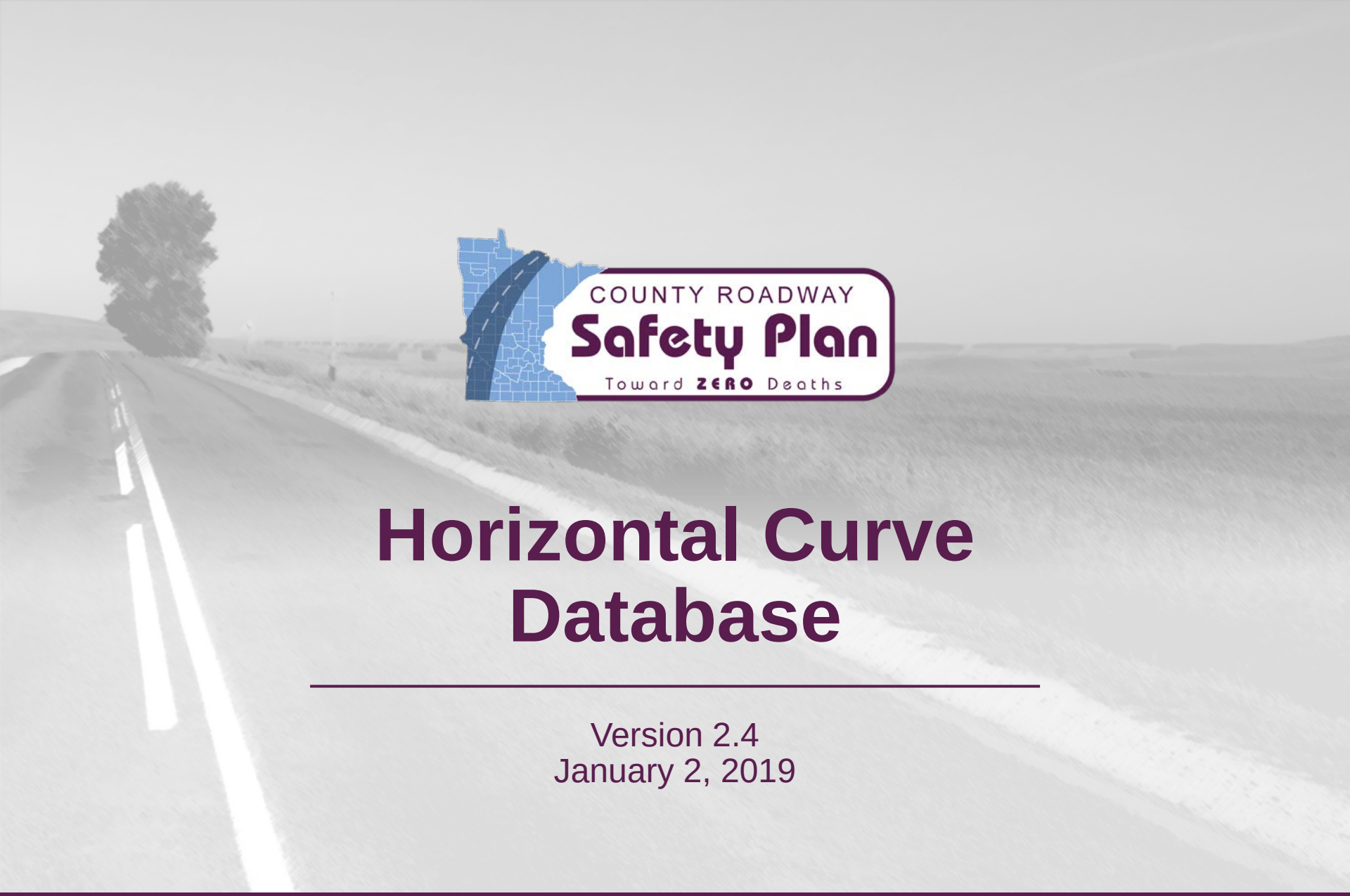


Horizontal Curve Database

Version 2.4
January 2, 2019

County Roadway Safety Plan Updates

Background Information

Data Input Protocol

- **Allowed**
  - **“Other”**
    - The allowed inputs for the applicable attribute do not include the correct type for the horizontal curve under review
      - E.g., Intersection *Design Type* is ‘Displaced Left Turn’, but this intersection type is not listed as one of the approved values under *Design Type*
    - Action: Describe in the “Comments” attribute
  - **“Unknown”**
    - The attribute cannot be confidently determined with the given sources of information (i.e., MnDOT Video Log, Google Earth)
      - E.g., No Google Street View/MnDOT Video Log at location
  - **“NA” – Not Applicable**
    - The attribute does not include a valid input due to another attribute
      - E.g., “Right_Turn_On_Red” attribute for a Thru-Stop intersection
  - **“NV” – No Value**
    - Used when data would otherwise be blank

- **Not Allowed**
  - Review your work regularly to check for and correct instances of the following:
    - Blanks
    - Dashes “-”
    - Acronyms (if not specified)
    - Abbreviations
    - Typos

Supporting Data

The attributes in the following slides will generally be pre-populated and no action is required.

- A basic understanding of these pre-populated attributes is recommended.
- Errors and other inconsistencies in this data should be identified and reported to the appropriate data manager for review.
- Any attribute may be pre-populated due to varying sources of data. This data should always be reviewed for accuracy.

Supporting Data: Attributes

- **Phase**
  - CRSP2 project phase
    - E.g., summer 2018 data collection is “2”
- **District**
  - MnDOT District/ATP number best corresponding to the county per a one-to-one correlation (note: not district boundaries)
    [SEE NEXT SLIDE]
- **County_Name**
  - County name with spelling as defined
    [SEE NEXT SLIDE]
- **County_Number**
  - County number: 1-87 (note: not FIPS)
    [SEE NEXT SLIDE]

Supporting Data: County Information

