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CHAPTER EIGHTY-TWO

TRAFFIC CONTROL PLAN DESIGN

To some extent, highway construction disrupts the normal flow of traffic and poses safety hazards to motorists, bicyclists, pedestrians, and workers. Therefore, to alleviate potential operational and safety problems, INDOT requires that work-zone traffic control be considered on each highway construction project. The work-zone traffic-control plan may range in scope from very detailed plans, incorporation of unique or recurring special provisions, or to merely referencing the INDOT *Standard Drawings*, *Standard Specifications*, or *Manual on Uniform Traffic Control Devices (MUTCD)*. This Chapter provides the necessary information to develop a well-conceived work-zone traffic-control plan that minimizes the adverse effects of traffic disruption and hazards.

82-1.0 PRELIMINARY ENGINEERING

82-1.01 Responsibilities

The Office of Environmental Services' Environmental Policy Team is responsible for initially addressing work-zone traffic control. This information is to be included in the Engineer's Report. In determining the initial work-zone traffic control, the Environmental Policy Team will perform the following:

1. collect all necessary data (e.g. traffic counts, accident history, roadway geometrics, proposed development, operating speeds);

2. coordinate planning and scoping meetings with the applicable participants (e.g., designer, Office of Traffic Engineering, district Office of Design, Highway Operations Division, local officials);

3. conduct analyses (e.g., capacity analyses, traffic impact studies, safety studies, queuing analysis);

4. review design alternates;

5. review traffic-control alternates (e.g., detour, crossovers, runaround, lane closure). The preferred plan will be incorporated into the Report;

6. estimate the construction cost and economic impact of various options and improvements;

7. coordinate funding and timing with other projects within the corridor; and

8. if required, form a transportation-management-plan team and include the team's recommendations in the Report. Chapter Eighty-one provides information on the development of a TMP.

<u>82-1.02 District Input</u>

During the development of the Engineer's Report, the Environmental Policy Team will obtain the following information from the district.

1. The district's concurrence in the selected traffic-control alternate;
2. detour-route location and additional travel distance;
3. traffic projections anticipated to use detour;
4. anticipated delays to fire, police, emergency-medical, or postal service;
5. number of school buses using facility (additional delay and distance); and
6. local roads which may be used for official or unofficial detour.

<u>82-1.03 Engineer's Report</u>

The Environmental Policy Team will be responsible for incorporating the proposed work zone traffic control plan in the Engineer's Report and ensuring that the following have been considered.

1. <u>Traffic-Control Alternates</u>. The Report will address the work-zone traffic-control information as follows:

    a. Applicability of INDOT *Standard Drawings*;
    b. alternate traffic-control strategies;
    c. alternate detour types and locations;
    d. construction scheduling and phasing requirements;
    e. alternate geometric design features;
    f. estimated costs for alternate traffic-control strategies; and
    g. special requirements of the work-zone traffic control.

2. <u>Construction Operation Selection</u>. The construction applications which may be considered are as follows:

    a. work beyond the shoulder;
    b. shoulder work and partial lane closure;

c. lane closure for a 2-lane highway;
d. single-lane closure for a 4-lane highway;
e. two-way traffic on a divided highway;
f. work within or near an intersection;
g. offset alignments; and
h. official or local detour (e.g., runaround, crossovers).

Chapter Eighty-one provides additional guidance for determining which of these construction applications may be appropriate.

3. Detour Location. The use of a detour (e.g., runaround, crossovers, alternate route) should be determined on a project-by-project basis. The detour location should be in accordance with the following:

   a. minimize impacts to adjacent developments (e.g., site access);
   b. minimize the magnitude and cost of utility relocations;
   c. minimize environmental impacts; and
   d. be offset a sufficient distance so that it will not interfere with construction.

   The Department may be required to repair local highways that may be damaged while being used as unofficial detour routes. See the *INDOT Detour Policy* for additional information. Investigations, details, and agreements with local officials may be required in subsequent phases.

4. Community Impact. The Report should address the impacts on neighborhoods, parks, schools, businesses, etc. A detour can significantly increase traffic through a community such that local traffic can no longer use the detour route. The Report should also address how the work-zone traffic control will affect fire, ambulance, police, and school-bus routes.

5. Interest Groups. The Report should address the concerns of local governments, agencies, public officials, or special interest groups (e.g., homeowner associations). If reasonable, changes should be made to the work-zone traffic-control to address their concerns. Working with local officials and organizations early in project development can significantly reduce opposition to or create support for a project by addressing local concerns.

6. Transportation-Management Plan. Where a project does not warrant the development of a Transportation Management Plan (TMP), the Environmental Policy Team still should review Chapter Eighty-one for applicable guidelines and criteria that should be discussed during this phase. The conclusion of this phase should result in a reasonable traffic-control strategy for the project.

82-2.0 TRAFFIC-CONTROL-PLAN DEVELOPMENT

82-2.01 Responsibilities

It is the designer's responsibility to ensure that an adequate traffic-control plan (TCP) is developed. If the traffic-control requirements are not entirely included in the INDOT *Standard Drawings* or *Standard Specifications*, the designer should prepare a TCP that will adequately address all required non-standard traffic-control work for the project. The designer will be responsible for the following.

1. reviewing the information in the Engineer's Report or, if not available, contacting the appropriate entity or agency (e.g., traffic-design, FHWA) to obtain the necessary information;
2. evaluating the propose design alternates (e.g., detour, crossovers, runaround, lane closure); see Chapter Eighty-one;
3. developing the geometric design for a specially-constructed detour (e.g., crossovers, runaround, offset alignment); see Section 82-3.0;
4. addressing the roadside-safety concerns within the construction zone (e.g., construction clear zone, temporary concrete barrier); see Section 82-4.0;
5. selecting and locating the required traffic control devices (e.g., pavement markings, barricades, signs); see Chapter Eighty-three;
6. developing and evaluating alternate construction sequences;
7. performing the necessary capacity and queuing analyses, if not already provided;
8. making a written request to the Office of Pavement Engineering regarding use of a shoulder or a portion of it for traffic maintenance. A copy of the request should be sent to the project manager. The request should include the construction-year AADT, percent trucks of AADT, and the approximate duration of traffic's shoulder use;
9. ensuring that the proposed traffic-control plan is discussed and reviewed during the Preliminary Field Check; and
10. coordinating with public-information officials to inform the public of proposed road closure, detour route, etc.

82-2.02 Plan Development

The TCP should be developed through the phases described below before it can be incorporated into the contract and approved for letting. The following describes the development of the TCP at each project phase.

1. Engineer's Report. The Environmental Policy Team will be responsible for determining the initial work-zone traffic control strategies to be used on the project. These should be shown in the Engineer's Report. If changes are made to the recommendations in the Report, the designer should notify the Environmental Policy Team of these changes.

2. Structure Type and Size (Bridge-Replacement Project) or Grade Review (Sight-Distance Improvement or Small Structure Replacement. At this plan development stage, the designer is responsible for contacting the appropriate district to obtain its input regarding traffic maintenance. Figure 82-2B is a blank memorandum copy which the designer should download, fill in the project information blanks, then transmit to the district. An editable version of this form may also be found on the Department's website at www.in.gov/dot/div/contracts/design/dmforms/. District input should be solicited if a TCP is specified in the Engineer's Report. The district should provide the requested information to the designer.

3. Preliminary Field Check. During the Preliminary Field Check, review the proposed traffic-control strategy against actual and anticipated field conditions and be prepared to perform the following tasks.

    a. drive the local detour;

    b. determine the environmental effects of a crossover or runaround;

    c. estimate the extent and cost of property damage caused by a crossover or runaround, including additional right-of-way requirements and costs;

    d. determine the feasibility of maintaining traffic on the facility (e.g., roadway, bridge) while work is in progress;

    e. evaluate the need for scheduling work activities to avoid traffic delays during peak commuter hours or local events;

    f. determine the effects on project constructability; and

    g. review the physical and operational elements of the TCP with other projects in the area to ensure that there are no conflicts with the proposed TCP.

At the conclusion of this phase, the preliminary geometric design, safety, and capacity analyses should be completed, and suggested plan modifications evaluated and reviewed. The designer should determine the proposed location of all traffic-control elements and special design elements (e.g., runaround, crossovers) and should establish the proposed construction phasing. The designer should contact the district for its input, even if the proposed TCP is recommended in the Engineer's Report.

4. Hearing. The plan and profile, cross-sections, construction schedule and phasing, and impact reports should be completed at this stage. Begin preparation of the required special provisions and the permit process. Prepare an estimate of the time required to re-open the facility (e.g., roadway, bridge) to traffic after construction starts.

5. Final Field Check. Review all issues emerging from the hearing stage and complete subsequent plan modifications. Review the project's physical and operational elements of the TCP with other projects in the area to ensure that there are no conflicts with the proposed TCP. Examples include detouring traffic onto a local road which is scheduled for reconstruction during the same time period or closing a highly-traveled highway during special events or seasons. Coordinate with the Office of Communications so that they can begin to inform the public of road closures or alternate detour routes.

6. District Construction Engineer Review. After design approval, the designer should submit the proposed TCP to the district construction engineer. The district construction engineer will provide written comments or concurrence regarding the proposed TCP to the designer, with a copy to the appropriate Production Management Division office manager. The office manager will provide written comments or concurrence regarding the proposed TCP to the designer. If necessary, the designer will revise the proposed TCP until both district construction engineer and office manager concur.

7. Final Plans Review. Determine and check all quantity estimates. Complete the detail drawings and include all relevant special provisions in the contract documents. Do not show unofficial detour routes in the plans or special provisions.

The Department requires a coordinated team effort to develop and successfully implement a TCP. Figure 82-2A lists the participants involved in each phase of its development.

82-2.03 Traffic-Control Plan Content

The type and size of a project greatly impacts the amount of information required in the TCP. For example, for a traffic-sign project, the TCP may only be a listing of the appropriate INDOT *Standard Drawings*. However, for a freeway reconstruction project, the TCP may include full-size drawings, special details, special provisions, special task forces, etc. The TCP content will be determined on a project-by-project basis. The TCP may include the following.

1. Construction Plan Sheets. A reconstruction project will require detailed plans for accommodating traffic at each construction stage (e.g., specially-built detour, crossovers, staged construction). These plans may include geometric layout details, positive-protection strategies, the traffic-control devices, etc. A smaller project (i.e., partial 3R, traffic signs, signals, or a spot improvement) will rarely require this level of detail. Chapters Fourteen and Fifteen provide the Department's plans-preparation criteria (e.g., sheet sizes, scales, line weights, CADD symbols) which are also applicable to a TCP. The INDOT *Typical Plan Sheets* document provides traffic-maintenance detail sheet examples.

