3. IDENTIFICATION OF VTRANS MID-TERM NEEDS[1]
(UPDATED FOR THE ~~2021~~ VTRANS MID-TERM NEEDS)

3.1 Need Category: Congestion Mitigation

Needs for Congestion Mitigation are identified through two performance measures:
- Percent Person-Miles Traveled in Excessively Congested Conditions (PECC): PECC is used to identify Needs for Congestion Mitigation for: (1) Interstate roadways within CoSS; and, (2) other select Limited Access Facilities (LAF), as noted in Appendix B.
- Travel Time Index (TTI). TTI is used to identify Needs for Congestion Mitigation for: (1) non-limited access roadways within CoSS; and, (2) all other roadways within RNs.

Performance Measure: Percent Person Miles Traveled in Excessively Congested Conditions (PECC)

What it Means: Percent of the total person-miles traveled (PMT) that takes place in conditions deemed as excessively congested (observed speed 75% or less of the posted speed limit). A higher number indicates more person-miles traveled are impacted by excessively congested conditions.

Applicable VTrans Travel Market: CoSS, RN

Identification of Needs
- Data Sources:
  - INRIX, Observed speed
  - VDOT Traffic Monitoring System, Traffic volume
  - Federal Highway Administration, 2018 National Household Travel Survey (NHTS) and Virginia supplement (additional surveys conducted) to the NHTS (Vehicle occupancy)
  - VDOT, Speed limit

- Year of analysis: ~~2018~~

- Period of analysis: A 14-hour period between 6 a.m. and 8 p.m. on weekdays and weekend days.

- Calculations
  1. Develop Vehicle-Miles Traveled (VMT) utilizing average traffic volume for each weekday and weekend day hour between 6 a.m. and 8 p.m. in the year of analysis.
  2. ~~Locate~~ hourly speed data along INRIX Traffic Message Channels (TMC) for each weekday and weekend day hour between 6 a.m. and 8 p.m. in the year of analysis.
  3. Summarize occupancy results from NHTS vehicle occupancy travel surveys and calculate average vehicle occupancy.
  4. Utilize the average vehicle occupancy to convert VMT to PMT.
  5. Assemble roadway characteristics layer with posted speed limit.
  6. ~~Identify average speeds in each time period for the period of analysis that fall below the posted speed limit.~~
  7. **Threshold for Defining "Excessive Congestion":** Roadway segments where average hourly travel speed is below 75 percent of the posted speed limit.
  8. ~~Identify roadway segments with excessive congestion in three weekday time periods: 6 a.m. - 10 a.m.; 10 a.m. - 4 p.m. and 4 p.m. 8 p.m., or one weekend day time period: 6 a.m. - 8 p.m.~~
  9. Select the one of the three weekday time periods with the highest percentage of PMT in excessively congested conditions (Output X) and select percentage of ~~person-miles traveled~~ in excessively congested conditions for the one weekend day period (Output Y)
  10. Identify the share of PMT that occurs in excessively congested conditions by performing the following: [(Output X * 5 weekdays) + (Output Y * 2 weekend days)] / 7 days.
  11. **Threshold for Need for Congestion Mitigation:** Roadway segments where the average weekday and weekend day share of person miles traveled in excessively congested conditions exceeds policy threshold of 2% are identified as those with Need for Congestion Mitigation

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[1] ~~Commonwealth Transportation Board, Actions to Approve the 2019 VTrans Vision, Goals, Objectives, Guiding Principles and the 2019 Mid-term Needs Identification Methodology and Accept the 2019 Mid-term Needs, January 15, 2020~~

Need Category: Congestion Mitigation

Performance Measure: Travel Time Index (TTI)

What it Means: The Travel Time Index is the ratio of the travel time during the peak period to the time required to make the same trip at reference (a.k.a typical) speeds. A higher number indicates more congestion.

Applicable VTrans Travel Market: CoSS, RN

Identification of Needs
- Data Sources
  - ~~INRIX, Travel Time Index~~

- Year of analysis: ~~2018~~

- Period of analysis: A 14-hour period between 6 a.m. and 8 p.m. on weekdays and weekend days.

- Calculations
  1. Utilizing RITIS[1], export weekday and weekend day average hourly travel time index for the year of analysis for every INRIX TMC.
  2. Calculate the number of hours for weekdays and weekend days between 6 a.m. and 8 p.m. for which hourly TTI exceeds 1.5.
  3. Calculate the number of hours for weekdays and weekend days between 6 a.m. and 8 p.m. for which hourly TTI exceeds 1.3.
  4. Calculate the weighted average of weekday and weekend TTI. First, multiply weekday TTI by 5/7 (i.e. weekdays/ all days). Second, multiply weekend TTI by 2/7 (i.e. weekend days/ all days). Sum the two figures.
  5. **Threshold for Need for Congestion Mitigation:** Roadway segments where the average weekday and weekend day TTI is greater than 1.5 for at least one hour, or 1.3 for at least three hours, are identified as those with a VTrans Mid-term Need for Congestion Mitigation.

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[1] Regional Integrated Transportation Information System, www.ritis.org

4.2 Step 2: Prioritize <u>Within</u> Need Categories

The second step utilizes the following two criteria to categorize VTrans Mid-term Needs as *Very High, High, Medium, and Low*.

1. Severity of the Need: This criterion takes into account the intensity or extremity of the Need. For example, roadway segments where vehicles spend the greatest number of hours in traffic are categorized as a *Very High* Need compared to roadway segments where vehicles spend fewer hours in traffic.
2. Magnitude of the Need: This criterion takes into account the number of residents, vehicles, or persons impacted by the Severity of the need.

