

Pennsylvania Demonstration Project:
Rehabilitation of SR 3011, Keyser
Avenue, Lackawanna County

Final Technical Brief
August 2015

HIGHWAYS FOR LIFE

Accelerating Innovation for the American Driving Experience.



U.S. Department of Transportation
Federal Highway Administration

FOREWORD

The purpose of the Highways for LIFE (HfL) pilot program is to accelerate the use of innovations that improve highway safety and quality while reducing congestion caused by construction. **LIFE** is an acronym for **L**onger-lasting highway infrastructure using **I**nnovations to accomplish the **F**ast construction of **E**fficient and safe highways and bridges.

Specifically, HfL focuses on speeding up the widespread adoption of proven innovations in the highway community. Such “innovations” encompass technologies, materials, tools, equipment, procedures, specifications, methodologies, processes, and practices used to finance, design, or construct highways. HfL is based on the recognition that innovations are available that, if widely and rapidly implemented, would result in significant benefits to road users and highway agencies.

Although innovations themselves are important, HfL is as much about changing the highway community’s culture from one that considers innovation something that only adds to the workload, delays projects, raises costs, or increases risk to one that sees it as an opportunity to provide better highway transportation service. HfL is also an effort to change the way highway community decision makers and participants perceive their jobs and the service they provide.

The HfL pilot program, described in Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) Section 1502, includes funding for demonstration construction projects. By providing incentives for projects, HfL promotes improvements in safety, construction-related congestion, and quality that can be achieved through the use of performance goals and innovations. This report documents one such HfL demonstration project.

Additional information on the HfL program is at www.fhwa.dot.gov/hfl.

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SI* (MODERN METRIC) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
LENGTH				
(none)	mil	25.4	micrometers	µm
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
AREA				
in ²	square inches	645.2	square millimeters	mm ²
ft ²	square feet	0.093	square meters	m ²
yd ²	square yards	0.836	square meters	m ²
ac	acres	0.405	hectares	ha
mi ²	square miles	2.59	square kilometers	km ²
VOLUME				
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft ³	cubic feet	0.028	cubic meters	m ³
yd ³	cubic yards	0.765	cubic meters	m ³
NOTE: volumes greater than 1000 L shall be shown in m ³				
MASS				
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
TEMPERATURE (exact degrees)				
°F	Fahrenheit	5 (F-32)/9 or (F-32)/1.8	Celsius	°C
ILLUMINATION				
fc	foot-candles	10.76	lux	lx
fl	foot-Lamberts	3.426	candela per square meter	cd/m ²
FORCE and PRESSURE or STRESS				
lbf	poundforce	4.45	Newtons	N
lbf/in ² (psi)	poundforce per square inch	6.89	kiloPascals	kPa
k/in ² (ksi)	kips per square inch	6.89	megaPascals	MPa
DENSITY				
lb/ft ³ (pcf)	pounds per cubic foot	16.02	kilograms per cubic meter	kg/m ³

APPROXIMATE CONVERSIONS FROM SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
LENGTH				
µm	micrometers	0.039	mil	(none)
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
AREA				
mm ²	square millimeters	0.0016	square inches	in ²
m ²	square meters	10.764	square feet	ft ²
m ²	square meters	1.195	square yards	yd ²
ha	hectares	2.47	acres	ac
km ²	square kilometers	0.386	square miles	mi ²
VOLUME				
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m ³	cubic meters	35.314	cubic feet	ft ³
m ³	cubic meters	1.307	cubic yards	yd ³
MASS				
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
Mg (or "t")	megagrams (or "metric ton")	1.103	short tons (2000 lb)	T
TEMPERATURE				
°C	Celsius	1.8C+32	Fahrenheit	°F
ILLUMINATION				
lx	lux	0.0929	foot-candles	fc
cd/m ²	candela per square meter	0.2919	foot-Lamberts	fl
FORCE and PRESSURE or STRESS				
N	Newtons	0.225	poundforce	lbf
kPa	kiloPascals	0.145	poundforce per square inch	lbf/in ² (psi)
MPa	megaPascals	0.145	kips per square inch	k/in ² (ksi)

*SI is the symbol for the International System of Units. Appropriate rounding should be made to comply with Section 4 of ASTM E380. (Revised March 2003)

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ABBREVIATIONS AND SYMBOLS

ADA	Americans with Disabilities Act
ADT	average daily traffic
FHWA	Federal Highway Administration
HfL	Highways for LIFE
HMA	hot mix asphalt
IRI	International Roughness Index
OBSI	onboard sound intensity
OSHA	Occupational Safety and Health Administration
PennDOT	Pennsylvania Department of Transportation
PWL	percent within limits
RSA	road safety audit
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
WMA	warm mix asphalt

INTRODUCTION

HIGHWAYS FOR LIFE DEMONSTRATION PROJECTS

Highways for LIFE (HfL) is the Federal Highway Administration's (FHWA) initiative to advance longer-lasting and promote efficient and safe construction of highways and bridges using innovative technologies and practices. The HfL program provides incentive funding to highway agencies to try proven but little-used innovations on eligible Federal-aid construction projects. The HfL team prioritizes projects that use innovative technologies, manufacturing processes, financing, contracting practices, and performance measures that demonstrate substantial improvements in safety, congestion, quality, and cost-effectiveness. An innovation must be one the applicant State has never or rarely used, even if it is standard practice in other States. Recognizing the challenges associated with deployment of innovations, the HfL program provides incentive funding for up to 15 demonstration construction projects a year. The funding amount typically totals up to 20 percent of the project cost, but not more than \$5 million.

