

Travel Time in Illinois

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Contents

Report Summary.....	3
Introduction.....	4
Methodology	5
Results	6
Discussion	12
Conclusion	15
Appendix A Starting and Ending Points Delineating data collection streets.....	16
Appendix B Screenshot of MapQuest map showing peak time in North Chicago area.....	17
Appendix C Screenshot of MapQuest map showing peak time in South Chicago area.....	18
Appendix D Screenshot of MapQuest map showing normal travel time in rural area.....	19
Appendix E Screenshot of MapQuest map showing normal travel time in Metro.....	20
Appendix F Average Travel Time (in minutes) for 10 miles	21
Appendix G Map of New Proposed Boundaries of Illinois Regions.....	Error! Bookmark not

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Report Summary

This report reviews travel distance standards in three areas of the State of Illinois: Chicago, Metro regions (including the greater Chicago area and the counties of Winnebago, Sangamon, Champaign, and Peoria), and the remaining areas of the state. The results may be used to support changes in CON application review criteria related to travel time.

Data used for this report include primarily two-way travel times for 10 miles between random points and hospitals in each area. A total of 940 data points were collected from MapQuest.com from August 23 to September 15, 2016 every 15 minutes from 8:30 am to 5pm Mondays and Tuesdays, and 8:30am to 1:30pm Thursdays. Additional 588 data points were collected at “peak” times from 6:30 am to 8:30am and 5:00pm to 6:30pm from October 18 to the 24th.

The results show that the average travel time is 3.08 minute per mile in Chicago area, 1.93 minutes per mile in Metro regions, and 1.54 minutes per mile in the rest of the state. Based on these statistics, previous travel-time multipliers should change from 1.25 to 2.00 for the Chicago area and 1.15 to 1.28 for the Metro regions. Average distances with corresponding Confidence Intervals (CIs) were estimated for three different combinations of travel distance standards for Illinois areas. The results are as follow: For one 30-minute travel time, the average distance was 10.31 ± 0.215 for Chicago, 15.76 ± 0.245 for Metro, and 20.11 ± 0.265 for rural areas. For one 45-minute travel time, the average distance was 15.46 ± 0.32 for Chicago, 23.65 ± 0.245 for Metro, and 30.17 ± 0.265 for rural areas. For a varying travel time method, the average distance for a 25-minute travel time in Chicago was 8.59 ± 0.18 , a 35-minute travel time in Metro areas was 18.39 ± 0.19 , and a 45 minute travel time in Rural areas was 30.17 ± 0.265 .

This study recommends:

- Use of the 30-minute travel distances measurement for simplicity of rule making, as well as to be parallel with current practical applications of the rule.
- Changes to rule 77 Ill. Adm. Code 1100.510(d): Part 1 should include the counties of Cook, DuPage, Kane, and Will, – the top 4 counties by population density. Part 2 should include the remaining Metro area: Kankakee, Grundy, Kendall, DeKalb, McHenry, and Lake counties, as well as the counties of Winnebago, Champaign, Sangamon, Peoria, Tazewell, Rock Island, Madison, and St Clair. Part 3 will include all other areas of Illinois. These changes are outlined in the map in Appendix G.

Introduction

The Illinois Certificate of Need (CON) program currently requires, in 77 Ill. Adm. Code 1100.510(d), a determination of travel time using MapQuest, Inc. and the application of an adjustment factor to determine the travel time based on the location of a proposed facility. Other rules require the Board and applicants to look at 45-minute travel time. Applications may require the Board to consider utilization of existing or approved healthcare facilities within a 45-minute travel of the proposed project size when considering service accessibility. *See* 77 Ill. Adm. Code 1110.530(c)(5)(A)(v), 630(c)(5)(A)(v), 730(c)(5)(A)(v), 1430(c)(5)(A)(v) *and* 1125.570(a)(5). The assumptions about 30 or 45-minute travel time built in the current rules were established many years ago and need to be revised as changes have occurred in transportation infrastructures and urbanization. The mandatory use of MapQuest.com to map nearby facilities when preparing CON applications (77 Ill. Adm. Code 510(d)) also motivates the revision of the travel time criteria in the CON rules. The issue arises that MapQuest has transitioned into using real-time traffic data instead of speed limit data to derive its travel times. The possible improvement of the accuracy of the average travel times conflicts with the variance of the travel times throughout the time of day, as traffic patterns shift. For example, a facility creating a map of nearby facilities at 5:00 PM might end up with a more condensed area than one creating the same map at 10:00 AM. Acknowledging these factors that impact travel time estimates, the Health Facilities and Services Review Board aims to implement distance standards, instead of time standards, in order to reflect a more consistent rule of travel time requirements used in CON application review. This report uses MapQuest traffic data to estimate 30, 45, and variable-minute travel distances for different areas of the state in support to the policy change decision making. Areas considered include

Chicago, the Chicago Metro regions, as well as the counties of Winnebago, Sangamon, Champaign, and Peoria, and the remaining areas of the state.

