

# **Interactive Highway Safety Design Model (IHSDM)**

## **IHSDM Highway Model**

*Developed for*  
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## 1. Introduction

This document explains the details of the highway model used within IHSDM. The document is written from a user's point of view. Developer's should refer to the source code for more information.

The IHSDM highway model consists of a number of elements. Each element consists of individual data items. All elements are vector based, that is, they have an initial point (station) and terminal point (station). For several elements, the initial point and terminal point are the same. Some elements also define intermediate points (stations) between the end points.

In a given highway, more than one instance of an element of a specific type may be needed to completely define the highway. The values of highway dataset elements may be set using the highway element editor (see Editing Highway Elements) or during the highway element checking process.

## 2. General

The general elements include terrain, functional classification, speed, and volume.

### 2.1 Terrain

This element specifies the highway terrain for the highway. If more than one terrain element is specified, there should be **no** gaps in the station bounds of the elements. This element is used by the Policy Review Module. The items in the Highway Terrain element are:

- **Start Sta.** - Unit of measure: STATION. The value of this item is the starting station for this highway or design element. This item defaults to the minimum station for the highway.
- **End Sta.** - Unit of measure: STATION. The value of this item is the ending station for this highway or design element. This item defaults to the maximum station for the highway.
- **Terrain** - This combo box determines the highway terrain. Terrain classifications pertain to the general character of topography of the the land traversed by the highway. The enumeration values are: **level**, **rolling**, **mountainous** and **null**.

### 2.2 Functional Classification

This element specifies the functional classification for the highway. If more than one functional classification element is specified, there should be **no** gaps in the station bounds of the elements. This element is used by the Policy Review Module. The items in the Functional Classification element are:

- **Start Sta.** - Unit of measure: STATION. The value of this item is the starting station for this highway or design element. This item defaults to the minimum station for the highway.
- **End Sta.** - Unit of measure: STATION. The value of this item is the ending station for this highway or design element. This item defaults to the maximum station for the highway.
- **Functional Class** - This combo box determines the functional classification of a highway. The functional classification of a highway describes the character of service it is intended to provide. The enumeration values are: **arterial**, **collector** and **local**.

### 2.3 Speed

There are two alignment speed elements: design speed, and 85th percentile speed. Other elements that are related to vehicle speed include posted speed.

### 2.3.1 Design Speed

The value of this item is the design speed for the span. The 2001 AASHTO policy defines design speed as a selected value used to determine the various geometric design features of the highway. If more than one design speed element is specified, there should be **no** gaps in the station bounds of the elements. This element is used by the Policy Review Module, the Design Consistency Module, the Crash Prediction Module and the Intersection Diagnostic Review Module. The items in the Design Speed element are:

- **Start Sta.** - Unit of measure: STATION. The value of this item is the starting station for this highway or design element. This item defaults to the minimum station for the highway.
- **End Sta.** - Unit of measure: STATION. The value of this item is the ending station for this highway or design element. This item defaults to the maximum station for the highway.
- **Speed** - Unit of measure: kilometers/hour (miles/hour). The value of this item is speed specified by the element, i.e., the design speed or turn speed. The enumeration values match those in the AASHTO design tables for the unit system. Note that both 35 mph and 40 mph are treated as equivalent to 60 km/h and both 60 mph and 65 mph are treated as equivalent to 100 km/h. When 60 km/h is convert to English units, it becomes 40 mph and when 100 km/h is convert to English units, it becomes 60 mph. The unit of measure for this item is kilometers/hour (miles/hour).

### 2.3.2 85th Percentile Speed

This item specifies an 85th percentile speed element for the highway. The 85th percentile speed is the speed at or below which 85 percent of the drivers are operating. This element is used by the Intersection Review Module as input. The items in the 85th Percentile element are:

- **Start Sta.** - Unit of measure: STATION. The value of this item is the starting station for this highway or design element. This item defaults to the minimum station for the highway.
- **End Sta.** - Unit of measure: STATION. The value of this item is the ending station for this highway or design element. This item defaults to the maximum station for the highway.
- **Side of Road** - This combo box determines the side of the road relative to the centerline (while traveling in the direction of increasing stations) for which the element applies. The enumeration values are:
  - **both** (applies to both sides of road),
  - **left** (applies to left side of road when facing increasing stations) and
  - **right** (applies to right side of road when facing increasing stations).
- **85th Percentile Speed** - Unit of measure: kilometers/hour (miles/hour). The value of this item is the 85th percentile speed is the speed at or below which 85 percent of the drivers are operating. The unit of measure for this item is kilometers/hour (miles/hour).

## 2.4 Volume

The traffic volume elements specify the basic alignment traffic volume. The elements included in this section are average daily traffic, design hour volume, and peak volume hour.