The HfL program promotes project performance goals that focus on the expressed needs and wants of highway users. They are set at a level that represents the best of what the highway community can do, not just the average of what has been done. The goals are categorized into the following categories:

1. Safety

- a. Work zone safety during construction—Work zone crash rate equal to or less than the preconstruction rate at the project location.
- b. Worker safety during construction—Incident rate for worker injuries of less than 4.0, based on incidents reported on Occupational Safety and Health Administration (OSHA) Form 300.
- c. Facility safety after construction—Twenty percent reduction in fatalities and injuries in 3-year average crash rates, using preconstruction rates as the baseline.

2. Construction Congestion

- a. Faster construction—Fifty percent reduction in the time highway users are impacted, compared to traditional methods.
- b. Trip time during construction—Less than 10 percent increase in trip time compared to the average preconstruction speed, using 100 percent sampling.
- c. Queue length during construction—A moving queue length of less than 0.5 miles in a rural area or less than 1.5 miles in an urban area (in both cases at a travel speed 20 percent less than the posted speed).

3. Quality

- a. Smoothness—International Roughness Index (IRI) measurement of less than 48 in/mi.
- b. Noise—Tire-pavement noise measurement of less than 96.0 A-weighted decibels (dB(A)), using the onboard sound intensity (OBSI) test method.

4. User Satisfaction

- a. An assessment of how satisfied users are with the new facility compared to its previous condition and with the approach used to minimize disruption during construction. The goal is a measurement of 4 or more on a 7-point Likert scale.

PROJECT OVERVIEW

As a part of the HfL initiative, the FHWA provided a \$1 million grant to the Pennsylvania Department of Transportation (PennDOT) to rehabilitate a 3.815-mile-long section of SR 3011 in Lackawanna County. The overall intent of the project is to demonstrate and encourage PennDOT district representatives and construction industry leaders to implement innovations such as road safety audits (RSA), warm mix asphalt (WMA), intelligent compaction, Safety Edge, and longitudinal joint best practices.

This multi-year project is scheduled for completion in October 2015. This report documents project progress until the end of February 2015 and primarily details the RSA that was completed. The remaining innovations are targeted for completion during the 2015 construction season. Mainline paving is scheduled to start in July 2015.

PROJECT DETAILS

PROJECT BACKGROUND AND LOCATION

This project involves restoration, resurfacing, and rehabilitation of a section of SR 3011 that extends from the Pennsylvania Turnpike Northeast Extension (I-476) through the city of Scranton, as shown in figure 1. This section of SR 3011 is also known as Keyser Avenue and carries average daily traffic (ADT) of about 16,000 vehicles per day, with 8 percent being truck traffic.

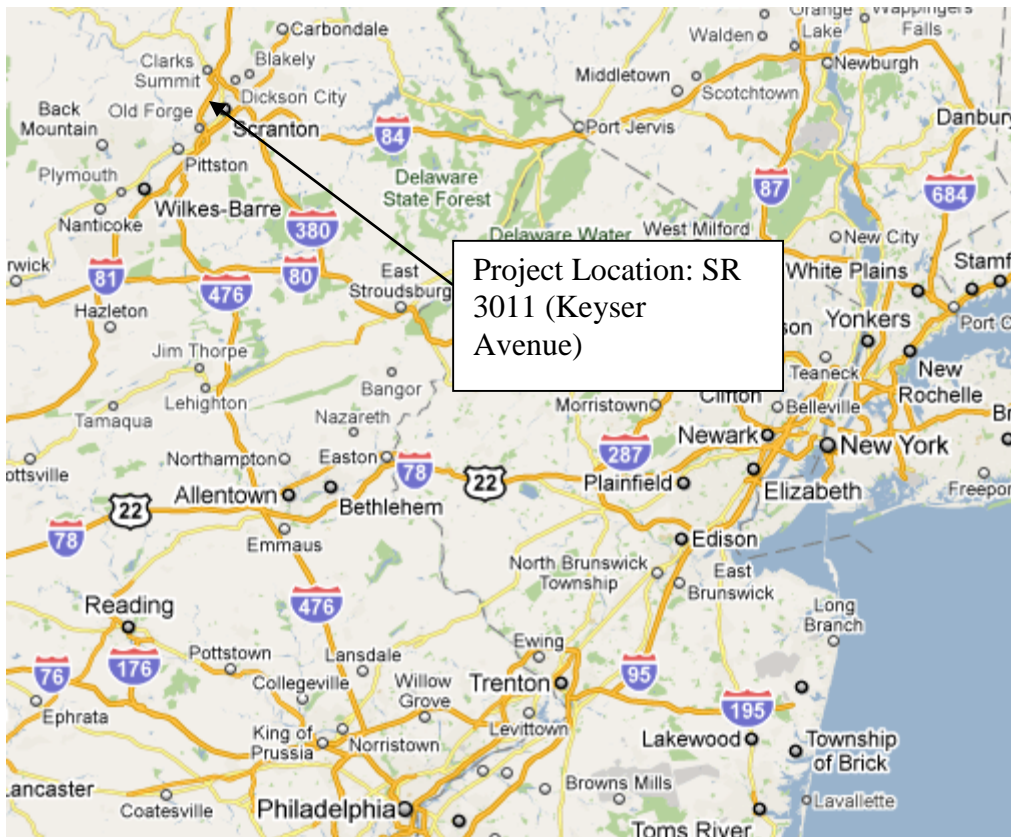


Figure 1. Map. Project location. (courtesy: Google Maps)

The purpose of this project is to reduce congestion and roadway deterioration, thereby improving safety conditions and accessibility for social and emergency services in the area. This project will also improve local and regional commerce. Figures 2 through 5 show the current condition of the roadway.

