MINUTES
(Audio recording is available)
PLANNING COMMISSION
OCTOBER 2, 2014
LAKEWOOD CITY HALL

PRE-REVIEW MEETING
6:30 P.M.
LOWER CONFERENCE ROOM

Review docket items

REGULAR MEETING
7:00 P.M.
AUDITORIUM

1. **Roll Call**

MEMBERS PRESENT	OTHERS PRESENT
Hanna Belsito	Jason Russell, Commission Secretary, Project Specialist II, P&D
Mary Cierebiej, Chairperson	Jennifer, Assistant Law Director
William Gaydos	Bryce Sylvester, Planner, Planning and Development
Louis McMahon	Dru Siley, Director for Planning and Development
Patrick Metzger	
Mark Papke, City Engineer	
Mark Stockman	

2. **Approve the Minutes of the September 4, 2014 meeting**

A motion was made by Mr. Gaydos, seconded by Mr. Papke to **APPROVE** the minutes of the September 4, 2014 meeting. All of the members voting yea, the motion passed.

3. **Opening Remarks**

Mr. Russell read the Opening Remarks; Mr. Russell reminded the public that anyone giving testimony was to state one's name and address and sign the Oath

RECALL OF HEARING

4. **Docket No. 02-03-14** **13100 Madison Avenue**
Lakewood One Stop

The request for a conditional use was granted at the February 6, 2014 Planning Commission meeting. The Planning Commission has asked for the recall of hearing for this item because the owner is storing rental trucks on the property, which is not permitted.

Ibrahim Fekieh, applicant requests the review and approval of a Conditional Use Permit to operate a gasoline service station, pursuant to Schedule 1129.02 (table) - Permitted Uses in Commercial Districts. This property is located in a C-2 Commercial and Business district. (Page 3)

Jason Russell reported the owners had recently implemented a business plan and storage of rental trucks had discontinued as of September 5, 2014. The City administration saw them operating their business as they should.

Julie Fetchick, property owner of 13100 Madison Avenue was present. She stated there had been a misunderstanding of the regulations and thought overnight parking was allowed. The rental vehicles were being stored at the West 117th Street, Cleveland location; however, trucks did come to the Madison Avenue location for fuel. A letter of explanation had been read by the Commission as it was included in the agenda.

Mr. Russell said the City recommended a ruling of "no action" and would continue to monitor the site.

There was no one from the public with a comment or question. The Commission thanked Ms. Fetchick.

A motion was made by Mr. McMahon, seconded by Mr. Metzger to **TAKE NO ACTION** for this item. All of the members voting, the motion passed.

COMMUNICATION

6. **Docket No. 10-26-14** **Update to the Planning Commission Regarding the Traffic / Parking Study for Birdtown Neighborhood, Presented by Andy Comer, Engineer, TMS Engineers, Inc.**

Following the approval of the Birdtown Brewery, the Planning and Development Department contracted with TMS Engineers to conduct a traffic/parking study for entire neighborhood to assess the potential impact of the current and future development on the neighborhood. The purpose of the study is to identify short and long term strategies to ensure future commercial development has minimal impact on parking and traffic flow in the neighborhood. Andy Comer of TMS Engineers will present their findings. (Page 6)

Andy Comer of TMS Engineers was present. A traffic count was done on September 4th on Dowd, Quail, Robin, Thrush and their intersections. The times of observation were 7:00 a.m. to 10:00 a.m., 11:00 a.m. to 1:00 p.m., and 2:00 p.m. to 6:00 p.m. (report made part of record). He discussed current traffic patterns and on-street parking, the project traffic conditions including one-way traffic streets, and the traffic analysis detailing parking and recommended roadway configuration.

Regarding the arrival and departure of the students at Harrison School, Mr. Comer said there were a number of ways people did it; one way was to stop in the street while second way was to pull into a driveway or empty parking spot. Discussion ensued about the various solutions to the school students and parking issues. There was not enough room for dedicated bike lanes or parking.

There was no one from the public with a comment or question. There were no further comments or questions from the Commission.

Mr. Siley said the study provided information to solve potential problems. An outreach to the community and schools would be forthcoming next year. Then recommendations would be presented to the Planning Commission later in 2015.

A motion was made by Mr. Stockman, seconded by McMahon to **RECEIVE AND FILE** the study. All of the members voting yea, the motion passed.

5. **Docket No. 10-25-14** **Update to the Planning Commission Regarding the Recommended Changes to the City's Parking Code as Presented by Bryce Sylvester, Planning and Development**

This is an update to the presentation given at the September 4, 2014 Planning Commission meeting. The Department of Planning and Development has spent several months reviewing the City's current parking code with the goal of establishing flexible vehicle parking requirements that support the Community's Vision to provide safe, convenient, and integrated transportation options throughout the city. Bryce Sylvester, City Planner, City of Lakewood, will present updated changes for consideration by the Planning Commission. (Page 5)

Bryce Sylvester, Planner for the City of Lakewood was present. Utilizing the PowerPoint presentation (made part of record), he noted some additional changes such as parking minimums and maximums, requirements for commercial uses, application of the codes, and etc.

The Commission recommended minor edits such as to the section about storm water, 1143.10(b)(3).

There was no one from the public with a comment or question.

A motion was made by Mr. McMahon, seconded by Mr. Gaydos to **RECOMMEND TO CITY COUNCIL** to pass something that was substantially similar to what was being presented. All of the members voting yea, the motion passed.

7. **Docket No. 10-27-14** **Update to the Planning Commission Regarding the Planned Development, Chapter 1156 of Lakewood's Zoning Code as presented by Dru Siley, Director, Planning and Development**

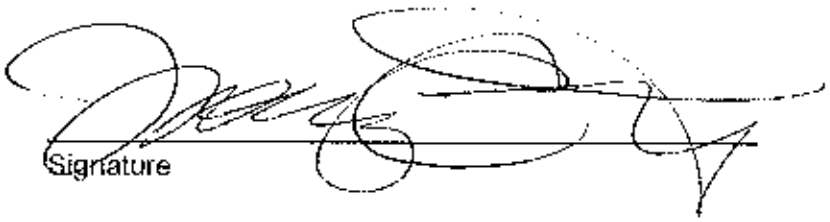
With the upcoming sale of McKinley Elementary to a private developer, now is a good time to begin reviewing the Planned Development zoning chapter that may be applied to this property. Planning Director Dru Siley will take the Commission through the chapter explaining the spirit of the code plus the options and the flexibility set forth in the code. (Page 7)

Dru Siley, Director for the Department of Planning and Development was present to explain the changes while referring to the presentation. With the demolition of McKinley Elementary School, the intent of the nearly three acres site was for the development of residential structures. He summarized the processes and meetings that led this juncture of the development, and provided a timetable that outlined the project from October 2014 to its anticipated completion in July 2017.

A motion was made by Mr. Gaydos, seconded by Mr. Papke to **RECEIVE AND FILE** the Update. All of the members voting yea, the motion passed.

ADJOURN

A motion was made by Mr. Stockman, seconded by Mr. Papke to **ADJOURN** the meeting at 8:15 p.m. All of the members voting yea, the motion passed.



Signature

11-6-14

Date

Oath

(You need not give an oath if you object. If you object to giving an oath, please notify the hearing officer or secretary before signing below.)

I, the undersigned, hereby solemnly swear that the testimony I give at this proceeding will be the truth, the whole truth and nothing but the truth:

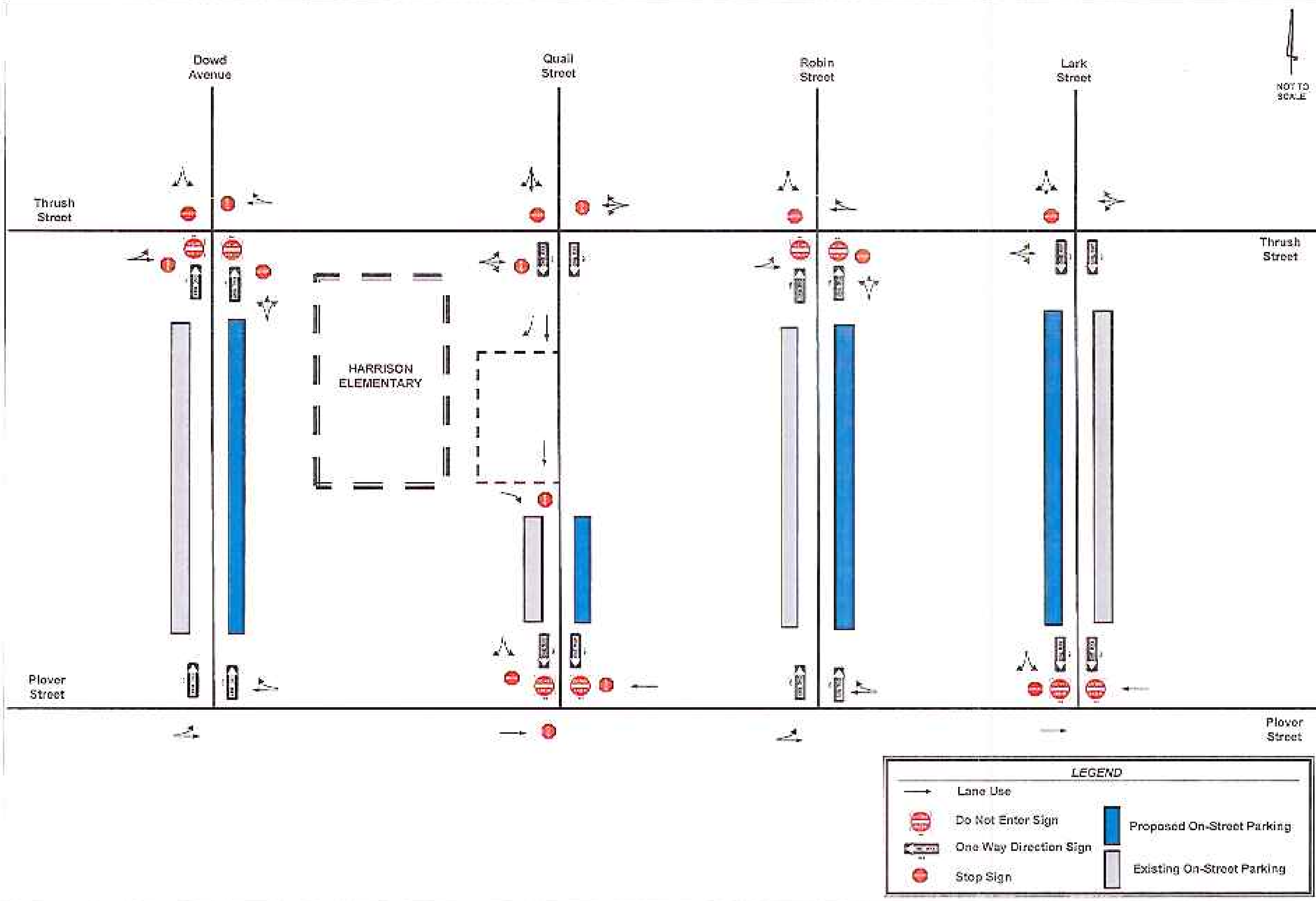
	PRINT NAME:	SIGN NAME:
1.	Julie Fetchik	Julie N Fetchik
2.	Bryce Sylvester	
3.	Dan Sley	
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		

Prepared by: The City of Lakewood Law Department, 12650 Detroit Ave., Lakewood, Ohio 44107

FOR CITY USE ONLY

Lakewood Administrative Procedure: ☐ ABR/BBS ☐ Citizens Advisory ☐ Civil Svc. ☐ Dangerous Dog ☐ Income Tax Appeals ☐ Loan Approval ☐ Nuisance Abatement Appeals ☐ Parking ■ Planning ☐ Zoning Appeals ☐ Other:

Date of Proceeding: October 2, 2014 Thursday

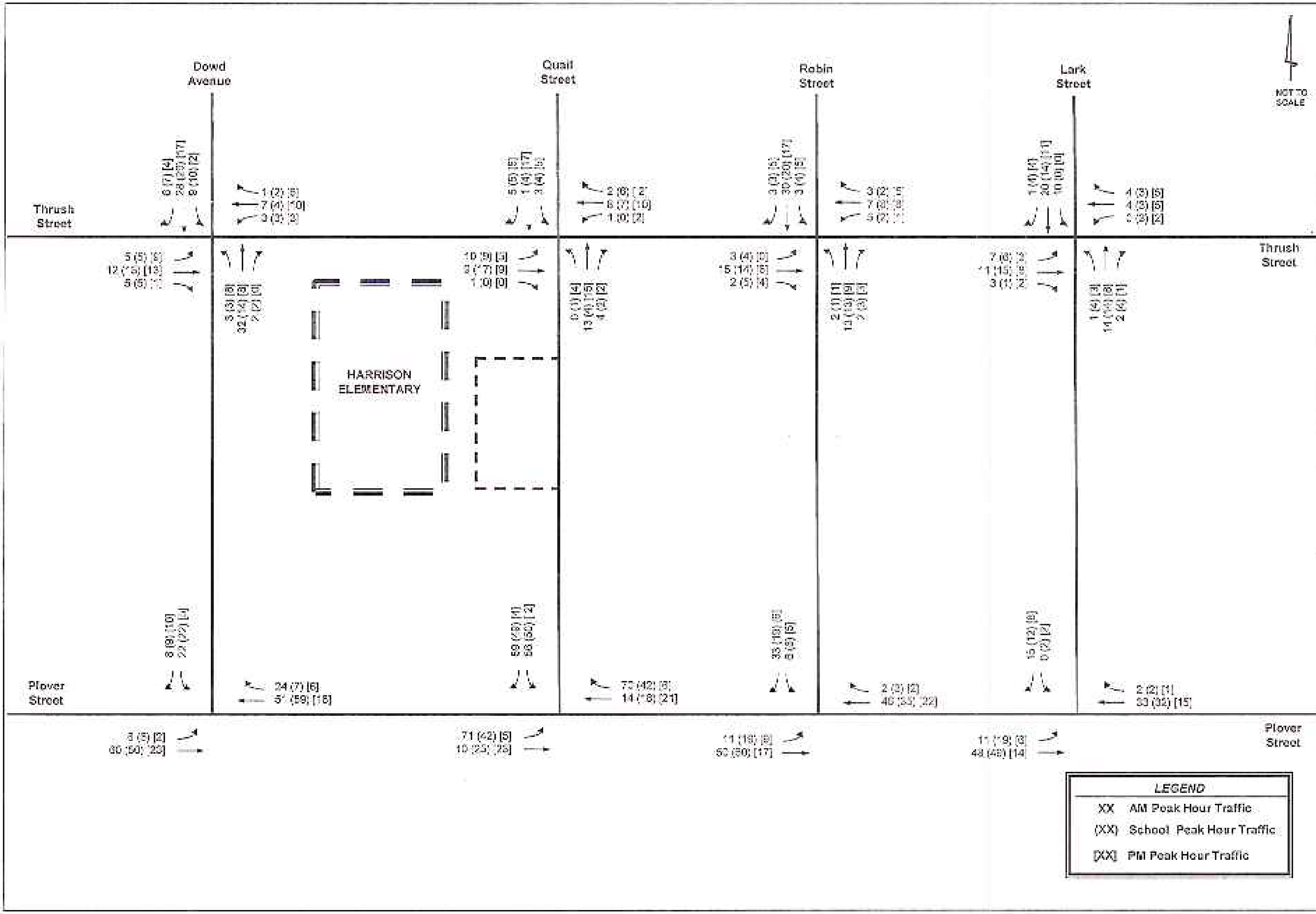


TMS Engineers, Inc.
Transportation Management Services
4547 Hudson Drive Stow, Ohio 44224
www.TMSEngineers.com

Birdtown Parking & Circulation Traffic Engineering Study
Lakewood, Ohio

One-Way Street Network Recommended Configuration

Figure 9



TMS Engineers, Inc.
Transportation Management Services

Birdtown Parking & Circulation
Traffic Engineering Study
Lakewood, Ohio

Existing Weekday
Peak Hour
Traffic Volumes
(Raw Count Data)

Figure 4

DRAFT TRAFFIC ENGINEERING STUDY
Birdtown Neighborhood
Parking & Circulation
Lakewood, Ohio

October 1, 2014

Prepared for:
The City of Lakewood
12650 Detroit Road
Lakewood, OH 44107

Providing Practical Experience
Technical Excellence and
Client Responsiveness

TMS Engineers, Inc.
Transportation Management Services
4547 Hudson Drive • Stow, Ohio 44224
Tel: (330) 686-5402 • Fax: (330) 686-5417
Email: Mail@TMSEngineers.com
Web site: http://www.TMSEngineers.com

TRAFFIC ENGINEERING STUDY

BIRDTOWN NEIGHBORHOOD
PARKING & CIRCULATION

LAKEWOOD, OHIO

OCTOBER 1, 2014

Prepared For:

THE CITY OF LAKEWOOD
12650 DETROIT AVENUE
LAKEWOOD, OHIO 44107

Prepared By:

TMS ENGINEERS, INC.
4547 HUDSON DRIVE
STOW, OHIO 44224

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EXECUTIVE SUMMARY

TMS Engineers, Inc. has been retained by the City of Lakewood to prepare a Traffic Engineering Study of the traffic circulation and parking availability within the Birdtown neighborhood. The purpose of the study will be to determine available on street parking within the neighborhood, evaluation of reconfiguring neighborhood streets for a one-way traffic pattern, and additional consideration of traffic safety enhancements within the Birdtown neighborhood.

The following roadways were considered in the analysis of the Birdtown neighborhood:

1. Thrush Street
2. Flower Street
3. Dowd Avenue
4. Quail Street
5. Robin Street
6. Lark Street

From the collected traffic data, the weekday AM peak hour of traffic was determined to be 8:00 AM to 9:00 AM, the PM peak hour of traffic was determined to be 5:00 PM to 6:00 PM, and 2:30 PM to 3:30 PM was determined to be the peak hour that coincided with the elementary school dismissal time. It should be noted that the AM peak hour also coincides with the start of the school day at the elementary school.

Based on a field review of available on-street parking within the study area it was determined that there is a total of 59 available on-street parking spaces along Dowd Avenue, Quail Street, Robin Street, and Lark Street.

The available development space in the Birdtown study area is expected to generate the following average hourly traffic during the peak periods after full build out of the available space:

NEW TRIP GENERATION
Available Development Space - Birdtown, Lakewood, Ohio

ITE TRIP GENERATION		SIZE (Square Feet)	TRIP ENDS			
ITE Code	Description		Peak Hour Between 7-9 AM (Enter/Exit)		Peak Hour Between 4-6 PM (Enter/Exit)	
820	Shopping Center	31,000	47	29	131	142
TOTAL NEW TRIPS			76		273	

No improvements were found to be necessary to accommodate the existing traffic at the study area intersections. The capacity analysis determined that the intersections and approaches are operating with an LOS B or better.

No improvements were found to be necessary to accommodate the anticipated build traffic volumes at the study area intersections. The capacity analysis determined that the intersections and approaches are expected to operate with an LOS B or better.

The study area traffic was re-distributed based on converting the four north-south roadways between Thrush Street and Plover Street to one-way streets. The direction of travel for each roadway was based on first providing access to the Harrison Elementary School access drives along the west side of Quail Street and then creating couplets of north and south traffic flow. The re-distribution resulting in Dowd Avenue and Robin Street serving northbound traffic and Quail Street and Lark Street serving southbound traffic.

The study area intersections were determined to operate with acceptable levels-of-service under the proposed one-way conditions. The capacity analysis determined that the intersections and approaches are expected to continue to operate with an LOS B or better.

The conversion of Dowd Avenue, Quail Street, Robin Street, and Lark Avenue to one-way streets would increase the available on-street parking by approximately 52 parking spaces. The amount of additional on-street parking spaces could be increased by 13 to 65 spaces if on-street parking were permitted the entire length of Dowd Avenue between Thrush Street and Plover Street.

Based on The American Association of State Highway and Transportation Officials publication **A Policy on Geometric Design of Highways and Streets** we recommend a cross section of 8 foot parallel parking lanes on each side of the roadways with a 10 foot travel lane in the center to accommodate one-way traffic flow on the study area roadways..

All recommended signs within the study area should be in conformance with the recommendations and guidelines found in the **Ohio Manual of Uniform Traffic Control Devices (OMUTCD)**.

The recommended lane use, traffic control, and signage for the study area to accommodate one-way traffic patterns along Dowd Avenue, Quail Street, Robin Street, and Lark Avenue can be seen in **Figure 9, Page 32**.

As result of implementing one-way traffic flow along Quail Street where access to Harrison Elementary School is provided we recommend two traffic lanes. The west curb lane would accommodate the school traffic and the other lane would accommodate through traffic not destined for the school. **Figure 10, Page 33** details the recommended lane use and traffic control for Quail Street at Harrison Elementary School.

1. *INTRODUCTION*

1.1 Purpose of Report

TMS Engineers, Inc. has been retained by the City of Lakewood to prepare a Traffic Engineering Study of the traffic circulation and parking availability within the Birdtown neighborhood. The purpose of the study will be to determine available on-street parking within the neighborhood, evaluation of reconfiguring neighborhood streets for a one-way traffic pattern, and additional consideration of traffic safety enhancements within the Birdtown neighborhood.

The Birdtown neighborhood is located in the City of Lakewood, Cuyahoga County, Ohio. The study analysis will focus on the area bounded by Thrush Street to the north, Plover Street to the south, Dowd Avenue to the west, and Lark Street to the east. The study area can be seen in the Location Map shown in Figure 1, Page 2.

1.2 *Study Objectives*

This study is structured for the following purposes;

- to adequately assess the existing traffic conditions and to identify existing safety issues and/or problems,
- to investigate the feasibility of implementing one-way traffic patterns within the neighborhood,
- to determine existing and potential available on-street parking within the neighborhood; and
- and to provide a technically sound basis to identify and provide geometric or operational improvements related to existing and/or anticipated problems..

This study documents the methodologies, findings and conclusions of the analysis, including the basis for all assumptions, traffic parameters utilized and conclusions reached.

The traffic impacts at the study area intersections will be evaluated through a review of the intersection capacity analyses. Levels-of-service will be calculated using the computerized version of the Transportation Research Board's Highway Capacity Manual, HCM2010 (HCS2010, Release 6.6).

2. AREA CONDITIONS

2.1 Transportation Network Study Area

The Ohio Department of Transportation functionally classifies roadways to help define a roadway's characteristics as well as identify roadways that are eligible for federal funds. Functional classification is the grouping of roads, streets, and highways in a hierarchy based on the type of highway service they provide. Generally, streets and highways perform two types of service. They provide either traffic mobility or land access and can be ranked in terms of the proportion of service they provide. The functional classification of the roadways in the study area can be seen on ODOT's website at:

http://www.dot.state.oh.us/Divisions/Planning/SPPM/SystemsPlanning/Pages/RoadwayFunctionalClass.aspx

The following roadways will be considered in the analysis of the Birdtown neighborhood:

1. Thrush Street
2. Plover Street
3. Dowd Avenue
4. Quail Street
5. Robin Street
6. Lark Street

These roadways can all be classified as urban local roadways. Urban roadways as classified by the Ohio Department of Transportation are intended to provide direct access to adjacent land, provide access to higher classification roadways, and typically carry no through traffic.

The roadways in the study area were found to have a speed limit of 25 miles per hour. It should be noted that there are school speed limit zones along the roadways adjacent to the Harrison Elementary School.

The land use in the study area is primarily residential. Harrison Elementary School is located between Thrush Street to the north, Plover Street to the south, Dowd Avenue to the west, and Quail Street to the east. There are industrial land uses located to the east and west of the site as well.

The intersections within the study area are all stop sign controlled intersections. The following intersections are all way stop intersections:

1. Thrush Street & Dowd Avenue
2. Thrush Street & Quail Street
3. Plover Street & Quail Street

The remaining intersections only have stop sign control on the minor street approaches. The main street approaches operate under free-flow conditions. There are no exclusive turn lanes with the study area.

The average daily traffic for each of the study area roadways can be seen below:

	ROADWAY	ADT
1.	Thrush Street	365
2.	Plover Street	760
3.	Dowd Avenue	375
4.	Quail Street	250
5.	Robin Street	370
6.	Lark Street	350

The previously shown ADT volumes were determined based on traffic data collected for this report in 2014.

It should also be noted that Quail Avenue at Thrush Street is closed to southbound traffic from 8:00 AM to 3:30 PM due to the traffic circulation plan in place for Harrison Elementary School. All vehicles must enter and exit Quail Avenue at Plover Street during these hours. Vehicles destined for the school enter at the northern most access and then must turn right to exit the site from the southern access drive.

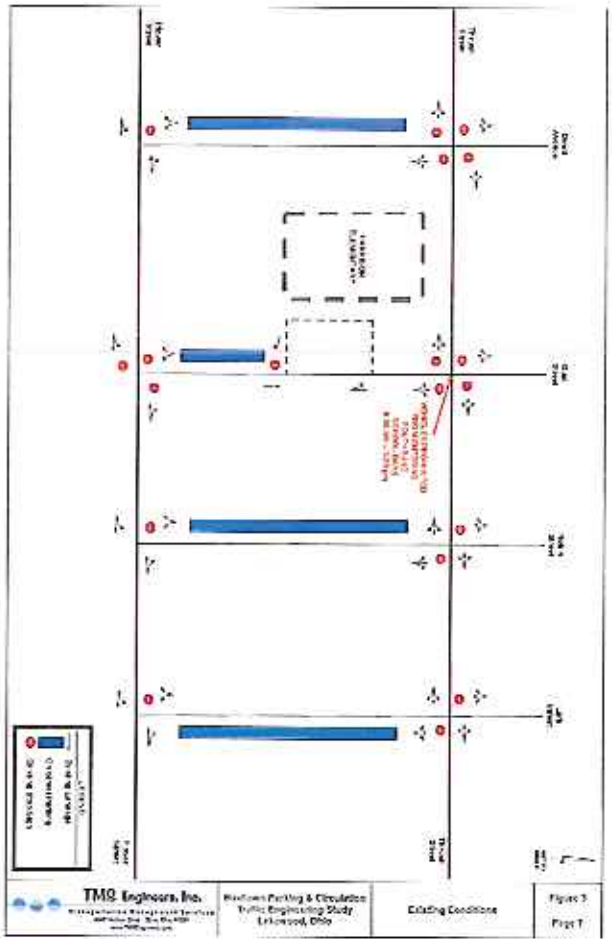
Figure 2, Page 6 shows an aerial view of the study area.

Figure 3, Page 7 shows the existing study area land use and traffic control including the existing traffic pattern for Harrison Elementary School, and available on street parking on Dowd Avenue, Quail Street, Robin Street, and Lark Street.

TMS Engineers, Inc.

Aerial View

Figure 6



TMS Engineers, Inc.

Existing Conditions

Figure 7

2.2 *Traffic*

Weekday one hour turning movement counts were performed at the following intersections within the study area:

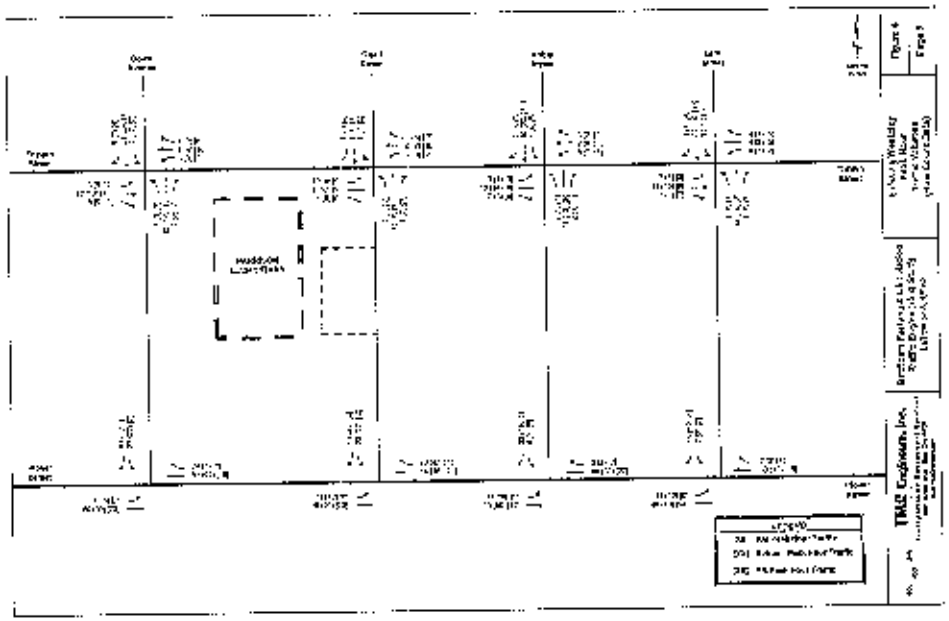
1. Thrush Street & Dowd Avenue
2. Thrush Street & Quail Street
3. Thrush Street & Robin Street
4. Thrush Street & Lark Street
5. Plover Street & Dowd Avenue
6. Plover Street & Quail Street
7. Plover Street & Robin Street
8. Plover Street & Lark Street

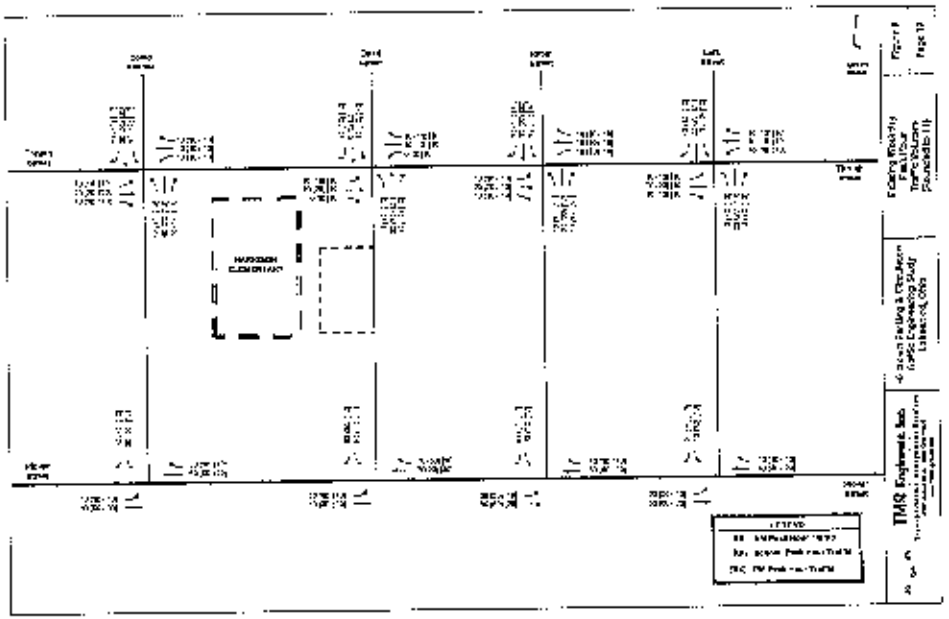
The surveys were taken on Thursday, September 4, 2014. The traffic counts were conducted in fifteen (15) minute intervals between the hours of 7 AM - 10 AM, 11 AM - 1 PM, and 2 PM - 6 PM, then hourly totals were calculated. Vehicle classification to determine the extent of trucks and buses was also performed. Copies of the intersection turn movement counts are included in Appendix A.

Average daily traffic was calculated for each of the study roads using expansion factors to account for daily and seasonal variations according to the recommendations and latest data from the Ohio Department of Transportation.

From the data, the weekday AM peak hour of traffic was determined to be 8:00 AM to 9:00 AM, the PM peak hour of traffic was determined to be 5:00 PM to 6:00 PM, and 2:30 PM to 3:30 PM was determined to be the peak hour that coincided with the elementary school dismissal time. It should be noted that the AM peak hour also coincides with the start of the school day at the elementary school.

These periods will be analyzed since they reflect the periods of the highest volume of traffic flow for the study area. It will provide a worst case scenario for all analysis. Current AM, School, and PM peak hour traffic volumes are shown in **Figure 4, Page 9**. The Ohio Department of Transportation recommends that all volumes be rounded to the nearest 10 for analysis. For the purpose of this analysis all volumes were rounded to the next highest 10. The rounded existing traffic volumes that will be used in the analysis can be seen in **Figure 5, Page 10**.





