

CITY OF MISSION PLANNING COMMISSION

AGENDA

October 28, 2019

7:00 PM

Mission City Hall - 6090 Woodson

Council Chambers

1. Call to Order
2. Approval of Minutes from the September 23, 2019 Meeting
3. New Business
 - A. Case #19-06: Amendment of the Final Development Plan for the Gateway - 4801 Johnson Drive, Matt Valenti, Cameron Group, LLC Applicant .

The Commission will be asked to consider an amendment to the final development plan for the Gateway development project at 4801 Johnson Drive. The amendment is for the addition of a food hall, addition of one level to the office building, and one level to the parking garage.

 1. Staff Report
 2. Amended Final Development Plan
4. Old Business
 - A. Case# 19-0: Preliminary and Final Development Plan for a Parcel of Property at the Northeast Corner of Johnson Drive and Roe Avenue.

A public hearing was held for this item at the September 23rd meeting, and then tabled until resolution of de-annexion could be reached. The parcel has been successfully de-annexed. The Planning Commission will need to take this item off the table and formally dispense with it.
5. PC Comments/CIP Committee Update
6. Staff Updates

*Questions concerning this meeting may be addressed to staff contact,
Brian Scott, Assistant City Administrator at (913) 676-8353 or bscott@missionks.org.*

Mike Lee, Chairperson
Stuart Braden, Vice-Chairperson

MINUTES OF THE PLANNING COMMISSION MEETING

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The regular meeting of the Mission Planning Commission was called to order by Chairman Mike Lee at 7:00 PM Monday, September 23, 2019. Members also present: Pete Christiansen, Stuart Braden, Brad Davidson, and Frank Bruce. Jami Casper, Robin Dukelow, Burton Taylor and Charlie Troppito were absent. Also in attendance: Brian Scott, Assistant City Administrator, and Audrey McClanahan, Secretary to the Planning Commission.

Approval of Minutes from the June 24, 2019 Meeting

Comm. Bruce moved and Comm. Christiansen seconded a motion to approve the minutes of the June 24, 2019, Planning Commission meeting.

The vote was taken (5-0). The **motion carried**.

New Business

Public Hearing - Application # 19-05: Land Use Application for Zoning of Property at the Northeast Corner of Johnson Drive and Roe Avenue; and a Preliminary and Final Development Plan for Parking on Said Property.
SMG Investments, LLC., Applicant

Mr. Scott: This is Application #19-05, a zoning and preliminary and final development plan for a medical office building and an associated parking lot. Our primary focus tonight is the associated parking lot. This is on a portion of a property at the northeast corner of Johnson Drive and Roe Avenue, Parcel ID KF251209-3004. The same address; we do not have a formal address yet. The applicant is Sunflower Medical Group Investments, LLC, 5555 West 58th Street, Mission, Kansas 66202. The owner of the property is the City of Roeland Park.

The subject property is located at the northeast corner of Johnson Drive and Roe Avenue. It is a portion of a larger parcel of property that is partly in the city of Roeland Park and partly in the city of Mission. The picture up here on the screen, the entire parcel is outlined in red. The portion that is actually in the city of Mission, kind of the southern portion, that is outlined in blue with the hatch marks that you can't see very well there. The entire parcel is approximately 2.7 acres. The smaller portion that's in the city of Mission is .74 acres. The larger parcel of property was at one time owned by the Kansas Department of Transportation and served as the right-of-way for a cloverleaf interchange between Johnson Drive, Roe Avenue, and Shawnee Mission Parkway. Those of you who have been here for a long time will remember that. The cloverleaf interchange was removed in 2003. The larger parcel of property was subsequently sold to the City of Roeland Park sometime around 2014. Sunflower Medical Group investors would like to develop the property into a medical office building. The proposed building would be two stories in height and approximately 31,500 square feet. The building would be located entirely on that portion of the property that is within the city of Roeland Park. The remainder of the property, including that portion located in the city of Mission, would be surface parking associated with the medical building. The applicant is requesting a rezoning of the property and consideration of a preliminary and final development plan with both the City of Roeland Park and the City of Mission. The portion in the city of Mission is currently not

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zoned. The Comprehensive Plan identifies this portion of property as right-of-way, but does not have a land use classification or zoning assigned to it. Surrounding properties are zoned and developed as follows: North portion in the city of Roeland Park is a single-family residential district. To the east is R-1, single-family residential district, detached single-family homes in the city of Fairway. And Business-2, business office district, office park, in the city of Fairway. To the west is Mixed-Use District, a bank and micro-hospital, located in the city of Roeland Park. To the south, there is no zoning; this area is right-of-way for US Routes 56 and 169, located in the city of Mission.

The portion of the property that is in the city of Roeland Park is currently zoned SFR, Single-Family Residential District. The property itself is vacant. A single-family subdivision does exist to the north and east. The City of Overland Park is proposing to rezone the property to CPO, Planned Office Building. A medical office building would be a permitted use within this zoning district.

As stated, the portion of property in the city of Mission does not currently have a zoning designation. Instead, it is designated on the City's zoning district map as right-of-way, as is all the land area within the city that is east of Roe Avenue. City staff proposes a designation of CP-O Planned Office Building District for that portion of the property that is located within the city of Mission. Medical office buildings are a permitted use in this zoning designation.

Municipal Code Section 410.070 provides requirements for the CP-0 Planned Office District. Permitted uses do include subsection (A)(3) – medical office buildings. Municipal Code Section 410.070(C) - Height - states, "Buildings, or structures located within District "CP-O" shall have no minimum or maximum height requirements except as governed by yard requirements and provided approval is given by the City during rezoning and final development plan approval." Front Yard - requires that minimum front yard shall not be less than thirty (30) feet. Side Yard - states, "Not less than fifteen (15) feet shall be provided on the street side of a corner lot up to two and one-half (2-½) story buildings." The front of the proposed building is situated along Roe Avenue with a front yard depth of approximately 25 feet from the back of curb. The existing sidewalk along Roe Avenue in front of the building will remain. This will provide the sense that the building is close to the sidewalk, and the front of the lot, which is in keeping with the Johnson Drive Design Guidelines. Due to utility easements that run through the property at the corner, it is not practical to bring the building to the corner of Roe and Johnson Drive. The proposed side-yard setback is well within the requirements of the zoning provisions. The City of Roeland Park is requesting an easement in this side-yard area for a City entrance monument. The applicant is also intending to place a piece of public art in this location, near the building. This is in keeping with Roeland Parks' requirement of 1% of construction costs to be dedicated for public art. Both the City entrance monument and the public art will provide a nice aesthetic presence to the corner that will be an enhancement for both communities.

Municipal Code Section 410.070(H) - Parking - stipulates, "The parking lot shall not be closer to the street right-of-way than one-half (½) of the front yard or street side yard requirements, nor closer than six (6) feet to the interior or rear lot lines." The surface

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parking lot area within that portion of the property that is in the city of Mission (essentially that area along Johnson Drive) is setback 6 feet from the property line and 35 feet from the back of curb of Johnson Drive. This is greater than $\frac{1}{2}$ of the street side yard or 7.5 feet (one-half of the 15 foot side yard requirement). Staff has requested, and the applicant has agreed, that an eight (8) foot wide sidewalk be placed on the Johnson Drive frontage from Roe Avenue to Granada Street. There will also be sidewalks to the interior of the site that provide connectivity for those walking to and from the street area to the site.

Code review for landscaping and parking. Municipal Code Section 415.090 provides minimum tree requirements per zoning district. The landscape plan provided as part of the final development plan indicates that there is approximately 400 feet of frontage along Johnson Drive. This would equate to eight trees being needed. The plans indicate that three Swamp White Oak (2.5" calbr.), four Black Gum (2.5 calbr.), and six Autumn Brilliance Serviceberry (1.5" calbr.) trees are proposed for the frontage. These will be planted both individually and in a cluster pattern. In addition, Sea Green Junipers and Maiden Grass will be planted along the edge of the parking lots to help in concealing the lot and parked vehicles. The plans indicate that there will be 155 parking spaces throughout the property, both in Roeland Park and Mission. This equates to 7.75 trees being required within the parking lot area. The landscape plans indicate eight Maidenhair trees (2.5" calbr.) will be planted in the parking lot islands. Additional plantings in the parking lot islands will include Buffalo Junipers and Iroquois Beauty Black Chokeberry bushes. All plantings are in accordance with Municipal Code Section 415.100 Planting requirements. Staff has stipulated to the applicant, as provided in the code, that sod must be planted in the right-of-way.

The total amount of parking surface within the city of Mission will equate to approximately 14,500 square feet or 45% of the land area. Municipal Code Section 425.020 - Minimum Space Requirements - stipulates that for general office buildings a minimum of 2.84 parking spaces is required for each 1,000 square feet of building space. The proposed building is 31,500 square feet. This would equate to 89.46 parking spaces being required. Plans indicate 155 parking spaces being provided. Approximately 47 parking spaces will be in the Mission portion of the property. Size of parking stalls and arrangement are within code.

Approval of Zoning Request: Section 440.140 (E) -Criteria for Considering Applications - lists the criteria to be used by the Planning Commission and City Council in the consideration of this application. An evaluation of these criteria is as follows: 1. The character of the neighborhood. The subject property is located at the northeast corner of Johnson Drive and Roe Avenue. Both are arterial roads connecting the area to the larger northeast Johnson County region. Commercial property (primarily non-retail) already exists with the office park in the city of Fairway to the east, and the bank and micro-hospital in the city of Roeland Park to the west. The Gateway development project is to the southwest. There is a residential subdivision to the northeast, but the proposed use should have little impact as the hours of operation will be during the weekday and not evening or weekend. The proposed use will provide a good buffer for this neighborhood

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to the traffic and surrounding uses. The proposed development of a medical office building is in keeping with the overall character of the neighborhood.

The zoning and uses of nearby properties, and the extent to which the proposed use would be in harmony with such zoning and uses. The proposed zoning and use is in harmony with surrounding zoning districts and uses.

3. The suitability of the property for the uses to which it has been restricted under the applicable zoning district regulations. CP-O zoning limits uses to office buildings, which should be compatible with the residential area to the north and the other commercial uses east and west.

Number 4, the extent to which approval of the application would detrimentally affect nearby properties. Approval of the application will not have a detrimental effect on the surrounding properties.

5. The length of time the property has remained vacant as zoned. It has never been zoned by the City of Mission for any particular land use, and has been vacant for about nine years.

The relative benefit to the public health, safety and welfare by retaining applicable restrictions on the property as compared to the destruction of the value of the property or hardship to the owner association with denying its request. Staff believes the proposed zoning of CP-O is appropriate and protects surrounding properties, while allowing the owner to realize the full value of the land.

The Master Plan or Comprehensive Plan, item number 7. The proposed zoning of "CP-O" is appropriate and in keeping with surrounding zoning uses in other cities, and the mixed-use zoning to the southwest, in the city of Mission.

8. The extent to which the proposed use would adversely affect the capacity or safety of that portion of the road network influenced by the use, or present parking problems in the vicinity of the property. The applicant has provided a traffic study, which is in your packet this evening. This was reviewed by the City's on-call traffic engineer. The on-call traffic engineer suggested that traffic counts for the proposed Gateway development be utilized for the study, to which a revised study was submitted by the applicant. The on-call traffic engineer believes that the applicant's updated traffic study still slightly under-estimates the associated total peak hour traffic from the adjacent Mission Gateway development in their analysis of the existing traffic plus the Mission Gateway plus the proposed medical office building. The overall Synchro result with the completed analysis for the Johnson/Roe intersection is LOS C. With the additional traffic from the Gateway development, the result should generally be the same. At worst, it may exceed the 35" average delay/vehicle threshold. which moves it into a LOS "D" condition, which is still acceptable for the projected critical peak hour condition.

The one individual movement at the intersection that may need further evaluation is the eastbound dual left-turn lanes, which are LOS "E." With the additional traffic, that movement may possibly degrade a bit more. The proposed medical office building will not

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have much impact on this particular movement and there is not really anything that can be done geometrically at the intersection to change the performance. Traffic conditions at the intersection of Johnson and Roe are being impacted by a number of factors and will need to be monitored over time to evaluate the effect of these factors.

Item 9, recommendation of the professional staff. The site plan has been reviewed by staff and the City's on-call engineer for compliance with zoning, design, and engineering standards, and all recommend approval of the proposed zoning and preliminary and final development plan.

Item number 10, the extent to which utilities and services, including but not limited to sewers, water service, police and fire protection, and parks and recreation facilities, are available and adequate to serve the proposed use. All utilities and services are in place and are adequate to serve the proposed use. Public improvements to sidewalks, crosswalks and street trees will be made by the applicant as a condition of approval.

Item number 11, the extent to which the proposed use would create excessive stormwater runoff, air pollution, water pollution, noise pollution or other environmental harm. The applicant provided a storm water study, which is in your packet this evening. This was reviewed by the City's on-call stormwater engineer. An initial study indicated that no detention was needed due to the amount of additional stormwater that would be created would be minor when compared to the entire watershed. The City's on-call consultant does not believe this is an accurate interpretation of stormwater management standards issued by the Kansas state chapter of the American Public Works Association. The stormwater actually indicates the overall increase in stormwater would be as much as 32 percent. In addition, the cubic feet per second volume will increase by 9 percent. A revised study was provided to your [inaudible] analysis and the addition of a pond site underground stormwater detention system. This will reduce the amount of additional stormwater to approximately 24.4 percent, which is within the acceptable range of the APWA standards. Stormwater will be released from the detention system at a rate similar to existing conditions currently. The revised stormwater study indicates that for the most part, the site will drain to a rain garden situated on the property. In accordance with section 15-515 of Ordinance No. 809 of Roeland Park, the owner will complete an annual certification inspection of the stormwater management systems and rain garden, and is subject to City inspection at least once every three years.

Number 12, the extent to which there is a need for the use in the community. The applicant is the Sunflower Medical Group, which is currently located within the City or Mission at 5555 W. 58th Street. They will be moving to a bigger facility, but still within the community and available to serve their clients here.

I'll skip item 13. Item 14, the ability of the applicant to satisfy any requirements applicable to the specific use imposed pursuant to the zoning district regulations. The applicant should be able to satisfy any requirements applicable to the specific use that will be allowed within the zoning regulations.

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Staff Recommendation: Staff recommends the Planning Commission recommend approval of Case #19-05 to the City Council for the following conditions:

- (a) That portion of a parcel of property located at the northeast corner of Johnson Drive and Roe Avenue that is within the corporate limits of the City of Mission (Parcel ID: KF251209-3004) be zoned as "CP-O" Planned Office Building District; and
- (b) That a preliminary development plan for a parking lot associated with a medical office building to be built on the property be approved with the following conditions:
 1. Landscaping be provided in accordance with the submitted landscape plans, and such landscaping (including the rain garden) will be maintained and adequately watered in accordance with a contract between the owner of the property and a landscaping company, such contract to be submitted to the City for review.
 2. Sod to be laid in grass areas along the Johnson Drive right-of-way and maintained in contract as stipulated in the first condition.
 3. Underground detention system be constructed as indicated in the submitted plans.
 4. An eight (8) foot sidewalk be constructed along Johnson Drive from Roe Avenue to a terminus at Granada Drive in accordance with the site plans submitted.
 5. A plat of the entire property be filed with both the City of Roeland Park and the City of Mission for approval by both cities, said plat indicating boundaries of the property, location of the building, dedicated easements and the dedication of right-of-way, be completed prior to the issuance of any permits for improvements.

That is my staff report. I will add this. The City of Mission and the City of Roeland Park have been in discussions for almost two years now about a possible de-annexation of that portion of property that is in the City of Mission, and annexation by the City of Roeland Park. It seems those discussions have gotten very fruitful in the last few weeks, and the City Council actually passed a resolution, after meeting last Wednesday evening, placing the de-annexation on the agenda for the October 16th meeting as a public hearing for consideration. That evening, if so decided, they can actually adopt a resolution that formally de-annexes this portion of the property from the City of Mission. And then, that evening, the City of Roeland Park, at a special meeting, would pass a resolution accepting that portion into their city, annexing it.

So, with that said, staff is proposing that once we hear from the applicant and take any comments on this and answer any questions you all might have, we suspend this public hearing and table the item to a date certain, the October 23rd Planning Commission meeting. If that is the desire of the Planning Commission. That is my report. Representatives of the applicant are here tonight.

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Chair Lee: Step forward.

Andy Gabbert, Landscape Architect, Renaissance Infrastructure Consulting, 5015 Northwest Canal Street, Riverside, MO, appeared before the Planning Commission and made the following comments:

Mr. Gabbert: Good evening. I'm a landscape architect with Renaissance Infrastructure Consulting. Thank you for hearing us tonight. I would like to extend another thanks to Brian for that wonderful staff report, and for all the help and attention they've given this project over the past couple of months. I'd like to keep it short. I'm here with our team. We've got our architect, Jeff Stockman of ACI Boland; our civil engineer, Dustin Burton, with RIC; and the president of our company, Chip Corcoran. With that, I'd like to open it up for any questions. We agree to all the stipulations.

Chair Lee: Any questions of the applicant?

Comm. Braden: I have a question for both staff and the applicant. In the description of the rainwater, there was some added verbiage that wasn't in our report, and it sounded like there was some concern with the calculations on the stormwater runoff, and [inaudible] and there was no longer a concern with that...? I'm sorry, I wasn't quite following that.

Mr. Scott: Staff is satisfied that a revised stormwater study has been submitted. The applicant is now proposing... You'll see that underground stormwater detention system, actually underneath the parking lot on Mission. That will meet our needs.

Comm. Braden: Okay, thank you.

Unidentified: Would it be better for you if we went ahead and approved this tonight? Or is it irrelevant as to whether we approve or wait on City Council to take action on it?

Mr. Burton: I would say that a vote for approval would just... I'm not sure. If there is a vote for approval tonight, if the City Council does not vote to annex or de-annex, there would not be a need for us to come back on the 23rd because you guys will have already approved it at that point.

Mr. Scott: If you vote for approval tonight, we would probably postpone taking it to City Council for their consideration. Normally, it would go to the next meeting, which would be October 16th. But given that they are already considering how to handle this parcel of property, we would probably just wait until the November meeting. It may be better at this point just to wait, table it.

Comm. Bruce: Would the applicant be better off if we tabled or we approved it?

Mr. Scott: There may be something that comes out of discussions about the annexation, too. It could have an impact on this. So, we need to bring it back to you all for further consideration. So, it might be best to wait until the meeting on the 23rd, where we can take it up again.

Comm. Bruce: This seems to be an exercise in futility for us because if it goes to Roeland Park their rules are going to apply anyway.

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Mr. Scott: Right. Trust me, I know the feeling of futility.

Chair Lee: Any other questions? [None.] At this point, we will open the public hearing. If anyone would like to step forward and speak either for or against, now is the time to do it.

Roemaine Bales appeared before the Planning Commission and made the following comments:

Mr. Bales: I used to live right in that curve right there, at the bottom of Granada. My parents and I lived there, I think it was 1968. Currently, I live in Prairie Village, and my wife and I still own this piece of property. So, I'm just a little concerned about how that stormwater will be handled. Many years ago, we had trouble with water in the basements at the bottom of that street. The house I'm speaking of, it's not, it's [inaudible] the last house in the street. But several of the houses along there had trouble during heavy rain, when you'd get days of rain, and all that. I'd just like to understand better what this system is going to be, to relieve the pressure from this building and this new enterprise here.

Mr. Burton: Could you point on the map there, show me where you're at?

Mr. Bales: It would be right about here.

Mr. Burton: And those are residences?

Mr. Bales: Oh, yes.

Chair Lee: Okay, not seeing anyone else who wishes to speak, we'll close the public hearing at this point. I'm assuming that regardless of which way it goes at this point, the stormwater is going to be handled the same way. So, if someone could give us an explanation.

Mr. Burton: Sure, I'd be happy to. We're actually going to be installing two stormwater [inaudible]. They're a little hard to see on this screen. We're going to be doing a small rain garden, roughly in this area here. That's primarily going to be for water quality, because if a small storm hits, about an inch, inch-and-a-half will be treated in that. For larger storms [inaudible] installing the underground system, consisting of three 48-inch pipes. The majority of water [inaudible] the building, and [inaudible] are going to be collected on site and into these pipes, 48-inch pipes, where we have a control plate [inaudible], creates detention on the site, so that [inaudible] over time, so that the impervious area [inaudible] building generates more, faster run-off, it slows down with that detention there. So, that's primarily what we're going to be doing to control on-site water. And [inaudible] the watershed in general. It's about six acres that's coming to this point here. Our site is only two acres of that six areas, so we're able to help control, not make things worse for our site, but not [inaudible] upstream [inaudible] beyond that. Thank you.

Chair Lee: Okay. Comments?

Unidentified: Just for the record, I was on the five-city exploratory committee two or three years ago, and evidently, as Brian just said, I guess I've been fired from that committee because I've not been a part of that for the last year or so. But, with that said, if you want

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to call a piece of property that is probably in the gray area not in compliance within... Not "not in compliance," but I'm just saying, a compliant piece of property because of the two cities. I know there's a lot going on, and the whole idea was to try to bring the two cities together because, like I said, the City of Mission has .7 acres, and the general consensus is basically that the City of Mission doesn't have a lot of, with .7 acres, into the project, that the general consensus is something like, what I just heard from the first time tonight, is the de-annexing of the property to the City of Roeland Park. With that said, I agree that it's probably best to table it, and if it's going to go back to the Council for that possibly to occur, then it all falls on the City of Roeland Park as far as their regulations and all that. So, it's hard to say our regulations and our compliances on a piece of property when there's not much, you know, to chew on. I just wanted to make that note.

Comm. Braden: I had one more question I forgot to ask. The parking count calculations, it appears that the required parking was space for 90, and then 155. I'm just curious why there's so many more than what's required. You're adding a lot of impervious surface, there will be run-off, and I see a lot of empty [inaudible] parking lot. I was curious about why that additional parking.

Mr. Gabbert: A couple of different things. Shawnee Mission Medical Group is not a new medical facility group. They are located in Roeland Park now and they have multiple facilities located around the metro area. They know their parking, they know their needs, so a lot of this is being driven by their other locations and what they see as a need for parking for them.

The other part to that question is, the other portion of the building will be leased out, and the more parking you can get, it helps open doors for other users. So, it's kind of a balance, but mostly driven by the needs of Shawnee Mission Medical Group.

Chair Lee: Are there any other comments? I would entertain a motion.

Comm. Braden: Mr. Chair, I would move that Application #19-05, Zoning and Preliminary and Final Development for a medical office building parking lot at the northeast corner of Johnson Drive and Roe Avenue be tabled to a date certain of Monday, October 28, 2019, at which time it will be taken up again for consideration by the Planning Commission.

Comm. Bruce: Second.

The vote was taken (5-0). The **motion carried.**

Old Business - None

PC Comments/CIP Committee Update - None

Staff Updates

Mr. Scott stated that two new department directors have been hired recently. Penn Almoney is the new Director of Parks and Recreation, and Celia Duran has been hired as

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the new Director of Public Works. Comm. Braden asked for an update on the Gateway project; Mr. Scott said he did not have anything to add regarding that project.

ADJOURNMENT

With no other agenda items, **Comm. Christiansen moved and Comm. seconded a motion to adjourn.** (Vote was unanimous). The **motion carried.** The meeting adjourned at 7:36 P.M.



Mike Lee, Chair

ATTEST:



Audrey McClanahan, Secretary

STAFF REPORT
Planning Commission Meeting October 28, 2019

AGENDA ITEM NO.: 1

PROJECT NUMBER / TITLE: Case # 19-06

REQUEST: Amendment of Final Site Development Plan for The Gateway Development

LOCATION: 4801 Johnson Drive (Approx. 17 acres bounded by Johnson Drive, Roeland Dr., Shawnee Mission Pkwy., and Roe Ave.)

APPLICANT: Matt Valenti, Cameron Group, LLC.

PROPERTY OWNER: Aryeh Realty, LLC
140 Broadway, FL 41
New York, NY 10005

STAFF CONTACT: Brian Scott, Assistant City Administrator



PUBLIC HEARING: N/A

Property Information:

The subject property is an approximately 17 acre parcel located at the southwest corner of Johnson Drive and Roe Avenue. It is the site of the former Mission Mall. The property is bounded by Johnson Drive on the north, Roe Avenue on the east, Shawnee Mission Parkway on the south and Roeland Drive on the west. The property is zoned Planned Mixed Use District "MXD." This district is intended to encourage a variety of land uses in closer proximity to one another than would be possible with more conventional zoning districts, and to encourage building configurations that create a distinctive and memorable sense of place. Developments in this district are allowed and expected to have a mixture of residential, office and retail uses, along with public spaces, entertainment uses and other specialty facilities that are compatible in both character and function. Developments are also expected to utilize shared parking facilities linked to multiple buildings and uses by an attractive and

logical pedestrian network that places more emphasis on the quality of the pedestrian experience than is generally found in a typical suburban development. Buildings are intended to

be primarily multi-story structures with differing uses organized vertically rather than the horizontal separation of uses that commonly results from conventional zoning districts. The property is also subject to the Mission, Kansas *Design Guidelines* for the Johnson Drive Corridor.

Surrounding properties are zoned and developed as follows:

North: Roeland Park “OB” Office Building District-small offices, “PUB” Public Services - park, and “MXD” Mixed Use District - bank and micro-hospital

West: Mission “RP-3” Planned Townhome District-Roeland Court Townhomes, “MS2” Main Street District 2 - restaurant and vacant building, “R-1” Single Family Residential District-detached dwelling units,

South: Mission “RP-6” Planned High Rise Apartment District-vacant “C-1” Restricted Business District-bank, “C-O” Office Building District-dentist and other office uses.

East: Fairway “R-1” Single Family Residential District-detached dwelling units.

Comprehensive Plan Future Land Use Recommendation for this area:

The Comprehensive Plan indicates this area is appropriate for Mixed Use High-Density to be composed of a pedestrian friendly mix of neighborhood and community office uses, retail-commercial and service-commercial uses, institutional, civic, and medium to high density residential.

Project Background:

In 2005 The Cameron Group, LLC, a development company from East Syracuse, New York, purchased the Mission Mall property with plans to build a mixed-use development on the site. In 2006 the Planning Commission reviewed and approved the rezoning and preliminary site plan for the redevelopment of the subject property for urban development composed of retail, office, hotel, restaurant, and residential uses (Ordinance #1203). Since the “MXD” zoning and preliminary site plan was first approved, the project has evolved through several revisions reflected in revised plans presented to the Planning Commission and City Council in 2007, 2008, 2012, 2015 and 2016. Each of these plan approvals included a range of stipulations for site development issues, and requirements for additional details to be provided with final plan reviews. A preliminary site plan was approved by the City Council on January 20, 2016 after a public hearing and consideration before the Planning Commission on September 28, 2015. A final site development plan was approved by the Planning Commission in March of 2017.

At the time of approval, the plan encompassed three, connected apartment buildings (Buildings “C,” “D” and “E”) at the corner of Johnson Drive and Roeland Drive; a seven-story hotel at the corner of Roeland Drive and Shawnee Mission Parkway (Building “B”); an office building (Building “F”); and a large, somewhat undefined retail space (Building “A”). Each of these buildings surrounded a three-level parking structure within the interior of the site. The developer’s intent was to proceed with the development of the project in three, sequential phases beginning with the apartment buildings and then the hotel and garage, and finally the retail space. The office building would be constructed when a tenant was identified and specific needs for use defined.

Project Update:

Since the approval of the final development plan by the Planning Commission in March of 2017, the developer has been presented with opportunities that better define the future retail component of the project and necessitate changing the phasing of the construction.

Construction plans were submitted to the City in the late winter of this year for an approximately 90,000 square foot movie theater and entertainment venue known as Cinergy, a company based out of Texas and new to the Kansas City market. Construction plans were approved and a building permit issued this summer. Preparation of the building site has been completed, and construction is expected to begin next month.

Plans for a proposed food hall have evolved to the point that programming of the space is defined and design elements can be set and presented for consideration by the Planning Commission.

A tenant, and possibly a second, has been identified for the office building. With tenant(s) identified, the needed square footage can be identified and final design elements further refined and set.

Further evaluation of the site and design work has resulted in reducing the footprint of the parking structure on the site, but adding an additional level to it.

The developer has also been in negotiations with the City to restructure their financing and development incentives so that they can re-engage in construction of the apartment buildings early next year, following in short order with the parking structure, hotel, office building, and the food hall. All construction is expected to be complete by the end of 2021, a year earlier than first planned.

At this time the applicant is requesting to make an amendment to the final site development plan (FDP) that was approved in March of 2017. The amendment reflects (1) consideration of design elements of the food hall component of the development project, (2) further clarification of the design elements of the office building and adding an additional level, and (3) a modification to the design of the garage reducing the footprint and adding an additional level.

Plan Review and Modifications

The approved plan identifies six buildings around the perimeter of the site with a partially free-standing, three level parking garage in the interior. Building "B" on the southwest corner of the site is a 202 room, 7-story hotel. To the north, Buildings "C", "D" and "E" along Roeland Drive and Johnson Drive are three, separate apartment buildings connected by an enclosed walkway between each. Each apartment building is 4-stories, three stories of residential units above small retail shops on the ground floor. There are 168 residential units between all three buildings. Both the hotel and the apartment buildings remain substantially the same since the FDP was approved in March of 2017. Minor modifications to the plans have been approved administratively as designs have been finalized.

Administrative approvals include moving the hotel entrance to the front, visible from Roeland Drive, and providing a direct, circular drive up to the hotel entrance. The original plans had the hotel entrance on the second level of the parking structure, which seemed "tucked away" and not obvious to the first time visitor. The new design provides a better presence and sense of arrival.

Other administrative approvals include replacing the Ipe wood decking material with a patterned concrete for the boardwalk that connects the surface parking lot on Roeland Drive to a green space adjacent to Buildings "C", "D" and "E". The developer has had reservations that the Ipe wood decking would not hold-up well to the elements, especially anti-ice treatment during the winter months. Instead, the boardwalk will be comprised of a patterned concrete in various

shades of grey. This will give the appearance of a decking, or wood planking, but will be much more durable and have a longer life span.

Finally, the grass in the courtyard area adjacent to buildings “C” and “D” will be replaced with a synthetic turf. Due to the height of the apartment buildings and parking structure, the courtyard area will only receive direct daylight for a few hours a day, making growth of natural grass difficult. In addition, the residents of the apartments may have dogs that will need a place to relieve themselves. Synthetic grass can be more easily cleaned by maintenance crews.

Building “A” was identified in the approved 2017 FDP as a single-story building with three retail tenant spaces totaling 119,160 square feet. The height of the proposed building was 27 feet with a “bump-up” at the entrance that stood at 44 feet in height.

This building is now identified as the Cinergy movie theater and entertainment complex. The building will include 10 movie screens; a 16-lane, bowling alley; 6 escape rooms; ax throwing area; zip-line area; arcade; and bar/restaurant. The entire building will be 89,300 square feet. The majority of the building is one-story at a height of 32 and a half feet. There is an additional story, or mezzanine, at the south end of the building for the movie theater area bringing the total height to 46 feet. The proposed building in the approved 2017 FDP was 27 feet in height at its lowest point, but with an entrance “bump-up” that stood at 44 feet in height. Construction of the building is in the same method as initially proposed for the retail space - tilt-up concrete panels. The new building will have more earth-tone coloring as opposed to the previously approved building, which had grey tones.

Immediately adjacent to the Cinergy building, on the northside, will be the food hall at 39,995 square feet. This building will be a 2-story building. The first story will comprise a 4,300 square foot, sit-down restaurant and an 18,000 square foot, food hall providing approximately 14 stalls for independent food vendors around an open dining area. The second story component will include a possible indoor golf experience (8,700 square feet) and restaurant terrace (1,000 square feet). The balance of the space is for kitchen, preparation and storage.

Building “F” was initially proposed in the approved 2017 FDP as a 3-story office building totalling 58,000 square feet. The developer is now proposing a 4-story office building totaling 76,487 square feet. The building will be mostly elevated at ground floor level providing clearance for vehicular circulation underneath, and future access to utilities that run under the building. The total height of the structure is 58 feet (all four stories). There is a mechanical screen on the roof bringing the overall height to 73 feet.

As proposed in the originally approved FDP, there will be a parking structure in the middle of the development site that provides parking for all of the above uses. The originally approved parking structure was a 3 level garage with 793 parking spaces. The parking structure connected directly to both the hotel and the office building. The parking structure has been redesigned to be a 4 level structure with 808 parking spaces, but with a smaller footprint on the site.

A comparison of the modifications between the approved FDP and the amended FDP is shown in the table below. The total floor area with the proposed amendment has been increased by 35,512 square feet or 6%. This increase is primarily in the office building component of the project (31%). Overall parking has been reduced by 71 spaces from 1,528 to 1,457.

| Component | 2017 Approved FDP | 2019 Proposed FDP | Change |
|-----------|-------------------|-------------------|--------|
|-----------|-------------------|-------------------|--------|

| Revisions | | | |
|------------------------|------------------------|-------------------------|----------------------------|
| Apartment Buildings | 168 Units | 168 Units | Same |
| | 177,812 sq. ft. | 178,878 sq. ft. | 1,066 sq. ft. (0.6%) |
| | | | |
| Hotel | 200 Rooms | 202 Rooms | 2 Additional Rooms |
| | 140,904 sq. ft. | 147,244 sq. ft. | 6,340 sq. ft. (4.5%) |
| | | | |
| Retail (total) | 173,778 sq. ft. | 183,913 sq. ft. | 10,135 sq. ft. (6%) |
| Small Shop Retail | 54,618 sq. ft. | 54,618 sq. ft. | |
| Jr. Anchor Tenants | 119,160 sq. ft. | Not Included | |
| Food Hall | Not Included | 39,995 sq. ft. | |
| Theater | Not Included | 89,300 sq. ft. | |
| | | | |
| Office Building | 3 Levels | 4 Levels | 1 Additional Level |
| | 58,516 sq. ft. | 76,487 sq. ft. . | 17,971 sq. ft. (31%) |
| | | | |
| Parking | 1,528 Total Spaces | 1,457 Total Spaces | 71 Spaces (-5%) |
| | | | |
| | 735 Surface Spaces | 649 Surface Spaces | 86 Less . (-12%) |
| | 793 Garage Spaces | 808 Garage Spaces | 15 Additional (2%) |
| | 3 Levels | 4 Levels | 1 Additional Level |
| | | | |
| OVERALL SQ. FT. | 551,010 sq. ft. | 586,522 sq. f.t. | 35,512 sq. ft. (6%) |

Johnson Drive Design Guidelines & Municipal Code Standards

The Johnson Drive Design Guidelines provide a wide range of recommended and required design elements applicable to the development. These and the site development standards of the municipal code are reviewed below specifically for the proposed amendments.

Design and Material Palette - Food Hall

The intent of the Johnson Drive Guidelines is to encourage detailed and articulated building elevations that create interesting facades, complementary massing, human scale elements, and high quality appearance materials. It acknowledges that Mission benefits from a diversity of architectural styles and would not prohibit modern styles that are compatible in form and proportion to buildings with their immediate context on Johnson Drive.

Architectural renderings and material selection for the proposed food hall are reflected in sheets FDP A300 and A301. The 2-story building will be fronting Johnson Drive, just to the west of Roe Avenue. The architectural design of the building, and use of materials and colors, breaks up the “front wall” of the building, giving it an appearance, at first, of being almost three, separate buildings.

The west end of the building has a “structural frame” around the facade composed of a buff color masonry material. Faux, wood grain metal panels are inserted within the structural frame, and then again toward the middle of the building on the second story. The panels provide a contrast in color and texture to the overall building. Aluminum metal panels on the west end of the second story provide a more modern appearance that ties the building to the apartment building and garage further west on the site. The second level will offer the visitor two outdoor terraces, one at the west end and one in the middle. The outdoor terraces will provide the visitor with interesting views of Johnson Drive and surrounding area while also giving some “life” or a human element to the building itself.

The lower level of the building will be composed primarily of grey masonry that will bring the building together and compliment the other materials. A charcoal colored canopy with wood tone accents is proposed for most of the lower level. The canopy, in addition to the 2-story building, and overall use of materials and design, gives the building a human scale and presents an inviting area for pedestrians.

The primary entrance to the food hall will be on the west end of the building from the parking lot. The entrance will be set back from the front facades of the food hall and the Cinergy building providing an outdoor plaza area comprised of patterned concrete same as to what is to be used in the boardwalk around the apartment buildings on the west side of the site. This will further tie the entire site together.

The east end of the food hall is proposed to be an outdoor venue for dining and yard games. Delivery area for the food hall will be on the east side of the building with access from Roe Avenue.

All of these design elements fit well with the requirements of the Johnson Drive Design Guidelines and, in the opinion of staff, are far better than what had initially been proposed in the approved 2017 FDP.

Design and Material Palette - Office Building

The office building is located at the back of the site adjacent to Shawnee Mission Parkway. The approved 2017 FDP indicated a 3-story office building of 58,516 square feet. The developer is now requesting to amend this component of the project to a 4-story office building of 76,487 square feet. This would be additional 17,971 square feet. The Mixed-Use zoning does not specify height limitations, so the proposed additional story would be acceptable.

The ground level of the building will be mostly open to allow for vehicle circulation underneath

and future access to utilities. There will be a small entry point comprised of a vestibule, elevator, and stairway. Toward the back of the ground level there will be an area for service deliveries, storage, maintenance and mechanical equipment. A bike storage area for employees wishing to ride their bike to work will also be located here. The upper three levels are comprised of open office space. Floor plans are shown on sheet FDP-A114.

The exterior of the building (sheet FDP-A205) is comprised of an aluminum curtain wall system with different shades of glass windows throughout the upper three levels. This makes for an interesting interplay between the metal and glazing. A large prodema panel inset is proposed for the upper two levels of the east elevation of the building. This will create a point of interest for the building, especially for those driving west on Shawnee Mission Parkway. It will also soften the building and give it additional "texture."

The mechanical equipment on the roof of the building will be screened in on all four sides with metal box-rib panels. The base of the building (ground level) will be board formed concrete that will match other elements on the site by the apartment buildings and hotel, again tying the entire site together (please see sheet FDP-L106).

Design and Material Palette - Parking Structure

The initial parking structure in the approved 2017 FDP was three-levels and abutted both the hotel and the office building. The entrance to the hotel was proposed to be on the second level of the parking structure.

The developer and their design team has further refined the design of the parking structure and are now proposing a 4-level structure with a smaller overall footprint. The structure will no longer abutt the two buildings, but will instead be connected by walkways. A one-level walk-way will connect the parking structure to each of the apartment buildings as well as the hotel. A three-level walkway will connect the structure to the office building, one level for each level in the office building. See sheet FDP A204 for elevations of the parking structure.

The ground level of the parking structure will be mostly open for traffic circulation and parking underneath. There will be a single, two-way ramp in the middle of the garage and a two-way ramp access from the circular drive at the front of the hotel. Stairwells will be located on the exterior of the structure and will be clad in an aluminum bar gate screening. The sides of the walkways will also be screened with aluminum bar gate.

In addition, the screening has been changed from what was originally undulating, perforated panels to a large mesh panel. The panels will be installed on the side of the structure in such a manner as to create a "wave" appearance with the left side of each panel projecting out a bit from the right side (please see sheet FDP-A211). The proposed mesh panels will allow more natural daylight into the parking structure, than what the other panels would have. It will give a greater sense of "openness", which can add to one's sense of safety. This design will be more compliant with the crime prevention through environmental design (CPTED) standards that the City follows when every possible. Staff has discussed with the developer and design team the need for heightened security measures in the parking structure.

Reducing the footprint of the parking structure provided more light to interior spaces within the site. It also allowed for a swimming pool to be placed behind apartment building "E" on the north side of the site. The pool is for use by the apartment building residents.

Parking and Loading

The approved 2017 FDP provided for a total of 1,528 parking spaces over the entire project site.

Surface parking (including on-street parking) totaled 735 spaces and structured parking totaled 793 spaces. The amended FDP has reduced the number number of surface parking spaces to 649 while increasing the number of structured parking spaces to 808. The total number of parking spaces overall has been reduced by 71 spaces to 1,457. A reduction of 5%.

Surface parking includes angled parking spaces along Johnson Drive adjacent to street-level retail in Building “E”, a surface parking lot along Roeland Drive adjacent to street-level retail in Buildings “C” and “D”, and interior to the site in front of and below the parking structure. Generally all of the surface parking is earmarked for the retail component of the development project.

Parking on the second level of the garage is primarily for hotel patrons and employees working in the office building. The walkway to the hotel is at this level. Parking on the third level is primarily for apartment building residents and office building employees. The four walkways to the apartment buildings are all on this level. Parking on the fourth level of the parking structure is for office employees and retail overflow. There is a walkway from each level of the parking structure to the office building.

MXD zoning provides the following parking requirements:

- 1 parking space for 4 seats in restaurants and theaters. This would equate to 345 parking spaces for both the Cinergy building and food hall.
- 1 parking space for each hotel room plus 1 parking space for each four employees. This would equate to approximately 220 parking spaces.
- 1.5 parking spaces for each residential unit. This would equate to 252 parking spaces for the three apartment buildings.

These three uses total 817 required parking spaces. The MXD zoning is silent on parking requirements for office uses or other retail uses.

Section 425.020 - Minimum Space Requirements of the City’s zoning code provides the following parking requirements:

- 2.84 parking spaces per 1,000 square feet for general offices. This would equate to 217 parking spaces for the proposed office building
- 4 parking spaces per lane for bowling facilities. This would equate to 64 parking spaces for the bowling component of the Cinergy building.
- 3.5 parking spaces per 1,000 square feet of shopping center. This would equate to 189 for the small shop retail on the ground floor of the apartment buildings.

All uses above total 1,287 parking spaces. This is 170, or 13%, less than 1,457 parking spaces being proposed.

Refuse containment will be within a room at the ground level portion of the office building. A trash compactor is located in a brick trash enclosure behind the Cinergy building. A trash enclosure will also be located in the loading/service area of the food hall.

Truck turning movements have been evaluated and found to be sufficient.

On and Off Site Public Improvements

The developer is responsible for installation of streetscaping around the perimeter of the site, which includes sidewalks, street trees, benches, bike racks, and street lights, and for providing public improvements off-site (crosswalks, modifications to traffic signals, turn lanes, etc). Many of these components have been accounted for in the approved 2017 FDP.

A minimum 8-foot wide sidewalk clear zone along Johnson Drive must be provided in addition to adequate space for a streetscape amenity zone (street trees, tree wells, street lights, signage, etc.) and a seating area zone for any proposed outdoor restaurant space. The ideal minimum width for all zones combined is 20-feet from the street curb to the building wall. This becomes challenging given how closely Building “E” sits to Johnson Drive. The proposed food hall, however, provides for a generous setback from Johnson Drive that meets these requirements. Submitted plans indicate a 5-foot wide sidewalk proposed for the portion in front of the food hall. This should be an 8-foot wide sidewalk to be consistent with the sidewalk further west on Johnson Drive. A 5-foot wide sidewalk will be installed along Roe Avenue.

Street trees should be planted between the curb and walking path of the sidewalk space 50’ on center. Trees may be clustered to work about other streetscape features, but should be provided at a rate of 1:50’ of frontage. Irrigation will be provided for all street trees. Qualifying trees are shown in the table below.

| Frontage | Required Street Trees | 2017 Approve FDP | 2019 Amended FDP | Notes |
|---------------|-----------------------|------------------|------------------|--|
| Johnson Drive | 21 | 15 | 21 | On-street parking and limited width along Building E reduce the number of trees provided. Adequate width should be provided and the number of trees increased. |
| Roe Avenue | 10 | 4 | 10 | Additional evergreen trees are proposed in place of shade trees. Screening is a priority in this corridor. |
| Roeland Drive | 21 | 21 | 21 | Trees must be located between back of curb and sidewalk. |

Most of the trees along Johnson Drive are clustered in front of the food hall. This may block out the food hall when fully grown and with full foliage. The numbers of trees could be reduced and spread out a bit more to the requirement of 50 feet on center. Plans note a planting bed between the sidewalk, and the walkway around the front of the building. Planting beds are also located in the courtyard plaza in front of the food hall. Plans also note a bench, trash receptacle and bike rack at the along the paved area area in front of the food hall.

Plans do not detail street lights, but these should be in accordance with the East Gateway Streetscape design standard, which is used elsewhere on the site.

Street trees are provided along Roe Avenue. And, a combination of shade trees and ornamental trees are proposed in the green area behind the hotel along Shawnee Mission Parkway.

Signage

The City’s Sign Code does not specify any signs by right in the “MXD” Planned Mixed Use District. Instead, the Code requires shopping centers to establish private sign criteria governing all exterior signs in the development and that the Planning Commission review and approve these criteria as part of a final site plan approval. The intent of the City’s sign code is to ensure

harmony and visual quality throughout the development. After approval, no sign permit will be issued by the City for a sign that does not conform to the criteria.

The developer will need to provide a sign criteria document for consideration in the future.

Public Transportation

The transit stop along the northeast side of the Gateway site is part of the system of newly enhanced bus facilities installed in the Metcalf Ave/Shawnee Mission Parkway corridor as part of a federal TIGER grant. The transit stop is served by proposed sidewalks along the south side of Johnson Drive and west side of Roe Avenue.

Rock Creek Trail Extension

The approved 2017 FDP called for a continuation of the Rock Creek Trail from Martway Street to the Roeland Drive/Johnson Drive intersection is required. The approved plans identify crosswalks at both intersections and a 10-ft wide sidewalk along the east side of Roeland Drive north of the Martway intersection, continuing north across Johnson Drive to Roeland Park.

Access Management & Traffic Impact

Access into the site is proposed from six access points, three on Roeland Drive, one on Johnson Drive, and two on Roe Avenue. The driveway access to the back of the Cinergy building off of Roe Avenue has been narrowed. All street intersections surrounding the subject property are currently signalized.

The applicant has submitted an update to the previous traffic impact study analyzing existing conditions, conditions in accordance with the approved 2017 FDP, and conditions with the proposed amendment to the FDP. The traffic impact study has made the following recommendations, which can be found on page 37 of the study.

1. Lengthen the eastbound left turn lane at Shawnee Mission Parkway and Roeland Drive from the current 330 feet to 390 feet to provide for deceleration and additional queuing.
2. Re-time signals at the intersections of Shawnee Mission Parkway with Roeland Drive and Roe Avenue with Johnson Drive to accommodate development trips.
3. Re-stripe the north leg of the intersection of Shawnee Mission Parkway and Roeland Drive to provide a dedicated southbound left-turn lane, shared through/left-turn lane, and dedicated southbound right-turn lane.
4. Modify the curb radius in the northeast quadrant of the intersection of Shawnee Mission Parkway and Roeland Drive to support large trucks. Provide turning templates and specific demission to Kansas Department of Transportation with final design.
5. The existing pavement markings for the outside through lane along Shawnee Mission Parkway at Roeland Drive should be restriped to provide an appropriate taper for the existing outside westbound lane. Turn lane including taper should be 350' in length to accommodate right-turn vehicles decelerating from 45 mph.
6. Extend the median along Roe Avenue to limit right-in/right-out access at Drives 5 and 6.
7. Provide appropriate corner radii at Drives 5 and 6 to accommodate truck traffic.
8. Provide a 100' southbound right-turn lane at Drive 5 along Roe Avenue.
9. Minimum throat distance of 75' should be provided at each proposed drive to allow for vehicles to stack internal the site without effecting vehicles maneuvering within the site.
10. Pedestrian accommodations should be provided along the north and west legs at the intersection of Shawnee Mission Parkway and Roeland Drive. Accommodations should conform with ADA standards, this includes adequate ramp design with detectable warnings and vibrotactile push buttons.

In addition, conditions should be re-evaluated in 15 to 20 years with the following possible recommendations in mind.

1. If volumes materialize in the future, it is recommended to consider the following improvements to improve operations at the intersection of Shawnee Mission Parkway and Roeland Drive:
2. Provide dual eastbound left turn lanes with 350' of storage.
3. Provide dedicated northbound left-turn lane with 100' of storage.
4. Provide dedicated westbound right-turn lane with 230' of storage.
5. Update signal timings.

The City's on-call traffic engineer, George Butler Associates (GBA), has reviewed the applicant's revised Traffic Impact study and the final site plans as well as the Kansas Department of Transportation. GBA accepts the applicant's proposed improvements as adequate for the expected traffic impacts of development of the site.

Stormwater Management

A multi-barrel reinforced concrete box (RCB) drainage system was installed across the site underground for this portion of Rock Creek. The RCB's were designed to convey the 100 year storm event and a letter of map revision (LOMR) has been approved by FEMA taking the property out of the flood zone. Therefore a floodplain permit is not required. Storm sewers for the site will direct water into this system at various locations and surface grading will direct overflows.

The City's on-call engineer at GBA has reviewed the Drainage Study and the proposed final site plans for storm water control. This included consideration of the amount of impervious surface in the development scenario, peak water flows after rain storms, and the location of below ground development features in relation to existing storm sewers. A reduction in the amount of impervious surface has been demonstrated by the addition of green space compared to the existing (pre-demolition) condition. The layout of any pier footings for the new buildings will be reviewed against the pier plan used during the construction of the RCB's. Venting for the proper function of the RCB's will be taken into consideration with the design of the parking structure and the food hall as part of building permit review.

Consideration of Final Site Plans (440.160 & 440.190)

Final site plans which contain modifications from the approved preliminary development plan but which are in substantial compliance with the preliminary plan, may be approved by the Planning Commission without a public hearing, provided that the Commission determines that the landscaping and screening plan is adequate and that all other submission requirements have been satisfied. In addition the site plan shall be approved by the Planning Commission if it determines that:

1. The site is capable of accommodating the building(s), parking areas and drives with appropriate open space.

-The building, parking area, driveways, and open space have been designed to meet codes and guidelines and have been reviewed by the City's engineers.

2. The plan provides for safe and easy ingress, egress and internal traffic circulation.

-There is adequate space on the site to allow for on-site circulation of customer traffic and design vehicles. Impacts to traffic on adjacent public streets has been studied Traffic Impact

Statement (TIS) and endorsed by City's engineers with stipulations.

3. The plan is consistent with good land planning and site engineering design principles.

-The proposed plan is consistent with the City's zoning and site development standards with the stipulations noted.

4. An appropriate degree of harmony will prevail between the architectural quality of the proposed building(s) and the surrounding neighborhood.

-The proposed project is of high quality design and adds to the diverse architecture of the surrounding area.

5. The plan represents an overall development pattern that is consistent with the Comprehensive Plan and other adopted planning policies.

-The proposed mixed use development is consistent in density and design with the City's adopted plans and policies.

6. Right-of-way for any abutting thoroughfare has been dedicated pursuant to the provisions of Chapter 455.

-A plat reflecting the proposed development pattern has not been submitted. One has been submitted to the City for review and is anticipated to be presented to the Planning Commission next month for consideration. Any required right-of-way changes for this site will be addressed at that time.

Staff Recommendation

While the development is generally in conformance with the approved preliminary site plan and site planning requirements, several details do remain unresolved.

Therefore, Staff recommends the Planning Commission approve the Amendment to the Final Site Development Plan Case # 19-06 for the Gateway development project with the following conditions:

1. Plans will need to be presented to the City and/or the Kansas Department of Transportation in accordance with the recommendations outlined in the Traffic Impact Study.
2. Submit a revised final site plan for staff review and approval showing the following:
 - a. Increase the width of the paved sidewalk along Johnson Drive in front of the food hall to 8 feet to be consistent with the rest of the sidewalk along Johnson Drive in front of the project site.
 - b. Reduce the number of street trees provided along Johnson Drive in front of the food hall so that trees are 50 feet on center.
3. Prior to the issuance of any building permits, a revised final plat must be approved by the City. Right-of-way should be dedicated including all on-street parking areas, sidewalks, and public infrastructure along Roeland Drive, Johnson Drive, and Roe Avenue.
4. Prior to building permit issuance for any building spanning the RCB's, demonstrate

venting for the proper function of the RCB's will be taken into consideration and that any piers or footings will not impact the facility.

5. Submission of a revised Private Sign Criteria to the Planning Commission for approval.

Planning Commission Actions

The Planning Commission will consider this application at their October 28,2019 meeting.



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Mission Gateway

A Multi-Use Retail Development
 Johnson Drive and Roe Avenue, Mission, Kansas

FINAL DEVELOPMENT PLAN
 MARCH 17, 2017
 REVISIONS
 UPDATES TO APPROVED FDP 09.16.2019

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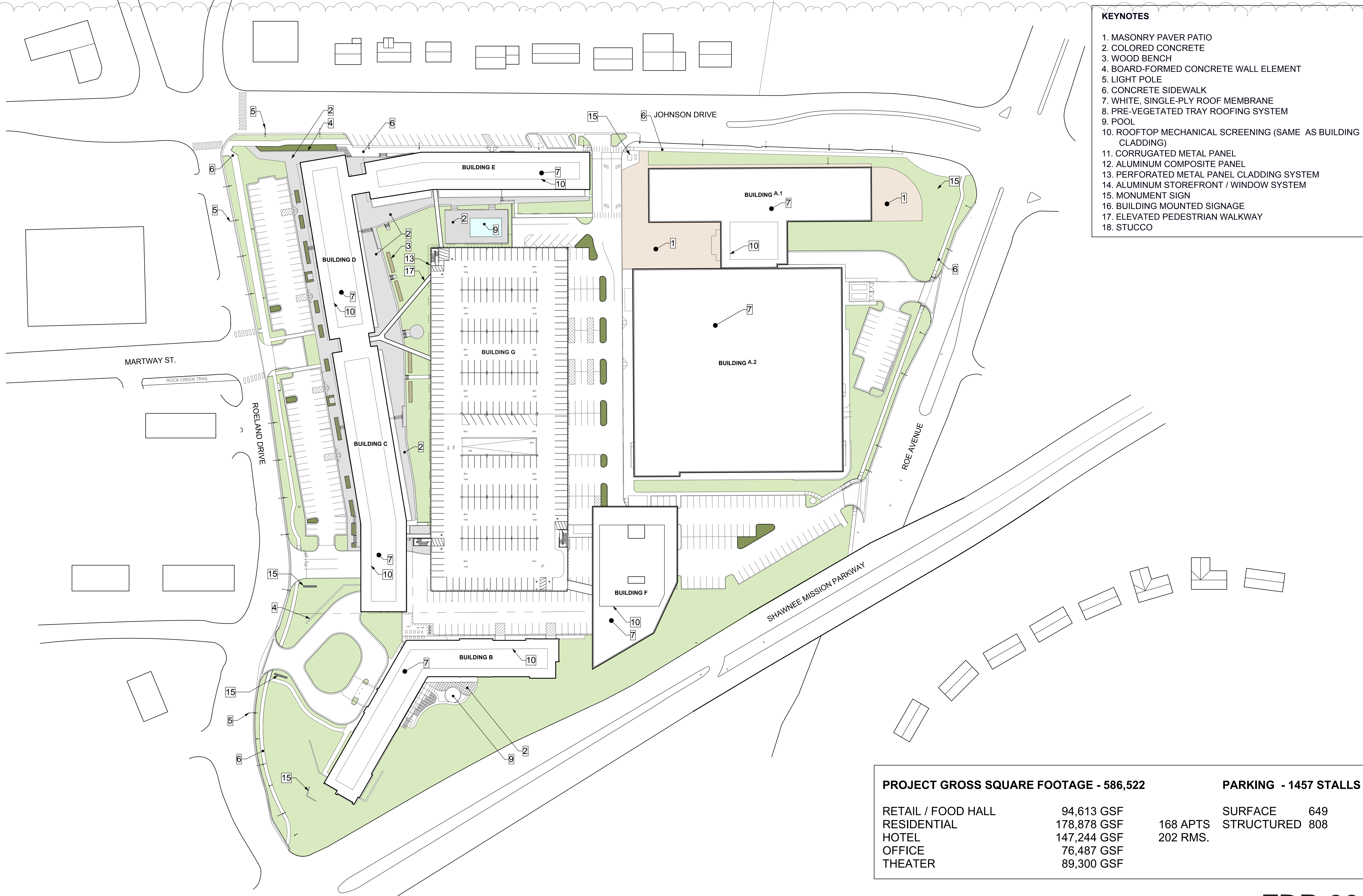
MISSION GATEWAY

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- KEYNOTES**
1. MASONRY PAVER PATIO
 2. COLORED CONCRETE
 3. WOOD BENCH
 4. BOARD-FORMED CONCRETE WALL ELEMENT
 5. LIGHT POLE
 6. CONCRETE SIDEWALK
 7. WHITE, SINGLE-PLY ROOF MEMBRANE
 8. PRE-VEGETATED TRAY ROOFING SYSTEM
 9. POOL
 10. ROOFTOP MECHANICAL SCREENING (SAME AS BUILDING CLADDING)
 11. CORRUGATED METAL PANEL
 12. ALUMINUM COMPOSITE PANEL
 13. PERFORATED METAL PANEL CLADDING SYSTEM
 14. ALUMINUM STOREFRONT / WINDOW SYSTEM
 15. MONUMENT SIGN
 16. BUILDING MOUNTED SIGNAGE
 17. ELEVATED PEDESTRIAN WALKWAY
 18. STUCCO



| | | | |
|---|-------------|------------------------------|----------------|
| PROJECT GROSS SQUARE FOOTAGE - 586,522 | | PARKING - 1457 STALLS | |
| RETAIL / FOOD HALL | 94,613 GSF | | SURFACE 649 |
| RESIDENTIAL | 178,878 GSF | 168 APTS | STRUCTURED 808 |
| HOTEL | 147,244 GSF | 202 RMS. | |
| OFFICE | 76,487 GSF | | |
| THEATER | 89,300 GSF | | |

01 SITE PLAN

FINAL DEVELOPMENT PLAN
 MARCH 17, 2017
 REVISIONS
 UPDATES TO APPROVED FDP 09.16.2019

CONSULTANTS:

| | | |
|--|--|---|
| CIVIL / LANDSCAPE: OLSSON ASSOCIATES 7301 WEST 153RD ST., SUITE 200 OVERLAND PARK, KANSAS 66213 TEL: 913-381-1170 FAX: 913-381-1174 | ME/P: PKMR ENGINEERS 13300 W. 88TH ST. LENEXA, KANSAS 66215 TEL: 913-492-2400 FAX: 913-492-2437 | STRUCTURAL: BOB D. CAMPBELL & CO., INC. 4338 BELLEVUE AVE. KANSAS CITY, MISSOURI 64111 TEL: 816-531-4144 FAX: 816-531-8572 |
|--|--|---|

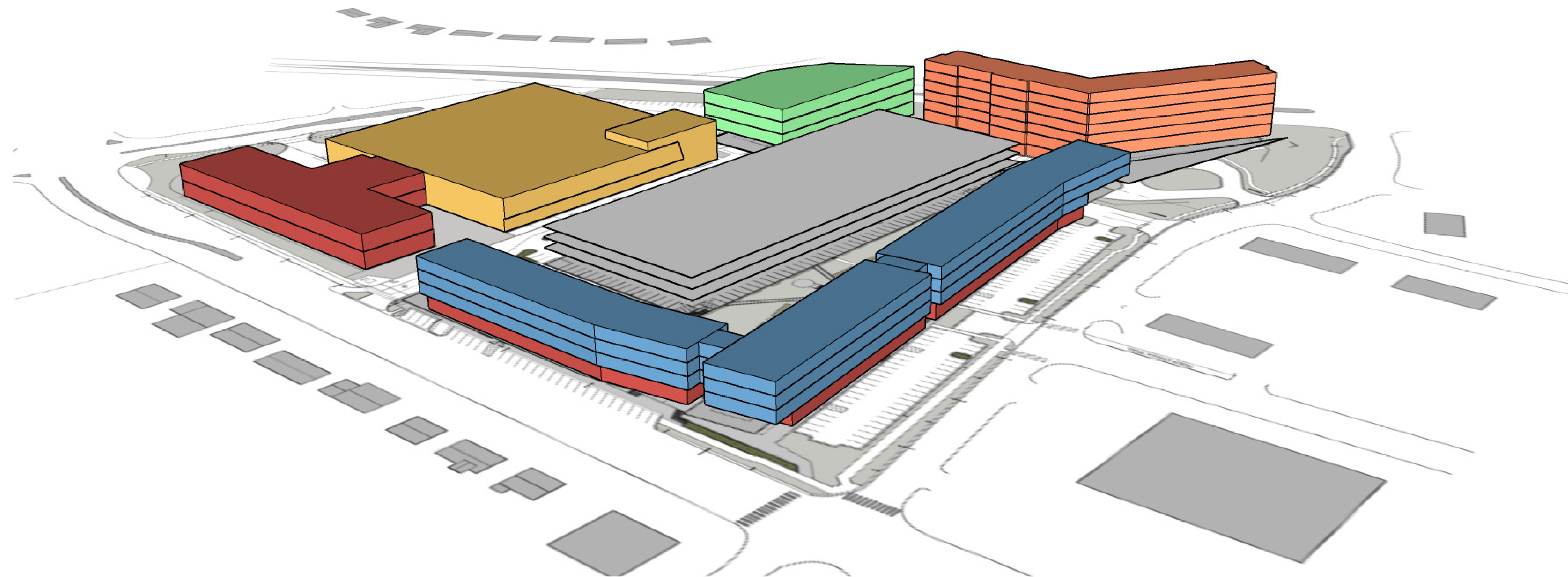
MISSION GATEWAY

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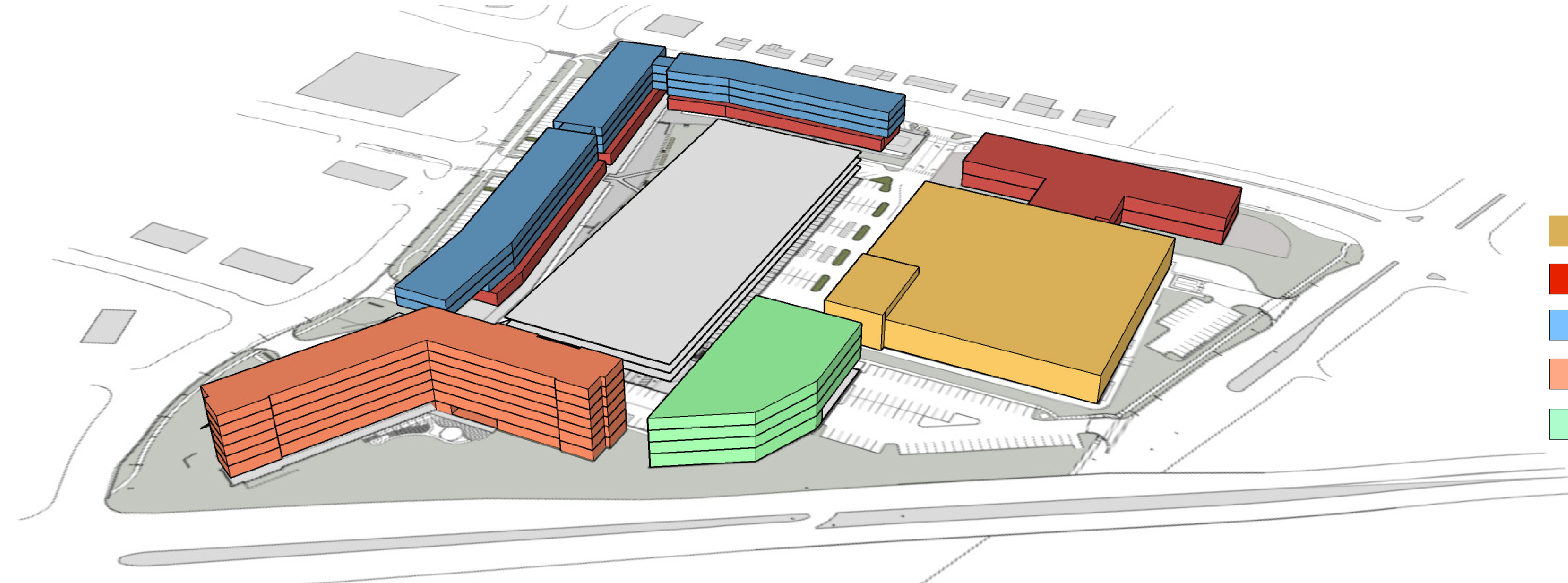
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FDP-001
SITE PLAN



STACKING DIAGRAM



STACKING DIAGRAM

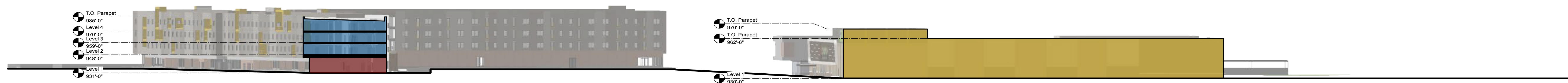
- THEATER
- RETAIL
- RESIDENTIAL
- HOTEL
- OFFICE

CONSULTANTS:

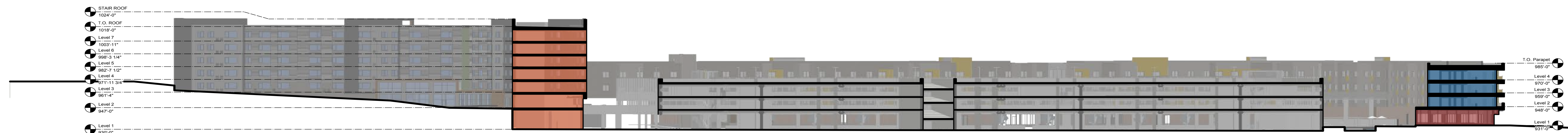
CIVIL / LANDSCAPE:
 OLSSON ASSOCIATES
 7501 WEST 153RD ST. SUITE 200
 OVERLAND PARK, KANSAS 66213
 TEL: 913-381-1170
 FAX: 913-381-1174

ME/P ENGINEERS:
 PKMR ENGINEERS
 13300 W. 98TH ST.
 LENEXA, KANSAS 66215
 TEL: 913-492-2400
 FAX: 913-492-2437

STRUCTURAL:
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 4338 BELLEVUE AVE.
 KANSAS CITY, MISSOURI 64111
 TEL: 816-531-4144
 FAX: 816-531-8572



02 SITE SECTION



01 SITE SECTION

- THEATER
- RETAIL
- RESIDENTIAL
- HOTEL
- OFFICE

FDP-003

FINAL DEVELOPMENT PLAN
 MARCH 17, 2017
 REVISIONS
 UPDATES TO APPROVED FDP 09.16.2019

CONSULTANTS:

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|---|---|--|
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|---|---|--|

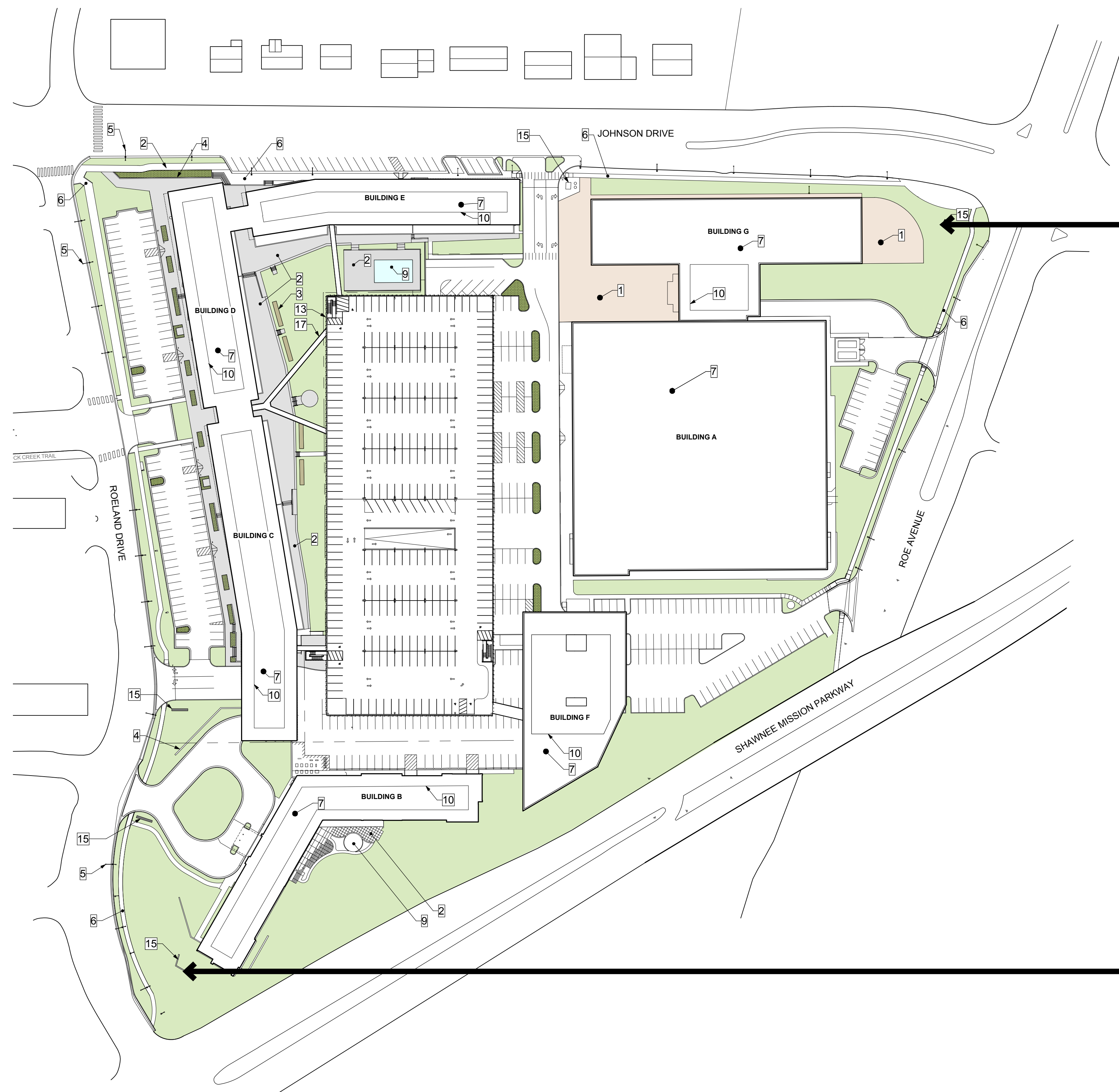
BUILDING & SITE SECTIONS

MISSION GATEWAY

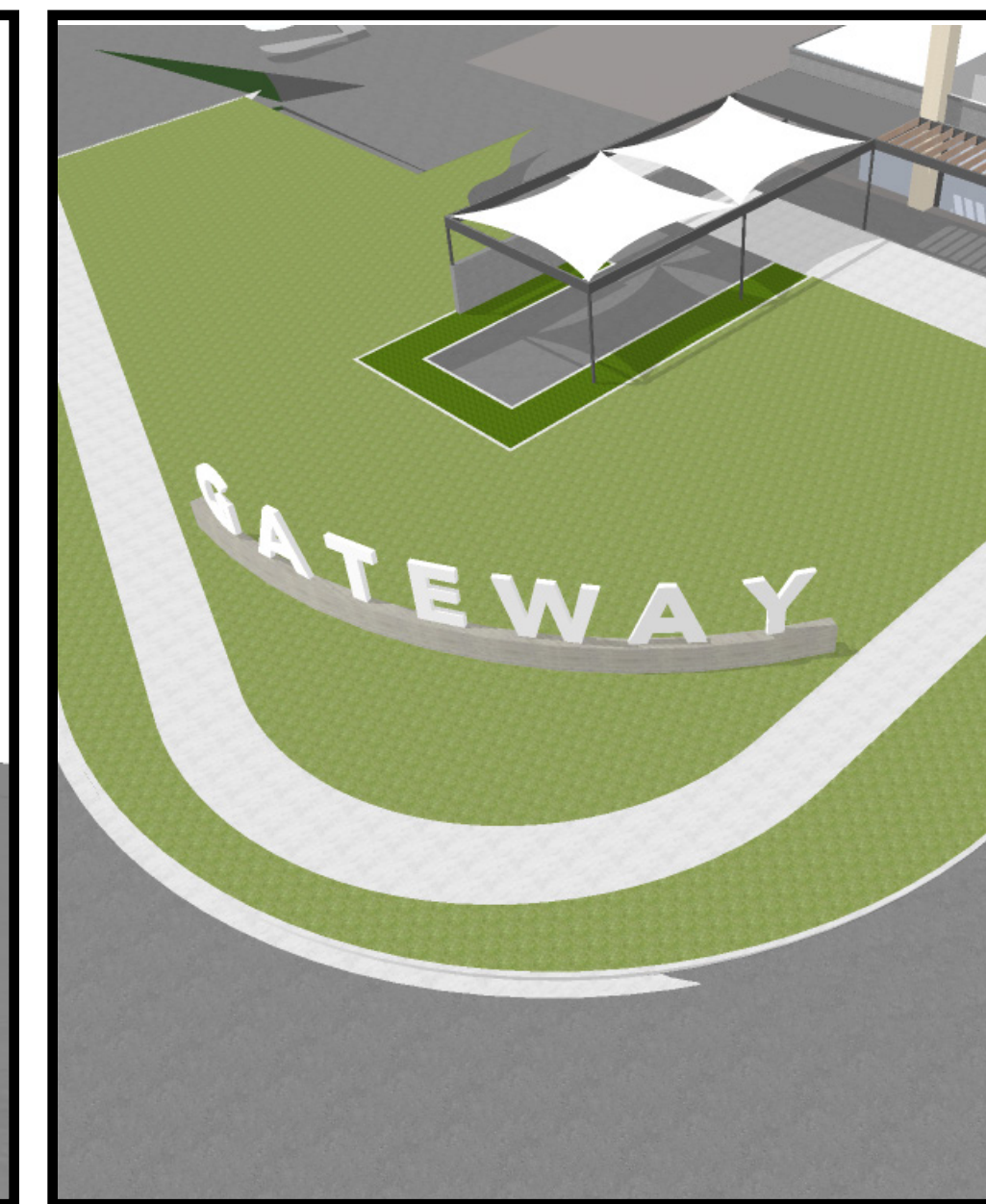
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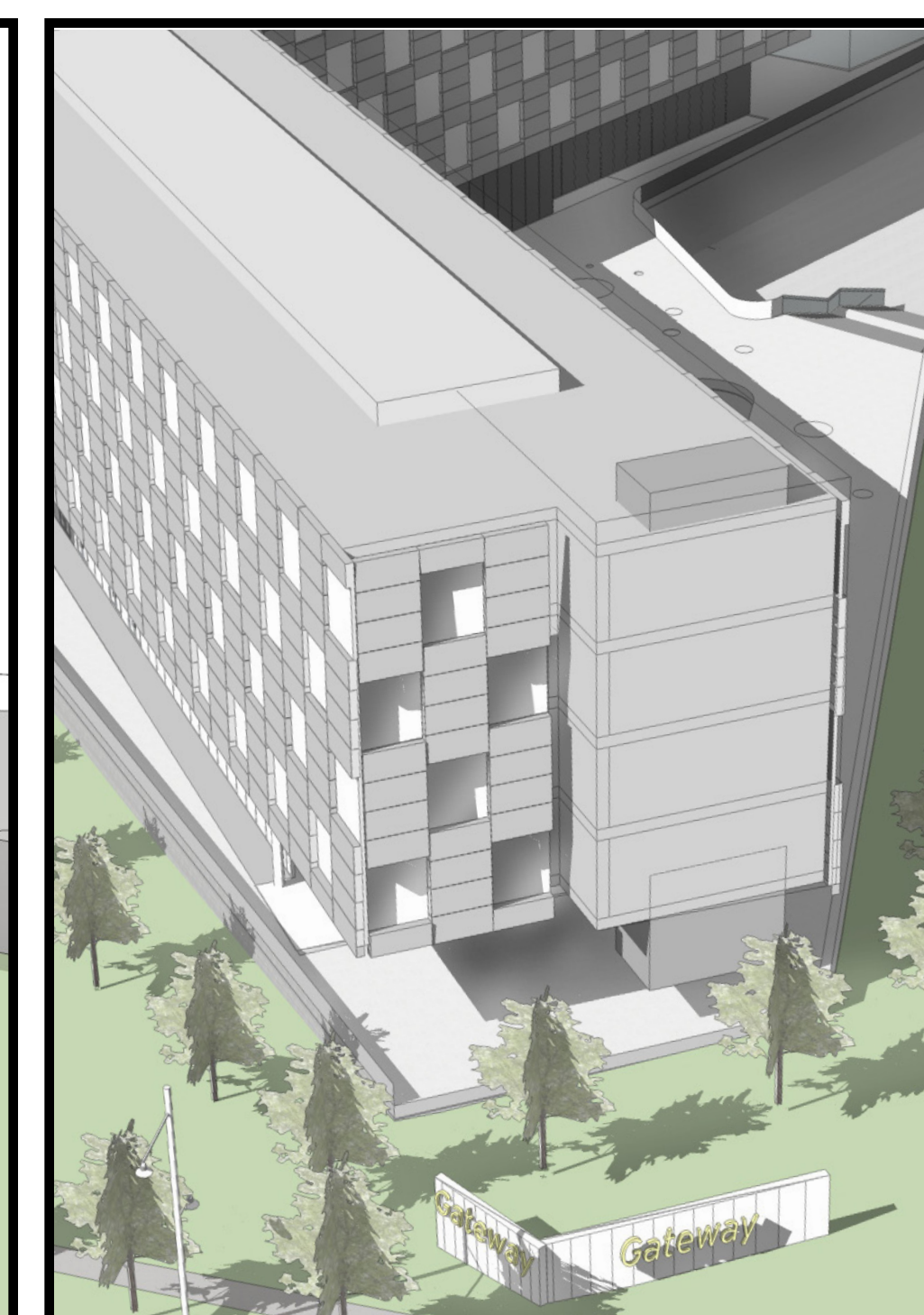
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Northeast Monument Sign



Southwest Monument Sign



CONSULTANTS:

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OVERLAND PARK, KANSAS 66213
TEL: 913-381-1170
FAX: 913-381-1174

ME/P ENGINEERS
PKMR ENGINEERS
13300 W. 98TH ST.
LENEXA, KANSAS 66215
TEL: 913-492-2400
FAX: 913-492-2437

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FAX: 816-531-8572

MISSION GATEWAY

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VIEW FROM NORTHWEST OF RETAIL / RESIDENTIAL



VIEW OF RETAIL / RESIDENTIAL COURTYARD



AERIAL FROM JOHNSON DRIVE ENTRY



VIEW OF POOL / RESIDENTIAL COURTYARD

CONSULTANTS:

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 OLSSON ASSOCIATES
 7301 WEST 153RD ST. SUITE 200
 OVERLAND PARK, KANSAS 66213
 TEL: 913-381-1170
 FAX: 913-381-1174

ME/P ENGINEERS
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 13300 W. 98TH ST.
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 4338 BELLEVUE AVE.
 KANSAS CITY, MISSOURI 64111
 TEL: 816-531-4144
 FAX: 816-531-8572



AERIAL FROM SOUTHEAST - SHAWNEE MISSION PARKWAY



AERIAL FROM NORTHEAST - ROE AVE. JOHNSON DRIVE



AERIAL FROM SOUTHWEST - ROELAND DRIVE AND SHAWNEE MISSION PARKWAY



AERIAL FROM NORTHWEST - JOHNSON DRIVE AND ROELAND DRIVE

CONSULTANTS:

CIVIL / LANDSCAPE:
OLSSON ASSOCIATES
7301 WEST 153RD ST. SUITE 200
OVERLAND PARK, KANSAS 66213
TEL: 913-381-1170
FAX: 913-381-1174

MEP ENGINEERS:
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MISSION GATEWAY

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OLSSON
ASSOCIATES

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ENGINEERS

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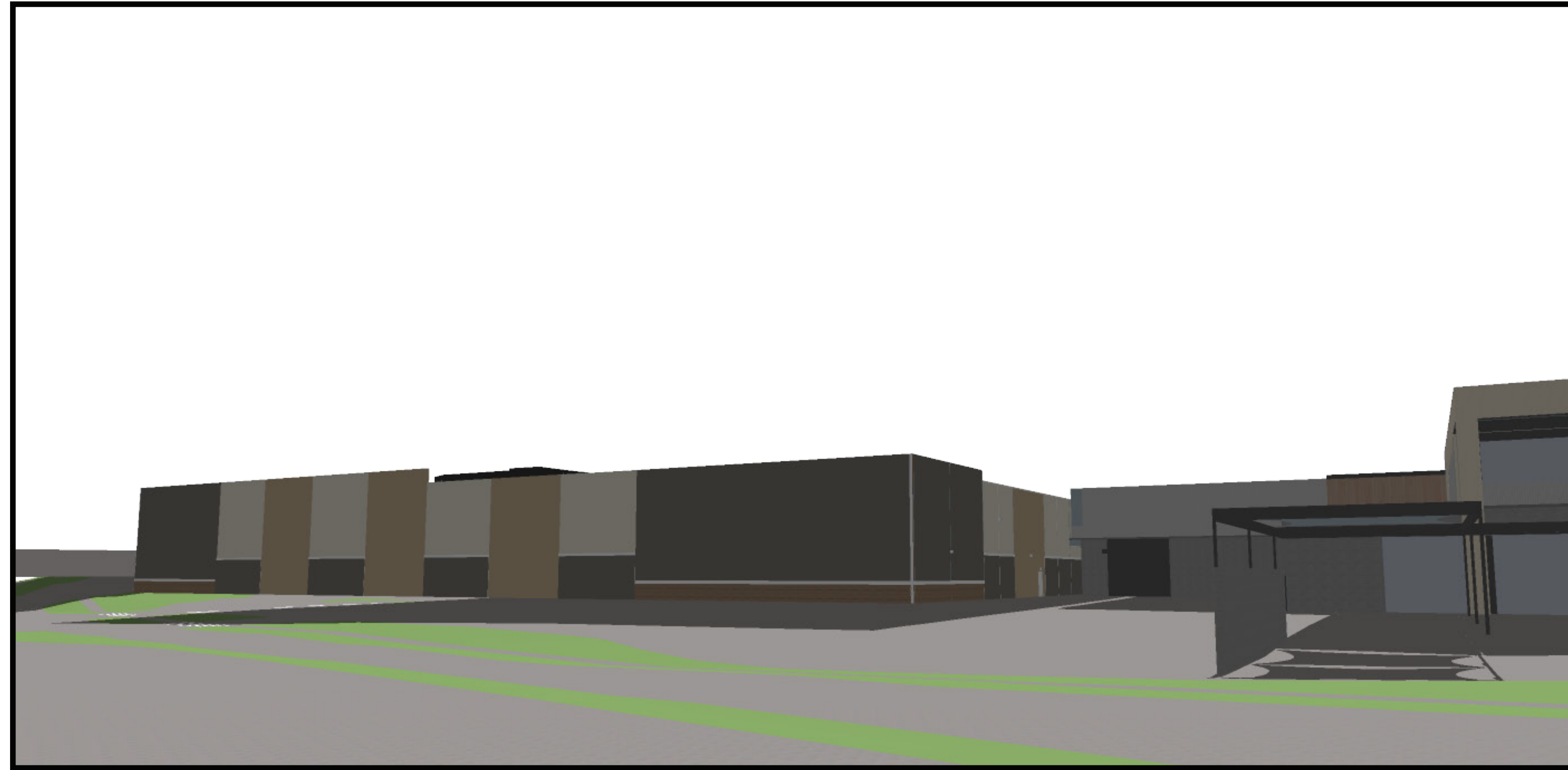
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STREET LEVEL VIEW - ENTRY AT JOHNSON DRIVE



STREET LEVEL VIEW - VIEW OF SITE FROM SHAWNEE MISSION PARKWAY LOOKING WEST



STREET LEVEL VIEW - VIEW OF SITE FROM CORNER OF JOHNSON DRIVE AND ROE AVE,



STREET LEVEL VIEW - VIEW OF SITE FROM CORNER OF ROELAND AND SHAWNEE MISSION PARKWAY

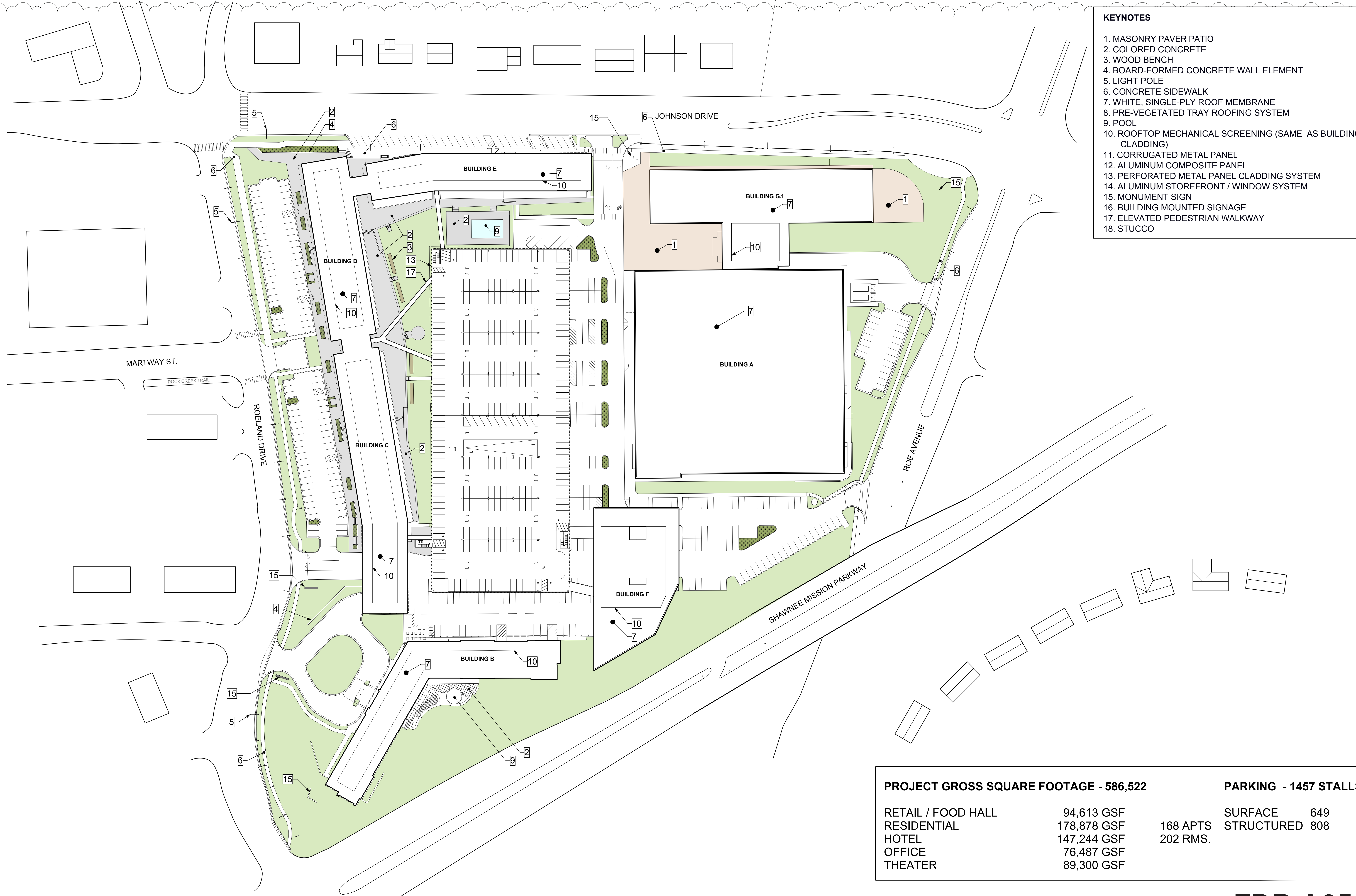
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CIVIL / LANDSCAPE:
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STRUCTURAL:
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4338 BELLEVUE AVE.
KANSAS CITY, MISSOURI 64111
TEL: 816-531-4144
FAX: 816-531-8572

- KEYNOTES**
1. MASONRY PAVER PATIO
 2. COLORED CONCRETE
 3. WOOD BENCH
 4. BOARD-FORMED CONCRETE WALL ELEMENT
 5. LIGHT POLE
 6. CONCRETE SIDEWALK
 7. WHITE, SINGLE-PLY ROOF MEMBRANE
 8. PRE-VEGETATED TRAY ROOFING SYSTEM
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 10. ROOFTOP MECHANICAL SCREENING (SAME AS BUILDING CLADDING)
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 16. BUILDING MOUNTED SIGNAGE
 17. ELEVATED PEDESTRIAN WALKWAY
 18. STUCCO



| | | | |
|---|-------------|------------------------------|----------------|
| PROJECT GROSS SQUARE FOOTAGE - 586,522 | | PARKING - 1457 STALLS | |
| RETAIL / FOOD HALL | 94,613 GSF | 168 APTS | SURFACE 649 |
| RESIDENTIAL | 178,878 GSF | 202 RMS. | STRUCTURED 808 |
| HOTEL | 147,244 GSF | | |
| OFFICE | 76,487 GSF | | |
| THEATER | 89,300 GSF | | |

01 SITE PLAN

FINAL DEVELOPMENT PLAN
 MARCH 17, 2017
 REVISIONS
 UPDATES TO APPROVED FDP 09.16.2019

FDP-A050
SITE PLAN

CONSULTANTS:

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|--|---|--|

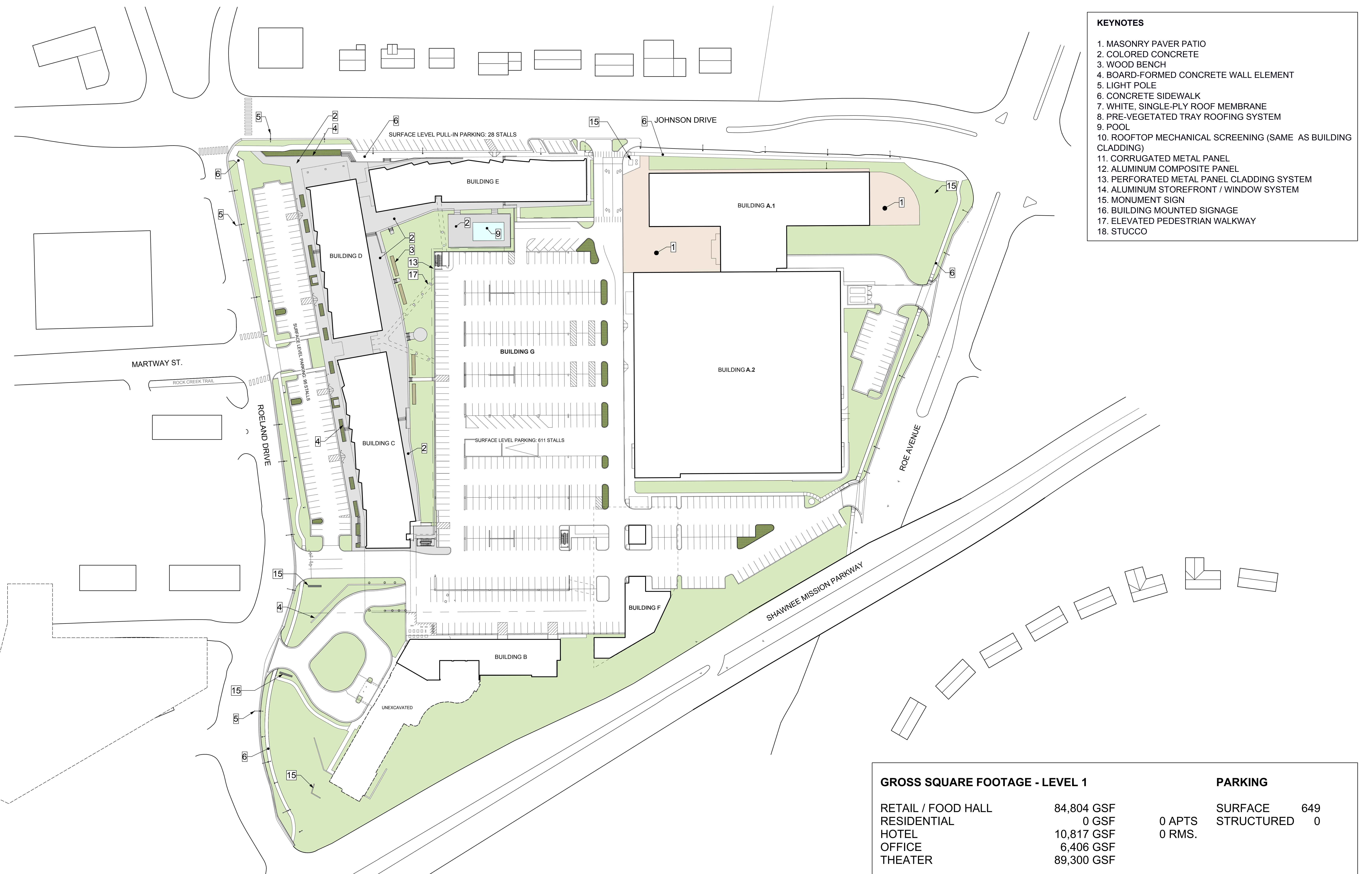
MISSION GATEWAY

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- KEYNOTES**
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 3. WOOD BENCH
 4. BOARD-FORMED CONCRETE WALL ELEMENT
 5. LIGHT POLE
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 14. ALUMINUM STOREFRONT / WINDOW SYSTEM
 15. MONUMENT SIGN
 16. BUILDING MOUNTED SIGNAGE
 17. ELEVATED PEDESTRIAN WALKWAY
 18. STUCCO



| GROSS SQUARE FOOTAGE - LEVEL 1 | | PARKING | |
|--------------------------------|------------|---------|--------------|
| RETAIL / FOOD HALL | 84,804 GSF | 0 APTS | SURFACE 649 |
| RESIDENTIAL | 0 GSF | 0 RMS. | STRUCTURED 0 |
| HOTEL | 10,817 GSF | | |
| OFFICE | 6,406 GSF | | |
| THEATER | 89,300 GSF | | |

01 SITE PLAN - LEVEL 1

FINAL DEVELOPMENT PLAN
 MARCH 17, 2017
 REVISIONS
 UPDATES TO APPROVED FDP 09.16.2019

CONSULTANTS:

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MISSION GATEWAY

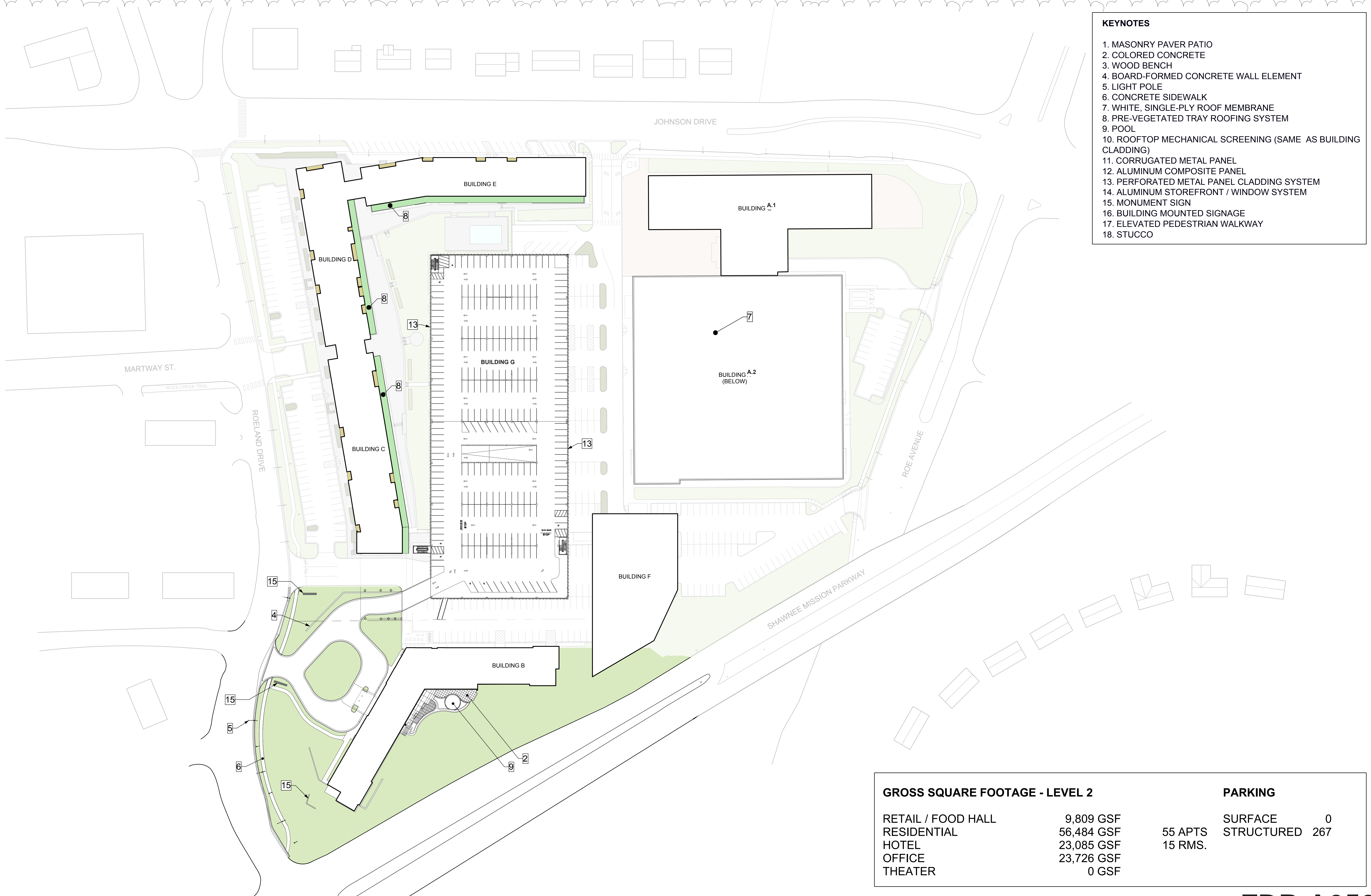
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FDP-A051
SITE PLAN (LEVEL 1)

- KEYNOTES**
1. MASONRY PAVER PATIO
 2. COLORED CONCRETE
 3. WOOD BENCH
 4. BOARD-FORMED CONCRETE WALL ELEMENT
 5. LIGHT POLE
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 14. ALUMINUM STOREFRONT / WINDOW SYSTEM
 15. MONUMENT SIGN
 16. BUILDING MOUNTED SIGNAGE
 17. ELEVATED PEDESTRIAN WALKWAY
 18. STUCCO



| GROSS SQUARE FOOTAGE - LEVEL 2 | | PARKING | |
|--------------------------------|------------|--------------------|-----|
| RETAIL / FOOD HALL | 9,809 GSF | SURFACE | 0 |
| RESIDENTIAL | 56,484 GSF | 55 APTS STRUCTURED | 267 |
| HOTEL | 23,085 GSF | 15 RMS. | |
| OFFICE | 23,726 GSF | | |
| THEATER | 0 GSF | | |

01 SITE PLAN - LEVEL 2

FINAL DEVELOPMENT PLAN
 MARCH 17, 2017
 REVISIONS
 UPDATES TO APPROVED FDP 09.16.2019

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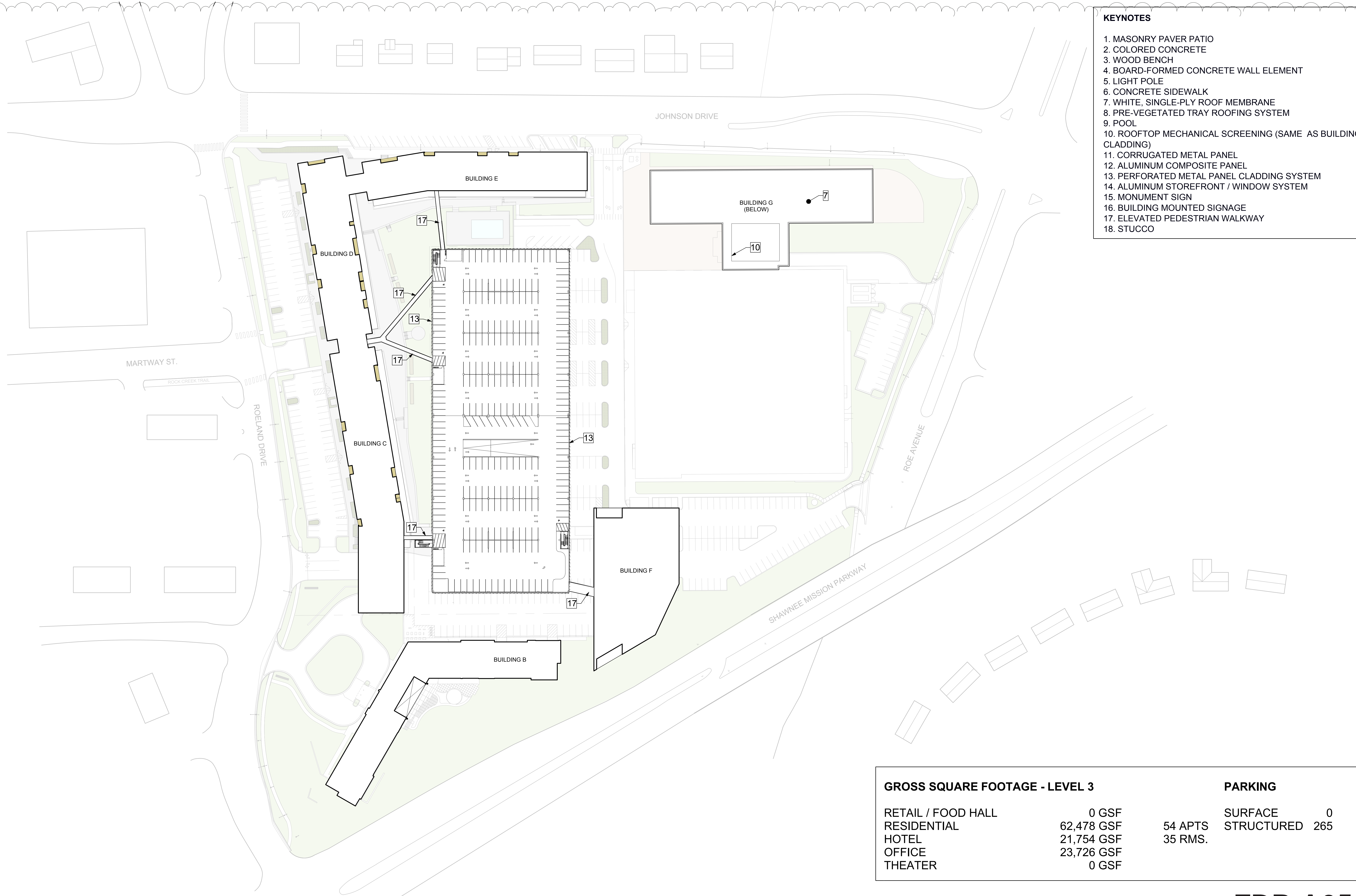
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FDP-A052
SITE PLAN (LEVEL 2)



- KEYNOTES**
1. MASONRY PAVER PATIO
 2. COLORED CONCRETE
 3. WOOD BENCH
 4. BOARD-FORMED CONCRETE WALL ELEMENT
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 14. ALUMINUM STOREFRONT / WINDOW SYSTEM
 15. MONUMENT SIGN
 16. BUILDING MOUNTED SIGNAGE
 17. ELEVATED PEDESTRIAN WALKWAY
 18. STUCCO

| GROSS SQUARE FOOTAGE - LEVEL 3 | | PARKING | |
|--------------------------------|------------|------------|-----|
| RETAIL / FOOD HALL | 0 GSF | SURFACE | 0 |
| RESIDENTIAL | 62,478 GSF | STRUCTURED | 265 |
| HOTEL | 21,754 GSF | | |
| OFFICE | 23,726 GSF | | |
| THEATER | 0 GSF | | |

01 SITE PLAN - LEVEL 3

FINAL DEVELOPMENT PLAN
 MARCH 17, 2017
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 UPDATES TO APPROVED FDP 09.16.2019

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|---|---|---|

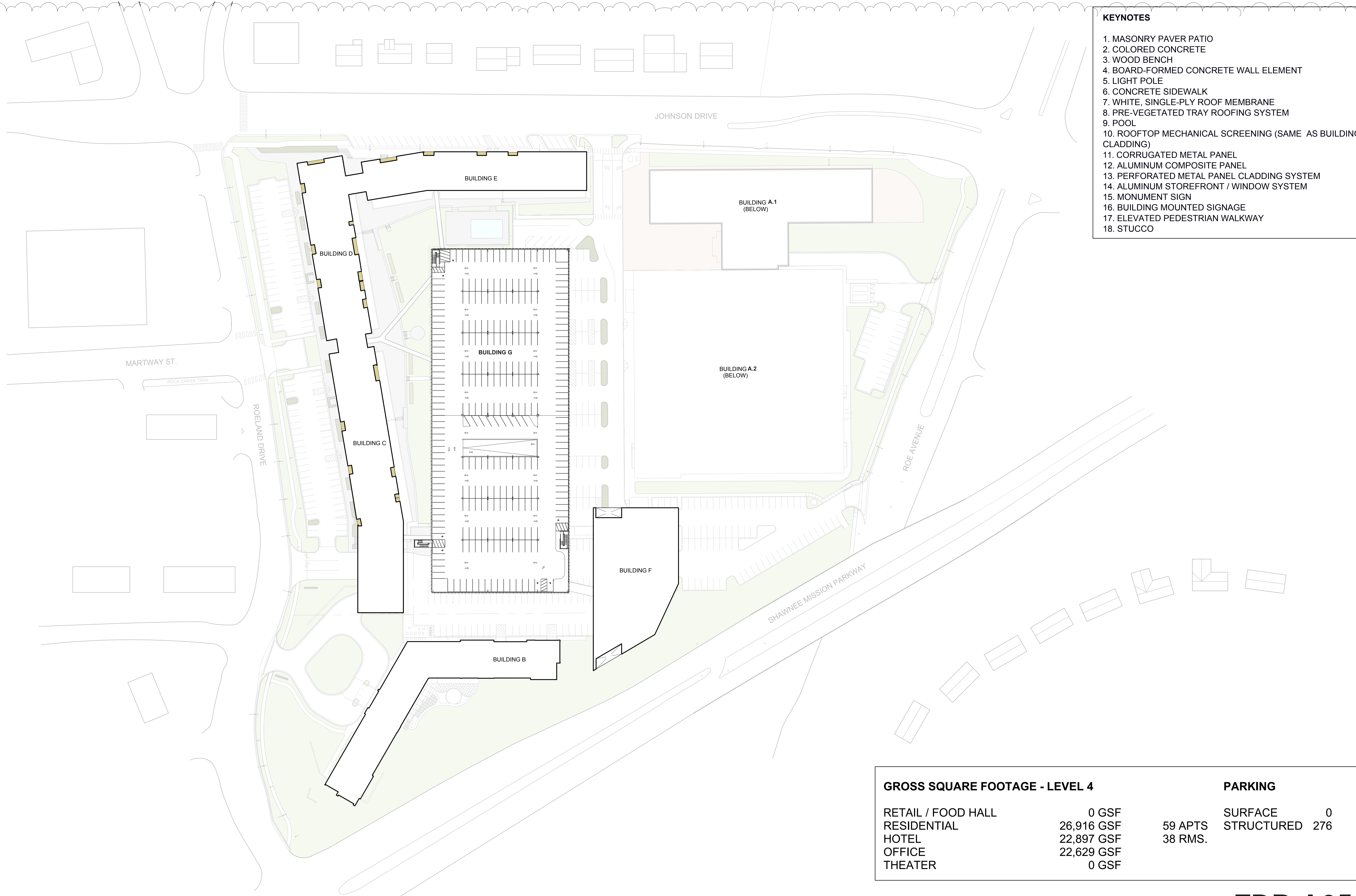
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FDP-A053
 SITE PLAN (LEVEL 3)



- KEYNOTES**
1. MASONRY PAVER PATIO
 2. COLORED CONCRETE
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 4. BOARD-FORMED CONCRETE WALL ELEMENT
 5. LIGHT POLE
 6. CONCRETE SIDEWALK
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 14. ALUMINUM STOREFRONT / WINDOW SYSTEM
 15. MONUMENT SIGN
 16. BUILDING MOUNTED SIGNAGE
 17. ELEVATED PEDESTRIAN WALKWAY
 18. STUCCO

| GROSS SQUARE FOOTAGE - LEVEL 4 | | PARKING | |
|--------------------------------|------------|---------|----------------|
| RETAIL / FOOD HALL | 0 GSF | SURFACE | 0 |
| RESIDENTIAL | 26,916 GSF | 59 APTS | STRUCTURED 276 |
| HOTEL | 22,897 GSF | 38 RMS. | |
| OFFICE | 22,629 GSF | | |
| THEATER | 0 GSF | | |

01 SITE PLAN - LEVEL 4

FINAL DEVELOPMENT PLAN
 MARCH 17, 2017
 REVISIONS
 UPDATES TO APPROVED FDP 09.16.2019

CONSULTANTS:

| | | |
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|---|--|---|

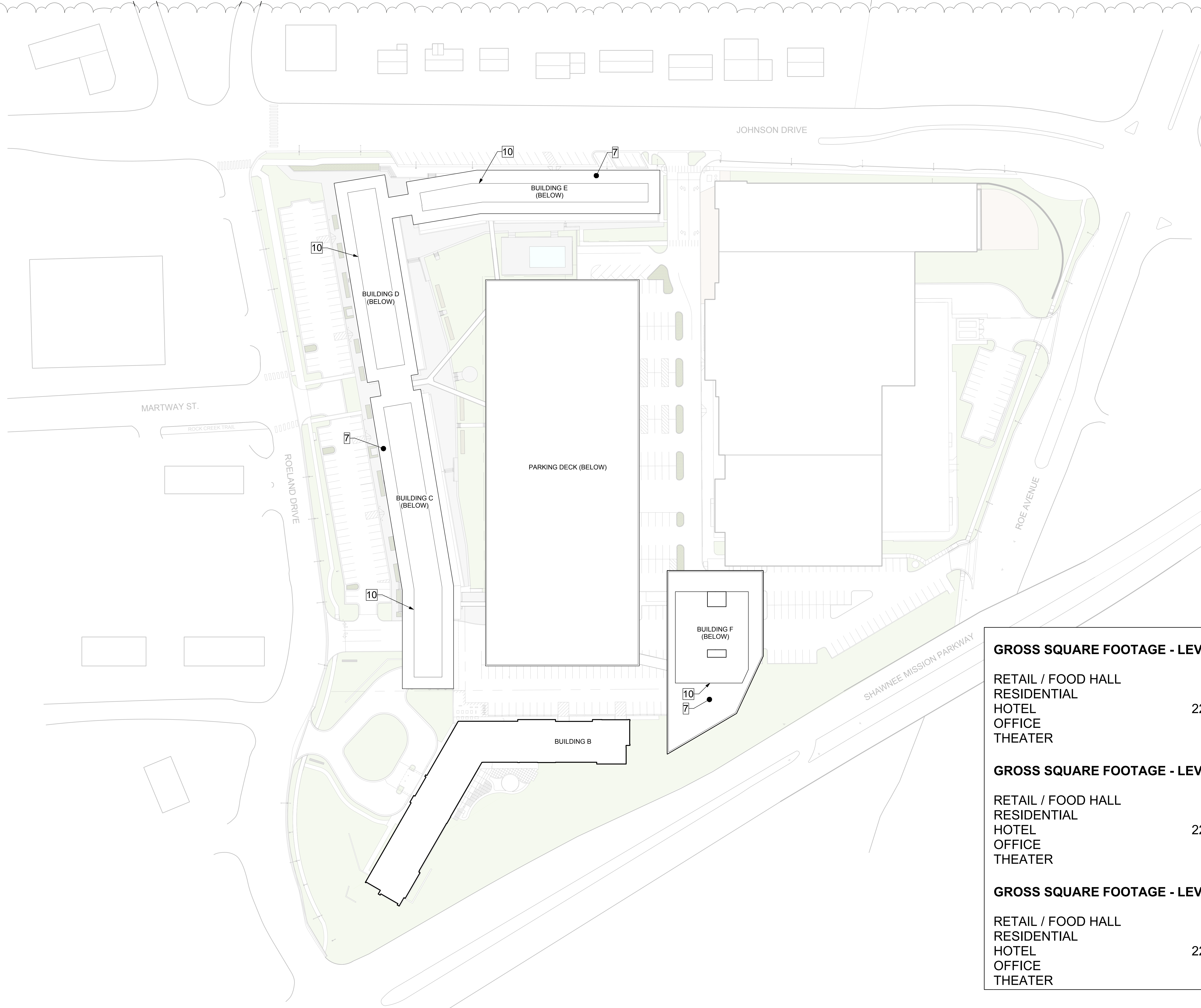
MISSION GATEWAY

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FDP-A054
SITE PLAN (LEVEL 4)



- KEYNOTES**
1. MASONRY PAVER PATIO
 2. COLORED CONCRETE
 3. WOOD BENCH
 4. BOARD-FORMED CONCRETE WALL ELEMENT
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 13. PERFORATED METAL PANEL CLADDING SYSTEM
 14. ALUMINUM STOREFRONT / WINDOW SYSTEM
 15. MONUMENT SIGN
 16. BUILDING MOUNTED SIGNAGE
 17. ELEVATED PEDESTRIAN WALKWAY
 18. STUCCO

| GROSS SQUARE FOOTAGE - LEVEL 5 | | | PARKING | |
|--------------------------------|------------|---------|------------|---|
| RETAIL / FOOD HALL | 0 GSF | | SURFACE | 0 |
| RESIDENTIAL | 0 GSF | 0 APTS | STRUCTURED | 0 |
| HOTEL | 22,897 GSF | 38 RMS. | | |
| OFFICE | 0 GSF | | | |
| THEATER | 0 GSF | | | |
| GROSS SQUARE FOOTAGE - LEVEL 6 | | | PARKING | |
| RETAIL / FOOD HALL | 0 GSF | | SURFACE | 0 |
| RESIDENTIAL | 0 GSF | 0 APTS | STRUCTURED | 0 |
| HOTEL | 22,897 GSF | 38 RMS. | | |
| OFFICE | 0 GSF | | | |
| THEATER | 0 GSF | | | |
| GROSS SQUARE FOOTAGE - LEVEL 7 | | | PARKING | |
| RETAIL / FOOD HALL | 0 GSF | | SURFACE | 0 |
| RESIDENTIAL | 0 GSF | 0 APTS | STRUCTURED | 0 |
| HOTEL | 22,897 GSF | 38 RMS. | | |
| OFFICE | 0 GSF | | | |
| THEATER | 0 GSF | | | |

01 SITE PLAN - LEVEL 5-7

FINAL DEVELOPMENT PLAN
 MARCH 17, 2017
 REVISIONS
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CONSULTANTS:

| | | |
|---|--|---|
| CIVIL / LANDSCAPE: OLSSON ASSOCIATES 7301 WEST 153RD ST. SUITE 200 OVERLAND PARK, KANSAS 66213 TEL: 913-381-1170 FAX: 913-381-1174 | ME/P ENGINEERS: PKMR ENGINEERS 13300 W. 98TH ST. LENEXA, KANSAS 66215 TEL: 913-492-2400 FAX: 913-492-2437 | STRUCTURAL: BOB D. CAMPBELL & CO., INC. 4338 BELLEVUE AVE. KANSAS CITY, MISSOURI 64111 TEL: 816-531-4144 FAX: 816-531-8572 |
|---|--|---|

MISSION GATEWAY

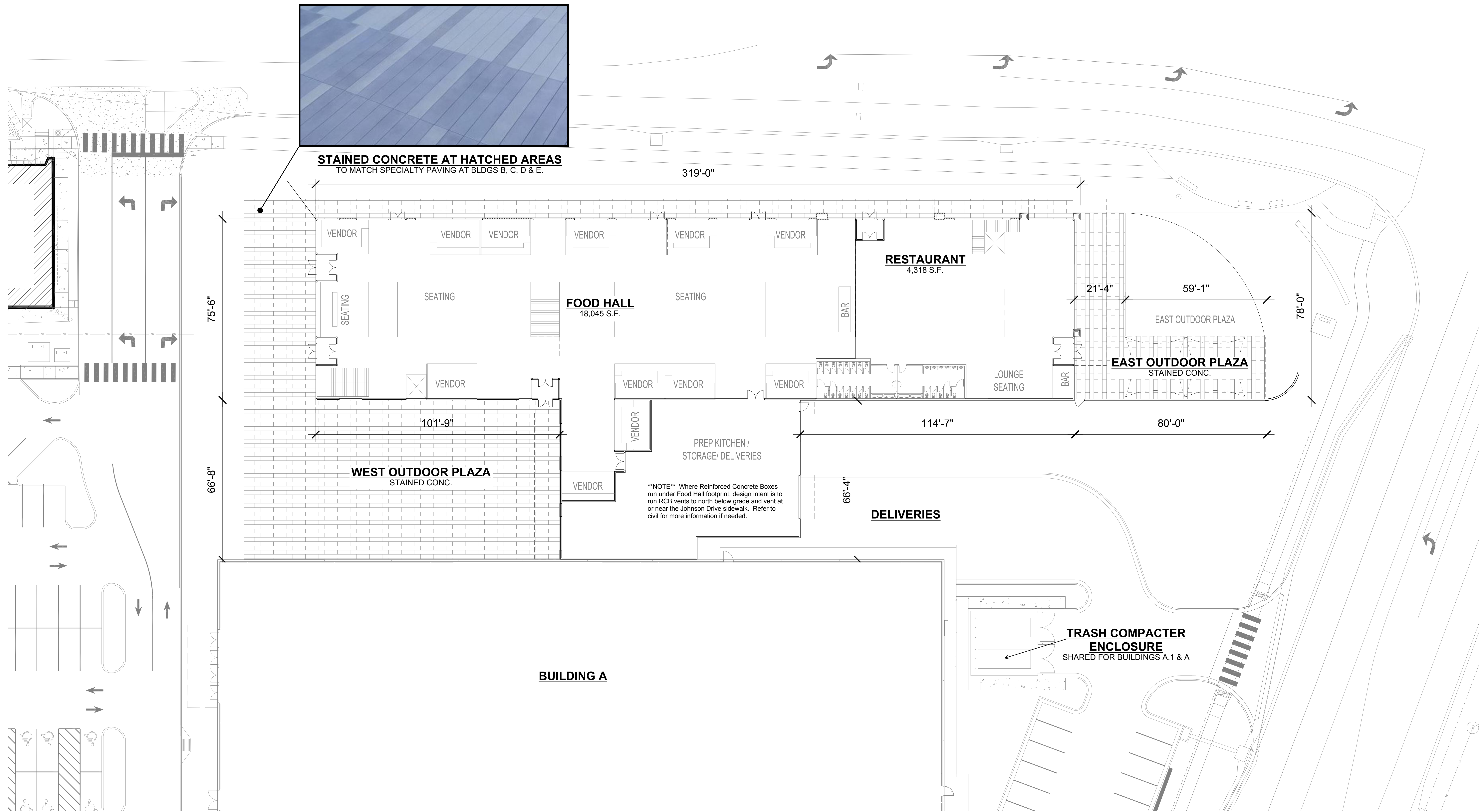
el dorado **OLSSON ASSOCIATES** **pkmr** **B D C**

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FDP-A055

SITE PLAN (LEVELS 5 - 7)



1 FIRST FLOOR PLAN
1/16" = 1'-0"

BUILDING AREA:

FIRST FLOOR: 30,146 S.F.
SECOND FLOOR: 9,809 S.F.
TOTAL: 39,995 S.F.

FINAL DEVELOPMENT PLAN
MARCH 17, 2017
REVISIONS
UPDATES TO APPROVED FDP09.16.2019

CONSULTANTS:

CIVIL / LANDSCAPE:
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FAX: 913-381-1174

MEP:
PKMR ENGINEERS
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STRUCTURAL:
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OLSSON ASSOCIATES

pkmr

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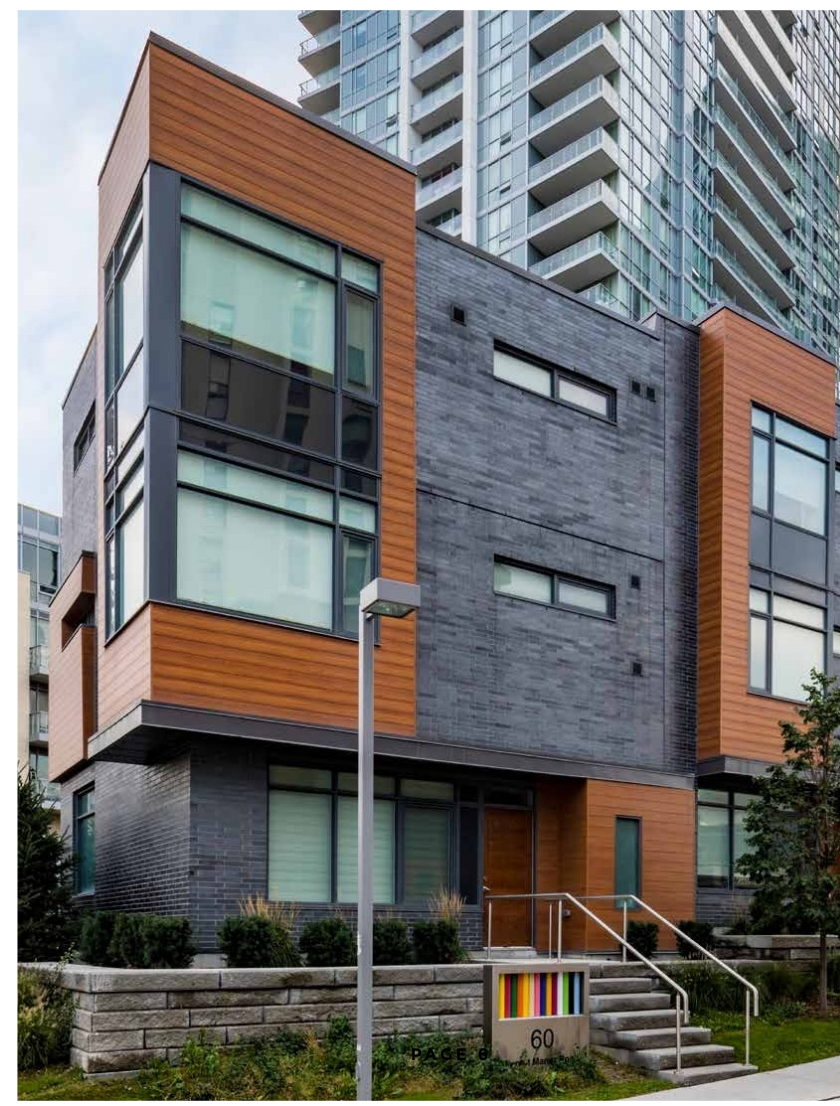
NSPJ
ARCHITECTS

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FDP-A100
BUILDING A.1 - FLOOR PLAN



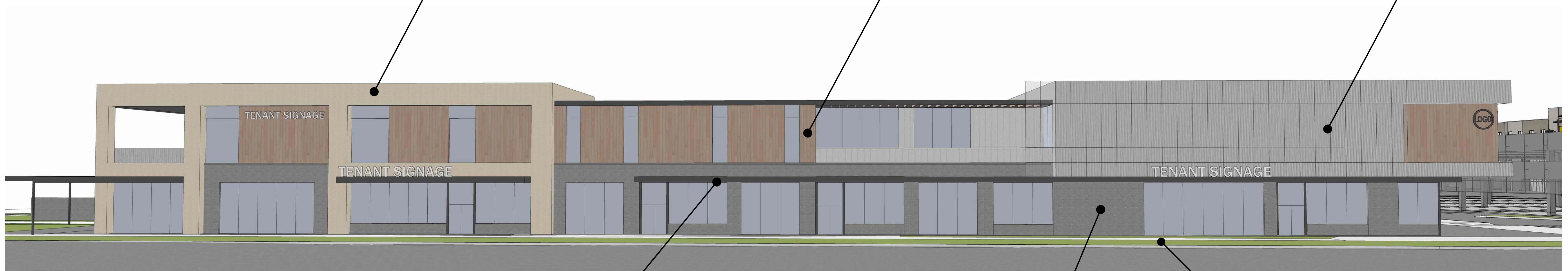
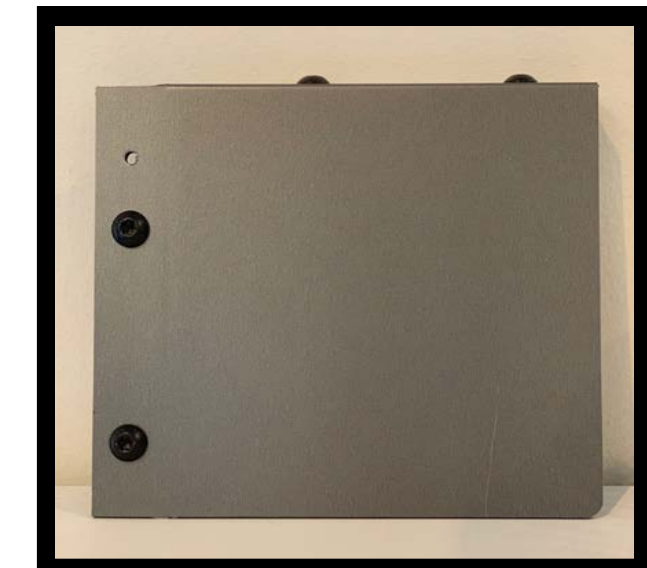
M1: Buff Colored Masonry



M2: Wood Grain Metal Panel



M3: Aluminum Metal Panel



Refer to Sheet FDP-L211 for landscape and planting plan at Food Hall.



