Railway/Highway At-Grade Crossing Surface Management

By

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Kentucky Transportation Cabinet
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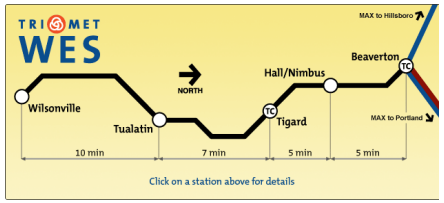
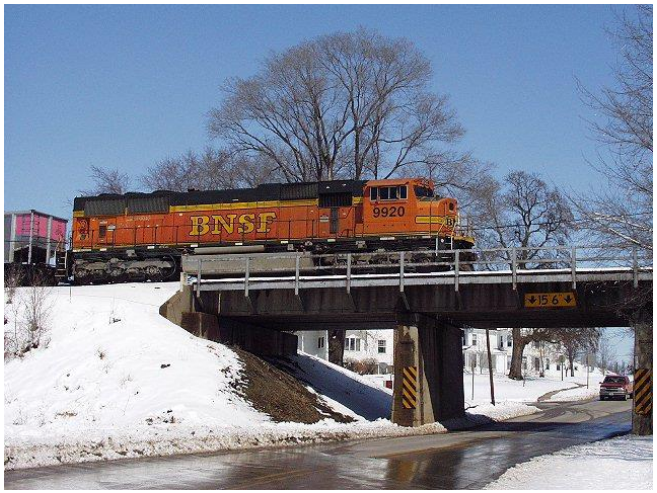
Lead Institution -- University of Illinois (UIUC)

Representative Governmental Agencies and Railroad Companies



The Best Crossings ----GRADE SEPARATED -- Over or Under



But Most Crossings are --

AT-GRADE LEVEL CROSSINGS

NEW CONSTRUCTION
or
DOUBLE TRACKING

Typical Crossings can Deteriorate, thus Low Ride Quality

R-0-U-G-H

&

L-O-W

Not as Applicable Today using Newer Technology

PERMANENT SETTLEMENT

- Impact Loadings
- Low Spot
- Impaired Drainage
- Deterioration
- Rehabilitated Frequently

PURPOSE OF AN AT-GRADE CROSSING

Provide a SMOOTH Surface for the SAFE & UNINHIBITED Passage of Rubber-Tired Highway Vehicles Across the Railroad Tracks

IDEAL OBJECTIVES

Crossing Management Program

- **Crossings will stay Smooth and Stable (not settle)**
  For long periods of Time – Long Serviceable Lives

- **Minimize Costly Frequent**
  Interruptions to Railway
  and Highway Traffic for
  Rehabilitation of Crossings

- **Improve Operating**
  Performance & Safety
  for the Railway and
  Highway Traffic

TWO TYPES OF CROSSING ROUGHNESS

Surface Roughness

Profile Roughness

$ Material Costs Per Track Foot

$100/tk-ft
(Track Only)

$100/tk-ft + $50-100/tk-ft
(Standard Surface)

$100/tk-ft + $300-400/tk-ft
(Premium Surface)

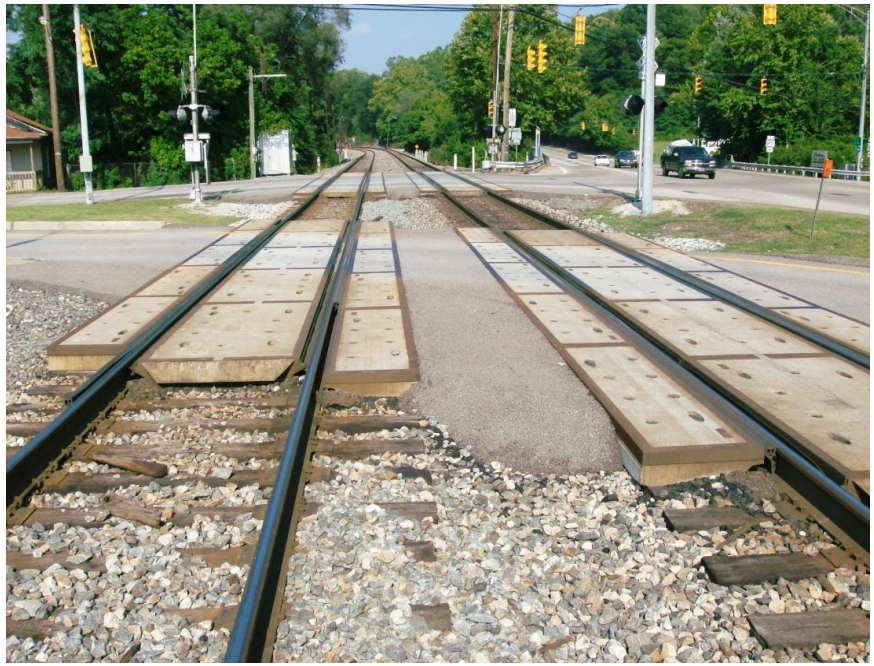
IDEAL ARRANGEMENT

- **Cooperative Effort to Optimize Expertise of Local Highway Agency and Railroad Company**

- **Thus -- Can Reduce Costs, Improve Quality, And Minimize Traffic Disruptions to the Railroad and Highway**

IDEAL OBJECTIVES

- Provide Adequate Strength and Support
- Minimize Deflections
- Reduce Permanent Deformations (Settlement)
- Waterproof Sublayers
- Provide Long-Life, Smooth Crossing
- Achieve 20-Year Design Life



IDEAL PRACTICES

- Rapidly Install/Renew (As Required)
- One Day (Railroad 4 hours/Highway 8-12 hours)
- Use Layered Support
- Properly Engineered
- Structurally Designed
- Use Premium Support Materials

DETERMINE (Optimum) REHABILITATION PROCEDURE

- **Each Project is Site Specific**
- **Decisions are Performance Driven based on Experience and Prevailing Conditions**
- **Costs (Economics) are Important – Vary from Site to Site**
- **Engineering Evaluation must be Conducted**
- **At-Grade Crossing Evaluation Form is Useful**

HIGHWAY/RAILWAY AT-GRADE CROSSING CONDITION EVALUATION FORM

- **Identification & Description of Crossing**

- **Qualitative Assessments of**
  - Pavement Approaches
  - Crossing Surface Material
  - Roughness/Rideability
  - Highway Geometrics
  - Drainage
  - Crossing Foundation

- **Overall Assessment for Rehabilitation**

  Only Adjustments/Improvements of the Highway Pavement Approaches

  Only Renewal of the Crossing Surface

  Complete Renewal of the Crossing Surface, Track Panel, and Trackbed Support

HIGHWAY/RAILWAY AT-GRADE CROSSING CONDITION EVALUATION

Agency _____Date_____

Location of Crossing:

DOT Number _____ Route Number/Street Name _____

County _____ City (specify in or near) _____

GPS: Latitude _____ Longitude_____

Highway Classification:

Rural Highway ____ or City Street ____; Primary ____, Secondary ____, or Collector ____

Highway Information:

Mile Point _____, ADT _____, % Trucks _____, Haul Route (y/n)_____

Railroad:

Company _____, Division _____, Mile Post _____

Primary Limits, From _____ To _____

Complete Form is in References 6 and 9

PLANNING MEETING

Railroad Company and Governmental/Highway Agency Must Agree on Three Aspects for a Project:

I. Select Date

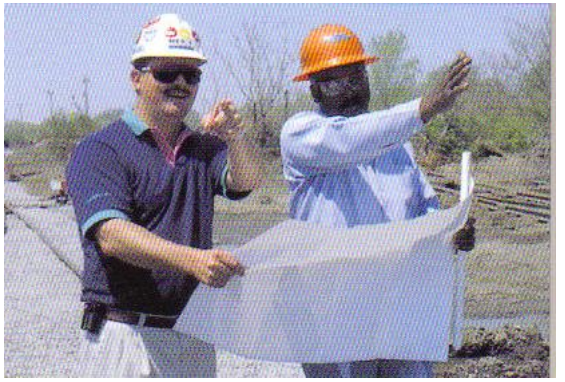
Railway Volume/Schedule

Highway Volume/Critical Detours

PLANNING MEETING

II. Assign Responsibilities

I. Arrange Highway Closure and Traffic Control
II. Arrange Public Announcements/Notifications
III. Arrange Railroad Curfew
IV. Arrange Temporary Highway Crossing/Detour
V. Secure Materials, Personnel, and Equipment
VI. Remove and Replace Track and Surface Track
VII. Pave Highway Approaches



PLANNING MEETING

III. Share Cost

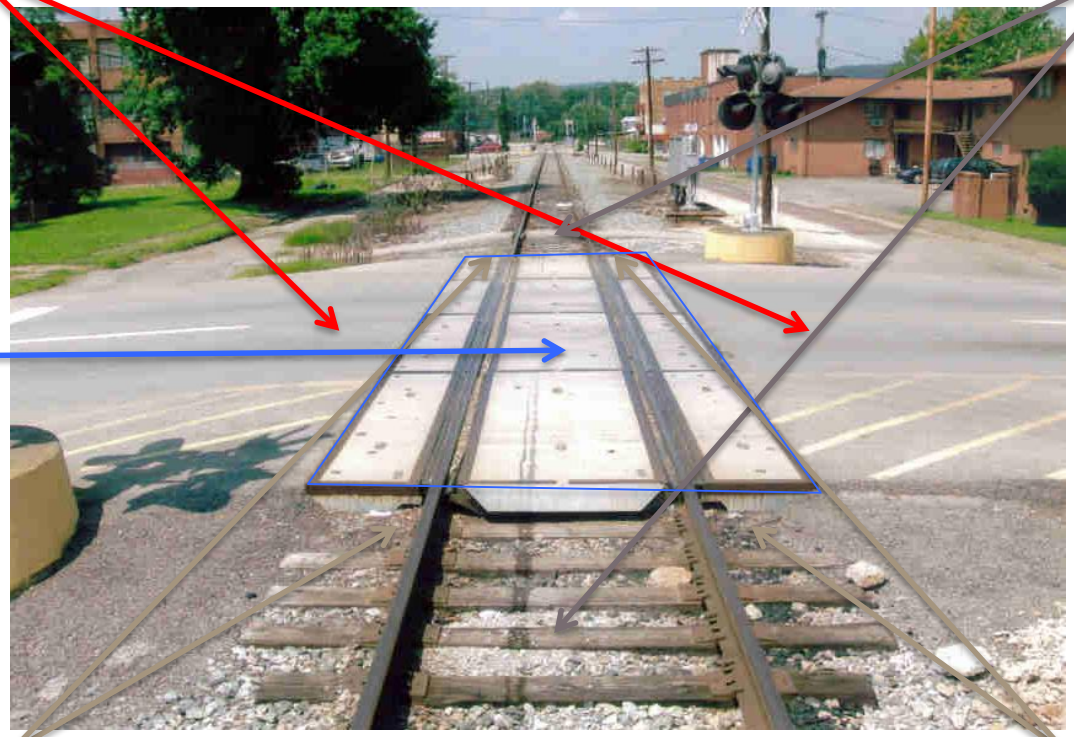
Removal and Installation of Track, Crossing, and Approaches (includes Materials, Personnel and Equipment),

Traffic Control,

Public Announcements,

Highway Paving

FOUR PARTS OF AN AT-GRADE CROSSING

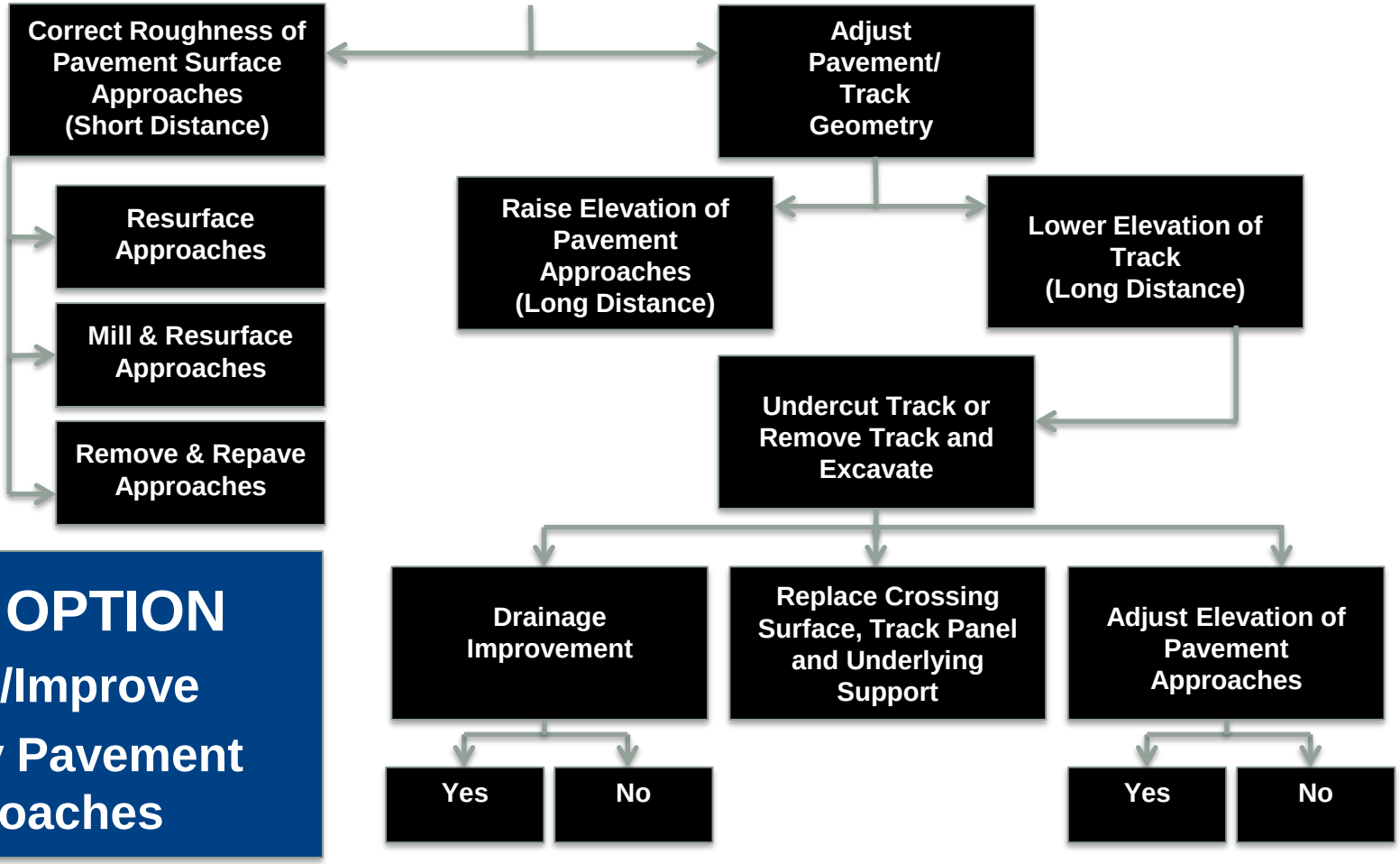


ASSESSING CROSSING REHABILITATION PROCEDURES

Three Categories

- **Only Renew Highway Crossing Approaches**
- **Only Renew Crossing Surface**
- **Complete Renewal of Crossing Surface, Track Panel and Underlying Support**