2.3 *On-Street Parking*

A field survey was conducted to determine the existing amount of available on-street parking on Dowd Avenue, Quail Street, Robin Street, and Lark Street between Thrush Street and Plover Street.

Currently parking is only allowed along one side of the streets as each street permits two-way traffic flow.

Parking is allowed along the west side of Dowd Avenue. The are 27 available parking spaces along the west side of Dowd Avenue. Parking is allowed along the west side of Quail Street. The are 9 available parking spaces along the west side of Quail Street. These parking spaces are located south of Harrison Elementary School. Parking is allowed along the west side of Robin Street. The are 18 available parking spaces along the west side of Robin Street. Parking is allowed along the east side of Lark Street. The are 15 available parking spaces along the east side of Lark Street.

Based on the previously discussed field review of available on-street parking within the study area it was determined that there is a total of 69 available parking spaces along Dowd Avenue, Quail Street, Robin Street, and Lark Street.

3. PROJECTED TRAFFIC CONDITIONS

3.1 Study Area Traffic

Design of new roadways or improvements to existing roadways should not usually be based on current traffic volumes alone, but should consider future traffic volumes expected to make use of the facilities. Roadways should be designed to accommodate the traffic volume that is likely to occur within the design life of the facility. In a practical sense, this design volume should be a value that can be estimated with reasonable accuracy. It is believed that the maximum design period is in the range of 15 to 24 years. Therefore, a period of twenty years is widely used as a basis for design. Traffic cannot usually be forecasted accurately beyond this period on a specific facility because of probable changes in the general regional economy, population, and land development along the roadway.

Arterial and collector roadways carry a predominate amount of through traffic due to their functional characteristics. Arterial streets usually carry more through traffic than collectors. This through traffic component generally increases as regional growth occurs. Local roadways as previously discussed do not carry through traffic. Local roadways typically experience traffic growth due to the development of land they provide access to.

Based upon sound engineering practice and the likelihood of no through traffic growth due to the functional characteristics of the study area roadways no growth rate will be applied to the study area traffic volumes.

3.2 Site Traffic

The previous section detailed that the study area is not expected to see the growth of through traffic due to regional influences, however the Birdtown study area includes buildings that once housed a commercial use or could be potentially converted to a commercial use. The development of these buildings would add additional traffic to the roadways.

Trip Generation

Calculating future total driveway trips, requires an estimate of the traffic generated by the proposed development. The most widely accepted method of determining the amount of traffic that a proposed development will generate is to compare the proposed site with existing facilities of the same use. The Institute of Transportation Engineers (ITE) has prepared a manual titled "Trip Generation Manual", which is a compilation of hundreds of similar traffic generation studies to aide in making such a comparison. The most recent update of this manual is the 9th edition and was utilized for this study.

The City of Lakewood provided the following square footage of potential development space within the Birdtown neighborhood:

Address	Est. Square Footage	Current Use
2052 Dowd	1,326	Residential
2050 Dowd	2,515	Residential
12228 Plover	3,218	Empty
12315 Plover	621	Residential
12507 Plover	5,274	Machine Shop
12511 Plover	1,135	Residential
12521 Plover	743	Residential
12529 Plover	1,249	Residential
12707 Plover	870	Residential
12721 Plover	2,000	Residential
2018 Lark	1,257	Residential
2032 Lark	1,557	Residential
2099 Lark	1,630	Residential
2050 Robin	1,420	Residential
2059 Robin	925	Residential
2051 Quail	2,063	Church
2101 Quail	3,188	Church
TOTAL	30,991	

The aforementioned structures fall under the mixed-use overlay zoning regulations which allow residential, entertainment, food and beverage, professional services, general retail, service retail, convenience retail, personal care services, and laundromat land uses. All uses must be at a neighborhood scale.

In order to provide a conservative estimate of traffic generated by the development due to the unknown specific land uses of several parcels and their time frame for development the entire available square footage was analyzed under the ITE Shopping Center land use. This will provide a conservative estimate of the generated traffic for the study area.

Internal Trips

Internal trips are vehicles that are attracted to the future development from another development on the same site. Internal connections within the neighborhood will allow trips between the different land uses. It can be assumed that due to the related uses of the proposed land uses and their location within a residential development that there would be shared trips. The analysis of the development as a whole unit will take into account the impact of internal trips.

Passer-by Trips

It should be noted that retail land uses generate a different mixture of traffic than land uses such as residential homes and office facilities, which add all of the "new" traffic to the adjacent roadway system. Retail and service land uses also attract motorists from the existing passing flow of traffic. A portion of the estimated total generated trips are actually vehicles that are currently using the adjacent roadway system (i.e. motorists who are already on the road and stop by the drugstore on the way home from work). These vehicles are referred to as 'Passer-by' trips.

The ITE **Trip Generation Handbook, Second Edition** provides pass-by rates for various land uses. The following table details the pass-by rates for a shopping center type development:

LAND USE	ITE CODE	PM PEAK HOUR		
		LOWEST	HIGHEST	AVERAGE
Shopping Center	820	8%	89%	34%

While some passer-by traffic is expected to occur during the AM peak hour, no percentages have been documented by the **Trip Generation Handbook**. To provide a conservative estimate and due to the low volume of through traffic throughout the neighborhood, no passer-by percentages will be used for the purposes of this analysis.

Copies of the trip generation worksheet can be found in **Appendix B**. Calculations made for the available development space are shown in the following table.

NEW TRIP GENERATION

Available Development Space - Birdtown, Lakewood, Ohio

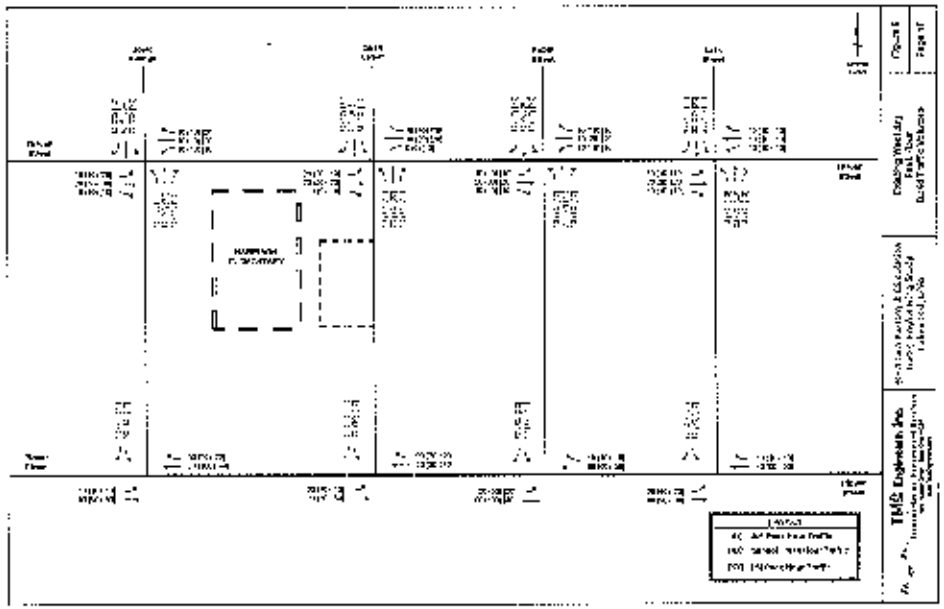
ITE TRIP GENERATION		SIZE (Square Feet)	TRIP ENDS			
ITE Code	Description		Peak Hour Between 7-9 AM (Enter/Exit)		Peak Hour Between 4-6 PM (Enter/Exit)	
820	Shopping Center	31,000	47	29	131	142
TOTAL NEW TRIPS			76		273	

It should be noted that the trip generation calculations do not provide data for the peak hour that coincides with the school dismissal period. In order to the provide an analysis of these build conditions during that time the PM peak hour generated volumes will also be applied to the School Peak Hour. This will provide a worst case scenario for the School Peak Hour conditions. The generated volumes during the 2:30 PM to 3:30 PM are likely to fall somewhere between the AM and PM hour generated traffic volumes.

3.3 Future Traffic

Build Condition

In order to estimate the future traffic at the study area intersections within the Birdtown neighborhood considering the estimated future traffic conditions, a growth rate was applied to all movements within the study area based on the existing traffic volumes entering and exiting the neighborhood as compared to the expected generated traffic as shown in the previous trip generation table. The estimated full build traffic for the Birdtown neighborhood is shown graphically in **Figure 6, Page 17.** These traffic volumes are the expected traffic volumes within the neighborhood if all the previously discussed development space is built out, or the "build" condition. These volumes have been rounded to the nearest tenth.



3.4 *One-Way Traffic*

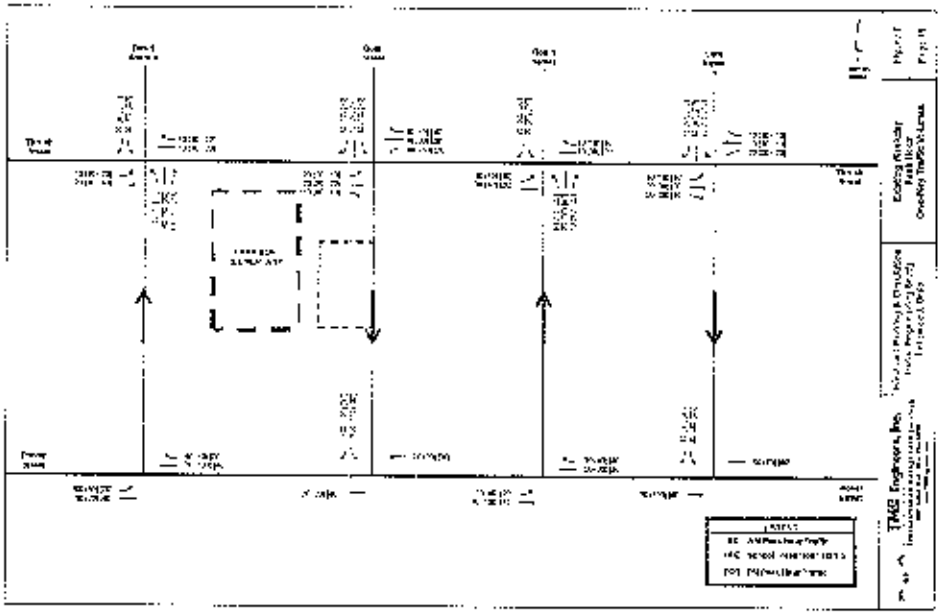
Traffic was re-distributed to the study area intersections to determine the impact of converting the roadways to one-way streets. In order to convert existing two-way streets to one-way it is necessary to pair two streets in a couplet opposite directions of travel.

The study area traffic was re-distributed based on converting the four north-south roadways between Thrush Street and Plover Street to one-way streets. The direction of travel for each roadway was based on first providing access to the Harrison Elementary School access drives along the west side of Quail Street and then creating couplets of north and south traffic flow.

Harrison Elementary School traffic currently must come from the Plover Street and Quail Street intersection to head northbound to the north access drive. Vehicles turn left into the school and then exit through the south access drive via a right turn and then through the Plover Street and Quail Street intersection. In order to allow vehicles to enter the north access and exit from the south access it would be necessary to make Quail Street a one-way southbound street. Dowd Avenue would then be the complementary northbound couplet to southbound Quail Street.

In order to alternate north and south traffic flow Roan Street would be one-way northbound with a complementary couplet in southbound Lark Street.

The re-distributed traffic volumes for 2 pairs of one-way couplets in the study area can be seen in **Figure 7, Page 19.**



4. TRAFFIC ANALYSIS

4.1 Capacity and LOS at Study Area Intersections

Intersection capacity analyses were performed at the study intersections using the procedures outlined in the computerized version of the Transportation Research Board's **Highway Capacity Manual, HCM2010 (HCS2010, Release 6.6)**. The capacity analyses were performed in order to estimate the maximum amount of traffic that can be accommodated by a roadway facility while maintaining recommended operational qualities. 2014 Existing, Build conditions, and proposed conditions peak hour traffic volumes were analyzed to determine the level-of-service (LOS) at the study area intersections.

The capacity analysis procedures provide a calculated "average vehicle delay", which is based on traffic volumes, number of lanes, type of traffic control, channelization, grade, and percentage of large vehicles in the traffic stream at each intersection. The average delay calculated at an intersection is then assigned a "grade" or level of service (LOS) ranging from LOS A, the best, to LOS F, the worst based upon driver expectation. The intersection LOS "grades" as defined by the Transportation Research Board are as follows:

INTERSECTION LOS

LOS	UNSIGNALIZED AVERAGE DELAY PER VEHICLE (sec)	SIGNALIZED AVERAGE DELAY PER VEHICLE (sec)
A	≤ 10.0	≤ 10.0
B	10.1 to 15.0	10.1 to 20.0
C	15.1 to 25.0	20.1 to 35.0
D	25.1 to 35.0	35.1 to 55.0
E	35.1 to 50.0	55.1 to 80.0
F	> 50	> 80

The capacity analysis procedures and the resulting level of service grades and delays are a recognized traffic engineering standard for measuring the efficiency of intersection operations by such organizations as the Institute of Transportation Engineers, American Association of State Highway and Transportation Officials, and the Ohio Department of Transportation.

Existing Conditions

Analyses were performed for the current conditions under the Existing scenario. These analyses will be used to identify existing capacity and/or operational deficiencies. The traffic volumes used in this analysis can be seen in Figure 5. Copies of the capacity worksheets are included in **Appendix C**. The results of the Existing analysis are shown in the following tables.

LEVELS OF SERVICE

(Existing Conditions - Thrush Street)

LOCATION	MOVEMENTS	AM PEAK LOS (DELAY)	SCHOOL PM PEAK LOS (DELAY)	PM PEAK LOS (DELAY)
Thrush Street &	Intersection	A (7.6)	A (7.5)	A (7.4)
Dowd Avenue	Eastbound	A (7.8)	A (7.4)	A (7.5)
	Westbound	A (7.4)	A (7.5)	A (7.4)
	Northbound	A (7.8)	A (7.5)	A (7.3)
	Southbound	A (7.8)	A (7.5)	A (7.4)
Thrush Street &	Intersection	A (7.4)	A (7.4)	A (7.4)
Quail Street	Eastbound	A (7.3)	A (7.4)	A (7.3)
	Westbound	A (7.4)	A (7.4)	A (7.3)
	Northbound	A (7.5)	A (7.5)	A (7.4)
	Southbound	A (7.3)	A (7.3)	A (7.4)
Thrush Street &	Eastbound	A (7.8)	A (7.3)	A (7.3)
Robin Street	Westbound	A (7.8)	A (7.3)	A (7.3)
	Northbound	A (9.5)	A (9.5)	A (9.3)
	Southbound	A (10.0)	A (9.7)	A (9.4)
Thrush Street &	Eastbound	A (7.3)	A (7.3)	A (7.3)
Lark Street	Westbound	A (7.3)	A (7.3)	A (7.3)
	Northbound	A (9.9)	A (9.6)	A (9.3)
	Southbound	A (9.9)	A (9.9)	A (9.5)

(XX.X) = Average vehicle delay in seconds per vehicle

2014 LEVELS OF SERVICE

(Existing Conditions - Plover Street)

LOCATION	MOVEMENTS	AM PEAK LOS (DELAY)	SCHOOL PM PEAK LOS (DELAY)	PM PEAK LOS (DELAY)
Plover Street &	Eastbound	A (7.6)	A (7.5)	A (7.3)
Dowd Avenue	Southbound	A (9.5)	B (10.0)	A (8.6)
Plover Street &	Intersection	A (8.7)	A (8.8)	A (7.2)
Quail Street	Eastbound	A (9.6)	A (8.8)	A (7.4)
	Westbound	A (7.8)	A (7.8)	A (7.2)
	Southbound	A (9.1)	A (8.8)	A (7.1)
Plover Street &	Eastbound	A (7.5)	A (7.5)	A (7.3)
Robin Street	Southbound	A (9.2)	A (9.4)	A (8.9)
Plover Street &	Eastbound	A (7.4)	A (7.4)	A (7.3)
Lark Street	Southbound	A (9.3)	A (9.1)	A (8.5)

(XX.X) = Average vehicle delay in seconds per vehicle

Conditions at all of the intersections within the study area are currently operating at an acceptable level-of-service during the peak hours. All intersection approaches were determined to be operating with an LOS B or better.

Build Conditions

Analyses were performed for the projected conditions under the Build scenario to determine the future levels of service at the study intersections under the anticipated build conditions. The traffic volumes used in this analysis can be seen in Figure 6. Copies of the capacity worksheets are included in Appendix D. The results of the Build analyses are shown in the following tables.

LEVELS OF SERVICE

(Build Conditions - Thrush Street)

LOCATION	MOVEMENTS	AM PEAK LOS (DELAY)	SCHOOL PM PEAK LOS (DELAY)	PM PEAK LOS (DELAY)
Thrush Street &	Intersection	A (7.7)	A (7.8)	A (7.8)
Dowd Avenue	Eastbound	A (7.7)	A (7.7)	A (7.9)
	Westbound	A (7.5)	A (7.7)	A (7.7)
	Northbound	A (7.6)	A (7.9)	A (7.7)
	Southbound	A (7.3)	A (7.8)	A (7.9)
Thrush Street &	Intersection	A (7.5)	A (7.6)	A (7.7)
Quail Street	Eastbound	A (7.6)	A (7.7)	A (7.6)
	Westbound	A (7.4)	A (7.5)	A (7.6)
	Northbound	A (7.6)	A (7.6)	A (7.7)
	Southbound	A (7.4)	A (7.4)	A (7.7)
Thrush Street &	Eastbound	A (7.3)	A (7.3)	A (7.3)
Robin Street	Westbound	A (7.3)	A (7.3)	A (7.2)
	Northbound	A (9.5)	A (10.0)	A (9.7)
	Southbound	B (10.0)	B (10.3)	A (10.0)
Thrush Street &	Eastbound	A (7.3)	A (7.3)	A (7.3)
Lark Street	Westbound	A (7.3)	A (7.3)	A (7.3)
	Northbound	A (9.5)	B (10.2)	A (9.5)
	Southbound	B (10.2)	B (10.3)	A (9.3)

(XX.X) = Average vehicle delay in seconds per vehicle

LEVELS OF SERVICE

(Build Conditions - Plover Street)

LOCATION	MOVEMENTS	AM PEAK LOS (DELAY)	SCHOOL PM PEAK LOS (DELAY)	PM PEAK LOS (DELAY)
Plover Street &	Eastbound	A (7.5)	A (7.5)	A (7.4)
Dowd Avenue	Southbound	B (10.2)	B (11.4)	A (9.0)
Plover Street &	Intersection	A (8.5)	B (11.3)	A (7.3)
Quail Street	Eastbound	A (8.1)	B (10.9)	A (7.5)
	Westbound	A (8.3)	A (8.1)	A (7.3)
	Southbound	B (10.1)	B (12.7)	A (7.2)
Plover Street &	Eastbound	A (7.5)	A (7.6)	A (7.4)
Robin Street	Southbound	A (9.4)	A (9.9)	A (9.2)
Plover Street &	Eastbound	A (7.4)	A (7.5)	A (7.4)
Lark Street	Southbound	A (8.3)	A (9.6)	A (9.0)

(XX.X) = Average vehicle delay in seconds per vehicle

Conditions at all of the intersections within the study area are expected to continue operating at an acceptable level-of-service during the peak hours under the anticipated build conditions. All intersection approaches were determined to continue to operate with an LOS B or better.

One-Way Conditions - Capacity Analysis

The peak hour levels-of-service for the study area intersections were calculated based on implementing one-way traffic flow. The traffic volumes used in this analysis can be seen in Figure 7. The results of the capacity analysis are summarized in the table below. Copies of the analysis worksheets are included in Appendix E.

LEVELS OF SERVICE

(One-Way Conditions - Thrush Street)

LOCATION	MOVEMENTS	AM PEAK LOS (DELAY)	SCHOOL PM PEAK LOS (DELAY)	PM PEAK LOS (DELAY)
Thrush Street &	Intersection	A (7.5)	A (7.9)	A (7.6)
Dowd Avenue	Eastbound	A (7.5)	A (8.0)	A (8.1)
	Westbound	A (7.4)	A (7.5)	A (7.5)
	Northbound	A (7.5)	A (9.1)	A (7.5)
	Southbound	A (7.6)	A (7.7)	A (7.7)
Thrush Street &	Intersection	A (8.5)	A (8.2)	A (7.7)
Quail Street	Eastbound	A (8.6)	A (7.5)	A (7.5)
	Westbound	A (9.2)	A (9.0)	A (7.7)
	Southbound	A (8.5)	A (8.0)	A (7.5)
Thrush Street &	Eastbound	A (7.3)	A (7.3)	A (7.3)
Robin Street	Northbound	B (10.2)	A (10.5)	A (9.7)
	Southbound	A (8.2)	A (9.4)	A (8.3)
Thrush Street &	Eastbound	A (7.3)	A (7.3)	A (7.3)
Lark Street	Westbound	A (7.4)	A (7.4)	A (7.3)
	Southbound	B (10.7)	B (10.8)	A (9.5)

(XX.X) = Average vehicle delay in seconds per vehicle

LEVELS OF SERVICE

(One-Way Conditions - Plover Street)

LOCATION	MOVEMENTS	AM PEAK LOS (DELAY)	SCHOOL PM PEAK LOS (DELAY)	PM PEAK LOS (DELAY)
Plover Street & Dowd Avenue	Eastbound	A (7.9)	A (8.3)	A (7.4)
Plover Street & Quail Street	Intersection	A (9.9)	B (10.5)	A (7.4)
	Eastbound	A (8.0)	B (8.2)	A (7.4)
	Westbound	A (8.1)	A (8.19)	A (7.4)
	Southbound	B (10.1)	B (10.9)	A (7.3)
Plover Street & Robin Street	Eastbound	A (7.8)	A (7.7)	A (7.5)
Plover Street & Lark Street	Southbound	A (9.5)	A (7.5)	A (8.1)

(XX.X) = Average vehicle delay in seconds per vehicle

Conditions at all of the intersections within the study area are expected to operate at an acceptable level-of-service during the peak hours under the anticipated build conditions with one-way traffic patterns within the neighborhood. All intersection approaches were determined to continue to operate with an LOS B or better.

4.2 *Parking Analysis*

The implementation of one-way traffic flow along Dowd Avenue, Quail Street, Robin Street, and Lark Avenue would allow for the implementation of on street parking along both sides of the street.

There is currently existing on street parking along the west side of Dowd Avenue, Quail Street, Robin Street and the east side of Lark Avenue. There are fire hydrants located along the opposite side of street from the on street parking. On-street parking should not block access these fire hydrants.

There are approximately 13 available parking spaces south of Harrison Elementary School along the east side of Dowd Avenue. Allowing parking along Dowd Avenue where the school is would allow an additional 13 spaces. There are approximately 26 available on street parking spaces along the east side of Dowd Avenue between Thrush Street and Plover Street.

There are approximately 9 available parking spaces south of Harrison Elementary School along the east side of Quail Street. We do not recommend allowing on-street parking along either side of Quail Street from Thrush Street to the southern edge of the school site due to the school access drives along the west side of the Quail Street.

There are approximately 18 available parking spaces along the east side of Robin Street.

There are approximately 15 available parking spaces along the west side of Lark Avenue.

The conversion of Dowd Avenue, Quail Street, Robin Street, and Lark Avenue to one-way streets would increase the available on-street parking by approximately 52 parking spaces. The amount of additional on-street parking spaces could be increased by 13 to 65 spaces if on-street parking were permitted the entire length of Dowd Avenue between Thrush Street and Plover Street.

4.3 Recommended Roadway Configuration

In order to facilitate the conversion of the existing two-way streets to one-way streets several geometric and signing improvements are recommended.

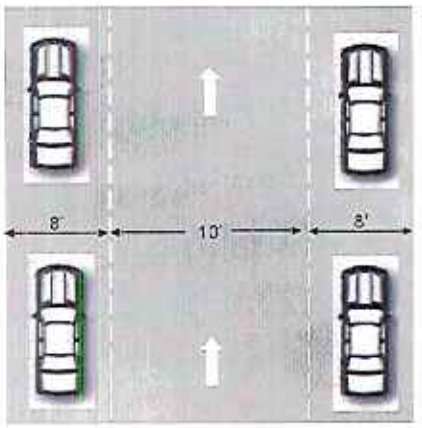
Dowd Avenue, Quail Street, Robin Street, and Lark Avenue are all approximately 29 feet wide from curb to curb. The American Association of State Highway and Transportation Officials publication **A Policy on Geometric Design of Highways and Streets** recommends a minimum width of 10 feet for roadway travel lanes and parallel parking lane with a minimum width of 7 feet.

Based on the minimum recommended lane widths we recommend a cross section of 8 foot parallel parking lanes on each side of the roadway with a 10 foot travel lane in the center. **Figure 8, Page 29** details the recommended cross-section for the study area roadways to accommodate one-way traffic flow and parallel parking on each side of the roadway.

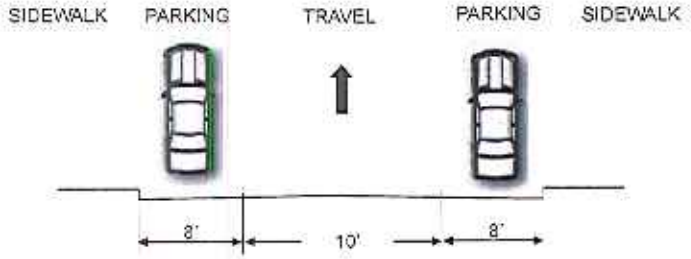
All recommended signs within the study area should be in conformance with the recommendations and guidelines found in the **Ohio Manual of Uniform Traffic Control Devices (OMUTCD)**.

The exit end of Dowd Avenue, Quail Street, Robin Street, and Lark Avenue should be properly marked with Do Not Enter signs. A sign should be erected on each corner. An example of the recommend sign with the OMUTCD sign code can be seen in the following picture:

R5-1



One-Way Roadway



One-Way Roadway Cross-Section

TMS Engineers, Inc.	Birdtown Parking & Circulation TES	Plan & Profile One-Way Street	Figure 8
			Page 29

One-way directional signs should also be erected at each end of the one-way sections to indicate the proper direction of travel. An example of the recommend sign with the OMUTCD sign code can be seen in the following picture:

R6-1

Additional signs that can be used to supplement and reinforce the one-way traffic patterns include the Wrong Way, Begin One Way, and End One Way signs. An example of these signs with the OMUTCD sign code can be seen in the following pictures:

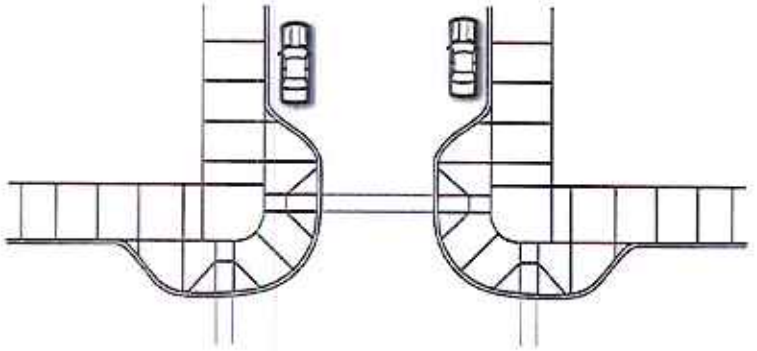
R5-1a

R6-6

R5-7

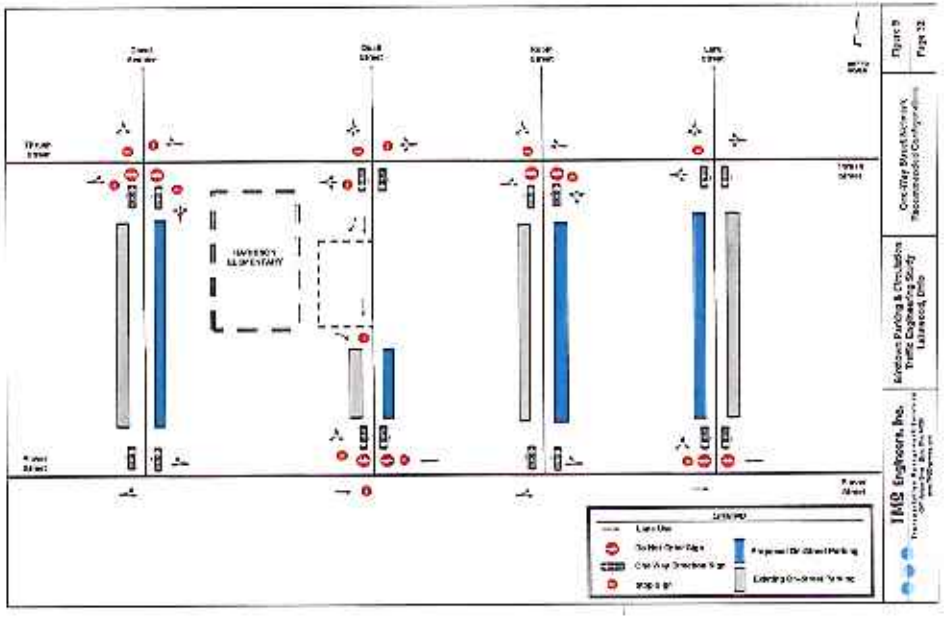
Curb extensions are an additional geometric feature that can be used to implement the one-way traffic patterns. The curb extension would provide several benefits to the road users as well as pedestrians in the study area.

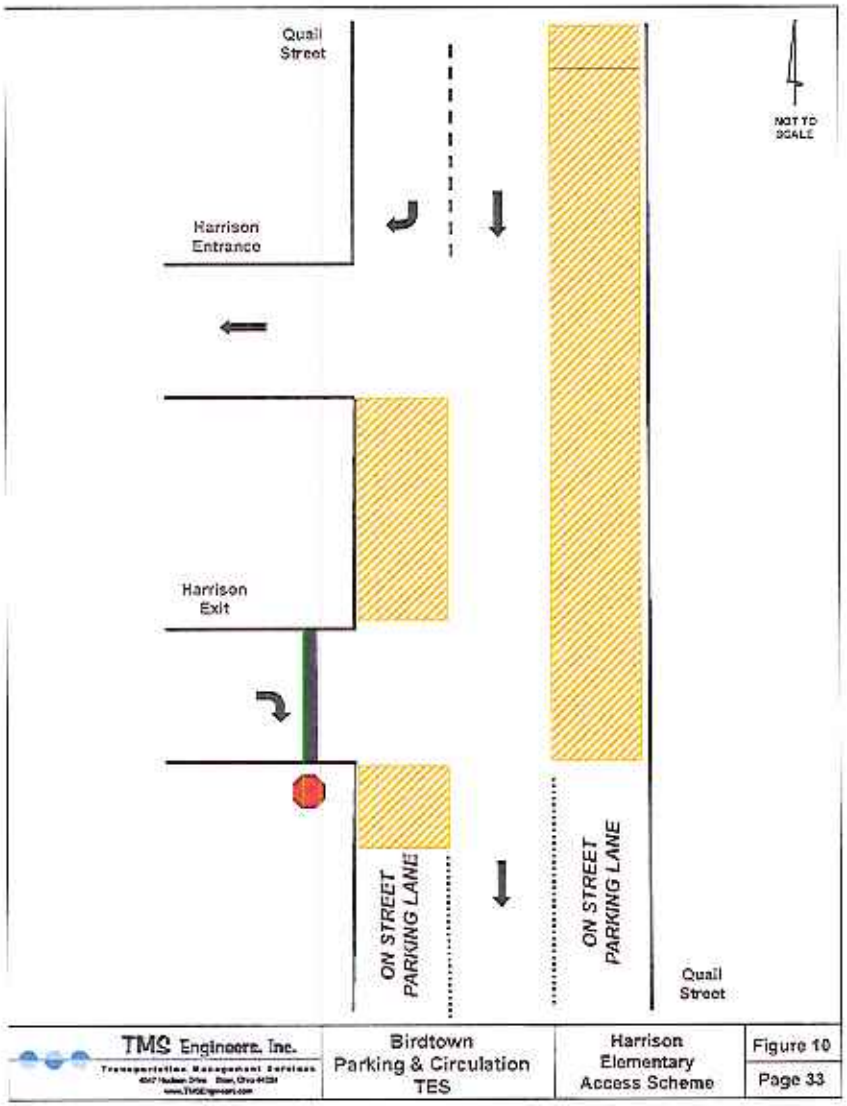
The curb extensions would extend out into the roadway to provide a separation from the parking lanes and the travel lanes. The bump outs would direct traffic into the center of the lane and help to keep parked cars far enough back from the intersections so as not to block the view of oncoming traffic on the adjacent roadways. The curb extensions also serves to move a crossing pedestrian out from behind parked cars to increase visibility and to shorten the amount of time the pedestrian is in the roadway crossing the street. The following picture illustrates the use of curb extensions at a one way street:



The recommended lane use, traffic control, and signage for the study area to accommodate one-way traffic patterns along Dowd Avenue, Quail Street, Robin Street, and Lark Avenue can be seen in Figure 9, Page 32.