   A traffic-maintenance plan that requires at least one shoulder to carry traffic on a temporary basis during construction should include information regarding shoulder-corrugation installation requirements. A note should be included that reads, "Corrugations shall not be milled into the _____ shoulder between Sta. _____ and Sta. _____ until after traffic is no longer temporarily using the shoulder."

2. Special Provisions. Special provisions are used to explain special procedures, materials, or equipment used in the TCP that are not addressed in the INDOT *Standard Specifications*. The TCP may only consist of special provisions. Prior to developing a new special provision, the designer should first ensure that its requirements do not already appear in the INDOT *Standard Specifications* or recurring special provisions. Chapter Nineteen provides information on the requirements for preparing a special provision.

3. Traffic-Control Devices. Include a complete listing of the traffic-control devices required to direct traffic through the work zone in the TCP. This may include the number of drums, barricades, cones, signs, temporary pavement markings, warning lights, flashing-arrow signs or other devices required to implement the construction. Chapter Seventeen provides the Department's criteria for determining plan quantities.

4. Construction Sequence and Time. The TCP should include a proposed construction sequence.

5. Work Schedule. A special provision should identify restricted work schedules which the contractor will be required to follow (e.g., no construction work during specified hours or days).

6. Telephone Numbers. A special provision should require the contractor to provide names and telephone numbers of the contractor's superintendent and one other responsible employee.

7. Permits. For restricted-lane width, the district Office of Construction will be responsible for coordinating with the Planning Division's Office of Roadway Safety and Mobility after the contract is let to obtain the necessary permits to allow oversize vehicles through the work zone.

8. Agreement or Legal Release. An agreement or legal release may be required before INDOT can use a local facility as a detour route. The designer should initiate this process early in the design of the work-zone traffic control.

9. Media. The designer should inform the Office of Communications as to when and where there will be a major road or ramp closure or detour.

10. Pedestrians and Bicyclists. The TCP should address the safe accommodation of pedestrians and bicyclists through the work area. Construction phasing may need to be scheduled around non-peak pedestrian-traffic times.

11. Local Businesses and Residents. Maintain at least one reasonable access to each site of business establishment or residency. The designer should also ensure that these entities are kept informed of planned street, ramp or driveway closures.

12. Emergency Vehicles. The TCP should address the safe and efficient accommodation of emergency vehicles through the construction area.

13. Checklist. Section 82-7.0 provides a checklist which should be reviewed to ensure that all applicable work-zone traffic-control elements have been addressed in the TCP.

82-2.04 Design Considerations

The objective of the TCP is to provide an implementation strategy that will minimize the adverse effects of traffic disruption on motorists, pedestrians, bicyclists, or workers. Therefore, the designer should consider the following design considerations when developing the TCP. For a more in-depth analysis of these elements, the designer should review Chapter Eighty-one.

82-2.04(01) Engineering

The designer should consider the following engineering elements in developing the TCP.

1. Geometrics. The TCP should provide adequate facilities for a motorist to safely maneuver through the construction area, day or night. The design should avoid frequent and abrupt changes in roadway geometrics, such as lane narrowing, a lane drop, or a transition which

requires a rapid maneuver. Section 82-3.0 provides geometric design criteria for a construction zone.

2. Roadside Safety. Motorist, pedestrian, bicyclist, and worker safety is a priority element of a TCP and should be an integral part of each phase of the construction project (i.e., planning, design, and construction). Section 82-4.0 addresses the roadside-safety issues which are encountered during construction.

3. Highway Capacity. The TCP should, where practical, provide the capacity necessary to maintain an acceptable level-of-service for the traveling public. This may require converting a shoulder to a travel lane, eliminating on-street parking, constructing a temporary lane, opening additional lanes during peak traffic-volume periods, or expanding public transportation. Section 82-5.0 provides further information on highway-capacity issues.

4. Traffic-Control Devices. Traffic-control devices should be included in the TCP to safely direct vehicles through or around the construction zone. Chapter Eighty-three provides guidance on the selection and location of traffic-control devices.

5. Overhead Lighting. The design should maintain existing overhead lighting and consider the need for supplemental roadway lighting at a potentially hazardous site within the work area. Chapter Eighty-three discusses the use of construction-zone lighting.

82-2.04(02) Constructability

The designer should evaluate the construction sequence to identify safety, operational, or logistical problems and to facilitate the timely completion of the project. Some of the elements which should be evaluated include the following:

1. the maneuverability of traffic through horizontal or vertical alignments during all construction phases;

2. the separation of opposing traffic, workers, equipment, or other hazards;

3. the work area which will be used for equipment maneuverability; and

4. the access points to work sites or material-storage sites.

** *PRACTICE POINTER* **

Adequate working space between the traffic and the work area should be provided. This applies especially where construction is phased or if the project includes a temporary runaround.

82-2.04(03) Construction Design

Available construction options that may improve the TCP include the following:

1. the use of special materials (e.g., quick-curing concrete that can support vehicular loads within hours after pouring);

2. the use of special designs (e.g., using a precast box structure instead of a bridge or cast-in-place box structure);

3. scheduling requirements which will reduce traffic disruptions (e.g., working at night and during off-peak traffic-volume hours);

4. project phasing which will allow traffic to use the facility prior to project completion; or

5. contractor cost incentives/disincentive for early or late completion of construction for a facility with a high AADT. For a project with FHWA oversight, a contractor incentive is subject to approval by the FHWA.

Chapter Eighty-one provides additional information on construction alternates.

82-2.04(04) Economic or Business Impact

The designer should consider the economic impacts a TCP may have on road users, adjacent businesses, or residential developments. The designer should consider the following:

1. vehicular travel time;
2. fuel consumption;
3. vehicular wear;
4. air pollution;
5. access to residential developments;
6. patron access to businesses (e.g., restaurants, gas stations, stores);
7. employee or delivery access to commercial developments; and
8. shipments to manufacturing companies.

The designer should also review the TCP to ensure that it does not restrict access to businesses during peak retail shopping periods. For example, a road closure should not be made in the vicinity of a regional retail mall during the period from Thanksgiving to Christmas. Coordination with local businesses, developers, or other land owners should be made early in the development of the TCP. At least one access should be maintained to each development throughout the contract time.

82-2.04(05) Pedestrians and Bicyclists

Address the safe accommodation of pedestrians or bicyclists through the construction zone early in project development. Locations that would warrant pedestrian or bicyclist considerations include the following:

1. where a sidewalk traverses the work zone;

2. where a designated school route traverses the work zone;

3. where significant pedestrian or bicyclist activity or evidence of such activity exists; or

4. where existing land use generates such activity (e.g., park, school, shop).

The considerations to be made in addressing pedestrian or bicyclist accommodation through a construction zone are as follows:

1. physical separation of pedestrians and vehicles where practical;

2. providing temporary lighting for each walkway that is currently lighted;

3. directing pedestrians or bicyclists to a safe location (e.g., the other side of a street) where a pedestrian walkway or bicycle path cannot be provided;

4. staging construction operations such that if there are two walkways they are both not out of service at the same time;

5. planning the construction such that temporary removal of a sidewalk will occur in the shortest practical time or is scheduled around non-peak pedestrian traffic-volume times; or

6. for information on handicapped-accessibility criteria, see Section 51-1.0.

82-3.0 GEOMETRIC DESIGN

The following provides design criteria which apply to temporary crossovers on a divided highway, an existing roadway through a construction zone, or a detour specifically designed for construction project (e.g., crossovers, runaround). These criteria do not apply to a detour over existing routes.

82-3.01 Construction-Zone Design Speed

The construction-zone design speed applies to the design of the geometric elements through the work zone. It does not apply to the regulations that are used for posting the speed limit through the work zone. Regulatory speed limit is discussed in Section 83-2.03. In selecting the construction-zone design speed, the designer should consider the following.

1. Posted Speed Limit. The construction zone design speed should take into account the following:

    a. the posted speed limit of the facility immediately prior to the work zone;

    b. the anticipated posted work-zone speed limit through the work zone (see Section 83-2.03); and

    c. the posted speed limit of the facility before construction begins. The construction-zone design speed should not be more than 15 km/h lower than the posted speed limit prior to construction.

2. Urban or Rural Area. The construction-zone design speed in a rural area should be higher than that in an urban area. This is consistent with the fewer constraints in a rural area (e.g., less development).

3. Terrain. A lower construction-zone design speed may be applicable to a rolling terrain. This is consistent with the higher construction costs as the terrain becomes more rugged.

4. Traffic Volume. The construction-zone design speed may vary according to the traffic volume. Therefore, consider a higher design speed as traffic volume increases.

The designer should work with the appropriate district traffic engineer to establish the construction-zone design speed for an INDOT route, or a local public agency's representative for a local-agency route. The designer should show the construction-zone design speed on the first sheet of the TCP.

If crossovers are used to maintain one lane of traffic in each direction on a rural Interstate route, the following will apply.

1. Use temporary concrete median barrier.

2. Unless the median shoulder is full depth, it is to be removed and replaced with a 1.8-m width section with its pavement design to be requested by the designer.

3. The traffic maintenance should be as shown in Figure 81-3A(0).

4. Shoulder corrugations are to be milled into the new shoulder after traffic is crossed over to the other side.

82-3.02 Lane or Shoulder Width

There should not be a reduction in the roadway-cross-section width through the construction zone. However, this may not be practical. Section 83-3.02 provides the minimum taper rate that should be used on an approach to a lane-width reduction. The following lane and shoulder widths should be used in a construction zone.

1. Divided Highway. For a freeway or other divided highway, maintain a minimum 3.3-m lane width with shoulders of 0.6 m or wider. Under restrictive conditions, however, the designer may consider a 3.0-m lane width if an alternate route is provided for wide vehicles.

2. Undivided Highway. Maintain a minimum 3.0-m lane width and 0.3-m shoulders width.

3. Runaround. Design a runaround with 3.6-m lane widths and 1.8-m shoulder widths.

4. Temporary Crossover. For 1-lane, one-way operations, the lane width should be 5.0 m with 1.5-m shoulder widths. For a multi-lane or multi-directional operation, each lane width should be 3.6 m with 1.5-m shoulder widths.

82-3.03 Transition Taper Rate

A lane closure, lane-width reduction, or lane shift requires the use of a transition taper to safely maneuver traffic around the encroaching restriction. Section 83-3.02 provides the minimum taper length for each taper application in a construction zone (e.g., lane closure, lane shift). Use the construction-zone design speed in selecting the appropriate taper rate from Section 83-3.02.

