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Part 12 - MISCELLANEOUS

1200 GENERAL

This chapter serves as a repository for miscellaneous information not addressed in the other chapters. Training provided by the **Office of Traffic Engineering (OTE)** and other **OTE** services are addressed, as well as traffic control standards, policies, guidelines and procedures that involve more than one of the traffic control areas discussed in other **TEM** chapters. Traffic Control Zones are also addressed.

1201 TRAINING AVAILABLE

1201-1 General

There are various training opportunities available in the traffic engineering field (internal and external). As noted herein and on the **OTE** website, **OTE** provides courses related to various aspects of traffic control design and application. Also, the **Office of Quality and Organizational Development** maintains on their Intranet web page a catalog of courses available, including technical training provided by **ODOT** offices.

1201-2 Design of Work Zone Traffic Control Course

The Design of Work Zone Traffic Control Course is provided to the **Districts** upon request, on a first come, first served basis, by the **OTE Maintenance of Traffic Section**. The course objective is to meet Federal and State standards in work zone layouts throughout the State and to improve general knowledge about work zones.

This is a two-day course, available statewide, designed for **Highway Worker 4s** and **County Managers**; however, **OTE** also offers an abbreviated one-day course for **Highway Maintenance Workers**. Up to thirty-six employees may be trained in one class. Course topics include:

1. Traffic Control Devices and Safety Hardware.
2. Elements of Traffic Control Plans.
3. Design Workshops.
4. Layouts for Stationary and Mobile Operations.
5. Installing and Removing Traffic Control Devices.

Additional information is available on the **OTE** website ***(Table 197-3)***. To request training, please contact Tim Michael, **OTE Maintenance of Traffic Section**, at 614-466-2168.

1201-3 Flagging Course

The Flagging Course is provided to the **Districts** upon request, on a first come, first served basis, by the **OTE Maintenance of Traffic Section**. The course objective is to obtain uniformity in hand signals throughout the State and improve general knowledge about flagging.

This is a four hour course, available statewide, designed for **Highway Maintenance Workers**. Up to

twenty-five employees may be trained in one class. Course topics include:

1. Attitude.

2. How to Use Flagging Equipment.

3. Proper Positioning.

4. Communication Commands.

5. Operations.

Additional information is available on the **OTE** website ***(Table 197-3)***. To request training, please contact Tim Michael, **OTE Maintenance of Traffic Section**, at 614-466-2168.

1201-4 ODOT Signal Construction

The course provides training to understand the new department processes relating to signal construction from pre-construction activities, focusing on field inspection, and covering post construction review.

Length of Course: 4 Hours
Designed for: This course is designed for those who are responsible for the construction, inspection and acceptance of traffic signals.
Prerequisities: None
Course Size: 4 Minimum, 15 Maximum
Location: District Offices
Program Manager: Satya Goyal, Office of Traffic Engineering
Contact Number: (614) 644-6624

1201-5 Overhead Sign Support

Purpose: This course is designed to help participants develop a basic understanding of the inspection and repair of overhead sign support.
Length of Course: 4 Hours (3 hours classroom, 1 hour field)
Designed For: Persons responsible for the inspection, maintenance and/or repair of overhead sign supports.
Prerequisites: None
Course Time: Varies
Course Size: 4 Minimum, 12 Maximum
Location: District or Central Office
Program Manager: Office of Traffic Engineering
Contact Number: (614) 752-0438 or 752-6109

1202 OTHER OTE SERVICES

1202-1 Time Lapse and Video Taping

The **OTE Maintenance of Traffic Section** provides both time lapse and real time video services to the **Districts** upon request. Time permitting, these services are also available to local jurisdictions. Services available include the following:

1. Time Lapse Video for:

    a. High Accident Locations.

    b. Traffic Delay (Backups).

    c. Signal Timing and Signal Warrants.

    d. Volume Counts.

    e. Liability Cases.

    f. Before and After Studies.

2. Real Time Video for:

    a. Training Seminars.

    b. Meetings.

    c. Technology Transfers.

    d. New Equipment Demonstrations.

    e. Haul Road Condition.

    f. Detour Operation.

The Section has a video van with two high quality aerial cameras that can be raised up to a height of 42 feet (12.8 meters) to obtain the best possible camera angles. The van is also equipped with three on-board recorders (a time lapse recorder, a one-half inch variable-speed recorder and a three-quarter inch recorder).

Requests for time lapse or real-time video services should be submitted using ***Form 1296-1*** (Time-Lapse & Video Request Form). A full-size version of the form is available on the **OTE** website and may be completed and submitted by e-mail. To complete the time-lapse request form (in Adobe Acrobat):

1. Save the form (T-Lapse.pdf) to your disk or open from the web page. The form contains interactive fields which allow you to input text directly on the document.

2. Once completed, save the document.

3. Attach the file to an e-mail message and send to Mike Keller, or print the form and mail it to Mike Keller, **Ohio Dept. of Transportation, Office of Traffic Engineering** - 3rd Floor, P.O. Box 899, Columbus, Ohio 43216.

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1210 TRAFFIC CONTROL ZONES

Traffic Control Zones include School Zones, Speed Zones, Parking Control Zones, Pedestrian Safety Zones, Loading Zones, No-Passing Zones and Temporary Traffic Control Zones (Work Zones).

ORC Section 4511.21 addresses the need to document the need for, and get approval of, Speed Zones and School Zone Extensions. See ***Section 1211*** regarding School Zones and School Zone Extensions. See ***Section 1212*** for information regarding Speed Zones, ***Section 1213*** for information regarding parking controls at locations not covered by existing law **(ORC Sections 4511.68 and 4511.69)**, and ***Section 1214*** for information on other zones.

1211 SCHOOL ZONES

OMUTCD Part 7B.11 addresses School Zones and School Zone Extensions and ***Section 704*** of this Manual describes the procedures for processing requests for School Zone Extensions. The related forms are also described in ***Part 7*** of this Manual.

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1212 SPEED ZONES

1212-1 General

A Speed Zone is a section of street or highway where, on the basis of a geometric and traffic characteristic study or an engineering and traffic investigation, the prima facie speed limit set forth in **ORC 4511.21 (B)(1)(a) to (D)** is determined to be greater or less that is reasonable or safe and the **Director** and/or appropriate local authorities have declared a reasonable and safe prima facie speed limit and erected signs in accordance with **ORC 4511.21.**

As noted in **OMUTCD Section 2B.11**, **ORC Section 4511.21** establishes speed limits for all streets and highways within the **State**. It also provides that the **Director** may alter speed limits, and that local authorities may request that the **Director** determine and declare a reasonable and safe speed limit on certain highways under their jurisdiction. Under **ORC Section 4511.21 (K)**, a **Board of Township Trustees** may, by resolution, declare a prima-facie speed limit on unimproved highways and on highways under their jurisdiction which are within residential and commercial subdivisions.

In altering speed limits, the minimum length of a zone not contiguous to an Speed Zone should be greater than 0.4 miles; however, extensions of existing warranted zones may be shorter.

Additional regulations on speed limits can be found in **ORC Sections 4511.211** (Speed limit on private residential road or driveway), **4511.22** (Slow speed), **4511.23** (Speed regulations on bridges) and **4511.24** (Emergency vehicles excepted from speed regulations).

Since speeds are presently only posted in English units (miles per hour), all studies related to speed limits shall be conducted and calculated in English units. This will simplify the study process and also eliminate any possibility of errors in the final determined speed caused by either additional calculations or the use of conversion factors

1212-2 Procedures for Authorizing Speed Zones

1212-2.1 General

Requests for Speed Zones are submitted through the **District** office using ***Form 1296-2*** (Speed Zone Warrant Sheet). The engineering study used with this form is outlined in ***Section 1212-3*.**

1212-2.2 ODOT-Maintained Highways

All proposals for alterations of speed limits on **ODOT**-maintained highways shall be documented with the appropriate engineering study as outlined in ***Section 1212-3***.

Once a determination has been made to alter a speed limit, the **District** shall forward the proposed speed limit reduction to the appropriate **Ohio State Highway Patrol (OSHP) District Office** for review and comment.

Following resolution of the **OSHP** comments, if any, the **District** shall prepare a description of the Speed Zone for the **Director's** approval using ***Form 1296-6*** (Speed Limit Revision).

Following approval, the **District** shall erect the appropriate Speed Limit signs, record the dates on ***Form 1296-6***, and notify the **OSHP** and other law enforcement agencies as appropriate.

1212-2.3 Local Roads

Except as provided below, all requests for alterations of speed limits on local roads (i.e.,roads under the jurisdiction of a highway authority other than **ODOT**) shall be submitted to the **District** in the form of a resolution of the local authorities. The appropriate engineering study, as outlined in ***Section 1212-3***, shall be included with all such requests. Concurrence from the appropriate enforcement agency should be included with the study. All requests shall be acknowledged, and the local authorities shall be notified whether additional data will be necessary to substantiate their request.

Under **ORC Section 4511.21 (K)**, a **Board of Township Trustees** may, by resolution, declare a prima-facie speed limit on unimproved highways and on highways under their jurisdiction which are within residential and commercial subdivisions.

Based on the engineering study, the **District** shall determine a reasonable and safe speed limit. If this determination is substantially different from that which was requested, the local authorities may be asked to further substantiate their original request, and a new determination may be made.

Following resolution of any comments, the **District** shall prepare a description of the Speed Zone for the **Director's** approval using ***Form 1296-6*** (Speed Limit Revision).

The **District** shall notify the local authorities of **ODOT's** final action on the proposed Speed Zone.

If, based upon the **District's** final determination, new Speed Limit signs are required, the local authorities shall erect the signs and, upon completion of the work, forward ***Form 1296-6*** (Speed Limit Revision) to the **District**.

Upon receipt of the completed ***Form 1296-6*** (Speed Limit Revision), the **District** shall notify the **OSHP** and other law enforcement agencies as appropriate.

1212-3 Engineering Study

1212-3.1 General

The engineering study used to support a request for alterations of speed limits should include ***Form 1296-2*** (Speed Zone Warrant Sheet), ***Form 1296-3*** (Speed Study Data Sheet), ***Form 1296-5*** (Speed Check Form). A scaled area map or sketch to identify the location of the proposed zone.

1212-3.2 Speed Study Data Sheet

The Speed Study Data Sheet (***Form 1296-3***) or a similar document, should be used to show physical conditions along and adjacent to the highway, traffic control devices and accident data. ***Form 1296-4*** is a sample of a completed Speed Study Data Sheet. The form should be prepared as follows:

1. The symbols shown in ***Table 1297-1*** should be used in representing physical features along the highway.

2. Width of lanes, width of pavement, width of berm, setback of the buildings, distance to any fixed objects within 10 feet of the pavement edge, and type and condition of the pavement surface should also be shown.

3. On **ODOT**-maintained routes use SLM log points. Use a 1 inch = 0.1 mile scale along the centerline of the roadway. Lateral dimensions need not be scaled.

4. Mark the beginning and end of the proposed zone, and log 500 feet beyond each end of the zone.

5. Pavement marking or restricted sight distances less than 600 feet, signals and flashers, and Warning and Regulatory Signs should be shown.

6. The number of, and point at which more than five pedestrians per hour cross or walk on the pavement should be shown.

7. Record each reported accident that occurred during the past three years by placing a symbol at the log point, and opposite the symbol, show the number of injured (I) and killed (K), or property damage (PD).

8. Test run date should also be recorded.

   a. Test runs are to be made by driving as fast as it is comfortably safe.

   b. Test runs are to be made so that other traffic will not delay the test car.

   c. Record at a range of 0.10 to 0.25 mile interval or more.

   d. The average speed of three test runs should be determined in each direction.

1212-3.3 Speed Check

A speed check shall be made using ***Form 1296-5*** (Speed Check Form) or a similar form.

1. Speed checks may be taken with any device that will indicate vehicle speed with an accuracy of ±10 percent.

2. Record speeds of 100 vehicles for each direction of travel (observation need not exceed one hour).

3. Speed checks should be taken at the 1/3 points (total of four checks) for zones 0.25-1.00 mile in length, and at 0.5-0.75 mile intervals for zones over 1 mile in length.

1212-3.4 Warrants for Speed Zones

The data collected and the following information are used to complete ***Form 1296-2*** (Speed Zone Warrant Sheet).

1. **Highway development** consists of evaluating the extent of building development and classification of intersections. These components are defined in ***Table 1297-2***. Intersections at the end of the study area should not be counted.

   The building development and intersection classification calculations are added and then the total is divided by the length (in miles) of the zone.

2. **Roadway Features** consists of evaluating the roadway design characteristics including lane width, shoulders curves and grades. ***Table 1297-3*** defines the Roadway Feature components

3. **85th Percentile Speed** is determined by taking spot speed observations during weekday off-peak periods. Spot speed checks should be taken to reflect only free-flowing vehicles. A

vehicle is considered free flow if there is a minimum of five seconds gap (headway) from the other vehicle ahead of it, and it is not accelerating or decelerating for other reasons. If it is not possible to observe free flow conditions, then the average speed of all vehicles should be increased 5 to 10 miles per hour to approximate the 85th percentile speed. If the 85th percentile speed of several speed checks vary considerably and are in more than one range in the warrant analysis, average the speed or select the most representative speed.

4. The **Pace** is the ten mile per hour range of speeds containing the greatest number of observed speeds. If the pace of several speed checks vary considerably and are in more than one range in the warrant analysis, average the pace or select the most representative pace.

5. For **Accident Experience** intersection accidents not on the approach to the section under study should not be included in the evaluation. Accidents at horizontal curves should be considered only after all appropriate Warning and Advisory Speed signs are in place. Caution needs to be exercised in applying the accident experience if there is an over representation of accidents caused by animals, the environment (such as ice), impaired driver, vehicle defect, construction, etc. It is desirable to consider a review of accidents over a three year period.

6. **Test Run** information is shown because the average test run speed is beneficial in supporting the spot speed data as reflecting free flow conditions. Also it is beneficial in comparing or matching the fit of the spot speed data to the full length of the section under study.

1212-3.5 Additional Information/Considerations

In addition to the required forms, additional data, such as photographs may be submitted. Also, there may be a need to consider adjusting the speed limit more than normal rounding to the nearest five miles per hour of the calculated speed as reflected in the speed study. Items to consider or additional information to provide when recommending a speed limit different than the calculated value may include:

1. A study area near or adjacent to an incorporated area or other warranted speed reduction(s).

2. Maintaining uniformity of speed limits within a contiguous section of highway.

3. Truck volumes along with the lane width should be considered, i.e., Volumes:

< 5%	Low impact/consideration
5% to 10%	Moderate impact/consideration
> 10%	High impact/consideration

   An effective width of 20 feet is considered adequate only for low volume roads where meeting and passing are infrequent and the truck volumes are low.

4. Land along the study area is generally fully developed based on local zoning and/or local subdivision regulations.

5. Other conditions:

   a. A large number of driveways with limited visibility.

   b. The results of the test runs are not representative of the 85th percentile or calculated speed.

c. Abnormal traffic volume flows.

d. A large number of horizontal and vertical curves requiring speed reductions.

e. The use of the road as related to access vs. mobility (e.g., functional classification).

f. Letter from local law enforcement stating that they recommend the reduction and will enforce the reduced speed limit.

g. An unincorporated area that looks to the driver the same as an incorporated area.

h. Large number of items that affects the assured clear stopping distance of the driver.

i. Volume of pedestrian traffic and/or official signed bike routes.

j. Proximity to a school.

1212-4 Withdrawal of Authorizations

The withdrawal of the authorization for a Speed Zone requires an engineering study and, insofar as is applicable, shall be accomplished in the same manner in which it was established. ***Form 1296-7*** (Withdrawal of Issued Speed Zone Authorization) is used to document the withdrawal.

1212-5 Documentation

Table 1297-4 shows the range of Revision Numbers to be used by each **District** for Speed Zones. These numbers shall be used on ***Forms 1296-6 and 1296-7***.

The **District** shall retain the reports used in establishing the Speed Zones in their permanent files. Originals of the official document authorizing the issuance or withdrawal, as well as any originals of local requests or resolutions, shall also be retained permanently in **District** files.

A copy of the signed authorizations ***(Forms 1296-6 or Form 1296-7)***, including date of sign erection or removal as appropriate, shall be forwarded to **OTE**.

For purposes of maintaining a statewide inventory and historical record, an inventory of Speed Zones shall be maintained by **OTE**. Speed Zone files are available for downloading from the ODOT internal network O drive at O:\Traffic\regulations. The electronic files are updated, depending on current workload, as revisions are received (quarterly as a minimum).

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1213 PARKING CONTROL ZONES

1213-1 General

As noted in **OMUTCD Section 2B.34**, **ORC Section 4511.68** establishes certain parking prohibitions and **ORC Section 4511.69** notes additional provisions related to parking locations and provisions. Special legal authority is required to establish parking controls at any type of location not covered under existing laws. For rural state highways, these Parking Control Zones must be authorized by the **Director**. In municipalities, such authority is granted by an Ordinance passed by the **Council** or by other local legal authority. The adoption of a Resolution by **County Commissioners** or **Township Trustees** provides similar authority in rural jurisdictions.

Any regulation established in addition to those specified in **ORC Section 4511.68** shall be indicated by the use of signs.

1213-2 Procedure for Authorizing Parking Control Zones

As noted in ***Section 1213-1***, **ODOT** has no responsibility for Parking Control Zones on local roads.

Requests for Parking Control Zones on **ODOT**-maintained highways are submitted through the **District** office. As noted in ***Section 1213-3***, an engineering study is conducted to determine if a Parking Control Zone is appropriate.

Once a determination has been made to establish a Parking Control Zone, the **District** shall forward the parking control proposal to the appropriate **OSHP District Office** for review and comment.

Following resolution of the **OSHP** comments, if any, the **District** shall prepare a description of the Parking Control Zone for the **Director's** approval using ***Form 1296-9*** (Establishment of No-Parking Restrictions).

