

Research Report
KTC -14-16/SPR-452-13-1F

Effect of Enhanced Trackbed Support on Railway/Highway At-Grade Crossing Performance

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**Effect of Enhanced Trackbed Support on Railway/Highway At-
Grade Crossing Performance**

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A B S T R A C T

This report documents the long-term performance of 89 railway/highway at-grade crossings in Kentucky and adjacent states that contain asphalt underlayment underneath the ballast. Asphalt underlayment increases load carrying capacity for trains and highway vehicles while enhancing the support structure's waterproofing and confinement. The asphalt underlayment crossings studied were installed at sites that had historically exhibited poor performance and short service lives. Most of the crossing sites evaluated were 10-15 years old; however, their ages ranged up to 30 years. All of the crossings investigated have shown excellent performance since the installation of asphalt underlayments. No crossing failures, such as excessive settlement or mud pumping, have been noted, and the service lives of the crossing surfaces have been significantly improved. Detailed results from periodic inspections are included. A literature survey focuses on eleven public agencies and railroad companies that implement asphalt underlayments. Most of these entities install asphalt underlayments at heavy traffic/tonnage crossings that have routinely shown evidence of weak support leading to inferior performance. This survey, along with the empirical results of this study, indicates that asphalt underlayment, irrespective of material used on crossing surfaces, extends the service life of crossings and improves their performance.

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EXECUTIVE SUMMARY

For over 30 years researchers at the University of Kentucky (UK) have performed railway trackbed research aimed at developing improved structural support for railway/highway at-grade crossings. Frequently replacing and rehabilitating railway/highway at-grade crossings is a major expense incurred by state transportation agencies as well as the railroad industry. An ideal crossing system is one that maintains a smooth surface and a stable highway/trackbed for a long period of time. This reduces maintenance costs as well as the number of inconvenient disruptions to highway and railway traffic.

This report documents the performance of 89 crossings, most of which are located in the State of Kentucky. Most of the crossings we evaluated varied in age from 10-15 years; however some ranged in age up to 30 years. Each of these crossings contains a layer of asphalt underneath the ballast; this trackbed system is known as an “asphalt underlayment” trackbed. This high-quality substructure provides increased load-carrying capacity for trains and highway vehicles by confining the ballast and providing subgrade waterproofing to the jointly-used crossing area common to both modes of traffic. All of the asphalt underlayments were installed at crossings that had historically exhibited poor performance and relatively brief service lives.

These crossings have performed excellently since having asphalt underlayments installed. Their performance improved significantly over what was attained with conventional all-granular trackbed designs. Critically, the use of asphalt underlayments in the crossing substructures has provided increased levels of performance and extended the useful lives of crossings irrespective of traffic volumes and loading magnitudes. The crossing surface material chosen has little effect on subsequent performance of crossings as long as adequate structural support is provided. Adopting asphalt underlayments enables government agencies and railroad companies to use more economical crossing surface materials with confidence, and with the knowledge that doing so will not shorten a crossing’s service life. No crossing failures due to inadequate support, such as excessive settlement or mud pumping, have been noted for any of the 89 crossings evaluated as part of this study.

A growing number of public agencies¹ and railroad companies have mandated the use of asphalt underlayments on select crossings, normally on heavy traffic/tonnage crossings that have weak support, as evidenced by track pumping, ballast fouling, and track settlement. The report concludes by summarizing how eleven public agencies and railroad companies, spread across the United States, currently implement asphalt underlayment.

¹ In this report, “government agencies” and “public agencies” are used interchangeably. They refer to any agency at the local, state, or federal level that plays a role in the design, maintenance, or oversight of crossings.

CHAPTER 1

Introduction to Asphalt Underlayment Applications

Over the past thirty years the Railroad Research Team in the University of Kentucky's Department of Civil Engineering has evaluated the benefits of using enhanced trackbed support for at-grade railway-highway crossing construction and rehabilitation practices. This effort has largely concentrated on assessing the benefits of placing an asphalt layer below the ballast as an addition to, or as a replacement for, typical all-granular subballast. The asphalt layer functions as an additional subballast layer. There are numerous benefits associated with using this layer, which include:

- A strengthened track support layer beneath the ballast that uniformly distributes reduced pressures to the roadbed and subgrade
- A waterproofing layer that confines the underlying roadbed; this offers consistent load-carrying capacity for track structures, even on marginal quality roadbeds
- An impermeable layer that diverts water to side ditches and essentially eliminates roadbed or subgrade moisture fluctuations, effectively improving and maintaining underlying support
- A consistently high level of confinement for the ballast, which enables the ballast to develop high shear strength and distribute pressures uniformly
- A resilient layer between the ballast and roadbed, which reduces the likelihood of subgrade pumping without substantially increasing track stiffness (Rose, et al., 2014, Rose, 2009, Rose, et al. 2009a, Rose, et al., 2009b)

Figure 1.1 portrays cross-sections for the two most common types of Asphalt Underlayment Trackbeds. To install the additional layer, the old crossing surface and track panel are removed; after this the underlying mixture of ballast, subballast, and subgrade is excavated to the required depth. The excavated materials are replaced with compacted layers of subballast (optional) and hot mix asphalt (termed the asphalt underlayment), a compacted layer of ballast, a new track panel, and a new crossing surface.

Chapter 2 of this report describes the initial designs for several installations and the subsequent on-site inspections for 89 crossings in four states. This is not an all-inclusive listing, but represents those crossings that the research team has been directly involved with to varying degrees. Most of the crossings—73 of 89—are located in Kentucky, with additional crossings situated in West Virginia, Michigan and Tennessee.

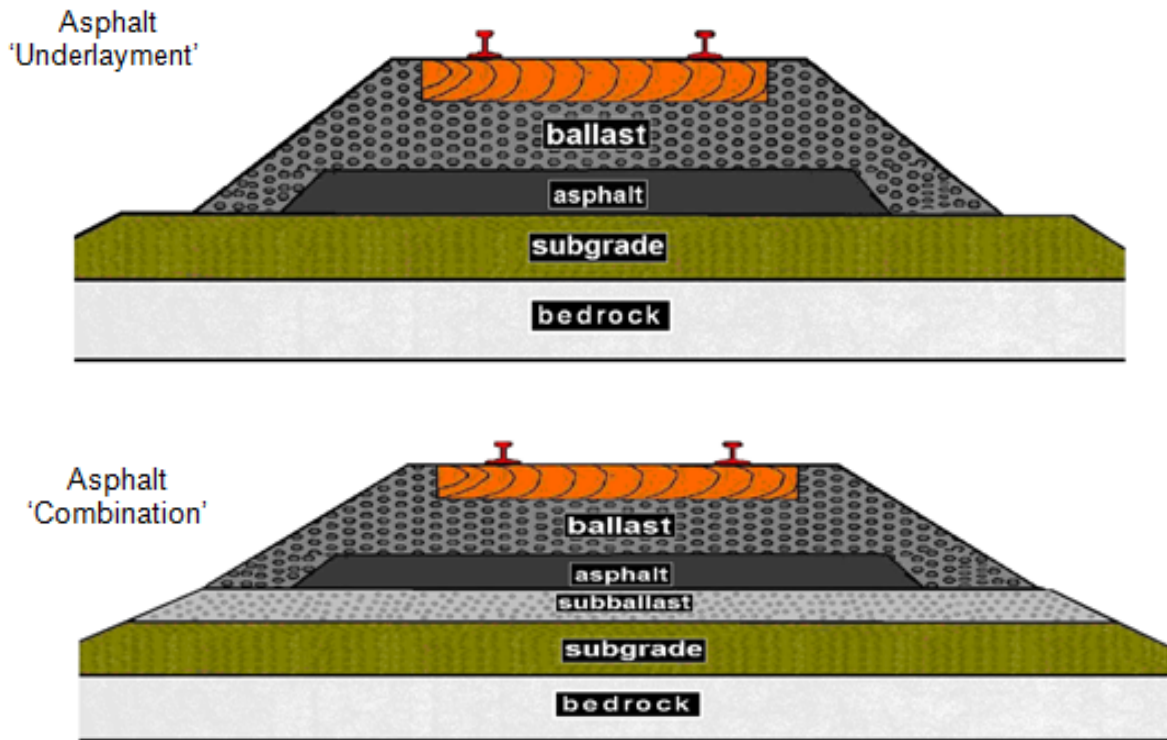


Figure 1.1. The two typical Asphalt Underlayment Trackbeds

The 89 crossings have been partitioned into 12 groups based on their geographical distribution as well as commonalities in their design parameters and placement dates. This classification scheme promotes better documentation and encourages a more focused discussion. Each group has a degree of uniqueness, which is described in the text.

Although application of asphalt trackbeds (asphalt underlayments) for railway-highway crossings began approximately 30 years ago, the practice has only been commonly used since 2000. Over the past fourteen years, several government agencies and railroad companies have increasingly turned to this practice, expanding its scope, and accelerating its rate of adoption.

Most of the crossings discussed in this report have been periodically reviewed onsite. We conducted detailed inspections for all crossings in 2011 and performed follow-up inspections for most of the crossings in 2013. This most recent series of inspections also looked at several crossings installed between the 2011 and 2013 inspections, so only the 2013 inspections are available for these sites. However, the majority of the crossings have been in service for at least 10 to 15 years, providing ample time to evaluate their long-term performance. Figures 1.2 and 1.3 are representative sites that were inspected during this research; each site is illustrative of a crossing that is in perfect condition well after installation has been completed.

Appendix A consists of spreadsheets that list summary information for the 89 crossings. The crossings are separated into twelve groups to facilitate discussion and evaluation. Appendix B provides detailed descriptions for each of the twelve groups.

Under the auspices of several public agencies, the team has participated in the evaluation of railway-highway crossing evaluations in several other states. However, inspections and performance evaluations have not been routinely conducted on many of these crossings. Due to the lack of documentation and space herein, descriptions of these crossings are excluded. But anecdotal evidence supported by cursory evaluations of these crossings indicates that excellent to exceptional performance is the norm. Increasingly, when railroad companies or government agencies need to renew rail/highway crossings, using asphalt underlayment is the preferred practice. Chapter 3 summarizes programs for ten additional government agencies and railroad companies that use asphalt underlayments for crossing rehabilitation or construction.

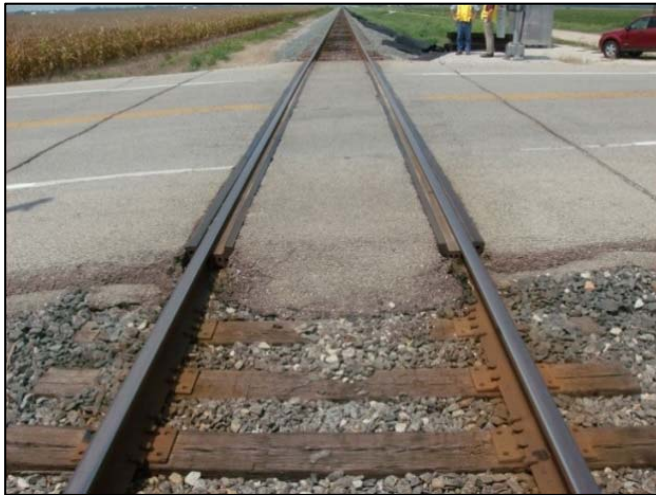


Figure 1.2. U.S. 60, Stanley, KY.
10 Years Old, Perfect Condition.



Figure 1.3. U.S. 60, Versailles, KY.
8 Years Old, Perfect Condition.

CHAPTER 2

Detailed Evaluations of Asphalt Underlayment Crossings

Discussion of Initial Renewals during Early to Mid-1980s

During the early/mid-1980s five Timber/Asphalt Crossings, all in Central Kentucky and on CSX lines, were renewed using asphalt underlayment. Before replacement, these crossings were in deplorable condition, exhibiting a combination of mud pumping, settlement, and surface deterioration, all of which contributed to unacceptable rideability conditions, and led to frequent maintenance and replacement. Table 2.1 lists these crossings:

Table 2.1. Kentucky Asphalt Underlayment Crossings in Mid-1980s*

Date Installed	Crossing Location	Original	Type of Surface	Current
1982	Forbes Road, Lexington	T/A	RS/A	CP
1983	Fairview Loop, Snider	T/A	RS/A	T/A
1984	Bridge Street, Cynthiana	T/A	RS/A	T/A
1984	Pike Street, Cynthiana	T/A	RS/A	RS/A
1984	Pleasant Street, Cynthiana	T/A	RS/A	T/A

*T/A=Timber and Asphalt, RS/A=Rubber Seal and Asphalt, CP=Concrete Panels

Intermittent performance monitoring has been conducted on these crossings over the past 30 years. All five crossings were originally renewed using Timber/Asphalt, which was the CSX standard during the early 1980s. For the first several years after replacement, the crossings performed very well, however, during the late 1990s the timber in the crossing surfaces began to decay. As a result, the crossing surfaces were renewed using Rubber Seal/Asphalt, the CSX standard at that time. After several years of exceptional performance, three of the crossing surfaces were renewed with the then-reestablished CSX standard of Timber/Asphalt. Pike Street in Cynthiana was the only crossing that remained Rubber Seal/Asphalt. The crossing exposed to the most significant highway traffic, Forbes Road, was replaced with a Concrete Panel crossing surface. The five crossings have performed very well over the past 30 years, with no evidence of mud pumping or settlement. This has translated into improved rideability for the motoring public. Appendices A and B contain detailed descriptions and photographs for these crossings.

Few, if any, additional crossings were renewed with asphalt underlayment during the late 1980s and through the 1990s. But a resurgent interest in this technique emerged in 2000, with

more railroad companies applying this technology. Eastern and Central Kentucky and West Virginia were two areas where asphalt underlayment was initially redeployed.

Discussion of Renewals Since 2000

Since 2000, 68 crossings in Kentucky, predominately containing Rubber Seal/Asphalt and Concrete Panel surfaces, have been renewed using asphalt underlayment. These crossings' performance has been periodically evaluated, along with another 16 crossings in West Virginia, Michigan, and Tennessee. The out-of-state crossings were installed using similar techniques as those in Kentucky and are included here as a point of comparison.

Information regarding the types of crossing surfaces initially used during renewal, as well as the types of crossing surfaces currently emplaced, are noted in Table 2.2 for the 68 Kentucky crossings and the 16 crossings in the other three states renewed since 2000.



Figure 2.1. Bridge Street, Cynthiana, KY – Age: 28 years, third surface.



Figure 2.2. Fairview Loop, Snyder, KY – Age: 31 years, third surface.

Table 2.3. Renewals since 2000 in Kentucky, Michigan, West Virginia, and Tennessee

Type of Surface	Initially Renewed in KY	Presently in KY	West Virginia*	Michigan*	Tennessee*
Rubber Seal/Asphalt (RS/A)	24	13**	0	3	0
Concrete Panel (CP)	28	25	5	2	0
Timber/Asphalt (T/A)	1	20**	0	0	0
Composite (COM)	6	5	0	2	0
All-Asphalt (A/A)	2	2	0	0	0
Rubber Seal/Concrete (RS/CP)	3	1	0	0	0
Timber (T)	1	0	0	1	0
Wide Rubber/Concrete (WR/CP)	2	2	0	0	1
Rubber (R)	1	0	0	1	0
Concrete Tub (CT)	0	0	0	0	0
3 Rail/Asphalt (3R/A)	0	0	0	1	0
Total	68	68	5	10	1

*As initially renewed and presently in-place

**Differences from Initially Renewed primarily due to CSX change in standard surface from RS/A to R/A

Crossing Surface Performance

The ensuing discussion of crossing performances at the 68 Kentucky sites renewed since 2000 is organized based on the type of crossing surface used. The two major types of surfaces are Rubber Seal/Asphalt and Concrete Panel. Of the 68 crossings, 35 percent are Rubber Seal/Asphalt and 41 percent are Concrete. These two surfaces constitute three-fourths of the crossing surfaces in the study.

Rubber Seal/Asphalt Surfaces (RS/A) – Compared to more premium surfaces, such as concrete, rubber, and certain composites, RS/A surfaces are less expensive. Many agencies and railroads consider RS/A as the standard surface for renewals.

With the exception of one site, all of the RS/A surfaces have performed extremely well, many them being located on high-traffic highways and rail lines. At these sites, workers paid close attention to ensure the ballast was thoroughly compacted before positioning the track panel; this minimized the amount of settling that subsequently occurred. For this type of surface, it is very important to sufficiently compact the ballast, provide adequate underlying support, and assure proper drainage. If these conditions are not met, RS/A surfaces tend to perform poorly and demand frequent maintenance. Some of the agencies that hold RS/A in low regard cite its poor performance and need for recurrent maintenance as the primary reason. However, as mentioned, 23 of the 24 RS/A surfaces evaluated have performed very well. All were supported on a layer of asphalt underlayment.

In 2012, eleven of the 24 RS/A surfaces were removed on CSX lines during surfacing and timbering activities. The surfaces had maintained excellent performance to that point. A few showed minor raveling of the asphalt adjacent to the rubber, however, this did not negatively impact the service provided by the crossing. The present CSX standard for RS/A crossings is a Timber/Asphalt surface. Additionally, the use of larger tie plates is now mandated on sharp curves. Due to the adoption of these standards, nine crossings were removed during a routine timbering and surfacing program, despite their good performance. Had they not been removed, these crossing surfaces could have remained functional for several more years.

The only RS/A surface that performed poorly is located on U.S. 41 near Sebree, a heavily trafficked road. On this crossing, wide rubber panels were reused on the field sides, with RS/A used in the center. Here, trucks moving at high speeds would bounce and hit the rail and asphalt in the center of the track after hitting the rubber panels. Once they had been struck, the rubber panels compressed so that the truck tires impacted the rail and asphalt in the center of the track. Repeated instances of trucks striking the panels loosened the rails, prompting the crossing to rapidly deteriorate. The combination of Rubber and RS/A surface did not perform well. In 2012, after eight years of service, the surface was removed and replaced with a regular (narrow) RS/A surface.

Concrete Panel Surfaces (CP) – CPs are premium surfaces, and therefore one of the more expensive options. Despite being high priced, they are widely used and are considered a standard crossing surface for a wide range of applications. CP surfaces were installed on 28 of the crossings and only three of the CP surfaces have since been removed.

Two of these crossings, located in Louisa and Isom, respectively, were located on heavily trafficked highways that carry significant numbers of very heavy coal trucks. The CP crossings performed well for several years, however, eventually the spikes came loose, which caused the rail to bounce up and down when heavy loads passed over them – producing increased impacts on the concrete panels. An additional problem stemmed the metal strappings; these became unfixed, striking the nearby concrete. After prolonged exposure these impacts, the concrete

panels cracked and deteriorated. The crossings remained smooth, and neither settlement nor mud pumping was evident. The impact of the heavy loads continued to deteriorate the concrete panels. A few panels at each site were replaced after the concrete began to deteriorate. The Isom crossing surface was patched with asphalt to smooth the ride quality for the high-speed traffic. Officials decided to replace the Louisa crossing with RS/A in 2010 after nine years of service, and to replace the Isom crossing with Timber/Asphalt in 2012 after ten years of service. Both crossings provided excellent performance, much better than ever experienced before concrete deterioration set in.

The other CP crossing that necessitated replacement is on KY 595 at Berea. The crossing performed satisfactorily for several years after installation. It was lengthened and renewed in 2002 during a major highway widening and upgrading procedure. As part of routine maintenance, the rail was changed out along sections of the track around the crossing. At this time, engineers decided to also change out the rail through the crossing, despite the fact that it had been in place for a relatively short time. This procedure created significant roughness at the crossing, due largely to the narrow asphalt approaches. In 2013, after 11 years of service, the concrete panels were removed during a timbering and surfacing program and replaced with a Timber/Asphalt surface with longer highway approaches to improve rideability.

The other 25 CP crossing surfaces continue to perform very well and have been in service for approximately ten years. We anticipate these crossings will perform acceptably and remain in good repair for several more years.

Timber/Asphalt Surfaces (T/A) – The only T/A crossing surface placed using asphalt underlayment was on KY 476 in Hazard during 2011. (The other five T/A surfaces were applied during the early/mid 1980s.) The asphalt underlayment consisted of asphalt millings. Nineteen T/A surfaces have been recently used as replacement surfaces.

Composite Surfaces (COM) – Six Composite crossing surfaces are included among our evaluations. One noteworthy surface has been marketed as an “Endurance” product. This product is formed by combining waste products with adhesives to bind the constituents into a durable product. Five COM crossings are still in service. The lone removal occurred at South Portsmouth in 2013 during a CSX timber and surfacing program. The crossing still performed well after 11 years of service. The other five COM crossings, which range from 2-11 years old, continue to function very well under heavy traffic conditions.

All-Asphalt Surfaces (AA) – Limited budgets restricted renewal options at two crossings on CSX lines in Eastern Kentucky. To keep costs down, CSX selected the least costly available surfaces, which were composed entirely of the asphalt used to pave the highway approaches. A hi-rail vehicle was used to form the flangeways in the asphalt surface while the asphalt mixture was at an elevated temperature.

The first crossing this technique was used at is located on George's Branch, just off of KY 15 near Vicco. It was set in place in 2001 and is still largely in the same condition as when it was installed 12 years ago. The good condition may be partially related to the frequency of coal trains diminishing over the past few years; however, the crossing still accommodates a limited number of coal trucks and vehicular traffic. This installation technique was also used in 2008 on the heavily traveled KY 7 near Beaver Gap. Both asphalt surfaces have suffered limited raveling of the asphalt near the rail and flangeway, but the crossings remain remarkably smooth.

Rubber Seal/Concrete Surfaces (RS/C) – Three RS/C crossing surfaces were placed on heavy-traffic crossings in Eastern Kentucky. The crossing at Bull Creek remains in place. The RS/C surface located at Lackey performed perfectly for three years until the asphalt approaches failed, which caused the adjacent concrete panel to crack. Before using asphalt underlayment, this crossing was rehabilitated at least once per year. This was largely due the presence of a sharp eight-degree curve in the track, the need for coal trucks to negotiate wide turns, and the high-impact loadings from the high-speed thru trucks. After five years it was changed to a RS/A surface, and during a recent rail change-out procedure it was renewed again with RS/A. Its performance has been significantly better than in the past.

Timber Surfaces (T) – Only one timber surface was included in the evaluations – a crossing located at South Shore on KY 7. By 2011, the wood had started to deteriorate and the lag screws loosened, which indicated that the wood was nearing the end of its useful life. The surface was removed during a timber/surfacing program in 2013 after having been in place for 11 years, and a T/A crossing surface was inserted. The Timber surface performed well and still provided a very smooth surface until its removal.

