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MEMORANDUM

To: CMAP Freight Committee

From: CMAP Staff

Date: March 21, 2016

Re: Highway-rail grade crossings planning level analysis

The region's dense rail network plays a key role in moving both goods and passengers, but it also imposes costs on local communities. As described in a previous [Policy Update](#), one key type of conflict occurs at the region's nearly 1,500 highway-rail grade crossings. Data from 2011 show that cars and trucks are delayed more than 7,800 hours each weekday at these locations, totaling more than 2 million hours of delay per year. Further, grade crossings are an important planning topic for a number of other reasons, including safety, traffic operations, and impacts on transit services. Motorist delay at grade crossings is a performance indicator identified in GO TO 2040 and tracked over time by CMAP. Staff is therefore expanding its understanding of the conditions that affect performance at grade crossings.

As part of the freight existing conditions report being prepared this year, staff is exploring highway-rail grade crossings in more detail. Specifically, staff is identifying options to rank the region's grade crossings to identify opportunities where conversion to a grade separation might generate the most public benefit. This ranking requires an understanding of delay, safety, and impact on transit. This memo describes sketch analysis completed to date and potential extensions for future work. This analysis is the first step in a series to quantitatively and qualitatively assess the region's high-delay grade crossings.

Methodology

Staff has completed an initial analysis of the region's highway-rail grade crossings, focusing understanding not only the extent of delay, but safety and users affected by delay. Primarily relying on two accepted data sources – the Illinois Commerce Commission's (ICC) 2011 motorist delay file and the ICC's 2015 overall crossing file – the analysis creates a composite score based on the following data fields:

- Hours of motorist delay
- Percent truck traffic

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- Crash prediction value (CPV), calculated by the Federal Railroad Administration
- Ridership on CTA or Pace bus routes at the crossing

The ICC’s two data files include a wealth of other data fields that were not included in this sketch analysis. Data on train volumes and highway volumes (measured by average annual daily traffic, or AADT) are included in the motorist delay estimate, so those items were excluded to avoid double counting. One potential concern was that the 2011 motorist delay estimates rely on out-of-date train volume and AADT data. However, staff compared the fields from the 2011 and 2015 files, and found that the data correlate strongly.

There are multiple ways to measure safety at rail crossings, including estimates of risk or the number of observed safety incidents. The CPV *estimates* the probability that a crash will occur between a train and highway vehicle, based on the operating (e.g., highway and train volumes, train speeds) and capital (number of vehicle lanes and railroad tracks, existing warning devices) characteristics of crossings, along with previous crash history. CPVs are consistently calculated by the FRA and available for all the region’s crossings. Staff compared the CPV values to the observed number of incidents reported in the FRA’s safety database from 2010-2014 and found that the two sources of data correlate well.

To develop a composite score for the region’s crossings, staff assigned weights to the data fields and scored each crossing. A weighting process implies a policy decision on the importance of the various metrics; any final or official ranking would require discussion with the Freight Committee. For an initial planning-level analysis, staff attempted to take as neutral an approach as possible. Because CMAP has a longstanding interest in motorist delay at grade crossings – e.g. as a GO TO 2040 performance indicator – staff assigned slightly over half the total points to that metric, and then split the remaining points evenly among the other three metrics. The resulting weighting for each metric is as follows: 55 points for average daily hours of motorist delay, 15 points for estimated percent of trucks in overall vehicle traffic, 15 points for the CPV, and 7.5 points each for CTA and Pace bus ridership (i.e. a possible total of 15 points for transit). The result is a total of 100 points possible. The 155 locations with missing data fields were excluded from the analysis, leaving a population of 1,339 crossings in this analysis.

