CHAPTER 601

Pavement Design Process

Design Memorandum	Revision Date	Sections Affected
20-01	Jan. 2020	Previously 304-1.0 through 5.0
22-02	Jan. 2022	601-5.01(04)
22-03	Jan. 2022	601-5.0, 601-5.03(new), 601-6.0, Fig. 601-5C (new)
23-21	Dec. 2023	601-2.0, 601-3.0, 601-5.01(04), Fig. 601-5C
24-04	Apr. 2024	601-4.0, 601-5.0, 601-5.01 (all sections), 601-6.0, Figures 601-4A thru -4F (deleted), Fig. 601-5A.

The design memorandum applicable revision date is noted in brackets next to each section heading below.

TABLE OF CONTENTS

TABLE OF CONTENTS 2

LIST OF FIGURES 3

601-1.0 INTRODUCTION 4

601-2.0 HISTORY [REV. DEC. 2023] 4

601-3.0 ABBREVIATIONS [Rev. Dec. 2023] 5

601-4.0 INDOT PAVEMENT DESIGN PHILOSOPHY [Rev. APR. 2024] 8

601-5.0 PAVEMENT DESIGN DEVELOPMENT [Rev. Jan. 2022, APR. 2024] 8
601-5.01 INDOT Pavement Design Process [Rev. Apr. 2024] 8
601-5.01(01) Responsibilities and Development Timeframes [Rev. Apr. 2024] 9
601-5.01(02) Preliminary Pavement Design (Scoping) [Rev. Apr. 2024] 10
601-5.01(03) Final Pavement Design [Rev. Jan. 2022, Apr. 2024] 10
601-5.01(04) Final Pavement Design Report [Rev. Apr. 2024] 12
601-5.02 Local Public Agency (LPA) Pavement Design Process 13
601-5.02(01) LPA Final Pavement Design for Locally-Owned, Non-NHS Routes 14
601-5.02(02) LPA Final Pavement Design for State and NHS Routes 14
601-5.02(03) Notification of Pavement Design Approval [Rev. Feb. 2018, Jan. 2022] 14
601-5.03 Standard Pavement Sections [Add Jan. 2022] 15
601-5.03(01) Standard Pavement Sections for Low Volume Roads and Trails [Add. Jan. 2022] 15
601-5.03(02) Standard Pavement Sections for Standalone Bridge and Small Structure Projects [Add. Jan. 2022] 15
601-5.03(03) Shoulder Pavement for Maintenance of Traffic [Add. Jan. 2022] 16

601-6.0 PAVEMENT DESIGN REQUEST [rev. Jan. 2022, APR. 2024] 16

Figures 18

LIST OF FIGURES

Figure	Title
601-4A	Pavement Design Life [Del. Apr. 2024]
601-4B	Performance criteria for New or Rehabilitation HMA Pavement [Del. Apr. 2024]
601-4C	Performance Criteria for New or Rehabilitation Concrete Pavement [Del. Apr. 2024]
601-4D	MEPDG General Input Values for Asphalt Pavement [Del. Apr. 2024]
601-4E	ESAL Category for QC/QA-HMA Mixtures [Del. Apr. 2024]
601-4F	Mixture Type HMA Mixtures [Del. Apr. 2024]
601-5A	INDOT Pavement Design Process [Rev. Apr. 2024]
601-5B	INDOT Pavement Design Process-LPA Projects Flowchart
601-5C	Pavement Design for Bridge and Small Structure Projects [Add. Jan. 2022]

CHAPTER 601

PAVEMENT DESIGN PROCESS

601-1.0 INTRODUCTION

This chapter provides guidance for the investigation, evaluation, and analysis of pavements for the public roadway system under the jurisdiction of the Indiana Department of Transportation (INDOT). It can also be used by local governments in Indiana at their discretion. The pavement design development process should be based on, but not limited to, sound pavement engineering principles, concepts, and economics, as well as geotechnical conditions, environmental conditions, pavement material properties, and traffic loadings. The ideal pavement treatment provides an appropriate design life while yielding the least cost of ownership to INDOT.

601-2.0 HISTORY [REV. DEC. 2023]

The history of pavements in Indiana has transcended a number of types and configurations from surfaces using bricks, aggregates, and Kentucky rock asphalt, to the most modern Superpave Asphalt Binders. Kentucky rock asphalt is naturally occurring asphalt that has not been used in recent years but can be found within an existing pavement structure when coring the roadway. Sand surfaces were used extensively on asphalt pavements in the 1970's and 1980's. Both sand surfaces and Kentucky rock asphalts appear as a relatively thin black dense layer in the core, typically less than an inch thick.

Most of the initial interstate pavement constructed in the 1960's and early 1970's was either continuously reinforce concrete (CRC) or jointed reinforced concrete pavement (JRCP) with 40-ft joint spacing. In the early 1980's these concrete pavements were undersealed and overlaid with at least two lifts of HMA as a first rehabilitation measure. In the 1990's the HMA was milled or removed and new HMA applied as a rehabilitation measure.

Also, in the 1990's the HMA was removed and the concrete pavements on the interstates were either cracked and seated, or rubblized as a new method of slab reduction emerged, these concrete pavements were then resurfaced with at least two lifts of HMA. INDOT did not get good performance from the cracked and seated pavements as the technology in equipment used to crack the concrete had not advanced enough. However, it is not sound engineering to fully rely on a pavement's history without obtaining pavement cores, non-destructive tests, etc.