Counties participating in Phase 2:

County Number	County Name	District	Phase
7	Blue Earth	7	2
10	Carver	5	2
14	Clay	4	2
20	Dodge	6	2
31	Itasca	1	2
34	Kandiyohi	8	2
37	Lac qui Parle	8	2
42	Lyon	8	2
60	Polk	2	2
64	Redwood	8	2
66	Rice	6	2
68	Roseau	2	2
70	Scott	5	2
71	Sherburne	3	2
80	Wadena	3	2
82	Washington	5	2

Complete list of all 87 counties in Minnesota:

Refer to Excel Worksheet (May 2018 Version):

Microsoft Excel Worksheet

Supporting Data: Attributes

Roadway Feature Identifiers

- **County_ID**
  - *Only applicable if county has requested a correlation between the CRSP2 study network and the county's internal use unique identifier*
- **CRSP1_Unique_ID**
  - If applicable, unique identifier as existing in CRSP1 deliverable database
- **CRSP2_Unique_ID**
  - Primary unique identifier for this project
    - Generated with a specific syntax that identifies key *[SEE NEXT SLIDE]*
    - This identifier is used among all files (KMZ, Excel, geodatabase, etc.) throughout this project.

CRSP2 Unique ID Syntax

Identifies **type** of feature:
- "**S**" for Segment
- "**C**" for Horizontal Curve
- "**I**" for Intersection

Identifies **county** by its defined number:
- Always two digits
- See Assumptions for statewide listing of county names and corresponding numbers

Identifies **route system number** of feature:
- "**4**" for CSAH (County State Aid Highway
- "**7**" for CR (County Road)

Identifies the **route number** of the county study roadway:
- Where multiple county roadways intersect:
  - CSAH takes precedent over CR
  - Smaller route numbers take precedent over larger ones
- Number of characters vary
- May include an alpha character, where applicable

Identifies the **sequential count** of the curve
- Always three digits (i.e., includes leading and lagging zeros where applicable)
- Numbers increase from West-to-East or South-to-North
- Assumption that the number of intersections along any one route will not exceed 999

This example would be a **Curve** in **Otter Tail County** along **CR 40**. This would be the **27th curve in count** from the beginning (southernmost or westernmost point) of the route.