Following approval, the **District** shall erect the appropriate Parking Control signs, record the dates on ***Form 1296-9***, and notify the **OSHP** and other law enforcement agencies as appropriate.

1213-3 Engineering Study

Section 1213 (Parking Control Zones) should be reviewed prior to submitting the study. The engineering study used to support a request for a Parking Control Zone shall include a field survey conducted to acquire necessary data to complete ***Form 1296-8*** (Field Report on Parking Practices). It should also include a sketch of the location and/or photographs to document the physical conditions noted in the survey report.

1213-4 Withdrawal of Authorization

The withdrawal of the authorization for a Parking Control Zone requires an engineering study and, insofar as is applicable, shall be accomplished in the same manner in which it was established. ***Form 1296-10*** (Withdrawal of Issued No-Parking Restrictions) is used to document the withdrawal.

1213-5 Documentation

Table 1297-4 establishes Revision Numbers to be used by each **District** for Parking Control Zones. These numbers shall be used on ***Forms 1296-9 and 1296-10***.

The **District** shall retain the reports used in establishing the Parking Zone in their permanent files. Originals of the official document authorizing the regulation shall also be retained permanently in **District** files.

A copy of the signed authorizations, including date of sign erection, shall be forwarded to the **Office of Traffic Engineering (OTE)**.

For purposes of maintaining a statewide inventory and historical record, an inventory of Parking Zones shall be maintained by **OTE**. No Passing Zone files are available for downloading from the ODOT internal network O drive at O:\Traffic\regulations. The electronic files are updated, depending on current workload, as revisions are received (quarterly as a minimum).

1214 OTHER ZONES

As noted in ***Section 1210***, Traffic Control Zones also include Pedestrian Safety Zones, Loading Zones, No-Passing Zones and Temporary Traffic Control Zones (Work Zones). No-Passing Zones are addressed in **OMUTCD Part 3**. Temporary Traffic Control Zones are addressed in **OMUTCD Part 6** and in ***Part 6 of the TEM***.

1215 RUMBLE STRIPS IN THE ROADWAY

Rumble strips are composed of a pattern of grooves or depressions made in the roadway or shoulder of the highway to produce an audible and/or vibratory warning to drivers. They are not, by themselves, considered traffic control devices (they are "geometric features of the roadway"). Rumble strips within the roadway (traveled lane) are addressed in this section.

Policy No. 322-001(P), Policy on the Use of Rumble Strips on Shoulders addresses details and procedures for the use of rumble strips on the shoulders of **ODOT**-maintained highways. **L&D Manual Volume One Section 605**, **SCD BP-9-1** and **CMS Item 618** address **ODOT** standards and specifications related to the use of shoulder rumble strips. For questions on shoulder rumble strips, contact the **Office of Roadway Engineering Services**.

Rumble strips have been shown to be effective in certain circumstances in slowing and/or alerting drivers for various applications. However, installation of rumble strips should only be considered when all other appropriate standard traffic control devices have failed to resolve the traffic problem satisfactorily.

The use of rumble strips at locations in the roadway shall be at the discretion of the **District Deputy Director**. This decision should be based on a review and recommendation by the **District Safety Review Team**. Applications for consideration of rumble strips include the following:

1. Rural stop approaches with high accident rates.
2. Signalized intersections with high accident rates.
3. Exit ramp deceleration lanes.
4. Gore areas.
5. Narrow and one-lane bridges.
6. Locations with abrupt changes in horizontal alignment.
7. Intersections with inadequate stopping sight distance caused by vertical or horizontal alignment.
8. Transitional areas from "high-type" facilities to "low-type."
9. Construction areas, e.g., median crossovers.
10. Approaches to toll booths.
11. Railroad crossings with sight distance restrictions and accident potential.

Design information is available upon request from the **OTE Standards Section**; however, detail designs are not currently available for each of the applications noted.

When rumble strips are installed, a RUMBLE STRIPS sign (W8-H15) should be used. This sign is shown in the **Standard Sign Design Manual** ***(Section 295-2)***

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1220 MATERIALS AND EQUIPMENT

1220-1 General

This section includes information about various procedures developed to address the review and approval of new products and the purchase of traffic control related materials and equipment.

1220-2 New Products

Information regarding the **ODOT** new products program will be incorporated into this section.

1220-3 Patented or Proprietary Materials

Patented or proprietary materials, specifications, or processes shall not be included in a contract unless one of the following conditions applies:

1. The item is to be purchased or obtained through competitive bidding with equally suitable items. In which case, the plans shall specify a minimum of two acceptable items and include the phrase "or approved equal."

2. No equally suitable alternate exists.

3. The item is essential for compatibility or synchronization with, or maintenance of, existing facilities or equipment.

4. The item is used for research, or for a distinctive type of construction, on relatively short sections of a facility for experimental purposes.

5. There is a determination by the **District Deputy Director (DDD)** that it is in the best public interest to specify one such item, to the exclusion of any other acceptable alternate.

Where a single item is specified, as in conditions 2 through 5, a request and justification shall be submitted to the appropriate **District**. The **District** shall evaluate the request; coordinate with the **DDD**, and when the situation described in condition 5 applies, coordinate with **FHWA** if appropriate; and subsequently notify the requesting agency of the disposition of the request.

Where research or experimentation is proposed, it will also be necessary to set up an evaluation program.

In the case of traffic signals, the vast majority of alternate bid requests are made for controllers or emergency vehicle preemption. **Districts** should consider the use of proprietary bids instead of alternate bids when:

1. The signal controllers are an extension of an existing arterial coordinated signal system. Typically the number of controllers being added is less than the number of existing controllers in the system. The coordinated arterial may be controlled by either on-street masters, directly by a central control center or simple hardwire with time based control. There should be no upgrading of the existing controllers, or the upgraded existing controllers will be evaluated as new/added controllers.

2. At least 50% of the agency's controllers are of a single brand. This is in recognition of the significant investment made by the maintaining agency. There should be no upgrading of the existing controllers, or the upgraded existing controllers will be evaluated as new/added controllers.

Preemption equipment and video detection may also be considered if 50% of the agency's signalized intersections operate with a single brand of equipment. The extension of preemption equipment on an existing preempted arterial will not be a basis for approval of proprietary bids for preemption equipment.

3. If at least 50% of the agency's equipment is comprised of two brands, consideration may be given to limiting the bids to the two brands without the use of the phrase "or approved equal".

4. If at least 50% of the agency's controllers are of a single brand, central control software upgrades may be considered. The single brand controllers do not have to be currently connected to the central control. Upgraded existing controllers will be evaluated as new/added controllers. The addition of an interconnection card to an existing controller is not considered an upgrade to the controller.

5. Aesthetically designed signal supports may be considered if at least 50% of the agency's signalized intersections utilize the supports. Extension of an arterial with existing aesthetically designed signal supports will not be a basis for approval of proprietary bids.

   Proprietary bids for aesthetically designed highway lighting supports should not be considered because of the numerous manufacturers of similar support designs.

   In lieu of proprietary bids for aesthetically designed signal or lighting supports, alternate bids may be taken using three brands of similar aesthetically designed supports for the generic bid and an alternate bid for the preferred choice. If three brands of similarly designed signal supports are not utilized, the generic bid will typically be for a standard painted TC-81.20 mast arm support.

For the occasional proprietary bid request that does not comprise the most common project work items, the **District** may submit the request to an ad hoc committee for review. The committee will be composed of representatives from **ODOT** Central Office, **Districts**, and the **FHWA**.

When determining if a proprietary bid is justified, the **District** should make every possible effort to determine that an alternate bid will not suffice instead of a proprietary bid. When a **District** determines that a proprietary bid is justified, written documentation must be kept on file supporting the use of proprietary items.

Should the request not be approved, the **District** must inform the requesting agency they may consider alternate bidding procedures, and that Federal-aid participation will be based on the lowest price so established.

1220-4 Cooperative Purchasing Program

Under the Cooperative Purchasing Program, political subdivisions may purchase machinery, materials, supplies and other articles from the **ODOT** Annual Term Contracts and the **ODOT** Single Purchase Contracts with their own funds. A copy of the program may be obtained from the **Office of Contracts, Purchasing Services** ***(Table 197-3)***.

1220-5 Alternative Purchasing Program for Local Agencies

1220-5.1 General

ODOT also sponsors another program with respect to the purchase of traffic control materials for installation and use by local government agencies. In this program, funding for the purchase of traffic control materials for installation and use by a requesting local governmental agency is allocated by **ODOT** to the local governmental agency and does not involve the use of **ODOT** term

purchase contracts. This method was developed primarily for traffic control materials, but can encompass the purchase of other roadway appurtenances such as roadway lighting, signing and street beautification items.

This purchase order procedure was originally created to provide local agencies with a means of purchasing traffic signal materials with Federal project funds. The procedure has also been used to purchase signing materials and can be expanded to include other roadway appurtenances. All materials acquired using this procedure are to be installed by the local agency without cost to **ODOT**.

If traffic signal material is involved, data must be submitted for evaluation of traffic signal warrants as contained in **OMUTCD Part 4**. The signal warrant data shall be evaluated and approved by the **District**. Assistance is available from **OTE** upon request. Only the intersections with **District** approved signal warrants are eligible for federal funding of traffic signal materials.

The following procedure has been the process to be followed in procuring materials and equipment for purchase order contracts. These functions are also shown as a flow chart in ***Figure 1298-1***. The steps shown in ***Sections 1220-5.7 through 1220-5.10*** are initiated concurrently.

1220-5.2 Programming and Funding

The **District** shall prepare and submit the programming package to the **Office of Systems Analysis Planning.** Any State or Federal funds allocated to the agency that are eligible may be utilized, except for nontraditional transportation funds. Funds shall be sufficient to encompass the material costs, plus preliminary and construction engineering if requested. Any additional cost in the procurement of materials due to increased costs, or to insure a completed installation, shall be the agency's responsibility unless changes are approved in advance and funds are available.

The agency's cost participation, the local share, whether due to normal project funding splits or 100 percent local cost items, shall be based on the estimate as provided by the agency in ***Section 1220-5.6(2a)***.

1220-5.3 Alternate Bids

Alternate bids cannot be used in the automated purchase order system. There must be only one bid item for each item.

1220-5.4 Proprietary Bids *(also see Section 1220-3)*

The purchasing regulations allow a vendor to supply a comparable item for any proprietary brand listed in the bid package. There are two ways to purchase approved proprietary items:

1. Appear before the **State Controlling Board** and request an exemption from the **Department of Administrative Services** purchasing regulations.

2. Have the agency use their own purchasing system to purchase the approved proprietary items. The Department utilizes a "Pass Through of Federal Funds" account in the **Office of Accounting** so that the agency does not have to use their own funds in the purchase. The agency submits the invoices from the vendors to the **District** for payment. This process requires that all preliminary engineering documents and approvals be processed as if the Department were the sole purchasing agent.

1220-5.5 Prequalification of Materials

The agency can prequalify a number of manufacturers of a purchase order item. A minimum of three brands should be listed and the supplied item must be one of these specified brands. The agency must document the procedure or reasons for limiting bidding.

1220-5.6 Bid Documents Package

The agency shall prepare the bid documents package and submit it to the **District**. The **District** shall coordinate and consolidate review comments and respond to the agency. The bid documents package shall include the following information as required:

1. Preliminary Plans or Sketches.

    a. For traffic signal projects, plans or sketches should depict existing and proposed signal operation and equipment locations. The complexity of the detail drawings will be determined by the **District** based on the extent of the signal work involved.

    b. If the work is not signal related, the drawings shall show the locations of all proposed items and any existing conditions that will be affected. Roadway lighting work may require an illumination review to determine the effect the proposed lighting will have on the roadway. Based on the scope of the roadway lighting, the **District** will determine if this review is necessary.

    c. Plans and sketches shall show right-of-way.

2. Summary of Estimated Quantities and Cost Estimate.

    a. Detailed sub-summaries with item descriptions and quantities shall be prepared. They shall be subdivided by each intersection and separately subtotaled for any funding splits.

    b. Two general summaries shall also be submitted; one with the cost estimate included for **ODOT's** use and the other without the cost estimate. The general summary without the cost estimate is used in the bid package that will be sent to the vendors and will provide places for the bid prices to be stated by the vendors.

    c. Usually, the project must be separated into multiple bid packages in order to group similar items so that the various vendors can bid on only the item group that they can supply.

3. Material Specifications.

    a. **ODOT's Construction and Material Specifications (CMS)** and **Supplemental Specifications** shall be used where feasible, but may be supplemented by the agency's requirements, as necessary.

    b. **ODOT** does not review and approve shop drawings or catalog sheets. If the agency wants to review and approve these items, this requirement must be included in the material specifications.

4. Miscellaneous Documentation.

    a. Assurance that all pavement markings, signing and signal installations within the project area are, or will be, in compliance with the **OMUTCD**. This should be accomplished by a field inspection by **District** and agency personnel, with any deficiencies documented.

The deficiencies shall be corrected by the agency prior to completion of their installation of the purchased materials. By performing this inspection early in the project development, materials can be included in the bid package to correct the deficiencies.

b. Assurance that all work is within the right-of-way.

c. A proposal for disposition of removed equipment.

d. Justification of any proprietary items or necessary documentation for computer controlled signal systems, signal preemption devices and other specialized equipment.

e. A schedule of the agency's installation work, based on equipment delivery dates. This should also be referenced in the agreement.

f. Maintenance of Traffic standards which will govern the agency's work.

All plans and documents in the bid document package shall be on 8 ½ x 11 inch (21.6 by 28 millimeter) sheets, and the agency shall submit all computerized plans and document files to the **District** on 3.5 inch computer disks or by electronic file transfer.

After the agency provides the **District** with the final, **District** approved, version of the bid documents package, the district will provide **OTE** with the originals of the bid documents package.

1220-5.7 Requisitions

The **District** or the **Office of Accounting** will enter the project into the automated purchasing system. The **OTE Administrator** shall be added as a required authorization on the requisition.

1220-5.8 Agreement

OTE will send to the **District** an agreement to be forwarded to the agency for signature.

The agreement will be reviewed by the agency, signed by the agency's contractual officer, and returned to the **District** for the **Deputy Director** to sign.

The **District** will keep the original of the executed agreement and provide copies to the agency and **OTE**.

If the agency is responsible for a share of the project costs:

1. A check shall accompany the agreement when returned to the **District**.

2. The **District** shall forward the check to the **Office of Payroll and Project Accounting** and that office will ensure that the agency's check is properly credited to the project and processed. The **District** will furnish **OTE** with a copy of the check transmittal letter.

1220-5.9 Federal Approval

If Federal funding is involved, **OTE** will submit a bid document package, excluding the agreement, to the **Office of Payroll and Project Accounting** to obtain PS&E approval from **FHWA**.

1220-5.10 Pass Through of Federal Funds

If a "Pass Through of Federal Funds" process is used as described in ***Section 1220-5.4***:

OTE will request that the **Office of Accounting** establish the account and create the requisition for the agency's items. The **Office of Accounting** shall add the **OTE Administrator** as a required authorization on the requisition.

1220-5.11 Approval and Invitation to Bid

When all of the concurrently initiated actions in ***Sections 1220-5.7 through 5.10*** are finalized, **OTE** will:

1. Approve the electronic requisitions so they proceed to **Purchasing Services**;

2. Forward the bid documents package to **Purchasing Services** to process an Invitation to Bid; and

3. Advise the agency to proceed with their purchase process if a "Pass Through of Federal Funds" process is used ***(see Section 1220-5.4)***.

1220-5.12 Recommendation for Award of Bids

After the bids have been received and reviewed by the **Purchasing Services**, they will be tabulated and sent to **OTE**. **OTE** shall process the bids as follows:

1. Discuss the bids with the **District** and the agency and make award recommendations.

2. In the case of Federal projects with active Federal oversight, obtain **FHWA's** concurrence with the award recommendations.

3. Forward award recommendations to **Purchasing Services** for further processing.

1220-5.13 Purchase Order

Purchasing Services will create the purchase orders to be issued to the supplier. The purchase order shall include:

1. A "Shop Drawing" note indicating that material catalog sheets or data sheets shall be submitted to the agency before any material is shipped; and

2. A note that all invoices are to be mailed directly to the **District** and materials shipped to the agency.

For those items requiring certified test data as determined by the **District**, the Puchase Order shall also indicate that submissions are required to be submitted to the **District** by the supplier. This would include any submissions which contain material composition analysis which must be in accordance with a recognized standard.

1220-5.14 Catalog Sheets, Certified Test Data and Testing

If specified in the project specifications, catalog sheets shall be received and reviewed by the agency. The agency will indicate comments on the catalog sheets as to the acceptability of the submitted items and their compliance with the material specifications. The submittal shall be marked "Approved," "Approved as Noted," or "Not Approved," and will be transmitted to the various affected parties.

The agency shall notify the material supplier as to the acceptability of the submitted product, thus

enabling them to commence fabrication and/or shipping in the case of an approval, or to make other arrangements in the case of disapproval. The supplier will be advised to send invoices to the **District**.

Certified test data shall be received by the agency with material shipment. It shall be sent to the **District** for review and retention.

Submittals requiring testing shall be conveyed to the **District Highway Management Administrator** and the **Office of Materials Management** for review and approval.

1220-5.15 Inspection of Material Received

Upon receipt of materials, the agency shall contact the **District** to arrange for the inspection of the materials and completion of the necessary **Receiving Forms (MR-541)** and **Field Inspection Report (TE-30)** if required. If only **Receiving Forms (MR-541)** are necessary, the **District** may direct the agency to fulfill this function.

1220-5.16 Invoice Payment

The following shall be submitted to the **District** for payment: invoice, **Invoice Coding Strip (AU-60), Receiving Form (MR-541)**, **Field Inspection Report (TE-30)** if required, and Certified test data if required.

1220-5.17 Project Completion

Upon project completion, the agency shall contact the **District** to arrange a final field inspection. If Federal funding was used and the project has direct Federal oversight, **FHWA** shall be included in the process and its representative should be given copies of all approved certified test data submittals.