M4: Charcoal Colored Metal Canopy and Wood tone accents



M5: Grey Masonry



CONSULTANTS:

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FAX: 913-492-2437

STRUCTURAL:
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① VIEW FROM GARAGE LOOKING NORTHEAST

FDP-A301

BUILDING A.1 - PERSPECTIVE

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CONSULTANTS:

CIVIL / LANDSCAPE:
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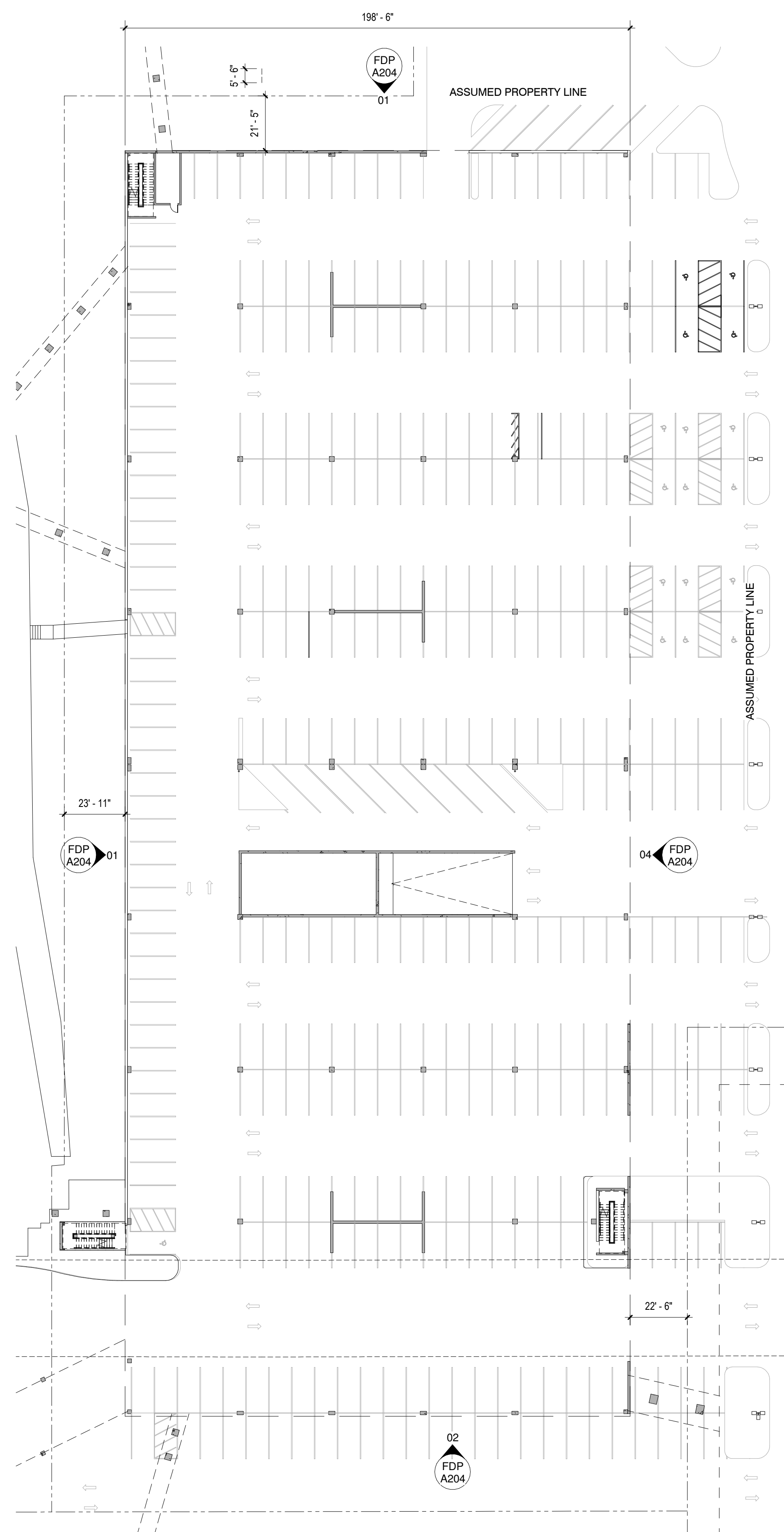
OLSSON ASSOCIATES

pkmr
ENGINEERS

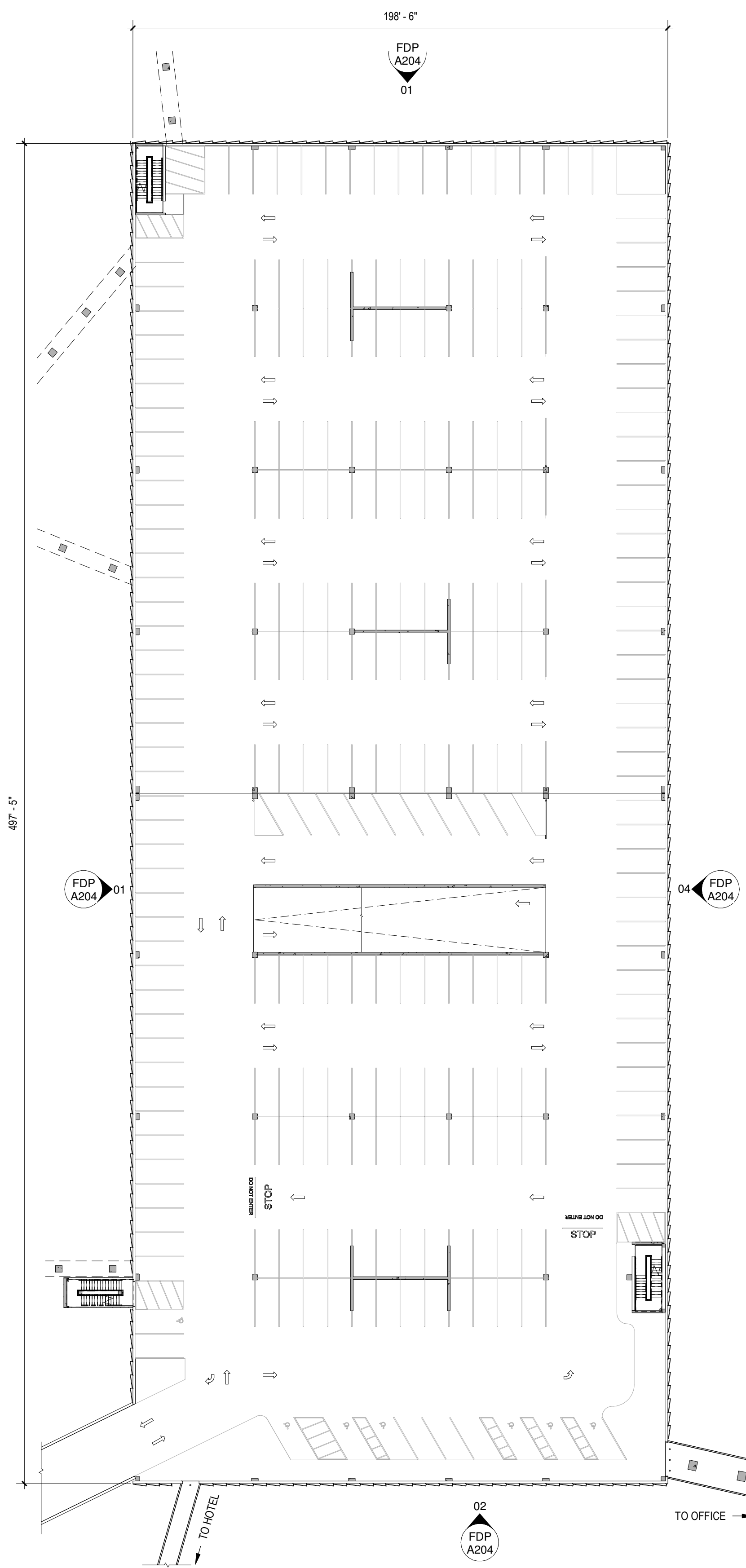
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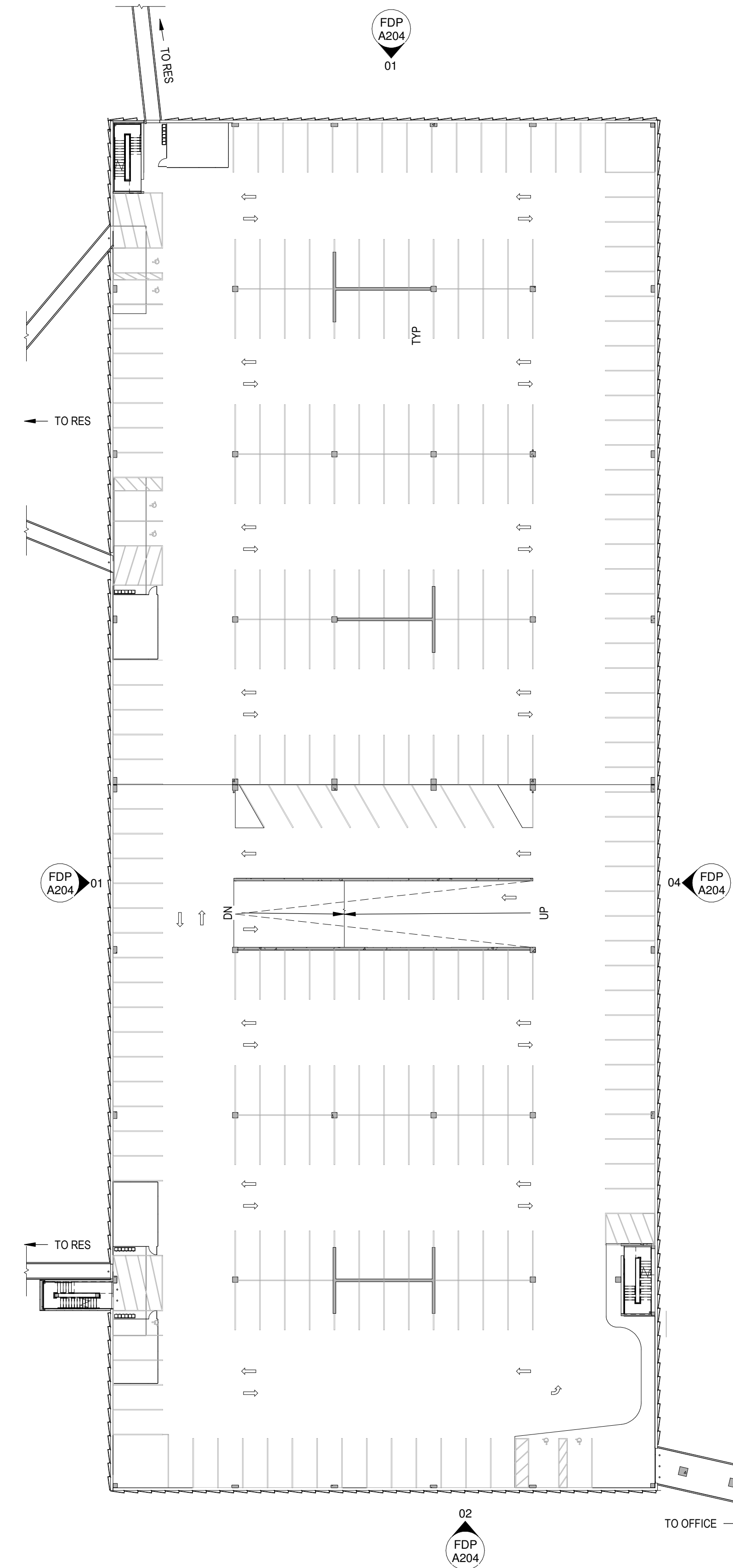
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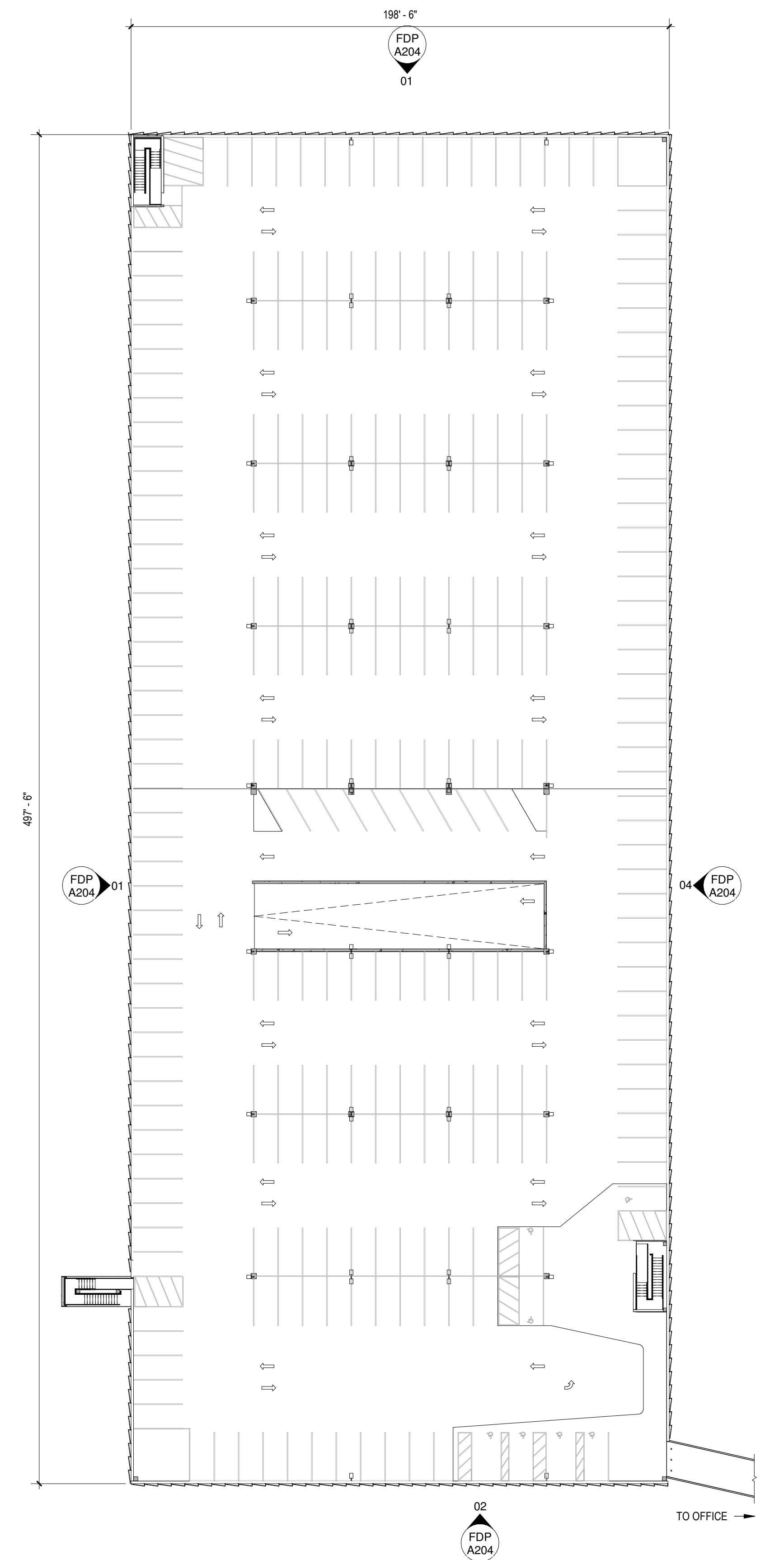
01 PLAN - LEVEL 01
SCALE: 1/32" = 1'-0"



02 PLAN - LEVEL 02
SCALE: 1/32" = 1'-0"



03 PLAN - LEVEL 03
SCALE: 1/32" = 1'-0"



04 PLAN - LEVEL 04
SCALE: 1/32" = 1'-0"

FDP-A113

FINAL DEVELOPMENT PLAN
MARCH 17, 2017
REVISIONS
UPDATES TO APPROVED FDP 09.16.2019

CONSULTANTS:

CIVIL / LANDSCAPE:
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FAX: 913-381-1174

MEP:
PKMR ENGINEERS
13300 W. 98TH ST.
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FAX: 913-492-2437

STRUCTURAL:
BOB D. CAMPBELL & CO., INC.
4338 BELLEVUE AVE.
KANSAS CITY, MISSOURI 64111
TEL: 816-531-4144
FAX: 816-531-8572

MISSION GATEWAY

el dorado

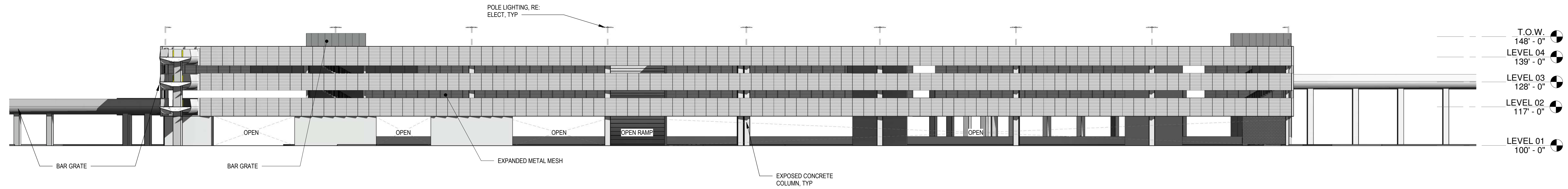
OLSSON ASSOCIATES

pkmr

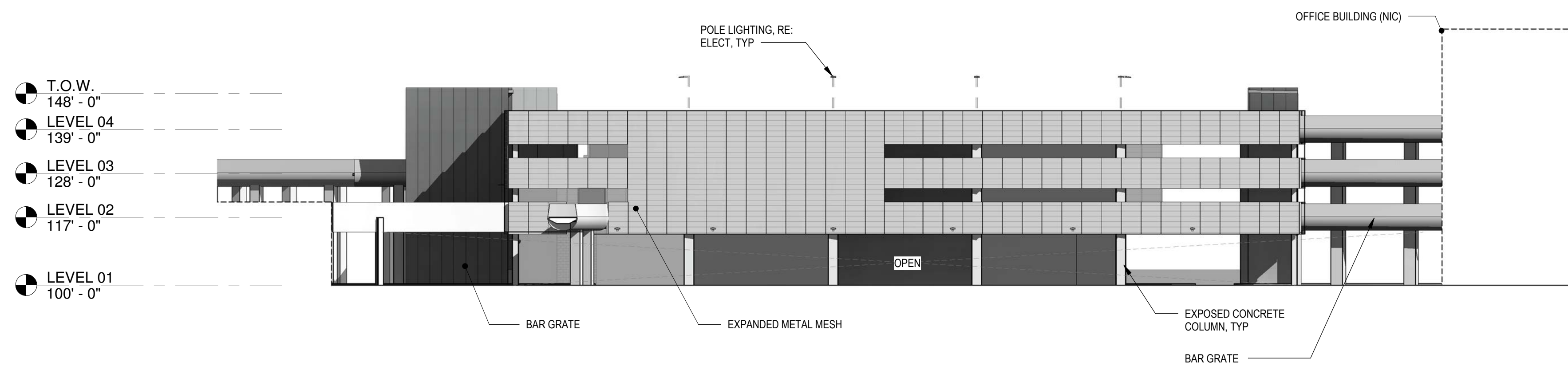
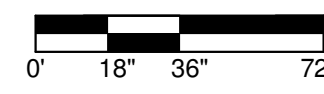
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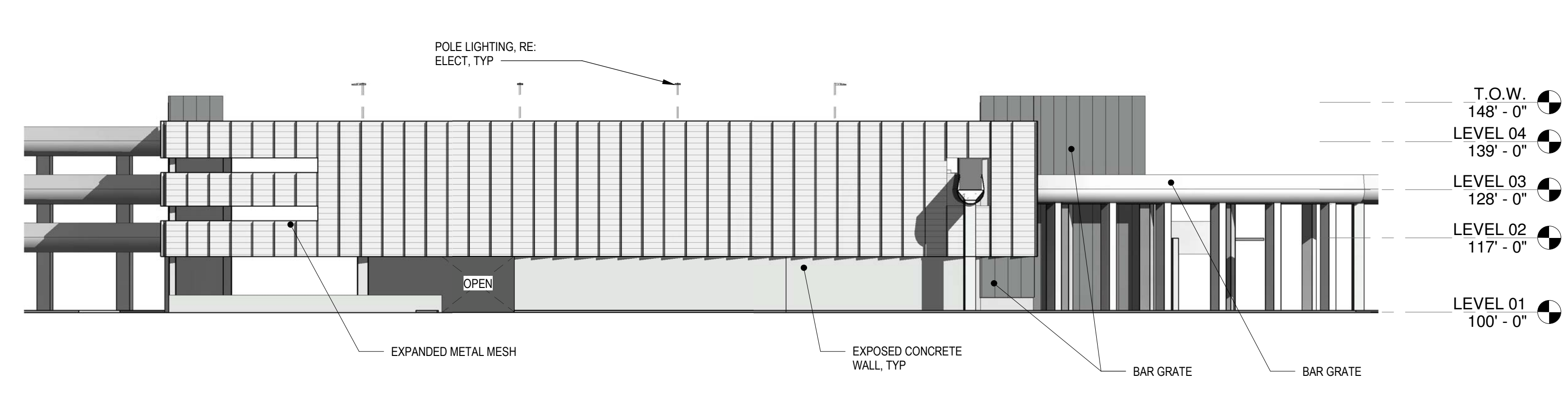
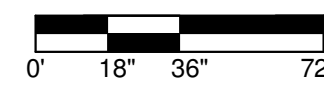
BUILDINGS G - FLOOR PLANS (LEVELS 1-4)



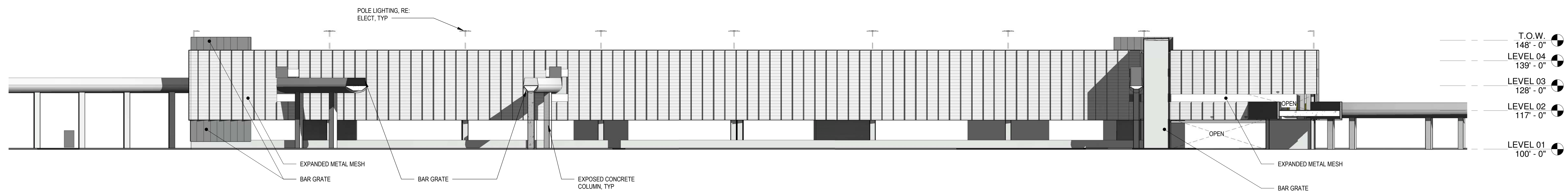
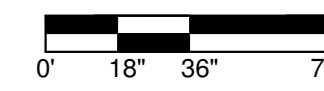
04 EAST ELEVATION
SCALE: 3/64" = 1'-0"



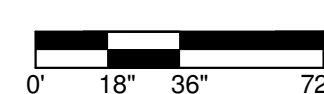
02 SOUTH ELEVATION
SCALE: 3/64" = 1'-0"



03 NORTH ELEVATION
SCALE: 3/64" = 1'-0"



01 WEST ELEVATION
SCALE: 3/64" = 1'-0"



FDP-A204

FINAL DEVELOPMENT PLAN
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UPDATES TO APPROVED FDP 09.16.2019

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FAX: 913-381-1174

MEP:
PKMR ENGINEERS
13300 W. 98TH ST.
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FAX: 913-492-2437

STRUCTURAL:
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FAX: 816-531-8572

MISSION GATEWAY

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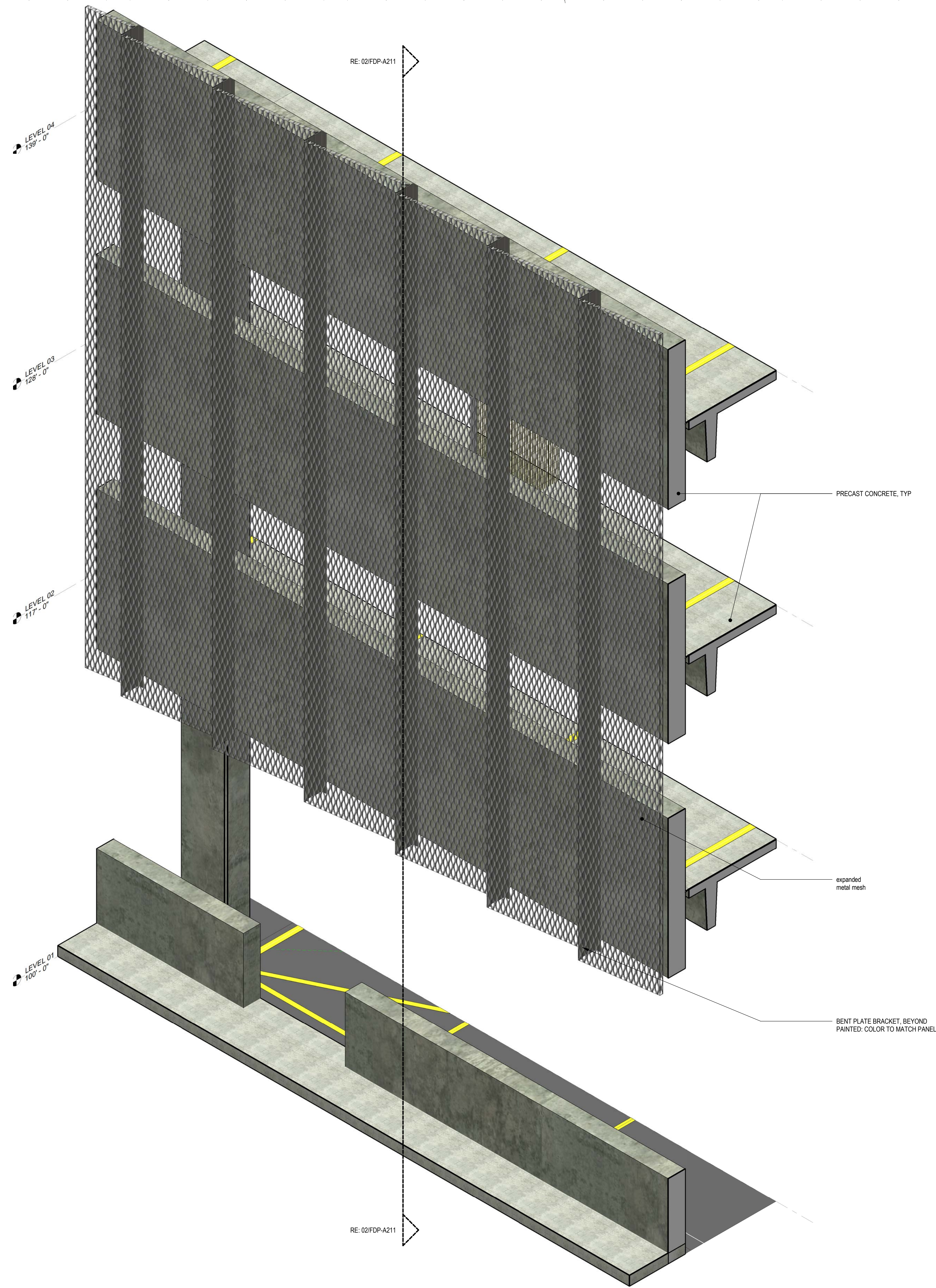
OLSSON
ASSOCIATES

pkmr
ENGINEERS

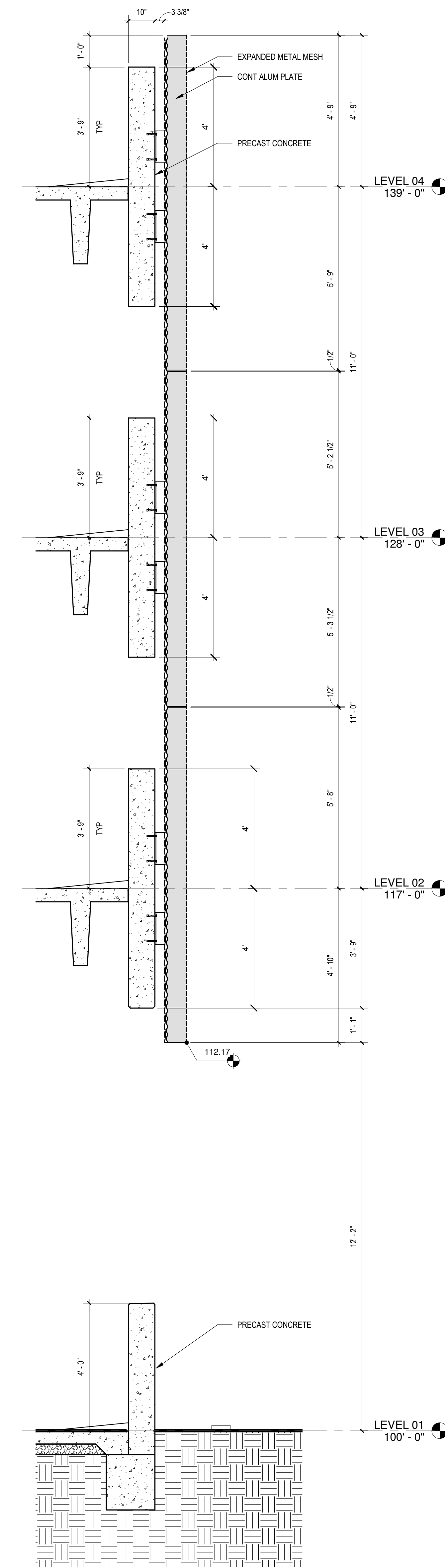
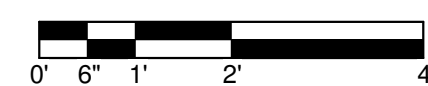
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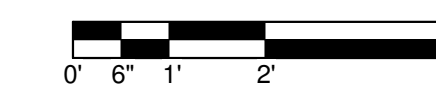
BUILDING G EXTERIOR ELEVATIONS



01 GARAGE PANEL DETAIL
SCALE:



02 WALL SECTION
SCALE: 1/2" = 1'-0"



FDP-A211

FINAL DEVELOPMENT PLAN
MARCH 17, 2017
REVISIONS
UPDATES TO APPROVED FDP 09.16.2019

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CIVIL / LANDSCAPE:
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OVERLAND PARK, KANSAS 66213
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LENEXA, KANSAS 66215
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FAX: 913-492-2437

STRUCTURAL:
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4338 BELLEVUE AVE.
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FAX: 816-531-8572

MISSION GATEWAY

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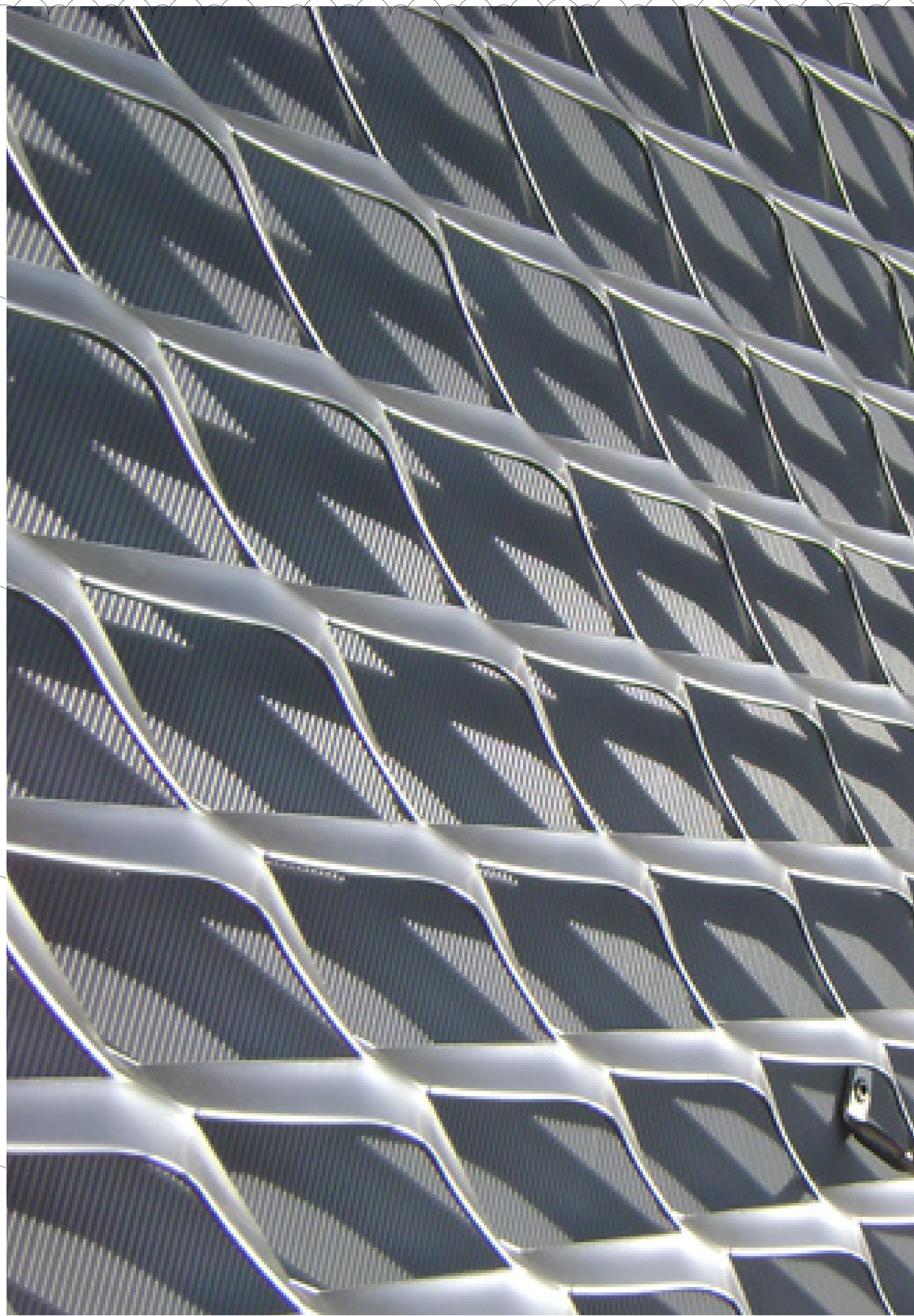
OLSSON
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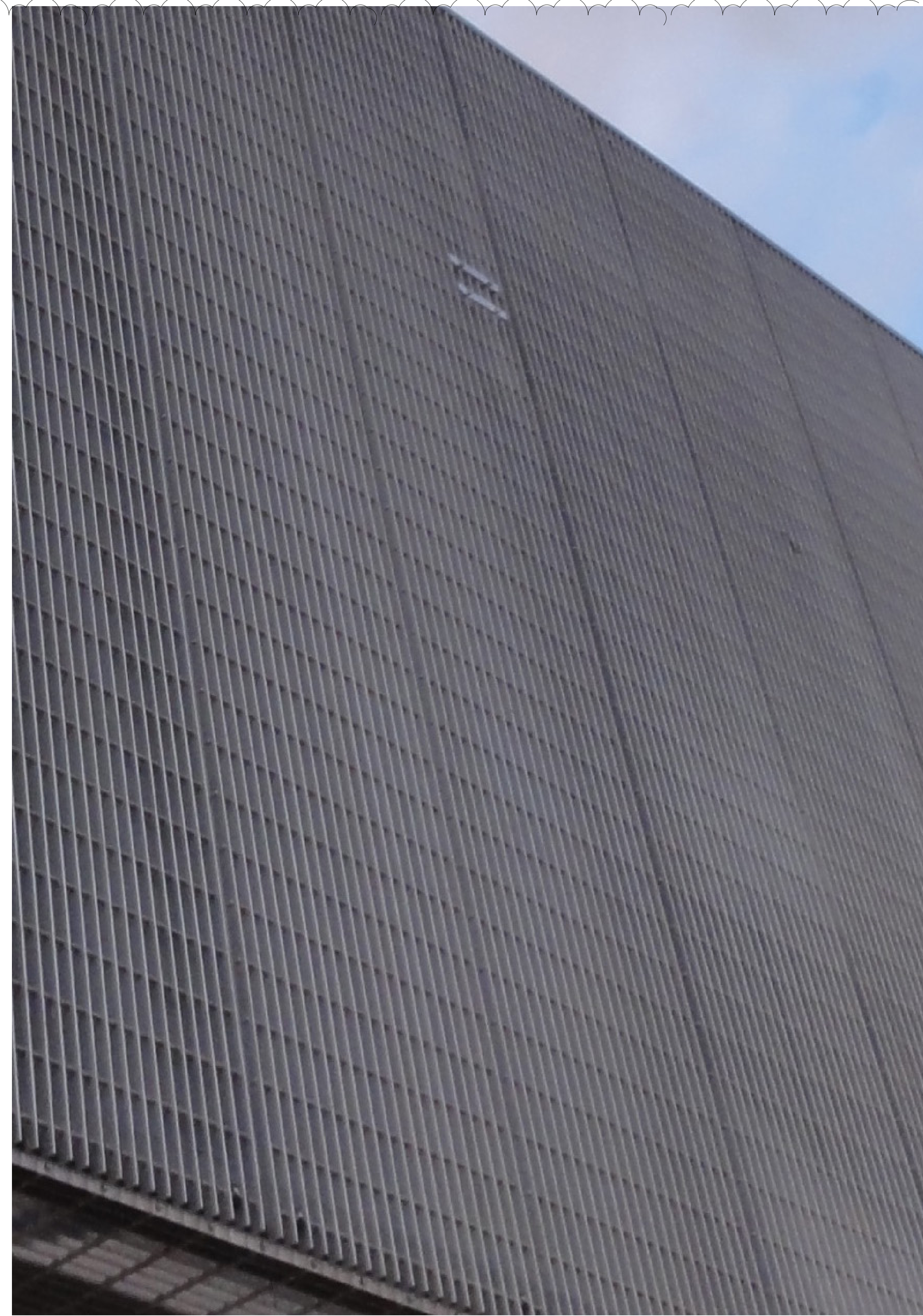
BUILDING G EXTERIOR ELEVATIONS DETAILS



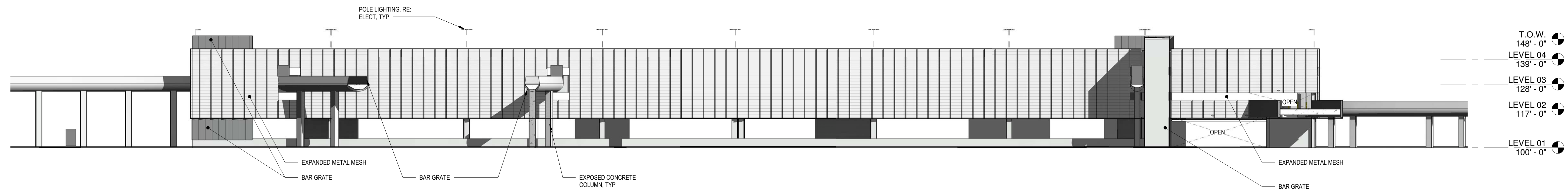
EXPANDED METAL MESH



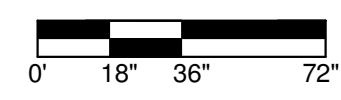
PRE-CAST CONCRETE



ALUMINUM BAR GRATE



01 WEST ELEVATION
SCALE: 3/64" = 1'-0"

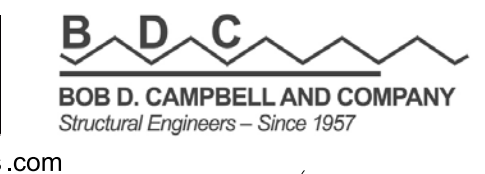


- T.O.W. 148'-0"
- LEVEL 04 139'-0"
- LEVEL 03 128'-0"
- LEVEL 02 117'-0"
- LEVEL 01 100'-0"

FINAL DEVELOPMENT PLAN
MARCH 17, 2017
REVISIONS
UPDATES TO APPROVED FDP 09.16.2019

CONSULTANTS:
 CIVIL / LANDSCAPE: OLSSON ASSOCIATES
 7501 WEST 153RD ST., SUITE 200
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 ME/P ENGINEERS: PKMR ENGINEERS
 13300 W. 98TH ST.
 LENEXA, KANSAS 66215
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 FAX: 913-492-2437
 STRUCTURAL: BOB D. CAMPBELL & CO., INC.
 4338 BELLEVUE AVE.
 KANSAS CITY, MISSOURI 64111
 TEL: 816-531-4144
 FAX: 816-531-8572

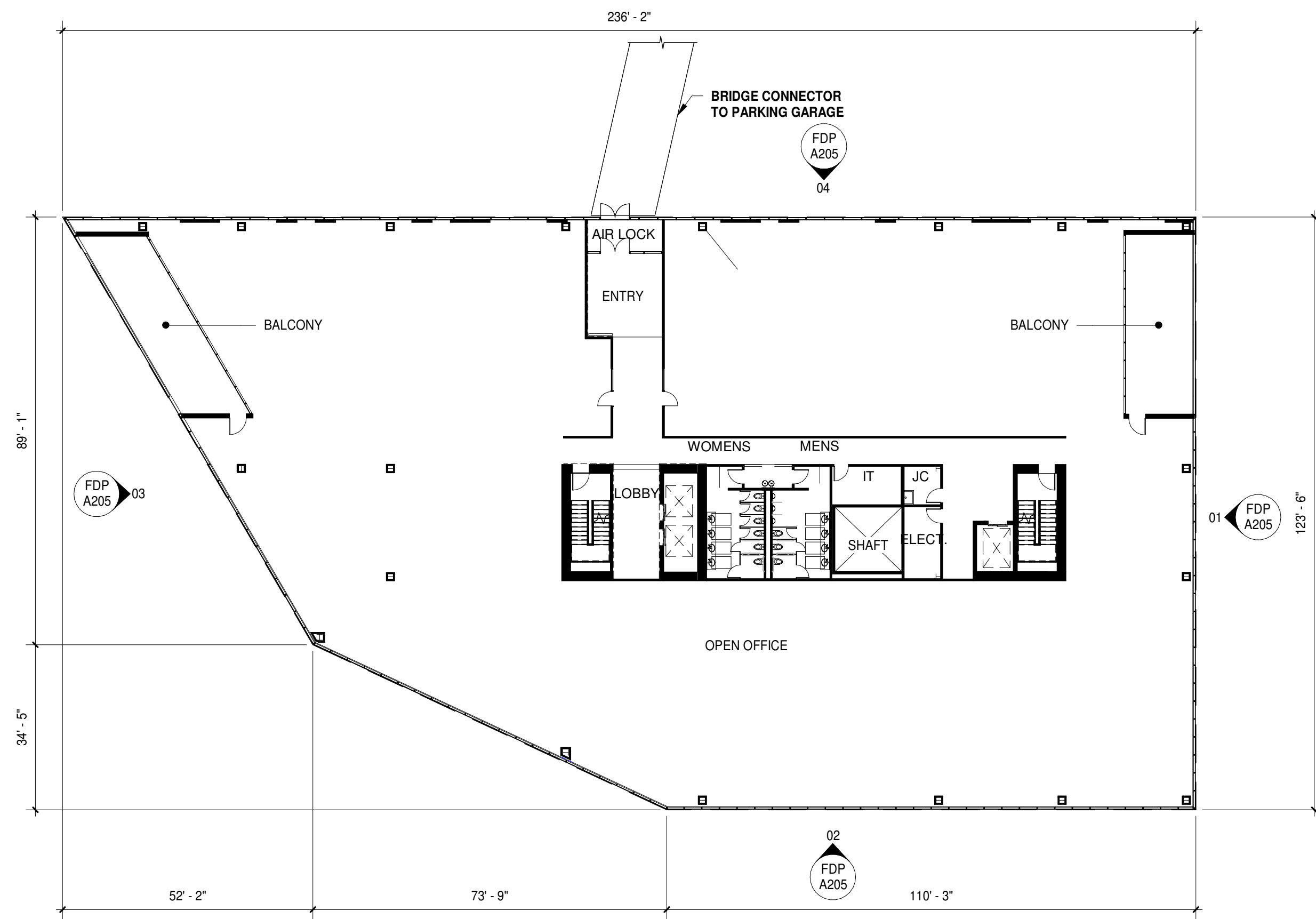
MISSION GATEWAY



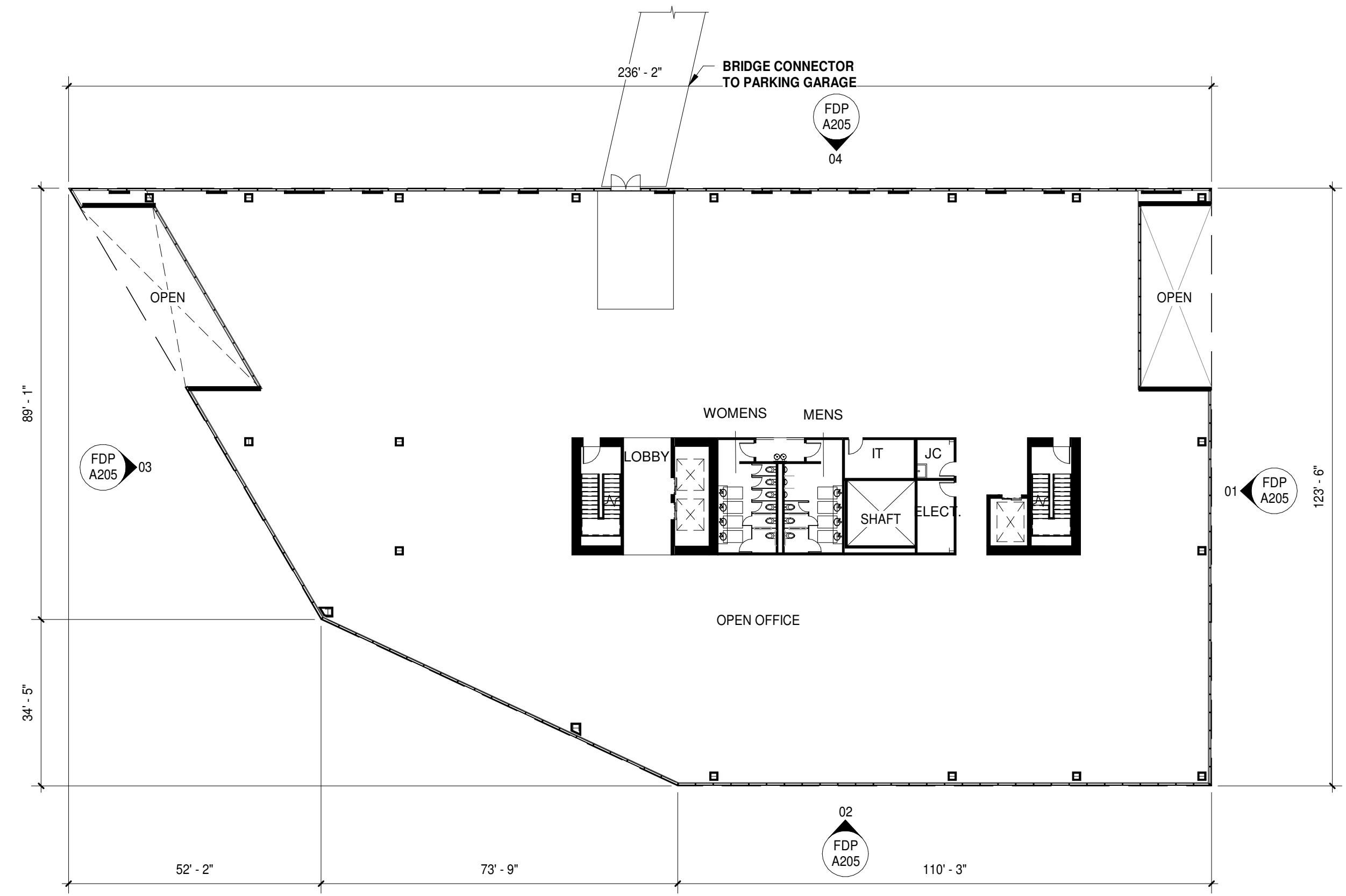
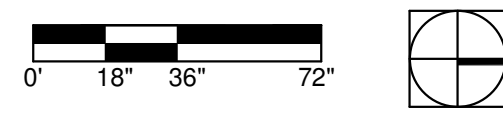
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FDP-A304

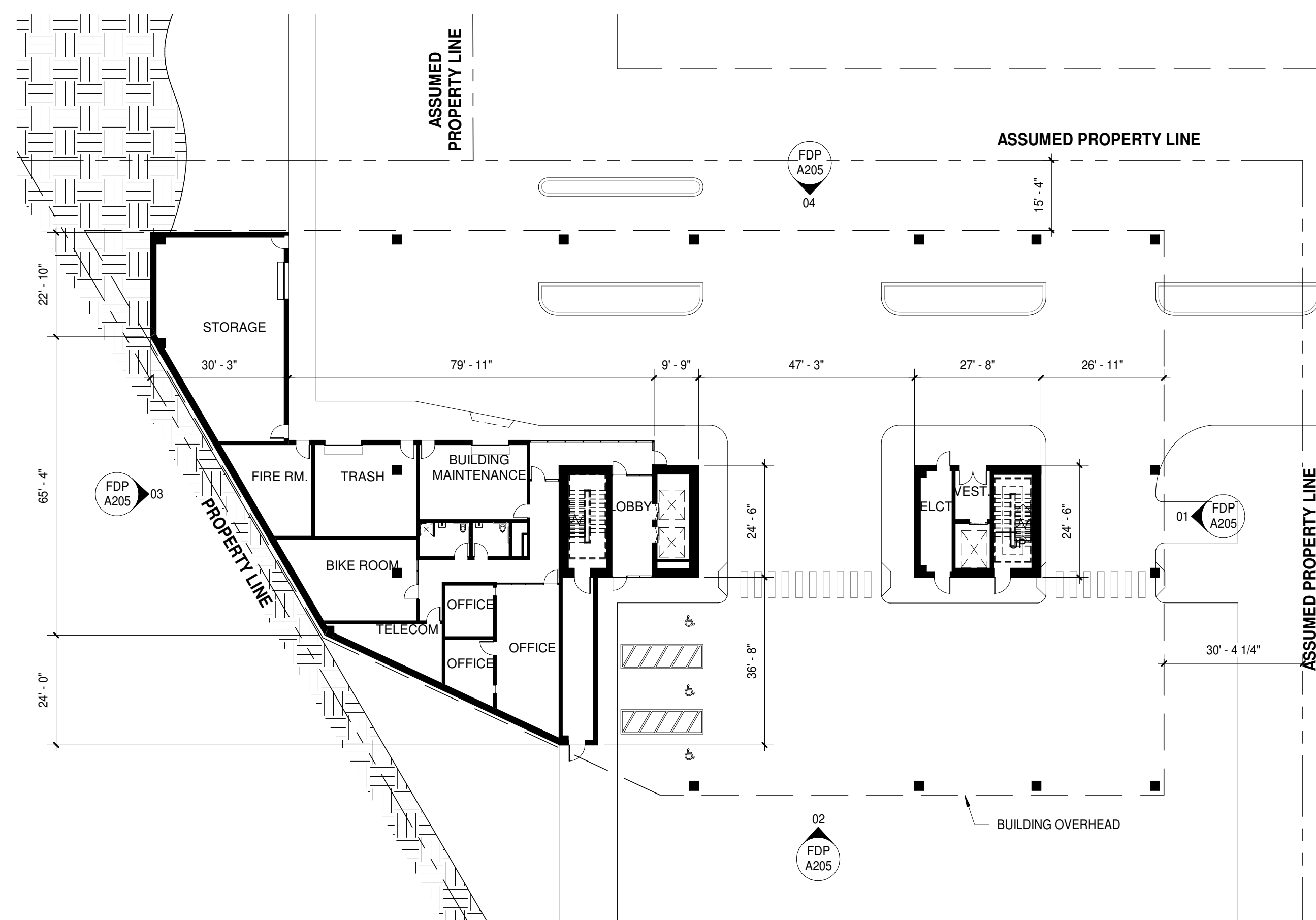
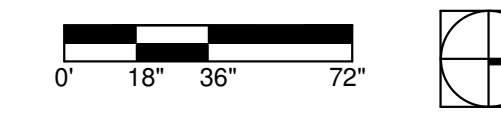
BUILDING G MATERIAL STUDIES



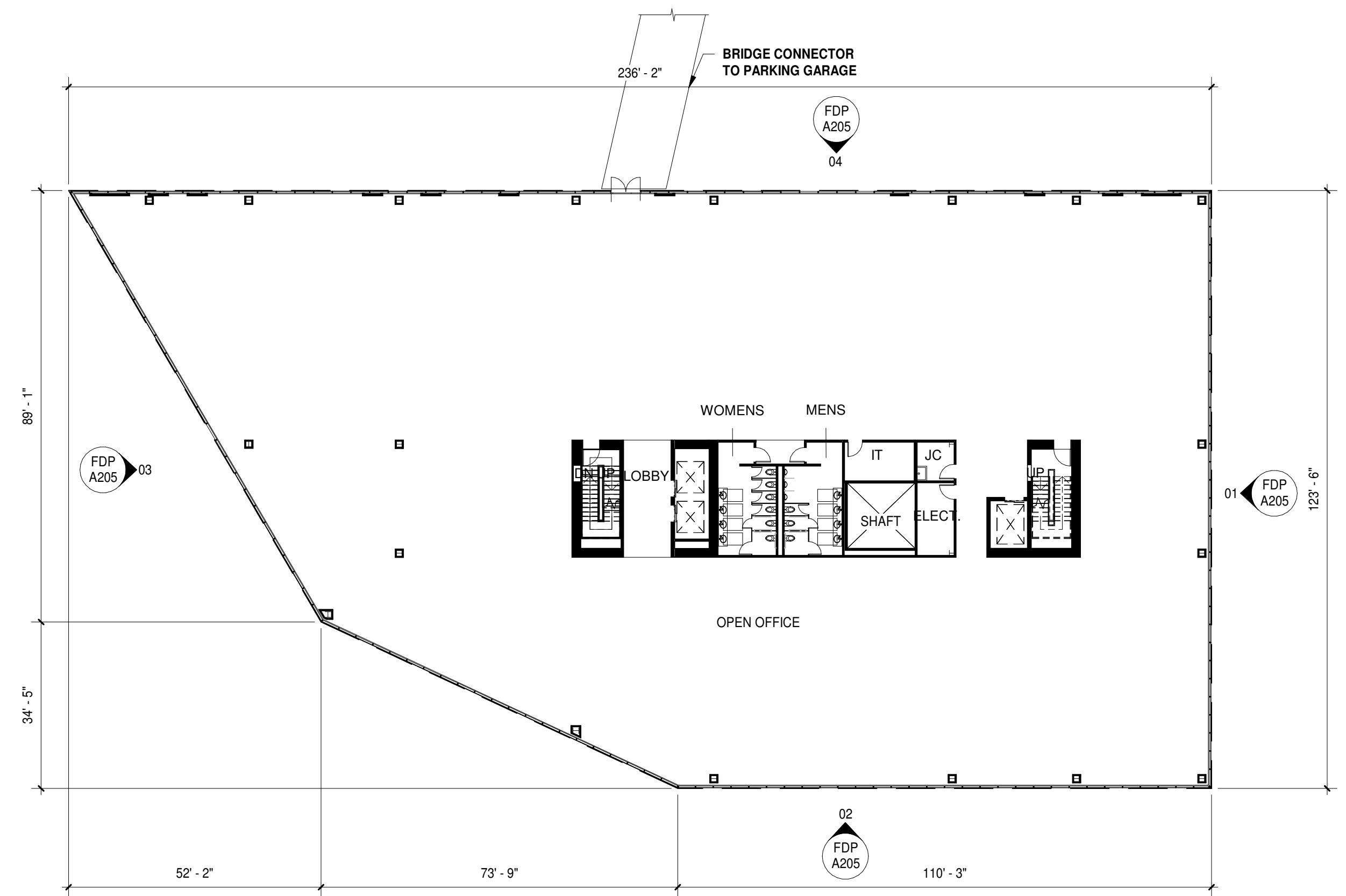
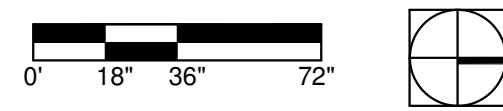
03 LOBBY-LEVEL 3
 SCAL 3/64" = 1'-0"
 E:



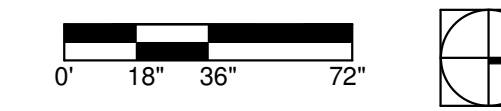
04 PLAN - LEVEL 04
 SCAL 3/64" = 1'-0"
 E:



01 PLAN - LEVEL 01
 SCAL 3/64" = 1'-0"
 E:



02 PLAN - LEVEL 02
 SCAL 3/64" = 1'-0"
 E:



FDP-A114

FINAL DEVELOPMENT PLAN
 MARCH 17, 2017
 REVISIONS
 UPDATES TO APPROVED FDP 09.16.2019

CONSULTANTS:

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M/E/P:
 PKMR ENGINEERS
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STRUCTURAL:
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 KANSAS CITY, MISSOURI 64111
 TEL: 816-531-4144
 FAX: 816-531-8572

BUILDINGS F - FLOOR PLANS (LEVELS 1-4 & ROOF)

MISSION GATEWAY

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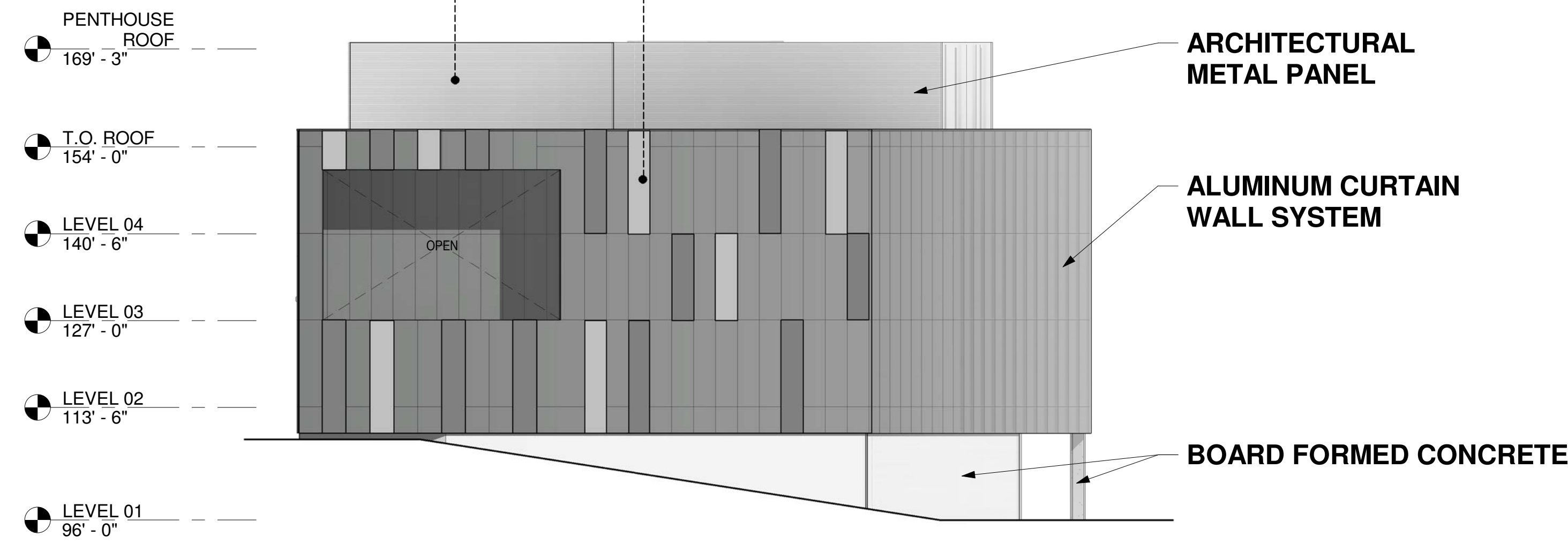
METAL BOX-RIB PANEL



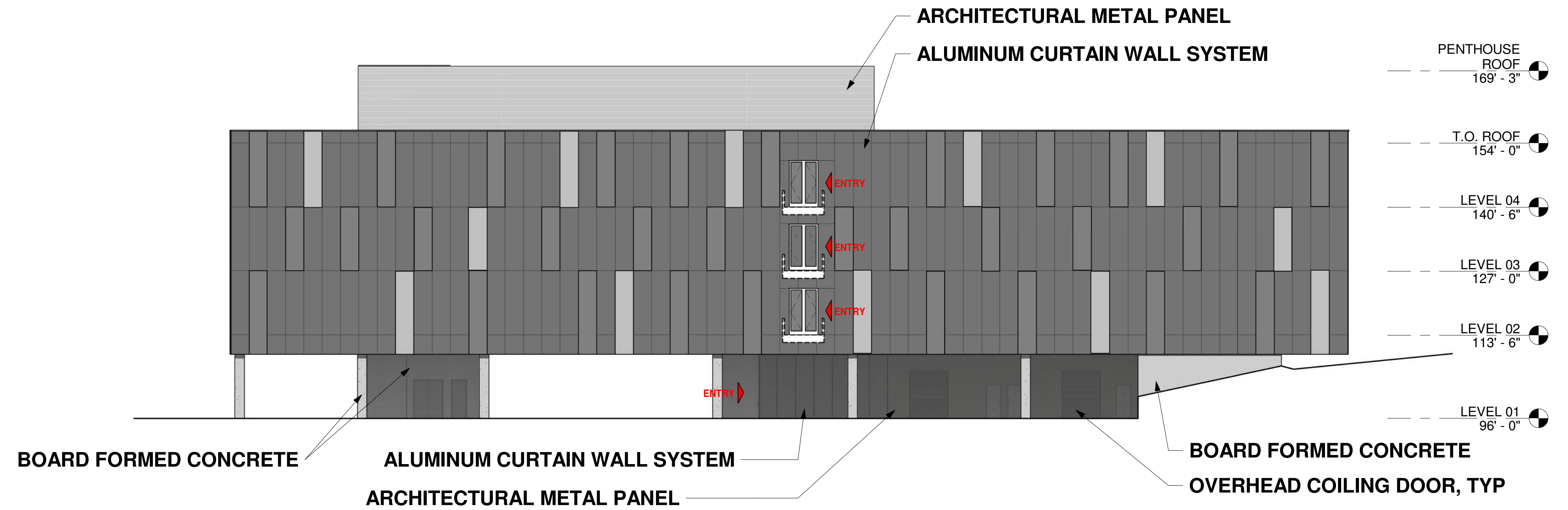
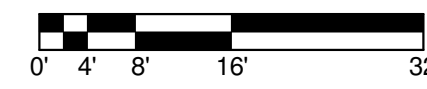
GLASS 1

GLASS 2

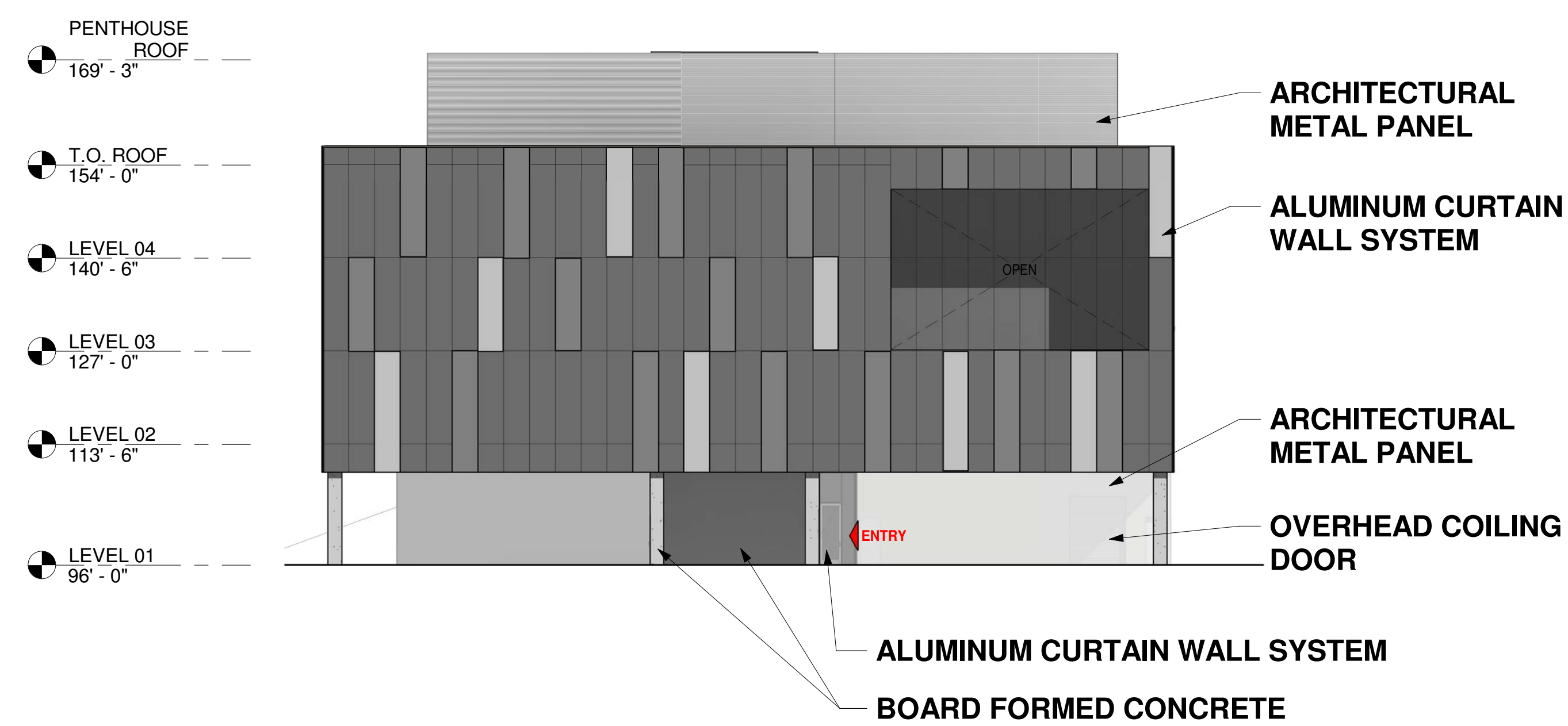
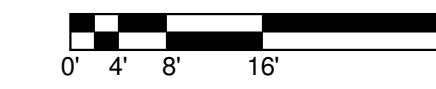
GLASS 3



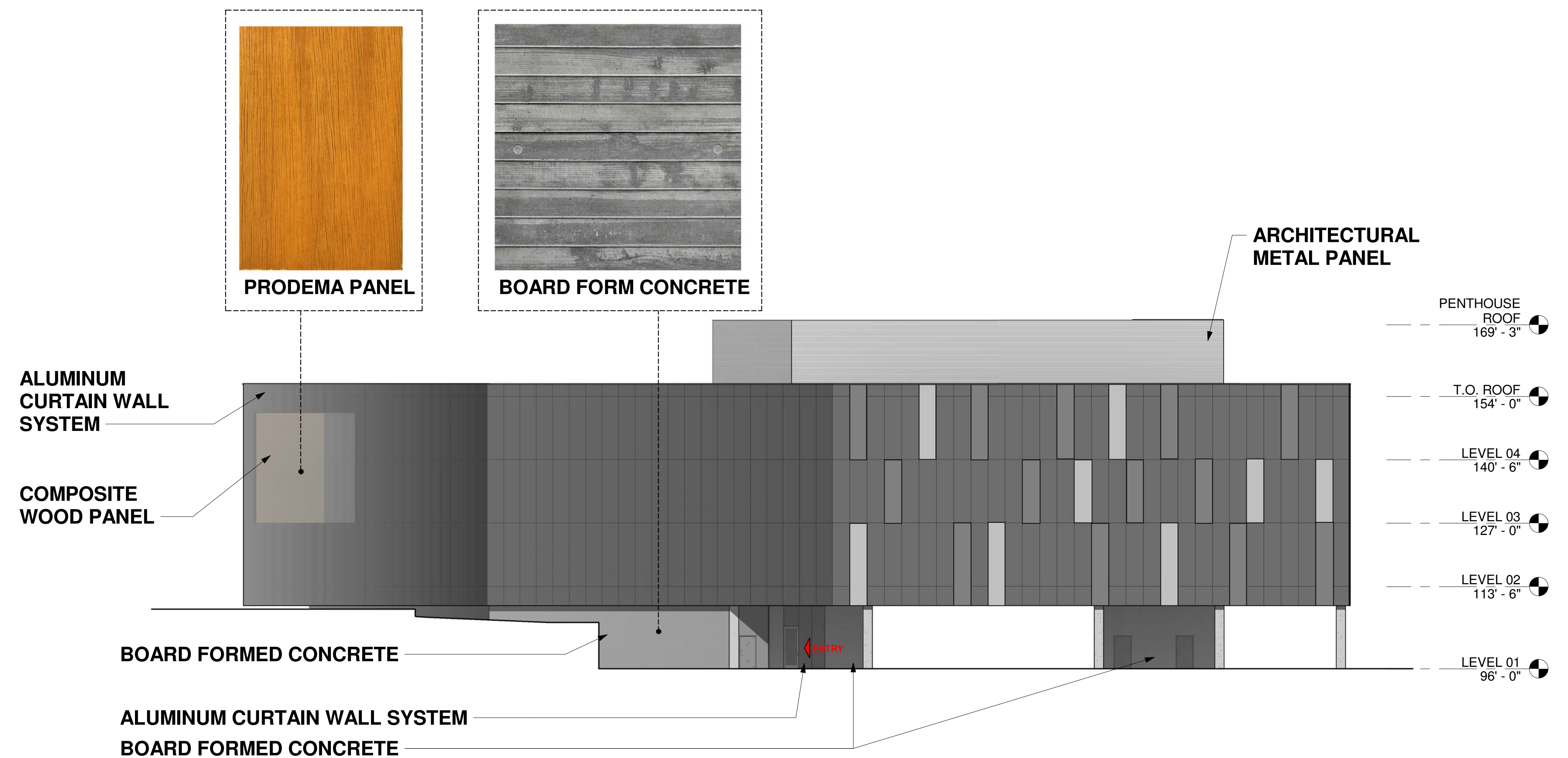
03 SOUTH ELEVATION
SCALE: 1/16" = 1'-0"



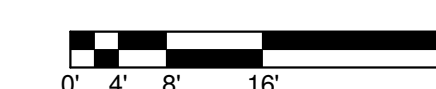
04 WEST ELEVATION
SCALE: 1/16" = 1'-0"



01 NORTH ELEVATION
SCALE: 1/16" = 1'-0"



02 EAST ELEVATION
SCALE: 1/16" = 1'-0"



FDP-A205

FINAL DEVELOPMENT PLAN
MARCH 17, 2017
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CONSULTANTS:

CIVIL / LANDSCAPE:
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ME/P:
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13300 W. 98TH ST.
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TEL: 913-492-2400
FAX: 913-492-2437

STRUCTURAL:
BOB D. CAMPBELL & CO., INC.
4338 BELLEVUE AVE.
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TEL: 816-531-4144
FAX: 816-531-8572

MISSION GATEWAY

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OLSSON
ASSOCIATES

pkmr
ENGINEERS

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BUILDING F EXTERIOR ELEVATIONS

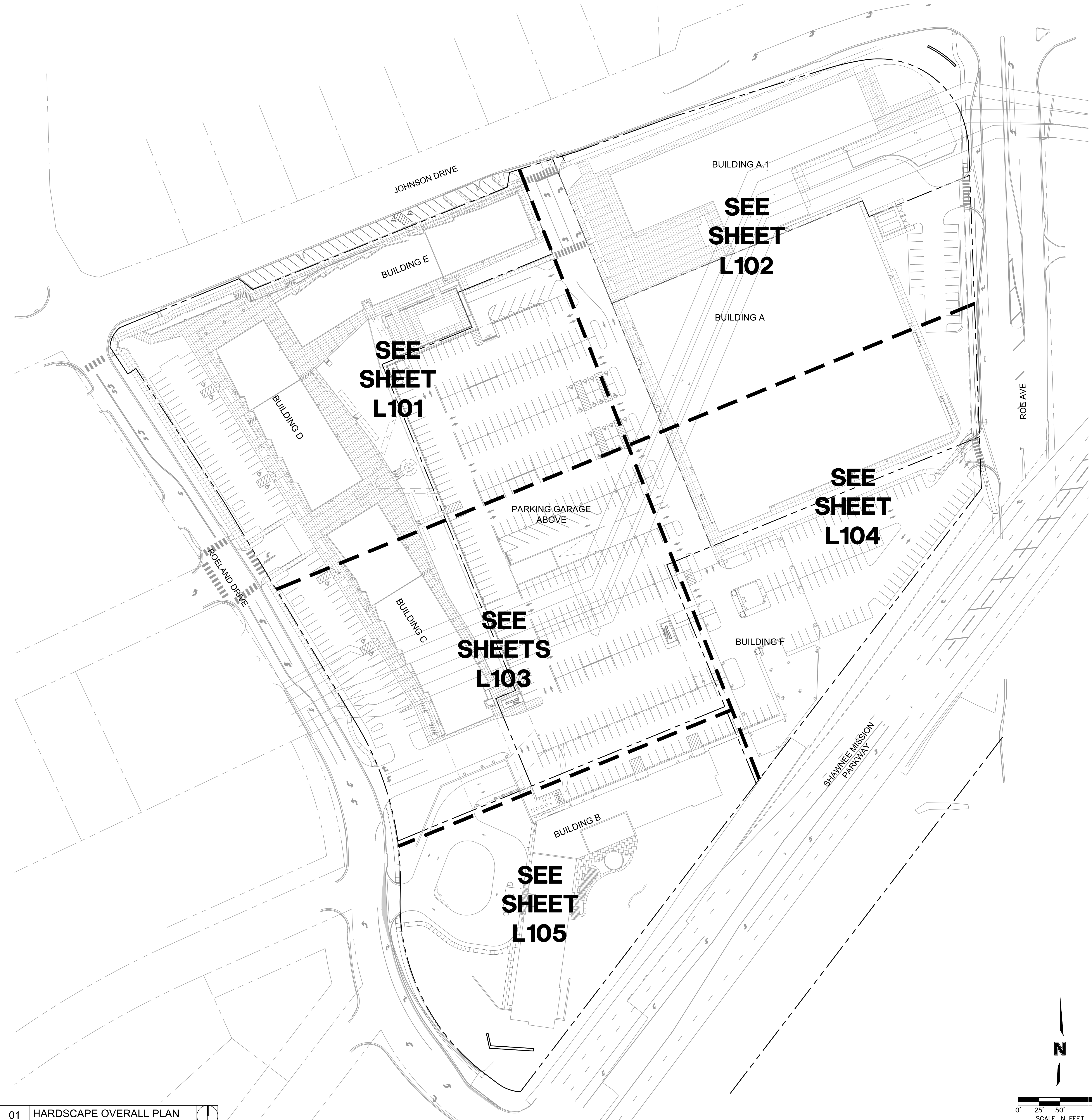
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USER: bmochele
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DATE: Oct 02, 2019 8:55am
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C:\BNDY_52039

LANDSCAPE LEGEND:

- RIGHT OF WAY / PROPERTY LINE
- SHEET MATCHLINE

HARDSCAPE GENERAL NOTES:

1. THE CONSTRUCTION COVERED BY THESE PLANS SHALL CONFORM TO ALL APPLICABLE STANDARDS AND SPECIFICATIONS OF THE CITY OF MISSION, KANSAS IN CURRENT USAGE. ALL STANDARDS NOT COVERED BY THE CITY SHALL BE APWA STANDARDS IN CURRENT USAGE UNLESS OTHERWISE NOTED.
2. THE UTILITY LOCATIONS SHOWN ON THESE PLANS ARE APPROXIMATE ONLY. THE CONTRACTOR SHALL VERIFY THE LOCATION AND DEPTH OF ALL UTILITIES PRIOR TO CONSTRUCTION TO PROVIDE NON-INTERUPTION OF SERVICE, TO ENSURE PROPER CLEARANCES, AND TO AVOID DAMAGE THERETO.
3. ALL DIMENSIONS ARE TO BACK OF CURB UNLESS OTHERWISE NOTED.
4. CONTRACTOR SHALL, BY HIS OWN INVESTIGATION, AND PRIOR TO COMMENCING WORK, SATISFY HIMSELF AS TO, AND ACCEPT THE SITE CONDITIONS TO BE ENCOUNTERED.
5. WHERE THE NEW IMPROVEMENTS ABUT EXISTING IMPROVEMENTS, THE CONTRACTOR SHALL BE RESPONSIBLE FOR MATCHING THE ELEVATION OF THE EXISTING IMPROVEMENTS UNLESS OTHERWISE NOTED.
6. THE CONTRACTOR SHALL PROVIDE A SECURE SITE TO PROTECT VEHICLES AND PEDESTRIANS FROM ACCIDENTAL FALLS AND HARM FROM THE CONSTRUCTION PROCESS.
7. CONTRACTOR SHALL BE RESPONSIBLE FOR DE-WATERING CONSTRUCTION AREAS IN ORDER TO PERMIT CONTINUATION OF THE WORK. ANY WATER ACCUMULATION SHALL BE REMOVED BY PUMPING.
8. CONTRACTOR IS RESPONSIBLE FOR ALL QUANTITIES OR MATERIALS AS SHOWN IN THESE PLANS. CONTRACTOR SHALL ACCOMMODATE ALL SLOPE AND GRADE CONDITIONS IN THEIR CALCULATION OF MATERIAL QUANTITIES FOR ALL WORK SHOWN ON THESE PLANS.
9. CONTRACTOR SHALL BE RESPONSIBLE FOR PEDESTRIAN AND VEHICULAR TRAFFIC CONTROL DURING CONSTRUCTION OPERATIONS. OWNER SHALL APPROVE MEASURES USED TO ALLOW TENANTS AND SHOPPERS PROPER ACCESS DURING CONSTRUCTION.



01 HARDSCAPE OVERALL PLAN

FINAL DEVELOPMENT PLAN
MARCH 17, 2017

REVISIONS:

REVISED LAYOUT 09.16.2019

CONSULTANTS:

| | | |
|--|---|---|
| CIVIL / LANDSCAPE: OLSSON ASSOCIATES 1301 BURLINGTON STREET SUITE 100 NORTH KANSAS CITY, MO 64116 TEL: 816.361.1177 | M/E/P: PKMR ENGINEERS 15300 W. 98TH ST. LENEXA, KANSAS 66215 TEL: 913-492-2400 FAX: 913-492-2437 | STRUCTURAL: BOB D. CAMPBELL & CO., INC. 4338 BELLEVUE AVE. KANSAS CITY, MISSOURI 64111 TEL: 816-531-4144 FAX: 816-531-9572 |
|--|---|---|

MISSION GATEWAY

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pkmr
ENGINEERS

BDC
BOB D. CAMPBELL & CO., INC.
Structural Engineers - Since 1982

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FDP-L100

HARDSCAPE OVERALL PLAN

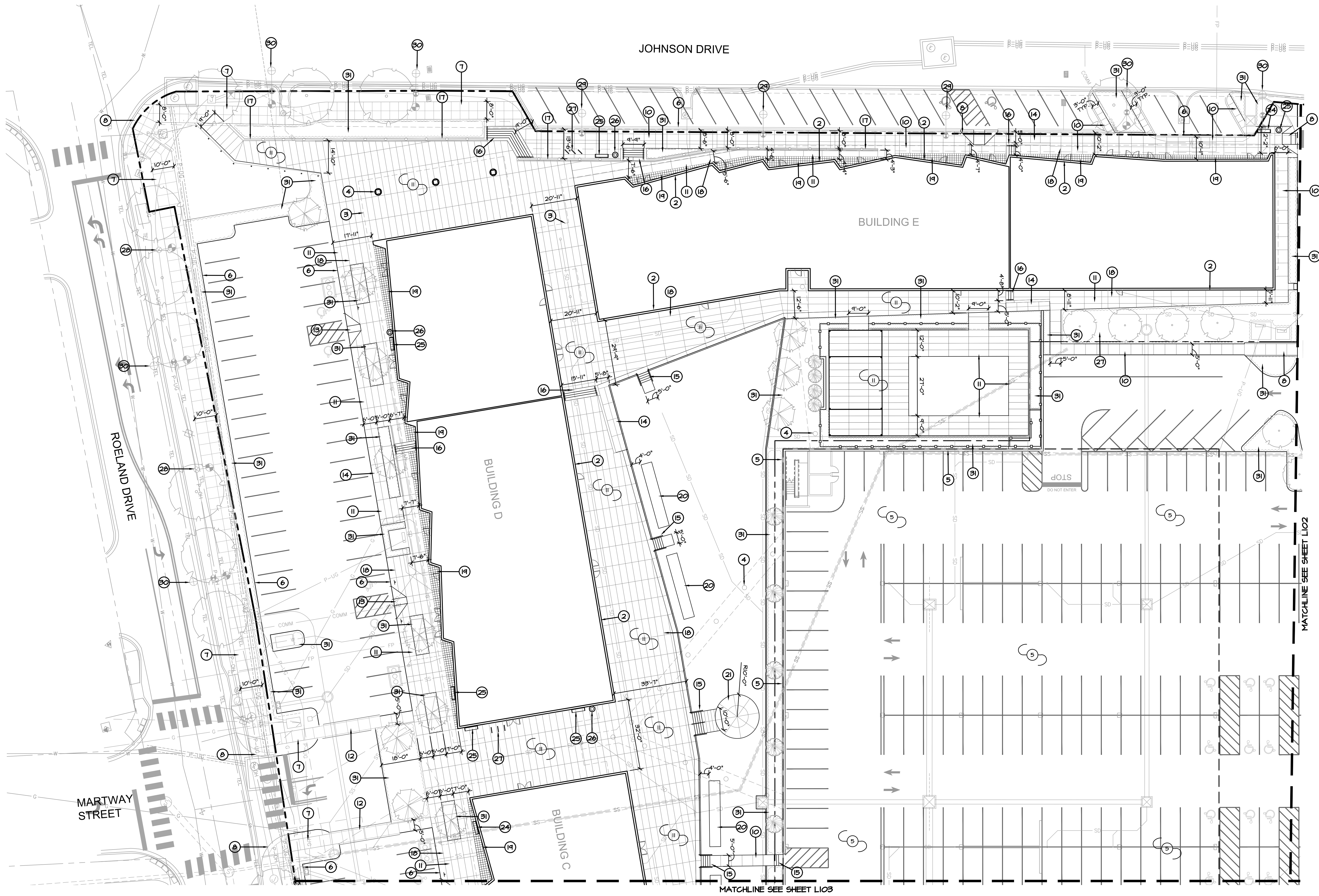
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HARDSCAPE LEGEND:

- RIGHT OF WAY / PROPERTY LINE
- - - SHEET MATCHLINE

HARDSCAPE PLAN NOTES:

- 1 EXISTING WALK
- 2 BUILDING FACADE, REF. ARCHITECTURAL PLANS
- 3 BUILDING CANOPY, REF. ARCHITECTURAL PLANS
- 4 BUILDING COLUMN, REF. ARCHITECTURAL PLANS
- 5 PARKING GARAGE, REF. CIVIL PLANS
- 6 BACK OF CURB, REF. CIVIL PLANS
- 7 CONCRETE SIDEWALK, REF. CIVIL PLANS
- 8 CONCRETE CURB RAMP, REF. CIVIL PLANS
- 9 RETAINING WALL, REF. CIVIL PLANS
- 10 CONCRETE PAVEMENT WITH STRAIGHT CUT JOINT
- 11 INTEGRAL COLOR OR STAINED CONCRETE WALK WITH "V" CUT JOINT
- 12 INTEGRAL COLOR CONCRETE CROSSWALK WITH "V" CUT JOINT
- 13 CONCRETE CURB RAMP
- 14 CONCRETE RAMP
- 15 CONCRETE STAIRS
- 16 CONCRETE STAIRS & BOARDFORM MALL
- 17 BOARD FORM CONCRETE WALL
- 18 CONTROL JOINT, TYP.
- 19 CONCRETE PAVERS
- 20 HARDWOOD BENCH, DARK STAIN FINISH
- 21 PERFORMANCE AREA, INTEGRAL COLOR CONCRETE
- 22 DIRECTIONAL SIGN, REF. 1/L106
- 23 MONUMENT SIGN, REF. 2/L106
- 24 MONUMENT SIGN, REF. 3/L106
- 25 LANDSCAPE FORMS MULTIPLICITY BENCHES
- 26 LANDSCAPE FORMS MULTIPLICITY TRASH RECEPTACLE
- 27 LANDSCAPE FORMS MULTIPLICITY BIKE RACKS
- 28 PEDESTRIAN LIGHT
- 29 STREET LIGHT
- 30 COMBINATION STREET & PEDESTRIAN LIGHT
- 31 PLANTING BED



01 HARDSCAPE PLAN

FINAL DEVELOPMENT PLAN
 MARCH 17, 2017

REVISIONS:

REVISED LAYOUT 09.16.2019

CONSULTANTS:
 CIVIL / LANDSCAPE:
 OLSSON ASSOCIATES
 1301 BURLINGTON STREET
 SUITE 100
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 PKMR ENGINEERS
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 FAX: 913-492-2437
 STRUCTURAL:
 BOB D. CAMPBELL & CO., INC.
 4338 BELLEVUE AVE.
 KANSAS CITY, MISSOURI 64111
 TEL: 816-531-4144
 FAX: 816-531-9572

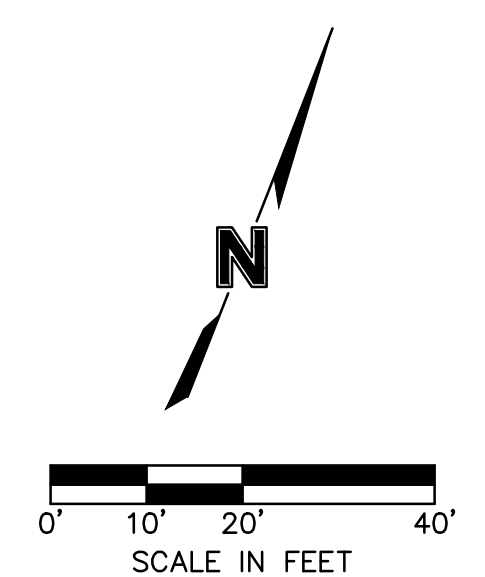
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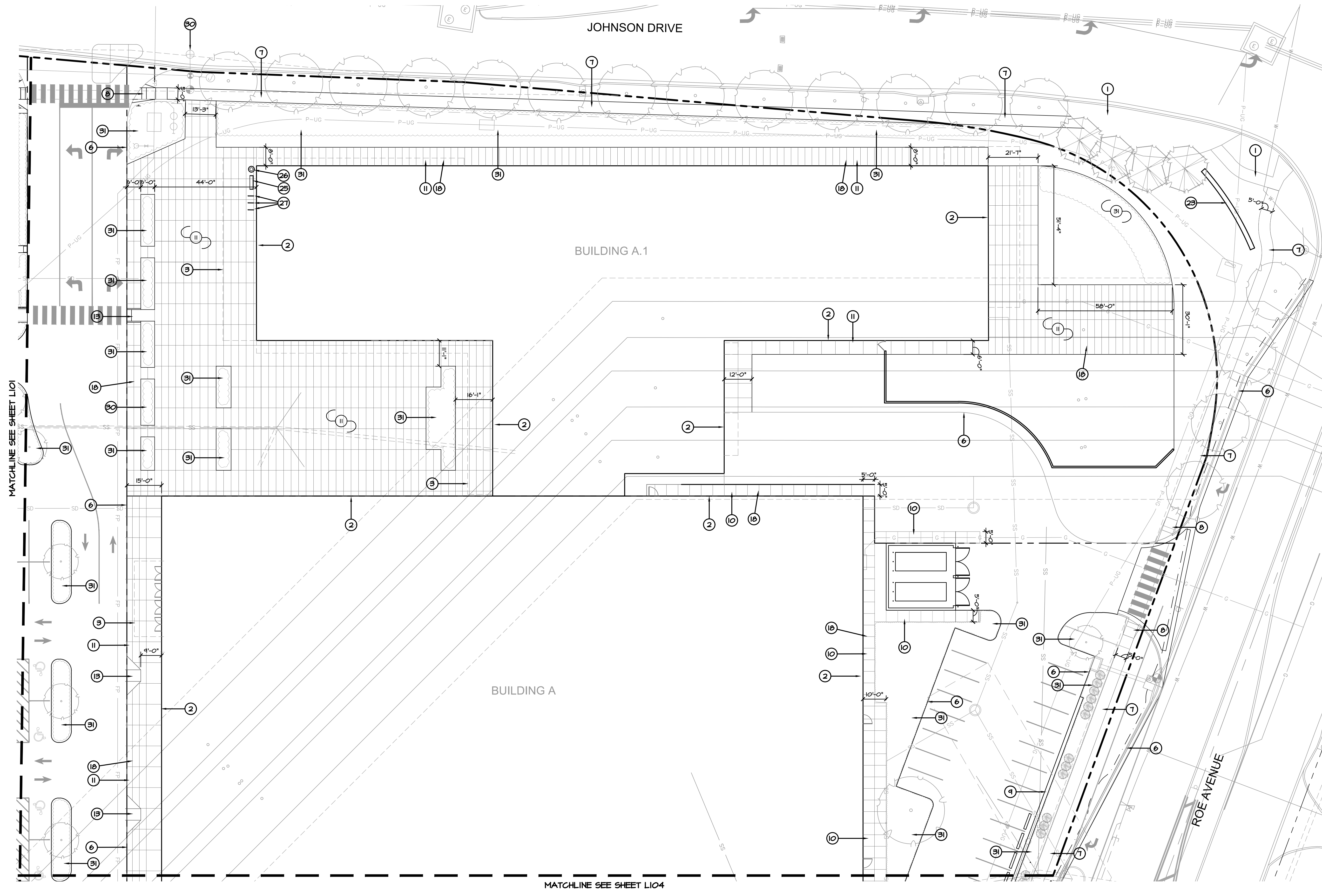
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FDP-L101

HARDSCAPE PLAN

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HARDSCAPE LEGEND:

- - - RIGHT OF WAY / PROPERTY LINE
- - - SHEET MATCHLINE

HARDSCAPE PLAN NOTES:

- 1 EXISTING WALK
- 2 BUILDING FACADE, REF. ARCHITECTURAL PLANS
- 3 BUILDING CANOPY, REF. ARCHITECTURAL PLANS
- 4 BUILDING COLUMN, REF. ARCHITECTURAL PLANS
- 5 PARKING GARAGE, REF. CIVIL PLANS
- 6 BACK OF CURB, REF. CIVIL PLANS
- 7 CONCRETE SIDEWALK, REF. CIVIL PLANS
- 8 CONCRETE CURB RAMP, REF. CIVIL PLANS
- 9 RETAINING WALL, REF. CIVIL PLANS
- 10 CONCRETE PAVEMENT WITH STRAIGHT CUT JOINT
- 11 INTEGRAL COLOR OR STAINED CONCRETE WALK WITH "V" CUT JOINT
- 12 INTEGRAL COLOR CONCRETE CROSSWALK WITH "V" CUT JOINT
- 13 CONCRETE CURB RAMP
- 14 CONCRETE RAMP
- 15 CONCRETE STAIRS
- 16 CONCRETE STAIRS + BOARDFORM WALL
- 17 BOARD FORM CONCRETE WALL
- 18 CONTROL JOINT, TYP.
- 19 CONCRETE PAVERS
- 20 HARDWOOD BENCH, DARK STAIN FINISH
- 21 PERFORMANCE AREA, INTEGRAL COLOR CONCRETE
- 22 DIRECTIONAL SIGN, REF. I/L106
- 23 MONUMENT SIGN, REF. 2/L106
- 24 MONUMENT SIGN, REF. 3/L106
- 25 LANDSCAPE FORMS MULTIPLICITY BENCHES
- 26 LANDSCAPE FORMS MULTIPLICITY TRASH RECEPTACLE
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- 28 PEDESTRIAN LIGHT
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01 HARDSCAPE PLAN

FINAL DEVELOPMENT PLAN
 MARCH 17, 2017

REVISIONS:

REVISED LAYOUT 09.16.2019

CONSULTANTS:

| | | |
|--|---|---|
| CIVIL / LANDSCAPE: OLSSON ASSOCIATES 1301 BURLINGTON STREET SUITE 100 NORTH KANSAS CITY, MO 64116 TEL: 816.361.1177 | M/E/P: PKMR ENGINEERS 13300 W. 98TH ST. LENEXA, KANSAS 66215 TEL: 913-452-2400 FAX: 913-452-2437 | STRUCTURAL: BOB D. CAMPBELL & CO., INC. 4338 BELLEVUE AVE. KANSAS CITY, MISSOURI 64111 TEL: 816-531-4144 FAX: 816-531-8572 |
|--|---|---|

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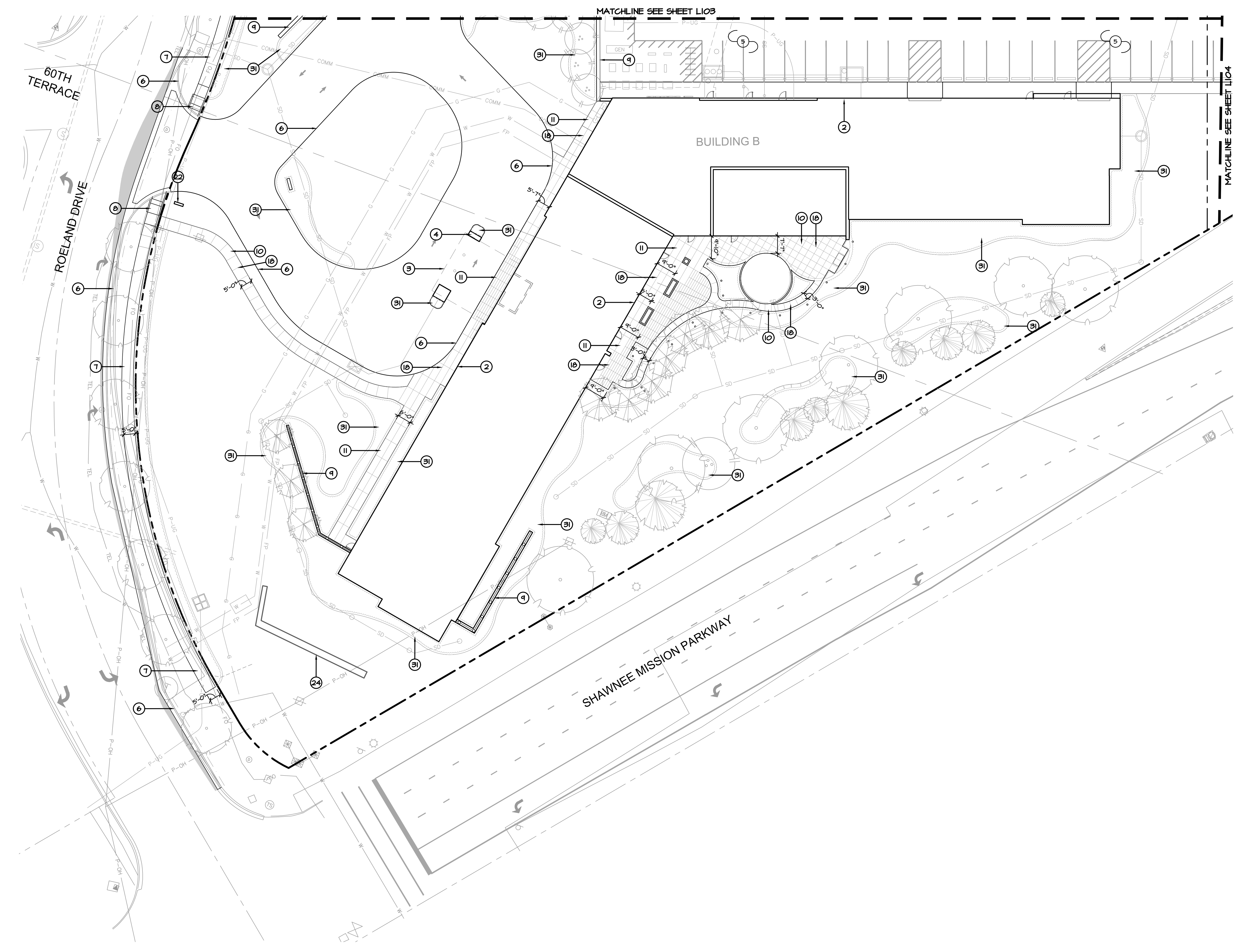
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 ENGINEERS

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 Structural Engineers - Since 1987

FDP-L102

HARDSCAPE PLAN

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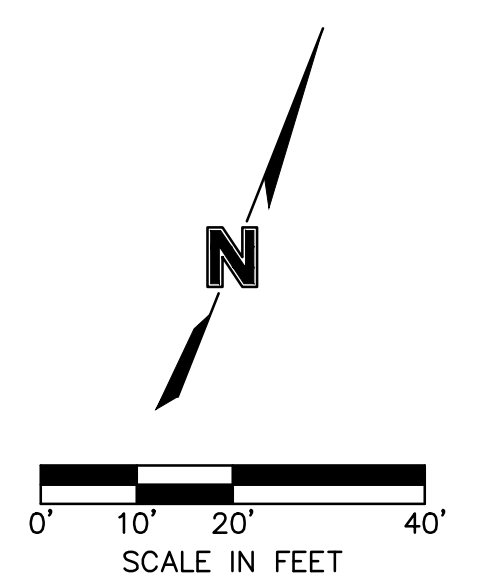


HARDSCAPE LEGEND:



HARDSCAPE PLAN NOTES:

- 1 EXISTING WALK
- 2 BUILDING FACADE, REF. ARCHITECTURAL PLANS
- 3 BUILDING CANOPY, REF. ARCHITECTURAL PLANS
- 4 BUILDING COLUMN, REF. ARCHITECTURAL PLANS
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- 17 BOARD FORM CONCRETE WALL
- 18 CONTROL JOINT, TYP.
- 19 CONCRETE PAVERS
- 20 HARDWOOD BENCH, DARK STAIN FINISH
- 21 PERFORMANCE AREA, INTEGRAL COLOR CONCRETE
- 22 DIRECTIONAL SIGN, REF. L1106
- 23 MONUMENT SIGN, REF. 2A106
- 24 MONUMENT SIGN, REF. 3A106
- 25 LANDSCAPE FORMS MULTIPLICITY BENCHES
- 26 LANDSCAPE FORMS MULTIPLICITY TRASH RECEPTACLE
- 27 LANDSCAPE FORMS MULTIPLICITY BIKE RACKS
- 28 PEDESTRIAN LIGHT
- 29 STREET LIGHT
- 30 COMBINATION STREET & PEDESTRIAN LIGHT
- 31 PLANTING BED



01 HARDSCAPE PLAN

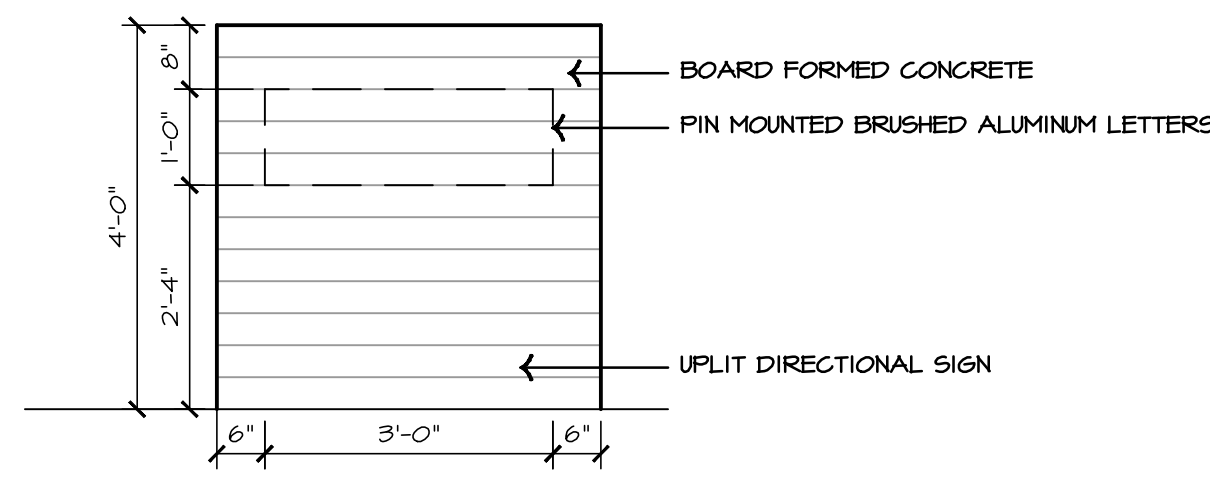
FINAL DEVELOPMENT PLAN
MARCH 17, 2017

REVISIONS:

REVISED LAYOUT 09.16.2019

CONSULTANTS:
CIVIL / LANDSCAPE:
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4338 BELLEVIEW AVE.
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FAX: 816-531-9572

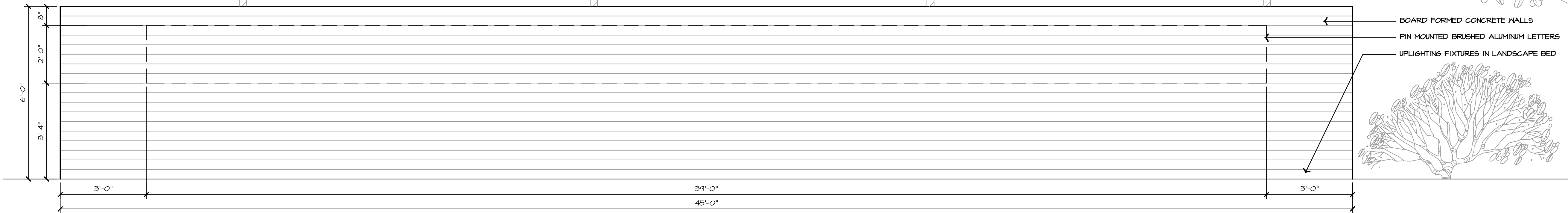
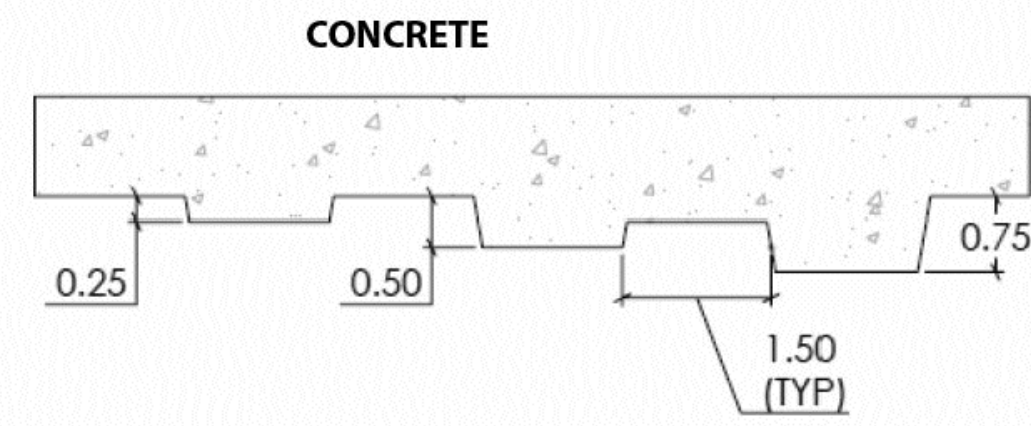
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ENGINEERS
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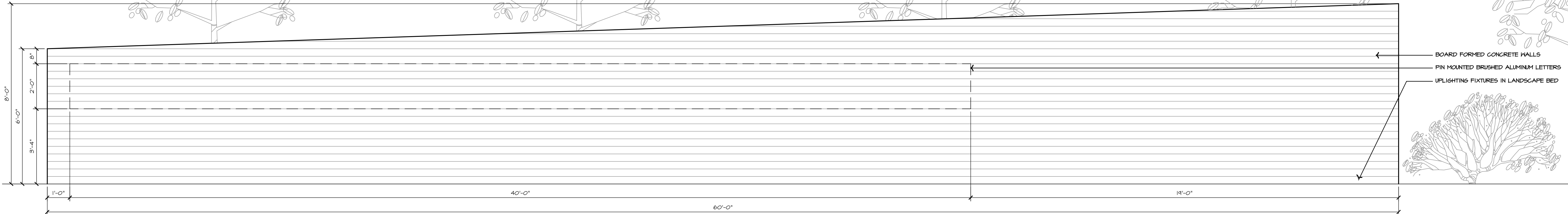
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SCALE: N.T.S



EXAMPLE OF BOARDFORM FINISH



2 CONCEPTUAL MONUMENT SIGN AT JOHNSON DR & ROE AVE
SCALE: N.T.S



3 CONCEPTUAL MONUMENT SIGN AT SHAWNEE MISSION PKWY & ROELAND AVE
SCALE: N.T.S

01 HARDSCAPE DETAILS

FINAL DEVELOPMENT PLAN
MARCH 17, 2017
REVISIONS:

REVISED LAYOUT 09.16.2019

CONSULTANTS:

CIVIL / LANDSCAPE:
OLSSON ASSOCIATES
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SUITE 100
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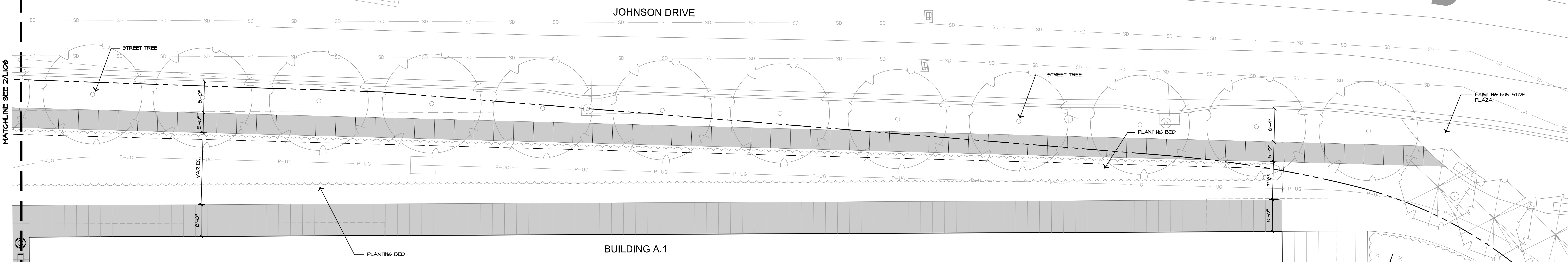
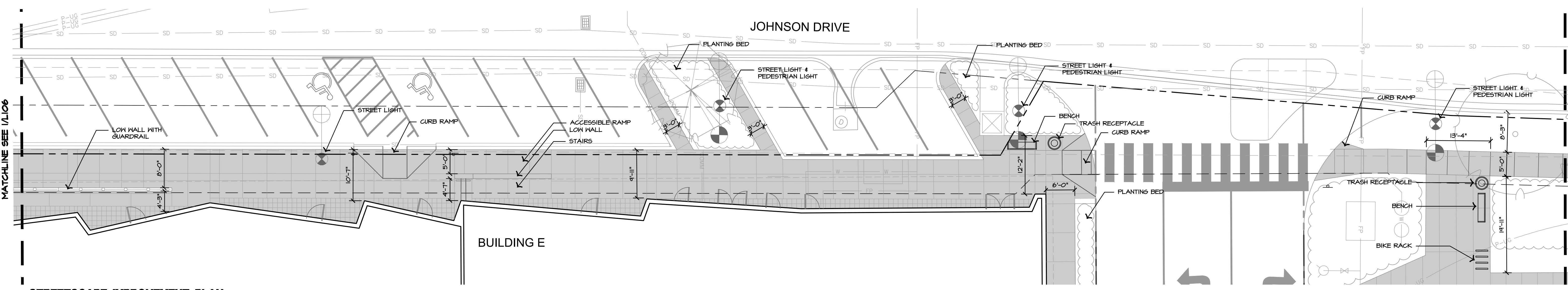
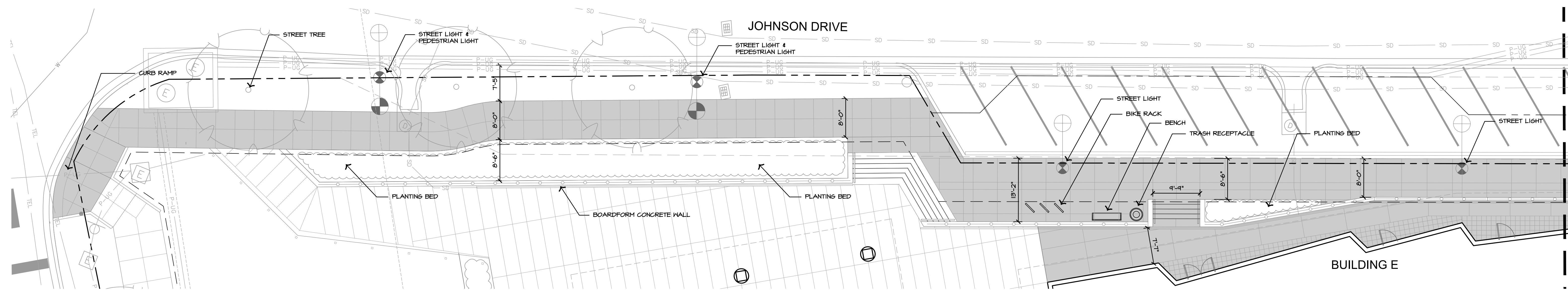
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HARDSCAPE DETAILS

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HARDSCAPE LEGEND:

-  RIGHT OF WAY / PROPERTY LINE
-  SHEET MATCHLINE
-  HARDSCAPE TO BE 60% CONCRETE AND 40% SPECIALTY PAVING

NOTE:
BIKE RACK, BENCH, AND LITTER RECEPTACLE TO BE COMPATIBLE WITH ESTABLISHED JOHNSON DRIVE STREETLIGHT AESTHETIC; REF: FDP-L102



01 STREETSCAPE PLAN

FINAL DEVELOPMENT PLAN
MARCH 17, 2017

REVISIONS:

REVISED LAYOUT 09.16.2019

CONSULTANTS:

CIVIL / LANDSCAPE:
OLSSON ASSOCIATES
1301 BURLINGTON STREET
SUITE 100
NORTH KANSAS CITY, MO 64116
TEL: 816.361.1177

M/E/P:
PKMR ENGINEERS
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LENEXA, KANSAS 66215
TEL: 913-492-2400
FAX: 913-492-2437

STRUCTURAL:
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KANSAS CITY, MISSOURI 64111
TEL: 816-531-4144
FAX: 816-531-9372

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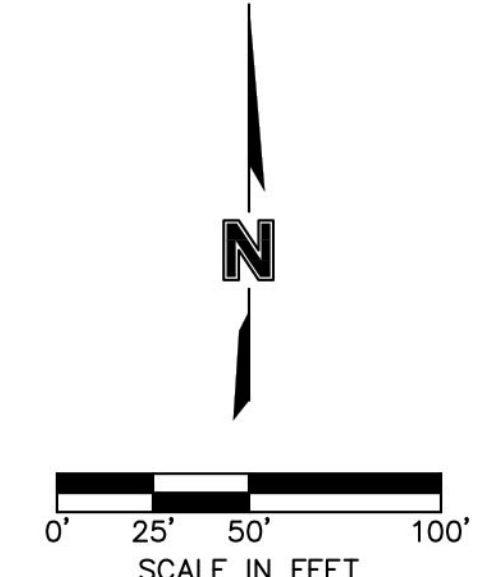
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ENGINEERS

B.D.C.
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PLAN KEY

- SITE BENCH ●
- BIKE RACK ●
- LITTER RECEPTACLE ●
- HARDWOOD BENCH —
- PUBLIC OPEN SPACE - 56,855,100 SQFT
- PRIVATE OPEN SPACE - 12,600 SQFT



01 OPEN SPACE & AMENITIES PLAN

FINAL DEVELOPMENT PLAN
MARCH 17, 2017

REVISIONS:

REVISED LAYOUT 09.16.2019

CONSULTANTS:

| | | |
|--|---|--|
| <p>CIVIL / LANDSCAPE: OLSSON ASSOCIATES 1301 BURLINGTON STREET SUITE 100 NORTH KANSAS CITY, MO 64116 TEL: 816.361.1177</p> | <p>M/E/P: PKMR ENGINEERS 13300 W. 98TH ST. LENEXA, KANSAS 66215 TEL: 913-492-2400 FAX: 913-492-2437</p> | <p>STRUCTURAL: BOB D. CAMPBELL & CO., INC. 4338 BELLEVIEW AVE. KANSAS CITY, MISSOURI 64111 TEL: 816-531-4144 FAX: 816-531-8872</p> |
|--|---|--|

MISSION GATEWAY

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ENGINEERS

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Structural Engineers - Since 1982

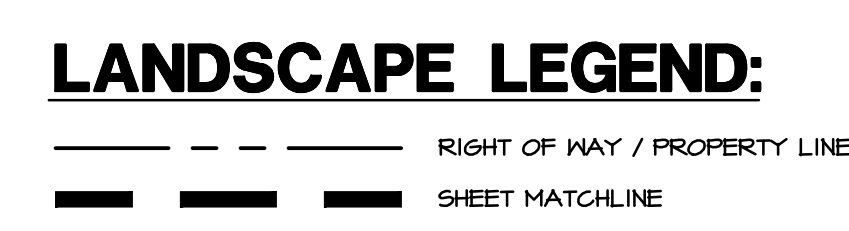
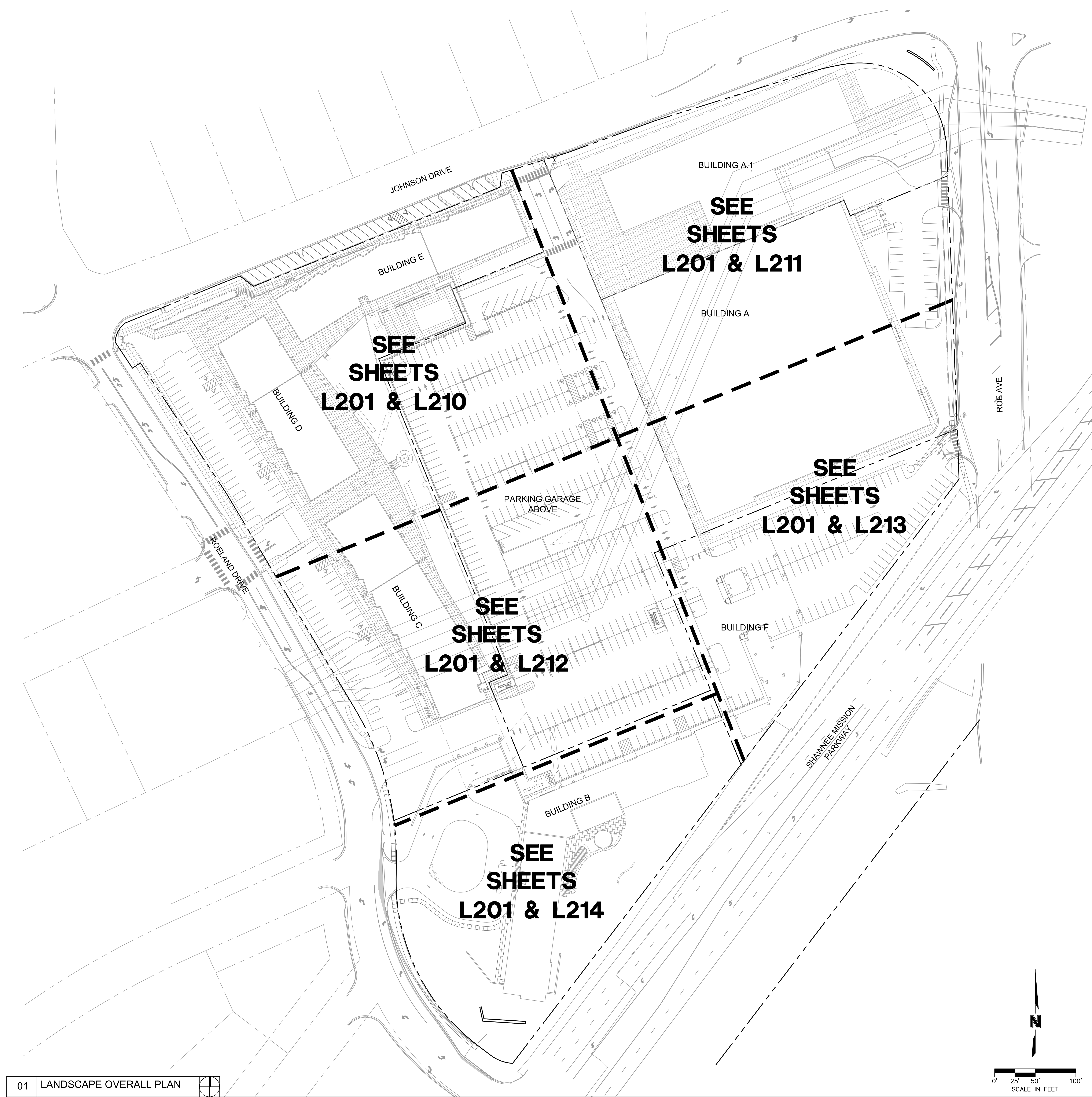
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FDP-L108

OPEN SPACE & AMENITIES PLAN

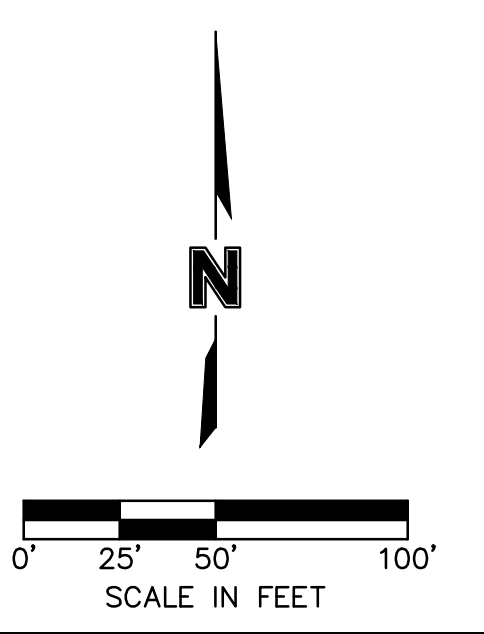
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- LANDSCAPE GENERAL NOTES:**
- THE CONSTRUCTION COVERED BY THESE PLANS SHALL CONFORM TO ALL APPLICABLE STANDARDS AND SPECIFICATIONS OF THE CITY OF MISSION, KANSAS IN CURRENT USAGE. ALL STANDARDS NOT COVERED BY THE CITY SHALL BE AFWA STANDARDS IN CURRENT USAGE UNLESS OTHERWISE NOTED.
 - CONTRACTOR SHALL VERIFY EXACT LOCATION OF ALL EXISTING UTILITIES, DRAIN LINES AND IRRIGATION PIPING PRIOR TO COMMENCING WORK AND AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE OCCASIONED BY THE CONTRACTOR'S FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES, DRAIN LINES AND IRRIGATION PIPING.
 - CONTRACTOR SHALL VERIFY AND COORDINATE ALL FINAL GRADES WITH LANDSCAPE ARCHITECT PRIOR TO COMPLETION.
 - DEBRIS SHALL NOT BE ALLOWED TO ACCUMULATE AND SHALL BE REMOVED AT FREQUENT INTERVALS. AT COMPLETION OF WORK IN EACH AREA, THE CONTRACTOR SHALL GATHER AND REMOVE ALL DEBRIS, EQUIPMENT, AND EXCESS MATERIAL FROM THAT AREA. AT FINAL COMPLETION OF ALL WORK HE SHALL REMOVE ALL SUCH ITEMS FROM THE PREMISES.
 - LOCATION AND PLACEMENT OF ALL PLANT MATERIAL SHALL BE COORDINATED WITH LANDSCAPE ARCHITECT PRIOR TO INSTALLATION.
 - THE LANDSCAPE PLANTING PLAN GRAPHICALLY ILLUSTRATES OVERALL PLANT MASSINGS. EACH PLANT SPECIES SHALL BE PLACED IN THE FIELD TO UTILIZE THE GREATEST COVERAGE OF THE GROUND PLANE. THE FOLLOWING APPLIES FOR INDIVIDUAL PLANTINGS:
 - ALL EVERGREEN SHRUBS AND CREEPING GROUNDCOVERS SHALL BE MINIMUM OF 2' FROM ANY PAVING EDGE.
 - ALL PLANTS OF THE SAME SPECIES SHALL BE EQUALLY SPACED AND SITED FOR THE BEST AESTHETIC VIEWING.
 - ALL TREES, EVERGREEN OR DECIDUOUS, SHALL BE A MINIMUM OF 4' FROM ANY PAVING EDGE.
 - ANY SUBSTITUTION OF SPECIFIED PLANT MATERIAL WILL NOT BE ALLOWED WITHOUT WRITTEN AUTHORIZATION FROM LANDSCAPE ARCHITECT PRIOR TO INSTALLATION.
 - MULCH ALL PLANTING AREAS TO A DEPTH OF 3" DEPTH ACCORDING TO PLANS AND SPECIFICATIONS. SAMPLES SHALL BE APPROVED BY LANDSCAPE ARCHITECT.
 - ALL PLANT MATERIAL WILL BE HEALTHY, VIGOROUS AND FREE OF DISEASE AND INSECTS PER AAN STANDARDS. LANDSCAPE ARCHITECT RESERVES THE RIGHT TO REJECT ANY INFERIOR OR OTHERWISE UNSUITABLE PLANT MATERIAL PROPOSED FOR USE ON THE PROJECT.
 - ALL PLANTING BEDS NOT FULLY CONTAINED BY CONCRETE CURBS OR WALKS SHALL BE EDGED ACCORDING TO PLANS AND SPECIFICATIONS.
 - PLANTS AND LANDSCAPE MATERIALS SHALL BE INSTALLED AS DETAILED ON PLANS.
 - PLANT BACKFILL FOR TREES AND SHRUBS SHALL BE PER SPECIFICATIONS.
 - ALL PLANTING BEDS SHALL BE TREATED WITH DACTHAL PRE-EMERGENT HERBICIDE AT MANUFACTURER RECOMMENDED RATES AND SHALL BE COVERED WITH SPECIFIED MULCH APPLICATION. APPLY LIGHTER APPLICATION OF DACTHAL HERBICIDE TO TOP OF MULCH LAYER.
 - ALL AREAS DISTURBED DURING CONSTRUCTION THAT ARE NOT DESIGNATED AS PLANTING BEDS OR PAVEMENT AREAS SHALL BE SOEDED WITH A TURF TYPE TALL FESCUE PER SPECIFICATIONS.
 - ALL PLANT MATERIAL SHALL BE GUARANTEED FOR A PERIOD OF ONE YEAR AFTER OWNER'S FINAL ACCEPTANCE OF FINISHED JOB. ALL DEAD AND DAMAGED PLANT MATERIAL SHALL BE REPLACED BY LANDSCAPE CONTRACTOR AT THEIR EXPENSE. LANDSCAPE CONTRACTOR SHALL MAINTAIN PLANT MATERIAL UNTIL FINAL ACCEPTANCE.
 - ALL LANDSCAPE BEDS SHALL BE MOUNDED AS SHOWN ON PLANS AND DETAILS.
 - LANDSCAPE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING ACTUAL PLANT QUANTITIES REQUIRED TO COMPLETE THE PROJECT, AS SHOWN ON PLANS, AND BASE THEIR BID ACCORDINGLY.
 - ALL LANDSCAPE AREAS WILL BE IRRIGATED WITH A FULLY AUTOMATIC IRRIGATION SYSTEM. TURF AREAS SHALL BE IRRIGATED WITH ROTOR OR SPRAY HEADS, AND ALL LANDSCAPE BEDS SHALL BE IRRIGATED WITH DRIP IRRIGATION. THE SYSTEM WILL INCLUDE QUICK COUPLERS FOR MANUAL IRRIGATION WHERE NEEDED.
 - PLANT KEY DESCRIPTION:

| | |
|-----|------------|
| (P) | PLANT TYPE |
| 3 | QUANTITY |



01 LANDSCAPE OVERALL PLAN

FINAL DEVELOPMENT PLAN
MARCH 17, 2017

REVISIONS:

REVISED LAYOUT 09.16.2019

CONSULTANTS:

| | | |
|--|---|---|
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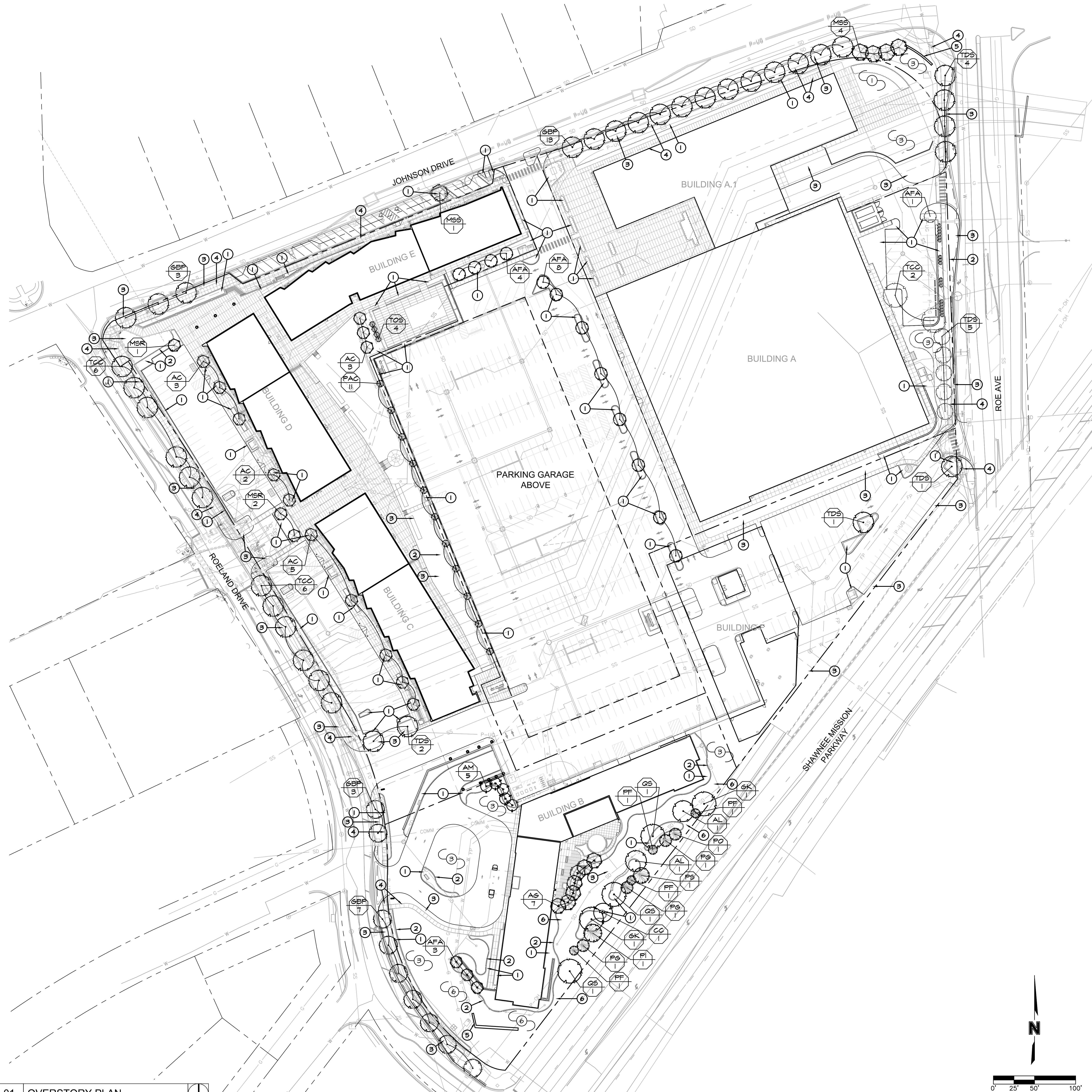
MISSION GATEWAY

el dorado olsson **pkmr** **BDC**

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FDP-L200
LANDSCAPE OVERALL PLAN

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 PROJECTS: 015-2039-10-D-156m
 REFERENCE: C:\BASE_FDP_52039



LANDSCAPE GENERAL NOTES:

- THE CONSTRUCTION COVERED BY THESE PLANS SHALL CONFORM TO ALL APPLICABLE STANDARDS AND SPECIFICATIONS OF THE CITY OF MISSION, KANSAS IN CURRENT USAGE. ALL STANDARDS NOT COVERED BY THE CITY SHALL BE AFA/MSR STANDARDS IN CURRENT USAGE UNLESS OTHERWISE NOTED.
- CONTRACTOR SHALL VERIFY EXACT LOCATION OF ALL EXISTING UTILITIES, DRAIN LINES AND IRRIGATION PIPING PRIOR TO COMMENCING WORK AND AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE OCCASIONED BY THE CONTRACTOR'S FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES, DRAIN LINES AND IRRIGATION PIPING.
- CONTRACTOR SHALL VERIFY AND COORDINATE ALL FINAL GRADES WITH LANDSCAPE ARCHITECT PRIOR TO COMPLETION.
- DEBRIS SHALL NOT BE ALLOWED TO ACCUMULATE AND SHALL BE REMOVED AT FREQUENT INTERVALS. AT COMPLETION OF WORK IN EACH AREA, THE CONTRACTOR SHALL GATHER AND REMOVE ALL DEBRIS, EQUIPMENT AND EXCESS MATERIAL FROM THAT AREA. AT FINAL COMPLETION HE SHALL REMOVE ALL SUCH ITEMS FROM THE PREMISES.
- LOCATION AND PLACEMENT OF ALL PLANT MATERIAL SHALL BE COORDINATED WITH LANDSCAPE ARCHITECT PRIOR TO INSTALLATION.
- THE LANDSCAPE PLANTING PLAN GRAPHICALLY ILLUSTRATES OVERALL PLANT MASSINGS. EACH PLANT SPECIES SHALL BE PLACED IN THE FIELD TO UTILIZE THE GREATEST COVERAGE OF THE GROUND PLANE. THE FOLLOWING APPLIES FOR INDIVIDUAL PLANTINGS:
 - ALL EVERGREEN SHRUBS AND CREEPING GROUNDCOVERS SHALL BE MINIMUM OF 2' FROM ANY PAVING EDGE.
 - ALL PLANTS OF THE SAME SPECIES SHALL BE EQUALLY SPACED AND SITED FOR THE BEST AESTHETIC VIEWING.
 - ALL TREES, EVERGREEN OR DECIDUOUS, SHALL BE A MINIMUM OF 4' FROM ANY PAVING EDGE.
- ANY SUBSTITUTION OF SPECIFIED PLANT MATERIAL WILL NOT BE ALLOWED WITHOUT WRITTEN AUTHORIZATION FROM LANDSCAPE ARCHITECT PRIOR TO INSTALLATION.
- MULCH ALL PLANTING AREAS TO A DEPTH OF 3" DEPTH ACCORDING TO PLANS AND SPECIFICATIONS. SAMPLES SHALL BE APPROVED BY LANDSCAPE ARCHITECT.
- ALL PLANT MATERIAL WILL BE HEALTHY, VIGOROUS AND FREE OF DISEASE AND INSECTS PER AAN STANDARDS. LANDSCAPE ARCHITECT RESERVES THE RIGHT TO REJECT ANY INTERIOR OR OTHERWISE UNSUITABLE PLANT MATERIAL PROPOSED FOR USE ON THE PROJECT.
- ALL PLANTING BEDS NOT FULLY CONTAINED BY CONCRETE CURBS OR WALKS SHALL BE EDED ACCORDING TO PLANS AND SPECIFICATIONS.
- PLANTS AND LANDSCAPE MATERIALS SHALL BE INSTALLED AS DETAILED ON PLANS.
- PLANT BACKFILL FOR TREES AND SHRUBS SHALL BE PER SPECIFICATIONS.
- ALL PLANTING BEDS SHALL BE TREATED WITH DACTHAL PRE-EMERGENT HERBICIDE AT MANUFACTURER RECOMMENDED RATES AND SHALL BE COVERED WITH SPECIFIED MULCH APPLICATION. APPLY LIGHTER APPLICATION OF DACTHAL HERBICIDE TO TOP OF MULCH LAYER.
- ALL AREAS DISTURBED DURING CONSTRUCTION THAT ARE NOT DESIGNATED AS PLANTING BEDS OR PAVEMENT AREAS SHALL BE SOODED WITH A TURF-TYPE TALL FESCUE PER SPECIFICATIONS.
- ALL PLANT MATERIAL SHALL BE GUARANTEED FOR A PERIOD OF ONE YEAR AFTER OWNER'S FINAL ACCEPTANCE OF FINISHED JOB. ALL DEAD AND DAMAGED PLANT MATERIAL SHALL BE REPLACED BY LANDSCAPE CONTRACTOR AT THEIR EXPENSE. LANDSCAPE CONTRACTOR SHALL MAINTAIN PLANT MATERIAL UNTIL FINAL ACCEPTANCE.
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- ALL LANDSCAPE AREAS WILL BE IRRIGATED WITH A FULLY AUTOMATIC IRRIGATION SYSTEM. TURF AREAS SHALL BE IRRIGATED WITH ROTORS OR SPRAY HEADS, AND ALL LANDSCAPE BEDS SHALL BE IRRIGATED WITH DRIP IRRIGATION. THE SYSTEM WILL INCLUDE QUICK COUPLERS FOR MANUAL IRRIGATION WHERE NEEDED.
- PLANT KEY DESCRIPTION:

LANDSCAPE LEGEND:



LANDSCAPE PLAN NOTES:

- PLANTING BED; REF: LANDSCAPE UNDERSTORY PLAN
- BED EDGE
- AREA TO BE SOODED WITH TURF-TYPE FESCUE GRASS 500
- TRAIL OR SIDEWALK; REF: CIVIL / HARDSCAPE PLANS
- MONUMENT SIGN
- AREA TO BE SEEDDED WITH NATIVE GRASS SEED

PLANT SCHEDULE - OVERSTORY

| QTY | KEY | BOTANICAL NAME | COMMON NAME | SIZE | COND. | COMMENTS |
|-------------------------|-----|---|--------------------------------|----------------|-------|-----------|
| SHADE TREES | | | | | | |
| 15 | AFA | Acer x Freemanii 'Armstrong' | ARMSTRONG MAPLE | 2" CAL. | B # B | N/A |
| 7 | AG | Acer glabrum | PARISH MAPLE | 2" CAL. | B # B | N/A |
| 2 | AL | Acer saccharum 'Legacy' | LEGACY SUGAR MAPLE | 2" CAL. | B # B | N/A |
| 26 | GBF | Ginkgo biloba 'Princeton Sentry' | PRINCETON SENTRY GINKGO | 2" CAL. | B # B | PILE ONLY |
| 2 | GK | Gymnocladia dioica | KENTUCKY COFFEE TREE | 2" CAL. | B # B | N/A |
| 5 | QS | Quercus shumardii | SHUMARD RED OAK | 2" CAL. | B # B | N/A |
| 14 | TCC | Tilia cordata 'Chancellor' | CHANCELLOR LITTLE LEAF LINDEN | 2" CAL. | B # B | N/A |
| 15 | TDS | Taxodium distichum 'Shamnee Brave' | SHAMNEE BRAVE BALD CYPRESS | 2" CAL. | B # B | N/A |
| ORNAMENTAL TREES | | | | | | |
| 15 | AC | Amelanchier canadensis 'Shadblow' | SHADBLOW SERVICEBERRY | 6'-0" HT. MIN. | B # B | N/A |
| 5 | AM | Amelanchier x grandiflora 'Autumn Brilliance' | AUTUMN BRILLIANCE SERVICEBERRY | 6'-0" HT. MIN. | B # B | N/A |
| 3 | CC | Cercis canadensis | EASTERN REDBUD | 6'-0" HT. MIN. | B # B | N/A |
| 3 | MSR | Magnolia stellata 'Royal Star' | ROYAL STAR MAGNOLIA | 6'-0" HT. MIN. | B # B | N/A |
| 5 | MSS | Malus 'Spring Snow' | SPRING SNOW CRABAPPLE | 6'-0" HT. MIN. | B # B | N/A |
| EVERGREEN TREES | | | | | | |
| 11 | PAC | Picea abies 'Sprenters' | COLUMBIAN NORWAY SPRUCE | 6'-8" HT. MIN. | B # B | N/A |
| 4 | PF | Pinus flexilis 'Vanderhoff's Pyramid' | VANDERHOF PINE | 6'-8" HT. MIN. | B # B | N/A |
| 1 | PI | Picea canadensis | NORWAY SPRUCE | 6'-8" HT. MIN. | B # B | N/A |
| 3 | PS | Picea pungens 'Sloaca' | COLORADO BLUE SPRUCE | 6'-8" HT. MIN. | B # B | N/A |
| 1 | PO | Picea omorika | SERBIAN SPRUCE | 6'-8" HT. MIN. | B # B | N/A |
| 1 | PS | Pinus strobus | WHITE PINE | 6'-8" HT. MIN. | B # B | N/A |
| 4 | TOS | Thuja occidentalis 'Smaragd' | EMERALD GREEN ARBORVITAE | 6'-8" HT. MIN. | B # B | N/A |

LANDSCAPING REQUIREMENTS:

CITY OF MISSION, KANSAS
 ZONING ORDINANCE CHAPTER 415 ARTICLE III
 CURRENT SITE ZONED: MCD
 TOTAL PROPERTY: 16.2 ACRES (105,612 SQ FT)

MINIMUM TREE REQUIREMENTS:

ONE (1) TREE FOR EACH FIFTY (50) FEET OF STREET FRONTAGE.

| | | |
|---|----------|----------|
| TOTAL FRONTAGE JOHNSON DRIVE = 1,030 LN FT TREES (1,030 / 50 = 20.6) | 21 TREES | 21 TREES |
| TOTAL FRONTAGE ROE AVENUE = 504 LN FT TREES (504 / 50 = 10.1) | 10 TREES | 10 TREES |
| TOTAL FRONTAGE SHAWNEE MISSION PARKWAY = 1,405 LN FT TREES (1,405 / 50 = 28.1) | 18 TREES | 18 TREES |
| TOTAL FRONTAGE ROELAND DRIVE = 1,050 LN FT TREES (1,050 / 50 = 21) | 21 TREES | 21 TREES |

ONE (1) TREE FOR EVERY THREE THOUSAND (3,000) SQUARE FEET OF LANDSCAPED OPEN SPACE.

| | | |
|---|----------|----------|
| TOTAL LANDSCAPED OPEN SPACE = 136,450 SQ FT TREES (136,450 / 3,000 = 46.5) | 46 TREES | 46 TREES |
|---|----------|----------|

ONE (1) TREE FOR EACH TWENTY (20) CARS OF PARKING AREA.

| | | |
|---|---------|---------|
| TOTAL PARKING SPACES BUILDINGS A, B, & F = 124 (UNCOVERED STALLS) TREES (124 / 20 = 6.2) | 4 TREES | 4 TREES |
| TOTAL PARKING SPACES BUILDINGS D & C = 94 TREES (94 / 20 = 4.7) | 5 TREES | 5 TREES |
| TOTAL PARKING SPACES BUILDING E = 28 (ON-STREET) | 0 TREES | 0 TREES |

PLANTING WITHIN PARKING AREAS REQUIREMENTS:

NOT LESS THAN SIX PERCENT (6%) OF THE INTERIOR OF A PARKING LOT SHALL BE LANDSCAPED.

| | | |
|--|------------------|------------------|
| TOTAL UNCOVERED PARKING SPACES BUILDINGS A, B, & F = 124 MINIMUM LANDSCAPE AREA (124 * 210 = 49,140 * 0.06 = 2,948.4) | 2,948 SQ FT | 3,302 SQ FT |
| TOTAL PARKING SPACES BUILDINGS D & C = 94 MINIMUM LANDSCAPE AREA (94 * 210 = 19,740 * 0.06 = 1,184.4) | 1,525 SQ FT | 1,894 SQ FT |
| LANDSCAPE TOTALS | 130 TREES | 130 TREES |
| | 4,471 SQ FT | 5,196 SQ FT |

SCALE IN FEET
 0' 25' 50' 100'

01 OVERSTORY PLAN

FINAL DEVELOPMENT PLAN
 MARCH 17, 2017

REVISIONS:

REVISED LAYOUT 09.16.2019

CONSULTANTS:
 CIVIL / LANDSCAPE: OLSSON ASSOCIATES
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 TEL: 816.531-4144
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MISSION GATEWAY

el dorado olsson **pkmr** **B.D.C.**

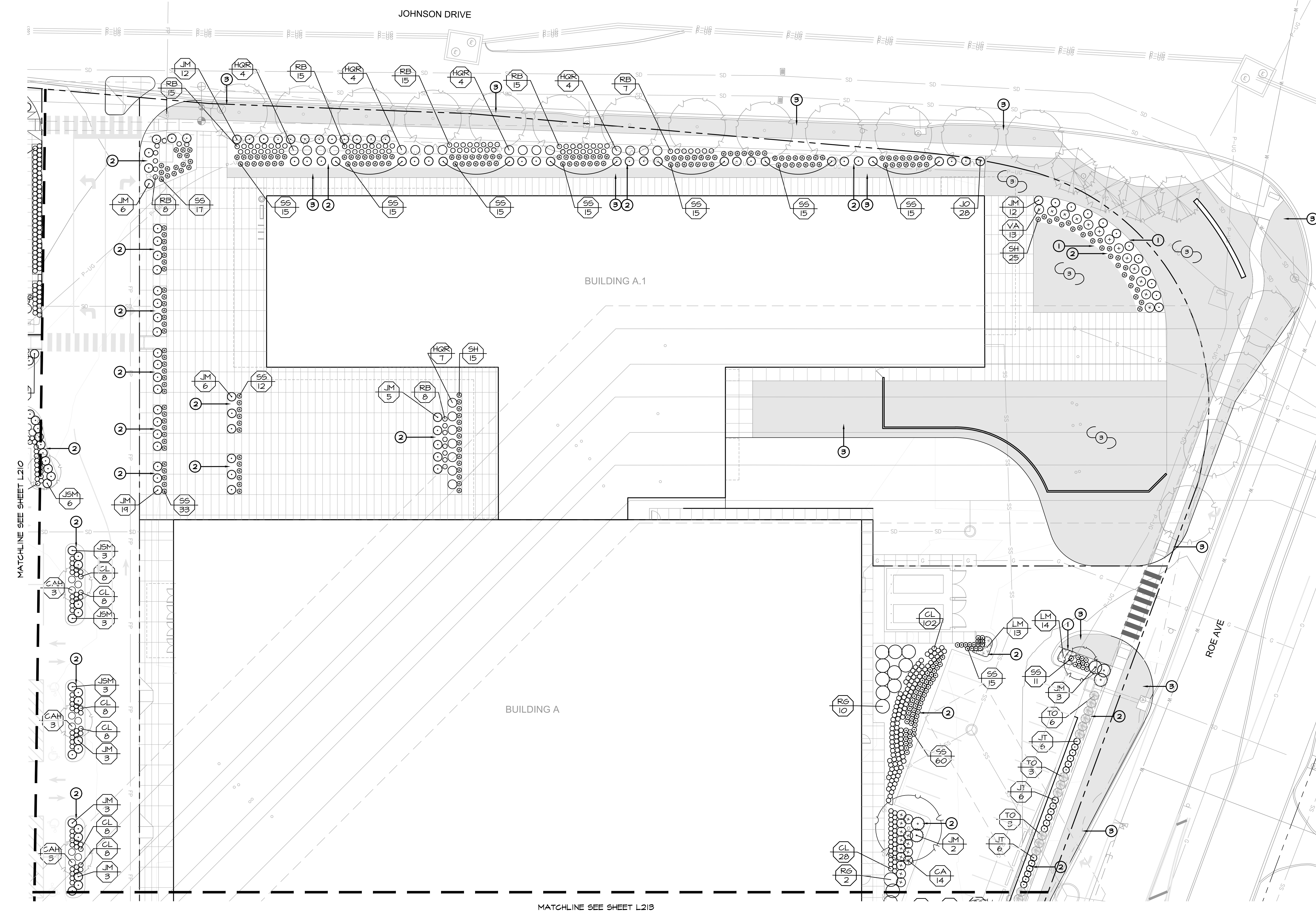
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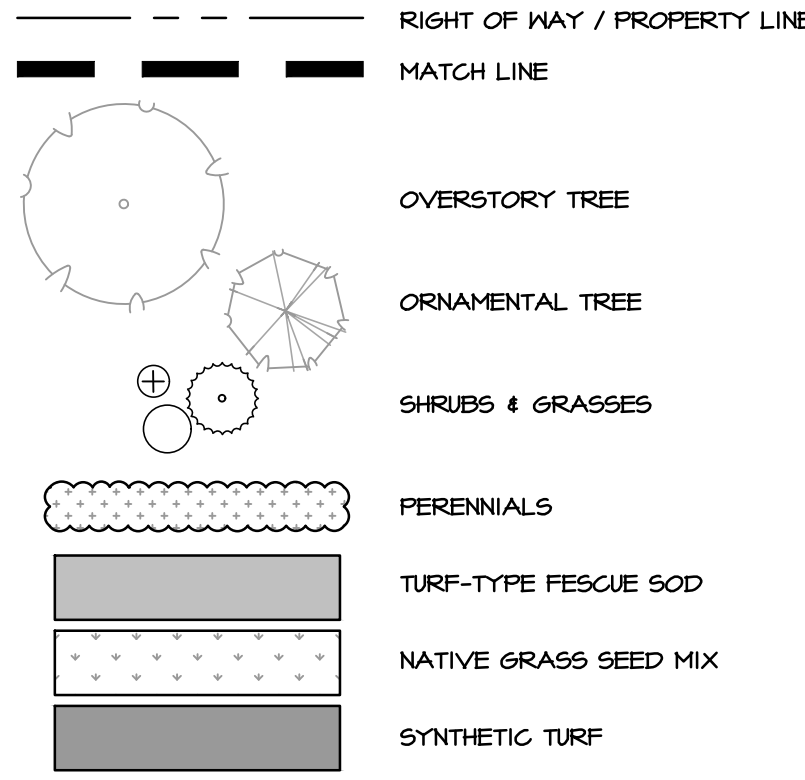
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LANDSCAPE OVERSTORY PLAN

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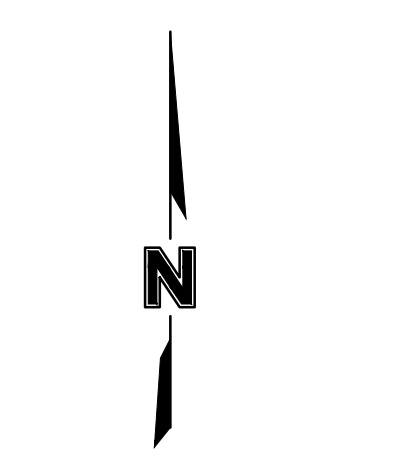


LANDSCAPE PLAN NOTES:

- 1 BED EDGE
- 2 PLANTING BED WITH HARDWOOD MULCH
- 3 AREA TO BE SOEDED WITH TURF-TYPE FESCUE SOD
- 4 AREA TO BE SEEDED WITH NATIVE GRASS SEED MIX
- 5 AREA TO BE SYNTHETIC TURF
- 6 AREA TO BE ROCK MULCH

