TABLE OF CONTENTS

LIST OF FIGURES

CHAPTER FIVE

ENGINEERING ASSESSMENT

This Chapter provides guidelines regarding evaluation of transportation improvement alternatives for a Department project. This Chapter outlines the processes and methods adopted by the Office of Environmental Services' Environmental Policy Team.

5-1.0 ENVIRONMENTAL POLICY TEAM

The responsibility of the Environmental Policy Team is to establish effective and efficient solutions to highway transportation problems. Effectiveness measures how well a plan meets the project objectives. As a measure of economic return on investment, efficiency is a function of project cost.

The engineering-assessment process involves the development and comparison of alternatives, final selection, and documentation. This phase of INDOT's project development schedule succeeds planning and programming, and precedes final design. The Team's mission is as follows:

1. ensure comprehensive consideration of reasonable improvement options;
2. integrate engineering/transportation and environmental objectives; and
3. effect recognition and selection of a cost-effective, satisfactory course of action.

From this assessment, the Planning Division's Roadway Inventory Team produces the Engineer's Report, also referred to as the Scope of Work Report. This document presents a formal record of the analysis of alternatives and identifies the proposal (recommendation) – the official agency record of decision for implementation.

The Engineer's Report principally guides downstream project-development stages such as field survey, other design functions, and the completion of the environmental review. The document also serves to refine upstream planning and programming elements of the project, notably construction, land acquisition, and design engineering costs. The Report often forms the basis for the consultant design agreement, if required, and serves as a resource to inform interested parties outside the Department.

The Roadway Inventory Team, its in-house staff or possibly a consultant, typically produces an Engineer's Report for the each project type as follows:

1. new bridge and road construction;
2. bridge replacement and removal;

3. small drainage structure new construction or replacement;
4. drainage correction;
5. protective buying of right-of-way;
6. added travel lanes and median construction;
7. intersection improvement;
8. new interchange construction or interchange modification;
9. sight-distance improvement;
10. Interstate-route pavement replacement or rehabilitation to 3R or 4R standards;
11. rest area construction or reconstruction;
12. weigh station (port of entry) construction or reconstruction; or
13. landslide correction.

The Team does not assess and report on each project type as follows:

1. bridge rehabilitation or repair;
2. pavement resurface to non-3R or non-4R standards;
3. shoulder rehabilitation;
4. roadside work;
5. access control;
6. guardrail repair or replacement; or
7. traffic-control-devices installation.

The Roadway Inventory Team continually studies and reports on transportation matters beyond the Department's routine project development structure. Among others; the Indiana Department of Commerce economic development plans; collaborative efforts with towns, cities, counties, or other states; and the Indiana Department of Natural Resources park access needs generate these special assignments. The Roadway Inventory Team annually appraises Interstate-route pavement rehabilitation and replacement plans in advance of project programming. This exercise is commonly called a mini-scope.

5-2.0 PREPARING THE ENGINEER'S REPORT

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.

5-2.01 Task 1 - Determine the Essential Project Need (Deficiency) and Purpose (Objective)

A clear, solid purpose and need statement explains why expenditure of public funds is appropriate and is the basis for consideration of alternative plans. Lack of a well-established project purpose and need complicates determination of alternatives, reasonableness, prudence, and practicality. INDOT's *Procedural Manual for Preparing Environmental Studies* provides further guidance on this subject.

An explicit need for the improvement accompanies each project entering the Department's work program. An initial task of engineering assessment is to specify, or in some cases to verify, present or impending deficiencies in the existing facility. Project needs may include elements such as lack of traffic-carrying capacity, operational/safety defect, poor intersection sight distance, substandard cross section, vertical profile or horizontal alignment, undesirable pavement condition, inadequate drainage, missing system linkage, etc. The statement of need for improvement logically drives some action.

Every project has a purpose that addresses the fundamental reason for the undertaking. The project objective is a broad definition of the intended result (e.g., the project purpose is to stabilize failure of the back slope). Objectives are neither statements of need/deficiencies nor are they a specific description of the solution. Examples of project purpose include the following:

1. reduce present or impending congestion;
2. enhance operational safety;
3. increase sight distance;
4. update geometrics;
5. improve pavement;
6. convey runoff; and
7. insert connecting links in the transportation network.

Engineering assessment seeks to establish an action plan that satisfies the project objectives while minimizing agency and user costs. An explicitly stated objective/purpose clarifies the comparison of alternative improvement strategies in terms of effectiveness and efficiency.

Initial statements of project purpose and need normally are determined in the planning and programming process, preceding the engineering-assessment phase. The Project Application form may document this prior action. Consult with the district development engineer, or, as required, the district construction or traffic engineers), Planning Division, or other responsible party to identify the purpose and need, to determine if the project remains viable and to double check whether the work-type classification is correct. During the later stages of engineering assessment, the project manager must verify that the project need is indeed credible. Engineering analysis may reveal that the needs perceived at the time of programming were not substantive. If at this initial step, or at any subsequent stage, there is a consensus that the project should be canceled or fundamentally changed, the project manager should request the district Office of Design or district Planning and Programming Division to initiate the program changes (through the Planning Division) and revise the project schedule accordingly. Also, the Environmental Policy Team may administer the changes.

5-2.02 Task 2 - Gather Information

Accurate information is essential to develop and assess alternative plans. In the information-gathering step, the project manager is directed to take advantage of the Department's resources to form a complete picture of the existing physical transportation infrastructure, plus environmental, social, and economic aspects of the project site. The project manager must execute basic data requests without delay, particularly traffic volumes and aerial photographs, as the time necessary to secure crucial information often takes several months. Likewise, events following data requests that render the information unnecessary call for immediate cancellation of the responsibility of the project manager. Figure 5-2A, Information-Gathering Guide, explains circumstances compelling the project manager to seek information.

The information that may be gathered is as follows:

1. Project Application. The data sheets are prepared by the district Production Division or the Planning Division. The Environmental Policy Team generally transmits the related Project Application to the project manager upon assignment.

2. Existing Road or Bridge Plans. The Planning Division's Research and Documents Library Team maintains microfilm and archived plans for existing State bridges, highways, traffic signals, and other related infrastructure. Contact the Research and Documents Library Team for such plans. Microfilm records can be printed at full or half size.

3. Aerial Photography/GIS Maps. Photographs or maps may be obtained from the following.

    a. County Coverage. The Department maintains a set of aerial photographs, although dated, that cover the entire State. This is known as county coverage. Contact prints, 9 in. x 9 in., are available at a 1:24 000 scale. Mylars can be made from the negatives. The largest scale available for county coverage is 1:4000. Requests should be directed to the Public Information Division's Office of Graphic Arts.

    b. New-Flight Coverage. If the project manager needs more-recent, larger-scale, or controlled-aerial photographs, new-flight coverage should be requested. Weather and seasonal restraints will result in varying delivery dates for new-flight aerials. Common scales of finished 24 in. x 36 in. mylars are 1:1000 for an urban area or 1:5000 for a rural area. However, intermediate scales are available (e.g., 1:2000). Upon explicit request, contact prints or their digital images are available to the project manager. Requests should be directed to the Office of Graphic Arts. Ground control for controlled aerials involves coordination with the Production Management Division's Survey Team.

c. Land Office. The State Land Office maintains a set of one- to ten-year-old aerial photographs covering the entire State. The photographs are at a 1:4800 scale, other than Marion County at 1:1200. The State Land Office is located in the Indiana Government Center, South Building.

d. GIS Maps. GIS maps depicting the existing infrastructure are available for select regions of the State. They are expected to become more widely available in the future. One example is the Indianapolis Metropolitan Area IMAGIS digitized database. These maps use controlled, ortho-rectified aerial photographs of the Marion County area which are digitized into their mapping database. The files or hardcopy format can be purchased from the IMAGIS Center at Indiana University Purdue University at Indianapolis.

e. Other Sources. Rapid, ongoing advances in technology are generating useful aerial mapping products. These alternative sources may produce cost-effective mapping/imaging, often in digital format.

