CTA Bus Slow Zone Study
Final Project Report
CTA Route #66
Chicago Avenue

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Chicago Transit Authority
Chicago Department of Transportation

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1 INTRODUCTION

The Chicago Department of Transportation (CDOT) and the Chicago Transit Authority (CTA) have identified the 79th Street corridor as a bus slow zone and are collaborating in an effort to improve CTA bus speed, travel time and reliability along this corridor. See Exhibit A for the project location map. The study is funded through a Community Planning Grant administered by the Regional Transportation Authority (RTA).

The Chicago Avenue Slow Zone study area is an east-west corridor located in the central and eastern part of the City of Chicago. The #66 Chicago CTA bus serves the Chicago Avenue corridor, see Exhibit B for the bus route map. The #66 serves Chicago Avenue from Austin Avenue to Fairbank Court. At Fairbanks Court, the #66 proceeds south and serves Navy Pier at Illinois Street and Grand Avenue before it returns back north to Chicago Avenue. The Chicago Avenue Slow Zone area includes three individual intersections and one segment:

1. Western Avenue
2. Ogden Avenue-Milwaukee Avenue
3. Larrabee Street
4. Franklin Street to Fairbanks Court

The stretch of Chicago Avenue being examined extends from the West Town community at Western Avenue to the Near North Side at Fairbanks Court. Along that stretch, Chicago Avenue passes through the highly populous neighborhoods of River North and Streeterville as well as the tourist attracting Magnificent Mile along Michigan Avenue. Except for a segment between Clark Street and Michigan Avenue, Chicago Avenue is a four-lane road with on-street parking along the entire length of the study limits. Western Avenue intersects Chicago Avenue with four lanes. The intersection at Ogden Avenue/Milwaukee Avenue is a three-road triangle intersection. Chicago Avenue and Ogden Avenue consist of four lanes while Milwaukee Avenue is made up of two lanes with separate bikes lanes traveling northwest and southeast. Larrabee Street is a one-lane one-way street south of Chicago Avenue and transitions to a two-lane two-way street north of Chicago Avenue. The stretch of Chicago Avenue from Franklin Street to Fairbanks Court is just over three-quarter miles long and intersects with many high pedestrian and traffic volume roads such as Michigan Avenue (Magnificent Mile).

The main CTA bus that serves this corridor is the #66 bus. The #66 serves Chicago Avenue from Austin Avenue to Fairbank Court. At Fairbanks Court, the #66 proceeds south and serves Navy Pier at Illinois Street and Grand Avenue before it returns back north to Chicago Avenue.

This Existing Conditions Memorandum describes the data collection methodology, and the physical, travel, socioeconomic and land use characteristics of the subject corridor. The project team also conducted crash and traffic analyses for the project areas to aid in determining deficiencies and potential causes for the slowdown of CTA buses in the project area.

2 DATA COLLECTION

The project team made a comprehensive effort to collect all the data necessary to complete this CTA Bus Slow Zone Memorandum. The data collected for this memorandum included: traffic (vehicle, pedestrian and bicycle) volume data, existing signal timing sheets, field observations, socioeconomic and land use data, and crash data.

The traffic volume data for the Synchro analysis was compiled from various sources. Recent traffic counts (2010 or newer) were either obtained from previous studies completed by the project teams, or conducted in 2017 for the bus slow zone study.

Existing signal timings were obtained from CDOT. The implementation dates of each of the intersection signal timings are shown in Table 1 below.

Table 1: Existing Signal Timing Implementation Dates

Location	Date
Chicago - Western	2/21/2017
Chicago - Milwaukee	8/5/2011
Chicago - Ogden	8/5/2011
Milwaukee - Ogden	8/5/2011
Chicago - Larrabee	8/6/2012
Chicago - Franklin	3/23/2012
Chicago - Wells	9/15/2015
Chicago - Lasalle	9/29/2011
Chicago - Clark	2/23/2012
Chicago - Dearborn	6/28/2011
Chicago - State	2/16/2012
Chicago - Wabash	2/16/2012
Chicago - Rush	4/4/2012
Chicago - Michigan	9/23/2016
Chicago - Mies Van Der Rohe	11/8/2011
Chicago - Fairbanks	1/30/2009

Field observations were conducted at all the intersections in the project area between May 31st and June 7th of 2017. Field observations for the physical characteristics were conducted during the off peak hours and field observations for the travel characteristics were conducted during the weekday peak periods.

Land use and demographic information such as population, the number of households and employment were provided by the Chicago Metropolitan Agency for Planning (CMAP), and were filtered to the areas surrounding the project area. CMAP used Census data to develop 2040 demographic forecast (Population of Households, Number of Households and Employment). These demographic forecasts are based on mathematical modeling techniques that use current population and land use trends to model how the distribution of population and employment would change in response to different planning strategies.

Five years (2010-2014) of crash data for the study area was provided by CDOT. The analyzed data includes date, time, driving direction, weather, roadway surface type, crash severity based on the type of injuries/deaths, crash type, and lighting condition. Crash data was provided in the form of Excel spreadsheets where each crash was categorized by the above-mentioned criteria.

3 EXISTING CONDITIONS

3.1 Physical Characteristics

Chicago Avenue is urban roadway facility and is functionally classified as a Minor Arterial. Between Western Avenue and Fairbanks Court, Chicago Avenue is a four-lane roadway with street lighting, sidewalks, and curb and gutters (two lanes each direction) except between Clark Street and Michigan Avenue and at the Chicago River bridge where the roadway reduces to one travel lane in each direction. There is a painted center median with turn lanes and on-street parking is permitted at intermittent locations. See Exhibit C for the corridors physical characteristics.

There is access to the CTA Blue Line subway station at Milwaukee Avenue near the Ogden Avenue-Milwaukee Avenue intersection triangle. Access to the CTA Brown Line elevated station is provided at the Franklin Street intersection and access to the CTA Red Line subway station is provided at the State Street intersection. There are numerous CTA bus connections and a robust pedestrian traffic area at these locations. Chicago Avenue between State Street and Fairbanks Court is highly urbanized and densely populated. Its proximity to Michigan Avenue makes it a tourist destination with many shops, hotels and restaurants that result in a number of drop-offs and pickups along Chicago Avenue. Northwest Memorial Hospital is located off Chicago Avenue just east of Michigan Avenue and makes it a primary route for patients, staff, visitors and emergency vehicles traveling to and from to the hospital.

The site visits in the project areas along Chicago Avenue consisted of checking the following parameters:

1. Lane widths and lane configuration
2. Existing traffic signal heads
3. Bus stop locations.
4. Accessibility of sidewalk ramps.
5. Signage for parking, standing and loading zones.

Key findings of the physical characteristics of each of the studied intersections at Chicago Avenue are summarized below:

3.1.1 Western Avenue

Figure 1: Northwest Corner of Chicago - Western Bus Stop

Chicago Avenue and Western Avenue are both four-lane roadways. Western Avenue has a functional classification as an Other Principal Arterial. The bus stops of concern are located on the north curb west of the intersection and at the southwest corner. The southwest corner bus stop has a shelter and a 4.5 foot wide sidewalk behind the shelter. Free parking is available on Chicago Avenue west of the intersection while pay to park is located east of Western Avenue. See exhibit C-1 for more detailed physical characteristics.

3.1.2 Ogden Avenue / Milwaukee Avenue

Figure 2: North Curb Bus Stop and Shelter between Milwaukee and Ogden

Chicago Avenue, Ogden Avenue and Milwaukee Avenue intersect at three closely spaced intersections that form a triangle. Ogden Avenue is a four-lane northeast-southwest roadway; Milwaukee Avenue is a two-lane northwest-southeast roadway; and Chicago Avenue is a four-lane east-west roadway. Both Ogden Avenue and Milwaukee Avenue are functionally classified as Major Collectors. The bus stops of concern are located on the southwest corner of Chicago Avenue and Milwaukee Avenue (5” curb), on the north curb of Chicago Avenue between Milwaukee Avenue and May Street (3” curb) and the southwest corner of Chicago Avenue and Carpenter Street (6” curb). The two bus stops east of Milwaukee Avenue have bus shelters. The two bus stops west of Ogden Avenue also are near stairwell entrances to the CTA Blue Line station. Pay-to-park is available on Chicago Avenue west of Milwaukee Avenue and with multiple parking restrictions east of Ogden Avenue. See exhibit C-2 for more detailed physical characteristics.

3.1.3 Larrabee Street

Larrabee Street is a two-way street north of Chicago Avenue and one-way northbound south of the intersection. Larrabee Street is functionally classified as a Major Collector north of the intersection and a local street south of Chicago Avenue. The bus stops are located near-side for westbound traffic and far-side for eastbound traffic. Both bus stops have shelters. The eastbound bus stop has a 5-foot wide sidewalk behind the shelter. Parking is not allowed west of the intersection but pay to park is available east of Larrabee Street on both sides of the street. The east leg has a significantly long diagonal crosswalk due to the offset of the intersection. The offset south approach creates safety concern. See exhibit C-3 for more detailed physical characteristics.

Figure 3: Northeast Corner of Chicago - Larrabee Bus Stop and Shelter

3.1.4 Franklin Street to Fairbanks Court

Figure 4: Northeast Corner of Chicago - Franklin Bus Stop and Shelter

Franklin Street is a two-lane roadway and has the CTA Brown Line travel above it south of Chicago Avenue. The intersection has curb bump outs for the northwest and southwest corners due to the CTA Brown Line columns. Entrances to the Brown Line are located east and west of the intersection on the south curb. Franklin Street is functionally classified as a local roadway. The bus stops being reviewed are located near-side for both eastbound and westbound directions. The westbound near-side bus stop has a shelter. Chicago Avenue has various pay-to-park and loading zones on both curbs on either side of Franklin Street. See exhibit C-4 for more detailed physical characteristics.

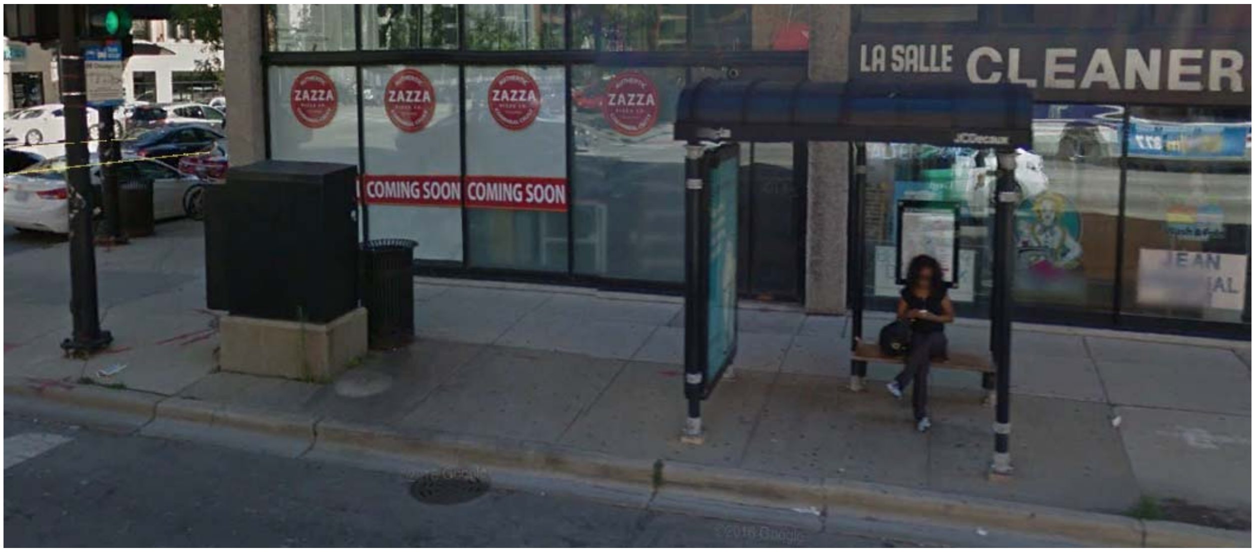

Figure 5: Southwest Corner Chicago - LaSalle Bus Stop and Shelter

LaSalle Street is four-lane roadway and is functionally classified as an Other Principal Arterial. The bus stops of concern are located near-side for eastbound traffic and far-side for westbound traffic. The eastbound near-side bus stop has a shelter. Pay-to-park is available west of the intersection on both curbs of Chicago Avenue and a combination of pay to park and no parking zones east of LaSalle Street. See exhibit C-5 for more detailed physical characteristics.

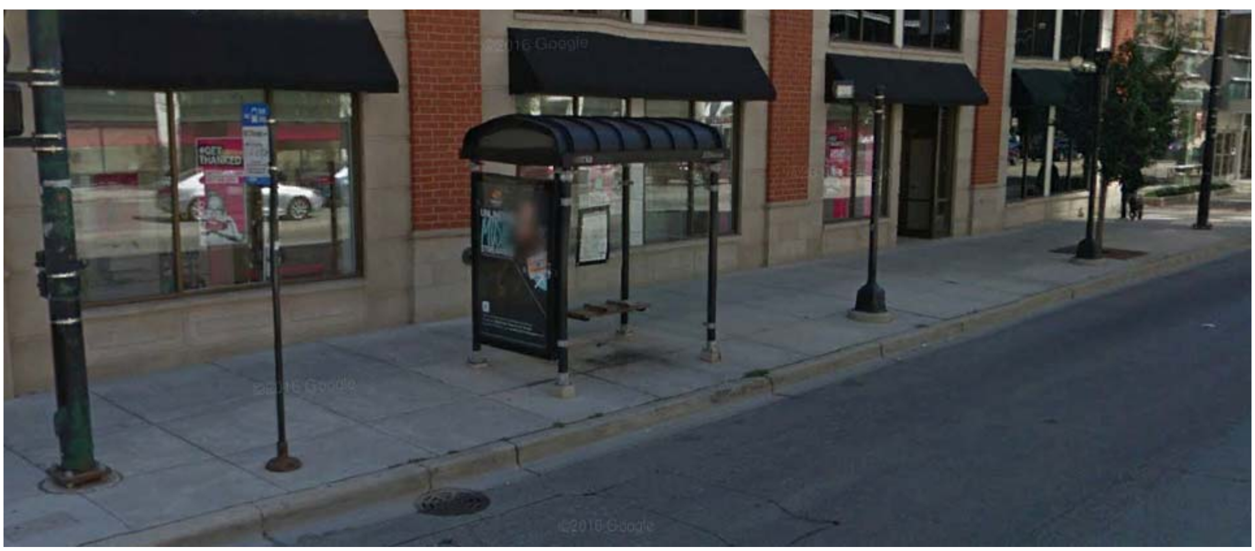

Figure 6: Northeast Corner of Chicago - Clark Bus Stop and Shelter

Clark Street and Dearborn Street are both three-lane one-way roadways forming a one-way pair. Both roadways are functionally classified as Major Collectors. Clark Street has southbound traffic and Dearborn Street has northbound traffic. The Clark Street bus stops are located near-side for both eastbound and westbound traffic, and both bus stops have shelters. The Dearborn Street has a shelter on the northeast corner but the bus stop is no longer in use. There is a combination of pay-to-park and no parking zones n both curbs between Clark Street and Dearborn Street. See exhibit C-6 for more detailed physical characteristics.

