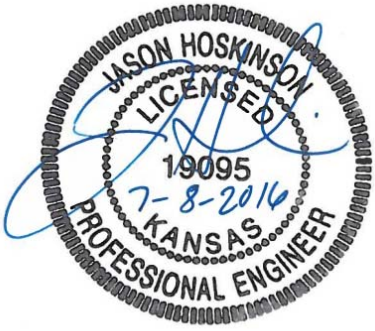
TRAFFIC IMPACT STUDY

for

USD #497 Warehouse and Bus Site



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BG Project No. 16-1200L
July 8, 2016

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Introduction: This Traffic Impact Study (TIS) has been prepared in accordance with the City of Lawrence Ordinance 7650 as required by the City's Land Development Code. The purpose of the TIS is to identify the basic land use and transportation characteristics of the proposed USD #497 Lawrence Public Schools use of the site at 711 E. 23rd Street.

Item #1: Proposed Development: The proposed site for the USD #497 Warehouse and Bus Site is a property currently owned by Douglas County. The site had been used by the Douglas County Public Works Department for vehicle storage, maintenance and refueling. Douglas County and USD #497 have been discussing the feasibility of exchanging ownership of the property. The USD #497 intends to use the site for similar purposes, including warehouse, maintenance and bus fleet storage. A site plan is currently unavailable as this site is in the process of being rezoned.

Item #2: Horizon 2020 Land Use: The Lawrence/Douglas County Comprehensive Plan identifies the future land use of this site as Office Research and/or Industrial/Warehouse/Distribution (Map 3-2, Horizon 2020). The proposed use is consistent with Comprehensive Plan for this location.

Item #3: Street Functional Classification: The site is bordered by two streets on the north. 23rd Street (K-10) is classified as an arterial street and N. Perimeter Road is classified as a local street (frontage road). A portion of this road is a private street along the north side of Haskell Indian Nations University. T2040 classifies 23rd Street (K-10) as the nearest arterial street to the proposed site.

Item #4: Allowable Access: Two existing access points of access will be retained to the N. Perimeter Road fronting this site. The east end of N. Perimeter Road accesses 23rd Street (K-10) at the east property line of the site.

Item #5: Adjacent Street Characteristics: N. Perimeter Road is the only public street adjacent to the site with an unposted speed limit, implying a statutory speed limit of 30 mph. 23rd Street also borders the north side of the site, serving as the nearest adjacent arterial street. The posted speed limit of 23rd Street is 45 mph and according to the latest traffic data from KDOT, the estimated Annual Average Daily Traffic (AADT) is 30,000 vehicles per day. The AADT may decrease slightly with opening of the South Lawrence Trafficway in several months.

N. Perimeter Road currently accesses 23rd Street as a STOP controlled, T-intersection. 23rd Street is a 5-lane urban street, providing a center two-way-left-turn (TWLTL) for westbound ingress traffic generated by the site. N. Perimeter Road is a 2-lane urban street allowing for 1-lane of travel in each direction along the north side of the property.

Sight distance was measured at the east intersection of 23rd Street and N. Perimeter Road. This is also the approximate location where the Site Access will access the frontage road and will be the primary point of access to 23rd Street for site generated traffic. Sight distance was found to be sufficient. For passenger cars making a left-turn from a stopped condition, a minimum time gap of 8.0 seconds is required. The available time gap in normal traffic flow was consistently measured at approximately 10.0

seconds to the west and well in excess of 10.0 seconds to the east. For bus traffic in particular, only right-turning egress movements are anticipated as will be discussed in further detail below. A minimum time gap for a bus to egress the site making a right turn from a stopped condition is 9.2 seconds. The available time gap for passenger cars of 10.0 seconds exceeds the required time. Furthermore, the actual available time gap for bus and truck traffic with a driver sitting at a higher elevation above the roadway would be greater than the recorded values for passenger cars.

Item #6: Proposed Access: The site currently has two access points to N. Perimeter Road, leading to one primary access point to 23rd Street at the east property line of the site. This area was recently reconstructed as a part of KDOT's replacement of the 23rd Street bridge immediately west of the site. With exception of 23rd Street and its frontage road, no other public streets offering access opportunities are adjacent to the site. Given the geometric and vertical constraints between 23rd Street and the N. Perimeter Road, relocation of the existing intersection to the west is not feasible.

