Bike Paths and Low Volume Mixes

Ohio Asphalt Paving Conference
Wednesday, February 7, 2018

Presented by
James A. Marszal, PE
Pavements, Materials & Field Applications Engineer
Flexible Pavements of Ohio

Bike Paths

aka……Shared Use Paths (Rail Trails, Greenway Trails, Waterfront Paths, Side Paths)
Multi-Use Paths
All Purpose Paths
Bikeways

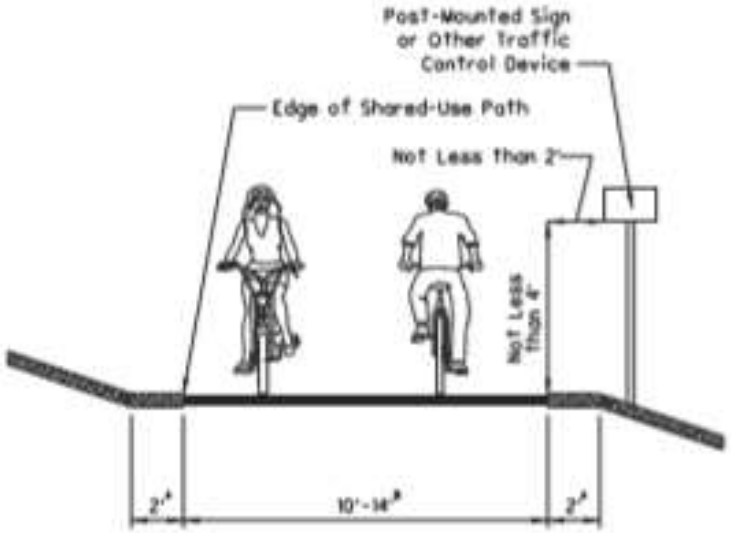
Shared Use Paths are multi-use paths designed primarily for use by bicyclists and pedestrians, including those with disabilities, for transportation and recreation purposes. Shared use paths are physically separated from motor vehicle traffic by an open space or barrier.

Topics Presented:

- Bike Path Design
  - Design resources
- Bike Path Construction
  - Issue(s) affecting pavement performance
  - Recommended solutions
- Low Volume Asphalt Concrete for Bike Paths

ODOT Location & Design Manual – Volume 1 Roadway Design

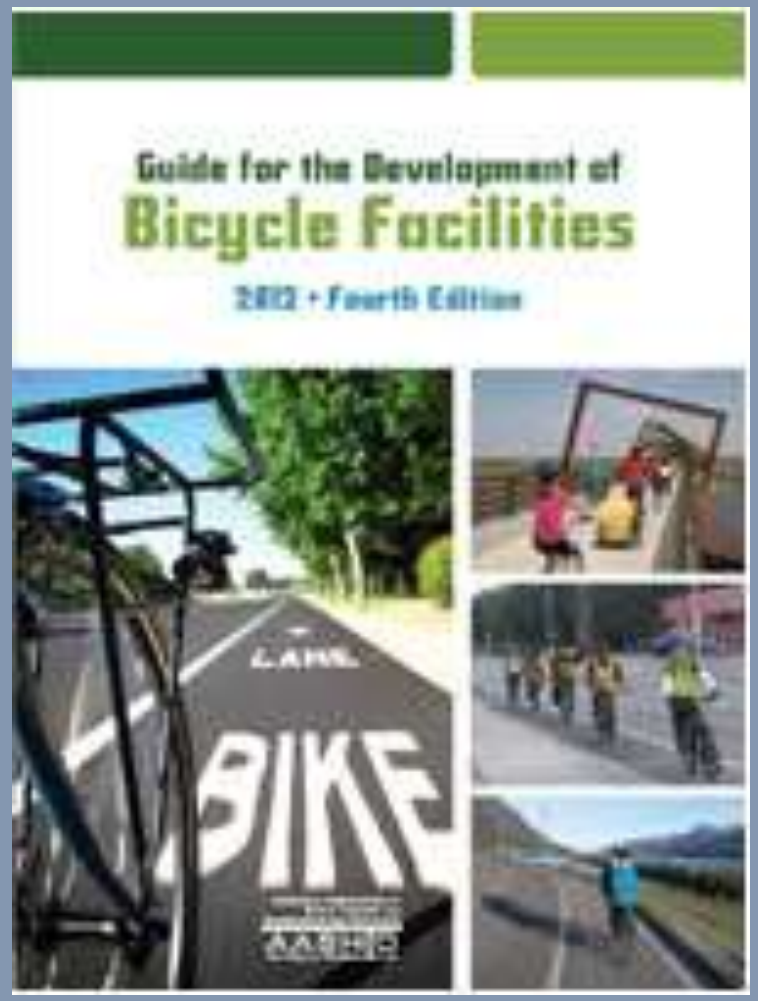
TYPICAL CROSS SECTION OF TWO-WAY, SHARED USE PATH ON INDEPENDENT RIGHT-OF-WAY	701-1E REFERENCE SECTIONS 700.2.1



Notes:
1. (1V:6H) Maximum Slope (typ.)

2. More if necessary to meet anticipated volumes and mix of users, per the FHWA *Shared Use Path Level of Service Calculator*

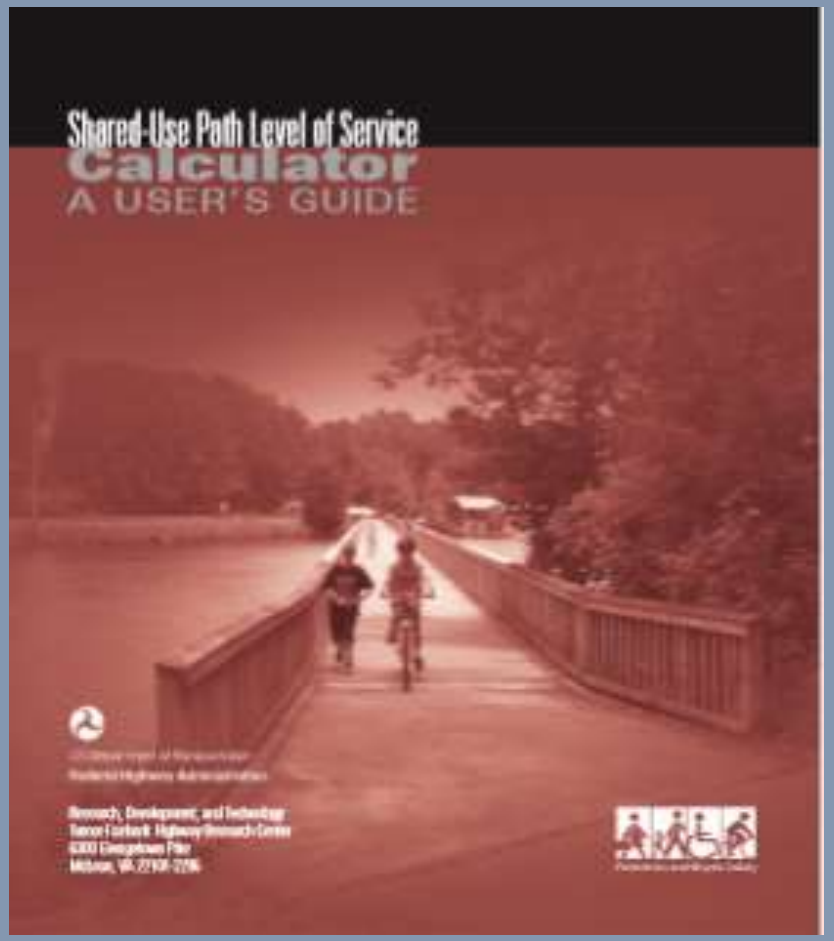
AASHTO - Guide for the Development of Bicycle Facilities, 4th Edition