Figure 7: Northeast Corner of Chicago - State Bus Stop and Shelter

State Street is a two-lane roadway and is functionally classified as a Major Collector. The bus stops are both east of the intersection and are near stairwells for the CTA Red Line subway station. The north curb bus stop includes a shelter. There is also a bus shelter on the southeast corner but the bus stop in no longer in use. There is a combination of pay-to-park and no parking zones between Dearborn Street and Wabash Avenue on Chicago Avenue. See exhibit C-7 for more detailed physical characteristics.

Wabash Avenue is a one-way southbound roadway functionally classified as a Major Collector south of Chicago Avenue and two-way local road north of the intersection. Rush Street is one-way northbound local road. Both Wabash Avenue and Rush Street have existing bus shelters on the northeast and southeast corners, respectively, but these shelters are no longer in use. Pay-to-park is available on both curbs of Chicago Avenue between Wabash Avenue and Rush Street with some peak hour restrictions. The east and west approaches at Rush Street and Chicago Avenue have significantly long diagonal crosswalks due to the skew of the north leg the intersection. See exhibit C-8 for more detailed physical characteristics.

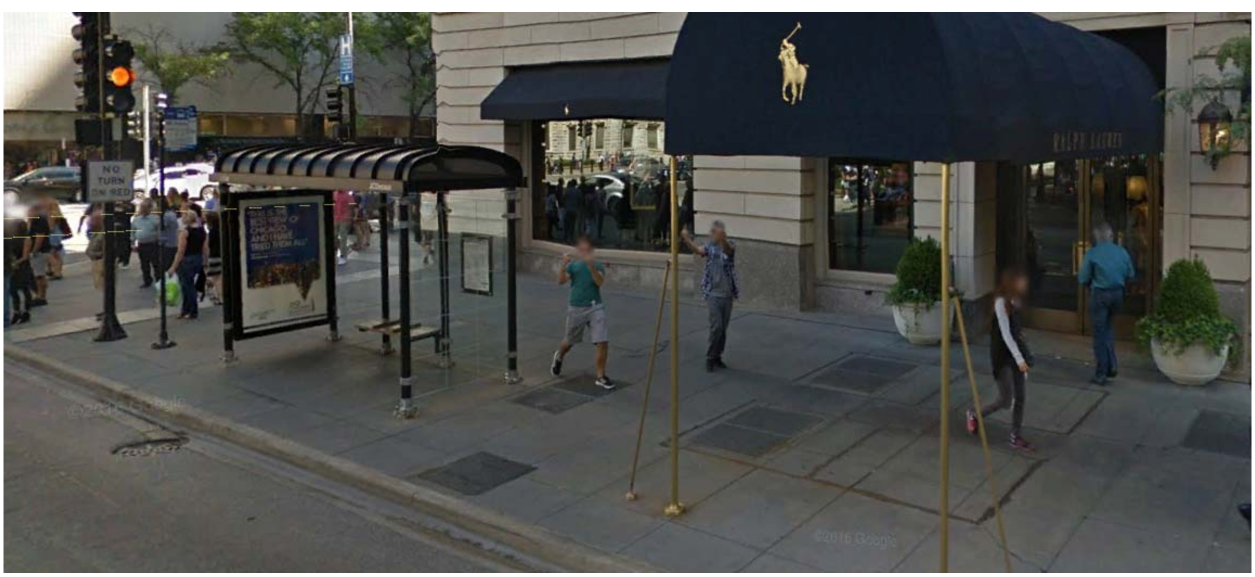

Figure 8: Southwest Corner of Chicago - Michigan Bus Stop and Shelter

Michigan Avenue is a six-lane roadway and is functionally classified as an Other Principal Arterial. The bus stops are located near-side for eastbound traffic and far-side for westbound traffic. Each bus stop has a bus shelter. Tower Court is located just west of Michigan Avenue and limits the length of the bus stop on the northwest corner. There are parking restrictions on both curbs of Chicago Avenue between Rush Street and Michigan Avenue. Similarly, parking is not allowed on the north curb of Chicago Avenue between Michigan Avenue and Mies Van Der Rohe Way, and a combination of loading and no parking zones on the south curb. See exhibit C-9 for more detailed physical characteristics.

Figure 9: Southwest Corner of Chicago - Mies Van Der Rohe Bus Stop and Shelter

Mies Van Der Rohe Way is a two-way local road and forms the north leg of a T-intersection with Chicago Avenue. The bus stops are located on the northeast corner and west of the intersection on the south curb. Both bus stops include a bus shelter. Similarly, Fairbanks Court is a two-way Major Collector and forms the south leg of a T-intersection with Chicago Avenue. The Fairbanks Court bus stop is located on the southwest corner and includes a shelter as well. No parking is allowed on either curb of Chicago Avenue between Mies Van Der Rohe Way and Fairbanks Court.

3.2 Travel Characteristics

The project team conducted field visits at the project areas along Chicago Avenue during the AM peak (7am – 9am) and the PM Peak (4pm – 6pm), and quantified the following every 15 minutes:

1. Wheelchair ramp deployments – number of times buses were required to use wheelchair ramp for disabled passengers during every period
2. Pickups – number of times pedestrians were picked up by non-CTA vehicles during every period
3. Drop offs – number of times pedestrians were dropped off by non-CTA vehicles during every period
4. Parking usage – number of non-CTA vehicles using curbside parking at the end of every period
5. Loading frequency – number of trucks completing loading during every period
6. Queue lengths – length of queue for approach at the end of every period

During the field visits, the project team also observed the following qualitative parameters:

1. Traffic flow
2. Infrastructure/street furniture
3. Parking/loading/pick-up/drop-off usage
4. CTA bus operations and ridership
5. Intersection operations

See Exhibit D for Travel Characteristics. The key findings of both the quantitative and qualitative parameters are summarized below:

3.2.1 Western Avenue

The buses are primarily affected by the congested conditions at the intersection. Significant queue lengths occurred for westbound traffic in the PM peak and for eastbound traffic in the AM peak. West of Western Avenue, the study team observed westbound buses skipping the bus stop one out of every four times due to lack of boarding or alighting passengers. The buses frequently lowered at the westbound stop to allow passengers to board causing some delays.

The location of the westbound bus stop should be reviewed in the future if the empty parcel in the northwest corner develops.

The parking usage varied from 11 to 17 vehicles every 15 minutes on the block west of Western Avenue and lower parking usage on the south curb of Chicago Avenue between Western Avenue and Oakley Boulevard. The study team also observed eastbound vehicles parking in the tow zone east on the intersection to go into the restaurant or use the nearby ATM. See exhibits D-1 and D-2 for more detailed travel characteristics.

3.2.2 Ogden Avenue / Milwaukee Avenue

This is a complex and busy group of intersections that also has a CTA Blue Line Station. The study team observed extended loading times for CTA buses at the eastbound bus station west of Milwaukee Avenue due to two factors: passengers experienced difficulties maneuvering around and exiting the nearby Blue Line Station stairwell; and CTA buses were observed bunching together west of May Street and loading and alighting passengers near the fire station.

For the CTA buses at the westbound bus station between May Street and Ogden Avenue, there were large volumes of boarding passengers, and similar to the eastbound bus stop, the study team observed the passengers having difficulties maneuvering around and exiting the nearby Blue Line Station stairwell as well. The westbound bus stop often received two buses simultaneously. Buses were frequently too full to accommodate everyone that was waiting at westbound stop between Milwaukee Avenue and Ogden Avenue.

The heavy westbound to southwest bound left turn movement from Chicago Avenue onto Ogden Avenue caused queuing and delays in the westbound direction.

Infrequent parking usage was observed on both the north and south curbs of Chicago. Some drop-offs were observed on the north curb of Chicago Avenue east of Ogden Avenue. Due to high traffic volumes, large queue lengths were observed (> 600 ft) for westbound traffic on Chicago Avenue during the PM peak and caused delay for CTA buses. Pedestrians and cyclists often disobeyed traffic signals and caused delays for all vehicles. An average queue length of 286 feet was observed for the AM peak for eastbound traffic on Chicago Avenue west of Milwaukee Avenue.

See exhibits D-3, D4 and D-5 for more detailed travel characteristics.

Note: The south curb lane of Chicago Avenue between Carpenter Street and Sangamon Street was closed due to construction during the field visits. The lane closure caused additional eastbound queue lengths.

3.2.3 Larrabee Street

Extremely long queues for eastbound traffic at Larrabee Street consistently backed up onto the Chicago River Bridge and caused delays for CTA buses. There was often not enough green arrow time for the eastbound to northbound left turn movement. Buses were observed bunching and frequently lowering the bus for all passengers.

The intersection has a split phase due to the offset south approach. The split phase is inefficient and causes delay at the intersection.

There were few passenger vehicle curbside activities (drop-offs, pick-ups, parking usage, etc.) on Chicago Avenue near Larrabee Street. Most drop-offs and pick-ups were observed on Larrabee Street north of the intersection near the 600 West Chicago Avenue building. Vehicles making this westbound to northbound right turn often impacted westbound buses as they queued in the westbound curbside lane in the bus stop. Westbound queues in the PM peak occupied most of the segment between Larrabee Street and Kingsbury Street on Chicago Avenue. See exhibits D-6, D7 and D-8 for more detailed travel characteristics.

3.2.4 Franklin Street to Fairbanks Court

The study team observed frequent eastbound and westbound bus bunching at Franklin Street. Non-CTA vehicles using the loading zone near the southwest corner of Franklin Street were observed hindering CTA buses trying to enter traffic from the bus stop west of the loading zone. Pedestrians were observed crossing Chicago Avenue between Franklin Street and Orleans Street and caused delays for traffic. All queue lengths were larger during the PM peak between Franklin Street and LaSalle Street.

Southbound LaSalle Street traffic consistently backed up into Chicago Avenue during the AM peak blocking eastbound traffic and caused delays for CTA buses. See exhibits D-9, D10 and D-11 for more detailed travel characteristics

Large queue lengths were observed for westbound traffic at Clark Street during the PM peak. Very little passenger vehicle movement other than thru traffic was observed on Chicago Avenue between LaSalle Street and Dearborn Street. See exhibits D-12 and D-13 for more detailed travel characteristics.

At State Street, the westbound queue lengths filled the entire block on Chicago Avenue for both peak periods. Despite parking restrictions, several McDonald’s customers and delivery trucks used the westbound curbside lane near State Street. These vehicles often impeded westbound CTA buses. The study team also observed westbound CTA buses between Dearborn Street and Wabash Avenue experience bunching as multiple buses would arrive simultaneously. Chicago Police Department vehicles were observed parking in eastbound and westbound curbside lanes between Dearborn Street and Wabash Avenue, causing CTA bus delays. See exhibits D-14 and D-15 for more detailed travel characteristics.

At Rush Street, the westbound queue lengths consistently filled the entire segment between Rush Street and Michigan Avenue for both peak periods. In addition to this congestion, backups from westbound to northbound right turning non-CTA vehicles at Michigan Avenue and large boarding volumes at the Michigan Avenue bus stop caused delays for westbound CTA buses. Large pedestrian volumes were observed on all crosswalks at the Michigan Avenue intersection. Specifically, the pedestrians using the south approach crosswalk caused delays to eastbound CTA buses due to the queue of right turning non-CTA vehicles. See exhibits D-16 and D-17 for more detailed travel characteristics.

The study team observed frequent drop-offs and pick-ups at the Consulate parking area and in front of the American Dental Association building on the south curb of Chicago Avenue between Michigan Avenue and Mies Van Der Rohe Way. However, these irregular movements did not appear to slow down eastbound bus traffic on Chicago Avenue. See exhibit D-18 for more detailed travel characteristics.

3.3 Bus Ridership and Travel Times

The Chicago Transit Authority (CTA) provided arrival and departure time data and ridership data for the locations included in this study. Arrival and departure time data was provided for May 24th 2016 and ridership data was provided for weekdays during October 2016.

The arrival and departure time data was used to develop bus speeds through the slow zone as well as speeds along Chicago Avenue between the slow zones. This data confirmed that buses running through the CTA selected slow zones were indeed running at a slower speed when compared to the speeds between the slow zones. Speeds through the Franklin Street to Fairbanks Court segment were generally lower than speeds at other slow zone locations. This is possibly due to the amount of parking and the high ridership along the segment. Dwell Time was roughly correlated with the amount of passengers boarding and alighting at each stop. The location of the stop, near-side vs far-side, did not have a major impact on the dwell time.

Ridership data provided insight into the usage of Route #66 buses. As anticipated, boarding and alighting counts were highest at the Blue Line Station (Milwaukee Avenue – Ogden Avenue), a major CTA ‘L’ Train connection. The Franklin Street stop, which is a connection to the Brown Line and Purple Line CTA “L” Train stops, also had high boarding and alighting counts. Volumes for boarding and alighting in the EB and WB direction show some correlation suggesting that the Route #66 bus passengers are returning to their AM departure stop in the PM. This trend did not apply to the WB AM Alighting and WB PM boarding at the Larrabee Street stop, suggesting that AM commuters to this stop are taking other forms of transportation home in the evening. A similar situation occurred, to a lesser extent, for EB AM Alighting and WB PM boarding at the Franklin Street stop.

