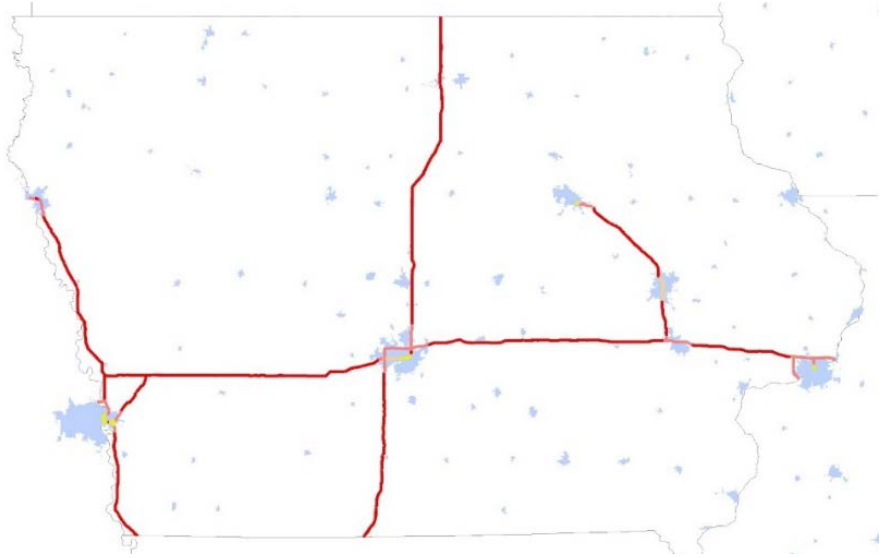
MAP-21 System Performance NPRM

Iowa Case Study May 2016

This notes document does not detail every step, as there are other resources for that. Visit www.glrtoc.org/operations/performance/nprm or contact nprm@glrtoc.org with questions or to discuss specifics.

Iowa DOT provided the TOPS Lab with GIS and a .dbf table associating posted speed limits with TMCs. This enables running the metrics and measures exactly as proposed in the NPRM



for Subpart E on statewide interstates, and both freight measures in Subpart F. Subpart E for statewide NHS needs to wait because of limited data availability on non-interstate NHS. Subpart E for metro areas and Subpart G do not apply in Iowa. Iowa interstate PSLs vary from 55 to 70 MPH.

Iowa has 550 interstate TMCs. For 2014 data, this goes back to Static version 2013Q2, which has three fewer TMCs, so for 2014 measures, only those 547 TMCs that existed throughout the year are used. This should be checked for every year and geography for the MAP-21 metrics.

	TMC Version				
Route	2013Q2	2014Q1	2014Q3	2015Q3	2015Q4
I-129	4	4	4	4	4
I-235	44	44	44	44	44
I-280	12	12	12	12	12
I-29	90	90	90	90	90
I-29/I-680	6	6	6	6	6
I-29/I-80	8	8	8	8	8
I-35	98	100	100	100	100
I-35/I-80	20	20	20	20	20
I-380	66	66	66	66	66
I-480	5	5	6	6	6
I-680	13	13	13	13	13
I-74	20	20	20	20	20
I-80	161	161	161	161	161
Total	547	549	550	550	550

TMC distances can change from version to version, emphasizing the importance of not calculating metrics using the travel times directly. Note the following:

- Two TMCs on I-35 just north of Des Moines saw their distances drop from over three miles to less than two miles;
- Four segment distances of I-29 and I-80 around their interchange Council Bluffs varied by 25%-55% between versions;
- 28 TMCs had distance changes of more than 100 feet; and
- 12 TMCs had distance changes of 10% or more.

In the TMC to PSL association file provided by Iowa DOT, observe two things:

- First, it contains 574 unique TMCs, which is 24 more than the NPMRDS indicates.
    - Two of these fall just across the state line into Minnesota. Five fall in Nebraska.
    - Twenty-two others are on state or US highways according to the NPMRDS, though they often are at a system interchange where a transition between a non-interstate and interstate occurs.
    - The balance consists of TMCs that weren't in the file, which is a handful of segments just inside the state border or ramp segments within a system interchange. One of these in Sioux City may actually be posted at 65 MPH, but for now assume they are all to be posted at 55 MPH.

- Second, because it is GIS link based, 45 TMCs have two different PSLs associated with it, and two TMCs have three PSLs. For these it is probably sufficient to apply a link distance-weighted average to the TMC, but for simplicity for now this proceeds with a simple average.

It is also assumed that PSLs are unchanged throughout 2014 and 2015. A small table is generated that contains just the valid TMCs of interest in 2014 and 2015 with their associated posted speed limits.