- Original Version 1999
- Current Version 2012

- 200 pages + figures & tables
- February 2013 Errata
- February 2017 Errata

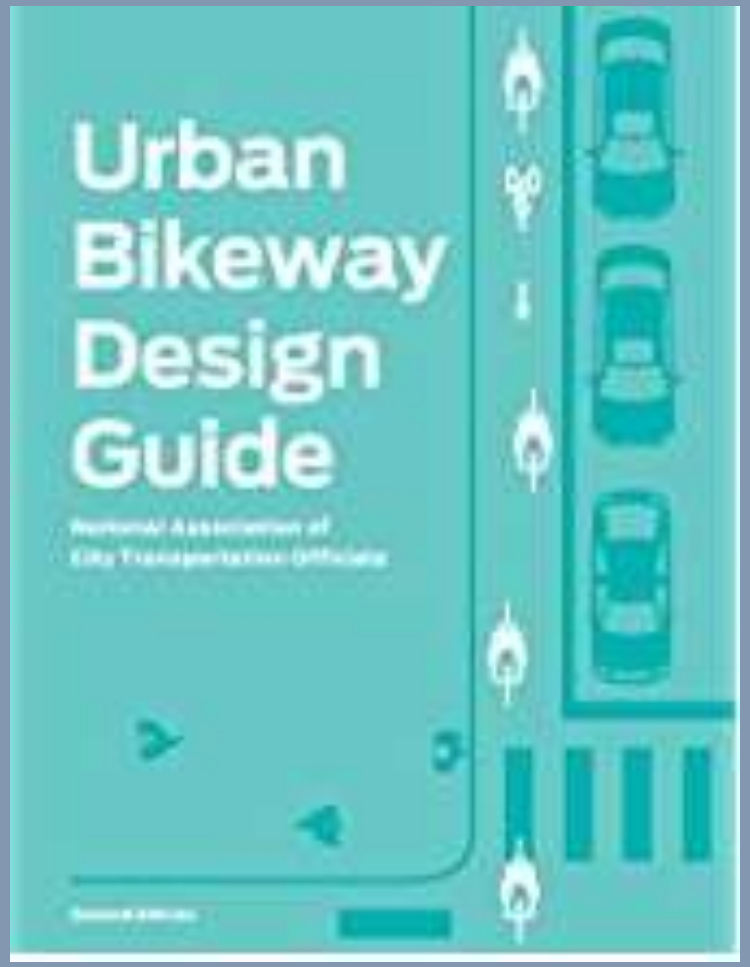
FHWA Shared-Use Path Level of Service Calculator, A Users Guide



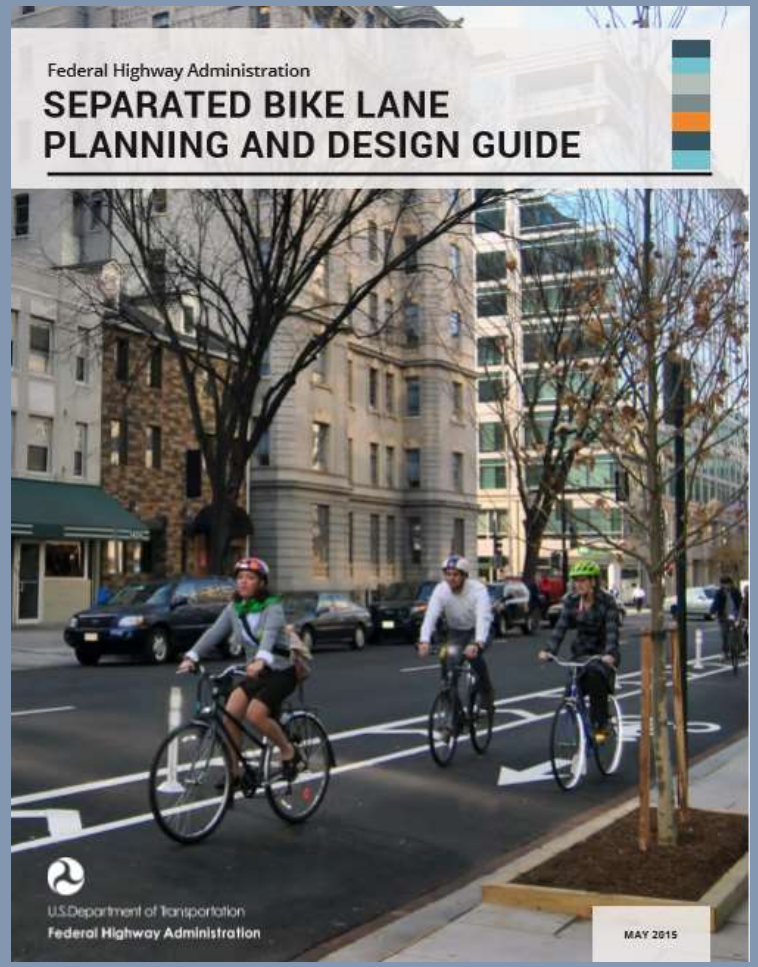
- July 2006
- This document describes how to use a new method to analyze the quality of service provided by shared-use paths of various widths that accommodate various travel mode splits
- Considers widths from 8-20 ft.

NACTO

-National Association of City Transportation Officials



FHWA



OHIO DEPARTMENT OF TRANSPORTATION

All Sites | Search ODOT

HOME | DISTRICTS | DIVISIONS | ODOT A-Z | EMPLOYMENT | SERVICES | CONTACTS

- Bike & Ped Home
- Program Information
- Contacts
- Design
- Resources
- Bike To Work
- Street Smarts
- Safe Routes to School
- Bikeways & Trails
  - Gallia Hike & Bike Trail
  - Grand Lakes St. Marys
  - Great Miami River Trail
  - Great Ohio Lake to River Greenway
  - Hike & Bike Trail
  - Hockhocking Adena Bikeway
  - Heritage Trail
  - Little Miami Scenic Trail
  - North Coastal Inland Trail
  - Ohio to Erie Trail
  - Richland B&O Trail
  - Paint Creek Recreational Trail
  - TJ Evans & Panhandle Trails
  - Wabash Cannonball Trail

ODOT Home ▸ Divisions ▸ Planning ▸ Statewide Planning & Research ▸ Bike & Pedestrian

Bicycle & Pedestrian Information

Visit the Ohio's Bikeways & Trails page for the latest information.