The National Highway System (NHS) routes were also constructed with different typical cross-sections; such as variable thickness 9-7-9 in. from edge to center to edge with portland cement concrete. These NHS routes were also typically 18 - 20 ft wide. Tilt sections were also common in the early interstate and NHS pavements. As the tilt section pavements reached the point of rehabilitation INDOT typically converted them to crown sections by milling and applying variable thickness of HMA overlays.

Pavements on most state routes were initially 9-ft lanes, with little to no shoulders. Some of these routes were initially county roads that were given to the State. Asphalt pavements used sand surfaces, hot asphalt emulsions (HAE), bituminous coated aggregate (BCA) or “Greasy 5’s” on these routes in the early days. The majority of all pavements today have been widened to at least 10-ft, 11-ft, or 12-ft lanes, with or without shoulders. Beginning in about 1992, SuperPave Performance Grade (PG) binders were being used and replaced the Marshall Method of HMA binder design. Beginning in 2011 most HMA pavement applied to these state routes with aggregate or earth shoulders had the safety edge incorporated. In 2023, The Multiple Stress Creep Recovery (MSCR) binder designation system was implemented to the asphalt binder specification.

Underdrains have been utilized since the 1950’s. Transverse underdrains were some of the first underdrains installed. Beginning in the 1960’s, longitudinal pipes were constructed along the edges of the pavement and outlet to the side ditches. Geocomposite edge drains were used as retrofit underdrains from the mid 1980’s to the mid 1990’s. From the mid 1990’s to present retrofit underdrains consist of open graded material and 4-in. or 6-in. pipe along the pavement’s edge. Little or no maintenance has been performed on the underdrain systems and studies show that poor performance of the underdrain systems is a primary cause of failures of pavement structures. INDOT has also improved on the design of underdrain systems since the mid 1990’s to facilitate better maintenance. This includes 45º elbows to facilitate video logging, paved outlet protector pads, and rodent screens. INDOT district maintenance now has underdrain maintenance as an activity on the Work Management System (WMS).

601-3.0 ABBREVIATIONS [REV. DEC. 2023]

AADT	Average Annual Daily Traffic
AADTT	Average Annual Daily Truck Traffic
AASHTO	American Association of State Highway and Transportation Officials
AC	Asphaltic Concrete
ACPA	American Concrete Pavement Association
ADA	Americans with Disabilities Act
ARRA	Asphalt Recycling and Reclaiming Association

APAI	Asphalt Pavement Association of Indiana
ASR	Alkali-Silica Reactivity
ASTM	American Society for Testing and Materials
BARM	Basic Asphalt Recycling Manual
BCA	Bituminous Coated Aggregate
CAB	Compacted Aggregate Base
CAP	Compacted Aggregate Pavement
CBR	California Bearing Ratio
CCPR	Cold Central Plant Recycling
CIR	Cold In-Place Recycling
CPP	Concrete Pavement Preservation
CPR	Concrete Pavement Restoration
CR	Cold Recycling
CRCP	Continuously Reinforced Concrete Pavement
CTE	Coefficient of Thermal Expansion
DMF	Design Mix Formula (for HMA)
HAE	Hot Asphalt Emulsion
ERC	Employee of Responsible Charge
ERMS	Electronic Records Management System
ESAL	Equivalent Single Axle Load (18-kip)
EUAC	Equivalent Uniform Annual Cost
FDR	Full Depth Reclamation
FHWA	Federal Highway Administration
FN	Friction Number
FWD	Falling Weight Deflectometer
GPR	Ground Penetrating Radar
HIR	Hot In-Place Recycling
HMA	Hot Mix Asphalt
ICM	Integrated Climatic Module
IHCP	Interstate Highway Congestion Policy
ID	Identification
IRI	International Roughness Index
JMF	Job Mix Formula (for HMA)
JPCP	Jointed Plain Concrete Pavement
JTRP	Joint Transportation Research Program

PLCC	Pavement Life-Cycle Cost
LCPCA	Life-Cycle Pavement Cost Analysis
LL	Liquid Limit
LOI	Loss on Ignition
LPA	Local Public Agency
LTE	Load Transfer Efficiency
LTPP	Long-Term Pavement Performance
MSCR	Multiple Stress Creep Recovery
MEPDG	Mechanistic Empirical Pavement Design Guide
MOT	Maintenance of Traffic
NCHRP	National Cooperative Highway Research Program
NDT	Non-Destructive Testing
NHS	National Highway System
NMAS	Nominal Maximum Aggregate Size
OG	Open-Graded
PCC	Portland Cement Concrete
PCCP	Portland Cement Concrete Pavement
PG Binder	Performance-Graded Binder
PI	Plasticity Index
PM	Preventive Maintenance
PMS	Pavement Management System
PPG	Pavement Peer Group
PPI	Pavement Preservation Initiative
PV	Present Value
PW	Present Worth
QC/QA-HMA	Quality Control / Quality Assurance Hot Mix Asphalt
QC/QA-PCCP	Quality Control / Quality Assurance Portland Cement Concrete Pavement
RCBA	Reinforced-Concrete Bridge Approach
RFC	Ready for Contract
RH	Relative Humidity
SMA	Stone Matrix Asphalt
SUPERPAVE	Superior Performing Asphalt Pavements
SV	Salvage Value
TWRG	Truck Weight Road Group
TCO	Thin Concrete Overlay

UBWC	Ultrathin Bonded Wearing Course
USCS	Unified Soil Classification System
WMS	Work Management System (INDOT Maintenance)

601-4.0 INDOT PAVEMENT DESIGN PHILOSOPHY [REV. APR. 2024]

The INDOT approach to pavement design is based on producing a cost-effective pavement section that provides acceptable design life at the least cost of ownership, represented by cost/lane mile/year of life.