Table 1: Summary of scoring metrics

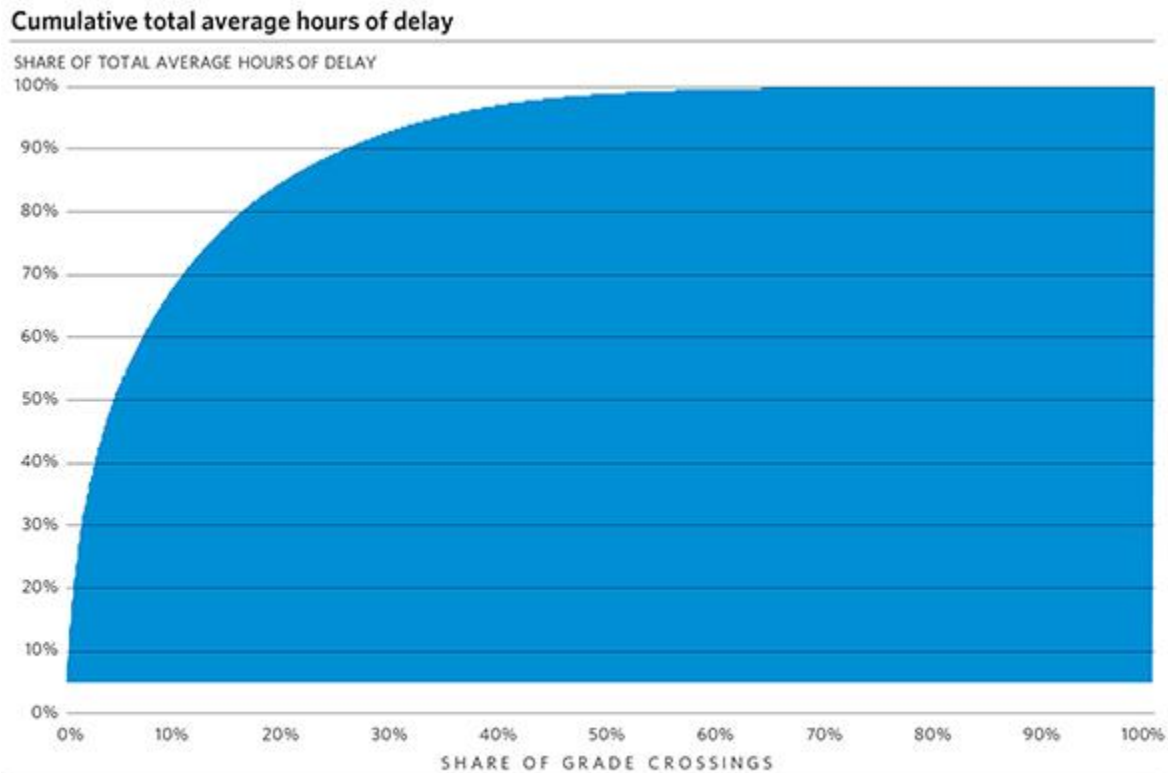
	Measure	Source	Total points available
Motorist delay	Average daily hours of motorist delay	Illinois Commerce Commission	55 points
Truck impact	Trucks as share of daily traffic	IDOT	15 points
Safety	Crash prediction value	FRA	15 points
Transit impact	Ridership on affected CTA and Pace bus routes	RTA	15 points (=7.5 points CTA+7.5 points Pace)

All scores were calculated in relation to the observed population, with the highest crossing receiving the full points available and the remaining crossings receiving proportional shares of the available points. For example, the crossing with the highest share of truck traffic – 59 percent – received the full 15 points for that category; a location with a 30-percent share of truck

traffic – half the highest observed value in the region – would therefore receive 7.5 points for that category.

