Seattle Department of Transportation

Magnolia Bridge Traffic Maintenance During Bridge Closure

November 10, 2017

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Seattle Department of Transportation

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Cover Photo Courtesy of the Port of Seattle

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EXECUTIVE SUMMARY

The Magnolia Bridge has been closed to traffic twice in the past 20 years due to natural disasters. The west end of the bridge was damaged by a landslide in 1997, requiring the Seattle Department of Transportation (SDOT) to repair and replace bridge columns and bracing, construct six additional supports, and construct a retaining wall north of the bridge to stabilize the bluff from further landslides. In 2001, the bridge was damaged by the Nisqually Earthquake (Nisqually Quake), which required SDOT to repair and replace column bracing at 27 of the 81 bridge supports. Following both events, the bridge was fully closed and traffic was rerouted to the two other points of access to the Magnolia neighborhood: W Dravus St and W Emerson St. According to those who experienced the closures, the alternative routes experienced extreme congestion due to the additional traffic volume with very long backups to reach the alternative routes.

SDOT has commissioned this study to plan ahead for the next potential emergency closure of the bridge. With luck, such a closure would only be required for a few days while the structure is evaluated. However, if the bridge is damaged beyond repair, traffic may have to be rerouted until a permanent replacement bridge is constructed, which could last several years. This study has two elements:

- **Emergency Bridge Closure Transportation Plan** to guide the movement of people and goods between the Magnolia neighborhood and the 15th Ave W corridor immediately following a catastrophic event if one or more of the bridges serving Magnolia are closed. Because the extent of the damage will only be known after such an event, the Emergency Transportation Plan provides for system redundancy, and some measures may not be needed.

- **Short-Term Transportation Plan** to improve the resilience of the transportation system in advance of a catastrophic or closure event, and help with recovery after an event. The plan focuses on the potential that the Magnolia Bridge—the most vulnerable of the bridges serving Magnolia—could be closed to all traffic until a permanent facility can be constructed. Measures recommended for implementation in advance of an event would also improve the capacity and operation of the existing system.

If the bridge never suffers a catastrophic closure, the measures evaluated and recommended herein could be used as temporary or longer-term detour routes during construction of a permanent facility. Some of the measures would also improve existing conditions if the bridge is never closed. The following summarizes the recommendations for the Emergency and Short-Term Plans.

Emergency Bridge Closure Transportation Plan

A two-page handout has been developed to guide SDOT staff and community volunteers immediately following a catastrophic event, presented as Exhibit 1. In addition, there are several elements recommended in the Short-Term Transportation Plan to implement in advance of an event that would improve the resilience and recovery following a catastrophe.

MAGNOLIA NEIGHBORHOOD – EMERGENCY BRIDGE CLOSURE TRANSPORTATION PLAN

PURPOSE

This plan will guide the movement of people and goods between the Magnolia neighborhood and 15th Avenue W corridor following a catastrophic event damaging one or all the bridges serving Magnolia. ***Safety priorities in order of importance are life safety, incident stabilization, reuniting families, and property/environmental conservation****. This plan will be implemented by the Seattle Department of Transportation (SDOT) with actions in order of priority based on the magnitude of the event. SDOT is prepared to partner with the Seattle Fire Department, Port of Seattle, BNSF, King County Metro and Seattle Public Schools to implement these actions as deemed necessary.*

GOALS/PRIORITY	1 IMMEDIATE	2 IMMEDIATE	3A ONCE STABILIZED	3B ONCE STABILIZED	4 ONCE STABILIZED
	ASSESS AND COMMUNICATE VIABLE ROUTES - • **Assess infrastructure damage** • **Identify safe travel routes** • **Communicate available routes to others.**	**PROVIDE REDUNDANT EMERGENCY VEHICLE ACCESS ROUTES – Provide temporary surface route(s) across BNSF railroad tracks for emergency vehicle access.**	**PROVIDE SYSTEM REDUNDANCY FOR MAGNOLIA RESIDENTS - Identify route options for residents to return to Magnolia by vehicle, bicycle and/or by foot.**	**PROVIDE TRANSPORTATION HUBS AND TRANSIT CONNECTIONS - Identify transportation hub locations with connections to public transit, school buses and/or ad-hoc shuttle services.**	**PROVIDE FOR GOODS DELIVERY - Provide route(s) for critical services including delivery of food, water, and medicine.**
ACTIONS	• Seattle Fire Department to perform windshield survey to assess damage (See Figure A on back). • SDOT dispatches personnel to inspect the three bridge connections to the Magnolia neighborhood. • Close affected bridge(s) and implement detour route(s) accordingly (see Figure A). • Use communication protocols (see Table A on back) to relay roadway status (e.g., downed power lines or broken water mains). Key groups include: o Neighborhood emergency preparedness team (feedback about route blockages). o Port of Seattle (available routes to/from Terminal 91) o Seattle Public Schools o BNSF o Elliott Bay Marina • Use existing dynamic messaging signs on 15th Ave W (near W Garfield St and NW 61st St) to inform the public about traffic conditions and detour routes.	• Work with BNSF to provide one or more surface crossings of tracks for emergency use only. The following potential surface access routes for emergency vehicles could be created by laying temporary gravel or mats over the tracks, and are shown on Figure A: A. Galer Street south of Magnolia Bridge (open the sliding gates). B. Through National Guard Armory N/O Magnolia Bridge (break through the BNSF fence). C. Via Armory Way (break through the BNSF fence). D. N/O Balmer Yard between Emerson Street and Gilman Blvd. E. W Ewing Street from east of 15th Ave W and under Ballard Bridge.	• If all three bridges are damaged, direct residents returning by vehicle to park near Interbay Golf Course or Interbay Stadium and walk to an emergency transportation hubs (described at right). • Guide people to one or more foot access routes across the tracks (see Figure B). • Clear surface rubble to evacuate Elliott Bay Marina through Terminal 91. • Implement ad hoc ferry passengers from downtown Seattle to Elliott Bay Marina and/or from Lake Union/Ship Canal to Fisherman's Terminal. • If W Dravus Street is a functional access route to Magnolia, have a temporary flagger posted at the W Dravus Street / 15th Avenue W when needed to allow double left-turns from northbound ramps (unless intersection has already been upgraded so that signal provides the dual left). • Reroute traffic on 15th Avenue W southbound off-ramp to W Bertona Street (instead of W Dravus Street).	• Open one or more transportation/communication hubs east and west of the railroad tracks at locations coordinated with MiQA volunteers. Potential locations are shown on Figure B: <u>Interbay (East of Tracks)</u> 1. Interbay Stadium & Playfield 2. Interbay Golf Course 3. Fisherman's Terminal West Wall <u>Magnolia (West of Tracks)</u> 4. Magnolia Community Center / Catherine Blaine K-8 School 5. Magnolia Manor Park 6. Magnolia Metropolitan Market 7. Our Lady of Fatima Church • Communicate with King County Metro Transit and Seattle Public Schools about status of hub locations and routes available on 15th Ave W corridor. • If needed, have volunteers shuttle people to and from the pick-up/drop-off hubs west of the bridges. • Encourage residents to walk and bicycle to hubs.	• Use one of the established emergency response routes (described to left) for other critical services including food, medicine, and water. • Coordinate with key Magnolia retailers (e.g. Albertson's, Metropolitan Market, Bartell Drugs) and service providers (e.g. medical and veterinary care providers) to ensure delivery of needed goods and supplies. • If needed, use portable dynamic message signs to direct traffic to and from Queen Anne to use routes other than W Dravus St.