PLANT SCHEDULE - UNDERSTORY

| QTY | KEY | BOTANICAL NAME | COMMON NAME | SIZE | COND. | COMMENTS |
|--|-----|--|---------------------------------------|-----------|-------|------------------|
| DECIDUOUS SHRUBS | | | | | | |
| 187 | CA | Cornus sericea 'Tartan' | ARCTIC FIRE DOGWOOD | 3 GAL. | CONT. | N/A |
| 27 | CEA | Clethra alnifolia 'Hummingbird' | HUMMINGBIRD SWEET PEPPERBUSH | 3 GAL. | CONT. | N/A |
| 11 | CH | Chaenactis speciosa 'Texas Scarlet' | TEXAS SCARLET COMMON FLOWERING QUINCE | 3 GAL. | CONT. | N/A |
| 17 | CS | Clethra alnifolia 'Steven's canalis' | SUMMERWREATH GLETTHERA | 3 GAL. | CONT. | N/A |
| 89 | CSK | Cornus sericea 'Katsink' | KELSIE'S DWARF REDDOBER DOGWOOD | 3 GAL. | CONT. | N/A |
| 18 | CSK | Cornus sericea 'Katsink Orange' | ROZANAC ORANGE BUSH-HONEYSUCKLE | 3 GAL. | CONT. | N/A |
| 69 | HGR | Hydrangea quercifolia 'Ruby Slippers' | RUBY SLIPPERS HYDRANGEA | 3 GAL. | CONT. | N/A |
| 12 | HGR | Hydrangea anomala subsp. 'Petalionis' | CLIMBING HYDRANGEA | 3 GAL. | CONT. | N/A |
| 12 | PH | Physocarpus opulifolius 'Dart's Gold' | YELLOW NINEBARK | 3 GAL. | CONT. | N/A |
| 200 | PL | Physocarpus opulifolius 'Donna May' | LITTLE DEVIL NINEBARK | 3 GAL. | CONT. | N/A |
| 21 | RS | Rhus aromatica 'Sora-Low' | SLOW-LOW FRAGRANT SUMAC | 3 GAL. | CONT. | N/A |
| 15 | VA | Viburnum dentatum 'Christom' | BLUE HIFFIN VIBURNUM | 3 GAL. | CONT. | N/A |
| 4 | V9 | Viburnum dentatum 'Synnevead' tm | CHICAGO LUSTRE ARBORVITAE VIBURNUM | 3 GAL. | CONT. | N/A |
| EVERGREEN SHRUBS | | | | | | |
| 16 | BSD | Buxus sempervirens 'Dee Rink' | DEE RINK BOXWOOD | 6'-8" HT. | CONT. | N/A |
| 24 | ICS | Ilex crenata 'Big Boy' | SKY PENCIL JAPANESE HOLLY | 6'-8" HT. | CONT. | N/A |
| 36 | JCC | Juniperus communis 'Compressa' | DWARF COMMON JUNIPER | 3 GAL. | CONT. | N/A |
| 171 | JM | Juniperus sabina 'Mona' | GALGARY CARPET JUNIPER | 3 GAL. | CONT. | N/A |
| 129 | JD | Juniperus virginiana 'Grey Owl' | GREY OWL JUNIPER | 3 GAL. | CONT. | N/A |
| 18 | JT | Juniperus virginiana 'Taylor' | TAYLOR EASTERN REDCEDAR | 6'-8" HT. | CONT. | N/A |
| 18 | TO | Taxus occidentalis 'Smaragd' | EMERALD GREEN ARBORVITAE | 6'-8" HT. | CONT. | N/A |
| GROUND COVER / PERENNIALS / GRASSES | | | | | | |
| 56 | AR | Anemone ranunculifolia 'Red October' | RED OCTOBER BIG BLUE STEW | 3 GAL. | CONT. | 30" O.C. SPACING |
| 391 | BB | Bouteloua gracilis 'Blonde Ambition' | BLONDE AMBITION BLUE GRAMA | 3 GAL. | CONT. | 24" O.C. SPACING |
| 25 | BMP | Brunnera macrophylla 'Jack Frost' | SIERRIAN BUXLOSS | 1 GAL. | CONT. | 24" O.C. SPACING |
| 219 | CAB | Carex blanda | EASTERN HOODLAND SEDGE | 3 GAL. | CONT. | 30" O.C. SPACING |
| 62 | CAK | Calamagrostis x acutiflora 'Karl Forester' | FEATHER REED GRASS | 3 GAL. | CONT. | 24" O.C. SPACING |
| 509 | CL | Cheilanthes latifolium | NORTHERN SEA GATS | 3 GAL. | CONT. | 36" O.C. SPACING |
| 150 | CSE | Coneopsis grandiflora 'Early Sunrise' | LARGE-FLOWERED TICKSEED | 1 GAL. | CONT. | 24" O.C. SPACING |
| 166 | CVZ | Coreopsis verticillata 'Zagreb' | THREADLEAF COREOPSIS | 1 GAL. | CONT. | 24" O.C. SPACING |
| 34 | EC | Echinacea purpurea 'White Swan' | WHITE SWAN CONEFLOWER | 1 GAL. | CONT. | 18" O.C. SPACING |
| 15 | EM | Echinacea purpurea 'Magnus' | MAGNUS PURPLE CONEFLOWER | 1 GAL. | CONT. | 36" O.C. SPACING |
| 169 | EP | Echinacea purpurea 'PASTORAL' | ROSY HORN HILLBERT CONEFLOWER | 1 GAL. | CONT. | 24" O.C. SPACING |
| 16 | EM | Echinacea purpurea 'Purpurea White' | POPPYBOWL WHITE CONEFLOWER | 1 GAL. | CONT. | 24" O.C. SPACING |
| 162 | HVG | Heuchera 'Citroneille' | CITRONELLE CORAL BELLS | 1 GAL. | CONT. | 18" O.C. SPACING |
| 126 | HVP | Heuchera 'Purple Palace' | PURPLE PALACE CORAL BELLS | 1 GAL. | CONT. | 18" O.C. SPACING |
| 80 | LM | Liriope muscari 'Big Blue' | BIG BLUE LILTURF | 1 GAL. | CONT. | 18" O.C. SPACING |
| 64 | LHV | Liriope muscari 'Variegata' | VARIEGATED LILTURF | 1 GAL. | CONT. | 18" O.C. SPACING |
| 31 | MAS | Miscanthus stratioliceps | OSTRICH FERN | 3 GAL. | CONT. | 30" O.C. SPACING |
| 6 | MG | Miscanthus sinensis 'Sacillimus' | MAIDEN GRASS | 1 GAL. | CONT. | 72" O.C. SPACING |
| 20 | MSA | Miscanthus sinensis 'Adagio' | ADAGIO MAIDEN GRASS | 3 GAL. | CONT. | 36" O.C. SPACING |
| 16 | NI | Nepeta x faassenii 'Walkers Low' | WALKERS LOW CATMINT | 1 GAL. | CONT. | 30" O.C. SPACING |
| 62 | PA | Patience sibirica | ROSE-LEAF RASHORT | 1 GAL. | CONT. | 18" O.C. SPACING |
| 271 | PN | Panicum virgatum 'Rostrobisbus' | ROSTROBISBUS SWITCHGRASS | 3 GAL. | CONT. | 24" O.C. SPACING |
| 74 | PV | Panicum virgatum 'Cloud Nine' | CLOUD NINE SWITCH GRASS | 3 GAL. | CONT. | 36" O.C. SPACING |
| 72 | PVN | Panicum virgatum 'Northern' | NORTHERN SWITCHGRASS | 1 GAL. | CONT. | 24" O.C. SPACING |
| 41 | RB | Rudbeckia frigidula | BLACK EYED SUSAN | 1 GAL. | CONT. | 18" O.C. SPACING |
| 10 | SC | Solidago nemoralis 'Caradonna' | CARADONNA PERENNIAL SALVIA | 1 GAL. | CONT. | 18" O.C. SPACING |
| 25 | SED | Sedum 'Maestro' | MAESTRO STONECROP | 1 GAL. | CONT. | 18" O.C. SPACING |
| 356 | SH | Sporobolus heterolepis | PRAIRIE GROFSEED | 1 GAL. | CONT. | 24" O.C. SPACING |
| 26 | SH | Solidago x polystachya 'May Night' | MAY NIGHT SAGE | 1 GAL. | CONT. | 18" O.C. SPACING |
| 954 | SS | Schizachyrium scoparium | LITTLE BLUESTEM | 1 GAL. | CONT. | 24" O.C. SPACING |
| 36 | TSS | Tierelia 'Sugar and Spice' | FOAM FLOWER | 1 GAL. | CONT. | 12" O.C. SPACING |
| 71 | VP | Verbena canadensis 'Homesstead Purple' | HOMESTEAD PURPLE VERBENA | 1 GAL. | CONT. | 24" O.C. SPACING |



01 UNDERSTORY PLAN

FINAL DEVELOPMENT PLAN
MARCH 17, 2017

REVISIONS:

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CONSULTANTS:

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MISSION GATEWAY



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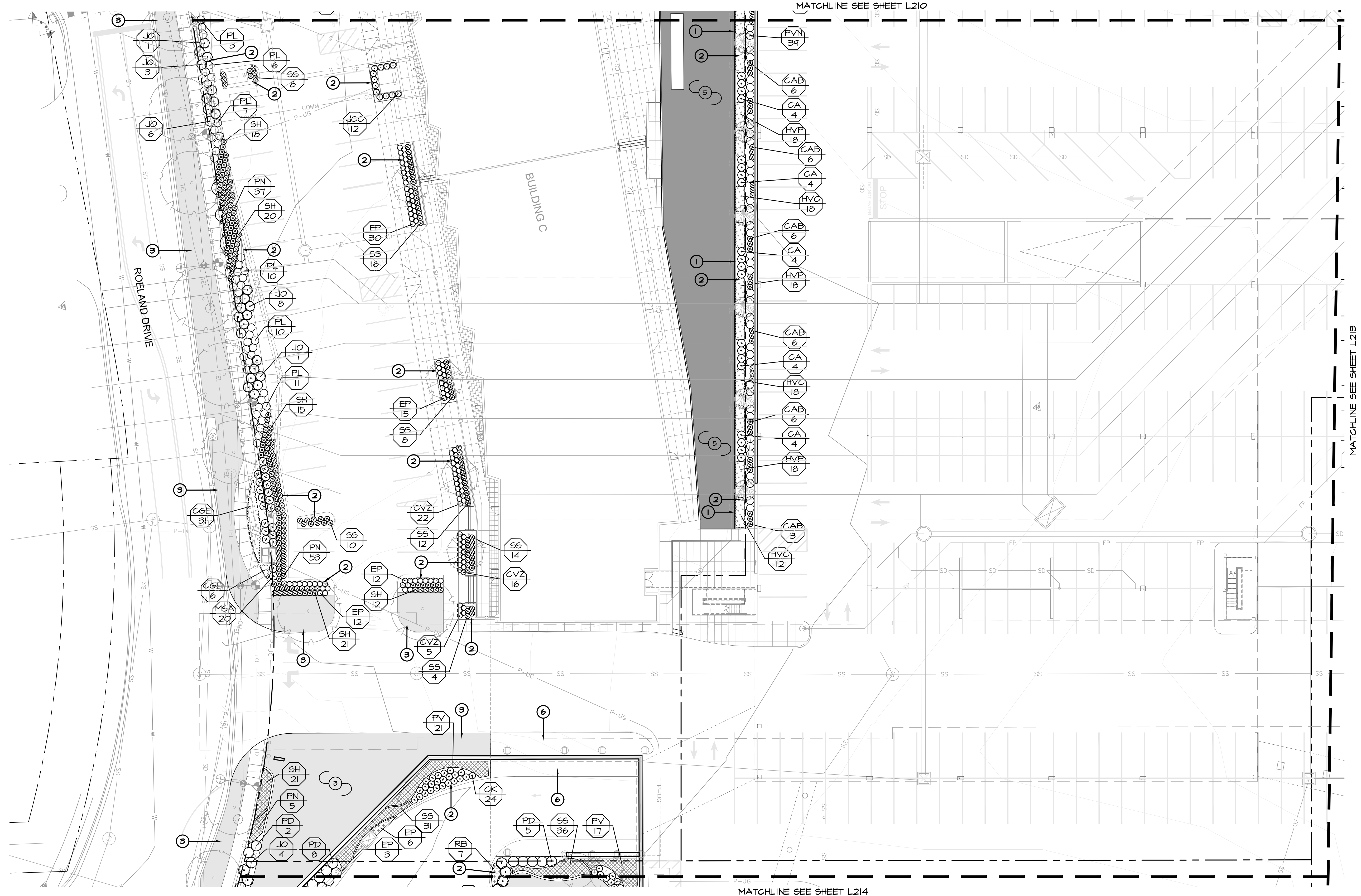
LANDSCAPE UNDERSTORY PLAN

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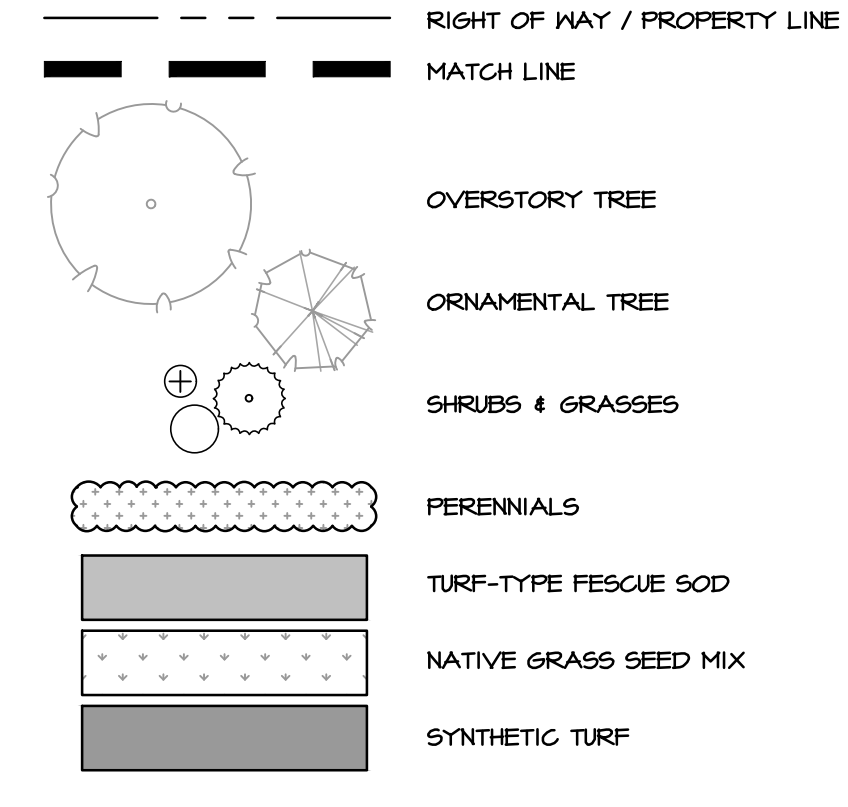
01 UNDERSTORY PLAN

FINAL DEVELOPMENT PLAN
 MARCH 17, 2017
 REVISIONS:

REVISED LAYOUT 09.16.2019



LANDSCAPE LEGEND:

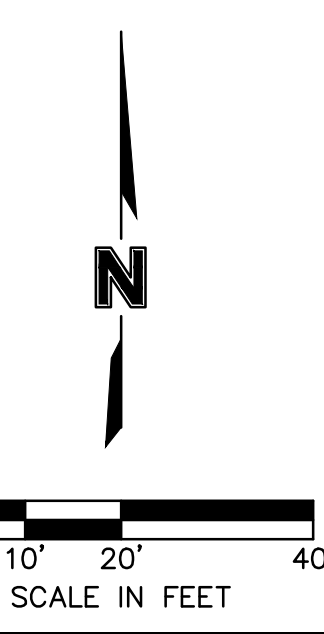


LANDSCAPE PLAN NOTES:

- BED EDGE
- PLANTING BED WITH HARDWOOD MULCH
- AREA TO BE SODDED WITH TURF-TYPE FESCUE SOD
- AREA TO BE SEEDED WITH NATIVE GRASS SEED MIX
- AREA TO BE SYNTHETIC TURF
- AREA TO BE ROCK MULCH

PLANT SCHEDULE - UNDERSTORY

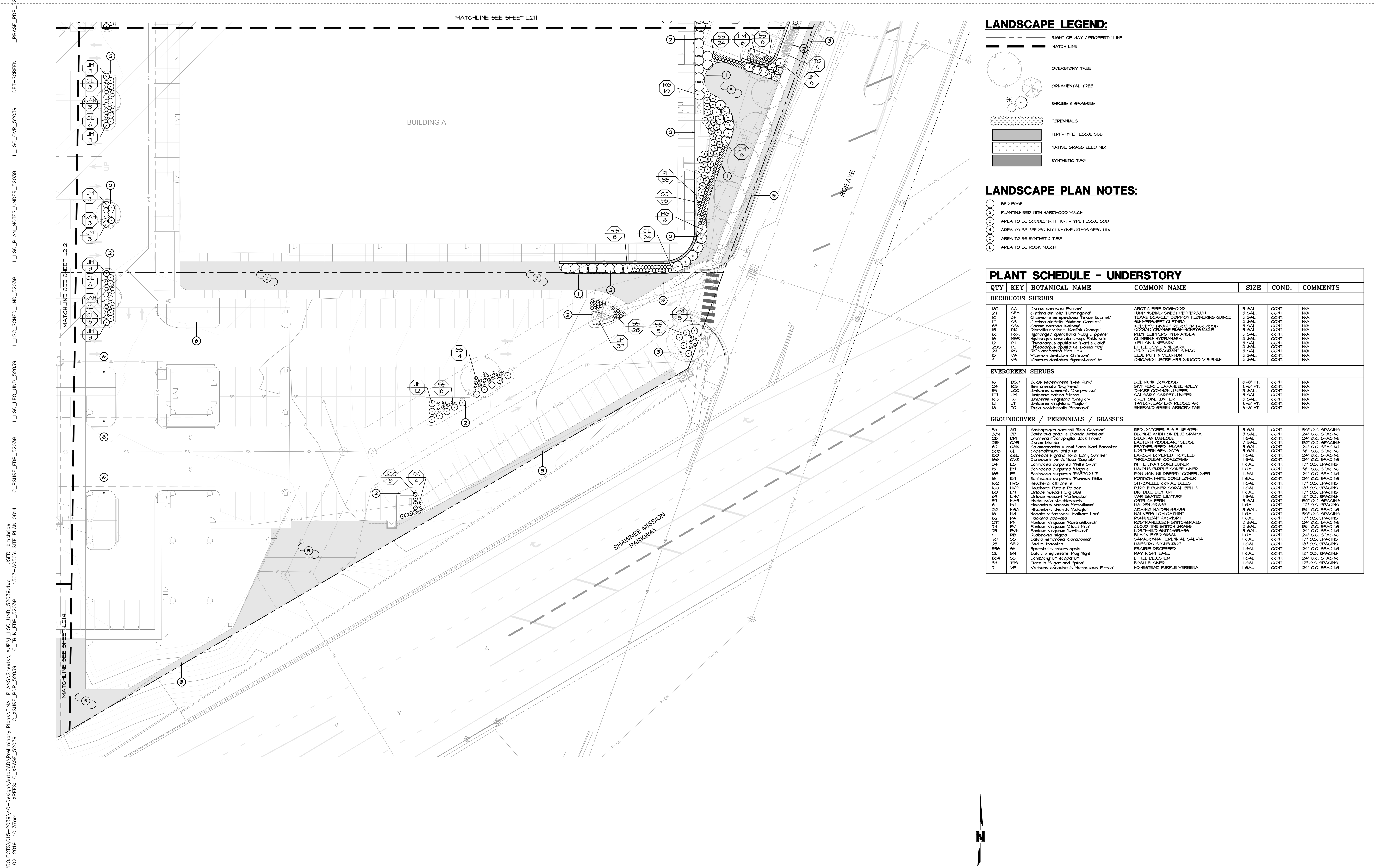
| QTY | KEY | BOTANICAL NAME | COMMON NAME | SIZE | COND. | COMMENTS |
|---|-----|---|---------------------------------------|-----------|-------|------------------|
| DECIDUOUS SHRUBS | | | | | | |
| 187 | CA | <i>Cornus sericea</i> 'Flam'* | ARCTIC FIRE DOGWOOD | 5 GAL. | CONT. | N/A |
| 27 | CEA | <i>Clethra alnifolia</i> 'Hummingbird' | HUMMINGBIRD SHEET PEPPERBUSH | 5 GAL. | CONT. | N/A |
| 10 | CS | <i>Chamaelirium luteum</i> 'Texas Scarlet' | TEXAS SCARLET COMMON FLOWERING QUINCE | 5 GAL. | CONT. | N/A |
| 17 | CS | <i>Clethra alnifolia</i> 'Sixteen Candles' | SIXTEEN CANDLES CLETHRA | 5 GAL. | CONT. | N/A |
| 15 | DK | <i>Cornus sericea</i> 'Kelsay' | KELSBERRY PEPPERBUSH | 5 GAL. | CONT. | N/A |
| 16 | DK | <i>Dierurgia fraxinea</i> 'Kodiak Orange' | KODIAK ORANGE BUSH-FRONT YUCCA | 5 GAL. | CONT. | N/A |
| 65 | HGR | <i>Hydrangea quercifolia</i> 'Ruby Slippers' | RUBY SLIPPERS HYDRANGEA | 5 GAL. | CONT. | N/A |
| 16 | HGR | <i>Hydrangea arborescens</i> 'Petals of Fire' | PETALS OF FIRE HYDRANGEA | 5 GAL. | CONT. | N/A |
| 12 | PH | <i>Physocarpus opulifolius</i> 'Dart's Gold' | DART'S GOLD | 5 GAL. | CONT. | N/A |
| 200 | PL | <i>Physocarpus opulifolius</i> 'Dona May' | DONA MAY | 5 GAL. | CONT. | N/A |
| 21 | RS | <i>Rhus aromatica</i> 'Sera-Low' | SMALL LEAF SUMAC | 5 GAL. | CONT. | N/A |
| 5 | VA | <i>Viburnum dentatum</i> 'Syracusa' | CRASHAW VIBURNUM | 5 GAL. | CONT. | N/A |
| 4 | VS | <i>Viburnum dentatum</i> 'Syracusa' | CHICAGO LUSTRE ARROWWOOD VIBURNUM | 5 GAL. | CONT. | N/A |
| EVERGREEN SHRUBS | | | | | | |
| 16 | BSD | <i>Buxus sempervirens</i> 'Dee Runk' | DEE RUNK BOXWOOD | 6"-8" HT. | CONT. | N/A |
| 24 | ICS | <i>Ilex crenata</i> 'Sky Pencil' | SKY PENCIL JAPANESE HOLLY | 6"-8" HT. | CONT. | N/A |
| 36 | JCC | <i>Juniperus communis</i> 'Compressa' | SPREADER COMMON JUNIPER | 5 GAL. | CONT. | N/A |
| 171 | JM | <i>Juniperus sabina</i> 'Mona' | CALGARY CARPET JUNIPER | 5 GAL. | CONT. | N/A |
| 105 | JO | <i>Juniperus virginiana</i> 'Sneez Owl' | GREY OWL JUNIPER | 5 GAL. | CONT. | N/A |
| 18 | JT | <i>Juniperus virginiana</i> 'Taylor' | TAYLOR EASTERN REDCEDAR | 6"-8" HT. | CONT. | N/A |
| 18 | TO | <i>Thuja occidentalis</i> 'Smaragd' | EMERALD GREEN ARBORVITAE | 6"-8" HT. | CONT. | N/A |
| GROUNDCOVER / PERENNIALS / GRASSES | | | | | | |
| 56 | AR | <i>Andropogon gerardii</i> 'Red October' | RED OCTOBER BIG BLUE STEM | 3 GAL. | CONT. | 30" O.C. SPACING |
| 334 | BB | <i>Boekenia gracilis</i> 'Blonde Ambition' | BLONDE AMBITION BLUE GRAMA | 3 GAL. | CONT. | 24" O.C. SPACING |
| 25 | BHF | <i>Brunnera macrophylla</i> 'Jack Frost' | SIBERIAN BUGLOSS | 1 GAL. | CONT. | 24" O.C. SPACING |
| 219 | CAB | <i>Calamagrostis x acutiflora</i> 'Karl Foerster' | EASTERN HOOGMOED SEDGE | 3 GAL. | CONT. | 30" O.C. SPACING |
| 62 | CAK | <i>Calamagrostis x acutiflora</i> 'Karl Foerster' | FEATHER REED GRASS | 3 GAL. | CONT. | 24" O.C. SPACING |
| 100 | CL | <i>Carex blanda</i> | NORTHERN SEA CATS | 1 GAL. | CONT. | 24" O.C. SPACING |
| 130 | CSE | <i>Coneopelis grandiflora</i> 'Earl's Sunrise' | LARGE-FLOWERED TICKSEED | 1 GAL. | CONT. | 24" O.C. SPACING |
| 166 | CVZ | <i>Coneopelis verticillata</i> 'Zigzag' | THREADED COREOPSIS | 1 GAL. | CONT. | 24" O.C. SPACING |
| 34 | EC | <i>Echinacea purpurea</i> 'White Swan' | WHITE SWAN CONEFLOWER | 1 GAL. | CONT. | 18" O.C. SPACING |
| 15 | EH | <i>Echinacea purpurea</i> 'Magnum' | MAGNUM PURPLE CONEFLOWER | 1 GAL. | CONT. | 36" O.C. SPACING |
| 165 | EP | <i>Echinacea purpurea</i> 'Pastorale' | IRON FOWL HILDBERRY CONEFLOWER | 1 GAL. | CONT. | 24" O.C. SPACING |
| 16 | EM | <i>Echinacea purpurea</i> 'Powwow White' | POWPOW WHITE CONEFLOWER | 1 GAL. | CONT. | 24" O.C. SPACING |
| 162 | HVC | <i>Heuchera citronella</i> | CITRONELLE CORAL BELLS | 1 GAL. | CONT. | 18" O.C. SPACING |
| 106 | HVF | <i>Heuchera purple Palace'</i> | PURPLE PALACE CORAL BELLS | 1 GAL. | CONT. | 18" O.C. SPACING |
| 80 | LM | <i>Liriope muscari</i> 'Big Blue' | BIG BLUE LILTURF | 1 GAL. | CONT. | 18" O.C. SPACING |
| 64 | LNV | <i>Liriope muscari</i> 'Viregat' | VARIEGATED LILTURF | 1 GAL. | CONT. | 18" O.C. SPACING |
| 31 | MAS | <i>Matricaria struthiopteris</i> | OSTRICH FEEL | 5 GAL. | CONT. | 30" O.C. SPACING |
| 6 | MG | <i>Miscanthus sinensis</i> 'Gracillimus' | HAIRY MAIDEN GRASS | 1 GAL. | CONT. | 72" O.C. SPACING |
| 20 | MSA | <i>Miscanthus sinensis</i> 'Adagio' | ADAGIO MAIDEN GRASS | 3 GAL. | CONT. | 36" O.C. SPACING |
| 16 | NK | <i>Nepeta x faassenii</i> 'Walkers Low' | WALKERS LOW CATMINT | 1 GAL. | CONT. | 30" O.C. SPACING |
| 271 | PN | <i>Panicum virgatum</i> 'Rostratum' | ROASTRAIL BUSH SWITCHGRASS | 3 GAL. | CONT. | 24" O.C. SPACING |
| 14 | PV | <i>Panicum virgatum</i> 'Cloud Nine' | CLOUD NINE SWITCHGRASS | 3 GAL. | CONT. | 36" O.C. SPACING |
| 75 | PVN | <i>Panicum virgatum</i> 'Northwind' | NORTHWIND SWITCHGRASS | 3 GAL. | CONT. | 24" O.C. SPACING |
| 41 | RB | <i>Rubicephala frigidula</i> | BLACK EYED SUSAN | 1 GAL. | CONT. | 24" O.C. SPACING |
| 10 | SC | <i>Salvia nemorosa</i> 'Caradonna' | CARADONNA PERENNIAL SALVIA | 1 GAL. | CONT. | 18" O.C. SPACING |
| 25 | SED | Sedum 'Maestro' | MAESTRO STONECROP | 1 GAL. | CONT. | 18" O.C. SPACING |
| 356 | SH | <i>Spiranthes heterolepis</i> | FRANKE DROPSIED | 1 GAL. | CONT. | 24" O.C. SPACING |
| 26 | SM | <i>Salvia x sylvestris</i> 'May Night' | MAY NIGHT SALVIA | 1 GAL. | CONT. | 18" O.C. SPACING |
| 854 | SP | <i>Schizanthus scoparium</i> | LITTLE BLUESTEM | 1 GAL. | CONT. | 24" O.C. SPACING |
| 36 | TSS | <i>Tabernaemontana 'Sugar and Spice'</i> | FOAM FLOWER | 1 GAL. | CONT. | 12" O.C. SPACING |
| 71 | VP | <i>Verbena canadensis</i> 'Homestead Purple' | HOMESTEAD PURPLE VERBENA | 1 GAL. | CONT. | 24" O.C. SPACING |



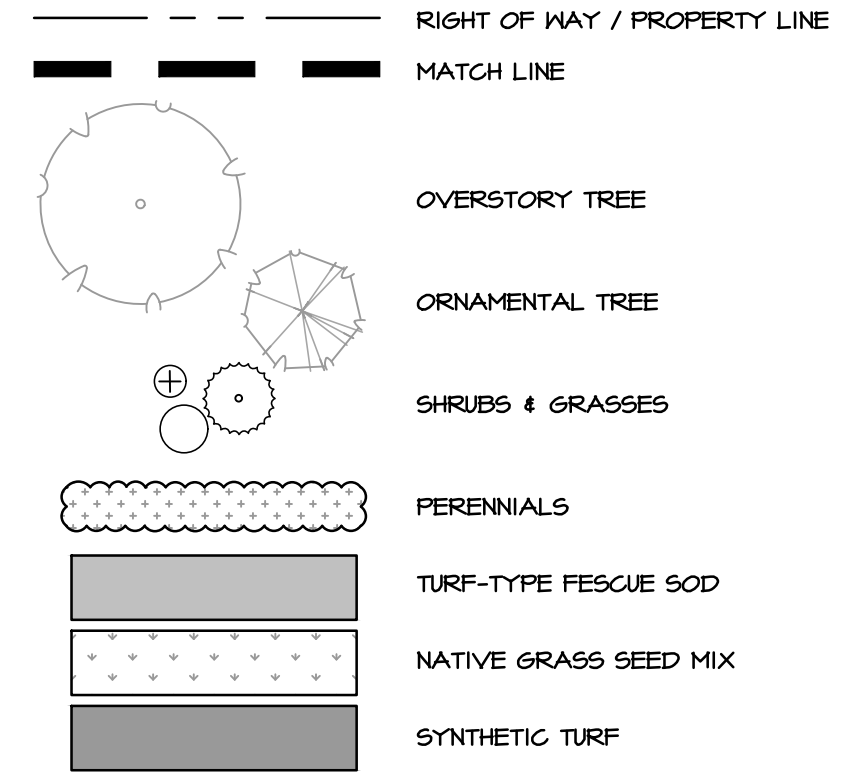
FDP-L212 LANDSCAPE UNDERSTORY PLAN

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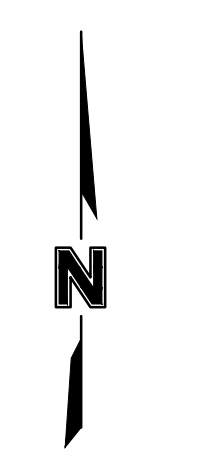


LANDSCAPE PLAN NOTES:

- 1 BED EDGE
- 2 PLANTING BED WITH HARDWOOD MULCH
- 3 AREA TO BE SODDED WITH TURF-TYPE FESCUE SOD
- 4 AREA TO BE SEEDDED WITH NATIVE GRASS SEED MIX
- 5 AREA TO BE SYNTHETIC TURF
- 6 AREA TO BE ROCK MULCH

PLANT SCHEDULE - UNDERSTORY

| QTY | KEY | BOTANICAL NAME | COMMON NAME | SIZE | COND. | COMMENTS |
|--|-----|--|---------------------------------------|-----------|-------|------------------|
| DECIDUOUS SHRUBS | | | | | | |
| 101 | CA | <i>Cornus sericea</i> 'Flamora' | ARCTIC FIRE DOGWOOD | 5 GAL. | CONT. | N/A |
| 27 | CEA | <i>Chaetochloa arifolia</i> 'Hummingbird' | HUMMINGBIRD SWEET FERREBUSH | 5 GAL. | CONT. | N/A |
| 10 | GH | <i>Chonemorpha speciosa</i> 'Texas Scarlet' | TEXAS SCARLET COMMON FLOWERING GUINCE | 5 GAL. | CONT. | N/A |
| 17 | SS | <i>Gaillardia arifolia</i> 'Sulsten Condies' | SUMMERSWEET GAELTREA | 5 GAL. | CONT. | N/A |
| 65 | CSK | <i>Cornus sericea</i> 'Kaiser' | REISEY'S DWARF REDOSIER DOGWOOD | 5 GAL. | CONT. | N/A |
| 15 | DK | <i>Dierilla involuta</i> 'Kaddak Orange' | KODIAK ORANGE BISH-HONEYSUCKLE | 5 GAL. | CONT. | N/A |
| 65 | HR | <i>Hydrangea operculata</i> 'Ruby Slippers' | RUBY SLIPPERS HYDRANGEA | 5 GAL. | CONT. | N/A |
| 16 | MSR | <i>Hydrangea anomala</i> subsp. <i>Petalolaris</i> | CLIMBING HYDRANGEA | 5 GAL. | CONT. | N/A |
| 19 | PH | <i>Physocarpus opulifolius</i> 'Diana's Gold' | YELLOW NINEBARK | 5 GAL. | CONT. | N/A |
| 200 | PL | <i>Physocarpus opulifolius</i> 'Donna May' | LITTLE DEVIL NINEBARK | 5 GAL. | CONT. | N/A |
| 24 | RS | <i>Rhus aromatica</i> 'Siro-Low' | GRACE-LOR PRAGER SUMAC | 5 GAL. | CONT. | N/A |
| 15 | VA | <i>Viburnum dentatum</i> 'Christine' | BLUE HUFFIN VIBURNUM | 5 GAL. | CONT. | N/A |
| 4 | VS | <i>Viburnum dentatum</i> 'Sympetvedt' tm | CHICAGO LISTRE ARROWWOOD VIBURNUM | 5 GAL. | CONT. | N/A |
| EVERGREEN SHRUBS | | | | | | |
| 16 | BSD | <i>Buxus sempervirens</i> 'Dae Runk' | DEE RUNK BOXWOOD | 6'-8" HT. | CONT. | N/A |
| 24 | ICJ | <i>Ilex crenata</i> 'Sky Pencil' | SKY PENCIL JAPANESE HOLLY | 6'-8" HT. | CONT. | N/A |
| 36 | JCC | <i>Juniperus communis</i> 'Compressa' | DWARF COMMON JUNIPER | 5 GAL. | CONT. | N/A |
| 177 | JM | <i>Juniperus ssp. nana</i> 'Monro' | CALSARY CARPET JUNIPER | 5 GAL. | CONT. | N/A |
| 105 | JO | <i>Juniperus virginiana</i> 'Grey Owl' | GREY OWL JUNIPER | 5 GAL. | CONT. | N/A |
| 18 | JT | <i>Juniperus virginiana</i> 'Taylor' | TAYLOR EASTERN REDCEDAR | 6'-8" HT. | CONT. | N/A |
| 18 | TO | <i>Thuja occidentalis</i> 'Emerald' | EMERALD GREEN ARBORVITAE | 6'-8" HT. | CONT. | N/A |
| GRANDCOVER / PERENNIALS / GRASSES | | | | | | |
| 56 | AR | <i>Andropogon gerardii</i> 'Red October' | RED OCTOBER BIG BLUE STEM | 3 GAL. | CONT. | 30" O.C. SPACING |
| 394 | BB | <i>Bouteloua gracilis</i> 'Blonde Ambition' | BLONDE AMBITION BLUE GRAMA | 3 GAL. | CONT. | 24" O.C. SPACING |
| 218 | CAB | <i>Carex blanda</i> | EASTERN WOODLAND SEDGE | 3 GAL. | CONT. | 30" O.C. SPACING |
| 62 | CAK | <i>Cortaderia selloana</i> 'Jack Frost' | FEATHER REED GRASS | 3 GAL. | CONT. | 24" O.C. SPACING |
| 508 | CL | <i>Chamaelirium luteolum</i> | NORTHERN SEA OATS | 3 GAL. | CONT. | 36" O.C. SPACING |
| 150 | CSE | <i>Coreopsis grandiflora</i> 'Early Sunrise' | LARGE FLOWERED TICKSEED | 1 GAL. | CONT. | 24" O.C. SPACING |
| 166 | CVZ | <i>Coreopsis verticillata</i> 'Zagreb' | THREADLEAF COREOPSIS | 1 GAL. | CONT. | 24" O.C. SPACING |
| 34 | EC | <i>Echinacea purpurea</i> 'White Swan' | WHITE SWAN CONEFLOWER | 1 GAL. | CONT. | 18" O.C. SPACING |
| 15 | BH | <i>Echinacea purpurea</i> 'Magna' | MAGNUS PURPLE CONEFLOWER | 1 GAL. | CONT. | 36" O.C. SPACING |
| 165 | EP | <i>Echinacea purpurea</i> 'Pastorale' | PASTORAL CONEFLOWER | 1 GAL. | CONT. | 24" O.C. SPACING |
| 16 | EW | <i>Echinacea purpurea</i> 'Powwow White' | POWOW WHITE CONEFLOWER | 1 GAL. | CONT. | 24" O.C. SPACING |
| 162 | HVC | <i>Heuchera coronilla</i> | CITRONELLE CORAL BELLS | 1 GAL. | CONT. | 18" O.C. SPACING |
| 106 | HVP | <i>Heuchera purpurea</i> 'Palace' | PURPLE POWER CORAL BELLS | 1 GAL. | CONT. | 18" O.C. SPACING |
| 20 | LH | <i>Liriope muscari</i> 'Big Blue' | BIG BLUE LILYTURF | 1 GAL. | CONT. | 18" O.C. SPACING |
| 64 | LHV | <i>Liriope muscari</i> 'Variegata' | VARIEGATED LILYTURF | 1 GAL. | CONT. | 18" O.C. SPACING |
| 37 | MAS | <i>Mastigia struthiopteris</i> | OSTRICH FERN | 5 GAL. | CONT. | 30" O.C. SPACING |
| 6 | MG | <i>Miscanthus sinensis</i> 'Gracillimus' | MAIDEN GRASS | 1 GAL. | CONT. | 12" O.C. SPACING |
| 20 | MSA | <i>Miscanthus sinensis</i> 'Adagio' | ADAGIO MAIDEN GRASS | 3 GAL. | CONT. | 36" O.C. SPACING |
| 16 | NH | <i>Nepeta x fossensis</i> 'Karl Foerster' | KARLS LOW CATMINT | 1 GAL. | CONT. | 30" O.C. SPACING |
| 62 | PA | <i>Panicum obtusifolium</i> | ROUNDLEAF RAGPOPP | 1 GAL. | CONT. | 18" O.C. SPACING |
| 277 | PN | <i>Panicum virgatum</i> 'Rusticoloratum' | AUSTRIAN PANICUM SWITCHGRASS | 3 GAL. | CONT. | 36" O.C. SPACING |
| 74 | PV | <i>Panicum virgatum</i> 'Cloud Nine' | CLOUD NINE SWITCH GRASS | 3 GAL. | CONT. | 36" O.C. SPACING |
| 75 | PVN | <i>Panicum virgatum</i> 'Northwind' | NORTHWIND SWITCHGRASS | 3 GAL. | CONT. | 24" O.C. SPACING |
| 41 | RB | <i>Rudbeckia fulgida</i> | BLACK EYED SUSAN | 1 GAL. | CONT. | 24" O.C. SPACING |
| 70 | SC | <i>Salvia nemorosa</i> 'Caradonna' | CARADONNA PERENNIAL SALVIA | 1 GAL. | CONT. | 18" O.C. SPACING |
| 25 | SED | <i>Sedum spectabile</i> | HAESTRIP STONECROP | 1 GAL. | CONT. | 18" O.C. SPACING |
| 356 | SH | <i>Sporobolus heterolepis</i> | PRAIRIE DROPSEED | 1 GAL. | CONT. | 24" O.C. SPACING |
| 26 | SH | <i>Salvia x sylvestris</i> 'May Night' | MAY NIGHT SAGE | 1 GAL. | CONT. | 18" O.C. SPACING |
| 804 | SS | <i>Schizanthus scaberrimus</i> | LITTLE BLUESTEM | 1 GAL. | CONT. | 24" O.C. SPACING |
| 36 | TSS | <i>Tianella 'Sugar and Spice'</i> | FOAM FLOWER | 1 GAL. | CONT. | 12" O.C. SPACING |
| 71 | VP | <i>Verbena canadensis</i> 'Homestead Purple' | HOMESTEAD PURPLE VERBENA | 1 GAL. | CONT. | 24" O.C. SPACING |



01 UNDERSTORY PLAN

FINAL DEVELOPMENT PLAN
MARCH 17, 2017

REVISIONS:

REVISED LAYOUT 09.16.2019

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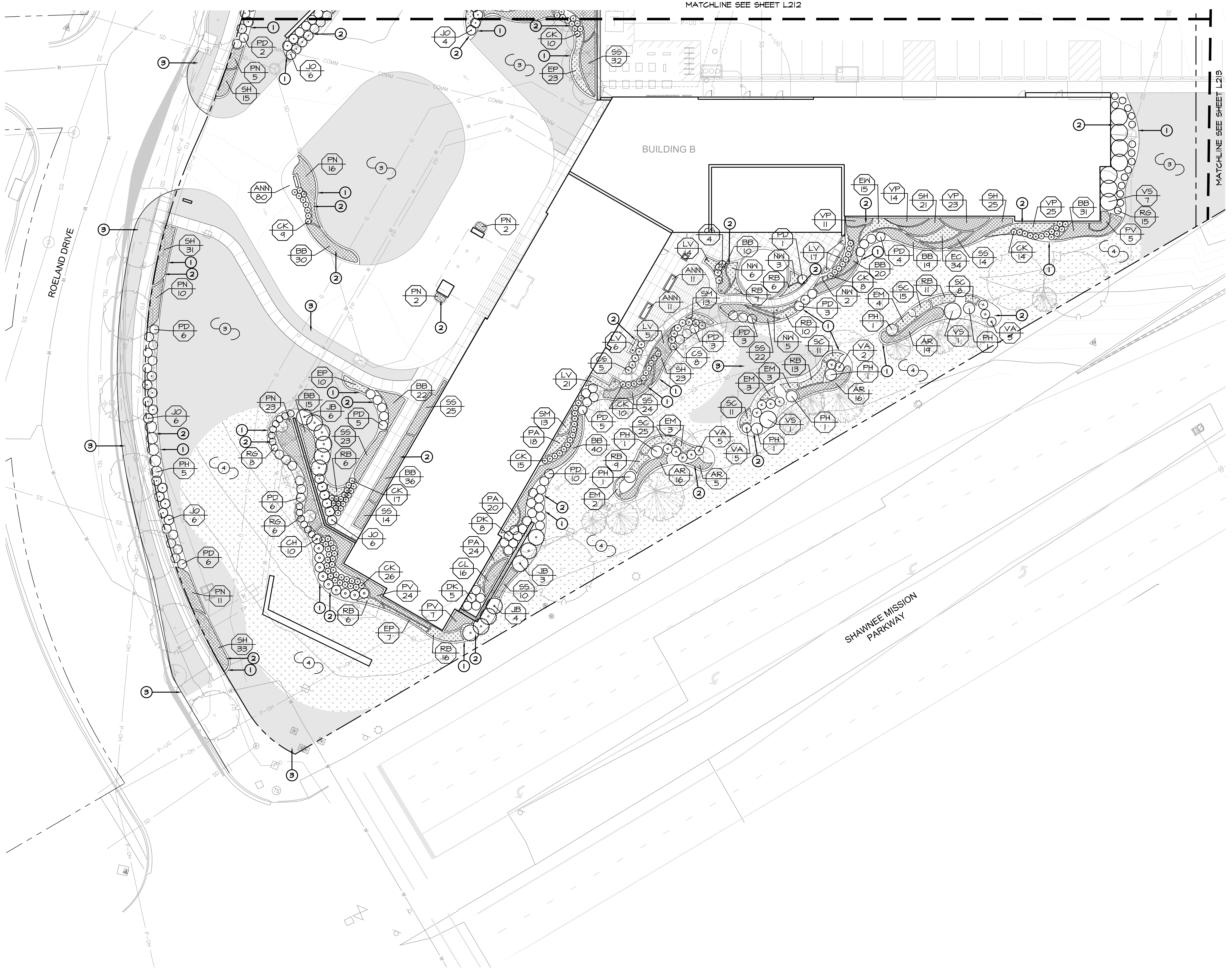
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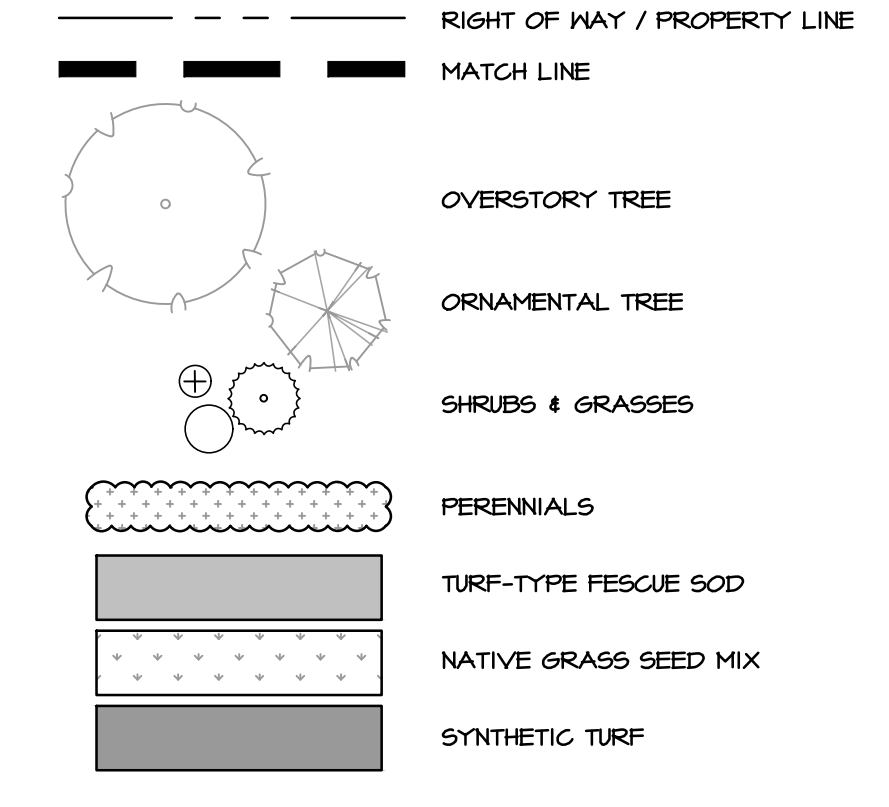
510 avenida cesar e chavez kansas city missouri 64108 p 816 474 3838 f 816 474 0836 www.eldoradoarchitects.com

FDP-L213
LANDSCAPE UNDERSTORY PLAN

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 DET-SCREEN



LANDSCAPE LEGEND:



LANDSCAPE PLAN NOTES:

- 1 BED EDGE
- 2 PLANTING BED WITH HARDWOOD MULCH
- 3 AREA TO BE SOCCDED WITH TURF-TYPE FESCUE SOD
- 4 AREA TO BE SEEDED WITH NATIVE GRASS SEED MIX
- 5 AREA TO BE SYNTHETIC TURF
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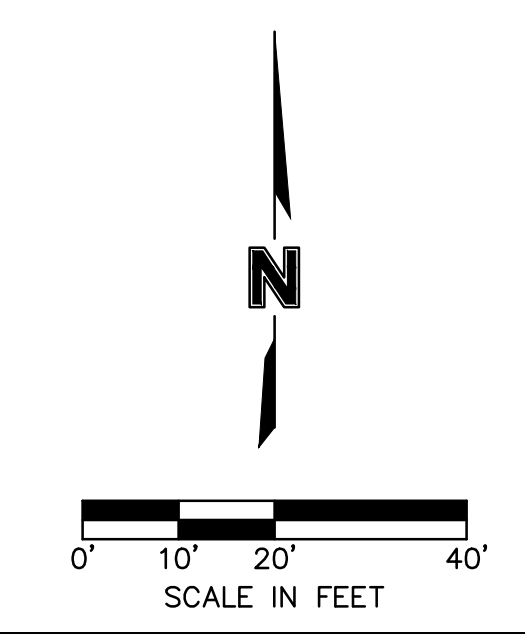
PLANT SCHEDULE - UNDERSTORY

| QTY | KEY | BOTANICAL NAME | COMMON NAME | SIZE | COND. | COMMENTS |
|---|-----|---|---------------------------------------|-----------|-------|------------------|
| DECIDUOUS SHRUBS | | | | | | |
| 187 | GA | <i>Cornus sericea</i> 'Flamco' | ARCTIC FIRE DOGWOOD | 5 GAL. | CONT. | N/A |
| 27 | CEA | <i>Clethra alnifolia</i> 'Hammingbird' | HUMMINGBIRD SWEET PEPPERBUSH | 5 GAL. | CONT. | N/A |
| 10 | GH | <i>Glaucostemmis spicata</i> 'Texas Scarlet' | TEXAS SCARLET COMMON FLOWERING QUINCE | 5 GAL. | CONT. | N/A |
| 17 | CS | <i>Clethra alnifolia</i> 'Sixteen Candles' | SUMMERSWEET CLETHRA | 5 GAL. | CONT. | N/A |
| 49 | CK | <i>Cornus sericea</i> 'Kelsey' | KELSEY'S DWARF REDCHIPER DOGWOOD | 5 GAL. | CONT. | N/A |
| 15 | DK | <i>Dryas octopetala</i> 'Kofax Orange' | KODIAK ORANGE BUSH-HONEY-SUCKLE | 5 GAL. | CONT. | N/A |
| 65 | HRR | <i>Hydrangea quercifolia</i> 'Ruby Slipper' | RUBY SLIPPERS HYDRANGEA | 5 GAL. | CONT. | N/A |
| 16 | HRR | <i>Hydrangea anomala</i> ssp. 'Petals of Ice' | GLIMMERING HYDRANGEA | 5 GAL. | CONT. | N/A |
| 12 | PH | <i>Physocarpus opulifolius</i> 'Dart's Gold' | YELLOW NINEBARK | 5 GAL. | CONT. | N/A |
| 200 | FL | <i>Physocarpus opulifolius</i> 'Dona May' | LITTLE DEVIL NINEBARK | 5 GAL. | CONT. | N/A |
| 24 | RG | <i>Rhus aromatica</i> 'Gro-Low' | GRO-LOW FRAGRANT SUMAC | 5 GAL. | CONT. | N/A |
| 15 | VA | <i>Viburnum dentatum</i> 'Christina' | BLUE HIFFIN VIBURNUM | 5 GAL. | CONT. | N/A |
| 4 | VS | <i>Viburnum dentatum</i> 'Synnystvedt' 'In' | CHICAGO LUSTRE ARROWWOOD VIBURNUM | 5 GAL. | CONT. | N/A |
| EVERGREEN SHRUBS | | | | | | |
| 16 | BSD | <i>Buxus sempervirens</i> 'Dee Runk' | DEE RUNK BOXWOOD | 6'-8" HT. | CONT. | N/A |
| 24 | ICS | <i>Ilex crenata</i> 'Sky Pencil' | SKY PENCIL JAPANESE HOLLY | 6'-8" HT. | CONT. | N/A |
| 36 | JCC | <i>Juniperus communis</i> 'Compressa' | DWARF COMMON JUNIPER | 5 GAL. | CONT. | N/A |
| 177 | JM | <i>Juniperus scopulorum</i> 'Monro' | CALGARY CARPET JUNIPER | 5 GAL. | CONT. | N/A |
| 105 | JV | <i>Juniperus virginiana</i> 'Smy Ovi' | GREY OVI JUNIPER | 5 GAL. | CONT. | N/A |
| 18 | JT | <i>Juniperus virginiana</i> 'Taylor' | TAYLOR EASTERN RED CEDAR | 6'-8" HT. | CONT. | N/A |
| 18 | TO | <i>Taxus occidentalis</i> 'Smagard' | EMERALD GREEN ARBORVITAE | 6'-8" HT. | CONT. | N/A |
| GROUNDCOVER / PERENNIALS / GRASSES | | | | | | |
| 56 | AR | <i>Andropogon gerardii</i> 'Red October' | RED OCTOBER BIG BLUE STEM | 3 GAL. | CONT. | 30" O.C. SPACING |
| 334 | BB | <i>Bouteloua gracilis</i> 'Blonde Ambition' | BLONDE AMBITION BLUE GRAMA | 3 GAL. | CONT. | 24" O.C. SPACING |
| 28 | BHP | <i>Brunnera macrophylla</i> 'Jack Frost' | SIBERIAN BUDLOSS | 1 GAL. | CONT. | 24" O.C. SPACING |
| 213 | CAB | <i>Carex blanda</i> | EASTERN MOORLAND SEDGE | 3 GAL. | CONT. | 30" O.C. SPACING |
| 62 | CAC | <i>Calamagrostis x acutiflora</i> 'Karl Foerster' | FEATHER REED GRASS | 3 GAL. | CONT. | 24" O.C. SPACING |
| 508 | CL | <i>Chamaenerion latifolium</i> | NORTHERN SEA GATS | 3 GAL. | CONT. | 36" O.C. SPACING |
| 150 | CGE | <i>Coneopogon grandiflora</i> 'Early Sunrise' | LARGE-FLOWERED TICKSEED | 1 GAL. | CONT. | 24" O.C. SPACING |
| 146 | CVZ | <i>Coneopogon verticillatus</i> 'Zagreb' | THREADLEAF COREOPSIS | 1 GAL. | CONT. | 24" O.C. SPACING |
| 34 | EC | <i>Echinacea purpurea</i> 'White Swan' | WHITE SWAN CONEFLOWER | 1 GAL. | CONT. | 18" O.C. SPACING |
| 15 | EM | <i>Echinacea purpurea</i> 'Magnus' | MAGNUS PURPLE CONEFLOWER | 1 GAL. | CONT. | 36" O.C. SPACING |
| 165 | EP | <i>Echinacea purpurea</i> 'Raspberry Blush' | POWNON HILDBERRY CONEFLOWER | 1 GAL. | CONT. | 24" O.C. SPACING |
| 16 | EP | <i>Echinacea purpurea</i> 'Powwow White' | POWNON WHITE CONEFLOWER | 1 GAL. | CONT. | 24" O.C. SPACING |
| 162 | HVG | <i>Heuchera citronella</i> | CITRONELLE CORAL BELLS | 1 GAL. | CONT. | 18" O.C. SPACING |
| 106 | HVP | <i>Heuchera purple Palace'</i> | PURPLE POWER CORAL BELLS | 1 GAL. | CONT. | 18" O.C. SPACING |
| 80 | LM | <i>Liriope muscari</i> 'Big Blue' | BIG BLUE LILY TURF | 1 GAL. | CONT. | 18" O.C. SPACING |
| 61 | LHV | <i>Liriope muscari</i> 'Variegata' | VARIEGATED LILY TURF | 1 GAL. | CONT. | 18" O.C. SPACING |
| 37 | MAS | <i>Mattuccia struthiopteris</i> | OSTRICH FERN | 5 GAL. | CONT. | 30" O.C. SPACING |
| 6 | MS | <i>Miscanthus sinensis</i> 'Gracillimus' | HAIRDEN GRASS | 1 GAL. | CONT. | 12" O.C. SPACING |
| 20 | NSA | <i>Miscanthus sinensis</i> 'Adagio' | ADAGIO MAIDEN GRASS | 3 GAL. | CONT. | 36" O.C. SPACING |
| 16 | NA | <i>Nepeta x faassenii</i> 'Walkers Low' | WALKERS LOW CATMINT | 1 GAL. | CONT. | 30" O.C. SPACING |
| 62 | PA | <i>Panicum scoparium</i> | ROSELEAF BROOMGRASS | 1 GAL. | CONT. | 18" O.C. SPACING |
| 277 | PN | <i>Panicum virgatum</i> 'Rostratahensch' | ROSTRATED RITCHEE GRASS | 5 GAL. | CONT. | 24" O.C. SPACING |
| 74 | PV | <i>Panicum virgatum</i> 'Cloud Nine' | CLOUD NINE SWITCH GRASS | 3 GAL. | CONT. | 36" O.C. SPACING |
| 75 | PVN | <i>Panicum virgatum</i> 'Northwind' | NORTHWIND SWITCH GRASS | 3 GAL. | CONT. | 24" O.C. SPACING |
| 41 | RB | <i>Rudbeckia hirta</i> | BLACK EYED SUSAN | 1 GAL. | CONT. | 24" O.C. SPACING |
| 10 | SC | <i>Salvia nemorosa</i> 'Caradonna' | CARADONNA PERENNIAL SALVIA | 1 GAL. | CONT. | 18" O.C. SPACING |
| 25 | SED | <i>Sedum 'maestro'</i> | MAESTRO STONECROP | 1 GAL. | CONT. | 18" O.C. SPACING |
| 356 | SH | <i>Sporobolus heterolepis</i> | PRAIRIE DROPSEED | 1 GAL. | CONT. | 24" O.C. SPACING |
| 26 | SM | <i>Salvia x sylvestris</i> 'May Night' | MAY NIGHT SAGE | 1 GAL. | CONT. | 18" O.C. SPACING |
| 854 | SS | <i>Schizachyrium scoparium</i> | LITTLE BLUESTEM | 1 GAL. | CONT. | 24" O.C. SPACING |
| 36 | TSS | <i>Titanilla 'Sugar and Spice'</i> | FOAM FLOWER | 1 GAL. | CONT. | 12" O.C. SPACING |
| 71 | VP | <i>Verbena canadensis</i> 'Homestead Purple' | HOMESTEAD PURPLE VERBENA | 1 GAL. | CONT. | 24" O.C. SPACING |

01 UNDERSTORY PLAN

FINAL DEVELOPMENT PLAN
MARCH 17, 2017

REVISIONS:
REVISED LAYOUT 09.16.2019



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 CIVIL / LANDSCAPE: OLSSON ASSOCIATES
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FDP-L214
LANDSCAPE UNDERSTORY PLAN

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01 LANDSCAPE PLAN

FINAL DEVELOPMENT PLAN
 MARCH 17, 2017
 REVISIONS:

CITY REVIEW COMMENTS 07.17.2017

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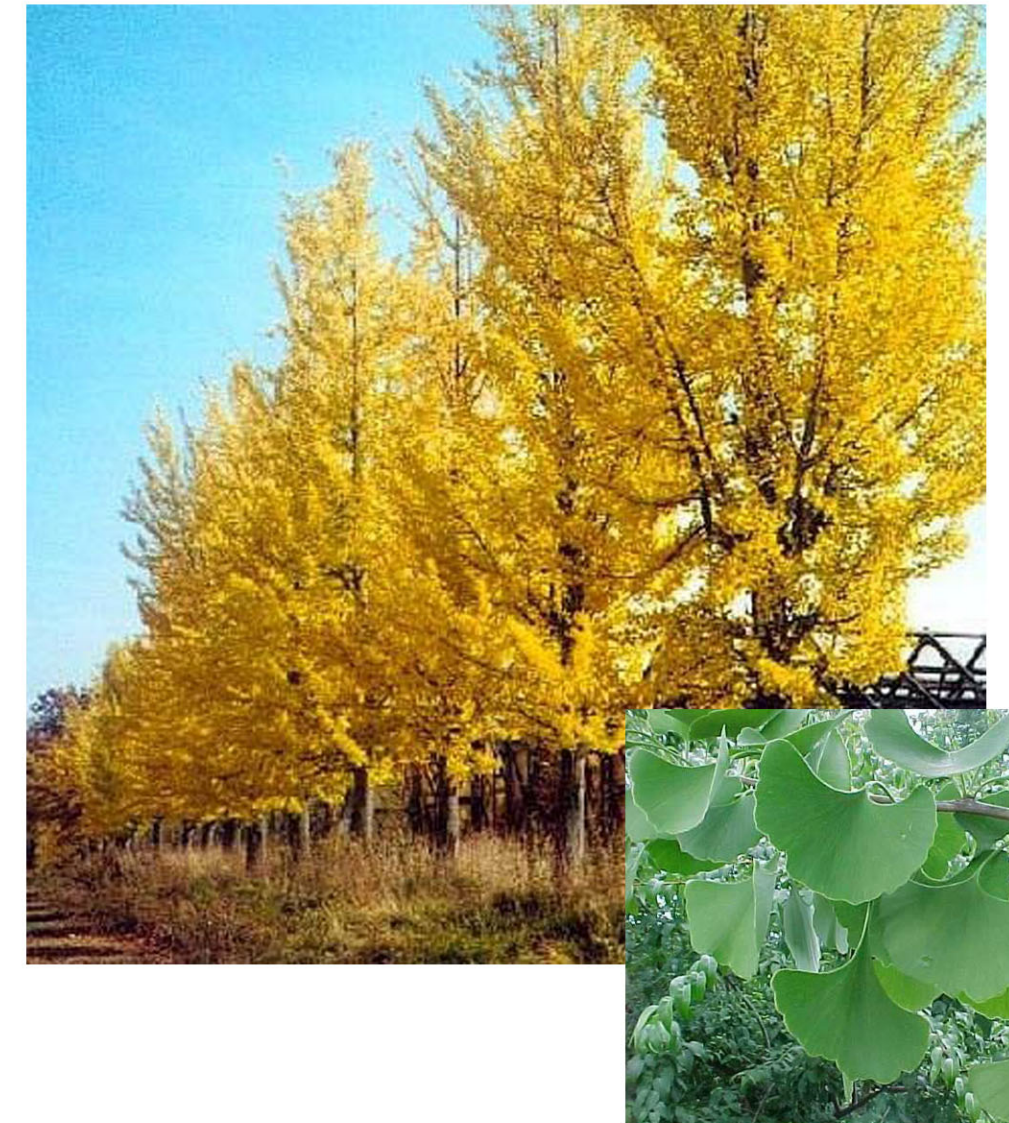
FDP-L300
LANDSCAPE PLAN

PLANT MATERIALS

DECIDUOUS TREES



LEGACY SUGAR MAPLE



PRINCETON SENTRY GINKGO



KENTUCKY COFFEETREE



ARMSTRONG MAPLE

ORNAMENTAL TREES



EASTERN REDBUD



SPRING SNOW CRABAPPLE



ROYAL STAR MAGNOLIA



SERVICEBERRY



SHUMARD OAK



SHAWNEE BRAVE BALD CYPRESS



PAPERBARK MAPLE



CHANCELLOR LITTLE LEAF LINDEN

EVERGREEN TREES



VANDERWOLF PINE



COLORADO BLUE SPRUCE



NORWAY SPRUCE



SERBIAN SPRUCE



WHITE PINE

DECIDUOUS SHRUBS



ARCTIC FIRE DOGWOOD



LITTLE DEVIL NINEBARK



DARTS GOLD NINEBARK



KELSEY DOGWOOD



VIBURNUM

EVERGREEN SHRUBS



CARPET & LOW JUNIPERS



COMPRESSA JUNIPER



DEE RUNK BOXWOOD



EMERALD GREEN ARBORVITAE



TAYLOR JUNIPER

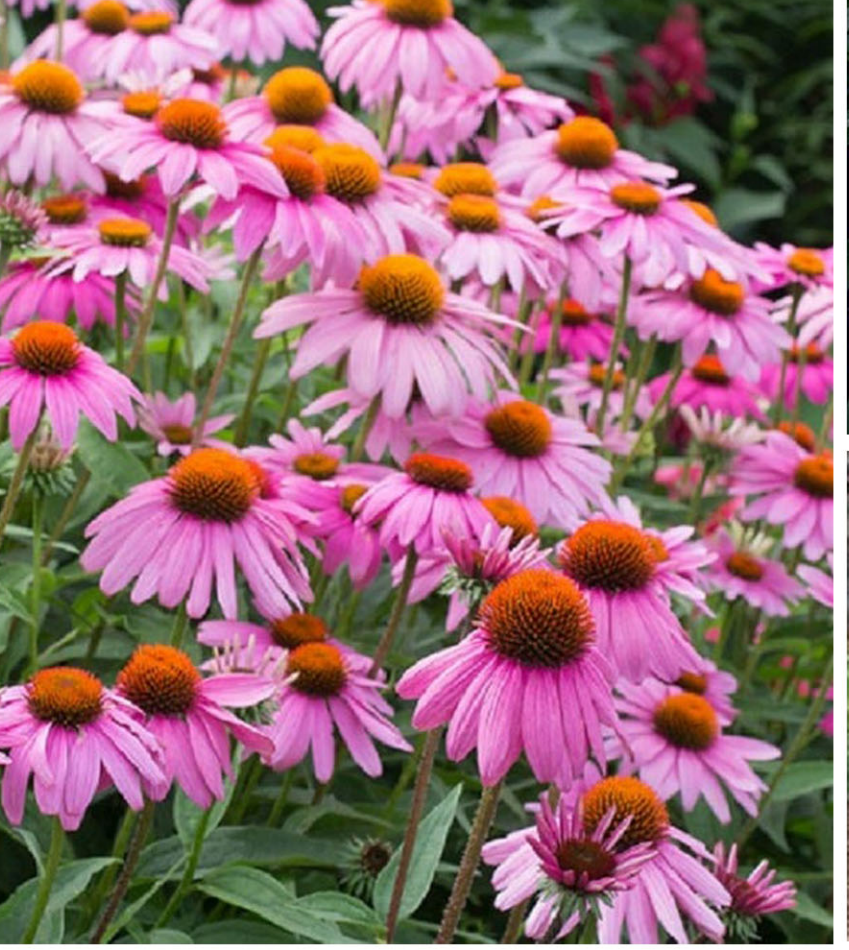
GRASSES



COREOPSIS



SALVIA



CONEFLOWER



CORAL BELLS

GRASSES



LITTLE BLUESTEM



NORTHWIND SWITCH GRASS



PRAIRIE DROPSIED



BLONDE AMBITION BLUE GRAMA



ADAGIO MAIDEN GRASS

CONSULTANTS:

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HARDSCAPE MATERIALS

LIGHTING



Eaton Arbor Bollard
PATH & PEDESTRIAN AREA LIGHTING



Eaton Pedestrian Area Lighting

FESTOON LIGHTING

AMENITIES



IPE WOOD CLAD BENCHES



Landscape Forms - 'Multiplicity' Bench and Bike Rack



Landscape Forms - 'Collect' Litter Receptacle

GROUND PLANE MATERIALS



GRAY CONCRETE - BROOM FINISH



INTEGRAL COLOR CONCRETE - SANDSTONE FINISH



CONCRETE WITH APPLIED COLOR STAIN



Natural Gray CONCRETE COLORS



Cobblestone Gray

WALLS



CONCRETE PAVERS



BOARD FORMED CONCRETE WALLS



CONSULTANTS:

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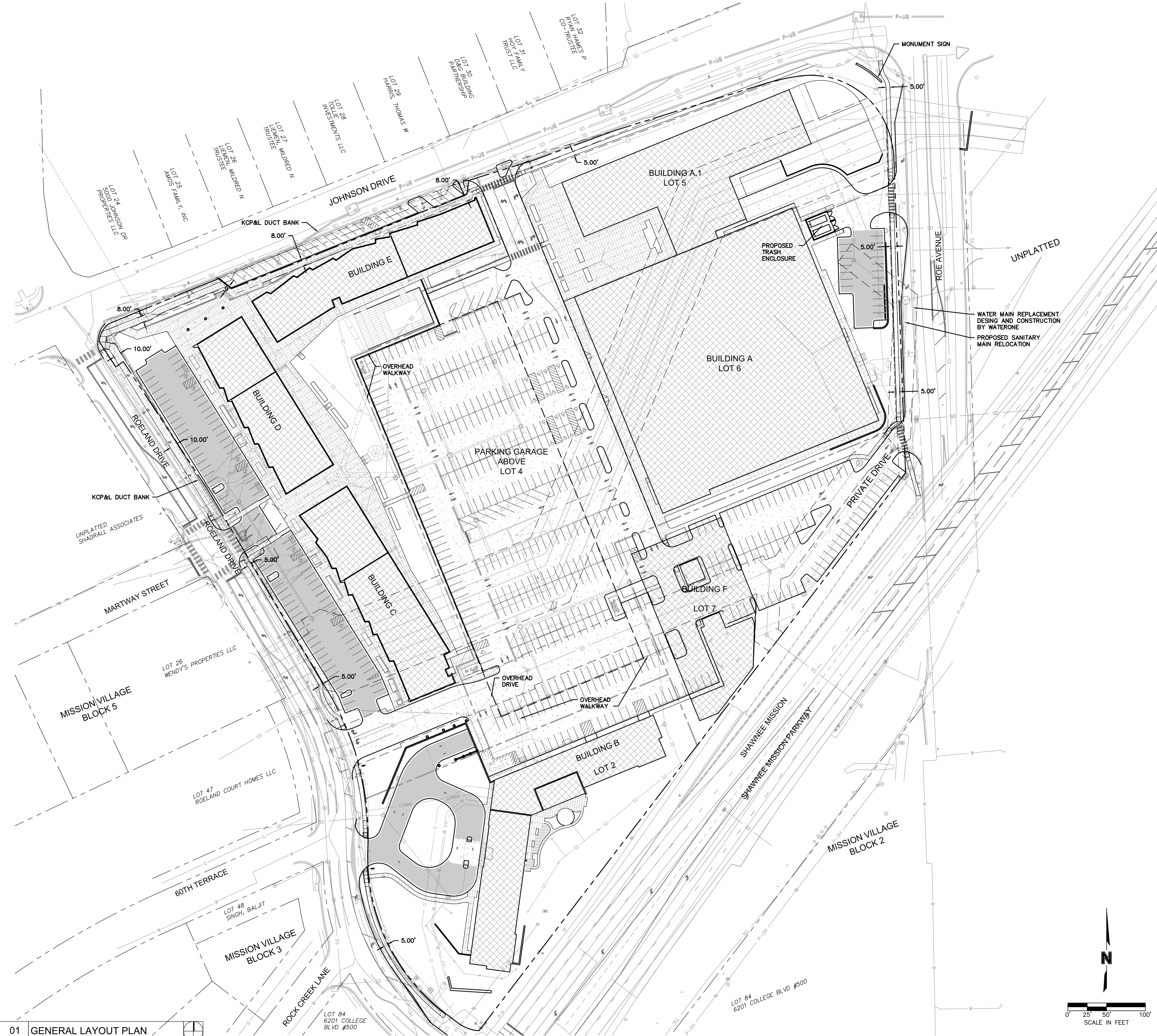
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LEGEND

| | |
|-------|------------------------------------|
| P-OH | EXISTING OVERHEAD POWER LINE |
| P-UG | EXISTING UNDERGROUND POWER LINE |
| TEL | EXISTING TELEPHONE LINE |
| COMM | EXISTING COMMUNICATION LINE |
| FO | EXISTING FIBER OPTIC LINE |
| G | EXISTING GAS LINE |
| W | EXISTING WATER LINE |
| SS | EXISTING SANITARY SEWER |
| SD | EXISTING STORM DRAIN |
| | EXISTING STORM SEWER |
| - - - | PROPERTY BOUNDARY |
| - - - | PROPOSED LOT LINE |
| - - - | EASEMENT LINE |
| UGP | PROPOSED UNDERGROUND ELECTRIC LINE |
| COMM | PROPOSED COMMUNICATION LINE |
| W | PROPOSED WATER LINE |
| G | PROPOSED GAS LINE |
| FP | PROPOSED FIRE PROTECTION LINE |
| ES | PROPOSED STORM SEWER |
| SS | PROPOSED SANITARY SEWER |
| C | COMPACT PARKING STALLS |

NOTE:
 ALL SIDEWALK IMPROVEMENTS SHALL MEET ADA AND MUTCD CRITERIA.
 SEE SHEET C1.3 FOR MORE DETAILS ABOUT UTILITY CONNECTION

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01 GENERAL LAYOUT PLAN

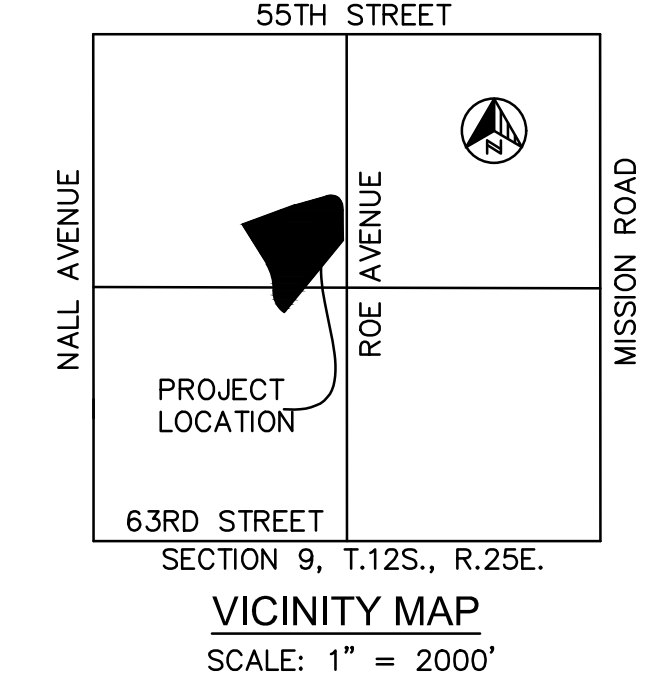
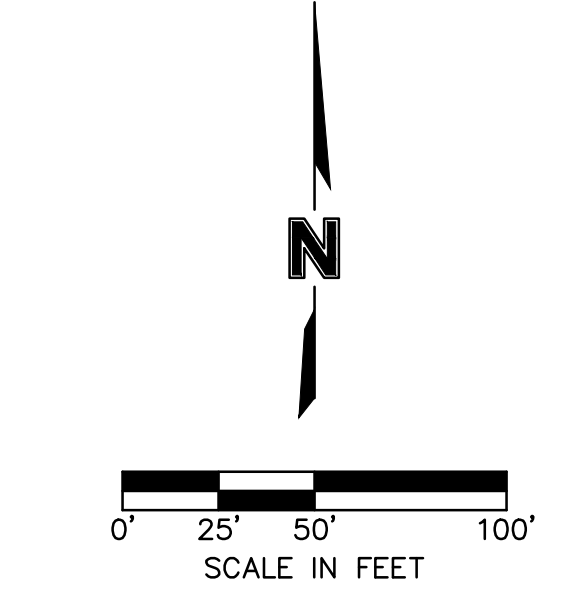
FINAL DEVELOPMENT PLAN
 MARCH 17, 2017

REVISIONS:

REVISED LAYOUT 09.16.2019

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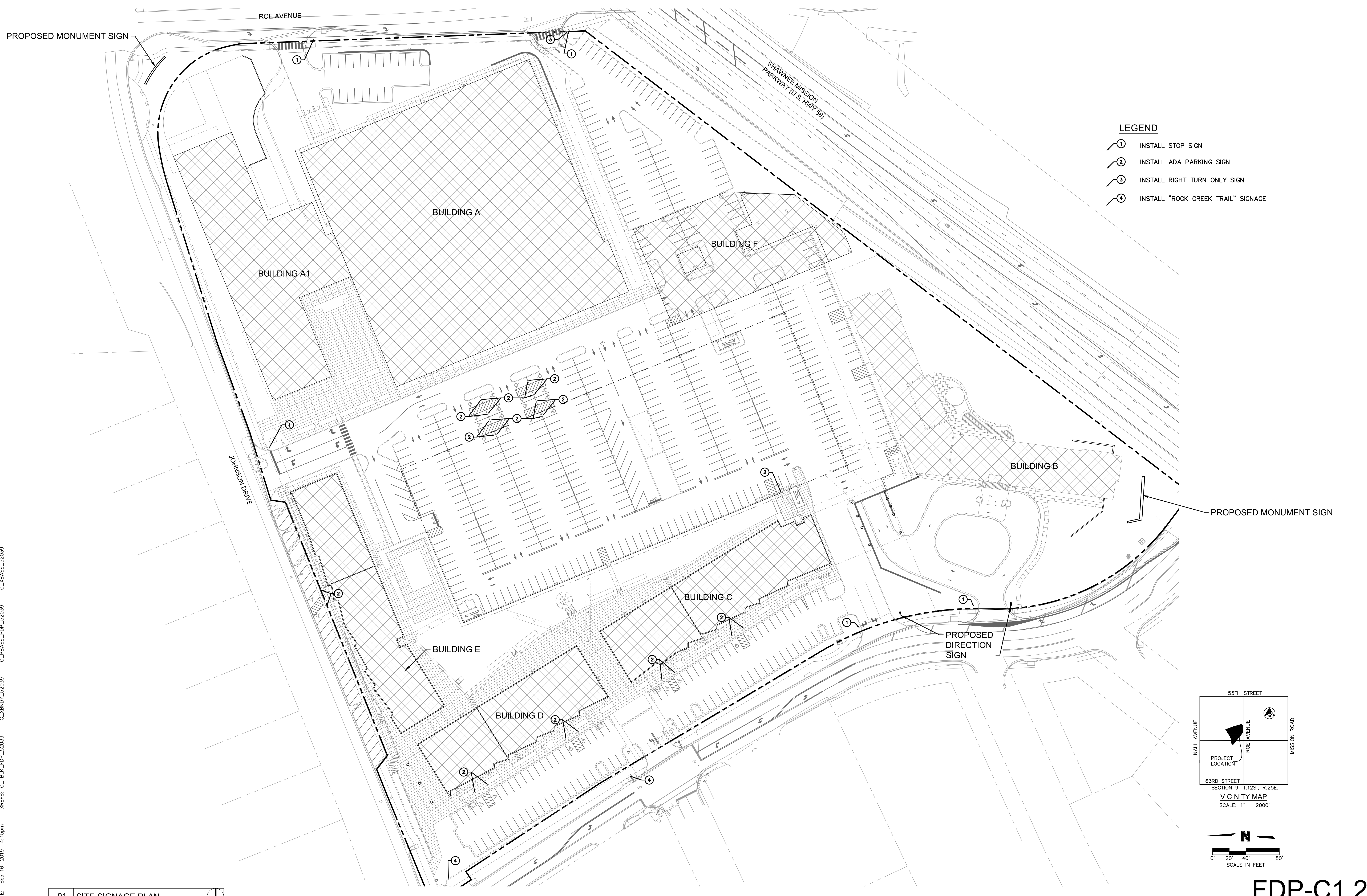
FDP-C1.0
 GENERAL LAYOUT PLAN

MISSION GATEWAY

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PROPOSED MONUMENT SIGN

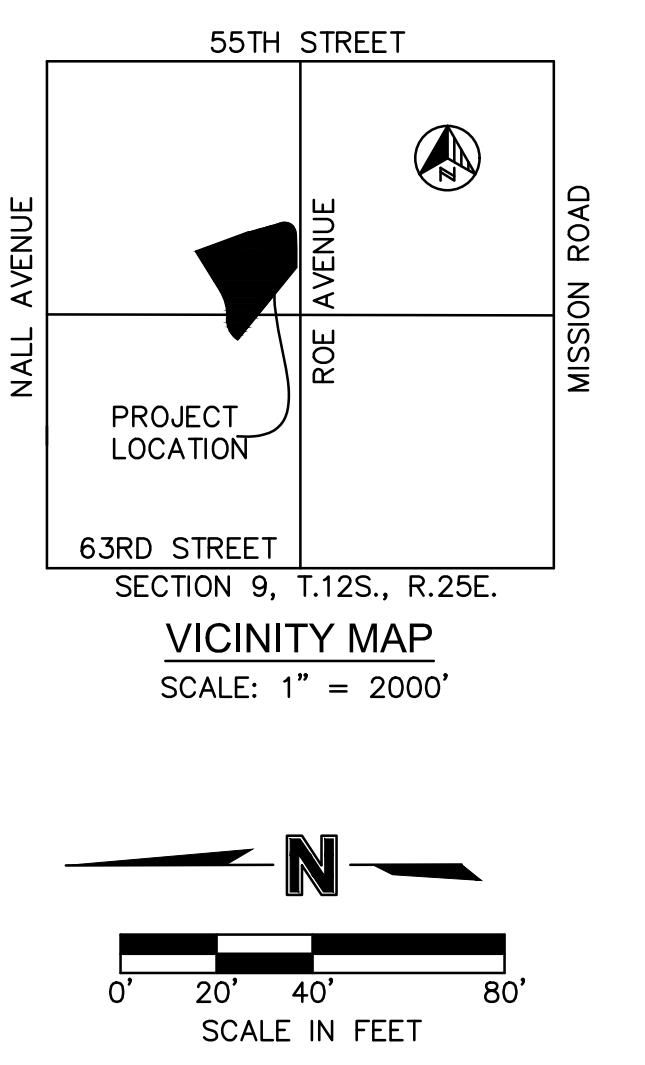


LEGEND

- ① INSTALL STOP SIGN
- ② INSTALL ADA PARKING SIGN
- ③ INSTALL RIGHT TURN ONLY SIGN
- ④ INSTALL "ROCK CREEK TRAIL" SIGNAGE

PROPOSED MONUMENT SIGN

PROPOSED DIRECTION SIGN



01 SITE SIGNAGE PLAN

FINAL DEVELOPMENT PLAN
MARCH 17, 2017

REVISIONS:

REVISED LAYOUT 09.16.2019

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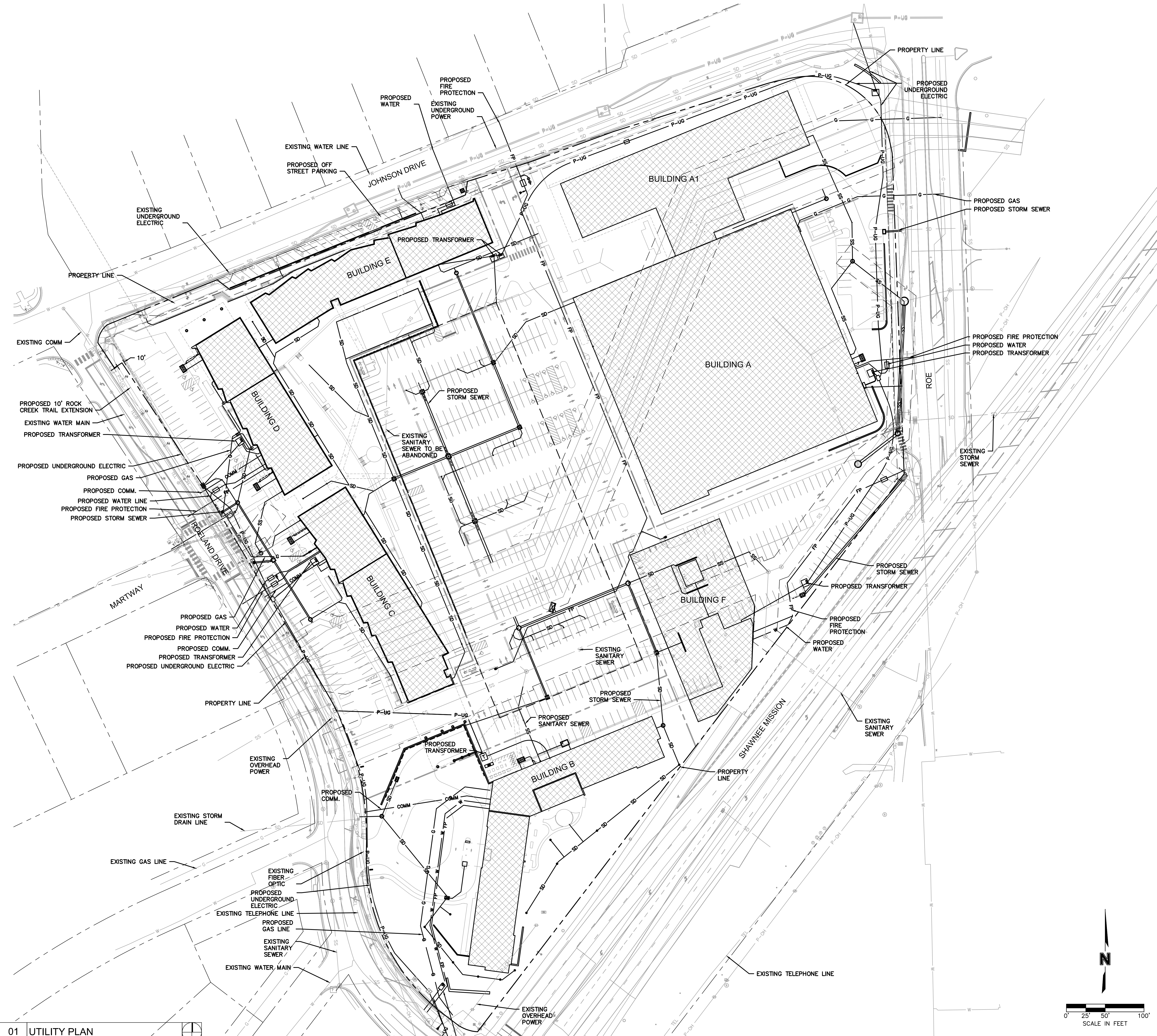
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FDP-C1.2
SITE SIGNAGE PLAN

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LEGEND

- P-OH ——— EXISTING OVERHEAD POWER LINE
- P-UG ——— EXISTING UNDERGROUND POWER LINE
- TEL ——— EXISTING TELEPHONE LINE
- COMM ——— COMMUNICATION LINE
- FO ——— EXISTING FIBER OPTIC LINE
- G ——— EXISTING GAS LINE
- W ——— EXISTING WATER LINE
- SS ——— EXISTING SANITARY SEWER
- SD ——— EXISTING STORM DRAIN
- EXISTING STORM SEWER
- PROPERTY BOUNDARY
- EASEMENT LINE
- UG ——— PROPOSED UNDERGROUND ELECTRIC LINE
- COMM ——— PROPOSED COMMUNICATION LINE
- W ——— PROPOSED WATER LINE
- G ——— PROPOSED GAS LINE
- FP ——— PROPOSED FIRE PROTECTION LINE
- ES ——— PROPOSED STORM SEWER
- SS ——— PROPOSED SANITARY SEWER
- C ——— COMPACT PARKING STALLS

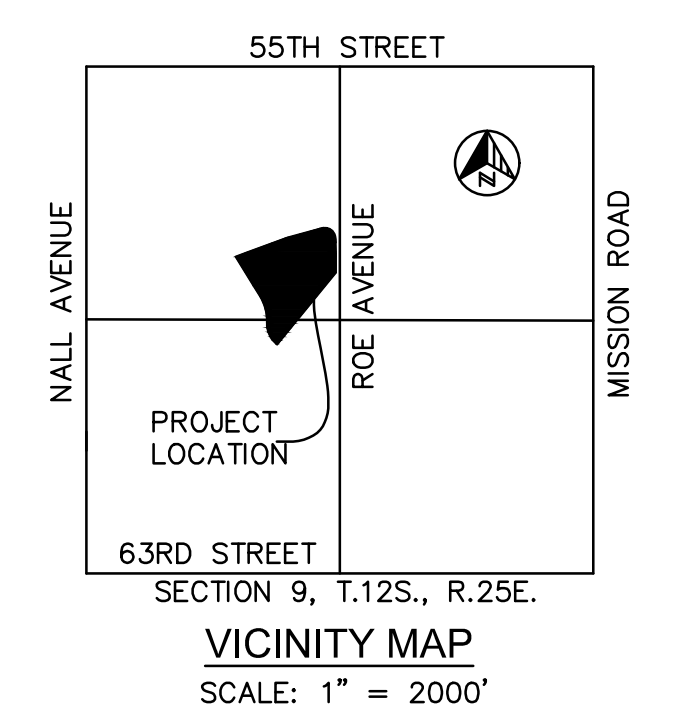
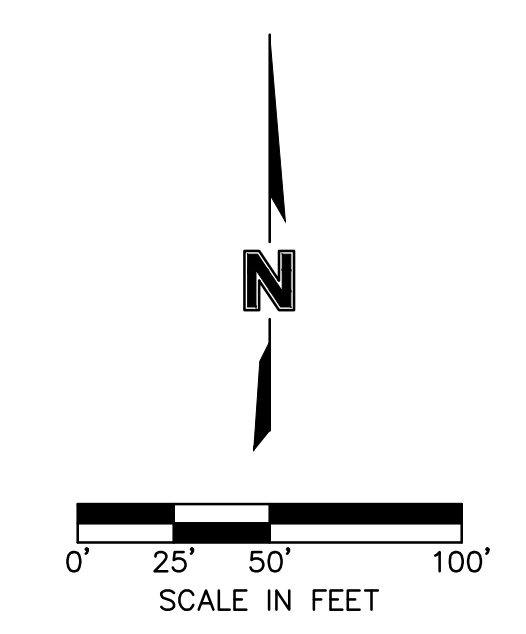


01 UTILITY PLAN

FINAL DEVELOPMENT PLAN
MARCH 17, 2017

REVISIONS:

REVISED LAYOUT 09.16.2019



FDP-C1.3
UTILITY PLAN

CONSULTANTS:

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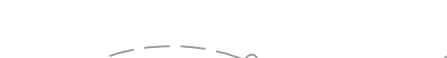

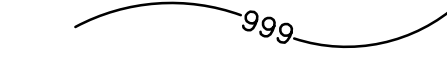
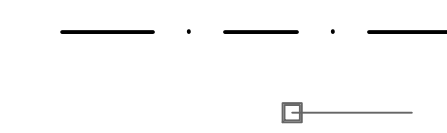
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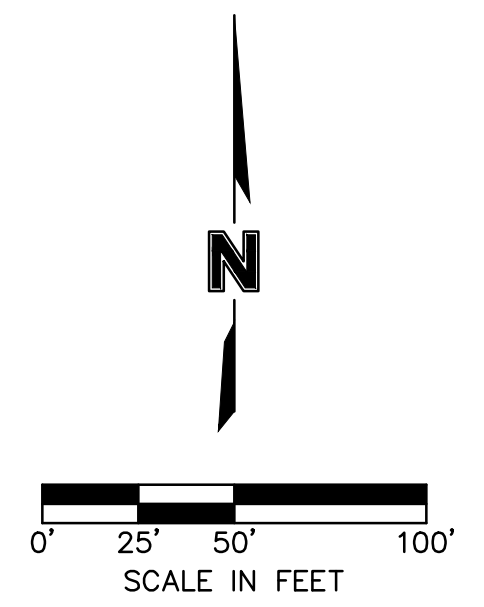
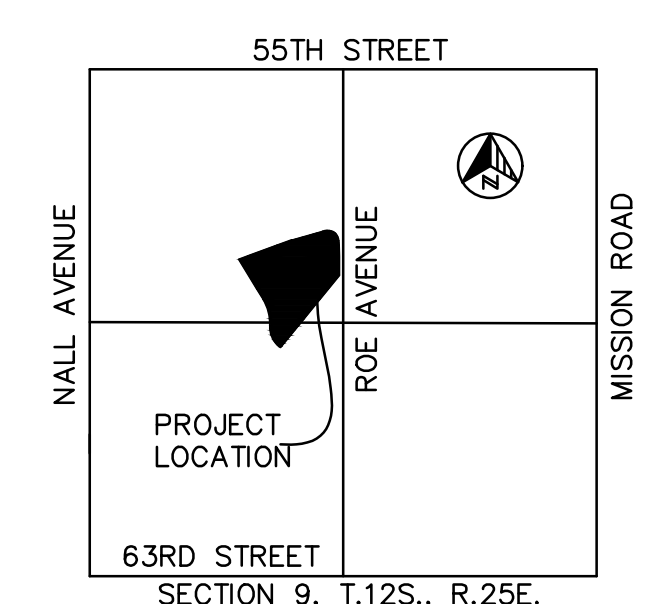
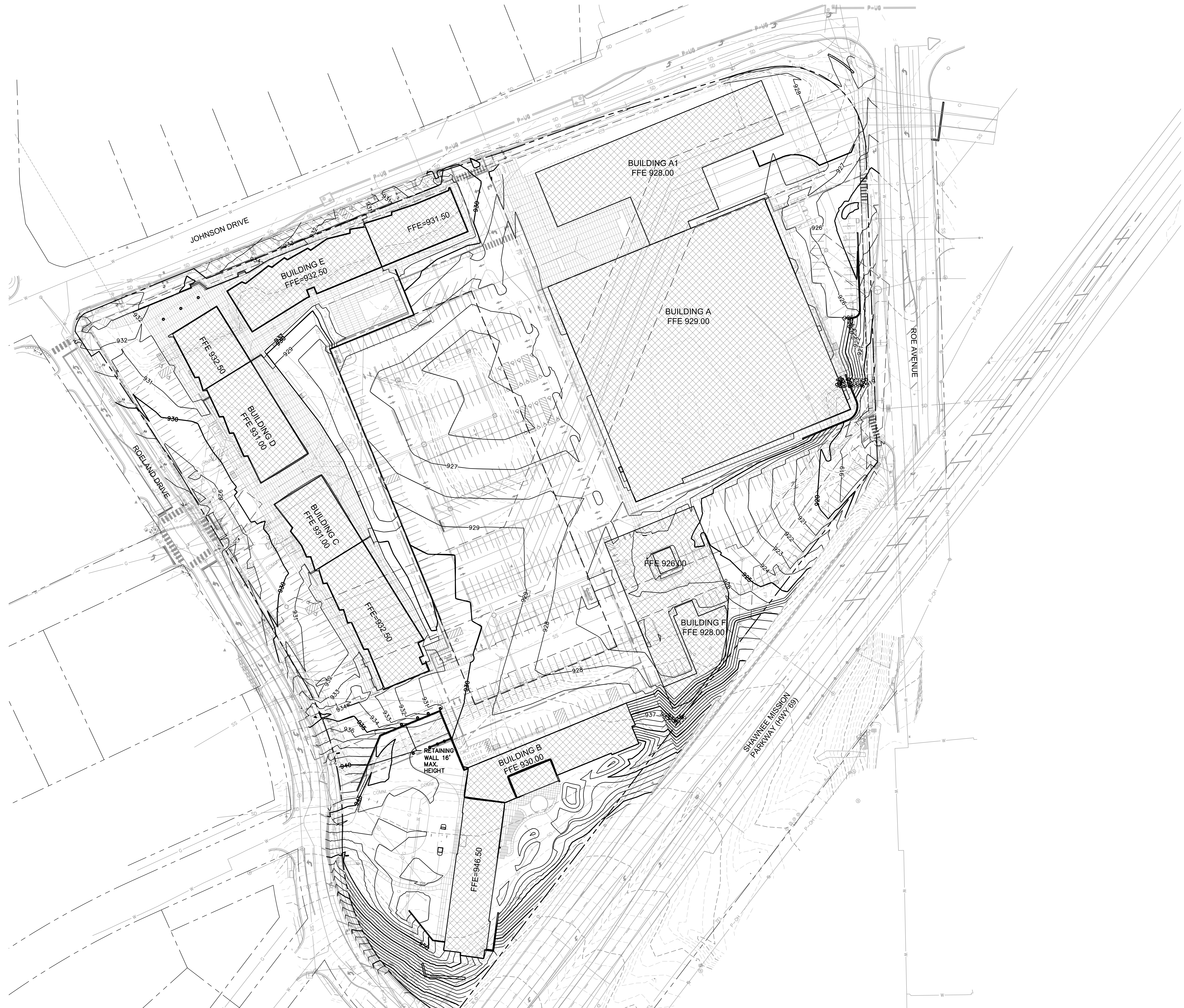
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LEGEND

-  PROPERTY BOUNDARY
-  EXISTING GRADE CONTOUR
-  FINISHED GRADE CONTOUR
-  DITCH CENTERLINE
-  PROPOSED STORM SEWER



01 GRADING PLAN

FINAL DEVELOPMENT PLAN
MARCH 17, 2017

REVISIONS:

REVISED LAYOUT 09.16.2019

CONSULTANTS:

| | | |
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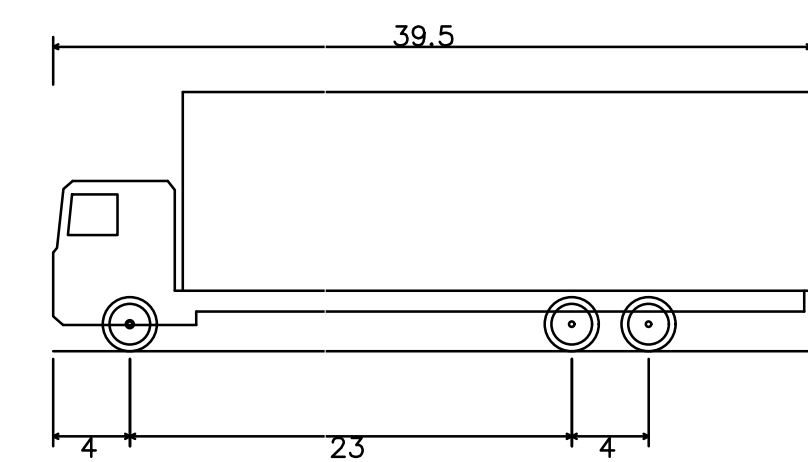
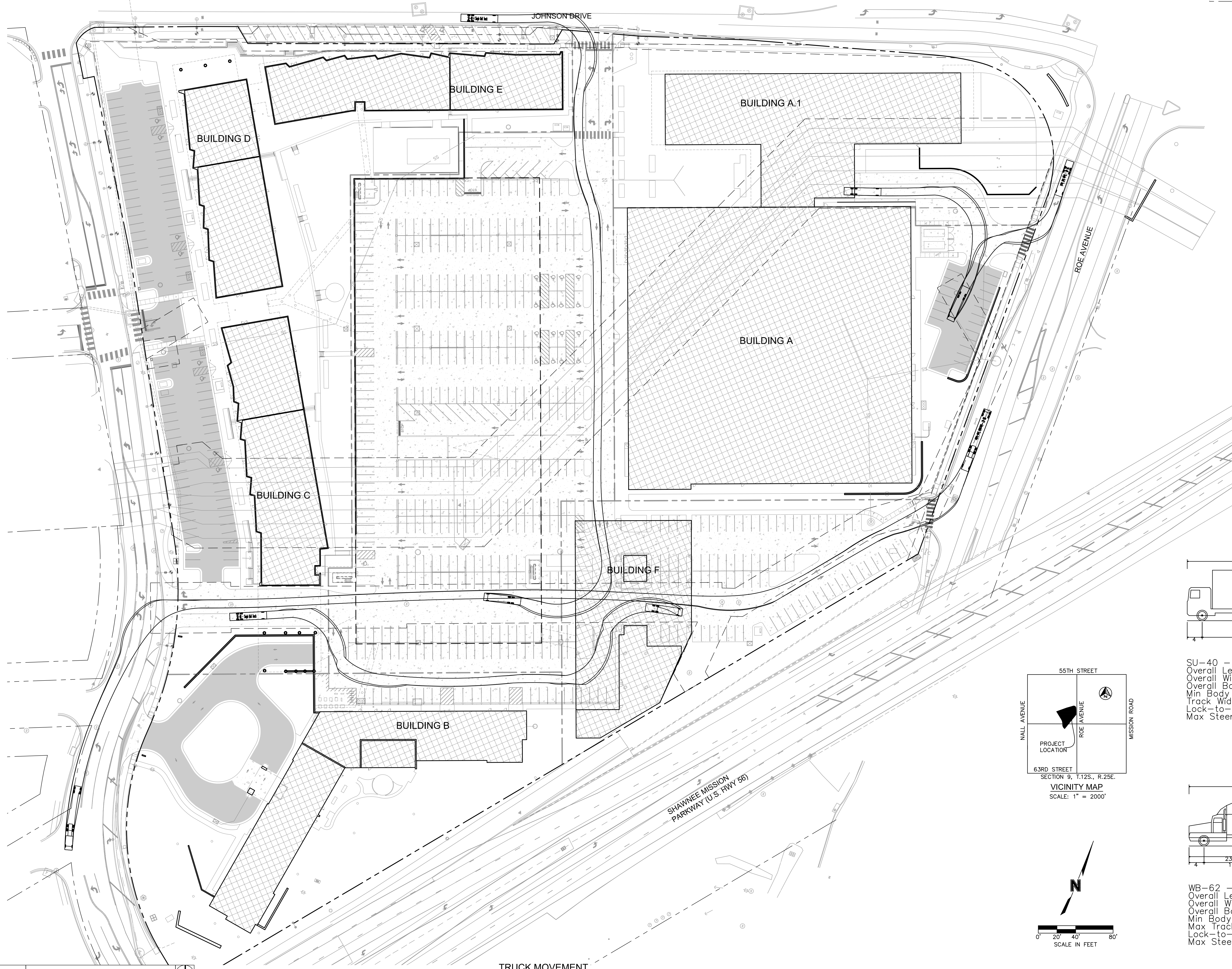
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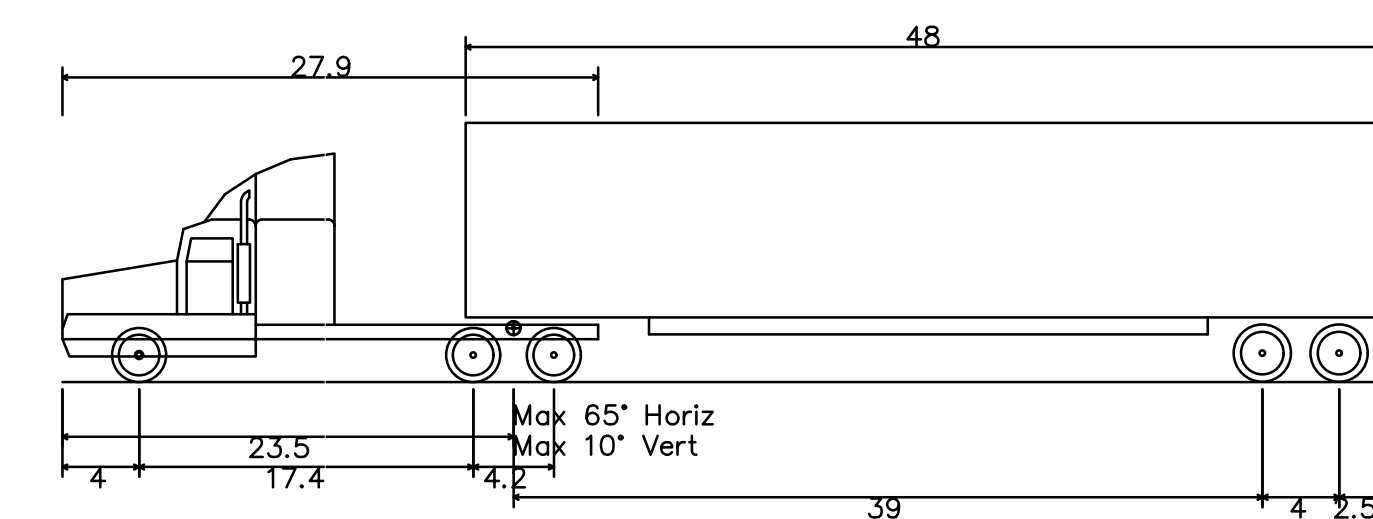
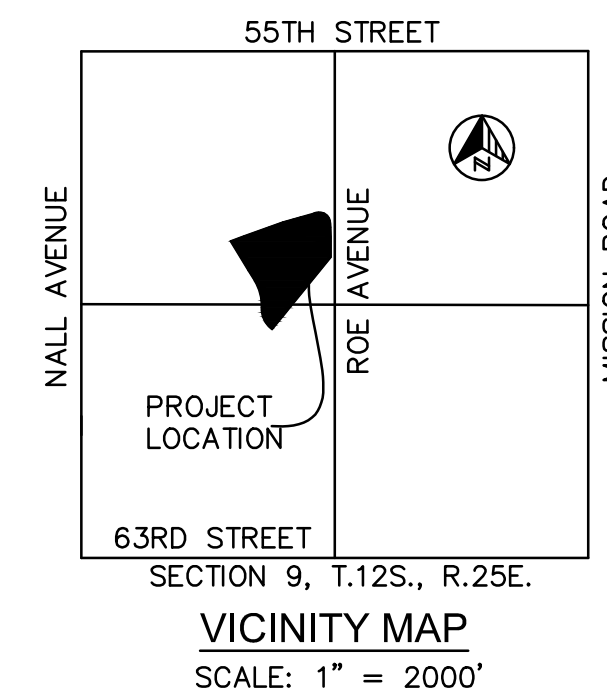
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FDP-C2.0
GRADING PLAN

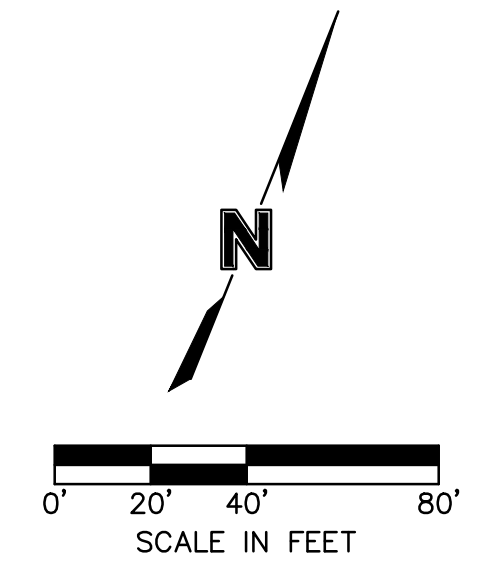
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SU-40 - Single Unit Truck
 Overall Length 39.500ft
 Overall Width 8.000ft
 Overall Body Height 13.500ft
 Min Body Ground Clearance 1.367ft
 Track Width 8.000ft
 Lock-to-lock time 5.00s
 Max Steering Angle (Virtual) 31.80°



WB-62 - Interstate Semi-Trailer
 Overall Length 69.000ft
 Overall Width 8.500ft
 Overall Body Height 13.540ft
 Min Body Ground Clearance 1.334ft
 Max Track Width 8.500ft
 Lock-to-lock time 6.00s
 Max Steering Angle (Virtual) 28.40°



01 TURNING TEMPLATE

TRUCK MOVEMENT

FINAL DEVELOPMENT PLAN
 MARCH 17, 2017

REVISIONS:

REVISED LAYOUT 09.16.2019

CONSULTANTS:

CIVIL / LANDSCAPE: OLSSON ASSOCIATES, 1301 BURLINGTON STREET, SUITE 100, NORTH KANSAS CITY, MO 64116, TEL: 816.361.1177
 M/E/P: PKMR ENGINEERS, 13300 W. 98TH ST., LENEXA, KANSAS 66215, TEL: 913.492-2400, FAX: 913.492-2437
 STRUCTURAL: BOB D. CAMPBELL & CO., INC., 4339 BELLEVUE AVE., KANSAS CITY, MISSOURI 64111, TEL: 816-531-4144, FAX: 816-531-4572

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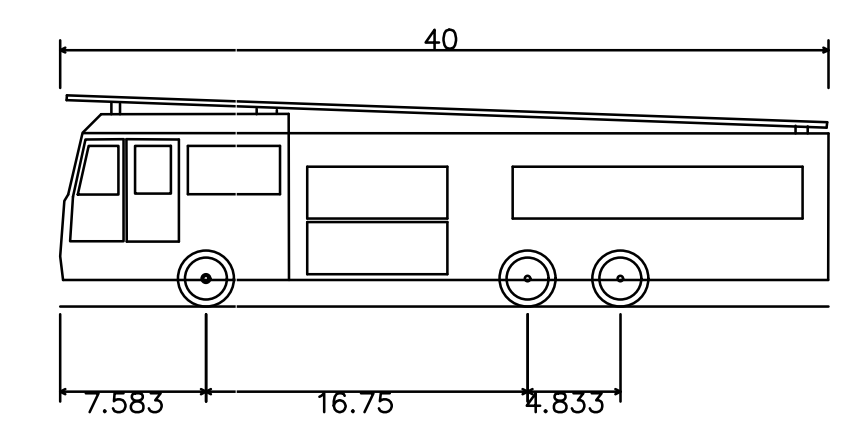
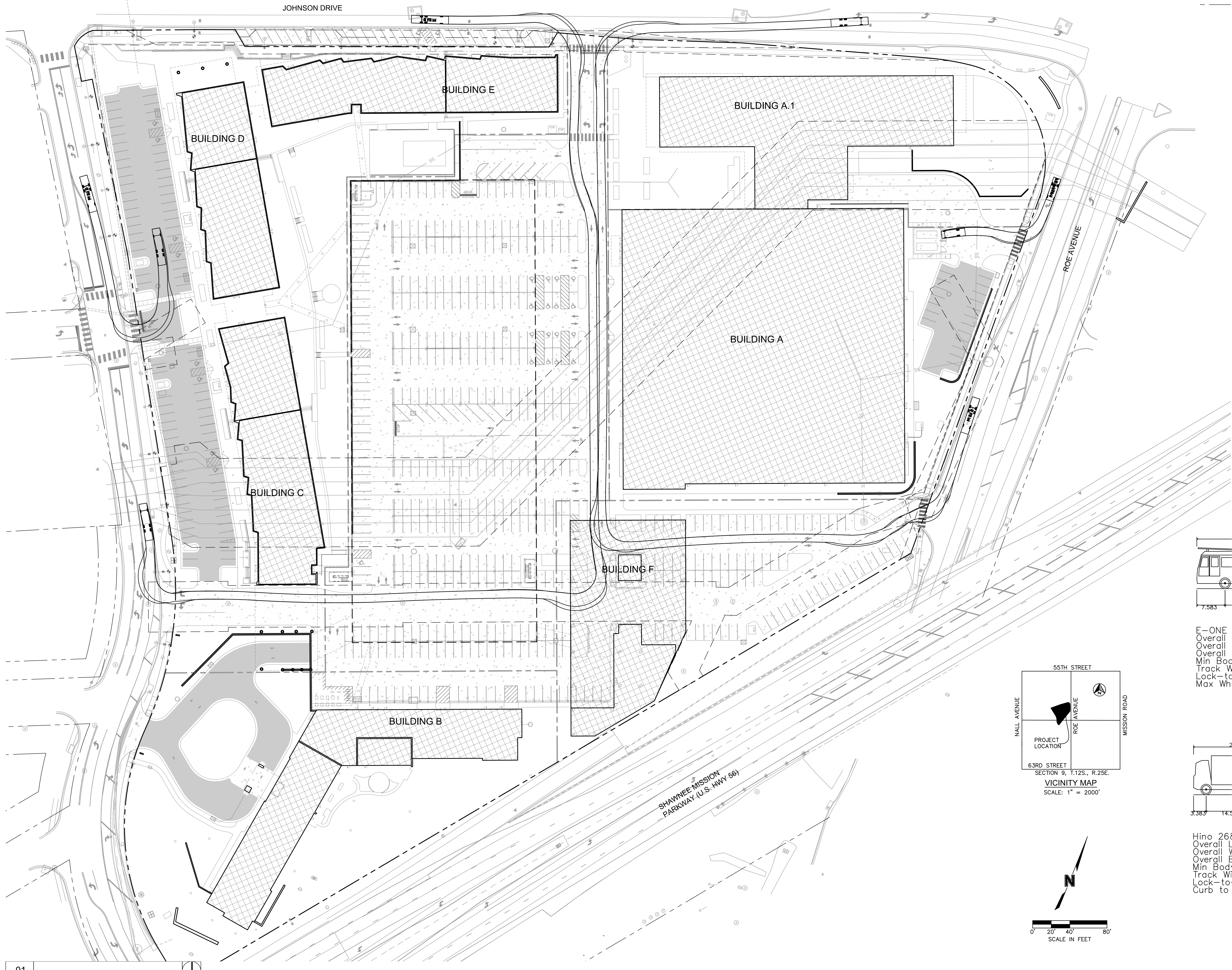
pkmr ENGINEERS

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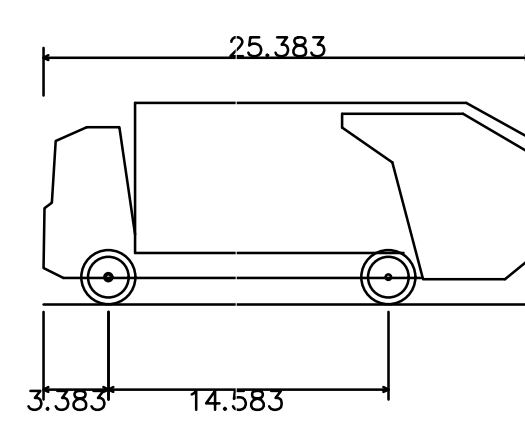
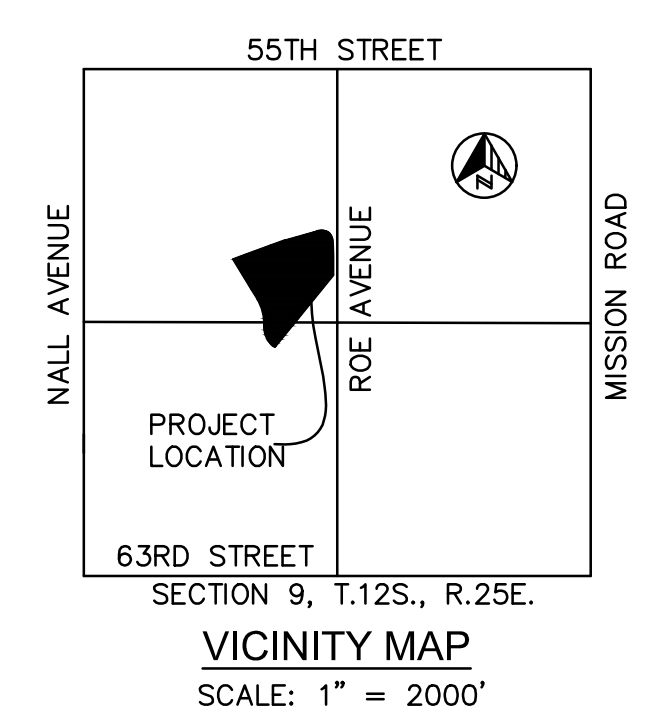
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FDP-C3.0
 TURNING TEMPLATE

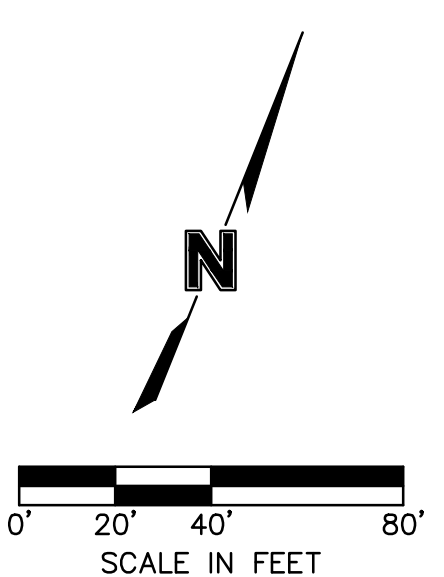
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E-ONE HP100 Aerial
 Overall Length 40.000ft
 Overall Width 8.333ft
 Overall Body Height 11.000ft
 Min Body Ground Clearance 1.393ft
 Track Width 6.000ft
 Lock-to-lock time 6.00s
 Max Wheel Angle 45.00°



Hino 268A J + Wayne Royal GT12 Refuse Truck
 Overall Length 25.383ft
 Overall Width 8.042ft
 Overall Body Height 10.488ft
 Min Body Ground Clearance 1.318ft
 Track Width 6.000ft
 Lock-to-lock time 6.00s
 Curb to Curb Turning Radius 23.900ft



01

FINAL DEVELOPMENT PLAN
 MARCH 17, 2017

REVISIONS:

REVISED LAYOUT 09.16.2019

CONSULTANTS:

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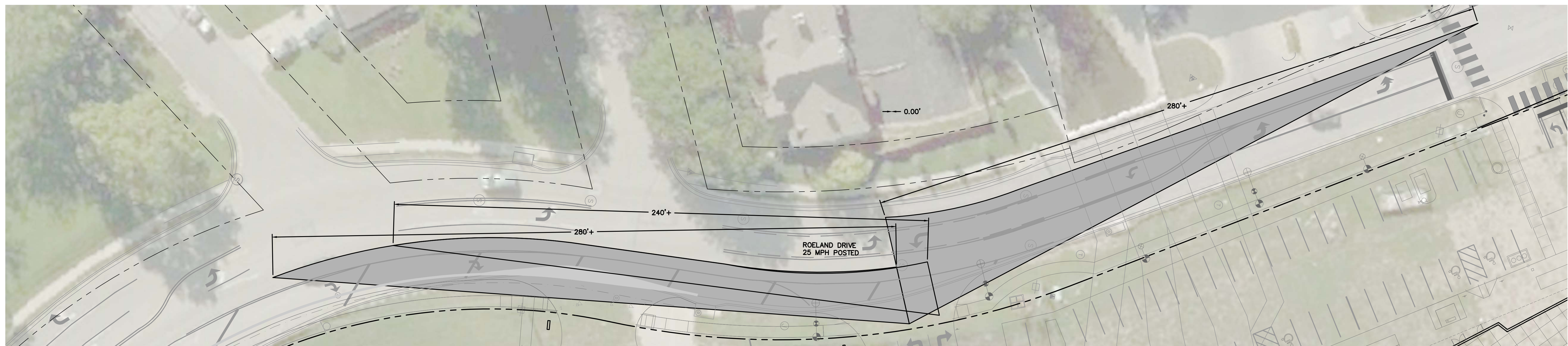
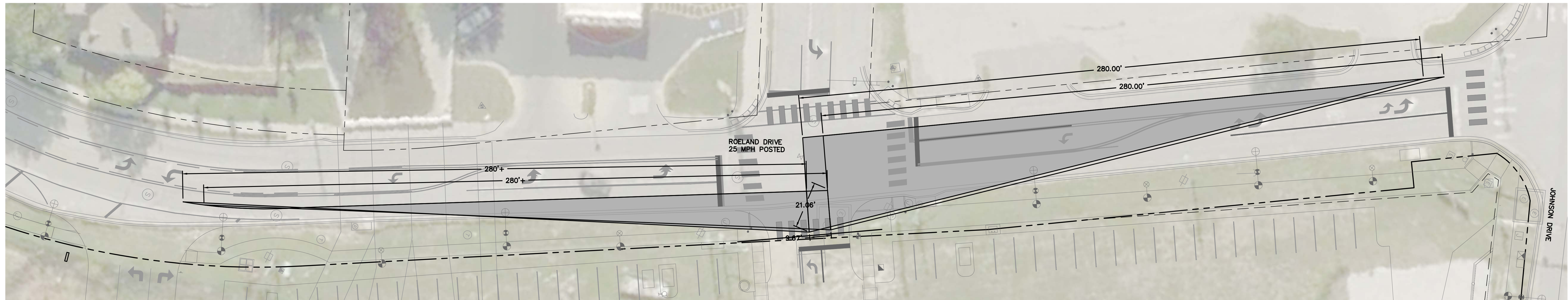
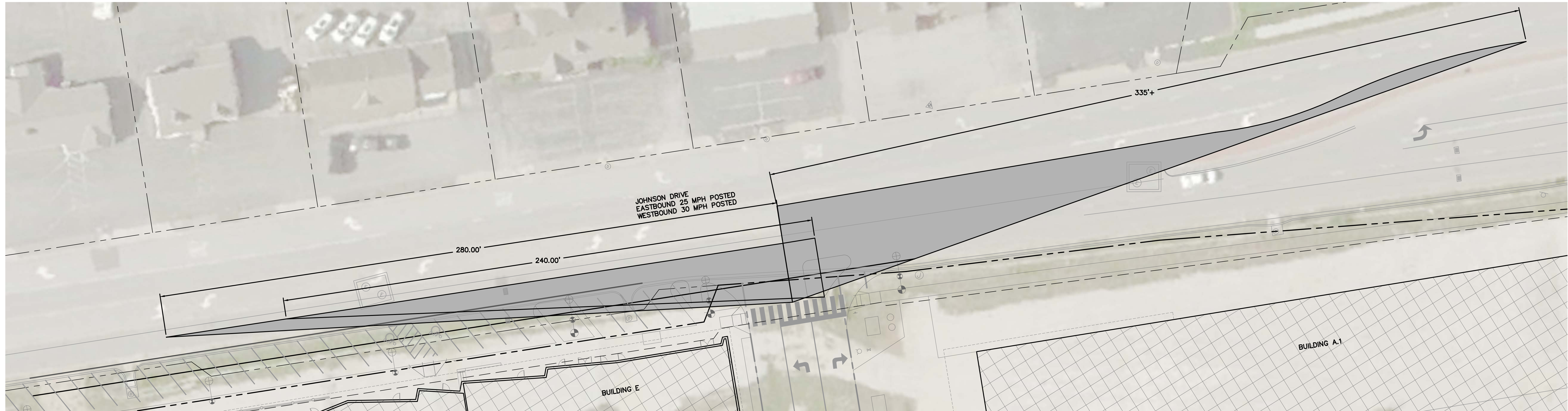
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FDP-C3.1
 TURNING TEMPLATE

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01 SIGHT TRIANGLES 

FINAL DEVELOPMENT PLAN
MARCH 17, 2017

REVISIONS:

REVISED LAYOUT 09.16.2019

CONSULTANTS:

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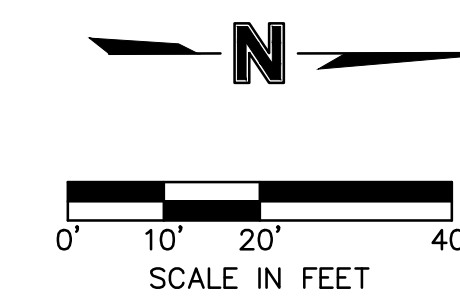
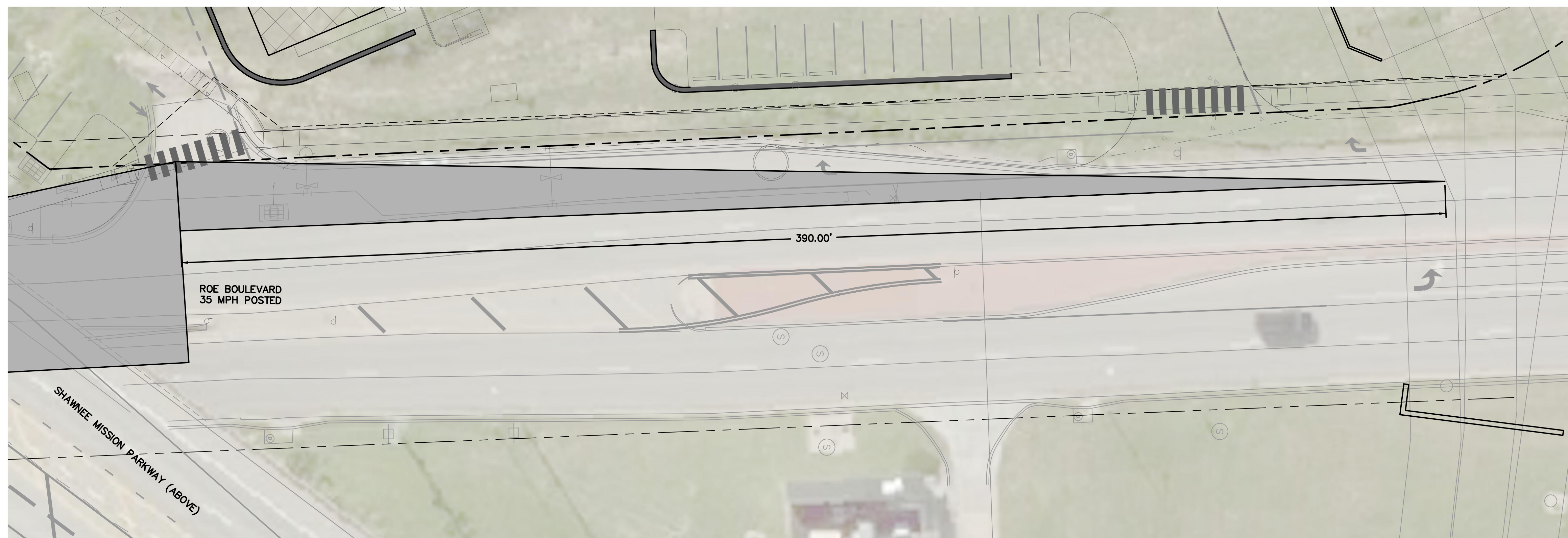
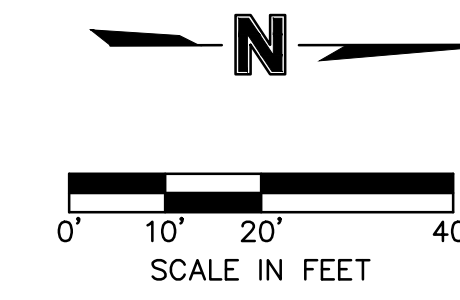
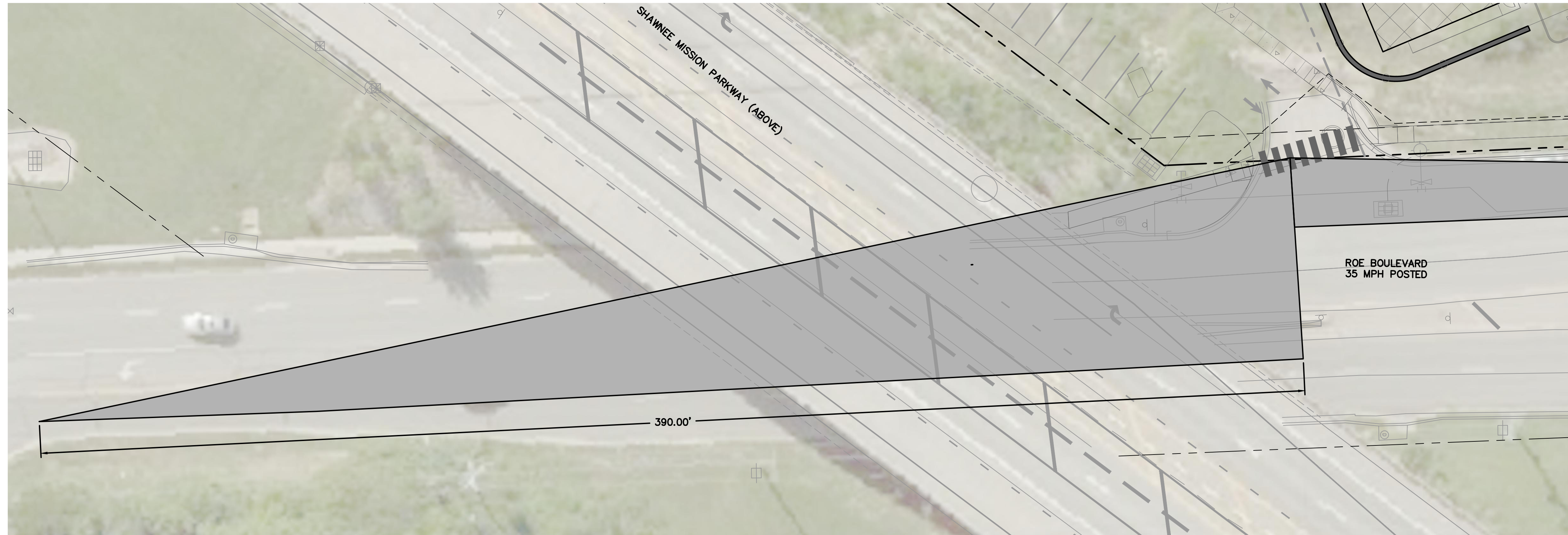
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EXH1
SIGHT TRIANGLES



01 SIGHT TRIANGLES

FINAL DEVELOPMENT PLAN
MARCH 17, 2017

REVISIONS:

REVISED LAYOUT 09.16.2019

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FAX: 816-531-9572

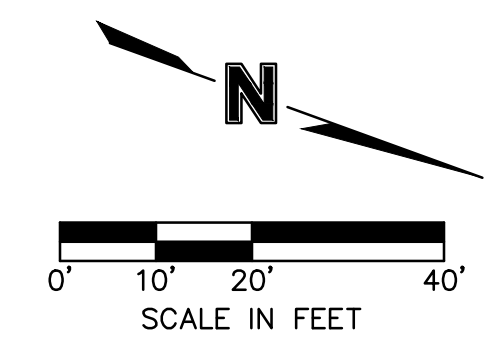
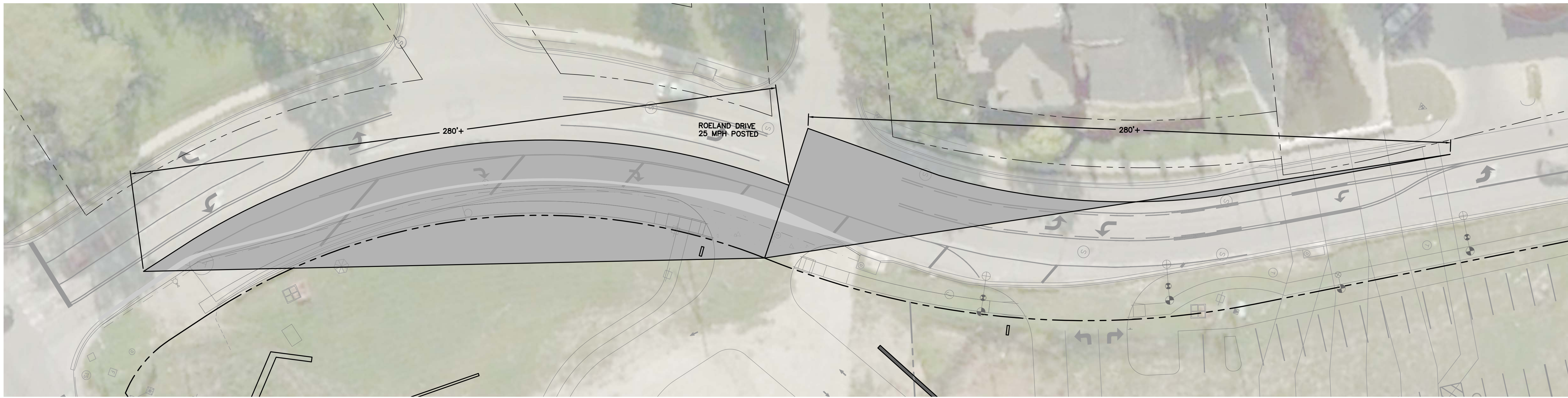
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EXH2
SIGHT TRIANGLES



01 SIGHT TRIANGLES 

FINAL DEVELOPMENT PLAN
MARCH 17, 2017

REVISIONS:

REVISED LAYOUT 09.16.2019

CONSULTANTS:

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KANSAS CITY, MISSOURI 64111
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FAX: 816-531-8572

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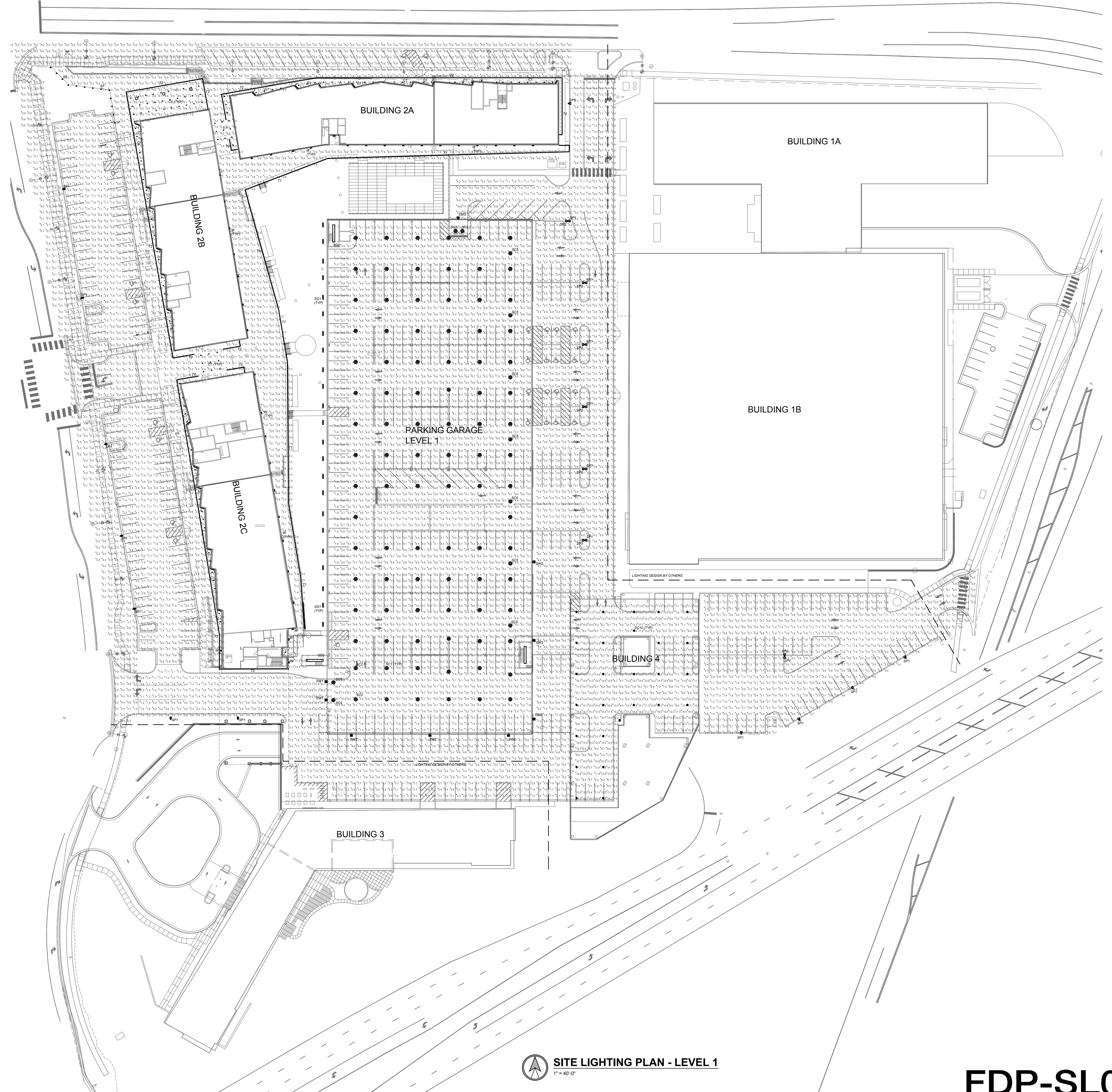
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EXH3

SIGHT TRIANGLES



| DESCRIPTION | MAINTAINED LIGHTING LEVELS | | | UNIFORMITY | |
|-----------------------------------|----------------------------|-------------|-------------|-------------|-------------|
| | AVG. (F.C.) | MAX. (F.C.) | MIN. (F.C.) | MAX. / MIN. | AVG. / MIN. |
| WEST & NORTH PROPERTY AREA | 0.3 | 4.7 | 0.0 | N/A | N/A |
| ENTRANCES AND DRIVE CONNECTION | 4.0 | 37 | 0.2 | 189.5 : 1 | 20.0 : 1 |
| PARKING - WEST LOT | 1.2 | 4.2 | 0.1 | 42.0 : 1 | 12.0 : 1 |
| PARKING - EAST LOT | 1.7 | 4.8 | 0.1 | 48.0 : 1 | 17.0 : 1 |
| PARKING - GARAGE 1ST LEVEL | 5.3 | 20.3 | 0.5 | 40.6 : 1 | 10.8 : 1 |
| PARKING - OFFICE 1ST LEVEL | 11.2 | 19.4 | 3.4 | 5.7 : 1 | 3.3 : 1 |
| PEDESTRIAN - OUTER SIDE OF RETAIL | 2.5 | 9.3 | 0.0 | N/A | N/A |
| PEDESTRIAN - BOARDWALK | 3.3 | 13.5 | 0.0 | N/A | N/A |

NOTES:
 1. NUMBERS INDICATE FOOTCANDLE LEVELS AT GRADE.
 2. CALCULATIONS PERFORMED USING VISUAL 2.05.
 3. THERE SHALL BE NO DIRECT ILLUMINATION OF RESIDENTIAL PROPERTIES ADJACENT TO THIS PROPERTY OR ACROSS PUBLIC RIGHT-OF-WAY.