The project scope includes rehabilitation and widening to accommodate two 12-foot travel lanes with 8-foot shoulders, including intermittent turning lanes through the project length. Additional work includes replacement of existing curbing, installation of new curbing, traffic signals, addition of left turning lanes at four intersections (Oak, Continental, Jackson, and Loop Streets), cleaning and/or replacing drainage facilities, and replacement of two deficient structures. Accommodations to comply with the Americans with Disabilities Act (ADA) are also included.



Figure 2. Photo. Existing roadway showing deteriorated condition.



Figure 3. Photo. Existing roadway showing deterioration and truck traffic.



Figure 4. Photo. Existing roadway showing severe fatigue cracking and other distresses.



Figure 5. Photo. Close-up of existing roadway showing severe fatigue cracking and other distresses.

INNOVATIONS

This project includes several innovations designed to enhance safety and durability:

1. Road safety audit.
2. Safety Edge bituminous paving technique.
3. Warm mix asphalt.
4. Intelligent compaction.
5. Best practices to obtain high longitudinal joint density.

These innovations are described below.

To date, the RSA has been successfully completed. Findings from the RSA have been addressed by including them in the project plans and specifications. The other innovations listed above are related to pavement construction and will be incorporated into the project during the 2015 construction season. Contract specifications for these items have been included in this brief for follow-up at a later date.

Road Safety Audit

An RSA is an examination of the safety performance of a roadway or intersection by an independent multidisciplinary team. The RSA is not intended as a replacement for design quality assurance or standard compliance checks, a traffic impact study, or a design safety review. Neither is an audit intended as a means for evaluating design work, checking compliance with standards, or investigating crashes.

The RSA for this project was performed by a team that included representatives from traffic safety, traffic studies, plans engineering, county maintenance and the police department. This independent team conducted both daytime and nighttime reviews of the project location. They also reviewed maintenance concerns and the most current 5-year crash data for the location to:

1. Identify potential safety issues that may be addressed by the project that would reduce the risk and severity of crashes.
2. Improve traffic flow along this section of roadway.
3. Improve mobility of pedestrians walking through this section of roadway.

The RSA team noted the following benefits of the project from the plan review in their report:

1. The wider shoulders will increase the recovery area for errant vehicles leaving the roadway, improve sight distance, and allow for emergency pull-off areas.
2. Curbing along sections of Keyser Avenue will improve access control.
3. Two new traffic signals will improve access onto and turning off of Keyser Avenue.
4. Traffic flow will improve along the roadway.
5. Drainage improvements along the roadway will better collect stormwater runoff and lessen water on the roadway.

6. Accessible curb ramps will be constructed in accordance with ADA requirements at all signalized intersections and at locations where existing curbs create barriers to access.

The RSA team made 42 observations with recommendations for improvement from the reviews for the project's designer, owner, and maintenance workforce to consider. These were separated into the following categories:

1. Priority 1A: Those improvements that can be made in the immediate future by highway maintenance personnel (2 observations).
2. Priority 1B: Those improvements that can be included with the roadway design (34 observations).
3. Priority 2: Those improvements that can be implemented as part of a future construction project or when funding becomes available (4 observations).

The RSA team's report is provided in its entirety in appendix A.

Safety Edge

Safety Edge is a bituminous paving technique that places a 30 degrees to 35 degrees angled wedge at the graded material interface in asphalt resurfacing projects. This replaces the near-vertical pavement edge that is normally incorporated and which can contribute to drivers losing control when attempting to recover from a roadway departure. A FHWA brochure highlights how the technology works, provides quick facts and contact information for training.⁽¹⁾ To date, Pennsylvania has incorporated Safety Edge on only a few pilot projects.

The SR 3011 project will incorporate the Safety Edge technique throughout the extent of the project. Existing areas of shoulders throughout the project that are not curbed and where there is no guiderail will benefit from the Safety Edge. The contract documents specify that any additional bituminous material necessary for the Safety Edge, the cost of establishing the paving technique, and assisting Department personnel with evaluation of the Safety Edge are incidental to shoulder paving items. The Safety Edge is not required on the intersecting side streets on this project.

PennDOT plans to compare postconstruction crash statistics with preconstruction crash data to evaluate the effectiveness of the Safety Edge on this project.

Warm Mix Asphalt

FHWA's Every Day Counts brochure on WMA states:⁽²⁾

Warm mix asphalt (WMA) is the generic term for a variety of technologies that allow asphalt mixtures to be produced, transported, placed, and compacted at lower temperatures. WMA technologies typically result in temperatures 30 to 75 degrees Fahrenheit lower than traditional hot-mix asphalt (HMA). Because less energy is needed to heat the asphalt mix, in many cases, less fuel is required to produce WMA. Fuel consumption during WMA production may be reduced by

20 percent with proper production plant modifications. It is a proven technology that can:

1. Improve compaction that improves pavement performance.
2. Reduce fuel or energy usage.
3. Improve worker comfort by reducing exposure to higher temperatures, fuel emissions, fumes, and odors.