Methodology

A total of 12 streets determined by starting points (a random location) and ending points (healthcare facilities) (Appendix A) were surveyed. The starting and ending points were selected from three pre-determined areas of Illinois to have an approximate distance of 10 miles. The areas which were assumed to vary in travel times per mile were outlined in 77 Ill. Adm. Code 1100.510(d), where part 1 defines the City of Chicago, part 2 defines the Greater Chicago Metropolitan Area (DuPage, Will, Kendall, Kane, McHenry, Lake, and Grundy counties) plus Winnebago, Peoria, Sangamon, and Champaign Counties (hereafter referred to as “Metro”), and part 3 defines other areas, including rural areas and most of Southern Illinois. The difference with the second and third areas was that 4 different health care facilities were used; the second using health facilities in Rockford, Peoria, Champaign-Urbana, and Springfield, and the third area using health facilities in Marion, Olney, Macomb, and Streator. We used Mapquest.com to collect travel time data over a period of three weeks from the defined streets. Chicago data was collected on Mondays and Tuesdays from 8:30 am to 5pm and Thursdays from 8:30am to 1:30pm from August 23 to September 15, 2016. The data were collected for four points around Chicago’s Mercy Medical on Pulaski. One point was selected north, south, east, and west of the health facility, and MapQuest estimated travel times were collected every 15 minutes. A similar process was followed for the 4 points in Winnebago, Champaign, Peoria, and Sangamon counties, as well as for 4 points in rural and southern Illinois counties. Example of screenshots of the MapQuest maps and times can be seen in Appendices B through E.

Results

The first assumption we tested was that travel distances per 10 miles do not vary significantly when traveling from a specific location to a health care facility and traveling from the health care facility back to the location. This assumption was tested using the data for each area with an Independent Samples Student's t-test with IBM SPSS software. The results of this test are shown in Table 1.

Table 1: Independent Samples T-Test for Travel Times To and From

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	p	t	df	p-value
ChicagoTT	Equal variances assumed	1.764	.189	1.157	68	.251
	Equal variances not assumed			1.157	64.427	.251
MetroTT	Equal variances assumed	2.542	.115	-.675	68	.502
	Equal variances not assumed			-.675	63.025	.502
RuralTT	Equal variances assumed	.175	.677	1.827	68	.072
	Equal variances not assumed			1.827	67.122	.072

The probability (p) of making the error of rejecting the hypothesis that the variability of the distances traveled from point A to point B and from point B to point A is not significant when this hypothesis is actually true is higher than 0.05 (the acceptable level of error). Table 1 shows the p values for Chicago which is 0.251, Metro which is 0.502 and Rural which is 0.072. Therefore, there is no evidence to reject the hypothesis that the variability of distances traveled to and from a specific location and a health care facility is not significant in the three areas.

The second assumption we tested was that there was no significant difference between weekday travel distances for the same time. This hypothesis was tested for Chicago and Metro

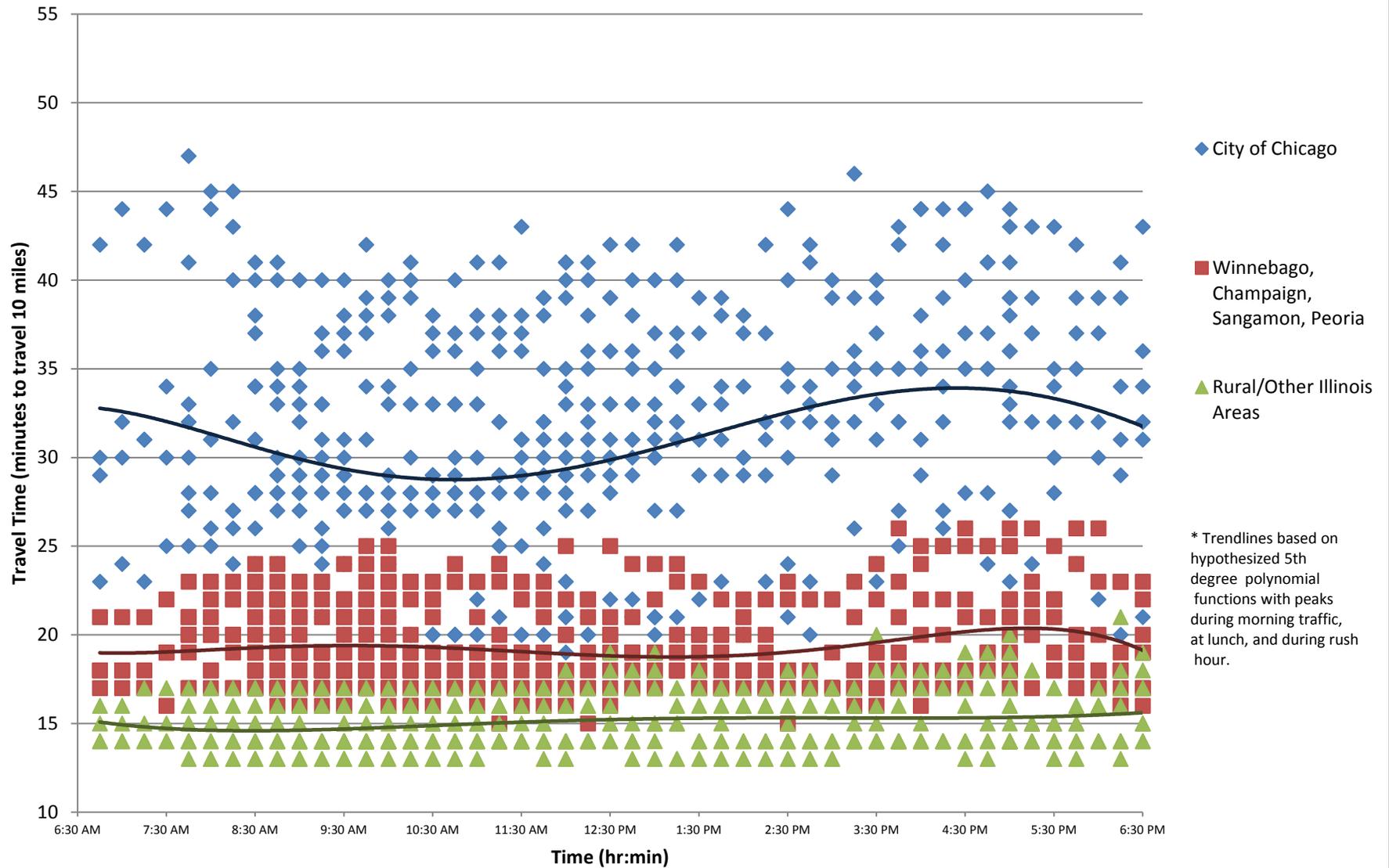
areas using t-tests, and for the rural area using an ANOVA. The t-test results for Chicago and Metro areas are shown in Table 2. The p-value was 0.553 for Chicago, 0.738 for Metro, and 0.328 for Rural. These values are higher than the acceptable 0.05 level of significance; therefore, we conclude that weekday travel times do not differ significantly.