Table 2: Eastbound Chicago Avenue Travel Speeds, Dwell Times, Boarding and Alighting

	Average Speed through Intersection (MPH)	Minimum Speed through Intersection (MPH)	Maximum Speed through Intersection (MPH)	Average Dwell Time (Sec)	Average Peak Boarding	Average Peak Alighting	Average Speed Between Slow Zones (MPH)
	Western – Near-side (Campbell to Oakley)						
EB AM	4.9	3	11	28	97	44	7.5
EB PM	5.8	4	9	20	54	46	9.0
	Milwaukee/Ogden – Near-side (Milwaukee to Sangamon)						
EB AM	4.83	3	11	73	390	402	9.9
EB PM	6.9	4	13	31	82	69	6.3
	Larrabee – Far-side (Halsted to Hudson)						
EB AM	6.3	4	13	11	60	160	15.3
EB PM	6.5	4	12	20	94	25	14.3
	Franklin – Near-side (Orleans to LaSalle)						
EB AM	4.7	3	8	18	67	301	4.7
EB PM	4.1	2	8	20	47	122	5.0
	State – Far-side (Clark to Wabash)						
EB AM	4.2	3	6	22	145	197	6.0
EB PM	4.0	2	7	23	36	186	4.7
	Michigan – Near-side (Rush to Huron)						
EB AM	4.7	3	8	25	23	229	N/A
EB PM	4.3	3	6	26	29	140	N/A

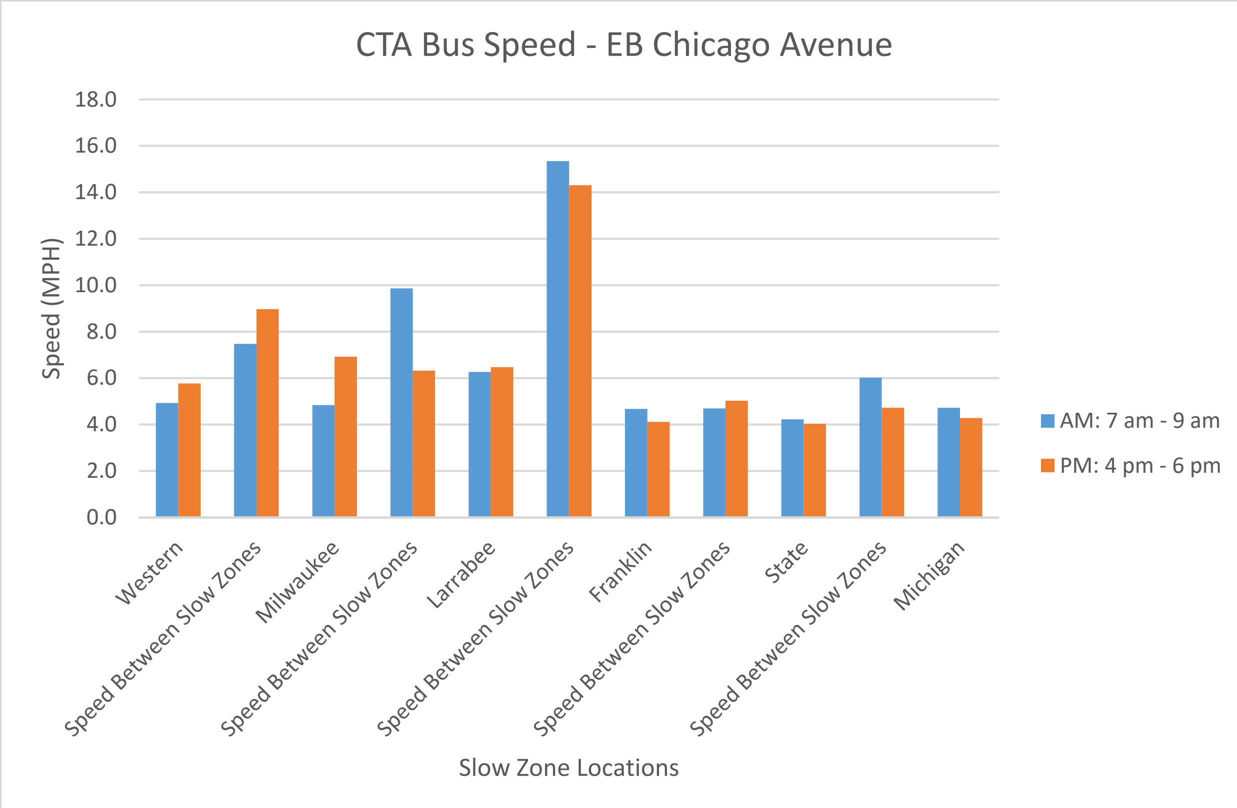

Figure 10: Eastbound Chicago Avenue Bus Speed

Table 3: Westbound Chicago Avenue Travel Speeds, Dwell Times, Boarding and Alighting

	Average Speed through Intersection (MPH)	Minimum Speed through Intersection (MPH)	Maximum Speed through Intersection (MPH)	Average Dwell Time (Sec)	Average Peak Boarding	Average Peak Alighting	Average Speed Between Slow Zones (MPH)
	Michigan – Far-side (Huron to Michigan)						
WB AM	5.9	3	12	14	128	8	11.3
WB PM	2.8	2	5	41	259	37	5.2
	State – Near-side (Wabash to Clark)						
WB AM	3.5	2	6	42	224	42	8.4
WB PM	2.8	2	5	44	221	136	5.5
	Franklin – Near-side (LaSalle to Orleans)						
WB AM	5.1	4	7	5	162	64	16.8
WB PM	4.1	2	5	37	175	62	6.4
	Larrabee – Near-side (Hudson to Halsted)						
WB AM	9.5	7	13	14	30	276	15.9
WB PM	4.3	3	6	6	134	40	11.0
	Milwaukee/Ogden – Near-side (Sangamon to May)						
WB AM	6.6	7	15	18	59	120	10.6
WB PM	2.6	2	4	68	344	452	7.7
	Western – Far-side (Oakley to Campbell)						
WB AM	10.6	11	16	10	46	36	N/A
WB PM	5.0	3	10	11	51	87	N/A

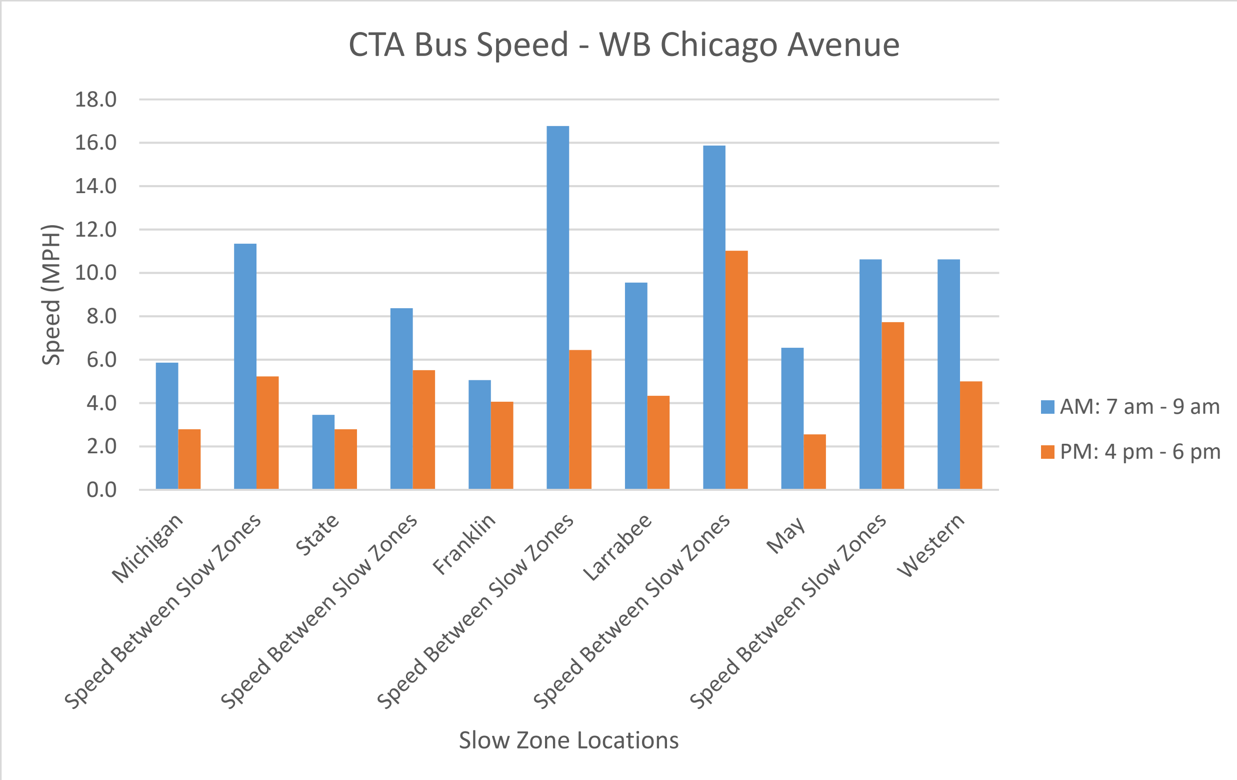

Figure 11: Westbound Chicago Avenue Bus Speed

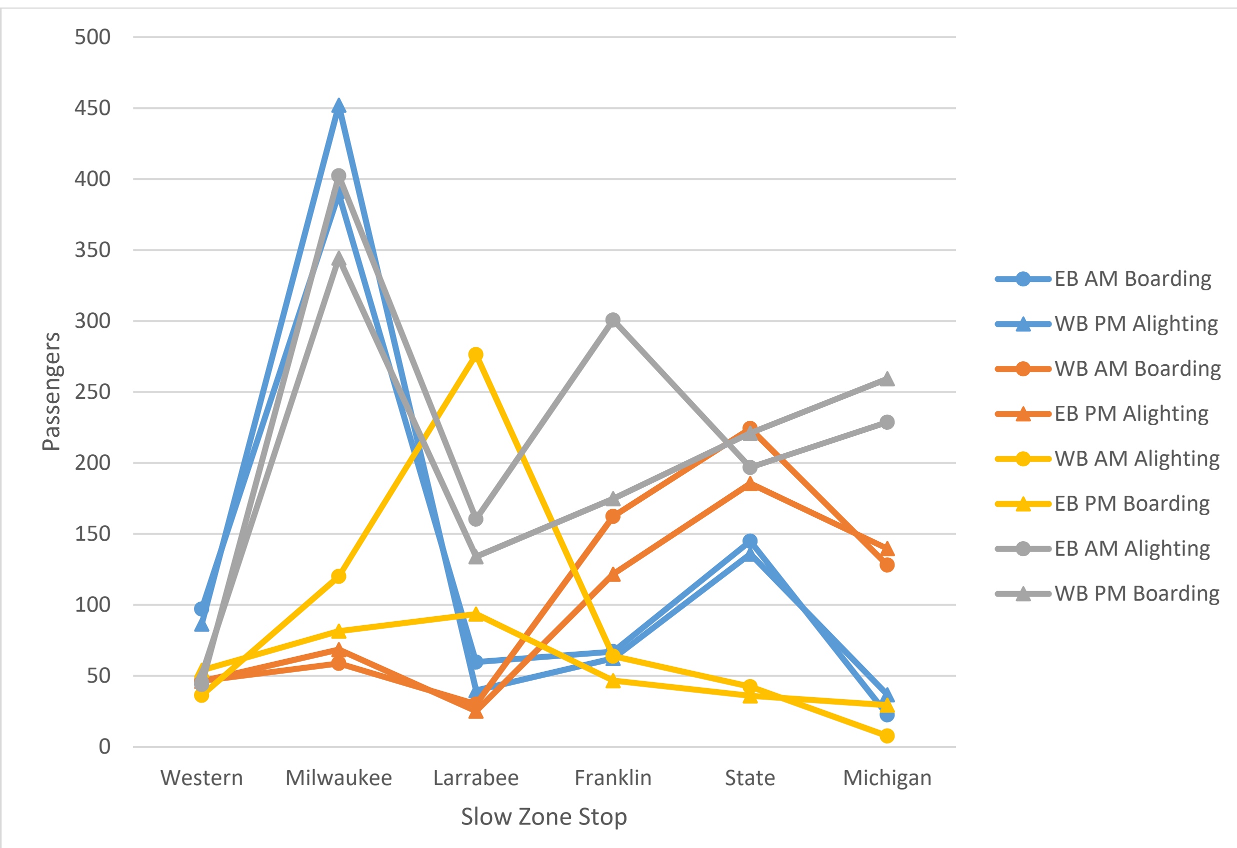

Figure 12: Chicago Avenue Boarding and Alighting

4 SOCIOECONOMIC AND LAND USE CHARACTERISTICS

The three built-environment characteristics that most influence travel behavior are population, employment and land use. Trends in population, employment, housing, socioeconomic factors provide a window into understanding growth and to help to characterize the study areas. Because a transportation network can influence where people live and work, existing and future socioeconomic factors are identified in order to address changing commuting patterns and habits of the area. Effectively integrating land use and socioeconomic factors help to define and shape priorities for a transportation system and help to ensure that land use, development patterns, transportation facilities and transportation services support and reinforce each other. See exhibit E for the socioeconomic and land use map exhibits.

4.1 Socioeconomic

Population and demographic trends have a significant impact on communities and where and how people chooses to live, work and play. It can shed light on areas where future housing and employment might take place within a community so that transportation services can be adjusted to future travel needs of the communities it serves.

In order to evaluate and recommend improvements for Bus Slow Zone corridors, it is important to understand the connections between the corridor and its surroundings in terms of the ways in which people travel around the corridor area and how they utilize the broader transportation network to access employment centers and other local attractions.

Currently, the Chicago Avenue Corridor is primarily a residential corridor at the four intersections reviewed. High population density is found at the western end near Western Avenue and at the eastern end in the segment between Franklin Street and Fairbanks Court with smaller concentrations found in the middle near the Ogden Avenue-Milwaukee Avenue intersection triangle and Larrabee Street intersection. By 2040, population is projected to rise modestly around the Western Avenue, Larrabee Avenue intersections and in the segment between Franklin Street and Fairbank Court. However, population is projected to rise sharply in the areas surrounding the Ogden Avenue/Milwaukee Avenue intersection. By 2040, employment is projected to increase in all four locations on Chicago Avenue. Employment in the area surrounding the Western Avenue and for the segment between Franklin Street and Fairbanks Court is projected to increase modestly 3.7% and 8.7%, respectively. However, higher increase in employment is projected in the area surrounding the Ogden Avenue/Milwaukee Avenue intersection triangle and Larrabee Street intersection by over 60% and 30%, respectively. See Table 4 showing current and 2040 population, household and employment statistics for each of the study intersections.