Bikeways & Trails

Ohio's Bikeways & Trails Page
Online overview of the state's significant bike trails

Announcements

Bicycle and Pedestrian Resources for Engineers

Resource Guide
This document provides links to research, resources, and guidance on designing for pedestrians and bicycles. National and Ohio Department of Transportation (ODOT) standards allow a range of flexibility in the design of facilities for walking and bicycling.

Final ODOT Active Transportation Guide
Active transportation is human-powered transportation that engages people in healthy physical activity while they travel from place to place. People walking, bicycling, using strollers, wheelchairs/mobility devices, skateboarding, and rollerblading are engaged in active transportation.

Share the Road License Plates Available
You may choose to support Share the Road by purchasing the Share the Road license plates. Five dollars of the total plate cost is distributed to the highway safety fund to publish and distribute a booklet that instructs bicycle riders on the methods and procedures of riding bicycles on the roads and streets of this state in a confident, legal, and safe manner.

2014 ODOT BikePed Summit
Check here to view

Sign Up!

The Bike & Pedestrian Program Listserv is available to communicate updates and technical information.
Provide your email address and hit the Sign Up button to join our mailing list!

SignUp

Bicycle & Pedestrian Info

Regional

- Akron
- Canton
- Cincinnati
- Clark County (West)
- Cleveland
- Columbus
- Dayton
- Lake County
- Marietta River Trails
- Richland County
- Sandusky/ERPC

OHIO DEPARTMENT OF TRANSPORTATION

All Sites | Search ODOT

HOME | DISTRICTS | DIVISIONS | ODOT A-Z | EMPLOYMENT | SERVICES | CONTACTS

- Bike & Ped Home
- Program Information
- Contacts
- Design
- Resources
- Bike To Work
- Street Smarts
- Safe Routes to School
- Bikeways & Trails
  - Gallia Hike & Bike Trail
  - Grand Lakes St. Marys
  - Great Miami River Trail
  - Great Ohio Lake to River Greenway
  - Hike & Bike Trail
  - Hockhocking Adena Bikeway
  - Heritage Trail
  - Little Miami Scenic Trail
  - North Coastal Inland Trail
  - Ohio to Erie Trail
  - Richland B&O Trail
  - Paint Creek Recreational Trail
  - TJ Evans & Panhandle Trails
  - Wabash Cannonball Trail

ODOT Home ▸ Divisions ▸ Planning ▸ Statewide Planning & Research ▸ Bike & Pedestrian ▸ Design

Ohio Bike & Pedestrian Program
Design

Designing pedestrian and bicycle facilities requires an understanding of the surrounding context and the needs of the community. Taking a context sensitive approach to understand the surrounding current and future land uses EARLY in the planning and preliminary engineering stages is key to constructing a successful project. Many of the Metropolitan Planning Organizations (MPOs) in Ohio have adopted bicycle and pedestrian plans that identify needs within their planning region.

Many MPOs or cities have adopted policies that require projects to consider bicycle and pedestrian accommodations when they are planning a transportation project. Please contact your local agency to ensure compliance. ODOT adheres to the 2005 Policy on Accommodating Bicycle and Pedestrian Travel on ODOT Owned or Maintained Facilities.

CE – Exempt Projects: The construction of bicycle lanes and pedestrian walkways, sidewalks, shared-use paths, and facilities, small passenger shelters, alterations to facilities or vehicles in order to make them accessible for elderly and handicapped persons (i.e. construction of a bike path on an existing railroad bed, designations of certain highways as bike routes, painting of existing paved shoulders as bike lanes, ADA ramps, etc.) are now considered CE –Exempt projects provided that no new disturbance will occur.

If you are receiving federal funding and/or ODOT is reviewing your project, bicycle and pedestrian facilities must conform to the standards in the following manuals:

- **ODOT's Location and Design Manual**
- **The Ohio Manual on Uniform Traffic Control Devices**
- The 2012 **AASHTO Guide for the Development of Bicycle Facilities.**

In 2013 The FHWA Released Guidance on Pedestrian and Bicycle Design Flexibility (read document below)
The guidance refers to: **NACTO Urban Bikeway Design Guide**

The 2005 ODOT Design Guidance for Independent and Roadway Based Bicycle Facilities are no longer being applied to projects. The Office of Roadway Engineering Services is planning to update the Location and Design Manual in spring of 2013 to include a chapter on Bicycle Facilities.

Certain designs such as bike boxes and signals are considered experimental and permitted by FHWA provided a local community conforms to the requirements. The State of Ohio has received Interim Approval for the use of green pavement markings for bike lanes within intersections and/or conflict points. Click here for more information on experimental and interim approved bicycle facilities.

Type	Name	Author	File Size
	Accessibility Guidelines for Pedestrian Facilities	US Accessibility Board	1583 KB
	Bikeway Design on Abandoned Railroad	ODOT	44 KB
	Curb Ramp Design	ODOT-Office of Roadway Engineering	1028 KB
	FHWA 2010 separatedbikelane_pdg		17654 KB
	FHWA Guidance on Pedestrian and Bicycle Design Flexibility	FHWA	1735 KB
	Links to Planning and Design Resources	ODOT-Office of Local Projects	41 KB

Bike Path Construction: Common Issues Affecting Bike Path Performance

- Soft Subgrade
- Poor Drainage
- Thin or Weak Pavement Structure

Observable Distress:

- Edge Cracking
- Irregular Settlement => Raveling/cracking/disintegration due to standing water or perpetually wet pavement or subgrade conditions
- Age related oxidation and fatigue cracking

Design/Construction Recommendations to improve performance:

- Consider conducting a sub-surface investigation
- Item 204 – Subgrade Compaction & Proof Rolling
- Item 304 – Aggregate Base; 6” preferred, 4” acceptable
- Extend aggregate base 6-12” beyond edges of bike path asphalt
- Inspect subgrade preparation and aggregate placement to ensure a uniform depth of aggregate base is placed full width. Avoid thin edges that will result in reduced support and potential edge failure
- Consider specifying granular material(s), geotextile fabrics and geogrids for undercuts in soft, weak or wet areas

Design/Construction Recommendations (continued):

- Install path above curb/roadway to help with drainage and reduce runoff across the path

Paving Operation:

- Consider smaller trucks or lighter loads for asphalt concrete delivery
- Consider load limits for distributor if tack coat is specified
- Consider including a plan note advising the contractor that he may encounter soft(er) subgrade conditions when constructing the bike path. State that the contractor shall be responsible for providing an appropriate paver, trucks and rollers suitable for those conditions

- When circumstances require paving over soft subgrades, consider placement of one lift of asphalt concrete surface course instead of separate intermediate and surface course lifts

