NATIONAL WESTERN CENTER

IMAGINE. DISCOVER. CULTIVATE.

TRAFFIC IMPACT STUDY

National Western Center Campus Placemaking Study

August 17, 2020

Prepared for:

DENVER
THE MILE HIGH CITY

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OV

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INTRODUCTION

This traffic impact study has been developed to support the National Western Center Redevelopment project located just north of downtown Denver, Colorado. The information presented in this report reflects the best information available about the land uses, projected uses of the site, development projects not controlled by the National Western Center, roadway configurations and alignments, project phasing and construction timelines, and other projects in the area. Due to the complex nature of the site and its uses, many assumptions were made based on data and information obtained over the last year through interviews with project participants and partners as well as research into other facilities of a similar nature.

The National Western Center Redevelopment will occur over at least two construction phases. The initial phase is referred to as Phase 1-2 and includes facilities and infrastructure that is located on the west side of the RTD/BNSF Railroad Corridor. Additional future phases are referred to in this study as Full Build Out. Full Build Out facilities are all located on the east side of the RTD/BNSF Railroad Corridor. Facilities being constructed in Phase 1-2 include new equestrian and livestock buildings, new stockyards and a new maintenance facility, and additional facilities being constructed by Colorado State University and the Western Stock Show Association. Transportation improvements occurring in Phase 1-2 include relocating the DRIR Railroad to be adjacent to the RTD/BNSF Railroad Corridor, reconstruction of the National Western Center Drive, constructing a new east-west roadway (Bettie Cram Drive), and constructing two new bridges over the South Platte River (one at 48th Avenue/Bettie Cram Drive and one at 51st Avenue). Significant pedestrian and bicycle improvements are planned in the Phase 1-2 area and a new pedestrian bridge over the DRIR/RTD/BNSF Railroad Corridor linking the Phase 1-2 area with the N-Line commuter rail station along Brighton Boulevard are planned. Full Build Out facilities and infrastructure used in this study are based on the 2015 NWC Master Plan.

This traffic impact study includes two infrastructure configurations and evaluates two operational scenarios for each configuration. The infrastructure configurations are Phase 1-2 complete, which constructs facilities and infrastructure on the west side of the RTD/BNSF Railroad Corridor, and Full Build Out, which assumes completion of the Master Plan elements located on the east side of the BNSF tracks. The operational scenarios evaluated for each infrastructure configuration are a normal weekday PM Peak hour and a weekend day large event peak hour.

The intent of this evaluation methodology is to determine the likely infrastructure requirements and operational conditions on a normal weekday and then to "stress test" that system with a large event scenario to determine operational conditions and potential mitigation strategies for large events.

This traffic impact study focuses on evaluating the proposed infrastructure included in the Phase 1-2 construction area to facilitate decision making relative to the new infrastructure elements being constructed in the Phase 1-2 portion of the National Wester Center Redevelopment project. The intersections that are located on the east side of the RTD/BNSF Railroad Corridor will be evaluated in a future traffic impact study.

PROJECT SITE

The project site is located north of downtown Denver, Colorado. The site is served by several high capacity transportation corridors including I-25 on the west side of the site and I-70 is on the south side of the site and it has interchange access at Washington Street and Brighton Boulevard. Washington Street is a major arterial located on the west side of the site and Brighton Boulevard is a major arterial located on the east side of the site.

See Exhibit 1 for the project site location and Exhibit 2 for the detailed site layout.

EXHIBIT 1: PROJECT AREA MAP

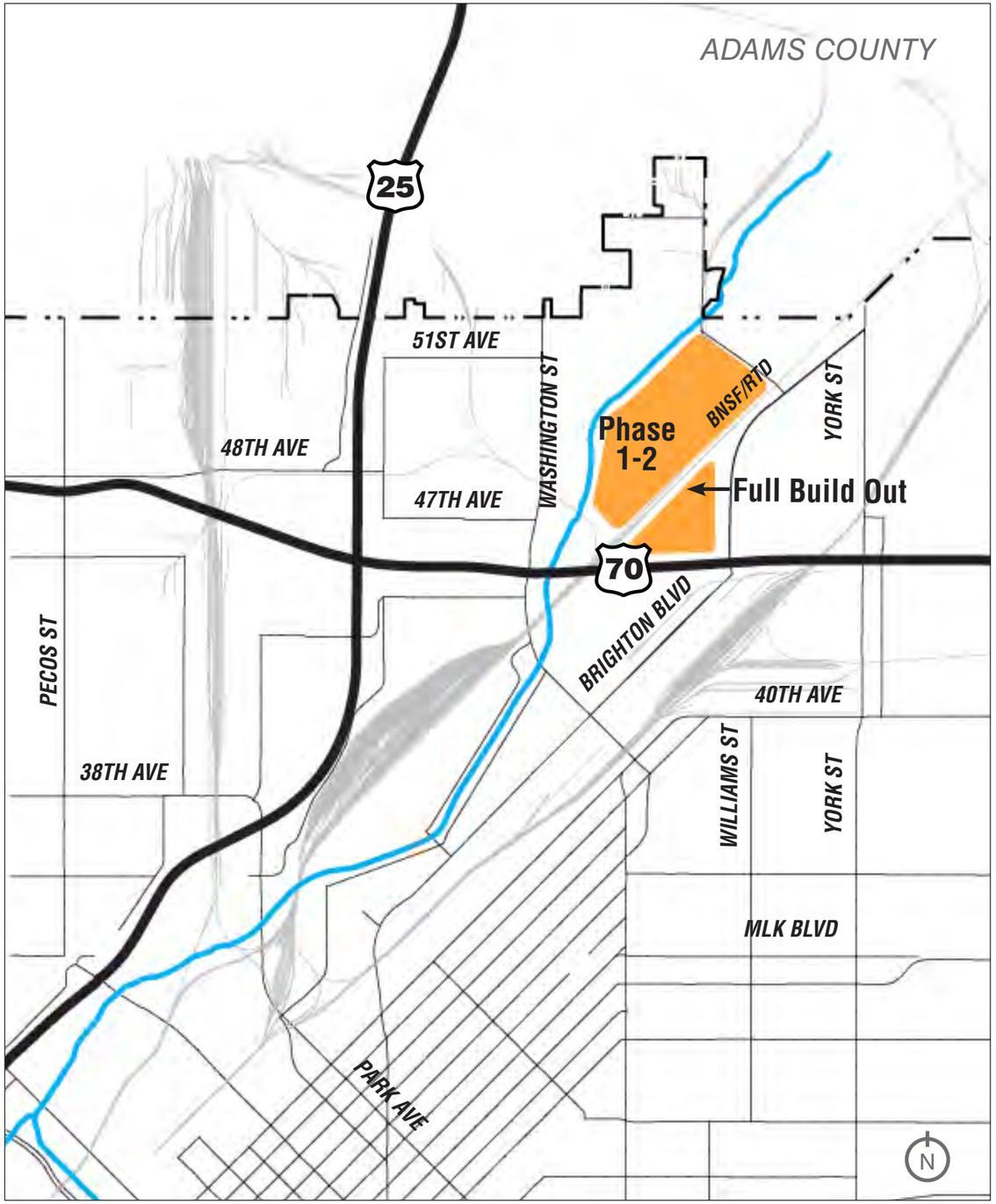
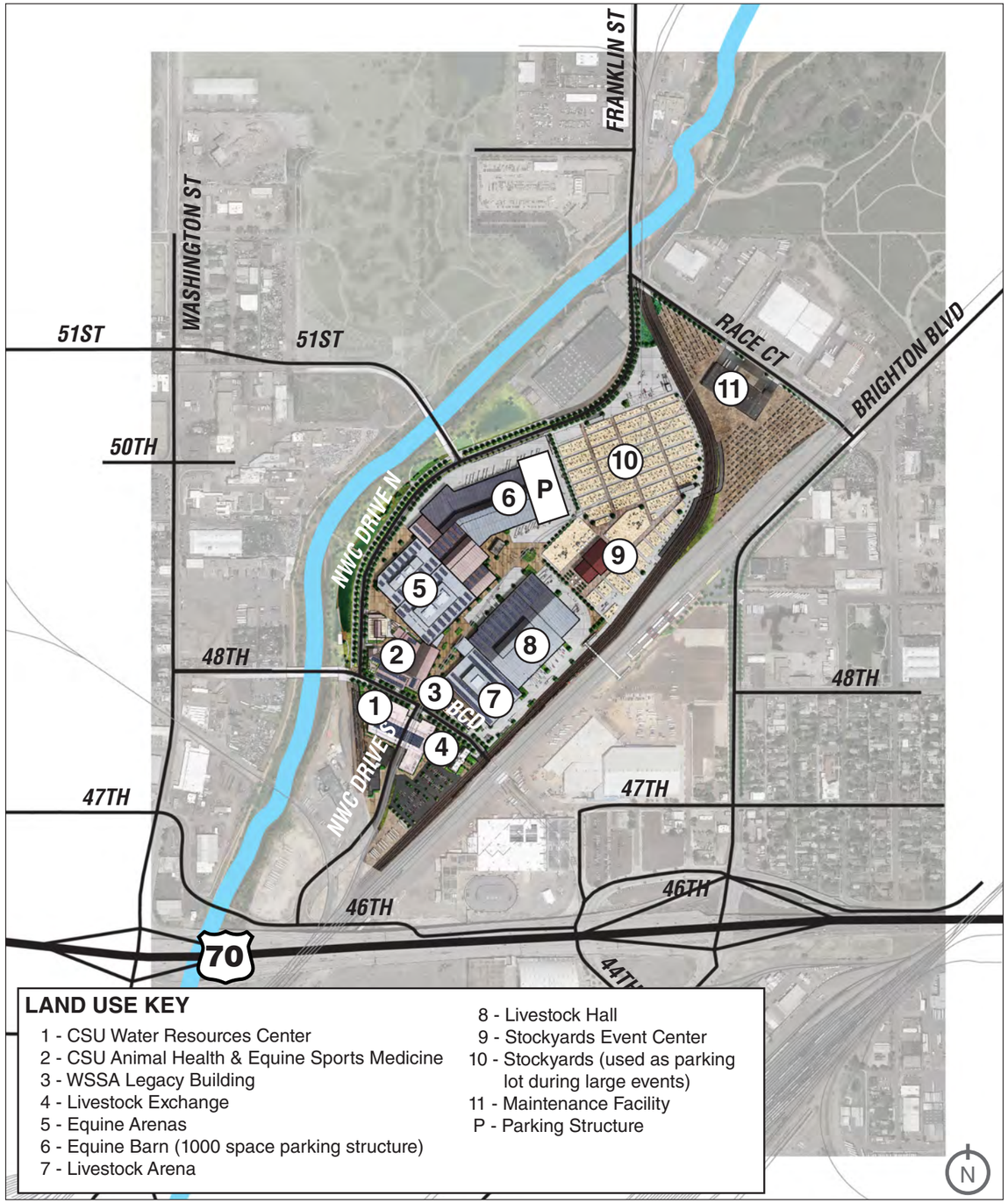


Exhibit 2: Site Layout | Phase 1-2 and Full Build Out



OVERALL FACTORS AND METHODOLOGIES FOR SCENARIO ANALYSIS

ANALYSIS METHODOLOGY

Capacity analysis results are listed in terms of Level of Service (LOS). LOS is a qualitative term describing operating conditions a driver will experience while traveling on a particular street or highway during a specific time interval. It ranges from A (very little delay) to F (long delays and congestion). Standard traffic engineering practice recommends intersection LOS D as the desirable threshold for acceptable operations. Table 1 below shows the definition of level of service for signalized and unsignalized intersections.

Table 1: Level of Service Definitions

Level of Service	Signalized Intersection Average Total Delay (sec/veh)	Unsignalized Intersection Average Total Delay (sec/veh)
A	≤ 10	≤ 10
B	> 10 and ≤ 20	> 10 and ≤ 15
C	> 20 and ≤ 35	> 15 and ≤ 25
D	> 35 and ≤ 55	> 25 and ≤ 35
E	> 55 and ≤ 80	> 35 and ≤ 50
F	> 80	> 50

The study area intersections were analyzed based on average delay analysis for signalized and unsignalized intersections. LOS was calculated using Synchro 9 Software providing the HCM 2010 results. All signalized intersections were assumed to have a 100 second cycle length and Synchro was allowed to optimize the timing for the splits.

TRIP REDUCTIONS

In most traffic impact studies, calculations are made to determine the appropriate number of vehicle trips to remove from the total trips generated by the site based on the site's proximity to transit, its' location in a downtown core or dense urban area, or the nature of the site such as a mixed-use development. Trips are further reduced by utilizing "by-pass capture" trips. These are vehicle trips that access the site that are already utilizing the surrounding roadway system so they are not counted as additional vehicle trips on the surrounding roadway system. Since the NWC Site is so complex, involves new land uses, develops new roadway connections and significantly enhances pedestrian, bicycle, and transit access to the area, it was determined that a stand-alone study to determine potential vehicle trip reductions would be performed.

The December 2017 National Western Center Parking and Transportation Demand Management Plan was developed specifically to develop strategies to reduce vehicular trips to the site and to reduce parking demand. The Plan involved national experts on parking and travel demand management and was vetted through a Project Management Team that included CCD Public Works, CCD Community Planning and Development, NWCO, WSSA, CSU, CDOT, RTD, RiNO, DRCOG, RTD, and Denver Coliseum representatives. Additionally, the Plan was developed and vetted in conjunction with a Technical Advisory Group and was presented to the NWC Citizens Advisory Committee and at a public open house. The Plan evaluated several scenarios that coincide with the scenarios being evaluated in this traffic impact study including a normal weekday and a large event scenario and developed packages of TDM elements that are targeted at reducing Single Occupant Vehicle (SOV) trips, Vehicle Miles Traveled (VMT), and Parking Demand. Table 2 contains a summary of the recommendations from that plan.

For the purposes of determining the number of vehicle trips accessing the site during the specific scenarios being evaluated in this traffic impact study, the percent reduction in parking demand was determined to be the most applicable to reducing vehicle trips accessing the site. Part of the TDM strategy is encouraging transportation network companies (TNC's), transit use, and rideshare which generate vehicle trips but not parking demand. Of these, TNC's have a potentially large impact on traffic operations in the area of the site during large event scenarios. Identifying and

Table 2: VMT, SOV and Parking Reduction Percentages*

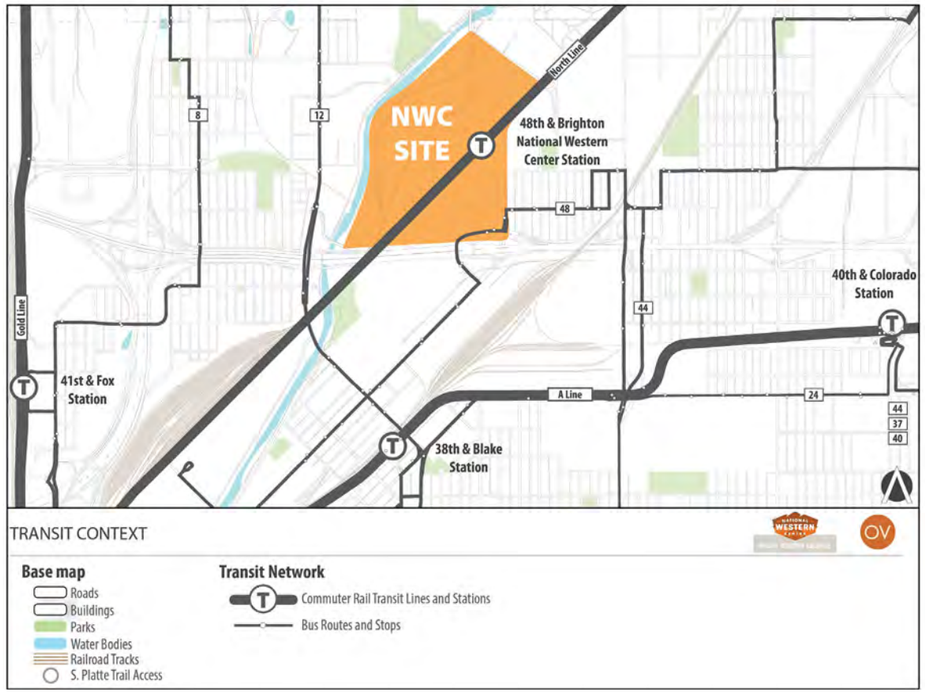
Timeframe and Scenario	Percent Reduction		
	VMT	SOV	Parking [1]
Phase 1-2 Operational- Typical Day	45%	21%	17%
Phase 1-2 Operational- Large Event	46%	22%	19%
Full Build Out- Typical Day	59%	28%	24%
Full Build Out- Large Event	50%	24%	20%

*Recommendations from NWC Parking and TDM Final Report, December 2017
[1] used for vehicle trip reduction

developing mobility hub areas and pick up and drop off patterns that support TNC operations is critical to ensuring efficient operations. Other sites in the Denver area such as Red Rocks were looked at for TNC operations. We also held discussions with Denver Arts and Venues to gather information on current TNC operating characteristics. Based on this information we have determined that up to 10% of all attendees coming to a large event scenario could use TNC's to access the site. Further information on TNC's, their anticipated patterns, and expected volumes are described for each large event scenario later in this document.

The rest of the portion of attendees using TDM related modes to access the site are expected to utilize one of several commuter rail stations in the area, the new pedestrian and bicycle facilities being constructed on site, and additional car-pooling, etc. Exhibit 3 shows the commuter rail stations near the site.

Exhibit 3: Transit Context



EXISTING CONDITIONS

ROADWAY NETWORK

The site is served by several high capacity transportation corridors including I-25 on the west side of the site and I-70 on the south side of the site, and has direct interchange access at Washington Street and Brighton Boulevard. Washington Street is a major arterial located on the west side of the site and Brighton Boulevard is a major arterial located on the east side of the site. Washington Street is separated from the site by the South Platte River. Access to the site from Washington Street is provided by one existing bridge over the river at 47th Avenue. The Phase 1-2 facilities being constructed on the west side of the site are separated from the Full Build Out facilities on the east side of the site by the BNSF main line and the RTD N-Line tracks. There are two existing public underpasses of these railroad tracks in the area; 46th Avenue and Race Court. The existing Race Court underpass of the railroad corridor has a deficient clearance height of 14'-0". There is one private underpass of the railroad tracks on the existing National Western Center grounds called the Bettie Cram Underpass (also known as the Marion Underpass) and located at approximately 47th Avenue.

There are several transportation infrastructure projects currently underway near the site including the I-70 Reconstruction Project, Brighton Boulevard Reconstruction Project from 29th Avenue to 44th Avenue, Brighton Boulevard Reconstruction Project from 46th Avenue to Race Court, and the construction of the RTD N-Line Commuter Rail. Another transportation project near the site that will be constructed in the near future is the Washington Street Reconstruction Project. It is assumed that the Washington Street Reconstruction Project will be complete when the National Western Center Phase 1-2 facilities open. (Note: All the projects mentioned are assumed to be complete when Phase 1-2 is complete.)

Site visits to the project area were performed to document the existing lane configurations and control for the intersections near the project site.

See Exhibit 4 for Existing Lane Configurations and Control.

PEDESTRIAN AND BICYCLE NETWORK

The existing pedestrian network on and near the site is incomplete and does not connect the area well. The site is served by several existing bicycle facilities including the Platte River Trail but in general is not well connected to other parts of Denver by bicycle. The existing pedestrian and bicycle facilities are shown in Exhibits 5 and 6.

TRAFFIC VOLUMES

Traffic data shown in this study for existing conditions was collected in August of 2018. Inquiries were made to Denver Public Works as well as to local data collection companies as to the existence of additional existing conditions data in this area but none were found.

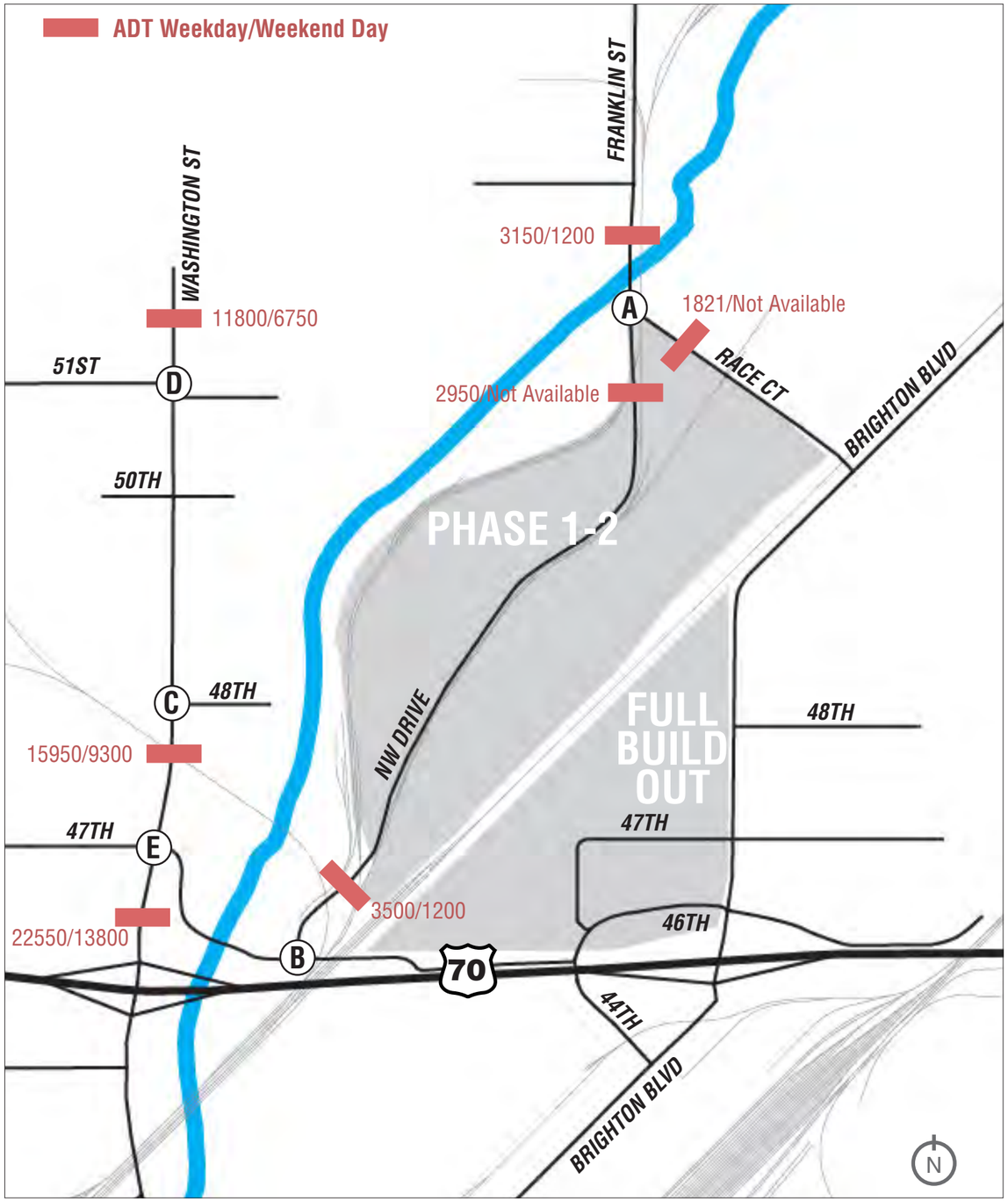
See Exhibits 7 and 8 for Existing Peak Hour Traffic.

OPERATIONAL ASSESSMENT

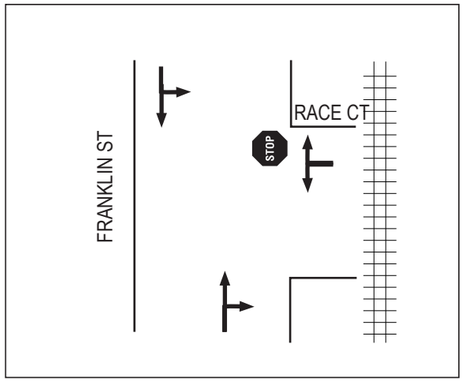
Based on existing and future traffic volumes, the weekday PM peak hour was determined to be the controlling condition for a normal weekday. Therefore, operational analyses were performed for the weekday PM peak hour and the weekend peak hour for a large event. All intersections operate at an acceptable LOS during the weekday PM peak hour and weekend day peak hour under current conditions. The criteria for acceptable intersection operations is that the overall intersection operates at LOS D or better with no movements operating worse than LOS E.

Table 3 and 4 show the operational results and delay for existing conditions.

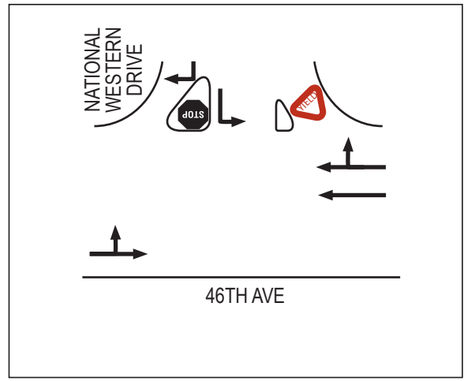
EXHIBIT 4: EXISTING LANE CONFIGURATIONS, CONTROLS AND ADT



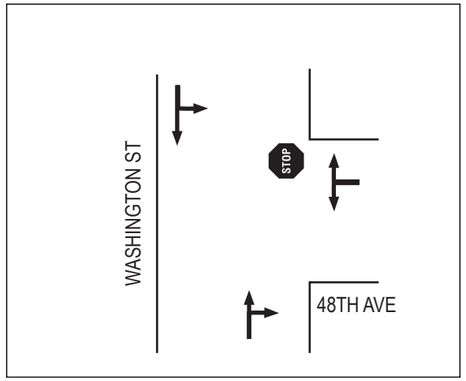
A - FRANKLIN ST & RACE CT



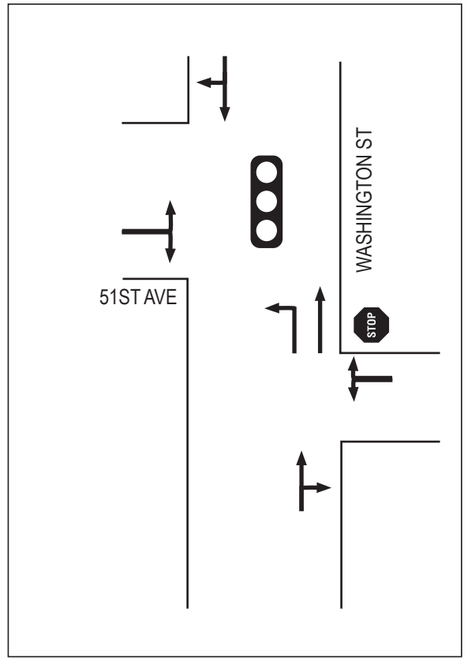
B - NW DRIVE & 46TH AVE



C - 48TH AVE & WASHINGTON



D - 51ST AVE & WASHINGTON



E - 47TH AVE & WASHINGTON

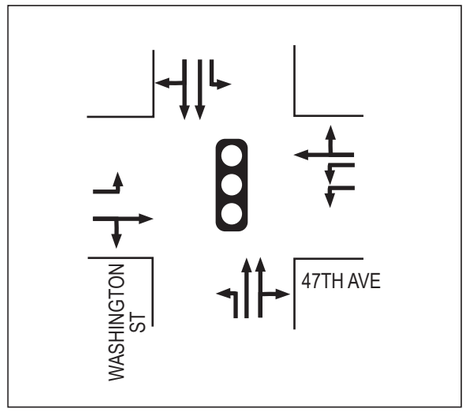
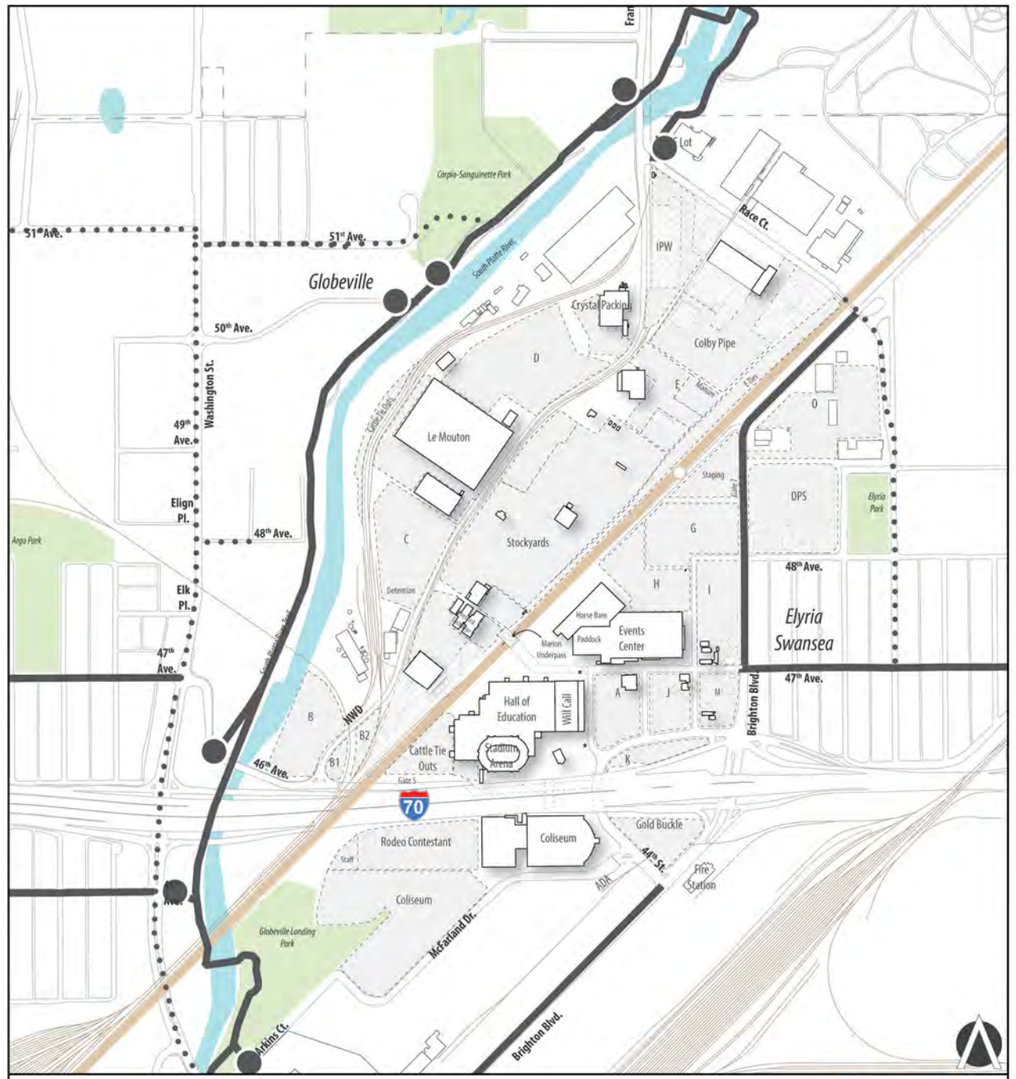


Exhibit 5: Bicycle Network | Existing

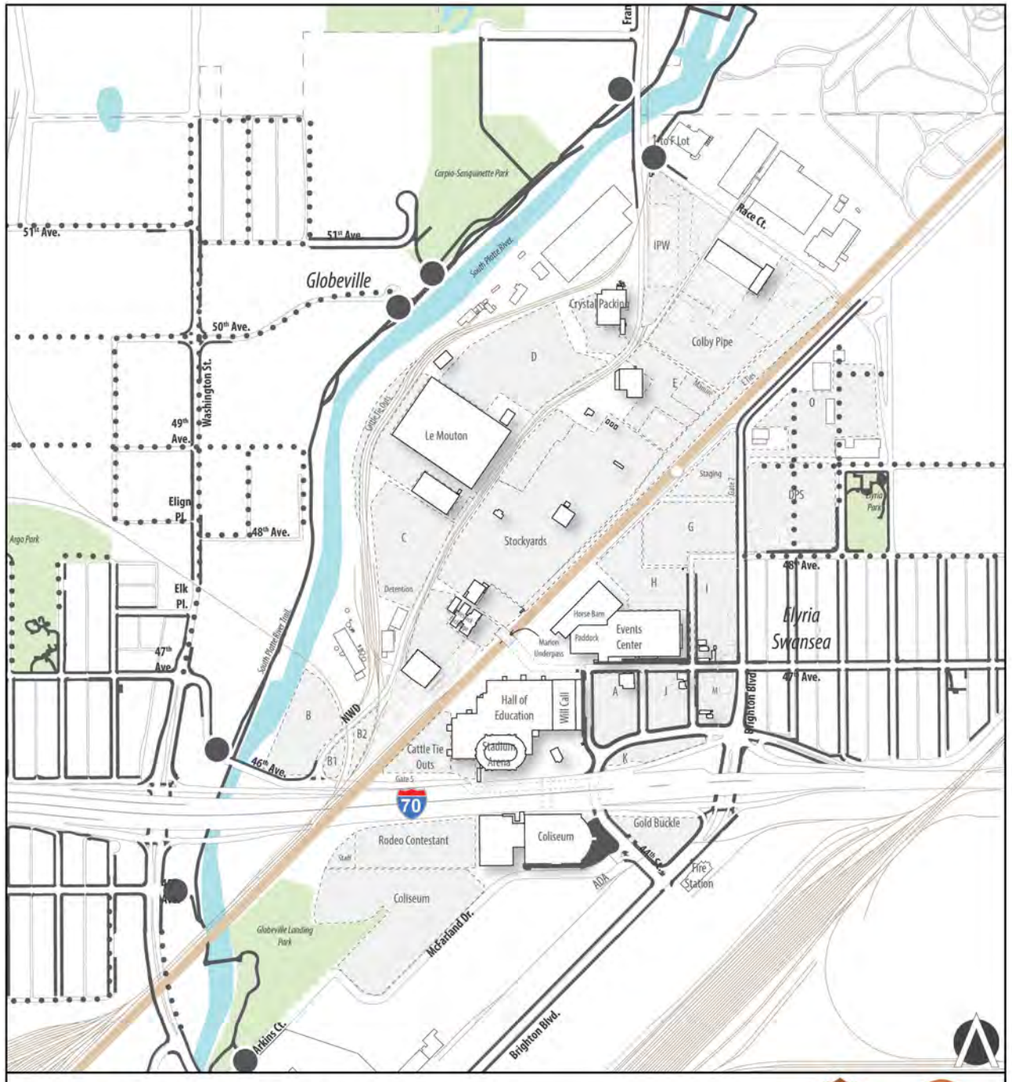


BICYCLE NETWORK | **EXISTING**

Base map
- Roads
- Buildings
- Parks
- Water Bodies
- Railroad Tracks
- S. Platte Trail Access

Bicycle Network
- Existing - Bicycle Facilities
- Existing - S. Platte Trail Access
- Future - Bicycle Facilities - By Others

Exhibit 6: Pedestrian Network | Existing

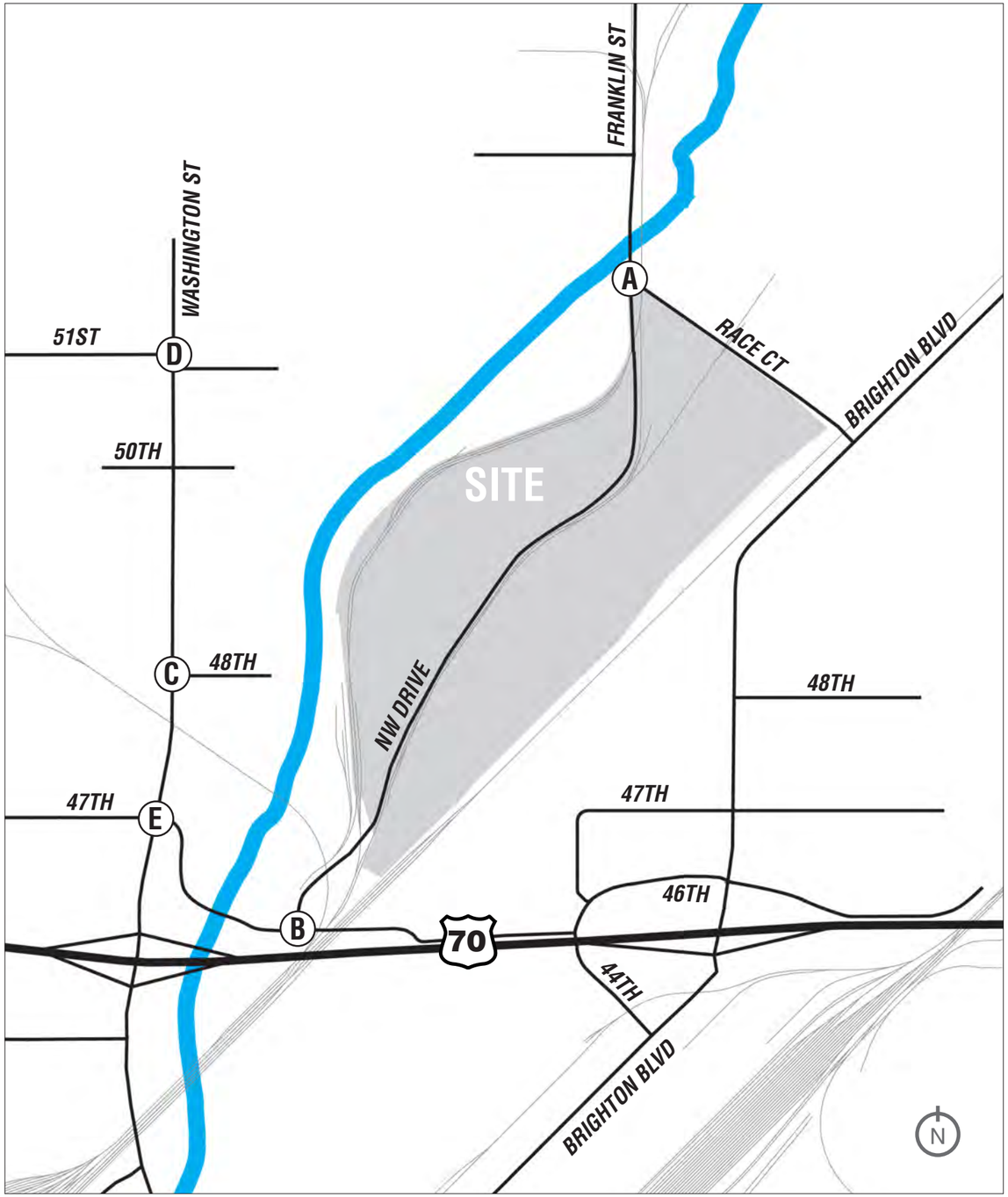


PEDESTRIAN NETWORK | **EXISTING**

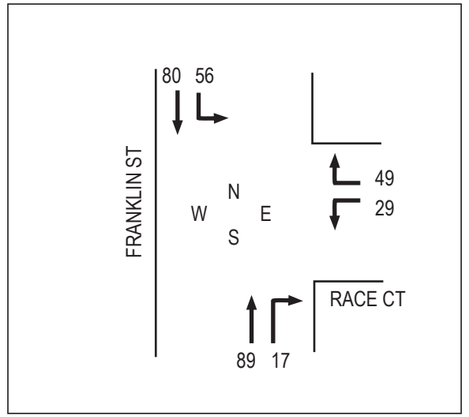
Base map
- Roads
- Buildings
- Parks
- Water Bodies
- Railroad Tracks
- S. Platte Trail Access

Pedestrian Network
- Existing - Pedestrian Facilities
- Existing - S. Platte Trail Access
- Future - Pedestrian Facilities - By Others

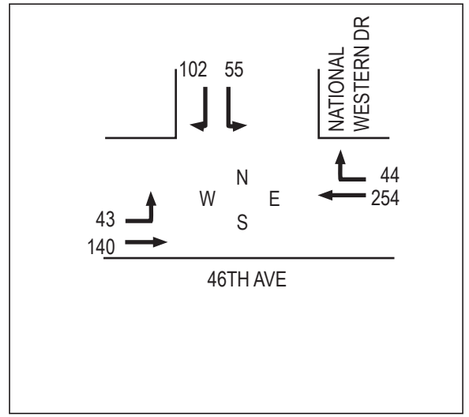
EXHIBIT 7: EXISTING TRAFFIC VOLUMES | WEEKDAY PM PEAK HOUR



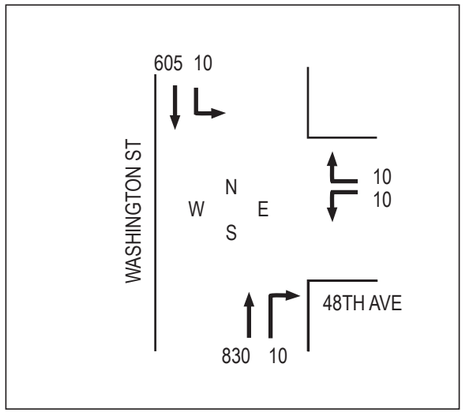
A - FRANKLIN ST & RACE CT



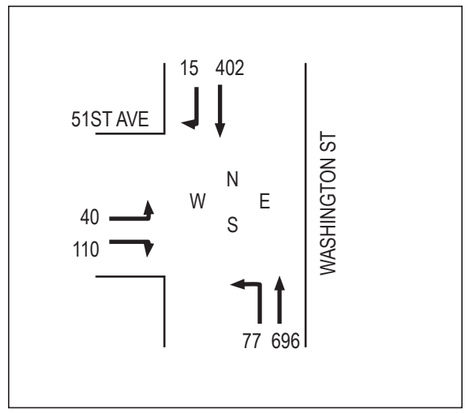
B - NW DRIVE & 46TH AVE



C - 48TH AVE & WASHINGTON



D - 51ST AVE & WASHINGTON



E - 47TH AVE & WASHINGTON

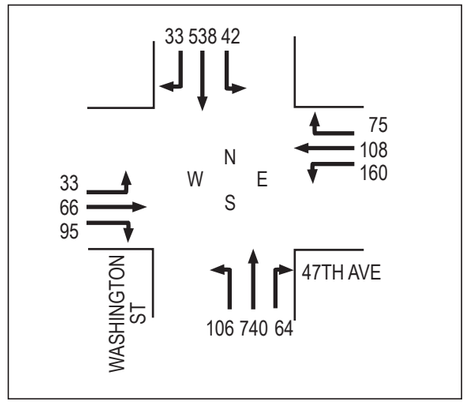
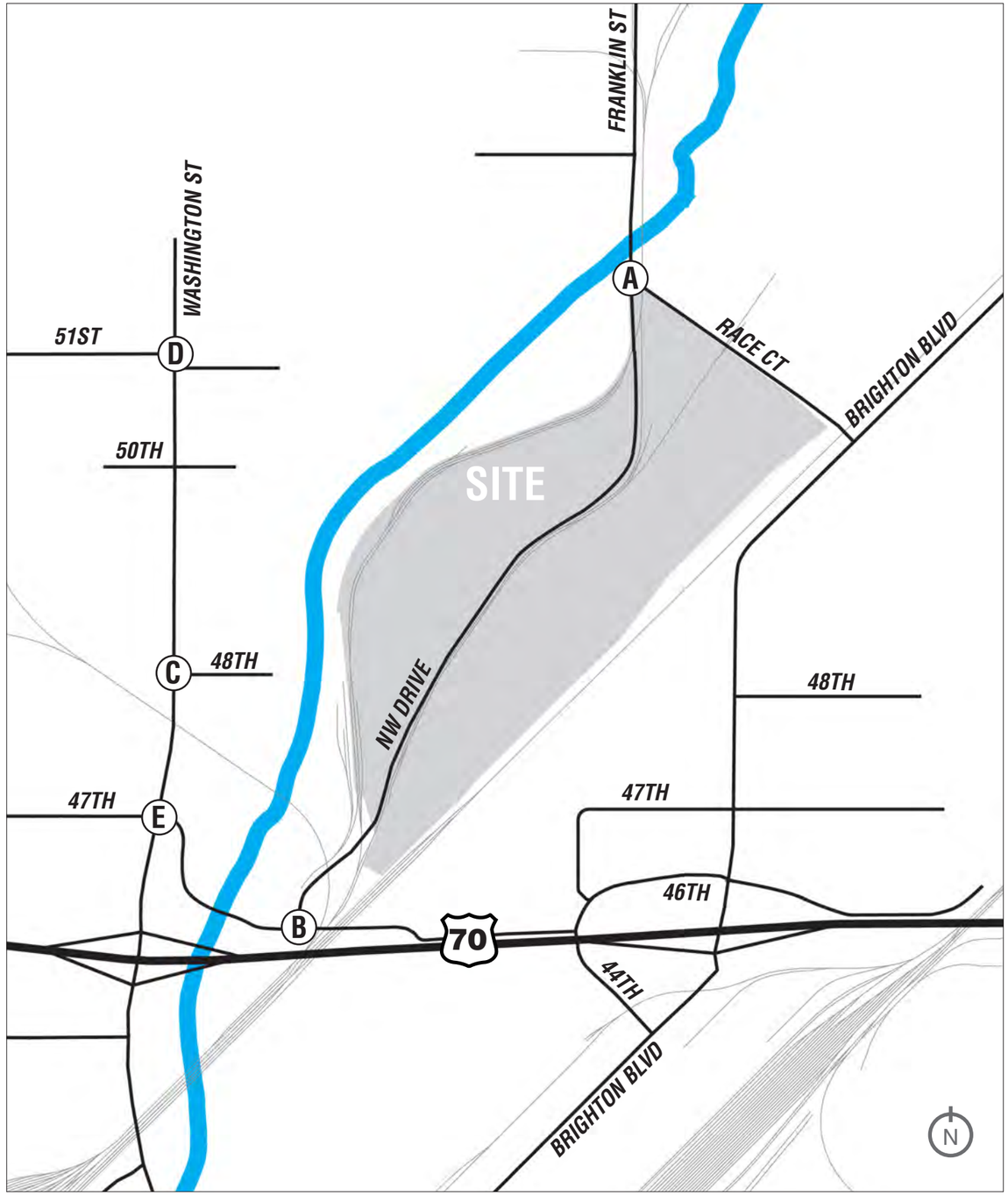


EXHIBIT 8: EXISTING TRAFFIC VOLUMES | WEEKEND PEAK HOUR



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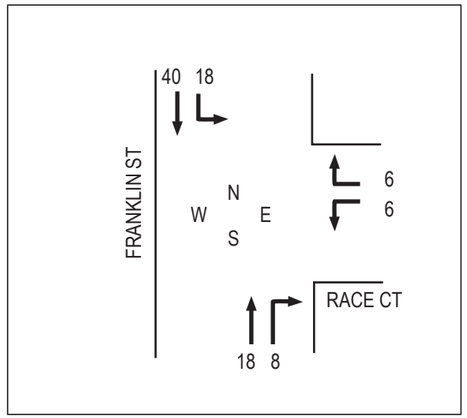

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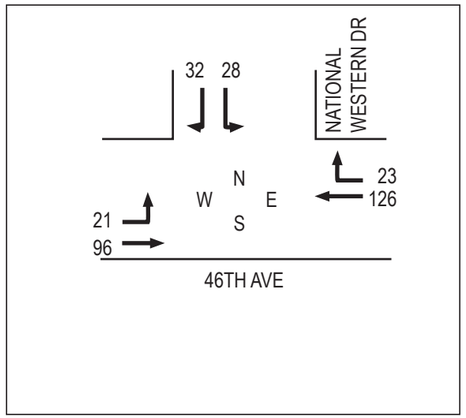

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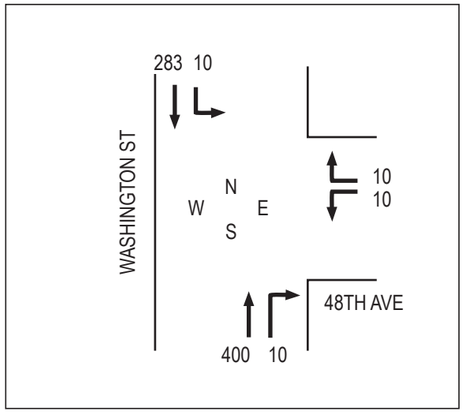
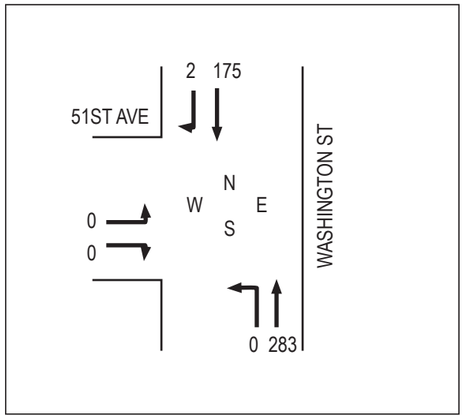


D - 51ST AVE & WASHINGTON



E - 47TH AVE & WASHINGTON

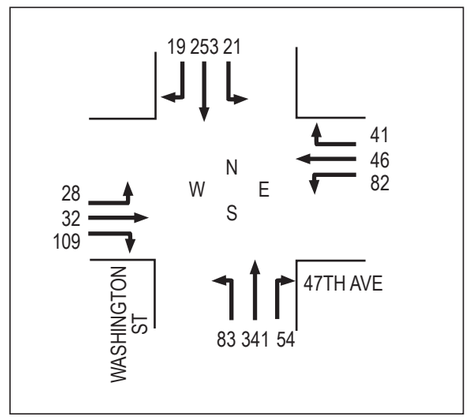


Table 3: Existing Conditions | Weekday PM Peak Hour Operational Results and Delay

		Movement											
Intersection	**Control Type**	**EBLT**	**EBT**	**EBRT**	**WBLT**	**WBT**	**WBRT**	**NBLT**	**NBT**	**NBRT**	**SBLT**	**SBT**	**SBRT**
A- Franklin St/Race Ct	Stop Sign for Race Ct				B/10.0/10						A/7.5/3		
B- NWD/46th Ave	Stop Sign for NWD	A/8.0/3	Shared Lane								B/13.9/10		A/9.8/10
C- Washington St/48th Ave	Stop Sign for 48th Ave				D/28.9/10		Shared Lane				A/9.9/0		
D- Washington St/51st Ave	Traffic Signal	C/33.8/78		Shared Lane				A/4.8/24	B/11.3/246			A/7.1/152	Shared Lane
E- Washington St/47th Ave	Traffic Signal	C/23.1/34	C/33.0/113	Shared Lane	C/23.4/58	C/32.9/151	Shared Lane	B/15.2/86	B/17.6/235	Shared Lane	A/4.3/45	A/1.1/180	Shared Lane

Note: HCM LOS / HCM Delay (sec) / 95% Queue Length (ft)

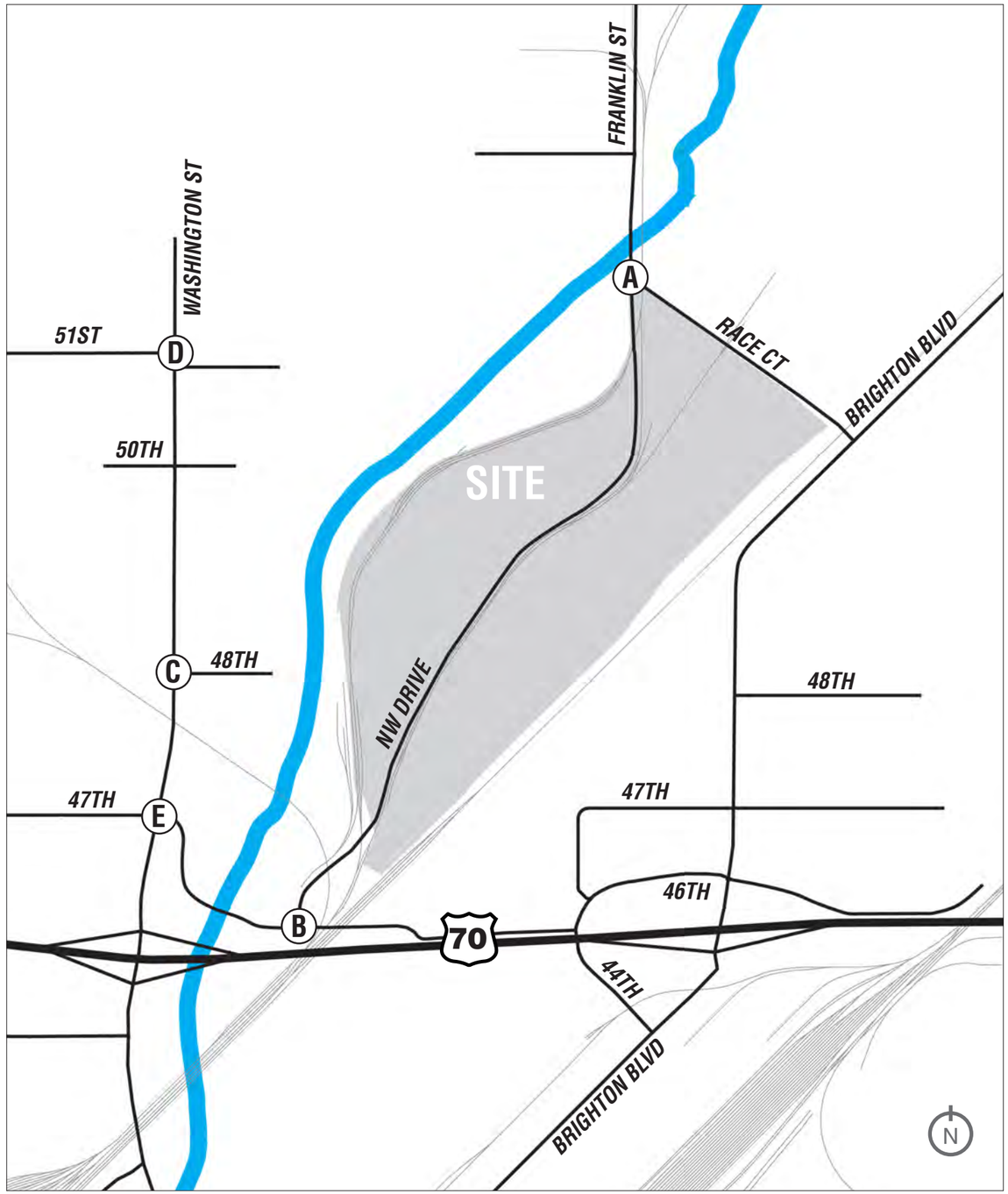
Table 4: Existing Conditions | Weekend Peak Hour Operational Results and Delay

		Movement											
Intersection	**Control Type**	**EBLT**	**EBT**	**EBRT**	**WBLT**	**WBT**	**WBRT**	**NBLT**	**NBT**	**NBRT**	**SBLT**	**SBT**	**SBRT**
A- Franklin St/Race Ct	Stop Sign for Race Ct				A/8.8/0		Shared Lane				A/7.3/0		
B- NWD/46th Ave	Stop Sign for NWD	A/7.6/0	Shared Lane								B/10.6/3		A/8.9/3
C- Washington St/48th Ave	Stop Sign for 48th Ave				B/13.2/3		Shared Lane				A/8.3/0		
D- Washington St/51st Ave	Traffic Signal	C/31.8/17		Shared Lane				A/3.9/3	A/4.9/79			A/5.1/58	Shared Lane
E- Washington St/47th Ave	Traffic Signal	B/18.2/29	C/23.8/47	Shared Lane	B/18.6/31	C/22.4/45	Shared Lane	C/23.3/62	C/20.1/106	Shared Lane	C/22.8/21	B/19.3/76	Shared Lane

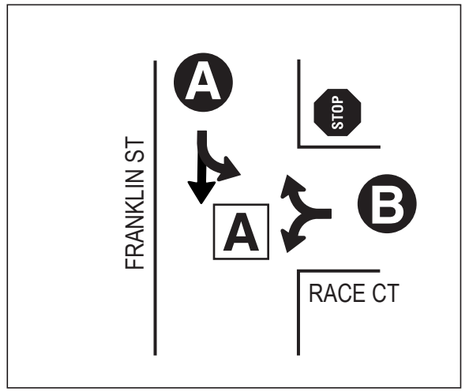
Note: HCM LOS / HCM Delay (sec) / 95% Queue Length (ft)

See Exhibits 9 and 10 for Existing Peak Hour LOS.

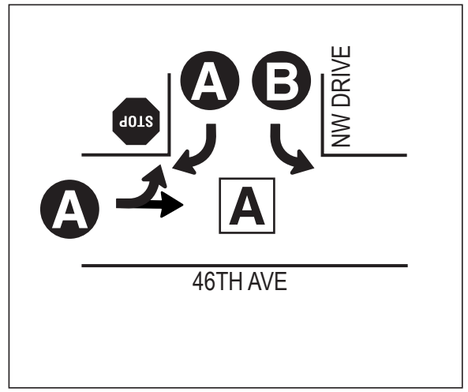
EXHIBIT 9: EXISTING CONDITIONS | LEVEL OF SERVICE WEEKDAY PM PEAK



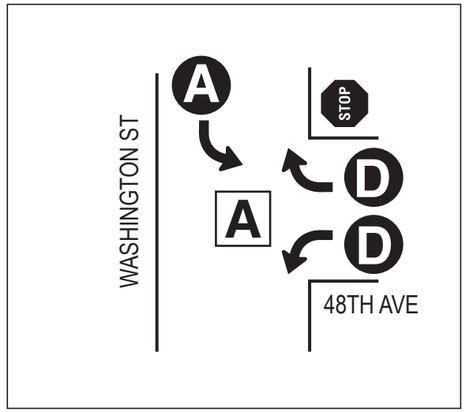
A - FRANKLIN ST & RACE CT



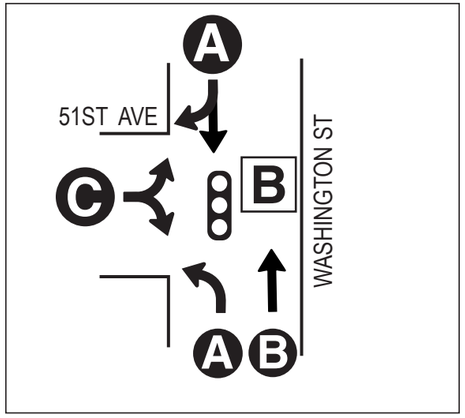
B - NW DRIVE & 46TH AVE



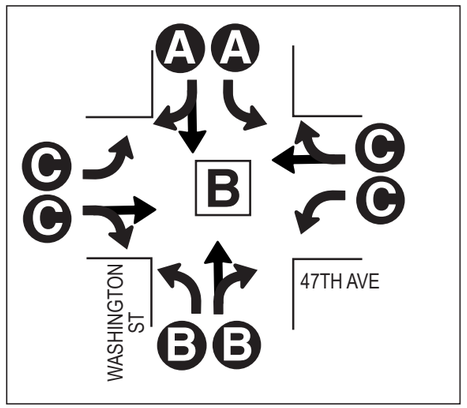
C - 48TH AVE & WASHINGTON



D - 51ST AVE & WASHINGTON



E - 47TH AVE & WASHINGTON

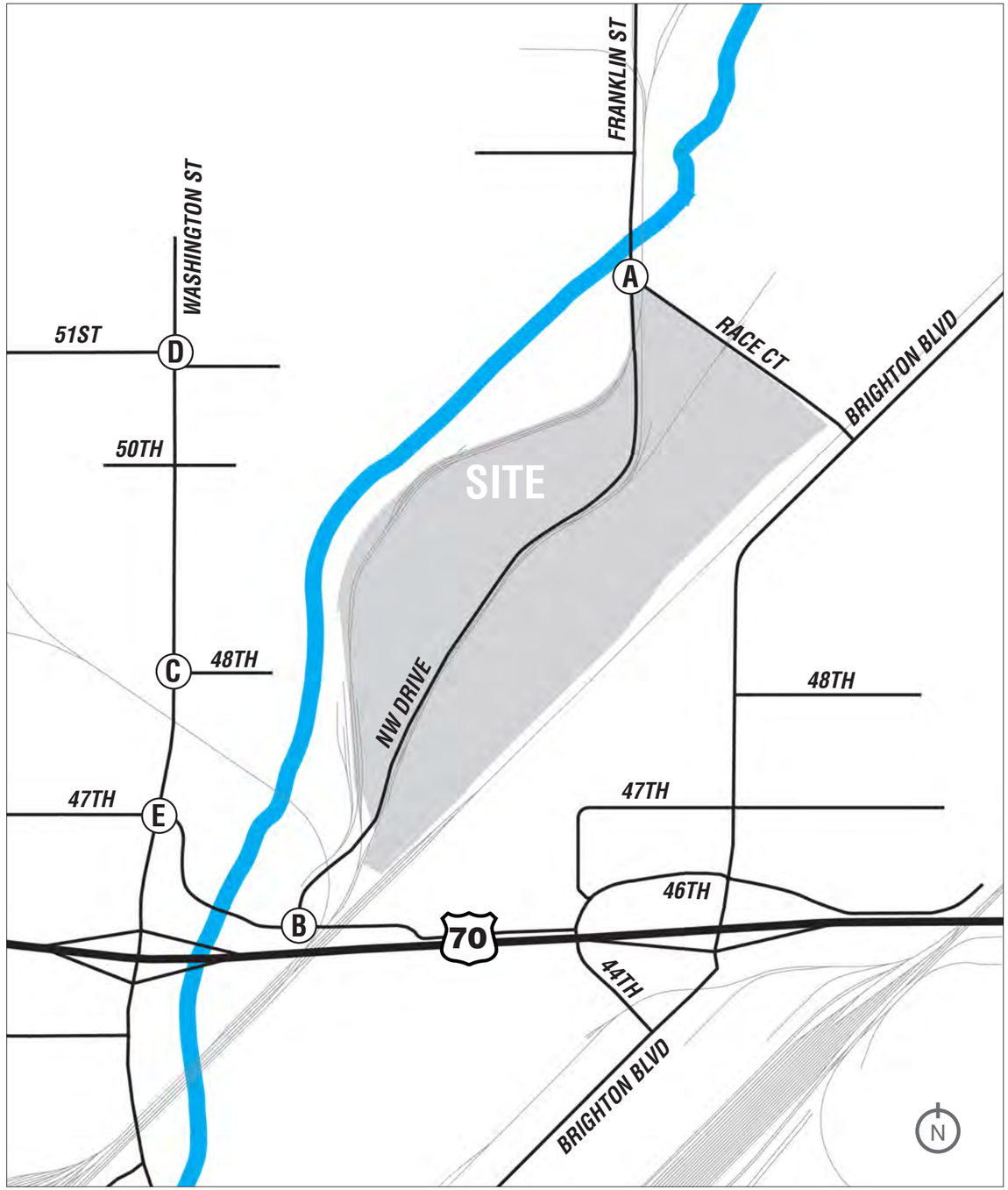


● = Movement LOS

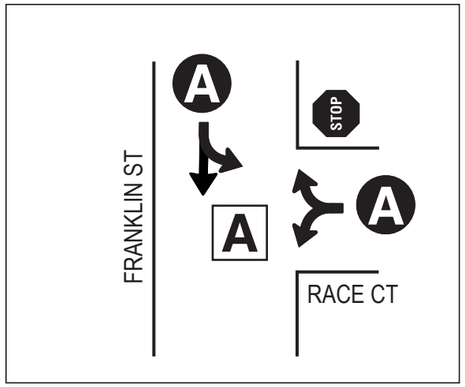
□ = Overall LOS

NOTE: Only movements with calculated LOS are shown.

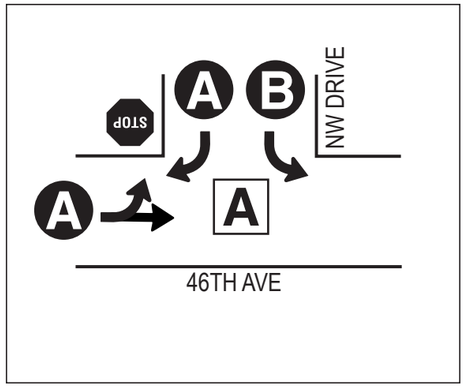
EXHIBIT 10: EXISTING CONDITIONS | LEVEL OF SERVICE WEEKEND PEAK



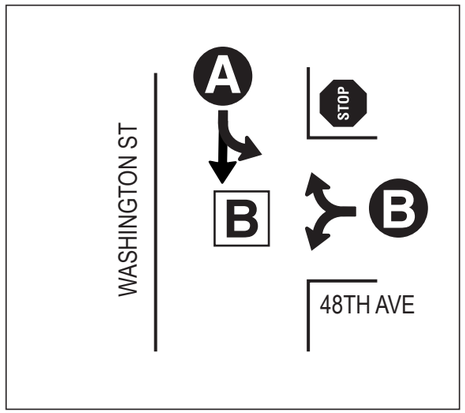
A - FRANKLIN ST & RACE CT



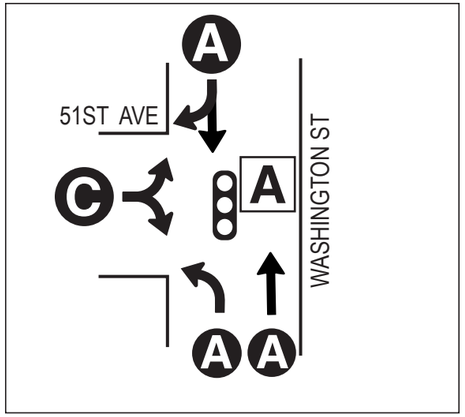
B - NW DRIVE & 46TH AVE



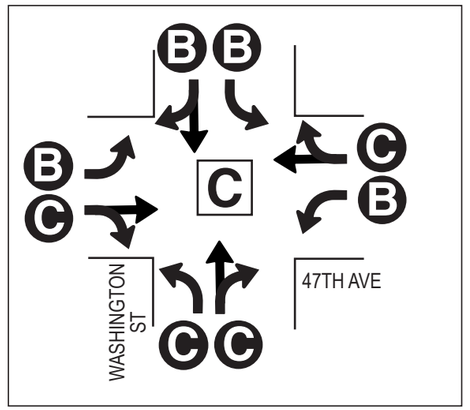
C - 48TH AVE & WASHINGTON



D - 51ST AVE & WASHINGTON



E - 47TH AVE & WASHINGTON



● = Movement LOS

□ = Overall LOS

NOTE: Only movements with calculated LOS are shown.

PHASE 1-2 COMPLETE ANALYSIS AND EVALUATION

PROJECT DESCRIPTION

The National Western Center Redevelopment will occur over at least two construction phases. The initial phase is referred to as Phase 1-2 and includes facilities and infrastructure that are located on the west side of the BNSF/RTD Railroad Corridor. Facilities being constructed by the Mayor's Office of the National Western Center (NWCO) in Phase 1-2 include new equestrian and livestock buildings as well as new Stockyards and a new maintenance facility. Additional facilities are being constructed in the Phase 1-2 area by other parties including Colorado State University and the Western Stock Show Association. Transportation improvements occurring in Phase 1-2 include relocating the DRIR Railroad to be adjacent to the BNSF/RTD Railroad Corridor, reconstruction National Western Center Drive, constructing a new east west roadway, Bettie Cram Drive, and constructing two new bridges over the South Platte River, one at 48th Avenue/Bettie Cram Drive and one at 51st Avenue. One key fact to know about the transportation infrastructure when Phase 1-2 is complete is that the Marion Underpass will not be open to public vehicle travel although it will be open for pedestrian and bicycle travel (this is a temporary condition, after Full Build Out, this will become a public vehicle travel way). Therefore, at the completion of Phase 1-2 construction, Bettie Cram Drive will not connect the east and west sides of the site under the DRIR/BNSF/RTD Railroad Corridor for automobiles. This fact affects trip assignment in that area.

LAND USE

Many land uses are not fully defined at the time of this traffic study. Facilities being developed by CSU and WSSA are in the preliminary phases and it is not possible to develop detailed characteristics of them yet. We have used the best information available at this time for all land uses. Phase 1-2 includes the development of the land uses shown in Exhibit 11.

Significant pedestrian and bicycle improvements are planned in the Phase 1-2 area and a new pedestrian bridge over the DRIR/BNSF/RTD Railroad Corridor linking the phase 1-2 area with the N-Line commuter rail station along Brighton Boulevard is planned. See Exhibits 12 and 13 for planned bicycle and pedestrian facilities to be constructed in Phase 1-2.

Another key element related to trip assignment for Phase 1-2 is the location of parking structures and lots on the site. There are currently two large pools of parking planned to be available during both a normal day and during the Large Event scenario being evaluated. There will be a stand alone parking structure located just to the northeast of the equestrian barn that is planned to have 600 spaces available at the completion of Phase 1-2 construction. It is planned to have two ingress/egress points, one right in/right out access along NWD between 51st Ave and the Service Drive and one full movement access along the Service Drive at a location east of NWD. The Stockyards will also be available for surface parking during many large event scenarios. The Stockyards are comprised of approximately 20 acres of hard surface area that can provide a large pool of surface parking. The Stockyards are accessed by four driveways along National Western Drive with the main access being located just past the north edge of the equestrian barn. There are also surface parking lots available near Brighton Boulevard that could be used by event attendees.

DIRECTIONAL DISTRIBUTION

The directional distribution of traffic is a means to quantify the percentage of site-generated traffic that approaches the site from a given cardinal direction and departs the site back to the original source direction. The directional distribution for the site was developed by looking at volumes along I-25, I-70, Brighton Boulevard, and Washington Street. Detailed assignment of site traffic to the available street system was based on the area street system characteristics, existing traffic patterns and volumes, proposed land use magnitude and location, the scenario type, parking garage and lot locations, and the available access system for the project.

Phase 1-2 Trip Distribution and Assignments for the Weekday and Weekend Day are detailed in Exhibits 14 and 15.

