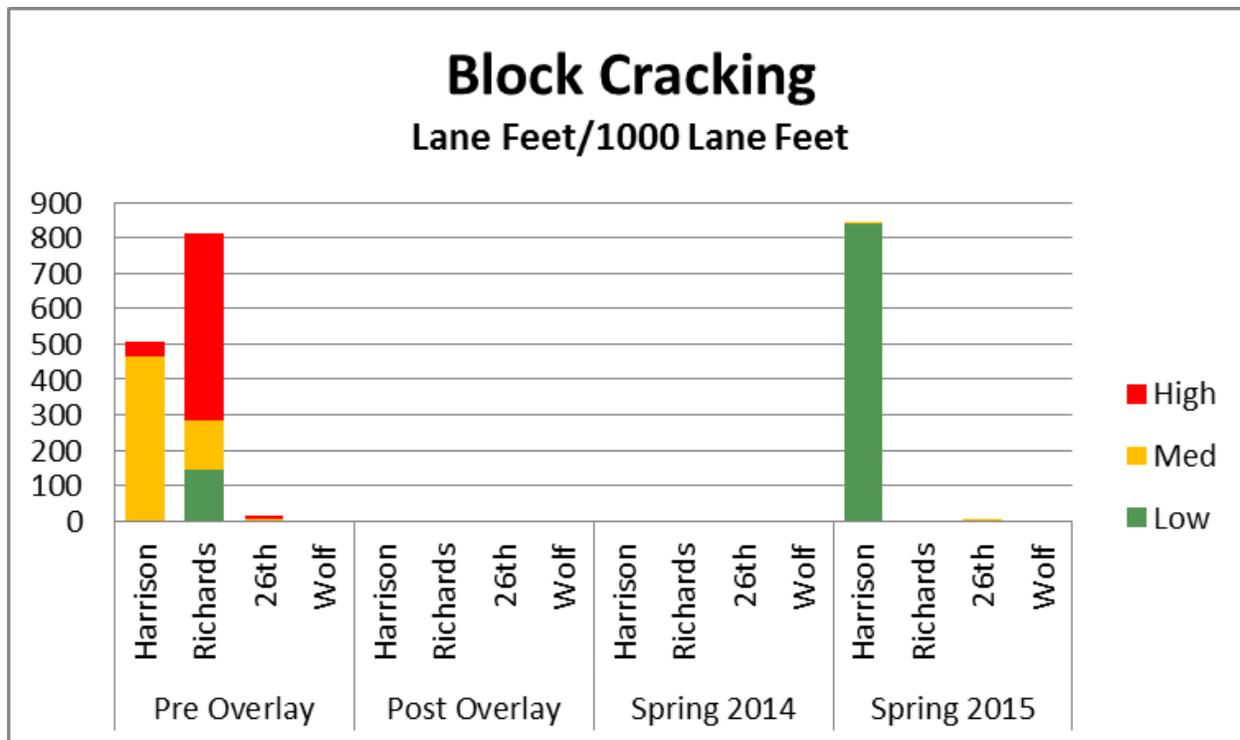


Figure 42. Block cracking by distress level for TRA projects.

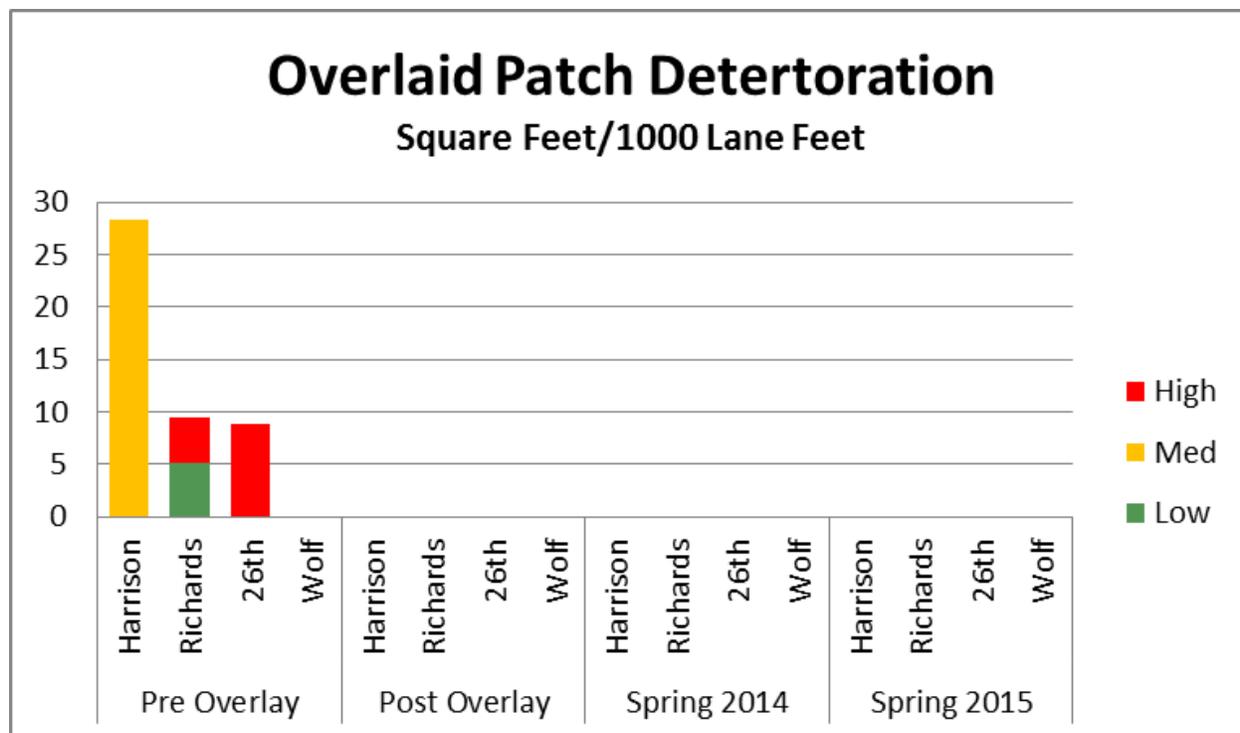


Figure 43. Overlaid patch deterioration by distress level for TRA projects.

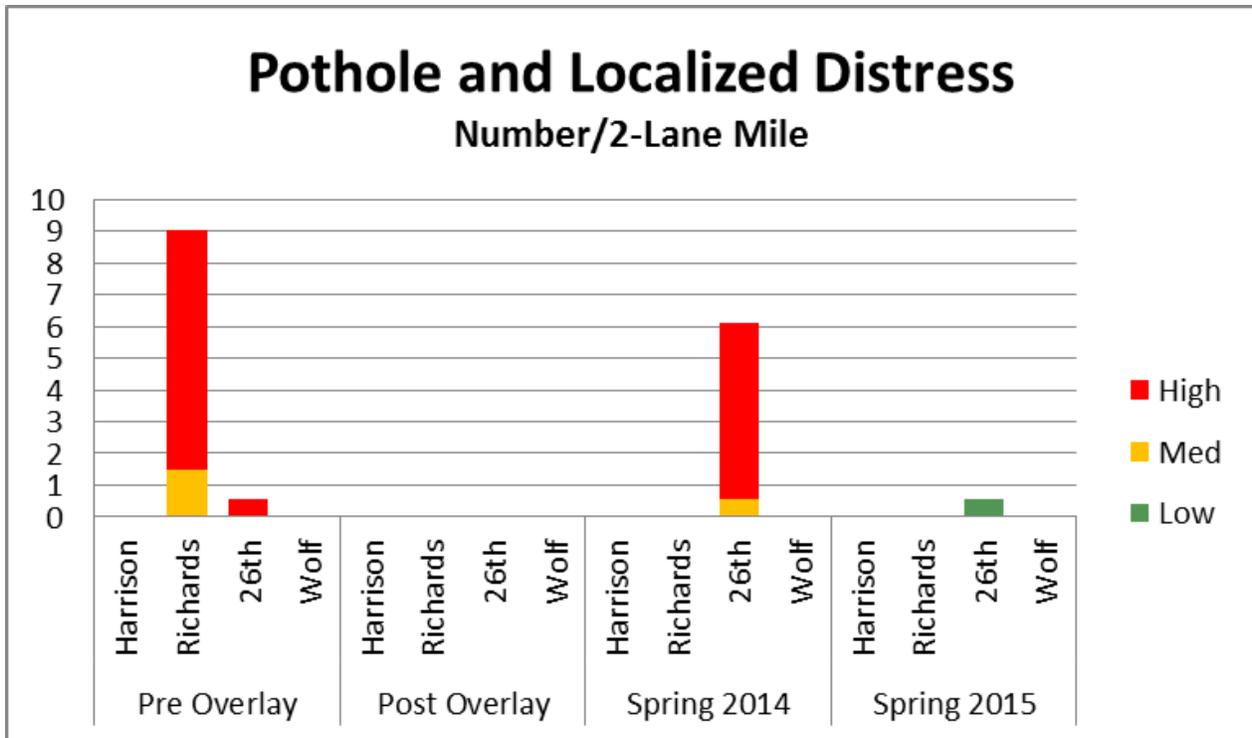


Figure 44. Pothole and localized distress by distress level for TRA projects.

7.2.2 Performance Summary

Based on data collected to date, along with the data presented in Figures 34 through 44, and Appendixes H and I, the following summary comments are offered.

7.2.2.1 26th Street Pavement Performance

After the winter of 2013–2014, it was evident that the centerline joint was not performing as expected; it showed significant amounts of high-severity distress along the project. The extent and severity of the centerline distress was more common to a pavement many years older. Several areas of the joint were repaired by milling partial depth along the centerline joint and replacing the material with new HMA. In 2014, approximately 20% of the joint length was treated that way to repair the most distressed areas. Unfortunately, the repair work was low-quality and showed premature distress in the spring 2015 survey. The loss of material at the centerline joint resulting in high severity ratings and the existence of raveling/weathering/segregation distress throughout the section is consistent with pavements constructed with a “dry” mix. Dry mixes are those for which there is insufficient asphalt binder available to coat the aggregate properly, resulting in a thin film thickness. Recycled concrete aggregate and slag aggregates may have absorption rates greater than natural aggregates and contribute to this problem. Appendix H provides a summary of distress data progression from 2014 through 2015.

7.2.2.2 Harrison Street Pavement Performance

After the winter of 2013–2014, little distress was noted other than transverse cracking from underlying joints and cracks. The pre-overlay survey indicated that the majority of transverse joints and cracks were distressed at a high severity. By measuring reflective cracking as a percentage of linear feet of pre-overlay transverse joints and cracks to the linear feet of cracks in the overlay, it was found that the

reflection rate was 88% after the first winter and 105% after the second winter. Note that patching performed as part of the improvement increased the number of possible reflective joints in the section and contributes to values over 100%. Also, after the second winter, other distresses such as block cracking, raveling/weathering/segregation, and centerline cracking began to appear. Appendix H provides a summary of distress data progression to 2015.

7.2.2.3 Richards Street Pavement Performance

After the winter of 2013–2014, little distress was noted other than transverse cracking from underlying joints and cracks at a rate of 7% and an area of fatigue cracking representing 1% of the lane-feet of the section. After the second winter, additional fatigue cracking was evident and at a higher severity level totaling just under 3% of the section lane-feet. Fatigue cracking is typically an indication of a structural and material problems. Other distresses such as raveling/weathering/ segregation and longitudinal cracking began to appear in 2015, which are more closely related to the properties of the surface material. At this point, comparing the three TRA sections with each other, Richards Street is the best-performing, with the lowest amount of pavement distress. Appendix H provides a summary of distress data progression to 2015.

7.2.2.4 Wolf Road Pavement Performance

After the winter of 2013–2014, little distress was noted other than transverse cracking from underlying joints and cracks at a rate of 29%. After the second winter, additional transverse cracking was evident at a rate of 33%. Other distresses are absent from the section. Comparing the three TRA sections with Wolf Road, Wolf Road is performing markedly better at this point than any of the TRA sections. It should be noted that Wolf Road was extensively patched in the years prior to the overlay in this study. As a result, the concrete pavement upon which the overlay was placed was in better condition than the underlying pavement of the TRA sections under study.

CHAPTER 8: SUMMARY, OBSERVATIONS, AND RECOMMENDATIONS

8.1 SUMMARY

The main purpose of this study is to document pre-existing conditions and construction procedures, characterize the materials used in the construction, and monitor the resulting performance of five experimental sections. The experiments used hot-mix asphalt (HMA) surface mixes that contain reclaimed asphalt pavement (RAP) with and without recycled asphalt shingles (RAS) at a variety of asphalt binder replacement (ABR) levels. To counter brittle asphalt from recycled sources, softer grades of PG asphalt binders were evaluated. This report serves to document the construction of two of the five projects—namely Crawford Avenue/Pulaski Road and the Western segment of US 52. Also provided is an update of the original total recycle asphalt (TRA) projects that contained 100% recycled aggregate.

8.2 KEY OBSERVATIONS

Cold-milling heads and the resulting surfaces do not have sufficient controls and allow deep grooving of the pavement surface when well-worn teeth are replaced with isolated new teeth in the milling head.

Tack coat applications have greatly improved since the adoption of new specifications; however, there is still slight “zebra striping” of the tack across the mat.

Design seems to be placing sufficient quantity of patching on plans; however, the plan quantities were not fully used for either Crawford Avenue/Pulaski Road or US 52.

The amount of crack filling seems excessive for both projects, with wide reflective distress indicating that some cracks and/or joints that were filled should have been patched, or that slightly deeper milling would have removed the damaged asphalt. Coring during the planning phase would assist in engineering the milling depth.

The partial-width level binder (one-half lane on Crawford Avenue/Pulaski Road and 1 ft less than surface width on US 52, producing a thickness “step” in the surface lift) is resulting in hairline cracking of the surface at the edge of the level binder. This cross-section detail was adopted early in the use of 4.75 mixes in District 1 to prevent the surface mix from moving on the very smooth level binder. For these projects, the surface course being placed did not seem to move under the rollers. Improved tack coat applications may have mitigated the need for the “step” detail.

Pre-existing conditions of the 2013 TRA projects were worse than the comparison section on Wolf Road.

While the 2013 TRA projects under observation are limited, there does appear to be a correlation between ABR and percentage of transverse joint and crack reflection rates. Additional data from the 2014 let projects will greatly assist in the evaluation of this relationship. However, this needs to be reviewed always in the context of exiting pavement conditions

For the 2013 TRA projects, distresses seen (i.e., centerline cracking and raveling/weathering/segregation) are typical of pavement with low asphalt film thickness. This suggests that the asphalt binder “available” in some of the mixes was below levels desirable for good performance.

8.3 RECOMMENDATIONS

Core the existing overlay to determine depth of cracks and asphalt layers, then adjust mill depth accordingly, would assist in reducing thin HMA layers that degrade under traffic.

Consider adopting cold-milling specifications that limit the variability of the milled surface. Such specifications are used by other states and are available.

Monitor tack coat applications for uniformity. The amount of “zebra striping” observed on these projects would be considered the maximum limit that would be allowed.

Patch any cracks/joints wider than 2 in and with a length of 3 or more ft.

Reevaluate the need for partial-width use of level binder. If partial-width use of level binder is to continue, consider adding a tapered edge detail by hand-luting.

Use grade reference devices of adequate length and consider using them on both sides. At a minimum, discourage “chasing yield” and implement cross-slope controls.

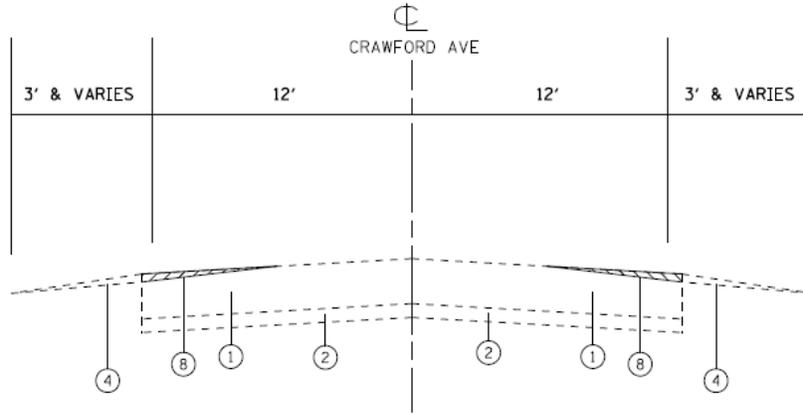
REFERENCES

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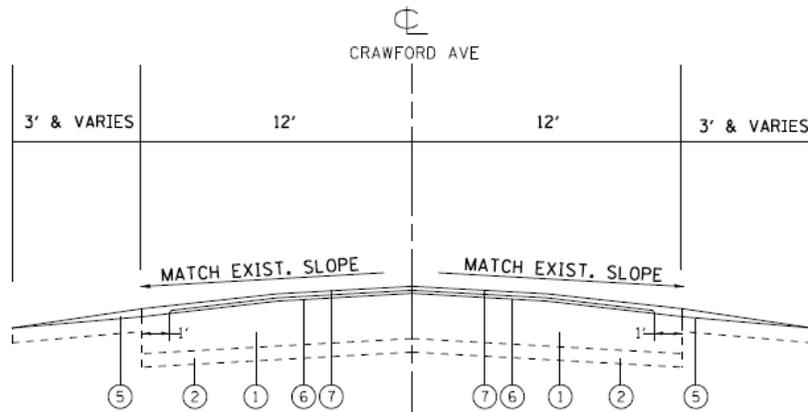
APPENDIX A: EXISTING AND PROPOSED CROSS-SECTIONS

APPENDIX A-1: CRAWFORD AVENUE/PULASKI ROAD

SEGMENT 1: SOUTHERN TWO-LANE SECTION



EXISTING TYPICAL CROSS SECTION
CRAWFORD AVE. (US 6 TO I-80)
 FROM STA. 12+81 TO 18+88



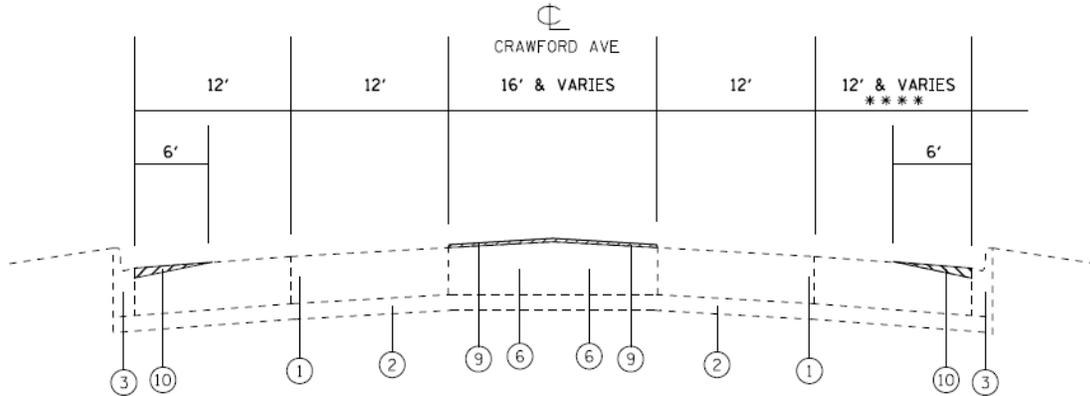
PROPOSED TYPICAL CROSS SECTION
CRAWFORD AVE. (US 6 TO I-80)
 FROM STA. 12+81 TO 18+88

LEGEND

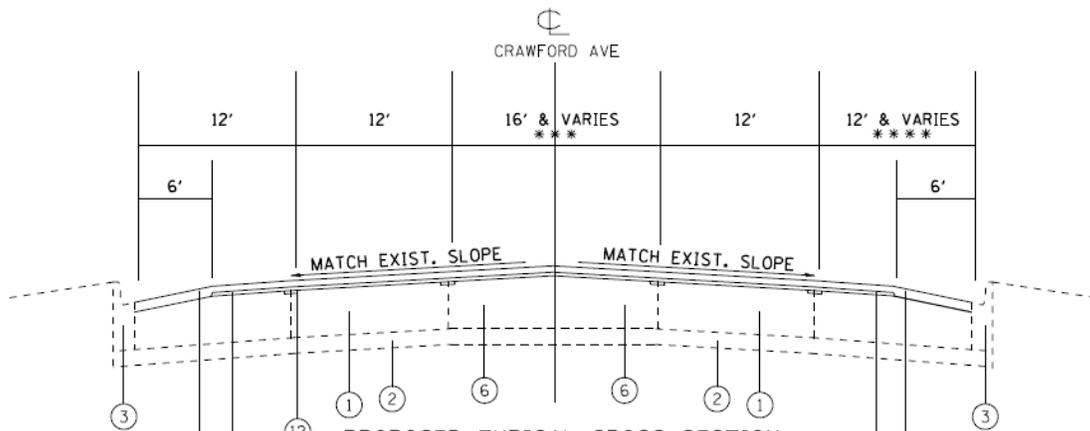
- ① EXISTING 10" PCC PAVEMENT
- ② EXISTING SUB-BASE GRANULAR MATERIAL 6"
- ③ EXISTING COMB. CURB & GUTTER, TYPE B-6.24
- ④ EXISTING AGGREGATE SHOULDER
- ⑤ PROPOSED AGGREGATE WEDGE SHOULDER, TYPE B (SEE AGGREGATE SHOULDER DETAIL)
- ⑥ PROPOSED POLYMERIZED LEVELING BINDER, IL-4.75, N50, 1"
- ⑦ PROPOSED HOT-MIX ASPHALT SURFACE COUSE. MIX "D", N70, 1 1/2"
- ⑧ PROPOSED P.C.C. SURFACE REMOVAL (VAR. DEPTH)
- ⑨ EXISTING HMA SHOULDER, 8"
- ⑩ PROPOSED HMA SHOULDER (SEE H.M.A. SHOULDER DETAIL), 1 1/2"
- ⑪ PROPOSED HMA SURFACE REMOVAL, 1 1/2"

APPENDIX A-2: CRAWFORD AVENUE/PULASKI ROAD

SEGMENT 2: CENTER MULTI-LANE SECTION BETWEEN I-57 AND I-80



EXISTING TYPICAL CROSS SECTION
CRAWFORD AVE. (US 6 TO I-80)
 FROM STA. 37+80 TO STA 59+64
 FROM STA. 73+60 TO STA 80+32



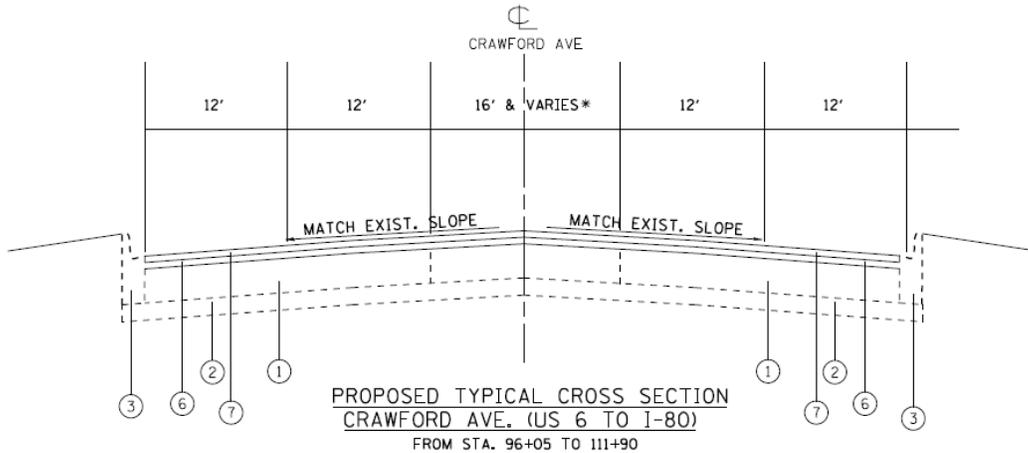
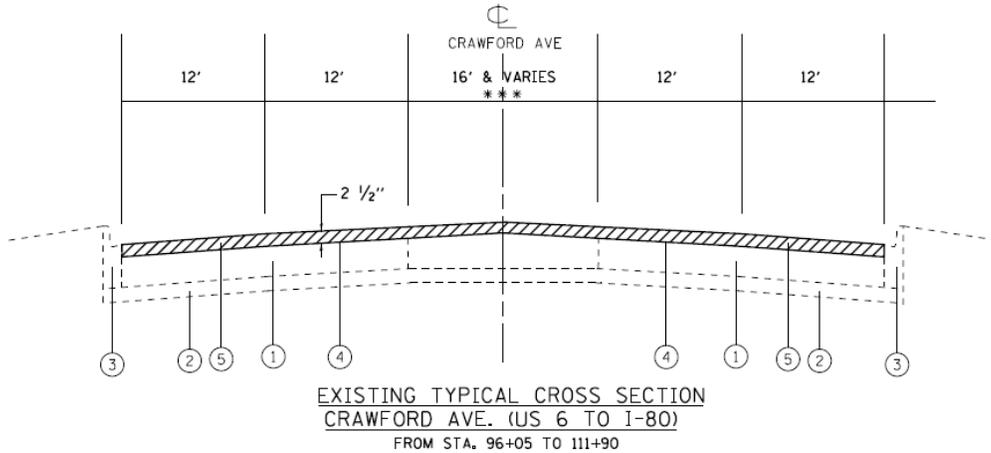
PROPOSED TYPICAL CROSS SECTION
CRAWFORD AVE. (US 6 TO I-80)
 FROM STA. 37+80 TO STA 59+64
 FROM STA. 73+60 TO STA 80+32

LEGEND

- ① EXISTING 10" PCC PAVEMENT
- ② EXISTING SUB-BASE GRANULAR MATERIAL 6"
- ③ EXISTING COMB. CURB & GUTTER, TYPE B-6.24
- ④ EXISTING COMB. CURB & GUTTER, TYPE M-2.12
- ⑤ EXISTING P.C.C. MOUNTABLE CONCRETE MEDIAN
- ⑥ EXISTING P.C.C. CONCRETE CORRUGATED MEDIAN
- ⑦ PROPOSED POLYMERIZED LEVELING BINDER, IL-4.75, N50, 1"
- ⑧ PROPOSED HOT-MIX ASPHALT SURFACE COUSE, MIX "D", N70, 1 1/2"
- ⑨ PROPOSED MEDIAN REMOVAL, PARTIAL DEPTH
- ⑩ PROPOSED P.C.C. SURFACE REMOVAL (VAR. DEPTH)
- ⑪ PROPOSED POLYMERIZED LEVELING BINDER, IL-4.75, N50, VARIABLE DEPTH
- ⑫ PROPOSED PARTIAL DEPTH REMOVAL, 3" (SEE DETAIL A)
- ⑬ PROPOSED BINDER COURSE, IL-19.0, N70 (SEE DETAIL A)

APPENDIX A-3: CRAWFORD AVENUE/PULASKI ROAD

SEGMENT 3: MULTI-LANE SECTION NORTH OF I-57

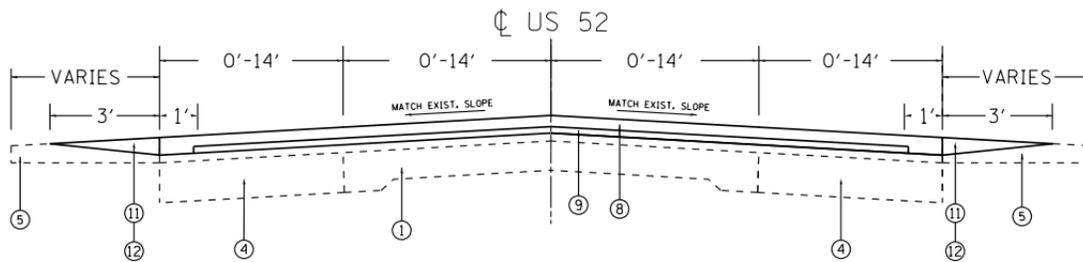
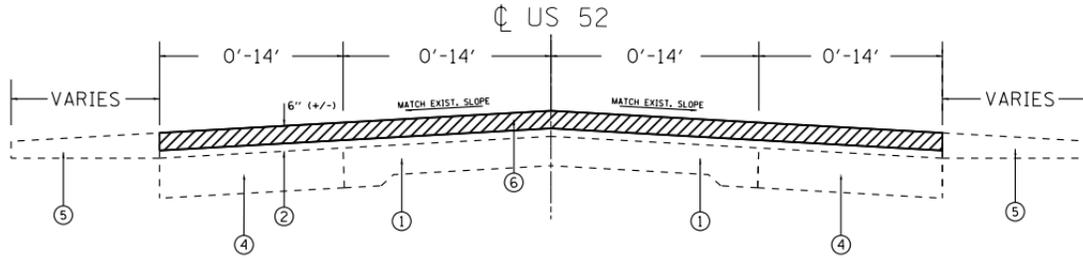


LEGEND

- ① EXISTING 10" PCC PAVEMENT
- ② EXISTING SUB-BASE GRANULAR MATERIAL 6"
- ③ EXISTING COMB. CURB & GUTTER, TYPE B-6.24
- ④ EXISTING HOT MIX ASPHALT PAVEMENT, ± 2 1/2"
- ⑤ PROPOSED H.M.A. REMOVAL ± 2 1/2"
- ⑥ PROPOSED POLYMERIZED LEVELING BINDER, IL-4.75, N50, 1"
- ⑦ PROPOSED HOT-MIX ASPHALT SURFACE COUSE, MIX "D", N70, 1 1/2"

APPENDIX A-4: US 52 (IL 53 TO LARAWAY ROAD)