After completion of the inspection and correction of any deficiencies, the **District** will document that **ODOT** accepts the physical work as performed by the agency. The **District** will also document that any deficiencies identified in the engineering phase of project development have been corrected.

The **District** shall formally advise the **Office of Payroll and Project Accounting** when the project is completed and acceptable to **ODOT** and **FHWA**. With this information the **Office of Payroll and Project Accounting** will seek final Federal reimbursement of project funds. This process will finalize the project.

1220-6 Alternate Bids for Traffic Control and Lighting Items

1220-6.1 General

The alternate bid procedure has been established to permit a local agency to obtain a specific brand, feature or design of traffic control or lighting device for use on a project.

Some of the generalized uses of the procedure are as follows:

1. To obtain a specific brand and model of equipment, which is expected to simplify maintenance and operation or reduce operating costs.

2. To obtain supports which include architectural features or designs used exclusively within the jurisdiction of the local agency, and which are more expensive than the support designs

normally used in **ODOT** plans. This may include items in local areas with historic or theme backgrounds.

3. To obtain a specialized design feature which is patented or manufactured by only one supplier, and which the agency expects will improve maintenance or operation.

4. To obtain devices which are not presently justified for efficient use on the project or are not acceptably justified by agreed future conditions but which the local agency believes will be necessary at some future time.

5. To obtain items whose extra costs are not justified when lower cost items can provide acceptable results.

1220-6.2 Eligibility

As early as practical during the design stage, the local agency should inquire from the **District Production Administrator** as to whether or not an item is eligible for normal project participation. In many cases where a precedent has not been established, the request is considered with **FHWA** (when Federal funds are involved) and a decision is rendered. This request may be made informally or in writing depending on the nature of items involved and precedents already established. If it is determined that alternate bids are necessary, the local agency shall submit a request in writing through the appropriate **District** that alternate bids be taken. ***Figure 1298-4*** shows a sample letter which may be used by local authorities to request alternate bids.

Each request must include the following information:

1. Specific brand (and model) or design features desired.

2. Reasons why the local agency desires the product or feature in question.

3. Locations for use on the project under consideration.

4. Past history or experience with the product where applicable.

5. Confirmation that the local agency understands the procedures of the alternate bid process ***(Section 1220-6.3)***.

6. Name and telephone number of the responsible authority within the local agency to be contacted after the bid opening to determine the disposition of the alternate bids.

1220-6.3 Procedure

The alternate bid procedure consists of adding a second bid item (alternate bid) for each general (generic) bid item which is affected by the local agency's special requirements. The generic bid item reflects the customary item that is sufficient to meet the needs of the project and is eligible for normal project participation. The alternate bid item describes a similar item that will satisfy the same needs of the project but also contains the local agency's special requirements. After bid opening, **ODOT** compares the costs of generic versus alternate bids for the affected bid items. In the event the generic items are bid at a higher price than the alternate items by the successful bidder, the award will normally be made on the basis of the alternate items with no additional cost incurred by the local agency. In the event the alternate items are bid at a higher price than the generic items, the maintaining agency will have the opportunity to either reject the alternate bids or to agree to accept the alternate bids with the understanding that local agency funds will pay the entire cost differential between the alternate bid and the generic bid.

A representative of the **District** will contact the responsible authority of the maintaining agency ***(see Section 1220-6.2 item number 6)*** by telephone and furnish unit prices and total bids for the generic and alternate bid items involved, including cost differentials for the apparent low bidder. Where the alternate bid process involves more than one item description, alternate bids can be selectively accepted or rejected; however, similar equipment types should be grouped together, such as all controller bid items or all preemption bid items. Only a limited period of time (one or two days) will be available for the maintaining agency to make known their preference by return telephone call (if time is needed to deliberate the preference) and to forward a letter with written confirmation to the **District**.

The apparent low bidder for the project will be determined solely on the generic bid prices submitted (not the alternate bid prices). The cost differential presented to the local agency will be based only upon generic and alternate bid prices submitted by the apparent low bidder. Alternate bid prices submitted by other bidders will not be considered when determining the local agency's added costs.

The project must be awarded or rejected within ten days of the bid opening; therefore, **ODOT** must receive the local agency's written acceptance of the alternate bids within the time period or **ODOT** may award the project on the basis of the lowest bids. If the local agency refuses the alternate bids, written confirmation is still required for **ODOT** documentation. The letter of confirmation must be sent directly to the **District Production Administrator**. The letter shall also include a statement of willingness of the maintaining agency to pay the entire difference in cost, if the local choice is alternate bids involving a higher cost than that for generic bid items. The letter shall be signed by the contractual officer for the local agency. ***Figure 1298-5*** shows a sample letter that may be used by local authorities to acknowledge acceptance or rejection of the alternate bids.

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1230 PLANNING / PROGRAMMING

1230-1 General

This section is intended to address miscellaneous planning issues, including various traffic engineering safety studies.

1230-2 Ball Banking Studies for Determining Curve Advisory Speeds

1230-2.1 General

The Ball Bank Indicator is an instrument used to determine the recommended maximum speed to display on an Advisory Speed plate when the plate is used to supplement a curve (or turn) Warning Sign. This recommended maximum speed is considered to be the maximum safe speed that a passenger car can comfortably traverse the curved section of roadway.

This instrument consists of a steel ball in a scaled curved glass tube filled with an alcohol solution. The tube, bent on the arc of a circle, is graduated from 0 to 20 degrees both to the left and right of the zero point. The tube is enclosed in a metal case ***(see Figure 1298-2)***.

Safe speeds on horizontal curves must also be related to the safe-stopping sight distance and various other factors which cannot be determined by using either the Ball Bank Indicator or the calculation method for determining curve advisory speed signing ***(Section 1230-3)***.

Since speeds are presently only posted in English units (miles per hour), all studies related to advisory speeds shall be conducted and calculated in English units. This method will simplify the study process and also eliminate any possibility of errors in the final determined speed caused by either additional calculations or the use of conversion factors.

1230-2.2 Mounting the Ball Bank Indicator

When mounting the Ball Bank Indicator, the car should be in a stationary level position. The speedometer of the automobile must be accurately calibrated and the tires uniformly inflated. The indicator should be mounted as near as possible on a vertical surface, with the steel ball at the zero point. All occupants who are to be in the car when the observations are to be made should be in the same position when mounting or checking the instrument as when making the test.

This is necessary because changing position of the passenger or the load in the car may cause the car body to tilt to the right or left depending on the transfer of the load from one side to the other and this tilting action or body roll is reflected in a change in the ball bank readings.

1230-2.3 Use of the Ball Bank Indicator

The use of the Ball Bank Indicator to measure the safe speed on curves involves the efforts of two persons - one to drive and the other to observe the indicator. The following directions should be observed in each test made:

The driver should:

1. Appraise the curve under observation to determine the approximate safe speed that may be maintained throughout the curve.

2. Conduct the first test at a speed 10 miles per hour below the appraised speed.

3. Make each succeeding test at a speed 5 miles per hour greater than the last one until the Ball Bank Indicator has reached 10, 12 or 14 degrees as specified in ***Section 1230-2.4***.

4. Attain the trial run speed on each test at a distance of at least one-quarter mile from the beginning of the curve.

5. Maintain a course throughout the curve precisely in the center of the lane and at uniform speed.

The observer carefully notes the position of the ball at the approximate center of the curve and records the reading. The reading shall be recorded as right or left of zero.

1230-2.4 Recording the Safe Speed Data

It is important that all information be recorded that is indicated on the heading of the Curve Study Sheet ***(Form 1296-11)***. A full size Curve Study Sheet is available from the **OTE** website.

As provided for on the Curve Study Sheet, trial runs should be made in each direction. For the specified speed ranges, the following ball bank angles shall be used:

Below 20 miles per hour - 14 degrees
20 to 30 miles per hour - 12 degrees
30 to 40 miles per hour - 10 degrees

1230-3 <u>Calculation Method to Determine Curve Advisory Speed</u>

If trial run information is not available, the advisory speed indications for horizontal curves may be calculated by inserting the curve data into the following equation relating superelevation, pavement friction, radius of curvature and vehicle speed:

$$Vmph = \sqrt{(e + f)R \div 0.067}$$

Where V = speed of vehicle in miles per hour
e = superelevation in feet per foot of horizontal width
f = transverse coefficient of friction
R = radius of curvature in feet.

Recommended Values of Transverse Coefficient of Friction:

Operating Speed	Transverse Coefficient of Friction
30 mph	0.16
40 mph	0.15
50 mph	0.14
60 mph	0.13

Safe speeds on horizontal curves must also be related to the safe-stopping sight distance and various other factors which cannot be determined by using either the Ball Bank Indicator ***(Section 1230-2)*** or this calculation method.

1230-4 Delay Studies

This section is reserved to address information available regarding delay studies. In the interim, contact **OTE** for such information if needed.

1230-5 Speed Studies

See information in ***Section 1212-3*** regarding the Speed Check and Test Runs used to evaluate proposed changes in speed limits.

1230-6 Safety Study Guidelines

1230-6.1 General

The following safety study guidelines are for use by **ODOT** personnel, consultants and local jurisdictions conducting safety engineering studies and preparing reports. The safety engineering study is an analysis of roadway and traffic related data to determine the possible cause of an identified crash pattern at an intersection or highway section. The safety engineering study also provides alternative countermeasure(s) meant to mitigate the crash pattern(s).

By establishing a uniform format for **ODOT** safety engineering studies and providing direction for completing safety engineering reports, these guidelines are intended to assure the completeness of a study and to expedite review and analysis of the reports. The following section outline the component parts of a safety study and the related report.

1230-6.2 Table of Contents

All safety study reports shall have a Table of Contents ***(see Figure 1298-6)***.

1230-6.3 Title Page

The title page of a safety study report should show the **District**, county, route, section, High Crash Location Identification System (HCLIS) Number (#), the year of the Safety Annual Work Program (SAWP), study completion date and a location map ***(see Figure 1298-7).***

1230-6.4 Executive Summary

1230-6.4.1 General

Every safety engineering study report shall include an Executive Summary, which can be used as an overall summary of the report. The following sections outline the information that should be included in this Summary.

1230-6.4.2 Purpose

This part of the Executive Summary is used to identify the location being studied and give the reasons for conducting the safety engineering study.

Example 1

The intersection of U.S. 250 & Kidron Road has been selected for analysis and study based upon a ranking of #305 in the 2001 HCLIS for the safety program. The purpose of the study is to determine safety issues at the intersection, establish priorities based upon rate of return, and develop improvements to enhance safety at this location.

Example 2

This section of road appears on District 5's 1999 listing of high crash locations, it is rated #348 in the state. The purpose of this report is to study this location and analyze the crashes to determine what if any actions can be taken to reduce these crashes.

1230-6.4.3 Background

This section of the Executive Summary is used to identify the location being studied, type of facility, type of traffic control, history of problems or crashes and reason for the study.

Example 1

This section of U.S. 20 is between the intersection of S.R. 58 and the four-lane section, which begins approximately 1 mile west of the interchange with S.R. 511. This portion of U.S. 20 is fairly straight and flat and it is marked with a single dashed center line except at the intersection of S.R. 58 where there is an exclusive left-turn lane on U.S. 20.

The section between SLM 6.60 and SLM 7.10 appears on the 1997 HCLIS as location #261 and on the District's 1998-99 AWP as location #33. However, a longer section was studied due to complaints received regarding the transition from the four-lane section to the two-lane section.

The complaints were received after two fatal crashes (one in 6/98 and one in 7/98) in which the U.S. 20 westbound vehicle traveled left of center and struck an eastbound vehicle head on. However, it does not appear as though the westbound drivers were confused by the transition, nor did it appear that they thought they were still on the four-lane section of highway. According to witness statements, there were no other westbound vehicles in the vicinity or any objects in the roadway. Therefore, they were not attempting to pass another vehicle or swerve to avoid an object. Both westbound drivers gradually crossed over the center line striking the eastbound vehicles.

Example 2

This approximately 1.16 mile section of S.R. 56 is located in Pickaway County. It is part of the rural state highway system under the jurisdiction of District 6 of the Ohio Department of Transportation (ODOT). The section under study, log point 26.44 to 27.60, begins at the intersection of S.R. 159 and S.R. 56 and extends in an easterly direction just beyond and including the Township Road (T.R.) 62 and S.R. 56 intersection. The project limits extend longitudinally 1000 feet along the center line at intersections and 200 feet laterally from the center line along the entire length of the study area. Based on information supplied by District 6, PIC-56-26.92 to 27.41 was ranked #135 on the 1997 HCLIS and #290 on the Department's 1998 HCLIS.

Example 3

This segment is located in central Knox county in Morris Township. It begins 1.20 miles north of the City of Mt. Vernon. It ends 3.50 miles south of the Village of Fredricktown. This section of S.R. 13 is curved and on a steep grade while crossing the CSX railway. S.R. 13 is generally straight and level north and south of this section. The CSX railroad crossing is at the 13.38 mile marker.

Example 4

U.S. 250 is a two-lane rural principal arterial that runs east and west and Kidron Road is a two-lane rural minor collector that runs north and south.

The intersection of U.S. 250 and Kidron Road (C.R. 52) is currently #305 statewide on the 1999 HCLIS, and #29 on the District 3 2000-2001 SAWP. This location was previously studied in January 2000 as #233 on the 1998 HCLIS, and in May 1997 as #177 on the 1995 HCLIS.

As a result of the January 2000 study, the following improvements were made: the unpaved island on the other approach of Kidron Road was paved, and the STOP sign which was in the island was removed and placed on the left side of Kidorn Road to create a dual installation. Also, both the north and south approaches were improved (grades leveled) to optimize sight distance. These improvements were completed approximately July of 1998.

1230-6.4.4 Possible Causes

The possible causes or deficiencies in the roadway location are identified in this section of the report through detailed analysis of crash patterns, roadway conditions, existing traffic control, traffic volumes, vehicle speeds, etc.

Example

The safety problems identified at this location are as follows:

- The sight distance for the south approach of Line Rd. is obstructed.
- There are an insufficient number of gaps for Line Rd. traffic to pull onto U.S. 36.
- There are no exclusive turn lanes to separate left turns from the rest of the traffic stream.
- The radii at the intersection are not large enough to allow heavy vehicles to turn easily.

1230-6.4.5 Recommended Countermeasure and Cost

Recommended countermeasures and their related costs are also noted in the Executive Summary. A recommended countermeasure is a highway safety treatment or corrective activity designed to alleviate a safety problem or a potentially hazardous location. The cost of every countermeasure is the cost of improvement through force account or contract work and should be included with every countermeasure identified. All countermeasures should address the possible causes identified earlier.

Example

- The trees and brush on the southwest corner of the intersection should be removed to allow 800 feet of sight distance. The estimated cost for this countermeasure is $$$$$.
- A traffic signal is warranted and should be installed. The estimated cost for this countermeasure is $$$$$.
- Left-turn lanes should be installed on U.S. 36 to correct the safety problems. Left-turn lanes should be installed on Line Rd. to optimize the operation of the traffic signal. The estimated cost for this countermeasure is $$$$$.

- The corner radii should be improved to 45 feet and berms should be stabilized. The estimated cost for this countermeasure is $$$$$.

1230-6.5 Existing Conditions

1230-6.5.1 Condition Diagram (Required)

The condition diagram is a “to scale” drawing of the most important physical conditions of an intersection or section of a roadway. It is used to relate the crash patterns found on the collision diagram with their probable causes to physical features on and near the roadway. It also documents the site conditions that exists. The following items should be located by reference to a benchmark that can be identified in the field at any time. A title block identifying the location will be used consistently in all drawings. See ***Figure 1298-8*** for an example of an existing condition diagram for a roadway section and ***Figure 1298-9*** for an intersection.

1230-6.5.1.1 Roadway Features Required

The following features shall be shown in the drawing or in the related descriptive text:

1. Intersections: Identify by name, type of pavement (if applicable) and width of street.
2. Traffic Control Devices (signs, signals and pavement markings) at the intersection.
3. Section: Identify by county, route and log point in the title block of the drawing.
4. North arrow and match line if more than one page.
5. Pavement Markings: Center Line, No Passing Zones, Auxiliary Markings, Stop Bars, Crosswalks, etc.
6. Signs: All signs within the right-of-way, including non-**OMUTCD** signs, sign sizes (optional).
7. Pavement and shoulder widths and any surface irregularities.
8. Speed limits on all approaches in drawing or text.
9. Driveways: Identify type of pavement of drive (concrete, asphalt, grass or gravel), and use (residential or commercial) when applicable.
10. Show Corporation Lines.
11. Curb: Identify type of curb, height, etc. (optional).
12. Median: Identify type of median (grass, concrete, asphalt, etc.) and width.
13. Cross-corner sight distance at intersection or driveway with crashes in diagram or text.
14. Bridges and culverts, if involved in the accident.
15. Legend is required when using symbols on diagram.
16. Other items that may be contributing factors.

1230-6.5.1.2 Roadway Features If Applicable

When applicable, the following items should also be included:

1. Show evidence of parking within the right-of-way, if any.
2. Utility/Strain Poles: If involved in crash or sight distance restriction.
3. Guardrail: Include distance from edge of pavement, type of end treatment and height of guardrail (distance and height of guardrail optional).
4. Fire Hydrants: If involved in crash or sight distance restrictions.
5. Highway lighting.
6. Widths of drive, street number address (optional): Commercial or residential, any restricted movement.
7. Catch basins (optional).
8. Manholes (optional).
9. Vegetation: If contributing factor to the crash problem (optional).
10. Trees in the right-of-way: Identify by diameter if contributing to crash problem (optional).
11. Roadside features: Steep grades, ditch locations along the roadside, but not behind guardrail.

1230-6.5.2 Physical Condition Writeup (Optional)

The physical condition writeup explains the type of location, type of roadway, traffic control devices in place, traffic and any operational deficiencies related to the location.