INDOT uses the Mechanistic Empirical Pavement Design Guide (MEPDG) and AASHTOWare Pavement ME software for pavement analysis and Design. See Chapter 604 for additional information on MEPDG. Pavement history, condition data, cores, and other pavement testing information are used along with the MEPDG analysis to determine the appropriate pavement treatment.

601-5.0 PAVEMENT DESIGN DEVELOPMENT [REV. JAN. 2022, APR. 2024]

The pavement design development process includes collecting, assessing, and analyzing pavement data to support alternatives that satisfy the project intent. The process varies depending on whether the project is an INDOT project or an LPA project. Standard pavement sections have been established for low volume roads with aggregate pavement, trails and other non-vehicular use facilities, standalone small structure replacement projects, and standalone bridge projects.

601-5.01 INDOT Pavement Design Process [Rev. Apr. 2024]

For Pavement projects, the pavement design process for INDOT projects includes a preliminary pavement design developed during scoping. For other project types, the process begins with the submittal of a pavement design request or determination of eligibility to use a standard pavement section. The process is complete when the final pavement design is approved by the Pavement Engineering Office. See Figure 601-5A, INDOT Pavement Design Process.

601-5.01(01) Responsibilities and Development Timeframes [Rev. Apr. 2024]

Responsibilities of the project designer and pavement designer and development timeframes are discussed below.

1. Responsibilities, Project Designer. The project designer is the engineer of record for the project. The project designer is responsible for determining if the project is eligible to use a standard pavement section or if a pavement design request is required. For INDOT projects that require a pavement design request, the project designer is responsible for completing the request and incorporating the approved pavement design into the Stage 3 plans. See 601-6.0 for additional information about the pavement design request process.

2. Responsibilities, Pavement Designer. A pavement designer is a qualified, licensed engineer who has been trained in pavement design analysis. For consultant pavement designers, prequalification is required. See the *INDOT Consultant Prequalification Manual* for Pavement Analysis – Design Services for prequalification requirements. The manual is available on the INDOT Consultants Prequalification webpage at https://www.in.gov/indot/2732.htm.

   The pavement designer is responsible for understanding the project intent and completing the final pavement design activities listed in 601-5.01(03).

3. Pavement Design Timeframe. Regardless of the project type and the development requirements associated with the project type, the final pavement design development should be complete prior to Stage 3 plan submission. The project designer should understand typical timeframes associated with compiling the required pavement design input to ensure there is adequate time to complete the pavement analysis and design prior to Stage 3.

A pavement design information matrix is available on the INDOT Pavement Design webpage, under Pavement Design Request Process. The document includes typical timeframes for requesting and receiving pavement design information and completing the pavement design process.

601-5.01(02) Preliminary Pavement Design (Scoping) [Rev. Apr. 2024]

Each year, Pavement projects are proposed by the Pavement Asset Engineer in each district as part of the Asset Management Project Prioritization Process based on pavement needs identification. During the initial steps of the process, the Pavement Engineering Office collaborates with the Pavement Asset Engineers to establish a preliminary pavement treatment. Proposed pavement projects are submitted as part of the Call for Projects, then scored and prioritized. Selected projects are programmed for a given fiscal year. See Ch 602 for pavement project categories.

The preliminary pavement design defined in the scope identifies potential pavement treatments to correct pavement structural or functional problems. In developing the pavement design, condition data such as International Roughness Index (IRI), rut depth, Friction Number (FN), cracking, pavement history, and maintenance history is considered. When available, FWD data, pavement cores, and geotechnical parameters are also considered as part of the recommended treatment.

The preliminary pavement design will be validated or updated as appropriate as part of the final pavement design process.

For non-pavement project work types that include pavement work, the pavement design is determined through the pavement design request process. Where the project includes significant pavement work, e.g. added travel lanes, early coordination with the Pavement Engineering Office during scoping should occur.

601-5.01(03) Final Pavement Design [Rev. Jan. 2022, Apr. 2024]

Final pavement design is initiated with a pavement design request, except for projects that are eligible to use a standard pavement section and for consultant-designed projects that includes a Pavement Design Services task in the contract. See 601-6.0 for additional information.

The pavement designer is responsible for completing the final pavement design activities described below.

1. Review project intent and scoping information.

2. Review pavement design information.
   a. Pavement history, age, treatment history, maintenance records, etc.
   b. Pavement condition data,
   c. Falling Weight Deflectometer (FWD)
   d. Pavement cores
   e. Geotechnical parameters (soil conditions and subgrade treatment)
   f. Traffic data forecast
   g. Other special testing. See Chapter 604 for additional pavement testing

3. Evaluate
   a. Identify types of pavement distresses, severity, and extent
   b. Identify causes of distresses
   c. Identify functional versus structural distress

4. Analyze
   a. Utilize Mechanistic-Empirical Pavement Design Guide (MEPDG) methodology and AASHTOWare Pavement ME Design software to develop multiple pavement treatment options, as requested. See Chapter 604 for the MEPDG Design Guide, performance criteria for asphalt and concrete pavement, and ESAL categories for HMA mixtures.

b. Analyze pavement design life (service life) and cost of ownership for each pavement treatment. See Chapter 604, Figure 604-2A, Pavement Design Life for design life expected for various pavement treatments.

1) Functional treatments must show a 30-year projection or until functional failure is observed, whichever is further.

2) Structural treatments must show a 50-year projection.