Wide Rubber/Concrete Surfaces (WR/C) –WR/C surfaces were used at two crossings in Eastern Kentucky. At these sites, existing wide rubber panels were repurposed for the field sides while concrete panels were inserted into the center sections. Both crossings perform well after 11 years.

Full-Depth Rubber Surfaces (R) – Only one Rubber crossing surface was included in our evaluations. This surface is located on Chenoweth Lane in Louisville. In 1996 it was installed to replace a deteriorated rubber crossing. It performed well for several years; however, it was replaced again in 2007 with a combination of timber/rubber/asphalt surface. The rail soon loosened and the approaches began to deteriorate.

Concrete Tub Surfaces (CT) – No Concrete Tub surfaces were included in the study.

Notable Study Crossing Findings and Exceptions

The following sections document noteworthy findings from our study crossings that contained asphalt underlayments. Each crossing has been periodically evaluated over the past 30 years. We performed two detailed inspections; one in 2011 and another in 2013.

Notable Findings and Conclusions (As of December 2013)

- The economical Rubber Seal/Asphalt surfaces have demonstrated exceptional performance at 23 of the 24 crossings they were installed at, including six crossings on KY 7 Corridor in Letcher County laid in 2005 as well as the U.S. 60 crossing at Stanley in Daviess County, which was installed in 2002.
- Both of the economical All-Asphalt crossings surfaces at George’s Branch in Perry County (2001) and KY 7 at Beaver Gap in Knott County (2008) have performed exceptionally.
- The Concrete crossing surface on U.S. 60, 35th Street in Catlettsburg in Boyd County (installed 2006) has performed unusually well compared to Timber/Asphalt surfaces at the adjacent 34th, 36th and 37th Street crossings, where conventional all-granular support was used.
- Four crossings installed in 2002 on CSX as part of the Cincinnati Subdivision projects have performed exceptionally well compared to the 16 other crossings on the subdivision that were renewed at the same time using conventional all-granular support
- The concrete crossing surfaces on high volume crossings on U.S. 25/Main Street in Richmond (2000), U.S. 60/Main Street and Broadway in Winchester (2003/2004), Waller Avenue and Rosemont Garden in Lexington (2002), and the two U.S. 60 Bypass crossings in Versailles (2002) have all performed remarkably well.
- The # 1 track and #2 track crossings at Broadway in Winchester containing Concrete and Rubber Seal/Asphalt surfaces, respectively, have performed comparably.
- The Rubber/Concrete crossing surface on U.S. 129 south of Knoxville, TN (2001) has held up exceptionally well, even as this is one of most trafficked non-interstate highways in the state.
- Similar Exceptional Performances have been observed for crossings in West Virginia and Michigan.

- The six experimental composite (Endurance) crossing surfaces have performed exceptionally.
- A Ballastless crossing was successfully installed (with Rubber Seal/Asphalt surface) on KY 292 in Martin County in 2011; it has performed well since.
- The detrimental effects of impact loadings on Concrete crossing surfaces can result in the loosening of rail and concrete panels, which can translate into their premature failure.
- Economical crossing surfaces often perform as well as premium, more expensive, crossings as long as they are properly designed, installed, and provide adequate support and efficient drainage.
- Using asphalt underlayments in the crossing substructures improves performance and extends their useful lives regardless of traffic volumes and loading magnitudes.
- Crossing surface materials appear only weakly correlated with a crossing's subsequent performance, provided that adequate structural support is available.
- Geometrical design considerations should minimize the possibility of highway vehicles experiencing sudden changes in vertical grades, thus increasing impact on the crossing surface.
- No crossing surface failures (due to factors such as excessive settlement and mud pumping) catalyzed by inadequate structural support have been noted for the 89 crossings evaluated in this study. Similar findings have been documented from cursory evaluations in several additional states.

Examples of Underperforming Surfaces (As of December 2013)

- KY 3, Madison Avenue in Louisa (Lawrence)
 - The Concrete crossing surface installed during 2001, had excellent performance for several years before the rail (spikes) and steel straps loosened and concrete panels began cracking and deteriorating. A new surface of Rubber Seal/Asphalt surface was installed in 2010.
- KY 15 in Isom (Letcher)
 - This Concrete crossing surface was installed in 2002, but faced similar problems as the Louisa crossing, which required patching holes with asphalt and replacing some panels. The crossing surface remained serviceable until it was replaced with Timber/Asphalt surface in 2012.
- U.S. 431 at Cleaton (Muhlenburg)
 - Many problems arose when this Concrete crossing surface was installed in 2002, similar to those at Louisa and Isom. It has been patched with asphalt several times and a number of panels have been replaced. As such, it remains serviceable even though it does not have a cosmetically pleasing appearance – there are plans to replace it with a Rubber crossing surface.

- U.S. 41 at Sebree (Webster)
 - At this crossing, a Rubber Seal/Asphalt surface was installed in 2004 in the gage area and wide Omni Rubber panels were reused on field sides of the crossing. The design was not properly executed – the rubber was too flexible, which increased impacts, eventually triggering a separation of crossing surface. It was replaced with a Rubber Seal/Asphalt surface in 2012.
- KY 550/KY 7 at Lackey (Floyd)
 - A Rubber Seal/Concrete crossing surface was installed at this site in 2001 on an eight-degree railroad curve that has wide truck turns and high-speed through moves. It performed well until an asphalt base failure on the approach occurred and the adjacent concrete panel deteriorated. A Rubber Seal/Asphalt surface with Pandrol clips was recently installed.
- U.S. 25E at Barbourville (Knox)
 - A Concrete crossing surface was installed in 2011 across four lanes and the median on a railroad curve with two inches (50 mm) of superelevation. This site experienced very high-impact loadings due to excessive superelevation, which loosened the concrete panels and asphalt approaches and caused them to decay. In 2013 the panels were removed and the superelevation was reduced to 0.5 in. (12 mm). The existing panels were reused during the rejuvenation. See Figure 2.3, below.



Figure 2.3. U.S. 25E – Barbourville, KY Concrete Panel Crossing Surface.

CHAPTER 3

Additional Applications of Asphalt Underlayment by Other Agencies and Railway Companies

With the numerous benefits of using asphalt underlayment having been catalogued, a growing number of railroad companies and public agencies have started to mandate the use of asphalt underlayments on select crossings. Crossings that have routinely shown evidence of weak support, as evidenced by track pumping, ballast fouling, and track settlement are the best candidates for the application of asphalt underlayment. Here, we review the instances where an assortment of railroad companies and public agencies have opted for asphalt underlayment. Some of these participating agencies and railroad companies include: Caltrain, Metrolink, Iowa DOT, Michigan DOT, West Virginia DOT, Tri-Met/WES, TTI, ICC and Indiana DOT, and Hillsborough County, Florida.

Caltrain

Caltrain, a 55-mile (88-km) regional rail link along the San Francisco Peninsula, has used asphalt underlayment on crossings since 1998. This high-traffic line carries predominately commuter trains and a limited number of Union Pacific (UP) freight trains. Since 1998, asphalt underlayment has been implemented on approximately 60 street and pedestrian crossings. This may be an underestimate as Caltrain's tally is incomplete. In addition, numerous crossovers, turnouts, stations, bridges, and tunnel approaches and inverts have been underlain with asphalt. Figure 3.1 represents the standard design Caltrain uses on highway-railway at-grade crossings, which features an eight in. (200-mm) thick layer of asphalt laid over a six in. (150-mm) thick layer of granular subballast. The asphalt layer extends 10 ft. (3 m) past the edge of the crossing surface.

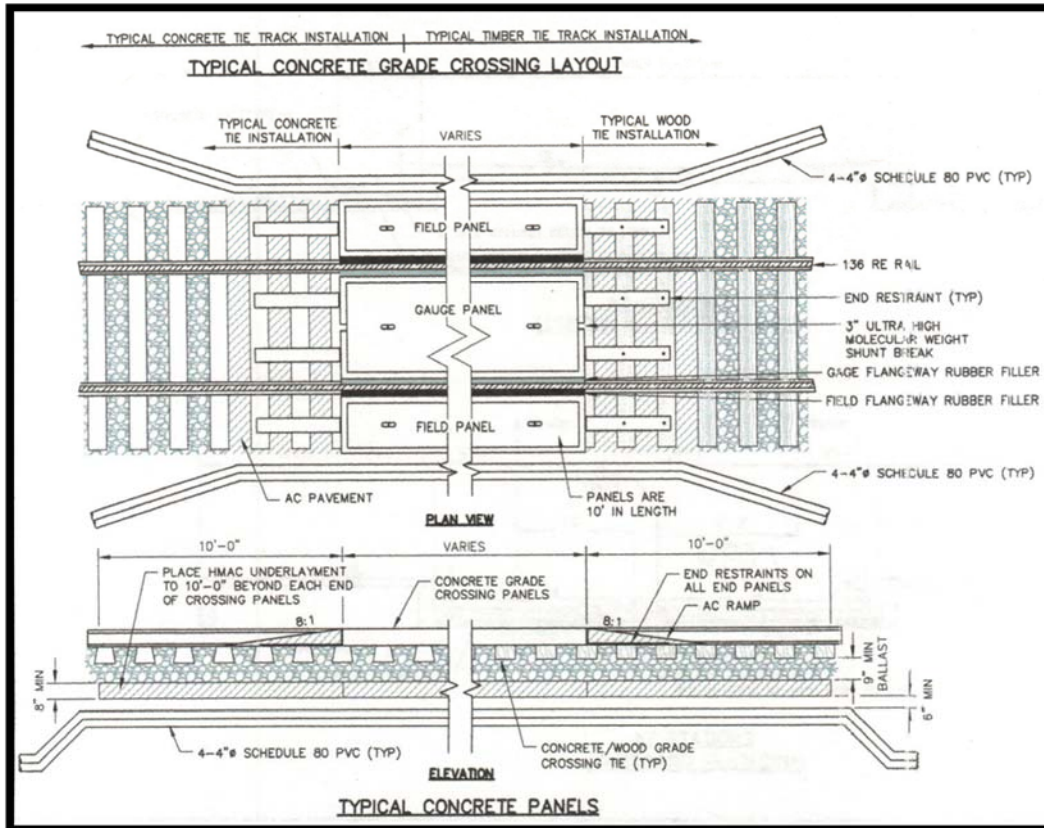


Figure 3.1. Standard Design for Caltrain At-Grade Crossings with Asphalt Underlayment.

Metrolink

Metrolink provides commuter rail service throughout the Los Angeles area. Since 2007, Metrolink has installed between 60 and 70 crossings with asphalt underlacements. A number of bridge and tunnel approaches, turnouts, crossovers, and yard tracks have been underlain with asphalt as well. It is now standard practice for all highway-railway crossings along the system to be fitted with asphalt underlayment. Metrolink specifies that a six in. (150-mm) thick HMAC underlayment be used in place of portions of the subballast and ballast beneath the track. The crossings have performed excellent so far, and minimal settlement has been observed. Figure 3.2 shows a recently completed crossing at Osborne Street on the Antelope Valley Line in the Sun Valley Area of Los Angeles.



Figure 3.2. Metrolink Osborne Street Crossing on the Antelope Valley Line.

Iowa Department of Transportation

Beginning in 2000, the Iowa DOT started using asphalt underlayment when rehabilitating crossings. Since beginning this practice, the service lives for crossings meeting the Iowa DOT's standards have significantly increased. Among crossings where asphalt underlayment has been used, no crossing failures have occurred due to a lack of structural support. Of the 167 crossings on the primary system, 80-90 contain asphalt underlayment. On most projects, the Iowa DOT uses a six in. (150-mm) layer of underlayment. Figure 3.3 shows a crossing on U.S. 34 in Albia, Iowa that contains asphalt underlayment.



Figure 3.3. Albia, IA Crossing Underlain with Asphalt.

West Virginia Department of Transportation

WVDOT began using asphalt underlayment in 2000. Since 2000, all crossings that have been rehabilitated as part of a “betterment” program under the supervision of WVDOT have included asphalt underlayment. Of the 14 crossings scheduled for renewal 2013, all were slated to use asphalt underlayment. The majority of these crossings are located on heavy tonnage, high-traffic portions of the railroad network. An estimated 125 crossings contain asphalt underlayment throughout the state, with the oldest having been in service for 13 years. The normal practice is to use a high-type surface material – commonly concrete precast panel – to improve support and drainage, which is achieved with a six in. (150-mm) layer of asphalt underlayment. This practice upgrades crossings and enhances their performance and service life – which qualifies this as a betterment program. Since the program began, no crossings with asphalt underlayment have failed due to lack of substructure support or excessive settlement. All have remained smooth and serviceable. Five crossings that contain asphalt underlayment have been monitored for long-term performance. Appendices A and B describe each crossing and record their performance. Figure 3.4 illustrates a crossing underlain with asphalt on U.S. 50 in Bridgeport, WV.



Figure 3.4. Bridgeport, WV Crossing Underlain with Asphalt.

Genessee & Wyoming—TriMet—WES

The Genessee and Wyoming Shortline Railroad began using asphalt underlayments on its Portland and Western (P&W) line in Oregon about six years ago. P&W rehabilitates 12-15 crossings per year with asphalt underlayment. The TriMet Westside Express Service (WES) commuter line, which stretches from Beaverton to Wilsonville in the Portland Metropolitan Areas, included asphalt underlayment on 18 public crossings rehabilitated on the old Oregon Electric Line when it was reconstructed to accommodate commuter service. These crossings have performed perfectly since the installation of asphalt. There has been no mud pumping, and they have required no extra surfacing and maintenance. Figure 3.5 shows the installation of an asphalt underlayment on the SW Durham Road crossing on the WES commuter line.

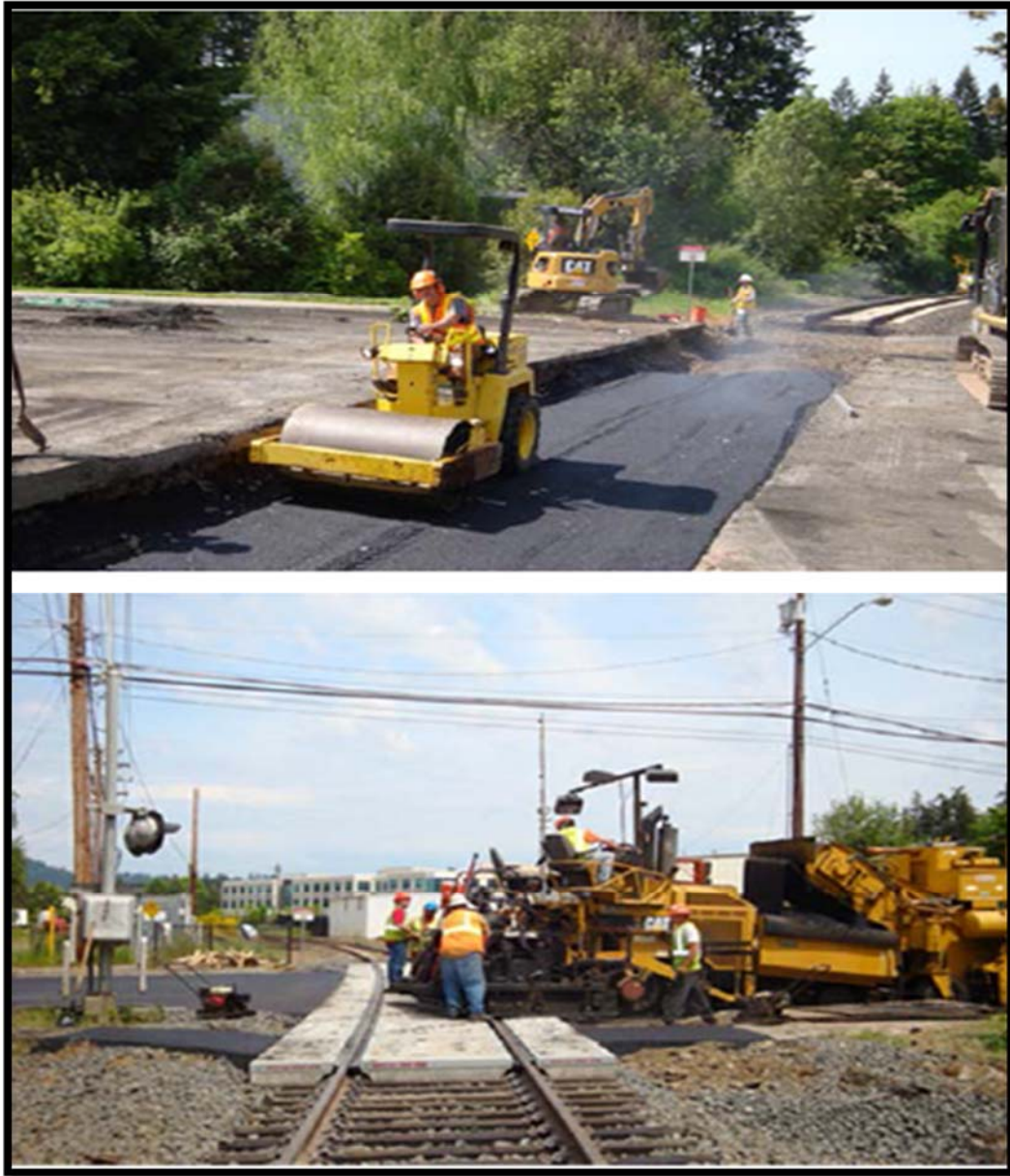


Figure 3.5. SW Durham Road Crossing on WES Line.

Transkentucky Transportation Railroad

Transkentucky Transportation (TTI) is a 50 mile (80 km) long short-line railroad that runs through northeastern Kentucky. It has used asphalt underlayments on several segments of its rail network since 1987. Documents from 1997 indicate that over the preceding 10 years asphalt underlayment was placed beneath the track in one tunnel, seven open track sites, 26 highway crossings, seven turnouts, five bridge approaches, and two shop tracks. The highway crossings and other applications remain serviceable today. TTI has not renewed or rehabilitated the

structural supports for any of these crossings. Crossing surface renewal has taken place at a few sites where the asphalt or timber portions deteriorated from weathering.

Illinois Commerce Commission and Illinois Department of Transportation

In the State of Illinois, the ICC began installing asphalt underlayments beneath crossings in 2010. Since then, 92 crossings have been underlain with asphalt. Another 36 crossings presently targeted for renewal will contain asphalt underlayment as well. There have been no recorded failures in crossings supported with asphalt underlayment, with all performing excellently. Likewise, the Illinois DOT has started using asphalt underlayment on many of its renewal/rehabilitation projects. Figure 3.6 depicts a typical Illinois DOT crossing.



Figure 3.6. Concrete Tub Crossing in Urbana, IL.

Hillsborough County, Florida

The Hillsborough County, Florida Official County Government launched an asphalt underlayment program in 2002. Since its inception, 11 crossings have been renewed, all of which include asphalt underlayment. These projects were undertaken in conjunction with major upgrades to the crossings, such as widening the crossings and installing curbs, gutters, and sidewalks and improving the crossing protection system. Precast concrete panels are used on the major upgrades. The performance of the crossings with asphalt underlayment has been excellent, with no failures observed due to lack of support or settlement. Only some minor adjustments to reattach or secure a few of the concrete panels have been necessary. The crossings remain smooth and fully serviceable with several approaching 11 years of service. Figure 3.7 presents the design standards used for crossings underlain with asphalt in Hillsborough County.

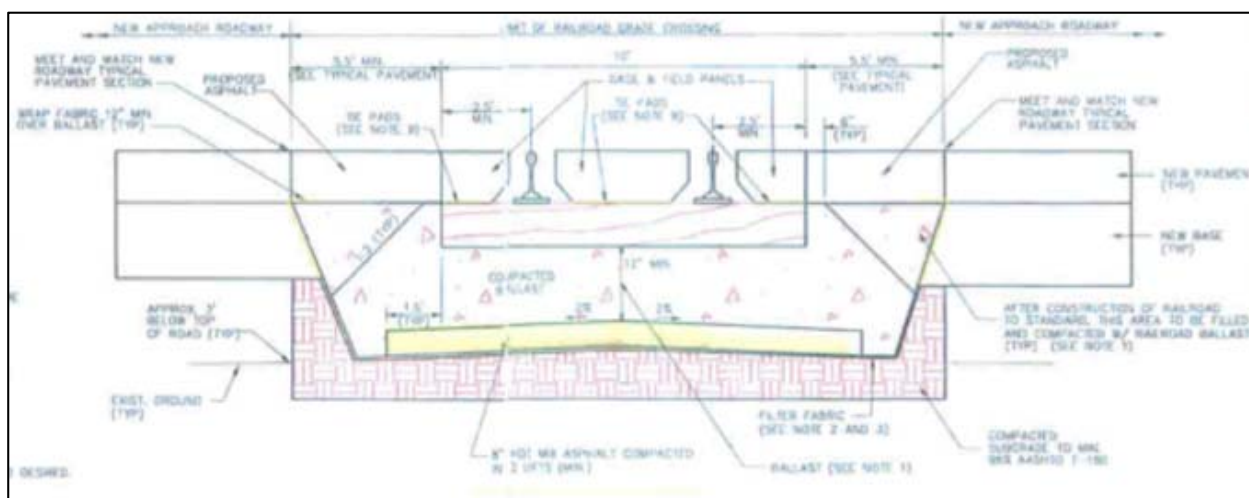


Figure 3.7. Standard Crossing Design for Hillsborough County, FL.

Michigan Department of Transportation

The Michigan Department of Transportation began using asphalt underlayments in 2002. Initially, 10 demonstration projects were selected for best practice evaluations. The Grade Crossing Surface Repair Issues Study detailed crossings featuring asphalt underlayment with different crossing wearing surfaces. The crossings were installed over a four-year period and included Class I and Shortline Railroads. The performances of these crossings have been evaluated periodically. No failures have been noted due to subgrade support issues. Only normal weathering of the surface material and the loosening of metal strapping at one concrete surface crossing has been observed. The crossings have performed very well since asphalt underlayment installation. Appendix B contains a comprehensive analysis of the 10 demonstration crossings.

This discussion includes illustrations and a summary of each crossing's performance. Figure 3.8 shows a full-depth rubber crossing in Ann Arbor.



Figure 3.8. State Street in Ann Arbor, Full-Depth Rubber.