<u>Example 1</u>

S.R. 13 is a two-lane asphaltic concrete roadway running north and south. The pavement is now in poor condition. It is 24 feet wide with berms approximately 2 feet wide. The sight distance from C.R. 13, also known as Green Valley Road, looking south across the railroad tracks is 340 feet.

<u>Example 2</u>

S.R. 56 is a rural two-lane roadway. The layout of S.R. 56 within the study area consists of horizontal and vertical curves, residential drives and a commercial drive. The driveways in the study section were counted and their distance from S.R. 159 measured. Standard center line and edge line markings exist throughout the study area. The curves between S.R. 159 and T.R. 62 are marked with warning signs and advisory speed plates. A number of vehicle types travel this roadway, including semi-trucks, farm equipment and horse-drawn buggies.

The intersection of S.R. 56 and S.R. 159 is a four-way stop with an all-way red intersection flasher. Each leg of the intersection is 21 feet in width from edge line to edge line with a 2-foot

paved berm and varying gravel berm beyond the edge of the paved berm. The two state routes come together to form an approximate 90 degree intersection. Stop bars and Stop Ahead signs are on all four approaches of the intersection. D-1 assemblies and standard route direction and confirmation markers are also on each approach of the intersection.

Example 3

The intersection under study is located approximately a third of a mile west of the City of Delaware corporation limits, as shown in Figure --. It is unsignalized with STOP signs on the approaches of South Section Line Road. Signs on South Section Line Road also indicates that U.S. 36 cross traffic does not stop (see pictures included in the Appendix). U.S. 36 runs mostly east-west, with a skew to southwest-northeast. South Section Line Road runs north-south and intersects other major traffic carriers; primarily Airport Road, U.S. 42 and U.S. 37. Average daily traffic on U.S. 36 and South Section Line Road is 8,610 and 4,575 vehicles, respectively. The posted speed limit is 45 mph on south Section Line Road and 55 mph on U.S. 36. There is no street lighting at the intersection. There are no exclusive turn lanes on any of the approaches. There is a slight crest on the east approach of U.S. 36 and a stand of trees on the southwest corner of the intersection.

1230-6.6 Collision Diagrams

A collision diagram is a schematic drawing that has been compiled from a series of individual crash reports relative to a specific location (intersection or section), which shows the direction the vehicles travel prior to contact, and pedestrians whose presence contributed to a collision. A minimum of three years of the latest crash data will be used to draft the collision diagram. See ***Figures 1298-10 and 1298-12*** for sample intersection collision diagrams and ***Figure 1298-11*** for a roadway section collision diagram.

The following information should be included in the collision diagram:

1. Title box with county, route, section, HCLIS year and rank (if applicable), and crash data time frame (e.g., 1/1/97 - 12/31/99). The title box should also have the initials of the person it was drawn by and the date it was completed.

2. Schematic of location: Each approach should be labeled and the north arrow shown.

3. Each crash should include the following information as a minimum: date, time and pavement conditions. This information is typically shown on the line for the driver at fault. Any other pertinent information about the accident, or driver at fault, should also be shown (e.g., injury, intoxicated, ran STOP sign or red light, etc.).

4. Legend key to denote all symbols used must be included in the collision diagram.

1230-6.7 Crash Data

Crash data helps identify crash patterns which are indicative of possible safety problems. A minimum of three years of the latest crash data shall be used for review of crash data and analysis.

Crash summaries should include summaries by crash type, severity, contributing factors, environmental conditions, time periods and other data as applicable. They should be useful for easy comparison and trend analysis.

See ***Figure 1298-13*** for typical crash data and analysis.

1230-6.8 Crash Analysis

The crash analysis procedures include the study and analysis of crash characteristics of a site. The characteristics such as crash type, severity, contributing factors, environmental conditions and time period data are analyzed. The detailed analysis of these characteristics are conducted to identify safety problems and their possible causes.

Example 1

Crash reports from January 1, 1994 through December 31, 1998 were obtained. During this five-year period, a total of sixty-one crashes occurred within the study limits. Of the sixty-one crashes, ten were animal crashes (deer) and one was due to a vehicle defect. Of the remaining fifty, six were rear-end, nine were angle, five were sideswipe, twenty-seven were fixed object and three were left-turn crashes. Sixteen of the crashes involved injury, but none fatal. Of the fifty crashes in the study area, thirty-eight occurred during the day and twenty-nine on dry pavement.

The crash diagrams show the approximate location of the 1996-1998 crashes in the study area. At the intersection of S.R. 56 and S.R. 159 (plate ---), five crashes occurred, four angle and one left turn. All five of the crashes took place during the day, and the vehicle that was traveling north on S.R. 159 was at fault in all situations.

The crash diagrams also showed seven crashes occurring 0.20 miles west of T.R. 62. Five of the seven were fixed object crashes where drivers were unable to maintain control of their vehicles on the horizontal curve (four of the fixed object crashes occurred on the same day, due to icy conditions). The other two crashes were “sideswipe passing” and “sideswipe meeting.” All of the vehicles that caused that crashes were traveling westbound. This indicates a possible skid problem in the westbound lane, drivers traveling at an excessive speed, and/or unsafe geometry.

The diagrams show four crashes that occurred in the vicinity of the Mini Mart gas/convenient store drive (plate---). Vehicles turning left into the Mini Mart driveway in front of opposing traffic caused two of the crashes. These crashes may have been caused by limited sight distance due to a sag vertical curve just east of the Mini Mart drive.

Example 2

Crash records were obtained for the years of 1996-1998.The database was checked for completeness with copies of actual police reports.

One of the fixed object crashes involved a heavy vehicle making a right turn from westbound U.S. 36 to northbound South Section Line Road.

Angle crashes may also be caused by high speeds on the major street, indicating the need for a speed study. Inadequate sight distance may also play a role in the number of angle crashes.

Excessive speed on the east and west approaches may also be a cause, meaning that major street traffic cannot stop in time when confronted with stopped traffic waiting to turn onto the minor street. The number of rear-end crashes indicates that roadway lighting may be inadequate, but the following study of crashes by environmental conditions shows that lighting does not influence crashes at this location.

The failure to yield and running a STOP sign circumstances resulted in angle crashes in the intersection. This emphasizes the problem of inadequate gaps for South Section Line Road traffic to pull out. The rear-end crashes on U.S. 36 were a result of drivers following too close. The “failure to control” and “driver inattention” circumstances resulted in “fixed object struck” crashes

on U.S. 36. Most of the contributing circumstances of crashes at this location are correctable.

Of the crashes that occurred during wet pavement conditions, most were angle crashes in the intersection. Only percent of all crashes were rear-end crashes occurring during wet pavement condition. This indicates that skidding is not a problem. The majority of crashes at this location occurred during daylight, indicating that street lighting was also not a problem.

A significant percentage of crashes occur during the peak volume times. Angle crashes made up the majority of crashes during the A.M. and P.M. peak hours. This also indicates that Line Road traffic has difficulty finding adequate gaps in U.S. 36 traffic.

To summarize, the possible causes of angle and rear-end crashes are lack of sufficient gaps in major street traffic, excessive speeds on the major street, lack of exclusive turn lanes at the intersection, and sight distance problems. The possible causes, as determined by the crash study, are used to determine areas of further study. These possible causes may be eliminated with further study.

Example 3

The crash history indicates that angle and turning crashes are 82 percent of the total. We will analyze these because they show identifiable patterns. Approximately 55 percent of the angle crashes occurred from the north approach and 45 percent from the south. The 1999 traffic count shows a traffic signal is justified for six hours by Warrant No.1. This is two hours less than the requirements, but if the hourly volumes are projected for five years at a growth rate of 3 percent per year, the eight hours are satisfied. The installation of a traffic signal would create the gaps for traffic to safely enter U.S. 62.

The turning crashes and rear ends on U.S. 62 should be reduced by the installation of left-turn storage lanes.

The ODOT L&D Manual and the Highway Capacity analysis were used to determine the appropriate turn lanes, signal phasing and level of service. This information is part of the report.

In addition to the traffic volumes generated by tourists coming to “Amish Country” and passing through this intersection, the crest vertical curve on U.S. 62 is limiting the needed intersection sight distance and stopping sight distance. These can be improved by lowering the crest and filling the sag just northeast of the intersection.

1230-6.9 Recommendations

The recommendations resulting from a safety study are based upon identified safety deficiencies at the location. Several factors need to be considered when developing countermeasures and recommendations. The recommendations should be based on knowledge of the effectiveness of the improvement being recommended in similar situations. Improvements should be based upon the traffic and site conditions. A combination of improvements may be the best practical countermeasure for a location. All practical improvements, including “do nothing,” should be identified and considered and analyzed for safety so that no feasible alternative is overlooked.

Example 1

From the crash analysis and field observation, it is apparent that the roadway needs to be widened. Due to the recent widening that was completed on the east end of the section, only the western portion of the section from approximately mile marker 2 to Shaker Rd., east junction, needs to be improved. This would create a project length of approximately 1.5 miles. The traveled

lanes should be widened to 12 feet and the shoulder should be widened to 8 feet. The shoulder should be bituminous surface treated, and half of it should be full-depth pavement. The three existing culverts should be extended to minimize the need for guardrail. Guardrail should be installed at all steep drop-off areas.

Example 2

Problem areas are the railroad intersection located within the "S" curve, and the intersection located north of the track. The following actions are recommended: work with the County Engineer to realign County Road; apply for safety funding to realign S.R. 13 and get crossing lights and gates installed at the highway-rail grade crossing.

Example 3

1. Construct left-turn storage lanes on the U.S. 62 approaches.
2. Construct right-turn storage lane on the C.R. 77 north approach.
3. Construct fully-actuated traffic signal.
4. Replace existing intersection lighting.

Example 4

1. Remove trees and brush on southwest corner to allow 800 feet sight distance.
2. Install a traffic signal.
3. Install an eastbound left-turn lane on U.S. 36 with a length of 345 feet.
4. Install a westbound left-turn lane on U.S. 36 with a length of 356 feet.
5. Install north and southbound left-turn lanes on south Section Line Road with lengths of 150 feet.
6. Improve corner radii to a minimum of 45 feet and stabilize berms.

1230-6.10 Rate of Return

The rate of return determines the benefits expected to be obtained by an improvement. It is a measure of expected "yield" or effective return of the safety countermeasure. This technique computes an estimated interest rate for a safety countermeasure at which the estimated net present annual worth of the countermeasure minus the estimated improvement cost is equal to zero. In this case, the net present annual worth of the countermeasure is the expected dollar value of safety benefits in terms of crashes prevented. The estimated improvement costs include those expected costs required for implementation and maintenance of the countermeasure.

Example: See ***Figure 1298-14***.

1230-6.11 Photos

Include relevant photos that show the probable cause of crashes at the location studied. Standard photographs shall be included as follows:

1. Intersections:

   a. 200 feet, 600 feet and 1000 feet from intersection.

   b. Cross-corner sight distance.

2. Highway Sections:

   a. At 400 foot intervals for the complete length of the section; and

   b. Extending 400 feet at each end.

Example: See ***Figures 1298-15 and 1298-16***.

1230-6.12 Other Issues and Data

Other relevant data and information are included when such information is essential in garnering support of the study and the countermeasures being recommended. Relevant information may include proposed developments, schools, shopping malls, public concerns/petitions, newspaper articles, and public and law enforcement officer's concerns.

1230-6.13 Appendix

The Appendix will include related material such as that shown below to further document and enhance the quality of the safety study. The references shown for the different topics are just a guide and are not meant to be the only source. These topics are covered by many traffic engineering manuals, including **ITE** handbooks, and those should be used as a source for reference.

1. Traffic Volume Count: Required.

   This is discussed elsewhere in this chapter of the **TEM** and in Chapter 2 of the **ITE Manual of Transportation Engineering Studies**.

2. Traffic Speed Studies: If applicable.

   This is discussed ***Section 1212-3*** and in Chapter 3 of the **ITE Manual of Transportation Engineering Studies**.

3. Crash Summaries: Required.

   This is discussed in ***Sections 1230-6.7 and 1230-6.8*** and ***Figure 1298-13***.

4. Standard Photographs: Required.

   See **Section 1230-6.11** and ***Figures 1298-15 and 1298-16***.

5. Traffic Signal Warrants: If applicable.

   See ***Section 402-3*** and **OMUTCD Part 4** for further information about traffic signal warrants.

6. Other Traffic Studies and Analyses: If applicable.
   See ***Sections 1211, 1212, 1213 and 1230*** and the **ITE Manual of Transportation Engineering Studies** for information about other traffic studies and analyses that may be

applicable.

7. Aerial and Other Photos of the Location: Optional.

8. Field Review Notes: Optional.

   See the Field Review Forms developed as part of the **ODOT** research report **Rural Highway Safety Advisor (RITA)**.

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1250 CONSTRUCTION

1250-1 General

This section will be used to provide additional information regarding construction related situations that involve more than one traffic engineering area or application.

1250-2 Local Government Agency / Utility Force Account Work

1250-2.1 General

Procedures for administering force account work associated with an active construction project are described herein, and they are also shown as a flow chart in ***Figure 1298-3***.

Federal procedures for requesting approval of force account work are contained in the **Federal-Aid Policy Guide, Subchapter G, Part 635, Subpart B**.

1250-2.2 Procedure

Force account proposals shall be submitted and evaluated prior to PS&E so that funds can be encumbered in a timely manner.

The agency proposing to perform the work shall submit the following information to the appropriate **District** for review and approval:

1. A Force Account Proposal documenting the work to be performed and why. It should include a detailed work description, an estimate, and explanation of the need for the work and why it is best performed by the force account method.

2. Plan Drawings that are clear enough to be followed by an engineer not familiar with the project. They shall define the extent and details of the necessary work, and they should include or refer to standards of quality which the work must meet (i.e., **ODOT Specifications, Ohio Manual of Uniform Traffic Control Devices, National Electric Code, National Electric Safety Code**, etc.)

3. A cost comparison which includes a comparison between the agency's proposed cost and the cost of having the work performed by the contractor.

In order to be approved, the above submittal must show that the force account method is cost effective assuring the lowest overall cost.

The **District** shall: review the submittal; and if it finds the proposal and other documentation to be acceptable, draft a tentative agreement between **ODOT** and the requesting agency. The agreement shall be sent to the requesting agency for signature.

In the case of federally funded projects, which are not Certified Acceptance Projects, the request, including the draft agreement, shall be sent to **FHWA** for concurrence.

Upon its return, the agreement will be sent to the **Office of Project Coordination** which will arrange to obtain the **Director's** signature. As part of the transmittal IOC to the **Office of Estimating**, an encumbrance number shall be requested for the force account work. The IOC shall also contain the estimated cost associated with the force account work.

After the agreement is signed and an encumbrance number assigned, the **District** will return a copy of the executed agreement along with formal approval of the proposal to the agency.

At such time as the work is being performed, the responsible agency will submit its billings to the **District** for review and approval. If the charges are reasonable and are in conformance with the proposal, they will be forwarded to the **District Business and Human Services Administrator** for payment.

1280 RESEARCH

This section will be reserved to address information about research that involves more than one of the traffic engineering area or application.

1295 REFERENCE RESOURCES

Various reference resources that may be useful have been noted in ***Sections 193, 194 and 195***.

1296 FORMS INDEX

1296-1 Time-Lapse and Video Request Form

Form 1296-1 is used to request **OTE** time-lapse or video services. This procedure and form are described in ***Section 1202-1***.

1296-2 Speed Zone Warrant Sheet

Form 1296-2 is used for a Speed Zone Warrant analysis. The procedure for using this form is described in ***Section 1212-3.4.***

1296-3 Speed Study Data Sheet

Form 1296-3 is used in recording data used in the Speed Zone Warrant Analysis. See ***Section 1212-3.1***.

1296-4 Sample Speed Study Data Sheet

Form 1296-4 is a sample of a completed version of ***Form 1296-3***.

1296-5 Speed Check Form

Form 1296-5 is used to record speed information to determine the 85th percentile and pace speeds. See ***Section 1212-3.2***.

1296-6 Speed Limit Revision

Form 1296-6 is used to establish a revised speed limit ***(see Section 1212-2)***. Note that the established limit becomes effective when appropriate signs giving notice thereof are erected.

1296-7 Withdrawal of Issued Speed Zone Authorization

Form 1296-7 is used to withdraw a revised speed limit ***(see Section 1212-4)***.

1296-8 Field Report on Parking Practices

Form 1296-8 is used to request a No-Parking Zone. The procedure for using this form is described in ***Section 1213.***

1296-9 Establishment of No-Parking Restrictions

Form 1296-9 is used to establish a No-Parking Restriction ***(see Section 1213-2)***. Note that the restriction becomes effective when appropriate signs giving notice thereof are erected.

1296-10 Withdrawal of Issued No-Parking Restrictions

Form 1296-10 is used to withdraw an established No-Parking Restriction ***(see Section 1213-4)***.

1296-11 Curve Study Form

Form 1296-11 is used in the Ball Banking Study described in ***Section 1230-2*** to determine if an Advisory Speed plate should be used to supplement a curve (or turn) Warning Sign and, if used, the

recommended maximum speed to use on the Advisory Speed plate.

1296-12 Completed Curve Study Form

Form 1296-12 is a sample of a completed ***Form 1296-11***.