Ranking existing conditions at grade crossings

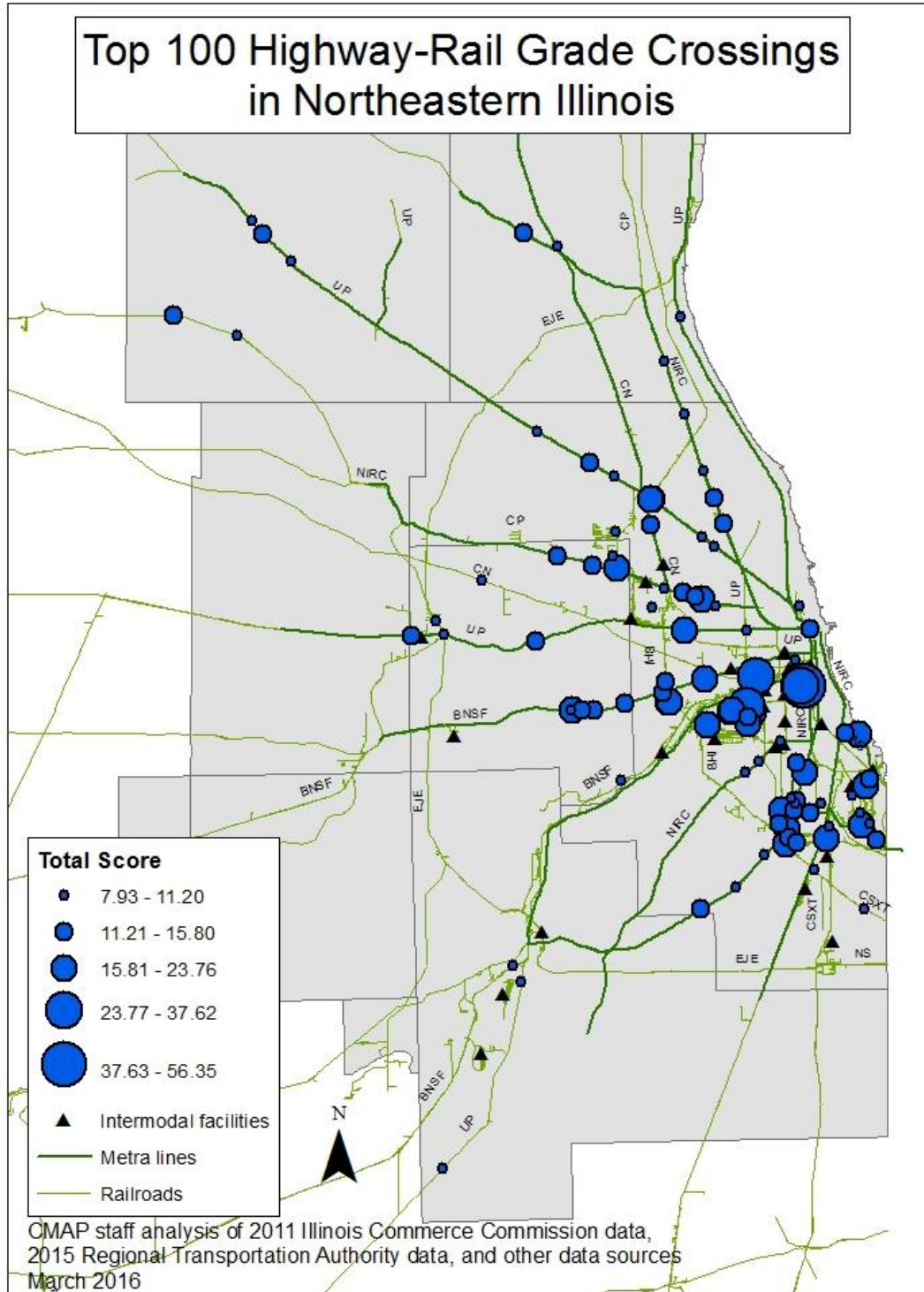
With this approach, the highest-scoring location in the region received only 56.35 points out of the 100 points possible; in fact, only 31 locations scored 15 points or more. This finding is consistent with CMAP’s previous analysis into grade-crossing delay, which found that average delay is heavily concentrated among a relatively small number of crossings. As described in a [Policy Update](#), only five percent of the region's grade crossings account for half the delay, and 10 percent of the grade crossings account for about two-thirds of the delay.