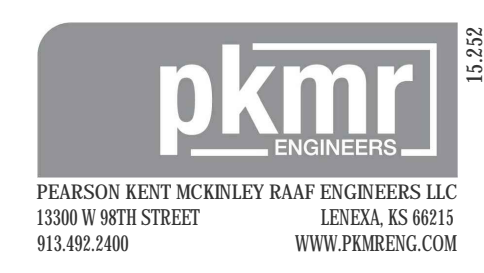
SITE LIGHTING PLAN - LEVEL 1
 1" = 40'-0"

FDP-SL001

01 SITE LIGHTING PLAN - LEVEL 1

FINAL DEVELOPMENT PLAN
 MARCH 17, 2017

REVISIONS
 UPDATES TO APPROVED FDP 09/16/2019
 CITY COMMENTS 10/21/2019

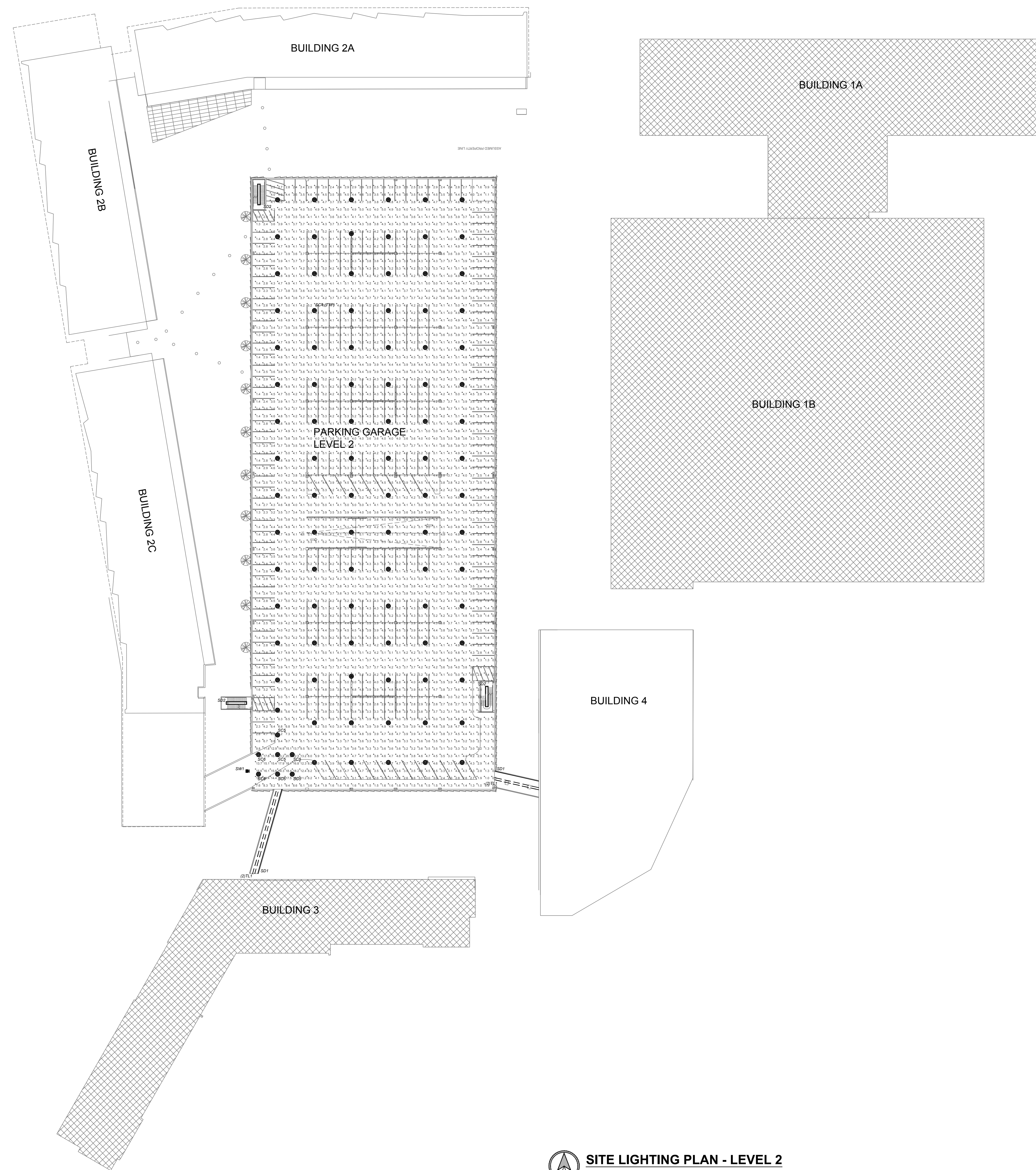


CONSULTANTS:
 CIVIL / LANDSCAPE: OLSSON ASSOCIATES, 7301 WEST 138RD ST. SUITE 200, OVERLAND PARK, KANSAS 66213, TEL: 913-492-2400, FAX: 913-381-1174
 M/E/P: PKMR ENGINEERS, 13300 W. 36TH ST., LENEXA, KANSAS 66215, TEL: 913-381-1170, FAX: 913-492-2437
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MISSION GATEWAY



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 **SITE LIGHTING PLAN - LEVEL 2**
1" = 40'-0"

01 SITE LIGHTING PLAN - LEVEL 2  

FINAL DEVELOPMENT PLAN

MARCH 17, 2017

REVISIONS
 UPDATES TO APPROVED FDP 09.16.2019
 CITY COMMENTS 10.21.2019



CONSULTANTS:

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 FAX: 913-492-2437

STRUCTURAL:
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 4338 BELLEVUE AVE.
 KANSAS CITY, MISSOURI 64111
 TEL: 816-531-4144
 FAX: 816-531-8572

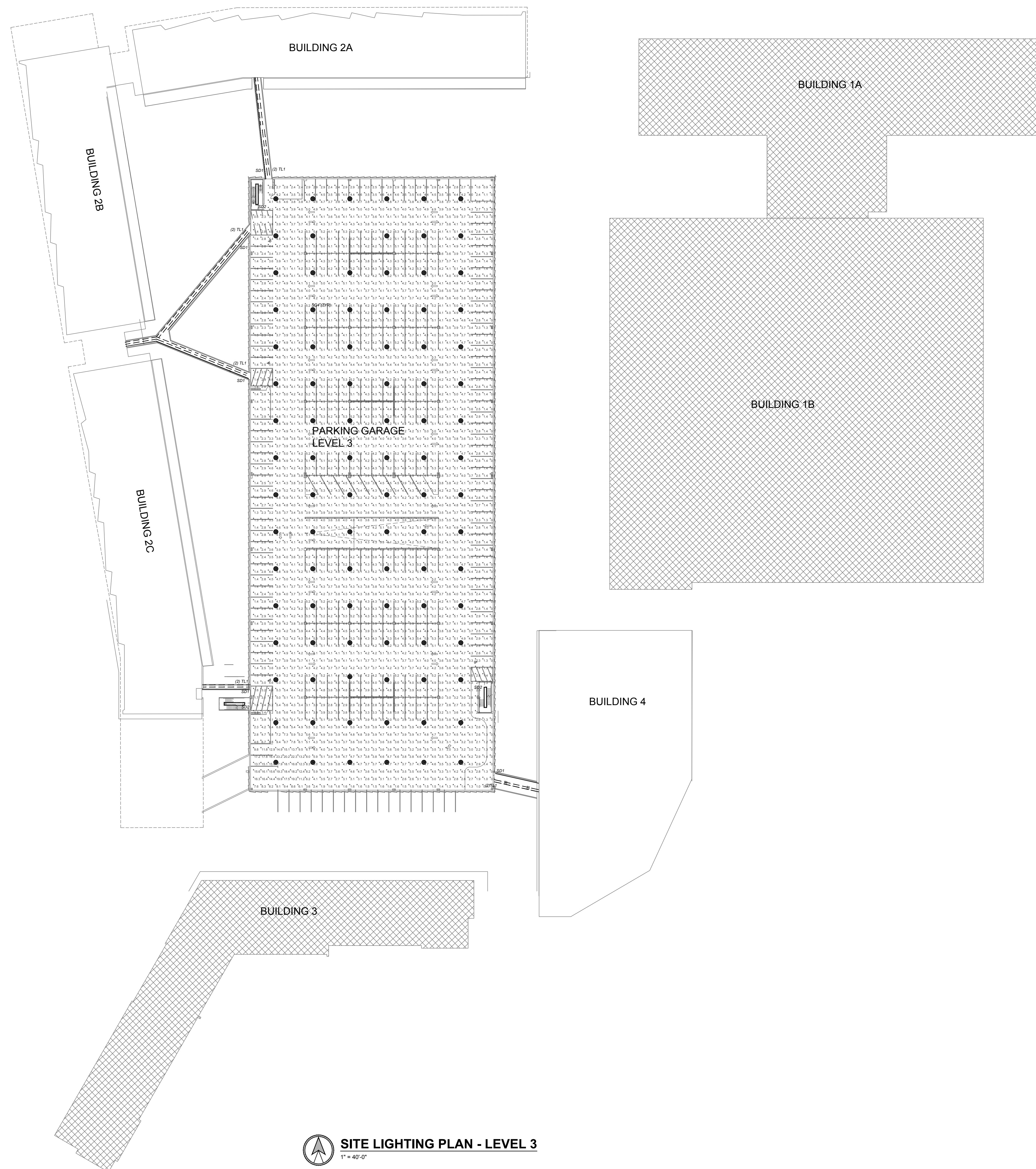
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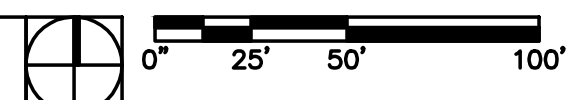
SITE LIGHTING PLAN (LEVEL 2)

FDP-SL002



SITE LIGHTING PLAN - LEVEL 3
1" = 40'-0"

01 SITE LIGHTING PLAN - LEVEL 3



FINAL DEVELOPMENT PLAN

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CITY COMMENTS 10.21.2019



PEARSON KENT MCKINLEY RAMP ENGINEERS LLC
1200 W. 9TH STREET
LENEKA, MO 64584
WWW.PKMR.COM

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STRUCTURAL:
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TEL: 816-531-4144
FAX: 816-531-8572

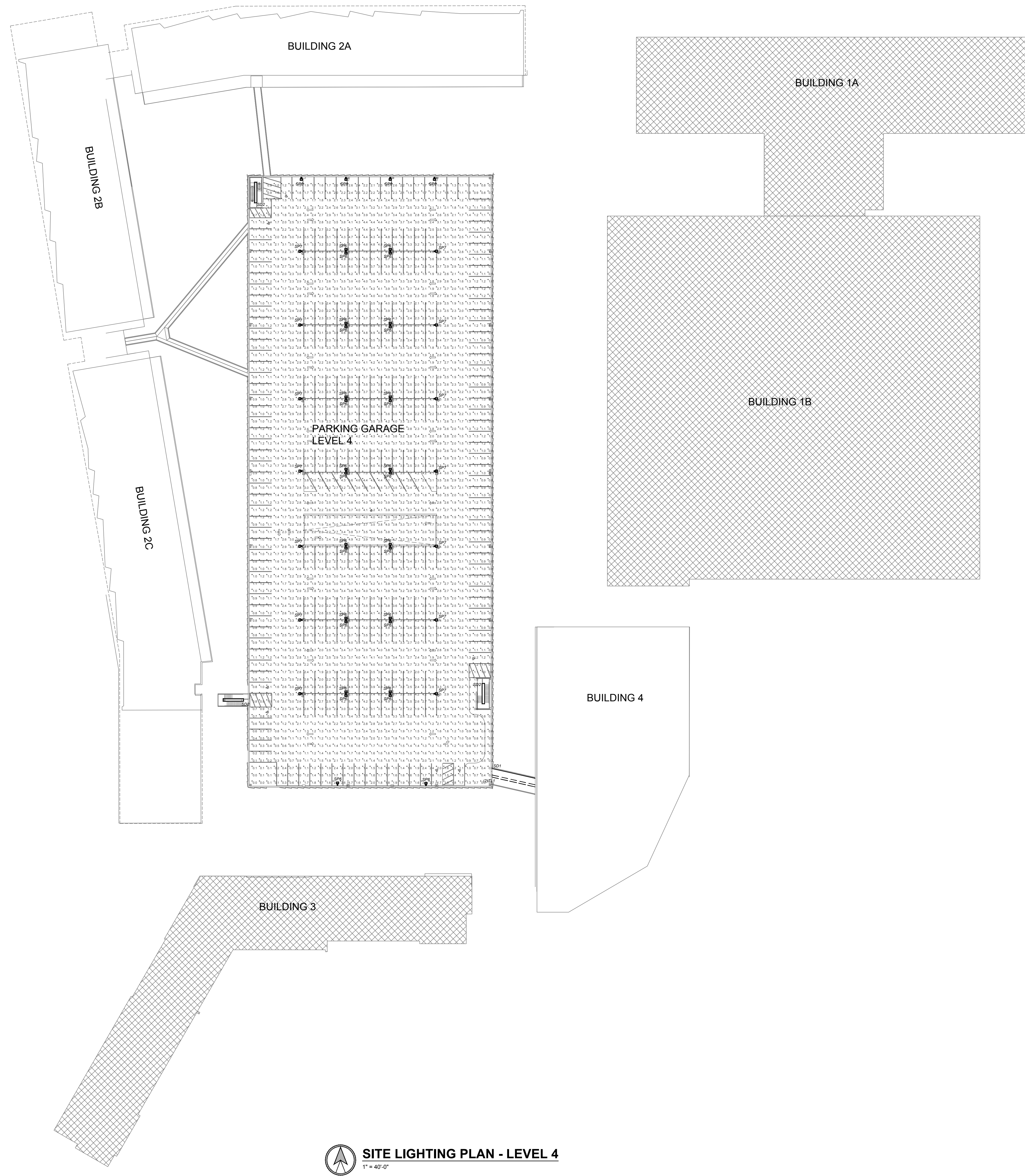
FDP-SL003

SITE LIGHTING PLAN (LEVEL 3)

MISSION GATEWAY



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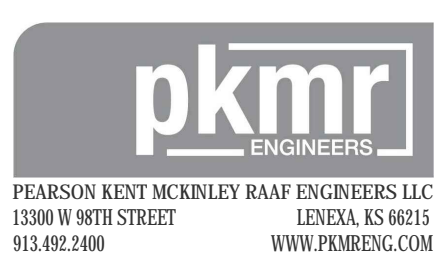


01 SITE LIGHTING PLAN - LEVEL 3

FINAL DEVELOPMENT PLAN

MARCH 17, 2017

REVISIONS
 UPDATES TO APPROVED FDP 09.16.2019
 CITY COMMENTS 10.21.2019



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SITE LIGHTING PLAN (LEVEL 4)

FDP-SL004

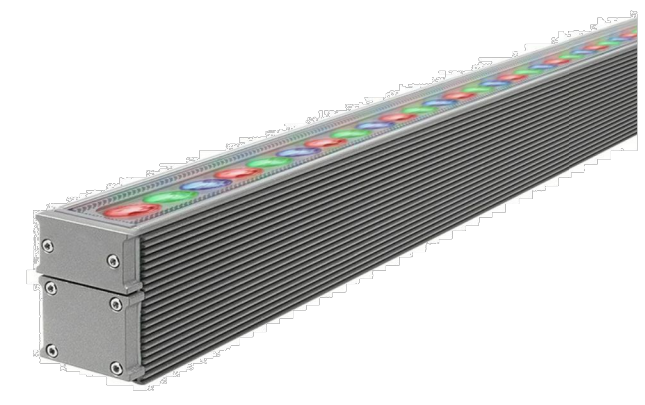
'SG' GARAGE FACADE UPLIGHT

Specification Sheet

Project Name _____ Qty _____

Type _____ Catalog / Part Number _____

lumenpulse
Stand Alone
LOGP
COLOR CHANGING



13 $\frac{3}{8}$ " 25 $\frac{3}{8}$ " 37 $\frac{3}{8}$ " 49 $\frac{3}{8}$ "

Top view

4" 2.5 $\frac{1}{16}$ "

3 $\frac{1}{2}$ "

*6 $\frac{1}{16}$ " on 1ft configuration

Front and side views

| | Delivered output (lm) | Intensity (peak cd) |
|---------|-----------------------|---------------------|
| WW | 1,565 | 2,464 |
| 8°x8° | 1,901* | 36,611* |
| 10°x10° | 1,771* | 18,023* |
| 10°x30° | 1,800* | 14,126* |
| 10°x60° | 1,898 | 8,350 |
| 10°x90° | 1,681* | 3,712* |
| 30°x30° | 1,770* | 6,921* |
| 30°x60° | 1,815* | 2,406* |
| 60°x60° | 1,620* | 1,417* |
| 90°x90° | 1,688* | 886* |

Based on RGB full output, 4ft (1219mm), DMX/RDM configuration.
Photometric performance is measured in compliance with IESNA LM-79-08.
*Estimated. Consult website for the latest photometric files.

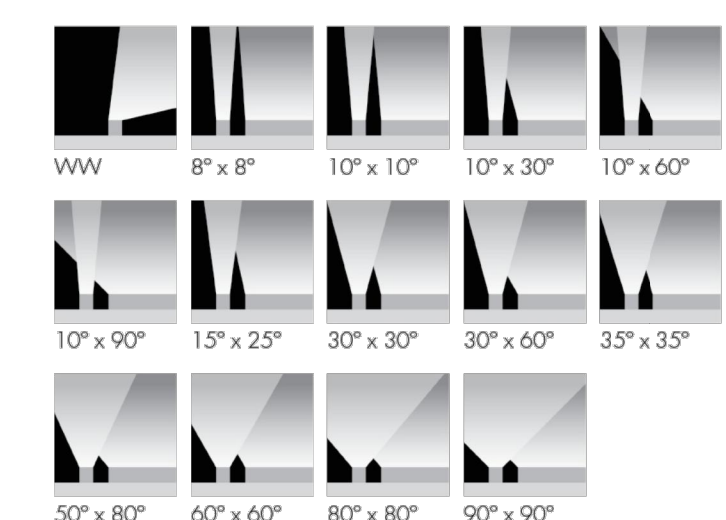
Description

The Lumenpulse Stand Alone Color Changing is a high-performance, linear LED luminaire for outdoor applications where individual units are preferred to continuous rows. The luminaire can be mounted to surfaces for colorful wall grazing or floodlighting, or suspended from ceilings to light large public spaces in color. Available in 12 in, 24 in, 36 in or 48 in sections, the luminaire offers a wide number of options including a choice of optics for grazing or floodlighting; RGB, RGBW or RGBA color mixing; various mounting options, finishes, accessories and controls. The Lumenpulse Stand Alone Color Changing is also available with a unique asymmetric wallwash distribution, providing exceptional uniformity and brightness for walls and signage.

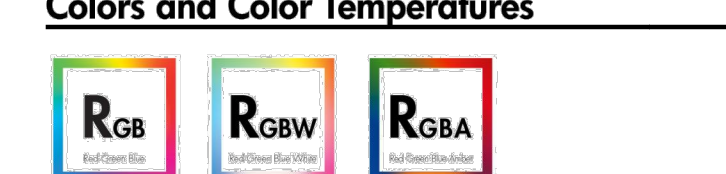
Features

| | |
|------------------------------------|---|
| Color and Color Temperature | Additive RGB, Additive RGB + white 4000K, Additive RGB + amber |
| Length (nominal) | 12 in, 24 in, 36 in, 48 in |
| Optics | Asymmetric Wallwash, 8° x 8°, 10° x 10°, 10° x 30°, 10° x 60°, 10° x 90°, 15° x 25°, 30° x 30°, 30° x 60°, 35° x 35°, 50° x 80°, 60° x 60°, 80° x 80°, 90° x 90° |
| Options | 90° angle cord output (bottom feed), Corrosion-resistant coating for hostile environments, 3G ANSI C136.31 Vibration Rating for bridge applications, CE (certification covers European Economic Area) |
| Power Consumption | 17.25 W/ft, Typically 20% higher for 12 in fixture lengths |
| Warranty | 5-year limited warranty |

Optics



Colors and Color Temperatures



lumenpulse 1220 Marie-Victoria Blvd., Longueville, QC J4G 2H9 CA T United States 617.307.5700 | Canada 1.877.937.3003 | 514.937.3003 F 514.937.6289
info@lumenpulse.com www.lumenpulse.com www.lumenpulse.com/products/1414/lumenpulse-stand-alone-color-changing

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'SD' SERIES ILLUMINATED HANDRAIL

LUMENLINEAR™ ASYMMETRIC

ANOTHER LUMENRAIL® COMPONENT FOR LIFE SAFETY AND LIGHT.

Our linear product is a state-of-the-art, low-voltage LED light fixture that provides exceptional lighting performance to enhance any stairway, ramp or walkway application. Its soft light provides ample illumination for safety and ambiance without the glare or harshness of overhead lighting. Available with warm, neutral or cool white color temperatures, and a range of solid color options for static hues. Standard, mid and high output offerings make Lumenlinear a highly flexible and practical solution for adding beauty and light to your life safety installations.




- Industry leading output:
 - 70° asymmetric @ 45° above nadir
- Matte and transparent lens options
- Available in:
 - 152, 284 or 413 lpf (4000 °K Values)
- IES full cutoff classification when installed in Wagner Architectural Systems hand rail
- Fully gasketed, extruded aluminum housing
- ETL wet location listed, UL1598 certified
- 5 year warranty
- Cast 316 stainless steel, mechanical mounting
- CCT standard in 5 white options
- 4 solid color options including wildfire amber
- Up to 88 CRI standard, 95+ available upon request
- 14 standard lengths from 6" to 80"



Specifications may change without prior notice, verify data at time of order, all rights reserved

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FINAL DEVELOPMENT PLAN

MARCH 17, 2017

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'TL1' LED TAPE LIGHTING

KLUS

Flexible LED Strip 9.6 Watt / M, IP 65, 24 V

UL LISTED

| Product code No. | Color Temp. | Watts/ Meter Watts/ Foot | LEDs/ Meter LEDs/ Foot | Lumens / Meter Lumens/ Foot | CRI | LED Chip Type | Beam Angle | Input Voltage |
|------------------|-------------|--------------------------|-------------------------|-----------------------------|-----|---------------|------------|---------------|
| WP-K-27-1220-24V | 2700K | 9.6 W/M 3 W/F | 120 LEDs/M 38 LEDs/F | 635 L/M 200 L/F | 90+ | Epistar 3528 | 140° | 24V |
| WP-K-30-1220-24V | 3000K | 9.6 W/M 3 W/F | 120 LEDs/M 38 LEDs/F | 750 L/M 230 L/F | 90+ | Epistar 3528 | 140° | 24V |
| WP-K-35-1220-24V | 3500K | 9.6 W/M 3 W/F | 120 LEDs/M 38 LEDs/F | 800 L/M 250 L/F | 90+ | Epistar 3528 | 140° | 24V |
| WP-K-40-1220-24V | 4000K | 9.6 W/M 3 W/F | 120 LEDs/M 38 LEDs/F | 845 L/M 265 L/F | 90+ | Epistar 3528 | 140° | 24V |

Operating Temperature: -22°F to 122°F, IP65, 24V DC, Dimmable, Outdoor, Hazardous, CE, RoHS.

Water and dust resistant – IP 65

Protects against:

- Rain and humidity
- Water splash
- Dust and dirt
- Water jets
- Particles

Wire options:

36"-72" wire leads (20 gauge jacketed wire)

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'SC10' PARKING UNDER OFFICE

304 Series™

LED Recessed Soffit Luminaire

Product Description

High performance energy efficient LED down light, designed for use in drop ceilings with 20-24" (508-610mm) on center building construction. Heavy gauge steel recessed mounting frame features 1-1/2" (38mm) deep aperture throat to accommodate most standard ceiling thicknesses, and universal mounting brackets that accept 1/2" (13mm) EMT conduit, C-channel mounting bars or flat bar hangers (all by others) with 5" (127mm) vertical adjustment from either above or below the ceiling. Luminaire is constructed from rugged die cast and extruded aluminum components. LED driver is mounted in a sealed weatheright center chamber that allows for access from below the luminaire. High performance heat sinks specifically designed for LED recessed soffit applications.

Applications: Petroleum stations, convenience stores, drive-thru banks and restaurants, retail and grocery

Performance Summary

Patented NanoOptic® Product Technology

Made in the U.S.A. of U.S. and imported parts

CRI: Minimum 70 CRI

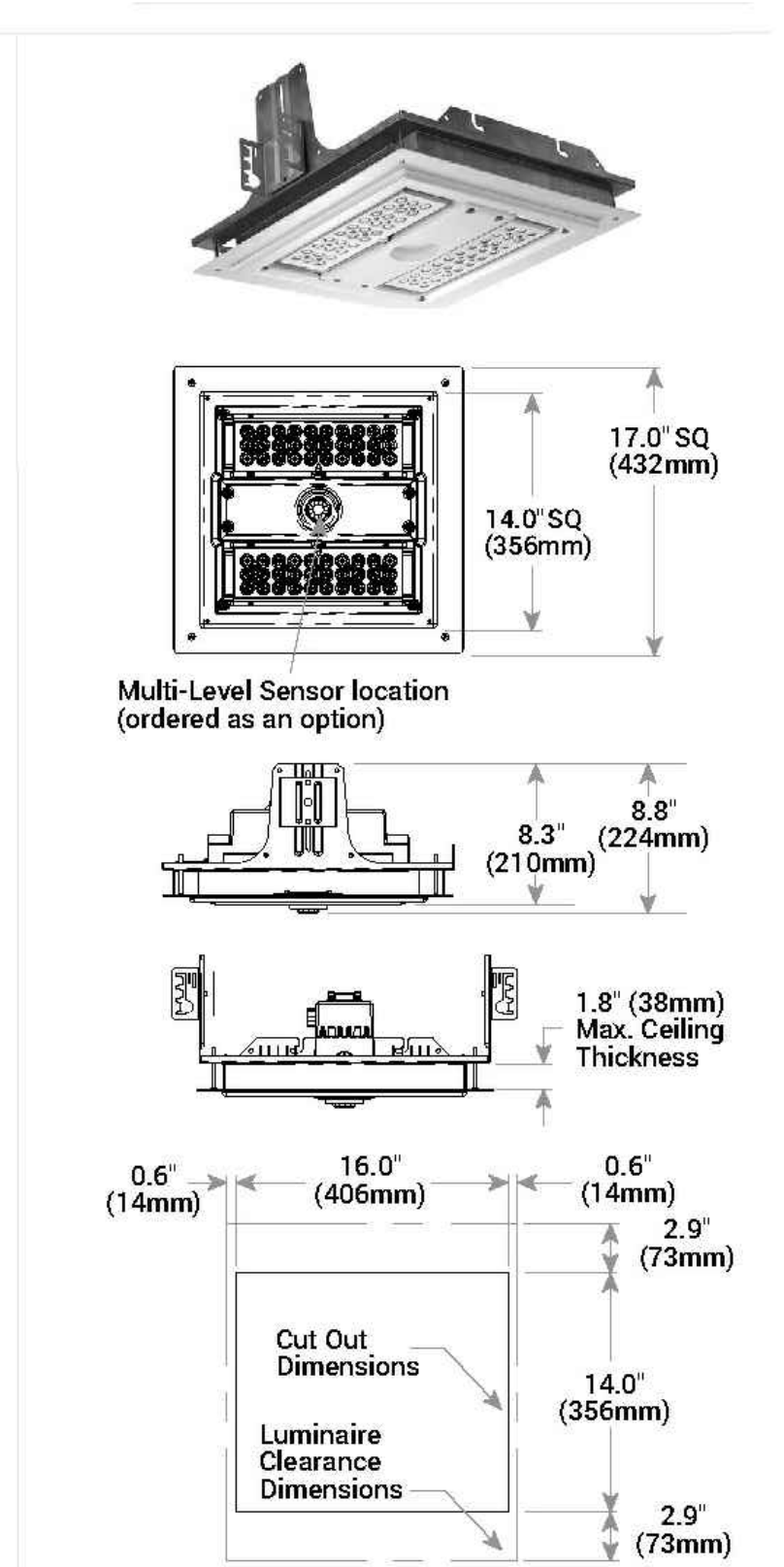
CCT: 4000K (+/- 300K), 5700K (+/- 500K) standard

Limited Warranty: 10 years on luminaire/10 years on Colorfast DeltaGuard® finish

See www.cree.com/lighting/products/warranty for warranty terms

Accessories

| Field-Installed | Mounting C-Channel |
|--|--|
| Hand-held Remote XA-SERIES • For successful implementation of the programmable multi-level option, a minimum of one hand-held remote is required | XA-MC14 • Pair of 14" (356mm) rigid 3/4" x 1/2" (19mm x 13mm) galvanized C-Channel bars XA-MC22 • Pair of 22" (559mm) rigid 3/4" x 1/2" (19mm x 13mm) galvanized C-Channel bars XA-MC28 • Pair of 30" (762mm) rigid 3/4" x 1/2" (19mm x 13mm) galvanized C-Channel bars |
| Hanger Bar | |
| Mounting Brackets XA-MB4 • MB contains 4 | |



| LED Count (x10) | Weight |
|-----------------|--------------------|
| D4 | 22.5 lbs. (10.2kg) |
| D6 | 22.5 lbs. (10.2kg) |

Ordering Information

Example: SFT304-SM-RM-04-E-UL-WH-350

| Product | Optic | Mounting | LED Count (x10) | Series | Voltage | Color Options | Drive Current | Options |
|---------|---|----------------|--|--------|--|--|---|---|
| SFT-304 | SM Type V Medium SS Type V Short PS Petroleum Symmetric S Sparks Petroleum | RM Recessed | 04 06 • Available on non-C rated luminaires only | E | UL Universal 120-277V • For use with IC option only UH Universal 345-480V • For use with IC option only 12 120V • Available on non-C rated luminaires only 27 277V • Available on non-C rated luminaires only | BK Black BE BZ Bronze SV Silver WH White | 350 350mA 525 525mA 700 700mA • Available on non-C rated luminaires only 40 40 LEDs at 350mA only | DM 0-10V Dimming • Control by others • Refer to Dimming spec sheet for details • Can't exceed specified drive current F Fuse • When code dictates fusing, use time delay fuse • Refer to ML spec sheet for availability with ML options IC Type IC Rated • Available with 40 LEDs at 350mA only ML Multi-Level • Refer to ML spec sheet for details PML Programmable Multi-Level • Refer to PML spec sheet for details DK 4000K Color Temperature • Minimum 70 CRI • Color temperature per luminaire |



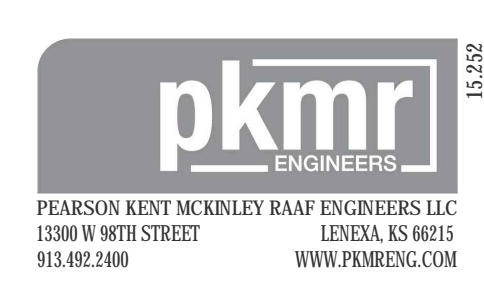
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Canada: www.cree.com/canada T (800) 473-1234 F (800) 890-7507

FINAL DEVELOPMENT PLAN
MARCH 17, 2017
REVISIONS
UPDATES TO APPROVED FDP 09.16.2019
CITY COMMENTS 10.21.2019



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MISSION GATEWAY



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MISSION GATEWAY TRAFFIC IMPACT STUDY

Prepared for:

GFI Capital Resources Group, Inc.
Mission, Kansas

Revised October 2019

Olsson Project No. 017-2145

olsson



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APPENDICES

- Appendix A: Data Collection
- Appendix B: Existing Plus Approved Conditions
- Appendix C: Existing Plus Approved Plus Proposed Development Conditions
- Appendix D: Future Year 2038 Conditions

1. INTRODUCTION

This report is an update to a traffic impact study submitted by Olsson in March of 2017 titled 'The Gateway Development'. The study has been updated to account for a modification to the proposed site plan. The residential/retail portion of the proposed site has been approved by the City and is currently being constructed. This study will provide an update regarding the unconstructed hotel, office, and retail uses located on the south and east sides of the development.

This report studies traffic impacts regarding a proposed development located in the northeast quadrant of Shawnee Mission Parkway and Roeland Drive. A portion of the development including residential apartment units and shopping center, has been approved with construction expected to be completed by Fall of 2020. The approved development also included office and retail land uses located south and east of the residential and shopping development. Modifications are proposed to the office and retail uses; thus, this study addresses traffic impacts of these proposed changes.

This report will review the impacts of the proposed development on the existing roadway network and will recommend additional turn lanes, storage bays, and intersection control methods as appropriate. Shawnee Mission Parkway (US-56) is maintained by the Kansas Department of Transportation (KDOT), thus KDOT's *Access Management Policy* was used to review Shawnee Mission Parkway (US-56) and Roeland Drive. The remaining study intersections and proposed site drives will be reviewed using KDOT criteria and engineering judgement.

- Roeland Drive and Martway Street
- Roeland Drive and Johnson Drive
- Johnson Drive and Roe Avenue
- Site driveways and access points, as appropriate

For this study, the following scenarios were analyzed:

- Existing plus Approved Development conditions*
- Existing plus Approved plus Proposed Development conditions*
- Future Conditions (2038)*

** Includes approved residential and retail development proposed in the existing plus development scenario of the previous report completed in 2017.*

The approximate location of the development is show on the vicinity map, **Figure 1**.

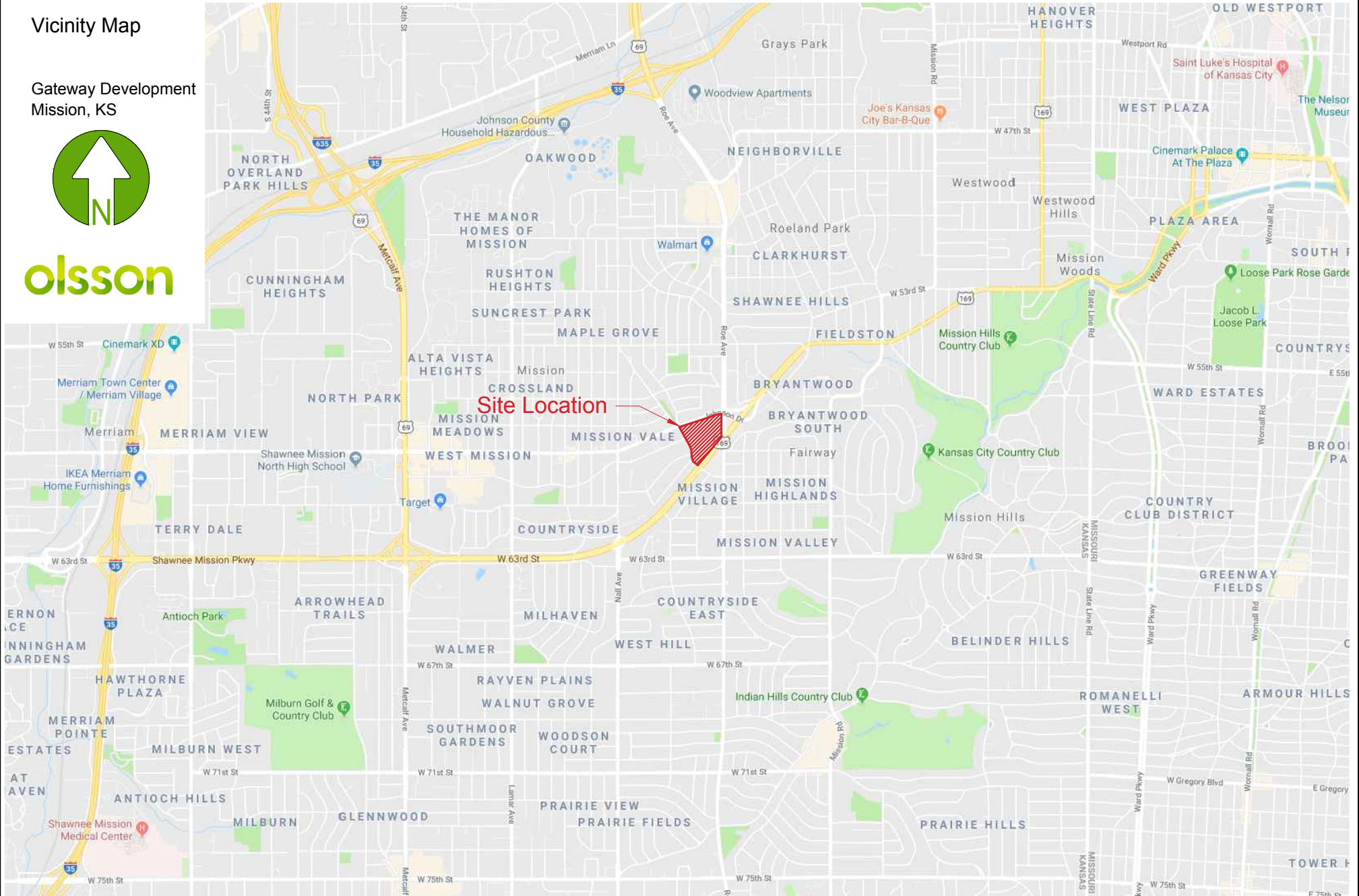
FIGURE 1

Vicinity Map

Gateway Development
Mission, KS



olsson



Source: Google Maps

2. DATA COLLECTION

The data collection effort included acquiring peak hour turning movement counts and documentation of current roadway geometrics. Traffic counts were collected on Tuesday, October 4th, 2018 at the study intersections listed in **Section 1.0**.

The counts were conducted during the typical weekday AM and PM peak periods from 7:00-9:00 AM and 4:00-6:00 PM. The AM peak hour period for the study intersections was determined to be from 7:30-8:30 AM. The PM peak hour period for the study intersections was determined to be from 5:00-6:00 PM. Existing peak hour count data is shown in **Figure 2**. Count data collected for this study can be found in **Appendix A**.

Existing signal timing information for the signalized intersections were obtained from Mid-America Regional Council (MARC), KCP&L and the previous study:

- Shawnee Mission Parkway (US-56) and Roeland Drive (MARC)
- Roeland Drive and Martway Street (Previous study)
- Roeland Drive and Johnson Drive (Previous study)
- Johnson Drive and Roe Avenue (KCP&L)

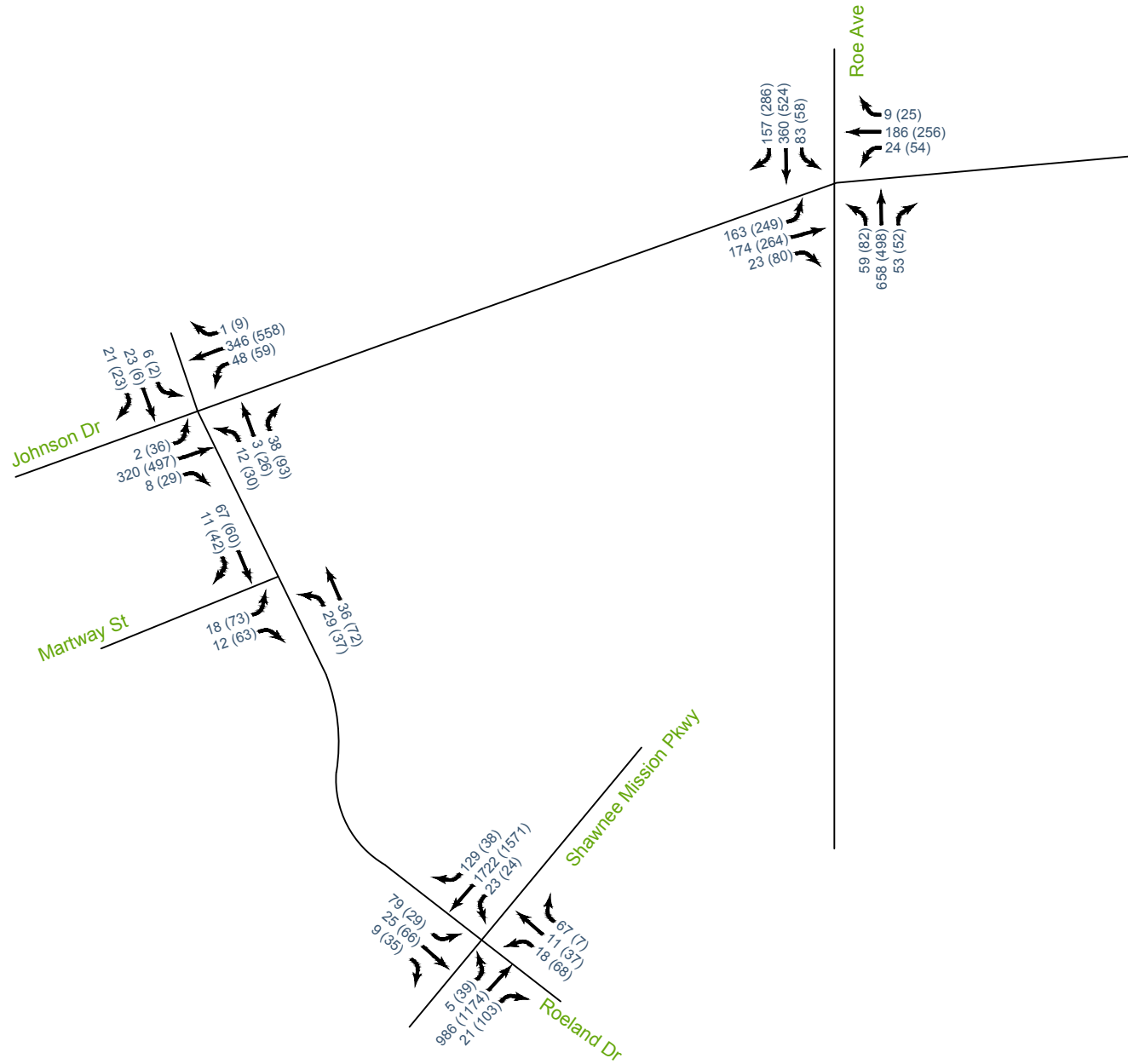
The signalized intersection of Roeland Drive with Martway Street is currently operating in “flash” mode. The northbound and southbound movements have the yellow “caution” indications, and the eastbound movement has the red “stop” indication. To account for improvements recommended in the 2017 study, the intersection of Roeland Drive and Martway Street was analyzed as a signalized intersection.

Signal timing information for the intersections mentioned above is provided in **Appendix A**.

FIGURE 2

Existing Peak Hour Volumes

Gateway Development
Mission, KS



LEGEND

AM (PM) Peak Hour Volume

3. EXISTING PLUS APPROVED DEVELOPMENT CONDITIONS

To account for the approved development that is currently under construction, trips were generated and added to the existing traffic volumes. Roadway improvements that are associated with the City approved residential and retail development outlined in the 2017 study were accounted for in this scenario as discussed in **Section 3.2**. This scenario includes the addition of two proposed drives along Roeland Drive and one proposed drive along Johnson Drive. The existing plus approved development traffic conditions were evaluated to provide a baseline for comparative purposes.

3.1. Network Characteristics

Five roadways are located within the study area: Shawnee Mission Parkway (US-56), Roeland Drive, Johnson Drive, Roe Avenue, and Martway Street. Referencing the KDOT *Access Management Policy*, KDOT Functional Classifications map and National Highway System map, current network characteristics were determined and are summarized in **Table 1**.

Table 1. Existing Network Summary

| Roadway | Functional Classification | KDOT Classification * | Section | Median Type | Posted Speed | NHS |
|-----------------------------------|---------------------------|-----------------------|---------|------------------------------|--------------|-----|
| Shawnee Mission Parkway (US-56)** | Principle Arterial | B | 4-Lane | Painted/ Grass Median | 45 MPH | Yes |
| Roeland Drive | Local Road | *** | 3-Lane | None | 25 MPH | No |
| Johnson Drive | Minor Arterial | *** | 3-Lane | Partial Raised Median | 30 MPH | No |
| Roe Avenue | Arterial Roadway | *** | 4-Lane | Raised/ Striped Median | 35 MPH | No |
| Martway Street | Local Road | *** | 3-Lane | None | 25 MPH | No |

* Based on Table 4-1 of KDOT's Access Management Policy.

**Roadway referred to as Shawnee Mission Parkway for the purposes of this report.

***Roadway is not maintained by KDOT, thus KDOT Classification was not considered.

Signalized intersection geometric characteristics (number of turn lanes, pedestrian accommodations, etc.) are as follows:

Shawnee Mission Parkway and Roeland Drive

- Dedicated left-turn lanes are provided for all movements at the intersection except the south approach.
- Dedicated right-turn lanes are provided for the southbound and eastbound movements.
- No pedestrian accommodations are provided at the intersection.

Roeland Drive and Johnson Drive

- Dedicated left-turn lanes are provided for all movements at the intersection except the north approach.
- Dedicated right-turn lanes are provided for the eastbound and westbound movements.
- Pedestrian accommodations are provided along the west and south legs of the intersection and include marked crosswalks, pedestrian indications, and push buttons.

Roeland Drive and Martway Drive

- Dedicated left-turn lanes are provided for the northbound and eastbound movements at the intersection.
- Pedestrian accommodations are provided for the southbound movement at the intersection, including marked crosswalks, pedestrian indications, and push buttons.
 - Currently, this signalized intersection operates in “Flash” mode for all periods of the day. During “Flash” operation mode, no signalized pedestrian accommodations are provided.

Roe Avenue and Johnson Drive

- Dedicated left-turn lanes are provided for all movements at the intersection with dual left-turn lanes allocated for the eastbound movement.
- A dedicated right-turn lane is provided for the southbound movement. A channelized right-turn lane is provided for the northbound movement.
- Pedestrian accommodations are provided along the west and north legs of the intersection and include marked crosswalks, pedestrian indications, and push buttons.

3.2. Approved Development Roadway Improvements

Roadway improvements and driveway additions associated with the approved residential and retail portions of the development along City maintained streets (outlined in the traffic study completed by Olsson in 2017) were accounted for under the existing plus approved

development scenario. These improvements and driveway additions are as follows and are expected to be completed in Fall of 2020 along with the retail and residential construction:

Roeland Drive and Drive 2

- Drive 2 is located 300' south of the intersection of Roeland Drive and Martway Street.
- A separate left-turn and right-turn lane will be provided for exiting traffic.
The north approach will be re-striped to provide a 75' southbound left-turn lane plus taper using the existing two-way left-turn lane.
- A throat distance of 75' was recommended at Drive 2. As stated in the 2017 report if adequate throat distance cannot be achieved "Do Not Block Intersection" signing for westbound vehicles approaching Roeland Drive is to be provided internal to the site along Drive 2 at the parking lot drive.

Roeland Drive and Martway Street/Drive 3

- Drive 3 will be constructed as the east leg of the intersection of Roeland Drive and Martway Street
- A separate 75' left-turn lane plus taper will be provided to mirror the west approach.
- The north approach will be re-striped to provide a 100' southbound left-turn lane plus taper using the existing two-way left-turn lane.
- A throat distance of 75' was recommended at Drive 3. As stated in the 2017 report if adequate throat distance cannot be achieved signing will be provided internal to the site to allow entering vehicles the right-of-way at the intersection of Drive 3 with the internal parking lots.
- Based on the previous study data collected, the Peak Hour Warrant (Warrant 3) was evaluated at Roeland Drive and Martway Street. Insufficient data to was available to perform the other signal warrants. Warrant 3 considers peak hour vehicular volume data to conduct the warrant and is vehicular focused. The signalized intersection of Roeland Street and Martway Street does not warrant a signal, however based on recommendations provided in the approved study a signal should be kept providing pedestrian accommodations for the Rock Creek Trail that crosses along the southside of the intersection. Modifications to the signal at this intersection will be completed with the approved development to accommodate both pedestrian and approved development traffic.

Johnson Drive and Drive 4

- Drive 4 will be constructed 575' east of the intersection of Roeland Drive and Johnson Drive.
- A throat distance of 125' will be provided at Drive 4.

- Separate left and right-turn lanes will be provided at Drive 4 for exiting traffic. The right turn lane will release traffic into the existing second eastbound through lane on the outside of Johnson Drive.
- An existing westbound left-turn lane will be used for access to Drive 4. The turn lane will have an approximate length of 150' plus taper.

3.3. Existing Crash Data

Crash data from 2013-2017 was obtained from KDOT for the study intersection of Shawnee Mission Parkway and Roeland Drive. Crash data provided included crashes at the intersection and approximately 250 feet in the vicinity of the intersection along each approach. The crash summary statistics were used to develop an intersection crash rate at this location. Additionally, the individual crash reports were reviewed to identify any crash patterns and possible countermeasures for consideration.

Intersection Crash Rate

The crash data from 2013-2017 was used to determine the average crash rate at the study intersection. Crashes were reviewed and incidents that were considered non-correctible or non-intersection related (such as crashes due to alcohol impairment, animals, inclement weather, or construction) were removed. This review resulted in a total of 14 crashes at the intersection over the analyzed time period. The crash total was compared to the average daily entering volume for the intersection. The calculated crash rate, reported in the number of crashes per ten million entering vehicles (TMEV), for the study intersection is illustrated in **Table 2** below. The equation used to calculate the intersection crash rate is also provided below.

Table 2. Crash Rate Summary.

| Intersection | Average Crash Rate 2013-2017 (Crashes/TMEV) |
|---|--|
| Shawnee Mission Parkway and Roeland Drive | 2.0 |

$$\text{Crash Rate} \left(\frac{\text{Crashes}}{\text{TMEV}} \right) = \frac{\text{5 Year Crash Total}}{\left(\frac{\text{Total Entering Vehicles per Day}}{10,000,000} \right) \times 365 \times 5}$$

Historically, the KDOT-reported statewide intersection crash rate is near 10.0 crashes/TMEV. To determine if the intersection is experiencing a higher number of crashes when compared to other intersections, the calculated intersection crash rate at the study intersection was compared to the KDOT average crash rate. When comparing the calculated rate to the statewide crash rates for non-interchange intersections, the Shawnee Mission Parkway and Roeland Drive intersection was found to be below the statewide average rate. The crash rate calculations are provided in **Appendix B**.

Crash Report Review – Shawnee Mission Parkway and Roeland Drive

As stated above, crashes that were considered non-correctible or non-intersection related were removed from the dataset; this resulted in 3 crashes being removed at this location. After removal of non-correctible/non-intersection related crashes, there were a total of 14 intersection related crashes observed from 2013-2017 at Shawnee Mission Parkway and Roeland Drive. These crashes were categorized by their observed crash pattern and summarized in **Table 3**. A graphical breakdown of observed crash pattern is illustrated in **Exhibit 1**.

Table 3. Crash Report Review Summary - Shawnee Mission Parkway and Roeland Drive.

| Observed Crash Pattern | No. Crashes (2013-2017; Partial 2018-2019) | Percent | Comments |
|--------------------------------|--|-------------|--|
| Following too Close / Rear End | 9 | 90% | Rear end crashes are the most common trend seen at signalized intersections. |
| Angle – Side Impact | 1 | 10% | One vehicle violated red signal. |
| Total | 10 | 100% | |

The most common crash type (90% of the total) was observed to be rear end crashes. Rear end crashes are typically the most common trend seen at signalized intersections occurring as vehicles are approaching stopped vehicles at a red signal indication. The remaining accident was a right-angle crash that was attributed to a vehicle violating the red signal. Overall the intersection of Shawnee Mission Parkway and Roeland Drive experiences fewer crashes than the statewide average and the crash pattern observed was consistent with crash types experienced at a signalized intersection.

3.4. Approved Development Trip Generation

To assess the impact of the approved development traffic on the roadway network, expected trips associated with the proposed site were generated and applied to the study network. The Institute of Transportation Engineers (ITE) provides methods for estimating traffic volumes of common land uses in the Trip Generation Manual (10th Edition). The land use that most resembles the approved development for this site is Land Use Code 220 (Apartment) and 820 (Shopping Center). *Expected trips associated with the approved development have been updated to reflect most current trip generation methodology.*

Based on the *ITE Trip Generation Manual*, trip generation characteristics were developed for the approved site. Trip generation characteristics expected for the site are shown in

Table 4. Detailed ITE trip generation information can be found in **Appendix C.**

Table 4. Approved Development Trip Generation

| Land Use | Size | Average Weekday | AM Peak Hour | | | PM Peak Hour | | |
|--------------------|-----------|-----------------|--------------|------------|------------|--------------|------------|------------|
| | | | Total | Enter | Exit | Total | Enter | Exit |
| Apartment | 168 DU | 1,230 | 79 | 19 | 60 | 94 | 60 | 34 |
| Shopping Center | 54,594 SF | 3,984 | 180 | 112 | 68 | 348 | 168 | 180 |
| Total Trips | | 5,214 | 259 | 131 | 128 | 442 | 228 | 214 |

Consistent with the previous report, internal capture was determined for the approved site. Internal capture calculations were updated to reflect the most current methodology. The site contains multiple land uses, thus internal trip capture was determined for both the AM and PM peak hours. When a site consists of multiple land uses, total trips to a development can be reduced due to internal capture on the site. These are trips that stay within the development area and do not leave the site to travel to other developments. The multi-use reduction percentage is determined using various tables included in the *Trip Generation Manual*. Worksheets used to determine the multi-use reduction percentage are included in **Appendix C**. Based on the worksheet results, the internal capture percentage was determined to be 1% in the AM peak hour and 19% in the PM peak hour. To be conservative, it was assumed that internal capture trips would not occur during the AM peak hour, thus no internal capture rates were used.

Consistent with the previous report, pass-by was determined for the approved site. Pass-by calculations were updated to reflect the most current methodology. Pass-by characteristics were determined for the Shopping Center land use using the *ITE Trip Generation Handbook (10th Edition)*. Pass-by trips are made by traffic already on the roadway and passing the site, versus making a direct trip to the development (primary trips). According to the *ITE Trip Generation Handbook*, the pass-by trips during the AM and PM peak hour periods for the described land use varies from 20% to 74%. To be conservative, the average rate of 34% pass-by trips was used for this study and was only applied to the PM peak hour period. Trip generation data considering internal capture and pass-by trips for the approved land uses are illustrated in **Table 5**.

Table 5. Approved Development Trip Generation with Internal Capture and Pass-by.

| Land Use | Average Weekday | AM Peak Hour | | | PM Peak Hour | | |
|--|-----------------|--------------|------------|------------|--------------|------------|------------|
| | | Total | Enter | Exit | Total | Enter | Exit |
| Total Approved Development Trips | 5,214 | 259 | 131 | 128 | 442 | 228 | 214 |
| Total with Internal Trip Capture Reduction (19%) | | - | - | - | 358 | 185 | 173 |
| 34% Pass-by Reduction (Shopping Center) | | - | - | - | 122 | 57 | 61 |
| Total External, Non-Pass-by Trips | | 259 | 131 | 128 | 236 | 128 | 112 |

Trips associated with approved development were distributed through the network based on the anticipated land use, the surrounding area, and the existing distribution of trips in the vicinity of the proposed site. Trip distribution is illustrated in **Table 6**. This distribution is slightly different than proposed with the previous study. The revised trip distribution considers distribution of existing (year 2018) traffic volumes. The expected trip distribution for the approved development is shown in **Figure 3**.

Table 6. Approved Development Trip Distribution.

| Direction | Trip Distribution |
|--------------------------------|-------------------|
| North (Roe Avenue) | 10% |
| South (Roe Avenue) | 10% |
| West (Shawnee Mission Parkway) | 30% |
| West (Johnson Drive) | 10% |
| East (Johnson Drive) | 10% |
| East (Shawnee Mission Parkway) | 30% |

The resulting existing plus approved development volumes are illustrated in **Figure 4**.

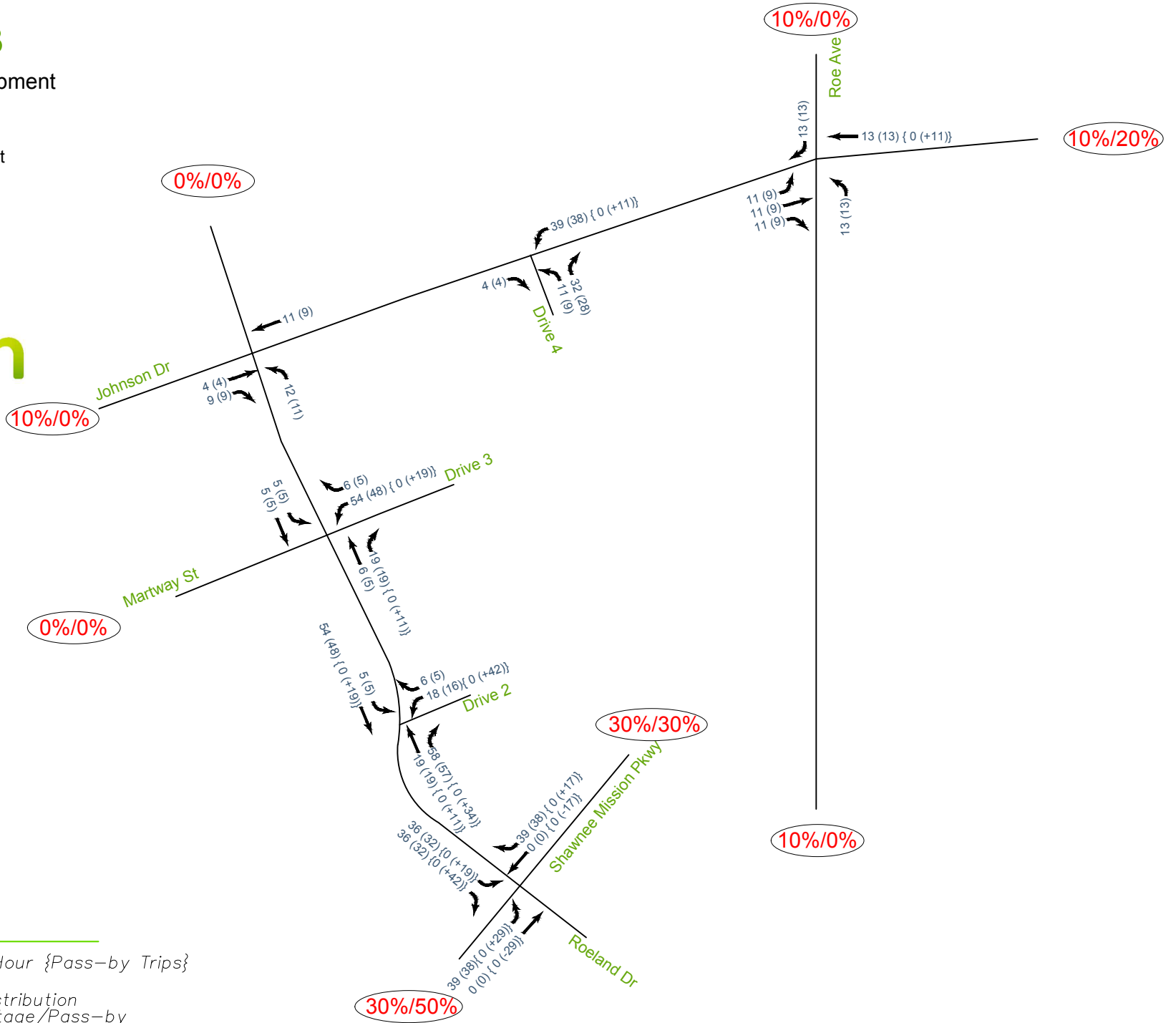
FIGURE 3

Approved Development Trip Distribution

Gateway Development
Mission, KS



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LEGEND

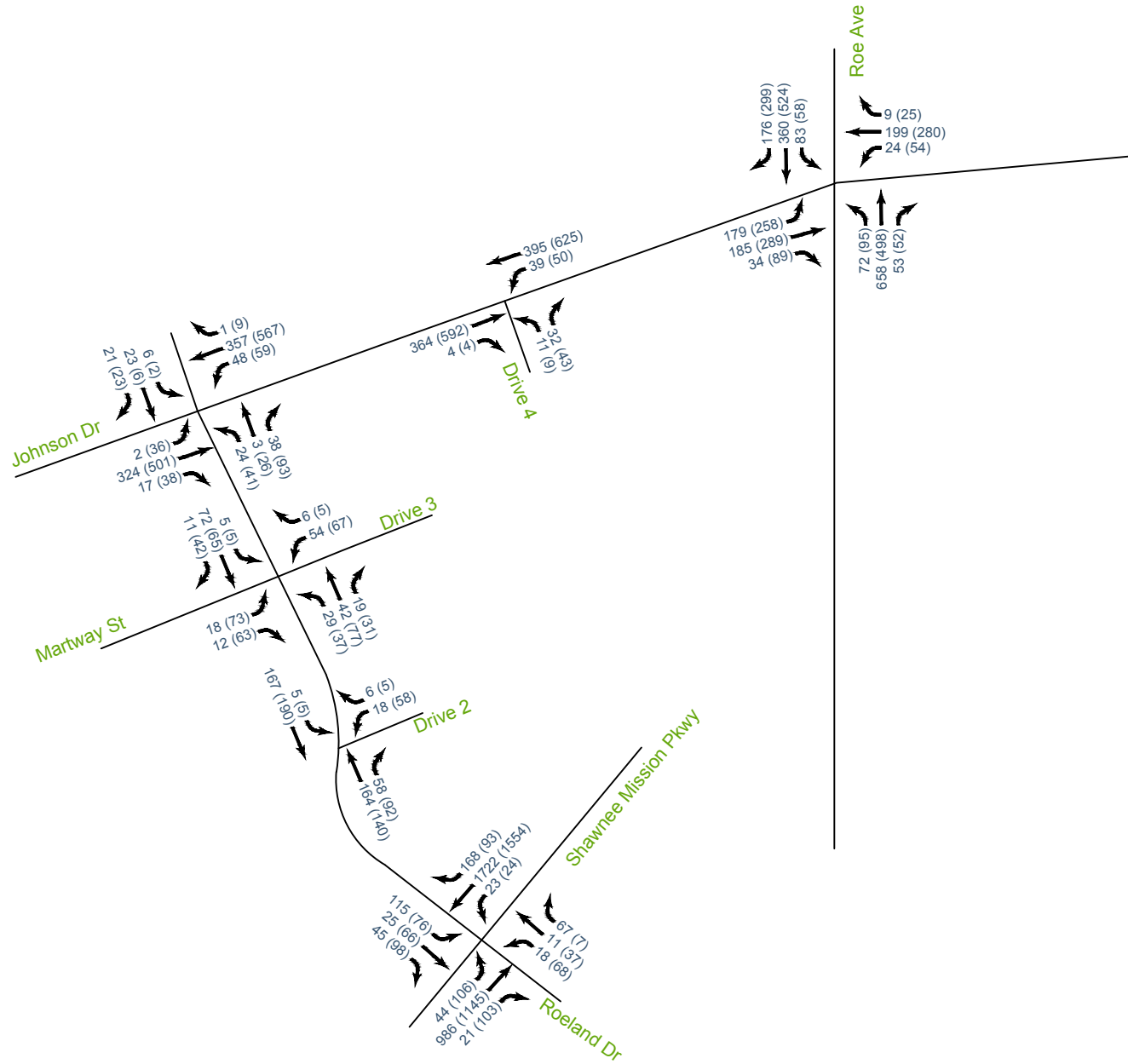
AM (PM) {AM (PM)} Peak Hour {Pass-by Trips}

X%/X% Trip Distribution
Percentage/Pass-by
Percentage

FIGURE 4

Existing plus Approved Peak Hour Volumes

Gateway Development
Mission, KS



LEGEND

AM (PM) Peak Hour Volume

3.5. Existing plus Approved Capacity Analysis

Capacity analysis was performed for the study intersections utilizing the existing lane configurations and traffic control, including proposed access associated with approved development. Analysis was conducted using Synchro, Version 10, based on the Highway Capacity Manual (HCM) delay methodologies. For the purposes of this report, capacity analysis was updated to reflect the most current methodology. For simplicity, the amount of control delay is equated to a grade or Level of Service (LOS) based on thresholds of driver acceptance. The amount of delay is assigned a letter grade A through F, LOS A representing little or no delay and LOS F representing very high delay. **Table 7** shows the delays associated with each LOS grade for signalized and unsignalized intersections, respectively.

Table 7. Intersection LOS Criteria.

| Level of Service | Average Control Delay (seconds) | |
|---|---------------------------------|--------------|
| | Signalized | Unsignalized |
| A | < 10 | < 10 |
| B | > 10-20 | > 10-15 |
| C | > 20-35 | > 15-25 |
| D | > 35-55 | > 25-35 |
| E | > 55-80 | > 35-50 |
| F | > 80 | > 50 |
| Highway Capacity Manual (HCM 6 th Edition) | | |

Results of the analysis indicate that the signalized intersections are expected to operate at a LOS C or better during the AM and PM peak hour periods. All individual movements at the intersections are expected to operate at a LOS D or better with acceptable queues during both peak hour periods with the exception of the following movements. The 95th percentile queue represents the queue length that has a 5 percent probability of being exceeded during the peak hour period.

Shawnee Mission Parkway and Roeland Drive

- During both peak hour periods the eastbound left and northbound movements are expected to operate at a LOS E.
 - High levels of delay for the eastbound left-turn movement is attributed to the timings at the intersection which cater to traffic along Shawnee Mission Parkway during the peak hour periods.

- Currently there is a lack of capacity for the northbound left-turn movement. Due to right-of-way constraints the northbound approach only has a single lane for all movements.
- During the AM peak hour, the southbound left-turn movement is expected to operate at a LOS F.
 - 95th-percentile queue lengths during the PM peak hour are expected to exceed the available capacity; however, the queue is not expected to encroach on the adjacent intersection of Roeland Drive and Rock Creek Lane. This movement will be monitored in later scenarios to determine if geometric changes are needed to accommodate the queue length.
- During the PM peak hour, the southbound right-turn movement is expected to operate at LOS E.
 - The 95th-percentile queue length during the PM peak hour is expected to be less than one vehicle length.

Roe Avenue and Johnson Drive

- During both peak hour periods the westbound left-turn movements are expected to operate at a LOS E.
 - 95th-percentile queue lengths are expected to be contained within the available storage length.
- During the PM peak hour, the eastbound left-turn movements are expected to operate at a LOS E.
 - 95th-percentile queue lengths are expected to be contained within the available storage length.

All movements at the unsignalized intersections are expected to operate at LOS C or better during both peak hour periods.

Merge analysis was performed for the Johnson Drive to Shawnee Mission Parkway ramp using McTrans Highway Capacity Software, Version 7.8, based on HCM density methodologies. Similar to intersection LOS criteria, merge and diverge segment density is equated to a grade or LOS based on thresholds of driver acceptance. **Table 8** shows the density associated with each LOS grade for merge and diverge segments.

Table 8. Merge and Diverge Segment LOS Criteria

| Level of Service | Density (pc/mi/ln) |
|---|-------------------------|
| A | < 10 |
| B | > 10-20 |
| C | > 20-28 |
| D | > 28-35 |
| E | > 35 |
| F | Demand Exceeds Capacity |
| Highway Capacity Manual (HCM 6 th Edition) | |

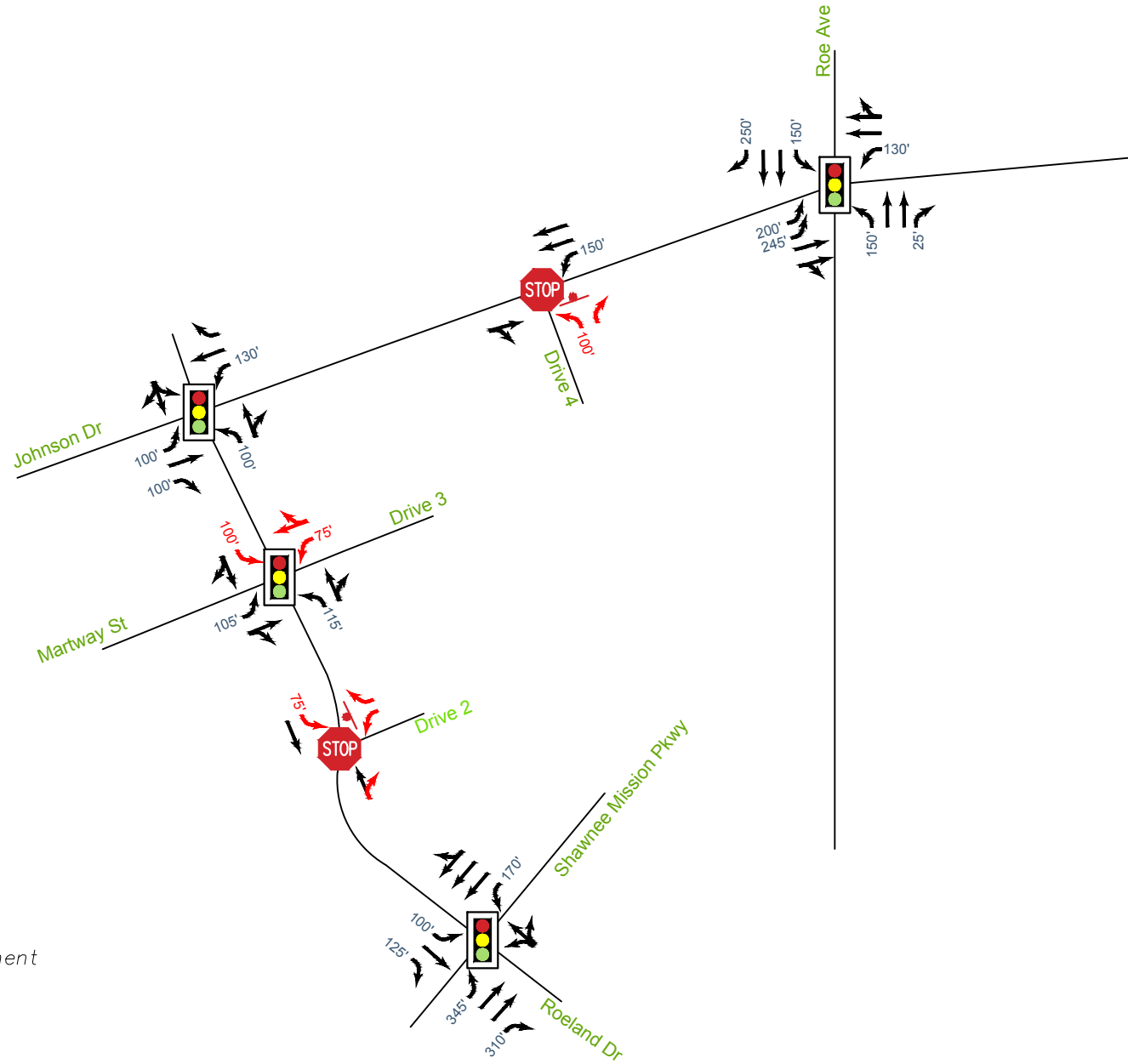
Results of the analysis indicate that the merge section is expected to operate acceptably at LOS B during both peak hour periods.

Existing lane configurations and traffic control for the study network are illustrated in **Figure 5**. The existing plus approved development conditions capacity analysis summary are illustrated in **Figure 6**. Detailed intersection and merge analysis results may be found in **Appendix C**.

FIGURE 5

Existing plus Approved Lane Configurations and Traffic Control

Gateway Development
Mission, KS



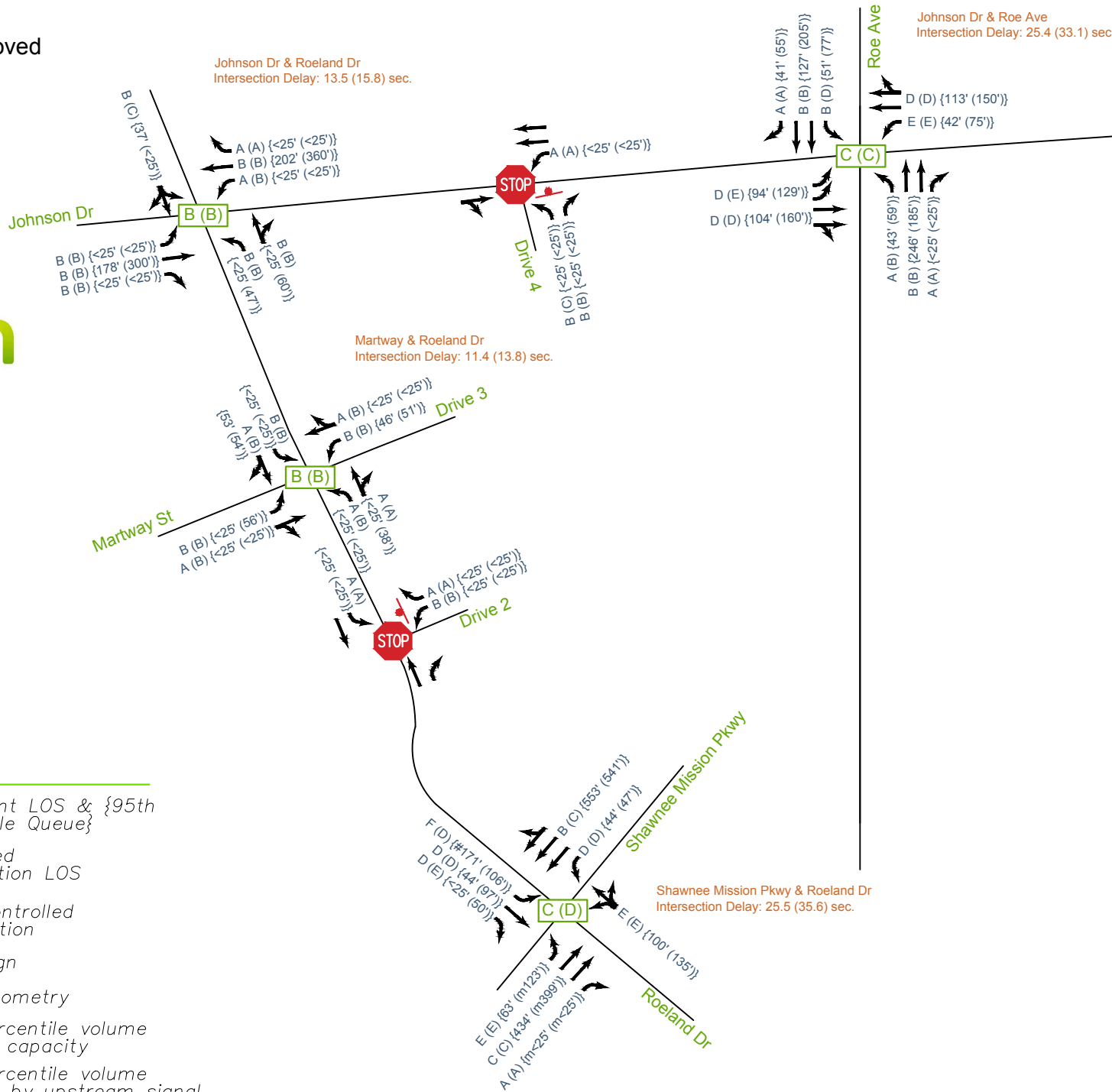
LEGEND

- xx' Lane Configuration & Storage Length
- xx' Approved Development Lane Configuration
- Signalized Intersection
- Stop Controlled Intersection
- Stop Sign

FIGURE 6

Existing plus Approved Level of Service

Gateway Development
Mission, KS



4. EXISTING PLUS APPROVED PLUS PROPOSED DEVELOPMENT CONDITIONS

Conditions with the remaining proposed development in place were evaluated to identify any potential geometric improvements that could be attributed to the additional traffic associated with the proposed development.

The proposed development site will consist of 38,750 square feet of high-turnover (sit-down) restaurant, 40,000 square feet of multipurpose recreational facility, an 18 lane bowling alley, a 10 screen movie theater, a 202 room hotel, and 75,000 square feet of general office building. The site is proposed in the northeast quadrant of the intersection of Shawnee Mission Parkway and Roeland Drive, south and east of the approved residential and retail development. The proposed site plan is illustrated in **Figure 7**.

4.1. Proposed Development Trip Generation and Distribution

Based on the *ITE Trip Generation Manual*, trip generation characteristics were developed for the proposed site using the methods described in **Section 3.3**. The land uses that most resembles the proposed development for this site are Land Use Code 310 (Hotel), Land Use Code 435 (Multipurpose Recreational Facility), Lane Use Code 437 (Bowling Alley), Land Use Code 445 (Movie Theatre), Land Use Code 710 (General Office Building) and Land Use Code 932 (High-Turnover Sit-Down Restaurant). Trip generation for the proposed site is shown in **Table 9**.

Table 9. Proposed Development Trip Generation.

| Land Use | Size | Average Weekday | AM Peak Hour | | | PM Peak Hour | | |
|--------------------------------------|------------|-----------------|--------------|------------|------------|--------------|------------|------------|
| | | | Total | Enter | Exit | Total | Enter | Exit |
| High-Turnover (Sit-Down) Restaurant | 38,750 SF | 4,347 | 386 | 213 | 173 | 379 | 235 | 144 |
| Multipurpose Recreational Facility * | 40,000 SF | 1,440 | - | - | - | 144 | 80 | 64 |
| Bowling Alley* | 18 lanes | 234 | 27 | 26 | 1 | 23 | 16 | 7 |
| Multiplex Movie Theater * | 10 screens | 1,380 | - | - | - | 138 | 71 | 67 |
| Hotel | 202 Rooms | 1,854 | 96 | 57 | 39 | 126 | 65 | 61 |
| General Office Building | 75,000 SF | 803 | 97 | 84 | 13 | 87 | 14 | 73 |
| Total Proposed Trips | | 10,058 | 606 | 380 | 226 | 897 | 481 | 416 |

* Daily ITE trip generation information was not provided. It was assumed that PM trips accounted for 10% of the daily trips.

Internal capture rates for the proposed development were calculated using methods described in **Section 3.3**. Reviewing the internal capture worksheet results, the internal capture percentage was determined to be 17% in the AM peak hour and 40% in the PM peak hour. Internal capture was updated to reflect the inclusion of approved development with proposed development internal capture calculations. Pass-by reduction was considered for the high-turnover sit-down restaurant portion of the proposed development. However, given the characteristics of the proposed restaurant space (integrated with the recreational facility) pass-by trips were not considered with proposed development. Pass-by only considers the retail portion of the approved development, as discussed in **Section 3.3**. Trip generation characteristics expected for the site are shown in **Table 10**. Detailed ITE trip generation information can be found in **Appendix C**.

Table 10. Approved Plus Proposed Development Trip Generation.

| Land Use | Size | Average Weekday | AM Peak Hour | | | PM Peak Hour | | |
|--|------------|-----------------|--------------|------------|------------|--------------|------------|------------|
| | | | Total | Enter | Exit | Total | Enter | Exit |
| Apartment* | 168 DU | 1,230 | 79 | 19 | 60 | 94 | 60 | 34 |
| Shopping Center* | 54,594 SF | 3,984 | 180 | 112 | 68 | 348 | 168 | 180 |
| High-Turnover Sit-Down Restaurant | 38,750 SF | 4,347 | 386 | 213 | 173 | 379 | 235 | 144 |
| Multipurpose Recreational Facility | 40,000 SF | 1,440 | - | - | - | 144 | 80 | 64 |
| Bowling Alley | 18 lanes | 234 | 27 | 26 | 1 | 23 | 16 | 7 |
| Multiplex Movie Theater | 10 screens | 1,380 | - | - | - | 138 | 71 | 67 |
| Hotel | 202 Rooms | 1,854 | 96 | 57 | 39 | 126 | 65 | 61 |
| General Office Building | 75,000 SF | 803 | 97 | 84 | 13 | 87 | 14 | 73 |
| Total Approved plus Proposed Trips | | 15,272 | 865 | 511 | 354 | 1339 | 709 | 630 |
| Total with Internal Trip Capture (AM 17%/PM 40%) | | | 718 | 424 | 294 | 804 | 425 | 378 |
| 34% Pass-by (Approved Shopping Center) | | | - | - | - | 98 | 47 | 51 |
| Total External, Non-Pass-by Trips | | | 718 | 424 | 294 | 705 | 378 | 327 |

*Trips were analyzed in existing plus approved scenario.

Trips were distributed through the network using the same trip distribution as developed for approved development as discussed in **Section 3.3**. The expected trip distribution for the approved and proposed development is shown in **Figure 8**. The resulting existing plus approved plus proposed development volumes are illustrated in **Figure 9**.

4.2. Access Characteristics

In addition to the drives constructed for the approved development, four additional access points are planned to serve the proposed development, as illustrated in the site plan (**Figure 7**). Drive 1 is proposed to be located 350' north of the intersection of Shawnee Mission Parkway and Roeland Drive. This access point will be the east leg of the unsignalized intersection of 60th Terrace and Roeland Drive. Drive 1 utilizes an existing curb cut at the intersection of Roeland Drive and 60th Terrace.

Two access points will be located along Roe Avenue, approximately 225' (Drive 5) and 550' (Drive 6) south of the intersection of Roe Avenue and Johnson Drive. Drive 6 corresponds with the location of an existing curb cut along Roe Avenue. All drives are proposed to provide two lanes, one lane each for egress and ingress traffic.

A raised median is currently provided along Roe Avenue south of Johnson Drive. Due to the presence of the median, access will be limited at Drives 5 and 6 to right-in/right-out movements only. It is recommended to extend the current median along the south leg of Roe Avenue and Johnson Drive south to the median under the Shawnee Mission Parkway overpass to ensure limitation of left-turn access at Drives 5 and 6 along Roe Avenue.

Minimum throat distance of 75' should be provided at each proposed drive to allow for vehicles to stack internal the site without effecting vehicles maneuvering within the site.

Access Spacing: Access spacing recommendations outlined in KDOT's AMP were reviewed to determine if the drives associated with the proposed development meet access spacing recommendations. Although Roe Avenue and Roeland Drive are not KDOT routes, access spacing requirements using KDOT policy were referenced. Roe Avenue was considered a Class C route, Roeland Drive was considered a Class D route.

According to the policy, access points along Class C and D routes in developed areas should be spaced 120' along roadways with a speed limit of 25 mph (Roeland Drive), and 200' along roadways with a speed limit of 35 mph (Roe Avenue).

Along Roeland Drive, Drive 1 meets minimum spacing guidance including acceptable spacing from the intersection of Shawnee Mission Parkway and Roeland Drive. The minimum upstream functional length for the intersection of Shawnee Mission Parkway and Roeland Drive was calculated to be 359'; the distance from Drive 1 to the stop bar of the southbound approach at Shawnee Mission Parkway and Roeland Drive is 360'. Corner clearance recommendations found in *Table 4-10* of the AMP requires 115' of spacing from the edge of the curb line of Shawnee Mission Parkway to the edge of curb line of Drive 1. The location of Drive 1 exceeds recommended corner clearance. Detailed calculations can be found in **Appendix C**. In addition to reviewing intersection spacing, alignment with existing drives was reviewed. Drive 1 is proposed to align with an existing intersection which is a preferred condition.

Along Roe Avenue, Drive 5 meets minimum spacing guidance. Drive 6 meets minimum spacing guidance from Drive 5. The access spacing between Drives 5 and 6 is 315' which is more than the recommended 200'.

Truck Movements: Considering the density of the development, truck and emergency access to and through the site should be considered when developing the site plan. It is indicated on the current site plan that Drive 5 may service large trucks (deliveries and trash disposal). It is

recommended that the parking lot that is served by Drive 5 be modified to accept truck traffic. This includes providing proper corner radii at driveways to accept truck traffic and space to maneuver within the site.

A 100' right-turn lane should be provided for the southbound movement at Drive 5 to accommodate anticipated truck traffic and to prevent truck traffic from impeding through traffic along Roe Avenue. Capacity analysis will be reviewed to determine if provided throat length at proposed drives is adequate to accommodate the expected vehicular traffic at each proposed access location.

FIGURE 7

Site Plan

Gateway Development
Mission, KS



olsson

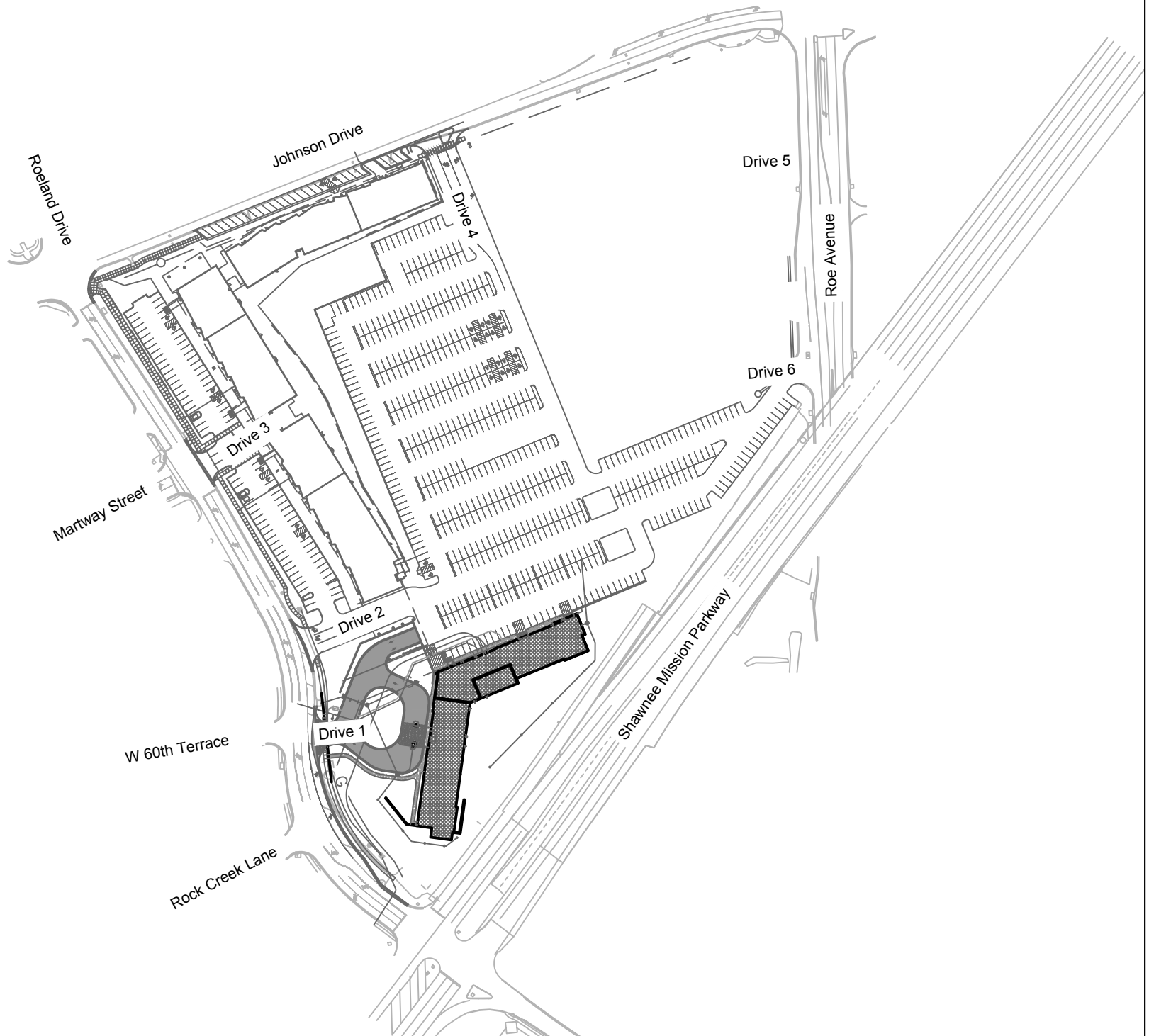


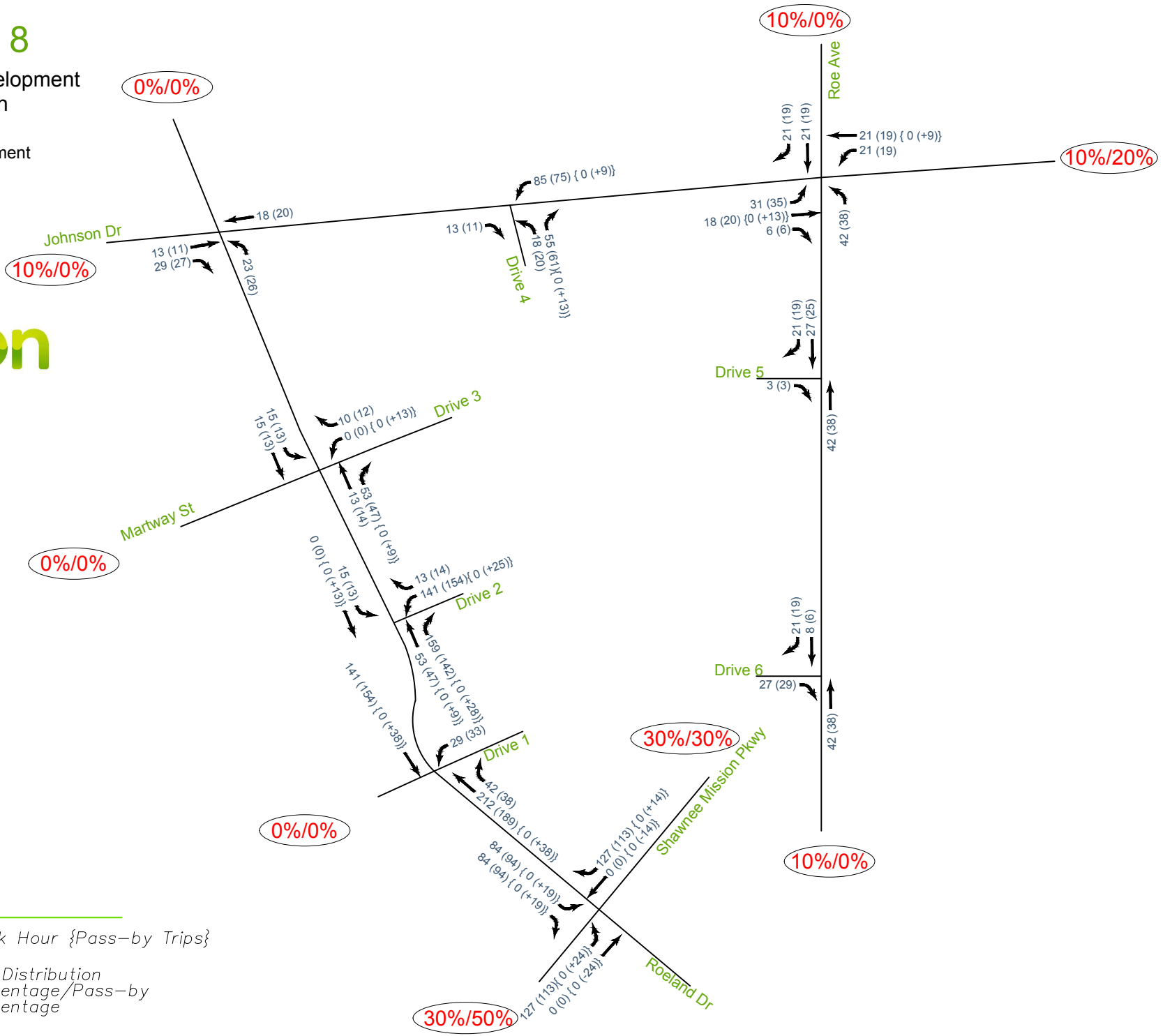
FIGURE 8

Proposed Development Trip Distribution

Gateway Development
Mission, KS



olsson



LEGEND

AM (PM) {AM (PM)} Peak Hour {Pass-by Trips}

X%/X% Trip Distribution
Percentage/Pass-by
Percentage

FIGURE 9

Existing plus Approved plus Development Peak Hour Volumes

Gateway Development
Mission, KS



LEGEND

AM (PM) Peak Hour Volume

4.3. Existing Plus Approved Plus Proposed Development Warrant Analysis

Existing plus Approved plus Proposed Development Turn Lane Warrants: The KDOT AMP *Table 4-26* was used to determine whether an auxiliary right-turn lane is warranted at each study intersection. According to the table, a westbound right-turn lane is warranted at Shawnee Mission Parkway and Roeland Drive. Currently, a third through lane is added at the intersection. This through lane begins approximately 250' to the northeast of the intersection and is part of a ramp that previously provided access from Roe Avenue to Shawnee Mission Parkway. The ramp has been removed and is not operational, however the portion of the lane that merged with Shawnee Mission Parkway remains. Due to the configuration of the additional lane as it approaches the intersection (as a merge lane from the removed ramp), the lane is underutilized by through traffic in its current state and operates primarily as a right-turn lane. It is recommended to provide an appropriate taper along Shawnee Mission Parkway by restriping the existing pavement markings. The turn lane, including taper, should have a total length of 350' to accommodate right-turn vehicles decelerating from 45 mph.

Table 4-26 relates right-turn lane requirements to roadway speed; roadways with speed limits less than 35 mph will not require a right-turn lane. Thus, the remaining study intersections do not warrant a right-turn lane due to the posted speed along the roadways.

Table 4-27 and *Table 4-28* of KDOT's AMP was used to determine whether an auxiliary left-turn lane is warranted at each study intersection. According to the tables, no additional left-turn lanes are warranted under existing plus approved plus proposed development conditions.

Existing lane configurations and traffic control for the study network are illustrated in **Figure 10**. Turn lane warrant analysis sheets can be found in **Appendix C**.

4.4. Existing Plus Approved Plus Proposed Development Capacity Analysis

Capacity analysis was performed for existing plus approved plus proposed development conditions using the methodologies described in **Section 3.5**. Existing timings were not modified; however, it is recommended to retime the signals at the intersections of Roe Avenue with Johnson Drive and Shawnee Mission Parkway and Roeland Drive to accommodate the proposed development traffic. Timing updates are expected to increase the operations of the intersection of Shawnee Mission Parkway and Roeland Drive. Capacity analysis will be illustrated in the figures for any improvements recommend in this section. Peak hour factors observed under existing conditions were changed to represent an increase in traffic.

Results of the analysis indicate that the signalized study intersections are expected to operate at similar levels of service to the existing plus approved development conditions with the following exceptions:

Johnson Drive and Roe Avenue

- During both peak hour periods
 - The westbound left-turn movement is expected to operate at LOS E. 95th-percentile queue lengths are expected to be contained with the available storage length and are not expected to encroach on the adjacent intersection.
- PM peak hour period
 - The eastbound left-turn movement is expected to operate at LOS E. 95th-percentile queue lengths are expected to be contained with the available storage length and are not expected to encroach on the adjacent intersection.

Shawnee Mission Parkway and Roeland Drive

- AM peak hour period
 - Overall operations are expected to be LOS D which is a decrease from the existing plus approved phase (LOS C).
 - Eastbound left, southbound left, and southbound right-turn movements are expected to operate at LOS F. Side street and turning movements at the intersection may operate at a lower level of service due to signal timings accommodating higher volume through traffic along Shawnee Mission Parkway.
 - The southbound right-turn movement 95th-percentile queue length is expected to be less than two vehicle length.
 - The eastbound left-turn movement 95th-percentile queue length is expected to be contained within the available storage length and is metered by the upstream signal at Shawnee Mission Parkway and Nall Avenue. However, the turn bay length does not meet current KDOT standards. To meet KDOT standard, it is recommended to extend the existing turn lane by 60' from 330' to 390' to meet the required KDOT turn lane length.
 - It is recommended to increase capacity of the southbound left-turn movement. It is anticipated that queue lengths will extend past the existing intersection of Roeland Drive and Rock Creek Lane during portions of the AM peak hour period. Due to the existing proximity to the unsignalized intersection of Roeland Drive and Rock Creek Lane, it is not feasible to extend the existing single left-turn lane to provide additional storage. Dual southbound left-turn lanes should be provided at the

intersection of Shawnee Mission Parkway and Roeland Drive to accommodate the southbound left-turn movement. The intersection is currently operating under split phasing for the north and southbound movements, thus additional capacity can be added for the left-turn movement by re-striping the southbound through lane to a through/left-turn lane.

- The curb radius of the northeast quadrant of the intersection should be modified to support large trucks . Curb radii should match the recommend 25'-45' radius for curb and gutter sections found in Table 4-16 of KDOT's AMP.
- PM peak hour period
 - The eastbound right-turn and eastbound/southbound left-turn movements are expected to operate at LOS F. As stated for the AM peak hour period, lower level of service may occur for side street or turning movements at the intersection as high volume through traffic along Shawnee Mission Parkway is accommodated.

All movements at the unsignalized intersections are expected to operate at LOS C or better during both peak hour periods, similar to existing plus approved development conditions.

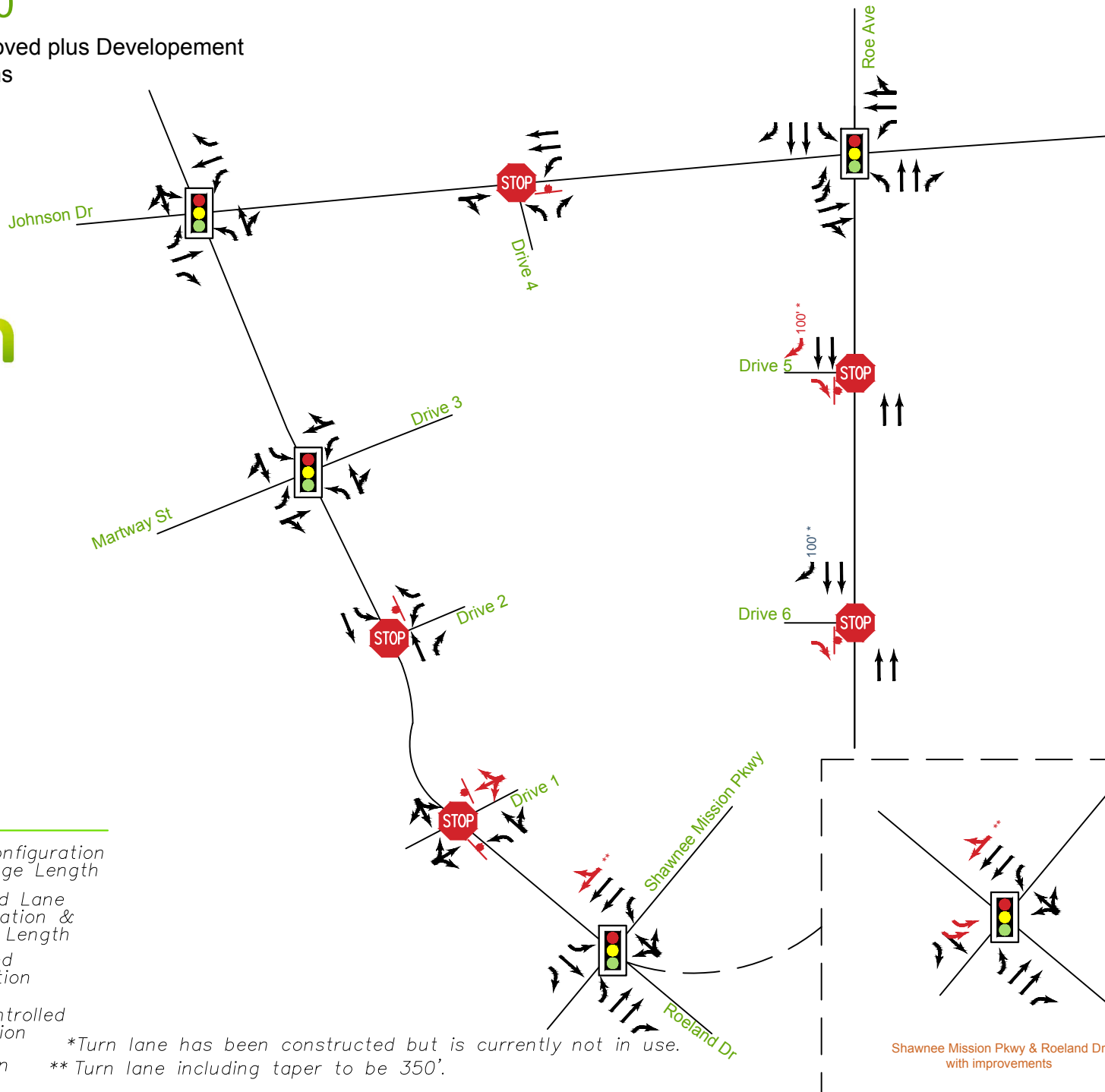
Merge analysis was performed for the Johnson Drive to Shawnee Mission Parkway ramp using the methodologies described in **Section 3.5**. Results of the analysis indicate that the merge section is expected to operate acceptably at LOS B during both peak hour periods.

The existing plus approved plus proposed development conditions capacity analysis summary are illustrated in **Figure 11**. Detailed intersection and merge analysis results may be found in **Appendix D**.

FIGURE 10

Existing plus Approved plus Development Lane Configurations and Traffic Control

Gateway Development
Mission, KS



LEGEND

- Lane Configuration & Storage Length
- Proposed Lane Configuration & Storage Length
- Signalized Intersection
- Stop Controlled Intersection
- Stop Sign

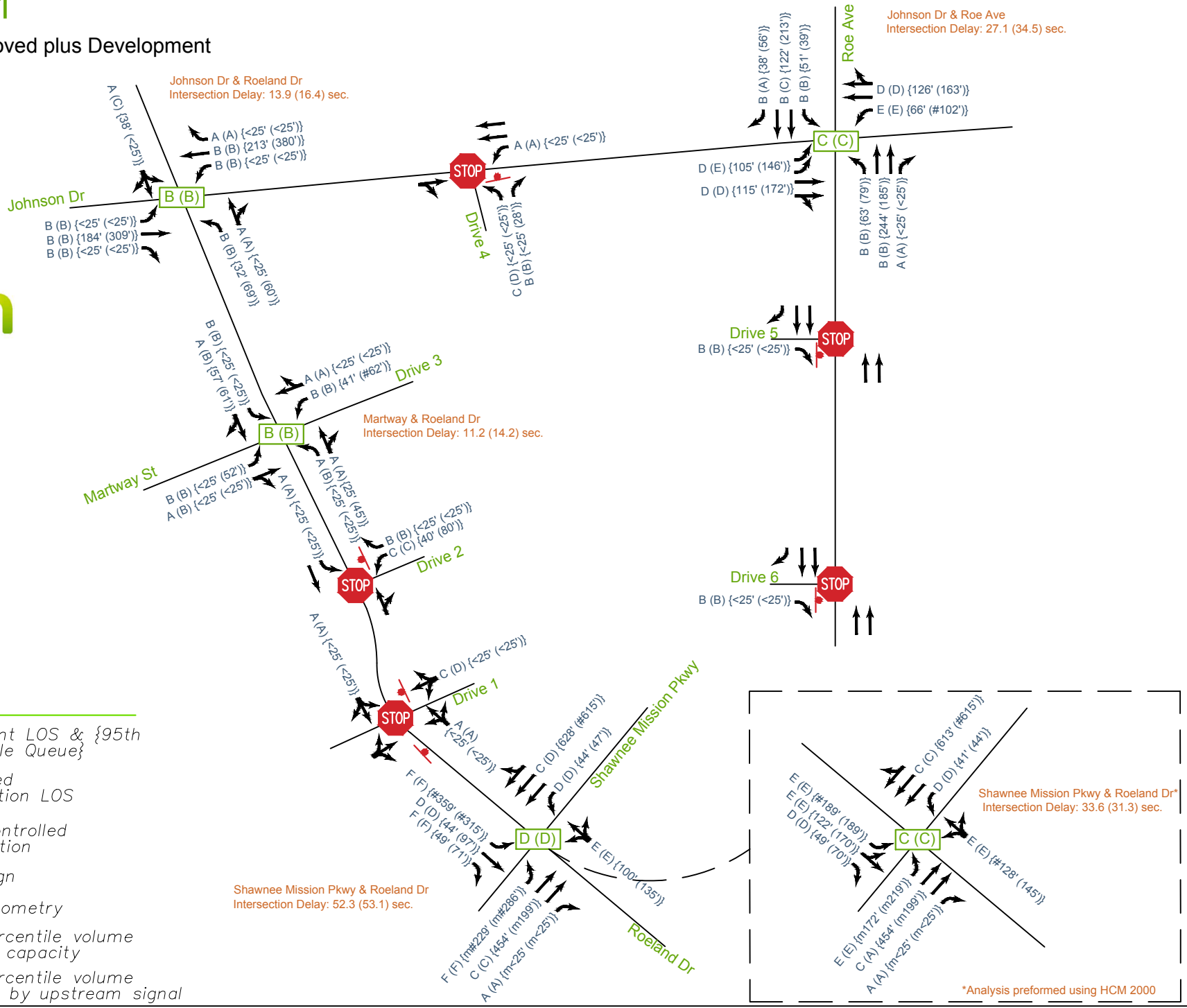
*Turn lane has been constructed but is currently not in use.
** Turn lane including taper to be 350'.

Shawnee Mission Pkwy & Roeland Dr
with improvements

FIGURE 11

Existing plus Approved plus Development Level of Service

Gateway Development
Mission, KS



LEGEND

AM (PM) {AM (PM)} Movement LOS & {95th Percentile Queue}

AM (PM) Signalized Intersection LOS

STOP Stop Controlled Intersection

Stop Sign

Lane Geometry

95th percentile volume exceeds capacity

m 95th percentile volume metered by upstream signal

*Analysis performed using HCM 2000

5. FUTURE YEAR 2038 CONDITIONS

The future year 2038 condition considers approved and proposed development volumes plus growth of background traffic volumes. Based on a review of historical traffic count data provided from 2011-2016 by KDOT along Shawnee Mission Parkway, a 3% annual growth rate was used for traffic volumes along public roadways. Growth rate used in the previous 2017 study was 0.5% based on data provided by KDOT at the time (2010-2014). Since this time data has been provided for 2015 and 2016 which resulted in an increase of the annual growth rate. The calculated growth rate was applied to existing volumes for the through movements at the study intersections of Shawnee Mission Parkway with Roeland Drive and Roe Avenue with Johnson Drive to obtain future year background volumes. Volumes were subsequently adjusted through adjacent study intersections. Background traffic growth volumes were added to existing plus approved plus development volumes to obtain future year 2038 traffic volumes.

Figure 12 illustrates the future year 2038 volumes. Additional information for the calculation of background traffic are provided in **Appendix E**.

5.1. Future Year 2038 Warrant Analysis

Turn Lane Warrants: It was determined that no additional turn lanes are warranted considering future year 2038 volumes.

Future year 2038 lane configuration and traffic control for the study network are illustrated in **Figure 13**. Turn lane warrant analysis sheets can be found in **Appendix E**.

5.2. Future Year 2038 Capacity Analysis

Capacity analysis was performed for future conditions using the methodologies described in **Section 3.3**. Split times were updated to account for an increase in background traffic while cycle lengths remained unchanged. Improved operations may be achieved by reviewing signal coordination along the Shawnee Mission Parkway and Roe Avenue corridors. All signalized individual movements are expected to operate with a similar LOS as existing plus approved plus proposed development conditions with the following exceptions:

Johnson Drive and Roe Avenue

- AM peak hour period
 - The westbound through/right-turn and left-turn movements are expected to operate at LOS E. 95th-percentile queue lengths are expected to be contained with the available storage length and are not expected to encroach on the adjacent intersection.
- PM peak hour period

- The eastbound left-turn movement is expected to operate at LOS E. 95th-percentile queue lengths are expected to be contained with the available storage length and are not expected to encroach on the adjacent intersection.

Shawnee Mission Parkway and Roeland Drive

- Overall operations at the intersection are expected to decrease to LOS F with numerous individual movements expected to operate at LOS F. Poor operations are attributed to the high volume of traffic served by the intersection (lack of capacity) and the signal operating split phased for the north and south movements.
 - If future traffic volumes materialize, it is recommended to consider the following improvements to improve operations:
 - Provide dual eastbound left turn lanes with 350' of storage.
 - Provide dedicated northbound left-turn lane with 100' of storage.
 - Provide dedicated westbound right-turn lane with 230' of storage.
 - Update signal timings.

All movements at the unsignalized intersections are expected to operate at LOS C or better during both peak hour periods, similar to existing plus approved plus proposed development conditions.

Merge analysis was performed for the Johnson Drive to Shawnee Mission Parkway ramp using the methodologies described in **Section 3.5**. Results of the analysis indicate that the merge section is expected to operate acceptably at LOS C and D during the AM and PM peak hours, respectively.

Future operations are based on an increase in background traffic growth based on historical traffic volumes. These volumes may materialize differently due to changes in development or modifications to the roadway network. Operations of study intersections should be monitored to determine if volumes materialize and roadway improvements made based on actual conditions. Poor operations indicated during the future scenario can be attributed to background traffic growth and is not specifically attributed to trips associated with the proposed development.

The future year conditions capacity analysis summary is illustrated in **Figure 14**. Detailed intersection and merge analysis results may be found in **Appendix E**.

FIGURE 12

Future 2038
Peak Hour Volumes

Gateway Development
Mission, KS



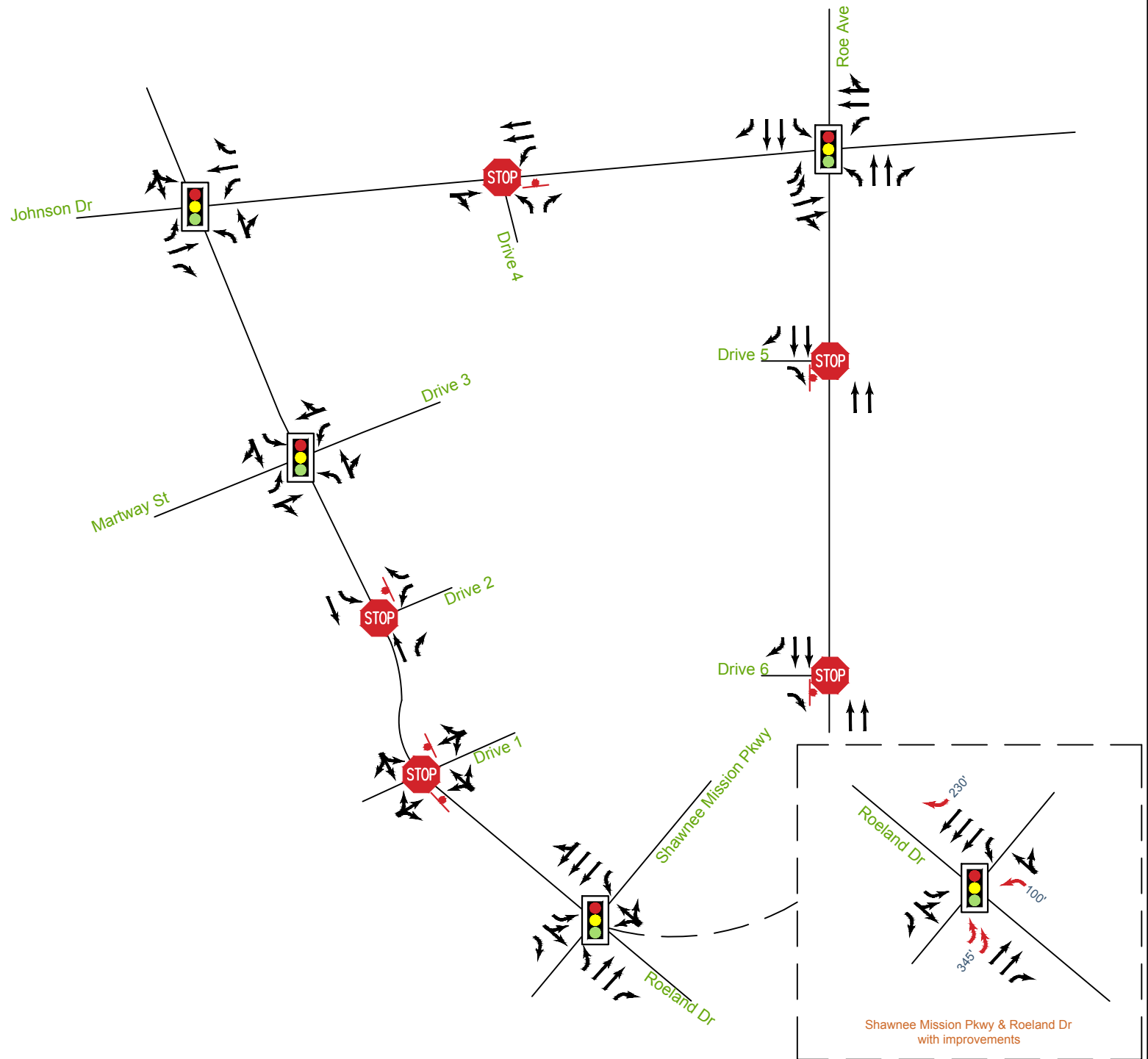
LEGEND

AM (PM) Peak Hour Volume

FIGURE 13

Future 2038 Lane Configurations and Traffic Control

Gateway Development
Mission, KS



LEGEND






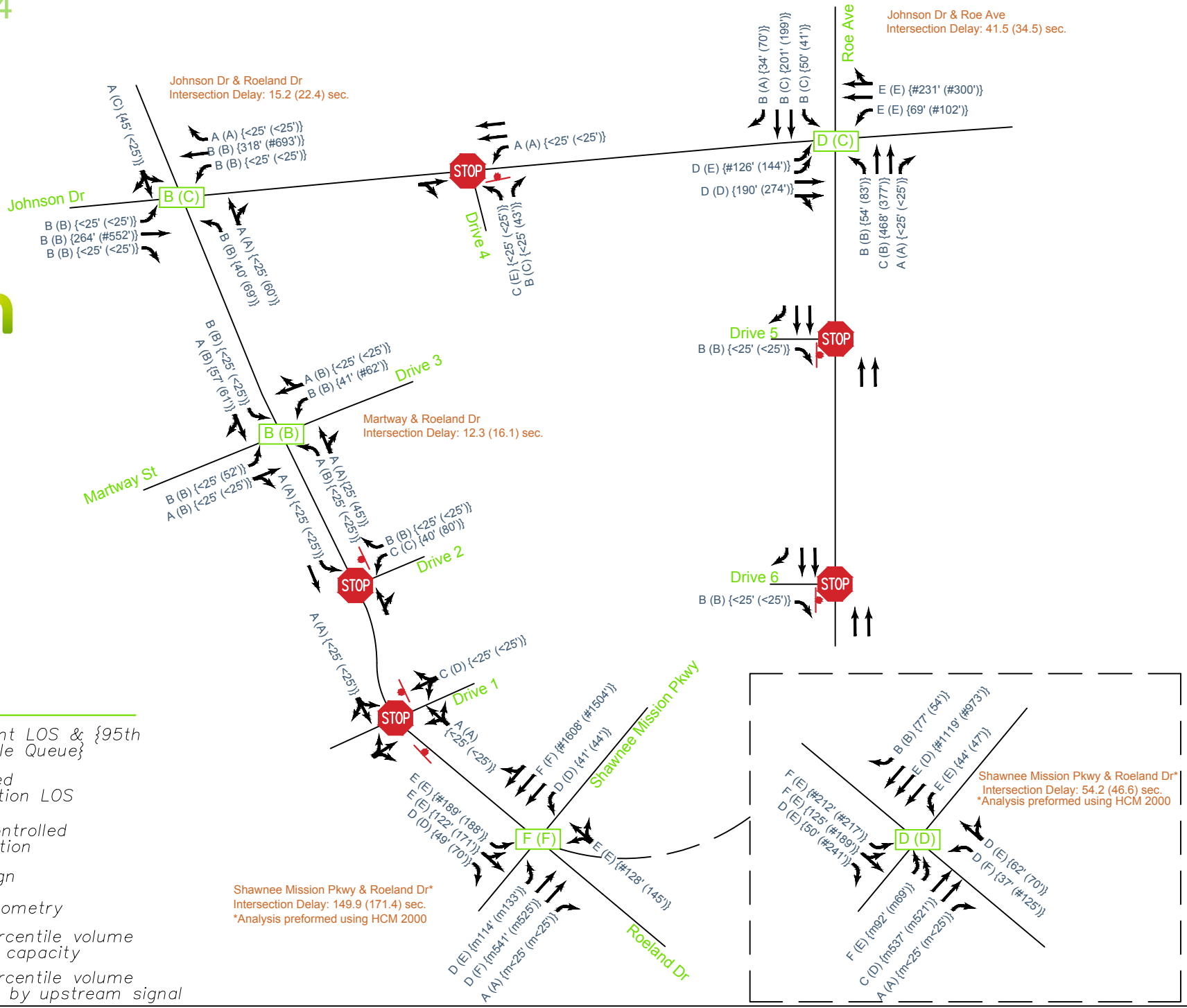
-  Lane Configuration & Storage Length
-  Proposed Lane Configuration & Storage Length
-  Signalized Intersection
-  Stop Controlled Intersection
-  Stop Sign

FIGURE 14

Future 2038
Level of Service

Gateway Development
Mission, KS



LEGEND

AM (PM) {AM (PM)} Movement LOS & {95th Percentile Queue}

AM (PM) Signalized Intersection LOS

Stop Controlled Intersection

Stop Sign

Lane Geometry

95th percentile volume exceeds capacity

m 95th percentile volume metered by upstream signal

6. SUMMARY

This report summarizes analysis conducted considering approved and proposed development located in the northeast quadrant of the intersection of Shawnee Mission Parkway and Roeland Drive in Mission, Kansas.

6.1. Conclusions

The general findings to note for the traffic impact study include the following:

1. Reviewing existing plus approved development conditions, study intersections are expected to operate at acceptable levels of service.
2. Based on the 2017 study the signal at Roeland Drive and Martway Street does not warrant a signal under Warrant 3 criteria. It was recommended in the previous study to keep the signal in place to provide pedestrian accommodations for the Rock Creek Trail. The intersection was analyzed as signalized because signal will be operational after the construction of the approved development.
3. After development of the site, traffic operations at the study intersections are not expected to be significantly impacted.
4. The site should be designed to accommodate truck traffic at Drives 5 and 6. This includes providing adequate corner radii at Drives 5, 6, and the northbound leg of Shawnee Mission Parkway and Roeland Drive. A southbound 100' right turn lane should also be provided at Drive 5. The parking lot that is currently shown on the site plan should be designed to allow truck traffic the ability to maneuver within the site.
5. Future year 2038 analysis indicates that the study intersections are expected to operate with longer queue lengths and delays. These volumes may materialize differently due to changes in development or modifications to the roadway network. Operations of study intersections should be monitored to determine if volumes materialize and roadway improvements are made based on actual conditions. Poor operations indicated during the future scenario can be attributed to background traffic growth and is not specifically attributed to trips associated with the proposed development.

6.2. Recommendations

Based on review and analysis of the approved and proposed development, the following improvements are recommended in addition to the approved improvements associated with the residential and retail development:

Existing plus Approved Conditions

- No additional improvements are recommended in addition to the approved improvements.

Existing plus Approved plus Proposed Development Conditions

- Increase the eastbound left-turn lane at Shawnee Mission Parkway and Roeland Drive by 60' from 330' to 390' to meet KDOT required turn lane length.
- Re-time signals at the intersections of Shawnee Mission Parkway with Roeland Drive and Roe Avenue with Johnson Drive to accommodate development trips.
- Re-stripe the north leg of the intersection of Shawnee Mission Parkway and Roeland Drive to provide a dedicated southbound left-turn lane, shared through/left-turn lane, and dedicated southbound right-turn lane.
- Modify the curb radius in the northeast quadrant of the intersection of Shawnee Mission Parkway and Roeland Drive to support large trucks. Plans are currently being completed by the design team, thus exact curb radius and anticipated design vehicle information is not available at this time. Intersection design should meet requirements of the maintaining agency (City or State).
- The existing pavement markings for the outside through lane along Shawnee Mission Parkway at Roeland Drive should be restriped to provide an appropriate taper for the existing outside westbound lane. Turn lane including taper should be 350' in length to accommodate right-turn vehicles decelerating from 45 mph.
- Extend the median along Roe Avenue to limit right-in/right-out access at Drives 5 and 6.
- Provide appropriate corner radii at Drives 5 and 6 to accommodate truck traffic.
- Provide a 100' southbound right-turn lane at Drive 5 along Roe Avenue.
- Minimum throat distance of 75' should be provided at each proposed drive to allow for vehicles to stack internal the site without effecting vehicles maneuvering within the site.
- Pedestrian accommodations should be provided along the north and west legs at the intersection of Shawnee Mission Parkway and Roeland Drive. Accommodations should conform with ADA standards, this includes adequate ramp design with detectable warnings and vibrotactile push buttons.

Future Year 2038 Conditions

- If volumes materialize in the future, it is recommended to consider the following improvements to improve operations at the intersection of Shawnee Mission Parkway and Roeland Drive:
 - Provide dual eastbound left turn lanes with 350' of storage.
 - Provide dedicated northbound left-turn lane with 100' of storage.
 - Provide dedicated westbound right-turn lane with 230' of storage.
 - Update signal timings.