In addition, WMA technologies allow asphalt mixtures to be hauled longer distances and can extend the paving season due to WMA's ability to maintain workability at lower temperatures. The proper use of WMA may result in reduced overall paving costs.

WMA technologies use chemicals, waxes, organic additives, water-bearing minerals, water, or a combination of technologies that allow the asphalt binder to remain fluid at lower temperatures during mixing to completely coat the aggregates.

The benefits of WMA are significant to States like Pennsylvania that experience cold temperatures, limited construction seasons, and extensive night paving, especially on large projects located in or near cities, as they reduce traffic disruption and congestion. Because of these benefits, PennDOT has implemented WMA aggressively. Contractors in the State placed over 1.5 million tons of WMA in 2013 and over 2.2 million tons in 2014.

This project will utilize four different types of flexible pavement resurfacing, including three types of WMA and traditional hot mix asphalt (HMA). The goal is to compare two new experimental types of WMA, one chemical and one organic, to traditional HMA and a foaming additive WMA, which PennDOT has had experience in using. The four types of surfaces will be placed in separate, equal sections over 5,000 feet long on both sides of the roadway. The project paving operations will be broken down as follows:

1. Sta. 347+60 to Sta. 397+89: WMA #1 Organic (Sonne Warm Mix, manufactured by Sonneborn, Inc.).
2. Sta. 397+89 to Sta. 448+25: WMA #2 Foaming.
3. Sta. 448+25 to Sta. 498+47: WMA #3 Chemical (Cecabase RT, manufactured by Arkema, Inc.).
4. Sta. 498+47 to Sta. 548+75: HMA control section.

PennDOT plans to document observations during construction and perform evaluation of the sections for performance once construction is completed.

Intelligent Compaction

Intelligent compaction uses vibratory rollers equipped with a measurement/documentation system that automatically displays and records various critical compaction parameters in real time during the process of compacting the road materials. Parameters of the intelligent compaction process include:

1. An intelligent compaction measurement value that is related to the stiffness of in-place material.
2. Asphalt temperature.
3. Location and number of roller passes.

The rollers are typically equipped with an integrated measurement system, global positioning system-based mapping, onboard computer reporting system, and (optionally) a feedback control.

Intelligent compaction rollers can compact greater amounts of pavement with fewer passes than the traditional static rollers, resulting in efficiencies in terms of time, cost, and fuel savings. Furthermore, using intelligent compaction technology reduces the possibility of under- or over-rolling.

Prior to bidding this project, PennDOT had tried intelligent compaction experimentally as part of a pooled fund study for soil compaction but had never used the technology for paving operations. The agency has included detailed specifications (shown in Appendix F) on intelligent compaction paving for this project that are applicable to the northbound side of the four wearing courses. The specifications also include a requirement for on-site training by the equipment manufacturer and training on how to use the data.

PennDOT expects that intelligent compaction will be more efficient than conventional rolling and will yield improved compaction uniformity, particularly along longitudinal joints.

Longitudinal Joint Density and Durability

Low joint density is a primary cause of premature longitudinal joint distress. If the density can be improved in the vicinity of longitudinal joints, the longevity of the overall pavement section may be improved.

PennDOT developed an incentive/disincentive specification based on pavement cores obtained directly over the longitudinal joint. A percent within limits (PWL) statistic determines the incentive/disincentive for joint density. PennDOT will apply this specification on this project in conjunction with intelligent compaction and the images obtained from the intelligent compaction equipment both over the joint and directly adjacent to the joint.

The project specifications also include incentive payments for achieving desirable pavement ride quality of IRI of less than 48 inches per mile and for achieving tire-pavement noise of 96.0 decibels or less. PennDOT plans to compare the tire-pavement noise of the three WMA mixes with the HMA mix as well.

**APPENDIX A
ROAD SAFETY AUDIT REPORT**

**SR 3011(Keyser Avenue) Section 203 & 271
Segment 0090, Offset 0793 to Segment 0170, Offset 1019
Taylor Borough and City of Scranton, Lackawanna County**

**Resurfacing, Restoration, Rehabilitation (3R) Project
Design Phase RSA**

MAY 2011



Prepared by:



**Pennsylvania Department of Transportation
Engineering District 4-0
55 Keystone Industrial Park
Dunmore, PA**

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**Road Safety Audit Report
SR 3011 (Keyser Avenue) Section 203 & 271
Segment 0090, Offset 0793 to Segment 0170, Offset 1019
Taylor Borough and City of Scranton, Lackawanna County
Resurfacing, Restoration, Rehabilitation (3R) Project
Design Phase RSA**

Introduction

The Pennsylvania Department of Transportation (PennDOT) conducted a Road Safety Audit (RSA). The purpose was to identify potential road safety issues and recommend improvements to correct those issues for inclusion into the project.

Scope of Audit

The Safety Audit Team met to conduct a formal Design Phase Road Safety Audit along SR 3011 (Keyser Avenue) located in the Borough of Taylor and the City of Scranton, Lackawanna County. The limits of work for the project begin at Segment 0090, Offset 0793 and end at Segment 0170, Offset 1019, for a total of 3.85 miles. The goal of this Road Safety Audit was to identify potential road safety issues and identify opportunities for safety improvements for all road users and pedestrians. The RSA was not intended as a replacement for design quality assurance or standard compliance checks, a traffic impact study, or a design safety review. Neither was the audit intended as a means of evaluating design work, checking compliance with standards, or investigating crashes. Instead, the team strived to consider safety issues from a different perspective and develop recommendations for potential safety enhancements.