Source: Chicago Metropolitan Agency for Planning analysis of Illinois Commerce Commission data.
 *Note: This chart includes data from 1,362 crossings, totalling 7,790 hours of delay.

The following map shows the locations of the top 100 grade crossings according to the initial ranking’s total composite scores. Seventy-two of the crossings are located in Cook County, 16 in DuPage county, five in McHenry County, four in Lake County, and three in Will County. The appendix provides maps for each of the four component scores.

Figure 1: Top 100 highway-rail grade crossings in northeastern Illinois



Many of the top 100 crossings are located along certain rail lines, such as the BNSF line in west Cook County and east DuPage, or are clustered in certain areas of the region, such as the greater Midway area and the south suburban area. This finding suggests that corridor- or district-based approaches may be needed to better understand physical and operating conditions in those locations.

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The following table lists the top 25 locations and their component scores. Many of these top 25 locations score very high in only one category (e.g., Morgan Street for motorist delay, 72nd Street for percent truck traffic, or 95th Street for safety), suggesting that the various component factors, as currently defined, may not be strongly correlated.

Table 2: Top 25 ranked locations, by total score

City	Street	Railroad	Motorist Delay Score	Percent Truck Score	FRA CPV Score	Transit Score	TOTAL SCORE
CHICAGO	MORGAN ST	NS	55.00	0.00	1.35	0.00	56.35
CHICAGO	PULASKI ROAD	IC	32.37	2.29	1.68	1.28	37.62
CHICAGO	55TH ST	BRC	21.13	1.27	5.05	1.74	29.20
CHICAGO	ARCHER AVE	BRC	23.06	1.78	2.48	1.69	29.01
CHICAGO	RACINE AVE	NS	13.73	3.56	8.04	0.00	25.33
CHICAGO	130TH ST	NS	9.40	3.31	10.84	0.21	23.76
LAGRANGE	47TH STREET	IHB	15.19	1.53	4.93	0.00	21.64
CHICAGO	55TH ST	BRC	17.17	1.27	1.73	0.13	20.31
CHICAGO	95TH ST	NIRC	2.76	1.78	15.00	0.75	20.29
CHICAGO	119TH ST	CSX	17.00	2.03	1.11	0.00	20.14
DOWNERS GROVE	MAIN ST	BNSF	5.62	1.27	13.20	0.04	20.13
CHICAGO	HARLEM AVE	NIRC	4.03	1.53	10.07	3.59	19.22
CHICAGO	63RD ST	BRC	12.54	1.78	2.04	2.62	18.97
RIVERSIDE	HARLEM AVE	BNSF	10.18	2.03	3.23	3.41	18.86
MAYWOOD	FIRST AVE	UP	7.78	1.53	9.12	0.00	18.43
BENSENVILLE	IRVING PARK RD	SOO	13.10	2.54	2.18	0.43	18.25
CHICAGO	E 72ND ST	NIRC	0.02	14.75	3.37	0.00	18.13
BLUE ISLAND	VERMONT ST	NIRC	1.41	3.05	11.53	1.76	17.75
CHICAGO	63RD ST	BRC	9.07	4.32	2.42	1.59	17.41
DES PLAINES	DES PLAINES RIVER	UP	3.86	1.27	12.20	0.00	17.34
MC COOK	EAST AVE	IHB	12.68	2.03	2.32	0.00	17.03
CHICAGO	CENTRAL AVE	BRC	13.58	1.27	1.89	0.00	16.74
DES PLAINES	PEARSON ST	UP	0.56	3.31	6.57	6.22	16.66
CHICAGO	138TH ST	CSX	12.97	1.02	2.66	0.00	16.65
CHICAGO	MUSKEGON AVE	BRC	13.65	1.27	1.46	0.00	16.38

Comparison to the CREATE program

The [Chicago Region Environmental and Transportation Efficiency \(CREATE\)](#) program of rail improvements is a longstanding list of 70 high-priority railroad improvements in northeastern Illinois, including 25 highway-rail grade separation projects. Staff compared the ranking of grade crossings in this sketch analysis to the list of projects prioritized in the CREATE program for grade separation, as well as the status of these projects as reported in the program’s latest [status report](#). The next two tables present the sketch analysis rankings vis-à-vis projects included in the CREATE program. Neither the highest-ranked group nor the lowest ranked group has a completed project, although two of the high-ranked locations have been initiated, along with one of the lowest-ranked locations.