Form 1296-1. Time-Lapse & Video Request Form

TIME-LAPSE & VIDEO REQUEST FORM

Request Source Agency _____ Date _____

For Details Contact _____ Phone _____

District No. ____ County _____ Route _____ Log point _____

Location Description :

Problem Statement and Justification of Time-Lapse [ ] or Video Request [ ]

Desired Day of the Week _____ Time of Day _____ to _____

and _____ _____

Additional comments regarding schedules, priority, deadlines, etc.:

Please send form by E-Mail to Mike Keller@TrafficEng@EngPolicy, or by mail to P.O. Box 899, Columbus, OH 43216

Central Office Use Only			
Date Scheduled _____		Date Completed _____	
Job Number _____	Time Lapse Speed _____	Tape Number _____	

Form 1296-2. Speed Zone Warrant Sheet

Ohio
Warrants for Speed Zones

DATE: _____

COUNTY: _____ ROUTE/STREET: _____

BEGIN: _____ END: _____ LENGTH: _____ ADT: _____

(End Length minus Begin Length)

I. HIGHWAY DEVELOPMENT

(A) BUILDING DEVELOPMENT

TYPE 1 - UNITS _____ x 1 = _____

TYPE 2 - UNITS _____ x 2 = _____

TYPE 3 - UNITS _____ x 3 = _____

TYPE 4 -UNITS _____ x 4 = _____

TOTAL TYPE (A) _____

(B) INTERSECTION CLASSIFICATION

CLASS A - NO. _____ x 2 = _____

CLASS B - NO. _____ x 3 = _____

CLASS C - NO. _____ x 4 = _____

TOTAL CLASS (B) _____

HIGHWAY DEVELOPMENT = $\frac{(A) + (B)}{\text{LENGTH (MILES)}}$ = _____ = _____

II. ROADWAY FEATURES

FACTORS	8	9	10	11	12	
1) LANE WIDTH, FEET	< 9	9	10	11	≥ 12	_____
2) SHOULDER.... UNIMPROVED	< 2	< 4	< 6	≥ 6		
IMPROVED		< 2	< 4	< 6	≥ 6	_____
3) CHARACTERISTICS	E	D	C	B	A	_____

TOTAL ROADWAY FEATURES = _____

III. ACCIDENT CALCULATIONS: $\frac{2740 \times \text{Accidents}}{\text{ADT} \times \text{Years} \times \text{Miles}}$ = $\frac{\text{Accidents}}{\text{Mil. Veh. Miles}}$ = _____

SPEED LIMIT FACTORS	45	55	64	73	82	91	100	
HIGHWAY DEVELOPMENT	> 80	69-80	57-68	45-56	33-44	21-32	<21	_____
ROADWAY FEATURES	24	25-26	27-28	29-30	31-32	33-34	35-36	_____
85TH PERCENTILE (MPH)	23-27	28-32	33-37	38-42	43-47	48-52	> 52	_____
PACE (MPH)	13-27	18-32	23-37	28-42	33-47	38-52	43-57	_____
ACCIDENTS/MVM	> 5.0	4.4-5.0	3.7-4.3	3.0-3.6	2.3-2.9	1.6-2.2	<1.5	_____

TOTAL FACTORS = _____

IV. CALCULATED SPEED: $\frac{\text{Total Factors}}{5} \times \frac{55}{100}$ = _____ = _____

V. TEST RUN, AVERAGE _____ **MPH** **WARRANTED SPEED =** [ ] **MPH**

Study by: _____ Requested Speed Limit _____

Additional information & comments _____

Form 1296-3. Speed Study Data Sheet

SPEED STUDY DATA SHEET

Indicate North

Date _____ County _____ Highway Name _____ Route Number _____

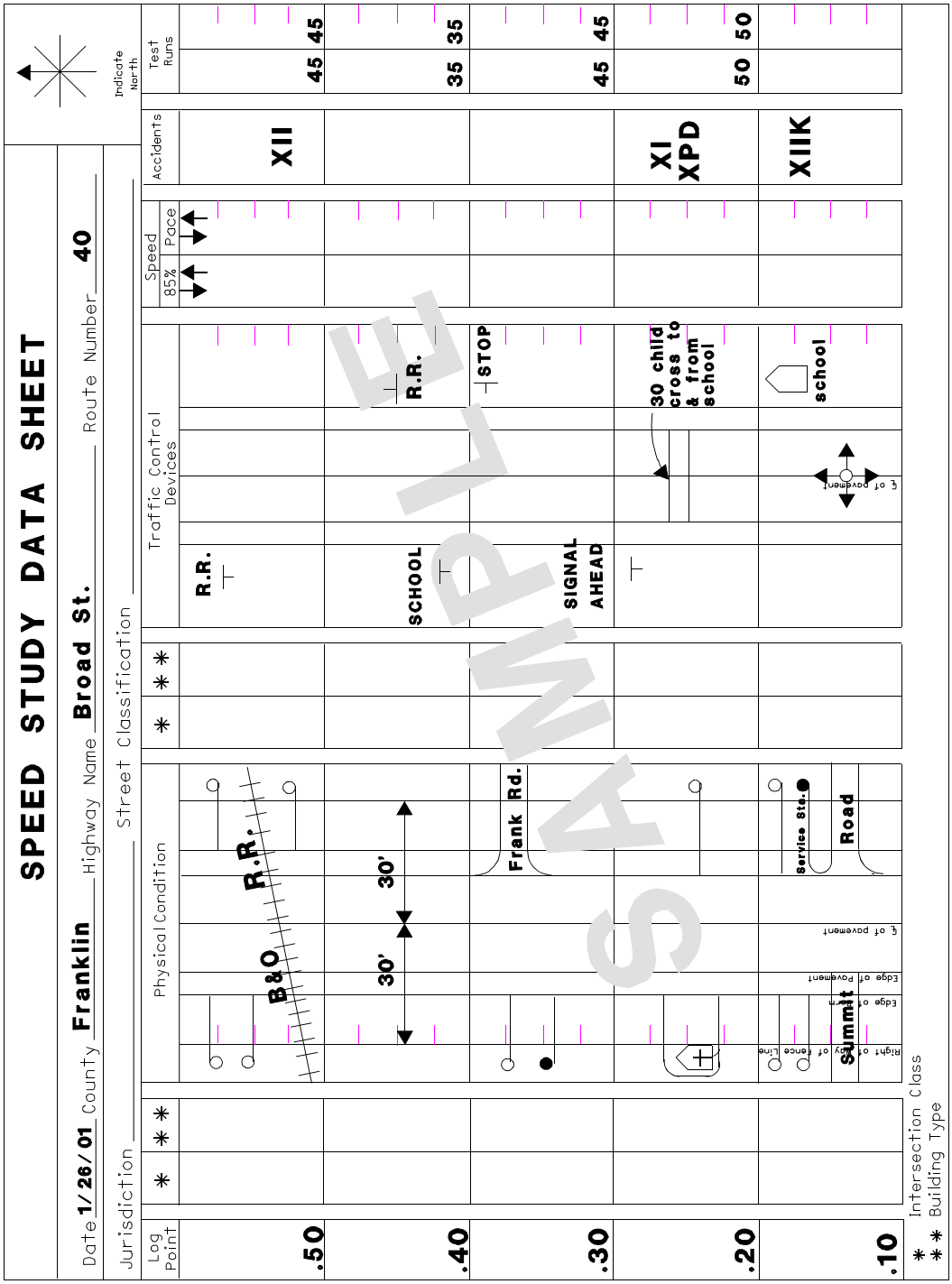
Jurisdiction _____ Street Classification _____

Log Point	*	**	Physical Condition	*	**	Traffic Control Devices	Speed 85%	Speed Pace	Accidents	Test Runs
			Right of Way of Fence Line							
			Edge of Berm							
			Edge of Pavement							
			℄ of pavement			℄ of pavement				

Intersection Class

** Building Type

Form 1296-4. Sample Speed Study Data Sheet



Form 1296-5. Speed Check Form

Speed Check

Location: _____
Date: _____ Day: _____ County: _____
Observer: _____
Type Pavement: _____ Dry: ____ Wet: ____ Condition: _____ Width: _____
Weather: _____ Temperature: _____

_____ Bound, Time: _____M to _____M					mph	_____ Bound, Time: _____M to _____M				
Com. %	Cum. Total	No.	Vehicles			Vehicles		No.	Cum. Total	Com. %
			Passenger Cars	Commercial		Passenger Cars	Commercial			
					Over					
					90.0					
					88.0					
					86.0					
					84.0					
					82.0					
					80.0					
					78.0					
					76.0					
					74.0					
					72.0					
					70.0					
					68.0					
					66.0					
					64.0					
					62.0					
					60.0					
					58.0					
					56.0					
					54.0					
					52.0					
					50.0					
					48.0					
					46.0					
					44.0					
					42.0					
					40.0					
					38.0					
					36.0					
					34.0					
					32.0					
					30.0					
					28.0					
					26.0					
					24.0					
					22.0					
					20.0					
					18.0					
					16.0					
					14.0					
					Below					
					Totals					

Form 1296-6. Speed Limit Revision

STATE OF OHIO
DEPARTMENT OF TRANSPORTATION

SPEED LIMIT REVISION

Location of Alteration:

District: ____ Revision No.: _____ Name of Street: _____

Municipality: _____ County: _____

State Route No.: _____ Co. Rd./Twp. Rd.: _____

Under Authority of Section 4511.21 of the Ohio Revised Code, the following revised prima facie speed limits, which have been determined upon the basis of a traffic and engineering investigation to be reasonable and safe, are hereby established for the streets and highways described herein. The prima facie speed limit or limits hereby established shall become effective when appropriate signs giving notice thereof are erected.

LOCATION OF REVISED PRIMA FACIE SPEED LIMITS

From	To	Approved Speed Limit (in MPH)	
		_____ Bound	_____ Bound

Signs giving notice of approved speed limits shall be erected immediately. Such signs shall conform to the Ohio Manual of Uniform Traffic Control Devices for Streets and Highways.

This authorization is revocable by the Director of Transportation whenever, in his opinion, any altered prima facie speed becomes unreasonable and, upon such withdrawal and notification such altered prima facie speed shall become ineffective and the signs relating thereto shall be immediately removed by the local authorities.

Date: _____ _____

Director of Transportation

Immediately after erection of the appropriate speed limit signs, return the attached copy of this Speed Limit Revision form to the ODOT District Deputy Director or his designee, with the following certification properly executed.

I hereby certify that appropriate signs, giving notice of the above prima facie speed limits were erected

on _____ Signed _____

Title _____

Form 1296-7. Withdrawal of Issued Speed Zone Authorization

STATE OF OHIO
DEPARTMENT OF TRANSPORTATION

WITHDRAWAL OF ISSUED SPEED ZONE AUTHORIZATION

Location of Alteration:

District: ____ **Revision No.:** _____ **Name of Street:** _____

Municipality: _____ **County:** _____

State Route No.: _____ **Co. Rd./Twp. Rd.:** _____

Under Authority of Section 4511.21 of the Ohio Revised Code, the following revised prima facie speed limit(s) approved by the Director of Transportation on _____, has been determined, on the basis of a traffic and engineering investigation, to be unreasonable and approval of the same is hereby withdrawn.

LOCATION OF REVISED PRIMA FACIE SPEED LIMITS

From	To	Approved Speed Limit (in MPH)	
		_____ Bound	_____ Bound

Signs relating to the altered prima facie speeds shall be immediately removed and the prima facie speed limit or limits after such removal shall be as specified in the Ohio Revised Code.

Date: _____ _____

Director of Transportation

Immediately after removal of the speed limit signs, return the attached copy of this Speed Limit Withdrawal form to the ODOT District Deputy Director or his designee, with the following certification properly executed.

I hereby certify that appropriate signs, giving notice of the above prima facie speed limits were removed

on _____ Signed _____

Title _____

Form 1296-8. Field Report on Parking Practices

State of Ohio
Department of Transportation
Field Report On Parking Practices

Location: The _____ sides of State Route _____ in _____ County at the following locations:

From: SLM log point _____

To: SLM log point _____

Date and time of field check: _____ at _____

Highway Features at Point of Study:

Pavement Type _____ Width _____ No. of Lanes _____

Type of Berm _____ Width of Berm _____

Other Features _____

_____

_____

Roadside Culture:

The major portion of the area included in this study should be described as:

- ❑ Residential
- ❑ Rural
- ❑ Industrial
- ❑ Business

Properties which abut the highway are used for the following purposes: _____

_____

_____

Traffic Control:

At the present time, the following traffic control measures are in use:

Signals - _____

Signs - _____

Pavement Markings - _____

Other - _____

The legal Speed Limit is now _____ mph.

Parking Practices:

There is evidence of the following parking practices: _____

_____

_____

Conclusion: (check one and fill in pertinent information)

❑ It is the opinion of this observer that these parking practices **constitute** a traffic hazard for the following reasons: _____

_____

_____

❑ It is the opinion of this observer that these parking practices **do not constitute** a traffic hazard for the following reasons: _____

_____

_____

Recommendations: I have reviewed the attached data and make the following recommendations:

❑ I recommend the establishment of a No-Parking restriction along the _____ side of SR _____ from SLM log point _____ to SLM log point _____, which includes a total length of _____ feet.

❑ I do not recommend the establishment of any No-Parking restrictions.

❑ I recommend the following corrective measures: _____

_____

Attached is a diagram and/or photographs showing the physical conditions outlined above.

Other attachments include: _____

Signature: _____ Title: _____

District: _____ Date: _____

Form 1296-9. Establishment of No-Parking Restrictions

STATE OF OHIO
DEPARTMENT OF TRANSPORTATION

ESTABLISHMENT OF NO-PARKING RESTRICTIONS

No.: _____

District: _____ **County:** _____

State Route No.: _____ **Section:** _____

Under Authority of Section 4511.10 - 4511.68 of the Ohio Revised Code, the following described No-Parking Zone is established. No person shall park or leave standing any vehicle, whether attended or unattended within the right-of-way within the No-Parking Zone indicated herein when appropriate signs giving notice thereof have been erected.

LOCATION OF NO-PARKING LIMITS

From	To	Along

This restriction shall become effective immediately upon the erection of signs giving notice thereof. Signs giving notice of the approved restriction shall be erected immediately.

Date: _____ _____
Director of Transportation

Immediately after the erection of appropriate No-Parking signs, return the attached copy of this No-Parking Restriction form to the ODOT District Deputy Director or his designee, with the following certification properly executed.

I hereby certify that appropriate signs, giving notice of the above No-Parking restriction were erected

on _____ Signed _____

Title _____

Form 1296-10. Withdrawal of Issued No-Parking Restrictions

STATE OF OHIO
DEPARTMENT OF TRANSPORTATION

WITHDRAWAL OF ISSUED NO-PARKING RESTRICTIONS

No. _____

District: _____ **County:** _____

State Route No.: _____ **Section:** _____

Under Authority of Section 4511.10 - 4511.68 of the Ohio Revised Code, the following described No-Parking restriction(s) approved by the Director of Transportation on _____, has been determined, on the basis of a traffic and engineering investigation, to be unreasonable and approval of the same is hereby withdrawn.

LOCATION OF NO-PARKING LIMITS

From	To	Along

Signs relating to the parking prohibition shall be immediately removed.

Date: _____ _____
Director of Transportation

Immediately after removal of the No-Parking signs, return the attached copy of this No-Parking Restriction Withdrawal form to the ODOT District Deputy Director or his designee, with the following certification properly executed.

I hereby certify that appropriate signs, giving notice of the above No-Parking restriction were removed

on _____ Signed _____

Title _____

Form 1296-11. Curve Study Form

CURVE STUDY SHEET

LOCATION _____ COUNTY _____

PAVEMENT: TYPE _____ WIDTH _____ CONDITION _____

CURVE: DEGREE _____ CENTRAL ANGLE _____ RADIUS _____

TRAFFIC SIGNS: END _____ END _____

	Trial No.	Ball-bank Angle for Various Trial Speeds								Superelevation Feet per Foot of Width	Recommended Speed
		50 MPH	45 MPH	40 MPH	35 MPH	30 MPH	25 MPH	20 MPH	15 MPH		
____ Bound	1										
	2										
	3										
	4										
	Speed At			10° Ball-bank angle =							
				12° Ball-bank angle =							
				14° Ball-bank angle =							

	Trial No.	Ball-bank Angle for Various Trial Speeds								Superelevation Feet per Foot of Width	Recommended Speed
		50 MPH	45 MPH	40 MPH	35 MPH	30 MPH	25 MPH	20 MPH	15 MPH		
____ Bound	1										
	2										
	3										
	4										
	Speed At			10° Ball-bank angle =							
				12° Ball-bank angle =							
				14° Ball-bank angle =							

REMARKS _____

Form 1296-12. Completed Curve Study Form

CURVE STUDY SHEET

LOCATION S.R. 37 - 1 mile East of Sunbury COUNTY Delaware

PAVEMENT: TYPE 20' Conc. Pav't. WIDTH Curve Widened=22.4' CONDITION Fair

CURVE: DEGREE 16° R. CENTRAL ANGLE 26° 40' RADIUS 358.09

TRAFFIC SIGNS: (E) END 30° L. Curve (W) END 30° R. Curve

	Trial No.	Ball-bank Angle for Various Trial Speeds								Superelevation Feet per Foot of Width	Recommended Speed
		50 MPH	45 MPH	40 MPH	35 MPH	30 MPH	25 MPH	20 MPH	15 MPH		
East Bound	1							2		.063	35
	2					6					
	3				9						
	4			10+							
	Speed At	10° Ball-bank angle = 37									
		12° Ball-bank angle =									
		14° Ball-bank angle =									

	Trial No.	Ball-bank Angle for Various Trial Speeds								Superelevation Feet per Foot of Width	Recommended Speed
		50 MPH	45 MPH	40 MPH	35 MPH	30 MPH	25 MPH	20 MPH	15 MPH		
West Bound	1							1		.063	35
	2					6					
	3				10						
	4			10+							
	Speed At	10° Ball-bank angle = 35									
		12° Ball-bank angle =									
		14° Ball-bank angle =									

REMARKS A 20° Ball Bank Indicator was used.

Sight distance is good. Road is ℄. Std. No Passing Lines.

Berms are 6' wide with Maximum Back Slopes of 2:1

Intentionally blank.

1297 TABLES INDEX

1297-1 Symbols For Use with the Speed Study Data Sheet

Table 1297-1 depicts the symbols mentioned in ***Section 1212-3.2*** that are used to represent physical features along the highway when completing the Speed Study Data Sheet ***(Form 1296-3)***.

1297-2 Speed Zone Warrant Analysis - Highway Development

Table 1297-2 defines components used in Highway Development portion of ***Form 1296-2*** for the Speed Zone Warrant Analysis ***(see Section 1212-3.4)***.

