DRAFT

AECOM Imagine it. Delivered.

Niles Station Feasibility Study

Station Spacing Technical Memorandum

Village of Niles

May 14, 2018

DRAFT

Prepared for:

Village of Niles

Prepared by:

AECOM
303 East Wacker Drive
Chicago, IL 60601
aecom.com

In association with:

The Lakota Group

Table of Contents

Figures

Tables

1. Introduction

The Village of Niles is conducting a comprehensive feasibility study for a new station on the Metra Milwaukee District North Line (MD-N) in the general location between Touhy Avenue and Howard Street. The study seeks answers to the following questions:

- Can a location be identified to physically accommodate a station and parking,
- Will the station be compatible with current railroad operations,
- Will there be a sufficient number of potential users,
- Will impacts to traffic, stormwater, and other factors be manageable,
- Can estimated costs be realistically funded, and
- Will a station stimulate the redevelopment of adjacent properties?

A question that needs to be answered early in the study is whether a station on this segment of the MD-N is appropriate, based on practical or theoretical station spacing considerations. The proposal is to study an infill station between Edgebrook at milepost (MP) 11.6 and Morton Grove at MP 14.3. The midpoint of this 2.7-mile span would be MP 13.0, approximately halfway between Touhy and Howard. Placing a station at this location would reduce the spacing from 2.7 miles to 1.4 miles. As such, this report will review whether this resultant spacing raises issues that could affect the overall viability of the new station, or how it is designed.

The report will cover the following areas:

- Theoretical basis for, and issues with, spacing of transit stops
- Implications of station spacing for Commuter Rail
- Guidelines, Standards and Practices of other Commuter Rail agencies
- Review of Metra actual station spacing
- Conclusions applied to Niles

2. Station Spacing Issues

A fundamental design challenge for any public transit system is deciding the distance between access points of the service. This applies to a local bus, light rail, rapid transit, commuter rail, or intercity rail. The choices are to have:

- Minimal number of stops (i.e., wider spacing) to offer faster service, or
- More stops (i.e., closer spacing) to provide access to a greater number of potential uses, but at slower speeds.

To illustrate the effect of station stops on travel time Table 2-1 shows scheduled travel times between Naperville and Union Station on the BNSF line serving the western suburbs. The two stations are 28.5 miles apart. As can be seen, the difference in travel time between an express train with no intermediate stops and an all-stop train (i.e., 22 intermediate stops) is 115 percent (33 minutes versus 71 minutes). Each added stop increases travel time by about two minutes; variations beyond number of stops are mostly due to differences in the level of ridership, where longer station dwell times are required with higher boardings / alightings.

Table 2-1. Selected BNSF Inbound Train Travel Times between Naperville and Union Station

Union Station Arrival	Intermediate Stops	Scheduled Travel Time (mins)	Added Time from No Stops (mins)	Added Time per Stop (mins)	Speed (MPH)
6:53 AM	0	33	0	--	51.8
5:32 AM	9	48	15	1.7	35.6
4:58 PM	11	55	22	2.0	31.1
7:00 AM	19	66	33	1.7	25.9
6:00 AM	22	71	38	1.7	24.1

SOURCE: Metra BNSF Timetable.

The need to provide closer spacing—at the expense of travel time—is driven by serving riders who access or egress by walking. Walking as an access mode is often less common for commuter rail service because commuter rail riders typically use park-n-ride and have the mobility to travel further to access a rail station of choice. Automobile access is a key attribute of commuter rail, which greatly enlarges the station market area from which riders can be drawn to a station. Use of the automobile by commuters to access stations can also mean that the market area can be comparatively less dense than would otherwise be needed to support transit, since the station parking facilities serve to collect riders from a large area.

Table 2-2 shows the distribution of originating riders by their mode of access to reach their boarding station. Access mode shares are from the Metra 2016 Origin-Destination Survey of riders traveling on AM trains, and are presented in rank order. For the Metra system as a whole, 52.8 percent of riders used an automobile to park at a station. Another 18.5 percent were dropped off or carpooled, totalling 71.3 percent who arrived by car. Riders using the walk mode of access, who would be most impacted by station spacing, accounted for 22.5 percent of surveyed riders. Table 2-2 also presents mode of access shares for the MD-N Line, which reveals a somewhat lower use of the walk mode, and a higher share arriving by car than for the system overall. MD-N stations near Niles (i.e., Morton Grove, Edgebrook, and Golf) have walk access modes ranging from roughly a quarter to half.