SEGMENT 1: DORIS AVENUE FOUR-LANE SEGMENT

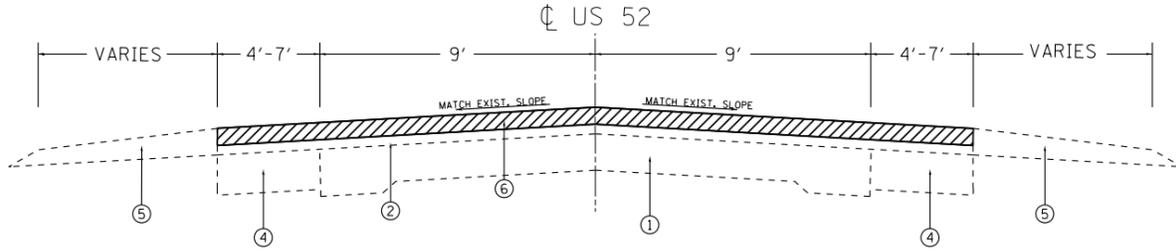


LEGEND

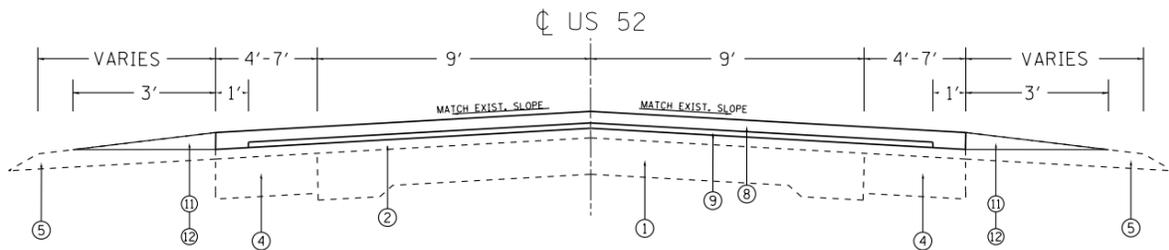
- ① EXIST. PCC BASE COURSE, 9''(±)
- ② EXIST. HOT-MIX ASPHALT SURFACE (BEFORE MILLING), 6''(±)
- ②A EXIST. HOT-MIX ASPHALT SURFACE (BEFORE MILLING), 2 1/2''(±)
- ③ EXIST. BIT. SHOULDER
- ④ EXIST. BIT. BASE COURSE WIDENING
- ⑤ EXIST. AGGREGATE SHOULDER TYPE B
- ⑥ PROP. HOT-MIX ASPHALT SURFACE REMOVAL - 2 1/4''
- ⑦ PROP. HOT-MIX ASPHALT SURFACE REMOVAL - 2 1/2''
- ⑧ PROP. HOT-MIX ASPHALT SURFACE COURSE, MIX "D", N70, 1 1/2''
- ⑨ PROP. POLYMERIZED LEVELING BINDER (MACHINE METHOD), MIX "D", N50, 3/4''
- ⑩ PROP. POLYMERIZED LEVELING BINDER (MACHINE METHOD), MIX "D", N50, 1''
- ⑪ PROP. AGGREGATE WEDGE SHOULDER, TYPE B
- ⑫ PROP. GRADING AND SHAPING SHOULDERS

APPENDIX A-5: US 52 (IL 53 TO LARAWAY ROAD)

SEGMENT 2: DORIS AVENUE TO LARAWAY ROAD



EXISTING TYPICAL SECTION
STATION:
18+85 TO 144+70
158+85 TO 185+18



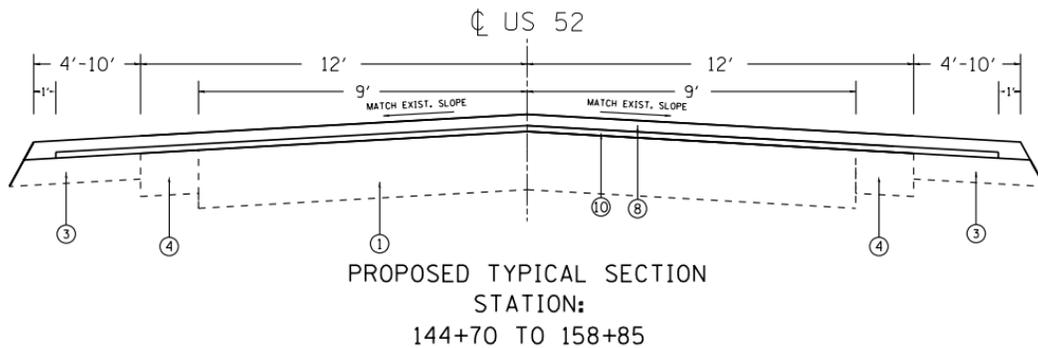
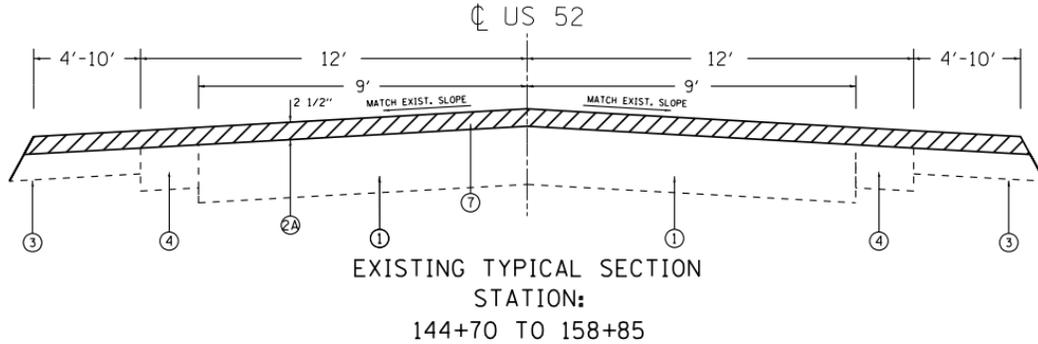
PROPOSED TYPICAL SECTION
STATION:
18+85 TO 144+70
158+85 TO 185+18

LEGEND

- ① EXIST. PCC BASE COURSE, 9''(±)
- ② EXIST. HOT-MIX ASPHALT SURFACE (BEFORE MILLING), 6''(±)
- ③ EXIST. BIT. SHOULDER
- ④ EXIST. BIT. BASE COURSE WIDENING
- ⑤ EXIST. AGGREGATE SHOULDER TYPE B
- ⑥ PROP. HOT-MIX ASPHALT SURFACE REMOVAL - 2 1/4''
- ⑦ PROP. HOT-MIX ASPHALT SURFACE REMOVAL - 2 1/2''
- ⑧ PROP. HOT-MIX ASPHALT SURFACE COURSE,
MIX "D", N70, 1 1/2''
- ⑨ PROP. POLYMERIZED LEVELING BINDER (MACHINE METHOD),
MIX "D", N50, 3/4''
- ⑩ PROP. POLYMERIZED LEVELING BINDER (MACHINE METHOD),
MIX "D", N50, 1''
- ⑪ PROP. AGGREGATE WEDGE SHOULDER, TYPE B
- ⑫ PROP. GRADING AND SHAPING SHOULDERS

APPENDIX A-6: US 52 (IL 53 TO LARAWAY ROAD)

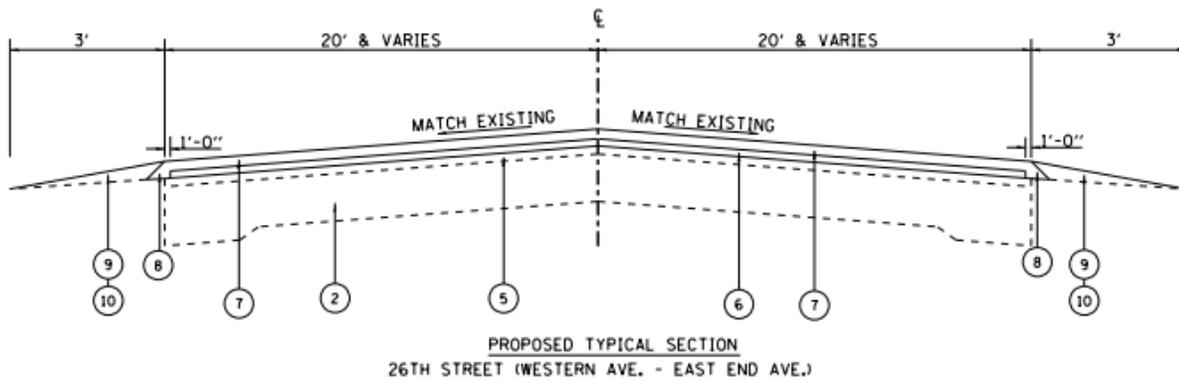
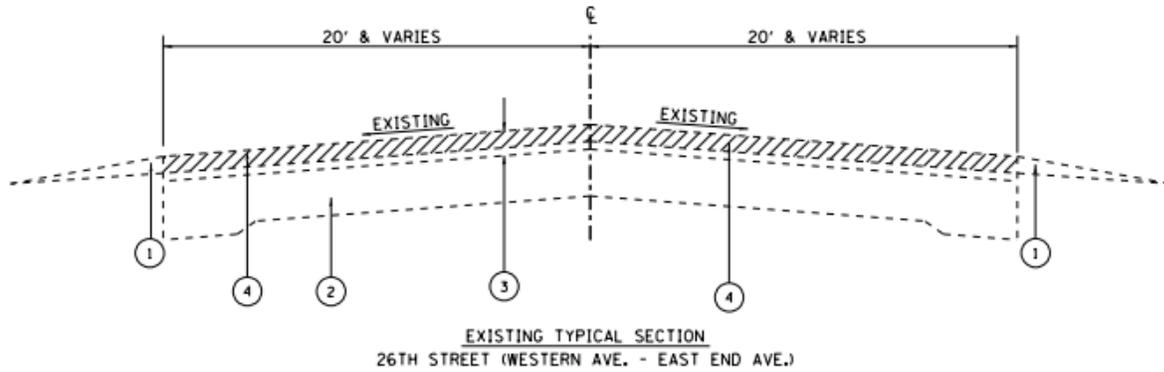
SEGMENT 3: CENTRAL INTERSECTION SEGMENT



LEGEND

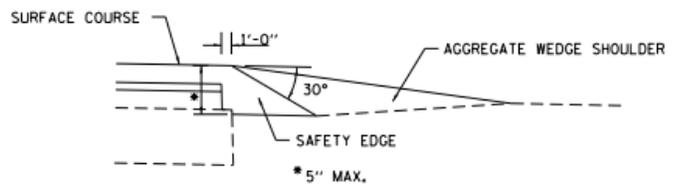
- ① EXIST. PCC BASE COURSE, 9''(±)
- ② EXIST. HOT-MIX ASPHALT SURFACE (BEFORE MILLING), 6''(±)
- ②A EXIST. HOT-MIX ASPHALT SURFACE (BEFORE MILLING), 2 1/2''(±)
- ③ EXIST. BIT. SHOULDER
- ④ EXIST. BIT. BASE COURSE WIDENING
- ⑤ EXIST. AGGREGATE SHOULDER TYPE B
- ⑥ PROP. HOT-MIX ASPHALT SURFACE REMOVAL - 2 1/4''
- ⑦ PROP. HOT-MIX ASPHALT SURFACE REMOVAL - 2 1/2''
- ⑧ PROP. HOT-MIX ASPHALT SURFACE COURSE,
MIX "D", N70, 1 1/2''
- ⑨ PROP. POLYMERIZED LEVELING BINDER (MACHINE METHOD),
MIX "D", N50, 3/4''
- ⑩ PROP. POLYMERIZED LEVELING BINDER (MACHINE METHOD),
MIX "D", N50, 1''
- ⑪ PROP. AGGREGATE WEDGE SHOULDER, TYPE B
- ⑫ PROP. GRADING AND SHAPING SHOULDERS

APPENDIX A-7: 26TH STREET



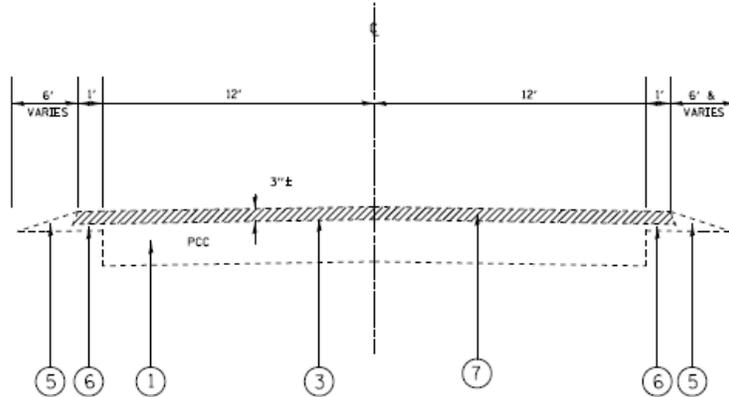
LEGEND

- ① EXISTING AGGREGATE SHOULDERS
- ② EXISTING P.C. CONCRETE PAVEMENT ± 9.0"
- ③ EXISTING HMA SURFACE COURSE ± 5 3/4 "
- ④ PROPOSED HMA SURFACE REMOVAL (2 1/4")
- ⑤ EXISTING HMA SURFACE OVERLAY AFTER MILLING, ± 3.5"
- ⑥ PROPOSED POLYMERIZED LEVELING BINDER (MACHINE METHOD), IL-4.75, N50 (3/4")
- ⑦ PROPOSED HMA SURFACE COURSE, MIX "D", N50 (1 1/2")
- ⑧ PROPOSED SAFETY EDGE SHOULDER
- ⑨ PROPOSED AGGREGATE WEDGE SHOULDER, TYPE B
- ⑩ PROPOSED GRADING AND SHAPING SHOULDERS

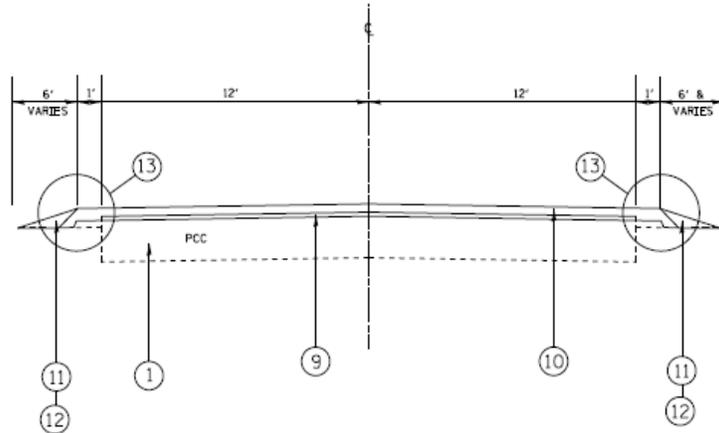


SAFETY EDGE TREATMENT SHALL BE APPLIED TO PAVED SHOULDER OF 1 FT OR LESS THAT IS ADJACENT TO AGGREGATE / EARTH SHOULDER.

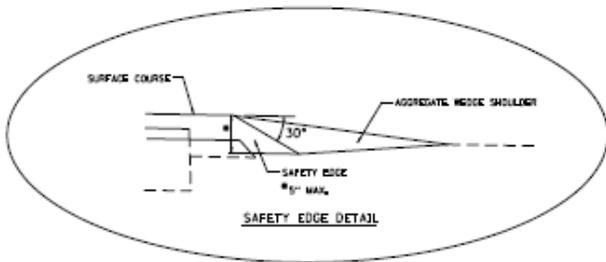
APPENDIX A-8: HARRISON STREET, TWO-LANE SEGMENT



EXISTING TYPICAL SECTION
HARRISON STREET
STA. 2+62 TO STA. 39+18



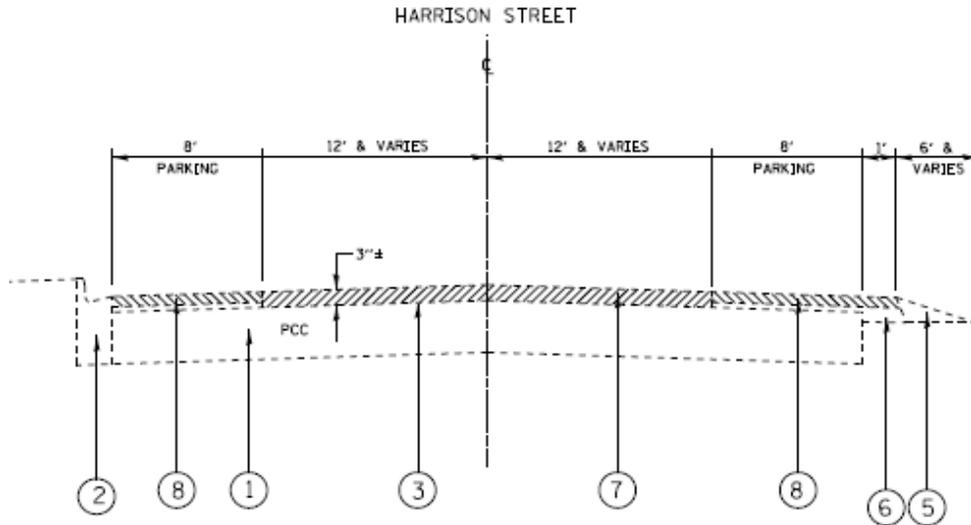
PROPOSED TYPICAL SECTION
HARRISON STREET
STA. 2+62 TO STA. 39+18



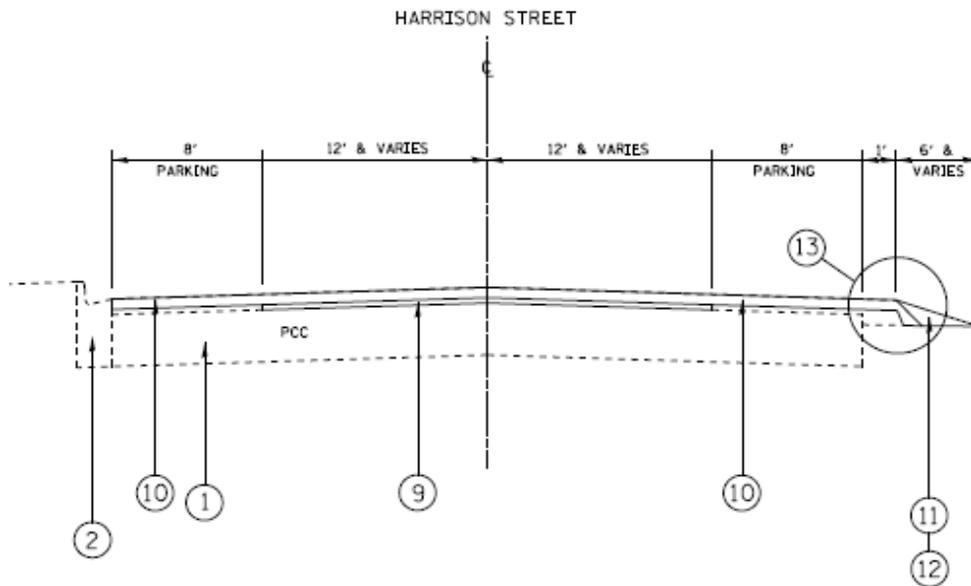
LEGEND:

- ① EXISTING PCC BASE COURSE, 10" (±)
- ② EXISTING CURB & GUTTER
- ③ EXISTING HOT-MIX ASPHALT SURFACE, 3" (±)
- ④ EXISTING HOT-MIX ASPHALT BASE, 7" (±)
- ⑤ EXISTING AGGREGATE SHOULDERS
- ⑥ EXISTING HOT-MIX ASPHALT SAFETY SHOULDER
- ⑦ PROPOSED HOT-MIX ASPHALT SURFACE REMOVAL, 3"
- ⑧ PROPOSED HOT-MIX ASPHALT SURFACE REMOVAL, 2"
- ⑨ PROPOSED POLYMERIZED LEVELING BINDER (MACHINE METHOD), IL-4.75, N50, 1"
- ⑩ PROPOSED HOT-MIX ASPHALT SURFACE COURSE, MIX "D", N50, 2"
- ⑪ PROPOSED AGGREGATE WEDGE SHOULDER, TYPE B
- ⑫ PROPOSED GRADING AND SHAPING SHOULDERS
- ⑬ PROPOSED SAFETY EDGE (SEE DETAIL)

APPENDIX A-8: HARRISON STREET, MULTI-LANE PCC SEGMENT

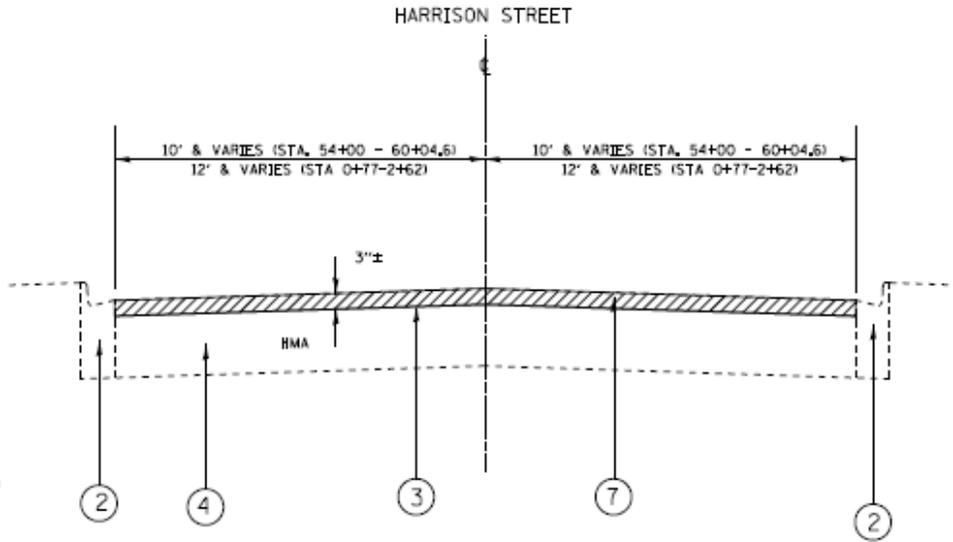


EXISTING TYPICAL SECTION
HARRISON STREET
STA. 39+18 TO STA. 54+00

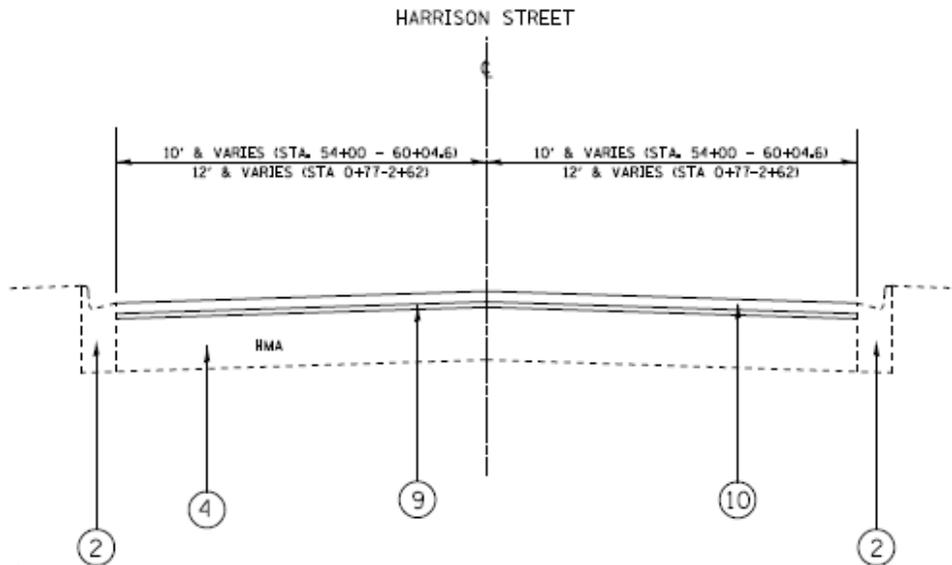


PROPOSED TYPICAL SECTION
HARRISON STREET
STA. 39+18 TO STA. 54+00

APPENDIX A-8: HARRISON STREET, HMA SEGMENT

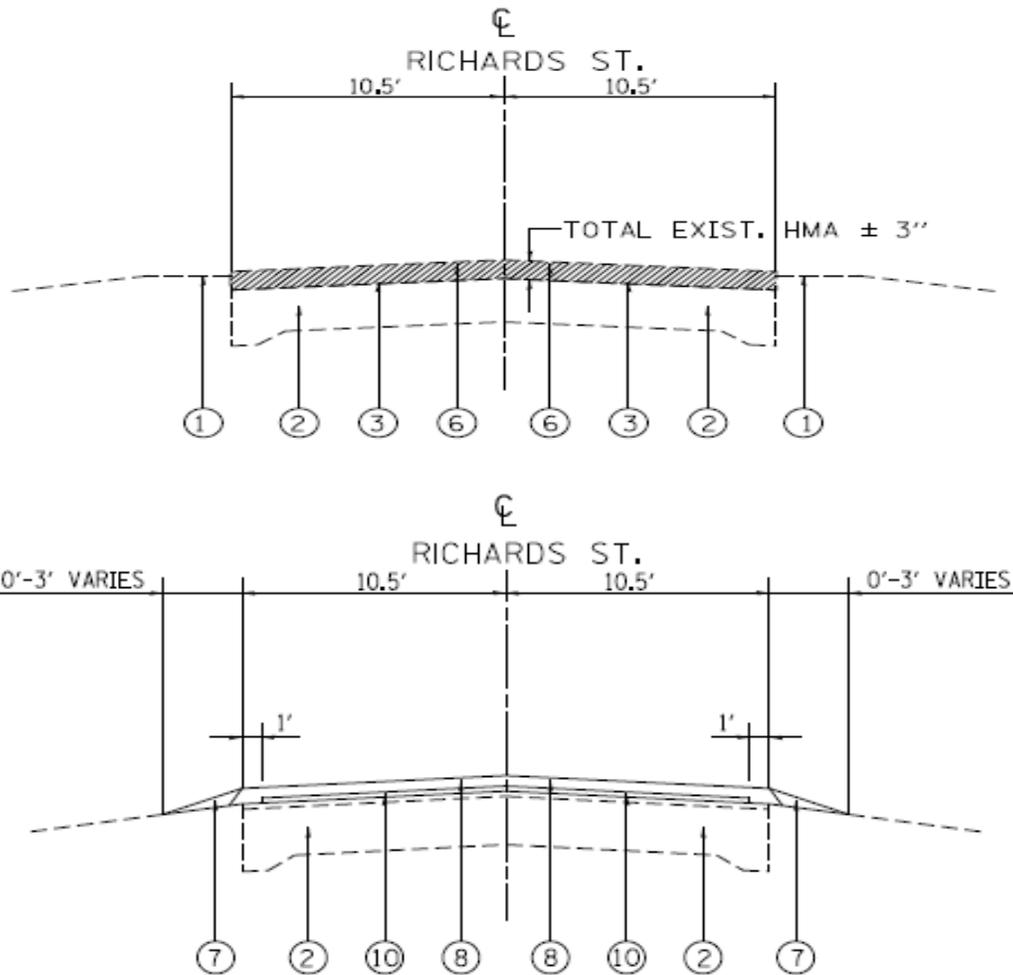


EXISTING TYPICAL SECTION
 HARRISON STREET
 STA. 0+77 TO STA. 2+62
 STA. 54+00 TO STA. 60+04.6



PROPOSED TYPICAL SECTION
 HARRISON STREET
 STA. 0+77 TO STA. 2+62
 STA. 54+00 TO STA. 60+04.6

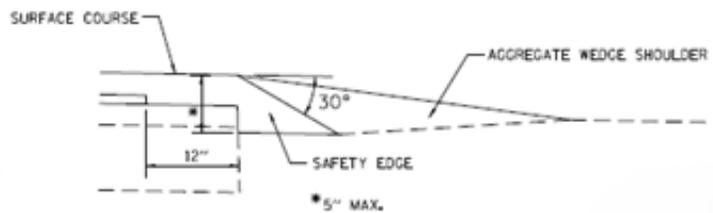
APPENDIX A-9: RICHARDS STREET, TWO-LANE SEGMENT



PROPOSED TYPICAL SECTION
RICHARDS ST.
 STA. 00+13.3 TO STA. 30+00

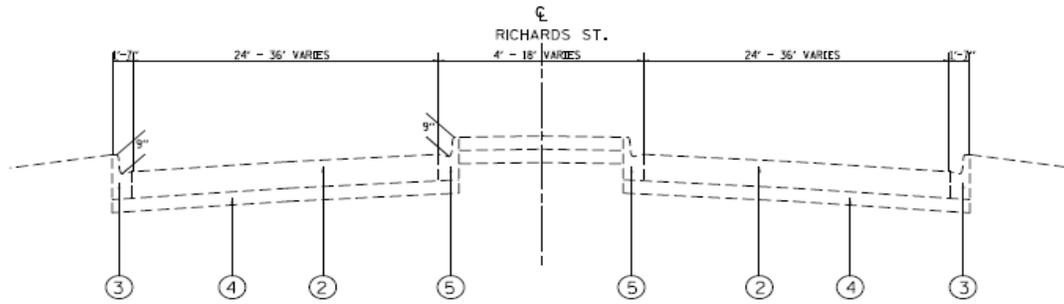
LEGEND

- ① EXIST. AGGREGATE
- ② EXIST. PCC BASE COURSE, (±10")
- ③ EXIST. COMBINATION CONCRETE CURB AND GUTTER, TYPE B 6.
- ④ EXIST. STABILIZED SUBBASE
- ⑤ EXIST. COMBINATION CONCRETE CURB AND GUTTER, TYPE B 9.
- ⑥ PROP. HOT-MIX ASPHALT SURFACE REMOVAL - 3"
- ⑦ PROP. AGGREGATE WEDGE SHOULDER, TYPE B
- ⑧ PROP. HOT-MIX ASPHALT SURFACE COURSE, MIX "D", N50, 2"
- ⑨ PROP. HOT-MIX ASPHALT SURFACE COURSE, MIX "D", N50, 1½"
- ⑩ PROP. POLYMERIZED LEVELING BINDER (MM), IL-4,75, N50, 1"
- ⑪ PROP. PCC SURFACE REMOVAL, VARIABLE DEPTH
- ⑫ PROP. MEDIAN REMOVAL, VARIABLE DEPTH