EXHIBIT 11: PHASE 1-2 | FUTURE LAND USES

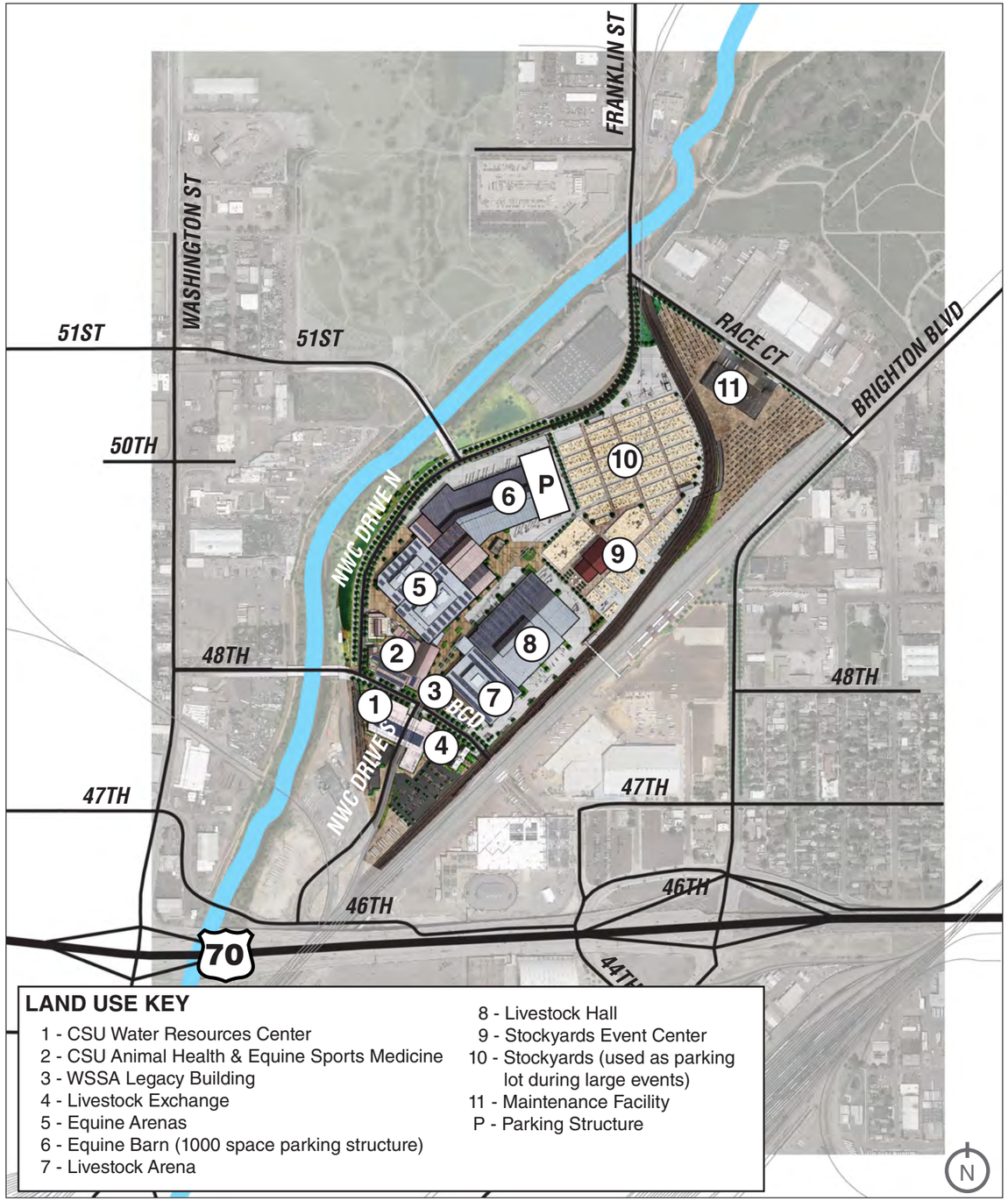
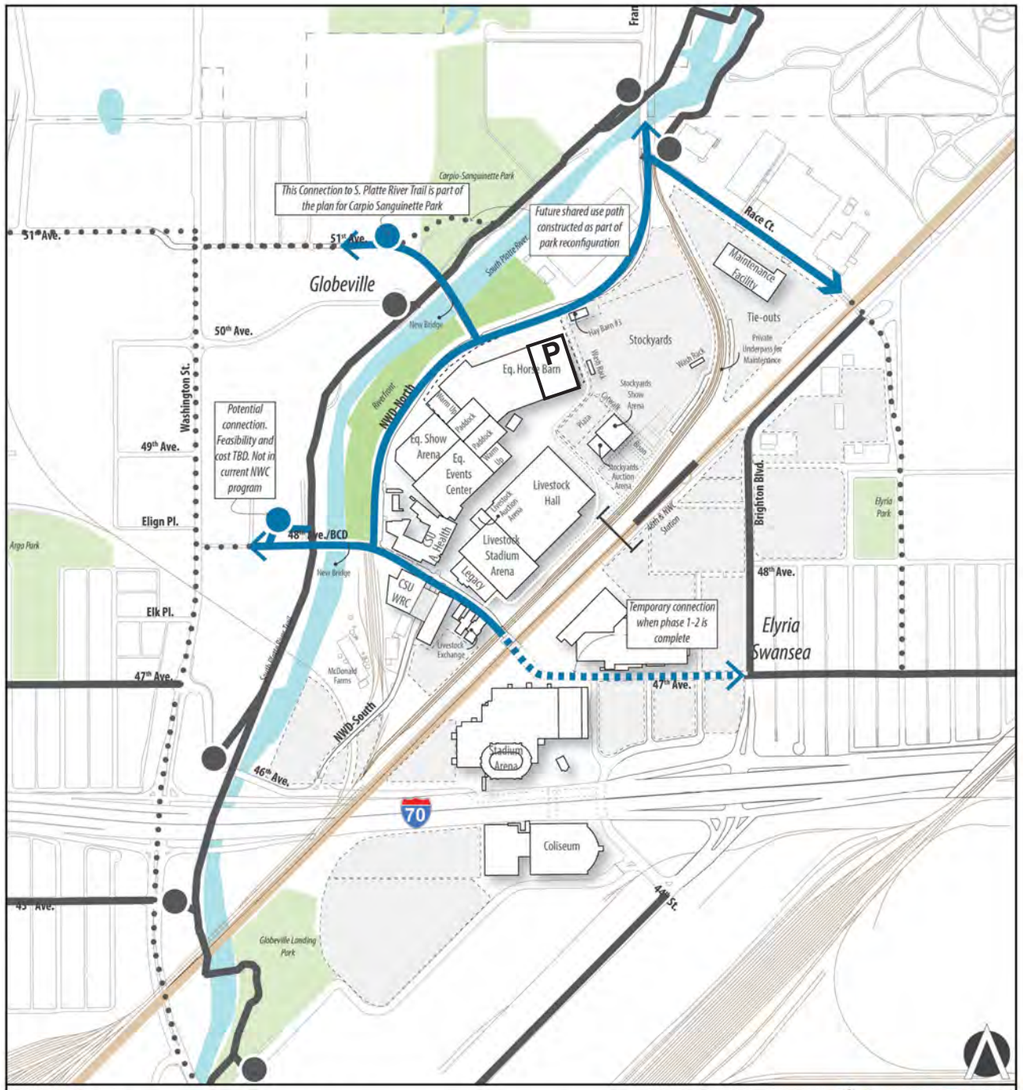


Exhibit 12: Bicycle Network | Phase 1-2

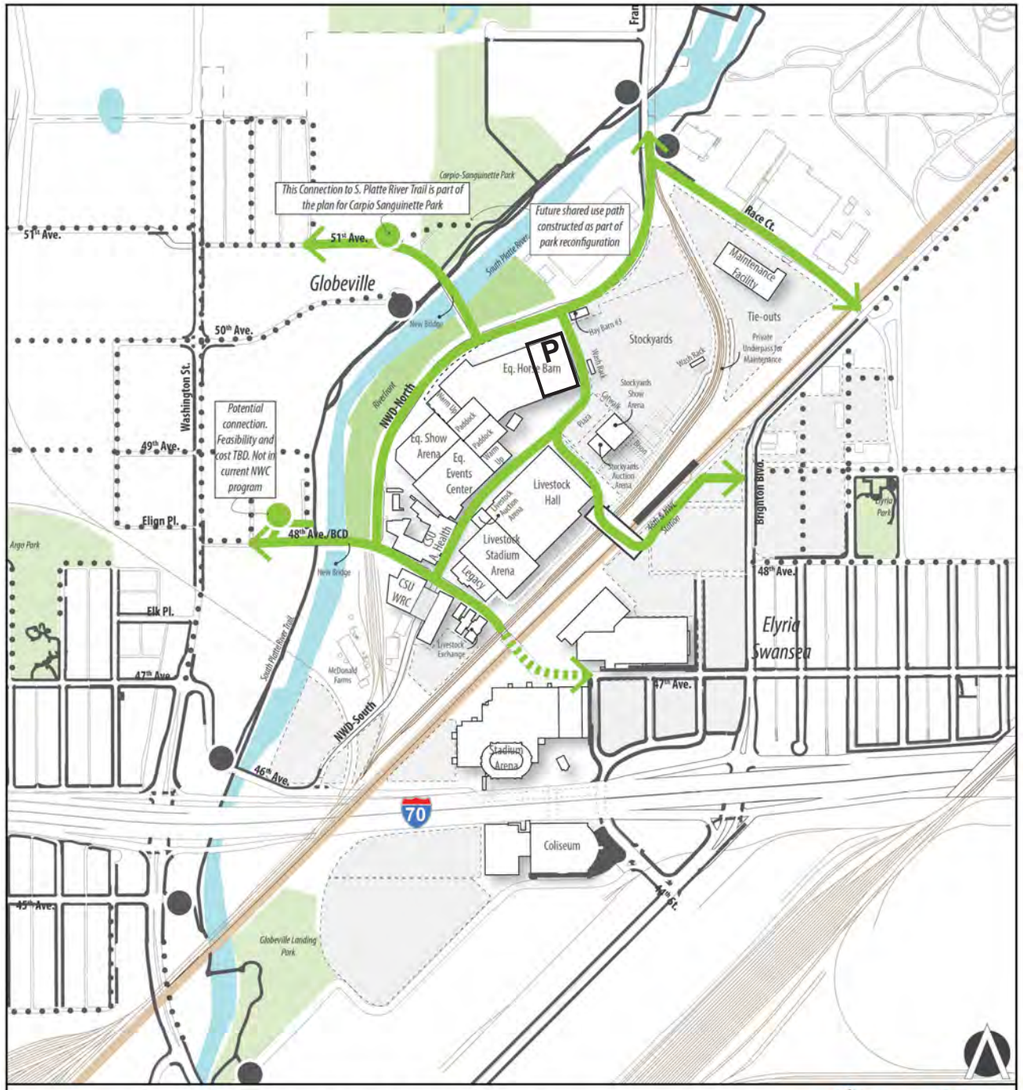


BICYCLE NETWORK | **PHASE 1-2 (WEST SIDE COMPLETE)**

Base map
- Roads
- Buildings
- Parks
- Water Bodies
- Railroad Tracks
- S. Platte Trail Access

Bicycle Network
- Existing - Bicycle Facilities
- Existing - S. Platte Trail Access
- Future - Bicycle Facilities - By Others
- Phase 1-2 - Bicycle Facilities - NWC Build
- Phase 1-2 - S. Platte Trail Access
- Phase 1-2 - Temporary Bicycle Facility - NWC Build

Exhibit 13: Pedestrian Network | Phase 1-2



PEDESTRIAN NETWORK | **PHASE 1-2 (WEST SIDE COMPLETE)**

Base map
- Roads
- Buildings
- Parks
- Water Bodies
- Railroad Tracks
- S. Platte Trail Access

Pedestrian Network
- Existing - Pedestrian Facilities
- Existing - S. Platte Trail Access
- Future - Pedestrian Facilities - By Others
- Phase 1-2 - Pedestrian Facilities - NWC Build
- Phase 1-2 - S. Platte Trail Access
- Phase 1-2 - Temporary Pedestrian Facility - NWC Build

Exhibit 14: Phase 1-2 | Trip Distribution & Assignment Normal Weekday

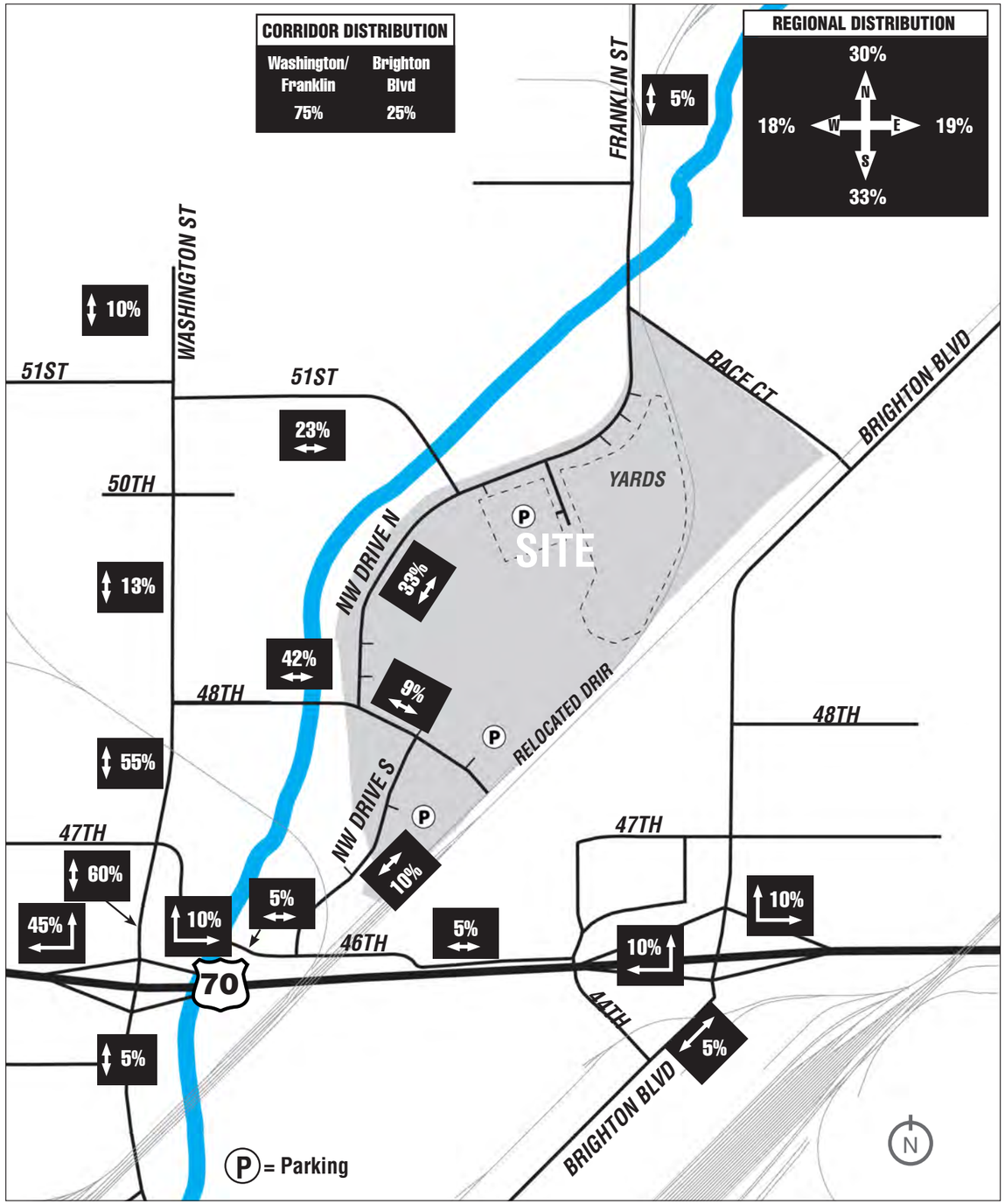
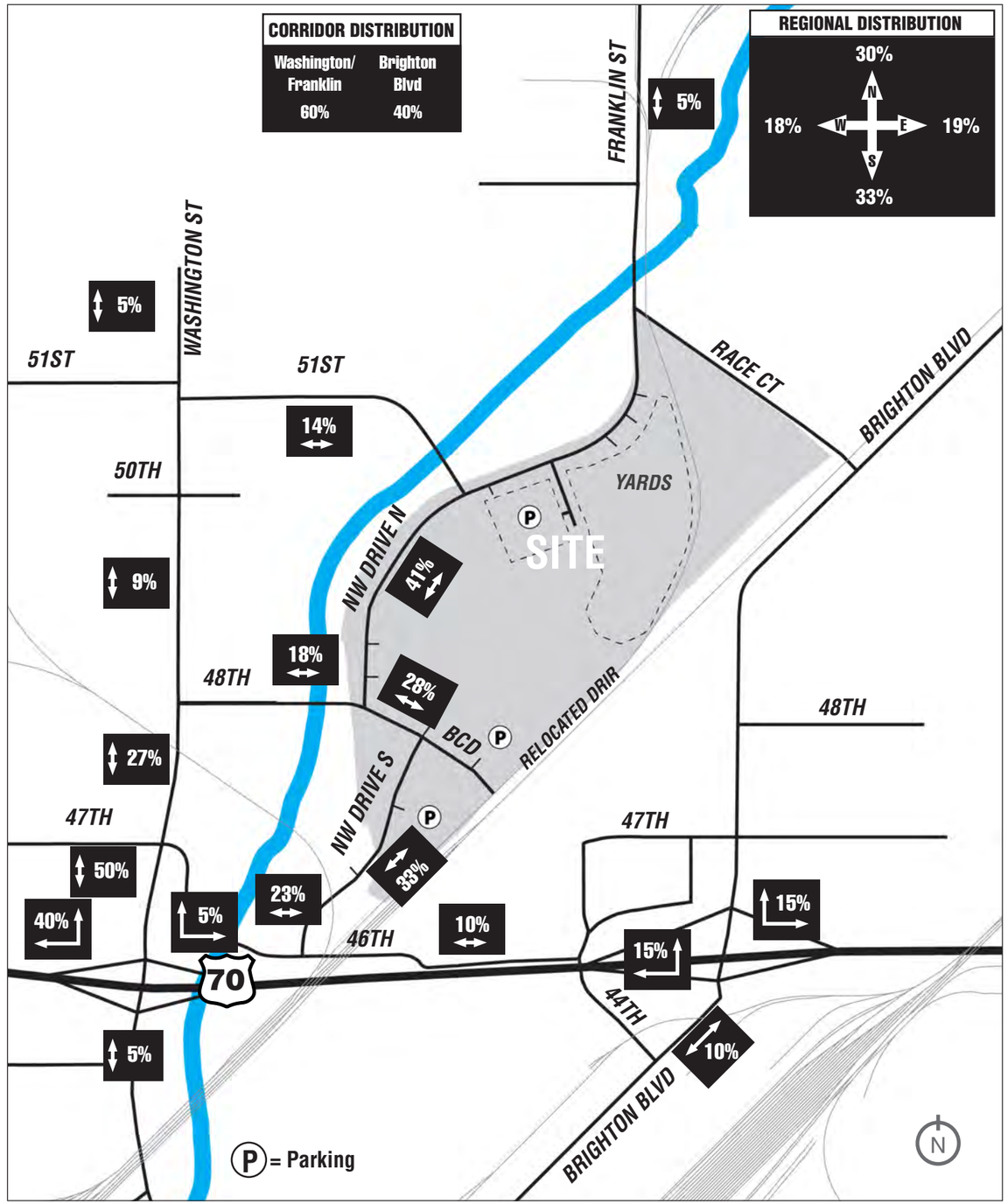


Exhibit 15: Phase 1-2 | Trip Distribution & Assignment Large Event Weekend Peak



ROADWAY NETWORK

Significant changes in access to the west side of the site over the South Platte River from Washington Street are included in the Phase 1-2 scenario. New bridges are being constructed at 48th Avenue/Bettie Cram Drive and at 51st Avenue. Bettie Cram Drive is a new east/west roadway through the site that will eventually cross under the DRIR/BNSF/RTD Railroad Corridor to connect the east and west sides of the NWC. Also, National Western Drive (N) between Bettie Cram Drive and the Service Drive is being designed with a wide pavement section with no bulb-outs so that the roadway can be flexed from two-lane roadway to a maximum of a four-lane roadway depending on special event transportation needs.

See Exhibit 16 for Phase 1-2 Roadway Network.

BACKGROUND TRAFFIC VOLUME DEVELOPMENT

Non-site generated background traffic was developed by utilizing the traffic volumes from the 2018 existing traffic counts in the project area. The traffic volumes were then modified to account for changes in the roadway network in the area that will be in place at the completion of Phase 1-2. No growth factor was applied to the existing traffic volumes in the development of background traffic for Phase 1-2 scenarios.

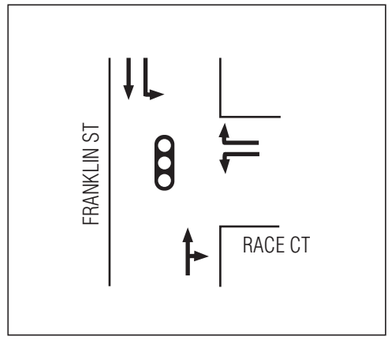
TRIP GENERATION

Trip Generation Rates were derived from the latest version of ITE Trip Generation Manual, 10th Edition for land uses that have trip generation data available. For other land uses, an estimate of their trip making characteristics was developed based on their size and function, their intended use, their operational condition during the timeframe being developed, and data developed through several years of on-site observations. For persons per vehicle estimates and percent arrival estimates for special event types of land uses, both the data collection reports from the 2015 and 2016 NWSS activities as well as Chapter 5, Event operations Planning of the FHWA publication “Managing Travel for Special Events” were utilized as data sources. The vehicle trip reduction rates used in the trip generation calculations were taken from the National Western Center Parking and Travel Demand Management study completed in 2018.

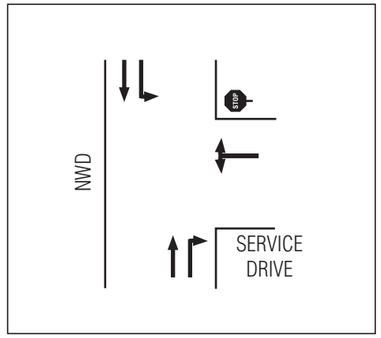
Additional notes regarding each land use and its trip generation are included in the trip generation tables. Tables 5 and 6 detail the trip generation for Phase 1-2.

EXHIBIT 16: PHASE 1-2 | ROADWAY NETWORK

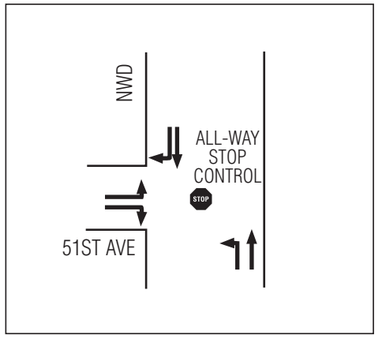
1 - FRANKLIN ST & RACE CT



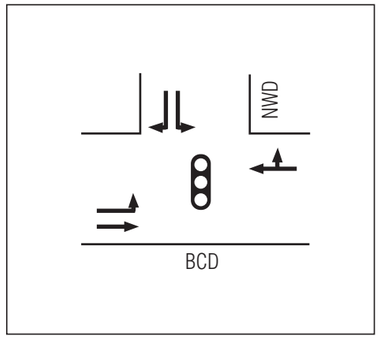
2 - NATIONAL WESTERN (N) & SERVICE DRIVE



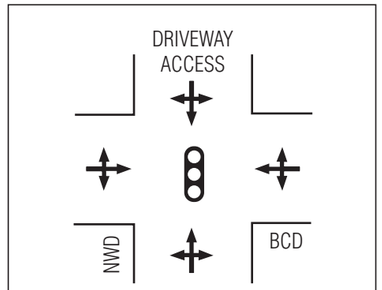
3 - NATIONAL WESTERN (N), & 51ST AVE



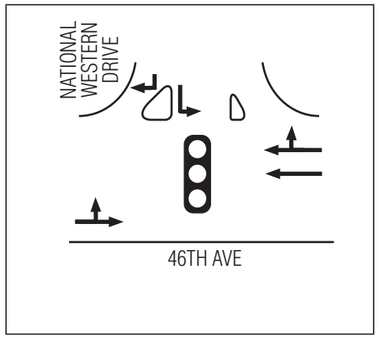
4 - NATIONAL WESTERN (N) & BCD



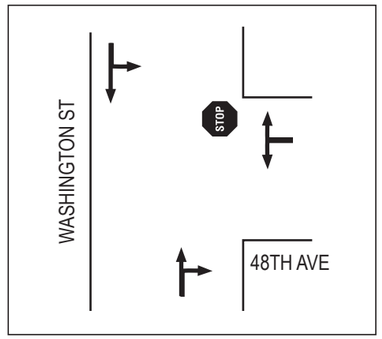
5 - NATIONAL WESTERN (S) & BCD



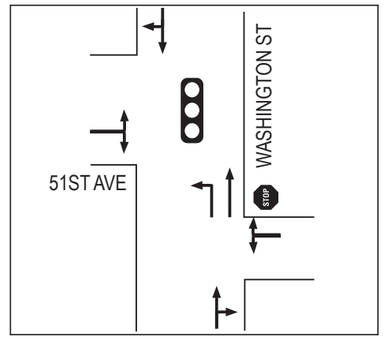
6 - NATIONAL WESTERN (S) & 46TH



7 - 48TH AVE & WASHINGTON



8 - 51ST AVE & WASHINGTON



9 - 47TH AVE & WASHINGTON

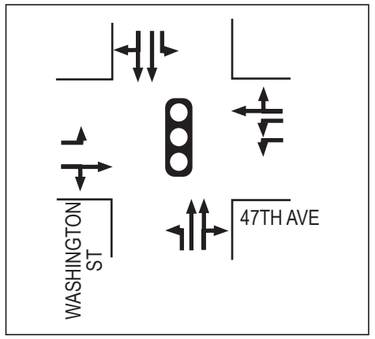


TABLE 5: TRIP GENERATION PHASE 1-2 | NORMAL WEEKDAY

					Trip Generation Rates			Number of Trips			Trip Orientation %				Trip Orientation #				
											AM Peak		PM Peak		AM Peak		PM Peak		
ITE Land Use Code	Description	Land Use Notes	Variable	Quantity	Daily	AM Peak	PM Peak	Daily	AM Peak	PM Peak	Entering	Exiting	Entering	Exiting	Entering	Exiting	Entering	Exiting	Other Notes
225	Off-Campus Student Apartment (Adjacent to Campus)	One use in 80KSF CSU Animal Health Building	Bedrooms	15	3.15	0.12	0.25	47	2	4	41%	59%	50%	50%	1	1	2	2	Based on current information from CSU
640	Animal Hospital/Veterinary Clinic	One use in 80KSF CSU Animal Health Building	1,000 sf GFA	10	21.50	3.64	3.53	215	36	35	67%	33%	40%	60%	24	12	14	21	Based on CSU program information and discussions
710	General Office	WSSA Legacy Building	1,000 sf GFA	75	9.74	1.16	1.15	731	87	86	86%	14%	14%	86%	75	12	12	74	Based on information provided by WSSA. Assumes all office for trip generation purposes even though there are other uses in the building.
710	General Office	Livestock Exchange Building	1,000 sf GFA	70	9.74	1.16	1.15	682	81	81	86%	14%	14%	86%	70	11	11	70	Estimated total SF from WSSA information
760	Research and Development Building	CSU Water Resource Building	1,000 sf GFA	150	11.26	0.42	0.49	1689	63	74	75%	25%	15%	85%	47	16	11	63	building uses include labroatory testing, research, education, etc.
N/A	Equine Sports Medicine Facility	One use in 80KSF CSU Animal Health Building	1,000 sf GFA	65	3.00	0.30	0.30	195	20	20	60%	40%	35%	65%	12	8	7	13	Trips based on discussions with CSU
N/A	Equine Large Arena	Primarily Focused on Equine Competitions	Seats	4500	0.20	0.01	0.04	900	45	180	65%	35%	100%	0%	29	16	180	0	assumes small equine competition
N/A	Equine Small Arena	Primarily Focused on Equine Competitions	Seats	500	0.20	0.01	0.04	100	5	20	65%	35%	100%	0%	3	2	20	0	assumes small equine competition
N/A	Equine Barn	Used to House Equine Competitors. Planned to be programmed with equine uses 50 weeks per year.	Stalls	800	1.00	0.20	0.20	800	160	160	65%	35%	35%	65%	104	56	56	104	Assumes 200 stalls filled during week with 4 trips per occupied stall
N/A	Livestock Arena	Multi-Purpose Arena with 3,000 fixed seats	Seats	3000	0.30	0.01	0.13	900	30	390	50%	50%	100%	0%	15	15	390	0	Assumes small concert wth 1000 seats filled. 2.2 people per vehicle. 82% arrive in hour before concert. Daily includes service traffic.
N/A	Livestock Hall Auction Arena	Small space adjacent to Livestock Barn	Seats	700	0.06	0.01	0.01	42	7	7	65%	35%	75%	25%	5	2	5	2	Assumes no event in this space
N/A	Livestock Barn	Flexible space that could hold livestock, indoor festivals, sporting events, trade and equipment shows, conventions, etc.	1,000 sf GFA	231	0.50	0.10	0.20	116	23	46	65%	35%	50%	50%	15	8	23	23	Assumes no event in this space
N/A	Stockyards Event Center- Auction Arena	Could host concerts, classes or lectures	Seats	650	0.60	0.01	0.25	390	7	163	65%	35%	100%	0%	5	2	163	0	Assumes lecture held in this space with approximately 350 attendees.
N/A	Stockyards Event Center- Show Arena	Could host small sporting events	Seats	1000	0.00	0.00	0.00	0	0	0	65%	35%	75%	25%	0	0	0	0	Assumes no event in this space
N/A	Stockyards	Used for surface parking, festival events, Denver County Fair, outdoor concerts and shows	Acres	20	0.00	0.00	0.00	0	0	0	50%	50%	50%	50%	0	0	0	0	Utilized for parking and storage.
N/A	Maintenance Facility	Year round maintenance staff	Employees	20	6.00	1.30	1.30	120	26	26	65%	35%	25%	75%	17	9	7	20	Employee and delivery traffic
							Total Vehicle Trips	6927	592	1292					422	170	901	392	
							Vehicle Trip Reduction (17%)	1178	101	220					72	29	153	67	
							Net Vehicle Trips	**5749**	**491**	**1072**					**350**	**141**	**748**	**325**	

TABLE 6: TRIP GENERATION PHASE 1-2 | LARGE EVENT WEEKEND DAY

					Trip Generation Rates		Number of Trips		Trip Orientation % Peak Hour		Trip Orientation # Peak Hour		
ITE Land Use Code	Description	Land Use Notes	Variable	Quantity	Daily	Peak Hour	Daily	Peak Hour	Entering	Exiting	Entering	Exiting	Other Notes
225	Off-Campus Student Apartment (Adjacent to Campus)	One use in 80KSF CSU Animal Health Building	Bedrooms	15	3.15	0.25	47	4	41%	59%	2	2	Based on current information from CSU
640	Animal Hospital/Veterinary Clinic	One use in 80KSF CSU Animal Health Building	1,000 sf GFA	10	21.50	3.53	215	35	67%	33%	23	12	Based on CSU program information and discussions
710	General Office	WSSA Legacy Building	1,000 sf GFA	75	0.53	0.06	40	5	54%	46%	3	2	Based on information provided by WSSA. Assumes all office for trip generation purposes even though there are other uses in the building.
710	General Office	Livestock Exchange Building	1,000 sf GFA	70	0.53	0.06	37	4	54%	46%	2	2	Estimated total SF from WSSA information
760	Research and Development Building	CSU Water Resource Building	1,000 sf GFA	150	1.90	0.24	285	36	50%	50%	18	18	building uses include labroatory testing, research, education, etc.
N/A	Equine Sports Medicine Facility	One use in 80KSF CSU Animal Health Building	1,000 sf GFA	65	3.00	0.30	195	20	50%	50%	10	10	Trips based on discussions with CSU
N/A	Equine Large Arena	Primarily Focused on Equine Competitions	Seats	4500	0.68	0.28	3060	1260	100%	0%	1260	0	large equine competition in arena in evening. 75% sold out. 2.2 people per car. 82% arrive in peak hour.
N/A	Equine Small Arena	Primarily Focused on Equine Competitions	Seats	500	0.20	0.01	100	5	100%	0%	5	0	not utilized by attendees in peak hour because all equine attendees are in large arena.
N/A	Equine Barn	Used to House Equine Competitors. Planned to be programmed with equine uses 50 weeks per year.	Stalls	800	3.00	0.20	2400	160	50%	50%	80	80	service traffic for animals in barn. Assumes 75% of stalls filled and 4 trips per day per occupied stall. Also assumes that during peak hour there is little service traffic.
N/A	Livestock Arena	Multi-Purpose Arena with 3,000 fixed seats	Seats	3000	0.80	0.32	2400	960	100%	0%	960	0	evening event. 85% sold out concert. 2.2 people/car. 82% arrive in peak hour.
N/A	Livestock Hall Auction Arena	Small space adjacent to Livestock Barn	Seats	700	0.06	0.01	42	7	65%	35%	5	2	not utilized in evening peak hour in this scenario. Service traffic only.
N/A	Livestock Barn	Flexible space that could hold livestock, indoor festivals, sporting events, trade and equipment shows, conventions, etc.	1,000 sf GFA	231	15.00	3.00	3465	693	15%	85%	104	589	all day event. home and garden show. 20% arrive/depart in peak hour. Assumes overlap with evening events.
N/A	Stockyards Event Center- Auction Arena	Could host concerts, classes or lectures	Seats	650	0.60	0.25	390	163	100%	0%	163	0	evening event. Lecture with 350 attendees. 82% arrive in peak hour.
N/A	Stockyards Event Center- Show Arena	Could host small sporting events	Seats	1000	0.68	0.28	680	280	100%	0%	280	0	Evening attendance at MMA competition. 75% sold out. 2.2 people/car. 82% arrive peak hour.
N/A	Stockyards	Used for surface parking, festival events, Denver County Fair, outdoor concerts and shows	Acres	20	0.00	0.00	0	0	50%	50%	0	0	Available for surface parking. Not used for large concert or festival in this scenario.
N/A	Maintenance Facility	Year round maintenance staff	Employees	40	6.00	1.30	240	52	50%	50%	26	26	service traffic for maintenance activities at venues plus some employee arrival/departures.
						Totals	13596	3684			2941	743	
						Vehicle Trip Reduction (19%)	2583	700			559	141	
						Net Vehicle Trips	**11013**	**2984**			**2382**	**602**	

TRAFFIC VOLUMES

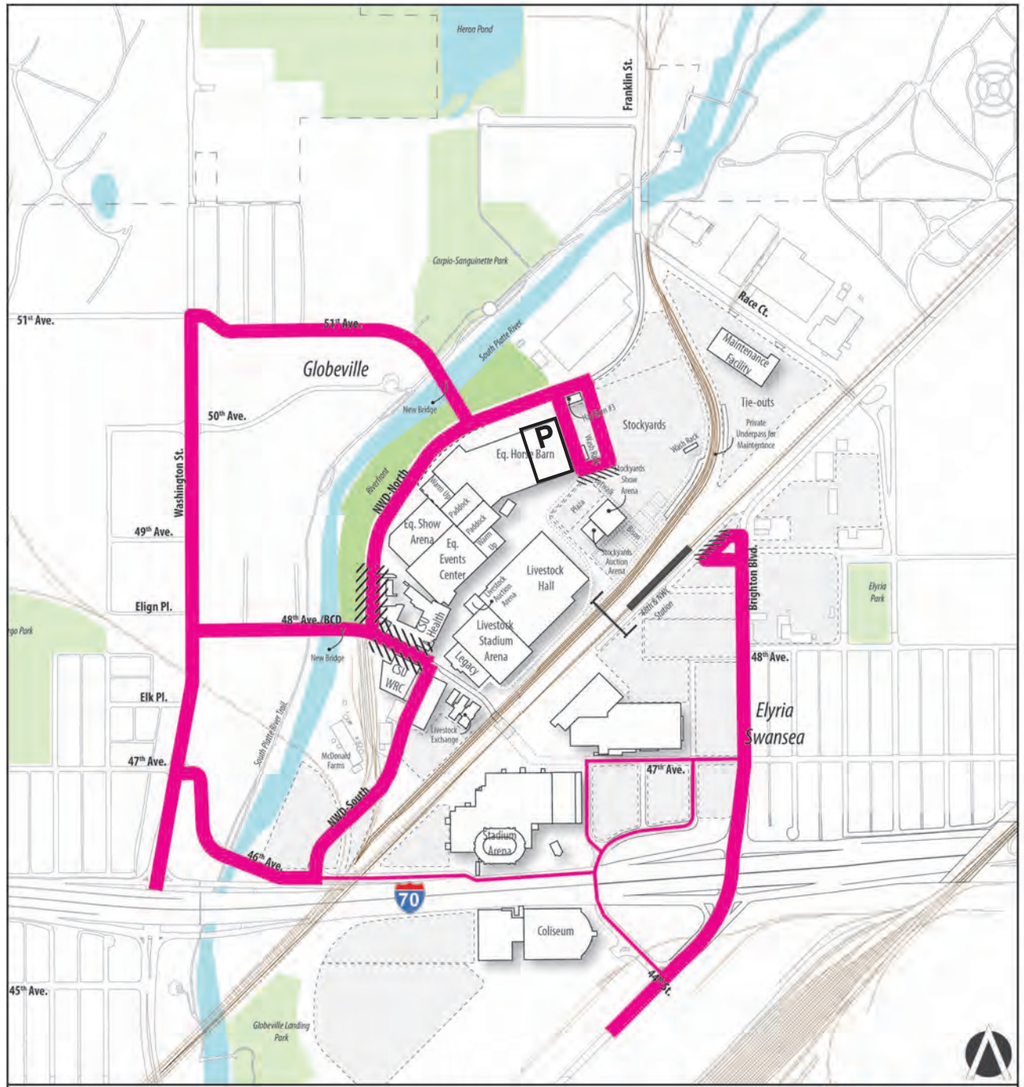
Background trips, site generated additional trips, and total trips were developed for the Phase 1-2 operational scenarios. The expected patterns, drop off zones, and volumes of TNC's were also developed and included in the Large Event time frame. This information is shown in Exhibit 17.

An important factor to determine is which timeframe is the critical timeframe for analysis during the weekend day large event scenario. Our definition of a Large Event on the site includes multiple small to medium size events happening at once. Some are oriented to daytime use and others are evening events. An evaluation of arrival and departure patterns for the individual events was performed and it was determined that the critical analysis hour was the time when attendees are leaving the daytime oriented events at the same time as other attendees are arriving for the evening events. This is a different condition than many special event venues where the exiting traffic conditions at the end of a large event is the critical analysis period.

See Exhibits 18-20 for the Phase 1-2 Weekday PM Peak Background, Additional, and Total Trips.

See Exhibits 21-24 for the Phase 1-2 Weekend Background, Additional, TNC and Total Trips.

EXHIBIT17: TNC NETWORK PHASE 1-2 | LARGE EVENT

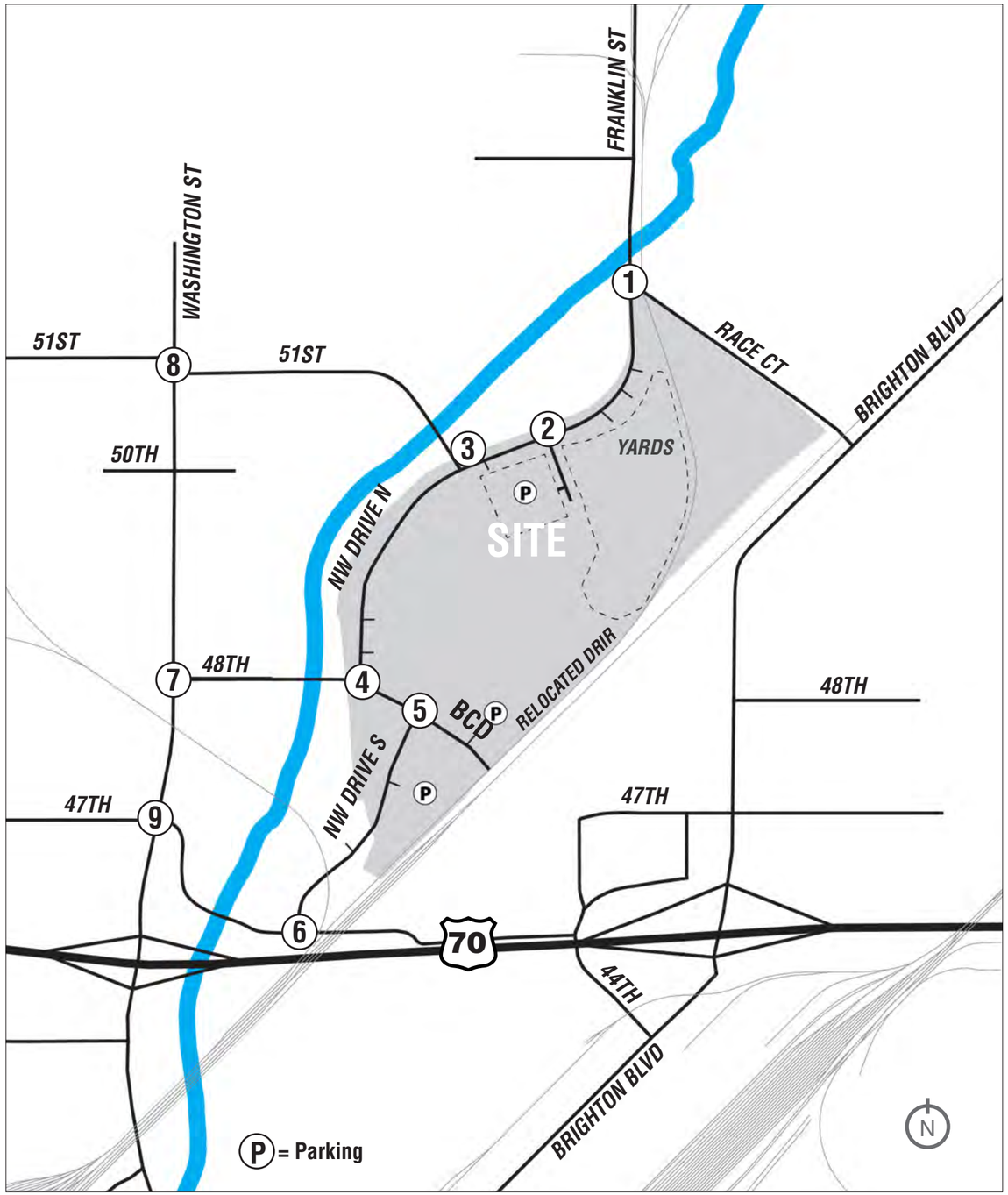


TNC NETWORK | **PHASE 1-2 | LARGE EVENT** (WEST SIDE COMPLETE)

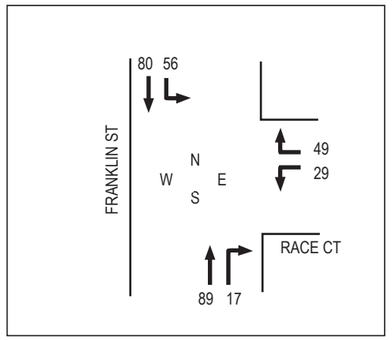
Base map
- Roads
- Buildings
- Parks
- Water Bodies
- Railroad Tracks
- S. Platte Trail Access

TNC Network
- High Use
- Low Use
- Drop-off Zones

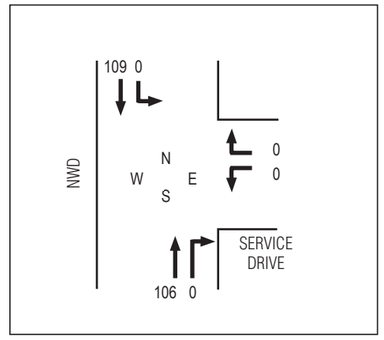
EXHIBIT 18: PHASE 1-2 | BACKGROUND TRAFFIC NORMAL WEEKDAY PM PEAK



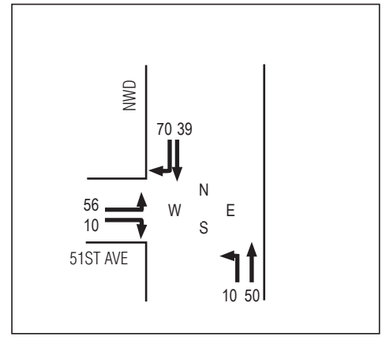
1 - FRANKLIN ST & RACE CT



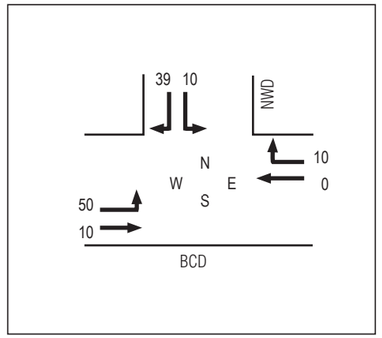
2 - NATIONAL WESTERN (N) & SERVICE DRIVE



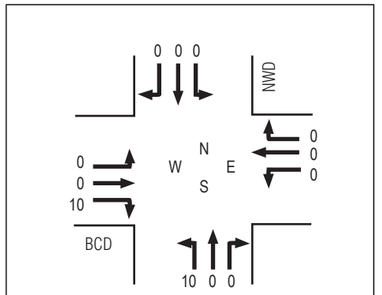
3 - NATIONAL WESTERN (N), & 51ST AVE



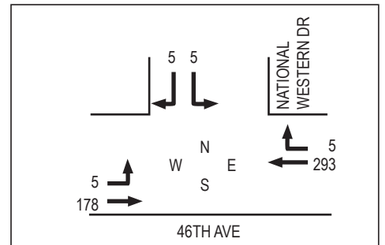
4 - NATIONAL WESTERN (N) & BCD



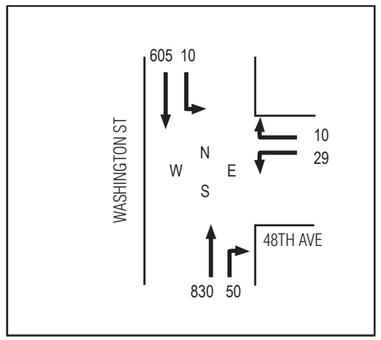
5 - NATIONAL WESTERN (S) & BCD



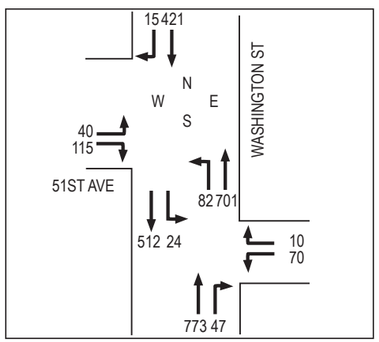
6 - NATIONAL WESTERN (S) & 46TH AVE



7 - 48TH AVE & WASHINGTON



8 - 51ST AVE & WASHINGTON



9 - 47TH AVE & WASHINGTON

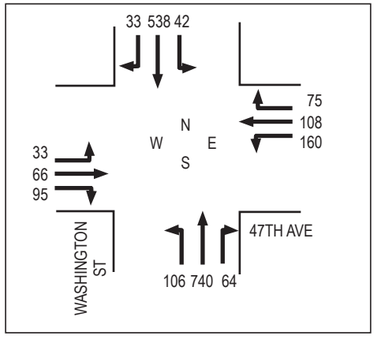
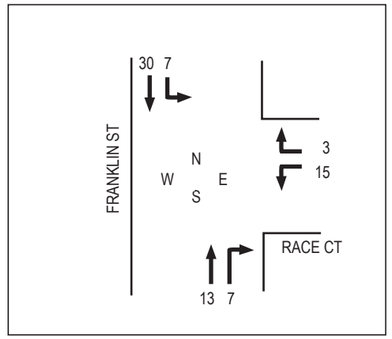
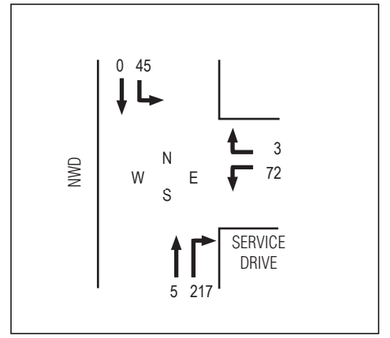


EXHIBIT 19: PHASE 1-2 | ADDITIONAL TRIPS NORMAL WEEKDAY PM PEAK

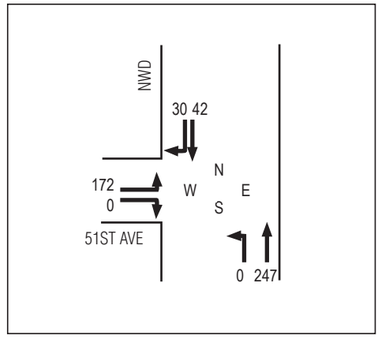
1 - FRANKLIN ST & RACE CT



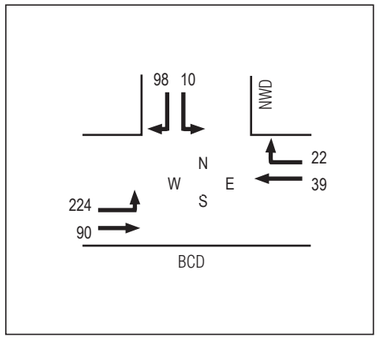
2 - NATIONAL WESTERN (N) & SERVICE DRIVE



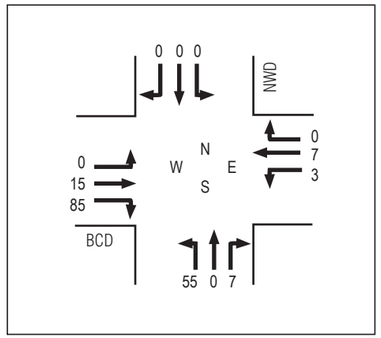
3 - NATIONAL WESTERN (N), & 51ST AVE



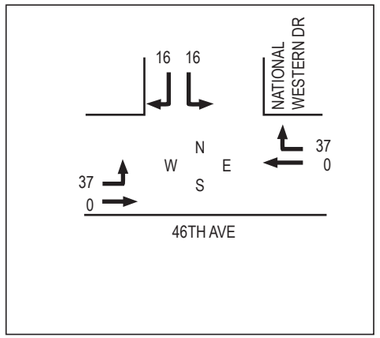
4 - NATIONAL WESTERN (N) & BCD



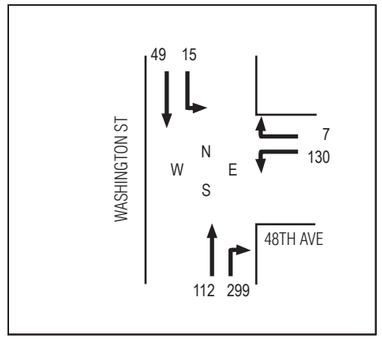
5 - NATIONAL WESTERN (S) & BCD



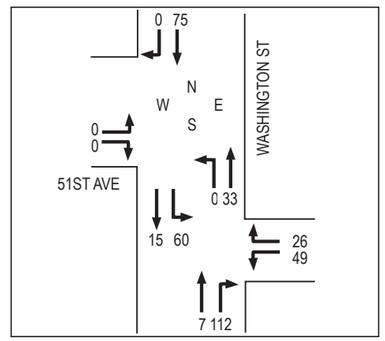
6 - NATIONAL WESTERN (S) & 46TH AVE



7 - 48TH AVE & WASHINGTON



8 - 51ST AVE & WASHINGTON



9 - 47TH AVE & WASHINGTON

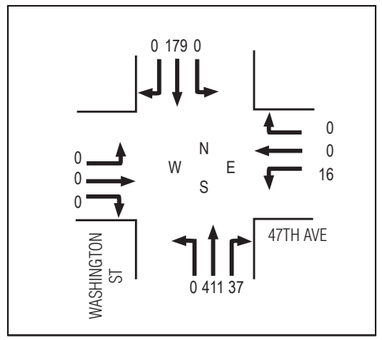
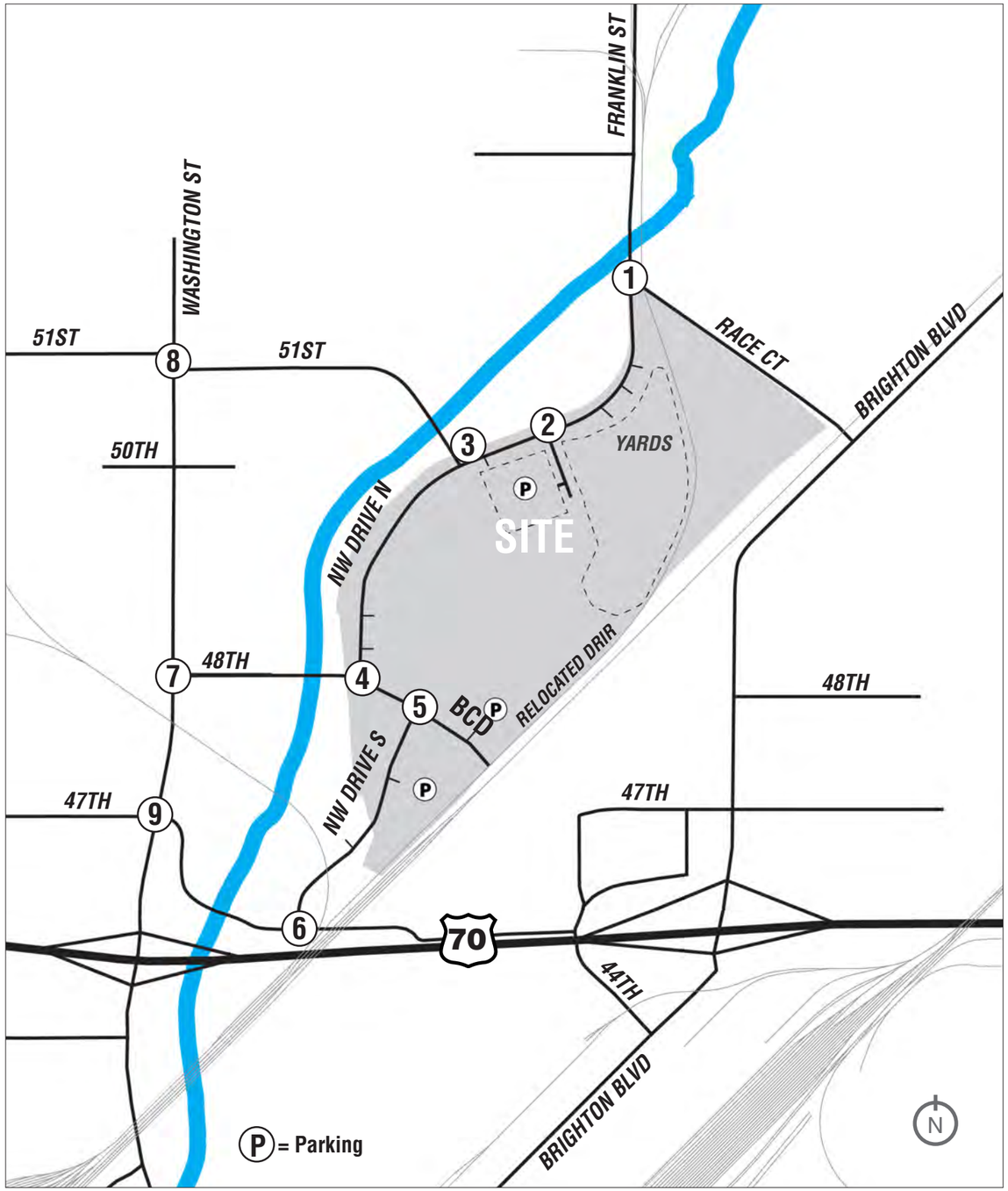
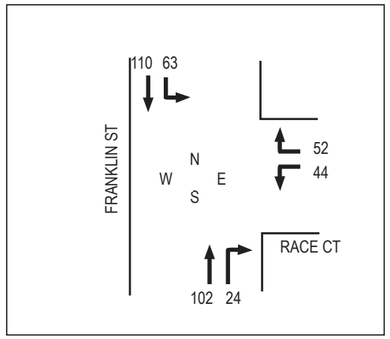


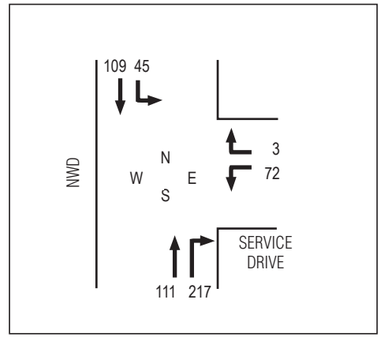
EXHIBIT 20: PHASE 1-2 | TOTAL TRIPS* NORMAL WEEKDAY PM PEAK



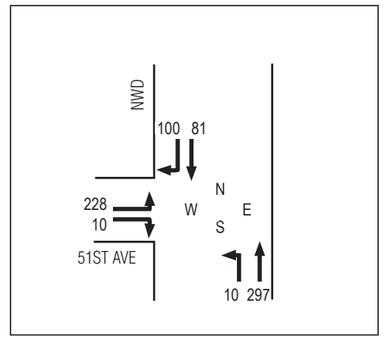
1 - FRANKLIN ST & RACE CT



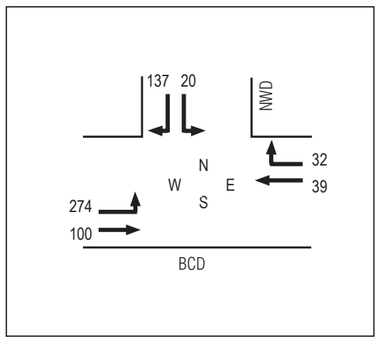
2 - NATIONAL WESTERN (N) & SERVICE DRIVE



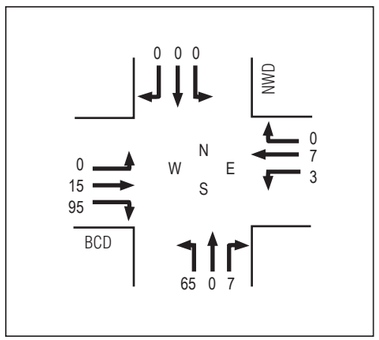
3 - NATIONAL WESTERN (N), & 51ST AVE



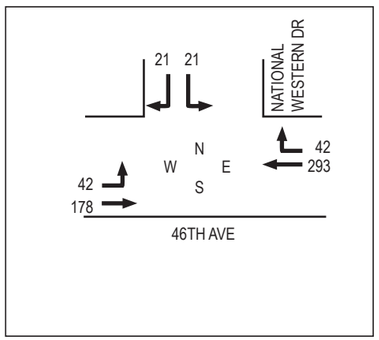
4 - NATIONAL WESTERN (N) & BCD



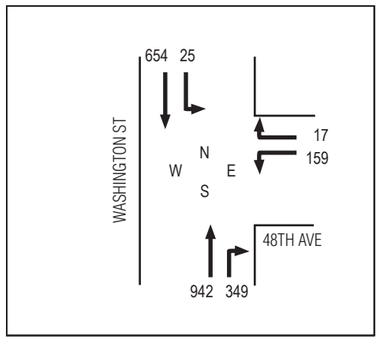
5 - NATIONAL WESTERN (S) & BCD



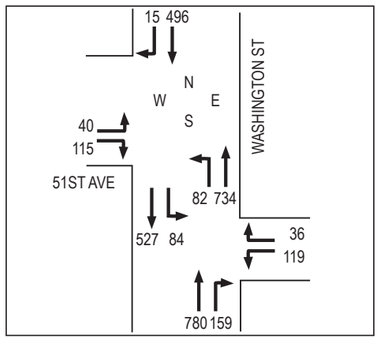
6 - NATIONAL WESTERN (S) & 46TH AVE



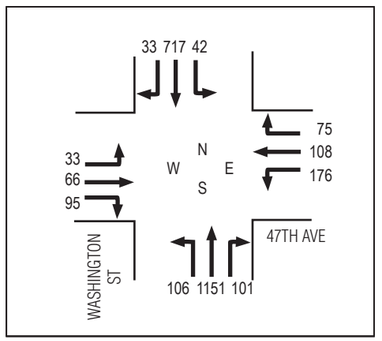
7 - 48TH AVE & WASHINGTON



8 - 51ST AVE & WASHINGTON

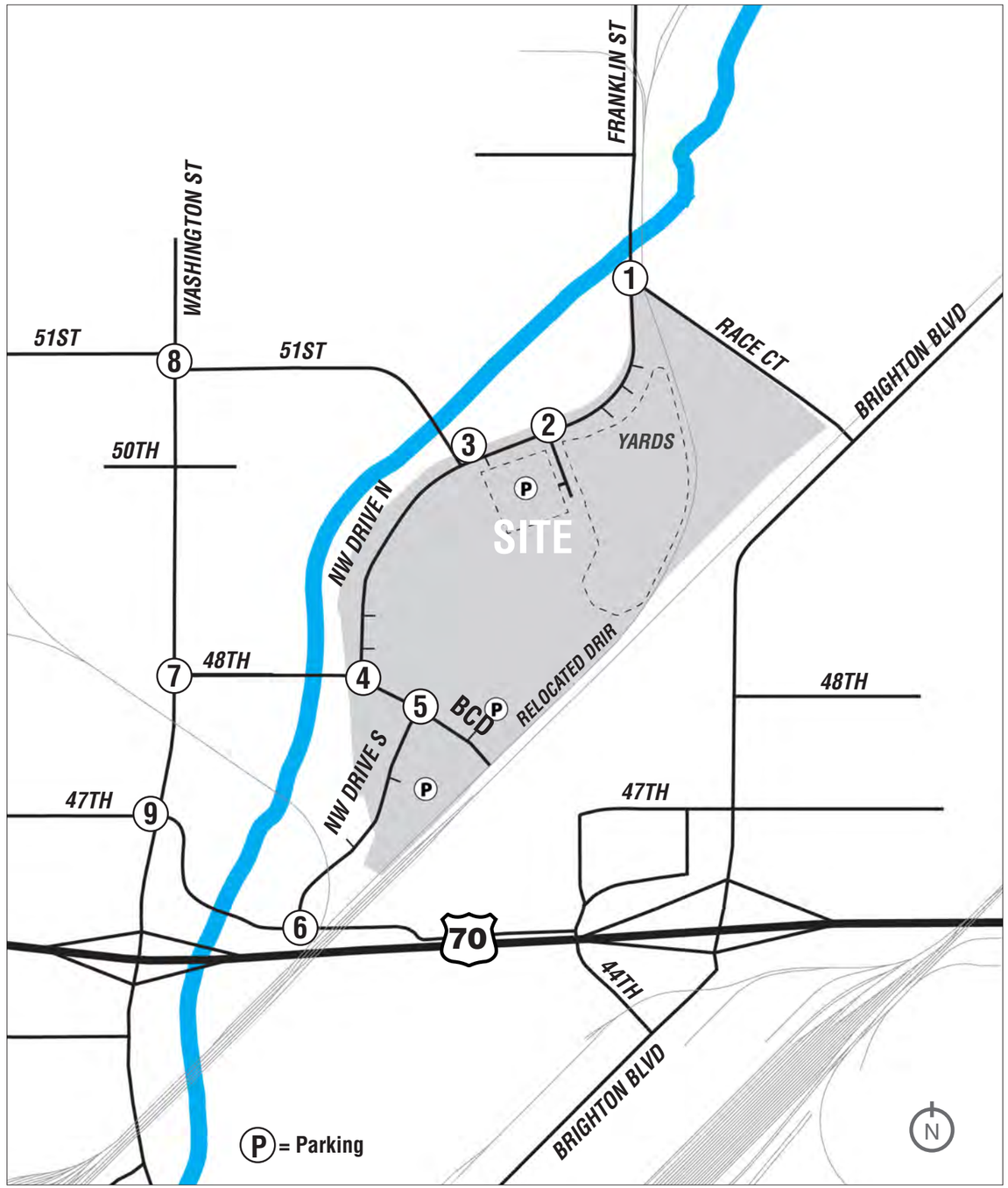


9 - 47TH AVE & WASHINGTON

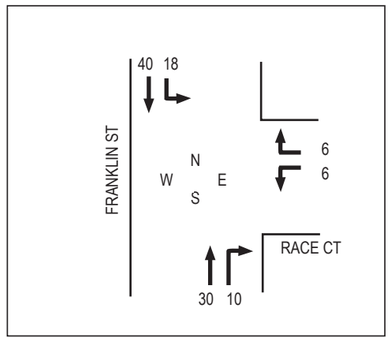


*Total Trips = Background + additional trips

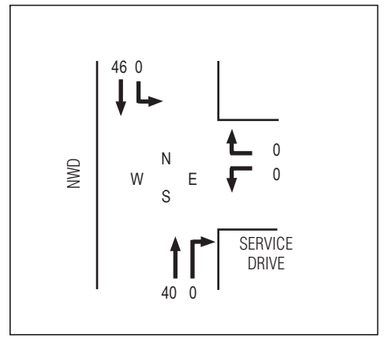
EXHIBIT 21: PHASE 1-2 | BACKGROUND TRAFFIC LARGE EVENT WEEKEND PEAK



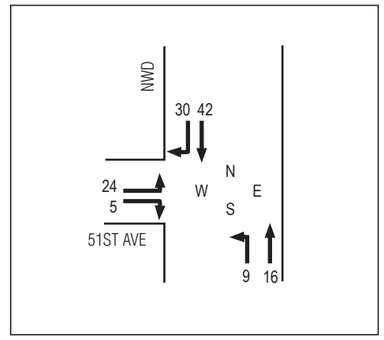
1 - FRANKLIN ST & RACE CT



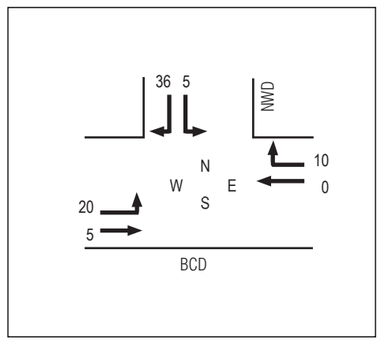
2 - NATIONAL WESTERN (N) & SERVICE DRIVE



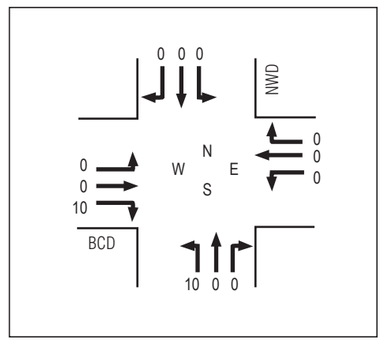
3 - NATIONAL WESTERN (N), & 51ST AVE



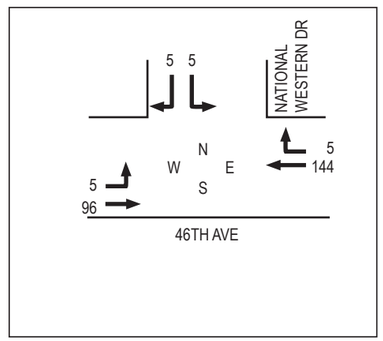
4 - NATIONAL WESTERN (N) & BCD



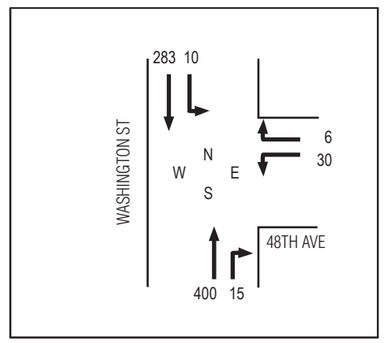
5 - NATIONAL WESTERN (S) & BCD



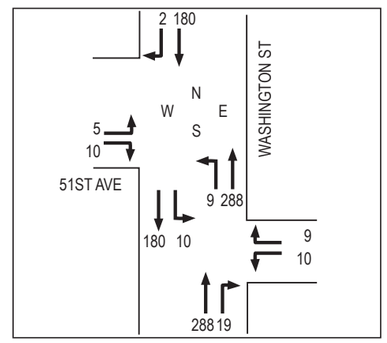
6 - NATIONAL WESTERN (S) & 46TH AVE



7 - 48TH AVE & WASHINGTON



8 - 51ST AVE & WASHINGTON



9 - 47TH AVE & WASHINGTON

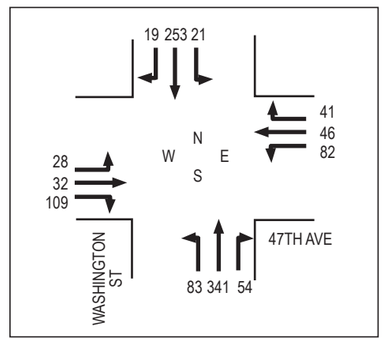
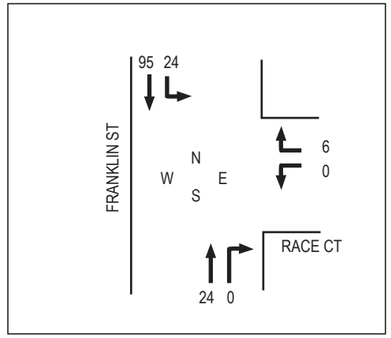
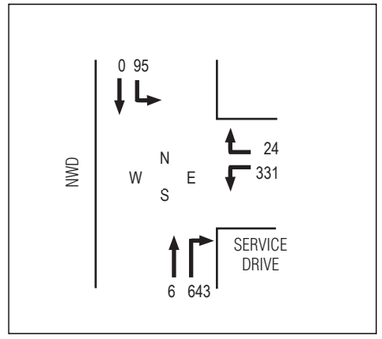


EXHIBIT 22: PHASE 1-2 | ADDITIONAL TRIPS LARGE EVENT WEEKEND PEAK

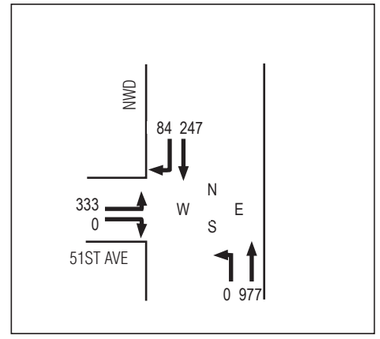
1 - FRANKLIN ST & RACE CT



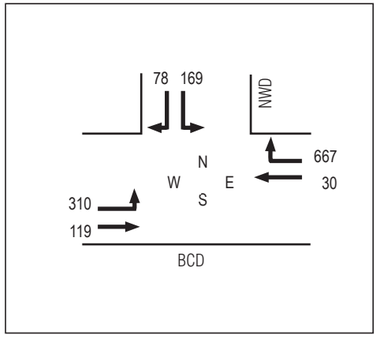
2 - NATIONAL WESTERN (N) & SERVICE DRIVE