As result of implementing one-way traffic flow along Quail Street where access to Harrison Elementary School is provided we recommend two traffic lanes. The west curb lane would accommodate the school traffic and the other lane would accommodate through traffic not destined for the school. Figure 10, Page 33 details the recommended lane use and traffic control for Quail Street at Harrison Elementary School.





TMS Engineers, Inc. Transportation Management Services	Birdtown Parking & Circulation TES	Harrison Elementary Access Scheme	Figure 10 Page 33

5. CONCLUSIONS

Based on the results of the analyses, we offer the following conclusions and recommendations:

5.1 TMS Engineers, Inc. has been retained by the City of Lakewood to prepare a Traffic Engineering Study of the traffic circulation and parking availability within the Birdtown neighborhood. The purpose of the study will be to determine available on street parking within the neighborhood, evaluation of reconfiguring neighborhood streets for a one-way traffic pattern, and additional consideration of traffic safety enhancements within the Birdtown neighborhood.

5.2 The following roadways were considered in the analysis of the Birdtown neighborhood:

1. Thrush Street
2. Plover Street
3. Dowd Avenue
4. Quail Street
5. Robin Street
6. Lark Street

5.3 From the collected traffic data, the weekday AM peak hour of traffic was determined to be 8:00 AM to 9:00 AM, the PM peak hour of traffic was determined to be 5:00 PM to 6:00 PM, and 2:30 PM to 3:30 PM was determined to be the peak hour that coincided with the elementary school dismissal time. It should be noted that the AM peak hour also coincides with the start of the school day at the elementary school.

5.4 Based on a field review of available on-street parking within the study area it was determined that there is a total of 59 available on-street parking spaces along Dowd Avenue, Quail Street, Robin Street, and Lark Street.

5.5 The available development space in the Birdtown study area is expected to generate the following average hourly traffic during the peak periods after full build out of the available space:

NEW TRIP GENERATION

Available Development Space - Birdtown, Lakewood, Ohio

ITE TRIP GENERATION		SIZE (Square Feet)	TRIP ENDS			
ITE Code	Description		Peak Hour Between 7-9 AM (Enter/Exit)		Peak Hour Between 4-6 PM (Enter/Exit)	
820	Shopping Center	31,000	47	29	131	142
TOTAL NEW TRIPS			76		273	

5.6 No improvements were found to be necessary to accommodate the existing traffic at the study area intersections. The capacity analysis determined that the intersections and approaches are operating with an LOS B or better.

5.7 No improvements were found to be necessary to accommodate the anticipated build traffic volumes at the study area intersections. The capacity analysis determined that the intersections and approaches are expected to operate with an LOS B or better.

5.8 The study area traffic was re-distributed based on converting the four north-south roadways between Thrush Street and Plover Street to one-way streets. The direction of travel for each roadway was based on first providing access to the Harrison Elementary School access drives along the west side of Quail Street and then creating couplets of north and south traffic flow. The re-distribution resulting in Dowd Avenue and Robin Street serving northbound traffic and Quail Street and Lark Street serving southbound traffic.

5.9 The study area intersections were determined to operate with acceptable levels-of-service under the proposed one-way conditions. The capacity analysis determined that the intersections and approaches are expected to continue to operate with an LOS B or better.

5.10 The conversion of Dowd Avenue, Quail Street, Robin Street, and Lark Avenue to one-way streets would increase the available on-street parking by approximately 52 parking spaces. The amount of additional on-street parking spaces could be increased by 13 to 65 spaces if on-street parking were permitted the entire length of Dowd Avenue between Thrush Street and Plover Street.

5.11 Based on The American Association of State Highway and Transportation Officials publication **A Policy on Geometric Design of Highways and Streets** we recommend a cross section of 8 foot parallel parking lanes on each side of the roadways with a 10 foot travel lane in the center to accommodate one-way traffic flow on the study area roadways..

5.12 All recommended signs within the study area should be in conformance with the recommendations and guidelines found in the **Ohio Manual of Uniform Traffic Control Devices (OMUTCD)**.

5.13 The recommended lane use, traffic control, and signage for the study area to accommodate one-way traffic patterns along Dowd Avenue, Quail Street, Robin Street, and Lark Avenue can be seen in **Figure 9, Page 32.**

5.14 As result of implementing one-way traffic flow along Quail Street where access to Harrison Elementary School is provided we recommend two traffic lanes. The west curb lane would accommodate the school traffic and the other lane would accommodate through traffic not destined for the school. **Figure 10, Page 33** details the recommended lane use and traffic control for Quail Street at Harrison Elementary School.

APPENDIX A
Traffic Counts

VEHICULAR TRAFFIC COUNT SUMMARY

Municipality: Lakewood — At Intersection of: Duval Avenue — and: Thrush Street

Date: 9/4/2014 — Day: Thu. — Comments: — Project: 14-165

Weather: Clear — Recorder(s): RMS — Data entry by: JJD — Data collected: Sep 4, 2014 — Duval Ave & Thrush St 090414

TIME BEGIN	Duval Ave. FROM NORTH						Duval Ave. FROM SOUTH						TOTAL NORTH SOUTH	Thrush St. FROM EAST						Thrush St. FROM WEST						TOTAL EAST WEST	TOTAL ALL DIRS.	PEAK HOUR FACTOR			
	Left	Thru	Right	Total	T/A	Bus	Left	Thru	Right	Total	T/A	Bus		Left	Thru	Right	Total	T/A	Bus	Left	Thru	Right	Total	T/A	Bus			North	South	East	West
06:00																														
07:00	0	13	2	15	0	0	0	4	1	5	0	0	20	1	7	4	12	0	0	0	11	0	12	1	0	32	52	0.625	0.625	0.500	0.500
08:00	5	72	5	77	0	0	1	7	4	12	0	0	89	9	22	6	43	2	0	3	22	2	27	0	0	70	113	0.833	0.917	0.875	0.875
09:00	6	7	7	14	0	0	1	7	1	9	1	0	24	2	7	1	10	0	0	1	9	0	10	1	0	20	44	0.625	0.804	0.625	0.625
10:00																														
11:00	2	7	1	11	0	0	2	10	2	14	1	0	25	5	6	4	14	1	1	1	8	0	10	0	0	24	49	0.500	0.833	0.625	0.625
12:00	3	9	4	16	0	0	1	14	0	17	0	0	33	7	14	4	12	1	1	1	4	3	12	1	0	31	64	0.500	0.107	0.750	0.500
1:00																														
2:00	5	11	7	14	0	0	2	7	0	15	1	0	30	3	21	9	23	4	0	1	3	5	7	0	0	46	76	0.750	0.536	0.557	0.639
3:00	6	14	4	10	0	0	4	12	2	32	0	0	58	4	14	5	23	0	0	0	21	7	28	0	0	49	87	0.556	0.600	0.520	0.722
4:00	6	9	6	20	0	0	7	5	1	7	0	0	27	2	8	4	14	0	0	1	10	0	11	0	0	25	53	0.625	0.433	0.625	0.625
5:00	3	13	1	17	0	1	5	10	6	21	0	0	38	2	12	1	24	0	0	1	2	0	9	0	0	32	62	0.667	0.292	0.125	0.563
6:00																														
7:00																														
8:00																														
9:00																														
TOTALS	32	93	28	151	0	1	15	79	22	116	3	0	266	46	131	44	197	8	2	10	102	10	133	3	0	330	596				
ADT	47	135	39	219	0.79		22	115	32	169	2.69		388	68	191	64	287	9.98		24	150	15	197	7.98		484	872				

AVERAGE FACTOR: 1.47 — MONTHLY FACTOR: 0.69 — COMBINED FACTOR: 1.45

TMS ENGINEERS, INC.
4547 Hudson Drive
Stow, Ohio 44224
(330) 686-6662 FAX: (330) 686-6417

Figure #:

Page #:

VEHICULAR TRAFFIC COUNT SUMMARY

Municipality: Lakewood — At Intersection of: Quail Street — and: Thrush Street

Date: 9/3/2014 — Day: Thu. — Comments: — Project: 14-164

Weather: Clear — Recorder(s): RMS — Data entry by: JJD — Data collected: Sep 4, 2014 — Quail St & Thrush St 090314

TIME BEGIN	Quail St. FROM NORTH						Quail St. FROM SOUTH						TOTAL NORTH SOUTH	Thrush St. FROM EAST						Thrush St. FROM WEST						TOTAL EAST WEST	TOTAL ALL DIRS.	PEAK HOUR FACTOR			
	Left	Thru	Right	Total	T/A	Bus	Left	Thru	Right	Total	T/A	Bus		Left	Thru	Right	Total	T/A	Bus	Left	Thru	Right	Total	T/A	Bus			North	South	East	West
06:00																														
07:00	1	9	1	11	0	0	0	4	0	4	0	0	15	0	1	1	2	0	0	7	5	1	12	0	0	14	29	0.625	0.500	0.500	0.583
08:00	5	1	4	9	0	0	0	13	4	17	2	0	26	1	8	2	11	0	0	10	4	1	15	0	0	31	57	0.650	0.708	0.688	0.775
09:00	4	1	1	6	0	0	3	4	2	9	1	0	15	0	5	1	6	0	0	5	6	0	11	0	0	17	32	0.500	0.417	0.750	0.688
10:00																														
11:00	3	2	1	6	0	0	1	6	4	11	2	0	16	0	10	1	11	1	0	1	12	2	15	0	0	26	42	0.500	0.417	0.708	0.708
12:00	5	5	2	12	0	0	1	6	0	7	0	0	20	1	8	3	12	2	0	2	11	0	14	0	0	26	46	0.542	0.583	0.625	0.813
1:00																														
2:00	6	2	4	12	0	0	0	6	3	9	0	0	19	0	14	5	19	0	0	15	7	0	22	1	0	41	60	0.625	0.750	0.864	0.917
3:00	3	11	7	21	0	0	1	7	4	12	0	0	33	0	10	5	15	0	0	6	14	2	22	0	0	37	69	0.875	0.688	0.542	0.750
4:00	4	9	5	18	0	0	1	11	2	14	0	0	32	0	7	3	10	0	0	4	1	3	10	0	0	20	49	0.542	0.571	0.625	0.714
5:00	5	17	5	27	0	0	4	14	7	25	1	0	43	2	10	2	14	0	0	5	3	0	14	0	0	28	76	0.844	0.750	0.700	0.875
6:00																														
7:00																														
8:00																														
9:00																														
TOTALS	33	55	29	116	0	0	11	77	33	106	6	0	221	4	78	24	125	3	0	67	67	9	143	1	0	241	462				
ADT	43	51	41	177	0.79		16	107	46	165	5.79		307	6	103	36	155	5.98		78	384	13	207	7.98		357	664				

AVERAGE FACTOR: 1.47 — MONTHLY FACTOR: 0.69 — COMBINED FACTOR: 1.45

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Figure #:

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VEHICULAR TRAFFIC COUNT SUMMARY

Municipality: Lakewood At Intersection of: Robin Street and Thrush Street

Date: 9/9/2014 Day: Thu. Comments: Project: 14-165

Weather: Clear Recorder(s): SFA Data entry by: JJG Data collected: Sep. 9, 2014 Robin St. | Thrush St 09092014

TIME BEGINS	Robin St. FROM NORTH						Robin St. FROM SOUTH						TOTAL SOUTH BOUND	Thrush St. FROM EAST						Thrush St. FROM WEST						TOTAL EAST WEST	TOTAL ALL DIRS.	PEAK HOUR FACTOR			
	Left	Thru	Right	Total	T/L	Bus	Left	Thru	Right	Total	T/L	Bus		Left	Thru	Right	Total	T/L	Bus	Left	Thru	Right	Total	T/L	Bus			North	South	East	West
06:00																														
07:00	1	0	0	1	0	0	0	3	1	4	0	0	11	0	4	4	8	0	0	2	2	0	0	0	0	16	25	0.550	1.000	0.500	0.667
08:00	3	30	3	36	1	0	7	15	7	12	0	0	53	6	7	3	15	0	0	3	15	2	20	0	0	35	88	0.750	0.662	0.536	0.778
09:00	1	4	1	7	0	0	2	6	3	11	0	0	18	1	3	4	8	0	0	2	7	2	11	0	0	19	37	0.625	0.662	0.400	0.833
10:00																														
11:00	4	3	3	9	0	0	3	7	3	13	0	0	22	0	5	7	12	0	0	1	6	5	12	1	0	24	46	0.563	0.650	0.625	0.750
12:00	2	6	5	13	0	0	3	4	0	7	1	0	20	7	4	4	8	0	0	4	7	2	13	0	0	21	41	0.650	0.625	0.600	0.813
1:00																														
2:00	2	14	4	21	0	0	2	6	3	10	0	0	31	4	10	3	17	1	0	0	9	4	13	0	0	30	61	0.688	0.238	0.750	0.213
3:00	0	18	6	25	0	0	0	12	3	15	0	0	55	0	7	1	8	0	0	6	14	4	24	0	0	32	80	0.250	0.525	0.500	0.417
4:00	1	17	4	22	0	0	1	5	0	6	0	0	33	3	5	3	11	0	0	4	9	0	13	0	0	27	55	0.727	0.750	0.650	0.700
5:00	0	17	5	27	0	0	1	9	5	15	0	0	42	1	8	5	15	0	0	0	6	4	10	0	0	24	64	0.563	0.833	0.625	0.625
6:00																														
7:00																														
8:00																														
9:00																														
TOTALS	35	154	30	169	1	0	34	65	15	95	1	0	264	17	61	26	60	1	0	23	80	33	136	1	0	295	459				
ADT	32	139	44	250	0.6%		21	56	24	101	0.1%		301	16	60	41	107	1.0%		24	113	34	157	0.6%		333	724				

HOURLY FACTOR: 1.67 MONTHLY FACTOR: 0.89 COMBINED FACTOR: 1.49

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Figure #:
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VEHICULAR TRAFFIC COUNT SUMMARY

Municipality: Lakewood At Intersection of: Lark Street and Thrush Street

Date: 9/9/2014 Day: Thu. Comments: Project: 14-165

Weather: Clear Recorder(s): SFA Data entry by: JJG Data collected: Sep. 9, 2014 Lark St | Thrush St 09092014

TIME BEGINS	Lark St. FROM NORTH						Lark St. FROM SOUTH						TOTAL SOUTH BOUND	Thrush St. FROM EAST						Thrush St. FROM WEST						TOTAL EAST WEST	TOTAL ALL DIRS.	PEAK HOUR FACTOR			
	Left	Thru	Right	Total	T/L	Bus	Left	Thru	Right	Total	T/L	Bus		Left	Thru	Right	Total	T/L	Bus	Left	Thru	Right	Total	T/L	Bus			North	South	East	West
06:00																														
07:00	1	4	1	6	0	0	7	7	1	15	0	0	15	0	3	1	4	0	0	5	4	0	9	0	0	13	34	0.417	0.536	0.500	0.563
08:00	1	30	10	41	1	0	1	14	2	17	1	0	48	0	4	2	6	0	0	2	11	4	21	0	0	27	77	0.536	0.607	0.500	0.750
09:00	4	4	1	9	1	0	2	12	4	18	0	0	28	0	7	2	9	0	0	2	7	0	9	0	0	18	38	0.667	0.500	0.500	0.750
10:00																														
11:00	5	5	4	10	0	0	1	8	0	9	0	0	19	2	1	2	4	0	0	2	11	1	14	0	0	22	41	0.650	0.345	0.500	0.500
12:00	2	9	2	13	0	0	1	4	0	5	0	0	22	1	4	1	6	0	0	3	7	2	12	0	0	18	36	0.650	0.345	0.500	0.600
1:00																														
2:00	2	14	6	22	1	0	4	11	4	15	0	0	38	6	5	3	14	1	0	3	11	0	14	0	0	29	66	0.625	0.250	0.500	0.525
3:00	2	7	1	10	0	0	4	14	3	21	0	0	31	2	5	1	8	0	0	0	11	1	20	0	0	28	59	0.625	0.525	0.500	0.700
4:00	1	9	3	13	0	0	2	7	3	12	0	0	25	4	4	1	9	0	0	4	7	1	10	0	0	19	43	0.650	0.750	0.667	0.833
5:00	0	11	4	15	0	0	3	5	1	12	0	0	27	3	4	4	12	0	0	3	2	2	13	0	0	25	52	0.938	0.750	0.750	0.948
6:00																														
7:00																														
8:00																														
9:00																														
TOTALS	18	93	32	143	3	0	19	99	34	156	1	0	252	16	46	20	72	1	0	27	64	10	123	0	0	195	445				
ADT	15	131	47	197	3.4%		26	139	37	192	0.0%		373	24	63	30	117	1.4%		40	104	15	179	0.0%		296	650				

HOURLY FACTOR: 1.67 MONTHLY FACTOR: 0.89 COMBINED FACTOR: 1.49

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VEHICULAR TRAFFIC COUNT SUMMARY

Municipality: Lakewood — At Intersection of: Bowd Avenue and Mayer Street

Date: 9/4/2014 Day: Thu Comments: Project: 14-105

Weather: Clear Recorder(s): MB Data entry by: JM Data entered: Sep 8, 2014 Excel Data Sheet 9/8/2014

TIME BEGINS	Bowd Ave. FROM NORTH						FROM SOUTH						TOTAL NORTH SOUTH	Mayer St. FROM EAST						Mayer St. FROM WEST						TOTAL EAST WEST	TOTAL ALL VEHS.	PEAK HOUR FACTOR			
	Left	Thru	Right	Total	Trk	Bus	Left	Thru	Right	Total	Trk	Bus		Left	Thru	Right	Total	Trk	Bus	Left	Thru	Right	Total	Trk	Bus			North	South	East	West
06:00																														
07:00	7	0	6	13	0	0							13	0	13	3	16	0	0	1	19	0	20	0	0	36	49	0.650		0.857	0.900
08:00	22	0	8	30	0	0							30	0	51	24	75	1	0	5	60	0	66	1	0	141	171	0.833		0.881	0.938
09:00	8	0	2	10	0	0							10	0	8	2	10	0	0	1	12	0	14	1	0	23	33	0.417		0.833	0.813
10:00																														
11:00	2	0	7	9	0	0							9	0	11	5	16	0	0	4	15	0	22	2	0	40	49	0.750		0.909	0.909
12:00	6	0	2	8	0	1							8	0	21	3	29	1	0	2	20	0	22	0	0	51	59	0.690		0.906	0.917
1:00																														
2:00	10	0	4	15	0	0							15	0	24	3	27	1	0	5	29	0	34	0	0	72	90	0.938		0.844	0.852
3:00	17	0	4	21	0	0							21	0	64	17	81	1	0	5	35	0	32	1	0	113	134	0.875		0.931	0.908
4:00	2	0	4	6	0	0							6	0	26	11	40	0	0	4	17	0	26	0	0	53	62	0.650		0.906	0.929
5:00	5	0	10	15	0	0							15	0	12	4	21	0	0	2	24	0	25	1	0	49	64	0.525		0.750	0.893
6:00																														
7:00																														
8:00																														
9:00																														
TOTALS	81	0	53	133	0	1							133	0	260	73	333	4	0	36	292	0	328	6	0	576	711				
AVE	10.1	0	7.7	13.7	0.0%								13.7	0	25.6	10.5	43.4	1.3%		4.5	43.1	0	47.9	0.9%		85.6	105.3				

HOURLY FACTOR: 1.67 MONTHLY FACTOR: 0.89 COMBINED FACTOR: 1.49

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Figure #:
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VEHICULAR TRAFFIC COUNT SUMMARY

Municipality: Lakewood — At Intersection of: Quail Street and Mayer Street

Date: 9/4/2014 Day: Thu Comments: Project: 14-105

Weather: Clear Recorder(s): MB Data entry by: JM Data entered: Sep 8, 2014 Excel Data Sheet 9/8/2014

TIME BEGINS	Quail St. FROM NORTH						FROM SOUTH						TOTAL NORTH SOUTH	Mayer St. FROM EAST						Mayer St. FROM WEST						TOTAL EAST WEST	TOTAL ALL VEHS.	PEAK HOUR FACTOR			
	Left	Thru	Right	Total	Trk	Bus	Left	Thru	Right	Total	Trk	Bus		Left	Thru	Right	Total	Trk	Bus	Left	Thru	Right	Total	Trk	Bus			North	South	East	West
06:00																														
07:00	7	0	4	6	0	0							6	0	7	3	10	0	0	15	11	0	26	0	0	36	42	0.900		0.900	0.433
08:00	10	0	93	103	0	1							105	0	11	20	62	1	1	21	10	0	21	1	0	105	200	0.214		0.210	0.250
09:00	0	0	6	14	0	0							18	0	4	2	14	0	0	11	11	0	22	1	0	37	50	0.611		0.750	0.611
10:00																														
11:00	4	0	7	11	0	0							11	0	10	1	11	0	0	11	9	0	20	2	0	31	42	0.688		0.688	0.625
12:00	0	0	12	16	2	0							18	0	15	9	25	1	0	15	11	0	26	1	0	51	67	0.521		0.781	0.722
1:00																														
2:00	6	0	14	19	0	0							19	1	37	28	66	1	0	21	12	0	33	0	0	95	113	0.490		0.838	0.825
3:00	43	0	61	104	0	1							105	1	15	24	40	1	1	22	23	1	45	1	0	85	190	0.602		0.714	0.878
4:00	3	0	12	15	0	0							15	0	28	8	36	0	0	6	10	1	16	0	0	52	67	0.417		0.643	0.842
5:00	2	1	4	7	0	0							7	0	21	6	27	0	0	6	24	1	31	1	0	58	65	0.553		0.750	0.806
6:00																														
7:00																														
8:00																														
9:00																														
TOTALS	152	1	177	330	2	2							330	3	334	142	504	4	3	146	176	4	323	7	0	593	908				
AVE	19.0	1	24.2	45.9	1.9%								45.9	3	19.3	23.8	43.1	3.1%		37.5	18.7	4	60.7	8.3%		82.7	154.7				

HOURLY FACTOR: 1.67 MONTHLY FACTOR: 0.89 COMBINED FACTOR: 1.49

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VEHICULAR TRAFFIC COUNT SUMMARY

Municipality: Lakewood — At Intersection of: Robin Street — and: Plover Street

Date: 9/4/2014 — Day: Thu — Comments: — Project: 14-105

Weather: Clear — Recorder(s): JEB — Date entered by: JAO — Date entered: Sep 8, 2014 — Robin St & Plover 09/04/14

TIME BEGINS	Robin St. FROM NORTH						FROM EAST						TOTAL NORTH EVENT	Plover St. FROM EAST						Plover St. FROM WEST						TOTAL EAST WEST	TOTAL ALL DIREC.	PEAK HOUR FACTOR			
	Left	Thru	Right	Total	Trk	Bus	Left	Thru	Right	Total	Trk	Bus		Left	Thru	Right	Total	Trk	Bus	Left	Thru	Right	Total	Trk	Bus			North	South	East	West
06:00																														
07:00	6	0	5	11	0	0							11	1	6	1	8	0	0	0	22	0	22	0	0	22	33	0.688		0.917	0.750
08:00	6	0	33	39	1	0							39	0	45	2	47	0	1	11	90	0	101	0	1	109	148	0.848		0.847	0.877
09:00	1	0	4	5	0	0							5	0	10	2	12	0	0	5	13	0	18	0	0	30	35	0.417		0.500	0.563
10:00																														
11:00	1	0	2	3	0	0							3	0	7	2	9	0	0	7	7	0	11	0	0	23	26	0.575		0.750	0.813
12:00	4	0	2	6	0	0							6	0	19	0	19	0	0	4	10	0	14	1	0	33	41	0.600		0.826	0.700
1:00																														
2:00	2	1	14	17	0	0							17	0	25	2	27	0	0	3	20	2	25	0	0	54	71	0.531		0.556	0.708
3:00	2	0	19	21	0	0							21	0	27	1	28	1	1	14	54	0	68	1	1	83	111	0.625		0.875	0.824
4:00	6	0	6	12	0	0							12	0	14	3	17	0	0	4	9	0	13	0	0	30	43	0.750		0.929	0.750
5:00	4	0	5	11	0	0							11	0	22	2	24	0	0	9	17	0	26	0	0	50	61	0.542		0.667	0.658
6:00																														
7:00																														
8:00																														
9:00																														
TOTALS	47	1	88	136	1	0							136	1	226	15	104	1	1	67	148	1	216	2	2	445	571				
ADT	65	1	130	197	0.8%								197	1	284	22	307	2.1%		63	265	1	329	1.8%		553	646				

HOURLY FACTOR: 1.67 — MONTHLY FACTOR: 0.69 — EXPANSION FACTOR: 1.64

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VEHICULAR TRAFFIC COUNT SUMMARY

Municipality: Lakewood — At Intersection of: Lark Street — and: Plover Street

Date: 9/4/2014 — Day: Thu — Comments: — Project: 14-105

Weather: Clear — Recorder(s): JAO — Date entered by: JAO — Date entered: Sep 8, 2014 — Lark St & Plover 09/04/14

TIME BEGINS	Lark St. FROM NORTH						FROM SOUTH						TOTAL SOUTH EVENT	Plover St. FROM EAST						Plover St. FROM WEST						TOTAL EAST WEST	TOTAL ALL DIREC.	PEAK HOUR FACTOR			
	Left	Thru	Right	Total	Trk	Bus	Left	Thru	Right	Total	Trk	Bus		Left	Thru	Right	Total	Trk	Bus	Left	Thru	Right	Total	Trk	Bus			North	South	East	West
06:00																														
07:00	0	0	2	2	1	0							2	0	4	2	6	0	0	1	22	0	23	0	0	30	32	0.500		0.375	0.719
08:00	0	0	15	15	0	0							15	0	33	2	35	0	1	11	45	0	57	0	1	84	108	0.536		0.729	0.824
09:00	1	0	3	4	1	0							5	0	6	2	11	0	0	5	13	0	18	0	0	29	34	0.417		0.917	0.806
10:00																														
11:00	1	0	2	3	0	0							3	0	10	2	12	0	0	4	7	0	10	0	0	22	25	0.750		0.600	0.625
12:00	2	0	1	3	0	0							3	0	15	3	18	0	0	4	10	0	14	0	0	32	49	0.400		0.231	0.667
1:00																														
2:00	1	0	3	10	0	0							10	0	34	4	38	1	0	5	20	0	25	0	0	64	64	0.625		0.633	0.781
3:00	1	0	7	8	0	0							8	0	34	2	36	1	1	15	45	0	60	1	1	89	97	0.400		0.881	0.878
4:00	1	1	4	6	0	0							5	0	12	6	24	0	0	8	12	0	37	0	0	61	66	0.625		0.750	0.841
5:00	2	1	8	11	0	0							11	0	15	1	16	0	0	6	11	0	33	0	0	26	42	0.917		0.667	0.778
6:00																														
7:00																														
8:00																														
9:00																														
TOTALS	8	2	56	67	2	0							67	0	240	26	275	2	2	46	166	0	252	1	2	427	494				
ADT	13	3	93	99	4.0%								99	0	221	39	293	2.3%		83	290	0	373	1.8%		666	732				

HOURLY FACTOR: 1.67 — MONTHLY FACTOR: 0.69 — EXPANSION FACTOR: 1.63

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APPENDIX B
Trip Generation Worksheet

SHOPPING CENTER

ITE CODE = 820

Available Development Space - Birdtown, Lakewood, Ohio

Date: 8/4/2014

Trip Generation based on: 1000 Sq Ft Gross Leasable Area

Size of Analysis Area: 31 1000 Sq Ft

	Average Rate	Standard Deviation	Adjustment factor	Driveway Volume
Average Weekday 2-way Volume	102.32	0.00	1.00	3172
7-9 AM Peak Hour Enter	1.53	0.00	1.00	47
7-9 AM Peak Hour Exit	0.94	0.00	1.00	29
7-9 AM Peak Hour Total	2.46	0.00	1.00	76
4-6 PM Peak Hour Enter	4.23	0.00	1.00	131
4-6 PM Peak Hour Exit	4.59	0.00	1.00	142
4-6 PM Peak Hour Total	8.82	0.00	1.00	273
Saturday 2-way Volume	142.51	0.00	1.00	4418
Saturday Peak Hour Enter	6.85	0.00	1.00	212
Saturday Peak Hour Exit	6.32	0.00	1.00	196
Saturday Peak Hour Total	13.17	0.00	1.00	408

The above rates were calculated from the equations shown below:

Average Weekday 2-way Volume	$Ln(T)=0.65*Ln(X)+5.83$		
7-9 AM Peak Hour Total	$Ln(T)=0.82*Ln(X)+2.24$	Enter	0.62
		Exit	0.38
4-6 PM Peak Hour Total	$Ln(T)=0.67*Ln(X)+3.31$	Enter	0.48
		Exit	0.52
Saturday 2-way Volume	$Ln(T)=0.83*Ln(X)+5.23$		
Saturday Peak Hour Volume	$Ln(T)=0.85*Ln(X)+3.78$	Enter	0.52
		Exit	0.48

Source: Institute of Transportation Engineers
Trip Generation, 9th Edition, 2012.