Table 2: Independent Samples T-Test for Weekday Travel Times

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	p	t	df	p-value
ChicagoTT	Equal variances assumed	2.500	.115	-.595	246	.553
	Equal variances not assumed			-.584	210.465	.560
MetroTT	Equal variances assumed	.104	.748	-.335	258	.738
	Equal variances not assumed			-.334	246.256	.738

With these assumptions met, the data is compiled for further analysis. Averages of travel time per 10 miles by time of day can be seen in Appendix F. Graphical representation demonstrates several noteworthy observations. Figure 1 show the plotted raw travel times from MapQuest for each area. Chicago travel times vary more than travel times in the other areas, and are generally much higher. All areas experience an increase (peak) in travel times as a great number of people go to work, go to lunch, and eventually leave work for home.

Figure 1: Mapquest Travel Times to Illinois Hospitals by Time and Area



The average travel time among all the City of Chicago data was 30.72 min/10mi. This comes out to 3.07 minutes per mile. The same distances for the Winnebago, Champaign, Peoria, Sangamon (19.15 min/10 mi, 1.92 min/mi) and the Rural/Other (15.15 min/10 mi, 1.51 min/mi) were calculated as well. The result of the t-tests performed on the days of the week for which we have more complete data reinforces the hypothesis that our sample is representative of all days in a week. As mentioned in the Discussion, “peak” data (before 8:30am and after 5:00pm) was added after analysis to augment the rule-making ability of the data. Table 3 demonstrates the standard and peak travel time differences.

Table 3: Travel Time Averages Peak/Non-Peak Times

		Total Travel Time Data		Non-Peak		Peak Data	
		Average Travel Time (minutes/10miles)	Average Travel Time (minutes/mile)	Average Travel Time (minutes/10miles)	Average Travel Time (minutes/mile)	Average Travel Time (minutes/10miles)	Average Travel Time (minutes/mile)
Region of Illinois	City of Chicago	30.78	3.08	29.95	3.00	32.10	3.21
	Metro Regions (Winnebago, Sangamon, Champaign, Peoria)	19.33	1.93	19.08	1.91	19.72	1.97
	Rural/Other	15.07	1.51	15.05	1.50	15.09	1.51

The peak time, as expected, increased the average travel times; however, the increases are very small and the peak time data do not skew the observed trends. The new data with the added peak measurements was divided by the minutes/mile average for 30, 45, and variable-minute travel times to get an estimated distance traveled in the specified number of minutes for each area. Table 4 illustrates these findings as well as an estimate of the expected values of 30, 45, and variable-minute travel distance based on the single minutes per mile number. This number is calculated experimentally in Table 5. The separation of the trend lines in Figure 1 above are generally represented by the bar graph in Figure 2. These numbers can be used to calculate an

updated version of the multiplier used by previous HFSRB rule to calculate travel times to be used in different areas when applied to a 45-minute standard.