### 2.4.1 Average Daily Traffic

Annual average daily traffic elements. The items in the Annual Average Daily Traffic element are:

- **Start Sta.** - Unit of measure: STATION. The value of this item is the starting station for this highway or design element.
- **End Sta.** - Unit of measure: STATION. The value of this item is the ending station for this highway or design element.
- **Year** - Unit of measure: YEAR. The value of this item is the year of associated traffic volume.
- **ADT** - Unit of measure: vehicles/day. The value of this item is the average daily traffic (ADT) for the specified year. No value needs to be specified for this item. The unit of measure for this item is vehicles/day.
- **Escalation Factor** - Unit of measure: percent. The value of this item is the subsequent year annual traffic volume escalation factor. This item specifies the annual percent increase (or decrease) in traffic volume for **subsequent** traffic volume years. No value needs to be specified for this item. The unit of measure for this item is percent.

The average daily traffic (ADT) element is designed to allow ADT to be specified on an annual basis for the Crash Prediction Module. The Policy Review Module and Intersection Diagnostic Review Module use the analysis year item to obtain specified ADT values.

### Examples

For a single ADT element specified as:

```
start station := 100
end station  := 1000
year         := 1995
ADT rate     := 500
escalation   := 5
```

The follow ADT are defined at **all** stations of the highway for the following years

```
Year < 1995, ADT is 500
Year 1995, ADT is 500
Year 1996, ADT is 525
Year 1997, ADT is 551
Year N, ADT is (ADT of previous year * 1.05 )
```

**Figure 1. Example 1 - Average Daily Traffic Specification**

For two ADT elements specified as:

```
start station := 100 100
end station  := 1000 1000
year         := 1995 2000
ADT rate     := 500 1000
escalation   :=
```

The follow ADT are defined at **all** stations of the highway for the following years

```
Year < 1995, ADT is 500
Year 1995, ADT is 500
Year 1996, ADT is 600
Year 1997, ADT is 700
Year 1998, ADT is 800
Year 1999, ADT is 900
Year 2000, ADT is 1000
Year > 2000, ADT is 1000
```

**Figure 2. Example 2 - Average Daily Traffic Specification**

## Limitations

1. The station limits for all annual ADT elements should be consistent for all years. For example, specifying an element for stations 100 to 1000 for 1995, and stations 100 to 500 for 1996 will cause the limits on the second element to be effectively ignored.
2. For a given station range, the first year element specification must include an ADT rate.
3. For a given station range, the ADT is constant for all years before the first year specification.
4. For a given station range, the ADT is constant for a specific year for all stations within the range.

### 2.4.2 Design Hour Volume

Design hourly volume elements. The items in the Design Hourly Volume element are:

- **Start Sta.** - Unit of measure: STATION. The value of this item is the starting station for this highway or design element. This item defaults to the minimum station for the highway.
- **End Sta.** - Unit of measure: STATION. The value of this item is the ending station for this highway or design element. This item defaults to the maximum station for the highway.
- **Design Hourly Volume** - Unit of measure: vehicles/hour. The value of this item is the design hourly volume (DHV). On two-lane rural highways, the DHV is the total traffic in both directions of travel. The unit of measure for this item is vehicles/hour.

### 2.4.3 Peak Hour Volume

Peak hour volume elements. The items in the Peak Hour Volume element are:

- **Start Sta.** - Unit of measure: STATION. The value of this item is the starting station for this highway or design element. This item defaults to the minimum station for the highway.
- **End Sta.** - Unit of measure: STATION. The value of this item is the ending station for this highway or design element. This item defaults to the maximum station for the highway.
- **Side of Road** - This combo box determines the side of the road relative to the centerline (while traveling in the direction of increasing stations) for which the element applies. The enumeration values are:
  - **both** (applies to both sides of road),
  - **left** (applies to left side of road when facing increasing stations) and
  - **right** (applies to right side of road when facing increasing stations).
- **Peak Hour Volume** - Unit of measure: vehicles/hour. The value of this item is the peak hour volume (PHV). In IHSDM, the PHV is the peak hourly traffic volume in a given direction. The unit of measure for this item is vehicles/hour.

## 3. Horizontal Alignment

The horizontal alignment elements specify the geometry of the horizontal alignment. These elements include horizontal tangent, horizontal simple curve, horizontal spiral curve, horizontal deflection, heading, coordinate, and station equation.

### 3.1 Horizontal Tangent

This element specifies a horizontal alignment tangent element. The items in the Tangent element are:

- **Start Sta.** - Unit of measure: STATION. The value of this item is the starting station for this highway or design element.
- **End Sta.** - Unit of measure: STATION. The value of this item is the ending station for this highway or design element.

### 3.2 Horizontal Simple Curve

Horizontal simple curve element. The items in the Simple Curve element are:

- **Start Sta.** - Unit of measure: STATION. The value of this item is the starting station for this highway or design element.
- **End Sta.** - Unit of measure: STATION. The value of this item is the ending station for this highway or design element.
- **Curve Radius** - Unit of measure: meters (feet). The value of this item is the radius of curvature. Choice of curve radii is related to design speed, maximum superelevation rates, and location (rural or urban). The unit of measure for this item is meters (feet).
- **Direction of Curve** - The value of this item is the direction of curve while facing increasing stations, i.e., either left or right. The enumeration values are:
  - **left** (left turn while facing increasing station (counter clockwise)) and
  - **right** (right turn while facing increasing station (clockwise)).