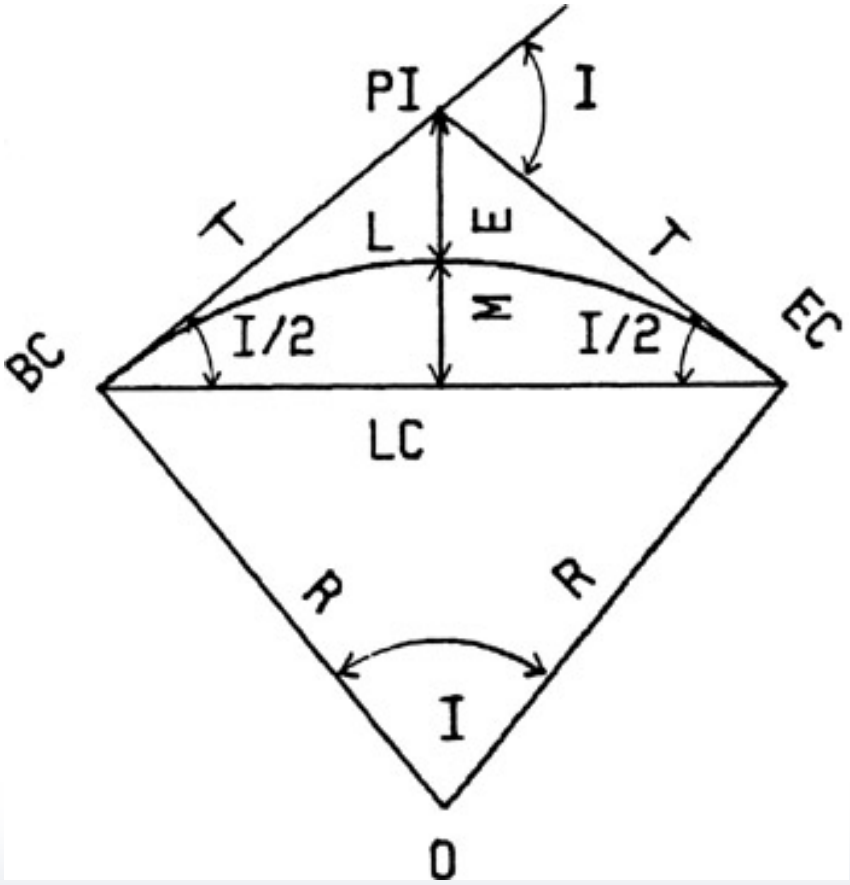
Supporting Data: Attributes

- **Route_System_Number & Route_System**
  - Route System [Number] per MnDOT TIS codes
  - Relevant to CRSP study network:
    - 04 – County State Aid Highway (CSAH)
    - 07 – County Road (CR)
- **Route_Number**
  - Route/highway number
    - E.g., CSAH 17 = ‘17’
    - Corresponds to Route Number in CRSP2_Unique_ID attribute

RTSYS (ROUTE SYSTEM)
1=INTERSTATE-ISTH
2=US TRNK HWY-USTH
3=MN ST TRUNK HWY
4=CNTY ST AID HWY
5=MUN STAT AID HWY
7=COUNTY RD-CNTY
8=TOWNSHIP RD-TWNS
9=UNRGNZD TNSHP RD
10=MUNIPAL STRT-MUN
11=NATL PRK RD-NATP
12=NTL FRST RD-NATF
13=INDN SRVC RD-IND
14=ST FOREST RD-SFR
15=ST PRK ROAD-SPRK
16=MILITARY RD-MIL
17=NTL MNNT RD-NATM
18=NTL WLDLF RFG RD
19=FRNTGE ROAD-FRNT
20=ST GAME RESRV RD
21=PRV RD OP TO PUB
23=AIRPORT ROADS
25=NON-TRAFFIC WAYS
30=ALLEYS & SO ON
98=NOT LOCATED

Supporting Data: Attributes

- **Length**
  - Length of curve arc in meters and feet
  - “L” in diagram
- **Radius**
  - Radius of the curve arc in meters and feet
  - “R” in diagram
- **Delta**
  - The central angle of the curve arc in degrees
  - “I” in diagram



