INDIANA DEPARTMENT OF TRANSPORTATION

Engineering Assessment Manual

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POLICY / MANUAL APPROVAL

Transmitted herewith is the Engineering Assessment Manual for the Indiana Department of Transportation (INDOT). This manual replaces all previous versions of the INDOT Design Manual's Chapter 5 and will be used in lieu of that chapter.

Minor changes to this manual may be made via executive memorandum with approval from the Managing Director of Asset Management or the Director of Statewide Technical Services. These changes will be incorporated into the copy of the Engineering Assessment Manual which is posted on the INDOT website.

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ENGINEERING ASSESSMENT

This manual provides processes and guidelines regarding development and evaluation of transportation improvement alternatives for any Department project. This manual outlines the processes and methods adopted by the Indiana Department of Transportation (INDOT) to facilitate the engineering assessment process (i.e. project scope development) portion of asset management and project development.

The engineering assessment process is a transportation decision-making process that facilitates project development from concept through design hand-off. Each scoping activity is developed to facilitate informed decision making based on an appropriate level of project development and risk management. The process encourages communication among disciplines, requires documentation of the reasoning behind project related decisions, eliminates duplicated effort among disciplines, and provides for early identification of potential issues. Involvement of all disciplines during the early stages of scope development ensures that issues affecting project type, schedule, and costs can be correctly evaluated and anticipated. *Well-developed scope documents simplify complicated situations*. The intention is to facilitate development of projects that are simple, direct, clear, concise, and flexible in nature.

Engineering assessment is a critical portion of the Department's Asset Management Project Prioritization Process (AMP3). For each project, the engineering assessment process is led by the respective District's Technical Services Division, often with assistance from Central Office staff, and sets the conditions for successful project development through project selection, funding, design and construction.

1-1.0 INTRODUCTION

1-1.01 Asset Management Project Prioritization Process (AMP3)

This is INDOT's process for project development, selection and funding. The intent of this document is to define the engineering assessment portion of this process.

1-1.02 District Activities, AMP3

The published AMP3 process does not detail the engineering assessment phase of the project prioritization process. All projects moving into the project prioritization process should have some type of engineering assessment document completed prior to being scored and prioritized at the district level.

1-1.03 Purpose of the Engineering Assessment Document

The project scope development process produces an engineering assessment document that:

- Facilitates each district's initial portion of the Department's Asset Management Project Prioritization Process (AMP3)
- Documents the engineering assessment phase / early preliminary engineering phase of a project completed prior to the Asset Team Prioritization portion of AMP3 (commonly called Project Deliberation)

- Documents coordination and sets conditions for successful integration with internal and external project stakeholders
- Serves as a guide for subsequent project development activities (e.g. survey, design, right-of-way acquisition, environmental assessment, and utility and railroad coordination)
- Establishes overall costs of reasonable improvement alternatives for analysis and comparison, sets baseline overall cost for preferred alternative(s)
- Establishes project Purpose and Need statement
- Evaluates feasible project alternatives and provide a recommended alternative that will address the project's purpose and need
- Serve as the public record of project decisions and is defensible

1-1.04 Definitions

Alternative. Any combination of proposed or potential facility improvements to the current transportation system within a specific study area. The term "alternative" is specific to the NEPA process per 40 CFR Parts 1500-1508. Until a project moves into the NEPA process, the preliminary planning / engineering assessment process (scoping) develops "preliminary alternatives" and provides a recommended alternative. Through the environmental assessment phase of project development, the recommended alternative is evolved into a preferred alternative.

Asset Owner/Engineer. District staff within the Technical Services Division that are the asset leads for the following asset groups: Bridge / Culvert / Mobility / Roadway / Safety.

Calendar year: the period of time of 12 months starting from the first of January of any given year.

Directed Alternative: A proposed improvement to the current transportation system that is being set forth by District Asset Engineers as the only viable alternative available given the condition of the asset, as well as the current asset management strategy. The corollary in NEPA is an alternative that is compared to the "Do Nothing" alternative.

Engineer. Individual responsible for conducting engineering assessment and developing documents for same. May be either an Asset Engineer or a Scoping Engineer.

INDOT Engineering Assessment SharePoint site. Available here: https://ingov.sharepoint.com/sites/INDOTEngineeringAssessment/
Note that access to this site is done through requesting access; this is not managed through ITAP but through SharePoint directly. Access may also be requested through a District Scoping Manager.

IDM. The Indiana Design Manual. Available here: https://www.in.gov/indot/design_manual/

Itemized Cost Estimate. A cost estimate is the summation of individual cost elements, using established methods and valid data, to estimate the future costs of a project, based on what is

known at the time of scope development. The itemization is based on the known and assumed items of work that compose the bulk of the expected or anticipated project scope.

Preventive Maintenance (PM) Project: A project that is governed by the standards found in Ch 56 of the IDM. Project work types that fall within this category are found in IDM Fig 602-1B and 602-1C http://www.in.gov/dot/div/contracts/design/Part%206/Chapter%20602%20-%20Project%20Categories%20and%20Pavement%20Types.pdf, as well as Fig 412-1A http://www.in.gov/dot/div/contracts/design/Part%204/Chapter%20412%20-%20Bridge%20Preservation.pdf.

TMP. Transportation Management Plan. A transportation management plan (TMP) is an overall strategy for accommodating traffic during construction. The TMP not only must address the alternatives confined to the project site, but it must also evaluate the impact traffic will have on the entire corridor. The TMP will address the proposed traffic-control plan, alternative traffic control applications, the effect traffic will have on other facilities, local concerns, cost effectiveness of various alternatives, etc. See IDM Ch 503 http://www.in.gov/dot/div/contracts/design/Part%205/Current%20Version%20of%20Chapter%20503%20-%20Traffic%20Maintenance.pdf for greater detail regarding TMP documentation and process.

2-1.0 DISTRICT PROJECT DEVELOPMENT

Developing an accurate and complete engineering assessment requires participation from a variety of stakeholders. The following table lists which individuals provide input for projects in development, generally after the identification of the project need and before the project deliberation process.

Position	Role	Responsibility
Technical Services Director (TSD)	Support/Approval	Provides informational support, confirms need for project, and advocates for support from other Departments.
System Asset Manager (SAM)	Support/Approval	Provides informational support and project approval. Approves District project priorities as needed. Facilitates coordination between projects and asset engineers.
District Scoping Manager (DSM)	Review / Facilitation / Approval Recommendation	Summarizes project and ensures all stakeholder input is provided and noted. Provides quality control review over engineering assessment documents. Facilitates engineering assessment process.
Capital Program Management Director (CPMD)	Support	Provides/ensures Department participation from In-house Design, Environmental Services, R/W, Utilities, and Railroads.

Position	Role	Responsibility
Consultant Services Manager	Support	Provides/ensures support from Consultant Services including expected development time and other informational support.
District Asset Engineers • Pavement • Bridge • Culvert • Safety • Mobility	Asset Lead/Approval Recommendation	Provides information regarding the primary treatment and ancillary treatment items as well as recommending scope approval. Develops project prioritization for approval by SAM if needed.
District Maintenance Director / Sub District Manager	Support	Provides/ensures support from Maintenance including participation from Maintenance Units, existing or historic issues relevant to the project, and other informational support.
District Traffic Engineer	Support/ Asset Lead / Approval Recommendation	Provides traffic support to project development. May have asset engineer responsibilities relative to safety and/or mobility project development. Provide guidance and direction for MOT recommendations.
District Construction Director (DCD)	Support	Provides/ensures support from construction including participation from the Area Engineer, input for MOT recommendations, constructability issues and other informational support.

3-1.0 NEED IDENTIFICATION

Step	By Whom	Output
Need Identification	District Asset Engineers (i.e., roadway, bridge, culvert, safety, mobility) or Central Office Staff	• Initial Project On-line Application • Preliminary Analysis

The engineering assessment process begins by identifying asset shortfalls, deficiencies, or transportation improvements and answering the following questions:

- What is the asset shortfall/deficiency/needed system improvement?
- What is the cause of the asset deficiency?

- What is the desired condition of the asset?
- What is the proposed solution (short term / long term) to correct the asset deficiency?
- Where is the asset and issue located?
- When should this issue be addressed?
- Why does this issue need to be addressed?

Once the asset deficiency and desired asset performance has been identified, the following information is captured through INDOT's online GIS application "INDOT Project Scoping Application":

- (Where) Corridor / Route
- (Where) Location of asset issue/concern
- (What/Why) Asset issue/concern/shortfall
- (What) Tentative project work type to address issue/shortfall/improvement of asset
- (When) Desired construction timeframe

3-2.0 DETERMINE ENGINEERING ASSESSMENT LEVEL

Step	By Whom	Output
Engineering Assessment Determination	District Scoping Managers	• Determine the level of engineering assessment required for each project • Determination of responsible personnel to conduct engineering assessment and develop the required scoping document (i.e., INDOT or consultant, etc.)