1297-3 Speed Zone Warrant Analysis - Roadway Features

Table 1297-3 defines components used in the Roadway Features portion of ***Form 1296-2*** for the Speed Zone Warrant Analysis ***(see Section 1212-3.4)***.

1297-4 Speed and Parking Zone Revision Number Assignments

Table 1297-4 assigns numbers to be used by **Districts** when submitting/reviewing a Speed or Parking Zone request ***(see Sections 1212-5 and 1213-5)***.

Intentionally blank.

Table 1297-1. Symbols for Use with the Speed Study Data Sheet

Symbol	Feature
	Residence
	Business
	School
	Church (or other house of worship)
	Intersection
	Driveway
	Traffic Sign
- - - -	Painted Lane and Center Line
—	No Passing Line
	Railroad
	Bridge Underpass
	Sidewalk
	Guardrail
	Signal or Flasher

Table 1297-2. Speed Zone Warrant Analysis - Highway Development

Building Development	
Type 1	residential, small apartment, commercial or public building, or other low volume generator
Type 2	Medium size commercial, public building, light industrial and multi-unit apartment type generators with traffic activity meeting one of the following general descriptions: a. Continuous, but light; b. Moderate at certain times, as opening, noon, or closing hours; c. Substantial on infrequent occasions.
Type 3	Substantial traffic generated by industry, shopping center or similar type large facility.
Type 4	Very large shopping mall, industrial park, major industry or similar large traffic generators with substantial, continuous volume. If the drive is signalized, it counts as a Class C intersection (instead of a Type 4 building development).
Intersection Classification	
Class A	Subdivision/residential type streets, low-volume Township Roads, and low-volume County Roads.
Class B	Through streets, through Township Roads, through County Roads, and State Routes.
Class C	Signalized intersections.

Table 1297-3. Speed Zone Warrant Analysis - Roadway Features

Roadway Feature		Definition
Lane Width, in feet		Consider average or most dominant lane width. Two feet may be deducted from the lane width in curbed sections.
Shoulder: (see Notes)	**Unimproved**	Unimproved shoulders are sod or loose aggregate.
	Improved	Shoulders are considered improved when paved, surface treated or compacted aggregate. Curbed sections shall be considered improved <2 feet (Factor = 9 on the form).
Characteristics: (see Notes)	**(A) Very Good**	Essentially level and tangent, with minimal intersection involvement, minimal sight distance restrictions.
	(B) Good	Curves and/or grades resulting in minor speed reduction, few intersections, mostly good sight distance.
	(C) Average	Curves and/or grades resulting in moderate speed reduction, some restrictive sight distance problems, some intersection involvement.
	(D) Adverse	Curves and/or grades resulting in substantial speed reduction, frequent sight distance and intersection problems.
	(E) Poor	Curves and/or grades resulting in excessive speed reduction, limited sight distance a dominant factor.
Volume (ADT/Lane)		If the volumes are not relatively consistent throughout the section under study, it may be necessary to evaluate shorter sections. This feature uses vehicles per continuous lane and turning lanes, or other special lanes, are not normally used in this calculation.

Notes:

It is recognized that shoulder features may not be consistent throughout the section under study. A judgment will need to be made to determine the most dominate design.

The characteristics noted are generalized descriptions which can be used to describe various roadway design characteristics in evaluating optimal operating speeds. Warning Signs with appropriate Advisory Speed signs should be considered before speed zoning for roadway characteristics.

Table 1297-4. Speed and Parking Zone Revision Number Assignments

Districts	Speed Zones	Parking Zones
District 1	10000 - 14999	10000 - 14999
District 2	15000 - 19999	15000 - 19999
District 3	20000 - 24999	20000 - 24999
District 4	25000 - 29999	25000 - 29999
District 5	30000 - 34999	30000 - 34999
District 6	35000 - 39999	35000 - 39999
District 7	40000 - 44999	40000 - 44999
District 8	45000 - 49999	45000 - 49999
District 9	50000 - 54999	50000 - 54999
District 10	50000 - 54999	50000 - 54999
District 11	60000 - 64999	60000 - 64999
District 12	65000 - 69999	65000 - 69999

1298 FIGURES INDEX

1298-1 Alternative Purchasing Program for Local Agencies

Figure 1298-1 presents a chart which visually depicts the process described in detail in ***Section 1220-5***.

1298-2 Ball Bank Indicator

Figure 1298-2 illustrates a Ball Bank Indicator which is described in detail in ***Section 1230-2.1***.

1298-3 Administering Local Government Agency / Utility Force Account Work

Figure 1298-3 presents a chart which visually depicts the process described in detail in ***Section 1250-2***.

1298-4 Sample Letter Requesting Alternate bids

Figure 1298-4 shows a sample letter from local authorities requesting alternate bids as referenced in ***Section 1220-6.2***.

1298-5 Sample Letter Stating Local Decision on Alternate Bids

Figure 1298-5 shows a sample letter of acceptance or rejection by local authorities of the alternate bids as referenced in ***Section 1220-6.3***.

1298-6 Sample Safety Study Table of Contents

Figure 1298-6 shows a sample Table of Contents for a Safety Study, as discussed in ***Section 1230-6.2***.

1298-7 Sample Safety Study Title Page

Figure 1298-7 shows a sample Title Page for a Safety Study, as discussed in ***Section 1230-6.3***.

1298-8 Sample Condition Diagram - Section

Figure 1298-8 shows a sample condition diagram for a section, as discussed in ***Section 1230-6.5.1***.

1298-9 Sample Condition Diagram - Intersection

Figure 1298-9 shows a sample condition diagram for an intersection, as discussed in ***Section 1230-6.5.1***.

1298-10 Collision Diagram for an Intersection

Figure 1298-7 shows a sample collision diagram for an intersection, as discussed in ***Section 1230-6.6***.

1298-11 Collision Diagram for a Section

Figure 1298-11 shows a sample collision diagram for a section, as discussed in ***Section 1230-6.6***.

1298-12 Sample Collision Diagram

Figure 1298-12 shows a sample collision diagram for an intersection, as discussed in ***Section 1230-6.6***.

1298-13 Sample Crash Analysis

Figure 1298-13 shows a sample crash analysis, as discussed in ***Section 1230-6.7***.

1298-14 Sample Rate of Return Worksheet

Figure 1298-14 shows a sample rate of return worksheet, as discussed in ***Section 1230-6.10***.

1298-15 Sample Photos for Safety Study

Figure 1298-15 shows sample photos for a safety study, as discussed in ***Section 1230-6.11***.

1298-16 Sample Photos for Safety Study

Figure 1298-16 shows sample photos for a safety study, as discussed in ***Section 1230-6.11***.

Figure 1298-1. Alternative Purchasing Program for Local Agencies
(Page 1 of 3)

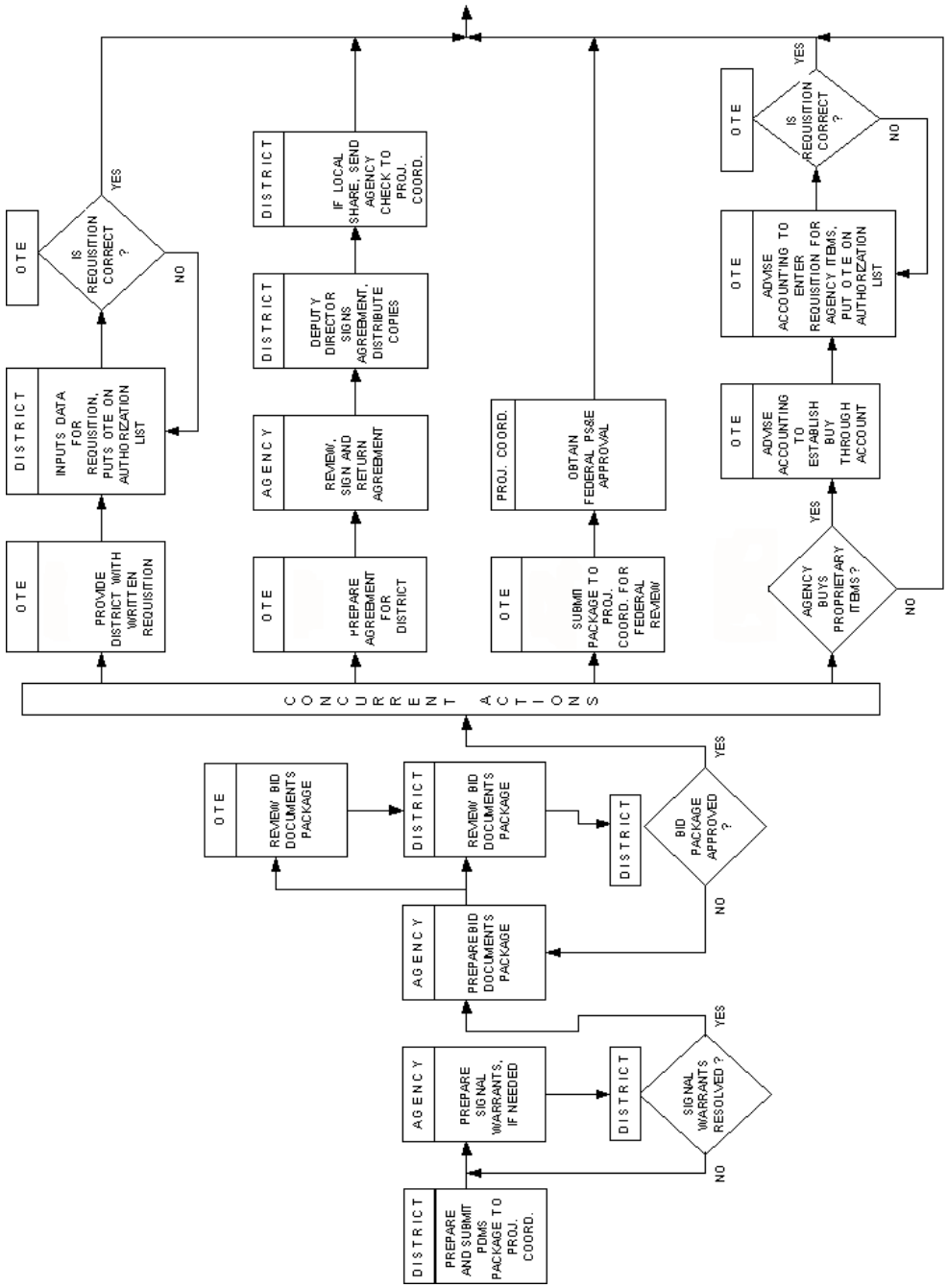


Figure 1298-1 continued (Page 2 of 3)

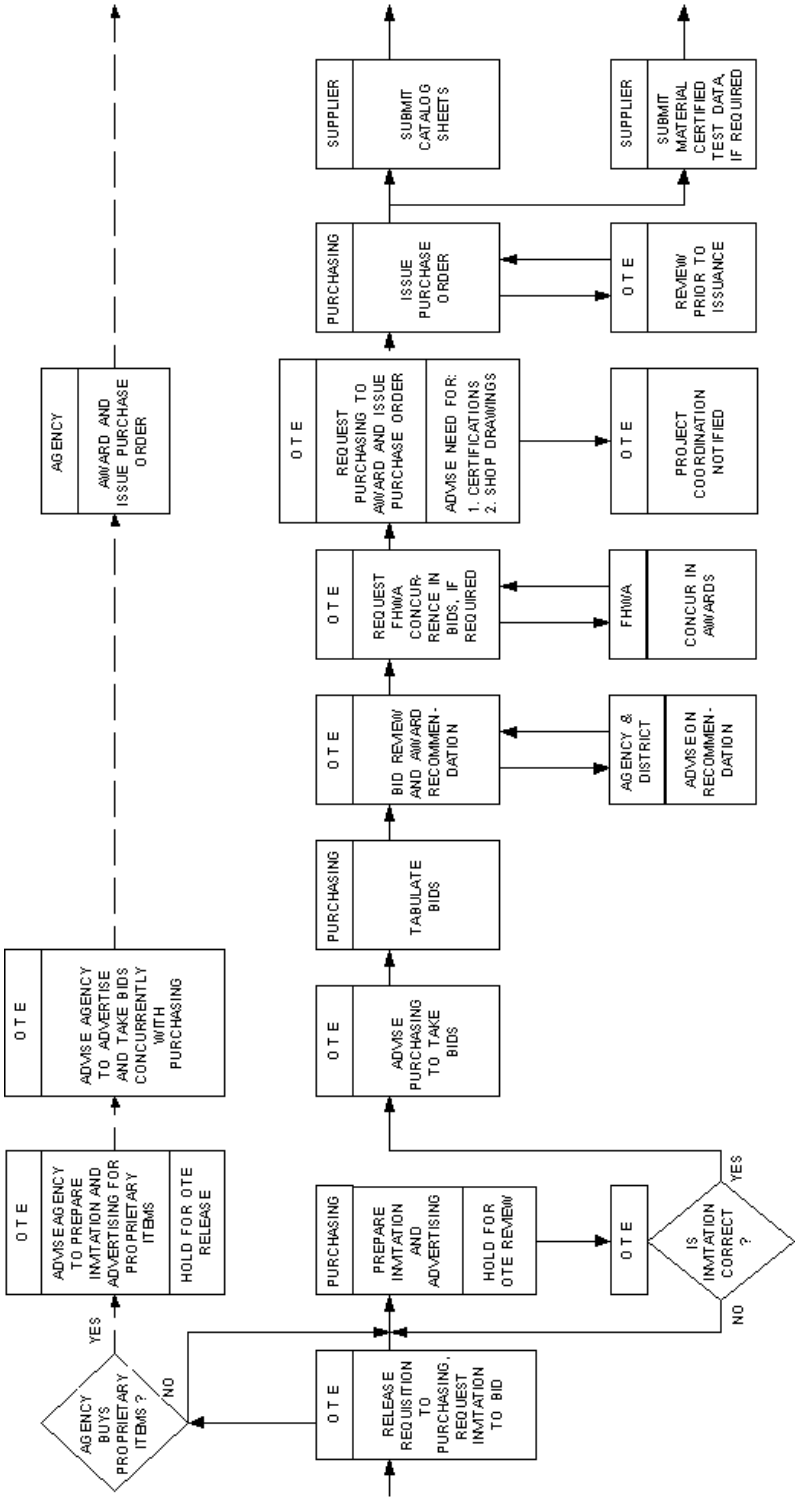


Figure 1298-1 continued (Page 3 of 3)

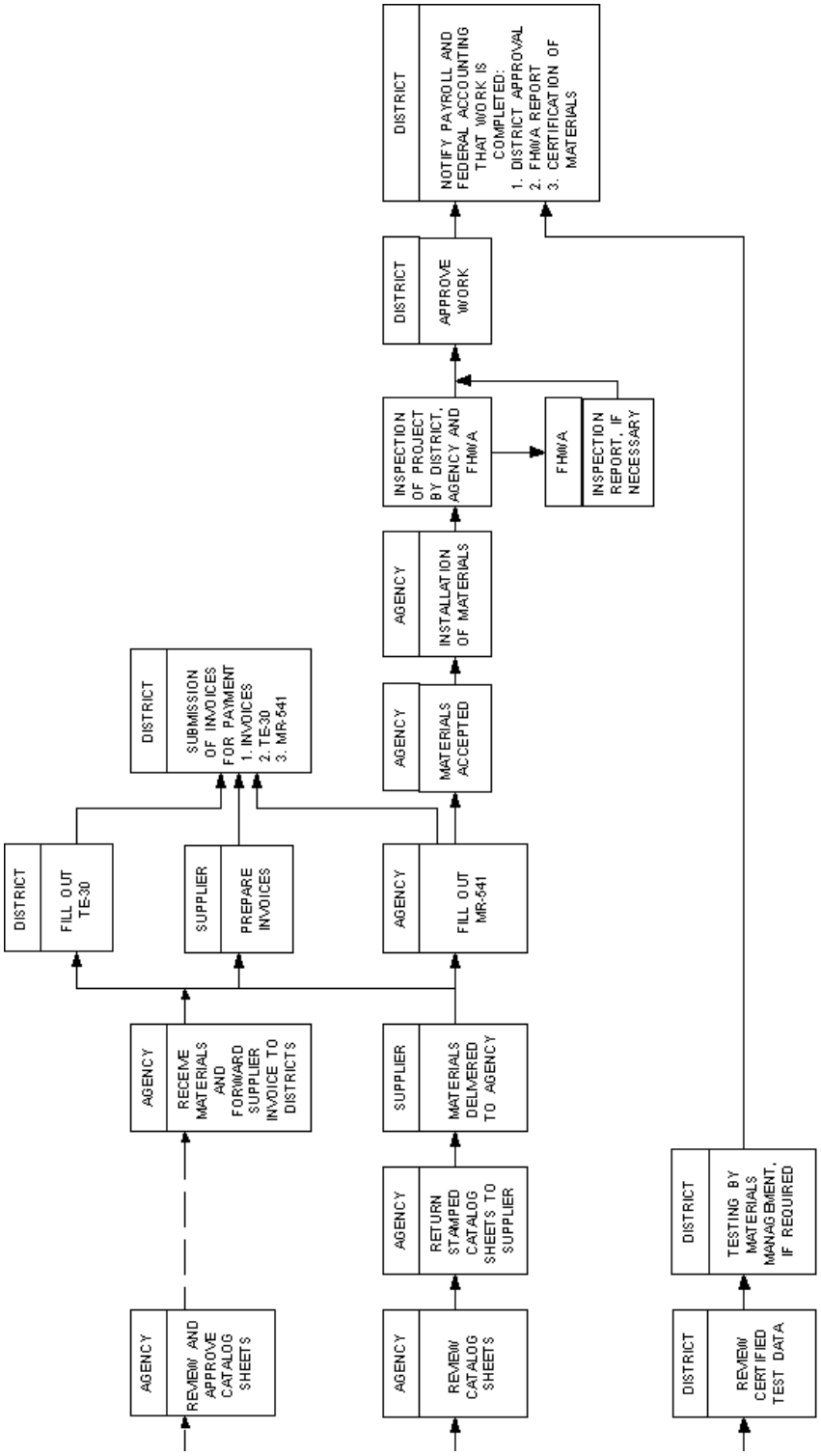
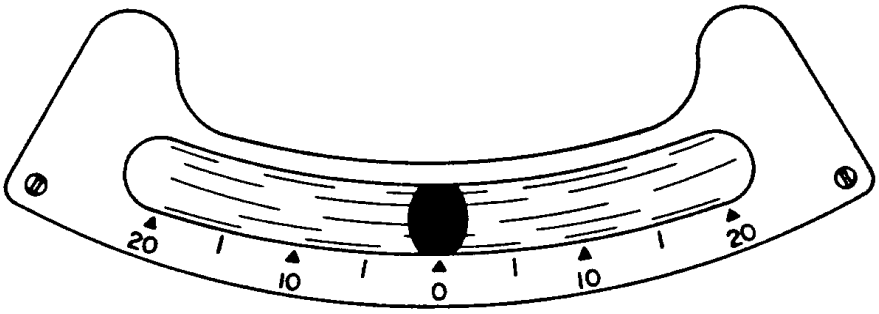
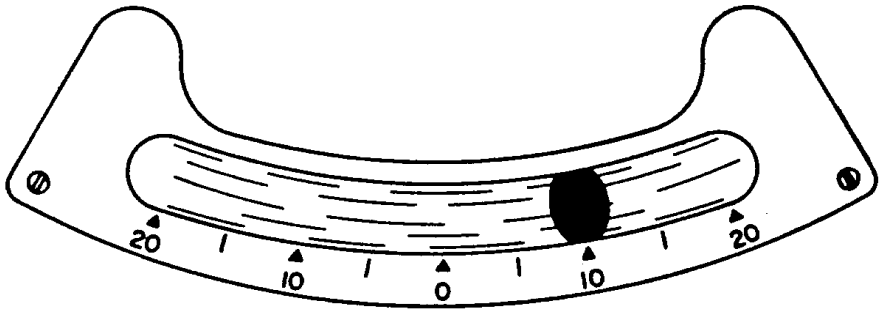