Item #7: Trip Generation: Detailed plans for use of the site have not been developed. With exception of the bus storage/staging, the anticipated use of the site and resulting trips will likely be very similar to the previous use by the Douglas County Public Works Department. For the purposes of this study, the trips generated by bus traffic and their circulation plan options will be discussed in further detail.

Traffic Type and Departure/Arrival Characteristics: First Student serves as the transportation provider for the USD #497. They currently have a fleet of 88 buses. 78 buses are in routine service and 10 buses are spares used only as needed or when buses are taken out of service for maintenance. Approximately one-half of the fleet are 40' long buses and the other one-half of the fleet are smaller buses. For the purpose of this analysis, 80 buses are assumed to be in service on a typical weekday with the type of bus used being split 50% / 50% between long / small buses.

A summary of the peak hours associated with the bus storage of this site is as follows:

- AM Peak Hour (typical weekday)
    - 6:00 am – 7:00 am: cars entering site and buses exiting site.
    - 8:00 am – 9:00 am: buses entering site and cars exiting site.
- PM Peak Hour (typical weekday)
    - 2:00 pm – 3:00 pm: cars entering site and buses existing site.
    - 4:00 pm – 5:00 pm: buses entering site and cars exiting site.

Site Circulation Plan: First Student currently uses a site on the north side of 23rd Street, approximately 1 mile east of the proposed 711 E. 23rd Street site. The company policy restricts the bus drivers' movements such that they may only enter the site via a westbound right-turn and they may only egress the site via southbound right-turn. No drivers are allowed to make left-turns into or out of the site while driving a school bus.

Several scenarios were explored regarding the access in/out of the proposed site as summarized below.

- Scenario #1: Existing Site Access
    - No turn restrictions for passenger cars in/out of the site.
    - School buses restricted to right-in/right-out only.
- Scenario #2: Existing Site Access
    - No turn restrictions for passenger cars in/out of the site.
    - School buses restricted to right-in and/or left-in.
    - School buses restricted to right-out only.
- Scenario #3: Alternate Site Access using frontage roads
    - No turn restrictions for passenger cars in/out of the site.
    - Consider allowing school buses making right-in movements to use the intersection of 23rd and N. Perimeter Road/Learnard.
    - Consider allowing school buses needing to go westbound on 23rd Street to use the frontage roads to cross 23rd Street to get to the intersection of 23rd and Learnard to make a right-turn movement.

Scenario #1: In Scenario #1, employees will arrive between 6:00 am and 6:30 am in passenger vehicles and then drive the buses out of the site between 6:30 am and 7:00 am. The buses will remain on their routes until mid-morning when all students are dropped off at the various USD #497 schools, returning to the site between 8:00 am and 9:00 pm.

The PM peak hours of the site will operate in a similar fashion with the peak demand of employees arriving to the site between 2:00 pm and 2:30 pm followed by buses exiting the site between 2:30 pm and 3:00 pm. Upon completion of their routes, the buses will return between 4:00 pm and 4:30 pm followed by employees leaving the site to go home between 4:30 pm and 5:00 pm.

For Scenario #1, First Student would be required to continue their policy of restricting bus movements to right-out egress and right-in ingress. Exhibit #1 shows the estimated volume and pattern of traffic movements. As previously noted, sight distance is sufficient for all vehicles, passenger cars and buses, to make all turning movements from a stopped condition at this access point to/from 23rd Street.

Scenario #2: Scenario #2 is identical to Scenario #1 with the exception of allowing left-ingress movements to the site from 23rd Street. First Student's policy will allow a bus to make a left-turn across a street such as 23rd Street if a dedicated left-turn lane is provided. A TWLTL currently exists to the east of the Site Access and the median is painted with yellow gore markings to the west of the Site Access.

Exhibit #2 shows the estimated volume and pattern of traffic movements. Again, sight distance is sufficient for all vehicles, passenger cars and buses, to make all turning movements from a stopped condition at this access point to/from 23rd Street in Scenario #2.