4. Traffic Data. The project manager should evaluate each project for the requisite nature of traffic data. The data generally include current-, or base-, year, intermediate-year and design-year average annual daily traffic (AADT), A.M. and P.M. design hourly volumes (DHV), and the percentage of commercial vehicles in daily and peak-hour traffic streams. Turning movements for a project with intersections and interchange ramp terminals may warrant non-standard approaches or auxiliary approach lanes. A select major project warrants travel demand modeling and/or an origin-destination study.

   Official traffic counts with projections are provided by the Planning Division's Traffic Monitoring Team. A request for traffic data should be transmitted to the Team's supervisor on the Request for Traffic Projections standard form. Figure 5-2B is a blank copy of such form. An editable version of this form may also be found on the Department's website at www.in.gov/dot/div/contracts/design/dmforms/. All traffic data must be routed through the Office of Environmental Services's Environmental Policy Team.

   The district traffic engineer also may have twelve-hour (or shorter period) counts for certain intersections, particularly signalized junctions or those previously studied for traffic control warrants. All relevant, independently secured counts should be forwarded to the Traffic Monitoring Team for its use in preparing formal turning-movement volumes.

5. Crash Data. Historical crash (accident) data are provided by the Planning Division's Safety Team. The records of crash events occurring on both the mainline and crossroads or interchange ramps should be requested. Satisfactory analysis generally requires the last three full years of historic data. There is a six- to nine-month time lag between a crash occurrence and its entry into the Department's computer data base.

A Request for Crash Records form should be submitted to the Team's crash analysis supervisor. Figure 5-2C is a blank copy of such form. An editable version of this form may also be found on the Department's website at www.in.gov/dot/div/contracts/design/dmforms/. The designer may sometimes contact a local police agency for supplemental information.

Retrieved records will be copied to a diskette, if so requested. Each record's file then can be read, reduced, and sorted through spreadsheet software. The project manager may find it helpful to review complete hard copy/microfilmed reports on fatal events.

6. Pavement Design. For a project with moderate pavement treatment in the scope of work, preliminary pavement design should be requested from the Planning Division's Office of Pavement Engineering. In the request, summarize the project objective. Also see Chapter Fifty-two for more information. For a project that does not require a site-specific preliminary design, the Office uses the Department's generalized pavement cross sections – replacement, overlay, or otherwise.

7. Hydraulic Information. Preliminary hydraulic analysis and recommendation commensurate with the specific project type are provided by the Production Management Division's Hydraulics Team. Small-structure replacement, bridge replacement, drainage corrections, or road reconstruction involving storm sewer work, among other project types, will benefit from an abridged report from the Department's hydraulic specialists. The Hydraulics Team's cursory analysis yields preliminary recommendations on various elements. This may include a tentative suggestion on one or more hydraulically adequate structure types and associated sizes. Appropriate skew angle, wingwall configuration, and anticipated grade changes are often provided. The Hydraulics Team can assist the project manager by evaluating overall roadway drainage and rendering a preliminary drainage design. The Hydraulics Team receives all requests. See Part IV for more information.

8. Geotechnical Information. To conduct an informed analysis of project alternatives it may be necessary to obtain data, and a recommendation, from the Production Management Division's Office of Geotechnical Services. This applies to landslide correction, erosion control, work in a landslide-prone area, or a project requiring significant earthwork. The geotechnical office manager should be consulted regarding geotechnical issues. See Chapter Eighteen for more information.

9. Functional Classification Maps. Functional classification maps are available from the Planning Division for inspection. Functional classification plays a role in the selection of design criteria. Though functional classification is an official designation approved by FHWA that may differ from the prevailing conditions, the latter a guide to selection of design class. For additional guidance, see Chapter Forty.

10. Statewide Project Activity. One source of information on planned or programmed improvements that may affect a project is the *Directory of INDOT Highway Projects*. It is published by the Planning Division. The Department's scheduling system database is another comprehensive source. It lists all programmed INDOT projects and local-agency projects using Federal-aid funds. This computer database includes pertinent information on each active project and those already constructed within the last decade or longer. The project manager may request a spring report listing related projects in the database from the Office of Environmental Services' scheduling coordinator or Planning Division's Feasibility Engineering Team.

11. Planning and Feasibility Studies. Completed and ongoing planning and feasibility studies may provide valuable background information. Such reports are reserved for major projects, and are held by the Planning Division.

12. Bicycle and Pedestrian Networks. The Planning Division's pedestrian/bicycle coordinator should be consulted if pedestrian and bicycle issues arise during the course of the engineering-assessment phase. The coordinator plans activity among INDOT, the metropolitan planning organization (MPO), and local interest groups. The district Office of Design and local officials may also assist in non-motorized transportation matters.

13. Local Long-Range Transportation and Thoroughfare Plans. Each local public agency occasionally adopts a comprehensive transportation plan outlining a long-range vision for its community's transportation system. Request these planning documents directly from the local agency. Seek resolution from the Office of Environmental Services if the local plans conflict with the project's objectives.

14. Computer Database. The Planning Division maintains data that may be of use in the development of the project scope of work. The Division oversees data held in the computer database (under DOT IDMS sites named RII and PFI managed by the Department of Administration). The database includes the road inventory consisting of collected geometric information for existing highways. The database also contains bridge inspection reports and reference-post landmarks among other data regarding existing infrastructure.

15. Pavement History, Condition. The Planning Division maintains a log of historic pavement treatments on State routes. The Division also collects data annually for the Interstate system and biennially for other State routes that includes video log and pavement status ratings.

16. Inventory of Bridges. The Planning Division publishes the *Inventory of Bridges*. It lists vital statistics on each bridge under the Department's jurisdiction.

17. Railroad Status. The project manager should secure pertinent data on each railroad crossing in the study area from the Production Management Division's Railroads Team.

18. Telemetry and Weigh-In-Motion Stations, and Traffic-Actuated Signals. The designer should check for telemetry stations and weigh-in-motion stations within the project limits. If these are present, the designer should consult with the Planning Division's Traffic Monitoring Team for further information, and work to incorporate treatment of them into the design. If traffic-actuated signals are present, the designer should consult the district traffic engineer for further information, and work to incorporate treatment of them into the design.

19. Strategic Highway Research Project (SHRP). The designer should check with the Office of Research and Development's Pavement Materials Team to determine if SHRP sections, Long-Term Pavement Performance (LTPP), INDOT research, or similar test projects are within the project limits. Where these exist, approval must be obtained from the Planning Division to proceed with the project.

20. Scheduling Production Management System (SPMS), and INSTIP. The designer should check the SPMS or INSTIP files regarding local-public-agency improvement requests such as intersection improvements, roadside-safety enhancements, or other improvements within the project limits. Such SPMS or INSTIP improvements could be considered for incorporation into the project work if approved.

21. Maintenance and Traffic Programs. The designer should check the District Maintenance and Traffic Contract Programs for work which may be incorporated into the project scope.

5-2.03 Task 3 - Conduct Field Inspection

Conduct a scoping field check prior to carrying out considerable engineering assessment of improvement plans. The on-site inspection provides an opportunity to witness the project site alongside key decision makers.