APPENDIX C
Capacity Analysis Worksheets
Existing Conditions

ALL-WAY STOP CONTROL ANALYSIS

General Information | **Site Information**

Analyst:	ABC	Intersection:	Third & Bond
Agency/Co.:	TKC Engineering	Jurisdiction:	City of Lakewood, CO
Date Performed:	9/1/2014	Analysis Year:	2014
Analysis Time Period:	AM Peak Period		

Project Description: Existing Conditions

East/West Street: Fourth Street | North/South Street: Bond Avenue

Volume Adjustments and Site Characteristics

Approach:	Eastbound			Westbound		
Movement:	L	T	R	L	T	R
Volume (veh/h):	10	20	10	10	10	10
%Thru Left Lane:						

Approach:	Northbound			Southbound		
Movement:	L	T	R	L	T	R
Volume (veh/h):	10	10	10	10	30	10
%Thru Left Lane:						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration:	LTR		LTR		LTR		LTR	
PHF:	0.91		0.83		0.83		0.81	
Flow Rate (veh/h):	77		36		63		81	
% Heavy Vehicles:	2		5		3		3	
No. Lanes:	1		1		1		1	
Geometry Group:	1		1		1		1	
Duration, T:	0.25							

Saturation Headway Adjustment Worksheet

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Prop. Left-Turns:	0.2		0.2		0.2		0.2	
Prop. Right-Turns:	0.2		0.3		0.2		0.2	
Prop. Heavy Vehicles:	0.0		0.0		0.0		0.0	
P(LT-adj):	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
ADJ(LT-adj):	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
P(HV-adj):	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
hdj, computed:	-0.1		-0.0		-0.0		-0.1	

Departure Headway and Service Time

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
hd, Initial value (s):	3.20		3.20		3.20		3.20	
x, Initial:	0.07		0.03		0.06		0.07	
hd, Final value (s):	4.19		4.25		4.22		4.16	
x, Final value:	0.09		0.04		0.07		0.09	
Move-up time, m (s):	2.0		2.0		2.0		2.0	
Service Time, t_s (s):	2.2		2.3		2.2		2.2	

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h):	327		288		313		331	
Delay (s/veh):	7.81		7.44		7.56		7.55	
LOS:	A		A		A		A	
Approach Delay (s/veh):	7.81		7.44		7.56		7.55	
Approach LOS:	A		A		A		A	
Intersection Delay (s/veh):	7.56							
Intersection LOS:	A							

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ALL-WAY STOP CONTROL ANALYSIS

General Information		Site Information	
Analyst	ABC	Intersection	Thrush & Robin
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	City of Lakewood, OH
Date Performed	5/13/2014	Analysis Year	2014
Analysis Time Period	AM Peak Hour		

Project Description: Existing Conditions

East/West Street: Thrush Street | North/South Street: Robin Street

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	10	10	10	10	10	10
%Thru-Left Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	10	20	10	10	10	10
%Thru-Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	LTR		LTR		LTR		LTR	
PHF	0.83		0.56		0.77		0.56	
Flow Rate (veh/h)	51		54		56		51	
% Heavy Vehicles	1		2		6		1	
No. Lanes	1		1		1		1	
Capacity Group	1		1		1		1	
Duration, T	0.25							

Saturation Headway Adjustment Worksheet

	Eastbound		Westbound		Northbound		Southbound	
Prop. Left-Turns	0.3		0.3		0.3		0.3	
Prop. Right-Turns	0.3		0.3		0.3		0.3	
Prop. Heavy Vehicles	0.0		0.0		0.1		0.0	
hLT-adj	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
hRT-adj	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
hHV-adj	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
hdj, computed	-0.1		-0.1		0.2		-0.1	

Departure Headway and Service Time

hd, Initial value (s)	3.20		3.20		3.20		3.20	
x, Initial value	0.05		0.05		0.06		0.05	
hd, Final value (s)	4.07		4.10		4.18		4.07	
x, Final value	0.06		0.06		0.07		0.06	
Move-up time, m (s)	2.0		2.0		2.0		2.0	
Service time, t_s (s)	2.1		2.1		2.2		2.1	

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	301		304		305		301	
Delay (s/veh)	7.32		7.37		7.47		7.32	
LOS	A		A		A		A	
Approach: Delay (s/veh)	7.32		7.37		7.47		7.32	
LOS	A		A		A		A	
Intersection Delay (s/veh)	7.37							
Intersection LOS	A							

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	ABC	Intersection	Thrush & Robin
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	City of Lakewood, OH
Date Performed	5/13/2014	Analysis Year	2014
Analysis Time Period	AM Peak Hour		

Project Description: Existing Conditions

East/West Street:	Thrush Street	North/South Street:	Robin Street
Intersection Orientation:	East-West	Study Period (hrs):	0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	10	20	10	10	10	10
Peak-Hour Factor, PHF	0.83	0.83	0.83	0.83	0.83	0.83
Hourly Flow Rate, HFR (veh/h)	10	30	10	10	10	10
Percent Heavy Vehicles	1	--	--	1	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	10	20	10	10	30	10
Peak-Hour Factor, PHF	0.61	0.61	0.61	0.75	0.75	0.75
Hourly Flow Rate, HFR (veh/h)	16	32	16	13	40	13
Percent Heavy Vehicles	1	1	1	1	1	1
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR	LTR			LTR		
v (veh/h)	10	10	54			55		
C (m) (veh/h)	1557	1565	803			795		
v/c	0.01	0.01	0.08			0.08		
95% queue length	0.03	0.03	0.26			0.27		
Control Delay (s/veh)	7.3	7.3	9.5			10.0		
LOS	A	A	A			A		
Approach Delay (s/veh)	--	--	9.5			10.0		
Approach LOS	--	--	A			A		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	ABC	Intersection	Thrush & Lark
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	City of Lakewood, OH
Date Performed	9/15/2014	Analysis Year	2014
Analysis Time Period	AM Peak Hour		
Project Description	Existing Conditions		
East/West Street:	Thrush Street	North/South Street:	Lark Street
Intersection Orientation:	East-West	Study Period (hrs):	0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	10	20	10	10	10	10
Peak-Hour Factor, PHF	0.75	0.75	0.75	0.50	0.50	0.50
Hourly Flow Rate, HFR (veh/h)	13	26	13	20	20	20
Percent Heavy Vehicles	1	--	--	1	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	10	20	10	10	20	10
Peak-Hour Factor, PHF	0.61	0.61	0.61	0.60	0.60	0.60
Hourly Flow Rate, HFR (veh/h)	16	32	16	16	32	16
Percent Heavy Vehicles	1	1	1	2	2	2
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR		LTR			LTR	
v (veh/h)	13	20		64			65	
C (m) (veh/h)	1576	1577		805			806	
v/c	0.01	0.01		0.08			0.08	
95% queue length	0.02	0.04		0.25			0.26	
Control Delay (s/veh)	7.3	7.3		9.9			9.9	
LOS	A	A		A			A	
Approach Delay (s/veh)	--	--		9.9			9.9	
Approach LOS	--	--		A			A	

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	ABC	Intersection	Power & Good
Agency/Co.	TMS Engineers, Inc	Jurisdiction	City of Lakewood, OH
Date Performed	9/15/2014	Analysis Year	2014
Analysis Time Period	AM Peak Period		
Project Description	Existing Conditions		
East/West Street:	Power Street	North/South Street:	David Avenue
Intersection Orientation:	East-West	Study Period (hrs):	0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	10	60			60	30
Peak-Hour Factor, PHF	0.83	0.80	1.00	1.00	0.56	0.55
Hourly Flow Rate, HFR (veh/h)	12	72	0	0	109	54
Percent Heavy Vehicles	7	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				30		10
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.68	1.00	0.58
Hourly Flow Rate, HFR (veh/h)	0	0	0	44	0	14
Percent Heavy Vehicles	0	0	0	7	0	7
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
v (veh/h)	12						68	
C (m) (veh/h)	1416						786	
v/c	0.01						0.07	
95% queue length	0.03						0.24	
Control Delay (s/veh)	7.6						9.9	
LOS	A						A	
Approach Delay (s/veh)	--	--					9.9	
Approach LOS	--	--					A	

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ALL-WAY STOP CONTROL ANALYSIS

General Information		Site Information	
Analyst	ABC	Intersection	Plover & Rock
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	City of Lakewood, OH
Date Performed	9/5/2014	Analysis Year	2014
Analysis Time Period	AM Peak Period		

East/West Street: Plover Street | North/South Street: Rock Street

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	80	10	0	0	20	70
%Thru Left Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	0	0	0	50	0	80
%Thru Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Shared Lane	LT		TR				LR	
PHF	0.88		0.70				0.45	
Flow Rate (veh/h)	101		119				260	
% Heavy Vehicles	2		2				1	
No. Lanes	1		1		0		1	
Geometry Group	1		1				1	
Duq Lan, T	0.25							

Saturation Headway Adjustment Worksheet

Prop. Left-Turns	0.9		0.0			0.5	
Prop. Right-Turns	0.0		0.8			0.5	
Prop. Heavy Vehicles	0.0		0.0			0.0	
hLT-adj	0.2	0.2	0.2	0.2		0.2	0.2
hRT-adj	-0.6	-0.6	-0.6	-0.6		-0.6	-0.6
hHV-adj	1.7	1.7	1.7	1.7		1.7	1.7
hadj, computed	0.2		-0.4			-0.2	

Departure Headway and Service Time

hd, initial value (s)	3.20		3.20		3.20
x, initial	0.09		0.11		0.23
hd, final value (s)	4.85		4.19		4.23
x, final value	0.14		0.14		0.31
Move-up time, m (s)	2.0		2.0		2.0
Service Time, ts (s)	2.9		2.2		2.2

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	351		369				510	
Delay (sec/)	8.61		7.87				9.09	
LOS	A		A				A	
Approach Delay (sec/veh)	8.61		7.87				9.09	
LOS	A		A				A	
Intersection Delay (sec/veh)	8.66							
Intersection LOS	A							

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	ABC	Intersection	Plover & Rock
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	City of Lakewood, OH
Date Performed	9/5/2014	Analysis Year	2014
Analysis Time Period	AM Peak Period		

Project Description: Existing Conditions

East/West Street: Plover Street	North/South Street: Rock Street
Intersection Orientation: East-West	Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	20	55			65	10
Peak-Hour Factor, PHF	0.48	0.48	1.00	1.00	0.87	0.87
Hourly Flow Rate, HFR (veh/h)	41	104	0	0	74	11
Percent Heavy Vehicles	2	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				10		40
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.81	1.00	0.81
Hourly Flow Rate, HFR (veh/h)	0	0	0	12	0	49
Percent Heavy Vehicles	0	0	0	1	0	1
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
v (vph/h)	41						61	
C (m) (vph/h)	1508						911	
v/c	0.03						0.07	
95% queue length	0.08						0.21	
Control Delay (s/veh)	7.5						9.2	
LOS	A						A	
Approach Delay (s/veh)	--	--					9.2	
Approach LOS	--	--					A	

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	ADC	Intersection	Plover & Lark
Agency/Co.	TMS Engineers, Inc	Jurisdiction	City of Lakewood, OH
Date Performed	9/15/2014	Analysis Year:	2014
Analysis Time Period	AM Peak Period		

Project Description: Existing Conditions

East/West Street: Plover Street	North/South Street: Lark Street
Intersection Orientation: East-West	Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	22	50			40	12
Peak-Hour Factor, PHF	0.65	0.65	1.00	1.00	0.73	0.73
Hourly Flow Rate, HFR (veh/h)	35	80	0	0	54	16
Percent Heavy Vehicles	1	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				10		20
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.54	1.00	0.54
Hourly Flow Rate, HFR (veh/h)	0	0	0	18	0	37
Percent Heavy Vehicles	0	0	0	3	0	3
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
v (veh/h)	35						55	
C (m) (veh/h)	1541						901	
v/c	0.02						0.06	
95% queue length	0.07						0.19	
Control Delay (s/veh)	7.4						9.3	
LOS	A						A	
Approach Delay (s/veh)	--	--					9.3	
Approach LOS	--	--					A	

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ALL-WAY STOP CONTROL ANALYSIS

General Information		Site Information	
Analyst	ADC	Intersection	Plover & Bowl
Agency/Co.	TMS Engineers, Inc	Jurisdiction	City of Lakewood, OH
Date Performed	9/15/2014	Analysis Year	2014
Analysis Time Period	School Peak Period		

Project ID / Existing Conditions

East/West Street: Plover Street	North/South Street: Bowl Avenue

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	10	20	10	10	10	10
%Thru Left Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	10	20	10	10	30	10
%Thru Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	LTR		LTR		LTR		LTR	
PHF	0.88		0.54		0.54		0.75	
Flow Rate (veh/h)	44		54		73		56	
% Heavy Vehicles	2		5		2		1	
No. Lanes	1		1		1		1	
Geometry Group	1		1		1		1	
Duration, T	0.25							

Saturation Headway Adjustment Worksheet

	Eastbound		Westbound		Northbound		Southbound	
Prop. Left-Turns	0.5		0.3		0.2		0.2	
Prop. Right-Turns	0.3		0.3		0.3		0.2	
Prop. Heavy Vehicles	0.5		0.5		0.0		0.0	
%Thd	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
%Thd	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
%Hdwy	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
Adj. Headway	-0.1		-0.0		-0.2		-0.1	

Departure Headway and Service Time

	Eastbound		Westbound		Northbound		Southbound	
hd, Initial value (s)	3.20		3.20		3.20		3.20	
x, Initial	0.04		0.05		0.05		0.06	
hd, final value (s)	3.20		3.20		4.14		4.13	
x, final value	0.05		0.06		0.09		0.08	
Move-up time, m (s)	2.0		2.0		2.0		2.0	
Service Time, ts (s)	2.2		2.2		2.1		2.1	

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	284		304		327		316	
Delay (sec/d)	7.42		7.48		7.52		7.47	
LOS	A		A		A		A	
Approach: Delay (s/veh)	7.42		7.48		7.52		7.47	
LOS	A		A		A		A	
Intersection Delay (sec/d)	7.48							
Intersection LOS	A							

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ALL-WAY STOP CONTROL ANALYSIS

General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	9/15/2014
Analysis Time Period	School Peak Hour

Site Information

Intersection	Thrush & Quail
Jurisdiction	City of Lakewood, OH
Analysis Year	2014

Project ID: Existing Conditions

East/West Street: Thrush Street | North/South Street: Quail Street

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	10	20	10	10	10	10
%Thru or Left Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	10	10	10	10	10	10
%Thru or Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	LTR		LTR		LTR		LTR	
PHF	0.62		0.59		0.45		0.63	
Flow Rate (veh/h)	56		48		66		49	
% Heavy Vehicles	1		3		6		1	
No. Lanes	1		1		1		1	
Geometry Group	1		1		1		1	
Duration, T	0.25							

Saturation Headway Adjustment Worksheet

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Prop. Left-Turns	0.3		0.3		0.2		0.3	
Prop. Right-Turns	0.3		0.3		0.3		0.3	
Prop. Heavy Vehicles	0.0		0.0		0.1		0.0	
P(LT=1)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
hRT=1)	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
hHV=1)	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
hHd, computed	-0.1		-0.1		-0.0		-0.1	

Departure Headway and Service Time

hd, initial value (s)	3.20		3.20		3.20		3.20	
x, initial	0.05		0.04		0.06		0.04	
hd, final value (s)	4.11		4.12		4.14		4.08	
x, final value	0.06		0.05		0.09		0.05	
Move-up time, m (s)	2.0		2.0		2.0		2.0	
Service Time, t_s (s)	2.1		2.1		2.1		2.1	

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	306		298		316		295	
Delay (s/veh)	7.39		7.36		7.46		7.30	
LOS	A		A		A		A	
Approach: Delay (s/veh)	7.39		7.36		7.46		7.30	
LOS	A		A		A		A	
Intersection Delay (s/veh)	7.39							
Intersection LOS	A							

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst:	ABC
Agency/Co.:	TMS Engineers, Inc
Date Performed	9/15/2014
Analysis Time Period:	School Peak Hour

Site Information

Intersection:	Thrush & Robin
Jurisdiction:	City of Lakewood, OH
Analysis Year:	2014

Project Description: Existing Conditions

East/West Street: Thrush Street | North/South Street: Robin Street

Intersection Orientation: East-West | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	10	20	10	10	10	10
Peak-Hour Factor, PHF	0.81	0.91	0.81	0.71	0.71	0.71
Hourly Flow Rate, HFR (veh/h)	12	24	12	14	14	14
Percent Heavy Vehicles	1	--	--	1	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	10	20	10	10	20	10
Peak-Hour Factor, PHF	0.63	0.83	0.62	0.59	0.59	0.59
Hourly Flow Rate, HFR (veh/h)	12	24	12	17	34	17
Percent Heavy Vehicles	1	1	1	1	1	1
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR		LTR			LTR	
v (veh/h)	12	14		49			68	
C (m) (veh/h)	1502	1581		631			839	
v/c	0.01	0.01		0.08			0.08	
95% queue length	0.02	0.03		0.26			0.25	
Control Delay (s/veh)	7.3	7.3		11.6			9.7	
LOS	A	A		B			A	
Approach Delay (s/veh)	--	--		11.6			9.7	
Approach LOS	--	--		B			A	

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	ABC	Intersection	Thrush & Lark
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	City of Lakewood, OH
Date Performed	9/15/2014	Analysis Year	2014
Analysis Time Period	School Peak Hour		
Project Description	Existing Conditions		
East/West Street	Thrush Street	North/South Street	Lark Street
Intersection Orientation	East-West	Study Period (hrs)	0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	10	20	10	10	10	10
Peak-Hour Factor, PHF	0.54	0.54	0.54	0.70	0.70	0.70
Hourly Flow Rate, HFR (veh/h)	18	37	18	14	14	14
Percent Heavy Vehicles	1	--	--	1	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	10	20	10	10	20	10
Peak-Hour Factor, PHF	0.75	0.75	0.75	0.53	0.53	0.53
Hourly Flow Rate, HFR (veh/h)	13	26	13	18	37	18
Percent Heavy Vehicles	1	1	1	2	2	2
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR		LTR			LTR	
v (veh/h)	18	14		62			73	
C (m) (veh/h)	1552	1559		799			805	
v/c	0.01	0.01		0.07			0.09	
95% queue length	0.03	0.03		0.21			0.30	
Control Delay (s/veh)	7.3	7.3		9.8			9.9	
LOS	A	A		A			A	
Approach Delay (s/veh)	--	--		9.8			9.9	
Approach LOS	--	--		A			A	

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	ABC	Intersection	Plover & Quail
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	City of Lakewood, OH
Date Performed	9/15/2014	Analysis Year	2014
Analysis Time Period	School Peak Period		
Project Description	Existing Conditions		
East/West Street	Plover Street	North/South Street	Quail Avenue
Intersection Orientation	East-West	Study Period (hrs)	0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	10	50			50	10
Peak-Hour Factor, PHF	0.56	0.56	1.00	1.00	0.61	0.67
Hourly Flow Rate, HFR (veh/h)	17	89	0	0	82	15
Percent Heavy Vehicles	2	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				50		10
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.50	1.00	0.50
Hourly Flow Rate, HFR (veh/h)	0	0	0	50	0	20
Percent Heavy Vehicles	0	0	0	1	0	1
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
v (veh/h)	17						93	
C (m) (veh/h)	1475						794	
v/c	0.01						0.10	
95% queue length	0.03						0.32	
Control Delay (s/veh)	7.5						10.0	
LOS	A						B	
Approach Delay (s/veh)	--	--					10.0	
Approach LOS	--	--					B	

ALL-WAY STOP CONTROL ANALYSIS

General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	9/15/2014
Analysis Time Period	School Peak Period

Site Information

Intersection	Flower & Rush
Jurisdiction	City of Lakewood, OH
Analysis Year	2014

Project ID: Existing Conditions

East/West Street: Flower Street

North/South Street: Rush Street

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	50	30	0	0	20	50
%Thru or %Left						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	0	0	0	50	0	50
%Thru or %Left						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	LT		TR				LR	
PHF	0.53		0.69				0.45	
Flow Rate (veh/h)	150		102				222	
% Heavy Vehicles	2		2				1	
No. Lanes	1		1		0		1	
Geometry Group	1		1				1	
Duration, t	0.25							

Saturation Headway Adjustment Worksheet

Prop. Left-Turns	0.6		0.0				0.5	
Prop. Right-Turns	0.0		0.7				0.5	
Prop. Heavy Vehicles	0.0		0.0				0.0	
f_LT,adj	0.2	0.2	0.2	0.2			0.2	0.2
f_RT,adj	-0.6	-0.6	-0.6	-0.6			-0.6	-0.6
f_HV,adj	1.7	1.7	1.7	1.7			1.7	1.7
f_adj, computed	0.2		-0.4				-0.2	

Departure Headway and Service Time

hd, initial value (s)	3.20		3.20				3.20	
x, initial	0.13		0.09				0.20	
hd, final value (s)	4.69		4.21				4.31	
x, final value	0.20		0.12				0.27	
Move-up time, m (s)	2.0		2.0				2.0	
Service Time, ts (s)	2.7		2.2				2.3	

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	400		352				472	
Delay (sec/veh)	8.83		7.78				8.66	
LOS	A		A				A	
Approach Delay (sec/veh)	8.83		7.78				8.66	
LOS	A		A				A	
Intersection Delay (sec/veh)	8.62							
Intersection LOS	A							

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	9/15/2014
Analysis Time Period	School Peak Period

Site Information

Intersection	Flower & Robin
Jurisdiction	City of Lakewood, OH
Analysis Year	2014

Project Description: Existing Conditions

East/West Street: Flower Street

North/South Street: Robin Street

Intersection Orientation: East-West

Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	20	60			40	10
Peak-Hour Factor, PHF	0.50	0.65	1.00	1.00	0.50	0.50
Hourly Flow Rate, HFR (veh/h)	40	92	0	0	80	20
Percent Heavy Vehicles	5	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				10		30
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.92	1.00	0.53
Hourly Flow Rate, HFR (veh/h)	0	0	0	10	0	57
Percent Heavy Vehicles	0	0	0	1	0	1
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound	
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
v (veh/h)	33						55	
C (m) (veh/h)	145.3						872	
v/c	0.02						0.06	
95% queue length	0.07						0.20	
Control Delay (s/veh)	7.5						9.4	
LOS	A						A	
Approach Delay (s/veh)	--	--					9.4	
Approach LOS	--	--					A	

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	ASC	Intersection	Plover & Lark
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	City of Lakewood, OH
Date Performed	9/15/2014	Analysis Year	2014
Analysis Time Period	School Peak Period		

Project Description: Existing Conditions

East/West Street: Plover Street | North/South Street: Lark Street

Intersection Orientation: East-West | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	20	50			40	10
Peak-Hour Factor, PHF	0.78	0.78	1.00	1.00	0.56	0.66
Hourly Flow Rate, HFR (veh/h)	25	64	0	0	85	15
Percent Heavy Vehicles	1	–	–	0	–	–
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				10		20
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.63	1.00	0.63
Hourly Flow Rate, HFR (veh/h)	0	0	0	15	0	31
Percent Heavy Vehicles	0	0	0	3	0	3
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	Eastbound		Westbound		Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12		
Lane Configuration	LT						LR			
v (veh/h)	25						46			
C (m) (veh/h)	1531						917			
v/c	0.02						0.05			
95% queue length	0.05						0.16			
Control Delay (s/veh)	7.4						9.1			
LOS	A						A			
Approach Delay (s/veh)	–		–				9.1			
Approach LOS	–		–				A			

ALL-WAY STOP CONTROL ANALYSIS

General Information

Analyst	ASC	Intersection	Plover & Dorf
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	City of Lakewood, OH
Date Performed	9/15/2014	Analysis Year	2014
Analysis Time Period	PM Peak Period		

Project Description: Existing Conditions

East/West Street: Project Street | North/South Street: Dorf Avenue

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	10	20	10	10	30	10
Within Lot Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	10	15	10	15	20	10
Within Lot Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	LTR		LTR		LTR		LTR	
PHF	0.56		0.60		0.75		0.63	
Lane Flow Rate*	89		85		38		64	
% Heavy Vehicles	2		5		3		1	
No. Lanes	1		1		1		1	
Geometry Group	1		1		1		1	
Duration, T	0.25							

Saturation Headway Adjustment Worksheet

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Prop. Left-Turns	0.2		0.5		0.3		0.3	
Prop. Right Turns	0.2		0.5		0.3		0.3	
Prop. Heavy Vehicles	0.0		0.0		0.0		0.0	
hLT-adj	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
hRT-adj	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
hHV-adj	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
hadj, computed	-0.1		-0.0		-0.1		-0.1	

Departure Headway and Service Time

	Eastbound		Westbound		Northbound		Southbound	
hd, initial value (s)	3.20		3.20		3.20		3.20	
x, initial value	0.08		0.04		0.03		0.06	
hd, final value (s)	4.10		4.14		4.13		4.10	
x, final value	0.09		0.05		0.04		0.07	
Move-up time, m (s)	2.0		2.0		2.0		2.0	
Service Time, t_s (s)	2.1		2.1		2.1		2.1	

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	319		295		266		314	
Delay (s/veh)	7.45		7.37		7.31		7.43	
LOS	A		A		A		A	
Approach Delay (s/veh)	7.45		7.37		7.31		7.43	
Approach LOS	A		A		A		A	
Intersection Delay (s/veh)	7.40							
Intersection LOS	A							

ALL-WAY STOP CONTROL ANALYSIS

General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	5/15/2014
Analysis Time Period	PM Peak Hour

Site Information

Intersection	Thrush & Robin
Jurisdiction	City of Lakewood, OH
Analysis Year	2014

Project ID: Existing Conditions

East/West Street: Thrush Street | North/South Street: Robin Street

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	10	10	10	10	10	10
%Thrus Left Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	10	20	10	10	20	10
%Thrus Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	LTR		LTR		LTR		LTR	
PHF	0.58		0.70		0.75		0.61	
Flow Rate (veh/h)	51		42		52		64	
% Heavy Vehicles	1		3		0		1	
No. Lanes	1		1		1		1	
Geometry Group	1		1		1		1	
Duration, T	0.25							

Saturation Headway Adjustment Worksheet

Prop. Left-Turns	0.3		0.3		0.3		0.3	
Prop. Right-Turns	0.0		0.3		0.3		0.3	
Prop. Heavy Vehicles	0.0		0.0		0.0		0.0	
hLT-adj	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
hRT-adj	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
hHV-adj	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
hadj, computed	-0.1		-0.1		0.0		-0.1	

Departure Headway and Service Time

hd, Initial value (s)	3.20		3.20		3.20		3.20	
x, Initial	0.05		0.04		0.05		0.06	
hd, Final value (s)	4.08		4.12		4.17		4.07	
x, Final value	0.06		0.05		0.06		0.07	
Move-up time, m (s)	2.0		2.0		2.0		2.0	
Service Time, t_s (s)	2.1		2.1		2.2		2.1	

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	301		297		302		314	
Delay (s/veh)	7.33		7.33		7.44		7.39	
LOS	A		A		A		A	
Approach: Delay (s/veh)	7.33		7.33		7.44		7.39	
LOS	A		A		A		A	
Intersection Delay (s/veh)	7.37							
Intersection LOS	A							

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	5/15/2014
Analysis Time Period	PM Peak Hour

Site Information

Intersection	Thrush & Robin
Jurisdiction	City of Lakewood, OH
Analysis Year	2014

Project Description: Existing Conditions

East/West Street: Thrush Street | North/South Street: Robin Street

Intersection Orientation: East-West | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	10	10	10	10	10	10
Peak-Hour Factor, PHF	0.63	0.63	0.63	0.68	0.68	0.85
Hourly Flow Rate, HFR (veh/h)	15	15	15	11	11	11
Percent Heavy Vehicles	1	--	--	1	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	10	10	10	10	20	10
Peak-Hour Factor, PHF	0.91	0.91	0.91	0.84	0.84	0.94
Hourly Flow Rate, HFR (veh/h)	10	10	10	11	23	11
Percent Heavy Vehicles	1	1	1	1	1	1
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	Eastbound		Westbound		Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12		
Lane Configuration	LTR	LTR		LTR			LTR			
v (veh/h)	15	11		30			45			
C (m) (veh/h)	1500	1085		677			854			
v/c	0.01	0.01		0.04			0.05			
95% queue length	0.02	0.03		0.13			0.17			
Control Delay (s/veh)	7.3	7.3		9.3			9.4			
LOS	A	A		A			A			
Approach Delay (s/veh)	--	--		9.3			9.4			
Approach LOS	--	--		A			A			

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	ABC	Intersection	Truman & Lark
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	City of Lakewood, OH
Date Performed	9/15/2014	Analysis Year	2014
Analysis Time Period	PM Peak Hour		

Project Description: Existing Conditions

East/West Street: Truman Street	North/South Street: Lark Street
Intersection Orientation: East-West	Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	10	10	10	10	10	10
Peak-Hour Factor, PHF	0.85	0.85	0.85	0.75	0.75	0.75
Hourly Flow Rate, HFR (veh/h)	15	15	15	13	13	13
Percent Heavy Vehicles	1	--	--	1	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	10	10	10	10	30	10
Peak-Hour Factor, PHF	0.75	0.75	0.75	0.94	0.94	0.94
Hourly Flow Rate, HFR (veh/h)	13	13	13	10	31	10
Percent Heavy Vehicles	1	1	1	2	2	2
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR		LTR			LTR	
v (veh/h)	15	13		39			41	
C (m) (veh/h)	1535	1569		872			841	
v/c	0.01	0.01		0.04			0.05	
95% queue length	0.03	0.02		0.14			0.15	
Control Delay (s/veh)	7.3	7.3		9.3			9.5	
LOS	A	A		A			A	
Approach Delay (s/veh)	--	--		9.3			9.5	
Approach LOS	--	--		A			A	

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	ABC	Intersection	Plover & Doyd
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	City of Lakewood, OH
Date Performed	9/15/2014	Analysis Year	2014
Analysis Time Period	PM Peak Period		

Project Description: Existing Conditions

East/West Street: Plover Street	North/South Street: David Avenue
Intersection Orientation: East-West	Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	10	30			20	10
Peak-Hour Factor, PHF	0.85	0.89	1.00	1.00	0.75	0.75
Hourly Flow Rate, HFR (veh/h)	11	33	0	0	25	13
Percent Heavy Vehicles	2	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				10		10
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.63	1.00	0.63
Hourly Flow Rate, HFR (veh/h)	0	0	0	15	0	15
Percent Heavy Vehicles	0	0	0	7	0	7
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
v (veh/h)	11						30	
C (m) (veh/h)	1571						972	
v/c	0.01						0.03	
95% queue length	0.02						0.10	
Control Delay (s/veh)	7.3						8.8	
LOS	A						A	
Approach Delay (s/veh)	--	--					8.8	
Approach LOS	--	--					A	

ALL-WAY STOP CONTROL ANALYSIS

General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	3/15/2014
Analysis Time Period	PM Peak Period

Site Information

Intersection	Plover & Dusk
Jurisdiction	City of Lakewood, OH
Analysis Year	2014

Project Description: Existing Conditions

East/West Street: Plover Street | North/South Street: Dusk Street

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	10	30	0	0	30	10
%Thru or Left Turn						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	0	5	0	10	0	10
%Thru or Left Turn						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	LT		TR				LR	
PHF	0.88		0.75				0.46	
Flow Rate (veh/h)	45		53				42	
% Heavy Vehicles	2		2				7	
No. Lanes	1		1		0		1	
Geometry Group	1		1				1	
Duration, T	0.25							

Saturation Headway Adjustment Worksheet

Prop. Left-Turns	0.2		0.0				0.5	
Prop. Right-Turns	0.0		0.2				0.5	
Prop. Heavy Vehicles	0.0		0.0				0.0	
[1-Turn]	0.2	0.2	0.2	0.2			0.2	0.2
[HV-adj]	-0.6	-0.6	-0.6	-0.6			-0.6	-0.6
[1-Rad]	1.7	1.7	1.7	1.7			1.7	1.7
[adj] component	0.1		-0.1				-0.2	

Departure Headway and Service Time

[illegible]	3.20		3.20				3.20	
[illegible]	0.04		0.06				0.04	
[illegible]	4.12		3.92				3.92	
[illegible]	0.06		0.06				0.06	
Minimum, m (s)	2.0		2.0				2.0	
Service Time, t_s (s)	2.1		1.9				1.9	

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	265		303				282	
Delay (s/veh)	7.35		7.16				7.11	
LOS	A		A				A	
Approach: Delay (s/veh)	7.35		7.16				7.11	
LOS	A		A				A	
Intersection Delay (s/veh)	7.21							
Intersection LOS	A							

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	3/15/2014
Analysis Time Period	PM Peak Period

Site Information

Intersection	Plover & Robin
Jurisdiction	City of Lakewood, OH
Analysis Year	2014

Project Description: Existing Conditions

East/West Street: Plover Street | North/South Street: Robin Street

Intersection Orientation: East-West | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound				Westbound	
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	10	25			35	10
Peak Hour Factor, PHF	0.81	0.81	1.00	1.00	0.81	0.97
Hourly Flow Rate, HFR (veh/h)	12	30	0	0	43	10
Percent Heavy Vehicles	0	–	–	0	–	–
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				10		10
Peak Hour Factor, PHF	1.00	1.00	1.00	0.63	1.00	0.55
Hourly Flow Rate, HFR (veh/h)	0	0	0	16	0	18
Percent Heavy Vehicles	0	0	0	1	0	1
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
v (veh/h)	42						58	
C (m) (veh/h)	1545						553	
v/c	0.01						0.04	
95% queue length	0.02						0.12	
Control Delay (s/veh)	7.3						6.9	
LOS	A						A	
Approach Delay (s/veh)	–	–					6.9	
Approach LOS	–	–					A	

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	ABC	Intersection	Plover & Lark
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	City of Lakewood, OH
Date Performed	9/15/2014	Analysis Year	2014
Analysis Time Period	PM Peak Period		
Project Description	Existing Conditions		
East/West Street:	Plover Street	North/South Street:	Lark Street
Intersection Orientation:	East-West	Study Period (hrs):	0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	10	20			20	12
Peak-Hour Factor, PHF	0.71	0.71	1.00	1.00	0.57	0.57
Hourly Flow Rate, HFR (veh/h)	14	28	0	0	35	17
Percent Heavy Vehicles	7	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				10		10
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.92	1.00	0.52
Hourly Flow Rate, HFR (veh/h)	0	0	0	10	0	19
Percent Heavy Vehicles	0	0	0	3	0	3
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
v (veh/h)	14						20	
C (m) (veh/h)	1552						991	
v/c	0.01						0.02	
95% queue length	0.03						0.06	
Control Delay (s/veh)	7.3						8.8	
LOS	A						A	
Approach Delay (s/veh)	--	--					8.8	
Approach LOS	--	--					A	

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APPENDIX D
Capacity Analysis Worksheets
Build Conditions