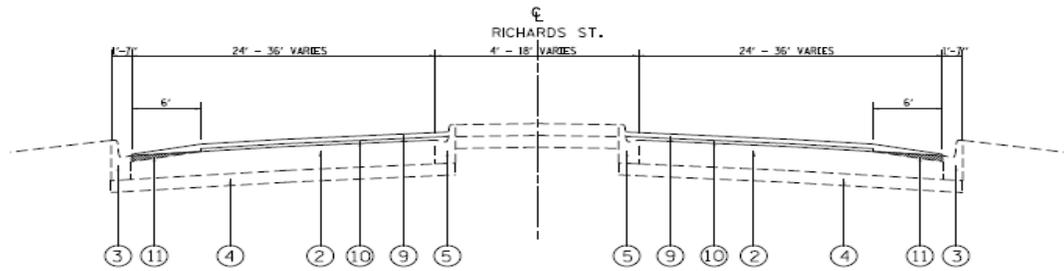


SAFETY EDGE DETAIL

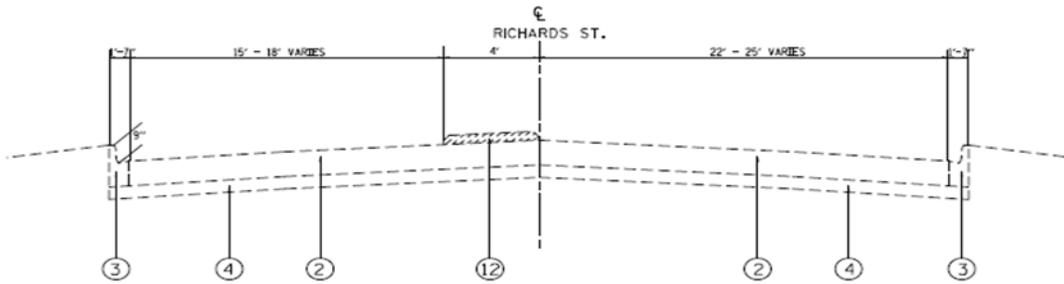
APPENDIX A-9: RICHARDS STREET, MULTI-LANE SEGMENT



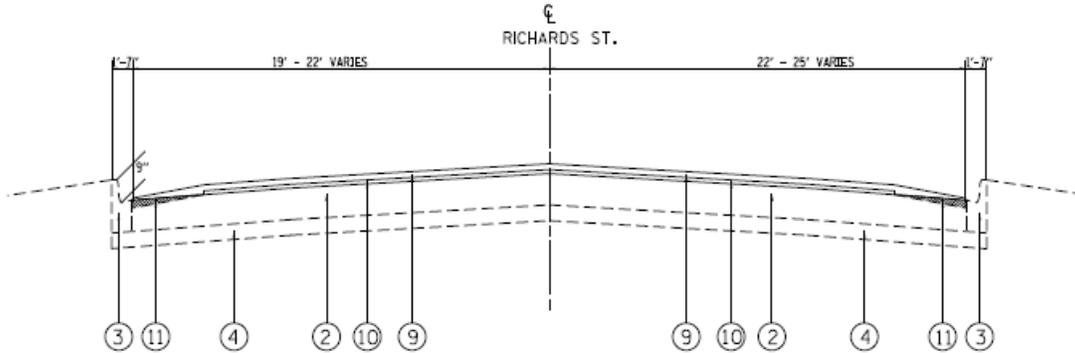
EXISTING TYPICAL SECTION
RICHARDS ST.
 STA. 30+82 TO STA. 53+63.3



PROPOSED TYPICAL SECTION
RICHARDS ST.
 STA. 30+82 TO STA. 53+63.3

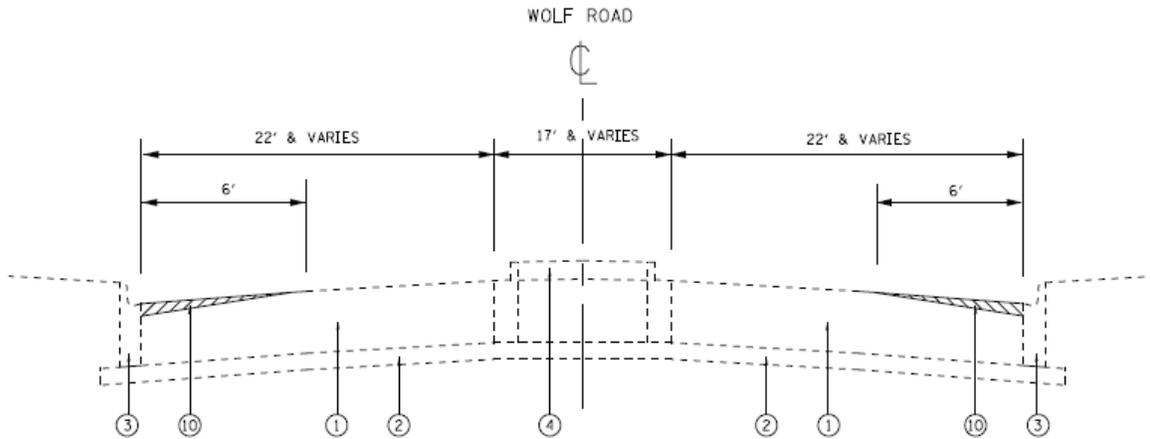


EXISTING TYPICAL SECTION
RICHARDS ST.
 STA. 30+00 TO STA. 30+82

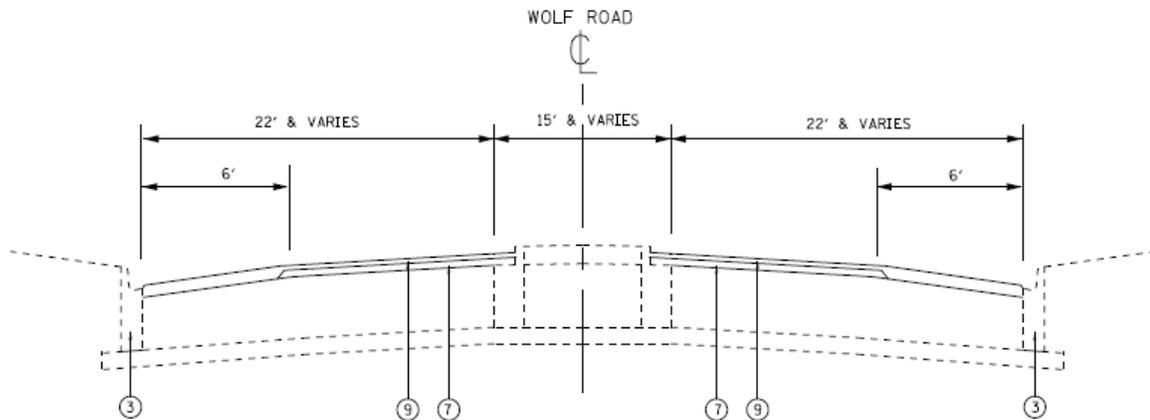


PROPOSED TYPICAL SECTION
RICHARDS ST.
 STA. 30+00 TO STA. 30+82

APPENDIX A-10: WOLF ROAD, SOUTH SECTION



EXISTING TYPICAL ROADWAY SECTION
STA. 4+22 TO STA. 28+94

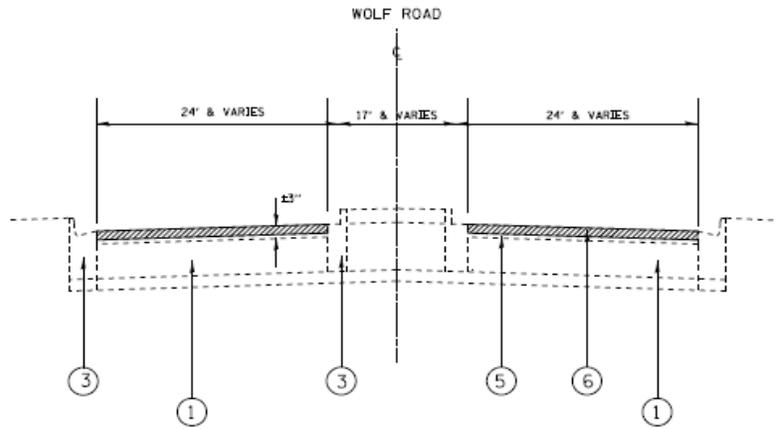


PROPOSED TYPICAL SECTION
STA. 4+22 TO STA. 28+94

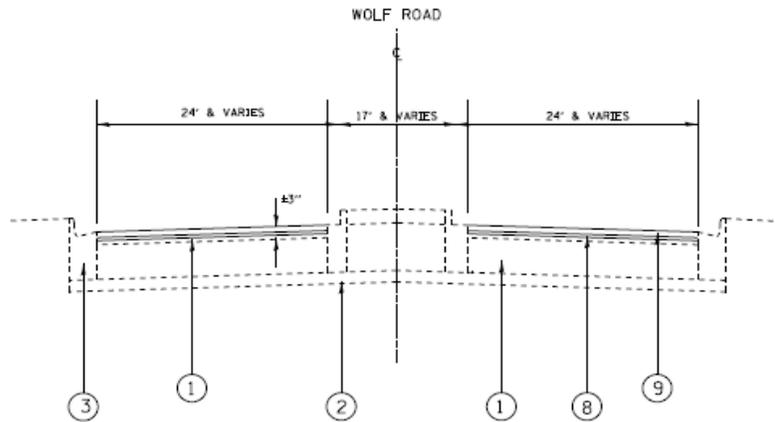
LEGEND:

- ① EXISTING P.C.C. PAVEMENT, 10"
- ② EXISTING STABILIZED SUB-BASE
- ③ EXISTING COMBINATION CONCRETE CURB AND GUTTER, TYPE B-6.12
- ④ EXISTING LANDSCAPE MEDIAN
- ⑤ EXISTING HOT-MIX ASPHALT SURFACE, ±3"
- ⑥ PROPOSED HOT-MIX ASPHALT SURFACE REMOVAL, 2 1/4"
- ⑦ PROPOSED POLYMERIZED LEVELING BINDER (MACHINE METHOD), IL-4.75, N50, 1"
- ⑧ PROPOSED POLYMERIZED LEVELING BINDER (MACHINE METHOD), IL-4.75, N50, 3/4"
- ⑨ PROPOSED HOT-MIX ASPHALT SURFACE COURSE, MIX "D", N70, 1 1/2"
- ⑩ PROPOSED P.C.C. SURFACE REMOVAL (VARIABLE DEPTH)
(SEE 'HMA TAPER AT EDGE OF P.C.C. PAVEMENT' DETAIL)
- ⑪ PROPOSED MEDIAN REMOVAL, PARTIAL DEPTH

APPENDIX A-10: WOLF ROAD, HARRISON INTERSECTION SECTION



EXISTING TYPICAL SECTION
WOLF ROAD
STA. 28+94 TO STA. 30+60



PROPOSED TYPICAL SECTION
WOLF ROAD
STA. 28+94 TO STA. 30+60

LEGEND:

- ① EXISTING P.C.C. PAVEMENT, 10"
- ② EXISTING STABILIZED SUB-BASE
- ③ EXISTING COMBINATION CONCRETE CURB AND GUTTER, TYPE B-6.12
- ④ EXISTING LANDSCAPE MEDIAN
- ⑤ EXISTING HOT-MIX ASPHALT SURFACE, $\pm 3"$
- ⑥ PROPOSED HOT-MIX ASPHALT SURFACE REMOVAL, 2 1/4"
- ⑦ PROPOSED POLYMERIZED LEVELING BINDER (MACHINE METHOD), IL-4.75, N50, 1"
- ⑧ PROPOSED POLYMERIZED LEVELING BINDER (MACHINE METHOD), IL-4.75, N50, 3/4"
- ⑨ PROPOSED HOT-MIX ASPHALT SURFACE COURSE, MIX "D", N70, 1 1/2"
- ⑩ PROPOSED P.C.C. SURFACE REMOVAL (VARIABLE DEPTH)
(SEE 'HMA TAPER AT EDGE OF P.C.C. PAVEMENT' DETAIL)
- ⑪ PROPOSED MEDIAN REMOVAL, PARTIAL DEPTH

APPENDIX B: DISTRESS SURVEY SUMMARIES

APPENDIX B-1: CRAWFORD AVENUE/PULASKI ROAD, SEGMENT 1

DISTRESS SUMMARY

| Crawford Avenue/Pulaski Road - Segment 1 North Bound (15% ABR, PG 64-22 w/ RAP and RAS) Surface Mix: 81BIT156M | | | | | | | | | | | | | | | | | |
|--|--------------|-----------------------------------|-----|------|-------|--|-----|------|-------|---|-----|------|-------|----------------------------|-----|------|-------|
| Distress Type | Unit | Pre Overlay Distress Level (2014) | | | | Post Overlay Distress Level (2015) | | | | Spring 2016 Distress Level | | | | Spring 2017 Distress Level | | | |
| | | Low | Med | High | Total | Low | Med | High | Total | Low | Med | High | Total | Low | Med | High | Total |
| Alligator or Fatigue Cracking | Lane-Feet | | | | - | - | - | - | - | | | | - | | | | - |
| Block Cracking | Lane-Feet | | | | - | - | - | - | - | | | | - | | | | - |
| Centerline Cracking | Linear Feet | | 19 | 121 | 140 | - | - | - | - | | | | - | | | | - |
| Longitudinal Cracking | Linear Feet | | | | - | - | - | - | - | | | | - | | | | - |
| Overlaid Patch Deterioration | Square Feet | | | | - | - | - | - | - | | | | - | | | | - |
| Permanent Patch Deterioration | Square Feet | | | | - | - | - | - | - | | | | - | | | | - |
| Pothole and Localized Distress | Each | | | | - | - | - | - | - | | | | - | | | | - |
| Raveling/Weathering/Segregation | Lane-Feet | | 19 | | 19 | - | - | - | - | | | | - | | | | - |
| Transverse Cracking | Linear Feet* | 96 | 48 | 324 | 468 | 14 | - | - | 14 | | | | - | | | | - |
| * Linear feet of cracking measured in lieu of occurrences | | | | | | | | | | | | | | | | | |
| | | Lane Feet in Section = 607 | | | | Centerline Joint Feet in Section = 607 | | | | Note Centerline Joint is shared between 2 mixes | | | | | | | |

| Crawford Avenue/Pulaski Road - Segment 1 South Bound (30% ABR, PG 58-28 w/ RAP and RAS) Surface Mix: 81BIT157M | | | | | | | | | | | | | | | | | |
|--|--------------|-----------------------------------|-----|------|-------|--|-----|------|-------|---|-----|------|-------|----------------------------|-----|------|-------|
| Distress Type | Unit | Pre Overlay Distress Level (2014) | | | | Post Overlay Distress Level (2015) | | | | Spring 2016 Distress Level | | | | Spring 2017 Distress Level | | | |
| | | Low | Med | High | Total | Low | Med | High | Total | Low | Med | High | Total | Low | Med | High | Total |
| Alligator or Fatigue Cracking | Lane-Feet | | | | - | - | - | - | - | | | | - | | | | - |
| Block Cracking | Lane-Feet | | | | - | - | - | - | - | | | | - | | | | - |
| Centerline Cracking | Linear Feet | | | | - | - | - | - | - | | | | - | | | | - |
| Longitudinal Cracking | Linear Feet | | | | - | - | - | - | - | | | | - | | | | - |
| Overlaid Patch Deterioration | Square Feet | | | | - | - | - | - | - | | | | - | | | | - |
| Permanent Patch Deterioration | Square Feet | | | | - | - | - | - | - | | | | - | | | | - |
| Pothole and Localized Distress | Each | | | | - | - | - | - | - | | | | - | | | | - |
| Raveling/Weathering/Segregation | Lane-Feet | | 19 | | 19 | - | - | - | - | | | | - | | | | - |
| Transverse Cracking | Linear Feet* | 180 | 48 | 276 | 504 | - | - | - | - | | | | - | | | | - |
| * Linear feet of cracking measured in lieu of occurrences | | | | | | | | | | | | | | | | | |
| | | Lane Feet in Section = 607 | | | | Centerline Joint Feet in Section = 607 | | | | Note Centerline Joint is shared between 2 mixes | | | | | | | |

APPENDIX B-2: CRAWFORD AVENUE/PULASKI ROAD, SEGMENT 2

DISTRESS SUMMARY

| Crawford Avenue/Pulaski Road - Segment 2 North Bound Lanes 1 and 2 (15% ABR, PG 64-22 w/ RAP and RAS) Surface Mix: 81BIT156M | | | | | | | | | | | | | | | | | |
|--|--------------|-----------------------------------|-----|-------|--------|------------------------------------|-----|------|-------|----------------------------|-----|------|-------|----------------------------|-----|------|-------|
| Distress Type | Unit | Pre Overlay Distress Level (2014) | | | | Post Overlay Distress Level (2015) | | | | Spring 2016 Distress Level | | | | Spring 2017 Distress Level | | | |
| | | Low | Med | High | Total | Low | Med | High | Total | Low | Med | High | Total | Low | Med | High | Total |
| Alligator or Fatigue Cracking | Lane-Feet | | | | - | | | | - | | | | - | | | | - |
| Block Cracking | Lane-Feet | | | | - | | | | - | | | | - | | | | - |
| Centerline Cracking | Linear Feet | | | | - | | | | - | | | | - | | | | - |
| Corner Break | Each | 5 | | 1 | | | | | | | | | | | | | |
| Longitudinal Cracking | Linear Feet | 63 | | 2 | 65 | | | | | | | | | | | | |
| Overlaid Patch Deterioration | Square Feet | | | | - | | | | - | | | | - | | | | - |
| Permanent Patch Deterioration | Square Feet | 11,890 | | 108 | 11,998 | | | | | | | | | | | | |
| Pothole and Localized Distress | Each | 3 | | 4 | 7 | | | | | | | | | | | | |
| Raveling/Weathering/Segregation | Lane-Feet | | | | - | | | | - | | | | - | | | | - |
| Transverse Cracking | Linear Feet* | 4,770 | 292 | 2,088 | 7,150 | 1,595 | 72 | | 1,667 | | | | | | | | |
| * Linear feet of cracking measured in lieu of occurrences | | | | | | | | | | | | | | | | | |
| Lane Feet in Section = 9,836 Centerline Joint Feet in Section = 4,918 | | | | | | | | | | | | | | | | | |

| Crawford Avenue/Pulaski Road - Segment 2 South Bound Lanes 1 and 2 (30% ABR, PG 58-28 w/ RAP and RAS) Surface Mix: 81BIT157M | | | | | | | | | | | | | | | | | |
|--|--------------|-----------------------------------|-----|-------|--------|------------------------------------|-----|------|-------|----------------------------|-----|------|-------|----------------------------|-----|------|-------|
| Distress Type | Unit | Pre Overlay Distress Level (2014) | | | | Post Overlay Distress Level (2015) | | | | Spring 2016 Distress Level | | | | Spring 2017 Distress Level | | | |
| | | Low | Med | High | Total | Low | Med | High | Total | Low | Med | High | Total | Low | Med | High | Total |
| Alligator or Fatigue Cracking | Lane-Feet | | | | - | | | | - | | | | - | | | | - |
| Block Cracking | Lane-Feet | | | | - | | | | - | | | | - | | | | - |
| Centerline Cracking | Linear Feet | | | | - | | | | - | | | | - | | | | - |
| Longitudinal Cracking | Linear Feet | 81 | 15 | 203 | 299 | | | | | | | | | | | | |
| Overlaid Patch Deterioration | Square Feet | | | | - | | | | - | | | | - | | | | - |
| Permanent Patch Deterioration | Square Feet | 10,796 | | | 10,796 | | | | | | | | | | | | |
| Pothole and Localized Distress | Each | | | 1 | 1 | | | | | | | | | | | | |
| Raveling/Weathering/Segregation | Lane-Feet | | | | - | | | | - | | | | - | | | | - |
| Transverse Cracking | Linear Feet* | 5,292 | 515 | 1,986 | 7,793 | 1,640 | | | 1,640 | | | | | | | | |
| * Linear feet of cracking measured in lieu of occurrences | | | | | | | | | | | | | | | | | |
| Lane Feet in Section = 9,836 Centerline Joint Feet in Section = 4,918 | | | | | | | | | | | | | | | | | |

APPENDIX B-3: CRAWFORD AVENUE/PULASKI ROAD, SEGMENT 3

DISTRESS SUMMARY

| Crawford Avenue/Pulaski Road - Segment 3 North Bound Lanes 1 and 2 (15% ABR, PG 64-22 w/ RAP and RAS) Surface Mix: 81BIT156M | | | | | | | | | | | | | | | | | |
|--|--------------|-----------------------------------|-------|------|-------|------------------------------------|-----|------|-------|----------------------------|-----|------|-------|----------------------------|-----|------|-------|
| Distress Type | Unit | Pre Overlay Distress Level (2014) | | | | Post Overlay Distress Level (2015) | | | | Spring 2016 Distress Level | | | | Spring 2017 Distress Level | | | |
| | | Low | Med | High | Total | Low | Med | High | Total | Low | Med | High | Total | Low | Med | High | Total |
| Alligator or Fatigue Cracking | Lane-Feet | 45 | | | 45 | - | - | - | - | | | | - | | | | - |
| Block Cracking | Lane-Feet | | | | - | - | - | - | - | | | | - | | | | - |
| Centerline Cracking | Linear Feet | | 1,585 | | 1,585 | 200 | - | - | 200 | | | | - | | | | - |
| Longitudinal Cracking | Linear Feet | | | | - | - | - | - | - | | | | - | | | | - |
| Overlaid Patch Deterioration | Square Feet | | | | - | - | - | - | - | | | | - | | | | - |
| Permanent Patch Deterioration | Square Feet | 1,156 | | 544 | 1,700 | - | - | - | - | | | | - | | | | - |
| Pothole and Localized Distress | Each | | | | - | - | - | - | - | | | | - | | | | - |
| Raveling/Weathering/Segregation | Lane-Feet | | 3,170 | | 3,170 | - | - | - | - | | | | - | | | | - |
| Transverse Cracking | Linear Feet* | 492 | 592 | 768 | 1,852 | 36 | - | - | 36 | | | | - | | | | - |
| * Linear feet of cracking measured in lieu of occurrences | | | | | | | | | | | | | | | | | |
| Lane Feet in Section = 3,170 Centerline Joint Feet in Section = 1,585 | | | | | | | | | | | | | | | | | |
| Crawford Avenue/Pulaski Road - Segment 3 South Bound Lanes 1 and 2 (30% ABR, PG 58-28 w/ RAP and RAS) Surface Mix: 81BIT157M | | | | | | | | | | | | | | | | | |
| Distress Type | Unit | Pre Overlay Distress Level (2014) | | | | Post Overlay Distress Level (2015) | | | | Spring 2016 Distress Level | | | | Spring 2017 Distress Level | | | |
| | | Low | Med | High | Total | Low | Med | High | Total | Low | Med | High | Total | Low | Med | High | Total |
| Alligator or Fatigue Cracking | Lane-Feet | | | 79 | 79 | - | - | - | - | | | | - | | | | - |
| Block Cracking | Lane-Feet | | | | - | - | - | - | - | | | | - | | | | - |
| Centerline Cracking | Linear Feet | | 1,585 | | 1,585 | 895 | - | - | 895 | | | | - | | | | - |
| Longitudinal Cracking | Linear Feet | | | | - | - | - | - | - | | | | - | | | | - |
| Overlaid Patch Deterioration | Square Feet | | | | - | - | - | - | - | | | | - | | | | - |
| Permanent Patch Deterioration | Square Feet | | | | - | - | - | - | - | | | | - | | | | - |
| Pothole and Localized Distress | Each | | | | - | - | - | - | - | | | | - | | | | - |
| Raveling/Weathering/Segregation | Lane-Feet | | 3,170 | | 3,170 | - | - | - | - | | | | - | | | | - |
| Transverse Cracking | Linear Feet* | 72 | 1,488 | 312 | 1,872 | 7 | - | - | 7 | | | | - | | | | - |
| * Linear feet of cracking measured in lieu of occurrences | | | | | | | | | | | | | | | | | |
| Lane Feet in Section = 3,170 Centerline Joint Feet in Section = 1,585 | | | | | | | | | | | | | | | | | |

APPENDIX B-4: US 52 (IL 53 TO LARAWAY ROAD), SEGMENT 1

DISTRESS SUMMARY

| US 52 (IL 53 to Laraway Road) - Segment 1 East Bound (30% ABR, PG 58-28 w/ RAP and RAS) Surface Mix: 81BIT140M | | | | | | | | | | | | | | | | | |
|--|--------------|-----------------------------------|-------|------|-------|------------------------------------|-----|------|-------|----------------------------|-----|------|-------|----------------------------|-----|------|-------|
| Distress Type | Unit | Pre Overlay Distress Level (2014) | | | | Post Overlay Distress Level (2015) | | | | Spring 2016 Distress Level | | | | Spring 2017 Distress Level | | | |
| | | Low | Med | High | Total | Low | Med | High | Total | Low | Med | High | Total | Low | Med | High | Total |
| Alligator or Fatigue Cracking | Lane-Feet | | | 156 | 156 | - | - | - | - | | | | | | | | |
| Block Cracking | Lane-Feet | 300 | 894 | | 1,194 | - | - | - | - | | | | | | | | |
| Centerline Cracking | Linear Feet | 150 | | 447 | 597 | - | - | - | - | | | | | | | | |
| Center of Lane Cracking | Linear Feet | | | | | | | | | | | | | | | | |
| Longitudinal Cracking | Linear Feet | 26 | | | 26 | 26 | - | - | 26 | | | | | | | | |
| Overlaid Patch Deterioration | Square Feet | | | | - | - | - | - | - | | | | | | | | |
| Permanent Patch Deterioration | Square Feet | | | | - | - | - | - | - | | | | | | | | |
| Pothole and Localized Distress | Each | | | | - | - | - | - | - | | | | | | | | |
| Raveling/Weathering/Segregation | Lane-Feet | | 1,194 | | 1,194 | - | - | - | - | | | | | | | | |
| Transverse Cracking | Linear Feet* | 204 | 248 | 204 | 656 | - | - | - | - | | | | | | | | |
| * Linear feet of cracking measured in lieu of occurrences | | | | | | | | | | | | | | | | | |
| Lane Feet in Section = 1,194 Centerline Joint Feet in Section = 597 | | | | | | | | | | | | | | | | | |
| US 52 (IL 53 to Laraway Road) - Segment 1 West Bound (30% ABR, PG 58-28 w/ RAP only) Surface Mix: 81BIT159M | | | | | | | | | | | | | | | | | |
| Distress Type | Unit | Pre Overlay Distress Level (2014) | | | | Post Overlay Distress Level (2015) | | | | Spring 2016 Distress Level | | | | Spring 2017 Distress Level | | | |
| | | Low | Med | High | Total | Low | Med | High | Total | Low | Med | High | Total | Low | Med | High | Total |
| Alligator or Fatigue Cracking | Lane-Feet | | | | - | - | - | - | - | | | | | | | | |
| Block Cracking | Lane-Feet | | 1,194 | | 1,194 | - | - | - | - | | | | | | | | |
| Centerline Cracking | Linear Feet | 597 | | | 597 | - | - | - | - | | | | | | | | |
| Center of Lane Cracking | Linear Feet | | | | | | | | | | | | | | | | |
| Longitudinal Cracking | Linear Feet | | | | - | - | - | - | - | | | | | | | | |
| Overlaid Patch Deterioration | Square Feet | | | | - | - | - | - | - | | | | | | | | |
| Permanent Patch Deterioration | Square Feet | | | | - | - | - | - | - | | | | | | | | |
| Pothole and Localized Distress | Each | | | | - | - | - | - | - | | | | | | | | |
| Raveling/Weathering/Segregation | Lane-Feet | | 1,194 | | 1,194 | - | - | - | - | | | | | | | | |
| Transverse Cracking | Linear Feet* | 204 | 408 | 120 | 732 | - | - | - | - | | | | | | | | |
| * Linear feet of cracking measured in lieu of occurrences | | | | | | | | | | | | | | | | | |
| Lane Feet in Section = 1,194 Centerline Joint Feet in Section = 597 | | | | | | | | | | | | | | | | | |

