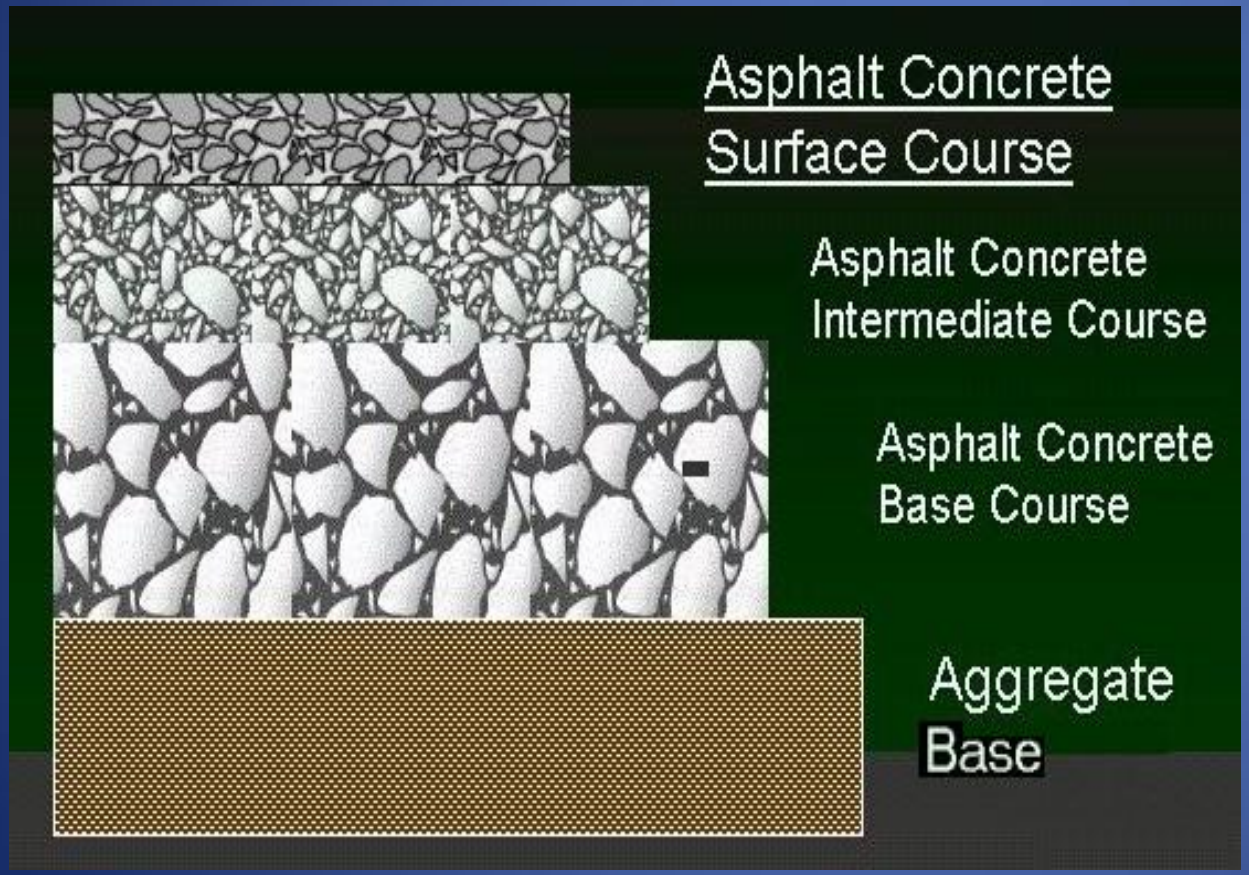
Engineering and Performance Considerations for Asphalt Base and Composite Pavements

Typical Asphalt Base Pavement



441, Type 1, etc.