ALL-WAY STOP CONTROL ANALYSIS

General Information

Analyst	ADC
Agency/Co.	TMS Engineers, Inc.
Date Performed	6/25/2014
Analysis Time Period	AM Peak Period

Site Information

Intersection	Church & Davis
Jurisdiction	City of Lawrence, GA
Analysis Year	2014

Project ID and Comments:

East/West Street:	Church Street
North/South Street:	Davis Avenue

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (vph)	10	20	10	10	10	10
% Thru + Left Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (vph)	10	40	10	20	40	10
% Thru + Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	LTR		LTR		LTR		LTR	
PHF	0.51		0.63		0.62		0.61	
Flow Rate (veh/h)	77		36		69		113	
% Heavy Vehicles	2		6		3		1	
No. Lanes	1		1		1		1	
Geometry Group	1		1		1		1	
Duration, T	0.25							

Saturation Headway Adjustment Worksheet

	Eastbound		Westbound		Northbound		Southbound	
Prop. Left-Turns	0.2		0.3		0.2		0.3	
Prop. Right-Turns	0.2		0.3		0.2		0.1	
Prop. Heavy Vehicles	0.0		0.0		0.0		0.0	
$P_{LT,adj}$	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.2
$P_{RT,adj}$	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
$P_{HV,adj}$	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
$h_{adj,computed}$	-0.1		-0.0		-0.0		-0.0	

Departure Headway and Service Time

$h_{d,initial value}$ (s)	3.20	3.20	3.20	3.20
$x_{initial}$	0.07	0.03	0.06	0.10
$h_{d,final value}$ (s)	4.27	4.33	4.26	4.21
$x_{final value}$	0.09	0.04	0.07	0.13
Move-up time, m (s)	2.0	2.0	2.0	2.0
Service Time, t_s (s)	2.3	2.3	2.3	2.2

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	327		286		313		362	
Delay (s/veh)	7.70		7.53		7.61		7.85	
LOS	A		A		A		A	
Approach: Delay (s/veh)	7.70		7.53		7.61		7.85	
LOS	A		A		A		A	
Intersection Delay (s/veh):	7.72							
Intersection LOS	A							

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ALL-WAY STOP CONTROL ANALYSIS

General Information

Analyst	ADC
Agency/Co.	TMS Engineers, Inc.
Date Performed	6/25/2014
Analysis Time Period	AM Peak Period

Site Information

Intersection	Church & Davis
Jurisdiction	City of Lawrence, GA
Analysis Year	2014

Project ID and Comments:

East/West Street:	Church Street
North/South Street:	Davis Avenue

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (vph)	20	20	10	10	10	10
% Thru + Left Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (vph)	10	20	10	10	10	10
% Thru + Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	LTR		LTR		LTR		LTR	
PHF	0.56		0.55		0.71		0.55	
Flow Rate (veh/h)	67		54		56		51	
% Heavy Vehicles	1		3		6		1	
No. Lanes	1		1		1		1	
Geometry Group	1		1		1		1	
Duration, T	0.25							

Saturation Headway Adjustment Worksheet

	Eastbound		Westbound		Northbound		Southbound	
Prop. Left-Turns	0.4		0.3		0.3		0.3	
Prop. Right-Turns	0.2		0.3		0.3		0.3	
Prop. Heavy Vehicles	0.0		0.0		0.0		0.0	
$P_{LT,adj}$	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
$P_{RT,adj}$	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
$P_{HV,adj}$	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
$h_{adj,computed}$	-0.2		-0.1		0.0		-0.1	

Departure Headway and Service Time

$h_{d,initial value}$ (s)	3.20	3.20	3.20	3.20
$x_{initial}$	0.09	0.05	0.05	0.05
$h_{d,final value}$ (s)	4.27	4.15	4.27	4.15
$x_{final value}$	0.10	0.06	0.07	0.05
Move-up time, m (s)	2.0	2.0	2.0	2.0
Service Time, t_s (s)	2.2	2.1	2.3	2.2

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	337		304		326		301	
Delay (s/veh)	7.64		7.42		7.57		7.41	
LOS	A		A		A		A	
Approach: Delay (s/veh)	7.64		7.42		7.57		7.41	
LOS	A		A		A		A	
Intersection Delay (s/veh):	7.53							
Intersection LOS	A							

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	ABC	Intersection	Thrush & Robin
Agency/Co.	TMS Engineers, Inc	Jurisdiction	City of Lakewood, OH
Date Performed	9/15/2014	Analysis Year	2014
Analysis Time Period	AM Peak Hour		

Project Description: Build Conditions

East/West Street: Thrush Street	North/South Street: Robin Street
Intersection Orientation: East-West	Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	10	20	10	10	10	10
Peak-Hour Factor, PHF	0.63	0.62	0.63	0.62	0.63	0.63
Hourly Flow Rate, HFR (veh/h)	16	31	15	15	15	15
Percent Heavy Vehicles	1	--	--	1	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	10	20	10	10	40	10
Peak-Hour Factor, PHF	0.61	0.61	0.61	0.75	0.75	0.75
Hourly Flow Rate, HFR (veh/h)	16	32	16	13	53	13
Percent Heavy Vehicles	1	1	1	1	1	1
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR		LTR			LTR	
v (veh/h)	16	15		64			78	
C (m) (veh/h)	1559	1568		805			752	
v/c	0.01	0.01		0.08			0.10	
95% queue length	0.03	0.03		0.26			0.33	
Control Delay (s/veh)	7.3	7.3		9.6			10.0	
LOS	A	A		A			B	
Approach Delay (s/veh)	--	--		9.6			10.0	
Approach LOS	--	--		A			B	

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	ABC	Intersection	Thrush & Lark
Agency/Co.	TMS Engineers, Inc	Jurisdiction	City of Lakewood, OH
Date Performed	9/15/2014	Analysis Year	2014
Analysis Time Period	AM Peak Hour		

Project Description: Build Conditions

East/West Street: Thrush Street	North/South Street: Lark Street
Intersection Orientation: East-West	Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	10	25	10	10	10	10
Peak-Hour Factor, PHF	0.75	0.75	0.75	0.63	0.63	0.63
Hourly Flow Rate, HFR (veh/h)	13	25	13	20	20	20
Percent Heavy Vehicles	1	--	--	1	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	10	20	10	20	30	10
Peak-Hour Factor, PHF	0.61	0.61	0.61	0.68	0.68	0.68
Hourly Flow Rate, HFR (veh/h)	16	32	16	30	43	15
Percent Heavy Vehicles	1	1	1	2	2	2
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR		LTR			LTR	
v (veh/h)	13	20		64			88	
C (m) (veh/h)	1575	1577		795			785	
v/c	0.01	0.01		0.08			0.12	
95% queue length	0.02	0.04		0.26			0.43	
Control Delay (s/veh)	7.3	7.3		9.6			10.2	
LOS	A	A		A			B	
Approach Delay (s/veh)	--	--		9.6			10.2	
Approach LOS	--	--		A			B	

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	ABC	Intersection	Flower & Dowd
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	City of Lakewood, OH
Date Performed	6/15/2014	Analysis Year	2014
Analysis Time Period	AM Peak Period		

Project Description: Build Conditions

East/West Street: Flower Street | North/South Street: Grant Avenue

Intersection Orientation: East-West | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	10	80			70	30
Peak-Hour Factor, PHF	0.83	0.92	1.00	1.00	0.55	0.69
Hourly Flow Rate, HFR (veh/h)	12	86	0	0	127	54
Percent Heavy Vehicles	2	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				30		10
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.80	1.00	0.58
Hourly Flow Rate, HFR (veh/h)	0	0	0	44	0	14
Percent Heavy Vehicles	0	0	0	1	0	1
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
v (veh/h)	12						98	
C (m) (veh/h)	1364						749	
v/c	0.01						0.08	
95% queue length	0.03						0.25	
Control Delay (s/veh)	7.6						10.2	
LOS	A						B	
Approach Delay (s/veh)	--						10.2	
Approach LOS	--						B	

ALL-WAY STOP CONTROL ANALYSIS

General Information

Analyst	ABC	Intersection	Flower & Dowd
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	City of Lakewood, OH
Date Performed	6/15/2014	Analysis Year	2014
Analysis Time Period	AM Peak Period		

Project Description: Build Conditions

East/West Street: Flower Street | North/South Street: Grant Street

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	90	20	0	0	20	90
%Thru + Left Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	0	0	0	70	0	80
%Thru + Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	LT		TR				LR	
PHF	0.90		0.75				0.46	
Flow Rate (veh/h)	124		148				325	
% Heavy Vehicles	2		2				1	
No. Lanes	1		1		0		1	
Geometry Group	1		1				1	
Duration, T	0.25							

Saturation Headway Adjustment Worksheet

Prop. Left-Turns	0.5		0.5				0.5	
Prop. Right-Turns	0.5		0.5				0.5	
Prop. Heavy Vehicles	0.0		0.0				0.0	
HT(s)	0.2	0.2	0.2	0.2			0.2	0.2
HT(adj)	-0.6	-0.6	-0.6	-0.6			-0.6	-0.6
HW(adj)	1.7	1.7	1.7	1.7			1.7	1.7
Total adjustment	0.2		-0.2				-0.2	

Departure Headway and Service Time

Initial headway (s)	3.30		3.30				3.30	
e (veh)	0.13		0.13				0.29	
Initial adjusted (s)	3.55		4.38				4.35	
s, final value	0.17		0.18				0.39	
Minimum time, m (s)	2.0		2.0				2.0	
Service Time, t (s)	3.0		2.4				2.3	

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	374		496				575	
Delay (s/veh)	9.11		8.32				10.12	
LOS	A		A				B	
Approach Delay (s/veh)	9.11		8.32				10.12	
LOS	A		A				B	
Intersection Delay (s/veh)	9.47							
Intersection LOS	A							

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	ABC	Intersection	Plover & Robin
Agency/Co.	TMS Engineers, Inc	Jurisdiction	City of Lakewood, OH
Date Performed	9/15/2014	Analysis Year	2014
Analysis Time Period	AM Peak Period		

Project Description: Build Conditions

East/West Street:	Plover Street	North/South Street:	Robin Street
Intersection Orientation:	East-West	Study Period (hrs):	0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound				Westbound	
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	20	60			65	10
Peak-Hour Factor, PHF	0.48	0.48	1.00	1.00	0.87	0.87
Hourly Flow Rate, HFR (veh/h)	41	125	0	0	89	14
Percent Heavy Vehicles	2	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				10		40
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.81	1.00	0.81
Hourly Flow Rate, HFR (veh/h)	0	0	0	12	0	49
Percent Heavy Vehicles	0	0	0	1	0	1
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
v (veh/h)	41						61	
C (m) (veh/h)	1489						987	
v/c	0.03						0.07	
95% queue length	0.08						0.22	
Control Delay (s/veh)	7.5						9.4	
LOS	A						A	
Approach Delay (s/veh)	--	--					9.4	
Approach LOS		--					A	

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	ABC	Intersection	Plover & Lark
Agency/Co.	TMS Engineers, Inc	Jurisdiction	City of Lakewood, OH
Date Performed	9/15/2014	Analysis Year	2014
Analysis Time Period	AM Peak Period		

Project Description: Build Conditions

East/West Street:	Plover Street	North/South Street:	Lark Street
Intersection Orientation:	East-West	Study Period (hrs):	0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound				Westbound	
Movement	1	2	3	4	5	6
		T	R	L	T	R
Volume (veh/h)	20	60			40	10
Peak-Hour Factor, PHF	0.85	0.85	1.00	1.00	0.73	0.73
Hourly Flow Rate, HFR (veh/h)	23	169	0	0	54	13
Percent Heavy Vehicles	1	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				10		25
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.54	1.00	0.54
Hourly Flow Rate, HFR (veh/h)	0	0	0	18	0	37
Percent Heavy Vehicles	0	0	0	3	0	3
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
v (veh/h)	23						55	
C (m) (veh/h)	1541						899	
v/c	0.02						0.06	
95% queue length	0.07						0.20	
Control Delay (s/veh)	7.4						9.3	
LOS	A						A	
Approach Delay (s/veh)	--	--					9.3	
Approach LOS		--					A	

ALL-WAY STOP CONTROL ANALYSIS

General Information

Analyst	ABC	Intersection	Thrush & Dove
Agency/Co.	TWS Engineers, Inc.	Jurisdiction	City of Lakewood, CO
Date Performed	6/15/2014	Analysis Year	2014
Analysis Time Period	School Early Peak		

Project ID And Description:

East/West Street: Thrush Street | North/South Street: Dove Avenue

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	10	30	10	10	30	10
%Thru + Left Only						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	10	30	10	20	50	20
%Thru + Left Only						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	LTR		LTR		LTR		LTR	
PHF	0.68		0.54		0.54		0.79	
Flow Rate (veh/h)	56		54		91		113	
% Heavy Vehicles	2		5		3		1	
No. Lanes	1		1		1		1	
Geometry Group	1		1		1		1	
Duration, T	0.25							

Saturation Headway Adjustment Worksheet

	Eastbound		Westbound		Northbound		Southbound	
Prop. Left-Turns	0.2		0.3		0.2		0.3	
Prop. Right-Turns	0.2		0.3		0.2		0.2	
Prop. Heavy Vehicles	0.0		0.0		0.0		0.0	
hLT-adj	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
hRT-adj	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
hHV-adj	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
hdj, combined	-0.0		-0.0		-0.0		-0.1	

Departure Headway and Service Time

	Eastbound		Westbound		Northbound		Southbound	
hd, Initial value (s)	3.20		3.20		3.20		3.20	
x, Initial	0.05		0.05		0.09		0.10	
hd, final value (s)	4.38		4.38		4.25		4.18	
x, final value	0.07		0.07		0.11		0.14	
Move-up time, m (s)	2.0		2.0		2.0		2.0	
Service Time, t_s (s)	2.4		2.4		2.2		2.2	

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	305		304		341		350	
Delay (s/veh)	7.70		7.69		7.76		7.64	
LOS	A		A		A		A	
Approach: Delay (s/veh)	7.70		7.69		7.76		7.64	
LOS	A		A		A		A	
Intersection Delay (s/veh)	7.77							
Intersection LOS	A							

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ALL-WAY STOP CONTROL ANALYSIS

General Information

Analyst	ABC	Intersection	Thrush & Dove
Agency/Co.	TWS Engineers, Inc.	Jurisdiction	City of Lakewood, CO
Date Performed	6/15/2014	Analysis Year	2014
Analysis Time Period	School Peak Hour		

Project ID And Description:

East/West Street: Thrush Street | North/South Street: Dove Street

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	20	30	10	10	20	10
%Thru + Left Only						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	10	20	10	10	10	10
%Thru + Left Only						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	LTR		LTR		LTR		LTR	
PHF	0.59		0.59		0.63		0.63	
Flow Rate (veh/h)	85		65		66		45	
% Heavy Vehicles	1		3		6		1	
No. Lanes	1		1		1		1	
Geometry Group	1		1		1		1	
Duration, T	0.25							

Saturation Headway Adjustment Worksheet

	Eastbound		Westbound		Northbound		Southbound	
Prop. Left-Turns	0.3		0.2		0.3		0.3	
Prop. Right-Turns	0.2		0.2		0.3		0.3	
Prop. Heavy Vehicles	0.0		0.0		0.1		0.0	
hLT-adj	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
hRT-adj	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
hHV-adj	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
hdj, combined	-0.0		-0.0		-0.0		-0.1	

Departure Headway and Service Time

	Eastbound		Westbound		Northbound		Southbound	
hd, Initial value (s)	3.20		3.20		3.20		3.20	
x, Initial	0.09		0.06		0.06		2.04	
hd, final value (s)	4.20		4.19		4.25		4.19	
x, final value	0.10		0.08		0.08		5.05	
Move-up time, m (s)	2.0		2.0		2.0		2.0	
Service Time, t_s (s)	2.2		2.2		2.2		2.2	

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	335		315		316		295	
Delay (s/veh)	7.66		7.59		7.61		7.42	
LOS	A		A		A		A	
Approach: Delay (s/veh)	7.65		7.59		7.61		7.42	
LOS	A		A		A		A	
Intersection Delay (s/veh)	7.57							
Intersection LOS	A							

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc
Date Performed	9/15/2014
Analysis Time Period	School Peak Hour

Site Information

Intersection	Thrush & Belle
Jurisdiction	City of Lakewood, OH
Analysis Year	2014

Project Description: Build Conditions

East/West Street: Thrush Street | North/South Street: Belle Street

Intersection Orientation: East-West | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	19	30	19	19	30	19
Peak-Hour Factor, PHF	0.81	0.81	0.81	0.71	0.71	0.71
Hourly Flow Rate, HFR (veh/h)	12	37	12	14	28	14
Percent Heavy Vehicles	1	--	--	1	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	19	30	19	19	40	19
Peak-Hour Factor, PHF	0.83	0.83	0.83	0.58	0.58	0.58
Hourly Flow Rate, HFR (veh/h)	12	36	12	17	58	17
Percent Heavy Vehicles	1	1	1	1	1	1
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR		LTR			LTR	
v (veh/h)	12	14		50			102	
C (m) (veh/h)	1572	1564		780			765	
v/c	0.01	0.01		0.06			0.13	
95% queue length	0.02	0.02		0.20			0.46	
Control Delay (s/veh)	7.3	7.3		10.0			10.3	
LOS	A	A		A			B	
Approach Delay (s/veh)	--	--		10.0			10.3	
Approach LOS	--	--		A			B	

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	9/15/2014
Analysis Time Period	School Peak Hour

Site Information

Intersection	Thrush & Lark
Jurisdiction	City of Lakewood, OH
Analysis Year	2014

Project Description: Build Conditions

East/West Street: Thrush Street | North/South Street: Lark Street

Intersection Orientation: East-West | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	19	30	19	19	19	19
Peak-Hour Factor, PHF	0.59	0.84	0.84	0.79	0.79	0.79
Hourly Flow Rate, HFR (veh/h)	18	86	18	14	14	14
Percent Heavy Vehicles	2	--	--	1	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	19	39	19	19	39	19
Peak-Hour Factor, PHF	0.75	0.75	0.75	0.83	0.83	0.83
Hourly Flow Rate, HFR (veh/h)	13	46	13	18	56	18
Percent Heavy Vehicles	1	1	1	2	2	2
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR		LTR			LTR	
v (veh/h)	18	14		86			92	
C (m) (veh/h)	1092	1529		751			775	
v/c	0.01	0.01		0.09			0.12	
95% queue length	0.03	0.02		0.29			0.41	
Control Delay (s/veh)	7.3	7.4		10.2			10.3	
LOS	A	A		B			B	
Approach Delay (s/veh)	--	--		10.2			10.3	
Approach LOS	--	--		B			B	

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	ABC	Intersection	Plover & Grand
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	City of Lakewood OH
Date Performed	9/15/2014	Analysis Year	2014
Analysis Time Period	School Peak Period		

Project Description: Build Conditions

East/West Street: Plover Street | North/South Street: Grand Avenue

Intersection Orientation: East-West | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	70	50			100	30
Peak-Hour Factor, PHF	0.56	0.56	1.00	1.00	0.81	0.81
Hourly Flow Rate, HFR (veh/h)	17	160	0	0	153	32
Percent Heavy Vehicles	2	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				40		20
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.50	1.00	0.50
Hourly Flow Rate, HFR (veh/h)	0	0	0	80	0	40
Percent Heavy Vehicles	0	0	0	1	0	1
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
v (veh/h)	17						120	
C (m) (veh/h)	1379						695	
v/c	0.01						0.17	
95% queue length	0.04						0.63	
Control Delay (s/veh)	7.6						11.4	
LOS	A						B	
Approach Delay (s/veh)	--	--					11.4	
Approach LOS	--	--					B	

ALL-WAY STOP CONTROL ANALYSIS

General Information

Analyst	ABC	Intersection	Plover & Grand
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	City of Lakewood, OH
Date Performed	9/15/2014	Analysis Year	2014
Analysis Time Period	School Peak Period		

Project: Build Conditions

East/West Street: Plover Street | North/South Street: Grand Street

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	70	50	0	0	30	70
%Thru Left Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	0	0	0	90	0	90
%Thru Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	LT		TR				LR	
PHF	0.59		0.58				0.45	
Flow Rate (veh/h)	226		146				400	
% Heavy Vehicles	2		2				1	
No. Lanes	1		1		0		1	
Geometry Group	1		1				2	
Duration, T	0.25							

Saturation Headway Adjustment Worksheet

Prop. Left-Turns	0.5		0.0				0.5	
Prop. Right-Turns	0.0		0.7				0.5	
Prop. Heavy Vehicles	0.0		0.0				0.0	
hLT adj	0.2	0.2	0.2	0.2			0.2	0.2
hRT adj	-0.5	-0.5	-0.5	-0.5			-0.5	-0.5
hHV adj	1.7	1.7	1.7	1.7			1.7	1.7
hadj, computed	0.2		-0.4				-0.2	

Departure Headway and Service Time

hd, initial value (s)	3.20		3.20				3.20	
x, initial	0.20		0.13				0.36	
hd, final value (s)	5.59		4.59				4.69	
x, final value	0.53		0.20				0.52	
Move-up time, m (s)	2.0		2.0				2.0	
Service Time, ts (s)	3.3		2.9				2.7	

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	475		336				660	
Delay (s/veh)	10.69		9.09				12.69	
LOS	B		A				B	
Approach Delay (s/veh)	10.69		9.09				12.69	
LOS	B		A				B	
Intersection Delay (s/veh)	11.48							
Intersection LOS	B							

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc
Date Performed	9/15/2014
Analysis Time Period	School Peak Period

Site Information

Intersection	Flower & Rosin
Jurisdiction	City of Lakewood, OH
Analysis Year	2014

Project Description: *Build Conditions*

East/West Street: *Flower Street* | North/South Street: *Rosin Street*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound				Westbound	
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	30	100			90	10
Peak-Hour Factor, PHF	0.65	0.90	1.00	1.00	0.90	0.90
Hourly Flow Rate, HFR (veh/h)	49	156	0	0	120	20
Percent Heavy Vehicles	2	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	2	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				15		45
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.92	1.00	0.92
Hourly Flow Rate, HFR (veh/h)	0	0	0	16	0	75
Percent Heavy Vehicles	0	0	0	1	0	1
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
v (veh/h)	49						91	
C (m) (veh/h)	1445						832	
v/c	0.03						0.11	
95% queue length	0.11						0.38	
Control Delay (s/veh)	7.6						9.9	
LOS	A						A	
Approach Delay (s/veh)	--	--					9.9	
Approach LOS	--	--					A	

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	9/15/2014
Analysis Time Period	School Peak Period

Site Information

Intersection	Flower & Lark
Jurisdiction	City of Lakewood, OH
Analysis Year	2014

Project Description: *Build Conditions*

East/West Street: *Flower Street* | North/South Street: *Lark Street*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound				Westbound	
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	40	95			65	10
Peak-Hour Factor, PHF	0.79	0.78	1.00	1.00	0.86	0.66
Hourly Flow Rate, HFR (veh/h)	51	110	0	0	90	15
Percent Heavy Vehicles	4	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				20		20
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.83	1.00	0.83
Hourly Flow Rate, HFR (veh/h)	0	0	0	15	0	21
Percent Heavy Vehicles	0	0	0	3	0	3
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
v (veh/h)	91						36	
C (m) (veh/h)	1498						830	
v/c	0.06						0.05	
95% queue length	0.21						0.16	
Control Delay (s/veh)	7.5						9.5	
LOS	A						A	
Approach Delay (s/veh)	--	--					9.5	
Approach LOS	--	--					A	

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ALL-WAY STOP CONTROL ANALYSIS

General Information		Site Information	
Analyst	ADC	Intersection	Thrush & Detroit
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	City of Lakewood, OH
Date Performed	8/25/2014	Analysis Year	2014
Analysis Time Period	PM Peak Hour		

Project ID and Comments:

Eastbound/West...	North/South Street: Detroit Avenue

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	20	30	10	10	20	20
%Thru + Left Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	10	20	10	10	40	10
%Thru + Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	LTR		LTR		LTR		LTR	
PHF	0.90		0.64		0.79		0.61	
Flow Rate (veh/h)	105		77		49		97	
% Heavy Vehicles	2		5		3		1	
No. Lanes	1		1		1		1	
Geometric Group	1		1		1		1	
Duration, T	0.25							

Saturation Headway Adjustment Worksheet

	Eastbound		Westbound		Northbound		Southbound	
Prop. Left-Turns	0.3		0.2		0.2		0.2	
Prop. Right-Turns	0.2		0.4		0.2		0.2	
Prop. Heavy Vehicles	0.0		0.0		0.0		0.0	
hLT-adj	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
hRT-adj	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
hHV-adj	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
hrd, computed	0.0		-0.1		-0.0		-0.0	

Departure Headway and Service Time

	Eastbound		Westbound		Northbound		Southbound	
hd, initial value (s)	3.20		3.20		3.20		3.20	
x, initial	0.09		0.07		0.04		0.05	
hd, final value (s)	4.32		4.23		4.27		4.32	
x, final value	0.13		0.09		0.05		0.12	
Move-up time, m (s)	2.0		2.0		2.0		2.0	
Service Time, t_s (s)	2.3		2.2		2.4		2.3	

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	355		327		299		347	
Delay (sec/h)	7.94		7.65		7.55		7.89	
LOS	A		A		A		A	
Approach: Delay (s/veh)	7.91		7.65		7.65		7.89	
LOS	A		A		A		A	
Intersection Delay (sec/h)	7.81							
Intersection LOS	A							

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ALL-WAY STOP CONTROL ANALYSIS

General Information		Site Information	
Analyst	ADC	Intersection	Warren & Detroit
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	City of Lakewood, OH
Date Performed	8/25/2014	Analysis Year	2014
Analysis Time Period	PM Peak Hour		

Project ID and Comments:

Eastbound/West...	North/South Street: Detroit Street

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	10	20	10	10	20	10
%Thru + Left Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	10	20	10	10	40	10
%Thru + Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	LTR		LTR		LTR		LTR	
PHF	0.58		0.70		0.75		0.81	
Flow Rate (veh/h)	62		36		66		97	
% Heavy Vehicles	2		3		6		1	
No. Lanes	1		1		1		1	
Geometric Group	1		1		1		1	
Duration, T	0.25							

Saturation Headway Adjustment Worksheet

	Eastbound		Westbound		Northbound		Southbound	
Prop. Left-Turns	0.3		0.3		0.2		0.2	
Prop. Right-Turns	0.3		0.3		0.2		0.2	
Prop. Heavy Vehicles	0.0		0.0		0.1		0.0	
hLT-adj	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
hRT-adj	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
hHV-adj	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
hrd, computed	-0.0		-0.0		0.0		-0.0	

Departure Headway and Service Time

	Eastbound		Westbound		Northbound		Southbound	
hd, initial value (s)	3.20		3.20		3.20		3.20	
x, initial	0.05		0.05		0.06		0.09	
hd, final value (s)	4.24		4.29		4.26		4.20	
x, final value	0.09		0.07		0.08		0.11	
Move-up time, m (s)	2.0		2.0		2.0		2.0	
Service Time, t_s (s)	2.2		2.3		2.3		2.2	

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	315		308		316		347	
Delay (sec/h)	7.61		7.50		7.57		7.74	
LOS	A		A		A		A	
Approach: Delay (s/veh)	7.61		7.50		7.57		7.74	
LOS	A		A		A		A	
Intersection Delay (sec/h)	7.67							
Intersection LOS	A							

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	ABC	Intersection	Thrush & Robin
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	City of Lakewood, OH
Date Performed	9/15/2014	Analysis Year	2014
Analysis Time Period	PM Peak Hour		

Project Description: Build Conditions

East/West Street: Thrush Street | North/South Street: Robin Street

Intersection Orientation: East-West | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	10	20	10	10	20	10
Peak-Hour Factor, PHF	0.63	0.63	0.62	0.89	0.88	0.88
Hourly Flow Rate, HFR (veh/h)	15	31	15	11	22	11
Percent Heavy Vehicles	1	--	--	1	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	10	20	10	10	40	10
Peak-Hour Factor, PHF	0.81	0.81	0.81	0.84	0.84	0.84
Hourly Flow Rate, HFR (veh/h)	12	24	12	11	47	11
Percent Heavy Vehicles	1	1	1	1	1	1
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR		LTR			LTR	
v (veh/h)	15	11		48			59	
C (m) (veh/h)	1585	1568		814			756	
v/c	0.01	0.01		0.06			0.08	
95% queue length	0.03	0.02		0.19			0.26	
Control Delay (s/veh)	7.3	7.3		9.7			10.0	
LOS	A	A		A			A	
Approach Delay (s/veh)	--	--		9.7			10.0	
Approach LOS	--	--		A			A	

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	ABC	Intersection	Thrush & Lark
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	City of Lakewood, OH
Date Performed	9/15/2014	Analysis Year	2014
Analysis Time Period	PM Peak Hour		

Project Description: Build Conditions

East/West Street: Thrush Street | North/South Street: Lark Street

Intersection Orientation: East-West | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	10	20	10	10	10	10
Peak-Hour Factor, PHF	0.55	0.85	0.85	0.75	0.75	0.75
Hourly Flow Rate, HFR (veh/h)	15	30	15	13	13	13
Percent Heavy Vehicles	1	--	--	1	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	10	20	10	10	20	10
Peak-Hour Factor, PHF	0.75	0.75	0.75	0.94	0.94	0.94
Hourly Flow Rate, HFR (veh/h)	13	26	13	10	21	10
Percent Heavy Vehicles	1	1	1	2	2	2
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR		LTR			LTR	
v (veh/h)	15	13		52			41	
C (m) (veh/h)	1595	1570		827			823	
v/c	0.01	0.01		0.06			0.05	
95% queue length	0.03	0.02		0.20			0.16	
Control Delay (s/veh)	7.2	7.3		9.6			9.6	
LOS	A	A		A			A	
Approach Delay (s/veh)	--	--		9.6			9.6	
Approach LOS	--	--		A			A	

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	ABC	Intersection	Plover & Quail
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	City of Lakewood, OH
Date Performed	9/15/2014	Analysis Year	2014
Analysis Time Period	PM Peak Period		

Project Description: Build Conditions

East/West Street: Plover Street — North/South Street: Quail Avenue

Intersection Orientation: East-West — Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound				Westbound	
Movement	1	2	3	4	5	6
	L	T	R	L	–	R
Volume (veh/h)	10	50			40	20
Peak-Hour Factor, PHF	0.69	0.86	1.00	1.00	0.75	0.75
Hourly Flow Rate, HFR (veh/h)	11	58	0	0	53	26
Percent Heavy Vehicles	2	–	–	0	–	–
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Northbound				Southbound	
Movement	7	8	9	10	11	12
	L	T	R	L	–	R
Volume (veh/h)				15		31
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.83	1.00	0.83
Hourly Flow Rate, HFR (veh/h)	0	0	0	15	0	31
Percent Heavy Vehicles	0	0	0	7	0	7
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
v (veh/h)	11						46	
C (m) (veh/h)	1519						949	
v/c	0.01						0.05	
95% queue length	0.02						0.15	
Control Delay (s/veh)	7.4						9.0	
LOS	A						A	
Approach Delay (s/veh)	–	–					9.0	
Approach LOS	–	–					A	

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ALL-WAY STOP CONTROL ANALYSIS

General Information

Analyst	ABC	Intersection	Plover & Quail
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	City of Lakewood, OH
Date Performed	9/15/2014	Analysis Year	2014
Analysis Time Period	PM Peak Period		

Project Description: Build Conditions

East/West Street: Plover Street — North/South Street: Quail Street

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	10	50	0	0	40	20
%Thru Left Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	0	0	0	15	0	15
%Thru Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	LT		TR				LR	
HHF	0.69		0.75				0.48	
Flow Rate (veh/h)	57		79				48	
% Heavy Vehicles	2		2				1	
No. Lanes	1		1		0		1	
Capacity Group	1		1				1	
Duration, T	0.25							

Saturation Headway Adjustment Worksheet

Prop. Left-Turns	0.7		0.0				0.5	
Prop. Right-Turns	0.0		0.3				0.5	
Prop. Heavy Vehicles	0.0		0.0				0.0	
f_LT-adj	0.2	0.2	0.2	0.2			0.2	0.2
f_RT-adj	-0.6	-0.6	-0.6	-0.6			-0.6	-0.6
f_HV-adj	1.7	1.7	1.7	1.7			1.7	1.7
f_adj computed	0.1		-0.2				-0.2	