Indiana Department of Transportation

The Indiana DOT has used asphalt underlayments on crossings along multiple lines throughout the state. The 140-mile (225 km) long Louisville & Indiana (L&I) Railroad line, which stretches from Avon Yard in Indianapolis to Louisville, began installing asphalt underlayments in 1996. Since then, 30 crossings on the L&I have been underlain with asphalt, 20 of which were completed using state funds. These crossings have performed perfectly since asphalt installation. Of the 30 installed crossings, only two have been changed out during subsequent projects that reconstructed and widened highways. The other crossings remain in perfect condition. In total, the line features 180 public and 60 private crossings. The Indiana Railroad (INRD) has also started implementing asphalt underlayment on its line stretching from Indianapolis to Newton, Illinois. Furthermore, the Indiana Department of Transportation's Fort Wayne District has included asphalt underlayments under several crossings in the city. Figure 3.9 illustrates a crossing along 3rd Street in Bloomington that contains asphalt underlayment.



Figure 3.9. 3rd Street Crossing on the INRD in Bloomington, IN, Underlain with Asphalt.

CONCLUSIONS

The long-term performance of 89 railway/highway at-grade crossings, containing *asphalt underlayments* within the track substructure, has been documented for crossings that use a variety of typical crossing surface materials. Before the use of asphalt underlayment gained traction, all-granular trackbed materials were typically adopted for renewal projects. However, crossings that relied on this more traditional method have performed poorly and have shorter service lives compared to those with asphalt underlayment. The performance of crossings that have been rehabilitated with asphalt underlayment has been phenomenal, with no crossing failures, such as excessive settlement, ballast fouling, or mud pumping taking place. The service lives have been significantly improved, as the crossings have remained smooth and serviceable for longer periods than crossing that use conventional renewal techniques (i.e. all-granular trackbed designs). A small percentage of the crossings have experienced the deterioration of crossing surface materials, however, this is due to the inherent aging of the surface materials and not the resiliency or durability of asphalt underlayments. The majority of crossings we evaluated were 10-15 years old, although some were built as many as 30 years ago.

When crossings are properly designed and granted adequate support, irrespective of the crossing surface used – whether a more economical or more premium material – asphalt underlayments extend their service life and boost performance. As such, the type of crossing surface material appears to have little effect on subsequent performance and service life of crossings that have adequate structural support and an efficient drainage network. Improved performance and longer service life have been achieved under varying railway and highway traffic volumes and loading magnitudes. The geometric design of the roadway near crossings should minimize the possibility of highway vehicles experiencing abrupt changes in vertical grades. When sudden changes in grade are present, they increase impacts to the crossing surface, which can lead to its premature failure, particularly on heavy-traffic roadways with concrete crossing surfaces. The effect is more pronounced for crossings possessing inadequate structural support. Careful design, along with the use of asphalt underlayments, holds great promise for enhancing the robustness of railway-highway at-grade crossings.

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Appendix A

Crossing Spreadsheets

1. Cincinnati Subdivision At-Grade Crossings in North East Kentucky
2. Ashland/Catlettsburg Area At-Grade Crossings in NE Kentucky
3. U.S. 23 Big Sandy Corridor At-Grade Crossings in Eastern Kentucky
4. Eastern Kentucky At-Grade Crossings with All-Asphalt Surfaces
5. KY 7 At-Grade Crossings in Eastern Kentucky
6. Additional At-Grade Crossings in Eastern Kentucky
7. Central Kentucky Area At-Grade Crossings
8. Louisville Area At-Grade Crossings
9. Western Kentucky At-Grade Crossings
10. West Virginia At-Grade Crossings
11. Michigan At-Grade Crossings
12. Tennessee At-Grade Crossings

(1) Cincinnati Subdivision At-Grade Crossings in North East Kentucky

Route/ Street	Location	County	Highway Milepost	Railroad Milepost	DOT Number	Date Installed	Railroad Company	Rail Classification	Rail Annual Tonnage	Highway ADT	Highway Lanes	Type Xing Surface	Single/ Double Track	Comments
KY 8	Concord	Lewis		CA 580.43	229236E	June 4, 2002	CSX	Main Line	Moderate	Light	two	Composite w/o rubber flangeway	Single	KYDOT
Main St.	Vanceburg	Lewis		CA 571.97	229208B	May 30, 2002	CSX	Main Line	Moderate	Moderate	two	Concrete	Single	KYDOT
Access Road	South Portsmouth	Greenup		CA 551.09	229497E	May 20, 2002	CSX	Main Line	Moderate	Very Light	two	Composite with rubber flangeway	Single	Greenup County Road Department
KY 7, Main St.	South Shore	Greenup		CA 548.19	229132X	May 23, 2002	CSX	Main Line	Moderate	Moderate	two	Timber	Double, #2 track only	KYDOT

(2) Ashland/Catlettsburg Area At-Grade Crossings in North-East Kentucky

Route/ Street	Location	County	Highway Milepost	Railroad Milepost	DOT Number	Date Installed	Railroad Company	Rail Classification	Rail Annual Tonnage	Highway ADT	Highway Lanes	Type Xing Surface	Single/Double Track	Comments
KY 168, Blackburn Ave.	Ashland	Boyd		COS 1.43	227344U	April, 2007	CSX	Industry Spur			two	Rubber Seal/Asphalt	Single	
US 60, 35th Street	Catlettsburg	Boyd		CMG 0.22	226980N	August, 2006	CSX	Main Line			two	Concrete	Double	

(3) US 23 Big Sandy Corridor At-Grade Crossings in Eastern Kentucky

Route/ Street	Location	County	Highway Milepost	Railroad Milepost	DOT Number	Date Installed	Railroad Company	Rail Classification	Rail Annual Tonnage	Highway ADT	Highway Lanes	Type Xing Surface	Single/ Double Track	Comments
KY 3, Madison Ave	Louisa	Lawrence		CMG 24.65	227064S	October 2 & 3, 2001	CSX	Main Line	Heavy	Very Heavy	two	Concrete	Single	KYDOT
Gallop Road	Chapman	Lawrence		CMG 33.55	227089M	November, 2003	CSX	Main Line	Heavy	Very Light	two	Rubber Seal/ Asphalt	Single	Lawrence County Road Dept.
KY 302	W. Van Lear	Johnson		CMG 61.63	227148M	October, 2002	CSX	Main Line	Heavy	Moderate	two	Rubber Seal/ Asphalt	Double, #1 track only	KYDOT
Industry Park Road	American Standard	Johnson		CMG 63.95	227152C	October, 2002	CSX	Main Line	Heavy	Very Light	two	Rubber Seal/Asphalt	Double, #1 track only	KYDOT
KY 302	Bull Creek	Floyd		CMG 77.23	227179L	November 1st, 2001	CSX	Main Line	Heavy	Heavy	two	Concrete/ Rubber Seal	Single	KYDOT
KY 1426	Banner	Floyd		CMG 85.55	227203K	November 20th, 2001	CSX	Main Line	Heavy	Heavy	two	Rubber Seal/Asphalt	Single	KYDOT
KY 680	Harold	Floyd		CMG 93.33	227215E	November 27th, 2001	CSX	Main Line	Heavy	Heavy	two	Concrete/ Omni Rubber	Single	KYDOT
KY 1426	Island Creek (Pikeville)	Pike		CMG 106.79	227241U	September 3rd, 2003	CSX	Main Line	Heavy	Heavy	two	Concrete/ Omni Rubber	Single	KYDOT
KY 122	Robinson Creek	Pike		CMN 5.68	228133B	November 4th, 2003	CSX	Branch	Light	Moderate	two	Concrete	Single	KYDOT
KY 1469	Penny	Pike		CMN 7.87	228230K	November 5th, 2003	CSX	Branch	Very Light	Moderate	two	Concrete	Single	KYDOT
KY 2552	Shelbiana	Pike		CMN 0.29	228120A	June, 2006	CSX	Branch	Light	Moderate	two	Concrete	Single	KYDOT In conjunction with new highway bridge

(4) Eastern Kentucky At-Grade Crossings with All-Asphalt Surfaces

Route/ Street	Location	County	Highway Milepost	Railroad Milepost	DOT Number	Date Installed	Railroad Company	Rail Classification	Rail Annual Tonnage	Highway ADT	Highway Lanes	Type Xing Surface	Single/ Double Track	Comments
George's Branch	Vicco	Perry		OVI 254.06	346317A	September 27, 2001	CSX	Branch	Very Light	Moderate	two	Asphalt	Single	Perry County Road Dept.
KY 7	Halls or Beaver Gap	Knott		CMO 39.43	227825M	July 23, 2008	CSX	Main Line	Heavy	Moderate	two	Asphalt	Single	KYDOT

(5) KY 7 Corridor At-Grade Crossings in Eastern Kentucky

Route/ Street	Location	County	Highway Milepost	Railroad Milepost	DOT Number	Date Installed	Railroad Company	Rail Classification	Rail Annual Tonnage	Highway ADT	Highway Lanes	Type Xing Surface	Single/ Double Track	Comments
KY 7	Colson	Letcher	19.454	OVG 281.16	346259G	July 21, 2005	CSX	Main Line	Moderate	Heavy	two	Rubber Seal/ Asphalt	Single	KYDOT
KY 7	Thorton Gap	Letcher	18.075	OVG 279.93	346255E	July 28, 2005	CSX	Main Line	Moderate	Heavy	two	Rubber Seal/ Asphalt	Single	Millings Used KYDOT
KY 7	Letcher Elem. School	Letcher	9.895	OVG 272.12	346235T	August 2, 2005	CSX	Main Line	Moderate	Heavy	two	Rubber Seal/ Asphalt	Single	KYDOT
KY 7	No Name	Letcher	7.635	OVG 269.84	346225M	October 14, 2005	CSX	Main Line	Moderate	Heavy	two	Rubber Seal/ Asphalt	Single	KYDOT
KY 7	Old Letcher School	Letcher	7.197	OVG 269.39	346224F	November 1, 2005	CSX	Main Line	Moderate	Heavy	two	Rubber Seal/ Asphalt	Single	KYDOT
KY 7	Indian Church	Letcher	6.936	OVG 269.13	346223Y	October 17, 2005	CSX	Main Line	Moderate	Heavy	two	Rubber Seal/ Asphalt	Single	KYDOT

(6) Additional At-Grade Crossings in Eastern Kentucky

Route/ Street	Location	County	Highway Milepost	Railroad Milepost	DOT Number	Date Installed	Railroad Company	Rail Classification	Rail Annual Tonnage	Highway ADT	Highway Lanes	Type Xing Surface	Single/ Double Track	Comments
KY 550/KY 7	Lackey	Floyd		CMO 18.2	227883H	June 18, 2001	CSX	Main Line	Heavy	Heavy	two	Concrete & All Asphalt	Single	KYDOT
KY 7	Jim	Floyd		CMO 23.6	227786Y	June 19, 2001	CSX	Main Line	Heavy	Moderate	two	Concrete & Rubber Seal/Asphalt	Single	KYDOT
KY 15	Isom	Letcher		OVG 276.37	346248U	November 6, 2002	CSX	Main Line	Moderate	Very Heavy	two	Concrete	Single	KYDOT
KY 451	Hazard	Perry		OVB 242.46	346112G	September, 2009	CSX	Main Line	Moderate	Heavy	two	Concrete	Double	New Construction KYDOT
KY 476, Lots Creek	Hazard	Perry		OWV 242.01	351721T	November 25, 2011	CSX	Branch	Very Light	Heavy	two	Timber/ Asphalt	Single	KYDOT
US 25E	Barbourville	Knox		OCQ 187.18	354037T	May 23 & 24, 2011	CSX	Branch	Light	Very Heavy	four	Concrete	Single	NB lanes w/ underlayment KYDOT
KY 292	Nolan	Martin		LF 0.4	482578W	October 26, 2011	NS	Branch	Light	Moderate	two	Rubber Seal/Asphalt	single	Ballastless KYDOT

(7) Central Kentucky Area At-Grade Crossings

Route/Street	Location	County	Highway Milepost	Railroad Milepost	DOT Number	Date Installed	Railroad Company	Rail Classification	Rail Annual Tonnage	Highway ADT	Highway Lanes	Type Xing Surface	Single/ Double Track	Comments
Forbes Road	Lexington	Fayette		OOW 92.45	346822U	October, 1982	L&N/RJC	Main Line	Light	Heavy	two	Timber/ Asphalt	Single	KYDOT
Fairview Loop	Snider	Rockcastle		OKC 137.13	353551H	June, 1983	SBD/CSX	Main Line	Heavy	Light	two	Timber/Asphalt	Double #2 Track Only	
Bridge St.	Cynthiana	Harrison		OKC 66.24	353424G	November, 1984	CSX	Main Line	Heavy	Heavy	two	Timber/ Asphalt	Single	KYDOT
Pike St.	Cynthiana	Harrison		OKC 66.15	353423A	November, 1984	CSX	Main Line	Heavy	Heavy	two	Timber/ Asphalt	Single	KYDOT
Pleasant St.	Cynthiana	Harrison		OKC 66.06	353422T	November, 1984	CSX	Main Line	Heavy	Heavy	two	Timber/ Asphalt	Single	KYDOT
Oddville Rd.	Cynthiana	Harrison		OKC 65.92	353421L	May 4, 2000	CSX	Main Line	Heavy	Heavy	two	Timber/ Asphalt	Single	KYDOT
US 25/421, Main St.	Richmond	Madison		OKC 118.77	353526A	September 13th, 2000	CSX	Main Line	Heavy	Very Heavy	three	Concrete	Single	KYDOT
KY 1032	Berry	Harrison		OKC 54.27	353402G	June 21, 2001	CSX	Main Line	Heavy	Light	two	Rubber Seal/Asphalt	Double, #2 track only	KYDOT
KY 595	Berea	Madison		OKC 130.39	353538U	April 3, 2002	CSX	Main Line	Heavy	Heavy	three	Concrete	Single	New Construction KYDOT
US 60 Bypass	Versailles	Woodford		LL 11.23	719869X	September, 2002	L&O/RJC	Main Line	Light	Very Heavy	four	Concrete	Single	KYDOT
US 60 Bypass	Versailles	Woodford		LL 0.4	734429U	September, 2002	L&O/RJC	Spur	Very Light	Very Heavy	four	Concrete	Single	KYDOT
Waller Ave.	Lexington	Fayette		82.44	724527H	August 6 & 7, 2002	NS	Main Line	Very Heavy	Very Heavy	two	Concrete	Double	KYDOT LFUCG
Rosemont Garden	Lexington	Fayette		83.18	724528P	July 23 & 24, 2002	NS	Main Line	Very Heavy	Heavy	two	Concrete	Double	KYDOT LFUCG
US 60, Main St.	Winchester	Clark		OKC 96.52	353486E	November 17-20, 2003	CSX	Main Line	Heavy	Very Heavy	three	Concrete	Double	KYDOT
Broadway	Winchester	Clark		OKC 96.84	353489A	September, 2004	CSX	Main Line	Heavy	Heavy	two	Concrete/ Rubber Seal/ Asphalt	Double	City of Winchester Road
Keller Dam	Cynthiana	Harrison		OKC 64.4	353417W	May 25, 2005	CSX	Main Line	Heavy	Light	one	Plastic & Rubber Seal/ Asphalt	Single	Harrison County Road Department
KY 1963, Lisle Road	Georgetown	Scott		72.9	724507W	August 15-16, 2011	NS	Main Line	Very Heavy	Moderate	two	Rubber Seal/Asphalt	Single	KYDOT
KY 1977, Spurr Road	Lexington	Fayette		77.0	724515N	August 15-16, 2011	NS	Main Line	Very Heavy	Moderate	two	Rubber Seal/Asphalt	Single	KYDOT
KY 2886, Kearney Road	Lexington	Fayette		76.4	724513A	August 16-17, 2011	NS	Main Line	Very Heavy	Moderate	two	Rubber Seal/Asphalt	Single	KYDOT
KY 1978, Greendale Rd.	Lexington	Fayette		77.2	724516V	August 22-23, 2011	NS	Main Line	Very Heavy	Moderate	two	Rubber Seal/Asphalt	Single	KYDOT

(8) Louisville Area At-Grade Crossings

Route/Street	Location	County	Highway Milepost	Railroad Milepost	DOT Number	Date Installed	Railroad Company	Rail Classification	Rail Annual Tonnage	Highway ADT	Highway Lanes	Type Xing Surface	Single/Double	Comments
Chenoweth Lane	Louisville	Jefferson		OOT 5.43	345951F	May 20, 1996	CSX	Main Line	Heavy	Heavy	three	Rubber	Single	KYDOT
KY 2052, Shepherdsville Road	Louisville	Jefferson		OGE 4.53	343936W	August 2, 2010	CSX	Industry Spur	Light	Heavy	five	Concrete	Single	KYDOT
KY 2843, Grade Lane	Louisville	Jefferson		OGE 0.70	343932U	June, 2010	CSX	Industry Spur	Light	Heavy	two	Concrete	Double	KYDOT
KY 61, Preston Highway	Louisville	Jefferson		OGE 2.8	343935P	June 3-4, 2011	CSX	Industry Spur	Light	Heavy	five	Concrete	Single	KYDOT
US 31 W, Dixie Highway	Louisville	Jefferson		S 0.1	296791H	July 16-18, 2010	P&L	Branch	Very Light	Heavy	four	Composite	Single	KYDOT
KY 1646, N. Logsdon Pkwy	Radcliff	Hardin		33.5	925670Y	August 1-4, 2011	P&L	Main Line	Moderate	Moderate	six	Concrete	Single	KY Shortline Assistance Program
KY 907, Valley Station	Louisville	Jefferson		12.0	296833S	August 8-10, 2011	P&L	Main Line	Moderate	Heavy	three	Composite	Single	KY Shortline Assistance Program

(9) Western Kentucky At-Grade Crossings

Route/Street	Location	County	Highway Milepost	Railroad Milepost	DOT Number	Date Installed	Railroad Company	Rail Classification	Rail Annual Tonnage	Highway ADT	Highway Lanes	Type Xing Surface	Single/Double Track	Comments
KY 380, Skyline Dr.	Hopkinsville	Christian		OOH 237.93	345254U	July, 1999	CSX	Main Line	Very Heavy	Heavy	three	Wide Rubber & Asphalt	Main and Siding	Millings or Cold Mix used for
US 60	Stanley	Daviess		OHR 123.07	344296C	May 16, 2002	CSX	Main Line	Moderate	Moderate	two	Rubber Seal/Asphalt	Single	KYDOT
US 60, East Main St.	Owensboro	Daviess		≈OHR 113	344227U	July 22, 2002	CSX	Industry Spur	Very Light	Heavy	four	Rubber Seal/Asphalt & Rubber	Single	KYDOT
US 431	Cleaton	Muhlenberg		OOD 176.99	347083C	Sept 14-16, 2002	CSX	Branch	Very Light	Heavy	two	Concrete	Single	KYDOT
US 41	Sebree	Webster		OHH 300.63	345374K	August 5, 2004	CSX	Industry Spur	Very Light	Heavy	two	Rubber & Rubber Seal/Asphalt	Single	KYDOT
US 231, South Main St.	Beaver Dam	Ohio	9.98	108.6	297012R	2009	P&L	Main Line	Moderate	Heavy	four	Composite	Main and Siding	Two Crossings KYDOT

(10) West Virginia At-Grade Crossings

Route/Street	Location	County	Highway Milepost	Railroad Milepost	DOT Number	Date Installed	Railroad Company	Rail Classification	Rail Annual Tonnage	Highway ADT	Highway Lanes	Type Xing Surface	Single/Double Track	Comments
3rd Ave W.	Huntington	Cabell		CA 502.56	225718R	August, 2000	CSX	Connector	Very Light	Moderate	four	Concrete	Single	WV DOT
US 60, 4th Ave W.	Huntington	Cabell		CA 502.56	225716C	August, 2000	CSX	Connector	Very Light	Moderate	three	Concrete	Single	WV DOT
US 60, 5th Ave W.	Huntington	Cabell		CA 502.56	225714N	August, 2000	CSX	Connector	Very Light	Moderate	two	Concrete	Single	WV DOT
US 60, 5th Ave E.	Huntington	Cabell		CA 502.56	225739J	July 18, 2009	CSX	Connector	Very Light	Moderate	four	Concrete	Single	WV DOT
WV 2	Ashton	Mason		BN 189.98	147906R	Nov 13-14, 2001	CSX	Main Line	Moderate	Moderate	two	Concrete	Single	WV DOT

(11) Michigan At-Grade Crossings

Route/Street	Location	County	Highway Milepost	Railroad Milepost	DOT Number	Date Installed	Railroad Company	Rail Classification	Rail Annual Tonnage	Highway ADT	Highway Lanes	Type Xing Surface	Single/Double Track	Comments
Kalamazoo Ave	Lansing	Ingham		CH 87.10	234417U	Oct, 2003	CSX	Branch	Light	Moderate	three	Concrete	Single	MDOT
Willow Street	Lansing	Ingham		2.21	536399J	Sept, 2004	NS/J&LRR	Industry Spur	Very Light	Moderate	two	Concrete	Single	MDOT
Pacific Street	Lansing	Ingham		35.09	536020U	Oct, 2006	NS/J&LRR	Main Line	Light	Moderate	two	Rubber Seal/Asphalt	Single	MDOT
Clifton Street	Three Rivers	St. Joseph		12.9	536490C	June, 2004	NS/GERW	Main Line	Light	Light	two	Rubber Seal/Asphalt	Double	MDOT
Fourth Street	Three Rivers	St. Joseph		69.68	903807E	Nov, 2005	NS/GERW	Yard Lead	Very Light	Light	two	Composite	Single	MDOT
Fourth Street	Three Rivers	St. Joseph		11	536480W	July, 2007	NS/GERW	Main Line	Light	Light	two	Timber	Single	MDOT
W. Liberty Street	Ann Arbor	Wash-Wash		45.4	000223R	July, 2005	Ann Arbor	Main Line	Light	Moderate	two	Composite	Single	MDOT
State Street	Ann Arbor	Wash-Wash		43.98	000209V	Aug, 2005	Ann Arbor	Main Line	Light	Heavy	four	Full-Depth Rubber	Single	MDOT
3-Mile Road	Traverse City	Grand Traverse		2.45	235371L	Aug, 2006	TBS - MDOT/GLC-MDOT	Branch	Light	Moderate	two	3-Rail Asphalt	Single	MDOT

(12) Tennessee At-Grade Crossings

Route/ Street	Location	County	Highway Milepost	Railroad Milepost	DOT Number	Date Installed	Railroad Company	Rail Classification	Rail Annual Tonnage	Highway ADT	Highway Lanes	Type Xing Surface	Single/Double Track	Comments
US 129	Alcoa/ Maryville, TN	Blount		KL 290.63	347665G	June 10, 2001	CSX	Industry Spur	Very Light	Very Heavy	four	Concrete/ Rubber	Single	TNDOT

Appendix B

Crossing Performance Evaluations

1. Cincinnati Subdivision At-Grade Crossings in North East Kentucky
2. Ashland/Catlettsburg Area At-Grade Crossings in NE Kentucky
3. U.S. 23 Big Sandy Corridor At-Grade Crossings in Eastern Kentucky
4. Eastern Kentucky At-Grade Crossings with All-Asphalt Surfaces
5. KY 7 At-Grade Crossings in Eastern Kentucky
6. Additional At-Grade Crossings in Eastern Kentucky
7. Central Kentucky Area At-Grade Crossings
8. Louisville Area At-Grade Crossings
9. Western Kentucky At-Grade Crossings
10. West Virginia At-Grade Crossings
11. Michigan At-Grade Crossings
12. Tennessee At-Grade Crossings

CSX Cincinnati Subdivision Crossings in North East Kentucky

These four crossings were renewed during May and June, 2002 as part of a programmed timbering and surfacing (T&S) activity, on this moderately high-traffic CSX Mainline along the south side of the Ohio River east of Cincinnati, OH. The old crossings were removed. An asphalt underlayment was placed with new ballast and new track panel. Multiple crossing types -- consisting of two composite, one concrete, and one all-timber (wood) crossing -- were utilized for comparative performance evaluations of asphalt underlayment crossing performance.