Table 2-2 also reveals that riders who access stations by walking travel the shortest distance between their origin and AM boarding station (0.4 miles straight-line distance, on average).

Table 2-2. Metra and MD-N Mode of AM Access and Average Distance

	Share of AM Trips		Avg. Dist.(miles)	
Access Mode	System	MD-N	System	MD-N
Drive Alone	52.8%	56.5%	1.9	1.8
Walk	22.5%	19.1%	0.4	0.4
Drop Off	14.6%	14.4%	1.4	1.5
Bicycle	2.5%	3.5%	0.9	1.0
Carpool Passenger	2.0%	1.8%	1.8	2.1
Carpool Driver	1.9%	1.9%	1.7	1.7
Pace Bus	1.6%	0.2%	2.2	3.9
CTA Bus	0.8%	1.3%	1.6	1.6
Other	0.5%	0.5%	1.5	1.4
Rideshare (Uber, Lyft, Via)	0.3%	0.3%	1.7	1.7
CTA Rapid Transit	0.2%	0.4%	2.5	3.7
Taxi	0.2%	0.1%	1.7	5.4
Another Metra Line	0.1%	0.0%	3.3	--
Divvy bike	0.1%	0.1%	0.9	0.6
Private Bus	0.0%	0.0%	2.6	10.2
Total / Average	100.0%	100.0%	1.7	1.6
Total AM Boardings	125,312	9,904		

SOURCE: Metra 2016 Origin-Destination Survey. Note: excludes downtown station responses.

While the majority of Metra riders board AM Peak Inbound trains at outlying stations and alight at a downtown Chicago station, there are stations in the system that also serve destination riders. A prominent example is the MD-N Lake Cook Road Station in Deerfield, which is supported by a system of distributor buses called Shuttle Bugs. Unlike the traditional commuter rail rider, who is destined for the highly concentrated area of jobs in downtown Chicago (about 700,000 jobs in a three-square mile area), riders traveling to endpoints outside of downtown are bound for destinations generally more dispersed—often beyond walking distance from an alighting station. The Metra Origin-Destination survey also included data on egress mode, which represented travel means used to reach one's ultimate destination during the AM. The percentages shown on Table 2-3 exclude responses for riders alighting one of Metra's five downtown stations. As can be seen, system-wide over one-half of respondents walked after alighting their train. The MD-N showed a lower share of walkers (40.6 percent), which was partly attributed to greater use of bus service. Table 2-3 also shows the average distance commuters travel from a non-downtown station to their destination. The average for walking is the same as for AM access (0.4 miles), but other modes tend to represent shorter distances.

Table 2-3. Metra and MD-N Mode of AM Egress and Average Distance

Egress Mode	Share of AM Trips		Avg. Dist. (miles)	
	System	MD-N	System	MD-N
Walk	52.3%	40.6%	0.4	0.4
Private Shuttle	8.8%	11.8%	1.1	1.4
Pace Bus	7.9%	20.1%	1.2	1.2
Get Picked Up	6.4%	6.5%	1.0	0.7
Drive Alone	6.0%	6.4%	1.2	1.2
CTA Bus	5.7%	3.7%	1.0	1.1
Bicycle	2.7%	3.1%	0.9	0.8
Rideshare (Lyft, Uber, Via)	2.2%	2.6%	1.3	1.3
CTA Rapid Transit	1.8%	0.8%	1.3	2.0
Taxi	1.7%	1.5%	1.2	1.2
Carpool Passenger	1.6%	1.3%	1.3	1.7
Other	1.5%	1.1%	1.0	0.7
Another Metra Train	0.7%	0.1%	0.8	n/a
Divvy Bike	0.4%	0.0%	1.2	n/a
Carpool Driver	0.4%	0.5%	1.3	n/a
Total / Average	100.0%	100.0%	1.0	0.7
Total AM Alightings	16,258	2,121		

SOURCE: Metra 2016 Origin-Destination Survey. Note: excludes downtown station responses.