Table 4: MapQuest Health Facility Travel Time Data for 3 Regions of Illinois

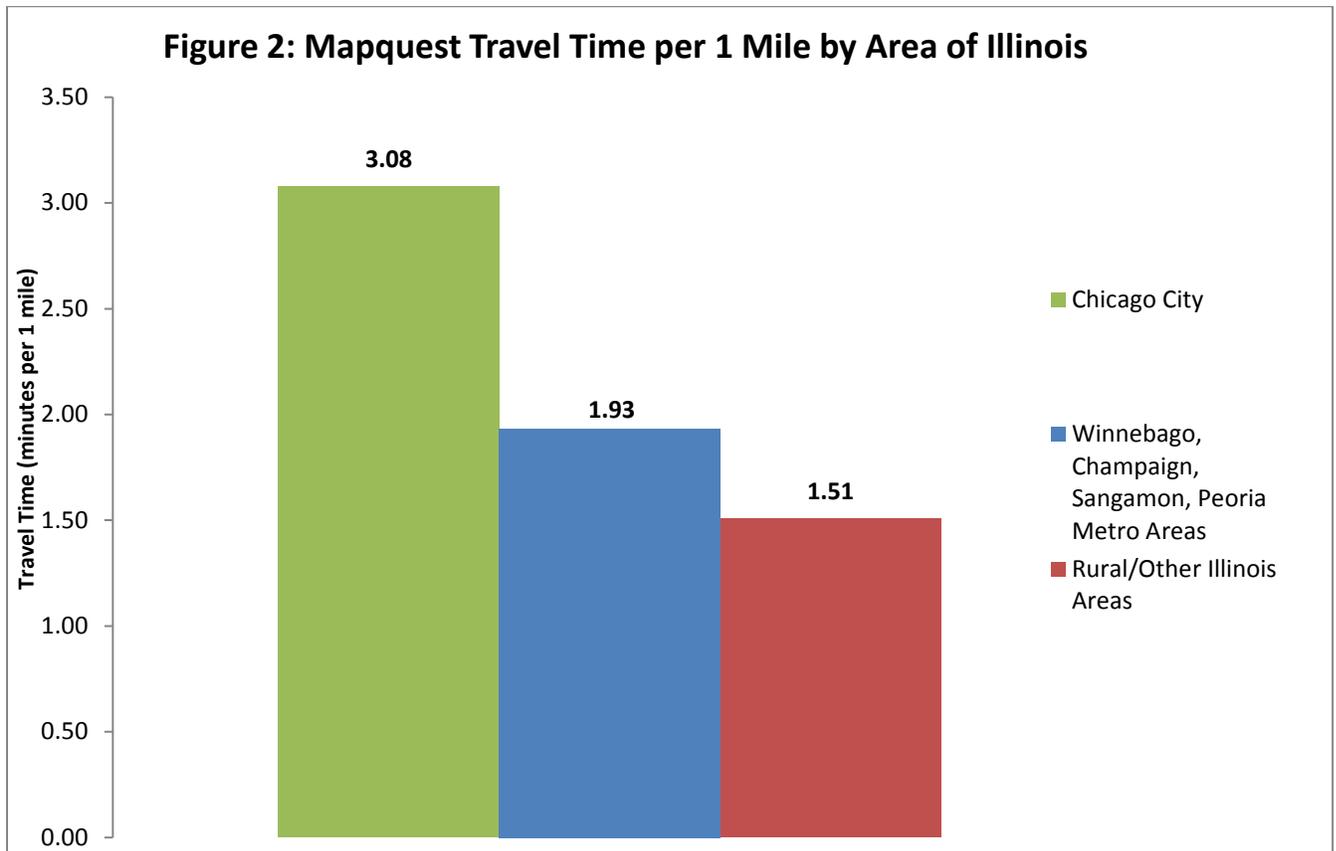
		Average Travel Time (minutes/10miles)	Average Travel Time (minutes/mile)	45-minute estimate (miles)	30-minute estimate (miles)	Calculated- minute estimate (miles/#minutes)
Region of Illinois	City of Chicago	30.78	3.08	14.61	9.74	8.12 mi/25min
	Metro Regions (Winnebago, Sangamon, Champaign, Peoria)	19.33	1.93	23.32	15.54	18.13 mi/35min
	Rural/Other	15.07	1.51	29.80	19.87	29.80 mi/45min

Since these travel times would be the proposed new standard used by the HFSRB, a simple formula allows the data to be transformed from minutes to travel 10 miles into miles traveled in another specified number of minutes. With MapQuest using real-time travel data, and thus (as demonstrated in Figure 1) changing travel times throughout the day, a standard based on an estimate of distance rather than time may be an easier and more effective standard to maintain.

The formula for this transformation is $M_{min} = \text{min} / .1 \text{ TT}_{10}$. We use the transformed data to compute distance boundaries that CON application reviewers can use for each distinguished area of Illinois. From the data, assuming the rural areas (1.51 minutes/mile) remain at a multiplier of 1, the factor for the Metro group (1.93 minutes/mile) would be 1.28, and the factor for the Chicago area (3.08 minutes/mile) would be approximately 2. Since the minutes/mile travel estimate should be a reflection of population density, and population density drives the density of health care facilities in an area, it is possible to use these multipliers to create new travel time parameters, hopefully reflecting facility density more than a flat time measurement would.

Applying these multipliers to the 45-minute travel time estimate and rounding for simplicity

would suggest a 25-minute travel time for Chicago, and a 35-minute travel time for Metro areas. Rural areas would retain the 45-minute travel time.



A confidence interval for the mean of travel distances provides the estimate of travel distances for 95% of 30-minute travels in the given area. Descriptive statistics and confidence intervals are given in Table 5.

Table 5: Confidence Intervals for Mean Distance for Travel Time

Travel Time Assumption	Illinois Area	Number of Records	Mean	Standard Deviation	95% Confidence Interval	
					Lower Bound	Upper Bound
30-minute travel times	Chicago	541	10.31	2.56	10.09	10.52
	Metro (Sangamon, Champaign, Peoria, Winnebago)	504	15.76	2.84	15.520	16.01
	Rural/Other	476	20.11	2.95	19.85	20.38
45-minute travel times	Chicago	541	15.46	3.84	15.14	15.78
	Metro (Sangamon, Champaign, Peoria, Winnebago)	504	23.65	2.84	23.40	23.89
	Rural/Other	476	30.17	2.95	29.91	30.44
Calculated travel times (25 minutes for Chicago, 35 minutes for Metro, 45 minutes for Rural)	Chicago	541	8.59	2.13	8.41	8.77
	Metro (Sangamon, Champaign, Peoria, Winnebago)	504	18.39	2.21	18.20	18.58
	Rural/Other	476	30.17	2.95	29.91	30.44

The mean travel distances for the 30, 45, and variable-minute travel time standard in each area is represented in Table 4, as well as the 95% confidence intervals for the mean. These values are close enough to the estimates calculated from the average minutes/mile in Table 4 to be considered reasonable.

Discussion

At this point, the discussion turns towards which numbers to use for rule making.