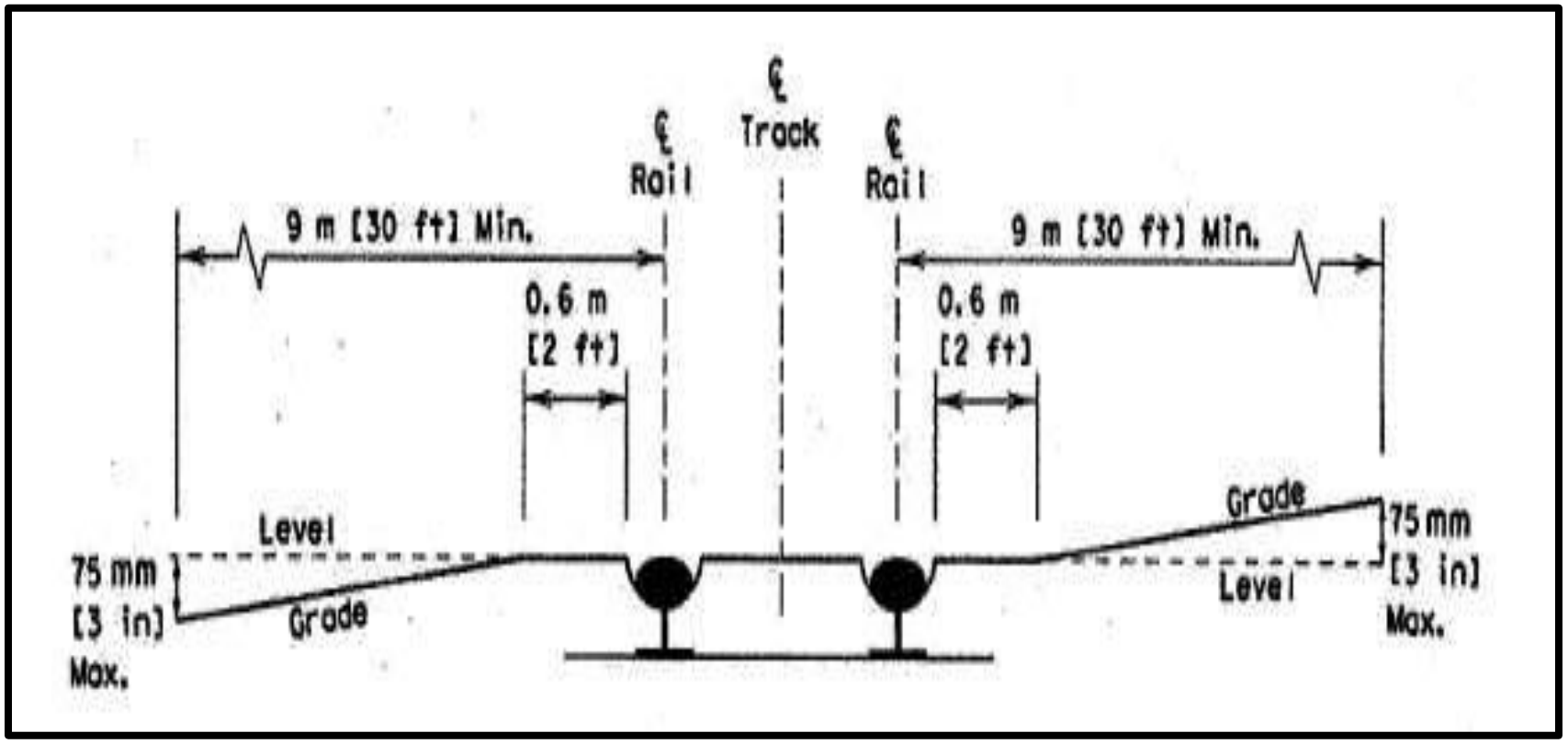
Highway Pavement Approaches Adjustments / Improvements



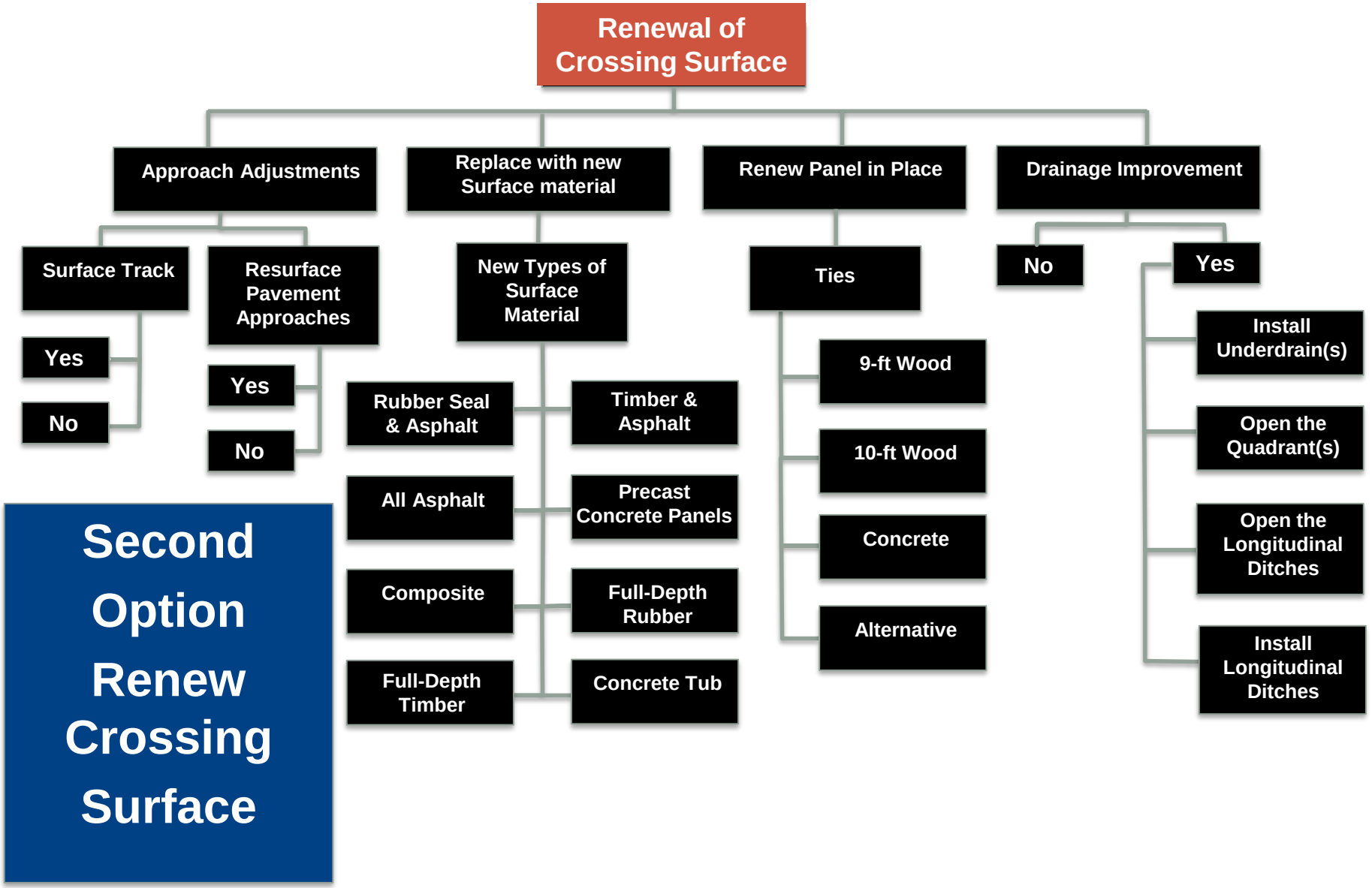
FIRST OPTION

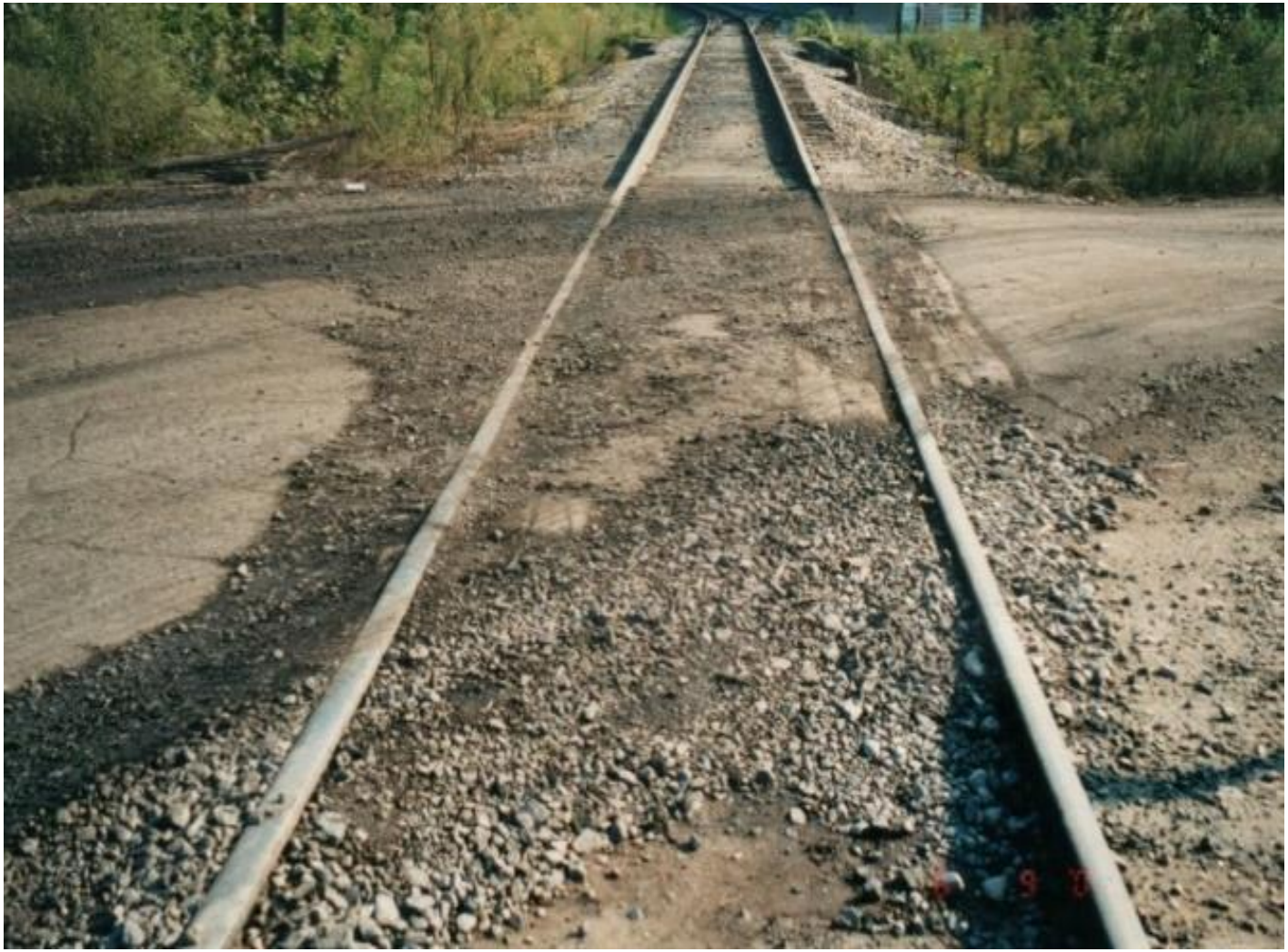
Adjust/Improve Highway Pavement Approaches

AASHTO RECOMMENDATIONS



3 inches in 30 feet ~ 0.85%


Renewal of Crossing Surface
Approach Adjustments
Surface Track
Yes
No
Resurface Pavement Approaches
Yes
No
Replace with new Surface material
New Types of Surface Material
Rubber Seal & Asphalt
All Asphalt
Composite
Full-Depth Timber
Timber & Asphalt
Precast Concrete Panels
Full-Depth Rubber
Concrete Tub
Renew Panel in Place
Ties
9-ft Wood
10-ft Wood
Concrete
Alternative
Drainage Improvement
No
Yes
Install Underdrain(s)
Open the Quadrant(s)
Open the Longitudinal Ditches
Install Longitudinal Ditches
Second Option Renew Crossing Surface