Engineering Assessment Level	Criteria	Engineering Assessment Product
Non-Complex	• Directed alternative; no engineering analysis required	Abbreviated Engineer's assessment (AbbEngRpt)
Complex	• No clear recommended or directed alternative provided: engineering analysis required to provide recommended treatment • Historic bridges • Interchange access • Safety analysis with no directed alternative • Mobility analysis with no directed alternative	Full Engineer's Assessment (EngRpt)

WORK TYPE SCOPE REQUIREMENTS

Work Type	Preliminary Alternative Analysis Required	Crash Analysis	Scope Document Recommended
ROAD			
HMA, PM Overlay	No	C	AbbEngRpt
HMA, Minor Structural Overlay or HMA, Functional Overlay	No	A (3R) B (Partial 3R)	AbbEngRpt
HMA, Structural Overlay	No	A (3R) B (Partial 3R)	AbbEngRpt
PCCP Patching	No	B	AbbEngRpt
Conc Pav't Restoration	No	B	AbbEngRpt
Conc Pav't Preservation	No	B	AbbEngRpt
Profiling, PCCP	No	C	AbbEngRpt
Surface Treatments, all types	No	B	AbbEngRpt
Shoulder Rehab & Repair	Maybe	B	AbbEngRpt or EngRpt
Crack and Seat, all types	No	A	AbbEngRpt
Rubblize	No	A	AbbEngRpt
Full-depth reclamation	No	A	AbbEngRpt or EngRpt (5)
PCCP on PCCP Pav't	No	A	EngRpt
Storm sewer repair/replace (4)	Yes	C	EngRpt AbbEngRpt (repair)
Pump/lift station	Yes	C	EngRpt
Pav't replacement, all types	Maybe	A	AbbEngRpt or EngRpt (5)
Slide correction	Yes	B	AbbEngRpt
BRIDGE			
Bridge replacement, all types (2) (S)	Maybe (6)	A	AbbEngRpt
New bridge (2) (S)	Yes	A	EngRpt
Bridge rehabilitation or repair (3) (S)	Maybe (6)	B	AbbEngRpt
Bridge deck overlay (either type) (S)	No	C	AbbEngRpt
Replace superstructure (2) (S)	No	A	AbbEngRpt
Replace deck (S)	No	A	AbbEngRpt
Bridge widening (2) (S)	No	A	AbbEngRpt
Bridge painting	No	C	AbbEngRpt
Substr repair/rehabilitation (3) (S)	No	C	AbbEngRpt
Bridge maintenance or repair (S)	No	C	AbbEngRpt
Repair/replace joints (S)	No	C	AbbEngRpt
Arch reconstruction / repair (S)	No	C	AbbEngRpt
Small structure replacement (4) (S)	Maybe	A	AbbEngRpt or EngRpt (5)
New small structure (4) (S)	Maybe	A	AbbEngRpt or EngRpt (5)
Small structure pipe lining (4) (S)	Maybe	C	AbbEngRpt or EngRpt (5)
Small culvert, all types (4) (S)	No	C	AbbEngRpt
SAFETY			
Curve correction	Maybe	A	AbbEngRpt or EngRpt
Sight correction, all types	Maybe	A	AbbEngRpt or EngRpt
Signal modification	No	B	AbbEngRpt
Intersection modification	Yes	A	EngRpt
Access control revision	No	B	AbbEngRpt
Added lane(s)	Maybe	A	AbbEngRpt or EngRpt
Pedestrian improvements	No	B	AbbEngRpt

Work Type	Preliminary Alternative Analysis Required	Crash Analysis	Scope Document Recommended
Highway lighting	No	B	AbbEngRpt
Barrier install (new or modernization)	No	B	AbbEngRpt
Signs & marking projects	No	B	AbbEngRpt
MOBILITY			
New interchange	Yes	A	EngRpt
Interchange modification	Yes	A	EngRpt
Add capacity	Yes	A	EngRpt
Reduce capacity (road diet)	Yes	A	EngRpt
Add travel lane (interstate)	Yes	A	EngRpt
Add turn lane @ intersection	No	A	AbbEngRpt

Key to letters in table:

A = Item is required with the project scope.
B = Item is optional for the project scope
C = Item is not required for the project scope

Notes:

(1) The Engineer developing the scope document shall ensure that the 3R/Partial 3R determination for a project is valid per the IDM
(2) Bridge replacement requires a structure, size and type (SS&T) report during design per IDM Ch 14. Details relative to SS&T should not be explored during the engineering assessment of this type of project.
(3) Bridge rehabilitation work is non-complex unless rehabilitation on a historic structure.
(4) Requires hydraulic analysis which should be done prior to, or as part of the engineering assessment process
(5) Given the nature of the project's context, the District Asset Engineer may direct a specific project treatment, thus eliminating the need for an EngRpt. The Scoping Engineer shall note the selection of a preferred treatment by the Asset Engineer in question within the scope document.
(6) Rehabilitation or replacement of a historic structure does require an alternative analysis per the HBAA process (see Section 3-3.03).
(S) The project is considered a spot improvement based on the work type. If the work type is not clear, District Asset Engineers may provide definition regarding a project being a spot or linear improvement.

Engineering judgement should be used to ensure that the project context is reviewed with each project's work type. Work type alone cannot dictate the level of engineering assessment required for an individual project.

Each project must have a documented engineer's assessment (an Abbreviated Engineer's Assessment or a full Engineer's Assessment) completed prior to moving through the Department's Asset Management Project Prioritization Process.

3-3.0 CONDUCT ENGINEERING ASSESSMENT

The tasks in the following sections are listed in order of prevailing use in practice. However, an individual project may vary in level of effort and processing order. The user must use flexibility when applying these guidelines. Projects that do not require a full Engineer's Assessment may not utilize all these steps. Frequently, the Engineer is developing an assessment based on a directed alternative from the District's Asset Engineer.

3-3.01 Task 1 - Determine the Essential Project Need (Deficiency) and Purpose (Objective) (Define the Problem and Establish Goals)

Primary Task Assignment: Asset Engineer
Supporting: Scoping Engineer
Engineering Assessment Level: Both (Non-complex and Complex)

Engineering assessment seeks to establish an action plan that satisfies the project objectives while minimizing agency and user costs. The purpose and need statement within the engineering assessment document serves as the basis for system-wide improvements and individual project development.

Every project should have a well-defined and documented purpose-and-need statement that specifies the problem to be solved and future goals of the corridor/system to be achieved by the proposed project. Any features that do not directly support the purpose-and-need statement should be re-evaluated, redesigned, or eliminated.

Initial statements of project purpose and need are determined in the beginning stages of engineering assessment and should precede development of any other activity within the assessment phase of a project.

The project Purpose and Need Statement establishes why the project is required. It develops a shared understanding of the transportation problems and desired performance of an asset as a result of the project. The Purpose and Need Statement helps to:

- Define a project's scope;
- Develop and evaluate alternatives;
- Achieve environmental streamlining;
- Identify potential context sensitive solutions;
- Allow transportation decisions to be legally defensible;
- Justify impacts and spending of funds; and
- Comply with other federal environmental laws.

The Purpose and Need Statement development process is as follows:

1. Review system performance
2. Identify gaps in system performance
3. Identify problems to be fixed → *Project Need*

4. Establish desired facility/asset performance → *Project Purpose*

A "need" is an underperforming aspect of your transportation system; a problem to correct. A "purpose" identifies how the transportation facility/asset should perform after implementing the project. Note that a "purpose" allows for a reasonable range of alternatives and does not define evaluation criteria for alternatives within the statement (i.e., "seek the most cost effective solution"). **Do not write the purpose as a specific solution**.

3-3.02 Task 2 – Gather Information (Define the Existing Project Environment)

Primary Task Assignment: Scoping Engineer
Supporting: Asset Engineer
Engineering Assessment Level: Both (Non-complex and Complex)

Once the Purpose and Need statement is developed, the Engineer continues to gather information relevant to the project. Gathering information begins with defining the purpose and need and continues throughout the engineering assessment process.

3-3.02(01) Field Inspection

Engineering Assessment Level: As Required by the Engineer

Field check during the engineering assessment phase may be done based on engineering judgement by the Scoping Engineer or Asset Engineer. Consideration should be given to the amount of time available to develop the engineering assessment for individual projects. Input from all stakeholders is necessary, though it may be very difficult to schedule field checks which includes all stakeholders for every project in the assessment process at the district level. Engineering judgement and creativity are critical to reviewing the existing conditions of a project firsthand and gaining input from the stakeholder group. The Field Inspection Checklist (Figure 3-3A) may be used as a guide for conducting the field inspection

3-3.02(02) Design Criteria

Engineering Assessment Level: Both (Non-complex and Complex)

Select the applicable design criteria based on the project's work type and functional classification. See Chapters 40 and 53 through 56 for more information. The Scoping Engineer should develop an initial assessment of the design criteria based on the level of capital improvement intended by the project work type.

3-3.02(03) Existing Roadway Geometry

Engineering Assessment Level: Both (Non-complex and Complex)

Based on the project work type, compare existing conditions to the selected geometric criteria. The Scoping Engineer may develop an initial assessment of the potential deficiencies in Level 1 and Level 2 design criteria to determine potential impacts to final scope. Note whether any deficiencies should be addressed by the project or if any design exceptions are anticipated. This

initial review of Level 1 and Level 2 Design Criteria does not relieve that requirement from the Design Engineer in subsequent phases of a project.

3-3.02(04) Existing Structure Condition Data
Engineering Assessment Level: Both (Non-complex and Complex)

Compare existing conditions to the desired condition data. Bridge and culvert condition data may be found in INDOT's Bridge Inspection Application System (BIAS).

3-3.02(05) Asset History
Engineering Assessment Level: Both (Non-complex and Complex)

The asset history provides life cycle context to the proposed (recommended) treatment. For pavement and bridge assets, this information is available in the following locations:

- Road: Pavement Sections and History Reference (available through INDOT GIS) at https://indot.maps.arcgis.com/sharing/oauth2/authorize?canHandleCrossOrgSignin=true&client_id=arcgisonline&response_type=code&state=%7B%22portalUrl%22%3A%22https%3A%2F%2Findot.maps.arcgis.com%22%2C%22uid%22%3A%22JCPCZ0lILFOKCfGiCsvF8bfYQliebwWAcAdvRx5GEIk%22%7D&expiration=20160&redirect_uri=https%3A%2F%2Findot.maps.arcgis.com%2Fapps%2Fwebappviewer%2Findex.html%3Fid%3Dd68641c6ee3c44129353bbd38b12b58b&redirectToUserOrgUrl=true&code_challenge=O1oQRJuZSth3_XVeYaGUMkLFCwdMzjYR3GtHPkt44w8&code_challenge_method=S256
- Bridge: BIAS, SPMS and District Bridge Asset Engineer
- Safety based histories may be available through the respective District Traffic Engineer.