5-2.03(01) Initial Research

The steps to be completed prior to the field check are as follows:

1. review existing design plans;
2. review any previous studies/reports;
3. review bridge inspection reports;

4. review traffic data;

5. review crash data;

6. review Project Application form;

7. view available aerial and ground-level photographs, topographic maps, or video;

8. identify apparent deficiencies/needs;

9. check other State or local projects in the area for consistency and conflicts;

10. determine functional classification;

11. determine NHS versus STP Indiana's 4R network versus 3R, National Truck Network Scenic Byways, and relinquishment status/funding;

12. review likely applicable design guidelines, e.g., 3R versus 4R standards, urban versus rural design class (not necessarily defined by functional classification); and

13. determine if the project is located in a floodplain, karst area, or other designated sensitive region.

5-2.03(02) Invitations

The individuals who should be invited to the field check are as follows:

1. district Design office manager, who will coordinate with the other appropriate district personnel and extend invitations as appropriate;

2. Environmental Policy Team member assigned to the project; and

3. Production Management Division representative, through the assigned office manager.

The project manager may, elect to have one or more of the individuals join the field inspection as follows:

1. Planning Division representative;

2. Hydraulics Team member;

3. Utilities Team member;

4. Office of Real Estate representative;

5. Office of Geotechnical Services engineer;

6. Pavement Engineering Office engineer;

7. Subdistrict Operations manager;

8. FHWA representative (for non-exempt Interstate-route project or other major project on the NHS);

9. metropolitan planning organization (MPO) representative;

10. city or county engineer;

11. county surveyor; or

12. others as appropriate.

5-2.03(03) On-Site Collection of Information

During the field review, the project manager should address the following:

1. record the names of all persons attending;

2. verify project need and purpose;

3. evaluate and note condition (state of repair) of existing infrastructure, including road, bridges, small structures, or traffic control devices;

4. formulate tentative solutions;

5. identify significant features, including historical structures, archaeological sites, cemeteries, churches, hospitals, fire stations, police stations, schools, parks, playgrounds, wetlands, Section 4(f) and 6(f) properties, etc;

6. evaluate existing drainage patterns and features;

7. check reasonableness of project termini;

8. discuss suitability of existing project schedule;

9. assess accommodation of pedestrian and bicycle traffic;

10. identify street lighting and its ownership;

11. discuss potential constructability issues and their solutions;

12. measure traveled way, roadway, and roadside cross sections. Measure bridge elements, clearances, etc. Determine right-of-way (property line) limits based on the locations of right-of-way markers, sidewalks, utility poles, fence lines, or other physical features;

13. secure (survey) approximate vertical profile, if necessary;

14. assess horizontal alignment and measure superelevation, if necessary;

15. measure intersection sight distance, if necessary;

16. measure turn-lane storage and deceleration lengths, tapers, or turning radii. Also, note lane configurations at intersections and interchanges;

17. note locations and design of public and private drives;

18. measure offsets to buildings and other structures subject to relocation;

19. check and record pH value of flow in small drainage structures;

20. perform drive-through inspection of potential official or unofficial detours;

21. obtain input on traffic maintenance plan, particularly from the district traffic and design engineers.

22. note posted speed limits and advisory speeds as well as other signs;

23. note land use (e.g., residential, commercial, industrial, agricultural, woodland, wetland);

24. identify terrain as either level or rolling;

25. identify traffic generators (e.g., schools, residential, industrial, commercial developments);

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

27. identify environmentally sensitive sites;

28. photograph critical features;

29. identify access control type;

30. identify soil and rock types, unsuitable soils (e.g., peat);

31. note adjoining septic systems and water wells;

32. identify substandard roadsides, particularly with respect to clear zone or obstruction-free zone;

33. assess probability of need of additional right of way and its location;

34. identify speed monitoring, telemetry, and weigh-in-motion sites;

35. identify active, abandoned, or potential-for-abandoned railroads (helpful in identifying rails-to-trails candidates);

36. note locations of backslopes that have been steepened due to lengthening acceleration and deceleration lanes, that have therefore developed slope stability problems; and

37. gather other information as needed.

5-2.03(04) Follow-Up

After the on-site inspection, the project manager is responsible for writing minutes and distributing copies to those attending and to those invited who did not attend. Immediately after the field meeting the project manager should consider the following:

1. request additional data or cancel unneeded requests;

2. effect revision to the project schedule or work type classification;

3. arrange further meetings to discuss and resolve issues, including a public information meeting; and

4. make a reasonable effort to provide the assigned environmental scientist with provisional right-of-way acquisition limits, if any. The providing of such information must sometimes await further development of alternatives. The footprint may be superimposed on aerial photographs, sketched in a plan view drawing, or outlined in a written description to the scientist. The purpose of this effort is to accelerate the environmental review process, specifically early coordination.

5-2.04 Task 4 - Choose Design Criteria

Select the applicable design criteria. Once the facility's functional classification, prevailing adjacent land use, NHS or non-NHS designation, 4R or 3R network location, National Truck Network, and project work type are known, the applicable design criteria can be determined. See Chapters Forty and Fifty-three through Fifty-six for more information.

5-2.05 Task 5 - Perform Data Analyses

5-2.05(01) Examination of Existing Roadway Geometrics

Compare existing conditions to the selected geometric criteria. Identify deficiencies in vertical profile, horizontal alignment, superelevation, roadsides, intersection sight distance, travel lane and shoulder (paved and usable) widths, structural condition, hydraulics, etc.

5-2.05(02) Traffic Analysis

At a minimum, traffic analyses should determine current- (base-) year and design-year (typically twenty years after construction) levels of service (LOS), both with and without proposed improvements. On occasion, the project manager may find it necessary to assess the provisional construction year and another intermediate year. A cursory consideration of Task 7 may need to precede Task 5. Use the Transportation Research Board's *Highway Capacity Manual* and companion software (or compatible software/methods) for analysis. Also, see Chapter Forty-one. A project may require other state-of-the-art methods and software (e.g., freeway systems, multiple signals on an arterial, or effects of a project on a transportation network).

5-2.05(03) Crash (Accident) Analysis

See Section 55-8.0 for further guidance on conducting a crash analysis.

Effective highway design can reduce risks associated with motor vehicle travel. At a project level, this effort begins with the identification of high-frequency crash locations through the analysis of crash data. Measures of effectiveness (MOE) with respect to traffic safety include crash events/rates, traffic conflicts/rates (time to collision, evasive maneuver, etc.), critical events (e.g., disregarding signal, aggressive behavior), and traffic-stream characteristics (e.g., pedestrian presence). Each carries varied levels of uncertainty and vagueness in requisite data. Unless circumstances dictate otherwise, the project manager should use simple, historic crash events and associated rates in evaluating safety. The steps to be used in this evaluation are as follows.

Step 1. Summarize Records. This summary may be in tabular form or mapped graphically. Distinguish each crash event by location, severity (e.g., fatal, personal-injury, property-damage) and collision type (e.g., rear-end, right-angle, left-turn). Depending on the project, especially its expressed need and objective, it may be beneficial to note environmental conditions (e.g., weather, light) and other contributing circumstances.

Step 2. Evaluate Sheer Crash Events. Inspect the data summary for evidence of crash concentrations (cluster analysis). Inspect the study area for spots or segments showing high-severity events. Look for apparent relationships between existing roadway geometry or operation (e.g., sharp horizontal curvature, lack of exclusive left-turn signal phase) and crash location and collision type. See Chapter Fifty-five or other widely available pattern/probable-cause/countermeasure tables for guidance.