Table 4: Percent Change in Socioeconomic Forecasts

Chicago Avenue Intersection Location	Population		% Change	Households		% Change	Employment		% Change
	YR 2010	YR 2040		YR 2010	YR 2040		YR 2010	YR 2040	
Western	19,099	22,249	16.5%	9,072	10,554	16.3%	6,179	6,409	3.7%
Ogden / Milwaukee	3,843	6,758	75.9%	2,032	3,557	75.0%	3,575	5,760	61.1%
Larrabee	7,985	8,940	12.0%	5,251	6,718	27.9%	4,828	6,292	30.3%
Franklin to Fairbanks	38,654	42,609	10.2%	19,144	34,457	80.0%	95,245	103,567	8.7%

4.2 Land Use

Land use near the three intersections and one segment along the Chicago Avenue corridor was examined. Land use mix near Western Avenue intersection is comprised of residential (59%) commercial (14%), institutional (8%), industrial (6%), Transportation/Communications/Utilities (6%), recreational (5%), approximately 2% of the parcels are vacant with the remainder distributed between construction and roadway right-of-way.

Land use mix near the Ogden Avenue-Milwaukee Avenue intersection triangle is diverse. The area is comprised of residential (30%), commercial (14%), institutional (4%) and industrial (10%), approximately 6% of the parcels are vacant with 2% distributed between recreational, construction and unknown uses. Transportation facilities comprise a significant share of land use with 14% of the area near the intersection triangle used for Transportation/Communications/Utilities (TCU) and 20% used for roadway right-of-way.

Land use mix near the Chicago Avenue and Larrabee Street intersection is comprised of residential (30%), industrial (18%), commercial (17%), institutional (5%), approximately 6% of the parcels are vacant with 8% distributed between recreational, construction, and unknown uses. It should be noted 16% of the parcels are zoned for Transportation/Communication/Utilities uses due to the close proximity to the Kennedy Expressway.

The Franklin Street-to-Fairbanks Court segment includes highly developed areas. Land use mix in this area is comprised of residential (27%), commercial (36%), and institutional (17%). Approximately 2% of the parcels are vacant with 2% distributed between industrial, recreational, and construction, while 7% and 9% of the parcels used for Transportation/Communications/Utilities and roadway right-of-way respectively.

5 CRASH ANALYSIS

The crash data for the project area intersections were tabulated into analysis tables depicting crash rate, crash types, injury severity, fatalities, road surface conditions, lighting conditions, and weather conditions. The primary collision types are described in Table 5.

Table 5: Collision Type Descriptions

Collision Type	Description
Rear End	Both vehicles are traveling in same direction on same route. Lead vehicle may be going straight or turning. Lead vehicle is hit from behind by following vehicle.
Sideswipe, Same Direction	Vehicles traveling in same direction on same route, usually caused by a lane change or swerving maneuver.
Sideswipe, Opposite Direction	Vehicles traveling in opposite direction on same route (approaching each other). Usually caused by a lane change or swerving maneuver, crossing the median, if applicable.
Fixed Object	Vehicle hits a fixed object such as a median barrier, bridge pier, light pole, or tree.
Other Object	Vehicle hits an object in roadway such as material that has fallen from a lead vehicle or from an overhead structure.
Head On	Vehicle traveling in opposite direction on same route (approaching each other) and collide head on.
Overturn	Driver lost control of vehicle resulting in the vehicle overturning within or adjacent to the roadway, without hitting another vehicle or object first.
Parked Vehicle	Vehicle traveling in roadway hits a parked vehicle within or to the side of the roadway.
Animal	Vehicle traveling in roadway hits an animal crossing the roadway.
Right Angle	Vehicles traveling along crossing routes crash at right angle even if one vehicle was making a left or right turn.
Left Turn	Vehicles traveling in opposite directions on same route (approaching each other) with one vehicle turning left to the crossing route or driveway, or by a vehicle making a U-turn within a route segment.
Pedestrian	Any crash involving a vehicle traveling along the route and a pedestrian.
Bicyclist (Pedal Cyclist)	Any crash involving a vehicle traveling along the route and a bicyclist.
Other Non-Collision	Any crash resulting from conditions not described by other collision types, such as a vehicle running off the roadway into an embankment.

Crash severity is a key indicator in evaluating the current safety condition of the route. Understanding the severity of injuries allows the implementation of appropriate countermeasures to reduce the severity of crashes in the future. Table 6 depicts the crash severity categories.

Table 6: Crash Severity Descriptions

Severity	Description
Fatal	A crash in which at least one person dies within 30 days of the crash as a result of injuries sustained during the crash.
Type A (Incapacitating Injury)	Any injury, other than fatal, that prevents the injured person from walking, driving, or normally continuing the activities he/she was capable of performing before the injury occurred. Includes: severe lacerations, broken/distorted limbs, skull injuries, chest injuries and abdominal injuries.
Type B (Non-incapacitating Injury)	Any injury, other than a fatal or incapacitating injury, that is evident to observers at the scene of the crash. Includes: lumps on the head, abrasions, bruises, and minor lacerations.
Type C (Reported, injury not evident)	Any injury reported or claimed that is not listed above. Includes: momentary unconsciousness, claims of injuries not evident, limping, complaints of pain, nausea.
Property Damage	No injuries or fatalities, but damage is caused to either vehicle or other objects.

A total of 1,302 crashes occurred within the project area in the five-year study period (2010-2014), with 255 (19.6%) occurring in 2010, 264 (20.3%) in 2011, 262 (20.1%) in 2012, 271 (20.8%) in 2013, and 250 (19.2%) in 2014. A graphical representation of the major crash types for the five-year period is depicted in Figure 13. Table 7 displays the break-down of injury crashes along Chicago Avenue from 2010-2014.

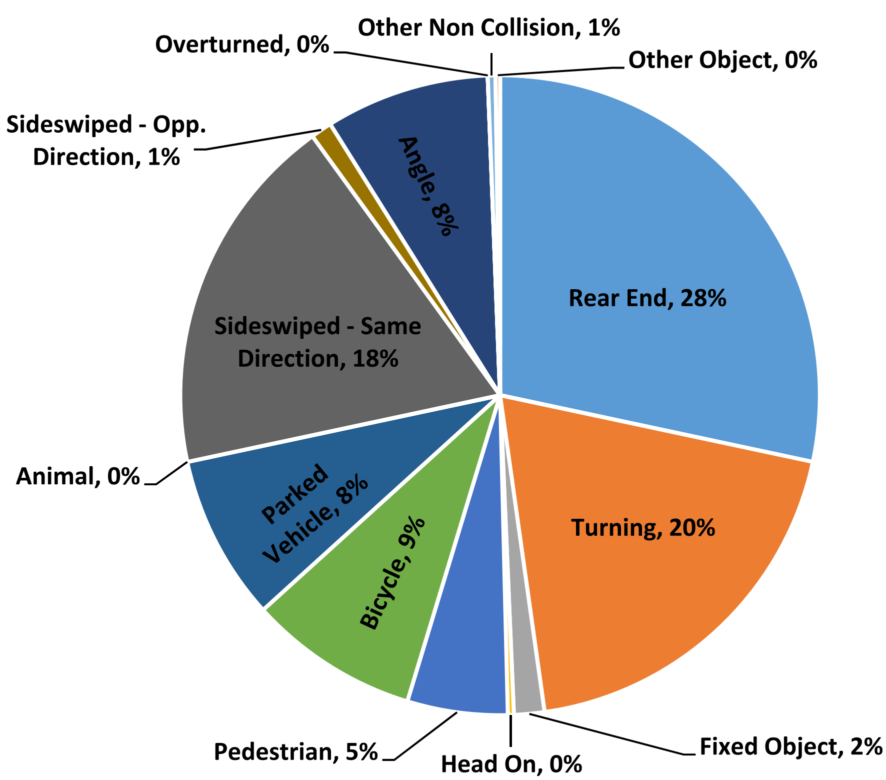

Figure 13: Total Crashes for Chicago Avenue Study Area 2010-2014

Table 7: Injury Crashes 2010-2014

Type of Injury Crash	2010	2011	2012	2013	2014	Total	Percentage of Total Crashes
Fatal Crashes	0	0	1	0	0	1	0.1
Type A Injury Crashes	4	8	12	8	8	40	3.1
Type B Injury Crashes	35	34	34	31	28	162	12.4
Type C Injury Crashes	19	20	23	29	19	110	8.4
Total Injury Crashes	**58**	**62**	**70**	**68**	**55**	**313**	**24.0**

5.1.1 Western Avenue

During the five-year analysis period, a total of 119 crashes occurred at the intersection of Chicago Avenue and Western Avenue. Figure 14 below shows the number crashes for the three most common crash types and bike and pedestrian crashes for each of the five years.

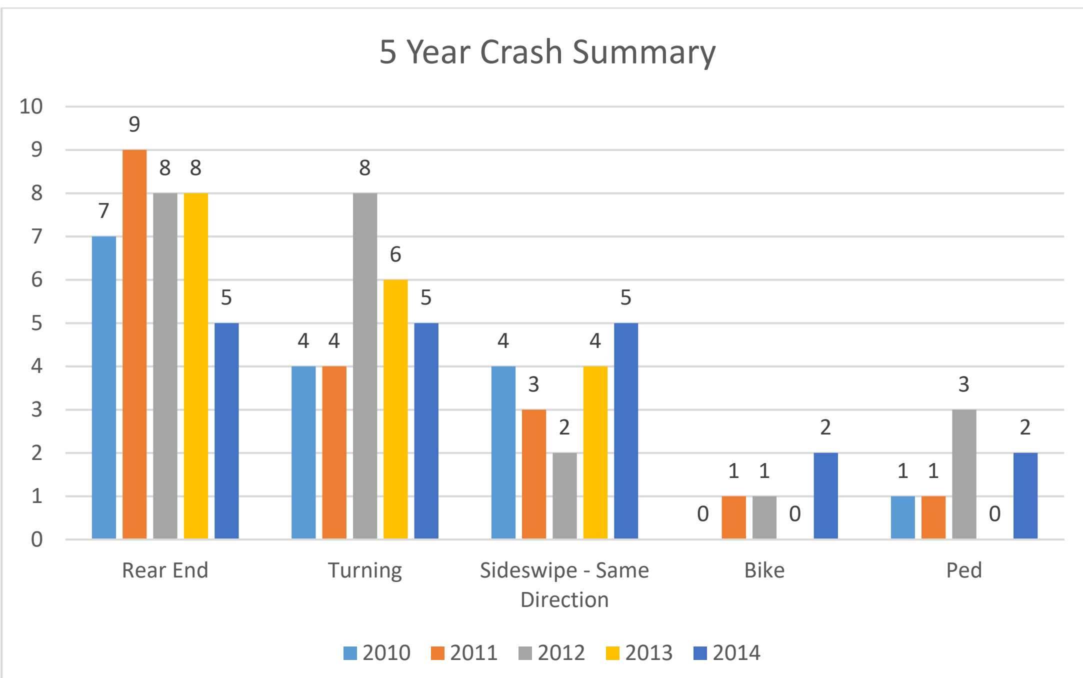

Figure 14: Crash Type Summary for Western Avenue

The most prevalent crash types were Rear-End, Turning, and Sideswipe – Same Direction, which accounted for 31 percent, 23 percent, and 15 percent of the total crashes reported, respectively. Of these 119 crashes, 15 collisions involved injuries of Type B or Type C severity. There were 4 crashes resulting in Type A injury and no crashes resulting in a fatality.

5.1.2 Ogden Avenue / Milwaukee Avenue

During the five-year analysis period, a total of 320 crashes occurred at the Chicago Avenue, Ogden Avenue, and Milwaukee Avenue intersection. Figure 15 below shows the number crashes for the two most common crash types and bike and pedestrian crashes for each of the five years.

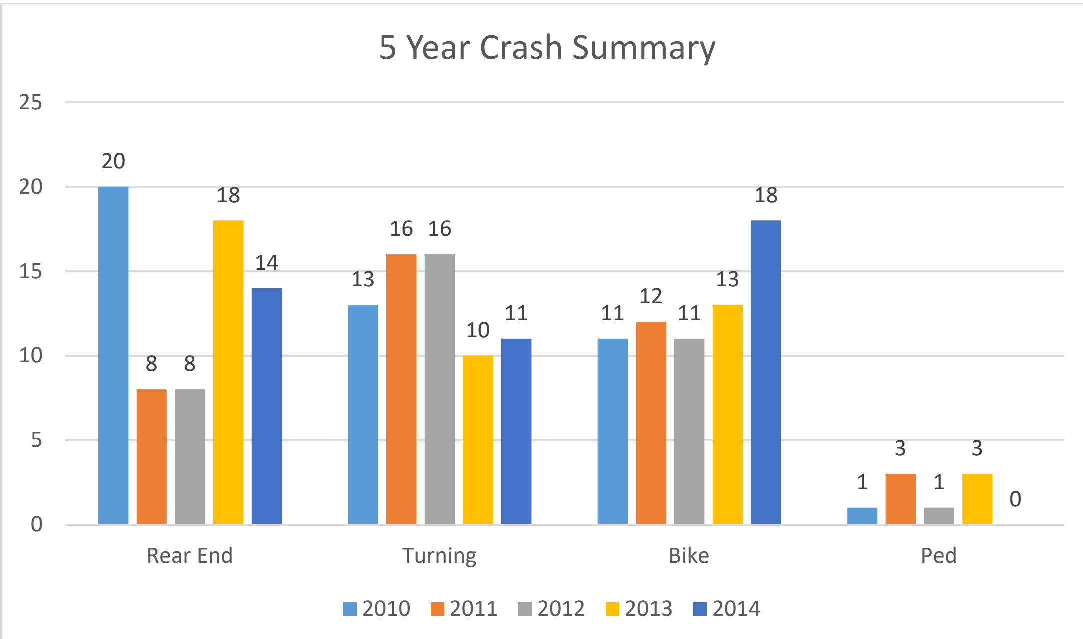

Figure 15: Crash Type Summary for Ogden Avenue / Milwaukee Avenue

The most prevalent crash types were Rear-End, Turning, and Bicycle collisions, which accounted for 21 percent, 21 percent and 20 percent of the total crashes, respectively. Of these 320 crashes, 93 collisions involved injuries of Type B or Type C severity. There was 1 fatal crash and 11 crashes that resulted in Type A injuries.