Departure Headway and Service Time

hd, initial value (s)	3.20		3.20				3.70	
x, initial	0.06		0.07				0.04	
hd, final value (s)	4.13		3.99				4.02	
x, final value	0.08		0.09				0.05	
Move-up time, m (s)	2.0		2.0				2.0	
Service time, t_s (s)	2.1		1.9				3.0	

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	317		329				352	
Delay (s/veh)	7.48		7.26				7.22	
LOS	A		A				A	
Approach Delay (s/veh)	7.48		7.26				7.22	
LOS	A		A				A	
Intersection Delay (s/veh)	7.29							
Intersection LOS	A							

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	ABC	Intersection	Plover & Robin
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	City of Lakewood, OH
Date Performed	9/15/2014	Analysis Year	2014
Analysis Time Period	PM Peak Period		
Project Description	Build Conditions		
East/West Street:	Plover Street	North/South Street:	Robin Street
Intersection Orientation:	East-West	Study Period (hrs):	0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	25	40			53	10
Peak-Hour Factor, PHF	0.91	0.91	1.00	1.00	0.87	0.67
Hourly Flow Rate, HFR (veh/h)	28	39	0	0	74	14
Percent Heavy Vehicles	2	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				10		20
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.55	1.00	0.55
Hourly Flow Rate, HFR (veh/h)	0	0	0	18	0	36
Percent Heavy Vehicles	0	0	0	1	0	1
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
v (veh/h)	24						54	
C (m) (veh/h)	1508						919	
v/c	0.02						0.06	
95% queue length	0.05						0.19	
Control Delay (s/veh)	7.4						9.2	
LOS	A						A	
Approach Delay (s/veh)	--	--					9.2	
Approach LOS							A	

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	ABC	Intersection	Plover & Lark
Agency/Co.	TMS Engineers, Inc	Jurisdiction	City of Lakewood, OH
Date Performed	9/15/2014	Analysis Year	2014
Analysis Time Period	PM Peak Period		
Project Description	Build Conditions		
East/West Street:	Plover Street	North/South Street:	Lark Street
Intersection Orientation:	East-West	Study Period (hrs):	0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	25	30			30	10
Peak-Hour Factor, PHF	0.71	0.71	1.00	1.00	0.57	0.67
Hourly Flow Rate, HFR (veh/h)	28	42	0	0	52	17
Percent Heavy Vehicles	1	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				10		20
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.92	1.00	0.92
Hourly Flow Rate, HFR (veh/h)	0	0	0	10	0	21
Percent Heavy Vehicles	0	0	0	3	0	3
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
v (veh/h)	28						51	
C (m) (veh/h)	1538						934	
v/c	0.02						0.05	
95% queue length	0.06						0.18	
Control Delay (s/veh)	7.4						9.0	
LOS	A						A	
Approach Delay (s/veh)	--	--					9.0	
Approach LOS							A	

APPENDIX E
Capacity Analysis Worksheets
One-Way Conditions

ALL-WAY STOP CONTROL ANALYSIS

General Information

Analyst	ADC
Agency/Co.	TMS Engineers, Inc
Date Performed	1/15/2014
Analysis Time Period	AM Peak Period

Site Information

Intersection	Thrush & Dale
Jurisdiction	City of Lakewood, CO
Analysis Year	2014

Thrush & Dale Roundabout - One Way

East/West Street: Thrush Street — North/South Street: Dale Avenue

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	30	20	10	10	10	10
%Thru + Left Turn						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	10	40	100	30	40	20
%Thru + Left Turn						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	LT		TR		LTR		LR	
Prop	0.67		0.33		0.92		0.61	
Flow Rate (veh/h)	58		24		161		61	
% Heavy Vehicles	2		5		3		1	
No. Lanes	1		1		1		1	
Critical Gap	7		7		7		7	
Duration	0.25							

Saturation Headway Adjustment Worksheet

Prop. Left-Turns	0.3		0.0		0.1		0.5	
Prop. Right-Turns	0.0		0.5		0.7		0.4	
Prop. Heavy Vehicles	0.0		0.0		0.0		0.0	
P_T(adj)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
P_RT(adj)	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
P_HV(adj)	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
Flow composition	0.1		-0.2		-0.3		-0.1	

Departure Headway and Service Time

Hc, initial value (s)	3.20		3.20		3.20		3.20	
x, initial	0.05		0.02		0.14		0.07	
Hc, final value (s)	4.55		4.25		3.84		4.15	
x, final value	0.07		0.03		0.17		0.09	
Move-up time, m (s)	2.0		2.0		2.0		2.0	
Service Time, t_s (s)	2.5		2.3		1.8		2.1	

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	308		274		411		331	
Delay (s/veh)	7.99		7.39		7.63		7.57	
LOS	A		A		A		A	
Approach: Delay (s/veh)	7.89		7.39		7.63		7.57	
LOS	A		A		A		A	
Intersection Delay (s/veh)	7.64							
Intersection LOS	A							

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ALL-WAY STOP CONTROL ANALYSIS

General Information		Site Information	
Analyst	ABC	Intersection	Thrush & Rose
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	City of Lakewood, OH
Date Performed	9/10/2014	Analysis Year	2014
Analysis Time Period	AM Peak Hour		

Project ID: Build Conditions - One Way

East/West Street: Thrush Street | North/South Street: Peak Street

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	20	20	110	100	10	10
%Thru in Left Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	10	20	10	10	30	10
%Thru in Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	LTR		LTR				LTR	
PHF	0.66		0.66				0.66	
Flow Rate (veh/h)	258		227				87	
% Heavy Vehicles	1		3				1	
No. Lanes	1		1		0		1	
Geometry Group	1		1				1	
Duration, T	0.25							

Saturation Headway Adjustment Worksheet

Prop. Left-Turns	0.1		0.8				0.2	
Prop. Right-Turns	0.7		0.1				0.2	
Prop. Heavy Vehicles	0.0		0.0				0.0	
%LT-Adj	0.2	0.2	0.2	0.2			0.2	0.2
%RT-Adj	-0.6	-0.6	-0.6	-0.6			-0.6	-0.6
HV-Adj	1.7	1.7	1.7	1.7			1.7	1.7
Adj. Headway	-0.4		0.2				-0.1	

Departure Headway and Service Time

hd, initial value (s)	3.20		3.20				3.20	
x, initial	0.24		0.19				0.08	
hd, final value (s)	3.97		4.56				4.88	
x, final value	0.29		0.27				0.12	
Move-up time, m (s)	2.0		2.0				2.0	
Service Time, t_s (s)	2.0		2.6				2.9	

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	516		467				337	
Delay (s/veh)	8.61		9.27				8.53	
LOS	A		A				A	
Approach: Delay (s/veh)	8.61		9.27				8.53	
LOS	A		A				A	
Intersection Delay (s/veh)	0.05							
Intersection LOS	A							

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	ABC	Intersection	Thrush & Rose
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	City of Lakewood, OH
Date Performed	9/10/2014	Analysis Year	2014
Analysis Time Period	AM Peak Hour		

Project Description: Build Conditions - One Way

East/West Street: Thrush Street	North/South Street: Peak Street
Intersection Orientation: East-West	Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	10	30			10	10
Peak-Hour Factor, PHF	0.63	0.63	0.63	0.63	0.63	0.63
Hourly Flow Rate, HFR (veh/h)	15	47	0	0	15	15
Percent Heavy Vehicles	1	--	--	1	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	60	25	10	25		20
Peak-Hour Factor, PHF	0.61	0.51	0.63	0.75	0.75	0.75
Hourly Flow Rate, HFR (veh/h)	98	49	16	33	0	26
Percent Heavy Vehicles	1	1	1	1	1	1
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	0	0
Configuration		LTR			LR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT			LTR			LR	
v (veh/h)	30			146			52	
C (m) (veh/h)	1585			841			915	
v/c	0.01			0.17			0.06	
95% queue length	0.03			0.62			0.19	
Control Delay (s/veh)	7.3			10.2			9.2	
LOS	A			B			A	
Approach Delay (s/veh)	--	--		10.2			9.2	
Approach LOS	--	--		B			A	

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	ABC	Intersection	Truxall & Lark
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	City of Lakewood, OH
Date Performed	9/15/2014	Analysis Year	2014
Analysis Time Period	AM Peak Hour		

Project Description: Build Conditions - One Way

East/West Street: Truxall Street | North/South Street: Lark Street

Intersection Orientation: East-West | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	10	20	20	20	70	10
Peak-Hour Factor, PHF	0.75	0.75	0.75	0.90	0.90	0.90
Hourly Flow Rate, HFR (veh/h)	13	26	26	22	77	11
Percent Heavy Vehicles	1	--	--	1	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				22	40	12
Peak-Hour Factor, PHF	0.61	0.61	0.61	0.90	0.90	0.90
Hourly Flow Rate, HFR (veh/h)	0	0	0	33	66	19
Percent Heavy Vehicles	1	1	1	2	2	2
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	2	1	0
Configuration					LTR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR					LTR	
v (veh/h)	13	45					115	
C (m) (veh/h)	1575	1590					746	
v/c	0.01	0.02					0.15	
95% queue length	0.02	0.02					0.54	
Control Delay (s/veh)	7.3	7.4					10.7	
LOS	A	A					B	
Approach Delay (s/veh)	--	--					10.7	
Approach LOS	--	--					B	

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	ABC	Intersection	Plover & David
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	City of Lakewood, OH
Date Performed	9/15/2014	Analysis Year	2014
Analysis Time Period	AM Peak Period		

Project Description: Build Conditions - One Way

East/West Street: Plover Street | North/South Street: David Avenue

Intersection Orientation: East-West | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	100	15			40	70
Peak-Hour Factor, PHF	0.83	0.83	1.00	1.00	0.95	0.95
Hourly Flow Rate, HFR (veh/h)	120	18	0	0	42	127
Percent Heavy Vehicles	2	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)						
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.66	1.00	0.66
Hourly Flow Rate, HFR (veh/h)	0	0	0	0	0	0
Percent Heavy Vehicles	0	0	0	1	0	1
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration						

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT							
v (veh/h)	120							
C (m) (veh/h)	1370							
v/c	0.09							
95% queue length	0.29							
Control Delay (s/veh)	7.9							
LOS	A							
Approach Delay (s/veh)	--	--						
Approach LOS	--	--						

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ALL-WAY STOP CONTROL ANALYSIS

General Information		Site Information	
Analyst	ABC	Intersection	Power & Dale
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	City of Lakewood, OH
Date Performed	9/15/2014	Analysis Year	2014
Analysis Time Period	AM Peak Period		

Project ID: Dale Conditions - One Way

East/West Street: Power Street | North/South Street: Dale Street

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	90	20	0	0	20	90
%Thru in Left Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	0	0	0	150	0	100
%Thru in Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	T		T				LR	
PHF	0.69		0.75				0.46	
Flow Rate (veh/h)	22		28				434	
% Heavy Vehicles	5		2				1	
No. Lanes	1		1		0		1	
Geometry Group	1		1				1	
Duration, T	0.25							

Saturation Headway Adjustment Worksheet

Prop. Left-Turns	0.0		0.0				0.5	
Prop. Right-Turns	0.0		0.0				0.5	
Prop. Heavy Vehicles	0.0		0.0				0.0	
hLT-adj	0.2	0.2	0.2	0.2			0.2	0.2
hRT-adj	-0.5	-0.5	-0.5	-0.5			-0.5	-0.5
hHV-adj	1.7	1.7	1.7	1.7			1.7	1.7
hrd, computed	0.0		0.0				-0.2	

Departure Headway and Service Time

hd, Initial value (s)	3.20		3.20				3.20	
x, initial	0.02		0.02				0.39	
hd, final value (s)	4.88		4.87				3.61	
x, final value	0.03		0.04				0.46	
Move-up time, m (s)	2.0		2.0				2.0	
Service Time, t_s (s)	2.9		2.9				1.6	

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	272		278				684	
Delay (s/veh)	8.03		8.05				10.11	
LOS	A		A				B	
Approach Delay (s/veh)	8.03		8.05				10.11	
LOS	A		A				B	
Intersection Delay (s/veh)	9.90							
Intersection LOS	A							

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst:	ABC	Intersection	Power & Robin
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	City of Lakewood, OH
Date Performed	9/15/2014	Analysis Year	2014
Analysis Time Period	AM Peak Period		

Project Description: Dale Conditions - One Way

East/West Street: Power Street | North/South Street: Robin Street

Intersection Orientation: East-West | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	35	70			70	20
Peak-Hour Factor, PHF	0.88	0.88	1.00	1.00	0.87	0.87
Hourly Flow Rate, HFR (veh/h)	82	148	0	0	104	29
Percent Heavy Vehicles	2	–	–	0	–	–
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	–	R	L	–	R
Volume (veh/h)						
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.81	1.00	0.81
Hourly Flow Rate, HFR (veh/h)	0	0	0	0	0	0
Percent Heavy Vehicles	0	0	0	1	0	1
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration						

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT							
v (veh/h)	52							
C (m) (veh/h)	1462							
v/c	0.04							
95% queue length	0.13							
Control Delay (s/veh)	7.5							
LOS	A							
Approach Delay (s/veh)	–	–						
Approach LOS	–	–						

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	ABC	Intersection	Plover & Lark
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	City of Lakewood, OH
Date Performed	9/15/2014	Analysis Year	2014
Analysis Time Period	AM Peak Period		

Project Description: Build Conditions - One Way

East/West Street: Plover Street | North/South Street: Lark Street

Intersection Orientation: East-West | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound				Westbound	
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		70			50	
Peak-Hour Factor, PHF	0.56	0.56	1.00	1.00	0.73	0.73
Hourly Flow Rate, HFR (veh/h)	0	127	0	0	68	0
Percent Heavy Vehicles	–	–	–	0	–	–
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		T			T	
Upstream Signal		0			0	

Minor Street	Northbound				Southbound	
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				20		40
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.54	1.00	0.54
Hourly Flow Rate, HFR (veh/h)	0	0	0	37	0	74
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration							LR	
v (veh/h)							111	
C (m) (veh/h)							915	
v/c							0.12	
95% queue length							0.41	
Control Delay (s/veh)							9.5	
LOS							A	
Approach Delay (s/veh)	–	–					9.5	
Approach LOS	–	–					A	

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ALL-WAY STOP CONTROL ANALYSIS

General Information		Site Information	
Analyst	ABC	Intersection	Plover & Lark
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	City of Lakewood, OH
Date Performed	9/15/2014	Analysis Year	2014
Analysis Time Period	School Start Peak		

Project ID: Build Conditions - One Way

East/West Street: Plover Street | North/South Street: Lark Street

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	10	70	10	10	50	10
Within Left Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	10	20	60	40	60	40
Within Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	LT		TR		LTR		LR	
PHF	0.89		0.94		0.54		0.75	
Flow Rate (veh/h)	45		36		221		186	
% Heavy Vehicles	2		5		3		1	
No. Lanes	1		1		1		1	
Geometry Group	1		1		1		1	
Duration, T	0.25							

Saturation Headway Adjustment Worksheet

	Eastbound		Westbound		Northbound		Southbound	
Prop. Left-Turns	0.2		0.0		0.1		0.5	
Prop. Right-Turns	0.0		0.5		0.7		0.5	
Prop. Heavy Vehicles	0.0		0.0		0.0		0.0	
P_LT-adj	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
P_RT-adj	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
P_HV-adj	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
h_adj computed	0.1		-0.2		-0.3		-0.2	

Departure Headway and Service Time

	Eastbound		Westbound		Northbound		Southbound	
hd, Initial value (s)	3.20		3.20		3.20		3.20	
x, Initial value	0.04		0.03		0.20		0.06	
hd, Final value (s)	4.70		3.42		3.87		4.12	
x, final value	0.06		0.04		0.24		0.13	
Move-up time, m (s)	2.0		2.0		2.0		2.0	
Service Time, t_s (s)	2.7		2.4		1.9		2.1	

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	295		256		471		356	
Delay (s/veh)	9.00		7.62		8.07		7.69	
LOS	A		A		A		A	
Approach Delay (s/veh)	9.00		7.62		8.07		7.69	
LOS	A		A		A		A	
Intersection Delay (s/veh)	7.92							
Intersection LOS	A							

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ALL-WAY STOP CONTROL ANALYSIS

General Information		Site Information	
Analyst	ABC	Intersection	Thrush & Quail
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	City of Lakewood, OH
Date Performed	5/15/2014	Analysis Year	2014
Analysis Time Period	School Peak Hour		

Project ID: Build Conditions - One Way

East/West Street: Thrush Street | North/South Street: Quail Street

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	20	30	60	60	20	10
%Thru in Left Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	10	10	10	10	20	10
%Thru in Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	LTR		LTR				LTR	
PHF	0.69		0.59				0.63	
Flow Rate (veh/h)	155		184				51	
% Heavy Vehicles	1		3				1	
No. Lanes	1		1		2		1	
Geometric Group	1		1				1	
Duration, T	0.25							

Saturation Headway Adjustment Worksheet

Prop. Left-Turns	0.2		0.7				0.2	
Prop. Right-Turns	0.6		0.1				0.2	
Prop. Heavy Vehicles	0.0		0.0				0.0	
hLT-adj	0.2	0.2	0.2	0.2			0.2	0.2
hRT-adj	-0.6	-0.6	-0.6	-0.6			-0.6	-0.6
hHV-adj	1.7	1.7	1.7	1.7			1.7	1.7
hadj, computed	-0.3		0.1				-0.1	

Departure Headway and Service Time

hd, initial value (s)	3.20		3.20				3.20	
x, initial value	0.17		0.16				0.05	
hd, final value (s)	3.92		4.37				4.01	
x, final value	0.20		0.22				0.06	
Move-up time, m (s)	2.0		2.0				2.0	
Service Time, t_s (s)	1.9		2.4				2.0	

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	436		434				311	
Delay (s/veh)	7.91		8.63				8.00	
LOS	A		A				A	
Approach Delay (s/veh)	7.91		8.63				8.00	
LOS	A		A				A	
Intersection Delay (s/veh)	8.23							
Intersection LOS	A							

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	ABC	Intersection	Thrush & Robin
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	City of Lakewood, OH
Date Performed	5/15/2014	Analysis Year	2014
Analysis Time Period	School Peak Hour		

Project Description: Build Conditions - One Way

East/West Street:	Thrush Street	North/South Street:	Robin Street
Intersection Orientation:	East-West	Study Period (hrs):	0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	10	40			20	10
Peak Hour Factor, PHF	0.81	0.81	0.81	0.71	0.71	0.71
Hourly Flow Rate, HFR (veh/h)	12	49	0	0	42	14
Percent Heavy Vehicles	1	--	--	1	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	50	30	10	20		60
Peak Hour Factor, PHF	0.82	0.83	0.83	0.58	0.58	0.58
Hourly Flow Rate, HFR (veh/h)	60	36	12	34	0	86
Percent Heavy Vehicles	1	1	1	1	1	1
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	0	0
Configuration		LTR			LR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT			LTR			LR	
v (veh/h)	72			108			120	
C (m) (veh/h)	1605			763			640	
v/c	0.01			0.14			0.19	
95% queue length	0.02			0.49			0.66	
Control Delay (s/veh)	7.2			10.5			9.4	
LOS	A			B			A	
Approach Delay (s/veh)	--	--		10.5			9.4	
Approach LOS	--	--		B			A	

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	ASC	Intersection	Through & Lark
Agency/Co.	TMS Engineers, Inc	Jurisdiction	City of Lakewood, OH
Date Performed	9/15/2014	Analysis Year	2014
Analysis Time Period	School Peak Hour		

Project Description: Build Conditions - One Way

East/West Street:	Through Street	North/South Street:	Lark Street
Intersection Orientation:	East-West	Study Period (hrs):	0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	10	30	20	20	10	10
Peak-Hour Factor, PHF	0.54	0.54	0.54	0.70	0.70	0.70
Hourly Flow Rate, HFR (veh/h)	18	55	37	28	14	14
Percent Heavy Vehicles	1	--	--	1	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				10	40	10
Peak-Hour Factor, PHF	0.75	0.75	0.75	0.53	0.53	0.53
Hourly Flow Rate, HFR (veh/h)	0	0	0	18	75	18
Percent Heavy Vehicles	1	1	1	2	2	2
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	1	0
Configuration					LTR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR					LTR	
v (veh/h)	78	28					111	
C (m) (veh/h)	1592	1556					739	
v/c	0.01	0.02					0.15	
95% queue length	0.03	0.05					0.53	
Control Delay (s/veh)	7.3	7.4					10.5	
LOS	A	A					B	
Approach Delay (s/veh)	--	--					10.5	
Approach LOS	--	--					B	

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	ASC	Intersection	Flower & Grant
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	City of Lakewood, OH
Date Performed	9/15/2014	Analysis Year	2014
Analysis Time Period	School Peak Period		

Project Description: Build Conditions - One Way

East/West Street:	Flower Street	North/South Street:	Grant Avenue
Intersection Orientation:	East-West	Study Period (hrs):	0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	80	20			100	40
Peak-Hour Factor, PHF	0.56	0.56	1.00	1.00	0.61	0.61
Hourly Flow Rate, HFR (veh/h)	142	35	0	0	163	65
Percent Heavy Vehicles	2	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)						
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.50	1.00	0.50
Hourly Flow Rate, HFR (veh/h)	0	0	0	0	0	0
Percent Heavy Vehicles	0	0	0	1	0	1
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration						

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT							
v (veh/h)	142							
C (m) (veh/h)	1040							
v/c	0.14							
95% queue length	0.45							
Control Delay (s/veh)	8.9							
LOS	A							
Approach Delay (s/veh)	--	--						
Approach LOS	--	--						

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ALL-WAY STOP CONTROL ANALYSIS

General Information

Analyst	ACC
Agency/Co.	TMS Engineers, Inc
Date Performed	9/15/2014
Analysis Time Period	School Peak Period

Site Information

Intersection	Power & Rush
Jurisdiction	City of Lukewood, OH
Analysis Year	2014

Project ID: Build Conditions - One Way

East/West Street: Power Street | North/South Street: Rush Street

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	70	30	0	0	20	70
%Thru or Left Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	0	0	0	110	0	100
%Thru or Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	T		T				LR	
PHF	0.53		0.68				0.45	
Flow Rate (veh/h)	37		29				466	
% Heavy Vehicles	2		2				1	
No. Lanes	1		1		0		1	
Geometry Group	1		1				1	
Duration, T	0.25							

Saturation Headway Adjustment Worksheet

	Eastbound		Westbound		Northbound		Southbound	
Prop. Left-Turns	0.0		0.0				0.5	
Prop. Right-Turns	0.0		0.0				0.5	
Prop. Heavy Vehicles	0.0		0.0				0.0	
hLT-adj	0.2	0.2	0.2	0.2			0.2	0.2
hRT-adj	-0.5	-0.5	-0.5	-0.5			-0.5	-0.5
hHV-adj	1.7	1.7	1.7	1.7			1.7	1.7
hadj, computed	0.0		0.0				-0.2	

Departure Headway and Service Time

	Eastbound		Westbound		Northbound		Southbound	
hd, Initial value (s)	3.20		3.20				3.20	
x, initial	0.03		0.03				0.41	
hd, final value (s)	4.97		4.98				2.93	
x, final value	0.05		0.04				0.91	
Move-up time, m (s)	2.0		2.0				2.0	
Service Time, ts (s)	3.0		3.0				1.9	

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	287		270				715	
Delay (sec/veh)	8.24		8.19				10.95	
LOS	A		A				B	
Approach Delay (sec/veh)	8.24		8.19				10.95	
LOS	A		A				B	
Intersection Delay (sec/veh):	10.52							
Intersection LOS:	B							

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	9/15/2014
Analysis Time Period	School Peak Period

Site Information

Intersection	Power & Robin
Jurisdiction	City of Lukewood, OH
Analysis Year	2014

Project Description: Build Conditions - One Way

East/West Street: Power Street | North/South Street: Robin Street

Intersection Orientation: East-West | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	45	105			90	60
Peak-Hour Factor, PHF	0.50	0.60	1.00	1.00	0.90	0.50
Hourly Flow Rate, HFR (veh/h)	65	160	0	0	80	120
Percent Heavy Vehicles	2	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)						
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.83	1.00	0.58
Hourly Flow Rate, HFR (veh/h)	0	0	0	0	0	0
Percent Heavy Vehicles	0	0	0	1	0	1
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration						

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT							
v (veh/h)	56							
C (m) (veh/h)	1356							
v/c	0.05							
95% queue length	0.15							
Control Delay (s/veh)	7.7							
LOS	A							
Approach Delay (s/veh)	--							
Approach LOS	--							

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	ABC	Intersection	Plover & Lark
Agency/Co.	TMS Engineers, Inc	Jurisdiction	City of Lakewood, OH
Date Performed	9/15/2014	Analysis Year	2014
Analysis Time Period	School Peak Period		

Project Description: Build Conditions - One Way

East/West Street: Plover Street	North/South Street: Lark Street
Intersection Orientation: East-West	Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		100			70	
Peak-Hour Factor, PHF	0.78	0.76	1.00	1.00	0.95	0.65
Hourly Flow Rate, HFR (veh/h)	0	128	0	0	155	0
Percent Heavy Vehicles	1	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		T			T	
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				20		30
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.53	1.00	0.83
Hourly Flow Rate, HFR (veh/h)	0	0	0	37	0	47
Percent Heavy Vehicles	0	0	0	3	0	3
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration							LR	
v (veh/h)							79	
C (m) (veh/h)							868	
v/c							0.09	
95% queue length							0.30	
Control Delay (s/veh)							9.6	
LOS							A	
Approach Delay (s/veh)	--	--					9.6	
Approach LOS	--	--					A	

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ALL-WAY STOP CONTROL ANALYSIS

General Information		Site Information	
Analyst	ABC	Intersection	Plover & Lark
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	City of Lakewood, OH
Date Performed	9/15/2014	Analysis Year	2014
Analysis Time Period	School Peak Period		

Project ID: Build Conditions - One Way

East/West Street: Plover Street	North/South Street: Lark Avenue

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	20	40	10	10	20	30
%Thru in Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	10	20	30	30	40	20
%Thru in Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	LT		TR		LTR		LR	
PHF	0.56		0.64		0.79		0.61	
Flow Rate (veh/h)	155		62		62		98	
% Heavy Vehicles	2		5		3		3	
No. Lanes	1		1		1		1	
Geometry Group	1		1		1		1	
Duration, T	0.25							

Saturation Headway Adjustment Worksheet

	Eastbound		Westbound		Northbound		Southbound	
Prop. Left-Turns	0.3		0.6		0.2		0.6	
Prop. Right-Turns	0.6		0.5		0.4		0.5	
Prop. Heavy Vehicles	0.0		0.0		0.0		0.0	
hLT-adj	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
hRT-adj	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
hHV-adj	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
hadj, computed	0.1		-0.2		-0.2		-0.2	

Departure Headway and Service Time

hd, initial value (s)	3.20		3.50		3.20		3.20	
x, initial value	0.09		0.06		0.06		0.06	
hd, final value (s)	4.42		4.16		4.24		4.17	
x, final value	0.12		0.07		0.07		0.11	
Move-up time, m (s)	2.0		2.0		2.0		2.0	
Service Time, t_s (s)	2.4		2.2		2.2		2.2	

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	358		312		312		348	
Delay (s/veh)	8.05		7.48		7.57		7.70	
LOS	A		A		A		A	
Approach: Delay (s/veh)	8.05		7.48		7.57		7.70	
LOS	A		A		A		A	
Intersection Delay (s/veh)	7.76							
Intersection LOS	A							

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ALL-WAY STOP CONTROL ANALYSIS

General Information		Site Information	
Analyst	ABC	Intersection	Thrush & Robin
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	City of Lakewood, OH
Date Performed	5/15/2014	Analysis Year	2014
Analysis Time Period	PM Peak Hour		

Project Description: Build Conditions - One Way

East/West Street: Thrush Street | North/South Street: Robin Street

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	10	20	40	20	20	10
%Thru or Left Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	10	30	10	10	50	10
%Thru or Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	LTR		LTR				LTR	
PHF	0.68		0.70				0.61	
Flow Rate (veh/h)	119		75				113	
% Heavy Vehicles	1		3				1	
No. Lanes	1		1		0		1	
Geometric Group	1		1				1	
Duration, T	0.25							

Saturation Headway Adjustment Worksheet

Prop. Left-Turns	0.1		0.4				0.1	
Prop. Right-Turns	0.6		0.2				0.1	
Prop. Heavy Vehicles	0.0		0.0				0.0	
%LT Adj	0.2	0.2	0.2	0.2			0.2	0.2
%RT Adj	-0.6	-0.6	-0.6	-0.6			-0.6	-0.6
%HV Adj	1.7	1.7	1.7	1.7			1.7	1.7
Final Combined	-0.3		0.0				-0.5	

Departure Headway and Service Time

Initial Headway (s)	3.20		3.20				3.20	
x value	0.11		0.06				0.10	
Final Headway (s)	3.92		4.29				4.86	
x final value	0.13		0.08				0.13	
Move-up time, (s)	2.0		2.0				2.0	
Service Time, (s)	1.9		2.3				2.3	

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	369		320				363	
Delay (s/veh)	7.53		7.68				7.92	
LOS	A		A				A	
Approach: Delay (s/veh)	7.53		7.68				7.92	
LOS	A		A				A	
Intersection Delay (s/veh)	7.71							
Intersection LOS	A							

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	ABC	Intersection	Thrush & Robin
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	City of Lakewood, OH
Date Performed	5/15/2014	Analysis Year	2014
Analysis Time Period	PM Peak Hour		

Project Description: Build Conditions - One Way

East/West Street: Thrush Street	North/South Street: Robin Street
Intersection Orientation: East-West	Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound				Westbound	
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	10	20			20	10
Peak-Hour Factor, PHF	0.63	0.83	0.63	0.88	0.88	0.88
Hourly Flow Rate, HFR (veh/h)	15	23	0	0	22	11
Percent Heavy Vehicles	1	--		1	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Northbound				Southbound	
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	25	30	25	35		30
Peak-Hour Factor, PHF	0.91	0.91	0.91	0.91	0.84	0.84
Hourly Flow Rate, HFR (veh/h)	24	46	24	35	0	35
Percent Heavy Vehicles	1	1	1	1	1	1
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	0	0
Configuration		LTR			LR	

Delay, Queue Length, and Level of Service

Approach	Eastbound		Westbound		Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12		
Lane Configuration	LT			LTR			LR			
v (veh/h)	15			57			70			
C (m) (veh/h)	1582			865			898			
v/c	0.01			0.11			0.08			
95% queue length	0.03			0.38			0.25			
Control Delay (s/veh)	7.3			9.7			9.3			
LOS	A			A			A			
Approach Delay (s/veh)	--		--	9.7			9.3			
Approach LOS	--		--	A			A			

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	ABC	Intersection	Thrush & Lark
Agency/Co.	TMS Engineers, Inc	Jurisdiction	City of Lakewood, OH
Date Performed	9/15/2014	Analysis Year	2014
Analysis Time Period	PM Peak Hour		

Project Description: Build Conditions - Con Way

East/West Street: Thrush Street | North/South Street: Lark Street

Intersection Orientation: East-West | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	12	20	10	22	10	12
Peak-Hour Factor, PHF	0.65	0.65	0.65	0.75	0.75	0.75
Hourly Flow Rate, HFR (veh/h)	18	30	15	29	12	16
Percent Heavy Vehicles	1	--	--	1	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				15	30	10
Peak-Hour Factor, PHF	0.75	0.75	0.75	0.94	0.94	0.94
Hourly Flow Rate, HFR (veh/h)	0	0	0	10	31	10
Percent Heavy Vehicles	1	1	1	2	2	2
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	1	0
Configuration					LTR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR					LTR	
v (veh/h)	15	26					41	
C (m) (veh/h)	1535	1570					733	
v/c	0.01	0.02					0.06	
95% queue length	0.02	0.05					0.21	
Control Delay (s/veh)	7.3	7.3					10.0	
LOS	A	A					A	
Approach Delay (s/veh)	--	--					9.9	
Approach LOS	--	--					A	

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	ABC	Intersection	Plover & Court
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	City of Lakewood, OH
Date Performed	9/15/2014	Analysis Year	2014
Analysis Time Period	PM Peak Period		