Table 2-4 shows the distribution of AM walk access and egress by one quarter-mile increment for stations outside of downtown Chicago. The first half mile accounts for between 73 and 77 percent.

Table 2-4. Walk Distances for AM Riders, System and MD-N

Miles	Mode of Access		Mode of Egress	
	System	MD-N	System	MD-N
0.00 - 0.25	38%	34%	44%	44%
0.26 - 0.50	37%	40%	29%	33%
0.51 - 0.75	17%	17%	21%	16%
0.76 - 1.00	5%	6%	8%	2%
1.01 - 1.25	2%	1%	2%	3%
1.26 - 1.50	1%	1%	1%	1%
1.51 +	2%	1%	0%	1%
	100%	100%	100%	100%

SOURCE: Metra 2016 Origin-Destination Survey. Note: excludes downtown station responses.

While the higher percentage of AM riders who walk from a non-downtown station suggests that closer spacing can be important, this segment of Metra ridership represents one-eighth the number of riders making Metra's traditional AM commuter trip. In addition, there were only 13 stations of 234 total non-downtown stations that reported more AM Peak offs than ons based on the 2016 Metra Passenger Count. As such, Metra's accommodation of destinations outside of downtown Chicago is limited to a relatively few areas in the region.

3. Commuter Rail Station Spacing Practice & Guidelines

Table 3-1 lists all commuter railroads in the United Stations who report statistics to the Federal Transit Administration's (FTA) National Transit Database (NTD), shown in rank order of unlinked passenger trips (i.e., count of each time a passenger boards a vehicle, even if part of the same journey from origin to destination). This data repository is required of FTA grant recipients, and includes variety of financial, operating, ridership, and asset data. For the 23 systems listed, 2016 data on route miles and number of stations was used to derive the average system spacing of stations. Overall, this statistic was 3.1 miles. This agency average was higher than the 2.0 miles for Metra, as well as higher than most of the older and largest commuter rail systems nationally. The top seven agencies have spacing averages lower than the 3.1 overall average; these agencies accounted for 89 percent of the reported unlinked trips in 2016.

Table 3-1. Station Spacing at US Commuter Railroads

Commuter Rail Agency	Primary city Served	Annual Unlinked Trips	Route Miles	Number of Stations	Average Spacing (miles)
MTA Long Island Rail Road	New York	103,196,857	319.1	124	2.6
New Jersey Transit Corporation	New York	90,872,267	500.9	165	3.0
Metro-North Commuter Railroad Company	New York	86,297,511	272.9	112	2.4
NE IL Regional Commuter Railroad Corp (Metra)	Chicago	72,289,606	487.7	241	2.0
Southeastern Pennsylvania Transp. Authority	Philadelphia	36,187,570	223.5	155	1.4
Massachusetts Bay Transportation Authority	Boston	33,830,904	388.0	138	2.8
Peninsula Corridor Joint Powers Board	San Francisco	18,355,641	76.8	32	2.4
Southern California Regional Rail Authority	Los Angeles	13,758,419	412.2	59	7.0
Maryland Transit Administration	Baltimore	8,961,892	200.2	42	4.8
Utah Transit Authority	Salt Lake City	4,545,849	87.2	16	5.5
Virginia Railway Express	Washington	4,352,814	86.8	19	4.6
Central Puget Sound Regional Transit Authority	Seattle	4,312,113	81.9	12	6.8
South Florida Regional Transportation Authority	Miami	4,241,486	71.1	18	4.0
Northern Indiana Commuter Transportation Dist.	Chicago	3,504,080	89.9	19	4.7
Dallas Area Rapid Transit	Dallas	2,054,001	36.2	10	3.6
North County Transit District	San Diego	1,556,056	41.1	8	5.1
Pennsylvania Department of Transportation	Philadelphia	1,416,029	72.2	12	6.0
Altamont Commuter Express	San Jose	1,290,085	86.0	10	8.6
Rio Metro Regional Transit District	Albuquerque	886,386	96.6	14	6.9
Connecticut Department of Transportation	Hartford	849,942	50.6	9	5.6
Metro Transit	Minneapolis	711,167	39.0	7	5.6
Northern New England Passenger Rail Authority	Boston	473,923	143.8	12	12.0
Regional Transportation Authority	Nashville	277,741	31.4	6	5.2
Commuter Rail Total / *Average*		**494,222,339**	**3,895.0**	**1,240**	***3.1***