SPEED
LIMIT
35

SURFACE CHOICES

All-Asphalt

Rubber Seal and Asphalt

Timber and Asphalt

Concrete Panels

Full-Depth Rubber

Full-Depth Timber

Composite

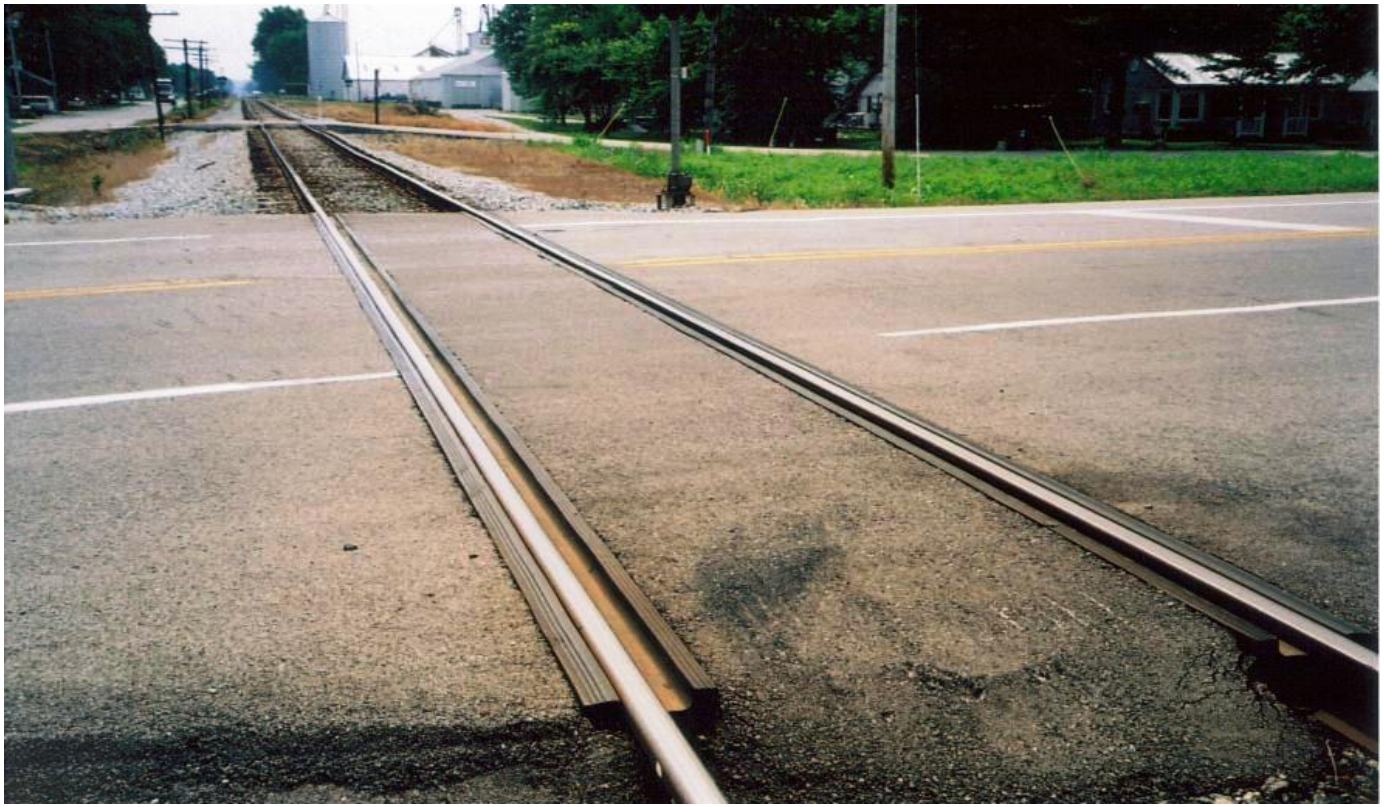
Concrete Tub

SURFACE CHOICES

All Asphalt

SURFACE CHOICES

Rubber Seal and Asphalt



SURFACE CHOICES

Timber and Asphalt

SURFACE CHOICES

Concrete Panels

SURFACE CHOICES

Full-Depth Rubber

SURFACE CHOICES

Full-Depth Timber

SURFACE CHOICES

Composite

SURFACE CHOICES

Concrete Tub

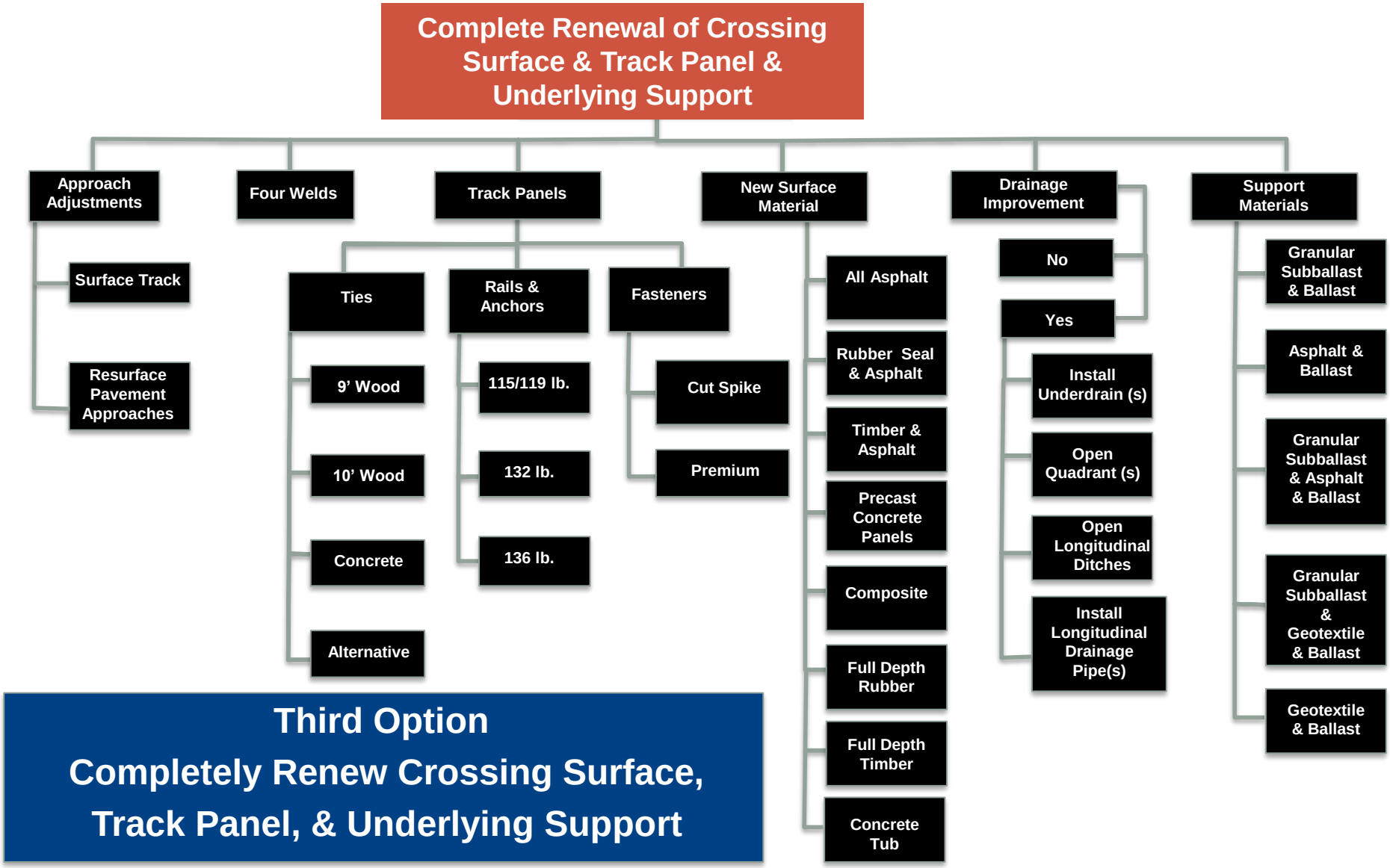
General Guideline for Crossing Material Selection

General Guideline for Crossing Material Selection

The following table provides guidance for selecting the proper crossing surface material. Recommendations are based on train tonnage, vehicular traffic, and truck traffic; these numbers are expressed in car equivalents per day. Several other factors, as discussed above, may influence the decision on the crossing surface used. In the table "standard" encompasses more economical crossing surfaces, such as rubber seal and asphalt, all-asphalt, and timber and asphalt. "Premium" includes surfaces that are more costly and require more extensive rehabilitation when they deteriorate. Premium surfaces include concrete panel, concrete tub, full-depth timber, full-depth rubber, and composite.

RAILROAD MGT	**CAR EQUIVALENTS PER DAY**		
	0-50,000	**50,000-100,000**	**100,000+**
0-20	STANDARD	STANDARD	PREMIUM
20+	STANDARD	PREMIUM	PREMIUM

**Car Equivalents Per Day = # of trucks x 100 per day + # of cars per day*


Complete Renewal of Crossing Surface & Track Panel & Underlying Support
Approach Adjustments
Surface Track
Resurface Pavement Approaches
Four Welds
Track Panels
Ties
9' Wood
10' Wood
Concrete
Alternative
Rails & Anchors
115/119 lb.
132 lb.
136 lb.
Fasteners
Cut Spike
Premium
New Surface Material
All Asphalt
Rubber Seal & Asphalt
Timber & Asphalt
Precast Concrete Panels
Composite
Full Depth Rubber
Full Depth Timber
Concrete Tub
Drainage Improvement
No
Yes
Install Underdrain (s)
Open Quadrant (s)
Open Longitudinal Ditches
Install Longitudinal Drainage Pipe(s)
Support Materials
Granular Subballast & Ballast
Asphalt & Ballast
Granular Subballast & Asphalt & Ballast
Granular Subballast & Geotextile & Ballast
Geotextile & Ballast
Third Option
Completely Renew Crossing Surface, Track Panel, & Underlying Support

Excavated Crossing

Pumping Crossing

Examples of Rough and Settled Crossings

Concrete Panel – Poor Condition

All Timber – Poor Condition

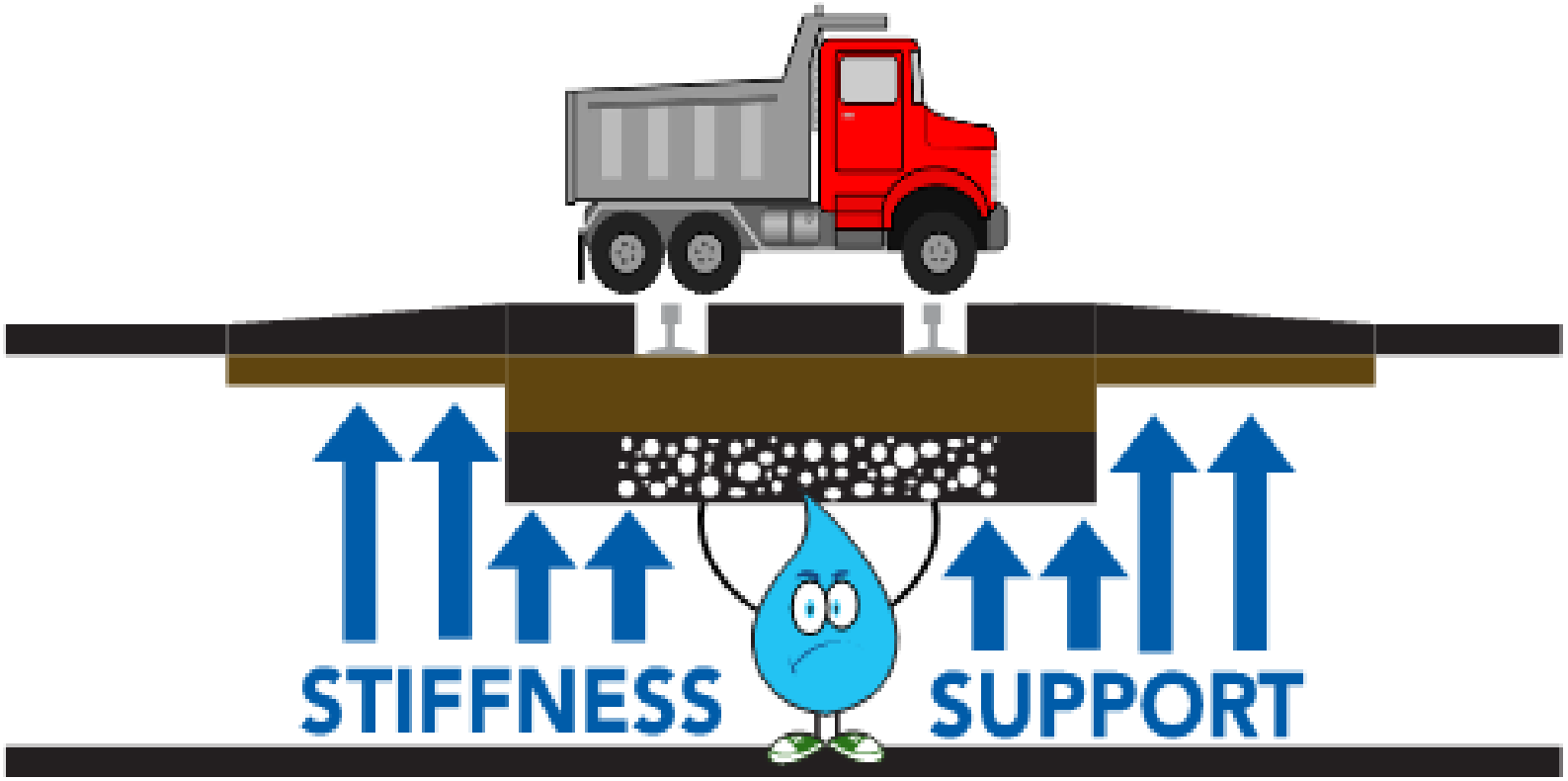
Timber and Asphalt – Poor Condition

All-Asphalt – Poor Condition

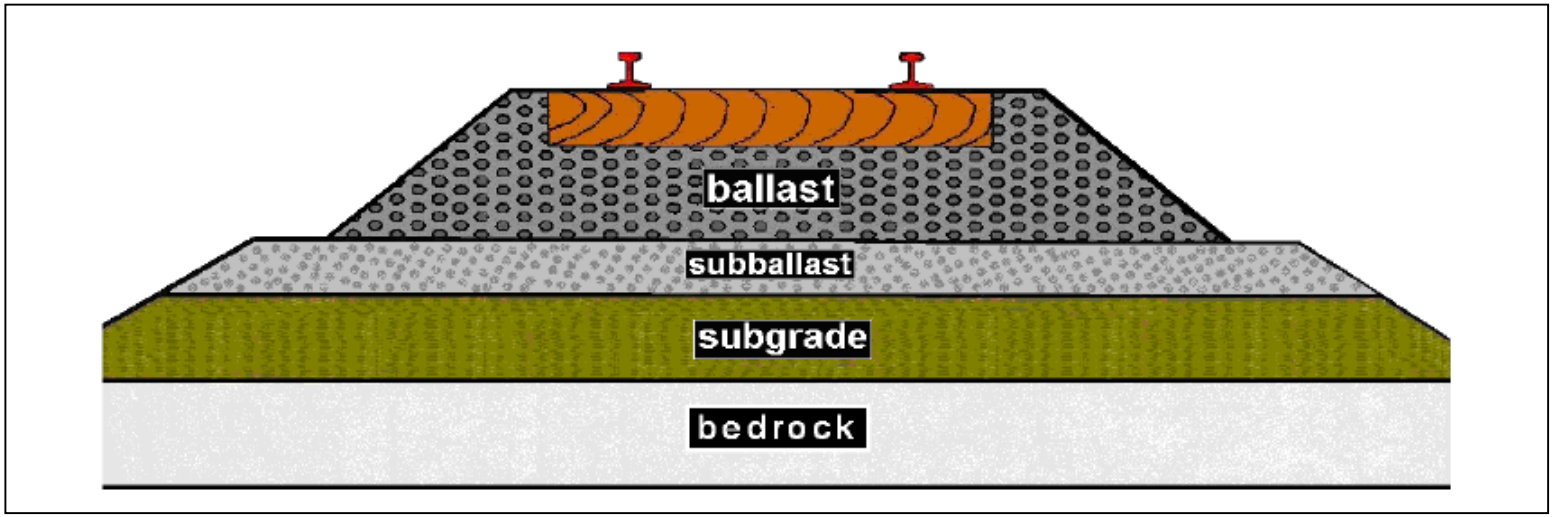
Rubber Seal and Asphalt – Poor Condition

Full-Depth Rubber – Poor Condition

Primary Concern for an At-Grade Crossing is Maintaining Adequate Support so that the Trackbed and Pavement Approaches Achieve Similar Levels of Stiffness/Support



Classic All-Granular Trackbed Support



Without Separation Layer, Structural Layer, and Adequate Drainage?