For all assets, the Scoping Engineer shall check for previous Emergency Relief permanent repairs. For major pavement (Minor Structural or above) or bridge projects (Deck Replacement or above), check to see if there has been a previous permanent ER repair made within the project limits. ER projects are tracked in a GIS layer and can be viewed on INDOT's intranet site (link forthcoming).

If the project is found to have had a previous permanent ER repair, the Scoping Engineer or Asset Engineer shall consider alternatives that could prevent or limit the need for another such repair in a similar future event.

3-3.02(06) Traffic Analysis
Engineering Assessment Level: Both (Non-complex and Complex)

Some form of traffic analysis is required for all projects. The project work type and context will drive the requirement for one or both types of traffic analysis. Traffic analysis is defined as one of two types:

1. Capacity Analysis: This analysis should be performed for a project when the method of intersection traffic control is being changed or revised, or when the need of the project requires a change in the capacity of the asset. Capacity analysis should follow INDOT's

Traffic Analysis Procedures (https://www.in.gov/indot/doing-business-with-indot/files/Intersection-Traffic-Analysis-Procedures_12-2019.pdf) and the INDOT Intersection Decision Guide. Use the approved software list from INDOT Intersection Traffic Analysis Procedures for capacity analysis. The common measures of effectiveness for this type of analysis are Level of Service (LOS), volume/capacity ratio (v/c ratio), travel time and queueing.

2. Traffic Forecast: At a minimum, traffic analysis should determine current- (base-) year and design-year (typically twenty years after construction) AADT. The most recent traffic data is available from the Traffic Count Database System (TCDS) which is accessible from the Department's Traffic Data webpage http://www.in.gov/indot/2469.htm, or directly from indot.ms2soft.com. Official traffic counts with projections are provided by the Technical Planning Support & Programming Division Office of Traffic Statistics. A request for a project traffic forecast should be made through the INDOT Technical Applications Pathway (ITAP). An ITAP user account and access to the Projector application is required.

3-3.02(07) Crash Analysis

Engineering Assessment Level: Both (Non-complex and Complex)

Crash analysis may be required by the Scoping Engineer to facilitate a complete assessment of a project. When required, a crash analysis should be done during the preliminary engineering/scoping phase of a project or should be noted in the scoping document as needed prior to STG1 design submission. In cases where analysis is not specifically required, engineering judgement is required to determine need for crash analysis and possible counter measures. Crash analysis may also be required to facilitate evaluation of possible design exceptions. The Scoping Engineer shall utilize an INDOT approved crash analysis tool (typically RoadHAT, current version) for project locations that may be considered at risk for safety concerns or high crash frequencies. The Scoping Engineer should develop a crash analysis for all non-PM (i.e., 3R or higher) project work types. A crash analysis shall follow these general guidelines:

1. The most recent three full calendar years of crash data for the project site shall be used for the RoadHAT analysis. A longer analysis period may be appropriate for additional examination in some cases.
2. A RoadHAT report should be prepared for the project length, location, or intersection, depending on the project type. Note that projects may require multiple iterations of analysis with RoadHAT depending on number of intersections and length of project.
3. A crash summary breakdown for manner / type of collision should be included.
4. Diagram of crash type and location within the project is helpful especially for intersections. These crash diagrams are recommended for locations with elevated crash rates/crash severity.

See Figure 3-3B for the crash analysis reporting format requirement. See IDM Section 55-8.0 for further guidance on conducting a crash analysis.

If the result of the crash analysis determines that there is an elevated crash rate, the crash patterns at those locations should be analyzed (typically via crash diagram and by reading the narratives of the crash reports). Effort should be taken to determine what the causes of the crashes are and what could be done (short term or long term) to address these patterns. Then the Engineer should determine whether these countermeasures can be reasonably added into the project. The District Traffic Engineer will be involved in this discussion to assist with decision making. The IDM also lists some possible countermeasure options based on crash patterns in table 55-8E.

If it is determined that the countermeasure cannot be reasonably added to the project, then the Engineer should still include a discussion of the safety analysis process in the report and provide a copy of the report to the District Traffic Engineer so that they can evaluate the location for improvement via other funding sources.

3-3.03 Task 3 – Develop Preliminary Alternatives

Engineering Assessment Level: Complex only

This section should only be utilized for a full engineering assessment where preliminary alternative analysis is required. For engineering assessment where District Asset Management staff have directed an alternative, move to Task 5 "Develop Recommended Alternative". For bridge replacements, this is not to replace the IDM Chapter 402 structure size and type evaluation process, simply to validate the requirement to replace the structure. If the Chapter 402 structure size and type analysis concludes that a replacement is not warranted, then the scope document shall be amended to reflect that change in project scope (see Section 3-4.04 of this manual).

Certain specific project types or work types have formal processes for alternative analysis that must be followed as part of engineering assessment. The following are engineering assessment processes that have directed alternative analysis:

Directed Alternative Analysis Requirement:
NOTE: Projects requiring these processes may have preliminary alternatives identified during scope development to facilitate project funding. NEPA processes must be initiated to initiate actual alternative analysis.

- Intersection analysis / improvement. Any intersection improvement must utilize the Intersection Decision Guide and document analysis and decisions in the Engineering Assessment.: http://www.in.gov/indot/files/ROP_IntersectionDecisionGuide.pdf

- Historic bridge alternative analysis: https://www.in.gov/indot/2531.htm
  Interchange access request: https://www.in.gov/indot/doing-business-with-indot/files/State-of-Indiana-Interstate-Access-Request-Procedures_5-2018.pdf

3-3.03(01) Outline of Recommended Alternative

Engineering judgment and coordination with project stakeholders are used in the development of conceptual solutions. Although there may be an infinite number of alternatives that solve a particular asset need, the Scoping Engineer should address only those alternatives which are

reasonable, prudent, practicable, and constructible. The alternatives that are developed in this step must satisfy the purpose and need, have logical termini, demonstrate independent utility, and should not restrict the consideration of future alternatives.

Sufficiently outline the plan to allow informed comparison with competing alternatives and convey the full scope-of-work to end-users (i.e., design engineers, environmental scientists, etc) of the Engineer's Assessment. The explanation may be presented in the form of drawings and/or written text. Essential elements include the typical cross section, horizontal (and, if required, vertical) alignment, major structures, and project limits. Additional detail regarding right-of-way impacts, construction costs, and maintenance of traffic during construction are only provided in this section if they have a direct bearing on the alterative comparison later in the report.

3-3.03(02) Hydraulic Analysis Requirements

1. Small Culvert Rehabilitation or Replacement: Hydraulic analysis is required to be reviewed by INDOT Hydraulic Sections for small culverts equivalent to or greater than 36 inches in diameter or span. For smaller diameters or spans, a hydraulic analysis is required, but calculations only need to be submitted as part of a stage submittal and not submitted directly to the INDOT Hydraulic Section. In some instances, for pipes less than 36 inches that are connected to median inlets, a median drain report could be required. Median drain reports should be submitted to INDOT Hydraulic Section for review

2. Small Structures Pipe Lining: Small Structure Pipe Lining work type projects shall have a hydraulic analysis done per IDM Ch 203-2 prior to submitting a project scope for prioritization and possible funding. The final hydraulic memo for the small structure pipe lining work type project shall be approved by the Office of Hydraulics as part of the scope development process.

3. Small Structure New or Replacement: Projects with a work type to either replace a small structure or install a new small structure should have a hydraulic analysis done per IDM Ch 203-2 prior to submitting a project scope for prioritization and possible funding.

4. Bridge Hydraulics: Hydraulic analysis for bridge projects is not required during the scoping / engineering assessment phase of a project. Hydraulic analysis for bridges shall be done in the design phase of a project per IDM Ch 14.

3-3.04 Task 4 – Evaluate Alternatives

Engineering Assessment Level: Complex only

This process is similar in concept to the process outlined in INDOT's "Procedures Manual for Preparing Environmental Documents". Evaluation criteria used for this step may be quantitative or qualitative, although quantitative criteria are preferred. Examples of criteria include cost, level of service, safety, impacts to the human and natural environment, engineering design issues, land use, and right of way acquisition. Evaluation criteria shall include the project specific major factors that directly impact the evaluation and selection of the directed or recommended alternative.

The documentation should identify all alternatives that were considered, describe the criteria and methodology that were used, define the no-build solution, identify solutions that were eliminated (and why each was eliminated), present the estimated costs for each solution, and recommend an alternative for further consideration. A matrix is strongly suggested as a clear way to present the results of the analysis. The alternative that survives this screening process is developed as the recommended alternative. Documentation and description of this process is required. A summary matrix is helpful but is not a stand-alone documentation of the evaluation process.

See Figure 3-3C Alternative Evaluation Matrix for examples of how to present a summary of analysis results.

Given the nature of the project's context, an Asset Engineer may direct a specific project alternative, thus eliminating the need to evaluate feasible alternatives. The Scoping Engineer shall note the selection of a directed alternative by the Asset Engineer in question within the Engineer's Assessment.

3-3.05 Task 5 – Develop Preferred/Recommended Alternatives

3-3.05(01) Recommended/Preferred Alternative

Engineering Assessment Level: Both (Non-complex and Complex)

Develop the proposal (i.e., recommended or directed alternative) in sufficient detail to the extent that the alignment and design features of the roadway are established, drainage needs are accommodated, environmental impacts may be outlined, and right-of-way requirements are determined at a preliminary level.