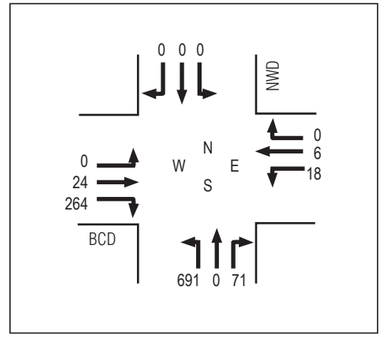
3 - NATIONAL WESTERN (N), & 51ST AVE



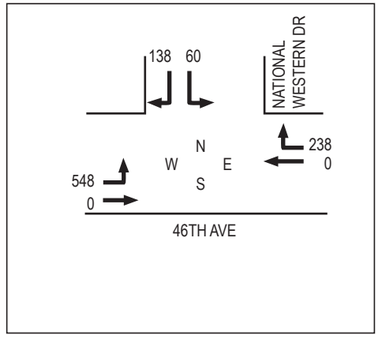
4 - NATIONAL WESTERN (N) & BCD



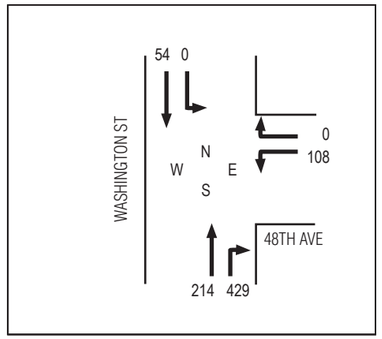
5 - NATIONAL WESTERN (S) & BCD



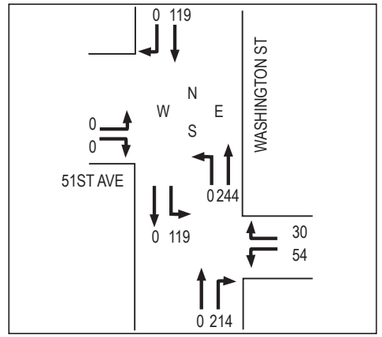
6 - NATIONAL WESTERN (S) & 46TH AVE



7 - 48TH AVE & WASHINGTON



8 - 51ST AVE & WASHINGTON



9 - 47TH AVE & WASHINGTON

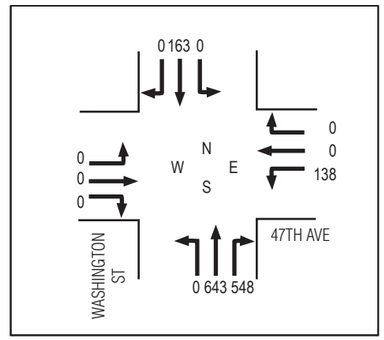
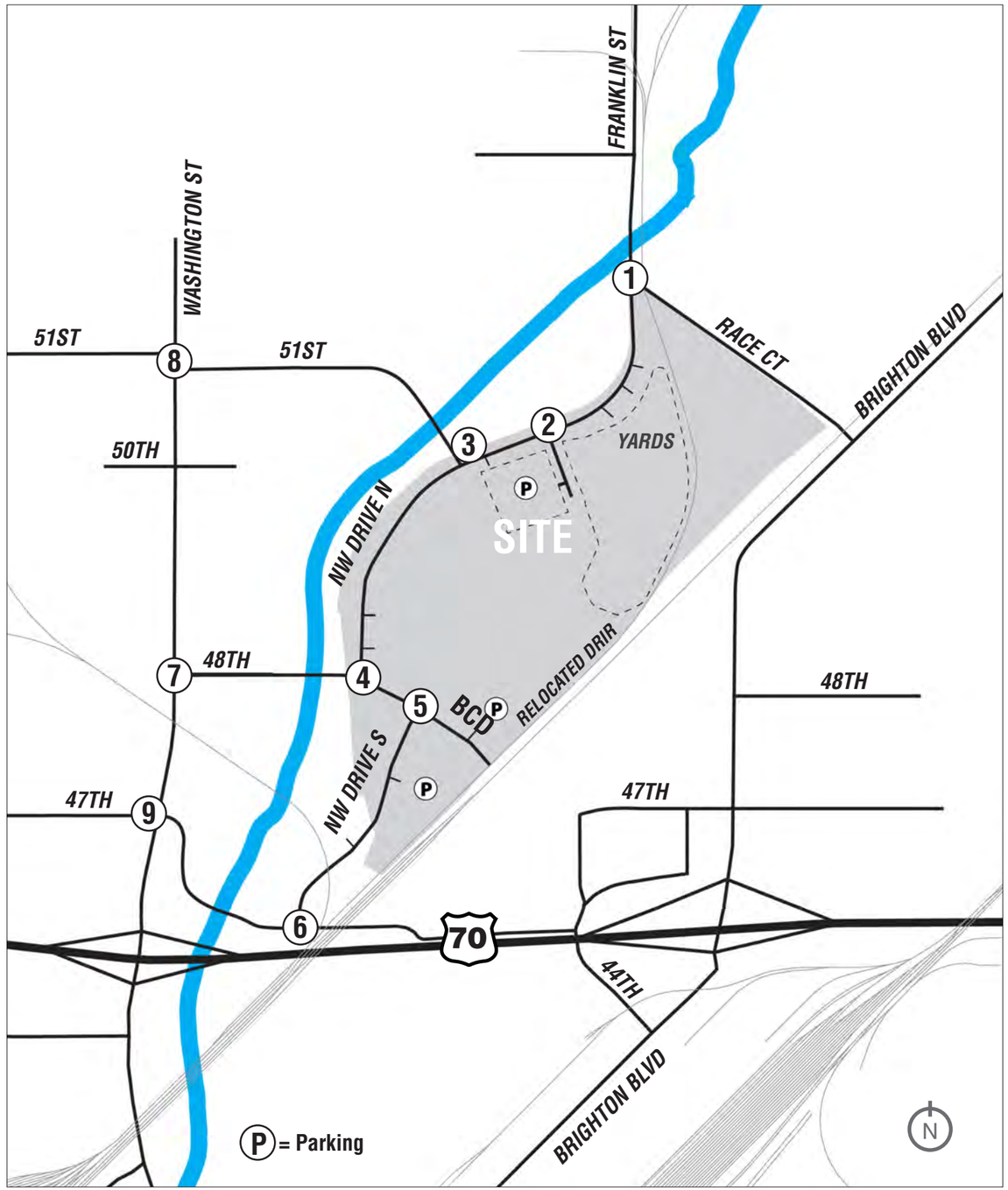
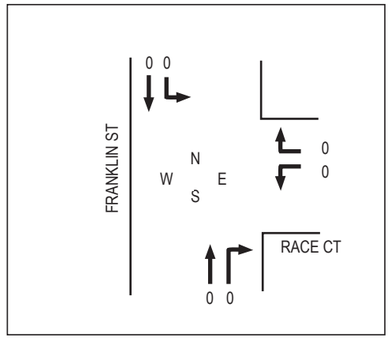


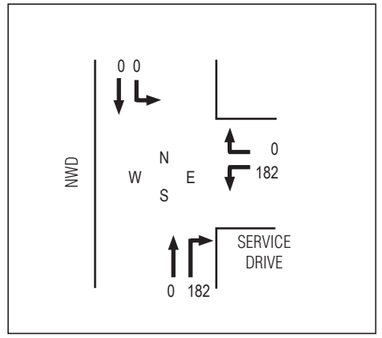
EXHIBIT 23: PHASE 1-2 | TNC* LARGE EVENT WEEKEND PEAK



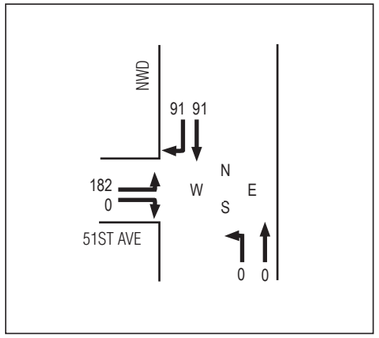
1 - FRANKLIN ST & RACE CT



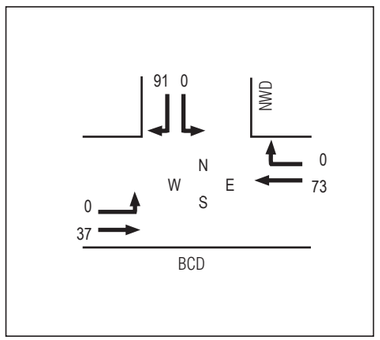
2 - NATIONAL WESTERN (N) & SERVICE DRIVE



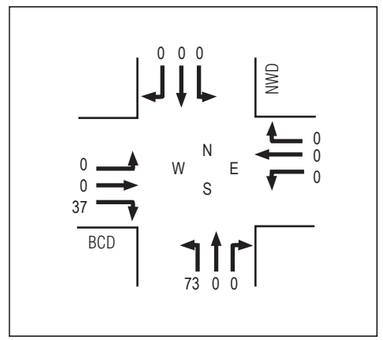
3 - NATIONAL WESTERN (N), & 51ST AVE



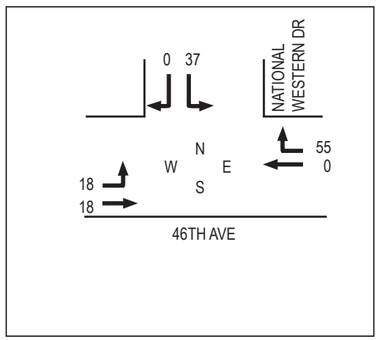
4 - NATIONAL WESTERN (N) & BCD



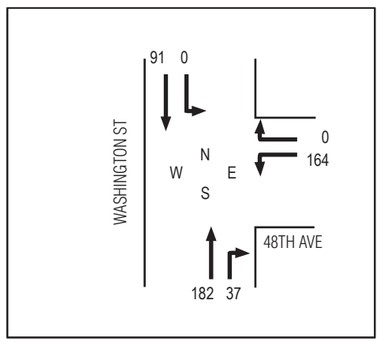
5 - NATIONAL WESTERN (S) & BCD



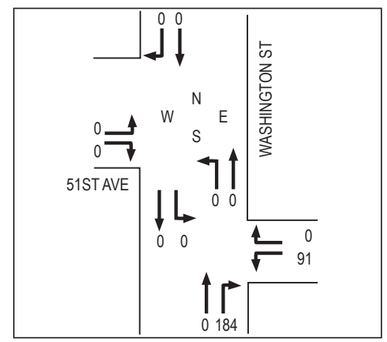
6 - NATIONAL WESTERN (S) & 46TH AVE



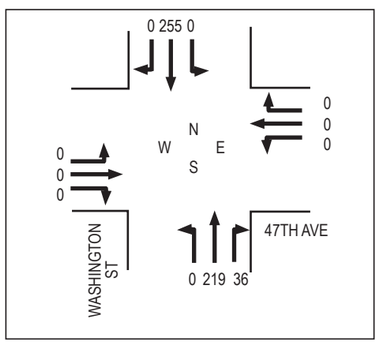
7 - 48TH AVE & WASHINGTON



8 - 51ST AVE & WASHINGTON



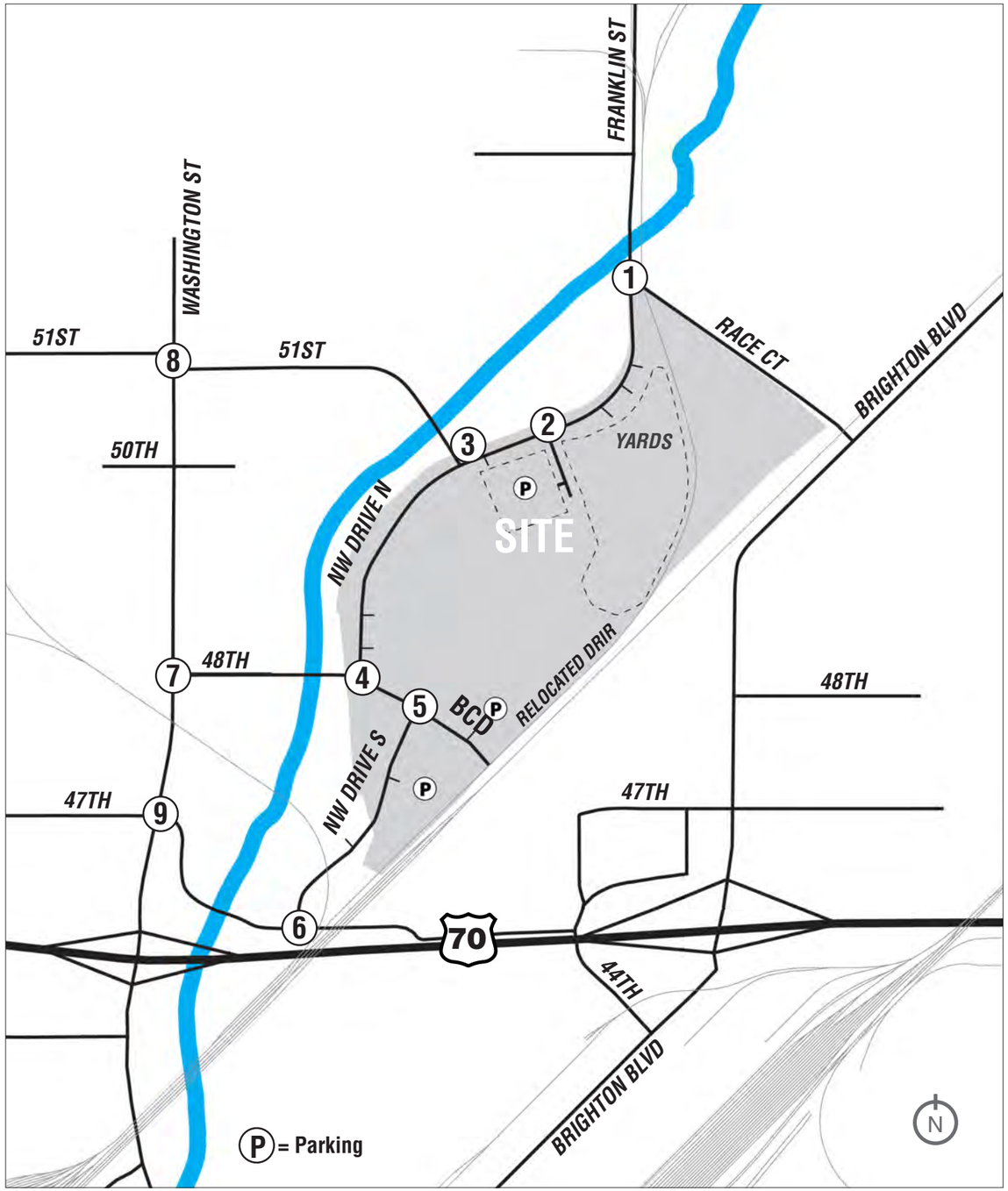
9 - 47TH AVE & WASHINGTON



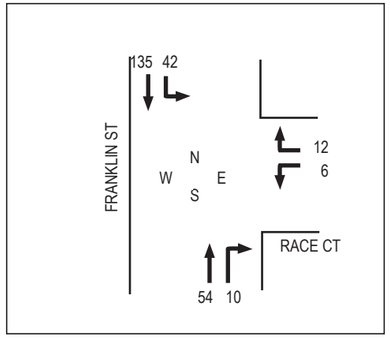
*TNC = Transportation Network Company (Uber, Lyft, etc.)

EXHIBIT 23: PHASE 1-2 | TNC* LARGE EVENT WEEKEND PEAK

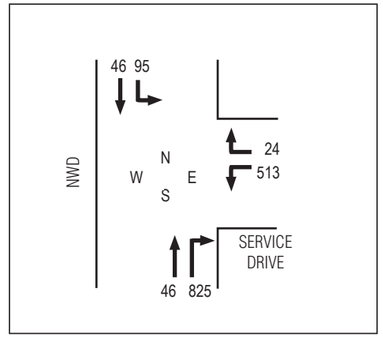
EXHIBIT 24: PHASE 1-2 | TOTAL TRIPS* LARGE EVENT WEEKEND PEAK



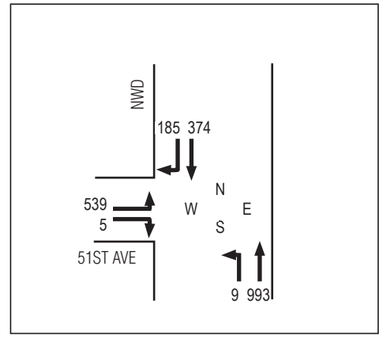
1 - FRANKLIN ST & RACE CT



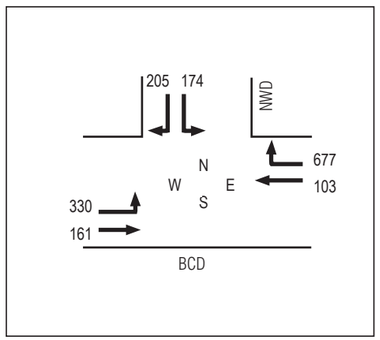
2 - NATIONAL WESTERN (N) & SERVICE DRIVE



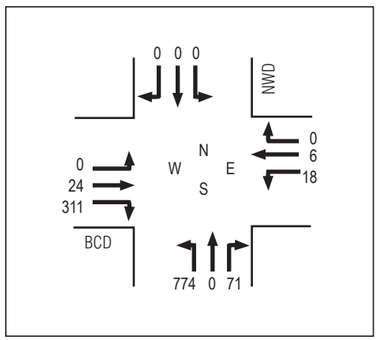
3 - NATIONAL WESTERN (N), & 51ST AVE



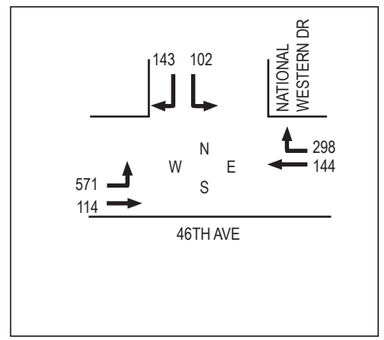
4 - NATIONAL WESTERN (N) & BCD



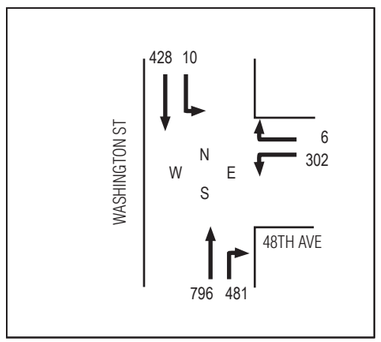
5 - NATIONAL WESTERN (S) & BCD



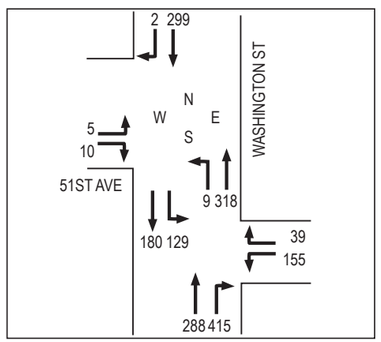
6 - NATIONAL WESTERN (S) & 46TH AVE



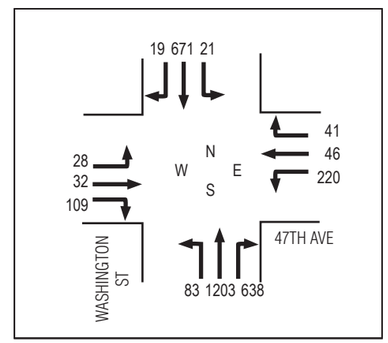
7 - 48TH AVE & WASHINGTON



8 - 51ST AVE & WASHINGTON



9 - 47TH AVE & WASHINGTON



*Total Trips = Background + additional trips + TNC

OPERATIONAL ASSESSMENT

The analyses indicate that during the weekday PM Peak Hour condition, most intersections operate at an acceptable LOS of D or better with no movements with a LOS worse than D as well. The exceptions are at the unsignalized intersections of 48th Avenue/Washington Street and 51st Avenue/Washington Street (South intersection). Due to the heavy volumes on Washington Street, westbound left turns cannot find enough gaps to make a safe turning maneuver at either intersection. Potential mitigations for these deficiencies, as well as several other mitigations, are listed below:

- If the NWC opens before the Washington St Reconstruction Project is complete, consider installing a temporary span wire signal at 48th Avenue/Washington Street to create safe gaps for westbound left turns and pedestrian and bicycle crossings. Also, consider prohibiting westbound left turns at the 51st Ave/Washington St intersection until the 51st Ave/Washington St intersection is reconstructed as part of the Washington Street Reconstruction Project.
- Restripe the roadway at 46th Avenue/National Western Drive (S) to allow for an eastbound left turn lane.
- Install a traffic signal at the intersection of Franklin Street/Race Court to allow for safe vehicular/train movements.

During Large Event conditions the same issues described above are present plus the intersection of NWD (N)/51st Ave operates at LOS F with the assumed AWSC condition. Additional analysis was performed at the intersection to evaluate its' performance under the Large Event scenario when controlled with a traffic signal. This analysis indicates that the NWD (N)/51st Ave intersection would operate at an acceptable LOS under the Phase 1-2 Large Event Scenario with traffic signal control. Additional information regarding the installation of a traffic signal at this intersection is included on pages 29 and 33 of this TIS. Additionally, although not shown as an operational issue in this TIS, the volume of traffic anticipated to utilize the Service Drive during the Large Event Scenario is significant enough that a three-lane wide roadway section should be considered for the Service Drive to improve access capacity and operational flexibility. Tables 7 and 8 below show the operational results, delay, and anticipated queue lengths for the Weekday PM Peak Hour and the Weekend Large Event Peak Hour respectively. See Exhibit 25-26 for the Phase 1-2 Weekday PM Peak and Weekend Peak LOS.

TABLE 7: PHASE 1-2 | WEEKDAY PM PEAK HOUR OPERATIONAL RESULTS AND DELAY

		Movement											
Intersection	**Control Type**	**EBLT**	**EBT**	**EBRT**	**WBLT**	**WBT**	**WBRT**	**NBLT**	**NBT**	**NBRT**	**SBLT**	**SBT**	**SBRT**
1- Franklin St / Race Ct	Traffic Signal				C/33.7/50		D/36.4/31		A/1.5/22	Shared Lane	A/1.7/14	A/1.5/22	
2- NWD / Access Drive	Stop Sign for Access Drive				B/11.4/10		Shared Lane				A/7.5/0		
3- NWD / 51st Ave	AWSC	B/14.4/58		A/8.1/0				A/9.0/0	B/14.2/75			B/10.7/30	Shared Lane
4- NWD (N) / BCD	Traffic Signal	B/12.8/54	A/8.9/22			A/8.7/29	Shared Lane				C/23.9/31		C/27.4/56
5- NWD (S) / BCD	Traffic Signal	Shared Lane	C/31.0/46	Shared Lane	Shared Lane	C/24.2/16	Shared Lane	Shared Lane	A/2.2/15	Shared Lane	Shared Lane	A/2.0/5	Shared Lane
6- NWD (S) / 46th Ave	Traffic Signal	Shared Lane	A/8.1/95			A/7.7/60	Shared Lane				C/26.8/30		C/26.9/19
7- Washington St / 48th Ave	Stop Sign for 48th Ave				F/969.4/425*		Shared Lane				B/12.8/3	B/12.8/3	
8- Washington St / 51st Ave south	Stop Sign for 51st Ave				F/471.9/348*		Shared Lane			Shared Lane	B/11.5/11	Shared Lane	
8- Washington St / 51st Ave north	Traffic Signal	C/30.4/74		Shared Lane				A/6.1/35	B/11.5/357			A/8.0/192	Shared Lane
9- Washington St / 47th Ave	Traffic Signal	C/31.6/41	D/44.6/130	Shared Lane	C/33.0/75	D/45.7/171	Shared Lane	A/9.5/67	B/13.7/315	Shared Lane	A/7.1/22	A/0.9/122	Shared Lane

Note: HCM LOS / HCM Delay (sec) / 95% Queue Length (ft)

* 95% volume exceeds capacity, queue may be longer

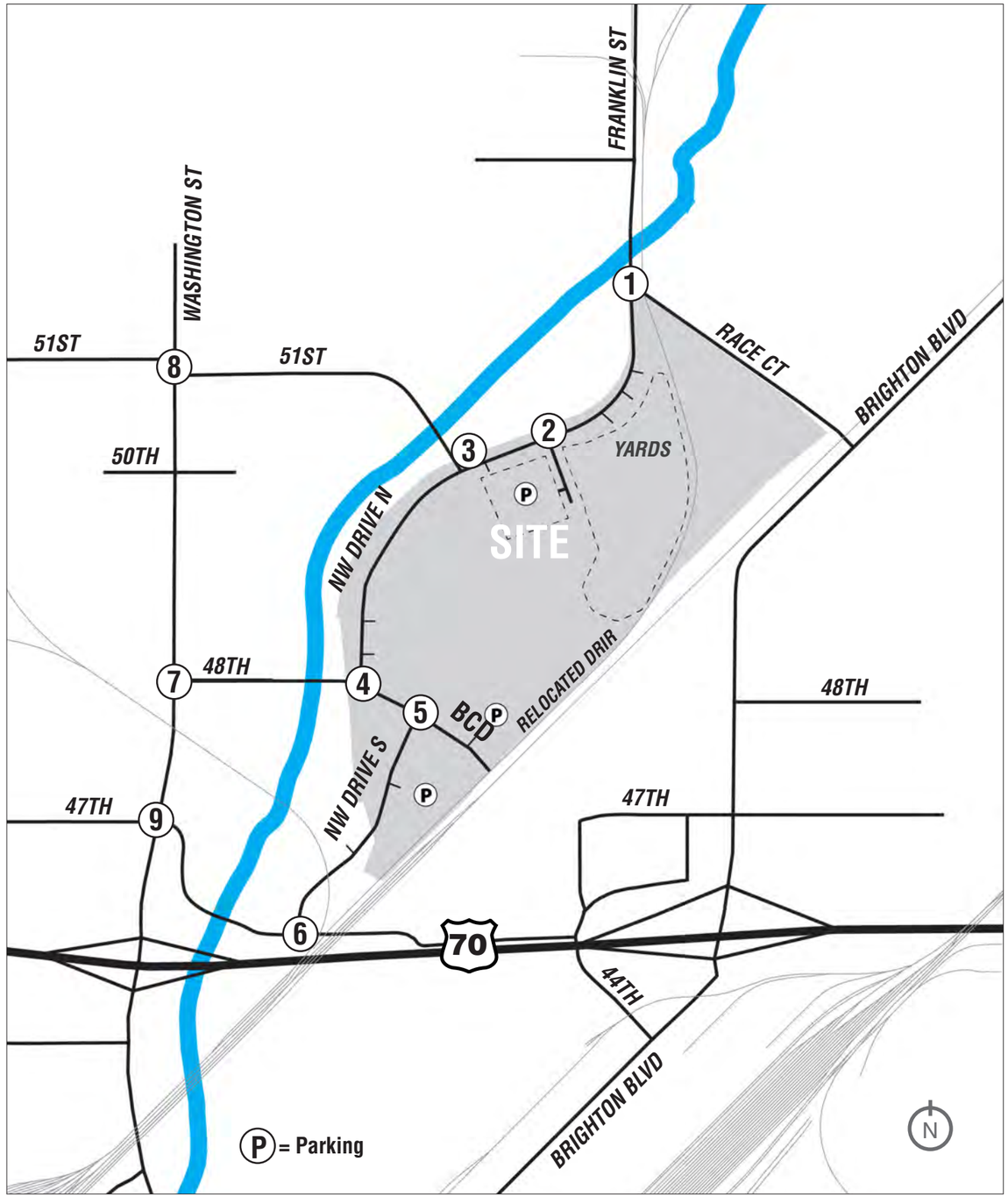
TABLE 8: PHASE 1-2 | WEEKEND LARGE EVENT PEAK OPERATIONAL RESULTS AND DELAY

		Movement											
Intersection	**Control Type**	**EBLT**	**EBT**	**EBRT**	**WBLT**	**WBT**	**WBRT**	**NBLT**	**NBT**	**NBRT**	**SBLT**	**SBT**	**SBRT**
1- Franklin St / Race Ct	Traffic Signal				D/39.1/18		D/43.3/19		A/0.8/10	Shared Lane	A/0.9/8	A/0.9/19	
2- NWD / Access Drive	Stop Sign for Access Drive				E/46.0/305		Shared Lane				A/7.4/5		
3- NWD / 51st Ave	AWSC	F/261.6/720		B/11.7/0				B/13.3/5	F/123.0/408			F/231.5/670	Shared Lane
4- NWD (N) / BCD	Traffic Signal	B/15.7/448*	A/4.7/27			A/4.2/42	Shared Lane				D/42.3/194		D/51.4/101
5- NWD (S) / BCD	Traffic Signal	Shared Lane	D/52.3/146	Shared Lane	Shared Lane	C/29.7/37	Shared Lane	Shared Lane	C/32.5/719*	Shared Lane	Shared Lane	A/6.0/9	Shared Lane
6- NWD (S) / 46th Ave	Traffic Signal	D/46.6/625*	A/3.8/33			A/5.7/60	Shared Lane				D/38.8/115		D/44.5/36
7- Washington St / 48th Ave	Stop Sign for 48th Ave				F/978.2/700*		Shared Lane				B/12.5/2	Shared Lane	
8- Washington St / 51st Ave south	Stop Sign for 51st Ave				F/70.0/154		Shared Lane				B/10.1/14	Shared Lane	
8- Washington St / 51st Ave north	Traffic Signal	C/31.9/20		Shared Lane				A/6.8/4	A/9.2/159			A/5.7/98	Shared Lane
9- Washington St / 47th Ave	Traffic Signal	C/30.7/37	D/43.3/75	Shared Lane	D/35.4/93	D/37.9/75	Shared Lane	A/8.4/48	D/39.7/650*	Shared Lane	D/39.3/17	A/0.8/150	Shared Lane

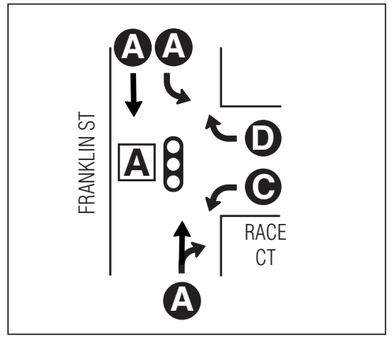
Note: HCM LOS / HCM Delay (sec) / 95% Queue Length (ft)

* 95% volume exceeds capacity, queue may be longer

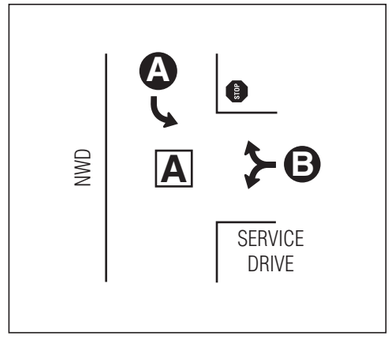
EXHIBIT 25: PHASE 1-2 | LEVEL OF SERVICE NORMAL WEEKDAY PM PEAK



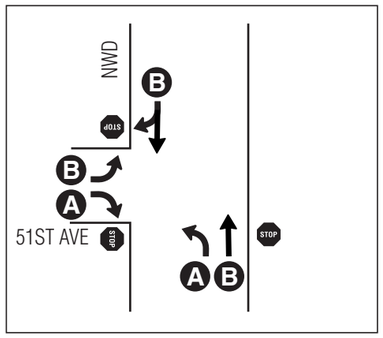
1 - FRANKLIN ST & RACE CT



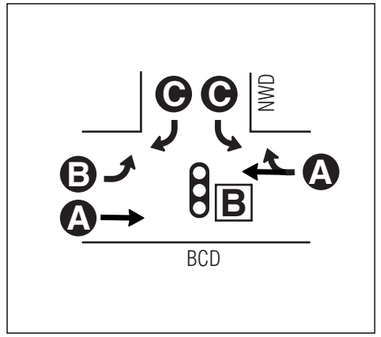
2 - NATIONAL WESTERN (N) & SERVICE DRIVE



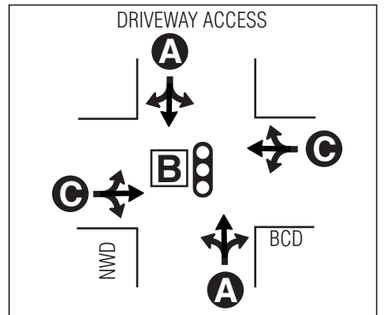
3 - NATIONAL WESTERN (N), & 51ST AVE



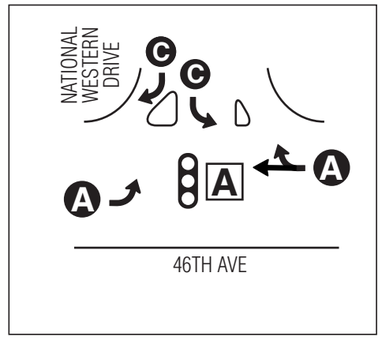
4 - NATIONAL WESTERN (N) & BCD



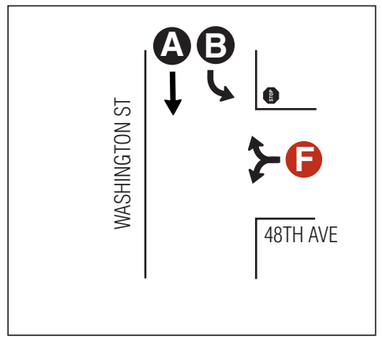
5 - NATIONAL WESTERN (S) & BCD



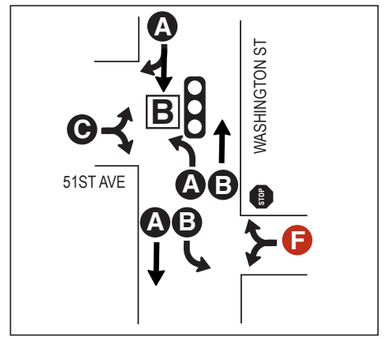
6 - NATIONAL WESTERN (S) & 46TH AVE



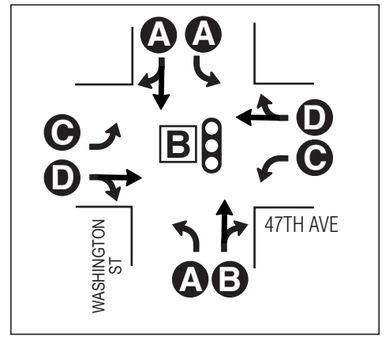
7 - 48TH AVE & WASHINGTON



8 - 51ST AVE & WASHINGTON



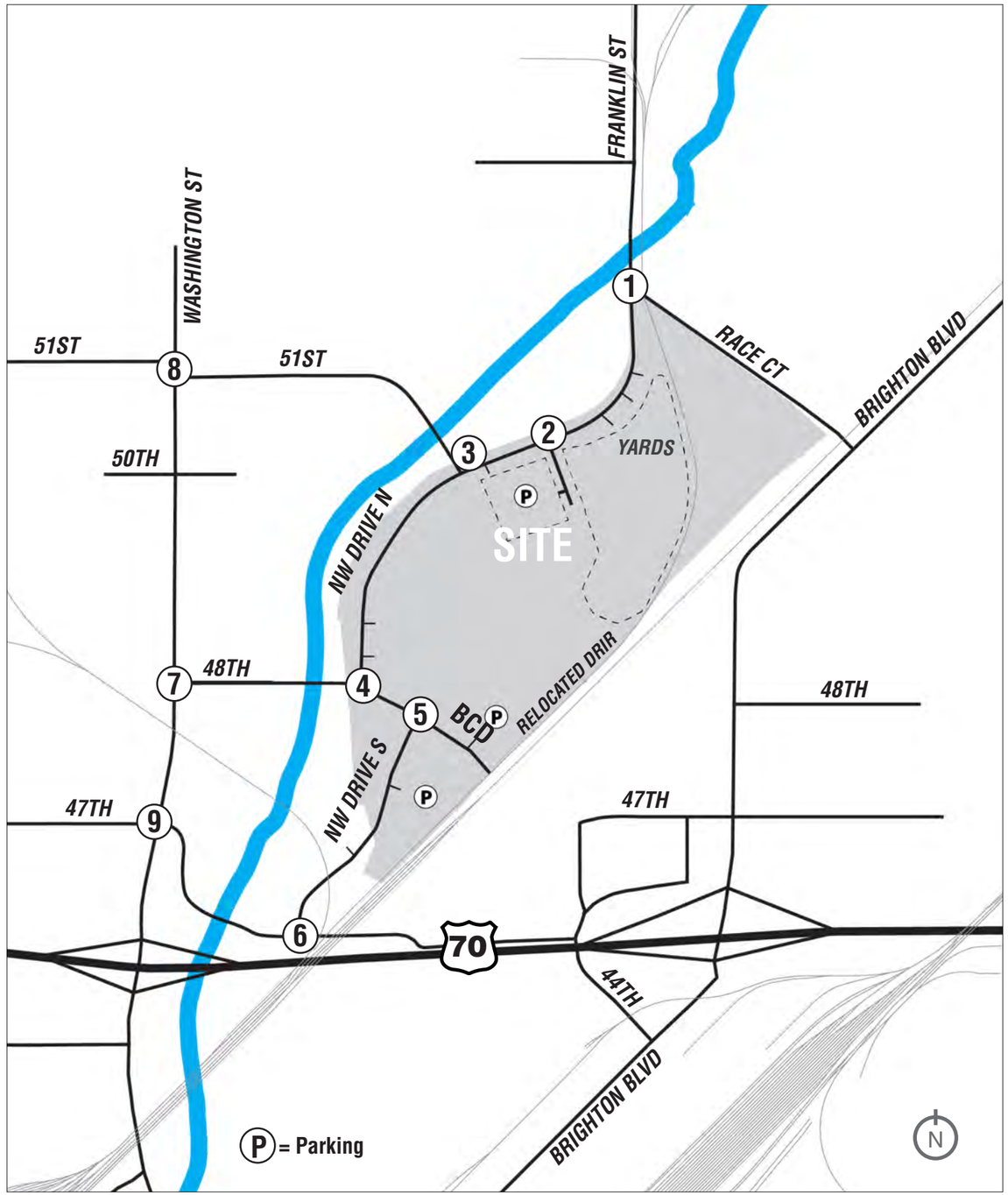
9 - 47TH AVE & WASHINGTON



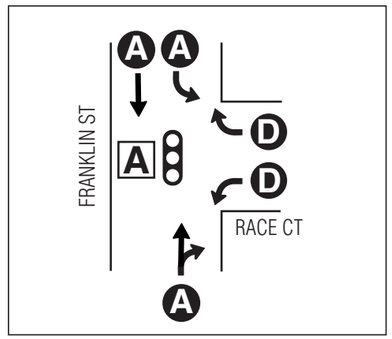
● = Movement LOS ☐ = Overall LOS

NOTE: Only movements with calculated LOS are shown.

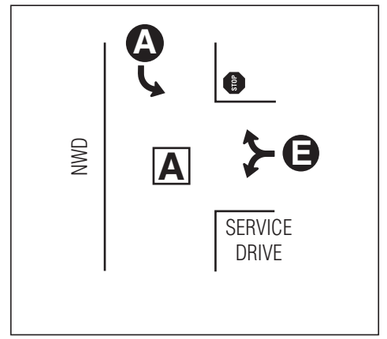
EXHIBIT 26: PHASE 1-2 | LEVEL OF SERVICE LARGE EVENT WEEKEND PEAK



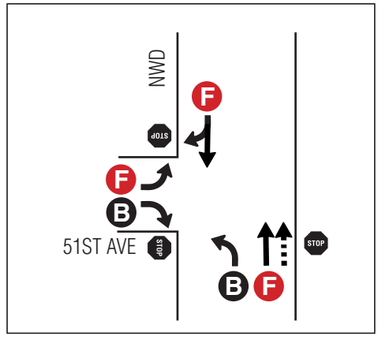
1 - FRANKLIN ST & RACE CT



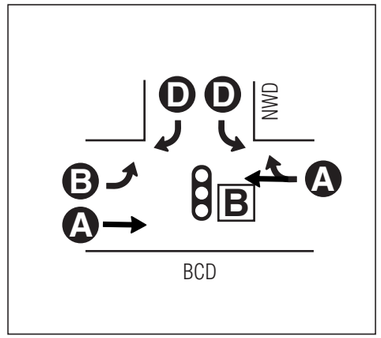
2 - NATIONAL WESTERN (N) & SERVICE DRIVE



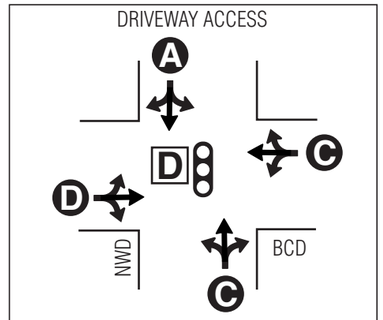
3 - NATIONAL WESTERN (N), & 51ST AVE



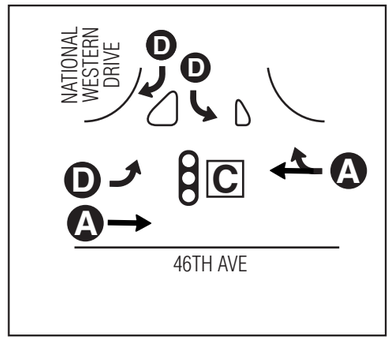
4 - NATIONAL WESTERN (N) & BCD



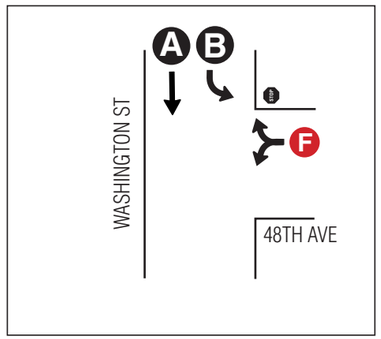
5 - NATIONAL WESTERN (S) & BCD



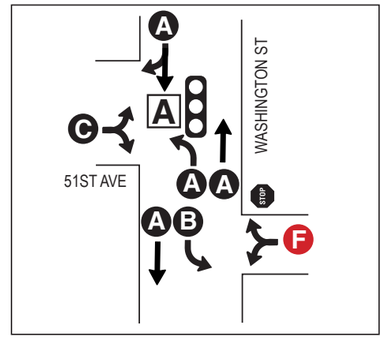
6 - NATIONAL WESTERN (S) & 46TH AVE



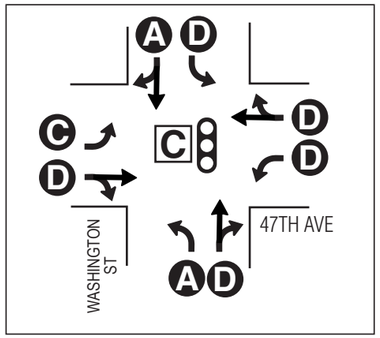
7 - 48TH AVE & WASHINGTON



8 - 51ST AVE & WASHINGTON



9 - 47TH AVE & WASHINGTON



● = Movement LOS ☐ = Overall LOS

NOTE: Only movements with calculated LOS are shown.

SIGNAL WARRANT ANALYSIS AND FUNDING SOURCES

Signal warrant analyses were performed to determine the likelihood of the proposed traffic signals to be warranted when Phase 1-2 is complete. All assumed traffic signal locations meet either Warrant 9 (Proximity to a Rail Grade Crossing) or Warrant 3 (Peak Hour Warrant) except for the intersection of the National Western Drive (N)/Access Drive (Intersection 2). A summary of the signal warrant analyses and currently identified funding sources is shown below in Table 9.

Table 9: Signal Warrant Results and Funding Sources | Phase 1-2

Intersection	Warrant Met	Funding Source
1- Franklin St & Race Ct	9	NWC
2- NWD (N) & Access Drive	None	Not applicable
3- NWD (N) & 51st Ave	3	NWC
4- NWD (N) & BCD	3	NWC
5- NWD (S) & BCD	3	NWC
6- NWD (S) & 46th Ave	3	Other
7- 48th Ave & Washington St	3	Other
8- 51st Ave & Washington St	Existing	Other
9- 47th Ave & Washington St	Existing	Other

ALL-WAY STOP CONTROL INVESTIGATION

Instead of installing traffic signals at the intersections of NWD (N)/ 51st Avenue, NWD (N)/ BCD, and NWD (S)/ BCD at the completion of the Phase 1-2 build program, the National Western Center would like to increase traffic control at these two intersections through a phased approach. The initial traffic control at these two intersections is proposed to be all-way stop control until traffic volumes and programming at the NWC increase to levels where full traffic signal control is warranted and necessary.

The City and County of Denver has adopted the criteria presented in the Manual on Uniform Traffic Control Devices (MUTCD) for the installation of stop signs and all-way stops to ensure traffic controls are both necessary and appropriate for each area. Before a stop sign can be installed at an intersection, an engineering investigation must be conducted in conformance with the MUTCD criteria. Each location is examined for pedestrian volumes, automobile traffic and frequency of accidents to determine if an all-way stop is warranted. The following MUTCD criteria were evaluated for each intersection based on the current data and information available:

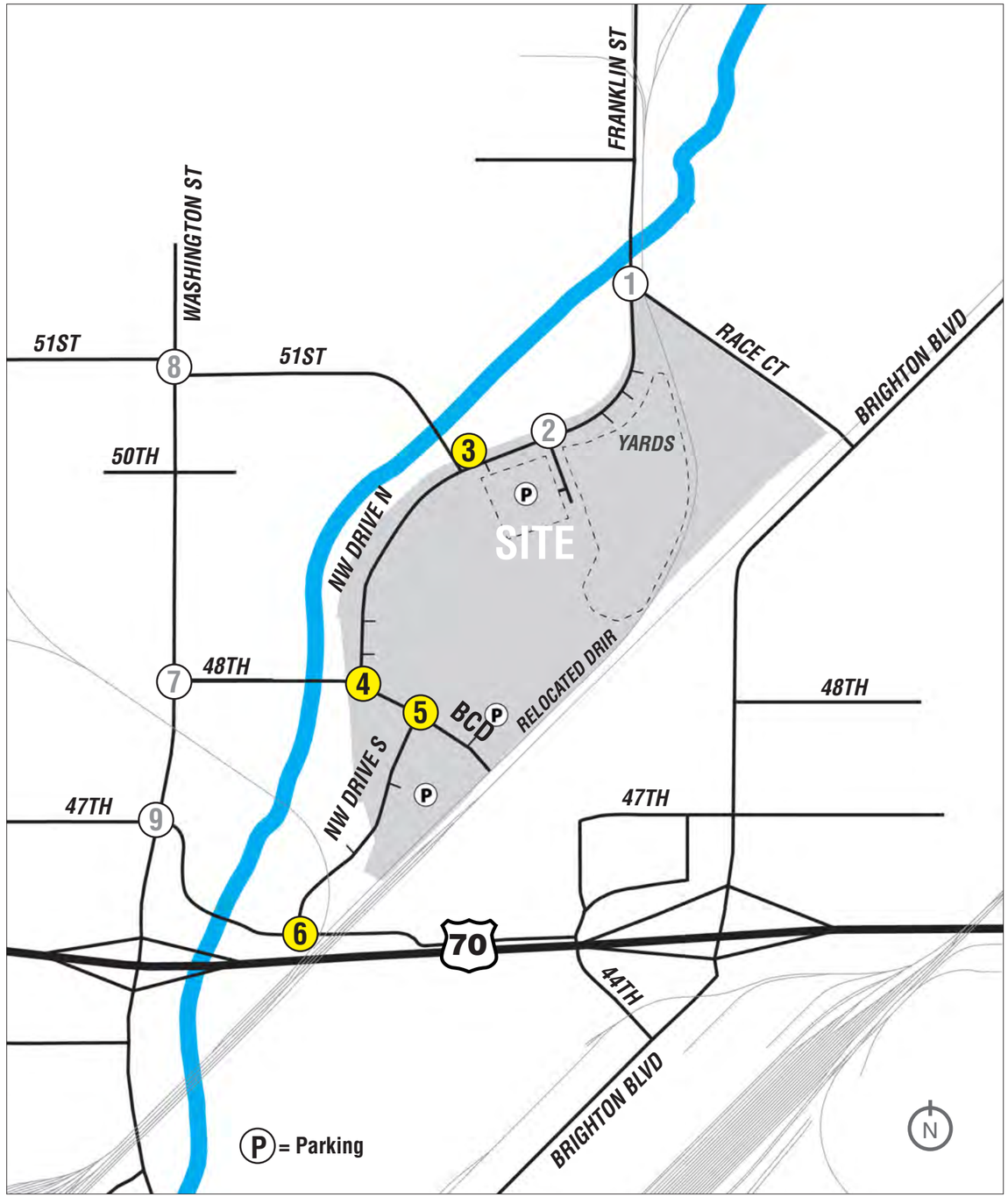
- Are there approximately equal volumes on the intersecting roads? YES
- Is a traffic control signal warranted? YES, when event programming reaches full capacity
- Is there an adverse crash history? No data is available
- Do the roadways meet the 8-hour minimum volume thresholds? NO, but there will be times as the event programming matures where the minimum volume thresholds will be exceeded for multiple hours. The actual 8-hour volumes that will be realized are difficult to project.
- Can the all-way stop control assist with left turning conflicts? YES, there is anticipated to be higher left turning volumes at each intersection.
- Are the intersections near locations that generate high pedestrian volumes? YES, there are also expected to be significant bicycle volumes at each of these intersections.
- Are the locations on intersections of two collector streets of a similar nature where all-way stop control would improve the traffic characteristics of the intersections? YES

Based on the criteria evaluation presented above, the installation of all-way stop control at the intersections of NWD (N)/ 51st Avenue, NWD (N)/ BCD, NWD (S)/ BCD and NWD (S)/ 46th Avenue are determined to meet a substantial portion of the criteria and are deemed to be beneficial to traffic operations and safety until such time as the installation of traffic signals at these intersections is warranted and justified.

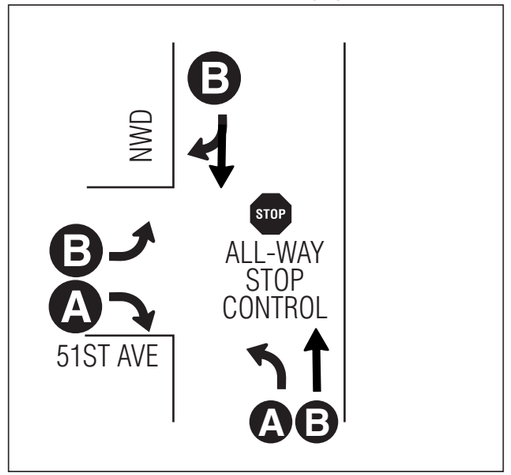
The operations characteristics of these intersections with all-way stop control was also evaluated. The intersections are anticipated to operate at acceptable LOS in the weekday peak hour scenario. The large event scenario showed poor performance of the westbound right turn movement at the NWD (N)/ BCD intersection, the northbound movements at NWD (S)/ BCD, most approaches at the NWD (N)/ 51st Avenue intersection, and the southbound left turn at NWD (S)/ 46th Avenue. The poor performance at NWD (N)/ BCD can be mitigated through the implementation of two northbound lanes on NWD (N) to create a separate receiving lane for the westbound right turn. The intersections of NWD (S)/ BCD, NWD (N) /51st Avenue, and NWD (S)/ 46th Avenue may need to be actively controlled during large events to allow for safe and efficient operations for traffic, pedestrians, and bicycles. A detailed event management plan outlining methods and devices for these large event mitigations should be completed prior to the completion of the Phase 1-2 build program.

See Exhibits 27 and 28 for the Phase 1-2 All-Way Stop Control Level of Service Normal Weekday PM Peak and Large Event Weekend Peak. See Exhibit 29 for the Phase 1-2 Recommendations for Lane Configurations, Control, and Signal Warrant Results.

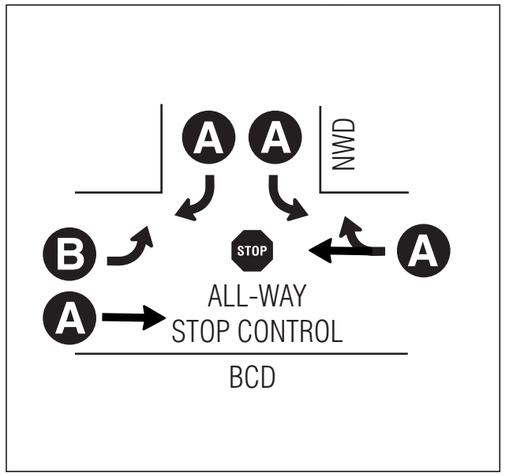
EXHIBIT 27: PHASE 1-2 | STOP CONTROL LEVEL OF SERVICE NORMAL WEEKDAY PM PEAK



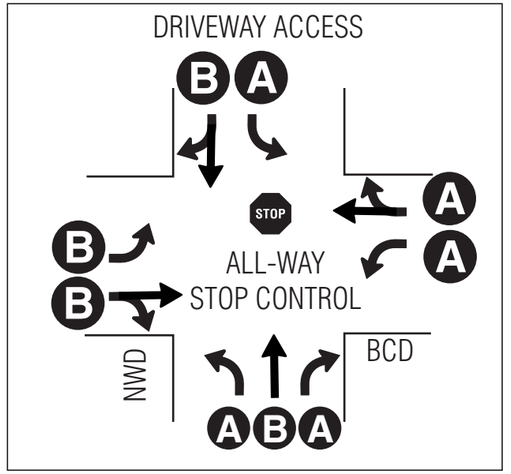
3 - NATIONAL WESTERN (N) & 51ST AVE



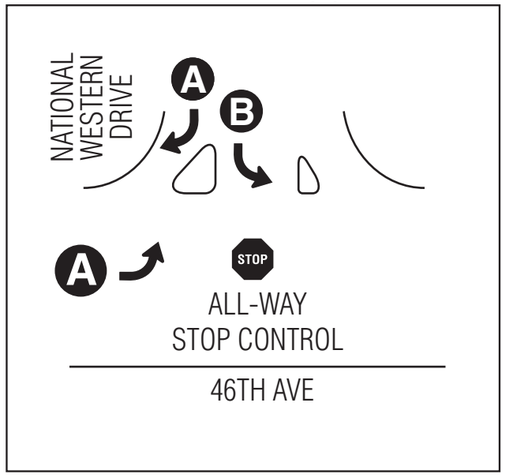
4 - NATIONAL WESTERN (N) & BCD



5 - NATIONAL WESTERN (S) & BCD

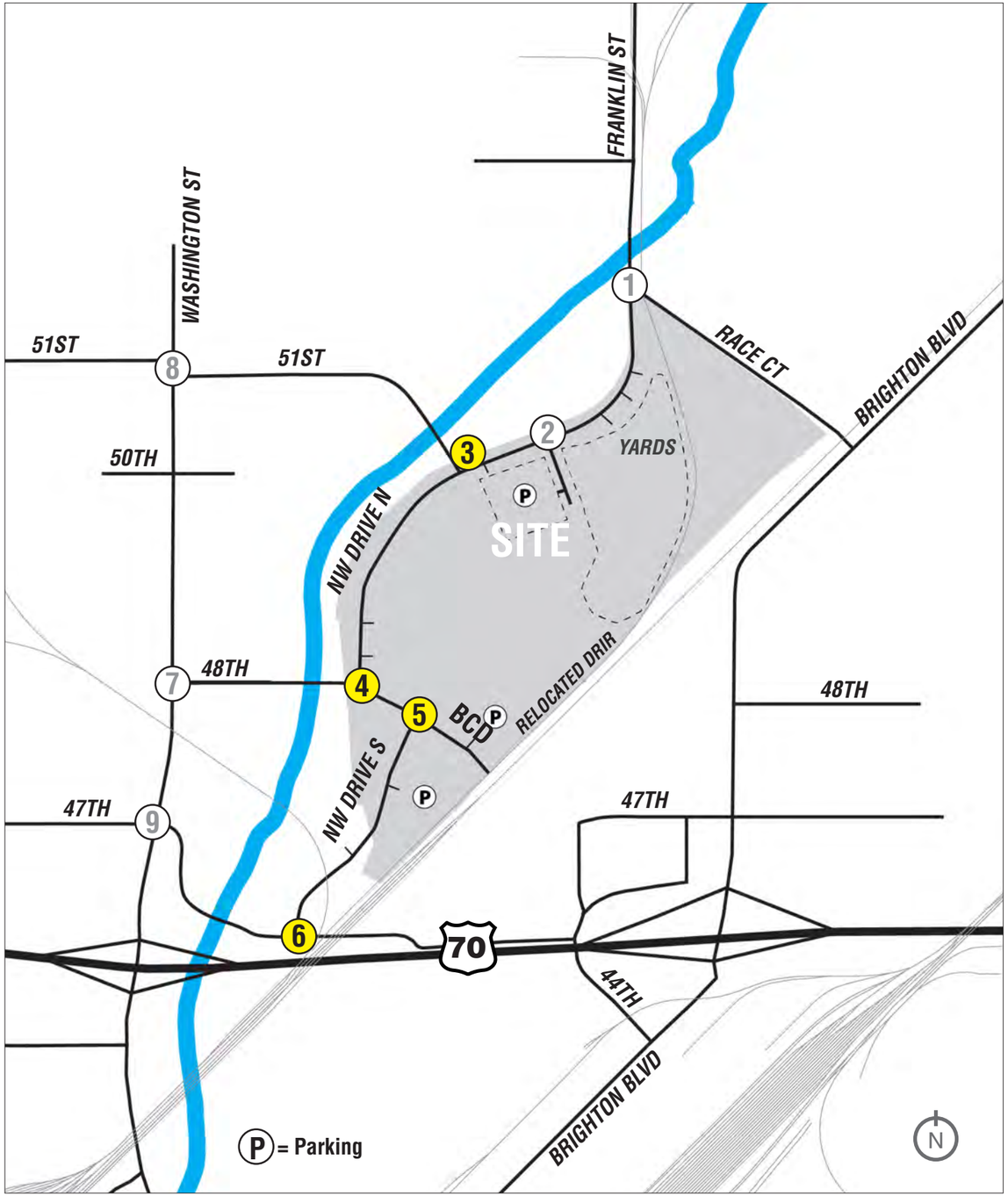


6 - NATIONAL WESTERN (S) & 46TH AVE

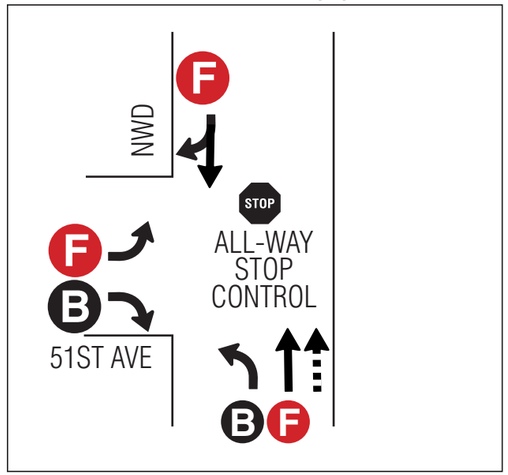


● = Movement LOS

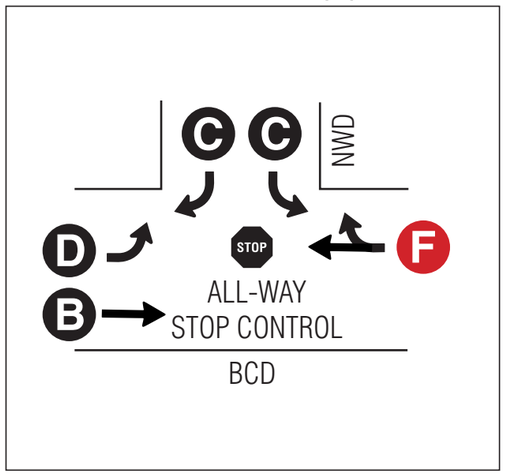
EXHIBIT 28: PHASE 1-2 | STOP CONTROL LEVEL OF SERVICE LARGE EVENT WEEKEND PEAK



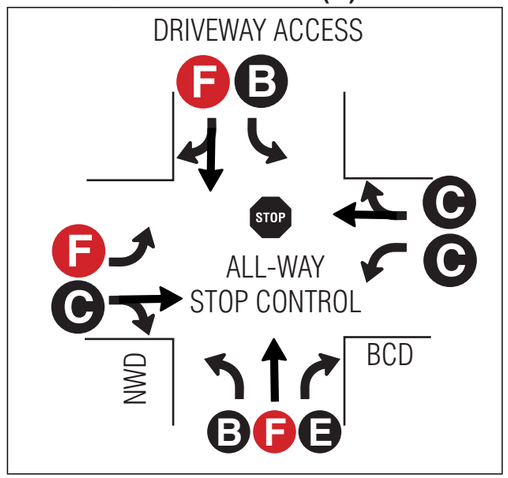
3 - NATIONAL WESTERN (N) & 51ST AVE



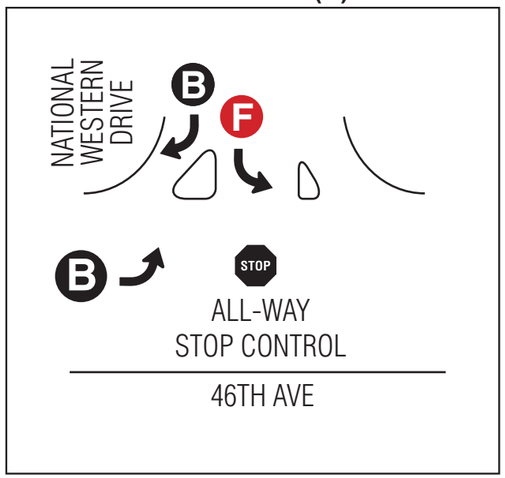
4 - NATIONAL WESTERN (N) & BCD



5 - NATIONAL WESTERN (S) & BCD

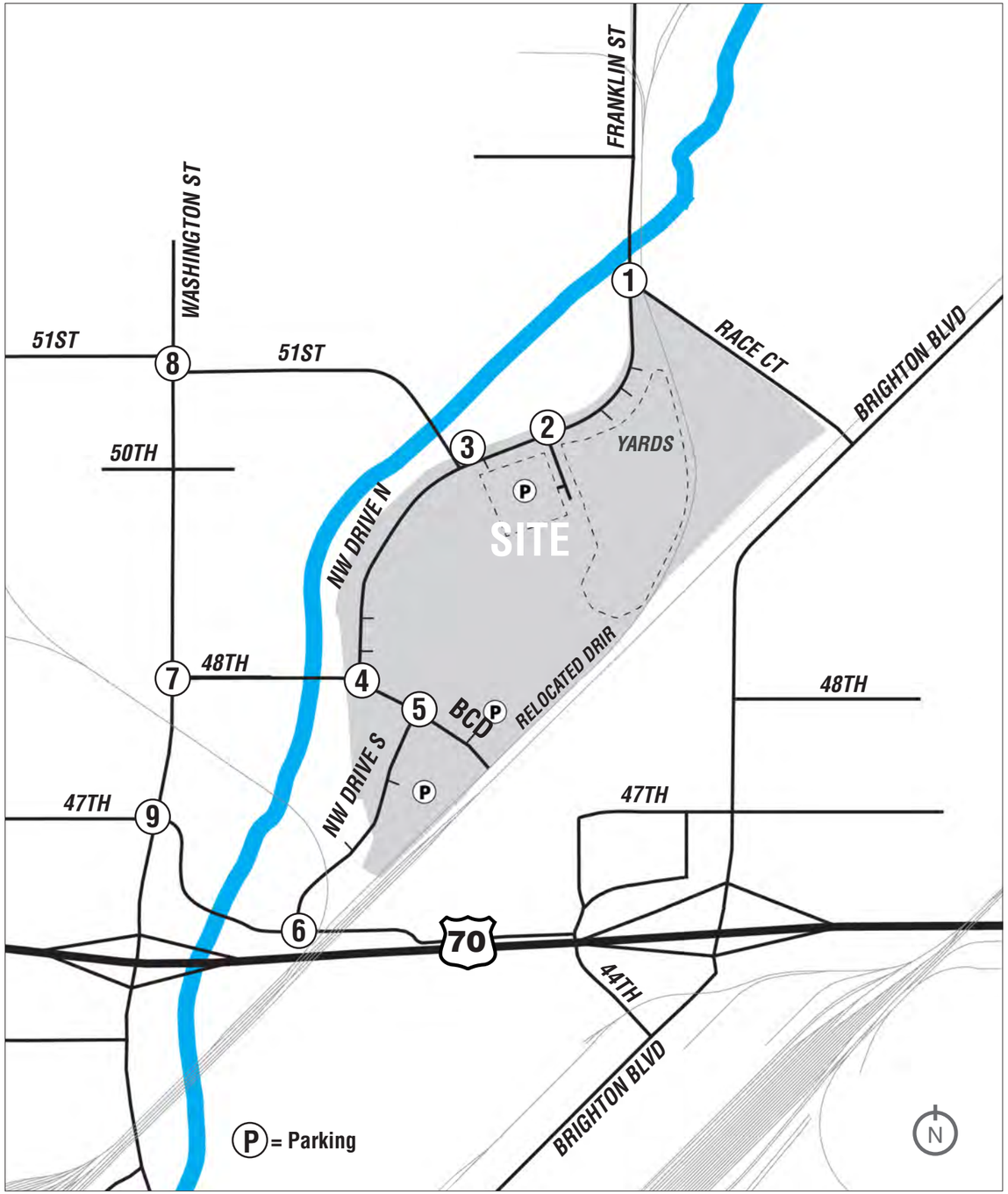


6 - NATIONAL WESTERN (S) & 46TH AVE



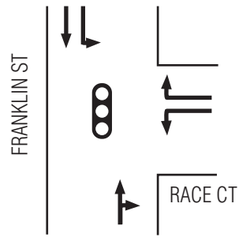
● = Movement LOS

EXHIBIT 29: PHASE 1-2 | RECOMMENDED LANE CONFIGURATIONS, CONTROLS AND SIGNAL WARRANT: INITIAL CONFIGURATION

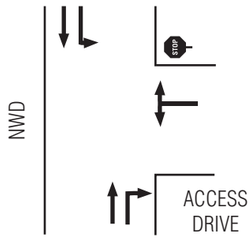


1 - FRANKLIN ST & RACE CT

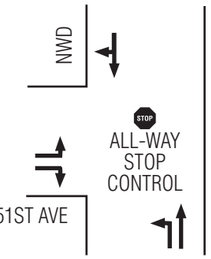
Signal meets Warrant 9



2 - NATIONAL WESTERN (N) & ACCESS DRIVE

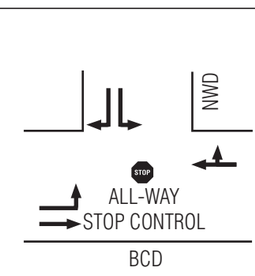


3 - NATIONAL WESTERN (N) & 51ST AVE



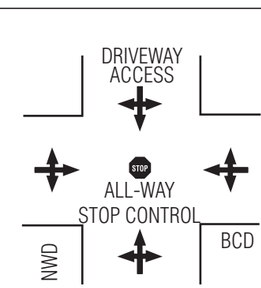
Monitor traffic for future signal installation

4 - NATIONAL WESTERN (N) & BCD



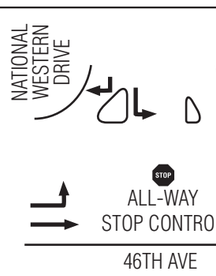
Monitor for future traffic signal installation

5 - NATIONAL WESTERN (S) & BCD



Monitor for future traffic signal installation

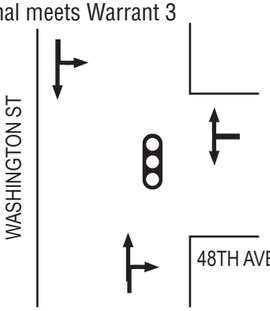
6 - NATIONAL WESTERN (S) & 46TH AVE



Monitor for future traffic signal installation

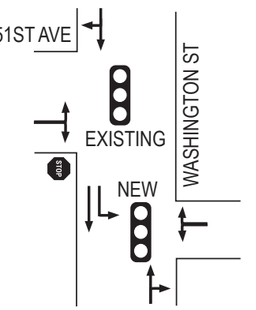
7 - 48TH AVE & WASHINGTON

Signal meets Warrant 3



Signal to be constructed by others

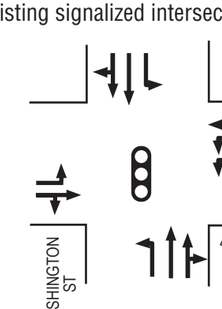
8 - 51ST AVE & WASHINGTON



Reconfigure intersection as part of Washington Street Reconstruction Project in the future

9 - 47TH AVE & WASHINGTON

Existing signalized intersection



PHASE 1-2 RECOMMENDATIONS

Key recommendations are:

- Install an all-way stop control at the intersection of 51st Avenue / NWD to facilitate traffic operations and allow for safe pedestrian and bicycle crossings of NWD. Monitor performance for converting to a traffic signal in the future.
- Install an all-way stop control at the intersection of National Western Drive (N)/Bettie Cram Drive to facilitate traffic operations and allow for safe pedestrian and bicycle crossings of the intersection. Monitor performance for converting to a traffic signal in the future.
- Install an all-way stop control at the intersection of National Western Drive (S)/Bettie Cram Drive to allow for efficient operations and to facilitate safe pedestrian and bicycle operations through the intersection. Monitor performance for converting to a traffic signal in the future.
- Install an all-way stop control at the intersection of National Western Drive (S)/46th Avenue to facilitate traffic operations and allow for safe pedestrian and bicycle crossings at the intersection. Monitor performance for converting to a traffic signal in the future.
- Develop an event management plan for large events that details the operations, methods, and equipment required at the NWD (N) / BCD, NWD (S) / BCD and 51st Ave/NWD (N) intersections to mitigate poor operational performance and to provide for safe pedestrian and bicycle mobility at these intersections during large events.
- Signalize the intersection of Franklin Street/National Western Drive/Race Court due to the close proximity of an at-grade rail crossing to the intersection.
- Signalize the intersection of Washington Street/48th Avenue to allow for safe and efficient traffic operations (funding by others).
- Consider constructing a three-lane section for the Service Drive to improve capacity and operational flexibility.
- Implement TNC arrival and departure patterns and pick up/drop off areas as shown in Exhibit 17.