Table 3: Highest-ranking CREATE projects, by total score

City	Street	Railroad	Total Score	CREATE status
CHICAGO	MORGAN ST	NS	56.35	IDOT Phase I
CHICAGO	ARCHER AVE	BRC	29.01	IDOT Phase I
LAGRANGE	47TH STREET	IHB	21.64	Initiation Pending
RIVERSIDE	HARLEM AVE	BNSF	18.86	Initiation Pending
MAYWOOD	FIRST AVE	UP	18.43	Initiation Pending

Table 4: Lowest-ranking CREATE projects, by total score

City	Street	Railroad	Total Score	CREATE status
MAYWOOD	5TH AVE	UP	7.63	Initiation Pending
CHICAGO	71 ST ST	CSX	7.63	IDOT Phase I
ALSIP	115TH ST	IHB	5.69	Initiation Pending
OAK LAWN	CENTRAL AVE	IHB	4.74	Initiation Pending
DOLTON	COTTAGE GROVE	IHB	3.90	Initiation Pending

Note that there are a variety of approaches to improve safety and congestion at highway-rail grade crossings, including not only grade separations but also installing safety devices or closing some crossings. Nor does the CREATE program include a listing of every potential high-priority grade separation in the region. Rather, the above tables provide a high-level look at how the CREATE project list compares to the sketch analysis.

Discussion and next steps

The analysis of highway-rail grade crossings is expected to be an important part of the upcoming regional freight plan, and this memo provides an initial exploration of existing conditions. The analysis relies on widely accepted data sources to incorporate average motorist delay, bus transit service, safety, and truck traffic into a sketch ranking.

Future work could build on this initial analysis to prioritize projects or corridors for additional analysis. Additional priority could be placed on rail lines that support Metra and Amtrak

service, or roadway links that are designated truck routes. Given the highly-concentrated nature of motorist delay, future analysis may likely focus on the relatively small set of high-delay locations.

This memo represents a first attempt by staff to better understand the factors affecting the region's highway-rail grade crossings. Any recommended improvements to rail crossings must consider the context of the location, including network effects on both the highway and rail sides. For example, separating one highway-rail crossing could reduce delay at nearby crossings, and reducing rail congestion through other types of improvements could improve motorist delay along a series of crossings throughout a corridor.

Staff is interested in the Freight Committee's comments on the initial analysis, along with potential methodological improvements. Specific discussion questions include the following:

- Are the four components of the score appropriate?
- Is the weighting of the components appropriate?
- In addition to those noted, what qualitative factors should we consider? Potential examples include the configuration of adjacent yards or proximity to other high-ranked crossings.

Staff recommends refining the grade crossing rankings based on the input received on the above discussion questions. Depending on the availability of resources, staff may take a closer look at a subset of high-ranking locations over the next year. Staff may also consider listing these high-ranking locations and other grade crossings as priority locations for improvement in the regional freight plan.

ACTION REQUESTED: Discussion

Appendix: Component scores of sketch ranking

The following series of maps shows the component scores (motorist delay, percent truck traffic, safety, and transit) of the top 100 ranked highway-grade crossings. The geographic distribution of high-scoring locations varies from one component to another. For example, motorist delay appears to be concentrated on the south and west sides of Chicago, along with inner-ring south and west Cook County suburbs. In contrast, percent truck traffic is a bit more dispersed, including sites in southeast Chicago as well as many suburban locations. Transit scores tend to be highest in the inner-ring Cook County suburbs, while safety scores tend to be distributed across the region.