APPENDIX B-5: US 52 (IL 53 TO LARAWAY ROAD), SEGMENT 2

DISTRESS SUMMARY

| US 52 (IL 53 to Laraway Road) - Segment 2 East Bound (30% ABR, PG 58-28 w/ RAP and RAS) Surface Mix: 81BIT140M | | | | | | | | | | | | | | | | | |
|--|--------------|-----------------------------------|--------|------|--------|---|-----|------|-------|---|-----|------|-------|----------------------------|-----|------|-------|
| Distress Type | Unit | Pre Overlay Distress Level (2014) | | | | Post Overlay Distress Level (2015) | | | | Spring 2016 Distress Level | | | | Spring 2017 Distress Level | | | |
| | | Low | Med | High | Total | Low | Med | High | Total | Low | Med | High | Total | Low | Med | High | Total |
| Alligator or Fatigue Cracking | Lane-Feet | | 40 | 371 | 411 | - | - | - | - | | | | - | | | | - |
| Block Cracking | Lane-Feet | 14,674 | 715 | | 15,389 | - | - | - | - | | | | - | | | | - |
| Centerline Cracking | Linear Feet | | | | - | - | - | - | - | | | | - | | | | - |
| Center of Lane Cracking | Linear Feet | | | 89 | | | | | | | | | | | | | |
| Longitudinal Cracking | Linear Feet | 7 | | 36 | 43 | - | - | - | - | | | | - | | | | - |
| Overlaid Patch Deterioration | Square Feet | | | | - | - | - | - | - | | | | - | | | | - |
| Permanent Patch Deterioration | Square Feet | 1,934 | 96 | | 2,030 | - | - | - | - | | | | - | | | | - |
| Pothole and Localized Distress | Each | 7 | 3 | | 10 | - | - | - | - | | | | - | | | | - |
| Raveling/Weathering/Segregation | Lane-Feet | 1,000 | 14,218 | 171 | 15,389 | 22 | - | - | 22 | | | | - | | | | - |
| Transverse Cracking | Linear Feet* | 2,255 | 4,336 | 924 | 7,515 | 196 | - | - | 196 | | | | - | | | | - |
| * Linear feet of cracking measured in lieu of occurrences | | | | | | | | | | | | | | | | | |
| | | Lane Feet in Section = 15,388 | | | | Centerline Joint Feet in Section = 15,388 | | | | Note Centerline Joint is shared between 2 mixes | | | | | | | |

| US 52 (IL 53 to Laraway Road) - Segment 2 West Bound (30% ABR, PG 58-28 w/ RAP only) Surface Mix: 81BIT159M | | | | | | | | | | | | | | | | | |
|---|--------------|-----------------------------------|--------|-------|--------|---|-----|------|-------|---|-----|------|-------|----------------------------|-----|------|-------|
| Distress Type | Unit | Pre Overlay Distress Level (2014) | | | | Post Overlay Distress Level (2015) | | | | Spring 2016 Distress Level | | | | Spring 2017 Distress Level | | | |
| | | Low | Med | High | Total | Low | Med | High | Total | Low | Med | High | Total | Low | Med | High | Total |
| Alligator or Fatigue Cracking | Lane-Feet | | | | - | - | - | - | - | | | | - | | | | - |
| Block Cracking | Lane-Feet | 14,754 | 643 | | 15,397 | - | - | - | - | | | | - | | | | - |
| Centerline Cracking | Linear Feet | 500 | 8,925 | 4,983 | 14,408 | 1,078 | - | - | 1,078 | | | | - | | | | - |
| Center of Lane Cracking | Linear Feet | | | 18 | | | | | | | | | | | | | |
| Longitudinal Cracking | Linear Feet | | 225 | | 225 | - | - | - | - | | | | - | | | | - |
| Overlaid Patch Deterioration | Square Feet | | | | - | - | - | - | - | | | | - | | | | - |
| Permanent Patch Deterioration | Square Feet | 1,500 | 216 | | 1,716 | - | - | - | - | | | | - | | | | - |
| Pothole and Localized Distress | Each | 12 | 9 | 4 | 25 | - | - | - | - | | | | - | | | | - |
| Raveling/Weathering/Segregation | Lane-Feet | 1,000 | 14,397 | | 15,397 | 53 | - | - | 53 | | | | - | | | | - |
| Transverse Cracking | Linear Feet* | 2,423 | 4,680 | 1,279 | 8,382 | 113 | - | - | 113 | | | | - | | | | - |
| * Linear feet of cracking measured in lieu of occurrences | | | | | | | | | | | | | | | | | |
| | | Lane Feet in Section = 15,388 | | | | Centerline Joint Feet in Section = 15,388 | | | | Note Centerline Joint is shared between 2 mixes | | | | | | | |

APPENDIX B-6: US 52 (IL 53 TO LARAWAY ROAD), SEGMENT 3

DISTRESS SUMMARY

| US 52 (IL 53 to Laraway Road) - Segment 3 East Bound (30% ABR, PG 58-28 w/ RAP and RAS) Surface Mix: 81BIT140M | | | | | | | | | | | | | | | | | |
|--|--------------|-----------------------------------|-------|------|-------|--|-----|------|-------|---|-----|------|-------|----------------------------|-----|------|-------|
| Distress Type | Unit | Pre Overlay Distress Level (2014) | | | | Post Overlay Distress Level (2015) | | | | Spring 2016 Distress Level | | | | Spring 2017 Distress Level | | | |
| | | Low | Med | High | Total | Low | Med | High | Total | Low | Med | High | Total | Low | Med | High | Total |
| Alligator or Fatigue Cracking | Lane-Feet | | | | - | - | - | - | - | | | | - | | | | - |
| Block Cracking | Lane-Feet | 1,361 | | | 1,361 | - | - | - | - | | | | - | | | | - |
| Centerline Cracking | Linear Feet | | | | - | - | - | - | - | | | | - | | | | - |
| Center of Lane Cracking | Linear Feet | | | | - | - | - | - | - | | | | - | | | | - |
| Longitudinal Cracking | Linear Feet | | | | - | - | - | - | - | | | | - | | | | - |
| Overlaid Patch Deterioration | Square Feet | | | | - | - | - | - | - | | | | - | | | | - |
| Permanent Patch Deterioration | Square Feet | | 84 | 168 | 252 | - | - | - | - | | | | - | | | | - |
| Pothole and Localized Distress | Each | 3 | 1 | 6 | 10 | - | - | - | - | | | | - | | | | - |
| Raveling/Weathering/Segregation | Lane-Feet | | 1,361 | | 1,361 | - | - | - | - | | | | - | | | | - |
| Transverse Cracking | Linear Feet* | 270 | 168 | 168 | 606 | 20 | - | - | 20 | | | | - | | | | - |
| * Linear feet of cracking measured in lieu of occurrences | | | | | | | | | | | | | | | | | |
| | | Lane Feet in Section = 1,415 | | | | Centerline Joint Feet in Section = 1,415 | | | | Note Centerline Joint is shared between 2 mixes | | | | | | | |

| US 52 (IL 53 to Laraway Road) - Segment 3 West Bound (30% ABR, PG 58-28 w/ RAP only) Surface Mix: 81BIT159M | | | | | | | | | | | | | | | | | |
|---|--------------|-----------------------------------|-------|------|-------|--|-----|------|-------|---|-----|------|-------|----------------------------|-----|------|-------|
| Distress Type | Unit | Pre Overlay Distress Level (2014) | | | | Post Overlay Distress Level (2015) | | | | Spring 2016 Distress Level | | | | Spring 2017 Distress Level | | | |
| | | Low | Med | High | Total | Low | Med | High | Total | Low | Med | High | Total | Low | Med | High | Total |
| Alligator or Fatigue Cracking | Lane-Feet | | | | - | - | - | - | - | | | | - | | | | - |
| Block Cracking | Lane-Feet | 1,361 | | | 1,361 | - | - | - | - | | | | - | | | | - |
| Centerline Cracking | Linear Feet | | 693 | | 693 | - | - | - | - | | | | - | | | | - |
| Center of Lane Cracking | Linear Feet | | | | - | - | - | - | - | | | | - | | | | - |
| Longitudinal Cracking | Linear Feet | | | | - | - | - | - | - | | | | - | | | | - |
| Overlaid Patch Deterioration | Square Feet | | | | - | - | - | - | - | | | | - | | | | - |
| Permanent Patch Deterioration | Square Feet | 528 | 228 | 180 | 936 | - | - | - | - | | | | - | | | | - |
| Pothole and Localized Distress | Each | - | 1 | 2 | 3 | - | - | - | - | | | | - | | | | - |
| Raveling/Weathering/Segregation | Lane-Feet | - | 1,361 | | 1,361 | - | - | - | - | | | | - | | | | - |
| Transverse Cracking | Linear Feet* | 432 | 294 | 36 | 762 | 24 | - | - | 24 | | | | - | | | | - |
| * Linear feet of cracking measured in lieu of occurrences | | | | | | | | | | | | | | | | | |
| | | Lane Feet in Section = 1,415 | | | | Centerline Joint Feet in Section = 1,415 | | | | Note Centerline Joint is shared between 2 mixes | | | | | | | |

APPENDIX C: AUTOMATED DISTRESS DATA - RUTTING AND INTERNATIONAL ROUGHNESS INDEX (IRI)

APPENDIX C-1: CRAWFORD AVENUE/PULASKI ROAD AUTOMATED DISTRESS DATA, AUGUST 15, 2014

PRE-CONSTRUCTION RUTTING AND INTERNATIONAL ROUGHNESS INDEX (IRI)

| Crawford Avenue/Pulaski Road | | | | | | | | | | | | | | | |
|------------------------------|------|--------|-----------|------------------------------|---------------------|-------|-----|-----|-----------|-------------------|----------|-----|--------------|----------|-------|
| Segment | Dir. | Lane | Test Date | Original Pavement Type | Overlay Surface Mix | | | | | IRI (Inches/Mile) | | | Rut (Inches) | | |
| | | | | | Mix | ABR % | RAS | RAP | Virgin PG | Left WP | Right WP | Ave | Left WP | Right WP | Ave |
| 1 | N | 1 | 8/15/2014 | 2-Lane Bare PCC | N70-15% ABR | 15 | Y | Y | 64-22 | 297 | 96 | 197 | 0.150 | 0.070 | 0.110 |
| 1 | S | 1 | 8/12/2014 | 2-Lane Bare PCC | N70-30% ABR | 30 | Y | Y | 58-28 | 373 | 335 | 354 | 0.300 | 0.190 | 0.245 |
| 2 | N | 1 (PL) | 8/15/2014 | 5-Lane Bare PCC | N70-15% ABR | 15 | Y | Y | 64-22 | 232 | 227 | 229 | 0.141 | 0.115 | 0.128 |
| 2 | N | 2 (DL) | 8/15/2014 | 5-Lane Bare PCC | N70-15% ABR | 15 | Y | Y | 64-22 | 256 | 308 | 282 | 0.168 | 0.263 | 0.215 |
| 2 | S | 1 (PL) | 8/15/2014 | 5-Lane Bare PCC | N70-30% ABR | 30 | Y | Y | 58-28 | 244 | 237 | 240 | 0.180 | 0.133 | 0.155 |
| 2 | S | 2 (DL) | 8/12/2014 | 5-Lane Bare PCC | N70-30% ABR | 30 | Y | Y | 58-28 | 231 | 277 | 253 | 0.163 | 0.236 | 0.198 |
| 3 | N | 1 (PL) | 8/15/2014 | 5-Lane HMA Overlay of PCC | N70-15% ABR | 15 | Y | Y | 64-22 | 205 | 213 | 209 | 0.178 | 0.108 | 0.144 |
| 3 | N | 2 (DL) | 8/15/2014 | 5-Lane HMA Overlay of PCC | N70-15% ABR | 15 | Y | Y | 64-22 | 245 | 292 | 269 | 0.124 | 0.206 | 0.164 |
| 3 | S | 1 (PL) | 8/15/2014 | 5-Lane HMA Overlay of PCC | N70-30% ABR | 30 | Y | Y | 58-28 | 200 | 224 | 212 | 0.265 | 0.168 | 0.215 |
| 3 | S | 2 (DL) | 8/12/2014 | 5-Lane HMA Overlay of PCC | N70-30% ABR | 30 | Y | Y | 58-28 | 269 | 340 | 305 | 0.245 | 0.283 | 0.264 |
| Direction | N | All | Aug. 2014 | All | N70-15% ABR | 15 | Y | Y | 64-22 | 240 | 257 | 249 | 0.153 | 0.176 | 0.164 |
| Direction | S | All | Aug. 2014 | All | N70-30% ABR | 30 | Y | Y | 58-28 | 234 | 263 | 248 | 0.193 | 0.200 | 0.195 |

APPENDIX C-2: CRAWFORD AVENUE/PULASKI ROAD AUTOMATED DISTRESS DATA DECEMBER 17, 2014

POST-CONSTRUCTION RUTTING AND INTERNATIONAL ROUGHNESS INDEX (IRI)

| Crawford Avenue/Pulaski Road | | | | | | | | | | | | | | | |
|------------------------------|------|--------|------------|------------------------------|---------------------|-------|-----|-----|-----------|-------------------|----------|-----|--------------|----------|-------|
| Segment | Dir. | Lane | Test Date | Orginal Pavement Type | Overlay Surface Mix | | | | | IRI (Inches/Mile) | | | Rut (Inches) | | |
| | | | | | Mix | ABR % | RAS | RAP | Virgin PG | Left WP | Right WP | Ave | Left WP | Right WP | Ave |
| 1 | N | 1 | 12/17/2014 | 2-Lane Bare PCC | N70-15% ABR | 15 | Y | Y | 64-22 | 111 | 138 | 125 | 0.015 | 0.018 | 0.018 |
| 1 | S | 1 | 12/17/2014 | 2-Lane Bare PCC | N70-30% ABR | 30 | Y | Y | 58-28 | 118 | 142 | 130 | 0.026 | 0.022 | 0.023 |
| 2 | N | 1 (PL) | 12/17/2014 | 5-Lane Bare PCC | N70-15% ABR | 15 | Y | Y | 64-22 | 93 | 159 | 126 | 0.019 | 0.032 | 0.025 |
| 2 | N | 2 (DL) | 12/17/2014 | 5-Lane Bare PCC | N70-15% ABR | 15 | Y | Y | 64-22 | 115 | 183 | 149 | 0.012 | 0.024 | 0.018 |
| 2 | S | 1 (PL) | 12/17/2014 | 5-Lane Bare PCC | N70-30% ABR | 30 | Y | Y | 58-28 | 107 | 169 | 138 | 0.014 | 0.031 | 0.023 |
| 2 | S | 2 (DL) | 12/17/2014 | 5-Lane Bare PCC | N70-30% ABR | 30 | Y | Y | 58-28 | 96 | 167 | 131 | 0.010 | 0.027 | 0.019 |
| 3 | N | 1 (PL) | 12/17/2014 | 5-Lane HMA Overlay of PCC | N70-15% ABR | 15 | Y | Y | 64-22 | 103 | 164 | 134 | 0.012 | 0.034 | 0.023 |
| 3 | N | 2 (DL) | 12/17/2014 | 5-Lane HMA Overlay of PCC | N70-15% ABR | 15 | Y | Y | 64-22 | 91 | 147 | 119 | 0.017 | 0.037 | 0.026 |
| 3 | S | 1 (PL) | 12/17/2014 | 5-Lane HMA Overlay of PCC | N70-30% ABR | 30 | Y | Y | 58-28 | 108 | 163 | 136 | 0.020 | 0.030 | 0.025 |
| 3 | S | 2 (DL) | 12/17/2014 | 5-Lane HMA Overlay of PCC | N70-30% ABR | 30 | Y | Y | 58-28 | 97 | 145 | 121 | 0.014 | 0.027 | 0.021 |
| Direction | N | All | 12/17/2014 | All | N70-15% ABR | 15 | Y | Y | 64-22 | 103 | 166 | 134 | 0.015 | 0.029 | 0.022 |
| Direction | S | All | 12/17/2014 | All | N70-30% ABR | 30 | Y | Y | 58-28 | 102 | 164 | 133 | 0.014 | 0.029 | 0.021 |

APPENDIX C-3: CRAWFORD AVENUE/PULASKI ROAD AUTOMATED DISTRESS DATA, MARCH 10, 2015

WINTER 2015 FROZEN GRADE RUTTING AND INTERNATIONAL ROUGHNESS INDEX (IRI)

| Crawford Avenue/Pulaski Road | | | | | | | | | | | | | | | |
|------------------------------|------|--------|-----------|------------------------------|---------------------|-------|-----|-----|-----------|-------------------|----------|-----|--------------|----------|-------|
| Segment | Dir. | Lane | Test Date | Orginal Pavement Type | Overlay Surface Mix | | | | | IRI (Inches/Mile) | | | Rut (Inches) | | |
| | | | | | Mix | ABR % | RAS | RAP | Virgin PG | Left WP | Right WP | Ave | Left WP | Right WP | Ave |
| 1 | N | 1 | 3/10/2015 | 2-Lane Bare PCC | N70-15% ABR | 15 | Y | Y | 64-22 | 128 | 163 | 145 | 0.015 | 0.037 | 0.026 |
| 1 | S | 1 | 3/10/2015 | 2-Lane Bare PCC | N70-30% ABR | 30 | Y | Y | 58-28 | 125 | 141 | 133 | 0.020 | 0.050 | 0.033 |
| 2 | N | 1 (PL) | 3/10/2015 | 5-Lane Bare PCC | N70-15% ABR | 15 | Y | Y | 64-22 | 94 | 156 | 125 | 0.012 | 0.030 | 0.021 |
| 2 | N | 2 (DL) | 3/10/2015 | 5-Lane Bare PCC | N70-15% ABR | 15 | Y | Y | 64-22 | 103 | 163 | 133 | 0.009 | 0.040 | 0.025 |
| 2 | S | 1 (PL) | 3/10/2015 | 5-Lane Bare PCC | N70-30% ABR | 30 | Y | Y | 58-28 | 107 | 161 | 134 | 0.008 | 0.031 | 0.020 |
| 2 | S | 2 (DL) | 3/10/2015 | 5-Lane Bare PCC | N70-30% ABR | 30 | Y | Y | 58-28 | 95 | 148 | 122 | 0.012 | 0.021 | 0.016 |
| 3 | N | 1 (PL) | 3/10/2015 | 5-Lane HMA Overlay of PCC | N70-15% ABR | 15 | Y | Y | 64-22 | 106 | 177 | 141 | 0.013 | 0.044 | 0.029 |
| 3 | N | 2 (DL) | 3/10/2015 | 5-Lane HMA Overlay of PCC | N70-15% ABR | 15 | Y | Y | 64-22 | 104 | 140 | 122 | 0.017 | 0.073 | 0.047 |
| 3 | S | 1 (PL) | 3/10/2015 | 5-Lane HMA Overlay of PCC | N70-30% ABR | 30 | Y | Y | 58-28 | 114 | 167 | 140 | 0.029 | 0.034 | 0.032 |
| 3 | S | 2 (DL) | 3/10/2015 | 5-Lane HMA Overlay of PCC | N70-30% ABR | 30 | Y | Y | 58-28 | 110 | 174 | 142 | 0.021 | 0.066 | 0.044 |
| Direction | N | All | 3/10/2015 | All | N70-15% ABR | 15 | Y | Y | 64-22 | 100 | 161 | 131 | 0.011 | 0.042 | 0.027 |
| Direction | S | All | 3/10/2015 | All | N70-30% ABR | 30 | Y | Y | 58-28 | 104 | 157 | 131 | 0.014 | 0.032 | 0.023 |

APPENDIX C-4: US 52 – IL 53 (CHICAGO STREET) TO LARAWAY ROAD, AUTOMATED DISTRESS DATA, AUGUST 15, 2014
PRE-CONSTRUCTION RUTTING AND INTERNATIONAL ROUGHNESS INDEX (IRI)

| US 52 - IL 53 (Chicago St.) to Laraway Road | | | | | | | | | | | | | | | |
|---|------|--------|-----------|---------------------------|---------------------|-------|-----|-----|-----------|-------------------|----------|-----|--------------|----------|------|
| Segment | Dir. | Lane | Test Date | Original Pavement Type | Overlay Surface Mix | | | | | IRI (Inches/Mile) | | | Rut (Inches) | | |
| | | | | | Mix | ABR % | RAS | RAP | Virgin PG | Left WP | Right WP | Ave | Left WP | Right WP | Ave |
| 1 | E | 2 (DL) | 8/15/2014 | 4-Lane HMA Overlay of PCC | N70-30% ABR | 30 | Y | Y | 58-28 | NA | NA | NA | 0.13 | 0.16 | 0.15 |
| 1 | W | 2 (DL) | 8/12/2014 | 4-Lane HMA Overlay of PCC | N70-30% ABR | 30 | N | Y | 58-28 | NA | NA | NA | 0.18 | 0.12 | 0.15 |
| 2 | E | 1 (DL) | 8/15/2014 | 2-Lane HMA Overlay of PCC | N70-30% ABR | 30 | Y | Y | 58-28 | 164 | 212 | 188 | 0.21 | 0.22 | 0.02 |
| 2 | W | 1 (DL) | 8/15/2014 | 2-Lane HMA Overlay of PCC | N70-30% ABR | 30 | N | Y | 58-28 | 179 | 240 | 210 | 0.20 | 0.25 | 0.23 |
| 3 | E | 1 (DL) | 8/15/2014 | 2-Lane HMA Overlay of PCC | N70-30% ABR | 30 | Y | Y | 58-28 | 292 | 319 | 305 | 0.26 | 0.29 | 0.28 |
| 3 | W | 1 (DL) | 8/12/2014 | 2-Lane HMA Overlay of PCC | N70-30% ABR | 30 | N | Y | 58-28 | 274 | 340 | 307 | 0.25 | 0.30 | 0.28 |
| Direction | E | All | Aug. 2014 | HMA Overlay of PCC | N70-30% ABR | 30 | Y | Y | 58-28 | 171 | 215 | 193 | 0.20 | 0.22 | 0.15 |
| Direction | W | All | Aug. 2014 | HMA Overlay of PCC | N70-30% ABR | 30 | N | Y | 58-28 | 200 | 260 | 230 | 0.21 | 0.22 | 0.22 |
| NA = Data not available | | | | | | | | | | | | | | | |

APPENDIX C-5: US 52 – IL 53 (CHICAGO STREET) TO LARAWAY ROAD, AUTOMATED DISTRESS DATA, DECEMBER 17, 2014

POST-CONSTRUCTION RUTTING AND INTERNATIONAL ROUGHNESS INDEX (IRI)

| US 52 - IL 53 (Chicago St.) to Laraway Road | | | | | | | | | | | | | | | |
|--|------|--------|------------|---------------------------|---------------------|-------|-----|-----|-----------|-------------------|----------|-----|--------------|----------|-------|
| Segment | Dir. | Lane | Test Date | Original Pavement Type | Overlay Surface Mix | | | | | IRI (Inches/Mile) | | | Rut (Inches) | | |
| | | | | | Mix | ABR % | RAS | RAP | Virgin PG | Left WP | Right WP | Ave | Left WP | Right WP | Ave |
| 1 | E | 2 (DL) | 12/17/2014 | 4-Lane HMA Overlay of PCC | N70-30% ABR | 30 | Y | Y | 58-28 | 61 | 134 | 97 | 0.015 | 0.024 | 0.020 |
| 1 | W | 2 (DL) | 12/17/2014 | 4-Lane HMA Overlay of PCC | N70-30% ABR | 30 | N | Y | 58-28 | 67 | 91 | 79 | 0.018 | 0.013 | 0.017 |
| 2 | E | 1 (DL) | 12/17/2014 | 2-Lane HMA Overlay of PCC | N70-30% ABR | 30 | Y | Y | 58-28 | 77 | 89 | 83 | 0.014 | 0.012 | 0.013 |
| 2 | W | 1 (DL) | 12/17/2014 | 2-Lane HMA Overlay of PCC | N70-30% ABR | 30 | N | Y | 58-28 | 72 | 84 | 78 | 0.012 | 0.010 | 0.011 |
| 3 | E | 1 (DL) | 12/17/2014 | 2-Lane HMA Overlay of PCC | N70-30% ABR | 30 | Y | Y | 58-28 | 100 | 92 | 96 | 0.007 | 0.013 | 0.011 |
| 3 | W | 1 (DL) | 12/17/2014 | 2-Lane HMA Overlay of PCC | N70-30% ABR | 30 | N | Y | 58-28 | 95 | 115 | 105 | 0.018 | 0.013 | 0.015 |
| Direction | E | All | 12/17/2014 | HMA Overlay of PCC | N70-30% ABR | 30 | Y | Y | 58-28 | 78 | 90 | 84 | 0.013 | 0.013 | 0.011 |
| Direction | W | All | 12/17/2014 | HMA Overlay of PCC | N70-30% ABR | 30 | N | Y | 58-28 | 73 | 86 | 80 | 0.013 | 0.013 | 0.017 |

APPENDIX C-6: US 52 – IL 53 (CHICAGO STREET) TO LARAWAY ROAD, AUTOMATED DISTRESS DATA, DECEMBER 17, 2014

WINTER 2015 FROZEN CONSTRUCTION RUTTING AND INTERNATIONAL ROUGHNESS INDEX (IRI)

| US 52 - IL 53 (Chicago St.) to Laraway Road | | | | | | | | | | | | | | | |
|--|------|--------|-----------|---------------------------|---------------------|-------|-----|-----|-----------|-------------------|----------|-----|--------------|----------|-------|
| Segment | Dir. | Lane | Test Date | Original Pavement Type | Overlay Surface Mix | | | | | IRI (Inches/Mile) | | | Rut (Inches) | | |
| | | | | | Mix | ABR % | RAS | RAP | Virgin PG | Left WP | Right WP | Ave | Left WP | Right WP | Ave |
| 1 | E | 2 (DL) | 3/10/2015 | 4-Lane HMA Overlay of PCC | N70-30% ABR | 30 | Y | Y | 58-28 | 58 | 121 | 89 | 0.014 | 0.078 | 0.047 |
| 1 | W | 2 (DL) | 3/10/2015 | 4-Lane HMA Overlay of PCC | N70-30% ABR | 30 | N | Y | 58-28 | 74 | 94 | 84 | 0.019 | 0.020 | 0.019 |
| 2 | E | 1 (DL) | 3/10/2015 | 2-Lane HMA Overlay of PCC | N70-30% ABR | 30 | Y | Y | 58-28 | 96 | 121 | 108 | 0.012 | 0.029 | 0.020 |
| 2 | W | 1 (DL) | 3/10/2015 | 2-Lane HMA Overlay of PCC | N70-30% ABR | 30 | N | Y | 58-28 | 93 | 104 | 98 | 0.011 | 0.024 | 0.017 |
| 3 | E | 1 (DL) | 3/10/2015 | 2-Lane HMA Overlay of PCC | N70-30% ABR | 30 | Y | Y | 58-28 | 110 | 116 | 113 | 0.004 | 0.025 | 0.016 |
| 3 | W | 1 (DL) | 3/10/2015 | 2-Lane HMA Overlay of PCC | N70-30% ABR | 30 | N | Y | 58-28 | 128 | 153 | 140 | 0.025 | 0.037 | 0.030 |
| Direction | E | All | 3/10/2015 | HMA Overlay of PCC | N70-30% ABR | 30 | Y | Y | 58-28 | 95 | 121 | 108 | 0.012 | 0.030 | 0.021 |
| Direction | W | All | 3/10/2015 | HMA Overlay of PCC | N70-30% ABR | 30 | N | Y | 58-28 | 95 | 107 | 101 | 0.012 | 0.025 | 0.018 |

APPENDIX D: PATCHING SCHEDULES

APPENDIX D-1: CRAWFORD AVENUE/PULASKI ROAD PATCHING SCHEDULE

| Route | Section | Pavement Type | Direction | Lane | Patch Station | Length (Feet) | Area (Sq. Yds.) |
|------------------|----------------|----------------------|------------------|-------------|----------------------|----------------------|------------------------|
| Crawford/Pulaski | 1 | 2-Lane Bare PCC | SB | 1 | 13.29 | 7.10 | 9.07 |
| Crawford/Pulaski | 1 | 2-Lane Bare PCC | SB | 1 | 13.58 | 7.20 | 9.12 |
| Crawford/Pulaski | 1 | 2-Lane Bare PCC | SB | 1 | 13.75 | 6.90 | 8.89 |
| Crawford/Pulaski | 1 | 2-Lane Bare PCC | SB | 1 | 14.00 | 6.90 | 8.89 |
| Crawford/Pulaski | 1 | 2-Lane Bare PCC | SB | 1 | 14.12 | 10.40 | 13.30 |
| Crawford/Pulaski | 1 | 2-Lane Bare PCC | SB | 1 | 14.34 | 6.30 | 8.40 |
| Crawford/Pulaski | 1 | 2-Lane Bare PCC | SB | 1 | 14.80 | 6.50 | 8.88 |
| Crawford/Pulaski | 1 | 2-Lane Bare PCC | SB | 1 | 15.00 | 6.40 | 8.75 |
| Crawford/Pulaski | 1 | 2-Lane Bare PCC | SB | 1 | 15.13 | 3.80 | 8.92 |
| Crawford/Pulaski | 1 | 2-Lane Bare PCC | SB | 1 | 15.40 | 6.30 | 8.26 |
| Crawford/Pulaski | 1 | 2-Lane Bare PCC | SB | 1 | 15.58 | 6.30 | 8.47 |
| Crawford/Pulaski | 1 | 2-Lane Bare PCC | SB | 1 | 15.80 | 6.00 | 8.40 |
| Crawford/Pulaski | 1 | 2-Lane Bare PCC | SB | 1 | 16.20 | 19.10 | 26.10 |
| Crawford/Pulaski | 1 | 2-Lane Bare PCC | SB | 1 | 16.90 | 26.50 | 36.20 |
| Crawford/Pulaski | 1 | 2-Lane Bare PCC | SB | 1 | 17.05 | 5.80 | 7.80 |
| Crawford/Pulaski | 1 | 2-Lane Bare PCC | SB | 1 | 17.40 | 10.40 | 14.20 |
| Crawford/Pulaski | 1 | 2-Lane Bare PCC | SB | 1 | 17.65 | 33.20 | 45.40 |
| Crawford/Pulaski | 2 | 5-Lane Bare PCC | NB | 1 | 35.25 | 13.90 | 19.15 |
| Crawford/Pulaski | 2 | 5-Lane Bare PCC | NB | 1 | 38.70 | 20.60 | 27.47 |
| Crawford/Pulaski | 2 | 5-Lane Bare PCC | NB | 1 | 43.25 | 22.60 | 30.13 |
| Crawford/Pulaski | 2 | 5-Lane Bare PCC | NB | 1 | 43.84 | 6.10 | 8.13 |
| Crawford/Pulaski | 2 | 5-Lane Bare PCC | NB | 1 | 45.30 | 6.70 | 8.93 |
| Crawford/Pulaski | 2 | 5-Lane Bare PCC | NB | 1 | 45.70 | 6.40 | 8.75 |
| Crawford/Pulaski | 2 | 5-Lane Bare PCC | NB | 1 | 46.25 | 9.80 | 13.28 |
| Crawford/Pulaski | 2 | 5-Lane Bare PCC | NB | 1 | 47.70 | 20.70 | 27.37 |
| Crawford/Pulaski | 2 | 5-Lane Bare PCC | NB | 1 | 48.10 | 7.80 | 10.40 |
| Crawford/Pulaski | 2 | 5-Lane Bare PCC | NB | 1 | 56.50 | 6.50 | 8.67 |
| Crawford/Pulaski | 2 | 5-Lane Bare PCC | NB | 1 | 61.00 | 6.90 | 9.28 |
| Crawford/Pulaski | 2 | 5-Lane Bare PCC | NB | 1 | 63.44 | 5.30 | 6.42 |
| Crawford/Pulaski | 2 | 5-Lane Bare PCC | NB | 1 | 64.00 | 5.50 | 6.91 |
| Crawford/Pulaski | 2 | 5-Lane Bare PCC | NB | 1 | 67.60 | 5.80 | 7.86 |