### 3.3 Horizontal Spirial Curve

The value of this item is a horizontal spiral curve. It is defined as a spiral curve that is not terminated with a simple curve at either end. Refer to HorizontalSpiralTransition for a spiral element with a simple curve at one end. The items in the Spiral Curve element are:

- **Start Sta.** - Unit of measure: STATION. The value of this item is the starting station for this highway or design element.
- **End Sta.** - Unit of measure: STATION. The value of this item is the ending station for this highway or design element.
- **Curve Radius** - Unit of measure: meters (feet). The value of this item is the radius of curvature. Choice of curve radii is related to design speed, maximum superelevation rates, and location (rural or urban). No value needs to be specified for this item. The unit of measure for this item is meters (feet).
- **Direction of Curve** - The value of this item is the direction of curve while facing increasing stations, i.e., either left or right. The enumeration values are:
  - **left** (left turn while facing increasing station (counter clockwise)) and
  - **right** (right turn while facing increasing station (clockwise)).

No value needs to be specified for this item.

- **Radius Position** - This combo box determines the position of the specified spiral radius. The position of the radius on the spiral element, that is, at either the start station or end station. The enumeration values are:

- **start** (radius is at start of curve (lowest station)) and
- **end** (radius is at end of curve (highest station)).

No value needs to be specified for this item.

### 3.4 Horizontal Deflection

Horizontal deflection element. The items in the Deflection element are:

- **Station** - Unit of measure: STATION. The value of this item is the specific station location associated with the highway or design element.
- **Deflection Angle** - Unit of measure: degrees. The value of this item is the angle of deflection (in degrees) from preceding (lower station) tangent. Positive angles represent a deflection to the right (when facing increasing stations), negative angles represent a deflection to the left. The unit of measure for this item is degrees.

### 3.5 Heading

This element specifies the (instantaneous) azimuth heading of the centerline, while facing increasing stations. Only one heading element need be specified for a highway. If more than one heading element is specified, only the first (lowest station number) is used. The items in the Heading element are:

- **Station** - Unit of measure: STATION. The value of this item is the specific station location associated with the highway or design element.
- **Heading Azimuth** - Unit of measure: degrees. The value of this item is the azimuth angle for the specified tangent. The azimuth heading (in degrees) of the tangent at the specified station. A geometric (map) coordinate system is used where North=0, East=90, South=180 and West=270. The unit of measure for this item is degrees.

### 3.6 Coordinate

Horizontal alignment X-Y coordinate. The items in the Coordinate element are:

- **Station** - Unit of measure: STATION. The value of this item is the specific station location associated with the highway or design element.
- **Northing Coordinate** - Unit of measure: meters (feet). The value of this item is the Northing (Y) coordinate at the specified station. The unit of measure for this item is meters (feet).
- **Easting Coordinate** - Unit of measure: meters (feet). The value of this item is the Easting (X) coordinate at the specified station. The unit of measure for this item is meters (feet).

### 3.7 Station Equations

The value of this item is a station equation. The items in the Station Equations element are:

- **Back Station** - Unit of measure: STATION. The value of this item is the 'back' station in the station equation.
- **Ahead Station** - Unit of measure: STATION. The value of this item is the 'ahead' station in the station equation.

## 4. Vertical Alignment

The vertical alignment elements specify the basic geometry of the vertical alignment. These elements are vertical point of intersection, vertical tangent, vertical curve and elevation. A complete vertical alignment must be specified for all IHSDM modules. If the vertical alignment is not defined for a range of stations, a vertical tangent is inserted for the missing element. The basic geometry should be specified using either a number of vertical point of intersection elements, or a number of vertical tangent - vertical curve sets, but not both.

### 4.1 Vertical Point of Intersection

Vertical Point of Intersection element. The items in the VPI element are:

- **VPI Station** - Unit of measure: STATION. This item specifies the location of the vertical point of intersection (VPI).
- **Back Grade** - Unit of measure: percent. The back (relative to increasing stations) grade is the grade at the vertical point of curvature (VPC). A negative value is descending; a positive value is ascending. The unit of measure for this item is percent.
- **Back Length** - Unit of measure: meters (feet). The back length is the length (along the horizontal axis) from the vertical point of curvature (VPC) to the vertical point of intersection (VPI). The unit of measure for this item is meters (feet).
- **Forward Grade** - Unit of measure: percent. The forward (relative to increasing stations) grade (in %) is the grade at the vertical point of tangency (VPT). A negative value is descending; a positive value is ascending. The unit of measure for this item is percent.
- **Forward Length** - Unit of measure: meters (feet). The forward length is the length (along the horizontal axis) from the vertical point of intersection (VPI) to the vertical point of tangency (VPT). The unit of measure for this item is meters (feet).

### 4.2 Vertical Tangent

Vertical tangent elements. The items in the Tangent element are:

- **Start Sta.** - Unit of measure: STATION. The value of this item is the starting station for this highway or design element.
- **End Sta.** - Unit of measure: STATION. The value of this item is the ending station for this highway or design element.
- **Tangent Grade** - Unit of measure: percent. The value of this item is the tangent grade. -% is descending; +% is ascending. The unit of measure for this item is percent.