Objectives

1. To identify potential safety issues that may be addressed by the proposed project thereby reducing the risk and severity of crashes.
2. To improve traffic flow along this section of roadway.
3. To improve mobility for pedestrians walking through this section of Keyser Avenue.

Project Elements

1. Installation of two (2) new traffic signals.
2. Upgrades to three (3) existing traffic signals.
3. Roadway and shoulder widening.
4. Roadway milling, base repair, and resurfacing.
5. Installation of two (2) new box culverts.
6. Installation of new drainage facilities and improvements to existing stormwater system.
7. Construction of turning lanes.
8. Construction of ADA compliant curb ramps.
9. Upgrades to traffic signing.
10. Access control for driveways.

The Briefing Meeting for the RSA Team was held on Tuesday May 10, 2011 at 8:00 AM at the PennDOT District Office located in Dunmore, Pennsylvania.

The Briefing Meeting was attended by:

- | | |
|-------------------------------|---------------------------------------------------|
| 1. Robert Wasilchak, P.E. | PennDOT District 4, Traffic Studies/Safety |
| 2. Bob Zilla | PennDOT District 4, Traffic Safety |
| 3. Keith Williams, P.E., PTOE | PennDOT District 4, Traffic Engineer |
| 4. Ed Armusik, P.E. | PennDOT District 4, Plans Engineer |
| 5. Tom Opalka, P.E. | PennDOT District 4, Lackawanna County Maintenance |
| 6. Terry McHenry | PennDOT District 4, Permits |
| 7. Brandon Motuk, P.E. | PennDOT Bureau of Construction and Materials |
| 8. Cpl. Richard Bachman | Scranton Police Department |
| 9. Sgt. William Roche | Taylor Police Department |
| 10. Jaime Tuddao, P.E. | Nevada Department of Transportation |

Topics of discussion at the briefing meeting:

1. Road Safety Audit purpose, procedures, objectives, and goals.
2. SR 3011 (Keyser Avenue) safety issues.
3. Crash data - most current 5 years of data (January 1, 2006 to December 31, 2011)
4. Current traffic operations.
5. Maintenance concerns.

Following the briefing meeting, the Audit Team traveled to the subject roadway for a daytime review. All persons present at the briefing meeting also attended the daytime review.

A nighttime review of the road was also conducted on Tuesday May 10, 2011 at 8:00 PM. Several concerns discovered during the night review were included with the observations. The following team members participated in the nighttime review:

- | | |
|-------------------------------|--------------------------------------------|
| 1. Robert Wasilchak, P.E. | PennDOT District 4, Traffic Studies/Safety |
| 2. Bob Zilla | PennDOT District 4, Traffic Safety |
| 3. Keith Williams, P.E., PTOE | PennDOT District 4, Traffic Engineer |
| 4. Ed Armusik, P.E. | PennDOT District 4, Plans Engineer |
| 5. Cpl. Richard Bachman | Scranton Police Department |

6. Jaime Tuddao, P.E. Nevada Department of Transportation

The debriefing meeting was held on Wednesday May 11, 2011 at 8:00 AM at the PennDOT District 4-0 office in Dunmore, PA. The meeting was attended by the following persons:

1. Robert Wasilchak, P.E. PennDOT District 4, Traffic Studies/Safety
2. Bob Zilla PennDOT District 4, Traffic Safety
3. Keith Williams, P.E., PTOE PennDOT District 4, Traffic Engineer
4. Ed Armusik, P.E. PennDOT District 4, Plans Engineer
5. Tom Opalka, P.E. PennDOT District 4, Lackawanna County Maintenance
6. Terry McHenry PennDOT District 4, Permits
7. Brandon Motuk, P.E. PennDOT Bureau of Construction and Materials
8. Cpl Richard Bachman Scranton Police Department
9. Jaime Tuddao, P.E. Nevada Department of Transportation

SR 3011 (Keyser Avenue) Segment 0090, Offset 0793 to Segment 0170, Offset 1019

General information:

1. The existing roadway is comprised of one travel lane in each direction with a separate left turn lane on Keyser Avenue at the signalized intersections.
2. The functional classification of SR 3011 (Keyser Avenue) is an Urban Principal Arterial.
3. The total length of the project is 3.85 miles.
4. The posted speed limit is 35 mph for the length of the project.
5. The current (2011) ADT estimates vary from 12,490 vpd to 15,861 vpd as follows:
6. 12,791 vpd –beginning of project 0090/0793 to 0090/1584 Oak St (SR 3012)
7. 12,490 vpd - 0090/1584 to 0120/0000 Ransom Rd (SR 3002) / Continental St
8. 12,957 vpd - 0120/0000 Ransom Rd (SR 3002) / Continental St to 0120/2535 Dalton St (SR 3014)
9. 14,187 vpd – 0120/2535 Dalton St to 0130/0352 Jackson St (SR 3003)
10. 15,861 vpd – 0130/0352 Jackson St (SR 3003) to end of project 0170/1019
11. The truck percentage varies from 6.0% to 9.0% along the length of the project.
12. The crash data reviewed consisted of reportable crashes for the most current 5 years of data available in the PennDOT CDART system (January 1, 2006 to December 31, 2010).
 - a. The crash data revealed a total of 153 crashes summarized as follows:
13. Predominant Crash Type - Rear End 72 crashes (47%); followed by 41 Angle crashes (27%); and 19 Hit fixed object type crashes (12%).
14. Crash Severity – 61 Property damage only crashes (40%); followed by 48 crashes with Unknown Severity (31%); and 35 Minor Injury crashes (23%).
15. Road Condition – 128 crashes occurred on a dry road surface (84%) followed by 13 crashes in wet conditions (8%).
16. Illumination – 118 crashes occurred during daylight hours (77%) followed by 25 crashes occurred with street lights (18%).
17. Driver Actions – 166 of the crashes were coded as “No Contributing Action” (47%); followed by 35 crashes with Unknown actions (10%); and 33 crashes were coded as “Driver Was Distracted” (9%).