441 Type 2, etc.

301(3” min.) or

302 (4” min)

304

on Prepared Subgrade, item 204, stabilized item 206

Asphalt base pavement performance

- Pavements with an asphalt base have a long and successful performance history on Ohio Highways
- This experience has shown that :
- Asphalt base is a long-life pavement
- Asphalt surfaces last longer on asphalt base
- Maintenance of an asphalt base pavement is simple, inexpensive and fast.
- Asphalt surfaces are smoother and quieter
- See the references for studies

Asphalt surfaces are smoother, quieter and look better

- Smoothness is important on high speed roadways: greater comfort, economy and less maintenance
- Paint markings last longer and are more visible on asphalt
- See our award photos at http://www.flexiblepavements.org/awards

Ensuring Good Performance in Flexible Pavement Design and Construction:

accomplished through:

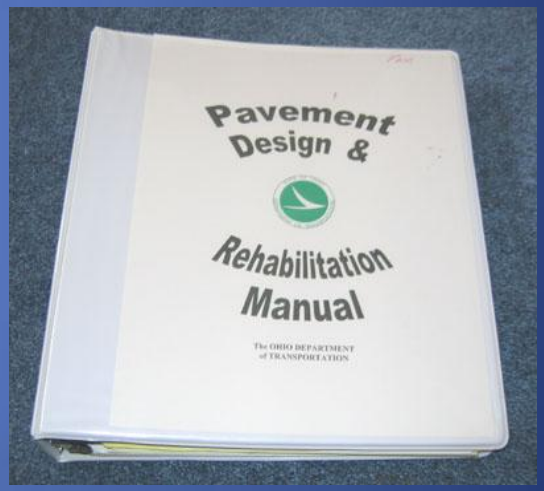
- Proper structural (thickness) design for the existing soil, anticipated loads and existing pavement condition for overlays.
- Optimum number of layers to facilitate stability, smoothness and economy
- Selection of the appropriate mix types for each of the layers to achieve stability, smoothness and economy
- Construction that complies with or exceeds the specifications for uniformity, smoothness and compaction(QC/QA and FQCS)

Maintenance of an asphalt base pavement is simple, inexpensive and fast.

- Maintenance consists of mill and fill and crack filling
- Maintenance of traffic is easier
- Do it overnight , if needed

Ensuring Proper Design

Follow guidance in the ODOT Pavement Design Manual for structural (thickness) design and Mix type and layer thickness selection



Section 200, Pavement Design Concepts

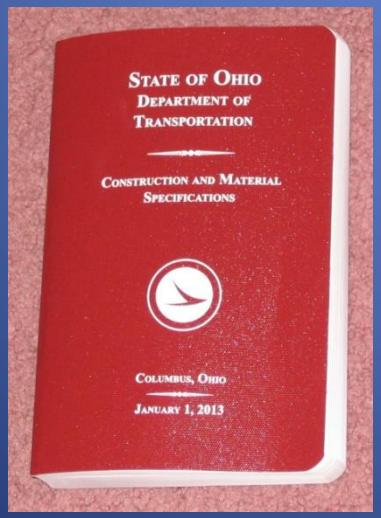
300, Rigid Pavement Design

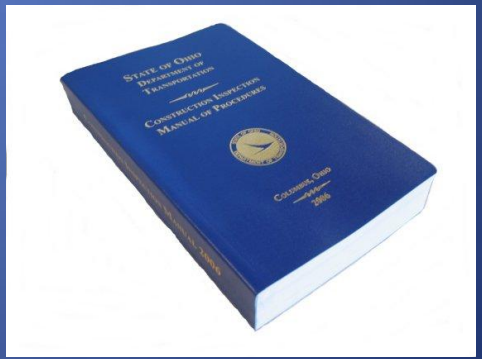
400, Flexible Pavement Design

500, Minor Rehabilitation

Ensure Proper Construction

- Follow the guidance in the ODOT Construction and Material Specifications and the Construction Administration Manual of Procedures





For more information on asphalt base pavement performance visit www.flexiblepavements.org

- "Economic Evaluation of Ohio's Flexible and Rigid Interstate Pavements“
- visit the "Sustainable Pavement' page.
- Also, visit the Federal Highway Administration's LTPP home page at http://www.fhwa.dot.gov/pavement/pub_details.cfm?id=8 to view the Tech Brief, "Performance Trends of Rehabilitated AC Pavements" Publication No. FHWA-RD-00-165
- ODOT research project report, (1) SJN 14783, Evaluation of Variation in Pavement performance between Districts, Univ. of Toledo, Dr. E. Chou, et. al., 2004 on the ODOT website at http://www.dot.state.oh.us/Divisions/Planning/SPR/Research/reportsandplans/_layouts/listform.aspx?PageType=4&ListId={7914B63D-DF9D-4762-92FF-4674BE7DD96A}&ID=36&ContentTypeID=0x0100A87157BC16FE6843984E26CC694CAAAB
- “Asphalt Base Pavements – The Best Value in Pavements”
- See ODOT study of thin overlays summary article in Ohio Asphalt Fall/Winter 2009:

Composite Pavement – asphalt on concrete

Composite pavements are:

- old concrete pavement overlaid with asphalt
- concrete base (Item 305 or RCC) with an asphalt wearing course
- other types including brick

Kinds of concrete pavement and base

- Reinforced (Item 451) – characterized by steel mesh reinforcement, doweled transverse joints and tied longitudinal joints,
- Plain (Item 452) – Has load transfer as 451 but no reinforcing mesh. Uses a short (15’) joint spacing to prevent mid slab cracks
- Concrete base (Item 305) – like 452
- Roller Compacted concrete –lean concrete placed like asphalt with low W/C ratio, no load transfer or steel

Reinforced concrete engineering and performance

- Transverse and longitudinal joints are used to control cracking
- Load transfer is the critical element at joints.
- Transverse joints with dowels, longitudinal joints with tie bars
- Reinforcing mesh allows longer (21') joint spacing with the expectation that mid-panel cracks will form but the steel will hold them tightly together and not allow further deterioration. Hairline cracks (less than approximately 1/8 inch (3 mm) wide) are common, even expected, in reinforced pavements and are little cause for concern. Wider cracks likely mean the steel has failed and the cracks are going to deteriorate and need repair. (ODOT PDM)

Non-reinforced (plain) concrete engineering and performance

- Uses doweled transverse and tied longitudinal joints for load transfer, no mesh.
- uses shorter (15’) joint spacing to prevent mid-panel cracking. Any cracks in non-reinforced pavement, even hairline, are likely to deteriorate and require repair
- Given the high temperature variations and heavy truck traffic in Ohio, aggregate interlock is not effective and faulting is the primary result. (ODOT PDM 303.1)
- Adequate concrete cover is needed to transfer stresses between the concrete and the dowel bars. Because of the required concrete cover, the minimum thickness of concrete pavement is 8 inches

Composite Pavement Performance

- Some pavements have been built new with a concrete base and an asphalt wearing surface
- An asphalt overlay is the most common rehabilitation treatment for a deteriorated concrete pavement
- But, an asphalt surface on a concrete base is not the best performing application of asphalt
- The problem is reflection cracking
- ODOT warns that reflection cracking is inevitable in composite pavement (ODOT PDM 504.04)
- Reflective cracking leads to accelerated deterioration and shortened life of the asphalt surface


Asphalt surface over RCC base

Ensuring best performance of an asphalt overlay on concrete

- Make adequate structural repairs to restore load transfer between slabs at cracks and joints
- Place a structurally adequate overlay
- Take measures to control reflection cracking
- Provide adequate ongoing maintenance

restore load transfer

Concrete pavement restoration (CPR):

- Retrofit subsurface drainage
- joint repair, item 255
- dowel bar retrofit, Item 258,
- undersealing, SS 812
- Crack and joint sealing, Item 423

structurally adequate overlay

- Asphalt overlay, min. 3”,
- Scarify, rubber tack (702.13)
- ODOT uses UTOVER program
- AASHTO, Chapter 5.6, evaluation and design methods
- Asphalt Institute, MS-17 procedures

Control of reflection cracking

- Extra thickness of overlay
- Saw and Seal (item 413) recommended for overlay placed over exposed concrete (PM 504.4.1)
- Fabrics and geogrids – only on longitudinal joints
- Crack relief layer (3.5 in. OG AC base)
- Fractured slab treatments

ongoing maintenance

- Crack Sealing with Routing, Type 1, for well-defined, moving joints and cracks
- Crack filling with type II, III or IV fiber filled crack filler on longitudinal cracks and random transverse cracks

Conclusions and Recommendations

- Asphalt overlays on concrete pavements are necessary and useful for extending the life of a concrete pavement
- Composite pavements will have maintenance issues from early in their life.
- For a new pavement: Don't start with a composite pavement

Questions?