> Example (from an abbreviated engineer's assessment):
> *SR99 is a two-lane roadway though much of the project length. The current project scope is considered a preventive maintenance treatment per IDM Sec 602-1.04.*
>
> *PAVEMENT:*
> *The existing asphalt pavement be milled 2 inches in depth and paved with 2 inches of HMA, to be determined by the pavement design. Full and partial depth patching is anticipated. Aggregate shoulder will be re-established with Compacted Aggregate #73. HMA millings may be screened to meet Compacted Aggregate #73 gradation standards and used in lieu of Compacted Aggregate #73.*
>
> *CROSS SECTION AND GEOMETRY:*
> - *No significant changes to horizontal or vertical geometry of SR99 is required.*
> - *Maintain/match existing cross slopes and side slopes*
> - *No sight distance corrections are required.*
> - *Maintain existing lane and shoulder widths.*
> - *No superelevation rate corrections are required with this project.*
>
> *INTERSECTING ROADWAYS AND PRIVATE DRIVES:*
> - *Intersecting Roadways: treat all public road approaches to mainline R/W line*
> - *Private Drives: Wedge 3ft adjacent to mainline pavement*

SIDEWALK:

- *All existing curb ramps within the project limits shall be upgraded to current PROWAG standards.*

DRAINAGE

- *Adjust all castings to finished grade. Provide for new castings as required based on condition of existing castings.*
- *Rehabilitate existing small culverts as shown on the attached structure data table.*
- *No underdrain work is required with this project.*
- *No side ditch reshaping or clean-out is required with this project.*

GUARDRAIL: The following existing guardrail locations shall be addressed as follows:

The Scoping Engineer shall consider addressing several details within the Recommended/Preferred Alternative narrative. The following items are examples of the various details for consideration as part of the Recommended/Directed Alternative narrative (NOTE: NOT AN EXHAUSTIVE LIST):

- Guardrail installation or replacement (full or partial run) (See IDM Ch 49 for further definition). Scoping engineer should conduct an evaluation of existing guardrail to determine if upgrades to current standard are required.
- Pavement or bridge deck patching
- Ancillary structure patch work (bridge)
- Sheet sign replacement
- ADA ramp upgrades to current PROWAG standard
- Small culvert treatments
- Drainage issues that need to be addressed
- Weight-in-Motion (WIM), Advanced Traffic Recorder (ATR), or other INDOT ITS locations that may require additional effort to maintain functionality
- Known utility relocations required as part of the Recommended/Preferred Treatment (for example, relocating utility conduit off a bridge to facilitate deck replacement or superstructure replacement)

3-3.05(02) Maintenance of Traffic Plan

Engineering Assessment Level: Both (Non-complex and Complex)

The Maintenance of Traffic (MOT) Plan is an integral part of the project scope, and critical to the development of a cost estimate that accurately reflects the project's financial requirements. Do not defer selection of a conceptual maintenance of traffic plan until the design phase of the project, as the maintenance of traffic plan may add significant cost to a project. The Scoping Engineer should ensure that the initial MOT plan considers and balances worker safety as well as IHCP minimum lane requirements (where applicable). In developing a project scope, the Scoping Engineer has the following requirements relative to the Maintenance of Traffic Plan:

Identify significant projects: The scope shall determine mobility significance per IDM Chapter 503 and provide a statement to that effect in the engineering assessment document. The Scoping Engineer should document the project's mobility significance with the Significant Work Zone Impact Determination Worksheet (SWZIDW) (https://www.in.gov/dot/div/contracts/design/dmforms/EdDoc%20503-2.02.1%20Significant%20Work%20Zone%20Impact%20Determination%20Worksheet.docx) and include that worksheet with the completed scope document.

Mobility Significant Project Statement:
"This project is considered a mobility significant project per IDM Section 503-2.02. The following is the temporary traffic control plan concept that may be used for the project:"

Not Mobility Significant Project Statement:
"This project is not considered a mobility significant project per IDM Section 503-2.02. The following is the temporary traffic control plan concept that may be used for the project:"

- **Identify construction staging approaches**: Analyze the options for maintenance of traffic during construction as outlined in IDM Chapter 503. The Scoping Engineer preparing the engineering assessment may choose to utilize the Traffic Control Plan Checklist (https://www.in.gov/dot/div/contracts/design/dmforms/EChk82-7A.doc) to facilitate initial definition of the environment for the maintenance of traffic plan.

  Where a series of proposed projects are along the same corridor or along corridors of proximity, a single MOT plan covering all projects should be used. If circumstances prohibit a single MOT plan, the individual plans should be coordinated.

- **Assess / analyze expected work zone impacts:** There are projects where the maintenance of traffic plan may warrant an alternative analysis of feasible MOT solutions due to the impact of the plan on the overall scope of the project. The Scoping Engineer may be required to analyze multiple MOT alternatives to facilitate the best fit concept for the recommended project alternate that maintains a safe work environment as well as a concept that maximizes motorist safety. In some cases, the feasibility of the maintenance of traffic plan is the required alternative analysis for a project. This analysis, when done, shall be documented within the draft TMP or in the scope document for the project.

- **Develop preliminary cost estimates for work zone implementation**: The maintenance of traffic plan initially developed by the Scoping Engineer should be developed to the degree needed to facilitate cost estimation for the project.

The Designer should evaluate the maintenance of traffic concept provided in the engineering assessment document to ensure relevance and completeness prior to developing the final maintenance of traffic plan.

3-3.05(03) Environmental Impacts
Engineering Assessment Level: Both (Non-complex and Complex)

The engineering assessment is an integral part of a larger group of pre-design activities that form the basis for compliance with the National Environmental Policy Act (NEPA) for study and disclosure of socio-economic and environmental impacts precipitated by a project. The engineering assessment document is developed considering the variety of possible environmental factors impacting project development. The Scoping Engineer should consult with the District Environmental Manager to evaluate the potential environmental impacts of the directed/recommended alternatives under consideration as needed. This cooperative effort will be documented in the engineering assessment document and may be used by the environmental manager in documenting environmental assessment. Projects vary in the level of environmental oversight necessary to satisfy NEPA.

The Scoping Engineer shall not direct or establish an environmental analysis Categorical Exclusion (CE or CATEX) level for the project in the engineering assessment of the project. Any notation of CE level or permit requirements in the scope document is a preliminary assessment to facilitate development of scope. Design team is required to conduct the actual environmental clearance documentation regardless of initial preliminary assessment within the scope document.

3-3.05(04) Community/External Stakeholder Context
Engineering Assessment Level: Both (Non-complex and Complex)

Stakeholder engagement is a key aspect of a successful project. Seeking stakeholder input during the engineering assessment portion of a project:

- Minimizes design changes, particularly late in the project development process
- Develops partnerships
- Improves customer service
- Facilitates timely conflict resolution
- Facilitates timely consideration of multi-modal facilities
- Facilitates community-focused context sensitive solutions that also balance environmental considerations with transportation needs.

One cornerstone of stakeholder engagement is to start early and plan for continuous input. The goal is to have a plan, engage in meaningful dialogue, keep things moving and be flexible. Opportunities to make changes diminish as a project nears design completion.

The Engineer should be mindful during stakeholder engagement to seek input from partners and not make binding commitments on behalf of INDOT.

3-3.05(05) Integration with Planning and Environmental Linkages (PEL) Studies
"Planning and Environment Linkages (PEL) represents a collaborative and integrated approach to transportation decision-making that 1) considers environmental, community, and economic goals early in the transportation planning process, and 2) uses the information, analysis, and products developed during planning to inform the environmental review process". (FHWA's Environmental Review Toolkit website).

A PEL may be done prior to Engineering Assessment or initiated during the EA process. The PEL may be specific to one project or cover a group of projects within a study area. Any of the following factors indicate that PEL may be beneficial for developing a project concept into a project scope that is ready for programming and NEPA analysis (see INDOT's PEL Implementation Guidance for more details).

- Large geographic scale and/or regionally significant proposal could result in multiple programmable projects with independent utility and logical termini
- Known or anticipated public controversy about scope, need, purpose, and/or potential alternatives
- Complex community impacts or complex environmental constraints
- Need and purpose is unclear, unstable, or requires additional definition
- Too many possible alternatives for an efficient NEPA process
- High cost and/or construction funding not programmed
- Even with a lot of initial work, NEPA process will not meet Environmental Assessment (1 year) or Environmental Impact Statement (2 year) time limits

Project concepts that may meet these criteria are reviewed by INDOT's PEL Committee for appropriateness to pursue as PEL studies. Project concepts that have a clear and non-controversial scope, that can be processed as a CE, should not use a PEL and should follow the normal project development process.

While a project scope may have been developed prior to a PEL, the Engineer shall review the project scope post PEL and ensure that the engineering assessment is aligned with the PEL results. A project scope that has been moved into a PEL process will not move forward into Design until the PEL process is complete, and funding has been awarded to the PEL revised project scope.

"If your scope won't gel, try a PEL!"

3-3.05(06) Cost Estimate
Engineering Assessment Level: Both (Non-complex and Complex)

The estimating process, during engineering assessment, includes determining the costs associated with all phases of a candidate project. The development of a complete and reasonable estimate is critical to a successful project scoping package and facilitates the project selection process. The estimate developed, as part of the engineering assessment process, is used to program the funding of the design, Right of Way (ROW) and construction for the project.

For non-complex engineering assessments, cost estimates should be developed for the directed alternative. For complex engineering assessments, cost estimates are required for all alternatives under consideration. The cost estimate should be for the current year only. Document all assumptions and generally round cost items to $10,000 to avoid the false impression of precision.

A reasonable amount of contingency should be included to account for the unknowns that may arise during the detailed design of the project. Contingency values account for change in

conditions, standards, specifications and policy implementations that occur between the time the project is scoped and time of construction, as well as other minor work items not easily estimated at the time of scoping.