**APPENDIX D-1: CRAWFORD AVENUE/PULASKI ROAD PATCHING SCHEDULE
(CONTINUED)**

| Route | Section | Pavement Type | Direction | Lane | Patch Station | Length (Feet) | Area (Sq. Yds.) |
|------------------|---------|------------------------------|---------------------------|------|---------------|---------------|-----------------|
| Crawford/Pulaski | 2 | 5-Lane Bare PCC | NB | 1 | 71.30 | 6.70 | 8.93 |
| Crawford/Pulaski | 2 | 5-Lane Bare PCC | NB | 1 | 80.88 | 6.70 | 8.19 |
| Crawford/Pulaski | 2 | 5-Lane Bare PCC | NB | 1 | 81.10 | 6.80 | 8.16 |
| Crawford/Pulaski | 2 | 5-Lane Bare PCC | SB | 1 | 29.20 | 19.70 | 27.36 |
| Crawford/Pulaski | 2 | 5-Lane Bare PCC | SB | 1 | 34.75 | 6.30 | 8.54 |
| Crawford/Pulaski | 2 | 5-Lane Bare PCC | SB | 1 | 35.24 | 5.90 | 7.87 |
| Crawford/Pulaski | 2 | 5-Lane Bare PCC | SB | 1 | 37.25 | 7.20 | 9.60 |
| Crawford/Pulaski | 2 | 5-Lane Bare PCC | SB | 1 | 38.15 | 8.50 | 11.33 |
| Crawford/Pulaski | 2 | 5-Lane Bare PCC | SB | 1 | 41.30 | 7.80 | 10.49 |
| Crawford/Pulaski | 2 | 5-Lane Bare PCC | SB | 1 | 44.70 | 8.10 | 10.80 |
| Crawford/Pulaski | 2 | 5-Lane Bare PCC | SB | 1 | 46.80 | 6.00 | 8.00 |
| Crawford/Pulaski | 2 | 5-Lane Bare PCC | SB | 1 | 67.60 | 6.00 | 7.27 |
| Crawford/Pulaski | 2 | 5-Lane Bare PCC | SB | 1 | 72.43 | 6.50 | 8.02 |
| Crawford/Pulaski | 2 | 5-Lane Bare PCC | SB | 1 | 76.50 | 6.60 | 7.99 |
| Crawford/Pulaski | 2 | 5-Lane Bare PCC | SB | 2 | 67.50 | 6.40 | 8.68 |
| Crawford/Pulaski | 2 | 5-Lane Bare PCC | SB | 2 | 72.40 | 6.40 | 8.46 |
| Crawford/Pulaski | 2 | 5-Lane Bare PCC | SB | 2 | 76.50 | 6.40 | 8.89 |
| Crawford/Pulaski | 2 | 5-Lane Bare PCC | SB | 2 | 80.60 | 26.80 | 35.70 |
| Crawford/Pulaski | 2 | 5-Lane Bare PCC | SB | 2 | 80.60 | 26.80 | 31.00 |
| Crawford/Pulaski | 2 | 5-Lane Bare PCC | SB | 2 | 81.25 | 6.30 | 8.75 |
| Crawford/Pulaski | 2 | 5-Lane Bare PCC | SB | 2 | 81.25 | 6.80 | 8.24 |
| Crawford/Pulaski | 2 | 5-Lane Bare PCC | SB | 2 | 82.00 | 11.80 | 15.90 |
| Crawford/Pulaski | 2 | 5-Lane Bare PCC | SB | 2 | 82.00 | 11.80 | 14.60 |
| Crawford/Pulaski | 2 | 5-Lane Bare PCC | SB | 2 | 82.40 | 10.60 | 9.54 |
| Crawford/Pulaski | 2 | 5-Lane Bare PCC | SB | 2 | 82.55 | 8.30 | 11.50 |
| Crawford/Pulaski | 2 | 5-Lane Bare PCC | SB | 2 | 82.55 | 10.40 | 9.36 |
| Crawford/Pulaski | 2 | 5-Lane Bare PCC | 167th Street Intersection | | | 6.50 | 9.03 |
| Crawford/Pulaski | 2 | 5-Lane Bare PCC | 167th Street Intersection | | | 6.50 | 10.40 |
| Crawford/Pulaski | 2 | 5-Lane Bare PCC | 167th Street Intersection | | | 7.40 | 14.88 |
| Crawford/Pulaski | 2 | 5-Lane Bare PCC | 167th Street Intersection | | | 11.00 | 48.89 |
| Crawford/Pulaski | 2 | 5-Lane Bare PCC | 167th Street Intersection | | | 6.90 | 13.03 |
| Crawford/Pulaski | 3 | 5-Lane HMA Overlay of PCC | NB | 2 | 104.60 | 7.20 | 30.72 |
| Crawford/Pulaski | 3 | 5-Lane HMA Overlay of PCC | NB | 2 | 108.70 | 15.00 | 20.00 |
| | | | | | Total Area | 891.92 | |

APPENDIX D-2: US 52 (IL 52 TO LARAWAY ROAD) PATCHING SCHEDULE

| Location | Segment | Direction | Length (Ft.) | Width (Ft.) | Area (Sq. Yd.) | | | |
|----------|---------------------------|-----------|-----------------|----------------|----------------|----------|---------|--------|
| | | | | | Type II | Type III | Type IV | Total |
| 144+74 | 3 | EB | 62 | 4 | | | 27.56 | 27.56 |
| 145+36 | 3 | EB | 108 | 7 | | | 84.00 | 84.00 |
| 146+14 | 3 | EB | 6 | 13 | 8.67 | | | 8.67 |
| 146+44 | 3 | EB | 6 | 14 | 9.33 | | | 9.33 |
| 146+73 | 3 | WB | 5 | 21 | 11.67 | | | 11.67 |
| 148+43 | 3 | EB | 199 | 4 | | | 88.44 | 88.44 |
| 148+75 | 3 | WB | 6 | 11.5 | 7.67 | | | 7.67 |
| 149+10 | 3 | WB | 21 | 10 | | 23.33 | | 23.33 |
| N Limit* | 3 | EB | 24 | 4 | 10.67 | | | 10.67 |
| 152+80 | 3 | WB | 6 | 17 | 11.33 | | | 11.33 |
| 153+30 | 3 | WB | 6 | 18 | 12.00 | | | 12.00 |
| 153+50 | 3 | WB | 6 | 18 | 12.00 | | | 12.00 |
| 153+80 | 3 | WB | 76 | 4 | | | 33.78 | 33.78 |
| 154+35 | 3 | WB | 6 | 17 | 11.33 | | | 11.33 |
| 155+09 | 3 | WB | 38 | 6 | | | 25.33 | 25.33 |
| 155+30 | 3 | WB | 6 | 16 | 10.67 | | | 10.67 |
| | Note: * Intersection area | | | Total | 105.33 | 23.33 | 259.11 | 387.78 |

APPENDIX E: LEVEL BINDER AND SURFACE COURSE MIX DESIGNS

APPENDIX E-1: CRAWFORD AVENUE/PULASKI ROAD, MIX 81BIT147M: 4.75 LEVEL BINDER – PG 70-28 – 35% ABR W/RAP & RAS

| | | | | | | | |
|-----------------------------|--|------------------------------|--|---------------------|--|---------------------------|--|
| IDOT Lab Verification No. → | | 28BITVMT9 | | Ver. 10.00-04.18.14 | | DATE: 04/17/15 | |
| Producer Name & Home → | | 9116-06 Sandeno East | | Hazel Crest | | Plant Location: 81BIT147M | |
| Material Code Number → | | 19510R HMA NS0 4.75 REC SURF | | | | | |

| Plant Bin # | #7 | #6 | #5 | #4 | #3 | #2 | #1 | MF | RCY | RCY | RAS #2 | RAP #1 | ASPHALT |
|------------------|-----|-----|----------|----------|----------|-----------|------------|----------|-----|-----|-----------|--------------|---------------|
| Size | | | 042CM11 | 032CM16 | 038FM20 | 037FM02 | 038FM20CRS | 004MF01 | | | 017FM98 | 017FM0400 | 10130 |
| Source (PROD #) | | | 50312-04 | 50312-04 | 50312-04 | 52600-06 | 5312-04 | 50312-66 | | | 6616-06 | 50315-12 | 1757-03 |
| (NAME) | | | Hanson | Hanson | Hanson | Moose Lk | Hanson | Hanson | | | Southwind | Sandeno East | Seneca |
| (LOC) | | | Thornton | Thornton | Thornton | Miles, MI | Thornton | Thornton | | | Thornton | Hazel Crest | Lemont |
| (ADD. INFO) | | | | | | | | | | | | | SBS PG 70-28 |
| Aggregate Blend: | | | | | | | | | 0.0 | 0.0 | 25.0 | 4.5 | < AB in RAP |
| | 0.0 | 0.0 | 0.0 | 0.0 | 45.0 | 16.0 | 0.0 | 1.0 | 0.0 | 0.0 | 4.0 | 34.0 | PG 70-28 |
| Mixture Blend: | | | | | | | | | 0.0 | 0.0 | 4.9 | 32.9 | 100.0 |
| | 0.0 | 0.0 | 0.0 | 0.0 | 41.5 | 14.8 | 0.0 | 0.9 | 0.0 | 0.0 | 4.9 | 32.9 | Totals: 100.0 |

| Agg No. | #7 | #6 | #5 | #4 | #3 | #2 | #1 | MF | RCY | RCY | RAS #2 | RAP #1 | Aggregate Blend | Mixture Comp Spec |
|----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|--------|-----------------|-------------------|
| 1" (25.0mm) | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100 | |
| 3/4" (19.0mm) | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100 | |
| 1/2" (12.5mm) | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100 | 100 |
| 3/8" (9.5mm) | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100 | 100 |
| No.4 (4.75mm) | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100 | 100 |
| No.8 (2.36mm) | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100 | 100 |
| No.16 (1.18mm) | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100 | 100 |
| No.30 (600µm) | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100 | 100 |
| No.50 (300µm) | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100 | 100 |
| No.100 (150µm) | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100 | 100 |
| No.200 (75µm) | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100 | 100 |
| Bulk Sp Gr | 1.000 | 1.000 | 2.573 | 2.669 | 2.576 | 2.591 | 2.662 | 2.900 | 1.000 | 1.000 | 2.500 | 2.660 | 2.651 | Dust/AB |
| Absorption, % | 1.00 | 1.00 | 1.60 | 1.79 | 1.20 | 1.20 | 1.80 | 1.00 | 1.00 | 1.00 | 1.00 | 1.11 | 1.31 | Ratio |
| | | | | | | | | | | | | | SP GR AB | 0.97 |

SUMMARY OF SUPERPAVE GYRATORY DESIGN DATA

| DATA for N-int. 6 | | | | | | | | | | Hamburg Wheel Information | |
|-------------------|----------|-------|-------|------------|------|------|-------|------|------|---------------------------|-------|
| MIX | AB, %MIX | Gmb | Gmm | Voids (Pa) | VMA | VFA | Vbe | Pbe | Pba | Sample No. Passes | 15000 |
| MIX 1 | 6.7 | 2.121 | 2.467 | 14.0 | 25.4 | 44.7 | 11.34 | 5.51 | 1.28 | Sample Wheel Depth | 5.13 |
| MIX 2 | 7.2 | 2.157 | 2.445 | 11.8 | 24.5 | 51.9 | 12.72 | 6.08 | 1.21 | TSR Information | |
| MIX 3 | 7.7 | 2.179 | 2.427 | 10.6 | 24.5 | 56.7 | 13.85 | 6.58 | 1.21 | Conditioned | 128.7 |
| MIX 4 | 8.2 | 2.177 | 2.412 | 9.7 | 24.5 | 60.4 | 14.87 | 7.04 | 1.26 | Unconditioned | 151.3 |
| | | | | | | | | | | TSR | 0.85 |
| | | | | | | | | | | CA Strip Rating | 1 |
| | | | | | | | | | | FA Strip Rating | 1 |
| | | | | | | | | | | Additive Prod # | |
| | | | | | | | | | | Additive Product Name | |
| | | | | | | | | | | Additive % | |

| DATA for N-das. 50 | | | | | | | | | | | |
|--------------------|-----|-------|-------|------------|------|------|-------|------|-------|------|--|
| MIX | AB | Gmb | Gmm | Voids (Pa) | VMA | VFA | Vbe | Pbe | Gse | Pba | |
| MIX 1 | 6.7 | 2.306 | 2.467 | 6.5 | 18.8 | 55.3 | 12.32 | 5.51 | 2.741 | 1.28 | |
| MIX 2 | 7.2 | 2.326 | 2.445 | 4.9 | 18.6 | 73.8 | 13.72 | 6.08 | 2.736 | 1.21 | |
| MIX 3 | 7.7 | 2.341 | 2.427 | 3.5 | 18.5 | 80.9 | 14.94 | 6.58 | 2.736 | 1.21 | |
| MIX 4 | 8.2 | 2.352 | 2.412 | 2.5 | 18.6 | 86.6 | 16.06 | 7.04 | 2.740 | 1.26 | |

| OPTIMUM DESIGN DATA @ Ndas | | | | | | | | | | | | | |
|----------------------------|-----|-------|-------|-------------|------|------|-------|-------|------|--------|-----------|------|-----|
| GYRATIONS | AB | Gmb | Gmm | %VOIDS (Pa) | VMA | VFA | Gse | Gsb | TSR | RCY AB | Virgin AB | ABR | |
| 50 | 7.7 | 2.341 | 2.426 | Target | 18.5 | 81.1 | 2.736 | 2.651 | 0.85 | 2.71 | 5.01 | 35.1 | |
| 10/08 mod | 7.7 | | | 3.5 | | | | | | | | | |
| REMARKS LINE 1 | | | | | | | | | | | | | |
| REMARKS LINE 2 | | | | | | | | | | | | | |
| BITUMINOUS MIXTURE AGED | | | | | | | | | | 1 | HOURS @ | | 295 |

Lab Preparing Design: PP
 Designing Lab Mix: _____
 Designing Lab Name: D Const.

Tested by: [Signature]
 Reviewed by: _____

Verified by: _____
 Final Approval: _____

81BIT147M

APPENDIX E-2: CRAWFORD AVENUE/PULASKI ROAD, MIX: 81BIT156M – SURFACE COURSE NORTH BOUND LANES – PG 64-22 – 15% ABR W/RAP & RAS

IDOT Lab Verificat on No.: Ver. 11.01-07.07.14 DATE: **81BIT156M**

TPN7015% **48BITVS87**
81BIT156M

Producer Number & Name → **5116-06 Sandeno East Hazel Crest** ← Plant Location
Material Code Number → **19524R HMA SC N70 D REC 9.5mm**

| Plant Bin # | #7 | #6 | #5 | #4 | #3 | #2 | #1 | MF | RCY | RCY | RAS #2 | RAP #1 | ASPHALT |
|-------------------|-----|-----|------|----------|----------|-----------|-----|----------|-----|-----|-----------|--------------|-------------|
| Size | | | | 032CM16 | 028FM20 | 037FM02 | | 004MF01 | | | | | 10127 |
| Source (PROD #) | | | | 56312-04 | 50312-04 | 52500-06 | | 50312-04 | | | 6616-06 | 50315-12 | Senneca |
| (NAME) | | | | Hanson | Hanson | Moose Lk | | Hanson | | | Southwind | Sandeno East | 1757-05 |
| (LOC) | | | | Thornton | Thornton | Niles, MI | | Thornton | | | Thornton | Hazel Crest | Lemont |
| (ADD. INFO) | | | | | | | | | | | | | PG 64-22 |
| Aggregate Blend: | | | | | | | | | 0.0 | 0.0 | 25.0 | 4.5 | < AB in RAP |
| 0.0 | 0.0 | 0.0 | 65.0 | 15.0 | 12.0 | 0.0 | 1.0 | 0.0 | 0.0 | 2.0 | 5.0 | 100.0 | PG 64-22 |
| Mixture Blend: | | | | | | | | | | | | | Totals: 1 |
| 0.0 | 0.0 | 0.0 | 61.3 | 14.2 | 11.3 | 0.0 | 0.9 | 0.0 | 0.0 | 2.5 | 4.9 | 100.0 | |

| Agg No. | #7 | #6 | #5 | #4 | #3 | #2 | #1 | MF | RCY | RCY | RAS #2 | RAP #1 | Aggregate Blend | Mixture Comp Spec |
|----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|--------|-----------------|-------------------|
| Sieve Size | | | | | | | | | | | | | | |
| 1" (25.0mm) | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100 | |
| 3/4" (19.0mm) | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100 | |
| 1/2" (12.5mm) | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100 | 100 |
| 3/8" (9.5mm) | 100.0 | 100.0 | 100.0 | 95.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 97 | 90-100 |
| No.4 (4.75mm) | 100.0 | 100.0 | 100.0 | 29.0 | 98.0 | 97.0 | 100.0 | 100.0 | 100.0 | 100.0 | 55.0 | 74.0 | 52 | 32-69 |
| No.8 (2.36mm) | 100.0 | 100.0 | 100.0 | 7.0 | 81.0 | 87.0 | 100.0 | 100.0 | 100.0 | 100.0 | 85.0 | 54.0 | 33 | 32-52 |
| No.16 (1.18mm) | 100.0 | 100.0 | 100.0 | 5.0 | 50.0 | 77.0 | 100.0 | 100.0 | 100.0 | 100.0 | 67.0 | 40.0 | 24 | 10-32 |
| No.30 (600µm) | 100.0 | 100.0 | 100.0 | 4.0 | 31.0 | 57.0 | 100.0 | 100.0 | 100.0 | 100.0 | 50.0 | 30.0 | 16 | |
| No.50 (300µm) | 100.0 | 100.0 | 100.0 | 4.0 | 18.0 | 23.0 | 100.0 | 100.0 | 100.0 | 100.0 | 40.0 | 19.0 | 11 | 4-15 |
| No.100 (150µm) | 100.0 | 100.0 | 100.0 | 3.0 | 10.0 | 3.0 | 100.0 | 95.0 | 100.0 | 100.0 | 35.0 | 12.0 | 6 | 3-10 |
| No.200 (75µm) | 100.0 | 100.0 | 100.0 | 2.0 | 5.3 | 1.1 | 100.0 | 90.0 | 100.0 | 100.0 | 28.5 | 8.8 | 4.7 | 4-8 |
| Bulk Sp Gr | 1.000 | 1.000 | 1.000 | 2.669 | 2.676 | 2.591 | 1.000 | 2.900 | 1.000 | 1.000 | 2.500 | 2.660 | 2.659 | Dur:AB |
| Absorption, % | 1.00 | 1.00 | 1.00 | 1.70 | 1.20 | 1.20 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.45 | Ratio |
| | | | | | | | | | | | | | 1.031 | 0.83 |

SUMMARY OF SUPERPAVE GYRATORY DESIGN DATA

| DATA for N-int. 7 | | | | | | | | | | Hamburg Wheel Information | |
|-------------------|----------|-------|-------|------------|------|------|-------|------|------|---------------------------|-------|
| | AB, %MIX | Gmb | Gmm | Voids (Pa) | VMA | VFA | Vbe | Pbe | Pba | Sample No. Passes | 10000 |
| MIX 1 | 5.2 | 2.129 | 2.512 | 15.3 | 24.1 | 36.7 | 8.84 | 4.28 | 0.97 | Sample Wheel Depth | 3.50 |
| MIX 2 | 5.7 | 2.148 | 2.494 | 13.9 | 23.8 | 41.8 | 9.95 | 4.78 | 0.98 | | |
| MIX 3 | 6.2 | 2.137 | 2.478 | 13.8 | 24.6 | 44.1 | 10.86 | 5.24 | 1.02 | | |
| MIX 4 | 6.7 | 2.127 | 2.460 | 13.5 | 25.4 | 46.6 | 11.82 | 5.73 | 1.04 | | |

| DATA for N-des. 70 | | | | | | | | | | TSR Information | | |
|--------------------|-----|-------|-------|------------|------|------|-------|------|-------|-----------------|-----------------|-------|
| | AB | Gmb | Gmm | Voids (Pa) | VMA | VFA | Vbe | Pbe | Gse | Pba | Conditioned | 129.2 |
| MIX 1 | 5.2 | 2.373 | 2.512 | 5.5 | 15.4 | 64.1 | 9.85 | 4.28 | 2.727 | 0.97 | Unconditioned | 144.1 |
| MIX 2 | 5.7 | 2.395 | 2.494 | 4.0 | 15.1 | 73.6 | 11.10 | 4.78 | 2.728 | 0.98 | TSR | 0.50 |
| MIX 3 | 6.2 | 2.410 | 2.478 | 2.7 | 15.0 | 81.7 | 12.25 | 5.24 | 2.731 | 1.02 | CA Strip Rating | 1 |
| MIX 4 | 6.7 | 2.420 | 2.460 | 1.6 | 15.1 | 89.2 | 13.45 | 5.73 | 2.732 | 1.04 | FA Strip Rating | 1 |

| OPTIMUM DESIGN DATA @ Ndes | | | | | | | | | | | | |
|----------------------------|---|-------|-------|-------------|------|------|-------|-------|------|--------|-----------|------|
| GYRATIONS | AB | Gmb | Gmm | %VOIDS (Pa) | VMA | VFA | Gse | Gsb | TSR | RCY AB | Virgin AB | ABR |
| 70 | 5.7 | 2.394 | 2.494 | Target 4.0 | 15.1 | 73.5 | 2.728 | 2.658 | 0.90 | 0.9 | 4.8 | 14.9 |
| REMARKS LINE 1 | <input type="text"/> | | | | | | | | | | | |
| REMARKS LINE 2 | <input type="text"/> | | | | | | | | | | | |
| | BITUMINOUS MIXTURE AGED <input type="text" value="1"/> HOURS @ <input type="text" value="295"/> | | | | | | | | | | | |

Lab Preparing Design Designing Lab Mix Tested by: _____ Verified by: _____

APPENDIX E-3: CRAWFORD AVENUE/PULASKI ROAD, MIX: 81BIT157M – SURFACE COURSE SOUTH BOUND LANES – PG 58-28 – 30% ABR W/RAP & RAS

81BIT157M
48BITV589

IDOT Lab Verification No. → _____ Ver. 11.01-07.07.14 DATE: 09/18/14

Producer Number & Name → 5116-06 Sandeno East Hazel Crest ← Plant Location
Material Code Number → 19524R HMA SC N70 D REC 9.5mm TPN7030%

| Plant Bin # | #7 | #6 | #5 | #4 | #3 | #2 | #1 | MF | RCY | RCY | RAS #2 | RAP #1 | ASPHALT |
|------------------|-----|-----|-----|------------|------------|------------|-----|----------|-----|-----|-----------|--------------|-------------|
| Size | | | | 032CM16 ✓ | 023FM20 ✓ | 027FM02 ✓ | | 004MF01 | | | 017FM08 | 017FM0400 | 10126 ✓ |
| Source (PROD #) | | | | 50312-04 ✓ | 50312-04 ✓ | 52600-05 ✓ | | 50312-04 | | | 6616-06 | 50315-12 | Seneca ✓ |
| (NAME) | | | | Hanson | Hanson | Moose Lk | | Hanson | | | Southwind | Sandeno East | 1757-06 ✓ |
| (LOC) | | | | Thornton | Thornton | Niles, MI | | Thornton | | | Thornton | Hazel Crest | Lemont ✓ |
| (ADD. INFO) | | | | | | | | | | | | | PG 58-28 ✓ |
| Aggregate Blend: | | | | | | | | | 0.0 | 0.0 | 25.0 | 4.5 | < A3 in RAP |
| | 0.0 | 0.0 | 0.0 | 62.0 | 13.0 | 10.0 | 0.0 | 1.0 ✓ | 0.0 | 0.0 | 4.0 | 10.0 | PG 58-28 |
| Mixture Blend: | | | | | | | | | | | | | 100.0 |
| | 0.0 | 0.0 | 0.0 | 68.4 | 12.2 | 9.4 | 0.0 | 0.9 | 0.0 | 0.0 | 5.0 | 9.9 | Totals ↓ |
| | | | | | | | | | | | | | 100.0 |

| Agg No. | #7 | #6 | #5 | #4 | #3 | #2 | #1 | MF | RCY | RCY | RAS #2 | RAP #1 | Aggregate Blend | Mixture Comp Spec |
|----------------|-------|-------|-------|---------|---------|---------|-------|---------|-------|-------|--------|--------|-----------------|-------------------|
| 1" (25.0mm) | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100 | |
| 3/4" (19.0mm) | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100 | |
| 1/2" (12.5mm) | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100 | |
| 3/8" (9.5mm) | 100.0 | 100.0 | 100.0 | 95.0 ✓ | 90.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100 | 100 |
| No.4 (4.75mm) | 100.0 | 100.0 | 100.0 | 29.0 ✓ | 95.0 | 97.0 | 100.0 | 100.0 | 100.0 | 100.0 | 95.0 ✓ | 74.0 | 97 | 32-69 ✓ |
| No.8 (2.36mm) | 100.0 | 100.0 | 100.0 | 7.0 | 81.0 ✓ | 87.0 | 100.0 | 100.0 | 100.0 | 100.0 | 85.0 ✓ | 54.0 | 33 | 32-52 ✓ |
| No.16 (1.18mm) | 100.0 | 100.0 | 100.0 | 5.0 | 60.0 | 77.0 | 100.0 | 100.0 | 100.0 | 100.0 | 67.0 ✓ | 40.0 | 25 | 10-32 ✓ |
| No.30 (600µm) | 100.0 | 100.0 | 100.0 | 4.0 | 31.0 ✓ | 57.0 ✓ | 100.0 | 100.0 | 100.0 | 100.0 | 50.0 ✓ | 30.0 | 18 | |
| No.50 (300µm) | 100.0 | 100.0 | 100.0 | 4.0 | 16.0 | 23.0 | 100.0 | 100.0 | 100.0 | 100.0 | 40.0 ✓ | 19.0 | 12 | 4-15 ✓ |
| No.100 (150µm) | 100.0 | 100.0 | 100.0 | 3.0 | 10.0 | 3.0 | 100.0 | 95.0 | 100.0 | 100.0 | 35.0 | 12.0 | 7 | 3-10 ✓ |
| No.200 (75µm) | 100.0 | 100.0 | 100.0 | 3.0 | 5.3 | 1.1 | 100.0 | 90.0 | 100.0 | 100.0 | 25.5 ✓ | 8.5 | 5.5 | 4-6 ✓ |
| Bulk Sp Gr | 1.000 | 1.000 | 1.000 | 2.669 ✓ | 2.676 ✓ | 2.591 ✓ | 1.000 | 2.990 ✓ | 1.000 | 1.000 | 2.500 | 2.660 | 2.656 | Dust/AB |
| Absorption, % | 1.00 | 1.00 | 1.00 | 1.70 ✓ | 1.20 ✓ | 1.20 ✓ | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.42 | Ratio |
| | | | | | | | | | | | | | 1.031 | 0.54 |

SUMMARY OF SUPERPAVE GYRATORY DESIGN DATA

| DATA for N-int. 7 | | | | | | | | | |
|-------------------|----------|-------|-------|------------|------|------|-------|------|------|
| MIX | AB, %MIX | Gmb | Gmm | Voids (Pa) | VMA | VFA | Vbe | Pbe | Pba |
| MIX 1 | 5.3 | 2.140 | 2.519 | 15.1 | 23.7 | 36.5 | 8.66 | 4.57 | 1.19 |
| MIX 2 | 6.8 | 2.155 | 2.499 | 13.8 | 23.6 | 41.6 | 9.80 | 4.69 | 1.18 |
| MIX 3 | 6.3 | 2.159 | 2.478 | 12.8 | 23.9 | 45.9 | 10.95 | 5.23 | 1.14 |
| MIX 4 | 6.8 | 2.165 | 2.461 | 12.0 | 24.0 | 49.9 | 12.01 | 6.72 | 1.16 |