82-3.04 Sight Distance

For the approach to the first physical indication of the construction zone, the sight distance available to the motorist should be based on the decision-sight-distance criteria provided in Section 42-2.0

and, at a minimum, based on the stopping-sight-distance criteria provided in Section 42-1.0. Through the construction zone itself, the designer should ensure that at least the minimum stopping sight distance is available to the motorist. Unfortunately, the locations of many design features are often dictated by construction operations. However, an element may have an optional location. For example, a lane closure or transition should be located where the approaching motorist has decision sight distance available to the lane closure on transition. Throughout a horizontal curve in the construction area, the designer should check the horizontal clearance (i.e., the middle ordinate) of the horizontal curve using its radius and the minimum stopping sight distance for the construction-zone design speed (see Section 43-4.0). Figure 43-4B provides the horizontal-clearance criteria for each combination of minimum stopping sight distance and curve radius. The designer should also consider the percentage of trucks and other heavy vehicles in determining the controlling sight distance.

Computations must be submitted for horizontal stopping sight distance at the Grade Review or Structure Type and Size stage, or the next plan submission if the project is already beyond the Grade Review or Structure Type and Size stage, for a temporary runaround or other traffic-maintenance means. A statement that a temporary runaround is in accordance with the INDOT *Standard Drawings* is not sufficient to verify that adequate horizontal-alignment stopping sight distance is provided.

Computations must be submitted for intersection sight distance for each traffic-maintenance phase.

82-3.05 Horizontal Curvature

Design the horizontal curvature using the selected construction-zone design speed. Use AASHTO Method 2 for distributing superelevation and side friction to determine the radius and superelevation rate of the horizontal curve. In this method, superelevation is introduced only after the maximum allowable side friction has been reached. If compared to AASHTO Method 5, this approach results in no superelevation on a flatter curve (i.e., maintaining the normal crown through the curve) and a reduced rate of superelevation on a sharper curve. Figure 82-3A, Minimum Radius for Horizontal Curve in Construction Zones, provides the minimum radius (including the radius for retention of the normal crown section) for a horizontal curve through a construction zone based on AASHTO Method 2. For other horizontal-curvature elements (e.g., superelevation transition length), the criteria described in Chapter Forty-three is also applicable to a construction zone.

Where it is necessary to use the shoulder as a travel lane, the shoulder cross slope may be a concern on a horizontal curve (i.e., the slope may be in opposite direction than the superelevated section). One or more of the following options may be considered to alleviate this problem.

1. Rebuild the shoulder so that it has the proper superelevation rate based on the selected construction-zone design speed.

2. Install an advisory-speed plate for the horizontal curve,

3. Install buzz strips in conjunction with Item 2 above in advance of the temporary travel lane (see Figure 83-4A, Flare Rate for Temporary Concrete Median Barrier.

4. Prohibit trucks or other large vehicles from using the temporary travel lane.

5. Detour such large vehicles to other facilities.

82-3.06 Vertical Curvature

Design a sag vertical curve using the selected construction-zone design speed and the comfort criterion provided in Figure 82-3B. The comfort criterion is based on the comfort effect of change in vertical direction through a sag vertical curve because of the combined gravitational and centrifugal forces. The ride through a sag vertical curve is considered comfortable if the centripetal acceleration does not exceed 0.3 m/s^2.

82-3.07 Cut or Fill Slope

Design a temporary cut or fill slope to satisfy the design criteria shown in Chapter Fifty-three and Section 45-3.0. However, a 3:1 fill slope may be used where there is sufficient clear-zone width available at the bottom of the slope (see Section 82-4.04). The use of a steeper fill slope may be considered, but it may require the installation of a roadside barrier.

Although a detour rarely involves excavation, a 3:1 cut slope is acceptable in place of the flatter slope required in Chapter Fifty-three. The use of a slope steeper than 3:1 for a cut depth of less than 3.0 m may be acceptable under restrictive conditions.

The anticipated traffic volume and the length of time that the detour will be in place should be considered in determining the final cut or fill slope. Stable embankment material must be used and placed in accordance with the INDOT *Standard Specifications*.

Drainage should be considered between the work zone and the traffic in establishing the phases of construction.

82-3.08 Maximum Grade

The vertical grade should be designed using the 3R criteria for the appropriate functional classification, rural or urban environment, and construction-zone design speed.

82-3.09 Through-Lane Cross Slope

The 3R criteria should be used for the appropriate functional classification and rural or urban environment. If the existing shoulder is used for through traffic, a 4% cross slope will be acceptable.

82-3.10 Vertical Clearances

The 3R criteria should be used for the appropriate functional classification and rural or urban environment.

If the design for a temporary runaround or other traffic-maintenance consideration excluding a detour over existing roads is not in accordance with the criteria for Level One elements, a design exception will be required.

82-4.0 ROADSIDE SAFETY

Through a construction zone, a motorist is often exposed to numerous hazards (e.g., restrictive geometrics, construction equipment, opposing traffic). A complete elimination of construction-zone hazards is impractical. A motorist's exposure to potential hazards should be reduced. The following lists roadside-safety criteria which apply only to the roadside elements within the construction zone. These criteria do not apply to a detour over existing routes.

82-4.01 Positive Protection [Revised Nov. 2009]

The designer should consider a traffic-control method which does not require the use of positive protection, minimizes the hazard exposure, or maximizes the separation of workers and traffic. However, positive protection is often required.

Psitive-protection devices should be considered in each work-zone situation that places workers at increased risk from motorized traffic, and where positive-protection devices offer the highest potential for increased safety for workers and road users. The decision regarding the use of positive protection is to be documented and placed in the project file. Locations where positive protection should be considered include the following:

1. exposed end of temporary concrete barrier;
2. untreated guardrail end in a 2-way, 2-lane operation;

3. bridge pier;
4. bridge-railing end;
5. structure foundation (e.g., bridge falsework, sign foundation);
6. excavation or rock cut;
7. gap in median between dual bridges;
8. pavement edge or shoulder drop-off in excess of 300 mm; or
9. other location where construction will increase the potential hazards of existing conditions.

Each location listed above should be addressed separately in the documentation. Because each TCP is project-specific, the Department has not developed criteria for positive protection within a construction zone. However, considerations for assessing the need for positive protection are as follows:

1. duration of construction activity (14 days or less);
2. traffic volume (including seasonal and special-event fluctuations);
3. nature of hazard;
4. length and depth of drop-off;
5. construction-zone design speed;
6. highway functional classification;
7. length of hazard;
8. proximity between traffic and construction workers;
9. proximity between traffic and construction equipment;
10. adverse geometrics which may increase the likelihood of a run-off-the-road vehicle;
11. two-way traffic on one roadway of a divided highway;
12. transition area at crossover;
13. lane closure or lane transition;
14. work zone that provides workers no means of escape from motorists; or
15. construction-zone design speed is 70 km/h or higher.

Other considerations may apply, as the above list is not considered to be all-inclusive. The decision regarding the use of positive protection should be documented and placed in the project file.

82-4.02 Appurtenance Type

In addition to Chapter Forty-nine and the INDOT *Standard Drawings*, the following provides additional information on roadside-safety appurtenances.

Positive guidance for crossed-over two-lane two-way traffic should be provided as follows.

1. Temporary concrete barrier and temporary solid yellow lines are to be used on a freeway.

2. Temporary tubular markers and temporary double solid yellow lines are to be used on a multi-lane divided roadway that is not a freeway.

3. Temporary double solid yellow lines are to be used on an urban or rural multi-lane undivided roadway.

Temporary asphalt divider is not to be used for separating traffic.

82-4.02(01) Guardrail

A temporary guardrail installation for an Interstate-route project should be in accordance with the permanent installation criteria described in Chapter Forty-nine and the INDOT *Standard Drawings*, except as shown in Figure 82-4B, Work-Zone Clear-Zone Width (m). For short-term construction, the installation of new temporary guardrail is not practical.

The following should be used to determine the temporary guardrail length at each corner of a temporary bridge in a two-lane runaround. For a construction-zone design speed of 70 km/h or lower, the minimum guardrail length is 15.24 m. For a construction zone design-speed of 80 km/h or higher, the minimum guardrail length is 30.48 m.

A temporary guardrail run should continue until the guardrail warrant for an embankment as shown in Section 49-4.04 is satisfied. The design speed, and not the construction-zone design speed, should be used to determine the guardrail warrant for an embankment.

82-4.02(02) Temporary Traffic Barrier (TTB)

A TTB is used to provide protection to the motorist and the workers in the work zone. The primary functions of TTB are as follows:

1. to separate two-way traffic;
2. to protect workers and pedestrians;
3. to keep traffic from entering a work area (e.g., excavation, storage site); and
4. to protect construction elements (e.g., bridge falsework, exposed objects).

1. <u>Types of TTB</u>.

    a. Type 1. This type is used only to separate two-way traffic.

    b. Type 2. This type is used to separate traffic from the work zone. It should be used to protect traffic from an obstruction, including an elevation differential of greater than

150 mm, which is inside the construction clear zone. It should also be used to shield traffic from an extreme hazard during construction that may necessitate consideration of a barrier between the construction clear zone and the permanent clear zone. For this situation, the designer should consider the construction-zone design speed, the extent of the obstruction, and the potential for an elevation differential, and use engineering judgment in determining whether a TTB is necessary.

c. Type 3. This is type 1 TTB which is to be left in place upon completion of the contract and becomes the property of the Department.

d. Type 4. This type is used as a readily-movable device to accommodate the shifting of traffic lanes possibly on a daily basis to better facilitate the directional distribution or other changing traffic volume during a day's peak traffic-volume hours. The barrier layout and signage for each phase, a staging-area diagram, and the location of the barrier-moving apparatus when it is not in use should be shown on the TCP. The size of the barrier-moving apparatus should be taken as 15 m long by 5 m wide.

2. <u>Construction Clear Zone and Flaring Considerations</u>. The terminal end of a TTB type 1, 2, or 4 should be flared away from the traveled way to a point outside the construction clear zone. Construction clear-zone width is shown in Figure 82-4B. The potentially hazardous conditions found within a construction zone warrant the use of considerable judgment when applying one of these widths. It is not necessary to adjust such width for horizontal curvature.

   Figure 82-4A, Flare Rate for Temporary Traffic Barrier, should be used to determine the desirable flare rate for the TTB based on the construction-zone design speed, and not a lower worksite speed limit.

   If a flared portion of TTB type 1 cannot be designed to end outside the construction clear zone, an acceptable construction-zone energy absorbing terminal as described in Section 83-4.02(03), Item 1, is required. A unit which has been successfully crash tested in accordance with NCHRP 350 Test Level 2 should be specified if the construction-zone design speed is 70 km/h or lower. A unit which has been successfully crash tested in accordance with NCHRP 350 Test Level 3 should be specified if the construction zone design speed is 80 km/h or higher.

   For a TTB type 2 or 4, if a field condition such as a public-road approach or drive renders the desirable flare rate impractical, the flare rate may range between 10:1 and 6:1. For a TTB type 2, the flare may be eliminated if the sharper flare rate cannot be attained. Such location and flare treatment should be shown on the TCP.