Figure 2: Motorist delay score (55 points possible) of top 100 highway-rail grade crossings

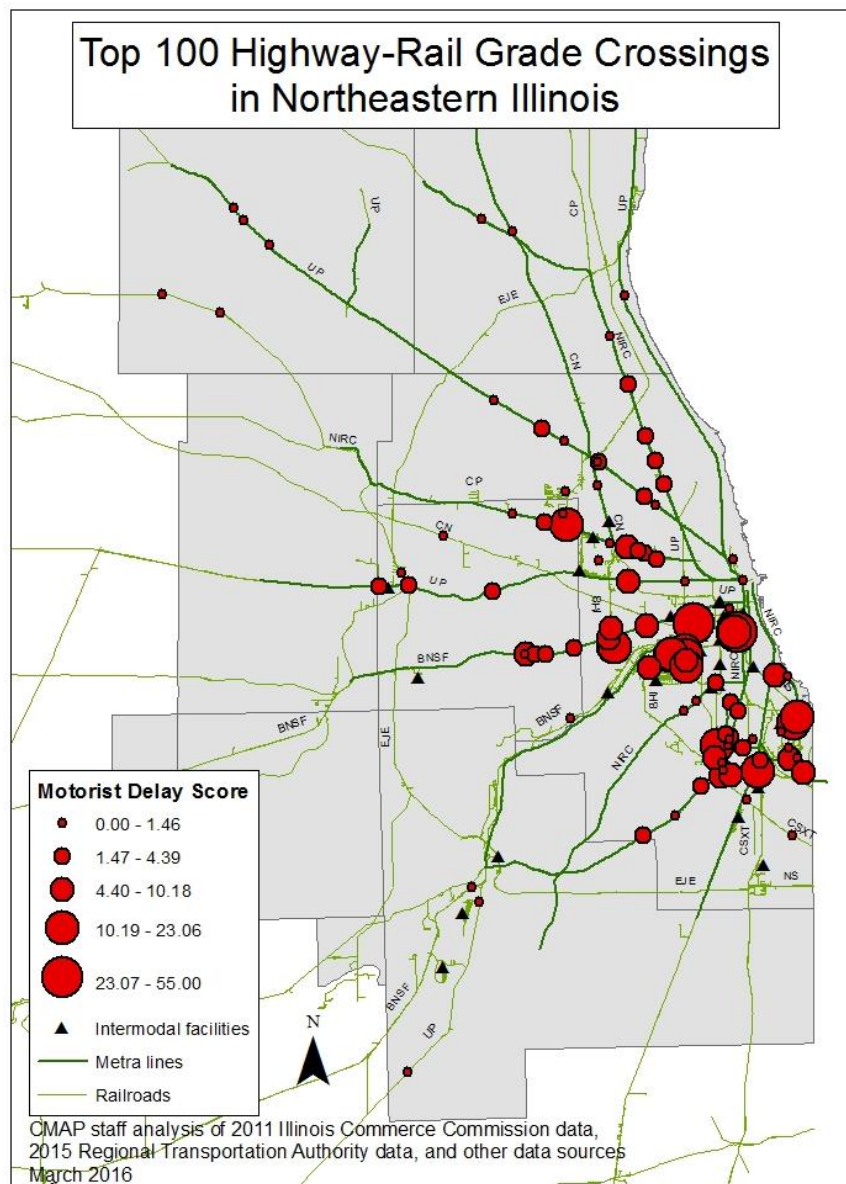


Figure 3: Percent truck score (15 points possible) of top 100 highway-rail grade crossings in Northeastern Illinois