Layered Trackbed Support

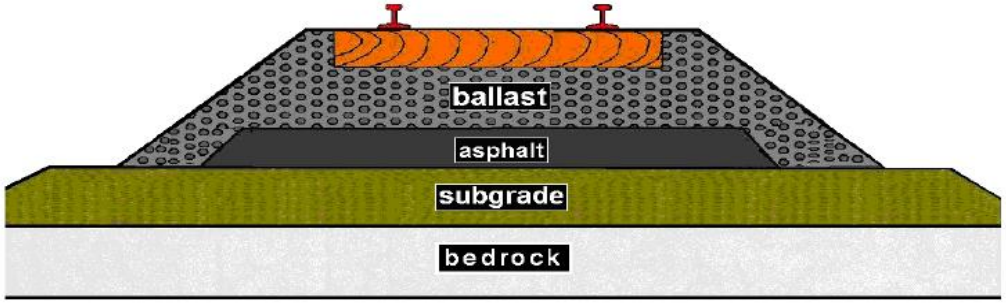


Figure 2a. Asphalt Underlayment trackbed without granular subballast layer

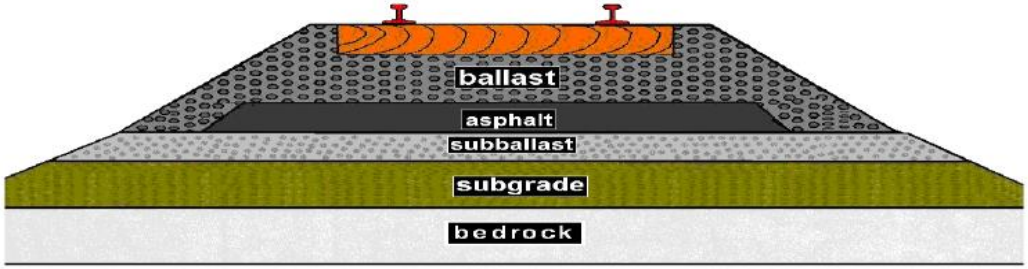


Figure 2b. Asphalt Combination trackbed containing both asphalt and subballast layers

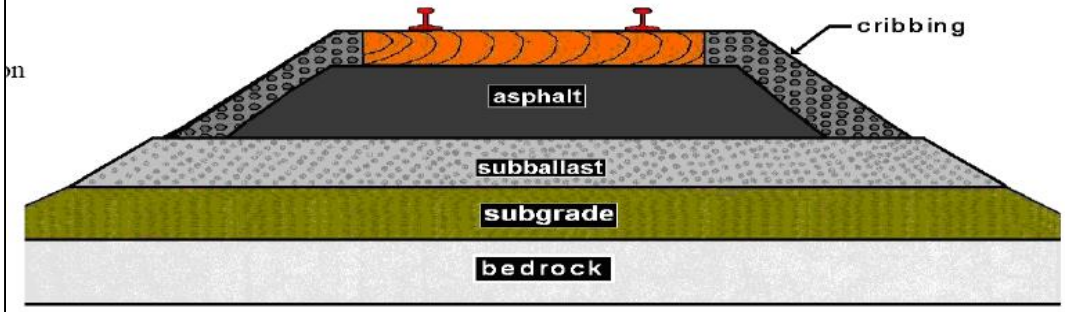
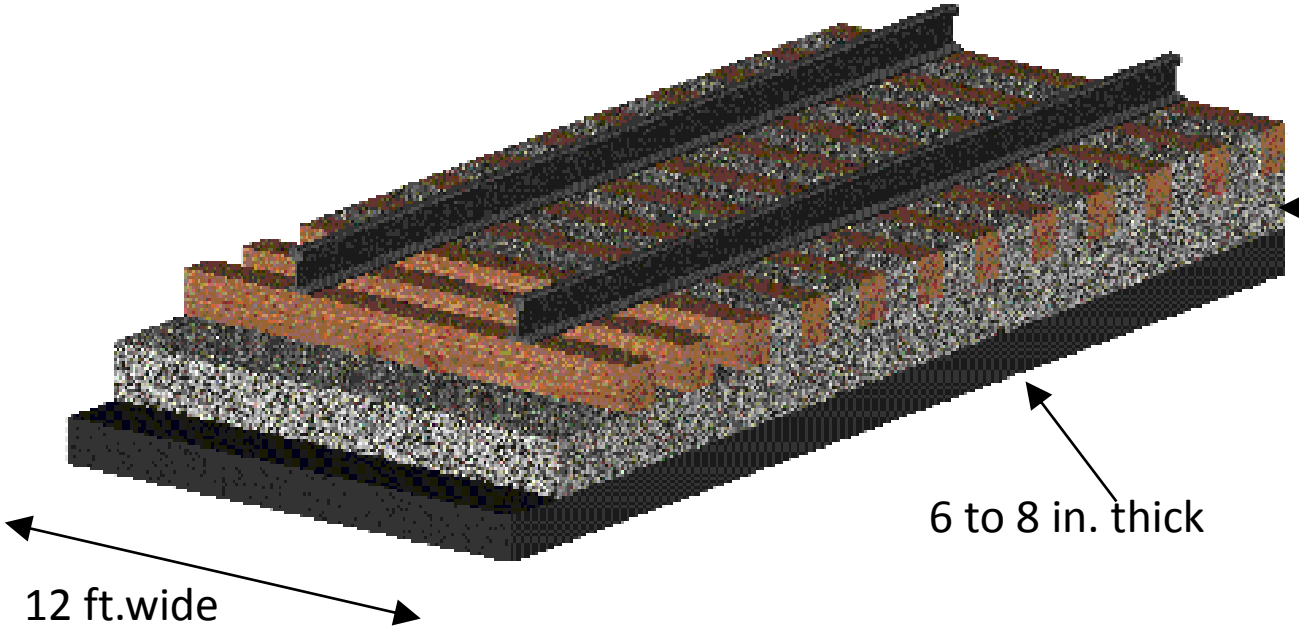
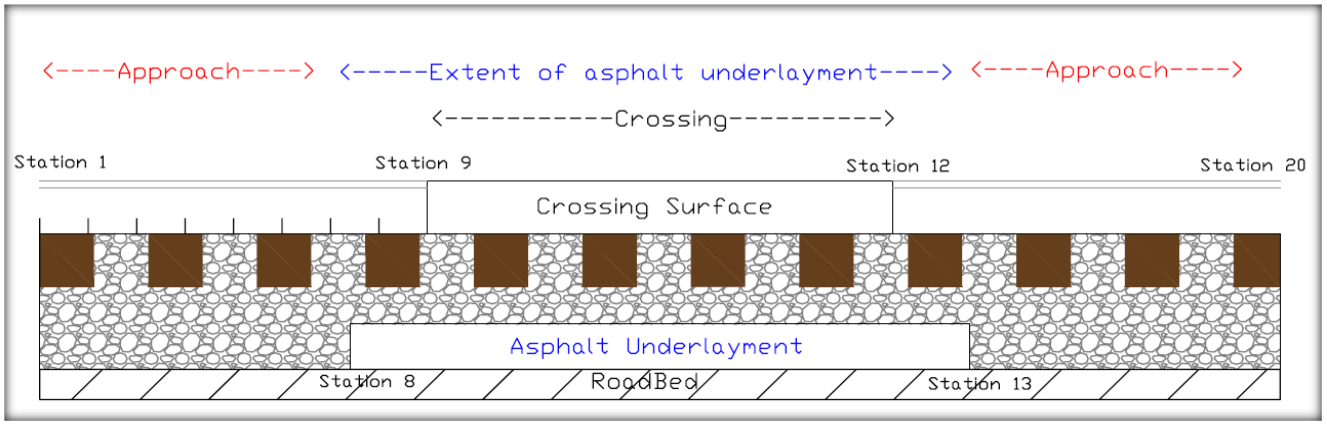


Figure 2c. Ballastless trackbed containing thickened asphalt and subballast layers

Strengthens Trackbed Support Waterproofs Underlying Roadbed Confines Ballast and Track





Dense-Graded Highway Base Mix 1 – 1 ½ in. Maximum Size Aggregate

Asphalt Binder +0.5% above Optimum (optional)
Low to Medium Modulus Mix, 1 - 3% Air Voids (optional)

P&W RR --- SW Durham Rd. May 15-16, 2010


CAT


DANGER
NO TRESPASSING


CAT


CAT

P&W RR --- SW Durham Rd. April 4, 2014

KYDOT Heavily Involved

Example Asphalt Underlayment Costs and Economics
(Assume Crossing will be Paneled)

Asphalt = $80/ton delivered

~½ ton/track-foot
(layer: 6 in. thick, 12 ft. wide)

$40/track-foot X 80 ft. long
= $3,200 for Underlayment

A Typical Crossing Renewal
≈ $10,000 to $40,000+

Benefits of an Asphalt Supported At-Grade Crossing

- **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, and**
- **A resilient layer between the ballast and roadbed, which reduces the likelihood of subgrade pumping without substantially increasing track stiffness.**

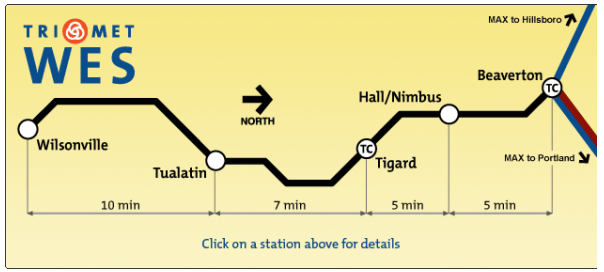
METROLINK

West Virginia Department of Transportation

Iowa Department of Transportation

Caltrain

P&W



THE INDIANA RAIL ROAD

ILLINOIS COMMERCE COMMISSION ICC

INDIANA DEPARTMENT OF TRANSPORTATION INDOT

Illinois Department of Transportation

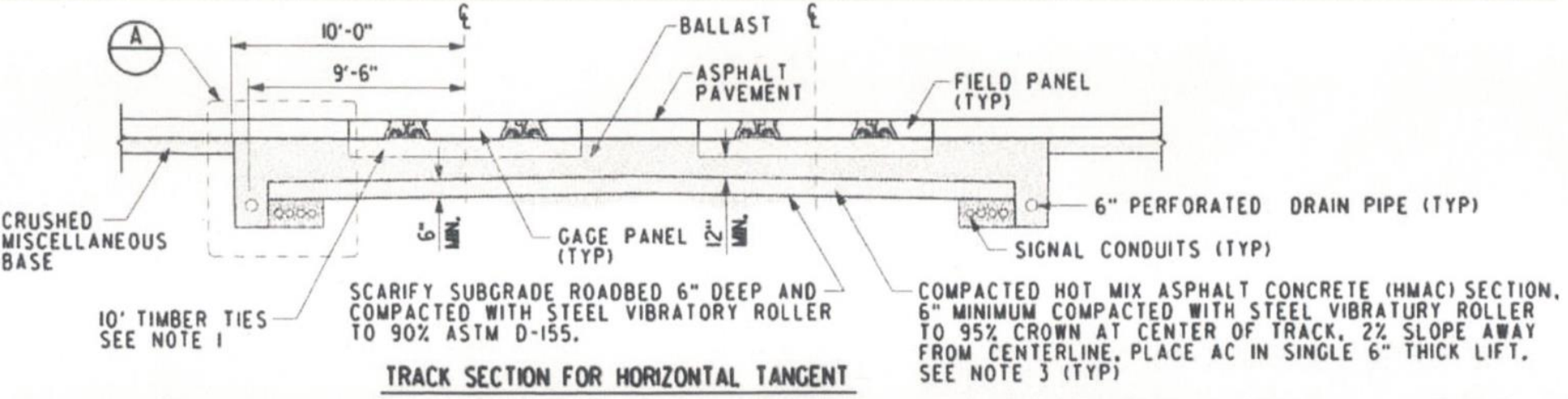

•Bridge Decks and Approaches
•Turnouts and Crossovers
•Highway Crossings
•Yards
MAP NOT TO SCALE
PACIFIC OCEAN
LA Union Station
LAX Airport
John Wayne Airport
Burbank-Bob Hope Airport
Van Nuys
Goleta
Santa Barbara
Carpinteria
Ventura
Montalvo
Oxnard
Camarillo
Moorpark
Simi Valley
Chatsworth
Northridge
Newhall
Santa Clarita
Via Princessa
Lancaster
Palmdale
Vincent Grade/ Acton
Sylmar/San Fernando
Sun Valley
Downtown Burbank
Glendale
Col State L.A.
El Monte
Baldwin Park
Covina
Pomona (North)
Claremont
Montclair
Upland
Rancho Cucamonga
Fontana
Rialto
San Bernardino
Industry
Downtown Pomona
E. Ontario
Pedley
Riverside-Downtown
Riverside-La Sierra
N. Main Corona
W. Corona
Placentia Future Station
Montebello/Commerce
Commerce
Norwalk/Santa Fe Springs
Buena Park
Fullerton
Anaheim
Anaheim Canyon
Orange
Santa Ana
Tustin
Irvine
Laguna Niguel/ Mission Viejo
San Juan Capistrano
San Clemente
San Clemente Pier Limited Service
Oceanside
Solana Beach
San Diego
SPRINTER To Escondido
VENTURA COUNTY
LOS ANGELES COUNTY
SAN BERNARDINO COUNTY
RIVERSIDE COUNTY
ORANGE COUNTY
SAN DIEGO COUNTY
metrolinktrains.com
METROLINK
METROLINK ROUTES
Antelope Valley Line
Inland Empire-Orange County Line
Orange County Line
Riverside Line
San Bernardino Line
Ventura County Line
91 Line (Riverside-Fullerton-LA)
Rail Transfer Station
Metrolink/Amtrak Shared Station
Amtrak Pacific Surfliner
Metro Rail/Metro Bus
Effective February 15, 2010