Supporting Data: Attributes

- **ADT_vpd & ADT_year**
  - 2-way official or estimated AADT/ADT & year it was collected
- **Corresponding_Segment**
  - Segment ID that curve is assigned to
- **City**
  - The name of city/municipality that curve falls within
- **Street_Name**
  - Intended to be retrieved from corresponding segment
  - If applicable, use county level name and local street name
    - E.g., “CASH 17/12th Avenue East” or “CR 7/North Minnesota Street”

Supporting Data: Attributes

- **Surface_Type** ***Confirm for every curve**
  - Paved
  - Gravel
  - Minimum Maintenance Road
    [see example images] →

Supporting Data: Attributes

Collect_Data

- "Yes" or "No"

Paved, Rural curves are the focus of this analysis**. Suburban curves may be included** if their shoulder type is graded (as opposed to curb & gutter).

After documenting the SURFACE_TYPE and AREA_TYPE, do NOT collect additional data if:

SURFACE_TYPE =

- Gravel
- Minimum Maintenance Road

AND/OR

AREA_TYPE =

- Urban Core
- Urban
- Suburban AND SHOULDER_TYPE = Curb & Gutter
- Small Town

Data Collection

Data Collection - Google Earth Aerial Imagery

The attributes in the following slides are normally best collected using Google Earth aerial imagery.

- In addition to aerial imagery, review or confirmation using Street View may be appropriate in some instances.
- Generally, Google Earth aerials are the most up-to-date imagery that is widely available.
  - Expected age of aerials is between 0 and 3 years.
  - Google Earth's *Historical Imagery* (application-based only) tool may be used if further investigation of a roadway feature is warranted.

- *To optimize functionality and speed of Google Earth:*
  - *Use a high-speed ethernet connection*
  - *Load KMZs from a copy on local hard drive instead of server, etc.*
  - *Disable all layers except 'Borders and Labels' and 'Roads' (Layers)*
  - *Adjust Cache size (Tools → Options → Cache)*
  - *Maximize Fly-To Speed (Tools → Options → Navigation)*
  - *Adjust Mouse Wheel Speed (Options → Navigation)*
  - *Enable 'Do not automatically tilt while zooming' (Options → Navigation)*

Data Collection: Aerial Attributes

Aerial_Imagery_Date

- Input the ‘Imagery Date’ as specified by Google Earth
  - The date may change as user zooms in/out; use the date at the most zoomed-in level
  - If date changes/multiple exist, default to the one being used to collect data

Data Collection

Street_View

- Yes
- No
- Partial
- Construction

StreetView_Date

- Format: MM/YYYY

(use the most up-to-date one)

Video_Log_Review*

- Yes
- No

**Automated based on the surface type and the year of StreetView imagery*

Data Collection: Aerial Attributes

Redraw_Flag

- Indicate whether curve linework may require redrawing and/or realignment to match existing geometry
  - “Yes”
  - “No”

Note: does not need to be perfect, but should roughly reflect the actual geometry, placement, etc. of the horizontal curve