### 4.3 Vertical Curve

This item specifies a symmetrical vertical curve bounded on both ends by vertical tangents. The items in the Curve element are:

- **Start Sta.** - Unit of measure: STATION. The value of this item is the starting station for this highway or design element.
- **End Sta.** - Unit of measure: STATION. The value of this item is the ending station for this highway or design element.

## 4.4 Elevation

Vertical elevation at specified station. The items in the Elevation element are:

- **Station** - Unit of measure: STATION. The value of this item is the specific station location associated with the highway or design element.
- **Elevation** - Unit of measure: meters (feet). The value of this item is the elevation in meters or feet at a specified station. The unit of measure for this item is meters (feet).

## 5. Cross Section

The cross section elements include those specifying the attributes of the highway cross slope, pavement, and the shoulder.

### 5.1 Highway Cross Slope

The highway model for highway cross slope includes one element: cross slope .

#### 5.1.1 Cross Slope

The cross slope elements are used to define the normal cross slope and superelevation of the highway. The superelevation and normal cross slope elements are found in the highway definition, they are converted to cross slope elements. Cross Slope elements should only be specified at specific points along the highway:

- **Normal Cross Slope** - locations with normal cross slope. Any points for which the cross slope and both sides of the road are between -1% and -7% are considered normal cross slope.
- **Full Superelevation** - locations with full superelevation. Any points for which the cross slopes have the same magnitude but different sign, and the magnitude is greater than 1.5% are considered full superelevation.
- **Runout-Runoff Transition** - locations that represent the transition between tangent runoff and runoff. Any points for which the high side cross slope is 0% and the low side is between -1% and -7% considered runout-runoff transitions.
- **Flat** - locations that represent a cross slope of 0% on both sides. Flat points should only be specified between two points of full superelevation when there is no runoff or runout between the points of full superelevation.

### 5.2 Pavement

Pavement type elements. The items in the Pavement Type element are:

- **Start Sta.** - Unit of measure: STATION. The value of this item is the starting station for this highway or design element. This item defaults to the minimum station for the highway.
- **End Sta.** - Unit of measure: STATION. The value of this item is the ending station for this highway or design element. This item defaults to the maximum station for the highway.
- **Pavement Type** - This combo box determines the pavement type. Pavements are categorized as high, intermediate, and low. The enumeration values are: **high-type**, **intermediate-type** and **low-type**.

### 5.3 Shoulder

The highway model for shoulder slope includes the following elements: normal shoulder slope, shoulder slope, shoulder width, shoulder material, and shoulder category.

### 5.3.1 Normal Shoulder Slope

Normal shoulder slope elements. The items in the Normal Shoulder Slope element are:

- **Start Sta.** - Unit of measure: STATION. The value of this item is the starting station for this highway or design element. This item defaults to the minimum station for the highway.
- **End Sta.** - Unit of measure: STATION. The value of this item is the ending station for this highway or design element. This item defaults to the maximum station for the highway.
- **Side of Road** - This combo box determines the side of the road relative to the centerline (while traveling in the direction of increasing stations) for which the element applies. The enumeration values are:
  - **both** (applies to both sides of road),
  - **left** (applies to left side of road when facing increasing stations) and
  - **right** (applies to right side of road when facing increasing stations).
- **Slope** - Unit of measure: %. The value of this item is the normal shoulder cross slope. The slope of the shoulder is negative when the outside edge of the traveled way has a greater elevation than the outside edge of shoulder. The unit of measure for this item is %.

### 5.3.2 Shoulder Slope

The value of this item is the shoulder slope. The shoulder slope element defines a shoulder slope which transitions from the normal shoulder slope to a slope and then back to the normal shoulder slope. The items in the Shoulder Slope element are:

- **Start Sta.** - Unit of measure: STATION. The value of this item is the starting station for this highway or design element.
- **Side of Road** - This combo box determines the side of the road relative to the centerline (while traveling in the direction of increasing stations) for which the element applies. The enumeration values are:
  - **both** (applies to both sides of road),
  - **left** (applies to left side of road when facing increasing stations) and
  - **right** (applies to right side of road when facing increasing stations).
- **Begin Full Slope** - Unit of measure: STATION. This item specifies the station at which the full element slope begins.
- **Slope** - Unit of measure: %. The value of this item is the shoulder slope. The slope of the shoulder is negative when the outside edge of the traveled way has a greater elevation than the outside edge of shoulder. The unit of measure for this item is %.
- **End Full Slope** - Unit of measure: STATION. This item specifies the station at which the full element slope begins.
- **End Sta.** - Unit of measure: STATION. The value of this item is the ending station for this highway or design element.

### 5.3.3 Shoulder Width

The shoulder width elements are used to specify the shoulder width at a specific location. The highway model assumes that the shoulder width changes linearly between shoulder width elements. For example, if the shoulder width is defined as 1.0 meters at station 0+000 and 2.0 meters at station 1+000, the shoulder width at stations 0+500 is 1.5 meters. The items in the

Shoulder Width element are:

- **Station** - Unit of measure: STATION. The value of this item is the specific station location associated with the highway or design element.
- **Side of Road** - This combo box determines the side of the road relative to the centerline (while traveling in the direction of increasing stations) for which the element applies. The enumeration values are:
  - **both** (applies to both sides of road),
  - **left** (applies to left side of road when facing increasing stations) and
  - **right** (applies to right side of road when facing increasing stations).
- **Shoulder Width** - Unit of measure: meters (feet). The value of this item is the shoulder width. The unit of measure for this item is meters (feet).