As mentioned previously, the multipliers for average minutes/mile travel time can be used to come up with travel distances for defined travel times. Results provided in table serve for this discussion. The mean distance may be used as a simple compromise within each confidence interval:

- For 30-minute travel, the distances would be 10.31 miles for Chicago, 15.76 miles for Metro, and 20.11 miles for Rural areas;
- For 45-minutes these distances are 15.46 miles for Chicago, 23.65 miles for Metro, and 30.17 miles for Rural area;
- Under a varying driving-minute assumption, the mean distance for 25 minutes in Chicago is 8.59 miles, for 35 minutes in metro areas it is 18.39 miles and for 45 minutes in rural areas, it is 30.17 miles. This option is more complex, but it is possible that it would prove to be a more reasonable travel time estimate for different locations in Illinois; where mean measurements for a 45-minute travel time might overestimate distances for Chicago, and 30 minutes might underestimate distance for rural areas.

A conservative method would be to round towards the upper bound of the interval. Using the upper bounds, or near to them should allow us to encompass a huge portion of possible travel time experiences with 95% confidence. Respectively, for 30 minutes these would become 11, 16, and 20 miles, and for 45 minutes the values would become 16, 24, and 30 miles. It is also important to weigh what may be perceived as small differences. One mile might not make as much of a difference in rounding for a facility in Springfield as it does for a facility in downtown Chicago.

Further consideration was given to 77 Ill. Adm. Code 1100.510(d) as well in the process of creating this report. Data points were taken in accordance with the original rule, but in reality it may be more reasonable to consider a change. Chicago traffic is not limited to the city limits, but extends far outside of Chicago. Practical experience would suggest that the entire county of Cook, as well as DuPage, Will, and Kane counties be included in part 1 of the rule as the new

“Chicago” area. This is supported by a significant increase in population density to these top four counties from the next highest county by density (highest being Cook at 3,197 people/sq mi, lowest being Will at 803.2 people/ sq mi): Winnebago (562.4 people /sq mi), as well as projected population increases in DuPage, Will and Kane counties. We retain the assumption that the rest of the Chicago Metro area be included in part because of increased traffic from Chicago, but suggest adding excluded counties with larger population densities than Champaign county (204.5 people/ sq mi) up to Winnebago at 562.4 people/sq mi. This would add Tazewell, Rock Island, Madison, and St Clair county to part 2 of the rule as “Metro” areas. The other areas will include all other counties, from densities of 11.7 people/sq mi in Pope county to 191.5 people/ sq mi in Boone county. Appendix G includes a map of Illinois outlining the suggested new regions of Illinois by rule, as well as starred locations of where data collection took place by previous rule.

Limitations of this study include possible bias related to selection of traffics and days for data. We collected data only from 12 streets (Appendix A) out of thousands existing in Illinois to conduct this study. This sample size is very limited; however, we selected streets in the south, north, east, and west side of Chicago to improve the geographical representativeness of the sample. Traffic in the Chicago area drastically change throughout the days whereas in the Metro and rural areas, the traffic shows some stability. We also control for distance by limiting traffic time data collection to 10 miles of travel distance for each selected streets. This procedure may not allow for measuring scarcity in flat travel time estimates. Places further away than the standardized distance in rural areas might affect the utilization of such facilities much more than closer facilities would in downtown Chicago, regardless of having a longer travel time.

We also collected most of the data on Monday and Tuesday from 8:30am-5:00pm, and Thursday from 8:30am-1:30pm. The peak time data were collected on Monday, Tuesday,

Wednesday and Thursday from 6:30am-9:30am, and 3:30pm-6:30pm. Skipping some days such as Fridays and times may reduce the capacity of study to capture traffic specificity of such period of time. However, as the statistical tests of significance of the differences between the collected weekday travel distances revealed that these differences were not significant, we assume that data of skipped days may not change the outcome of this study.

Conclusion and Recommendations

The average travel distances were around 10.31 for Chicago, 15.76 for Metro, and 20.11 for rural areas using a 30 minute travel time standard. For a 45-minute standard, they were around 15.46 for Chicago, 23.65 for Metro, and 30.17 for rural areas. Using the varying travel time method, they were around 8.59 for a 25 minute travel time in Chicago, 18.39 for a 35 minute travel time in Metro areas, and 30.17 for a 45-minute travel time in rural areas. These numbers can be used to change rules for CON travel distance standards.

We recommend:

- Use of the 30-minute travel distances measurement for simplicity of rule making, as well as to be parallel with current practical applications of the rule.
- Changes to the rule also include a change to 77 Ill. Adm. Code 1100.510(d). Part 1 should now include the full counties of Cook, DuPage, Kane, and Will, – the top 4 Illinois counties by population density. Part 2 should now include the remaining Chicago Metro area: Kankakee, Grundy, Kendall, DeKalb, McHenry, and Lake counties, as well as the counties of Winnebago, Champaign, Sangamon, Peoria, Tazewell, Rock Island, Madison, and St Clair. Part 3 will include all other areas of Illinois. These changes are outlined in the map in Appendix G.

