

PROCEDURES FOR DEVELOPING DESIGN DESIGNATIONS  
FOR NON-INTERSTATE BRIDGE  
REPLACEMENT/REHABILITATION PROJECTS

OHIO DEPARTMENT OF TRANSPORTATION  
OFFICE OF TECHNICAL SERVICES

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PROCEDURES FOR DEVELOPING DESIGN DESIGNATIONS  
FOR NON-INTERSTATE BRIDGE

# REPLACEMENT/REHABILITATION PROJECTS

The procedures contained in this revised procedural manual are to be used to develop design designations for non-interstate bridge replacement/rehabilitation projects. Such bridge projects may be located on U.S. highways, state routes, county routes, township routes, or local streets. These procedures replace those found in the manual dated November 17, 1993.

Traffic forecasts for bridge projects on the Interstate System must continue to be provided or certified by the Office of Technical Services. For these bridges, the district offices may either forward design designations to Technical Services or request that the Technical Services provide them. Design designations for bridge projects that include more than simple replacement/rehabilitation must also be provided by Technical Services. This would include bridges with major approach work, bridges on new alignments, or bridges that are part of major capacity addition projects.

Bridge projects within a metropolitan planning organization (MPO) area should be coordinated with the MPO. Since a bridge project involving federal funds must be included on the MPO's transportation improvement program (TIP), coordination should take place at the time the project is added to the TIP.

This responsibility was originally delegated to the district offices in November, 1993, based on approval from FHWA in a letter dated September 29, 1993 (see Appendix A). The original version of this manual was designed to provide a cookbook approach to developing design designations for bridge projects for use by the district offices. The changes are intended to make the projections more accurate by giving the district offices more flexibility in developing them.

The major changes in this edition of the manual are as follows:

- The elimination of generalized growth rates by county and their replacement with a statewide continuous range of rates to provide flexibility in the selection of an accurate rate specific to the site and the individual project;
- Changes in the terminology used to refer to the year of construction from "Current Year" to "Opening Year" to eliminate confusing "current" with the current calendar year or with the year of the most recent count data;
- Changing the Design Year to be either 12 or 20 years after the Opening Year, consistent with the draft Pavement Design Manual (paragraph 2.02.1.1);
- Providing a range of values for the selection of the K factor, the calculation of the DHV on the worksheet, and the replacement in the design designation of K with the DHV;
- Three choices for the D factor, depending on whether the bridge is within or outside an MPO's boundaries and whether the bridge is one-way or two-way;
- Providing a "comments" section on the worksheet for use in documenting the selection of the growth rate, for substituting refined output from the MPO models, for noting more detailed available truck information (the "B" and "C" components), and/or for noting directional imbalances in the ADT such as those found on bridges on routes over freeways between ramp termini;
- Dropping the request for forwarding completed design designations to Technical Services; and
- The update of terms to reflect current terminology in use in the department.

The worksheet, itself, is now larger, the equivalent of two 8 ½ by 11 inch sheets. However, the form can be reproduced as a two-sided 8 ½ by 11 inch form or side by side on an 11 by 17 inch sheet, etc.

Any comments or questions on the use of this manual, including the discovery of any errors or inconsistencies, should be directed to the Office of Technical Services at (614) 644-8195.