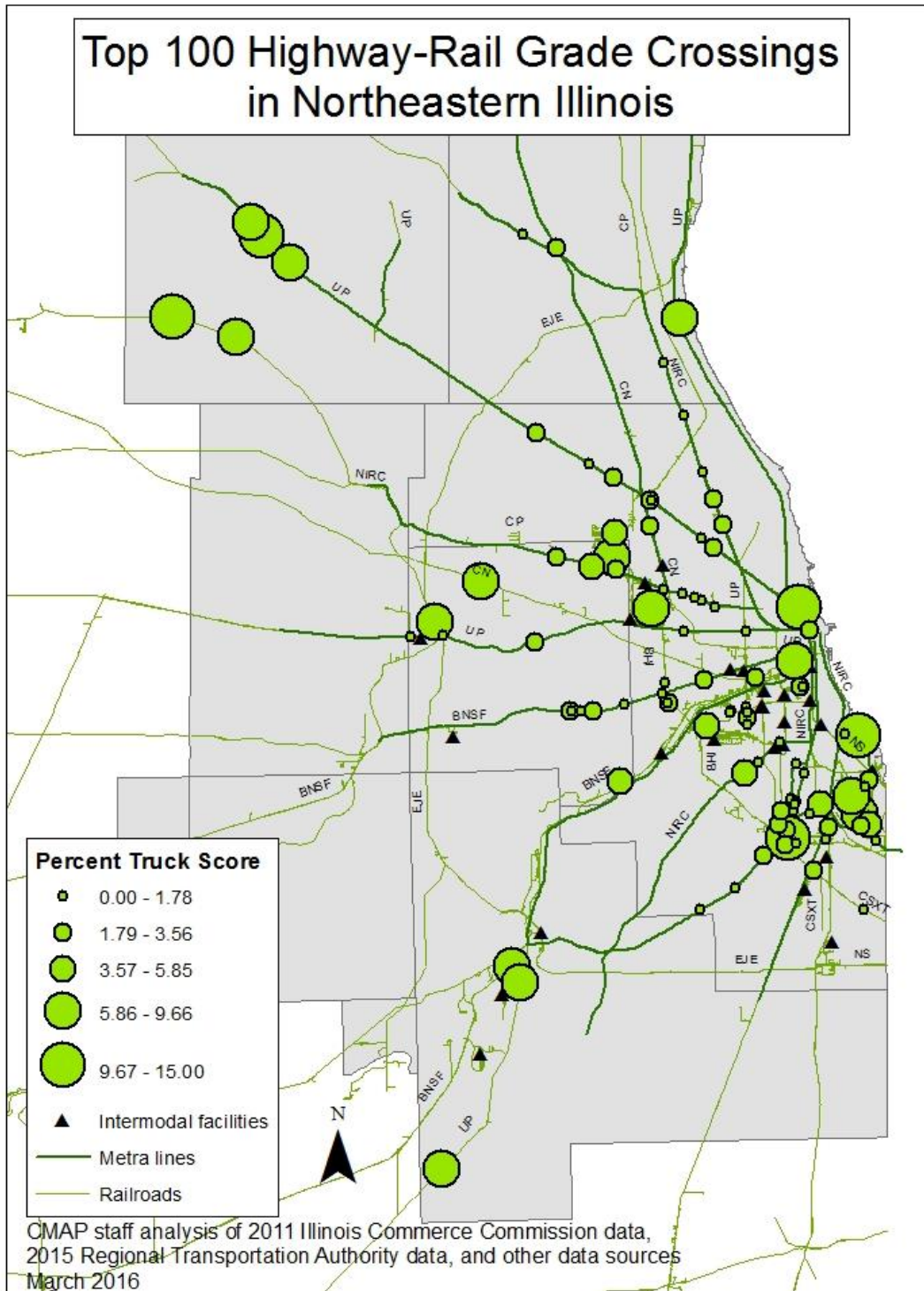


Figure 4: Safety score (15 points possible) of top 100 highway-rail grade crossings in Northeastern Illinois