These criteria are explained in more detail below for both Statewide Priority Locations and the Construction District Priority Locations.

As a note, only areas where a need was identified in the Identification of the Mid-term Needs are included in the calculations for the Prioritization of the Mid-term Needs. No new needs were identified as part of the prioritization process, but some needs identified as a node-based representation were transferred to a roadway segment-based representation for the purposes of aggregation and weighting.

4.2.1 Prioritization within Congestion Mitigation Need Category

Applicable VTrans Travel Market: CoSS, RN

Utilized for: Establishing Statewide Priority Locations (based on CoSS Needs) and Construction District Priority Locations (based on RN Needs)

VTrans Mid-term Needs for Congestion Mitigation are identified through two performance measures:
- Percent Person-Miles Traveled in Excessively Congested Conditions (PECC): PECC is used to identify Need for Congestion Mitigation for: (1) Interstate roadway segments within CoSS; and, (2) Other select limited access facilities (LAF) included in Appendix B.
- Travel Time Index (TTI). TTI is used to identify Need for Congestion Mitigation for: (1) non-limited access facilities within CoSS; and, (2) all other roadway segments within RNs.

Two criteria, Severity and Magnitude, are utilized to categorize VTrans Mid-term Needs for Congestion Mitigation as *Very High, High, Medium, and Low*, in the following manner.

Severity of VTrans Mid-term Need for Congestion Mitigation
- Source data
  - Interstate roadway segments within CoSS and other select limited access facilities (LAFs): PECC values used to identify VTrans Mid-term Needs for Congestion Mitigation
  - For non-limited access facilities within CoSS and all other roadway segments within RNs: TTI values used to identify VTrans Mid-term Needs for Congestion Mitigation

- Calculations
  - Interstate roadway segments within CoSS and other select LAFs: PECC values used to establish VTrans Mid-term Needs for Congestion Mitigation
  - For non-limited access roadway segments within CoSS and all other roadway segments within RNs:
  - Calculate cumulative total value of all average hourly TTI values greater than 1.3 over the period from 6 AM – 8 PM using the following equation:

  - $TTI = 5/7 \times (\text{sum of weekday TTI} > 1.3) + 2/7 \times (\text{sum of weekend TTI} > 1.3)$

  - And set any outliers with an equation value > 8 (90th percentile), to 8.

Magnitude of VTrans Mid-term Needs for Congestion Mitigation

- Source data
  - Interstate roadway segments within CoSS and other select LAFs: PECC values used to establish VTrans Mid-term Needs for Congestion Mitigation reflect PMTs and therefore no additional criteria are used for Magnitude.
  - For non-limited access roadway segments within CoSS and all other roadway segments within RNs:
    - VDOT Traffic Engineering Division - Average Annual Daily Traffic (AADT) data
    - Highway Capacity Manual[1] guidance: If AADT for a segment is null or 0, populate AADT with default values based on the roadway segment's functional classification (see Appendix E)

Consideration of Severity and Magnitude Criteria

- The first step is to normalize PECC values to be able to compare PECC against TTI values.
- PECC is normalized using the following equation. Scores are normalized separately for CoSS to establish Statewide Priority Locations and normalized separately within each VDOT Construction District to establish Construction District Priority Locations. A ceiling of 100% is set for PECC.

$$PECC\ normalized = \frac{PECC\text{-}minimum\ PECC}{maximum\ PECC\text{-}minimum\ PECC}$$

- For TTI, the product resulting from the multiplication of the Severity criterion and Magnitude criterion is normalized utilizing the following equation for CoSS to establish Statewide Priority Locations and normalized separately within each VDOT Construction district to establish Construction District Priority Locations.

$$TTI\_AADT\ normalized = \frac{TTI\_AADT\text{-}minimum\ TTI\_AADT}{maximum\ TTI\_AADT\text{-}minimum\ TTI\_AADT}$$

- Assign the PECC normalized score to limited access facilities and the TTI normalized score to non-limited access roadway segments. If a roadway segment was not given a value using this method, the maximum of the two normalized scores is used.

Prioritizing within Congestion Mitigation Needs Category

Prioritization within this VTrans Mid-term Needs Category occurs in the following manner:
- Sort the *PECC _normalized* and *TTI_AADT_normalized* in descending order and assign the following values based on mileage to develop statewide and for each VDOT Construction District *Very High, High, Medium,* and *Low* categorizations for Need for Congestion Mitigation:[2]
  - *Very High* (Score 7): Top 5% of the total mileage
  - *High* (Score 6): 5.001%–10%
  - *High* (Score 5): 10.001%–15%
  - *Medium* (Score 4): 15.001%–20%
  - Medium (Score 3): 20.001%–25%
  - *Low* (Score 2): 25.001%–50%
  - *Low* (Score 1): Bottom 50.001%–100%

If RN Need for Congestion Mitigation has fewer than 20 total miles of Congestion Needs in a VDOT Construction District, the following method is used:
- Sort *PECC _normalized* and *TTI_AADT_normalized* in descending order and assign the following values based on mileage:
  - *Very High* (Score 7): Top 0–5 miles
  - *High* (Score 6): 5.001–10 miles
  - *High* (Score 5): 10.001–15 miles
  - *Medium* (Score 4): 15.001–20 miles

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[1] Transportation Research Board, Highway Capacity Manual, Sixth Edition: A Guide for Multimodal Mobility Analysis, 2016.

[2] Where prioritization values do not break exactly at the percentile categories, assign all values to the higher category until there is a new prioritization value. For example, if the top 7% of roadway miles all have the same score, then 7% of miles would be classified as *Very High*.