### 5.3.4 Shoulder Material

The value of this item is the shoulder type (material). Shoulder materials include turf, gravel or crushed rock, and asphalt, concrete, or bituminous pavements. The items in the Shoulder Material element are:

- **Start Sta.** - Unit of measure: STATION. The value of this item is the starting station for this highway or design element. This item defaults to the minimum station for the highway.
- **End Sta.** - Unit of measure: STATION. The value of this item is the ending station for this highway or design element. This item defaults to the maximum station for the highway.
- **Side of Road** - This combo box determines the side of the road relative to the centerline (while traveling in the direction of increasing stations) for which the element applies. The enumeration values are:
  - **both** (applies to both sides of road),
  - **left** (applies to left side of road when facing increasing stations) and
  - **right** (applies to right side of road when facing increasing stations).
- **Type of Shoulder Material** - This combo box determines the type of shoulder material. The enumeration values are: **turf**, **gravel**, **paved** and **composite**.

### 5.3.5 Shoulder Category

Shoulder category elements. The items in the Shoulder Category element are:

- **Start Sta.** - Unit of measure: STATION. The value of this item is the starting station for this highway or design element. This item defaults to the minimum station for the highway.
- **End Sta.** - Unit of measure: STATION. The value of this item is the ending station for this highway or design element. This item defaults to the maximum station for the highway.
- **Side of Road** - This combo box determines the side of the road relative to the centerline (while traveling in the direction of increasing stations) for which the element applies. The enumeration values are:
  - **both** (applies to both sides of road),
  - **left** (applies to left side of road when facing increasing stations) and
  - **right** (applies to right side of road when facing increasing stations).

- **Shoulder Category** - This combo box determines the shoulder category. The enumeration values are: **usable** and **graded**.

## 6. Lane

The lane elements include thru lane, auxiliary lane, lane offset, and curve widening.

### 6.1 Thru Lane

The items in the Thru Lane element are:

- **Start Sta.** - Unit of measure: STATION. The value of this item is the starting station for this highway or design element. This item defaults to the minimum station for the highway.
- **End Sta.** - Unit of measure: STATION. The value of this item is the ending station for this highway or design element. This item defaults to the maximum station for the highway.
- **Side of Road** - This combo box determines the side of the road relative to the centerline (while traveling in the direction of increasing stations) for which the element applies. The enumeration values are:
  - **both** (applies to both sides of road),
  - **left** (applies to left side of road when facing increasing stations) and
  - **right** (applies to right side of road when facing increasing stations).
- **Lane Width** - Unit of measure: meters (feet). The value of this item is the width of lane. The unit of measure for this item is meters (feet).

### 6.2 Auxiliary Lanes

The auxiliary lane elements include passing lane, turn lane, two-way left turn lane, and climbing lane.

#### 6.2.1 Passing Lane

The items in the Passing Lane element are:

- **Start Sta.** - Unit of measure: STATION. The value of this item is the starting station for this highway or design element.
- **End Sta.** - Unit of measure: STATION. The value of this item is the ending station for this highway or design element.
- **Side of Road** - This combo box determines the side of the road relative to the centerline (while traveling in the direction of increasing stations) for which the element applies. The enumeration values are:
  - **both** (applies to both sides of road),
  - **left** (applies to left side of road when facing increasing stations) and
  - **right** (applies to right side of road when facing increasing stations).
- **Lane Width** - Unit of measure: meters (feet). The value of this item is the width of lane. The unit of measure for this item is meters (feet).
- **Begin Full Width** - Unit of measure: STATION. It specifies the station at which the initial taper ends and the full width begins.
- **End Full Width** - Unit of measure: STATION. This item specifies the station at which the full width ends and the final taper begins.

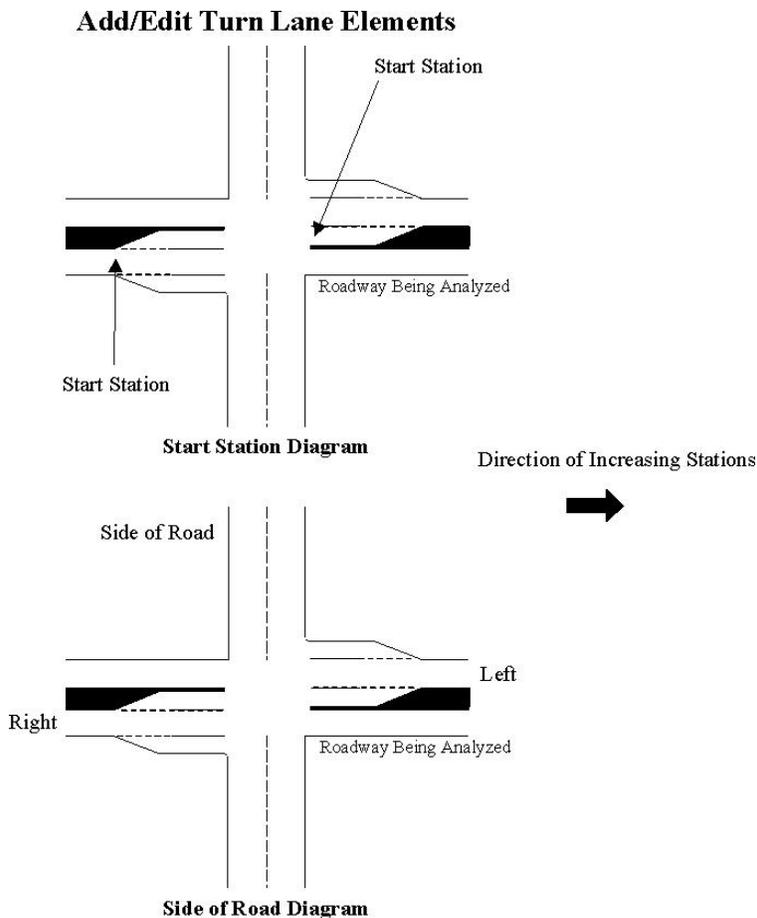
- **Passing Prohibited On Opposing Lane(s)** - The value of this item describes whether or not passing is prohibited on the lane(s) opposing this Lane.