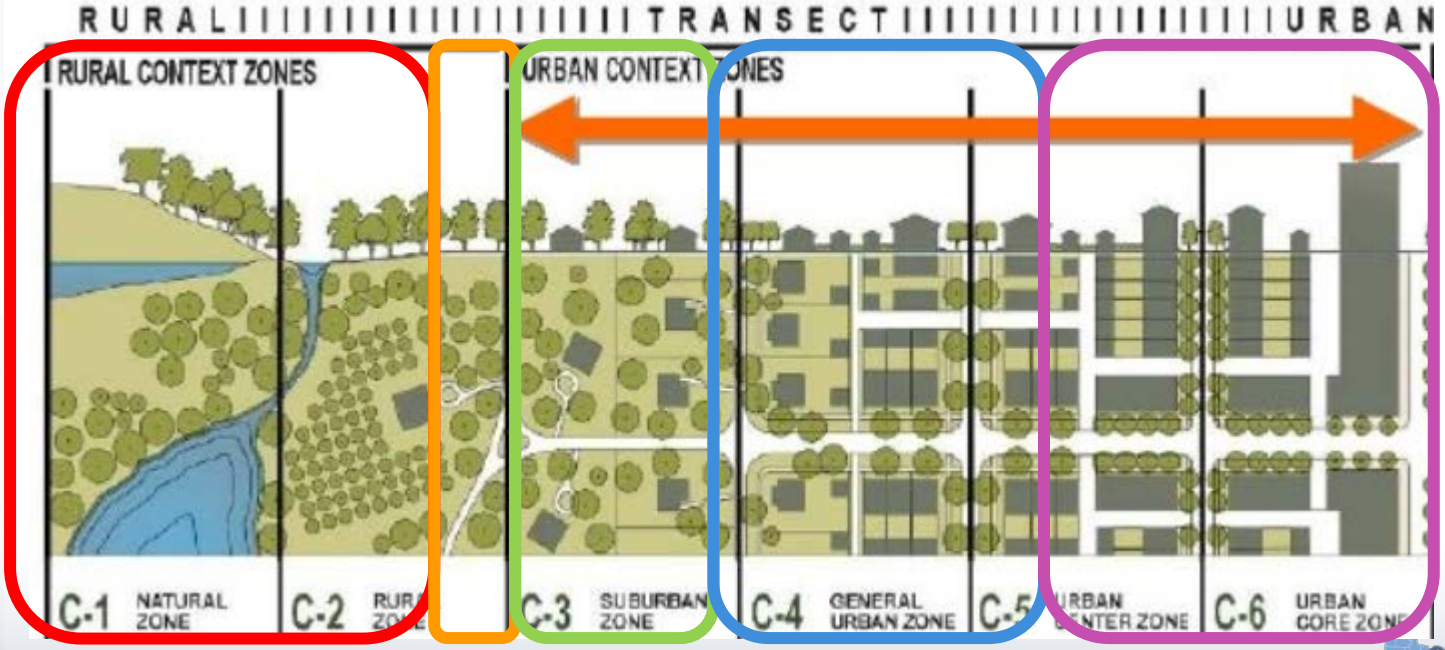
- *E.g., check alignment with actual road, radius, length, deflection, etc.*

Data Collection: Aerial Attributes

- **Area_Type**
  - Rural
  - Small Town
  - Suburban
  - Urban
  - Urban Core

Modified version of the ITE Context Zone definitions: http://library.ite.org/pub/e1cfb244-2354-d714-517d-2004292b5f99

** Be aware of which municipalities are county seats; roadways in these areas may receive additional attention.*



Data Collection: Aerial Attributes

- **High Side of Curve Shoulder_Type**

  Refer to Segment Analyst Guide for examples

  - Curb & Gutter
  - Paved
  - Gravel
  - Composite
  - None

- **Curve_Division**

  - Divided
  - Undivided
  - One-Way

Not to be confused with Divided

(Undivided)

(One-Way)

(Divided)

Data Collection: Aerial Attributes

- *[From Segments]* **Start & End Segment Description**
  - Free form description of start and end points
  - Should be sufficient for location identification independent from other attributes
- **Cross_Section**
  - 1-Lane
  - 2-Lane
  - 3-Lane
  - 4-Lane
  - 5-Lane
  - 6-Lane

Should have a continuous center two-way left turn lane

Attributes (Surroundings)

- **Context_Zone (listed by Hierarchy)**
  - Commercial
    - Business which is usually for serving customers.
  - Campus
    - E.g., Hospital, University
  - Mixed Use
    - Zoned specifically to be a combination of commercial and residential
    - E.g., multi-story building with offices or restaurants on the first floor with apartments on higher floors
  - Industrial
  - Recreational
    - E.g., Regional Park, Zoo, Theme Park, Golf Course
  - Residential
  - Cabins
  - Agriculture
    - E.g., Farmland
  - Natural

Attributes (Surroundings - Campus)

Context_Zone

- Campus
  - E.g., Hospital, University

Attributes (Surroundings – Mixed Use)

Context_Zone

- Mixed Use

  Zoned specifically to be a combination of commercial and residential

  E.g., multi-story building with offices or restaurants on the first floor with apartments on higher floors

  Mixed_Use IS NOT a combination of a Commercial area adjacent to Residential area. The hierarchy in this example would be Commercial.