2.740-2.736 = .004 OK

| DATA for N-des. 70 | | | | | | | | | |
|--------------------|-----|-------|-------|------------|------|------|-------|------|-------|
| MIX | AB | Gmb | Gmm | Voids (Pa) | VMA | VFA | Vbe | Pbe | Pba |
| MIX 1 | 5.3 | 2.378 | 2.519 | 5.6 | 15.2 | 63.2 | 9.62 | 4.17 | 2.740 |
| MIX 2 | 6.8 | 2.397 | 2.499 | 4.1 | 15.0 | 72.8 | 10.90 | 4.69 | 2.739 |
| MIX 3 | 6.3 | 2.408 | 2.478 | 2.8 | 15.1 | 81.3 | 12.22 | 5.23 | 2.736 |
| MIX 4 | 6.8 | 2.419 | 2.461 | 1.7 | 15.1 | 88.7 | 15.42 | 6.72 | 2.738 |

| OPTIMUM DESIGN DATA @ Ndes | | | | | | | | | | | | |
|----------------------------|-----|-------|-------|-------------|------|------|-------|-------|------|--------|-----------|--------|
| GYRATIONS | AB | Gmb | Gmm | %VOIDS (Pa) | VMA | VFA | Gee | Gsb | TSR | RCY AB | Virgin AB | ABR |
| 70 | 5.3 | | | Target | | | | | | | | |
| | 5.3 | 2.398 | 2.498 | 4.0 | 15.0 | 73.3 | 2.739 | 2.656 | 0.88 | 1.70 | 4.13 | 29.2 ✓ |

REMARKS LINE 1: _____
REMARKS LINE 2: _____

BITUMINOUS MIXTURE AGED: 1 HOURS @ 295

MAX ABR = 30%
1.6955 = 1.29, 08
5.83

TPN7030%

Lab Preparing Design: PP
Designing Lab Mix: TPN7030%
Designing Lab Name: D Con

Tested by: _____
Reviewed by: _____

Verified by: _____
Final Approval: _____

APPENDIX E-4: US 52 (IL 53 TO LARAWAY RD), MIX 81BIT141M: 4.75 LEVEL BINDER – PG 70-28 – 35% ABR W/RAP & RAS

IDOT Lab Verification No.: 48BITVR01 Ver. 10.00-04.16.13 DATE: 02/04/14

Producer Number & Name: 5116-05 D Construction Rockdale Plant Location: BIT141M

Material Code Number: 19510R HMA N50 4.75 REC SURF

| Plant Bin # | #7 | #8 | #6 | #4 | #3 | #2 | #1 | MF | FRAP #4 | RAS #3 | RCY | RCY | ASPHALT |
|------------------|----------|----------|----------|-----|-----|-----|-----|----------|-----------|-----------|-----|-----|--------------------------|
| Size | 038FM20 | 037FM02 | 038FM22 | | | | | 004MF01 | 017FM0400 | 017FM88 | | | 101B0 |
| Source (PROD #) | 61972-16 | 60990-64 | 61972-16 | | | | | 6118-06 | 6118-06 | 6618-06 | | | 1767-06 |
| (NAME) | LaFarge | KellyCo | LaFarge | | | | | D Const | D Const | Southwind | | | Seneca |
| (LOC) | Joliet | Norway | Joliet | | | | | Rockdale | Rockdale | Thornton | | | Lemont |
| (ADD. INFO) | | | | | | | | | | | | | SSS PG 70-28 |
| Aggregate Blend: | | | | | | | | | 4.4 | 26.0 | 0.0 | 0.0 | AS In RAP |
| | 43.3 | 22.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.7 | 30.0 | 4.0 | 0.0 | 0.0 | Plan PG Grade > PG 70-28 |
| Mixture Blend: | | | | | | | | | | | | | Total |
| | 39.9 | 20.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.7 | 28.9 | 4.9 | 0.0 | 0.0 | 100.0 |

| App No. | #7 | #8 | #6 | #4 | #3 | #2 | #1 | MF | FRAP #4 | RAS #3 | RCY | RCY | Aggregate Blend | Mixture Comp |
|----------------|-------|-------|-------|-------|-------|-------|-------|-------|---------|--------|-------|-------|-----------------|--------------|
| Sieve Size | | | | | | | | | | | | | | Spec |
| 1" (25.0mm) | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100 | |
| 3/4" (19.0mm) | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100 | |
| 1/2" (12.5mm) | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100 | 100 |
| 3/8" (9.5mm) | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100 | 100 |
| No.4 (4.75mm) | 100.0 | 97.0 | 68.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 73.0 | 96.0 | 100.0 | 100.0 | 81 | 80-100 |
| No.8 (2.38mm) | 89.0 | 83.0 | 20.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 47.0 | 86.0 | 100.0 | 100.0 | 71 | 70-80 |
| No.16 (1.18mm) | 68.0 | 67.0 | 12.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 36.0 | 67.0 | 100.0 | 100.0 | 64 | 60-66 |
| No.30 (600µm) | 32.0 | 47.0 | 8.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 32.0 | 60.0 | 100.0 | 100.0 | 37 | 36-66 |
| No.60 (300µm) | 26.0 | 20.0 | 6.0 | 100.0 | 100.0 | 100.0 | 100.0 | 96.0 | 21.0 | 40.0 | 100.0 | 100.0 | 24 | 16-30 |
| No.100 (150µm) | 11.0 | 8.0 | 4.0 | 100.0 | 100.0 | 100.0 | 100.0 | 90.0 | 19.0 | 36.0 | 100.0 | 100.0 | 12 | 10-18 |
| No.200 (75µm) | 4.9 | 3.9 | 2.4 | 100.0 | 100.0 | 100.0 | 100.0 | 86.0 | 8.8 | 26.6 | 100.0 | 100.0 | 7.2 | 7-8 |
| Bulk Sp Gr | 2.718 | 2.689 | 2.878 | 1.000 | 1.000 | 1.000 | 1.000 | 2.900 | 2.980 | 2.600 | 1.000 | 1.000 | 2.882 | Dust/AB |
| Absorption, % | 0.80 | 1.30 | 1.70 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | Ratio |
| | | | | | | | | | | | | | SP GR AB | 1.040 |
| | | | | | | | | | | | | | | 0.92 |

SUMMARY OF SUPERPAVE GYRATORY DESIGN DATA

| DATA for N-int. 8 | | | | | | | | | |
|-------------------|----------|-------|-------|-----------|------|------|-------|------|------|
| | AB, %MIX | Gmb | Gmm | Volc (Pa) | VMA | VFA | Vbe | Pbe | Pba |
| MIX 1 | 7.3 | 2.183 | 2.448 | 11.8 | 24.7 | 62.8 | 13.04 | 8.27 | 1.11 |
| MIX 2 | 7.8 | 2.187 | 2.432 | 10.9 | 24.9 | 68.3 | 14.04 | 8.74 | 1.16 |
| MIX 3 | 8.3 | 2.187 | 2.419 | 9.2 | 24.3 | 82.3 | 16.13 | 7.16 | 1.24 |
| MIX 4 | 8.8 | 2.209 | 2.403 | 8.1 | 24.3 | 88.8 | 16.26 | 7.86 | 1.28 |

| Hamburg Wheel Information | |
|---------------------------|-------|
| Sample No. Passes | 20000 |
| Sample Wheel Depth | -2.08 |

| DATA for N-des. 60 | | | | | | | | | |
|--------------------|-----|-------|-----------|-----|------|------|-------|------|-------|
| | Gmb | Gmm | Volc (Pa) | VMA | VFA | Vbe | Pbe | Gse | Pba |
| MIX 1 | 7.3 | 2.344 | 2.448 | 4.3 | 18.4 | 78.9 | 14.13 | 8.27 | 2.740 |
| MIX 2 | 7.8 | 2.344 | 2.432 | 3.8 | 18.8 | 80.8 | 16.19 | 8.74 | 2.743 |
| MIX 3 | 8.3 | 2.069 | 2.419 | 2.1 | 18.4 | 83.7 | 16.31 | 7.16 | 2.748 |
| MIX 4 | 8.8 | 2.978 | 2.403 | 1.0 | 18.5 | 84.4 | 17.49 | 7.86 | 2.761 |

| TSR Information | |
|-----------------------|-------|
| Conditioned | 155.1 |
| Unconditioned | 180.3 |
| TSR | 0.92 |
| CA Strip Rating | 1 |
| FA Strip Rating | 1 |
| Additive Prod # | |
| Additive Product Name | |
| Additive % | |

| OPTIMUM DESIGN DATA @ Ndes | | | | | | | | | | | | |
|----------------------------|---------------------------------------|-------|-------|-------------|------|------|-------|-------|------|--------|-----------|------|
| GYRATIONS | AB | Gmb | Gmm | %VOIDS (Pa) | VMA | VFA | Gse | Gsb | TSR | RCY AB | Virgin AB | ABR |
| | 7.84 | | | Target | | | | | | | | |
| 60 | 7.8 | 2.348 | 2.431 | 3.6 | 18.8 | 81.4 | 2.743 | 2.882 | 0.92 | 2.60 | 6.34 | 31.9 |
| REMARKS LINE 1 | | | | | | | | | | | | |
| REMARKS LINE 2 | BITUMINOUS MIXTURE AGED 2 HOURS @ 305 | | | | | | | | | | | |

Lab Preparing Design: PP Tested by: _____ Verified by: _____

Designing Lab Mix: E18BIT086M Reviewed by: _____ Final Approval: _____

Designing Lab Name: D Const

BIT141M

APPENDIX E-5: US 52 (IL 53 TO LARAWAY ROAD), MIX 81BIT159M: N70 SURFACE – PG 58-28 – 30% ABR W/ RAS ONLY

APPENDIX E-6: US 52 (IL 53 TO LARAWAY ROAD), MIX 81BIT140M: N70 SURFACE – PG 58-28 – 30% ABR W/RAP & RAS

1618-V

81BIT159M

873 (33) L only

81BIT159M
48BITVS 96

131/14

DOT Lab Verification No. → _____ Ver. 11.01-07.07.14

DATE: October 21 2014

DC14003

Plant Location: _____

Producer Number & Name → 5116-05 D Construction Rockdale

Material Code Number → 19524R HMA N70 REC SURFACE

| Plant Bin # | #7 | #8 | #5 | #4 | #3 | #2 | #1 | MF | FRAP #4 | FRAP #3 | RCY | RCY | ASPHALT |
|------------------|----------|------|-----|-----|----------|----------|-----|----------|-----------|----------|-----|-----|-------------|
| Size | | | | | | | | | | | | | |
| Source (PROD #) | 032CM16 | | | | 03BFM22 | 03BFM20 | | 054MF02 | 017CM1204 | 017FM400 | | | 10126 |
| (NAME) | 51972-15 | | | | 51972-15 | 51972-15 | | 5116-05 | 5116-05 | 5116-05 | | | 1757-05 |
| (LOC) | Lafarge | | | | Lafarge | Lafarge | | D Const. | D Const. | D Const. | | | Seneca |
| (ADD. INFO) | Joliet | | | | Joliet | Joliet | | Rockdale | Rockdale | Rockdale | | | Lamont |
| | | | | | | | | | 3.5 | 6.0 | 0.0 | 0.0 | PG 58-28 |
| | | | | | | | | | | | | | < AB in RAP |
| | | | | | | | | | | | | | PG 64-22 |
| Aggregate Blend: | 0.0 | 30.0 | 0.0 | 0.0 | 29.5 | 6.0 | 0.0 | 0.5 | 14.0 | 20.0 | 0.0 | 0.0 | 100.0 |
| Mixture Blend: | 0.0 | 28.2 | 0.0 | 0.0 | 27.7 | 5.6 | 0.0 | 0.5 | 13.7 | 20.0 | 0.0 | 0.0 | 100.0 |

| Agg No. | #7 | #8 | #5 | #4 | #3 | #2 | #1 | MF | FRAP #4 | FRAP #3 | RCY | RCY | Aggregate Blend | Mixture Comp |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|---------|---------|-------|-------|-----------------|--------------|
| Sieve Size | | | | | | | | | | | | | | |
| 1" (25.0mm) | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100 |
| 3/4" (19.0mm) | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 90-100 |
| 1/2" (12.5mm) | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 92.0 | 100.0 | 100.0 | 100.0 | 81 |
| 3/8" (9.5mm) | 100.0 | 97.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 45.0 | 99.0 | 100.0 | 100.0 | 100.0 | 32-52 |
| No. 4 (4.75mm) | 100.0 | 36.0 | 100.0 | 100.0 | 100.0 | 88.0 | 100.0 | 100.0 | 25.0 | 78.0 | 100.0 | 100.0 | 100.0 | 24 |
| No. 8 (2.36mm) | 100.0 | 7.0 | 100.0 | 100.0 | 100.0 | 58.0 | 100.0 | 100.0 | 17.0 | 59.0 | 100.0 | 100.0 | 100.0 | 17 |
| No. 16 (1.18mm) | 100.0 | 5.0 | 100.0 | 100.0 | 100.0 | 32.0 | 100.0 | 100.0 | 13.0 | 29.0 | 100.0 | 100.0 | 100.0 | 13 |
| No. 30 (500µm) | 100.0 | 4.0 | 100.0 | 100.0 | 100.0 | 25.0 | 100.0 | 100.0 | 9.0 | 19.0 | 100.0 | 100.0 | 100.0 | 9 |
| No. 50 (300µm) | 100.0 | 4.0 | 100.0 | 100.0 | 100.0 | 11.0 | 100.0 | 100.0 | 5.0 | 10.0 | 100.0 | 100.0 | 100.0 | 5-10 |
| No. 100 (150µm) | 100.0 | 4.0 | 100.0 | 100.0 | 100.0 | 4.0 | 100.0 | 100.0 | 3.0 | 6.7 | 100.0 | 100.0 | 100.0 | 6.0 |
| No. 200 (75µm) | 100.0 | 3.3 | 100.0 | 100.0 | 100.0 | 2.4 | 100.0 | 100.0 | 1.0 | 1.3 | 100.0 | 100.0 | 100.0 | 4-6 |
| Dust Sp Gr | 1.000 | 2.659 | 1.000 | 1.000 | 2.878 | 2.716 | 1.000 | 2.900 | 2.660 | 2.660 | 1.000 | 1.000 | 2.660 | Dust/AB |
| Absorption, % | 1.00 | 1.80 | 1.00 | 1.00 | 1.70 | 0.90 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.33 | Ratio |
| | | | | | | | | | | | | | 1.040 | SP GR AB |

SUMMARY OF SUPERPAVE GYRATORY DESIGN DATA

| DATA for N-Int. | 7 | Gmb | Gmm | Voids (Pa) | VMA | VFA | Vbe | Pbe | Pbe |
|-----------------|-----|-------|-------|------------|------|------|-------|------|------|
| MIX 1 | 5.0 | 2.129 | 2.555 | 16.7 | 24.2 | 31.2 | 7.55 | 3.60 | 1.38 |
| MIX 2 | 5.5 | 2.146 | 2.533 | 15.3 | 24.0 | 38.4 | 8.73 | 4.23 | 1.34 |
| MIX 3 | 6.0 | 2.159 | 2.517 | 14.2 | 24.0 | 46.7 | 9.74 | 4.69 | 1.39 |
| MIX 4 | 6.5 | 2.167 | 2.494 | 13.1 | 24.1 | 45.6 | 11.00 | 5.28 | 1.31 |

| DATA for H-des. | 70 | Gmb | Gmm | Voids (Pa) | VMA | VFA | Vbe | Pbe | Gse | Pbe |
|-----------------|-----|-------|-------|------------|------|------|-------|------|-------|------|
| MIX 1 | 5.0 | 2.380 | 2.555 | 6.9 | 15.3 | 55.2 | 8.44 | 3.69 | 2.767 | 1.34 |
| MIX 2 | 5.5 | 2.401 | 2.533 | 5.2 | 15.0 | 65.2 | 9.77 | 4.23 | 2.764 | 1.39 |
| MIX 3 | 6.0 | 2.414 | 2.517 | 4.1 | 15.0 | 72.7 | 10.89 | 4.69 | 2.758 | 1.39 |
| MIX 4 | 6.5 | 2.425 | 2.494 | 2.8 | 15.1 | 81.6 | 12.31 | 5.28 | 2.762 | 1.31 |

| OPTIMUM DESIGN DATA @ Ndes | Gmb | Gmm | %VOIDS (Pa) | VMA | VFA | Gse | Gsb | TSR | RCY AB | Virgin AB | ABR |
|----------------------------|---------------------------------------|-------|-------------|-----|------|------|-------|-------|--------|-----------|------|
| GYRATIONS | | | Target | | | | | | | | |
| 70 | 6.0 | 2.415 | 2.516 | 4.0 | 15.0 | 73.3 | 2.768 | 2.669 | 1.00 | 1.72 | 4.31 |
| REMARKS LINE 1 | BITUMINOUS MIXTURE AGED 1 HOURS @ 295 | | | | | | | | | | |
| REMARKS LINE 2 | | | | | | | | | | | |

Lab Preparing Design: _____

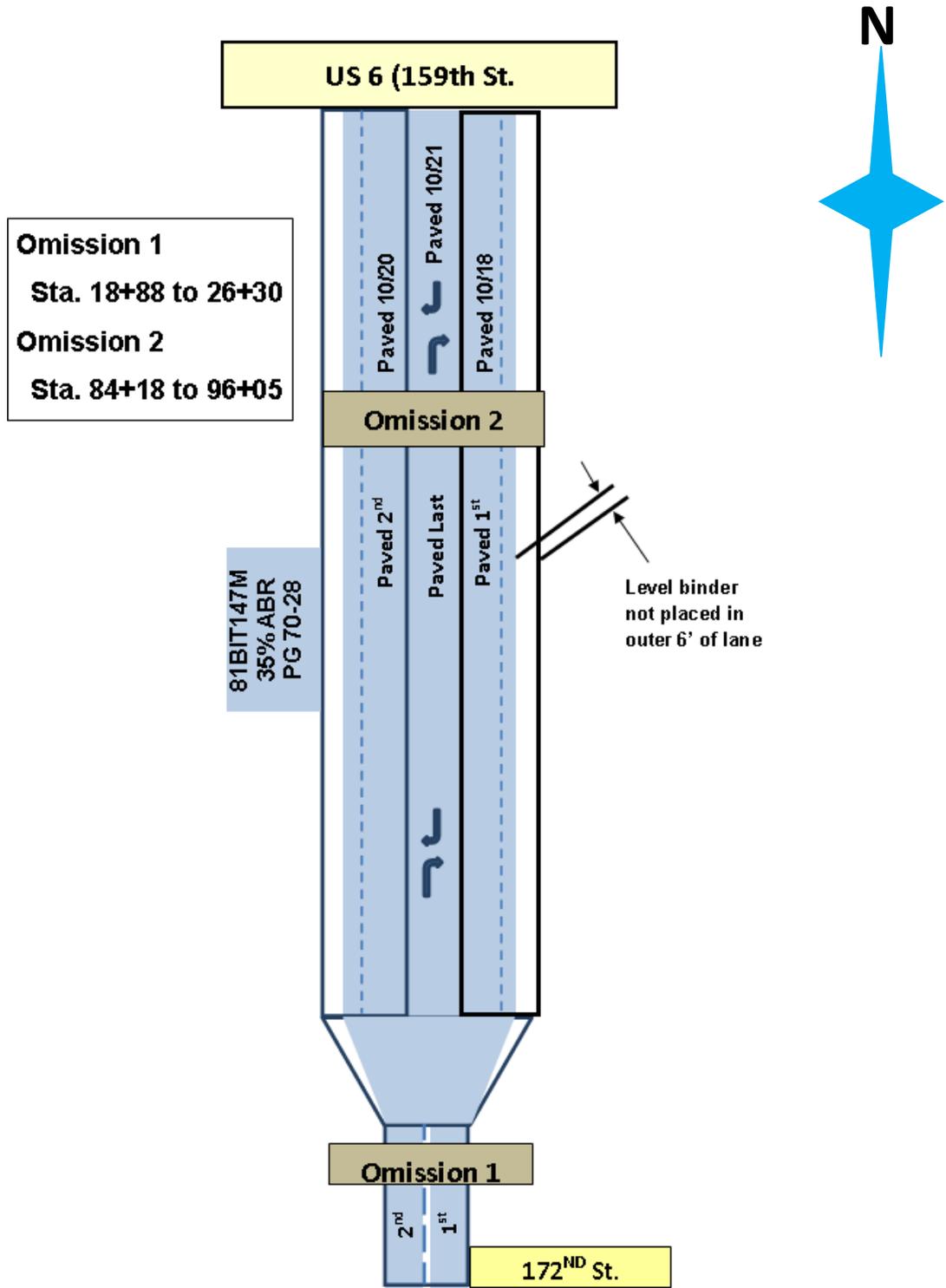
Tested by: _____

Final Approval: _____

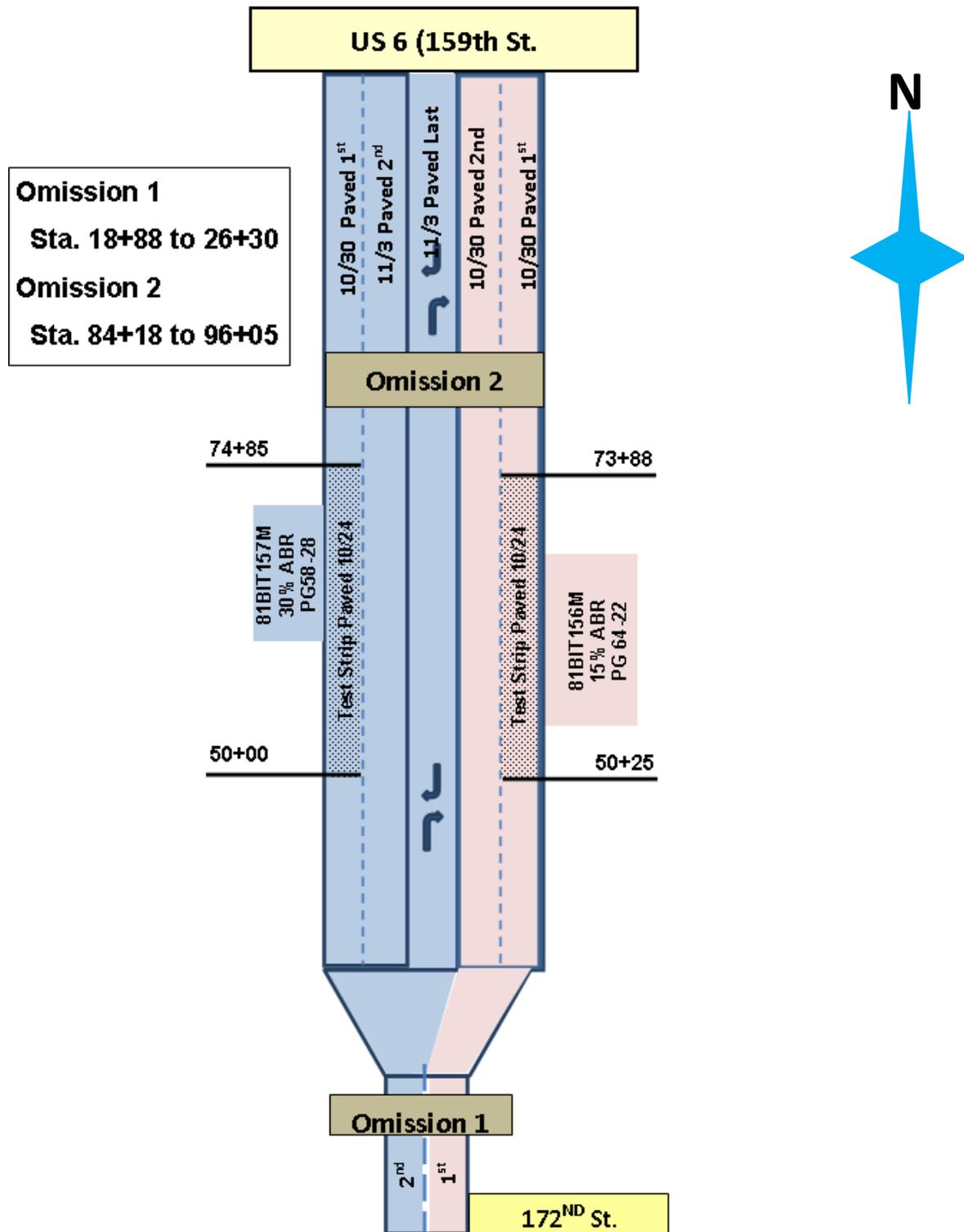
DC14003

APPENDIX F: PAVING SEQUENCE OF LEVEL BINDER AND SURFACE COURSE

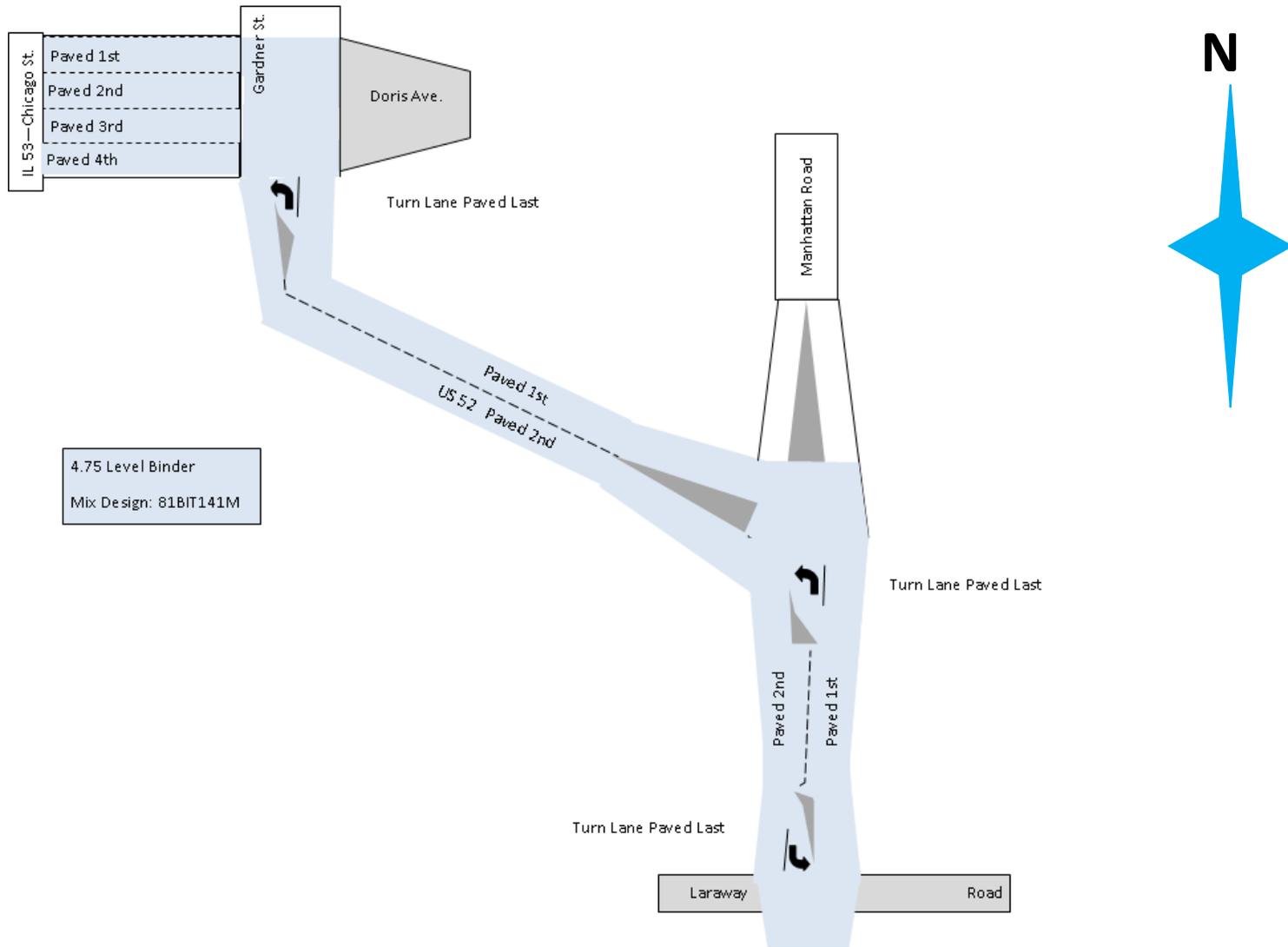
APPENDIX F-1: CRAWFORD AVENUE/PULASKI ROAD, LEVEL BINDER PAVING SEQUENCE



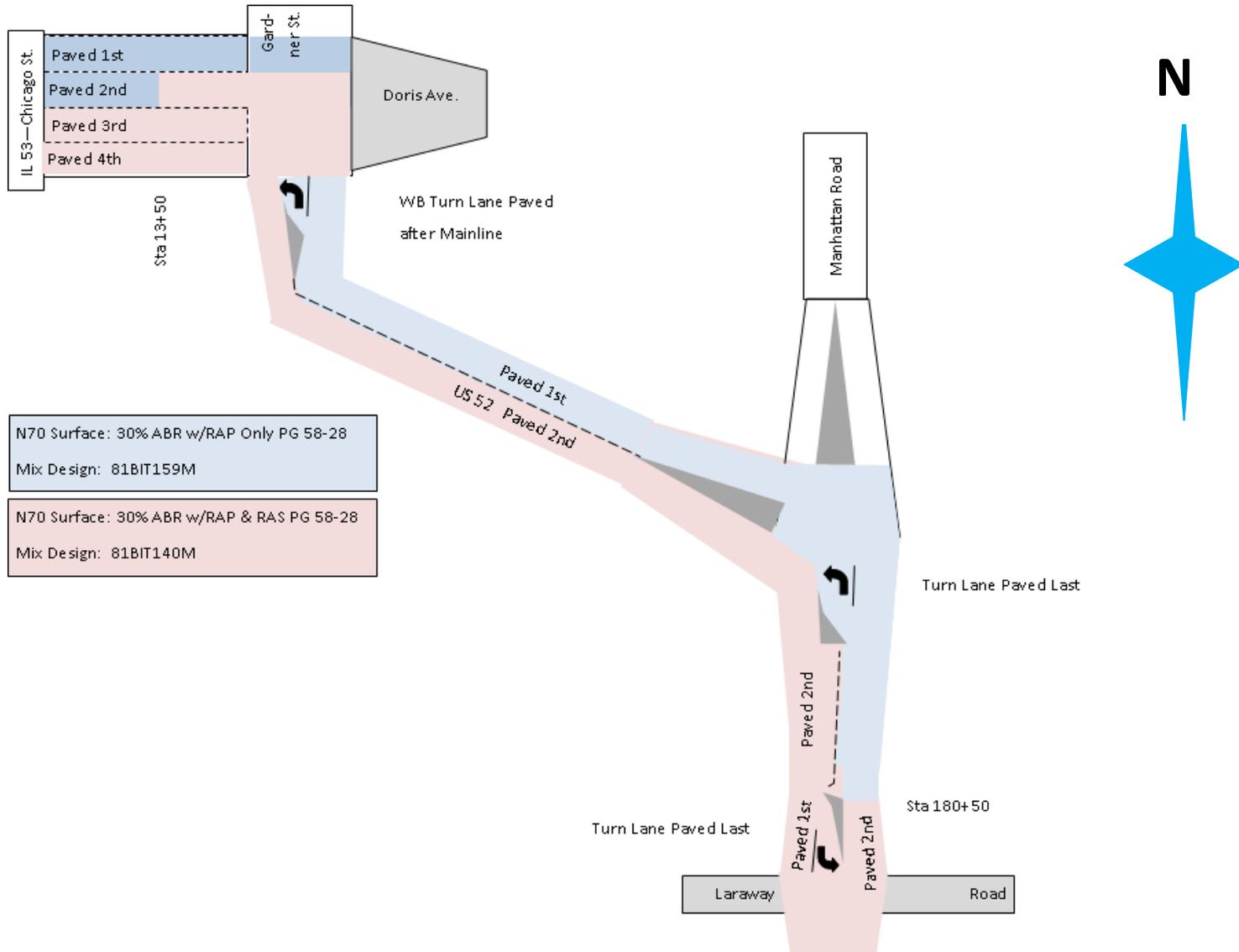
APPENDIX F-2: CRAWFORD AVENUE/PULASKI ROAD, SURFACE COURSE PAVING SEQUENCE



APPENDIX F-3: US 52 (IL 53 TO LARAWAY ROAD) , LEVEL BINDER PAVING SEQUENCE



APPENDIX F-4: US 52 (IL 53 to LARAWAY ROAD), SURFACE COURSE PAVING SEQUENCE



APPENDIX G: LABORTORY TESTING SUMMARIES

APPENDIX G-1: LABORATORY TEST RESULTS ON PLANT SAMPLED MIX 81BIT147M

| | | | | | |
|--|-----------------|------------|------------|------------|-----------------|
| Crawford Avenue/Pulaski Road 4.75 Level Binder from 172nd to US Rt. 6 | | | | | |
| Mix Design | Contract | ABR | RAS | RAP | PG Grade |
| 81BIT147M | 60Y03 | 30% | YES | YES | 70-28 |