Existing Conditions

The following observations of existing conditions were noted as part of the field review:

1. Turning lanes are present at several intersections.
2. Keyser Avenue is comprised of mainly tangent sections of roadway.
3. Overhead street lighting is present at areas along the road, and businesses contribute ambient lighting to illuminate the signs and roadway.
4. Minimal pedestrian activity was observed along the roadway.
5. Some of the utility poles along Keyser Avenue were located at the right-of-way line.
6. Guiderail was present in areas along Keyser Avenue.
7. The clear zones along the roadside were reasonably good.
8. Most of the signs were visible along the road.
9. Drainage structures are enclosed and/or protected by guiderail.

Project Benefits

The following benefits of the proposed project were noted from the plan review:

1. The wider shoulders will increase the recovery area for errant vehicles leaving the roadway, improve sight distance, and allow for emergency pull-off areas.
2. Curbing along sections of Keyser Avenue will improve access control.
3. Two (2) new traffic signals will improve access onto and turning off of Keyser Avenue.
4. Traffic flow will improve along the roadway.
5. Drainage improvements along the roadway will better collect stormwater runoff and lessen water on the roadway.
6. Handicapped accessible curb ramps will be constructed in accordance with ADA requirements at all signalized intersections, and at locations where existing curbs create barriers to access.

The observations, comments, and recommendations from the May 10, 2011 briefing meeting and field reviews, and the May 11, 2011 debriefing meeting are compiled below with a priority grade and recommendations from the audit team. Please note that the bulleted items are observations, and the recommendations are in ***bold italics***.

Priority Grading

Priority 1A – is defined as those improvements that can be done in the immediate future by PennDOT staff or maintenance crews.

Priority 1B – is defined as those improvements that can be included with the roadway design improvements.

Priority 2 – is defined as those improvements that can be implemented as part of a future construction project or when funding becomes available.

General Observations to be considered along the entire project:

1. There are numerous driveway openings along Keyser Avenue that are wide and do not control ingress/egress.
 - a. ***Priority 1B – Review the widths of the driveway openings in accordance with Title 67, PA Code Chapter 441.***
2. A two-way center left turn lane would allow turning vehicles a refuge without blocking through traffic.
 - a. ***Priority 1B - Review the roadway cross-sections for the inclusion of a two-way center left turn lane where possible.***
3. The existing utility poles near/in sidewalks do not provide enough clearance for pedestrians/handicapped.
 - a. ***Priority 1B – Review all utility poles that will be relocated as part of the project to ensure a minimum 3 ft clearance on the sidewalk.***
4. The pedestrian crossings at all non-signalized intersections do not appear ADA compliant.
 - a. ***Priority 1B - Verify ADA compliance at all non-signalized intersections.***
5. The end treatments on guiderail should not end in front of a utility pole.
 - a. ***Priority 1B – Review the guiderail designs to ensure guiderail does not end at a fixed object.***
6. Separate left turn phasing for both approaches of Keyser Avenue at the signalized intersections would make turning movements safer.
 - a. ***Priority 1B - Review all signalized intersections for appropriate left turn phasing. If phasing cannot be included at this time, install a signal controller and wiring that is able to accommodate the phasing in the future.***
7. A police presence during construction activities would slow traffic making the work zone safer.
 - a. ***Priority 1B – Review schedules and request local or state police to monitor traffic in the work zone.***
8. The temporary roadway detour around the bridge on Main Avenue at the opposite end of Oak Street (SR 3012) should be opened before work begins on Keyser Avenue to relieve some of the traffic congestion.

- a. ***Priority 1B – Review the project schedule for the Main Avenue project to determine when this temporary road can be opened.***
9. Installing backplates on the signal heads at intersections will increase their visibility to motorists.
 - a. ***Priority 1B – Install backplates on the signal heads at the signalized intersections.***
10. Seatbelt and DUI signing should be added to the project to increase awareness.
 - a. ***Priority 1B – Review the signing plan for inclusion of “Buckle-Up” (I14-6A) and “DUI” (I60-1) signing.***

Observations from the field review:

1. At the intersection with Oak Street (SR 3012), pedestrians cross outside of the crosswalk. How can pedestrians be encouraged to cross at the intersection?
 - a. ***Priority 1B – Review the design for the location of crosswalks and concrete curbing.***
2. Traffic traveling northbound on Keyser Avenue approaching the proposed signal at Oak Street (SR 3012) might not see the signal or vehicles stopped at the intersection.
 - a. ***Priority 1B – Check sight distance on northbound Keyser Avenue to proposed signal at Oak Street; a “signal ahead” sign may be needed.***
3. There are several mailboxes on posts close to the edge of the roadway that can be hit.
 - a. ***Priority 2 – Relocate the mailboxes away from the roadside.***
4. A fire hydrant on the northwest corner of the intersection with Oak Street (SR 3012) appears to be located in a sidewalk on the plans.
 - a. ***Priority 1B – Verify that the fire hydrant will not restrict access to the sidewalk (3 ft clearance).***
5. Drainage along the west side of Keyser Avenue should be reviewed.
 - a. ***Priority 1B – Verify that the proposed drainage improvements are sufficient to control stormwater runoff.***