3) When in doubt, show a 50-year projection.

c. Complete Life-Cycle Pavement Cost Analysis (LCPCA) for alternate bid projects (projects with pavement area equal to or greater than 15,000 yd^2). LCPCA examples are available on the INDOT Pavement Design webpage at https://www.in.gov/indot/3418.htm

5. Complete the Final Pavement Design Report.

601-5.01(04) Final Pavement Design Report [Rev. Apr. 2024]

The final pavement design should be documented in a Final Pavement Design Report, consisting of the information below. A consultant pavement designer should submit the final pavement design report on their letterhead and provide evidence that all pavement designs have been checked and signed by a qualified peer. The final pavement design report should be signed and sealed by a professional engineer licensed in Indiana.

The final pavement design report is reviewed by Pavement Engineering Office staff. After comments are resolved, the report is routed to the Pavement Engineering Office Manager for approval.

1. Executive Summary. The executive summary should be clear and concise and only include the necessary pavement information to implement the design.

2. Project Information; Project intent/scope, table of design criteria

3. Pavement History; existing pavement type, initial construction through the last treatment, thickness of all layers

4. Pavement Design Methodology. Include the project rationale, binder selection, and Pavement ME design input values used to select to preferred pavement treatment.
5. Site visit assessment of Current Pavement Condition (Functional and Structural) with photographs;
6. Pavement Design Recommendations. Include all alternative evaluated, even if not selected.
7. Patching Summary Table (where applicable). The table should be included. A separate patching summary table in Excel format should be sent to the project designer after the pavement design is approved so that it may be included in the contract documents before the letting.
8. Life-Cycle Pavement Cost Analysis (LCPCA) for projects with pavement area equal to or greater than 15,000 yd^2;
9. Service Life. Functional and structural service life and cost of ownership of the pavement alternatives analyzed;
10. Construction issues and concerns. Constructability issues include temporary widening, temporary runarounds, temporary ramps, assumed pavement thicknesses or variations, profile grade assumptions, and other challenges.
11. Appendices as follows:
    a. Traffic Data;
    b. Geotechnical Investigation Report;
    c. Pavement Cores with Photographs
    d. Pavement Distress Photographs;
    e. Non-Destructive Testing Results, such as FWD;
    f. Project Plans. Include historic and preliminary for current project.
    g. AASHTOWare Pavement ME design input summary;
    h. AASHTOWare Pavement ME design output, at least the optimal design and then one failure iteration;
    i. LCPCA Results.

601-5.02 Local Public Agency (LPA) Pavement Design Process

The qualifications of the pavement designer noted in Section 601-5.01 apply to LPA Projects that involve federal funding. The project intent and its impacts on the pavement structure should be understood prior to developing the pavement treatment recommendation. LPA pavement designs may be reviewed by INDOT as noted in the following sections.

601-5.02(01) LPA Final Pavement Design for Locally-Owned, Non-NHS Routes

Projects that include work on a locally-owned, non-NHS route do not require review and approval by INDOT.

The LPA may follow the INDOT Pavement Design Process or choose to use their own pavement design criteria.

Where an LPA chooses to use their own pavement design criteria, the following will apply:

1. The LPA is responsible for the design and performance of the pavement section.
2. A Life-Cycle Pavement Cost Analysis in accordance with Section 606-1.0 is not required.
3. It is the LPA's responsibility to ensure that the pavement pay items are compatible with the INDOT Standard Specifications.
4. If the LPA uses a standard typical pavement section, it must be included in the final pavement design.
5. The final pavement design must be initialed by the Employee in Responsible Charge (ERC) sealed, signed, and dated by a licensed Indiana Professional Engineer and uploaded to ERMS as the Final Pavement Design.

See Figure 601-5B, INDOT Pavement Design Process-LPA Projects Flowchart for details regarding LPA pavement design process requirements.

601-5.02(02) LPA Final Pavement Design for State and NHS Routes

Projects that include work on a State route or NHS route must be reviewed and approved by a Central Office Pavement Design Engineer and follow the INDOT pavement design process. See Section 601-5.01.

601-5.02(03) Notification of Pavement Design Approval [Rev. Feb. 2018, Jan. 2022]

For projects reviewed and approved by INDOT, the Central Office pavement engineer will send a Letter of Pavement Analysis/Design Acceptance (acceptance letter) to the ERC, INDOT project manager, and the LPA pavement designer.

The acceptance letter should be initialed by the ERC, combined with the final pavement design, and uploaded into ERMS as the Final Pavement Design. Preferably, the file should be uploaded within two weeks of receiving the acceptance letter. The pavement designer should notify the district coordinator, INDOT project manager, INDOT Central Office Pavement Design Coordinator, and the ERC when the file has been uploaded.

601-5.03 Standard Pavement Sections [Add Jan. 2022]

A pavement design request is not required for low volume roads with aggregate pavement, trails and other non-vehicular use facilities, as well as for projects that are limited to short lengths of full depth pavement as described in this section. INDOT has developed standard pavement sections for these applications.

601-5.03(01) Standard Pavement Sections for Low Volume Roads and Trails [Add. Jan. 2022]

Standard pavement sections may be used in lieu of project-specific pavement designs for aggregate pavement on low volume roads and trails and other non-vehicular use facilities as follows:

1. Aggregate Pavement on Low Volume Roads, AADTT ≤ 50 trucks. The pavement section will consist of:

   4 in. Compacted Aggregate No. 73, on
   6 in. Compacted Aggregate No. 53, on
   Subgrade Treatment, Type III, or as specified in the geotechnical report

2. Trails and other Non-Vehicular Use Facilities. The pavement sections will consist of the section as shown on the INDOT *Standard Drawings* series 502-NVUF for concrete pavement and 604-NVUF for HMA pavement.