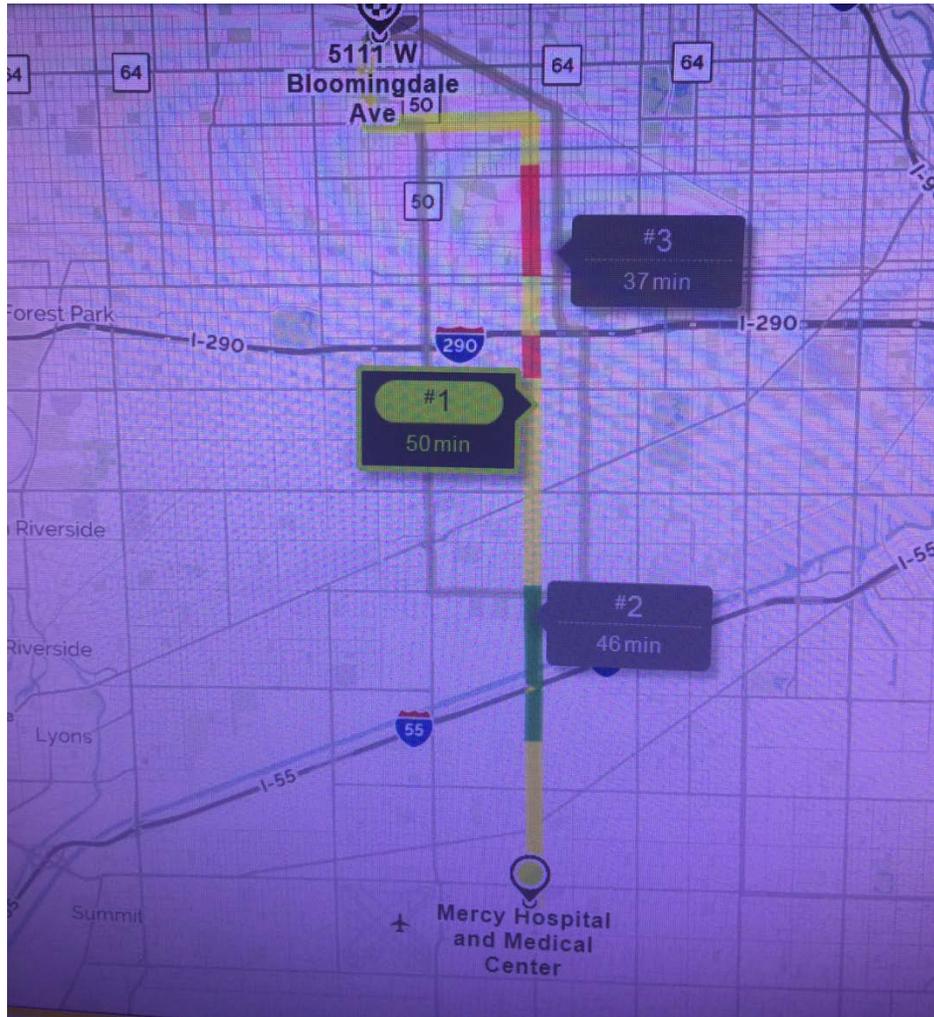
Appendix A

Starting and Ending Points Delineating data collection streets

Starting Point	Ending Point (Health care facilities)
9099 Shields Ave, Brookfield, IL 60513-2057 (West Chicago)	Mercy Medical, 4321 S Pulaski Rd, Chicago, IL 60632
1143 E 82 nd St, Chicago, IL 60619-4513 (East Chicago)	Mercy Medical, 4321 S Pulaski Rd, Chicago, IL 60632
5111 w Bloomingdale Ave, Chicago, IL 60639-4544 (North Chicago)	Mercy Medical, 4321 S Pulaski Rd, Chicago, IL 60632
13509 S Crawford Ave, Robbins, IL 60472-1411 (South Chicago)	Mercy Medical, 4321 S Pulaski Rd, Chicago, IL 60632
7516 N Cherry Vale Mall Dr, Cherry Valley, IL 61016-9466	Rockford Memorial Hospital, 2400 N Rockton Ave, Rockford, IL 61103
10931 N Highcrest Ln, Dunlap, IL 61525-8700	Kindred Hospital, 500 W Romeo B Garrett Ave, Peoria, IL 61605
2775 Haydon Dr, Urbana, IL 61802-9445	Carle Foundation Hospital, 1701 Curtis Rd, Champaign, IL 61822
3999 Spaulding Orchard Rd, Springfield, IL 62711-9412	St John's Hospital, 320 E Carpenter St, Springfield, IL 62702
17391 Shed Church Rd, Marion, IL 62959-7230	Heartland Regional Medical Center, 3333 W Deyoung St, Marion, IL 62959
189 Walnut St, West Liberty, IL 62475	Richland Memorial hospital, 800 E Locust St, Olney, IL 62450
840 Constitution Rd, Colchester, IL 62326	MDH Convenient Care, 1600 E Jackson St, Macomb, IL 61455
2650 N 13th Rd, Streator, IL 61364-9702	OSF St. Elizabeth Medical Center, 111 Spring St, Streator, IL 61364-3332