Project Description: Build Conditions - Con Way

East/West Street: Plover Street | North/South Street: David Avenue

Intersection Orientation: East-West | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	20	45			45	20
Peak-Hour Factor, PHF	0.85	0.89	1.00	1.00	0.75	0.75
Hourly Flow Rate, HFR (veh/h)	22	44	0	0	53	25
Percent Heavy Vehicles	2	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)						
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.63	1.00	0.63
Hourly Flow Rate, HFR (veh/h)	0	0	0	0	0	0
Percent Heavy Vehicles	0	0	0	1	0	1
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration						

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT							
v (veh/h)	22							
C (m) (veh/h)	1513							
v/c	0.01							
95% queue length	0.04							
Control Delay (s/veh)	7.4							
LOS	A							
Approach Delay (s/veh)	--	--						
Approach LOS	--	--						

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ALL-WAY STOP CONTROL ANALYSIS

General Information		Site Information	
Analyst	AEG	Intersection	Plover & Robin
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	City of Lakewood, OH
Date Performed	5/13/2014	Analysis Year	2014
Analysis Time Period	PM Peak Period		

Project Description: Build Condition - One Way

East/West Street: Plover Street | North/South Street: Robin Street

Volume Adjustments and Site Characteristics						
Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	10	40	0	0	30	20
%Thru in Left Lane						
Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	0	0	0	20	0	30
%Thru in Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	T		T				TR	
PHF	0.88		0.75				0.46	
Flow Rate (veh/h)	45		40				108	
% Heavy Vehicles	2		2				1	
No. Lanes	1		1		0		1	
Geometry Group	1		1				1	
Duration, T	0.25							

Saturation Headway Adjustment Worksheet								
Prop. Left-Turns	0.0		0.0				0.4	
Prop. Right-Turns	0.0		0.0				0.6	
Prop. Heavy Vehicles	0.0		0.0				0.0	
%LT-Adj	0.2	0.2	0.2	0.2			0.2	0.2
%RT-Adj	-0.6	-0.6	-0.6	-0.6			-0.6	-0.6
%HV-Adj	1.7	1.7	1.7	1.7			1.7	1.7
Ped-Adj	0.0		0.0				-0.3	

Departure Headway and Service Time								
hd, initial value (s)	3.20		3.20				3.20	
x, initial	0.04		0.04				0.10	
hd, final value (s)	4.26		4.21				3.82	
x, final value	0.05		0.05				0.11	
Move-up time, m (s)	2.0		2.0				2.0	
Service Time, t_s (s)	2.2		2.2				1.8	

Capacity and Level of Service								
	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	830		850				968	
Delay (sec)	7.43		7.41				7.32	
LOS	A		A				A	
Approach Delay (sec)	7.43		7.41				7.32	
LOS	A		A				A	
Intersection Delay (sec/veh)	7.36							
Intersection LOS	A							

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	AEG	Intersection	Plover & Robin
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	City of Lakewood, OH
Date Performed	5/13/2014	Analysis Year	2014
Analysis Time Period	PM Peak Period		

Project Description: Build Condition - One Way

East/West Street: Plover Street | North/South Street: Robin Street

Intersection Orientation: East-West | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments						
Major Street	Eastbound				Westbound	
Movement	1	2	3	4	5	6
	L		R	L	T	R
Volume (veh/h)	30	40			30	40
Peak Hour Factor, PHF	0.91	0.81	1.00	1.00	0.67	0.57
Hourly Flow Rate, HFR (veh/h)	24	49	0	0	44	59
Percent Heavy Vehicles	2	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	
Minor Street	Northbound				Southbound	
Movement	7	8	9	10	11	12
	--	T	R	L	T	R
Volume (veh/h)						
Peak Hour Factor, PHF	1.00	1.00	1.00	0.55	1.00	0.55
Hourly Flow Rate, HFR (veh/h)	0	0	0	0	0	0
Percent Heavy Vehicles	0	0	0	1	0	1
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration						

Delay, Queue Length, and Level of Service												
Approach	Eastbound	Westbound	Northbound				Southbound					
Movement	1	4	7	8	9	10	11	12				
Lane Configuration	LT											
v (veh/h)	24											
C (m) (veh/h)	1489											
v/c	0.02											
95% queue length	0.05											
Control Delay (s/veh)	7.5											
LOS	A											
Approach Delay (s/veh)	--	--										
Approach LOS	--	--										

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	ABC	Intersection	Flower & Lark
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	City of Lakewood, OH
Date Performed	9/15/2014	Analysis Year	2014
Analysis Time Period	PM Peak Period		

Project Description: Build Conditions - One Way

East/West Street: Flower Street | North/South Street: Lark Street

Intersection Orientation: East-West | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		40			40	
Peak-Hour Factor, PHF	0.71	0.71	1.00	1.00	0.57	0.57
Hourly Flow Rate, HFR (veh/h)	0	56	0	0	70	0
Percent Heavy Vehicles	3	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		T			T	
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	--	R	L	T	R
Volume (veh/h)				20		40
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.92	1.00	0.92
Hourly Flow Rate, HFR (veh/h)	0	0	0	21	0	42
Percent Heavy Vehicles	0	0	0	3	0	3
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound	
Movement	1	4	7	8	9	10	11	12
Lane Configuration							LR	
v (veh/h)							84	
C (m) (veh/h)							945	
v/c							0.07	
95% queue length							0.22	
Control Delay (s/veh)							9.1	
LOS							A	
Approach Delay (s/veh)	--	--					9.1	
Approach LOS	--	--					A	

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TRAFFIC ENGINEERING STUDY

BIRDTOWN NEIGHBORHOOD
PARKING & CIRCULATION

LAKEWOOD, OHIO

OCTOBER 1, 2014

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THE CITY OF LAKEWOOD
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CERTIFICATION NO. 2234

"This document was prepared consistent with local agency requirements and/or applicable guidelines contained in this report."

PROFESSIONAL TRAFFIC OPERATIONS ENGINEER

CHAPTER 1143
Parking

September 30, 2014

CROSS REFERENCES
State regulations - see Ohio R.C. 4501.01
Wireless Telecommunication facilities - see P.& Z. 1159.05(l)
Sexually oriented businesses - see P.& Z. 1163.06
Mixed Use Overlay District - see P.& Z. Ch. 1135
Planned Development - see P.& Z. Ch. 1156
Parking Design - see BLDG. 1325.08
Parking Enforcement -- see Traffic Code Ch. 351

1143.01 PURPOSE

The purpose of this Chapter is to establish flexible vehicle parking requirements that support the Community's Vision to provide safe, convenient, and integrated transportation options throughout the city. Parking requirements are based on the needs of the community and consider the context of the neighborhood, transit availability, on-street parking, density, mix of uses, walkability, and the use of alternative modes of transportation. Parking requirements are designed to accommodate average day-to-day demand, as opposed to peak demand, in order to reduce excessive off-street parking and free up land for more economically productive or environmentally conscious uses.

1143.02 GENERAL PROVISIONS

(a) For every building hereafter erected or expanded, or where the use is changed or enlarged, there shall be provided parking as set forth in this Chapter.

(b) No permits shall be issued for any building, improvement or use of land, including, but not limited to, building permits and certificates of occupancy, until a parking plan is submitted to the Director showing such parking spaces as is hereunder required. Such plan shall be prepared at a reasonable scale, showing property lines, the dimensions of the property, the size and arrangement of all parking spaces, the means of ingress and egress to such parking spaces from the street and interior circulation within the property, the extent of any change required in existing site conditions to provide required parking spaces and such other conditions as may be necessary to permit review and approval of the proposed parking spaces.

(c) Off-street, on-site parking spaces, as defined in Section 1103.02, for all uses as required by this Chapter shall be designed and maintained in accordance with applicable

sections of these Ordinances so as to be safe, attractive and free of hazard, nuisance or other unsafe condition.

(d) Unenclosed parking spaces shall not be used for repair of a motor vehicle.

(e) Parking for all motor vehicles shall be on an improved surface of concrete, asphalt or other materials approved by the Building Commissioner.

1143.03 DETERMINATION OF REQUIRED OFF-STREET PARKING SPACES.

(a) Where floor area is designed as the standard for determining parking space requirements, floor area shall be computed on the gross floor area (GFA), in square feet, of all floors of the building, including the exterior walls.

(b) Where number of employees is the standard, employees shall mean the regular working staff, (paid, volunteer or otherwise) at maximum strength/per shift and in full-time equivalent numbers necessary to operate, maintain or service any given facility or use under normal levels of service.

(c) The number of parking spaces required will be computed to the next largest number.

(d) In the case of mixed uses or more uses as listed in Section 1143.04, the total parking spaces shall be equal to the requirements of various uses computed separately.

(e) Cumulative parking requirements for mixed-use occupancies may be reduced upon review and approval by the Planning Commission where it can be determined that the peak requirement of the several occupancies occurs at different times (either daily or seasonally).

1143.04 USE CATEGORIES.

For the sole purpose of calculating parking requirements, uses are defined as follows:

(a) Commercial

(1) Car Wash: Including facilities for washing, waxing and cleaning of vehicles and vehicle components but expressly prohibiting facilities or equipment for the repair, overhaul or storage of motor vehicles or vehicle components.

(2) Commercial lodging: including hotels, motels, motor lodges and motor courts.

(3) Office: Means use of a building for business, professional, administrative or medical office. A general office is characterized by a low proportion of vehicle trips attributable to visitors or clients in relationship to employees.

(4) Retail: Means sale or service to the final consumer for direct consumption or an establishment providing retail sale of products or services to the public. Restaurants and bars are included in this category.

(5) Storage/Warehouse: Including, but not limited to, mini warehouse with secured, individual storage units, which are leased for a fee to individual companies or persons.

(b) Industrial: Means manufacturing processing, assembly, and/or packaging plants of all types.

(c) Institutional: Means buildings of all types and facilities used by public, quasi-public or nonprofit agencies that serve or assist the public or provide an accepted public purpose, including hospitals.

(d) Residential

(1) Single-family structures; including detached houses and duplexes, townhouses, and clustered dwelling units that may be attached but have separate entrances.

(2) Multi-family structures; including condominium and apartment buildings with common entranceways and/or parking areas for two (2) or more dwelling units.

(3) Senior housing; including any multi-family dwelling occupied ninety percent (90%) or more by elderly persons, as defined by United States Department of Housing and Urban Development.

(4) Sleeping rooms; including boarding, lodging, rectories and convents, and rooms that are rented or used on an individual basis by non-family members.

(6) Group/convalescent/nursing homes and assisted living; where unrelated persons reside under supervision for special care, treatment, training or other purposes on a temporary or permanent basis.

(7) Day-care centers; where unrelated persons are cared for during limited periods each day in a supervised facility.

(e) Public Assembly: Including, but are not limited to, all buildings or portions of buildings, used for gathering together 100 or more persons for such purposes as deliberation, worship, entertainment, eating, drinking, or amusement. Examples of assembly include, but are not limited to, large meeting rooms and classrooms, auditoriums with fixed or loose chair seating, multi-purpose rooms, concert halls, and theaters. Restaurants and bars, or other rooms used primarily for the service of food or alcohol to the general public are not considered places of public assembly per this section.

(f) Wireless Telecommunication Facilities: pursuant to Section 1159.05(l).

(g) Sexually Oriented Businesses: pursuant to Section 1163.06.

(h) Mixed Use Overlay District: pursuant to Section 1135.03(b).

(i) Planned Development: pursuant to Section 1156.05(e).

(j) Drive-through facilities; including but not limited to, fast-food restaurants, financial institutions, car washes, photo uses, and drug stores.

1143.05 SCHEDULE OF USES AND SPACE REQUIREMENTS.

The required number of off-street parking spaces for a use category described in Section 1143.04 shall be as set forth in Schedule 1143.05 following this Chapter. Parking in accordance with the schedule is required.

The Director is hereby authorized to determine the required off-street parking requirements for uses not specifically listed in this Ordinance, based on the most similar use(s) that are listed. Such determination by the Director shall be in writing and shall be appealable to Planning Commission, per Section 1173.03.

1143.06 UNLICENSED, IMMOBILIZED VEHICLES.

No person shall store or permit to be stored, for a period of more than three (3) consecutive days, any motor vehicles not having current year license plates and/or damaged or immobilized so as to render it incapable of being moved under its own power, upon any lot or land designated as within any district, unless the same shall be in a completely enclosed building or garage. "Motor Vehicle" shall have the same meaning as in O.R.C. 4501.01. This Section shall not apply to motor vehicle sales lots.

1143.07 APPLICABILITY.

The Director shall enforce the provisions of Chapter 1143, or such other persons as the Director may designate, and may ask for advisement from the Planning Commission on manners related to parking.

1143.08 PARKING LOT DESIGN.

Parking Lots, as defined in Section 1103.02, in the Multiple-Family, Low Density Districts (ML), and Multiple-Family High Density Districts (MH); Commercial Districts, C1 Office, C2 Retail, C3 General Business, C4 Public School, and the Industrial (I) District, are regulated pursuant to Section 1325.08 of the Building Code.

1143.09 PARKING PLAN REVIEW; PLANNING COMMISSION

The Planning Commission shall review applications for parking plans that do not meet the set schedule in 1143.05. In addition to referencing Section 1143.09 and Section 1143.10, the Commission may consider the following when reviewing an application:

(a) Impact on central character of residential neighborhoods taking on overflow parking;

(b) Available surface Parking Lots in the neighborhood that could be used for shared parking;

(c) Similarly scaled projects throughout the city to compare parking footprint;

(d) When a restaurant use is proposed, the total number of tables to parking spaces;

(e) Total number of employees;

(f) Alternative forms of transportation available in the neighborhood;

(g) Implementation of bicycle facilities, including but not limited to, bicycle racks, covered bicycle parking, and shower facilities for employees;

(h) Peak demand for parking spaces from all uses compared to the total supply of spaces;

(i) Traffic impact analysis and/or a traffic demand study;

(j) For uses defined as Institutional or Public Assembly in Schedule 1143.05, the Commission may consider the following guidelines:

(1) 1 space for each 80 sq ft of all auditoria and public assembly rooms

(2) 1 space for each employee

1143.10 EXCEPTIONS TO REQUIRED MINIMUMS

The number of parking spaces required may be reduced in accordance with the following credits as determined by the Planning Commission when reviewing an application for a reduction to the minimum number of parking spaces required per Schedule 1143.05.

The Board of Zoning Appeals shall determine whether the applicant can demonstrate that enforcement of minimum parking requirements will result in practical difficulty according to the criteria set forth in Section 1173.04(c).

(a) For uses defined as Commercial in Section 1143.04 the Planning Commission may consider the following:

(1) One space credit for each off-site parking space which is owned or rented by the property or business owner for the purpose of providing parking to the subject property. Such off-site spaces shall be located within 1,000 feet of the use, as measured by using the shortest pedestrian route from the nearest corner of the Parking Space/Lot to the main public entrance of the use served.

(2) One space credit for each off-site parking space provided by valet parking service. The property or business owner shall submit to the department written documentation of permission to use an off-site parking for valet parking. The Director may request a review of the agreement as often as annually to ensure compliance.

(3) One space credit for each space in a Parking Lot or parking structure provided for public use located within 1,000 feet, as measured by using the shortest pedestrian route from the nearest corner of the Parking Lot or structure to the main public entrance of the use served.

(4) A determination by the Director is made that there is no change in use and the same parking facilities are in place.

(b) For uses defined as Residential in Section 1143.04 the Planning Commission may consider implementing an improvement to the property that aligns with the general goals and objectives as described in the Vision including, but not limited to, the following:

(1) For properties not connected properly to the city's sanitary and storm system per Section 913.05, the applicant can make the necessary improvements to connect correctly.

(2) Implement improvements to the property that may reduce carbon emissions and improve energy efficiency using environmental best practices as defined by the Environmental Protection Agency;

(3) Implement storm water management techniques such as bio-swales, rain gardens, and pervious pavements;

(4) Construct a shed or storage building on site for landscaping equipment and additional storage;

(5) Install an innovative landscaping plan, considered to be over and above the landscaping requirements as typically required by the Architectural Board of Review.

(A) Plant, flower, and tree type, size, design, location and irrigation may be considered as part of the landscape plan to be reviewed

1143.11 EXCEPTIONS TO REQUIRED MAXIMUMS

The number of Parking Spaces provided may exceed the maximum specified per the following options as determined by the Planning Commission when reviewing an application to exceed the maximum number of Parking Spaces allowed per 1143.05.

(a) One space increase for each space located in a parking structure.

(b) Implementation of additional measures that control the flow of stormwater runoff on the project site pursuant to EPA Best Management Practices (BMP) by:

(1) Providing and treating an additional volume above the computed Water Quality Volume (WQv) as determined by Chapter 1339. Post-Construction BMP exemptions mentioned in Chapter 1339 shall not apply to this section.
(2) Projects that disturb an area less than 8,000 square feet may use this exception

(c) Installation of a streetscape improvement for public use, including, but not limited to:

(1) A transit waiting environment along an existing bus route.

(A) The transit waiting environment (e.g., bus stop) shall take into consideration design guidelines for transit waiting environments produced by the local transit authority, and any other design guidelines or standards as recommended by the Administration or City Council;
(B) Location of the transit waiting environment is to be determined by the Planning Director or such other persons as the Director may designate

(2) Public art installation;

(3) Public pedestrian seating, street trees, or decorative street lighting;

(4) Streetscape improvements shall require approval by the Architectural Board of Review;

(d) Implementation of an innovative landscaping plan, considered to be over and above the landscaping typically required by the Architectural Board of Review;

(1) Plant, flower, and tree type, size, design, location and irrigation may be considered as part of the landscape plan to be reviewed

(e) The property or business owner will make its parking lot available for shared parking with neighboring businesses.

1143.12 BICYCLE PARKING REQUIREMENTS

All uses defined as Retail or Office shall provide bicycle parking, in conformance with the following standards.

(a) One (1) bicycle Parking Space per 2,500 square feet for uses defined as Retail or Office;

(b) Required bicycle parking shall be provided in a safe, accessible and convenient location;

(c) The bicycle Parking Space shall be within 250 feet of at least one main entrance of the building, as measured along the most direct pedestrian access route;

(1) Bicycle Parking Spaces already installed within 250 feet of one main entrance shall count towards the bicycle parking requirement;

(d) There must be an aisle at least 5 feet wide behind all required bicycle parking to allow room for bicycle maneuvering. Where the bicycle parking is adjacent to a sidewalk, the maneuvering area may extend into the right-of-way; and

(e) Bike rack design shall follow the recommendations in the Association of Pedestrian and Bicycle Professionals (APBP) Bicycle Parking Guidelines.

1143.13 STACKING SPACE REQUIREMENTS

Stacking spaces not specified shall be determined on an individual basis by the Commission. The following business uses shall be subject to the following stacking requirements:

(a) Bank, Pharmacy, Photo or other low to moderate use: 2/Lane

(b) Motor Vehicle Sales/Gas Station: 2/Gas Pump Island

(c) Car Wash: 5/Car Wash Lane

(d) All other uses defined as Commercial with a Drive-Through Lane: 10/Drive-Through Lane.

1143.05 SCHEDULE OF USES AND SPACE REQUIREMENTS

Uses	Parking Space Requirement
Residential	
Single-, Two-, Three-Family	Min 1/Dwelling Unit; No Max; One (1) required space shall be in a garage.
Type B Home Occupation	Min is same for residential use; Max of 3, in addition to requirement for residential use
Bed & Breakfast	Min is same for residential use; Max 1/Guest Room, in addition to requirement for residential use
Multi-Family, Studio, 1 Bedroom, 2+ Bedroom	Min of 1/Dwelling Unit; Max of 2/Dwelling Unit
Sleeping Rooms	Min of .5/Roomer; Max of 1/Roomer
Senior Housing	Min of .5/employee; Max of 1/employee or .25/Dwelling Unit
Group/Nursing/Convalescent/Assisted Living Home	Min of .5/employee; Max of 1/employee or 1 space/bed
Day Care	Min of .5/employee plus 4 drop off spaces; Max of 1/employee plus 8 drop off spaces
Commercial	
Retail*	Min 1 for each 1,000 sq ft GFA; Max 2.5 for each 1,000 sq ft GFA
Office*	Min 2 for each 1,000 sq ft GFA; Max 3.5 for each 1,000 sq ft GFA
Car Wash	No Min; Max of 1/Employee
Storage/Warehouse	Min of 1/Employee; Max of 1.5/Employee
Commercial Lodging	Min of .5/Room; Max of 1/Room

*Businesses occupying existing buildings or tenant spaces under 2,500 sq ft are not required to provide off street parking	
Industrial	
Any use described in Section 1131.02	Min .25/Employee; Max 1.5/Employee
Wireless Telecommunication Facilities - Any use described in Section 1159.05(l)	No min; Max 1/Facility
Institutional	
Elementary, Secondary and High Schools, College, Trade School	As required by the Planning Commission per Section 1143.09
Church	As required by the Planning Commission per Section 1143.09
Hospital	As required by the Planning Commission per Section 1143.09
Public Recreation	As required by the Planning Commission per Section 1143.09
Other	
Public Assembly	As required by the Planning Commission per Section 1143.
Wireless Telecommunication Facilities	Pursuant to Section 1159.05(l)
Sexually Oriented Businesses	Pursuant to Section 1163.06
Mixed Use Overlay District	Pursuant to Section 1135.03(b)
Planned Development	Pursuant to Section 1156.05(e)

Section 2. That new sub-section 1103.02 (__) Parking Lot is hereby enacted to read as follows:

§1103.02( ) **Parking Lot** means any outdoor space, plot, place, lot, parcel, yard or enclosure or any portion thereof, where more than two motor vehicles may be parked, stored, serviced, housed or kept.

Section 3. That new sub-section 1103.02 (__) Parking Space is hereby enacted to read as follows:

§1103.02(__) **Parking Space** means an area designated for the parking of a bicycle or space designated by pavement markings intended for the parking of a motor vehicle.

Section 5. That Section 1171.03, Planning Commission, is hereby enacted to read as follows:

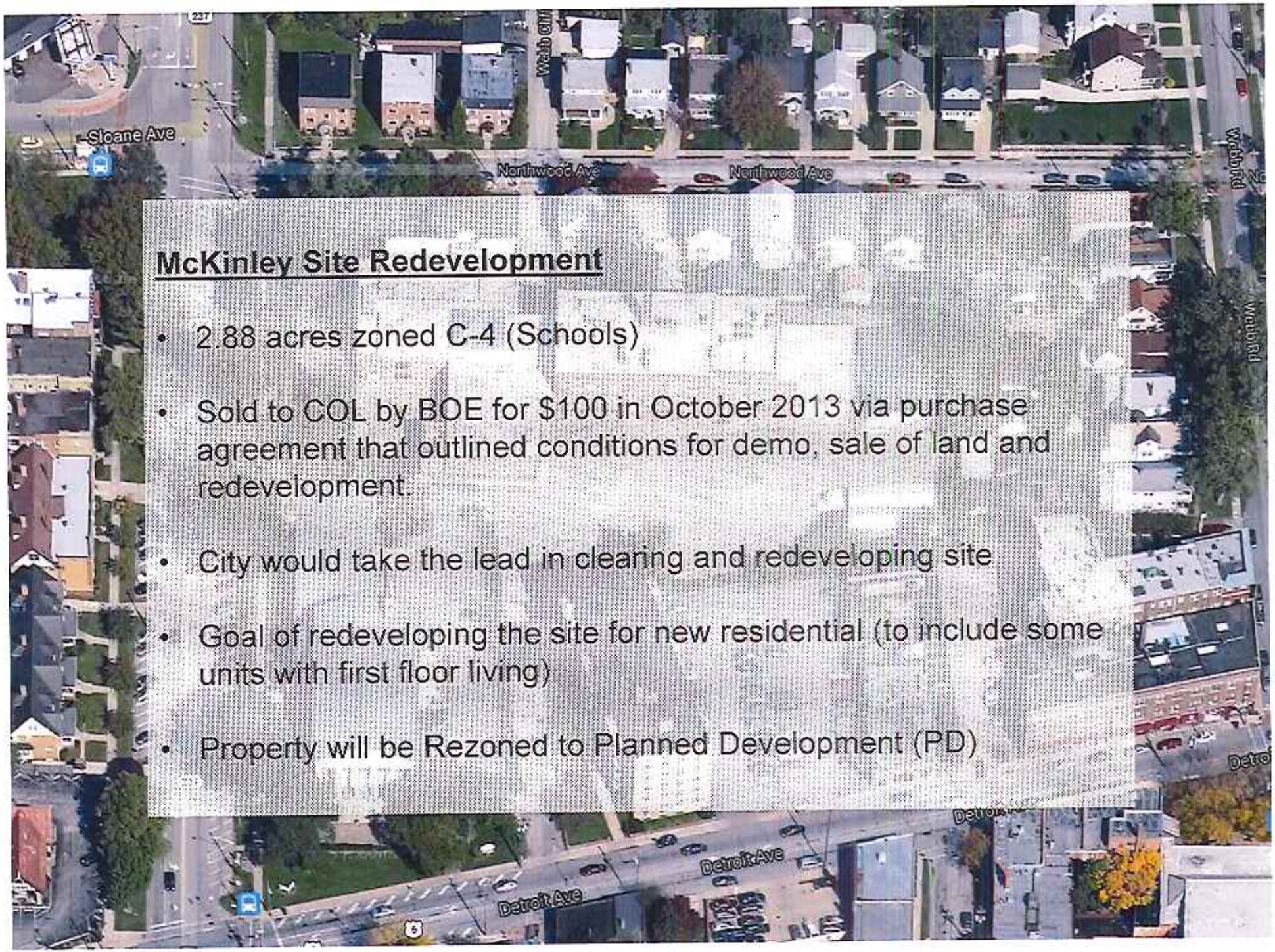
1171.03 PLANNING COMMISSION.

In addition to the powers and duties conferred by Charter the Commission shall, for purposes of this Code, have the following duties:

...

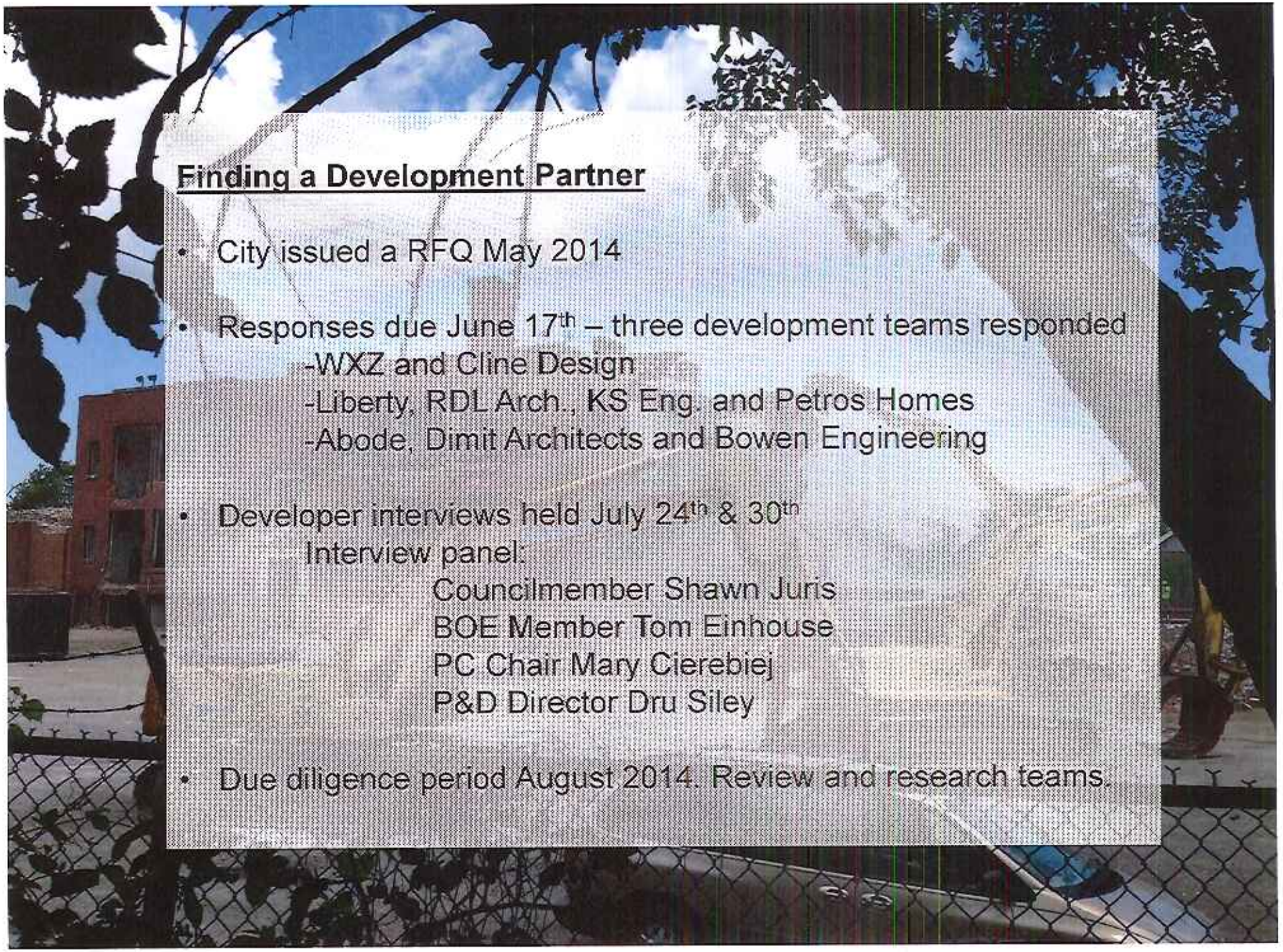
(i) To review and approve or disapprove parking plans submitted that do not meet the schedule of use and space requirements in Section 1143.05.

Planned Development Zone District Overview
McKinley Site Redevelopment
Planning Commission
October 2nd, 2014
Dru Siley, Director of Planning & Development



McKinley Site Redevelopment

- 2.88 acres zoned C-4 (Schools)
- Sold to COL by BOE for $100 in October 2013 via purchase agreement that outlined conditions for demo, sale of land and redevelopment.
- City would take the lead in clearing and redeveloping site
- Goal of redeveloping the site for new residential (to include some units with first floor living)
- Property will be Rezoned to Planned Development (PD)



Finding a Development Partner

- City issued a RFQ May 2014
- Responses due June 17th – three development teams responded
  - -WXZ and Cline Design
  - -Liberty, RDL Arch., KS Eng. and Petros Homes
  - -Abode, Dimit Architects and Bowen Engineering
- Developer interviews held July 24th & 30th
  - Interview panel:
    - Councilmember Shawn Juris
    - BOE Member Tom Einhouse
    - PC Chair Mary Cierebiej
    - P&D Director Dru Siley
- Due diligence period August 2014. Review and research teams.

1156.01 PURPOSE.

A Planned Development (PD) is meant to encourage more compact mixed use development, pedestrian-friendly site design, and an urban street character, in order to increase pedestrian traffic, reduce vehicular traffic, promote energy-efficient design, and **accommodate a range of compatible land uses through appropriate site design.**

PD's are intended to permit **a more flexible approach to land use control and to promote a variety of housing types developed** among neighborhood-serving commercial uses and employment opportunities.

1156.02 LOCATION OF PLANNED DEVELOPMENTS.

A Planned Development may be permitted in a C1 Office, C2 Retail, C3 General Business District, **C4 Public School District**, or the MH Multiple-Family, High Density Residential District, on approval by the Commission and City Council in accordance with this Chapter 1156.

1156.04 Preliminary PD Process

Procedures for Approval of a Preliminary PD Plan. Planned Developments, similar to subdivisions, are first approved in preliminary form, and then approved in final form.

Preliminary PD Plan:

(1) Pre-application conceptual review meeting. A pre-application conceptual review meeting shall be mandatory for all persons intending to submit an application for approval of a Preliminary PD Plan.

(2) **The Commission's role** shall be to review all applications for Preliminary PD Plans and make a recommendation to the Director to approve, approve with conditions, or deny the application based on compliance with Section 1156.03 of this ***Code***.

(3) A plan previously receiving Preliminary Plan approval may proceed with Final PD Plan approval.

(4) Upon receipt of the approved Preliminary PD Plan from the **Commission**, the Director shall forward the application to the Architectural Board of Review for review of the application based on compliance with the standards set forth in subsection (j).