601-5.03(02) Standard Pavement Sections for Standalone Bridge and Small Structure Projects [Add. Jan. 2022]

Standard pavement sections may be used in lieu of project-specific pavement designs as shown below. For projects that do not meet all the criteria below, a pavement design request is required.

1. The project is a standalone bridge or small structure with minimal increase in profile grade. A minimal increase is considered 12 in. or less.
2. The project does not include any of the following elements:

a. Underdrains

b. Curbed roadway cross section

c. Inadequate cover over the buried structure

d. Existing shoulder used for maintenance of traffic. This item is conditional (See section 601-5.03(03).

Standard pavement sections and selection criteria are shown in Figure 601-5C, Pavement Designs for Standalone Bridge and Small Structure Projects. Where more than one application is included in a project, the pavement type and section should be considered separately for each application. The appropriate pavement section should be shown on the plans.

For HMA pavement, transition milling or resurfacing should be provided beyond the full depth pavement. Where the profile grade for the full depth pavement section ties in at the existing profile grade, a minimum of 50 ft resurfacing (milling 1.5 in., 1.5 in. surface course) should be provided. Where the profile grade for the full depth pavement section ties in above the existing pavement, transition milling should be provided. See INDOT *Standard Drawings* series 306-TPMT for transition milling.

Contact the Pavement Design Office Manager for guidance when there is uncertainty about using the standard section.

601-5.03(03) Shoulder Pavement for Maintenance of Traffic [Add. Jan. 2022]

Where the existing shoulder will be used for MOT, it should be evaluated for condition and sufficient structural capacity prior to use. A pavement design request for shoulder evaluation should be submitted. The Shoulder MOT request form is available on the INDOT Design Manual Editable Documents webpage, under Pavement.

For planning purposes, pavement in good condition with a minimum 9 in. pavement structure will typically be adequate for short durations. The information does not preclude the requirement for evaluation.

Where the shoulder structural capacity and or condition is deemed inadequate for the proposed MOT, Figure 601-5C should be used to determine the reconstructed shoulder pavement section.

601-6.0 PAVEMENT DESIGN REQUEST [REV. JAN. 2022, APR. 2024]

For projects that are eligible to use a standard pavement section, a pavement design request should not be submitted.

For consultant-designed projects that include a Pavement Design Services task in the contract, a pavement design request should not be submitted. For this type of contract, the consultant is responsible for gathering the pavement design information, completing the pavement design, and submitting it for review and approval.

For all other projects, the project designer is responsible for completing the pavement design request. The request process includes gathering the pavement design input information, completing the request form, and submitting the completed packet to the Pavement Engineering Office. The Pavement Engineering Office will determine if the request is complete. Incomplete requests will require comments to be resolved and the request to be resubmitted prior to beginning the final pavement design.

The completed Pavement Design Request form and attachments should be uploaded as a single file to ERMS using the following naming convention, as appropriate.

PVMTDGN Request [Des #] for Roadway Services

PVMTDGN Request [Des #] for Roadway Services Shoulder MOT

An editable version of the Pavement Design Request is available from the INDOT Design Manual Editable Documents webpage, at www.in.gov/dot/div/contracts/design/dmforms/, under Pavement.

FIGURES

601-4A Pavement Design Life [Del. Apr. 2024]

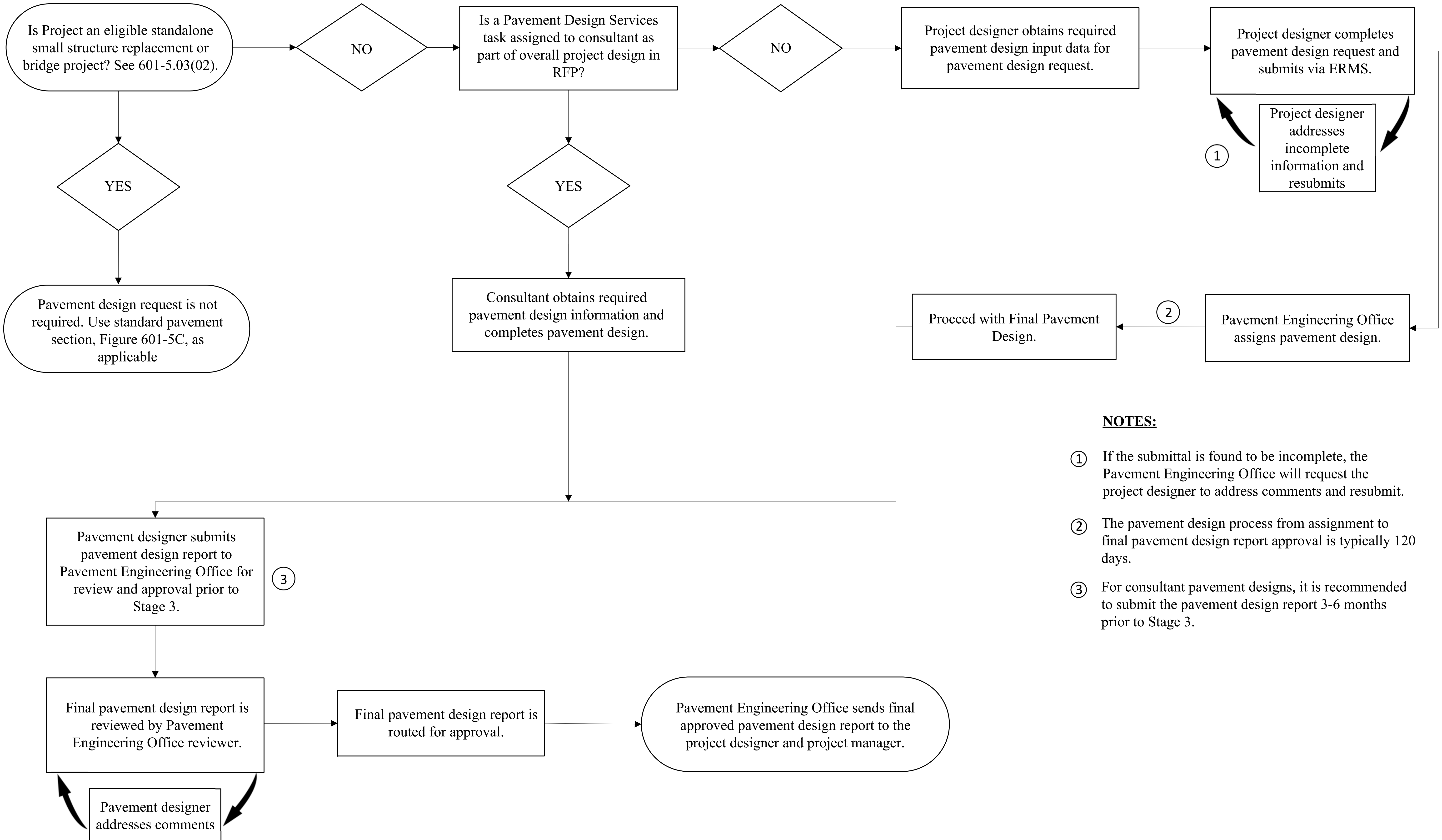
601-4B Performance criteria for New or Rehabilitation HMA Pavement [Del. Apr. 2024]