Table A. Emergency Contacts & Websites

SDOT Emergency Management and Security
Lawrence Eichhorn
Lawrence.Eichhorn@Seattle.Gov
206-684-7574

Office of Emergency Management (OEM)
Seattle OEM Staff Duty Officer
Seattle-EOC@Seattle.Gov
206-233-5147

BNSF

Emergency contact number:
1-800-832-5452

Ham Radio Protocols
Mark Sheppard
Auxiliary Communications Services Coordinator
Mark.Sheppard@Seattle.Gov
206-684-5027

Port of Seattle Security & Preparedness
Randy Hansen
Sr. Mgr. Emergency Preparedness
(206) 787-7871 Office
(206) 519-7454 Mobile

Websites for Traffic Conditions
http://alert.seattle.gov
https://www.google.com/maps

Figure A – Potential Surface Routes for Emergency Responders

X = Railroad crossing that will need temporary surface to allow a vehicle to cross.

Figure B – Potential Transportation Hubs and Foot Routes

= Communication and Transportation Hub
= Fire Station
= Potential Ferry Landing
= Potential foot access route
= Transit stops on the 15th Ave W corridor

November 10, 2017

Short-Term Transportation Plan Recommendations

The Short-Term Transportation Plan provides a menu of projects that would improve operations if a portion or all of the Magnolia Bridge is closed for an extended period (e.g., for a temporary construction detour route or following a catastrophic event). Some of those projects could be implemented now so that they are in place prior to a potential closure event. This Short-Term Plan focused on evaluating low cost solutions that would increase street and intersection capacity to provide safe and reliable access to/from the Magnolia and Interbay neighborhoods. The recommended improvements are described below. Exhibit 2 summarizes the recommended short-term measures and the condition under which each should be enacted.

A. Advance Planning and Implementation:

The following are improvements that could be implemented now to improve resilience of the transportation system if the Magnolia Bridge must be suddenly closed to traffic. These advance preparation items are intended to reduce the time it would take to implement changes. The Advance Planning element would develop shelf-ready plans that can be implemented when needed and includes projects that should be constructed now (Advance Implementation) so that they are already in place if the bridge needs to be closed.

Advance Implementation

1. **Upgrade Signal Equipment at W Dravus St/15th Ave W Ramp Intersections.** Upgrade the existing traffic signal equipment at the W Dravus St/15th Ave W ramp intersections, which will require a new controller (and cabinet), signal detections, and connection to the 15th Ave W communications spine.
2. **Upgrade W Dravus St/20th Ave W Intersection.** SDOT plans to create a two-way protected bicycle lane (PBL) along the east side of 20th Ave W that would cross through this intersection. As part of the upgrades for the PBL, SDOT will upgrade the signal controller and add detection to provide a protected southbound left turn movement (to separate that movement from bicycle crossings). In addition to these changes, SDOT should add detection and left turn signals for eastbound and westbound traffic at W Dravus St/20th Ave W and provide fully-actuated control. If the Magnolia Bridge is closed, the additional improvements would allow SDOT to implement either a protected westbound left turn movement or split east/west phasing depending on the traffic flow needs. The with-closure recommendations are described in Section B below.

Advance Planning

3. **Prepare detour plans** that correspond to potential events that may cause the Magnolia Bridge to close (e.g., weight limit only-no trucks, partial bridge closure, and full bridge closure). The detour plan prepared for the 2001 Nisqually Quake is appropriate for the full closure condition. The prior plan is shown in Appendix C.
4. **Design lane configuration changes at W Dravus St/15th Ave W Northbound Ramp.** Prepare design plan to change the northbound off-ramp to allow a dual left-turn movement, and include provisions for large trucks to make this turn. This operation may be possible using the signals to clear the queue, and by adding striping to indicate the turning paths of vehicles. Signage could be added to inform general-purpose drivers that trucks may utilize both lanes to make left turns. Engineering for striping and signage changes should be completed in advance of a closure event so that they can be

quickly implemented when and if needed. (See Section 5.1.1 and Appendix B for detailed analysis, and signal phasing and signage recommendations.)

5. **Prepare alternative signal timing protocols** for the 15th Ave W corridor's traffic responsive signal system, the W Dravus St/15th Ave W ramp intersections (see #4 above), and W Dravus St/20th Ave W intersection that could be quickly implemented if the Magnolia Bridge is closed to traffic. The changes on 15th Ave W will need to account for signal phasing changes at the W Garfield St intersection (e.g., no turns to or from W Garfield St) and to account for increased traffic flow on the segment between W Dravus St and W Garfield St due to a bridge closure.
6. Work with Port of Seattle to i**dentify an alternative truck loading area for the Anthony's Seafood building** that would replace the existing loading area accessed from the bridge.
7. **Work with the BNSF Railway to pre-stage gravel and/or mats in the Interbay neighborhood** to quickly provide emergency access across the railroad tracks. Potential emergency surface crossings from south to north on 15th Ave W could include W Galer St, north of the Magnolia Bridge, along the National Guard Armory, at the north end of Balmer Yard, and at W Ewing St.
8. **Study the feasibility of adding a new signalized intersection at 15th Ave W/ W Bertona St.** This will require breaking through the median and restriping 15th Ave W to provide a northbound left turn lane. Study should include a survey of the grade change between the northbound and southbound lanes and a Drainage Report.
9. **Monitor the W Emerson St/Gilman Ave W intersection** to determine if the intersection warrants a traffic signal after implementation of the protected bicycle lanes.

B. Implement with Closure Event

The following measures would be implemented immediately following an unexpected closure of the bridge due to an event, or in advance of a planned closure such as a construction detour.

1. **Sign detour routes.** Implement an appropriate detour plan that corresponds to the type of closure (e.g., weight restriction, partial closure, full closure).
2. **Reroute transit.** Work with King County Metro to implement alternative bus routing using the designated snow route or alternative route.
3. **Implement the "with closure" traffic signal timing plans** for the 15th Ave W corridor and W Dravus St/20th Ave W intersection. The initial 'with closure' phasing plan at the W Dravus St/20th Ave W intersection should have a split eastbound and westbound phasing, which requires no changes to the existing lane configuration on W Dravus St. Monitor the conditions at this intersection to determine if a protected westbound/eastbound left turn phase would improve operations, and if so, modify the existing lane configuration to stripe designated westbound and eastbound left turn lanes.
4. **Make capacity improvements at the W Dravus St/15th Ave W ramp intersections.** This includes implementing the dual left turn movement on the northbound ramp (see #4 above), and prohibiting general-purpose through traffic from using the southbound off-ramp. Southbound traffic would be detoured to W Bertona St and 17th Ave W, with the exception of transit vehicles that would have access to the Rapid Ride bus stop on 15th Ave W south of W Dravus St. Also implement additional signal phasing changes to extend the eastbound clearance phase to clear queued traffic from the W Dravus St bridge in order to accommodate the dual left turn from the northbound off-ramp.

5. **Provide alternate access to Elliott Bay Marina.** Work with the Port of Seattle to create a temporary access to Elliott Bay Marina through Terminal 91.
6. **Provide alternate loading for Anthony's Seafood building.** Work with the Port to move truck loading from the bridge level to surface level.
7. **Change the stop sign location at the W Hayes St/Thorndyke Ave W intersection.** A single stop sign currently controls traffic on southbound Thorndyke Ave W, and the other movements (northbound Thorndyke and eastbound W Hayes Street) flow free. With a full closure of the Magnolia Bridge, north-south traffic should flow free and W Hayes Street should be stop-controlled.