Step 3. Develop Crash Rates. Crash rates are a function of traffic volumes traveling through the facility during the study period, typically three full years. These rates are critical in assessing operation, because they relate crash frequency to traffic exposure. The use of rates provides a common denominator for identifying locations with unusually high crash experience.

Divide the study area into mid-block highway segments and major intersections. Determine respectively cumulative traffic exposure. Express mid-block segments in units of millions of vehicle miles (mvmi) and intersections in millions of entering vehicles (mev). Divide absolute crash numbers by the appropriate mvmi or mev. Produce a separate rate for the three crash severities, plus in aggregate for each highway segment and intersection.

The formula used to calculate intersection crash rate is as follows:

$$R_i = \frac{(A)(1{,}000{,}000)}{(T)\ (V)}$$

Where:

R_i = intersection accident rate expressed in accidents per million entering vehicles (mev)
A = number of accidents during the subject period
T = time period in days
V = total average daily traffic (ADT) entering the intersection

The formula for calculating the crash rate for a roadway (mid-block) segment is as follows:

$$R_S = \frac{(A)(1{,}000{,}000)}{(T)\ (V)\ (L)}$$

Where:

R_s = segment accident rate expressed in accidents per million vehicle miles
A = number of accidents during the subject period
T = time period in days
V = total average daily traffic (ADT)
L = segment length in miles

Step 4. Compare Crash Rates. The project manager should compare the site's crash rates with those of similar facilities in Indiana and the United States. The U.S. DOT's Bureau of Transportation Statistics publishes pertinent statistics, which are useful in comparative analyses especially for roadway and mid-block analyses. For Indiana, Figure 5-2D shows motor vehicle fatalities and injuries – 1997, 1998, and 1999 averages. Such averages may be used to determine if a particular section of highway exhibits above-average crash rates. The averages should be reviewed with the intent of reducing crashes. A computed intersection rate which exceeds 1.5 crashes per million entering vehicles at a major intersection should alert the project manager to a potential operational problem.

Step 5. Advanced Statistical Analysis. Though generally reserved for extraordinary circumstances, the project manager may wish to employ statistical methods to minimize inherent weaknesses in judging a facility's status exclusively by use of unadjusted, historic crash data. Processes vary in complexity. The results allow the analyst to state with distinct statistical confidence whether the crash risk is disproportionately high at a particular site and, therefore, whether certain remedial treatments are likely effective.

Step 6. Countermeasures. Choosing efficient, effective corrective measures logically follows the identification of safety concerns. Guidelines on effective forms of countermeasures are obtainable. The basic, key elements to safe operation to be considered are as follows:

a. consistent design (uniformity, standardization);
b. sound access control; and

c. forgiving roadsides.

Efficiency (optimal return on investment) of a proposal may also need to be addressed, though this is reserved only for a select project. See Section 5-2.09 for a discussion on economic analysis. Such a benefit-cost exercise commonly requires the use of accident-reduction factors (point values on expected impact, or reduction, on crash occurrence) and explicit values on human fatalities and injuries.

The project manager has at his/her disposal numerous reference textbooks, manuals, papers, etc., addressing traffic safety and crash analysis. Sources include TRB, AASHTO, ITE and ASCE. The ITE *Traffic Engineering Handbook* is one source normally accessible to practicing engineers and analysts.

5-2.06 Task 6 - Verify and Refine Project Needs and Objectives

Technical analyses and engineering judgment should generate clear needs. These are specific deficiencies in the transportation system as identified by the project manager and other knowledgeable parties. Project needs reflect the unacceptable, substandard performance of the facility. Ensure that the stated objectives logically address identified needs.

***** PRACTICE POINTER *****

Each structure of span of 20 ft or longer is considered a bridge and must have a bridge file number, separate Des number, separate Estimator cost estimate, and may warrant a separate project number. Other distinctly-separate work categories, such as a geographically-separate wetland mitigation site linked to a major project, will also require a separate Des number, separate Estimator cost estimate, and separate project number.

5-2.07 Task 7 - Develop Project Alternatives

Project needs and objectives, as defined in Task 1 and Task 6, form the basis for any potential alternative developed for consideration.

5-2.07(01) Outline Physical Features of Alternatives

Engineering judgment and coordination with project stakeholders are used in the development of the alternatives. Although there may be an infinite number of alternatives that solve a particular highway engineering problem, the project manager should address only those alternatives which are reasonable, prudent, practicable, and constructible.

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 Report. The explanation may be presented in the form of drawings and/or written text. Essential elements include the typical cross section, horizontal (and, to an extent, vertical) alignment, major structures, project limits, right-of-way impacts, construction costs, and traffic maintenance during construction. Develop the proposal (i.e., recommendation or selected preferred alternative) in sufficient detail to the extent that the alignment and design features of the roadway are established, drainage needs are accommodated, environmental impacts can be assessed and mitigated, and right-of-way requirements are determined at a preliminary level.

Alternatives under active consideration (i.e., considered viable) at any given point in time must be developed in equal detail. Document for the file and/or on the Engineer's Report rationale supporting deletion of alternatives at each screening step.

5-2.07(02) Traffic Maintenance

Analyze the options for maintaining traffic during construction as outlined in Chapters Eighty-One and Eighty-Two. The project manager may in sometimes find it necessary to defer selection of a traffic maintenance plan to the design phase, or to qualify the selection as tentative. The extent to which the traffic maintenance plan influences the selection of alternatives will determine the level of detail necessary for this analysis. Costs should be determined for various traffic maintenance options. Appropriate Department staff should be consulted regarding the viability of various traffic management/maintenance alternatives. The level of commitment to the preferred traffic maintenance plan should be documented (i.e., the level of support and potential for revision as the project develops downstream). If circumstances warrant, the project manager is charged with forming and, at least initially, steering the transportation management action group according to the criteria described in Chapter Eighty-One.

5-2.07(03) Determine Alternatives' Environmental Impacts

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 Engineer's Report is developed in concert with the Office of Environmental Services' assigned scientist, and it assists in analysis of the project's environmental impacts and preparation of the environmental document. The project manager should collaborate with the scientist to evaluate the environmental impacts of alternatives under consideration. This cooperative effort will be documented in the Engineer's Report and will be used by the environmental scientist in documenting environmental assessment. Projects vary in the level of environmental oversight necessary to satisfy NEPA.

5-2.07(04) Estimate Costs

Rudimentary cost estimates should be developed for each alternative. 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.

5-2.08 Task 8 - Build Consensus for an Alternative

The alternative-screening process involves a coordination element to ensure that decisions made in the engineering-assessment phase will be supported and remain intact throughout the entire project development life. The level of coordination varies by project. Coordination of a project is a vital aspect of consensus building. Not every stakeholder may agree with the proposed solution. It is the project manager's responsibility to negotiate and arbitrate with all interested parties. It may be necessary to involve office managers, division directors and INDOT's executive staff in this process so that binding decisions can be made and the project can be advanced in a timely manner. It is important to maintain clear, organized records of meetings, conversations, and correspondence that document the coordination efforts. A select project may call for a formal memorandum of understanding (MOA).

The project manager may find it helpful to confer with the individuals, groups, or agencies as follows:

1. district design and program management offices;
2. district construction engineer;
3. district traffic engineer;
4. district operations engineer;
5. Planning Division;
6. Office of Real Estate;
7. Production Management Division, notably the assigned office manager, staff engineer, and hydraulics engineer;

8. Office of Materials Management;

9. Office of Environmental Services;

10. INDOT executive staff;

11. State and local elected officials;

12. city or county engineer, surveyor, or planner;

13. Indiana Department of Natural Resources;

14. Federal Highway Administration, Indiana Division office;

15. special interest groups stakeholders; and

16. others as appropriate.