Standard for All Highway-Rail Grade Crossings

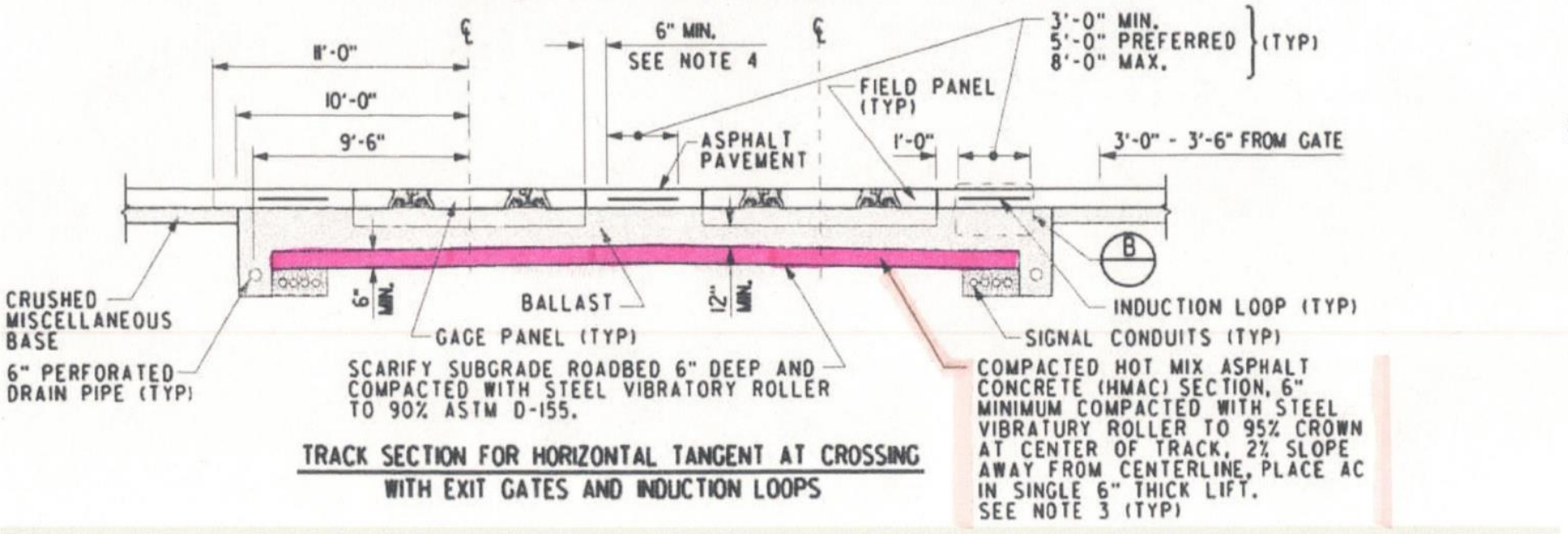
6-inch Thickness of HMAC Underlayment

Installed An estimated 60 to 70 Highway Crossings with Asphalt Underlayments between 2007 and 2012

Performance has been Excellent



TRACK SECTION FOR HORIZONTAL TANGENT



TRACK SECTION FOR HORIZONTAL TANGENT AT CROSSING
WITH EXIT GATES AND INDUCTION LOOPS

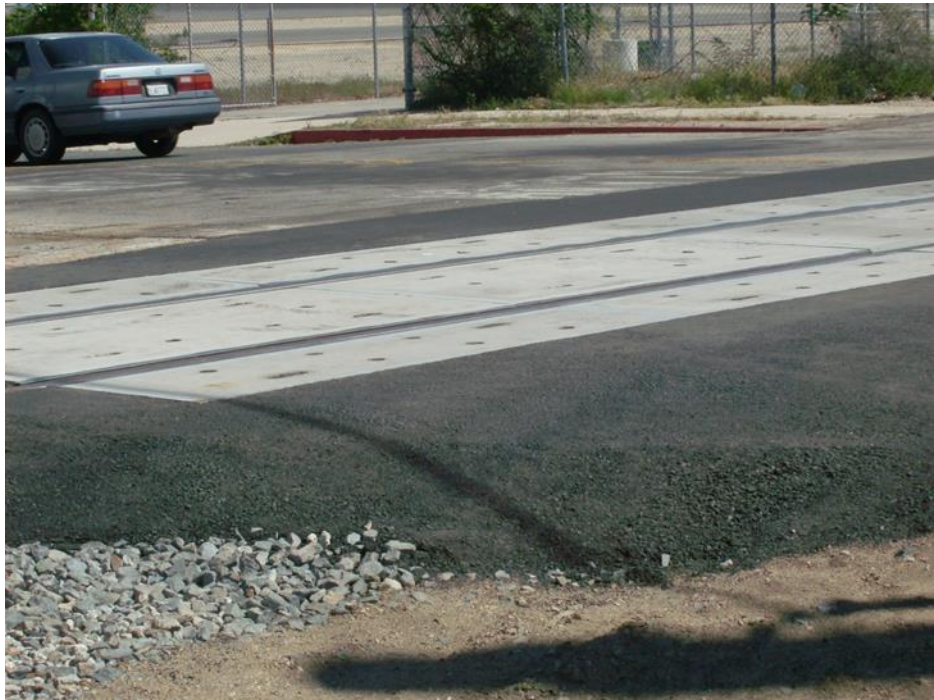

Metrolink
Los Angeles


NO
DUMPING
PROHIBIDO
VIOLATORS WILL BE PROSECUTED
PENAL CODES 555-602.374.3
Osborne Street


Pierce Street

Polymerized Cold-Mix Asphalt

METROLINK



West Virginia

- Began AUC in 2000
- Do 7 to 8 AUC per year
  (14 in 2013, 12 in 2014, 11 in 2015, 6+ in 2016)
- Estimate over 150 AUC Installations
- Typically use Concrete Surfaces
- AU is 6 inches thick

WVDOT pays for:

- Crossing Materials
- 6-in. Asphalt Underlayment
- Traffic Control
- Drainage Pipe
- Tie Differential

US 60 Rainelle, WV

- **No Failures due to Lack of Support**
- **Standard Practice if State Money is Used**
- **Considered a Betterment Program to Upgrade Crossings for Improved Performance**

Fifth Avenue
Huntington

US 50
Bridgeport

Ashton, WV
WV 2
Installed November 2001
CSX

stem Map

55 Miles Long

Trains per Day -- Caltrain (92), UP (3)

Used Asphalt Underlayment Since 1999

Caltrain 1250 San Carlos Avenue San Carlos, CA 94070	CHIEF ENGINEER D. MAXEY PROJECT MANAGEMENT D. GREENAWAY STRUCTURES Z. AMARE TRACK/CIVIL R. SCARPINO	PENINSULA CORRIDOR JOINT POWERS BOARD BAY AREA RAIL NETWORK CALTRAIN SYSTEM SCHEMATIC MAP

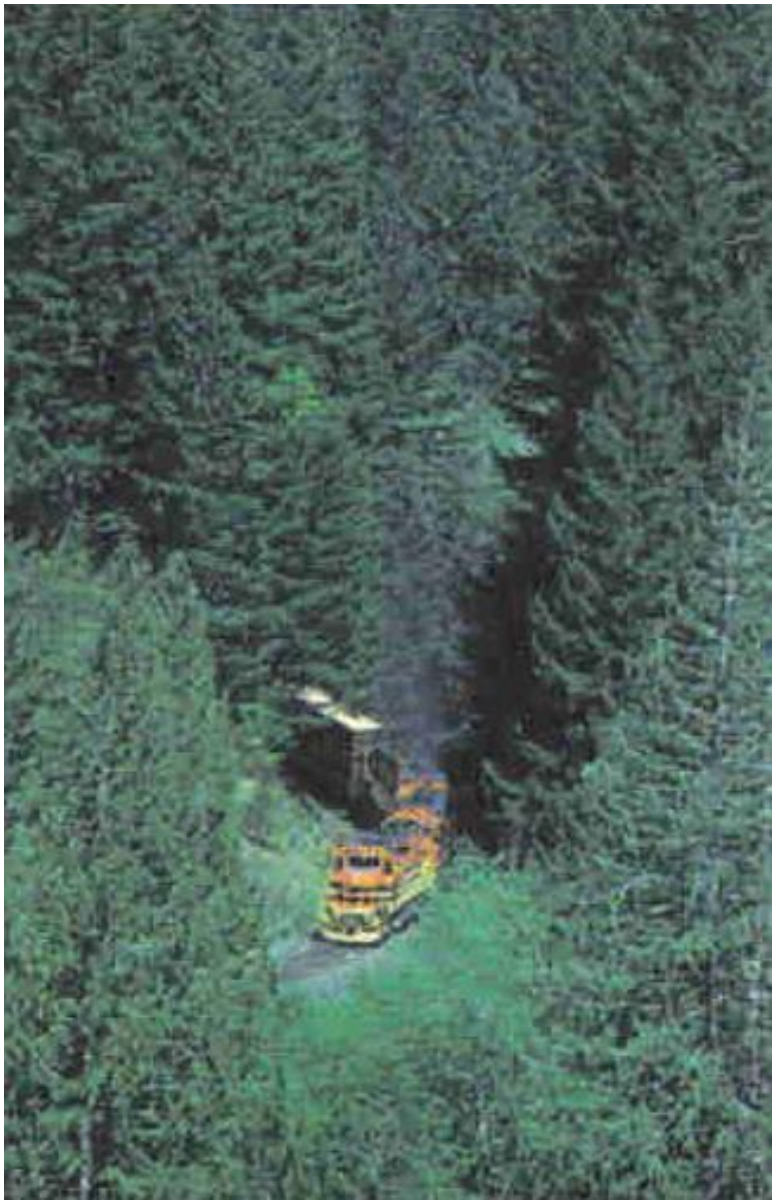
1999 to 2013

- Crossovers #20 = 10
- Turnouts = 12
- Street & Pedestrian Crossings = over 59
- Stations since = 10
- Tunnel Approaches = 4
- Tunnel Inverts = 2
- Bridges Approaches = 15


SAN MATEO

Portland &Western Railroad

Portland & Western Railroad

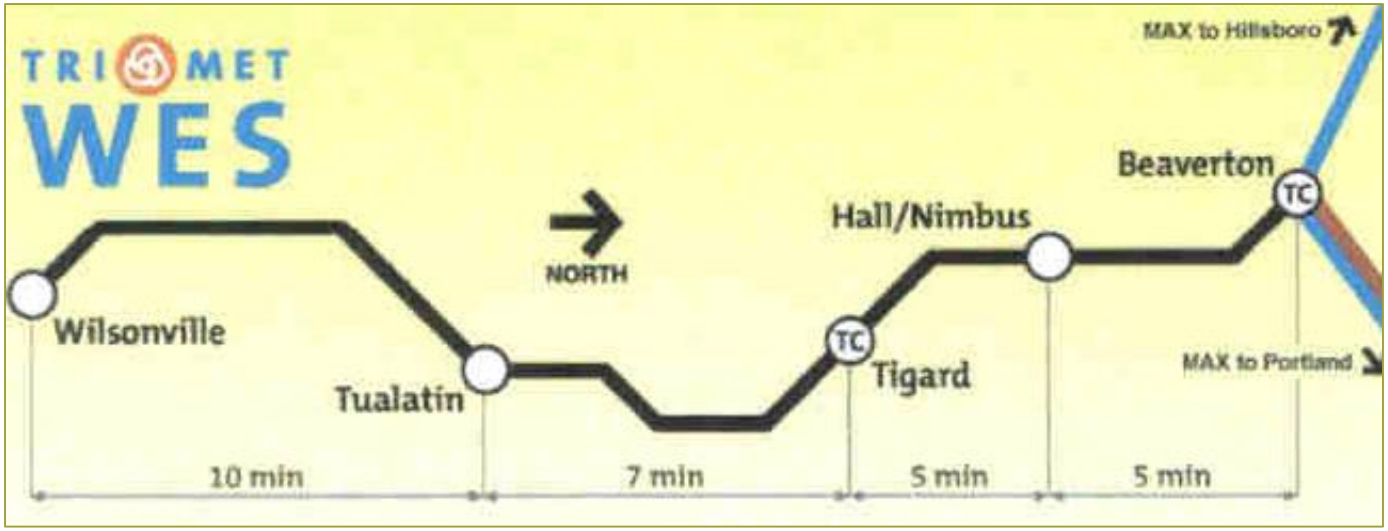


WES – All 18 Public Crossings plus an Underpass

P&W – Do 12 to 15 Crossings per year,

Oregon DOT pays for Materials, RR Railroad pays for Labor/Equipment
Fairly standard procedure,

Perfect performance, no mud, no surfacing required.




Santium, OR
April 23, 2014


Junction City, OR
April 23, 2014, 3500 feet long
Also, Independence, OR, 2000 feet long
Many completed ranging from 30 to 350 feet long
Several more crossing planned for rehabilitation


April 24, 2014


April 24, 2014


Welcome To
LAKE
OSWEGO

Typical Crossing on WES Commuter Line

SW 5th Street in Beavertown

SW Scholls Ferry Road

Typical Crossing on P&W Freight Line

SW Teton Avenue in Tualatin May 2010

SW Teton Avenue in Tualatin May 2009

Geary Street in Albany

Salem Avenue SE in Albany

OFFICE OF RAIL TRANSPORTATION

Iowa Department of Transportation Primary Highway Crossing Program

Mary Jo Key, Grade Crossing Project Manager

Travis Tinken, Construction Inspector

September 25, 2012

Iowa Department of Transportation

OFFICE OF RAIL TRANSPORTATION

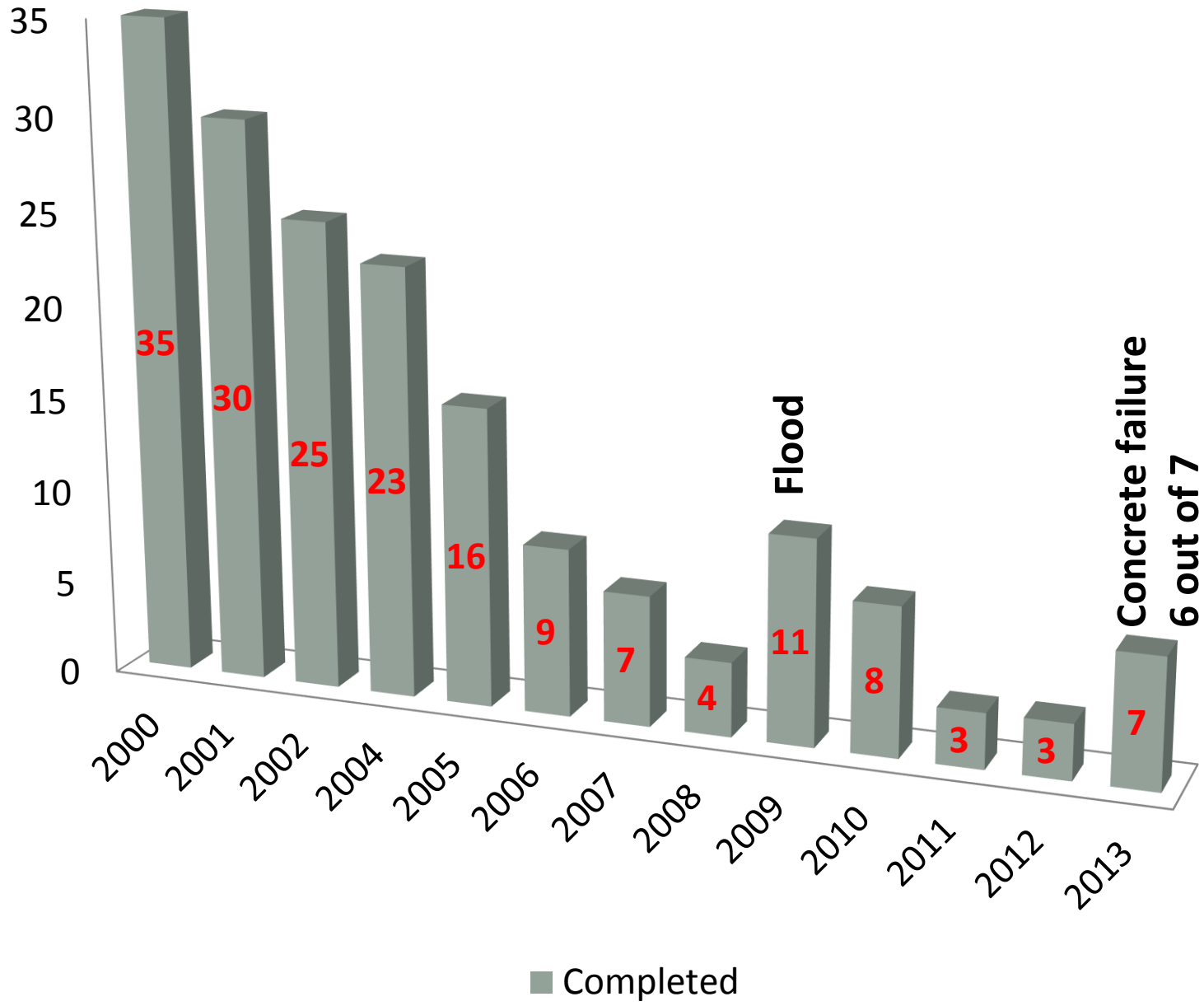
State Surface Repair

- Road Use Tax Fund
- Application based
- First come, first serve
- 60% fund, 20% local, & 20% RR
- 10 year back log in 1998
- Crossing life was 2 years
- Since 2000 – 80 to 90 of the 167 crossings on the Iowa DOT primary system have been underlain with asphalt
- No crossings failures to date due to structural failures or settlement