601-4C Performance Criteria for New or Rehabilitation Concrete Pavement [Del. Apr. 2024]

601-4D MEPDG General Input Values for Asphalt Pavement [Del. Apr. 2024]

601-4E ESAL Category for QC/QA-HMA Mixtures [Del. Apr. 2024]

601-4F Mixture Type HMA Mixtures [Del. Apr. 2024]



NOTES:

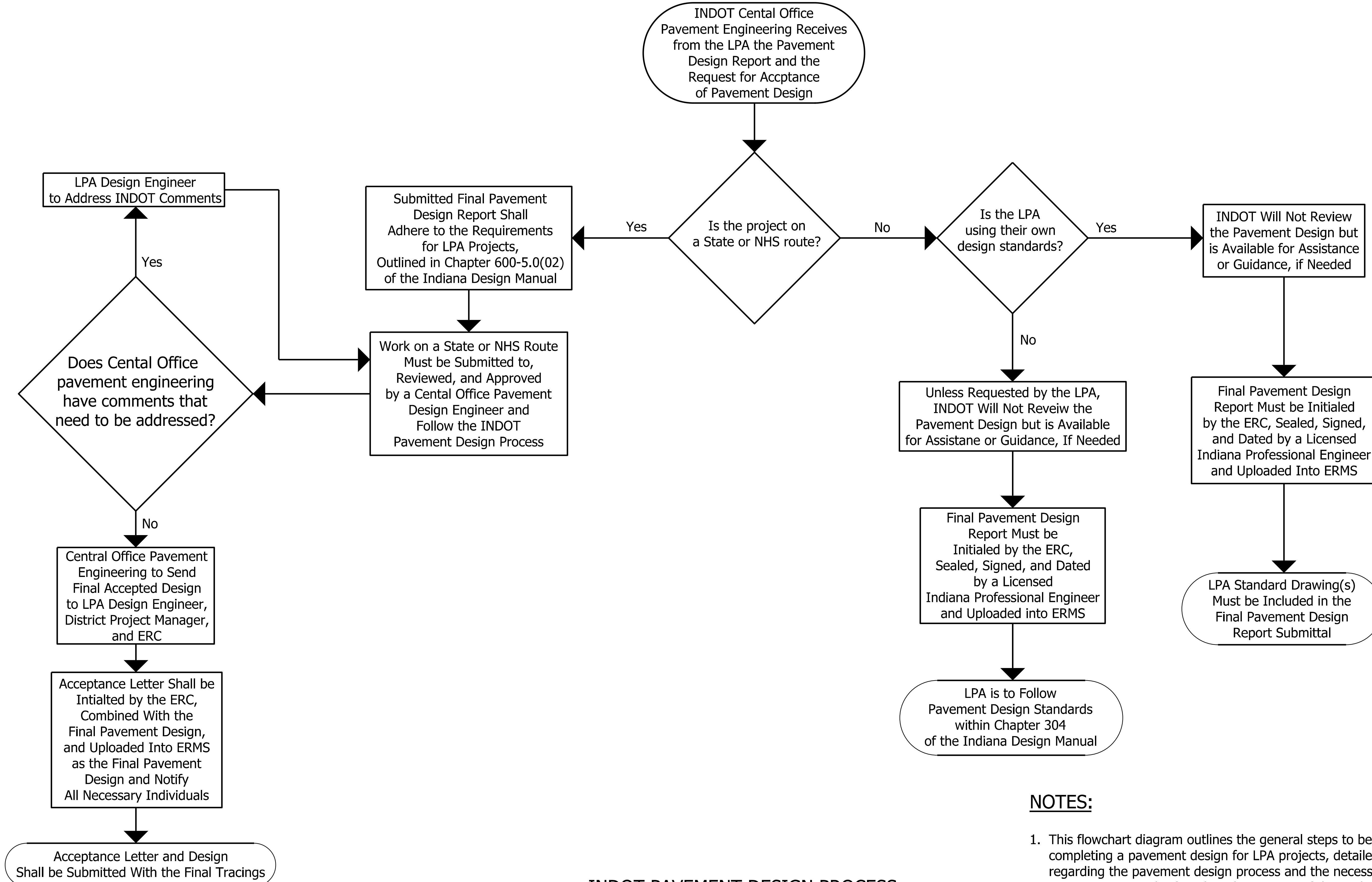
① If the submittal is found to be incomplete, the Pavement Engineering Office will request the project designer to address comments and resubmit.