3. <u>Glare Screen</u>. A glare screen may be used in combination with TTB type 1 or type 3 to

eliminate headlight glare from opposing traffic. The application is at a crossover transition or in a 2-way, 2-lane operation. Guidance regarding consideration of a glare screen is described in Section 49-4.05(03), though INDOT has not adopted specific warrants for the use of a glare screen.

4. Anchoring. TTB type 1, 2, or 3 should be anchored where indicated on the INDOT *Standard Drawings*. The locations of anchored TTB should be shown on the plans.

5. Traffic-Control-Plan Information. Types, locations, and quantities of TTB, including locations and quantities of glare screens and energy absorbing terminals, along with flare rates should be shown on the TCP for each traffic-maintenance phase.

See Section 17-3.13 for information regarding determination of pay quantities.

82-4.02(03) End Treatment or Impact Attenuator

The following discusses the end treatments or impact attenuators that may be used.

1. Energy-Absorbing Terminal. The use of a construction-zone energy-absorbing terminal should be based on National Cooperative Highway Research Program *Report 350* Test Levels. The Test Level 3 (TL-3) terminal should be specified for an Interstate or other route with a construction-zone speed limit of 50 mph or higher. The TL-2 terminal should be specified for a non-interstate route with a construction-zone speed limit of 45 mph or lower. If a lower temporary worksite speed limit is to occasionally apply, each terminal's Test Level should still correspond to that for the construction-zone speed limit. The location of each terminal with its Test Level should be shown on the TCP.

2. Guardrail. The treatment for an exposed end of guardrail includes the following:

   a. Connection to existing barrier;
   b. using an acceptable end treatment. Use the construction year AADT, and see Section 49-5.04(01);
   c. flaring the end to a point outside the construction clear zone; or
   d. burying the end in the backslope.

3. Gravel-Barrel Array. Due to the size of the array, a gravel-barrel array has limited application in a work zone.

4. Other. Other INDOT-approved end treatments may be applicable. Chapter Forty-nine provides information on some of the end treatments used by the Department. Provide the most applicable end treatment consistent with cost and geometric considerations.

82-4.03 Design/Layout

Where practical, a temporary roadside-safety appurtenance should be designed and located as determined in Chapter Forty-nine (e.g., deflection distance, length of need). However, it is not cost-effective to satisfy the permanent-installation criteria due to the limited time a motorist is exposed to a construction hazard. The designer will need to evaluate the exposure time of the hazard in determining the need for installing a roadside-safety appurtenance. The following provide alternatives the designer may consider in designing and locating a temporary roadside-safety appurtenance within a construction zone.

1. Construction Clear Zone. Applying the clear-zone width as described in Chapter Forty-nine to a work zone is often impractical. Therefore, construction clear-zone width is shown in Figure 82-4B. However, the potentially hazardous conditions found within a construction zone warrant the use of engineering judgment in applying the construction clear-zone distance. It is not necessary to adjust the clear-zone-width value shown in Figure 82-4B for horizontal curvature.

2. Shoulder Widening. Where a temporary barrier is placed adjacent to a shoulder, it is not necessary to provide extra shoulder widening.

3. Flare Rate. A TCB terminal should be flared beyond the traveled way to a point outside the construction clear zone. Figure 82-4A provides the desirable flare rate for the TCB based on the selected construction-zone design speed. The designer should provide the flare rate unless extenuating circumstances render it impractical (e.g., stop condition, drive, intersection). See Section 82-4.03.

4. Opening. An opening in the barrier should be avoided. Where an opening is necessary, the barrier end should be shielded with acceptable end treatment as discussed in Section 83-4.03(03).

82-4.04 Pavement Edge Drop-off on Multilane Divided Highway

A pavement edge drop-off should be avoided immediately adjacent to a lane open to traffic during a construction activity such as shoulder rehabilitation or crossover construction.

In developing a traffic-maintenance plan, the desirable option is to close the lane adjacent to an edge drop-off. This will ensure that the edge drop-off is located outside the construction clear zone.

If the traffic lane adjacent to the edge drop-off cannot be closed for an extended period of time, a full-depth rehabilitated shoulder section should be provided that can be placed to within 75 mm of the top of pavement elevation before the end of a day's work. This should be done, for example, where the shoulder work is to be done at night so that all of the existing traffic lanes can be kept open during daylight hours. The pavement section required to fill a shoulder drop-off to within 75 mm of the top before exposure to adjacent traffic should be obtained from the Office of Pavement Engineering. A unique special provision will be required to address the time frame imposed on the contractor for bringing the shoulder paving up to the required grade. Also, drums should be placed on the shoulder drop-off, spaced as shown in Figure 83-3D, Suggested Maximum Spacing of Channelization Devices.

Where it is not feasible to limit exposure to the edge drop-off by the means described above, and the edge drop-off is greater than 75 mm, one of the mitigating measures should be considered as follows:

1. Placing a temporary wedge of material along the face of the drop-off. The wedge should consist of asphalt material placed at a 45 deg angle or flatter. Warning signs should be placed in advance of and throughout the treatment. A 150-mm width solid edge line should be used to delineate the edge of the travel lane.

2. Placing drums along the traffic side of the drop-off and maintaining, if practical, a 1-m width buffer between the edge of the travel lane and the drop-off. Warning signs should be placed in advance of and throughout the treatment.

3. Installing a temporary concrete barrier or other acceptable positive protection device with a buffer between the barrier face and the traveled way. An acceptable crashworthy terminal or flared barrier should be installed at the upstream end of the section. For nighttime use, standard delineation devices must supplement the barrier. Specifying the use of a temporary movable concrete barrier system will involve the use of proprietary materials.

If the work is to include deep milling or asphalt-pavement replacement and the drop-off between adjacent lanes is greater than 40 mm, mitigating measure No. 1 or No. 2 should be considered.

82-5.0 HIGHWAY CAPACITY

82-5.01 Traffic-Capacity Analysis

The need for a traffic-capacity analysis during the development of the TCP will be determined on a project-by-project basis. A freeway reconstruction project is a candidate for analysis, as is another project type under similar conditions. Maintaining an acceptable level-of-service during construction is especially important on a freeway or other high-speed rural highway.

The operational elements of a facility under construction (e.g., lane segments, ramp, intersection) should maintain a level-of-service which is not less than that provided by the facility prior to construction, although this is not always attainable. Achieving this may require the following:

1. converting a shoulder to a travel lane;
2. eliminating on-street parking (during peak traffic-volume hours or at all times);
3. constructing a temporary lane;
4. opening additional lanes during peak traffic-volume periods;
5. providing public transportation;
6. constructing a jug-handle type configuration for an indirect left-turn at an intersection;
7. closing or metering ramps at an interchange;
8. providing a turnout along long, restrictive stretch of highway construction;
9. constructing a passing blister at a T intersection;
10. providing a two-way, left-turn lane on an urban facility;
11. adjusting signal phasing and timing at an intersection;
12. providing an additional turn lane at an intersection;
13. lengthening a turn-lane storage bay;
14. adjusting acceleration or deceleration length at an interchange ramp;
15. closing an intersection;
16. restricting turns at an intersection;
17. providing extra pavement width;
18. providing signal or flagger control in a 1-lane, two-way operation;
19. public information; or
20. providing a temporary ramp connection.

82-5.02 Queuing Analysis

A TCP developed for a freeway reconstruction project should include, at a minimum, a queuing analysis to determine the anticipated traffic backups at particular times of the day. The results of the queuing analysis should be included with the proposed TCP and should be used to determine whether or not to consider the following:

1. restricting construction operations to off-peak traffic-volume hours or nighttime;
2. closing a ramp;
3. using alternate routes;
4. developing public relations strategies; or
5. temporary widening for an extra lane or for roadway capacity.

If a queuing analysis is required, the designer should use the FHWA computer program QUEWZ or other approved program to accomplish the task. QUEWZ is designed to evaluate a freeway work zone, but the designer may find it useful for another type of highway with 4 or more lanes. Section 81-4.0 provides additional information on the program. The program can provide the following:

1. estimation of vehicular capacity through a work zone;
2. calculation of average speed;
3. calculation of delay through a lane-closure section;
4. calculation of queue length;
5. estimate of percentage of diverted traffic; and
6. total user cost.

82-6.0 APPLICATIONS

Section 81-2.0 discusses the factors to consider in determining which construction application to use. The following provides the design considerations for such applications.

82-6.01 Lane or Shoulder Closure

In addition to the INDOT *Standard Drawings*, the designer should consider the following for a lane or shoulder closure.

1. Taper. A lane closure, lane-width reduction, or lane shift requires the use of a transition taper to safely shift traffic around the encroaching restriction. The designer should review Sections 82-3.03 and 83-3.02 regarding a transition taper.

2. Sight Distance. Provide decision sight distance to the beginning of the lane closure or transition. Section 82-3.04 provides additional information on sight distance within a construction zone.

3. Lane Width. Section 82-3.02 provides the Department's criteria for reduced lane width.

4. Shoulder Usage as Travel Lane. If the TMP involves placement of traffic on the shoulder or a portion of the shoulder, the designer should make a written request to the Office of Pavement Engineering, regarding the shoulder's use. The construction year AADT, percent trucks of AADT, and the approximate length of time during which traffic is expected to use the shoulder should be provided.

   The median shoulder should be replaced with a 1.8-m width section. See the INDOT *Standard Drawings*. The proposed median shoulder for the new pavement section constructed in the first phase should also be 1.8 m wide. Its pavement design should be provided by the Office of Pavement Engineering. Such shoulder will carry traffic during subsequent phases. The entire 1.8-m width should remain in place. Shoulder corrugations are to be milled into the new shoulder after traffic is crossed over to the other roadway.

5. Lane Closure. The length of a lane closure should be held to a minimum so that the motorist is not passing a long section of a closed lane where no work activity is occurring.

6. Roadside Safety. A roadside barrier should not be used as a transition device. A transition should be provided with the appropriate traffic-control devices (see Chapter Eighty-three). Provide sufficient distance between the transition devices and roadside barrier to allow an errant motorist to safely return to the traveled way. A roadside barrier (e.g., temporary traffic barrier) may be used as a channelization device beyond the taper. Where shifting traffic to be next to a roadside barrier, the shy distance, as discussed in Section 49-5.0, should be provided.

7. Traffic-Control Devices. Chapter Eighty-three and the INDOT *Standard Drawings* provide the Department's criteria for the placement of traffic-control devices.

8. Bridge. Figure 82-6A, Lane Closure on a Bridge, illustrates a TCP for closing a lane on a bridge-reconstruction or -rehabilitation project. Figure 82-6A is applicable to a 9.0-m wide structure on a 4-lane divided facility. The designer will need to adjust the design for another situation. Figure 82-6A provides the detail for a left-lane closure. This detail may also be used for a right-lane closure.