The following are the cost estimating requirements / guidelines:

- Itemized cost estimates are required for all projects of the following types:
  - Roadway, rehabilitation through reconstruction
  - ADA upgrades
  - Safety
  - Mobility
  - Large culvert/small structure (spans from 48" through 20'), all types
  - Bridge deck overlay
  - Small culvert
- Non-itemized cost estimates may be developed by INDOT staff for bridge work not listed above.
- Cost estimates may have up to a 20% contingency as part of the estimate
- Unit prices for cost estimates shall be based on historical bid prices, restricted to the past three years of data, specific to the District. More than three years of bid history may be used where sufficient data is not contained within a three year cycle.
- HMA pay item cost histories are restricted to the past two years of data only due to industry fluctuations, specific to the District
- Where bid history for a unit price is not available for a specific District, additional Districts' histories may be used to facilitate development of a unit cost.
- Cost estimate must include significant MOT items (temporary concrete barrier, crossovers, etc)

The construction cost estimate shall be broken down by the amount of funding required for each asset group. This practice aids in developing and maintaining funding for the various asset costs tracked by INDOT. The following is an example of the asset cost breakdown:

Construction Cost Estimate Asset Cost Breakdown:

Phase	**Amount**	**Comments**	**Phase Definition (1)**
Construction (CN) Total			*Sum total of all asset group funding below*
Construction (Primary asset group)			*This is the main asset group's construction cost.*
ADA			*Costs for upgrading and maintaining PROWAG standards*
Sidewalks			*Costs for installation of new or upgrading of existing sidewalk.*
Small Culvert / Drainage			*Costs for drainage appurtenance rehabilitation*

Phase	Amount	Comments	Phase Definition (1)
Overhead Sign Structures			*Repair / replacement costs only. New assets of this type require the asset to be the project specific asset group*
MSE Walls			*Repair / replacement costs only. New assets of this type require the asset to be the project specific asset group*
Noise Walls			*Repair / replacement costs only. New assets of this type require the asset to be the project specific asset group*
Traffic Signal			*Modernization only. New installation requires the signal to be the project specific asset group.*
ITS			*Repair / relocation costs only. New assets of this type require the asset to be the project specific asset group*
High Mast Tower Lighting			*Repair / replacement costs only. New assets of this type require the asset to be the project specific asset group*

NOTES:
1) The Phase Definition is included to provide explanation to each asset grouping. The column is not included in scope documents.
2) Asset group costs are broken out into subordinate groups when that asset group is not the project's managing asset. Example, for a bridge project that has MSE wall repair, the cost of the MSE wall repair would be captured in the "MSE Wall" line.

3-3.06 Task 6 – Write the Engineer's Assessment (Present Recommendation)

3-4.0 ENGINEERING ASSESSMENT TYPES

3-4.01 Abbreviated Engineer's Assessment (AbbEngRpt)

Primary Task Assignment: Scoping Engineer
Supporting: Asset Engineer

The abbreviated engineer's assessment is a succinct document that summarizes the project scope. This type of assessment is the most common and anticipated for the majority of all projects within INDOT's capital program.

3-4.02 Engineer's Assessment (EngRpt)

The engineer's assessment is a full assessment document that details the project scope. This type of assessment is uncommon and anticipated for a minor number of projects within INDOT's capital program.

3-4.03 Engineer's Assessment Contents

The report may take one of two formats. The most common format is through INDOT online application "INDOT Project Scoping Application". This online tool is not a complete conveyance of the full project scope, and additional documents are required to be uploaded into the application (see list below). If the online application is the only format being used for the report, that document, once complete, should be printed to a PDF and saved into ProjectWise with all required supporting documents.

Engineer's Assessment Content

Report Section	Requirement			Information Source / Notes
	AbbEngRpt	EngRpt	As Needed	
Purpose of Report	•	•		
Project Location	•	•		Must have RP location ("At" or "To/From") as well as latitude-longitude location
Existing Facility	•	•		See below for information requirements
Drainage	•	•		AbbEngRpt: as neeeded
Railroads	•	•		
Traffic Analysis	•	•		AbbEngRpt – existing traffic req'd
Capacity Analysis		•	•	EngRpt – required for Mobility / Safety projects
Crash Analysis			•	Required based on work type of project
Purpose & Need Statement	•	•		
Alternative & Analysis		•		
Directed Alternative (AbbEngRpt)	•			See Section 3-3.05(01). Include construction timeframe if project is expected to take more than one season. Include information regarding related projects as needed.
Recommended Alternative (EngRpt)		•		
No Action Consequences	•	•		The "No Build" Alternative
Maintenance of Traffic Concept	•	•		Based on the detailed alternative • Is the project mobility significant per IDM Ch 503? • Does the project require a TMP • Can the road be closed to traffic (detour)? • Does the project require an IHCP exception?

Report Section	Requirement			Information Source / Notes
	AbbEngRpt	EngRpt	As Needed	
Community Context			•	Based on the detailed alternative; include potential construction impacts
Environmental Impacts	•	•		Significant impacts based on the detailed alternative (may be other impacts not listed here) • Is tree clearing required? • Are there known adjacent historic properties? • Are there known wetland areas within the project limits?
Permits Anticipated	•	•		Anticipated based on the recommended alternative • USACE 404? • IDEM Construction Stormwater General Permit? • IDEM 401? • IDNR CIF? • IDNR Navigable Waterway? • What Storm Water Quality Manager Level is anticipated?
ROW Impacts	•	•		Impacts based on the recommended alternative. On AbbEngRpt, this may be covered in summary comments in the Cost Estimate section
RR Impacts	•	•		Impacts based on the recommended alternative. On AbbEngRpt, this may be covered in summary comments in the Cost Estimate section
Utility Impacts	•	•		Impacts based on the recommended alternative. On AbbEngRpt, this may be covered in summary comments in the Cost Estimate section
Preliminary Cost Est	•	•		Based on the recommended alternative
Phase costs for CN/PE/RR/RW/UT	•	•		Phase costs based on the recommended alternative

3-4.03(01) Purpose of Report

State the purpose of the Engineer's Assessment, which generally is to document the engineering assessment phase and, most important, to outline the proposal (recommendation). Explain the Assessment's intended use.

Recommended Report Purpose: "The purpose of this report is to document the engineering assessment phase of project development, including all coordination that has

been completed in preparation for this [road/bridge] project. This document outlines the proposal and is intended to serve as a guide for subsequent survey, design, environmental, right of way and other project activities leading to construction. The recommended alternative identified in this document is considered predecisional, pending the outcome of environmental studies."

3-4.03(02) Project Location

Example:

This project is located on SR 18, 2.45 miles west of US 41 at reference post 5+27 in Benton County. The GPS coordinates are 40°37'19.0" North and 87°25'38.9" West. The project is in the Indiana Department of Transportation's Crawfordsville District, West Lafayette Sub-District. This location is in a rural planning organization region, the Kankakee-Iroquois Regional Planning Commission.

Road / Safety / Mobility

Pavt Section ID (PK):		*From RP+Offset*	
Route:		*To RP+Offset*	
Location:		*State Log Mile From*	
		State Log Mile To	

District:				
Subdistrict:			*Pavement Area:*	
County:			*Underdrains?*	
Project Length:			*Curbs Present?*	
# Through Lanes:			*ADA Deficiencies?*	
# Lane Miles:			*Small Culverts?*	

Bridge / Culvert

Str Number:		*RP+Offset:*	*0+0.0*
Route:	*SR17*	*Year Built:*	*xxxx*
Location:	*From SR 25 to 1.30 mi N of SR 25 (Northern Ave), City of Logansport*	*Last Rehab:*	*yyyy*

District:	
Subdistrict:	
County:	

3-4.03(03) Existing Facility Information

1. All Projects

Basic Design Elements	
Functional Class	*Interstate*

Member Road Systems	*On NHS*
	On National Truck Network
Rural/Urban	*Rural*
Terrain	*Level*
Access Control	*Limited Access*

Basic Design Criteria	
Design Criteria	*Partial 3R (Non Freeway)*
Design Standard	*Fig 55-3A, 2 Lane*
Design Speed	*55 mph*
Posted Speed	*55 mph*
Lane Width	*12' (match existing)*
Shoulder Width (Paved)	*4'*
Shoulder Width (Useable)	*6'*
Side Slopes	*3H:1V (desirable)*
Obstruction Free Zone	*6'*
Clear Zone	*24'*

2. Asset History: Road / Safety / Mobility

Year	*Project Type*	*Contract #*	*Work Type*
2019	*Minor Treatment*	*Maint*	*Crack Seal*
2015	*Surface Treatment*	*Maint*	*Chip Seal*
2006	*Resurface*	*RS27576*	*HMA Overlay, Minor Str*
1989	*Resurface*	*RS18045*	*Resurface (Non 3R)*

3. Asset History: Bridge / Culvert

Year	*Project Type*	*Contract #*	*Work Type*
2034	*Rehab*		*Deck Overlay*
2026	*PM*		*Thin Deck Overlay*
2016	*PM*		*Thin Deck Overlay*
2012	*Built*		*Bridge Replacement*

4. Road / Safety / Mobility

- Pavement History:
    a. Project History: Last functional project / last structural project
    b. Maintenance History: Last major treatment / last minor treatment
- Condition Data: ((req'd pavement condition data pending))

5. Bridge / Culvert

Please note that the following information is integrated into INDOT's online GIS application "INDOT Project Scope" and will automatically populate in that application.