② The pavement design process from assignment to final pavement design report approval is typically 120 days.

③ For consultant pavement designs, it is recommended to submit the pavement design report 3-6 months prior to Stage 3.

INDOT PAVEMENT DESIGN PROCESS
(INDOT PROJECT)

Figure 601-5A



INDOT PAVEMENT DESIGN PROCESS
LPA PROJECTS

Figure 601-5B

NOTES:

1. This flowchart diagram outlines the general steps to be taken when completing a pavement design for LPA projects, detailed information regarding the pavement design process and the necessary requirements can be found in Chapter 600 of the *Indiana Design Manual*.

2. The "design engineer" or "consultant engineer" for each project is the designer preparing the roadway plans and geometrics for the project, sometimes referred to as the site designer.

Road Category	Annual Average Daily Truck Traffic (Construction Year)	ESAL (millions)	ESAL Category Name	Minimum HMA Pavement Depth (in.)	Pavement Type[2]
Interstate (A)	1900 < AADTT < 5700[1]	10 < ESAL < 30	High	14	QC/QA-HMA Cat. 4 / HMA Type D
Freeway and Principal Arterial (B)	AADTT < 570	< 3	Low	10	QC/QA-HMA Cat. 3 / HMA Type B
	570 < AADTT < 1900	3 < ESAL < 10	Medium	12	QC/QA-HMA Cat. 3 / HMA Type C
	1900 < AADTT < 5700[1]	10 < ESAL < 30	High	14	QC/QA-HMA Cat. 4 / HMA Type D
Remaining Road Classes (C)	AADTT < 510	< 3	Low	10	QC/QA-HMA Cat. 3 / HMA Type B
	510 < AADTT < 1700	3 < ESAL < 10	Medium	12	QC/QA-HMA Cat. 3 / HMA Type C
	1700 < AADTT < 5700[1]	10 < ESAL < 30	High	14	QC/QA-HMA Cat. 4 / HMA Type D

[1] AADTT > 5700 requires a pavement design request
[2] Pavement type and section based on application

Application		PAVEMENT TYPE AND SECTION		
		Low ESAL	Medium ESAL	High ESAL
New/Reconstructed Full Depth Pavement, HMA **Mainline and Adjacent Shoulder**	All Shoulder Widths, Without Terminal Joint	165 lbs/syd QC/QA-HMA, 3, 58S, Surface, 9.5 mm on 275 lbs/syd QC/QA-HMA, 3, 58S, Intermediate, 19.0 mm on 660 lbs/syd QC/QA-HMA, 3, 58S, Base, 25.0 mm on Subgrade Treatment Type IC on Geotextile for Pavement Type 2B (or per Geotechnical Report)	165 lbs/syd QC/QA-HMA, 3, 58H, Surface, 9.5 mm on 275 lbs/syd QC/QA-HMA, 3, 58H, Intermediate, 19.0 mm on 880 lbs/syd QC/QA-HMA, 3, 58S, Base, 25.0 mm on Subgrade Treatment Type IC on Geotextile for Pavement, Type 2B (or per Geotechnical Report)	165 lbs/syd QC/QA-HMA, 4, 58E, Surface, 9.5 mm on 275 lbs/syd QC/QA-HMA, 4, 58E, Intermediate, 19.0 mm on 1100 lbs/syd QC/QA-HMA, 4, 58S, Base, 25.0 mm on Subgrade Treatment Type IC on Geotextile for Pavement, Type 2B (or per Geotechnical Report)
	All Shoulder Widths, Includes Terminal Joint, HMA (pavement depth 15 in. all ESALs)	165 lbs/syd QC/QA-HMA, 3, 58S, Surface, 9.5 mm on 275 lbs/syd QC/QA-HMA, 3, 58S, Intermediate, 19.0 mm on 1210 lbs/syd QC/QA-HMA, 3, 58S, Base, 25.0 mm on 6 inches of Compacted Aggregate, No. 53 on Subgrade Treatment, Type IC on Geotextile for Pavement, Type 2B	165 lbs/syd QC/QA-HMA, 3, 58H, Surface, 9.5 mm on 275 lbs/syd QC/QA-HMA, 3, 58H, Intermediate, 19.0 mm on 1210 lbs/syd QC/QA-HMA, 3, 58S, Base, 25.0 mm on 6 inches of Compacted Aggregate, No. 53 on Subgrade Treatment, Type IC on Geotextile for Pavement, Type 2B.	165 lbs/syd QC/QA-HMA, 4, 58E, Surface, 9.5 mm on 275 lbs/syd QC/QA-HMA, 4, 58E, Intermediate, 19.0 mm on 1210 lbs/syd QC/QA-HMA, 4, 58S, Base, 25.0 mm on 6 inches of Compacted Aggregate, No. 53 on Subgrade Treatment, Type IC on Geotextile for Pavement, Type 2B.
New/Reconstructed Full Depth Pavement, HMA **Shoulder Only**	Shoulder Width > 8 ft	165 lbs/syd QC/QA-HMA, 3, 58S, Surface, 9.5 mm on 275 lbs/syd QC/QA-HMA, 3, 58S, Intermediate, 19.0 mm on 660 lbs/syd QC/QA-HMA, 3, 58S, Base, 25.0 mm on Subgrade Treatment Type IC (or per Geotechnical Report)	165 lbs/syd QC/QA-HMA, 3, 58H, Surface, 9.5 mm on 275 lbs/syd QC/QA-HMA, 3, 58H, Intermediate, 19.0 mm on 880 lbs/syd QC/QA-HMA, 3, 58S, Base, 25.0 mm on Subgrade Treatment Type IC (or per Geotechnical Report)	165 lbs/syd QC/QA-HMA, 4, 58E, Surface, 9.5 mm on 275 lbs/syd QC/QA-HMA, 4, 58E, Intermediate, 19.0 mm on 1100 lbs/syd QC/QA-HMA, 4, 58S, Base, 25.0 mm on Subgrade Treatment Type IC (or per Geotechnical Report)
	Shoulder Width ≤ 8 ft	Widening with HMA, Type B, consisting of 165 lbs/syd HMA Surface, Type B[3] on 275 lbs/syd HMA Intermediate, Type B on 660 lbs/syd HMA Base, Type B on Subgrade Treatment Type IC (or per Geotechnical Report)	Widening with HMA, Type C, consisting of 165 lbs/syd HMA Surface, Type C[3] on 275 lbs/syd HMA Intermediate, Type C on 880 lbs/syd HMA Base, Type C on Subgrade Treatment Type IC (or per Geotechnical Report)	Widening with HMA, Type D, consisting of 165 lbs/syd HMA Surface, Type D[3] on 275 lbs/syd HMA Intermediate, Type D on 1100 lbs/syd HMA Base, Type D on Subgrade Treatment Type IC (or per Geotechnical Report)