SOURCE: 2016 Federal Transit Administration (FTA) National Transit Database

A review of commuter rail agency policies at the five largest commuter rail agencies in terms of ridership found that none have specific guidelines or standards on the spacing of stations. Guidance on spacing can be found in Alternative Analysis studies that include evaluation of candidate transit technologies. In addition, selected state department of transportation departments have published characteristics of transit technologies as an aid to state-wide transportation planning. Agencies have also included guidelines to assist agencies in transit-oriented development planning.

Table 3-2 indicates that published guidelines are generally much wider than commuter rail agencies experience in practice, especially compared to older and larger legacy systems. This is believed to be due to guidelines being used principally for new start-up systems, where the main travel market to be served is the suburb-to-center city work commute trip. The guidelines are mostly presented as ranges from two miles to up to ten miles.

Table 3-2. Selected Guidelines Age on Commuter Rail Spacing

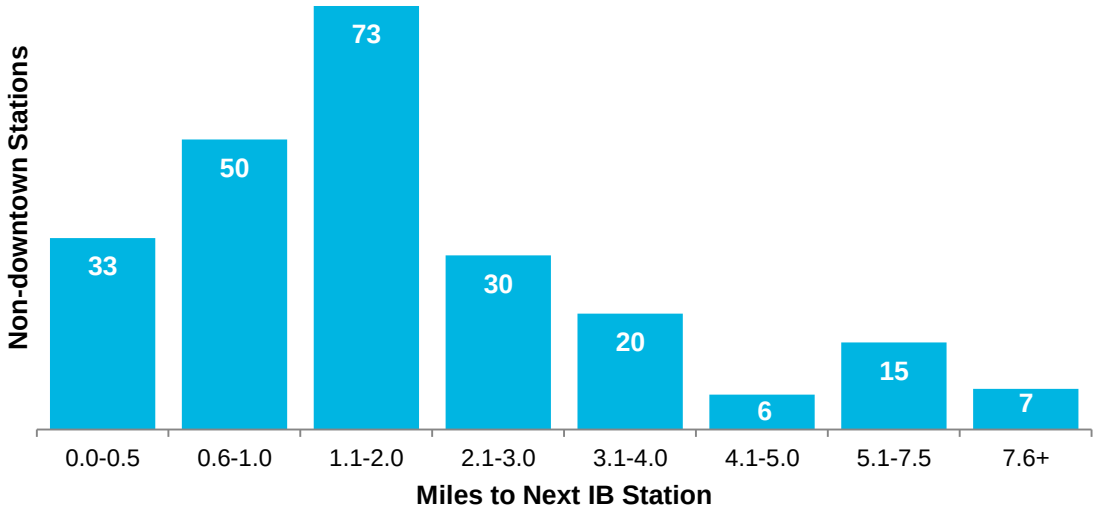
Report	Sponsoring Agency	Published	Spacing in Miles
Wisconsin Urban Rail Transit Technology Alternatives	State of Wisconsin Reference Bureau	1998	3 to 6
New Hartford Springfield Commuter Rail Implementation Plan	Connecticut DOT	2004	5
Circle Line Alternatives Analysis	Chicago Transit Authority	2006	3 to 7
Transit Service Design Guidelines	Virginia Department of Rail & Public Transportation	2008	5 to 10
Planning for Transit-Supportive Development	FTA Research	2014	2 to 5
Understanding the Range of Transit Choices	Florida Department of Transportation	2015	2 to 8
Regional Transit Guidelines	Metropolitan Council (Twin Cities Region)	2016	5 to 7

4. Metra Practice

The Metra system includes 241 stations, including five downtown stations. For the purpose of this analysis, two stations that serve more than one line were treated as single stations (i.e., Joliet-RID/HC and Clybourn-UP-N&NW). As a result, the following is based on 234 stations. This count does not include the Romeoville Station on the Heritage Corridor Line, which opened in February 2018.