STA 355+00 Looking northbound from Oak Street

1. The driveway/parking lot opening at Alfieri's Restaurant is too wide and should be restricted.
 - a. ***Priority 1B – Verify that the driveway opening will be 24 ft wide in accordance with Department standards.***
2. The concrete sidewalk at the edge of the gravel parking for Alfieri's should be made ADA accessible.
 - a. ***Priority 2 – This transition can be addressed as part of a future sidewalk project in the Borough.***
3. ADA accessible ramps are needed on east side of intersection with William Street.
 - a. ***Priority 1B – Include appropriate ADA accessible ramps on the east side of intersection with William Street.***
4. Pavement base repair is needed along Keyser Avenue through the intersection with William Street.
 - a. ***Priority 1B – Include additional pavement base repair at this location.***

5. ADA ramps are needed at the intersection with Prince Street.
 - a. ***Priority 1B – Include appropriate ADA accessible ramps on the east side of intersection with Prince Street.***

6. In the area north of Prince Street, the pavement is in poor condition with rutting and cracking.
 - a. ***Priority 1B – Include milling and overlay, or use a leveling course and overlay from the intersection with Prince Street north to where milling starts.***

7. Trees and brush are close to the travel lane on the west side of Keyser Avenue in the area of Spott Street.
 - a. ***Priority 1A – Department forces can trim the trees and brush in this area.***

8. A parallel pipe is shown on the plan that will be installed on the west side of Keyser Avenue in the area of Spott Street. Is this pipe needed or can an open swale be graded?
 - a. ***Priority 1B – Review the drainage plan and calculations to determine if the pipe can be eliminated.***

9. At STA 378+00 on the east side of Keyser Avenue, an inlet and cross pipe would be beneficial to keep roadway stormwater runoff from washing out residents' yards and driveways.
 - a. ***Priority 1B – Review the drainage plan and calculations to determine if an inlet and cross pipe can be added.***

10. At STA 381+75, recommend eliminating the inlet on the west side of the roadway and install a headwall at end of open swale.
 - a. ***Priority 1B – Review the drainage plan and calculations to determine if the inlet can be replaced.***

11. At STA 398+75, extend outlet pipe and add fill around pipe to move open ditch farther from roadway.
 - a. ***Priority 1B – Review the drainage and roadway plans to determine if the pipe can be extended.***



STA 400+00 Looking northbound toward Continental Street

1. At approximate STA 399+00 approaching intersection with Ransom Road (SR 3002) / Continental Street northbound, a “Signal Ahead Sign” and/or “Watch for Stopped Vehicles” signs may be needed. Sight distance to back of a vehicle of a stopped vehicle is restricted by the crest vertical curve in the roadway.
 - a. ***Priority 1B – Review the sight distance and roadway plans to determine if the roadway grade can be lowered and/or install the appropriate warning devices.***
2. At the intersection with Ransom Road (SR 3002) / Continental Street, the signing for McDade Park needs to be replaced.
 - a. ***Priority 1B – Replace the existing deteriorated signs with new signs.***
3. Northbound trucks turning onto Continental Street would benefit from a right turn lane.
 - a. ***Priority 2 – Recommend the addition of a deceleration lane for northbound trucks turning right onto Continental Street.***
4. Base repair is needed through the intersection of Continental Street.
 - a. ***Priority 1B – Include additional pavement base repair at this location.***

5. The “To 81” directional signing near the corner of Continental Street may block drivers seeing pedestrians waiting to cross. Add another set of directional signs to the far left corner of intersection.
 - a. ***Priority 1B – Recommend relocating “To 81” directional signing farther back along Continental Street and install an additional set of directional signs on the far left corner of the intersection.***
6. The lengths of the crosswalks at the intersection with Continental Street appear long.
 - a. ***Priority 1B – Review the crosswalk locations to determine if any could be relocated for a shortened crossing distance.***
7. The box culvert north of the intersection with Ransom Road (SR 3002) / Continental Street ends close to the edge of pavement.
 - a. ***Priority 1B – Recommend extending the box culvert farther from the roadway.***
8. Stormwater runoff on the east side of Keyser Ave might bypass the inlet at STA 415+20 and collect at Continental Street.
 - a. ***Priority 1B – Verify the inlet location and grate type are designed adequately to collect runoff.***
9. Incorporate the protected-prohibited/protected-permitted phasing at Dalton Street (SR 3014) to change operation during certain times of the day.
 - a. ***Priority 2 – Currently, this type of signal phasing is not approved for use in Pennsylvania, recommend implementing this phasing when approved by the Dept.***
10. Between STA 443+00 and STA 447+00 the pavement marking arrows for the proposed center two-way left turn lane are drawn on the plans incorrectly. Review plans for other similar sections.
 - a. ***Priority 1B – Revise the pavement marking plan to show the correct arrangement.***
11. Between STA 458+00 and STA 468+00, can a two-way left turn lane be added?
 - a. ***Priority 1B – Recommend reviewing the roadway cross-sections to determine if a two-way center left turn lane can be added.***
12. There is a large radius proposed at the intersection with Loop Street.