NEXT STEPS

TRAFFIC SIGNALS

Proposed traffic signals at the intersection of NWD (N)/ BCD, NWD (N)/51st Ave, NWD (S)/BCD, and NWD (S)/46th Ave are not going to be constructed during the NWC Phase 1-2 build out. Signal Warrant Analysis based on estimated peak hour volumes was performed and shows that these locations are likely to meet Warrant 3, the Peak Hour Signal Warrant, after completion of Phase 1-2 build out. However, before the actual installation of a traffic signal, it is preferred that additional warrant analysis be performed such as Warrant 1 (Eight-Hour Vehicular Volume) or Warrant 2 (Four-Hour Vehicular Volume). Therefore, the overall next steps for traffic signal implementation is to monitor and wait until Warrant 1 (Eight-Hour Vehicular Volume) or Warrant 2 (Four-Hour Vehicular Volume) is met before constructing the signals.

In the interim period, the NWC will utilize event management plans and practices to manage event traffic. This will be achieved through event permit requirements and a portion of the event fees will include operational expenses for traffic management. As the campus continues to grow and mature, the NWC and the City will reevaluate this structure.

Traffic monitoring will be performed by the NWC and the City with specific traffic data collection performed by the NWC or developers as additional phases of the NWC come online.

Designs for future traffic signals will need to consider the high level of multi-modal activity on the NWC Campus and accommodate these high use levels and dedicated facilities being constructed for pedestrians and bicycles.

ADDITIONAL TRAFFIC STUDIES FOR FUTURE PHASES

For future phases, a traffic study "lite" or memo to document what will be done as part of next phase will be required and should reference the overall traffic study. This process will refine the traffic volumes and projections over time and give the NWC and the City a better understanding of traffic volume patterns in the area and a process for triggering the installation of a traffic signal.

The NWC Authority would be responsible for developing traffic study memos based on original TIS. Future signal warrant studies would be funded and signals constructed (if warranted) by the NWC Authority or other developer.

WASHINGTON STREET PROJECT INTERFACE

The Washington Street Reconstruction Project will be responsible for constructing and implementing traffic signals at Washington Street/48th Ave and Washington St/51st Ave. There are two potential coordination and timeline risks associated with this. The first is that the Washington Street project may not be complete by opening day of the NWC Phase 1-2 facilities. In this case, special traffic management plans may need to be developed to coordinate construction activities with event scheduling and also to assign event traffic management resources to the Washington Street corridor. The NWC Authority and the City should maintain close coordination on this issue and one year out from opening day for the NWC, a determination of whether Washington Street will be complete should be made and if the answer is no, event traffic management planning should begin immediately to allow for enough plan development time. In addition, a plan for temporary improvements along 48th Avenue and 51st Avenue should be made so any gaps in the vehicular, pedestrian, and bicycle systems are addressed.

The second risk is that there will be a gap between what the NWC Phase 1-2 project constructs and what the Washington Street Reconstruction project constructs. There is currently a gap of several hundred feet between the construction limits of each project along 48th Avenue and 51st Avenue. If this gap is not closed, there will be a significant disconnect between the improved streets on both ends, with a very narrow and unimproved gap between them that has inadequate vehicular, pedestrian, and bicycle facilities. The construction limits of the NWC Phase 1-2 project have been set and cannot be adjusted at this time. So, either the construction limits of the Washington Street Reconstruction Project will need to be modified, or a solution to install temporary facilities in the gap section will need to be developed. The NWC Authority and the City should maintain close coordination on this issue and one year out from opening day for the NWC, a determination of whether Washington Street will make improvements in the current gap areas along 48th Avenue and 51st Avenue should be made. If the answer is no, a plan for temporary facilities to bridge the gaps needs to be developed and implemented.

FULL BUILD OUT ANALYSIS AND EVALUATION

PROJECT DESCRIPTION

This scenario assumes the Full Build Out of the site as described in the 2016 National Western Center Master Plan. Many things are uncertain with this scenario including the exact mix of land uses, access, parking asset locations, etc. The analysis presented here utilized the best information available at the current time. It is our belief that this scenario is best used to stress test the transportation system and to understand relationships and interfaces between the west and east sides of the site. There is not enough detailed information available for this evaluation to act as a traffic impact study for the future phases of the NWC Redevelopment.

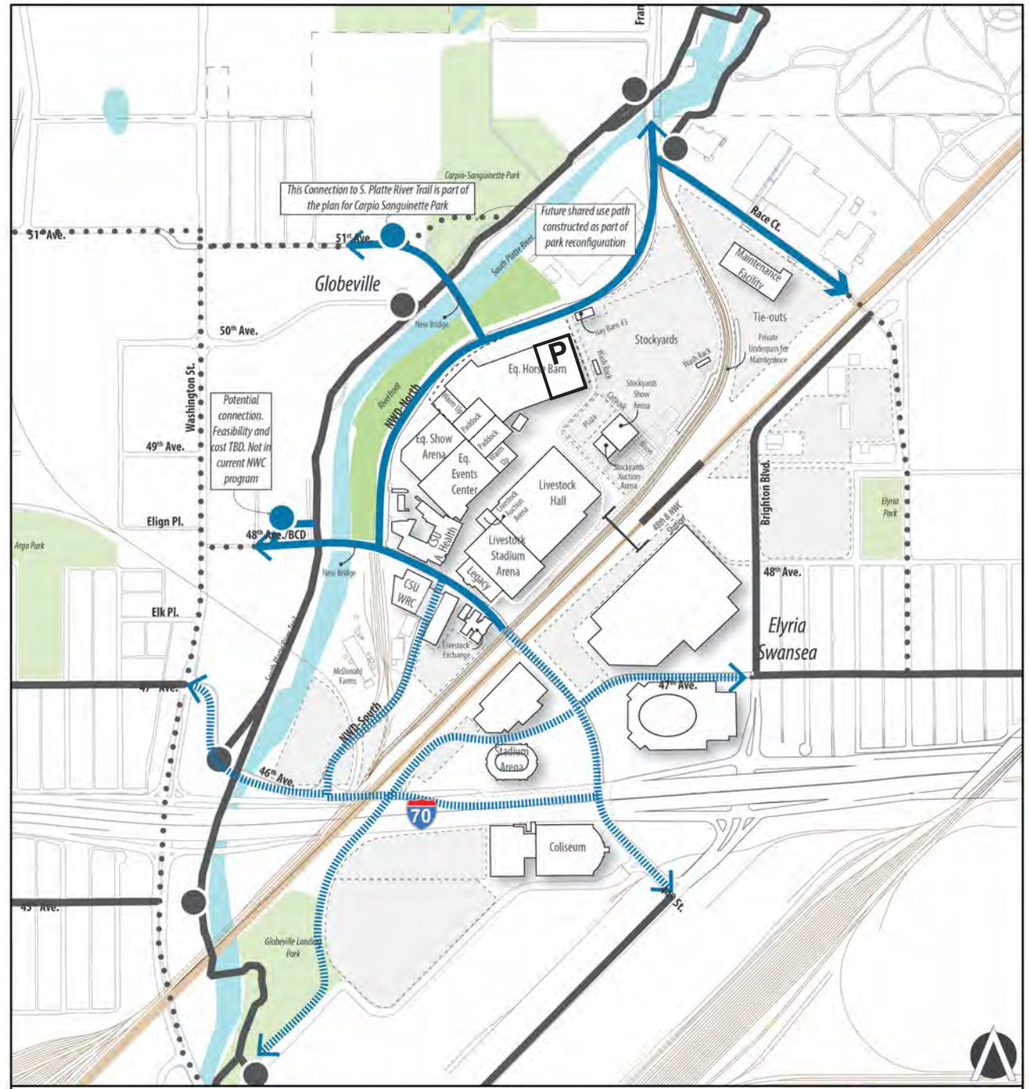
LAND USE

The land uses utilized in this scenario include the facilities developed in Phase 1-2 plus the anticipated facilities included in the Master Plan on the east side of the Railroad Corridor and an expansion of the stand alone parking structure to 900 spaces. Best efforts were made to correctly quantify the future land uses based on the currently available information.

Additional pedestrian and bicycle improvements are planned during Full Build Out. See Exhibits 30 and 31 for planned bicycle and pedestrian facilities to be constructed in Full Build Out.

See Exhibit 32 for the Full Build Out Land Use.

EXHIBIT 30: BICYCLE NETWORK | FULL BUILD OUT

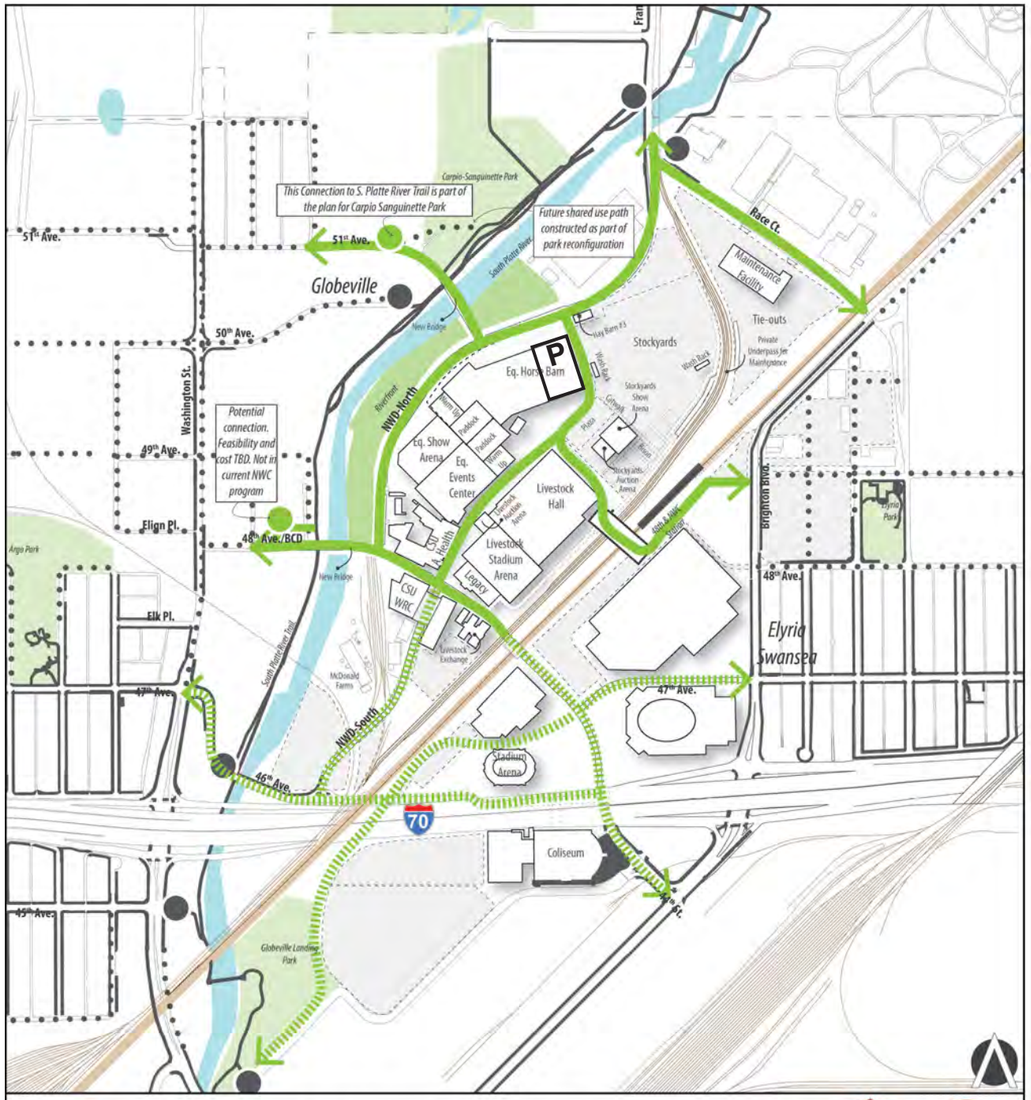


BICYCLE NETWORK | **FULL BUILD OUT (WEST/EAST SIDES COMPLETE)**

Base map
- Roads
- Buildings
- Parks
- Water Bodies
- Railroad Tracks
- S. Platte Trail Access

Bicycle Network
- Existing - Bicycle Facilities
- Existing - S. Platte Trail Access
- Future - Bicycle Facilities - By Others
- Phase 1-2 - Bicycle Facilities - NWC Build
- Phase 1-2 - S. Platte Trail Access
- Full Build Out - Bicycle Facilities - NWC Build

Exhibit 31: Pedestrian Network | Full Build Out



PEDESTRIAN NETWORK | **FULL BUILD OUT (WEST/EAST SIDES COMPLETE)**

Base map
- Roads
- Buildings
- Parks
- Water Bodies
- Railroad Tracks
- S. Platte Trail Access

Pedestrian Network
- Existing - Pedestrian Facilities
- Existing - S. Platte Trail Access
- Future - Pedestrian Facilities - By Others
- Phase 1-2 - Pedestrian Facilities - NWC Build
- Phase 1-2 - S. Platte Trail Access
- Full Build Out - Pedestrian Facilities - NWC Build

Exhibit 32: Full Build Out | Future Land Uses

LAND USE KEY

1 - CSU Water Resources Center
2 - CSU Animal Health & Equine Sports Medicine
3 - WSSA Legacy Building
4 - Livestock Exchange
5 - Equine Arenas
6 - Equine Barn (1000 space parking structure)
7 - Livestock Arena
8 - Livestock Hall
9 - Stockyards Event Center
10 - Stockyards (used for parking under certain circumstances)
11 - Maintenance Facility
12 - 1909 Stadium Arena
13 - CSU Center
14 - Arena
15 - Trade Show / Expo Hall
P - Parking Structure

TRIP DISTRIBUTION AND ASSIGNMENT

The trip distribution and assignment for Full Build Out was modified from Phase 1-2 assumptions to reflect new facilities and roadway connections across the site. Exhibits 33 and 34 show the Full Build Trip Distribution and Assignment patterns.

ROADWAY NETWORK

The main change in the roadway network as it relates to our analysis area is the completion of the Bettie Cram Drive east west connection under the Railroad Corridor. This addition to the roadway network results in a new assignment for background traffic. See Exhibit 35 for the Full Build Out Roadway Network.

TRIP GENERATION

Tables 10 and 11 detail the trip generation rates and resultant trips for the Weekday PM Peak and the Weekend Peak. Trip Generation Rates were derived from the latest version of ITE Trip Generation Manual, 10th Edition. The site trips shown in Tables 10 and 11 are additional trips generated by the new Full Build Out uses. These additional site trips plus the Phase 1-2 site trips shown in Tables 5 and 6 equal the total site trips for the Full Build Out scenarios. The vehicle trip reduction rates used in the trip generation calculations were taken from the National Western Center Parking and Travel Demand Management study completed in 2018.

Table 10: Trip Generation | Full Build Out Additional Trips Normal Weekday

					Trip Generation Rates			Number of Trips			Trip Orientation % AM Peak		Trip Orientation % PM Peak		Trip Orientation # AM Peak		Trip Orientation # PM Peak		
ITE Land Use Code	Description	Land Use Notes	Variable	Quantity	Daily	AM Peak	PM Peak	Daily	AM Peak	PM Peak	Entering	Exiting	Entering	Exiting	Entering	Exiting	Entering	Exiting	Other Notes
N/A	Trade Show/Expo Hall	Primary Convention and show space	1,000 sf GFA	350	2.00	0.20	0.20	700	70	70	65%	35%	50%	50%	46	25	35	35	Assumes no show on a normal weekday. Just load in/out and maintenance/service activity
N/A	Arena	Larger concerts and sporting events. Replaces existing Coliseum.	seats	10000	0.04	0.01	0.01	400	50	50	50%	50%	50%	50%	25	25	25	25	Assumes no event on a normal weekday. Replaces Denver Colisueum which is also a 10,000 seat facility.
710	General Office	Acts as event space on weekends	1,000 sf GFA	120	9.74	1.16	1.15	1169	139	138	85%	15%	15%	85%	118	21	21	117	Assume it operates as general office on weekdays during peak hours.
875	Department Store	1909 Stadium Arena. Open Air Market and retail	1,000 sf GFA	90	22.88	0.58	1.95	2059	52	176	64%	36%	50%	50%	33	19	88	88	No good data for this type of use exists. Farmer's Market data is limited and Food Cart Pod data is also limited and hard to estimate. Department store was chosen as most conservative.
							Total Vehicle Trips	4328	311	434					222	90	169	265	
							Vehicle Trip Reduction (24%)	1039	75	104					53	22	41	64	
							Net Vehicle Trips	**3289**	**236**	**330**					**169**	**68**	**128**	**201**	

Table 11: Trip Generation | Full Build Out Additional Trips Large Event Weekend Day

					Trip Generation Rates		Number of Trips		Trip Orientation % Peak Hour		Trip Orientation # Peak Hour		
ITE Land Use Code	Description	Land Use Notes	Variable	Quantity	Daily	Peak Hour	Daily	Peak Hour	Entering	Exiting	Entering	Exiting	Other Notes
N/A	Trade Show/Expo Hall	Primary Convention and show space	1,000 sf GFA	350	15.00	3.00	5250	1050	15%	85%	158	893	Most leaving at peak evening time period
N/A	Arena	Larger concerts and sporting events. Replaces existing Coliseum.	seats	10000	0.95	0.37	9500	3730	100%	0%	3730	0	evening event. 85% sold out concert. 2.2 people/car. 82% arrive/depart in peak hour.
N/A	CSU Center	Functions as event venue on weekends	seats	1000	0.95	0.37	950	373	100%	0%	373	0	On weekend this operates more like an event center than office. evening event. Event with 1,000 attendees. 2.2 people per car. 82% arrive in peak hour.
875	Department Store (1909 Stadium Arena)	Open Air Market and retail	1,000 sf GFA	90	25.40	3.45	2286	311	50%	50%	156	156	No good data for this type of use exists. Farmer's Market data is limited and Food Cart Pod data is also limited and hard to estimate. Department store was chosen as most conservative.
						Totals	17986	5464			4417	1049	
						Vehicle Trip Reduction (20%)	3597	1093			883	210	
						Net Vehicle Trips	**14389**	**4371**			**3534**	**839**	

Exhibit 33: Full Build Out | Trip Distribution & Assignment Normal Weekday

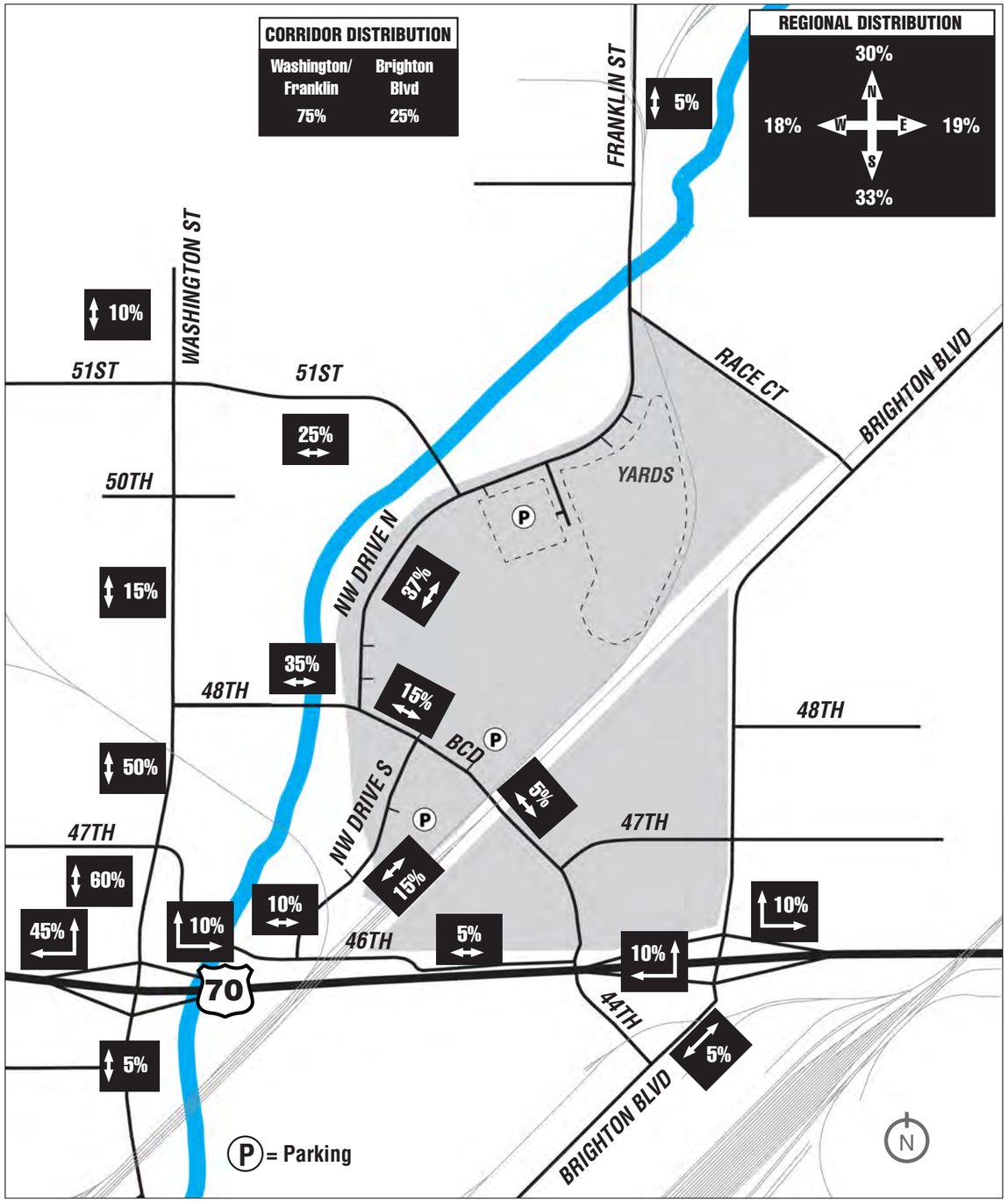


Exhibit 34: Full Build Out | Trip Distribution & Assignment Large Event Weekend Peak

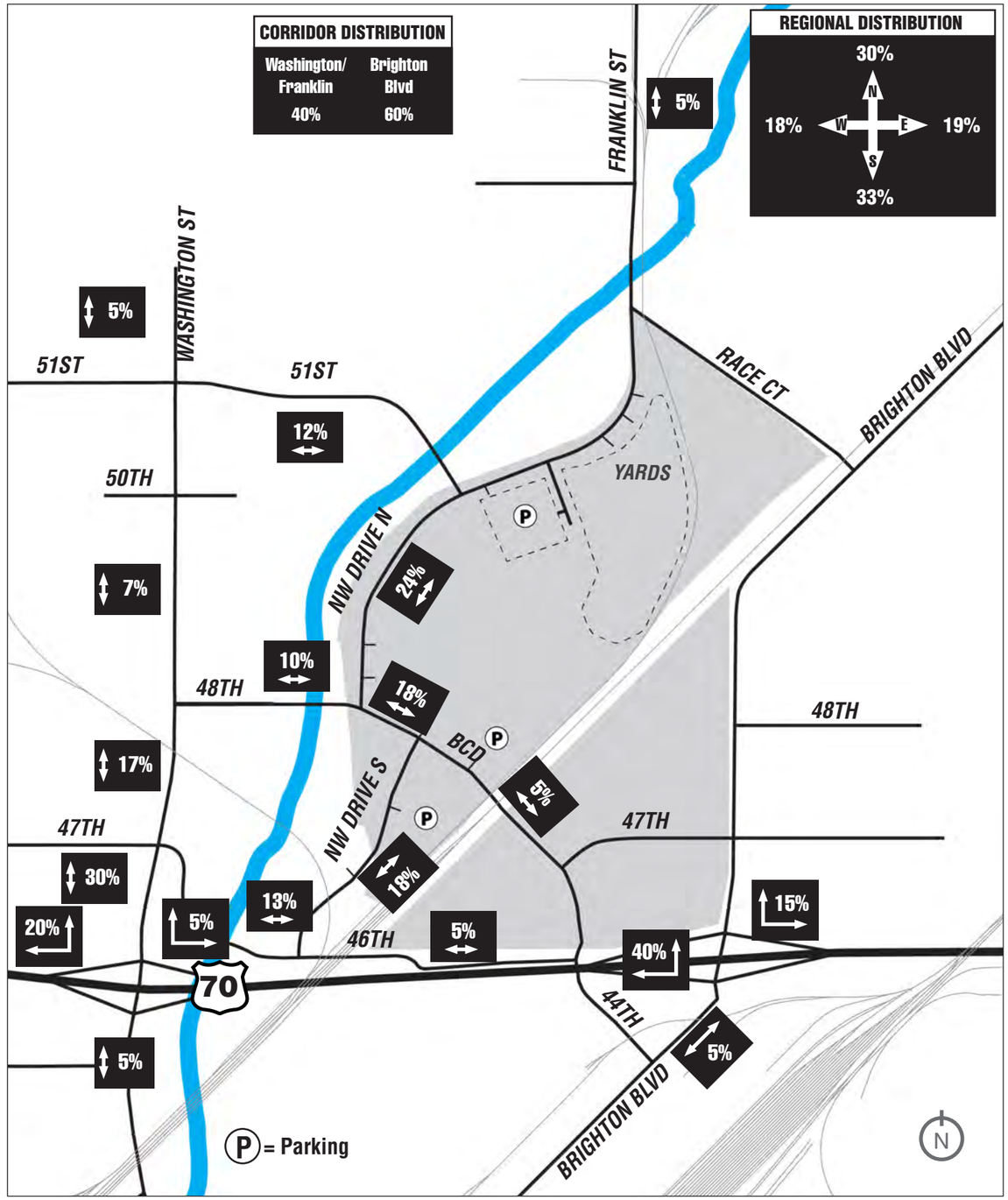
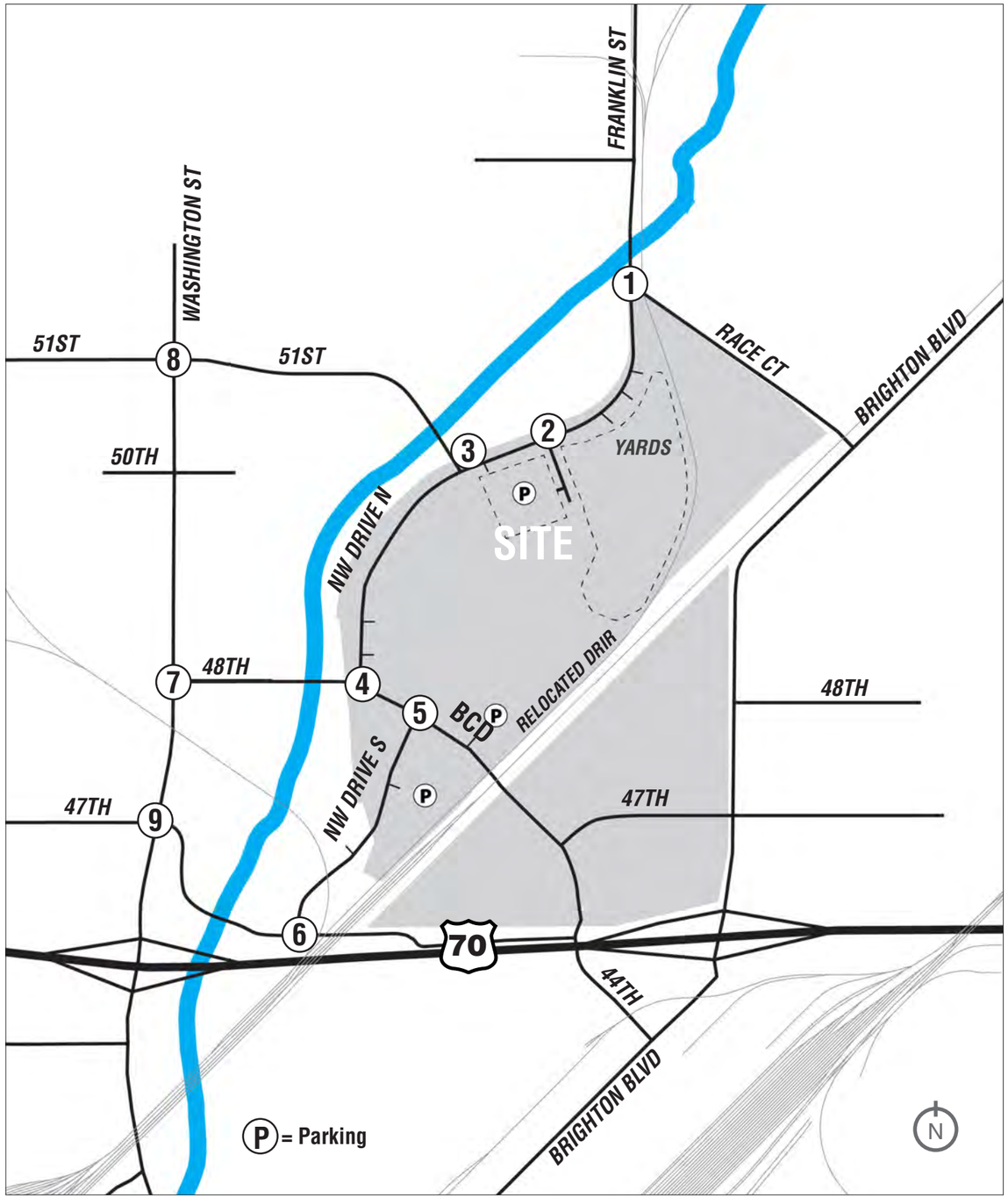
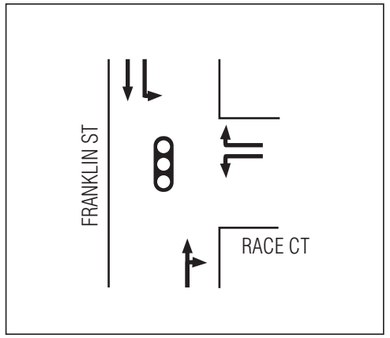


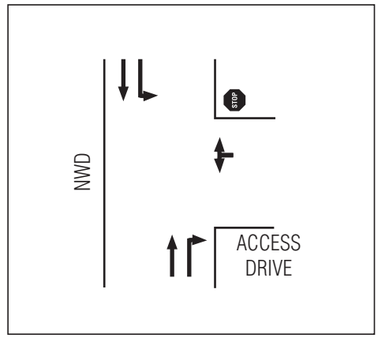
EXHIBIT 35: FULL BUILD OUT | ROADWAY NETWORK



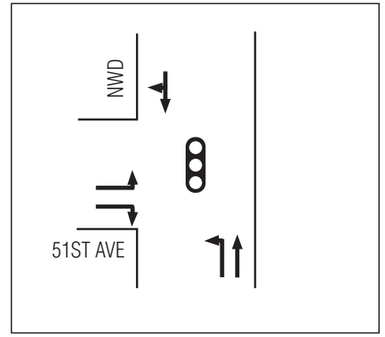
1 - FRANKLIN ST & RACE CT



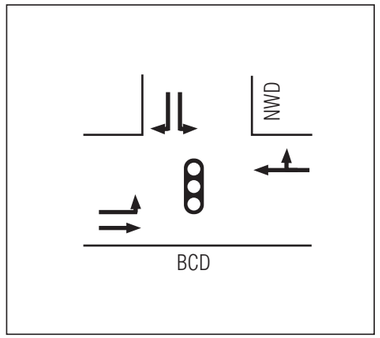
2 - NATIONAL WESTERN (N) & ACCESS DRIVE



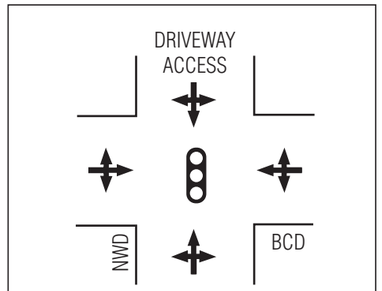
3 - NATIONAL WESTERN (N) & 51ST AVE



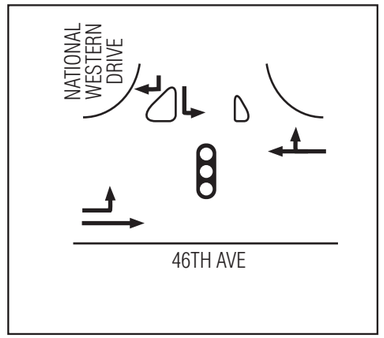
4 - NATIONAL WESTERN (N) & BCD



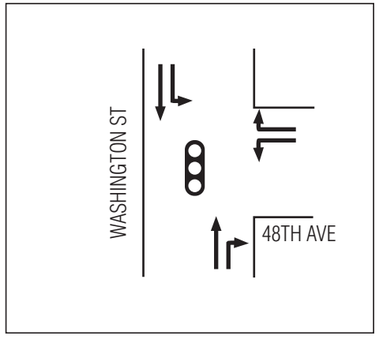
5 - NATIONAL WESTERN (S) & BCD



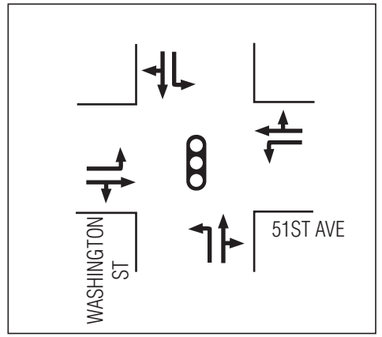
6 - NATIONAL WESTERN (S) & 46TH AVE



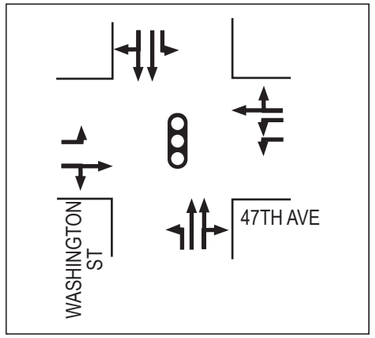
7 - 48TH AVE & WASHINGTON*



8 - 51ST AVE & WASHINGTON*



9 - 47TH AVE & WASHINGTON



*Assumes Washington Street Bond Project is complete and intersection configurations shown are implemented.

TRAFFIC VOLUMES

Background traffic volumes, site generated trips and total trips were developed as part of this analysis. The expected patterns, drop off zones, and volumes of TNC's were also developed and included in the Large Event time frame. This information is shown in Exhibit 36.

An important factor to determine is which timeframe is the critical timeframe for analysis during the weekend day large event scenario. Our definition of a Large Event on the site includes multiple small to medium size events happening at once. Some are oriented to daytime use and others are evening events. An evaluation of arrival and departure patterns for the individual events was performed and it was determined that the critical analysis hour was the time when attendees are leaving the daytime oriented events at the same time as other attendees are arriving for the evening events. This is a different condition than many special event venues where the exiting traffic conditions at the end of a large event is the critical analysis period.

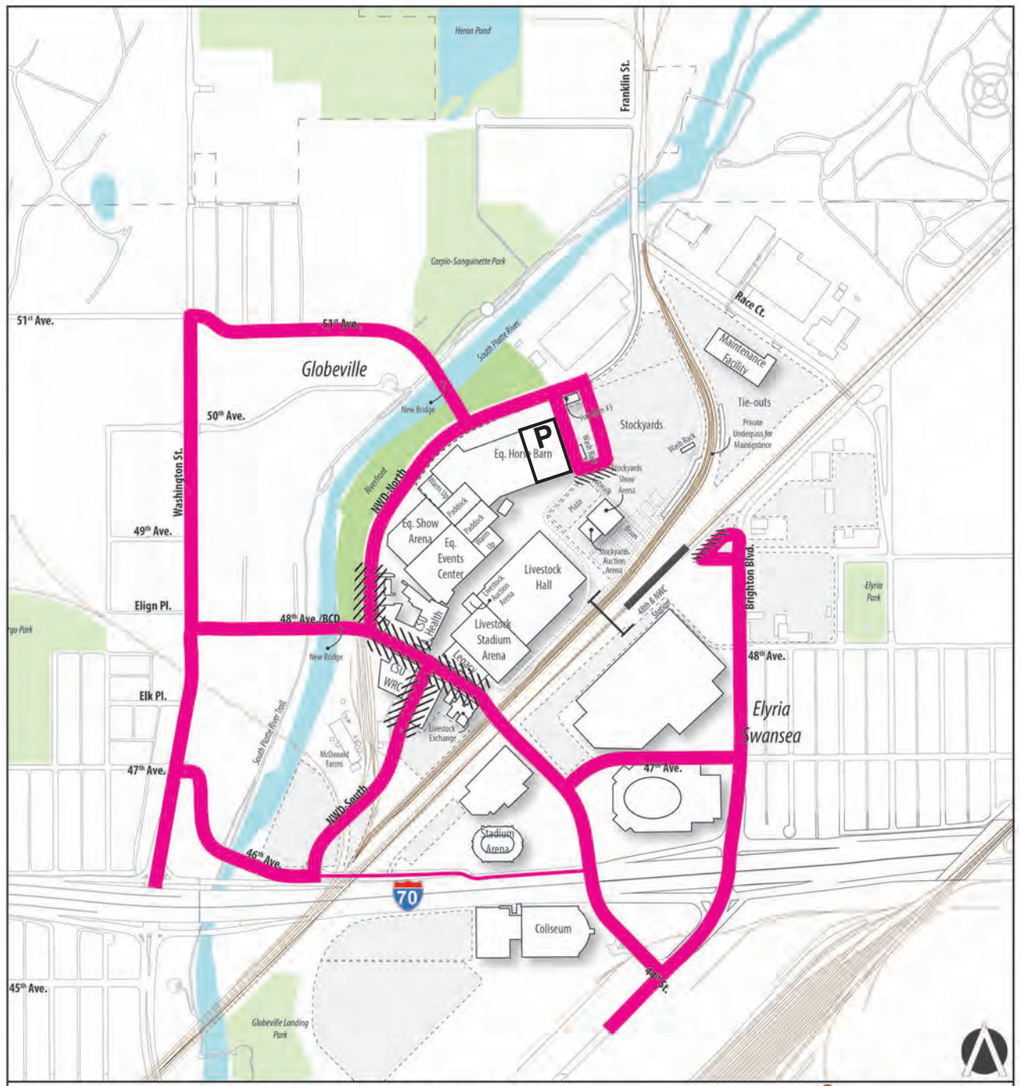
BACKGROUND TRAFFIC

The Full Build-Out scenario uses the Year 2038 as the evaluation year. The projected 20-year traffic growth in the area along I-70 and I-25 as provided by the CDOT OTIS system were analyzed and a 20-year growth factor of 1.2 was derived. All background traffic was increased by this factor to arrive at 2038 background traffic.

See Exhibits 37-39 for the Full Build Out Weekday PM Peak Background, Additional, and Total Trips.

See Exhibits 40-43 for the Full Build Out Weekend Background, Additional, TNC and Total Trips.

EXHIBIT 36: TNC NETWORK | FULL BUILD OUT

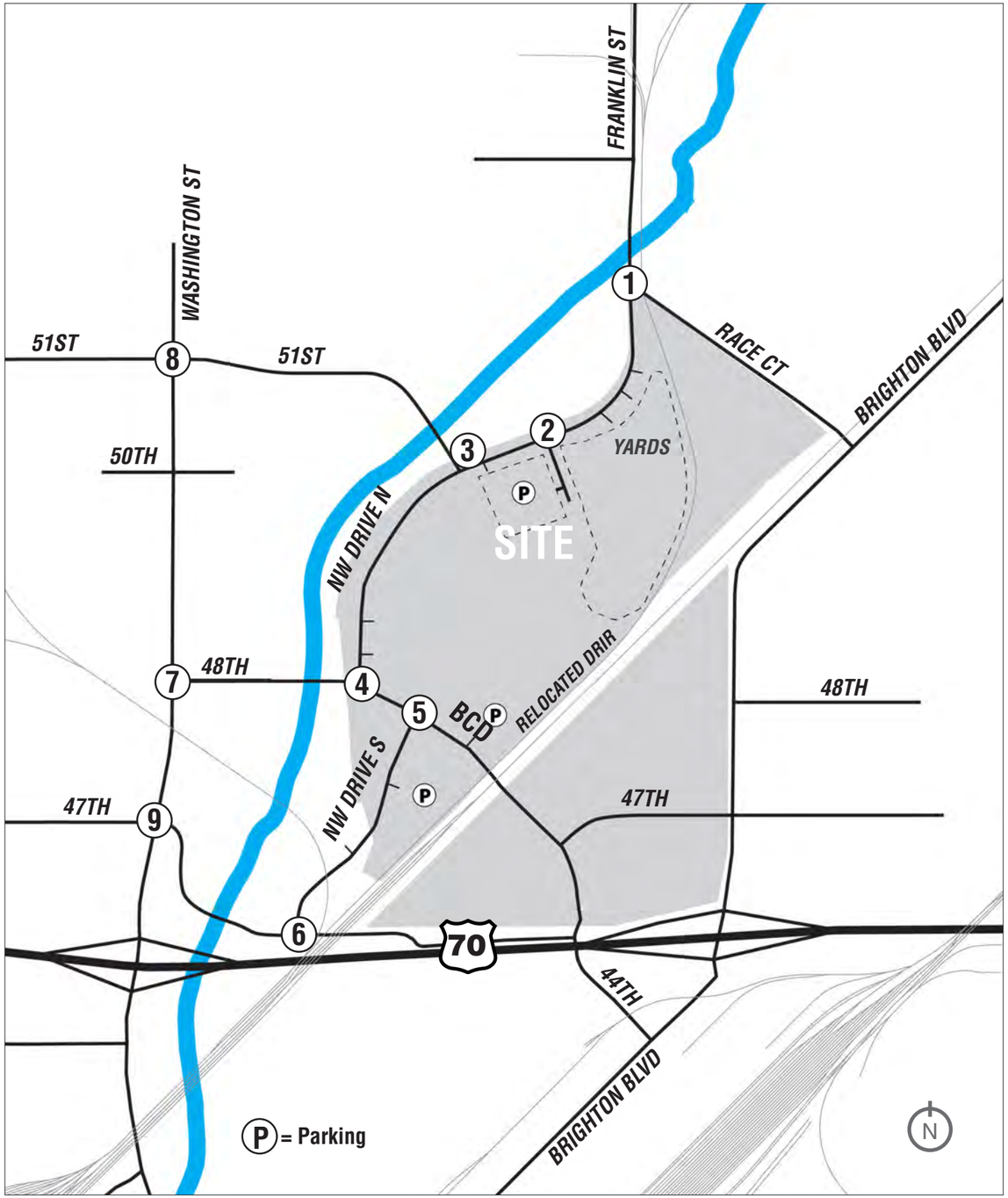


TNC NETWORK | **FULL BUILDOUT | LARGE EVENT**
(WEST/EAST SIDE COMPLETE)

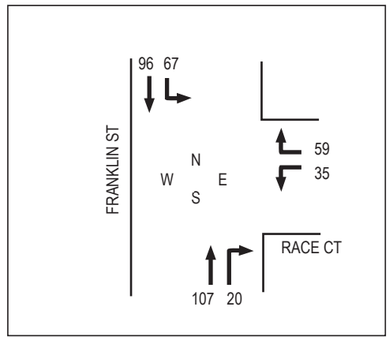
Base map
- Roads
- Buildings
- Parks
- Water Bodies
- Railroad Tracks
- S. Platte Trail Access

TNC Network
- High Use
- Low Use
- Drop-off Zones

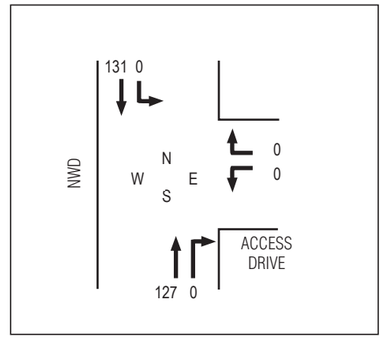
EXHIBIT 37: FULL BUILD OUT | BACKGROUND TRAFFIC NORMAL WEEKDAY PM PEAK



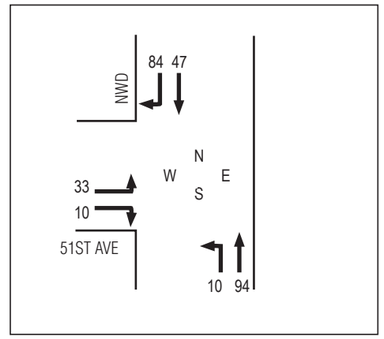
1 - FRANKLIN ST & RACE CT



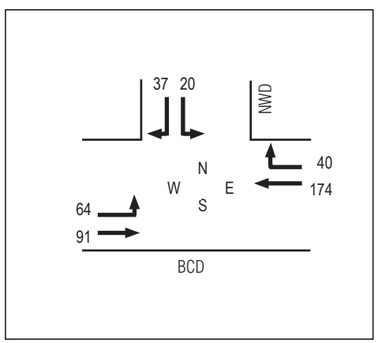
2 - NATIONAL WESTERN (N) & ACCESS DRIVE



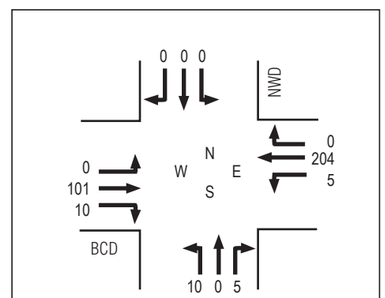
3 - NATIONAL WESTERN (N) & 51ST AVE



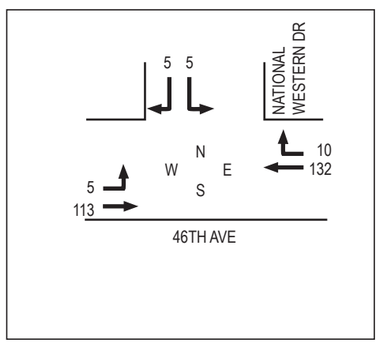
4 - NATIONAL WESTERN (N) & BCD



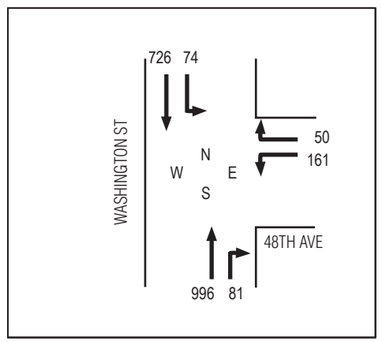
5 - NATIONAL WESTERN (S) & BCD



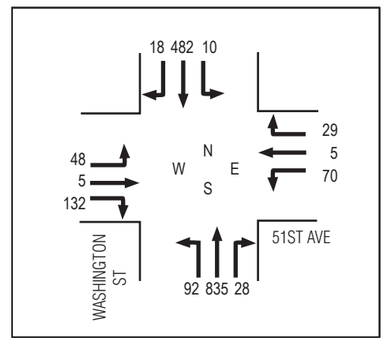
6 - NATIONAL WESTERN (S) & 46TH AVE



7 - 48TH AVE & WASHINGTON



8 - 51ST AVE & WASHINGTON



9 - 47TH AVE & WASHINGTON

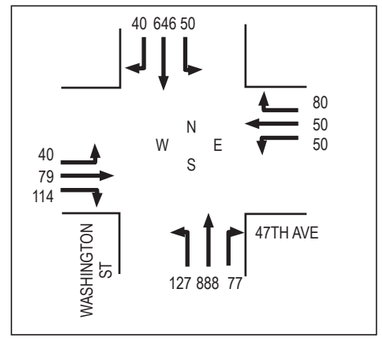
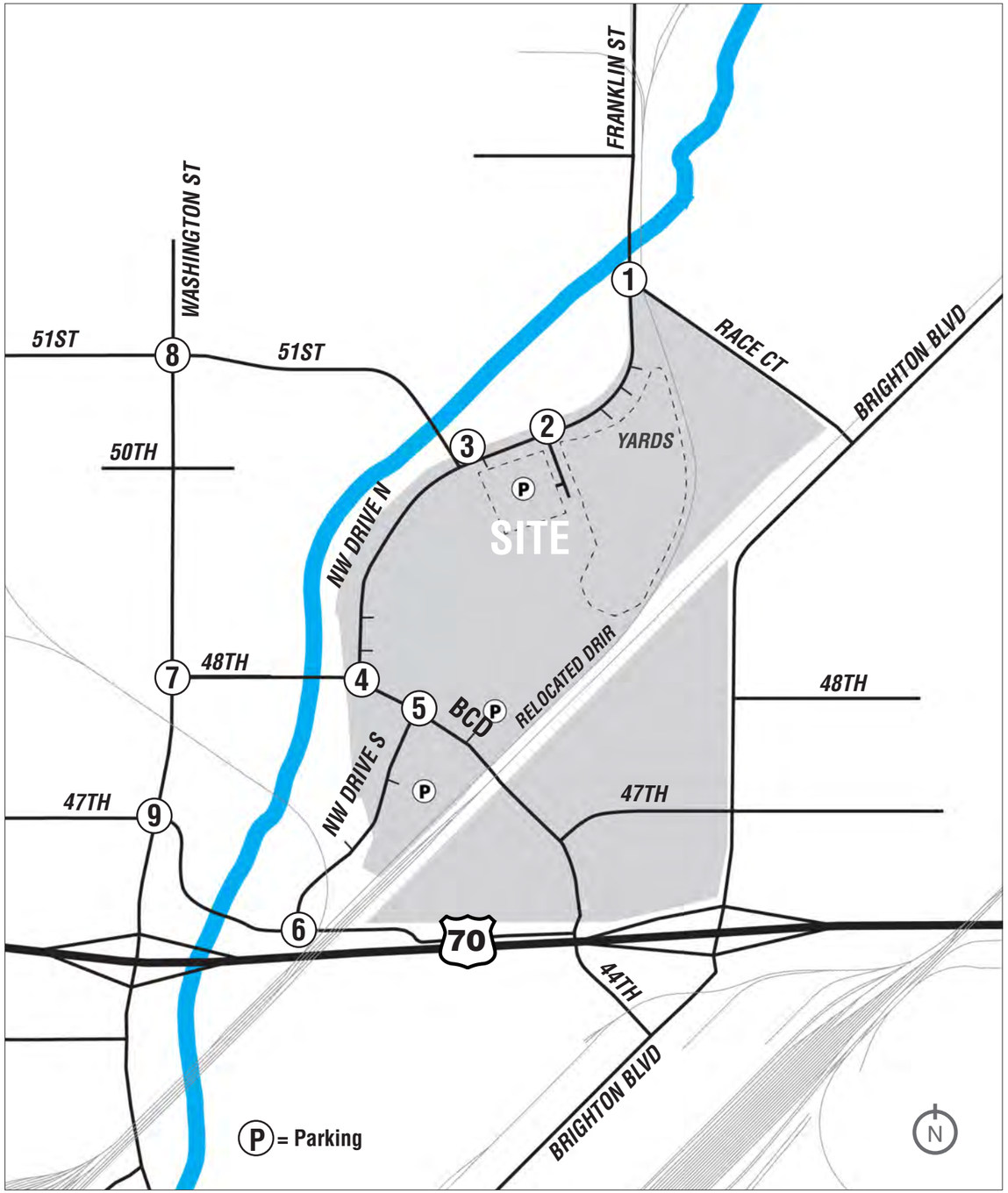
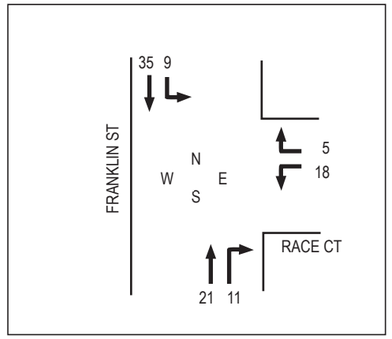


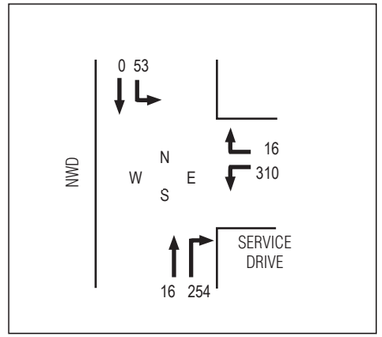
EXHIBIT 38: FULL BUILD OUT | ADDITIONAL TRIPS NORMAL WEEKDAY PM PEAK



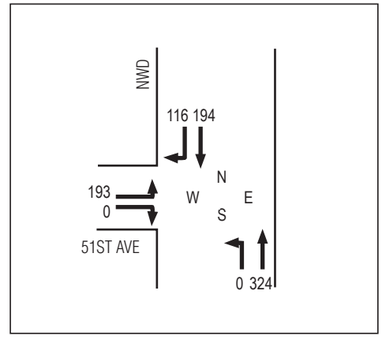
1 - FRANKLIN ST & RACE CT



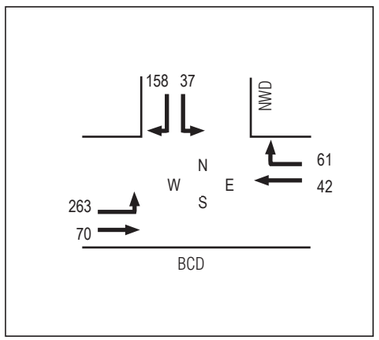
2 - NATIONAL WESTERN (N) & SERVICE DRIVE



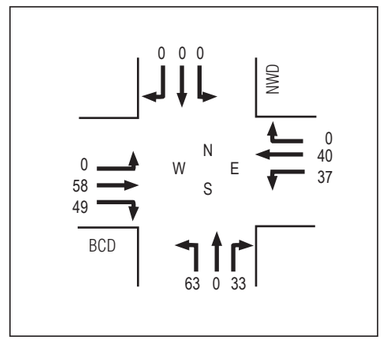
3 - NATIONAL WESTERN (N), & 51ST AVE



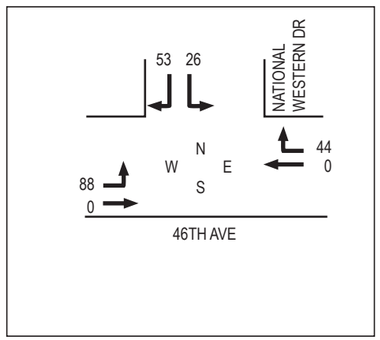
4 - NATIONAL WESTERN (N) & BCD



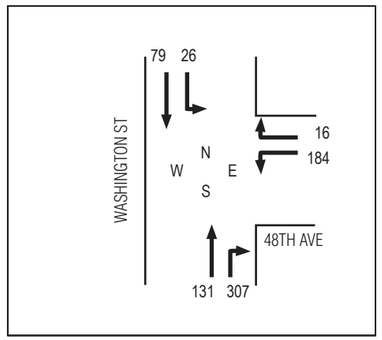
5 - NATIONAL WESTERN (S) & BCD



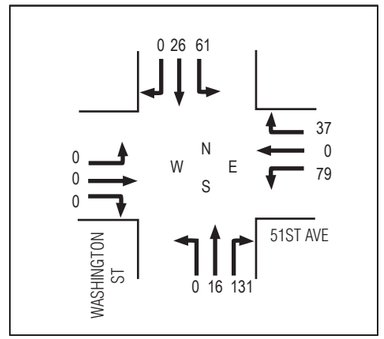
6 - NATIONAL WESTERN (S) & 46TH AVE



7 - 48TH AVE & WASHINGTON



8 - 51ST AVE & WASHINGTON



9 - 47TH AVE & WASHINGTON

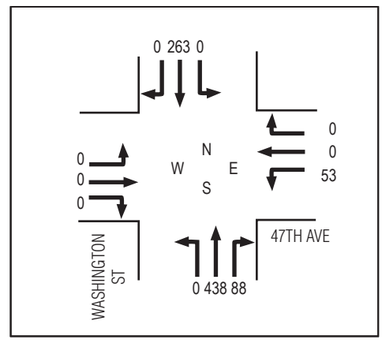
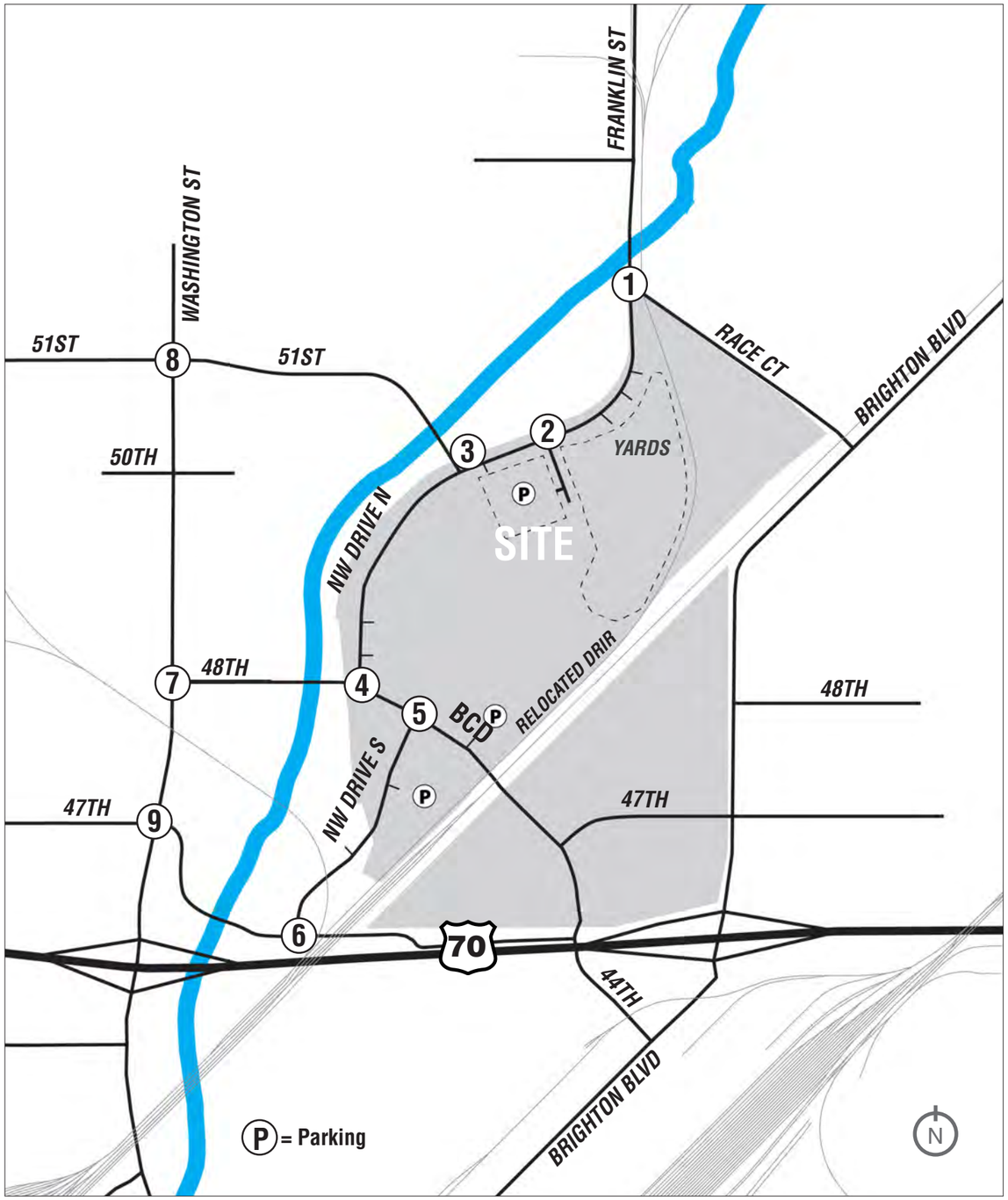
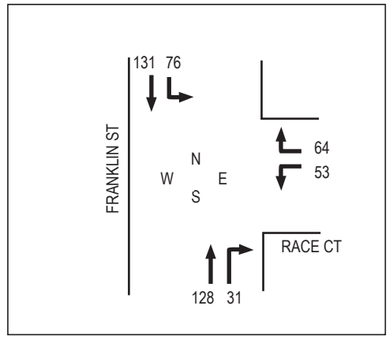


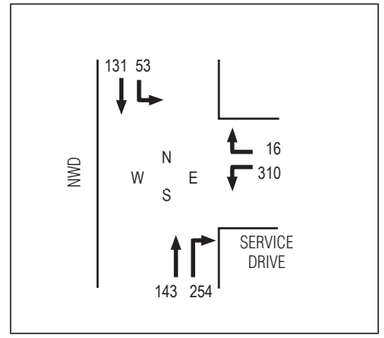
EXHIBIT 39: FULL BUILD OUT | TOTAL TRIPS* NORMAL WEEKDAY PM PEAK



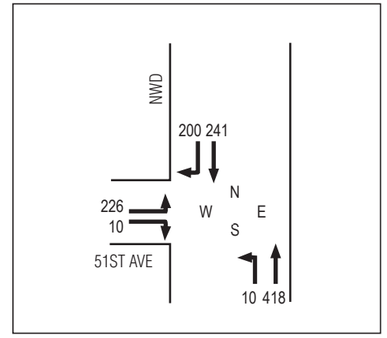
1 - FRANKLIN ST & RACE CT



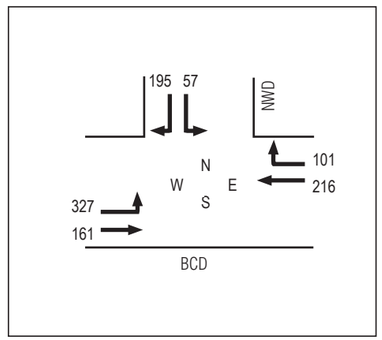
2 - NATIONAL WESTERN (N) & SERVICE DRIVE



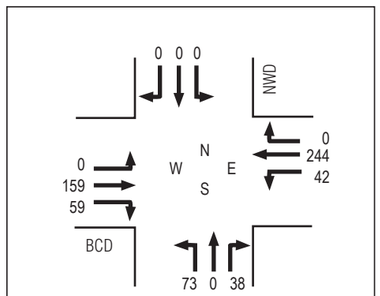
3 - NATIONAL WESTERN (N), & 51ST AVE



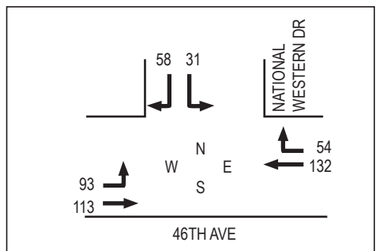
4 - NATIONAL WESTERN (N) & BCD



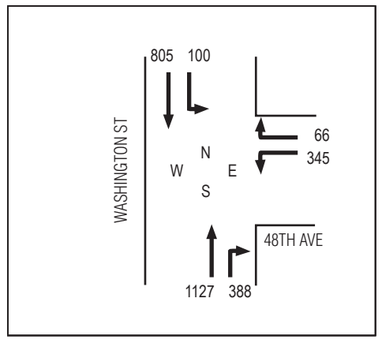
5 - NATIONAL WESTERN (S) & BCD



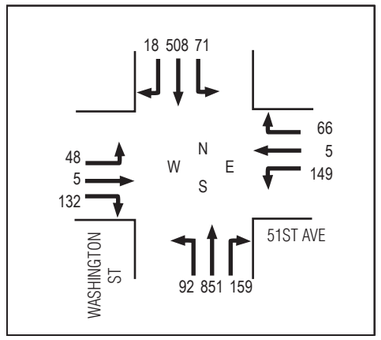
6 - NATIONAL WESTERN (S) & 46TH AVE



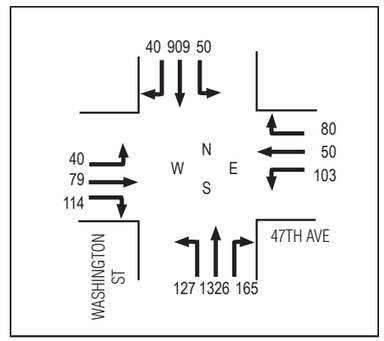
7 - 48TH AVE & WASHINGTON



8 - 51ST AVE & WASHINGTON

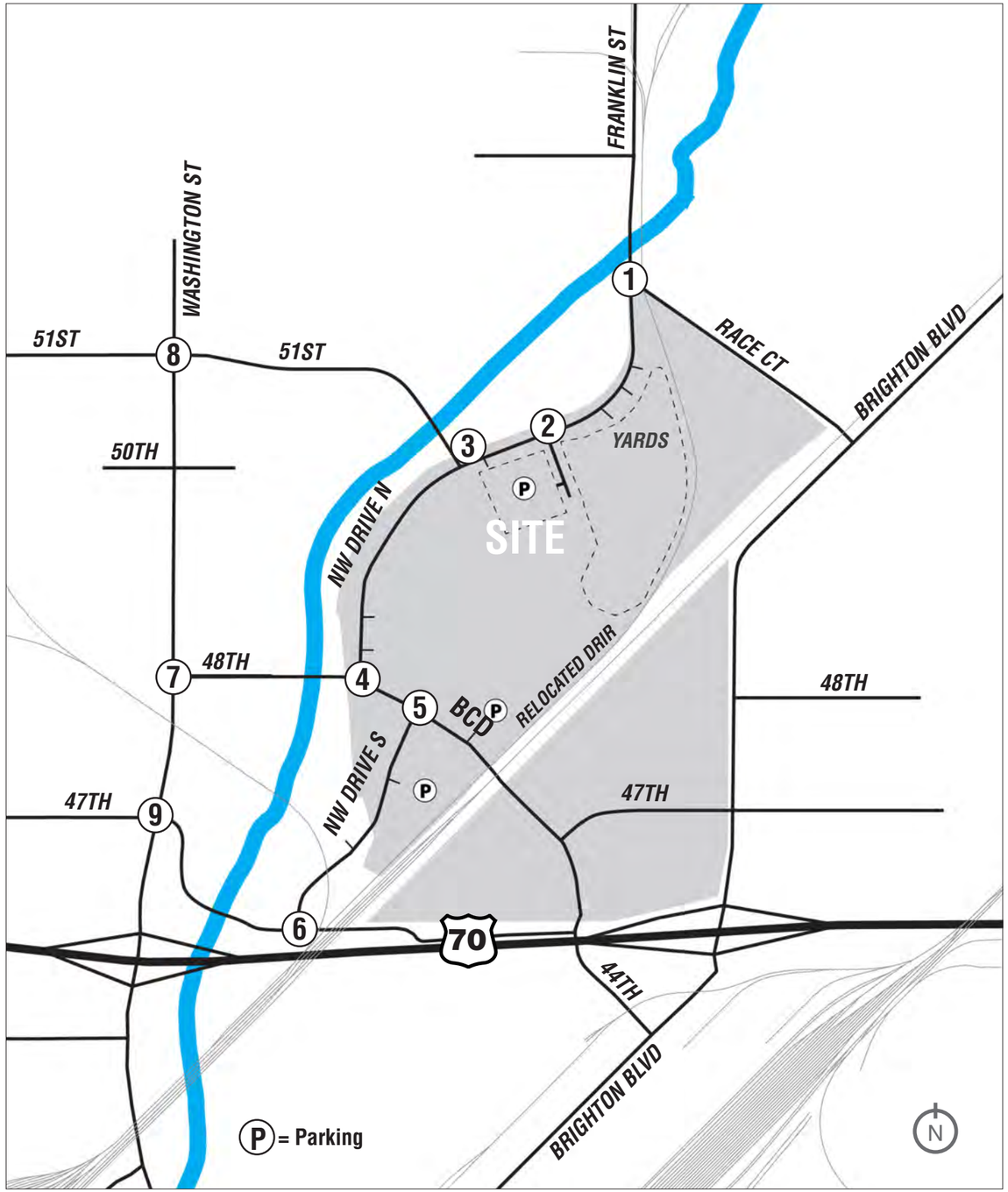


9 - 47TH AVE & WASHINGTON

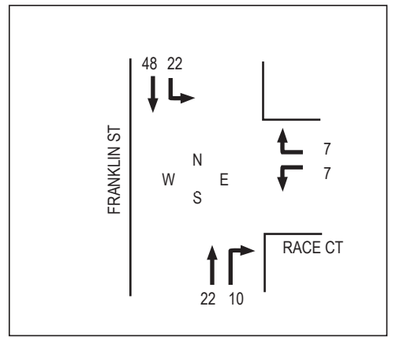


*Total Trips = Background + additional trips

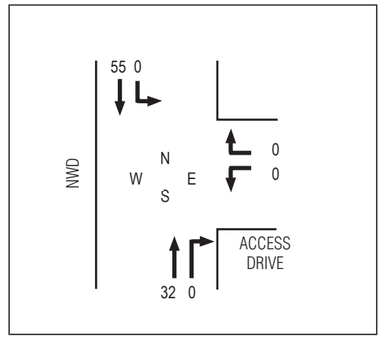
EXHIBIT 40: FULL BUILD OUT | BACKGROUND TRAFFIC LARGE EVENT WEEKEND PEAK



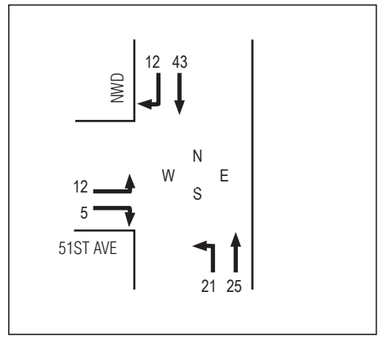
1 - FRANKLIN ST & RACE CT



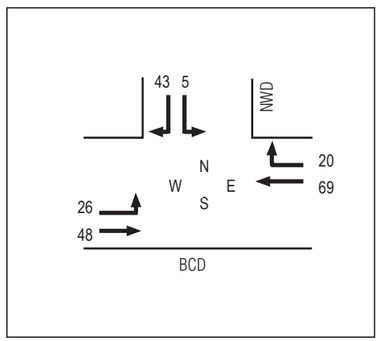
2 - NATIONAL WESTERN (N) & ACCESS DRIVE



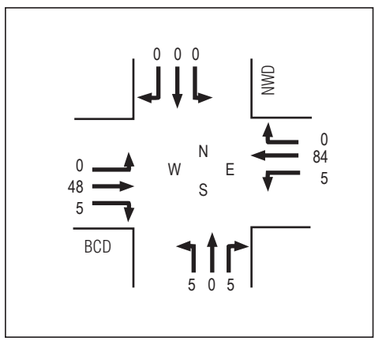
3 - NATIONAL WESTERN (N) & 51ST AVE



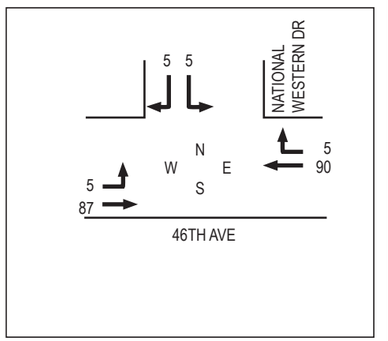
4 - NATIONAL WESTERN (N) & BCD



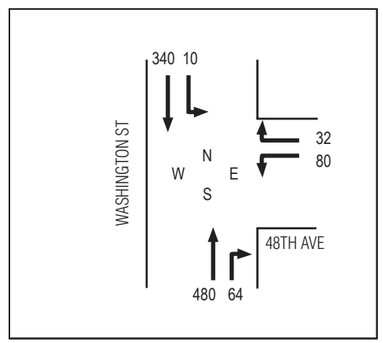
5 - NATIONAL WESTERN (S) & BCD



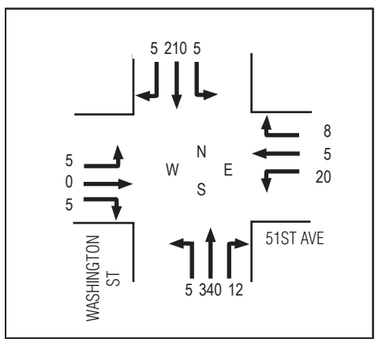
6 - NATIONAL WESTERN (S) & 46TH AVE



7 - 48TH AVE & WASHINGTON



8 - 51ST AVE & WASHINGTON



9 - 47TH AVE & WASHINGTON

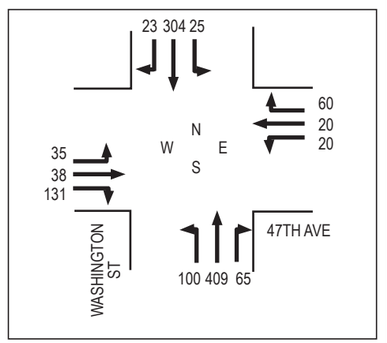
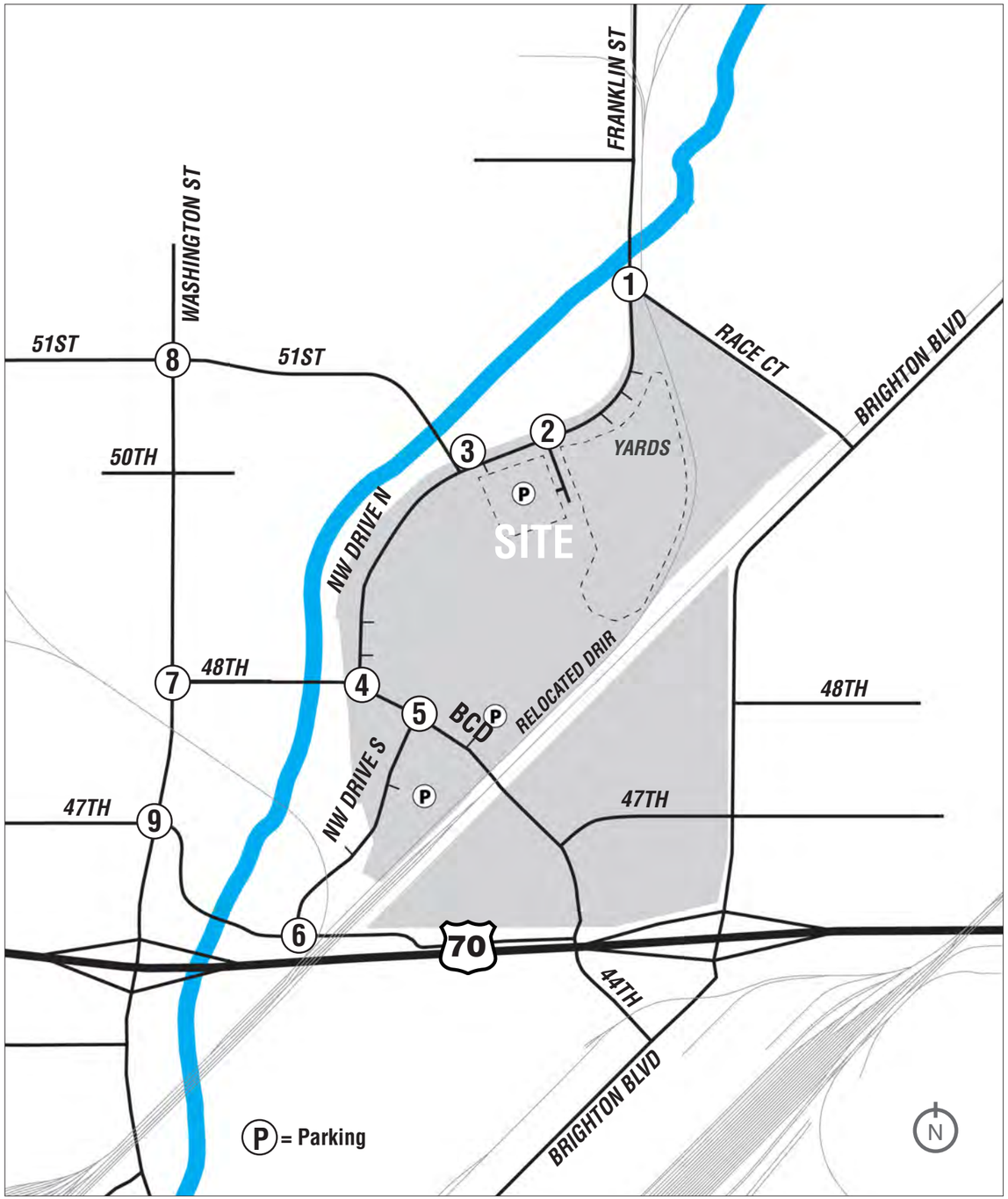
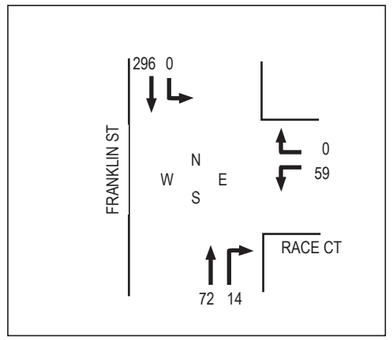