APPENDIX A
Data Collection

Count Data

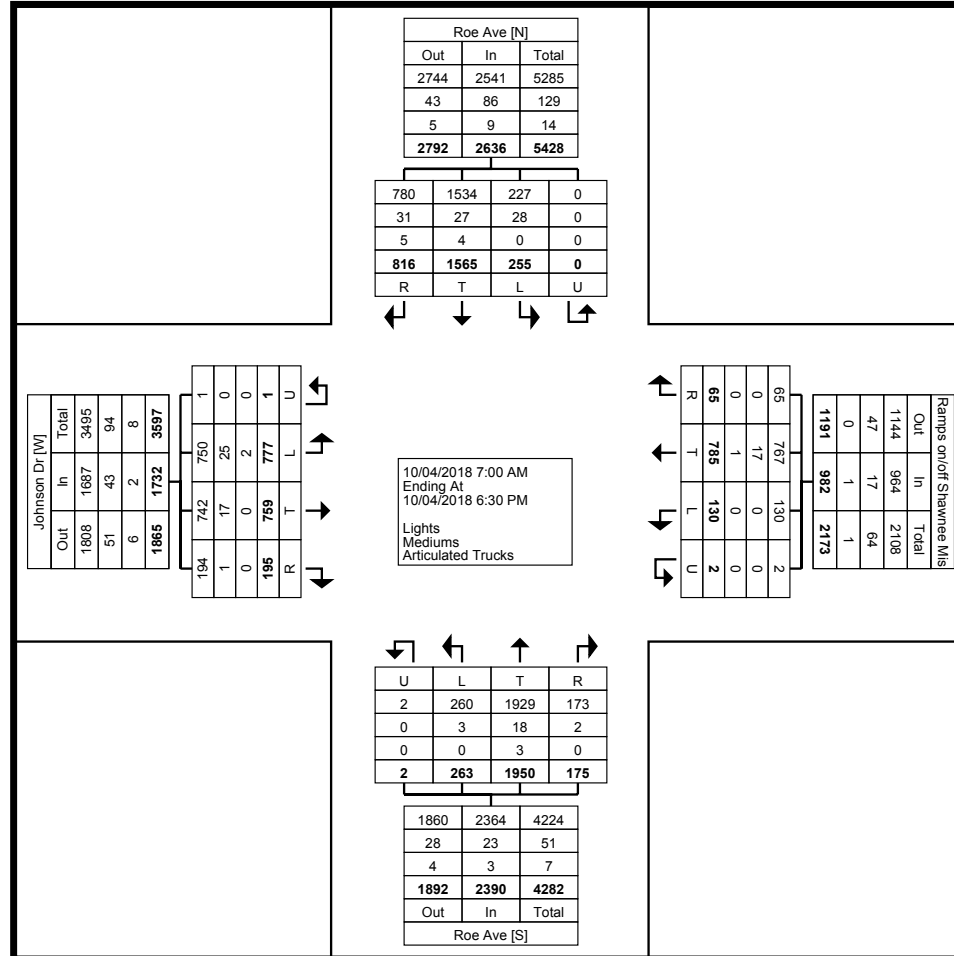
Olsson Associates : Overland Park
7301 West 133rd St

Overland Park, Kansas, United States 66213
913.381.1170 tmchenry@olssonassociates.com

Count Name: Johnson Dr & Roe Ave
Site Code:
Start Date: 10/04/2018
Page No: 1

Turning Movement Data

| Start Time | Roe Ave Southbound | | | | | Ramps on/off Shawnee Mission Pkwy Westbound | | | | | Roe Ave Northbound | | | | | Johnson Dr Eastbound | | | | | Int. Total |
|----------------------|--------------------|------|------|--------|------------|---|------|-------|--------|------------|--------------------|------|------|--------|------------|----------------------|------|------|--------|------------|------------|
| | Right | Thru | Left | U-Turn | App. Total | Right | Thru | Left | U-Turn | App. Total | Right | Thru | Left | U-Turn | App. Total | Right | Thru | Left | U-Turn | App. Total | |
| 7:00 AM | 26 | 51 | 11 | 0 | 88 | 1 | 38 | 2 | 0 | 41 | 8 | 81 | 10 | 0 | 99 | 1 | 27 | 19 | 0 | 47 | 275 |
| 7:15 AM | 32 | 67 | 25 | 0 | 124 | 0 | 24 | 3 | 0 | 27 | 7 | 95 | 11 | 0 | 113 | 7 | 28 | 36 | 0 | 71 | 335 |
| 7:30 AM | 45 | 96 | 17 | 0 | 158 | 1 | 39 | 7 | 0 | 47 | 17 | 159 | 7 | 0 | 183 | 7 | 38 | 45 | 0 | 90 | 478 |
| 7:45 AM | 34 | 96 | 24 | 0 | 154 | 1 | 47 | 6 | 0 | 54 | 16 | 174 | 23 | 0 | 213 | 3 | 45 | 44 | 0 | 92 | 513 |
| Hourly Total | 137 | 310 | 77 | 0 | 524 | 3 | 148 | 18 | 0 | 169 | 48 | 509 | 51 | 0 | 608 | 18 | 138 | 144 | 0 | 300 | 1601 |
| 8:00 AM | 41 | 89 | 20 | 0 | 150 | 7 | 53 | 5 | 0 | 65 | 2 | 192 | 13 | 0 | 207 | 9 | 41 | 47 | 0 | 97 | 519 |
| 8:15 AM | 37 | 79 | 22 | 0 | 138 | 0 | 47 | 6 | 0 | 53 | 18 | 133 | 16 | 0 | 167 | 4 | 50 | 27 | 0 | 81 | 439 |
| 8:30 AM | 36 | 71 | 21 | 0 | 128 | 0 | 37 | 7 | 0 | 44 | 9 | 122 | 12 | 0 | 143 | 4 | 40 | 46 | 0 | 90 | 405 |
| 8:45 AM | 36 | 79 | 17 | 0 | 132 | 4 | 32 | 9 | 0 | 45 | 11 | 111 | 14 | 0 | 136 | 5 | 33 | 47 | 0 | 85 | 398 |
| Hourly Total | 150 | 318 | 80 | 0 | 548 | 11 | 169 | 27 | 0 | 207 | 40 | 558 | 55 | 0 | 653 | 22 | 164 | 167 | 0 | 353 | 1761 |
| *** BREAK *** | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 4:30 PM | 76 | 111 | 10 | 0 | 197 | 5 | 60 | 12 | 0 | 77 | 10 | 87 | 15 | 0 | 112 | 25 | 59 | 51 | 0 | 135 | 521 |
| 4:45 PM | 64 | 116 | 13 | 0 | 193 | 10 | 75 | 6 | 0 | 91 | 8 | 88 | 21 | 1 | 118 | 18 | 46 | 60 | 0 | 124 | 526 |
| Hourly Total | 140 | 227 | 23 | 0 | 390 | 15 | 135 | 18 | 0 | 168 | 18 | 175 | 36 | 1 | 230 | 43 | 105 | 111 | 0 | 259 | 1047 |
| 5:00 PM | 81 | 105 | 11 | 0 | 197 | 5 | 74 | 12 | 0 | 91 | 8 | 105 | 27 | 1 | 141 | 23 | 69 | 82 | 0 | 174 | 603 |
| 5:15 PM | 74 | 156 | 14 | 0 | 244 | 10 | 58 | 14 | 0 | 82 | 13 | 146 | 18 | 0 | 177 | 25 | 72 | 70 | 0 | 167 | 670 |
| 5:30 PM | 53 | 140 | 20 | 0 | 213 | 7 | 62 | 17 | 2 | 88 | 18 | 137 | 18 | 0 | 173 | 15 | 55 | 45 | 0 | 115 | 589 |
| 5:45 PM | 78 | 123 | 13 | 0 | 214 | 3 | 62 | 9 | 0 | 74 | 13 | 110 | 18 | 0 | 141 | 17 | 68 | 51 | 1 | 137 | 566 |
| Hourly Total | 286 | 524 | 58 | 0 | 868 | 25 | 256 | 52 | 2 | 335 | 52 | 498 | 81 | 1 | 632 | 80 | 264 | 248 | 1 | 593 | 2428 |
| 6:00 PM | 52 | 96 | 7 | 0 | 155 | 3 | 40 | 9 | 0 | 52 | 8 | 119 | 21 | 0 | 148 | 16 | 40 | 64 | 0 | 120 | 475 |
| 6:15 PM | 51 | 90 | 10 | 0 | 151 | 8 | 37 | 6 | 0 | 51 | 9 | 91 | 19 | 0 | 119 | 16 | 48 | 43 | 0 | 107 | 428 |
| Grand Total | 816 | 1565 | 255 | 0 | 2636 | 65 | 785 | 130 | 2 | 982 | 175 | 1950 | 263 | 2 | 2390 | 195 | 759 | 777 | 1 | 1732 | 7740 |
| Approach % | 31.0 | 59.4 | 9.7 | 0.0 | - | 6.6 | 79.9 | 13.2 | 0.2 | - | 7.3 | 81.6 | 11.0 | 0.1 | - | 11.3 | 43.8 | 44.9 | 0.1 | - | - |
| Total % | 10.5 | 20.2 | 3.3 | 0.0 | 34.1 | 0.8 | 10.1 | 1.7 | 0.0 | 12.7 | 2.3 | 25.2 | 3.4 | 0.0 | 30.9 | 2.5 | 9.8 | 10.0 | 0.0 | 22.4 | - |
| Lights | 780 | 1534 | 227 | 0 | 2541 | 65 | 767 | 130 | 2 | 964 | 173 | 1929 | 260 | 2 | 2364 | 194 | 742 | 750 | 1 | 1687 | 7556 |
| % Lights | 95.6 | 98.0 | 89.0 | - | 96.4 | 100.0 | 97.7 | 100.0 | 100.0 | 98.2 | 98.9 | 98.9 | 98.9 | 100.0 | 98.9 | 99.5 | 97.8 | 96.5 | 100.0 | 97.4 | 97.6 |
| Mediums | 31 | 27 | 28 | 0 | 86 | 0 | 17 | 0 | 0 | 17 | 2 | 18 | 3 | 0 | 23 | 1 | 17 | 25 | 0 | 43 | 169 |
| % Mediums | 3.8 | 1.7 | 11.0 | - | 3.3 | 0.0 | 2.2 | 0.0 | 0.0 | 1.7 | 1.1 | 0.9 | 1.1 | 0.0 | 1.0 | 0.5 | 2.2 | 3.2 | 0.0 | 2.5 | 2.2 |
| Articulated Trucks | 5 | 4 | 0 | 0 | 9 | 0 | 1 | 0 | 0 | 1 | 0 | 3 | 0 | 0 | 3 | 0 | 0 | 2 | 0 | 2 | 15 |
| % Articulated Trucks | 0.6 | 0.3 | 0.0 | - | 0.3 | 0.0 | 0.1 | 0.0 | 0.0 | 0.1 | 0.0 | 0.2 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.3 | 0.0 | 0.1 | 0.2 |



Turning Movement Data Plot

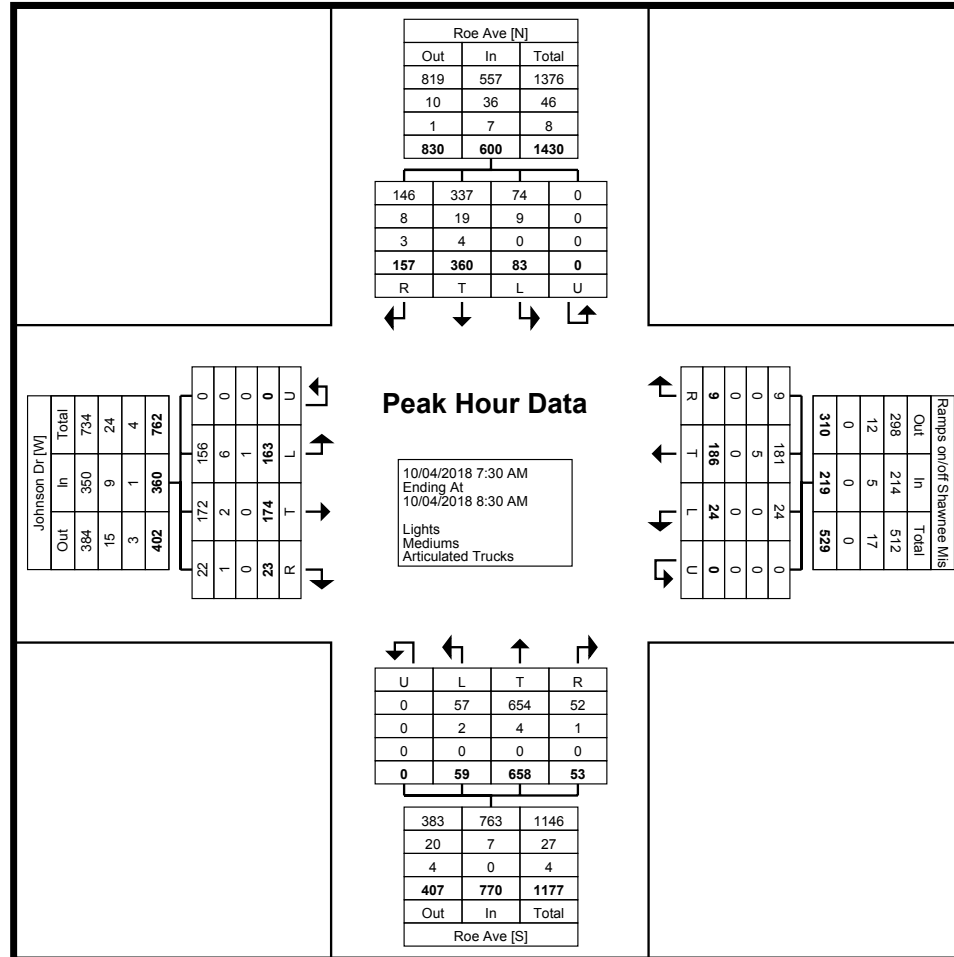
Olsson Associates : Overland Park
7301 West 133rd St

Overland Park, Kansas, United States 66213
913.381.1170 tmchenry@olssonassociates.com

Count Name: Johnson Dr & Roe Ave
Site Code:
Start Date: 10/04/2018
Page No: 3

Turning Movement Peak Hour Data (7:30 AM)

| Start Time | Roe Ave Southbound | | | | | Ramps on/off Shawnee Mission Pkwy Westbound | | | | | Roe Ave Northbound | | | | | Johnson Dr Eastbound | | | | | Int. Total |
|----------------------|--------------------|-------|-------|--------|------------|---|-------|-------|--------|------------|--------------------|-------|-------|--------|------------|----------------------|-------|-------|--------|------------|------------|
| | Right | Thru | Left | U-Turn | App. Total | Right | Thru | Left | U-Turn | App. Total | Right | Thru | Left | U-Turn | App. Total | Right | Thru | Left | U-Turn | App. Total | |
| 7:30 AM | 45 | 96 | 17 | 0 | 158 | 1 | 39 | 7 | 0 | 47 | 17 | 159 | 7 | 0 | 183 | 7 | 38 | 45 | 0 | 90 | 478 |
| 7:45 AM | 34 | 96 | 24 | 0 | 154 | 1 | 47 | 6 | 0 | 54 | 16 | 174 | 23 | 0 | 213 | 3 | 45 | 44 | 0 | 92 | 513 |
| 8:00 AM | 41 | 89 | 20 | 0 | 150 | 7 | 53 | 5 | 0 | 65 | 2 | 192 | 13 | 0 | 207 | 9 | 41 | 47 | 0 | 97 | 519 |
| 8:15 AM | 37 | 79 | 22 | 0 | 138 | 0 | 47 | 6 | 0 | 53 | 18 | 133 | 16 | 0 | 167 | 4 | 50 | 27 | 0 | 81 | 439 |
| Total | 157 | 360 | 83 | 0 | 600 | 9 | 186 | 24 | 0 | 219 | 53 | 658 | 59 | 0 | 770 | 23 | 174 | 163 | 0 | 360 | 1949 |
| Approach % | 26.2 | 60.0 | 13.8 | 0.0 | - | 4.1 | 84.9 | 11.0 | 0.0 | - | 6.9 | 85.5 | 7.7 | 0.0 | - | 6.4 | 48.3 | 45.3 | 0.0 | - | - |
| Total % | 8.1 | 18.5 | 4.3 | 0.0 | 30.8 | 0.5 | 9.5 | 1.2 | 0.0 | 11.2 | 2.7 | 33.8 | 3.0 | 0.0 | 39.5 | 1.2 | 8.9 | 8.4 | 0.0 | 18.5 | - |
| PHF | 0.872 | 0.938 | 0.865 | 0.000 | 0.949 | 0.321 | 0.877 | 0.857 | 0.000 | 0.842 | 0.736 | 0.857 | 0.641 | 0.000 | 0.904 | 0.639 | 0.870 | 0.867 | 0.000 | 0.928 | 0.939 |
| Lights | 146 | 337 | 74 | 0 | 557 | 9 | 181 | 24 | 0 | 214 | 52 | 654 | 57 | 0 | 763 | 22 | 172 | 156 | 0 | 350 | 1884 |
| % Lights | 93.0 | 93.6 | 89.2 | - | 92.8 | 100.0 | 97.3 | 100.0 | - | 97.7 | 98.1 | 99.4 | 96.6 | - | 99.1 | 95.7 | 98.9 | 95.7 | - | 97.2 | 96.7 |
| Mediums | 8 | 19 | 9 | 0 | 36 | 0 | 5 | 0 | 0 | 5 | 1 | 4 | 2 | 0 | 7 | 1 | 2 | 6 | 0 | 9 | 57 |
| % Mediums | 5.1 | 5.3 | 10.8 | - | 6.0 | 0.0 | 2.7 | 0.0 | - | 2.3 | 1.9 | 0.6 | 3.4 | - | 0.9 | 4.3 | 1.1 | 3.7 | - | 2.5 | 2.9 |
| Articulated Trucks | 3 | 4 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 8 |
| % Articulated Trucks | 1.9 | 1.1 | 0.0 | - | 1.2 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | 0.6 | - | 0.3 | 0.4 |



Turning Movement Peak Hour Data Plot (7:30 AM)

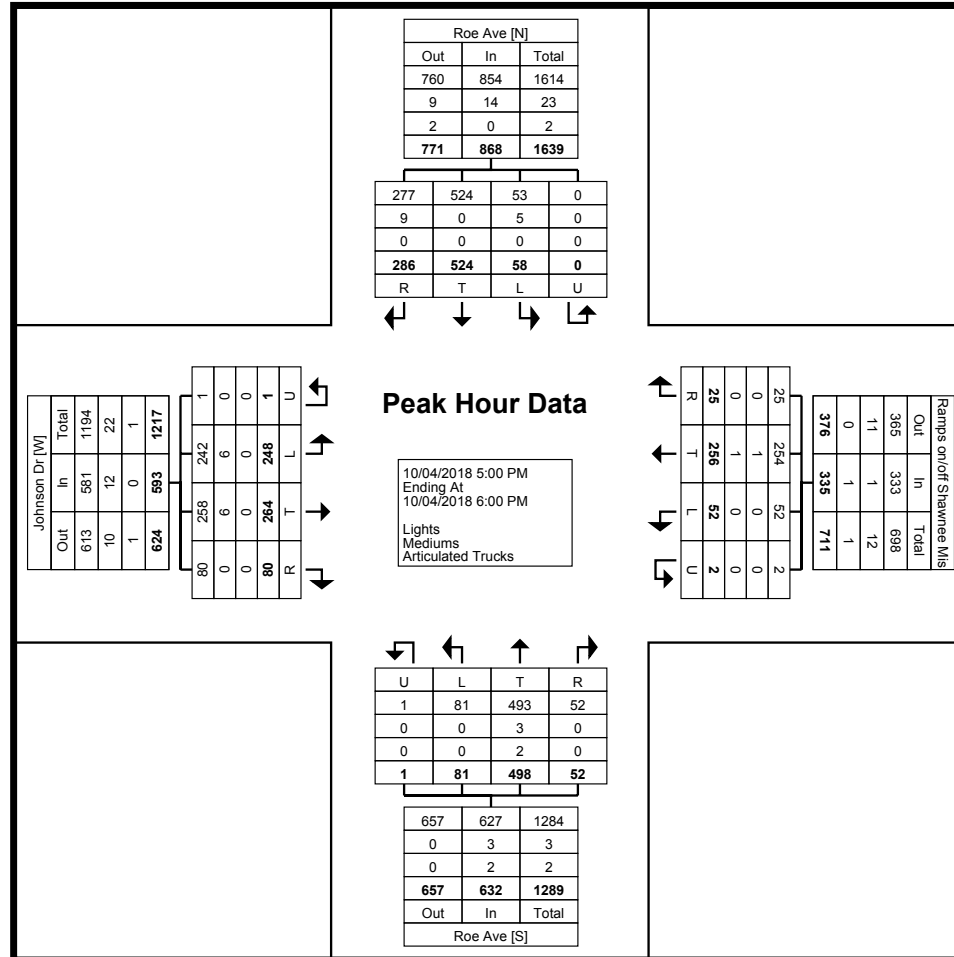
Olsson Associates : Overland Park
7301 West 133rd St

Overland Park, Kansas, United States 66213
913.381.1170 tmchenry@olssonassociates.com

Count Name: Johnson Dr & Roe Ave
Site Code:
Start Date: 10/04/2018
Page No: 5

Turning Movement Peak Hour Data (5:00 PM)

| Start Time | Roe Ave Southbound | | | | | Ramps on/off Shawnee Mission Pkwy Westbound | | | | | Roe Ave Northbound | | | | | Johnson Dr Eastbound | | | | | Int. Total |
|----------------------|--------------------|-------|-------|--------|------------|---|-------|-------|--------|------------|--------------------|-------|-------|--------|------------|----------------------|-------|-------|--------|------------|------------|
| | Right | Thru | Left | U-Turn | App. Total | Right | Thru | Left | U-Turn | App. Total | Right | Thru | Left | U-Turn | App. Total | Right | Thru | Left | U-Turn | App. Total | |
| 5:00 PM | 81 | 105 | 11 | 0 | 197 | 5 | 74 | 12 | 0 | 91 | 8 | 105 | 27 | 1 | 141 | 23 | 69 | 82 | 0 | 174 | 603 |
| 5:15 PM | 74 | 156 | 14 | 0 | 244 | 10 | 58 | 14 | 0 | 82 | 13 | 146 | 18 | 0 | 177 | 25 | 72 | 70 | 0 | 167 | 670 |
| 5:30 PM | 53 | 140 | 20 | 0 | 213 | 7 | 62 | 17 | 2 | 88 | 18 | 137 | 18 | 0 | 173 | 15 | 55 | 45 | 0 | 115 | 589 |
| 5:45 PM | 78 | 123 | 13 | 0 | 214 | 3 | 62 | 9 | 0 | 74 | 13 | 110 | 18 | 0 | 141 | 17 | 68 | 51 | 1 | 137 | 566 |
| Total | 286 | 524 | 58 | 0 | 868 | 25 | 256 | 52 | 2 | 335 | 52 | 498 | 81 | 1 | 632 | 80 | 264 | 248 | 1 | 593 | 2428 |
| Approach % | 32.9 | 60.4 | 6.7 | 0.0 | - | 7.5 | 76.4 | 15.5 | 0.6 | - | 8.2 | 78.8 | 12.8 | 0.2 | - | 13.5 | 44.5 | 41.8 | 0.2 | - | - |
| Total % | 11.8 | 21.6 | 2.4 | 0.0 | 35.7 | 1.0 | 10.5 | 2.1 | 0.1 | 13.8 | 2.1 | 20.5 | 3.3 | 0.0 | 26.0 | 3.3 | 10.9 | 10.2 | 0.0 | 24.4 | - |
| PHF | 0.883 | 0.840 | 0.725 | 0.000 | 0.889 | 0.625 | 0.865 | 0.765 | 0.250 | 0.920 | 0.722 | 0.853 | 0.750 | 0.250 | 0.893 | 0.800 | 0.917 | 0.756 | 0.250 | 0.852 | 0.906 |
| Lights | 277 | 524 | 53 | 0 | 854 | 25 | 254 | 52 | 2 | 333 | 52 | 493 | 81 | 1 | 627 | 80 | 258 | 242 | 1 | 581 | 2395 |
| % Lights | 96.9 | 100.0 | 91.4 | - | 98.4 | 100.0 | 99.2 | 100.0 | 100.0 | 99.4 | 100.0 | 99.0 | 100.0 | 100.0 | 99.2 | 100.0 | 97.7 | 97.6 | 100.0 | 98.0 | 98.6 |
| Mediums | 9 | 0 | 5 | 0 | 14 | 0 | 1 | 0 | 0 | 1 | 0 | 3 | 0 | 0 | 3 | 0 | 6 | 6 | 0 | 12 | 30 |
| % Mediums | 3.1 | 0.0 | 8.6 | - | 1.6 | 0.0 | 0.4 | 0.0 | 0.0 | 0.3 | 0.0 | 0.6 | 0.0 | 0.0 | 0.5 | 0.0 | 2.3 | 2.4 | 0.0 | 2.0 | 1.2 |
| Articulated Trucks | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 3 |
| % Articulated Trucks | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 | 0.3 | 0.0 | 0.4 | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 |



Turning Movement Peak Hour Data Plot (5:00 PM)

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Count Name: Johnson Dr & Roe Ave
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Start Date: 10/04/2018
Page No: 7

Olsson Associates : Overland Park
7301 West 133rd St

Overland Park, Kansas, United States 66213
913.381.1170 tmchenry@olssonassociates.com

Count Name: Johnson Dr & Roeland Dr
Site Code:
Start Date: 10/04/2018
Page No: 1

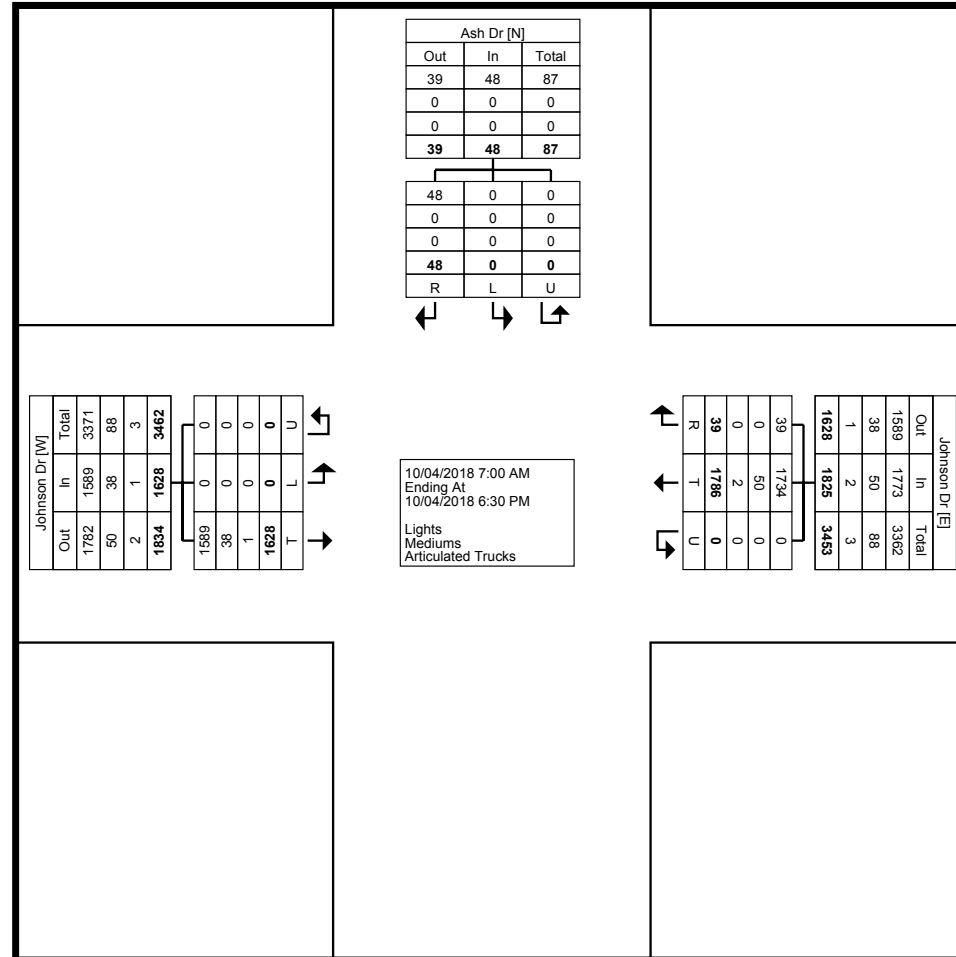
Turning Movement Data

| Start Time | Ash Dr Southbound | | | | Johnson Dr Westbound | | | | Johnson Dr Eastbound | | | | Int. Total |
|----------------------|----------------------|------|--------|------------|-------------------------|------|--------|------------|-------------------------|------|--------|------------|------------|
| | Right | Left | U-Turn | App. Total | Right | Thru | U-Turn | App. Total | Thru | Left | U-Turn | App. Total | |
| 7:00 AM | 0 | 0 | 0 | 0 | 1 | 75 | 0 | 76 | 50 | 0 | 0 | 50 | 126 |
| 7:15 AM | 2 | 0 | 0 | 2 | 0 | 61 | 0 | 61 | 61 | 0 | 0 | 61 | 124 |
| 7:30 AM | 5 | 0 | 0 | 5 | 0 | 88 | 0 | 88 | 79 | 0 | 0 | 79 | 172 |
| 7:45 AM | 5 | 0 | 0 | 5 | 1 | 99 | 0 | 100 | 84 | 0 | 0 | 84 | 189 |
| Hourly Total | 12 | 0 | 0 | 12 | 2 | 323 | 0 | 325 | 274 | 0 | 0 | 274 | 611 |
| 8:00 AM | 2 | 0 | 0 | 2 | 1 | 103 | 0 | 104 | 82 | 0 | 0 | 82 | 188 |
| 8:15 AM | 1 | 0 | 0 | 1 | 1 | 94 | 0 | 95 | 86 | 0 | 0 | 86 | 182 |
| 8:30 AM | 5 | 0 | 0 | 5 | 0 | 85 | 0 | 85 | 80 | 0 | 0 | 80 | 170 |
| 8:45 AM | 2 | 0 | 0 | 2 | 0 | 74 | 0 | 74 | 82 | 0 | 0 | 82 | 158 |
| Hourly Total | 10 | 0 | 0 | 10 | 2 | 356 | 0 | 358 | 330 | 0 | 0 | 330 | 698 |
| *** BREAK *** | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 4:30 PM | 3 | 0 | 0 | 3 | 1 | 136 | 0 | 137 | 113 | 0 | 0 | 113 | 253 |
| 4:45 PM | 5 | 0 | 0 | 5 | 6 | 157 | 0 | 163 | 122 | 0 | 0 | 122 | 290 |
| Hourly Total | 8 | 0 | 0 | 8 | 7 | 293 | 0 | 300 | 235 | 0 | 0 | 235 | 543 |
| 5:00 PM | 1 | 0 | 0 | 1 | 12 | 165 | 0 | 177 | 161 | 0 | 0 | 161 | 339 |
| 5:15 PM | 4 | 0 | 0 | 4 | 1 | 157 | 0 | 158 | 152 | 0 | 0 | 152 | 314 |
| 5:30 PM | 5 | 0 | 0 | 5 | 5 | 119 | 0 | 124 | 120 | 0 | 0 | 120 | 249 |
| 5:45 PM | 1 | 0 | 0 | 1 | 3 | 152 | 0 | 155 | 130 | 0 | 0 | 130 | 286 |
| Hourly Total | 11 | 0 | 0 | 11 | 21 | 593 | 0 | 614 | 563 | 0 | 0 | 563 | 1188 |
| 6:00 PM | 1 | 0 | 0 | 1 | 2 | 115 | 0 | 117 | 116 | 0 | 0 | 116 | 234 |
| 6:15 PM | 6 | 0 | 0 | 6 | 5 | 106 | 0 | 111 | 110 | 0 | 0 | 110 | 227 |
| Grand Total | 48 | 0 | 0 | 48 | 39 | 1786 | 0 | 1825 | 1628 | 0 | 0 | 1628 | 3501 |
| Approach % | 100.0 | 0.0 | 0.0 | - | 2.1 | 97.9 | 0.0 | - | 100.0 | 0.0 | 0.0 | - | - |
| Total % | 1.4 | 0.0 | 0.0 | 1.4 | 1.1 | 51.0 | 0.0 | 52.1 | 46.5 | 0.0 | 0.0 | 46.5 | - |
| Lights | 48 | 0 | 0 | 48 | 39 | 1734 | 0 | 1773 | 1589 | 0 | 0 | 1589 | 3410 |
| % Lights | 100.0 | - | - | 100.0 | 100.0 | 97.1 | - | 97.2 | 97.6 | - | - | 97.6 | 97.4 |
| Mediums | 0 | 0 | 0 | 0 | 0 | 50 | 0 | 50 | 38 | 0 | 0 | 38 | 88 |
| % Mediums | 0.0 | - | - | 0.0 | 0.0 | 2.8 | - | 2.7 | 2.3 | - | - | 2.3 | 2.5 |
| Articulated Trucks | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 | 1 | 0 | 0 | 1 | 3 |
| % Articulated Trucks | 0.0 | - | - | 0.0 | 0.0 | 0.1 | - | 0.1 | 0.1 | - | - | 0.1 | 0.1 |

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Count Name: Johnson Dr & Roeland Dr
Site Code:
Start Date: 10/04/2018
Page No: 2



Turning Movement Data Plot

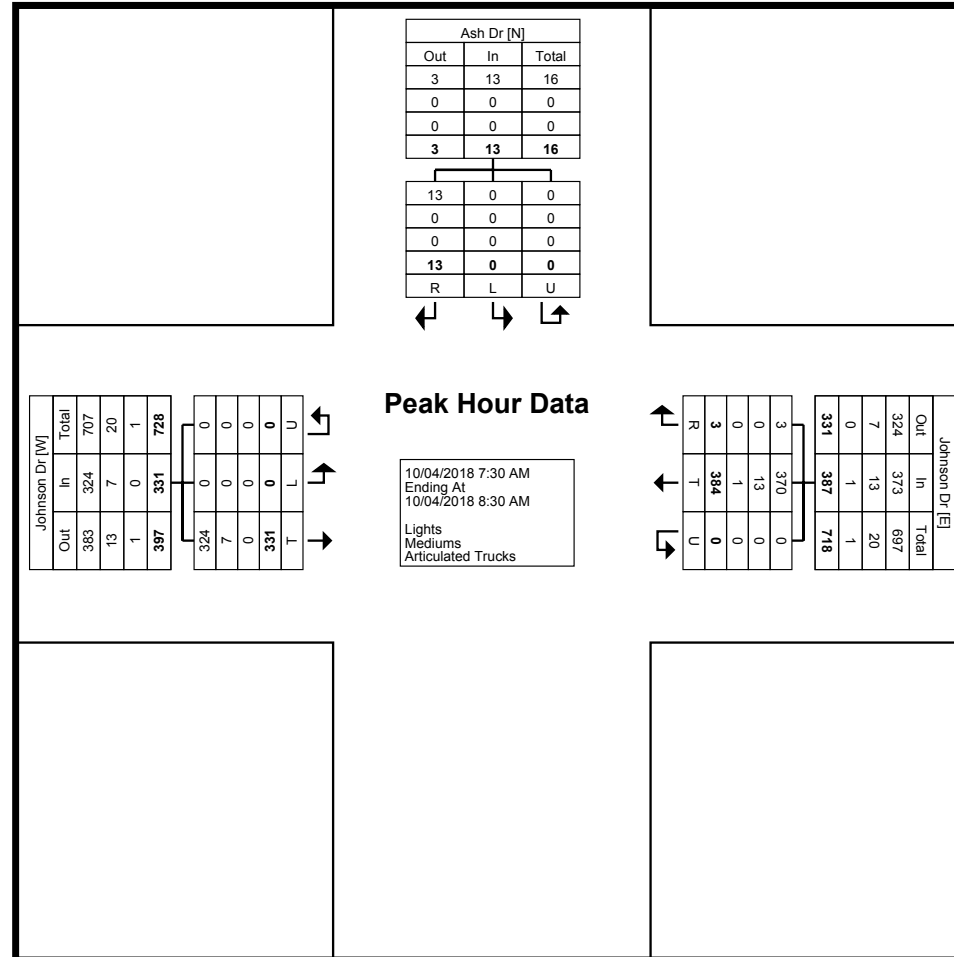
Olsson Associates : Overland Park
7301 West 133rd St

Overland Park, Kansas, United States 66213
913.381.1170 tmchenry@olssonassociates.com

Count Name: Johnson Dr & Roeland Dr
Site Code:
Start Date: 10/04/2018
Page No: 3

Turning Movement Peak Hour Data (7:30 AM)

| Start Time | Ash Dr Southbound | | | | Johnson Dr Westbound | | | | Johnson Dr Eastbound | | | | Int. Total |
|----------------------|----------------------|-------|--------|------------|-------------------------|-------|--------|------------|-------------------------|-------|--------|------------|------------|
| | Right | Left | U-Turn | App. Total | Right | Thru | U-Turn | App. Total | Thru | Left | U-Turn | App. Total | |
| 7:30 AM | 5 | 0 | 0 | 5 | 0 | 88 | 0 | 88 | 79 | 0 | 0 | 79 | 172 |
| 7:45 AM | 5 | 0 | 0 | 5 | 1 | 99 | 0 | 100 | 84 | 0 | 0 | 84 | 189 |
| 8:00 AM | 2 | 0 | 0 | 2 | 1 | 103 | 0 | 104 | 82 | 0 | 0 | 82 | 188 |
| 8:15 AM | 1 | 0 | 0 | 1 | 1 | 94 | 0 | 95 | 86 | 0 | 0 | 86 | 182 |
| Total | 13 | 0 | 0 | 13 | 3 | 384 | 0 | 387 | 331 | 0 | 0 | 331 | 731 |
| Approach % | 100.0 | 0.0 | 0.0 | - | 0.8 | 99.2 | 0.0 | - | 100.0 | 0.0 | 0.0 | - | - |
| Total % | 1.8 | 0.0 | 0.0 | 1.8 | 0.4 | 52.5 | 0.0 | 52.9 | 45.3 | 0.0 | 0.0 | 45.3 | - |
| PHF | 0.650 | 0.000 | 0.000 | 0.650 | 0.750 | 0.932 | 0.000 | 0.930 | 0.962 | 0.000 | 0.000 | 0.962 | 0.967 |
| Lights | 13 | 0 | 0 | 13 | 3 | 370 | 0 | 373 | 324 | 0 | 0 | 324 | 710 |
| % Lights | 100.0 | - | - | 100.0 | 100.0 | 96.4 | - | 96.4 | 97.9 | - | - | 97.9 | 97.1 |
| Mediums | 0 | 0 | 0 | 0 | 0 | 13 | 0 | 13 | 7 | 0 | 0 | 7 | 20 |
| % Mediums | 0.0 | - | - | 0.0 | 0.0 | 3.4 | - | 3.4 | 2.1 | - | - | 2.1 | 2.7 |
| Articulated Trucks | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| % Articulated Trucks | 0.0 | - | - | 0.0 | 0.0 | 0.3 | - | 0.3 | 0.0 | - | - | 0.0 | 0.1 |



Turning Movement Peak Hour Data Plot (7:30 AM)

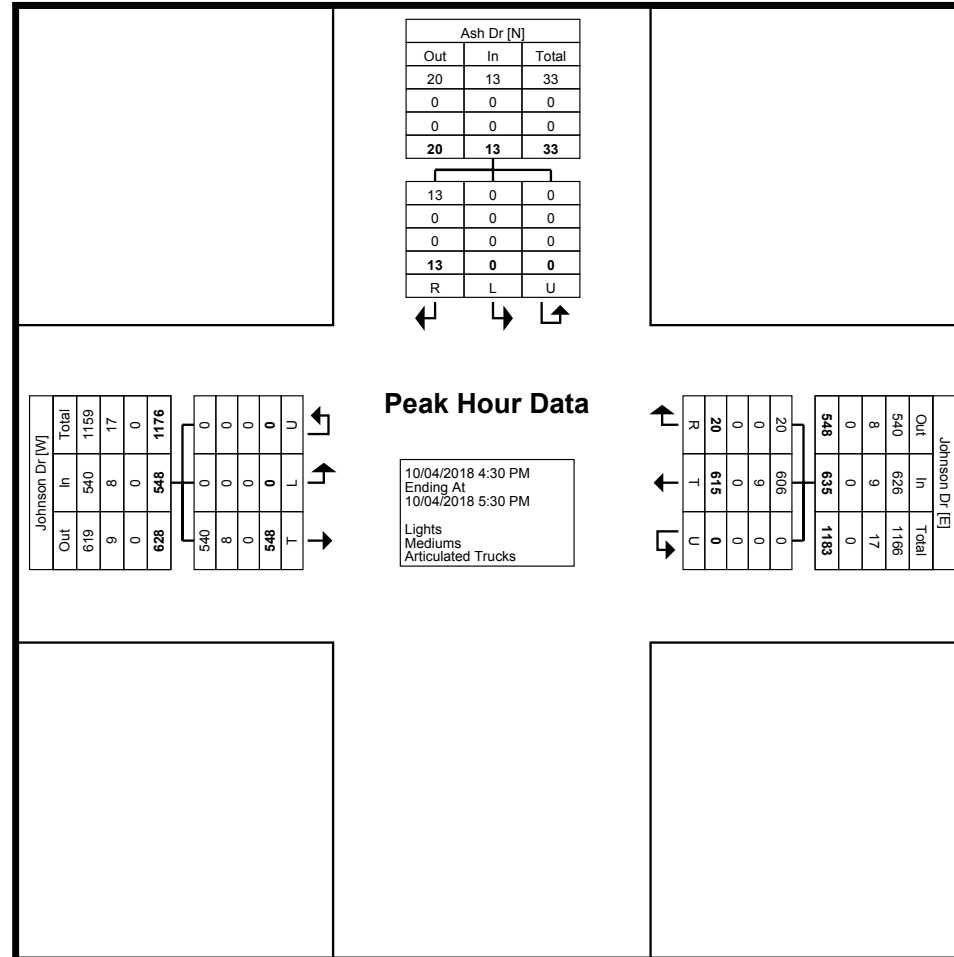
Olsson Associates : Overland Park
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Count Name: Johnson Dr & Roeland Dr
Site Code:
Start Date: 10/04/2018
Page No: 5

Turning Movement Peak Hour Data (4:30 PM)

| Start Time | Ash Dr Southbound | | | | Johnson Dr Westbound | | | | Johnson Dr Eastbound | | | | Int. Total |
|----------------------|----------------------|-------|--------|------------|-------------------------|-------|--------|------------|-------------------------|-------|--------|------------|------------|
| | Right | Left | U-Turn | App. Total | Right | Thru | U-Turn | App. Total | Thru | Left | U-Turn | App. Total | |
| 4:30 PM | 3 | 0 | 0 | 3 | 1 | 136 | 0 | 137 | 113 | 0 | 0 | 113 | 253 |
| 4:45 PM | 5 | 0 | 0 | 5 | 6 | 157 | 0 | 163 | 122 | 0 | 0 | 122 | 290 |
| 5:00 PM | 1 | 0 | 0 | 1 | 12 | 165 | 0 | 177 | 161 | 0 | 0 | 161 | 339 |
| 5:15 PM | 4 | 0 | 0 | 4 | 1 | 157 | 0 | 158 | 152 | 0 | 0 | 152 | 314 |
| Total | 13 | 0 | 0 | 13 | 20 | 615 | 0 | 635 | 548 | 0 | 0 | 548 | 1196 |
| Approach % | 100.0 | 0.0 | 0.0 | - | 3.1 | 96.9 | 0.0 | - | 100.0 | 0.0 | 0.0 | - | - |
| Total % | 1.1 | 0.0 | 0.0 | 1.1 | 1.7 | 51.4 | 0.0 | 53.1 | 45.8 | 0.0 | 0.0 | 45.8 | - |
| PHF | 0.650 | 0.000 | 0.000 | 0.650 | 0.417 | 0.932 | 0.000 | 0.897 | 0.851 | 0.000 | 0.000 | 0.851 | 0.882 |
| Lights | 13 | 0 | 0 | 13 | 20 | 606 | 0 | 626 | 540 | 0 | 0 | 540 | 1179 |
| % Lights | 100.0 | - | - | 100.0 | 100.0 | 98.5 | - | 98.6 | 98.5 | - | - | 98.5 | 98.6 |
| Mediums | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 9 | 8 | 0 | 0 | 8 | 17 |
| % Mediums | 0.0 | - | - | 0.0 | 0.0 | 1.5 | - | 1.4 | 1.5 | - | - | 1.5 | 1.4 |
| Articulated Trucks | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| % Articulated Trucks | 0.0 | - | - | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | - | - | 0.0 | 0.0 |



Turning Movement Peak Hour Data Plot (4:30 PM)

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Count Name: Johnson Dr & Roeland Dr
Site Code:
Start Date: 10/04/2018
Page No: 7

Olsson Associates : Overland Park
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913.381.1170 tmchenry@olssonassociates.com

Count Name: Roeland Dr & Martway St
Site Code:
Start Date: 10/04/2018
Page No: 1

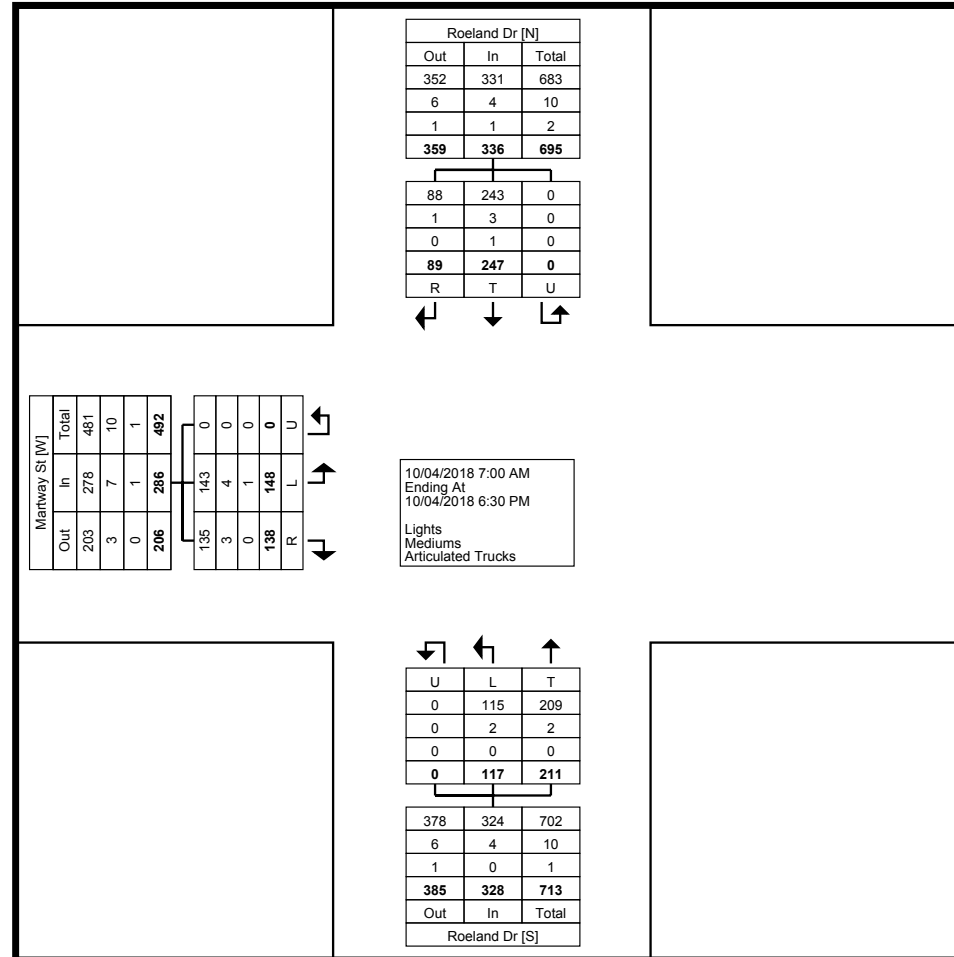
Turning Movement Data

| Start Time | Roeland Dr Southbound | | | | Roeland Dr Northbound | | | | Martway St Eastbound | | | | Int. Total |
|----------------------|-----------------------|------|--------|------------|-----------------------|------|--------|------------|----------------------|------|--------|------------|------------|
| | Right | Thru | U-Turn | App. Total | Thru | Left | U-Turn | App. Total | Right | Left | U-Turn | App. Total | |
| 7:00 AM | 0 | 10 | 0 | 10 | 4 | 1 | 0 | 5 | 4 | 0 | 0 | 4 | 19 |
| 7:15 AM | 4 | 15 | 0 | 19 | 15 | 2 | 0 | 17 | 3 | 5 | 0 | 8 | 44 |
| 7:30 AM | 2 | 22 | 0 | 24 | 6 | 5 | 0 | 11 | 1 | 5 | 0 | 6 | 41 |
| 7:45 AM | 3 | 12 | 0 | 15 | 14 | 5 | 0 | 19 | 3 | 3 | 0 | 6 | 40 |
| Hourly Total | 9 | 59 | 0 | 68 | 39 | 13 | 0 | 52 | 11 | 13 | 0 | 24 | 144 |
| 8:00 AM | 3 | 21 | 0 | 24 | 8 | 8 | 0 | 16 | 3 | 5 | 0 | 8 | 48 |
| 8:15 AM | 3 | 12 | 0 | 15 | 8 | 11 | 0 | 19 | 5 | 5 | 0 | 10 | 44 |
| 8:30 AM | 0 | 7 | 0 | 7 | 11 | 10 | 0 | 21 | 4 | 7 | 0 | 11 | 39 |
| 8:45 AM | 5 | 15 | 0 | 20 | 12 | 8 | 0 | 20 | 5 | 7 | 0 | 12 | 52 |
| Hourly Total | 11 | 55 | 0 | 66 | 39 | 37 | 0 | 76 | 17 | 24 | 0 | 41 | 183 |
| *** BREAK *** | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 4:30 PM | 7 | 16 | 0 | 23 | 11 | 5 | 0 | 16 | 9 | 15 | 0 | 24 | 63 |
| 4:45 PM | 7 | 19 | 0 | 26 | 20 | 11 | 0 | 31 | 20 | 8 | 0 | 28 | 85 |
| Hourly Total | 14 | 35 | 0 | 49 | 31 | 16 | 0 | 47 | 29 | 23 | 0 | 52 | 148 |
| 5:00 PM | 5 | 12 | 0 | 17 | 22 | 12 | 0 | 34 | 18 | 23 | 0 | 41 | 92 |
| 5:15 PM | 13 | 18 | 0 | 31 | 20 | 12 | 0 | 32 | 19 | 19 | 0 | 38 | 101 |
| 5:30 PM | 9 | 15 | 0 | 24 | 13 | 6 | 0 | 19 | 12 | 13 | 0 | 25 | 68 |
| 5:45 PM | 15 | 15 | 0 | 30 | 17 | 7 | 0 | 24 | 14 | 18 | 0 | 32 | 86 |
| Hourly Total | 42 | 60 | 0 | 102 | 72 | 37 | 0 | 109 | 63 | 73 | 0 | 136 | 347 |
| 6:00 PM | 11 | 21 | 0 | 32 | 16 | 6 | 0 | 22 | 9 | 9 | 0 | 18 | 72 |
| 6:15 PM | 2 | 17 | 0 | 19 | 14 | 8 | 0 | 22 | 9 | 6 | 0 | 15 | 56 |
| Grand Total | 89 | 247 | 0 | 336 | 211 | 117 | 0 | 328 | 138 | 148 | 0 | 286 | 950 |
| Approach % | 26.5 | 73.5 | 0.0 | - | 64.3 | 35.7 | 0.0 | - | 48.3 | 51.7 | 0.0 | - | - |
| Total % | 9.4 | 26.0 | 0.0 | 35.4 | 22.2 | 12.3 | 0.0 | 34.5 | 14.5 | 15.6 | 0.0 | 30.1 | - |
| Lights | 88 | 243 | 0 | 331 | 209 | 115 | 0 | 324 | 135 | 143 | 0 | 278 | 933 |
| % Lights | 98.9 | 98.4 | - | 98.5 | 99.1 | 98.3 | - | 98.8 | 97.8 | 96.6 | - | 97.2 | 98.2 |
| Mediums | 1 | 3 | 0 | 4 | 2 | 2 | 0 | 4 | 3 | 4 | 0 | 7 | 15 |
| % Mediums | 1.1 | 1.2 | - | 1.2 | 0.9 | 1.7 | - | 1.2 | 2.2 | 2.7 | - | 2.4 | 1.6 |
| Articulated Trucks | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 2 |
| % Articulated Trucks | 0.0 | 0.4 | - | 0.3 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.7 | - | 0.3 | 0.2 |

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Count Name: Roeland Dr & Martway St
Site Code:
Start Date: 10/04/2018
Page No: 2



Turning Movement Data Plot

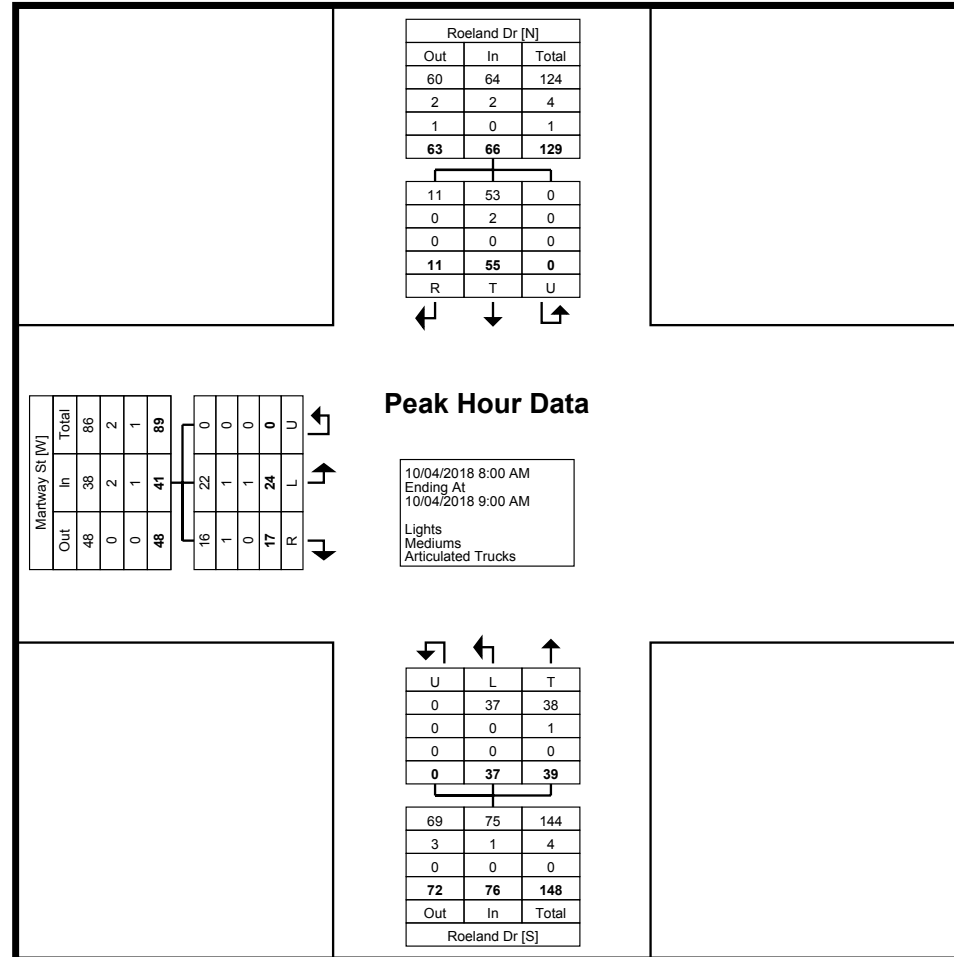
Olsson Associates : Overland Park
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Overland Park, Kansas, United States 66213
913.381.1170 tmchenry@olssonassociates.com

Count Name: Roeland Dr & Martway St
Site Code:
Start Date: 10/04/2018
Page No: 3

Turning Movement Peak Hour Data (8:00 AM)

| Start Time | Roeland Dr Southbound | | | | Roeland Dr Northbound | | | | Martway St Eastbound | | | | Int. Total |
|----------------------|--------------------------|-------|--------|------------|--------------------------|-------|--------|------------|-------------------------|-------|--------|------------|------------|
| | Right | Thru | U-Turn | App. Total | Thru | Left | U-Turn | App. Total | Right | Left | U-Turn | App. Total | |
| 8:00 AM | 3 | 21 | 0 | 24 | 8 | 8 | 0 | 16 | 3 | 5 | 0 | 8 | 48 |
| 8:15 AM | 3 | 12 | 0 | 15 | 8 | 11 | 0 | 19 | 5 | 5 | 0 | 10 | 44 |
| 8:30 AM | 0 | 7 | 0 | 7 | 11 | 10 | 0 | 21 | 4 | 7 | 0 | 11 | 39 |
| 8:45 AM | 5 | 15 | 0 | 20 | 12 | 8 | 0 | 20 | 5 | 7 | 0 | 12 | 52 |
| Total | 11 | 55 | 0 | 66 | 39 | 37 | 0 | 76 | 17 | 24 | 0 | 41 | 183 |
| Approach % | 16.7 | 83.3 | 0.0 | - | 51.3 | 48.7 | 0.0 | - | 41.5 | 58.5 | 0.0 | - | - |
| Total % | 6.0 | 30.1 | 0.0 | 36.1 | 21.3 | 20.2 | 0.0 | 41.5 | 9.3 | 13.1 | 0.0 | 22.4 | - |
| PHF | 0.550 | 0.655 | 0.000 | 0.688 | 0.813 | 0.841 | 0.000 | 0.905 | 0.850 | 0.857 | 0.000 | 0.854 | 0.880 |
| Lights | 11 | 53 | 0 | 64 | 38 | 37 | 0 | 75 | 16 | 22 | 0 | 38 | 177 |
| % Lights | 100.0 | 96.4 | - | 97.0 | 97.4 | 100.0 | - | 98.7 | 94.1 | 91.7 | - | 92.7 | 96.7 |
| Mediums | 0 | 2 | 0 | 2 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 2 | 5 |
| % Mediums | 0.0 | 3.6 | - | 3.0 | 2.6 | 0.0 | - | 1.3 | 5.9 | 4.2 | - | 4.9 | 2.7 |
| Articulated Trucks | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 |
| % Articulated Trucks | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 4.2 | - | 2.4 | 0.5 |



Turning Movement Peak Hour Data Plot (8:00 AM)

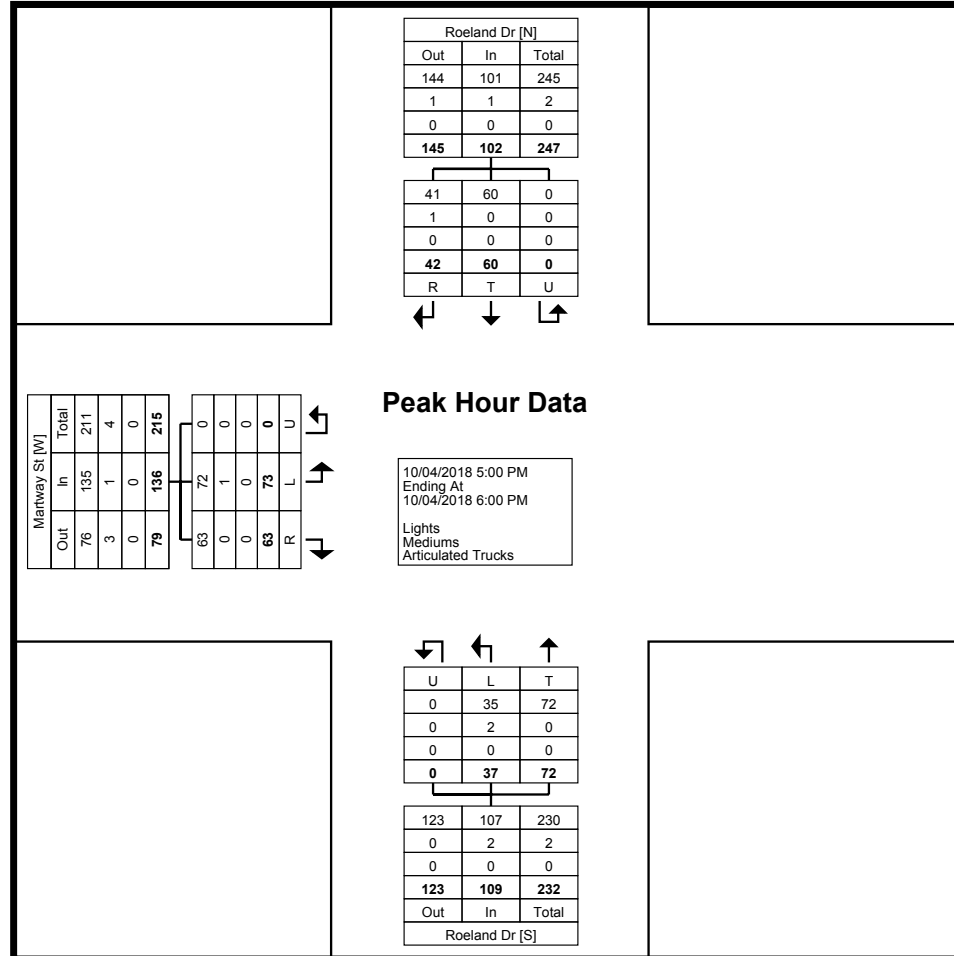
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Count Name: Roeland Dr & Martway St
Site Code:
Start Date: 10/04/2018
Page No: 5

Turning Movement Peak Hour Data (5:00 PM)

| Start Time | Roeland Dr Southbound | | | | Roeland Dr Northbound | | | | Martway St Eastbound | | | | Int. Total |
|----------------------|--------------------------|-------|--------|------------|--------------------------|-------|--------|------------|-------------------------|-------|--------|------------|------------|
| | Right | Thru | U-Turn | App. Total | Thru | Left | U-Turn | App. Total | Right | Left | U-Turn | App. Total | |
| 5:00 PM | 5 | 12 | 0 | 17 | 22 | 12 | 0 | 34 | 18 | 23 | 0 | 41 | 92 |
| 5:15 PM | 13 | 18 | 0 | 31 | 20 | 12 | 0 | 32 | 19 | 19 | 0 | 38 | 101 |
| 5:30 PM | 9 | 15 | 0 | 24 | 13 | 6 | 0 | 19 | 12 | 13 | 0 | 25 | 68 |
| 5:45 PM | 15 | 15 | 0 | 30 | 17 | 7 | 0 | 24 | 14 | 18 | 0 | 32 | 86 |
| Total | 42 | 60 | 0 | 102 | 72 | 37 | 0 | 109 | 63 | 73 | 0 | 136 | 347 |
| Approach % | 41.2 | 58.8 | 0.0 | - | 66.1 | 33.9 | 0.0 | - | 46.3 | 53.7 | 0.0 | - | - |
| Total % | 12.1 | 17.3 | 0.0 | 29.4 | 20.7 | 10.7 | 0.0 | 31.4 | 18.2 | 21.0 | 0.0 | 39.2 | - |
| PHF | 0.700 | 0.833 | 0.000 | 0.823 | 0.818 | 0.771 | 0.000 | 0.801 | 0.829 | 0.793 | 0.000 | 0.829 | 0.859 |
| Lights | 41 | 60 | 0 | 101 | 72 | 35 | 0 | 107 | 63 | 72 | 0 | 135 | 343 |
| % Lights | 97.6 | 100.0 | - | 99.0 | 100.0 | 94.6 | - | 98.2 | 100.0 | 98.6 | - | 99.3 | 98.8 |
| Mediums | 1 | 0 | 0 | 1 | 0 | 2 | 0 | 2 | 0 | 1 | 0 | 1 | 4 |
| % Mediums | 2.4 | 0.0 | - | 1.0 | 0.0 | 5.4 | - | 1.8 | 0.0 | 1.4 | - | 0.7 | 1.2 |
| Articulated Trucks | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| % Articulated Trucks | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 |



Turning Movement Peak Hour Data Plot (5:00 PM)

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Site Code:
Start Date: 10/04/2018
Page No: 7

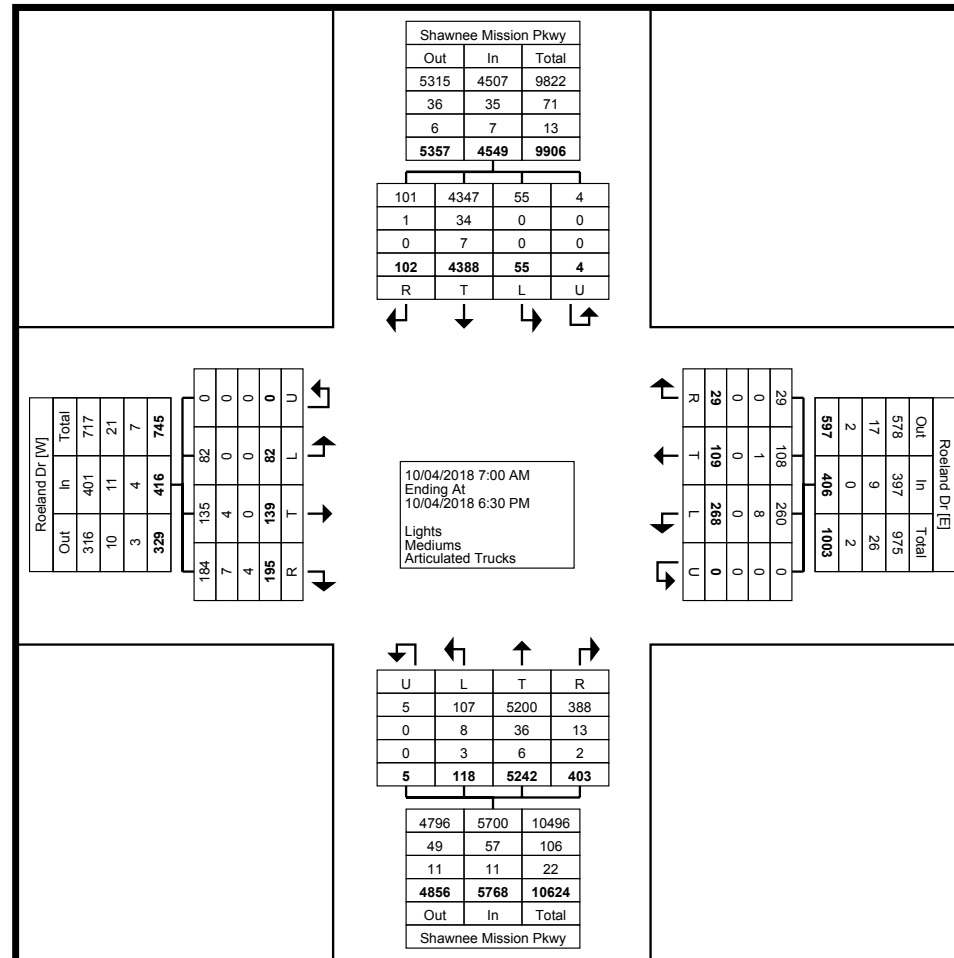
Olsson Associates : Overland Park
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Overland Park, Kansas, United States 66213
913.381.1170 tmchenry@olssonassociates.com

Count Name: Roeland Dr & Shawnee Mission
Pkwy
Site Code:
Start Date: 10/04/2018
Page No: 1

Turning Movement Data

| Start Time | Shawnee Mission Pkwy Southbound | | | | | Roeland Dr Westbound | | | | | Shawnee Mission Pkwy Northbound | | | | | Roeland Dr Eastbound | | | | | Int. Total |
|----------------------|------------------------------------|------|-------|--------|------------|-------------------------|------|------|--------|------------|------------------------------------|------|------|--------|------------|-------------------------|------|-------|--------|------------|------------|
| | Right | Thru | Left | U-Turn | App. Total | Right | Thru | Left | U-Turn | App. Total | Right | Thru | Left | U-Turn | App. Total | Right | Thru | Left | U-Turn | App. Total | |
| 7:00 AM | 2 | 122 | 0 | 0 | 124 | 1 | 1 | 15 | 0 | 17 | 12 | 306 | 3 | 0 | 321 | 9 | 1 | 2 | 0 | 12 | 474 |
| 7:15 AM | 6 | 185 | 0 | 0 | 191 | 0 | 4 | 24 | 0 | 28 | 14 | 409 | 6 | 0 | 429 | 11 | 3 | 5 | 0 | 19 | 667 |
| 7:30 AM | 4 | 288 | 1 | 0 | 293 | 2 | 3 | 25 | 0 | 30 | 28 | 448 | 2 | 1 | 479 | 20 | 4 | 2 | 0 | 26 | 828 |
| 7:45 AM | 7 | 236 | 1 | 0 | 244 | 3 | 5 | 19 | 0 | 27 | 38 | 452 | 8 | 0 | 498 | 14 | 5 | 1 | 0 | 20 | 789 |
| Hourly Total | 19 | 831 | 2 | 0 | 852 | 6 | 13 | 83 | 0 | 102 | 92 | 1615 | 19 | 1 | 1727 | 54 | 13 | 10 | 0 | 77 | 2758 |
| 8:00 AM | 5 | 256 | 1 | 0 | 262 | 2 | 7 | 20 | 0 | 29 | 29 | 396 | 6 | 2 | 433 | 20 | 2 | 6 | 0 | 28 | 752 |
| 8:15 AM | 5 | 188 | 2 | 0 | 195 | 2 | 10 | 15 | 0 | 27 | 34 | 426 | 4 | 0 | 464 | 13 | 0 | 6 | 0 | 19 | 705 |
| 8:30 AM | 8 | 162 | 1 | 1 | 172 | 2 | 5 | 14 | 0 | 21 | 26 | 329 | 9 | 0 | 364 | 4 | 4 | 4 | 0 | 12 | 569 |
| 8:45 AM | 6 | 145 | 1 | 1 | 153 | 1 | 6 | 15 | 0 | 22 | 21 | 306 | 8 | 0 | 335 | 12 | 8 | 3 | 0 | 23 | 533 |
| Hourly Total | 24 | 751 | 5 | 2 | 782 | 7 | 28 | 64 | 0 | 99 | 110 | 1457 | 27 | 2 | 1596 | 49 | 14 | 19 | 0 | 82 | 2559 |
| *** BREAK *** | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 4:30 PM | 7 | 419 | 11 | 1 | 438 | 1 | 5 | 12 | 0 | 18 | 31 | 226 | 7 | 0 | 264 | 18 | 7 | 4 | 0 | 29 | 749 |
| 4:45 PM | 9 | 390 | 6 | 0 | 405 | 3 | 6 | 22 | 0 | 31 | 16 | 289 | 9 | 0 | 314 | 9 | 21 | 10 | 0 | 40 | 790 |
| Hourly Total | 16 | 809 | 17 | 1 | 843 | 4 | 11 | 34 | 0 | 49 | 47 | 515 | 16 | 0 | 578 | 27 | 28 | 14 | 0 | 69 | 1539 |
| 5:00 PM | 12 | 413 | 7 | 0 | 432 | 0 | 13 | 12 | 0 | 25 | 26 | 299 | 11 | 0 | 336 | 8 | 15 | 4 | 0 | 27 | 820 |
| 5:15 PM | 11 | 380 | 3 | 0 | 394 | 2 | 12 | 12 | 0 | 26 | 27 | 312 | 13 | 0 | 352 | 10 | 15 | 9 | 0 | 34 | 806 |
| 5:30 PM | 6 | 388 | 8 | 0 | 402 | 2 | 6 | 22 | 0 | 30 | 34 | 274 | 5 | 1 | 314 | 8 | 15 | 6 | 0 | 29 | 775 |
| 5:45 PM | 4 | 330 | 2 | 1 | 337 | 6 | 10 | 15 | 0 | 31 | 21 | 305 | 8 | 1 | 335 | 8 | 15 | 7 | 0 | 30 | 733 |
| Hourly Total | 33 | 1511 | 20 | 1 | 1565 | 10 | 41 | 61 | 0 | 112 | 108 | 1190 | 37 | 2 | 1337 | 34 | 60 | 26 | 0 | 120 | 3134 |
| 6:00 PM | 5 | 244 | 6 | 0 | 255 | 1 | 9 | 15 | 0 | 25 | 25 | 241 | 10 | 0 | 276 | 19 | 11 | 7 | 0 | 37 | 593 |
| 6:15 PM | 5 | 242 | 5 | 0 | 252 | 1 | 7 | 11 | 0 | 19 | 21 | 224 | 9 | 0 | 254 | 12 | 13 | 6 | 0 | 31 | 556 |
| Grand Total | 102 | 4388 | 55 | 4 | 4549 | 29 | 109 | 268 | 0 | 406 | 403 | 5242 | 118 | 5 | 5768 | 195 | 139 | 82 | 0 | 416 | 11139 |
| Approach % | 2.2 | 96.5 | 1.2 | 0.1 | - | 7.1 | 26.8 | 66.0 | 0.0 | - | 7.0 | 90.9 | 2.0 | 0.1 | - | 46.9 | 33.4 | 19.7 | 0.0 | - | - |
| Total % | 0.9 | 39.4 | 0.5 | 0.0 | 40.8 | 0.3 | 1.0 | 2.4 | 0.0 | 3.6 | 3.6 | 47.1 | 1.1 | 0.0 | 51.8 | 1.8 | 1.2 | 0.7 | 0.0 | 3.7 | - |
| Lights | 101 | 4347 | 55 | 4 | 4507 | 29 | 108 | 260 | 0 | 397 | 388 | 5200 | 107 | 5 | 5700 | 184 | 135 | 82 | 0 | 401 | 11005 |
| % Lights | 99.0 | 99.1 | 100.0 | 100.0 | 99.1 | 100.0 | 99.1 | 97.0 | - | 97.8 | 96.3 | 99.2 | 90.7 | 100.0 | 98.8 | 94.4 | 97.1 | 100.0 | - | 96.4 | 98.8 |
| Mediums | 1 | 34 | 0 | 0 | 35 | 0 | 1 | 8 | 0 | 9 | 13 | 36 | 8 | 0 | 57 | 7 | 4 | 0 | 0 | 11 | 112 |
| % Mediums | 1.0 | 0.8 | 0.0 | 0.0 | 0.8 | 0.0 | 0.9 | 3.0 | - | 2.2 | 3.2 | 0.7 | 6.8 | 0.0 | 1.0 | 3.6 | 2.9 | 0.0 | - | 2.6 | 1.0 |
| Articulated Trucks | 0 | 7 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 3 | 0 | 11 | 4 | 0 | 0 | 0 | 4 | 22 |
| % Articulated Trucks | 0.0 | 0.2 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.5 | 0.1 | 2.5 | 0.0 | 0.2 | 2.1 | 0.0 | 0.0 | - | 1.0 | 0.2 |



Turning Movement Data Plot

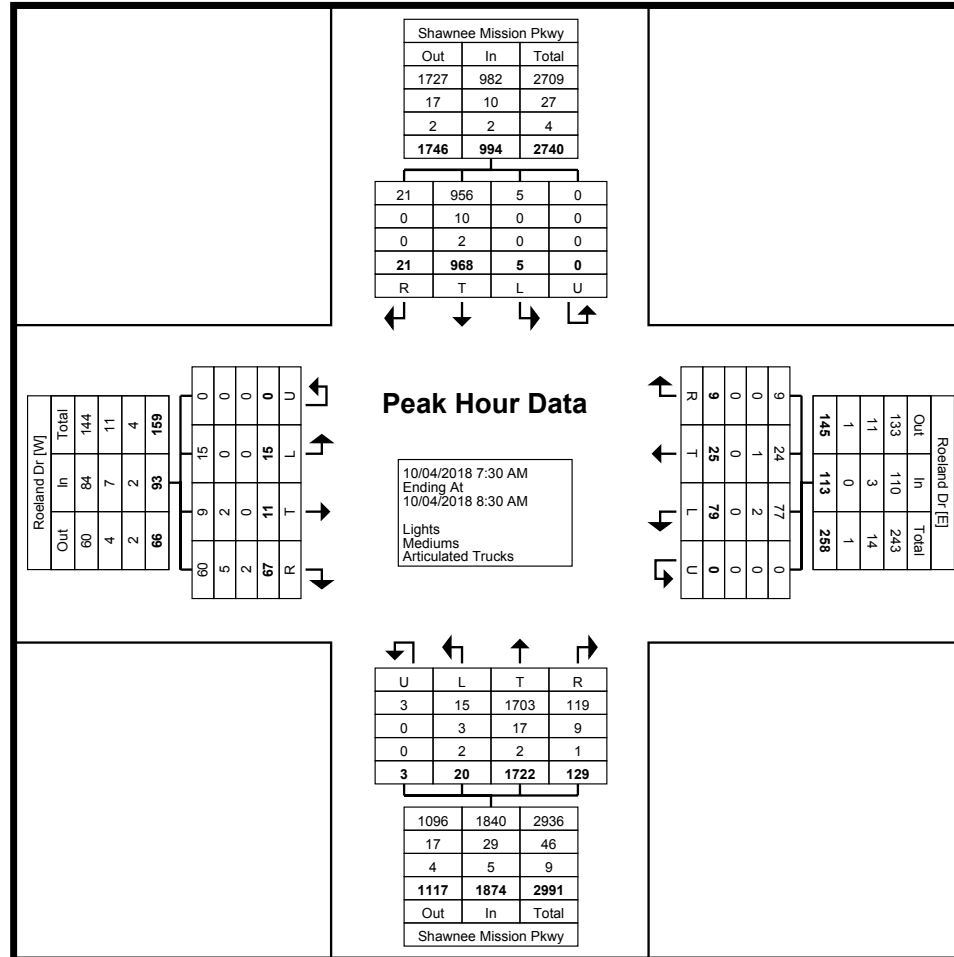
Olsson Associates : Overland Park
7301 West 133rd St

Overland Park, Kansas, United States 66213
913.381.1170 tmchenry@olssonassociates.com

Count Name: Roeland Dr & Shawnee Mission
Pkwy
Site Code:
Start Date: 10/04/2018
Page No: 3

Turning Movement Peak Hour Data (7:30 AM)

| Start Time | Shawnee Mission Pkwy Southbound | | | | | Roeland Dr Westbound | | | | | Shawnee Mission Pkwy Northbound | | | | | Roeland Dr Eastbound | | | | | Int. Total |
|----------------------|------------------------------------|-------|-------|--------|------------|-------------------------|-------|-------|--------|------------|------------------------------------|-------|-------|--------|------------|-------------------------|-------|-------|--------|------------|------------|
| | Right | Thru | Left | U-Turn | App. Total | Right | Thru | Left | U-Turn | App. Total | Right | Thru | Left | U-Turn | App. Total | Right | Thru | Left | U-Turn | App. Total | |
| 7:30 AM | 4 | 288 | 1 | 0 | 293 | 2 | 3 | 25 | 0 | 30 | 28 | 448 | 2 | 1 | 479 | 20 | 4 | 2 | 0 | 26 | 828 |
| 7:45 AM | 7 | 236 | 1 | 0 | 244 | 3 | 5 | 19 | 0 | 27 | 38 | 452 | 8 | 0 | 498 | 14 | 5 | 1 | 0 | 20 | 789 |
| 8:00 AM | 5 | 256 | 1 | 0 | 262 | 2 | 7 | 20 | 0 | 29 | 29 | 396 | 6 | 2 | 433 | 20 | 2 | 6 | 0 | 28 | 752 |
| 8:15 AM | 5 | 188 | 2 | 0 | 195 | 2 | 10 | 15 | 0 | 27 | 34 | 426 | 4 | 0 | 464 | 13 | 0 | 6 | 0 | 19 | 705 |
| Total | 21 | 968 | 5 | 0 | 994 | 9 | 25 | 79 | 0 | 113 | 129 | 1722 | 20 | 3 | 1874 | 67 | 11 | 15 | 0 | 93 | 3074 |
| Approach % | 2.1 | 97.4 | 0.5 | 0.0 | - | 8.0 | 22.1 | 69.9 | 0.0 | - | 6.9 | 91.9 | 1.1 | 0.2 | - | 72.0 | 11.8 | 16.1 | 0.0 | - | - |
| Total % | 0.7 | 31.5 | 0.2 | 0.0 | 32.3 | 0.3 | 0.8 | 2.6 | 0.0 | 3.7 | 4.2 | 56.0 | 0.7 | 0.1 | 61.0 | 2.2 | 0.4 | 0.5 | 0.0 | 3.0 | - |
| PHF | 0.750 | 0.840 | 0.625 | 0.000 | 0.848 | 0.750 | 0.625 | 0.790 | 0.000 | 0.942 | 0.849 | 0.952 | 0.625 | 0.375 | 0.941 | 0.838 | 0.550 | 0.625 | 0.000 | 0.830 | 0.928 |
| Lights | 21 | 956 | 5 | 0 | 982 | 9 | 24 | 77 | 0 | 110 | 119 | 1703 | 15 | 3 | 1840 | 60 | 9 | 15 | 0 | 84 | 3016 |
| % Lights | 100.0 | 98.8 | 100.0 | - | 98.8 | 100.0 | 96.0 | 97.5 | - | 97.3 | 92.2 | 98.9 | 75.0 | 100.0 | 98.2 | 89.6 | 81.8 | 100.0 | - | 90.3 | 98.1 |
| Mediums | 0 | 10 | 0 | 0 | 10 | 0 | 1 | 2 | 0 | 3 | 9 | 17 | 3 | 0 | 29 | 5 | 2 | 0 | 0 | 7 | 49 |
| % Mediums | 0.0 | 1.0 | 0.0 | - | 1.0 | 0.0 | 4.0 | 2.5 | - | 2.7 | 7.0 | 1.0 | 15.0 | 0.0 | 1.5 | 7.5 | 18.2 | 0.0 | - | 7.5 | 1.6 |
| Articulated Trucks | 0 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 2 | 0 | 5 | 2 | 0 | 0 | 0 | 2 | 9 |
| % Articulated Trucks | 0.0 | 0.2 | 0.0 | - | 0.2 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.8 | 0.1 | 10.0 | 0.0 | 0.3 | 3.0 | 0.0 | 0.0 | - | 2.2 | 0.3 |



Turning Movement Peak Hour Data Plot (7:30 AM)

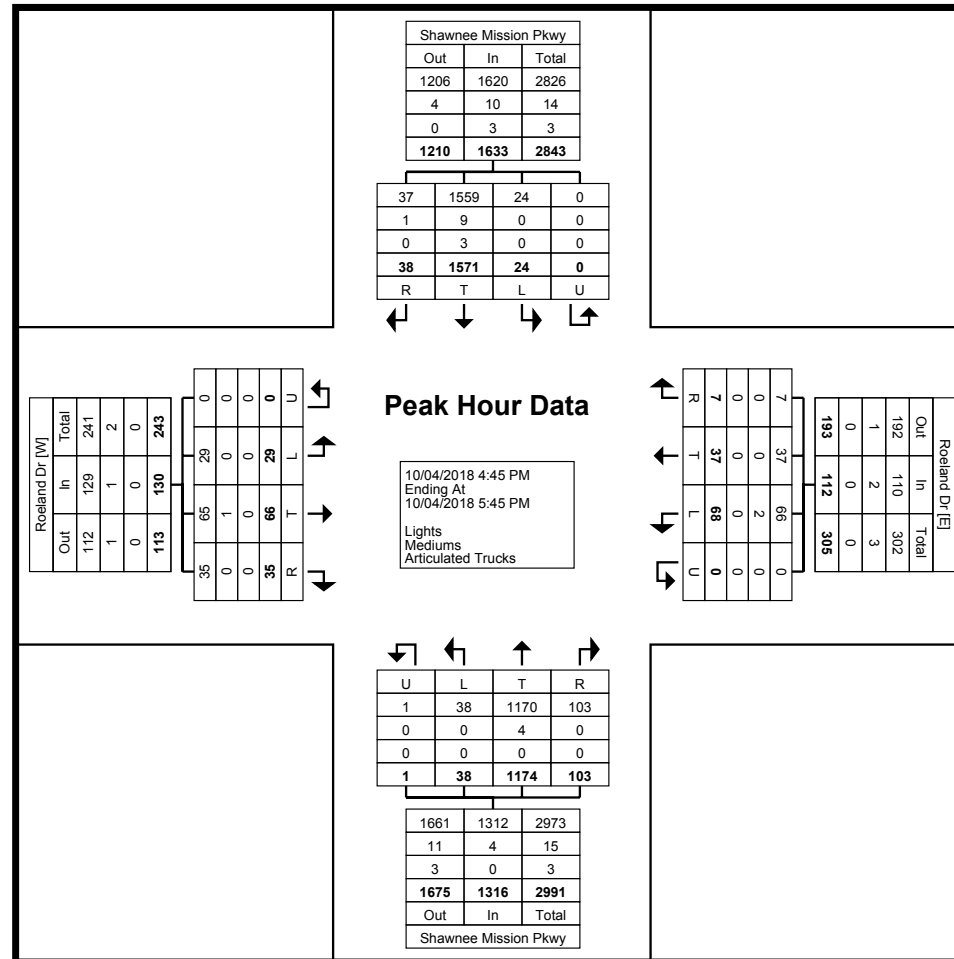
Olsson Associates : Overland Park
7301 West 133rd St

Overland Park, Kansas, United States 66213
913.381.1170 tmchenry@olssonassociates.com

Count Name: Roeland Dr & Shawnee Mission
Pkwy
Site Code:
Start Date: 10/04/2018
Page No: 5

Turning Movement Peak Hour Data (4:45 PM)

| Start Time | Shawnee Mission Pkwy Southbound | | | | | Roeland Dr Westbound | | | | | Shawnee Mission Pkwy Northbound | | | | | Roeland Dr Eastbound | | | | | Int. Total |
|----------------------|------------------------------------|-------|-------|--------|------------|-------------------------|-------|-------|--------|------------|------------------------------------|-------|-------|--------|------------|-------------------------|-------|-------|--------|------------|------------|
| | Right | Thru | Left | U-Turn | App. Total | Right | Thru | Left | U-Turn | App. Total | Right | Thru | Left | U-Turn | App. Total | Right | Thru | Left | U-Turn | App. Total | |
| 4:45 PM | 9 | 390 | 6 | 0 | 405 | 3 | 6 | 22 | 0 | 31 | 16 | 289 | 9 | 0 | 314 | 9 | 21 | 10 | 0 | 40 | 790 |
| 5:00 PM | 12 | 413 | 7 | 0 | 432 | 0 | 13 | 12 | 0 | 25 | 26 | 299 | 11 | 0 | 336 | 8 | 15 | 4 | 0 | 27 | 820 |
| 5:15 PM | 11 | 380 | 3 | 0 | 394 | 2 | 12 | 12 | 0 | 26 | 27 | 312 | 13 | 0 | 352 | 10 | 15 | 9 | 0 | 34 | 806 |
| 5:30 PM | 6 | 388 | 8 | 0 | 402 | 2 | 6 | 22 | 0 | 30 | 34 | 274 | 5 | 1 | 314 | 8 | 15 | 6 | 0 | 29 | 775 |
| Total | 38 | 1571 | 24 | 0 | 1633 | 7 | 37 | 68 | 0 | 112 | 103 | 1174 | 38 | 1 | 1316 | 35 | 66 | 29 | 0 | 130 | 3191 |
| Approach % | 2.3 | 96.2 | 1.5 | 0.0 | - | 6.3 | 33.0 | 60.7 | 0.0 | - | 7.8 | 89.2 | 2.9 | 0.1 | - | 26.9 | 50.8 | 22.3 | 0.0 | - | - |
| Total % | 1.2 | 49.2 | 0.8 | 0.0 | 51.2 | 0.2 | 1.2 | 2.1 | 0.0 | 3.5 | 3.2 | 36.8 | 1.2 | 0.0 | 41.2 | 1.1 | 2.1 | 0.9 | 0.0 | 4.1 | - |
| PHF | 0.792 | 0.951 | 0.750 | 0.000 | 0.945 | 0.583 | 0.712 | 0.773 | 0.000 | 0.903 | 0.757 | 0.941 | 0.731 | 0.250 | 0.935 | 0.875 | 0.786 | 0.725 | 0.000 | 0.813 | 0.973 |
| Lights | 37 | 1559 | 24 | 0 | 1620 | 7 | 37 | 66 | 0 | 110 | 103 | 1170 | 38 | 1 | 1312 | 35 | 65 | 29 | 0 | 129 | 3171 |
| % Lights | 97.4 | 99.2 | 100.0 | - | 99.2 | 100.0 | 100.0 | 97.1 | - | 98.2 | 100.0 | 99.7 | 100.0 | 100.0 | 99.7 | 100.0 | 98.5 | 100.0 | - | 99.2 | 99.4 |
| Mediums | 1 | 9 | 0 | 0 | 10 | 0 | 0 | 2 | 0 | 2 | 0 | 4 | 0 | 0 | 4 | 0 | 1 | 0 | 0 | 1 | 17 |
| % Mediums | 2.6 | 0.6 | 0.0 | - | 0.6 | 0.0 | 0.0 | 2.9 | - | 1.8 | 0.0 | 0.3 | 0.0 | 0.0 | 0.3 | 0.0 | 1.5 | 0.0 | - | 0.8 | 0.5 |
| Articulated Trucks | 0 | 3 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| % Articulated Trucks | 0.0 | 0.2 | 0.0 | - | 0.2 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.1 |



Turning Movement Peak Hour Data Plot (4:45 PM)

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Count Name: Roeland Dr & Shawnee Mission
Pkwy
Site Code:
Start Date: 10/04/2018
Page No: 7

Signal Timings

Configuration Submenu

MM-1-1-1 Phase Ring Assignment (PRI = Priority)

| Sequence 1 | | | | | | | | | | | | | | | | | |
|------------|-------------------|----------|----------|----------|-----------|-----------|-----------|-----------|----|----|----|----|----|----|----|----|------------------------------|
| | CONFIGURE UTILITY | | | | <i>F</i> | | | | | | | | | | | | HW ALTERNATE SEQUENCE ENABLE |
| PRI | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | |
| BC | : | | | | | | | | | | | | | | | | |
| R1 | <i>1</i> | <i>2</i> | <i>3</i> | <i>4</i> | <i>9</i> | <i>10</i> | <i>13</i> | <i>14</i> | | | | | | | | | |
| R2 | <i>5</i> | <i>6</i> | <i>7</i> | <i>8</i> | <i>11</i> | <i>12</i> | <i>15</i> | <i>6</i> | | | | | | | | | |
| R3 | | | | | | | | | | | | | | | | | |
| R4 | | | | | | | | | | | | | | | | | |

| Sequence 2 | | | | | | | | | | | | | | | | |
|------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| PRI | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| BC | | | | | | | | | | | | | | | | |
| R1 | | | | | | | | | | | | | | | | |
| R2 | | | | | | | | | | | | | | | | |
| R3 | | | | | | | | | | | | | | | | |
| R4 | | | | | | | | | | | | | | | | |

| Sequence 3 | | | | | | | | | | | | | | | | |
|------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| PRI | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| BC | | | | | | | | | | | | | | | | |
| R1 | | | | | | | | | | | | | | | | |
| R2 | | | | | | | | | | | | | | | | |
| R3 | | | | | | | | | | | | | | | | |
| R4 | | | | | | | | | | | | | | | | |

| Sequence 4 | | | | | | | | | | | | | | | | |
|------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| PRI | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| BC | | | | | | | | | | | | | | | | |
| R1 | | | | | | | | | | | | | | | | |
| R2 | | | | | | | | | | | | | | | | |
| R3 | | | | | | | | | | | | | | | | |
| R4 | | | | | | | | | | | | | | | | |

Controller Submenu

MM-2-1 Controller Timing Data, sheet 1 of 2

| TIMING PLAN _____ | Johnson Dr & Roe | | | | | | | | | | | | | | | |
|--------------------------------------|------------------|----|----|----|----|----|----|----|---|----|----|----|----|----|----|----|
| PHASE | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| MINIMUM GREEN | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | | | | | | | | |
| BICYCLE MINIMUM GREEN | | | | | | | | | | | | | | | | |
| CONDITIONAL SERVICE MIN. GREEN | | | | | | | | | | | | | | | | |
| DELAYED GREEN | | | | | | | | | | | | | | | | |
| WALK | | 9 | | | | | | 8 | | | | | | | | |
| WALK 2 | | | | | | | | | | | | | | | | |
| WALK MAX | | | | | | | | | | | | | | | | |
| PEDESTRIAN CLEARANCE | | 31 | | | | | | 30 | | | | | | | | |
| PEDESTRIAN CLEARANCE 2 | | | | | | | | | | | | | | | | |
| PEDESTRIAN CLEARANCE MAX | | | | | | | | | | | | | | | | |
| PEDESTRIAN CARRY OVER | | | | | | | | | | | | | | | | |
| VEHICLE EXTENSION | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | | | | | | | | |
| VEHICLE EXTENSION 2 | | | | | | | | | | | | | | | | |
| MAX1 | 15 | 18 | 33 | 33 | 22 | 22 | 33 | 33 | | | | | | | | |
| MAX2 | | | | | | | | | | | | | | | | |
| MAX3 | | | | | | | | | | | | | | | | |
| DYNAMIC MAX | | | | | | | | | | | | | | | | |
| DYNAMIC MAX STEP | | | | | | | | | | | | | | | | |
| YELLOW CHANGE | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | | | | | | | | |
| RED CLEARANCE | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | | | | | | | | |
| RED MAX | | | | | | | | | | | | | | | | |
| RED REVERT | | | | | | | | | | | | | | | | |
| ACTUATIONS BEFORE GAP REDUCTION | | | | | | | | | | | | | | | | |
| SECONDS PER ACTIONS ADDED TO INITIAL | | | | | | | | | | | | | | | | |
| MAXIMUM ADDED INITIAL GREEN | | | | | | | | | | | | | | | | |
| TIME BEFORE GAP REDUCTION | | | | | | | | | | | | | | | | |
| CARS WAITING BEFORE GAP REDUCTION | | | | | | | | | | | | | | | | |
| STEP TO REDUCE | | | | | | | | | | | | | | | | |
| TIME TO REDUCE TO MINIMUM | | | | | | | | | | | | | | | | |
| MINIMUM GAP | | | | | | | | | | | | | | | | |

MM-2-4 Guaranteed Minimum Times

| OL/PHASE | A01 | B02 | C03 | D04 | E05 | F06 | G07 | H08 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|
| MIN GRN | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| WALK | | | | | | | | |
| PED CLR | | | | | | | | |
| YELLOW | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| RED CLR | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| OVL GRN | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |

| OL/PHASE | I09 | J10 | K11 | L12 | M13 | N14 | O15 | P16 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|
| MIN GRN | | | | | | | | |
| WALK | | | | | | | | |
| PED CLR | | | | | | | | |
| YELLOW | | | | | | | | |
| RED CLR | | | | | | | | |
| OVL GRN | | | | | | | | |

MM-2-5 Start/Flash Data

| START UP | | | | | | | | | | | | | | | | |
|----------------|----|------------|---|---|---|---|---|--------------|---|----|----|----|----|----|----|----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| PHASE | | Y | | | | Y | | | | | | | | | | |
| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P |
| OVERLAP | X | X | X | X | | | | | | | | | | | | |
| FLASH>MON. | NO | FLASH TIME | | | | | 0 | ALL RED TIME | | | | | 8 | | | |
| PWR START SEQ. | | | | | | | | | | | | | | | | |

| AUTOMATIC FLASH | | | | | | | | | | | | | | | | |
|-----------------|----|------------|---|---|---|---|---|-----------|---|----|----|----------------------|----|----|----|----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| ENTRY | | X | | | | X | | | | | | | | | | |
| EXIT | | X | | | | X | | | | | | | | | | |
| OVERLAP | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P |
| EXIT | X | X | X | X | | | | | | | | | | | | |
| FLASH>MON. | NO | EXIT FLASH | | | | | W | MIN FLASH | | | | | 8 | | | |
| MINIMUM RECALL | NO | | | | | | | | | | | CYCLE THROUGH PHASES | | NO | | |

MM-2-8 Phase Recall Options

| TIMING PLAN NUMBER [1] | | | | | | | | | | | | | | | | |
|------------------------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|
| PHASE | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| LOCK DET INPUT | | | | | | | | | | | | | | | | |
| VEH RECALL | | | | X | | | | λ | | | | | | | | |
| PED RECALL | | | | | | | | | | | | | | | | |
| MAX TIME RECALL | | | | | | | | | | | | | | | | |
| SOFT RECALL | | | | | | | | | | | | | | | | |
| NO REST IN PHASE | | | | | | | | | | | | | | | | |
| ADDED INIT CALC | | | | | | | | | | | | | | | | |
| TIMING PLAN NUMBER [2] | | | | | | | | | | | | | | | | |
| PHASE | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| LOCK DET INPUT | | | | | | | | | | | | | | | | |
| VEH RECALL | | | | | | | | | | | | | | | | |
| PED RECALL | | | | | | | | | | | | | | | | |
| MAX TIME RECALL | | | | | | | | | | | | | | | | |
| SOFT RECALL | | | | | | | | | | | | | | | | |
| NO REST IN PHASE | | | | | | | | | | | | | | | | |
| ADDED INIT CALC | | | | | | | | | | | | | | | | |
| TIMING PLAN NUMBER [3] | | | | | | | | | | | | | | | | |
| PHASE | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| LOCK DET INPUT | | | | | | | | | | | | | | | | |
| VEH RECALL | | | | | | | | | | | | | | | | |
| PED RECALL | | | | | | | | | | | | | | | | |
| MAX TIME RECALL | | | | | | | | | | | | | | | | |
| SOFT RECALL | | | | | | | | | | | | | | | | |
| NO REST IN PHASE | | | | | | | | | | | | | | | | |
| ADDED INIT CALC | | | | | | | | | | | | | | | | |
| TIMING PLAN NUMBER [4] | | | | | | | | | | | | | | | | |
| PHASE | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| LOCK DET INPUT | | | | | | | | | | | | | | | | |
| VEH RECALL | | | | | | | | | | | | | | | | |
| PED RECALL | | | | | | | | | | | | | | | | |
| MAX TIME RECALL | | | | | | | | | | | | | | | | |
| SOFT RECALL | | | | | | | | | | | | | | | | |
| NO REST IN PHASE | | | | | | | | | | | | | | | | |
| ADDED INIT CALC | | | | | | | | | | | | | | | | |

Coordinator Submenu

MM-3-1 Coordinator Options

| COORD OPTIONS | | | |
|-----------------|---------------|-----------------|----------------|
| MANUAL PATTERN | <i>AUTO</i> | ECPI COORD | <i>YES</i> |
| SYSTEM SOURCE | <i>TBC</i> | SYSTEM FORMAT | <i>STD</i> |
| SPLITS IN | <i>90</i> | OFFSET IN | <i>Sec's</i> |
| TRANSITION | <i>Smooth</i> | MAX SELECT | <i>Max JVA</i> |
| DWELL/ADD TIME | <i>0</i> | ENABLE MAN SYNC | <i>NO</i> |
| DLY COORD WK-LZ | <i>NO</i> | FORCE OFF | <i>FLOAT</i> |
| OFFSET REF | <i>LEAD</i> | CAL USE PED TM | <i>YES</i> |
| PED RECALL | <i>NO</i> | PED RESERVE | <i>NO</i> |
| LOCAL ZERO OVRD | <i>NO</i> | FO ADD INI GRN | <i>NO</i> |
| RE-SYNC COUNT | <i>0</i> | MULTISYNC | <i>NO</i> |

MM-3-2 Coordinator Pattern, sheet 1 of 2

| | |
|----------------------|-------|
| COORDINATOR PATTERN | 1 |
| USE SPLIT PATTERN | 1 |
| TS2 PATTERN / OFFSET | 4-1 |
| CYCLE | 100's |
| OFFSET VAL | 45 |
| ACTUATED COORD | Yes |
| ACT WALK REST | NO |
| PHASE RESERVICE | NO |
| MAX SELECT | NONE |

| | |
|----------------|------|
| STD (COS) | 111 |
| DWELL/ADD TIME | 0 |
| TIMING PLAN | 1 |
| SEQUENCE | 0 |
| ACTION PLAN | 1 |
| FORCE OFF | NONE |

| SPLIT PREFERENCE PHASES | | | | | | | | |
|-------------------------|----|----|----|-------------|----|----|----|----|
| PHASE | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| SPLIT PATTERN | 15 | 35 | 15 | 35 | 15 | 35 | 15 | 35 |
| PREF 1 | | | | | | | | |
| PREF 2 | | | | | | | | |
| SPLT EXT | | | | | | | | |
| VEH PERM | | | | | | | | |
| RING DISP | | | | | | | | |
| | | | | DISP | | | | |
| | | | | (RINGS 2-4) | | | | |

| SPLIT PREFERENCE PHASES | | | | | | | | |
|-------------------------|---|----|----|----|----|----|----|----|
| PHASE | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| SPLIT PATTERN | | | | | | | | |
| PREF 1 | | | | | | | | |
| PREF 2 | | | | | | | | |

| SPLIT DEMAND PATTERN (1 or 2) | | | | | | | | X ARTERY PATTERN | | | | | | | | |
|-------------------------------|---|---|---|---|---|---|---|------------------|---|----|----|----|----|----|----|----|
| PHASE | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| COORD | | | | X | | | | X | | | | | | | | |
| VE RCALL | | | | | | | | | | | | | | | | |
| PD RCALL | | | | | | | | | | | | | | | | |
| MX RCALL | | | | | | | | | | | | | | | | |
| OMIT | | | | | | | | | | | | | | | | |
| SF OUT | | | | | | | | | | | | | | | | |
| | | | | | | | | (1-8) | | | | | | | | |

MM-3-2 Coordinator Pattern, sheet 1 of 2

| | |
|----------------------|-------|
| COORDINATOR PATTERN | 2 |
| USE SPLIT PATTERN | 2 |
| TS2 PATTERN / OFFSET | 0-2 |
| CYCLE | 100's |
| OFFSET VAL | 70 |
| ACTUATED COORD | YES |
| ACT WALK REST | NO |
| PHASE RESERVICE | NO |
| MAX SELECT | NONE |

| | |
|----------------|-------|
| STD (COS) | 121 |
| DWELL/ADD TIME | Ø |
| TIMING PLAN | 1 |
| SEQUENCE | Ø |
| ACTION PLAN | 2 |
| FORCE OFF | FLOAT |

| SPLIT PREFERENCE PHASES | | | | | | | | |
|-------------------------|-------------|----|----|----|----|----|----|----|
| PHASE | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| SPLIT PATTERN | 2 18 | 19 | 18 | 45 | 13 | 24 | 17 | 46 |
| PREF 1 | | | | | | | | |
| PREF 2 | | | | | | | | |
| SPLT EXT | | | | | | | | |
| VEH PERM | | | | | | | | |
| RING DISP | (RINGS 2-4) | | | | | | | |

| SPLIT PREFERENCE PHASES | | | | | | | | |
|-------------------------|---|----|----|----|----|----|----|----|
| PHASE | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| SPLIT PATTERN | | | | | | | | |
| PREF 1 | | | | | | | | |
| PREF 2 | | | | | | | | |

| SPLIT DEMAND PATTERN (1 or 2) | | | | | | | | X ARTERY PATTERN | | | | | | | | |
|-------------------------------|---|---|---|---|---|---|---|------------------|-------|----|----|----|----|----|----|----|
| PHASE | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| COORD | | | | X | | | | X | | | | | | | | |
| VE RCALL | | | | | | | | | | | | | | | | |
| PD RCALL | | | | | | | | | | | | | | | | |
| MX RCALL | | | | | | | | | | | | | | | | |
| OMIT | | | | | | | | | | | | | | | | |
| SF OUT | | | | | | | | | (1-8) | | | | | | | |

MM-3-2 Coordinator Pattern, sheet 1 of 2

| | |
|----------------------|-------|
| COORDINATOR PATTERN | 3 |
| USE SPLIT PATTERN | 3 |
| TS2 PATTERN / OFFSET | 0-3 |
| CYCLE | 100's |
| OFFSET VAL | 90 |
| ACTUATED COORD | yes |
| ACT WALK REST | NO |
| PHASE RESERVICE | NO |
| MAX SELECT | None |

| | |
|----------------|-------|
| STD (COS) | 131 |
| DWELL/ADD TIME | 0 |
| TIMING PLAN | 1 |
| SEQUENCE | 0 |
| ACTION PLAN | 2 |
| FORCE OFF | Flopt |

| SPLIT PREFERENCE PHASES | | | | | | | | | | | | | | | | |
|-------------------------|-------------|----|---|----|---|----|---|----|---|----|---|----|---|----|---|----|
| PHASE | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | |
| SPLIT PATTERN | 3 | 19 | | 24 | | 15 | | 42 | | 14 | | 29 | | 18 | | 39 |
| PREF 1 | | | | | | | | | | | | | | | | |
| PREF 2 | | | | | | | | | | | | | | | | |
| SPLT EXT | | | | | | | | | | | | | | | | |
| VEH PERM | | | | | | | | | | | | | | | | |
| RING DISP | | | | | | | | | | | | | | | | |
| DISP | (RINGS 2-4) | | | | | | | | | | | | | | | |

| SPLIT PREFERENCE PHASES | | | | | | | | | | | | | | | | |
|-------------------------|---|--|----|--|----|--|----|--|----|--|----|--|----|--|----|--|
| PHASE | 9 | | 10 | | 11 | | 12 | | 13 | | 14 | | 15 | | 16 | |
| SPLIT PATTERN | | | | | | | | | | | | | | | | |
| PREF 1 | | | | | | | | | | | | | | | | |
| PREF 2 | | | | | | | | | | | | | | | | |

| SPLIT DEMAND PATTERN (1 or 2) | | | | | | | | | | X ARTERY PATTERN | | | | | | |
|-------------------------------|---|---|---|---|---|---|---|---|---|------------------|----|----|----|----|----|----|
| PHASE | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| COORD | | | | X | | | | X | | | | | | | | |
| VE RCALL | | | | | | | | | | | | | | | | |
| PD RCALL | | | | | | | | | | | | | | | | |
| MX RCALL | | | | | | | | | | | | | | | | |
| OMIT | | | | | | | | | | | | | | | | |
| SF OUT | | | | | | | | | | | | | | | | |

(1-8)

MM-3-3 Split Pattern, sheet 1 of 4

| | | | | | | | | | | | | | | | | | |
|----------------------|--|----|---|----|---|----|---|----|---|----|----|----|----|----|----|----|----|
| SPLIT PATTERN NUMBER | | / | | | | | | | | | | | | | | | |
| PHASE | | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | |
| SPLIT | | 15 | | 35 | | 15 | | 35 | | 15 | | 35 | | 15 | | 35 | |
| PHASE | | 9 | | 10 | | 11 | | 12 | | 13 | | 14 | | 15 | | 16 | |
| SPLIT | | | | | | | | | | | | | | | | | |
| PHASE | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| COORD | | | | | X | | | | X | | | | | | | | |
| VEH RECALL | | | | | | | | | | | | | | | | | |
| PED RECALL | | | | | | | | | | | | | | | | | |
| MAX RECALL | | | | | | | | | | | | | | | | | |
| OMIT | | | | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | |
|----------------------|--|----|---|----|---|----|---|----|---|----|----|----|----|----|----|----|----|
| SPLIT PATTERN NUMBER | | 2 | | | | | | | | | | | | | | | |
| PHASE | | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | |
| SPLIT | | 18 | | 19 | | 18 | | 45 | | 13 | | 24 | | 17 | | 46 | |
| PHASE | | 9 | | 10 | | 11 | | 12 | | 13 | | 14 | | 15 | | 16 | |
| SPLIT | | | | | | | | | | | | | | | | | |
| PHASE | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| COORD | | | | | X | | | | X | | | | | | | | |
| VEH RECALL | | | | | | | | | | | | | | | | | |
| PED RECALL | | | | | | | | | | | | | | | | | |
| MAX RECALL | | | | | | | | | | | | | | | | | |
| OMIT | | | | | | | | | | | | | | | | | |

▪ Appendix D

MM-3-3 Split Pattern, sheet 2 of 4

| | | | | | | | | | | | | | | | | | |
|----------------------|--|----|---|----|---|----|---|----|---|----|----|----|----|----|----|----|----|
| SPLIT PATTERN NUMBER | | 3 | | | | | | | | | | | | | | | |
| PHASE | | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | |
| SPLIT | | 19 | | 24 | | 15 | | 42 | | 14 | | 29 | | 18 | | 39 | |
| PHASE | | 9 | | 10 | | 11 | | 12 | | 13 | | 14 | | 15 | | 16 | |
| SPLIT | | | | | | | | | | | | | | | | | |
| PHASE | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| COORD | | | | | X | | | | X | | | | | | | | |
| VEH RECALL | | | | | | | | | | | | | | | | | |
| PED RECALL | | | | | | | | | | | | | | | | | |
| MAX RECALL | | | | | | | | | | | | | | | | | |
| OMIT | | | | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | |
|----------------------|--|---|---|----|---|----|---|----|---|----|----|----|----|----|----|----|----|
| SPLIT PATTERN NUMBER | | | | | | | | | | | | | | | | | |
| PHASE | | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | |
| SPLIT | | | | | | | | | | | | | | | | | |
| PHASE | | 9 | | 10 | | 11 | | 12 | | 13 | | 14 | | 15 | | 16 | |
| SPLIT | | | | | | | | | | | | | | | | | |
| PHASE | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| COORD | | | | | | | | | | | | | | | | | |
| VEH RECALL | | | | | | | | | | | | | | | | | |
| PED RECALL | | | | | | | | | | | | | | | | | |
| MAX RECALL | | | | | | | | | | | | | | | | | |
| OMIT | | | | | | | | | | | | | | | | | |

Preemptor Submenu

MM-4-1 Preemptor, sheet 1 of 2

| PREEMPTOR NUMBER | | 3 | | | | | | | | | | | | | | | |
|------------------------------|-----------|---|----|---------------------------|--------|---|-------------------------------|---|--------|--------|----|----------------------------|--------|----|----|----|-----|
| VEH/PED | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | |
| OVERLAP | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | |
| TRACKCLR V | | | | | | | | | | | | | | | | | |
| TRACKCLR O | | | | | | | | | | | | | | | | | |
| ENATRL | | | | | | | | | | | | | | | | | |
| DWEL VEH | | | | X | | | X | | | | | | | | | | |
| DWEL PED | | | | | | | | | | | | | | | | | |
| DWEL OLP | | | | | | | | | | | | | | | | | |
| CYC VEH | | | | | | | | | | | | | | | | | |
| CYC PED | | | | | | | | | | | | | | | | | |
| CYC OLP | | | | | | | | | | | | | | | | | |
| EXIT PH | | | | X | | | | X | | | | | | | | | |
| EXIT CAL | | | | | | | | | | | | | | | | | |
| SP FUNC | | | | | | | | | | | | | | | | | |
| ENABLE | yes | | | PREEMPTION OVERRIDE | | | | | - | | | INTERLOCK ENABLE | | | | | NO |
| NON-LOCK INPUT | - | | | DELAY TIME (SECONDS) | | | | | ∅ | | | INHIBIT TIME (SECONDS) | | | | | ∅ |
| AUTOMATIC FLASH HAS PRIORITY | X | | | DURATION TIME (SECONDS) | | | | | ∅ | | | RED CLEAR GOES GREEN | | | | | NO |
| TERMINATE OVERLAPS ASAP | NO | | | PED CLEAR THRU YELLOW | | | | | NO | | | TERM PH | | | | | NO |
| PED DARK | NO | | | TRACK CLEARANCE RESERVICE | | | | | NO | | | DWELL FL | | | | | OFF |
| LINKED PREEMPTOR | ∅ | | | FLASH EXIT COLOR | | | | | GRN | | | PREEMPTION TO COORDINATION | | | | | OFF |
| EXIT TIMING PLAN | ∅ | | | RESERVICE TIME | | | | | ∅ | | | | | | | | |
| FREE DURING PREEMPTION | RING 1 | | NO | | RING 2 | | NO | | RING 3 | | NO | | RING 4 | | NO | | |
| TIMING | WALK | | | PED CLEAR | | | MIN GREEN | | | YELLOW | | | RED | | | | |
| ENTRANCE MIN TIMES | ∅ | | | 255 | | | 5 | | | 4 | | | 1 | | | | |
| | MIN GREEN | | | EXT GREEN | | | MAX GREEN | | | YELLOW | | | RED | | | | |
| TRACK CLEAR | ∅ | | | ∅ | | | ∅ | | | 4 | | | 1 | | | | |
| | MIN DWELL | | | PMT EXT | | | MAX TIME | | | YELLOW | | | RED | | | | |
| DWELL/CYCLE - EXIT | 20 | | | ∅ | | | 1∅∅ | | | 4 | | | 1 | | | | |
| PREEMPTOR ACTIVE OUT | | | | ON | | | PREEMPTOR ACTIVE OUT IN DWELL | | | | | | NO | | | | |
| OTHER PRIORITY PREEMPTOR OUT | | | | OFF | | | NON-PRIORITY PREEMPTOR OUT | | | | | | OFF | | | | |
| INHIBIT EXTENSION TIME | | | | ∅ | | | | | | | | | | | | | |

Preemptor Submenu

MM-4-1 Preemptor, sheet 1 of 2

| PREEMPTOR NUMBER | 4 | | | | | | | | | | | | | | | |
|------------------------------|-----------|---------------------------|-----------|-------------------------------|-----------|----|--------|----|-----|----|----|----|----|----|----|----|
| VEH/PED | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| OVERLAP | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P |
| TRACKCLR V | | | | | | | | | | | | | | | | |
| TRACKCLR O | | | | | | | | | | | | | | | | |
| ENA TRL | | | | | | | | | | | | | | | | |
| DWEL VEH | | | X | | | | | X | | | | | | | | |
| DWEL PED | | | | | | | | | | | | | | | | |
| DWEL OLP | | | | | | | | | | | | | | | | |
| CYC VEH | | | | | | | | | | | | | | | | |
| CYC PED | | | | | | | | | | | | | | | | |
| CYC OLP | | | | | | | | | | | | | | | | |
| EXIT PH | | | | X | | | | X | | | | | | | | |
| EXIT CAL | | | | | | | | | | | | | | | | |
| SP FUNC | | | | | | | | | | | | | | | | |
| ENABLE | YES | PREEMPTION OVERRIDE | - | INTERLOCK ENABLE | NO | | | | | | | | | | | |
| NON-LOCK INPUT | - | DELAY TIME (SECONDS) | 0 | INHIBIT TIME (SECONDS) | 0 | | | | | | | | | | | |
| AUTOMATIC FLASH HAS PRIORITY | X | DURATION TIME (SECONDS) | 0 | RED CLEAR GOES GREEN | NO | | | | | | | | | | | |
| TERMINATE OVERLAPS ASAP | NO | PED CLEAR THRU YELLOW | NO | TERM PH | NO | | | | | | | | | | | |
| PED DARK | NO | TRACK CLEARANCE RESERVICE | NO | DWELL FL | OFF | | | | | | | | | | | |
| LINKED PREEMPTOR | 0 | FLASH EXIT COLOR | GRN | PREEMPTION TO COORDINATION | OFF | | | | | | | | | | | |
| EXIT TIMING PLAN | 0 | RESERVICE TIME | 0 | | | | | | | | | | | | | |
| FREE DURING PREEMPTION | RING 1 | NO | RING 2 | NO | RING 3 | NO | RING 4 | NO | | | | | | | | |
| TIMING | WALK | | PED CLEAR | | MIN GREEN | | YELLOW | | RED | | | | | | | |
| ENTRANCE MIN TIMES | 0 | | 255 | | 5 | | 4 | | 1 | | | | | | | |
| | MIN GREEN | | EXT GREEN | | MAX GREEN | | YELLOW | | RED | | | | | | | |
| TRACK CLEAR | 0 | | 0 | | 0 | | 4 | | 1 | | | | | | | |
| | MIN DWELL | | PMT EXT | | MAX TIME | | YELLOW | | RED | | | | | | | |
| DWELL/CYCLE - EXIT | 20 | | 0 | | 100 | | 4 | | 1 | | | | | | | |
| PREEMPTOR ACTIVE OUT | ON | | | PREEMPTOR ACTIVE OUT IN DWELL | | | NO | | | | | | | | | |
| OTHER PRIORITY PREEMPTOR OUT | OFF | | | NON-PRIORITY PREEMPTOR OUT | | | OFF | | | | | | | | | |
| INHIBIT EXTENSION TIME | 0 | | | | | | | | | | | | | | | |

MM-4-1 Preemptor, sheet 2 of 2

| PREEMPTOR NUMBER | | 5 | | | | | | | | | | | | | | | |
|------------------------------|-----------|---------------------------|-------------------------------|----|-----------|----|--------|----------------------------|-----|----|----|----|-----|----|----|----|--|
| VEH/PED | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | |
| OVERLAP | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | |
| TRACKCLR V | | | | | | | | | | | | | | | | | |
| TRACKCLR O | | | | | | | | | | | | | | | | | |
| ENA TRL | | | | | | | | | | | | | | | | | |
| DWEL VEH | | X | | | X | | | | | | | | | | | | |
| DWEL PED | | | | | | | | | | | | | | | | | |
| DWEL OLP | | | | | | | | | | | | | | | | | |
| CYC VEH | | | | | | | | | | | | | | | | | |
| CYC PED | | | | | | | | | | | | | | | | | |
| CYC OLP | | | | | | | | | | | | | | | | | |
| EXIT PH | | X | | | | X | | | | | | | | | | | |
| EXIT CAL | | | | | | | | | | | | | | | | | |
| SP FUNC | | | | | | | | | | | | | | | | | |
| ENABLE | Yes | PREEMPTION OVERRIDE | | | | | - | INTERLOCK ENABLE | | | | | NO | | | | |
| NON-LOCK INPUT | - | DELAY TIME (SECONDS) | | | | | 0 | INHIBIT TIME (SECONDS) | | | | | 0 | | | | |
| AUTOMATIC FLASH HAS PRIORITY | X | DURATION TIME (SECONDS) | | | | | 0 | RED CLEAR GOES GREEN | | | | | NO | | | | |
| TERMINATE OVERLAPS ASAP | NO | PED CLEAR THRU YELLOW | | | | | NO | TERM PH | | | | | NO | | | | |
| PED DARK | NO | TRACK CLEARANCE RESERVICE | | | | | NO | DWELL FL | | | | | OFF | | | | |
| LINKED PREEMPTOR | 0 | FLASH EXIT COLOR | | | | | GEN | PREEMPTION TO COORDINATION | | | | | OFF | | | | |
| EXIT TIMING PLAN | 0 | RESERVICE TIME | | | | | 0 255 | | | | | | | | | | |
| FREE DURING PREEMPTION | RING 1 | NO | RING 2 | NO | RING 3 | NO | RING 4 | NO | | | | | | | | | |
| TIMING | WALK | | PED CLEAR | | MIN GREEN | | YELLOW | | RED | | | | | | | | |
| ENTRANCE MIN TIMES | 0 | | 255 | | 5 | | 4 | | 1 | | | | | | | | |
| | MIN GREEN | | EXT GREEN | | MAX GREEN | | YELLOW | | RED | | | | | | | | |
| TRACK CLEAR | 0 | | 0 | | 0 | | 4 | | 1 | | | | | | | | |
| | MIN DWELL | | PMT EXT | | MAX TIME | | YELLOW | | RED | | | | | | | | |
| DWELL/CYCLE - EXIT | 20 | | 0 | | 100 | | 4 | | 1 | | | | | | | | |
| PREEMPTOR ACTIVE OUT | ON | | PREEMPTOR ACTIVE OUT IN DWELL | | | | | NO | | | | | | | | | |
| OTHER PRIORITY PREEMPTOR OUT | OFF | | NON-PRIORITY PREEMPTOR OUT | | | | | OFF | | | | | | | | | |
| INHIBIT EXTENSION TIME | 0 | | | | | | | | | | | | | | | | |

Preemptor Submenu

MM-4-1 Preemptor, sheet 1 of 2

| PREEMPTOR NUMBER | 6 | | | | | | | | | | | | | | | |
|------------------------------|-----------|---|---------------------------|---|-------------------------------|---|--------|---|--------|----|----------------------------|----|--------|----|-----|----|
| VEH/PED | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| OVERLAP | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P |
| TRACKCLR V | | | | | | | | | | | | | | | | |
| TRACKCLR O | | | | | | | | | | | | | | | | |
| ENATRL | | | | | | | | | | | | | | | | |
| DWEL VEH | X | | | | | X | | | | | | | | | | |
| DWEL PED | | | | | | | | | | | | | | | | |
| DWEL OLP | | | | | | | | | | | | | | | | |
| CYC VEH | | | | | | | | | | | | | | | | |
| CYC PED | | | | | | | | | | | | | | | | |
| CYC OLP | | | | | | | | | | | | | | | | |
| EXIT PH | | X | | | | X | | | | | | | | | | |
| EXIT CAL | | | | | | | | | | | | | | | | |
| SP FUNC | | | | | | | | | | | | | | | | |
| ENABLE | Yes | | PREEMPTION OVERRIDE | | | | - | | | | INTERLOCK ENABLE | | | | NO | |
| NON-LOCK INPUT | - | | DELAY TIME (SECONDS) | | | | 0 | | | | INHIBIT TIME (SECONDS) | | | | 0 | |
| AUTOMATIC FLASH HAS PRIORITY | X | | DURATION TIME (SECONDS) | | | | 0 | | | | RED CLEAR GOES GREEN | | | | NO | |
| TERMINATE OVERLAPS ASAP | NO | | PED CLEAR THRU YELLOW | | | | NO | | | | TERM PH | | | | NO | |
| PED DARK | NO | | TRACK CLEARANCE RESERVICE | | | | NO | | | | DWELL FL | | | | OFF | |
| LINKED PREEMPTOR | 0 | | FLASH EXIT COLOR | | | | GEN | | | | PREEMPTION TO COORDINATION | | | | OFF | |
| EXIT TIMING PLAN | 0 | | RESERVICE TIME | | | | 0 255 | | | | | | | | | |
| FREE DURING PREEMPTION | RING 1 | | NO | | RING 2 | | NO | | RING 3 | | NO | | RING 4 | | NO | |
| TIMING | WALK | | PED CLEAR | | MIN GREEN | | YELLOW | | RED | | | | | | | |
| ENTRANCE MIN TIMES | 0 | | 255 | | 5 | | 4 | | 1 | | | | | | | |
| | MIN GREEN | | EXT GREEN | | MAX GREEN | | YELLOW | | RED | | | | | | | |
| TRACK CLEAR | 0 | | 0 | | 0 | | 4 | | 1 | | | | | | | |
| | MIN DWELL | | PMT EXT | | MAX TIME | | YELLOW | | RED | | | | | | | |
| DWELL/CYCLE - EXIT | 20 | | 0 | | 100 | | 4 | | 1 | | | | | | | |
| PREEMPTOR ACTIVE OUT | ON | | | | PREEMPTOR ACTIVE OUT IN DWELL | | | | NO | | | | | | | |
| OTHER PRIORITY PREEMPTOR OUT | OFF | | | | NON-PRIORITY PREEMPTOR OUT | | | | OFF | | | | | | | |
| INHIBIT EXTENSION TIME | 0 | | | | | | | | | | | | | | | |

▪ Appendix D

MM-4-2 Low Priority Preemptor Selection

| ENABLE PREEMPT FILTERING & TSP/SCP | | |
|------------------------------------|--------|---------|
| FILTERED INPUT | SOLID | PULSING |
| 1 | Bypass | BP |
| 2 | Bypass | BP |
| 3 | Pre 3 | TSP 1 |
| 4 | Pre 4 | TSP 2 |
| 5 | Pre 5 | Pre 9 |
| 6 | Pre 6 | Pre 10 |
| 7 | BP | BP |
| 8 | BP | BP |
| 9 | BP | BP |
| 10 | BP | BP |

MM-4-3 TSP/SCP Plan (Optional)

| TSP/SCP PLAN | 1 | 2 | 3 | 4 | 5 | 6 |
|---------------------------------|-----|------------------|---|-----|---|---|
| TSP/SCP ENABLED | yes | yes | | | | |
| SIGNAL TYPE (S or P) | P | P | | | | |
| DETECTOR LOCK | X | X | | | | |
| DELAY TIME | ∅ | ∅ | | | | |
| MAX PRESENCE | 100 | 100 | | | | |
| PREEMPT ENABLES RESERVICE | . | . | | | | |
| NO DELAY IN TSP PHASES | . | . | | | | |
| ACTION SPECIAL FUNCTION INHIBIT | ∅ | ∅ | | | | |
| RESERVICE CYCLES | 31 | 31 | | | | |
| BUS HEADING (NB, SB, EB, WB) | . | . | | | | |
| MODE (TSP or SCP) | TSP | FREE DEFAULT PTN | | 120 | | |
| HEADWAY ALLOWANCE | ∅ | | | | | |

| — TSP/SCP PHASE — | | | | | | | | | | | | | | | | |
|-------------------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|
| VEH/PED | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| TSP/SCP1 | | | X | | X | T | | | | | | | | | | |
| TSP/SCP2 | | X | X | | X | | | | | | | | | | | |
| TSP/SCP3 | | | | | | | | | | | | | | | | |
| TSP/SCP4 | | | | | | | | | | | | | | | | |
| TSP/SCP5 | | | | | | | | | | | | | | | | |
| TSP/SCP6 | | | | | | | | | | | | | | | | |

MM-4-4 TSP/SCP Split Pattern (Optional)

| TSP/SCP SPLIT PATTERN | | 1 | | | | | | | |
|-----------------------|--------------------------|----|--------------------------|----|----|----|----|----|--|
| PHASE | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | |
| MAX REDUCTION | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| MIN GREEN | 15 | 35 | (computed automatically) | | | | 15 | 35 | |
| MAX EXTENSION | | | | | | | | | |
| TSP/SCP SPLIT PATTERN | | 2 | | | | | | | |
| PHASE | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | |
| MAX REDUCTION | | | | | | | | | |
| MIN GREEN | (computed automatically) | | | | | | | | |
| MAX EXTENSION | | | | | | | | | |

2

0 0 0 7 2 0 0 7
 18 19 18 38 11 24 17 39

3

0 0 0 7 0 0 0 7
 19 24 15 35 14 29 18 32

Time Base Submenu

MM-5-1 Clock/Calendar Data

| | | | |
|---|-----|------------------------|----------|
| Are the Date and Time set OK? (Yes, No) | | STANDARD TIME FROM GMT | YES |
| MANUAL ACTION PLAN | | SYNC REFERENCE | REF |
| SYNC REFERENCE TIME | 0:0 | DAYLIGHT SAVINGS | 1/22/12 |
| TIME RESET INPUT TIME SET | | | 03:30:00 |

MM-5-2 Action Plan, sheet 1 of 4

| ACTION PLAN | / | | | | | | | | | | | | | | | |
|-----------------------------|------|---|---|---|---|---|---|---|---|----|----|----|----|----|----|-------|
| PATTERN | Free | | | | | | | | | | | | | | | |
| TIMING PLAN | / | | | | | | | | | | | | | | | |
| VEHICLE DETECTOR PLAN | / | | | | | | | | | | | | | | | |
| FLASH | / | | | | | | | | | | | | | | | |
| VEHICLE DET DIAGNOSTIC PLAN | / | | | | | | | | | | | | | | | |
| DIMMING ENABLE | NO | | | | | | | | | | | | | | | |
| SYSTEM OVERRIDE | NO | | | | | | | | | | | | | | | |
| SEQUENCE | / | | | | | | | | | | | | | | | |
| DETECTOR LOG | / | | | | | | | | | | | | | | | |
| RED REST | / | | | | | | | | | | | | | | | |
| PED DET DIAGNOSTIC PLAN | NO | | | | | | | | | | | | | | | |
| PHASE | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| PED RECALL | | | | | | | | | | | | | | | | |
| WALK 2 | | | | | | | | | | | | | | | | |
| VEH EXT 2 | | | | | | | | | | | | | | | | |
| VEH RECALL | | | | | | | | | | | | | | | | |
| MAX RECALL | | | | | | | | | | | | | | | | |
| MAX 2 | | | | | | | | | | | | | | | | |
| MAX 3 | | | | | | | | | | | | | | | | |
| CS INHIBIT | | | | | | | | | | | | | | | | |
| PHASE OMIT | | | | | | | | | | | | | | | | |
| SPEC FUNCTION | | | | | | | | | | | | | | | | (1-8) |
| AUX FUNCTION | | | | | | | | | | | | | | | | (1-3) |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | |
| LP 1-15 | | | | | | | | | | | | | | | | |
| LP 16-30 | | | | | | | | | | | | | | | | |
| LP 31-45 | | | | | | | | | | | | | | | | |
| LP 46-60 | | | | | | | | | | | | | | | | |
| LP 61-75 | | | | | | | | | | | | | | | | |
| LP 76-90 | | | | | | | | | | | | | | | | |
| LP 91-100 | | | | | | | | | | | | | | | | |

MM-5-2 Action Plan, sheet 2 of 4

| ACTION PLAN | 2 | | | | | | | | | | | | | | | |
|-----------------------------|-----|---|---|---|---|---|---|---|---|----|----|----|----|----|----|-------|
| PATTERN | 2 | | | | | | | | | | | | | | | |
| TIMING PLAN | 1 | | | | | | | | | | | | | | | |
| VEHICLE DETECTOR PLAN | 0 | | | | | | | | | | | | | | | |
| FLASH | - | | | | | | | | | | | | | | | |
| VEHICLE DET DIAGNOSTIC PLAN | 0 | | | | | | | | | | | | | | | |
| DIMMING ENABLE | NO | | | | | | | | | | | | | | | |
| SYSTEM OVERRIDE | NO | | | | | | | | | | | | | | | |
| SEQUENCE | 0 | | | | | | | | | | | | | | | |
| DETECTOR LOG | NOW | | | | | | | | | | | | | | | |
| RED REST | NO | | | | | | | | | | | | | | | |
| PED DET DIAGNOSTIC PLAN | 0 | | | | | | | | | | | | | | | |
| PHASE | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| PED RECALL | | | | | | | | | | | | | | | | |
| WALK 2 | | | | | | | | | | | | | | | | |
| VEH EXT 2 | | | | | | | | | | | | | | | | |
| VEH RECALL | | | | | | | | | | | | | | | | |
| MAX RECALL | | | | | | | | | | | | | | | | |
| MAX 2 | | | | | | | | | | | | | | | | |
| MAX 3 | | | | | | | | | | | | | | | | |
| CS INHIBIT | | | | | | | | | | | | | | | | |
| PHASE OMIT | | | | | | | | | | | | | | | | |
| SPEC FUNCTION | | | | | | | | | | | | | | | | (1-8) |
| AUX FUNCTION | | | | | | | | | | | | | | | | (1-3) |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | |
| LP 1-15 | | | | | | | | | | | | | | | | |
| LP 16-30 | | | | | | | | | | | | | | | | |
| LP 31-45 | | | | | | | | | | | | | | | | |
| LP 46-60 | | | | | | | | | | | | | | | | |
| LP 61-75 | | | | | | | | | | | | | | | | |
| LP 76-90 | | | | | | | | | | | | | | | | |
| LP 91-100 | | | | | | | | | | | | | | | | |

Appendix D

MM-5-2 Action Plan, sheet 3 of 4

| ACTION PLAN | 3 | | | | | | | | | | | | | | | | |
|-----------------------------|----|---|---|-------|---|---|---|---|-------------------------|------|----|----|----|----|----|----|--|
| PATTERN | 3 | | | | | | | | SYSTEM OVERRIDE | No | | | | | | | |
| TIMING PLAN | 1 | | | | | | | | SEQUENCE | 0 | | | | | | | |
| VEHICLE DETECTOR PLAN | 2 | | | | | | | | DETECTOR LOG | None | | | | | | | |
| FLASH | 1 | | | | | | | | RED REST | No | | | | | | | |
| VEHICLE DET DIAGNOSTIC PLAN | 0 | | | | | | | | PED DET DIAGNOSTIC PLAN | 0 | | | | | | | |
| DIMMING ENABLE | NO | | | | | | | | | | | | | | | | |
| PHASE | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | |
| PED RECALL | | | | | | | | | | | | | | | | | |
| WALK 2 | | | | | | | | | | | | | | | | | |
| VEH EXT 2 | | | | | | | | | | | | | | | | | |
| VEH RECALL | | | | | | | | | | | | | | | | | |
| MAX RECALL | | | | | | | | | | | | | | | | | |
| MAX 2 | | | | | | | | | | | | | | | | | |
| MAX 3 | | | | | | | | | | | | | | | | | |
| CS INHIBIT | | | | | | | | | | | | | | | | | |
| PHASE OMIT | | | | | | | | | | | | | | | | | |
| SPEC FUNCTION | | | | | | | | | | | | | | | | | |
| AUX FUNCTION | | | | (1-3) | | | | | | | | | | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | | |
| LP 1-15 | | | | | | | | | | | | | | | | | |
| LP 16-30 | | | | | | | | | | | | | | | | | |
| LP 31-45 | | | | | | | | | | | | | | | | | |
| LP 46-60 | | | | | | | | | | | | | | | | | |
| LP 61-75 | | | | | | | | | | | | | | | | | |
| LP 76-90 | | | | | | | | | | | | | | | | | |
| LP 91-100 | | | | | | | | | | | | | | | | | |

MM-5-3 Day Plan, sheet 1 of 2

| DAY PLAN # | | | |
|------------|---------------|------------|----|
| EVENT # | ACTION PLAN # | START TIME | |
| 1 | 1 | 00:01 | 26 |
| 2 | 2 | 06:00 | 27 |
| 3 | 1 | 08:00 | 28 |
| 4 | 3 | 16:00 | 29 |
| 5 | 1 | 18:00 | 30 |
| 6 | | : | 31 |
| 7 | | : | 32 |
| 8 | | : | 33 |
| 9 | | : | 34 |
| 10 | | : | 35 |
| 11 | | : | 36 |
| 12 | | : | 37 |
| 13 | | : | 38 |
| 14 | | : | 39 |
| 15 | | : | 40 |
| 16 | | : | 41 |
| 17 | | : | 42 |
| 18 | | : | 43 |
| 19 | | : | 44 |
| 20 | | : | 45 |
| 21 | | : | 46 |
| 22 | | : | 47 |
| 23 | | : | 48 |
| 24 | | : | 49 |
| 25 | | : | 50 |

MM-5-3 Day Plan, sheet 2 of 2

| DAY PLAN # | | | | | |
|------------|---------------|------------|---------|---------------|------------|
| EVENT # | ACTION PLAN # | START TIME | EVENT # | ACTION PLAN # | START TIME |
| 1 | / | 1:15:00 | 26 | | : |
| 2 | | : | 27 | | : |
| 3 | | : | 28 | | : |
| 4 | | : | 29 | | : |
| 5 | | : | 30 | | : |
| 6 | | : | 31 | | : |
| 7 | | : | 32 | | : |
| 8 | | : | 33 | | : |
| 9 | | : | 34 | | : |
| 10 | | : | 35 | | : |
| 11 | | : | 36 | | : |
| 12 | | : | 37 | | : |
| 13 | | : | 38 | | : |
| 14 | | : | 39 | | : |
| 15 | | : | 40 | | : |
| 16 | | : | 41 | | : |
| 17 | | : | 42 | | : |
| 18 | | : | 43 | | : |
| 19 | | : | 44 | | : |
| 20 | | : | 45 | | : |
| 21 | | : | 46 | | : |
| 22 | | : | 47 | | : |
| 23 | | : | 48 | | : |
| 24 | | : | 49 | | : |
| 25 | | : | 50 | | : |

MM-5-4 Schedule, sheet 1 of 3

| | | | | | | | | | | | | | | |
|--------------------|-----|----|-----|----|-----|----|-----|----|-----|----|-----|---|-----|--|
| SCHEDULE NUMBER | | / | | | | | | | | | | | | |
| DAY PLAN NUMBER | | / | | | | | | | | | | | | |
| MONTH | J | F | M | A | M | J | J | A | S | O | N | D | | |
| | X | X | X | X | X | X | X | X | X | X | X | X | | |
| DAY OF WEEK (DOW) | SUN | | MON | | TUE | | WED | | THU | | FRI | | SAT | |
| | | | X | | X | | X | | X | | X | | | |
| DAY OF MONTH (DOM) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | | |
| | X | X | X | X | X | X | X | X | X | X | X | | | |
| | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | | | |
| | X | X | X | X | X | X | X | X | X | X | X | | | |
| | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | | | | | |
| | X | X | X | X | X | X | X | X | X | | | | | |

| | | | | | | | | | | | | | | |
|--------------------|-----|----|-----|----|-----|----|-----|----|-----|----|-----|---|-----|--|
| SCHEDULE NUMBER | | 2 | | | | | | | | | | | | |
| DAY PLAN NUMBER | | 2 | | | | | | | | | | | | |
| MONTH | J | F | M | A | M | J | J | A | S | O | N | D | | |
| | X | X | X | X | X | X | X | X | X | X | X | X | | |
| DAY OF WEEK (DOW) | SUN | | MON | | TUE | | WED | | THU | | FRI | | SAT | |
| | X | | | | | | | | | | | | X | |
| DAY OF MONTH (DOM) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | | |
| | X | X | X | X | X | X | X | X | X | X | X | | | |
| | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | | | |
| | X | X | X | X | X | X | X | X | X | X | X | | | |
| | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | | | | | |
| | X | X | X | X | X | X | X | X | X | | | | | |

APPENDIX B

Existing Plus Approved Development

Capacity Analysis

Queues

3: Roe Avenue & Johnson Drive/Johnson Drive WB

12/27/2018



| Lane Group | EBL | EBT | WBL | WBT | NBL | NBT | NBR | SBL | SBT | SBR |
|-------------------------|------|------|------|------|------|------|------|------|------|------|
| Lane Group Flow (vph) | 206 | 266 | 28 | 254 | 113 | 765 | 72 | 97 | 383 | 202 |
| v/c Ratio | 0.53 | 0.36 | 0.22 | 0.60 | 0.20 | 0.45 | 0.09 | 0.25 | 0.24 | 0.25 |
| Control Delay | 46.6 | 32.6 | 47.4 | 45.6 | 11.2 | 20.5 | 0.2 | 11.8 | 19.2 | 3.9 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 46.6 | 32.6 | 47.4 | 45.6 | 11.2 | 20.5 | 0.2 | 11.8 | 19.2 | 3.9 |
| Queue Length 50th (ft) | 64 | 72 | 17 | 77 | 30 | 174 | 0 | 25 | 78 | 0 |
| Queue Length 95th (ft) | 94 | 104 | 42 | 113 | 43 | 246 | 0 | 51 | 127 | 41 |
| Internal Link Dist (ft) | | 512 | | 629 | | 477 | | | 492 | |
| Turn Bay Length (ft) | 245 | | 130 | | 150 | | 25 | 150 | | 250 |
| Base Capacity (vph) | 431 | 746 | 134 | 474 | 603 | 1696 | 844 | 468 | 1594 | 824 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.48 | 0.36 | 0.21 | 0.54 | 0.19 | 0.45 | 0.09 | 0.21 | 0.24 | 0.25 |

Intersection Summary

HCM 6th Signalized Intersection Summary
 3: Roe Avenue & Johnson Drive/Johnson Drive WB

12/27/2018



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|------------------------------|------|------|-------|------|------|------|------|------|------|------|------|------|
| Lane Configurations | ↔↔ | ↕↔ | | ↔ | ↕↔ | | ↔ | ↕↕ | ↔ | ↔ | ↕↕ | ↔ |
| Traffic Volume (veh/h) | 179 | 185 | 34 | 24 | 199 | 9 | 72 | 658 | 53 | 83 | 360 | 176 |
| Future Volume (veh/h) | 179 | 185 | 34 | 24 | 199 | 9 | 72 | 658 | 53 | 83 | 360 | 176 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 |
| Adj Flow Rate, veh/h | 206 | 213 | 53 | 28 | 226 | 28 | 112 | 765 | 0 | 97 | 383 | 0 |
| Peak Hour Factor | 0.87 | 0.87 | 0.64 | 0.86 | 0.88 | 0.32 | 0.64 | 0.86 | 0.74 | 0.86 | 0.94 | 0.87 |
| Percent Heavy Veh, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Cap, veh/h | 278 | 420 | 102 | 48 | 302 | 37 | 638 | 1900 | | 458 | 1908 | |
| Arrive On Green | 0.08 | 0.15 | 0.15 | 0.03 | 0.09 | 0.09 | 0.05 | 0.53 | 0.00 | 0.06 | 0.54 | 0.00 |
| Sat Flow, veh/h | 3456 | 2834 | 690 | 1781 | 3187 | 390 | 1781 | 3554 | 1585 | 1781 | 3554 | 1585 |
| Grp Volume(v), veh/h | 206 | 132 | 134 | 28 | 125 | 129 | 112 | 765 | 0 | 97 | 383 | 0 |
| Grp Sat Flow(s),veh/h/ln | 1728 | 1777 | 1746 | 1781 | 1777 | 1800 | 1781 | 1777 | 1585 | 1781 | 1777 | 1585 |
| Q Serve(g_s), s | 5.8 | 6.8 | 7.1 | 1.6 | 6.8 | 7.0 | 2.8 | 12.8 | 0.0 | 2.4 | 5.6 | 0.0 |
| Cycle Q Clear(g_c), s | 5.8 | 6.8 | 7.1 | 1.6 | 6.8 | 7.0 | 2.8 | 12.8 | 0.0 | 2.4 | 5.6 | 0.0 |
| Prop In Lane | 1.00 | | 0.39 | 1.00 | | 0.22 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Lane Grp Cap(c), veh/h | 278 | 263 | 259 | 48 | 168 | 171 | 638 | 1900 | | 458 | 1908 | |
| V/C Ratio(X) | 0.74 | 0.50 | 0.52 | 0.58 | 0.74 | 0.76 | 0.18 | 0.40 | | 0.21 | 0.20 | |
| Avail Cap(c_a), veh/h | 415 | 320 | 314 | 125 | 231 | 234 | 749 | 1900 | | 582 | 1908 | |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 |
| Uniform Delay (d), s/veh | 45.0 | 39.2 | 39.3 | 48.1 | 44.1 | 44.1 | 9.5 | 13.8 | 0.0 | 9.8 | 12.0 | 0.0 |
| Incr Delay (d2), s/veh | 3.9 | 1.5 | 1.6 | 10.6 | 8.0 | 9.0 | 0.1 | 0.6 | 0.0 | 0.2 | 0.2 | 0.0 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 2.6 | 3.1 | 3.1 | 0.8 | 3.4 | 3.5 | 1.0 | 5.0 | 0.0 | 0.9 | 2.2 | 0.0 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 48.8 | 40.6 | 40.9 | 58.7 | 52.1 | 53.2 | 9.6 | 14.4 | 0.0 | 10.0 | 12.3 | 0.0 |
| LnGrp LOS | D | D | D | E | D | D | A | B | | B | B | |
| Approach Vol, veh/h | | 472 | | | 282 | | | 877 | A | | 480 | A |
| Approach Delay, s/veh | | 44.3 | | | 53.2 | | | 13.8 | | | 11.8 | |
| Approach LOS | | D | | | D | | | B | | | B | |
| Timer - Assigned Phs | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | | | |
| Phs Duration (G+Y+Rc), s | 14.0 | 15.5 | 11.0 | 59.5 | 8.7 | 20.8 | 10.8 | 59.7 | | | | |
| Change Period (Y+Rc), s | 6.0 | 6.0 | * 5.4 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | | | | |
| Max Green Setting (Gmax), s | 12.0 | 13.0 | * 13 | 39.0 | 7.0 | 18.0 | 11.0 | 40.0 | | | | |
| Max Q Clear Time (g_c+I1), s | 7.8 | 9.0 | 4.4 | 14.8 | 3.6 | 9.1 | 4.8 | 7.6 | | | | |
| Green Ext Time (p_c), s | 0.2 | 0.5 | 0.1 | 5.5 | 0.0 | 0.9 | 0.1 | 2.6 | | | | |

Intersection Summary

| | |
|--------------------|------|
| HCM 6th Ctrl Delay | 25.4 |
| HCM 6th LOS | C |

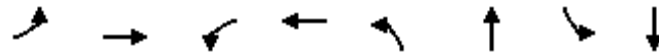
Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.
 Unsignalized Delay for [NBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Queues

6: Roeland Drive & Martway Street/Drive 3

12/27/2018



| Lane Group | EBL | EBT | WBL | WBT | NBL | NBT | SBL | SBT |
|-------------------------|------|------|------|------|------|------|------|------|
| Lane Group Flow (vph) | 20 | 20 | 59 | 7 | 44 | 87 | 5 | 107 |
| v/c Ratio | 0.07 | 0.02 | 0.23 | 0.01 | 0.07 | 0.09 | 0.01 | 0.12 |
| Control Delay | 20.1 | 0.1 | 20.6 | 0.0 | 8.6 | 7.1 | 16.8 | 15.0 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 20.1 | 0.1 | 20.6 | 0.0 | 8.6 | 7.1 | 16.8 | 15.0 |
| Queue Length 50th (ft) | 3 | 0 | 9 | 0 | 4 | 6 | 1 | 10 |
| Queue Length 95th (ft) | 22 | 0 | 46 | 0 | 16 | 21 | 9 | 53 |
| Internal Link Dist (ft) | | 773 | | 54 | | 238 | | 267 |
| Turn Bay Length (ft) | 105 | | | | 115 | | 75 | |
| Base Capacity (vph) | 1227 | 1339 | 255 | 1089 | 826 | 1784 | 1048 | 1471 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.02 | 0.01 | 0.23 | 0.01 | 0.05 | 0.05 | 0.00 | 0.07 |

Intersection Summary

HCM 6th Signalized Intersection Summary
6: Roeland Drive & Martway Street/Drive 3

12/27/2018



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|------------------------------|------|-------|------|------|------|------|------|------|------|------|------|------|
| Lane Configurations | ↖ | ↗ | | ↖ | ↗ | | ↖ | ↗ | | ↖ | ↗ | |
| Traffic Volume (veh/h) | 18 | 0 | 12 | 54 | 0 | 6 | 29 | 42 | 19 | 5 | 72 | 11 |
| Future Volume (veh/h) | 18 | 0 | 12 | 54 | 0 | 6 | 29 | 42 | 19 | 5 | 72 | 11 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 |
| Adj Flow Rate, veh/h | 20 | 0 | 20 | 59 | 0 | 7 | 44 | 66 | 21 | 5 | 95 | 12 |
| Peak Hour Factor | 0.90 | 0.92 | 0.60 | 0.92 | 0.92 | 0.92 | 0.66 | 0.64 | 0.92 | 0.92 | 0.76 | 0.92 |
| Percent Heavy Veh, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Cap, veh/h | 99 | 0 | 88 | 147 | 0 | 131 | 495 | 536 | 171 | 457 | 296 | 37 |
| Arrive On Green | 0.06 | 0.00 | 0.06 | 0.08 | 0.00 | 0.08 | 0.06 | 0.39 | 0.39 | 0.18 | 0.18 | 0.18 |
| Sat Flow, veh/h | 1781 | 0 | 1585 | 1781 | 0 | 1585 | 1781 | 1360 | 433 | 1310 | 1628 | 206 |
| Grp Volume(v), veh/h | 20 | 0 | 20 | 59 | 0 | 7 | 44 | 0 | 87 | 5 | 0 | 107 |
| Grp Sat Flow(s),veh/h/ln | 1781 | 0 | 1585 | 1781 | 0 | 1585 | 1781 | 0 | 1792 | 1310 | 0 | 1833 |
| Q Serve(g_s), s | 0.4 | 0.0 | 0.4 | 1.0 | 0.0 | 0.1 | 0.6 | 0.0 | 1.0 | 0.1 | 0.0 | 1.7 |
| Cycle Q Clear(g_c), s | 0.4 | 0.0 | 0.4 | 1.0 | 0.0 | 0.1 | 0.6 | 0.0 | 1.0 | 0.1 | 0.0 | 1.7 |
| Prop In Lane | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 0.24 | 1.00 | | 0.11 |
| Lane Grp Cap(c), veh/h | 99 | 0 | 88 | 147 | 0 | 131 | 495 | 0 | 707 | 457 | 0 | 334 |
| V/C Ratio(X) | 0.20 | 0.00 | 0.23 | 0.40 | 0.00 | 0.05 | 0.09 | 0.00 | 0.12 | 0.01 | 0.00 | 0.32 |
| Avail Cap(c_a), veh/h | 1460 | 0 | 1299 | 465 | 0 | 414 | 1199 | 0 | 2883 | 1531 | 0 | 1836 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 1.00 |
| Uniform Delay (d), s/veh | 14.9 | 0.0 | 14.9 | 14.3 | 0.0 | 13.9 | 8.4 | 0.0 | 6.4 | 11.1 | 0.0 | 11.7 |
| Incr Delay (d2), s/veh | 1.0 | 0.0 | 1.3 | 1.8 | 0.0 | 0.2 | 0.1 | 0.0 | 0.1 | 0.0 | 0.0 | 0.5 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 0.1 | 0.0 | 0.1 | 0.4 | 0.0 | 0.0 | 0.2 | 0.0 | 0.3 | 0.0 | 0.0 | 0.6 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 15.8 | 0.0 | 16.2 | 16.1 | 0.0 | 14.1 | 8.5 | 0.0 | 6.4 | 11.1 | 0.0 | 12.3 |
| LnGrp LOS | B | A | B | B | A | B | A | A | A | B | A | B |
| Approach Vol, veh/h | | 40 | | | 66 | | | 131 | | | 112 | |
| Approach Delay, s/veh | | 16.0 | | | 15.9 | | | 7.1 | | | 12.2 | |
| Approach LOS | | B | | | B | | | A | | | B | |
| Timer - Assigned Phs | | 2 | | 4 | | 6 | 7 | 8 | | | | |
| Phs Duration (G+Y+Rc), s | | 8.1 | | 18.0 | | 6.8 | 7.0 | 11.0 | | | | |
| Change Period (Y+Rc), s | | * 5.4 | | 5.0 | | 5.0 | 5.0 | 5.0 | | | | |
| Max Green Setting (Gmax), s | | * 8.6 | | 53.0 | | 27.0 | 15.0 | 33.0 | | | | |
| Max Q Clear Time (g_c+I1), s | | 3.0 | | 3.0 | | 2.4 | 2.6 | 3.7 | | | | |
| Green Ext Time (p_c), s | | 0.0 | | 0.5 | | 0.1 | 0.0 | 0.6 | | | | |

Intersection Summary

| | |
|--------------------|------|
| HCM 6th Ctrl Delay | 11.4 |
| HCM 6th LOS | B |

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

| Intersection | | | | | | |
|--------------------------|------|------|------|------|------|-------|
| Int Delay, s/veh | 0.9 | | | | | |
| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
| Lane Configurations | ↻ | | ↻ | ↻↻ | ↻ | ↻ |
| Traffic Vol, veh/h | 364 | 4 | 39 | 395 | 11 | 32 |
| Future Vol, veh/h | 364 | 4 | 39 | 395 | 11 | 32 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Stop | Stop |
| RT Channelized | - | None | - | None | - | Yield |
| Storage Length | - | - | 150 | - | 100 | 0 |
| Veh in Median Storage, # | 0 | - | - | 0 | 0 | - |
| Grade, % | 0 | - | - | 0 | 0 | - |
| Peak Hour Factor | 96 | 96 | 86 | 86 | 92 | 92 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 379 | 4 | 45 | 459 | 12 | 35 |

| Major/Minor | Major1 | Major2 | Minor1 | Minor2 | Minor3 |
|----------------------|--------|--------|--------|--------|--------|
| Conflicting Flow All | 0 | 0 | 383 | 0 | 701 |
| Stage 1 | - | - | - | - | 381 |
| Stage 2 | - | - | - | - | 320 |
| Critical Hdwy | - | - | 4.13 | - | 6.63 |
| Critical Hdwy Stg 1 | - | - | - | - | 5.43 |
| Critical Hdwy Stg 2 | - | - | - | - | 5.83 |
| Follow-up Hdwy | - | - | 2.219 | - | 3.519 |
| Pot Cap-1 Maneuver | - | - | 1174 | - | 389 |
| Stage 1 | - | - | - | - | 690 |
| Stage 2 | - | - | - | - | 710 |
| Platoon blocked, % | - | - | - | - | - |
| Mov Cap-1 Maneuver | - | - | 1174 | - | 374 |
| Mov Cap-2 Maneuver | - | - | - | - | 474 |
| Stage 1 | - | - | - | - | 664 |
| Stage 2 | - | - | - | - | 710 |

| Approach | EB | WB | NB |
|----------------------|----|-----|------|
| HCM Control Delay, s | 0 | 0.7 | 11.2 |
| HCM LOS | | | B |

| Minor Lane/Major Mvmt | NBLn1 | NBLn2 | EBT | EBR | WBL | WBT |
|-----------------------|-------|-------|-----|-----|-------|-----|
| Capacity (veh/h) | 474 | 665 | - | - | 1174 | - |
| HCM Lane V/C Ratio | 0.025 | 0.052 | - | - | 0.039 | - |
| HCM Control Delay (s) | 12.8 | 10.7 | - | - | 8.2 | - |
| HCM Lane LOS | B | B | - | - | A | - |
| HCM 95th %tile Q(veh) | 0.1 | 0.2 | - | - | 0.1 | - |

| Intersection | | | | | | |
|--------------------------|------|------|------|------|------|------|
| Int Delay, s/veh | 0.7 | | | | | |
| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
| Lane Configurations | ↘ | ↗ | ↑ | ↗ | ↘ | ↑ |
| Traffic Vol, veh/h | 18 | 6 | 164 | 58 | 5 | 167 |
| Future Vol, veh/h | 18 | 6 | 164 | 58 | 5 | 167 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Stop | Stop | Free | Free | Free | Free |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | 0 | 0 | - | 130 | 75 | - |
| Veh in Median Storage, # | 0 | - | 0 | - | - | 0 |
| Grade, % | 0 | - | 0 | - | - | 0 |
| Peak Hour Factor | 92 | 92 | 92 | 92 | 92 | 92 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 20 | 7 | 178 | 63 | 5 | 182 |

| Major/Minor | Minor1 | Major1 | Major2 | | |
|----------------------|--------|--------|--------|---|-------|
| Conflicting Flow All | 370 | 178 | 0 | 0 | 241 |
| Stage 1 | 178 | - | - | - | - |
| Stage 2 | 192 | - | - | - | - |
| Critical Hdwy | 6.42 | 6.22 | - | - | 4.12 |
| Critical Hdwy Stg 1 | 5.42 | - | - | - | - |
| Critical Hdwy Stg 2 | 5.42 | - | - | - | - |
| Follow-up Hdwy | 3.518 | 3.318 | - | - | 2.218 |
| Pot Cap-1 Maneuver | 630 | 865 | - | - | 1326 |
| Stage 1 | 853 | - | - | - | - |
| Stage 2 | 841 | - | - | - | - |
| Platoon blocked, % | | | - | - | - |
| Mov Cap-1 Maneuver | 627 | 865 | - | - | 1326 |
| Mov Cap-2 Maneuver | 671 | - | - | - | - |
| Stage 1 | 850 | - | - | - | - |
| Stage 2 | 841 | - | - | - | - |

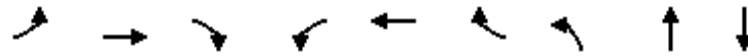
| Approach | WB | NB | SB |
|----------------------|------|----|-----|
| HCM Control Delay, s | 10.2 | 0 | 0.2 |
| HCM LOS | B | | |

| Minor Lane/Major Mvmt | NBT | NBRWBLn1 | WBLn2 | SBL | SBT |
|-----------------------|-----|----------|-------|-------|-------|
| Capacity (veh/h) | - | - | 671 | 865 | 1326 |
| HCM Lane V/C Ratio | - | - | 0.029 | 0.008 | 0.004 |
| HCM Control Delay (s) | - | - | 10.5 | 9.2 | 7.7 |
| HCM Lane LOS | - | - | B | A | A |
| HCM 95th %tile Q(veh) | - | - | 0.1 | 0 | 0 |

Queues

29: Roeland Drive & Johnson Drive

12/27/2018



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | SBT |
|-------------------------|------|------|------|------|------|------|------|------|------|
| Lane Group Flow (vph) | 8 | 338 | 25 | 56 | 388 | 4 | 48 | 44 | 72 |
| v/c Ratio | 0.01 | 0.30 | 0.02 | 0.08 | 0.30 | 0.00 | 0.13 | 0.10 | 0.24 |
| Control Delay | 7.0 | 13.9 | 0.1 | 6.7 | 9.8 | 0.0 | 16.0 | 7.2 | 18.3 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 7.0 | 13.9 | 0.1 | 6.7 | 9.8 | 0.0 | 16.0 | 7.2 | 18.3 |
| Queue Length 50th (ft) | 1 | 65 | 0 | 4 | 37 | 0 | 11 | 1 | 10 |
| Queue Length 95th (ft) | 2 | 178 | 0 | 24 | 202 | 0 | 19 | 15 | 37 |
| Internal Link Dist (ft) | | 180 | | | 509 | | | 267 | 783 |
| Turn Bay Length (ft) | 100 | | 100 | 130 | | | 100 | | |
| Base Capacity (vph) | 736 | 1672 | 1435 | 724 | 1672 | 1435 | 404 | 878 | 397 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.01 | 0.20 | 0.02 | 0.08 | 0.23 | 0.00 | 0.12 | 0.05 | 0.18 |

Intersection Summary

HCM 6th Signalized Intersection Summary
 29: Roeland Drive & Johnson Drive

12/27/2018

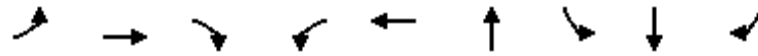


| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 2 | 324 | 17 | 48 | 357 | 1 | 24 | 3 | 38 | 6 | 23 | 21 |
| Future Volume (veh/h) | 2 | 324 | 17 | 48 | 357 | 1 | 24 | 3 | 38 | 6 | 23 | 21 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 |
| Adj Flow Rate, veh/h | 8 | 338 | 25 | 56 | 388 | 4 | 48 | 4 | 40 | 12 | 32 | 28 |
| Peak Hour Factor | 0.25 | 0.96 | 0.67 | 0.86 | 0.92 | 0.25 | 0.50 | 0.75 | 0.95 | 0.50 | 0.72 | 0.75 |
| Percent Heavy Veh, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Cap, veh/h | 347 | 501 | 425 | 409 | 607 | 514 | 537 | 43 | 428 | 124 | 91 | 71 |
| Arrive On Green | 0.01 | 0.27 | 0.27 | 0.07 | 0.32 | 0.32 | 0.06 | 0.29 | 0.29 | 0.11 | 0.11 | 0.11 |
| Sat Flow, veh/h | 1781 | 1870 | 1585 | 1781 | 1870 | 1585 | 1781 | 146 | 1461 | 186 | 843 | 655 |
| Grp Volume(v), veh/h | 8 | 338 | 25 | 56 | 388 | 4 | 48 | 0 | 44 | 72 | 0 | 0 |
| Grp Sat Flow(s),veh/h/ln | 1781 | 1870 | 1585 | 1781 | 1870 | 1585 | 1781 | 0 | 1607 | 1683 | 0 | 0 |
| Q Serve(g_s), s | 0.1 | 6.5 | 0.5 | 0.9 | 7.2 | 0.1 | 0.9 | 0.0 | 0.8 | 0.1 | 0.0 | 0.0 |
| Cycle Q Clear(g_c), s | 0.1 | 6.5 | 0.5 | 0.9 | 7.2 | 0.1 | 0.9 | 0.0 | 0.8 | 1.6 | 0.0 | 0.0 |
| Prop In Lane | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 0.91 | 0.17 | | 0.39 |
| Lane Grp Cap(c), veh/h | 347 | 501 | 425 | 409 | 607 | 514 | 537 | 0 | 471 | 285 | 0 | 0 |
| V/C Ratio(X) | 0.02 | 0.67 | 0.06 | 0.14 | 0.64 | 0.01 | 0.09 | 0.00 | 0.09 | 0.25 | 0.00 | 0.00 |
| Avail Cap(c_a), veh/h | 631 | 2168 | 1837 | 593 | 2168 | 1837 | 735 | 0 | 832 | 474 | 0 | 0 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 0.00 |
| Uniform Delay (d), s/veh | 10.8 | 13.3 | 11.0 | 9.8 | 11.7 | 9.3 | 12.7 | 0.0 | 10.4 | 16.8 | 0.0 | 0.0 |
| Incr Delay (d2), s/veh | 0.0 | 1.6 | 0.1 | 0.2 | 1.1 | 0.0 | 0.1 | 0.0 | 0.1 | 0.5 | 0.0 | 0.0 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 0.0 | 2.4 | 0.1 | 0.3 | 2.5 | 0.0 | 0.3 | 0.0 | 0.2 | 0.6 | 0.0 | 0.0 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 10.9 | 14.9 | 11.1 | 9.9 | 12.8 | 9.3 | 12.8 | 0.0 | 10.5 | 17.3 | 0.0 | 0.0 |
| LnGrp LOS | B | B | B | A | B | A | B | A | B | B | A | A |
| Approach Vol, veh/h | | 371 | | | 448 | | | 92 | | | 72 | |
| Approach Delay, s/veh | | 14.5 | | | 12.4 | | | 11.7 | | | 17.3 | |
| Approach LOS | | B | | | B | | | B | | | B | |
| Timer - Assigned Phs | 1 | 2 | | 4 | 5 | 6 | 7 | 8 | | | | |
| Phs Duration (G+Y+Rc), s | 5.5 | 18.2 | | 16.9 | 7.8 | 15.9 | 7.5 | 9.4 | | | | |
| Change Period (Y+Rc), s | 5.0 | 5.0 | | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | | | | |
| Max Green Setting (Gmax), s | 7.0 | 47.0 | | 21.0 | 7.0 | 47.0 | 7.0 | 9.0 | | | | |
| Max Q Clear Time (g_c+I1), s | 2.1 | 9.2 | | 2.8 | 2.9 | 8.5 | 2.9 | 3.6 | | | | |
| Green Ext Time (p_c), s | 0.0 | 2.6 | | 0.1 | 0.0 | 2.3 | 0.0 | 0.1 | | | | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 6th Ctrl Delay | | | | 13.5 | | | | | | | | |
| HCM 6th LOS | | | | B | | | | | | | | |

Queues

1470: Roeland Drive & Shawnee Mission Parkway

12/27/2018



| Lane Group | EBL | EBT | EBR | WBL | WBT | NBT | SBL | SBT | SBR |
|-------------------------|------|------|------|------|------|------|------|------|------|
| Lane Group Flow (vph) | 70 | 1174 | 28 | 37 | 2011 | 120 | 146 | 40 | 60 |
| v/c Ratio | 0.55 | 0.55 | 0.02 | 0.28 | 0.74 | 0.56 | 0.72 | 0.19 | 0.19 |
| Control Delay | 51.7 | 35.1 | 0.0 | 58.0 | 21.6 | 35.6 | 71.3 | 49.9 | 1.3 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 51.7 | 35.1 | 0.0 | 58.0 | 21.6 | 35.6 | 71.3 | 49.9 | 1.3 |
| Queue Length 50th (ft) | 52 | 441 | 0 | 27 | 459 | 40 | 109 | 28 | 0 |
| Queue Length 95th (ft) | 63 | 434 | m0 | 44 | 553 | 100 | #171 | 44 | 0 |
| Internal Link Dist (ft) | | 682 | | | 2401 | 499 | | 439 | |
| Turn Bay Length (ft) | 345 | | 310 | 170 | | | 100 | | 125 |
| Base Capacity (vph) | 140 | 2134 | 1583 | 140 | 2708 | 274 | 206 | 217 | 321 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.50 | 0.55 | 0.02 | 0.26 | 0.74 | 0.44 | 0.71 | 0.18 | 0.19 |

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

HCM 6th Signalized Intersection Summary
 1470: Roeland Drive & Shawnee Mission Parkway

12/27/2018



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|------------------------------|------|------|------|------|------|-------|------|------|------|------|------|------|
| Lane Configurations | ↘ | ↑↑ | ↗ | ↘ | ↑↑↑ | | | ↕ | | ↘ | ↑ | ↗ |
| Traffic Volume (veh/h) | 44 | 986 | 21 | 23 | 1722 | 168 | 18 | 11 | 67 | 115 | 25 | 45 |
| Future Volume (veh/h) | 44 | 986 | 21 | 23 | 1722 | 168 | 18 | 11 | 67 | 115 | 25 | 45 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 |
| Adj Flow Rate, veh/h | 70 | 1174 | 0 | 37 | 1813 | 198 | 29 | 12 | 79 | 146 | 40 | 60 |
| Peak Hour Factor | 0.63 | 0.84 | 0.75 | 0.63 | 0.95 | 0.85 | 0.63 | 0.95 | 0.85 | 0.79 | 0.63 | 0.75 |
| Percent Heavy Veh, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Cap, veh/h | 107 | 1910 | | 200 | 2657 | 289 | 35 | 15 | 95 | 171 | 179 | 152 |
| Arrive On Green | 0.06 | 0.54 | 0.00 | 0.11 | 0.60 | 0.60 | 0.09 | 0.09 | 0.09 | 0.10 | 0.10 | 0.10 |
| Sat Flow, veh/h | 1781 | 3554 | 1585 | 1781 | 4443 | 483 | 400 | 165 | 1089 | 1781 | 1870 | 1585 |
| Grp Volume(v), veh/h | 70 | 1174 | 0 | 37 | 1280 | 731 | 120 | 0 | 0 | 146 | 40 | 60 |
| Grp Sat Flow(s),veh/h/ln | 1781 | 1777 | 1585 | 1781 | 1571 | 1783 | 1654 | 0 | 0 | 1781 | 1870 | 1585 |
| Q Serve(g_s), s | 4.6 | 27.4 | 0.0 | 2.3 | 33.2 | 33.5 | 8.6 | 0.0 | 0.0 | 9.7 | 2.4 | 4.3 |
| Cycle Q Clear(g_c), s | 4.6 | 27.4 | 0.0 | 2.3 | 33.2 | 33.5 | 8.6 | 0.0 | 0.0 | 9.7 | 2.4 | 4.3 |
| Prop In Lane | 1.00 | | 1.00 | 1.00 | | 0.27 | 0.24 | | 0.66 | 1.00 | | 1.00 |
| Lane Grp Cap(c), veh/h | 107 | 1910 | | 200 | 1879 | 1066 | 145 | 0 | 0 | 171 | 179 | 152 |
| V/C Ratio(X) | 0.65 | 0.61 | | 0.18 | 0.68 | 0.69 | 0.83 | 0.00 | 0.00 | 0.86 | 0.22 | 0.39 |
| Avail Cap(c_a), veh/h | 141 | 1910 | | 200 | 1879 | 1066 | 214 | 0 | 0 | 171 | 179 | 152 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 0.00 | 1.00 | 1.00 | 1.00 |
| Uniform Delay (d), s/veh | 55.2 | 19.2 | 0.0 | 48.3 | 16.4 | 16.4 | 53.8 | 0.0 | 0.0 | 53.4 | 50.1 | 51.0 |
| Incr Delay (d2), s/veh | 2.5 | 1.5 | 0.0 | 0.2 | 2.0 | 3.6 | 10.2 | 0.0 | 0.0 | 31.0 | 0.2 | 0.6 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 2.1 | 10.8 | 0.0 | 1.0 | 11.1 | 13.3 | 4.0 | 0.0 | 0.0 | 5.8 | 1.1 | 1.7 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 57.6 | 20.7 | 0.0 | 48.4 | 18.4 | 20.0 | 64.0 | 0.0 | 0.0 | 84.4 | 50.4 | 51.6 |
| LnGrp LOS | E | C | | D | B | C | E | A | A | F | D | D |
| Approach Vol, veh/h | | 1244 | A | | 2048 | | | 120 | | | 246 | |
| Approach Delay, s/veh | | 22.7 | | | 19.5 | | | 64.0 | | | 70.9 | |
| Approach LOS | | C | | | B | | | E | | | E | |
| Timer - Assigned Phs | 1 | 2 | | 4 | 5 | 6 | | 8 | | | | |
| Phs Duration (G+Y+Rc), s | 11.7 | 77.3 | | 15.0 | 19.0 | 70.0 | | 16.0 | | | | |
| Change Period (Y+Rc), s | 4.5 | 5.5 | | 4.5 | 5.5 | * 5.5 | | 4.5 | | | | |
| Max Green Setting (Gmax), s | 9.5 | 64.5 | | 15.5 | 9.5 | * 65 | | 11.5 | | | | |
| Max Q Clear Time (g_c+I1), s | 6.6 | 35.5 | | 10.6 | 4.3 | 29.4 | | 11.7 | | | | |
| Green Ext Time (p_c), s | 0.0 | 11.1 | | 0.2 | 0.0 | 5.8 | | 0.0 | | | | |

Intersection Summary

| | |
|--------------------|------|
| HCM 6th Ctrl Delay | 25.5 |
| HCM 6th LOS | C |

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.
 Unsignalized Delay for [EBR] is excluded from calculations of the approach delay and intersection delay.