Mixed Use Context Zone definitions: https://en.wikipedia.org/wiki/Mixed-use_development

Attributes (Surroundings - Industrial)

Context_Zone

- Industrial
  - Manufacturing of goods, factories or construction that deals with big items.
  - Not intended to include temporary/short-term use such as construction zones

Attributes (Surroundings - Cabins)

Context_Zone

- Cabins
  - Seasonal residences, typically near natural areas
  - May fall under either rural, small town, or suburban area types

Attributes (Curve Surroundings)

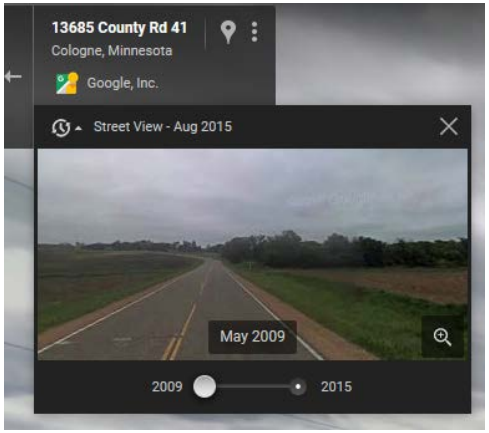
- **High_Side_of_Curve_Shoulder_Wdith**
  - Numerical value measured in feet
  - Measured only on one side of shoulder
- **Lane_Width**
  - Numerical value measured in feet, nearest 0.5 ft to 1 ft depending on aerial quality
  - Measure the width between the inside of the striping
- **Adjacent_Intersection** (along or within roughly 50 ft of curve termini)
  - None
  - Intersection
    - Note: residential driveways and farm accesses do not qualify
  - Railroad
- **Visual_Trap**
  - None
  - Present
    - E.g., other road, tree line, utility line etc. extend on either mainline tangent
- **Curve_Lighting**
  - None
  - Present
- **Isolated_Curve**
  - No
  - Yes
    - Nearby curve no more than 0.5 miles away from current study curve
    - Don't need to be on the same segment

(Visual Trap)

Data Collection - Google Earth Street View

The attributes in the following slides are usually best collected using Google Earth Street View.

- In some areas, Google Earth Street View may be unavailable or too outdated for data collection.
  - Use judgment to identify whether Street View may inconsistent with more recent aerial or too old for data collection.
    - If Street View is unavailable or too old, manually flag for 'Video Log Review'
  - Google Maps (web-based only) *Historical Imagery* → tool may be used if further investigation of a roadway feature via Street View is warranted.



- *To optimize functionality and speed of Google Earth:*
  - *Use a high-speed ethernet connection*
  - *Load KMZs from a copy on local hard drive instead of server, etc.*
  - *Disable all layers except 'Borders and Labels' and 'Roads' (Layers)*
  - *Adjust Cache size (Tools → Options → Cache)*
  - *Maximize Fly-To Speed (Tools → Options → Navigation)*
  - *Adjust Mouse Wheel Speed (Options → Navigation)*
  - *Enable 'Do not automatically tilt while zooming' (Options → Navigation)*

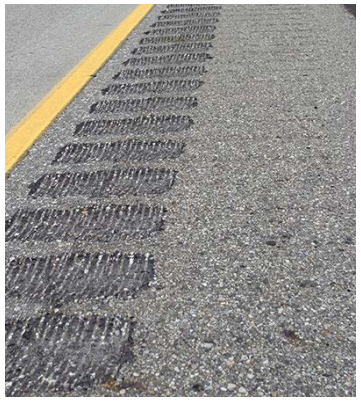
Curve Signing

- **Advance_Warning_Sign_Type (use words)**
  - None
  - Curve Warning (W1-2 or W1-10)
  - Turn Warning (W1-1)
  - Winding Road (W1-5)
  - S-Curve (W1-4)
  - S-Turn (W1-3)
  - Other
    - Hairpin, etc.
  - Unknown (If no street view or video log)
- **Speed_Advisory_Sign (Fill in with None or Present)**
  - None
  - Unknown (If no street view or video log)
  - Present
    - Plaque (W13-1P)
    - On Advance Warning Sign (W1-1a or W1-2a)
- **Advisory_Speed**
  - – Numerical Value of Speed MPH
    - https://mutcd.fhwa.dot.gov/htm/2009/part2/fig2c_01_longdesc.htm
    - If unknown, fill in with NA
- **In_Curve_Delineation (use words)**
  - None
  - Chevrons (W1-8)
  - Arrow Board (W1-6)
  - Delineators