**Worksheet Instructions** (Note: the worksheet is found on pages 6 and 7.)

- 1A. Enter the PID.
- 1B. Enter the Count-Route-Log. If the project is not on the State System, enter an appropriate project identifier.
- 2A. Enter the Existing ADT. The ADT selected should be the most recent, accurate, seasonally adjusted 24-hour volume available. The most recent ADT may be obtained from the latest Traffic Survey Report (TSR) if the project is on the State System. Other data sources may be used (ODOT data obtained since the last TSR, count data from county engineers, MPOs, consultants, cities, etc.). Partial-day counts may be expanded to 24-hours using average values for the proportion of each hour in the daily total. Expansion tables and season adjustment factors can be obtained from the Office of Technical Services' Traffic Monitoring Section. If the available count data is three (3) years or older, consideration should be given to obtaining a new count.
- 2B. Enter the 24-hour B&C volume (trucks). If no data is available, leave this box blank.
- 2C. Enter the Existing Year. This is the year the count was taken. For TSR data, assume this is the year of the report (e.g., for a report published in 1996, assume the data is from 1996) unless the specific ADT is known to come from a count taken in an earlier year.
3. Enter the Opening Year. The Opening Year is the year construction will be completed and the bridge will reopen to traffic.
4. Enter the Design Year. The Design Year is either 12 or 20 years after the Opening Year. This is determined by the scope and intent of the project and is unlikely to be an option available to the user of this manual. Most projects will have a 20-year life; a 12-year design year would occur only when the bridge is part of an overall 12-year pavement rehabilitation project.
- 5A. Enter the number of years from the Existing Year to the Opening Year. Enter the difference between the Opening Year and the Existing Year: (3) - (2C).
- 5B. Enter the number of years from the Existing Year to the Design Year. Enter the difference between the Design Year and the Existing Year: (4) - (2C).
6. Select a growth rate. The growth rate is to be selected from the continuous range of rates shown on the worksheet. The range of rates for each category is subjective, as are the categories, themselves. Judgement must be used in selecting an appropriate rate. If the project lies within an MPO area, manually adjusted output from a travel demand forecasting model provided by the MPO may be used in place of the growth rate. A rate derived from a regression analysis of historical traffic volumes over at least a twelve year period (equivalent to three traffic survey reports - five preferred) may be used as a tool for selecting the growth rate. It is important to recognize that a high rate derived from a regression analysis, based on only a few data points may not be sustainable when projected 20 or more years into the future. The implicit growth rate based on the Design Year ADT and the Existing Year ADT should be calculated and evaluated against the rates shown. The use of model output in place of the given rates should be noted in "Comments" (Section 15) of the worksheet.
7. Enter the Opening Year Factor. This factor is calculated as follows:  $[(6) \times (5A)] + 1$ . Multiply the growth rate by the difference between the Opening Year and the Existing Year, then add 1.
8. Enter the Design Year Factor. This factor is calculated as follows:  $[(6) \times (5B)] + 1$ . Multiply the growth rate by the difference between the Design Year and the Existing Year, then add 1.

9. Enter the Opening Year ADT. The Opening Year ADT is obtained by multiplying the Existing ADT by the Opening Year Factor:  $(2A) \times (7)$ .
10. Enter the Design Year ADT. The Design Year ADT is obtained by multiplying the Existing ADT by the Design Year Factor:  $(2A) \times (8)$ .
- 11A. Enter K. The K factor is selected from the chart on the worksheet. The volume groupings shown are subjective. When count data exists, it is possible to estimate K by dividing the peak hour volume by the ADT. However, K is to reflect the 30<sup>th</sup> highest hour of the year. For a count on a given day, there is no way to know how the peak hour for that day compares to the 30<sup>th</sup> highest hour, but "true" K would almost always be higher than this estimated K.
- 11B. Enter the DHV. The DHV (Design Hourly Volume) is obtained by multiplying the projected Design Year ADT by the K Factor:  $(10) \times (11A)$ .
12. Enter the D factor. The D factor is assumed to be .55 for projects outside an MPO's boundaries and .60 for projects on or within an MPO's boundaries, except for a one-way bridge, in which case the D factor is always 1.00. The D factor, representing the directional distribution in the design hour, is used to calculate the Directional Design Hourly volume (DDHV). Like the K factor, it can also be estimated from available count data.  
  
