**“2018\_4\_2\_Roads\_P\_CCA\_NRI\_AADT\_Risk**” shapefile Includes all state and local highways.

**“2018\_4\_2\_Structures\_P\_CCA\_NRI\_AADT\_Risk”** shapefile includes all long structures (spans greater than 20 feet) on state and town highways, and all bridges with spans less than 20 feet and all culverts on the state highway system.

These shapefiles include fields that describe the location and characteristics of the road segment, bridge or culverts that are common for these types of GIS data. They also include the data and results for the vulnerability analysis prepared by Milone and MacBroom and the criticality and risk analysis using data provide by the UVM TRC joined to the original vulnerability shape files.  The two tables below describe the fields related to the vulnerability analysis and the criticality/risk analysis.

The data sources and methods for the vulnerability analysis are described in the attached [April 2018 memo from Milone and MacBroom](https://vtrans.vermont.gov/sites/aot/files/planning/documents/trpt/VTransMTPmemoFinal.pdf).

The fields in Table 1 below include the data and outputs of the flood vulnerability analysis described in the April 2018 memo. These data are a subset of the data used at the watershed scale analysis in the Transportation Resilience Planning Tool. They were selected for use statewide because they are available statewide, and they are strongly correlated to predicting flood vulnerability. Vulnerability has been estimated for inundation (ISCORE), erosion (ESCORE) and deposition (DSCORE). MAXSCORE is the maximum of the inundation, erosion and deposition scores. See pages 8 and 9 in the  [TRPT User Guide](https://vtrans.vermont.gov/sites/aot/files/planning/documents/planning/TRPT%20User%20Guide%201.0.pdf) for a description of the vulnerability score.

**Table 1. Fields Related to Vulnerability Analysis in the Structures and Road Shape File Fields**

|  |  |  |
| --- | --- | --- |
| **Field Name** | **Description** | **Units/Values** |
| Slope\_Ch\_P | Channel Slope | % |
| w\_W\_m2 | Stream Power | watts/square meter |
| Slope\_S | Slope Vulnerability | L/M/H |
| ER\_PWRS | Erosion Power Vulnerability | L/M/H |
| DP\_PWRS | Deposition Power  Vulnerability | L/M/H |
| Road\_D | Road Damage | I/E/D |
| LenROW\_FP | Length of Road in the Floodplain | Feet |
| LenROW\_FPS | Length of Road in the Floodplain Vulnerability | L/M/H |
| LenROW\_RC | Length of Road in the River Corridor | Feet |
| LenROW\_RCS | Length of Road in the River Corridor Vulnerability | L/M/H |
| ISCORE | Inundation Vulnerability | 0-5 |
| ESCORE | Erosion Vulnerability | 0-10 |
| DSCORE | Deposition Vulnerability | 0-10 |
| MAXSCORE | Maximum of I, E and D Vulnerability | 0-10 |

Fields 1-10 in Table 2 were joined by VTrans to the road and structures vulnerability shape files created by the consultant as described in the April 18 memo. Fields 11-14 were calculated by VTrans within ArcMap. The method used to calculate criticality and risk is described in overview of the statewide flood vulnerability and risk analysis on the previous web-page. The specific formulas are provided in Table 2.

**Table 2.** **Fields Related to the Criticality and Risk Analysis in the Structures and Road Shape File Fields**

|  | **Field Name** | **Description** | **Units/Values – Notes** |
| --- | --- | --- | --- |
| 1 | CCA | Critical Closeness Accessibility - quantifies the relative importance of each link in a roadway network with respect to its system-wide contribution to emergency service accessibility and is calculated on a link-by-link basis | No unit. Used in combination with MNRI2A for total criticality score (Crit\_Total). Available all state and local roads |
| 2 | NRI1 | Network Robustness Index – Original Version. Based strictly on systemwide travel time impacts if the link is closed | No unit. Not used in the calculation of risk. Limited to roads in the statewide travel demand model (all federal aid highways and some local roads) |
| 3 | MNRI2A | Modified NRI – Version 2A. Based on cost value of different travel purposes (Business, commuting, personal, freight) | No Unit. Used in combination with CCA for total criticality score (Crit\_Total). Limited to roads in the statewide travel demand model (all federal aid highways and some local roads) |
| 4 | MNRI2B | Modified NRI – Version 2B. Based on time spent doing an activity | No Unit. Not used in the calculation of risk. Limited to roads in the statewide travel demand model (all federal aid highways and some local roads) |
| 5 | MNRI2C | Modified NRI – Version 2C. Based on the ratio of time spent travelling for to time spent doing | No Unit. Not used in the calculation of risk. Limited to roads in the statewide travel demand model (all federal aid highways and some local roads) |
| 6 | AADT | Average Annual Daily Traffic | Vehicles per day |
| 7 | ATRStation | Traffic count station ID when available | No Unit. Left over from the AADT Spatial Join. Not used in the calculation of risk |
| 8 | StandardRo | Route Location of count | No Unit. Left over from the AADT Spatial Join. Not used in the calculation of risk |
| 9 | Status | Count status | No Unit. Left over from the AADT Spatial Join. Not used in the calculation of risk |
| 10 | Year | Year of count | No Unit. Left over from the AADT Spatial Join. Not used in the calculation of risk |
| 11 | Crit\_Total | Combination of CCA and MN | To create a combined transportation criticality score, the mNRI2A and CCA values were normalized to 1.0 and then added together. The specific formula is (([MNRI2A] / 7463.075176)+( [CCA] / 559.633676)), where 7463.075176 is the max MNRI2A score for all road segments and 559.633676 is the max CCA score.  **Valid only for roads in the statewide travel demand model (all federal aid highways and some local roads).** |
| 12 | Crit\_Gen | Categorizes Crit\_Tot into general categories associated with a 0-10 scale. | High criticality value = 10, – “Crit\_Tot” > 0.07 (97.5th percentile);  Medium criticality value = 6, "Crit\_Tot" <= 0.07 AND "Crit\_Tot" > 0.025 (between 85th and 97.5th percentile)  Low Criticality value = 2, Crit\_Tot <= 0.025 AND "Crit\_Tot" > 0.0007 (between 50th and 85th percentile)  Not critical value = 0,  "Crit\_Tot" < 0.0007  **Valid only for roads in the statewide travel demand model (all federal aid highways and some local roads).** |
| 13 | Vul\_Gen | Categorizes the MAXSCORE value into general categories | High Vulnerability value of 10 =  "MAXSCORE" = 10 OR "MAXSCORE" = 9  Medium Vulnerability value of 6 = "MAXSCORE" = 5, 6, 7, or 8  Low vulnerability value of 2 = “MAXSCORE” = 1, 2, 3 or 4  Not vulnerable – MAXSCORE less than 1  **Valid only for roads in the statewide travel demand model (all federal aid highways and some local roads).** |
| 14 | Risk | Risk | Average of Crit\_Gen and Vul\_Gen  **Valid only for roads in the statewide travel demand model (all federal aid highways and some local roads).** |