These four crossings had the heaviest highway traffic within the limits of the T&S program. The remaining crossings, many being private, were merely surfaced through without removing the crossings. Most of these have been reworked once or twice since then. KYDOT assisted with the three crossings on state highways, the Greenup County Road Department assisted with the crossing on the county road.

This section of track had a T&S program during April 2013 and the four crossings were re-worked as described. During the previous T&S program the crossings had been skipped.

KY 8 East of Concord

Route/Street	DOT Number	Highway ADT
KY 8	229236E	Light
Location	Date Installed	Highway Lanes
Concord	June 4, 2002	Two
County	Railroad Company	Type Xing Surface
Lewis	CSX	Composite w/o Rubber Flangeway
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Single
Railroad Milepost	Rail Annual Tonnage	Comments
CA 580.43	Moderate	KYDOT



KY 8 near Concord in 2002 prior to Renewal with LT Resources Composite Surface



2003



2006



2011, Crossing Still Performing Well



2013 After Removing/Reusing Composite Surface and Repaving Approaches

This crossing surface was an Endurance (LT Resources) composite crossing, consisting of recycled plastics, metals, etc. and appeared similar to timber crossing material. The rubber seal flangeway material was not used.

The 2011 inspection indicated that the crossing was still very smooth, no track surfacing or other maintenance had been required. A few of the panels and lag screws were marginally loose, some exhibiting slight chipping of the composite material. The performance after nine years was very acceptable.

The 2013 inspection indicated that the crossing panels had been temporarily removed during a T&S program, the crossing has been surfaced through, and the composite panels had been reused, although the crossing width had been shortened by one panel length. Thus the crossing was slightly narrower, but sufficiently wide for vehicular traffic. The asphalt pavement approaches were renewed. The rideability was considered smooth and very acceptable.

Main Street in Vanceburg

Route/Street	DOT Number	Highway ADT
Main St.	229208B	Moderate
Location	Date Installed	Highway Lanes
Vanceburg	May 30, 2002	Two
County	Railroad Company	Type Xing Surface
Lewis	CSX	Concrete
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Single
Railroad Milepost	Rail Annual Tonnage	Comments
CA 571.97	Moderate	KYDOT



2002- Before Renewal with Concrete Surface



2003, Main Street in Vanceburg



2006



2011, Still in Perfect Condition



2013, After Removing Panels, Surfacing Through, and Repaving Approaches

This crossing surface was composed of typical pre-cast concrete panels. A short time after the crossing was installed in 2002 a derailed wheel was dragged over the crossing slightly scarring the west end of the crossing, but did not damage the panels.

The 2011 inspection indicated that the crossing was still very smooth, no track surfacing or other maintenance had been required. The rail appeared to be loose, although no damage had occurred to the crossing panels.

The 2013 inspection indicated that the crossing had been recently surfaced through, with the panels being temporarily removed and repositioned along with new asphalt pavement approaches. This was the only maintenance required during the 11 years. The rideability is considered smooth and very acceptable.

Access Road to South Portsmouth

Route/Street	DOT Number	Highway ADT
Access Road	229497E	Very Light
Location	Date Installed	Highway Lanes
South Portsmouth	May 20, 2002	Two
County	Railroad Company	Type Xing Surface
Greenup	CSX	Composite with Rubber Flangeway
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Single
Railroad Milepost	Rail Annual Tonnage	Comments
CA 551.09	Moderate	Greenup County Road Department



South Portsmouth Access Road in 2002 prior to Renewal with LT Resources Composite Surface



2003



2006



2011 After Changing out Rail and Replacing Composite Surface. Still in Perfect Condition



2013 After Renewing with Timber/Asphalt Surface Earlier in the Year

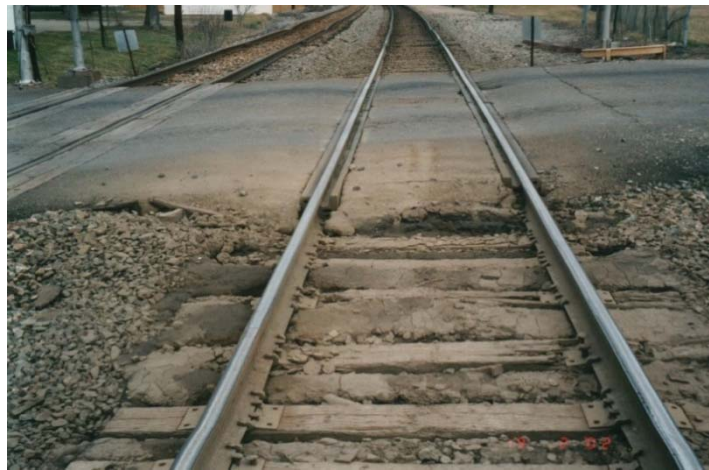
This crossing surface was also a composite, or Endurance, product. However, unlike the Concord crossing, it did have the rubber flangeway material. The high rail was changed out in 2009/2010 during a curve patch program. Very narrow asphalt patches were used on the field side. The crossing remained very smooth.

The 2011 inspection indicated the crossing was still in perfect condition, very smooth and tight, with no maintenance required during the nine years except to change out the curve rail.

The 2013 inspection revealed that during the T&S program the Endurance crossing material had been replaced with a new timber and asphalt crossing. It is unsure as to why the Endurance material was not reused, as it had been at Concord, unless it had deteriorated significantly since 2011. The crossing is very solid and smooth.

KY 7 Main Street in South Shore

Route/Street	DOT Number	Highway ADT
KY 7, Main St.	229132X	Moderate
Location	Date Installed	Highway Lanes
South Shore	May 23, 2002	Two
County	Railroad Company	Type Xing Surface
Greenup	CSX	Timber/Wood
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Double, #2 Track Only
Railroad Milepost	Rail Annual Tonnage	Comments
CA 548.19	Moderate	KYDOT



KY 7, Main Street in South Shore in 2002 prior to Renewal with Timber Surface



2003



2006



2011, Still in Reasonably Acceptable Condition



2013 After Replaced with Timber/Asphalt Surface Earlier in the Year

The crossing material was also installed in 2002 for the No. 2 track and consisted of full depth/width creosoted wood/timber. The No. 1 track crossing material was not changed.

The 2011 inspection indicated that the timber crossing was still very smooth and no maintenance had been required. However, the wood had deteriorated to a degree, some of the panels were loose due to the deterioration, and the rail was loose. The crossing surface was expected to continue to deteriorate even though it had not settled.

The 2013 inspection revealed that the timber crossing had been replaced with the standard timber/asphalt surface during the April T&S program through the area. So the timber crossing surface had been removed after 11 years to allow the track to be surfaced and due to the wood deterioration a new timber/asphalt surface was installed. The crossing is very solid, smooth and serviceable.

CSX Ashland/Catlettsburg Area Crossings

These two crossings were installed at about the same time. The conditions differ significantly. The two installations are discussed separately.

U.S. 60, 35th Street in Catlettsburg

Route/Street	DOT Number	Highway ADT
U.S. 60- 35th St.	226980N	Heavy
Location	Date Installed	Highway Lanes
Catlettsburg	August, 2006	Two
County	Railroad Company	Type Xing Surface
Boyd	CSX	Concrete
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Double
Railroad Milepost	Rail Annual Tonnage	Comments
CMG 0.22	Heavy	KYDOT



U.S. 60, 35th Street in Catlettsburg in 2006 just prior to Renewal with Concrete Surfaces



2006



2008



2011, In Perfect Condition



2013, Still in Perfect Condition

This double-track crossing on the Big Sandy mainline was renewed during a T&S program in 2006. KYDOT assisted with the project by providing the asphalt for the underlayment and the concrete surfaces. The three adjacent crossings (34th, 36th, and 37th Streets) were merely surfaced through with timber/asphalt crossing surfaces installed. All three

soon began pumping and settling with attendant roughness. These three crossings have been reworked to varying degrees during the past seven years. The crossings are still rough compared to the U.S. 60 crossing, having substantially more traffic that was rehabilitated with asphalt underlayment.

The 2011 inspection indicated that the concrete crossings were still very smooth, no maintenance had been required, and were very solid and firm.

The 2013 inspection revealed essentially the same as the 2011 evaluation, still in perfect condition with no settlement, solid, and very smooth.

KY 168 Blackburn Avenue in Ashland

Route/Street	DOT Number	Highway ADT
KY 168, Blackburn Ave.	227344U	Moderate
Location	Date Installed	Highway Lanes
Ashland	April, 2007	Two
County	Railroad Company	Type Xing Surface
Boyd	CSX	Rubber Seal/Asphalt
Highway Milepost	Rail Classification	Number of Tracks
-----	Industry Spur	Single
Railroad Milepost	Rail Annual Tonnage	Comments
COS 1.43	Very Light	KYDOT



2007- Shortly After Renewal



2011, Four Years after Renewal



2013, Crossing Essentially in Perfect Condition

This crossing is on a spur line that was basically abandoned, but was rehabilitated in 2007 to accommodate increased freight traffic to a sanitary land field. The highway has moderate to heavy traffic, so the decision was made to renew the crossing with a rubber seal/asphalt surface.

The 2011 inspection indicated that the crossing was very smooth, although the asphalt surface approaches had rippled slightly due to an unstable asphalt surface mix. The crossing was very solid. The new track panel through the crossing had large rail. The vertical geometry was less than desirable as the crossing was at the crest of the highway.

The 2013 inspection revealed that the crossing was still very stable and tight with no settlement. The highway had been recently resurfaced, although the resurface stopped about 20 feet short of the crossing. The pavement approaches are still slightly rippled, a similar condition as was observed in 2011. The crossing is basically in perfect condition after six years.

U.S. 23 Big Sandy Corridor Crossings in Eastern Kentucky

The initial eight crossings with the “CMG” prefix preceding the Milepost number are on the Big Sandy Subdivision and carry significant tonnage of coal and other freight trains. The last three crossings with “CMN” prefixes are on a branch line to coal mines and carry low tonnage. Most of these crossings were rehabilitated 10 to 12 years ago with asphalt underlayments to withstand the heavy tonnage rail traffic and moderate to heavy highway traffic, particularly heavy coal trucks. Historically these crossings had exhibited excessive wear and deterioration as a function of the heavy loadings and lack of adequate trackbed support.

KY 3, Madison Avenue in Louisa

Route/Street	DOT Number	Highway ADT
KY 3, Madison Ave.	227064S	Very Heavy
Location	Date Installed	Highway Lanes
Louisa	October 2 & 3, 2001	Two
County	Railroad Company	Type Xing Surface
Lawrence	CSX	Concrete
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Single
Railroad Milepost	Rail Annual Tonnage	Comments
CMG 24.65	Heavy	KYDOT



2001- Before Renewal



2001- Before Renewal



November 2001-After Renewal with Concrete



August 2006 Before Surfacing Through



October 2006 After Surfacing/ Replacing Panels



2011 – Converted to Rubber Seal/Asphalt in 2010



2013, Perfect Condition

Madison Avenue serves as the approach to the bridge into West Virginia and is a primary route for coal trucks delivering to the barge loadouts on the Kentucky side of the Big Sandy River. A concrete surface was placed on the original roadbed in 1994. By 1998 several of the concrete panels were cracked. It was surfaced through and the cracked panels were exchanged from the traveled lanes to the shoulder. The crossing was surfaced through again in 2000 and a cracked panel and a few ties were replaced. By 2001 the crossing had further deteriorated and had settled.

The decision was made to renew it with an asphalt underlayment and a new concrete surface to remedy the chronic problems with maintaining the crossing. In October 2001 the new crossing was installed. It performed perfectly for several years, but around 2008 the rail became loose and several of the straps around the concrete panels loosened. Several of the concrete panels cracked as a result of the increased impacts.

In 1910 the concrete surface was removed, after nine years of service, and replaced with a rubber seal/asphalt surface. A new wood tie track panel with Pandrol clips was used. The highway approaches were paver-laid for long distances from the crossing.

The 2011 inspection indicated that the new rubber seal/asphalt surface was performing perfectly and little if any impact was observed from the heavy truck loadings. The crossing was very smooth.

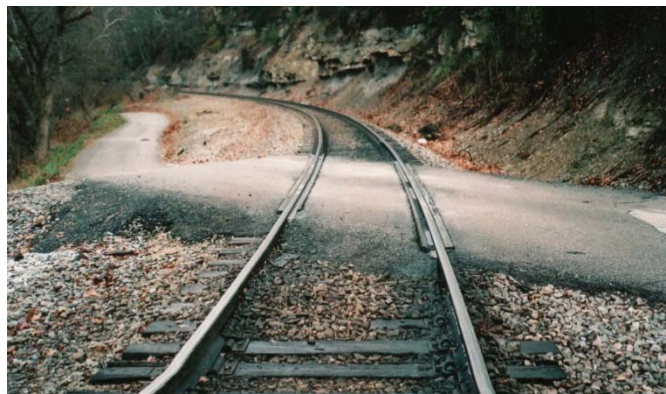
The 2013 inspection revealed that the rubber seal/asphalt crossing was in perfect condition. The crossing is slightly elevated above the highway providing a slight thrill bump. Coal truck traffic seems to have abated very little, if at all, since 2001. The crossing is very solid and smooth.

Gallop Road south of Louisa near Chapman

Route/Street	DOT Number	Highway ADT
Gallop Road	227089M	Very Light
Location	Date Installed	Highway Lanes
Chapman	November, 2003	Two
County	Railroad Company	Type Xing Surface
Lawrence	CSX	Rubber Seal/ Asphalt
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Single
Railroad Milepost	Rail Annual Tonnage	Comments
CMG 33.55	Heavy	Lawrence County Road Department



January, 2004- After Renewal of this Crossing on this Lightly Traveled County Road



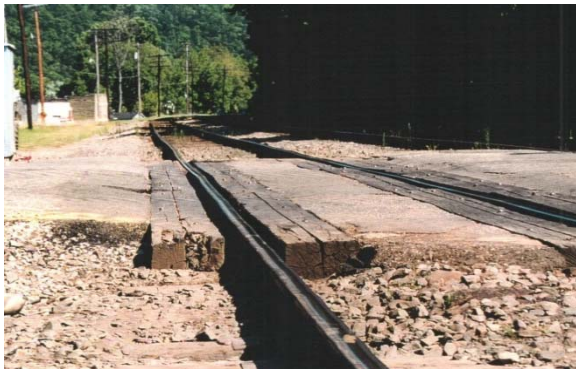
2006, Crossing Performing Perfectly

This lightly traveled county road crossing was renewed during 2003. The asphalt was supplied by the Lawrence County Road Department. An underlayment was used with a rubber seal/asphalt surface.

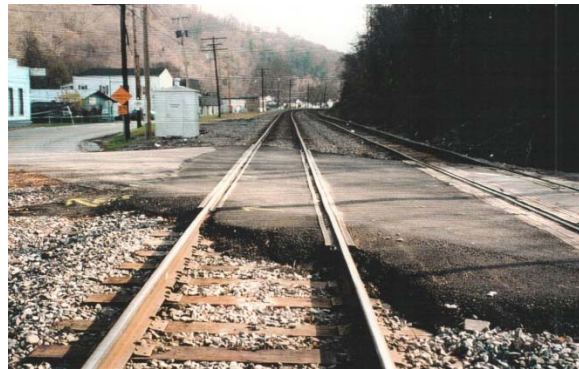
An inspection in 2006 indicated the crossing was in perfect condition. No further inspections have been conducted.

KY 302 near West Van Lear

Route/Street	DOT Number	Highway ADT
KY 302	227148M	Moderate
Location	Date Installed	Highway Lanes
W. Van Lear	October, 2002	Two
County	Railroad Company	Type Xing Surface
Johnson	CSX	Rubber Seal/Asphalt
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Double, #1 Track Only
Railroad Milepost	Rail Annual Tonnage	Comments
CMG 61.63	Heavy	KYDOT



August, 2002 – Before Renewal



November, 2002 – After Renewal



January, 2004 – After Renewal



2006



2011



2011



2013



2013

The # 1 track had an asphalt underlayment installed during the rehabilitation of the track during 2002. A rubber seal/asphalt surface was applied.

The 2011 inspection indicated that the crossing was in perfect condition. The # 2 track is higher, so there is a bump in the profile of the two crossings. There is some pumping at the ends of the crossing, likely did not place the underlayment beyond the immediate crossing, but no sign of settlement. The highway has been re-surfaced and the approaches are a little high.

The 2013 inspection revealed that the rubber seal/asphalt surface had been changed out to a CSX standard timber/asphalt surface. The existing track panel was reused. The two tracks are at a different elevation which slightly degrades the ride quality.

Industry Park Road south of Paintsville

Route/Street	DOT Number	Highway ADT
Industry Park Road	227152C	Very Light
Location	Date Installed	Highway Lanes
American Standard	October, 2002	Two
County	Railroad Company	Type Xing Surface
Johnson	CSX	Rubber Seal/Asphalt
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Double, #1 Track Only
Railroad Milepost	Rail Annual Tonnage	Comments
CMG 63.95	Heavy	KYDOT



August, 2002 – Before Renewal



November, 2002 – After Renewal



January, 2004 – After Renewal



2006



2011



2011



2013



2013

The # 1 track had an asphalt underlayment installed during the rehabilitation of the track during 2002. A rubber seal/asphalt surface was applied.

The 2011 inspection indicated that the crossing was still in perfect condition.

The 2013 inspection revealed that the rubber seal/asphalt surface had been changed out to a CSX standard timber/rubber seal/asphalt surface. The existing track panel was reused.

KY 302 at Bull Creek

Route/Street	DOT Number	Highway ADT
KY 302	227179L	Heavy
Location	Date Installed	Highway Lanes
Bull Creek	November 1st, 2001	Two
County	Railroad Company	Type Xing Surface
Floyd	CSX	Concrete/Rubber Seal
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Single
Railroad Milepost	Rail Annual Tonnage	Comments
CMG 77.23	Heavy	KYDOT



2001 – Before Renewal



October, 2001 – Before Renewal



January, 2004



2006



2008



August, 2009



2011



2011



2013



2013

This heavily used crossing had been a continuing maintenance problem for many years requiring frequent replacement and resurfacing to maintain acceptable ride quality. The roughness was due to settlement and distortion of the surface.

The very heavy traffic single track crossing was rehabilitated on November 1, 2001 in a single day using asphalt underlayment and the fast-track method. Precast concrete panels were used for the center (gage) portion for the crossing and rubber seal/asphalt was used for the outside (field) sides. The crossing is on the spiral to a curve, therefore the rail was changed out in 2009. Prior to that the crossing had performed perfectly and was remarkably smooth considering the amount of coal trucks using the crossing.

The 2011 inspection indicated the crossing was still performing well, although the approaches were not as smooth as they were prior to the rail change out.

The 2013 inspection revealed that the crossing was still performing reasonably well, the low rail had been changed out and the rubber seal was missing. The crossing has performed admirably for 12 years under heavy traffic. No obvious settlement or track instability was apparent.

KY 1426 at Banner

Route/Street	DOT Number	Highway ADT
KY 1426	227203K	Heavy
Location	Date Installed	Highway Lanes
Banner	November 20, 2001	Two
County	Railroad Company	Type Xing Surface
Floyd	CSX	Rubber Seal/Asphalt
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Single
Railroad Milepost	Rail Annual Tonnage	Comments
CMG 85.55	Heavy	KYDOT



2001 Before Renewal



January, 2004



2006 After Renewal due to Derailment



2011



2013

This heavily traveled crossing had the rail changed out and the approaches repaved in 2000. Within 11 months the crossing had settled significantly and was very rough. The decision was made to renew it with asphalt underlayment.

The crossing, which carries considerable coal trucks, was rehabilitated in 2001 using the fast-track method. Rubber seal/asphalt was used for the surface.

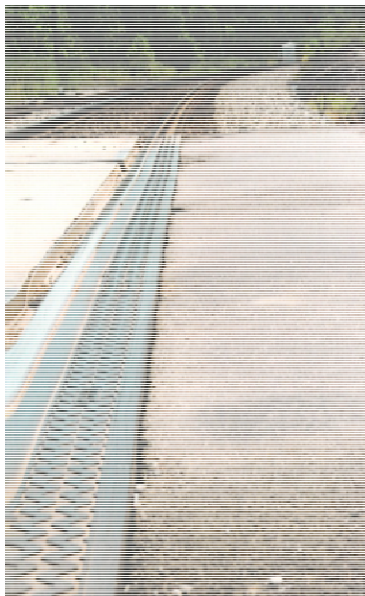
The surface was replaced in 2006 due to a derailment in close proximity to the crossing.

The 2011 inspection indicated that the crossing surface had been recently replaced with a new rubber seal/asphalt surface. It was in perfect condition.

The 2013 inspection revealed that the crossing was fairly smooth, but the short approaches resulted in some degree of roughness.