5-2.09 Task 9 - Evaluate Alternatives

5-2.09(01) Background

The project manager must select from the alternatives the proposal/recommendation for advancement to design and further environmental study. Efficiency (money's worth) and effectiveness (satisfying objectives) frame most decisions. The selected course of action identified in the Engineer's Report should most efficiently and effectively satisfy project purpose and need.

One purpose of decision analysis is to clarify the problem by enhancing recognition of costs and consequences of available alternatives. The process clarifies issues, often leading to identification of new, superior alternatives. The decision analysis process also assists in building consensus for improvement strategies.

No method can possibly reflect all factors. Questions arise regarding appropriate measures of worth and associated units. Sensible decision-making involves some semblance of valuation. Informed, subjective, yet impartial judgments on the part of the project manager and others are inescapable and in fact critical in making sound decisions.

Decision-making is rarely a rigid process. It is iterative, with continual adjustments. Often the decision is straightforward or lends itself to engineering judgment or discovery rather than extensive evaluation. Sometimes it is complex, requiring sophisticated evaluation of the alternatives' consequences. Ultimately, the selected path depends on the person(s) making the decision, the nature of the decision, and the characteristics of alternatives deemed worthy of consideration.

The broad categories of decision analysis are described below. These are strategies for making decisions, not decision rules. The processes vary in complexity. A critical distinction among the available techniques is the manner in which internal (user and sponsoring agency) versus external (non-user) factors are compared and how market (economic) versus non-market (environmental and social) elements are assessed. The decision analyses are as follows:

1. Informal Analysis. Judgment regarding optimal improvement strategy relies on standard procedure and intuitive balancing of agency costs, user benefits, and external impacts. A project assigned to the Office of Environmental Services most often may fittingly be addressed in this informal manner.

2. Engineering Economic Analysis. This analysis is limited to user and sponsoring-agency components having a tangible market dollar value in a life-cycle approach. Commonly known as traditional benefit-cost analysis, the procedure is appropriate for a project having no appreciable non-user, environmental, or social consequences. The analysis has less-frequent applications than Informal Analysis, but more so than Cost-Effectiveness Analysis.

3. Cost-Effectiveness Analysis. This analysis blends objective and subjective reasoning along with qualitative and quantitative measures into the decision. It is a more comprehensive form of benefit-cost analysis. A contemporary infrastructure improvement project often has multiple objectives, demanding accounting of non-user and external consequences. Only rarely will an engineering assessment call for such analysis, generally reserved for a massive capital improvement project on a cross-county corridor, e.g., a bypass.

5-2.09(02) Informal Analysis

Many elements of road and bridge plans have been specified in advance. The project manager is bound to these prior decisions. They are specified by the design criteria and policies adopted by the Department. For example, Chapter Fifty-three dictates that, for a rural freeway, travel lanes of 12 ft width and full access control are required. These advance instructions result from judgments of economic worth. A project with only a single improvement alternative essentially relies on these criteria and policies for full description of the appropriate scope of work. This does not require further decision analysis.

A project with more than one improvement alternative may warrant no structured approach to arrive at a sound decision regarding the best alternative. Often no more than a cursory review of the alternatives' costs, benefits, and consequences is necessary to render a valid decision. One option may clearly dominate all others with respect to the stated project objectives. Relevant issues affecting optimal choice are clear. Rigorous analysis is unnecessary in this scenario.

5-2.09(03) Engineering Economic Analysis

Engineering economic analysis is the classical means for assessing a public-works project. Comparison of road-user benefits against project costs, incorporating money's time value, is the essence of engineering economic analysis. The process historically has been the most widely used project evaluation approach. Subjective influence imparted by the decision maker is restricted. The potential weakness of this traditional form of benefit-cost (B-C) analysis is that it recognizes only tangible attributes. Non-monetary, external impacts (e.g., social and environmental consequences) receive no direct consideration. However, engineering economic analysis applies well where non-user impacts are absent, minimal or identical for all alternatives, and user impacts have a market value.

Comparison of transportation user benefits against project development costs is the essence of engineering economic analysis. Traditional B-C is moderately rigorous and rigid. It separates characteristics of each alternative into two categories, benefits and costs. All factors convert to dollar values. The accounting procedure is to identify as benefits all user-related expenses (negative or positive) and as costs all agency-related expenses (negative or positive). Usually the existing facility, absent of improvements other than routine maintenance, serves as the base (null alternative) against which net benefits and costs are derived. Convert future cash flows to present worth. A discount rate of 5 to 7 percent (real, as opposed to nominal) is a reasonable starting point. Always test the sensitivity of B-C results to changes in key input variables possessing uncertainty, such as discount rate and economic life. In lieu of computer applications tailored to engineering economic analysis (e.g., MicroBENCOST), an electronic-spreadsheet software may be used to assist in the computations.

Benefits reflect dollars spent or saved by users of the facility. The three traditional, basic user benefit (or dis-benefit) components are vehicle operation, occupants' travel time, and crash potential. Other priceable factors may be included under particular circumstances. Although published values are available from various sources, defining sheer dollar costs associated with fatal and personal injury crashes is perplexing. The question arises as to what costs to include. One is cost to society. The other is lost quality of life. The two lumped together consist of a comprehensive crash cost. Considerable uncertainty exists with respect to expressing lost quality of life in monetary terms. As well, it is statistically difficult to predict and project rare events such as a fatal or personal injury crash. The project manager should test B-C results to the sensitivity of a range of values.

Costs are also measured in dollars. Sponsoring agency costs are those associated with project development and construction. Terminal (salvage) value may be added, though views differ on gauging its worth. Recurrent or annual facility operation and maintenance costs and future rehabilitation outlays (or receipts) over the project's life cycle may be included, adjusted for money's time value.

After benefits and costs have been identified and valued, the analyst is ready to compare, accept, and reject alternatives. B-C results may be presented in various forms. Primary measures of project worth include net present value (NPV), also called net present worth, which is present value of benefits minus present value of costs; benefit-cost ratio (B/C), which is present worth of benefits divided by present worth of costs; and internal rate of return (IRR), which is rate generating NPV = 0 and B/C = 1. Each is valid. Use of NPV in describing alternatives' worthiness is preferred. NPV is the least ambiguous and the most straightforward. B/C ratios between alternatives within a project cannot be compared directly, as incremental, pair-wise comparison is essential.

Practical guidance in conducting traditional B-C analysis is accessible from various sources. TRB, ASCE, AASHTO, FHWA and ITE, among other organizations and individuals, publish literature in transportation and economic affairs. The normally-accessible specific sources are as follows:

1. *Civil Engineering Reference Manual*, by M. Lindeburg;
2. AASHTO's *A Manual on User Benefit Analysis of Highway and Bus-Transit Improvements*; and
3. *MicroBENCOST*, a software package for analyzing benefits and costs of highway improvements, published by the Texas Transportation Institute.

5-2.09(04) Cost-Effectiveness Analysis

Cost-effectiveness (C-E) is a class of decision processes that incorporates user, non-user, market, and non-market elements. The appraisal and program monitoring technique assists the decision-maker during evaluation of a project generating intangibles (no dollar value) and externalities (secondary impacts). Though itself a form of and often labeled a benefit-cost analysis, it differs from engineering economic analysis/traditional B-C. C-E attempts to provide a full accounting of costs: broad private, agency, and social gains and losses. The more-comprehensive approach arose from the awareness that it is difficult to credibly convert all major impacts into monetary terms, and that failure to internalize secondary impacts leads to inefficient allocation of transportation resources. As a matter of policy, the act of pricing (i.e., attaching a dollar value) to intangibles is discouraged. More suitable means exist to account for such influences.