Queues

3: Roe Avenue & Johnson Drive/Johnson Drive WB

12/27/2018



| Lane Group | EBL | EBT | WBL | WBT | NBL | NBT | NBR | SBL | SBT | SBR |
|-------------------------|------|------|------|------|------|------|------|------|------|------|
| Lane Group Flow (vph) | 339 | 425 | 71 | 366 | 127 | 586 | 72 | 79 | 624 | 340 |
| v/c Ratio | 0.70 | 0.52 | 0.48 | 0.68 | 0.33 | 0.41 | 0.10 | 0.51 | 0.47 | 0.42 |
| Control Delay | 49.8 | 32.7 | 54.7 | 45.6 | 15.5 | 24.2 | 0.3 | 54.9 | 26.2 | 4.6 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 49.8 | 32.7 | 54.7 | 45.6 | 15.5 | 24.2 | 0.3 | 54.9 | 26.2 | 4.6 |
| Queue Length 50th (ft) | 105 | 113 | 44 | 113 | 41 | 150 | 0 | 48 | 160 | 0 |
| Queue Length 95th (ft) | 129 | 160 | 75 | 150 | 59 | 185 | 0 | 77 | 205 | 55 |
| Internal Link Dist (ft) | | 513 | | 629 | | 477 | | | 492 | |
| Turn Bay Length (ft) | 245 | | 130 | | 150 | | 25 | 150 | | 250 |
| Base Capacity (vph) | 493 | 856 | 156 | 635 | 431 | 1471 | 753 | 169 | 1343 | 812 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.69 | 0.50 | 0.46 | 0.58 | 0.29 | 0.40 | 0.10 | 0.47 | 0.46 | 0.42 |

Intersection Summary

HCM Signalized Intersection Capacity Analysis

3: Roe Avenue & Johnson Drive/Johnson Drive WB

12/27/2018



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|------------------------|-------|------|------|------|-------|------|-------|------|------|-------|-------|------|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 258 | 289 | 89 | 54 | 280 | 25 | 95 | 498 | 52 | 58 | 524 | 299 |
| Future Volume (vph) | 258 | 289 | 89 | 54 | 280 | 25 | 95 | 498 | 52 | 58 | 524 | 299 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 6.0 | 6.0 | | 6.0 | 6.0 | | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 |
| Lane Util. Factor | 0.97 | 0.95 | | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |
| Frt | 1.00 | 0.96 | | 1.00 | 0.98 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3433 | 3401 | | 1770 | 3481 | | 1770 | 3539 | 1583 | 1770 | 3539 | 1583 |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.31 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3433 | 3401 | | 1770 | 3481 | | 575 | 3539 | 1583 | 1770 | 3539 | 1583 |
| Peak-hour factor, PHF | 0.76 | 0.92 | 0.80 | 0.76 | 0.86 | 0.63 | 0.75 | 0.85 | 0.72 | 0.73 | 0.84 | 0.88 |
| Adj. Flow (vph) | 339 | 314 | 111 | 71 | 326 | 40 | 127 | 586 | 72 | 79 | 624 | 340 |
| RTOR Reduction (vph) | 0 | 35 | 0 | 0 | 9 | 0 | 0 | 0 | 45 | 0 | 0 | 216 |
| Lane Group Flow (vph) | 339 | 390 | 0 | 71 | 357 | 0 | 127 | 586 | 27 | 79 | 624 | 124 |
| Turn Type | Prot | NA | | Prot | NA | | pm+pt | NA | Perm | Prot | NA | Perm |
| Protected Phases | 1 | 6 | | 5 | 2 | | 7 | 4 | | 3 | 8 | |
| Permitted Phases | | | | | | | 4 | | 4 | | | 8 |
| Actuated Green, G (s) | 14.0 | 23.1 | | 7.2 | 16.3 | | 47.3 | 38.1 | 38.1 | 7.6 | 36.5 | 36.5 |
| Effective Green, g (s) | 14.0 | 23.1 | | 7.2 | 16.3 | | 47.3 | 38.1 | 38.1 | 7.6 | 36.5 | 36.5 |
| Actuated g/C Ratio | 0.14 | 0.23 | | 0.07 | 0.16 | | 0.47 | 0.38 | 0.38 | 0.08 | 0.36 | 0.36 |
| Clearance Time (s) | 6.0 | 6.0 | | 6.0 | 6.0 | | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | 480 | 785 | | 127 | 567 | | 381 | 1348 | 603 | 134 | 1291 | 577 |
| v/s Ratio Prot | c0.10 | 0.11 | | 0.04 | c0.10 | | 0.03 | 0.17 | | c0.04 | c0.18 | |
| v/s Ratio Perm | | | | | | | 0.13 | | 0.02 | | | 0.08 |
| v/c Ratio | 0.71 | 0.50 | | 0.56 | 0.63 | | 0.33 | 0.43 | 0.05 | 0.59 | 0.48 | 0.22 |
| Uniform Delay, d1 | 41.0 | 33.4 | | 44.9 | 39.0 | | 15.5 | 23.0 | 19.5 | 44.7 | 24.5 | 21.9 |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 4.7 | 0.5 | | 5.3 | 2.2 | | 0.5 | 1.0 | 0.1 | 6.5 | 1.3 | 0.9 |
| Delay (s) | 45.7 | 33.9 | | 50.1 | 41.2 | | 16.1 | 24.0 | 19.6 | 51.2 | 25.8 | 22.7 |
| Level of Service | D | C | | D | D | | B | C | B | D | C | C |
| Approach Delay (s) | | 39.1 | | | 42.7 | | | 22.3 | | | 26.7 | |
| Approach LOS | | D | | | D | | | C | | | C | |

Intersection Summary

| | | | |
|-----------------------------------|-------|---------------------------|------|
| HCM 2000 Control Delay | 31.0 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.56 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 24.0 |
| Intersection Capacity Utilization | 55.6% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

HCM 6th Signalized Intersection Summary
 3: Roe Avenue & Johnson Drive/Johnson Drive WB

12/27/2018



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Lane Configurations | ↖↗ | ↕ | | ↖ | ↕ | | ↖ | ↕ | ↗ | ↖ | ↕ | ↗ |
| Traffic Volume (veh/h) | 258 | 289 | 89 | 54 | 280 | 25 | 95 | 498 | 52 | 58 | 524 | 299 |
| Future Volume (veh/h) | 258 | 289 | 89 | 54 | 280 | 25 | 95 | 498 | 52 | 58 | 524 | 299 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 |
| Adj Flow Rate, veh/h | 339 | 314 | 111 | 71 | 326 | 40 | 127 | 586 | 0 | 79 | 624 | 0 |
| Peak Hour Factor | 0.76 | 0.92 | 0.80 | 0.76 | 0.86 | 0.63 | 0.75 | 0.85 | 0.72 | 0.73 | 0.84 | 0.88 |
| Percent Heavy Veh, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Cap, veh/h | 407 | 510 | 177 | 91 | 416 | 51 | 445 | 1592 | | 114 | 1614 | |
| Arrive On Green | 0.12 | 0.20 | 0.20 | 0.05 | 0.13 | 0.13 | 0.06 | 0.45 | 0.00 | 0.06 | 0.45 | 0.00 |
| Sat Flow, veh/h | 3456 | 2588 | 898 | 1781 | 3189 | 388 | 1781 | 3554 | 1585 | 1781 | 3554 | 1585 |
| Grp Volume(v), veh/h | 339 | 214 | 211 | 71 | 180 | 186 | 127 | 586 | 0 | 79 | 624 | 0 |
| Grp Sat Flow(s),veh/h/ln | 1728 | 1777 | 1709 | 1781 | 1777 | 1800 | 1781 | 1777 | 1585 | 1781 | 1777 | 1585 |
| Q Serve(g_s), s | 9.6 | 11.0 | 11.3 | 3.9 | 9.8 | 10.0 | 3.8 | 10.9 | 0.0 | 4.3 | 11.6 | 0.0 |
| Cycle Q Clear(g_c), s | 9.6 | 11.0 | 11.3 | 3.9 | 9.8 | 10.0 | 3.8 | 10.9 | 0.0 | 4.3 | 11.6 | 0.0 |
| Prop In Lane | 1.00 | | 0.53 | 1.00 | | 0.22 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Lane Grp Cap(c), veh/h | 407 | 350 | 337 | 91 | 232 | 235 | 445 | 1592 | | 114 | 1614 | |
| V/C Ratio(X) | 0.83 | 0.61 | 0.63 | 0.78 | 0.78 | 0.79 | 0.29 | 0.37 | | 0.70 | 0.39 | |
| Avail Cap(c_a), veh/h | 449 | 409 | 393 | 143 | 320 | 324 | 556 | 1592 | | 160 | 1614 | |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 |
| Uniform Delay (d), s/veh | 43.1 | 36.6 | 36.8 | 46.9 | 42.1 | 42.1 | 13.9 | 18.2 | 0.0 | 45.9 | 18.1 | 0.0 |
| Incr Delay (d2), s/veh | 11.7 | 2.0 | 2.4 | 13.1 | 8.0 | 8.7 | 0.3 | 0.7 | 0.0 | 7.4 | 0.7 | 0.0 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 4.7 | 4.9 | 4.9 | 2.1 | 4.8 | 5.0 | 1.5 | 4.4 | 0.0 | 2.1 | 4.7 | 0.0 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 54.8 | 38.7 | 39.2 | 60.0 | 50.1 | 50.9 | 14.2 | 18.9 | 0.0 | 53.3 | 18.8 | 0.0 |
| LnGrp LOS | D | D | D | E | D | D | B | B | | D | B | |
| Approach Vol, veh/h | | 764 | | | 437 | | | 713 | A | | 703 | A |
| Approach Delay, s/veh | | 46.0 | | | 52.0 | | | 18.1 | | | 22.7 | |
| Approach LOS | | D | | | D | | | B | | | C | |
| Timer - Assigned Phs | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | | | |
| Phs Duration (G+Y+Rc), s | 17.8 | 19.0 | 12.4 | 50.8 | 11.1 | 25.7 | 11.8 | 51.4 | | | | |
| Change Period (Y+Rc), s | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | | | | |
| Max Green Setting (Gmax), s | 13.0 | 18.0 | 9.0 | 36.0 | 8.0 | 23.0 | 12.0 | 33.0 | | | | |
| Max Q Clear Time (g_c+I1), s | 11.6 | 12.0 | 6.3 | 12.9 | 5.9 | 13.3 | 5.8 | 13.6 | | | | |
| Green Ext Time (p_c), s | 0.2 | 1.1 | 0.0 | 3.9 | 0.0 | 1.8 | 0.1 | 4.0 | | | | |

Intersection Summary

| | |
|--------------------|------|
| HCM 6th Ctrl Delay | 33.1 |
| HCM 6th LOS | C |

Notes

Unsignalized Delay for [NBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Queues

6: Roeland Drive & Martway Street/Drive 3

12/27/2018



| Lane Group | EBL | EBT | WBL | WBT | NBL | NBT | SBL | SBT |
|-------------------------|------|------|------|------|------|------|------|------|
| Lane Group Flow (vph) | 81 | 105 | 73 | 5 | 56 | 154 | 5 | 132 |
| v/c Ratio | 0.23 | 0.12 | 0.19 | 0.01 | 0.08 | 0.13 | 0.01 | 0.15 |
| Control Delay | 20.9 | 0.3 | 19.8 | 0.0 | 10.6 | 9.0 | 19.6 | 14.8 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 20.9 | 0.3 | 19.8 | 0.0 | 10.6 | 9.0 | 19.6 | 14.8 |
| Queue Length 50th (ft) | 23 | 0 | 20 | 0 | 11 | 25 | 1 | 25 |
| Queue Length 95th (ft) | 56 | 0 | 51 | 0 | 21 | 38 | 9 | 54 |
| Internal Link Dist (ft) | | 773 | | 54 | | 238 | | 267 |
| Turn Bay Length (ft) | 105 | | | | 115 | | 75 | |
| Base Capacity (vph) | 462 | 955 | 471 | 928 | 684 | 1150 | 613 | 903 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.18 | 0.11 | 0.15 | 0.01 | 0.08 | 0.13 | 0.01 | 0.15 |

Intersection Summary

HCM Signalized Intersection Capacity Analysis

6: Roeland Drive & Martway Street/Drive 3

12/27/2018



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|------------------------|-------|------|------|-------|------|------|-------|-------|------|------|------|------|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 73 | 0 | 63 | 67 | 0 | 5 | 37 | 77 | 31 | 5 | 65 | 42 |
| Future Volume (vph) | 73 | 0 | 63 | 67 | 0 | 5 | 37 | 77 | 31 | 5 | 65 | 42 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 5.0 | 5.0 | | 5.4 | 5.4 | | 5.0 | 5.0 | | 5.0 | 5.0 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.85 | | 1.00 | 0.85 | | 1.00 | 0.97 | | 1.00 | 0.95 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1770 | 1583 | | 1770 | 1583 | | 1770 | 1801 | | 1770 | 1765 | |
| Flt Permitted | 0.95 | 1.00 | | 0.91 | 1.00 | | 0.52 | 1.00 | | 0.66 | 1.00 | |
| Satd. Flow (perm) | 1770 | 1583 | | 1693 | 1583 | | 967 | 1801 | | 1228 | 1765 | |
| Peak-hour factor, PHF | 0.90 | 0.92 | 0.60 | 0.92 | 0.92 | 0.92 | 0.66 | 0.64 | 0.92 | 0.92 | 0.76 | 0.92 |
| Adj. Flow (vph) | 81 | 0 | 105 | 73 | 0 | 5 | 56 | 120 | 34 | 5 | 86 | 46 |
| RTOR Reduction (vph) | 0 | 97 | 0 | 0 | 5 | 0 | 0 | 15 | 0 | 0 | 27 | 0 |
| Lane Group Flow (vph) | 81 | 8 | 0 | 73 | 0 | 0 | 56 | 139 | 0 | 5 | 105 | 0 |
| Turn Type | Split | NA | | Perm | NA | | pm+pt | NA | | Perm | NA | |
| Protected Phases | 6 | 6 | | | 2 | | 7 | 4 | | | | 8 |
| Permitted Phases | | | | 2 | | | 4 | 4 | | 8 | | |
| Actuated Green, G (s) | 3.9 | 3.9 | | 4.4 | 4.4 | | 25.1 | 25.1 | | 16.9 | 16.9 | |
| Effective Green, g (s) | 3.9 | 3.9 | | 4.4 | 4.4 | | 25.1 | 25.1 | | 16.9 | 16.9 | |
| Actuated g/C Ratio | 0.08 | 0.08 | | 0.09 | 0.09 | | 0.51 | 0.51 | | 0.35 | 0.35 | |
| Clearance Time (s) | 5.0 | 5.0 | | 5.4 | 5.4 | | 5.0 | 5.0 | | 5.0 | 5.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 141 | 126 | | 152 | 142 | | 550 | 926 | | 425 | 611 | |
| v/s Ratio Prot | c0.05 | 0.01 | | | 0.00 | | 0.01 | c0.08 | | | 0.06 | |
| v/s Ratio Perm | | | | c0.04 | | | 0.05 | | | 0.00 | | |
| v/c Ratio | 0.57 | 0.07 | | 0.48 | 0.00 | | 0.10 | 0.15 | | 0.01 | 0.17 | |
| Uniform Delay, d1 | 21.6 | 20.8 | | 21.1 | 20.2 | | 6.2 | 6.2 | | 10.5 | 11.1 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 5.6 | 0.2 | | 2.4 | 0.0 | | 0.1 | 0.1 | | 0.0 | 0.1 | |
| Delay (s) | 27.2 | 21.0 | | 23.5 | 20.2 | | 6.3 | 6.3 | | 10.5 | 11.2 | |
| Level of Service | C | C | | C | C | | A | A | | B | B | |
| Approach Delay (s) | | 23.7 | | | 23.3 | | | 6.3 | | | 11.2 | |
| Approach LOS | | C | | | C | | | A | | | B | |

Intersection Summary

| | | | |
|-----------------------------------|-------|---------------------------|------|
| HCM 2000 Control Delay | 14.9 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.29 | | |
| Actuated Cycle Length (s) | 48.8 | Sum of lost time (s) | 20.4 |
| Intersection Capacity Utilization | 27.8% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

HCM 6th Signalized Intersection Summary
6: Roeland Drive & Martway Street/Drive 3

12/27/2018



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|------------------------------|------|-------|------|------|------|------|------|------|------|------|------|------|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 73 | 0 | 63 | 67 | 0 | 5 | 37 | 77 | 31 | 5 | 65 | 42 |
| Future Volume (veh/h) | 73 | 0 | 63 | 67 | 0 | 5 | 37 | 77 | 31 | 5 | 65 | 42 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 |
| Adj Flow Rate, veh/h | 81 | 0 | 105 | 73 | 0 | 5 | 56 | 120 | 34 | 5 | 86 | 46 |
| Peak Hour Factor | 0.90 | 0.92 | 0.60 | 0.92 | 0.92 | 0.92 | 0.66 | 0.64 | 0.92 | 0.92 | 0.76 | 0.92 |
| Percent Heavy Veh, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Cap, veh/h | 244 | 0 | 217 | 158 | 0 | 141 | 433 | 510 | 144 | 389 | 183 | 98 |
| Arrive On Green | 0.14 | 0.00 | 0.14 | 0.09 | 0.00 | 0.09 | 0.07 | 0.36 | 0.36 | 0.16 | 0.16 | 0.16 |
| Sat Flow, veh/h | 1781 | 0 | 1585 | 1781 | 0 | 1585 | 1781 | 1402 | 397 | 1233 | 1147 | 613 |
| Grp Volume(v), veh/h | 81 | 0 | 105 | 73 | 0 | 5 | 56 | 0 | 154 | 5 | 0 | 132 |
| Grp Sat Flow(s),veh/h/ln | 1781 | 0 | 1585 | 1781 | 0 | 1585 | 1781 | 0 | 1799 | 1233 | 0 | 1760 |
| Q Serve(g_s), s | 1.5 | 0.0 | 2.3 | 1.5 | 0.0 | 0.1 | 0.9 | 0.0 | 2.2 | 0.1 | 0.0 | 2.6 |
| Cycle Q Clear(g_c), s | 1.5 | 0.0 | 2.3 | 1.5 | 0.0 | 0.1 | 0.9 | 0.0 | 2.2 | 0.1 | 0.0 | 2.6 |
| Prop In Lane | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 0.22 | 1.00 | | 0.35 |
| Lane Grp Cap(c), veh/h | 244 | 0 | 217 | 158 | 0 | 141 | 433 | 0 | 654 | 389 | 0 | 281 |
| V/C Ratio(X) | 0.33 | 0.00 | 0.48 | 0.46 | 0.00 | 0.04 | 0.13 | 0.00 | 0.24 | 0.01 | 0.00 | 0.47 |
| Avail Cap(c_a), veh/h | 427 | 0 | 380 | 456 | 0 | 405 | 640 | 0 | 1007 | 488 | 0 | 422 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 1.00 |
| Uniform Delay (d), s/veh | 14.6 | 0.0 | 15.0 | 16.2 | 0.0 | 15.6 | 10.2 | 0.0 | 8.3 | 13.3 | 0.0 | 14.3 |
| Incr Delay (d2), s/veh | 0.8 | 0.0 | 1.7 | 2.1 | 0.0 | 0.1 | 0.1 | 0.0 | 0.2 | 0.0 | 0.0 | 1.2 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 0.5 | 0.0 | 0.7 | 0.5 | 0.0 | 0.0 | 0.3 | 0.0 | 0.7 | 0.0 | 0.0 | 0.9 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 15.4 | 0.0 | 16.6 | 18.3 | 0.0 | 15.7 | 10.4 | 0.0 | 8.5 | 13.3 | 0.0 | 15.5 |
| LnGrp LOS | B | A | B | B | A | B | B | A | A | B | A | B |
| Approach Vol, veh/h | | 186 | | | 78 | | | 210 | | | 137 | |
| Approach Delay, s/veh | | 16.1 | | | 18.2 | | | 9.0 | | | 15.5 | |
| Approach LOS | | B | | | B | | | A | | | B | |
| Timer - Assigned Phs | | 2 | | 4 | | 6 | 7 | 8 | | | | |
| Phs Duration (G+Y+Rc), s | | 8.7 | | 18.7 | | 10.1 | 7.7 | 11.0 | | | | |
| Change Period (Y+Rc), s | | * 5.4 | | 5.0 | | 5.0 | 5.0 | 5.0 | | | | |
| Max Green Setting (Gmax), s | | * 9.6 | | 21.0 | | 9.0 | 7.0 | 9.0 | | | | |
| Max Q Clear Time (g_c+I1), s | | 3.5 | | 4.2 | | 4.3 | 2.9 | 4.6 | | | | |
| Green Ext Time (p_c), s | | 0.1 | | 0.7 | | 0.3 | 0.0 | 0.2 | | | | |

Intersection Summary

| | |
|--------------------|------|
| HCM 6th Ctrl Delay | 13.8 |
| HCM 6th LOS | B |

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

| Intersection | | | | | | |
|--------------------------|------|------|------|------|------|-------|
| Int Delay, s/veh | 0.9 | | | | | |
| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
| Lane Configurations | ↔ | | ↔ | ↕↕ | ↔ | ↔ |
| Traffic Vol, veh/h | 592 | 4 | 50 | 625 | 9 | 43 |
| Future Vol, veh/h | 592 | 4 | 50 | 625 | 9 | 43 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Stop | Stop |
| RT Channelized | - | None | - | None | - | Yield |
| Storage Length | - | - | 150 | - | 100 | 0 |
| Veh in Median Storage, # | 0 | - | - | 0 | 0 | - |
| Grade, % | 0 | - | - | 0 | 0 | - |
| Peak Hour Factor | 92 | 92 | 92 | 92 | 92 | 92 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 643 | 4 | 54 | 679 | 10 | 47 |

| Major/Minor | Major1 | Major2 | Minor1 | | |
|----------------------|--------|--------|--------|---|-------|
| Conflicting Flow All | 0 | 0 | 647 | 0 | 1093 |
| Stage 1 | - | - | - | - | 645 |
| Stage 2 | - | - | - | - | 448 |
| Critical Hdwy | - | - | 4.13 | - | 6.63 |
| Critical Hdwy Stg 1 | - | - | - | - | 5.43 |
| Critical Hdwy Stg 2 | - | - | - | - | 5.83 |
| Follow-up Hdwy | - | - | 2.219 | - | 3.519 |
| Pot Cap-1 Maneuver | - | - | 937 | - | 222 |
| Stage 1 | - | - | - | - | 521 |
| Stage 2 | - | - | - | - | 612 |
| Platoon blocked, % | - | - | - | - | - |
| Mov Cap-1 Maneuver | - | - | 937 | - | 209 |
| Mov Cap-2 Maneuver | - | - | - | - | 333 |
| Stage 1 | - | - | - | - | 491 |
| Stage 2 | - | - | - | - | 612 |

| Approach | EB | WB | NB |
|----------------------|----|-----|----|
| HCM Control Delay, s | 0 | 0.7 | 14 |
| HCM LOS | | | B |

| Minor Lane/Major Mvmt | NBLn1 | NBLn2 | EBT | EBR | WBL | WBT |
|-----------------------|-------|-------|-----|-----|-------|-----|
| Capacity (veh/h) | 333 | 471 | - | - | 937 | - |
| HCM Lane V/C Ratio | 0.029 | 0.099 | - | - | 0.058 | - |
| HCM Control Delay (s) | 16.1 | 13.5 | - | - | 9.1 | - |
| HCM Lane LOS | C | B | - | - | A | - |
| HCM 95th %tile Q(veh) | 0.1 | 0.3 | - | - | 0.2 | - |

| Intersection | | | | | | |
|--------------------------|------|------|------|------|------|------|
| Int Delay, s/veh | 1.5 | | | | | |
| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
| Lane Configurations | ↘ | ↗ | ↑ | ↗ | ↘ | ↑ |
| Traffic Vol, veh/h | 58 | 5 | 140 | 92 | 5 | 190 |
| Future Vol, veh/h | 58 | 5 | 140 | 92 | 5 | 190 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Stop | Stop | Free | Free | Free | Free |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | 0 | 0 | - | 130 | 75 | - |
| Veh in Median Storage, # | 0 | - | 0 | - | - | 0 |
| Grade, % | 0 | - | 0 | - | - | 0 |
| Peak Hour Factor | 92 | 92 | 92 | 92 | 92 | 92 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 63 | 5 | 152 | 100 | 5 | 207 |

| Major/Minor | Minor1 | Major1 | Major2 | | |
|----------------------|--------|--------|--------|---|-------|
| Conflicting Flow All | 369 | 152 | 0 | 0 | 252 |
| Stage 1 | 152 | - | - | - | - |
| Stage 2 | 217 | - | - | - | - |
| Critical Hdwy | 6.42 | 6.22 | - | - | 4.12 |
| Critical Hdwy Stg 1 | 5.42 | - | - | - | - |
| Critical Hdwy Stg 2 | 5.42 | - | - | - | - |
| Follow-up Hdwy | 3.518 | 3.318 | - | - | 2.218 |
| Pot Cap-1 Maneuver | 631 | 894 | - | - | 1313 |
| Stage 1 | 876 | - | - | - | - |
| Stage 2 | 819 | - | - | - | - |
| Platoon blocked, % | | | - | - | - |
| Mov Cap-1 Maneuver | 628 | 894 | - | - | 1313 |
| Mov Cap-2 Maneuver | 670 | - | - | - | - |
| Stage 1 | 872 | - | - | - | - |
| Stage 2 | 819 | - | - | - | - |

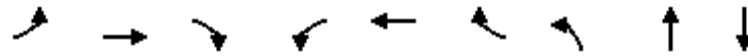
| Approach | WB | NB | SB |
|----------------------|------|----|-----|
| HCM Control Delay, s | 10.8 | 0 | 0.2 |
| HCM LOS | B | | |

| Minor Lane/Major Mvmt | NBT | NBRWBLn1 | WBLn2 | SBL | SBT |
|-----------------------|-----|----------|-------|-------|-------|
| Capacity (veh/h) | - | - | 670 | 894 | 1313 |
| HCM Lane V/C Ratio | - | - | 0.094 | 0.006 | 0.004 |
| HCM Control Delay (s) | - | - | 10.9 | 9.1 | 7.8 |
| HCM Lane LOS | - | - | B | A | A |
| HCM 95th %tile Q(veh) | - | - | 0.3 | 0 | 0 |

Queues

29: Roeland Drive & Johnson Drive

12/27/2018



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | SBT |
|-------------------------|------|------|------|------|------|------|------|------|------|
| Lane Group Flow (vph) | 48 | 583 | 42 | 76 | 652 | 24 | 49 | 144 | 52 |
| v/c Ratio | 0.11 | 0.53 | 0.04 | 0.15 | 0.59 | 0.02 | 0.15 | 0.32 | 0.21 |
| Control Delay | 6.3 | 15.2 | 0.1 | 6.5 | 16.3 | 0.0 | 24.8 | 10.6 | 20.3 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 6.3 | 15.2 | 0.1 | 6.5 | 16.3 | 0.0 | 24.8 | 10.6 | 20.3 |
| Queue Length 50th (ft) | 8 | 200 | 0 | 12 | 232 | 0 | 16 | 9 | 6 |
| Queue Length 95th (ft) | 16 | 300 | 0 | 24 | 360 | 0 | 47 | 60 | 15 |
| Internal Link Dist (ft) | | 180 | | | 507 | | | 267 | 783 |
| Turn Bay Length (ft) | 100 | | 100 | 130 | | | 100 | | |
| Base Capacity (vph) | 471 | 1416 | 1238 | 518 | 1416 | 1238 | 350 | 755 | 320 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.10 | 0.41 | 0.03 | 0.15 | 0.46 | 0.02 | 0.14 | 0.19 | 0.16 |

Intersection Summary

HCM Signalized Intersection Capacity Analysis

29: Roeland Drive & Johnson Drive

12/27/2018



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|------------------------|-------|------|------|-------|-------|------|-------|------|------|------|------|------|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 36 | 501 | 38 | 59 | 567 | 9 | 41 | 26 | 93 | 2 | 6 | 23 |
| Future Volume (vph) | 36 | 501 | 38 | 59 | 567 | 9 | 41 | 26 | 93 | 2 | 6 | 23 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | | | 5.0 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.88 | | | 0.91 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 1.00 | |
| Satd. Flow (prot) | 1770 | 1863 | 1583 | 1770 | 1863 | 1583 | 1770 | 1638 | | | 1682 | |
| Flt Permitted | 0.26 | 1.00 | 1.00 | 0.31 | 1.00 | 1.00 | 0.58 | 1.00 | | | 0.96 | |
| Satd. Flow (perm) | 477 | 1863 | 1583 | 573 | 1863 | 1583 | 1084 | 1638 | | | 1614 | |
| Peak-hour factor, PHF | 0.75 | 0.86 | 0.91 | 0.78 | 0.87 | 0.38 | 0.83 | 0.93 | 0.80 | 0.50 | 0.50 | 0.64 |
| Adj. Flow (vph) | 48 | 583 | 42 | 76 | 652 | 24 | 49 | 28 | 116 | 4 | 12 | 36 |
| RTOR Reduction (vph) | 0 | 0 | 20 | 0 | 0 | 12 | 0 | 92 | 0 | 0 | 33 | 0 |
| Lane Group Flow (vph) | 48 | 583 | 22 | 76 | 652 | 12 | 49 | 52 | 0 | 0 | 19 | 0 |
| Turn Type | pm+pt | NA | Perm | pm+pt | NA | Perm | pm+pt | NA | | Perm | NA | |
| Protected Phases | 1 | 6 | | 5 | 2 | | 7 | 4 | | | 8 | |
| Permitted Phases | 6 | | 6 | 2 | | 2 | 4 | | | 8 | | |
| Actuated Green, G (s) | 36.8 | 33.7 | 33.7 | 37.0 | 33.8 | 33.8 | 13.8 | 13.8 | | | 5.6 | |
| Effective Green, g (s) | 36.8 | 33.7 | 33.7 | 37.0 | 33.8 | 33.8 | 13.8 | 13.8 | | | 5.6 | |
| Actuated g/C Ratio | 0.56 | 0.51 | 0.51 | 0.56 | 0.51 | 0.51 | 0.21 | 0.21 | | | 0.09 | |
| Clearance Time (s) | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | | | 5.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | | 3.0 | |
| Lane Grp Cap (vph) | 328 | 955 | 811 | 380 | 958 | 814 | 261 | 344 | | | 137 | |
| v/s Ratio Prot | 0.01 | 0.31 | | c0.01 | c0.35 | | c0.01 | 0.03 | | | | |
| v/s Ratio Perm | 0.08 | | 0.01 | 0.10 | | 0.01 | c0.03 | | | | 0.01 | |
| v/c Ratio | 0.15 | 0.61 | 0.03 | 0.20 | 0.68 | 0.02 | 0.19 | 0.15 | | | 0.14 | |
| Uniform Delay, d1 | 7.9 | 11.3 | 7.9 | 7.5 | 11.9 | 7.8 | 21.3 | 21.2 | | | 27.8 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 1.00 | |
| Incremental Delay, d2 | 0.2 | 1.2 | 0.0 | 0.3 | 2.0 | 0.0 | 0.4 | 0.2 | | | 0.5 | |
| Delay (s) | 8.1 | 12.5 | 7.9 | 7.7 | 13.9 | 7.8 | 21.6 | 21.4 | | | 28.3 | |
| Level of Service | A | B | A | A | B | A | C | C | | | C | |
| Approach Delay (s) | | 11.9 | | | 13.1 | | | 21.4 | | | 28.3 | |
| Approach LOS | | B | | | B | | | C | | | C | |

Intersection Summary

| | | | |
|-----------------------------------|-------|---------------------------|------|
| HCM 2000 Control Delay | 14.1 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.57 | | |
| Actuated Cycle Length (s) | 65.7 | Sum of lost time (s) | 20.0 |
| Intersection Capacity Utilization | 56.3% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

HCM 6th Signalized Intersection Summary
 29: Roeland Drive & Johnson Drive

12/27/2018



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 36 | 501 | 38 | 59 | 567 | 9 | 41 | 26 | 93 | 2 | 6 | 23 |
| Future Volume (veh/h) | 36 | 501 | 38 | 59 | 567 | 9 | 41 | 26 | 93 | 2 | 6 | 23 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 |
| Adj Flow Rate, veh/h | 48 | 583 | 42 | 76 | 652 | 24 | 49 | 28 | 116 | 4 | 12 | 36 |
| Peak Hour Factor | 0.75 | 0.86 | 0.91 | 0.78 | 0.87 | 0.38 | 0.83 | 0.93 | 0.80 | 0.50 | 0.50 | 0.64 |
| Percent Heavy Veh, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Cap, veh/h | 323 | 771 | 653 | 377 | 804 | 681 | 443 | 79 | 326 | 75 | 45 | 115 |
| Arrive On Green | 0.06 | 0.41 | 0.41 | 0.07 | 0.43 | 0.43 | 0.06 | 0.25 | 0.25 | 0.10 | 0.10 | 0.10 |
| Sat Flow, veh/h | 1781 | 1870 | 1585 | 1781 | 1870 | 1585 | 1781 | 318 | 1316 | 61 | 443 | 1133 |
| Grp Volume(v), veh/h | 48 | 583 | 42 | 76 | 652 | 24 | 49 | 0 | 144 | 52 | 0 | 0 |
| Grp Sat Flow(s),veh/h/ln | 1781 | 1870 | 1585 | 1781 | 1870 | 1585 | 1781 | 0 | 1634 | 1636 | 0 | 0 |
| Q Serve(g_s), s | 0.8 | 15.0 | 0.9 | 1.3 | 17.2 | 0.5 | 1.3 | 0.0 | 4.1 | 0.0 | 0.0 | 0.0 |
| Cycle Q Clear(g_c), s | 0.8 | 15.0 | 0.9 | 1.3 | 17.2 | 0.5 | 1.3 | 0.0 | 4.1 | 1.6 | 0.0 | 0.0 |
| Prop In Lane | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 0.81 | 0.08 | | 0.69 |
| Lane Grp Cap(c), veh/h | 323 | 771 | 653 | 377 | 804 | 681 | 443 | 0 | 404 | 235 | 0 | 0 |
| V/C Ratio(X) | 0.15 | 0.76 | 0.06 | 0.20 | 0.81 | 0.04 | 0.11 | 0.00 | 0.36 | 0.22 | 0.00 | 0.00 |
| Avail Cap(c_a), veh/h | 445 | 1561 | 1323 | 466 | 1561 | 1323 | 563 | 0 | 609 | 329 | 0 | 0 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 0.00 |
| Uniform Delay (d), s/veh | 10.7 | 14.1 | 10.0 | 10.0 | 14.0 | 9.3 | 18.8 | 0.0 | 17.5 | 23.5 | 0.0 | 0.0 |
| Incr Delay (d2), s/veh | 0.2 | 1.5 | 0.0 | 0.3 | 2.0 | 0.0 | 0.1 | 0.0 | 0.5 | 0.5 | 0.0 | 0.0 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 0.3 | 5.7 | 0.3 | 0.4 | 6.5 | 0.2 | 0.5 | 0.0 | 1.5 | 0.6 | 0.0 | 0.0 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 10.9 | 15.7 | 10.0 | 10.2 | 16.1 | 9.3 | 18.9 | 0.0 | 18.0 | 23.9 | 0.0 | 0.0 |
| LnGrp LOS | B | B | B | B | B | A | B | A | B | C | A | A |
| Approach Vol, veh/h | | 673 | | | 752 | | | 193 | | | | 52 |
| Approach Delay, s/veh | | 15.0 | | | 15.3 | | | 18.2 | | | | 23.9 |
| Approach LOS | | B | | | B | | | B | | | | C |
| Timer - Assigned Phs | 1 | 2 | | 4 | 5 | 6 | 7 | 8 | | | | |
| Phs Duration (G+Y+Rc), s | 8.2 | 29.2 | | 18.9 | 9.2 | 28.2 | 8.2 | 10.7 | | | | |
| Change Period (Y+Rc), s | 5.0 | 5.0 | | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | | | | |
| Max Green Setting (Gmax), s | 7.0 | 47.0 | | 21.0 | 7.0 | 47.0 | 7.0 | 9.0 | | | | |
| Max Q Clear Time (g_c+I1), s | 2.8 | 19.2 | | 6.1 | 3.3 | 17.0 | 3.3 | 3.6 | | | | |
| Green Ext Time (p_c), s | 0.0 | 5.0 | | 0.6 | 0.0 | 4.4 | 0.0 | 0.1 | | | | |

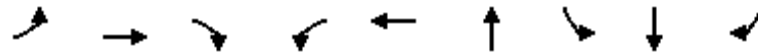
Intersection Summary

| | |
|--------------------|------|
| HCM 6th Ctrl Delay | 15.8 |
| HCM 6th LOS | B |

Queues

1470: Roeland Drive & Shawnee Mission Parkway

12/27/2018



| Lane Group | EBL | EBT | EBR | WBL | WBT | NBT | SBL | SBT | SBR |
|-------------------------|------|------|------|------|------|------|------|------|------|
| Lane Group Flow (vph) | 145 | 1218 | 136 | 32 | 1754 | 152 | 104 | 84 | 111 |
| v/c Ratio | 0.84 | 0.59 | 0.09 | 0.24 | 0.72 | 0.70 | 0.59 | 0.45 | 0.43 |
| Control Delay | 69.3 | 5.4 | 0.0 | 56.9 | 25.1 | 65.9 | 64.8 | 58.2 | 14.2 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 69.3 | 5.4 | 0.0 | 56.9 | 25.1 | 65.9 | 64.8 | 58.2 | 14.2 |
| Queue Length 50th (ft) | 121 | 30 | 0 | 24 | 394 | 113 | 79 | 63 | 0 |
| Queue Length 95th (ft) | m123 | m399 | m0 | 47 | 541 | 135 | 106 | 97 | 50 |
| Internal Link Dist (ft) | | 682 | | | 2401 | 499 | | 439 | |
| Turn Bay Length (ft) | 345 | | 310 | 170 | | | 100 | | 125 |
| Base Capacity (vph) | 184 | 2081 | 1583 | 140 | 2434 | 293 | 228 | 240 | 301 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.79 | 0.59 | 0.09 | 0.23 | 0.72 | 0.52 | 0.46 | 0.35 | 0.37 |

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

HCM 6th Signalized Intersection Summary
 1470: Roeland Drive & Shawnee Mission Parkway

12/27/2018



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Lane Configurations | ↘ | ↑↑ | ↗ | ↘ | ↑↑↑ | | | ↕ | | ↘ | ↑ | ↗ |
| Traffic Volume (veh/h) | 106 | 1145 | 103 | 24 | 1554 | 93 | 68 | 37 | 7 | 76 | 66 | 98 |
| Future Volume (veh/h) | 106 | 1145 | 103 | 24 | 1554 | 93 | 68 | 37 | 7 | 76 | 66 | 98 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 |
| Adj Flow Rate, veh/h | 145 | 1218 | 0 | 32 | 1636 | 118 | 88 | 52 | 12 | 104 | 84 | 111 |
| Peak Hour Factor | 0.73 | 0.94 | 0.76 | 0.75 | 0.95 | 0.79 | 0.77 | 0.71 | 0.58 | 0.73 | 0.79 | 0.88 |
| Percent Heavy Veh, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Cap, veh/h | 368 | 1673 | | 323 | 2060 | 148 | 105 | 62 | 14 | 157 | 164 | 139 |
| Arrive On Green | 0.21 | 0.47 | 0.00 | 0.18 | 0.45 | 0.45 | 0.10 | 0.10 | 0.10 | 0.09 | 0.09 | 0.09 |
| Sat Flow, veh/h | 1781 | 3554 | 1585 | 1781 | 4620 | 333 | 1038 | 613 | 142 | 1781 | 1870 | 1585 |
| Grp Volume(v), veh/h | 145 | 1218 | 0 | 32 | 1112 | 642 | 152 | 0 | 0 | 104 | 84 | 111 |
| Grp Sat Flow(s),veh/h/ln | 1781 | 1777 | 1585 | 1781 | 1571 | 1810 | 1793 | 0 | 0 | 1781 | 1870 | 1585 |
| Q Serve(g_s), s | 8.4 | 33.1 | 0.0 | 1.8 | 36.4 | 36.5 | 10.0 | 0.0 | 0.0 | 6.8 | 5.1 | 8.2 |
| Cycle Q Clear(g_c), s | 8.4 | 33.1 | 0.0 | 1.8 | 36.4 | 36.5 | 10.0 | 0.0 | 0.0 | 6.8 | 5.1 | 8.2 |
| Prop In Lane | 1.00 | | 1.00 | 1.00 | | 0.18 | 0.58 | | 0.08 | 1.00 | | 1.00 |
| Lane Grp Cap(c), veh/h | 368 | 1673 | | 323 | 1401 | 807 | 182 | 0 | 0 | 157 | 164 | 139 |
| V/C Ratio(X) | 0.39 | 0.73 | | 0.10 | 0.79 | 0.80 | 0.83 | 0.00 | 0.00 | 0.66 | 0.51 | 0.80 |
| Avail Cap(c_a), veh/h | 368 | 1673 | | 323 | 1401 | 807 | 291 | 0 | 0 | 230 | 242 | 205 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 0.00 | 1.00 | 1.00 | 1.00 |
| Uniform Delay (d), s/veh | 41.1 | 25.6 | 0.0 | 40.9 | 28.5 | 28.5 | 52.9 | 0.0 | 0.0 | 53.0 | 52.3 | 53.7 |
| Incr Delay (d2), s/veh | 0.3 | 2.8 | 0.0 | 0.0 | 4.7 | 8.0 | 5.6 | 0.0 | 0.0 | 1.8 | 0.9 | 7.4 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 3.6 | 13.7 | 0.0 | 0.8 | 13.7 | 16.6 | 4.8 | 0.0 | 0.0 | 3.1 | 2.5 | 3.6 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 41.4 | 28.4 | 0.0 | 41.0 | 33.2 | 36.5 | 58.5 | 0.0 | 0.0 | 54.8 | 53.2 | 61.0 |
| LnGrp LOS | D | C | | D | C | D | E | A | A | D | D | E |
| Approach Vol, veh/h | | 1363 | A | | 1786 | | | 152 | | | 299 | |
| Approach Delay, s/veh | | 29.8 | | | 34.5 | | | 58.5 | | | 56.7 | |
| Approach LOS | | C | | | C | | | E | | | E | |
| Timer - Assigned Phs | 1 | 2 | | 4 | 5 | 6 | | 8 | | | | |
| Phs Duration (G+Y+Rc), s | 29.3 | 59.0 | | 16.7 | 26.3 | 62.0 | | 15.1 | | | | |
| Change Period (Y+Rc), s | 4.5 | 5.5 | | 4.5 | 4.5 | 5.5 | | 4.5 | | | | |
| Max Green Setting (Gmax), s | 12.5 | 53.5 | | 19.5 | 9.5 | 56.5 | | 15.5 | | | | |
| Max Q Clear Time (g_c+I1), s | 10.4 | 38.5 | | 12.0 | 3.8 | 35.1 | | 10.2 | | | | |
| Green Ext Time (p_c), s | 0.0 | 6.9 | | 0.3 | 0.0 | 5.6 | | 0.3 | | | | |

Intersection Summary

| | |
|--------------------|------|
| HCM 6th Ctrl Delay | 35.6 |
| HCM 6th LOS | D |

Notes

Unsignalized Delay for [EBR] is excluded from calculations of the approach delay and intersection delay.

Crash Data

Total Crashes per KDOT Summary

| Year | Roeland Drive |
|---------------|---------------|
| 2013 | 0 |
| 2014 | 10 |
| 2015 | 4 |
| 2016 | 3 |
| 2017 | 0 |
| Total* | 17 |

*2018 & 2019 Excluded from crash rate due to incomplete/unofficial data (per KDOT)

Sorted Crash Data After Review ("Random" Crashes Removed)

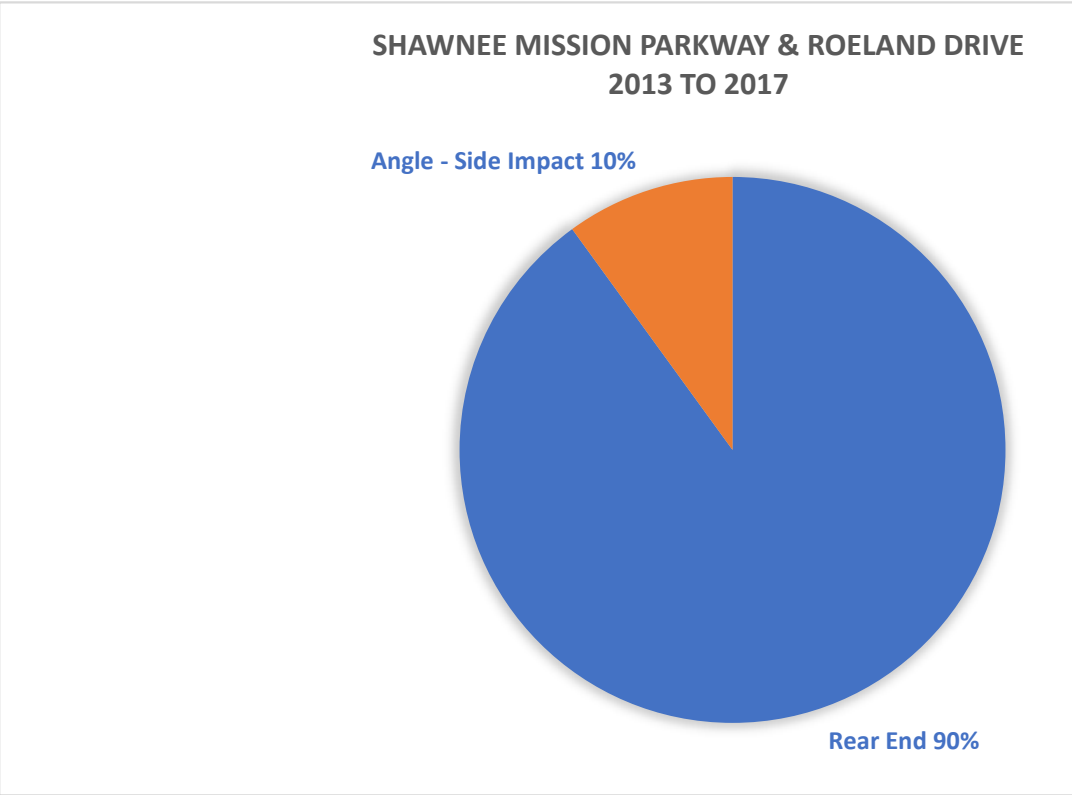
| Year | Roeland Drive |
|---------------|---------------|
| 2013 | 0 |
| 2014 | 5 |
| 2015 | 2 |
| 2016 | 3 |
| 2017 | 0 |
| Total* | 10 |

*2018 & 2019 Excluded from crash rate due to incomplete/unofficial data (per KDOT)

Examples of "random" crashes include those deemed to be caused by: alcohol impairment, animals, construction, inclement weather, a previous crash emergency vehicle, vehicle malfunction, or medical complications.

| CWOV |
|---------------------|
| Rear End |
| Rear End |
| Rear End |
| Angle - Side Impact |
| Rear End |
| Rear End |
| Rear End |
| Rear End |
| Rear End |
| Rear End |
| |
| |
| |
| |
| |
| |

| | |
|-----------------|----------------------------|
| Rear End | Angle - Side Impact |
| 9 | 1 |



| | Intersection | | Total Entering Vehicles (TEV/day) | Ten Million Entering Vehicles (TMEV/5 years) | 2013-2017 Total | Intersection Crash Rate (crashes/TMEV) |
|---------------------|--------------|---------------|-----------------------------------|--|-----------------|--|
| | Street | Street | | | | |
| Intersection | | | | | | |
| 1 | US-73 | Roeland Drive | 38,360 | 7.0 | 10 | 1.43 |

Note: Crash rate only includes crashes occurring from 2013-2017. Crashes that were considered "random" were not included in the crash rate calculation

Merge Analysis

HCS7 Freeway Merge Report

Project Information

| | | | |
|---------------------|--|----------------------|-----------|
| Analyst | TCM | Date | 5/20/2019 |
| Agency | Olsson | Analysis Year | 2019 |
| Jurisdiction | Mission, KS | Time Period Analyzed | AM |
| Project Description | EB Johnson Drive On-Ramp to NB Shawnee Mission Parkway | | |

Geometric Data

| | Freeway | Ramp |
|--|---------|---------|
| Number of Lanes (N), ln | 2 | 1 |
| Free-Flow Speed (FFS), mi/h | 45.0 | 25.0 |
| Segment Length (L) / Acceleration Length (LA),ft | 1500 | 150 |
| Terrain Type | Rolling | Rolling |
| Percent Grade, % | - | - |
| Segment Type / Ramp Side | Freeway | Right |

Adjustment Factors

| | | |
|--|--------------------|--------------------|
| Driver Population | All Familiar | All Familiar |
| Weather Type | Non-Severe Weather | Non-Severe Weather |
| Incident Type | No Incident | - |
| Final Speed Adjustment Factor (SAF) | 1.000 | 1.000 |
| Final Capacity Adjustment Factor (CAF) | 1.000 | 1.000 |
| Demand Adjustment Factor (DAF) | 1.000 | 1.000 |

Demand and Capacity

| | | |
|---------------------------------------|-------|-------|
| Demand Volume (Vi) | 1228 | 399 |
| Peak Hour Factor (PHF) | 0.94 | 0.86 |
| Total Trucks, % | 0.02 | 0.02 |
| Single-Unit Trucks (SUT), % | - | - |
| Tractor-Trailers (TT), % | - | - |
| Heavy Vehicle Adjustment Factor (fHV) | 1.000 | 1.000 |
| Flow Rate (vi),pc/h | 1306 | 464 |
| Capacity (c), pc/h | 4500 | 1900 |
| Volume-to-Capacity Ratio (v/c) | 0.39 | 0.24 |

Speed and Density

| | | | |
|--|-------|---|-------|
| Upstream Equilibrium Distance (LEQ), ft | - | Number of Outer Lanes on Freeway (NO) | 0 |
| Distance to Upstream Ramp (LUP), ft | - | Speed Index (Ms) | 0.336 |
| Downstream Equilibrium Distance (LEQ), ft | - | Flow Outer Lanes (VOA), pc/mi/ln | - |
| Distance to Downstream Ramp (LDOWN), ft | - | On-Ramp Influence Area Speed (SR), mi/h | 44.0 |
| Prop. Freeway Vehicles in Lane 1 and 2 (PFM) | 1.000 | Outer Lanes Freeway Speed (So), mi/h | - |
| Flow in Lanes 1 and 2 (v12), pc/h | 1306 | Ramp Junction Speed (S), mi/h | 44.0 |
| Flow Entering Ramp-Infl. Area (vR12), pc/h | 1770 | Average Density (D), pc/mi/ln | 20.1 |
| Level of Service (LOS) | B | Density in Ramp Influence Area (DR), pc/mi/ln | 18.2 |

HCS7 Freeway Merge Report

Project Information

| | | | |
|---------------------|--|----------------------|-----------|
| Analyst | TCM | Date | 5/20/2019 |
| Agency | Olsson | Analysis Year | 2019 |
| Jurisdiction | Mission, KS | Time Period Analyzed | AM |
| Project Description | EB Johnson Drive On-Ramp to NB Shawnee Mission Parkway | | |

Geometric Data

| | Freeway | Ramp |
|--|---------|---------|
| Number of Lanes (N), In | 2 | 1 |
| Free-Flow Speed (FFS), mi/h | 45.0 | 25.0 |
| Segment Length (L) / Acceleration Length (LA),ft | 1500 | 150 |
| Terrain Type | Rolling | Rolling |
| Percent Grade, % | - | - |
| Segment Type / Ramp Side | Freeway | Right |

Adjustment Factors

| | | |
|--|--------------------|--------------------|
| Driver Population | All Familiar | All Familiar |
| Weather Type | Non-Severe Weather | Non-Severe Weather |
| Incident Type | No Incident | - |
| Final Speed Adjustment Factor (SAF) | 1.000 | 1.000 |
| Final Capacity Adjustment Factor (CAF) | 1.000 | 1.000 |
| Demand Adjustment Factor (DAF) | 1.000 | 1.000 |

Demand and Capacity

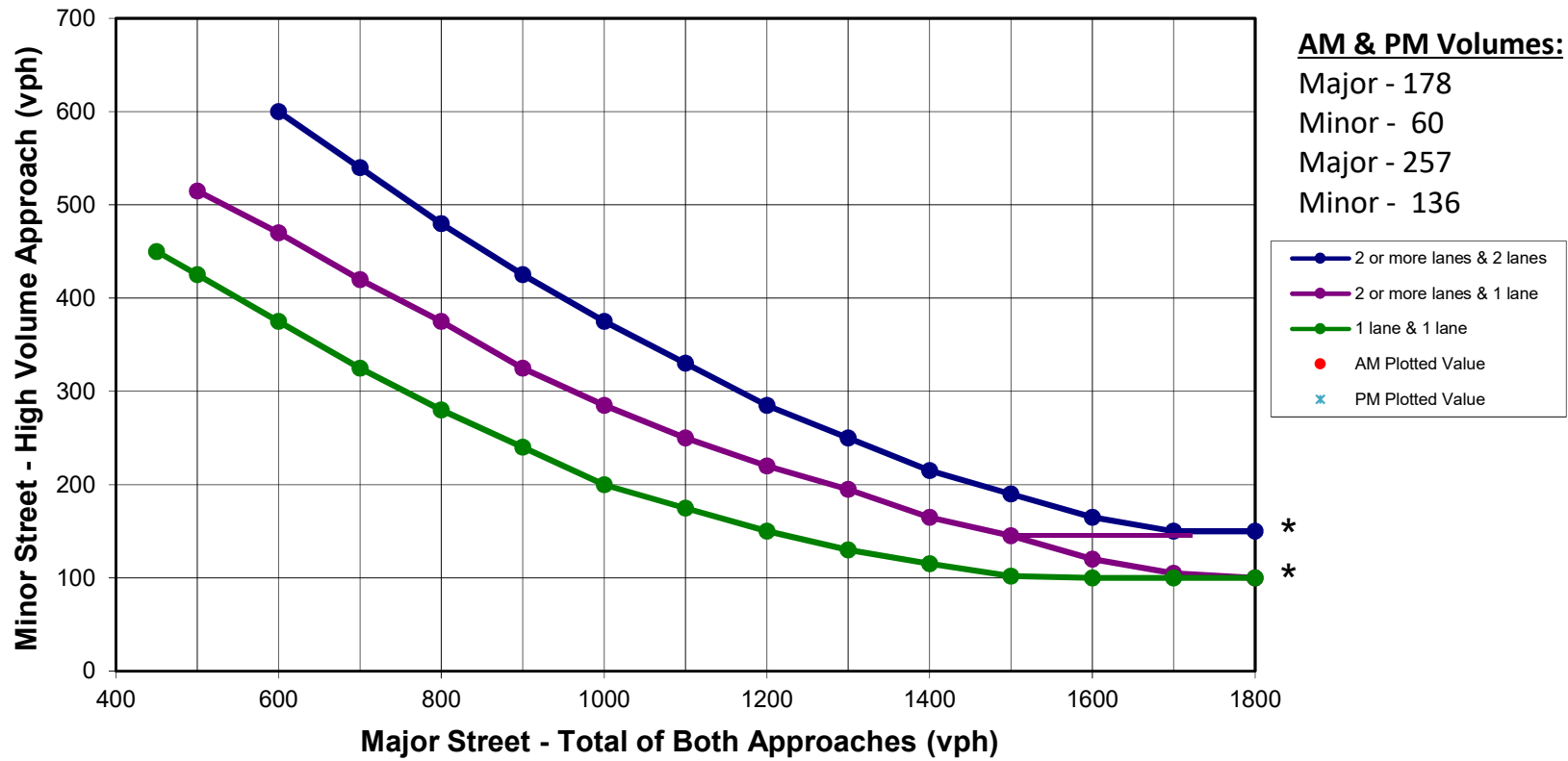
| | | |
|---------------------------------------|-------|-------|
| Demand Volume (Vi) | 1168 | 321 |
| Peak Hour Factor (PHF) | 0.84 | 0.85 |
| Total Trucks, % | 0.02 | 0.02 |
| Single-Unit Trucks (SUT), % | - | - |
| Tractor-Trailers (TT), % | - | - |
| Heavy Vehicle Adjustment Factor (fHV) | 1.000 | 1.000 |
| Flow Rate (vi),pc/h | 1390 | 378 |
| Capacity (c), pc/h | 4500 | 1900 |
| Volume-to-Capacity Ratio (v/c) | 0.39 | 0.20 |

Speed and Density

| | | | |
|--|-------|---|-------|
| Upstream Equilibrium Distance (LEQ), ft | - | Number of Outer Lanes on Freeway (No) | 0 |
| Distance to Upstream Ramp (LUP), ft | - | Speed Index (Ms) | 0.336 |
| Downstream Equilibrium Distance (LEQ), ft | - | Flow Outer Lanes (VOA), pc/mi/ln | - |
| Distance to Downstream Ramp (LDOWN), ft | - | On-Ramp Influence Area Speed (SR), mi/h | 44.0 |
| Prop. Freeway Vehicles in Lane 1 and 2 (PFM) | 1.000 | Outer Lanes Freeway Speed (So), mi/h | - |
| Flow in Lanes 1 and 2 (v12), pc/h | 1390 | Ramp Junction Speed (S), mi/h | 44.0 |
| Flow Entering Ramp-Infl. Area (vR12), pc/h | 1768 | Average Density (D), pc/mi/ln | 20.1 |
| Level of Service (LOS) | B | Density in Ramp Influence Area (DR), pc/mi/ln | 18.2 |

Signal Warrants

Peak Hour Volume Warrant Roeland Drive and Martway Street



*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes

Trip Generation

| NCHRP 8-51 Internal Trip Capture Estimation Tool | | | | | |
|--|----------------------|---------------|------------|--|--|
| Project Name: | Mission Gateway | Organization: | Olsson | | |
| Project Location: | Mission, KS | Performed By: | TCM | | |
| Scenario Description: | Approved Development | Date: | 11/16/2018 | | |
| Analysis Year: | 2018 | Checked By: | | | |
| Analysis Period: | PM Street Peak Hour | Date: | | | |

| Table 1-P: Base Vehicle-Trip Generation Estimates (Single-Use Site Estimate) | | | | | | |
|--|---|----------|-------|-------------------------|----------|---------|
| Land Use | Development Data (For Information Only) | | | Estimated Vehicle-Trips | | |
| | ITE LUCs ¹ | Quantity | Units | Total | Entering | Exiting |
| Office | | | | 0 | | |
| Retail | 820 | 54,594 | SQF | 348 | 168 | 180 |
| Restaurant | | | | 0 | | |
| Cinema/Entertainment | | | | 0 | | |
| Residential | 220 | 168 | DU | 94 | 60 | 34 |
| Hotel | | | | 0 | | |
| All Other Land Uses ² | | | | 0 | | |
| Total | | | | 442 | 228 | 214 |

| Table 2-P: Mode Split and Vehicle Occupancy Estimates | | | | | | |
|---|----------------|-----------|-----------------|---------------|-----------|-----------------|
| Land Use | Entering Trips | | | Exiting Trips | | |
| | Veh. Occ. | % Transit | % Non-Motorized | Veh. Occ. | % Transit | % Non-Motorized |
| Office | | | | | | |
| Retail | | | | | | |
| Restaurant | | | | | | |
| Cinema/Entertainment | | | | | | |
| Residential | | | | | | |
| Hotel | | | | | | |
| All Other Land Uses ² | | | | | | |

| Table 3-P: Average Land Use Interchange Distances (Feet Walking Distance) | | | | | | |
|---|------------------|--------|------------|----------------------|-------------|-------|
| Origin (From) | Destination (To) | | | | | |
| | Office | Retail | Restaurant | Cinema/Entertainment | Residential | Hotel |
| Office | | | | | | |
| Retail | | | | | | |
| Restaurant | | | | | | |
| Cinema/Entertainment | | | | | | |
| Residential | | | | | | |
| Hotel | | | | | | |

| Table 4-P: Internal Person-Trip Origin-Destination Matrix* | | | | | | |
|--|------------------|--------|------------|----------------------|-------------|-------|
| Origin (From) | Destination (To) | | | | | |
| | Office | Retail | Restaurant | Cinema/Entertainment | Residential | Hotel |
| Office | | 0 | 0 | 0 | 0 | 0 |
| Retail | 0 | | 0 | 0 | 28 | 0 |
| Restaurant | 0 | 0 | | 0 | 0 | 0 |
| Cinema/Entertainment | 0 | 0 | 0 | | 0 | 0 |
| Residential | 0 | 14 | 0 | 0 | | 0 |
| Hotel | 0 | 0 | 0 | 0 | 0 | |

| Table 5-P: Computations Summary | | | |
|---|-------|----------|---------|
| | Total | Entering | Exiting |
| All Person-Trips | 442 | 228 | 214 |
| Internal Capture Percentage | 19% | 18% | 20% |
| External Vehicle-Trips ³ | 358 | 186 | 172 |
| External Transit-Trips ⁴ | 0 | 0 | 0 |
| External Non-Motorized Trips ⁴ | 0 | 0 | 0 |

| Table 6-P: Internal Trip Capture Percentages by Land Use | | |
|--|----------------|---------------|
| Land Use | Entering Trips | Exiting Trips |
| Office | N/A | N/A |
| Retail | 8% | 16% |
| Restaurant | N/A | N/A |
| Cinema/Entertainment | N/A | N/A |
| Residential | 47% | 41% |
| Hotel | N/A | N/A |

¹Land Use Codes (LUCs) from *Trip Generation Informational Report*, published by the Institute of Transportation Engineers.

²Total estimate for all other land uses at mixed-use development site-not subject to internal trip capture computations in this estimator

³Vehicle-trips computed using the mode split and vehicle occupancy values provided in Table 2-P

⁴Person-Trips

*Indicates computation that has been rounded to the nearest whole number.

Estimation Tool Developed by the Texas Transportation Institute

Total Enter
Total Exit

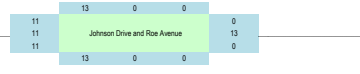
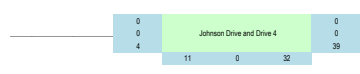
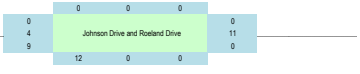
130
127

0%

10%

10%

13

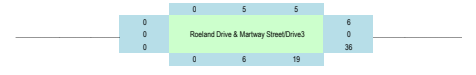


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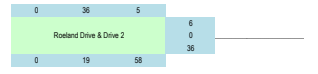
42
33%

10%

0%

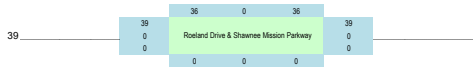


42 33%



42 33%

30%



30%

0%

Total Enter
Total Exit

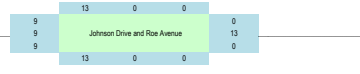
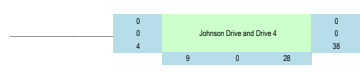
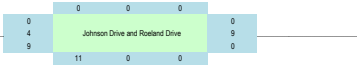
128
112

0%

10%

10%

13



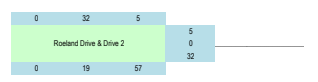
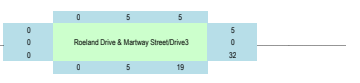
10%

37
33%

10%

0%

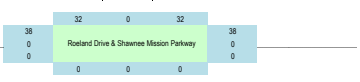
37 33%



37 33%

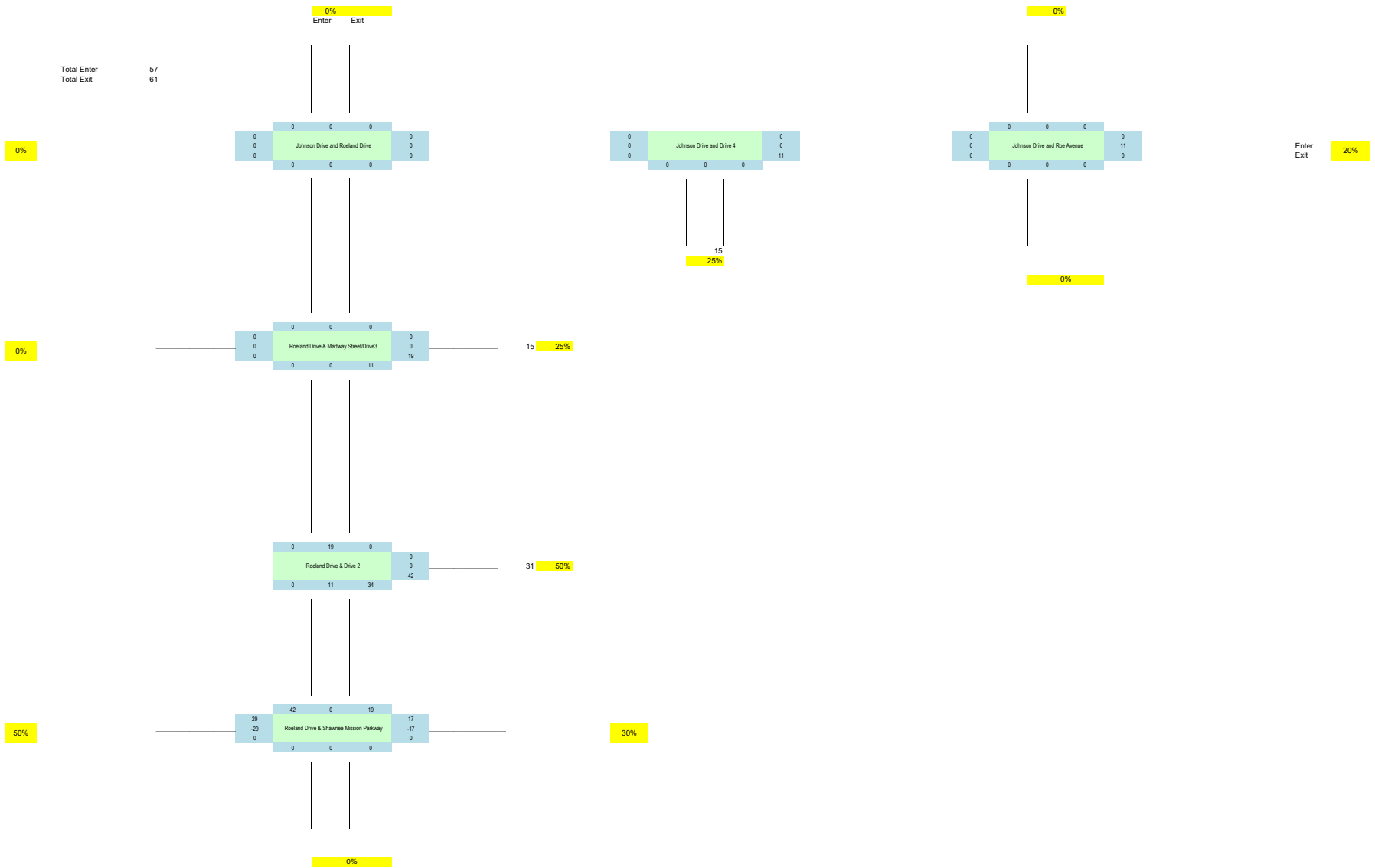
30%

38



30%

0%



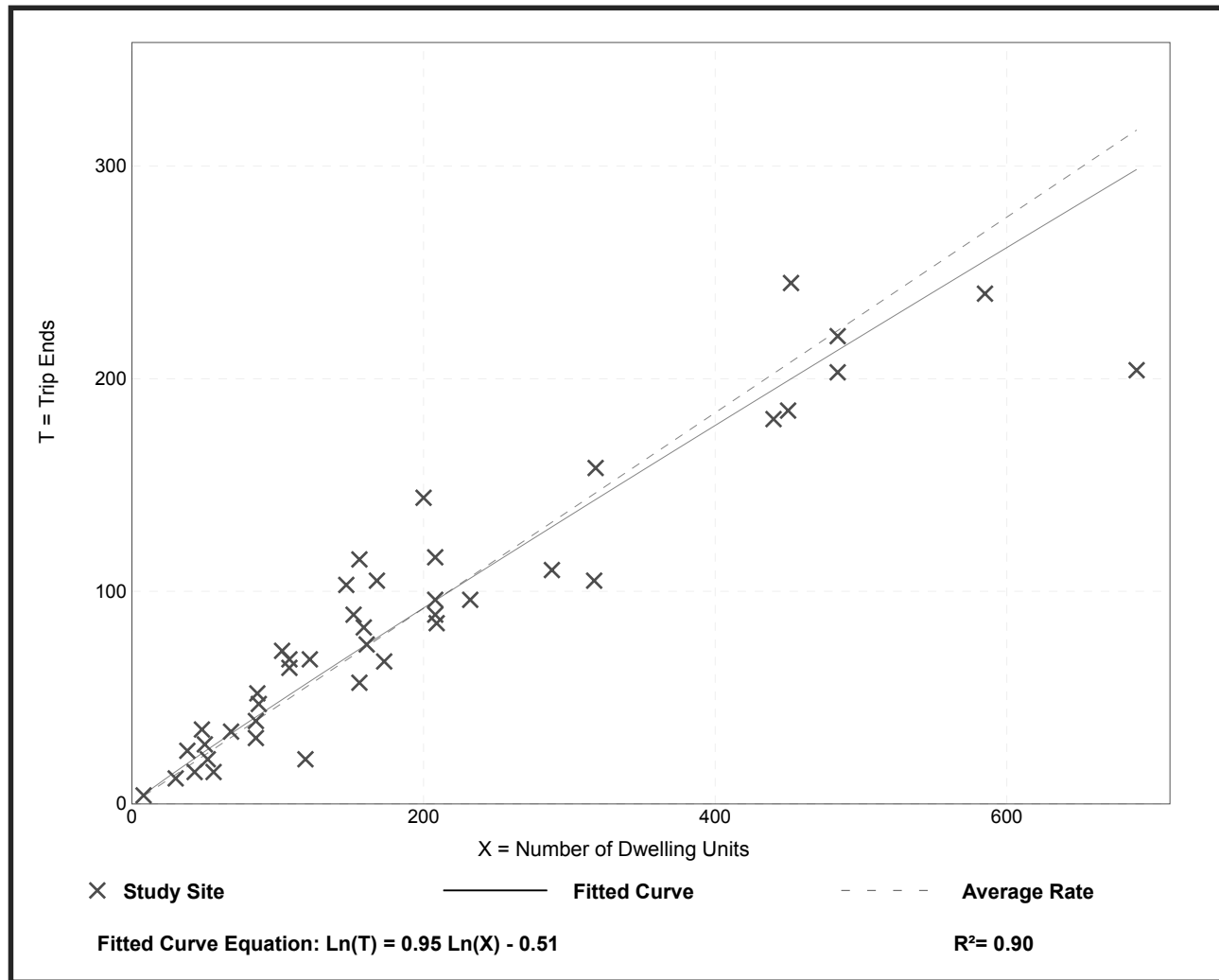
Multifamily Housing (Low-Rise) (220)

Vehicle Trip Ends vs: Dwelling Units
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.
Setting/Location: General Urban/Suburban
 Number of Studies: 42
 Avg. Num. of Dwelling Units: 199
 Directional Distribution: 23% entering, 77% exiting

Vehicle Trip Generation per Dwelling Unit

| Average Rate | Range of Rates | Standard Deviation |
|--------------|----------------|--------------------|
| 0.46 | 0.18 - 0.74 | 0.12 |

Data Plot and Equation



Trip Generation Manual, 10th Edition • Institute of Transportation Engineers

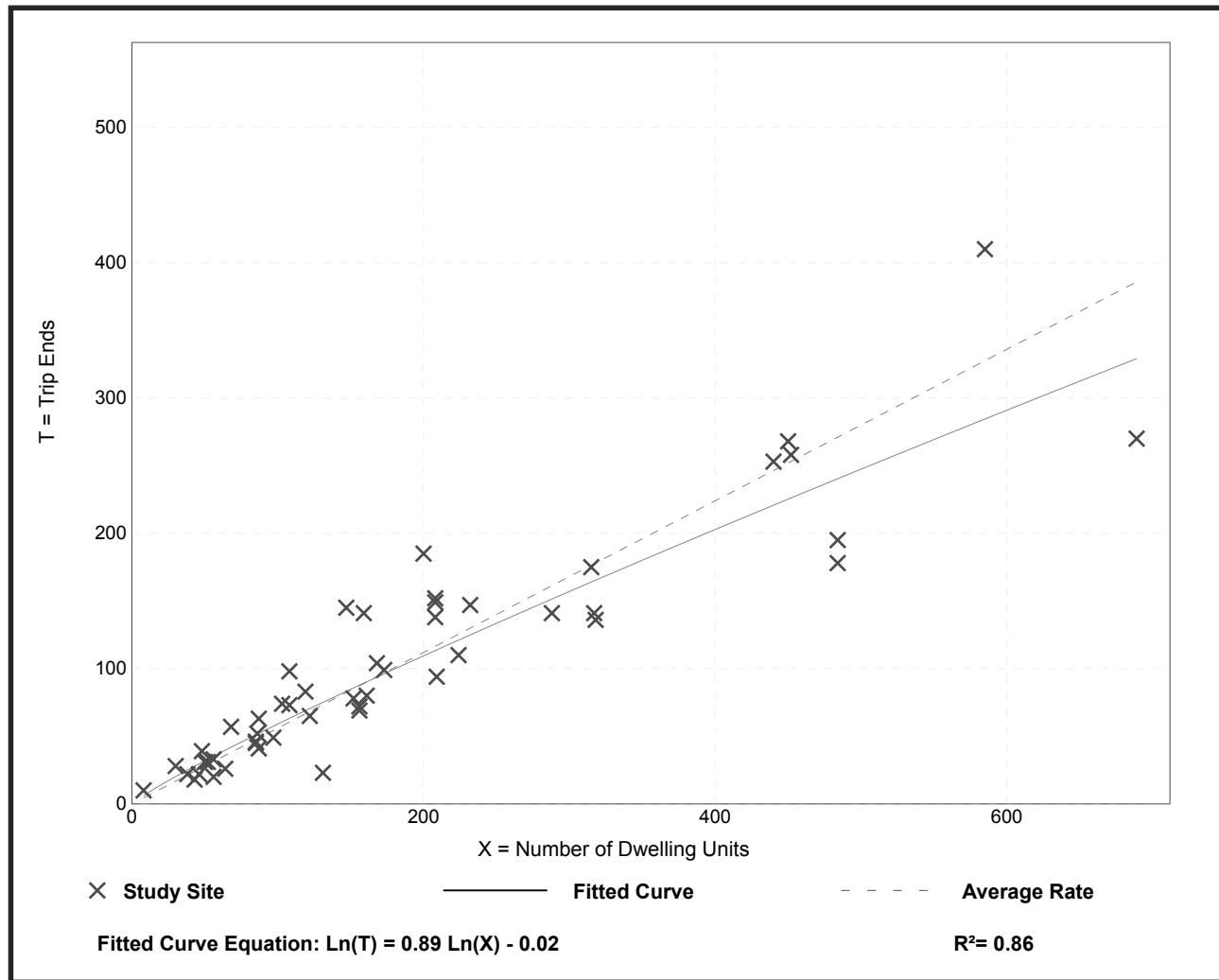
Multifamily Housing (Low-Rise) (220)

Vehicle Trip Ends vs: Dwelling Units
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.
Setting/Location: General Urban/Suburban
 Number of Studies: 50
 Avg. Num. of Dwelling Units: 187
 Directional Distribution: 63% entering, 37% exiting

Vehicle Trip Generation per Dwelling Unit

| Average Rate | Range of Rates | Standard Deviation |
|--------------|----------------|--------------------|
| 0.56 | 0.18 - 1.25 | 0.16 |

Data Plot and Equation



Trip Generation Manual, 10th Edition • Institute of Transportation Engineers

Land Use: 220

Multifamily Housing (Low-Rise)

Description

Low-rise multifamily housing includes apartments, townhouses, and condominiums located within the same building with at least three other dwelling units and that have one or two levels (floors). Multifamily housing (mid-rise) (Land Use 221), multifamily housing (high-rise) (Land Use 222), and off-campus student apartment (Land Use 225) are related land uses.

Additional Data

In prior editions of *Trip Generation Manual*, the low-rise multifamily housing sites were further divided into rental and condominium categories. An investigation of vehicle trip data found no clear differences in trip making patterns between the rental and condominium sites within the ITE database. As more data are compiled for future editions, this land use classification can be reinvestigated.

For the three sites for which both the number of residents and the number of occupied dwelling units were available, there were an average of 2.72 residents per occupied dwelling unit.

For the two sites for which the numbers of both total dwelling units and occupied dwelling units were available, an average of 96.2 percent of the total dwelling units were occupied.

This land use included data from a wide variety of units with different sizes, price ranges, locations, and ages. Consequently, there was a wide variation in trips generated within this category. Other factors, such as geographic location and type of adjacent and nearby development, may also have had an effect on the site trip generation.

Time-of-day distribution data for this land use are presented in Appendix A. For the 10 general urban/suburban sites with data, the overall highest vehicle volumes during the AM and PM on a weekday were counted between 7:15 and 8:15 a.m. and 4:45 and 5:45 p.m., respectively. For the one site with Saturday data, the overall highest vehicle volume was counted between 9:45 and 10:45 a.m. For the one site with Sunday data, the overall highest vehicle volume was counted between 11:45 a.m. and 12:45 p.m.

For the one dense multi-use urban site with 24-hour count data, the overall highest vehicle volumes during the AM and PM on a weekday were counted between 7:00 and 8:00 a.m. and 6:15 and 7:15 p.m., respectively.

For the three sites for which data were provided for both occupied dwelling units and residents, there was an average of 2.72 residents per occupied dwelling unit.

The average numbers of person trips per vehicle trip at the five general urban/suburban sites at which both person trip and vehicle trip data were collected were as follows:

- 1.13 during Weekday, Peak Hour of Adjacent Street Traffic, one hour between 7 and 9 a.m.
- 1.21 during Weekday, Peak Hour of Adjacent Street Traffic, one hour between 4 and 6 p.m.

The sites were surveyed in the 1980s, the 1990s, the 2000s, and the 2010s in British Columbia (CAN), California, District of Columbia, Florida, Georgia, Illinois, Indiana, Maine, Maryland, Minnesota, New Jersey, New York, Ontario, Oregon, Pennsylvania, South Dakota, Tennessee, Texas, Utah, Virginia, and Washington.

It is expected that the number of bedrooms and number of residents are likely correlated to the number of trips generated by a residential site. Many of the studies included in this land use did not indicate the total number of bedrooms. To assist in the future analysis of this land use, it is important that this information be collected and included in trip generation data submissions.

Source Numbers

168, 187, 188, 204, 211, 300, 305, 306, 319, 320, 321, 357, 390, 412, 418, 525, 530, 571, 579, 583, 864, 868, 869, 870, 896, 903, 918, 946, 947, 948, 951

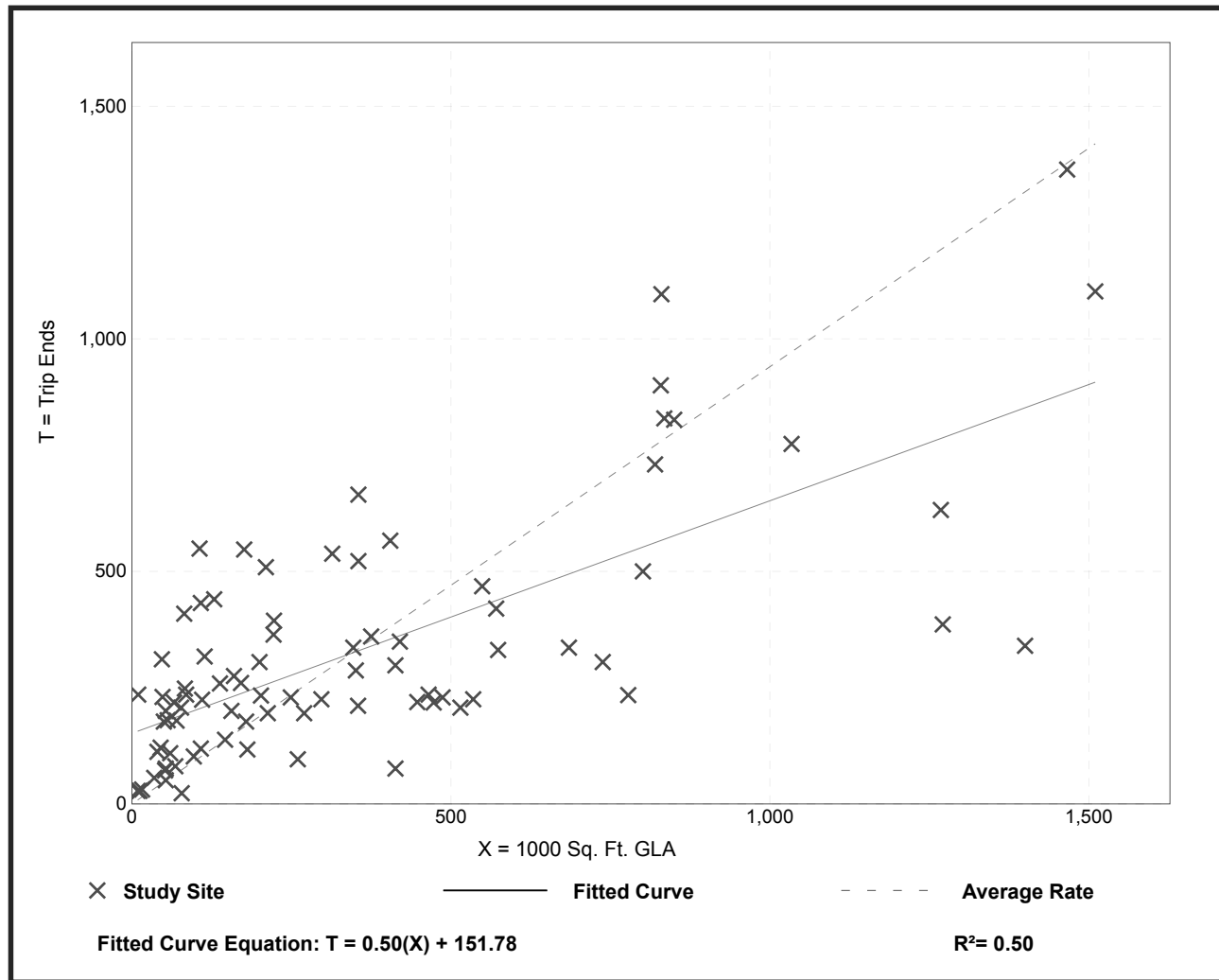
Shopping Center (820)

Vehicle Trip Ends vs: 1000 Sq. Ft. GLA
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.
Setting/Location: General Urban/Suburban
 Number of Studies: 84
 Avg. 1000 Sq. Ft. GLA: 351
 Directional Distribution: 62% entering, 38% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GLA

| Average Rate | Range of Rates | Standard Deviation |
|--------------|----------------|--------------------|
| 0.94 | 0.18 - 23.74 | 0.87 |

Data Plot and Equation



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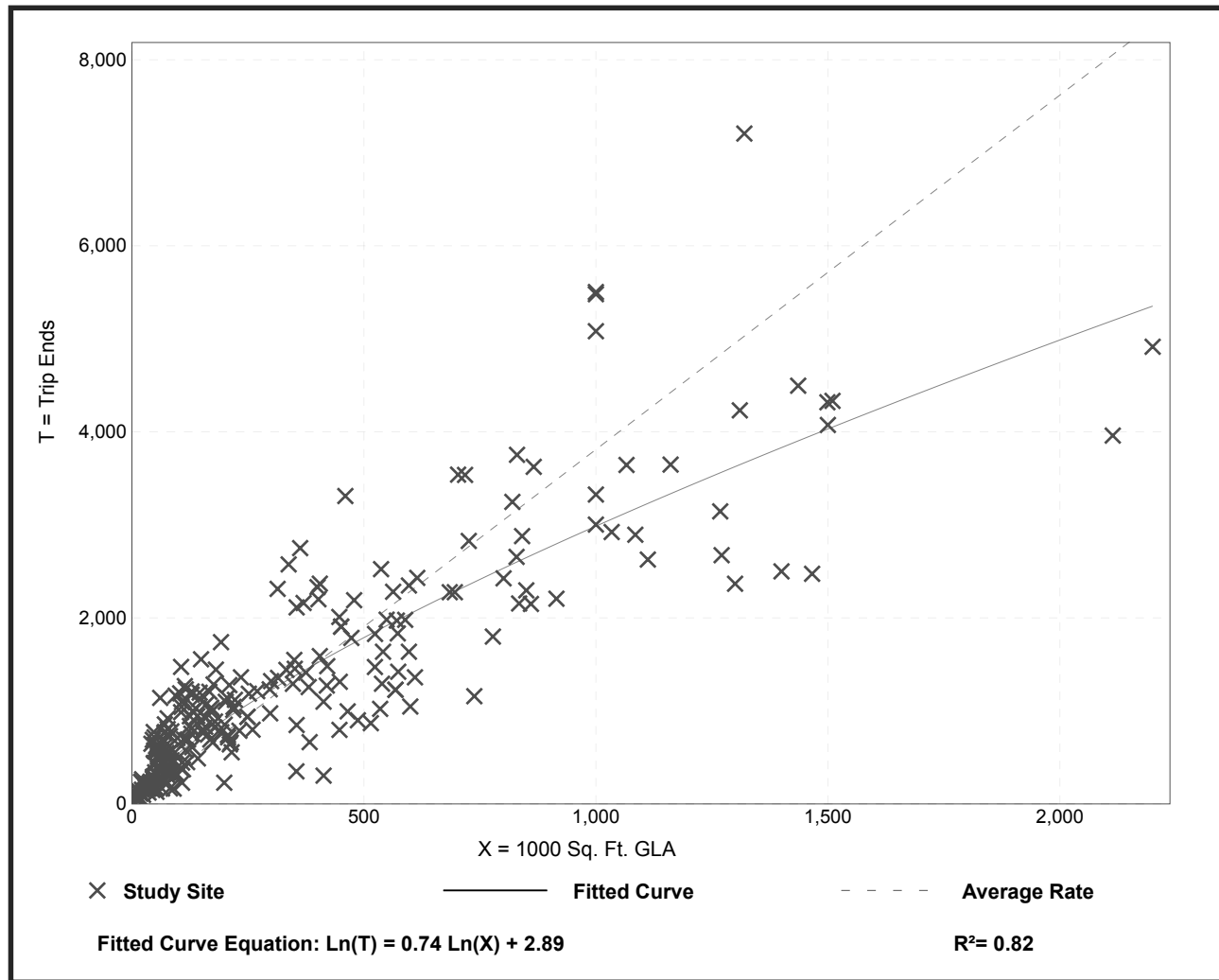
Shopping Center (820)

Vehicle Trip Ends vs: 1000 Sq. Ft. GLA
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.
Setting/Location: General Urban/Suburban
 Number of Studies: 261
 Avg. 1000 Sq. Ft. GLA: 327
 Directional Distribution: 48% entering, 52% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GLA

| Average Rate | Range of Rates | Standard Deviation |
|--------------|----------------|--------------------|
| 3.81 | 0.74 - 18.69 | 2.04 |

Data Plot and Equation



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Land Use: 820

Shopping Center

Description

A shopping center is an integrated group of commercial establishments that is planned, developed, owned, and managed as a unit. A shopping center's composition is related to its market area in terms of size, location, and type of store. A shopping center also provides on-site parking facilities sufficient to serve its own parking demands. Factory outlet center (Land Use 823) is a related use.

Additional Data

Shopping centers, including neighborhood centers, community centers, regional centers, and super regional centers, were surveyed for this land use. Some of these centers contained non-merchandising facilities, such as office buildings, movie theaters, restaurants, post offices, banks, health clubs, and recreational facilities (for example, ice skating rinks or indoor miniature golf courses).

Many shopping centers, in addition to the integrated unit of shops in one building or enclosed around a mall, include outparcels (peripheral buildings or pads located on the perimeter of the center adjacent to the streets and major access points). These buildings are typically drive-in banks, retail stores, restaurants, or small offices. Although the data herein do not indicate which of the centers studied included peripheral buildings, it can be assumed that some of the data show their effect.

The vehicle trips generated at a shopping center are based upon the total GLA of the center. In cases of smaller centers without an enclosed mall or peripheral buildings, the GLA could be the same as the gross floor area of the building.

Time-of-day distribution data for this land use are presented in Appendix A. For the 10 general urban/suburban sites with data, the overall highest vehicle volumes during the AM and PM on a weekday were counted between 11:45 a.m. and 12:45 p.m. and 12:15 and 1:15 p.m., respectively.

The average numbers of person trips per vehicle trip at the 27 general urban/suburban sites at which both person trip and vehicle trip data were collected were as follows:

- 1.31 during Weekday, AM Peak Hour of Generator
- 1.43 during Weekday, Peak Hour of Adjacent Street Traffic, one hour between 4 and 6 p.m.
- 1.46 during Weekday, PM Peak Hour of Generator

The sites were surveyed in the 1980s, the 1990s, the 2000s, and the 2010s in Alberta (CAN), British Columbia (CAN), California, Colorado, Connecticut, Delaware, District of Columbia, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Maine, Maryland, Massachusetts, Michigan, Minnesota, Nevada, New Jersey, New York, North Carolina, Ohio, Oklahoma, Oregon, Pennsylvania, South Dakota, Tennessee, Texas, Vermont, Virginia, Washington, West Virginia, and Wisconsin.

Source Numbers

105, 110, 154, 156, 159, 186, 190, 198, 199, 202, 204, 211, 213, 239, 251, 259, 260, 269, 294, 295, 299, 300, 301, 304, 305, 307, 308, 309, 310, 311, 314, 315, 316, 317, 319, 358, 365, 376, 385, 390, 400, 404, 414, 420, 423, 428, 437, 440, 442, 444, 446, 507, 562, 580, 598, 629, 658, 702, 715, 728, 868, 870, 871, 880, 899, 908, 912, 915, 926, 936, 944, 946, 960, 961, 962, 973, 974, 978

APPENDIX C

Existing Plus Approved Development Plus Proposed
Development

Capacity Analysis

HCM 6th TWSC
2: Roeland Drive & Drive 1

12/27/2018

| Intersection | | | | | | | | | | | | |
|--------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Int Delay, s/veh | 0.8 | | | | | | | | | | | |
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations | | ↕ | | ↕ | | | | ↕ | | | ↕ | |
| Traffic Vol, veh/h | 0 | 0 | 0 | 29 | 0 | 0 | 0 | 435 | 42 | 0 | 324 | 0 |
| Future Vol, veh/h | 0 | 0 | 0 | 29 | 0 | 0 | 0 | 435 | 42 | 0 | 324 | 0 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Free | Free | Free | Free | Free | Free |
| RT Channelized | - | - | None | - | - | None | - | - | None | - | - | None |
| Storage Length | - | - | - | 0 | - | - | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Peak Hour Factor | 92 | 92 | 92 | 78 | 92 | 92 | 87 | 87 | 78 | 87 | 87 | 87 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 0 | 0 | 0 | 37 | 0 | 0 | 0 | 500 | 54 | 0 | 372 | 0 |

| Major/Minor | Minor2 | | Minor1 | | Major1 | | | Major2 | | | | |
|----------------------|--------|-------|--------|-------|--------|---|-------|--------|---|-------|---|---|
| Conflicting Flow All | 899 | 926 | 372 | 899 | - | - | 372 | 0 | 0 | 554 | 0 | 0 |
| Stage 1 | 372 | 372 | - | 527 | - | - | - | - | - | - | - | - |
| Stage 2 | 527 | 554 | - | 372 | - | - | - | - | - | - | - | - |
| Critical Hdwy | 7.12 | 6.52 | 6.22 | 7.12 | - | - | 4.12 | - | - | 4.12 | - | - |
| Critical Hdwy Stg 1 | 6.12 | 5.52 | - | 6.12 | - | - | - | - | - | - | - | - |
| Critical Hdwy Stg 2 | 6.12 | 5.52 | - | 6.12 | - | - | - | - | - | - | - | - |
| Follow-up Hdwy | 3.518 | 4.018 | 3.318 | 3.518 | - | - | 2.218 | - | - | 2.218 | - | - |
| Pot Cap-1 Maneuver | 260 | 269 | 674 | 260 | 0 | 0 | 1186 | - | - | 1016 | - | - |
| Stage 1 | 648 | 619 | - | 535 | 0 | 0 | - | - | - | - | - | - |
| Stage 2 | 535 | 514 | - | 648 | 0 | 0 | - | - | - | - | - | - |
| Platoon blocked, % | | | | | | | | | | | | |
| Mov Cap-1 Maneuver | 260 | 269 | 674 | 260 | - | - | 1186 | - | - | 1016 | - | - |
| Mov Cap-2 Maneuver | 260 | 269 | - | 260 | - | - | - | - | - | - | - | - |
| Stage 1 | 648 | 619 | - | 535 | - | - | - | - | - | - | - | - |
| Stage 2 | 535 | 514 | - | 648 | - | - | - | - | - | - | - | - |

| Approach | EB | | WB | | NB | | | SB | | |
|----------------------|----|--|------|--|----|--|--|----|--|--|
| HCM Control Delay, s | 0 | | 21.1 | | 0 | | | 0 | | |
| HCM LOS | A | | C | | | | | | | |

| Minor Lane/Major Mvmt | NBL | NBT | NBR | EBLn1WBLn1 | SBL | SBT | SBR |
|-----------------------|------|-----|-----|------------|-------|------|-----|
| Capacity (veh/h) | 1186 | - | - | - | 260 | 1016 | - |
| HCM Lane V/C Ratio | - | - | - | - | 0.143 | - | - |
| HCM Control Delay (s) | 0 | - | - | 0 | 21.1 | 0 | - |
| HCM Lane LOS | A | - | - | A | C | A | - |
| HCM 95th %tile Q(veh) | 0 | - | - | - | 0.5 | 0 | - |

Queues

3: Roe Avenue & Johnson Drive/Johnson Drive WB

12/27/2018



| Lane Group | EBL | EBT | WBL | WBT | NBL | NBT | NBR | SBL | SBT | SBR |
|-------------------------|------|------|------|------|------|------|------|------|------|------|
| Lane Group Flow (vph) | 236 | 294 | 52 | 278 | 178 | 765 | 72 | 97 | 405 | 220 |
| v/c Ratio | 0.57 | 0.44 | 0.37 | 0.64 | 0.33 | 0.47 | 0.08 | 0.25 | 0.27 | 0.27 |
| Control Delay | 46.7 | 35.1 | 50.8 | 47.2 | 13.6 | 21.3 | 0.2 | 12.2 | 19.9 | 3.7 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 46.7 | 35.1 | 50.8 | 47.2 | 13.6 | 21.3 | 0.2 | 12.2 | 19.9 | 3.7 |
| Queue Length 50th (ft) | 74 | 81 | 32 | 86 | 51 | 179 | 0 | 26 | 88 | 0 |
| Queue Length 95th (ft) | 105 | 115 | 66 | 126 | 63 | 244 | 0 | 51 | 122 | 38 |
| Internal Link Dist (ft) | | 556 | | 629 | | 199 | | | 492 | |
| Turn Bay Length (ft) | 245 | | 130 | | 150 | | 25 | 150 | | 250 |
| Base Capacity (vph) | 465 | 710 | 145 | 471 | 545 | 1644 | 855 | 477 | 1611 | 840 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.51 | 0.41 | 0.36 | 0.59 | 0.33 | 0.47 | 0.08 | 0.20 | 0.25 | 0.26 |

Intersection Summary

HCM 6th Signalized Intersection Summary
 3: Roe Avenue & Johnson Drive/Johnson Drive WB

12/27/2018



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|------------------------------|------|------|-------|------|------|------|------|------|------|------|------|------|
| Lane Configurations | ↔↔ | ↕↔ | | ↔ | ↕↔ | | ↔ | ↕↕ | ↔ | ↔ | ↕↕ | ↔ |
| Traffic Volume (veh/h) | 205 | 203 | 39 | 45 | 220 | 9 | 114 | 658 | 53 | 83 | 381 | 191 |
| Future Volume (veh/h) | 205 | 203 | 39 | 45 | 220 | 9 | 114 | 658 | 53 | 83 | 381 | 191 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 |
| Adj Flow Rate, veh/h | 236 | 233 | 61 | 52 | 250 | 28 | 178 | 765 | 0 | 97 | 405 | 0 |
| Peak Hour Factor | 0.87 | 0.87 | 0.64 | 0.86 | 0.88 | 0.32 | 0.64 | 0.86 | 0.74 | 0.86 | 0.94 | 0.87 |
| Percent Heavy Veh, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Cap, veh/h | 310 | 427 | 109 | 68 | 326 | 36 | 616 | 1846 | | 444 | 1810 | |
| Arrive On Green | 0.09 | 0.15 | 0.15 | 0.04 | 0.10 | 0.10 | 0.06 | 0.52 | 0.00 | 0.06 | 0.51 | 0.00 |
| Sat Flow, veh/h | 3456 | 2801 | 718 | 1781 | 3225 | 358 | 1781 | 3554 | 1585 | 1781 | 3554 | 1585 |
| Grp Volume(v), veh/h | 236 | 146 | 148 | 52 | 137 | 141 | 178 | 765 | 0 | 97 | 405 | 0 |
| Grp Sat Flow(s),veh/h/ln | 1728 | 1777 | 1741 | 1781 | 1777 | 1806 | 1781 | 1777 | 1585 | 1781 | 1777 | 1585 |
| Q Serve(g_s), s | 6.7 | 7.6 | 7.9 | 2.9 | 7.5 | 7.6 | 4.8 | 13.2 | 0.0 | 2.5 | 6.3 | 0.0 |
| Cycle Q Clear(g_c), s | 6.7 | 7.6 | 7.9 | 2.9 | 7.5 | 7.6 | 4.8 | 13.2 | 0.0 | 2.5 | 6.3 | 0.0 |
| Prop In Lane | 1.00 | | 0.41 | 1.00 | | 0.20 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Lane Grp Cap(c), veh/h | 310 | 271 | 266 | 68 | 180 | 182 | 616 | 1846 | | 444 | 1810 | |
| V/C Ratio(X) | 0.76 | 0.54 | 0.56 | 0.76 | 0.76 | 0.77 | 0.29 | 0.41 | | 0.22 | 0.22 | |
| Avail Cap(c_a), veh/h | 449 | 338 | 331 | 125 | 231 | 235 | 616 | 1846 | | 586 | 1810 | |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 |
| Uniform Delay (d), s/veh | 44.5 | 39.1 | 39.3 | 47.6 | 43.8 | 43.8 | 10.5 | 14.7 | 0.0 | 10.9 | 13.6 | 0.0 |
| Incr Delay (d2), s/veh | 4.6 | 1.7 | 1.8 | 16.1 | 10.5 | 11.5 | 0.3 | 0.7 | 0.0 | 0.2 | 0.3 | 0.0 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 3.0 | 3.4 | 3.5 | 1.6 | 3.8 | 4.0 | 1.8 | 5.2 | 0.0 | 0.9 | 2.5 | 0.0 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 49.0 | 40.8 | 41.1 | 63.7 | 54.2 | 55.3 | 10.8 | 15.4 | 0.0 | 11.1 | 13.9 | 0.0 |
| LnGrp LOS | D | D | D | E | D | E | B | B | | B | B | |
| Approach Vol, veh/h | | 530 | | | 330 | | | 943 | A | | 502 | A |
| Approach Delay, s/veh | | 44.5 | | | 56.2 | | | 14.5 | | | 13.3 | |
| Approach LOS | | D | | | E | | | B | | | B | |
| Timer - Assigned Phs | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | | | |
| Phs Duration (G+Y+Rc), s | 15.0 | 16.1 | 11.0 | 57.9 | 9.8 | 21.2 | 12.0 | 56.9 | | | | |
| Change Period (Y+Rc), s | 6.0 | 6.0 | * 5.4 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | | | | |
| Max Green Setting (Gmax), s | 13.0 | 13.0 | * 14 | 37.0 | 7.0 | 19.0 | 6.0 | 44.0 | | | | |
| Max Q Clear Time (g_c+I1), s | 8.7 | 9.6 | 4.5 | 15.2 | 4.9 | 9.9 | 6.8 | 8.3 | | | | |
| Green Ext Time (p_c), s | 0.3 | 0.5 | 0.1 | 5.3 | 0.0 | 1.1 | 0.0 | 2.8 | | | | |

Intersection Summary

| | |
|--------------------|------|
| HCM 6th Ctrl Delay | 27.1 |
| HCM 6th LOS | C |

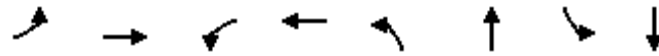
Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.
 Unsignalized Delay for [NBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Queues

6: Roeland Drive & Martway Street/Drive 3

12/27/2018



| Lane Group | EBL | EBT | WBL | WBT | NBL | NBT | SBL | SBT |
|-------------------------|------|------|------|------|------|------|------|------|
| Lane Group Flow (vph) | 20 | 20 | 69 | 22 | 44 | 178 | 24 | 125 |
| v/c Ratio | 0.06 | 0.02 | 0.19 | 0.02 | 0.06 | 0.16 | 0.04 | 0.12 |
| Control Delay | 17.9 | 0.1 | 18.2 | 0.1 | 8.0 | 5.0 | 15.8 | 13.7 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 17.9 | 0.1 | 18.2 | 0.1 | 8.0 | 5.0 | 15.8 | 13.7 |
| Queue Length 50th (ft) | 2 | 0 | 8 | 0 | 4 | 7 | 2 | 10 |
| Queue Length 95th (ft) | 20 | 0 | 41 | 0 | 15 | 25 | 19 | 57 |
| Internal Link Dist (ft) | | 773 | | 54 | | 238 | | 267 |
| Turn Bay Length (ft) | 105 | | | | 115 | | 75 | |
| Base Capacity (vph) | 646 | 1002 | 373 | 1024 | 727 | 1255 | 664 | 1019 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.03 | 0.02 | 0.18 | 0.02 | 0.06 | 0.14 | 0.04 | 0.12 |

Intersection Summary

HCM 6th Signalized Intersection Summary
6: Roeland Drive & Martway Street/Drive 3

12/27/2018



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|------------------------------|------|-------|------|------|------|------|------|------|------|------|------|------|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 18 | 0 | 12 | 54 | 0 | 17 | 29 | 55 | 72 | 19 | 86 | 11 |
| Future Volume (veh/h) | 18 | 0 | 12 | 54 | 0 | 17 | 29 | 55 | 72 | 19 | 86 | 11 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 |
| Adj Flow Rate, veh/h | 20 | 0 | 20 | 69 | 0 | 22 | 44 | 86 | 92 | 24 | 113 | 12 |
| Peak Hour Factor | 0.90 | 0.92 | 0.60 | 0.78 | 0.92 | 0.78 | 0.66 | 0.64 | 0.78 | 0.78 | 0.76 | 0.92 |
| Percent Heavy Veh, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Cap, veh/h | 99 | 0 | 88 | 182 | 0 | 162 | 470 | 319 | 341 | 428 | 296 | 31 |
| Arrive On Green | 0.06 | 0.00 | 0.06 | 0.10 | 0.00 | 0.10 | 0.06 | 0.39 | 0.39 | 0.18 | 0.18 | 0.18 |
| Sat Flow, veh/h | 1781 | 0 | 1585 | 1781 | 0 | 1585 | 1781 | 827 | 884 | 1206 | 1662 | 177 |
| Grp Volume(v), veh/h | 20 | 0 | 20 | 69 | 0 | 22 | 44 | 0 | 178 | 24 | 0 | 125 |
| Grp Sat Flow(s),veh/h/ln | 1781 | 0 | 1585 | 1781 | 0 | 1585 | 1781 | 0 | 1711 | 1206 | 0 | 1839 |
| Q Serve(g_s), s | 0.4 | 0.0 | 0.4 | 1.2 | 0.0 | 0.4 | 0.6 | 0.0 | 2.4 | 0.6 | 0.0 | 2.0 |
| Cycle Q Clear(g_c), s | 0.4 | 0.0 | 0.4 | 1.2 | 0.0 | 0.4 | 0.6 | 0.0 | 2.4 | 0.6 | 0.0 | 2.0 |
| Prop In Lane | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 0.52 | 1.00 | | 0.10 |
| Lane Grp Cap(c), veh/h | 99 | 0 | 88 | 182 | 0 | 162 | 470 | 0 | 661 | 428 | 0 | 327 |
| V/C Ratio(X) | 0.20 | 0.00 | 0.23 | 0.38 | 0.00 | 0.14 | 0.09 | 0.00 | 0.27 | 0.06 | 0.00 | 0.38 |
| Avail Cap(c_a), veh/h | 633 | 0 | 564 | 348 | 0 | 310 | 732 | 0 | 1065 | 535 | 0 | 490 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 1.00 |
| Uniform Delay (d), s/veh | 15.2 | 0.0 | 15.2 | 14.2 | 0.0 | 13.8 | 8.8 | 0.0 | 7.1 | 11.6 | 0.0 | 12.2 |
| Incr Delay (d2), s/veh | 1.0 | 0.0 | 1.3 | 1.3 | 0.0 | 0.4 | 0.1 | 0.0 | 0.2 | 0.1 | 0.0 | 0.7 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 0.1 | 0.0 | 0.1 | 0.4 | 0.0 | 0.1 | 0.2 | 0.0 | 0.6 | 0.1 | 0.0 | 0.7 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 16.2 | 0.0 | 16.5 | 15.5 | 0.0 | 14.2 | 8.9 | 0.0 | 7.3 | 11.7 | 0.0 | 13.0 |
| LnGrp LOS | B | A | B | B | A | B | A | A | A | B | A | B |
| Approach Vol, veh/h | | 40 | | | 91 | | | 222 | | | 149 | |
| Approach Delay, s/veh | | 16.4 | | | 15.1 | | | 7.6 | | | 12.8 | |
| Approach LOS | | B | | | B | | | A | | | B | |
| Timer - Assigned Phs | | 2 | | 4 | | 6 | 7 | 8 | | | | |
| Phs Duration (G+Y+Rc), s | | 8.8 | | 18.0 | | 6.9 | 7.0 | 11.0 | | | | |
| Change Period (Y+Rc), s | | * 5.4 | | 5.0 | | 5.0 | 5.0 | 5.0 | | | | |
| Max Green Setting (Gmax), s | | * 6.6 | | 21.0 | | 12.0 | 7.0 | 9.0 | | | | |
| Max Q Clear Time (g_c+I1), s | | 3.2 | | 4.4 | | 2.4 | 2.6 | 4.0 | | | | |
| Green Ext Time (p_c), s | | 0.1 | | 0.9 | | 0.0 | 0.0 | 0.3 | | | | |

Intersection Summary

| | |
|--------------------|------|
| HCM 6th Ctrl Delay | 11.2 |
| HCM 6th LOS | B |

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

| Intersection | | | | | | |
|--------------------------|------|------|------|------|------|------|
| Int Delay, s/veh | 0 | | | | | |
| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
| Lane Configurations | | ↗ | | ↕↕ | ↕↕ | ↗ |
| Traffic Vol, veh/h | 0 | 3 | 0 | 825 | 444 | 21 |
| Future Vol, veh/h | 0 | 3 | 0 | 825 | 444 | 21 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Stop | Stop | Free | Free | Free | Free |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | - | 0 | - | - | - | 100 |
| Veh in Median Storage, # | 0 | - | - | 0 | 0 | - |
| Grade, % | 0 | - | - | 0 | 0 | - |
| Peak Hour Factor | 92 | 78 | 92 | 92 | 85 | 78 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 0 | 4 | 0 | 897 | 522 | 27 |

| Major/Minor | Minor2 | Major1 | Major2 | | |
|----------------------|--------|--------|--------|---|---|
| Conflicting Flow All | - | 261 | - | 0 | 0 |
| Stage 1 | - | - | - | - | - |
| Stage 2 | - | - | - | - | - |
| Critical Hdwy | - | 6.94 | - | - | - |
| Critical Hdwy Stg 1 | - | - | - | - | - |
| Critical Hdwy Stg 2 | - | - | - | - | - |
| Follow-up Hdwy | - | 3.32 | - | - | - |
| Pot Cap-1 Maneuver | 0 | 738 | 0 | - | - |
| Stage 1 | 0 | - | 0 | - | - |
| Stage 2 | 0 | - | 0 | - | - |
| Platoon blocked, % | | | | - | - |
| Mov Cap-1 Maneuver | - | 738 | - | - | - |
| Mov Cap-2 Maneuver | - | - | - | - | - |
| Stage 1 | - | - | - | - | - |
| Stage 2 | - | - | - | - | - |

| Approach | EB | NB | SB |
|----------------------|-----|----|----|
| HCM Control Delay, s | 9.9 | 0 | 0 |
| HCM LOS | A | | |

| Minor Lane/Major Mvmt | NBT | EBLn1 | SBT | SBR |
|-----------------------|-----|-------|-----|-----|
| Capacity (veh/h) | - | 738 | - | - |
| HCM Lane V/C Ratio | - | 0.005 | - | - |
| HCM Control Delay (s) | - | 9.9 | - | - |
| HCM Lane LOS | - | A | - | - |
| HCM 95th %tile Q(veh) | - | 0 | - | - |

| Intersection | | | | | | |
|--------------------------|------|------|------|------|------|-------|
| Int Delay, s/veh | 2.5 | | | | | |
| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
| Lane Configurations | | | | | | |
| Traffic Vol, veh/h | 364 | 17 | 124 | 395 | 29 | 87 |
| Future Vol, veh/h | 364 | 17 | 124 | 395 | 29 | 87 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Stop | Stop |
| RT Channelized | - | None | - | None | - | Yield |
| Storage Length | - | - | 150 | - | 100 | 0 |
| Veh in Median Storage, # | 0 | - | - | 0 | 0 | - |
| Grade, % | 0 | - | - | 0 | 0 | - |
| Peak Hour Factor | 96 | 96 | 86 | 86 | 92 | 92 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 379 | 18 | 144 | 459 | 32 | 95 |

| Major/Minor | Major1 | Major2 | Minor1 | | |
|----------------------|--------|--------|--------|---|-------|
| Conflicting Flow All | 0 | 0 | 397 | 0 | 906 |
| Stage 1 | - | - | - | - | 388 |
| Stage 2 | - | - | - | - | 518 |
| Critical Hdwy | - | - | 4.13 | - | 6.63 |
| Critical Hdwy Stg 1 | - | - | - | - | 5.43 |
| Critical Hdwy Stg 2 | - | - | - | - | 5.83 |
| Follow-up Hdwy | - | - | 2.219 | - | 3.519 |
| Pot Cap-1 Maneuver | - | - | 1160 | - | 291 |
| Stage 1 | - | - | - | - | 685 |
| Stage 2 | - | - | - | - | 563 |
| Platoon blocked, % | - | - | - | - | - |
| Mov Cap-1 Maneuver | - | - | 1160 | - | 255 |
| Mov Cap-2 Maneuver | - | - | - | - | 334 |
| Stage 1 | - | - | - | - | 600 |
| Stage 2 | - | - | - | - | 563 |

| Approach | EB | WB | NB |
|----------------------|----|----|------|
| HCM Control Delay, s | 0 | 2 | 12.8 |
| HCM LOS | | | B |

| Minor Lane/Major Mvmt | NBLn1 | NBLn2 | EBT | EBR | WBL | WBT |
|-----------------------|-------|-------|-----|-----|-------|-----|
| Capacity (veh/h) | 334 | 659 | - | - | 1160 | - |
| HCM Lane V/C Ratio | 0.094 | 0.143 | - | - | 0.124 | - |
| HCM Control Delay (s) | 16.9 | 11.4 | - | - | 8.5 | - |
| HCM Lane LOS | C | B | - | - | A | - |
| HCM 95th %tile Q(veh) | 0.3 | 0.5 | - | - | 0.4 | - |

| Intersection | | | | | | |
|--------------------------|------|------|------|------|------|------|
| Int Delay, s/veh | 3.6 | | | | | |
| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
| Lane Configurations | | | | | | |
| Traffic Vol, veh/h | 159 | 19 | 217 | 217 | 19 | 167 |
| Future Vol, veh/h | 159 | 19 | 217 | 217 | 19 | 167 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Stop | Stop | Free | Free | Free | Free |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | 0 | 0 | - | - | 75 | - |
| Veh in Median Storage, # | 0 | - | 0 | - | - | 0 |
| Grade, % | 0 | - | 0 | - | - | 0 |
| Peak Hour Factor | 85 | 78 | 85 | 85 | 78 | 87 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 187 | 24 | 255 | 255 | 24 | 192 |

| Major/Minor | Minor1 | Major1 | Major2 | | |
|----------------------|--------|--------|--------|---|-------|
| Conflicting Flow All | 623 | 383 | 0 | 0 | 510 |
| Stage 1 | 383 | - | - | - | - |
| Stage 2 | 240 | - | - | - | - |
| Critical Hdwy | 6.42 | 6.22 | - | - | 4.12 |
| Critical Hdwy Stg 1 | 5.42 | - | - | - | - |
| Critical Hdwy Stg 2 | 5.42 | - | - | - | - |
| Follow-up Hdwy | 3.518 | 3.318 | - | - | 2.218 |
| Pot Cap-1 Maneuver | 450 | 664 | - | - | 1055 |
| Stage 1 | 689 | - | - | - | - |
| Stage 2 | 800 | - | - | - | - |
| Platoon blocked, % | | | - | - | - |
| Mov Cap-1 Maneuver | 440 | 664 | - | - | 1055 |
| Mov Cap-2 Maneuver | 527 | - | - | - | - |
| Stage 1 | 673 | - | - | - | - |
| Stage 2 | 800 | - | - | - | - |

| Approach | WB | NB | SB |
|----------------------|------|----|----|
| HCM Control Delay, s | 14.9 | 0 | 1 |
| HCM LOS | B | | |

| Minor Lane/Major Mvmt | NBT | NBRWBLn1 | WBLn2 | SBL | SBT |
|-----------------------|-----|----------|-------|-------|-------|
| Capacity (veh/h) | - | - | 527 | 664 | 1055 |
| HCM Lane V/C Ratio | - | - | 0.355 | 0.037 | 0.023 |
| HCM Control Delay (s) | - | - | 15.5 | 10.6 | 8.5 |
| HCM Lane LOS | - | - | C | B | A |
| HCM 95th %tile Q(veh) | - | - | 1.6 | 0.1 | 0.1 |

| Intersection | | | | | | |
|--------------------------|------|------|------|------|------|------|
| Int Delay, s/veh | 0.2 | | | | | |
| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
| Lane Configurations | Y | | | ↑↑ | ↑↑ | ↑ |
| Traffic Vol, veh/h | 0 | 27 | 0 | 825 | 426 | 21 |
| Future Vol, veh/h | 0 | 27 | 0 | 825 | 426 | 21 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Stop | Stop | Free | Free | Free | Free |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | 0 | - | - | - | - | 100 |
| Veh in Median Storage, # | 0 | - | - | 0 | 0 | - |
| Grade, % | 0 | - | - | 0 | 0 | - |
| Peak Hour Factor | 92 | 78 | 78 | 92 | 85 | 78 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 0 | 35 | 0 | 897 | 501 | 27 |

| Major/Minor | Minor2 | Major1 | Major2 | | | |
|----------------------|--------|--------|--------|---|---|---|
| Conflicting Flow All | 950 | 251 | - | 0 | - | 0 |
| Stage 1 | 501 | - | - | - | - | - |
| Stage 2 | 449 | - | - | - | - | - |
| Critical Hdwy | 6.84 | 6.94 | - | - | - | - |
| Critical Hdwy Stg 1 | 5.84 | - | - | - | - | - |
| Critical Hdwy Stg 2 | 5.84 | - | - | - | - | - |
| Follow-up Hdwy | 3.52 | 3.32 | - | - | - | - |
| Pot Cap-1 Maneuver | 258 | 749 | 0 | - | - | - |
| Stage 1 | 574 | - | 0 | - | - | - |
| Stage 2 | 610 | - | 0 | - | - | - |
| Platoon blocked, % | | | | - | - | - |
| Mov Cap-1 Maneuver | 258 | 749 | - | - | - | - |
| Mov Cap-2 Maneuver | 388 | - | - | - | - | - |
| Stage 1 | 574 | - | - | - | - | - |
| Stage 2 | 610 | - | - | - | - | - |

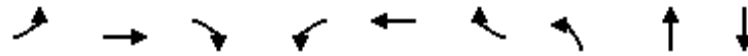
| Approach | EB | NB | SB |
|----------------------|----|----|----|
| HCM Control Delay, s | 10 | 0 | 0 |
| HCM LOS | B | | |

| Minor Lane/Major Mvmt | NBT | EBLn1 | SBT | SBR |
|-----------------------|-----|-------|-----|-----|
| Capacity (veh/h) | - | 749 | - | - |
| HCM Lane V/C Ratio | - | 0.046 | - | - |
| HCM Control Delay (s) | - | 10 | - | - |
| HCM Lane LOS | - | B | - | - |
| HCM 95th %tile Q(veh) | - | 0.1 | - | - |

Queues

29: Roeland Drive & Johnson Drive

12/27/2018



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | SBT |
|-------------------------|------|------|------|------|------|------|------|------|------|
| Lane Group Flow (vph) | 8 | 351 | 70 | 56 | 408 | 4 | 94 | 44 | 72 |
| v/c Ratio | 0.01 | 0.38 | 0.08 | 0.09 | 0.38 | 0.00 | 0.23 | 0.09 | 0.26 |
| Control Delay | 7.5 | 16.3 | 0.3 | 7.8 | 12.0 | 0.0 | 17.0 | 7.3 | 19.9 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 7.5 | 16.3 | 0.3 | 7.8 | 12.0 | 0.0 | 17.0 | 7.3 | 19.9 |
| Queue Length 50th (ft) | 1 | 104 | 0 | 9 | 83 | 0 | 22 | 1 | 14 |
| Queue Length 95th (ft) | 2 | 184 | 0 | 23 | 213 | 0 | 32 | 15 | 38 |
| Internal Link Dist (ft) | | 180 | | | 464 | | | 267 | 783 |
| Turn Bay Length (ft) | 100 | | 100 | 130 | | | 100 | | |
| Base Capacity (vph) | 622 | 1598 | 1378 | 615 | 1598 | 1378 | 413 | 792 | 359 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.01 | 0.22 | 0.05 | 0.09 | 0.26 | 0.00 | 0.23 | 0.06 | 0.20 |

Intersection Summary

HCM 6th Signalized Intersection Summary
 29: Roeland Drive & Johnson Drive

12/27/2018



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Lane Configurations | ↖ | ↑ | ↗ | ↖ | ↑ | ↗ | ↖ | ↗ | | | ↕ | |
| Traffic Volume (veh/h) | 2 | 337 | 47 | 48 | 375 | 1 | 47 | 3 | 38 | 6 | 23 | 21 |
| Future Volume (veh/h) | 2 | 337 | 47 | 48 | 375 | 1 | 47 | 3 | 38 | 6 | 23 | 21 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 |
| Adj Flow Rate, veh/h | 8 | 351 | 70 | 56 | 408 | 4 | 94 | 4 | 40 | 12 | 32 | 28 |
| Peak Hour Factor | 0.25 | 0.96 | 0.67 | 0.86 | 0.92 | 0.25 | 0.50 | 0.75 | 0.95 | 0.50 | 0.72 | 0.75 |
| Percent Heavy Veh, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Cap, veh/h | 326 | 511 | 433 | 389 | 614 | 520 | 572 | 46 | 458 | 116 | 88 | 68 |
| Arrive On Green | 0.01 | 0.27 | 0.27 | 0.07 | 0.33 | 0.33 | 0.09 | 0.31 | 0.31 | 0.10 | 0.10 | 0.10 |
| Sat Flow, veh/h | 1781 | 1870 | 1585 | 1781 | 1870 | 1585 | 1781 | 146 | 1461 | 184 | 845 | 655 |
| Grp Volume(v), veh/h | 8 | 351 | 70 | 56 | 408 | 4 | 94 | 0 | 44 | 72 | 0 | 0 |
| Grp Sat Flow(s),veh/h/ln | 1781 | 1870 | 1585 | 1781 | 1870 | 1585 | 1781 | 0 | 1607 | 1684 | 0 | 0 |
| Q Serve(g_s), s | 0.1 | 7.3 | 1.5 | 0.9 | 8.1 | 0.1 | 1.8 | 0.0 | 0.8 | 0.2 | 0.0 | 0.0 |
| Cycle Q Clear(g_c), s | 0.1 | 7.3 | 1.5 | 0.9 | 8.1 | 0.1 | 1.8 | 0.0 | 0.8 | 1.7 | 0.0 | 0.0 |
| Prop In Lane | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 0.91 | 0.17 | | 0.39 |
| Lane Grp Cap(c), veh/h | 326 | 511 | 433 | 389 | 614 | 520 | 572 | 0 | 503 | 272 | 0 | 0 |
| V/C Ratio(X) | 0.02 | 0.69 | 0.16 | 0.14 | 0.66 | 0.01 | 0.16 | 0.00 | 0.09 | 0.26 | 0.00 | 0.00 |
| Avail Cap(c_a), veh/h | 591 | 2027 | 1718 | 555 | 2027 | 1718 | 692 | 0 | 778 | 443 | 0 | 0 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 0.00 |
| Uniform Delay (d), s/veh | 11.5 | 14.1 | 12.0 | 10.4 | 12.5 | 9.8 | 13.1 | 0.0 | 10.5 | 18.2 | 0.0 | 0.0 |
| Incr Delay (d2), s/veh | 0.0 | 1.7 | 0.2 | 0.2 | 1.2 | 0.0 | 0.1 | 0.0 | 0.1 | 0.5 | 0.0 | 0.0 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 0.0 | 2.8 | 0.4 | 0.3 | 2.9 | 0.0 | 0.6 | 0.0 | 0.3 | 0.6 | 0.0 | 0.0 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 11.5 | 15.8 | 12.2 | 10.5 | 13.8 | 9.8 | 13.2 | 0.0 | 10.6 | 18.7 | 0.0 | 0.0 |
| LnGrp LOS | B | B | B | B | B | A | B | A | B | B | A | A |
| Approach Vol, veh/h | | 429 | | | 468 | | | 138 | | | 72 | |
| Approach Delay, s/veh | | 15.1 | | | 13.3 | | | 12.4 | | | 18.7 | |
| Approach LOS | | B | | | B | | | B | | | B | |
| Timer - Assigned Phs | 1 | 2 | | 4 | 5 | 6 | 7 | 8 | | | | |
| Phs Duration (G+Y+Rc), s | 5.6 | 19.2 | | 18.6 | 7.9 | 16.8 | 9.1 | 9.5 | | | | |
| Change Period (Y+Rc), s | 5.0 | 5.0 | | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | | | | |
| Max Green Setting (Gmax), s | 7.0 | 47.0 | | 21.0 | 7.0 | 47.0 | 7.0 | 9.0 | | | | |
| Max Q Clear Time (g_c+I1), s | 2.1 | 10.1 | | 2.8 | 2.9 | 9.3 | 3.8 | 3.7 | | | | |
| Green Ext Time (p_c), s | 0.0 | 2.8 | | 0.1 | 0.0 | 2.6 | 0.1 | 0.1 | | | | |

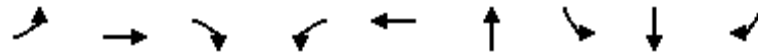
Intersection Summary

| | |
|--------------------|------|
| HCM 6th Ctrl Delay | 14.2 |
| HCM 6th LOS | B |

Queues

1470: Roeland Drive & Shawnee Mission Parkway

12/27/2018



| Lane Group | EBL | EBT | EBR | WBL | WBT | NBT | SBL | SBT | SBR |
|-------------------------|-------|------|------|------|------|------|-------|------|------|
| Lane Group Flow (vph) | 197 | 1174 | 28 | 37 | 2160 | 120 | 229 | 40 | 155 |
| v/c Ratio | 1.41 | 0.57 | 0.02 | 0.28 | 0.87 | 0.56 | 0.97 | 0.16 | 0.45 |
| Control Delay | 244.5 | 37.1 | 0.0 | 58.0 | 28.5 | 35.6 | 103.7 | 48.8 | 12.0 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 244.5 | 37.1 | 0.0 | 58.0 | 28.5 | 35.6 | 103.7 | 48.8 | 12.0 |
| Queue Length 50th (ft) | ~190 | 455 | 0 | 27 | 545 | 40 | 177 | 28 | 0 |
| Queue Length 95th (ft) | m#229 | 454 | m0 | 44 | 628 | 100 | #359 | 44 | 49 |
| Internal Link Dist (ft) | | 682 | | | 2401 | 499 | | 330 | |
| Turn Bay Length (ft) | 345 | | 310 | 170 | | | 100 | | 125 |
| Base Capacity (vph) | 140 | 2067 | 1583 | 140 | 2482 | 274 | 236 | 248 | 345 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 1.41 | 0.57 | 0.02 | 0.26 | 0.87 | 0.44 | 0.97 | 0.16 | 0.45 |

Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
- m Volume for 95th percentile queue is metered by upstream signal.