### 6.2.2 Turn Lane

The items in the Turn Lane element are:

- **Start Sta.** - Unit of measure: STATION. The value of this item is the starting station for this highway or design element.
- **End Sta.** - Unit of measure: STATION. The value of this item is the ending station for this highway or design element.
- **Side of Road** - This combo box determines the side of the road relative to the centerline (while traveling in the direction of increasing stations) for which the element applies. The enumeration values are:
  - **both** (applies to both sides of road),
  - **left** (applies to left side of road when facing increasing stations) and
  - **right** (applies to right side of road when facing increasing stations).
- **Lane Width** - Unit of measure: meters (feet). The value of this item is the width of lane. The unit of measure for this item is meters (feet).
- **Begin Full Width** - Unit of measure: STATION. It specifies the station at which the initial taper ends and the full width begins.
- **Turn Lane Type** - This combo box determines the turning lane type designation. The enumeration values are:
  - **left** (exclusive left turn lane) and
  - **right** (exclusive right turn lane).
- **Taper Type** - This combo box determines the taper type. Taper Type: straight line, partial tangent, symmetrical reverse curve, asymmetrical reverse curve. The enumeration values are: **straight line, partial tangent, symmetrical reverse curve** and **asymmetrical reverse curve**.
- **Taper Tangent Length** - Unit of measure: meters (feet). The value of this item is the taper tangent length. The unit of measure for this item is meters (feet).

### Examples



**Figure 3 Turn Lane Diagram**

### 6.2.3 Two-way Left Turn Lane

The items in the Two-way Left Turn Lane element are:

- **Start Sta.** - Unit of measure: STATION. The value of this item is the starting station for this highway or design element.
- **Start Centerline Offset** - Unit of measure: meters (feet). This item specifies the lateral offset of the start of the two-way left turn lane from the centerline of the highway. A positive value represents an offset to the right side of the road (relative to the direction of increasing stations) and a negative value represent represents an offset to the left side of the road. The unit of measure for this item is meters (feet).
- **Begin Full Width** - Unit of measure: STATION. It specifies the station at which the initial taper ends and the full width begins.
- **Lane Width** - Unit of measure: meters (feet). The value of this item is the width of lane. The unit of measure for this item is meters (feet).
- **End Full Width** - Unit of measure: STATION. This item specifies the station at which the full width ends and the final taper begins.
- **End Centerline Offset** - Unit of measure: meters (feet). This item specifies the lateral offset of the end of the two-way left turn lane from the centerline of the highway. A positive value represents an offset to the right side of the road (relative to the direction of increasing stations) and a negative value represent represents an offset to the left side of the road. The

unit of measure for this item is meters (feet).

- **End Sta.** - Unit of measure: STATION. The value of this item is the ending station for this highway or design element.

#### 6.2.4 Climbing Lane

The items in the Climb Lane element are:

- **Start Sta.** - Unit of measure: STATION. The value of this item is the starting station for this highway or design element.
- **End Sta.** - Unit of measure: STATION. The value of this item is the ending station for this highway or design element.
- **Side of Road** - This combo box determines the side of the road relative to the centerline (while traveling in the direction of increasing stations) for which the element applies. The enumeration values are:
  - **both** (applies to both sides of road),
  - **left** (applies to left side of road when facing increasing stations) and
  - **right** (applies to right side of road when facing increasing stations).
- **Lane Width** - Unit of measure: meters (feet). The value of this item is the width of lane. The unit of measure for this item is meters (feet).
- **Begin Full Width** - Unit of measure: STATION. It specifies the station at which the initial taper ends and the full width begins.
- **End Full Width** - Unit of measure: STATION. This item specifies the station at which the full width ends and the final taper begins.
- **Passing Prohibited On Opposing Lane(s)** - The value of this item describes whether or not passing is prohibited on the lane(s) opposing this Lane.