KY 680 at Harold

Route/Street	DOT Number	Highway ADT
KY 680	227215E	Heavy
Location	Date Installed	Highway Lanes
Harold	November 27, 2001	Two
County	Railroad Company	Type Xing Surface
Floyd	CSX	Concrete/Omni Rubber
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Single
Railroad Milepost	Rail Annual Tonnage	Comments
CMG 93.33	Heavy	KYDOT



2001 – Before Renewal



January, 2004



2006



2008



2011



2013

This high-traffic crossing had a concrete surface installed in 2000. In less than one year the middle two of the four nine-foot center panels had already cracked and the asphalt approaches had rutted. The crossing deflected significantly under loading.

An asphalt underlayment was installed when it was rehabilitated in 2001. The existing concrete panels were reused for the center portion and Omni rubber/asphalt was used for the field sides.

The 2011 inspection indicated that the crossing was still solid and smooth. The reused concrete panels are still in service.

The 2013 inspection revealed that the crossing was still solid and very smooth and the combination of reused concrete panels and Omni rubber/asphalt for the surface was still adequate for the crossing.

KY 1426 at Island Creek

Route/Street	DOT Number	Highway ADT
KY 1426	227241U	Heavy
Location	Date Installed	Highway Lanes
Island Creek (Pikeville)	September 3, 2003	Two
County	Railroad Company	Type Xing Surface
Pike	CSX	Concrete/Omni Rubber
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Single
Railroad Milepost	Rail Annual Tonnage	Comments
CMG 106.79	Heavy	KYDOT



January, 2004 – After Renewal



2006



2011



2013

This crossing carries moderate to heavy traffic. It was rehabilitated in 2003 using precast concrete panels for the center portion and rubber seal/asphalt on the field sides.

The 2011 inspection indicated that the crossing was slightly lower than the highway approaches and there was some minor pumping at the ends. It was still providing an acceptable crossing.

The 2013 inspection revealed that the crossing was still in very good condition and was smooth with no observable settlement.

KY 122 Robinson Creek

Route/Street	DOT Number	Highway ADT
KY 122	228133B	Moderate
Location	Date Installed	Highway Lanes
Robinson Creek	November 4, 2003	Two
County	Railroad Company	Type Xing Surface
Pike	CSX	Concrete
Highway Milepost	Rail Classification	Number of Tracks
-----	Branch	Single
Railroad Milepost	Rail Annual Tonnage	Comments
CMN 5.68	Light	KYDOT



January, 2004 – After Renewal



2006



2011



2013

The precast concrete crossing and underlayment, on the lightly traveled branch line, were placed during the rehabilitation of the crossing in 2003. Pandrol clips were used on the curve.

The 2011 inspection indicated the crossing was still in perfect condition. It is on a curve.

The 2013 inspection revealed that the concrete crossing is still in perfect condition. It has Pandrol clips. The asphalt approaches are not sloped correctly which provides some measure, abet minor, of roughness to the crossing. The crossing is very smooth and shows no signs of problems.

KY 1469 Penny Road

Route/Street	DOT Number	Highway ADT
KY 1469	228230K	Moderate
Location	Date Installed	Highway Lanes
Penny	November 5, 2003	Two
County	Railroad Company	Type Xing Surface
Pike	CSX	Concrete
Highway Milepost	Rail Classification	Number of Tracks
-----	Branch	Single
Railroad Milepost	Rail Annual Tonnage	Comments
CMN 7.87	Very Light	KYDOT



January, 2004 – After Renewal



2006



2011



2013

The precast concrete crossing and underlayment, on the lightly traveled branch line, were placed during the rehabilitation of the crossing in 2003.

The 2011 inspection indicated the crossing was in perfect condition.

The 2013 inspection revealed that the crossing was in perfect condition and the approaches were very smooth.

KY 2552 at Shelbiana

Route/Street	DOT Number	Highway ADT
KY 2552	228120A	Moderate
Location	Date Installed	Highway Lanes
Shelbiana	June, 2006	Two
County	Railroad Company	Type Xing Surface
Pike	CSX	Concrete
Highway Milepost	Rail Classification	Number of Tracks
-----	Branch	Single
Railroad Milepost	Rail Annual Tonnage	Comments
CMN 0.29	Light	KYDOT



2006



2011



2013

This concrete crossing was installed during the re-construction of an approach to a new bridge adjacent to the track in 2006.

The 2011 inspection indicated the crossing was in perfect condition.

The 2013 inspection revealed that the crossing and approaches were still in perfect condition and very smooth.

Eastern Kentucky Crossings with All-Asphalt Surfaces

These two crossings in Eastern Kentucky, both on highways that carry coal trucks and typical traffic mix, were rehabilitated with asphalt underlayments and all-asphalt surfaces. Both of the crossings were rehabilitated using the fast-track system, since the detours were extensive.

The performances of the two crossing surfaces indicate that even a low cost all-asphalt surface can provide adequate service, even for heavy truck loadings, if adequately supported.

Descriptions of the two installations follow:

George's Branch near Vicco

Route/Street	DOT Number	Highway ADT
George's Branch	346317A	Moderate
Location	Date Installed	Highway Lanes
Vicco	September 27, 2001	Two
County	Railroad Company	Type Xing Surface
Perry	CSX	Asphalt
Highway Milepost	Rail Classification	Number of Tracks
-----	Branch	Single
Railroad Milepost	Rail Annual Tonnage	Comments
OVI 254.06	Light	Perry Co. Road Dept.



2001 Before Construction



2001 After Construction



August 2009, Crossing was in Perfect Condition



2011, Crossing was Still in Perfect Condition



2013, Similar Condition, Slight Raveling of Flangeways

This crossing on a Perry County road was rehabilitated on September 27, 2001 using the fast-track system. An asphalt underlayment and all-asphalt surface were utilized. The Perry County Road Department, with assistance from KYDOT, provided the asphalt and traffic

control. A one-lane temporary crossing was provided for local traffic. There was no detour route as this is the only way for highway travel to this portion of the county. The coal trucks were not accommodated during the day. This is on the CSX Carr Creek Spur line. It gets one or two unit coal trains per day and numerous loaded coal trucks, since some of the mines haul to tipples closer to the mainline at Jeff. Additional heavily loaded trucks, providing support for the extensive mining activity on this branch line, and local traffic for several hundred residences also use the crossing.

The 2011 inspection indicated the crossing was still very smooth with no settlement.

The 2013 inspection revealed that the crossing was still very serviceable and had not required any maintenance over the past 12 years. The asphalt surface was slightly low which had been the situation since it was placed. However, it was smooth and had not settled. The abutting pavement had been resurfaced.

KY 7 at Beaver Gap near Deane

Route/Street	DOT Number	Highway ADT
KY 7	227825M	Moderate
Location	Date Installed	Highway Lanes
Halls/ Beaver Gap	July 23, 2008	Two
County	Railroad Company	Type Xing Surface
Knott	CSX	Asphalt
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Single
Railroad Milepost	Rail Annual Tonnage	Comments
CMO 39.43	Heavy	KYDOT



2008 Before Construction



2011, Still Smooth, Slight Amount of Raveling of the Asphalt Next to the Flangeway



2013, Still Performing Very Satisfactorily After Five Years

This crossing on the CSX mainline and heavily traveled KY 7 at the Knott/Letcher County line was rehabilitated on July 23, 2008 using the fast-track system. This is the main through highway in the area and the detour was several miles. KY 7 is second only to KY 15 in this area relative to the number of coal trucks and additional traffic. The rail line is a mainline for CSX coal trains, typically 10 to 15 trains per day. KYDOT provided assistance with the asphalt and traffic control.

The 2011 inspection indicated the crossing was still very smooth and had not settled.

The 2013 inspection revealed that the crossing is still in essentially perfect condition, just small amounts of raveling of the asphalt near the flangeway which occurred soon after placement. It has not settled and is very smooth and solid. A later inspection revealed that KY 7 had been resurfaced during the fall, but the crossing area was skipped.

KY 7 Corridor Crossing Improvements in Letcher County

This corridor improvement program was performed during the late summer/fall of 2005. Six crossings on KY 7, the main highway artery in the area, crossing the mainline of CSX's coal-hauling line were rehabilitated with asphalt underlayment and rubber seal/asphalt surfaces. This was in conjunction with a timbering/surfacing activity. All six crossings were renewed using the fast-track method within one day, due to the extremely long detour distances. In addition, improvements were made to the roadway geometrics on three of the crossings. This included widening the crossings, adjusting the pavement approach slopes and superelevation, and improving the vertical profile on the highway approaches.

The KYDOT provided the asphalt for the underlayment and surface and also provided traffic control during the renewal of the six crossings.

The crossings performed admirably for the seven years prior to the 2012 timber and surfacing activity. It was decided to renew the six crossings with the present standard crossing surface consisting of timber and asphalt. The four crossings on curves were repaneled and the larger tie plates were used. The two crossings on tangents were merely surfaced through prior to installing the timber/asphalt surfaces.

KY 7 at Colson

Route/Street	DOT Number	Highway ADT
KY 7	346259G	Heavy
Location	Date Installed	Highway Lanes
Colson	July 21, 2005	Two
County	Railroad Company	Type Xing Surface
Letcher	CSX	Rubber Seal/Asphalt
Highway Milepost	Rail Classification	Number of Tracks
19.454	Main Line	Single
Railroad Milepost	Rail Annual Tonnage	Comments
OVG 281.16	Moderate	KYDOT



2005, Before Renewal



August 2009



2011, Still Performing Well



2013, New Surface Installed in 1912

This crossing was renewed on July 21, 2005. It was the first of the six crossings. The crossing was placed at the same elevation as the highway approaches. The approaches were milled slightly to match the elevation of the crossing. Therefore the highway approaches were not removed and replaced. The railroad is on a curve with superelevation, so there is a geometric deviation in the highway profile.

The 2011 inspection indicated that the crossing still had a certain amount of reverse superelevation for highway traffic. The highway approaches were milled in 2005 during the renewal. The highway approaches were still slightly higher than the crossing. However, the crossing was still fairly smooth and serviceable. The high rail did not have the rubber flangeway material and the rail was loose. There was a slight amount of asphalt deterioration after six years. The crossing was still very solid.

The 2013 inspection revealed that the crossing was repaveled in 2012 with a wide timber/asphalt crossing surface with the longer tie plates. It is very smooth and solid.

KY 7 at Thorton Gap

Route/Street	DOT Number	Highway ADT
KY 7	346255E	Heavy
Location	Date Installed	Highway Lanes
Thorton Gap	July 28, 2005	Two
County	Railroad Company	Type Xing Surface
Letcher	CSX	Rubber Seal/Asphalt
Highway Milepost	Rail Classification	Number of Tracks
18.075	Main Line	Single
Railroad Milepost	Rail Annual Tonnage	Comments
OVG 279.93	Moderate	KYDOT



2005, Before Renewal



August 2009, Note Scar From Derailed Wheel



2011, Still Very Serviceable and Smooth



2013 After Renewal



2013 After Renewal

This crossing was rehabilitated on July 28, 2005. The asphalt plant broke down after one load of hot-mix was received, the remainder of the underlayment used asphalt millings. Soon after installation a derailed wheel was drug across the crossing. It scarred the surface but did not damage the surface.

The 2011 inspection indicated that the crossing was still in perfect condition. It was very tight with no deflection and continued to be very smooth.

The 2013 inspection revealed that the crossing had been repaveled in 2012 with CSX's present standard crossing surface consisting of timber and asphalt. The crossing was very smooth and in perfect condition.

KY 7 at Letcher Elementary School

Route/Street	DOT Number	Highway ADT
KY 7	346235T	Heavy
Location	Date Installed	Highway Lanes
Letcher Elem. School	August 2, 2005	Two
County	Railroad Company	Type Xing Surface
Letcher	CSX	Rubber Seal/Asphalt
Highway Milepost	Rail Classification	Number of Tracks
9.895	Main Line	Single
Railroad Milepost	Rail Annual Tonnage	Comments
OVG 272.12	Moderate	KYDOT



2005, Before Renewal



August, 2009



2011 Still Performing Well



2013 After Renewal

This was the third crossing rehabilitated on August 2, 2005. It was in perfect condition in 2010 when the adjacent open-deck bridge was raised to convert it to a ballast deck bridge, therefore the crossing was raised a few inches requiring removal and replacement of the crossing surface and also repaving the asphalt approaches to match the higher elevation of the crossing. The crossing was not quite as smooth, but very serviceable.

The 2011 inspection indicated that the crossing was very tight and solid, although the crossing was not quite as smooth as it had been prior to the raise.

The 2013 inspection revealed that the crossing had been re-paneled with the wide timber/asphalt crossing surface with the larger tie plates during the timber/surfacing activity. It was very smooth.

KY 7 at No Name

Route/Street	DOT Number	Highway ADT
KY 7	346225M	Heavy
Location	Date Installed	Highway Lanes
No Name	October 14, 2005	Two
County	Railroad Company	Type Xing Surface
Letcher	CSX	Rubber Seal/Asphalt
Highway Milepost	Rail Classification	Number of Tracks
7.635	Main Line	Single
Railroad Milepost	Rail Annual Tonnage	Comments
OVG 269.84	Moderate	KYDOT



2005 Before Renewal



August, 2009



2011, Still Performing Well



2013 After Renewal

This was the fourth crossing rehabilitated on October 14, 2005. During the renewal the width of the crossing was increased to permit two vehicles to meet safely on the crossing. This improved the geometrics of the skewed crossing.

The 2011 inspection indicated that the crossing was still essentially in perfect condition. There was a slight amount of raveling of the asphalt next to the rubber seal.

The 2013 inspection revealed that the crossing had been repaveled with the wide timber/asphalt crossing surface with the larger tie plates. It was very solid and smooth.

KY 7 at Old Letcher School

Route/Street	DOT Number	Highway ADT
KY 7	346224F	Heavy
Location	Date Installed	Highway Lanes
Old Letcher School	November 1, 2005	Two
County	Railroad Company	Type Xing Surface
Letcher	CSX	Rubber Seal/Asphalt
Highway Milepost	Rail Classification	Number of Tracks
7.197	Main Line	Single
Railroad Milepost	Rail Annual Tonnage	Comments
OVG 269.39	Moderate	KYDOT



2005 Before Renewal



August, 2009



2011 Still Performing Well



2013 After Renewal

This was the sixth and last crossing rehabilitated on November 1, 2005. The crossing approaches were improved to provide for a smoother ride quality.

The 2011 inspection indicated that the crossing was still in perfect condition and very smooth.

The 2013 inspection revealed that this crossing, being on a tangent, was not repaneled, but the crossing surface (rubber seal/asphalt) was removed and the crossing was surfaced through and a new timber/rubber/asphalt surface was installed. The crossing was very solid and tight and smooth, although the sharp drop-off on one side of the crossing was still present.

KY 7 at Indian Church

Route/Street	DOT Number	Highway ADT
KY 7	346223Y	Heavy
Location	Date Installed	Highway Lanes
Indian Church	October 17, 2005	Two
County	Railroad Company	Type Xing Surface
Letcher	CSX	Rubber Seal/Asphalt
Highway Milepost	Rail Classification	Number of Tracks
6.936	Main Line	Single
Railroad Milepost	Rail Annual Tonnage	Comments
OVG 269.12	Moderate	KYDOT



2005 Before Renewal



August, 2009



2011 Still Performing Well



2013 After Renewal

This crossing was the fifth crossing rehabilitated on October 17, 2005. The crossing was widened to provide ample room for two vehicles to meet, thus improving the geometrics of the crossing which is on a skew.

The 2011 inspection indicated that the crossing was still in essentially perfect condition. There was a slight amount of deterioration of the asphalt next to the rubber seal.

The 2013 inspection revealed that the crossing had not been repaveled, since it was on a tangent, but the rubber seal/asphalt surface had been removed so the crossing could be surfaced through and the current CSX standard surface, timber/asphalt, was installed. The crossing is very smooth and solid.

Additional Crossings in Eastern Kentucky

Several other crossings, in addition to the concentration on the Big Sandy River area, have been renewed with asphalt underlayments. These include three early crossings projects along KY 7 that served as guidelines for later installations, two recent crossings in the Hazard area, a recent crossing installation near Barbourville and an innovative crossing design in Martin County. These are described individually as follows:

KY 550 at Lackey

Route/Street	DOT Number	Highway ADT
KY 550/KY 7	227883H	Heavy
Location	Date Installed	Highway Lanes
Lackey	June 18, 2001	Two
County	Railroad Company	Type Xing Surface
Floyd	CSX	Concrete & All Asphalt
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Single
Railroad Milepost	Rail Annual Tonnage	Comments
CMO 18.2	Heavy	KYDOT



December, 2000 – Before Renewal



June, 2001 – After Renewal



June, 2001 – After Renewal



January, 2004



2006



October, 2007



2011



2013



2013



2013

This crossing was renewed in June, 2001. Omni concrete panels were used for the center. The asphalt pavement was placed directly against the rail on the field sides. It has several hundred heavy coal trucks traverse the crossing each day in addition to regular traffic. Many of the coal trucks make a 60 degree turn on the crossing to and from KY 550. Other trucks travel straight through at a fairly high rate of speed. The railroad is on a 12 degree curve.

This was the initial crossing underlain with asphalt in the Eastern Kentucky area. KYDOT participated in the renewal, which was accomplished in a single day. Four load cells were positioned on top of the asphalt underlayment and trackbed pressures were periodically monitored. The crossing was very solid and smooth.

The crossing surface performed extremely well for 2 ½ years considering the railroad curvature and the heavy coal truck volumes—both the slow speed turning movements and the higher speed straight through movements. Also, the performance of the asphalt next to the field side rails exceeded all expectations. It was widely reported that previous crossing renewals performed poorly and the crossing became rough very soon and routinely required maintenance every few months.

However in early 2004 one of the concrete panels cracked and the asphalt approaches adjacent to the rail failed. Localized repairs were made to the asphalt and a new concrete panel was installed. The crossing structure remained very firm and structurally adequate.

After additional cracking of the concrete panels and failures of the asphalt approaches, the concrete was removed in 2006 and replaced with an all-asphalt surface. No rubber seal, wood, or concrete was used. This surface renewal was made during an asphalt pavement resurfacing of KY 550. By this time the spikes had loosened and the rail was moving up and down under traffic. Over a period of time the asphalt crossing was damaged.

Although the crossing had not performed perfectly, it is considered to be the most significant success story in all of Eastern Kentucky. The turning movements and high speeds of the coal trucks subjected the crossing to significant impact and shearing stresses. Although the surface deteriorated, the crossing remained reasonably smooth and serviceable.

In 2008 the surface was renewed with rubber seal/asphalt during the resurfacing of the adjacent highway.

The 2011 inspection indicated some deterioration of the asphalt, but the crossing was very solid and smooth.

The 2013 inspection revealed that the rubber seal/asphalt surface was performing reasonably well, but the asphalt approaches had slightly deteriorated.

KY 7 at Jim

Route/Street	DOT Number	Highway ADT
KY 7	227786Y	Moderate
Location	Date Installed	Highway Lanes
Jim	June 19, 2001	Two
County	Railroad Company	Type Xing Surface
Floyd	CSX	Concrete & Rubber/Asphalt
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Single
Railroad Milepost	Rail Annual Tonnage	Comments
CMO 23.6	Heavy	KYDOT



2001- Before Renewal



January, 2004 – After Renewal



2006



2011



2013



2013



2013

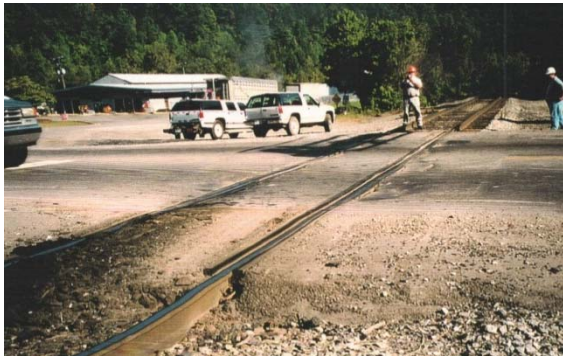
This crossing was renewed in 2001, the day after the Lackey crossing. Omni concrete panels were used for the center and conventional rubber seal/asphalt was used for the field sides. It was installed in one day using the fast track system. The crossing carries a significant amount of heavy, high-speed traffic.

The 2011 inspection indicated that there was some slight deterioration of the asphalt next to the rubber. However, the crossing was still very solid and smooth.

The 2013 inspection revealed that the crossing approaches were fairly rough, mainly as a result of changing out the rail. The concrete surface was replaced in late 2013 with a wide timber/asphalt surface. It is very smooth.