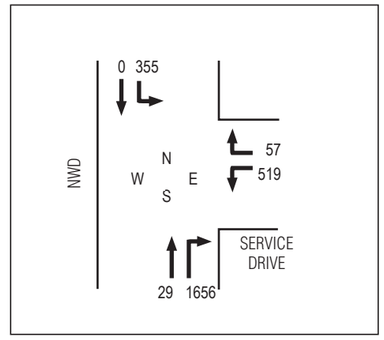
EXHIBIT 41: FULL BUILD OUT | ADDITIONAL TRIPS LARGE EVENT WEEKEND PEAK



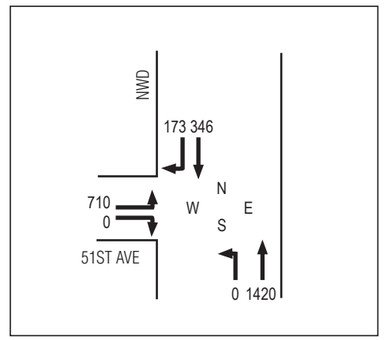
1 - FRANKLIN ST & RACE CT



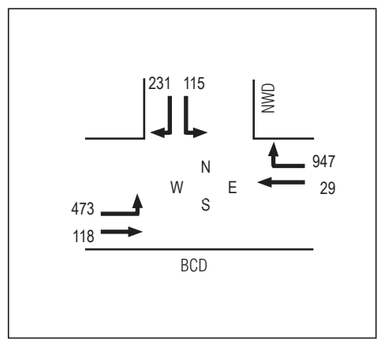
2 - NATIONAL WESTERN (N) & SERVICE DRIVE



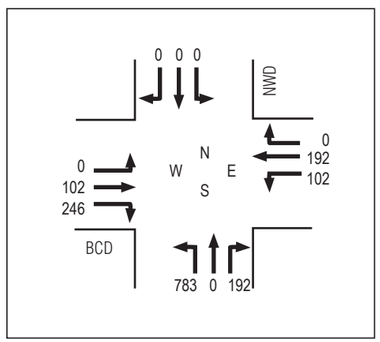
3 - NATIONAL WESTERN (N), & 51ST AVE



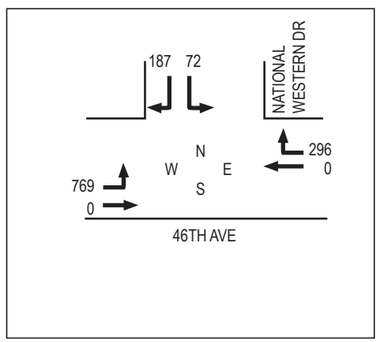
4 - NATIONAL WESTERN (N) & BCD



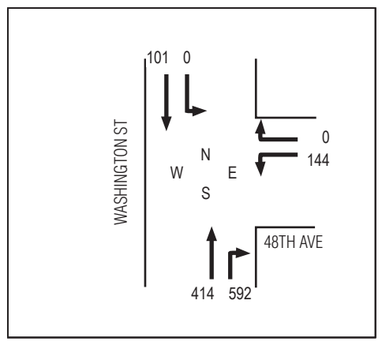
5 - NATIONAL WESTERN (S) & BCD



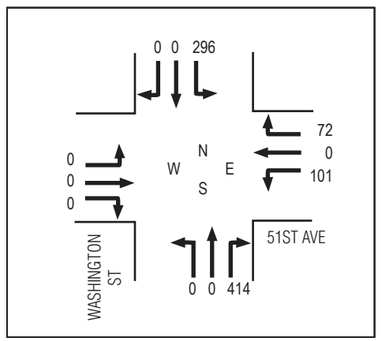
6 - NATIONAL WESTERN (S) & 46TH AVE



7 - 48TH AVE & WASHINGTON



8 - 51ST AVE & WASHINGTON



9 - 47TH AVE & WASHINGTON

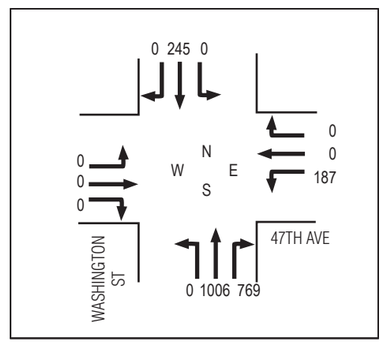
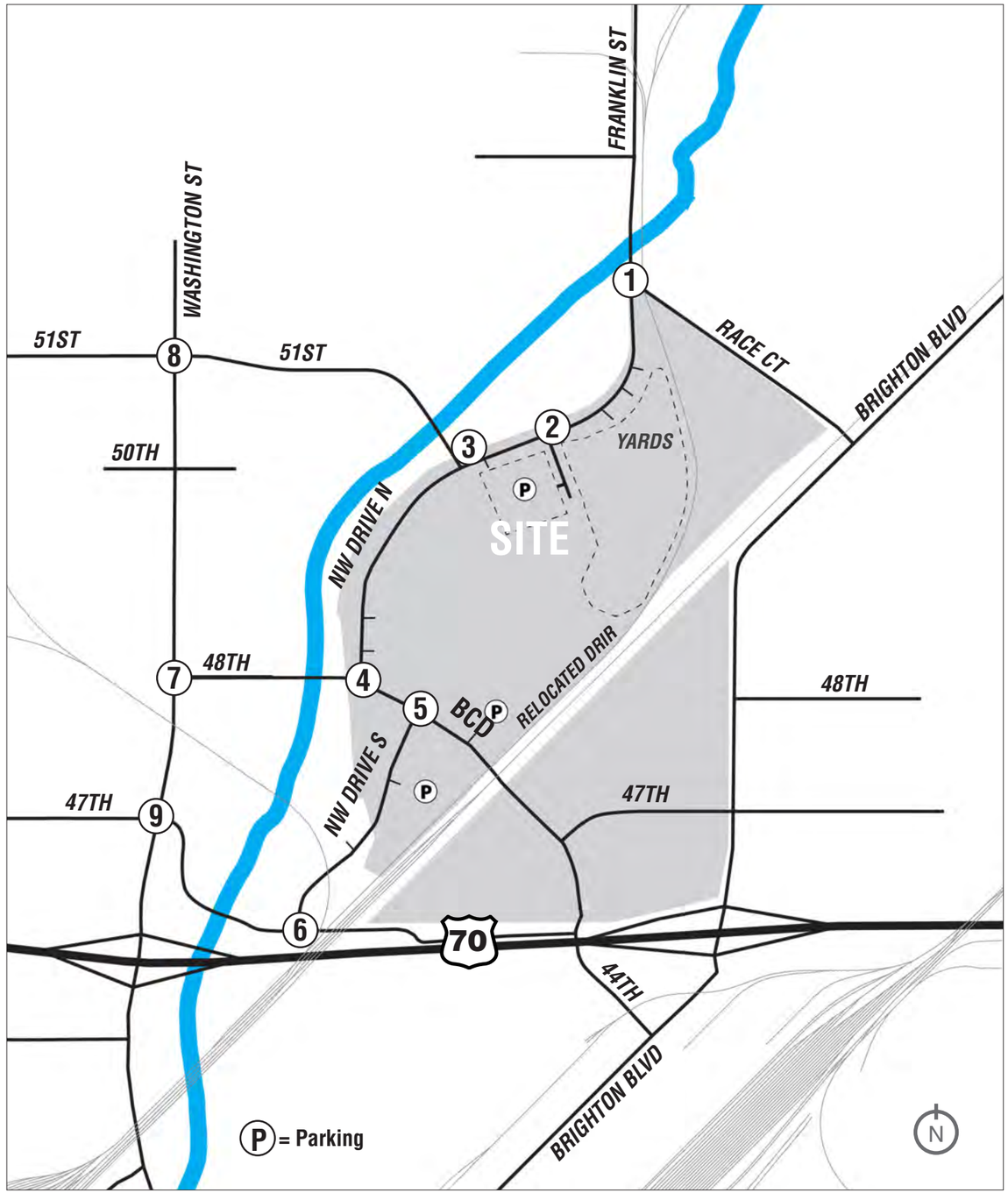
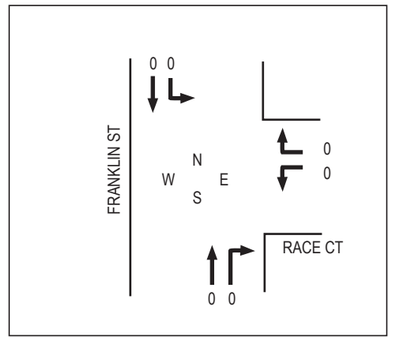


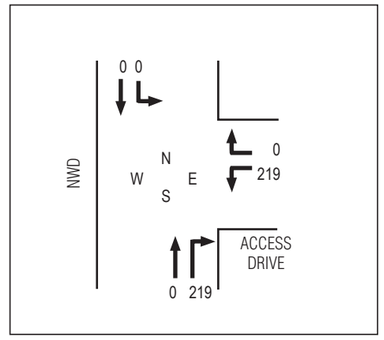
EXHIBIT 42: FULL BUILD OUT | TNC* LARGE EVENT WEEKEND PEAK



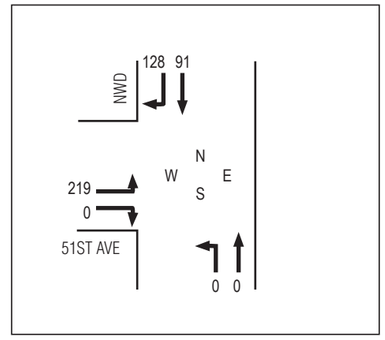
1 - FRANKLIN ST & RACE CT



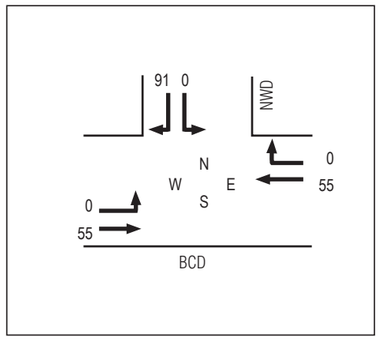
2 - NATIONAL WESTERN (N) & ACCESS DRIVE



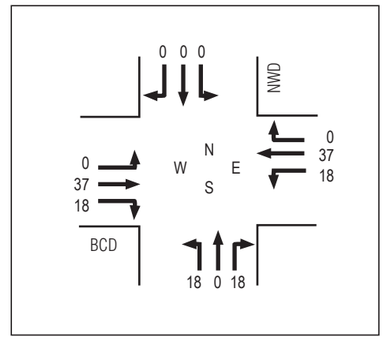
3 - NATIONAL WESTERN (N) & 51ST AVE



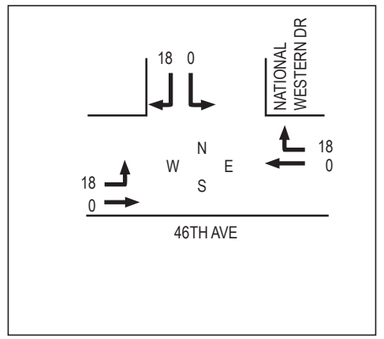
4 - NATIONAL WESTERN (N) & BCD



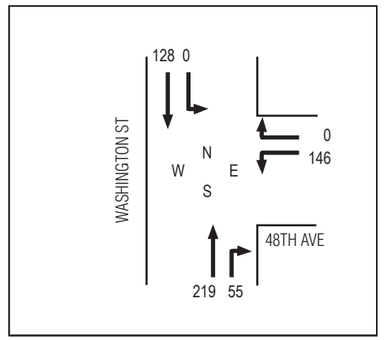
5 - NATIONAL WESTERN (S) & BCD



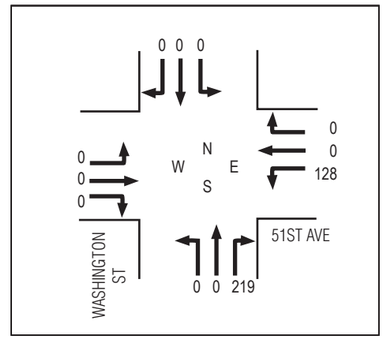
6 - NATIONAL WESTERN (S) & 46TH AVE



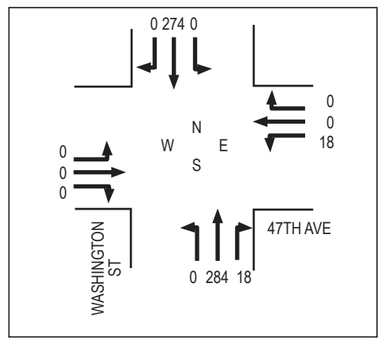
7 - 48TH AVE & WASHINGTON



8 - 51ST AVE & WASHINGTON

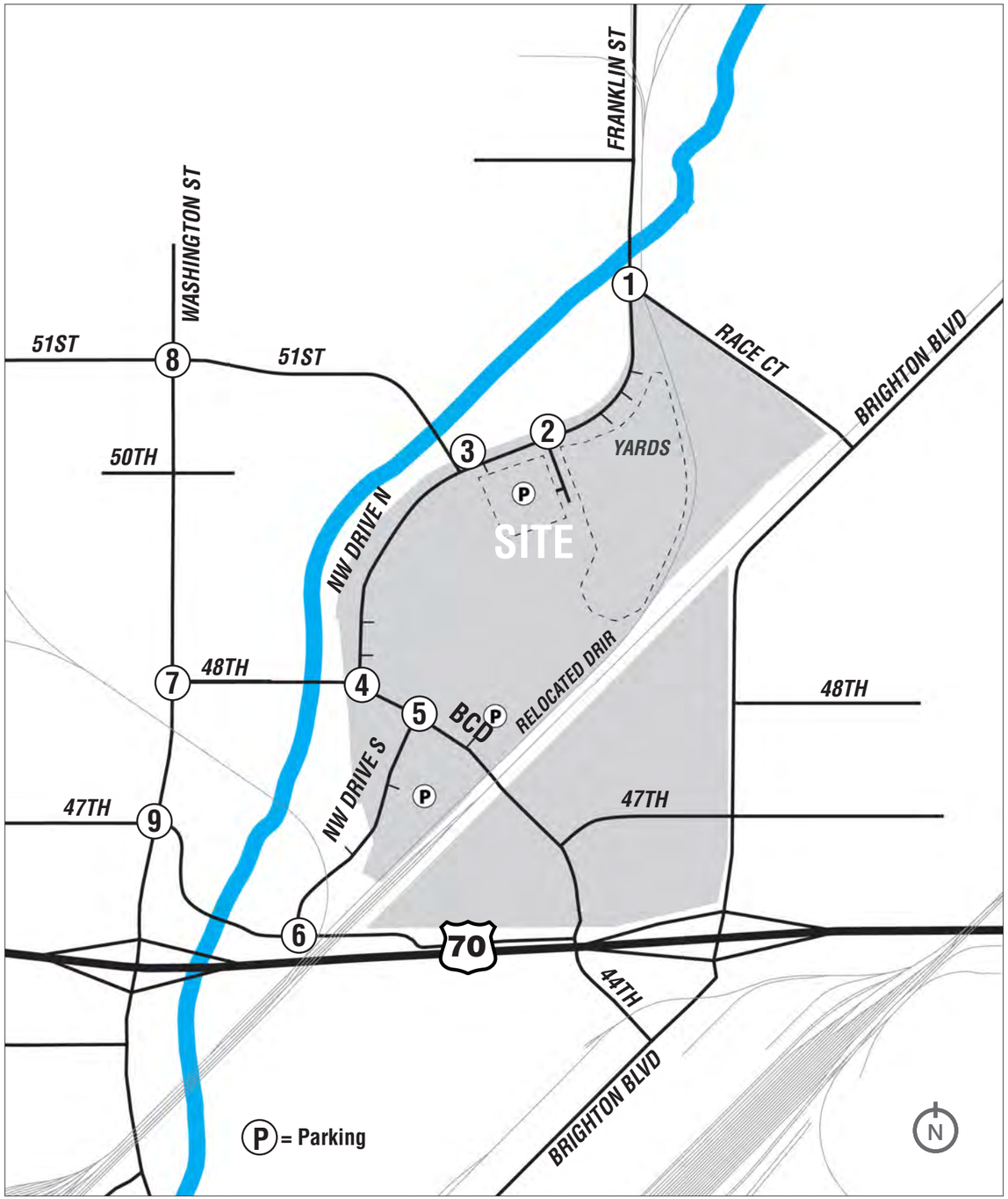


9 - 47TH AVE & WASHINGTON

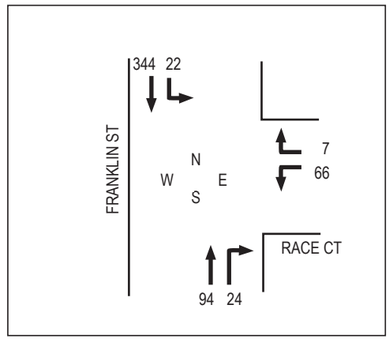


*TNC = Transportation Network Company (Uber, Lyft, etc.)

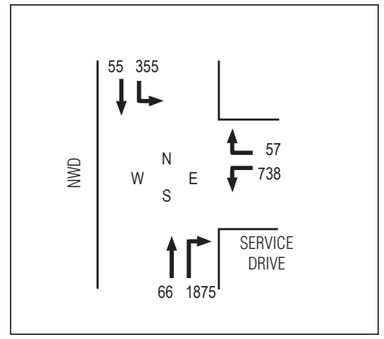
EXHIBIT 43: FULL BUILD OUT | TOTAL TRIPS* LARGE EVENT WEEKEND PEAK



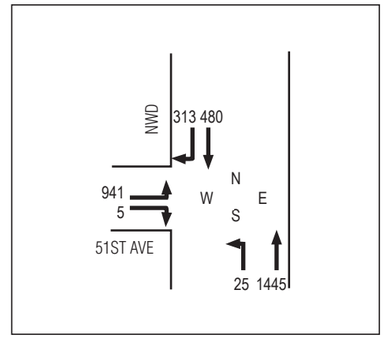
1 - FRANKLIN ST & RACE CT



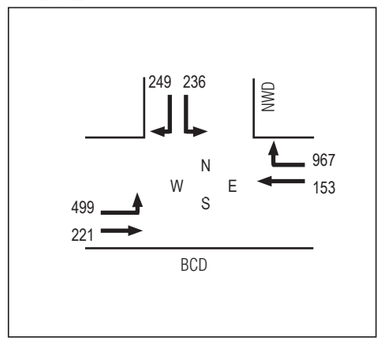
2 - NATIONAL WESTERN (N) & SERVICE DRIVE



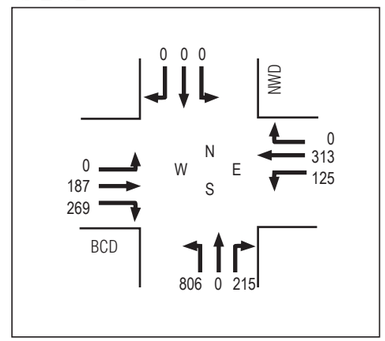
3 - NATIONAL WESTERN (N), & 51ST AVE



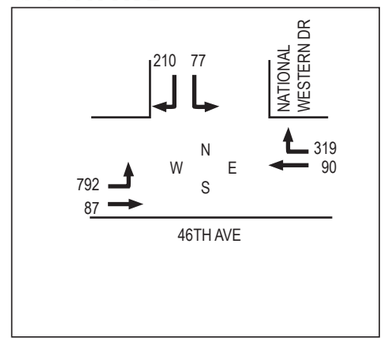
4 - NATIONAL WESTERN (N) & BCD



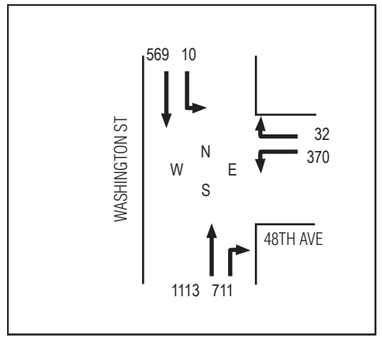
5 - NATIONAL WESTERN (S) & BCD



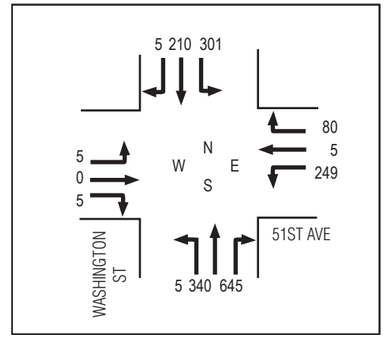
6 - NATIONAL WESTERN (S) & 46TH AVE



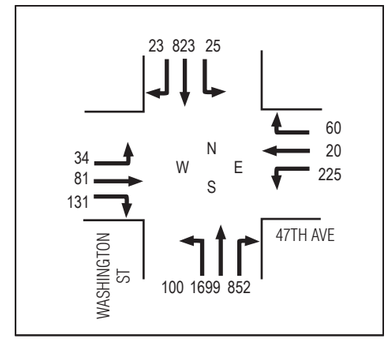
7 - 48TH AVE & WASHINGTON



8 - 51ST AVE & WASHINGTON



9 - 47TH AVE & WASHINGTON



*Total Trips = Background + additional trips + TNC

OPERATIONAL ASSESSMENT

During the Weekend Peak Large Event Scenario there are several operational issues anticipated:

- The intersection of 51st Avenue/National Western Drive experiences very high and peaked loading conditions. A potential mitigation for this issue is to operate National Western Drive (N) as a four-lane roadway during large events. This would provide additional northbound capacity thus freeing up signal time to accommodate the eastbound left turn. Even though this does not improve intersection operations to LOS D or better, it significantly reduces delays and queue lengths and will help the intersection perform better during large events.
- Traffic exiting the Stockyards at the National Western Drive/Stockyards Access Road intersection experiences significant delays due to the high volume of entering traffic. Further analysis was performed that reassigned the exiting traffic at the National Western Drive/Stockyards intersection to another driveway to the north which improved the expected LOS at this main ingress point. Stockyards exiting traffic may need to be required to utilize one of the other Stockyards driveway access points to facilitate safe and efficient operations of the Stockyards as a parking facility.
- The intersection of NWD (S) / BCD experiences poor performance during large events. This intersection may need to be actively controlled during large events to provide peak operational efficiency while providing safe bicycle and pedestrian mobility through this intersection during large events.
- Although the calculated LOS for the westbound left and right turns at the Washington Street/48th Ave intersection is acceptable, they may perform poorly during large events after Full Build Out is complete depending on how concentrated departing traffic is from the NWC site. Active control of this intersection may be required during large events. The operational performance of this intersection should be closely monitored during large events.

Tables 12 and 13 show the operational results, delay, and anticipated queue lengths for the Full Build Out Weekday PM Peak Hour and the Full Build Out Weekend Large Event Peak Hour respectively. See Exhibit 44-45 for the Full Build Out Weekday PM Peak and Weekend Peak LOS.

Table 12: Full Build Out | Weekday PM Peak Operational Results and Delay

		Movement											
Intersection	**Control Type**	**EBLT**	**EBT**	**EBRT**	**WBLT**	**WBT**	**WBRT**	**NBLT**	**NBT**	**NBRT**	**SBLT**	**SBT**	**SBRT**
1- Franklin St / Race Ct	Traffic Signal				C/32.6/55		D/35.9/33		A/1.7/29	Shared Lane	A/2.0/18	A/1.7/27	
2- NWD / Access Drive	Stop Sign for Access Drive				C.20.4/100		Shared Lane				A/7.6/3		
3- NWD / 51st Ave	Traffic Signal	D/38.0/195	C/27.9/13					A/6.1/8	A/4.8/166			A/15.2/159	Shared Lane
4- NWD (N) / BCD	Traffic Signal	B/10.6/35	A/6.4/17			A/0.6/89	Shared Lane				C/30.2/70		D/38.4/69
5- NWD (S) / BCD	Traffic Signal	Shared Lane	A/0.5/77	Shared Lane	Shared Lane	B/12.8/159	Shared Lane	Shared Lane	C/23.4/123	Shared Lane	Shared Lane	C/21.1/18	Shared Lane
6- NWD (S) / 46th Ave	Traffic Signal	B/14.3/57	B/10.8/63			B/11.6/87	Shared Lane				C/21.4/44		C/22.1/51
7- Washington St / 48th Ave	Traffic Signal				D/49.2/368*		C/29.6/9		C/24.8/1074*	A/1.2/13	A/4.4/198*	A/3.5/338	
8- Washington St / 51st Ave	Traffic Signal	D/35.6/60	D/36.6/52	Shared Lane	D/54.0/188*	C/32.9/53	Shared Lane	A/2.6/34	A/2.6/422	Shared Lane	A/6.8/117*	A/8.3/211	Shared Lane
9- Washington St / 47th Ave	Traffic Signal	C/31.7/47	D/50.6/162	Shared Lane	C/32.6/48	D/41.8/95	Shared Lane	B/11.0/105	B/15.9/416	Shared Lane	B/15.0/24	A/1.3/189	Shared Lane

Note: HCM LOS / HCM Delay (sec) / 95% Queue Length (ft)

* 95% volume exceeds capacity, queue may be longer

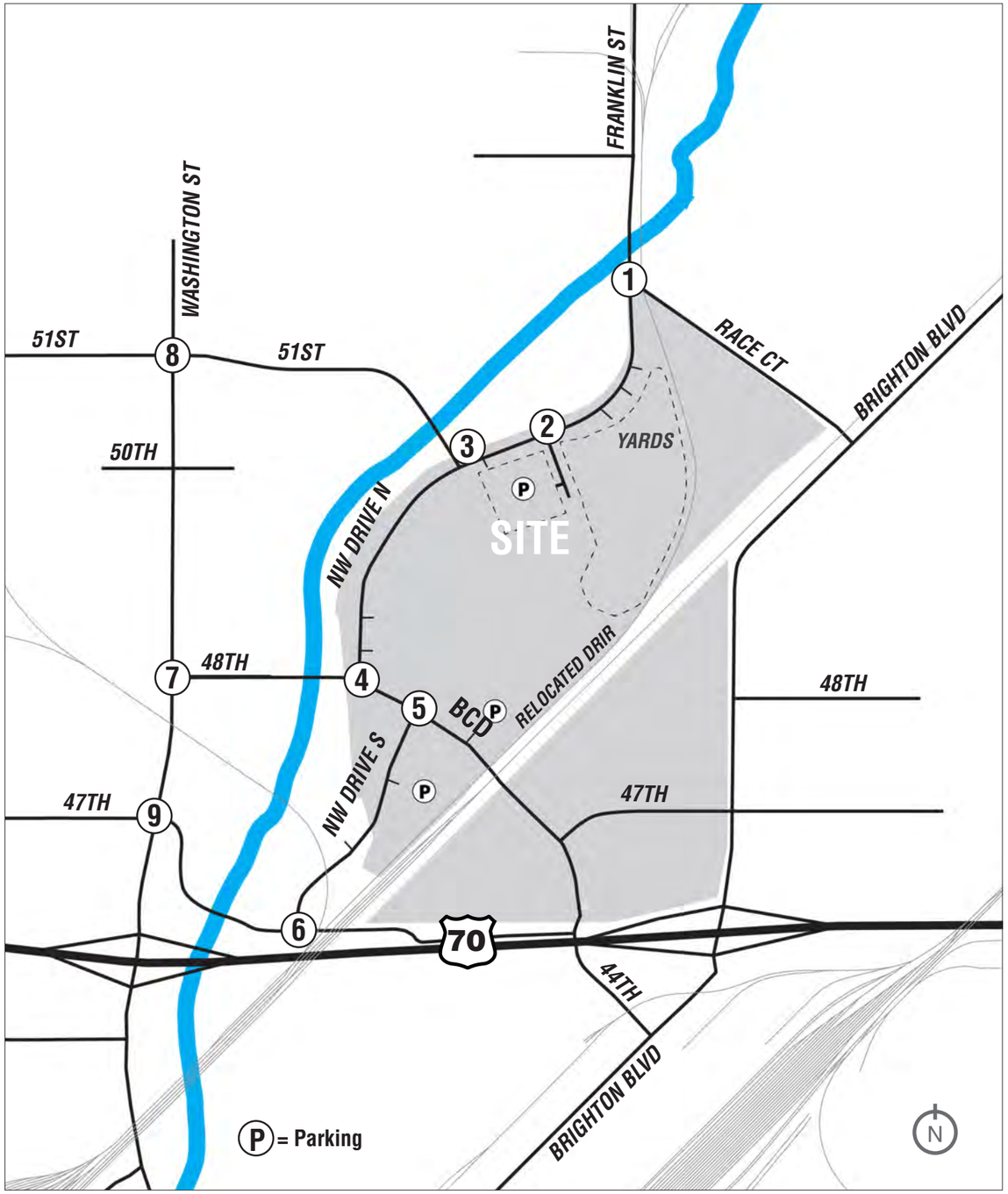
Table 13: Full Build Out | Weekend Large Event Peak Operational Results and Delay

		Movement											
Intersection	**Control Type**	**EBLT**	**EBT**	**EBRT**	**WBLT**	**WBT**	**WBRT**	**NBLT**	**NBT**	**NBRT**	**SBLT**	**SBT**	**SBRT**
1- Franklin St / Race Ct	Traffic Signal				D/45.3/77		C/34.8/13		A/1.4/23	Shared Lane	A/1.4/8	A/1.8/75	
2- NWD / Access Drive	Stop Sign for Access Drive				F/1197.0/2043		Shared Lane				A/8.2/25		
3- NWD / 51st Ave	Traffic Signal	F/116.1/942*		B/15.3/8				F/82.5/58*	F/66.7/827*			F/118.1/999*	Shared Lane
4- NWD (N) / BCD	Traffic Signal	B/11.2/850*	A/5.7/30			A/0.2/33	Shared Lane				D/45.2/208		D/54.5/106
5- NWD (S) / BCD	Traffic Signal	Shared Lane	D/49.7/388	Shared Lane	Shared Lane	F/179.0/614*	Shared Lane	Shared Lane	F/164.7/1023*	Shared Lane	Shared Lane	B/10.0/12	Shared Lane
6- NWD (S) / 46th Ave	Traffic Signal	B/15.5/748*	A/4.4/30			C/34.0/375*	Shared Lane				D/35.7/32		D/52.5/61
7- Washington St / 48th Ave	Traffic Signal				D/50.5/361*		C/27.6/9		C/25.7/1065*	A/5.1/29	A/0.5/4	A/1.5/111	
8- Washington St / 51st Ave	Traffic Signal	C/34.5/12	C/30.7/16	Shared Lane	D/49.8/251*	C/34.1/37	Shared Lane	A/0.1/2	B/12.6/341	Shared Lane	C/22.8/408*	A/5.4/70	Shared Lane
9- Washington St / 47th Ave	Traffic Signal	C/29.4/41	D/44.8/83	Shared Lane	C/33.4/93	D/36.8/53	Shared Lane	A/9.6/67	B/18.0/548	C/32.2/53	C/29.5/14	A/1.1/176	Shared Lane

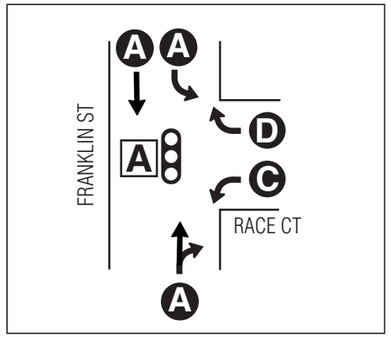
Note: HCM LOS / HCM Delay (sec) / 95% Queue Length (ft)

* 95% volume exceeds capacity, queue may be longer

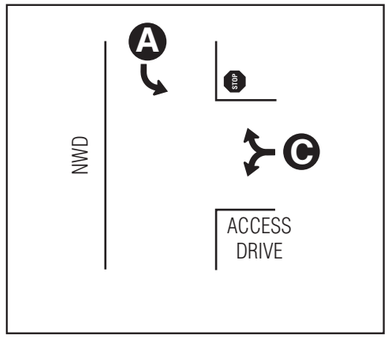
EXHIBIT 44: FULL BUILD OUT | LEVEL OF SERVICE NORMAL WEEKDAY PM PEAK



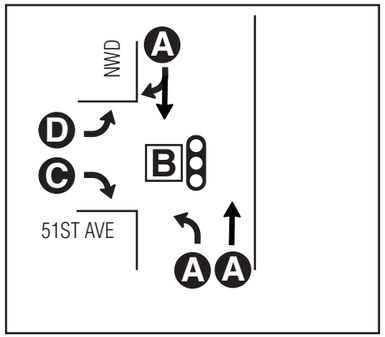
1 - FRANKLIN ST & RACE CT



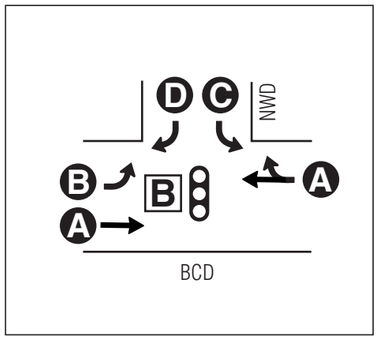
2 - NATIONAL WESTERN (N) & ACCESS DRIVE



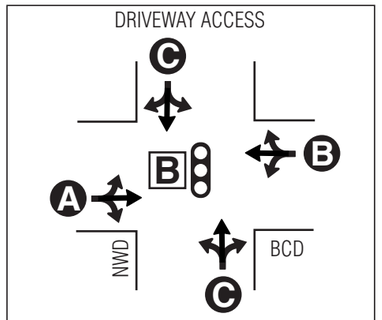
3 - NATIONAL WESTERN (N) & 51ST AVE



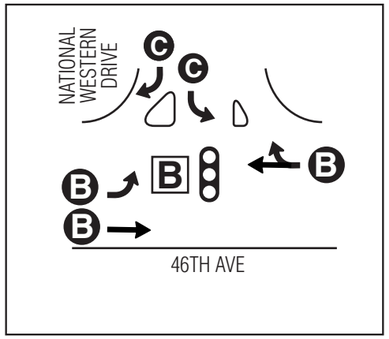
4 - NATIONAL WESTERN (N) & BCD



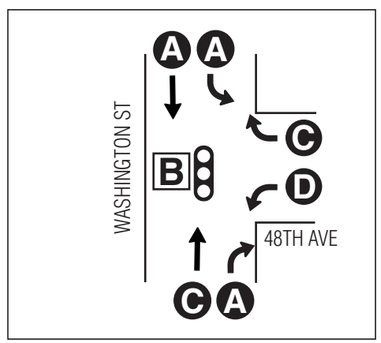
5 - NATIONAL WESTERN (S) & BCD



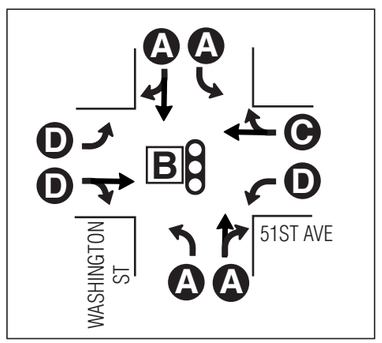
6 - NATIONAL WESTERN (S) & 46TH AVE



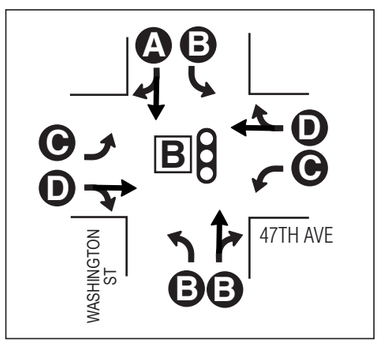
7 - 48TH AVE & WASHINGTON



8 - 51ST AVE & WASHINGTON



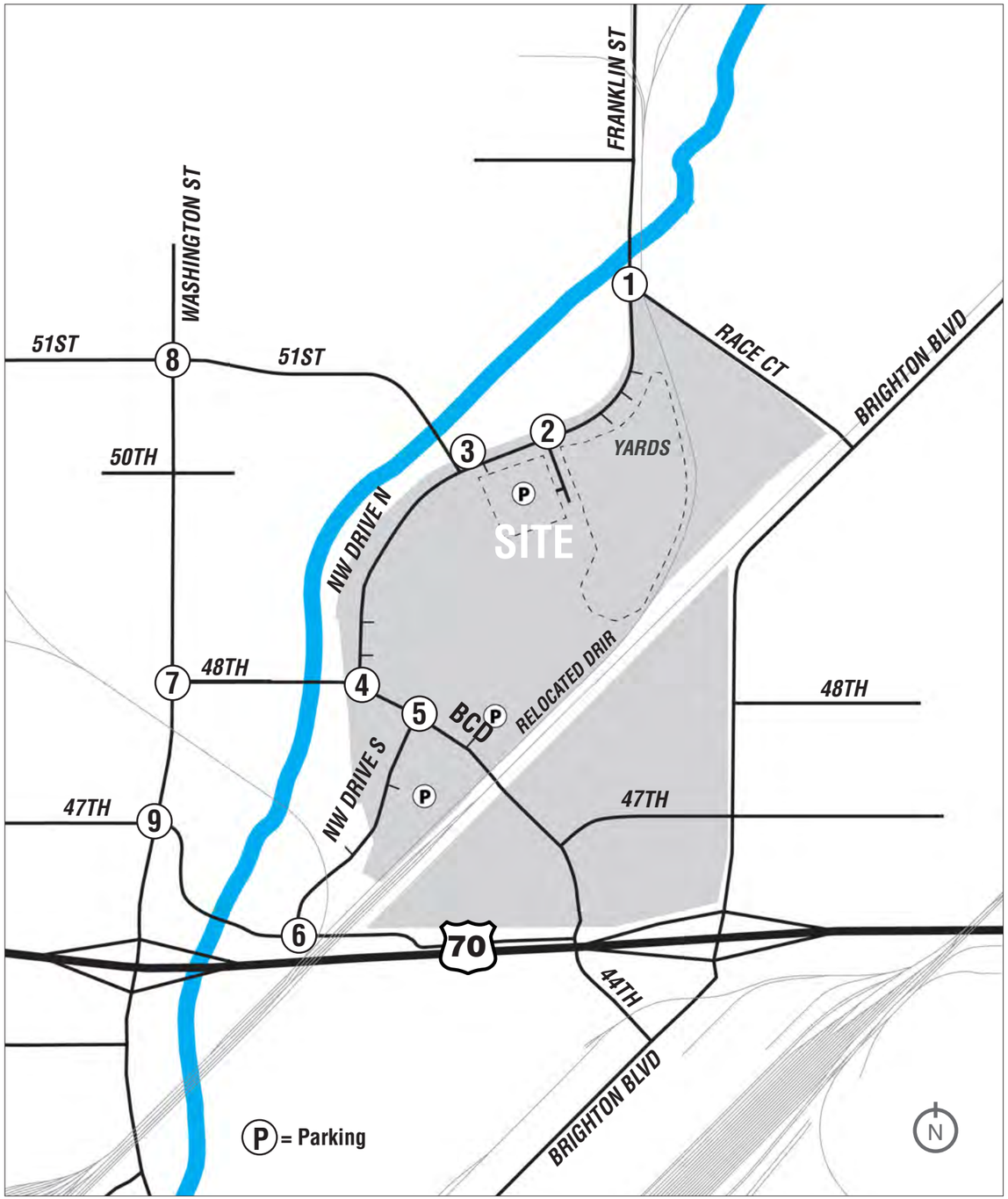
9 - 47TH AVE & WASHINGTON



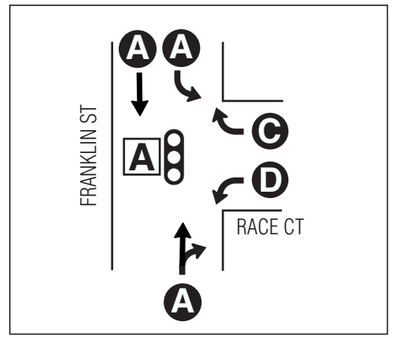
● = Movement LOS ☐ = Overall LOS

NOTE: Only movements with calculated LOS are shown.

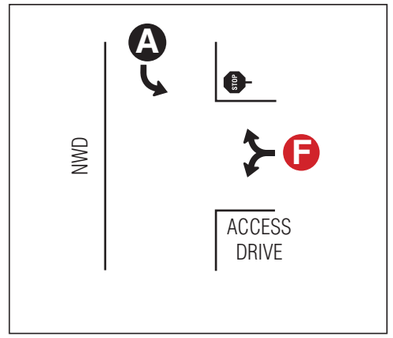
EXHIBIT 45: FULL BUILD OUT | LEVEL OF SERVICE LARGE EVENT WEEKEND PEAK



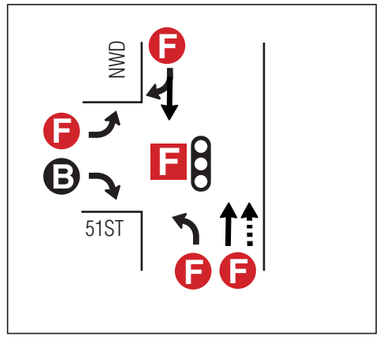
1 - FRANKLIN ST & RACE CT



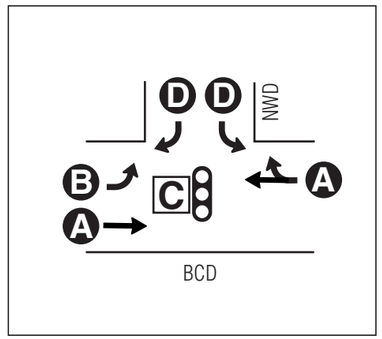
2 - NATIONAL WESTERN (N) & ACCESS DRIVE



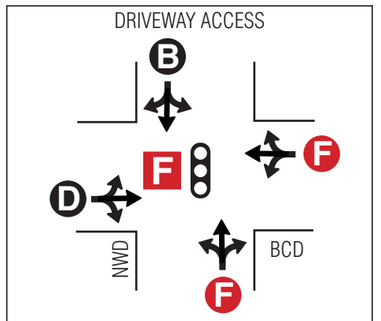
3 - NATIONAL WESTERN (N) & 51ST AVE



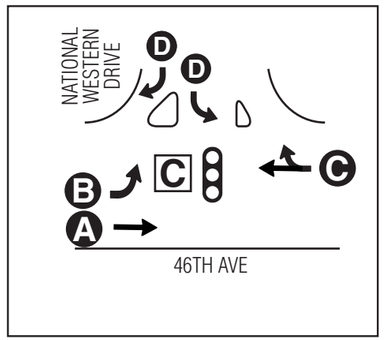
4 - NATIONAL WESTERN (N) & BCD



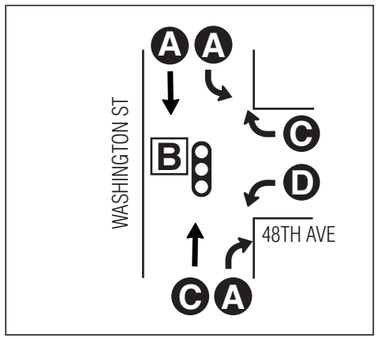
5 - NATIONAL WESTERN (S) & BCD



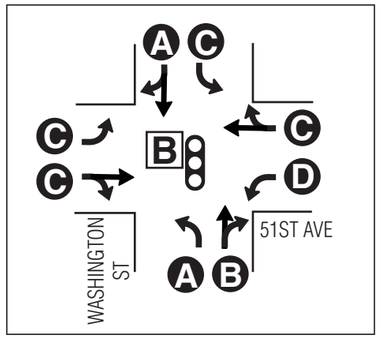
6 - NATIONAL WESTERN (S) & 46TH AVE



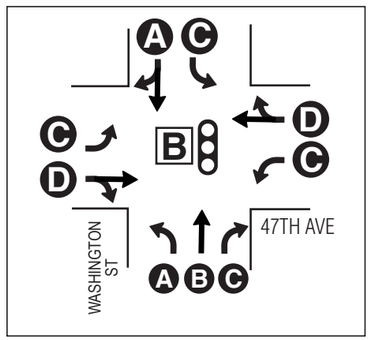
7 - 48TH AVE & WASHINGTON



8 - 51ST AVE & WASHINGTON



9 - 47TH AVE & WASHINGTON



● = Movement LOS ☐ = Overall LOS

NOTE: Only movements with calculated LOS are shown.

SIGNAL WARRANT ANALYSIS AND FUNDING SOURCES

Signal warrant analyses were performed to determine the likelihood of the proposed traffic signals to be warranted when Full Build Out is complete. All assumed traffic signal locations meet either Warrant 9 (Proximity to a Rail Grade Crossing) or Warrant 3 (Peak Hour Warrant). A summary of the signal warrant analyses and currently identified funding sources is shown below in Table 14.

See Exhibit 46 for the Full Build Out Recommendations for Lane Configurations, Controls and Signal Warrant.

Table 14: Signal Warrant Results and Funding Sources | Full Build Out

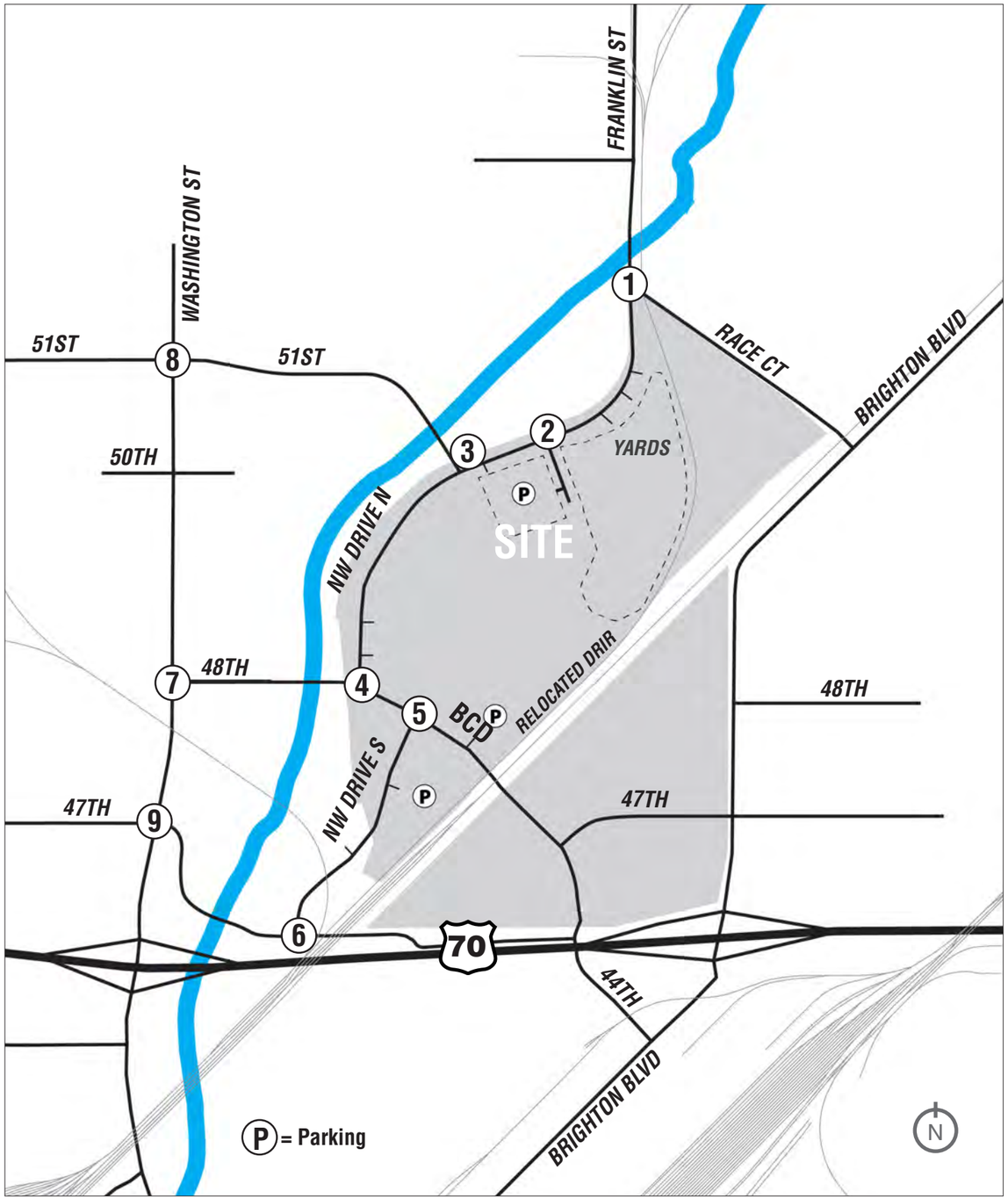
Intersection	Warrant Met	Funding Sources
1- Franklin St & Race Ct	9	NWC
2- NWD (N) & Access Drive	None	Not applicable
3- NWD (N) & 51st Ave	3	NWC
4- NWD (N) & BCD	3	NWC
5- NWD (S) & BCD	3	NWC
6- NWD (S) & 46th Ave	3	Other
7- 48th Ave & Washington St	3	Other
8- 51st Ave & Washington St	Existing	Other
9- 47th Ave & Washington St	Existing	Other

FULL BUILD OUT RECOMMENDATIONS

Key recommendations in addition to the Phase 1-2 recommendations are:

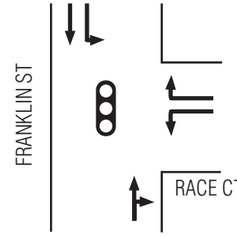
- Operate National Western Drive (N) as a four-lane roadway during large events to provide additional capacity and to mitigate intersection performance issues.
- Stockyards exiting traffic during Large Events should be required to utilize one of the other Stockyards driveway access points rather than the main National Western Drive/Stockyards Access Road intersection to facilitate safe and efficient operations of the Stockyards as a parking facility.
- Make adjustments as needed to TNC arrival and departure patterns and pick up/drop off areas to mitigate intersection performance issues.
- Consider active management during Large Events for Washington Street at 48th Avenue to enhance efficiency for westbound turning vehicles.
- Consider implementing wayfinding signage to direct attendees arriving from the north to Franklin Street.
- Develop detailed event management plans for large event scenarios.

EXHIBIT 46: FULL BUILD OUT | RECOMMENDED LANE CONFIGURATIONS, CONTROLS AND SIGNAL WARRANT

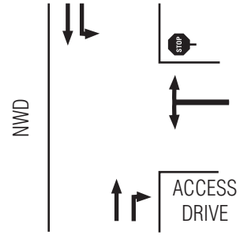


1 - FRANKLIN ST & RACE CT

Signal meets Warrant 9

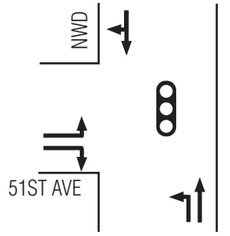


2 - NATIONAL WESTERN (N) & ACCESS DRIVE



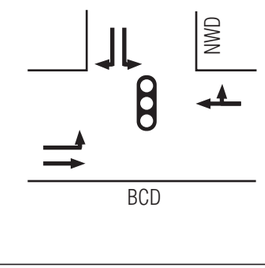
3 - NATIONAL WESTERN (N) & 51ST

Signal meets Warrant 3



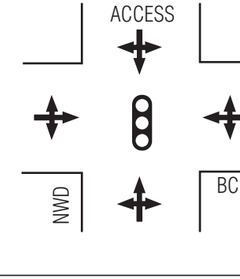
4 - NATIONAL WESTERN (N) & BCD

Signal meets Warrant 3



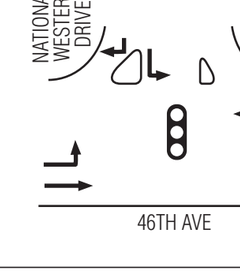
5 - NATIONAL WESTERN (S) & BCD

Signal meets Warrant 3



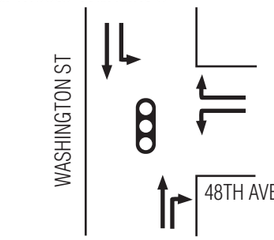
6 - NATIONAL WESTERN (S) & 46TH

Signal meets Warrant 3
Reconfigured intersection



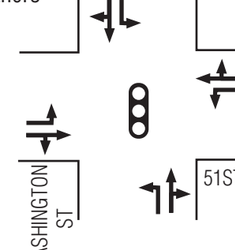
7 - 48TH AVE & WASHINGTON*

Reconfigured intersection by others - Signal meets Warrant 3



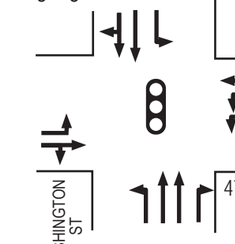
8 - 51ST AVE & WASHINGTON*

Reconfigured intersection and signal by others



9 - 47TH AVE & WASHINGTON*

Reconfigured intersection by others - existing signal



***Assumes Washington Street Bond Project is complete and intersection configurations shown are implemented.**

TRAFFIC IMPACT STUDY

National Western Center Campus Placemaking Study

Appendices

August 17, 2020

Prepared for:

DENVER
THE MILE HIGH CITY

Prepared by:

OV Consulting
1200 Bannock Street
Denver, CO 80204

Appendix A: Intersection Count Data

All Traffic Data

Wheat Ridge, CO 80033

Date Start: 18-Aug-18
Date End: 18-Aug-18
Site Code: 4
WASHINGTON ST S.O. 47TH AVE

Start Time	18-Aug-18 Sat	NB	SB							Total
12:00 AM		86	145							231
01:00		69	92							161
02:00		66	62							128
03:00		46	54							100
04:00		86	71							157
05:00		168	151							319
06:00		226	218							444
07:00		318	283							601
08:00		377	359							736
09:00		457	404							861
10:00		482	406							888
11:00		**484**	**460**							**944**
12:00 PM		500	484							**984**
01:00		**505**	460							965
02:00		443	**498**							941
03:00		390	477							867
04:00		323	488							811
05:00		309	444							753
06:00		296	359							655
07:00		257	319							576
08:00		240	220							460
09:00		197	202							399
10:00		176	220							396
11:00		174	269							443
Total		6675	7145							13820
Percent		48.3%	51.7%							
AM Peak	-	11:00	11:00	-	-	-	-	-	-	11:00
Vol.	-	484	460	-	-	-	-	-	-	944
PM Peak	-	13:00	14:00	-	-	-	-	-	-	12:00
Vol.	-	505	498	-	-	-	-	-	-	984
Grand Total		6675	7145							13820
Percent		48.3%	51.7%							
ADT		ADT 13,820		AADT 13,820						

All Traffic Data

Wheat Ridge, CO 80033

Date Start: 18-Aug-18
Date End: 18-Aug-18
Site Code: 5
WASHINGTON ST S.O. 48TH AVE

Start Time	18-Aug-18 Sat	NB	SB							Total
12:00 AM		61	99							160
01:00		47	59							106
02:00		48	39							87
03:00		23	33							56
04:00		65	47							112
05:00		94	83							177
06:00		161	158							319
07:00		234	178							412
08:00		284	241							525
09:00		367	293							660
10:00		391	301							692
11:00		**400**	**317**							**717**
12:00 PM		**381**	289							670
01:00		340	287							627
02:00		338	**334**							**672**
03:00		322	289							611
04:00		251	265							516
05:00		248	274							522
06:00		196	254							450
07:00		171	154							325
08:00		125	129							254
09:00		108	89							197
10:00		110	101							211
11:00		138	104							242
Total		4903	4417							9320
Percent		52.6%	47.4%							
AM Peak	-	11:00	11:00	-	-	-	-	-	-	11:00
Vol.	-	400	317	-	-	-	-	-	-	717
PM Peak	-	12:00	14:00	-	-	-	-	-	-	14:00
Vol.	-	381	334	-	-	-	-	-	-	672
Grand Total		4903	4417							9320
Percent		52.6%	47.4%							
ADT		ADT 9,320		AADT 9,320						

All Traffic Data Services

Wheat Ridge, CO 80033

Date Start: 18-Aug-18
Date End: 18-Aug-18
Site Code: 6
WASHINGTON ST S.O. 52ND AVE

Start Time	18-Aug-18 Sat	NB	SB							Total
12:00 AM		43	73							116
01:00		28	50							78
02:00		32	23							55
03:00		21	17							38
04:00		35	38							73
05:00		73	67							140
06:00		117	131							248
07:00		169	145							314
08:00		215	183							398
09:00		**299**	**252**							**551**
10:00		233	153							386
11:00		242	162							404
12:00 PM		**280**	182							462
01:00		252	185							437
02:00		270	**215**							**485**
03:00		234	194							428
04:00		187	189							376
05:00		184	204							388
06:00		166	191							357
07:00		143	95							238
08:00		108	82							190
09:00		74	81							155
10:00		116	89							205
11:00		128	106							234
Total		3649	3107							6756
Percent		54.0%	46.0%							
AM Peak	-	09:00	09:00	-	-	-	-	-	-	09:00
Vol.	-	299	252	-	-	-	-	-	-	551
PM Peak	-	12:00	14:00	-	-	-	-	-	-	14:00
Vol.	-	280	215	-	-	-	-	-	-	485
Grand Total		3649	3107							6756
Percent		54.0%	46.0%							
ADT		ADT 6,756		AADT 6,756						

All Traffic Data

Wheat Ridge, CO 80033

Date Start: 18-Aug-18
Date End: 18-Aug-18
Site Code: 9
NATIONAL WESTER DR N.O. 47TH AVE

Start Time	18-Aug-18 Sat	NB	SB							Total
12:00 AM		6	7							13
01:00		4	7							11
02:00		1	4							5
03:00		12	5							17
04:00		9	8							17
05:00		44	19							63
06:00		**56**	39							95
07:00		40	37							77
08:00		40	37							77
09:00		43	33							76
10:00		45	**58**							**103**
11:00		26	56							82
12:00 PM		**44**	58							**102**
01:00		34	50							84
02:00		16	40							56
03:00		21	46							67
04:00		21	**80**							101
05:00		14	19							33
06:00		14	20							34
07:00		5	6							11
08:00		7	9							16
09:00		10	9							19
10:00		8	5							13
11:00		10	7							17
Total		530	659							1189
Percent		44.6%	55.4%							
AM Peak	-	06:00	10:00	-	-	-	-	-	-	10:00
Vol.	-	56	58	-	-	-	-	-	-	103
PM Peak	-	12:00	16:00	-	-	-	-	-	-	12:00
Vol.	-	44	80	-	-	-	-	-	-	102
Grand Total		530	659							1189
Percent		44.6%	55.4%							
ADT		ADT 1,189		AADT 1,189						

All Traffic Data Services

Wheat Ridge, CO 80033

Date Start: 18-Aug-18
Date End: 18-Aug-18
Site Code: 10
FRANKLIN AVE N.O. RACE CT

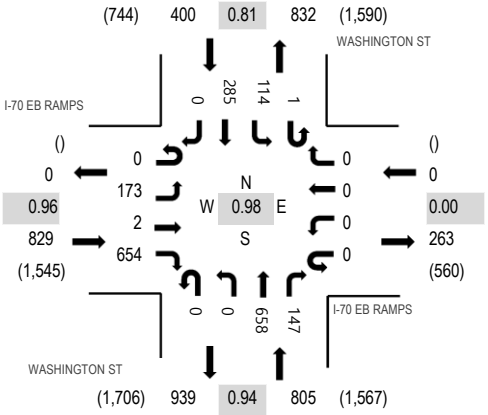
Start Time	18-Aug-18 Sat	NB	SB							Total
12:00 AM		3	5							8
01:00		4	10							14
02:00		1	3							4
03:00		1	4							5
04:00		2	8							10
05:00		25	19							44
06:00		34	53							87
07:00		**44**	29							73
08:00		26	33							59
09:00		39	29							68
10:00		36	**65**							**101**
11:00		26	62							88
12:00 PM		**53**	66							**119**
01:00		26	55							81
02:00		19	57							76
03:00		30	40							70
04:00		25	**88**							113
05:00		16	33							49
06:00		15	24							39
07:00		10	12							22
08:00		8	13							21
09:00		7	12							19
10:00		4	7							11
11:00		5	4							9
Total		459	731							1190
Percent		38.6%	61.4%							
AM Peak	-	07:00	10:00	-	-	-	-	-	-	10:00
Vol.	-	44	65	-	-	-	-	-	-	101
PM Peak	-	12:00	16:00	-	-	-	-	-	-	12:00
Vol.	-	53	88	-	-	-	-	-	-	119
Grand Total		459	731							1190
Percent		38.6%	61.4%							
ADT		ADT 1,190		AADT 1,190						

All Traffic Data Services Inc.