5.1.3 Larrabee Street

During the five-year analysis period, a total of 147 crashes occurred at the intersection of Chicago Avenue and Larrabee Street. Figure 16 below shows the number crashes for the three most common crash types and bike and pedestrian crashes for each of the five years.

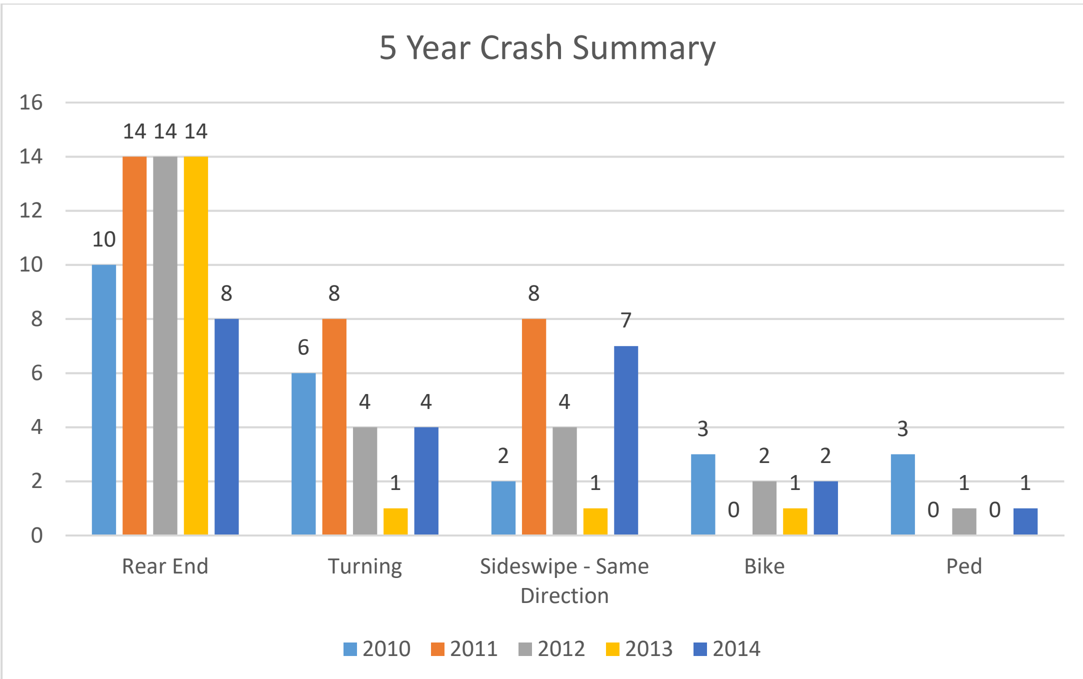

Figure 16: Crash Type Summary for Larrabee Street

The most prevalent crash types were Rear End, Turning, and Sideswipe – Same Direction. which accounted for 41 percent, 16 percent, and 15 percent of the total crashes reported, respectively. Of the 147 crashes, 24 of them involved injuries of Type B and C severity. There were no fatal crashes but 8 crash resulted in Type A injuries.

5.1.4 Franklin Street to Fairbanks Court

During the five-year analysis period, a total of 716 crashes occurred on Chicago Avenue from Franklin Street to Fairbanks Court. Figure 17 below shows the number crashes for the three most common crash types and bike and pedestrian crashes for each of the five years.

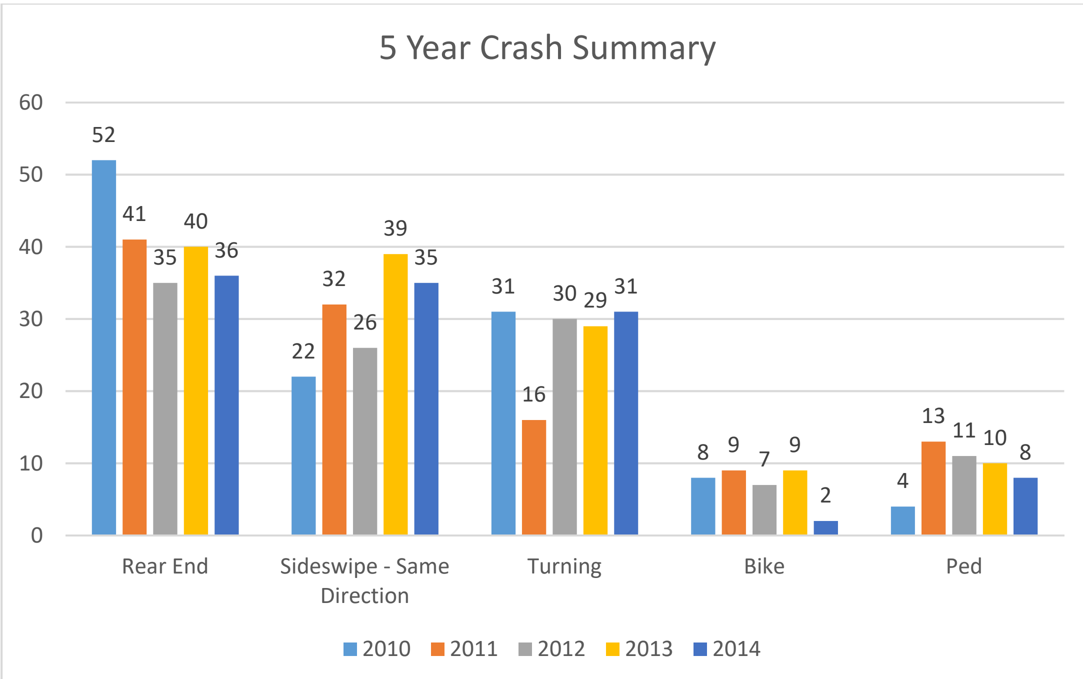

Figure 17: Crash Type Summary for Franklin Street to Fairbanks Court

The most prevalent crash types were Rear-End, Sideswipe - Same Direction, and Turning collisions, which accounted for 29 percent, 22 percent, and 19 percent of the total crashes, respectively. Of these 716 crashes, 140 collisions involved injuries of Type B or Type C severity. There were 0 fatal crashes and 18 crashes that resulted in Type A injuries.

5.2 Crash Findings

At intersection of Chicago Avenue and Ogden Avenue/Milwaukee Avenue, bicycle crashes accounted for 20.3% of the total reported crashes. None of the other intersections or segments exceeded 6%. As stated before this could be attributed to the complex intersection layout. It may also be attributed to the high bike traffic volumes on the Milwaukee Avenue bike lanes.

The most prevalent types of crashes reported for the three intersections and one segment were Rear End, Turning, and Sideswipe – Same Direction. Those three crash types accounted for 28 percent, 19 percent, and 18 percent respectively. In total, they accounted for 65 percent of all crashes examined in the study. The majority of these crashes occurred on dry pavement during clear daylight hours.

369 of the 1,302 crashes reported were Rear-End collisions. Rear-End collisions were the most common type of collision during the five year period. A contributing factor may be that drivers were traveling at a too high rate of speed for conditions and rear ended vehicles that had slowed or stopped at signalized intersections, side streets, or at local business driveways.

Of the 1,302 crashes, there were 253 Turning crashes which was the second most common type of crash during the five-year period. A contributing factor to these turning collisions may be traffic signal timing issues. This could include insufficient yellow plus all red time for turning vehicles to complete the turn, or drivers traveling at a too high rate of speed for conditions and unable to avoid colliding with turning vehicles in their path.

Sideswiped – Same Direction type crashes were the third most common type of crash during the five year period with 239 of the 1,302 crashes reported. Inadequate roadway design, pavement markings, or signage can be a common causes of sideswipe collisions.

Of the 1,302 crashes observed over the five-year study period, there was 1 fatal injury crash, 40 Type A injury crashes, 162 Type B injury crashes, and 110 Type C injury crashes. The remaining 989 crashes had no injuries. Injury crashes of any kind account for 24 percent of the total crashes reported.

The crash data for these intersections was tabulated into analysis tables depicting crash rate, crash types, injury severity, fatalities, road surface conditions, lighting conditions, and weather conditions. These tables are located in Appendix A.

6 EXISTING CONDITIONS TRAFFIC ANALYSIS

The study team completed the traffic analysis of the study areas with Synchro 8, a microsimulation software. Existing data such as traffic volumes, peak hour factors, heavy vehicle percentages, lane widths, and pedestrian volumes were input into the software to analyze the existing traffic conditions.

The result tables show the delay, level of service (LOS), volume to capacity ratio (V/C) and 95th percentile queue length (feet) for each approach and intersection. According to the Highway Capacity Manual, Level of service (LOS) is defined in terms of a weighted average control delay for the entire intersection. Control delay quantifies the increase in travel time that a vehicle experiences due to the traffic signal control as well as provides a surrogate measure for driver discomfort and fuel consumption. Signalized intersection LOS is stated in terms of average control delay per vehicle (in seconds) during a specified time period (e.g., weekday PM peak hour). Control delay is a complex measure based on many variables, including signal phasing and coordination (i.e., progression of movements through the intersection and along the corridor), signal cycle length, and traffic volumes with respect to intersection capacity and resulting queues. Table 8 shows LOS criteria for signalized intersections, as described in the Highway Capacity Manual (Transportation Research Board, Special Report 209, 2000).

Table 8: Level of Service Criteria for Signalized Intersections

Level of Service	Average Control Delay (sec/veh)	General Description
A	≤10	Free flow
B	>10 - 20	Stable flow (slight delays)
C	>20 - 35	Stable flow (acceptable delays)
D	>35 - 55	Approaching unstable flow (tolerable delay, occasionally wait through more than one signal cycle before proceeding)
E	>55 - 80	Unstable flow (intolerable delay)
F	>80	Forced flow (congested and queues fail to clear)

The study team focused on approaches that had LOS E or F (unstable or forced flow), V/C ratio > 1.00 (traffic volume is greater than capacity of intersection) and 95th percentile queue lengths of > 330 feet (queue lengths greater than half a Chicago block), to identify problem areas that contribute to the 79th Street bus slow zones. The performance of each of the intersections is discussed below, and a detailed Synchro output is in Appendix B. Also the exsiting ADT map can be found as exhibit F.

6.1.1 Western Avenue

The eastbound and southbound approaches performed poorly during the AM peak period. The high volumes of eastbound through vehicles during the AM peak contributed to high delays, large v/c ratios and long queues that caused delays for eastbound CTA buses. Similarly, in the PM peak, the large volume of westbound through and right turning vehicles contributed to high delays and caused delays for westbound CTA buses.

Table 9: Western Avenue Synchro Results Summary

Intersection	Approach	AM Existing				PM Existing			
		Delay	LOS	V/C*	Queue**	Delay	LOS	V/C*	Queue**
Chicago / Western	Eastbound	125.5	F	1.22	640	54.5	D	0.85	252
	Westbound	48.3	D	0.93	234	90.2	F	1.06	352
	Northbound	52.7	D	0.89	371	60.4	E	1.04	658
	Southbound	146.7	F	1.27	674	29.1	C	0.74	340
	Overall	105.3	F	1.14	674	56.1	E	1.06	658

*Note: The highest approach V/C is used for overall intersection V/C.

**Note: The highest approach Queue is used for overall intersection Queue.

6.1.2 Ogden Avenue / Milwaukee Avenue

The westbound approach at Chicago-Milwaukee performed poorly during the PM peak due to the large volume of through and right turning non-CTA vehicles. This caused delay for CTA buses. The southeast bound and northwest bound approaches performed at intolerable levels as well.

Table 10: Ogden Avenue / Milwaukee Avenue Synchro Results Summary

Intersection	Approach	AM Existing				PM Existing			
		Delay	LOS	V/C*	Queue**	Delay	LOS	V/C*	Queue**
Chicago / Milwaukee	Eastbound	33.4	C	0.75	232	31.0	C	0.59	162
	Westbound	11.9	B	0.49	1	60.2	E	0.85	272
	Southeastbound	88.6	F	1.05	570	93.8	F	1.08	529
	Northwestbound	15.3	B	0.52	109	70.2	E	1.01	213
	Overall	44.8	D	1.05	570	66.3	E	1.08	529
Chicago / Ogden	Eastbound	18.1	B	0.56	159	11.0	B	0.44	88
	Westbound	85.0	F	1.32	298	144.6	F	1.22	500
	Northeastbound	132.3	F	1.30	350	92.3	F	1.23	383
	Southwestbound	29.8	C	0.32	105	30.9	C	31.80	117
	Overall	68.8	E	1.32	350	94.8	F	1.23	500
Ogden / Milwaukee	Northeastbound	55.6	E	0.84	238	96.0	F	0.97	286
	Southwestbound	57.3	E	0.38	65	32.3	C	0.34	51
	Southeastbound	51.6	D	0.69	39	55.2	E	0.82	103
	Northwestbound	31.7	C	0.61	158	108.9	F	1.25	473
	Overall	50.9	D	0.84	238	77.6	E	1.25	473

*Note: The highest approach V/C is used for overall intersection V/C.

**Note: The highest approach Queue is used for overall intersection Queue.

At the Chicago-Ogden intersection, two approaches performed poorly and had high v/c ratios: westbound and northeast bound. The westbound approach has a high number of non-CTA vehicles completing through and left turn movements, especially in the PM peak which led to a large queue length. These vehicles lack the necessary green time and phasing (no westbound to southwest bound green arrow) to proceed through the intersection in a timely manner and contributing to delays of CTA buses. The northeast bound approach performed poorly due to the high-volume northeast bound to eastbound right turns in both the AM and PM peak periods. This movement lacks a right turn arrow.

The Ogden-Milwaukee intersection showed high delays for the southwest bound approach during the AM peak and both the northeast bound and northwest bound approaches during the PM peak. The large amount of northwest bound to southwest bound left turn traffic (131 veh) does not have a protected phase and lacks enough gaps in opposing southeast bound traffic to complete the movement at acceptable level of service.

6.1.3 Larrabee Street

The Synchro traffic analysis determined that the intersection of Chicago-Larrabee performed poorly at all the approaches and overall in both peak periods. Along with a large through movement, the eastbound approach has large amounts of traffic making the eastbound to northbound left turn (> 200 veh), a very short left turn arrow and limited storage space due the two-lane Chicago River Bridge west of the intersection. Similarly, there are high volumes of vehicles making a westbound to northbound right turn from a shared lane. These vehicles lack a protected arrow and impede traffic flow on the westbound approach. The relatively long crosswalk walk time for pedestrians crossing Chicago Avenue reduces the amount of available green for eastbound and westbound traffic as well. The southbound approach performs the worse with the large amount of left and right turning vehicles. Overall, the split phasing currently in operation at the intersection contributed to the lack of available green time for all the movements. The excessive delay of non-CTA vehicles contributes to significant delay of both eastbound and westbound CTA buses during both peak periods.