[3] Where existing mainline pavement is resurfaced, use QC/QA HMA surface course as shown for shoulder width > 8 ft. Intermediate and base courses should consist of type specified.

PAVEMENT DESIGN FOR STANDALONE BRIDGE AND SMALL STRUCTURE PROJECTS

Figure 601-5C (Page 1 of 2) (Rev. Dec. 2023)

<table>
<tr><th colspan="2" rowspan="2">Application</th><th colspan="3">PAVEMENT TYPE AND SECTION</th></tr>
<tr><th>Low ESAL</th><th>Medium ESAL</th><th>High ESAL</th></tr>
<tr><td>HMA Transition Milling/Resurfacing</td><td colspan="4">For HMA pavement, transition milling or resurfacing should be provided beyond the full depth pavement. Where the profile grade for the full depth pavement section ties in at the existing profile grade, 50 ft minimum of resurfacing (milling 1.5 in., 1.5 in. surface course) should be provided. Where the profile grade for the full depth pavement section ties in above the existing pavement, transition milling should be provided. See INDOT Standard Drawings series 306-TPMT for transition milling.</td></tr>
<tr><td>New/Reconstructed Full Depth Pavement, Composite

Mainline and Adjacent Shoulder</td><td>All Shoulder Widths</td><td>165 lbs/syd QC/QA-HMA, 3, 58S, Surface, 9.5 mm on
275 lbs/syd QC/QA-HMA, 3, 58S, Intermediate, 19.0 mm on
varies(4) lbs/syd QC/QA-HMA, 3, 58S, Base, 25.0 mm on
Subgrade Treatment, Type IC (or per Geotechnical Report)</td><td>165 lbs/syd QC/QA-HMA, 3, 58H, Surface, 9.5 mm on
275 lbs/syd QC/QA-HMA, 3, 58H, Intermediate, 19.0 mm on
varies(4) lbs/syd QC/QA-HMA, 3, 58S, Base, 25.0 mm on
Subgrade Treatment, Type IC (or per Geotechnical Report)</td><td>165 lbs/syd QC/QA-HMA, 4, 58E, Surface, 9.5 mm on
275 lbs/syd QC/QA-HMA, 4, 58E, Intermediate, 19.0 mm on
varies(4) lbs/syd QC/QA-HMA, 4, 58S, Base, 25.0 mm on
Subgrade Treatment, Type IC (or per Geotechnical Report)</td></tr>
<tr><td colspan="5">(4) Top of subgrade should match existing subgrade elevation. Base course thickness is that necessary to match the thickness of the existing composite pavement section or minimum depth based on ESAL, whichever is greater.</td></tr>
<tr><td rowspan="2">New/Reconstructed Full Depth Pavement, PCCP

Mainline and Adjacent Shoulder</td><td>All Shoulder Widths, Without Terminal Joint</td><td colspan="3">Contact Pavement Design Office</td></tr>
<tr><td>All Shoulder Widths, Includes Terminal Joint, PCCP (pavement depth 12 in., all ESALs)</td><td colspan="3">Initial 40 ft of new mainline and shoulder pavement, use: JRCP as per Standard Drawing E 503-BATJ-02.

Pavement beyond the initial 40 ft, use: Plain jointed PCCP, 12 in. (match JRCP thickness) with tied PCCP shoulders on
Subbase for PCCP on
Subgrade Treatment, Type IC on Geotextile
for Pavement, Type 2B
1.5 in. diameter dowel bars and D-1 joints spaced at 15 feet</td></tr>
</table>

Note:
Subgrade Treatment, Type IC is 12 in. coarse aggregate No. 53 in accordance with INDOT *Standard Specifications* section 301. Where the geotechnical report recommendation for subgrade treatment differs from this figure, the subgrade treatment in the geotechnical report should be used.

PAVEMENT DESIGN FOR STANDALONE BRIDGE AND SMALL STRUCTURE PROJECTS

Figure 601-5C (Page 2 of 2) (Rev. Dec. 2023)