C. Within Six Months of Closure Event

If the Magnolia Bridge is expected to remain closed until a replacement facility is constructed, and/or if additional streets and bridges are damaged in a catastrophic event, then additional improvements may be desired. The level of improvement will depend on the expected duration of closure and state of the system. Potential additional improvements include:

1. **Signalize the W Emerson St/Gilman Ave W intersection** if increased traffic volumes with a bridge closure warrant it. With a signal, the west leg of the intersection (W Thurman St) should be converted to one-way westbound.
2. If feasible per Item A7 and deemed necessary to reduce congestion at the W Dravus St/15th Ave W interchange or W Emerson St/W Nickerson St intersection, **install a new signal at the 15th Ave W/W Bertona St intersection.**
3. **Prioritize transit and/or high-occupancy vehicles (HOV) and encourage bicycle use.** If a catastrophic event affects roadway capacity elsewhere in the Elliott Avenue corridor or the City, then strategies that substantially reduce traffic may be needed. These could include limiting single-occupant vehicle travel and incentivizing carpooling, transit bicycle and walking modes of travel by establishing temporary park-and-ride facilities (e.g., near Interbay Stadium or Fisherman's Terminal), and converting general-purpose travel lanes to transit/HOV only. Transit priority could be considered at the potential signalized intersection at 15th Ave W/W Bertona Street (restrict northbound left turns to transit only), and the curb lane on eastbound on W Dravus St where a queue jump to the southbound 15th Ave W on-ramp could be provided with signal priority. If needed, the existing transit lane on the 15th Ave W/Elliott Ave W corridor could be converted to allow for high carpool occupancies (e.g., 3 or 4+ persons per vehicle). Bicycle improvements could include making sure that existing bike trails are cleared of obstructions, and increasing bicycle parking at key transit stops.

Exhibit 2. Magnolia Bridge Short-Term Closure Plan

Measure	Implement Now	Advance Planning	Weight Restriction on Magnolia Bridge (No Large Trucks)	Upper Magnolia Bridge is Closed (west of 23rd Ave W)	Full Bridge Closure – Short Duration	Full Closure - Long Duration
A. Advance Planning and Implementation						
1. Upgrade signal equipment at W Dravus St/ 15th Ave W intersections	√					
2. Upgrade W Dravus St/ 20th Ave W intersection	√					
3. Prepare detour plans		√				
4. Design lane configuration changes at W Dravus St/15th Ave W northbound ramp.		√				
5. Prepare alternative signal timing plans for 15th Ave W corridor, W Dravus St/15th Ave W ramp intersections, and W Dravus St/20th Ave W intersection		√				
6. Identify alternative loading for Anthony's Seafood building		√				
7. Work with BNSF to pre-stage materials for temporary surface crossing		√				
8. Study feasibility of new signal at W Bertona St / 15th Ave W intersection		√				
9. Monitor W Emerson St/Gilman Ave W intersection for traffic signal warrants		√				
B. Implement With Magnolia Bridge Closure						
1. Sign detour plans			√	√	√	√
2. Reroute transit			√	√	√	√
3. Implement with-closure traffic signal timing plans for the 15th Ave W corridor, and W Dravus St/20th Ave W intersection.				√	√	√
4. Make capacity improvements (southbound detour, dual northbound left turn, and signal phasing changes) at the W Dravus St/15th Ave W intersections.				√	√	√
5. Create a temporary access to Elliott Bay Marina			√		√	√
6. Provide alternate loading for Anthony's Seafood building.			√		√	√

Measure	Implement Now	Advance Planning	Weight Restriction on Magnolia Bridge (No Large Trucks)	Upper Magnolia Bridge is Closed (west of 23rd Ave W)	Full Bridge Closure – Short Duration	Full Closure - Long Duration
7. Change location of stop signs at W Hayes St/Thorndyke Ave W intersection				√	√	√
C. Implement Within 6 Months of Closure						
1. Signalize W Emerson St/Gilman Ave W intersection if warranted					√	√
2. Install new signal at W Bertona St/ 15th Ave W intersection if feasible						√
3. Prioritize transit, HOV and bicycle use.					√	√

1. Introduction

1.1 Prior Studies and Alternatives

The original Magnolia Bridge was constructed in 1929 and has been modified, strengthened, and repaired several times. Structural improvements were made following the 1997 landslide and 2001 Nisqually Quake. Even so, the bridge is old and susceptible to catastrophic failure in an earthquake or landslide.

According to SDOT[1], the process to identify the best Magnolia Bridge replacement alternative began in October 2002. SDOT selected a design team to conduct a Type, Size and Location (TS&L) Study as well as perform environment analysis. This prior process included the following key elements:

- The project team brainstormed a list of 25 alignment possibilities.
- The project team applied "fatal flaw" criteria, eliminating 12 alignments and consolidating the remaining 13 into nine "surviving alignments."
- The project team then developed detailed criteria to evaluate the remaining nine alignments. Evaluation criteria were split into four general categories: Environmental, Traffic, Urban Design, and Cost. Four alignments scored well based on the team's criteria evaluation (Alternatives A, B, D, and H).
- After further technical review, Mayor Nickels requested on April 14, 2003, that SDOT eliminate Alternative B from further consideration, citing environmental, permitting, and legal obstacles. In March 2004, SDOT removed Alternative H from consideration because review of traffic operations found that the option would be unable to handle the future forecasted traffic demand.
- Because SDOT wanted to evaluate at least three alternatives, the agency added a version of Alternative C, the next best alternative evaluated during earlier steps in the process, to Alternative A and D for further study. Alternative C provided a unique surface/structure combination significantly different from Alternatives A and D.
- In Spring 2005, SDOT also decided to consider the Rehabilitation – or Rehab – Alternative to ensure that a robust range of options would be evaluated. The Rehab Alternative involved bringing the bridge up to current load and design standards using the existing bridge structure to the extent possible.
- In March 2006, in consultation with the Mayor's office, Alternative A was selected as the preferred alternative, if funding could be obtained, for further development and eventual construction. In November 2006, SDOT selected a bridge structure type following several public outreach events and consultations with the project's Design Advisory Group and the Seattle Design Commission.

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1 SDOT Website: http://www.seattle.gov/transportation/magbridgehistory.htm, accessed April 27, 2017.

- An Environmental Assessment for the project was completed in May 2015. Funding was never obtained and the project was put on hold.
- In 2015, SDOT secured funding to evaluate new alternatives to replace the Magnolia Bridge through the Move Seattle Levy. In September 2017, SDOT engaged a consultant team that will evaluate new alternatives for the Magnolia Bridge. The study will focus on reduced cost alternatives that may have a higher chance of being funded while providing for the functional needs of the corridor.
- In Spring 2017, SDOT embarked on this "Maintenance of Traffic During Bridge Closure" study (the results of which are presented herein) to identify short-term solutions that could be implemented until a new facility is constructed. Many of the measures could also improve conditions during construction of the permanent facility.
- Currently, SDOT conducts frequent inspections and maintenance on the bridge to ensure it is safe for travel.

1.2 Purpose and Goals of Emergency Closure and Short-Term Closure Transportation Plans

Until an alternative facility is constructed, there is a chance that the existing Magnolia Bridge could be closed to traffic, either for a short time or permanently, and traffic would be detoured to alternative routes such as W Dravus St and W Emerson St. SDOT could also limit the weight of loads allowed on the bridge, requiring trucks to find alternative routes. The goals and objectives guiding the short-term plans are as follows:

1.2.1. Emergency Closure Transportation Plan

Purpose: The Emergency Closure Transportation Plan will guide the movement of people and goods between the Magnolia neighborhood and 15th Ave W corridor immediately following a catastrophic event if one or more of the bridges serving Magnolia are closed. Safety priorities in order of importance are life safety, incident stabilization, reuniting families, and property/environmental conservation. The plan will be implemented by SDOT, but other City departments including the Office of Emergency Management (OEM), Seattle Public Utilities, and emergency responders are also likely to be engaged in post-event operations.