Table 11: Larrabee Street Synchro Results Summary

Intersection	Approach	AM Existing				PM Existing			
		Delay	LOS	V/C*	Queue**	Delay	LOS	V/C*	Queue**
Chicago / Larrabee	Eastbound	80.3	F	1.50	274	111.5	F	1.76	225
	Westbound	101.4	F	1.12	275	217.6	F	1.40	343
	Northbound	65.3	E	0.78	395	69.9	E	0.84	286
	Southbound	292.8	F	1.76	512	415.6	F	1.95	399
	Overall	134.2	F	1.76	512	216.8	F	1.95	490

*Note: The highest approach V/C is used for overall intersection V/C.

**Note: The highest approach Queue is used for overall intersection Queue.

6.1.4 Franklin Street to Fairbanks Court

All the approaches for the Chicago Avenue intersections at Franklin Street and State Street performed at acceptable levels for both peak periods.

The Chicago-Wells intersection performed well except for the southbound approach. The large number of through vehicles with one through lane creates intolerable delay, V/C > 1 and long queues.

The southbound and eastbound approaches during the PM peak period at Chicago-LaSalle intersection have v/c ratios greater than 1.00. Both the southbound to eastbound and eastbound to northbound left turns are only permitted (no protected phases) and lack enough sufficient gaps available from opposing through traffic to complete their movements.

At Clark Street, the eastbound approach is four lanes and changes to two lanes for the westbound approach. The Chicago-Clark intersection showed poor performance for the eastbound and southbound approaches during the AM peak and for the westbound approach during the PM peak. The eastbound approach experiences a higher volume of through and right turning vehicles than can be accommodated by the allotted green time. There are more than 1,000 through vehicles for the southbound approach and relatively short green signal (30 sec), which leads to the low performance. For the westbound approach, the large number of through vehicles with one through lane creates poor performance. The large volume of non-CTA vehicles for the eastbound and westbound approaches cause delay for CTA buses.

The eastbound approach during the AM peak and westbound approach during PM peak at Chicago-Dearborn intersection showed low performance metrics. The single through lane, large through volume and relatively short green time contributed to the low performance for the eastbound approach. Similarly, the shared through-right lane, large through and right turning volumes and lack of green time resulted in low performance for the westbound approach. These large volumes of non-CTA vehicles slow down CTA buses.

The Chicago-Wabash intersection displayed poor performance for the eastbound approach during both peak periods and the westbound approach during the PM peak period. The high volume of through traffic with only one through lane available with inadequate green time, led to poor performance for both approaches. The non-CTA vehicles congestion will cause delay to CTA buses.

The northbound approach has inadequate green time and the eastbound approach has a long queue for the Chicago-Rush intersection during the PM peak period, which leads to the low performance.

The Chicago-Michigan intersection showed poor performance for the eastbound and northbound approaches during the PM peak period and for the southbound approach for both peak periods. The eastbound approach has a large amount of through and right turning vehicles with one through lane and inadequate green time. The lack a capacity for eastbound traffic will delay CTA buses. Even with three through lanes, the large amount of through traffic (1384 veh) on the northbound approach results in a V/C > 1. Similarly, the southbound approach has large amounts of through traffic and experiences poor performance.

The westbound approach at Chicago-Mies Van Der Rohe has a long queue. The southbound approach has a large amount of southbound to eastbound left turn traffic (216 veh) and the green time is inadequate.

Table 12: Franklin Street to Fairbanks Court Synchro Results Summary

Intersection	Approach	AM Existing				PM Existing			
		Delay	LOS	V/C*	Queue**	Delay	LOS	V/C*	Queue**
Chicago / Franklin	Eastbound	12.1	B	0.78	150	12.8	B	0.87	116
	Westbound	23.8	C	0.60	210	11.5	B	0.78	61
	Northbound	24.0	C	0.36	89	29.2	C	0.56	314
	Southbound	21.5	C	0.23	66	25.2	C	0.43	181
	Overall	17.6	B	0.78	210	14.5	B	0.87	314
Chicago / Wells	Eastbound	19.8	B	0.87	357	57.3	E	1.05	336
	Westbound	21.7	C	0.75	181	33.6	C	0.96	325
	Northbound	21.9	C	0.16	53	24.2	C	0.30	80
	Southbound	111.0	F	1.16	465	120.3	F	1.17	404
	Overall	41.4	D	1.16	465	58.6	E	1.17	404

Intersection	Approach	AM Existing				PM Existing			
		Delay	LOS	V/C*	Queue**	Delay	LOS	V/C*	Queue**
Chicago / LaSalle	Eastbound	27.7	C	0.97	255	27.6	C	1.01	114
	Westbound	16.5	B	0.63	134	19.0	B	0.79	76
	Northbound	17.2	B	0.79	131	19.5	B	0.68	207
	Southbound	14.4	B	0.61	190	26.3	C	1.00	153
	Overall	18.7	B	0.97	255	22.7	C	1.01	153
Chicago / Clark	Eastbound	79.6	E	1.00	274	45.8	C	0.93	291
	Westbound	14.0	B	0.75	85	147.5	F	1.30	358
	Southbound	87.9	F	0.98	306	44.2	D	0.96	293
	Overall	70.2	E	1.00	306	74.5	E	1.30	358
Chicago / Dearborn	Eastbound	76.3	E	1.05	283	56.2	E	1.01	340
	Westbound	38.8	D	0.87	356	209.8	F	1.41	515
	Northbound	20.1	C	0.48	140	29.9	C	0.78	250
	Overall	47.0	D	1.05	140	82.9	F	1.41	515
Chicago / State	Eastbound	33.5	C	0.97	155	36.6	D	0.99	143
	Westbound	13.1	B	0.49	95	17.8	B	0.86	71
	Northbound	25.9	C	0.58	192	35.8	D	0.80	265
	Southbound	22.8	C	0.50	164	38.8	D	0.83	281
	Overall	25.7	C	0.97	192	32.4	C	0.99	281
Chicago / Wabash	Eastbound	148.5	F	1.34	363	270.4	F	1.65	447
	Westbound	28.0	C	0.68	200	186.9	F	1.39	501
	Southbound	38.7	D	0.74	204	58.7	E	0.90	257
	Overall	92.9	F	1.34	363	201.5	F	1.65	501
Chicago / Rush	Eastbound	19.7	B	0.55	270	44.3	C	0.76	425
	Westbound	11.1	B	0.37	111	16.0	B	0.68	205
	Northbound	48.6	D	0.68	223	87.8	F	0.98	336
	Overall	22.3	C	0.68	270	40.7	D	0.98	425
Chicago / Michigan	Eastbound	38.9	D	0.78	312	81.8	F	1.01	475
	Westbound	26.5	C	0.30	131	32.6	C	0.73	164
	Northbound	30.9	C	0.82	315	71.4	E	1.07	491
	Southbound	196.8	F	1.36	721	203.0	F	1.37	537
	Overall	105.1	F	1.36	721	112.1	F	1.37	537
Chicago / Mies Van Der Rohe	Eastbound	11.1	B	0.25	81	17.0	B	0.40	113
	Westbound	25.8	C	0.28	171	40.4	D	0.81	338
	Southbound	40.0	D	0.65	173	158.6	F	1.21	345
	Overall	22.4	C	0.65	173	58.2	E	1.21	345
Chicago / Fairbanks	Eastbound	11.7	B	0.35	68	21.4	C	0.76	274
	Westbound	17.3	B	0.16	42	16.5	B	0.27	77
	Northbound	22.9	C	0.48	155	38.8	D	0.83	332
	Overall	16.8	B	0.48	155	28.2	C	0.83	

*Note: The highest approach V/C is used for overall intersection V/C.

**Note: The highest approach Queue is used for overall intersection Queue.

7 SUMMARY OF EXISTING CONDITIONS

The study team analyzed the Chicago Avenue Slow Zone study intersections and identified the areas of deficiency and possible causes summarized below. These findings largely mirror the previous conclusions reached in the original CTA study in 2013/14.

7.1 Western Avenue

Eastbound CTA bus delay factors:

1. Illegally parked vehicles on south curb of Chicago Avenue east of Western Avenue causing buses to maneuver around.

General CTA bus delay factors:

1. The congested conditions in the eastbound direction during the AM peak period and westbound direction during the PM peak period cause delays to the buses.

Other factors like bus stop location and infrastructure did not contribute to the bus operations at this location. The location of the far-side westbound bus stop should be reviewed in the future.

7.2 *Ogden Avenue / Milwaukee Avenue*

Eastbound CTA bus delay factors:

1. Bus bunching at near-side Milwaukee Avenue bus stop results in slow boarding and delays for the first bus in the bunch. Passengers not accommodated on the first bus have to walk towards May Street to board another bus. The bus stop needs space for two buses to stop simultaneously.
2. Low curb height of 3" at near-side Milwaukee Avenue bus stop adds to the loading time of passengers.

Westbound CTA bus slowdown factors:

1. The bus stop sign is not located near the shelter. Some buses stop at the bus stop and some at the shelter.
2. Large passenger volumes are causing longer alighting and boarding time.
3. Bus bunching is also caused due to the delays at the bus stop. Passengers not accommodated on the first bus must walk towards Ogden Avenue to board another bus. The bus stop needs space for two buses to stop simultaneously.
4. High through non-CTA vehicle traffic delays bus arrivals.
5. Lack of left turn phase for large westbound to southwest bound traffic volume at Ogden Avenue.

General CTA bus delay factors:

1. Closely spaced bus stops and intersections delay buses in both directions.
2. Lack of sidewalk width for passengers to wait while boarding bus due to Blue Line stairwells at both eastbound and westbound bus stops.
3. Lack of green time for eastbound and westbound traffic.
4. The short westbound left turn lane at Ogden Avenue create queuing on Chicago Avenue causing delays and long queues.

7.3 Larrabee Street

Eastbound CTA bus delay factors:

1. Bus bunching results in slower boarding times, due to increased passenger presence.
2. High passenger vehicle through and left turn traffic delays bus arrival at stops.
3. Long left turn queues block eastbound through traffic and CTA buses.
4. Inadequate eastbound capacity on Chicago River bridge (only 1 lane).

Westbound CTA bus delay factors:

1. Roadway narrows west of the intersection due to bridge over Chicago River (only 1 lane).
2. Excessive passenger vehicle through traffic delays bus arrivals.

General CTA bus delay factors:

1. Inefficient split phasing (northbound and southbound traffic each have their own phase) versus running northbound and southbound phases concurrently, does not provide enough green time for eastbound and westbound through phases.
2. The offset intersection is also a safety concern.
3. Only using 20-foot wide northbound approach for one lane instead of two lanes and increasing intersection capacity.

7.4 Franklin Street (CTA Brown Line)

The corridor between Franklin Street and Michigan Avenue is busy area with an active retail and commercial land use, on-street parking, high vehicular traffic and pedestrians crossing the roadway. The corridor also has CTA train stations. This area also has on-street parking creating slow operating speeds in the eastbound and westbound direction. The pavement markings on Chicago Avenue have deteriorated and needs replacement.

Eastbound CTA bus delay factors:

1. Non-CTA vehicles utilizing the loading zone in front of the bus stop hinder CTA buses trying to re-enter traffic.
2. Pedestrian crossing Chicago Avenue mid-block causes delays in traffic.

General CTA bus delay factors:

1. Bus bunching results in slower boarding times, due to increased passenger presence.

7.5 LaSalle Street

Eastbound CTA bus delay factors:

1. Southbound LaSalle traffic backs up into intersection, impeding eastbound traffic.
2. Lack of left turn phase for large eastbound to northbound volume.

7.6 Clark Street, Dearbourn Street, Wabash Avenue and Rush Street

General CTA bus delay factor:

1. Inadequate green time for eastbound and westbound traffic.

7.7 State Street

Westbound CTA bus delay factors:

1. McDonald's customers and delivery trucks used the westbound curbside and impeded westbound CTA buses.
2. Bus bunching results in slow boarding and delays for first bus.

General CTA bus delay factor:

1. Chicago Police Department vehicles parking in curbside lanes and causing CTA bus delays.

7.8 Michigan Avenue

Eastbound CTA bus slowdown factor:

1. Inadequate green time for eastbound traffic.
2. Backups from eastbound to southbound right turning non-CTA vehicles.

Westbound CTA bus slowdown factor:

1. Inadequate green time for northbound traffic.
2. Backups from eastbound to southbound right turning non-CTA vehicles.

7.9 Mies Van Der Rohe Way

Westbound CTA bus slowdown factor:

1. Inadequate green time for westbound traffic.

8 IMPROVEMENT ALTERNATIVES TOOLBOX

The toolbox presented in this section describes "tools" or potential solutions to mitigate deficiencies causing delays to the buses. Each intersection included in the study was evaluated, using this toolbox, to assess the benefit(s), potential impact(s), and feasibility of implementing each potential solution. This process was used to develop the recommendations and considerations discussed in Section 4. The toolbox is shown in Table 1 and discussed in detail in below.

Table 13: Alternatives Toolbox

	Evaluation Category	Delay Factors	Alternatives
1	Bus Stop Location	• Near or Far-Side	• Relocate bus stop
2	Bus Stop Infrastructure	• Layout and Geometry • Boarding/Alighting Volume • High Disabled Usage	• Level or near-level boarding • Shelter layout • Bus stop bump out • Bus stop pull out • PROWAG compliance
3	Intersection Operations	• Traffic Control • Signal Operations • Emergency Preemption	• Traffic signals • Remove stop sign on bus route • Intersection phasing and timing • Transit signal priority
4	Roadway and Intersection Geometry	• Intersection Geometry • Lane Configuration • On-street Parking • Loading Zones	• Revise intersection geometry • Additional channelization • Bus lane • Queue jump lane • Evaluate parking restrictions • Evaluate loading zone restrictions • Pavement Marking
5	Fare Collection	Prepaid	• Evaluate prepaid boarding

The toolbox has been discussed according to evaluation categories.