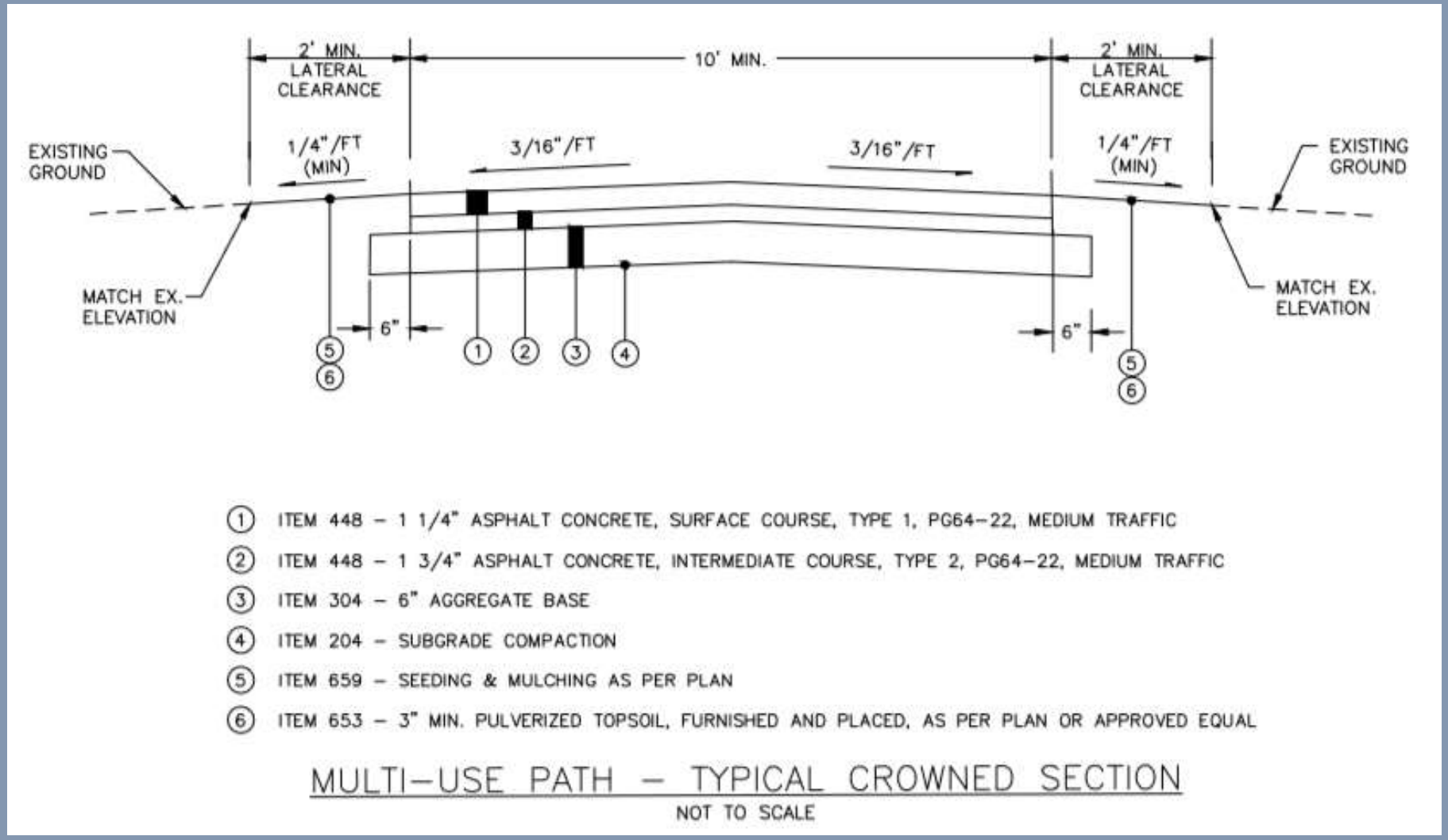
- Bike path pavement looks better if concrete curb ramps can be installed first so that paving can be pulled away from ramps. This approach also prevents concrete ramps from cracking.

Generally Not Recommended:

Item 206 – Subgrade Stabilization

- Rarely used
- Costly
- Impractical for most bike path projects

Typical Bike Path Cross Section:




693
2017/04/26


TEREX
2017/04/26


ROADMIX
2017/04/26


2017/05/02


2016/08/26


2016/08/23

Low Volume Asphalt Concrete for Bike Paths

What Attributes do we want for Low Volume Asphalt Concrete?

- Resilient (self-healing, less brittle, improved crack resistance, slower oxidation)
- Places consistently with uniform texture and is segregation resistant
- Low permeability is desired
- Aesthetically positive to the owner/agency and user

How do we achieve those attributes?

- Softer binders
- Higher binder content
- Finer aggregate gradation
- Polymer binders
  - Resistant to cracking (fatigue and thermal)
  - Resistant to moisture damage (stripping, raveling)
  - Durability = reduced maintenance effort/costs
  - Extends service life of pavement (2-5 yrs/5-10 yrs)

Misc. Pavement Design Issues:

- Item 408 Prime Coat
- Item 407 Tack Coat (0.40 gal/sy or fog spray)
- Assuming 3 inch Bike Path Pavement
  - 1 ¾ “ Intermediate / 1 ¼ ” Surface
  - 2 ” Intermediate / 1 ” Surface
  - 3 ” Surface

Item 424 – Fine Graded Polymer Asphalt Concrete, Type A

- Recipe mix (for light or medium traffic applications)
- Blend of sands w/ 8.5% polymer modified asphalt binder (PG 76-22M)
- Silicon dioxide requirement on the fine agg. ensures good skid resistance
- Highest polymer dosage used in today's market enhances mix toughness, stability, and longevity
- 5/8 ” < thickness < 1”


Cuy-82, Broadview Hts.
2003


Cuy-21, Brecksville
2007 Project
2012 Picture

Item 424 – Fine Graded Polymer Asphalt Concrete, Type B

- Volumetric mix design (typ. for medium or heavy traffic)
- ½-inch max. sized coarse agg. and sand particles w/ min. polymer binder content of 6.4% (PG 76-22M)
- Silicon dioxide requirement on the fine agg. ensures good skid resistance
- One of the highest polymer dosages used in today's market enhances mix toughness, stability, and longevity
- 10% RAP permitted
- ¾ ” < thickness < 1 ¼ ”

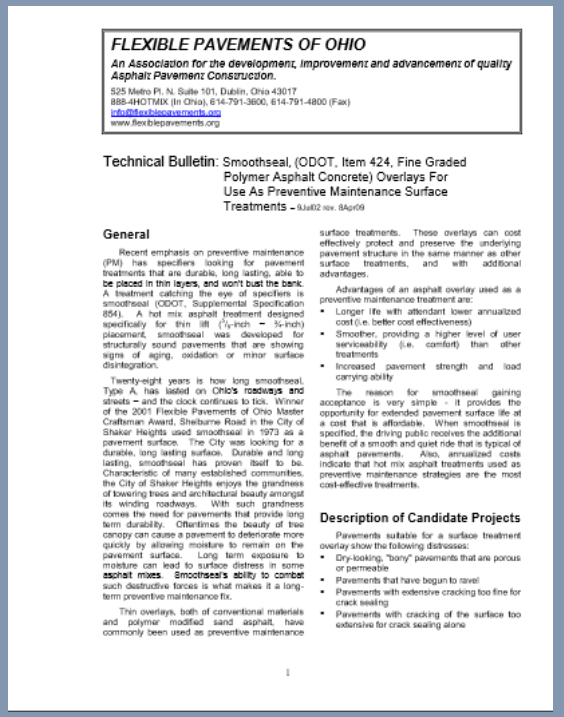

US-6 Wood and Henry Counties
2001/02

Gea-306, ODOT D-12
2009 Project
2012 Picture

Smoothseal **-** Ohio DOT's Fine-Graded Polymer Asphalt Concrete

Types of *Smoothseal*

Technical Resources: Smoothseal



FLEXIBLE PAVEMENTS OF OHIO

An Association for the development, improvement and advancement of quality Asphalt Pavement Construction.