Goals:

- Assess infrastructure damage and communicate viable routes;
- Provide redundant emergency vehicle access routes to/from Magnolia;
- Provide system redundancy for residents to return to Magnolia by vehicle, or if necessary by foot, if one or more bridges is unusable.
- Provide transportation hubs and transit connections east and west of the railroad tracks where students at local schools, employees of local businesses, or residents could rendezvous after an emergency and be better served by public transit and/or ad hoc transportation services.
- Provide route(s) for critical services including delivery of food, water and medicine.

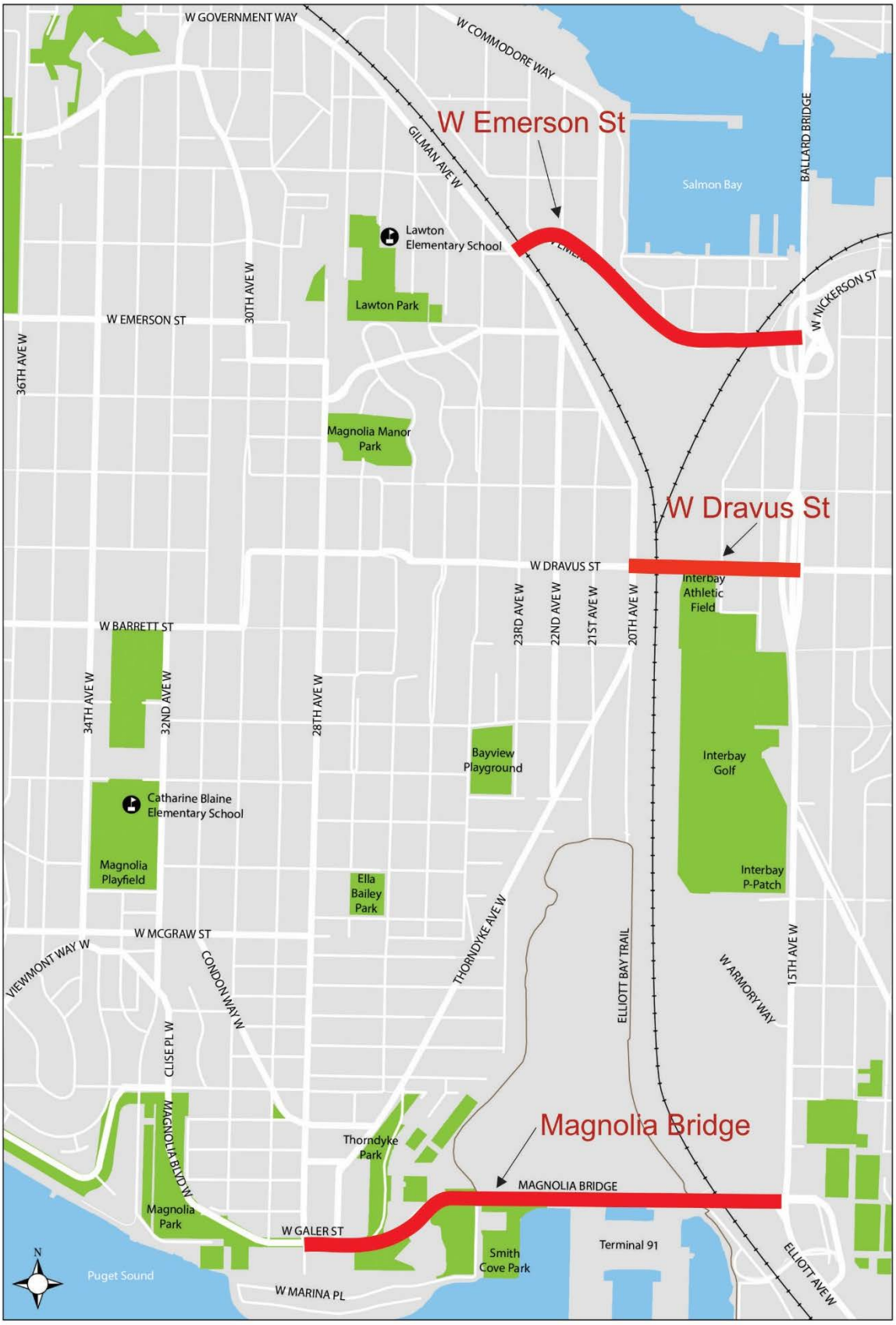
1.2.2. Short-Term Closure Transportation Plan

Purpose: The Short-Term Transportation Plan provides a menu of improvements that can be implemented if the Magnolia Bridge is closed for an extended period (e.g., following a catastrophic event, or as a detour route while an alternative to the Magnolia Bridge is constructed). This Short-Term Plan should prioritize safe and reliable access to/from the Magnolia and Interbay neighborhoods with low-cost solutions such as increasing street and intersection capacity. The goals of the Short-Term Plan solutions are:

Goals:

- Provide at least one access route to all affected properties including the Elliott Bay Marina.
- Prioritize the movement of people instead of vehicles, with an emphasis on transit/carpool improvements and pedestrian/bicycle connections to frequent transit routes within the Magnolia neighborhood and the 15th Ave W corridor.
- Retain freight access for the Port of Seattle, industrial properties in Interbay, and businesses in Magnolia Village.
- Optimize vehicular traffic flow with low-cost solutions that focus on minimizing bottlenecks to alternate routes that connect to 15th Ave W.

Figure 1. Study Area



2. Existing Conditions

This section presents information about the existing transportation system and arterial connections serving the Magnolia neighborhood. It presents information about roadway configurations, existing and historic traffic volumes, emergency access, transit service, pedestrian and bicycle facilities, freight needs, and parking.

2.1 Connections to Magnolia

There are three major routes that connect the Magnolia and Interbay neighborhoods to 15th Ave W: the Magnolia Bridge, W Dravus St and W Emerson St. Two additional routes connect from W Emerson St over and under the BNSF mainline tracks via the Fort Street Bridge and W Commodore Way. This report focuses on the three major connections. The configuration of each street is described in Figure 2.

Figure 2. Characteristics of the Magnolia Connections

Magnolia Bridge • Minor Arterial • Two lanes westbound and one lane eastbound • Westbound off-ramp and eastbound on-ramp at 23rd Ave W provides access to Terminal 91, Elliott Bay Marina, and Smith Cove Park • Pedestrian walkway on south side of bridge	
W Dravus St • Principal Arterial • Two lanes in each direction • Pedestrian walkways on both sides of bridge	
W Emerson St • Principal Arterial • One lane in each direction • Pedestrian walkway on north side of bridge • Two-way Protected bicycle lane (PBL) proposed on south side of bridge; construction planned for summer 2017.	