- a. ***Priority 1B – Recommend reviewing the truck turning radius to determine if the appropriate radius can be smaller.***



STA 549+50 Looking southbound from Ferdinand Street

1. The southbound lane configuration for the merge area approaching the intersection with Ferdinand Street appears to be confusing.
 - a. ***Priority 1A – Recommend revising the pavement markings and/or signing to better direct motorists to the appropriate travel lanes.***
2. At the northwest corner of the intersection with Ferdinand Street, there is a fire hydrant in the middle of the sidewalk that restricts pedestrians.
 - a. ***Priority 1B – Recommend relocating the fire hydrant to allow access to the sidewalk.***
3. At the northwest corner of the intersection with Ferdinand Street, the foundation for the existing mast arm is too high creating a tripping hazard.
 - a. ***Priority 1B – Recommend adjusting the top of the foundation to eliminate the hazard.***

4. Backplates should be added to the signal at the intersection with Ferdinand Street to increase visibility.
 - a. **Priority 1B –Install backplates on the signal heads at this intersection.**

Summary of Recommendations

Priority 1A – Recommended improvements that can be done in the immediate future by PennDOT staff or maintenance crews.

1. *Department forces can trim the trees and brush in this area.*
2. *Recommend revising the pavement markings and/or signing to better direct motorists to the appropriate travel lanes.*

Priority 1B – Recommended improvements for inclusion with this project.

1. *Review the widths of the driveway openings in accordance with Title 67, PA Code Chapter 441.*
2. *Review the roadway cross-sections for the inclusion of a two-way center left turn lane where possible.*
3. *Review all utility poles that will be relocated as part of the project to ensure a minimum 3 ft clearance on the sidewalk.*
4. *Verify ADA compliance at all non-signalized intersections.*
5. *Review the guiderail designs to ensure guiderail does not end at a fixed object.*
6. *Review all signalized intersections for appropriate left turn phasing. If phasing cannot be included at this time, install a signal controller and wiring that is able to accommodate the phasing in the future.*
7. *Review schedules and request local or state police to monitor traffic in the work zone.*
8. *Review the project schedule for the Main Avenue project to determine when this temporary road can be opened.*
9. *Install backplates on the signal heads at the signalized intersections.*
10. *Review the signing plan for inclusion of “Buckle-Up” (114-6A) and “DUI” (160-1) signing.*
11. *Review the design for the location of crosswalks and concrete curbing.*
12. *Check sight distance on northbound Keyser Avenue to proposed signal at Oak Street; a “signal ahead” sign may be needed.*
13. *Verify that the fire hydrant will not restrict access to the sidewalk (3 ft clearance).*
14. *Verify that the proposed drainage improvements are sufficient to control stormwater runoff.*
15. *Verify that the driveway opening will be 24 ft wide in accordance with Department standards.*
16. *Include appropriate ADA accessible ramps on the east side of intersection with William Street.*
17. *Include additional pavement base repair at this location.*

18. *Include appropriate ADA accessible ramps on the east side of intersection with Prince Street.*
19. *Include milling and overlay, or use a leveling course and overlay from the intersection with Prince Street north to where milling starts.*
20. *Review the drainage plan and calculations to determine if the pipe can be eliminated.*
21. *Review the drainage plan and calculations to determine if an inlet and cross pipe can be added.*
22. *Review the drainage plan and calculations to determine if the inlet can be replaced.*
23. *Review the drainage and roadway plans to determine if the pipe can be extended.*
24. *Review the sight distance and roadway plans to determine if the roadway grade can be lowered and/or install the appropriate warning devices.*
25. *Replace the existing deteriorated signs with new signs.*
26. *Include additional pavement base repair at this location.*
27. *Recommend relocating "To 81" directional signing farther back along Continental Street and install an additional set of directional signs on the far left corner of the intersection.*
28. *Review the crosswalk locations to determine if any could be relocated for a shortened crossing distance.*
29. *Recommend extending the box culvert farther from the roadway.*
30. *Verify the inlet location and grate type are designed adequately to collect runoff.*
31. *Revise the pavement marking plan to show the correct arrangement.*
32. *Recommend reviewing the roadway cross-sections to determine if a two-way center left turn lane can be added.*
33. *Recommend reviewing the truck turning radius to determine if the appropriate radius can be smaller.*
34. *Recommend relocating the fire hydrant to allow access to the sidewalk.*
35. *Recommend adjusting the top of the foundation to eliminate the hazard.*
36. *Install backplates on the signal heads at the intersection of Keyser Avenue & Ferdinand Street.*

Priority 2 – Recommended improvements that can be implemented as part of a future construction project or when funding becomes available.

1. *Relocate the mailboxes away from the roadside.*
2. *This transition can be addressed as part of a future sidewalk project in the Borough.*
3. *Recommend the addition of a deceleration lane for northbound trucks turning right onto Continental Street.*
4. *Recommend implementing protected-prohibited / protected-permitted signal phasing when approved by the Dept.*

REFERENCES

1. The Safety Edge, A Pavement Edge Drop-Off Treatment, Publication Number FHWA-SA-10-034, Federal Highway Administration, US Department of Transportation.
2. WMA Technologies, Warm Mix Asphalt Technologies, a brochure published by Federal Highway Administration, US Department of Transportation.

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