525 Metro Pl. N. Suite 101, Dublin, Ohio 43017
888-4HOTMIX (In Ohio), 614-791-3600, 614-791-4800 (Fax)
info@flexiblepavements.org
www.flexiblepavements.org

Technical Bulletin: Smoothseal, (ODOT, Item 424, Fine Graded Polymer Asphalt Concrete) Overlays For Use As Preventive Maintenance Surface Treatments – 9Jul02 rev. 8Apr09

General

Recent emphasis on preventive maintenance (PM) has specifiers looking for pavement treatments that are durable, long lasting, able to be placed in thin layers, and won't bust the bank. A treatment catching the eye of specifiers is smoothseal (ODOT, Supplemental Specification 854). A hot mix asphalt treatment designed specifically for thin lift (⅜-inch – ¾-inch) placement, smoothseal was developed for structurally sound pavements that are showing signs of aging, oxidation or minor surface disintegration.

Twenty-eight years is how long smoothseal, Type A, has lasted on Ohio's roadways and streets – and the clock continues to tick. Winner of the 2001 Flexible Pavements of Ohio Master Craftsman Award, Shelburne Road in the City of Shaker Heights used smoothseal in 1973 as a pavement surface. The City was looking for a durable, long lasting surface. Durable and long lasting, smoothseal has proven itself to be. Characteristic of many established communities, the City of Shaker Heights enjoys the grandness of towering trees and architectural beauty amongst its winding roadways. With such grandness comes the need for pavements that provide long term durability. Oftentimes the beauty of tree canopy can cause a pavement to deteriorate more quickly by allowing moisture to remain on the pavement surface. Long term exposure to moisture can lead to surface distress in some asphalt mixes. Smoothseal's ability to combat such destructive forces is what makes it a long-term preventive maintenance fix.

Thin overlays, both of conventional materials and polymer modified sand asphalt, have commonly been used as preventive maintenance surface treatments. These overlays can cost effectively protect and preserve the underlying pavement structure in the same manner as other surface treatments, and with additional advantages.

Advantages of an asphalt overlay used as a preventive maintenance treatment are:

- Longer life with attendant lower annualized cost (i.e. better cost effectiveness)
- Smoother, providing a higher level of user serviceability (i.e. comfort) than other treatments
- Increased pavement strength and load carrying ability

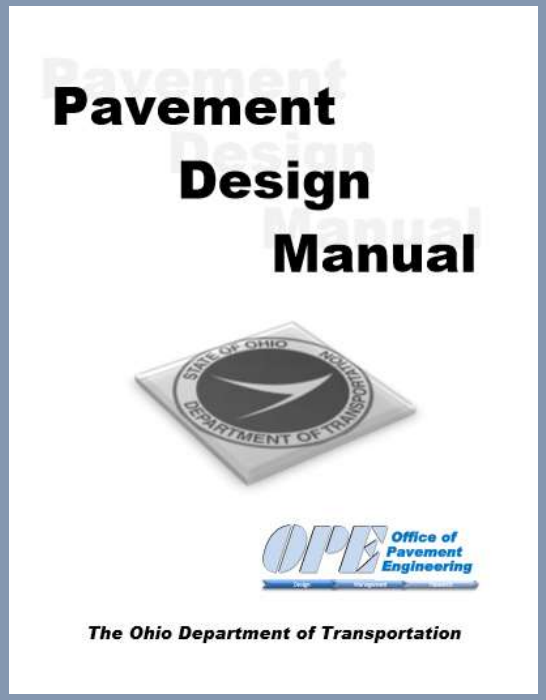
The reason for smoothseal gaining acceptance is very simple - it provides the opportunity for extended pavement surface life at a cost that is affordable. When smoothseal is specified, the driving public receives the additional benefit of a smooth and quiet ride that is typical of asphalt pavements. Also, annualized costs indicate that hot mix asphalt treatments used as preventive maintenance strategies are the most cost-effective treatments.

Description of Candidate Projects

Pavements suitable for a surface treatment overlay show the following distresses:

- Dry-looking, "bony" pavements that are porous or permeable
- Pavements that have begun to ravel
- Pavements with extensive cracking too fine for crack sealing
- Pavements with cracking of the surface too extensive for crack sealing alone

1



Pavement Design Manual

Office of Pavement Engineering

The Ohio Department of Transportation

SMOOTHSEAL™ POLYMER MODIFIED ASPHALT CONCRETE

Flexible Pavements of Ohio

A LONG-LASTING PREVENTIVE MAINTENANCE SOLUTION THAT DELIVERS SUPERIOR VALUE

Smoothseal™ is one of the most economical applications available for rehabilitating and maintaining pavements.

Specially formulated for thin applications ranging from 3/4" to 1" thick, Smoothseal™ is the trademarked name for ODOT Specification Item 424, Fine Graded Polymer Modified Asphalt Concrete, type A or B.

It blends high quality aggregates with polymer modified asphalt, producing one of the most durable, dense graded paving mixtures available, and is the perfect material for a variety of economical preventive maintenance overlays.

Delivering Both Better Performance and Economy

- Increased flexibility - can be placed thin to save curb reveal. Tapers to zero, accommodating utility access points.
- Improved adhesion of mix to base pavement - prevents delamination.
- Improved mix cohesion - reduces raveling, even in shaded or moist conditions. Keeps reflective cracks tight, preserving ride comfort.

Smoothseal™ makes dollars and sense.

Most surface maintenance treatments only delay the inevitable. But Smoothseal not only provides a new pavement surface for a fraction of the cost of starting over, it's the only preventive maintenance technique that adds structural value to the roadway, while helping to extend pavement service life.

You end up with a stronger, more beautiful pavement that improves the ride quality for drivers, and reduces traffic noise for the community.

The use of a thin-mix asphalt overlay such as Smoothseal™, is a superior approach to preventive maintenance as it is the only technique that adds structural value to the roadway and is long lasting.