(Delineators)

Attributes

- **Rumble_Strips**
  - None
  - Centerline
  - Edge line (edge line painted *in* rumbles)
  - Shoulder (edge line NOT painted rumbles)
  - Both
  - Unknown (If no street view or video log)



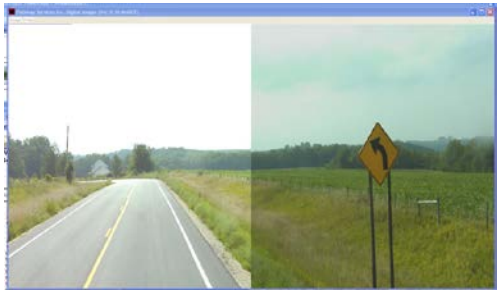
Rumble Strip

- **Mumble_Strips**
  - None
  - Centerline
  - Edge line (edge line painted *in* rumbles)
  - Shoulder (edge line NOT painted rumbles)
  - Both
  - Unknown (If no street view or video log)

Mumble Strip (Centerline)

Attributes (Edge Risk)

- **High_Side_of_Curve_Edge_Risk**
  - **1** – Usable Shoulder, Reasonable Clear Zone

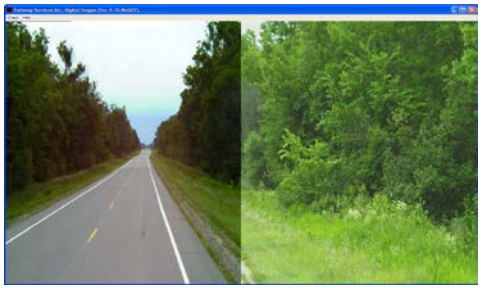


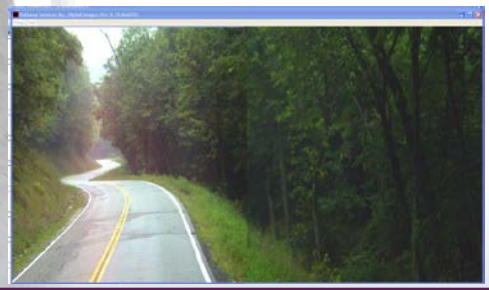
2S – No Usable Shoulder, Reasonable Clear Zone

Clear zone should consider the slideslope ratio and presence, density, and distance of fixed objects within approximately 30 ft of the road or shoulder edge

- **2C** – Usable Shoulder, Roadside with Fixed Objects

What shoulder is considered useable should be based on engineering judgment; may differ based on the shoulder type, etc.





3 – No Usable Shoulder, Roadside with Fixed Object

Attributes

- **Complex Design**
  - Use engineering judgment: is there a complexity, conflict, or other issue with the design of the curve, not otherwise documented in this data, that makes it difficult to document or may put it at increased risk for crashes?
- **Speed_Limit_mph**
  - Numerical Value Only (If there is no speed advisory sign nearby use the statutory assumptions)

    Statutory Assumption - https://www.house.leg.state.mn.us/hrd/pubs/ss/ssspdlt.pdf
    - 10 – alleys, mobile home parks and campgrounds
    - 30 – Urban Streets
    - 55 – Rural 2-Lane undivided
    - 65 – Divided Highways with controlled access
- **SpeedLimit_Source**
  - Because the speed limit may not be easily determined, the source of speed limit should be documented:
    - Statutory
    - Imagery (YEAR)
    - County (if County provided)

Data Collection: Other

- **Comments**
  - Free form field allowing for any miscellaneous information
  - Note: this is an attribute that is allowed to remain blank