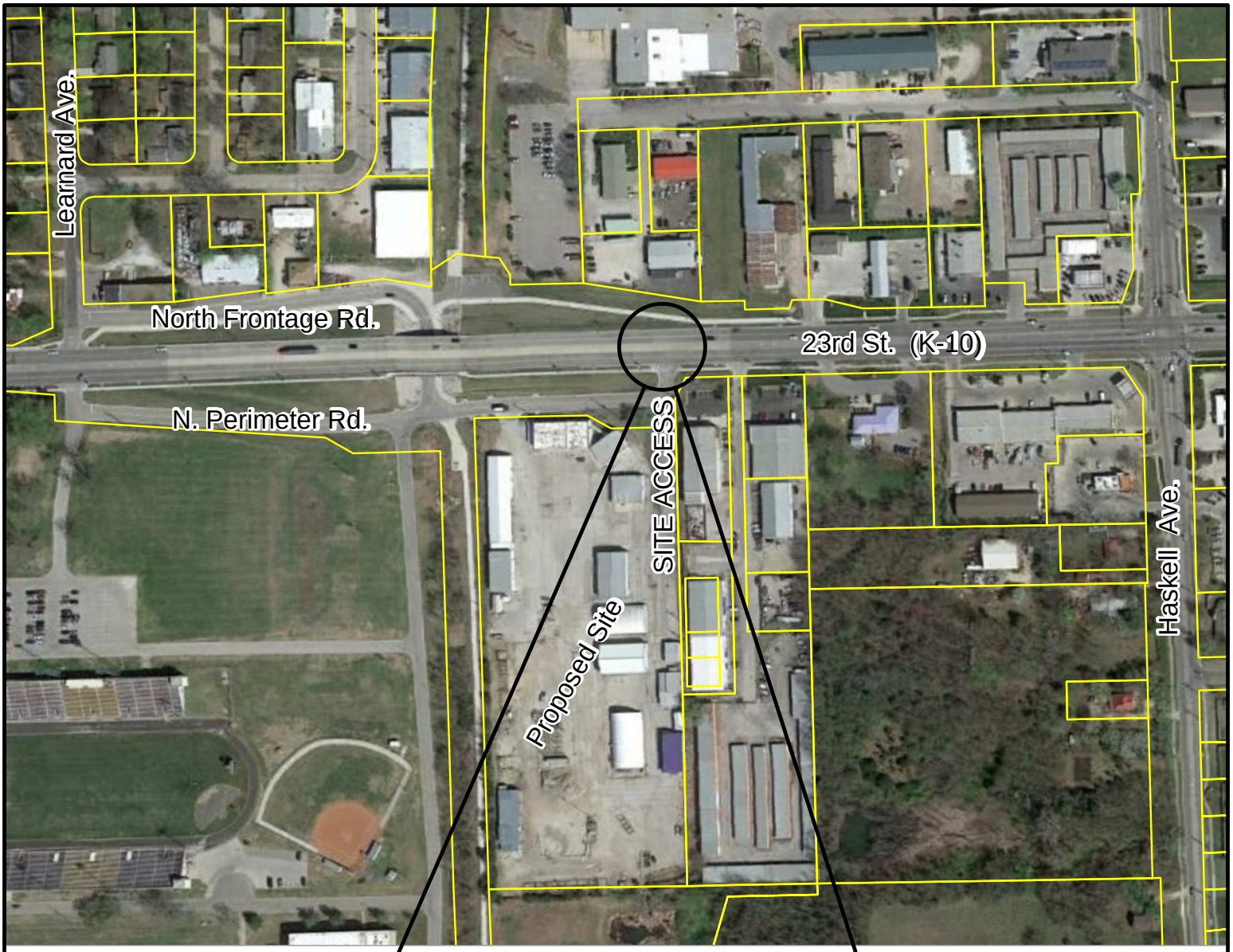
If First Student desires to pursue Scenario #2, the travel pattern policy would have to be modified to allow the buses to make a left-turn from the TWLTL at the Site Access. Restriping the west end of the TWLTL to provide a dedicated left-turn lane into the proposed site is not feasible due to existing access points on the north side of 23rd Street beginning 150 feet east of the proposed Site Access.