Asphalt

Thinlay Asphalt Concrete

- Volumetric Mix Design
- One Specification with 4 mixes designed for various traffic levels
- ¼” (6.3 mm) max. nominal aggregate size
- Minimum Total Binder 6.6% For LT and ULT Mixes; 6.4% for MED Mix
- PG 58-28 for LT Mix; PG 52-28 for ULT Mix; PG 64-22 for MED Mix
- ¾ ” < thickness < 1”

Ohio Thinlay Asphalt Concrete

Application				
Traffic Condition:	HT	MED	LT	ULT
ADT:	---	---	<2500	<500
ADTT:	>1500	250-1499	<250	<25
Course Thickness:	¾ to 1-inch	¾ to 1-inch	¾ to 1-inch	¾ to 1-inch

Ohio Thinlay Asphalt Concrete

Composition				
Traffic:	HT	MED	LT	ULT
Gradation:	6.3 mm (1/4-inch) Maximum Nominal Aggregate Size			
Fine agg. (passing no. 8) proportions:	Blend 65/35h (95% mec. crush/nat. sd.)	Blend 50/50 (95% mech. crush/nat. sd.)	>50% nat. sd.	>50% nat. sd.
Coarse agg. angularity:	90% mech. Crushed	90% mech. Crushed	per 703.05	per 703.05
RAP (max %):	25	25	25	25
RAP Preparation:	ODOT Method 2 (extended) RAP, Table 401.04-2, 100% pass 9/16-inch sieve			
Virgin Binder (min.):	5.2	5.2	5.2	5.2
Total Binder (min):	6.4	6.4	6.6	6.6
Virgin Binder (type):	70-22M	64-22	58-28	52-28


CR-51, Ottawa County
Village of Genoa
Genoa Clay Center Road
Kokosing Construction
PG 64-22
7/21/17


ASD-60, ODOT D-3
Shelly & Sands, Inc.
PG 58-28
8/16/17

Wayne-539, ODOT D-3
Shelly & Sands, Inc.
PG 52-28
8/18/17


Lak-20, ODOT D-12
Karvo Paving
PG 70-22M
8/28/17

Technical Resources: Thinlay Asphalt Concrete

FLEXIBLE PAVEMENTS OF OHIO

An Association for the development, improvement and advancement of quality Asphalt Pavement Construction.

6205 Emerald Parkway, Suite B, Dublin, Ohio 43016
888-4HOTMIX (In Ohio), 614-791-3600, 614-791-4800 (Fax)
info@flexiblepavements.org
www.flexiblepavements.org

Technical Bulletin: **Thinlays** For Use As Pavement Preservation Surface Treatments – 19Sept2017

General

The heightened interest in pavement preservation (aka, preventive maintenance) has specifiers looking for pavement treatments that are durable, long lasting, able to be placed in thin layers, and won't break the budget. A treatment developed specifically for the purpose and for use in Ohio is Thinlay Asphalt Concrete. An asphalt concrete treatment designed specifically for thin lift (¾-inch, minimum) placement, Thinlay Asphalt Concrete was developed for use in pavement preservation on structurally sound pavements that are showing signs of aging, oxidation or minor surface disintegration.

Figure 1: Paving Thinlay Asphalt.

The specifications for Thinlay Asphalt Concrete are based upon the extensive Ohio experience with other thin lift asphalt concrete materials including 404, Smoothseal (Item 424, Fine Graded Polymer Asphalt Concrete) and 404LVT.

Thin overlays, have commonly been used as preventive maintenance surface treatments. These overlays can cost effectively protect and preserve the underlying pavement structure in the same manner as other surface treatments, and with additional advantages.

Advantages of an asphalt overlay used as a pavement preservation treatment are:

- Longer life with attendant lower annualized cost (i.e. better cost effectiveness)
- Smoother, providing a higher level of user serviceability (i.e. comfort) than other treatments
- Increased pavement strength and load carrying ability

The reason for pavement preservation gaining acceptance is very simple - it provides the opportunity for extended pavement surface life at a cost that is affordable. When a Thinlay is specified, the driving public receives the additional benefit of a smooth and quiet ride that is typical of asphalt pavements. Also, annualized costs indicate that asphalt concrete treatments used as pavement preservation strategies are among the most cost-effective treatments.

Description of Candidate Projects

Pavements suitable for a surface treatment Thinlay show the following distresses:

- Dry-looking, "bony" pavements that are porous or permeable;
- Pavements that have begun to ravel;
- Pavements with extensive cracking too fine for crack sealing; or
- Pavements with cracking of the surface too extensive for crack sealing alone.

Suitable candidate projects will have no unrepaired structural (fatigue) damage and will have sufficient remaining structural capacity to last the expected life of the pavement preservation treatment. Rapidly deteriorating projects are not good candidates for pavement preservation as the rapidly declining condition may be indicative of structural inadequacy. Thinlay should be used wherever pavement preservation is the objective of a treatment. It should be placed on structurally sound pavements that are exhibiting only surface distress. Raveling and minor cracking due to oxidation are the types of distresses for which a Thinlay is ideally suited.
If significant rutting exists (>¼ inch) in a candidate pavement, the cause must be determined and

THINLAY ASPHALT CONCRETE
September 19, 2017

Notes to Designers:

THINLAY ASPHALT CONCRETE is a pavement preservation material. The THINLAY specification was developed for use on all traffic applications ranging from interstate highway to arterial pavement and low volume rural roads. It provides a value-competitive alternative to chip sealing and microsurfacing all the while providing a superior driving experience. A THINLAY pavement surface is smooth, eliminates dust, is free of loose stone chips, and is quiet and completely reusable into new asphalt pavement.

THINLAY ASPHALT CONCRETE is a minimum 3/4-inch thick asphalt overlay that preserves a pavement by correcting minor surface distresses, provides increased pavement strength that resists pavement fatigue, enhances ride comfort, and improves road profile and driver safety. (Note: A variable-depth intermediate course is recommended where profile or crown are excessive.)

THINLAY ASPHALT CONCRETE is non-proprietary and can be furnished by any asphalt producer. THINLAY is produced as either a hot mix asphalt or warm mix asphalt product.

THINLAY ASPHALT CONCRETE has been designed to be rich in asphalt binder, fine-textured with a tight surface matrix to resist aging. THINLAYs used in lighter traffic applications require a softer grade asphalt binder (PG58-28) and a minimum of 50% of the virgin fine aggregate to be natural sand. This facilitates attaining mix density, flexibility, and resilience. These are necessary properties for ensuring longevity and successful mix performance on light traffic roadways where oxidation and cracking are the primary pavement distresses.

To ensure longevity and flexibility on the lightest trafficked roadways the specification introduces Performance Graded binder PG52-28. An oft mentioned positive attribute of seals and other cold asphalt treatments is the effect of soft asphalt binders with respect to sealing and providing resistance to surface cracking. THINLAY ASPHALT CONCRETE ULT is designed with this feature in mind by using PG52-28.

The mix specified must be appropriate for the traffic conditions to which it will be subjected and the following guidelines should be applied:

Mix Type:	HT (High Traffic)	MED (Medium Traffic)	LT (Light Traffic)	ULT (Ultralight Traffic)
ADT:			<2,500	<500
ADTT:	>1,500	250-1,499	<250	<25

Agencies are requested to contact Flexible Pavements of Ohio for additional guidance and to obtain the most current specification in an MSWord file. Contact Flexible Pavements of Ohio at 1-888-4HOT MIX (446-8649) or info@flexiblepavements.org

SS 823 – Light Traffic Asphalt Mixture Composition Requirements

- Item 823 – Asphalt Concrete Surface Course, Type 1, (448)
- Item 823 – Asphalt Concrete Intermediate Course, Type 1, (448)
- Item 823 – Asphalt Concrete Intermediate Course, Type 2, (448)