Figure 1298-2. Ball Bank Indicator



ZERO POSITION



INDICATES 10° LEFT BANK

Figure 1298-3. Local Government Agency / Utility Force Account Work

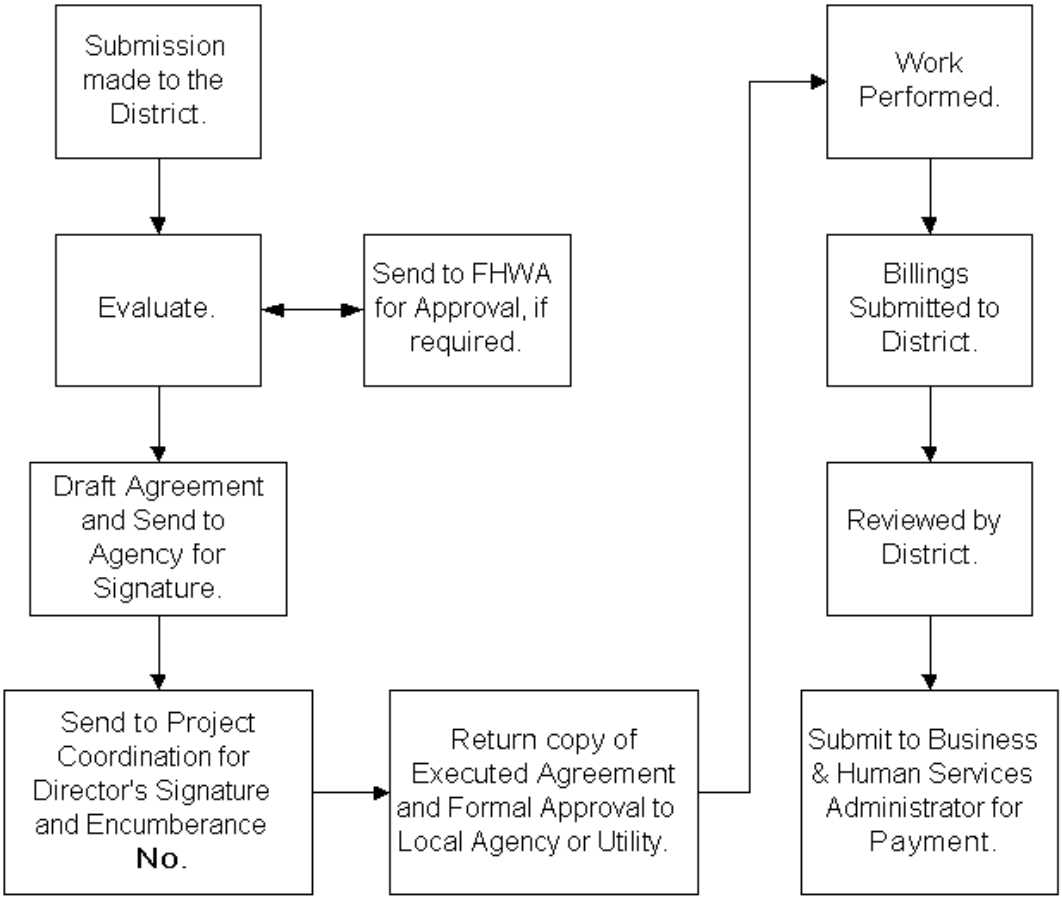


Figure 1298-4. Sample Letter Requesting Alternate Bids

Date: _____

District Production Administrator
Ohio Department of Transportation
Street
City

RE: County - Route - Section

Gentlemen:

We request that alternate bids be incorporated into the subject plan for the following item(s):

1.
2.

This item(s) will be used at the following locations:

1.
2.

We further request that the alternate bids describe the following brand and model of equipment:

1.
2.

We make this request because ....

At such time as bids have been taken, please contact (Phone _____) to advise us of the comparative prices. We understand that our decision concerning acceptance or rejection of the alternates must be made quickly and reported by telephone. We also understand that our letter confirming this decision and agreeing to pay any extra costs must be in your hands within 10 calendar days following opening of bids.

Signed

(Contractual Officer)

Figure 1298-5. Sample Letter Stating Local Decision on Alternate Bids

Date:_____

District Production Administrator
Ohio Department of Transportation
Street
City

RE: County - Route -Section
Project _____
Alternate Bids

Dear _____:

We have been advised, by a telephone call from _____ of your office, of the bid prices received for the alternate items on this project.

This letter confirms our recent telephone conversation concerning disposition of those alternate bids.

We request that the award be based upon the alternate (Brand Name) bids for reference items ___-A, ___-A .... ___-A. We understand that this will increase our financial obligation to the project by $ _____ and agree to pay this when invoiced.

OR

We request that the award be based upon the generic bids for reference items ___, ___ .... and ___. This decision will not increase our project financial obligation.

Signed

(Contractual Officer)

Figure 1298-6. Sample Safety Study Table of Contents

TABLE OF CONTENTS

Page

Title Page 1

Executive Summary 2

i) Purpose 2
ii) Background 3
iii) Brief Overview of Possible Causes 3
iv) Recommended Countermeasures and Related Costs 4

Existing Conditions 5

i) Condition Diagram 6
ii) Physical Condition Writeup 9

Collision Diagram 10

Crash Data 14

Crash Analysis 16

Recommendations 19

Rate of Return 21

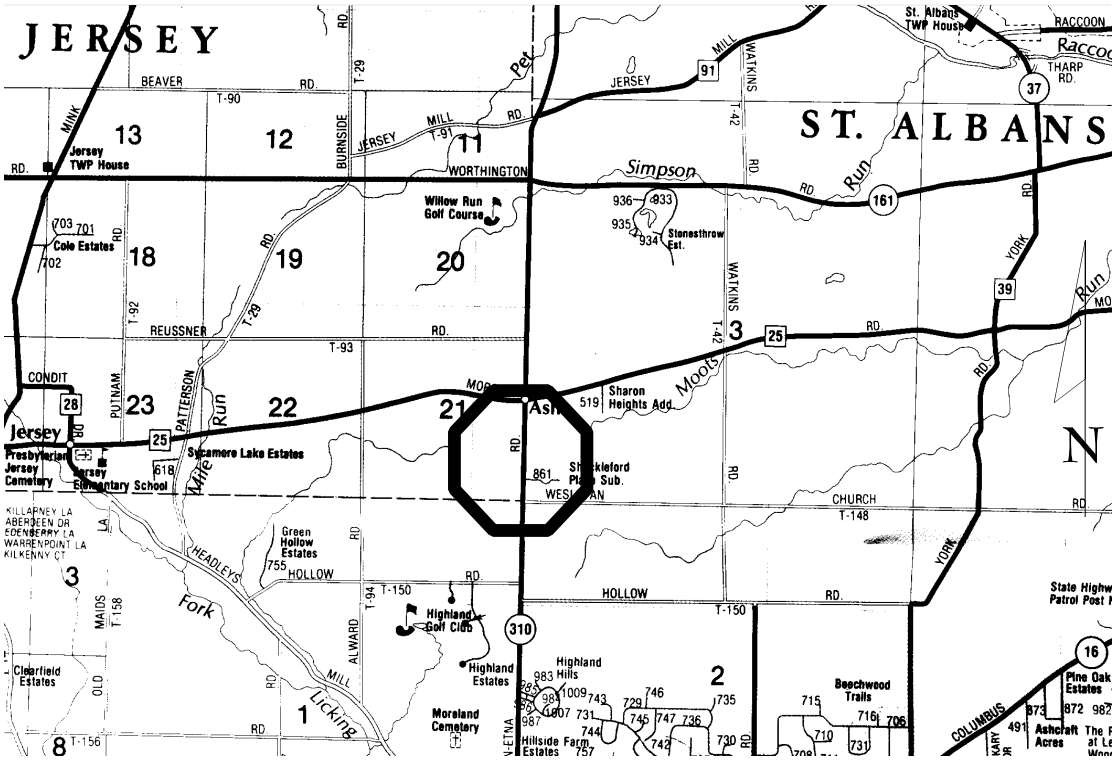
Photos 23

Other Issues 26

Appendix

Figure 1298-7 Sample Safety Study Title Page

SAFETY STUDY
LIC CO: SR. 310 AND CR. 25 (Morse Rd.)
Dist. 5
1999 HCLIS #26



Completed By:
Completion Date:

Figure 1298-8. Sample Condition Diagram - Section

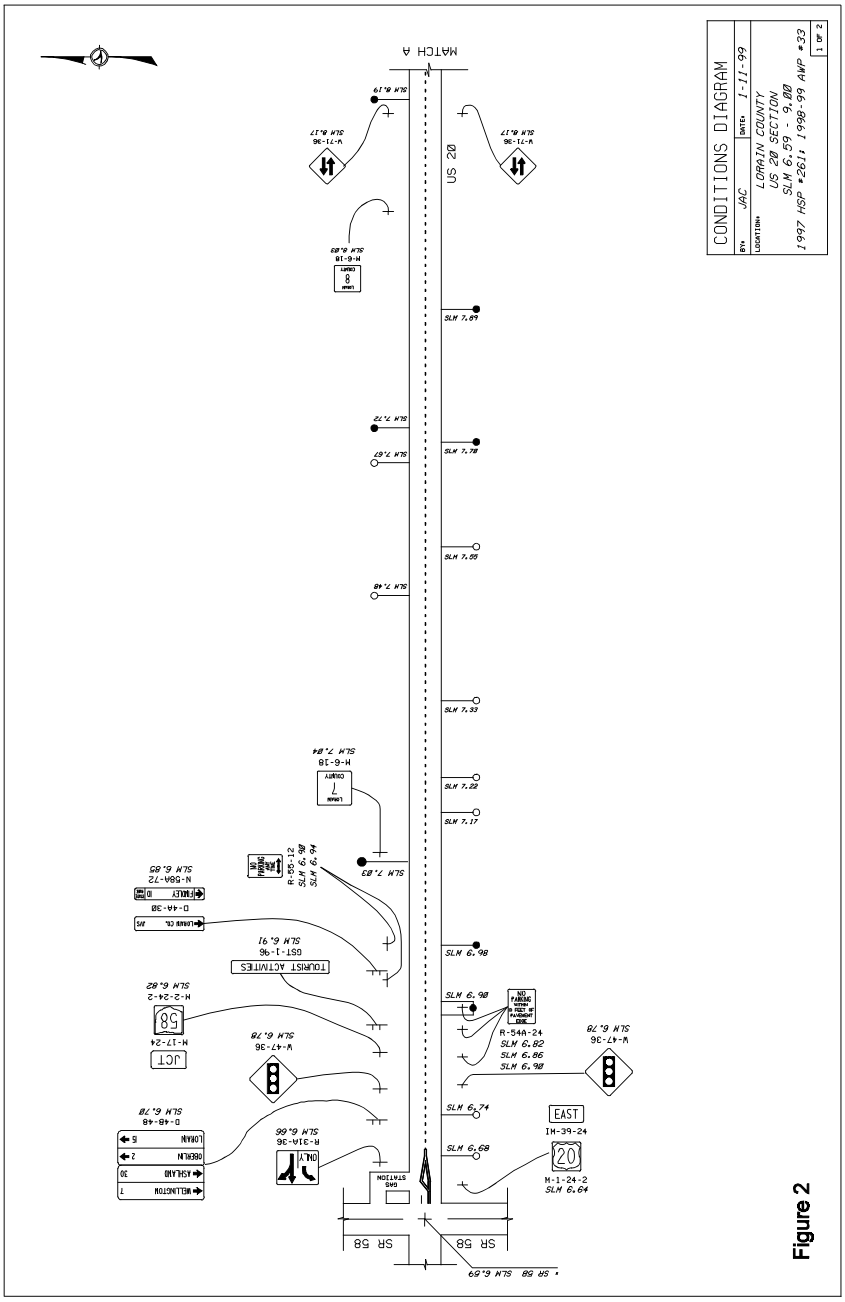


Figure 1298-9. Sample Condition Diagram - Intersection

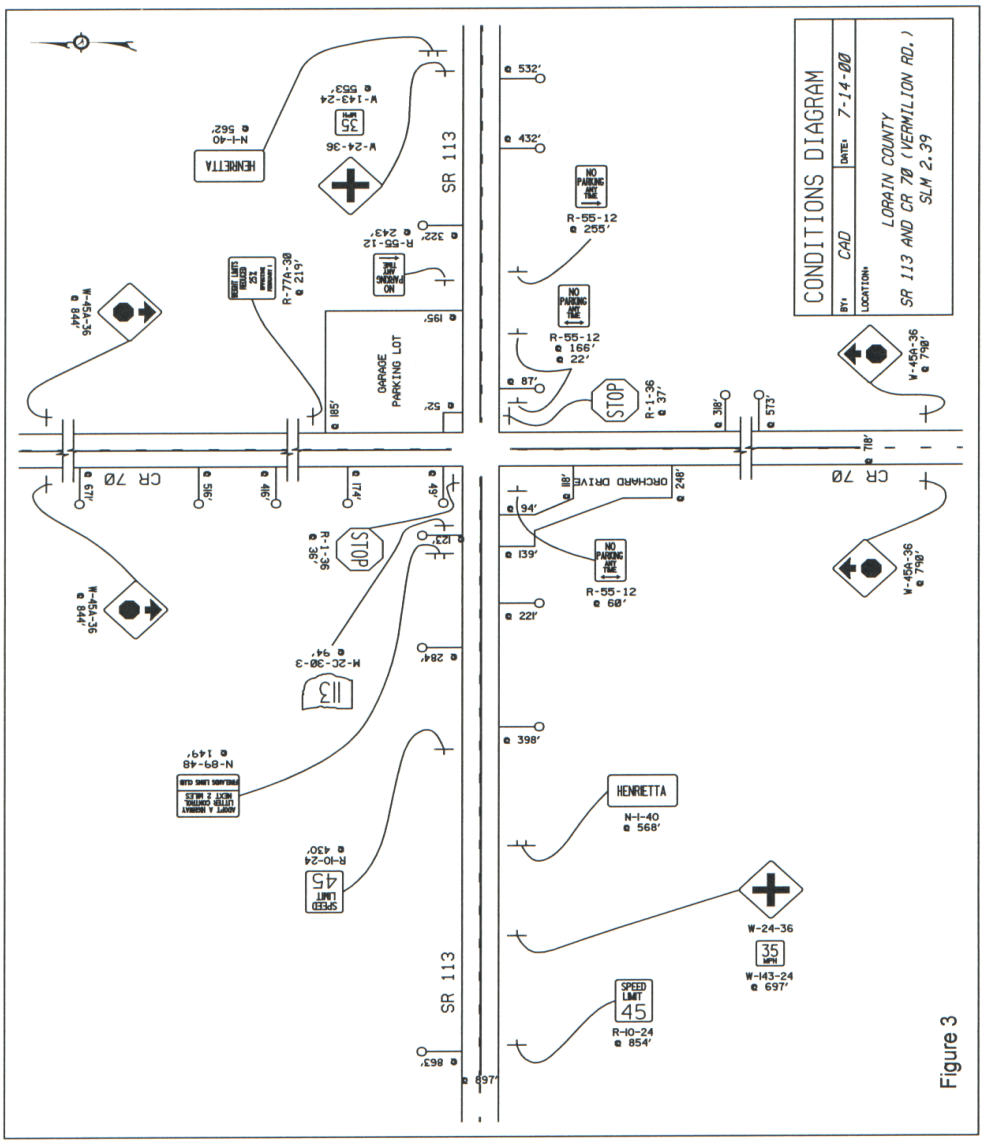


Figure 1298-10. Collision Diagram for an Intersection

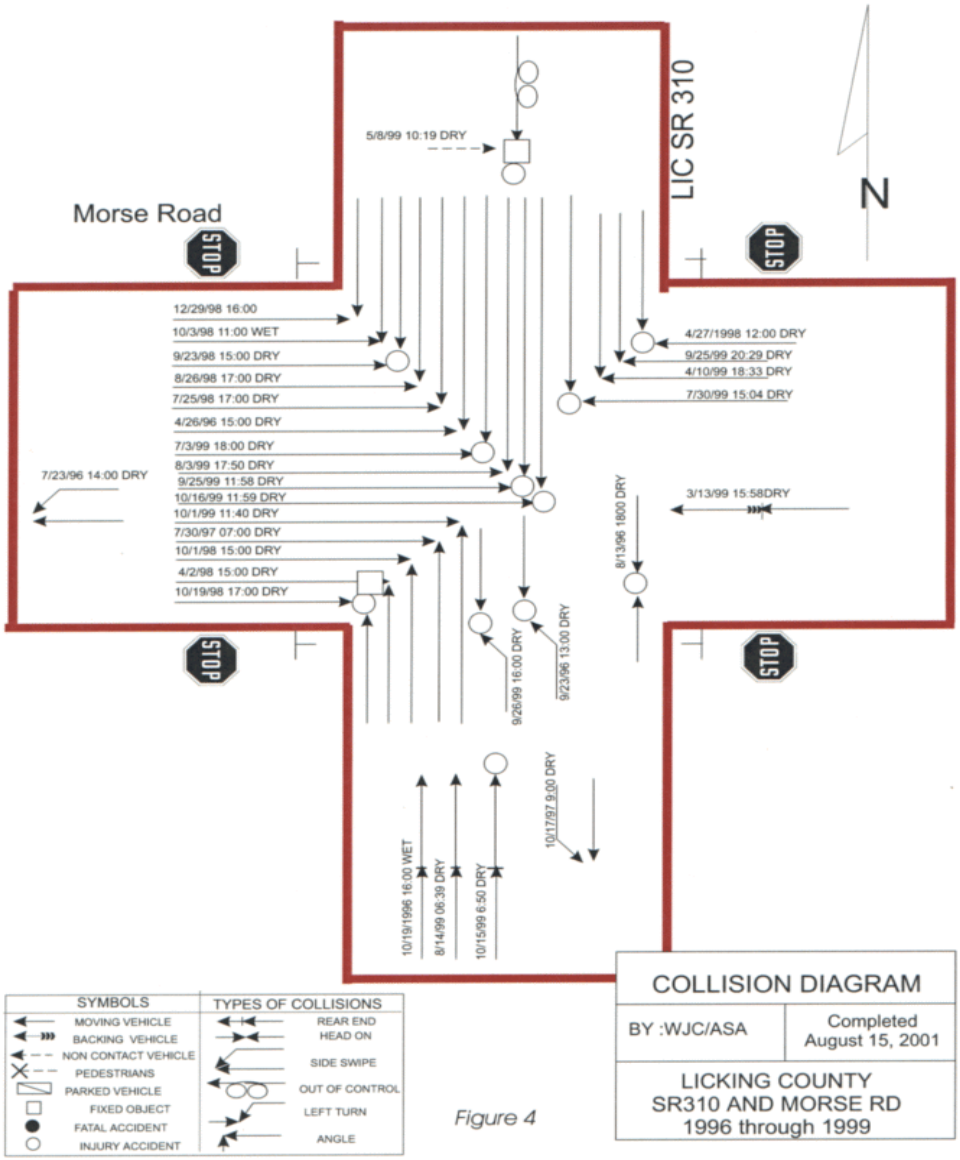


Figure 1298-11. Collision Diagram for a Section

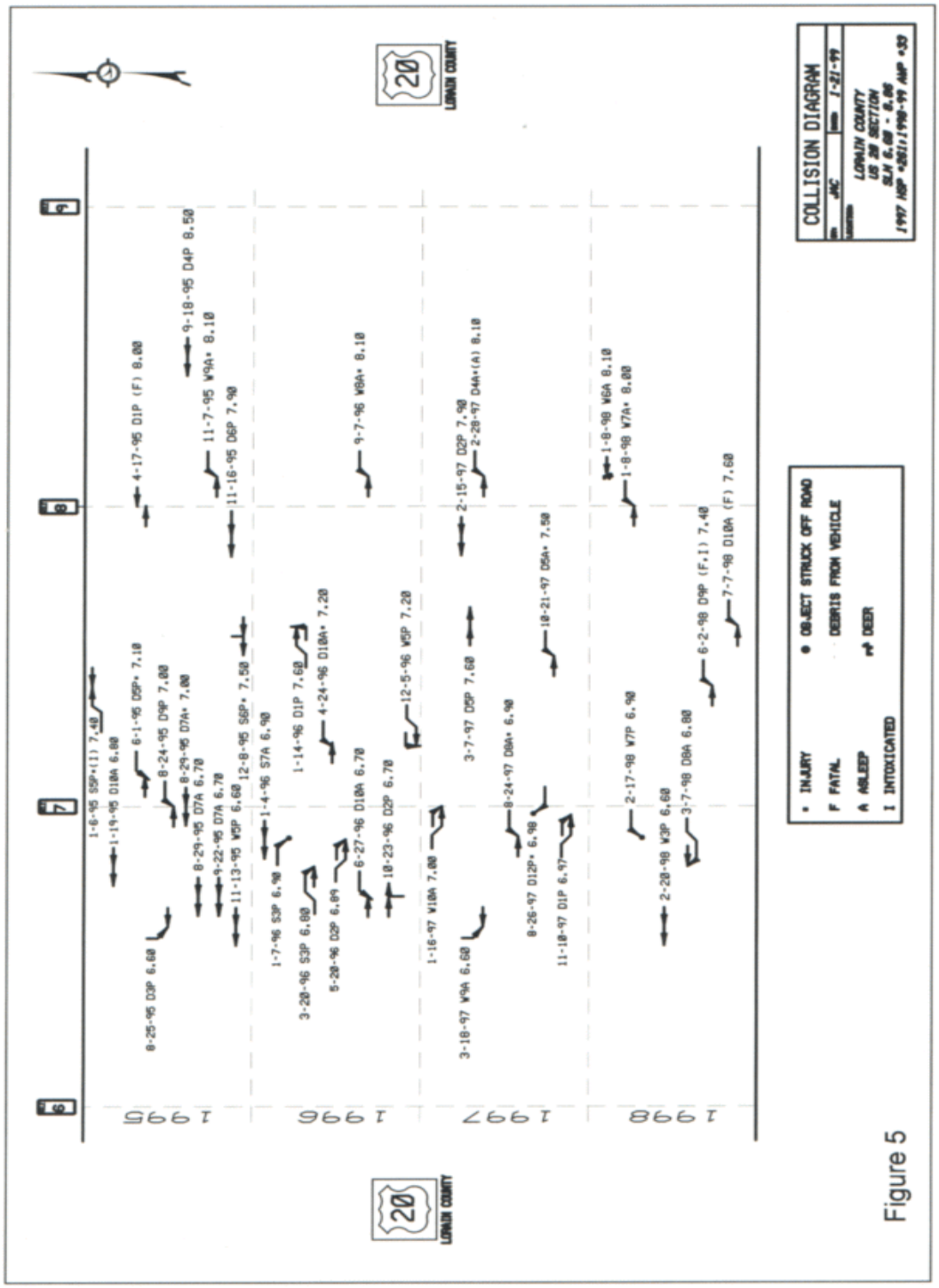


Figure 1298-12. Sample Collision Diagram

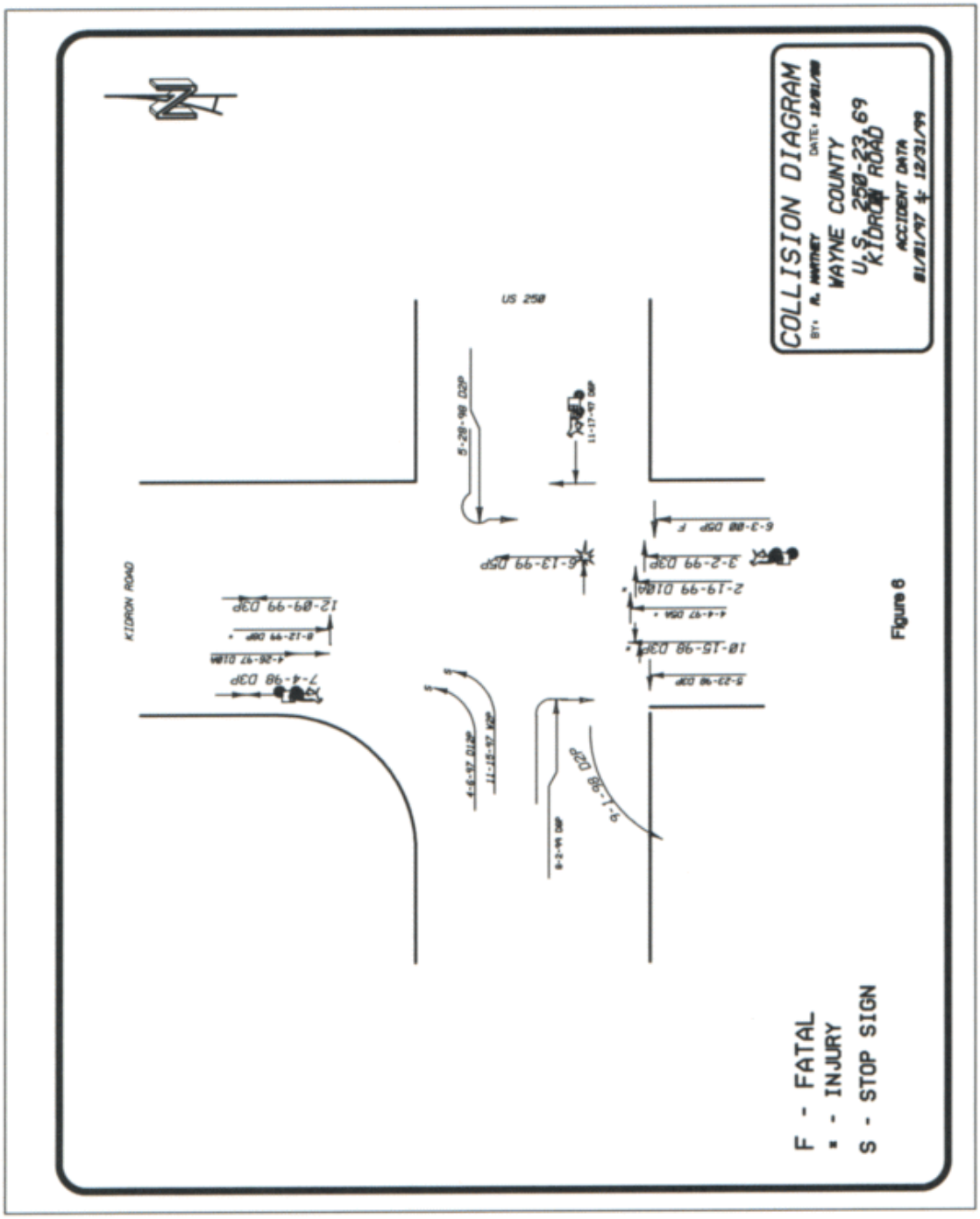


Figure 1298-13. Sample Crash Analysis

Figure7

TRAFFIC ACCIDENT ANALYSIS

YEARS

County _____ Main Roadway _____ Begin SLM _____ End SLM _____ Office of Traffic Engineering

Prepared by _____ Intersecting Roadway _____ Date _____

Year	TIME OF DAY						ROADWAY CONDITION						CRASH TYPE																													
	DAY		NITE		N. S.		DRY		WET		N. S.		L. T.		R. T.		ANGLE		REAREND		HEAD ON		S. S.		F. O.		BACKING		RE -Minor		TOTAL	
	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	9	9
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	9	9
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	9	9
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	9	9
Subtotal	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	27	27
Total	6		6		6		6		6		6		6		6		6		6		6		6		6		6		6		54	

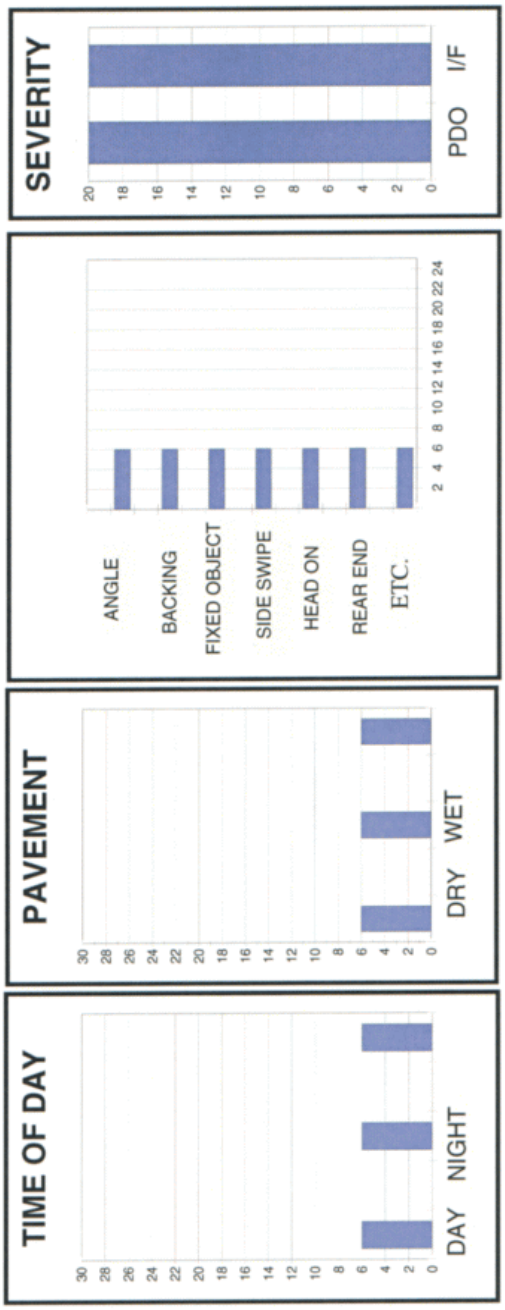


Figure 1298-14. Sample Rate of Return Worksheet

RATE OF RETURN - ECONOMIC ANALYSIS WORKSHEET - OPTION 1

Ohio Department of Transportation
Office of Traffic Engineering

County: LIC
Main Roadway: SR 310
Intersecting Roadway: CR 25 MORSE RD
Begin SLM: 8.6
End SLM: 8.6
Prepared by: ASA
Date: 07-27-01

Year	TIME OF DAY						ROADWAY CONDITION						CRASH TYPE																			
	DAY		NITE		N. S.		DRY		WET		N. S.		L. T.		R. T.		ANGLE		REAREND		HEAD ON		S. S.		F.O		BACKING		RE -Minor		TOTAL	
	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F
97	2	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	2	0
98	5	4	0	0	0	0	4	4	1	0	0	0	0	0	0	0	5	4	0	0	0	0	0	0	0	0	0	0	0	0	5	4
99	5	7	1	0	0	0	6	7	0	0	0	0	0	0	0	0	4	5	1	1	0	0	0	0	0	1	1	0	0	0	6	7
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	12	11	1	0	0	0	12	11	1	0	0	0	0	0	0	0	10	9	1	1	0	0	1	0	0	1	1	0	0	0	13	11
AVG.	4.00	3.67	0.33	0.00	0.00	0.00	4.00	3.67	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.33	3.00	0.33	0.33	0.00	0.00	0.33	0.00	0.00	0.33	0.33	0.00	0.00	0.00	4.33	3.67

RECOMMENDED IMPROVEMENTS

1. INSTALL SIGNAL
2.
3.
4.
5.
6.
7.
8.

CRASH TYPE	PDO CRASHES R1	R2	R3	R4	RT	AVG PDO	EST. RED.	INJ. - FAT. CRASHES R1	R2	R3	R4	RT	AVG INJ-FAT	EST. RED.
Left Turn	0.10				0.10	0.00	0.00	0.10				0.10	0.00	0.00
Right Turn	0.10				0.10	0.00	0.00	0.10				0.10	0.00	0.00
Angle	0.80				0.80	3.33	2.67	0.80				0.80	3.00	2.40
Rearend	-0.10				-0.10	0.33	-0.03	-0.10				-0.10	0.33	-0.03
Head On	0.00				0.00	0.00	0.00	0.00				0.00	0.00	0.00
Side Swipe	0.10				0.10	0.33	0.03	0.10				0.10	0.00	0.00
Fixed Object	0.00				0.00	0.00	0.00	0.00				0.00	0.33	0.00
					0.00	0.33	0.00					0.00	0.00	0.00
					0.00	0.00	0.00					0.00	0.00	0.00
	ESTIMATED PDO CRASH REDUCTION						2.67	ESTIMATED INJ. - FAT. CRASH REDUCTION						2.37

ADT Factor

Project Service Life: 20 years
Present ADT (PADT): 4630
Future ADT (FADT): 11640

Average ADT = (PADT + FADT)/2 = (4630 + 11640) / 2 = 8135
ADT Factor = Average ADT / PADT = 8135 / 4630 = 1.76

Average Annual Benefits

Annual PDO Benefits = Estimated PDO Crash Reduction * Avg PDO Cost = 2.67 * $2,500 = $6,667
Annual INJ.-FAT. Benefits = Estimated INJ.-FAT. Crash Reduction * Avg INJ.-FAT. Cost = 2.37 * $67,900 = $160,697
Total Benefits = $167,363
Average Annual Benefits = Total Benefits * ADT Factor = 1.76 * $167,363 = $294,061

Rate of Return

Project Cost: $70,000
Maintenance and Energy Costs:
Salvage Value:

Rate of Return: 420%

Figure 8

Figure 1298-15. Sample Photos for a Safety Study

Southbound Approach at 200 feet - Photo 1

Southbound Approach at 600 feet - Photo 2

Figure 1298-16. Sample Photos for a Safety Study

Southbound Approach at 1000 feet- Photo 3

Northbound Approach at 200 feet- Photo 4