9. Roadway Under Overpass Structure. Work may include full-depth bridge-deck patching, structure removal or placement not protected by a bridge railing, or other work activity that affects under passing lanes that are open to traffic. Such work may not take place directly above such lanes. Appropriate warning signs and traffic-control devices should be provided on the under passing roadway to warn motorists of lane closures for such work. Such signs and devices are required if no work is being done on the under passing roadway.

82-6.02 Two-Way Traffic on a Divided Highway

The following provides the considerations for where two-way traffic is to be placed onto a single roadway of a divided highway.

1. Length. The optimum segment length is less than 6 km. Where the segment length exceeds 6 to 8 km, operational efficiency may be severely reduced as traffic backs up behind slower vehicles.

2. Positive Protection.

a. Freeway. Temporary traffic barrier along with temporary solid yellow lines as shown on the INDOT *Standard Drawings* should be used within each crossover and between the crossovers to separate opposing traffic.

b. Other Multilane Roadway. Tubular markers should be used to enhance the delineation and separation of the opposing traffic flows on each side of a temporary double solid yellow line. The tubular markers are placed onto the pavement between the solid yellow lines as shown on the INDOT *Standard Drawings*.

Where construction activities require temporary revision of traffic patterns within the construction zone to two-lane two-way operation at or near an intersection, the end of the temporary double solid yellow line should match the end of the existing broken white lane line.

For a roadway with lanes which are narrower than 3.6 m without paved or aggregate shoulders, compacted aggregate size No. 73 is required where slope and ditch conditions permit, as shown on the INDOT *Standard Drawings*. Such conditions must be assessed when developing the traffic-control plan. The cross slope of each temporary compacted aggregate shoulder is to be as shown on the INDOT *Standard Drawings*. Quantities for the compacted aggregate must be determined.

3. <u>Roadside Safety</u>. Where traffic is directed onto the opposing roadway, the designer should consider the effect this will have on the operational characteristics of roadside appurtenances. For example, an existing trailing end of an unprotected bridge railing may require an approach-guardrail transition or impact attenuator. A blunt guardrail terminal may need to be protected with an acceptable end treatment.

4. <u>Crossover</u>. The following should be considered in the design of a crossover.

a. The taper for a lane drop should not be contiguous with the crossover. See Section 82-3.03 for the acceptable taper rate and length.

b. The crossover should have a construction-zone design speed that is not more than 15 km/h (10 mph) below the posted speed limit before the construction zone; see Section 82-3.01.

c. The crossover design should accommodate the anticipated truck traffic of the roadway (e.g., surfacing width, loads).

d. A clear recovery area should be provided adjacent to the crossover; see Section 82-4.04.

e. Temporary traffic barrier and the excessive use of traffic-control devices cannot compensate for a poor geometric design of a crossover.

f. Provide signing prior to the crossover to indicate the length of the 2-way, 2-lane section. In addition, signing may be provided within the 2-lane section indicating the remaining distance of the 2-lane section.

5. Interchange. Maintain access to a freeway interchange ramp if the work space is in the lane adjacent to the ramps. An additional crossover for the purpose of maintaining full interchange access may be required. If interchange access is not feasible or presents a capacity problem, a ramp should be closed using proper detour signing for alternative routes. Where a ramp closure is deemed necessary, early coordination should be conducted with local officials having jurisdiction over the affected crossroad or street. The designer should also check that sufficient deceleration or acceleration distance is maintained where there is work in the vicinity of an interchange ramp. If this is not practical, additional traffic control devices or closing the ramp may be required. The designer should review the safety aspects and conduct a capacity analysis to determine the appropriate action.

7. Capacity. Conduct a capacity analysis to ensure that traffic can be reasonably handled in the one lane. If not, an alternate construction application should be considered (e.g., lane shift to the shoulder).

   The needs of a left-turning motorist should be considered in developing a phased-construction scheme that reduces a 4-lane road to one lane in each direction.

82-6.03 Interstate-Highway Lane Closure

Past work-zone traffic-maintenance practices should be consolidated with new requirements to eliminate or reduce traffic delay caused by a work zone on an Interstate route. Central to this consolidation is managing the capacity to maintain traffic flow. Ultimately this will enhance customer satisfaction while traveling through such a work zone.

1. General Requirements. Figure 82-6B, Interstate-Route Lane-Closure Policy – Statewide, and Figure 82-6C, Interstate-Route Lane-Closure Policy – Selected Urban Areas, define the allowable times of the week or day during which lanes may be closed on an Interstate route. This policy is based on the threshold of lane restrictions which may generate up to a 1.6-km queue or 10-min road user delay, and applies to each contracted expansion, preventative-maintenance, or planned-maintenance activity, except for a work activity denoted in INDOT's *Work Management System as Performance Standards* performed by INDOT personnel.

At the times when an Interstate route is designated as an alternate or detour route for another Interstate route, the allowable times for lane closure shown in the figures will not apply. Only work designated as an emergency may be performed during this time.

2. Determining Lane Closure Based on Maps in Figures. Figures 82-6B and 82-6C illustrate where and at what times a restriction may be present along a rural portion of an Interstate route.

Time descriptions are defined as follows:

a. Anytime. One lane may always be closed in each direction.

b. Weekend or Nighttime Only. One lane may be closed in each direction from Friday 9:00 p.m. through Monday 6:00 a.m., and weekdays from 9:00 p.m. to 6:00 a.m. along a route with significant commuter traffic.

c. Weekday or Nighttime Only. One lane may be closed in each direction except from Friday 6:00 a.m. to Sunday 9:00 p.m. along a route which experiences significant increases in traffic during the weekends.

d. Nighttime. One lane may be closed in each direction nightly from 9:00 p.m. to 6:00 a.m. along a route with heavy traffic where a queue longer than 1.6 km can be expected during the daylight hours.

e. Executive Approval. Such approval is required for one lane to be closed in each direction along a rural four-lane route with Average Annual Daily Traffic (AADT) greater than 50,000. Except for a condition designated as an emergency, approval by the Chief Engineer for a Production Management Division-developed project, or the District Operations and Traffic Management Deputy Director for a district-developed project, is required before a lane closure may be shown on the TCP.

f. Minimum Two Lanes in Each Direction. A minimum of two lanes in each direction should be open at all times along an urban route with six total lanes and AADT greater than 100,000.

g. Minimum Three Lanes in Each Direction. A minimum of three lanes in each direction should be open at all times along an urban route with eight total lanes or more.

3. Determining Lane Closure Independent of Maps in Figures. If an operation is to restrict or extend a lane closure during times not shown on Figure 82-6B or 82-6C, the designer or planner should complete a quantitative analysis and a TMP with the request for an exception.

For each repair deemed an emergency, see Item 6 below.

The Office of Environmental Services' Environmental Policy Team, or district Office of Design should analyze the impact on the motoring public of a proposed lane closure not permitted by Figure 82-6B or 82-6C.

For contract work, the analysis should occur during the planning process after the pavement recommendation has been formulated, or if the need for bridge work has been determined. The analysis should always occur before beginning scoping of the final design.

For a Design-Build project, the Traffic Management Plan will be completed, approved, and reflected in the scope of services.

Analysis of a permit or force-account work-zone impact should occur prior to the implementation of a lane restriction.

4. <u>Qualitative Analysis</u>. A quantitative analysis should be performed to determine the queue length that will be generated if a lane closure is proposed for times not shown on Figure 82-6B or 82-6C.

   a. Projected Queue Shorter than Threshold Length. The final development process may commence. Documentation of the analysis must be retained on file. A work zone strategy chosen that will result in impacts of less than the allowable delay thresholds but increases the project cost by 20% or $1,000,000 should be submitted to the Chief Engineer for approval.

   b. Projected Queue Equal to or Longer than Threshold length. An exception request should be submitted to the Chief Engineer or Deputy Commissioner of Highway Management. The exception request should identify the alternative selected as the preferred option and the reasoning for the selection. The exception request should also address the impact on the current INSTIP program if the request were to be denied.

5. <u>Traffic Management Plan (TMP)</u>. The TMP should be completed for the strategy selected and should incorporate the applicable additional elements as follows:

   a. consideration of stakeholders' needs during the decision-making process;

   b. incident-management strategies;

   c. public-relations campaign; and

d. identification of alternate routes.

6. Emergency Repairs. Repair work deemed as an emergency which occur at times not shown on Figure 82-6B or 82-6C will not require prior approval before a lane closure action is taken. Such work includes, but is not limited to, pavement or bridge-deck failure, bridge-structure impact damage, roadside appurtenance, or slope stability. Notification of the closure must satisfy current Departmental procedures.

7. Routine District Maintenance. Some non-contractual routine maintenance activities, such as crack sealing, pavement markings, raised-pavement-markers restoration, etc., are performed on a recurring basis by district maintenance forces. Such activities are exempt from this policy and are addressed under a separate *District Maintenance Interstate Lane Closure Policy* developed by the districts and the Highway Operations Division.

8. Queue Analysis. The criterion used to determine the impact of a proposed work zone will be queue length. QuickZone, Quewz-92, Synchro/Simtraffic, Corsim, or a similar computer program may be used to model the expected queue that may be generated. Multiple stages of construction should be analyzed for each traffic-maintenance phase. The speed limit used in the computer models should be the posted legal construction-zone speed limit. Volume data supplied by INDOT for input into the models should be current (not older than three years), should account for seasonal traffic surges that may occur during construction, and should reflect current regional traffic patterns. Traffic volume should be expanded to the construction-year level through the use of growth factors. In an urban area where congestion occurs under normal unrestricted conditions, the queue length should be considered.

Use of a microscopic model (Synchro/Simtraffic, Corsim, etc.) is encouraged for modeling of a work zone queue. The effect of a significant ramp merge on a queue should be included in the model.

A vehicle will be considered part of a queue if its average operating speed is approximately 15 km/h or lower. Discretion is required during both the analysis portion and field evaluation of the implemented work zone in determining what constitutes a queue. A condition that causes driver frustration due to stop-and-go operations should be considered a queue.

The following thresholds should be used for the evaluation of a queue length as determined by the computer model.

a. For a queue shorter than 1.6 km, the work zone impacts are acceptable.

b. For a queue of 1.6 km or longer but shorter than 2.5 km, the work-zone impacts are acceptable if the queue length exceeds 1.6 km for 2 h or less. Where a queue is expected, additional advanced work-zone warning signing should be specified.

c. For a queue of 1.6 km or longer for more than 2 h, or for a queue of 2.5 km or longer for any period of time, the work-zone impacts are unacceptable. Alternate strategies should be considered based on this policy.

82-6.04 Runaround or Detour

In addition to the criteria shown on the INDOT *Standard Drawings*, a temporary runaround or specially-built detour should satisfy the geometric and roadside-safety criteria provided in Sections 82-3.0 and 82-4.0.

The embankment for a temporary runaround should be shown on the mainline cross sections.