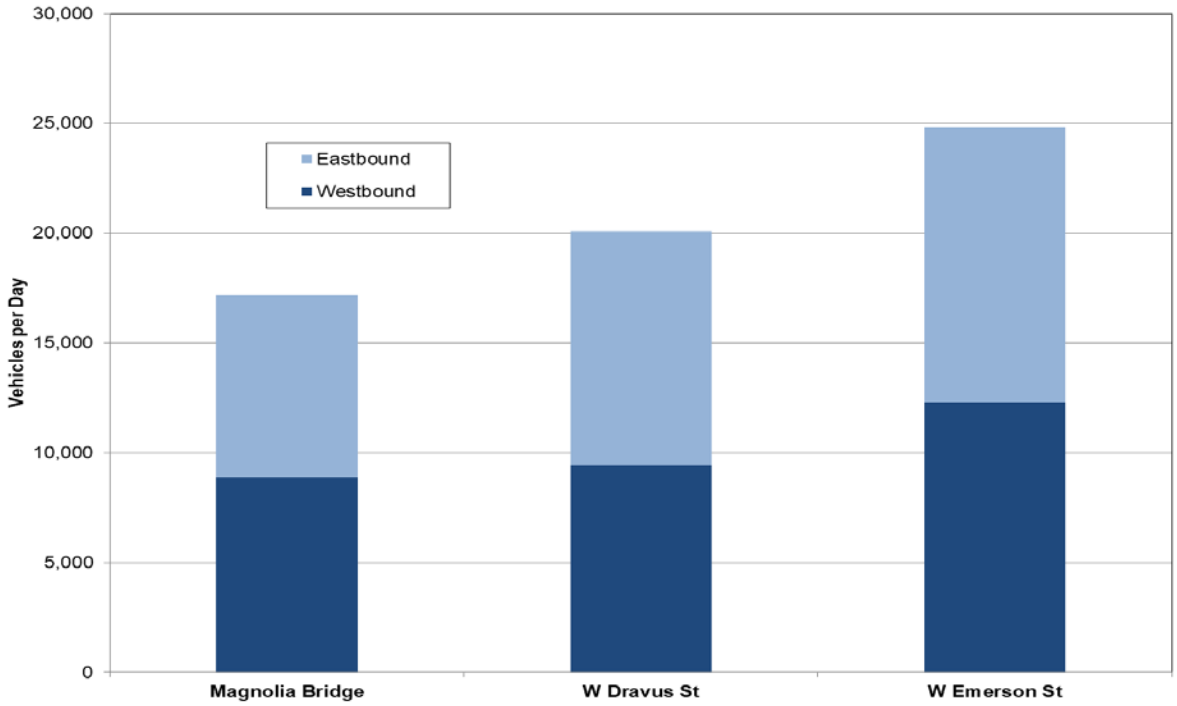
Note: All photos looking east.

2.2 Traffic Volumes

2.2.1. Existing Traffic Volumes

SDOT performed full week traffic counts on the three major Magnolia connection routes in March and April 2017. These data were compiled to determine the average weekday traffic volumes and volumes by time of day for the corridor. Figure 3 compares the average weekday traffic on each bridge. Combined, the three bridges serve about 62,000 vehicles per day. W Emerson St has the highest weekday volume and the Magnolia Bridge has the lowest weekday volume of the three bridges.

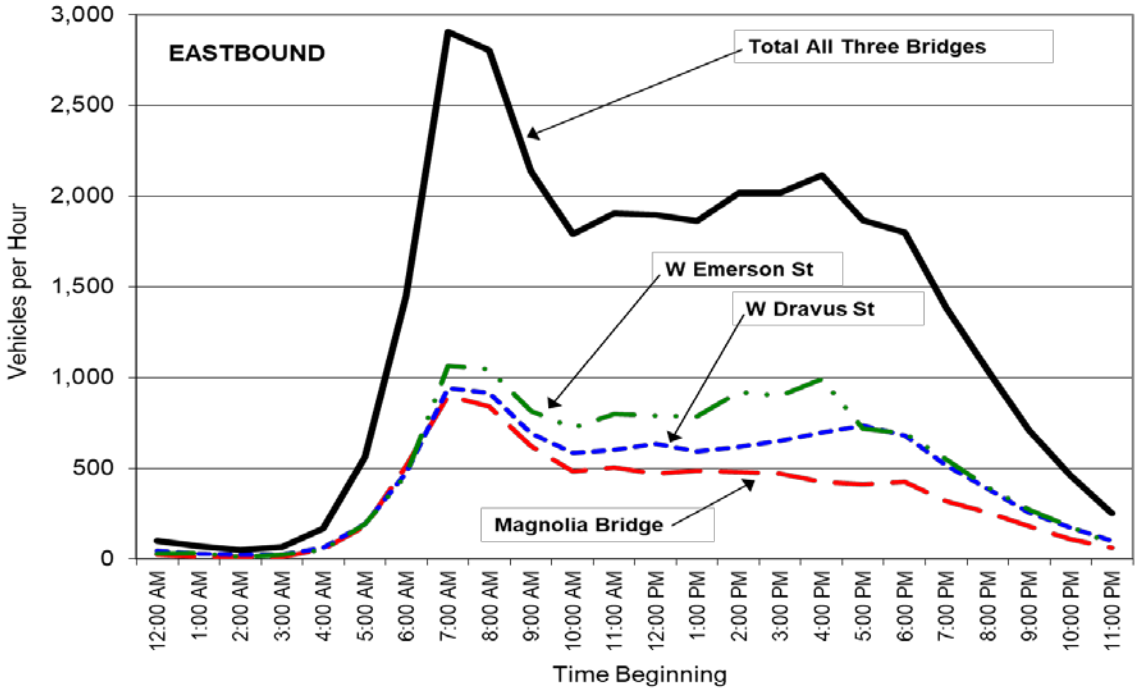
Figure 3. Average Weekday Traffic Volumes - 2017

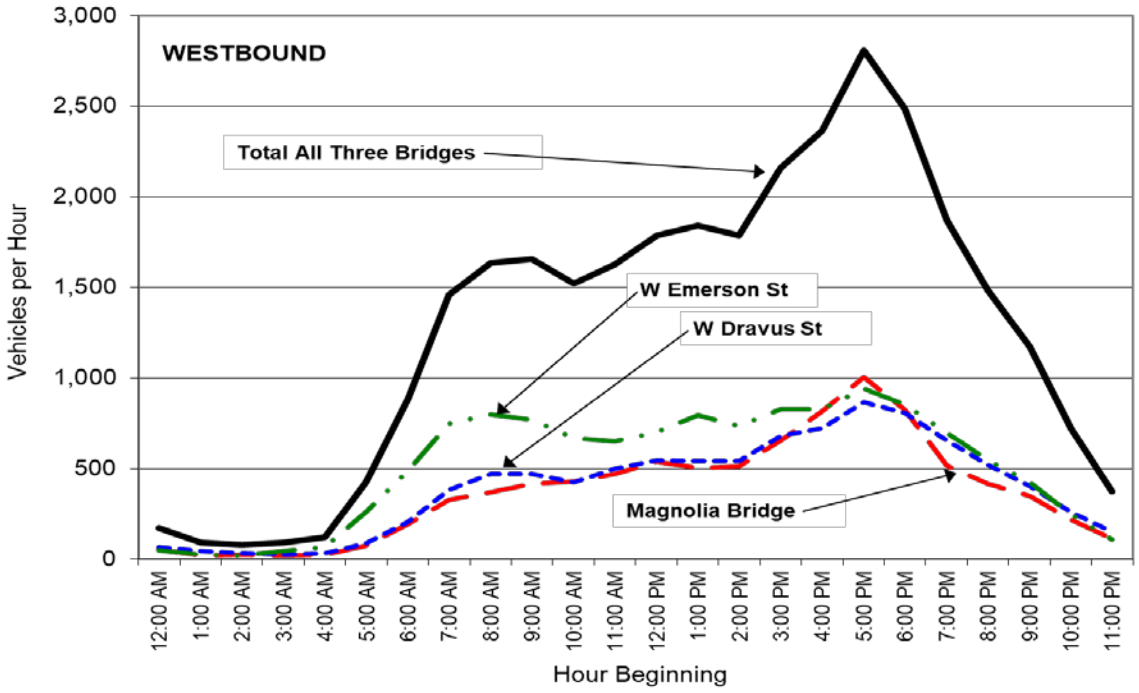


Source: SDOT. Counts on Magnolia Bridge and W Dravus St performed the week of April 17, 2017; counts on W Emerson St performed the week of March 27, 2017. The volumes reflect the average of Tuesday, Wednesday and Thursday of the week.

Hourly volumes for the average weekday were also compiled for each bridge. Figure 4 shows each bridge's hourly volumes for the eastbound and westbound directions, respectively. Eastbound traffic is highest in the morning peak hour with about 2,800 vehicles on the combined bridges during the 7:00 A.M. hour; westbound traffic is highest in the afternoon with about 2,900 vehicles on the combined bridges during the 5:00 P.M. hour.