HCM 6th Signalized Intersection Summary
 1470: Roeland Drive & Shawnee Mission Parkway

12/27/2018



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|------------------------------|-------|------|------|------|------|-------|------|------|------|-------|-------|-------|
| Lane Configurations | ↖ | ↗ | ↘ | ↖ | ↗ | ↘ | | ↕ | | ↖ | ↗ | ↘ |
| Traffic Volume (veh/h) | 171 | 986 | 21 | 23 | 1722 | 295 | 18 | 11 | 67 | 199 | 25 | 129 |
| Future Volume (veh/h) | 171 | 986 | 21 | 23 | 1722 | 295 | 18 | 11 | 67 | 199 | 25 | 129 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 |
| Adj Flow Rate, veh/h | 197 | 1174 | 0 | 37 | 1813 | 347 | 29 | 12 | 79 | 229 | 40 | 155 |
| Peak Hour Factor | 0.87 | 0.84 | 0.75 | 0.63 | 0.95 | 0.85 | 0.63 | 0.95 | 0.85 | 0.87 | 0.63 | 0.83 |
| Percent Heavy Veh, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Cap, veh/h | 141 | 1910 | | 200 | 2373 | 448 | 35 | 15 | 95 | 171 | 179 | 152 |
| Arrive On Green | 0.08 | 0.54 | 0.00 | 0.11 | 0.58 | 0.58 | 0.09 | 0.09 | 0.09 | 0.10 | 0.10 | 0.10 |
| Sat Flow, veh/h | 1781 | 3554 | 1585 | 1781 | 4099 | 774 | 400 | 165 | 1089 | 1781 | 1870 | 1585 |
| Grp Volume(v), veh/h | 197 | 1174 | 0 | 37 | 1384 | 776 | 120 | 0 | 0 | 229 | 40 | 155 |
| Grp Sat Flow(s),veh/h/ln | 1781 | 1777 | 1585 | 1781 | 1571 | 1731 | 1654 | 0 | 0 | 1781 | 1870 | 1585 |
| Q Serve(g_s), s | 9.5 | 27.4 | 0.0 | 2.3 | 39.8 | 41.0 | 8.6 | 0.0 | 0.0 | 11.5 | 2.4 | 11.5 |
| Cycle Q Clear(g_c), s | 9.5 | 27.4 | 0.0 | 2.3 | 39.8 | 41.0 | 8.6 | 0.0 | 0.0 | 11.5 | 2.4 | 11.5 |
| Prop In Lane | 1.00 | | 1.00 | 1.00 | | 0.45 | 0.24 | | 0.66 | 1.00 | | 1.00 |
| Lane Grp Cap(c), veh/h | 141 | 1910 | | 200 | 1819 | 1002 | 145 | 0 | 0 | 171 | 179 | 152 |
| V/C Ratio(X) | 1.40 | 0.61 | | 0.18 | 0.76 | 0.77 | 0.83 | 0.00 | 0.00 | 1.34 | 0.22 | 1.02 |
| Avail Cap(c_a), veh/h | 141 | 1910 | | 200 | 1819 | 1002 | 214 | 0 | 0 | 171 | 179 | 152 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 0.00 | 1.00 | 1.00 | 1.00 |
| Uniform Delay (d), s/veh | 55.3 | 19.2 | 0.0 | 48.3 | 19.0 | 19.3 | 53.8 | 0.0 | 0.0 | 54.3 | 50.1 | 54.3 |
| Incr Delay (d2), s/veh | 215.8 | 1.5 | 0.0 | 0.2 | 3.1 | 5.8 | 10.2 | 0.0 | 0.0 | 187.6 | 0.2 | 78.5 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 12.6 | 10.8 | 0.0 | 1.0 | 13.7 | 16.4 | 4.0 | 0.0 | 0.0 | 14.0 | 1.1 | 7.9 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 271.1 | 20.7 | 0.0 | 48.4 | 22.1 | 25.1 | 64.0 | 0.0 | 0.0 | 241.8 | 50.4 | 132.7 |
| LnGrp LOS | F | C | | D | C | C | E | A | A | F | D | F |
| Approach Vol, veh/h | | 1371 | A | | 2197 | | | 120 | | | 424 | |
| Approach Delay, s/veh | | 56.6 | | | 23.6 | | | 64.0 | | | 183.9 | |
| Approach LOS | | E | | | C | | | E | | | F | |
| Timer - Assigned Phs | 1 | 2 | | 4 | 5 | 6 | | 8 | | | | |
| Phs Duration (G+Y+Rc), s | 14.0 | 75.0 | | 15.0 | 19.0 | 70.0 | | 16.0 | | | | |
| Change Period (Y+Rc), s | 4.5 | 5.5 | | 4.5 | 5.5 | * 5.5 | | 4.5 | | | | |
| Max Green Setting (Gmax), s | 9.5 | 64.5 | | 15.5 | 9.5 | * 65 | | 11.5 | | | | |
| Max Q Clear Time (g_c+I1), s | 11.5 | 43.0 | | 10.6 | 4.3 | 29.4 | | 13.5 | | | | |
| Green Ext Time (p_c), s | 0.0 | 11.0 | | 0.2 | 0.0 | 5.8 | | 0.0 | | | | |

Intersection Summary

| | |
|--------------------|------|
| HCM 6th Ctrl Delay | 52.3 |
| HCM 6th LOS | D |

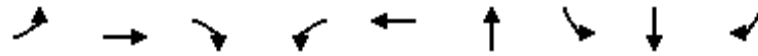
Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.
 Unsignalized Delay for [EBR] is excluded from calculations of the approach delay and intersection delay.

Queues

1470: Roeland Drive & Shawnee Mission Parkway

12/27/2018



| Lane Group | EBL | EBT | EBR | WBL | WBT | NBT | SBL | SBT | SBR |
|-------------------------|------|------|------|------|------|------|------|------|------|
| Lane Group Flow (vph) | 197 | 1174 | 28 | 37 | 2160 | 120 | 133 | 136 | 155 |
| v/c Ratio | 0.92 | 0.54 | 0.02 | 0.21 | 0.85 | 0.68 | 0.76 | 0.76 | 0.51 |
| Control Delay | 76.9 | 34.1 | 0.0 | 51.3 | 26.9 | 47.7 | 78.8 | 79.1 | 13.9 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 76.9 | 34.1 | 0.0 | 51.3 | 26.9 | 47.7 | 78.8 | 79.1 | 13.9 |
| Queue Length 50th (ft) | 152 | 455 | 0 | 26 | 532 | 44 | 106 | 108 | 0 |
| Queue Length 95th (ft) | m172 | 454 | m0 | 41 | 613 | #128 | #189 | 122 | 49 |
| Internal Link Dist (ft) | | 682 | | | 2401 | 499 | | 330 | |
| Turn Bay Length (ft) | 345 | | 310 | 170 | | | 100 | | 125 |
| Base Capacity (vph) | 218 | 2155 | 1583 | 213 | 2546 | 176 | 189 | 192 | 315 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.90 | 0.54 | 0.02 | 0.17 | 0.85 | 0.68 | 0.70 | 0.71 | 0.49 |

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis
 1470: Roeland Drive & Shawnee Mission Parkway

12/27/2018



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|------------------------|-------|------|-------|------|-------|------|-------|-------|------|-------|-------|------|
| Lane Configurations | ↖ | ↗ | ↘ | ↖ | ↗ | ↘ | | ↕ | | ↖ | ↗ | ↘ |
| Traffic Volume (vph) | 171 | 986 | 21 | 23 | 1722 | 295 | 18 | 11 | 67 | 199 | 25 | 129 |
| Future Volume (vph) | 171 | 986 | 21 | 23 | 1722 | 295 | 18 | 11 | 67 | 199 | 25 | 129 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.5 | 5.5 | 4.0 | 4.5 | 5.5 | | | 4.5 | | 4.5 | 4.5 | 4.5 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | *0.85 | | | 1.00 | | 0.95 | 0.95 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.98 | | | 0.91 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 0.99 | | 0.95 | 0.97 | 1.00 |
| Satd. Flow (prot) | 1770 | 3539 | 1583 | 1770 | 4636 | | | 1677 | | 1681 | 1709 | 1583 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 0.99 | | 0.95 | 0.97 | 1.00 |
| Satd. Flow (perm) | 1770 | 3539 | 1583 | 1770 | 4636 | | | 1677 | | 1681 | 1709 | 1583 |
| Peak-hour factor, PHF | 0.87 | 0.84 | 0.75 | 0.63 | 0.95 | 0.85 | 0.63 | 0.95 | 0.85 | 0.87 | 0.63 | 0.83 |
| Adj. Flow (vph) | 197 | 1174 | 28 | 37 | 1813 | 347 | 29 | 12 | 79 | 229 | 40 | 155 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 20 | 0 | 0 | 58 | 0 | 0 | 0 | 139 |
| Lane Group Flow (vph) | 197 | 1174 | 28 | 37 | 2140 | 0 | 0 | 62 | 0 | 133 | 136 | 16 |
| Turn Type | Prot | NA | Free | Prot | NA | | Split | NA | | Split | NA | Perm |
| Protected Phases | 1 | 6 | | 5 | 2 | | 4 | 4 | | 8 | 8 | |
| Permitted Phases | | | Free | | | | | | | | | 8 |
| Actuated Green, G (s) | 14.6 | 71.3 | 120.0 | 8.7 | 65.4 | | | 8.5 | | 12.5 | 12.5 | 12.5 |
| Effective Green, g (s) | 14.6 | 71.3 | 120.0 | 8.7 | 65.4 | | | 8.5 | | 12.5 | 12.5 | 12.5 |
| Actuated g/C Ratio | 0.12 | 0.59 | 1.00 | 0.07 | 0.55 | | | 0.07 | | 0.10 | 0.10 | 0.10 |
| Clearance Time (s) | 4.5 | 5.5 | | 4.5 | 5.5 | | | 4.5 | | 4.5 | 4.5 | 4.5 |
| Vehicle Extension (s) | 1.5 | 2.0 | | 1.5 | 2.0 | | | 2.0 | | 2.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 215 | 2102 | 1583 | 128 | 2526 | | | 118 | | 175 | 178 | 164 |
| v/s Ratio Prot | c0.11 | 0.33 | | 0.02 | c0.46 | | | c0.04 | | 0.08 | c0.08 | |
| v/s Ratio Perm | | | 0.02 | | | | | | | | | 0.01 |
| v/c Ratio | 0.92 | 0.56 | 0.02 | 0.29 | 0.85 | | | 0.53 | | 0.76 | 0.76 | 0.10 |
| Uniform Delay, d1 | 52.1 | 14.8 | 0.0 | 52.7 | 23.1 | | | 53.8 | | 52.3 | 52.3 | 48.6 |
| Progression Factor | 0.77 | 2.13 | 1.00 | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 31.2 | 0.8 | 0.0 | 0.5 | 3.7 | | | 2.0 | | 15.9 | 15.9 | 0.1 |
| Delay (s) | 71.6 | 32.3 | 0.0 | 53.2 | 26.8 | | | 55.8 | | 68.2 | 68.3 | 48.7 |
| Level of Service | E | C | A | D | C | | | E | | E | E | D |
| Approach Delay (s) | | 37.2 | | | 27.3 | | | 55.8 | | | 61.1 | |
| Approach LOS | | D | | | C | | | E | | | E | |

Intersection Summary

| | | | |
|-----------------------------------|-------|---------------------------|------|
| HCM 2000 Control Delay | 34.9 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.82 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 19.0 |
| Intersection Capacity Utilization | 74.2% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

HCM 6th TWSC
2: Roeland Drive & 60th Terrace/Drive 1

12/27/2018

| Intersection | | | | | | | | | | | | |
|--------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Int Delay, s/veh | 1 | | | | | | | | | | | |
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations | | ↕ | | | ↕ | | | ↕ | ↕ | | ↕ | |
| Traffic Vol, veh/h | 0 | 0 | 0 | 33 | 0 | 0 | 0 | 458 | 38 | 0 | 440 | 0 |
| Future Vol, veh/h | 0 | 0 | 0 | 33 | 0 | 0 | 0 | 458 | 38 | 0 | 440 | 0 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Free | Free | Free | Free | Free | Free |
| RT Channelized | - | - | None | - | - | None | - | - | None | - | - | None |
| Storage Length | - | - | - | - | - | - | - | - | 150 | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Peak Hour Factor | 92 | 92 | 92 | 78 | 92 | 92 | 87 | 87 | 78 | 87 | 87 | 87 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 0 | 0 | 0 | 42 | 0 | 0 | 0 | 526 | 49 | 0 | 506 | 0 |

| Major/Minor | Minor2 | | Minor1 | | Major1 | | Major2 | | | | | |
|----------------------|--------|-------|--------|-------|--------|-------|--------|---|---|-------|---|---|
| Conflicting Flow All | 1057 | 1081 | 506 | 1032 | 1032 | 526 | 506 | 0 | 0 | 575 | 0 | 0 |
| Stage 1 | 506 | 506 | - | 526 | 526 | - | - | - | - | - | - | - |
| Stage 2 | 551 | 575 | - | 506 | 506 | - | - | - | - | - | - | - |
| Critical Hdwy | 7.12 | 6.52 | 6.22 | 7.12 | 6.52 | 6.22 | 4.12 | - | - | 4.12 | - | - |
| Critical Hdwy Stg 1 | 6.12 | 5.52 | - | 6.12 | 5.52 | - | - | - | - | - | - | - |
| Critical Hdwy Stg 2 | 6.12 | 5.52 | - | 6.12 | 5.52 | - | - | - | - | - | - | - |
| Follow-up Hdwy | 3.518 | 4.018 | 3.318 | 3.518 | 4.018 | 3.318 | 2.218 | - | - | 2.218 | - | - |
| Pot Cap-1 Maneuver | 203 | 218 | 566 | 211 | 233 | 552 | 1059 | - | - | 998 | - | - |
| Stage 1 | 549 | 540 | - | 535 | 529 | - | - | - | - | - | - | - |
| Stage 2 | 519 | 503 | - | 549 | 540 | - | - | - | - | - | - | - |
| Platoon blocked, % | | | | | | | | - | - | - | - | - |
| Mov Cap-1 Maneuver | 203 | 218 | 566 | 211 | 233 | 552 | 1059 | - | - | 998 | - | - |
| Mov Cap-2 Maneuver | 203 | 218 | - | 211 | 233 | - | - | - | - | - | - | - |
| Stage 1 | 549 | 540 | - | 535 | 529 | - | - | - | - | - | - | - |
| Stage 2 | 519 | 503 | - | 549 | 540 | - | - | - | - | - | - | - |

| Approach | EB | WB | NB | SB |
|----------------------|----|------|----|----|
| HCM Control Delay, s | 0 | 26.3 | 0 | 0 |
| HCM LOS | A | D | | |

| Minor Lane/Major Mvmt | NBL | NBT | NBR | EBLn1WBLn1 | SBL | SBT | SBR |
|-----------------------|------|-----|-----|------------|-------|-----|-----|
| Capacity (veh/h) | 1059 | - | - | - | 211 | 998 | - |
| HCM Lane V/C Ratio | - | - | - | - | 0.201 | - | - |
| HCM Control Delay (s) | 0 | - | - | 0 | 26.3 | 0 | - |
| HCM Lane LOS | A | - | - | A | D | A | - |
| HCM 95th %tile Q(veh) | 0 | - | - | - | 0.7 | 0 | - |

Queues

3: Roe Avenue & Johnson Drive/Johnson Drive WB

12/27/2018



| Lane Group | EBL | EBT | WBL | WBT | NBL | NBT | NBR | SBL | SBT | SBR |
|-------------------------|------|------|------|------|------|------|------|------|------|------|
| Lane Group Flow (vph) | 386 | 453 | 96 | 399 | 177 | 586 | 72 | 79 | 646 | 361 |
| v/c Ratio | 0.75 | 0.59 | 0.58 | 0.72 | 0.47 | 0.42 | 0.10 | 0.20 | 0.52 | 0.46 |
| Control Delay | 51.1 | 34.8 | 58.5 | 46.4 | 18.3 | 24.4 | 0.3 | 15.0 | 28.8 | 4.9 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 51.1 | 34.8 | 58.5 | 46.4 | 18.3 | 24.4 | 0.3 | 15.0 | 28.8 | 4.9 |
| Queue Length 50th (ft) | 119 | 121 | 58 | 124 | 62 | 152 | 0 | 26 | 181 | 0 |
| Queue Length 95th (ft) | 146 | 172 | #102 | 163 | 79 | 185 | 0 | 39 | 213 | 56 |
| Internal Link Dist (ft) | | 556 | | 629 | | 141 | | | 492 | |
| Turn Bay Length (ft) | 245 | | 130 | | 150 | | 25 | 150 | | 250 |
| Base Capacity (vph) | 515 | 818 | 169 | 635 | 399 | 1444 | 742 | 416 | 1267 | 798 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.75 | 0.55 | 0.57 | 0.63 | 0.44 | 0.41 | 0.10 | 0.19 | 0.51 | 0.45 |

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

HCM 6th Signalized Intersection Summary
 3: Roe Avenue & Johnson Drive/Johnson Drive WB

12/27/2018



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Lane Configurations | ↖↗ | ↕ | | ↖ | ↕ | | ↖ | ↕ | ↗ | ↖ | ↕ | ↗ |
| Traffic Volume (veh/h) | 293 | 307 | 95 | 73 | 309 | 25 | 133 | 498 | 52 | 58 | 543 | 318 |
| Future Volume (veh/h) | 293 | 307 | 95 | 73 | 309 | 25 | 133 | 498 | 52 | 58 | 543 | 318 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 |
| Adj Flow Rate, veh/h | 386 | 334 | 119 | 96 | 359 | 40 | 177 | 586 | 0 | 79 | 646 | 0 |
| Peak Hour Factor | 0.76 | 0.92 | 0.80 | 0.76 | 0.86 | 0.63 | 0.75 | 0.85 | 0.72 | 0.73 | 0.84 | 0.88 |
| Percent Heavy Veh, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Cap, veh/h | 448 | 517 | 181 | 121 | 448 | 50 | 432 | 1569 | | 436 | 1472 | |
| Arrive On Green | 0.13 | 0.20 | 0.20 | 0.07 | 0.14 | 0.14 | 0.08 | 0.44 | 0.00 | 0.05 | 0.41 | 0.00 |
| Sat Flow, veh/h | 3456 | 2581 | 904 | 1781 | 3226 | 357 | 1781 | 3554 | 1585 | 1781 | 3554 | 1585 |
| Grp Volume(v), veh/h | 386 | 228 | 225 | 96 | 197 | 202 | 177 | 586 | 0 | 79 | 646 | 0 |
| Grp Sat Flow(s),veh/h/ln | 1728 | 1777 | 1708 | 1781 | 1777 | 1806 | 1781 | 1777 | 1585 | 1781 | 1777 | 1585 |
| Q Serve(g_s), s | 10.9 | 11.8 | 12.1 | 5.3 | 10.7 | 10.9 | 5.6 | 11.0 | 0.0 | 2.5 | 13.0 | 0.0 |
| Cycle Q Clear(g_c), s | 10.9 | 11.8 | 12.1 | 5.3 | 10.7 | 10.9 | 5.6 | 11.0 | 0.0 | 2.5 | 13.0 | 0.0 |
| Prop In Lane | 1.00 | | 0.53 | 1.00 | | 0.20 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Lane Grp Cap(c), veh/h | 448 | 356 | 342 | 121 | 247 | 251 | 432 | 1569 | | 436 | 1472 | |
| V/C Ratio(X) | 0.86 | 0.64 | 0.66 | 0.79 | 0.80 | 0.81 | 0.41 | 0.37 | | 0.18 | 0.44 | |
| Avail Cap(c_a), veh/h | 449 | 409 | 393 | 143 | 320 | 325 | 509 | 1569 | | 507 | 1472 | |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 |
| Uniform Delay (d), s/veh | 42.6 | 36.7 | 36.8 | 45.9 | 41.7 | 41.7 | 15.5 | 18.7 | 0.0 | 15.4 | 21.0 | 0.0 |
| Incr Delay (d2), s/veh | 15.7 | 2.7 | 3.3 | 22.2 | 10.2 | 10.8 | 0.6 | 0.7 | 0.0 | 0.2 | 1.0 | 0.0 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 5.6 | 5.3 | 5.3 | 3.1 | 5.3 | 5.5 | 2.2 | 4.5 | 0.0 | 1.0 | 5.4 | 0.0 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 58.3 | 39.4 | 40.1 | 68.1 | 51.8 | 52.5 | 16.1 | 19.4 | 0.0 | 15.6 | 21.9 | 0.0 |
| LnGrp LOS | E | D | D | E | D | D | B | B | | B | C | |
| Approach Vol, veh/h | | 839 | | | 495 | | | 763 | A | | 725 | A |
| Approach Delay, s/veh | | 48.3 | | | 55.3 | | | 18.6 | | | 21.2 | |
| Approach LOS | | D | | | E | | | B | | | C | |
| Timer - Assigned Phs | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | | | |
| Phs Duration (G+Y+Rc), s | 19.0 | 19.9 | 11.0 | 50.1 | 12.8 | 26.0 | 13.7 | 47.4 | | | | |
| Change Period (Y+Rc), s | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | | | | |
| Max Green Setting (Gmax), s | 13.0 | 18.0 | 9.0 | 36.0 | 8.0 | 23.0 | 12.0 | 33.0 | | | | |
| Max Q Clear Time (g_c+I1), s | 12.9 | 12.9 | 4.5 | 13.0 | 7.3 | 14.1 | 7.6 | 15.0 | | | | |
| Green Ext Time (p_c), s | 0.0 | 1.0 | 0.1 | 3.9 | 0.0 | 1.8 | 0.2 | 4.0 | | | | |

Intersection Summary

| | |
|--------------------|------|
| HCM 6th Ctrl Delay | 34.5 |
| HCM 6th LOS | C |

Notes

Unsignalized Delay for [NBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Queues

6: Roeland Drive & Martway Street/Drive 3

12/27/2018



| Lane Group | EBL | EBT | WBL | WBT | NBL | NBT | SBL | SBT |
|-------------------------|------|------|------|------|------|------|------|------|
| Lane Group Flow (vph) | 81 | 105 | 103 | 22 | 56 | 254 | 23 | 149 |
| v/c Ratio | 0.24 | 0.13 | 0.40 | 0.03 | 0.11 | 0.31 | 0.06 | 0.23 |
| Control Delay | 19.0 | 0.3 | 26.5 | 0.1 | 11.0 | 9.0 | 18.2 | 15.3 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 19.0 | 0.3 | 26.5 | 0.1 | 11.0 | 9.0 | 18.2 | 15.3 |
| Queue Length 50th (ft) | 15 | 0 | 20 | 0 | 9 | 31 | 4 | 20 |
| Queue Length 95th (ft) | 52 | 0 | #62 | 0 | 20 | 45 | 20 | 61 |
| Internal Link Dist (ft) | | 773 | | 54 | | 238 | | 267 |
| Turn Bay Length (ft) | 105 | | | | 115 | | 75 | |
| Base Capacity (vph) | 553 | 931 | 256 | 834 | 526 | 1054 | 410 | 672 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.15 | 0.11 | 0.40 | 0.03 | 0.11 | 0.24 | 0.06 | 0.22 |

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

HCM 6th Signalized Intersection Summary
6: Roeland Drive & Martway Street/Drive 3

12/27/2018



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|------------------------------|------|-------|------|------|------|------|------|------|------|------|------|------|
| Lane Configurations | ↖ | ↗ | | ↖ | ↗ | | ↖ | ↗ | | ↖ | ↗ | |
| Traffic Volume (veh/h) | 73 | 0 | 63 | 80 | 0 | 17 | 37 | 91 | 87 | 18 | 78 | 42 |
| Future Volume (veh/h) | 73 | 0 | 63 | 80 | 0 | 17 | 37 | 91 | 87 | 18 | 78 | 42 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 |
| Adj Flow Rate, veh/h | 81 | 0 | 105 | 103 | 0 | 22 | 56 | 142 | 112 | 23 | 103 | 46 |
| Peak Hour Factor | 0.90 | 0.92 | 0.60 | 0.78 | 0.92 | 0.78 | 0.66 | 0.64 | 0.78 | 0.78 | 0.76 | 0.92 |
| Percent Heavy Veh, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Cap, veh/h | 239 | 0 | 212 | 204 | 0 | 182 | 406 | 343 | 271 | 360 | 190 | 85 |
| Arrive On Green | 0.13 | 0.00 | 0.13 | 0.11 | 0.00 | 0.11 | 0.07 | 0.35 | 0.35 | 0.15 | 0.15 | 0.15 |
| Sat Flow, veh/h | 1781 | 0 | 1585 | 1781 | 0 | 1585 | 1781 | 969 | 764 | 1126 | 1225 | 547 |
| Grp Volume(v), veh/h | 81 | 0 | 105 | 103 | 0 | 22 | 56 | 0 | 254 | 23 | 0 | 149 |
| Grp Sat Flow(s),veh/h/ln | 1781 | 0 | 1585 | 1781 | 0 | 1585 | 1781 | 0 | 1733 | 1126 | 0 | 1772 |
| Q Serve(g_s), s | 1.6 | 0.0 | 2.4 | 2.1 | 0.0 | 0.5 | 0.9 | 0.0 | 4.3 | 0.7 | 0.0 | 3.0 |
| Cycle Q Clear(g_c), s | 1.6 | 0.0 | 2.4 | 2.1 | 0.0 | 0.5 | 0.9 | 0.0 | 4.3 | 0.7 | 0.0 | 3.0 |
| Prop In Lane | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 0.44 | 1.00 | | 0.31 |
| Lane Grp Cap(c), veh/h | 239 | 0 | 212 | 204 | 0 | 182 | 406 | 0 | 613 | 360 | 0 | 274 |
| V/C Ratio(X) | 0.34 | 0.00 | 0.49 | 0.50 | 0.00 | 0.12 | 0.14 | 0.00 | 0.41 | 0.06 | 0.00 | 0.54 |
| Avail Cap(c_a), veh/h | 552 | 0 | 491 | 303 | 0 | 270 | 603 | 0 | 939 | 447 | 0 | 412 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 1.00 |
| Uniform Delay (d), s/veh | 15.2 | 0.0 | 15.6 | 16.1 | 0.0 | 15.4 | 10.8 | 0.0 | 9.5 | 14.1 | 0.0 | 15.1 |
| Incr Delay (d2), s/veh | 0.8 | 0.0 | 1.8 | 1.9 | 0.0 | 0.3 | 0.2 | 0.0 | 0.4 | 0.1 | 0.0 | 1.7 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 0.5 | 0.0 | 0.7 | 0.8 | 0.0 | 0.1 | 0.3 | 0.0 | 1.3 | 0.2 | 0.0 | 1.1 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 16.1 | 0.0 | 17.3 | 18.0 | 0.0 | 15.7 | 11.0 | 0.0 | 9.9 | 14.2 | 0.0 | 16.8 |
| LnGrp LOS | B | A | B | B | A | B | B | A | A | B | A | B |
| Approach Vol, veh/h | | 186 | | | 125 | | | 310 | | | | 172 |
| Approach Delay, s/veh | | 16.8 | | | 17.6 | | | 10.1 | | | | 16.4 |
| Approach LOS | | B | | | B | | | B | | | | B |
| Timer - Assigned Phs | | 2 | | 4 | | 6 | 7 | 8 | | | | |
| Phs Duration (G+Y+Rc), s | | 9.8 | | 18.7 | | 10.2 | 7.7 | 11.0 | | | | |
| Change Period (Y+Rc), s | | * 5.4 | | 5.0 | | 5.0 | 5.0 | 5.0 | | | | |
| Max Green Setting (Gmax), s | | * 6.6 | | 21.0 | | 12.0 | 7.0 | 9.0 | | | | |
| Max Q Clear Time (g_c+I1), s | | 4.1 | | 6.3 | | 4.4 | 2.9 | 5.0 | | | | |
| Green Ext Time (p_c), s | | 0.1 | | 1.3 | | 0.4 | 0.0 | 0.3 | | | | |

Intersection Summary

| | |
|--------------------|------|
| HCM 6th Ctrl Delay | 14.2 |
| HCM 6th LOS | B |

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

| Intersection | | | | | | |
|--------------------------|------|------|------|------|------|------|
| Int Delay, s/veh | 0 | | | | | |
| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
| Lane Configurations | | ↗ | | ↕↕ | ↕↕ | ↗ |
| Traffic Vol, veh/h | 0 | 3 | 0 | 683 | 692 | 19 |
| Future Vol, veh/h | 0 | 3 | 0 | 683 | 692 | 19 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Stop | Stop | Free | Free | Free | Free |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | - | 0 | - | - | - | 100 |
| Veh in Median Storage, # | 0 | - | - | 0 | 0 | - |
| Grade, % | 0 | - | - | 0 | 0 | - |
| Peak Hour Factor | 92 | 78 | 92 | 92 | 85 | 78 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 0 | 4 | 0 | 742 | 814 | 24 |

| Major/Minor | Minor2 | Major1 | Major2 | | |
|----------------------|--------|--------|--------|---|---|
| Conflicting Flow All | - | 407 | - | 0 | - |
| Stage 1 | - | - | - | - | - |
| Stage 2 | - | - | - | - | - |
| Critical Hdwy | - | 6.94 | - | - | - |
| Critical Hdwy Stg 1 | - | - | - | - | - |
| Critical Hdwy Stg 2 | - | - | - | - | - |
| Follow-up Hdwy | - | 3.32 | - | - | - |
| Pot Cap-1 Maneuver | 0 | 593 | 0 | - | - |
| Stage 1 | 0 | - | 0 | - | - |
| Stage 2 | 0 | - | 0 | - | - |
| Platoon blocked, % | | | | - | - |
| Mov Cap-1 Maneuver | - | 593 | - | - | - |
| Mov Cap-2 Maneuver | - | - | - | - | - |
| Stage 1 | - | - | - | - | - |
| Stage 2 | - | - | - | - | - |

| Approach | EB | NB | SB |
|----------------------|------|----|----|
| HCM Control Delay, s | 11.1 | 0 | 0 |
| HCM LOS | B | | |

| Minor Lane/Major Mvmt | NBT | EBLn1 | SBT | SBR |
|-----------------------|-----|-------|-----|-----|
| Capacity (veh/h) | - | 593 | - | - |
| HCM Lane V/C Ratio | - | 0.006 | - | - |
| HCM Control Delay (s) | - | 11.1 | - | - |
| HCM Lane LOS | - | B | - | - |
| HCM 95th %tile Q(veh) | - | 0 | - | - |

| Intersection | | | | | | |
|--------------------------|------|------|------|------|------|-------|
| Int Delay, s/veh | 2.8 | | | | | |
| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
| Lane Configurations | ↶ | | ↷ | ↶↷ | ↷ | ↶ |
| Traffic Vol, veh/h | 592 | 15 | 135 | 625 | 30 | 102 |
| Future Vol, veh/h | 592 | 15 | 135 | 625 | 30 | 102 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Stop | Stop |
| RT Channelized | - | None | - | None | - | Yield |
| Storage Length | - | - | 150 | - | 100 | 0 |
| Veh in Median Storage, # | 0 | - | - | 0 | 0 | - |
| Grade, % | 0 | - | - | 0 | 0 | - |
| Peak Hour Factor | 92 | 78 | 79 | 92 | 78 | 79 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 643 | 19 | 171 | 679 | 38 | 129 |

| Major/Minor | Major1 | Major2 | Minor1 | | |
|----------------------|--------|--------|--------|---|-------------|
| Conflicting Flow All | 0 | 0 | 662 | 0 | 1335 653 |
| Stage 1 | - | - | - | - | 653 - |
| Stage 2 | - | - | - | - | 682 - |
| Critical Hdwy | - | - | 4.13 | - | 6.63 6.23 |
| Critical Hdwy Stg 1 | - | - | - | - | 5.43 - |
| Critical Hdwy Stg 2 | - | - | - | - | 5.83 - |
| Follow-up Hdwy | - | - | 2.219 | - | 3.519 3.319 |
| Pot Cap-1 Maneuver | - | - | 925 | - | 157 466 |
| Stage 1 | - | - | - | - | 517 - |
| Stage 2 | - | - | - | - | 464 - |
| Platoon blocked, % | - | - | - | - | - |
| Mov Cap-1 Maneuver | - | - | 925 | - | 128 466 |
| Mov Cap-2 Maneuver | - | - | - | - | 213 - |
| Stage 1 | - | - | - | - | 421 - |
| Stage 2 | - | - | - | - | 464 - |

| Approach | EB | WB | NB |
|----------------------|----|----|----|
| HCM Control Delay, s | 0 | 2 | 18 |
| HCM LOS | | | C |

| Minor Lane/Major Mvmt | NBLn1 | NBLn2 | EBT | EBR | WBL | WBT |
|-----------------------|-------|-------|-----|-----|-------|-----|
| Capacity (veh/h) | 213 | 466 | - | - | 925 | - |
| HCM Lane V/C Ratio | 0.181 | 0.277 | - | - | 0.185 | - |
| HCM Control Delay (s) | 25.6 | 15.7 | - | - | 9.8 | - |
| HCM Lane LOS | D | C | - | - | A | - |
| HCM 95th %tile Q(veh) | 0.6 | 1.1 | - | - | 0.7 | - |

| Intersection | | | | | | |
|--------------------------|------|------|------|------|------|------|
| Int Delay, s/veh | 5.5 | | | | | |
| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
| Lane Configurations | ↙ | ↗ | ↖ | | ↙ | ↗ |
| Traffic Vol, veh/h | 237 | 19 | 196 | 262 | 18 | 203 |
| Future Vol, veh/h | 237 | 19 | 196 | 262 | 18 | 203 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Stop | Stop | Free | Free | Free | Free |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | 0 | 0 | - | - | 75 | - |
| Veh in Median Storage, # | 0 | - | 0 | - | - | 0 |
| Grade, % | 0 | - | 0 | - | - | 0 |
| Peak Hour Factor | 85 | 78 | 85 | 85 | 78 | 87 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 279 | 24 | 231 | 308 | 23 | 233 |

| Major/Minor | Minor1 | Major1 | Major2 | | |
|----------------------|--------|--------|--------|---|-------|
| Conflicting Flow All | 664 | 385 | 0 | 0 | 539 |
| Stage 1 | 385 | - | - | - | - |
| Stage 2 | 279 | - | - | - | - |
| Critical Hdwy | 6.42 | 6.22 | - | - | 4.12 |
| Critical Hdwy Stg 1 | 5.42 | - | - | - | - |
| Critical Hdwy Stg 2 | 5.42 | - | - | - | - |
| Follow-up Hdwy | 3.518 | 3.318 | - | - | 2.218 |
| Pot Cap-1 Maneuver | 426 | 663 | - | - | 1029 |
| Stage 1 | 688 | - | - | - | - |
| Stage 2 | 768 | - | - | - | - |
| Platoon blocked, % | | | - | - | - |
| Mov Cap-1 Maneuver | 417 | 663 | - | - | 1029 |
| Mov Cap-2 Maneuver | 512 | - | - | - | - |
| Stage 1 | 673 | - | - | - | - |
| Stage 2 | 768 | - | - | - | - |

| Approach | WB | NB | SB |
|----------------------|------|----|-----|
| HCM Control Delay, s | 19.3 | 0 | 0.8 |
| HCM LOS | C | | |

| Minor Lane/Major Mvmt | NBT | NBRWBLn1 | WBLn2 | SBL | SBT |
|-----------------------|-----|----------|-------|-------|-------|
| Capacity (veh/h) | - | - | 512 | 663 | 1029 |
| HCM Lane V/C Ratio | - | - | 0.545 | 0.037 | 0.022 |
| HCM Control Delay (s) | - | - | 20.1 | 10.6 | 8.6 |
| HCM Lane LOS | - | - | C | B | A |
| HCM 95th %tile Q(veh) | - | - | 3.2 | 0.1 | 0.1 |

| Intersection | | | | | | |
|--------------------------|------|------|------|------|------|------|
| Int Delay, s/veh | 0.1 | | | | | |
| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
| Lane Configurations | ↘↗ | | | ↑↑ | ↑↑ | ↗ |
| Traffic Vol, veh/h | 0 | 16 | 0 | 683 | 676 | 19 |
| Future Vol, veh/h | 0 | 16 | 0 | 683 | 676 | 19 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Stop | Stop | Free | Free | Free | Free |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | 0 | - | - | - | - | 100 |
| Veh in Median Storage, # | 0 | - | - | 0 | 0 | - |
| Grade, % | 0 | - | - | 0 | 0 | - |
| Peak Hour Factor | 92 | 78 | 78 | 92 | 85 | 78 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 0 | 21 | 0 | 742 | 795 | 24 |

| Major/Minor | Minor2 | Major1 | Major2 | | | |
|----------------------|--------|--------|--------|---|---|---|
| Conflicting Flow All | 1166 | 398 | - | 0 | - | 0 |
| Stage 1 | 795 | - | - | - | - | - |
| Stage 2 | 371 | - | - | - | - | - |
| Critical Hdwy | 6.84 | 6.94 | - | - | - | - |
| Critical Hdwy Stg 1 | 5.84 | - | - | - | - | - |
| Critical Hdwy Stg 2 | 5.84 | - | - | - | - | - |
| Follow-up Hdwy | 3.52 | 3.32 | - | - | - | - |
| Pot Cap-1 Maneuver | 187 | 601 | 0 | - | - | - |
| Stage 1 | 405 | - | 0 | - | - | - |
| Stage 2 | 668 | - | 0 | - | - | - |
| Platoon blocked, % | | | | - | - | - |
| Mov Cap-1 Maneuver | 187 | 601 | - | - | - | - |
| Mov Cap-2 Maneuver | 308 | - | - | - | - | - |
| Stage 1 | 405 | - | - | - | - | - |
| Stage 2 | 668 | - | - | - | - | - |

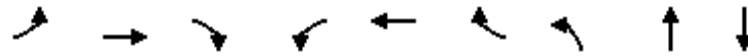
| Approach | EB | NB | SB |
|----------------------|------|----|----|
| HCM Control Delay, s | 11.2 | 0 | 0 |
| HCM LOS | B | | |

| Minor Lane/Major Mvmt | NBT | EBLn1 | SBT | SBR |
|-----------------------|-----|-------|-----|-----|
| Capacity (veh/h) | - | 601 | - | - |
| HCM Lane V/C Ratio | - | 0.034 | - | - |
| HCM Control Delay (s) | - | 11.2 | - | - |
| HCM Lane LOS | - | B | - | - |
| HCM 95th %tile Q(veh) | - | 0.1 | - | - |

Queues

29: Roeland Drive & Johnson Drive

12/27/2018



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | SBT |
|-------------------------|------|------|------|------|------|------|------|------|------|
| Lane Group Flow (vph) | 48 | 595 | 71 | 76 | 676 | 24 | 80 | 144 | 52 |
| v/c Ratio | 0.11 | 0.54 | 0.07 | 0.15 | 0.61 | 0.02 | 0.24 | 0.32 | 0.22 |
| Control Delay | 6.2 | 15.2 | 0.1 | 6.4 | 16.6 | 0.0 | 25.9 | 10.8 | 20.5 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 6.2 | 15.2 | 0.1 | 6.4 | 16.6 | 0.0 | 25.9 | 10.8 | 20.5 |
| Queue Length 50th (ft) | 8 | 206 | 0 | 12 | 245 | 0 | 27 | 9 | 7 |
| Queue Length 95th (ft) | 16 | 309 | 0 | 24 | 380 | 0 | 69 | 60 | 15 |
| Internal Link Dist (ft) | | 180 | | | 464 | | | 267 | 783 |
| Turn Bay Length (ft) | 100 | | 100 | 130 | | | 100 | | |
| Base Capacity (vph) | 458 | 1406 | 1230 | 513 | 1406 | 1230 | 346 | 746 | 316 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.10 | 0.42 | 0.06 | 0.15 | 0.48 | 0.02 | 0.23 | 0.19 | 0.16 |

Intersection Summary

HCM 6th Signalized Intersection Summary
 29: Roeland Drive & Johnson Drive

12/27/2018



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Lane Configurations | ↖ | ↗ | ↘ | ↖ | ↗ | ↘ | ↖ | ↗ | ↘ | | ↕ | |
| Traffic Volume (veh/h) | 36 | 512 | 65 | 59 | 588 | 9 | 66 | 26 | 93 | 2 | 6 | 23 |
| Future Volume (veh/h) | 36 | 512 | 65 | 59 | 588 | 9 | 66 | 26 | 93 | 2 | 6 | 23 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 |
| Adj Flow Rate, veh/h | 48 | 595 | 71 | 76 | 676 | 24 | 80 | 28 | 116 | 4 | 12 | 36 |
| Peak Hour Factor | 0.75 | 0.86 | 0.91 | 0.78 | 0.87 | 0.38 | 0.83 | 0.93 | 0.80 | 0.50 | 0.50 | 0.64 |
| Percent Heavy Veh, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Cap, veh/h | 309 | 789 | 669 | 366 | 820 | 695 | 456 | 81 | 335 | 71 | 43 | 110 |
| Arrive On Green | 0.06 | 0.42 | 0.42 | 0.07 | 0.44 | 0.44 | 0.07 | 0.25 | 0.25 | 0.10 | 0.10 | 0.10 |
| Sat Flow, veh/h | 1781 | 1870 | 1585 | 1781 | 1870 | 1585 | 1781 | 318 | 1316 | 61 | 443 | 1133 |
| Grp Volume(v), veh/h | 48 | 595 | 71 | 76 | 676 | 24 | 80 | 0 | 144 | 52 | 0 | 0 |
| Grp Sat Flow(s),veh/h/ln | 1781 | 1870 | 1585 | 1781 | 1870 | 1585 | 1781 | 0 | 1634 | 1636 | 0 | 0 |
| Q Serve(g_s), s | 0.9 | 16.1 | 1.6 | 1.3 | 18.9 | 0.5 | 2.2 | 0.0 | 4.3 | 0.0 | 0.0 | 0.0 |
| Cycle Q Clear(g_c), s | 0.9 | 16.1 | 1.6 | 1.3 | 18.9 | 0.5 | 2.2 | 0.0 | 4.3 | 1.7 | 0.0 | 0.0 |
| Prop In Lane | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 0.81 | 0.08 | | 0.69 |
| Lane Grp Cap(c), veh/h | 309 | 789 | 669 | 366 | 820 | 695 | 456 | 0 | 416 | 223 | 0 | 0 |
| V/C Ratio(X) | 0.16 | 0.75 | 0.11 | 0.21 | 0.82 | 0.03 | 0.18 | 0.00 | 0.35 | 0.23 | 0.00 | 0.00 |
| Avail Cap(c_a), veh/h | 420 | 1475 | 1250 | 447 | 1475 | 1250 | 533 | 0 | 576 | 311 | 0 | 0 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 0.00 |
| Uniform Delay (d), s/veh | 11.3 | 14.6 | 10.4 | 10.4 | 14.7 | 9.5 | 19.8 | 0.0 | 18.2 | 25.1 | 0.0 | 0.0 |
| Incr Delay (d2), s/veh | 0.2 | 1.5 | 0.1 | 0.3 | 2.2 | 0.0 | 0.2 | 0.0 | 0.5 | 0.5 | 0.0 | 0.0 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 0.3 | 6.2 | 0.5 | 0.5 | 7.3 | 0.2 | 0.9 | 0.0 | 1.5 | 0.7 | 0.0 | 0.0 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 11.5 | 16.1 | 10.5 | 10.7 | 16.9 | 9.6 | 19.9 | 0.0 | 18.7 | 25.6 | 0.0 | 0.0 |
| LnGrp LOS | B | B | B | B | B | A | B | A | B | C | A | A |
| Approach Vol, veh/h | | 714 | | | 776 | | | 224 | | | | 52 |
| Approach Delay, s/veh | | 15.2 | | | 16.0 | | | 19.1 | | | | 25.6 |
| Approach LOS | | B | | | B | | | B | | | | C |
| Timer - Assigned Phs | 1 | 2 | | 4 | 5 | 6 | 7 | 8 | | | | |
| Phs Duration (G+Y+Rc), s | 8.3 | 31.1 | | 20.2 | 9.3 | 30.1 | 9.4 | 10.8 | | | | |
| Change Period (Y+Rc), s | 5.0 | 5.0 | | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | | | | |
| Max Green Setting (Gmax), s | 7.0 | 47.0 | | 21.0 | 7.0 | 47.0 | 7.0 | 9.0 | | | | |
| Max Q Clear Time (g_c+I1), s | 2.9 | 20.9 | | 6.3 | 3.3 | 18.1 | 4.2 | 3.7 | | | | |
| Green Ext Time (p_c), s | 0.0 | 5.2 | | 0.6 | 0.0 | 4.6 | 0.0 | 0.1 | | | | |

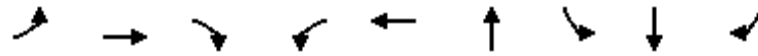
Intersection Summary

| | |
|--------------------|------|
| HCM 6th Ctrl Delay | 16.4 |
| HCM 6th LOS | B |

Queues

1470: Roeland Drive & Shawnee Mission Parkway

12/27/2018



| Lane Group | EBL | EBT | EBR | WBL | WBT | NBT | SBL | SBT | SBR |
|-------------------------|-------|------|------|------|------|------|------|------|------|
| Lane Group Flow (vph) | 279 | 1194 | 136 | 32 | 1901 | 152 | 222 | 84 | 252 |
| v/c Ratio | 1.52 | 0.63 | 0.09 | 0.24 | 0.89 | 0.70 | 0.81 | 0.29 | 0.55 |
| Control Delay | 271.2 | 8.1 | 0.0 | 56.9 | 35.8 | 65.9 | 72.1 | 48.5 | 10.7 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 271.2 | 8.1 | 0.0 | 56.9 | 35.8 | 65.9 | 72.1 | 48.5 | 10.7 |
| Queue Length 50th (ft) | ~313 | 360 | 0 | 24 | 531 | 113 | 165 | 57 | 0 |
| Queue Length 95th (ft) | m#286 | m199 | m0 | 47 | #615 | 135 | #315 | 97 | 71 |
| Internal Link Dist (ft) | | 682 | | | 2401 | 499 | | 332 | |
| Turn Bay Length (ft) | 345 | | 310 | 170 | | | 100 | | 125 |
| Base Capacity (vph) | 184 | 1888 | 1583 | 140 | 2137 | 293 | 274 | 288 | 458 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 1.52 | 0.63 | 0.09 | 0.23 | 0.89 | 0.52 | 0.81 | 0.29 | 0.55 |

Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
- m Volume for 95th percentile queue is metered by upstream signal.

HCM 6th Signalized Intersection Summary
 1470: Roeland Drive & Shawnee Mission Parkway

12/27/2018



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|------------------------------|------|------|------|------|------|------|------|------|------|-------|------|-------|
| Lane Configurations | ↖ | ↗ | ↘ | ↖ | ↗ | ↘ | | ↕ | | ↖ | ↗ | ↘ |
| Traffic Volume (veh/h) | 243 | 1122 | 103 | 24 | 1540 | 221 | 68 | 37 | 7 | 193 | 66 | 222 |
| Future Volume (veh/h) | 243 | 1122 | 103 | 24 | 1540 | 221 | 68 | 37 | 7 | 193 | 66 | 222 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 |
| Adj Flow Rate, veh/h | 279 | 1194 | 0 | 32 | 1621 | 280 | 88 | 52 | 12 | 222 | 84 | 252 |
| Peak Hour Factor | 0.87 | 0.94 | 0.76 | 0.75 | 0.95 | 0.79 | 0.77 | 0.71 | 0.58 | 0.87 | 0.79 | 0.88 |
| Percent Heavy Veh, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Cap, veh/h | 294 | 1673 | | 250 | 1858 | 319 | 105 | 62 | 14 | 230 | 242 | 205 |
| Arrive On Green | 0.17 | 0.47 | 0.00 | 0.14 | 0.45 | 0.45 | 0.10 | 0.10 | 0.10 | 0.13 | 0.13 | 0.13 |
| Sat Flow, veh/h | 1781 | 3554 | 1585 | 1781 | 4167 | 716 | 1038 | 613 | 142 | 1781 | 1870 | 1585 |
| Grp Volume(v), veh/h | 279 | 1194 | 0 | 32 | 1220 | 681 | 152 | 0 | 0 | 222 | 84 | 252 |
| Grp Sat Flow(s),veh/h/ln | 1781 | 1777 | 1585 | 1781 | 1571 | 1741 | 1793 | 0 | 0 | 1781 | 1870 | 1585 |
| Q Serve(g_s), s | 18.6 | 32.1 | 0.0 | 1.9 | 42.2 | 42.7 | 10.0 | 0.0 | 0.0 | 14.9 | 4.9 | 15.5 |
| Cycle Q Clear(g_c), s | 18.6 | 32.1 | 0.0 | 1.9 | 42.2 | 42.7 | 10.0 | 0.0 | 0.0 | 14.9 | 4.9 | 15.5 |
| Prop In Lane | 1.00 | | 1.00 | 1.00 | | 0.41 | 0.58 | | 0.08 | 1.00 | | 1.00 |
| Lane Grp Cap(c), veh/h | 294 | 1673 | | 250 | 1401 | 776 | 182 | 0 | 0 | 230 | 242 | 205 |
| V/C Ratio(X) | 0.95 | 0.71 | | 0.13 | 0.87 | 0.88 | 0.83 | 0.00 | 0.00 | 0.96 | 0.35 | 1.23 |
| Avail Cap(c_a), veh/h | 294 | 1673 | | 250 | 1401 | 776 | 291 | 0 | 0 | 230 | 242 | 205 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 0.00 | 1.00 | 1.00 | 1.00 |
| Uniform Delay (d), s/veh | 49.6 | 25.3 | 0.0 | 45.2 | 30.1 | 30.2 | 52.9 | 0.0 | 0.0 | 52.0 | 47.6 | 52.3 |
| Incr Delay (d2), s/veh | 38.4 | 2.6 | 0.0 | 0.1 | 7.7 | 13.3 | 5.6 | 0.0 | 0.0 | 49.0 | 0.3 | 138.9 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 11.2 | 13.2 | 0.0 | 0.8 | 16.4 | 19.5 | 4.8 | 0.0 | 0.0 | 9.8 | 2.3 | 14.0 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 88.0 | 27.9 | 0.0 | 45.3 | 37.8 | 43.5 | 58.5 | 0.0 | 0.0 | 101.0 | 48.0 | 191.2 |
| LnGrp LOS | F | C | | D | D | D | E | A | A | F | D | F |
| Approach Vol, veh/h | | 1473 | A | | 1933 | | | 152 | | | | 558 |
| Approach Delay, s/veh | | 39.3 | | | 39.9 | | | 58.5 | | | | 133.7 |
| Approach LOS | | D | | | D | | | E | | | | F |
| Timer - Assigned Phs | 1 | 2 | | 4 | 5 | 6 | | 8 | | | | |
| Phs Duration (G+Y+Rc), s | 24.3 | 59.0 | | 16.7 | 21.3 | 62.0 | | 20.0 | | | | |
| Change Period (Y+Rc), s | 4.5 | 5.5 | | 4.5 | 4.5 | 5.5 | | 4.5 | | | | |
| Max Green Setting (Gmax), s | 12.5 | 53.5 | | 19.5 | 9.5 | 56.5 | | 15.5 | | | | |
| Max Q Clear Time (g_c+I1), s | 20.6 | 44.7 | | 12.0 | 3.9 | 34.1 | | 17.5 | | | | |
| Green Ext Time (p_c), s | 0.0 | 5.4 | | 0.3 | 0.0 | 5.5 | | 0.0 | | | | |

Intersection Summary

| | |
|--------------------|------|
| HCM 6th Ctrl Delay | 53.1 |
| HCM 6th LOS | D |

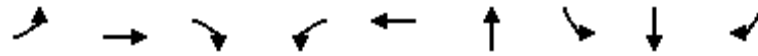
Notes

Unsignalized Delay for [EBR] is excluded from calculations of the approach delay and intersection delay.

Queues

1470: Roeland Drive & Shawnee Mission Parkway

12/27/2018



| Lane Group | EBL | EBT | EBR | WBL | WBT | NBT | SBL | SBT | SBR |
|-------------------------|------|------|------|------|------|------|------|------|------|
| Lane Group Flow (vph) | 279 | 1194 | 136 | 32 | 1901 | 152 | 151 | 155 | 252 |
| v/c Ratio | 1.03 | 0.60 | 0.09 | 0.17 | 0.88 | 0.84 | 0.76 | 0.76 | 0.62 |
| Control Delay | 76.5 | 7.3 | 0.0 | 49.6 | 34.4 | 86.9 | 74.9 | 73.9 | 12.8 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 76.5 | 7.3 | 0.0 | 49.6 | 34.4 | 86.9 | 74.9 | 73.9 | 12.8 |
| Queue Length 50th (ft) | ~239 | 230 | 0 | 22 | 519 | 115 | 120 | 123 | 0 |
| Queue Length 95th (ft) | m219 | m199 | m0 | 44 | #615 | 145 | 188 | 171 | 70 |
| Internal Link Dist (ft) | | 682 | | | 2401 | 499 | | 332 | |
| Turn Bay Length (ft) | 345 | | 310 | 170 | | | 100 | | 125 |
| Base Capacity (vph) | 272 | 1985 | 1583 | 228 | 2171 | 189 | 231 | 238 | 435 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 1.03 | 0.60 | 0.09 | 0.14 | 0.88 | 0.80 | 0.65 | 0.65 | 0.58 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis
 1470: Roeland Drive & Shawnee Mission Parkway

12/27/2018



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|------------------------|-------|------|-------|------|-------|------|-------|-------|------|-------|------|------|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 243 | 1122 | 103 | 24 | 1540 | 221 | 68 | 37 | 7 | 193 | 66 | 222 |
| Future Volume (vph) | 243 | 1122 | 103 | 24 | 1540 | 221 | 68 | 37 | 7 | 193 | 66 | 222 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.5 | 5.5 | 4.0 | 4.5 | 5.5 | | | 4.5 | | 4.5 | 4.5 | 4.5 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | *0.84 | | | 1.00 | | 0.95 | 0.95 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.98 | | | 0.99 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 0.97 | | 0.95 | 0.98 | 1.00 |
| Satd. Flow (prot) | 1770 | 3539 | 1583 | 1770 | 4590 | | | 1791 | | 1681 | 1730 | 1583 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 0.97 | | 0.95 | 0.98 | 1.00 |
| Satd. Flow (perm) | 1770 | 3539 | 1583 | 1770 | 4590 | | | 1791 | | 1681 | 1730 | 1583 |
| Peak-hour factor, PHF | 0.87 | 0.94 | 0.76 | 0.75 | 0.95 | 0.79 | 0.77 | 0.71 | 0.58 | 0.87 | 0.79 | 0.88 |
| Adj. Flow (vph) | 279 | 1194 | 136 | 32 | 1621 | 280 | 88 | 52 | 12 | 222 | 84 | 252 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 17 | 0 | 0 | 3 | 0 | 0 | 0 | 222 |
| Lane Group Flow (vph) | 279 | 1194 | 136 | 32 | 1884 | 0 | 0 | 149 | 0 | 151 | 155 | 30 |
| Turn Type | Prot | NA | Free | Prot | NA | | Split | NA | | Split | NA | Perm |
| Protected Phases | 1 | 6 | | 5 | 2 | | 4 | 4 | | 8 | 8 | |
| Permitted Phases | | | Free | | | | | | | | | 8 |
| Actuated Green, G (s) | 20.3 | 65.5 | 120.0 | 9.3 | 54.5 | | | 12.0 | | 14.2 | 14.2 | 14.2 |
| Effective Green, g (s) | 20.3 | 65.5 | 120.0 | 9.3 | 54.5 | | | 12.0 | | 14.2 | 14.2 | 14.2 |
| Actuated g/C Ratio | 0.17 | 0.55 | 1.00 | 0.08 | 0.45 | | | 0.10 | | 0.12 | 0.12 | 0.12 |
| Clearance Time (s) | 4.5 | 5.5 | | 4.5 | 5.5 | | | 4.5 | | 4.5 | 4.5 | 4.5 |
| Vehicle Extension (s) | 1.5 | 2.0 | | 1.5 | 2.0 | | | 2.0 | | 2.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 299 | 1931 | 1583 | 137 | 2084 | | | 179 | | 198 | 204 | 187 |
| v/s Ratio Prot | c0.16 | 0.34 | | 0.02 | c0.41 | | | c0.08 | | c0.09 | 0.09 | |
| v/s Ratio Perm | | | 0.09 | | | | | | | | | 0.02 |
| v/c Ratio | 0.93 | 0.62 | 0.09 | 0.23 | 0.90 | | | 0.83 | | 0.76 | 0.76 | 0.16 |
| Uniform Delay, d1 | 49.2 | 18.7 | 0.0 | 52.0 | 30.3 | | | 53.0 | | 51.3 | 51.2 | 47.5 |
| Progression Factor | 1.07 | 0.36 | 1.00 | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 5.6 | 0.1 | 0.0 | 0.3 | 7.0 | | | 26.0 | | 14.4 | 13.4 | 0.1 |
| Delay (s) | 58.4 | 6.8 | 0.0 | 52.3 | 37.3 | | | 79.0 | | 65.7 | 64.7 | 47.7 |
| Level of Service | E | A | A | D | D | | | E | | E | E | D |
| Approach Delay (s) | | 15.2 | | | 37.6 | | | 79.0 | | | 57.3 | |
| Approach LOS | | B | | | D | | | E | | | E | |

Intersection Summary

| | | | |
|-----------------------------------|-------|---------------------------|------|
| HCM 2000 Control Delay | 33.2 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.88 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 19.0 |
| Intersection Capacity Utilization | 73.0% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

Drive Spacing – Influence Area Calculations

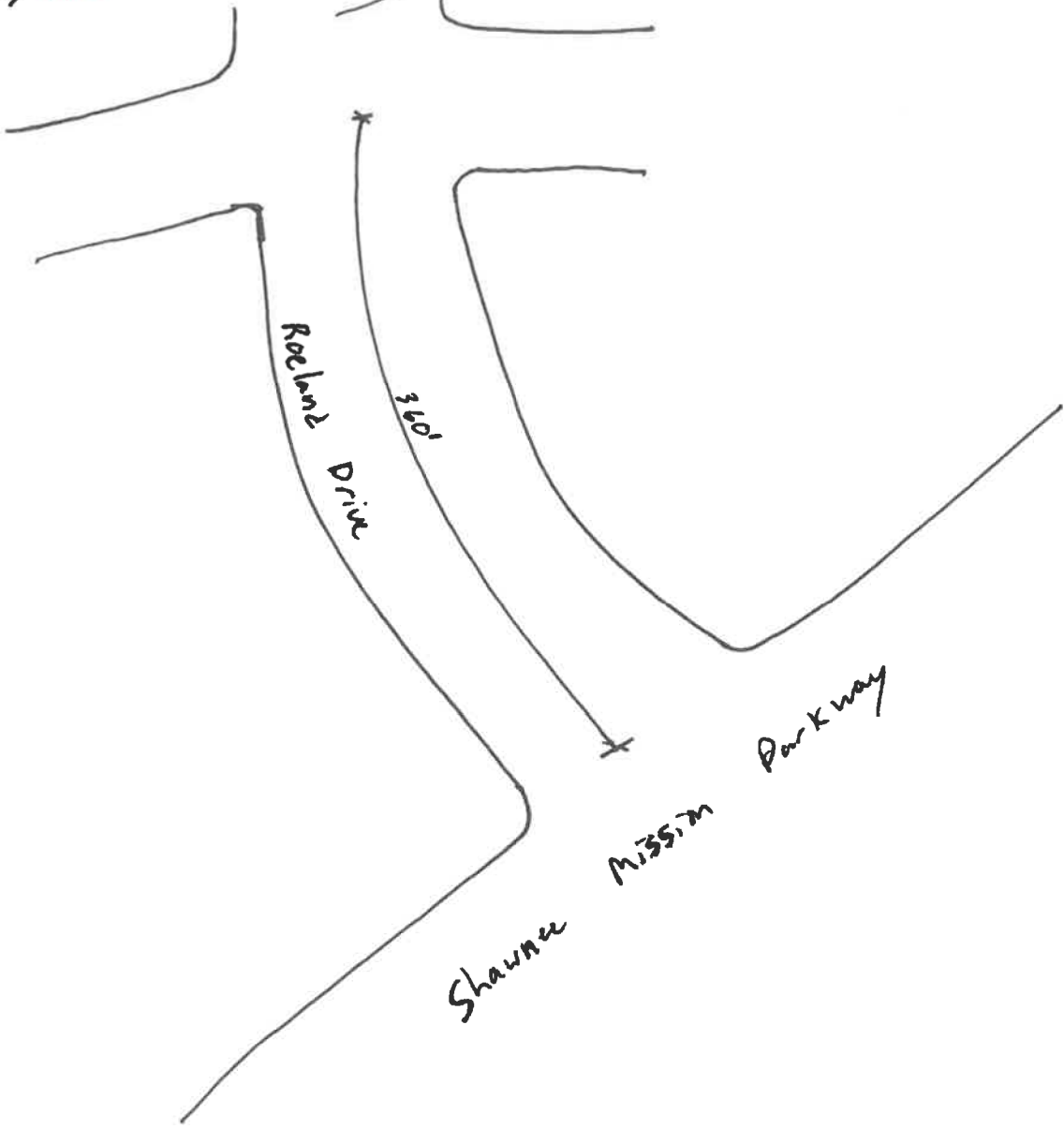
Drive 1 = 560' center to stop bar from SMP: Roeland Dr.
Ex + App + Dev.

$D_1 \Rightarrow$ ~~Developer~~ Developer = 55'

$D_2 \Rightarrow$ 115'

$D_3 \Rightarrow$ 189'

$$= 55' + 115' + 109' = 359'$$



Ex + Base App + Dev

PROJECT: 077-2145 (Miss. & Gateway)

project no.:
drawn by: TCM
date: ~~11/1~~
page 1 of 1

Merge Analysis

HCS7 Freeway Merge Report

Project Information

| | | | |
|---------------------|--|----------------------|-----------|
| Analyst | TCM | Date | 5/20/2019 |
| Agency | Olsson | Analysis Year | 2019 |
| Jurisdiction | Mission, KS | Time Period Analyzed | AM |
| Project Description | EB Johnson Drive On-Ramp to NB Shawnee Mission Parkway | | |

Geometric Data

| | Freeway | Ramp |
|--|---------|---------|
| Number of Lanes (N), In | 2 | 1 |
| Free-Flow Speed (FFS), mi/h | 45.0 | 25.0 |
| Segment Length (L) / Acceleration Length (LA),ft | 1500 | 150 |
| Terrain Type | Rolling | Rolling |
| Percent Grade, % | - | - |
| Segment Type / Ramp Side | Freeway | Right |

Adjustment Factors

| | | |
|--|--------------------|--------------------|
| Driver Population | All Familiar | All Familiar |
| Weather Type | Non-Severe Weather | Non-Severe Weather |
| Incident Type | No Incident | - |
| Final Speed Adjustment Factor (SAF) | 1.000 | 1.000 |
| Final Capacity Adjustment Factor (CAF) | 1.000 | 1.000 |
| Demand Adjustment Factor (DAF) | 1.000 | 1.000 |

Demand and Capacity

| | | |
|---------------------------------------|-------|-------|
| Demand Volume (Vi) | 1252 | 339 |
| Peak Hour Factor (PHF) | 0.85 | 0.85 |
| Total Trucks, % | 0.02 | 0.02 |
| Single-Unit Trucks (SUT), % | - | - |
| Tractor-Trailers (TT), % | - | - |
| Heavy Vehicle Adjustment Factor (fHV) | 1.000 | 1.000 |
| Flow Rate (vi),pc/h | 1473 | 399 |
| Capacity (c), pc/h | 4500 | 1900 |
| Volume-to-Capacity Ratio (v/c) | 0.42 | 0.21 |

Speed and Density

| | | | |
|--|-------|---|-------|
| Upstream Equilibrium Distance (LEQ), ft | - | Number of Outer Lanes on Freeway (NO) | 0 |
| Distance to Upstream Ramp (LUP), ft | - | Speed Index (Ms) | 0.339 |
| Downstream Equilibrium Distance (LEQ), ft | - | Flow Outer Lanes (VOA), pc/mi/ln | - |
| Distance to Downstream Ramp (LDOWN), ft | - | On-Ramp Influence Area Speed (SR), mi/h | 44.0 |
| Prop. Freeway Vehicles in Lane 1 and 2 (PFM) | 1.000 | Outer Lanes Freeway Speed (So), mi/h | - |
| Flow in Lanes 1 and 2 (v12), pc/h | 1473 | Ramp Junction Speed (S), mi/h | 44.0 |
| Flow Entering Ramp-Infl. Area (vR12), pc/h | 1872 | Average Density (D), pc/mi/ln | 21.3 |
| Level of Service (LOS) | B | Density in Ramp Influence Area (DR), pc/mi/ln | 19.0 |

HCS7 Freeway Merge Report

Project Information

| | | | |
|---------------------|--|----------------------|-----------|
| Analyst | TCM | Date | 5/20/2019 |
| Agency | Olsson | Analysis Year | 2019 |
| Jurisdiction | Mission, KS | Time Period Analyzed | PM |
| Project Description | EB Johnson Drive On-Ramp to NB Shawnee Mission Parkway | | |

Geometric Data

| | Freeway | Ramp |
|--|---------|---------|
| Number of Lanes (N), ln | 2 | 1 |
| Free-Flow Speed (FFS), mi/h | 45.0 | 25.0 |
| Segment Length (L) / Acceleration Length (LA),ft | 1500 | 150 |
| Terrain Type | Rolling | Rolling |
| Percent Grade, % | - | - |
| Segment Type / Ramp Side | Freeway | Right |

Adjustment Factors

| | | |
|--|--------------------|--------------------|
| Driver Population | All Familiar | All Familiar |
| Weather Type | Non-Severe Weather | Non-Severe Weather |
| Incident Type | No Incident | - |
| Final Speed Adjustment Factor (SAF) | 1.000 | 1.000 |
| Final Capacity Adjustment Factor (CAF) | 1.000 | 1.000 |
| Demand Adjustment Factor (DAF) | 1.000 | 1.000 |

Demand and Capacity

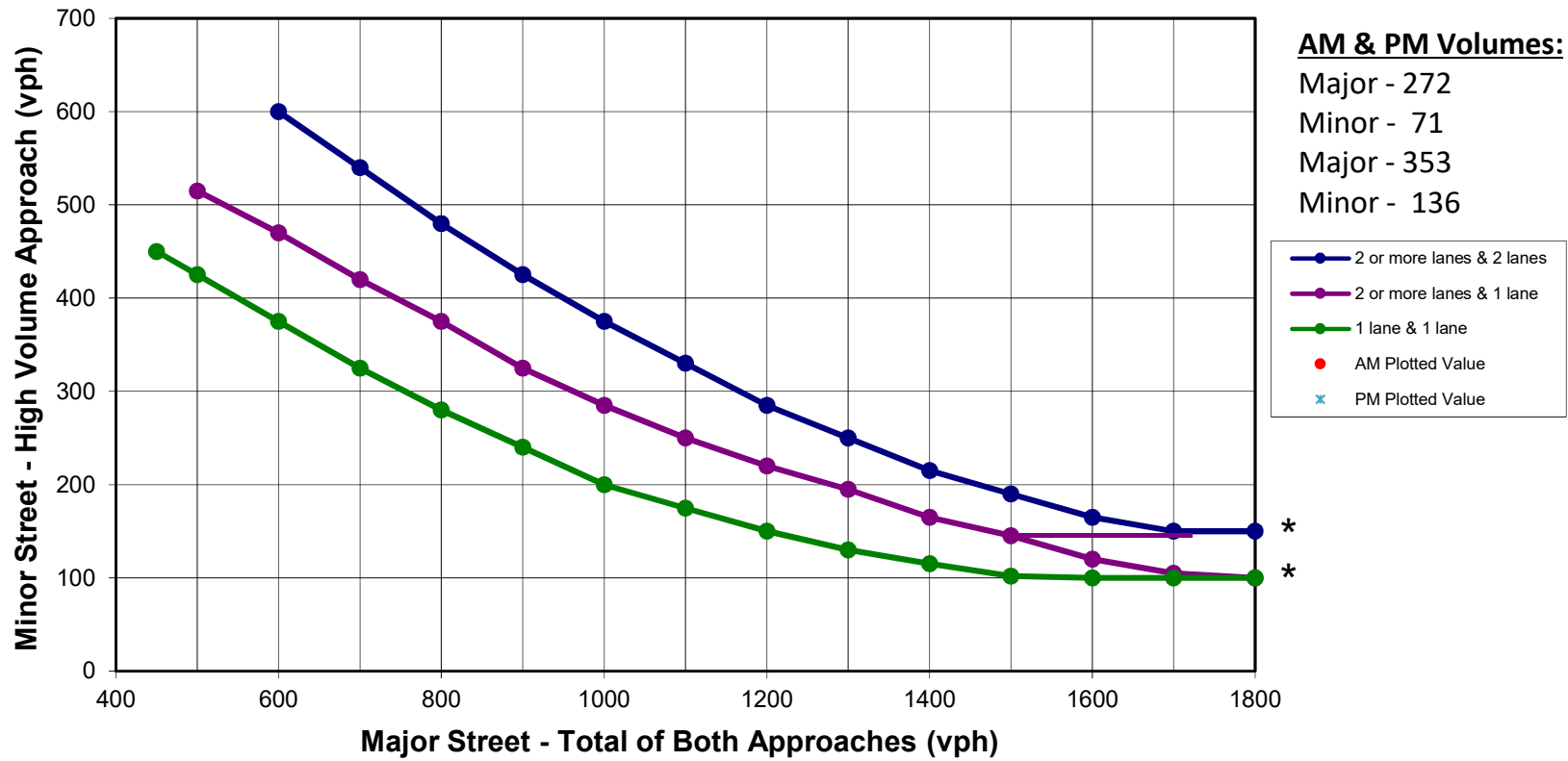
| | | |
|---------------------------------------|-------|-------|
| Demand Volume (Vi) | 1332 | 417 |
| Peak Hour Factor (PHF) | 0.94 | 0.86 |
| Total Trucks, % | 0.02 | 0.02 |
| Single-Unit Trucks (SUT), % | - | - |
| Tractor-Trailers (TT), % | - | - |
| Heavy Vehicle Adjustment Factor (fHV) | 1.000 | 1.000 |
| Flow Rate (vi),pc/h | 1417 | 485 |
| Capacity (c), pc/h | 4500 | 1900 |
| Volume-to-Capacity Ratio (v/c) | 0.42 | 0.26 |

Speed and Density

| | | | |
|--|-------|---|-------|
| Upstream Equilibrium Distance (LEQ), ft | - | Number of Outer Lanes on Freeway (No) | 0 |
| Distance to Upstream Ramp (LUP), ft | - | Speed Index (Ms) | 0.340 |
| Downstream Equilibrium Distance (LEQ), ft | - | Flow Outer Lanes (voA), pc/mi/ln | - |
| Distance to Downstream Ramp (LDOWN), ft | - | On-Ramp Influence Area Speed (SR), mi/h | 44.0 |
| Prop. Freeway Vehicles in Lane 1 and 2 (PFM) | 1.000 | Outer Lanes Freeway Speed (So), mi/h | - |
| Flow in Lanes 1 and 2 (v12), pc/h | 1417 | Ramp Junction Speed (S), mi/h | 44.0 |
| Flow Entering Ramp-Infl. Area (vR12), pc/h | 1902 | Average Density (D), pc/mi/ln | 21.6 |
| Level of Service (LOS) | B | Density in Ramp Influence Area (DR), pc/mi/ln | 19.2 |

Signal Warrant

Peak Hour Volume Warrant Roeland Drive and Martway Street



*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes

Trip Generation

| NCHRP 8-51 Internal Trip Capture Estimation Tool | | | |
|--|------------------------|----------------------|------------|
| Project Name: | Mission Gateway | Organization: | Olsson |
| Project Location: | Mission, KS | Performed By: | TCM |
| Scenario Description: | Approved + Development | Date: | 11/16/2018 |
| Analysis Year: | 2018 | Checked By: | |
| Analysis Period: | PM Street Peak Hour | Date: | |

| Table 1-P: Base Vehicle-Trip Generation Estimates (Single-Use Site Estimate) | | | | | | |
|--|---|----------|---------|-------------------------|------------|------------|
| Land Use | Development Data (For Information Only) | | | Estimated Vehicle-Trips | | |
| | ITE LUCs ¹ | Quantity | Units | Total | Entering | Exiting |
| Office | 710 | 75,000 | SQF | 87 | 14 | 73 |
| Retail | 820 | 54,594 | SQF | 348 | 168 | 180 |
| Restaurant | 932 | 38,750 | SQF | 379 | 235 | 144 |
| Cinema/Entertainment | 445 | 10 | SCREENS | 138 | 71 | 67 |
| Residential | 220 | 168 | DU | 94 | 60 | 34 |
| Hotel | 310 | 202 | ROOMS | 126 | 65 | 61 |
| All Other Land Uses ² | | | | | | |
| Total | | | | 1172 | 613 | 559 |

| Table 2-P: Mode Split and Vehicle Occupancy Estimates | | | | | | |
|---|----------------|-----------|-----------------|---------------|-----------|-----------------|
| Land Use | Entering Trips | | | Exiting Trips | | |
| | Veh. Occ. | % Transit | % Non-Motorized | Veh. Occ. | % Transit | % Non-Motorized |
| Office | | | | | | |
| Retail | | | | | | |
| Restaurant | | | | | | |
| Cinema/Entertainment | | | | | | |
| Residential | | | | | | |
| Hotel | | | | | | |
| All Other Land Uses ² | | | | | | |

| Table 3-P: Average Land Use Interchange Distances (Feet Walking Distance) | | | | | | |
|---|------------------|--------|------------|----------------------|-------------|-------|
| Origin (From) | Destination (To) | | | | | |
| | Office | Retail | Restaurant | Cinema/Entertainment | Residential | Hotel |
| Office | | | | | | |
| Retail | | | | | | |
| Restaurant | | | | | | |
| Cinema/Entertainment | | | | | | |
| Residential | | | | | | |
| Hotel | | | | | | |

| Table 4-P: Internal Person-Trip Origin-Destination Matrix* | | | | | | |
|--|------------------|--------|------------|----------------------|-------------|-------|
| Origin (From) | Destination (To) | | | | | |
| | Office | Retail | Restaurant | Cinema/Entertainment | Residential | Hotel |
| Office | | 13 | 3 | 0 | 1 | 0 |
| Retail | 4 | | 52 | 7 | 28 | 9 |
| Restaurant | 4 | 59 | | 12 | 10 | 10 |
| Cinema/Entertainment | 1 | 7 | 7 | | 2 | 1 |
| Residential | 1 | 14 | 7 | 0 | | 1 |
| Hotel | 0 | 3 | 12 | 0 | 0 | |

| Table 5-P: Computations Summary | | | |
|---|-------|----------|---------|
| | Total | Entering | Exiting |
| All Person-Trips | 1,172 | 613 | 559 |
| Internal Capture Percentage | 46% | 44% | 48% |
| External Vehicle-Trips ³ | 636 | 345 | 291 |
| External Transit-Trips ⁴ | 0 | 0 | 0 |
| External Non-Motorized Trips ⁴ | 0 | 0 | 0 |

| Table 6-P: Internal Trip Capture Percentages by Land Use | | |
|--|----------------|---------------|
| Land Use | Entering Trips | Exiting Trips |
| Office | 71% | 23% |
| Retail | 57% | 56% |
| Restaurant | 34% | 66% |
| Cinema/Entertainment | 27% | 27% |
| Residential | 68% | 68% |
| Hotel | 32% | 25% |

¹Land Use Codes (LUCs) from *Trip Generation Informational Report*, published by the Institute of Transportation Engineers.

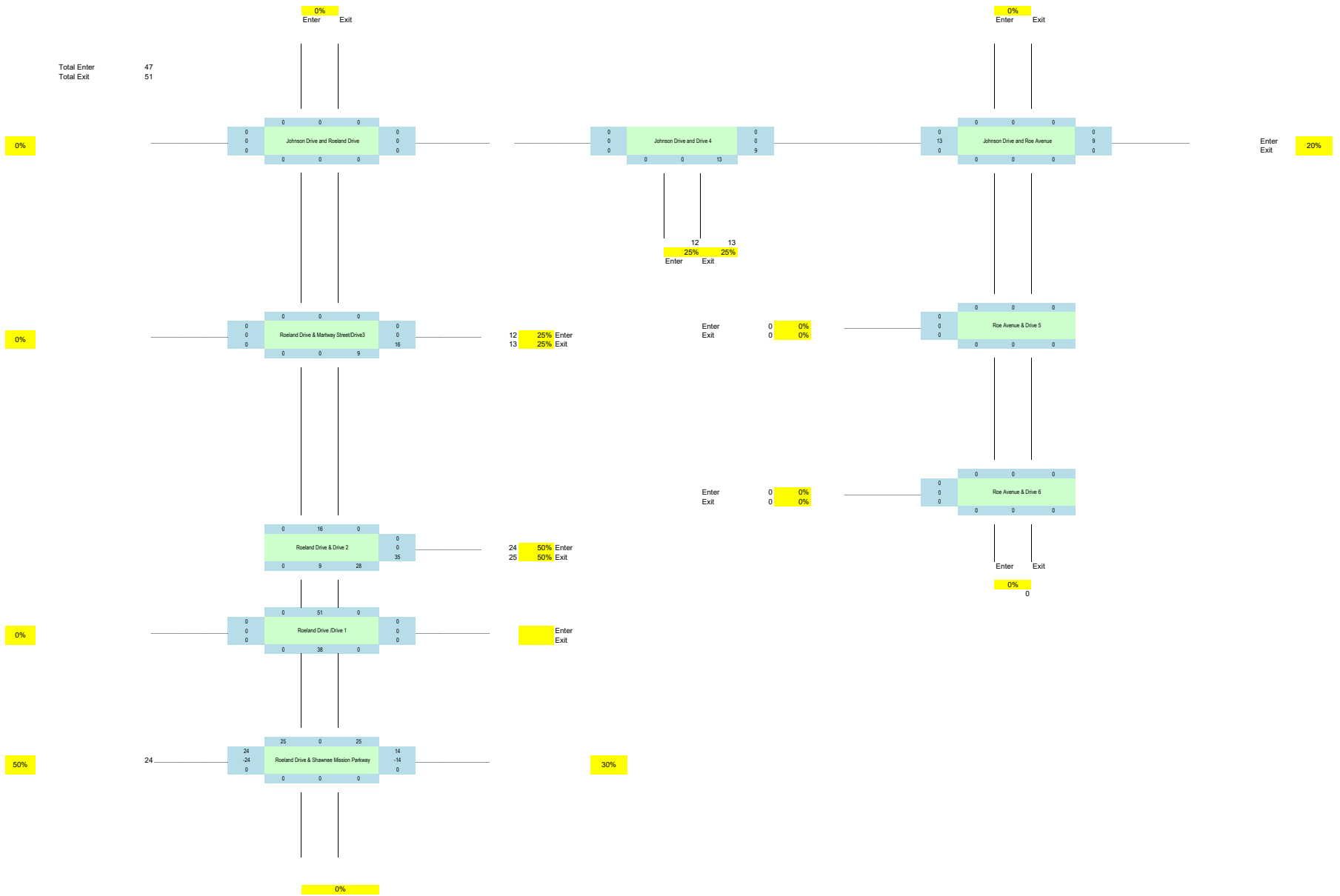
²Total estimate for all other land uses at mixed-use development site-not subject to internal trip capture computations in this estimator

³Vehicle-trips computed using the mode split and vehicle occupancy values provided in Table 2-P

⁴Person-Trips

*Indicates computation that has been rounded to the nearest whole number.

Estimation Tool Developed by the Texas Transportation Institute



Hotel (310)

Vehicle Trip Ends vs: Employees
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.

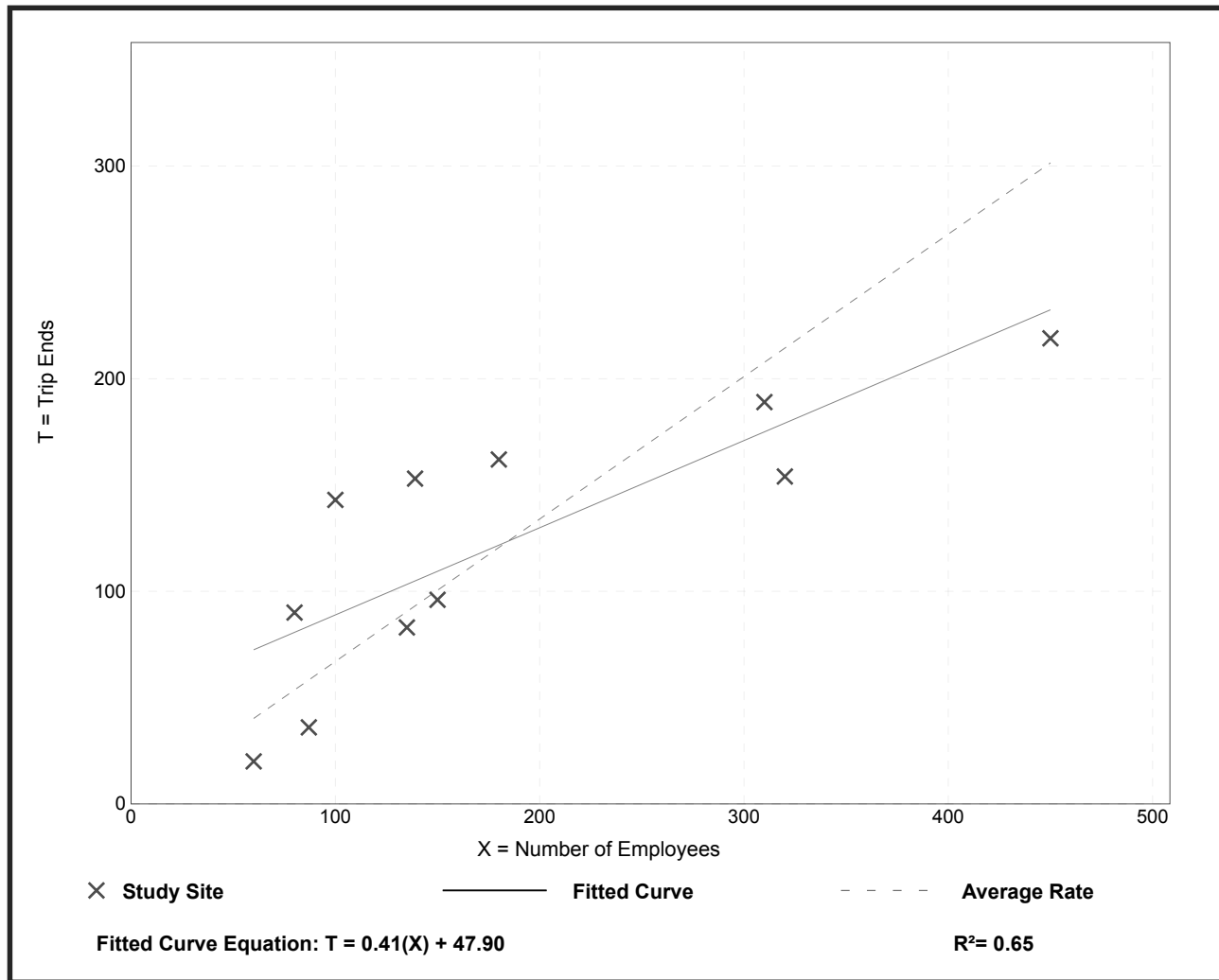
Setting/Location: General Urban/Suburban

Number of Studies: 11
 Avg. Num. of Employees: 183
 Directional Distribution: 60% entering, 40% exiting

Vehicle Trip Generation per Employee

| Average Rate | Range of Rates | Standard Deviation |
|--------------|----------------|--------------------|
| 0.67 | 0.33 - 1.43 | 0.29 |

Data Plot and Equation



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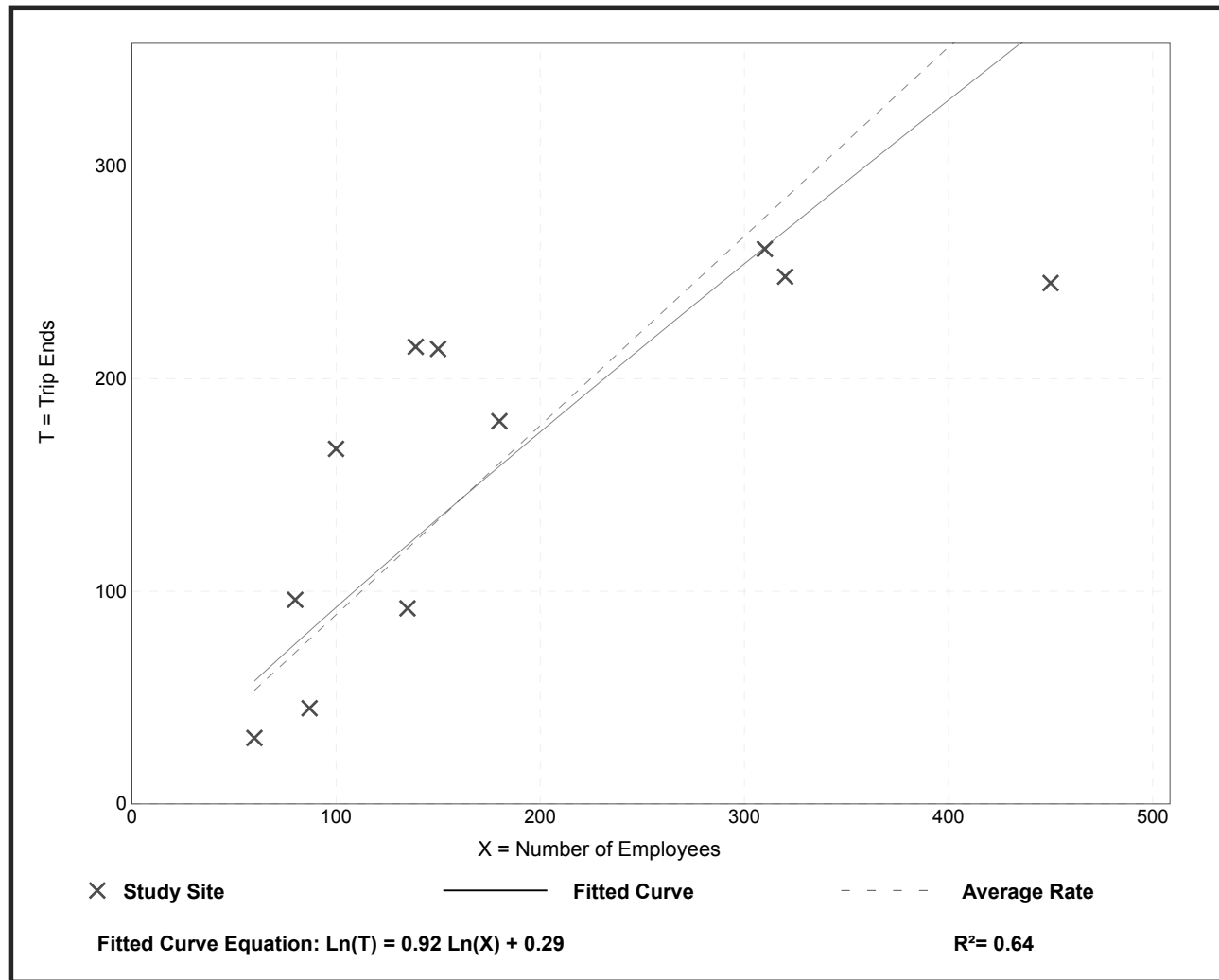
Hotel (310)

Vehicle Trip Ends vs: Employees
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.
Setting/Location: General Urban/Suburban
 Number of Studies: 11
 Avg. Num. of Employees: 183
 Directional Distribution: 54% entering, 46% exiting

Vehicle Trip Generation per Employee

| Average Rate | Range of Rates | Standard Deviation |
|--------------|----------------|--------------------|
| 0.89 | 0.52 - 1.67 | 0.38 |

Data Plot and Equation



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Land Use: 310

Hotel

Description

A hotel is a place of lodging that provides sleeping accommodations and supporting facilities such as restaurants, cocktail lounges, meeting and banquet rooms or convention facilities, limited recreational facilities (pool, fitness room), and/or other retail and service shops. All suites hotel (Land Use 311), business hotel (Land Use 312), motel (Land Use 320), and resort hotel (Land Use 330) are related uses.

Additional Data

Studies of hotel employment density indicate that, on the average, a hotel will employ 0.9 employees per room.¹

Twenty-five studies provided information on occupancy rates at the time the studies were conducted. The average occupancy rate for these studies was approximately 82 percent.

Some properties contained in this land use provide guest transportation services such as airport shuttles, limousine service, or golf course shuttle service, which may have an impact on the overall trip generation rates.

Time-of-day distribution data for this land use are presented in Appendix A. For the one center city core site with data, the overall highest vehicle volumes during the AM and PM on a weekday were counted between 8:30 and 9:30 a.m. and 3:15 and 4:15 p.m., respectively. On Saturday and Sunday, the peak hours were between 5:00 and 6:00 p.m. and 10:15 and 11:15 a.m., respectively.

The sites were surveyed in the 1980s, the 1990s, the 2000s, and the 2010s in California, District of Columbia, Florida, Georgia, Indiana, Minnesota, New York, Pennsylvania, South Dakota, Texas, Vermont, Virginia, and Washington.

For all lodging uses, it is important to collect data on occupied rooms as well as total rooms in order to accurately predict trip generation characteristics for the site.

Trip generation at a hotel may be related to the presence of supporting facilities such as convention facilities, restaurants, meeting/banquet space, and retail facilities. Future data submissions should specify the presence of these amenities. Reporting the level of activity at the supporting facilities such as full, empty, partially active, number of people attending a meeting/banquet during observation may also be useful in further analysis of this land use.

Source Numbers

170, 260, 262, 277, 280, 301, 306, 357, 422, 507, 577, 728, 867, 872, 925, 951

¹ Buttke, Carl H. Unpublished studies of building employment densities, Portland, Oregon.

Land Use: 435

Multipurpose Recreational Facility

Description

A multipurpose recreational facility contains two or more of the following land uses combined at one site: miniature golf, batting cages, video arcade, bumper boats, go-carts, and golf driving range. Refreshment areas may also be provided. Golf course (Land Use 430), miniature golf course (Land Use 431), golf driving range (Land Use 432), batting cages (Land Use 433), rock climbing gym (Land Use 434), and trampoline park (Land Use 436) are related uses.

Additional Data

The sites were surveyed in the 1990s and the 2000s in Oregon.

Specialized Land Use Data

A survey conducted in Pennsylvania in 1998 was submitted for an indoor race track facility containing a go-cart racing track, arcade, laser tag, restaurant, and party function rooms. The trip generation rates for this facility differ considerably from those contained in this land use. The site gross floor area was 118,000 square feet. The counted vehicle trips were as follows:

- 235 on a weekday
- 28 during the weekday, AM peak hour of the generator
- 29 during the weekday, PM peak hour of the generator
- 20 during the weekday, PM peak hour of adjacent street traffic
- 277 on a Saturday
- 34 during the Saturday peak hour of the generator

Source Numbers

583, 611, 618

Bowling Alley (437)

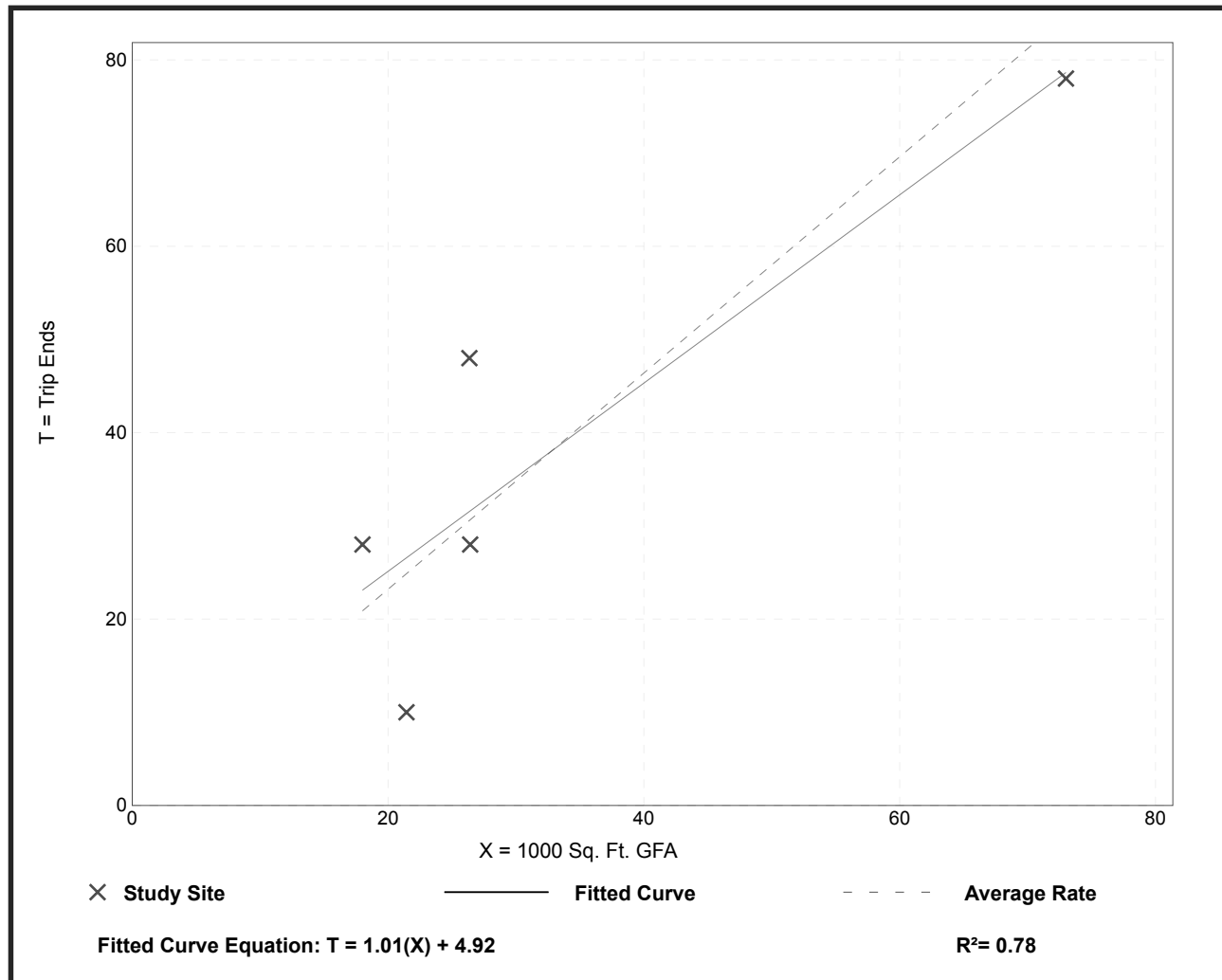
Vehicle Trip Ends vs: 1000 Sq. Ft. GFA
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.
Setting/Location: General Urban/Suburban
 Number of Studies: 5
 Avg. 1000 Sq. Ft. GFA: 33
 Directional Distribution: 65% entering, 35% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

| Average Rate | Range of Rates | Standard Deviation |
|--------------|----------------|--------------------|
| 1.16 | 0.47 - 1.82 | 0.44 |

Data Plot and Equation

Caution – Small Sample Size



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Land Use: 437

Bowling Alley

Description

A bowling alley is a recreational facility that includes bowling lanes. A small lounge, restaurant and/or snack bar, video games, and pool tables may also be available.

Additional Data

The sites were surveyed in the 1990s, the 2000s, and the 2010s in Connecticut, Florida, and Texas.

Source Numbers

400, 721, 945

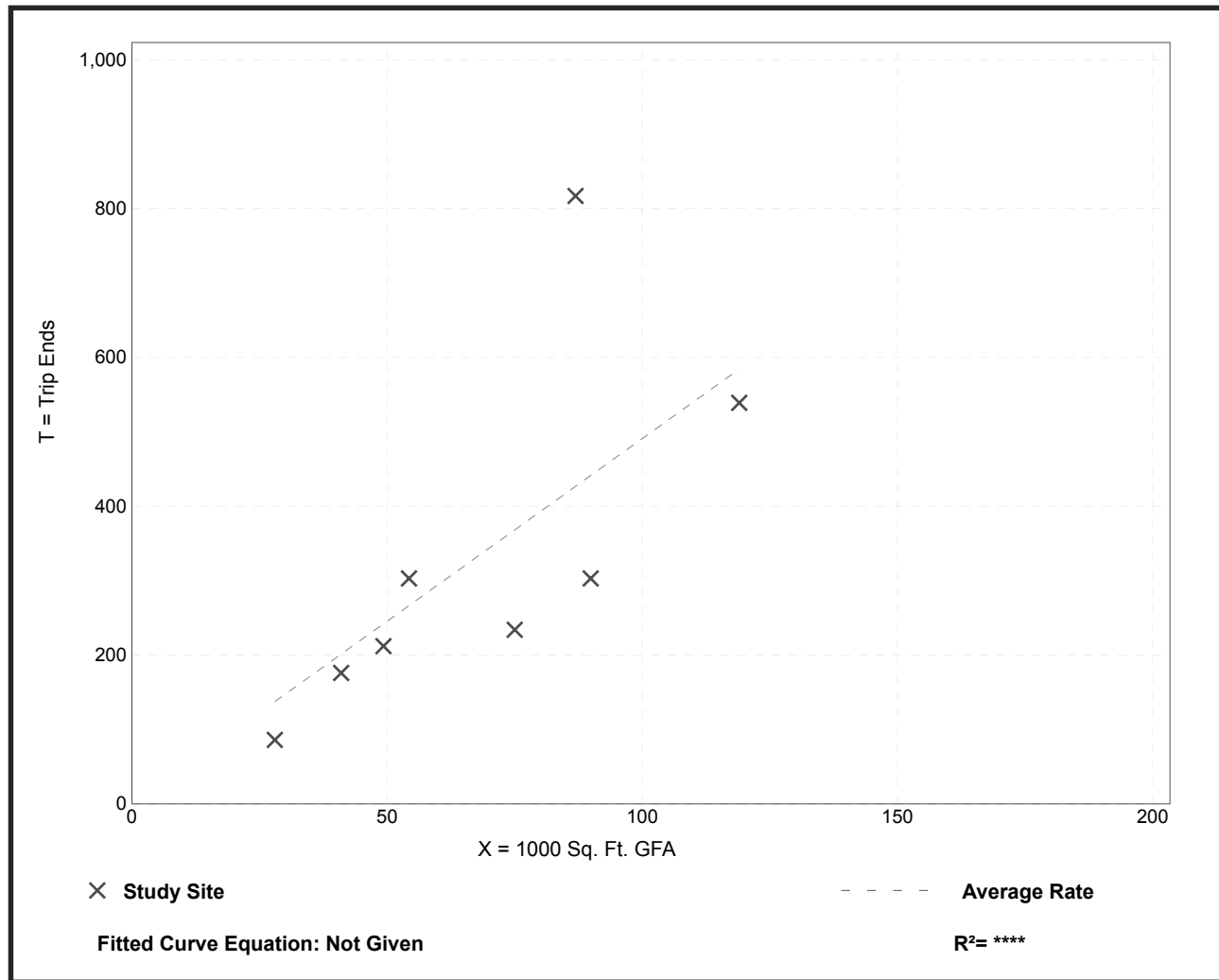
Multiplex Movie Theater (445)

Vehicle Trip Ends vs: 1000 Sq. Ft. GFA
On a: Friday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.
Setting/Location: General Urban/Suburban
Number of Studies: 8
Avg. 1000 Sq. Ft. GFA: 68
Directional Distribution: 62% entering, 38% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

| Average Rate | Range of Rates | Standard Deviation |
|--------------|----------------|--------------------|
| 4.91 | 3.07 - 9.40 | 2.24 |

Data Plot and Equation



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Land Use: 445

Multiplex Movie Theater

Description

A multiplex movie theater consists of audience seating, a minimum of 10 screens, a lobby, and a refreshment area. The development generally has one or more of the following amenities: digital sound, tiered stadium seating, and moveable or expandable walls. Theaters included in this category are primarily stand-alone facilities with separate parking and dedicated driveways. All theaters in the category show only first-run movies or movies not previously seen through any other media. They may also have matinee showings. Movie theater (Land Use 444) is a related use.

Additional Data

Caution should be used when applying these data, as the peaking characteristics for this land use could have a significant impact on trip generation rates. Peaking at movie theaters typically occurred in time periods shorter than an hour. Movie theaters' start and end times may be staggered to reduce peak surging impacts.

Multiplex theaters typically house a smaller number of seats per screen than traditional theaters. For the 19 sites in Land Use 445 with data for both number of movie screens and number of seats, the average number of seats per movie screen was 230. For the eight sites in Land Use 444 with data for both number of movie screens and number of seats, the average number of seats per movie screen was 343.

The peak hour of the generator for multiplex movie theaters occurred during Friday and Saturday evenings between 6:00 p.m. and 10:00 p.m.

For additional information on multiplex movie theaters, refer to the ITE Informational Report, *Trip Generation Characteristics of Traditional and Multiplex Movie Theaters*.²

The sites were surveyed in the 1990s, the 2000s, and the 2010s in California, Connecticut, Georgia, Hawaii, New York, North Carolina, Ohio, Oregon, Pennsylvania, South Carolina, Texas, Virginia, and Wisconsin.

Source Numbers

418, 433, 443, 450, 451, 452, 453, 455, 456, 457, 458, 459, 513, 618, 959

² *Trip Generation Characteristics of Traditional and Multiplex Movie Theaters*. Washington, DC, USA: Institute of Transportation Engineers, March 2001.

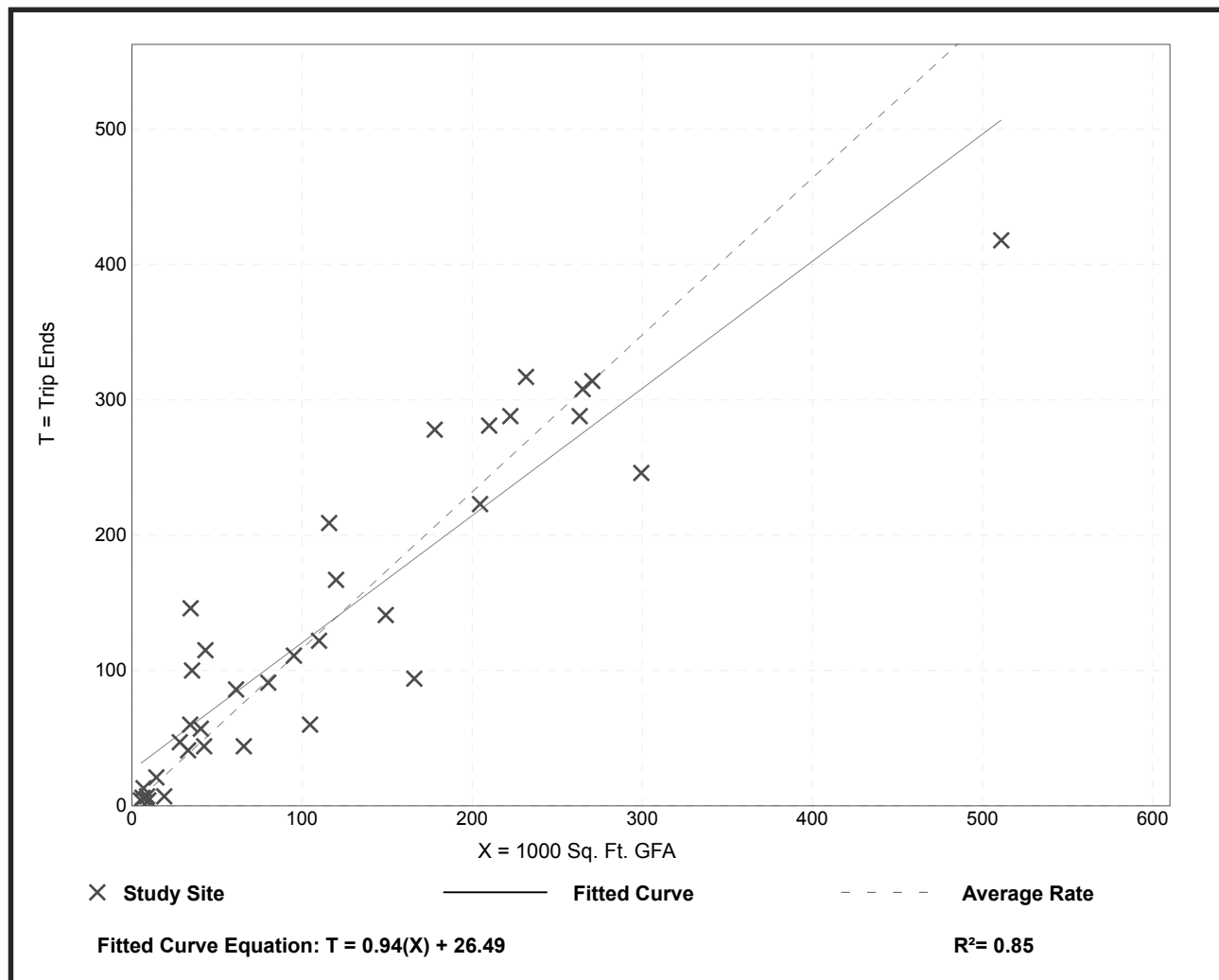
General Office Building (710)

Vehicle Trip Ends vs: 1000 Sq. Ft. GFA
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.
Setting/Location: General Urban/Suburban
 Number of Studies: 35
 Avg. 1000 Sq. Ft. GFA: 117
 Directional Distribution: 86% entering, 14% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

| Average Rate | Range of Rates | Standard Deviation |
|--------------|----------------|--------------------|
| 1.16 | 0.37 - 4.23 | 0.47 |

Data Plot and Equation



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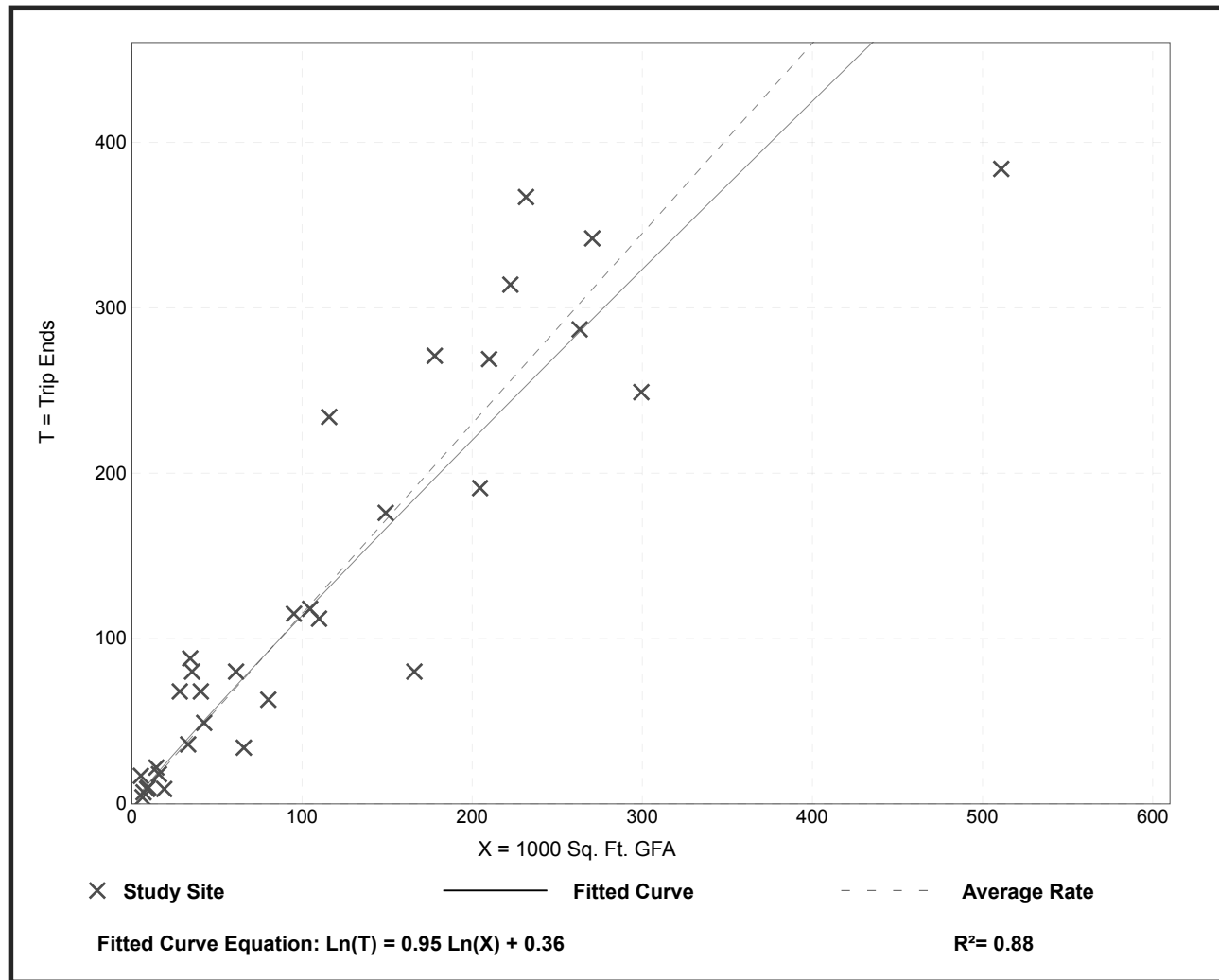
General Office Building (710)

Vehicle Trip Ends vs: 1000 Sq. Ft. GFA
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.
Setting/Location: General Urban/Suburban
 Number of Studies: 32
 Avg. 1000 Sq. Ft. GFA: 114
 Directional Distribution: 16% entering, 84% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

| Average Rate | Range of Rates | Standard Deviation |
|--------------|----------------|--------------------|
| 1.15 | 0.47 - 3.23 | 0.42 |

Data Plot and Equation



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Land Use: 710

General Office Building

Description

A general office building houses multiple tenants; it is a location where affairs of businesses, commercial or industrial organizations, or professional persons or firms are conducted. An office building or buildings may contain a mixture of tenants including professional services, insurance companies, investment brokers, and tenant services, such as a bank or savings and loan institution, a restaurant, or cafeteria and service retail facilities. A general office building with a gross floor area of 5,000 square feet or less is classified as a small office building (Land Use 712). Corporate headquarters building (Land Use 714), single tenant office building (Land Use 715), office park (Land Use 750), research and development center (Land Use 760), and business park (Land Use 770) are additional related uses.

If information is known about individual buildings, it is suggested that the general office building category be used rather than office parks when estimating trip generation for one or more office buildings in a single development. The office park category is more general and should be used when a breakdown of individual or different uses is not known. If the general office building category is used and if additional buildings, such as banks, restaurants, or retail stores are included in the development, the development should be treated as a multiuse project. On the other hand, if the office park category is used, internal trips are already reflected in the data and do not need to be considered.

When the buildings are interrelated (defined by shared parking facilities or the ability to easily walk between buildings) or house one tenant, it is suggested that the total area or employment of all the buildings be used for calculating the trip generation. When the individual buildings are isolated and not related to one another, it is suggested that trip generation be calculated for each building separately and then summed.

Additional Data

The average building occupancy varied considerably within the studies for which occupancy data were provided. The reported occupied gross floor area was 88 for general urban/suburban sites and 96 percent for the center city core and dense multi-use urban sites.

Time-of-day distribution data for this land use for a weekday, Saturday, and Sunday are presented in Appendix A. For the 16 general urban/suburban sites with data, the overall highest vehicle volumes during the AM and PM on a weekday were counted between 7:30 and 8:30 a.m. and 4:30 and 5:30 p.m., respectively.

For the three general urban/suburban sites with person trip data, the overall highest volumes during the AM and PM on a weekday were counted between 8:45 and 9:45 a.m. and 12:45 and 1:45 p.m., respectively. For the three dense multi-use urban sites with person trip data, the overall highest volumes during the AM and PM on a weekday were counted between 8:30 and 9:30 a.m. and 4:45 and 5:45 p.m., respectively. For the four center city core sites with person trip data, the overall highest volumes during the AM and PM on a weekday were counted between 9:00 and 10:00 a.m. and 12:45 and 1:45 p.m., respectively.

The average numbers of person trips per vehicle trip at the eight center city core sites at which both person trip and vehicle trip data were collected were as follows:

- 2.76 during Weekday, Peak Hour of Adjacent Street Traffic, one hour between 7 and 9 a.m.
- 2.90 during Weekday, AM Peak Hour of Generator
- 2.91 during Weekday, Peak Hour of Adjacent Street Traffic, one hour between 4 and 6 p.m.
- 3.02 during Weekday, PM Peak Hour of Generator

The average numbers of person trips per vehicle trip at the 18 dense multi-use urban sites at which both person trip and vehicle trip data were collected were as follows:

- 1.47 during Weekday, Peak Hour of Adjacent Street Traffic, one hour between 7 and 9 a.m.
- 1.47 during Weekday, AM Peak Hour of Generator
- 1.46 during Weekday, Peak Hour of Adjacent Street Traffic, one hour between 4 and 6 p.m.
- 1.53 during Weekday, PM Peak Hour of Generator

The average numbers of person trips per vehicle trip at the 23 general urban/suburban sites at which both person trip and vehicle trip data were collected were as follows:

- 1.30 during Weekday, Peak Hour of Adjacent Street Traffic, one hour between 7 and 9 a.m.
- 1.34 during Weekday, AM Peak Hour of Generator
- 1.32 during Weekday, Peak Hour of Adjacent Street Traffic, one hour between 4 and 6 p.m.
- 1.41 during Weekday, PM Peak Hour of Generator

The sites were surveyed in the 1980s, the 1990s, the 2000s, and the 2010s in Alberta (CAN), California, Colorado, Connecticut, Georgia, Illinois, Indiana, Kansas, Kentucky, Maine, Maryland, Michigan, Minnesota, Missouri, Montana, New Hampshire, New Jersey, New York, Pennsylvania, Texas, Utah, Virginia, and Washington.

Source Numbers

161, 175, 183, 184, 185, 207, 212, 217, 247, 253, 257, 260, 262, 273, 279, 297, 298, 300, 301, 302, 303, 304, 321, 322, 323, 324, 327, 404, 407, 408, 418, 419, 423, 562, 734, 850, 859, 862, 867, 869, 883, 884, 890, 891, 904, 940, 944, 946, 964, 965, 972

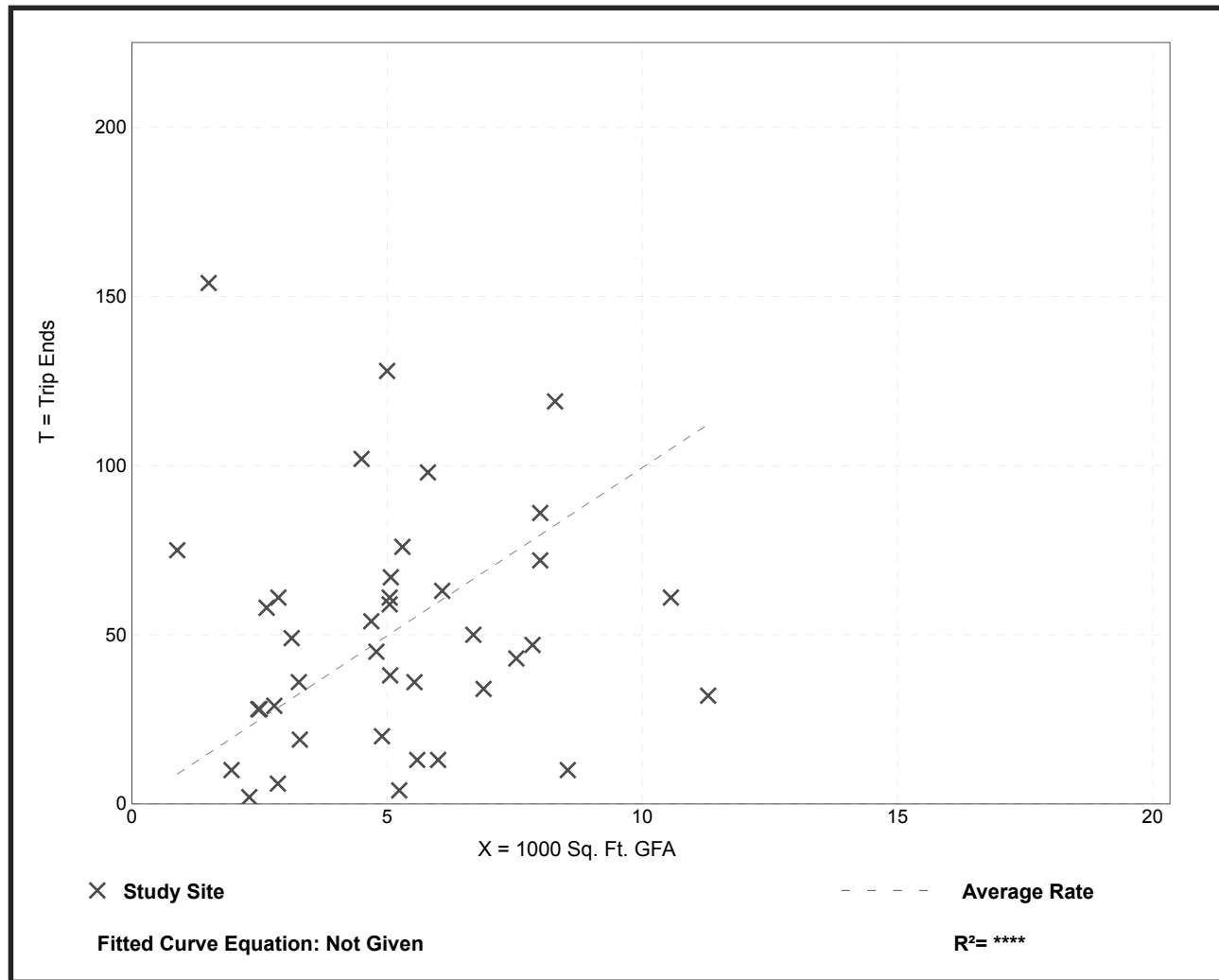
High-Turnover (Sit-Down) Restaurant (932)

Vehicle Trip Ends vs: 1000 Sq. Ft. GFA
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.
Setting/Location: General Urban/Suburban
 Number of Studies: 39
 Avg. 1000 Sq. Ft. GFA: 5
 Directional Distribution: 55% entering, 45% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

| Average Rate | Range of Rates | Standard Deviation |
|--------------|----------------|--------------------|
| 9.94 | 0.76 - 102.39 | 11.33 |

Data Plot and Equation



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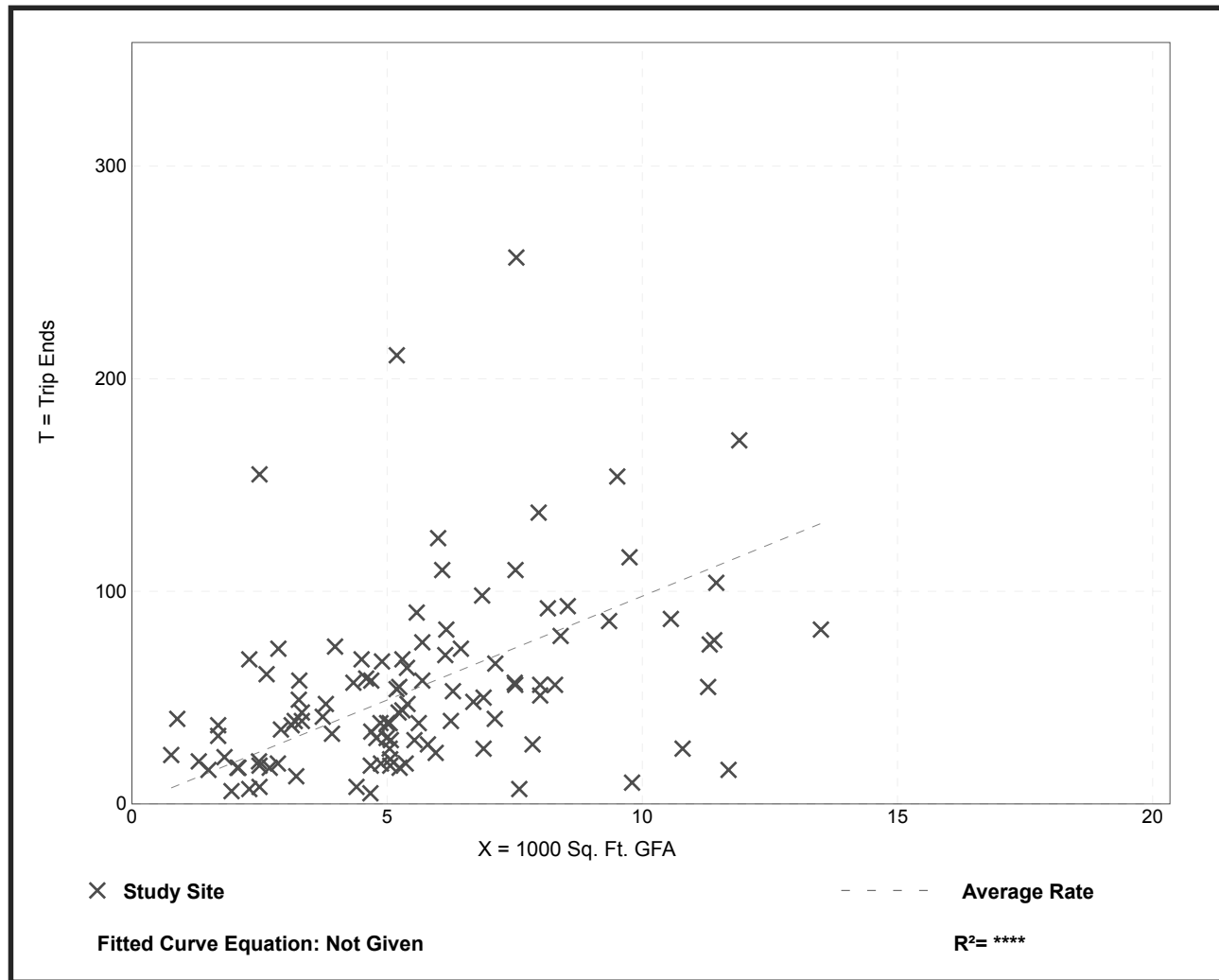
High-Turnover (Sit-Down) Restaurant (932)

Vehicle Trip Ends vs: 1000 Sq. Ft. GFA
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.
Setting/Location: General Urban/Suburban
Number of Studies: 107
Avg. 1000 Sq. Ft. GFA: 6
Directional Distribution: 62% entering, 38% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

| Average Rate | Range of Rates | Standard Deviation |
|--------------|----------------|--------------------|
| 9.77 | 0.92 - 62.00 | 7.37 |

Data Plot and Equation



Land Use: 932

High-Turnover (Sit-Down) Restaurant

Description

This land use consists of sit-down, full-service eating establishments with typical duration of stay of approximately one hour. This type of restaurant is usually moderately priced and frequently belongs to a restaurant chain. Generally, these restaurants serve lunch and dinner; they may also be open for breakfast and are sometimes open 24 hours a day. These restaurants typically do not take reservations. Patrons commonly wait to be seated, are served by a waiter/waitress, order from menus and pay for their meal after they eat. Some facilities contained within this land use may also contain a bar area for serving food and alcoholic drinks. Fast casual restaurant (Land Use 930), quality restaurant (Land Use 931), fast-food restaurant without drive-through window (Land Use 933), fast-food restaurant with drive-through window (Land Use 934), and fast-food restaurant with drive-through window and no indoor seating (Land Use 935) are related uses.

Additional Data

Users should exercise caution when applying statistics during the AM peak periods, as the sites contained in the database for this land use may or may not be open for breakfast. In cases where it was confirmed that the sites were not open for breakfast, data for the AM peak hour of the adjacent street traffic were removed from the database.

The outdoor seating area is not included in the overall gross floor area. Therefore, the number of seats may be a more reliable independent variable on which to establish trip generation rates for facilities having significant outdoor seating.

Time-of-day distribution data for this land use for a weekday, Saturday, and Sunday are presented in Appendix A. For the 38 general urban/suburban sites with data, the overall highest vehicle volumes during the AM and PM on a weekday were counted between 11:45 a.m. and 12:45 p.m. and 12:00 and 1:00 p.m., respectively.

The sites were surveyed in the 1980s, the 1990s, the 2000s, and the 2010s in Alberta (CAN), California, Florida, Georgia, Indiana, Kentucky, Massachusetts, Minnesota, New Hampshire, New Jersey, New York, Ohio, Oklahoma, Oregon, Pennsylvania, South Dakota, Texas, Vermont, and Wisconsin.