Bridge

Structure Number:	*I94-21-02188 CEBL*
NBI Number:	*049020*
Feature Intersected:	*US 20, Willow Creek, & CSX RR*
Historic Structure:	*No*
Last Inspection Date:	*4/10/2018*
Surface Type:	
Deck Width (o-o Copings):	
Str Length (o-o Br Floor):	
Deck Area:	*55,544 sft*
Skew Angle:	*40°*
Superstructure Type:	*4 - Steel continuous*
# Spans:	
Span Length(s):	
Approach Rd Width:	*63 ft*
Lanes Carried (over):	*3*
Inventory Rating:	*38 Tons*
Operating Rating:	*64 Tons*
Unofficial Sufficiency Rating:	*89.7*

Structure Inspection Observations: STR NO

Deck	*7*	*Some transverse cracking visible underneath in areas without deck pans*
Wearing Surface	*7*	
Superstructure	*8*	*Beam repairs performed in 2006 & 2014. Some surface rust present*
Substructure	*7*	*Pedestals have been replaced. No cracking noticed in the new pedestals. Some beam seat pedestal corners are cracked and some are spalled.*
Channel Protection	*8*	*A-jacks scour countermeasures installed along stream bank*

6. Culvert

3-4.03(04) Traffic Analysis

YEAR	*AADT*	*DHV*	*COMMERCIAL*
2018	*3,073*	*338 (11%)*	*928 (30%)*
2038			

3-4.03(05) Crash Analysis

Crash data was reviewed as part of this assessment and a RoadHAT analysis was prepared. A total of xx recorded crashes took place within the project limits during the three-year crash study period (20aa through 20bb). The following tables summarizes the number and types of crashes, as well as the RoadHAT results.

Crash History

I_{CC}		*Number of Crashes*	
I_{CF}		*Number of Fatal and Incapacitating Crashes*	
First Year of Crash Data		*Number of Non-Incapacitating Crashes*	
Last Year of Crash Data		*Number of Property Damage Only Crashes*	

Crash Patterns: Manner of Collision

Manner of Collision	***Number***	***Percent***
Backing Crash	*X (Y)*	
*Collision With Animal (Including Deer) **	*X (Y)*	
Collision With Object in Road	*X (Y)*	
Head On (Between Motor Vehicles)	*X (Y)*	
Left Turn, Right Turn or Angle	*X (Y)*	
Opposite Direction Sideswipe	*X (Y)*	
Ran Off Road	*X (Y)*	
Rear End	*X (Y)*	
Same Direction Sideswipe	*X (Y)*	
Other	*X (Y)*	
Total	*X (Y)*	

X (Y): X indicates the number of crash type
Y indicates those resulting in injury

***In almost all cases, deer crashes and other animal crashes should be removed from the analysis completely prior to completing the RoadHAT report.*

Example:

The RoadHAT analysis resulted in an Index of Crash Frequency (ICF) of 1.26 and an Index of Crash Cost (ICC) of 3.13. This analysis indicates that this road section is not performing as expected and that the number of crashes significantly exceeds the expected number of crashes for this type of roadway. The high value of the ICC indicates that the crash severity is higher than should be expected for this type of roadway. Based on the existing crash patterns, this report will focus alternative development to integrate crash mitigation treatments that will facilitate reduction of the rear end, right angle, and sideswipe crash types. The following crash mitigation treatments were reviewed to improve the overall safety of the corridor:

- *Install a Two-way Left Turn Lane (TWLTL)*
- *Pave deteriorated shoulder (8ft)*
- *Install centerline rumble strips*
- *Install edge line rumble strips*

3-4.03(06) Project Purpose & Need

The following is a recommended format of a Project Purpose & Need statement:

Project Purpose and Need
See Section 3-3.01 for example

3-4.03(07) Directed / Recommended Alternative

The following is a recommended format of the directed or recommended alternative narrative:

Details of Recommended (or Directed) Alternative

See Section 3-3.05(01) for example

3-4.03(08) Maintenance of Traffic

With respect to the recommended or directed alternative, explain traffic maintenance options and provide a recommendation. Clarify any decisions deferred to the design phase.

Mobility Significant Project Statement:
"This project is considered a mobility significant project per IDM Section 503-2.02. The draft Transportation Management Plan (attached) shall be used to guide efforts to ensure that the work zone activity and maintaining traffic plan is integrated with project stakeholders."

Not Mobility Significant Project Statement:
"This project is not considered a mobility significant project per IDM Section 503-2.02. The following is the temporary traffic control plan concept that shall be used for the project:"

A partial closure of SR 39 with a detour is acceptable for this project due to the low ADT and the estimated time of construction. One direction (NB) of SR 39 will be closed and detoured, creating a one-way work zone through the length of the project. During the project construction a detour route will be provided for NB SR 39 that will utilize US 20, I94, and M239 (prior coordination with MDOT Coloma Business Office will be required for the detour route). The official detour length will be approximately 12 miles, but only requires an additional seven miles of travel. No local detour has been coordinated for this project.

3-4.03(09) Potential Environmental Impacts

List potential environmental constraints and permit conditions associated with the recommend/directed alternative.

	Description	*Notes*
☐	*Additional coordination with resource agencies*	
☐	*Red Flag/HAZMAT revisions*	
☐	*Section 106/4F/6F/Archaeology*	
☐	*Waters Report Update*	

3-4.03(10) Permits Anticipated

	Description	*Notes*
☒	*USACE 404*	*The proposed project will impact the UNT Lemer-Berger Ditch. The USGS quadrangle map for the project location does not delineate a channel, however the channel has defined Ordinary High-Water Mark (OHWM) and channel banks. Therefore, the UNT to Lemer-Berger Ditch is considered a Waters of the U.S.*
☐	*IDEM 401*	
☐	*IDNR CIF*	
☐	*IDNR Navigable Waterway*	
☐	*IDEM Rule 5*	
1	*Storm Water Quality Level*	

3-4.03(11) Cost Estimate

Tabulate present-year costs for construction, right of way, and design engineering. The cost estimate in the report main body is ONLY for the recommend/directed alternative. See Section 3-3.05(05) for guidance for cost estimate development. Ensure that CN costs for unique asset classes are separated per Section 3-3.05(06).

The cost of Alternative B is as follows:

Phase	***Amount***	***Comments***
Right of Way Purchase		
Preliminary Engineering		
Railroad PE		
Utilities PE		
Construction (CN)		
Construction (Primary asset group)		
ADA		
Sidewalks		
Small Culvert / Drainage		
Other Considerations		
TOTAL		

3-4.03(12) Engineer's Assessment Additional Documents:

	Requirement			
Document	AbbEngRpt	EngRpt	As Needed	Information Source / Notes
Location Map	•	•		

Document	Requirement			Information Source / Notes
	AbbEngRpt	EngRpt	As Needed	
Str Inspection Report	•	•		Required for Bridge or Culvert projects
Typical Section			•	
MOT Typical Section			•	Optional (encouraged for Interstate and significant projects)
Conceptual Project Layout		•	•	Optional – AbbEngRpt Optional – Bridge projects Req'd - 3R/Safety/Mobility

3-4.04 Report Concurrence Matrix

Individuals in the following positions provide concurrence for each document type as outlined in the chart below:

	AbbEngRpt	EngRpt
Scoping Manager	(1)	(1)
Asset Engineer	(2)	(2)
System Asset Manager	Yes	Yes
Tech Services Director	Optional	Optional
Capital Program Management Director		Optional
Central Office Corridor Development Group	-	Yes (3)

Notes:

(1) Reviews document for concurrence with original need identification and recommended alternative.

(2) Reviews document for quality control of engineering assessment and documentation of same.

(3) For large scale interstate mobility project scope development.

Any engineering assessment document prepared for a project shall have concurrence as shown herein.

3-4.04(01) Typical Concurrence Block

See Figure 3-4A for a typical concurrence block used on engineering assessment documents. If the (Abbreviated) Engineer's Assessment is authored by an unlicensed engineer, the document shall be co-signed by an engineer in responsible charge (ERC) of the report. The signature of the ERC of the document shall constitute acceptance of full responsibility of the document per 864 IAC 1.1. Affixing a seal is not required.

3-4.05 Scope Addendum Process

The engineering assessment process presented does not end with the creation of a document, rather engineering assessment is conducted and refined through the life of the project. Once the

engineering assessment document is complete the project must be deliberated for funding approval. Once it is an approved project it is still necessary to follow the project through design development by participating in kickoff meetings and field checks to ensure the project's scope is maintained or to help determine when it needs to be adjusted. It is also necessary to support Project Managers by answering questions and assisting in any necessary change management applications.

The designer is responsible for designing the project to comply with the intent of the published engineering assessment document. In the event the designer determines a need to deviate from the scope, the Project Manager, Asset Engineer and Scoping Engineer must be notified to review and determine if the scope warrants revision.

The following are guidelines to determine when a scope addendum may be warranted:

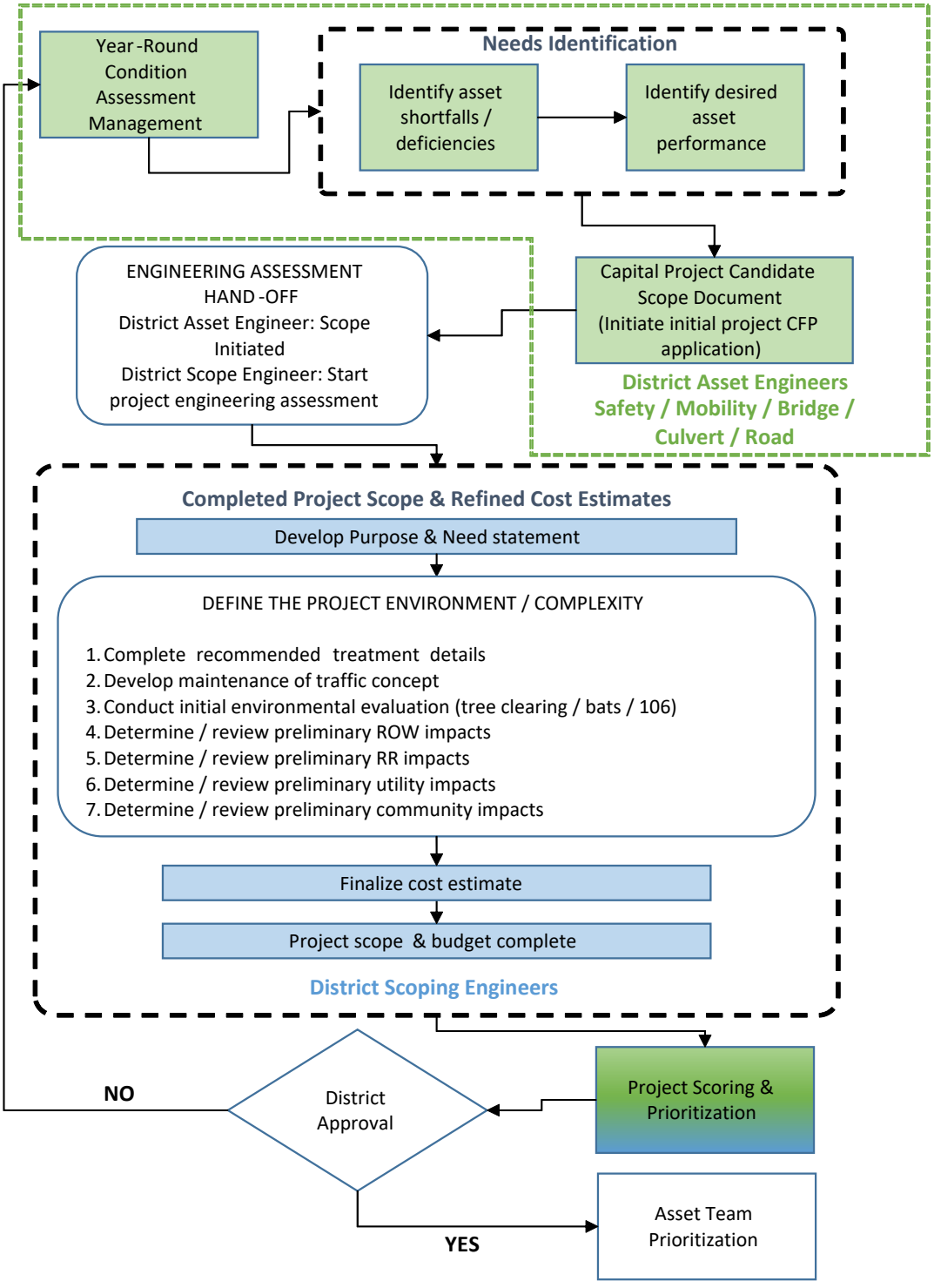
- Change in work type (i.e., bridge rehabilitation moving to a bridge replacement);
- Changes from recommended or directed alternative to a different alternative;
- Alters the recommended (or directed) alternative;
- Inclusion of work outside of the project purpose;
- Revision of project termini sufficient to necessitate change management activities;
- Has potential to impact protected resources, right of way, utilities, railroads, or the proposed traffic maintenance scheme of sufficient magnitude that either project schedule or budget could be compromised;
- Changes the design standards identified in the scope (i.e., going from 3R to 4R, 3R to Partial 3R, etc.);
- Proposed changes to Level 1 criteria that are specifically addressed in the scope.

Note that minor changes to the preferred (or directed) alternative that do not have impacts off of the primary project asset (outside of the lane markings (pavement, safety, mobility)), off of the structure (bridge/culvert)) or do not have impacts that change the project's environmental category may be amended through a note to the file.

Revisions to a project's scope are then reviewed and approved per the Report Concurrence Matrix. See Figure 3-4B for the format required for addendums to engineer's assessment / abbreviated engineer's assessment documents.

FIGURES

1-1A District Activities, Asset Management Project Prioritization Process



3-3A Field Inspection Checklist

Note this is available as a stand-alone document upon request from a District Scoping Manager.

Project Location

Location:

Work Type:

Design Speed _____ ***mph*** ***Posted Speed*** _____ ***mph***

Initial Investigation

- ☐ Review existing plans, previous studies, or reports (including previous assessments completed) (note or collect old plans in project folder)
- ☐ Review traffic data
- ☐ Review crash data (if required); will further crash analysis be required?
- ☐ Identify apparent deficiencies / needs from Asset Engineer(s)

- ☐ Identify apparent functional, structural, hydraulic, geometric, or safety deficiencies

- ☐ Review other projects in the area: possible project bundling?

- ☐ Review other projects in the area (INDOT and LPA): possible MOT conflicts?

- ☐ Determine functional classification
- ☐ Determine NHS & National Truck Network status
- ☐ Determine if the project is located in a flood plain, karst area or other designated sensitive region

Field Investigation / Assessment Review

Photos: include photos of existing conditions (pavement, culverts, bridge items, etc). ***Photo critical features***

Person(s) Attending Field Review / conducting assessment review:

Virtual or in field assessment?

Verify project purpose and need:

Existing Infrastructure Conditions

General Conditions:

Check reasonableness of project termini:

Identify potential constructability issues & solutions:

Identify traffic generators (e.g., schools, residential, industrial, commercial developments):

Note land use (e.g., residential, commercial, industrial, agricultural, woodland, wetland, and existing drive locations):

Access control type:

Evaluate and note condition (state of repair) and presence (or lack thereof) of existing infrastructure (pavement, bridge, small structure, drainage appurtenances, traffic control devices, etc). If no infrastructure items exist within project limits please note. Identify any existing sub-standard infrastructure

Pavement, mainline:
Pavement, shoulder:
Pavement, other:
Curb & gutter:
Guardrail (note height to top of rail):
Turn lanes:
Interchange ramps:
PTR/WIM stations:
Sheet signs:
Panel signs:
Sidewalk:
Sidewalk ramps:
Assessment of pedestrian / non-motorized traffic / ADA concerns:

Bridge / Large Culvert

Existing condition notes (note if work will be required underneath the bridge)

Roadway over/under:
Stream/river under:
Deck:
Deck joints:
Deck drains:
Railing:
Beams:
Paint:
Terminal joints:
Abutments:
RCBAs:
Slope wall:
Approach guardrail (note height to top of rail):
Field entrances in any quadrant adjacent/near bridge:
Scour issues or concerns:
Can the underside of the structure be accessed by construction vehicles?

Drainage

Existing condition notes

Existing drainage patterns and features:

Municipal storm sewer:
Slope stability concerns / settlement areas:

Traffic Control

Identify traffic control (e.g., signals, flashing beacons, two-way and four-way stop, railroad crossing protection)

Traffic Control – Signals Not Applicable? ☐

Intersection	Type	Ped Signals?	Ped Push Buttons?	Traffic Loops?

Environmental

Validate possible impacts to significant features including:

- ☐ Historical structures:
- ☐ Archeological sites:
- ☐ Cemeteries:
- ☐ Churches:
- ☐ Hospitals:
- ☐ Fire Stations:
- ☐ Police Stations:
- ☐ Schools:
- ☐ Parks / playgrounds:
- ☐ Wetlands:
- ☐ Private septic systems:
- ☐ Private or public wells:

Will tree clearing be required?:

Utilities

Does INDOT have ITS facilities within the project?:

Identify any overhead or underground utility markers:

Identify street lighting and its ownership, and if relocation is required:

Right-of-Way

Identify ROW that may require acquisition:

Identify ROW that may require re-acquisition:

Railroad

Identify active or abandoned railroads:

Identify locations for potential Near Terminus actions (upgrading RR crossing safety devices) within project:

3-3B Crash Analysis Format

Note this is available as a stand-alone document upon request from a District Scoping Manager.

Crash data was reviewed as part of this assessment and a RoadHAT analysis was prepared. A total of xx recorded crashes took place within the project limits during the three-year crash study period (20aa through 20bb). The following tables summarizes the number and types of crashes, as well as the RoadHAT results.

Crash History

I_{CC}		Number of Crashes	
I_{CF}		Number of Fatal and Incapacitating Crashes	
First Year of Crash Data		Number of Non-Incapacitating Crashes	
Last Year of Crash Data		Number of Property Damage Only Crashes	

Crash Patterns: Manner of Collision

Manner of Collision	**Number**	**Percent**
Backing Crash	X (Y)	
Collision With Animal (Including Deer) *	X (Y)	
Collision With Object in Road	X (Y)	
Head On (Between Motor Vehicles)	X (Y)	
Left Turn, Right Turn or Angle	X (Y)	
Opposite Direction Sideswipe	X (Y)	
Ran Off Road	X (Y)	
Rear End	X (Y)	
Same Direction Sideswipe	X (Y)	
Other	X (Y)	
Total	X (Y)	

X (Y): X indicates the number of crash type
Y indicates those resulting in injury

*In almost all cases, deer crashes and other animal crashes should be removed from the analysis completely prior to completing the RoadHAT report.

The top two tables shall be included in the Crash Analysis section of the scope document (AbbEngRpt or EngRpt). Include a summary analysis of the analysis as well as recommendations based on the analysis' findings.

Example:

The RoadHAT analysis resulted in an Index of Crash Frequency (ICF) of 1.26 and an Index of Crash Cost (ICC) of 3.13. This analysis indicates that this road section is not performing as expected and that the number of crashes significantly exceeds the expected number of crashes for this type of roadway. The high value of the ICC indicates that the crash severity is higher than should be expected for this type of roadway. Based on the existing crash patterns, this report will

focus alternative development to integrate crash mitigation treatments that will facilitate reduction of the rear end, right angle, and sideswipe crash types. The following crash mitigation treatments were reviewed to improve the overall safety of the corridor:

- *Install a Two-way Left Turn Lane (TWLTL)*
- *Pave deteriorated shoulder (8ft)*
- *Install centerline rumble strips*
- *Install edge line rumble strips*

Crash Pattern Analysis

Pavement Condition Percentages

Type	Number	Percent	Standard Value* Comparison:
On Snowy or Icy Pavement			11.18%
On Wet Pavement			15.49%
On Dry Pavement			73.17%
On Other Condition Pavement			0.16%

*Standard values are based on 2014-2018 data for all state-owned facilities. Standard values are included for comparison purposes only.

