FMS Requirements Document

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# Definitions

Day – 12:00 pm to 11:59 pm

# Quality Assurance/Quality Control

## Detector level

In the current methodology, each row in a processed detector file represents a 5-minute window of time. If that row does not pass each of the checks below it is flagged. The number of flags divided by the number rows is how a validity score for each detector is produced.

|  |  |
| --- | --- |
| **Category** | **Metric** |
| Speed | Speed > 85 mph in any lane |
| Speed < 5 mph and > 0 in any lane |
| Speedn+1 < (0.45 × speedn) and speedn+1> 0 (In the same lane as n) |
| Volume | Volume > 3,000 vph per lane |
| Density > 220 vehicles per mile per lane |
| Occupancy | Occupancy > 80% in any lane |
| Difference Error | Speed, volume, or occupancy = 0 where the sum of all is > 0 |
| Zero Error | All lanes = 0 |
| Any individual lane = 0 continuously for 20-minutes or more. |

Criteria adapted from the TTI Urban Congestion Report methodology and research from the University of Washington.

### Formulas:

Average Speed (Single Lane) – If X > 0 and Y > 0, then X \* Y / Z. Where X = lane speed, Y = the number of vehicles per hour and Z = total vehicles per hour for the lane.

## Corridor Level

The corridor level checks are dependent on the quality of the underlying detector data. The ability to easily review the validity of the detector comprising each corridor will be required.

## Additional Checks

Using the detector-level criteria, produce a report/text file using the following criteria:

* + - <50% valid – Bad
    - >75% valid – Good
    - Between 50% and 75% – Review

The report should also include the following information:

* + - Time period of input data (i.e. selected by the user)
    - Percent valid data – (# of flagged rows/total # of rows)
      * All
      * Weekday
      * Weekend
    - HOV data (yes/no)
    - # of General Purpose Lanes
    - Lanes with bad data

# Outputs

In general, replicate outputs based on the previous excel process. If available, data should be represented for all lanes, general-purpose lanes, and HOV lanes. Ideally, data outputs will be customizable by both time and date.

The format in which these outputs are produced is open for conversation although I think the ability to export to excel will be a requirement.

## Detector Level

* Data:
  + Date
  + % of valid data
  + Speed
  + Volume per hour
  + Occupancy
  + Average Annual Daily Traffic (AADT)
  + Average Annual Weekday Traffic (AAWT)
* Charts:
  + Annual Hourly Average Speeds – Weekday
  + Annual Hourly Average Throughput Per Lane – Weekday
  + Annual Hourly Average Occupancy Percent – Weekday
  + Annual Average by Lane
  + Distribution of Data Passing Quality Control Criteria by Date
  + Distribution of data Passing Quality Control Criteria by Weekday
  + Annual Quality Control Flags by Hour of Day – Weekday
  + Flow vs. Density – All Data Rows & 5-min Weekday Average
  + Speed vs. Density – All Data Rows & 5-min Weekday Average
  + Speed vs. Flow – All Data Rows & 5-min Weekday Average

## Corridor Level

* Charts:
  + Summary results for Hourly Speed & Throughput

# Analysis Tools

* Allow user to specify periods, both date and time, for analysis. Think seasonal
* Allow user to specify which individual detectors to place into corridors and to save that information. This can be a configuration file but a spatial selection feature may be more useful.
* Develop new procedures to compute the following Travel Time Reliability metrics[[1]](#footnote-1):
  + Travel Time Index, Planning Time Index, and Buffer Index
  + Will require calculating:
    - Free Flow Travel Times (85th Percentile Night Time [8PM – 6AM])
    - 95th Percentile Travel Times for specific time periods
  + Travel Time Index (for specific time period):
  + Planning Time Index (for specific time period):
  + Buffer Index (for specific time period):
* Frequency of Congestion – Done on a facility level and interpolated to produce congestion for each half mile.
* Lost Productivity – Currently a single detector is used as a representative of the corridor. Should be calculated for all, GP and HOV.
  + Calculation:
    - All Lanes: If the speed of all lanes is less than 45 mph and greater than 0 miles per hour then (2000\* (# of GP lanes + # of HOV lanes) – vehicles per hour, all lanes) / (2000\*(# of GP lanes + # of HOV lanes)).
    - GP Lanes: If the speed of GP lanes is less than 45 mph and greater than 0 miles per hour then (2000\* (# of GP lanes) – vehicles per hour, GP lanes) / (2000\*(# of GP lanes)).
    - HOV Lanes: If the speed of HOV lanes is less than 45 mph and greater than 0 miles per hour then (2000– (# of HOV lanes) – vehicles per hour, HOV lanes) / (2000\*(# of HOV lanes)).
* Crosswalk file from detectors to TMCs used in HERE data?

# FMs Internal QA/QC Platform

The spatial nature of FMS detectors lends itself to the creation of an internal, GIS-based, quality assurance platform. The current process relies heavily on a number of Excel spreadsheets which makes viewing the “big picture” difficult at a glance. By incorporating tools previously developed for the FLCP Management Tool and developing Java-based processing methods, the Transportation Performance program can create a useful and intuitive system to validate FMS data.

## Homepage/Landing Page

Following the design of the FLCP homepage, it is envisioned that the landing page for the FMS platform will consist of a single map consisting of all the FMS detector locations for which we have data.

When clicking on a detector, an informational window should appear containing:

* Detector number, hyperlinked to detector individual page.
* Validity of the data for the last 5 years.

## Individual Detector Page

Should mirror the individual detector excel files and contain a small map showing the location of the detector.

Additional fields:

* Analysis Year
* Number of days in the data set – Calculated from the database.
* Number of General Purpose Lanes
* Number of HOV Lanes
* Table of failed flags.
* 6 main charts (pending performance):
  + Annual Hourly Speed
  + Annual Throughput
  + TTI
  + PTI
  + Quality by day
  + Quality by year
* Additional charts (resource intensive)
  + Annual hourly average occupancy percent -

Decision points:

* How many years of data should we show? Only the latest year? How should a user switch between years?
* Do we want to make any year over year comparisons?
* Do we need the ability to export tables?
* Should the page be “printable” or dynamic?
* Should the page alert users when a table or number is “out of range”, i.e. unusable data.

Users should:

* Quickly be able determine the validity of data for the detector
* Identify potential issues with the detector. Perhaps through notes or a summary section.

## Corridor Page

The detectors used to calculate a corridor vary based on the availability and quality of data. Our process would be substantial improved if we could quickly decide which detectors should or should not be included in a corridor calculation. The ability to create bespoke or one-off corridor calculations is also desired.

Decision points:

* How should we develop and maintain the detector to corridor linkage? i.e. a table, a map?
* How can we save and report on corridors already developed?
* Where should calculation of corridor metrics occur?

1. FHWA Formulas [↑](#footnote-ref-1)