If the AADT is 5,000 or greater, or if the percent trucks is 10% or greater, a project-specific pavement design is required for a temporary runaround. See the INDOT *Standard Drawings* for the pavement section to be used if the AADT is less than 5000, or if the percentage of trucks is less than 10%.

** *PRACTICE POINTER* **

Unofficial detour routes should not be shown on the plans or in the special provisions.

A temporary runaround should be in accordance with the design criteria included herein. The following Level One elements should satisfy the criteria as follows.

	Element	Design Criterion
1.	Design speed	Section 82-3.01
2.	Lane width	Section 82-3.02
3.	Shoulder width	Section 82-3.02
4.	Bridge width	Standard Specifications Section 713.04
5.	Structural capacity	Standard Specifications Section 713.04
6.	Horizontal curvature	Figure 82-3A

7.	Superelevation transition length	Section 82-3.05 and Chapter 43
8a.	Stopping sight distance at horizontal curve	Section 82-3.04. Design speed should be used in the construction zone. Section 43-4.0
8b.	Stopping sight distance at vertical curve	Sag: Section 82-3.06; Crest: Section 82-3.04 and Chapter 44.
9.	Maximum grade	3R criteria for the design speed for the construction zone, appropriate functional classification, and rural or urban environment.
10.	Through lane cross slope	3R criteria for the appropriate functional classification and rural or urban environment. If the existing shoulder is used for through traffic, 4% cross slope will be acceptable.
11.	Superelevation rate	Section 82-3.05
12.	Vertical clearance	3R criteria for the appropriate functional classification.
13.	Americans with Disabilities Act requirements	Section 51-1.08, where sidewalk exists prior to construction.
14.	Bridge-railing safety performance	Standard Specifications Section 713.04

If the design for a temporary runaround or other traffic-maintenance means does not satisfy the above criteria, a design exception must be requested. The procedure established in Section 40-8.0 should be followed.

The INDOT reviewer should verify that the above criteria are satisfied as part of the limited review of a consultant-designed project.

A TCP checklist is shown as Figure 82-7A. An editable version of this form may also be found on the Department's website at www.in.gov/dot/div/contracts/design/dmforms/.

Participant	Project Stage				
	Scoping of Project	Prelim. Field Check	Hearing	Final Field Check	Final Plan Review
Designer	X	X	X	X	X
Office of Environmental Services	X	X	X	X	X
Consultant (if applicable)		X	X	X	X
District	X	X		X	X
Federal Highway Administration (if applicable)	X	X		X	
Communications Division (if applicable)	X		X	X	
Local Public Agency (City or Town, County, School, Fire Department)	X	X	X		X
Highway Operations Division (TMP)	X	X		X	

PARTICIPANTS DURING TRAFFIC-CONTROL-PLAN DEVELOPMENT

Figure 82-2A

TRAFFIC MAINTENANCE QUESTIONNAIRE
Metric-Units Project

(Date)__________________

MEMORANDUM

TO: ________________________
District Deputy Director

ATTENTION: ________________________
District Traffic Office Manager

ATTENTION: ________________________
District Design Office Manager

FROM: ________________________
Project Manager

SUBJECT: Traffic Maintenance for Metric-Units Project

Route: __________________________
Des.: ____________
Project No.: __________________________
Bridge File: __________________________
Location: __________________________
County: __________________________
Description: ____

We are preparing plans for the above noted project and are in the process of evaluating the relative merits of a temporary bridge and runaround, maintaining traffic through the project limits, or a detour during the construction period. In order that district input may be considered in this decision, we ask that you complete the blanks in this memorandum and return it to:

____
Project Manager
Indiana Department of Transportation
100 North Senate Ave., Room N642
Indianapolis, IN 46204-2216

If a detour is recommended, please submit the official detour map and signage with this memorandum with the blanks filled in. If the official detour route is totally over local roads, please initiate early coordination with the affected local public agency or agencies regarding the unofficial detour route.

The Engineer's Report recommended the following:
a temporary runaround should be used;
traffic should be maintained through the project limits;
an official detour should be used.

The AADT during the construction year is ___________

A. TRAFFIC-MAINTENANCE OPTIONS ANALYSIS

1. OPTION 1: TEMPORARY RUNAROUND

RUNAROUND COMPUTATIONS FURNISHED BY DESIGNER

Length of Runaround, m* x Cost per Meter**	_______ m x $ ________ = $ ______________
Length of Temporary Bridge x $3,000/m or Cost of Pipe	_______ m x $3,000 = $ ______________ $ ______________
Total Runaround Cost (Total Cost Option 1)	$ ______________

* Length of Runaround = Distance from tie-in point to tie-in point minus Length of Temporary Bridge.

** For average fill height ≤ 2 m, use $420/m
For average fill height > 2 m, increase as necessary

2. OPTION 2: TRAFFIC MAINTAINED THROUGH PROJECT LIMITS

Length of Roadway Treatment, m* x Cost per Meter*	_______ m x $ ________ = $ ______________
Length of Temporary Concrete Barrier x Cost per Meter	_______ m x $ ________= $ ______________
Cost of Crossovers	$ ______________
Total Maintained-Traffic Cost (Total Cost Option 2)	$ ______________

3. OPTION 3: INDOT-ROUTES OFFICIAL DETOUR

a. Best available official detour route over INDOT routes:

____

____

b. Extra distance to be traveled by through traffic using this route: _____ km

c. Percent of the traffic which would use this detour route: ______________________

d. Road(s) that would be used as an unofficial detour route:

____

____

(1) Existing condition and type of pavement for each road, (i.e., good, very good, rutted, gravel, asphalt, etc.)

____

____

(2) Distance over the above unofficial detour route: ______ km

INDOT-ROUTES OFFICIAL-DETOUR COMPUTATIONS

Detour	Through	Local
Detour Duration (days)		
Extra Distance (km)		
Vehicles per Day		
User Cost per Kilometer	$0.20	$0.20
Total User Cost	$_________	$_________

User Cost = Detour Duration x Extra Distance x Vehicles per Day x $0.16/km

e. Total User Cost = Through User Cost + Local User Cost. Therefore, Total User Cost = $____________.

f. Estimated payment to local public agencies due to use of unofficial detour route = $____________.

Total Cost Option 3 (e + f) $_____________

4. OPTION 4: LOCAL-ROADS OFFICIAL DETOUR

a. Best available official detour route over local roads. It is feasible for this route to include one or more INDOT routes.

____

____

____

b. Extra distance to be traveled by through traffic using this route: _____ km

c. Percent of the traffic which would use this detour route: _______ %

d. Cost to upgrade the local roads to accommodate INDOT traffic:
$ _________________

e. Existing condition and type of pavement for each road. (i.e., good, very good, rutted, gravel, asphalt, etc.)

____

____

LOCAL-ROADS OFFICIAL DETOUR COMPUTATIONS

Detour	Through	Local
Detour Duration (days)		
Extra Distance (km)		
Vehicles per Day		
User Cost per Kilometer	$0.20	$0.20
User Cost	$_________	$_________
Cost to Improve Local Roads (See Item 3b)	$_________	N / A

User cost = Detour Duration x Extra Distance x Vehicles per Day x $0.20/km

Total User cost = Through User Cost + Local User Cost + Cost to Improve Local Roads. Therefore, Total Cost Option 4 = $________________

B. AFFECTS OF PROJECT WORK ON PUBLIC SERVICES

1. TIME DELAYS
   Fire and police protection: ______ min
   Emergency medical service: ______ min
   Postal service: ______ min

2. SCHOOL BUSES
   Number of school buses using the facility per day: _____
   Additional travel distance required per bus: ______ km
   Total additional school-bus travel distance required ______ km

3. BUSINESSES AND PUBLIC FACILITIES
   Businesses or public facilities which are sensitive to the presence of this road work, and the degree of impact the work would have:
   ____
   ____
   ____

C. DISTRICT RECOMMENDATION

1. RECOMMENDATION: ____
   Rationale for this recommendation if it is different than what is included in the Engineer's Report:
   ____
   ____
   ____

2. DETOUR ROUTE MARKER ASSEMBLIES:
   If an official detour is recommended, ______ detour route marker assemblies will be required.

3. MAP OF OFFICIAL DETOUR:
   If an official detour is recommended, a map of the detour with sign locations is shown on an accompanying sheet.

Construction Zone Design Speed, V (km/h)	f_{max} for Open-Roadway Conditions	Normal Crown Section Minimum Radius, R_{min} (m), e = -0.02	Superelevated Section Minimum Radius, R_{min} (m), e= +0.08
30	0.17	50	30
40	0.17	85	55
50	0.16	145	85
60	0.15	220	125
70	0.14	325	180
80	0.14	420	230
90	0.13	580	305

Notes:

1. *Curve Radius. The radius is calculated from the equation as follows:*

$$R_{min} = \frac{V^2}{127\,(e + f_{max})};$$

value shown in the table for design has been rounded up to the next higher 5-m increment.

2. *Normal-Crown Section. If the normal-crown section is maintained through the horizontal curve, the superelevation rate is -0.02 assuming a typical cross slope of 2%. Therefore, the R_{min} column with e = -0.02 lists the minimum radius which can be used if retaining the normal section through the horizontal curve.*

3. *Other Radius. For a proposed radius or superelevation rate intermediate between the table values, the equation in Note 1 may be used to determine the proper curvature layout. For example, if the construction-zone design speed is 100 km/h and the proposed curve radius is 500 m, the superelevation rate is determined as follows:*

$$e = \frac{V^2}{127\,R} - f$$

$$e = \frac{(100)^2}{(127)(500)} - 0.12$$

$$e = +0.37$$

MINIMUM RADIUS FOR HORIZONTAL CURVE IN CONSTRUCTION ZONE

Figure 82-3A

Construction-Zone Design Speed (km/h)	Calculated K Value ($K = V^2/395$)	K Value Rounded For Design
30	2.3	3
40	4.1	5
50	6.3	7
60	9.1	10
70	12.4	13
80	16.2	17
90	20.5	21

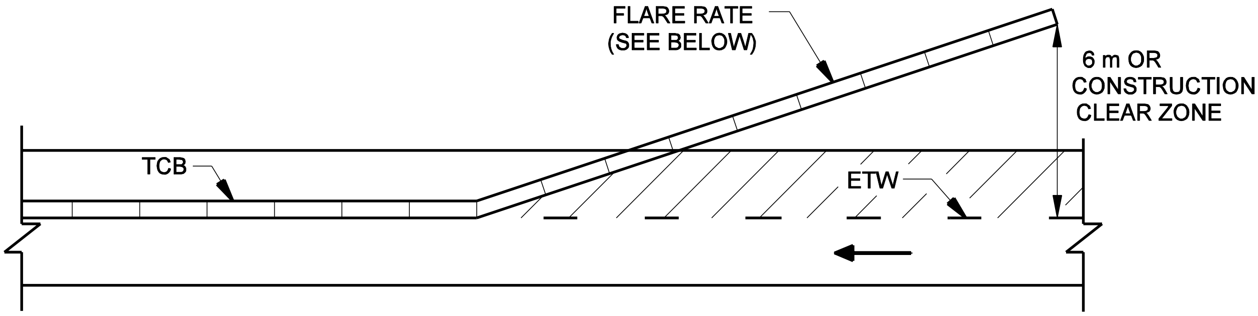
$$L = \frac{AV^2}{46.5} = KA$$

Where:

- *L* = *Length of vertical curve, m*
- *A* = *Algebraic difference between grades, %*
- *K* = *Horizontal distance required to effect a 1% change in gradient*
- *V* = *Design speed, km/h*

_K_ VALUE FOR SAG VERTICAL CURVE
(Comfort Criteria in a Construction Zone)

Figure 82-3B



Construction Zone Design Speed (km/h)	Flare Rates
≤ 60	10:1
70	12:1
80	14:1
90	16:1

FLARE RATES FOR TEMPORARY CONCRETE MEDIAN BARRIER
(Construction Zones)

Figure 82-4A

Construction-Zone Design Speed	Cut Slope					Fill Slope			
	3:1	4:1	5:1	6:1	Flatter Than 6:1	6:1	5:1	4:1	3:1
60 km/h or lower	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	3.0	See Note 2
70 km/h	2.5	2.5	2.5	2.5	2.5	2.5	3.0	3.0	3.5	
80 km/h	2.5	3.0	3.0	3.0	3.0	3.0	3.5	4.0	4.5	
90 km/h	2.5	3.5	3.5	3.5	3.5	3.5	4.0	4.5	5.5	

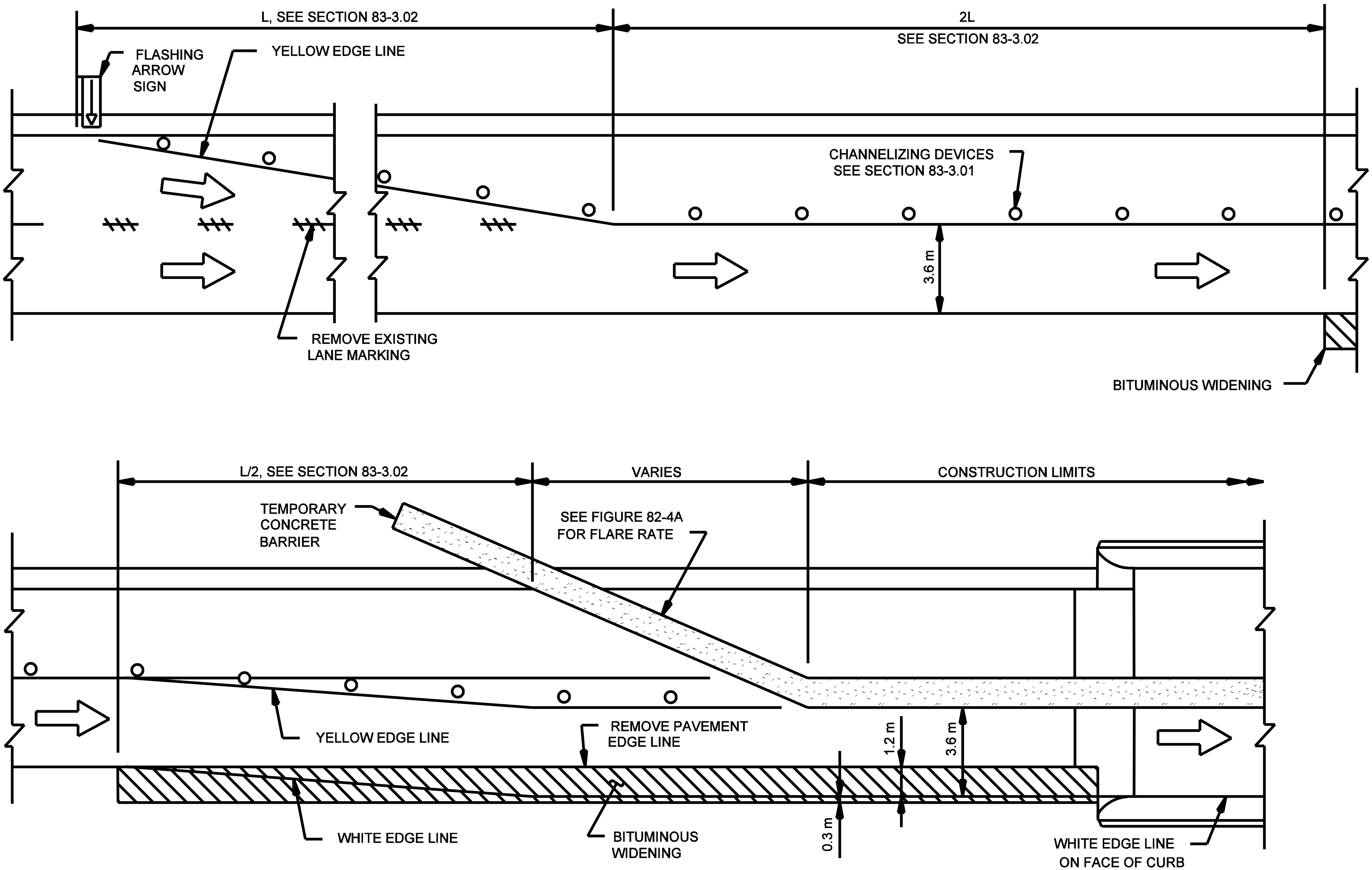
Notes:

1. *Width is measured from the edge of traveled way.*

2. *For a facility with 3:1 fill slopes, the clear-zone width shown above should be used in conjunction with the procedures described in Section 49-2.03(01).*

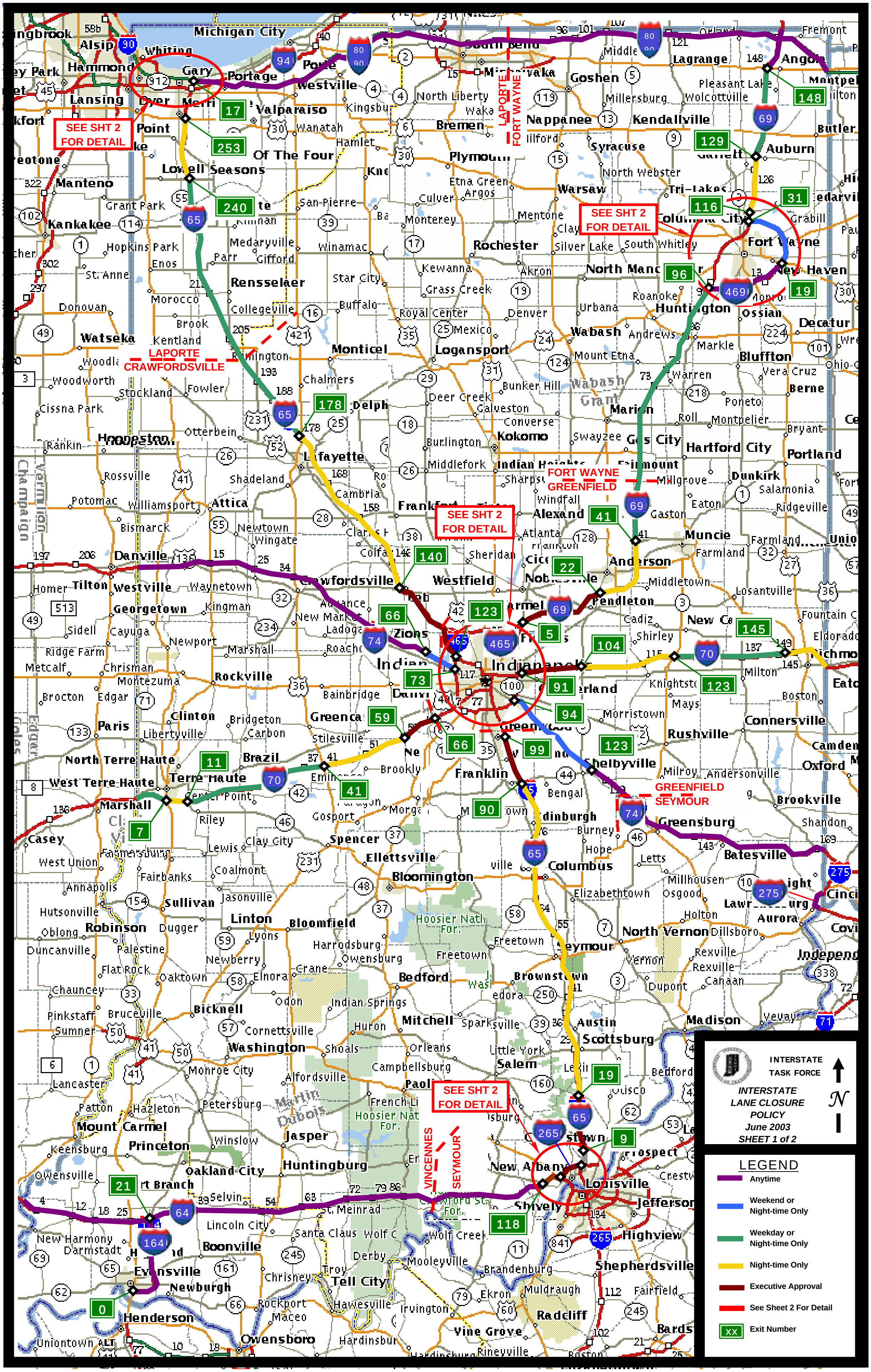
CLEAR-ZONE WIDTH (m)
FOR CONSTRUCTION ZONE

Figure 82-4B



LANE CLOSURES ON BRIDGES

Figure 82-6A


INTERSTATE TASK FORCE
INTERSTATE LANE CLOSURE POLICY
June 2003
SHEET 1 of 2
LEGEND
Anytime
Weekend or Night-time Only
Weekday or Night-time Only
Night-time Only
Executive Approval
See Sheet 2 For Detail
XX Exit Number
SEE SHT 2 FOR DETAIL
LAPORTE
FORT WAYNE
CRAWFORDSVILLE
GREENFIELD
SEYMOUR
VINCENNES
Michigan City
South Bend
Gary
Fort Wayne
Lafayette
Indianapolis
Muncie
Terre Haute
Columbus
Bloomington
Evansville
Louisville
New Albany

LEGEND - URBANIZED AREAS

- Anytime
- Weekend or Night-time Only
- Weekday or Night-time Only
- Night-time Only
- Executive Approval
- Min. 3 Lanes / Direction All Times
- Min. 2 Lanes / Direction All Times
- XX Exit Number