Appendix B

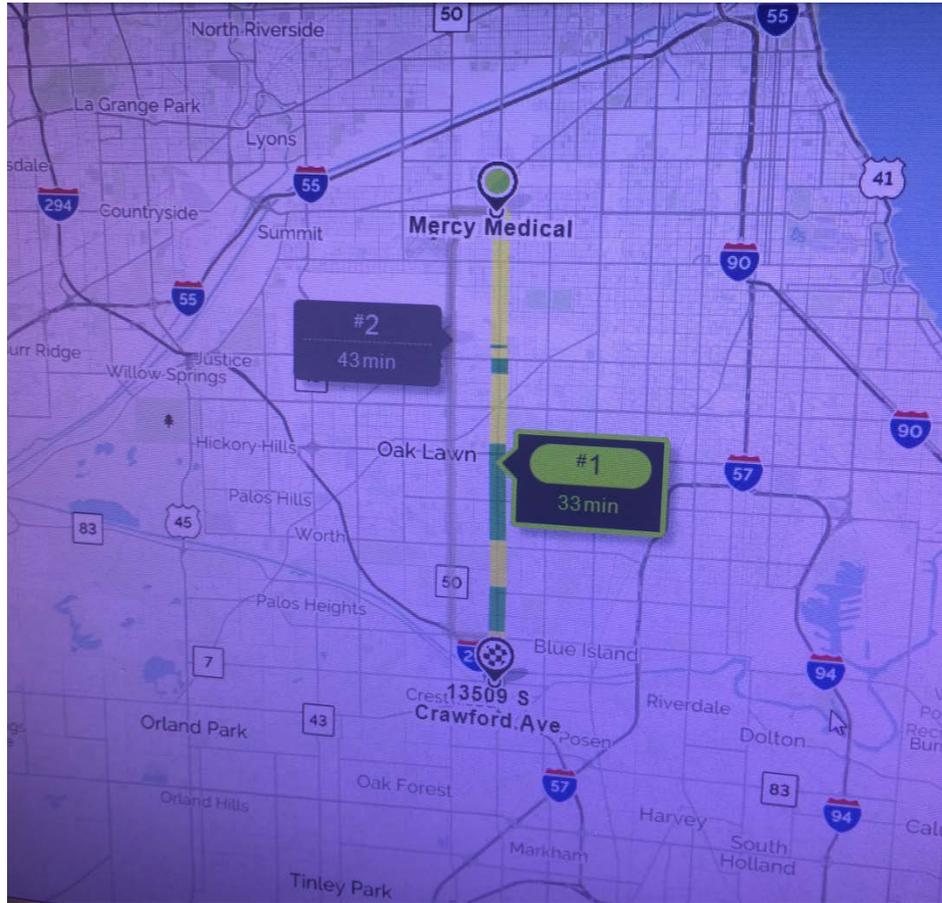
Screenshot of MapQuest map showing peak time in North Chicago area at 5:00pm



Source: MapQuest.com

Appendix C

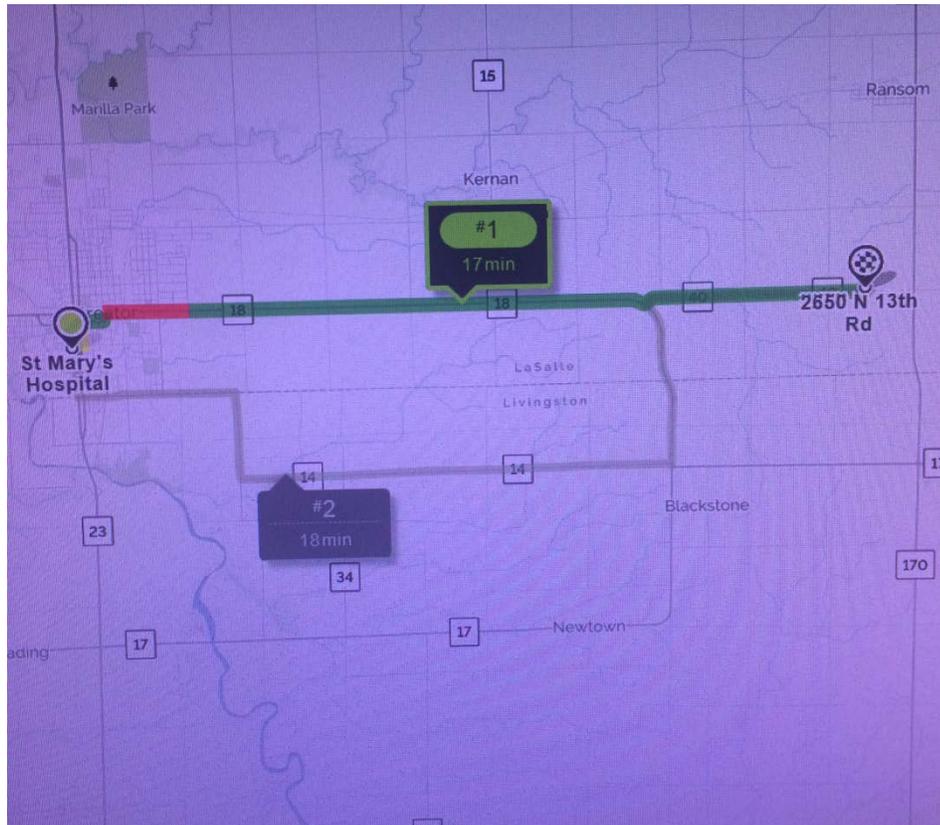
Screenshot of MapQuest map showing peak time in South Chicago area