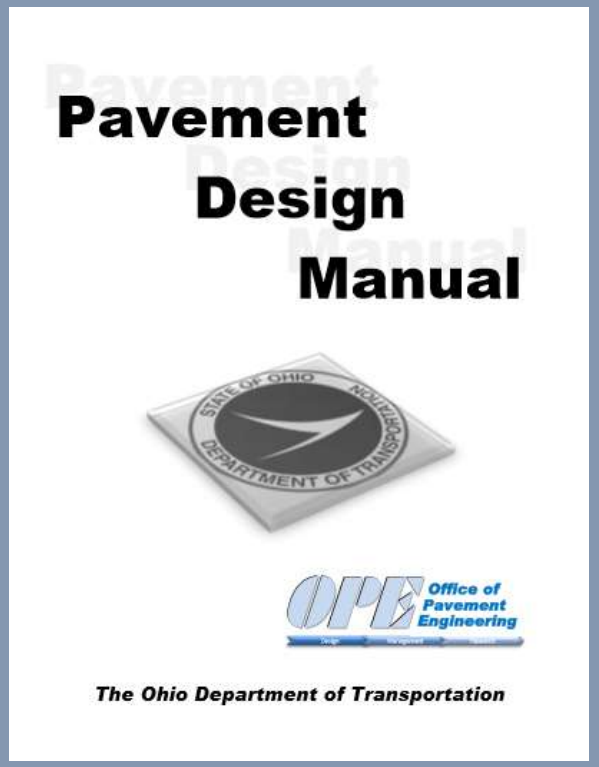
Designer Note: This item is for use in locations with little or no truck traffic (<50 trucks per day). Locations where this item may be used include state park roads, parking lots, driveways, and bike paths. This item is not for use on any state highway.

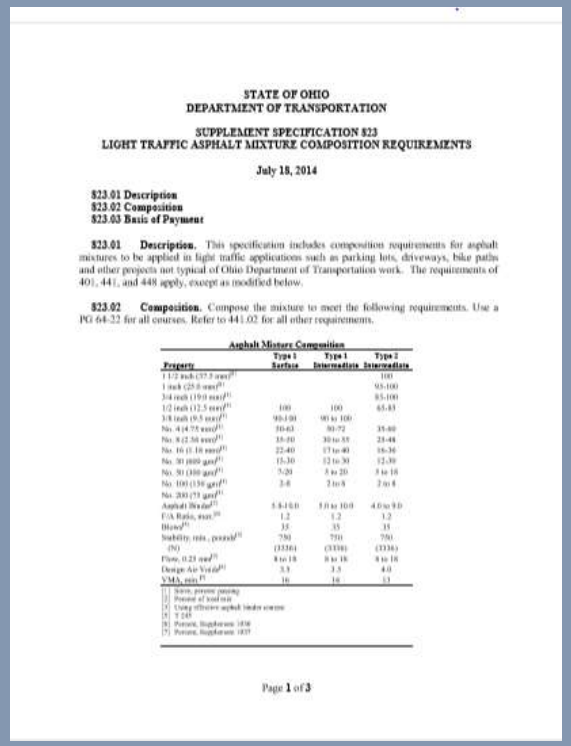
- PG 64-22 binder
- 35 blow design = higher binder content; + 0.2-0.3% typ. => 6.0-6.4%
- Gradation; surface ½ " max, but, slightly finer than 441 Type 1
- 1"< thickness < 1 ½"; typical thickness = 1 ¼"

Item 441 – Asphalt Concrete Surface Course, Type 1, (448)

- Volumetric Mix Design
- Designed for Medium Traffic, i.e. 50 blow mix
- ½ “ max. aggregate
- Asphalt Binder: PG 64-22 at 5.8-10.0%; Typ. 5.8-6.1%
- 1” < thickness < 1 ½ ”; typical thickness = 1 ¼ “
- Or…one 3” lift when paving over soft subgrades
- Item 441 – Asphalt Concrete Intermediate Course, Type 2, (448)
  - Typ. placed at 1 ¾ ” (min); but can be placed at 2”+

Technical Resources: ODOT Items 823-Type 1 and 441-Type 1





STATE OF OHIO
DEPARTMENT OF TRANSPORTATION

SUPPLEMENT SPECIFICATION 823
LIGHT TRAFFIC ASPHALT MIXTURE COMPOSITION REQUIREMENTS

July 18, 2014

823.01 Description
823.02 Composition
823.03 Basic of Payment

823.01 Description. This specification includes composition requirements for asphalt mixtures to be applied in light traffic applications such as parking lots, driveways, bike paths and other projects not typical of Ohio Department of Transportation work. The requirements of 401, 441, and 448 apply, except as modified below.

823.02 Composition. Compose the mixture to meet the following requirements. Use a PG 64-22 for all courses. Refer to 441.02 for all other requirements.

Asphalt Mixture Composition

Property	Type 1 Surface	Type 1 Intermediate	Type 2 Intermediate
1 1/2 inch (37.5 mm)[1]			100
1 inch (25.0 mm)[1]			95-100
3/4 inch (19.0 mm)[1]			85-100
1/2 inch (12.5 mm)[1]	100	100	65-85
3/8 inch (9.5 mm)[1]	90-100	90 to 100	
No. 4 (4.75 mm)[1]	50-65	30-72	35-60
No. 8 (2.36 mm)[1]	35-50	30 to 55	25-48
No. 16 (1.18 mm)[1]	22-40	17 to 40	16-36
No. 30 (600 µm)[1]	15-30	12 to 30	12-30
No. 50 (300 µm)[1]	7-20	5 to 20	5 to 18
No. 100 (150 µm)[1]	3-8	2 to 8	2 to 8
No. 200 (75 µm)[1]			
Asphalt Binder[2]	5.8-10.0	5.0 to 10.0	4.0 to 9.0
F/A Ratio, max.[10]	1.2	1.2	1.2
Blend[1]	35	35	35
Stability, min., pounds[1]	750	750	750
(N)	(3336)	(3336)	(3336)
Flow, 0.25 mm[2]	8 to 18	8 to 18	8 to 18
Design Air Void[1]	3.5	3.5	4.0
VMA, min.[2]	16	16	13

[1] Sieve, percent passing
[2] Percent of lead mix
[3] Using effective asphalt binder content
[5] T 245
[8] Percent, Supplement 1030
[9] Percent, Supplement 1035

Page 1 of 3

Special Pavement Option:

Porous Asphalt Pavement

FLEXIBLE PAVEMENTS OF OHIO

An association for the development, improvement and advancement of quality asphalt pavement construction.

6205 Emerald Parkway, Suite B, Dublin, OH, 43016
888-4HOTMIX (In Ohio), 614-791-3800, 614-791-4800 (Fax)
info@flexiblepavements.org
www.flexiblepavements.org

Technical Bulletin: Porous Asphalt Pavement, (Rev. 09June2016)

Introduction

Porous asphalt pavements are being used to reduce or eliminate storm water runoff from parking lots and other such facilities. A porous asphalt pavement is constructed over a stone-filled reservoir to collect and store storm water and to allow it to infiltrate into the soil between rainfalls. Where low soil permeability is not conducive to infiltration, a similar design can be used as a detention facility or an exfiltration solution that filters pollutants from the first flush and improves the water quality of the runoff. These designs can reduce pollution and replace expensive detention and treatment facilities. Porous pavement systems are rapidly gaining favor with designers and regulators as an economical approach to storm water management for sustainable or low-impact development. As the NPDES permit requirements have become more widely applicable, it has become necessary that developers find more innovative means of compliance. Porous pavement systems are commonly being used as part of a strategy to obtain Leadership for Energy and Environmental Design (LEED®) certification for green building projects. Another benefit of porous pavement for parking lots is the absence of ponded water on the pavement during and after rainfall. Patrons never have to step in a puddle again!