Source Numbers

126, 269, 275, 280, 300, 301, 305, 338, 340, 341, 358, 384, 424, 432, 437, 438, 444, 507, 555, 577, 589, 617, 618, 728, 868, 884, 885, 903, 927, 944, 961, 962, 977

Turn Lane Warrant

APPENDIX D

Future Year 2038 Conditions

Capacity Analysis

Queues

1470: Roeland Drive & Shawnee Mission Parkway

01/09/2019



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | SBL | SBT | SBR |
|-------------------------|-------|------|------|------|-------|------|------|------|------|------|------|
| Lane Group Flow (vph) | 197 | 1875 | 28 | 37 | 3274 | 347 | 29 | 91 | 133 | 136 | 155 |
| v/c Ratio | 1.23 | 0.81 | 0.02 | 0.30 | 1.19 | 0.34 | 0.24 | 0.50 | 0.83 | 0.83 | 0.53 |
| Control Delay | 150.8 | 24.8 | 0.0 | 59.9 | 113.8 | 6.1 | 58.3 | 24.9 | 90.0 | 90.9 | 15.0 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 150.8 | 24.8 | 0.0 | 59.9 | 113.8 | 6.1 | 58.3 | 24.9 | 90.0 | 90.9 | 15.0 |
| Queue Length 50th (ft) | ~185 | 811 | 0 | 28 | ~1212 | 50 | 22 | 9 | 107 | 110 | 0 |
| Queue Length 95th (ft) | m92 | m538 | m0 | 44 | #1299 | 89 | 37 | 62 | #212 | 125 | 50 |
| Internal Link Dist (ft) | | 682 | | | 2401 | | | 499 | | 330 | |
| Turn Bay Length (ft) | 345 | | 310 | 170 | | 230 | 100 | | 100 | | 125 |
| Base Capacity (vph) | 160 | 2303 | 1583 | 125 | 2757 | 1011 | 125 | 188 | 165 | 167 | 295 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 1.23 | 0.81 | 0.02 | 0.30 | 1.19 | 0.34 | 0.23 | 0.48 | 0.81 | 0.81 | 0.53 |

Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
- m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis
 1470: Roeland Drive & Shawnee Mission Parkway

01/09/2019



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|------------------------|-------|------|-------|------|-------|------|-------|------|------|-------|-------|------|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 171 | 1781 | 21 | 23 | 3110 | 295 | 18 | 11 | 67 | 199 | 25 | 129 |
| Future Volume (vph) | 171 | 1781 | 21 | 23 | 3110 | 295 | 18 | 11 | 67 | 199 | 25 | 129 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.5 | 5.5 | 4.0 | 4.5 | 5.5 | 5.5 | 4.5 | 4.5 | | 4.5 | 4.5 | 4.5 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | *0.84 | 1.00 | 1.00 | 1.00 | | 0.95 | 0.95 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.87 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 0.97 | 1.00 |
| Satd. Flow (prot) | 1770 | 3539 | 1583 | 1770 | 4694 | 1583 | 1770 | 1620 | | 1681 | 1709 | 1583 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 0.97 | 1.00 |
| Satd. Flow (perm) | 1770 | 3539 | 1583 | 1770 | 4694 | 1583 | 1770 | 1620 | | 1681 | 1709 | 1583 |
| Peak-hour factor, PHF | 0.87 | 0.95 | 0.75 | 0.63 | 0.95 | 0.85 | 0.63 | 0.95 | 0.85 | 0.87 | 0.63 | 0.83 |
| Adj. Flow (vph) | 197 | 1875 | 28 | 37 | 3274 | 347 | 29 | 12 | 79 | 229 | 40 | 155 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 82 | 0 | 74 | 0 | 0 | 0 | 140 |
| Lane Group Flow (vph) | 197 | 1875 | 28 | 37 | 3274 | 265 | 29 | 17 | 0 | 133 | 136 | 15 |
| Turn Type | Prot | NA | Free | Prot | NA | Perm | Split | NA | | Split | NA | Perm |
| Protected Phases | 1 | 6 | | 5 | 2 | | 4 | 4 | | 8 | 8 | |
| Permitted Phases | | | Free | | | 2 | | | | | | 8 |
| Actuated Green, G (s) | 10.9 | 76.3 | 120.0 | 5.1 | 70.5 | 70.5 | 8.1 | 8.1 | | 11.5 | 11.5 | 11.5 |
| Effective Green, g (s) | 10.9 | 76.3 | 120.0 | 5.1 | 70.5 | 70.5 | 8.1 | 8.1 | | 11.5 | 11.5 | 11.5 |
| Actuated g/C Ratio | 0.09 | 0.64 | 1.00 | 0.04 | 0.59 | 0.59 | 0.07 | 0.07 | | 0.10 | 0.10 | 0.10 |
| Clearance Time (s) | 4.5 | 5.5 | | 4.5 | 5.5 | 5.5 | 4.5 | 4.5 | | 4.5 | 4.5 | 4.5 |
| Vehicle Extension (s) | 1.5 | 2.0 | | 1.5 | 2.0 | 2.0 | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 160 | 2250 | 1583 | 75 | 2757 | 930 | 119 | 109 | | 161 | 163 | 151 |
| v/s Ratio Prot | c0.11 | 0.53 | | 0.02 | c0.70 | | c0.02 | 0.01 | | 0.08 | c0.08 | |
| v/s Ratio Perm | | | 0.02 | | | 0.17 | | | | | | 0.01 |
| v/c Ratio | 1.23 | 0.83 | 0.02 | 0.49 | 1.19 | 0.29 | 0.24 | 0.16 | | 0.83 | 0.83 | 0.10 |
| Uniform Delay, d1 | 54.5 | 16.9 | 0.0 | 56.2 | 24.8 | 12.3 | 53.0 | 52.7 | | 53.3 | 53.3 | 49.5 |
| Progression Factor | 0.88 | 1.41 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 109.2 | 0.4 | 0.0 | 1.9 | 88.3 | 0.8 | 0.4 | 0.2 | | 26.8 | 28.0 | 0.1 |
| Delay (s) | 157.4 | 24.3 | 0.0 | 58.0 | 113.1 | 13.0 | 53.4 | 53.0 | | 80.0 | 81.4 | 49.6 |
| Level of Service | F | C | A | E | F | B | D | D | | F | F | D |
| Approach Delay (s) | | 36.4 | | | 103.0 | | | 53.1 | | | 69.3 | |
| Approach LOS | | D | | | F | | | D | | | E | |

Intersection Summary

| | | | |
|-----------------------------------|-------|---------------------------|------|
| HCM 2000 Control Delay | 77.6 | HCM 2000 Level of Service | E |
| HCM 2000 Volume to Capacity ratio | 1.07 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 19.0 |
| Intersection Capacity Utilization | 94.5% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

HCM 6th TWSC
2: Roeland Drive & Drive 1

12/27/2018

| Intersection | | | | | | | | | | | | |
|--------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Int Delay, s/veh | 0.8 | | | | | | | | | | | |
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations | | ↕ | | ↕ | | | | ↕ | | | ↕ | |
| Traffic Vol, veh/h | 0 | 0 | 0 | 29 | 0 | 0 | 0 | 435 | 42 | 0 | 324 | 0 |
| Future Vol, veh/h | 0 | 0 | 0 | 29 | 0 | 0 | 0 | 435 | 42 | 0 | 324 | 0 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Free | Free | Free | Free | Free | Free |
| RT Channelized | - | - | None | - | - | None | - | - | None | - | - | None |
| Storage Length | - | - | - | 0 | - | - | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Peak Hour Factor | 92 | 92 | 92 | 78 | 92 | 92 | 87 | 87 | 78 | 87 | 87 | 87 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 0 | 0 | 0 | 37 | 0 | 0 | 0 | 500 | 54 | 0 | 372 | 0 |

| Major/Minor | Minor2 | | Minor1 | | Major1 | | | Major2 | | | | |
|----------------------|--------|-------|--------|-------|--------|---|-------|--------|---|-------|---|---|
| Conflicting Flow All | 899 | 926 | 372 | 899 | - | - | 372 | 0 | 0 | 554 | 0 | 0 |
| Stage 1 | 372 | 372 | - | 527 | - | - | - | - | - | - | - | - |
| Stage 2 | 527 | 554 | - | 372 | - | - | - | - | - | - | - | - |
| Critical Hdwy | 7.12 | 6.52 | 6.22 | 7.12 | - | - | 4.12 | - | - | 4.12 | - | - |
| Critical Hdwy Stg 1 | 6.12 | 5.52 | - | 6.12 | - | - | - | - | - | - | - | - |
| Critical Hdwy Stg 2 | 6.12 | 5.52 | - | 6.12 | - | - | - | - | - | - | - | - |
| Follow-up Hdwy | 3.518 | 4.018 | 3.318 | 3.518 | - | - | 2.218 | - | - | 2.218 | - | - |
| Pot Cap-1 Maneuver | 260 | 269 | 674 | 260 | 0 | 0 | 1186 | - | - | 1016 | - | - |
| Stage 1 | 648 | 619 | - | 535 | 0 | 0 | - | - | - | - | - | - |
| Stage 2 | 535 | 514 | - | 648 | 0 | 0 | - | - | - | - | - | - |
| Platoon blocked, % | | | | | - | - | - | - | - | - | - | - |
| Mov Cap-1 Maneuver | 260 | 269 | 674 | 260 | - | - | 1186 | - | - | 1016 | - | - |
| Mov Cap-2 Maneuver | 260 | 269 | - | 260 | - | - | - | - | - | - | - | - |
| Stage 1 | 648 | 619 | - | 535 | - | - | - | - | - | - | - | - |
| Stage 2 | 535 | 514 | - | 648 | - | - | - | - | - | - | - | - |

| Approach | EB | | WB | | NB | | | SB | | |
|----------------------|----|--|------|--|----|--|--|----|--|--|
| HCM Control Delay, s | 0 | | 21.1 | | 0 | | | 0 | | |
| HCM LOS | A | | C | | | | | | | |

| Minor Lane/Major Mvmt | NBL | NBT | NBR | EBLn1WBLn1 | SBL | SBT | SBR |
|-----------------------|------|-----|-----|------------|-------|------|-----|
| Capacity (veh/h) | 1186 | - | - | - | 260 | 1016 | - |
| HCM Lane V/C Ratio | - | - | - | - | 0.143 | - | - |
| HCM Control Delay (s) | 0 | - | - | 0 | 21.1 | 0 | - |
| HCM Lane LOS | A | - | - | A | C | A | - |
| HCM 95th %tile Q(veh) | 0 | - | - | - | 0.5 | 0 | - |

Queues

3: Roe Avenue & Johnson Drive/Johnson Drive WB

12/27/2018



































| Lane Group | EBL | EBT | WBL | WBT | NBL | NBT | NBR | SBL | SBT | SBR |
|-------------------------|------|------|------|------|------|------|------|------|------|------|
| Lane Group Flow (vph) | 236 | 455 | 52 | 448 | 178 | 1381 | 72 | 97 | 714 | 220 |
| v/c Ratio | 0.75 | 0.66 | 0.49 | 0.90 | 0.47 | 0.81 | 0.09 | 0.46 | 0.43 | 0.26 |
| Control Delay | 60.4 | 42.3 | 61.3 | 64.1 | 14.8 | 28.0 | 0.2 | 17.7 | 18.9 | 2.9 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 60.4 | 42.3 | 61.3 | 64.1 | 14.8 | 28.0 | 0.2 | 17.7 | 18.9 | 2.9 |
| Queue Length 50th (ft) | 77 | 142 | 33 | 147 | 48 | 398 | 0 | 25 | 153 | 0 |
| Queue Length 95th (ft) | #126 | 190 | 69 | #231 | 54 | 468 | 0 | 50 | 201 | 34 |
| Internal Link Dist (ft) | | 556 | | 629 | | 125 | | | 492 | |
| Turn Bay Length (ft) | 245 | | 130 | | 150 | | 25 | 150 | | 250 |
| Base Capacity (vph) | 314 | 689 | 108 | 499 | 376 | 1699 | 845 | 229 | 1663 | 860 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.75 | 0.66 | 0.48 | 0.90 | 0.47 | 0.81 | 0.09 | 0.42 | 0.43 | 0.26 |

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis
 3: Roe Avenue & Johnson Drive/Johnson Drive WB

12/27/2018

| |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |   |   | |   |   | |   |   |   |   |   |   |
| Traffic Volume (vph) | 205 | 343 | 39 | 45 | 370 | 9 | 114 | 1188 | 53 | 83 | 671 | 191 |
| Future Volume (vph) | 205 | 343 | 39 | 45 | 370 | 9 | 114 | 1188 | 53 | 83 | 671 | 191 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 6.0 | 6.0 | | 6.0 | 6.0 | | 6.0 | 6.0 | 6.0 | 5.4 | 6.0 | 6.0 |
| Lane Util. Factor | 0.97 | 0.95 | | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |
| Frt | 1.00 | 0.98 | | 1.00 | 0.99 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3433 | 3468 | | 1770 | 3506 | | 1770 | 3539 | 1583 | 1770 | 3539 | 1583 |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.31 | 1.00 | 1.00 | 0.09 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3433 | 3468 | | 1770 | 3506 | | 570 | 3539 | 1583 | 164 | 3539 | 1583 |
| Peak-hour factor, PHF | 0.87 | 0.87 | 0.64 | 0.86 | 0.88 | 0.32 | 0.64 | 0.86 | 0.74 | 0.86 | 0.94 | 0.87 |
| Adj. Flow (vph) | 236 | 394 | 61 | 52 | 420 | 28 | 178 | 1381 | 72 | 97 | 714 | 220 |
| RTOR Reduction (vph) | 0 | 12 | 0 | 0 | 5 | 0 | 0 | 0 | 39 | 0 | 0 | 120 |
| Lane Group Flow (vph) | 236 | 443 | 0 | 52 | 443 | 0 | 178 | 1381 | 33 | 97 | 714 | 100 |
| Turn Type | Prot | NA | | Prot | NA | | pm+pt | NA | Perm | pm+pt | NA | Perm |
| Protected Phases | 1 | 6 | | 5 | 2 | | 7 | 4 | | 3 | 8 | |
| Permitted Phases | | | | | | | 4 | | 4 | 8 | | 8 |
| Actuated Green, G (s) | 9.2 | 19.5 | | 4.9 | 15.2 | | 52.1 | 45.8 | 45.8 | 51.7 | 45.3 | 45.3 |
| Effective Green, g (s) | 9.2 | 19.5 | | 4.9 | 15.2 | | 52.1 | 45.8 | 45.8 | 51.7 | 45.3 | 45.3 |
| Actuated g/C Ratio | 0.09 | 0.20 | | 0.05 | 0.15 | | 0.52 | 0.46 | 0.46 | 0.52 | 0.45 | 0.45 |
| Clearance Time (s) | 6.0 | 6.0 | | 6.0 | 6.0 | | 6.0 | 6.0 | 6.0 | 5.4 | 6.0 | 6.0 |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | 315 | 676 | | 86 | 532 | | 372 | 1620 | 725 | 187 | 1603 | 717 |
| v/s Ratio Prot | c0.07 | c0.13 | | 0.03 | c0.13 | | 0.03 | c0.39 | | c0.03 | 0.20 | |
| v/s Ratio Perm | | | | | | | 0.22 | | 0.02 | 0.23 | | 0.06 |
| v/c Ratio | 0.75 | 0.66 | | 0.60 | 0.83 | | 0.48 | 0.85 | 0.05 | 0.52 | 0.45 | 0.14 |
| Uniform Delay, d1 | 44.3 | 37.1 | | 46.6 | 41.2 | | 13.3 | 24.1 | 15.0 | 18.0 | 18.7 | 16.0 |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 9.4 | 2.3 | | 11.4 | 10.7 | | 1.0 | 5.9 | 0.1 | 2.4 | 0.9 | 0.4 |
| Delay (s) | 53.7 | 39.4 | | 58.0 | 51.9 | | 14.3 | 30.0 | 15.1 | 20.4 | 19.6 | 16.4 |
| Level of Service | D | D | | E | D | | B | C | B | C | B | B |
| Approach Delay (s) | | 44.3 | | | 52.5 | | | 27.6 | | | 19.0 | |
| Approach LOS | | D | | | D | | | C | | | B | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 31.5 | | | | HCM 2000 Level of Service | | | C | | |
| HCM 2000 Volume to Capacity ratio | | | 0.82 | | | | | | | | | |
| Actuated Cycle Length (s) | | | 100.0 | | | | Sum of lost time (s) | | | 24.0 | | |
| Intersection Capacity Utilization | | | 73.7% | | | | ICU Level of Service | | | D | | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

c Critical Lane Group

HCM 6th Signalized Intersection Summary
 3: Roe Avenue & Johnson Drive/Johnson Drive WB

12/27/2018



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|------------------------------|------|------|-------|------|------|------|------|------|------|------|------|------|
| Lane Configurations | ↔↔ | ↕↔ | | ↔ | ↕↔ | | ↔ | ↕↕ | ↔ | ↔ | ↕↕ | ↔ |
| Traffic Volume (veh/h) | 205 | 343 | 39 | 45 | 370 | 9 | 114 | 1188 | 53 | 83 | 671 | 191 |
| Future Volume (veh/h) | 205 | 343 | 39 | 45 | 370 | 9 | 114 | 1188 | 53 | 83 | 671 | 191 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 |
| Adj Flow Rate, veh/h | 236 | 394 | 61 | 52 | 420 | 28 | 178 | 1381 | 0 | 97 | 714 | 0 |
| Peak Hour Factor | 0.87 | 0.87 | 0.64 | 0.86 | 0.88 | 0.32 | 0.64 | 0.86 | 0.74 | 0.86 | 0.94 | 0.87 |
| Percent Heavy Veh, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Cap, veh/h | 301 | 583 | 90 | 68 | 473 | 31 | 430 | 1716 | | 232 | 1681 | |
| Arrive On Green | 0.09 | 0.19 | 0.19 | 0.04 | 0.14 | 0.14 | 0.06 | 0.48 | 0.00 | 0.06 | 0.47 | 0.00 |
| Sat Flow, veh/h | 3456 | 3087 | 474 | 1781 | 3382 | 225 | 1781 | 3554 | 1585 | 1781 | 3554 | 1585 |
| Grp Volume(v), veh/h | 236 | 226 | 229 | 52 | 220 | 228 | 178 | 1381 | 0 | 97 | 714 | 0 |
| Grp Sat Flow(s),veh/h/ln | 1728 | 1777 | 1785 | 1781 | 1777 | 1830 | 1781 | 1777 | 1585 | 1781 | 1777 | 1585 |
| Q Serve(g_s), s | 6.7 | 11.8 | 12.0 | 2.9 | 12.2 | 12.2 | 5.2 | 32.9 | 0.0 | 2.7 | 13.3 | 0.0 |
| Cycle Q Clear(g_c), s | 6.7 | 11.8 | 12.0 | 2.9 | 12.2 | 12.2 | 5.2 | 32.9 | 0.0 | 2.7 | 13.3 | 0.0 |
| Prop In Lane | 1.00 | | 0.27 | 1.00 | | 0.12 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Lane Grp Cap(c), veh/h | 301 | 336 | 337 | 68 | 249 | 256 | 430 | 1716 | | 232 | 1681 | |
| V/C Ratio(X) | 0.78 | 0.67 | 0.68 | 0.76 | 0.88 | 0.89 | 0.41 | 0.80 | | 0.42 | 0.42 | |
| Avail Cap(c_a), veh/h | 311 | 336 | 337 | 107 | 249 | 256 | 430 | 1716 | | 286 | 1681 | |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 |
| Uniform Delay (d), s/veh | 44.7 | 37.7 | 37.8 | 47.6 | 42.2 | 42.2 | 13.3 | 21.9 | 0.0 | 18.5 | 17.4 | 0.0 |
| Incr Delay (d2), s/veh | 12.0 | 5.2 | 5.5 | 16.1 | 29.1 | 29.5 | 0.6 | 4.1 | 0.0 | 1.2 | 0.8 | 0.0 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 3.3 | 5.6 | 5.7 | 1.6 | 7.3 | 7.6 | 2.0 | 13.7 | 0.0 | 1.1 | 5.3 | 0.0 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 56.8 | 42.8 | 43.2 | 63.7 | 71.3 | 71.7 | 13.9 | 26.0 | 0.0 | 19.7 | 18.2 | 0.0 |
| LnGrp LOS | E | D | D | E | E | E | B | C | | B | B | |
| Approach Vol, veh/h | | 691 | | | 500 | | | 1559 | A | | 811 | A |
| Approach Delay, s/veh | | 47.7 | | | 70.7 | | | 24.6 | | | 18.4 | |
| Approach LOS | | D | | | E | | | C | | | B | |
| Timer - Assigned Phs | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | | | |
| Phs Duration (G+Y+Rc), s | 14.7 | 20.0 | 11.0 | 54.3 | 9.8 | 24.9 | 12.0 | 53.3 | | | | |
| Change Period (Y+Rc), s | 6.0 | 6.0 | * 5.4 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | | | | |
| Max Green Setting (Gmax), s | 9.0 | 14.0 | * 8.6 | 45.0 | 6.0 | 17.0 | 6.0 | 47.0 | | | | |
| Max Q Clear Time (g_c+I1), s | 8.7 | 14.2 | 4.7 | 34.9 | 4.9 | 14.0 | 7.2 | 15.3 | | | | |
| Green Ext Time (p_c), s | 0.0 | 0.0 | 0.1 | 6.5 | 0.0 | 0.8 | 0.0 | 5.3 | | | | |

Intersection Summary

| | |
|--------------------|------|
| HCM 6th Ctrl Delay | 34.1 |
| HCM 6th LOS | C |

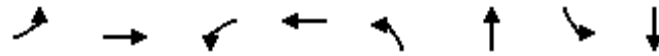
Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.
 Unsignalized Delay for [NBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Queues

6: Roeland Drive & Martway Street/Drive 3

12/27/2018



| Lane Group | EBL | EBT | WBL | WBT | NBL | NBT | SBL | SBT |
|-------------------------|------|------|------|------|------|------|------|------|
| Lane Group Flow (vph) | 20 | 20 | 69 | 22 | 44 | 178 | 24 | 125 |
| v/c Ratio | 0.06 | 0.02 | 0.19 | 0.02 | 0.06 | 0.16 | 0.04 | 0.12 |
| Control Delay | 17.9 | 0.1 | 18.2 | 0.1 | 8.0 | 5.0 | 15.8 | 13.7 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 17.9 | 0.1 | 18.2 | 0.1 | 8.0 | 5.0 | 15.8 | 13.7 |
| Queue Length 50th (ft) | 2 | 0 | 8 | 0 | 4 | 7 | 2 | 10 |
| Queue Length 95th (ft) | 20 | 0 | 41 | 0 | 15 | 25 | 19 | 57 |
| Internal Link Dist (ft) | | 773 | | 54 | | 238 | | 267 |
| Turn Bay Length (ft) | 105 | | | | 115 | | 75 | |
| Base Capacity (vph) | 646 | 1002 | 373 | 1024 | 727 | 1255 | 664 | 1019 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.03 | 0.02 | 0.18 | 0.02 | 0.06 | 0.14 | 0.04 | 0.12 |

Intersection Summary

HCM Signalized Intersection Capacity Analysis

6: Roeland Drive & Martway Street/Drive 3

12/27/2018



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|------------------------|-------|------|------|-------|------|------|-------|-------|------|------|-------|------|
| Lane Configurations | ↖ | ↗ | | ↖ | ↗ | | ↖ | ↗ | | ↖ | ↗ | |
| Traffic Volume (vph) | 18 | 0 | 12 | 54 | 0 | 17 | 29 | 55 | 72 | 19 | 86 | 11 |
| Future Volume (vph) | 18 | 0 | 12 | 54 | 0 | 17 | 29 | 55 | 72 | 19 | 86 | 11 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 5.0 | 5.0 | | 5.4 | 5.4 | | 5.0 | 5.0 | | 5.0 | 5.0 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.85 | | 1.00 | 0.85 | | 1.00 | 0.92 | | 1.00 | 0.99 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1770 | 1583 | | 1770 | 1583 | | 1770 | 1718 | | 1770 | 1836 | |
| Flt Permitted | 0.95 | 1.00 | | 1.00 | 1.00 | | 0.52 | 1.00 | | 0.64 | 1.00 | |
| Satd. Flow (perm) | 1770 | 1583 | | 1863 | 1583 | | 977 | 1718 | | 1201 | 1836 | |
| Peak-hour factor, PHF | 0.90 | 0.92 | 0.60 | 0.78 | 0.92 | 0.78 | 0.66 | 0.64 | 0.78 | 0.78 | 0.76 | 0.92 |
| Adj. Flow (vph) | 20 | 0 | 20 | 69 | 0 | 22 | 44 | 86 | 92 | 24 | 113 | 12 |
| RTOR Reduction (vph) | 0 | 19 | 0 | 0 | 20 | 0 | 0 | 43 | 0 | 0 | 5 | 0 |
| Lane Group Flow (vph) | 20 | 1 | 0 | 69 | 2 | 0 | 44 | 135 | 0 | 24 | 120 | 0 |
| Turn Type | Split | NA | | Perm | NA | | pm+pt | NA | | Perm | NA | |
| Protected Phases | 6 | 6 | | | 2 | | 7 | 4 | | | 8 | |
| Permitted Phases | | | | 2 | | | 4 | 4 | | 8 | | |
| Actuated Green, G (s) | 2.0 | 2.0 | | 3.6 | 3.6 | | 24.2 | 24.2 | | 17.2 | 17.2 | |
| Effective Green, g (s) | 2.0 | 2.0 | | 3.6 | 3.6 | | 24.2 | 24.2 | | 17.2 | 17.2 | |
| Actuated g/C Ratio | 0.04 | 0.04 | | 0.08 | 0.08 | | 0.54 | 0.54 | | 0.38 | 0.38 | |
| Clearance Time (s) | 5.0 | 5.0 | | 5.4 | 5.4 | | 5.0 | 5.0 | | 5.0 | 5.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 78 | 70 | | 148 | 126 | | 558 | 919 | | 457 | 698 | |
| v/s Ratio Prot | c0.01 | 0.00 | | | 0.00 | | 0.00 | c0.08 | | | c0.07 | |
| v/s Ratio Perm | | | | c0.04 | | | 0.04 | | | 0.02 | | |
| v/c Ratio | 0.26 | 0.01 | | 0.47 | 0.01 | | 0.08 | 0.15 | | 0.05 | 0.17 | |
| Uniform Delay, d1 | 20.9 | 20.7 | | 19.9 | 19.2 | | 5.3 | 5.3 | | 8.8 | 9.3 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 1.7 | 0.1 | | 2.3 | 0.0 | | 0.1 | 0.1 | | 0.0 | 0.1 | |
| Delay (s) | 22.6 | 20.7 | | 22.2 | 19.2 | | 5.3 | 5.4 | | 8.9 | 9.4 | |
| Level of Service | C | C | | C | B | | A | A | | A | A | |
| Approach Delay (s) | | 21.7 | | | 21.5 | | | 5.4 | | | 9.3 | |
| Approach LOS | | C | | | C | | | A | | | A | |

Intersection Summary

| | | | |
|-----------------------------------|-------|---------------------------|------|
| HCM 2000 Control Delay | 10.8 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.23 | | |
| Actuated Cycle Length (s) | 45.2 | Sum of lost time (s) | 20.4 |
| Intersection Capacity Utilization | 34.1% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

HCM 6th Signalized Intersection Summary
 6: Roeland Drive & Martway Street/Drive 3

12/27/2018



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|------------------------------|------|-------|------|------|------|------|------|------|------|------|------|------|
| Lane Configurations | ↖ | ↗ | | ↖ | ↗ | | ↖ | ↗ | | ↖ | ↗ | |
| Traffic Volume (veh/h) | 18 | 0 | 12 | 54 | 0 | 17 | 29 | 55 | 72 | 19 | 86 | 11 |
| Future Volume (veh/h) | 18 | 0 | 12 | 54 | 0 | 17 | 29 | 55 | 72 | 19 | 86 | 11 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 |
| Adj Flow Rate, veh/h | 20 | 0 | 20 | 69 | 0 | 22 | 44 | 86 | 92 | 24 | 113 | 12 |
| Peak Hour Factor | 0.90 | 0.92 | 0.60 | 0.78 | 0.92 | 0.78 | 0.66 | 0.64 | 0.78 | 0.78 | 0.76 | 0.92 |
| Percent Heavy Veh, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Cap, veh/h | 99 | 0 | 88 | 182 | 0 | 162 | 470 | 319 | 341 | 428 | 296 | 31 |
| Arrive On Green | 0.06 | 0.00 | 0.06 | 0.10 | 0.00 | 0.10 | 0.06 | 0.39 | 0.39 | 0.18 | 0.18 | 0.18 |
| Sat Flow, veh/h | 1781 | 0 | 1585 | 1781 | 0 | 1585 | 1781 | 827 | 884 | 1206 | 1662 | 177 |
| Grp Volume(v), veh/h | 20 | 0 | 20 | 69 | 0 | 22 | 44 | 0 | 178 | 24 | 0 | 125 |
| Grp Sat Flow(s),veh/h/ln | 1781 | 0 | 1585 | 1781 | 0 | 1585 | 1781 | 0 | 1711 | 1206 | 0 | 1839 |
| Q Serve(g_s), s | 0.4 | 0.0 | 0.4 | 1.2 | 0.0 | 0.4 | 0.6 | 0.0 | 2.4 | 0.6 | 0.0 | 2.0 |
| Cycle Q Clear(g_c), s | 0.4 | 0.0 | 0.4 | 1.2 | 0.0 | 0.4 | 0.6 | 0.0 | 2.4 | 0.6 | 0.0 | 2.0 |
| Prop In Lane | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 0.52 | 1.00 | | 0.10 |
| Lane Grp Cap(c), veh/h | 99 | 0 | 88 | 182 | 0 | 162 | 470 | 0 | 661 | 428 | 0 | 327 |
| V/C Ratio(X) | 0.20 | 0.00 | 0.23 | 0.38 | 0.00 | 0.14 | 0.09 | 0.00 | 0.27 | 0.06 | 0.00 | 0.38 |
| Avail Cap(c_a), veh/h | 633 | 0 | 564 | 348 | 0 | 310 | 732 | 0 | 1065 | 535 | 0 | 490 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 1.00 |
| Uniform Delay (d), s/veh | 15.2 | 0.0 | 15.2 | 14.2 | 0.0 | 13.8 | 8.8 | 0.0 | 7.1 | 11.6 | 0.0 | 12.2 |
| Incr Delay (d2), s/veh | 1.0 | 0.0 | 1.3 | 1.3 | 0.0 | 0.4 | 0.1 | 0.0 | 0.2 | 0.1 | 0.0 | 0.7 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 0.1 | 0.0 | 0.1 | 0.4 | 0.0 | 0.1 | 0.2 | 0.0 | 0.6 | 0.1 | 0.0 | 0.7 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 16.2 | 0.0 | 16.5 | 15.5 | 0.0 | 14.2 | 8.9 | 0.0 | 7.3 | 11.7 | 0.0 | 13.0 |
| LnGrp LOS | B | A | B | B | A | B | A | A | A | B | A | B |
| Approach Vol, veh/h | | 40 | | | 91 | | | 222 | | | 149 | |
| Approach Delay, s/veh | | 16.4 | | | 15.1 | | | 7.6 | | | 12.8 | |
| Approach LOS | | B | | | B | | | A | | | B | |
| Timer - Assigned Phs | | 2 | | 4 | | 6 | 7 | 8 | | | | |
| Phs Duration (G+Y+Rc), s | | 8.8 | | 18.0 | | 6.9 | 7.0 | 11.0 | | | | |
| Change Period (Y+Rc), s | | * 5.4 | | 5.0 | | 5.0 | 5.0 | 5.0 | | | | |
| Max Green Setting (Gmax), s | | * 6.6 | | 21.0 | | 12.0 | 7.0 | 9.0 | | | | |
| Max Q Clear Time (g_c+I1), s | | 3.2 | | 4.4 | | 2.4 | 2.6 | 4.0 | | | | |
| Green Ext Time (p_c), s | | 0.1 | | 0.9 | | 0.0 | 0.0 | 0.3 | | | | |

Intersection Summary

| | |
|--------------------|------|
| HCM 6th Ctrl Delay | 11.2 |
| HCM 6th LOS | B |

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

| Intersection | | | | | | |
|--------------------------|------|------|------|------|------|------|
| Int Delay, s/veh | 0 | | | | | |
| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
| Lane Configurations | | ↗ | | ↕↕ | ↕↕ | ↗ |
| Traffic Vol, veh/h | 0 | 3 | 0 | 1355 | 734 | 21 |
| Future Vol, veh/h | 0 | 3 | 0 | 1355 | 734 | 21 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Stop | Stop | Free | Free | Free | Free |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | - | 0 | - | - | - | 100 |
| Veh in Median Storage, # | 0 | - | - | 0 | 0 | - |
| Grade, % | 0 | - | - | 0 | 0 | - |
| Peak Hour Factor | 92 | 78 | 92 | 92 | 85 | 78 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 0 | 4 | 0 | 1473 | 864 | 27 |

| Major/Minor | Minor2 | Major1 | Major2 | | |
|----------------------|--------|--------|--------|---|---|
| Conflicting Flow All | - | 432 | - | 0 | 0 |
| Stage 1 | - | - | - | - | - |
| Stage 2 | - | - | - | - | - |
| Critical Hdwy | - | 6.94 | - | - | - |
| Critical Hdwy Stg 1 | - | - | - | - | - |
| Critical Hdwy Stg 2 | - | - | - | - | - |
| Follow-up Hdwy | - | 3.32 | - | - | - |
| Pot Cap-1 Maneuver | 0 | 572 | 0 | - | - |
| Stage 1 | 0 | - | 0 | - | - |
| Stage 2 | 0 | - | 0 | - | - |
| Platoon blocked, % | | | | - | - |
| Mov Cap-1 Maneuver | - | 572 | - | - | - |
| Mov Cap-2 Maneuver | - | - | - | - | - |
| Stage 1 | - | - | - | - | - |
| Stage 2 | - | - | - | - | - |

| Approach | EB | NB | SB |
|----------------------|------|----|----|
| HCM Control Delay, s | 11.3 | 0 | 0 |
| HCM LOS | B | | |

| Minor Lane/Major Mvmt | NBT | EBLn1 | SBT | SBR |
|-----------------------|-----|-------|-----|-----|
| Capacity (veh/h) | - | 572 | - | - |
| HCM Lane V/C Ratio | - | 0.007 | - | - |
| HCM Control Delay (s) | - | 11.3 | - | - |
| HCM Lane LOS | - | B | - | - |
| HCM 95th %tile Q(veh) | - | 0 | - | - |

| Intersection | | | | | | |
|--------------------------|------|------|------|------|------|-------|
| Int Delay, s/veh | 2.2 | | | | | |
| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
| Lane Configurations | ↻ | | ↻ | ↻↻ | ↻ | ↻ |
| Traffic Vol, veh/h | 500 | 17 | 124 | 551 | 29 | 87 |
| Future Vol, veh/h | 500 | 17 | 124 | 551 | 29 | 87 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Stop | Stop |
| RT Channelized | - | None | - | None | - | Yield |
| Storage Length | - | - | 150 | - | 100 | 0 |
| Veh in Median Storage, # | 0 | - | - | 0 | 0 | - |
| Grade, % | 0 | - | - | 0 | 0 | - |
| Peak Hour Factor | 96 | 96 | 86 | 86 | 92 | 92 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 521 | 18 | 144 | 641 | 32 | 95 |

| Major/Minor | Major1 | Major2 | Minor1 | Minor2 | Minor3 |
|----------------------|--------|--------|--------|--------|--------|
| Conflicting Flow All | 0 | 0 | 539 | 0 | 1139 |
| Stage 1 | - | - | - | - | 530 |
| Stage 2 | - | - | - | - | 609 |
| Critical Hdwy | - | - | 4.13 | - | 6.63 |
| Critical Hdwy Stg 1 | - | - | - | - | 5.43 |
| Critical Hdwy Stg 2 | - | - | - | - | 5.83 |
| Follow-up Hdwy | - | - | 2.219 | - | 3.519 |
| Pot Cap-1 Maneuver | - | - | 1027 | - | 208 |
| Stage 1 | - | - | - | - | 589 |
| Stage 2 | - | - | - | - | 506 |
| Platoon blocked, % | - | - | - | - | - |
| Mov Cap-1 Maneuver | - | - | 1027 | - | 179 |
| Mov Cap-2 Maneuver | - | - | - | - | 271 |
| Stage 1 | - | - | - | - | 507 |
| Stage 2 | - | - | - | - | 506 |

| Approach | EB | WB | NB |
|----------------------|----|-----|------|
| HCM Control Delay, s | 0 | 1.7 | 14.7 |
| HCM LOS | | | B |

| Minor Lane/Major Mvmt | NBLn1 | NBLn2 | EBT | EBR | WBL | WBT |
|-----------------------|-------|-------|-----|-----|------|-----|
| Capacity (veh/h) | 271 | 548 | - | - | 1027 | - |
| HCM Lane V/C Ratio | 0.116 | 0.173 | - | - | 0.14 | - |
| HCM Control Delay (s) | 20 | 12.9 | - | - | 9.1 | - |
| HCM Lane LOS | C | B | - | - | A | - |
| HCM 95th %tile Q(veh) | 0.4 | 0.6 | - | - | 0.5 | - |

| Intersection | | | | | | |
|--------------------------|------|------|------|------|------|------|
| Int Delay, s/veh | 3.6 | | | | | |
| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
| Lane Configurations | | | | | | |
| Traffic Vol, veh/h | 159 | 19 | 217 | 217 | 19 | 167 |
| Future Vol, veh/h | 159 | 19 | 217 | 217 | 19 | 167 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Stop | Stop | Free | Free | Free | Free |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | 0 | 0 | - | - | 75 | - |
| Veh in Median Storage, # | 0 | - | 0 | - | - | 0 |
| Grade, % | 0 | - | 0 | - | - | 0 |
| Peak Hour Factor | 85 | 78 | 85 | 85 | 78 | 87 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 187 | 24 | 255 | 255 | 24 | 192 |

| Major/Minor | Minor1 | Major1 | Major2 | | |
|----------------------|--------|--------|--------|---|-------|
| Conflicting Flow All | 623 | 383 | 0 | 0 | 510 |
| Stage 1 | 383 | - | - | - | - |
| Stage 2 | 240 | - | - | - | - |
| Critical Hdwy | 6.42 | 6.22 | - | - | 4.12 |
| Critical Hdwy Stg 1 | 5.42 | - | - | - | - |
| Critical Hdwy Stg 2 | 5.42 | - | - | - | - |
| Follow-up Hdwy | 3.518 | 3.318 | - | - | 2.218 |
| Pot Cap-1 Maneuver | 450 | 664 | - | - | 1055 |
| Stage 1 | 689 | - | - | - | - |
| Stage 2 | 800 | - | - | - | - |
| Platoon blocked, % | | | - | - | - |
| Mov Cap-1 Maneuver | 440 | 664 | - | - | 1055 |
| Mov Cap-2 Maneuver | 527 | - | - | - | - |
| Stage 1 | 673 | - | - | - | - |
| Stage 2 | 800 | - | - | - | - |

| Approach | WB | NB | SB |
|----------------------|------|----|----|
| HCM Control Delay, s | 14.9 | 0 | 1 |
| HCM LOS | B | | |

| Minor Lane/Major Mvmt | NBT | NBRWBLn1 | WBLn2 | SBL | SBT |
|-----------------------|-----|----------|-------|-------|-------|
| Capacity (veh/h) | - | - | 527 | 664 | 1055 |
| HCM Lane V/C Ratio | - | - | 0.355 | 0.037 | 0.023 |
| HCM Control Delay (s) | - | - | 15.5 | 10.6 | 8.5 |
| HCM Lane LOS | - | - | C | B | A |
| HCM 95th %tile Q(veh) | - | - | 1.6 | 0.1 | 0.1 |

| Intersection | | | | | | |
|--------------------------|------|------|------|------|------|------|
| Int Delay, s/veh | 0.2 | | | | | |
| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
| Lane Configurations | | ↗ | | ↕↕ | ↕↕ | ↗ |
| Traffic Vol, veh/h | 0 | 27 | 0 | 1355 | 716 | 21 |
| Future Vol, veh/h | 0 | 27 | 0 | 1355 | 716 | 21 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Stop | Stop | Free | Free | Free | Free |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | - | 0 | - | - | - | 100 |
| Veh in Median Storage, # | 0 | - | - | 0 | 0 | - |
| Grade, % | 0 | - | - | 0 | 0 | - |
| Peak Hour Factor | 92 | 78 | 78 | 92 | 85 | 78 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 0 | 35 | 0 | 1473 | 842 | 27 |

| Major/Minor | Minor2 | Major1 | Major2 |
|----------------------|--------|--------|--------|
| Conflicting Flow All | - | 421 | 0 |
| Stage 1 | - | - | - |
| Stage 2 | - | - | - |
| Critical Hdwy | - | 6.94 | - |
| Critical Hdwy Stg 1 | - | - | - |
| Critical Hdwy Stg 2 | - | - | - |
| Follow-up Hdwy | - | 3.32 | - |
| Pot Cap-1 Maneuver | 0 | 581 | 0 |
| Stage 1 | 0 | - | 0 |
| Stage 2 | 0 | - | 0 |
| Platoon blocked, % | | | |
| Mov Cap-1 Maneuver | - | 581 | - |
| Mov Cap-2 Maneuver | - | - | - |
| Stage 1 | - | - | - |
| Stage 2 | - | - | - |

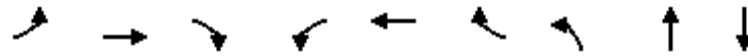
| Approach | EB | NB | SB |
|----------------------|------|----|----|
| HCM Control Delay, s | 11.6 | 0 | 0 |
| HCM LOS | B | | |

| Minor Lane/Major Mvmt | NBT | EBLn1 | SBT | SBR |
|-----------------------|-----|-------|-----|-----|
| Capacity (veh/h) | - | 581 | - | - |
| HCM Lane V/C Ratio | - | 0.06 | - | - |
| HCM Control Delay (s) | - | 11.6 | - | - |
| HCM Lane LOS | - | B | - | - |
| HCM 95th %tile Q(veh) | - | 0.2 | - | - |

Queues

29: Roeland Drive & Johnson Drive

12/27/2018



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | SBT |
|-------------------------|------|------|------|------|------|------|------|------|------|
| Lane Group Flow (vph) | 8 | 493 | 70 | 56 | 577 | 4 | 94 | 44 | 72 |
| v/c Ratio | 0.02 | 0.47 | 0.07 | 0.10 | 0.49 | 0.00 | 0.27 | 0.10 | 0.28 |
| Control Delay | 6.5 | 15.8 | 0.1 | 6.9 | 12.0 | 0.0 | 22.1 | 9.4 | 23.7 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 6.5 | 15.8 | 0.1 | 6.9 | 12.0 | 0.0 | 22.1 | 9.4 | 23.7 |
| Queue Length 50th (ft) | 1 | 163 | 0 | 9 | 134 | 0 | 26 | 1 | 16 |
| Queue Length 95th (ft) | 2 | 264 | 0 | 22 | 318 | 0 | 40 | 18 | 45 |
| Internal Link Dist (ft) | | 180 | | | 464 | | | 267 | 783 |
| Turn Bay Length (ft) | 100 | | 100 | 130 | | | 100 | | |
| Base Capacity (vph) | 543 | 1487 | 1293 | 557 | 1487 | 1293 | 365 | 721 | 328 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.01 | 0.33 | 0.05 | 0.10 | 0.39 | 0.00 | 0.26 | 0.06 | 0.22 |
| Intersection Summary | | | | | | | | | |

HCM Signalized Intersection Capacity Analysis

29: Roeland Drive & Johnson Drive

12/27/2018



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|------------------------|-------|------|------|-------|-------|------|-------|------|------|------|------|------|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 2 | 473 | 47 | 48 | 531 | 1 | 47 | 3 | 38 | 6 | 23 | 21 |
| Future Volume (vph) | 2 | 473 | 47 | 48 | 531 | 1 | 47 | 3 | 38 | 6 | 23 | 21 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | | | 5.0 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.86 | | | 0.95 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 0.99 | |
| Satd. Flow (prot) | 1770 | 1863 | 1583 | 1770 | 1863 | 1583 | 1770 | 1609 | | | 1750 | |
| Flt Permitted | 0.35 | 1.00 | 1.00 | 0.34 | 1.00 | 1.00 | 0.53 | 1.00 | | | 0.93 | |
| Satd. Flow (perm) | 656 | 1863 | 1583 | 640 | 1863 | 1583 | 983 | 1609 | | | 1644 | |
| Peak-hour factor, PHF | 0.25 | 0.96 | 0.67 | 0.86 | 0.92 | 0.25 | 0.50 | 0.75 | 0.95 | 0.50 | 0.72 | 0.75 |
| Adj. Flow (vph) | 8 | 493 | 70 | 56 | 577 | 4 | 94 | 4 | 40 | 12 | 32 | 28 |
| RTOR Reduction (vph) | 0 | 0 | 36 | 0 | 0 | 2 | 0 | 31 | 0 | 0 | 26 | 0 |
| Lane Group Flow (vph) | 8 | 493 | 34 | 56 | 577 | 2 | 94 | 13 | 0 | 0 | 46 | 0 |
| Turn Type | pm+pt | NA | Perm | pm+pt | NA | Perm | pm+pt | NA | | Perm | NA | |
| Protected Phases | 1 | 6 | | 5 | 2 | | 7 | 4 | | | 8 | |
| Permitted Phases | 6 | | 6 | 2 | | 2 | 4 | | | 8 | | |
| Actuated Green, G (s) | 32.1 | 31.3 | 31.3 | 37.1 | 33.8 | 33.8 | 14.2 | 14.2 | | | 3.9 | |
| Effective Green, g (s) | 32.1 | 31.3 | 31.3 | 37.1 | 33.8 | 33.8 | 14.2 | 14.2 | | | 3.9 | |
| Actuated g/C Ratio | 0.50 | 0.49 | 0.49 | 0.58 | 0.53 | 0.53 | 0.22 | 0.22 | | | 0.06 | |
| Clearance Time (s) | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | | | 5.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | | 3.0 | |
| Lane Grp Cap (vph) | 344 | 913 | 776 | 430 | 986 | 838 | 284 | 358 | | | 100 | |
| v/s Ratio Prot | 0.00 | 0.26 | | c0.01 | c0.31 | | c0.03 | 0.01 | | | | |
| v/s Ratio Perm | 0.01 | | 0.02 | 0.07 | | 0.00 | c0.05 | | | | 0.03 | |
| v/c Ratio | 0.02 | 0.54 | 0.04 | 0.13 | 0.59 | 0.00 | 0.33 | 0.04 | | | 0.46 | |
| Uniform Delay, d1 | 8.3 | 11.3 | 8.5 | 6.6 | 10.2 | 7.1 | 20.6 | 19.4 | | | 28.9 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 1.00 | |
| Incremental Delay, d2 | 0.0 | 0.6 | 0.0 | 0.1 | 0.9 | 0.0 | 0.7 | 0.0 | | | 3.3 | |
| Delay (s) | 8.3 | 11.9 | 8.5 | 6.7 | 11.1 | 7.1 | 21.2 | 19.5 | | | 32.2 | |
| Level of Service | A | B | A | A | B | A | C | B | | | C | |
| Approach Delay (s) | | 11.4 | | | 10.7 | | | 20.7 | | | 32.2 | |
| Approach LOS | | B | | | B | | | C | | | C | |

Intersection Summary

| | | | |
|-----------------------------------|-------|---------------------------|------|
| HCM 2000 Control Delay | 13.1 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.56 | | |
| Actuated Cycle Length (s) | 63.8 | Sum of lost time (s) | 20.0 |
| Intersection Capacity Utilization | 54.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

HCM 6th Signalized Intersection Summary
 29: Roeland Drive & Johnson Drive

12/27/2018



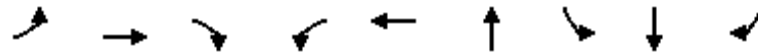
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Lane Configurations | ↖ | ↗ | ↘ | ↖ | ↗ | ↘ | ↖ | ↗ | ↘ | | ↕ | ↘ |
| Traffic Volume (veh/h) | 2 | 473 | 47 | 48 | 531 | 1 | 47 | 3 | 38 | 6 | 23 | 21 |
| Future Volume (veh/h) | 2 | 473 | 47 | 48 | 531 | 1 | 47 | 3 | 38 | 6 | 23 | 21 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 |
| Adj Flow Rate, veh/h | 8 | 493 | 70 | 56 | 577 | 4 | 94 | 4 | 40 | 12 | 32 | 28 |
| Peak Hour Factor | 0.25 | 0.96 | 0.67 | 0.86 | 0.92 | 0.25 | 0.50 | 0.75 | 0.95 | 0.50 | 0.72 | 0.75 |
| Percent Heavy Veh, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Cap, veh/h | 279 | 652 | 553 | 358 | 750 | 636 | 514 | 42 | 416 | 102 | 82 | 63 |
| Arrive On Green | 0.01 | 0.35 | 0.35 | 0.06 | 0.40 | 0.40 | 0.09 | 0.28 | 0.28 | 0.10 | 0.10 | 0.10 |
| Sat Flow, veh/h | 1781 | 1870 | 1585 | 1781 | 1870 | 1585 | 1781 | 146 | 1461 | 182 | 848 | 655 |
| Grp Volume(v), veh/h | 8 | 493 | 70 | 56 | 577 | 4 | 94 | 0 | 44 | 72 | 0 | 0 |
| Grp Sat Flow(s),veh/h/ln | 1781 | 1870 | 1585 | 1781 | 1870 | 1585 | 1781 | 0 | 1607 | 1685 | 0 | 0 |
| Q Serve(g_s), s | 0.1 | 11.6 | 1.5 | 0.9 | 13.3 | 0.1 | 2.1 | 0.0 | 1.0 | 0.3 | 0.0 | 0.0 |
| Cycle Q Clear(g_c), s | 0.1 | 11.6 | 1.5 | 0.9 | 13.3 | 0.1 | 2.1 | 0.0 | 1.0 | 1.9 | 0.0 | 0.0 |
| Prop In Lane | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 0.91 | 0.17 | | 0.39 |
| Lane Grp Cap(c), veh/h | 279 | 652 | 553 | 358 | 750 | 636 | 514 | 0 | 458 | 247 | 0 | 0 |
| V/C Ratio(X) | 0.03 | 0.76 | 0.13 | 0.16 | 0.77 | 0.01 | 0.18 | 0.00 | 0.10 | 0.29 | 0.00 | 0.00 |
| Avail Cap(c_a), veh/h | 507 | 1768 | 1499 | 493 | 1768 | 1499 | 609 | 0 | 679 | 387 | 0 | 0 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 0.00 |
| Uniform Delay (d), s/veh | 11.3 | 14.3 | 11.0 | 10.3 | 12.9 | 8.9 | 15.8 | 0.0 | 13.1 | 21.2 | 0.0 | 0.0 |
| Incr Delay (d2), s/veh | 0.0 | 1.8 | 0.1 | 0.2 | 1.7 | 0.0 | 0.2 | 0.0 | 0.1 | 0.6 | 0.0 | 0.0 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 0.1 | 4.4 | 0.5 | 0.3 | 4.8 | 0.0 | 0.8 | 0.0 | 0.3 | 0.8 | 0.0 | 0.0 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 11.4 | 16.1 | 11.1 | 10.5 | 14.6 | 8.9 | 16.0 | 0.0 | 13.2 | 21.8 | 0.0 | 0.0 |
| LnGrp LOS | B | B | B | B | B | A | B | A | B | C | A | A |
| Approach Vol, veh/h | | 571 | | | 637 | | | 138 | | | | 72 |
| Approach Delay, s/veh | | 15.5 | | | 14.2 | | | 15.1 | | | | 21.8 |
| Approach LOS | | B | | | B | | | B | | | | C |
| Timer - Assigned Phs | 1 | 2 | | 4 | 5 | 6 | 7 | 8 | | | | |
| Phs Duration (G+Y+Rc), s | 5.6 | 24.9 | | 19.2 | 8.2 | 22.3 | 9.4 | 9.8 | | | | |
| Change Period (Y+Rc), s | 5.0 | 5.0 | | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | | | | |
| Max Green Setting (Gmax), s | 7.0 | 47.0 | | 21.0 | 7.0 | 47.0 | 7.0 | 9.0 | | | | |
| Max Q Clear Time (g_c+I1), s | 2.1 | 15.3 | | 3.0 | 2.9 | 13.6 | 4.1 | 3.9 | | | | |
| Green Ext Time (p_c), s | 0.0 | 4.3 | | 0.1 | 0.0 | 3.7 | 0.0 | 0.1 | | | | |

| Intersection Summary | | | | | | | | | | | | |
|----------------------|--|--|--|--|--|--|--|--|--|--|------|--|
| HCM 6th Ctrl Delay | | | | | | | | | | | 15.2 | |
| HCM 6th LOS | | | | | | | | | | | B | |

Queues

1470: Roeland Drive & Shawnee Mission Parkway

12/27/2018



| Lane Group | EBL | EBT | EBR | WBL | WBT | NBT | SBL | SBT | SBR |
|-------------------------|------|------|------|------|-------|------|------|------|------|
| Lane Group Flow (vph) | 197 | 1875 | 28 | 37 | 3621 | 120 | 133 | 136 | 155 |
| v/c Ratio | 0.92 | 0.87 | 0.02 | 0.21 | 1.43 | 0.68 | 0.76 | 0.76 | 0.51 |
| Control Delay | 46.1 | 47.6 | 0.0 | 51.3 | 222.0 | 47.7 | 78.8 | 79.1 | 13.9 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 46.1 | 47.6 | 0.0 | 51.3 | 222.0 | 47.7 | 78.8 | 79.1 | 13.9 |
| Queue Length 50th (ft) | 163 | 816 | 0 | 26 | ~1526 | 44 | 106 | 108 | 0 |
| Queue Length 95th (ft) | m114 | m541 | m0 | 41 | #1608 | #128 | #189 | 122 | 49 |
| Internal Link Dist (ft) | | 682 | | | 2401 | 499 | | 330 | |
| Turn Bay Length (ft) | 345 | | 310 | 170 | | | 100 | | 125 |
| Base Capacity (vph) | 218 | 2155 | 1583 | 213 | 2531 | 176 | 189 | 192 | 315 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.90 | 0.87 | 0.02 | 0.17 | 1.43 | 0.68 | 0.70 | 0.71 | 0.49 |

Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
- m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis
 1470: Roeland Drive & Shawnee Mission Parkway

12/27/2018



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|------------------------|------|-------|-------|------|-------|------|-------|-------|------|-------|-------|------|
| Lane Configurations | ↘ | ↑↑ | ↗ | ↘ | ↑↑↑ | | | ↕ | | ↘ | ↗ | ↗ |
| Traffic Volume (vph) | 171 | 1781 | 21 | 23 | 3110 | 295 | 18 | 11 | 67 | 199 | 25 | 129 |
| Future Volume (vph) | 171 | 1781 | 21 | 23 | 3110 | 295 | 18 | 11 | 67 | 199 | 25 | 129 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.5 | 5.5 | 4.0 | 4.5 | 5.5 | | | 4.5 | | 4.5 | 4.5 | 4.5 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | *0.84 | | | 1.00 | | 0.95 | 0.95 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | | | 0.91 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 0.99 | | 0.95 | 0.97 | 1.00 |
| Satd. Flow (prot) | 1770 | 3539 | 1583 | 1770 | 4627 | | | 1677 | | 1681 | 1709 | 1583 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 0.99 | | 0.95 | 0.97 | 1.00 |
| Satd. Flow (perm) | 1770 | 3539 | 1583 | 1770 | 4627 | | | 1677 | | 1681 | 1709 | 1583 |
| Peak-hour factor, PHF | 0.87 | 0.95 | 0.75 | 0.63 | 0.95 | 0.85 | 0.63 | 0.95 | 0.85 | 0.87 | 0.63 | 0.83 |
| Adj. Flow (vph) | 197 | 1875 | 28 | 37 | 3274 | 347 | 29 | 12 | 79 | 229 | 40 | 155 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 58 | 0 | 0 | 0 | 139 |
| Lane Group Flow (vph) | 197 | 1875 | 28 | 37 | 3611 | 0 | 0 | 62 | 0 | 133 | 136 | 16 |
| Turn Type | Prot | NA | Free | Prot | NA | | Split | NA | | Split | NA | Perm |
| Protected Phases | 1 | 6 | | 5 | 2 | | 4 | 4 | | 8 | 8 | |
| Permitted Phases | | | Free | | | | | | | | | 8 |
| Actuated Green, G (s) | 14.6 | 71.3 | 120.0 | 8.7 | 65.4 | | | 8.5 | | 12.5 | 12.5 | 12.5 |
| Effective Green, g (s) | 14.6 | 71.3 | 120.0 | 8.7 | 65.4 | | | 8.5 | | 12.5 | 12.5 | 12.5 |
| Actuated g/C Ratio | 0.12 | 0.59 | 1.00 | 0.07 | 0.55 | | | 0.07 | | 0.10 | 0.10 | 0.10 |
| Clearance Time (s) | 4.5 | 5.5 | | 4.5 | 5.5 | | | 4.5 | | 4.5 | 4.5 | 4.5 |
| Vehicle Extension (s) | 1.5 | 2.0 | | 1.5 | 2.0 | | | 2.0 | | 2.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 215 | 2102 | 1583 | 128 | 2521 | | | 118 | | 175 | 178 | 164 |
| v/s Ratio Prot | 0.11 | c0.53 | | 0.02 | c0.78 | | | c0.04 | | 0.08 | c0.08 | |
| v/s Ratio Perm | | | 0.02 | | | | | | | | | 0.01 |
| v/c Ratio | 0.92 | 0.89 | 0.02 | 0.29 | 1.43 | | | 0.53 | | 0.76 | 0.76 | 0.10 |
| Uniform Delay, d1 | 52.1 | 21.0 | 0.0 | 52.7 | 27.3 | | | 53.8 | | 52.3 | 52.3 | 48.6 |
| Progression Factor | 0.71 | 2.24 | 1.00 | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 6.0 | 0.6 | 0.0 | 0.5 | 197.0 | | | 2.0 | | 15.9 | 15.9 | 0.1 |
| Delay (s) | 42.9 | 47.7 | 0.0 | 53.2 | 224.3 | | | 55.8 | | 68.2 | 68.3 | 48.7 |
| Level of Service | D | D | A | D | F | | | E | | E | E | D |
| Approach Delay (s) | | 46.6 | | | 222.6 | | | 55.8 | | | 61.1 | |
| Approach LOS | | D | | | F | | | E | | | E | |

Intersection Summary

| | | | |
|-----------------------------------|--------|---------------------------|------|
| HCM 2000 Control Delay | 149.9 | HCM 2000 Level of Service | F |
| HCM 2000 Volume to Capacity ratio | 1.21 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 19.0 |
| Intersection Capacity Utilization | 101.0% | ICU Level of Service | G |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

Queues

1470: Roeland Drive & Shawnee Mission Parkway

01/09/2019































| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | SBL | SBT | SBR |
|-------------------------|------|-------|------|------|------|------|------|------|------|------|------|
| Lane Group Flow (vph) | 279 | 2200 | 136 | 32 | 2954 | 280 | 88 | 64 | 151 | 155 | 252 |
| v/c Ratio | 1.03 | 0.98 | 0.09 | 0.26 | 1.00 | 0.28 | 0.71 | 0.48 | 0.81 | 0.81 | 0.87 |
| Control Delay | 91.7 | 31.9 | 0.0 | 58.6 | 42.0 | 5.1 | 84.6 | 60.4 | 82.5 | 81.4 | 52.9 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 91.7 | 31.9 | 0.0 | 58.6 | 42.0 | 5.1 | 84.6 | 60.4 | 82.5 | 81.4 | 52.9 |
| Queue Length 50th (ft) | ~122 | ~1029 | 0 | 24 | ~887 | 32 | 68 | 43 | 121 | 124 | 94 |
| Queue Length 95th (ft) | m69 | m521 | m0 | 47 | #973 | 54 | #113 | 69 | #214 | #176 | #221 |
| Internal Link Dist (ft) | | 682 | | | 2401 | | | 499 | | 332 | |
| Turn Bay Length (ft) | 345 | | 310 | 170 | | 230 | | | 100 | | 125 |
| Base Capacity (vph) | 271 | 2240 | 1583 | 125 | 2955 | 998 | 125 | 134 | 203 | 209 | 305 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 1.03 | 0.98 | 0.09 | 0.26 | 1.00 | 0.28 | 0.70 | 0.48 | 0.74 | 0.74 | 0.83 |

Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
- m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis
 1470: Roeland Drive & Shawnee Mission Parkway

01/09/2019

| |  |  |  |  |  |  |  |  |  |  |  |  | |
|-----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|--|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR | |
| Lane Configurations |   |   |  |  |    |  |  |  | |  |   |  | |
| Traffic Volume (vph) | 243 | 2068 | 103 | 24 | 2806 | 221 | 68 | 37 | 7 | 193 | 66 | 222 | |
| Future Volume (vph) | 243 | 2068 | 103 | 24 | 2806 | 221 | 68 | 37 | 7 | 193 | 66 | 222 | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | |
| Total Lost time (s) | 4.5 | 5.5 | 4.0 | 4.5 | 5.5 | 5.5 | 4.5 | 4.5 | | 4.5 | 4.5 | 4.5 | |
| Lane Util. Factor | 0.97 | 0.95 | 1.00 | 1.00 | 0.91 | 1.00 | 1.00 | 1.00 | | 0.95 | 0.95 | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.97 | | 1.00 | 1.00 | 0.85 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 0.98 | 1.00 | |
| Satd. Flow (prot) | 3433 | 3539 | 1583 | 1770 | 5085 | 1583 | 1770 | 1810 | | 1681 | 1730 | 1583 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 0.98 | 1.00 | |
| Satd. Flow (perm) | 3433 | 3539 | 1583 | 1770 | 5085 | 1583 | 1770 | 1810 | | 1681 | 1730 | 1583 | |
| Peak-hour factor, PHF | 0.87 | 0.94 | 0.76 | 0.75 | 0.95 | 0.79 | 0.77 | 0.71 | 0.58 | 0.87 | 0.79 | 0.88 | |
| Adj. Flow (vph) | 279 | 2200 | 136 | 32 | 2954 | 280 | 88 | 52 | 12 | 222 | 84 | 252 | |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 80 | 0 | 7 | 0 | 0 | 0 | 116 | |
| Lane Group Flow (vph) | 279 | 2200 | 136 | 32 | 2954 | 200 | 88 | 57 | 0 | 151 | 155 | 136 | |
| Turn Type | Prot | NA | Free | Prot | NA | Perm | Split | NA | | Split | NA | Perm | |
| Protected Phases | 1 | 6 | | 5 | 2 | | 4 | 4 | | 8 | 8 | | |
| Permitted Phases | | | Free | | | 2 | | | | | | 8 | |
| Actuated Green, G (s) | 11.3 | 74.2 | 120.0 | 5.1 | 68.0 | 68.0 | 8.4 | 8.4 | | 13.3 | 13.3 | 13.3 | |
| Effective Green, g (s) | 11.3 | 74.2 | 120.0 | 5.1 | 68.0 | 68.0 | 8.4 | 8.4 | | 13.3 | 13.3 | 13.3 | |
| Actuated g/C Ratio | 0.09 | 0.62 | 1.00 | 0.04 | 0.57 | 0.57 | 0.07 | 0.07 | | 0.11 | 0.11 | 0.11 | |
| Clearance Time (s) | 4.5 | 5.5 | | 4.5 | 5.5 | 5.5 | 4.5 | 4.5 | | 4.5 | 4.5 | 4.5 | |
| Vehicle Extension (s) | 1.5 | 2.0 | | 1.5 | 2.0 | 2.0 | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 323 | 2188 | 1583 | 75 | 2881 | 897 | 123 | 126 | | 186 | 191 | 175 | |
| v/s Ratio Prot | c0.08 | c0.62 | | 0.02 | 0.58 | | c0.05 | 0.03 | | c0.09 | 0.09 | | |
| v/s Ratio Perm | | | 0.09 | | | 0.13 | | | | | | 0.09 | |
| v/c Ratio | 0.86 | 1.01 | 0.09 | 0.43 | 1.03 | 0.22 | 0.72 | 0.46 | | 0.81 | 0.81 | 0.78 | |
| Uniform Delay, d1 | 53.6 | 22.9 | 0.0 | 56.0 | 26.0 | 12.9 | 54.6 | 53.6 | | 52.1 | 52.1 | 51.9 | |
| Progression Factor | 1.29 | 1.32 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 2.3 | 7.2 | 0.0 | 1.4 | 23.6 | 0.6 | 15.1 | 1.0 | | 21.8 | 21.3 | 17.9 | |
| Delay (s) | 71.3 | 37.3 | 0.0 | 57.4 | 49.6 | 13.5 | 69.8 | 54.6 | | 74.0 | 73.5 | 69.8 | |
| Level of Service | E | D | A | E | D | B | E | D | | E | E | E | |
| Approach Delay (s) | | 39.0 | | | 46.6 | | | 63.4 | | | 71.9 | | |
| Approach LOS | | D | | | D | | | E | | | E | | |
| Intersection Summary | | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 46.1 | | HCM 2000 Level of Service | | | | | | D | | |
| HCM 2000 Volume to Capacity ratio | | | 0.97 | | | | | | | | | | |
| Actuated Cycle Length (s) | | | 120.0 | | Sum of lost time (s) | | | | | | 19.0 | | |
| Intersection Capacity Utilization | | | 89.7% | | ICU Level of Service | | | | | | E | | |
| Analysis Period (min) | | | 15 | | | | | | | | | | |

c Critical Lane Group

HCM 6th TWSC
 2: Roeland Drive & Rock Creek Lane/Drive 1

12/27/2018

| Intersection | | | | | | | | | | | | |
|--------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Int Delay, s/veh | 1 | | | | | | | | | | | |
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations | | ↕ | | | ↕ | | | ↕ | ↕ | | ↕ | |
| Traffic Vol, veh/h | 0 | 0 | 0 | 33 | 0 | 0 | 0 | 458 | 38 | 0 | 440 | 0 |
| Future Vol, veh/h | 0 | 0 | 0 | 33 | 0 | 0 | 0 | 458 | 38 | 0 | 440 | 0 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Free | Free | Free | Free | Free | Free |
| RT Channelized | - | - | None | - | - | None | - | - | None | - | - | None |
| Storage Length | - | - | - | - | - | - | - | - | 150 | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Peak Hour Factor | 92 | 92 | 92 | 78 | 92 | 92 | 87 | 87 | 78 | 87 | 87 | 87 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 0 | 0 | 0 | 42 | 0 | 0 | 0 | 526 | 49 | 0 | 506 | 0 |

| Major/Minor | Minor2 | | Minor1 | | Major1 | | Major2 | | | | | |
|----------------------|--------|-------|--------|-------|--------|-------|--------|---|---|-------|---|---|
| Conflicting Flow All | 1057 | 1081 | 506 | 1032 | 1032 | 526 | 506 | 0 | 0 | 575 | 0 | 0 |
| Stage 1 | 506 | 506 | - | 526 | 526 | - | - | - | - | - | - | - |
| Stage 2 | 551 | 575 | - | 506 | 506 | - | - | - | - | - | - | - |
| Critical Hdwy | 7.12 | 6.52 | 6.22 | 7.12 | 6.52 | 6.22 | 4.12 | - | - | 4.12 | - | - |
| Critical Hdwy Stg 1 | 6.12 | 5.52 | - | 6.12 | 5.52 | - | - | - | - | - | - | - |
| Critical Hdwy Stg 2 | 6.12 | 5.52 | - | 6.12 | 5.52 | - | - | - | - | - | - | - |
| Follow-up Hdwy | 3.518 | 4.018 | 3.318 | 3.518 | 4.018 | 3.318 | 2.218 | - | - | 2.218 | - | - |
| Pot Cap-1 Maneuver | 203 | 218 | 566 | 211 | 233 | 552 | 1059 | - | - | 998 | - | - |
| Stage 1 | 549 | 540 | - | 535 | 529 | - | - | - | - | - | - | - |
| Stage 2 | 519 | 503 | - | 549 | 540 | - | - | - | - | - | - | - |
| Platoon blocked, % | | | | | | | | - | - | - | - | - |
| Mov Cap-1 Maneuver | 203 | 218 | 566 | 211 | 233 | 552 | 1059 | - | - | 998 | - | - |
| Mov Cap-2 Maneuver | 203 | 218 | - | 211 | 233 | - | - | - | - | - | - | - |
| Stage 1 | 549 | 540 | - | 535 | 529 | - | - | - | - | - | - | - |
| Stage 2 | 519 | 503 | - | 549 | 540 | - | - | - | - | - | - | - |

| Approach | EB | | WB | | NB | | SB | |
|----------------------|----|--|------|--|----|--|----|--|
| HCM Control Delay, s | 0 | | 26.3 | | 0 | | 0 | |
| HCM LOS | A | | D | | | | | |

| Minor Lane/Major Mvmt | NBL | NBT | NBR | EBLn1WBLn1 | SBL | SBT | SBR |
|-----------------------|------|-----|-----|------------|-------|-----|-----|
| Capacity (veh/h) | 1059 | - | - | - | 211 | 998 | - |
| HCM Lane V/C Ratio | - | - | - | - | 0.201 | - | - |
| HCM Control Delay (s) | 0 | - | - | 0 | 26.3 | 0 | - |
| HCM Lane LOS | A | - | - | A | D | A | - |
| HCM 95th %tile Q(veh) | 0 | - | - | - | 0.7 | 0 | - |

Queues

3: Roe Avenue & Johnson Drive/Johnson Drive WB

12/27/2018



































| Lane Group | EBL | EBT | WBL | WBT | NBL | NBT | NBR | SBL | SBT | SBR |
|-------------------------|------|------|------|------|------|------|------|------|------|------|
| Lane Group Flow (vph) | 386 | 683 | 96 | 639 | 177 | 1058 | 72 | 79 | 646 | 361 |
| v/c Ratio | 0.82 | 0.77 | 0.70 | 0.94 | 0.55 | 0.79 | 0.10 | 0.39 | 0.50 | 0.46 |
| Control Delay | 57.0 | 40.5 | 71.0 | 63.3 | 23.5 | 33.6 | 0.3 | 19.6 | 26.1 | 5.8 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 57.0 | 40.5 | 71.0 | 63.3 | 23.5 | 33.6 | 0.3 | 19.6 | 26.1 | 5.8 |
| Queue Length 50th (ft) | 124 | 206 | 61 | 212 | 62 | 324 | 0 | 26 | 164 | 14 |
| Queue Length 95th (ft) | 144 | 274 | #102 | #300 | 83 | 377 | 0 | 41 | 199 | 70 |
| Internal Link Dist (ft) | | 556 | | 629 | | 141 | | | 492 | |
| Turn Bay Length (ft) | 245 | | 130 | | 150 | | 25 | 150 | | 250 |
| Base Capacity (vph) | 482 | 883 | 142 | 679 | 322 | 1346 | 703 | 216 | 1309 | 791 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.80 | 0.77 | 0.68 | 0.94 | 0.55 | 0.79 | 0.10 | 0.37 | 0.49 | 0.46 |

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis
 3: Roe Avenue & Johnson Drive/Johnson Drive WB

12/27/2018

| |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |   |   | |   |   | |   |   |   |   |   |   |
| Traffic Volume (vph) | 293 | 519 | 95 | 73 | 515 | 25 | 133 | 899 | 52 | 58 | 543 | 318 |
| Future Volume (vph) | 293 | 519 | 95 | 73 | 515 | 25 | 133 | 899 | 52 | 58 | 543 | 318 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 6.0 | 6.0 | | 6.0 | 6.0 | | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 |
| Lane Util. Factor | 0.97 | 0.95 | | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |
| Frt | 1.00 | 0.97 | | 1.00 | 0.99 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3433 | 3447 | | 1770 | 3506 | | 1770 | 3539 | 1583 | 1770 | 3539 | 1583 |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.31 | 1.00 | 1.00 | 0.11 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3433 | 3447 | | 1770 | 3506 | | 575 | 3539 | 1583 | 203 | 3539 | 1583 |
| Peak-hour factor, PHF | 0.76 | 0.92 | 0.80 | 0.76 | 0.86 | 0.63 | 0.75 | 0.85 | 0.72 | 0.73 | 0.84 | 0.88 |
| Adj. Flow (vph) | 386 | 564 | 119 | 96 | 599 | 40 | 177 | 1058 | 72 | 79 | 646 | 361 |
| RTOR Reduction (vph) | 0 | 18 | 0 | 0 | 5 | 0 | 0 | 0 | 46 | 0 | 0 | 206 |
| Lane Group Flow (vph) | 386 | 665 | 0 | 96 | 634 | 0 | 177 | 1058 | 26 | 79 | 646 | 155 |
| Turn Type | Prot | NA | | Prot | NA | | pm+pt | NA | Perm | pm+pt | NA | Perm |
| Protected Phases | 1 | 6 | | 5 | 2 | | 7 | 4 | | 3 | 8 | |
| Permitted Phases | | | | | | | 4 | | 4 | 8 | | 8 |
| Actuated Green, G (s) | 13.8 | 25.1 | | 7.9 | 19.2 | | 43.1 | 36.8 | 36.8 | 42.9 | 36.7 | 36.7 |
| Effective Green, g (s) | 13.8 | 25.1 | | 7.9 | 19.2 | | 43.1 | 36.8 | 36.8 | 42.9 | 36.7 | 36.7 |
| Actuated g/C Ratio | 0.14 | 0.25 | | 0.08 | 0.19 | | 0.43 | 0.37 | 0.37 | 0.43 | 0.37 | 0.37 |
| Clearance Time (s) | 6.0 | 6.0 | | 6.0 | 6.0 | | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | 473 | 865 | | 139 | 673 | | 323 | 1302 | 582 | 184 | 1298 | 580 |
| v/s Ratio Prot | c0.11 | c0.19 | | 0.05 | c0.18 | | c0.03 | c0.30 | | 0.03 | 0.18 | |
| v/s Ratio Perm | | | | | | | 0.20 | | 0.02 | 0.16 | | 0.10 |
| v/c Ratio | 0.82 | 0.77 | | 0.69 | 0.94 | | 0.55 | 0.81 | 0.05 | 0.43 | 0.50 | 0.27 |
| Uniform Delay, d1 | 41.9 | 34.8 | | 44.9 | 39.9 | | 18.5 | 28.5 | 20.3 | 20.0 | 24.5 | 22.2 |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 10.4 | 4.2 | | 13.8 | 21.6 | | 1.9 | 5.6 | 0.1 | 1.6 | 1.4 | 1.1 |
| Delay (s) | 52.3 | 38.9 | | 58.6 | 61.4 | | 20.4 | 34.1 | 20.5 | 21.6 | 25.9 | 23.3 |
| Level of Service | D | D | | E | E | | C | C | C | C | C | C |
| Approach Delay (s) | | 43.7 | | | 61.1 | | | 31.5 | | | 24.7 | |
| Approach LOS | | D | | | E | | | C | | | C | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 38.0 | | | | HCM 2000 Level of Service | | | D | | |
| HCM 2000 Volume to Capacity ratio | | | 0.83 | | | | | | | | | |
| Actuated Cycle Length (s) | | | 100.0 | | | | Sum of lost time (s) | | | 24.0 | | |
| Intersection Capacity Utilization | | | 72.4% | | | | ICU Level of Service | | | C | | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

c Critical Lane Group

HCM 6th Signalized Intersection Summary
 3: Roe Avenue & Johnson Drive/Johnson Drive WB

12/27/2018



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Lane Configurations | ↔↔ | ↕↔ | | ↔ | ↕↔ | | ↔ | ↕↕ | ↔ | ↔ | ↕↕ | ↔ |
| Traffic Volume (veh/h) | 293 | 519 | 95 | 73 | 515 | 25 | 133 | 899 | 52 | 58 | 543 | 318 |
| Future Volume (veh/h) | 293 | 519 | 95 | 73 | 515 | 25 | 133 | 899 | 52 | 58 | 543 | 318 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 |
| Adj Flow Rate, veh/h | 386 | 564 | 119 | 96 | 599 | 40 | 177 | 1058 | 0 | 79 | 646 | 0 |
| Peak Hour Factor | 0.76 | 0.92 | 0.80 | 0.76 | 0.86 | 0.63 | 0.75 | 0.85 | 0.72 | 0.73 | 0.84 | 0.88 |
| Percent Heavy Veh, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Cap, veh/h | 453 | 739 | 155 | 121 | 642 | 43 | 368 | 1382 | | 230 | 1347 | |
| Arrive On Green | 0.13 | 0.25 | 0.25 | 0.07 | 0.19 | 0.19 | 0.06 | 0.39 | 0.00 | 0.05 | 0.38 | 0.00 |
| Sat Flow, veh/h | 3456 | 2922 | 615 | 1781 | 3381 | 225 | 1781 | 3554 | 1585 | 1781 | 3554 | 1585 |
| Grp Volume(v), veh/h | 386 | 342 | 341 | 96 | 314 | 325 | 177 | 1058 | 0 | 79 | 646 | 0 |
| Grp Sat Flow(s),veh/h/ln | 1728 | 1777 | 1760 | 1781 | 1777 | 1830 | 1781 | 1777 | 1585 | 1781 | 1777 | 1585 |
| Q Serve(g_s), s | 10.9 | 17.8 | 17.9 | 5.3 | 17.4 | 17.5 | 6.0 | 25.9 | 0.0 | 2.7 | 13.8 | 0.0 |
| Cycle Q Clear(g_c), s | 10.9 | 17.8 | 17.9 | 5.3 | 17.4 | 17.5 | 6.0 | 25.9 | 0.0 | 2.7 | 13.8 | 0.0 |
| Prop In Lane | 1.00 | | 0.35 | 1.00 | | 0.12 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Lane Grp Cap(c), veh/h | 453 | 449 | 445 | 121 | 338 | 348 | 368 | 1382 | | 230 | 1347 | |
| V/C Ratio(X) | 0.85 | 0.76 | 0.77 | 0.79 | 0.93 | 0.93 | 0.48 | 0.77 | | 0.34 | 0.48 | |
| Avail Cap(c_a), veh/h | 484 | 449 | 445 | 143 | 338 | 348 | 368 | 1382 | | 284 | 1347 | |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 |
| Uniform Delay (d), s/veh | 42.5 | 34.6 | 34.6 | 45.9 | 39.9 | 39.9 | 19.0 | 26.6 | 0.0 | 20.7 | 23.6 | 0.0 |
| Incr Delay (d2), s/veh | 13.1 | 7.5 | 7.8 | 22.2 | 31.8 | 31.7 | 1.0 | 4.1 | 0.0 | 0.9 | 1.2 | 0.0 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 5.4 | 8.5 | 8.5 | 3.1 | 10.5 | 10.8 | 2.5 | 11.2 | 0.0 | 1.1 | 5.8 | 0.0 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 55.6 | 42.1 | 42.4 | 68.1 | 71.6 | 71.6 | 20.0 | 30.7 | 0.0 | 21.6 | 24.8 | 0.0 |
| LnGrp LOS | E | D | D | E | E | E | B | C | | C | C | |
| Approach Vol, veh/h | | 1069 | | | 735 | | | 1235 | A | | 725 | A |
| Approach Delay, s/veh | | 47.1 | | | 71.1 | | | 29.1 | | | 24.4 | |
| Approach LOS | | D | | | E | | | C | | | C | |
| Timer - Assigned Phs | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | | | |
| Phs Duration (G+Y+Rc), s | 19.1 | 25.0 | 11.0 | 44.9 | 12.8 | 31.3 | 12.0 | 43.9 | | | | |
| Change Period (Y+Rc), s | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | | | | |
| Max Green Setting (Gmax), s | 14.0 | 19.0 | 8.0 | 35.0 | 8.0 | 25.0 | 6.0 | 37.0 | | | | |
| Max Q Clear Time (g_c+I1), s | 12.9 | 19.5 | 4.7 | 27.9 | 7.3 | 19.9 | 8.0 | 15.8 | | | | |
| Green Ext Time (p_c), s | 0.2 | 0.0 | 0.0 | 3.9 | 0.0 | 1.9 | 0.0 | 4.3 | | | | |

Intersection Summary

| | |
|--------------------|------|
| HCM 6th Ctrl Delay | 41.5 |
| HCM 6th LOS | D |

Notes

Unsignalized Delay for [NBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Queues

6: Roeland Drive & Martway Street/Drive 3

12/27/2018



| Lane Group | EBL | EBT | WBL | WBT | NBL | NBT | SBL | SBT |
|-------------------------|------|------|------|------|------|------|------|------|
| Lane Group Flow (vph) | 81 | 105 | 103 | 22 | 56 | 254 | 23 | 149 |
| v/c Ratio | 0.24 | 0.13 | 0.40 | 0.03 | 0.11 | 0.31 | 0.06 | 0.23 |
| Control Delay | 19.0 | 0.3 | 26.5 | 0.1 | 11.0 | 9.0 | 18.2 | 15.3 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 19.0 | 0.3 | 26.5 | 0.1 | 11.0 | 9.0 | 18.2 | 15.3 |
| Queue Length 50th (ft) | 15 | 0 | 20 | 0 | 9 | 31 | 4 | 20 |
| Queue Length 95th (ft) | 52 | 0 | #62 | 0 | 20 | 45 | 20 | 61 |
| Internal Link Dist (ft) | | 773 | | 153 | | 238 | | 267 |
| Turn Bay Length (ft) | 105 | | | | 115 | | 75 | |
| Base Capacity (vph) | 553 | 931 | 256 | 834 | 526 | 1054 | 410 | 672 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.15 | 0.11 | 0.40 | 0.03 | 0.11 | 0.24 | 0.06 | 0.22 |

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

6: Roeland Drive & Martway Street/Drive 3

12/27/2018



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|------------------------|-------|------|------|-------|------|------|-------|-------|------|------|------|------|
| Lane Configurations | ↔ | ↔ | | ↔ | ↔ | | ↔ | ↔ | | ↔ | ↔ | |
| Traffic Volume (vph) | 73 | 0 | 63 | 80 | 0 | 17 | 37 | 91 | 87 | 18 | 78 | 42 |
| Future Volume (vph) | 73 | 0 | 63 | 80 | 0 | 17 | 37 | 91 | 87 | 18 | 78 | 42 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 5.0 | 5.0 | | 5.4 | 5.4 | | 5.0 | 5.0 | | 5.0 | 5.0 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.85 | | 1.00 | 0.85 | | 1.00 | 0.93 | | 1.00 | 0.95 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1770 | 1583 | | 1770 | 1583 | | 1770 | 1740 | | 1770 | 1776 | |
| Flt Permitted | 0.95 | 1.00 | | 0.80 | 1.00 | | 0.48 | 1.00 | | 0.60 | 1.00 | |
| Satd. Flow (perm) | 1770 | 1583 | | 1490 | 1583 | | 893 | 1740 | | 1121 | 1776 | |
| Peak-hour factor, PHF | 0.90 | 0.92 | 0.60 | 0.78 | 0.92 | 0.78 | 0.66 | 0.64 | 0.78 | 0.78 | 0.76 | 0.92 |
| Adj. Flow (vph) | 81 | 0 | 105 | 103 | 0 | 22 | 56 | 142 | 112 | 23 | 103 | 46 |
| RTOR Reduction (vph) | 0 | 92 | 0 | 0 | 20 | 0 | 0 | 47 | 0 | 0 | 25 | 0 |
| Lane Group Flow (vph) | 81 | 13 | 0 | 103 | 2 | 0 | 56 | 207 | 0 | 23 | 124 | 0 |
| Turn Type | Split | NA | | Perm | NA | | pm+pt | NA | | Perm | NA | |
| Protected Phases | 6 | 6 | | | 2 | | 7 | 4 | | | 8 | |
| Permitted Phases | | | | 2 | | | 4 | 4 | | 8 | | |
| Actuated Green, G (s) | 6.0 | 6.0 | | 5.0 | 5.0 | | 20.3 | 20.3 | | 13.1 | 13.1 | |
| Effective Green, g (s) | 6.0 | 6.0 | | 5.0 | 5.0 | | 20.3 | 20.3 | | 13.1 | 13.1 | |
| Actuated g/C Ratio | 0.13 | 0.13 | | 0.11 | 0.11 | | 0.43 | 0.43 | | 0.28 | 0.28 | |
| Clearance Time (s) | 5.0 | 5.0 | | 5.4 | 5.4 | | 5.0 | 5.0 | | 5.0 | 5.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 227 | 203 | | 159 | 169 | | 429 | 756 | | 314 | 498 | |
| v/s Ratio Prot | c0.05 | 0.01 | | | 0.00 | | 0.01 | c0.12 | | | 0.07 | |
| v/s Ratio Perm | | | | c0.07 | | | 0.05 | | | 0.02 | | |
| v/c Ratio | 0.36 | 0.07 | | 0.65 | 0.01 | | 0.13 | 0.27 | | 0.07 | 0.25 | |
| Uniform Delay, d1 | 18.6 | 17.9 | | 20.0 | 18.6 | | 8.0 | 8.5 | | 12.3 | 13.0 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 1.0 | 0.1 | | 8.8 | 0.0 | | 0.1 | 0.2 | | 0.1 | 0.3 | |
| Delay (s) | 19.6 | 18.0 | | 28.8 | 18.7 | | 8.1 | 8.7 | | 12.4 | 13.3 | |
| Level of Service | B | B | | C | B | | A | A | | B | B | |
| Approach Delay (s) | | 18.7 | | | 27.0 | | | 8.6 | | | 13.1 | |
| Approach LOS | | B | | | C | | | A | | | B | |

Intersection Summary

| | | | |
|-----------------------------------|-------|---------------------------|------|
| HCM 2000 Control Delay | 14.8 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.41 | | |
| Actuated Cycle Length (s) | 46.7 | Sum of lost time (s) | 20.4 |
| Intersection Capacity Utilization | 34.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

HCM 6th Signalized Intersection Summary
6: Roeland Drive & Martway Street/Drive 3

12/27/2018



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|------------------------------|------|-------|------|------|------|------|------|------|------|------|------|------|
| Lane Configurations | ↖ | ↗ | | ↖ | ↗ | | ↖ | ↗ | | ↖ | ↗ | |
| Traffic Volume (veh/h) | 73 | 0 | 63 | 80 | 0 | 17 | 37 | 91 | 87 | 18 | 78 | 42 |
| Future Volume (veh/h) | 73 | 0 | 63 | 80 | 0 | 17 | 37 | 91 | 87 | 18 | 78 | 42 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 |
| Adj Flow Rate, veh/h | 81 | 0 | 105 | 103 | 0 | 22 | 56 | 142 | 112 | 23 | 103 | 46 |
| Peak Hour Factor | 0.90 | 0.92 | 0.60 | 0.78 | 0.92 | 0.78 | 0.66 | 0.64 | 0.78 | 0.78 | 0.76 | 0.92 |
| Percent Heavy Veh, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Cap, veh/h | 239 | 0 | 212 | 204 | 0 | 182 | 406 | 343 | 271 | 360 | 190 | 85 |
| Arrive On Green | 0.13 | 0.00 | 0.13 | 0.11 | 0.00 | 0.11 | 0.07 | 0.35 | 0.35 | 0.15 | 0.15 | 0.15 |
| Sat Flow, veh/h | 1781 | 0 | 1585 | 1781 | 0 | 1585 | 1781 | 969 | 764 | 1126 | 1225 | 547 |
| Grp Volume(v), veh/h | 81 | 0 | 105 | 103 | 0 | 22 | 56 | 0 | 254 | 23 | 0 | 149 |
| Grp Sat Flow(s),veh/h/ln | 1781 | 0 | 1585 | 1781 | 0 | 1585 | 1781 | 0 | 1733 | 1126 | 0 | 1772 |
| Q Serve(g_s), s | 1.6 | 0.0 | 2.4 | 2.1 | 0.0 | 0.5 | 0.9 | 0.0 | 4.3 | 0.7 | 0.0 | 3.0 |
| Cycle Q Clear(g_c), s | 1.6 | 0.0 | 2.4 | 2.1 | 0.0 | 0.5 | 0.9 | 0.0 | 4.3 | 0.7 | 0.0 | 3.0 |
| Prop In Lane | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 0.44 | 1.00 | | 0.31 |
| Lane Grp Cap(c), veh/h | 239 | 0 | 212 | 204 | 0 | 182 | 406 | 0 | 613 | 360 | 0 | 274 |
| V/C Ratio(X) | 0.34 | 0.00 | 0.49 | 0.50 | 0.00 | 0.12 | 0.14 | 0.00 | 0.41 | 0.06 | 0.00 | 0.54 |
| Avail Cap(c_a), veh/h | 552 | 0 | 491 | 303 | 0 | 270 | 603 | 0 | 939 | 447 | 0 | 412 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 1.00 |
| Uniform Delay (d), s/veh | 15.2 | 0.0 | 15.6 | 16.1 | 0.0 | 15.4 | 10.8 | 0.0 | 9.5 | 14.1 | 0.0 | 15.1 |
| Incr Delay (d2), s/veh | 0.8 | 0.0 | 1.8 | 1.9 | 0.0 | 0.3 | 0.2 | 0.0 | 0.4 | 0.1 | 0.0 | 1.7 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 0.5 | 0.0 | 0.7 | 0.8 | 0.0 | 0.1 | 0.3 | 0.0 | 1.3 | 0.2 | 0.0 | 1.1 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 16.1 | 0.0 | 17.3 | 18.0 | 0.0 | 15.7 | 11.0 | 0.0 | 9.9 | 14.2 | 0.0 | 16.8 |
| LnGrp LOS | B | A | B | B | A | B | B | A | A | B | A | B |
| Approach Vol, veh/h | | 186 | | | 125 | | | 310 | | | 172 | |
| Approach Delay, s/veh | | 16.8 | | | 17.6 | | | 10.1 | | | 16.4 | |
| Approach LOS | | B | | | B | | | B | | | B | |
| Timer - Assigned Phs | | 2 | | 4 | | 6 | 7 | 8 | | | | |
| Phs Duration (G+Y+Rc), s | | 9.8 | | 18.7 | | 10.2 | 7.7 | 11.0 | | | | |
| Change Period (Y+Rc), s | | * 5.4 | | 5.0 | | 5.0 | 5.0 | 5.0 | | | | |
| Max Green Setting (Gmax), s | | * 6.6 | | 21.0 | | 12.0 | 7.0 | 9.0 | | | | |
| Max Q Clear Time (g_c+I1), s | | 4.1 | | 6.3 | | 4.4 | 2.9 | 5.0 | | | | |
| Green Ext Time (p_c), s | | 0.1 | | 1.3 | | 0.4 | 0.0 | 0.3 | | | | |

Intersection Summary

| | |
|--------------------|------|
| HCM 6th Ctrl Delay | 14.2 |
| HCM 6th LOS | B |

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

| Intersection | | | | | | |
|--------------------------|------|------|------|------|------|------|
| Int Delay, s/veh | 0 | | | | | |
| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
| Lane Configurations | | ↗ | | ↕↕ | ↕↕ | ↗ |
| Traffic Vol, veh/h | 0 | 3 | 0 | 1084 | 692 | 19 |
| Future Vol, veh/h | 0 | 3 | 0 | 1084 | 692 | 19 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Stop | Stop | Free | Free | Free | Free |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | - | 0 | - | - | - | 100 |
| Veh in Median Storage, # | 0 | - | - | 0 | 0 | - |
| Grade, % | 0 | - | - | 0 | 0 | - |
| Peak Hour Factor | 92 | 78 | 92 | 92 | 85 | 78 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 0 | 4 | 0 | 1178 | 814 | 24 |

| Major/Minor | Minor2 | Major1 | Major2 |
|----------------------|--------|--------|--------|
| Conflicting Flow All | - | 407 | 0 |
| Stage 1 | - | - | - |
| Stage 2 | - | - | - |
| Critical Hdwy | - | 6.94 | - |
| Critical Hdwy Stg 1 | - | - | - |
| Critical Hdwy Stg 2 | - | - | - |
| Follow-up Hdwy | - | 3.32 | - |
| Pot Cap-1 Maneuver | 0 | 593 | 0 |
| Stage 1 | 0 | - | 0 |
| Stage 2 | 0 | - | 0 |
| Platoon blocked, % | | | - |
| Mov Cap-1 Maneuver | - | 593 | - |
| Mov Cap-2 Maneuver | - | - | - |
| Stage 1 | - | - | - |
| Stage 2 | - | - | - |

| Approach | EB | NB | SB |
|----------------------|------|----|----|
| HCM Control Delay, s | 11.1 | 0 | 0 |
| HCM LOS | B | | |

| Minor Lane/Major Mvmt | NBT | EBLn1 | SBT | SBR |
|-----------------------|-----|-------|-----|-----|
| Capacity (veh/h) | - | 593 | - | - |
| HCM Lane V/C Ratio | - | 0.006 | - | - |
| HCM Control Delay (s) | - | 11.1 | - | - |
| HCM Lane LOS | - | B | - | - |
| HCM 95th %tile Q(veh) | - | 0 | - | - |

| Intersection | | | | | | |
|--------------------------|------|------|------|------|------|-------|
| Int Delay, s/veh | 2.9 | | | | | |
| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
| Lane Configurations | ↔ | | ↔ | ↕↕ | ↔ | ↔ |
| Traffic Vol, veh/h | 805 | 15 | 135 | 831 | 30 | 102 |
| Future Vol, veh/h | 805 | 15 | 135 | 831 | 30 | 102 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Stop | Stop |
| RT Channelized | - | None | - | None | - | Yield |
| Storage Length | - | - | 150 | - | 100 | 0 |
| Veh in Median Storage, # | 0 | - | - | 0 | 0 | - |
| Grade, % | 0 | - | - | 0 | 0 | - |
| Peak Hour Factor | 92 | 78 | 79 | 92 | 78 | 79 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 875 | 19 | 171 | 903 | 38 | 129 |

| Major/Minor | Major1 | Major2 | Minor1 | | |
|----------------------|--------|--------|--------|---|-------------|
| Conflicting Flow All | 0 | 0 | 894 | 0 | 1679 885 |
| Stage 1 | - | - | - | - | 885 - |
| Stage 2 | - | - | - | - | 794 - |
| Critical Hdwy | - | - | 4.13 | - | 6.63 6.23 |
| Critical Hdwy Stg 1 | - | - | - | - | 5.43 - |
| Critical Hdwy Stg 2 | - | - | - | - | 5.83 - |
| Follow-up Hdwy | - | - | 2.219 | - | 3.519 3.319 |
| Pot Cap-1 Maneuver | - | - | 757 | - | 95 343 |
| Stage 1 | - | - | - | - | 402 - |
| Stage 2 | - | - | - | - | 407 - |
| Platoon blocked, % | - | - | - | - | - |
| Mov Cap-1 Maneuver | - | - | 757 | - | 74 343 |
| Mov Cap-2 Maneuver | - | - | - | - | 155 - |
| Stage 1 | - | - | - | - | 311 - |
| Stage 2 | - | - | - | - | 407 - |

| Approach | EB | WB | NB |
|----------------------|----|-----|------|
| HCM Control Delay, s | 0 | 1.8 | 24.9 |
| HCM LOS | | | C |

| Minor Lane/Major Mvmt | NBLn1 | NBLn2 | EBT | EBR | WBL | WBT |
|-----------------------|-------|-------|-----|-----|-------|-----|
| Capacity (veh/h) | 155 | 343 | - | - | 757 | - |
| HCM Lane V/C Ratio | 0.248 | 0.376 | - | - | 0.226 | - |
| HCM Control Delay (s) | 35.7 | 21.7 | - | - | 11.1 | - |
| HCM Lane LOS | E | C | - | - | B | - |
| HCM 95th %tile Q(veh) | 0.9 | 1.7 | - | - | 0.9 | - |

| Intersection | | | | | | |
|--------------------------|------|------|------|------|------|------|
| Int Delay, s/veh | 5.5 | | | | | |
| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
| Lane Configurations | ↘ | ↗ | ↖ | | ↘ | ↗ |
| Traffic Vol, veh/h | 237 | 19 | 196 | 262 | 18 | 203 |
| Future Vol, veh/h | 237 | 19 | 196 | 262 | 18 | 203 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Stop | Stop | Free | Free | Free | Free |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | 0 | 0 | - | - | 75 | - |
| Veh in Median Storage, # | 0 | - | 0 | - | - | 0 |
| Grade, % | 0 | - | 0 | - | - | 0 |
| Peak Hour Factor | 85 | 78 | 85 | 85 | 78 | 87 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 279 | 24 | 231 | 308 | 23 | 233 |

| Major/Minor | Minor1 | Major1 | Major2 | | |
|----------------------|--------|--------|--------|---|-------|
| Conflicting Flow All | 664 | 385 | 0 | 0 | 539 |
| Stage 1 | 385 | - | - | - | - |
| Stage 2 | 279 | - | - | - | - |
| Critical Hdwy | 6.42 | 6.22 | - | - | 4.12 |
| Critical Hdwy Stg 1 | 5.42 | - | - | - | - |
| Critical Hdwy Stg 2 | 5.42 | - | - | - | - |
| Follow-up Hdwy | 3.518 | 3.318 | - | - | 2.218 |
| Pot Cap-1 Maneuver | 426 | 663 | - | - | 1029 |
| Stage 1 | 688 | - | - | - | - |
| Stage 2 | 768 | - | - | - | - |
| Platoon blocked, % | | | - | - | - |
| Mov Cap-1 Maneuver | 417 | 663 | - | - | 1029 |
| Mov Cap-2 Maneuver | 512 | - | - | - | - |
| Stage 1 | 673 | - | - | - | - |
| Stage 2 | 768 | - | - | - | - |

| Approach | WB | NB | SB |
|----------------------|------|----|-----|
| HCM Control Delay, s | 19.3 | 0 | 0.8 |
| HCM LOS | C | | |

| Minor Lane/Major Mvmt | NBT | NBRWBLn1 | WBLn2 | SBL | SBT |
|-----------------------|-----|----------|-------|-------|-------|
| Capacity (veh/h) | - | - | 512 | 663 | 1029 |
| HCM Lane V/C Ratio | - | - | 0.545 | 0.037 | 0.022 |
| HCM Control Delay (s) | - | - | 20.1 | 10.6 | 8.6 |
| HCM Lane LOS | - | - | C | B | A |
| HCM 95th %tile Q(veh) | - | - | 3.2 | 0.1 | 0.1 |

| Intersection | | | | | | |
|--------------------------|------|------|------|------|------|------|
| Int Delay, s/veh | 0.1 | | | | | |
| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
| Lane Configurations | | ↗ | | ↕↕ | ↕↕ | ↗ |
| Traffic Vol, veh/h | 0 | 16 | 0 | 1084 | 676 | 19 |
| Future Vol, veh/h | 0 | 16 | 0 | 1084 | 676 | 19 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Stop | Stop | Free | Free | Free | Free |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | - | 0 | - | - | - | 100 |
| Veh in Median Storage, # | 0 | - | - | 0 | 0 | - |
| Grade, % | 0 | - | - | 0 | 0 | - |
| Peak Hour Factor | 92 | 78 | 78 | 92 | 85 | 78 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 0 | 21 | 0 | 1178 | 795 | 24 |

| Major/Minor | Minor2 | Major1 | Major2 | | |
|----------------------|--------|--------|--------|---|---|
| Conflicting Flow All | - | 398 | - | 0 | - |
| Stage 1 | - | - | - | - | - |
| Stage 2 | - | - | - | - | - |
| Critical Hdwy | - | 6.94 | - | - | - |
| Critical Hdwy Stg 1 | - | - | - | - | - |
| Critical Hdwy Stg 2 | - | - | - | - | - |
| Follow-up Hdwy | - | 3.32 | - | - | - |
| Pot Cap-1 Maneuver | 0 | 601 | 0 | - | - |
| Stage 1 | 0 | - | 0 | - | - |
| Stage 2 | 0 | - | 0 | - | - |
| Platoon blocked, % | | | | - | - |
| Mov Cap-1 Maneuver | - | 601 | - | - | - |
| Mov Cap-2 Maneuver | - | - | - | - | - |
| Stage 1 | - | - | - | - | - |
| Stage 2 | - | - | - | - | - |

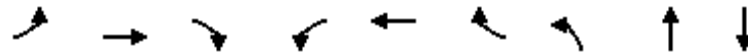
| Approach | EB | NB | SB |
|----------------------|------|----|----|
| HCM Control Delay, s | 11.2 | 0 | 0 |
| HCM LOS | B | | |

| Minor Lane/Major Mvmt | NBT | EBLn1 | SBT | SBR |
|-----------------------|-----|-------|-----|-----|
| Capacity (veh/h) | - | 601 | - | - |
| HCM Lane V/C Ratio | - | 0.034 | - | - |
| HCM Control Delay (s) | - | 11.2 | - | - |
| HCM Lane LOS | - | B | - | - |
| HCM 95th %tile Q(veh) | - | 0.1 | - | - |

Queues

29: Roeland Drive & Johnson Drive

12/27/2018



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | SBT |
|-------------------------|------|------|------|------|------|------|------|------|------|
| Lane Group Flow (vph) | 48 | 843 | 71 | 76 | 911 | 24 | 80 | 144 | 52 |
| v/c Ratio | 0.18 | 0.80 | 0.07 | 0.26 | 0.81 | 0.02 | 0.31 | 0.37 | 0.28 |
| Control Delay | 6.7 | 23.3 | 0.2 | 7.4 | 23.0 | 0.0 | 31.3 | 11.9 | 22.8 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 6.7 | 23.3 | 0.2 | 7.4 | 23.0 | 0.0 | 31.3 | 11.9 | 22.8 |
| Queue Length 50th (ft) | 8 | 364 | 0 | 12 | 415 | 0 | 36 | 12 | 8 |
| Queue Length 95th (ft) | 16 | #552 | 0 | 24 | #693 | 0 | 69 | 60 | 15 |
| Internal Link Dist (ft) | | 180 | | | 464 | | | 267 | 783 |
| Turn Bay Length (ft) | 100 | | 100 | 130 | | | 100 | | |
| Base Capacity (vph) | 288 | 1206 | 1076 | 306 | 1209 | 1078 | 262 | 556 | 231 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.17 | 0.70 | 0.07 | 0.25 | 0.75 | 0.02 | 0.31 | 0.26 | 0.23 |

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

29: Roeland Drive & Johnson Drive

12/27/2018



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|------------------------|-------|------|------|-------|-------|------|-------|------|------|------|------|------|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 36 | 725 | 65 | 59 | 793 | 9 | 66 | 26 | 93 | 2 | 6 | 23 |
| Future Volume (vph) | 36 | 725 | 65 | 59 | 793 | 9 | 66 | 26 | 93 | 2 | 6 | 23 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | | | 5.0 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.88 | | | 0.91 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 1.00 | |
| Satd. Flow (prot) | 1770 | 1863 | 1583 | 1770 | 1863 | 1583 | 1770 | 1638 | | | 1682 | |
| Flt Permitted | 0.12 | 1.00 | 1.00 | 0.13 | 1.00 | 1.00 | 0.57 | 1.00 | | | 0.96 | |
| Satd. Flow (perm) | 217 | 1863 | 1583 | 245 | 1863 | 1583 | 1069 | 1638 | | | 1614 | |
| Peak-hour factor, PHF | 0.75 | 0.86 | 0.91 | 0.78 | 0.87 | 0.38 | 0.83 | 0.93 | 0.80 | 0.50 | 0.50 | 0.64 |
| Adj. Flow (vph) | 48 | 843 | 71 | 76 | 911 | 24 | 80 | 28 | 116 | 4 | 12 | 36 |
| RTOR Reduction (vph) | 0 | 0 | 32 | 0 | 0 | 10 | 0 | 93 | 0 | 0 | 33 | 0 |
| Lane Group Flow (vph) | 48 | 843 | 39 | 76 | 911 | 14 | 80 | 51 | 0 | 0 | 19 | 0 |
| Turn Type | pm+pt | NA | Perm | pm+pt | NA | Perm | pm+pt | NA | | Perm | NA | |
| Protected Phases | 1 | 6 | | 5 | 2 | | 7 | 4 | | | 8 | |
| Permitted Phases | 6 | | 6 | 2 | | 2 | 4 | | 8 | | | |
| Actuated Green, G (s) | 47.6 | 44.2 | 44.2 | 51.2 | 46.0 | 46.0 | 16.0 | 16.0 | | | 5.6 | |
| Effective Green, g (s) | 47.6 | 44.2 | 44.2 | 51.2 | 46.0 | 46.0 | 16.0 | 16.0 | | | 5.6 | |
| Actuated g/C Ratio | 0.59 | 0.55 | 0.55 | 0.64 | 0.57 | 0.57 | 0.20 | 0.20 | | | 0.07 | |
| Clearance Time (s) | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | | | 5.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | | 3.0 | |
| Lane Grp Cap (vph) | 194 | 1024 | 870 | 254 | 1065 | 905 | 259 | 325 | | | 112 | |
| v/s Ratio Prot | 0.01 | 0.45 | | c0.02 | c0.49 | | c0.02 | 0.03 | | | | |
| v/s Ratio Perm | 0.14 | | 0.02 | 0.17 | | 0.01 | c0.04 | | | | 0.01 | |
| v/c Ratio | 0.25 | 0.82 | 0.04 | 0.30 | 0.86 | 0.02 | 0.31 | 0.16 | | | 0.17 | |
| Uniform Delay, d1 | 12.3 | 14.9 | 8.4 | 11.3 | 14.4 | 7.4 | 27.2 | 26.6 | | | 35.2 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 1.00 | |
| Incremental Delay, d2 | 0.7 | 5.5 | 0.0 | 0.7 | 6.9 | 0.0 | 0.7 | 0.2 | | | 0.7 | |
| Delay (s) | 13.0 | 20.3 | 8.4 | 12.0 | 21.3 | 7.4 | 27.9 | 26.9 | | | 35.9 | |
| Level of Service | B | C | A | B | C | A | C | C | | | D | |
| Approach Delay (s) | | 19.1 | | | 20.3 | | | 27.2 | | | 35.9 | |
| Approach LOS | | B | | | C | | | C | | | D | |

Intersection Summary

| | | | |
|-----------------------------------|-------|---------------------------|------|
| HCM 2000 Control Delay | 20.8 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.75 | | |
| Actuated Cycle Length (s) | 80.4 | Sum of lost time (s) | 20.0 |
| Intersection Capacity Utilization | 67.7% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

HCM 6th Signalized Intersection Summary
 29: Roeland Drive & Johnson Drive

12/27/2018

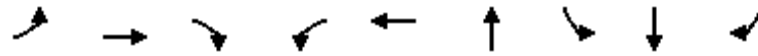


| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Lane Configurations | ↖ | ↑ | ↗ | ↖ | ↑ | ↗ | ↖ | ↗ | | | ↕ | |
| Traffic Volume (veh/h) | 36 | 725 | 65 | 59 | 793 | 9 | 66 | 26 | 93 | 2 | 6 | 23 |
| Future Volume (veh/h) | 36 | 725 | 65 | 59 | 793 | 9 | 66 | 26 | 93 | 2 | 6 | 23 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 |
| Adj Flow Rate, veh/h | 48 | 843 | 71 | 76 | 911 | 24 | 80 | 28 | 116 | 4 | 12 | 36 |
| Peak Hour Factor | 0.75 | 0.86 | 0.91 | 0.78 | 0.87 | 0.38 | 0.83 | 0.93 | 0.80 | 0.50 | 0.50 | 0.64 |
| Percent Heavy Veh, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Cap, veh/h | 247 | 984 | 833 | 293 | 1008 | 854 | 369 | 67 | 277 | 57 | 35 | 89 |
| Arrive On Green | 0.05 | 0.53 | 0.53 | 0.06 | 0.54 | 0.54 | 0.06 | 0.21 | 0.21 | 0.08 | 0.08 | 0.08 |
| Sat Flow, veh/h | 1781 | 1870 | 1585 | 1781 | 1870 | 1585 | 1781 | 318 | 1316 | 62 | 441 | 1132 |
| Grp Volume(v), veh/h | 48 | 843 | 71 | 76 | 911 | 24 | 80 | 0 | 144 | 52 | 0 | 0 |
| Grp Sat Flow(s),veh/h/ln | 1781 | 1870 | 1585 | 1781 | 1870 | 1585 | 1781 | 0 | 1634 | 1635 | 0 | 0 |
| Q Serve(g_s), s | 0.9 | 29.2 | 1.7 | 1.4 | 32.8 | 0.5 | 2.9 | 0.0 | 5.7 | 0.0 | 0.0 | 0.0 |
| Cycle Q Clear(g_c), s | 0.9 | 29.2 | 1.7 | 1.4 | 32.8 | 0.5 | 2.9 | 0.0 | 5.7 | 2.2 | 0.0 | 0.0 |
| Prop In Lane | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 0.81 | 0.08 | | 0.69 |
| Lane Grp Cap(c), veh/h | 247 | 984 | 833 | 293 | 1008 | 854 | 369 | 0 | 344 | 180 | 0 | 0 |
| V/C Ratio(X) | 0.19 | 0.86 | 0.09 | 0.26 | 0.90 | 0.03 | 0.22 | 0.00 | 0.42 | 0.29 | 0.00 | 0.00 |
| Avail Cap(c_a), veh/h | 323 | 1173 | 994 | 346 | 1173 | 994 | 419 | 0 | 458 | 247 | 0 | 0 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 0.00 |
| Uniform Delay (d), s/veh | 14.3 | 15.3 | 8.8 | 13.1 | 15.5 | 8.1 | 27.0 | 0.0 | 25.6 | 32.8 | 0.0 | 0.0 |
| Incr Delay (d2), s/veh | 0.4 | 5.6 | 0.0 | 0.5 | 9.0 | 0.0 | 0.3 | 0.0 | 0.8 | 0.9 | 0.0 | 0.0 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 0.3 | 12.3 | 0.5 | 0.5 | 14.4 | 0.2 | 1.2 | 0.0 | 2.2 | 0.9 | 0.0 | 0.0 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 14.6 | 21.0 | 8.9 | 13.5 | 24.6 | 8.1 | 27.3 | 0.0 | 26.4 | 33.7 | 0.0 | 0.0 |
| LnGrp LOS | B | C | A | B | C | A | C | A | C | C | A | A |
| Approach Vol, veh/h | | 962 | | | 1011 | | | 224 | | | | 52 |
| Approach Delay, s/veh | | 19.8 | | | 23.3 | | | 26.7 | | | | 33.7 |
| Approach LOS | | B | | | C | | | C | | | | C |
| Timer - Assigned Phs | 1 | 2 | | 4 | 5 | 6 | 7 | 8 | | | | |
| Phs Duration (G+Y+Rc), s | 8.8 | 45.4 | | 20.8 | 9.8 | 44.4 | 9.9 | 10.9 | | | | |
| Change Period (Y+Rc), s | 5.0 | 5.0 | | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | | | | |
| Max Green Setting (Gmax), s | 7.0 | 47.0 | | 21.0 | 7.0 | 47.0 | 7.0 | 9.0 | | | | |
| Max Q Clear Time (g_c+I1), s | 2.9 | 34.8 | | 7.7 | 3.4 | 31.2 | 4.9 | 4.2 | | | | |
| Green Ext Time (p_c), s | 0.0 | 5.6 | | 0.6 | 0.0 | 6.0 | 0.0 | 0.1 | | | | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 6th Ctrl Delay | | | | 22.4 | | | | | | | | |
| HCM 6th LOS | | | | C | | | | | | | | |

Queues

1470: Roeland Drive & Shawnee Mission Parkway

12/27/2018



| Lane Group | EBL | EBT | EBR | WBL | WBT | NBT | SBL | SBT | SBR |
|-------------------------|------|-------|------|------|-------|------|------|------|------|
| Lane Group Flow (vph) | 279 | 2200 | 136 | 32 | 3234 | 152 | 151 | 155 | 252 |
| v/c Ratio | 1.03 | 1.11 | 0.09 | 0.17 | 1.48 | 0.84 | 0.76 | 0.76 | 0.62 |
| Control Delay | 76.5 | 70.6 | 0.0 | 49.6 | 247.0 | 86.9 | 74.9 | 73.9 | 12.8 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 76.5 | 70.6 | 0.0 | 49.6 | 247.0 | 86.9 | 74.9 | 73.9 | 12.8 |
| Queue Length 50th (ft) | ~238 | ~1181 | 0 | 22 | ~1398 | 115 | 120 | 123 | 0 |
| Queue Length 95th (ft) | m133 | m525 | m0 | 44 | #1504 | 145 | 188 | 171 | 70 |
| Internal Link Dist (ft) | | 682 | | | 2401 | 499 | | 332 | |
| Turn Bay Length (ft) | 345 | | 310 | 170 | | | 100 | | 125 |
| Base Capacity (vph) | 272 | 1985 | 1583 | 228 | 2182 | 189 | 231 | 238 | 435 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 1.03 | 1.11 | 0.09 | 0.14 | 1.48 | 0.80 | 0.65 | 0.65 | 0.58 |

Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
- m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis
 1470: Roeland Drive & Shawnee Mission Parkway

12/27/2018



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|------------------------|-------|-------|-------|------|-------|------|-------|-------|------|-------|------|------|
| Lane Configurations | ↗ | ↑↑ | ↖ | ↗ | ↑↑↑ | | | ↕ | | ↗ | ↖ | ↗ |
| Traffic Volume (vph) | 243 | 2068 | 103 | 24 | 2806 | 221 | 68 | 37 | 7 | 193 | 66 | 222 |
| Future Volume (vph) | 243 | 2068 | 103 | 24 | 2806 | 221 | 68 | 37 | 7 | 193 | 66 | 222 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.5 | 5.5 | 4.0 | 4.5 | 5.5 | | | 4.5 | | 4.5 | 4.5 | 4.5 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | *0.84 | | | 1.00 | | 0.95 | 0.95 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | | | 0.99 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 0.97 | | 0.95 | 0.98 | 1.00 |
| Satd. Flow (prot) | 1770 | 3539 | 1583 | 1770 | 4633 | | | 1791 | | 1681 | 1730 | 1583 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 0.97 | | 0.95 | 0.98 | 1.00 |
| Satd. Flow (perm) | 1770 | 3539 | 1583 | 1770 | 4633 | | | 1791 | | 1681 | 1730 | 1583 |
| Peak-hour factor, PHF | 0.87 | 0.94 | 0.76 | 0.75 | 0.95 | 0.79 | 0.77 | 0.71 | 0.58 | 0.87 | 0.79 | 0.88 |
| Adj. Flow (vph) | 279 | 2200 | 136 | 32 | 2954 | 280 | 88 | 52 | 12 | 222 | 84 | 252 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 3 | 0 | 0 | 0 | 222 |
| Lane Group Flow (vph) | 279 | 2200 | 136 | 32 | 3226 | 0 | 0 | 149 | 0 | 151 | 155 | 30 |
| Turn Type | Prot | NA | Free | Prot | NA | | Split | NA | | Split | NA | Perm |
| Protected Phases | 1 | 6 | | 5 | 2 | | 4 | 4 | | 8 | 8 | |
| Permitted Phases | | | Free | | | | | | | | | 8 |
| Actuated Green, G (s) | 20.3 | 65.5 | 120.0 | 9.3 | 54.5 | | | 12.0 | | 14.2 | 14.2 | 14.2 |
| Effective Green, g (s) | 20.3 | 65.5 | 120.0 | 9.3 | 54.5 | | | 12.0 | | 14.2 | 14.2 | 14.2 |
| Actuated g/C Ratio | 0.17 | 0.55 | 1.00 | 0.08 | 0.45 | | | 0.10 | | 0.12 | 0.12 | 0.12 |
| Clearance Time (s) | 4.5 | 5.5 | | 4.5 | 5.5 | | | 4.5 | | 4.5 | 4.5 | 4.5 |
| Vehicle Extension (s) | 1.5 | 2.0 | | 1.5 | 2.0 | | | 2.0 | | 2.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 299 | 1931 | 1583 | 137 | 2104 | | | 179 | | 198 | 204 | 187 |
| v/s Ratio Prot | c0.16 | c0.62 | | 0.02 | c0.70 | | | c0.08 | | c0.09 | 0.09 | |
| v/s Ratio Perm | | | 0.09 | | | | | | | | | 0.02 |
| v/c Ratio | 0.93 | 1.14 | 0.09 | 0.23 | 1.53 | | | 0.83 | | 0.76 | 0.76 | 0.16 |
| Uniform Delay, d1 | 49.2 | 27.2 | 0.0 | 52.0 | 32.8 | | | 53.0 | | 51.3 | 51.2 | 47.5 |
| Progression Factor | 1.07 | 0.64 | 1.00 | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 5.6 | 63.4 | 0.0 | 0.3 | 242.4 | | | 26.0 | | 14.4 | 13.4 | 0.1 |
| Delay (s) | 58.4 | 80.8 | 0.0 | 52.3 | 275.1 | | | 79.0 | | 65.7 | 64.7 | 47.7 |
| Level of Service | E | F | A | D | F | | | E | | E | E | D |
| Approach Delay (s) | | 74.2 | | | 272.9 | | | 79.0 | | | 57.3 | |
| Approach LOS | | E | | | F | | | E | | | E | |

Intersection Summary

| | | | |
|-----------------------------------|-------|---------------------------|------|
| HCM 2000 Control Delay | 171.4 | HCM 2000 Level of Service | F |
| HCM 2000 Volume to Capacity ratio | 1.23 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 19.0 |
| Intersection Capacity Utilization | 97.5% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

HCM 6th Edition methodology does not support turning movements with shared & exclusive lanes.

Drive Spacing – Influence Are Calculations

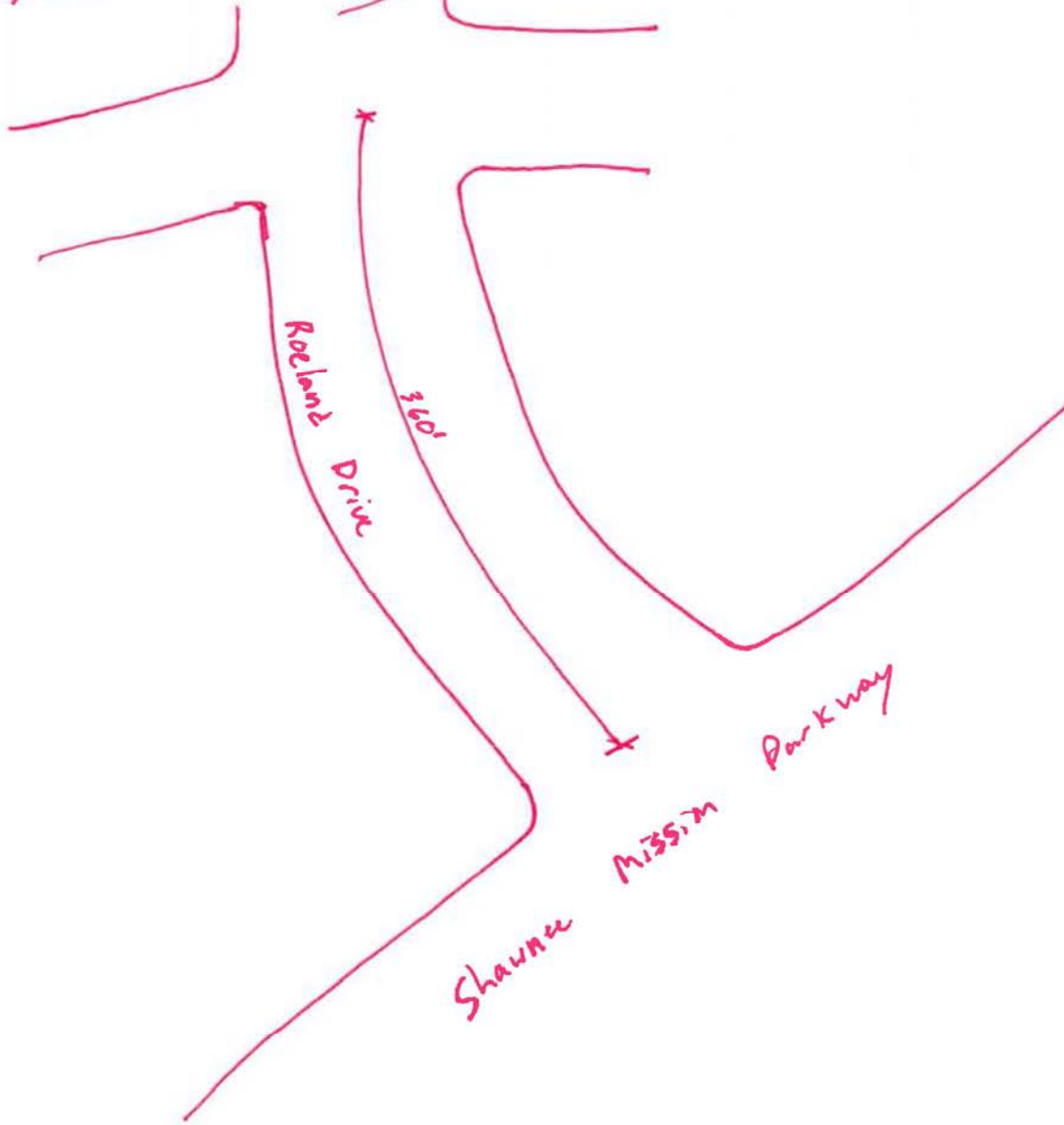
Drive 1 = 360' center to stop bar from SMP; Roeland Dr.

$D_1 \Rightarrow$ ~~Developed~~ Developer = 55'

$D_2 \Rightarrow$ 115'

$D_3 \Rightarrow$ 217'

$= 55' + 115' + 217' = \boxed{387'}$



olsson

PROJECT: Future 017-2145 (Miss. & Gateway)

project no.:

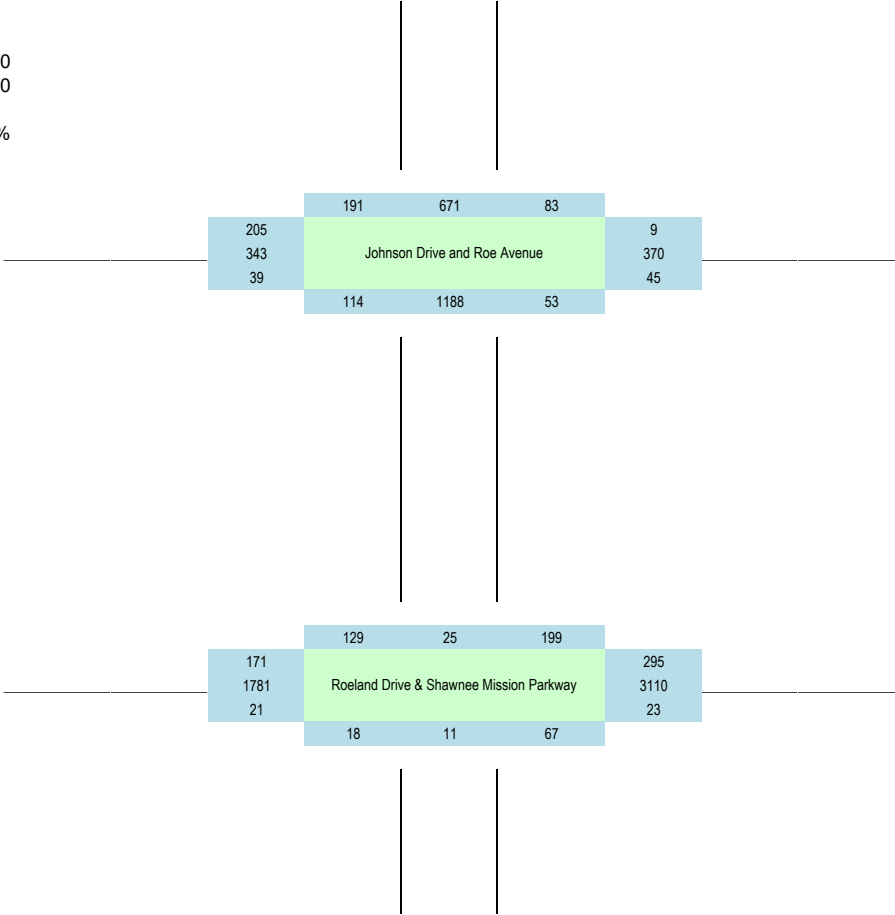
drawn by: TCM

date: ~~1/17~~

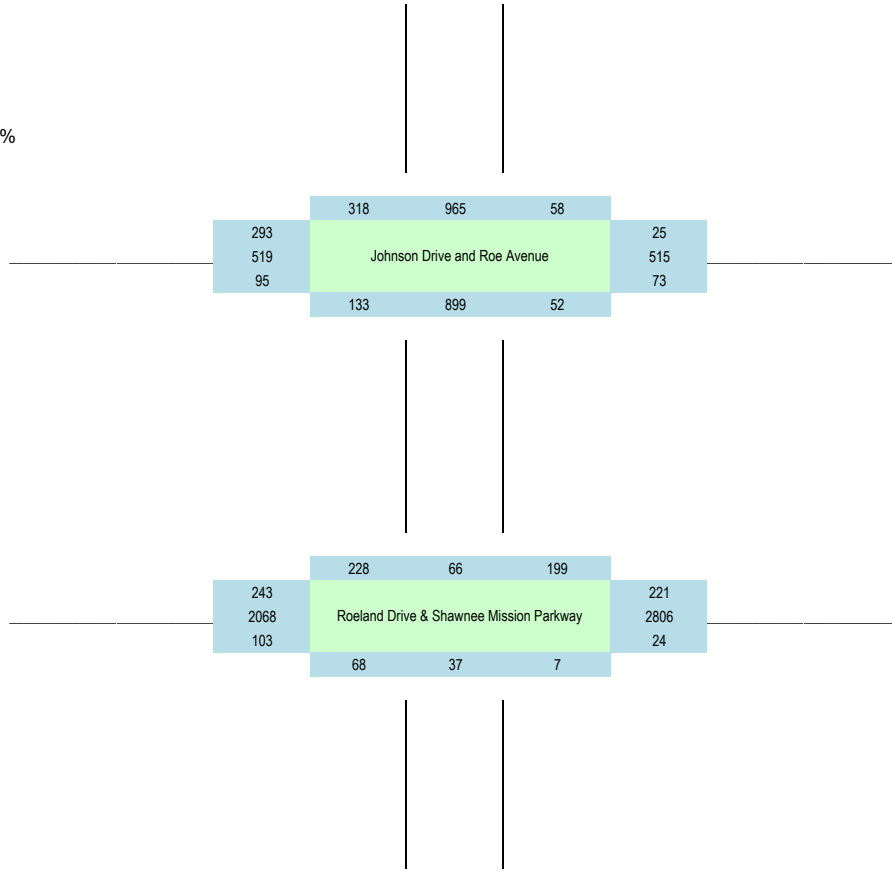
page 1 of 1

Future Growth

Year 2012 23,700
 Year 2016 26,600
 Growth Rate 3%

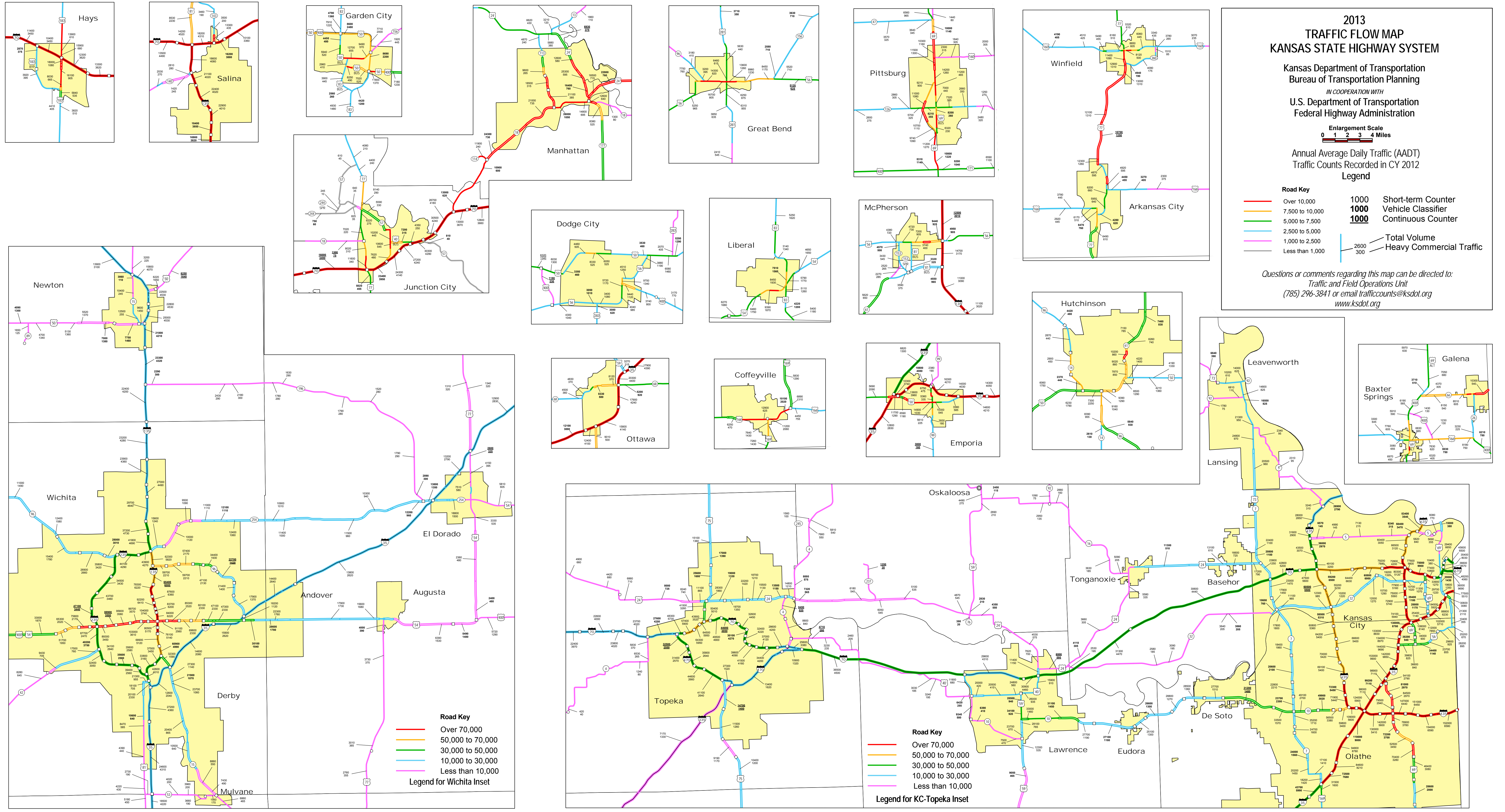


Growth Rate 3%



| Year | 2016 | 2015 | 2014 | 2013 | 2012 | 2011 | 2010 |
|----------------------------------|--------|--------|--------|--------|--------|--------|--------|
| Volumes | 26,600 | 25,700 | 20,400 | 20,100 | 23,700 | 22,600 | 20,300 |
| Percent Growth From Year to Year | 4.61% | | | | | | |
| | 3.31% | | | | | | |
| | 2.93% | | | | | | |
| | 9.79% | | | | | | |
| | 14.19% | | | | | | |
| | 3.50% | | | | | | |
| | 11.33% | | | | | | |
| | 8.05% | | | | | | |
| | -0.33% | | | | | | |
| | 0.12% | | | | | | |
| 4.83% | | | | | | | |
| 4.61% | | | | | | | |

Red numbers seem artificially low. Percentages represent growth between years. For example, between 2016 and 2015 the growth was 3.5%, between 2016 and 2015 the growth rate was 14.19%, ect.



**2013
TRAFFIC FLOW MAP
KANSAS STATE HIGHWAY SYSTEM**

Kansas Department of Transportation
Bureau of Transportation Planning
IN COOPERATION WITH
U.S. Department of Transportation
Federal Highway Administration

Enlargement Scale
0 1 2 3 4 Miles

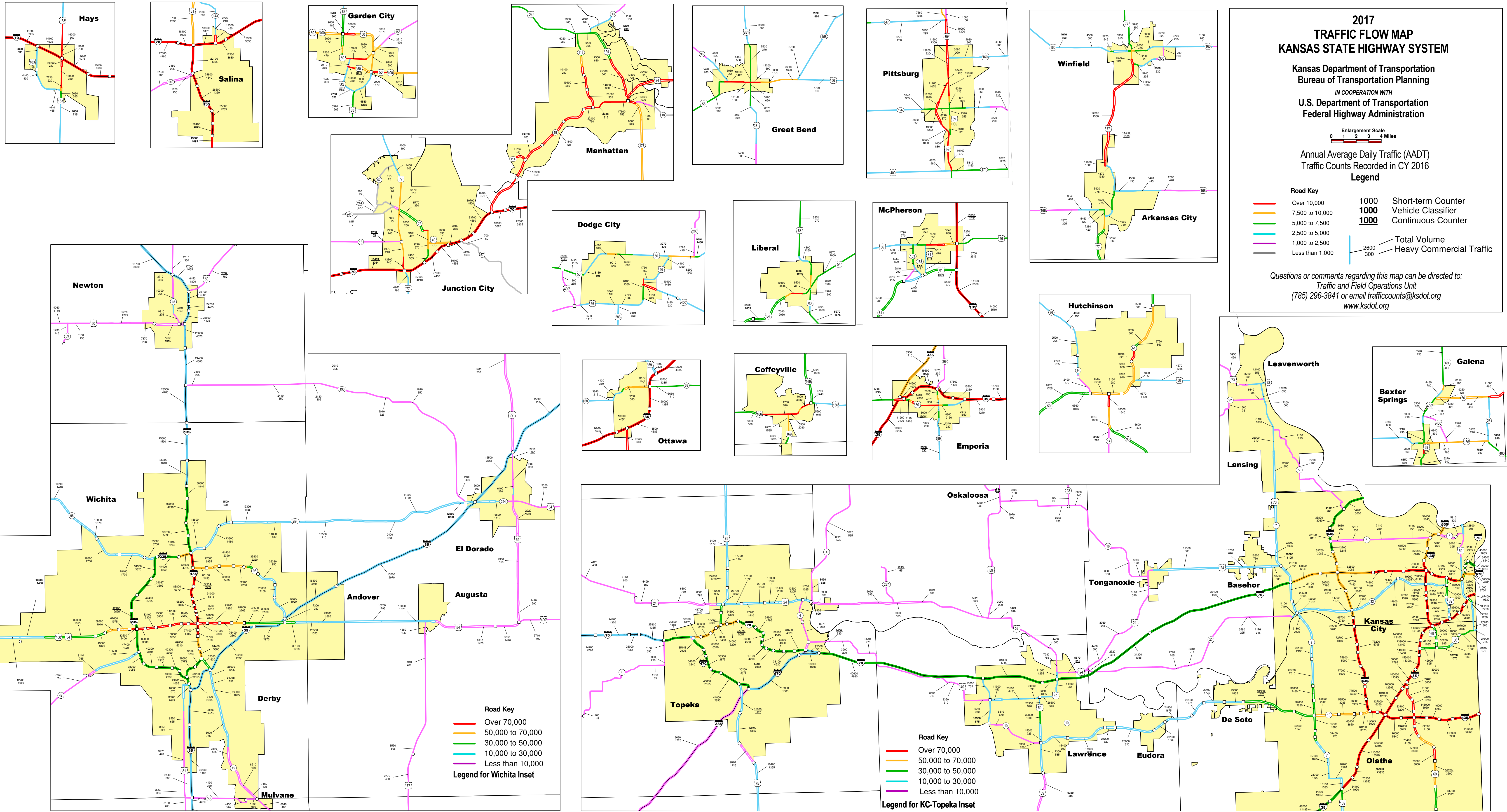
Annual Average Daily Traffic (AADT)
Traffic Counts Recorded in CY 2012
Legend

- | | |
|---|--------------------------------|
| — Over 10,000 | 1000 Short-term Counter |
| — 7,500 to 10,000 | 1000 Vehicle Classifier |
| — 5,000 to 7,500 | 1000 Continuous Counter |
| — 2,500 to 5,000 | |
| — 1,000 to 2,500 | |
| — Less than 1,000 | |
| — 2600 | Total Volume |
| — 300 | Heavy Commercial Traffic |

Questions or comments regarding this map can be directed to:
Traffic and Field Operations Unit
(785) 296-3841 or email trafficcoun@ksdot.org
www.ksdot.org

- Road Key**
- Over 70,000
 - 50,000 to 70,000
 - 30,000 to 50,000
 - 10,000 to 30,000
 - Less than 10,000
- Legend for Wichita Inset

- Road Key**
- Over 70,000
 - 50,000 to 70,000
 - 30,000 to 50,000
 - 10,000 to 30,000
 - Less than 10,000
- Legend for KC-Topeka Inset



**2017
TRAFFIC FLOW MAP
KANSAS STATE HIGHWAY SYSTEM**

Kansas Department of Transportation
Bureau of Transportation Planning
IN COOPERATION WITH
U.S. Department of Transportation
Federal Highway Administration

Enlargement Scale
0 1 2 3 4 Miles

Annual Average Daily Traffic (AADT)
Traffic Counts Recorded in CY 2016

Legend

- | | |
|---|---|
| — Over 10,000 | 1000 Short-term Counter |
| — 7,500 to 10,000 | 1000 Vehicle Classifier |
| — 5,000 to 7,500 | 1000 Continuous Counter |
| — 2,500 to 5,000 | |
| — 1,000 to 2,500 | |
| — Less than 1,000 | |
| | — 2600 Total Volume |
| | — 300 Heavy Commercial Traffic |

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www.ksdot.org

Road Key
— Over 70,000
— 50,000 to 70,000
— 30,000 to 50,000
— 10,000 to 30,000
— Less than 10,000
Legend for Wichita Inset

Road Key
— Over 70,000
— 50,000 to 70,000
— 30,000 to 50,000
— 10,000 to 30,000
— Less than 10,000
Legend for KC-Topeka Inset

Merge Analysis

HCS7 Freeway Merge Report

Project Information

| | | | |
|---------------------|--|----------------------|-----------|
| Analyst | TCM | Date | 5/20/2019 |
| Agency | Olsson | Analysis Year | 2019 |
| Jurisdiction | Mission, KS | Time Period Analyzed | AM |
| Project Description | EB Johnson Drive On-Ramp to NB Shawnee Mission Parkway | | |

Geometric Data

| | Freeway | Ramp |
|--|---------|---------|
| Number of Lanes (N), ln | 2 | 1 |
| Free-Flow Speed (FFS), mi/h | 45.0 | 25.0 |
| Segment Length (L) / Acceleration Length (LA),ft | 1500 | 150 |
| Terrain Type | Rolling | Rolling |
| Percent Grade, % | - | - |
| Segment Type / Ramp Side | Freeway | Right |

Adjustment Factors

| | | |
|--|--------------------|--------------------|
| Driver Population | All Familiar | All Familiar |
| Weather Type | Non-Severe Weather | Non-Severe Weather |
| Incident Type | No Incident | - |
| Final Speed Adjustment Factor (SAF) | 1.000 | 1.000 |
| Final Capacity Adjustment Factor (CAF) | 1.000 | 1.000 |
| Demand Adjustment Factor (DAF) | 1.000 | 1.000 |

Demand and Capacity

| | | |
|---------------------------------------|-------|-------|
| Demand Volume (Vi) | 2047 | 479 |
| Peak Hour Factor (PHF) | 0.95 | 0.85 |
| Total Trucks, % | 0.02 | 0.02 |
| Single-Unit Trucks (SUT), % | - | - |
| Tractor-Trailers (TT), % | - | - |
| Heavy Vehicle Adjustment Factor (fHV) | 1.000 | 1.000 |
| Flow Rate (vi),pc/h | 2155 | 564 |
| Capacity (c), pc/h | 4500 | 1900 |
| Volume-to-Capacity Ratio (v/c) | 0.60 | 0.30 |

Speed and Density

| | | | |
|--|-------|---|-------|
| Upstream Equilibrium Distance (LEQ), ft | - | Number of Outer Lanes on Freeway (NO) | 0 |
| Distance to Upstream Ramp (LUP), ft | - | Speed Index (Ms) | 0.373 |
| Downstream Equilibrium Distance (LEQ), ft | - | Flow Outer Lanes (VOA), pc/mi/ln | - |
| Distance to Downstream Ramp (LDOWN), ft | - | On-Ramp Influence Area Speed (SR), mi/h | 43.9 |
| Prop. Freeway Vehicles in Lane 1 and 2 (PFM) | 1.000 | Outer Lanes Freeway Speed (So), mi/h | - |
| Flow in Lanes 1 and 2 (v12), pc/h | 2155 | Ramp Junction Speed (S), mi/h | 43.9 |
| Flow Entering Ramp-Infl. Area (vR12), pc/h | 2719 | Average Density (D), pc/mi/ln | 31.0 |
| Level of Service (LOS) | C | Density in Ramp Influence Area (DR), pc/mi/ln | 25.6 |

HCS7 Freeway Merge Report

Project Information

| | | | |
|---------------------|--|----------------------|-----------|
| Analyst | TCM | Date | 5/20/2019 |
| Agency | Olsson | Analysis Year | 2019 |
| Jurisdiction | Mission, KS | Time Period Analyzed | PM |
| Project Description | EB Johnson Drive On-Ramp to NB Shawnee Mission Parkway | | |

Geometric Data

| | Freeway | Ramp |
|--|---------|---------|
| Number of Lanes (N), ln | 2 | 1 |
| Free-Flow Speed (FFS), mi/h | 45.0 | 25.0 |
| Segment Length (L) / Acceleration Length (LA),ft | 1500 | 150 |
| Terrain Type | Rolling | Rolling |
| Percent Grade, % | - | - |
| Segment Type / Ramp Side | Freeway | Right |

Adjustment Factors

| | | |
|--|--------------------|--------------------|
| Driver Population | All Familiar | All Familiar |
| Weather Type | Non-Severe Weather | Non-Severe Weather |
| Incident Type | No Incident | - |
| Final Speed Adjustment Factor (SAF) | 1.000 | 1.000 |
| Final Capacity Adjustment Factor (CAF) | 1.000 | 1.000 |
| Demand Adjustment Factor (DAF) | 1.000 | 1.000 |

Demand and Capacity

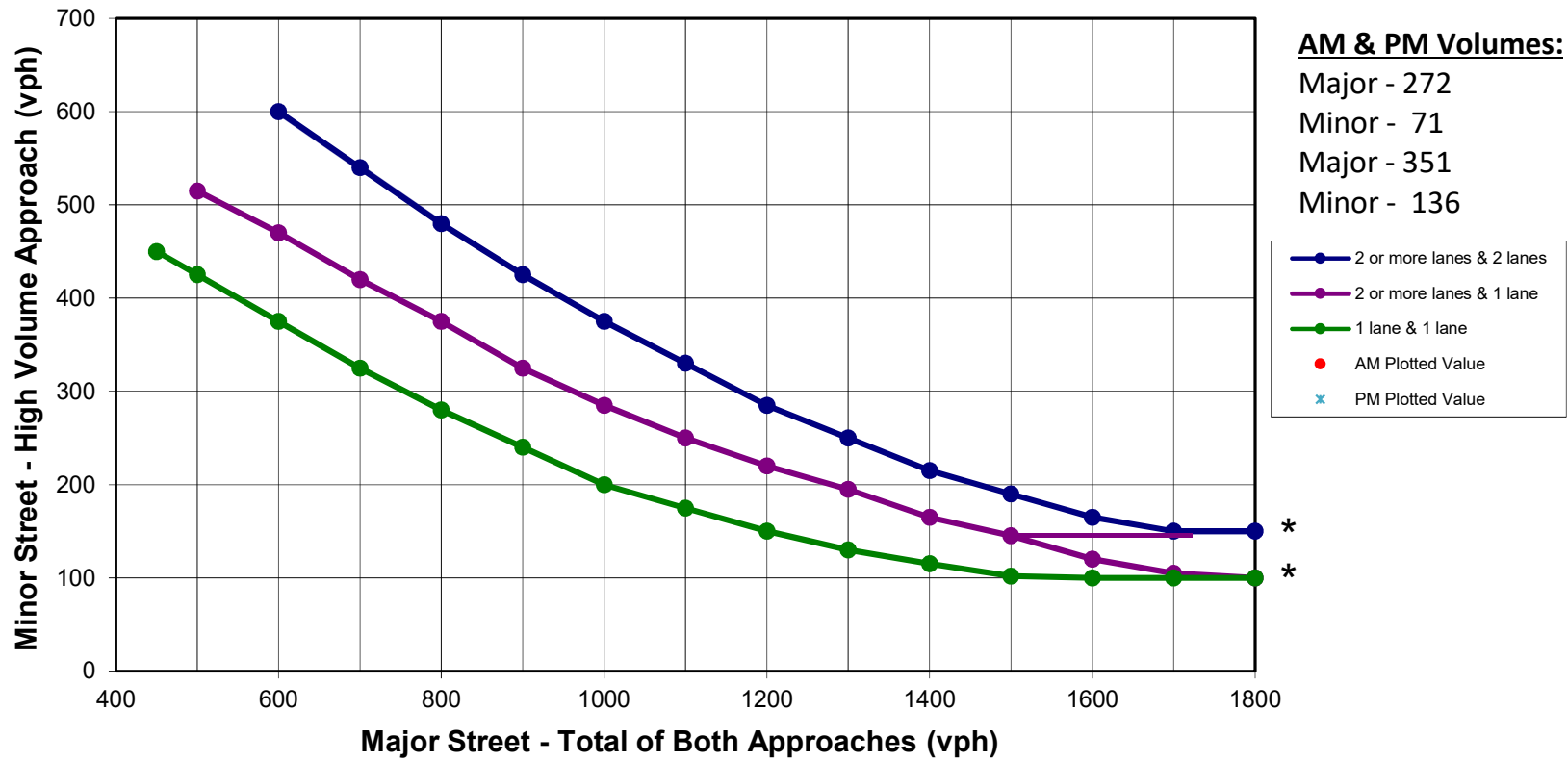
| | | |
|---------------------------------------|-------|-------|
| Demand Volume (Vi) | 2268 | 629 |
| Peak Hour Factor (PHF) | 0.94 | 0.86 |
| Total Trucks, % | 0.02 | 0.02 |
| Single-Unit Trucks (SUT), % | - | - |
| Tractor-Trailers (TT), % | - | - |
| Heavy Vehicle Adjustment Factor (fHV) | 1.000 | 1.000 |
| Flow Rate (vi),pc/h | 2413 | 731 |
| Capacity (c), pc/h | 4500 | 1900 |
| Volume-to-Capacity Ratio (v/c) | 0.70 | 0.38 |

Speed and Density

| | | | |
|--|-------|---|-------|
| Upstream Equilibrium Distance (LEQ), ft | - | Number of Outer Lanes on Freeway (NO) | 0 |
| Distance to Upstream Ramp (LUP), ft | - | Speed Index (Ms) | 0.404 |
| Downstream Equilibrium Distance (LEQ), ft | - | Flow Outer Lanes (VOA), pc/mi/ln | - |
| Distance to Downstream Ramp (LDOWN), ft | - | On-Ramp Influence Area Speed (SR), mi/h | 43.8 |
| Prop. Freeway Vehicles in Lane 1 and 2 (PFM) | 1.000 | Outer Lanes Freeway Speed (So), mi/h | - |
| Flow in Lanes 1 and 2 (v12), pc/h | 2413 | Ramp Junction Speed (S), mi/h | 43.8 |
| Flow Entering Ramp-Infl. Area (vR12), pc/h | 3144 | Average Density (D), pc/mi/ln | 35.9 |
| Level of Service (LOS) | D | Density in Ramp Influence Area (DR), pc/mi/ln | 28.8 |

Signal Warrants

Peak Hour Volume Warrant Roeland Drive and Martway Street



*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes

Turn Lane Warrant

Future Year 2050 - Shawnee Mission Parkway + Roeland Drive

Table 4-26

| | <u>AM</u> | <u>WB</u> | <u>PM</u> |
|-------------------|-----------|-----------|-----------|
| Highway volume => | 3110 | | 221 |
| | 295 | | 2806 |
| | <u>23</u> | | <u>24</u> |
| | 3428 | | 3051 |

| | | | |
|---------------|-----------|--|-----------|
| Right turn => | <u>1h</u> | | <u>PM</u> |
| | 295 | | 221 |

Highway speed => 45mph => to meet right turn lane warrant
rt. volume > 14 uph

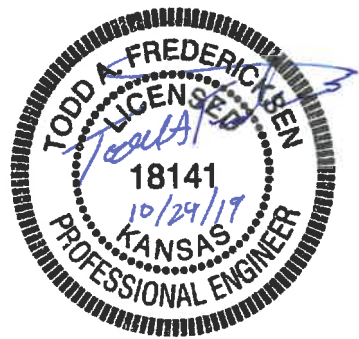
| | | |
|-----------|-----------|--------------------|
| <u>AM</u> | <u>PM</u> | RT Lane is warrant |
| 295 > 14 | 221 > 14 | |

Turn lanes are not warranted along Roeland Drive,
Johnson Drive, or Roe Avenue due to low speeds.

Table 4-27/4-28

Speeds along Roeland Drive, Johnson Drive, or Roe Avenue
are too low to warrant.

SMR has left turn lanes.



MISSION GATEWAY

Mission, Kansas – 2019

Revised October 2019

Olsson Project No. 017-2145