The project manager should use the C-E analysis only where there is a complicated or vague problem structure that suggests foregoing informal and engineering economic analyses. The presence of numerous and conflicting objectives, externalities, intangibles, long-time horizons, interest groups, multiple decision makers, high stakes, etc., call for some form of C-E.

The cost side of C-E analysis, efficiency, represents economic return on investment. It is a function of tangible costs, whether agency- or user-related. Also, costs can be internal (e.g., long-term maintenance) or external (e.g., adjacent streets' reduced congestion). Efficiency consideration is limited to elements having a tangible market value, lending them to dollar-value conversion. In this sense, measures such as net present value and benefit-cost ratio, derived from traditional B-C analysis, satisfactorily represent project efficiency and can be incorporated into C-E analysis.

Balancing the costs is the effectiveness of the proposed solution. This is the degree to which an alternative satisfies project objectives or purpose. Measures of effectiveness (MOE) may include mobility factors and such environmental impacts as air pollution and wetland encroachment, plus other difficult-to-price social consequences (e.g., noise and neighborhood disruption). The best alternative attains highest satisfaction of project objectives with lowest project cost.

Selection of values within and importance (weights) of these MOE are sometimes derived subjectively, though impartially. The decision-maker should be aware of the implications of including in the decision process factors beyond those having a definite economic worth. The breadth of C-E decision analysis necessarily involves eliciting the decision-maker's subjective judgments, most often on importance of non-market externalities (e.g., wetland impact). The key is to conduct the study in a meticulous, unbiased manner using available tools to reconcile the lack of a common basis (unit) to examine market and non-market based objectives. The project manager and/or requisite group of decision-makers is responsible for making reasonable judgments.

A host of available C-E methods range from the rather simple (e.g., a chart of qualitative descriptions) to the highly sophisticated (e.g., stochastic modeling). A typical process involves forming a decision matrix from selected determinants. The magnitude and often their relative influence form a matrix that is often normalized via scaling factors. Preference lies with C-E decision-making tools that break down the problem in successive steps, particularly with paired comparison of objectives and alternatives' component values. The project manager is responsible for deciding what form the C-E analysis should take. It will hinge on the desired level of precision in assessing the worthiness of project alternatives.

Information on C-E analyses and procedures can be obtained from TRB, ASCE, AASHTO, FHWA, ITE, and other sources.

5-2.10 Task 10 - Write Engineer's Report

The Engineer's Report for an INDOT project will outline the proposed project. Generally, it will note known required design exceptions.

The general form of the Engineer's Report is a memorandum from the project manager to the Environmental Policy Team leader. He or she can provide, upon request, samples for various project types. The Environmental Policy Team leader's concurrence signature on the Report certifies the Department's official position with respect to the selected improvement plan (scope of work).

The project manager is instructed to document crucial information gathered during the engineering assessment phase, concisely and with precision. Minimize repetition, as information presented in attached drawings need not be additionally described in verbiage of the Report body.

5-2.10(01) Engineer's Report Contents

The following is a suggested outline, not a rigid framework. The project manager has the discretion of making adjustments to section headings and their sequence. The Report size will vary, principally as a function of project type. The typical sections listed in the Engineer's Report are as follows:

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

2. Project Location. Specify subject mainline road, crossing roads, stream or other feature; site's offset from nearest State, U.S., or Interstate highway, reference post(s), county, city or town, and district. Refer to project location maps and photographs, routinely appended.

3. Project Purpose and Need. Give succinct statements of the highway's deficiencies and project's objective.

4. Project History, Prior Studies. Discuss any relevant, previous study of the project or site.

5. Existing Facility. Describe the history and status of the present facility, its roads, bridges, small structures, traffic control devices, land use, etc.

6. Field Check. Highlight events of the on-site inspection. Append field-check minutes. Summarize decisions made in the field.

7. Traffic Data and Capacity Analysis. Furnish traffic counts and results of capacity analysis. Discuss meaning of results.

8. Crash Data and Analysis. Provide crash history, its analysis, and countermeasures.

9. Discussion of Alternatives / Identification of Proposal. Outline alternative improvement plans. Describe alternatives evaluation. State design guidelines. Discuss hydraulic,

geotechnical, and pavement elements. Identify the proposal (recommendation, preference, selection).

10. Cost Estimate. Tabulate present-year costs for construction, right of way, and design engineering. List separate costs for road and individual traffic signal, lighting, and bridge elements to simplify scheduling.

11. Environmental Issues. List potential environmental constraints associated with the proposal.

12. Survey Requirements. Indicate the limits of requisite field survey of the proposal.

13. Right-of-Way Impact. Indicate the limits of additional permanent and temporary right of way needed to contain road improvements and consequent impacts. State land area and type, number of parcels, number and type of relocations, etc.

14. Traffic Maintenance During Construction. With respect to the selected alternative, explain traffic maintenance options and, if appropriate, make a binding recommendation. Clarify any decisions deferred to the design phase.

15. Related Projects, Consistency. Note related projects in the area and on any selected detour. Discuss any coordination necessary among projects, their timing in particular.

16. Coordination, Meetings, Concurrence. Summarize contacts made in association with the engineering assessment phase. Include information regarding any public meeting held during the process. State agreements made in principle to the proposal.

17. Report Distribution List.

    a. Office of Environmental Services, Environmental Policy Team leader;

    b. District Design office manager;

    c. Production Management Division, office manager - 4 copies;

    d. Production Management Division, Design Team leader;

    e. Production Management Division, Survey Team leader;

    f. Production Management Division, Utilities Team Leader [(1)];

    g. Production Management Division, Property Management Team Leader [(2)];

h. Production Management Division, Office of Geotechnical Services engineer;

i. Planning Division, route transfer specialist [3];

j. Contract Administration Division, Local Program Assistance Team leader [4];

k. Federal Highway Administration, Indiana Division, field operations engineer;

l. Indiana Department of Natural Resources, Engineering Division, chief civil engineer [5]; and

m. Others as needed or requested, e.g., local officials, MPO, Office of Materials Management engineer, district traffic or construction engineers.

Notes:

(1) Required only for non-Interstate-route project in urban or suburban area, moderate to major expansion in rural area, or other project having unusual utility impact.

(2) Required only for project involving right-of-way acquisition.

(3) Required only for project involving road identified as candidate for relinquishment, or project proposal effecting relinquishment condition.

(4) Required only for Federal-aid funded local project.

(5) Required only for park access road project.

18. Appendices. Include as attachments relevant maps, drawings, photographs, correspondence, etc. These routinely include the following.

a. Appendix A – Graphics.

(1) Statewide project location map;

(2) topographic project location map;

(3) aerial and ground-level photographs, often with the proposal superimposed; and

(4) other graphics, drawings, exhibits (e.g., typical cross sections, plan and profile, geometric layouts, traffic maintenance plan schematic);

b. Appendix B - Data and Analysis.

(1) traffic data and capacity analysis summary (or place in Report body);
(2) crash (accident) data and analysis summary (or place in Report body);
(3) preliminary hydraulic data and recommendation;
(4) preliminary pavement data and recommendation; and
(5) geotechnical report/study and analysis.

c. Appendix C - Correspondence, Other.

(1) relevant correspondence (e.g., signing and lighting design, bridge inspection report excerpts, field inspection and other meeting minutes);

(2) Project Application form and other planning or programming support documents; and

(3) other relevant material.