8.1 Bus Stop Location

Bus stop spacing has a great influence on transit performance and reliability. When fewer bus stops are further apart, the bus is required to stop less often and its travel times is reduced. The tradeoff is that the rider may have to walk farther to or from the bus stop. The corridor was examined for potential areas where closely spaced stops could be combined without significantly altering the distance a bus rider would have to walk.

The location of a bus stop can be near-side, far-side or midblock in relation to an intersection. Each stop location type has advantages and disadvantages that are summarized in the Table 2. Bus stop locations were concurrently evaluated with consolidation opportunities.

Table 14: Comparison of Bus Stop Locations

Stop Type	Advantages	Disadvantages
Near-Side	• Minimizes interference when traffic is heavy on the far-side of the intersection • Passengers access buses closest to crosswalk • Intersection available to assist in pulling away from curb • No double stopping • Buses can service passengers while stopped at a red light • Provides driver with opportunity to look for oncoming traffic including other buses with potential passengers	• Conflicts with right turning vehicles are increased • Stopped buses may obscure curbside traffic control devices and crossing pedestrians • Sight distance is obscured for crossing vehicles stopped to the right of the bus. • The through lane may be blocked during peak periods by queuing buses • Increases sight distance problems for crossing pedestrians
Far-Side	• Minimizes conflicts between right turning vehicles and buses • Provides additional right turn capacity by making curb lane available for traffic • Minimizes sight distance problems on approaches to intersection • Encourages pedestrians to cross behind the bus • Requires shorter deceleration distances for buses • Gaps in traffic flow are created for buses re-entering the flow of traffic at signalized intersections	• Intersections may be blocked during peak periods by queuing buses • Sight distance may be obscured for crossing vehicles • Increases sight distance problems for crossing pedestrians • Stopping far-side after stopping for a red light interferes with bus operations and all traffic in general • May increase number of rear-end accidents since drivers do not expect buses to stop again after stopping at a red light
Mid-block	• Minimizes sight distance problems for vehicles and pedestrians • Passenger waiting areas experience less pedestrian congestion	• Requires additional distance for no-parking restrictions • Encourages patrons to cross street at mid-block (jaywalking) • Increases walking distance for patrons crossing at intersections

Source: Federal Transit Administration

8.2 Bus Stop Infrastructure

The layout and other elements of the bus stop can contribute to inefficient boarding or alighting of passengers causing delays. High commuter volumes can exacerbate the problems experienced at a bus stop. The bus stops were reviewed to identify improvements.

8.2.1 Bus Stop Bump Out and Bus Bays (Pull Out)

Bus bump outs are a section of sidewalk that extends from the curb of a parking lane to the edge of the through lane. When used at a bus stop, the buses stop in the traffic lane instead of moving into the parking lane therefore there is no delay in re-entering the traffic stream. Figure 18 provides an example of bus bump out on a city street.

Table 3 gives a comparison of the advantages and disadvantages of implementing bus bump out. For this project, a bump out was considered only when two through lanes exist in a direction.

Bus bays or pull outs provide for the bus to pull out of the travel lane and into a dedicated bus loading zone to board and alight passengers without blocking traffic. In congested areas and during peak travel periods, buses often have trouble reentering the travel lane adding delay to bus travel time.

The Chicago Avenue slow zones were evaluated to determine if and where bus bump outs would be appropriate and could provide benefit. Bus bays are not feasible in urban corridors with limited roadway widths and Right-of-way.

Figure 18: Example of a Bus Bump Out

Source: www.nacto.org

Table 15: Bus Bump Out Comparison

Advantages	Disadvantages
• Permits more on-street parking • Decreases the walking distance (and time) for pedestrians crossing the street • Provides better sight lines to bus patrons waiting for the bus • Provides additional sidewalk area for bus patrons to wait • Segregates waiting bus patrons from circulating pedestrian flow on the sidewalk • Results in minimal delay to the bus and its on-board passengers by reducing bus merge delay • Provides additional space for amenities including bus shelters	• Can cause traffic to queue behind a stopped bus, thus causing traffic congestion • May cause drivers to make unsafe maneuvers when changing lanes to avoid a stopped bus • Costs more to install compared with curbside stops, particularly for addressing street drainage requirements

Note 1 Source: Federal Transit Administration

8.2.2 Level or Near-Level Boarding

The height difference at a sidewalk or curb level stop is often 4-6 inches between the ground level and the bus floor. For the handicapped, elderly, or passengers carrying luggage or large items, buses are equipped with an adjustable suspension which allows for the driver to physically lower the bus to provide easier access entering the bus. Kneeling buses can add delay to the travel route because of the time it takes for the bus to adjust its suspension level. Level or near-level boarding refers to raising the sidewalk at a bus stop that provides a reduced height difference between curb and bus floor. The level or near-level boarding reduces bus dwell time by eliminating the need for the driver to adjust the bus suspension.

Providing level or near-level boarding is not possible at all locations because of multiple doorways, physical constraints and other impacts associated with raising a curb height 4-6 inches for the length of the bus stop. CTA prefers a minimum 100-foot area for a bus to stop to accommodate articulated buses. Raising the curb height can have impacts on Americans with Disabilities Act (ADA) and Public Right of Way Access Guide (PROWAG) compliance for sidewalks in public right of ways. Water flow and drainage could also be impacted and design of level boarding must prevent water from ponding in the sidewalk or backflowing into buildings. Narrow sidewalks with driveway and business front access pose implementation challenges. Raised curbs should be avoided where there is adjacent street parking because of conflicts with the passenger car door levels and potential vehicle damage. Examples of boarding types are shown in Figure 2 and Figure 3.

The Chicago Avenue Study areas were evaluated to determine if and where level or near-level boarding would be appropriate and could provide benefit. The physical constraints and passenger volumes were reviewed for this evaluation.

Figure 19: Example of Non-Near-Level Boarding

Source: Chicago Tribune

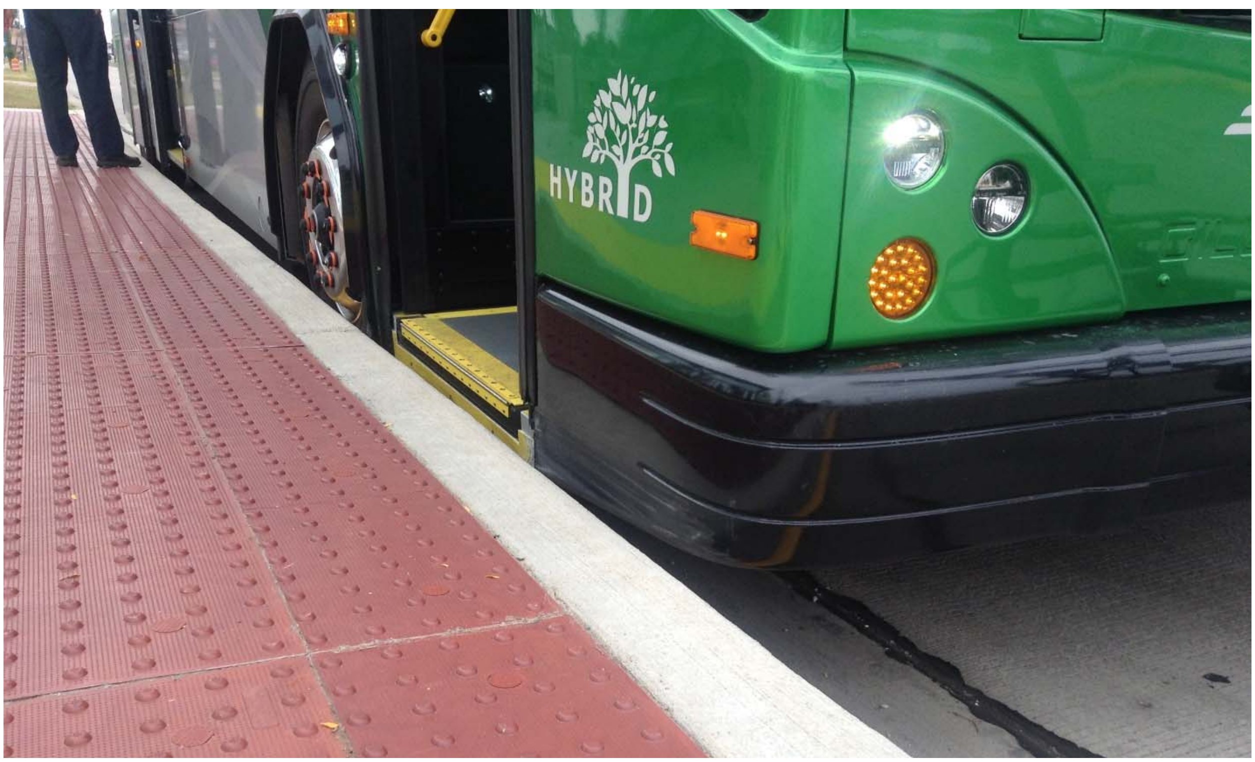

Figure 20: Example of Near-Level Boarding

Source: ByteofKnowledge via Wikimedia Commons (Open Source)

Detailed topographic survey is needed to evaluate PROWAG compliance of a bus stop. An evaluation of the bus stop locations is recommended during the preliminary engineering phase of the project if near-level boarding is desired at that location.

8.3 Intersection Operations

The intersection operations play a critical role is the progression of traffic and the delay experienced by buses. The intersection traffic control and operations were reviewed to identify measures to improve traffic flow.

8.3.1 Traffic Signal Warrant Analysis

The Manual on Uniform Traffic Control Devices (MUTCD) is a document produced by the Federal Highway Administration (FHWA) and is a compilation of national standards for all traffic control devices, including road markings, highway signs, and traffic signals. The MUTCD requires an engineering study of current traffic conditions, pedestrian characteristics, and physical characteristics for implementing a traffic signal at a specific location. The process of evaluating the need for a traffic control signal investigates the operation and safety of the location and the potential for improvement through a series of nine warrants.

Stop controlled intersections were examined to determine the operational and safety improvement potential for implementing a new traffic control signal using the Traffic Signal Warrant Analysis methodology established in the MUTCD.

8.3.2 Traffic Signal Optimization

Optimized traffic signals process vehicles more efficiently than unoptimized signals. FHWA describes "Traffic Signal Optimization" as the process of developing optimal signal-phasing and timing plans for isolated signalized intersections, arterial streets or signal networks. For this study, the software program Synchro was used to determine and evaluate signal coordination potential, optimal cycle lengths, phase splits, and offset timings. Coordinated signals operate on the same cycle length and can improve traffic progression along corridors. Signal coordination is not always possible due to differences in traffic patterns or distance between intersections. When possible, coordinating and optimizing signals together allows for better over all traffic flow, although, an individual signal in a system of coordinated signals may not optimally operate as a single intersection.

Using Synchro, optimized timing plans were developed for each Slow Zone along the Chicago Avenue study area for the AM and PM peak hour periods for existing and proposed conditions. Section 10 PROPOSED CONDITIONS TRAFFIC ANALYSIS discusses the results of traffic signal optimization in further detail.

8.3.3 Transit Signal Priority

Transit signal priority (TSP) gives special treatment to transit vehicles at signalized intersections using location detection technology. An active priority strategy involves detecting the presence of a transit vehicle at a signal and the system giving an early green signal or extending a green signal that is already displaying.

Currently, TSP is present on Ashland Avenue and Western Avenue. TSP on Chicago Avenue was not considered at intersections with existing crossing TSP route.

8.4 Roadway and Intersection Geometry

The roadway including intersection geometry, pavement markings, lane configuration, on-street parking and loading zones were reviewed to identify improvements and determine impacts.

8.4.1 Intersection Geometry and Pavement Marking

Intersection geometry and lane configuration was reviewed to identify opportunities for turn lane changes to improve intersection operations. Efficient intersection operations can benefit bus operations by reducing delays for all vehicles. Intersections were also reviewed for addition of protected left turn phases.

Pavement marking that are either missing, incorrect or in poor condition can cause confusion and negatively affect safety. Slow zone intersections were reviewed for pavement marking condition.

8.4.2 Dedicated Curbside Bus Lanes

A dedicated curbside bus lane is a transit-only facility in the right-most travel lane on a street, as shown in Figure 4. There are several different configurations of dedicated bus lanes, for example, bus lanes can be in the median or in offset configurations where the dedicated bus lane runs adjacent to parking, a right turn lane, a bike lane or any combination in the outermost portion of the right-of-way. Bus lanes can also operate as a dedicated bus lane at peak travel periods, with appropriate signing and enforcement, and provide for general curbside uses, such as parking permitting mixed traffic, at other times. Figure 5 is an example of a peak hour bus facility sign used by the LA Metro.

Dedicated bus lanes are typically a minimum width of 11-feet, although, a 12-foot lane is generally preferred, the width can be as low as 10-feet in certain circumstances.

Figure 21: Example of a Dedicated Bus Lanes

Figure 22: Example of a Peak-Hour Bus Lane

Source: NACTO.org (credit LA Metro)

8.4.3 Queue Jump Lane

A queue jump lane is a short stretch of bus lane located at the intersection and the bus gets dedicated signal. These enable buses to by-pass traffic queues but cutting out in front by getting an early green signal. In many instances, a queue jump lane functions as a combined bus plus right-turn only lane, permitting straight-through movements for buses only. This minimizes the overall traffic congestion an intersection by removing buses out of through-travel traffic lanes or out of a queue of traffic when at a stop light or stop sign. Additionally, queue bypass / right-turn lanes reduce merging conflicts with other motorists while accessing far-side bus stops, and freeing lane space for other motorists to proceed through an intersection with less congestion. Figure 6 and Figure 7 show implementation of queue jump lanes.

Both TSP and queue jump lanes work most efficiently with far-side bus stops. The Chicago Avenue Study area was evaluated for locations where the implementation of queue jump lanes could benefit bus performance. The implementation of a queue jump lane requires the installation of a dedicated bus signal head. A new ATC 1000 controller is proposed at locations a queue jump lane is proposed to facilitate bus detection and implementation of the queue jump phase.