Iowa Department of Transportation

Rt 69 Story City, Iowa
Placed in 2000
4000 ADT, 4% Trucks
50 MPH Traffic

Russell, Iowa
BNSF Double Main
Placed in 2000


35
30
25
20
15
10
5
0
35
30
25
23
16
9
7
4
11
8
3
3
7
Flood
Concrete failure
6 out of 7
2000
2001
2002
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
Completed

Iowa DOT and Driver Benefits

- Safer, smoother, longer lasting crossings
- Limited crossing complaints
- IowaDOT manpower, equipment, funding and resources can be used else where
- Streamed line processes allows fewer IowaDOT staff members to manage
- Fewer highway closures and driver disruptions

Iowa Department of Transportation

RR Benefit After Rebuild

- RR production track work done by gangs do not have to go thru the crossings -- skip
- The signal department has significantly fewer false activation issues
- Less maintenance time spent on surface failures and repairs
- Fewer slow orders


APR 26 2002


CAT
PM-465
APR 26 2002


09 11 2011


09 14 2011


CASE
APR 30 2002


APR 30 2002


CAT


APR 30 2002


CAT


APR 30 2002


KOBELCO
05 09 2012


05.08.2012


MAY 2 2002


MAY 3 2002


09.11.2012

ILLINOIS DEPARTMENT OF TRANSPORTATION
REGION and DISTRICT BOUNDARIES

Region 1
Diane M. O'Keefe

DISTRICT 1
201 WEST CENTER COURT
SCHAUMBURG, ILLINOIS 60196-1096
PHONE: 847/705-4000

Region 2
Eric S. Therkildsen (Acting)

DISTRICT 2
819 DEPOT AVENUE
DIXON, ILLINOIS 61021-3546
PHONE: 815/284-2271

DISTRICT 3
700 EAST NORRIS DRIVE
OTTAWA, ILLINOIS 61350-1628
PHONE: 815/434-6131

Region 3
Joseph E. Crowe

DISTRICT 4
401 MAIN STREET
PEORIA, ILLINOIS 61602-1111
PHONE: 309/671-3333

DISTRICT 5
13473 IL Hwy. 133
P. O. BOX 610
PARIS, ILLINOIS 61944-0610
PHONE: 217/465-4181

Region 4
Roger L. Driskell

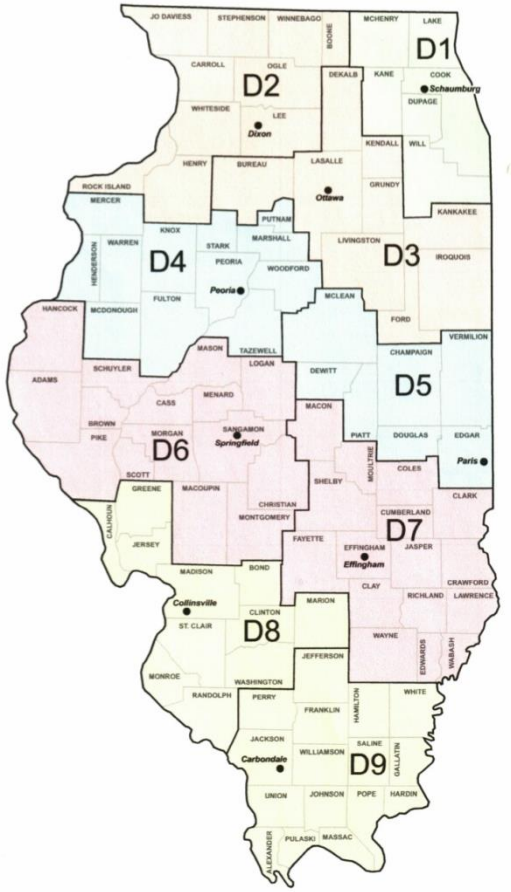
DISTRICT 6
126 EAST ASH STREET
SPRINGFIELD, ILLINOIS 62704-4792
PHONE: 217/782-7301

DISTRICT 7
400 WEST WABASH
EFFINGHAM, ILLINOIS 62401-2699
PHONE: 217/342-3951

Region 5
Mary C. Lamie

DISTRICT 8
1102 EASTPORT PLAZA DRIVE
COLLINSVILLE, ILLINOIS 62234-6198
PHONE: 618/346-3100

DISTRICT 9
STATE TRANSPORTATION BUILDING
P. O. BOX 100
CARBONDALE, ILLINOIS 62903-0100
PHONE: 618/549-2171



January 2011

Illinois Department of Transportation

The Illinois Commerce Commission Manages 6900 Public Crossings on Local Roads and Streets

The Grade Crossing Protection Fund (GCPF), administered by the ICC, was established by the Illinois General Assembly in 1955. Beginning with state fiscal year 2010 (beginning July 1, 2009), the ICC was given permission to utilize the GCPF to help pay for grade crossing surface renewal projects. The GCPF is used to reimburse railroads for all materials, including contract labor (i.e., asphalt paving, traffic control, etc.). The railroads pay all labor costs to install the new crossing surfaces.

Since 2010, 32 crossings renewals have utilized asphalt underlayment. The asphalt layer is specified as 6-in. thick, 12-ft wide and extend a minimum of 25 ft beyond ends of the crossing.

Asphalt underlayment is designated for all crossings on designated truck routes and all crossings on roads/streets with

traffic volumes > 5,000 vehicles per day.

Guidelines for Railroads
Applying for GCPF Assistance to Renew
Public Highway-Rail Grade Crossing Surfaces
(Local Roads and Streets ONLY)

Below are guidelines for the renewal of highway-rail grade crossing surfaces located on the local roads and streets system where assistance from the Grade Crossing Protection Fund (GCPF) is requested.

-SAMPLE-

LETTER OF REQUEST
(Use LETTERHEAD of Railroad Company Making the Request)

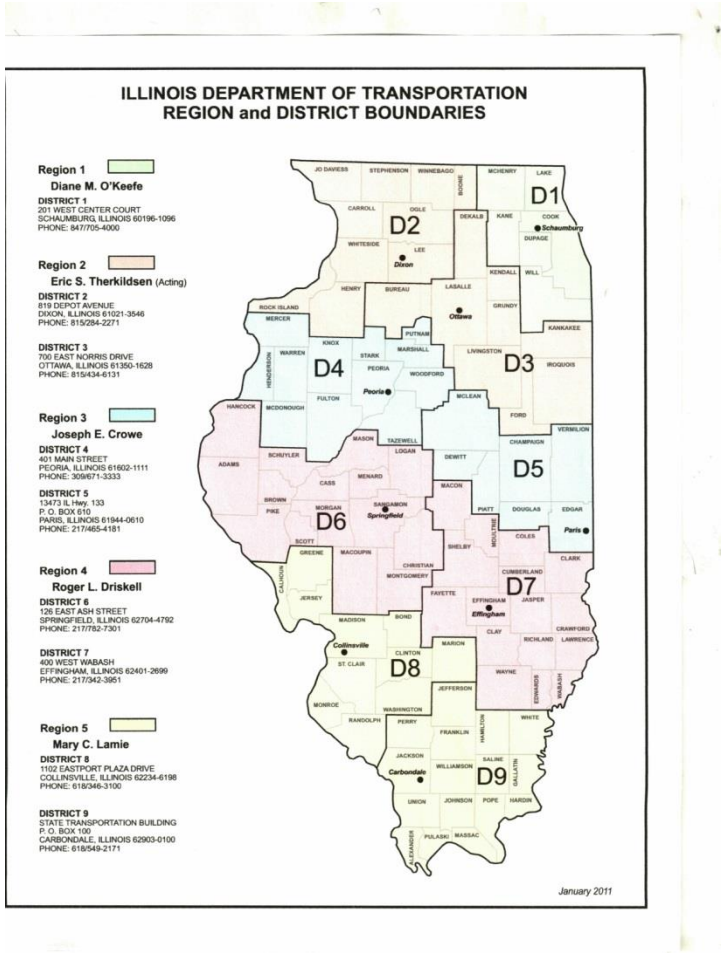
Current Date

Mr. Michael E. Stead
Rail Safety Program Administrator
Illinois Commerce Commission
527 E. Capitol Avenue
Springfield, IL 62701


Eldorado Street
Decatur CSX
Installed 2010
Picture 2013

Champaign County Fair Drive
CN, Installed 2012
Endurance/Composite
Picture 2013

IDOT Manages 760 Public Crossings on State/Federal Routes



- The Nine Districts are primarily involved utilizing “Railroad Corridors”.
- IDOT is similarly involved as ICC relative to utilizing asphalt underlayment.

Illinois Department of Transportation


IL Rt. 119, Vermilion County
KBSR RR, Installed 2009
Picture 2016

Urbana @ Lincoln/University
Startrack Installed 2012
Picture 2013


US 51 Clinton
De Witt County
CN, Installed 2004?
Picture 2013

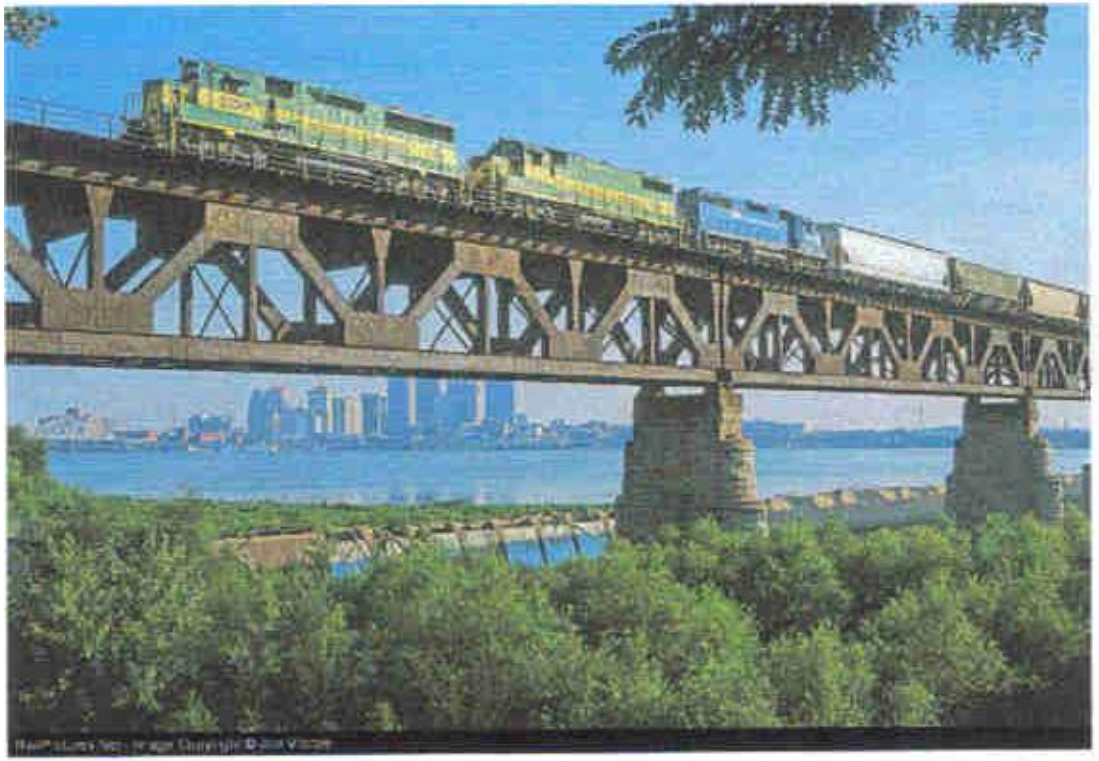
IL Rt. 1 Gordon's Jct.
INRD Renewed 2011
Picture 2016
Startrack


IL Rt. 33 Palestine
INRD Renewal 2013
Picture 2016


INDIANA DEPARTMENT OF TRANSPORTATION
INDOT

140-mile line

Began using asphalt underlayment in 1996
Since then 30+ crossings underlain
(20+ with state funds)