KY 15 in Isom

Route/Street	DOT Number	Highway ADT
KY 15	346248U	Very Heavy
Location	Date Installed	Highway Lanes
Isom	November 6, 2002	Two
County	Railroad Company	Type Xing Surface
Letcher	CSX	Concrete
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Single
Railroad Milepost	Rail Annual Tonnage	Comments
OVG 276.37	Moderate	KYDOT



August, 2002 – Before Renewal



January, 2004 – After Renewal



2006



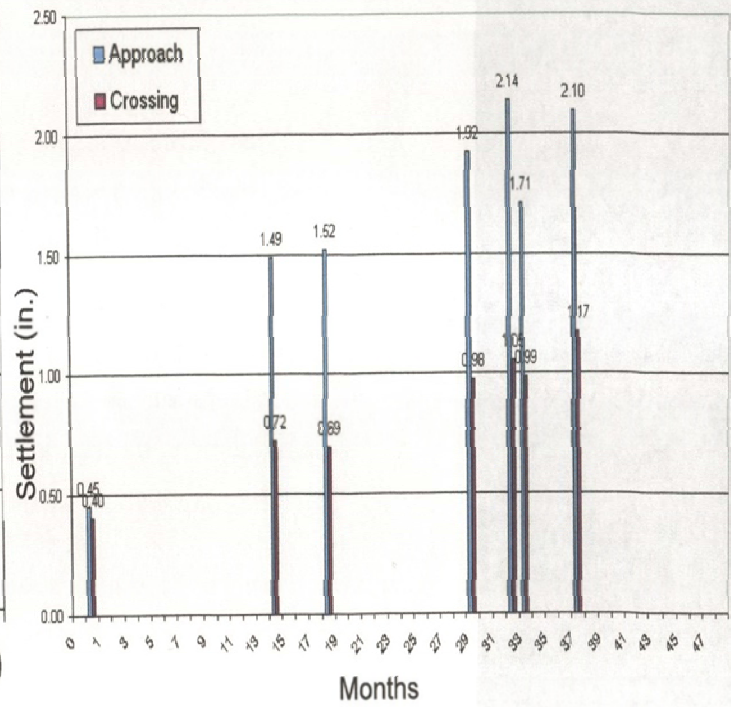
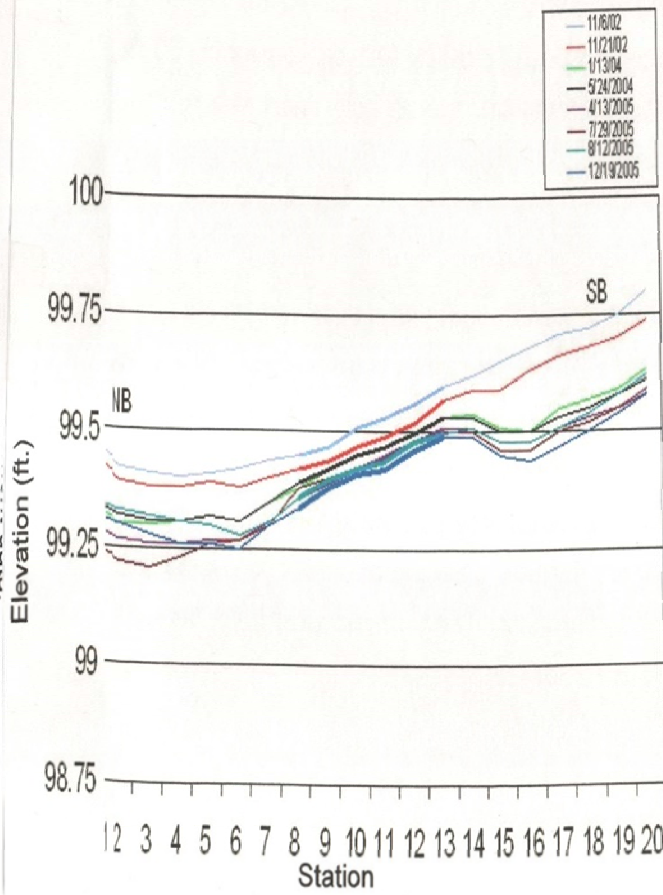
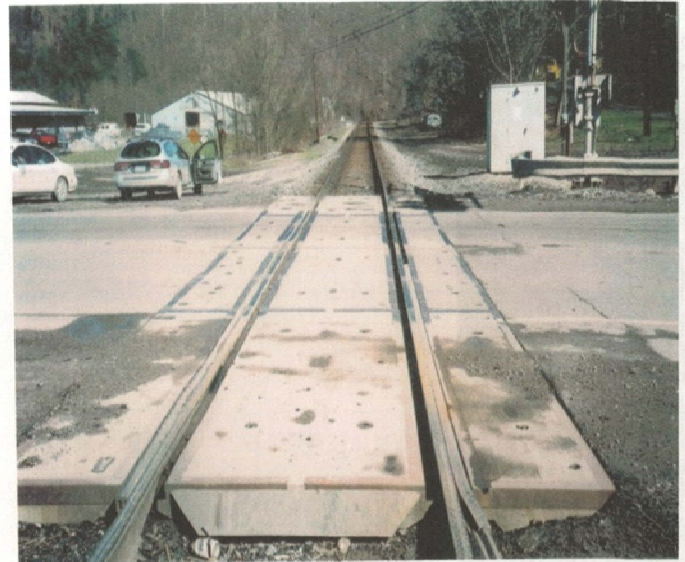
2011



2013

Top-of-Rail Settlements

Isom



2006 – Crossing Settlement

This heavy truck and automobile traffic crossing on KY 15, the main route into the area, was renewed in 2002 with asphalt underlayment and concrete panels. The crossing had required frequent maintenance over the years to maintain acceptable ride quality. The ride quality normally deteriorated soon after the crossing was rehabilitated primarily due to settlement.

The crossing performed very well for four years. However, in 2006 the metal encasement for one of the field side concrete panels loosened. In addition, the rail loosened from the ties. The increased impact cracked and deteriorated one of the concrete panels. KYDOT used cold patch asphalt to replace the concrete that had spalled out of the panel. Several of the panels over the next couple of years were replaced. However the crossing remained very smooth for the 60 mph traffic and heavy trucks. Eventually the field concrete panels were replaced with rubber seal/asphalt.

The 2011 inspection indicated that the concrete panels were still in the center, but badly cracked. The crossing was still tight and reasonably smooth for the high speeds, although the appearance was less than desirable.

The 2013 inspection revealed that the new timber/asphalt surface and new track panel installed in 2012 were providing a very acceptable crossing that was very smooth and tight.

KY 451 in Hazard

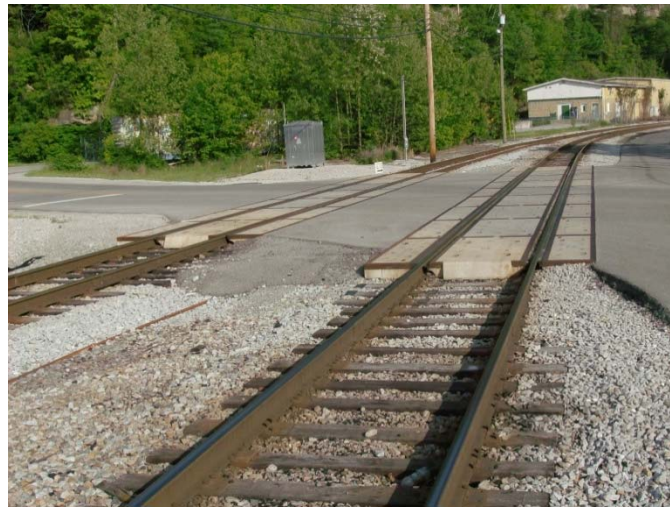
Route/Street	DOT Number	Highway ADT
KY 451	346112G	Heavy
Location	Date Installed	Highway Lanes
Hazard	September, 2009	Two
County	Railroad Company	Type Xing Surface
Perry	CSX	Concrete
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Double
Railroad Milepost	Rail Annual Tonnage	Comments
OVB 242.46	Moderate	KYDOT



2011



2011



2013

These two concrete surfaces with asphalt underlayment were placed in 2009 during the construction of a new highway bridge and the realignment of the highway. The project was conducted in conjunction with the new highway alignment, replacing the existing crossing.

The 2011 inspection indicated the crossings were in perfect condition.

The 2013 inspection revealed the same.

KY 476 in Hazard

Route/Street	DOT Number	Highway ADT
KY 476, Lots Creek	351721T	Heavy
Location	Date Installed	Highway Lanes
Hazard	November 25, 2011	Two
County	Railroad Company	Type Xing Surface
Perry	CSX	Timber/Asphalt
Highway Milepost	Rail Classification	Number of Tracks
-----	Branch	Single
Railroad Milepost	Rail Annual Tonnage	Comments
OWV 242.01	Very Light	KYDOT



2011- Before Renewal



2013

This crossing, on a light-traffic coal branch line was renewed in November 2011 with an asphalt underlayment, consisting of asphalt millings. The standard CSX timber/asphalt surface was applied.

The 2013 inspection revealed that the crossing was still in perfect condition and was very smooth considering the superelevation of the railroad through the curve.

U.S. 25E in Barbourville

Route/Street	DOT Number	Highway ADT
U.S. 25E	354037T	Very Heavy
Location	Date Installed	Highway Lanes
Barbourville	May 23 & 24, 2011	Four
County	Railroad Company	Type Xing Surface
Knox	CSX	Concrete
Highway Milepost	Rail Classification	Number of Tracks
12.179	Branch	Single
Railroad Milepost	Rail Annual Tonnage	Comments
OCQ 187.18	Light	NB Lanes w/ Underlayment



2011



2011



2012- Before Adjustment



2012- Before Adjustment



2013- After Adjustment



2013- After Adjustment

This four-lane crossing on the heavily traveled U.S. 25E highway was renewed in 2011 with a full-width concrete crossing and asphalt underlayment replacing a combined rubber and concrete crossing. The railroad is on a curve. Approximately two inches of superelevation (2.2 percent slope) was used.

Although the crossing was very smooth and tight, soon the field side concrete panels on the low side of the crossing began to loosen and twist resulting in cracked panels. These were initially replaced. However the decision was made in 2013 to remove most of the superelevation to minimize impact from the heavy trucks bouncing as they passed over the crossing.

Therefore the crossing panels were removed and the low rail was raised to provide only about one half inch of superelevation. The concrete panels were re-installed and the pavement approaches were adjusted (mainly raised on the low side) to transition with the crossing and pavement.

The 2013 inspection indicated that the adjustment to the superelevation had significantly reduced the impact from vehicular traffic and the crossing was very smooth and solid.

KY 292 at Nolan

Route/Street	DOT Number	Highway ADT
KY 292	482578W	Moderate
Location	Date Installed	Highway Lanes
Nolan	October 26, 2011	Two
County	Railroad Company	Type Xing Surface
Martin	NS	Rubber Seal/Asphalt
Highway Milepost	Rail Classification	Number of Tracks
-----	Branch	Single
Railroad Milepost	Rail Annual Tonnage	Comments
LF 0.4	Light	KYDOT



2011- Before Renewal



November 2011 During the Installation



2012, Excellent Performance of the "Ballastless" Crossing

This crossing on NS was renewed in October 2011 using a variation of asphalt underlayment and a typical rubber seal/asphalt surface. The existing concrete surface had cracked and settled adversely, affecting the ride quality of the crossing. The variation involved placing the new track panel directly on the asphalt layer with no intervening ballast between the bottom of the ties and the asphalt layer. This technique is known as a “ballastless” support. Ballast was used to fill in the crib areas between the ties and along the shoulders level with the top of the ties. Extreme care was exercised to make sure the top of the asphalt underlayment layer was at the correct elevation so the panel would seat level.

This is a slow speed branch line having a couple of unit coal trains per day. The highway has moderate traffic including numerous heavy coal trucks. KYDOT participated by providing the asphalt for the underlayment and approaches and the traffic control. It was install in one day to minimize interruptions and long detours for the highway traffic.

The 2013 inspection indicated that the innovative “ballastless” crossing was performing perfectly. It was very solid and smooth.

Central Kentucky Area Crossings

Numerous crossings in Central Kentucky have been underlain with asphalt over the years, beginning with the very first crossings in the early 1980s to recent ones. These will be discussed individually based on a chronological grouping.

This section describes the renewal of the initial five crossings with asphalt underlayments in Kentucky, these being in the central part of the state, with the first one being Forbes Road in Lexington in 1982. This was followed by one just south of Berea at Snider in 1983. The following year a 1300-ft long underlayment was placed in downtown Cynthiana, which included three crossings, during the removal of double track and replacing with a single track.

Forbes Road in Lexington

Route/Street	DOT Number	Highway ADT
Forbes Road	346822U	Heavy
Location	Date Installed	Highway Lanes
Lexington	October, 1982	Two
County	Railroad Company	Type Xing Surface
Fayette	L&N/RJC	Timber /Asphalt
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Single
Railroad Milepost	Rail Annual Tonnage	Comments
OOW 92.45	Light	KYDOT



1982, Before Renewal



1982, During Renewal



1983



2011



2013



2013

This crossing was installed in 1982 and represented the first crossing renewed with asphalt underlayment and also used the fast-track one-day renewal process. This crossing had exhibited excessive track fouling and settlement over the years due largely to drainage conditions. Water from the uphill section of Forbes Road would wash down the highway and the fine debris would settle in the track approaches to the crossing. Also, runoff from the stockyards compounded the situation. The softened trackbed support was incapable of providing adequate support for the crossing.

The initial surface was timber/asphalt for about ten years. This was followed with a rubber seal/asphalt surface. The present concrete surface has been in place less than ten years.

The 2011 inspection indicated that the crossing was still in perfect condition, no track pumping or settlement. Debris still settles in the track approaches next to the crossing but does not contribute negatively to crossing performance, just the aesthetics.

The 2013 inspection revealed the same conditions as the 2013 inspection. The crossing is still solid, although there is a slight thrill bump due to the vertical grade of the street.

Fairview Loop Road at Snider

Route/Street	DOT Number	Highway ADT
Fairview Loop Rd.	353551H	Light
Location	Date Installed	Highway Lanes
Snider	June 1983	Two
County	Railroad Company	Type Xing Surface
Rockcastle	CSX	Timber /Asphalt
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Double, No. 2 Track Only
Railroad Milepost	Rail Annual Tonnage	Comments
OKC 137.13	Heavy	-----



1983, Before Renewal



1986, Three Years After Renewal



2011



October, 2013

This crossing on # 2 track was renewed with an asphalt underlayment during a major asphalt underlayment research installation just south of the crossing in 1983. The crossing at that time was exhibiting pumping and settlement so an asphalt underlayment was installed. A timber/asphalt surface was installed in 1983. Several years later during a T/S program a rubber seal/asphalt surface was installed. The present surface is timber/asphalt. No pumping or settlement has been noticed during the intervening years.

The 2011 inspection indicated that the crossing was in perfect condition.

The 2013 inspections revealed similar findings.

Another early application of asphalt underlayment involved the replacement of three crossings involving 1300 feet of track in the town of Cynthiana. The track to be abandoned was removed, the muddy, fouled trackbed was excavated, and an eight foot wide lane of asphalt underlayment was placed. The remaining track was slid over on the asphalt, ballast was added and the track was raised and surfaced. Train operations continued on the temporarily positioned track. The other side of the trackbed was excavated, an eight foot wide/ 1300 feet long lane of asphalt was placed, ballast was added and the single track was centered. The three crossings are discussed separately.

Bridge Street in Cynthiana

Route/Street	DOT Number	Highway ADT
Bridge St.	353424G	Heavy
Location	Date Installed	Highway Lanes
Cynthiana	November, 1984	Two
County	Railroad Company	Type Xing Surface
Harrison	CSX	Timber/Asphalt
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Single
Railroad Milepost	Rail Annual Tonnage	Comments
OKC 66.24	Heavy	KYDOT



October, 1984 – Before Renewal



October, 1984 – Before Renewal



October, 1984 – During Paving



1999



February, 2002



2013

The project began just south of the Bridge Street crossing and included the turnout. The trackbed and roadbed were very muddy around Bridge Street and between Bridge Street and Pike Street. As noted in the pictures, it was necessary to pull the asphalt laydown machine with a dozer due to the softness of the subgrade.

The 2013 inspection revealed no pumping or settlement of the timber/asphalt crossing. There were some loose crossing timbers and some minor asphalt deterioration. However, the crossing is sufficiently smooth and serviceable.

Pike Street in Cynthiana

Route/Street	DOT Number	Highway ADT
Pike St.	353423A	Heavy
Location	Date Installed	Highway Lanes
Cynthiana	November, 1984	Two
County	Railroad Company	Type Xing Surface
Harrison	CSX	Timber
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Single
Railroad Milepost	Rail Annual Tonnage	Comments
OKC 66.15	Heavy	KYDOT



1999



February, 2002



2013

Pike Street was the middle crossing. It was placed under the same conditions as the Bridge Street crossing.

The 2013 inspection revealed that the rubber seal/asphalt crossing was very smooth and there was no indication of pumping or deterioration.

Pleasant Street in Cynthiana

Route/Street	DOT Number	Highway ADT
Pleasant St.	353422T	Heavy
Location	Date Installed	Highway Lanes
Cynthiana	November, 1984	Two
County	Railroad Company	Type Xing Surface
Harrison	CSX	Timber /Asphalt
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Single
Railroad Milepost	Rail Annual Tonnage	Comments
OKC 66.06	Heavy	KYDOT



1999



February, 2002



2013

This crossing was the third crossing renewed in Cynthiana.

The 2013 inspection revealed that the timber/rubber seal/asphalt surface is very smooth with no pumping.

The next series of crossings in central Kentucky using asphalt underlayment during the renewal process are described in this section. These were placed in the very early 2000s during the time period when the use of asphalt underlayment accelerated elsewhere as well. These four installations are discussed separately as each was unique in situations and conditions.

U.S. 62, Oddville Road in Cynthiana

Route/Street	DOT Number	Highway ADT
Oddville Rd.	353421L	Heavy
Location	Date Installed	Highway Lanes
Cynthiana	May 4th, 2000	Two
County	Railroad Company	Type Xing Surface
Harrison	CSX	Timber /Asphalt
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Single
Railroad Milepost	Rail Annual Tonnage	Comments
OKC 65.92	Heavy	KYDOT



1999 Before Renewal, Note the Settlement and Roughness



February, 2002



2013

This crossing represented the fourth crossing in Cynthiana, the northern most crossing in the downtown business district. The previous three crossing renewals, involving a continuous stretch of 3000 feet of track in 1984 stopped short of Oddville Road. The decision was made 16 years later to use asphalt underlayment during the renewal of the crossing.

Unfortunately the underlayment was only placed to the end of the crossing with no placement under the track approaches. The approaches soon became muddy due to pumping. Some remedial work was beneficial at rectifying the problem.

The 2013 inspection revealed that the timber/rubber seal/asphalt surface is fairly rough, although there is no indication of pumping or settlement.

U.S. 25/421, Main Street in Richmond

Route/Street	DOT Number	Highway ADT
U.S. 25/421 Main St.	353526A	Very Heavy
Location	Date Installed	Highway Lanes
Richmond	September 13, 2000	Three
County	Railroad Company	Type Xing Surface
Madison	CSX	Concrete
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Single
Railroad Milepost	Rail Annual Tonnage	Comments
OKC 118.77	Heavy	KYDOT



August, 2000- Before Renewal



February, 2001



2010



2011



2013



2013

This was the first asphalt underlayment installed using the fast-track system in 2002.

The crossing was closed at 8:00 am. A train could have passed by. The crossing was opened to highway traffic by 7:00 pm. The crossing remained very smooth and tight for several years. In 2010 the crossing was surfaced through during a surfacing program. The concrete

panels were reused. The crossing approaches, after surfacing through the crossing, are not as smooth as the preceding ten years.

KY 1032 in Berry

Route/Street	DOT Number	Highway ADT
KY 1032	353402G	Light
Location	Date Installed	Highway Lanes
Berry	June 21st, 2001	Two
County	Railroad Company	Type Xing Surface
Harrison	CSX	Rubber Seal /Asphalt
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Double, #2 Track Only
Railroad Milepost	Rail Annual Tonnage	Comments
OKC 54.27	Heavy	KYDOT



2011



2013

This crossing was renewed during a T&S operation. An adjacent series of load cells were placed on an open track section. A rubber seal/asphalt surface was used.

The 2011 inspection indicated that the rubber seal/asphalt surface, installed in 2001 was still in place and was performing perfectly.

The 2013 inspection revealed that a new timber/asphalt surface had been used during a recent T&S program. The crossing was in perfect condition with no settlement or pumping.

KY 595 in Berea

Route/Street	DOT Number	Highway ADT
KY 595	353538U	Heavy
Location	Date Installed	Highway Lanes
Berea	April 3, 2002	Three
County	Railroad Company	Type Xing Surface
Madison	CSX	Concrete
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Single
Railroad Milepost	Rail Annual Tonnage	Comments
OKC 130.39	Heavy	New Construction KYDOT



May, 2001- Before Removing the Crossing as Part of a Highway Widening Project



2011 After Replacing Rail and Reusing Surface



2013 After Replacing Concrete Surface with a Timber/Asphalt Surface

This crossing was widened and rebuilt as part of a highway widening project in 2002. Several years later the rail was changed out through the area and was also changed out through the crossing, although the rail in the crossing was nearly new. The highway approaches were not replaced satisfactorily and reduced the rideability of the crossing. Later the crossing was renewed with a timber/asphalt surface.

Two very high traffic crossings on the four lane U.S. 60 Versailles Bypass were renewed during late September, 2002. This project was basically funded in total by KYDOT for a shortline – Lexington & Ohio Railroad. The light traffic line from Lexington to Versailles was subsequently purchased by R.J. Corman. A semi fast-track method was used during the construction since there were ample crossovers through the wide median to detour and single-lane traffic on the opposing lanes. Outside contractors were used for the track and highway work. One of the crossings is on the mainline, the other on an industry spur.

U.S. 60 Bypass in Versailles (main line)

Route/Street	DOT Number	Highway ADT
U.S. 60 Bypass	719869X	Very Heavy
Location	Date Installed	Highway Lanes
Versailles	September, 2002	Four
County	Railroad Company	Type Xing Surface
Woodford	L&O/RJC	Concrete
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Single
Railroad Milepost	Rail Annual Tonnage	Comments
LL 11.23	Light	KYDOT



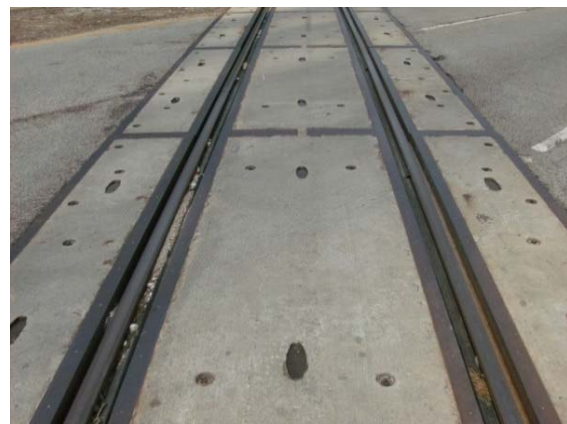
2001- Before Renewal



2011



2013



2013

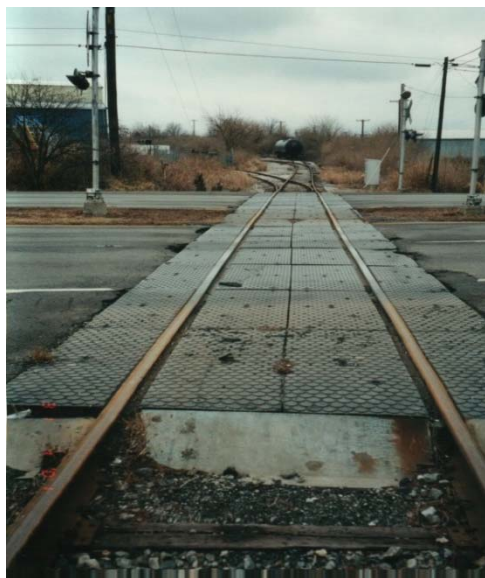
By 2002 the existing rubber crossing had deteriorated and settled resulting in undesirable rideability for the typical 60 mph heavy traffic on the U.S. 60 Bypass. All four crossings were completely removed and asphalt underlayments were used.

The 2011 inspection of this mainline crossing indicated that the crossing was in excellent condition.