Figure 4-1 shows the distribution of stations by range of miles to the next inbound station. Eighty-three stations (35 percent of all stations) have a spacing of one mile or less. Stations between one and two miles number 73 (31 percent). The remaining one-third of stations range between 2.1 and 21.2 miles.

Figure 4-1. Metra Non-Downtown Stations by Miles to the Next Inbound Station

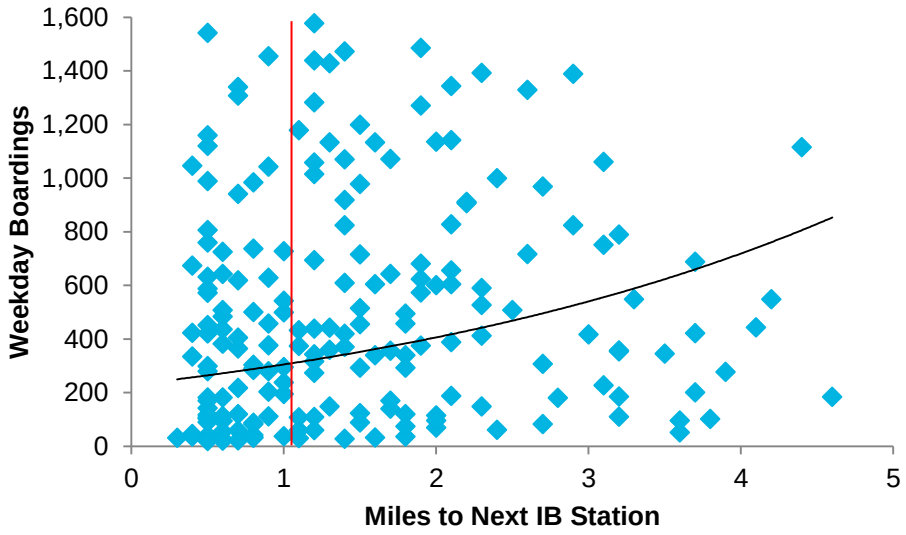


An important question related to the spacing of Metra stations is whether wider spacing translates to higher ridership. That is, when stations are spaced more closely together, does demand spread between stations such that ridership at an individual station is lower?

Figure 4-2 is a scatter plot of boardings by distance to inbound station. The vertical red line represents the 1.3-mile mark—the distance between the proposed Niles station site and the Edgebrook station. At this spacing, boardings range from below 50 to over 2,000. The median weekday boardings for stations between 1.1 and 1.5 miles from the next inbound station is 526.

This scatterplot illustrates that as spacing increases, so do boardings, but the correlation is very weak. In order to find a stronger correlation between spacing and ridership, over 25 scatterplot analyses were carried out using different subcategories such as travel time to downtown, location, station type, service levels, parking capacity, etc. None of these yielded a strong correlation, which indicates that spacing on its own cannot cause high or low ridership—multiple other factors influence station performance and may vary by station spacing.

Figure 4-2. Station Boardings by Distance to Next Inbound Station



Another way of considering the issue of appropriate spacing for a new infill station is examining Metra's experience in adding stations. Table 4-1 lists the 32 stations added to the system since 1983. Stations included new infill stations, stations on new lines/extensions, and consolidations. Stations are listed in rank order of the gap in miles that was filled by the station. A Niles station would fill the gap between Morton Grove and Edgebrook, a distance of 2.7 miles. This distance would be on the closer end of the range of new stations. Table 4-1 also includes weekday boardings, which indicates a wide range of performance. The range in boardings includes two of the most lightly used stations (Manhattan with 22 boardings and Laraway Road with 24) as well at the single busiest station on the Metra network outside of downtown Chicago (i.e., Route 59 with 5,781 boardings).