PROCEDURE NOTES

The travel time data are joined with the TMC distances according to their date and corresponding static file version. Travel times are converted to the distance-neutral travel rates in minutes per mile. Posted speed limits are also inverted to a rate.

At this point, be aware that the five-minute intervals (epochs) are incomplete. That is to say, if a travel time is not available for a TMC, that TMC-epoch entry will be absent from the data. The

travel time entry for all vehicles is never included as a null or missing value. The entire row will not be there. If a travel time for passenger vehicles and/or a travel time for freight vehicles is available, then the travel time for all vehicles will also be present. It is common for one or the other of passenger or freight to be missing, in which case that entry will be present but null.

For the truck metrics (Subpart F, see www.glrtoc.org/operations/performance/nprm), null truck rates are filled in with the slower (greater) of either the rate for all vehicles or the rate at the PSL.

Optionally, calculate the percent of available observations per TMC, per metric, for quality checks later.

Expand the table to include all possible epochs for all TMCs. For Iowa interstates in 2015, this table should now be 57,816,000 rows (550 TMCs X 365 days X 24 hours/day X 12 epochs/hour).

Fill in the newly created null entries with the rate at PSL for both freight and all vehicles.

These measures for Iowa, as proposed, entail no special handling of holidays or outliers.

Identify or flag the four time blocks for LOTTR. For each TMC and time block, identify the 50^{th} and 80^{th} percentile travel rates for all vehicles. The LOTTR is the ratio of these, and for a TMC to be reliable, per the NPRM, this ratio must be below 1.5 for all four time blocks.

For each TMC, identify the mean and 50^{th} and 95^{th} percentile travel rates for trucks. Truck reliability also means the ratio falls below 1.5. For average truck speed, the average TMC speed must be above 50 MPH.

RESULTS

Here we compare the three measures results calculated exactly as the NPRM proposes to the results following the more streamlined rank approach discussed on the GLRTOC site and in more detail in the GLRTOC comments document (PDF).

% of Interstate Mileage	Year	As Proposed	Rank Method
Reliable (all vehicles, $80^{th}/50^{th} < 1.5$)	2014	100.0%	99.9%
	2015	99.8%	99.7%
Reliable Truck Travel ($95^{th}/50^{th} < 1.5$)	2014	99.6%	99.8%
	2015	99.5%	99.7%
Uncongested Truck Travel (avg > 50 MPH)	2014	99.7%	99.8%
	2015	99.4%	99.5%

Note that the differences between the PSL and the simpler rank methods are just one or two-tenths of one percent, and they follow the same trend from 2014 to 2015. Nonetheless, some additional comments on the differences:

- As proposed, nothing is done with outliers, while the rank approach recommends at a minimum, filtering out the recurring 1 KPH anomalies. This theoretically tends to lower the very high percentiles such as the 95th, but the effect is so negligible that it really isn't relevant here.
- Regarding reliability for all vehicles, there are certainly differences in the LOTTR metric, more so with shorter TMCs and TMCs with lower observation percent, but the aggregate measure does not change much.
    - An example of a TMC that the rank method assigns a higher LOTTR ratio to is one of those unusual system interchange TMCs at the I-29 and I-680 interchange near Omaha. This relates to a feedback comment that GLRTOC has about those situations.

- In those instances where the observation percent is low enough such that an 80th percentile can be estimated but not a 50th, the rank method assumes a 35 MPH infill, i.e., if the 80th percentile is slower than about 23 MPH, the TMC distance will be counted unreliable. The slowest infill as proposed for Iowa is the rate at 55 MPH, but it does not appear to make much difference in Iowa.
- The very high percentages also reinforce the feedback being circulated that the 1.5 thresholds as proposed are probably too high, and a lower threshold, or an additional reported measure may be helpful.
- Regarding differences in the truck reliability measure, a nice example for contrast is an I-29 segment in Sioux City (TMC 118N04975).
    - The percent of observations for this segment is just under half, so the rank methodology does not find a 50th percentile thus substitutes the travel rate equivalent to 35 MPH.
    - The rank method identifies the 95th percentile rate equivalent to 32.6 MPH, so the ratio is just 1.07.

    - The NPRM methodology with posted limit fill in identifies the 95th percentile rate equivalent to 32.4 MPH, which is very close to the 32.6 MPH, and the difference could be attributable to removing the 1 KPH anomalies. However, the posted speed provided on this TMC included 65 and 70 MPH, thus 67.5 MPH was used for fill in, resulting in a ratio of 2.08. That's very different from 1.07.