Source: MapQuest.com

Appendix D

Screenshot of MapQuest map showing normal travel time in rural area



Source: MapQuest.com

Appendix F

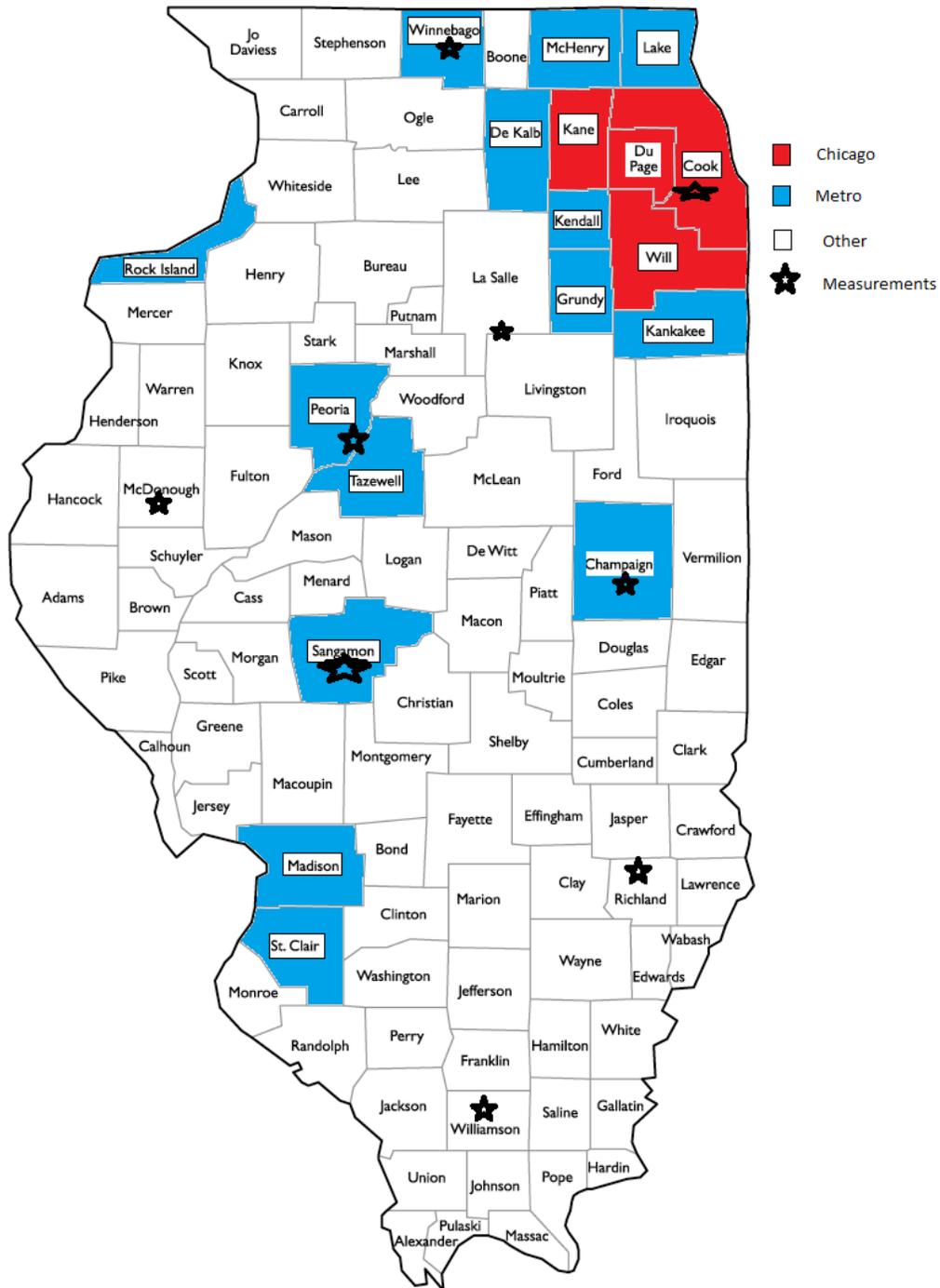
Average Travel Time (in minutes) for 10 miles

Hour	Areas		
	Chicago	Metro	Rural
6:45:00 AM	31	19	15
7:00:00 AM	33	19	15
7:15:00 AM	32	18	15
7:30:00 AM	33	19	15
7:45:00 AM	33	20	15
8:00:00 AM	32	20	15
8:15:00 AM	33	20	15
8:30:00 AM	31	20	15
8:45:00 AM	30	19	15
9:00:00 AM	29	19	15
9:15:00 AM	29	19	15
9:30:00 AM	29	19	15
9:45:00 AM	30	20	15
10:00:00 AM	28	19	15
10:15:00 AM	29	19	15
10:30:00 AM	28	19	15
10:45:00 AM	28	19	15
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11:15:00 AM	29	19	15
11:30:00 AM	29	19	15
11:45:00 AM	30	19	15
12:00:00 PM	30	19	15
12:15:00 PM	30	19	15
12:30:00 PM	31	20	16
12:45:00 PM	31	19	15
1:00:00 PM	30	19	16
1:15:00 PM	31	20	15
1:30:00 PM	31	19	15
1:45:00 PM	31	19	15
2:00:00 PM	30	19	15
2:15:00 PM	31	18	15
2:30:00 PM	33	19	15
2:45:00 PM	32	19	15
3:00:00 PM	31	19	15
3:15:00 PM	34	18	15

Hour	Areas		
	Chicago	Metro	Rural
3:30:00 PM	33	19	16
3:45:00 PM	34	20	15
4:00:00 PM	35	20	15
4:15:00 PM	35	20	16
4:30:00 PM	36	21	16
4:45:00 PM	36	21	16
5:00:00 PM	34	21	16
5:15:00 PM	33	24	15
5:30:00 PM	32	21	15
5:45:00 PM	33	20	15
6:00:00 PM	31	20	15
6:15:00 PM	31	19	16
6:30:00 PM	31	19	16
6:45:00 PM	32	18	15
7:00:00 PM	33	18	16
Daily average	31	19	15

Appendix G

Map of New Proposed Boundaries of Illinois Regions



Background map source: <http://www.worldatlas.com/webimage/countrys/namerica/usstates/counties/ilnames.gif>