#### 6.3 Lane Offset

The items in the Lane Offset element are:

- **Start Sta.** - Unit of measure: STATION. The value of this item is the starting station for this highway or design element.
- **End Sta.** - Unit of measure: STATION. The value of this item is the ending station for this highway or design element.
- **Side of Road** - This combo box determines the side of the road relative to the centerline (while traveling in the direction of increasing stations) for which the element applies. The enumeration values are:
  - **right** (applies to right side of road when facing increasing stations),
  - **left** (applies to left side of road when facing increasing stations) and
  - **both** (applies to both sides of road).
- **Full Offset** - Unit of measure: meters (feet). The value of this item is the offset of the inner lane from centerline. The full (greatest) offset of the inside (left) edge of the innermost lane on this side of road. The unit of measure for this item is meters (feet).
- **Begin Full Width** - Unit of measure: STATION. It specifies the station at which the initial taper ends and the full width begins.

- **End Full Width** - Unit of measure: STATION. This item specifies the station at which the full width ends and the final taper begins.

## 6.4 Curve Widening

The items in the Curve Widening element are:

- **Start Sta.** - Unit of measure: STATION. The value of this item is the starting station for this highway or design element.
- **End Sta.** - Unit of measure: STATION. The value of this item is the ending station for this highway or design element.
- **Side of Road** - This combo box determines the side of the road relative to the centerline (while traveling in the direction of increasing stations) for which the element applies. The enumeration values are:
  - **right** (applies to right side of road when facing increasing stations),
  - **left** (applies to left side of road when facing increasing stations) and
  - **both** (applies to both sides of road).
- **Widening** - Unit of measure: meters (feet). The value of this item is the full amount of widening. The unit of measure for this item is meters (feet).
- **Begin Full Width** - Unit of measure: STATION. It specifies the station at which the initial taper ends and the full width begins.
- **End Full Width** - Unit of measure: STATION. This item specifies the station at which the full width ends and the final taper begins.

## 7. Roadside

The roadside elements include foreslope, backslope, ditch, obstruction offset, bike facilities, driveway density, and hazard rating.

### 7.1 Foreslope

Information concerning the foreslopes includes width and cross slope for each side of the road. The items in the Roadside Foreslope element are:

- **Station** - Unit of measure: STATION. The value of this item is the specific station location associated with the highway or design element.
- **Side of Road** - This combo box determines the side of the road relative to the centerline (while traveling in the direction of increasing stations) for which the element applies. The enumeration values are:
  - **both** (applies to both sides of road),
  - **left** (applies to left side of road when facing increasing stations) and
  - **right** (applies to right side of road when facing increasing stations).
- **Slope** - Unit of measure: rise:run. The value of this item is the roadside cross slope. A negative value denotes a fill slope (e.g. the ground elevation decreases moving away from the shoulder); a positive value denotes a cut slope (ground elevation increases moving away from the shoulder). This item may be expressed as a ratio of 'rise:run', e.g., 1:10 denotes a 10% slope. The unit of measure for this item is rise:run.

- **Width of Slope** - Unit of measure: meters (feet). The value of this item is the width of the foreslope or backslope element. The unit of measure for this item is meters (feet).

## 7.2 Backslope

Information concerning the backslopes includes width and cross slope for each side of the road. The items in the Roadside Backslope element are:

- **Station** - Unit of measure: STATION. The value of this item is the specific station location associated with the highway or design element.
- **Side of Road** - This combo box determines the side of the road relative to the centerline (while traveling in the direction of increasing stations) for which the element applies. The enumeration values are:
  - **both** (applies to both sides of road),
  - **left** (applies to left side of road when facing increasing stations) and
  - **right** (applies to right side of road when facing increasing stations).
- **Slope** - Unit of measure: rise:run. The value of this item is the roadside cross slope. A negative value denotes a fill slope (e.g. the ground elevation decreases moving away from the shoulder); a positive value denotes a cut slope (ground elevation increases moving away from the shoulder). This item may be expressed as a ratio of 'rise:run', e.g., 1:10 denotes a 10% slope. The unit of measure for this item is rise:run.
- **Width of Slope** - Unit of measure: meters (feet). The value of this item is the width of the foreslope or backslope element. The unit of measure for this item is meters (feet).

## 7.3 Ditch

This item contains the ditch bottom elements. Ditches collect runoff from the highway and the rest of the right-of-way and carry the runoff to the appropriate drainage facility. The items in the Ditch Bottom element are:

- **Station** - Unit of measure: STATION. The value of this item is the specific station location associated with the highway or design element.
- **Side of Road** - This combo box determines the side of the road relative to the centerline (while traveling in the direction of increasing stations) for which the element applies. The enumeration values are:
  - **both** (applies to both sides of road),
  - **left** (applies to left side of road when facing increasing stations) and
  - **right** (applies to right side of road when facing increasing stations).
- **Ditch Bottom Shape** - The value of this item is the ditch bottom shape. Ditches can be 'V' shaped or trapezoidal. Trapezoidal ditch bottoms can be rounded or flat. The enumeration values are: **true V**, **rounded V**, **rounded trapezoidal** and **flat trapezoidal**.
- **Ditch Bottom Width** - Unit of measure: meters (feet). The value of this item is the width of bottom of the ditch. The unit of measure for this item is meters (feet).