(303) 216-2439
www.alltrafficdata.net

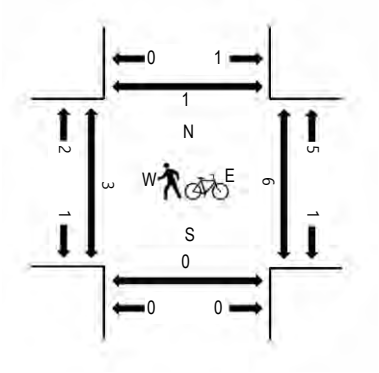
Location: 1 WASHINGTON ST & I-70 EB RAMPS Noon
Date and Start Time: Saturday, August 18, 2018
Peak Hour: 12:00 PM - 01:00 PM
Peak 15-Minutes: 12:30 PM - 12:45 PM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles on Crosswalk



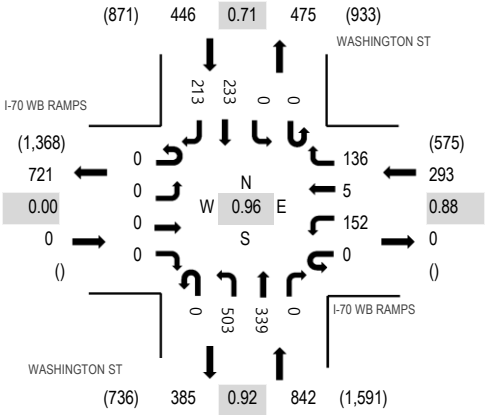
Traffic Counts

Interval Start Time	I-70 EB RAMPS Eastbound				I-70 EB RAMPS Westbound				WASHINGTON ST Northbound				WASHINGTON ST Southbound					Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
11:00 AM	0	45	1	112	0	0	0	0	0	0	130	47	0	37	45	0	417	1,822	0	0	0	0
11:15 AM	0	39	2	130	0	0	0	0	0	0	155	41	0	29	48	0	444	1,913	1	5	0	0
11:30 AM	0	38	2	151	0	0	0	0	0	0	170	38	0	30	62	0	491	1,973	0	6	0	0
11:45 AM	0	37	2	157	0	0	0	0	0	0	143	38	1	30	62	0	470	2,002	0	0	0	0
12:00 PM	0	47	1	158	0	0	0	0	0	0	173	40	0	13	76	0	508	2,034	0	1	0	1
12:15 PM	0	42	1	155	0	0	0	0	0	0	154	29	0	43	80	0	504		0	2	0	0
12:30 PM	0	47	0	168	0	0	0	0	0	0	174	40	1	25	65	0	520		3	0	0	0
12:45 PM	0	37	0	173	0	0	0	0	0	0	157	38	0	33	64	0	502		0	2	0	0
Count Total	0	332	9	1,204	0	0	0	0	0	0	1,256	311	2	240	502	0	3,856		4	16	0	1
Peak Hour	0	173	2	654	0	0	0	0	0	0	658	147	1	114	285	0	2,034		3	5	0	1

All Traffic Data Services Inc.
(303) 216-2439
www.alltrafficdata.net

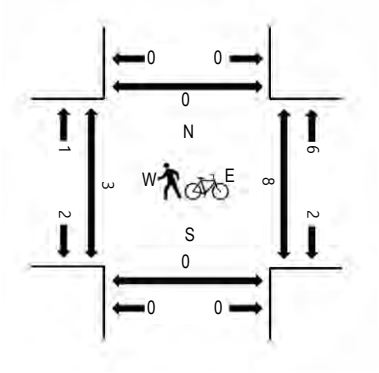
Location: 2 WASHINGTON ST & I-70 WB RAMPS Noon
Date and Start Time: Saturday, August 18, 2018
Peak Hour: 12:00 PM - 01:00 PM
Peak 15-Minutes: 12:15 PM - 12:30 PM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles on Crosswalk



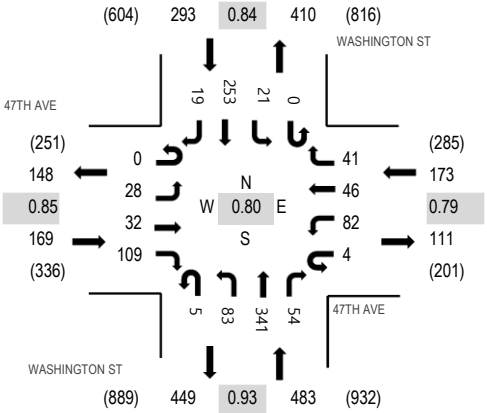
Traffic Counts

Interval Start Time	I-70 WB RAMPS Eastbound				I-70 WB RAMPS Westbound				WASHINGTON ST Northbound				WASHINGTON ST Southbound				Total	Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right			West	East	South	North
11:00 AM	0	0	0	0	0	21	2	35	1	101	81	0	0	0	60	45	346	1,456	1	1	0	0
11:15 AM	0	0	0	0	0	23	3	34	0	111	75	0	0	0	59	53	358	1,489	1	4	0	0
11:30 AM	0	0	0	0	0	35	1	47	0	135	73	0	0	0	59	46	396	1,544	0	3	0	0
11:45 AM	0	0	0	0	0	32	2	47	0	106	66	0	0	0	61	42	356	1,556	0	0	0	0
12:00 PM	0	0	0	0	0	60	1	29	0	127	103	0	0	0	27	32	379	1,581	0	2	0	0
12:15 PM	0	0	0	0	0	30	1	33	0	110	81	0	0	0	86	72	413		2	3	0	0
12:30 PM	0	0	0	0	0	32	1	34	0	140	88	0	0	0	55	58	408		0	0	0	0
12:45 PM	0	0	0	0	0	30	2	40	0	126	67	0	0	0	65	51	381		0	1	0	0
Count Total	0	0	0	0	0	263	13	299	1	956	634	0	0	0	472	399	3,037		4	14	0	0
Peak Hour	0	0	0	0	0	152	5	136	0	503	339	0	0	0	233	213	1,581		2	6	0	0

All Traffic Data Services Inc.
(303) 216-2439
www.alltrafficdata.net

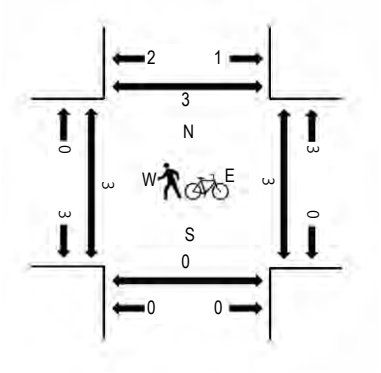
Location: 3 WASHINGTON ST & 47TH AVE Noon
Date and Start Time: Saturday, August 18, 2018
Peak Hour: 11:45 AM - 12:45 PM
Peak 15-Minutes: 12:15 PM - 12:30 PM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles on Crosswalk



Traffic Counts

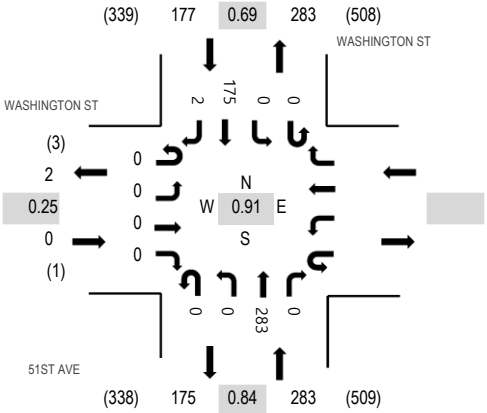
Interval Start Time	47TH AVE Eastbound				47TH AVE Westbound				WASHINGTON ST Northbound				WASHINGTON ST Southbound					Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
11:00 AM	0	7	8	25	0	12	6	4	0	11	92	12	0	5	66	3	251	1,042	0	0	0	2
11:15 AM	0	16	1	26	0	10	5	12	2	12	72	15	0	11	74	6	262	1,023	2	4	2	0
11:30 AM	0	6	3	30	0	17	4	12	0	18	92	8	0	3	60	7	260	1,109	0	3	0	1
11:45 AM	0	13	7	31	0	16	10	3	1	25	82	10	0	5	61	5	269	1,118	0	0	0	0
12:00 PM	0	8	14	16	4	12	9	13	0	13	90	16	0	2	29	6	232	1,115	1	2	0	1
12:15 PM	0	3	8	26	0	25	15	15	2	21	90	18	0	8	111	6	348		1	0	0	1
12:30 PM	0	4	3	36	0	29	12	10	2	24	79	10	0	6	52	2	269		1	0	0	1
12:45 PM	0	7	6	32	0	17	7	6	1	23	80	11	0	7	68	1	266		0	4	0	0
Count Total	0	64	50	222	4	138	68	75	8	147	677	100	0	47	521	36	2,157		5	13	2	6
Peak Hour	0	28	32	109	4	82	46	41	5	83	341	54	0	21	253	19	1,118		3	2	0	3

All Traffic Data Services Inc.

(303) 216-2439
www.alltrafficdata.net

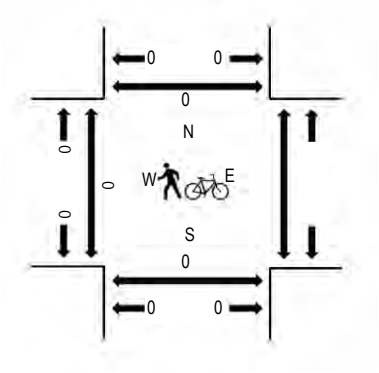
Location: 7 51ST AVE & WASHINGTON ST Noon
Date and Start Time: Saturday, August 18, 2018
Peak Hour: 12:00 PM - 01:00 PM
Peak 15-Minutes: 12:15 PM - 12:30 PM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles on Crosswalk



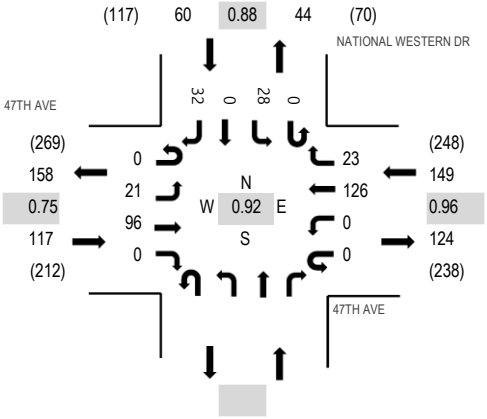
Traffic Counts

Interval Start Time	WASHINGTON ST Eastbound				Westbound				51ST AVE Northbound				WASHINGTON ST Southbound				Total	Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right			West	East	South	North
11:00 AM	0	0	0	0					0	1	50	0	0	0	34	0	85	389	0		6	0
11:15 AM	0	0	0	0					0	0	61	0	0	0	48	0	109	421	0		0	0
11:30 AM	0	0	0	0					0	0	72	0	0	0	27	0	99	439	9		0	0
11:45 AM	0	0	0	1					0	0	42	0	0	0	53	0	96	444	0		0	0
12:00 PM	0	0	0	0					0	0	81	0	0	0	35	1	117	460	0		0	0
12:15 PM	0	0	0	0					0	0	84	0	0	0	43	0	127		0		0	0
12:30 PM	0	0	0	0					0	0	70	0	0	0	33	1	104		0		0	0
12:45 PM	0	0	0	0					0	0	48	0	0	0	64	0	112		0		0	0
Count Total	0	0	0	1					0	1	508	0	0	0	337	2	849		9		6	0
Peak Hour	0	0	0	0					0	0	283	0	0	0	175	2	460		0		0	0

All Traffic Data Services Inc.
(303) 216-2439
www.alltrafficdata.net

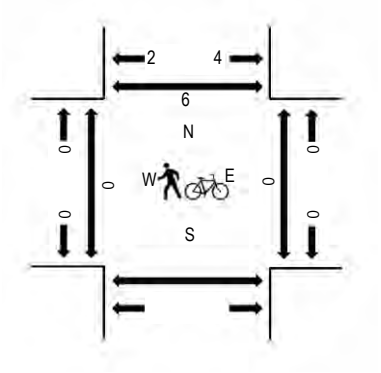
Location: 8 NATIONAL WESTERN DR & 47TH AVE Noon
Date and Start Time: Saturday, August 18, 2018
Peak Hour: 12:00 PM - 01:00 PM
Peak 15-Minutes: 12:00 PM - 12:15 PM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles on Crosswalk



Traffic Counts

Interval Start Time	47TH AVE Eastbound				47TH AVE Westbound				Northbound				NATIONAL WESTERN DR Southbound				Total	Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right			West	East	South	North
11:00 AM	0	2	26	0	0	0	16	2					0	7	0	12	65	251	0	2		1
11:15 AM	0	3	23	0	0	0	22	8					0	6	0	2	64	275	0	0		2
11:30 AM	0	1	15	0	0	0	23	2					0	8	0	8	57	299	0	0		4
11:45 AM	0	4	21	0	2	0	20	4					0	6	0	8	65	314	0	0		0
12:00 PM	0	7	32	0	0	0	26	10					0	8	0	6	89	326	0	0		1
12:15 PM	0	10	23	0	0	0	38	1					0	5	0	11	88		0	0		1
12:30 PM	0	2	18	0	0	0	39	0					0	4	0	9	72		0	0		2
12:45 PM	0	2	23	0	0	0	23	12					0	11	0	6	77		0	0		1
Count Total	0	31	181	0	2	0	207	39					0	55	0	62	577		0	2		12
Peak Hour	0	21	96	0	0	0	126	23					0	28	0	32	326		0	0		5

All Traffic Data

Wheat Ridge, CO 80033

Date Start: 31-Jul-18
Date End: 31-Jul-18
Site Code: 7
WASHINGTON ST N.O. 51ST AVE

Start Time	31-Jul-18 Tue	NB	SB							Total
12:00 AM		23	32							55
01:00		11	20							31
02:00		15	36							51
03:00		15	31							46
04:00		48	70							118
05:00		249	242							491
06:00		316	513							829
07:00		297	**556**							**853**
08:00		295	391							686
09:00		274	231							505
10:00		**344**	314							658
11:00		328	323							651
12:00 PM		359	360							719
01:00		355	332							687
02:00		390	339							729
03:00		479	318							797
04:00		519	380							899
05:00		**764**	**390**							**1154**
06:00		339	343							682
07:00		213	208							421
08:00		140	151							291
09:00		86	105							191
10:00		50	65							115
11:00		56	54							110
Total		5965	5804							11769
Percent		50.7%	49.3%							
AM Peak	-	10:00	07:00	-	-	-	-	-	-	07:00
Vol.	-	344	556	-	-	-	-	-	-	853
PM Peak	-	17:00	17:00	-	-	-	-	-	-	17:00
Vol.	-	764	390	-	-	-	-	-	-	1154
Grand Total		5965	5804							11769
Percent		50.7%	49.3%							
ADT		ADT 11,769		AADT 11,769						

All Traffic Data

Wheat Ridge, CO 80033

Date Start: 31-Jul-18
Date End: 31-Jul-18
Site Code: 8
WASHINGTON ST S.O. 48TH AVE

Start Time	31-Jul-18 Tue	NB	SB							Total
12:00 AM		36	41							77
01:00		18	26							44
02:00		21	41							62
03:00		23	30							53
04:00		107	67							174
05:00		382	213							595
06:00		**476**	555							1031
07:00		449	**615**							**1064**
08:00		454	523							977
09:00		468	381							849
10:00		462	443							905
11:00		449	513							962
12:00 PM		520	549							1069
01:00		472	519							991
02:00		492	569							1061
03:00		541	582							1123
04:00		582	**605**							1187
05:00		**761**	539							**1300**
06:00		400	488							888
07:00		253	322							575
08:00		193	212							405
09:00		107	134							241
10:00		79	101							180
11:00		67	71							138
Total		7812	8139							15951
Percent		49.0%	51.0%							
AM Peak	-	06:00	07:00	-	-	-	-	-	-	07:00
Vol.	-	476	615	-	-	-	-	-	-	1064
PM Peak	-	17:00	16:00	-	-	-	-	-	-	17:00
Vol.	-	761	605	-	-	-	-	-	-	1300
Grand Total		7812	8139							15951
Percent		49.0%	51.0%							
ADT		ADT 15,951		AADT 15,951						

All Traffic Data

Wheat Ridge, CO 80033

Date Start: 31-Jul-18
Date End: 31-Jul-18
Site Code: 9
WASHINTON ST N.O. I-70 WB RAMPS

Start Time	31-Jul-18 Tue	NB	SB							Total
12:00 AM		51	58							109
01:00		36	36							72
02:00		41	52							93
03:00		52	69							121
04:00		161	128							289
05:00		534	352							886
06:00		**733**	710							1443
07:00		662	**829**							**1491**
08:00		666	732							1398
09:00		636	599							1235
10:00		680	620							1300
11:00		621	706							1327
12:00 PM		676	759							1435
01:00		665	724							1389
02:00		697	733							1430
03:00		729	865							1594
04:00		773	**891**							1664
05:00		**950**	813							**1763**
06:00		567	590							1157
07:00		344	509							853
08:00		252	356							608
09:00		199	212							411
10:00		128	155							283
11:00		98	111							209
Total		10951	11609							22560
Percent		48.5%	51.5%							
AM Peak	-	06:00	07:00	-	-	-	-	-	-	07:00
Vol.	-	733	829	-	-	-	-	-	-	1491
PM Peak	-	17:00	16:00	-	-	-	-	-	-	17:00
Vol.	-	950	891	-	-	-	-	-	-	1763
Grand Total		10951	11609							22560
Percent		48.5%	51.5%							
ADT		ADT 22,560		AADT 22,560						

All Traffic Data

Wheat Ridge, CO 80033

Date Start: 31-Jul-18
Date End: 31-Jul-18
Site Code: 10
NATIONAL WESTERN DR N.O. 47TH AVE

Start Time	31-Jul-18 Tue	NB	SB							Total
12:00 AM		5	6							11
01:00		1	5							6
02:00		6	3							9
03:00		12	13							25
04:00		36	18							54
05:00		135	43							178
06:00		**172**	117							**289**
07:00		119	141							260
08:00		118	118							236
09:00		87	122							209
10:00		116	117							233
11:00		129	**146**							275
12:00 PM		**125**	120							245
01:00		118	117							235
02:00		124	143							267
03:00		91	**191**							**282**
04:00		96	180							276
05:00		79	106							185
06:00		35	54							89
07:00		24	30							54
08:00		20	31							51
09:00		11	22							33
10:00		6	14							20
11:00		2	9							11
Total		1667	1866							3533
Percent		47.2%	52.8%							
AM Peak	-	06:00	11:00	-	-	-	-	-	-	06:00
Vol.	-	172	146	-	-	-	-	-	-	289
PM Peak	-	12:00	15:00	-	-	-	-	-	-	15:00
Vol.	-	125	191	-	-	-	-	-	-	282
Grand Total		1667	1866							3533
Percent		47.2%	52.8%							
ADT		ADT 3,533		AADT 3,533						

All Traffic Data

Wheat Ridge, CO 80033

Date Start: 31-Jul-18
Date End: 31-Jul-18
Site Code: 11
FRANKLIN ST N.O. RACE CT

Start Time	31-Jul-18 Tue	NB	SB							Total
12:00 AM		5	3							8
01:00		0	5							5
02:00		2	8							10
03:00		5	16							21
04:00		7	30							37
05:00		56	77							133
06:00		66	**173**							**239**
07:00		66	156							222
08:00		77	130							207
09:00		77	107							184
10:00		83	93							176
11:00		**102**	99							201
12:00 PM		90	**140**							230
01:00		96	95							191
02:00		152	104							256
03:00		142	125							267
04:00		**156**	131							**287**
05:00		113	85							198
06:00		58	36							94
07:00		25	20							45
08:00		21	35							56
09:00		10	25							35
10:00		11	8							19
11:00		10	4							14
Total		1430	1705							3135
Percent		45.6%	54.4%							
AM Peak	-	11:00	06:00	-	-	-	-	-	-	06:00
Vol.	-	102	173	-	-	-	-	-	-	239
PM Peak	-	16:00	12:00	-	-	-	-	-	-	16:00
Vol.	-	156	140	-	-	-	-	-	-	287
Grand Total		1430	1705							3135
Percent		45.6%	54.4%							
ADT		ADT 3,135		AADT 3,135						

All Traffic Data

Wheat Ridge, CO 80033

Date Start: 31-Jul-18
Date End: 31-Jul-18
Site Code: 12
FRANKLIN ST S.O. RACE CT

Start Time	31-Jul-18 Tue	NB	SB							Total
12:00 AM		5	4							9
01:00		0	2							2
02:00		3	3							6
03:00		10	6							16
04:00		32	13							45
05:00		105	36							141
06:00		**138**	116							**254**
07:00		90	**124**							214
08:00		82	111							193
09:00		66	101							167
10:00		84	99							183
11:00		97	117							214
12:00 PM		97	115							212
01:00		102	94							196
02:00		**107**	137							**244**
03:00		87	**152**							239
04:00		96	139							235
05:00		77	69							146
06:00		35	47							82
07:00		25	19							44
08:00		17	27							44
09:00		8	23							31
10:00		5	7							12
11:00		2	2							4
Total		1370	1563							2933
Percent		46.7%	53.3%							
AM Peak	-	06:00	07:00	-	-	-	-	-	-	06:00
Vol.	-	138	124	-	-	-	-	-	-	254
PM Peak	-	14:00	15:00	-	-	-	-	-	-	14:00
Vol.	-	107	152	-	-	-	-	-	-	244
Grand Total		1370	1563							2933
Percent		46.7%	53.3%							
ADT		ADT 2,933		AADT 2,933						

All Traffic Data

Wheat Ridge, CO 80033

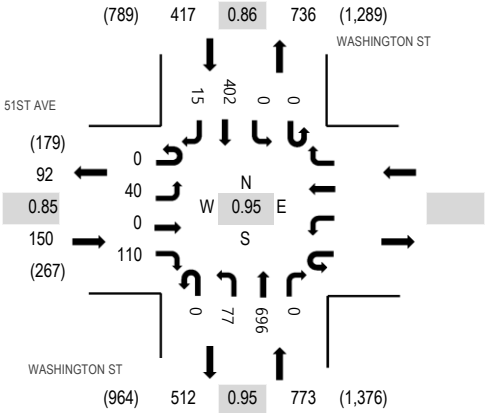
Date Start: 31-Jul-18
Date End: 31-Jul-18
Site Code: 13
RACE CT E.O. FRANKLIN ST

Start Time	31-Jul-18 Tue	EB	WB							Total
12:00 AM		3	6							9
01:00		3	0							3
02:00		8	1							9
03:00		22	5							27
04:00		48	8							56
05:00		**118**	30							**148**
06:00		67	**52**							119
07:00		69	33							102
08:00		52	33							85
09:00		51	42							93
10:00		33	38							71
11:00		53	41							94
12:00 PM		49	49							98
01:00		68	53							121
02:00		47	**115**							**162**
03:00		**71**	91							162
04:00		69	82							151
05:00		51	63							114
06:00		15	34							49
07:00		22	17							39
08:00		20	22							42
09:00		16	14							30
10:00		7	18							25
11:00		5	9							14
Total		967	856							1823
Percent		53.0%	47.0%							
AM Peak	-	05:00	06:00	-	-	-	-	-	-	05:00
Vol.	-	118	52	-	-	-	-	-	-	148
PM Peak	-	15:00	14:00	-	-	-	-	-	-	14:00
Vol.	-	71	115	-	-	-	-	-	-	162
Grand Total		967	856							1823
Percent		53.0%	47.0%							
ADT		ADT 1,823		AADT 1,823						

All Traffic Data Services Inc.
(303) 216-2439
www.alltrafficdata.net

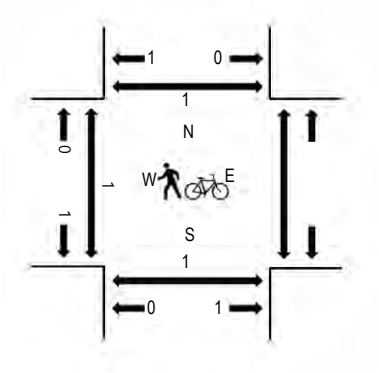
Location: 1 WASHINGTON ST & 51ST AVE PM
Date and Start Time: Tuesday, July 31, 2018
Peak Hour: 04:45 PM - 05:45 PM
Peak 15-Minutes: 05:00 PM - 05:15 PM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles on Crosswalk



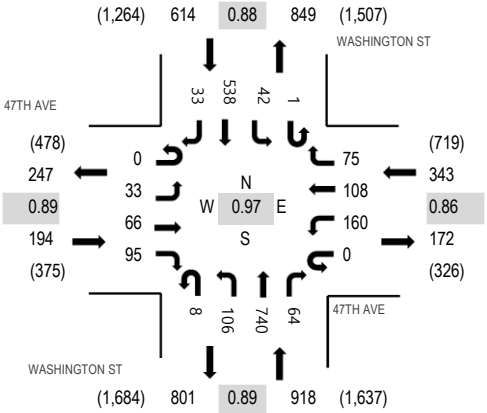
Traffic Counts

Interval Start Time	51ST AVE Eastbound				Westbound				WASHINGTON ST Northbound				WASHINGTON ST Southbound				Total	Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right			West	East	South	North
4:00 PM	0	6	0	34					0	20	105	0	0	0	85	1	251	1,094	0		0	1
4:15 PM	0	1	0	23					0	22	137	0	0	0	92	5	280	1,196	0		0	0
4:30 PM	0	6	0	22					0	12	101	0	0	0	105	6	252	1,254	1		0	0
4:45 PM	0	10	0	32					0	23	143	0	0	0	99	4	311	1,340	0		0	0
5:00 PM	0	14	0	30					0	17	164	0	0	0	124	4	353	1,338	1		1	0
5:15 PM	0	10	0	25					0	17	197	0	0	0	85	4	338		0		0	0
5:30 PM	0	6	0	23					0	20	192	0	0	0	94	3	338		0		0	0
5:45 PM	0	6	0	19					0	15	191	0	0	0	72	6	309		0		0	0
Count Total	0	59	0	208					0	146	1,230	0	0	0	756	33	2,432		2		1	1
Peak Hour	0	40	0	110					0	77	696	0	0	0	402	15	1,340		1		1	0

All Traffic Data Services Inc.
(303) 216-2439
www.alltrafficdata.net

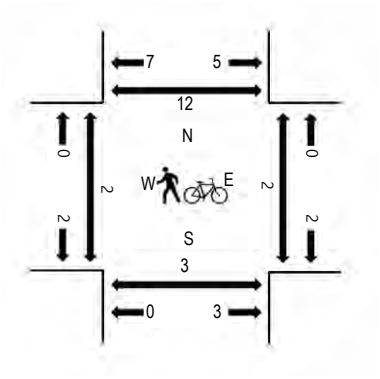
Location: 2 WASHINGTON ST & 47TH AVE PM
Date and Start Time: Tuesday, July 31, 2018
Peak Hour: 05:00 PM - 06:00 PM
Peak 15-Minutes: 05:00 PM - 05:15 PM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles on Crosswalk



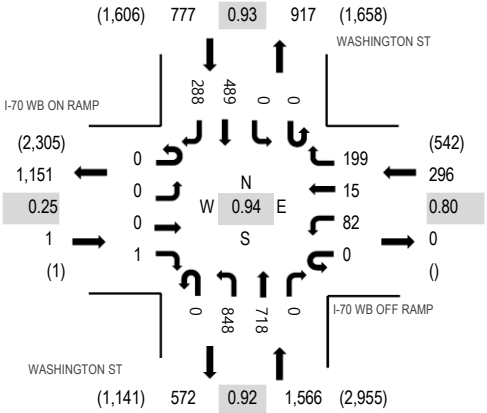
Traffic Counts

Interval Start Time	47TH AVE Eastbound				47TH AVE Westbound				WASHINGTON ST Northbound				WASHINGTON ST Southbound					Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
4:00 PM	0	8	11	24	0	49	25	14	3	18	136	20	0	16	152	7	483	1,926	0	0	0	2
4:15 PM	0	6	12	21	0	50	21	11	0	25	125	12	0	10	142	6	441	1,978	0	0	0	0
4:30 PM	0	12	9	25	0	60	28	23	1	29	152	14	0	11	137	11	512	2,040	0	0	0	1
4:45 PM	0	8	15	30	0	45	30	20	1	25	143	15	0	9	143	6	490	2,045	1	0	0	0
5:00 PM	0	7	14	20	0	49	32	14	0	22	168	19	0	14	171	5	535	2,069	1	0	1	5
5:15 PM	0	7	16	23	0	41	19	16	0	21	191	17	0	8	137	7	503		0	0	1	4
5:30 PM	0	12	19	24	0	41	31	29	3	22	178	18	0	12	117	11	517		0	1	0	0
5:45 PM	0	7	17	28	0	29	26	16	5	41	203	10	1	8	113	10	514		1	1	0	1
Count Total	0	67	113	195	0	364	212	143	13	203	1,296	125	1	88	1,112	63	3,995		3	2	2	13
Peak Hour	0	33	66	95	0	160	108	75	8	106	740	64	1	42	538	33	2,069		2	2	2	10

All Traffic Data Services Inc.
(303) 216-2439
www.alltrafficdata.net

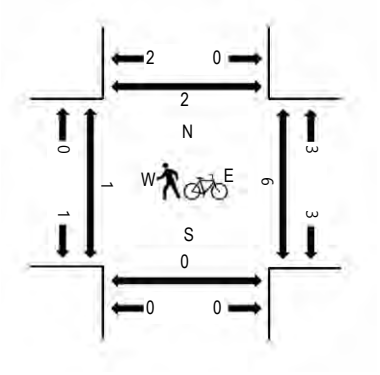
Location: 3 WASHINGTON ST & I-70 WB OFF RAMP PM
Date and Start Time: Tuesday, July 31, 2018
Peak Hour: 05:00 PM - 06:00 PM
Peak 15-Minutes: 05:15 PM - 05:30 PM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles on Crosswalk



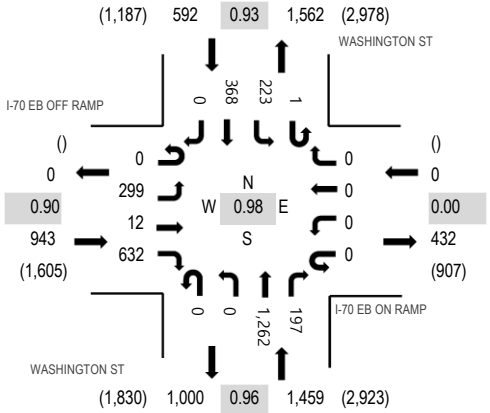
Traffic Counts

Interval Start Time	I-70 WB ON RAMP Eastbound				I-70 WB OFF RAMP Westbound				WASHINGTON ST Northbound				WASHINGTON ST Southbound					Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
4:00 PM	0	0	0	0	0	21	1	36	0	204	142	0	0	0	132	86	622	2,464	0	2	0	0
4:15 PM	0	0	0	0	0	20	4	35	0	210	129	0	0	0	113	81	592	2,490	0	0	0	0
4:30 PM	0	0	0	0	0	13	1	49	0	209	147	0	1	0	135	74	629	2,597	0	0	0	0
4:45 PM	0	0	0	0	0	16	3	47	0	193	155	0	0	0	119	88	621	2,579	2	1	0	0
5:00 PM	0	0	0	0	0	17	2	38	0	209	155	0	0	0	142	85	648	2,640	0	0	0	0
5:15 PM	0	0	0	0	0	22	5	53	0	238	184	0	0	0	121	76	699		0	0	0	0
5:30 PM	0	0	0	0	0	20	3	44	0	186	169	0	0	0	123	66	611		0	3	0	2
5:45 PM	0	0	0	1	0	23	5	64	0	215	210	0	0	0	103	61	682		1	0	0	0
Count Total	0	0	0	1	0	152	24	366	0	1,664	1,291	0	1	0	988	617	5,104		3	6	0	2
Peak Hour	0	0	0	1	0	82	15	199	0	848	718	0	0	0	489	288	2,640		1	3	0	2

All Traffic Data Services Inc.
(303) 216-2439
www.alltrafficdata.net

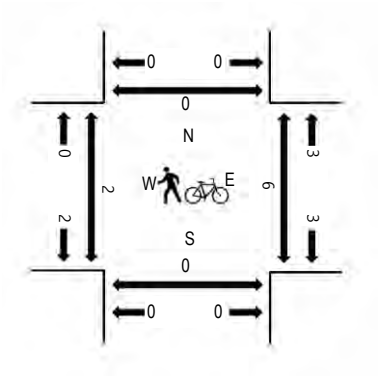
Location: 4 WASHINGTON ST & I-70 EB ON RAMP PM
Date and Start Time: Tuesday, July 31, 2018
Peak Hour: 05:00 PM - 06:00 PM
Peak 15-Minutes: 05:15 PM - 05:30 PM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles on Crosswalk



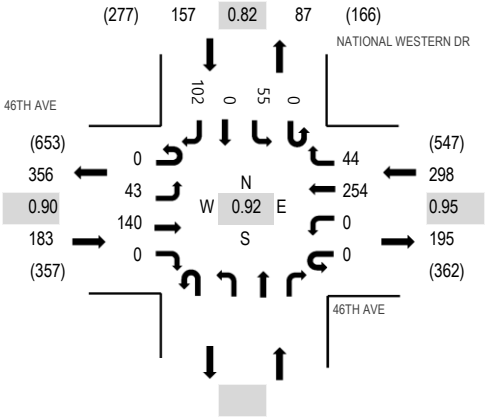
Traffic Counts

Interval Start Time	I-70 EB OFF RAMP Eastbound				I-70 EB ON RAMP Westbound				WASHINGTON ST Northbound				WASHINGTON ST Southbound					Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
4:00 PM	0	45	2	116	0	0	0	0	0	0	311	64	0	68	89	0	695	2,721	1	3	0	0
4:15 PM	0	40	0	115	0	0	0	0	0	0	304	45	0	56	78	0	638	2,769	0	0	0	0
4:30 PM	0	38	0	102	0	0	0	0	0	0	320	60	0	63	95	0	678	2,897	0	0	0	0
4:45 PM	0	55	1	148	0	0	0	0	0	0	303	57	0	59	87	0	710	2,972	2	1	1	0
5:00 PM	0	67	0	152	0	0	0	0	0	0	297	60	0	68	99	0	743	2,994	0	0	0	0
5:15 PM	0	66	7	156	0	0	0	0	0	0	345	41	0	54	97	0	766		1	0	0	0
5:30 PM	0	76	4	153	0	0	0	0	0	0	311	60	0	54	95	0	753		0	4	0	0
5:45 PM	0	90	1	171	0	0	0	0	0	0	309	36	1	47	77	0	732		1	1	0	0
Count Total	0	477	15	1,113	0	0	0	0	0	0	2,500	423	1	469	717	0	5,715		5	9	1	0
Peak Hour	0	299	12	632	0	0	0	0	0	0	1,262	197	1	223	368	0	2,994		2	5	0	0

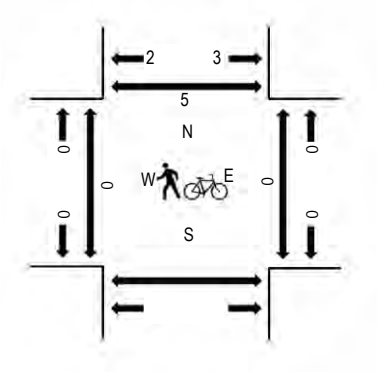
All Traffic Data Services Inc.
(303) 216-2439
www.alltrafficdata.net

Location: 5 NATIONAL WESTERN DR & 46TH AVE PM
Date and Start Time: Tuesday, July 31, 2018
Peak Hour: 04:30 PM - 05:30 PM
Peak 15-Minutes: 04:30 PM - 04:45 PM

Peak Hour - All Vehicles



Peak Hour - Pedestrians/Bicycles on Crosswalk



Note: Total study counts contained in parentheses.

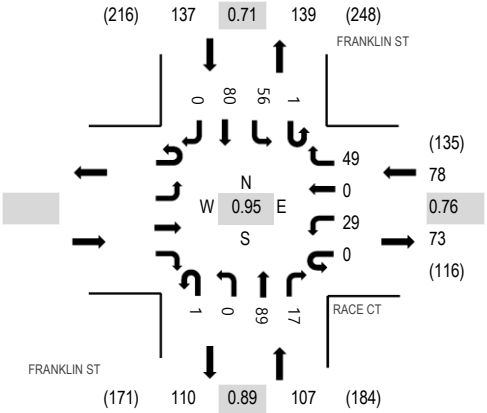
Traffic Counts

Interval Start Time	46TH AVE Eastbound				46TH AVE Westbound				Northbound				NATIONAL WESTERN DR Southbound				Total	Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right			West	East	South	North
4:00 PM	0	11	35	0	0	0	50	13					0	10	0	29	148	605	0	0		0
4:15 PM	0	10	28	0	0	0	41	9					0	16	0	30	134	625	0	0		1
4:30 PM	0	10	36	0	0	0	63	10					0	17	0	37	173	638	0	0		1
4:45 PM	0	14	27	0	0	0	59	11					0	12	0	27	150	607	0	0		1
5:00 PM	0	12	40	0	0	0	62	17					0	15	0	22	168	576	0	0		0
5:15 PM	0	7	37	0	0	0	70	6					0	11	0	16	147		0	0		0
5:30 PM	0	14	36	0	0	0	65	11					0	3	0	13	142		0	0		1
5:45 PM	0	7	33	0	0	0	56	4					0	6	0	13	119		0	0		0
Count Total	0	85	272	0	0	0	466	81					0	90	0	187	1,181		0	0		4
Peak Hour	0	43	140	0	0	0	254	44					0	55	0	102	638		0	0		2

All Traffic Data Services Inc.
(303) 216-2439
www.alltrafficdata.net

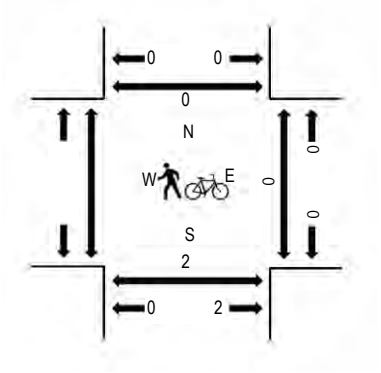
Location: 6 FRANKLIN ST & RACE CT PM
Date and Start Time: Tuesday, July 31, 2018
Peak Hour: 04:15 PM - 05:15 PM
Peak 15-Minutes: 04:15 PM - 04:30 PM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles on Crosswalk



Traffic Counts

Interval Start Time	Eastbound				RACE CT Westbound				FRANKLIN ST Northbound				FRANKLIN ST Southbound					Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
4:00 PM					0	5	0	11	0	0	24	2	0	6	23	0	71	317	0	0	0	0
4:15 PM					0	5	0	9	0	0	19	4	0	23	25	0	85	322	0	0	0	0
4:30 PM					0	10	0	16	0	0	22	3	1	13	18	0	83	278	0	1	0	0
4:45 PM					0	9	0	14	1	0	22	7	0	9	16	0	78	247	0	0	0	0
5:00 PM					0	5	0	10	0	0	26	3	0	11	21	0	76	218	0	0	0	0
5:15 PM					0	6	0	3	0	0	11	1	0	13	7	0	41		0	0	0	0
5:30 PM					0	4	0	11	0	0	23	0	0	9	5	0	52		0	0	0	0
5:45 PM					0	5	0	12	0	0	14	2	0	10	6	0	49		0	3	1	0
Count Total					0	49	0	86	1	0	161	22	1	94	121	0	535		0	4	1	0
Peak Hour					0	29	0	49	1	0	89	17	1	56	80	0	322		0	1	0	0

Appendix B: Intersection Analysis Worksheets

NoAc A

Existing pm peak

Intersection	
Int Delay, s/veh	3.8

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	29	49	89	17	56	80
Future Vol, veh/h	29	49	89	17	56	80
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	-	-	-	-	-
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	32	53	97	18	61	87

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	315	106	0	0	115	0
Stage 1	106	-	-	-	-	-
Stage 2	209	-	-	-	-	-
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	678	948	-	-	1474	-
Stage 1	918	-	-	-	-	-
Stage 2	826	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	649	948	-	-	1474	-
Mov Cap-2 Maneuver	649	-	-	-	-	-
Stage 1	918	-	-	-	-	-
Stage 2	790	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10	0	3.1
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	809	1474	-
HCM Lane V/C Ratio	-	-	0.105	0.041	-
HCM Control Delay (s)	-	-	10	7.5	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.4	0.1	-

Intersection	
Int Delay, s/veh	3.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↰	↑↱		↰	↱
Traffic Vol, veh/h	43	140	254	44	55	102
Future Vol, veh/h	43	140	254	44	55	102
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	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	47	152	276	48	60	111

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	324	0	-	0	546	162
Stage 1	-	-	-	-	300	-
Stage 2	-	-	-	-	246	-
Critical Hdwy	4.13	-	-	-	6.63	6.93
Critical Hdwy Stg 1	-	-	-	-	5.83	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.219	-	-	-	3.519	3.319
Pot Cap-1 Maneuver	1234	-	-	-	483	855
Stage 1	-	-	-	-	726	-
Stage 2	-	-	-	-	794	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1234	-	-	-	463	855
Mov Cap-2 Maneuver	-	-	-	-	463	-
Stage 1	-	-	-	-	726	-
Stage 2	-	-	-	-	761	-

Approach	EB	WB	SB
HCM Control Delay, s	1.9	0	11.2
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1234	-	-	-	463	855
HCM Lane V/C Ratio	0.038	-	-	-	0.129	0.13
HCM Control Delay (s)	8	0	-	-	13.9	9.8
HCM Lane LOS	A	A	-	-	B	A
HCM 95th %tile Q(veh)	0.1	-	-	-	0.4	0.4

Node C

Existing PM Peak

Intersection	
Int Delay, s/veh	0.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	10	10	830	10	10	605
Future Vol, veh/h	10	10	830	10	10	605
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	-	-	-	-	-
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	11	11	902	11	11	658

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1587	908	0	0	913	0
Stage 1	908	-	-	-	-	-
Stage 2	679	-	-	-	-	-
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	119	334	-	-	746	-
Stage 1	393	-	-	-	-	-
Stage 2	504	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	116	334	-	-	746	-
Mov Cap-2 Maneuver	116	-	-	-	-	-
Stage 1	393	-	-	-	-	-
Stage 2	492	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	28.9	0	0.2
HCM LOS	D		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	172	746	-
HCM Lane V/C Ratio	-	-	0.126	0.015	-
HCM Control Delay (s)	-	-	28.9	9.9	0
HCM Lane LOS	-	-	D	A	A
HCM 95th %tile Q(veh)	-	-	0.4	0	-

HCM Signalized Intersection Capacity Analysis

Existing PM Peak

11: Washington St & 51st Ave

Node D

02/27/2019

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	40	110	77	696	402	15
Future Volume (vph)	40	110	77	696	402	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0		5.0	5.0	5.0	
Lane Util. Factor	1.00		1.00	1.00	1.00	
Frt	0.90		1.00	1.00	1.00	
Flt Protected	0.99		0.95	1.00	1.00	
Satd. Flow (prot)	1656		1770	1863	1854	
Flt Permitted	0.99		0.46	1.00	1.00	
Satd. Flow (perm)	1656		861	1863	1854	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	43	120	84	757	437	16
RTOR Reduction (vph)	95	0	0	0	1	0
Lane Group Flow (vph)	68	0	84	757	452	0
Turn Type	Perm		Perm	NA	NA	
Protected Phases				2	6	
Permitted Phases	4		2			
Actuated Green, G (s)	21.0		69.0	69.0	69.0	
Effective Green, g (s)	21.0		69.0	69.0	69.0	
Actuated g/C Ratio	0.21		0.69	0.69	0.69	
Clearance Time (s)	5.0		5.0	5.0	5.0	
Lane Grp Cap (vph)	347		594	1285	1279	
v/s Ratio Prot				c0.41	0.24	
v/s Ratio Perm	c0.04		0.10			
v/c Ratio	0.20		0.14	0.59	0.35	
Uniform Delay, d1	32.5		5.3	8.1	6.4	
Progression Factor	1.00		0.82	1.17	1.00	
Incremental Delay, d2	1.3		0.4	1.8	0.8	
Delay (s)	33.8		4.8	11.3	7.1	
Level of Service	C		A	B	A	
Approach Delay (s)	33.8			10.6	7.1	
Approach LOS	C			B	A	

Intersection Summary			
HCM 2000 Control Delay	12.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	54.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM 2010 Signalized Intersection Summary
13: Washington St & 47th Ave

Node E

Existing PM Peak

02/27/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	33	66	95	160	108	75	106	740	64	42	538	33
Future Volume (veh/h)	33	66	95	160	108	75	106	740	64	42	538	33
Number	7	4	14	3	8	18	5	2	12	1	6	16
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
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	37	74	107	186	126	87	119	831	72	48	611	38
Adj No. of Lanes	1	1	0	2	1	0	1	2	0	1	2	0
Peak Hour Factor	0.89	0.89	0.89	0.86	0.86	0.86	0.89	0.89	0.89	0.88	0.88	0.88
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	407	183	264	847	283	195	473	1698	147	288	1743	108
Arrive On Green	0.08	0.26	0.26	0.09	0.28	0.28	0.51	0.51	0.51	1.00	1.00	1.00
Sat Flow, veh/h	1774	690	997	3442	1028	710	779	3296	286	615	3385	210
Grp Volume(v), veh/h	37	0	181	186	0	213	119	446	457	48	319	330
Grp Sat Flow(s),veh/h/ln	1774	0	1687	1721	0	1738	779	1770	1812	615	1770	1826
Q Serve(g_s), s	1.4	0.0	8.8	3.7	0.0	10.1	8.7	16.3	16.3	2.9	0.0	0.0
Cycle Q Clear(g_c), s	1.4	0.0	8.8	3.7	0.0	10.1	8.7	16.3	16.3	19.3	0.0	0.0
Prop In Lane	1.00		0.59	1.00		0.41	1.00		0.16	1.00		0.12
Lane Grp Cap(c), veh/h	407	0	447	847	0	478	473	911	933	288	911	940
V/C Ratio(X)	0.09	0.00	0.40	0.22	0.00	0.45	0.25	0.49	0.49	0.17	0.35	0.35
Avail Cap(c_a), veh/h	407	0	447	847	0	478	473	911	933	288	911	940
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	22.7	0.0	30.3	22.8	0.0	30.0	13.9	15.7	15.7	3.1	0.0	0.0
Incr Delay (d2), s/veh	0.4	0.0	2.7	0.6	0.0	3.0	1.3	1.9	1.8	1.2	1.1	1.0
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	0.7	0.0	4.5	1.8	0.0	5.2	2.1	8.4	8.6	0.6	0.3	0.3
LnGrp Delay(d),s/veh	23.1	0.0	33.0	23.4	0.0	32.9	15.2	17.6	17.6	4.3	1.1	1.0
LnGrp LOS	C		C	C		C	B	B	B	A	A	A
Approach Vol, veh/h		218			399			1022			697	
Approach Delay, s/veh		31.3			28.5			17.3			1.3	
Approach LOS		C			C			B			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		56.0	13.0	31.0		56.0	12.0	32.0
Change Period (Y+Rc), s		4.5	4.5	4.5		4.5	4.5	4.5
Max Green Setting (Gmax), s		51.5	8.5	26.5		51.5	7.5	27.5
Max Q Clear Time (g_c+I1), s		18.3	5.7	10.8		21.3	3.4	12.1
Green Ext Time (p_c), s		14.3	0.1	2.0		13.8	0.0	2.0

Intersection Summary	
HCM 2010 Ctrl Delay	15.7
HCM 2010 LOS	B

Queues
11: Washington St & 51st Ave

Node D

Existing PM Peak

02/27/2019

Lane Group	EBL	NBL	NBT	SBT
Lane Group Flow (vph)	163	84	757	453
v/c Ratio	0.37	0.14	0.59	0.35
Control Delay	13.5	5.0	11.7	7.2
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	13.5	5.0	11.7	7.2
Queue Length 50th (ft)	22	13	133	103
Queue Length 95th (ft)	78	24	246	152
Internal Link Dist (ft)	301		1390	41
Turn Bay Length (ft)				
Base Capacity (vph)	442	594	1285	1279
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.37	0.14	0.59	0.35

Intersection Summary

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	37	181	186	213	119	903	48	649
v/c Ratio	0.09	0.36	0.23	0.42	0.35	0.50	0.21	0.36
Control Delay	19.6	20.2	20.2	27.8	18.2	16.8	20.6	18.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	19.6	20.2	20.2	27.8	18.2	16.8	20.6	18.3
Queue Length 50th (ft)	14	55	38	93	43	185	18	136
Queue Length 95th (ft)	34	113	58	151	86	235	45	180
Internal Link Dist (ft)		307		338		520		540
Turn Bay Length (ft)	75		150		100		50	
Base Capacity (vph)	391	501	821	505	336	1807	227	1810
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	0.09	0.36	0.23	0.42	0.35	0.50	0.21	0.36

Intersection Summary

Intersection	
Int Delay, s/veh	2.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	6	6	18	8	18	40
Future Vol, veh/h	6	6	18	8	18	40
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	-	-	-	-	-
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	7	7	20	9	20	43

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	107	24	0	0	28	0
Stage 1	24	-	-	-	-	-
Stage 2	83	-	-	-	-	-
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	891	1052	-	-	1585	-
Stage 1	999	-	-	-	-	-
Stage 2	940	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	879	1052	-	-	1585	-
Mov Cap-2 Maneuver	879	-	-	-	-	-
Stage 1	999	-	-	-	-	-
Stage 2	928	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	8.8	0	2.3
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	958	1585	-
HCM Lane V/C Ratio	-	-	0.014	0.012	-
HCM Control Delay (s)	-	-	8.8	7.3	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0	0	-

Intersection	
Int Delay, s/veh	2.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↰	↑↑↱		↰	↱
Traffic Vol, veh/h	21	96	126	23	28	32
Future Vol, veh/h	21	96	126	23	28	32
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	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	23	104	137	25	30	35

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	162	0	-	0	299	81
Stage 1	-	-	-	-	149	-
Stage 2	-	-	-	-	150	-
Critical Hdwy	4.13	-	-	-	6.63	6.93
Critical Hdwy Stg 1	-	-	-	-	5.83	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.219	-	-	-	3.519	3.319
Pot Cap-1 Maneuver	1416	-	-	-	680	963
Stage 1	-	-	-	-	864	-
Stage 2	-	-	-	-	877	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1416	-	-	-	668	963
Mov Cap-2 Maneuver	-	-	-	-	668	-
Stage 1	-	-	-	-	864	-
Stage 2	-	-	-	-	862	-

Approach	EB	WB	SB
HCM Control Delay, s	1.4	0	9.7
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1416	-	-	-	668	963
HCM Lane V/C Ratio	0.016	-	-	-	0.046	0.036
HCM Control Delay (s)	7.6	0	-	-	10.6	8.9
HCM Lane LOS	A	A	-	-	B	A
HCM 95th %tile Q(veh)	0	-	-	-	0.1	0.1

Existing weekend peak

Node C

Intersection	
Int Delay, s/veh	0.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	10	10	400	10	10	283
Future Vol, veh/h	10	10	400	10	10	283
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	-	-	-	-	-
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	11	11	435	11	11	308

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	769	440	0	0	446	0
Stage 1	440	-	-	-	-	-
Stage 2	329	-	-	-	-	-
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	369	617	-	-	1114	-
Stage 1	649	-	-	-	-	-
Stage 2	729	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	365	617	-	-	1114	-
Mov Cap-2 Maneuver	365	-	-	-	-	-
Stage 1	649	-	-	-	-	-
Stage 2	720	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	13.2	0	0.3
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	459	1114	-
HCM Lane V/C Ratio	-	-	0.047	0.01	-
HCM Control Delay (s)	-	-	13.2	8.3	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.1	0	-

Existing weekend peak

HCM Signalized Intersection Capacity Analysis
9: Washington St & 51st Ave

Node D

02/27/2019

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	5	5	5	283	175	5
Future Volume (vph)	5	5	5	283	175	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5		4.5	4.5	4.5	
Lane Util. Factor	1.00		1.00	1.00	1.00	
Frt	0.93		1.00	1.00	1.00	
Flt Protected	0.98		0.95	1.00	1.00	
Satd. Flow (prot)	1695		1770	1863	1856	
Flt Permitted	0.98		0.64	1.00	1.00	
Satd. Flow (perm)	1695		1183	1863	1856	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	5	5	5	308	190	5
RTOR Reduction (vph)	4	0	0	0	1	0
Lane Group Flow (vph)	6	0	5	308	194	0
Turn Type	Prot		Perm	NA	NA	
Protected Phases	4			2	6	
Permitted Phases			2			
Actuated Green, G (s)	20.5		70.5	70.5	70.5	
Effective Green, g (s)	20.5		70.5	70.5	70.5	
Actuated g/C Ratio	0.20		0.70	0.70	0.70	
Clearance Time (s)	4.5		4.5	4.5	4.5	
Lane Grp Cap (vph)	347		834	1313	1308	
v/s Ratio Prot	c0.00			c0.17	0.10	
v/s Ratio Perm			0.00			
v/c Ratio	0.02		0.01	0.23	0.15	
Uniform Delay, d1	31.7		4.4	5.2	4.9	
Progression Factor	1.00		0.88	0.86	1.00	
Incremental Delay, d2	0.1		0.0	0.4	0.2	
Delay (s)	31.8		3.9	4.9	5.1	
Level of Service	C		A	A	A	
Approach Delay (s)	31.8			4.9	5.1	
Approach LOS	C			A	A	

Intersection Summary			
HCM 2000 Control Delay	5.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.19		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	26.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Existing weekend peak

HCM 2010 Signalized Intersection Summary
13: Washington St & 47th Ave

Node E

02/27/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	28	32	109	82	46	41	83	341	54	21	253	19
Future Volume (veh/h)	28	32	109	82	46	41	83	341	54	21	253	19
Number	7	4	14	3	8	18	5	2	12	1	6	16
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
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	33	38	128	104	58	52	89	367	58	25	301	23
Adj No. of Lanes	1	1	0	2	1	0	1	2	0	1	2	0
Peak Hour Factor	0.85	0.85	0.85	0.79	0.79	0.79	0.93	0.93	0.93	0.84	0.84	0.84
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	589	146	491	1041	352	315	473	1358	213	417	1477	112
Arrive On Green	0.05	0.39	0.39	0.05	0.39	0.39	0.44	0.44	0.44	0.44	0.44	0.44
Sat Flow, veh/h	1774	375	1264	3442	907	813	1052	3067	481	958	3334	253
Grp Volume(v), veh/h	33	0	166	104	0	110	89	210	215	25	159	165
Grp Sat Flow(s),veh/h/ln	1774	0	1640	1721	0	1719	1052	1770	1778	958	1770	1818
Q Serve(g_s), s	1.2	0.0	7.5	1.9	0.0	4.6	6.2	8.2	8.4	1.9	6.0	6.1
Cycle Q Clear(g_c), s	1.2	0.0	7.5	1.9	0.0	4.6	12.3	8.2	8.4	10.2	6.0	6.1
Prop In Lane	1.00		0.77	1.00		0.47	1.00		0.27	1.00		0.14
Lane Grp Cap(c), veh/h	589	0	636	1041	0	667	473	784	787	417	784	805
V/C Ratio(X)	0.06	0.00	0.26	0.10	0.00	0.16	0.19	0.27	0.27	0.06	0.20	0.20
Avail Cap(c_a), veh/h	589	0	636	1041	0	667	473	784	787	417	784	805
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	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	18.0	0.0	22.8	18.4	0.0	21.9	22.5	19.3	19.3	22.6	18.7	18.7
Incr Delay (d2), s/veh	0.2	0.0	1.0	0.2	0.0	0.5	0.9	0.8	0.9	0.3	0.6	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	0.6	0.0	3.6	0.9	0.0	2.3	1.9	4.2	4.3	0.5	3.0	3.2
LnGrp Delay(d),s/veh	18.2	0.0	23.8	18.6	0.0	22.4	23.3	20.1	20.2	22.8	19.3	19.3
LnGrp LOS	B		C	B		C	C	C	C	C	B	B
Approach Vol, veh/h		199			214			514			349	
Approach Delay, s/veh		22.9			20.6			20.7			19.5	
Approach LOS		C			C			C			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		53.0	9.5	47.0		53.0	9.5	47.0
Change Period (Y+Rc), s		4.5	4.5	4.5		4.5	4.5	4.5
Max Green Setting (Gmax), s		48.5	5.0	42.5		48.5	5.0	42.5
Max Q Clear Time (g_c+I1), s		14.3	3.9	9.5		12.2	3.2	6.6
Green Ext Time (p_c), s		5.4	0.0	1.8		5.5	0.0	1.8

Intersection Summary	
HCM 2010 Ctrl Delay	20.7
HCM 2010 LOS	C

Existing weekend peak

Queues
9: Washington St & 51st Ave

Node D

02/27/2019

Lane Group	EBL	NBL	NBT	SBT
Lane Group Flow (vph)	10	5	308	195
v/c Ratio	0.03	0.01	0.23	0.15
Control Delay	24.7	4.0	5.0	5.1
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	24.7	4.0	5.0	5.1
Queue Length 50th (ft)	3	1	54	35
Queue Length 95th (ft)	17	m3	79	58
Internal Link Dist (ft)	200		1150	190
Turn Bay Length (ft)				
Base Capacity (vph)	351	834	1313	1310
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.03	0.01	0.23	0.15

Intersection Summary

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

Existing weekend peak

Queues

13: Washington St & 47th Ave

Node E

02/27/2019

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	33	166	104	110	89	425	25	324
v/c Ratio	0.06	0.21	0.11	0.14	0.18	0.25	0.06	0.19
Control Delay	17.5	6.1	17.8	10.4	15.8	14.7	14.3	14.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	17.5	6.1	17.8	10.4	15.8	14.7	14.3	14.4
Queue Length 50th (ft)	12	14	20	21	31	75	8	56
Queue Length 95th (ft)	29	47	31	45	62	106	21	76
Internal Link Dist (ft)		219		257		263		450
Turn Bay Length (ft)	75		150		75		50	
Base Capacity (vph)	543	773	969	765	493	1694	429	1703
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	0.06	0.21	0.11	0.14	0.18	0.25	0.06	0.19

Intersection Summary

Node 1

HCM 2010 Signalized Intersection Summary

11: NWD & Race Ct

Phase 1-2 weekday PM 02/27/2019

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	44	52	102	24	63	110
Future Volume (veh/h)	44	52	102	24	63	110
Number	3	18	2	12	1	6
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1900	1863	1863
Adj Flow Rate, veh/h	48	57	111	26	68	120
Adj No. of Lanes	1	1	1	0	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	112	100	1178	276	1090	1502
Arrive On Green	0.06	0.06	0.81	0.81	0.81	0.81
Sat Flow, veh/h	1774	1583	1460	342	1247	1863
Grp Volume(v), veh/h	48	57	0	137	68	120
Grp Sat Flow(s),veh/h/ln	1774	1583	0	1802	1247	1863
Q Serve(g_s), s	1.8	2.4	0.0	1.1	0.8	0.9
Cycle Q Clear(g_c), s	1.8	2.4	0.0	1.1	1.9	0.9
Prop In Lane	1.00	1.00		0.19	1.00	
Lane Grp Cap(c), veh/h	112	100	0	1453	1090	1502
V/C Ratio(X)	0.43	0.57	0.00	0.09	0.06	0.08
Avail Cap(c_a), veh/h	915	817	0	1453	1090	1502
HCM Platoon Ratio	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
Uniform Delay (d), s/veh	31.1	31.4	0.0	1.4	1.6	1.4
Incr Delay (d2), s/veh	2.6	5.1	0.0	0.1	0.1	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.0	1.2	0.0	0.6	0.3	0.5
LnGrp Delay(d),s/veh	33.7	36.4	0.0	1.5	1.7	1.5
LnGrp LOS	C	D		A	A	A
Approach Vol, veh/h	105		137			188
Approach Delay, s/veh	35.2		1.5			1.6
Approach LOS	D		A			A

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2				6		8
Phs Duration (G+Y+Rc), s		60.0				60.0		8.8
Change Period (Y+Rc), s		4.5				4.5		4.5
Max Green Setting (Gmax), s		55.5				55.5		35.5
Max Q Clear Time (g_c+I1), s		3.1				3.9		4.4
Green Ext Time (p_c), s		1.8				1.8		0.3

Intersection Summary	
HCM 2010 Ctrl Delay	9.8
HCM 2010 LOS	A

Lane Group	WBL	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	48	57	137	68	120
v/c Ratio	0.28	0.28	0.09	0.07	0.08
Control Delay	36.4	13.0	1.9	2.3	2.2
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	36.4	13.0	1.9	2.3	2.2
Queue Length 50th (ft)	24	0	9	5	9
Queue Length 95th (ft)	50	31	22	14	22
Internal Link Dist (ft)	413		933		315
Turn Bay Length (ft)					
Base Capacity (vph)	795	743	1507	1032	1544
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.06	0.08	0.09	0.07	0.08

Intersection Summary

Intersection	
Int Delay, s/veh	2.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	72	3	111	217	45	109
Future Vol, veh/h	72	3	111	217	45	109
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	-	-	300	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	78	3	121	236	49	118

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	337	121	0	0	121	0
Stage 1	121	-	-	-	-	-
Stage 2	216	-	-	-	-	-
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	658	930	-	-	1467	-
Stage 1	904	-	-	-	-	-
Stage 2	820	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	636	930	-	-	1467	-
Mov Cap-2 Maneuver	636	-	-	-	-	-
Stage 1	904	-	-	-	-	-
Stage 2	793	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	11.4	0	2.2
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	644	1467	-
HCM Lane V/C Ratio	-	-	0.127	0.033	-
HCM Control Delay (s)	-	-	11.4	7.5	-
HCM Lane LOS	-	-	B	A	-
HCM 95th %tile Q(veh)	-	-	0.4	0.1	-

Intersection	
Intersection Delay, s/veh	13.2
Intersection LOS	B

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	228	10	10	297	81	100
Future Vol, veh/h	228	10	10	297	81	100
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	248	11	11	323	88	109
Number of Lanes	1	1	1	1	1	0

Approach	EB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	2
Conflicting Approach Left	SB	EB	
Conflicting Lanes Left	1	2	0
Conflicting Approach Right	NB		EB
Conflicting Lanes Right	2	0	2
HCM Control Delay	14.1	14	10.7
HCM LOS	B	B	B

Lane	NBLn1	NBLn2	EBLn1	EBLn2	SBLn1
Vol Left, %	100%	0%	100%	0%	0%
Vol Thru, %	0%	100%	0%	0%	45%
Vol Right, %	0%	0%	0%	100%	55%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	10	297	228	10	181
LT Vol	10	0	228	0	0
Through Vol	0	297	0	0	81
RT Vol	0	0	0	10	100
Lane Flow Rate	11	323	248	11	197
Geometry Grp	7	7	7	7	4
Degree of Util (X)	0.019	0.51	0.447	0.016	0.295
Departure Headway (Hd)	6.196	5.691	6.495	5.282	5.404
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	581	636	555	678	665
Service Time	3.896	3.391	4.225	3.012	3.433
HCM Lane V/C Ratio	0.019	0.508	0.447	0.016	0.296
HCM Control Delay	9	14.2	14.4	8.1	10.7
HCM Lane LOS	A	B	B	A	B
HCM 95th-tile Q	0.1	2.9	2.3	0	1.2

HCM 2010 Signalized Intersection Summary
2: 48th Ave/BCD & NWD Node 4 Phase 1-2 Weekday PM

02/27/2019

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	274	100	39	32	20	137
Future Volume (veh/h)	274	100	39	32	20	137
Number	7	4	8	18	1	16
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1900	1863	1863
Adj Flow Rate, veh/h	298	109	42	35	22	149
Adj No. of Lanes	1	1	1	0	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	831	1108	560	466	559	499
Arrive On Green	0.60	0.60	0.60	0.60	0.31	0.31
Sat Flow, veh/h	1317	1863	941	784	1774	1583
Grp Volume(v), veh/h	298	109	0	77	22	149
Grp Sat Flow(s),veh/h/ln	1317	1863	0	1724	1774	1583
Q Serve(g_s), s	12.4	2.5	0.0	1.9	0.9	7.1
Cycle Q Clear(g_c), s	14.3	2.5	0.0	1.9	0.9	7.1
Prop In Lane	1.00			0.45	1.00	1.00
Lane Grp Cap(c), veh/h	831	1108	0	1026	559	499
V/C Ratio(X)	0.36	0.10	0.00	0.08	0.04	0.30
Avail Cap(c_a), veh/h	831	1108	0	1026	559	499
HCM Platoon Ratio	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
Uniform Delay (d), s/veh	11.6	8.7	0.0	8.6	23.8	25.9
Incr Delay (d2), s/veh	1.2	0.2	0.0	0.1	0.1	1.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.7	1.3	0.0	0.9	0.4	3.3
LnGrp Delay(d),s/veh	12.8	8.9	0.0	8.7	23.9	27.4
LnGrp LOS	B	A		A	C	C
Approach Vol, veh/h		407	77		171	
Approach Delay, s/veh		11.8	8.7		27.0	
Approach LOS		B	A		C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		8
Phs Duration (G+Y+Rc), s				64.0		36.0		64.0
Change Period (Y+Rc), s				4.5		4.5		4.5
Max Green Setting (Gmax), s				59.5		31.5		59.5
Max Q Clear Time (g_c+I1), s				16.3		9.1		3.9
Green Ext Time (p_c), s				2.2		0.5		2.2

Intersection Summary	
HCM 2010 Ctrl Delay	15.4
HCM 2010 LOS	B

Queues
2: 48th Ave/BCD & NWD Node 4 Phase 1-2 Weekday PM

02/27/2019

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	298	109	77	22	149
v/c Ratio	0.38	0.10	0.07	0.04	0.25
Control Delay	6.2	4.7	5.4	27.3	8.4
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	6.2	4.7	5.4	27.3	8.4
Queue Length 50th (ft)	38	13	10	10	0
Queue Length 95th (ft)	54	22	29	31	56
Internal Link Dist (ft)		1187	352	219	
Turn Bay Length (ft)	500				300
Base Capacity (vph)	783	1108	1054	557	600
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.38	0.10	0.07	0.04	0.25

Intersection Summary

HCM 2010 Signalized Intersection Summary
7: NWD/driveway & BCD Node 5 Phase 1-2 Weekday PM

02/27/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Volume (veh/h)	0	15	95	3	7	0	65	0	7	5	5	5
Future Volume (veh/h)	0	15	95	3	7	0	65	0	7	5	5	5
Number	7	4	14	3	8	18	5	2	12	1	6	16
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
Adj Sat Flow, veh/h/ln	1900	1863	1900	1900	1863	1900	1900	1863	1900	1900	1863	1900
Adj Flow Rate, veh/h	0	16	103	3	8	0	71	0	8	5	5	5
Adj No. of Lanes	0	1	0	0	1	0	0	1	0	0	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	0	23	147	92	146	0	1057	6	107	440	439	399
Arrive On Green	0.00	0.10	0.10	0.10	0.10	0.00	0.74	0.00	0.74	0.74	0.74	0.74
Sat Flow, veh/h	0	217	1399	145	1387	0	1266	8	144	484	589	536
Grp Volume(v), veh/h	0	0	119	11	0	0	79	0	0	15	0	0
Grp Sat Flow(s),veh/h/ln	0	0	1616	1532	0	0	1418	0	0	1609	0	0
Q Serve(g_s), s	0.0	0.0	4.3	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	0.0	0.0	4.3	4.3	0.0	0.0	0.8	0.0	0.0	0.1	0.0	0.0
Prop In Lane	0.00		0.87	0.27		0.00	0.90		0.10	0.33		0.33
Lane Grp Cap(c), veh/h	0	0	170	238	0	0	1170	0	0	1278	0	0
V/C Ratio(X)	0.00	0.00	0.70	0.05	0.00	0.00	0.07	0.00	0.00	0.01	0.00	0.00
Avail Cap(c_a), veh/h	0	0	1257	1349	0	0	1170	0	0	1278	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)	0.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	0.0	0.0	25.8	24.1	0.0	0.0	2.1	0.0	0.0	2.0	0.0	0.0
Incr Delay (d2), s/veh	0.0	0.0	5.2	0.1	0.0	0.0	0.1	0.0	0.0	0.0	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	0.0	2.1	0.2	0.0	0.0	0.4	0.0	0.0	0.1	0.0	0.0
LnGrp Delay(d),s/veh	0.0	0.0	31.0	24.2	0.0	0.0	2.2	0.0	0.0	2.0	0.0	0.0
LnGrp LOS			C	C			A			A		
Approach Vol, veh/h		119			11			79			15	
Approach Delay, s/veh		31.0			24.2			2.2			2.0	
Approach LOS		C			C			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		49.0		10.8		49.0		10.8
Change Period (Y+Rc), s		4.5		4.5		4.5		4.5
Max Green Setting (Gmax), s		44.5		46.5		44.5		46.5
Max Q Clear Time (g_c+I1), s		2.8		6.3		2.1		6.3
Green Ext Time (p_c), s		0.5		0.8		0.5		0.8

Intersection Summary	
HCM 2010 Ctrl Delay	18.6
HCM 2010 LOS	B

Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	119	11	79	15
v/c Ratio	0.45	0.06	0.07	0.01
Control Delay	13.7	24.8	2.2	2.1
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	13.7	24.8	2.2	2.1
Queue Length 50th (ft)	6	4	4	1
Queue Length 95th (ft)	45	16	15	5
Internal Link Dist (ft)	352	381	539	69
Turn Bay Length (ft)				
Base Capacity (vph)	1204	1167	1195	1376
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.10	0.01	0.07	0.01

Intersection Summary

HCM 2010 Signalized Intersection Summary
23: 46th Ave & NWD (S) Node 6 Phase 1-2 Weekday PM

02/27/2019

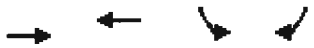
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	42	178	293	42	21	21
Future Volume (veh/h)	42	178	293	42	21	21
Number	7	4	8	18	1	16
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1863	1900	1863	1863
Adj Flow Rate, veh/h	46	193	318	46	23	23
Adj No. of Lanes	0	1	2	0	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	213	870	1974	283	488	435
Arrive On Green	0.63	0.63	0.63	0.63	0.28	0.28
Sat Flow, veh/h	268	1370	3201	445	1774	1583
Grp Volume(v), veh/h	239	0	180	184	23	23
Grp Sat Flow(s),veh/h/ln	1638	0	1770	1784	1774	1583
Q Serve(g_s), s	0.0	0.0	4.1	4.2	1.0	1.1
Cycle Q Clear(g_c), s	5.4	0.0	4.1	4.2	1.0	1.1
Prop In Lane	0.19			0.25	1.00	1.00
Lane Grp Cap(c), veh/h	1083	0	1124	1133	488	435
V/C Ratio(X)	0.22	0.00	0.16	0.16	0.05	0.05
Avail Cap(c_a), veh/h	1083	0	1124	1133	488	435
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	7.6	0.0	7.4	7.4	26.6	26.7
Incr Delay (d2), s/veh	0.5	0.0	0.3	0.3	0.2	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.9	0.0	2.1	2.1	0.5	0.5
LnGrp Delay(d),s/veh	8.1	0.0	7.7	7.7	26.8	26.9
LnGrp LOS	A		A	A	C	C
Approach Vol, veh/h		239	364		46	
Approach Delay, s/veh		8.1	7.7		26.9	
Approach LOS		A	A		C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		8
Phs Duration (G+Y+Rc), s				68.0		32.0		68.0
Change Period (Y+Rc), s				4.5		4.5		4.5
Max Green Setting (Gmax), s				63.5		27.5		63.5
Max Q Clear Time (g_c+I1), s				7.4		3.1		6.2
Green Ext Time (p_c), s				4.2		0.1		4.2

Intersection Summary	
HCM 2010 Ctrl Delay	9.2
HCM 2010 LOS	A

Queues

23: 46th Ave & NWD (S) Node 6 Phase 1-2 Weekday PM 02/27/2019



Lane Group	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	239	364	23	23
v/c Ratio	0.23	0.16	0.05	0.05
Control Delay	8.5	7.0	27.1	11.0
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	8.5	7.0	27.1	11.0
Queue Length 50th (ft)	59	41	11	0
Queue Length 95th (ft)	95	60	30	19
Internal Link Dist (ft)	380	492	194	
Turn Bay Length (ft)				50
Base Capacity (vph)	1043	2216	486	452
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.23	0.16	0.05	0.05

Intersection Summary

Phase 1-2
Weekday PM Peak

existing control scheme

HCM 2010 TWSC
7 16: Washington St & 48th Ave
07/02/2019

Intersection	
Int Delay, s/veh	79.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	159	17	942	349	25	654
Future Vol, veh/h	159	17	942	349	25	654
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	-	-
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	173	18	1024	379	27	711

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1979	1214	0	0	1403	0
Stage 1	1214	-	-	-	-	-
Stage 2	765	-	-	-	-	-
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	~ 68	221	-	-	487	-
Stage 1	281	-	-	-	-	-
Stage 2	459	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	~ 62	221	-	-	487	-
Mov Cap-2 Maneuver	~ 62	-	-	-	-	-
Stage 1	281	-	-	-	-	-
Stage 2	417	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	$ 969.4	0	0.5
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	67	487	-
HCM Lane V/C Ratio	-	-	2.855	0.056	-
HCM Control Delay (s)	-	-	$ 969.4	12.8	0
HCM Lane LOS	-	-	F	B	A
HCM 95th %tile Q(veh)	-	-	19.3	0.2	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Phase 1-2
Weekday PM Peak

HCM Signalized Intersection Capacity Analysis

7 ~~16~~ Washington St & 48th Ave

Alternate control scheme

07/02/2019

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	159	17	942	349	25	654
Future Volume (vph)	159	17	942	349	25	654
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5		4.5			4.5
Lane Util. Factor	1.00		1.00			1.00
Frt	0.99		0.96			1.00
Flt Protected	0.96		1.00			1.00
Satd. Flow (prot)	1759		1795			1859
Flt Permitted	0.96		1.00			0.43
Satd. Flow (perm)	1759		1795			794
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	173	18	1024	379	27	711
RTOR Reduction (vph)	4	0	13	0	0	0
Lane Group Flow (vph)	187	0	1390	0	0	738
Turn Type	Prot		NA		Perm	NA
Protected Phases	8		2			6
Permitted Phases					6	
Actuated Green, G (s)	18.0		73.0			73.0
Effective Green, g (s)	18.0		73.0			73.0
Actuated g/C Ratio	0.18		0.73			0.73
Clearance Time (s)	4.5		4.5			4.5
Lane Grp Cap (vph)	316		1310			579
v/s Ratio Prot	c0.11		0.77			
v/s Ratio Perm						c0.93
v/c Ratio	0.59		1.06			1.27
Uniform Delay, d1	37.6		13.5			13.5
Progression Factor	1.03		0.89			1.00
Incremental Delay, d2	7.8		40.5			136.6
Delay (s)	46.7		52.6			150.1
Level of Service	D		D			F
Approach Delay (s)	46.7		52.6			150.1
Approach LOS	D		D			F

Intersection Summary			
HCM 2000 Control Delay	83.0	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.14		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	88.2%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Phase 1-2
weekday pm peak

Alternate control scheme

Queues

7 1: Washington St & 48th Ave

07/02/2019

Lane Group	WBL	NBT	SBT
Lane Group Flow (vph)	191	1403	738
v/c Ratio	0.60	1.06	1.27
Control Delay	46.5	54.4	155.3
Queue Delay	0.0	0.0	0.0
Total Delay	46.5	54.4	155.3
Queue Length 50th (ft)	111	~672	~598
Queue Length 95th (ft)	189	#1249	#449
Internal Link Dist (ft)	1187	510	1606
Turn Bay Length (ft)	150		
Base Capacity (vph)	320	1324	579
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	0	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.60	1.06	1.27

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.