The directional distribution in the ADT is entirely different from D. In the ADT, the directional split is usually close to 50/50. If known to vary significantly from 50/50/, such as between the ramps on a bridge on a roadway over a freeway, then the directional distribution should be noted in the "Comments" section of the worksheet.
13. Enter the T24 factor. T24 represents the proportion of B&C commercial vehicles in the ADT. T24 is calculated based on the Existing Year data and assumed to apply to the Design Year. Information is seldom available that warrants selecting a T24 value for the Design Year that differs from T24 as calculated from the Existing Year data. T24 is calculated as:  $(2B)/(2C)$ . If no count data exists, assume  $T24 = .03$  or obtain new count data that provides truck data.
14. Enter the TD factor. TD is the proportion of B&C commercial vehicles in the design hour. If the number of trucks in the peak hour is included in any available count data, an estimate of TD can be calculated directly. However, TD is usually close to 60 percent of the T24 value, which an acceptable approximation for use here. TD is calculated as  $(13) \times .6$ .
15. The comments section may be used for noting the substitution of MPO model output for volume estimates based on growth rates, the B and C components of the truck traffic, a significant departure from the expected 50/50 split in the daily directional distribution rate, or anything else the user wishes to document.

The Design Designation is summarized at the end of the worksheet from the above information. The design values (D, T24, and TD) are commonly listed as percents rather than decimal proportions. DHV is usually shown on the plans instead of K, although to assess the reasonableness of the DHV, it is usually easier to think in terms of K.

#### References:

1. Pavement Design and Rehabilitation Manual, Draft, Office of Materials Management, transmitted on August 10, 1998.

2. Guidelines for Developing Design Year Traffic on Local Roads and Streets, prepared by the Bureau of Technical Services, December, 1976.
3. Procedures for ODOT District Offices for use in Developing Design Designations for Non-Interstate Bridge Replacement/ Rehabilitation Project, Bureau of Technical Services, November 17, 1993.
4. Traffic Survey Reports prepared by the Bureau/Office of Technical Services, 1975-1998 (some in preparation, older reports exist).

BRIDGE PROJECT DESIGN DESIGNATION WORKSHEET											
1A	Enter the PID:		1A								
1B	Enter the County-Route-Log or other identifier:		1B								
2A	Enter the Existing ADT (Total Vehicles):		2A								
2B	Enter 24-hour B&C (commercial) volume if available:		2B								
2C	Enter the Existing Year:		2C								
3	Enter the Opening Year:		3								
4	Enter the Design Year:		4								
5A	Enter the number of years from the Existing Year to the Opening Year: (3) - (2C) =		5A								
5B	Enter the number of years from the Existing Year to the Design Year: (4) - (2C) =		5B								
6	Select a growth rate from the following range of rates: Stable .0025-.0050      Moderate .0100-.0200 Low .0050-.0100      High .0200-.0300		6								
7	Enter the Opening Year Factor: [(6) x (5A)] + 1 =		7								
8	Enter the Design Year Factor: [(6) x (5B)] + 1 =		8								
9	Enter the Opening Year ADT: (2A) x (7) = Round to nearest 100 vehicles (nearest 10 vehicles if < 1000)		9								
10	Enter the Design Year ADT: (2A) x (8) = Round to nearest 100 vehicles (nearest 10 vehicles if < 1000)		10								
11A	Enter K, selected from the following table of Design Year ADT: <table style="margin-left: 40px; border: none;"> <tr> <td>&lt; 1000</td> <td>.12</td> <td>5001 - 15000</td> <td>.10</td> </tr> <tr> <td>1001 - 5000</td> <td>.11</td> <td>15001 &lt;</td> <td>.09</td> </tr> </table>	< 1000	.12	5001 - 15000	.10	1001 - 5000	.11	15001 <	.09		11A
< 1000	.12	5001 - 15000	.10								
1001 - 5000	.11	15001 <	.09								
11B	Enter the DHV: (10) x (11A) =		11B								
12	Enter the D Factor (for DDHV): within an MPO area: .60 outside an MPO area: .55 any one-way bridge: 1.00		12								
13	Enter the T24 factor (the proportion of B&C vehicles in ADT): [(2B)/2A] or .03 if (2B) is blank		13								
14	Enter the TD factor (the proportion of B&C vehicles in the design hour): (13) x 0.6		14								

## BRIDGE PROJECT DESIGN DESIGNATION WORKSHEET

15 COMMENTS		15
DESIGN DESIGNATION (summarized from above) PID		1A
County-Route-Log		1B
Opening Year ADT =		9
Design Year ADT =		10
K =		11A
D =		12
T24 =		13
TD =		14