The designer is still responsible for designing the project to comply with the intent of the Engineer's Report and this *Manual*. The designer is not to decrease the design speed, lane widths, or shoulder widths (paved and usable) shown in the Report, even though the *Manual* would permit a lesser value. For example, if the Report specifies an 8 ft usable shoulder, including 3 ft paved shoulder, and the *Manual* would permit a 6 ft usable shoulder, including 3 ft paved shoulder, the designer should provide the Report-specified values.

5-2.10(02) Revisions to the Engineer's Report (Scope of Work Change)

Essential criteria that determine whether explicit, formal concurrence from the Environmental Policy Team leader is required for revision to the adopted proposal (recommendation) are as follows:

1. project objective changes,
2. project termini change significantly,
3. basic design criteria change, or
4. cost substantially increases or decreases.

Proposed variances for Level One criteria included in the Engineer's Report should be considered as a proposed change in the scope.

The procedure for proposing changes in the scope of work is as follows.

1. The designer sends the proposed change in scope to the appropriate Production Management Division office manager.

2. The office manager will prepare a routing slip and route the change to the project reviewer.

3. If the change in scope is satisfactory, the project reviewer sends it to the appropriate Production Management Division's Design Team leader along with a memorandum expressing the Production Management Division's concurrence with the proposed changes.

4. If the change in scope is satisfactory, the office manager sends it to the Production Management Division director.

5. If the change in scope is satisfactory, the Production Management Division director sends it to the Office of Environmental Services's Office's Environmental Policy Team leader for concurrence.

6. If the Environmental Policy Team leader concurs in the change in scope, he or she returns it to the project manager for distribution.

Sufficient time should be granted for consideration of the revision, normally two weeks or more. The response will be in the form of outright rejection, partial acceptance, unconditional agreement, or petition for more information. Once signed concurrence is granted by the Office of Environmental Services manager, he or she will distribute the petitioner's memorandum to the appropriate individuals.

5-2.11 Checklist for Beginning Design Work on an Abbreviated Engineering Assessment (Mini-Scope) Project

1. The designer should determine if aerial photos showing the anticipated right of way are available from the Office of Environmental Services' Environmental Policy Team. Since the Mini-Scope lacks detail about right-of-way takes, aerial photographs showing the anticipated right of way have already been prepared. These aerials were developed to facilitate preparation of the environmental document.

2. The designer should determine if the environmental-document preparation work is progressing, and find out if there are any known environmental concerns. The environmental document is usually prepared concurrently with the preliminary design. Lack of an approved environmental document can hinder design work in environmentally-sensitive areas and will prevent a project from being advanced to the Design Hearing stage.

3. A non-Interstate-route pavement-rehabilitation Mini-Scope project is usually a 3R project,

with a 15- to 20-year service life for the resurfaced areas. The following criteria should be used in evaluating a 3R project.

a. The horizontal alignment should be evaluated in accordance with Section 55-4.03.

b. Superelevation should be upgraded to standard, or a design exception will be required.

c. A substandard vertical curve may remain in place if it satisfies the benefit/cost criteria outlined in Section 55-4.04. Design documentation will generally suffice, rather than a full design exception. Old plans should be obtained, if possible, so the existing vertical curve can be checked against the required design criteria.

d. If vertical alignment correction is necessary to obtain intersection sight distance, the vertical alignment should be improved to standard.

4. If the Mini-Scope recommends a 6:1 or 4:1 roadway foreslope within the obstruction-free zone, there is generally no reason to exceed the given recommendation. The intent is to keep embankment reconstruction and right-of-way acquisition to a minimum.

5. The designer should review the pavement design recommended in the Mini-Scope. If the project is primarily partial 3R to extend the service life of the existing pavement, the project can be designed without underdrains. This will permit the use of substantially shallower roadside ditches. The Planning Division’s Pavement Engineering Office manager’s preliminary recommendations regarding underdrains should be obtained. If the project requires pavement replacement in excess of 30%, spot usage of underdrains may be required.

6. Verify the Mini-Scope recommendations regarding maintenance of traffic with the district construction engineer. If the project is to be constructed under traffic, substantial changes to the vertical alignment will result in significant additional expense for temporary widening or a temporary runaround.

7. A grade review meeting or even possibly a pre-grade review meeting should be held. Representatives should be invited from the Office of Environmental Services’ Environmental Policy Team, the Pavement Engineering Office, the district Design Office, and the Production Management Division.

5-3.0 MISCELLANEOUS

<u>5-3.01 Project File</u>

The project manager should maintain a project file. Typically it should include the following:

1. project history and background information;
2. cost estimate working notes;
3. field check notes;
4. engineering calculations and worksheets;
5. project manager's notes to file;
6. software output for highway capacity analysis;
7. meeting and conference minutes;
8. correspondence, including hardcopies of electronic mail; and
9. Engineer's Report original plus file copy.

All duplicate and reproducible material shall be purged from the file upon completion of the engineering-assessment phase.

5-3.02 Route Relinquishment

The term relinquishment refers to the process of transferring maintenance responsibility of a State or U.S. route, including all right of way, bridges, and appurtenances, between highway agencies. If a roadway's alignment changes, the facility being replaced must be either removed or relinquished to the appropriate local government agency. Limited alignment changes (e.g., construction of a bridge on new alignment, intersection relocation) can trigger relinquishment activities.

Sometimes a project is created to satisfy a condition defined in a signed relinquishment agreement between INDOT and another local highway agency. The project manager should consider whether a route transfer agreement will need to be developed.

The project manager or the Planning Division's road relinquishment specialist is instructed to advise local officials of relinquishment issues early in the engineering-assessment phase. Willingness and conditions imposed by the local officials will influence the recommended course of action. The relinquishment specialist is responsible for leading the Department's discussions and negotiations with a local agency regarding relinquishment.

5-3.03 Access Control

Access control is a critical element in protecting through-movement capacity and enhancing safety. A roadway provides access to adjacent properties and mobility to through traffic. These functions often conflict. A roadway that offers unlimited access to abutting properties will generally provide less-efficient travel for through traffic than a roadway on which the frequency of driveways is limited. Establish the suitable level of access control by assessing the official functional classification and apparent roadway function. Evaluate the study area according to Chapters Forty and Eighty-six, as well as guidelines from Chapters Fifty-three to Fifty-five.

5-3.04 Scheduling and Programming Considerations

A large, complex project often has component parts for which schedules for baby projects and costs should be segregated. It may be appropriate to divide a larger mother project to effect more streamlined project development or construction. The project manager should work with the Planning Division's Office of Systems Analysis and Planning to ensure that scheduling and programming issues are addressed. Unless circumstances suggest otherwise, simplify program management by deferring, or at least minimizing, creation of baby projects, pending completion of the engineering assessment phase.

5-3.05 Public Input Guidelines

For additional guidance on public involvement procedures, see Chapter Eight and the Office of Public Hearings publication, *Public Involvement Procedures*.

5-3.05(01) Public Hearing

A public hearing is an opportunity for the public to make formal statements of position. The Planning Division's Office of Public Hearings oversees these meetings. The Department views the hearing as a specific observable administrative benchmark for public involvement. Only one public hearing is required. It occurs most often in the design phase. For guidance on public hearing requirements, see Section 8-8.0.

The Office of Public Hearings is responsible for any hearing deemed necessary in the corridor-location stage of engineering and environmental assessments. A public-information meeting may later be held by the Production Management Division to acquaint the public with the project details. If the public hearing is held during the design phase, the Production Management Division will represent the Department.

The Office of Public Hearings transcribes the event. Disposition of comments typically is a collaborative effort on the part of the hearings examiner and the host division.