Phase 1-2 weekday PM Peak

HCM 2010 TWSC

8 19: Washington St & 51st Ave (Eastbound) South Intersection

existing control scheme

07/02/2019

Intersection	
Int Delay, s/veh	43.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	119	36	780	159	84	527
Future Vol, veh/h	119	36	780	159	84	527
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	10	10	10	10	10	10
Mvmt Flow	129	39	848	173	91	573

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1689	934	0	0	1021	0
Stage 1	934	-	-	-	-	-
Stage 2	755	-	-	-	-	-
Critical Hdwy	6.5	6.3	-	-	4.2	-
Critical Hdwy Stg 1	5.5	-	-	-	-	-
Critical Hdwy Stg 2	5.5	-	-	-	-	-
Follow-up Hdwy	3.59	3.39	-	-	2.29	-
Pot Cap-1 Maneuver	~ 98	311	-	-	649	-
Stage 1	370	-	-	-	-	-
Stage 2	450	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	~ 78	311	-	-	649	-
Mov Cap-2 Maneuver	~ 78	-	-	-	-	-
Stage 1	370	-	-	-	-	-
Stage 2	357	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	$ 471.9	0	1.6
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	94	649	-
HCM Lane V/C Ratio	-	-	1.792	0.141	-
HCM Control Delay (s)	-	-	$ 471.9	11.5	0
HCM Lane LOS	-	-	F	B	A
HCM 95th %tile Q(veh)	-	-	13.9	0.5	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Phase 1-2 weekday PM Peak

HCM Signalized Intersection Capacity Analysis

8 20: Washington St + 51st Ave (westbound) North Intersection existing control scheme

07/02/2019

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	40	115	82	734	496	15
Future Volume (vph)	40	115	82	734	496	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5		4.5	4.5	4.5	
Lane Util. Factor	1.00		1.00	1.00	1.00	
Frt	0.90		1.00	1.00	1.00	
Flt Protected	0.99		0.95	1.00	1.00	
Satd. Flow (prot)	1534		1641	1727	1721	
Flt Permitted	0.99		0.40	1.00	1.00	
Satd. Flow (perm)	1534		683	1727	1721	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	43	125	89	798	539	16
RTOR Reduction (vph)	98	0	0	0	1	0
Lane Group Flow (vph)	70	0	89	798	554	0
Heavy Vehicles (%)	10%	10%	10%	10%	10%	10%
Turn Type	Prot		Perm	NA	NA	
Protected Phases	4			2	6	
Permitted Phases			2			
Actuated Green, G (s)	19.5		61.5	61.5	61.5	
Effective Green, g (s)	19.5		61.5	61.5	61.5	
Actuated g/C Ratio	0.22		0.68	0.68	0.68	
Clearance Time (s)	4.5		4.5	4.5	4.5	
Lane Grp Cap (vph)	332		466	1180	1176	
v/s Ratio Prot	c0.05			c0.46	0.32	
v/s Ratio Perm			0.13			
v/c Ratio	0.21		0.19	0.68	0.47	
Uniform Delay, d1	28.9		5.2	8.4	6.7	
Progression Factor	1.00		1.00	1.00	1.00	
Incremental Delay, d2	1.4		0.9	3.1	1.4	
Delay (s)	30.4		6.1	11.5	8.0	
Level of Service	C		A	B	A	
Approach Delay (s)	30.4			11.0	8.0	
Approach LOS	C			B	A	

Intersection Summary			
HCM 2000 Control Delay	12.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	55.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Phase 1-2 Weekday PM Peak

Queues

8 20: Washington St + 51st Ave (westbound) North Intersection

existing control scheme

07/02/2019

Lane Group	EBL	NBL	NBT	SBT
Lane Group Flow (vph)	168	89	798	555
v/c Ratio	0.39	0.19	0.68	0.47
Control Delay	12.6	6.4	12.0	8.2
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	12.6	6.4	12.0	8.2
Queue Length 50th (ft)	20	16	232	127
Queue Length 95th (ft)	74	35	357	192
Internal Link Dist (ft)	278		44	1261
Turn Bay Length (ft)				
Base Capacity (vph)	430	466	1180	1176
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.39	0.19	0.68	0.47

Intersection Summary

Phase 1-2
Weekday PM Peak

HCM Signalized Intersection Capacity Analysis

8 19: Washington St & 51st Ave (Eastbound)

South Intersection

Alternate control scheme

07/02/2019

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	119	36	780	159	84	527
Future Volume (vph)	119	36	780	159	84	527
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5		4.5		4.5	4.5
Lane Util. Factor	1.00		1.00		1.00	1.00
Frt	0.97		0.98		1.00	1.00
Flt Protected	0.96		1.00		0.95	1.00
Satd. Flow (prot)	1611		1688		1641	1727
Flt Permitted	0.96		1.00		0.15	1.00
Satd. Flow (perm)	1611		1688		260	1727
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	129	39	848	173	91	573
RTOR Reduction (vph)	12	0	8	0	0	0
Lane Group Flow (vph)	156	0	1013	0	91	573
Heavy Vehicles (%)	10%	10%	10%	10%	10%	10%
Turn Type	Perm		NA		Perm	NA
Protected Phases			2			6
Permitted Phases	8				6	
Actuated Green, G (s)	18.0		63.0		63.0	63.0
Effective Green, g (s)	18.0		63.0		63.0	63.0
Actuated g/C Ratio	0.20		0.70		0.70	0.70
Clearance Time (s)	4.5		4.5		4.5	4.5
Lane Grp Cap (vph)	322		1181		182	1208
v/s Ratio Prot			c0.60			0.33
v/s Ratio Perm	c0.10				0.35	
v/c Ratio	0.48		0.86		0.50	0.47
Uniform Delay, d1	31.9		10.1		6.2	6.1
Progression Factor	1.00		1.00		1.00	1.00
Incremental Delay, d2	5.1		8.1		9.5	1.3
Delay (s)	37.0		18.3		15.7	7.4
Level of Service	D		B		B	A
Approach Delay (s)	37.0		18.3			8.5
Approach LOS	D		B			A

Intersection Summary			
HCM 2000 Control Delay	16.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	75.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Phase 1-2 Weekday PM Peak

Alternate Control Scheme

Queues

8: Washington St & 51st Ave (Eastbound) South Intersection

07/02/2019

Lane Group	WBL	NBT	SBL	SBT
Lane Group Flow (vph)	168	1021	91	573
v/c Ratio	0.50	0.86	0.50	0.47
Control Delay	35.1	19.4	17.8	7.6
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	35.1	19.4	17.8	7.6
Queue Length 50th (ft)	78	365	20	125
Queue Length 95th (ft)	142	#740	73	189
Internal Link Dist (ft)	1044	1606		44
Turn Bay Length (ft)	150		150	
Base Capacity (vph)	334	1189	182	1208
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.50	0.86	0.50	0.47

Intersection Summary

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

Intersection	
Int Delay, s/veh	4.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	40	115	82	734	496	15
Future Vol, veh/h	40	115	82	734	496	15
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	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	10	10	10	10	10	10
Mvmt Flow	43	125	89	798	539	16

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1523	547	555	0	-	0
Stage 1	547	-	-	-	-	-
Stage 2	976	-	-	-	-	-
Critical Hdwy	6.5	6.3	4.2	-	-	-
Critical Hdwy Stg 1	5.5	-	-	-	-	-
Critical Hdwy Stg 2	5.5	-	-	-	-	-
Follow-up Hdwy	3.59	3.39	2.29	-	-	-
Pot Cap-1 Maneuver	125	522	976	-	-	-
Stage 1	564	-	-	-	-	-
Stage 2	353	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	105	522	976	-	-	-
Mov Cap-2 Maneuver	105	-	-	-	-	-
Stage 1	564	-	-	-	-	-
Stage 2	295	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	41.9	0.9	0
HCM LOS	E		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	976	-	258	-	-
HCM Lane V/C Ratio	0.091	-	0.653	-	-
HCM Control Delay (s)	9.1	0	41.9	-	-
HCM Lane LOS	A	A	E	-	-
HCM 95th %tile Q(veh)	0.3	-	4.1	-	-

HCM 2010 Signalized Intersection Summary
1: Washington St & 47th Ave Node 9 Phase 1-2 Weekday PM 02/27/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	33	66	95	176	108	75	106	1151	101	42	717	33
Future Volume (veh/h)	33	66	95	176	108	75	106	1151	101	42	717	33
Number	7	4	14	3	8	18	5	2	12	1	6	16
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
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	36	72	103	191	117	82	115	1251	110	46	779	36
Adj No. of Lanes	1	1	0	2	1	0	1	2	0	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	259	127	182	540	191	134	491	2064	181	230	2160	100
Arrive On Green	0.05	0.18	0.18	0.05	0.19	0.19	0.63	0.63	0.63	1.00	1.00	1.00
Sat Flow, veh/h	1774	694	993	3442	1021	716	667	3293	289	398	3445	159
Grp Volume(v), veh/h	36	0	175	191	0	199	115	671	690	46	400	415
Grp Sat Flow(s),veh/h/ln	1774	0	1687	1721	0	1736	667	1770	1812	398	1770	1835
Q Serve(g_s), s	1.6	0.0	9.5	4.5	0.0	10.5	7.8	22.8	22.9	5.2	0.0	0.0
Cycle Q Clear(g_c), s	1.6	0.0	9.5	4.5	0.0	10.5	7.8	22.8	22.9	28.1	0.0	0.0
Prop In Lane	1.00		0.59	1.00		0.41	1.00		0.16	1.00		0.09
Lane Grp Cap(c), veh/h	259	0	309	540	0	325	491	1110	1136	230	1110	1150
V/C Ratio(X)	0.14	0.00	0.57	0.35	0.00	0.61	0.23	0.60	0.61	0.20	0.36	0.36
Avail Cap(c_a), veh/h	259	0	309	540	0	325	491	1110	1136	230	1110	1150
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	30.5	0.0	37.2	31.2	0.0	37.3	8.4	11.2	11.2	5.1	0.0	0.0
Incr Delay (d2), s/veh	1.1	0.0	7.3	1.8	0.0	8.4	1.1	2.4	2.4	1.9	0.9	0.9
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	0.9	0.0	5.1	2.2	0.0	5.8	1.6	11.8	12.1	0.7	0.3	0.3
LnGrp Delay(d),s/veh	31.6	0.0	44.6	33.0	0.0	45.7	9.5	13.7	13.7	7.1	0.9	0.9
LnGrp LOS	C		D	C		D	A	B	B	A	A	A
Approach Vol, veh/h		211			390			1476			861	
Approach Delay, s/veh		42.4			39.5			13.3			1.2	
Approach LOS		D			D			B			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		67.2	10.0	22.8		67.2	9.6	23.2
Change Period (Y+Rc), s		4.5	4.5	4.5		4.5	4.5	4.5
Max Green Setting (Gmax), s		62.7	5.5	18.3		62.7	5.1	18.7
Max Q Clear Time (g_c+I1), s		24.9	6.5	11.5		30.1	3.6	12.5
Green Ext Time (p_c), s		24.1	0.0	1.2		21.9	0.0	1.1

Intersection Summary	
HCM 2010 Ctrl Delay	15.3
HCM 2010 LOS	B

Queues
1: Washington St & 47th Ave Node 9 Phase 1-2 Weekday PM 02/27/2019

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	36	175	191	199	115	1361	46	815
v/c Ratio	0.15	0.48	0.37	0.57	0.32	0.62	0.29	0.37
Control Delay	28.0	28.2	29.8	38.1	11.8	12.7	10.9	6.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	28.0	28.2	29.8	38.1	11.8	12.7	10.9	6.8
Queue Length 50th (ft)	17	63	47	98	31	251	11	98
Queue Length 95th (ft)	41	130	75	171	67	315	m22	122
Internal Link Dist (ft)		478		722		282		510
Turn Bay Length (ft)	75		150		75		50	
Base Capacity (vph)	244	362	515	351	356	2199	157	2206
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	0.48	0.37	0.57	0.32	0.62	0.29	0.37

Intersection Summary

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

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	6	12	54	10	42	135
Future Volume (veh/h)	6	12	54	10	42	135
Number	3	18	2	12	1	6
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1900	1863	1863
Adj Flow Rate, veh/h	7	13	59	11	46	147
Adj No. of Lanes	1	1	1	0	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	40	36	1315	245	1227	1604
Arrive On Green	0.02	0.02	0.86	0.86	0.86	0.86
Sat Flow, veh/h	1774	1583	1528	285	1325	1863
Grp Volume(v), veh/h	7	13	0	70	46	147
Grp Sat Flow(s),veh/h/ln	1774	1583	0	1812	1325	1863
Q Serve(g_s), s	0.3	0.6	0.0	0.4	0.4	0.9
Cycle Q Clear(g_c), s	0.3	0.6	0.0	0.4	0.8	0.9
Prop In Lane	1.00	1.00		0.16	1.00	
Lane Grp Cap(c), veh/h	40	36	0	1560	1227	1604
V/C Ratio(X)	0.17	0.36	0.00	0.04	0.04	0.09
Avail Cap(c_a), veh/h	563	502	0	1560	1227	1604
HCM Platoon Ratio	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
Uniform Delay (d), s/veh	37.0	37.2	0.0	0.8	0.8	0.8
Incr Delay (d2), s/veh	2.0	6.1	0.0	0.1	0.1	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.3	0.0	0.2	0.2	0.5
LnGrp Delay(d),s/veh	39.1	43.3	0.0	0.8	0.9	0.9
LnGrp LOS	D	D		A	A	A
Approach Vol, veh/h	20		70			193
Approach Delay, s/veh	41.8		0.8			0.9
Approach LOS	D		A			A

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2				6		8
Phs Duration (G+Y+Rc), s		71.0				71.0		6.2
Change Period (Y+Rc), s		4.5				4.5		4.5
Max Green Setting (Gmax), s		66.5				66.5		24.5
Max Q Clear Time (g_c+I1), s		2.4				2.9		2.6
Green Ext Time (p_c), s		1.5				1.5		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	3.8
HCM 2010 LOS	A

Lane Group	WBL	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	7	13	70	46	147
v/c Ratio	0.06	0.11	0.04	0.04	0.08
Control Delay	42.8	23.2	0.9	1.0	0.9
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	42.8	23.2	0.9	1.0	0.9
Queue Length 50th (ft)	4	0	0	0	0
Queue Length 95th (ft)	18	19	10	8	19
Internal Link Dist (ft)	413		933		315
Turn Bay Length (ft)					
Base Capacity (vph)	481	439	1707	1238	1743
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.01	0.03	0.04	0.04	0.08

Intersection Summary

Intersection	
Int Delay, s/veh	16.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	513	24	46	825	95	70
Future Vol, veh/h	513	24	46	825	95	70
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	-	-	300	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	558	26	50	897	103	76

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	333	50	0	0	50	0
Stage 1	50	-	-	-	-	-
Stage 2	283	-	-	-	-	-
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	662	1018	-	-	1557	-
Stage 1	972	-	-	-	-	-
Stage 2	765	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	618	1018	-	-	1557	-
Mov Cap-2 Maneuver	618	-	-	-	-	-
Stage 1	972	-	-	-	-	-
Stage 2	714	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	46	0	4.3
HCM LOS	E		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	629	1557	-
HCM Lane V/C Ratio	-	-	0.928	0.066	-
HCM Control Delay (s)	-	-	46	7.5	-
HCM Lane LOS	-	-	E	A	-
HCM 95th %tile Q(veh)	-	-	12.2	0.2	-

Intersection	
Intersection Delay, s/veh	168.6
Intersection LOS	F

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	539	5	9	993	374	185
Future Vol, veh/h	539	5	9	993	374	185
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	586	5	10	1079	407	201
Number of Lanes	1	1	1	2	1	0

Approach	EB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	3
Conflicting Approach Left	SB	EB	
Conflicting Lanes Left	1	2	0
Conflicting Approach Right	NB		EB
Conflicting Lanes Right	3	0	2
HCM Control Delay	259.3	84.2	231.5
HCM LOS	F	F	F

Lane	NBLn1	NBLn2	NBLn3	EBLn1	EBLn2	SBLn1
Vol Left, %	100%	0%	0%	100%	0%	0%
Vol Thru, %	0%	100%	100%	0%	0%	67%
Vol Right, %	0%	0%	0%	0%	100%	33%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	9	497	497	539	5	559
LT Vol	9	0	0	539	0	0
Through Vol	0	497	497	0	0	374
RT Vol	0	0	0	0	5	185
Lane Flow Rate	10	540	540	586	5	608
Geometry Grp	7	7	7	8	8	8
Degree of Util (X)	0.022	1.144	0.884	1.492	0.012	1.423
Departure Headway (Hd)	10.344	9.816	7.985	10.133	8.877	9.799
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	348	372	459	363	406	377
Service Time	8.044	7.516	5.685	7.833	6.577	7.499
HCM Lane V/C Ratio	0.029	1.452	1.176	1.614	0.012	1.613
HCM Control Delay	13.3	123	46.7	261.6	11.7	231.5
HCM Lane LOS	B	F	E	F	B	F
HCM 95th-tile Q	0.1	16.3	9.4	28.8	0	26.8

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	539	5	9	993	374	185
Future Volume (veh/h)	539	5	9	993	374	185
Number	7	14	5	2	6	16
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1900
Adj Flow Rate, veh/h	586	5	10	1079	407	201
Adj No. of Lanes	1	1	1	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	577	515	368	1090	689	340
Arrive On Green	0.32	0.32	0.58	0.58	0.58	0.58
Sat Flow, veh/h	1774	1583	809	1863	1178	582
Grp Volume(v), veh/h	586	5	10	1079	0	608
Grp Sat Flow(s),veh/h/ln	1774	1583	809	1863	0	1760
Q Serve(g_s), s	32.5	0.2	0.8	57.1	0.0	21.9
Cycle Q Clear(g_c), s	32.5	0.2	22.7	57.1	0.0	21.9
Prop In Lane	1.00	1.00	1.00			0.33
Lane Grp Cap(c), veh/h	577	515	368	1090	0	1030
V/C Ratio(X)	1.02	0.01	0.03	0.99	0.00	0.59
Avail Cap(c_a), veh/h	577	515	368	1090	0	1030
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	33.8	22.9	20.4	20.5	0.0	13.2
Incr Delay (d2), s/veh	41.6	0.0	0.1	25.0	0.0	2.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	22.5	0.1	0.2	36.6	0.0	11.2
LnGrp Delay(d),s/veh	75.4	22.9	20.5	45.5	0.0	15.6
LnGrp LOS	F	C	C	D		B
Approach Vol, veh/h	591			1089	608	
Approach Delay, s/veh	75.0			45.2	15.6	
Approach LOS	E			D	B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		63.0		37.0		63.0		
Change Period (Y+Rc), s		4.5		4.5		4.5		
Max Green Setting (Gmax), s		58.5		32.5		58.5		
Max Q Clear Time (g_c+I1), s		59.1		34.5		23.9		
Green Ext Time (p_c), s		0.0		0.0		19.1		

Intersection Summary	
HCM 2010 Ctrl Delay	45.1
HCM 2010 LOS	D

Lane Group	EBL	EBR	NBL	NBT	SBT
Lane Group Flow (vph)	586	5	10	1079	608
v/c Ratio	1.02	0.01	0.03	0.99	0.57
Control Delay	69.7	9.8	9.1	47.0	14.6
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	69.7	9.8	9.1	47.0	14.6
Queue Length 50th (ft)	~376	1	3	633	209
Queue Length 95th (ft)	#608	m1	10	#958	310
Internal Link Dist (ft)	585			1132	418
Turn Bay Length (ft)	300		300		
Base Capacity (vph)	575	517	338	1089	1058
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	1.02	0.01	0.03	0.99	0.57

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.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	539	5	9	993	374	185
Future Volume (veh/h)	539	5	9	993	374	185
Number	7	14	5	2	6	16
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1900
Adj Flow Rate, veh/h	586	5	10	1079	407	201
Adj No. of Lanes	1	1	1	2	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	789	705	220	1646	548	271
Arrive On Green	0.44	0.44	0.47	0.47	0.47	0.47
Sat Flow, veh/h	1774	1583	809	3632	1178	582
Grp Volume(v), veh/h	586	5	10	1079	0	608
Grp Sat Flow(s),veh/h/ln	1774	1583	809	1770	0	1760
Q Serve(g_s), s	27.4	0.2	1.0	23.5	0.0	28.2
Cycle Q Clear(g_c), s	27.4	0.2	29.3	23.5	0.0	28.2
Prop In Lane	1.00	1.00	1.00			0.33
Lane Grp Cap(c), veh/h	789	705	220	1646	0	818
V/C Ratio(X)	0.74	0.01	0.05	0.66	0.00	0.74
Avail Cap(c_a), veh/h	789	705	220	1646	0	818
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	23.0	15.5	33.8	20.6	0.0	21.9
Incr Delay (d2), s/veh	6.2	0.0	0.4	2.1	0.0	6.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	14.7	0.1	0.3	11.9	0.0	15.1
LnGrp Delay(d),s/veh	29.2	15.5	34.2	22.6	0.0	27.9
LnGrp LOS	C	B	C	C		C
Approach Vol, veh/h	591			1089	608	
Approach Delay, s/veh	29.1			22.7	27.9	
Approach LOS	C			C	C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		51.0		49.0		51.0		
Change Period (Y+Rc), s		4.5		4.5		4.5		
Max Green Setting (Gmax), s		46.5		44.5		46.5		
Max Q Clear Time (g_c+I1), s		31.3		29.4		30.2		
Green Ext Time (p_c), s		10.2		1.8		10.7		

Intersection Summary	
HCM 2010 Ctrl Delay	25.8
HCM 2010 LOS	C

Lane Group	EBL	EBR	NBL	NBT	SBT
Lane Group Flow (vph)	586	5	10	1079	608
v/c Ratio	0.74	0.01	0.05	0.66	0.72
Control Delay	24.3	5.4	15.8	23.0	26.2
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	24.3	5.4	15.8	23.0	26.2
Queue Length 50th (ft)	312	1	3	269	286
Queue Length 95th (ft)	407	m1	13	341	423
Internal Link Dist (ft)	585			1132	418
Turn Bay Length (ft)	300		300		
Base Capacity (vph)	787	707	192	1645	844
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.74	0.01	0.05	0.66	0.72

Intersection Summary

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

HCM 2010 Signalized Intersection Summary Phase 1-2 Weekend Lg Event Peak

2: 48th Ave/BCD & NWD Node 4

02/27/2019

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	330	161	103	677	174	205
Future Volume (veh/h)	330	161	103	677	174	205
Number	7	4	8	18	1	16
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1900	1863	1863
Adj Flow Rate, veh/h	359	175	112	736	189	223
Adj No. of Lanes	1	1	1	0	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	535	1332	153	1002	346	309
Arrive On Green	0.71	0.71	1.00	1.00	0.19	0.19
Sat Flow, veh/h	647	1863	213	1402	1774	1583
Grp Volume(v), veh/h	359	175	0	848	189	223
Grp Sat Flow(s),veh/h/ln	647	1863	0	1615	1774	1583
Q Serve(g_s), s	35.5	3.0	0.0	0.0	9.6	13.2
Cycle Q Clear(g_c), s	35.5	3.0	0.0	0.0	9.6	13.2
Prop In Lane	1.00			0.87	1.00	1.00
Lane Grp Cap(c), veh/h	535	1332	0	1155	346	309
V/C Ratio(X)	0.67	0.13	0.00	0.73	0.55	0.72
Avail Cap(c_a), veh/h	535	1332	0	1155	346	309
HCM Platoon Ratio	1.00	1.00	1.67	1.67	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	9.1	4.5	0.0	0.0	36.3	37.7
Incr Delay (d2), s/veh	6.6	0.2	0.0	4.2	6.1	13.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.2	1.6	0.0	1.3	5.3	6.9
LnGrp Delay(d),s/veh	15.7	4.7	0.0	4.2	42.3	51.4
LnGrp LOS	B	A		A	D	D
Approach Vol, veh/h		534	848		412	
Approach Delay, s/veh		12.1	4.2		47.2	
Approach LOS		B	A		D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		8
Phs Duration (G+Y+Rc), s				76.0		24.0		76.0
Change Period (Y+Rc), s				4.5		4.5		4.5
Max Green Setting (Gmax), s				71.5		19.5		71.5
Max Q Clear Time (g_c+I1), s				37.5		15.2		2.0
Green Ext Time (p_c), s				15.6		0.6		19.5

Intersection Summary	
HCM 2010 Ctrl Delay	16.4
HCM 2010 LOS	B

Phase 1-2 Weekend Lg Event Peak

Queues

2: 48th Ave/BCD & NWD Node 4

02/27/2019

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	359	175	848	189	223
v/c Ratio	1.10	0.13	0.61	0.55	0.46
Control Delay	90.3	3.1	3.4	50.5	17.7
Queue Delay	0.0	0.0	10.8	0.0	0.0
Total Delay	90.3	3.1	14.2	50.5	17.7
Queue Length 50th (ft)	~265	20	47	121	31
Queue Length 95th (ft)	#448	27	m42	194	101
Internal Link Dist (ft)		1187	352	219	
Turn Bay Length (ft)	500				300
Base Capacity (vph)	327	1332	1385	345	488
Starvation Cap Reductn	0	0	513	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	1.10	0.13	0.97	0.55	0.46

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 2010 Signalized Intersection Summary Phase ~~Peak~~ 1-2 Weekend Lg Event Peak

7: NWD/driveway & BCD Node 5

02/27/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Volume (veh/h)	5	24	311	18	6	5	774	5	71	5	5	5
Future Volume (veh/h)	5	24	311	18	6	5	774	5	71	5	5	5
Number	7	4	14	3	8	18	5	2	12	1	6	16
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
Adj Sat Flow, veh/h/ln	1900	1863	1900	1900	1863	1900	1900	1863	1900	1900	1863	1900
Adj Flow Rate, veh/h	5	26	338	20	7	5	841	5	77	5	5	5
Adj No. of Lanes	0	1	0	0	1	0	0	1	0	0	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	38	33	374	145	49	25	914	5	77	417	416	392
Arrive On Green	0.25	0.25	0.25	0.25	0.25	0.25	0.65	0.65	0.65	0.65	0.65	0.65
Sat Flow, veh/h	6	128	1467	340	191	98	1291	8	118	563	635	599
Grp Volume(v), veh/h	369	0	0	32	0	0	923	0	0	15	0	0
Grp Sat Flow(s),veh/h/ln	1602	0	0	630	0	0	1416	0	0	1798	0	0
Q Serve(g_s), s	4.4	0.0	0.0	0.0	0.0	0.0	64.2	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	22.3	0.0	0.0	1.8	0.0	0.0	64.5	0.0	0.0	0.3	0.0	0.0
Prop In Lane	0.01		0.92	0.62		0.16	0.91		0.08	0.33		0.33
Lane Grp Cap(c), veh/h	445	0	0	219	0	0	997	0	0	1225	0	0
V/C Ratio(X)	0.83	0.00	0.00	0.15	0.00	0.00	0.93	0.00	0.00	0.01	0.00	0.00
Avail Cap(c_a), veh/h	445	0	0	219	0	0	997	0	0	1225	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	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	36.0	0.0	0.0	28.3	0.0	0.0	17.0	0.0	0.0	6.0	0.0	0.0
Incr Delay (d2), s/veh	16.2	0.0	0.0	1.4	0.0	0.0	15.5	0.0	0.0	0.0	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	11.8	0.0	0.0	0.8	0.0	0.0	29.2	0.0	0.0	0.1	0.0	0.0
LnGrp Delay(d),s/veh	52.3	0.0	0.0	29.7	0.0	0.0	32.5	0.0	0.0	6.0	0.0	0.0
LnGrp LOS	D			C			C			A		
Approach Vol, veh/h		369			32			923			15	
Approach Delay, s/veh		52.3			29.7			32.5			6.0	
Approach LOS		D			C			C			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		70.0		30.0		70.0		30.0
Change Period (Y+Rc), s		4.5		4.5		4.5		4.5
Max Green Setting (Gmax), s		65.5		25.5		65.5		25.5
Max Q Clear Time (g_c+I1), s		66.5		24.3		2.3		3.8
Green Ext Time (p_c), s		0.0		0.3		10.3		2.7

Intersection Summary	
HCM 2010 Ctrl Delay	37.6
HCM 2010 LOS	D

Phase Weekend Lg Event Peak

Queues

7: NWD/driveway & BCD Node S

02/27/2019

Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	369	32	923	15
v/c Ratio	0.55	0.10	1.04	0.01
Control Delay	21.5	26.2	55.6	4.9
Queue Delay	0.2	0.0	14.5	0.0
Total Delay	21.7	26.2	70.1	4.9
Queue Length 50th (ft)	104	13	~634	2
Queue Length 95th (ft)	146	37	m#719	9
Internal Link Dist (ft)	352	381	539	69
Turn Bay Length (ft)				
Base Capacity (vph)	667	326	888	1015
Starvation Cap Reductn	30	0	0	0
Spillback Cap Reductn	0	0	32	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.58	0.10	1.08	0.01

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.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	571	114	144	298	102	143
Future Volume (veh/h)	571	114	144	298	102	143
Number	7	4	8	18	1	16
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1900	1863	1863
Adj Flow Rate, veh/h	621	124	157	324	111	155
Adj No. of Lanes	1	1	1	0	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	649	1378	402	830	319	285
Arrive On Green	0.74	0.74	0.74	0.74	0.18	0.18
Sat Flow, veh/h	910	1863	543	1121	1774	1583
Grp Volume(v), veh/h	621	124	0	481	111	155
Grp Sat Flow(s),veh/h/ln	910	1863	0	1665	1774	1583
Q Serve(g_s), s	63.4	1.9	0.0	10.6	5.5	8.9
Cycle Q Clear(g_c), s	74.0	1.9	0.0	10.6	5.5	8.9
Prop In Lane	1.00			0.67	1.00	1.00
Lane Grp Cap(c), veh/h	649	1378	0	1232	319	285
V/C Ratio(X)	0.96	0.09	0.00	0.39	0.35	0.54
Avail Cap(c_a), veh/h	649	1378	0	1232	319	285
HCM Platoon Ratio	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
Uniform Delay (d), s/veh	20.5	3.6	0.0	4.8	35.9	37.3
Incr Delay (d2), s/veh	26.1	0.1	0.0	0.9	3.0	7.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	21.8	1.0	0.0	5.1	2.9	4.5
LnGrp Delay(d),s/veh	46.6	3.8	0.0	5.7	38.8	44.5
LnGrp LOS	D	A		A	D	D
Approach Vol, veh/h		745	481		266	
Approach Delay, s/veh		39.4	5.7		42.2	
Approach LOS		D	A		D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		8
Phs Duration (G+Y+Rc), s				78.0		22.0		78.0
Change Period (Y+Rc), s				4.0		4.0		4.0
Max Green Setting (Gmax), s				74.0		18.0		74.0
Max Q Clear Time (g_c+I1), s				76.0		10.9		12.6
Green Ext Time (p_c), s				0.0		0.5		11.4

Intersection Summary	
HCM 2010 Ctrl Delay	29.0
HCM 2010 LOS	C

Queues

Phase 1-2 weekend Lg Event Peak

23: 46th Ave & NWD (S) Node 6

02/27/2019

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	621	124	481	111	155
v/c Ratio	1.00	0.09	0.36	0.35	0.38
Control Delay	50.8	3.8	2.5	29.8	4.3
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	50.8	3.8	2.5	29.8	4.3
Queue Length 50th (ft)	329	19	31	70	11
Queue Length 95th (ft)	#625	33	60	115	36
Internal Link Dist (ft)		380	492	194	
Turn Bay Length (ft)					50
Base Capacity (vph)	623	1378	1327	318	412
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	1.00	0.09	0.36	0.35	0.38

Intersection Summary

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

Phase 1-2
Large event weekend peak

HCM 2010 TWSC

7 16: Washington St & 48th Ave

existing control scheme

07/02/2019

Intersection	
Int Delay, s/veh	149

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	302	6	796	481	10	428
Future Vol, veh/h	302	6	796	481	10	428
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	-	-
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	328	7	865	523	11	465

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1614	1127	0	0	1388	0
Stage 1	1127	-	-	-	-	-
Stage 2	487	-	-	-	-	-
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	~ 114	249	-	-	493	-
Stage 1	~ 309	-	-	-	-	-
Stage 2	618	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	~ 111	249	-	-	493	-
Mov Cap-2 Maneuver	~ 111	-	-	-	-	-
Stage 1	~ 309	-	-	-	-	-
Stage 2	599	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	$ 978.2	0	0.3
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	112	493	-
HCM Lane V/C Ratio	-	-	2.989	0.022	-
HCM Control Delay (s)	-	-	$ 978.2	12.5	0
HCM Lane LOS	-	-	F	B	A
HCM 95th %tile Q(veh)	-	-	31.8	0.1	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Large event weekend peak
Phase 1-2

HCM Signalized Intersection Capacity Analysis

7 16: Washington St & 48th Ave

Alternate control scheme

07/02/2019

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	302	6	796	481	10	428
Future Volume (vph)	302	6	796	481	10	428
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5		4.5			4.5
Lane Util. Factor	1.00		1.00			1.00
Frt	1.00		0.95			1.00
Flt Protected	0.95		1.00			1.00
Satd. Flow (prot)	1771		1768			1861
Flt Permitted	0.95		1.00			0.60
Satd. Flow (perm)	1771		1768			1124
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	328	7	865	523	11	465
RTOR Reduction (vph)	1	0	22	0	0	0
Lane Group Flow (vph)	334	0	1366	0	0	476
Turn Type	Prot		NA		Perm	NA
Protected Phases	8		2			6
Permitted Phases					6	
Actuated Green, G (s)	18.0		73.0			73.0
Effective Green, g (s)	18.0		73.0			73.0
Actuated g/C Ratio	0.18		0.73			0.73
Clearance Time (s)	4.5		4.5			4.5
Lane Grp Cap (vph)	318		1290			820
v/s Ratio Prot	c0.19		c0.77			
v/s Ratio Perm						0.42
v/c Ratio	1.05		1.06			0.58
Uniform Delay, d1	41.0		13.5			6.3
Progression Factor	0.93		0.63			0.70
Incremental Delay, d2	61.1		35.3			2.9
Delay (s)	99.3		43.8			7.4
Level of Service	F		D			A
Approach Delay (s)	99.3		43.8			7.4
Approach LOS	F		D			A

Intersection Summary			
HCM 2000 Control Delay	44.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.06		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	95.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Phase 1-2
Large Event weekend Peak

Alternate control scheme

Queues

7 16: Washington St & 48th Ave

07/02/2019

Lane Group	WBL	NBT	SBT
Lane Group Flow (vph)	335	1388	476
v/c Ratio	1.05	1.06	0.58
Control Delay	99.6	46.3	7.7
Queue Delay	0.0	0.0	0.0
Total Delay	99.6	46.3	7.7
Queue Length 50th (ft)	~233	~363	65
Queue Length 95th (ft)	#411	m#1130	94
Internal Link Dist (ft)	1187	550	1606
Turn Bay Length (ft)	150		
Base Capacity (vph)	319	1312	819
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	0	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	1.05	1.06	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.

Phase 1-2
Large event weekend PM

HCM 2010 TWSC

8 19: Washington St & 51st Ave Eastbound South Intersection

Existing Ctrl Scheme

07/02/2019

Intersection	
Int Delay, s/veh	12.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	155	39	288	415	129	180
Future Vol, veh/h	155	39	288	415	129	180
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	-	-
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	168	42	313	451	140	196

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1015	539	0	0	764	0
Stage 1	539	-	-	-	-	-
Stage 2	476	-	-	-	-	-
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	264	542	-	-	849	-
Stage 1	585	-	-	-	-	-
Stage 2	625	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	215	542	-	-	849	-
Mov Cap-2 Maneuver	215	-	-	-	-	-
Stage 1	585	-	-	-	-	-
Stage 2	509	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	70	0	4.2
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	245	849	-
HCM Lane V/C Ratio	-	-	0.861	0.165	-
HCM Control Delay (s)	-	-	70	10.1	0
HCM Lane LOS	-	-	F	B	A
HCM 95th %tile Q(veh)	-	-	7	0.6	-

Phase 1-2
Large Event Weekend Peak

HCM Signalized Intersection Capacity Analysis

8 20: Washington St + 51st Ave Westbound North Intersection

Existing Control Scheme

07/02/2019

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	5	10	9	318	299	2
Future Volume (vph)	5	10	9	318	299	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5		4.5	4.5	4.5	
Lane Util. Factor	1.00		1.00	1.00	1.00	
Frt	0.91		1.00	1.00	1.00	
Flt Protected	0.98		0.95	1.00	1.00	
Satd. Flow (prot)	1664		1770	1863	1861	
Flt Permitted	0.98		0.55	1.00	1.00	
Satd. Flow (perm)	1664		1018	1863	1861	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	5	11	10	346	325	2
RTOR Reduction (vph)	9	0	0	0	0	0
Lane Group Flow (vph)	7	0	10	346	327	0
Turn Type	Prot		Perm	NA	NA	
Protected Phases	4			2	6	
Permitted Phases			2			
Actuated Green, G (s)	20.5		70.5	70.5	70.5	
Effective Green, g (s)	20.5		70.5	70.5	70.5	
Actuated g/C Ratio	0.20		0.70	0.70	0.70	
Clearance Time (s)	4.5		4.5	4.5	4.5	
Lane Grp Cap (vph)	341		717	1313	1312	
v/s Ratio Prot	c0.00			c0.19	0.18	
v/s Ratio Perm			0.01			
v/c Ratio	0.02		0.01	0.26	0.25	
Uniform Delay, d1	31.7		4.4	5.3	5.3	
Progression Factor	1.00		1.54	1.65	1.00	
Incremental Delay, d2	0.1		0.0	0.4	0.5	
Delay (s)	31.9		6.8	9.2	5.7	
Level of Service	C		A	A	A	
Approach Delay (s)	31.9			9.1	5.7	
Approach LOS	C			A	A	

Intersection Summary			
HCM 2000 Control Delay	8.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.21		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	28.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Large event weekend peak
Phase 1-2

Queues

8 20: Washington St + 51st Ave westbound North Intersection

existing Control Scheme
07/02/2019

Lane Group	EBL	NBL	NBT	SBT
Lane Group Flow (vph)	16	10	346	327
v/c Ratio	0.05	0.01	0.26	0.25
Control Delay	20.2	6.9	9.4	5.8
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	20.2	6.9	9.4	5.8
Queue Length 50th (ft)	3	2	120	64
Queue Length 95th (ft)	20	m4	m159	98
Internal Link Dist (ft)	467		74	1231
Turn Bay Length (ft)				
Base Capacity (vph)	349	718	1313	1312
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.05	0.01	0.26	0.25

Intersection Summary

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

Phase 1-2
Large Event Weekend Peak

HCM Signalized Intersection Capacity Analysis

8 19: Washington St & 51st Ave eastbound South Intersection

Alternate Control Scheme

07/02/2019

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	155	39	288	415	129	180
Future Volume (vph)	155	39	288	415	129	180
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5		4.5		4.5	4.5
Lane Util. Factor	1.00		1.00		1.00	1.00
Frt	0.97		0.92		1.00	1.00
Flt Protected	0.96		1.00		0.95	1.00
Satd. Flow (prot)	1743		1714		1770	1863
Flt Permitted	0.96		1.00		0.27	1.00
Satd. Flow (perm)	1743		1714		498	1863
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	168	42	313	451	140	196
RTOR Reduction (vph)	9	0	52	0	0	0
Lane Group Flow (vph)	201	0	712	0	140	196
Turn Type	Perm		NA		Perm	NA
Protected Phases			2			6
Permitted Phases	8				6	
Actuated Green, G (s)	23.5		67.5		67.5	67.5
Effective Green, g (s)	23.5		67.5		67.5	67.5
Actuated g/C Ratio	0.24		0.68		0.68	0.68
Clearance Time (s)	4.5		4.5		4.5	4.5
Lane Grp Cap (vph)	409		1156		336	1257
v/s Ratio Prot			c0.42			0.11
v/s Ratio Perm	c0.12				0.28	
v/c Ratio	0.49		0.62		0.42	0.16
Uniform Delay, d1	33.1		9.0		7.3	5.9
Progression Factor	0.76		1.63		1.00	1.00
Incremental Delay, d2	3.9		1.6		3.8	0.3
Delay (s)	29.0		16.4		11.1	6.2
Level of Service	C		B		B	A
Approach Delay (s)	29.0		16.4			8.2
Approach LOS	C		B			A

Intersection Summary			
HCM 2000 Control Delay	16.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	70.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Phase 1-2
Large event weekend peak

Queues

8 ~~10~~: Washington St & 51st Ave eastbound south intersection

alternate ~~control~~ control scheme

07/02/2019

Lane Group	WBL	NBT	SBL	SBT
Lane Group Flow (vph)	210	764	140	196
v/c Ratio	0.50	0.63	0.42	0.16
Control Delay	28.1	13.5	12.0	6.3
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	28.1	13.5	12.0	6.3
Queue Length 50th (ft)	117	247	36	40
Queue Length 95th (ft)	186	289	80	66
Internal Link Dist (ft)	1044	1606		74
Turn Bay Length (ft)	150		150	
Base Capacity (vph)	419	1208	335	1257
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.50	0.63	0.42	0.16

Intersection Summary

Phase 1-2
Large event weekend peak

HCM 2010 TWSC

8 20: Washington St + 51st Ave westbound North intersection

Alternate control scheme

07/02/2019

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	5	10	9	318	299	2
Future Vol, veh/h	5	10	9	318	299	2
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	-	-	-	-	-
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	5	11	10	346	325	2

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	691	326	327	0	-	0
Stage 1	326	-	-	-	-	-
Stage 2	365	-	-	-	-	-
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	410	715	1233	-	-	-
Stage 1	731	-	-	-	-	-
Stage 2	702	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	406	715	1233	-	-	-
Mov Cap-2 Maneuver	406	-	-	-	-	-
Stage 1	731	-	-	-	-	-
Stage 2	695	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	11.5	0.2	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1233	-	570	-	-
HCM Lane V/C Ratio	0.008	-	0.029	-	-
HCM Control Delay (s)	7.9	0	11.5	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

HCM 2010 Signalized Intersection Summary Phase 1-2 Weekend Lg Event Peak

1: Washington St & 47th Ave Node 9

02/27/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	28	32	109	220	46	41	83	1203	638	21	671	19
Future Volume (veh/h)	28	32	109	220	46	41	83	1203	638	21	671	19
Number	7	4	14	3	8	18	5	2	12	1	6	16
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
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	30	35	118	239	50	45	90	1308	693	23	729	21
Adj No. of Lanes	1	1	0	2	1	0	1	2	0	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	334	68	229	550	165	148	521	1462	712	81	2224	64
Arrive On Green	0.05	0.18	0.18	0.05	0.18	0.18	0.63	0.63	0.63	1.00	1.00	1.00
Sat Flow, veh/h	1774	375	1265	3442	905	814	709	2310	1124	214	3513	101
Grp Volume(v), veh/h	30	0	153	239	0	95	90	975	1026	23	367	383
Grp Sat Flow(s),veh/h/ln	1774	0	1640	1721	0	1719	709	1770	1664	214	1770	1845
Q Serve(g_s), s	1.3	0.0	8.4	5.1	0.0	4.8	5.3	45.0	59.0	4.3	0.0	0.0
Cycle Q Clear(g_c), s	1.3	0.0	8.4	5.1	0.0	4.8	5.3	45.0	59.0	63.3	0.0	0.0
Prop In Lane	1.00		0.77	1.00		0.47	1.00		0.68	1.00		0.05
Lane Grp Cap(c), veh/h	334	0	297	550	0	313	521	1120	1054	81	1120	1168
V/C Ratio(X)	0.09	0.00	0.52	0.43	0.00	0.30	0.17	0.87	0.97	0.28	0.33	0.33
Avail Cap(c_a), veh/h	334	0	297	550	0	313	521	1120	1054	81	1120	1168
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	30.2	0.0	37.0	32.9	0.0	35.4	7.7	15.0	17.6	30.8	0.0	0.0
Incr Delay (d2), s/veh	0.5	0.0	6.3	2.5	0.0	2.5	0.7	9.3	22.1	8.5	0.8	0.8
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	0.7	0.0	4.3	2.8	0.0	2.5	1.2	24.6	33.3	0.8	0.2	0.2
LnGrp Delay(d),s/veh	30.7	0.0	43.3	35.4	0.0	37.9	8.4	24.3	39.7	39.3	0.8	0.8
LnGrp LOS	C		D	D		D	A	C	D	D	A	A
Approach Vol, veh/h		183			334			2091			773	
Approach Delay, s/veh		41.2			36.1			31.2			1.9	
Approach LOS		D			D			C			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		67.8	9.6	22.6		67.8	9.5	22.7
Change Period (Y+Rc), s		4.5	4.5	4.5		4.5	4.5	4.5
Max Green Setting (Gmax), s		63.3	5.1	18.1		63.3	5.0	18.2
Max Q Clear Time (g_c+I1), s		61.0	7.1	10.4		65.3	3.3	6.8
Green Ext Time (p_c), s		2.2	0.0	0.8		0.0	0.0	1.1

Intersection Summary	
HCM 2010 Ctrl Delay	25.5
HCM 2010 LOS	C

Queues

Phase 1-2 Weekend Lg Event Peak

1: Washington St & 47th Ave Node 9

02/27/2019

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	30	153	239	95	90	2001	23	750
v/c Ratio	0.09	0.39	0.45	0.27	0.23	0.91	0.31	0.34
Control Delay	27.6	14.1	32.1	24.0	9.7	22.3	20.1	8.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.6	14.1	32.1	24.0	9.7	22.3	20.1	8.1
Queue Length 50th (ft)	14	19	60	30	23	494	7	118
Queue Length 95th (ft)	37	75	93	75	48	#650	m17	150
Internal Link Dist (ft)		275		283		301		550
Turn Bay Length (ft)	75		150		75		50	
Base Capacity (vph)	322	394	532	347	392	2193	74	2233
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	0.09	0.39	0.45	0.27	0.23	0.91	0.31	0.34

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 2010 Signalized Intersection Summary
11: NWD & Race Ct Node 1

Full Build out weekday PM Peak 02/27/2019

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	53	64	128	31	76	131
Future Volume (veh/h)	53	64	128	31	76	131
Number	3	18	2	12	1	6
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1900	1863	1863
Adj Flow Rate, veh/h	58	70	139	34	83	142
Adj No. of Lanes	1	1	1	0	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	126	113	1150	281	1040	1481
Arrive On Green	0.07	0.07	0.80	0.80	0.80	0.80
Sat Flow, veh/h	1774	1583	1446	354	1207	1863
Grp Volume(v), veh/h	58	70	0	173	83	142
Grp Sat Flow(s),veh/h/ln	1774	1583	0	1800	1207	1863
Q Serve(g_s), s	2.1	2.9	0.0	1.5	1.1	1.1
Cycle Q Clear(g_c), s	2.1	2.9	0.0	1.5	2.6	1.1
Prop In Lane	1.00	1.00		0.20	1.00	
Lane Grp Cap(c), veh/h	126	113	0	1432	1040	1481
V/C Ratio(X)	0.46	0.62	0.00	0.12	0.08	0.10
Avail Cap(c_a), veh/h	989	882	0	1432	1040	1481
HCM Platoon Ratio	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
Uniform Delay (d), s/veh	30.0	30.4	0.0	1.6	1.9	1.5
Incr Delay (d2), s/veh	2.6	5.5	0.0	0.2	0.1	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.1	1.4	0.0	0.8	0.4	0.6
LnGrp Delay(d),s/veh	32.6	35.9	0.0	1.7	2.0	1.7
LnGrp LOS	C	D		A	A	A
Approach Vol, veh/h	128		173			225
Approach Delay, s/veh	34.4		1.7			1.8
Approach LOS	C		A			A

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2				6		8
Phs Duration (G+Y+Rc), s		58.0				58.0		9.3
Change Period (Y+Rc), s		4.5				4.5		4.5
Max Green Setting (Gmax), s		53.5				53.5		37.5
Max Q Clear Time (g_c+I1), s		3.5				4.6		4.9
Green Ext Time (p_c), s		2.3				2.3		0.4

Intersection Summary	
HCM 2010 Ctrl Delay	9.7
HCM 2010 LOS	A

Queues

11: NWD & Race Ct Node 1 Full Build Out weekday PM peak 02/27/2019

Lane Group	WBL	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	58	70	173	83	142
v/c Ratio	0.32	0.31	0.12	0.08	0.09
Control Delay	35.1	12.0	2.2	2.6	2.4
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	35.1	12.0	2.2	2.6	2.4
Queue Length 50th (ft)	27	0	13	7	12
Queue Length 95th (ft)	55	33	29	18	27
Internal Link Dist (ft)	413		933		315
Turn Bay Length (ft)					
Base Capacity (vph)	874	817	1485	986	1523
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.07	0.09	0.12	0.08	0.09

Intersection Summary

Intersection	
Int Delay, s/veh	7.8

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	310	16	143	254	53	131
Future Vol, veh/h	310	16	143	254	53	131
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	-	-	300	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	337	17	155	276	58	142

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	413	155	0	0	155	0
Stage 1	155	-	-	-	-	-
Stage 2	258	-	-	-	-	-
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	595	891	-	-	1425	-
Stage 1	873	-	-	-	-	-
Stage 2	785	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	571	891	-	-	1425	-
Mov Cap-2 Maneuver	571	-	-	-	-	-
Stage 1	873	-	-	-	-	-
Stage 2	753	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	20.4	0	2.2
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	581	1425	-
HCM Lane V/C Ratio	-	-	0.61	0.04	-
HCM Control Delay (s)	-	-	20.4	7.6	-
HCM Lane LOS	-	-	C	A	-
HCM 95th %tile Q(veh)	-	-	4.1	0.1	-

Intersection	
Intersection Delay, s/veh	25.4
Intersection LOS	D

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	226	10	10	418	241	200
Future Vol, veh/h	226	10	10	418	241	200
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	246	11	11	454	262	217
Number of Lanes	1	1	1	1	1	0

Approach	EB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	2
Conflicting Approach Left	SB	EB	
Conflicting Lanes Left	1	2	0
Conflicting Approach Right	NB		EB
Conflicting Lanes Right	2	0	2
HCM Control Delay	18.1	27.9	26.9
HCM LOS	C	D	D

Lane	NBLn1	NBLn2	EBLn1	EBLn2	SBLn1
Vol Left, %	100%	0%	100%	0%	0%
Vol Thru, %	0%	100%	0%	0%	55%
Vol Right, %	0%	0%	0%	100%	45%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	10	418	226	10	441
LT Vol	10	0	226	0	0
Through Vol	0	418	0	0	241
RT Vol	0	0	0	10	200
Lane Flow Rate	11	454	246	11	479
Geometry Grp	7	7	7	7	4
Degree of Util (X)	0.02	0.786	0.52	0.019	0.781
Departure Headway (Hd)	6.738	6.229	7.623	6.396	5.868
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	528	577	472	556	614
Service Time	4.516	4.007	5.406	4.177	3.944
HCM Lane V/C Ratio	0.021	0.787	0.521	0.02	0.78
HCM Control Delay	9.7	28.3	18.5	9.3	26.9
HCM Lane LOS	A	D	C	A	D
HCM 95th-tile Q	0.1	7.4	2.9	0.1	7.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	226	10	10	418	241	200
Future Volume (veh/h)	226	10	10	418	241	200
Number	7	14	5	2	6	16
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1900
Adj Flow Rate, veh/h	246	11	11	454	262	217
Adj No. of Lanes	1	1	1	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	297	265	648	1341	679	563
Arrive On Green	0.17	0.17	0.72	0.72	0.72	0.72
Sat Flow, veh/h	1774	1583	912	1863	943	781
Grp Volume(v), veh/h	246	11	11	454	0	479
Grp Sat Flow(s),veh/h/ln	1774	1583	912	1863	0	1725
Q Serve(g_s), s	10.7	0.5	0.4	7.2	0.0	8.6
Cycle Q Clear(g_c), s	10.7	0.5	9.0	7.2	0.0	8.6
Prop In Lane	1.00	1.00	1.00			0.45
Lane Grp Cap(c), veh/h	297	265	648	1341	0	1242
V/C Ratio(X)	0.83	0.04	0.02	0.34	0.00	0.39
Avail Cap(c_a), veh/h	744	664	648	1341	0	1242
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	32.1	27.9	6.1	4.1	0.0	4.3
Incr Delay (d2), s/veh	5.9	0.1	0.0	0.7	0.0	0.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.7	0.2	0.1	3.9	0.0	4.3
LnGrp Delay(d),s/veh	38.0	27.9	6.1	4.8	0.0	5.2
LnGrp LOS	D	C	A	A		A
Approach Vol, veh/h	257			465	479	
Approach Delay, s/veh	37.6			4.9	5.2	
Approach LOS	D			A	A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		62.0		17.9		62.0		
Change Period (Y+Rc), s		4.5		4.5		4.5		
Max Green Setting (Gmax), s		57.5		33.5		57.5		
Max Q Clear Time (g_c+I1), s		11.0		12.7		10.6		
Green Ext Time (p_c), s		7.7		0.7		7.8		

Intersection Summary	
HCM 2010 Ctrl Delay	12.0
HCM 2010 LOS	B

Lane Group	EBL	EBR	NBL	NBT	SBT
Lane Group Flow (vph)	246	11	11	454	479
v/c Ratio	0.70	0.03	0.02	0.35	0.39
Control Delay	42.4	13.7	5.4	6.8	6.2
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	42.4	13.7	5.4	6.8	6.2
Queue Length 50th (ft)	120	0	2	82	73
Queue Length 95th (ft)	195	13	8	166	159
Internal Link Dist (ft)	585			1132	418
Turn Bay Length (ft)	300		300		
Base Capacity (vph)	697	630	581	1296	1237
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.35	0.02	0.02	0.35	0.39

Intersection Summary

HCM 2010 Signalized Intersection Summary
2: 48th Ave/BCD & NWD Node 4 Full Build Out Weekday PM Peak 02/27/2019

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	327	161	216	101	57	195
Future Volume (veh/h)	327	161	216	101	57	195
Number	7	4	8	18	1	16
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1900	1863	1863
Adj Flow Rate, veh/h	355	175	235	110	62	212
Adj No. of Lanes	1	1	1	0	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	758	1239	799	374	435	388
Arrive On Green	0.67	0.67	1.00	1.00	0.25	0.25
Sat Flow, veh/h	1031	1863	1201	562	1774	1583
Grp Volume(v), veh/h	355	175	0	345	62	212
Grp Sat Flow(s),veh/h/ln	1031	1863	0	1764	1774	1583
Q Serve(g_s), s	17.6	3.5	0.0	0.0	2.7	11.7
Cycle Q Clear(g_c), s	17.6	3.5	0.0	0.0	2.7	11.7
Prop In Lane	1.00			0.32	1.00	1.00
Lane Grp Cap(c), veh/h	758	1239	0	1173	435	388
V/C Ratio(X)	0.47	0.14	0.00	0.29	0.14	0.55
Avail Cap(c_a), veh/h	758	1239	0	1173	435	388
HCM Platoon Ratio	1.00	1.00	2.00	2.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	8.6	6.2	0.0	0.0	29.5	32.9
Incr Delay (d2), s/veh	2.1	0.2	0.0	0.6	0.7	5.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.4	1.8	0.0	0.2	1.4	5.7
LnGrp Delay(d),s/veh	10.6	6.4	0.0	0.6	30.2	38.4
LnGrp LOS	B	A		A	C	D
Approach Vol, veh/h		530	345		274	
Approach Delay, s/veh		9.2	0.6		36.5	
Approach LOS		A	A		D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		8
Phs Duration (G+Y+Rc), s				71.0		29.0		71.0
Change Period (Y+Rc), s				4.5		4.5		4.5
Max Green Setting (Gmax), s				66.5		24.5		66.5
Max Q Clear Time (g_c+I1), s				19.6		13.7		2.0
Green Ext Time (p_c), s				5.9		0.6		5.9

Intersection Summary	
HCM 2010 Ctrl Delay	13.2
HCM 2010 LOS	B

Queues

2: 48th Ave/BCD & NWD Node 4 Full Build Out Weekday PM Peak 02/27/2019

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	355	175	345	62	212
v/c Ratio	0.55	0.14	0.29	0.14	0.39
Control Delay	5.5	2.7	5.8	30.9	7.9
Queue Delay	0.0	0.0	0.2	0.0	0.0
Total Delay	5.5	2.7	6.0	30.9	7.9
Queue Length 50th (ft)	34	16	59	33	0
Queue Length 95th (ft)	m35	m17	89	70	69
Internal Link Dist (ft)		1187	352	219	
Turn Bay Length (ft)	500				300
Base Capacity (vph)	650	1238	1202	433	547
Starvation Cap Reductn	0	0	320	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.55	0.14	0.39	0.14	0.39

Intersection Summary

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

HCM 2010 Signalized Intersection Summary
7: NWD/driveway & BCD Node 5 Full Build out Weekday PM Peak 02/27/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Volume (veh/h)	5	159	59	42	244	5	73	5	38	5	5	5
Future Volume (veh/h)	5	159	59	42	244	5	73	5	38	5	5	5
Number	7	4	14	3	8	18	5	2	12	1	6	16
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
Adj Sat Flow, veh/h/ln	1900	1863	1900	1900	1863	1900	1900	1863	1900	1900	1863	1900
Adj Flow Rate, veh/h	5	173	64	46	265	5	79	5	41	5	5	5
Adj No. of Lanes	0	1	0	0	1	0	0	1	0	0	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	42	719	260	150	838	15	378	34	172	215	214	190
Arrive On Green	1.00	1.00	1.00	0.56	0.56	0.56	0.35	0.35	0.35	0.35	0.35	0.35
Sat Flow, veh/h	9	1295	469	196	1510	27	898	96	485	470	602	536
Grp Volume(v), veh/h	242	0	0	316	0	0	125	0	0	15	0	0
Grp Sat Flow(s),veh/h/ln	1774	0	0	1733	0	0	1479	0	0	1607	0	0
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	0.0	4.6	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	0.0	0.0	0.0	9.1	0.0	0.0	5.7	0.0	0.0	0.6	0.0	0.0
Prop In Lane	0.02		0.26	0.15		0.02	0.63		0.33	0.33		0.33
Lane Grp Cap(c), veh/h	1021	0	0	1003	0	0	584	0	0	618	0	0
V/C Ratio(X)	0.24	0.00	0.00	0.31	0.00	0.00	0.21	0.00	0.00	0.02	0.00	0.00
Avail Cap(c_a), veh/h	1021	0	0	1003	0	0	584	0	0	618	0	0
HCM Platoon Ratio	2.00	2.00	2.00	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	0.00	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	0.0	0.0	0.0	11.9	0.0	0.0	22.6	0.0	0.0	21.0	0.0	0.0
Incr Delay (d2), s/veh	0.5	0.0	0.0	0.8	0.0	0.0	0.8	0.0	0.0	0.1	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	0.2	0.0	0.0	4.9	0.0	0.0	2.6	0.0	0.0	0.3	0.0	0.0
LnGrp Delay(d),s/veh	0.5	0.0	0.0	12.8	0.0	0.0	23.4	0.0	0.0	21.1	0.0	0.0
LnGrp LOS	A			B			C			C		
Approach Vol, veh/h		242			316			125			15	
Approach Delay, s/veh		0.5			12.8			23.4			21.1	
Approach LOS		A			B			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		40.0		60.0		40.0		60.0
Change Period (Y+Rc), s		4.5		4.5		4.5		4.5
Max Green Setting (Gmax), s		35.5		55.5		35.5		55.5
Max Q Clear Time (g_c+I1), s		7.7		2.0		2.6		11.1
Green Ext Time (p_c), s		0.8		4.0		0.8		3.9

Intersection Summary	
HCM 2010 Ctrl Delay	10.6
HCM 2010 LOS	B

Queues

7: NWD/driveway & BCD Node 5 Full Build out weekday PM peak 02/27/2019

Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	242	316	125	15
v/c Ratio	0.24	0.33	0.23	0.03
Control Delay	10.2	13.3	26.0	17.0
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	10.2	13.3	26.0	17.0
Queue Length 50th (ft)	49	103	64	4
Queue Length 95th (ft)	77	159	123	18
Internal Link Dist (ft)	352	381	539	69
Turn Bay Length (ft)				
Base Capacity (vph)	1003	957	537	599
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.24	0.33	0.23	0.03

Intersection Summary

HCM 2010 Signalized Intersection Summary
23: 46th Ave & NWD (S) Node 6 Full Build out Weekday PM Peak 02/27/2019

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	93	113	132	54	31	58
Future Volume (veh/h)	93	113	132	54	31	58
Number	7	4	8	18	1	16
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1900	1863	1863
Adj Flow Rate, veh/h	101	123	143	59	34	63
Adj No. of Lanes	1	1	1	0	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	657	1034	696	287	630	562
Arrive On Green	0.56	0.56	0.56	0.56	0.35	0.35
Sat Flow, veh/h	1175	1863	1254	517	1774	1583
Grp Volume(v), veh/h	101	123	0	202	34	63
Grp Sat Flow(s),veh/h/ln	1175	1863	0	1771	1774	1583
Q Serve(g_s), s	4.7	3.1	0.0	5.7	1.3	2.7
Cycle Q Clear(g_c), s	10.4	3.1	0.0	5.7	1.3	2.7
Prop In Lane	1.00			0.29	1.00	1.00
Lane Grp Cap(c), veh/h	657	1034	0	983	630	562
V/C Ratio(X)	0.15	0.12	0.00	0.21	0.05	0.11
Avail Cap(c_a), veh/h	657	1034	0	983	630	562
HCM Platoon Ratio	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
Uniform Delay (d), s/veh	13.8	10.6	0.0	11.2	21.2	21.7
Incr Delay (d2), s/veh	0.5	0.2	0.0	0.5	0.2	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.6	1.7	0.0	2.9	0.6	1.2
LnGrp Delay(d),s/veh	14.3	10.8	0.0	11.6	21.4	22.1
LnGrp LOS	B	B		B	C	C
Approach Vol, veh/h		224	202		97	
Approach Delay, s/veh		12.4	11.6		21.8	
Approach LOS		B	B		C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		8
Phs Duration (G+Y+Rc), s				60.0		40.0		60.0
Change Period (Y+Rc), s				4.5		4.5		4.5
Max Green Setting (Gmax), s				55.5		35.5		55.5
Max Q Clear Time (g_c+I1), s				12.4		4.7		7.7
Green Ext Time (p_c), s				2.5		0.3		2.5

Intersection Summary	
HCM 2010 Ctrl Delay	13.9
HCM 2010 LOS	B

Queues

23: 46th Ave & NWD (S) Node 6 Full Buildout weekday PM peak 02/27/2019

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	101	123	202	34	63
v/c Ratio	0.16	0.12	0.20	0.05	0.10
Control Delay	11.7	11.0	9.8	23.2	15.4
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	11.7	11.0	9.8	23.2	15.4
Queue Length 50th (ft)	30	35	50	18	14
Queue Length 95th (ft)	57	63	87	44	51
Internal Link Dist (ft)		380	492	194	
Turn Bay Length (ft)					50
Base Capacity (vph)	638	1033	1008	628	602
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.16	0.12	0.20	0.05	0.10

Intersection Summary

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	345	66	1127	388	100	805
Future Volume (veh/h)	345	66	1127	388	100	805
Number	3	18	2	12	1	6
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	375	72	1225	422	109	875
Adj No. of Lanes	1	1	1	1	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	461	412	1229	1045	272	1229
Arrive On Green	0.26	0.26	1.00	1.00	1.00	1.00
Sat Flow, veh/h	1774	1583	1863	1583	302	1863
Grp Volume(v), veh/h	375	72	1225	422	109	875
Grp Sat Flow(s),veh/h/ln	1774	1583	1863	1583	302	1863
Q Serve(g_s), s	19.8	3.5	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	19.8	3.5	0.0	0.0	0.0	0.0
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	461	412	1229	1045	272	1229
V/C Ratio(X)	0.81	0.17	1.00	0.40	0.40	0.71
Avail Cap(c_a), veh/h	461	412	1229	1045	272	1229
HCM Platoon Ratio	1.00	1.00	2.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	34.7	28.7	0.0	0.0	0.0	0.0
Incr Delay (d2), s/veh	14.5	0.9	24.8	1.2	4.4	3.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	11.5	1.6	8.5	0.3	0.3	1.2
LnGrp Delay(d),s/veh	49.2	29.6	24.8	1.2	4.4	3.5
LnGrp LOS	D	C	C	A	A	A
Approach Vol, veh/h	447		1647			984
Approach Delay, s/veh	46.0		18.8			3.6
Approach LOS	D		B			A

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2				6		8
Phs Duration (G+Y+Rc), s		70.0				70.0		30.0
Change Period (Y+Rc), s		4.0				4.0		4.0
Max Green Setting (Gmax), s		66.0				66.0		26.0
Max Q Clear Time (g_c+I1), s		2.0				2.0		21.8
Green Ext Time (p_c), s		47.8				47.8		0.6

Intersection Summary	
HCM 2010 Ctrl Delay	17.9
HCM 2010 LOS	B

Queues

16: Washington St & 48th Ave Node 7 Full Build out Weekday PM peak

02/27/2019

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	375	72	1225	422	109	875
v/c Ratio	0.82	0.16	1.00	0.37	1.45	0.71
Control Delay	44.2	5.4	32.4	1.4	281.4	11.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	44.2	5.4	32.4	1.4	281.4	11.4
Queue Length 50th (ft)	174	0	178	7	~96	213
Queue Length 95th (ft)	#368	9	#1074	13	m#198	338
Internal Link Dist (ft)	1187		550			1606
Turn Bay Length (ft)	150			150	150	
Base Capacity (vph)	460	464	1229	1131	75	1229
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.82	0.16	1.00	0.37	1.45	0.71

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 2010 Signalized Intersection Summary
19: Washington St & 51st Ave Node 8 Full Build Out Weekday PM Peak 02/27/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	48	5	132	149	5	66	92	851	159	71	508	18
Future Volume (veh/h)	48	5	132	149	5	66	92	851	159	71	508	18
Number	7	4	14	3	8	18	5	2	12	1	6	16
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
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	52	5	143	162	5	72	100	925	173	77	552	20
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	317	12	346	252	23	336	527	1046	196	422	1224	44
Arrive On Green	0.22	0.22	0.22	0.22	0.22	0.22	1.00	1.00	1.00	0.69	0.69	0.69
Sat Flow, veh/h	1317	54	1538	1235	104	1495	837	1527	286	511	1787	65
Grp Volume(v), veh/h	52	0	148	162	0	77	100	0	1098	77	0	572
Grp Sat Flow(s),veh/h/ln	1317	0	1591	1235	0	1599	837	0	1812	511	0	1851
Q Serve(g_s), s	3.3	0.0	7.9	12.9	0.0	3.9	3.0	0.0	0.0	5.6	0.0	14.1
Cycle Q Clear(g_c), s	7.3	0.0	7.9	20.9	0.0	3.9	17.1	0.0	0.0	5.6	0.0	14.1
Prop In Lane	1.00		0.97	1.00		0.94	1.00		0.16	1.00		0.03
Lane Grp Cap(c), veh/h	317	0	358	252	0	360	527	0	1241	422	0	1268
V/C Ratio(X)	0.16	0.00	0.41	0.64	0.00	0.21	0.19	0.00	0.88	0.18	0.00	0.45
Avail Cap(c_a), veh/h	317	0	358	252	0	360	527	0	1241	422	0	1268
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00	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	34.5	0.0	33.1	42.0	0.0	31.6	1.8	0.0	0.0	5.8	0.0	7.2
Incr Delay (d2), s/veh	1.1	0.0	3.5	12.0	0.0	1.4	0.8	0.0	9.4	0.9	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	1.3	0.0	3.8	5.3	0.0	1.9	0.8	0.0	3.2	0.9	0.0	7.6
LnGrp Delay(d),s/veh	35.6	0.0	36.6	54.0	0.0	32.9	2.6	0.0	9.4	6.8	0.0	8.3
LnGrp LOS	D		D	D		C	A		A	A		A
Approach Vol, veh/h		200			239			1198			649	
Approach Delay, s/veh		36.4			47.2			8.8			8.2	
Approach LOS		D			D			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		73.0		27.0		73.0		27.0
Change Period (Y+Rc), s		4.5		4.5		4.5		4.5
Max Green Setting (Gmax), s		68.5		22.5		68.5		22.5
Max Q Clear Time (g_c+I1), s		19.1		9.9		16.1		22.9
Green Ext Time (p_c), s		26.0		1.7		26.7		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	15.1
HCM 2010 LOS	B