While detention basins are often used to collect and slow the rate of runoff from the impermeable surfaces of roofs and pavements and are effective, they require additional land. Especially on re-development sites, additional land may not be available or may be prohibitively expensive. The porous pavement/recharge bed design may be the solution to the problem.

Figure 1: Parking Facility of the Mansfield Art Center, Richland County, Ohio

The "Porous Pavement" concept was conceived in the Franklin Institute Research Laboratories in 1968 and was developed there under a grant from the U.S. Environmental Protection Agency during 1970 and 1971. After the final report on the project was issued, interest in the concept prompted Edmund Thelen and Leslie Fielding Howe to prepare a book about its development that included a design guide. The publication, ***Porous Pavement***, was published by the Franklin Institute Press in 1978. The book is out of print, but, is still available in some technical libraries and on-line (2). The Ohio Department of Natural Resources has developed a comprehensive guide for the use of porous asphalt pavement. It is contained in the ODNR, *Rainwater and Land Development Manual*

Flexible Pavements of Ohio

An association for the development, improvement and advancement of quality asphalt pavement construction.

- HOMEPAGE
- CALENDAR
- NEWS
- ABOUT FPO
- AWARDS
- ASPHALT CONTRACTORS LIST
- ODOT
- OHIO ASPHALT MAGAZINE
- SCHOLARSHIPS
- SUSTAINABILITY
  - Sustainability
  - Porous Asphalt
  - Asphalt and the Environment
- EDUCATION/TRAINING
- GOVERNMENT RESOURCES
- TECHNICAL RESOURCES
- SITE MAP
- FACEBOOK PAGE
- TWITTER FEED
- YOUTUBE CHANNEL

Porous Asphalt

Home » Sustainability » Porous Asphalt

Porous asphalt pavements are being used to reduce or eliminate storm water runoff from parking lots and other such facilities. A porous asphalt pavement is constructed over a stone filled reservoir to collect and store storm water and to allow it to infiltrate into the soil between rainfalls (Figure 1). Where low soil permeability is not conducive to infiltration, a similar design can be used as a detention facility or an exfiltration solution that filters pollutants from the first flush and improves the water quality of the runoff. These designs can reduce pollution and replace expensive detention and treatment facilities.

Porous pavement systems are rapidly gaining favor with designers and regulators as an economical approach to storm water management for sustainable or low-impact development. As the NPDES permit requirements have become more widely applicable, it has become necessary that developers find more innovative means of compliance. Porous pavement systems are commonly being used as part of a strategy to obtain Leadership for Energy and Environmental Design (LEED®) certification for green building projects.

Porous Asphalt Pavement Resources

From the National Asphalt Pavement Association:
Porous Asphalt Webpage
Six page design brochure on "Porous Asphalt Pavements" (IS-33E)
"Porous Asphalt Pavement", a presentation by Kent Hansen, Director of Engineering, National Asphalt Pavement Association.

From the Ohio Department of Natural Resources: Information on the design, construction & maintenance of permeable paving materials can found in Chapter 2, Section 2.11 of the Ohio Department of Natural Resources Rainwater & Land Development Manual

From the University of New Hampshire Stormwater Center:
UNHSC Design Specifications for Porous Asphalt Pavement and Infiltration Beds (Rev. 10/09)
Winter Maintenance Guidelines for Porous Pavements
Economic and Adaption Benefits of Low Impact Development

From the Franklin Institute: The original Porous Pavement Design Guide, developed by Thelen and Howe

From the Minnesota Asphalt Pavement Association:
The Shingle Creek Watershed Management Commission in Minnesota is monitoring the snow and ice control requirements of two porous asphalt intersections in Robbinsdale, MN. See the "Shingle Creek Watershed Porous Asphalt Pavement Study" article in MnAPA newsletter for more information.

From the Asphalt Pavement Association of Oregon:
"Porous Asphalt for Stormwater Management, It's Not Just for Parking Lots Anymore", a presentation by Gary Thompson, PE, Training Director for the Asphalt Pavement Association of Oregon on the use of porous pavement in

Resource Materials

- Porous Asphalt Pavement FAQ (16July12)
- Technical Bulletin: Porous Asphalt Pavement (9June16)
- Porous Asphalt Pavement Surface Course Specification (9June16)
- Porous Asphalt Pavement Base Course Specification (9June16)
- NCAT Report 99-03 Design of New-Generation Open-Graded Friction Course
- Franklin Institute Porous Pavement Design Guide
- UNHSC Porous Asphalt Design Specification (October2009)
- APA Cleaner Water with Asphalt Pavements
- FHWA Open Graded Friction Courses Technical Advisory
- NAPA Porous Asphalt Pavements Presentation
- "Porous Asphalt for Stormwater Management, It's Not Just for Parking Lots Anymore" Presentation
- "Porous Asphalt Pavement Debuts at Sand Run Metro Park" Presentation
- "Porous Pavement, A Green Step Forward" Presentation
- Asphalt-the Right Choice for Porous Pavements
- Thinking Green with Porous Asphalt
- Lenexa, Kansas Tries Porous Asphalt on for Size
- Shingle Creek Watershed Porous Asphalt Pavement Study

Conclusion:

1) **Bike Path Design**
   - Refer to AASHTO - Guide for the Development of Bicycle Facilities, 4th Edition
   - See ODOT Internet Planning Site for additional information and links

2) **Construction**
   - Extend 304 aggregate 6-12” beyond limits of bike path pavement and inspect for uniform depth
   - Adjust equipment, methods and materials when paving over soft subgrades

Conclusion:

3) Low Volume Asphalt Concrete

- **Intermediate Course**
  - Item 823 – Asphalt Concrete Intermediate Course, Type 2, (448)
  - Item 441 – Asphalt Concrete Intermediate Course, Type 2, (448)

- **Surface Course**
  - Item 424 – Fine Graded Polymer Asphalt Concrete, Type A
  - Item 424 – Fine Graded Polymer Asphalt Concrete, Type B
  - Item 690 – Thinlay Asphalt Concrete, Type (ULT, LT, MED), (448)
  - Item 823 – Asphalt Concrete Surface Course, Type 1, (448)
  - Item 441 – Asphalt Concrete Surface Course, Type 1, (448)

  - Item Special – Porous Asphalt Pavement

I would like to thank
Bradley Foster, PE, PS
Assistant County Engineer
Franklin County, Ohio
for the Franklin County Bike Path Background
Information and Pictures

Questions?

Thank you!

James A. Marszal, P.E.
Pavements, Materials and Field Applications Engineer
Flexible Pavements of Ohio
james.marszal@flexiblepavements.org
info@flexiblepavements.org
www.flexiblepavements.org
p 888.4HOTMIX