5-3.05(02) Public Information Meeting

A public information meeting may be held during the engineering-assessment phase at the discretion of the project manager, Office of Environmental Services, and Office of Public Hearings. This decision is often made in conjunction with the Department's executive staff and the district. Such a meeting is normally conducted before the environmental document has been prepared. A public information meeting held during the engineering-assessment phase should accomplish these objectives as follows:

1. solicit public input on alternatives under consideration; and
2. inform the public of INDOT's improvement plan: the proposal/recommendation.

5-3.05(03) Guidelines for Public Information Meeting

The public information meeting is structured in the same manner as a formal public hearing. However, it is not a formal hearing and is not a substitute for the public hearing required by NEPA regulations. The Office of Public Hearings is responsible for the public information meeting. It must be requested by the Office of Environmental Services at least eight weeks in advance of the desired meeting date.

The information to be provided to the Office of Public Hearings when requesting a public information meeting should be as follows:

1. clearly stated goal of the meeting;
2. narrative describing the project and the alternatives being considered;
3. list of property owners, if possible or deemed necessary; and
4. maps, drawings, sketches, displays, or aerial photographs.

Information packets will be provided to the public. The project manager may wish to design the information packet. If so, the Office of Public Hearings must receive the draft packet a minimum of seven work days before the meeting. The Office of Public Hearings will review and edit the packet within two work days. If the Office of Public Hearings prepares the information packet, a draft copy of the packet will be provided to the project manager seven work days before the information meeting. Revisions must be submitted within two work days to the Office of Public Hearings. The Office of Public Hearings will copy the information packet for the meeting.

The hearings examiner will oversee the meeting. He or she will make introductions and guide the meeting through its agenda. A typical agenda will include the following:

1. explanation of the public meeting process;
2. explanation of methods in which the public can record its comments;
3. introductions of the Department's staff or representatives;
4. presentation of the project plans by the project manager; and
5. public comment opportunity.

Transcription and disposition of comments are addressed as required. The Department may choose to forego these tasks for an informal public meeting.

5-3.05(04) Press Release

In lieu of or in addition to a public information meeting, a press release is sometimes an effective means of informing the public of improvement plans. The project manager will work through the Public Information Division to generate a press release.

Data Type	Project Type								
	Bridge Construction, Replacement, Removal	Small Structure, Drainage Correction	Added Travel Lanes	Intersection Improvement	Interchange Construction	Sight Distance Improvement	Road Rehab., Construction	Landslide	Rest Area, Weigh Station
Project Application	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Existing Road, Bridge Plans	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Aerial Photographs									
New	Yes	No	Yes	Yes	Yes	Yes	C/C	No	Yes
Existing	No	Yes	No	No	No	No	C/C	Yes	No
Traffic Data									
Mainline	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Turning	No	No	Yes	Yes	Yes	C/C	C/C	No	C/C
Crash Data	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pavement Design	No	No	Yes	No	Yes	No	Yes	No	Yes
Hydraulic Data	Yes	Yes	Yes	No	C/C	No	C/C	No	C/C
Geotechnical Study/Report	No	No	No	No	No	No	No	Yes	No
Feasibility/Planning Study/Report	No	No	Yes	No	Yes	No	C/C	No	C/C
Road/Pavement History	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: "C/C" abbreviates case-by-case. Whether a road project warrants new aerial flight/photography depends on anticipated extent of work and nature of land use, among other factors. Turning movements of course only apply where an intersection or interchange ramp terminal is present. The project manager may find it necessary to request of the chief geotechnical engineer, through the Engineering Assessment Section manager, a formal geotechnical analysis, if no recent study exists at a landslide site. Feasibility studies may or may not have been conducted for those marked as "Yes" or "C/C."

A GENERALIZED GUIDE

Figure 5-2A

TRAFFIC PROJECTIONS REQUEST

Date ___________________

MEMORANDUM

TO: _______________________________
Urban and Corridor Modeling and Forecasting Program Director
Planning Division

FROM: _______________________________
Project Manager

____
INDOT location or consultant

ROUTE ___________________________
DES. NO. __________
PROJECT NO. _____________________
_______ ______ of ________ to _______ ______ of ________
COUNTY: _________________________

For additional information contact __________________________; Telephone: _____________.

Type of work planned: ____

Year for Traffic Projections: ________

The data requested is as follows:

____
____
____
____
____
____

Attached additional information to be returned: ☐ Yes ☐ No

[Please include any additional information that will prove helpful in fulfilling your request (i.e., Project Location Map, aerial photos, etc.).]

Click When Done   Clear Data

INDIANA DEPARTMENT OF TRANSPORTATION

INDIANAPOLIS, INDIANA 46204

INTERDEPARTMENT COMMUNICATION

, 20

REQUEST FOR CRASH RECORDS

MEMORANDUM

TO:

Project Manager

FROM:

Designer

☐ Division

☐ District

☐ Design Firm,

ROUTE NO. OR ROAD NAME(s):
DES NO.
COUNTY:
CITY OR TOWN:

Please provide three years of crash data for the following location.
[check one and complete necessary data including all known road names]

☐ Intersection of [main road] with [crossroad]

☐ Ramp of [main road] with [crossroad]

☐ Road segment from to

:

Functional Class Categories	Fatal Crashes	Fatal-Crash Rate	Injury Crashes	Injury-Crash Rate	Property-Damage Crashes	P.-D. Crash Rate	Total All Cashes	All-Crash Rate
RURAL								
Interstate Freeway	60	0.73	1,445	17.63	5,626	68.08	7,131	86.34
Other Principal Arterial	118	1.96	2,828	47.15	8,244	137.45	11,190	186.57
Minor Arterial	99	2.06	2,583	53.48	7,536	155.98	10,218	211.52
Major Collector	168	1.38	9,837	81.13	28,215	232.66	38,220	315.18
Minor Collector	45	1.97	2,039	89.67	5,787	254.57	7,871	346.21
Local Road	112	3.65	2,702	87.96	7,660	249.45	10,474	341.07
RURAL SUBTOTAL	*602*	*1.65*	*21,434*	*58.62*	*63,067*	*172.42*	*85,103*	*232.69*
URBAN								
Interstate Freeway	24	0.33	1,065	14.50	4,068	55.38	5,157	70.21
Other Freeway or Expressway	36	3.12	518	45.27	1,513	132.28	2,067	180.67
Other Principal Arterial	64	0.61	10,591	99.50	32,383	304.39	43,038	404.50
Minor Arterial	70	0.93	8,336	110.51	27,553	365.16	35,959	476.59
Collector	37	1.56	2,671	113.24	8,893	376.64	11,601	491.43
Local Road	37	0.68	6,027	111.89	20,084	372.67	26,147	485.24
URBAN SUBTOTAL	*267*	*0.78*	*29,208*	*84.83*	*94,493*	*274.41*	*123,968*	*360.02*
Interstate System	84	0.54	2,509	16.08	9,694	62.05	12,287	78.67
All Other Roads	785	1.42	48,133	86.84	147,867	266.77	196,784	355.03
STATEWIDE TOTAL	*869*	*1.22*	*50,642*	*71.34*	*157,560*	*221.92*	*209,071*	*294.48*

Notes:

1. Fatal- and Injury-crash rates are number of Fatal / Injury crashes per 160 million vehicle kilometers of travel.
2. The average of uninvestigated crashes of 40,013 events is not included in the above totals.
3. Data are from Program Development Division’s congestion and safety management engineer.

MOTOR VEHICLE FATALITIES AND INJURIES – AVERAGES FOR 1997, 1998, AND 1999

Figure 5-2D