Queues

19: Washington St & 51st Ave Node 8 Full Build out weekday PM peak 02/27/2019

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	52	148	162	77	100	1098	77	572
v/c Ratio	0.18	0.32	0.66	0.19	0.20	0.88	0.64	0.45
Control Delay	33.2	8.1	62.3	20.8	10.1	19.9	37.4	8.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.2	8.1	62.3	20.8	10.1	19.9	37.4	8.5
Queue Length 50th (ft)	27	3	105	0	33	416	24	146
Queue Length 95th (ft)	60	52	#188	53	m34	m422	#117	211
Internal Link Dist (ft)		443		1044		1606		1385
Turn Bay Length (ft)	150		150		150		150	
Base Capacity (vph)	296	469	247	416	488	1251	121	1270
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	0.32	0.66	0.19	0.20	0.88	0.64	0.45

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 2010 Signalized Intersection Summary
1: Washington St & 47th Ave Node 9 Full Build out weekday PM peak 02/27/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	40	79	114	103	50	80	127	1326	165	50	909	40
Future Volume (veh/h)	40	79	114	103	50	80	127	1326	165	50	909	40
Number	7	4	14	3	8	18	5	2	12	1	6	16
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
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	43	86	124	112	54	87	138	1441	179	54	988	43
Adj No. of Lanes	1	1	0	2	1	0	1	2	0	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	291	124	179	460	116	187	418	2015	248	173	2194	95
Arrive On Green	0.05	0.18	0.18	0.05	0.18	0.18	0.63	0.63	0.63	1.00	1.00	1.00
Sat Flow, veh/h	1774	691	996	3442	643	1036	545	3173	391	310	3455	150
Grp Volume(v), veh/h	43	0	210	112	0	141	138	798	822	54	506	525
Grp Sat Flow(s),veh/h/ln	1774	0	1687	1721	0	1680	545	1770	1794	310	1770	1836
Q Serve(g_s), s	1.9	0.0	11.7	2.6	0.0	7.5	12.4	30.0	30.9	11.7	0.0	0.0
Cycle Q Clear(g_c), s	1.9	0.0	11.7	2.6	0.0	7.5	12.4	30.0	30.9	42.5	0.0	0.0
Prop In Lane	1.00		0.59	1.00		0.62	1.00		0.22	1.00		0.08
Lane Grp Cap(c), veh/h	291	0	304	460	0	302	418	1124	1139	173	1124	1166
V/C Ratio(X)	0.15	0.00	0.69	0.24	0.00	0.47	0.33	0.71	0.72	0.31	0.45	0.45
Avail Cap(c_a), veh/h	291	0	304	460	0	302	418	1124	1139	173	1124	1166
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	30.7	0.0	38.4	31.4	0.0	36.7	8.9	12.1	12.3	10.3	0.0	0.0
Incr Delay (d2), s/veh	1.1	0.0	12.2	1.3	0.0	5.1	2.1	3.8	4.0	4.6	1.3	1.3
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	1.0	0.0	6.5	1.3	0.0	3.9	2.1	15.6	16.3	1.2	0.4	0.4
LnGrp Delay(d),s/veh	31.7	0.0	50.6	32.6	0.0	41.8	11.0	15.9	16.3	15.0	1.3	1.3
LnGrp LOS	C		D	C		D	B	B	B	B	A	A
Approach Vol, veh/h		253			253			1758			1085	
Approach Delay, s/veh		47.4			37.7			15.7			2.0	
Approach LOS		D			D			B			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		68.0	9.5	22.5		68.0	9.5	22.5
Change Period (Y+Rc), s		4.5	4.5	4.5		4.5	4.5	4.5
Max Green Setting (Gmax), s		63.5	5.0	18.0		63.5	5.0	18.0
Max Q Clear Time (g_c+I1), s		32.9	4.6	13.7		44.5	3.9	9.5
Green Ext Time (p_c), s		25.6	0.0	0.8		16.8	0.0	1.3

Intersection Summary	
HCM 2010 Ctrl Delay	15.3
HCM 2010 LOS	B

Queues

1: Washington St & 47th Ave Node 9 Full Build out Weekday PM peak 02/27/2019

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	43	210	112	141	138	1620	54	1031
v/c Ratio	0.15	0.59	0.26	0.39	0.51	0.73	0.54	0.46
Control Delay	28.6	33.5	28.9	22.2	18.0	14.7	26.3	8.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
Total Delay	28.6	33.5	28.9	22.2	18.0	14.8	26.3	8.1
Queue Length 50th (ft)	20	86	27	39	43	331	15	145
Queue Length 95th (ft)	47	162	48	95	105	416	m24	189
Internal Link Dist (ft)		286		258		298		550
Turn Bay Length (ft)	75		150		75		50	
Base Capacity (vph)	281	357	435	362	271	2218	100	2236
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	1	0	93	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.15	0.59	0.26	0.39	0.51	0.76	0.54	0.46

Intersection Summary

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

HCM 2010 Signalized Intersection Summary

11: NWD & Race Ct Model full Build out weekend Large Event Peak

02/27/2019

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	66	7	94	24	22	344
Future Volume (veh/h)	66	7	94	24	22	344
Number	3	18	2	12	1	6
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1900	1863	1863
Adj Flow Rate, veh/h	72	8	102	26	24	374
Adj No. of Lanes	1	1	1	0	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	99	88	1185	302	1117	1540
Arrive On Green	0.06	0.06	0.83	0.83	0.83	0.83
Sat Flow, veh/h	1774	1583	1433	365	1257	1863
Grp Volume(v), veh/h	72	8	0	128	24	374
Grp Sat Flow(s),veh/h/ln	1774	1583	0	1798	1257	1863
Q Serve(g_s), s	3.1	0.4	0.0	1.0	0.3	3.3
Cycle Q Clear(g_c), s	3.1	0.4	0.0	1.0	1.3	3.3
Prop In Lane	1.00	1.00		0.20	1.00	
Lane Grp Cap(c), veh/h	99	88	0	1487	1117	1540
V/C Ratio(X)	0.73	0.09	0.00	0.09	0.02	0.24
Avail Cap(c_a), veh/h	635	567	0	1487	1117	1540
HCM Platoon Ratio	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
Uniform Delay (d), s/veh	35.7	34.4	0.0	1.2	1.4	1.4
Incr Delay (d2), s/veh	9.7	0.4	0.0	0.1	0.0	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.8	0.2	0.0	0.5	0.1	1.8
LnGrp Delay(d),s/veh	45.3	34.8	0.0	1.4	1.4	1.8
LnGrp LOS	D	C		A	A	A
Approach Vol, veh/h	80		128			398
Approach Delay, s/veh	44.3		1.4			1.8
Approach LOS	D		A			A

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2				6		8
Phs Duration (G+Y+Rc), s		68.0				68.0		8.8
Change Period (Y+Rc), s		4.5				4.5		4.5
Max Green Setting (Gmax), s		63.5				63.5		27.5
Max Q Clear Time (g_c+I1), s		3.0				5.3		5.1
Green Ext Time (p_c), s		3.6				3.5		0.2

Intersection Summary	
HCM 2010 Ctrl Delay	7.3
HCM 2010 LOS	A

Lane Group	WBL	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	72	8	128	24	374
v/c Ratio	0.41	0.05	0.08	0.02	0.24
Control Delay	45.0	20.0	1.9	2.3	2.7
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	45.0	20.0	1.9	2.3	2.7
Queue Length 50th (ft)	43	0	9	2	40
Queue Length 95th (ft)	77	13	23	8	75
Internal Link Dist (ft)	413		933		315
Turn Bay Length (ft)					
Base Capacity (vph)	536	485	1520	1051	1558
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.13	0.02	0.08	0.02	0.24

Intersection Summary

Intersection	
Int Delay, s/veh	303.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	738	57	66	1875	355	55
Future Vol, veh/h	738	57	66	1875	355	55
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	-	-	300	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	802	62	72	2038	386	60

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	904	72	0	0	72	0
Stage 1	72	-	-	-	-	-
Stage 2	832	-	-	-	-	-
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	~ 307	990	-	-	1528	-
Stage 1	951	-	-	-	-	-
Stage 2	~ 427	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	~ 229	990	-	-	1528	-
Mov Cap-2 Maneuver	~ 229	-	-	-	-	-
Stage 1	951	-	-	-	-	-
Stage 2	~ 319	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	$ 1197	0	7.1
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	242	1528	-
HCM Lane V/C Ratio	-	-	3.571	0.253	-
HCM Control Delay (s)	-	-	$ 1197	8.2	-
HCM Lane LOS	-	-	F	A	-
HCM 95th %tile Q(veh)	-	-	81.7	1	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Intersection Delay, s/veh	762.4
Intersection LOS	F

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	941	5	25	1445	480	313
Future Vol, veh/h	941	5	25	1445	480	313
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1023	5	27	1571	522	340
Number of Lanes	1	1	1	1	1	0

Approach	EB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	2
Conflicting Approach Left	SB	EB	
Conflicting Lanes Left	1	2	0
Conflicting Approach Right	NB		EB
Conflicting Lanes Right	2	0	2
HCM Control Delay	620	1063.8	373.5
HCM LOS	F	F	F

Lane	NBLn1	NBLn2	EBLn1	EBLn2	SBLn1
Vol Left, %	100%	0%	100%	0%	0%
Vol Thru, %	0%	100%	0%	0%	61%
Vol Right, %	0%	0%	0%	100%	39%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	25	1445	941	5	793
LT Vol	25	0	941	0	0
Through Vol	0	1445	0	0	480
RT Vol	0	0	0	5	313
Lane Flow Rate	27	1571	1023	5	862
Geometry Grp	7	7	7	7	4
Degree of Util (X)	0.061	3.329	2.312	0.01	1.72
Departure Headway (Hd)	13.507	12.963	11.118	9.793	14.647
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	267	298	338	368	259
Service Time	11.207	10.663	8.818	7.493	12.647
HCM Lane V/C Ratio	0.101	5.272	3.027	0.014	3.328
HCM Control Delay	17.1	1081.9	623.2	12.6	373.5
HCM Lane LOS	C	F	F	B	F
HCM 95th-tile Q	0.2	84.9	57.9	0	27.8

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	941	5	25	1445	480	313
Future Volume (veh/h)	941	5	25	1445	480	313
Number	7	14	5	2	6	16
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1900
Adj Flow Rate, veh/h	1023	5	27	1571	522	340
Adj No. of Lanes	1	1	1	2	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	880	785	60	1519	453	295
Arrive On Green	0.50	0.50	0.43	0.43	0.43	0.43
Sat Flow, veh/h	1774	1583	639	3632	1055	687
Grp Volume(v), veh/h	1023	5	27	1571	0	862
Grp Sat Flow(s),veh/h/ln	1774	1583	639	1770	0	1742
Q Serve(g_s), s	59.5	0.2	0.0	51.5	0.0	51.5
Cycle Q Clear(g_c), s	59.5	0.2	51.5	51.5	0.0	51.5
Prop In Lane	1.00	1.00	1.00			0.39
Lane Grp Cap(c), veh/h	880	785	60	1519	0	747
V/C Ratio(X)	1.16	0.01	0.45	1.03	0.00	1.15
Avail Cap(c_a), veh/h	880	785	60	1519	0	747
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	30.2	15.3	60.0	34.2	0.0	34.3
Incr Delay (d2), s/veh	85.8	0.0	22.5	32.4	0.0	83.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	50.0	0.1	1.3	31.9	0.0	42.1
LnGrp Delay(d),s/veh	116.1	15.3	82.5	66.7	0.0	118.1
LnGrp LOS	F	B	F	F		F
Approach Vol, veh/h	1028			1598	862	
Approach Delay, s/veh	115.6			67.0	118.1	
Approach LOS	F			E	F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		56.0		64.0		56.0		
Change Period (Y+Rc), s		4.5		4.5		4.5		
Max Green Setting (Gmax), s		51.5		59.5		51.5		
Max Q Clear Time (g_c+I1), s		53.5		61.5		53.5		
Green Ext Time (p_c), s		0.0		0.0		0.0		

Intersection Summary	
HCM 2010 Ctrl Delay	93.9
HCM 2010 LOS	F

Lane Group	EBL	EBR	NBL	NBT	SBT
Lane Group Flow (vph)	1023	5	27	1571	862
v/c Ratio	1.17	0.01	0.44	1.03	1.11
Control Delay	116.9	11.6	50.1	66.7	99.2
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	116.9	11.6	50.1	66.7	99.2
Queue Length 50th (ft)	~942	1	14	~688	~750
Queue Length 95th (ft)	#1195	8	#58	#827	#999
Internal Link Dist (ft)	585			1132	418
Turn Bay Length (ft)	300		300		
Base Capacity (vph)	877	786	62	1518	776
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	1.17	0.01	0.44	1.03	1.11

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.

HCM 2010 Signalized Intersection Summary
2: 48th Ave/BCD & NWD Node 4 Full Build Out WKend Lg Event Peak 02/27/2019

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	499	221	153	967	236	249
Future Volume (veh/h)	499	221	153	967	236	249
Number	7	4	8	18	1	16
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1900	1863	1863
Adj Flow Rate, veh/h	542	240	166	0	257	271
Adj No. of Lanes	1	1	1	0	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	916	1295	1295	0	381	340
Arrive On Green	0.69	0.69	1.00	0.00	0.22	0.22
Sat Flow, veh/h	1215	1863	1863	0	1774	1583
Grp Volume(v), veh/h	542	240	166	0	257	271
Grp Sat Flow(s),veh/h/ln	1215	1863	1863	0	1774	1583
Q Serve(g_s), s	24.6	4.5	0.0	0.0	13.3	16.2
Cycle Q Clear(g_c), s	24.6	4.5	0.0	0.0	13.3	16.2
Prop In Lane	1.00			0.00	1.00	1.00
Lane Grp Cap(c), veh/h	916	1295	1295	0	381	340
V/C Ratio(X)	0.59	0.19	0.13	0.00	0.67	0.80
Avail Cap(c_a), veh/h	916	1295	1295	0	381	340
HCM Platoon Ratio	1.00	1.00	1.67	1.67	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	8.4	5.3	0.0	0.0	36.0	37.2
Incr Delay (d2), s/veh	2.8	0.3	0.2	0.0	9.2	17.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.8	2.4	0.1	0.0	7.5	8.7
LnGrp Delay(d),s/veh	11.2	5.7	0.2	0.0	45.2	54.5
LnGrp LOS	B	A	A		D	D
Approach Vol, veh/h		782	166		528	
Approach Delay, s/veh		9.5	0.2		50.0	
Approach LOS		A	A		D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		8
Phs Duration (G+Y+Rc), s				74.0		26.0		74.0
Change Period (Y+Rc), s				4.5		4.5		4.5
Max Green Setting (Gmax), s				69.5		21.5		69.5
Max Q Clear Time (g_c+I1), s				26.6		18.2		2.0
Green Ext Time (p_c), s				5.3		0.6		5.4

Intersection Summary	
HCM 2010 Ctrl Delay	22.9
HCM 2010 LOS	C

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	542	240	1217	257	271
v/c Ratio	7.23	0.19	0.89	0.68	0.49
Control Delay	2830.4	3.0	7.3	55.2	20.7
Queue Delay	0.0	0.0	47.6	0.0	0.0
Total Delay	2830.4	3.0	54.9	55.2	20.7
Queue Length 50th (ft)	~641	26	519	168	73
Queue Length 95th (ft)	#850	30	m33	m208	m106
Internal Link Dist (ft)		1187	352	219	
Turn Bay Length (ft)	500				300
Base Capacity (vph)	75	1294	1371	380	553
Starvation Cap Reductn	0	0	408	0	0
Spillback Cap Reductn	0	105	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	7.23	0.20	1.26	0.68	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 2010 Signalized Intersection Summary
7: NWD/driveway & BCD

Node 5 Full Build out Weekend by Event Peak

02/28/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Volume (veh/h)	5	187	269	125	313	5	806	5	215	5	5	5
Future Volume (veh/h)	5	187	269	125	313	5	806	5	215	5	5	5
Number	7	4	14	3	8	18	5	2	12	1	6	16
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
Adj Sat Flow, veh/h/ln	1900	1863	1900	1900	1863	1900	1900	1863	1900	1900	1863	1900
Adj Flow Rate, veh/h	5	203	292	136	340	5	876	5	234	5	5	5
Adj No. of Lanes	0	1	0	0	1	0	0	1	0	0	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	38	254	359	124	249	3	691	4	168	341	340	317
Arrive On Green	0.12	0.12	0.12	0.35	0.35	0.35	0.56	0.56	0.56	0.56	0.56	0.56
Sat Flow, veh/h	5	715	1011	220	700	10	1130	6	302	528	613	570
Grp Volume(v), veh/h	500	0	0	481	0	0	1115	0	0	15	0	0
Grp Sat Flow(s),veh/h/ln	1731	0	0	930	0	0	1438	0	0	1711	0	0
Q Serve(g_s), s	0.0	0.0	0.0	6.8	0.0	0.0	55.1	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	28.7	0.0	0.0	35.5	0.0	0.0	55.5	0.0	0.0	0.4	0.0	0.0
Prop In Lane	0.01		0.58	0.28		0.01	0.79		0.21	0.33		0.33
Lane Grp Cap(c), veh/h	651	0	0	376	0	0	862	0	0	998	0	0
V/C Ratio(X)	0.77	0.00	0.00	1.28	0.00	0.00	1.29	0.00	0.00	0.02	0.00	0.00
Avail Cap(c_a), veh/h	651	0	0	376	0	0	862	0	0	998	0	0
HCM Platoon Ratio	0.33	0.33	0.33	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	0.00	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	41.2	0.0	0.0	34.9	0.0	0.0	24.3	0.0	0.0	10.0	0.0	0.0
Incr Delay (d2), s/veh	8.5	0.0	0.0	144.2	0.0	0.0	140.4	0.0	0.0	0.0	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	15.1	0.0	0.0	25.4	0.0	0.0	57.4	0.0	0.0	0.2	0.0	0.0
LnGrp Delay(d),s/veh	49.7	0.0	0.0	179.0	0.0	0.0	164.7	0.0	0.0	10.0	0.0	0.0
LnGrp LOS	D			F			F			B		
Approach Vol, veh/h		500			481			1115			15	
Approach Delay, s/veh		49.7			179.0			164.7			10.0	
Approach LOS		D			F			F			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		60.0		40.0		60.0		40.0
Change Period (Y+Rc), s		4.5		4.5		4.5		4.5
Max Green Setting (Gmax), s		55.5		35.5		55.5		35.5
Max Q Clear Time (g_c+I1), s		57.5		30.7		2.4		37.5
Green Ext Time (p_c), s		0.0		2.8		15.6		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	139.6
HCM 2010 LOS	F

Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	500	481	1115	15
v/c Ratio	0.76	1.40	1.44	0.02
Control Delay	39.4	224.8	227.5	8.1
Queue Delay	2.3	0.0	1.2	0.0
Total Delay	41.6	224.8	228.6	8.1
Queue Length 50th (ft)	260	~415	~957	3
Queue Length 95th (ft)	388	#614	m#1023	12
Internal Link Dist (ft)	352	381	539	69
Turn Bay Length (ft)				
Base Capacity (vph)	657	344	775	836
Starvation Cap Reductn	68	0	0	0
Spillback Cap Reductn	0	0	129	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.85	1.40	1.73	0.02

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 2010 Signalized Intersection Summary
23: 46th Ave & NWD (S) Node #6 Full Build Out WKend Lg Event Peak 02/27/2019

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	792	87	90	319	77	210
Future Volume (veh/h)	792	87	90	319	77	210
Number	7	4	8	18	1	16
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1900	1863	1863
Adj Flow Rate, veh/h	861	95	98	0	84	228
Adj No. of Lanes	1	1	1	0	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	1101	1332	400	0	346	309
Arrive On Green	0.46	0.71	0.22	0.00	0.19	0.19
Sat Flow, veh/h	1774	1863	1863	0	1774	1583
Grp Volume(v), veh/h	861	95	98	0	84	228
Grp Sat Flow(s),veh/h/ln	1774	1863	1863	0	1774	1583
Q Serve(g_s), s	29.2	1.5	4.4	0.0	4.0	13.5
Cycle Q Clear(g_c), s	29.2	1.5	4.4	0.0	4.0	13.5
Prop In Lane	1.00			0.00	1.00	1.00
Lane Grp Cap(c), veh/h	1101	1332	400	0	346	309
V/C Ratio(X)	0.78	0.07	0.24	0.00	0.24	0.74
Avail Cap(c_a), veh/h	1101	1332	400	0	346	309
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	9.9	4.3	32.5	0.0	34.0	37.9
Incr Delay (d2), s/veh	5.6	0.1	1.4	0.0	1.7	14.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	15.6	0.8	2.4	0.0	2.1	12.6
LnGrp Delay(d),s/veh	15.5	4.4	34.0	0.0	35.7	52.5
LnGrp LOS	B	A	C		D	D
Approach Vol, veh/h		956	98		312	
Approach Delay, s/veh		14.4	34.0		48.0	
Approach LOS		B	C		D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6	7	8
Phs Duration (G+Y+Rc), s				76.0		24.0	50.0	26.0
Change Period (Y+Rc), s				4.5		4.5	4.5	4.5
Max Green Setting (Gmax), s				71.5		19.5	45.5	21.5
Max Q Clear Time (g_c+I1), s				3.5		15.5	31.2	6.4
Green Ext Time (p_c), s				1.2		0.4	3.1	0.8

Intersection Summary	
HCM 2010 Ctrl Delay	23.5
HCM 2010 LOS	C

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	861	95	445	84	228
v/c Ratio	0.98	0.07	0.92	0.24	0.46
Control Delay	48.4	4.4	50.3	10.9	7.8
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	48.4	4.4	50.3	10.9	7.8
Queue Length 50th (ft)	465	16	185	35	72
Queue Length 95th (ft)	#748	30	#375	m32	m61
Internal Link Dist (ft)		380	492	194	
Turn Bay Length (ft)					50
Base Capacity (vph)	879	1332	485	345	492
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.98	0.07	0.92	0.24	0.46

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 2010 Signalized Intersection Summary
16: Washington St & 48th Ave Node #7 Full Build out wKend lg Event Peak

02/27/2019

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	370	32	1113	711	10	569
Future Volume (veh/h)	370	32	1113	711	10	569
Number	3	18	2	12	1	6
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	402	35	1210	773	11	618
Adj No. of Lanes	1	1	1	1	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	479	427	1211	1029	214	1211
Arrive On Green	0.27	0.27	1.00	1.00	1.00	1.00
Sat Flow, veh/h	1774	1583	1863	1583	218	1863
Grp Volume(v), veh/h	402	35	1210	773	11	618
Grp Sat Flow(s),veh/h/ln	1774	1583	1863	1583	218	1863
Q Serve(g_s), s	21.4	1.7	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	21.4	1.7	0.0	0.0	0.0	0.0
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	479	427	1211	1029	214	1211
V/C Ratio(X)	0.84	0.08	1.00	0.75	0.05	0.51
Avail Cap(c_a), veh/h	479	427	1211	1029	214	1211
HCM Platoon Ratio	1.00	1.00	2.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	34.5	27.2	0.0	0.0	0.0	0.0
Incr Delay (d2), s/veh	16.1	0.4	25.7	5.1	0.5	1.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	12.6	0.8	8.6	1.4	0.0	0.5
LnGrp Delay(d),s/veh	50.5	27.6	25.7	5.1	0.5	1.5
LnGrp LOS	D	C	C	A	A	A
Approach Vol, veh/h	437		1983			629
Approach Delay, s/veh	48.7		17.7			1.5
Approach LOS	D		B			A

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2				6		8
Phs Duration (G+Y+Rc), s		69.0				69.0		31.0
Change Period (Y+Rc), s		4.0				4.0		4.0
Max Green Setting (Gmax), s		65.0				65.0		27.0
Max Q Clear Time (g_c+I1), s		2.0				2.0		23.4
Green Ext Time (p_c), s		41.1				41.1		0.5

Intersection Summary	
HCM 2010 Ctrl Delay	18.8
HCM 2010 LOS	B

Queues

16: Washington St & 48th Ave Node 7 Full Build Out wKend Lg Event Peak 02/27/2019

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	402	35	1210	773	11	618
v/c Ratio	0.84	0.08	1.00	0.65	0.15	0.51
Control Delay	48.5	11.9	35.3	3.4	8.0	5.8
Queue Delay	0.0	0.0	0.0	0.1	0.0	0.0
Total Delay	48.5	11.9	35.3	3.6	8.0	5.8
Queue Length 50th (ft)	236	0	708	17	1	88
Queue Length 95th (ft)	m#361	m9	#1065	29	m4	m111
Internal Link Dist (ft)	1187		520			1606
Turn Bay Length (ft)	150			150	150	
Base Capacity (vph)	477	452	1210	1189	74	1210
Starvation Cap Reductn	0	0	0	43	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.84	0.08	1.00	0.67	0.15	0.51

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 2010 Signalized Intersection Summary

19: Washington St & 51st Ave Node 9 Full Build Out WKend Lg Event peak 02/27/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	5	5	249	5	80	5	340	645	301	210	5
Future Volume (veh/h)	5	5	5	249	5	80	5	340	645	301	210	5
Number	7	4	14	3	8	18	5	2	12	1	6	16
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
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	5	5	5	271	5	87	5	370	701	327	228	5
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	296	188	188	373	19	332	823	404	765	439	1271	28
Arrive On Green	0.22	0.22	0.22	0.22	0.22	0.22	1.00	1.00	1.00	0.70	0.70	0.70
Sat Flow, veh/h	1299	856	856	1399	87	1510	1143	577	1093	525	1816	40
Grp Volume(v), veh/h	5	0	10	271	0	92	5	0	1071	327	0	233
Grp Sat Flow(s),veh/h/ln	1299	0	1712	1399	0	1596	1143	0	1670	525	0	1856
Q Serve(g_s), s	0.3	0.0	0.5	18.8	0.0	4.8	0.0	0.0	0.0	49.6	0.0	4.3
Cycle Q Clear(g_c), s	5.1	0.0	0.5	19.3	0.0	4.8	4.3	0.0	0.0	49.6	0.0	4.3
Prop In Lane	1.00		0.50	1.00		0.95	1.00		0.65	1.00		0.02
Lane Grp Cap(c), veh/h	296	0	377	373	0	351	823	0	1169	439	0	1299
V/C Ratio(X)	0.02	0.00	0.03	0.73	0.00	0.26	0.01	0.00	0.92	0.74	0.00	0.18
Avail Cap(c_a), veh/h	296	0	377	373	0	351	823	0	1169	439	0	1299
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.67	1.67	1.67	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	34.4	0.0	30.6	38.2	0.0	32.3	0.1	0.0	0.0	11.9	0.0	5.1
Incr Delay (d2), s/veh	0.1	0.0	0.1	11.7	0.0	1.8	0.0	0.0	12.6	10.9	0.0	0.3
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	0.2	8.5	0.0	2.3	0.0	0.0	4.1	8.4	0.0	2.3
LnGrp Delay(d),s/veh	34.5	0.0	30.7	49.8	0.0	34.1	0.1	0.0	12.6	22.8	0.0	5.4
LnGrp LOS	C		C	D		C	A		B	C		A
Approach Vol, veh/h		15			363			1076			560	
Approach Delay, s/veh		32.0			45.8			12.6			15.6	
Approach LOS		C			D			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		74.0		26.0		74.0		26.0
Change Period (Y+Rc), s		4.0		4.0		4.0		4.0
Max Green Setting (Gmax), s		70.0		22.0		70.0		22.0
Max Q Clear Time (g_c+I1), s		6.3		7.1		51.6		21.3
Green Ext Time (p_c), s		29.4		1.2		13.6		0.1

Intersection Summary	
HCM 2010 Ctrl Delay	19.6
HCM 2010 LOS	B

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	5	10	271	92	5	1071	327	233
v/c Ratio	0.02	0.03	0.88	0.22	0.01	0.86	2.10	0.18
Control Delay	31.0	23.7	57.3	12.7	7.4	16.5	532.8	5.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	31.0	23.7	57.3	12.7	7.4	16.5	532.8	5.5
Queue Length 50th (ft)	3	3	188	23	1	334	~234	44
Queue Length 95th (ft)	12	16	m#251	m37	m2	m341	#408	70
Internal Link Dist (ft)		443		1044		1606		1385
Turn Bay Length (ft)	150		150		150		150	
Base Capacity (vph)	283	382	307	419	793	1244	156	1300
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	0.03	0.88	0.22	0.01	0.86	2.10	0.18

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 2010 Signalized Intersection Summary
1: Washington St & 47th Ave Node 9 ~~AM~~ Full Build Out WKend Lg Event Peak 02/27/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	34	38	131	225	20	60	100	1699	852	25	823	23
Future Volume (veh/h)	34	38	131	225	20	60	100	1699	852	25	823	23
Number	7	4	14	3	8	18	5	2	12	1	6	16
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
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1863	1863	1863	1900
Adj Flow Rate, veh/h	37	41	142	245	22	65	109	1847	926	27	895	25
Adj No. of Lanes	1	1	0	2	1	0	1	2	1	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	367	70	242	555	79	234	453	2230	997	94	2216	62
Arrive On Green	0.06	0.19	0.19	0.06	0.19	0.19	0.63	0.63	0.63	1.00	1.00	1.00
Sat Flow, veh/h	1774	367	1271	3442	416	1230	605	3539	1583	99	3517	98
Grp Volume(v), veh/h	37	0	183	245	0	87	109	1847	926	27	450	470
Grp Sat Flow(s),veh/h/ln	1774	0	1638	1721	0	1646	605	1770	1583	99	1770	1845
Q Serve(g_s), s	1.6	0.0	10.2	5.7	0.0	4.5	8.1	40.4	52.1	22.6	0.0	0.0
Cycle Q Clear(g_c), s	1.6	0.0	10.2	5.7	0.0	4.5	8.1	40.4	52.1	63.0	0.0	0.0
Prop In Lane	1.00		0.78	1.00		0.75	1.00		1.00	1.00		0.05
Lane Grp Cap(c), veh/h	367	0	311	555	0	313	453	2230	997	94	1115	1163
V/C Ratio(X)	0.10	0.00	0.59	0.44	0.00	0.28	0.24	0.83	0.93	0.29	0.40	0.40
Avail Cap(c_a), veh/h	367	0	311	555	0	313	453	2230	997	94	1115	1163
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	28.8	0.0	36.9	30.9	0.0	34.6	8.3	14.3	16.5	22.1	0.0	0.0
Incr Delay (d2), s/veh	0.5	0.0	7.9	2.5	0.0	2.2	1.3	3.7	15.7	7.5	1.1	1.0
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	0.8	0.0	5.3	2.9	0.0	2.2	1.5	20.6	26.7	0.9	0.3	0.3
LnGrp Delay(d),s/veh	29.4	0.0	44.8	33.4	0.0	36.8	9.6	18.0	32.2	29.5	1.1	1.0
LnGrp LOS	C		D	C		D	A	B	C	C	A	A
Approach Vol, veh/h		220			332			2882			947	
Approach Delay, s/veh		42.2			34.3			22.3			1.9	
Approach LOS		D			C			C			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		67.0	10.0	23.0		67.0	10.0	23.0
Change Period (Y+Rc), s		4.0	4.0	4.0		4.0	4.0	4.0
Max Green Setting (Gmax), s		63.0	6.0	19.0		63.0	6.0	19.0
Max Q Clear Time (g_c+I1), s		54.1	7.7	12.2		65.0	3.6	6.5
Green Ext Time (p_c), s		8.7	0.0	0.9		0.0	0.0	1.3

Intersection Summary	
HCM 2010 Ctrl Delay	19.8
HCM 2010 LOS	B

Queues

1: Washington St & 47th Ave Node 9 Full Build Out WKend Lg Event Peak 02/27/2019

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	37	183	245	87	109	1847	926	27	920
v/c Ratio	0.11	0.43	0.47	0.24	0.35	0.83	0.70	0.37	0.41
Control Delay	26.8	13.6	30.9	14.7	12.8	18.5	4.0	20.8	7.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0
Total Delay	26.8	13.6	30.9	14.7	12.8	18.9	4.0	20.8	7.5
Queue Length 50th (ft)	17	22	61	12	30	438	8	8	144
Queue Length 95th (ft)	41	83	93	53	67	548	53	m14	m176
Internal Link Dist (ft)		349		685		355			520
Turn Bay Length (ft)	75		150		75			50	
Base Capacity (vph)	352	427	526	366	308	2229	1327	73	2222
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	1	0	80	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.11	0.43	0.47	0.24	0.35	0.86	0.70	0.37	0.41

Intersection Summary

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

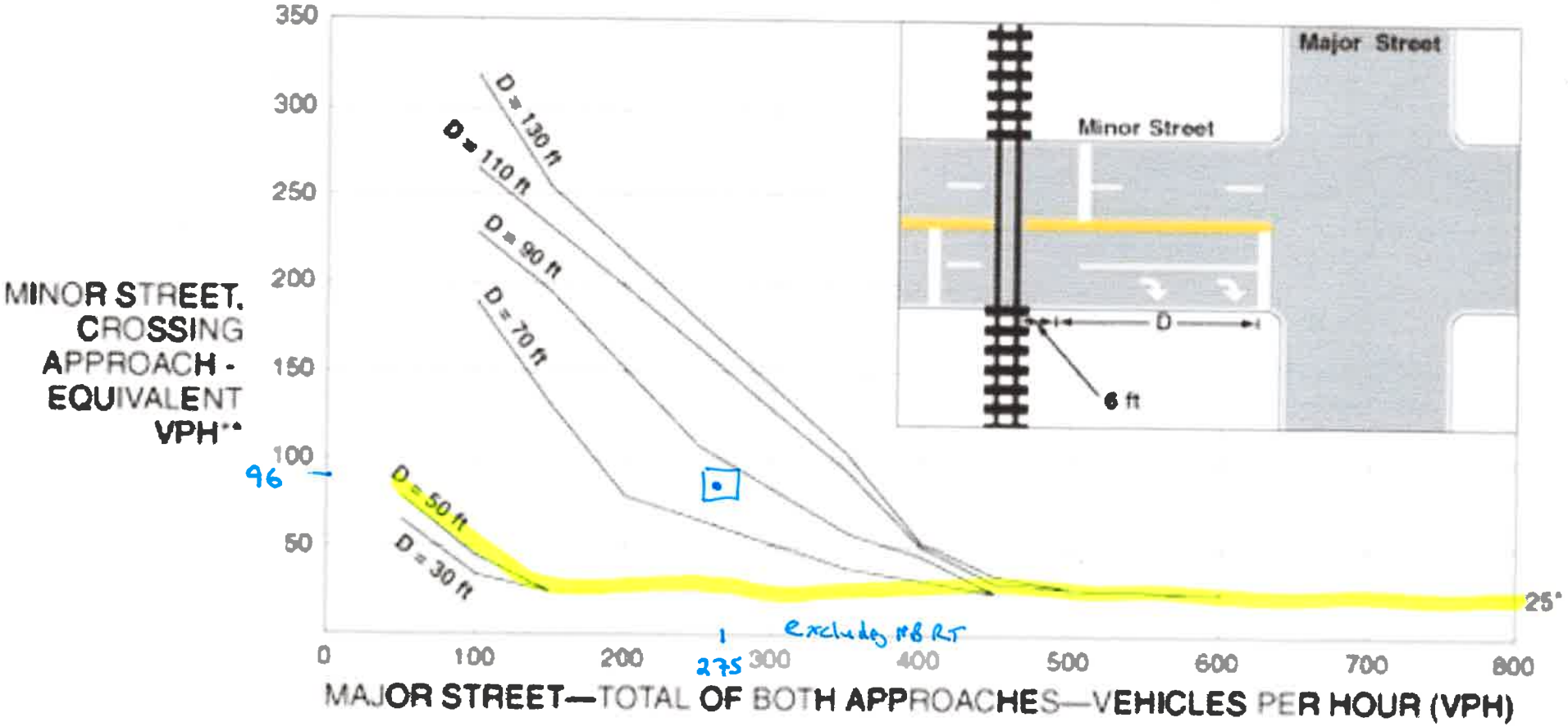
Appendix C: Signal Warrant Analysis

1- Franklin St/ Race Ct.

Warrant MET

Phase 1-2 Weekday PM Peak

Figure 4C-10. Warrant 9, Intersection Near a Grade Crossing (Two or More Approach Lanes at the Track Crossing)



* 25 vph applies as the lower threshold volume

** VPH after applying the adjustment factors in Tables 4C-2, 4C-3, and/or 4C-4, if appropriate

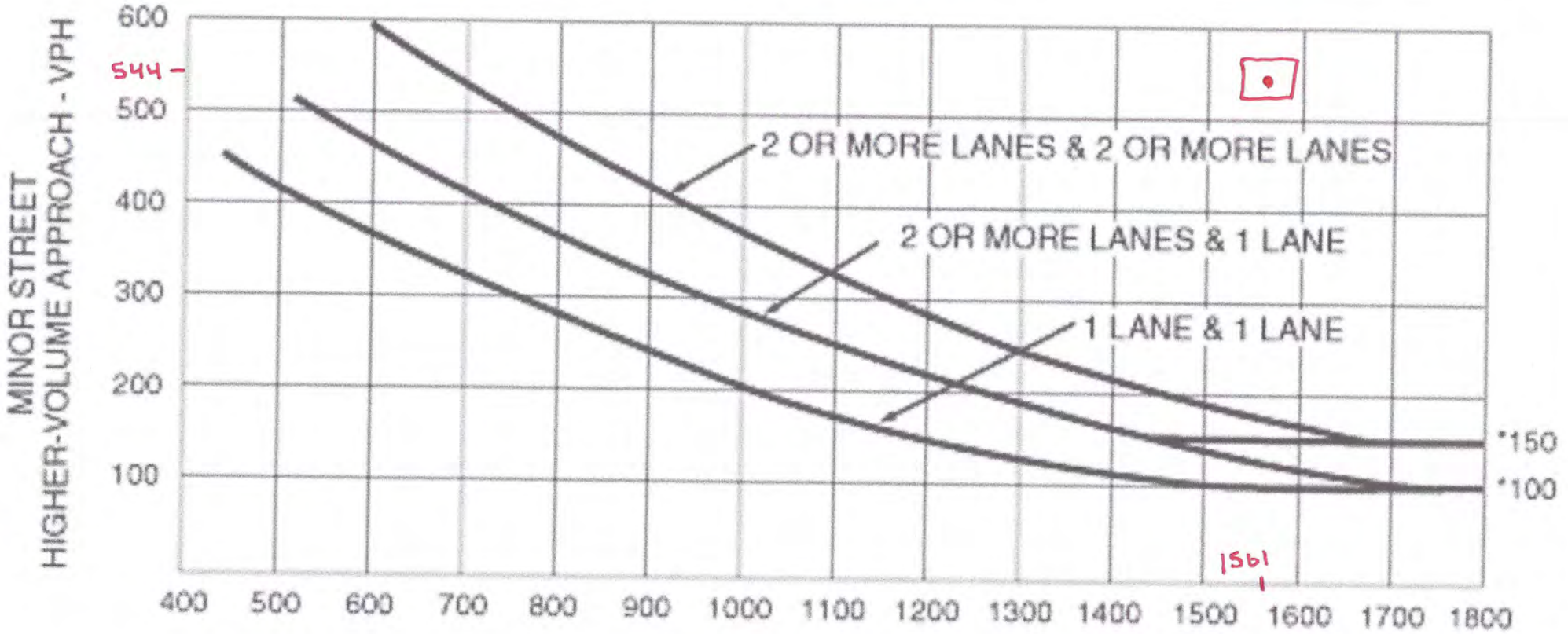
8/15/20
COV

Figure 4C-3. Warrant 3, Peak Hour

3- NWD / 51st Ave.

Warrant Met

Phase 1-2 weekend Large Event



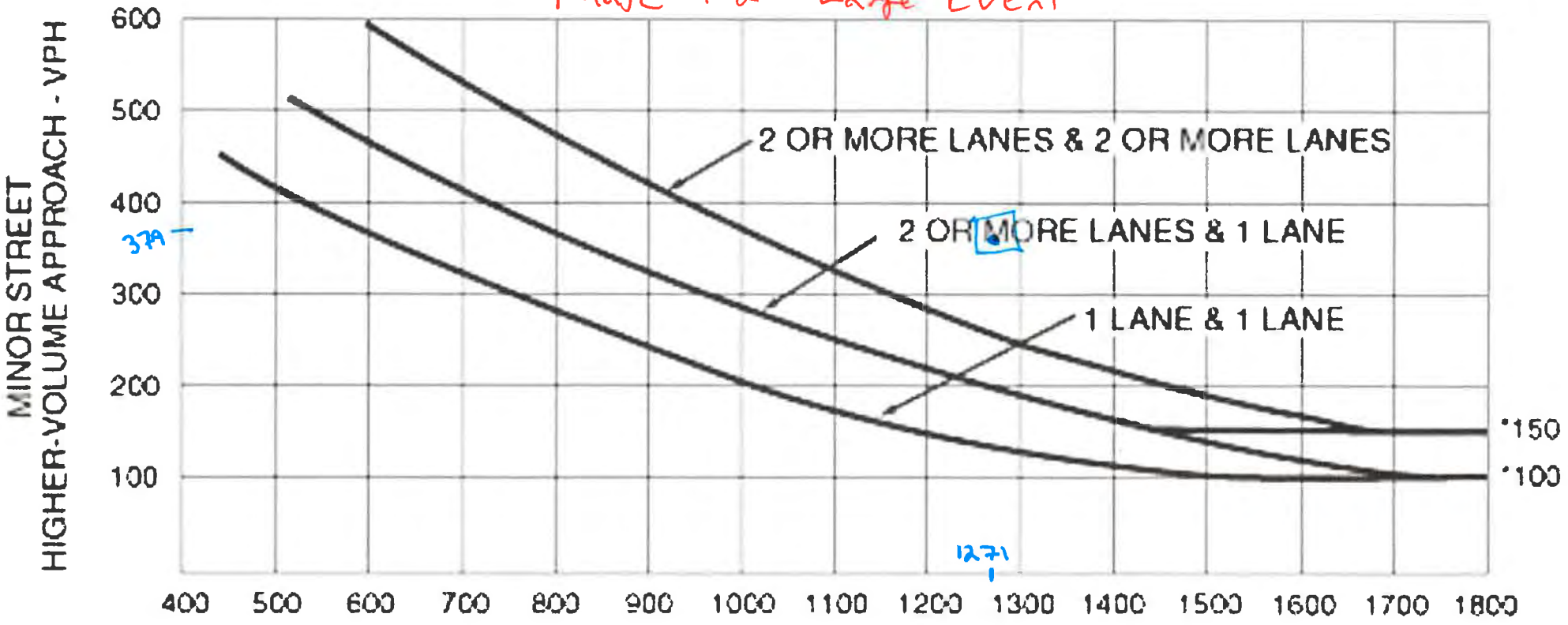
*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Figure 4C-3. Warrant 3, Peak Hour

4- NWD(N)/BCD

Warrant MET

Phase 1-2 Large Event



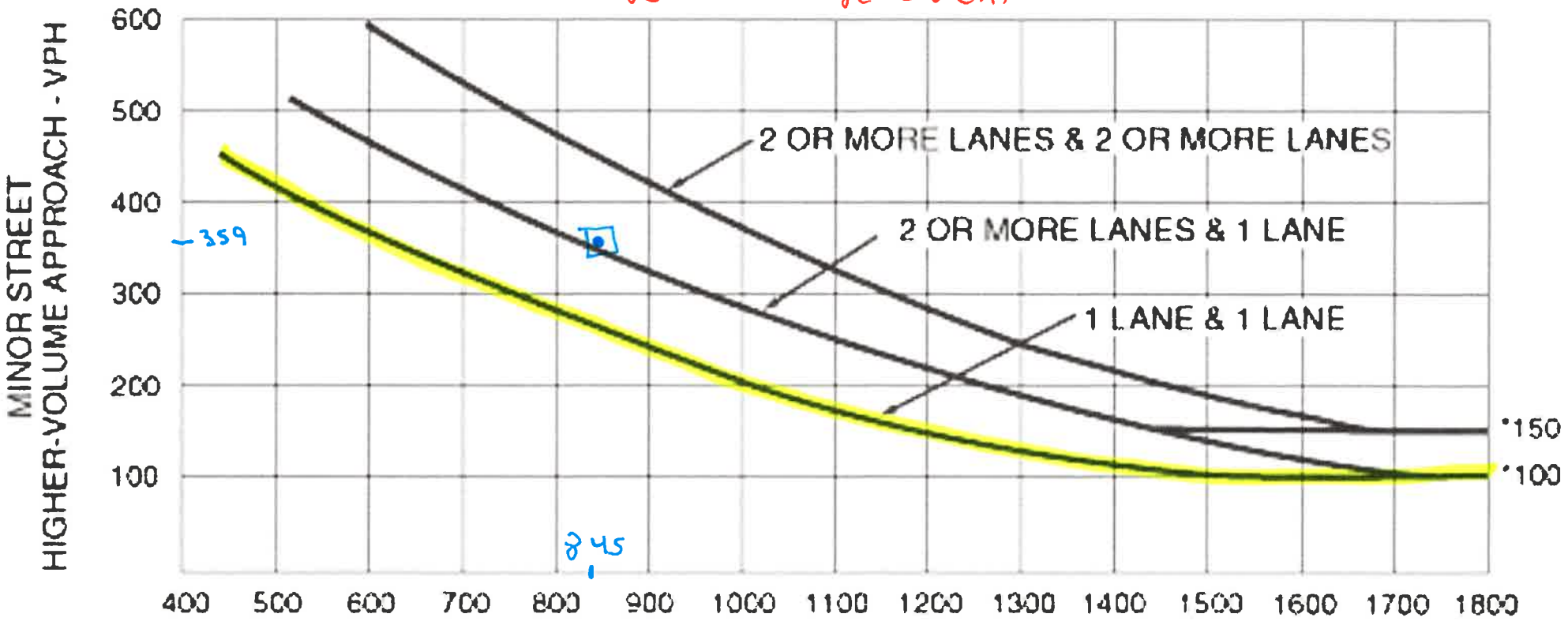
*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Figure 4C-3. Warrant 3, Peak Hour

Warrant MET

5- NWD(S)/BCD

Phase 1-2 Large Event



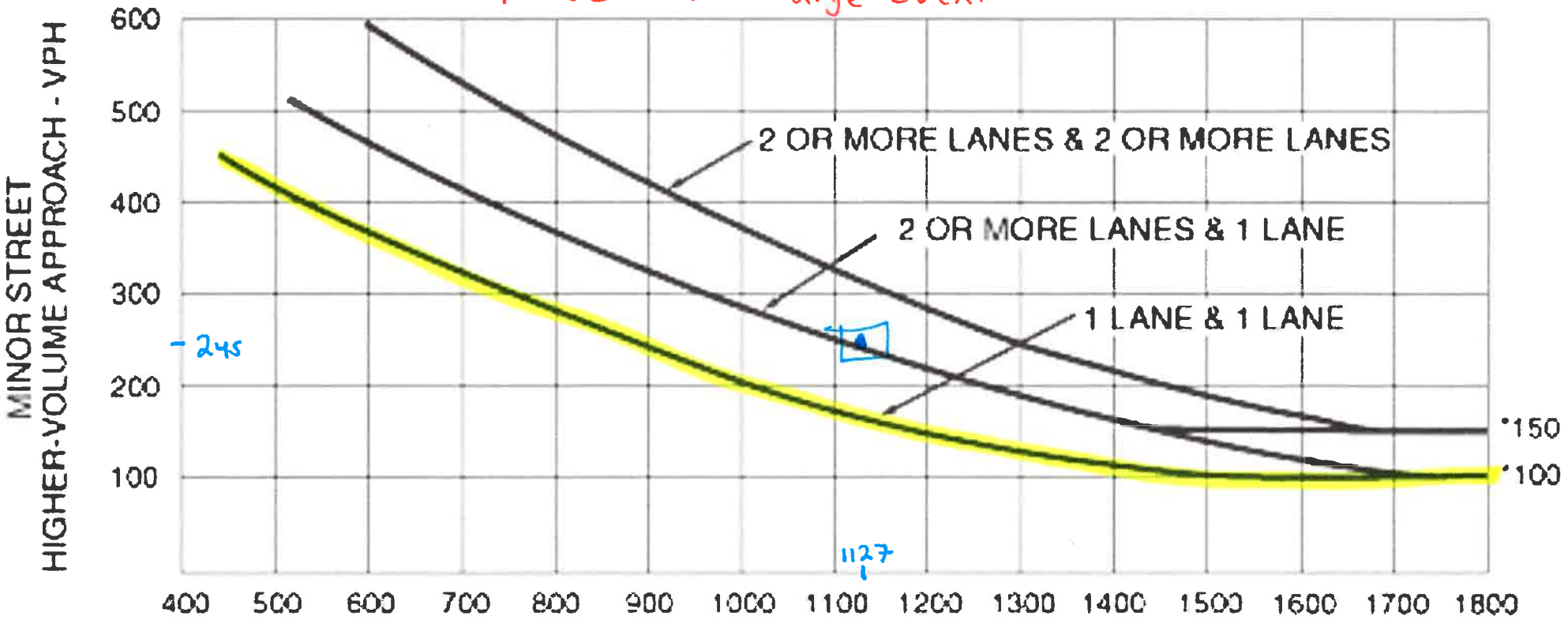
*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Figure 4C-3. Warrant 3, Peak Hour

6- NWD (5) / 46th Ave

warrant MET

Phase 1-2 Large Event



MAJOR STREET—TOTAL OF BOTH APPROACHES—
VEHICLES PER HOUR (VPH)

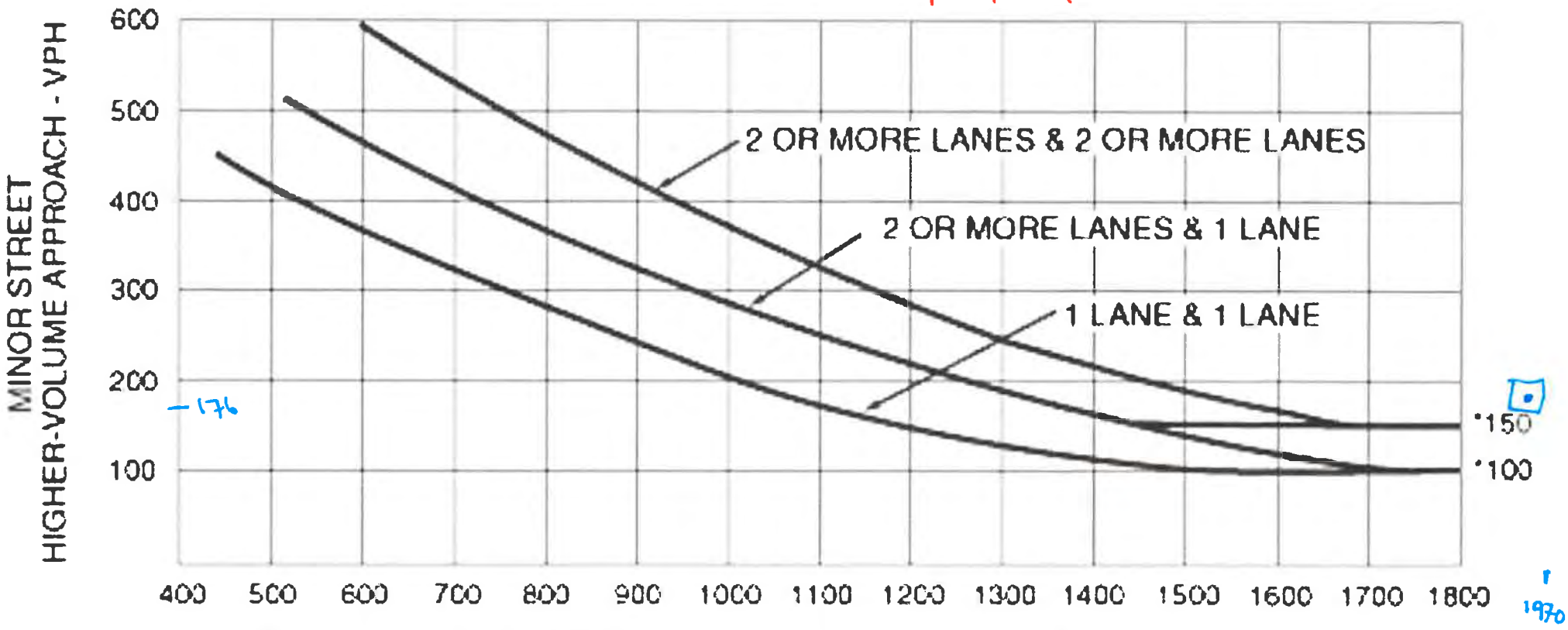
*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Figure 4C-3. Warrant 3, Peak Hour

Warrant MET

7- Washington / 48th Ave

Phase 1-2 Weekday PM Peak



MAJOR STREET—TOTAL OF BOTH APPROACHES—
VEHICLES PER HOUR (VPH)

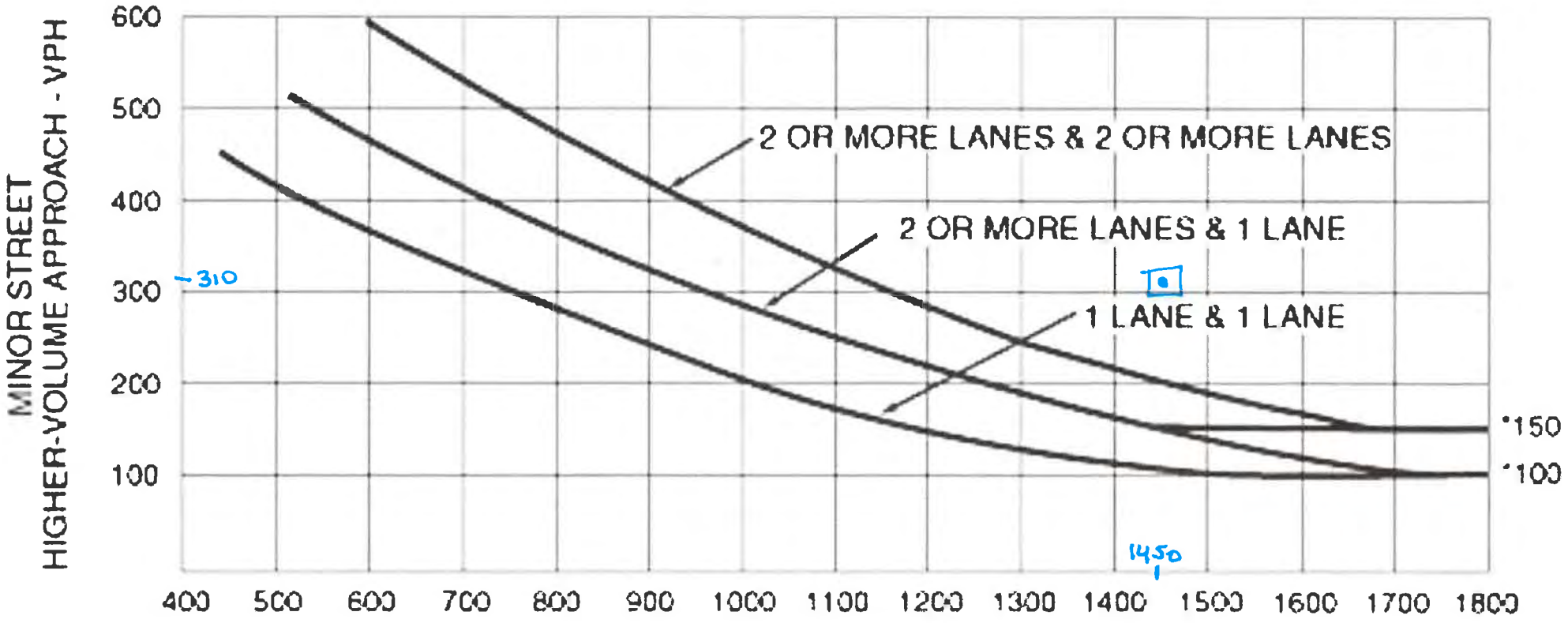
*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Figure 4C-3. Warrant 3, Peak Hour

8- Washington / 51st Ave

Warrant Met

Phase 1-2 weekday PM Peak



MAJOR STREET—TOTAL OF BOTH APPROACHES—
VEHICLES PER HOUR (VPH)

*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

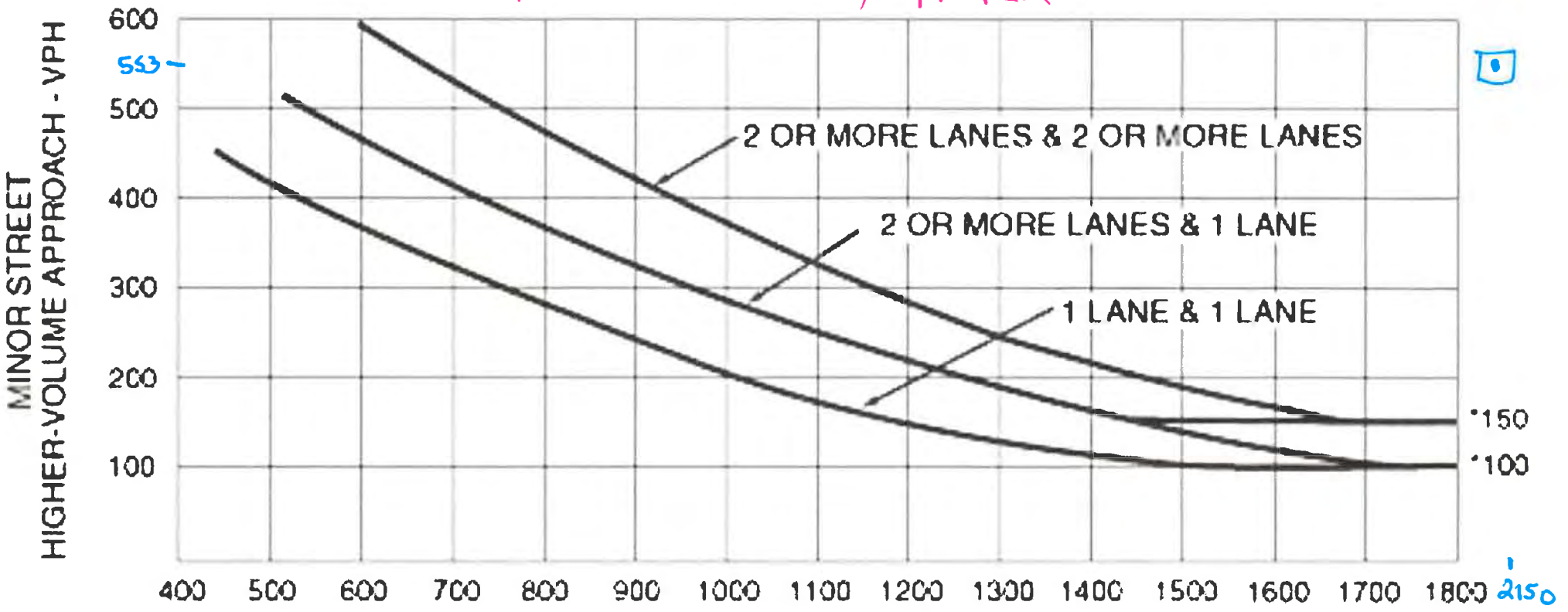
Figure 4C-3. Warrant 3, Peak Hour

warrant MET

9- 47th / Washington

existing traffic signal

Phase 1-2 weekday PM Peak



MAJOR STREET—TOTAL OF BOTH APPROACHES—
VEHICLES PER HOUR (VPH)

*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Appendix D: All Way Stop Control Analysis

AWSC- Normal weekday PM Peak
Phase 1-2

HCM 2010 AWSC

4: 48th Ave/BCD & NWD (N) 07/02/2019

Intersection	
Intersection Delay, s/veh	10.7
Intersection LOS	B

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	274	100	39	32	20	137
Future Vol, veh/h	274	100	39	32	20	137
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	298	109	42	35	22	149
Number of Lanes	1	1	1	0	1	1

Approach	EB	WB	SB
Opposing Approach	WB	EB	
Opposing Lanes	1	2	0
Conflicting Approach Left	SB		WB
Conflicting Lanes Left	2	0	1
Conflicting Approach Right		SB	EB
Conflicting Lanes Right	0	2	2
HCM Control Delay	11.8	8.6	9.1
HCM LOS	B	A	A

Lane	EBLn1	EBLn2	WBLn1	SBLn1	SBLn2
Vol Left, %	100%	0%	0%	100%	0%
Vol Thru, %	0%	100%	55%	0%	0%
Vol Right, %	0%	0%	45%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	274	100	71	20	137
LT Vol	274	0	0	20	0
Through Vol	0	100	39	0	0
RT Vol	0	0	32	0	137
Lane Flow Rate	298	109	77	22	149
Geometry Grp	7	7	4	7	7
Degree of Util (X)	0.458	0.152	0.107	0.038	0.209
Departure Headway (Hd)	5.54	5.038	4.98	6.265	5.056
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	649	710	716	571	709
Service Time	3.287	2.784	3.036	4.005	2.796
HCM Lane V/C Ratio	0.459	0.154	0.108	0.039	0.21
HCM Control Delay	12.9	8.7	8.6	9.3	9.1
HCM Lane LOS	B	A	A	A	A
HCM 95th-tile Q	2.4	0.5	0.4	0.1	0.8

Phase 1-2
Awsc - Weekday PM Peak

HCM 2010 AWSC
7: NWD/driveway & BCD

07/02/2019

Intersection	
Intersection Delay, s/veh	7.4
Intersection LOS	A

Movement	EBU	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Vol, veh/h	0	0	15	95	3	7	0	65	0	7	5	5
Future Vol, veh/h	0	0	15	95	3	7	0	65	0	7	5	5
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	16	103	3	8	0	71	0	8	5	5
Number of Lanes	0	0	1	0	0	1	0	0	1	0	0	1

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	7.1	7.4	7.8	7.2
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	90%	0%	30%	33%
Vol Thru, %	0%	14%	70%	33%
Vol Right, %	10%	86%	0%	33%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	72	110	10	15
LT Vol	65	0	3	5
Through Vol	0	15	7	5
RT Vol	7	95	0	5
Lane Flow Rate	78	120	11	16
Geometry Grp	1	1	1	1
Degree of Util (X)	0.093	0.119	0.013	0.019
Departure Headway (Hd)	4.296	3.588	4.25	4.089
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	833	990	834	870
Service Time	2.331	1.645	2.318	2.141
HCM Lane V/C Ratio	0.094	0.121	0.013	0.018
HCM Control Delay	7.8	7.1	7.4	7.2
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.3	0.4	0	0.1

Phase 1-2
AWSC - weekday PM Peak

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBR
Lane Configurations	
Traffic Vol, veh/h	5
Future Vol, veh/h	5
Peak Hour Factor	0.92
Heavy Vehicles, %	2
Mvmt Flow	5
Number of Lanes	0

Approach	
Opposing Approach	
Opposing Lanes	
Conflicting Approach Left	
Conflicting Lanes Left	
Conflicting Approach Right	
Conflicting Lanes Right	
HCM Control Delay	
HCM LOS	

AWSC - Large event weekend peak phase 1-2

HCM 2010 AWSC

4: 48th Ave/BCD & NWD (N) 07/02/2019

Intersection	
Intersection Delay, s/veh	111.5
Intersection LOS	F

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	330	161	103	677	174	205
Future Vol, veh/h	330	161	103	677	174	205
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	359	175	112	736	189	223
Number of Lanes	1	1	1	0	1	1

Approach	EB	WB	SB
Opposing Approach	WB	EB	
Opposing Lanes	1	2	0
Conflicting Approach Left	SB		WB
Conflicting Lanes Left	2	0	1
Conflicting Approach Right		SB	EB
Conflicting Lanes Right	0	2	2
HCM Control Delay	23.5	213.2	16.3
HCM LOS	C	F	C

Lane	EBLn1	EBLn2	WBLn1	SBLn1	SBLn2
Vol Left, %	100%	0%	0%	100%	0%
Vol Thru, %	0%	100%	13%	0%	0%
Vol Right, %	0%	0%	87%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	330	161	780	174	205
LT Vol	330	0	0	174	0
Through Vol	0	161	103	0	0
RT Vol	0	0	677	0	205
Lane Flow Rate	359	175	848	189	223
Geometry Grp	7	7	4	7	7
Degree of Util (X)	0.724	0.329	1.412	0.418	0.418
Departure Headway (Hd)	7.806	7.29	5.995	8.631	7.388
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	466	497	610	420	490
Service Time	5.506	4.99	4.025	6.331	5.088
HCM Lane V/C Ratio	0.77	0.352	1.39	0.45	0.455
HCM Control Delay	28.4	13.5	213.2	17.4	15.3
HCM Lane LOS	D	B	F	C	C
HCM 95th-tile Q	5.8	1.4	38.9	2	2

Awsc - large event weekend peak
phase 1-2

HCM 2010 AWSC

5: NWD/driveway & BCD

07/02/2019

Intersection	
Intersection Delay, s/veh	126.7
Intersection LOS	F

Movement	EBU	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Vol, veh/h	0	5	24	311	18	6	5	774	5	71	5	5
Future Vol, veh/h	0	5	24	311	18	6	5	774	5	71	5	5
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	5	26	338	20	7	5	841	5	77	5	5
Number of Lanes	0	0	1	0	0	1	0	0	1	0	0	1

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	16.3	10.9	176.9	9.7
HCM LOS	C	B	F	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	91%	1%	62%	33%
Vol Thru, %	1%	7%	21%	33%
Vol Right, %	8%	91%	17%	33%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	850	340	29	15
LT Vol	774	5	18	5
Through Vol	5	24	6	5
RT Vol	71	311	5	5
Lane Flow Rate	924	370	32	16
Geometry Grp	1	1	1	1
Degree of Util (X)	1.333	0.551	0.057	0.027
Departure Headway (Hd)	5.193	6.1	7.403	6.472
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	693	595	487	556
Service Time	3.268	4.1	5.403	4.472
HCM Lane V/C Ratio	1.333	0.622	0.066	0.029
HCM Control Delay	176.9	16.3	10.9	9.7
HCM Lane LOS	F	C	B	A
HCM 95th-tile Q	37.5	3.3	0.2	0.1

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBR
Lane Configurations	
Traffic Vol, veh/h	5
Future Vol, veh/h	5
Peak Hour Factor	0.92
Heavy Vehicles, %	2
Mvmt Flow	5
Number of Lanes	0

Approach	
Opposing Approach	
Opposing Lanes	
Conflicting Approach Left	
Conflicting Lanes Left	
Conflicting Approach Right	
Conflicting Lanes Right	
HCM Control Delay	
HCM LOS	

Intersection	
Int Delay, s/veh	1.4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↰	↑↑↱		↰	↱
Traffic Vol, veh/h	42	178	293	42	21	21
Future Vol, veh/h	42	178	293	42	21	21
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	50
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	46	193	318	46	23	23

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	364	0	-	0	626	182
Stage 1	-	-	-	-	341	-
Stage 2	-	-	-	-	285	-
Critical Hdwy	4.13	-	-	-	6.63	6.93
Critical Hdwy Stg 1	-	-	-	-	5.83	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.219	-	-	-	3.519	3.319
Pot Cap-1 Maneuver	1193	-	-	-	432	830
Stage 1	-	-	-	-	693	-
Stage 2	-	-	-	-	763	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1193	-	-	-	413	830
Mov Cap-2 Maneuver	-	-	-	-	413	-
Stage 1	-	-	-	-	693	-
Stage 2	-	-	-	-	730	-

Approach	EB	WB	SB
HCM Control Delay, s	1.6	0	11.9
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1193	-	-	-	413	830
HCM Lane V/C Ratio	0.038	-	-	-	0.055	0.028
HCM Control Delay (s)	8.1	0	-	-	14.2	9.5
HCM Lane LOS	A	A	-	-	B	A
HCM 95th %tile Q(veh)	0.1	-	-	-	0.2	0.1

Intersection	
Int Delay, s/veh	72.4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	571	114	144	298	102	143
Future Vol, veh/h	571	114	144	298	102	143
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	0	50
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	621	124	157	324	111	155

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	480	0	-	0	1683	318
Stage 1	-	-	-	-	318	-
Stage 2	-	-	-	-	1365	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1082	-	-	-	~ 104	723
Stage 1	-	-	-	-	738	-
Stage 2	-	-	-	-	237	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1082	-	-	-	~ 44	723
Mov Cap-2 Maneuver	-	-	-	-	~ 44	-
Stage 1	-	-	-	-	738	-
Stage 2	-	-	-	-	~ 101	-

Approach	EB	WB	SB
HCM Control Delay, s	10.6	0	$ 375.8
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1082	-	-	-	44	723
HCM Lane V/C Ratio	0.574	-	-	-	2.52	0.215
HCM Control Delay (s)	12.7	-	-	-	$ 886.7	11.3
HCM Lane LOS	B	-	-	-	F	B
HCM 95th %tile Q(veh)	3.8	-	-	-	11.9	0.8

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

project

subject

date

7/2/19

AWSC Warrant

ADT weekday/weekend high event