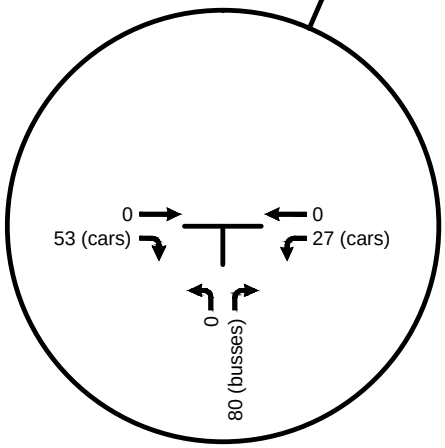
Scenario #3: Scenario #3 explores several options for ingress/egress utilizing the existing frontage roads. One option considered under this scenario would allow buses to utilize this intersection for right-turns in and out of the site. The available sight distance is somewhat greater at this location, measured at approximately 12 seconds to the west as compared to 10 seconds at the proposed Site Access, and excellent to the east for passenger cars. However, a portion of the south frontage road, known as N. Perimeter Road, is a private street and an agreement would likely need to be made between First Student and the US Government to utilize this street across the frontage of Haskell Indian Nations University for bus traffic. The buses would also be required to cross the existing hike/bike trail at grade located at the west property line of the proposed site.

Another option considered in Scenario #3 would allow bus traffic ultimately wanting to go westbound on 23rd Street to utilize the frontage roads to cross under 23rd Street, ultimately accessing Learnard Avenue and using Learnard Avenue to access westbound 23rd Street via right-turn. However, the intersections of the North Frontage Road/Learnard Avenue and 23rd Street/Learnard Avenue are in such close proximity to each other that a bus would be unable to make the necessary turning movements without blocking Learnard Avenue traffic and potentially causing northbound Learnard Avenue traffic queues to spill back onto 23rd Street.

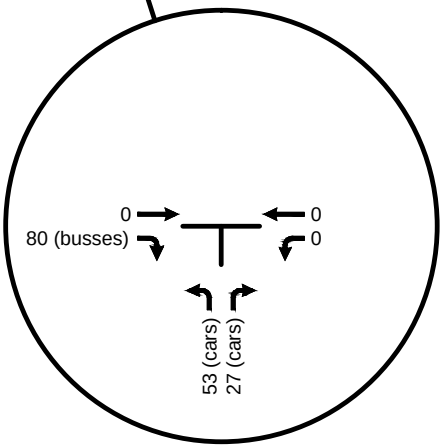
Exhibit #3 highlights the bus travel pattern options explored in Scenario #3. Due to the geometric limitations of the existing roadway and the relatively minor increase in available sight distance, we do not recommend pursuing any of the options considered in Scenario #3.

Summary: The proposed reuse of the existing site at 711 E. 23rd Street is anticipated to have similar impacts on the existing public street system as was experienced by the past user (Douglas County Public Works). Based on the analysis summarized in this report, we recommend First Student and the USD #497 pursue implementation of Scenario #1 and continue the policy of requiring right-in and right-out only movements for bus traffic.





AM Peak Hour (6:00 am - 7:00 am)
PM Peak Hour (2:00 pm - 3:00 pm)



AM Peak Hour (8:00 am - 9:00 am)
PM Peak Hour (4:00 pm - 5:00 pm)