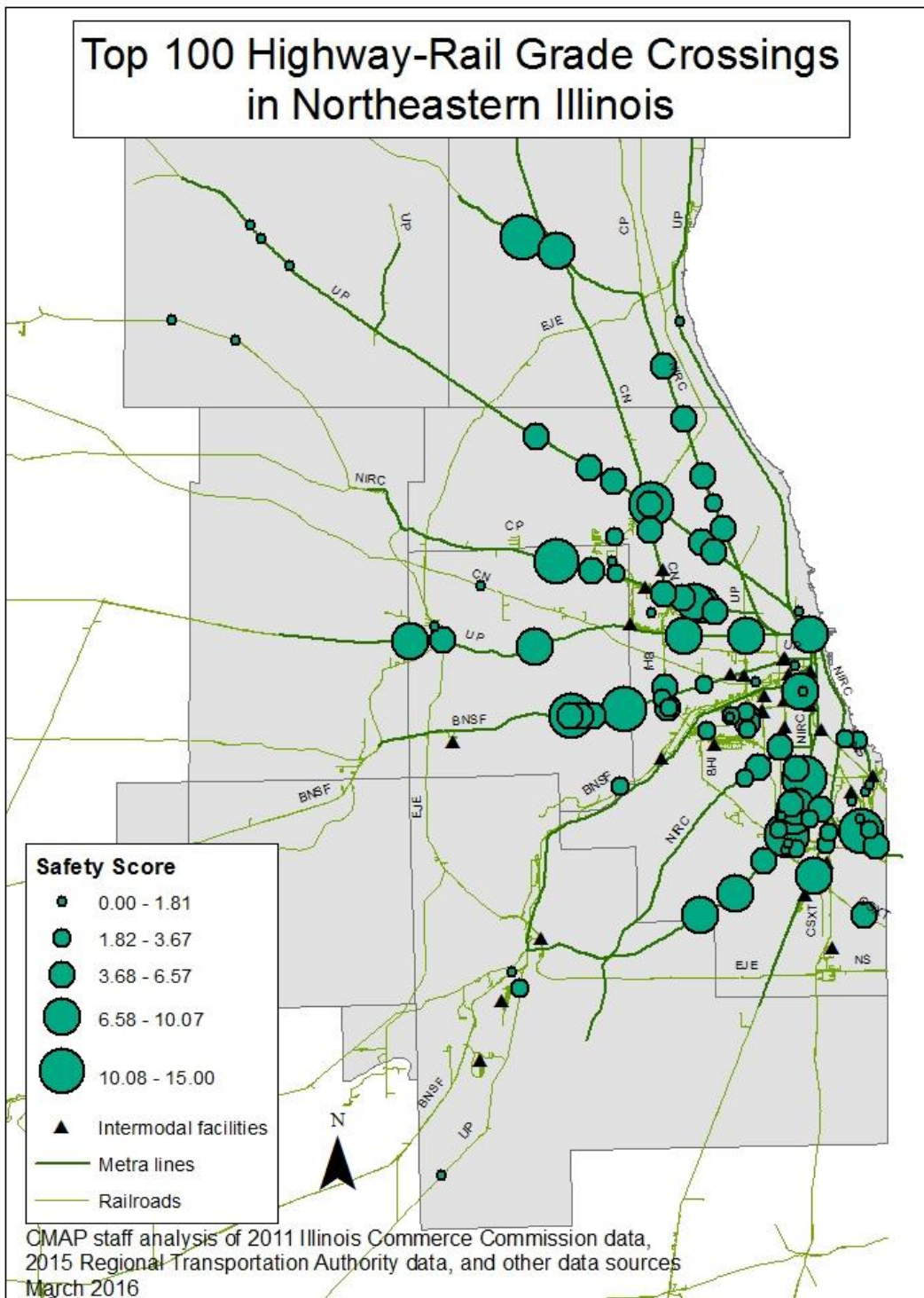


Figure 5: Transit score (15 points possible) of top 100 highway-rail grade crossings in Northeastern Illinois