| | | | | | | | | | | | |
|---|---------------|--------------------|--------------------------------|----------------------|-------------|------------------|------------------|------------|------------------|-------------|------------|
| Crawford/Pulaski Contract 60Y03 MIX: 81BIT147M | | | | | | | | | | | |
| N 50 4.75 Level Binder PG 70-28 | | | | | | | | | | | |
| Mix Properties | | | | | | | | | | | |
| Experimental Properties | | | | Extraction | | | | | | | |
| | | | | Sieve inch | % Design | Sample % Passing | % Diff. | | | | |
| PG Grade | 58-28 | 3/4 | | | 0.0 | | | | | | |
| ABR | 30% | 1/2 | | | 0.0 | | | | | | |
| RAP | Yes | 3/8 | 100 | 100 | 0.0 | | | | | | |
| RAS | Yes | #4 | 90 | 91 | 0.7 | | | | | | |
| Maximum Density Gmm | | #8 | 73 | 70 | -3.0 | | | | | | |
| | | #16 | 52 | 48 | -4.0 | | | | | | |
| Design | 2.426 | Sample | 2.429 | #30 | 36 | 32 | -4.0 | | | | |
| | | | | #50 | 21 | 18 | -3.0 | | | | |
| | | | | #100 | 11 | 9 | -1.7 | | | | |
| | | | | #200 | 7.5 | 6.4 | -1.1 | | | | |
| | | | | AC % | 7.7 | 8.0 | 0.3 | | | | |
| Stability and Flow 150mm Gyrotory | | | | | | | | | | | |
| 4% Voids | | | 8% Voids | | | 10% Voids | | | 12% Voids | | |
| Brick No. | Stability | Flow | Brick No. | Stability | Flow | Brick No. | Stability | Flow | Brick No. | Stability | Flow |
| 1 | 7700 | 3 | 1 | 4250 | N/A | 4 | 4350 | N/A | 1 | 3100 | N/A |
| 2 | 7700 | 4 | 2 | 4100 | N/A | 5 | 3500 | N/A | 2 | 3000 | N/A |
| 3 | 7700 | 3 | 3 | 4200 | N/A | 6 | 4000 | N/A | 3 | 2950 | N/A |
| Average | 7700 | 3.3 | Average | 4183 | N/A | Average | 3950 | N/A | Average | 3017 | N/A |
| Stability and Flow 4-inch Sample @ 4% Voids | | | | | | | | | | | |
| Marshall | | | Cored from 150 Gyrotory | | | | | | | | |
| Brick No. | Stability | Flow | Brick No. | Stability | Flow | | | | | | |
| 1 | 3100 | 2 | 2 | 3375 | 2 | | | | | | |
| 2 | 3225 | 1 | 3 | 3300 | 2 | | | | | | |
| 3 | 3075 | 2 | 4 | 3125 | 1 | | | | | | |
| Average | 3133 | 1.7 | Average | 3267 | 1.7 | | | | | | |
| Cantabro Loss | | | | | | | | | | | |
| 7% Voids | | 10% Voids | | 12% Voids | | | | | | | |
| Brick No. | % Loss | Brick No. | % Loss | Brick No. | % Loss | | | | | | |
| 5 | 1.9 | 1 | 2.0 | 1 | 2.2 | | | | | | |
| 3 | 2.9 | 5 | 2.0 | 2 | 2.7 | | | | | | |
| 4 | 2.9 | 4 | 1.9 | 4 | 2.1 | | | | | | |
| Average | 2.6 | Average | 2.0 | Average | 2.3 | | | | | | |
| Tensile Strength and Tensile Strength Ratio | | | | | | | | | | | |
| Conditioned | | | | Unconditioned | | | | | | | |
| Brick No. | Load | Tensile Strength | Strip Rating C/F | Brick No. | Load | Tensile Strength | Strip Rating C/F | | | | |
| 1 | 4000 | 115.5 | 1/1 | 2 | 4800 | 138.6 | 1/1 | | | | |
| 5 | 3900 | 112.3 | 1/1 | 6 | 4800 | 138.2 | 1/1 | | | | |
| 7 | 4200 | 121 | 1/1 | 8 | 4950 | 142.6 | 1/1 | | | | |
| Average | 4000 | 116.3 | 1/1 | Average | 4800 | 139.8 | 1/1 | | | | |
| Tensile Strength Ratio | | | | 0.83 | | | | | | | |
| Texas Overlay Tester | | | | | | | | | | | |
| Specimen No. | Cycles Tested | Initial Load (kPa) | Reduction of Load % | No. of Cracks | | | | | | | |
| 2T | 1000 | 2.613 | 79.3 | 1 | | | | | | | |
| 2B | 1000 | 2.481 | 81.2 | 1 | | | | | | | |
| 3T | 769 | 2.668 | 93.1 | 1 | | | | | | | |
| 3B | 762 | 2.668 | 93.1 | 1 | | | | | | | |
| 4T | 757 | 2.548 | 93.2 | 1 | | | | | | | |
| 4B | 733 | 2.612 | 93.2 | 1 | | | | | | | |
| Average | 837 | 2.598 | 88.9 | 1 | | | | | | | |

**APPENDIX G-1: LABORATORY TEST RESULTS ON PLANT SAMPLED MIX 81BIT147M
(CONTINUED)**

| Level Binder Mix: 81BIT147M PG Grade 70-28 | | | |
|---|---------------|----------------------|-----------------|
| Hamburg Displacement, mm | | | |
| | | Pass Criteria | Ultimate |
| Brick Pairs | | 15,000 | 20,000 |
| H2 | H6 | 2.9 | 3.0 |
| H4 | H5 | 2.6 | 2.9 |
| H1 7.0 | H3 7.1 | 3.1 | 3.3 |
| Maximum Displacement | | 3.1 | 3.3 |
| Average Displacement | | 2.9 | 3.1 |

| SCB with Flexibility Index (FI) | | | | | |
|--|------------------------------|------------------|--------------|-------------|-------------------|
| Replicate Name | Fracture Energy (LLD) | Peak Load | Slope | FI | FI AVERAGE |
| 147M-B1.dat | 2110.80 | 4.15 | -4.94 | 4.27 | 5.27 |
| 147M-B2.dat | 2215.49 | 4.04 | -4.67 | 4.75 | |
| 147M-T1.dat | 2259.78 | 4.05 | -3.03 | 7.45 | |
| 147M-T2.dat | 2177.31 | 4.09 | -4.73 | 4.60 | |

APPENDIX G-2: LABORATORY TEST RESULTS ON PLANT SAMPLED MIX 81BIT156M

| Crawford Avenue/Pulaski Road Northbound Surface from 172nd to US Rt. 6 | | | | | |
|---|-----------------|------------|------------|------------|-----------------|
| Mix Design | Contract | ABR | RAS | RAP | PG Grade |
| 81BIT156M | 60Y03 | 15% | YES | YES | 64-22 |

| Crawford/Pulaski Contract 60Y03 MIX 81BIT156M | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|----------|------------------|--------------------------------|--|----------|-------|--------|-------|-----|-----|-----|-----|---|--|--|-------------------|--|--|--|------------|----------|------------------|---------|-----|--|--|-----|-----|-----|-----|-----|-----|----|----|-----|----|----|----|-----|----|----|----|------|-----|----|----|------|-----|----|----|------|-----|----|----|------|------|---|---|------|------|-----|-----|-----|------|-----|-----|------|
| Northbound Lanes N 70 D Surface PG64-22 ABR 15% w/ RAP and RAS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Mix Properties | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <table border="1"> <thead> <tr> <th colspan="2">Level Binder Properties</th> </tr> </thead> <tbody> <tr> <td>PG Grade</td> <td>64-22</td> </tr> <tr> <td>ABR</td> <td>14.9%</td> </tr> <tr> <td>RAP</td> <td>Yes</td> </tr> <tr> <td>RAS</td> <td>Yes</td> </tr> </tbody> </table> | | | Level Binder Properties | | PG Grade | 64-22 | ABR | 14.9% | RAP | Yes | RAS | Yes | <table border="1"> <thead> <tr> <th colspan="4">Extraction</th> </tr> <tr> <th>Sieve inch</th> <th>% Design</th> <th>Sample % Passing</th> <th>% Diff.</th> </tr> </thead> <tbody> <tr> <td>3/4</td> <td></td> <td></td> <td>0.0</td> </tr> <tr> <td>1/2</td> <td>100</td> <td>100</td> <td>0.0</td> </tr> <tr> <td>3/8</td> <td>97</td> <td>97</td> <td>0.0</td> </tr> <tr> <td>#4</td> <td>52</td> <td>53</td> <td>1.0</td> </tr> <tr> <td>#8</td> <td>33</td> <td>32</td> <td>-1.0</td> </tr> <tr> <td>#16</td> <td>24</td> <td>23</td> <td>-1.0</td> </tr> <tr> <td>#30</td> <td>18</td> <td>17</td> <td>-1.0</td> </tr> <tr> <td>#50</td> <td>11</td> <td>10</td> <td>-1.0</td> </tr> <tr> <td>#100</td> <td>6</td> <td>6</td> <td>-0.2</td> </tr> <tr> <td>#200</td> <td>4.7</td> <td>4.7</td> <td>0.0</td> </tr> <tr> <td>AC %</td> <td>5.7</td> <td>5.6</td> <td>-0.1</td> </tr> </tbody> </table> | | | Extraction | | | | Sieve inch | % Design | Sample % Passing | % Diff. | 3/4 | | | 0.0 | 1/2 | 100 | 100 | 0.0 | 3/8 | 97 | 97 | 0.0 | #4 | 52 | 53 | 1.0 | #8 | 33 | 32 | -1.0 | #16 | 24 | 23 | -1.0 | #30 | 18 | 17 | -1.0 | #50 | 11 | 10 | -1.0 | #100 | 6 | 6 | -0.2 | #200 | 4.7 | 4.7 | 0.0 | AC % | 5.7 | 5.6 | -0.1 |
| | | | Level Binder Properties | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PG Grade | 64-22 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ABR | 14.9% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RAP | Yes | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RAS | Yes | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Extraction | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Sieve inch | % Design | Sample % Passing | % Diff. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3/4 | | | 0.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1/2 | 100 | 100 | 0.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3/8 | 97 | 97 | 0.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| #4 | 52 | 53 | 1.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| #8 | 33 | 32 | -1.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| #16 | 24 | 23 | -1.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| #30 | 18 | 17 | -1.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| #50 | 11 | 10 | -1.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| #100 | 6 | 6 | -0.2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| #200 | 4.7 | 4.7 | 0.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| AC % | 5.7 | 5.6 | -0.1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <table border="1"> <thead> <tr> <th colspan="2">Maximum Density Gmm</th> </tr> </thead> <tbody> <tr> <td>Design</td> <td>2.494</td> </tr> <tr> <td>Sample</td> <td>2.508</td> </tr> </tbody> </table> | | | Maximum Density Gmm | | Design | 2.494 | Sample | 2.508 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Maximum Density Gmm | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Design | 2.494 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Sample | 2.508 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| Stability and Flow 150mm Gyrotory | | | | | | | | | | | |
|--|-------------|------------|-----------------|-------------|------------|------------------|-------------|------------|------------------|-------------|------------|
| 4% Voids | | | 8% Voids | | | 10% Voids | | | 12% Voids | | |
| Brick No. | Stability | Flow | Brick No. | Stability | Flow | Brick No. | Stability | Flow | Brick No. | Stability | Flow |
| 1 | 5800 | 3 | 1 | 3900 | 2 | 3 | 3850 | 2 | 3 | 3350 | 3 |
| 2 | 6100 | 2 | 2 | 3850 | 3 | 5 | 3700 | 3 | 4 | 3250 | 3 |
| 3 | 6100 | 2 | 3 | 4100 | 2 | 6 | 3600 | 3 | 5 | 3500 | 3 |
| Average | 6000 | 2.3 | Average | 3950 | 2.3 | Average | 3717 | 2.7 | Average | 3367 | 3.0 |

| Stability and Flow 4-inch Sample @ 4% Voids | | | | | |
|--|-------------|------------|--------------------------------|-------------|------------|
| Marshall | | | Cored from 150 Gyrotory | | |
| Brick No. | Stability | Flow | Brick No. | Stability | Flow |
| 7 | 3600 | 1.5 | 1 | 3000 | 1 |
| 8 | 3300 | 1.5 | 2 | 2850 | 2 |
| 9 | 3500 | 2 | 3 | 2900 | 2 |
| Average | 3467 | 1.7 | Average | 2917 | 1.7 |

| Cantabro Loss | | | | | |
|----------------------|------------|------------------|------------|------------------|------------|
| 7% Voids | | 10% Voids | | 12% Voids | |
| Brick No. | % Loss | Brick No. | % Loss | Brick No. | % Loss |
| 1 | 9.6 | 7 | 8.1 | 2 | 10.1 |
| 4 | 8.4 | 5 | 7.8 | 3 | 9.5 |
| 3 | 8.8 | 8 | 7.1 | 4 | 9.9 |
| Average | 8.9 | Average | 7.7 | Average | 9.8 |

| Tensile Strength and Tensile Strength Ratio | | | | | | | |
|--|------|------------------|------------------|----------------------|------|------------------|------------------|
| Conditioned | | | | Unconditioned | | | |
| Brick No. | Load | Tensile Strength | Strip Rating C/F | Brick No. | Load | Tensile Strength | Strip Rating C/F |
| 5 | 5100 | 146.9 | 1/1 | 6 | 5800 | 167.1 | 1/1 |
| 8 | 5100 | 146.9 | 1/1 | 9 | 5200 | 149.8 | 1/1 |
| 11 | 4800 | 138.2 | 1/1 | 10 | 5100 | 146.9 | 1/1 |
| Average | | 144.0 | 1/1 | Average | | 154.6 | 1/1 |
| Tensile Strength Ratio | | | | 0.93 | | | |

| Texas Overlay Tester | | | | |
|-----------------------------|---------------|--------------------|---------------------|---------------|
| Specimen No. | Cycles Tested | Initial Load (kPa) | Reduction of Load % | No. of Cracks |
| 1T | 370 | 2.426 | 93.1 | 1 |
| 1B | 311 | 2.451 | 93.4 | 1 |
| 2T | 247 | 2.381 | 93 | 1 |
| 3T | 260 | 2.569 | 93.2 | 1 |
| 3B | 422 | 2.542 | 93.1 | 1 |
| Average | 322 | 2.47 | 93.2 | 1 |

**APPENDIX G-2: LABORATORY TEST RESULTS ON PLANT SAMPLED MIX 81BIT156M
(CONTINUED)**

| Hamburg Displacement, mm | | | |
|--|----|----------------------|-----------------|
| Surface Mix: 81BIT156M PG Grade 64-22 | | | |
| | | Pass Criteria | Ultimate |
| Brick Pairs | | 7,500 | 20,000 |
| H1 | H2 | 2.4 | 3.0 |
| H3 | H6 | 1.8 | 2.4 |
| H5 | H4 | 1.9 | 2.4 |
| H3 | H6 | 0.6 | 0.7 |
| Maximum Displacement | | 2.4 | 3.0 |
| Average Displacement | | 1.7 | 2.1 |

| SCB with Flexibility Index (FI) | | | | | |
|--|------------------------------|------------------|--------------|-----------|-------------------|
| Replicate Name | Fracture Energy (LLD) | Peak Load | Slope | FI | FI AVERAGE |
| 156M-B1.dat | 2205.09 | 4.03 | -3.49 | 6.32 | 4.94 |
| 156M-B2.dat | 2024.84 | 3.97 | -4.60 | 4.40 | |
| 156M-T1.dat | 2185.79 | 4.00 | -4.65 | 4.70 | |
| 156M-T2.dat | 1935.40 | 4.14 | -4.45 | 4.35 | |

APPENDIX G-3: LABORATORY TEST RESULTS ON PLANT SAMPLED MIX 81BIT157M

| Crawford Avenue/Pulaski Road Southbound Surface from 172nd to US Rt. 6 | | | | | |
|---|-----------------|------------|------------|------------|-----------------|
| Mix Design | Contract | ABR | RAS | RAP | PG Grade |
| BIT157M | 60Y03 | 30% | YES | YES | 58-28 |

| Crawford/Pulaski Contract 60Y03 MIX 81BIT157M | | | | | | | | | | | | |
|---|-------------|------------------|-------------------------|----------------|-------------|----------------------|------------------|-----------------------------|----------------|--------------------|---------------------|---------------|
| Southbound Lanes N 70 D Surface PG58-28 ABR 30% w/ RAP and RAS | | | | | | | | | | | | |
| Mix Properties | | | | | | | | | | | | |
| | | | | | | Extraction | | | | | | |
| | | | | | | Sieve inch | % Design | Sample % Passing | % Diff. | | | |
| Level Binder Properties | | | | | | 3/4 | | | 0.0 | | | |
| | | | | | | 1/2 | 100 | 100 | 0.0 | | | |
| PG Grade | | 58-28 | | | | 3/8 | 97 | 97 | 0.0 | | | |
| ABR | | 29.2% | | | | #4 | 53 | 53 | -0.5 | | | |
| RAP | | Yes | | | | #8 | 33 | 32 | -1.0 | | | |
| RAS | | Yes | | | | #16 | 25 | 23 | -2.0 | | | |
| Maximum Density Gmm | | | | | | #30 | 18 | 17 | -1.0 | | | |
| | | | | | | #50 | 12 | 11 | -1.0 | | | |
| Design | | 2.431 | | Sample | | 2.438 | | #100 | 7 | 7 | 0.0 | |
| | | | | | | #200 | 5.5 | 5.5 | 0.0 | | | |
| | | | | | | AC % | 5.8 | 5.7 | -0.1 | | | |
| Stability and Flow 150mm Gyrotory | | | | | | | | | | | | |
| 4% Voids | | | 8% Voids | | | 10% Voids | | | 12% Voids | | | |
| Brick No. | Stability | Flow | Brick No. | Stability | Flow | Brick No. | Stability | Flow | Brick No. | Stability | Flow | |
| 1 | 6100 | 2 | 1 | 4000 | 3 | 3 | 3800 | 3 | 1 | 3000 | 3 | |
| 2 | 5900 | 2 | 2 | 3800 | 4 | 4 | 3600 | 3 | 2 | 2750 | 3 | |
| 3 | 5300 | 2 | 3 | 4150 | 3 | 5 | 3700 | 2 | 4 | 3100 | 3 | |
| Average | 5767 | 2.0 | Average | 3983 | 3.3 | Average | 3700 | 2.7 | Average | 2950 | 3.0 | |
| Stability and Flow 4-inch Sample @ 4% Voids | | | | | | Cantabro Loss | | | | | | |
| Marshall | | | Cored from 150 Gyrotory | | | 7% Voids | | 10% Voids | | 12% Voids | | |
| Brick No. | Stability | Flow | Brick No. | Stability | Flow | Brick No. | % Loss | Brick No. | % Loss | Brick No. | % Loss | |
| 3 | 3400 | 1 | 4 | 2400 | 1 | 1 | 5.4 | 3 | 6.5 | 3 | 6.5 | |
| 5 | 3150 | 1 | 5 | 2500 | 1 | 2 | 4.5 | 4 | 6.7 | 4 | 5.3 | |
| 6 | 3300 | 1 | 6 | 2350 | 1 | 3 | 4.9 | 5 | 6.4 | 5 | 7.3 | |
| Average | 3283 | 1.0 | Average | 2417 | 1.0 | Average | 4.9 | Average | 6.5 | Average | 6.4 | |
| Tensile Strength and Tensile Strength Ratio | | | | | | | | Texas Overlay Tester | | | | |
| Conditioned | | | | Unconditioned | | | | Specimen No. | Cycles Tested | Initial Load (kPa) | Reduction of Load % | No. of Cracks |
| Brick No. | Load | Tensile Strength | Strip Rating C/F | Brick No. | Load | Tensile Strength | Strip Rating C/F | 1T | 311 | 2.189 | 93.2 | 1 |
| 2 | 4250 | 122.4 | 1/1 | 3 | 4400 | 126.7 | 1/1 | 1B | 242 | 2.307 | 93 | 1 |
| 5 | 4200 | 121.0 | 1/1 | 4 | 4500 | 129.6 | 1/1 | 2T | 746 | 2.169 | 93.1 | 1 |
| 7 | 4200 | 121.0 | 1/1 | 6 | 4450 | 128.2 | 1/1 | 2B | 246 | 2.228 | 93.2 | 1 |
| Average | 4200 | 121.5 | 1/1 | Average | 4450 | 128.2 | 1/1 | 3T | 269 | 2.319 | 93 | 1 |
| Tensile Strength Ratio | | | | 0.95 | | | | 3B | 288 | 2.14 | 93.5 | 1 |
| | | | | | | | | Average | 350 | 2.23 | 93.2 | 1 |

**APPENDIX G-3: LABORATORY TEST RESULTS ON PLANT SAMPLED MIX 81BIT157M
(CONTINUED)**

| Hamburg Displacement, mm | | | |
|--|----|----------------------|-----------------|
| Surface Mix: 81BIT157M PG Grade 58-28 | | | |
| | | Pass Criteria | Ultimate |
| Brick Pairs | | 5,000 | 20,000 |
| H1 | H5 | 1.9 | 2.6 |
| H4 | H5 | 2.4 | 3.2 |
| H2 | H3 | 2.6 | 3.6 |
| H1 | H6 | 2.2 | 3.1 |
| Maximum Displacement | | 2.6 | 3.6 |
| Average Displacement | | 2.3 | 3.1 |

| SCB with Flexibility Index (FI) | | | | | |
|--|------------------------------|------------------|--------------|-----------|-------------------|
| Replicate Name | Fracture Energy (LLD) | Peak Load | Slope | FI | FI AVERAGE |
| 157M-B1.dat | 1687.58 | 4.14 | -5.31 | 3.18 | 3.53 |
| 157M-B2.dat | 1942.53 | 4.18 | -4.90 | 3.96 | |
| 157M-T1.dat | 2064.95 | 4.37 | -5.53 | 3.74 | |
| 157M-T2.dat | 1843.91 | 4.14 | -5.72 | 3.23 | |

APPENDIX G-4: LABORATORY TEST RESULTS ON PLANT SAMPLED MIX 81BIT141M

| US 52 4.75 Level Binder from IL 53 (Chicago Street) to Laraway Road | | | | | |
|--|-----------------|------------|------------|------------|-----------------|
| Mix Design | Contract | ABR | RAS | RAP | PG Grade |
| 81BIT141M | 60Y02 | 35% | YES | YES | 70-28 |

| US 52 Contract 60Y02 MIX 81BIT141M | | | | | | | |
|--|-------|--------|-------|-------------------|----------|------------------|---------|
| 4.75 Level Binder N 50 D PG70-28 ABR 35% w/ RAP and RAS | | | | | | | |
| Mix Properties | | | | Extraction | | | |
| Level Binder Properties | | | | Sieve inch | % Design | Sample % Passing | % Diff. |
| PG Grade | 70-28 | | | 3/4 | | | |
| ABR | 35% | | | 1/2 | | | |
| RAP | Yes | | | 3/8 | 100 | 100 | 0.0 |
| RAS | Yes | | | #4 | 91 | 91 | 0.0 |
| Maximum Density Gmm | | | | #8 | 71 | 73 | 2.0 |
| Design | 2.431 | Sample | 2.438 | #16 | 54 | 51 | -3.0 |
| | | | | #30 | 37 | 35 | -2.0 |
| | | | | #50 | 24 | 23 | -1.0 |
| | | | | #100 | 12 | 14 | 2.0 |
| | | | | #200 | 7.2 | 7.0 | -0.2 |
| | | | | AC % | 7.8 | 7.7 | -0.1 |

| Stability and Flow 150mm Gyrotory | | | | | | | | | | | |
|--|-------------|------------|-----------------|-------------|------------|------------------|-------------|------------|------------------|-------------|------------|
| 4% Voids | | | 8% Voids | | | 10% Voids | | | 12% Voids | | |
| Brick No. | Stability | Flow | Brick No. | Stability | Flow | Brick No. | Stability | Flow | Brick No. | Stability | Flow |
| 1 | 4500 | 3 | 1 | 3900 | 3.5 | 2 | 3500 | 3 | 2 | 2800 | 4 |
| 2 | 4400 | 3 | 2 | 3900 | 4 | 3 | 3700 | 2 | 3 | 2700 | 4 |
| 3 | 4450 | 3 | 3 | 4000 | 3.5 | 4 | 3700 | 3 | 4 | 2750 | 4 |
| Average | 4450 | 3.0 | Average | 3933 | 3.7 | Average | 3633 | 2.7 | Average | 2750 | 4.0 |

| Stability and Flow 4-inch Sample @ 4% Voids | | | | | |
|--|-------------|------------|--------------------------------|-------------|------------|
| Marshall | | | Cored from 150 Gyrotory | | |
| Brick No. | Stability | Flow | Brick No. | Stability | Flow |
| 3 | 2875 | 2 | 1 | 2600 | 1 |
| 4 | 3075 | 2 | 3 | 2700 | 1 |
| 5 | 2975 | 2 | 4 | 2650 | 1 |
| Average | 2975 | 2.0 | Average | 2650 | 1.0 |

| Cantabro Loss | | | | | |
|----------------------|------------|------------------|------------|------------------|------------|
| 7% Voids | | 10% Voids | | 12% Voids | |
| Brick No. | % Loss | Brick No. | % Loss | Brick No. | % Loss |
| 2 | 2.9 | 2 | 2.6 | 2 | 2.9 |
| 3 | 2.5 | 3 | 3.2 | 3 | 2.6 |
| 4 | 2.7 | 4 | 2.6 | 4 | 3.3 |
| Average | 2.7 | Average | 2.8 | Average | 2.9 |

| Tensile Strength and Tensile Strength Ratio | | | | | | | |
|--|-------------|------------------|------------------|----------------------|-------------|------------------|------------------|
| Conditioned | | | | Unconditioned | | | |
| Brick No. | Load | Tensile Strength | Strip Rating C/F | Brick No. | Load | Tensile Strength | Strip Rating C/F |
| 3 | 4150 | 264.2 | 1/1 | 4 | 4700 | 299.2 | 1/1 |
| 5 | 4300 | 273.7 | 1/1 | 6 | 4700 | 299.2 | 1/1 |
| 7 | 4200 | 267.4 | 1/1 | 8 | 4700 | 299.2 | 1/1 |
| Average | 4217 | 268.4 | 1/1 | Average | 4700 | 299.2 | 1/1 |
| Tensile Strength Ratio | | | | 0.90 | | | |

| Texas Overlay Tester | | | | |
|-----------------------------|---------------|--------------------|---------------------|---------------|
| Specimen No. | Cycles Tested | Initial Load (kPa) | Reduction of Load % | No. of Cracks |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