Figure 4. Traffic by Time of Day – Average Weekday in 2017





Source: SDOT. Counts on Magnolia Bridge and W Dravus St performed the week of April 17, 2017; counts on W Emerson St performed the week of March 27, 2017. The volumes reflect the average of Tuesday, Wednesday and Thursday of the week.

SDOT performed intersection turning movement counts in March and April 2017. The peak hour volumes at each intersection were compiled and are shown on Figures 5 and 6 for the AM and PM peak hours, respectively.

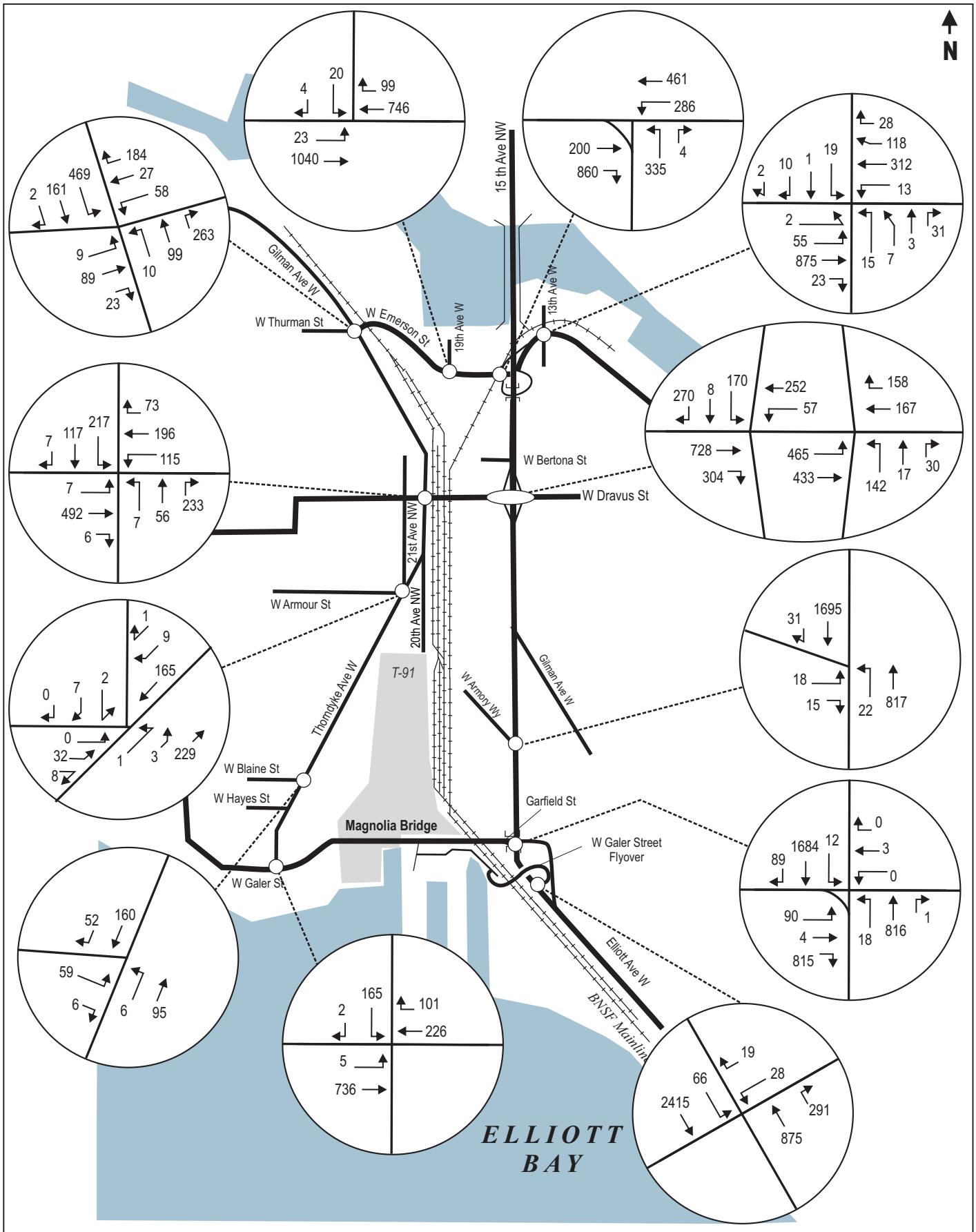
2.3 Emergency Access

There are two fire stations that serve Magnolia: Station 41, which is located at 2416 34th Ave W just south of the Magnolia Playfield, and Station 20, located at 2800 15th Ave W (not shown on the map). Immediately following an earthquake, crews will be dispatched from each station to drive a pre-set route and assess the damage. The route for Magnolia is shown at the right. Crews are expected to complete the route and report on conditions before responding to emergency needs.

If the bridges connecting Magnolia to the 15th Ave W corridor are so badly damaged that they are not passable, emergency services will find alternative routes such as crossing the railroad tracks at surface. The Emergency Closure Plan recommends potential surface crossings for emergency services following a catastrophic event.

Earthquake Damage Assessment Route

Source: SDOT, 2017



MAGNOLIA BRIDGE
SHORT-TERM CLOSURE
TRANSPORTATION PLAN

Figure 5
Existing (2017) AM Peak Hour Traffic Volumes

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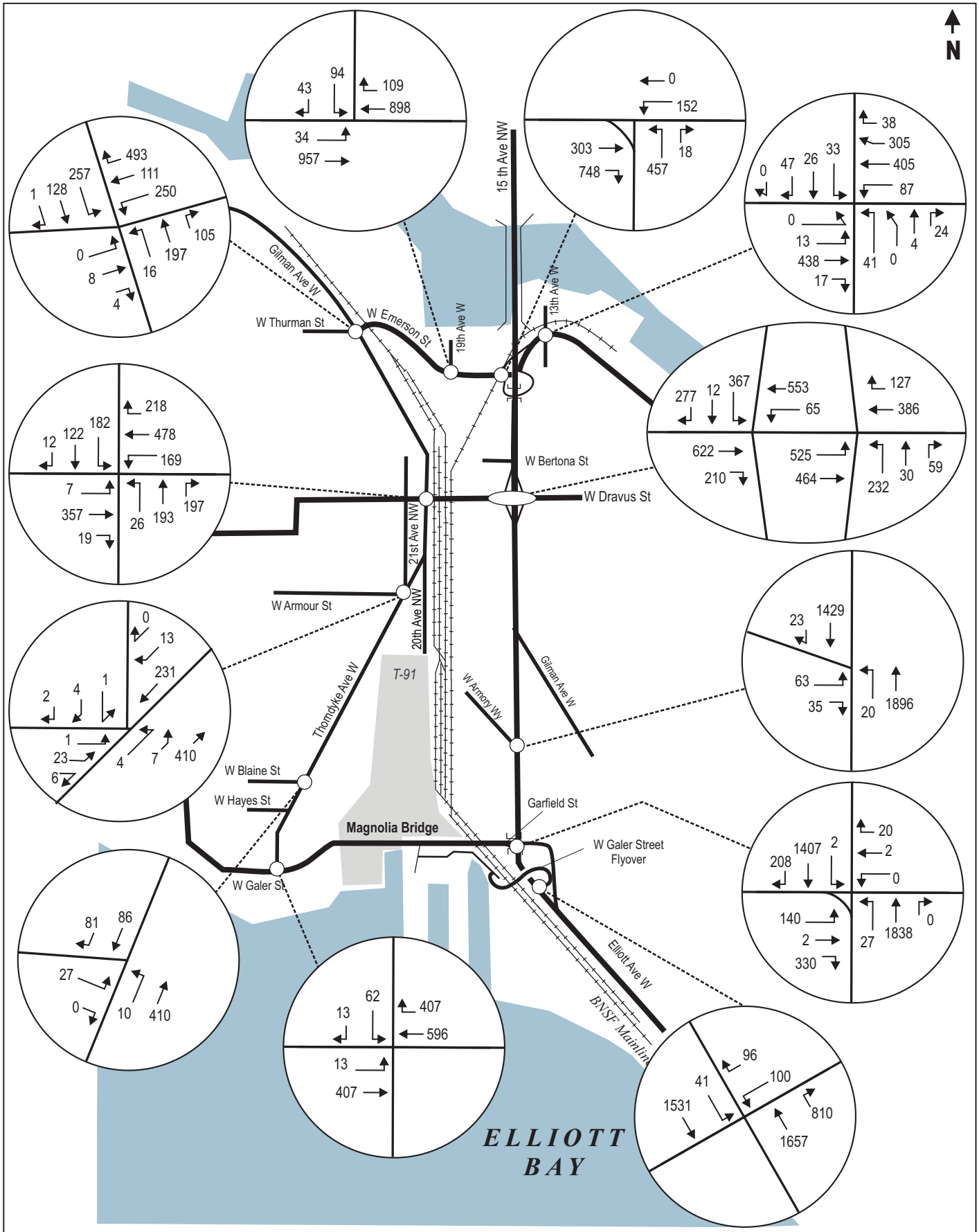