The 2013 inspection revealed similar conclusions. The asphalt approaches are still slightly higher than the crossing panels, and have been since the renewal, but the ride quality is very acceptable. The asphalt is raveling a small amount next to the concrete panels, which is due to the natural aging of the asphalt pavement approaches.

U.S. 60 Bypass in Versailles (spur)

Route/Street	DOT Number	Highway ADT
U.S. 60 Bypass	734429U	Very Heavy
Location	Date Installed	Highway Lanes
Versailles	September, 2002	Four
County	Railroad Company	Type Xing Surface
Woodford	L&O/RJC	Concrete
Highway Milepost	Rail Classification	Number of Tracks
-----	Spur	Single
Railroad Milepost	Rail Annual Tonnage	Comments
LL 0.4	Very Light	KYDOT



2001 – Before Renewal



2011



2013



2013

The crossings on the spur line were renewed during the same time as those on the mainline.

The 2011 inspection indicated that the crossings were in excellent condition. There is still a slight thrill bump due to the vertical grade of the highway intersection and the flat grade of the crossing, although this is a minor condition.

The 2013 inspection revealed that the crossing was still performing perfectly; the only noticeable effect was the slight thrill bump.

These two very high traffic highway and double-track rail crossings were renewed during a four day period during 2002. The fast-track method was used. The crossings are about one mile apart.

The KDOT and Lexington/Fayette Urban County Government provided the announcements, traffic control, asphalt, and crossing surfaces as a cooperative effort with Norfolk Southern. Dates were selected during expected lower volumes of highway traffic.

These crossings were skipped by the surfacing and timbering/surfacing programs until 2010 when the panels were temporarily removed to permit the track surfacing equipment to re-work the track approaches that had continued to settle during the intervening eight years and had been repeatedly raised and surfaced.

Waller Avenue in Lexington

Route/Street	DOT Number	Highway ADT
Waller Ave.	724527H	Very Heavy
Location	Date Installed	Highway Lanes
Lexington	August 6 & 7, 2002	Two
County	Railroad Company	Type Xing Surface
Fayette	NS	Concrete
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Double
Railroad Milepost	Rail Annual Tonnage	Comments
82.44	Very Heavy	Remove Panels, Surface Track, Reuse Panels, Nov. 2010 KYDOT LFUCG



October, 2001- Before Renewal



May, 2006



2011



2011



2013 – 11 Years After Renewal



2013- 11 Years After Renewal

The 2011 inspection indicated that the crossings were in perfect condition. There was some mud pumping beyond the crossing, but the crossings were still smooth.

The 2013 inspection revealed similar performance as the 2011 inspection. The asphalt approaches were not as smooth as the paver-laid 2002 approaches.

Rosemont Garden in Lexington

Route/Street	DOT Number	Highway ADT
Rosemont Garden	724528P	Heavy
Location	Date Installed	Highway Lanes
Lexington	July 23 & 24, 2002	Two
County	Railroad Company	Type Xing Surface
Fayette	NS	Concrete
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Double
Railroad Milepost	Rail Annual Tonnage	Comments
83.18	Very Heavy	Remove Panels, Surface Track, Reuse Panels, Nov. 2010 KYDOT LFUCG



July, 2002 – Before Renewal



May, 2006



2011



2011



2013 - 11 Years After Renewal



2013 – 11 Years After Renewal

The 2011 inspection indicated that the crossings were still performing perfectly and with the exception of the newly replaced approaches the rideability was acceptable.

The 2013 inspection revealed similar findings as noted in the 2011 inspection.

These two double-track crossings in Winchester were renewed during 2003 and 2004. KYDOT and the Winchester Public Works Department provided significant assistance.

U.S. 60, Main Street in Winchester

Route/Street	DOT Number	Highway ADT
U.S. 60/Main St.	353486E	Very Heavy
Location	Date Installed	Highway Lanes
Winchester	November 17-20, 2003	Three
County	Railroad Company	Type Xing Surface
Clark	CSX	Concrete
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Double
Railroad Milepost	Rail Annual Tonnage	Comments
OKC 96.52	Heavy	KYDOT



2003- Before Renewal



2003- Before Renewal



July, 2007



2011



2011



2013



2013



2013

This double-track crossing was renewed in September, 2004. KYDOT provided significant assistance to CSX. There had been documented complaints from the public relative to the roughness of the crossings. CSX and KYDOT planned and executed a plan and design to provide smooth crossings that would provide acceptable ride quality for an extended period. As noted in the inspections after seven and nine years, the crossings are still very smooth and serviceable.

The 2011 inspection indicated that both crossings were still very tight and solid and the ride quality was very good considering the minor effects of the thrill bump due to the superelevated railroad curve. The treated timber in the flangeways was still performing well.

The 2013 inspection revealed similar conclusions as the 2011 inspection, except one field-side panel was noted as being loose.

Broadway in Winchester

Route/Street	DOT Number	Highway ADT
Broadway	353489A	Heavy
Location	Date Installed	Highway Lanes
Winchester	September, 2004	Two
County	Railroad Company	Type Xing Surface
Clark	CSX	Concrete/Rubber /Asphalt
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Double
Railroad Milepost	Rail Annual Tonnage	Comments
OKC 96.84	Heavy	City of Winchester Road Dept.



2011, 7 Years after Renewal



2011



2013



2013

Following the favorable performance of the Main Street crossings, the City of Winchester teamed with CSX in renewing the Broadway crossings, as a short distance from Main Street. This was accomplished in September 2004, one year later. CSX had several concrete panels that had been used for testing as part of a research project. These were obtained and used for one of the crossings, with the standard rubber seal/asphalt used for the shoulders. The other crossing on # 2 track utilized the standard rubber seal/asphalt crossing.

The 2011 inspection indicated that both crossings are still performing perfectly and are very tight and smooth. The track still is very muddy beyond the north end of the crossings, as has been the case for several years; however the crossings have not been adversely affected.

The 2013 inspection revealed that both crossings are still performing equally well; there is no difference in the concrete and rubber seal/asphalt smoothness or appearance.

The Keller Dam crossing was somewhat unique relative to the crossing surface. The center portion of the crossing consisted of plastic segments with treated wood spacers/shims. The segments are used for spill trays where contaminants are likely to be spilled during tending to locomotives or transferring liquids. These were lightweight and could be handled singularly without mechanical means. The purpose was to be able to remove the units temporarily during routine track maintenance activities and replace with minimum effort and time.

Keller Dam Road near Cynthiana

Route/Street	DOT Number	Highway ADT
Keller Dam	353417W	Light
Location	Date Installed	Highway Lanes
Cynthiana	May 25TH, 2005	One
County	Railroad Company	Type Xing Surface
Harrison	CSX	Plastic & Rubber Seal/Asphalt
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Single
Railroad Milepost	Rail Annual Tonnage	Comments
OKC 64.4	Heavy	Harrison County Road Department



2005 – Before Renewal



2007



March, 2008



2011



2013

The units were installed in 2005. Conventional rubber seal/asphalt was used on the field sides. One year later it was necessary to change out the low rail through the curve and the units were temporarily removed and replaced. In 2010 the panels were again removed during a T&S program and were not replaced. The replacement was a full rubber seal/asphalt surface.

The 2011 inspection indicated that the reasonably new rubber seal/asphalt surface was very smooth with no pumping or settlement.

The 2013 inspection revealed that the crossing was in perfect condition and had been skipped during a recent track maintenance activity.

These four crossings north of Lexington were renewed in 2011 on the NS mainline during a T&S program. The fast track method was used so that the crossings would not have to be closed to highway traffic overnight. This was accomplished for three of the crossings, only Greendale Road was closed overnight. This was due to excessive train traffic delaying the start of the project that day until sufficient time was not available to finish the crossing to accommodate highway traffic, so it was decided to withhold paving the highway approaches until the next day.

Actually, the beginnings of the removal activities for the other three crossings were also delayed due to accommodating train traffic. Actually sufficient time was not available to raise the track sufficiently to match the existing pavement approaches. Therefore, the desired smoothness levels of the crossings were not achieved, although the rideability was significantly improved.

KYDOT cooperated significantly by providing the asphalt for the underlayment and surface and traffic protection.

During 2013, in conjunction with a track surfacing activity, the crossing rubber and asphalt were removed temporarily so that the crossing could be resurfaced with the **intention**

that the track within the crossing area would be raised sufficiently to improve the rideability. The intention is that the crossings, all on single track, will not have to be removed during the next several track maintenance activities.

KY 1963, Lisle Road in Georgetown

Route/Street	DOT Number	Highway ADT
KY 1963, Lisle Road	724507W	Moderate
Location	Date Installed	Highway Lanes
Georgetown	August 15 & 16, 2011	Two
County	Railroad Company	Type Xing Surface
Scott	NS	Rubber Seal /Asphalt
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Single
Railroad Milepost	Rail Annual Tonnage	Comments
72.9	Very Heavy	KYDOT



2011- Before Renewal



2011- Before Renewal



2013



2013



2013



2013

As part of this renewal process the crossing protection was upgraded and the light standards were moved farther away from the pavement so that the pavement approaches could be widened to permit two vehicles to meet on the crossing. This improved the highway geometrics and safety.

The 2013 inspection revealed that the crossing was very smooth and solid. There was a slight thrill bump due to the vertical profile of the road.

KY 1977, Spurr Road in Lexington

Route/Street	DOT Number	Highway ADT
KY 1977, Spurr Road	724515N	Moderate
Location	Date Installed	Highway Lanes
Lexington	August 15 & 16, 2011	Two
County	Railroad Company	Type Xing Surface
Fayette	NS	Rubber Seal /Asphalt
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Single
Railroad Milepost	Rail Annual Tonnage	Comments
77.0	Very Heavy	KYDOT



2011- Before Renewal



2011-Before Renewal



2013



2013



2013

This crossing was also renewed. The pavement approaches on the existing crossing had warped and in combination with the slight vertical grade resulted in a rough crossing. The crossing was raised and most of the warp was removed.

The 2013 inspection revealed that the crossing was very solid and the ride quality had been improved.

KY 2886, Kearney Road in Lexington

Route/Street	DOT Number	Highway ADT
KY 2886, Kearney Road	724513A	Moderate
Location	Date Installed	Highway Lanes
Lexington	August 16 & 17, 2011	Two
County	Railroad Company	Type Xing Surface
Fayette	NS	Rubber Seal /Asphalt
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Single
Railroad Milepost	Rail Annual Tonnage	Comments
76.4	Very Heavy	KYDOT



2011- Before Renewal



2011- Before Renewal



2013



2013



2013

The existing crossing was somewhat similar to Spurr Road with slight warps on the pavement approaches and in combination with the slight dip in the vertical alignment resulted in a rough crossing. The crossing was raised to minimize the geometric deviation.

The 2013 inspection revealed that the crossing was still slightly low relative to the abutting pavement approaches. It was very solid and the ride quality had been improved.

KY 1978, Greendale Road in Lexington

Route/Street	DOT Number	Highway ADT
KY 1978, Greendale Rd.	724516V	Moderate
Location	Date Installed	Highway Lanes
Lexington	August 22 & 23, 2011	Two
County	Railroad Company	Type Xing Surface
Fayette	NS	Rubber Seal /Asphalt
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Single
Railroad Milepost	Rail Annual Tonnage	Comments
77.2	Very Heavy	KYDOT



2011- Before Renewal



2011- Before Renewal



2013



2013



2013

This crossing had a restriction in the width of the travelled lanes, just past the crossing, due to an open cross-drain pipe inlet being close to the pavement. It was difficult for two passenger vehicles to meet on the crossing. As part of the crossing renewal of the crossing, the pipe was extended and the shoulder was filled over the pipe level with the pavement. This effectively widened the road so that two passenger vehicles could pass safely.

In addition, the pavement approaches were warped and the steep grade on one side of the crossing provided a thrill bump. The decision was to improve the rideability of the crossing.

The 2013 inspection indicated that the crossing was very smooth and solid. The effect of the thrill bump and vertical grade had been minimized.

Louisville Area Crossings

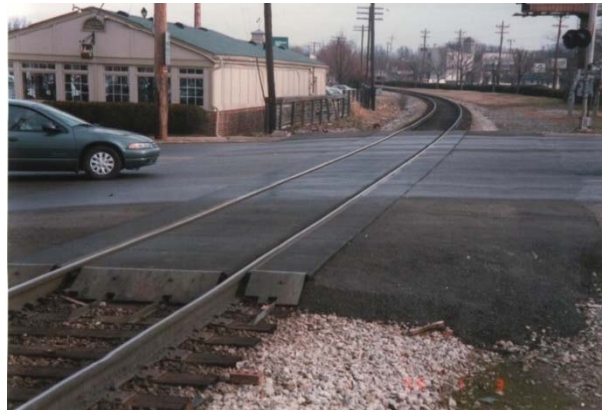
This section describes a variety of crossings renewed with asphalt underlayment in the Louisville area. These include an early installation on CSX at Chenoweth Lane, the recent three CSX installations on the industry spur line, and three P&L crossings. These are major crossings with heavy highway traffic. Each crossing is discussed separately.

Chenoweth Lane in Louisville

Route/Street	DOT Number	Highway ADT
Chenoweth Lane	345951F	Heavy
Location	Date Installed	Highway Lanes
Louisville	May 20, 1996	Three
County	Railroad Company	Type Xing Surface
Jefferson	CSX	Rubber
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Single
Railroad Milepost	Rail Annual Tonnage	Comments
OOT 5.43	Heavy	KYDOT



1996- Before Renewal



1998- After Renewal



2002



2011

This rubber crossing surface was placed in 1996 on an asphalt underlayment. The crossing performed well for several years until the rubber surface was removed to change out the rail on the curve. The rubber was re-installed, but before long it began to degrade and ripple. It was changed out to the combination rubber seal/timber/asphalt surface. However the ballast was not compacted on the field side of the crossing and the high rail settled adversely affecting the ride quality of the crossing.

The 1911 inspection indicated that the high rail was loose and several of the timbers were loose. The ride quality was still satisfactory for the slow speed crossing.

Shepherdsville Road in Louisville

Route/Street	DOT Number	Highway ADT
KY 2052, Shepherdsville Road	343936W	Heavy
Location	Date Installed	Highway Lanes
Louisville	August 2nd, 2010	Five
County	Railroad Company	Type Xing Surface
Jefferson	CSX	Concrete
Highway Milepost	Rail Classification	Number of Tracks
0.729	Industry Spur	Single
Railroad Milepost	Rail Annual Tonnage	Comments
OGE 4.53	Light	KYDOT



2011



2013



2013

This crossing, on CSX's Industry Spur line, was renewed in 2010 with an asphalt underlayment.

The 2011 and 2013 inspections indicated that the crossing was in perfect condition.

Grade Lane in Louisville

Route/Street	DOT Number	Highway ADT
KY 2843, Grade Lane	343932U	Heavy
Location	Date Installed	Highway Lanes
Louisville	June, 2010	Two
County	Railroad Company	Type Xing Surface
Jefferson	CSX	Concrete
Highway Milepost	Rail Classification	Number of Tracks
-----	Industry Spur	Double
Railroad Milepost	Rail Annual Tonnage	Comments
OGE 0.70	Light	-----



2011



2013



2013

This crossing, on CSX's Industry Spur line, was renewed in 2010 with an asphalt underlayment.

The 2011 and 2013 inspections indicated that the crossing was in perfect condition.

KY 61, Preston Highway in Louisville

Route/Street	DOT Number	Highway ADT
KY 61, Preston Highway	343935P	Heavy
Location	Date Installed	Highway Lanes
Louisville	June 3-4, 2011	Five
County	Railroad Company	Type Xing Surface
Jefferson	CSX	Concrete
Highway Milepost	Rail Classification	Number of Tracks
-----	Industry Spur	Single
Railroad Milepost	Rail Annual Tonnage	Comments
OGE 2.8	Light	KYDOT



2011



2013



2013

This crossing, on CSX's Industry Spur line, was renewed in 2011 with an asphalt underlayment.

The 2011 and 2013 inspections indicated that the crossing was in perfect condition.

U.S. 31, W Dixie Highway in Louisville

Route/Street	DOT Number	Highway ADT
U.S. 31W, Dixie Highway	296791H	Heavy
Location	Date Installed	Highway Lanes
Louisville	July 16-18, 2010	Four
County	Railroad Company	Type Xing Surface
Jefferson	P&L	Composite
Highway Milepost	Rail Classification	Number of Tracks
-----	Branch	Single
Railroad Milepost	Rail Annual Tonnage	Comments
S 0.1	Very Light	KYDOT



2011



2013



2013

This composite crossing, utilizing the most recent design, was installed by the P&L Railroad in 2010.

The 2011 and 2013 inspections indicated that the crossing was performing perfectly.

KY 1646, N. Logsdon Pkwy in Radcliff

Route/Street	DOT Number	Highway ADT
KY 1646, N. Logsdon Pkwy	925670Y	Moderate
Location	Date Installed	Highway Lanes
Radcliff	August 1-4, 2011	Six
County	Railroad Company	Type Xing Surface
Hardin	P&L	Concrete
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Single
Railroad Milepost	Rail Annual Tonnage	Comments
33.5	Moderate	KY Shortline Assistance Program



2011, Before Renewal



2013



2013

This crossing was renewed in August, 2011 using the KY Shortline Assistance Program. The highway was being resurfaced during that time and the approaches were placed as part of the resurfacing program.

The 2013 inspection revealed that the crossing was in near perfect condition and very smooth.

KY 907, Valley Station in Louisville

Route/Street	DOT Number	Highway ADT
KY 907, Valley Station	296833S	Heavy
Location	Date Installed	Highway Lanes
Louisville	August 8-10, 2011	Three
County	Railroad Company	Type Xing Surface
Jefferson	P&L	Concrete
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Single
Railroad Milepost	Rail Annual Tonnage	Comments
12.0	Moderate	KY Short-line Assistance Program



Valley Station Road, KY 907 in 2011 prior to Renewal



2013



2013

This crossing was renewed in August, 2011 using the KY Shortline Assistance Program. A rubber crossing was removed.

The 2013 inspection revealed that the crossing was in near perfect^[a2] condition and very smooth.

Western Kentucky Crossings

Several crossings have been underlain with asphalt during the past several years under a variety of operating conditions. These are discussed individually as follows:

KY 380, Skyline Drive in Hopkinsville

Route/Street	DOT Number	Highway ADT
KY 380, Skyline Dr.	345254U	Heavy
Location	Date Installed	Highway Lanes
Hopkinsville	July, 1999	Three
County	Railroad Company	Type Xing Surface
Christian	CSX	Omni Rubber & Asphalt
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Main & Siding
Railroad Milepost	Rail Annual Tonnage	Comments
OOH 237.93	Very Heavy	Millings or Cold Mix Used for Underlayment



2001- Two Years After Renewal



2006, Main Track Immediately After Renewal 2006, Industry Spur Track, not Renewed in 2006



2011, Mainline on the Left, Siding on the Right

The two crossings were renewed in 1999 using asphalt millings as underlayments and Omni rubber/asphalt for the surface. The crossings performed very well for several years. The mainline was renewed with timber/asphalt surface in 2006.

The 2011 inspection indicated that some of the timbers on the mainline crossing were loose and had deteriorated. The crossing was solid with no pumping. The siding was still performing well with the original surface.

U.S. 60 at Stanley

Route/Street	DOT Number	Highway ADT
U.S. 60	344296C	Moderate
Location	Date Installed	Highway Lanes
Stanley	May 16,2002	Two
County	Railroad Company	Type Xing Surface
Daviess	CSX	Rubber Seal/Asphalt/Timber
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Single
Railroad Milepost	Rail Annual Tonnage	Comments
OHR 123.07	Moderate	KYDOT



2002 Before Renewal



2006

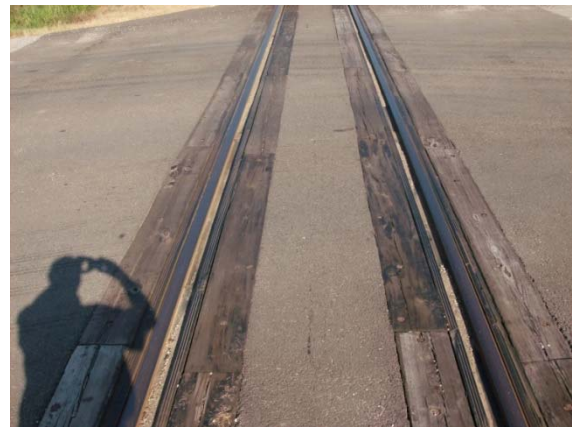


2011 Crossing Still in Perfect Condition





2012 Just Before Replacing Crossing Surface



2013 Timber/Asphalt Surface Placed in 2012 During Timbering Program

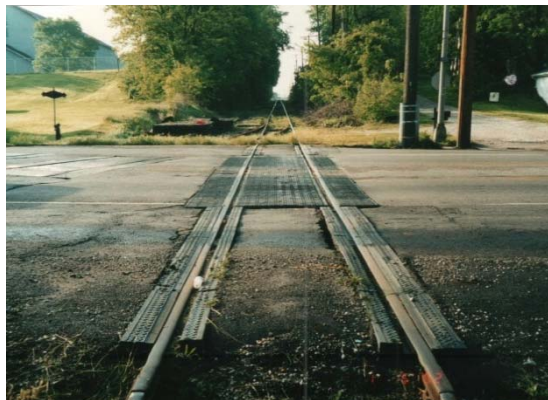
This crossing was renewed with asphalt underlayment and a rubber seal/asphalt surface during 2002 using the fast-track method. KYDOT participated by providing the asphalt and traffic control. The crossing was still in perfect condition in 2012, however during a timbering/surfacing program over the territory the crossing was removed and surfaced through. The track panel was reused.

The 2011 and 2012 inspections indicated that the crossing was in perfect condition with no settlement or deterioration and it was very smooth.

The 2013 inspection revealed that the new crossing surface was very smooth.

U.S. 60, E Main Street in Owensboro

Route/Street	DOT Number	Highway ADT
U.S. 60, East Main St.	344227U	Heavy
Location	Date Installed	Highway Lanes
Owensboro	July 22, 2002	Four
County	Railroad Company	Type Xing Surface
Daviess	CSX	Rubber Seal/Asphalt & Rubber
Highway Milepost	Rail Classification	Number of Tracks
-----	Industry Spur	Single
Railroad Milepost	Rail Annual Tonnage	Comments
~OHR 113	Very Light	KYDOT



2002 Before Renewal



2006



2011

This crossing was renewed in 2002. The field side rubber panels were reused.