**APPENDIX G-4: LABORATORY TEST RESULTS ON PLANT SAMPLED MIX 81BIT141M
(CONTINUED)**

| Hamburg Displacement, mm | | | |
|---|---------------|----------------------|-----------------|
| Level Binder Mix: 81BIT141M PG Grade 70-28 | | | |
| | | Pass Criteria | Ultimate |
| Brick Pairs | | 15,000 | 20,000 |
| H1 7.0 | H4 7.0 | 2.7 | 2.9 |
| H2 7.1 | H3 7.1 | 3.4 | 3.7 |
| H5 7.0 | H6 6.8 | 3.1 | 3.2 |
| Maximum Displacement | | 3.4 | 3.7 |
| Average Displacement | | 3.1 | 3.3 |

| SCB with Flexibility Index (FI) | | | | | |
|--|------------------------------|------------------|--------------|-------------|-------------------|
| Replicate Name | Fracture Energy (LLD) | Peak Load | Slope | FI | FI AVERAGE |
| 141M-B1.dat | 2095.54 | 3.72 | -3.94 | 5.32 | 5.13 |
| 141M-B2.dat | 2093.12 | 3.66 | -3.96 | 5.29 | |
| 141M-T1.dat | 1983.84 | 3.94 | -3.77 | 5.26 | |
| 141M-T2.dat | 1890.31 | 3.81 | -4.07 | 4.64 | |

APPENDIX G-5: LABORATORY TEST RESULTS ON PLANT SAMPLED MIX 81BIT140

| US 52 East Bound Surface from IL 53 (Chicago Street) to Laraway Road | | | | | |
|--|----------|-----|-----|-----|----------|
| Mix Design | Contract | ABR | RAS | RAP | PG Grade |
| 81BIT140 | 60Y02 | 30% | YES | YES | 58-28 |

| US 52 Contract 60Y02 MIX 81BIT140M | | | | | | | | | | | |
|--|---------------|--------------------|-------------------------|---------------|------|-------------------|------------------|------------------|-----------|-----------|------|
| Eastbound Lane N 70 D Surface Course PG 58-28 ABR 30% w/ RAP and RAS | | | | | | | | | | | |
| Mix Properties | | | | | | | | | | | |
| Experimental Properties | | | | | | Extraction | | | | | |
| | | | | | | Sieve inch | % Design | Sample % Passing | % Diff. | | |
| PG Grade 58-28 | | | | | | 3/4 | 100 | 100 | 0.0 | | |
| ABR 30% | | | | | | 1/2 | 97 | 98 | 0.0 | | |
| RAP Yes | | | | | | 3/8 | 61 | 53 | -8.0 | | |
| RAS Yes | | | | | | #4 | 37 | 32 | -5.0 | | |
| Maximum Density Gmm | | | | | | #8 | 28 | 22 | -6.0 | | |
| | | | | | | #16 | 19 | 16 | -3.0 | | |
| Design 2.502 | | | | | | #30 | 13 | 11 | -2.0 | | |
| Sample 2.524 | | | | | | #50 | 8 | 7 | -1.0 | | |
| | | | | | | #100 | 5.5 | 4.6 | -0.9 | | |
| | | | | | | #200 | 5.8 | 5.5 | -0.3 | | |
| | | | | | | AC % | | | | | |
| Stability and Flow 150mm Gyratory | | | | | | | | | | | |
| 4% Voids | | | 8% Voids | | | 10% Voids | | | 12% Voids | | |
| Brick No. | Stability | Flow | Brick No. | Stability | Flow | Brick No. | Stability | Flow | Brick No. | Stability | Flow |
| 1 | 5000 | 2.5 | 2 | 2750 | 2.5 | 2 | 2650 | 2.5 | 1 | 2000 | 2 |
| 2 | 5000 | 2 | 3 | 2950 | 2.5 | 3 | 2500 | 2 | 2 | 2000 | 2.5 |
| 3 | 5200 | 2 | 4 | 2850 | 2 | 4 | 2700 | 2 | 3 | 2000 | 2 |
| Average | 5067 | 2.2 | Average | 2850 | 2.3 | Average | 2617 | 2.2 | Average | 2000 | 2.2 |
| Stability and Flow 4-inch Sample @ 4% Voids | | | | | | | | | | | |
| Marshall | | | Cored from 150 Gyratory | | | | | | | | |
| Brick No. | Stability | Flow | Brick No. | Stability | Flow | | | | | | |
| 2 | 2750 | 1 | 2 | 2150 | 3 | | | | | | |
| 3 | 2850 | 1 | 3 | 2200 | 2.5 | | | | | | |
| 4 | 2675 | 0.5 | 4 | 2025 | 2 | | | | | | |
| Average | 2758 | 0.8 | Average | 2125 | 2.5 | | | | | | |
| Cantabro Loss | | | | | | | | | | | |
| 7% Voids | | | 10% Voids | | | 12% Voids | | | | | |
| Brick No. | % Loss | | Brick No. | % Loss | | Brick No. | % Loss | | | | |
| 2 | 5.3 | | 3 | 4.3 | | 1 | 4.7 | | | | |
| 3 | 4.8 | | 4 | 5.1 | | 2 | 3.9 | | | | |
| 4 | 4.2 | | 5 | 4.4 | | 3 | 4.0 | | | | |
| Average | 4.8 | | Average | 4.6 | | Average | 4.2 | | | | |
| Tensile Strength and Tensile Strength Ratio | | | | | | | | | | | |
| Conditioned | | | | Unconditioned | | | | | | | |
| Brick No. | Load | Tensile Strength | Strip Rating C/F | Brick No. | Load | Tensile Strength | Strip Rating C/F | | | | |
| 2 | 2800 | 80.6 | 1/1 | 4 | 3000 | 86.4 | 1/1 | | | | |
| 5 | 3000 | 86.4 | 1/1 | 6 | 3300 | 95.0 | 1/1 | | | | |
| 6 | 3000 | 86.4 | 1/1 | 7 | 3100 | 89.3 | 1/1 | | | | |
| Average | | 84.5 | 1/1 | Average | | 90.2 | 1/1 | | | | |
| Tensile Strength Ratio | | | | 0.94 | | | | | | | |
| Texas Overlay Tester | | | | | | | | | | | |
| Specimen No. | Cycles Tested | Initial Load (kPa) | Reduction of Load % | No. of Cracks | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

**APPENDIX G-5: LABORATORY TEST RESULTS ON PLANT SAMPLED MIX 81BIT140
(CONTINUED)**

| Hamburg Displacement, mm | | | |
|--|---------------|----------------------|-----------------|
| Surface Mix: 81BIT140M PG Grade 58-28 | | | |
| | | Pass Criteria | Ultimate |
| Brick Pairs | | 5,000 | 20,000 |
| H2 7.3 | H6 7.4 | 2.7 | 3.8 |
| H4 7.1 | H5 7.3 | 2.6 | 4.0 |
| H1 7.0 | H3 6.9 | 2.5 | 3.7 |
| Maximum Displacement | | 2.7 | 4.0 |
| Average Displacement | | 2.6 | 3.8 |

| SCB with Flexibility Index (FI) | | | | | |
|--|------------------------------|------------------|--------------|-------------|-------------------|
| Replicate Name | Fracture Energy (LLD) | Peak Load | Slope | FI | FI AVERAGE |
| 140M-B1.dat | 1779.44 | 3.07 | -2.65 | 6.71 | 6.18 |
| 140M-B2.dat | 1958.12 | 3.16 | -2.95 | 6.64 | |
| 140M-T1.dat | 1643.45 | 3.25 | -3.95 | 4.16 | |
| 140M-T2.dat | 1716.17 | 2.88 | -2.38 | 7.22 | |

APPENDIX G-6: LABORATORY TEST RESULTS ON PLANT SAMPLED MIX 81BIT159M

| US 52 West Bound Surface from IL 53 (Chicago Street) to Laraway Road | | | | | |
|---|-----------------|------------|------------|------------|-----------------|
| Mix Design | Contract | ABR | RAS | RAP | PG Grade |
| 81BIT159M | 60Y02 | 30% | NO | YES | 58-28 |

| US 52 Contract 60Y02 MIX: 81BIT159M | | | | | | | | | | | | | |
|--|----------|--------------------------------|---------|----------|-------|-----|-----|-----|-----|-----|----|-------------------|--|
| Westbound Lane N 70 D Surface Course PG 58-28 | | | | | | | | | | | | | |
| Mix Properties | | | | | | | | | | | | | |
| <table border="1"> <tr> <th colspan="2">Experimental Properties</th> </tr> <tr> <td>PG Grade</td> <td>58-28</td> </tr> <tr> <td>ABR</td> <td>30%</td> </tr> <tr> <td>RAP</td> <td>Yes</td> </tr> <tr> <td>RAS</td> <td>No</td> </tr> </table> | | Experimental Properties | | PG Grade | 58-28 | ABR | 30% | RAP | Yes | RAS | No | Extraction | |
| | | Experimental Properties | | | | | | | | | | | |
| | | PG Grade | 58-28 | | | | | | | | | | |
| | | ABR | 30% | | | | | | | | | | |
| | | RAP | Yes | | | | | | | | | | |
| | | RAS | No | | | | | | | | | | |
| Sieve inch | % Design | Sample % Passing | % Diff. | | | | | | | | | | |
| 3/4 | 100 | 100 | 0.0 | | | | | | | | | | |
| 1/2 | 100 | 100 | 0.0 | | | | | | | | | | |
| 3/8 | 98 | 98 | 0.0 | | | | | | | | | | |
| #4 | 61 | 57 | -4.0 | | | | | | | | | | |
| #8 | 32 | 30 | -2.0 | | | | | | | | | | |
| #16 | 24 | 20 | -4.0 | | | | | | | | | | |
| #30 | 17 | 15 | -2.0 | | | | | | | | | | |
| #50 | 13 | 11 | -2.0 | | | | | | | | | | |
| #100 | 9 | 8 | -1.0 | | | | | | | | | | |
| #200 | 6.0 | 6.1 | 0.1 | | | | | | | | | | |
| AC % | 6.0 | 6.0 | 0.0 | | | | | | | | | | |
| Maximum Density Gmm | | | | | | | | | | | | | |
| Design | 2.516 | Sample | 2.511 | | | | | | | | | | |

| Stability and Flow 150mm Gyrotory | | | | | | | | | | | |
|--|-------------|------------|-----------------|-------------|------------|------------------|-------------|------------|------------------|-------------|------------|
| 4% Voids | | | 8% Voids | | | 10% Voids | | | 12% Voids | | |
| Brick No. | Stability | Flow | Brick No. | Stability | Flow | Brick No. | Stability | Flow | Brick No. | Stability | Flow |
| 1 | 4950 | 2 | 1 | 3350 | 3 | 1 | 3000 | 3 | 2 | 2400 | 3 |
| 2 | 4800 | 3 | 2 | 3250 | 2.5 | 2 | 2900 | 3 | 3 | 2500 | 2.5 |
| 3 | 5280 | 3 | 3 | 3200 | 3 | 3 | 2850 | 3 | 4 | 2500 | 2.5 |
| Average | 5010 | 2.7 | Average | 3267 | 2.8 | Average | 2917 | 3.0 | Average | 2467 | 2.7 |

| Stability and Flow 4-inch Sample @ 4% Voids | | | | | |
|--|-------------|------------|--------------------------------|-------------|------------|
| Marshall | | | Cored from 150 Gyrotory | | |
| Brick No. | Stability | Flow | Brick No. | Stability | Flow |
| 3 | 2725 | 1 | 2 | 2225 | 2 |
| 4 | 2850 | 1 | 3 | 2150 | 1 |
| 5 | 2825 | 1 | 4 | 2150 | 2 |
| Average | 2800 | 1.0 | Average | 2175 | 1.7 |

| Cantabro Loss | | | | | |
|----------------------|------------|------------------|------------|------------------|------------|
| 7% Voids | | 10% Voids | | 12% Voids | |
| Brick No. | % Loss | Brick No. | % Loss | Brick No. | % Loss |
| 1 | 5.2 | 2 | 6.1 | 2 | 4.0 |
| 2 | 4.5 | 3 | 5.4 | 3 | 5.0 |
| 3 | 4.7 | 4 | 5.3 | 4 | 5.6 |
| Average | 4.8 | Average | 5.6 | Average | 4.9 |

| Tensile Strength and Tensile Strength Ratio | | | | | | | |
|--|------|------------------|------------------|----------------------|------|------------------|------------------|
| Conditioned | | | | Unconditioned | | | |
| Brick No. | Load | Tensile Strength | Strip Rating C/F | Brick No. | Load | Tensile Strength | Strip Rating C/F |
| 2 | 3450 | 99.4 | 1/1 | 5 | 3750 | 108.0 | 1/1 |
| 3 | 3600 | 104.0 | 1/1 | 6 | 3700 | 106.6 | 1/1 |
| 4 | 3900 | 112.6 | 1/1 | 7 | 3850 | 110.9 | 1/1 |
| Average | | 105.3 | 1/1 | Average | | 108.5 | 1/1 |
| Tensile Strength Ratio | | | | 0.97 | | | |

| Texas Overlay Tester | | | | |
|-----------------------------|---------------|--------------------|---------------------|---------------|
| Specimen No. | Cycles Tested | Initial Load (kPa) | Reduction of Load % | No. of Cracks |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

**APPENDIX G-6: LABORATORY TEST RESULTS ON PLANT SAMPLED MIX 81BIT159M
(CONTINUED)**

| Hamburg Displacement, mm | | | |
|--|-----------|----------------------|-----------------|
| Surface Mix: 81BIT159M PG Grade 58-28 | | | |
| | | Pass Criteria | Ultimate |
| Brick Pairs | | 5,000 | 20,000 |
| H3 | H6 | 3.1 | 5.0 |
| H2 | H5 | 3.0 | 4.3 |
| Maximum Displacement | | 3.1 | 5.0 |
| Average Displacement | | 3.1 | 4.7 |

| SCB with Flexibility Index (FI) | | | | | |
|--|------------------------------|------------------|--------------|--------------|-------------------|
| Replicate Name | Fracture Energy (LLD) | Peak Load | Slope | FI | FI AVERAGE |
| 159M-B1.dat | 2008.90 | 3.03 | -2.23 | 9.02 | 10.46 |
| 159M-B2.dat | 2031.33 | 3.06 | -1.93 | 10.51 | |
| 159M-T1.dat | 1850.71 | 3.26 | -2.72 | 6.80 | |
| 159M-T2.dat | 2602.26 | 3.16 | -1.68 | 15.52 | |

APPENDIX G-7: LABORATORY TEST RESULTS ON NEAT ASPHALT BINDERS

| | PG 70-28 Mod. Seneca-Lemont, IL (Level Binder) Mix: 81BIT147M | PG 58-28 Seneca-Lemont, IL (Surface Coarse) Mix: 81BIT157M | PG 64-22 Seneca-Lemont, IL (Surface Coarse) Mix 81BIT156M | PG 70-28 Mod. Seneca-Lemont, IL (Level Binder) Mix: 81BIT141M | PG 58-28 Seneca-Lemont, IL (Surface Coarse) Mix: 81BIT140M and 81BIT159M | Spec: AASHTO M320 Table 1 / IL PG+ |
|---|---|--|---|---|---|---|
| Date Sampled | 10/20/2014 | 10/30/14 | 10/30/2014 | 11/11/14 | 12/02/14 | ---- |
| Specific Gravity 15.6C | 1.032 | 1.034 | 1.040 | 1.029 | 1.032 | ---- |
| Flash (C.O.C.), °C | 318 | 326 | 346 | Not determ. / water | 338 | 230 min. |
| Rotational Viscosity @ 135°C, Pa-s | 0.990 | 0.336 | 0.474 | 1.060 | 0.339 | 3.0 max. |
| Mass Loss RTFO, % | -0.262 | -0.176 | -0.184 | -0.395 | -0.170 | 1.00 max. |
| Original DSR, kPa | 1.31 | 1.44 | 1.48 | 1.33 | 1.43 | 1.00 min. |
| Phase Angle (delta °) | 70.7 | 86.8 | 87.0 | 67.2 | 86.8 | ---- |
| RTFO DSR, kPa | 2.83 | 3.67 | 3.89 | 3.15 | 3.71 | 2.20 min. |
| PAV DSR, kPa | 1850 | 4380 | 3870 | 1740 | 3910 | 5000 max. |
| BBR, m-value | 0.333 | 0.337 | 0.330 | 0.322 | 0.332 | 0.300 min. |
| BBR, Stiffness, MPa | 190 | 218 | 184 | 168 | 203 | 300 max. |
| Force Ratio @ 4°C (unaged) | 0.83 | NA | NA | 1.11 | NA | 0.30 min. |
| Elastic Recovery @ 25°C (RTFO), % (ASTM D6084 Proc. A) | 88 | NA | NA | 92 | NA | 60 min. |
| Separation of Polymer | 0 | NA | NA | 0 | NA | 2.0 °C max. |
| True high temp. grade | PG 74.9 | PG 61.8 | PG 68.2 | PG 75.4 | PG 61.6 | |
| | | | | | | |
| MSCR results: (inform. purposes only) | tested @ 64C | tested @ 58C | tested @ 64C | tested @ 64C | tested @ 58C | Spec: AASHTO M332 |
| Jnr @ 3.2 kPa, 1/kPa (RTFO) | 0.61 | 2.57 | 2.63 | 0.32 | 2.60 | 4.5 max. for "S" 2.0 max. for "H" 1.0 max. for "V" 0.5 max for "E" |
| % Jnr difference, (b/twn 0.1 & 3.2 kPa) | 48.7 | 9.20 | 7.0 | 38.7 | 10.5 | 75 max. |
| % Recovery @ 3.2 kPa | 53.0 | 0.8 | 0.6 | 70.6 | 0.9 | ----- |
| PG Grade | PG 64 V -28 | PG 58 S -28 | PG 64 S -22 | PG 64 E -28 | PG 58 S -28 | |

APPENDIX H: TOTAL RECYCLE DISTRESS SUMMARIES

APPENDIX H-1: 26TH STREET TOTAL RECYCLE ASPHALT SECTION

| 26th Street | | | | | | | | | | | | | | | | | |
|---|--------------|----------------------------|-------|-------|--------|-----------------------------|-----|------|-------|----------------------------|-----|-------|-------|----------------------------|------|------|--------|
| Distress Type | Unit | Pre Overlay Distress Level | | | | Post Overlay Distress Level | | | | Spring 2014 Distress Level | | | | Spring 2015 Distress Level | | | |
| | | Low | Med | High | Total | Low | Med | High | Total | Low | Med | High | Total | Low | Med | High | Total |
| Alligator or Fatigue Cracking | Lane-Feet | 2 | - | 2 | 4 | - | - | - | - | - | - | - | - | - | - | - | - |
| Block Cracking | Lane-Feet | - | 125 | 138 | 263 | - | - | - | - | - | - | - | - | 25 | | | 25 |
| Centerline Cracking | Linear Feet | - | - | 9,000 | 9,000 | - | - | - | - | 1,641 | 10 | 7,389 | 9,040 | 2073 | 310 | 6164 | 8,547 |
| Longitudinal Cracking | Linear Feet | 4,600 | 94 | 430 | 5,124 | - | - | - | - | 288 | - | - | 288 | 397 | 190 | 175 | 762 |
| Overlaid Patch Deterioration | Square Feet | - | - | 168 | 168 | - | - | - | - | - | - | - | - | - | - | - | - |
| Permanent Patch Deterioration | Square Feet | 19,958 | 720 | - | 20,678 | - | - | - | - | - | - | - | - | 944 | 330 | 652 | 1,926 |
| Pothole and Localized Distress | Each | - | - | 1 | 1 | - | - | - | - | - | 1 | 10 | 11 | 1 | | | 1 |
| Raveling/Weathering/Segregation | Lane-Feet | - | - | - | - | 4 | - | - | 4 | 369 | 10 | - | 379 | 17571 | 57 | 372 | 18,000 |
| Transverse Cracking | Linear Feet* | 2,362 | 2,557 | 4,990 | 9,909 | 36 | - | - | 36 | 3,251 | 36 | - | 3,287 | 3955 | 1166 | 58 | 5,179 |
| * Linear feet of cracking measured in lieu of occurrences | | | | | | | | | | | | | | | | | |
| Lane Feet in Section = 19,000 Centerline Joint Feet in Section = 9,500 | | | | | | | | | | | | | | | | | |

APPENDIX H-2: HARRISON STREET TOTAL RECYCLE ASPHALT SECTION

| Harrison Street | | | | | | | | | | | | | | | | | | | |
|---|--------------|-------------------------------|-------|-------|-------|--|-----|------|-------|----------------------------|-----|------|-------|----------------------------|-------|-------|--------|--|--|
| Distress Type | Unit | Pre Overlay Distress Level | | | | Post Overlay Distress Level | | | | Spring 2014 Distress Level | | | | Spring 2015 Distress Level | | | | | |
| | | Low | Med | High | Total | Low | Med | High | Total | Low | Med | High | Total | Low | Med | High | Total | | |
| Alligator or Fatigue Cracking | Lane-Feet | 202 | - | 130 | 332 | - | - | - | - | - | - | - | - | 567 | - | - | 567 | | |
| Block Cracking | Lane-Feet | - | 5,500 | 500 | 6,000 | - | - | - | - | - | - | - | - | 9953 | 36 | 0 | 9,989 | | |
| Centerline Cracking | Linear Feet | - | 6,000 | - | 6,000 | - | - | - | - | 47 | - | - | 47 | - | 3,943 | 1,980 | 5,923 | | |
| Longitudinal Cracking | Linear Feet | - | - | - | - | - | - | - | - | 497 | - | - | 497 | 570 | - | - | 570 | | |
| Overlaid Patch Deterioration | Square Feet | - | 336 | - | 336 | - | - | - | - | - | - | - | - | - | - | - | - | | |
| Permanent Patch Deterioration | Square Feet | 314 | 108 | - | 422 | - | - | - | - | - | - | - | - | - | - | - | - | | |
| Pothole and Localized Distress | Each | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | | |
| Raveling/Weathering/Segregation | Lane-Feet | - | - | - | - | 4 | - | - | 4 | 4 | - | - | 4 | 11846 | 0 | 0 | 11,846 | | |
| Transverse Cracking | Linear Feet* | 969 | 1,695 | 3,894 | 6,558 | - | - | - | - | 5,472 | 331 | - | 5,803 | 3,888 | 2,347 | 660 | 6,895 | | |
| * Linear feet of cracking measured in lieu of occurrences | | | | | | | | | | | | | | | | | | | |
| | | Lane Feet in Section = 11,846 | | | | Centerline Joint Feet in Section = 5,923 | | | | | | | | | | | | | |

APPENDIX H-3: RICHARDS STREET TOTAL RECYCLE ASPHALT SECTION

| Richards Road | | | | | | | | | | | | | | | | | |
|---|--------------|-------------------------------|-------|-------|--------|--|-----|------|-------|----------------------------|-----|------|-------|----------------------------|-----|------|--------|
| Distress Type | Unit | Pre Overlay Distress Level | | | | Post Overlay Distress Level | | | | Spring 2014 Distress Level | | | | Spring 2015 Distress Level | | | |
| | | Low | Med | High | Total | Low | Med | High | Total | Low | Med | High | Total | Low | Med | High | Total |
| Alligator or Fatigue Cracking | Lane-Feet | - | - | 36 | 36 | - | - | - | - | 172 | - | - | 172 | 154 | | 215 | 369 |
| Block Cracking | Lane-Feet | 2,016 | 1,960 | 7,440 | 11,416 | - | - | - | - | - | - | - | - | | | | - |
| Centerline Cracking | Linear Feet | - | - | 2,942 | 2,942 | - | - | - | - | 81 | - | - | 81 | 6,592 | | | 6,592 |
| Longitudinal Cracking | Linear Feet | 6 | - | - | 6 | - | - | - | - | 300 | - | - | 300 | 285 | | 30 | 315 |
| Overlaid Patch Detertoration | Square Feet | 72 | - | 60 | 132 | - | - | - | - | - | - | - | - | | | | - |
| Permanent Patch Deterioration | Square Feet | 19,897 | 204 | 420 | 20,521 | - | - | - | - | - | - | - | - | | | | - |
| Pothole and Localized Distress | Each | - | 2 | 10 | 12 | - | - | - | - | - | - | - | - | | | | - |
| Raveling/Weathering/Segregation | Lane-Feet | - | - | - | - | - | - | - | - | - | - | - | - | 13,334 | | | 13,334 |
| Transverse Cracking | Linear Feet* | 6,215 | 1,464 | 3,203 | 10,882 | - | - | - | - | 720 | - | - | 720 | 2,000 | 202 | 36 | 2,238 |
| * Linear feet of cracking measured in lieu of occurrences | | | | | | | | | | | | | | | | | |
| | | Lane Feet in Section = 14,052 | | | | Centerline Joint Feet in Section = 7,026 | | | | | | | | | | | |

APPENDIX H-4: WOLF ROAD COMPARISON SECTION

| Wolf Road | | | | | | | | | | | | | | | | | | | | | |
|--------------------------------------|--------------|------------------------------|-----|------|--------|---|-----|------|-------|----------------------------|-----|------|-------|----------------------------|-----|------|-------|--|--|--|--|
| Distress Type | Unit | Pre Overlay Distress Level** | | | | Post Overlay Distress Level | | | | Spring 2014 Distress Level | | | | Spring 2015 Distress Level | | | | | | | |
| | | Low | Med | High | Total | Low | Med | High | Total | Low | Med | High | Total | Low | Med | High | Total | | | | |
| Alligator or Fatigue Cracking | Lane-Feet | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | | | | |
| Block Cracking | Lane-Feet | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | | | | |
| Centerline Cracking | Linear Feet | - | - | - | - | - | - | - | - | 52 | - | - | 52 | 52 | - | - | 52 | | | | |
| Longitudinal Cracking | Linear Feet | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | | | | |
| Overlaid Patch Deterioration | Square Feet | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | | | | |
| Permanent Patch Deterioration | Square Feet | 39,144 | - | - | 39,144 | - | - | - | - | - | - | - | - | - | - | - | - | | | | |
| Pothole and Localized Distress | Each | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | | | | |
| Raveling/Weathering/Segregation | Lane-Feet | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | | | | |
| Transverse Cracking | Linear Feet* | 11,058 | - | - | 11,058 | - | - | - | - | 3,080 | 108 | - | 3,188 | 3512 | 108 | - | 3,620 | | | | |
| * Linear feet of cracking and joints | | | | | | **Estimated from Google street view (2011) survey section length 2470 | | | | | | | | | | | | | | | |
| | | Lane Feet in Section = 9,880 | | | | Centerline Joint Feet in Section = 4,940 | | | | | | | | | | | | | | | |

APPENDIX I: TOTAL RECYCLE ASPHALT PHOTOS 2014 AND 2015

APPENDIX I-1: 26TH STREET TOTAL RECYCLE ASPHALT SECTION

| 2014 | 2015 |
|--|---|
|  A long shot of a two-lane asphalt road with a yellow center line and white edge lines. A dark car is parked on the left shoulder. The road surface shows some wear and shadows from trees. |  A long shot of the same road in 2015. The road surface shows more significant cracking and a large patch of new asphalt in the center lane. A person is visible on the right shoulder. |
|  A long shot of the road from a different angle. A dark SUV is parked on the right shoulder. The road surface shows some cracking. |  A long shot of the road in 2015, showing more extensive cracking and a large patch of new asphalt in the center lane. A person is visible on the right shoulder. |
|  A close-up view of the road surface showing a crack and a white number '6' painted on the asphalt. |  A close-up view of the road surface in 2015, showing the same crack and white number '6' painted on the asphalt, with shadows from trees cast across it. |

APPENDIX I-2: HARRISON STREET TOTAL RECYCLE ASPHALT SECTION

| 2014 | 2015 |
|---|--|
|  |  |
|  |  |
|  |  |

APPENDIX I-3: RICHARDS STREET TOTAL RECYCLE ASPHALT SECTION

| 2014 | 2015 |
|--|---|
|  A wide-angle photograph of Richards Street in 2014. The road is paved with dark asphalt and has a yellow dashed center line and white solid edge lines. The background shows commercial buildings, utility poles, and trees under a clear sky. |  A wide-angle photograph of Richards Street in 2015, showing the same scene as the 2014 image but with long shadows cast across the road from the right, indicating a different time of day. A person in a high-visibility vest is visible on the right shoulder. |
|  A close-up photograph of a longitudinal crack in the asphalt pavement in 2014. The crack runs through the center of the lane. A white painted number '15' is visible on the pavement to the left of the crack. |  A close-up photograph of the same longitudinal crack in the asphalt pavement in 2015. The crack appears slightly wider and more pronounced than in 2014. The white painted number '15' is still visible. |
|  A close-up photograph of a longitudinal crack in the asphalt pavement in 2014, viewed from a different angle. A white painted number '15' is visible on the pavement to the right of the crack. |  A close-up photograph of the same longitudinal crack in the asphalt pavement in 2015, viewed from the same angle as the 2014 image. The crack is clearly visible and consistent with the 2014 image. |

APPENDIX I-4: WOLF ROAD COMPARISON SECTION

| 2014 | 2015 |
|---|--|
|  |  |
|  |  |
|  |  |