MAGNOLIA BRIDGE
SHORT-TERM CLOSURE
TRANSPORTATION PLAN

Figure 6
Existing (2017) PM Peak Hour Traffic Volumes

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2.4 Transit Service and Facilities

Table 1 summarizes the existing transit service; routes and stops are shown on Figure 7. During a snow event, Routes 19, 24, and 33 will divert off of the Magnolia Bridge and use W Dravus St (via Thorndyke Ave W for Routes 19 and 24, and via 20th Ave W for Route 33). These are the same detours that were implemented during the last Magnolia Bridge closure following the Nisqually Quake.

Table 1. Existing Transit Service

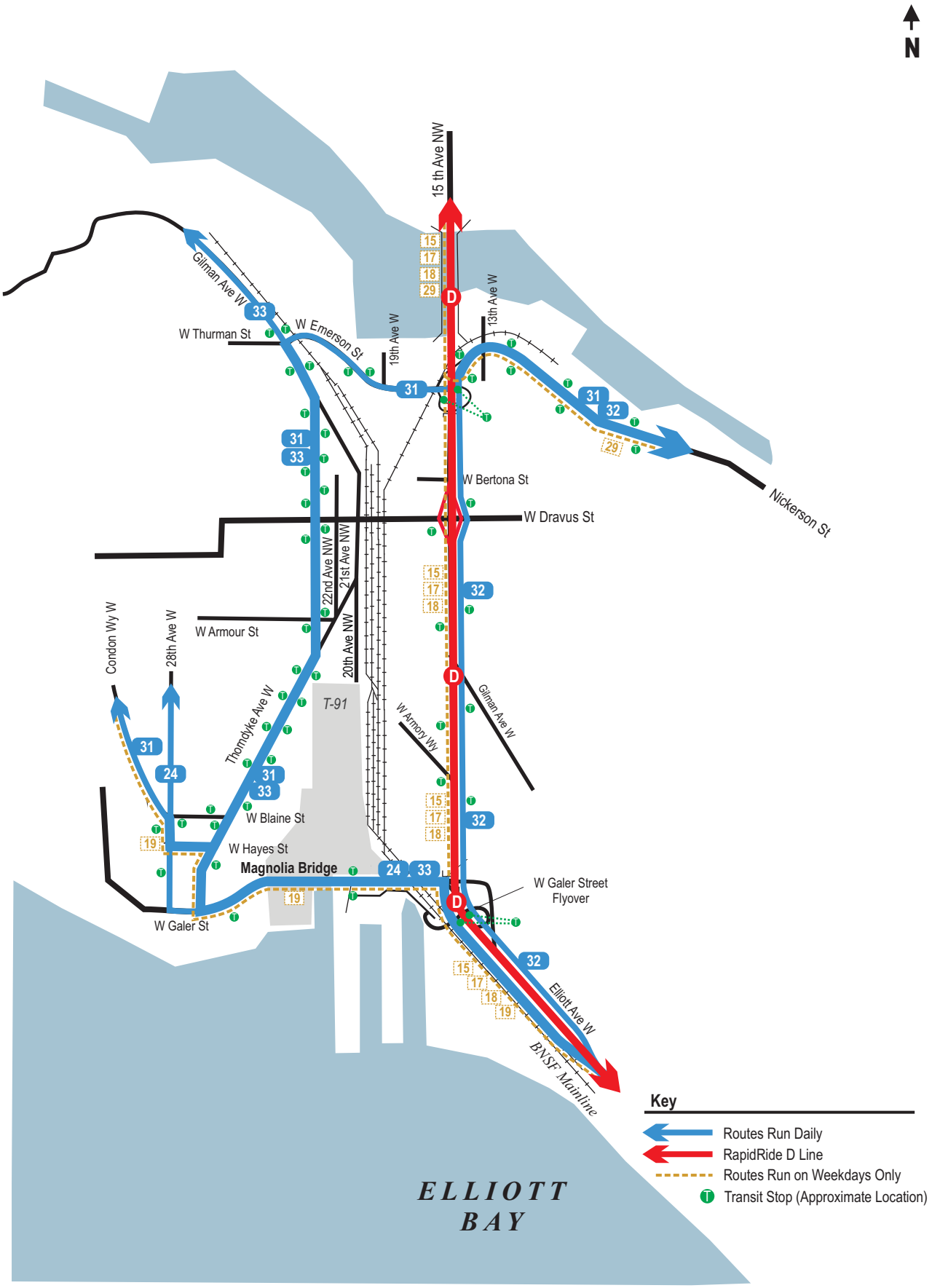
Routes	Destinations Served	Number of Buses	
		Weekday AM Commute Period [a]	Weekday PM Commute Period [b]
RapidRide D Line	Crown Hill, Ballard, Interbay, Seattle Center, and Downtown Seattle	To Downtown: 22 To Crown Hill: 20	To Downtown: 26 To Crown Hill: 24
15, 17, & 18 [c]	Blue Ridge, Sunset Hill, North Beach, Crown Hill, Ballard, Seattle Center, and Downtown Seattle	To Downtown: 27 To North Ballard: 0	To Downtown: 0 To North Ballard: 22
29 [c]	Ballard, Seattle Pacific University, Queen Anne, and Downtown Seattle	To Downtown: 10 To Ballard: 0	To Downtown: 0 To Ballard: 9
24 (& 19 [c])	Magnolia, Seattle Center, and Downtown Seattle	To Downtown: 13 To Magnolia: 6	To Downtown: 6 To Magnolia: 13
31	Magnolia, Seattle Pacific University, Fremont, Wallingford, and the University District	To University District: 8 To Magnolia: 4	To University District: 6 To Magnolia: 8
32	Seattle Center, Interbay, Seattle Pacific University, Fremont, Wallingford, and the University District	To University District: 8 To Seattle Center: 7	To University District: 9 To Seattle Center: 8
33	Discovery Park, Interbay, Seattle Center, and Downtown Seattle	To Downtown: 10 To Discovery Park: 6	To Downtown: 7 To Discovery Park: 9

Source: King County Metro Transit Website, September 2017.

a. AM commute service provided between ~6:00 A.M. and 9:00 A.M.

b. PM commute service provided between ~3:00 P.M. and 6:00 P.M.

c. Routes only operate during the weekday peak hours and only serves the peak direction of travel.