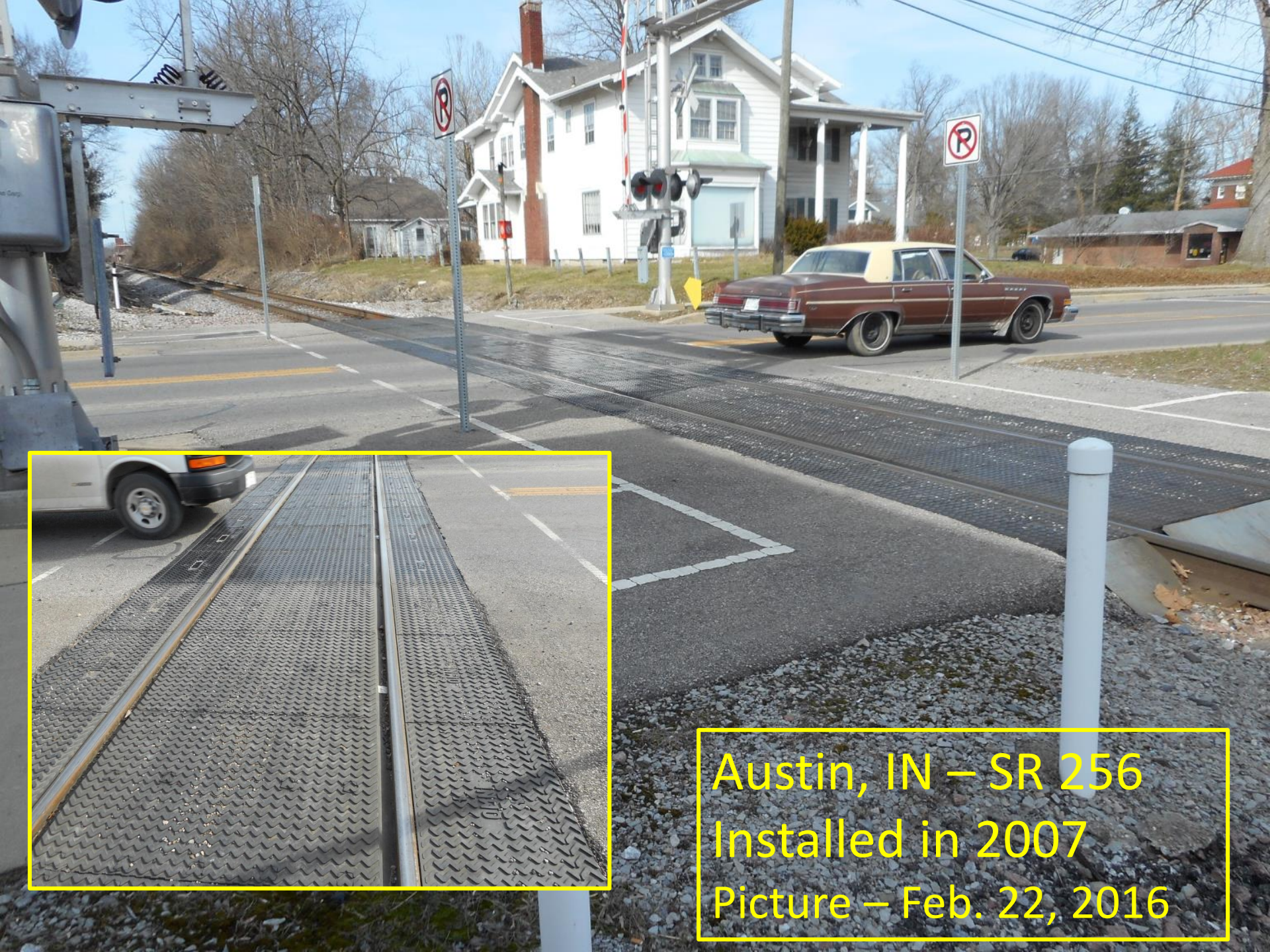


Major Crossings

All in Perfect Condition
(Two changed out During Widening)

Have 180 Public
and
60 Private Crossings

Charlestown NA Pike, MP 104.75
Jeffersonville, IN – Installed 2003



Austin, IN – SR 256
Installed in 2007
Picture – Feb. 22, 2016


New Rail Laid in Fall 2015
Crossing Placed in 2007
February 22, 2016

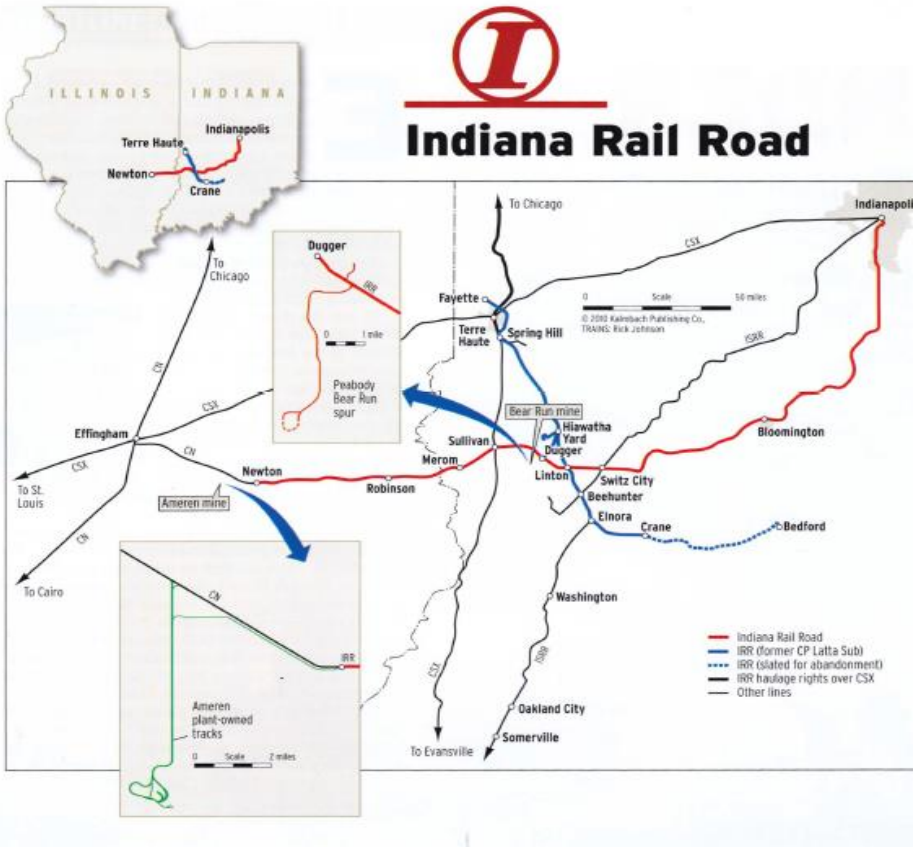

RODEO
TAQUERÍA
LA MEJOR
US 50 Seymour, IN
Installed in 2008
Picture Feb. 22, 2016

US 50
Seymour, IN
Feb. 22, 2016

2014 2008

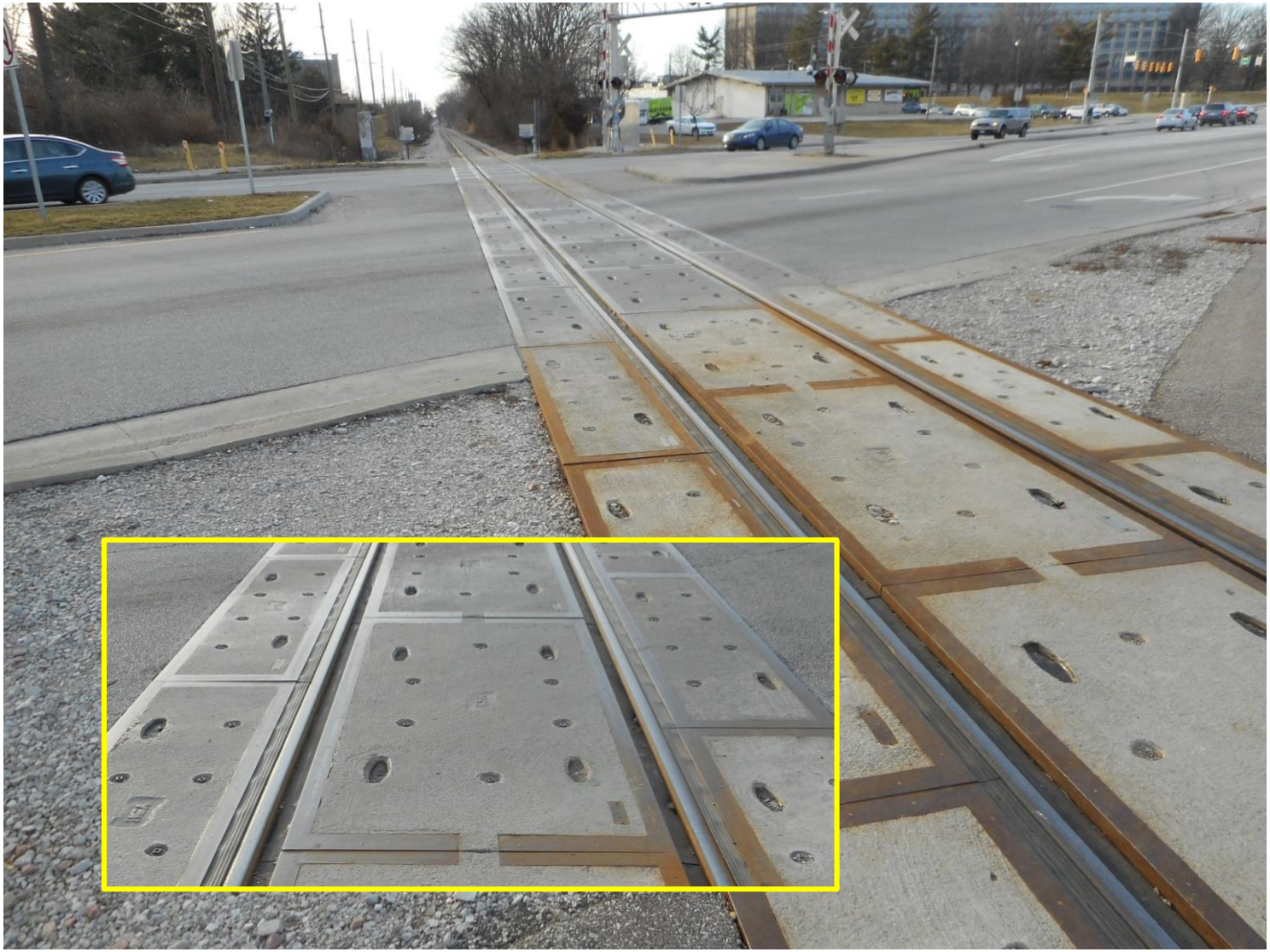

S. Walesboro
SR 450
Installed 2010
Picture 2016


42
THE INDIANA
INRD.COM
STOP


Indiana Rail Road
ILLINOIS
INDIANA
Terre Haute
Indianapolis
Newton
Crane
To Chicago
Dugger
IRR
Peabody Bear Run spur
Fayette
Terre Haute
Spring Hill
Bear Run mine
Hiawatha Yard
Dugger
Sullivan
Merom
Linton
Switz City
Beehunter
Elnora
Crane
Bedford
Washington
Oakland City
Somerville
To Evansville
Effingham
CSX
CN
To St. Louis
To Cairo
Newton
Robinson
Ameren mine
Ameren plant-owned tracks
Bloomington
KSR
Indianapoli
Indiana Rail Road
IRR (former CP Latta Sub)
IRR (slated for abandonment)
IRR haulage rights over CSX
Other lines