Not to Scale

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EXHIBIT #1

Scenario #1 Estimated Peak Hour Traffic Patterns

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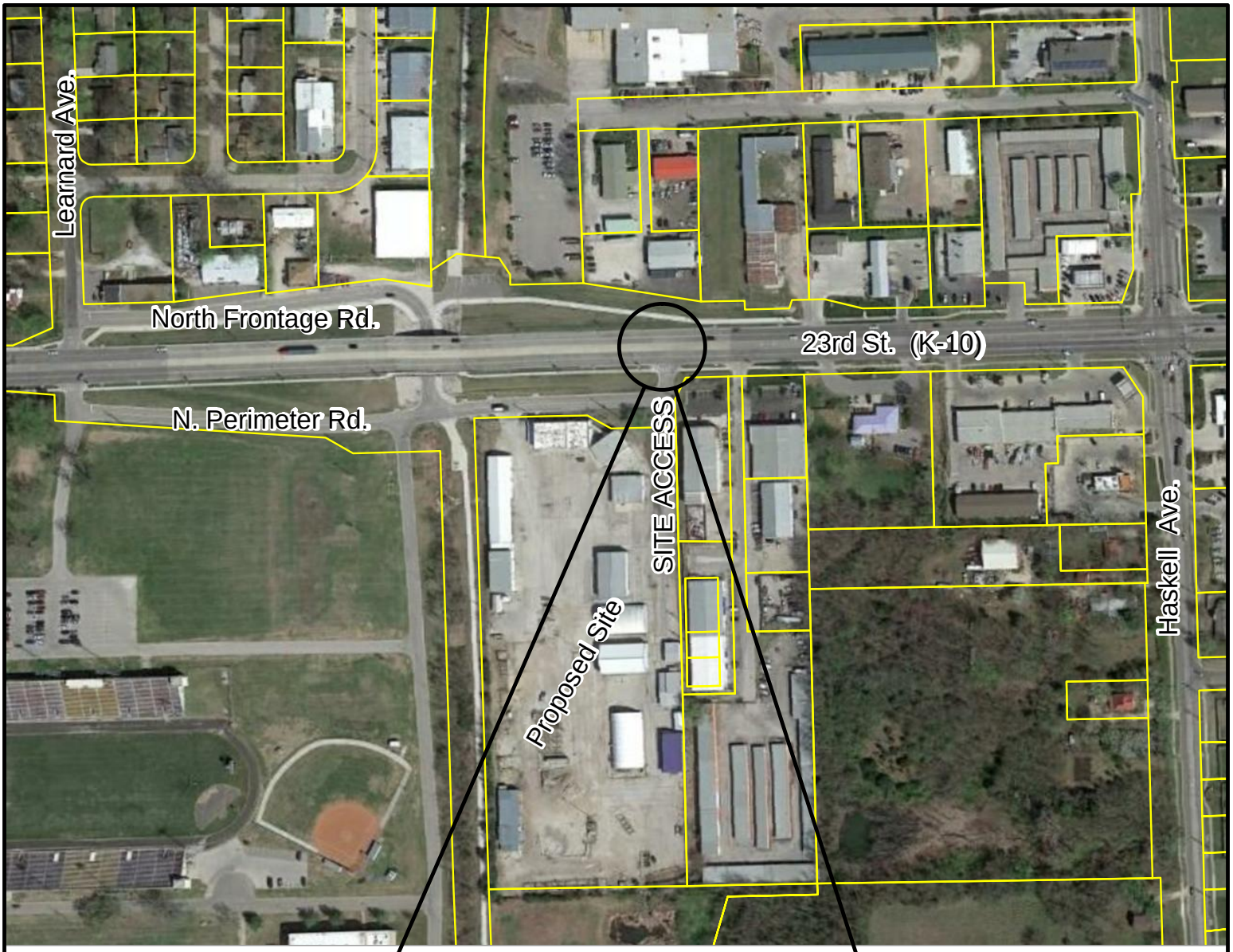
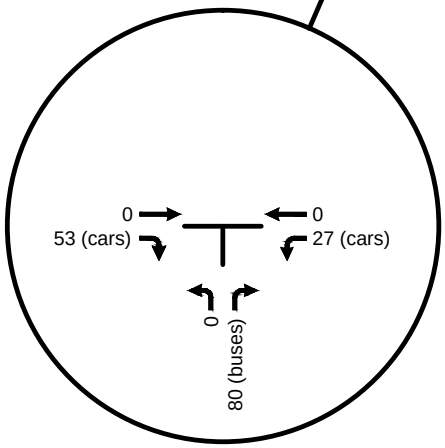
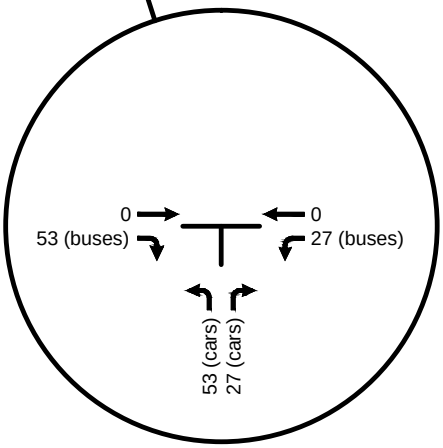
Prepared: July 8, 2016





AM Peak Hour (6:00 am - 7:00 am)
PM Peak Hour (2:00 pm - 3:00 pm)