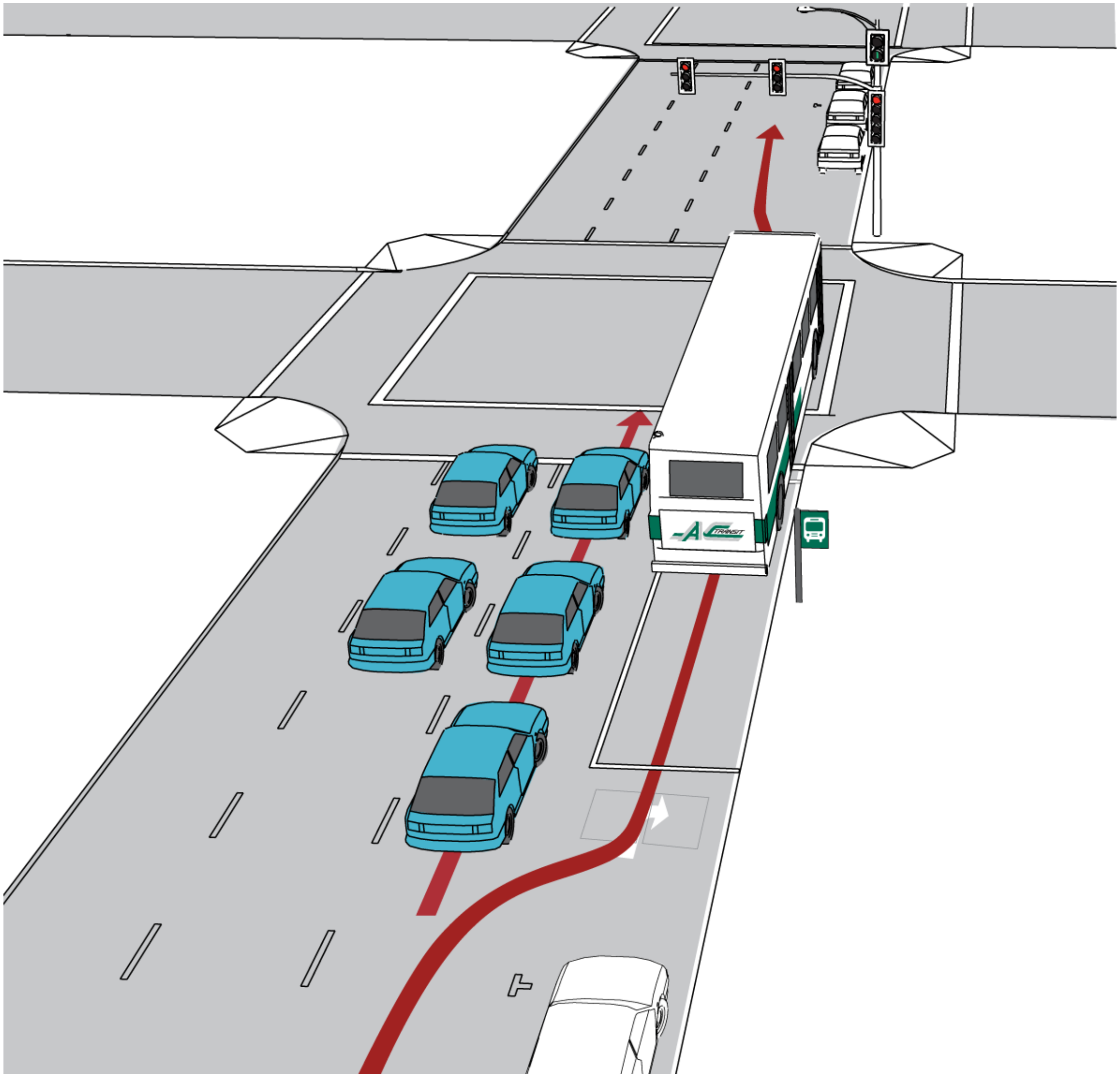

Figure 23: Example of a Queue Jump Lane

Figure 24: *Example of Bus Priority Signal and Signage*

Note 2 Source: raisethehammer.org

8.4.4 Parking and Loading Zone Restrictions

The on-street parking and loading zones are important in urban areas for local businesses. The limits and type of on-street parking and loading zones were surveyed. The parking and loading zones were reviewed for modifications to help bus access to bus stops and accommodation of bus lanes. Any impacts due to recommended improvement have been noted on the exhibits.

8.5 Fare Collection

The ticket payment although electronic occurs on the bus and requires the swiping of the Ventra card. During peak periods, when the boarding volumes are high, the ticket collection process can delay the buses. The elimination of on-board fare collection can help reduce bus delays. Prepaid boarding options were reviewed at each slow zone bus stops.

CTA has conducted pilot studies to evaluate prepaid boarding that were reviewed for this slow zone study. The pilot study included two locations:

1. Loop Link – Madison/Dearborn Platform

   This concept included platforms designed for turnstile installation at the top of each ramp. Mobile fare collection equipment located at the turnstile is used for fare collection.

2. Belmont Blue Line Station

   This concept included fenced areas for controlling the flow of passengers and to discourage evasion. Mobile fare collection equipment located in the fenced area is used for fare collection.

In both methods, a bus supervisor will be on duty to help customers prepay and board efficiently, and to discourage evasion. A TRTW employee will assist as resources permit.

The current method for implementing pre-paid boarding have space requirements and resource needs that are challenges for bus stops located on roadways in congested conditions.

9 IMPROVEMENT RECOMMENDATIONS

Each slow zone was reviewed using the Alternatives Tool Box to identify potential improvements. All likely improvement alternatives were identified for consideration irrespective of its cost, negative impacts or constructability. Alternatives not considered feasible due to site constraints and other factors were eliminated from further consideration. The improvements considered feasible and expected to reduce bus delays are discussed in this section. Short term improvements are considered if they are easy to implement, are lower in cost and can be implemented quickly. Long term improvements involve larger capital expense and will require further planning and work to implement.

The alternatives analysis is documented in tables for each slow zone and is included in Appendix F.

9.1 Western Avenue

In order to reduce bus delays due to long queues, peak hour bus lanes are recommended in the eastbound and westbound directions. The existing roadway lane configuration would have to be modified from four through lanes to two through lanes with parking allowed only during off-peak periods. This change would also have 3 paid parking impacts east of Western Avenue in the eastbound direction. The peak hour bus lanes would become a combined bus and right turn lane for a length of 100 feet in advance of Western Avenue in both directions.

The current near-side bus stop is recommended to be relocated to the far-side location in the eastbound direction. The far-side location provides more space for passengers to stand.

Other improvements include resurfacing and restriping of the intersection to account for future turn lane queuing and traffic signal optimization of the intersection. The improvement recommendations at the Western Avenue slow zone are shown in Exhibit H.

9.2 Milwaukee Avenue / Ogden Avenue

The intersections of Chicago Avenue, Milwaukee Avenue and Ogden Avenue form closely spaced intersections. The signal timing and phasing optimization is recommended to improve intersections operations. Also, two alternatives have been proposed for this slow zone.

In order to improve safety, access to May Street is recommended to be closed by implementing a cul-de-sac. The addition of sidewalk at this location can be utilized to relocate the existing bus stop and shelter currently located to the east of the Blue Line entrance. This could alleviate the pedestrian congestion that occurs when transit users are waiting for the next bus.

A curb bump out on the south approach of May Street would also provide more room for transit users waiting for the next bus. In addition, removing the bench and relocating the light pole will also provide more space for transit users.

Other Improvements include widening Chicago Avenue between Ogden Avenue and Carpenter Street. This would allow a full westbound 9-foot left turn lane, 9.5-foot through lanes and 10.5-foot curbside bus lanes. In order to accomplish this, the existing bus stop and shelter will need to be removed and the existing street light will need to be relocated. This will also impact the existing pedestrian crossings at Carpenter Street requiring the ramps to be reconstructed.

Operational improvements include traffic signal optimization of the three intersections and the implementation of a protected left turn phase at Ogden Avenue. The improvement recommendations at the Milwaukee Avenue and Ogden Avenue slow zone are shown in Exhibit I and J.

Bus Lane Alternative

In the westbound direction, a bus lane would allow buses to bypass the long queues that occur at these intersections. The bus lane would be signed and marked for combined right turns 70 feet in advance of each intersection.

In the eastbound direction, a bus lane beginning at May Street and continuing through Ogden Avenue would allow buses to bypass any queues that occur during the peak hours. A combined right turn and bus lane would be provided at Milwaukee Avenue beginning at May Street.

The bus lanes are presented as an alternative and have not been included in the traffic analysis at this time.

9.3 Larrabee Street – Larrabee Street - Orleans Street

Under existing conditions, the intersection operates with a split phase timing due to Larrabee Street being one-way northbound south of Chicago Avenue. This current configuration causes the intersection to operate inefficiently. It is recommended that the flow of traffic be reversed to allow only southbound traffic on Larrabee St, south of Chicago Avenue. This will require the removal of some of the existing street signs and signals. Other improvements include realigning the north-south pedestrian crossings.

In the eastbound direction, a bus lane can be implemented in the parking lanes with peak hour parking restrictions along the whole corridor. At signalized intersections, the bus lane can be marked and signed to allow right turns 70 feet in advance of each intersection. A westbound left turn lane is recommended if Larrabee Street is changed to one-way southbound.

The existing eastbound stop is a candidate for a near-level boarding platform. The implementation of the platform would only impact the existing shelter, one tree planter and one street light. The westbound near-side stop is also a candidate for near-level boarding, however, several utility manholes located near the stop may prevent implementation.

In the westbound direction, in order to reduce bus delays, a queue jump lane is proposed at the intersection. This will be a shared queue jump and right turn lane. A bus lane that extends across the Larrabee Street intersection is not feasible due to the narrow roadway width at the bridge and adjacent business. Also, a bus lane can be implemented in the parking lanes with peak hour parking restrictions along the whole corridor. At signalized intersections, the bus lane can be marked and signed to allow right turns 70 feet in advance of each intersection.

It is also recommended that the eastbound and westbound stops at Orleans Street be eliminated due to adjacent stops at the Brown Line station. The improvement recommendations for the Larrabee Street slow zone are shown in Exhibit K.

9.4 Franklin Street (Brown Line Station– Fairbanks Court

The improvements in this slow zone were reviewed at a corridor level and at individual intersections. The improvement recommendations for the Franklin Street to Fairbanks Court slow zone are shown in Exhibit L.

Corridor Improvements

In both eastbound and westbound directions bus lanes are recommended that can be achieved by reducing left turn and through lane width. Three alternatives can be considered that involve modifying the parking lane.

- Permanent bus lanes implemented by eliminating on-street parking along the entire length of the corridor.
- Peak hour bus lanes during both peak periods in both directions.
- Peak hour bus in the eastbound direction during the morning peak period and in the westbound direction during the evening peak period.

The bus lanes are feasible by reducing the lane widths of left and through lanes. The implementation of bus lanes will require additional signs and complete replacement of pavement markings. Parking enforcement will be critical if peak hour bus lanes are implemented.

There will be exceptions at Franklin Street and State Street due to changing roadway widths. In addition, signals will be optimized along the Chicago Avenue corridor.

The peak hour bus lanes along the corridor are recommended for a minimum period of two hours in the morning and evening. The traffic data available for the study included two hours of counts for the period of 7:00 am to 9:00 am and 4:00 pm to 6:00 pm collected in various years before 2017. The peak hour restriction could vary along the corridor and should be based on current traffic data collected for at least three hours in the morning and evening peak period.

Intersection Improvements

Franklin Street (Brown Line station):

The roadway under the Brown Line station is insufficient to continue full bus lanes from the Larrabee Street improvements. Due to high through volumes it is recommended that left turns from Chicago Avenue be restricted onto Franklin Street in both directions. East of the Brown Line stop, curbside peak hour bus lanes can be implemented until Clark Street. A queue jump lane is recommended in the westbound direction.

Clark Street:

Eastbound at Clark Street, the roadway narrows and the peak hour bus lane will need to be dropped and a queue jump implemented to allow the buses to merge over into the existing through lanes. After the merge, a peak hour bus lane can be re implemented in the curbside lane all the way to Fairbanks Court.

Michigan Avenue:

In the eastbound direction, we recommended moving the existing near-side shelter and stop to the shown far-side location. This will allow buses to clear the intersection before having to stop for transit passengers. However, the existing loading zone will have to be relocated.

Mies Van Der Rohe Way:

In the west bound direction, the near-side stop and shelter can be relocated before the east stop bar where sidewalk will have to be constructed in the existing parkway. If desired, this location can provide near-level boarding.

10 PROPOSED CONDITIONS TRAFFIC ANALYSIS

The project team completed traffic analysis of the slow zones using Synchro 10, a microsimulation software. Data including traffic volumes, peak hour factors, heavy vehicle percentages, lane widths, and pedestrian volumes were input into the software to analyze the traffic conditions. Traffic analysis was conducted for existing traffic conditions and projected 2040 traffic volumes with and without the improvement recommendations for the morning and evening peak period. The projected 2040 ADT's were obtained from CMAP. The ADT and DHV map is included as Exhibit G.

The proposed scenarios analyzed are as follows:

- Existing Traffic Volumes, Existing Geometry, Optimized Signal Timing
- 2040 Projected Traffic Volumes, Existing Geometry, Optimized Signal Timing
- 2015 Existing Traffic Volumes Proposed Geometry and Optimized Signal Timings
- 2040 Projected Traffic Volumes, Proposed Geometry and Optimized Signal Timings

Exhibit M shows the LOS for each scenario. The analysis summary tables are included in Appendix G and detailed Synchro outputs and included in Appendix H. The result tables show the delay and level of service (LOS) of each movement, approach and intersection.

The key findings of the traffic analysis are as follows.

- The optimization of traffic signal timings improves operations and is recommended at all slow zones intersections.
- A short queue jump phase has minimal negative impact on the intersection operations.
- The implementation of a shared bus and right turn lane benefits the intersection by eliminating the right turns and buses from the through traffic. There is a capacity benefit from this improvement.
- The intersection of Western Avenue is an exception where the through capacity is reduced by the implementation of the bus lane.
- The evaluation of the Ogden Avenue and Milwaukee Avenue intersections should consider delay per passenger in developing the final recommendations.
- The traffic is anticipated to increase according to the 2040 projections. However, the implementation of a shared bus and right turn lane at the intersections and bus lanes, dedicated or peak hour lanes, will help reduce the effects of the increased traffic. It should be noted that the traffic projections do not account for a major change to the transportation system by adding bus lanes.

11 CONCULSION

The City will pursue recommended improvements along the corridor potentially in larger or smaller segments and scope, depending on availability of funds. The improvements could be pursued in combination with other roadway projects. The City could also pursue improvements with private developments along the corridor. The improvements could be implemented using City funds or the City may pursue federal funds. Additional studies will be required if federal funds are considered to meet IDOT and FHWA requirements.