## 7.4 Obstruction Offset

Offset from center line sight distance obstructions. The items in the Obstruction Offset element are:

- **Start Sta.** - Unit of measure: STATION. The value of this item is the starting station for this highway or design element. This item defaults to the minimum station for the highway.
- **End Sta.** - Unit of measure: STATION. The value of this item is the ending station for this highway or design element. This item defaults to the maximum station for the highway.
- **Side of Road** - This combo box determines the side of the road relative to the centerline (while traveling in the direction of increasing stations) for which the element applies. The enumeration values are:
  - **both** (applies to both sides of road),
  - **left** (applies to left side of road when facing increasing stations) and
  - **right** (applies to right side of road when facing increasing stations).
- **Centerline Offset** - Unit of measure: meters (feet). The value of this item is the offset from centerline to sight distance obstructions. The nominal obstruction offset used for sight distance calculation measured from the highway centerline. The unit of measure for this item is meters (feet).

## 7.5 Bike Facilities

Bicycle facility elements. The items in the Bike Facility element are:

- **Start Sta.** - Unit of measure: STATION. The value of this item is the starting station for this highway or design element. This item defaults to the minimum station for the highway.
- **End Sta.** - Unit of measure: STATION. The value of this item is the ending station for this highway or design element. This item defaults to the maximum station for the highway.
- **Side of Road** - This combo box determines the side of the road relative to the centerline (while traveling in the direction of increasing stations) for which the element applies. The enumeration values are:
  - **both** (applies to both sides of road),
  - **left** (applies to left side of road when facing increasing stations) and
  - **right** (applies to right side of road when facing increasing stations).

## 7.6 Driveway Density

The items in the Driveway Density element are:

- **Start Sta.** - Unit of measure: STATION. The value of this item is the starting station for this highway or design element.
- **End Sta.** - Unit of measure: STATION. The value of this item is the ending station for this highway or design element.
- **Driveway Density** - Unit of measure: driveways/kilometer (driveways/mile). The value of this item is the driveway density for both sides of the highway combined. The unit of measure for this item is driveways/kilometer (driveways/mile).

## 7.7 Hazard Rating

The items in the Roadside Hazard Rating element are:

- **Start Sta.** - Unit of measure: STATION. The value of this item is the starting station for this highway or design element.
- **End Sta.** - Unit of measure: STATION. The value of this item is the ending station for this highway or design element.
- **Roadside Hazard Rating** - Unit of measure: INT. The value of this item is the roadside hazard rating for both sides of the road. The enumeration values are: **1, 2, 3, 4, 5, 6** and **7**.

## 8. Other

Other elements include posted speed, bridge, and decision sight distance.

### 8.1 Posted Speed

The items in the Posted Speed element are:

- **Start Sta.** - Unit of measure: STATION. The value of this item is the starting station for this highway or design element. This item defaults to the minimum station for the highway.
- **End Sta.** - Unit of measure: STATION. The value of this item is the ending station for this highway or design element. This item defaults to the maximum station for the highway.
- **Side of Road** - This combo box determines the side of the road relative to the centerline (while traveling in the direction of increasing stations) for which the element applies. The enumeration values are:
  - **both** (applies to both sides of road),
  - **left** (applies to left side of road when facing increasing stations) and
  - **right** (applies to right side of road when facing increasing stations).
- **Speed Limit** - Unit of measure: kilometers/hour (miles/hour). The value of this item is the posted speed limit. The unit of measure for this item is kilometers/hour (miles/hour).

The basic vehicle speeds for the alignment are specified by the speed elements.

### 8.2 Bridge

Bridge elements. The items in the Bridge element are:

- **Start Sta.** - Unit of measure: STATION. The value of this item is the starting station for this highway or design element.
- **End Sta.** - Unit of measure: STATION. The value of this item is the ending station for this highway or design element.
- **Bridge Width** - Unit of measure: meters (feet). The value of this item is the total width of bridge, not including sidewalks. Clear highway dimension from face of curb to face of curb on bridge, not including sidewalks. The unit of measure for this item is meters (feet).
- **Type of Bridge Project** - This combo box determines the type of project or study for bridges. Policy Guidance varies for new and reconstructed bridges and for bridge to remain in place. The enumeration values are: **new/reconstruction** and **existing will remain**.

### 8.3 Decision Sight Distance

The items in the Decision Sight Distance element are:

- **Station** - Unit of measure: STATION. The value of this item is the station of the location to which decision sight distance is provided, where a stop or speed/path/direction change maneuver must be completed. A station number may be specified using any of three notations: 'xx+yyy.zzz', 'xx+yy.zzz' or 'xx.zzz'. Each of these notations may be suffixed with a region number when station equations cause ambiguous station numbers, for example, 'xx+yyy.zzz(r)'. The unit system (Metric or English) is specified at the project level.
- **Maneuver Type** - The value of this item is the avoidance maneuver type. The type of maneuver a driver has to perform (A - stop on rural road or C - speed/path/direction change on rural road ) determines the DSD needed. Other maneuver types specified in AASHTO policy (B, D, and E) apply to urban or suburban areas. The enumeration values are: **A - stop (rural road)** and **C - speed/path/direction change (rural road)**.

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