N

INTERSTATE TASK FORCE

INTERSTATE LANE CLOSURE POLICY
JUNE 2003
SHEET 2 of 2

TRAFFIC CONTROL PLAN CHECKLIST Route _______ Des ________ GENERAL INFORMATION		YES	NO	N/A	On Plans
1.	Has a transportation management plan been developed?	☐	☐	☐	☐
	a. Have all recommendations been implemented?	☐	☐	☐	☐
	b. Has Preliminary Engineering Studies Section been notified of any major changes?	☐	☐	☐	☐
2.	Have all applicable work zone types listed below been adequately considered?				
	a. Work outside of roadway	☐	☐	☐	☐
	b. Lane constriction	☐	☐	☐	☐
	c. Lane closure	☐	☐	☐	☐
	d. One-lane, two-way operation	☐	☐	☐	☐
	e. Runaround	☐	☐	☐	☐
	f. Intermittent closure	☐	☐	☐	☐
	g. Use of shoulder or median	☐	☐	☐	☐
	h. Crossovers	☐	☐	☐	☐
	i. Two-way traffic on one roadway of divided facility	☐	☐	☐	☐
	j. Detour	☐	☐	☐	☐
3.	Has all information listed below been incorporated into the contract plans?				
	a. INDOT *Standard Drawings*	☐	☐	☐	☐
	b. INDOT *Standard Specifications*	☐	☐	☐	☐
	c. Recurring special provisions	☐	☐	☐	☐
	d. Unique special provisions	☐	☐	☐	☐
	e. Detail plans	☐	☐	☐	☐
4.	Will extra publicity be required prior to letting (e.g., radio, T.V., newspapers, clubs)?	☐	☐	☐	☐
5.	The contractor can restrict the roadway during:				
	a. Morning or evening rush hours				
	i. One direction	☐	☐	☐	☐
	ii. Both directions	☐	☐	☐	☐
	b. Local celebrations	☐	☐	☐	☐
	c. Holidays or weekends	☐	☐	☐	☐
	d. Other special events: ___________________________	☐	☐	☐	☐
	e. Overnights	☐	☐	☐	☐
6.	Nighttime hours of operation required? If Yes, When?	☐	☐	☐	☐
	a. Between _______ p.m. and _______ a.m.				
	b. Are special precautions needed (e.g., lighting, clearance lights on equipment)?	☐	☐	☐	☐

GENERAL INFORMATION (Cont'd.)		YES	NO	N/A	On Plans
7. Are there any changes that cannot be made concurrently for traffic routing, fire, police, etc.? If Yes, What? ______		☐	☐	☐	☐
8. Can two adjacent street or road crossings be closed at the same time? If Yes, where or which ones? ______		☐	☐	☐	☐
9. Will the source of material from off the project site interfere with traffic?		☐	☐	☐	☐
	a. On and off project limits	☐	☐	☐	☐
	b. Certain roads may not be used (e.g., environmental, recreational). If Yes, which ones? ______	☐	☐	☐	☐
10. Is the contractor required to provide advance notice for any change in traffic?		☐	☐	☐	☐
11. The starting and/or completion date is controlled by:					
	a. School closings or openings	☐	☐	☐	☐
	b. Holidays: ______	☐	☐	☐	☐
	c. Other projects	☐	☐	☐	☐
	d. Sporting events: ______	☐	☐	☐	☐
	e. Other: ______	☐	☐	☐	☐
12. Are there present or future contracts in the immediate area that may affect traffic or the Contractor's operations?		☐	☐	☐	☐
DETOUR		YES	NO	N/A	On Plans
1. Will traffic be detoured? If Yes, is the detour adequate in terms of:		☐	☐	☐	☐
	a. Weight restrictions	☐	☐	☐	☐
	b. Height – width	☐	☐	☐	☐
	c. Wide loads	☐	☐	☐	☐
	d. Capacity	☐	☐	☐	☐
	e. Adequate traffic control devices	☐	☐	☐	☐
	f. Railroad crossings and controls	☐	☐	☐	☐
	g. Geometrics (turning radii, etc.)	☐	☐	☐	☐
	h. Bridge restrictions and other structures	☐	☐	☐	☐
If No for a. through h., what correctives can be taken? ______					
2. Will trucks using the detour conflict with other traffic using the detour?		☐	☐	☐	☐

DETOUR (Cont'd.)	YES	NO	N/A	On Plans
3. Will there be other construction along the detour that might influence traffic flow?	☐	☐	☐	☐
4. Have other affected Districts or States been notified?	☐	☐	☐	☐
5. If the detour is to be established on other than a State highway, has contact been made with:				
a. County?	☐	☐	☐	☐
b. City?	☐	☐	☐	☐
c. Town?	☐	☐	☐	☐
6. Will there be an unofficial detour?	☐	☐	☐	☐
If Yes, has a Letter of Understanding been sent to the local officials?	☐	☐	☐	☐
7. Will all fronting businesses have acceptable ingress and egress?	☐	☐	☐	☐
8. Can the detour be continued over winter (snow removal)?	☐	☐	☐	☐
9. Are alternate routes available to local motorists?	☐	☐	☐	☐
10. Should the following be contacted?				
a. Public school system	☐	☐	☐	☐
b. Public transit system	☐	☐	☐	☐
c. Police, fire, and ambulance services	☐	☐	☐	☐
d. Postal Mail Route service	☐	☐	☐	☐
e. Others: ____________________	☐	☐	☐	☐
If any Yes, list who and when, with telephone numbers. ____________________ ____________________ ____________________ ____________________				
11. Has the District established a detour route?	☐	☐	☐	☐

WORK ZONE	YES	NO	N/A	On Plans
1. Will capacity be restricted? If Yes, what is extent of restriction? ____________________ ____________________	☐	☐	☐	☐
a. Where will excess traffic be diverted? ____________________				
b. Can an alternate route handle the traffic?	☐	☐	☐	☐

WORK ZONE (Cont'd.)	YES	NO	N/A	On Plans
2. How will staging be addressed (e.g., lengths of times of permitted construction)?				
a. In the plans	☐	☐	☐	☐
b. Have the contractor provide a plan	☐	☐	☐	☐
c. The contractor may stage work differently than planned	☐	☐	☐	☐
3. Where runaround or temporary widening is required:				
a. What criteria should be applied regarding:				
i. Design speed? ___________ ii. Lane widths? _______________ iii. Alignment? ________________ iv. Pavement thickness? ____________ v. Pedestrian traffic? _________________________				
b. Has the location been determined?	☐	☐	☐	☐
4. Number of lanes maintained in each direction:				
a. At all times, ☐ One ☐ Two				
b. During rush hours, ☐ One ☐ Two ☐ Three				
c. Reversible lanes required, ☐ One ☐ Two				
5. What is the facility's traffic-carrying capability considering the effect of winter:				
a. Adequate	☐	☐	☐	☐
b. Special traffic control devices are required	☐	☐	☐	☐
c. Procedure modifications are necessary for snow removal and maintenance	☐	☐	☐	☐
d. Modifications are required to the pavement structure:				
i. HMA Base	☐	☐	☐	☐
ii. HMA Base and Surface	☐	☐	☐	☐

TRAFFIC CONTROL DEVICES	YES	NO	N/A	On Plans
1. Traffic control signing layout will be:				
a. Shown in the plans	☐	☐	☐	☐
b. Available prior to contract letting	☐	☐	☐	☐
c. Consisting of special traffic delay or advance signs	☐	☐	☐	☐
d. That for temporary crossover, designed to match INDOT *Standard Drawings*	☐	☐	☐	☐
2. Will the effects of construction operation require sign message modifications to permanent signage?	☐	☐	☐	☐

TRAFFIC CONTROL DEVICES (Cont'd.)			YES	NO	N/A	On Plans
3.	Are temporary traffic signals required?		☐	☐	☐	☐
	a.	Equipment type:				
		i. Manual	☐	☐	☐	☐
		ii. Fixed timed	☐	☐	☐	☐
		iii. Actuated	☐	☐	☐	☐
	b.	Will existing signals need to be kept operational?	☐	☐	☐	☐
	c.	Has an agreement been reached with the local municipality?	☐	☐	☐	☐
4.	Will temporary street lighting be needed? If Yes, what type of equipment?		☐	☐	☐	☐
	a.	Wood poles	☐	☐	☐	☐
	b.	Breakaway poles	☐	☐	☐	☐
	c.	Agreement with power company required?	☐	☐	☐	☐
5.	What temporary pavement markings are required?					
	a.	Paint	☐	☐	☐	☐
	b.	Tape	☐	☐	☐	☐
	c.	Raised pavement markers	☐	☐	☐	☐
6.	Striping removal required of:					
	a.	Center line / Lane lines	☐	☐	☐	☐
	b.	Right edgeline	☐	☐	☐	☐
	c.	Left edgeline	☐	☐	☐	☐
	d.	Both edgelines	☐	☐	☐	☐
7.	Flashing warning lights required for:					
	a.	Any equipment kept overnight within 9 m (30 ft) of traveled way	☐	☐	☐	☐
	b.	All barricades and warning signs	☐	☐	☐	☐
	c.	Construction roadside hazards	☐	☐	☐	☐
8.	Steady-burn warning lights required for:					
	a.	Edge of travelway, dropoff of ________ mm	☐	☐	☐	☐
	b.	Channelizing traffic	☐	☐	☐	☐
9.	Have speed limits been considered? If Yes, what limits?		☐	☐	☐	☐
	a.	Work zone, _____ mph				
	b.	Worksite, _____ mph				
	c.	Minimum, _____ mph				
	d.	Advisory, _____ mph				

ROADSIDE SAFETY		YES	NO	N/A	On Plans
1.	Temporary barriers				
	a. Required for traffic protection	☐	☐	☐	☐
	b. Required for workers protection	☐	☐	☐	☐
	c. Delineation of barriers provided by:				
	i. Electrical devices	☐	☐	☐	☐
	ii. Reflectorization	☐	☐	☐	☐
	d. Upon completion of project, retained by:				
	i. Department	☐	☐	☐	☐
	ii. Contractor	☐	☐	☐	☐
2.	Will temporary impact attenuators be required? If Yes, Type ______	☐	☐	☐	☐
3.	Extra protection will be required for:				
	a. Pedestrians	☐	☐	☐	☐
	b. School area and crossings	☐	☐	☐	☐
	c. Playgrounds and parks	☐	☐	☐	☐
	d. Type of protection: ______________________________				
4.	Where may the contractor store equipment, construction material and waste material?				
	a. On site with flashers or other protection	☐	☐	☐	☐
	b. 9 m or more from edge of traveled way	☐	☐	☐	☐
	c. Designated storage site	☐	☐	☐	☐
5.	Where may contractor’s employees park personal vehicles?				
	a. On-site	☐	☐	☐	☐
	b. Off-site	☐	☐	☐	☐

Click When Done

Clear Data