Route 46 --- Bloomington
Installed 2011 – Picture 2013

Route 46 Bloomington
Installed 2011 – Picture 2016




CATERPILLAR

3rd Street --- Bloomington
Installed 2011 – Picture 2013


2013

3rd Street --- Bloomington
Installed 2011 – Picture 2016

INDOT
Ft. Wayne District
Projects

Placed 9/9/11
Photo 2/15/13

US 20
Angola, IN


10/14/2011


10/14/2011


SR 8 east of Auburn
NS, installed Aug.2012
2013.02.26

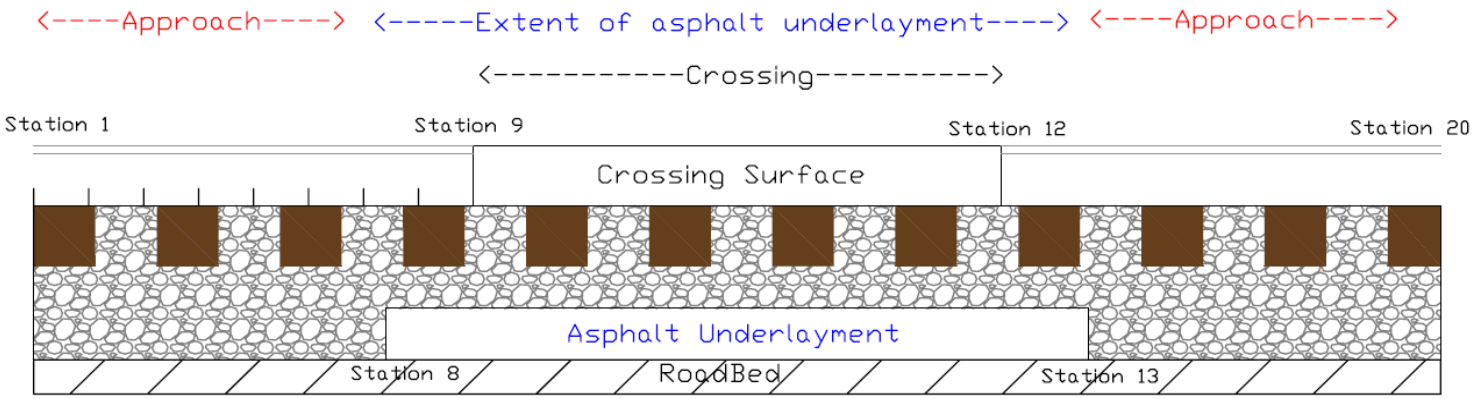

2013.02.26


SR 8 in Auburn
Shortline RR, installed March 2012
2012.07.23

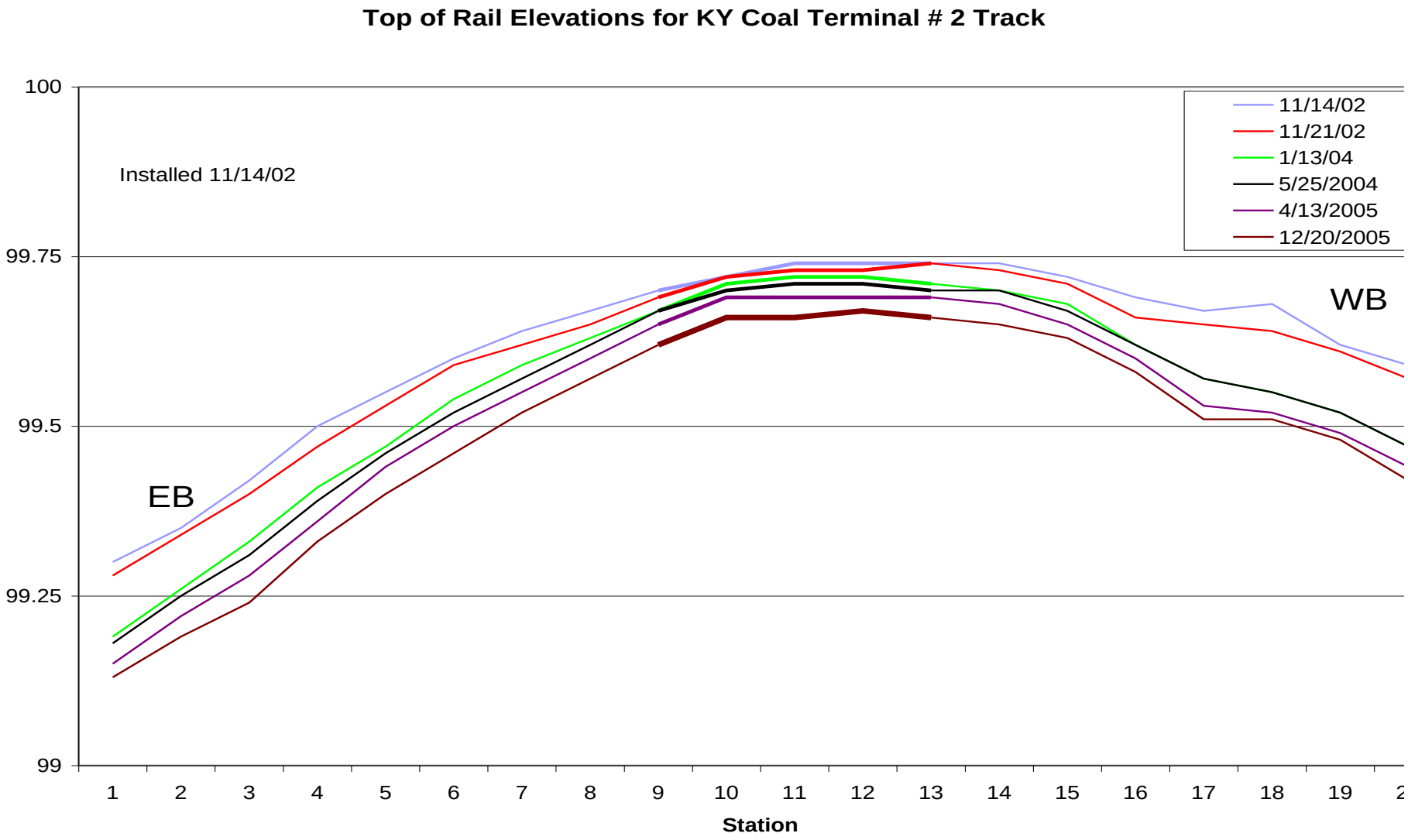

BUYING
OLD JEWELRY
2013.02.26

Long-Term Trackbed Settlement

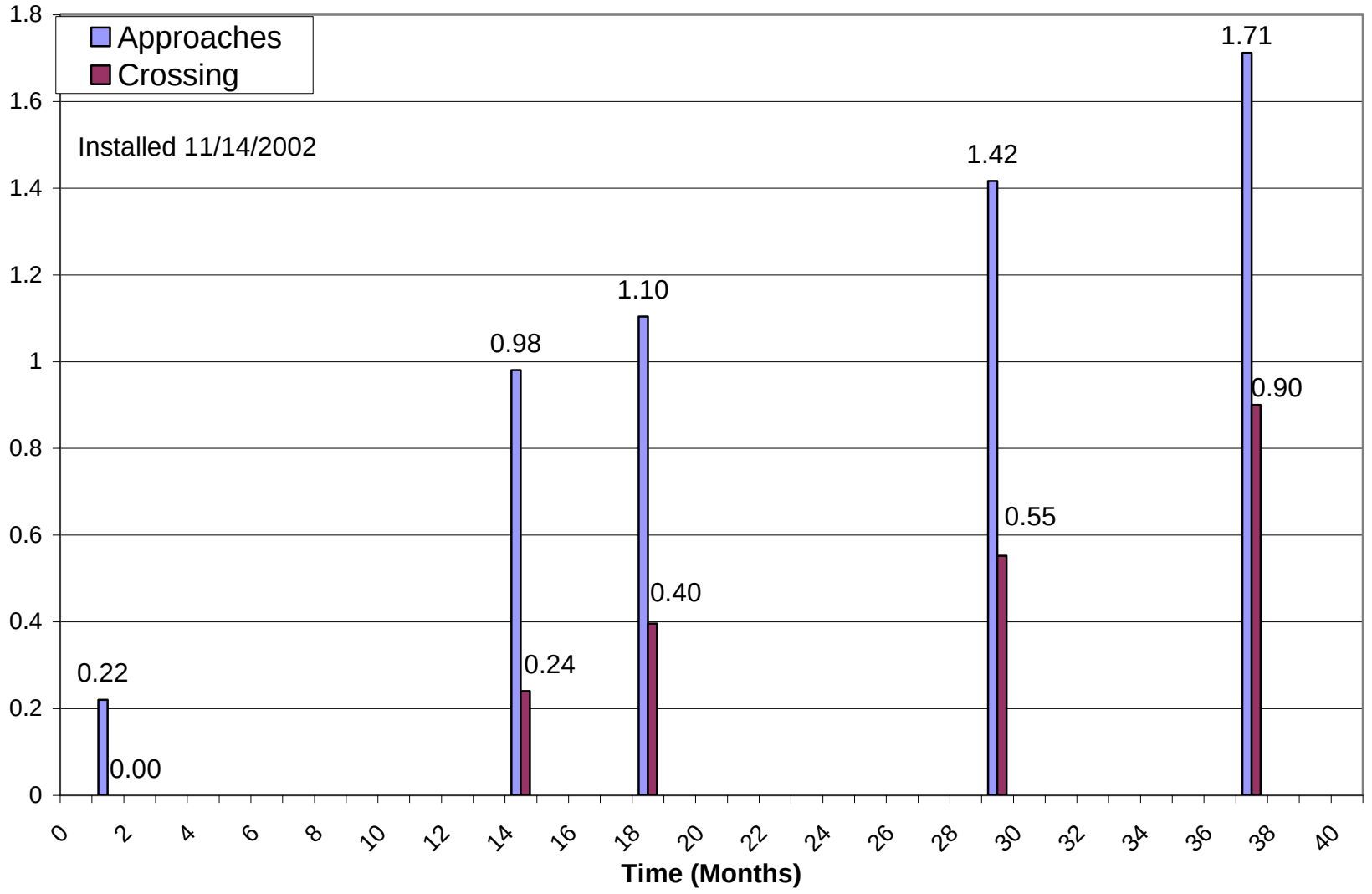
Longitudianl view of highway/rail crossing containing asphalt underlayment



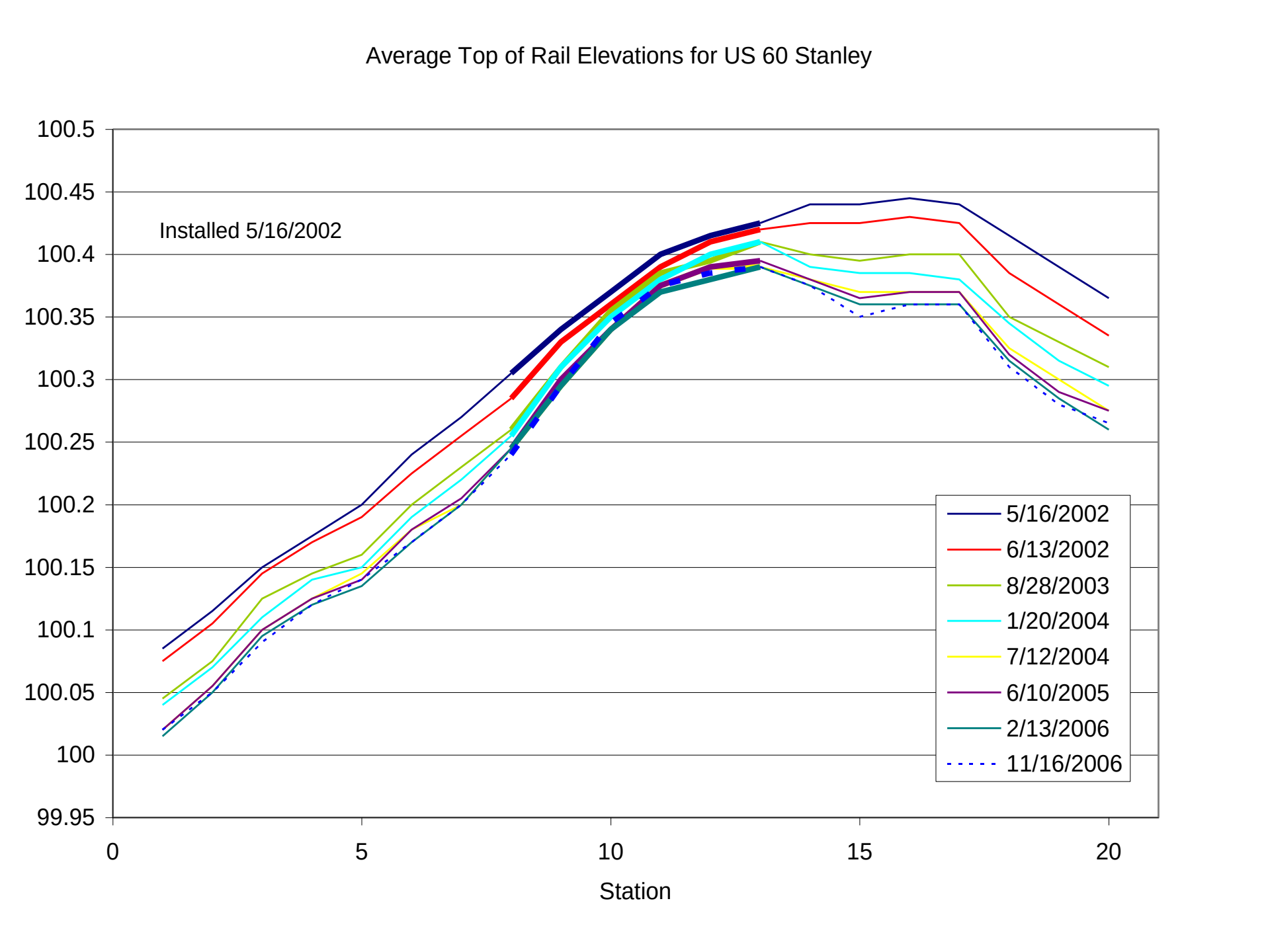
KY Coal Terminal--Heavy Train and Extra Heavy Highway Traffic with ASPHALT

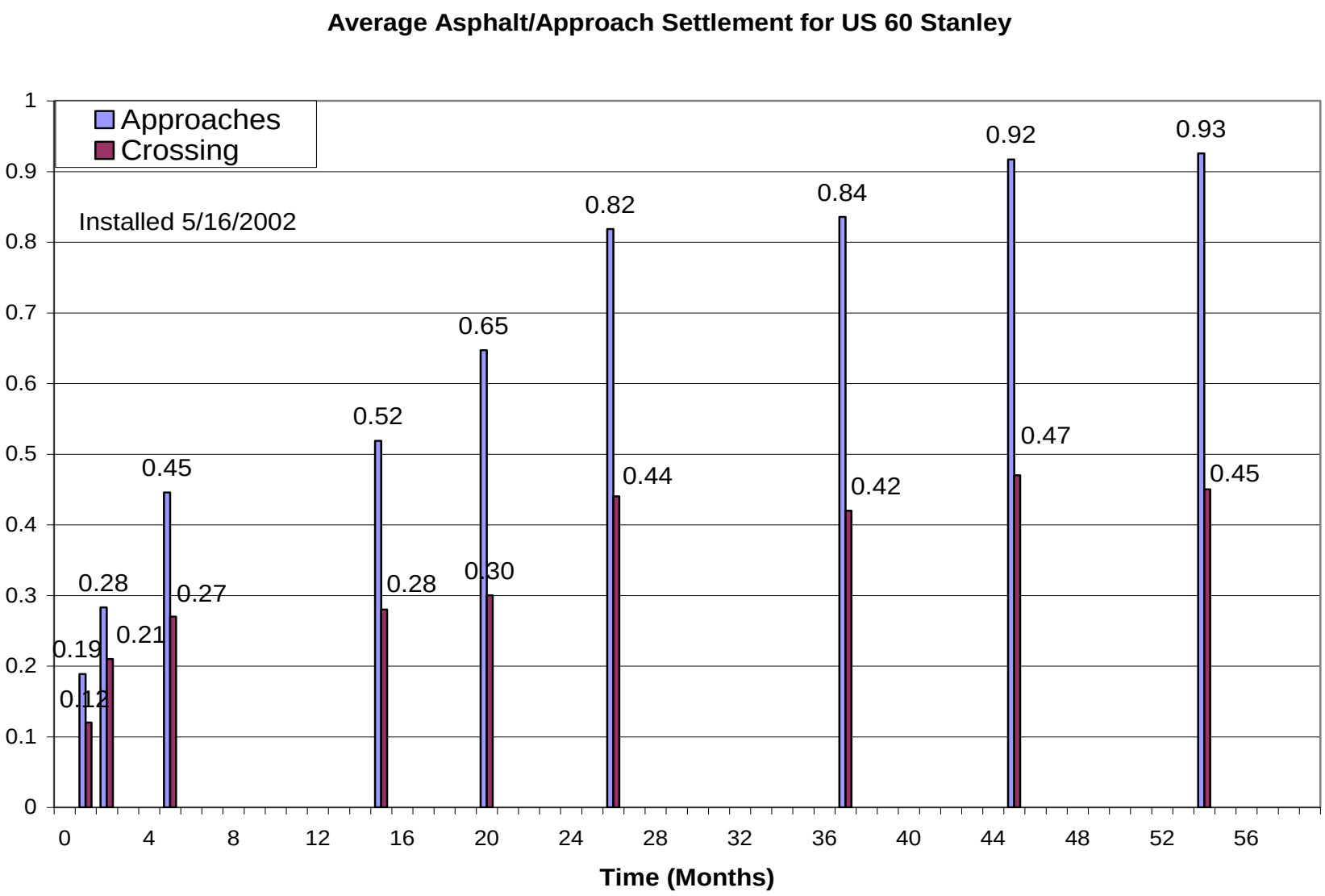

Top of Rail Elevations for KY Coal Terminal # 2 Track
100
99.75
99.5
99.25
99
Installed 11/14/02
EB
WB
11/14/02
11/21/02
1/13/04
5/25/2004
4/13/2005
12/20/2005
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
Station

Average Asphalt/Approach Settlement for KY Coal Terminal #2



Stanley (US 60)--Medium Train and Heavy Highway Traffic with ASPHALT


Average Top of Rail Elevations for US 60 Stanley
Installed 5/16/2002
100.5
100.45
100.4
100.35
100.3
100.25
100.2
100.15
100.1
100.05
100
99.95
0
5
10
15
20
Station
5/16/2002
6/13/2002
8/28/2003
1/20/2004
7/12/2004
6/10/2005
2/13/2006
11/16/2006


Average Asphalt/Approach Settlement for US 60 Stanley
Approaches
Crossing
Installed 5/16/2002
0.19
0.12
0.28
0.21
0.45
0.27
0.52
0.28
0.65
0.30
0.82
0.44
0.84
0.42
0.92
0.47
0.93
0.45
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
4
8
12
16
20
24
28
32
36
40
44
48
52
56
Time (Months)

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9. Malloy, B.R., Rose, J.G. and R.R. Souleyrette (2016). Rehabilitation of Railway/Highway At-Grade Crossings: Recommendations and Guides. Transportation Research RECORD, *Journal of the Transportation Research Board*, Washington, D.C., January 2016, 27 pages.

Thank You for Your Attention Any Questions

Represent Typical Activities

Not All-Encompassing

Represent Current Practices

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