1156.04 Final PD Process

(1) A plan previously receiving preliminary approval may be submitted for Final Approval.

(2) A Final PD Plan may cover the entire area covered by the Preliminary PD Plan, or it may include only a phase or phases of the Preliminary PD Plan. Only such phases as receive Final Approval may be advanced for purposes of obtaining building permits and being constructed.

(3) A preliminary plan complying with the requirements set forth in Section 1155.03, Subdivision Regulations, General Requirements, and a plat complying with the requirements set forth in Section 1155.03, Subdivision Regulations, General Requirements, shall be prepared for each lot consolidation and submitted with an application for approval to the Director, except, at the discretion of the Director, the preliminary plan may be waived, prior to the deadline established by the **Commission** by rule.

The purposes of the preliminary plan are to allow the Commission to determine if it qualifies as a potential PD and its compliance with other *City* codes.

1156.04 Final PD Process (continued)

(4) Concurrent with submission of an application for approval of a Final PD Plan, the Director shall submit to City Council a final Development Agreement, if applicable, for review and execution.

(5) **The Commission's role** shall be to review any application for Final PD Plan approval and make a recommendation to the Director to approve, approve with conditions, or deny the application based on its compliance with Section 1156.03 of this ***Code***.

(6) If the **Commission** recommends approval of an application with conditions, the applicant shall resubmit to the Commission a revised Final PD Plan that reflects the changes or modifications required or suggested by the Commission in its initial review.

(7) Upon receipt of the approved Final PD Plan from the **Commission** the Director shall forward the application to the Architectural Board of Review for review of the application based on compliance with the standards set forth in subsection (j) below

1156.05 DESIGN PRINCIPLES.

The following Design Principles provide certain guidelines and requirements, as noted, in the design preparation of a Preliminary PD Plan.

Building and Site Design
Building Materials.
Vehicular Circulation and Access.
Pedestrian Access and Circulation.
Parking.
Landscaping and Screening.
Streetscape Improvements.
Service Area and Mechanical Screening.
Signage.
Lighting.
Urban Open Space.
Amenities.


Draft Project Schedule – Next Steps
• October: PC workshop regarding Planned Development
• October, November, December: ABR workshops
• December: Final PD reviewed by Planning Commission
• Nov. - December: Council reviews of draft development agreement
• January 2015: Final approval of development agreement & PD
•
• January: Sale of property to developer
• February – May: Review of construction documents
• July: Construction begins
• July 2017: Construction complete

Planning Commission

September 2014

LAKEWOOD OHIO

LAKEWOOD OHIO

Planning Commission
September 2014

12906 Madison Ave

LAKEWOOD OHIO

Planning Commission
September 2014

12906 Madison Ave

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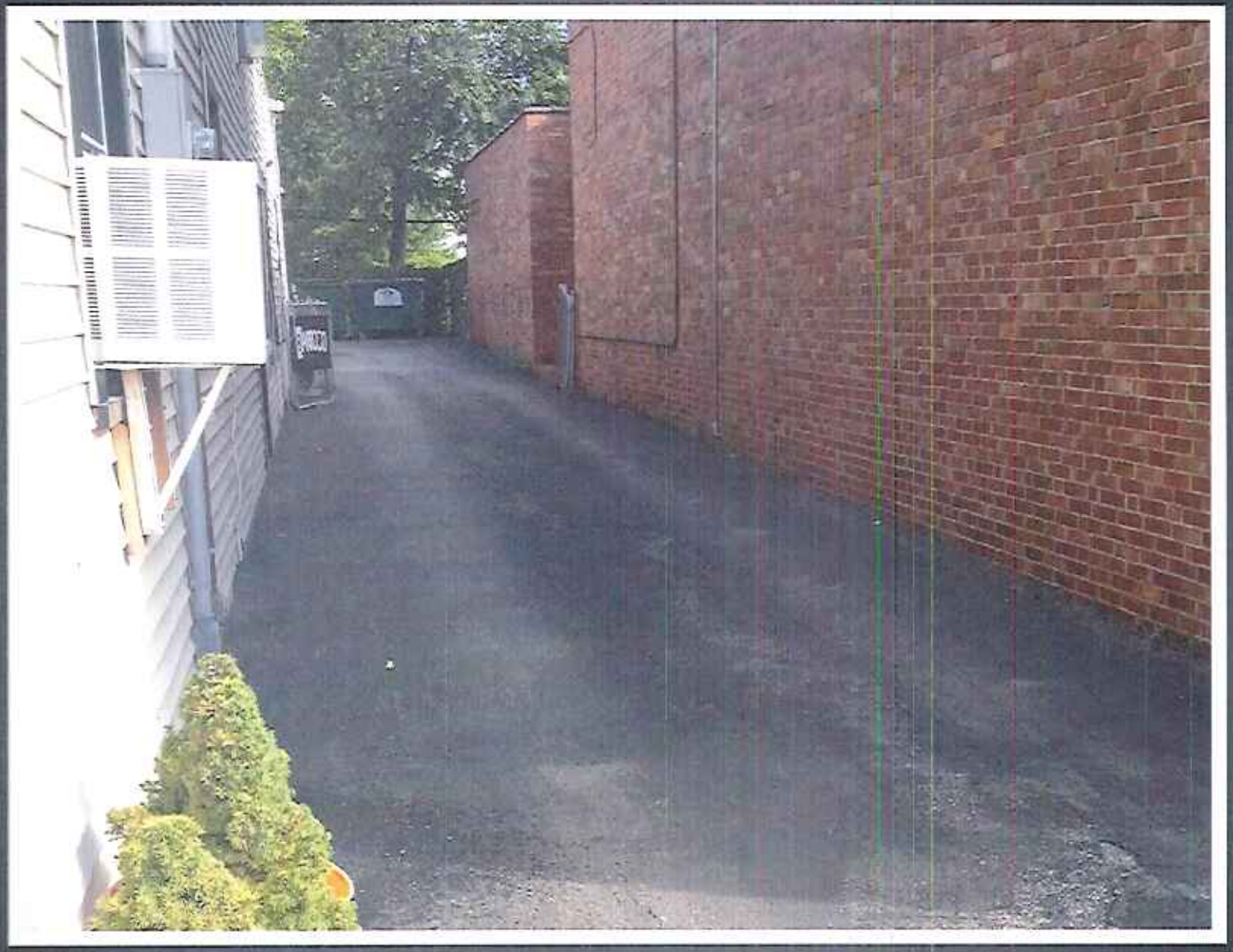
12906 Madison Ave



LAKEWOOD OHIO

Planning Commission
September 2014

12906 Madison Ave

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September 2014

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Planning Commission
September 2014

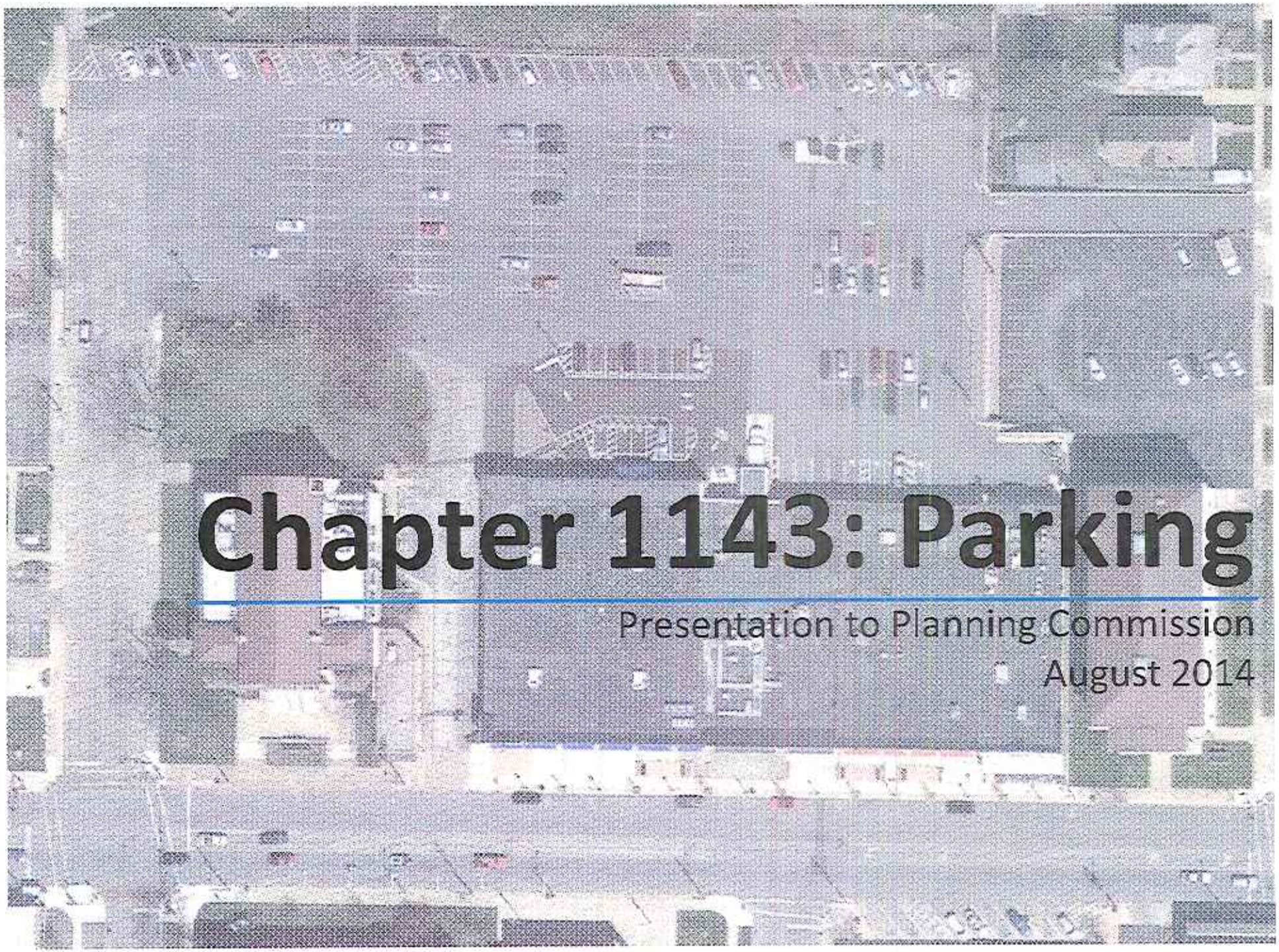
12906 Madison Ave

City Parking Code Update

LAKEWOOD OHIO

Birdtown Traffic Study

LAKEWOOD OHIO



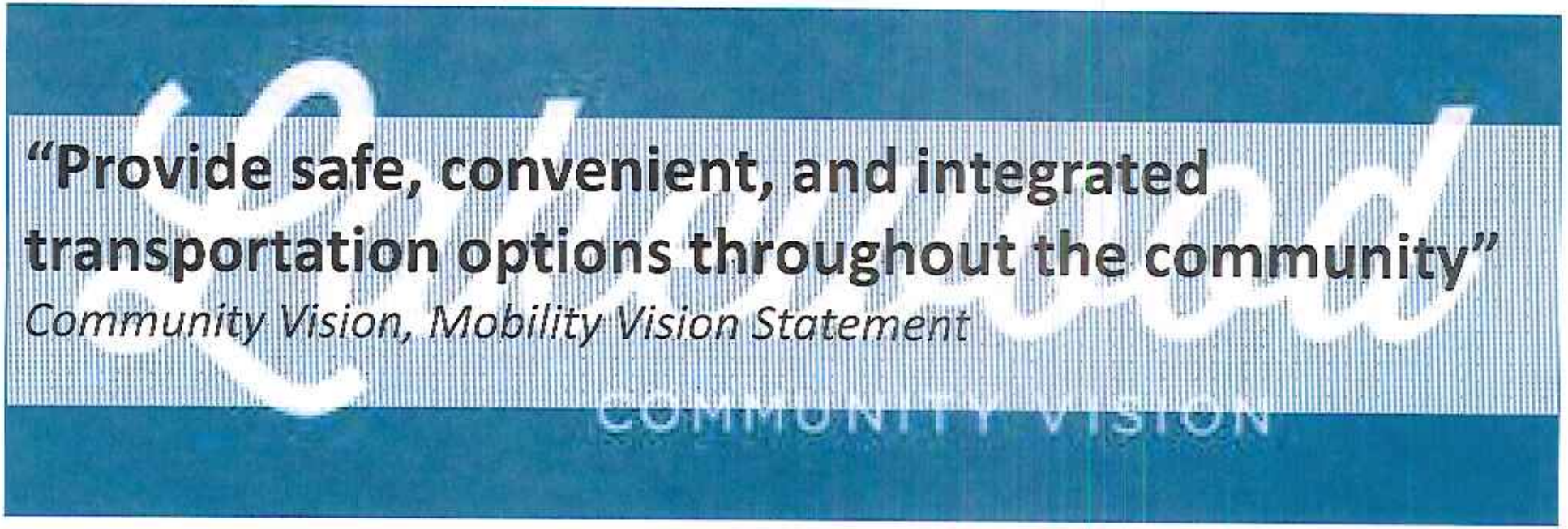
Chapter 1143: Parking

Presentation to Planning Commission

August 2014

"Continue to invest in infrastructure improvements to maintain and improve the transportation network"

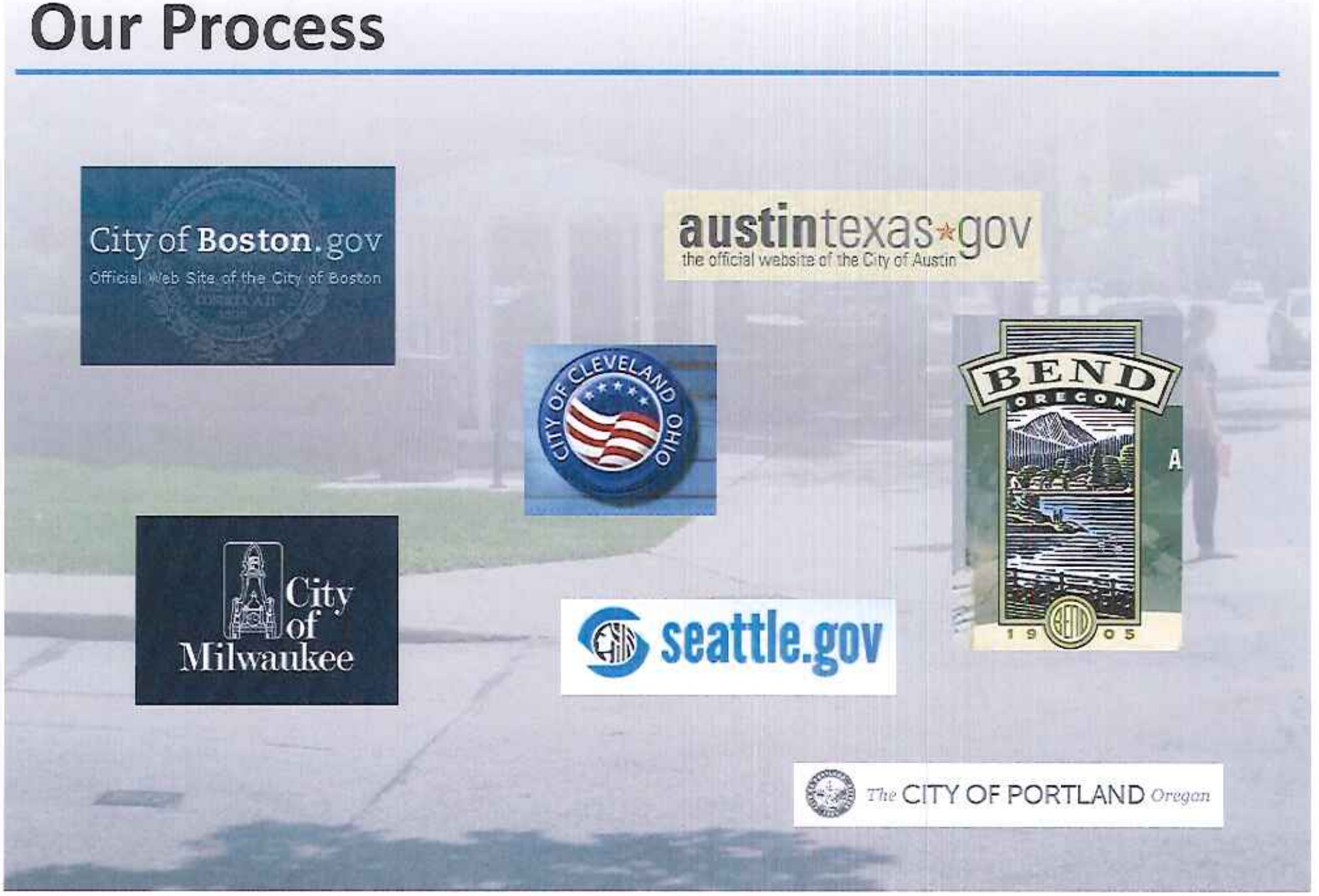
Mobility Objective, Creating Places for People



"Pursue alternative solutions to meet parking demands other than a car"

Mobility Goal #3

Our Process


City of Boston.gov
Official Web Site of the City of Boston
austintexas.gov
the official website of the City of Austin
CITY OF CLEVELAND OHIO
BEND
OREGON
1905
City of Milwaukee
seattle.gov
The CITY OF PORTLAND Oregon

Motivation for the update

- Code is written for a suburban environment
- Burden on small business needing variances
- Achieve more efficient use of land in new development projects
- Address bike parking, storm water management, public transit improvements
- Write a code that is flexible – can respond to market conditions

Simplifying Use Categories

Proposed Code

- Residential
- Retail
- Food & Beverage
- Office & Business Services
- Storage/Warehouse
- Industrial
- Telecommunication
- Education
- Cultural/Recreational/Entertainment

Commercial Use Category

Current Code

- 18 separate uses defined under Commercial

Proposed Code

- 5 separate uses defined under Commercial

Office: Means use of a building for business, professional, administrative or medical office. A general office is characterized by a low proportion of vehicle trips attributable to visitors or clients in relationship to employees.

Retail: Means sale or service to the final consumer for direct consumption. Means an establishment providing retail sale of products or services to the public.

Parking Minimums & Maximums

Parking Minimum – "Single-Family Homes are required to have a minimum of 1 space per unit" or "a Retail business is required to have a minimum of 1 space for each 1,000 sq ft GFA"

Parking Maximum – "Single-Family Homes are required to have a maximum 2 spaces per unit" or "a Retail business is allowed to have a maximum of 2.5 spaces for each 1,000 sq ft GFA"

Requirements for Commercial Uses

- Existing or new businesses under 2,000 sq ft are not required to provide off street parking.
- Existing businesses over 2,000 and up to 5,000 sq ft shall receive parking conformance ruling from Commissioner.
- Existing businesses over 5,000 sq ft, new construction projects or expansions over 20% of GFA shall apply for conditional use permit to Planning Commission for review.

Applying the code

Projects not required to submit a parking plan

- Cleveland Pickle, Sushi Roxu, Taco Tontos, Root Café

Projects that would submit parking plan for approval by Commissioner

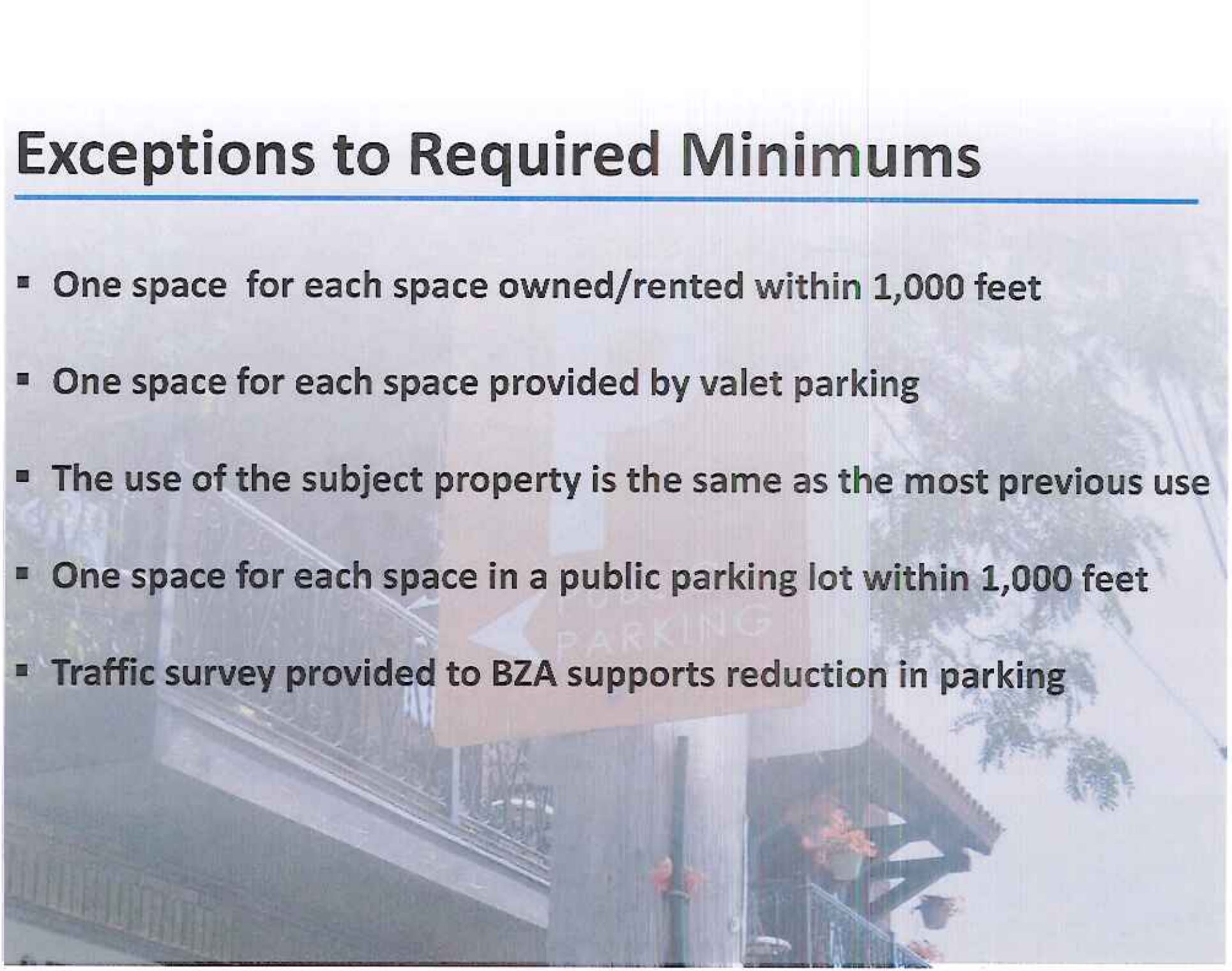
- 16 Bit Bar, El Carnicero, Melt, STEM Soaps, Good Goat Gallery

Projects that would apply for conditional use permit

- Drug Mart East, Family Dollar, Bob Evans, CVS, School Construction, GetGo

Exceptions to Required Minimums

- One space for each space owned/rented within 1,000 feet
- One space for each space provided by valet parking
- The use of the subject property is the same as the most previous use
- One space for each space in a public parking lot within 1,000 feet
- Traffic survey provided to BZA supports reduction in parking

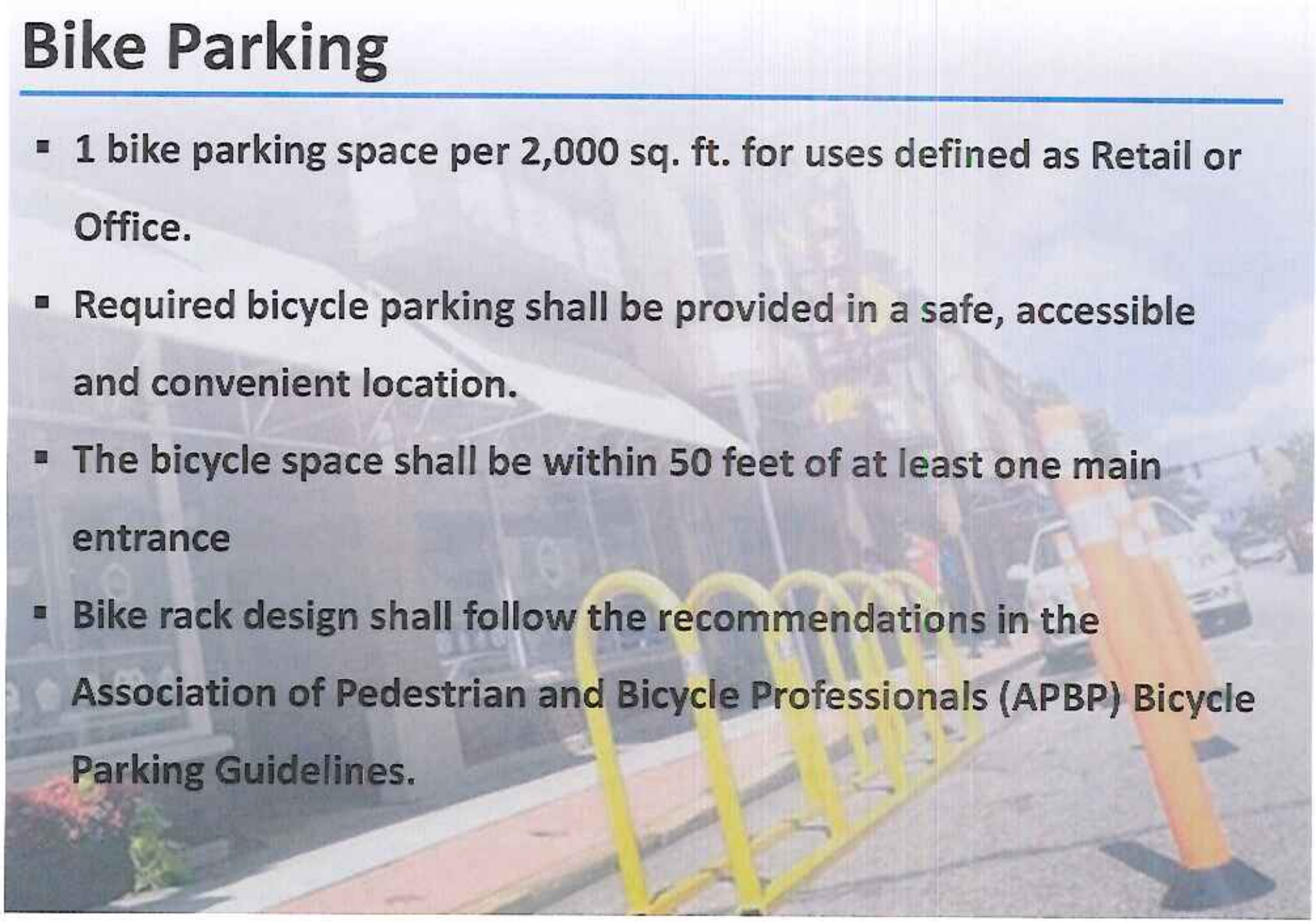


Exceptions to Required Maximums

- One space for each space located in a parking structure
- One space for each 5% of total site area devoted to facilities handling or treating stormwater runoff
- Increase of 10% of the maximum allowed for the installation of an approved transit waiting environment
- Increase of 10% of the maximum allowed for the implementation of an innovative landscaping plan
- Traffic survey provided to BZA supports reduction in parking

Bike Parking

- 1 bike parking space per 2,000 sq. ft. for uses defined as Retail or Office.
- Required bicycle parking shall be provided in a safe, accessible and convenient location.
- The bicycle space shall be within 50 feet of at least one main entrance
- Bike rack design shall follow the recommendations in the Association of Pedestrian and Bicycle Professionals (APBP) Bicycle Parking Guidelines.



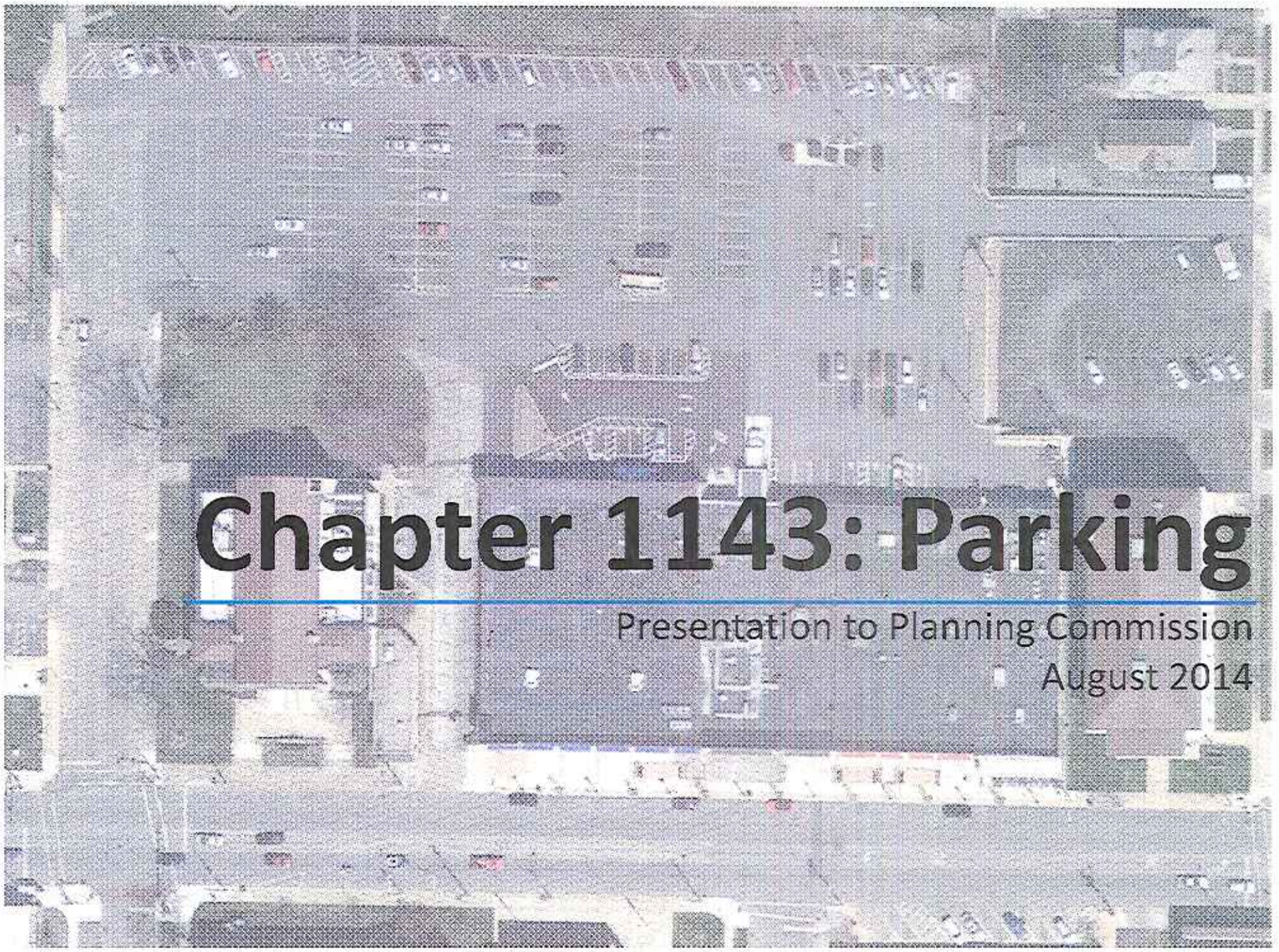
Examples

20,000 square foot medical office building

- Ruling would come from Planning Commission
- Minimum: 1 space/1,000 sqft – 20 spaces
  - Use exceptions if business wants less than 20 spaces
- Maximum: 3.5 spaces/1,000 sqft – 70 spaces
  - Use exceptions if business wants more than 70 spaces
- Required 10 bike parking spaces

50,000 square foot restaurant

- Ruling would come from Commissioner
- Minimum: 1 space/1,000 sqft – 50 spaces
  - Use exceptions if business wants less than 50 spaces
- Maximum: 3.5 spaces/1,000 sqft – 175 spaces
  - Use exceptions if business wants more than 175 spaces
- Required 13 bike parking spaces



Chapter 1143: Parking

Presentation to Planning Commission

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