Table 4-1. New Metra Stations since 1983

Station	Line	Mile Post	Opening Year	Gap Filled (miles)	2016 Boardings
Palos Heights	SWS	19.2	2004	2.1	238
Rosemont	NCS	15.6	2006	2.3	35
Schiller Park	NCS	14.8	2006	2.6	36
Elburn	UP-W	43.6	2006	2.7	307
Lake Cook Road	MD-N	23.0	1996	3.1	1,271
Big Timber Road	MD-W	39.8	1986	3.2	789
Belmont Ave./Franklin Park	NCS	13.0	2006	3.4	32
Prairie View	NCS	31.6	1996	3.5	388
Glen of North Glenview	MD-N	18.8	2001	3.7	1,070
Round Lake Beach	NCS	45.9	1996	4.3	115
Buffalo Grove	NCS	29.5	1996	4.4	590
Hickory Creek	RID	27.5	1993	4.5	999
Antioch	NCS	52.8	1996	4.6	184
Pingree Road	UP-NW	41.7	2005	4.6	751
Grand/Cicero	MD-W	6.5	2006	4.8	96
Manhattan	SWS	40.8	2006	5.0	22
Washington St./Grayslake	NCS	43.9	2006	5.2	110
Orland Park, 153rd St.	SWS	25.2	1990	5.3	604
Vernon Hills	NCS	33.0	1996	5.3	370
Prairie Crossing/Libertyville	MD-N	39.2	2004	5.5	422
Wheeling	NCS	27.2	1996	5.5	353
Lake Villa	NCS	48.2	1996	6.9	148
Prairie Crossing/Libertyville	NCS	40.7	1996	7.0	102
Romeoville	HC	29.2	2018	7.6	n/a
Mundelein	NCS	36.9	1996	7.7	277
La Fox	UP-W	40.9	2006	8.1	276
O'Hare Transfer	NCS	17.1	1996	8.4	123
Route 59	BNSF	31.6	1989	9.0	5,781
35th St.	RID	3.1	2011	9.8	227
Prospect Heights	NCS	24.0	1996	10.1	266
Orland Park, 179th St.	SWS	28.9	1995	10.6	201
Laraway Road	SWS	35.8	2006	11.9	24

5. Conclusions Applied to Niles

This review concludes that based on the resultant spacing of a Niles station alone, there is no reason that this initiative cannot be considered. The factors leading to this conclusion includes the following:

- The addition of another station on the MD-N line will result in increased travel times for some current upstream riders due to the dwell time required at the station for each stop (approximately two minutes). These impacts will need to be carefully evaluated, and considered in the context of new Metra riders that the station could attract.
- The availability of parking is an important component provided at Metra stations, and needs to be included in the Niles station design plans. But accommodations for walk access and egress can also be an important consideration in attracting ridership to the station. This walkability goes hand-in-hand with developing the station area to maximize the use of transit. Further, opportunities to create destinations that would be accessible by commuter rail should be fully explored. The success of the Lake Cook Road Shuttle Bug program offers evidence that station area workers are willing to use connecting bus service.
- The experience of larger, legacy commuter rail systems shows comparative close spacing of stations, many with averages falling below three miles.
- Published guidelines suggest that commuter rail stations should be comparatively widely spaced (e.g., more than 3 miles). This would be a reasonable parameter to follow if a downtown-destined service were being developed from scratch. But for the Niles situation, where parking is constrained at nearby stations and the opportunity to serve destinations is present, the consideration for a more closely spaced station appears viable.
- Metra average spacing is two miles, including 83 stations within one mile of the next inbound station. Importantly, there is not a clear correlation that closer spacing results in lower station ridership.
- New stations that have been added to the Metra network have filled gaps ranging from 2.1 to 11.9 miles, and there has not been an obvious effect on performance related to the distance between stations that were filled.

In sum, while station spacing can be an important element to the success of a potential commuter rail station and guidelines generally recommend wider spacing than the expected 1.3 miles at the potential Niles station, this analysis shows that spacing alone does not determine ridership performance. Service levels, station amenities, and the size of the potential ridership market are likely to be deciding factors in the feasibility of an infill station between Morton Grove and Edgebrook.

AECOM
303 East Wacker Drive
Suite 1400
Chicago, IL 60601