The 2011 inspection indicated that the crossing was still smooth, the asphalt had revealed a slight amount and some of the rubber panels were loose. However, the crossing was performing satisfactorily.

The 2013 inspection revealed that the crossing was still smooth and solid with essentially no change from the 2011 inspection.

U.S. 431 at Cleaton

Route/Street	DOT Number	Highway ADT
U.S. 431	347083C	Heavy
Location	Date Installed	Highway Lanes
Cleaton	September 14-16,2002	Two
County	Railroad Company	Type Xing Surface
Muhlenberg	CSX	Concrete
Highway Milepost	Rail Classification	Number of Tracks
-----	Branch	Single
Railroad Milepost	Rail Annual Tonnage	Comments
OOD 176.99	Very Light	KYDOT



2001 Before Renewal



2002 Removing the Old Surface



2002, Soon after Renewal, Note the Crossing was Low





2006



2011



2013 After 11 Years of Service, Containing Numerous Asphalt Patches

This crossing was renewed in 2002. Some problems were encountered with installing the crossing. It was lower than the pavement approaches, which provided impact loadings from the frequent heavily loaded trucks. Periodically the crossing was patched and a few of the broken panels were replaced.

The 2011 inspection indicated that the old crossing surface was still intact, although missing seven field panels. It was still very solid with no settlement and was reasonably smooth for the 70 mph traffic.

The 2013 inspection revealed little change from the 2011 inspection. Panels for a new rubber surface were stacked nearby to use for changing out the surface. The panels had been on site for several months, maybe over a year.

U.S. 41 North of Sebree

Route/Street	DOT Number	Highway ADT
U.S. 41	345374K	Heavy
Location	Date Installed	Highway Lanes
Sebree	August 5,2004	Two
County	Railroad Company	Type Xing Surface
Webster	CSX	Rubber Seal/Asphalt & Rubber
Highway Milepost	Rail Classification	Number of Tracks
-----	Industry Spur	Single
Railroad Milepost	Rail Annual Tonnage	Comments
OHH 300.63	Very Light	KYDOT



2004 Before Renewal



2006

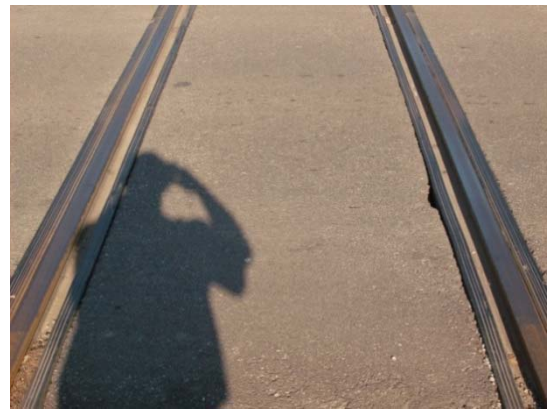


2011 Rubber Panels and Rail were Loose and Deflected Under Heavy Loads





2012 New Surface



2013 After replacing the Rubber/Asphalt Surface

This crossing was renewed in 2004. It had settled significantly and was very rough with pumping and loose rail. Rubber panels were used for the field sides and rubber seal/asphalt was used for the center of the crossing. The resilient rubber deflected under the heavy trucks which impacted the crossing rails. The rails soon loosened and the crossing surface deteriorated. The surface was replaced in 2011 with a rubber seal/asphalt surface.

The 2011 inspection indicated that both the rubber panels and rail were loose and deflecting significantly under the heavy truck loads. The surface needed replacement.

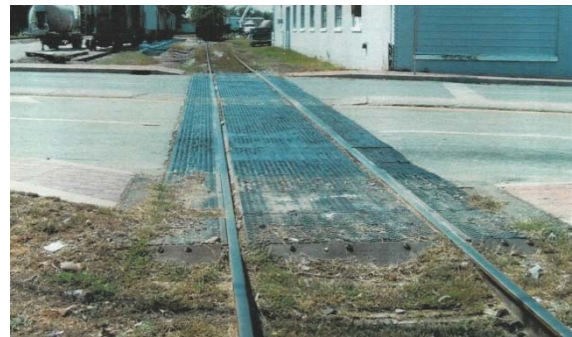
The 2013 inspection revealed that the crossing was very solid and smooth, although the rail appeared to be slightly loose and vibrated under the heavy truck loads.

U.S. 231, S Main Street in Beaver Dam

Route/Street	DOT Number	Highway ADT
U.S. 231, South Main St.	297012R	Heavy
Location	Date Installed	Highway Lanes
Beaver Dam	2009	Four
County	Railroad Company	Type Xing Surface
Ohio	P&L	Composite
Highway Milepost	Rail Classification	Number of Tracks
9.98	Main Line	Main and Siding
Railroad Milepost	Rail Annual Tonnage	Comments
108.6	Moderate	KYDOT



2009- Mainline Before Renewal



2009- Siding Before Renewal



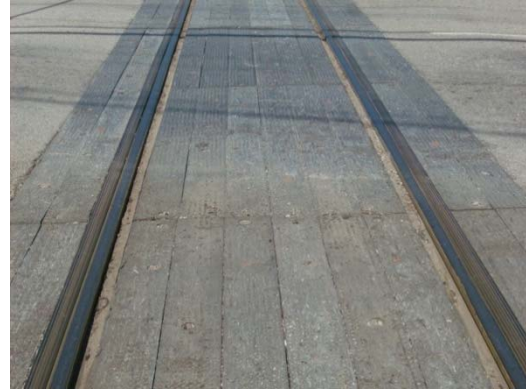
2011



2011



2013 Mainline



2013 Mainline



2013 Siding

These two composite crossings were placed during the renewal of the crossings in 2009.

The 2011 inspection indicated that the mainline was very smooth. The siding was smooth, but the highway approaches were slightly low.

The 2013 inspection revealed similar observations. The crossings were still very smooth and solid.

West Virginia Crossings

The West Virginia DOT began utilizing asphalt underlayments during the rehabilitation of crossings in 2000. Since 2000, an average of seven to eight crossings are normally underlain with asphalt each year, most of which have been on heavy tonnage, high traffic, crossings. Fourteen crossings will be underlain with asphalt in 2013. It is estimated that over 125 crossings have asphalt underlayment, the oldest having been in service 13 years.

Normal practice is to use a high-type surface material, commonly concrete precast panels, and improved support and drainage, achieved with a six in. (150-mm) thick asphalt underlayment. This practice is considered as a betterment program to upgrade crossings for improved performance and increased service life. On crossing rehabilitation projects, WVDOT pays for crossing materials differential, asphalt underlayment, traffic control, drainage pipe, and tie differential.

Since the program began, no crossings have failed due to lack of substructure support or excessive settlement, as they have all remained smooth and serviceable. When WVDOT funds are used for crossing rehabilitation projects, the use of asphalt underlayment is considered as a standard practice.

Following are descriptions for a small sample of crossing renewed with asphalt underlayment. These represent four of the very projects in 2000/2001.

3rd Avenue W. in Huntington

Route/Street	DOT Number	Highway ADT
3rd Ave W.	225718R	Moderate
Location	Date Installed	Highway Lanes
Huntington	August, 2000	Four
County	Railroad Company	Type Xing Surface
Cabell	CSX	Concrete
Highway Milepost	Rail Classification	Number of Tracks
-----	Connector	Single
Railroad Milepost	Rail Annual Tonnage	Comments
CA 502.56	Very Light	WVDOT



3rd Ave W in Huntington in 2000 soon after construction



2011



2011



2013, After 13 Years

This crossing, along with 4th Avenue and 5th Avenue, were renewed on successive days in August, 2000. KSA concrete crossings were used to replace the badly deteriorated timber/asphalt crossings to enhance the rideability of the crossings. These were the initial crossings in the area to use asphalt underlayment. It was placed five inches thick and rolled with a vibratory roller. The ballast was also compacted prior to setting in the new track panel.

The 2011 inspection indicated that the crossing was still very serviceable, although several straps were loose and one strap was missing. One field side panel was badly cracked. The field sides have the 18-inch narrow concrete panels. The street had been resurfaced.

The 2013 inspection revealed that the several straps were still loose or missing, some concrete had spalled, but the crossing was still smooth and solid.

U.S. 60, 4th Avenue W. in Huntington

Route/Street	DOT Number	Highway ADT
U.S. 60, 4th Ave. W.	225716C	Moderate
Location	Date Installed	Highway Lanes
Huntington	August, 2000	Three
County	Railroad Company	Type Xing Surface
Cabell	CSX	Concrete
Highway Milepost	Rail Classification	Number of Tracks
-----	Connector	Single
Railroad Milepost	Rail Annual Tonnage	Comments
CA 502.56	Very Light	WVDOT



2000, Prior to Renewal



2000, After Renewal



2000, After Renewal



2011



2011



2013, After 13 Years

This was the first of the three crossings renewed in August 2000. The technique was similar to the 3rd Avenue installation.

The 2011 inspection indicated that the crossing was still in perfect shape. It may have settled ¼ inch.

The 2013 inspection revealed that the crossing was still in perfect shape, very smooth and solid.

U.S. 60, 5th Avenue W. in Huntington

Route/Street	DOT Number	Highway ADT
5th Ave. W.	225714N	Moderate
Location	Date Installed	Highway Lanes
Huntington	August, 2000	Two
County	Railroad Company	Type Xing Surface
Cabell	CSX	Concrete
Highway Milepost	Rail Classification	Number of Tracks
-----	Connector	Single
Railroad Milepost	Rail Annual Tonnage	Comments
CA 502.56	Very Light	WVDOT



2000, Prior to Renewal



2000, Compacting the Asphalt Underlayment



2000, Compacting the Ballast



2011



2011



2013, After 13 Years

This was the second crossing renewed in August 2000.

The 2011 inspection indicated that the crossing was still very smooth with no pumping, one strap was missing and one was loose. Two of the center panels had minor cracks, crossing may have settled slightly.

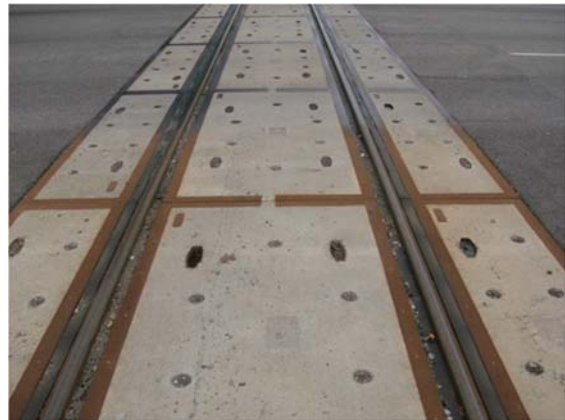
The 2013 inspection revealed that the crossing remains smooth, the street was resurfaced and the crossing was skipped.

U.S. 60, 5th Avenue E. in Huntington

Route/Street	DOT Number	Highway ADT
U.S. 60, 5th Ave. E.	225739J	Moderate
Location	Date Installed	Highway Lanes
Huntington	July 18, 2009	Four
County	Railroad Company	Type Xing Surface
Cabell	CSX	Concrete
Highway Milepost	Rail Classification	Number of Tracks
-----	Connector	Single
Railroad Milepost	Rail Annual Tonnage	Comments
CA 502.56	Very Light	WVDOT



2011



2011



2013, 4 Years After Renewal

This crossing, on the east side of Huntington, was renewed in 2009 using the same procedure as used nine years ago for the three crossings on the west side of Huntington.

The 2011 inspection indicated that the crossing was in perfect condition.

The 2013 inspection revealed that the crossing was performing perfectly.

WV 2 in Ashton

Route/Street	DOT Number	Highway ADT
WV 2	147906R	Moderate
Location	Date Installed	Highway Lanes
Ashton	November 13 & 14, 2001	Two
County	Railroad Company	Type Xing Surface
Mason	CSX	Concrete
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Single
Railroad Milepost	Rail Annual Tonnage	Comments
BN 189.98	Moderate	WVDOT



2003, Two Years after Renewal



2011



2011



2013, 12 Years After Renewal



This crossing was renewed with asphalt underlayment one year after the initial three crossings were renewed in Huntington. The previous crossing was installed in 1996, using conventional practices, and the performance was considered unacceptable within the five year interval. A 130-foot long wood tie panel was used for the 66 foot long concrete surface. The track was back in service within eight hours and the crossing surface and highway approaches were placed the following day.

The 2011 inspection indicated that the crossing was performing essentially perfectly. A couple of the concrete panels were loose and moved slightly under traffic.

The 2013 inspection revealed that the crossing was still in essentially perfect condition. A slight amount of asphalt spalling next to the concrete panels was evident as a result of the natural weathering of the asphalt pavement.

Michigan Crossings

The Michigan Department of Transportation provided support for the use of asphalt underlayment under local agency road crossings in 2002. Ten demonstration projects were selected for “Best Practices” evaluations. Asphalt underlayments with various crossing wearing surfaces were included in the Grade Crossing Surface Repair Issues Study.

The crossings were installed over a four year period. Both Class I and Shortline Railroads were included. The performances of these crossings have been evaluated periodically. No failures have been noted due to subgrade support issues, only normal weathering of the surface material and loosening of the metal strapping at one of the concrete surface crossings has been observed. The crossings have performed very well since asphalt underlayment installation.

Descriptions for the ten projects are provided below:

Kalamazoo Avenue in Lansing

Route/Street	DOT Number	Highway ADT
Kalamazoo Ave.	234417U	Moderate
Location	Date Installed	Highway Lanes
Lansing	October, 2003	Three
County	Railroad Company	Type Xing Surface
Ingham	CSX	Concrete
Highway Milepost	Rail Classification	Number of Tracks
-----	Branch	Single
Railroad Milepost	Rail Annual Tonnage	Comments
CH 87.10	Light	MDOT



2007, four Years after Renewal



2011, eight Years after Renewal, Street was being Widened

The 2011 inspection indicated that the crossing was still in perfect condition, the street was being widened, and thus some mud had been tracked on the crossing as noted in the pictures.

Willow Street in Lansing

Route/Street	DOT Number	Highway ADT
Willow St.	536399J	Moderate
Location	Date Installed	Highway Lanes
Lansing	September, 2004	Two
County	Railroad Company	Type Xing Surface
Ingham	NS/J&LRR	Concrete
Highway Milepost	Rail Classification	Number of Tracks
-----	Industry Spur	Single
Railroad Milepost	Rail Annual Tonnage	Comments
2.21	Very Light	MDOT



2004- Before Renewal



2004- During Construction



2004- During Construction



2007, Three Years after Renewal



2011, Seven Years after Renewal

The 2011 inspection indicated that the crossing was still very smooth and serviceable. However, the strapping was loose on one of the panels and the concrete had spalled as a result.

Pacific Street in Lansing

Route/Street	DOT Number	Highway ADT
Pacific St.	536020U	Moderate
Location	Date Installed	Highway Lanes
Lansing	October, 2006	Two
County	Railroad Company	Type Xing Surface
Ingham	NS/J&LRR	Rubber Seal/Asphalt
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Single
Railroad Milepost	Rail Annual Tonnage	Comments
35.09	Light	MDOT



2007, One Year after Renewal



2011, Five Years after Renewal

The 2011 inspection indicated that the rubber seal/asphalt surface was performing perfectly.

Clifton Street in Three Rivers

Route/Street	DOT Number	Highway ADT
Clifton St.	536490C	Light
Location	Date Installed	Highway Lanes
Three Rivers	June, 2004	Two
County	Railroad Company	Type Xing Surface
St. Joseph	NS/GERW	Rubber Seal/Asphalt
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Double
Railroad Milepost	Rail Annual Tonnage	Comments
12.9	Light	MDOT



2007, Three Years after Renewal



2011, Seven Years after Renewal

The 2011 inspection indicated that the Rubber Seal/Asphalt crossing was performing perfectly.

Fourth Street (Yard Lead) in Three Rivers

Route/Street	DOT Number	Highway ADT
Fourth St.	903807E	Light
Location	Date Installed	Highway Lanes
Three Rivers	November, 2005	Two
County	Railroad Company	Type Xing Surface
St. Joseph	NS/GERW	Composite
Highway Milepost	Rail Classification	Number of Tracks
-----	Yard Lead	Single
Railroad Milepost	Rail Annual Tonnage	Comments
69.68	Very Light	MDOT



2007, Two Years after Renewal

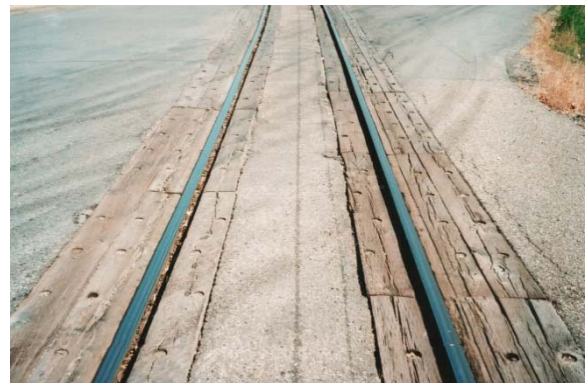


2011, Six Years after Renewal

The 2011 inspection indicated that the composite crossing material was in perfect shape.

Fourth Street (Main Line) in Three Rivers

Route/Street	DOT Number	Highway ADT
Fourth St.	536480W	Light
Location	Date Installed	Highway Lanes
Three Rivers	July, 2007	Two
County	Railroad Company	Type Xing Surface
St. Joseph	NS/GERW	Timber
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Single
Railroad Milepost	Rail Annual Tonnage	Comments
11	Light	MDOT



2007 – Before Renewal

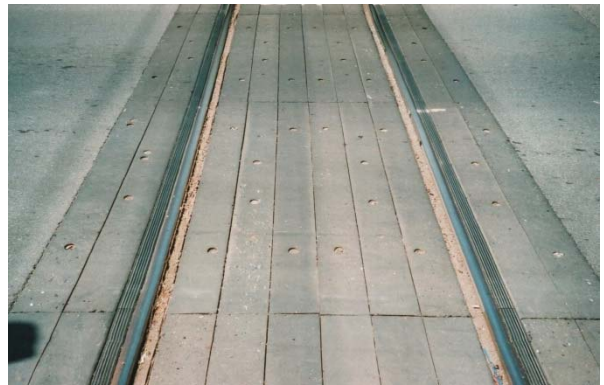


2011, Four Years after Renewal

The 2011 inspection indicated that the all timber crossing was in perfect condition.

W. Liberty Street in Ann Arbor

Route/Street	DOT Number	Highway ADT
W. Liberty St.	000223R	Moderate
Location	Date Installed	Highway Lanes
Ann Arbor	July, 2005	Two
County	Railroad Company	Type Xing Surface
Wash-Wash	Ann Arbor	Composite
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Single
Railroad Milepost	Rail Annual Tonnage	Comments
45.4	Light	MDOT



2007, Two Years after Renewal



2011, Six Years after Renewal

The 2011 inspection indicated that this composite crossing was performing reasonably well, although a few panels were loose and contained minor cracks. The crossing was still very smooth and solid.

State Street in Ann Arbor

Route/Street	DOT Number	Highway ADT
State St.	000209V	Heavy
Location	Date Installed	Highway Lanes
Ann Arbor	August, 2005	Four
County	Railroad Company	Type Xing Surface
Wash-Wash	Ann Arbor	Full-Depth Rubber
Highway Milepost	Rail Classification	Number of Tracks
-----	Main Line	Single
Railroad Milepost	Rail Annual Tonnage	Comments
43.98	Light	MDOT



2005, Spreading the Asphalt Underlayment



2005, Compacting the Asphalt Underlayment



2005, Compacting the Second Lift



2005, Dumping the Ballast on the Underlayment



2007, Two Years after Renewal



2011, Six Years after Renewal

The 2011 inspection indicated that this long crossing was performing perfectly.

3 Mile Road in Grand Traverse

Route/Street	DOT Number	Highway ADT
3-Mile Road	235371L	Moderate
Location	Date Installed	Highway Lanes
Traverse City	August, 2006	Two
County	Railroad Company	Type Xing Surface
Grand Traverse	TBS-MDOT/GLC-MDOT	3-Rail Asphalt
Highway Milepost	Rail Classification	Number of Tracks
-----	Branch	Single
Railroad Milepost	Rail Annual Tonnage	Comments
2.45	Light	MDOT



March, 2009, Three Years after Renewal

This three rail asphalt crossing was renewed with asphalt underlayment in 2006. An inspection in 2009 indicated that the crossing was performing satisfactorily.

Tennessee Crossings

This was a significant project. U.S. 129 at this location, with 35,000 vehicles per day, is one of the heaviest traveled non-access-controlled highways in the state of Tennessee. The planning, scheduling and execution for this project was a cooperative effort of the Tennessee DOT, the cities of Alcoa and Maryville, and CSX Transportation. All four lanes were replaced in a single day. A Sunday was chosen to minimize the effect on the traveling public. Bypass highway routes were chosen so that all four lanes of traffic could be closed.

The highway was closed at 6:00 am. By 12 noon the trackwork was finished and a train could have passed, although that was not necessary as this rail line is a lightly used industry spur. The two new wood tie track panels totaled 141 feet long. The concrete crossing panels totaled 88 feet. Specific attention was given to providing a stable support incorporating asphalt underlayment.

Paving of the approaches began at 3:00 pm. The asphalt approaches were placed with a paver and extended approximately 100 feet from the crossing to transition with the existing pavement beyond the crossing area. All eight lanes of traffic were opened to traffic by 8:00 pm. The only remaining activity was stripping/marking the approaches.

The crossings have remained remarkably smooth for the typical 60 mph traffic. The only maintenance has been minor skin patching of the asphalt approaches. There is no observable settlement of the crossings after 12 years.

U.S. 129 in Alcoa/Maryville

Route/Street	DOT Number	Highway ADT
U.S. 129	347665G	Very Heavy
Location	Date Installed	Highway Lanes
Alcoa/Maryville, TN	June 10, 2001	Four
County	Railroad Company	Type Xing Surface
Blount	CSX	Concrete/Rubber
Highway Milepost	Rail Classification	Number of Tracks
-----	Industry Spur	Single
Railroad Milepost	Rail Annual Tonnage	Comments
KL 290.63	Very Light	TNDOT



2001, Prior to Renewal, Note the Settlement of the Crossing



Dumping & Spreading Asphalt Underlayment



Rolling Ballast on Compacted Asphalt



Finished Project, Two Weeks Later



May, 2008, Slight Releveling of Asphalt Approaches



2010



2010



2012



2012



2012