Lighting Condition Percentages

Type	Number	Percent	Standard Value* Comparison:
Dark (Lighted or Unlighted)			32.76%
Dawn/Dusk			5.49%
Daylight			61.66%
Other			0.10%

*Standard values are based on 2014-2018 data for all state-owned facilities. Standard values are included for comparison purposes only.

Weather Condition Percentages

Type	Number	Percent	Standard Value* Comparison:
Clear			62.39%
Cloudy			18.33%
Fog (Or Smoke or Smog)			0.68%
Rain			9.79%
Snow or Sleet			6.41%
Blowing Material			2.13%
Severe Cross Winds			0.26%

*Standard values are based on 2014-2018 data for all state-owned facilities. Standard values are included for comparison purposes only.

The RoadHAT output, crash statistics summary and crash diagrams shall be included as attachments to this report appendix.

3-3C Treatment Evaluation Matrix Example

Decision Matrix – Example 1

This Decision Matrix was developed to provide a method to compare the project alternatives. Various quantitative and qualitative elements were included and assigned weights according to the project scope and engineering judgement.

Quantitative items for each Alternative are listed below:

	Alternative 1 – Do Nothing	Alternative 2 – Partially Enclosed System	Alternative 3a – Enclosed System, 24 in. Outfall	Alternative 3b – Enclosed System, 30 in. Outfall	Alternative 3c – Enclosed System, 36 in. Outfall	Alternative 4 – Split System
Conveyance Capacity (cfs)	n/a	9.5	9.5	14.8	24.0	14.9
Construction Cost ($)	0	910,000	1,000,000	1,040,000	1,070,000	1,020,000
Land Acquisition ($)	0	105,000	95,000	95,000	95,000	155,000

PER and Temporary R/W required for each Alternative. Permanent R/W Required for Alts. 2 and 6.

Numerical scores were assigned to each item and alternate. Right-of-Way scores were based upon permanent right-of-way requirements. Appeal scores were based upon how improvements would impact the appearance and function of each parcel.

Alternative Matrix

Criteria	**Weight**	Alternative 1 – Do Nothing	Alternative 2 – Partially Enclosed System	Alternative 3a – Enclosed System, 24 in. Outfall	Alternative 3b – Enclosed System, 30 in. Outfall	Alternative 3c – Enclosed System, 36 in. Outfall	Alternative 6 – Split System, 24 in. Outfall
Drainage	50%	0	7	7	9	10	9
Cost	20%	10	9	7	5	3	6
R/W	20%	10	5	10	10	10	2
Appeal	10%	10	7	10	10	10	7
Total	**100%**	**5.0**	**7.0**	**7.9**	**8.5**	**8.6**	**6.8**
						Preferred	

Decision Matrix – Example 2

Alternative Comparison
SR 23 Small Structure Replacement
Des. No. 19abcde

Alternative	Replace Culvert	Add Guardrail (1)	Design Exceptions Req'd	Add'l ROW Req'd (acre)	Construction Cost	Advantages	Disadvantages	Reason Alternative was Eliminated/Selected
1 Maintain ex cross section	Yes 14x4 RCB	No	L1 = 3 L2 = 1	0.45 ac	$180,000	Low Construction Cost, Small amount of R/W required	Design Exceptions required for Lane Width, Horizontal Radius, Superelevation, and Roadside Safety.	Does not provide mitigation measures for substandard horizontal curve and superelevation; therefore alternative in not recommended.
2 Impr shoulders, add guardrail	Yes 14x4 RCB	Yes	L1 = 3	0.5 ac	$235,000	4' paved shoulders are a mitigation measure for the substandard horizontal radius and superelevation	Design Exceptions required for Lane Width, Horizontal Radius and Superelevation	Roadside Safety Design Criteria are met wtih new guardrail installation. Due to the similiar construction cost, and that the guardrail itself could be a potential hazard, Alternative 2B is recommended over Alternative 2.
2A Impr shoulders, no add'l guardrail	Yes 14x4 RCB	No	L1 = 3 L2 = 1	0.5 ac	$220,000	4' paved shoulders are a mitigation measure for the substandard horizontal radius and superelevation	Design Exceptions required for Lane Width, Horizontal Radius, Superelevation, and Roadside Safety.	Roadside Safety Deisgn Criteria are not met due to ends of culvert being inside clear zone and unprotected. Alternative 2B is recommended over this alternative due to improved roadside safety despite additional cost increase for Alternative 2B.
2B (Recommended) Impr shoulders, extend culvert ends beyond CZ	**Yes 14x4 RCB**	**No**	**L1 = 3**	**0.5 ac**	**$235,000**	**4' paved shoulders are a mitigation measure for the substandard horizontal radius and superelevation. Eliminates design exception for Roadside Safety**	**Design Exceptions required for Lane Width, Horizontal Radius and Superelevation**	**Roadside Design Safety Criteria are met by extending culvert ends outside clear zone and providing traversable slopes near the structure. Due to the minimal ROW required, construction cost, low number of crashes occuring in this area, and eliminating the need for guardrail, this is the recommended alternative.**
3 Impr shoulders, horiz alignment, & pavt cross slope; add guardrail	Yes 14x4 RCB	Yes	L1 = 1	0.80 ac	$340,000	Design exception only required for Lane Width	High Construction Cost, Large Amount of R/W Required	Alternative corrects substandard horizontal radius and superelevation; however, it has the highest construction and R/W requirement. Based on crash anaylsis, there is no evidence that requires the improvement of the alignment or superelevation to current standards. Due to these reasons this alternative is not recommended.
4- No Build	No	No	No	No	$0	No Construction Cost	Does not provide a long term solution for this crossing.	Alternative is not recommended as the existing temporary culvert does not provide a long term solution for this crossing. Multiple structure opening crossings similar to the three CMPA culverts are prone to collecting debris which will increase overtopping occurences and will likely lead to future failures.

NOTES:
(1) Adding guardrail presents additional roadside hazard due to cross section geometry. No guardrail is better at this location than guardrail.
(2) Raising the profile grade above existing will result in greater ROW acquisition. Desire is to minimize the change to the profile grade.

Note the original document shown herein will be available on the Engineering Assessment website.

3-4A Report Concurrence Block

Note this is available as a stand-alone document upon request from a District Scoping Manager.

The following is a typical report concurrence block that shall be used on engineering assessment documents:

This document was prepared by:

_____ [Date]
[Name]
[Title]

Reviewed by:
Scope Manager Review

_____ [Date]
[Name]
[Title]

Reviewed by:
Asset Engineer Review

_____ [Date]
[Name]
[Title]

Approved by:
System Asset Manager Review

_____ [Date]
[Name]
System Asset Manager, [District]

Changes to the scope /work type require a formal addendum per Section 3-4.04 of the Engineering Assessment Manual

Additional approval blocks may be added below the System Asset Manager approval as needed.

3-4B Engineer's Assessment / Abbreviated Engineer's Assessment Addendum Format
Note this is available as a stand-alone document upon request from a District Scoping Manager.

The following is the addendum format required to document and approve scope revisions:

ADDENDUM No. [#]
TO (ABBREVIATED) ENGINEER'S ASSESSMENT

Project Number:	[Des#]
Route / Feature Crossed:	[INDOT Road] [over/under] [Feature Crossed]
Project Location:	[SPMS Project Location Description]
Date:	[Document date]

ADDENDUM JUSTIFICATION:
[Provide a brief reason and/or justification for addendum.]

REVISION TO ORIGINAL SCOPE DOCUMENT:
The (Abbreviated) Engineer's Assessment is being revised as follows:

Any sections of the original report that are being revised shall be shown in this section. For example, if the project scope is changing from a HMA PM overlay to a Minor Structural overlay, the revision of the "Recommended Alternative" section of the report will be placed herein complete as a revised section. If a section is not changing, it does not need to be placed in this document. This addendum document will be attached to the front of the original scope document to show the revision history for the scope of a project.

Attach any documents that support the addendum (pavement design memo, etc).

The questions below must remain; remove statements below questions that are not required.

Does the revision change the project's Purpose & Need statement? ☐ Yes ☐ No

[Insert revised Purpose & Need statement here]

Does the revision change the project's recommended treatment? ☐ Yes ☐ No

[Insert revised recommended alternative statement here]

Does the revision change the project's cost estimate? ☐ Yes ☐ No

Remove table below if cost is not revised; state in the comments section if there is no change to a specific portion of project cost. For example, the CN cost may increase without changing the ROW requirements or railroad costs.

Estimated Total Project Costs	*Revised Amount*	*Original Amount*
Right of Way Purchase		

Estimated Total Project Costs	*Revised Amount*	*Original Amount*
Right of Way Services		
Preliminary Engineering		
Railroad PE		
Utilities PE		
Construction Total:		
Construction (Primary asset group)		
ADA		
Sidewalks		
Small Culvert / Drainage		
Other Considerations		
TOTAL:		

Does the revision change the project's environmental impacts? ☐ Yes ☐ No

Remove table below if there are no revisions to the project's environmental impacts due to the proposed addendum.

	Description	*Notes*
☐	Additional coordination with resource agencies	
☐	Red Flag/HAZMAT revisions	
☐	Section 106/4F/6F/Archaeology	
☐	Waters Report Update	

Does the revision require additional Right-of-Way? ☐ Yes ☐ No

[Summarize the revised Right-of-Way needs]

Does the revision change the project's schedule (design or construction)? ☐ Yes ☐ No

[Provide revised project schedule]

Does the revision require additional coordination with utility companies? ☐ Yes ☐ No

[Provide revised project schedule]

ADDENDUM CONCURRENCE

This document was prepared by:

_____ [Date]

[Name]
[Title]

Reviewed by:
Scope Manager Review

_____ [Date]

[Name]
[Title]

Reviewed by:
Asset Engineer Review

_____ [Date]

[Name]
[Title]

Approved by:
System Asset Manager Review

_____ [Date]

[Name]
Systems Asset Manager, [District]