AM Peak Hour (8:00 am - 9:00 am)
PM Peak Hour (4:00 pm - 5:00 pm)

Not to Scale

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EXHIBIT #2

Scenario #2 Estimated Peak Hour Traffic Patterns

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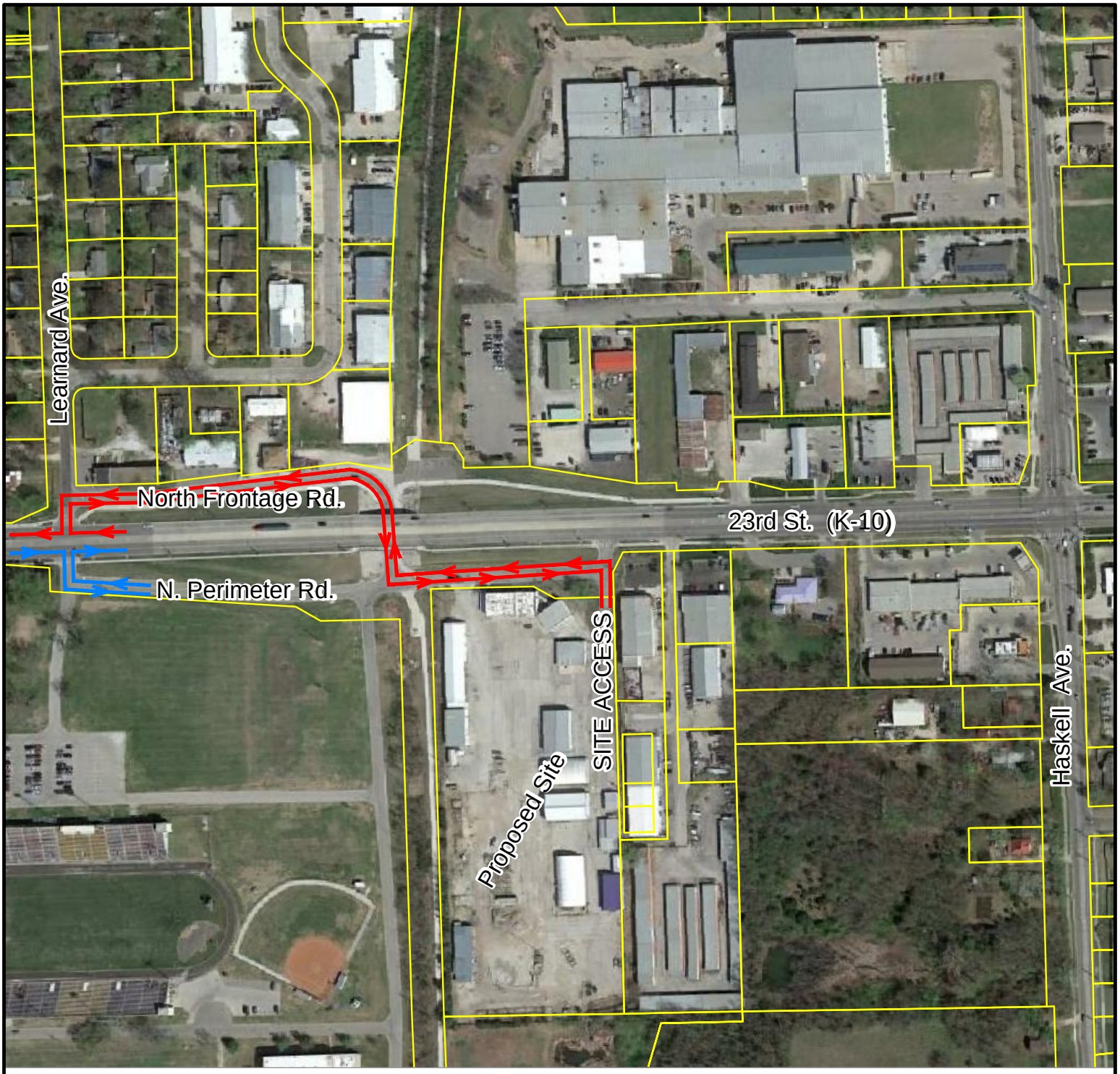

N

Not to Scale

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EXHIBIT #3

Scenario #3 Optional Traffic Patterns Considered

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