MAGNOLIA BRIDGE
SHORT-TERM CLOSURE
TRANSPORTATION PLAN

Figure 7

Transit Routes and Stops

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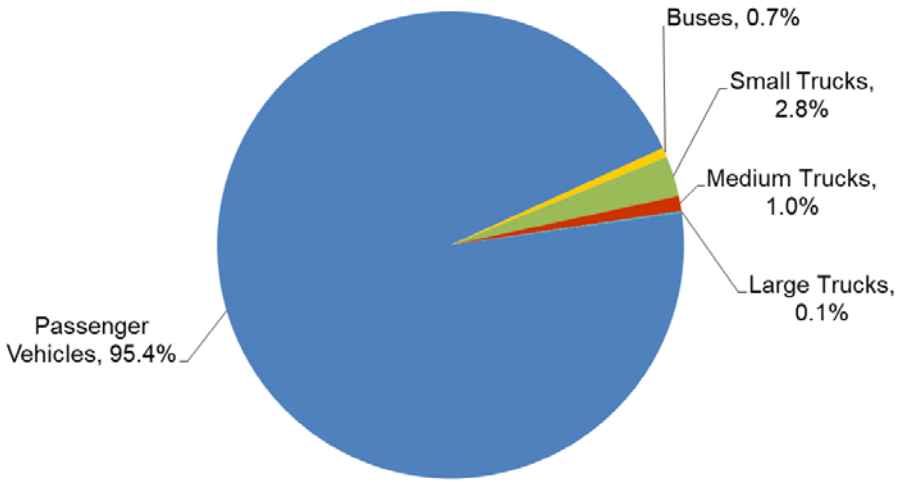
2.5 Freight and Port Access

The City's *Freight Master Plan*[2] identifies a network of truck streets that serve freight movement throughout Seattle. In the Magnolia/Interbay area, 15th Ave W is designated as a Major Truck Street. A loop of designated Minor Truck Streets includes W Emerson St, W Gilman Ave/20th Ave W and W Dravus St. The Magnolia Bridge between 15th Ave W and 23rd Ave W, and W Commodore Way are designated as First/Last Mile Connectors.

Nearly all trucks that enter and exit the Port of Seattle's Terminal 91 and cruise terminal use the Galer Street Flyover south of the Magnolia Bridge. Vehicle classification counts performed on the Magnolia Bridge for a week in March 2017, summarized on Figure 8, determined that the vast majority of the traffic using the bridge is passenger vehicles. Medium and large trucks account for just over 1% of the traffic. Based on classification counts performed at the top of the bridge and just east of 15th Ave W, it is estimated that about 60 small to medium trucks access the Port terminals and/or the Elliott Bay Marina area from the bridge each day. One building at Terminal 91, currently occupied by Anthony's Seafood, has a second floor loading area directly from the Magnolia Bridge.

Figure 8. Types of Vehicles Using the Magnolia Bridge



Source: SDOT Vehicle Classification Count on Magnolia Bridge east of W Galer St, Average of counts performed from March 27, 2017 through April 3, 2017.

[2] SDOT, City of Seattle Freight Master Plan, September 2016.

3. Impact of Magnolia Bridge Closure

The Magnolia Bridge could be closed following a catastrophic event, because the bridge is no longer structurally able to accommodate traffic along all or part of its length, or because of the need to detour traffic during construction of a permanent facility. If the bridge is closed due to a catastrophic event, traffic conditions will likely be in an emergency state for days and possibly weeks following the event. Ultimately, the goal would be to resume everyday activities including commuting to work and school, shopping, and participating in outside activities. If the Magnolia Bridge remains closed—either following a catastrophic event or as part of a planned closure—alternative routes including W Dravus St and W Emerson St are expected to become congested. The following sections describe conditions that could occur if the alternative routes had to accommodate all of the traffic diverted from the Magnolia Bridge.

3.1 Traffic Diversions with Bridge Closure

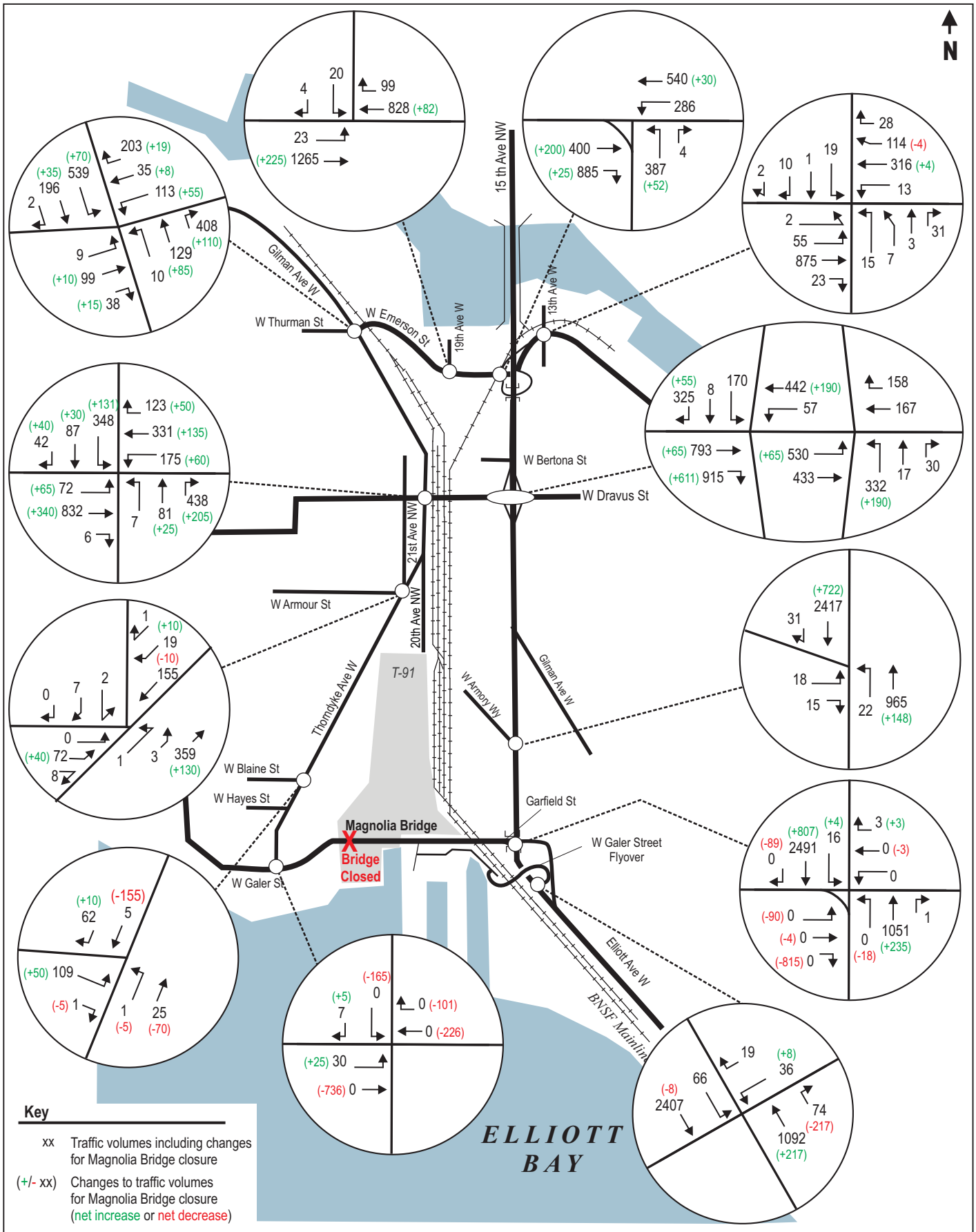
The analysis performed herein focuses on a potential closure that could occur in the short term. For this reason, all analysis was performed using existing traffic volumes that have been rerouted to emulate a full closure of the Magnolia Bridge. Subsequent studies of the long-term permanent facility will account for growth in the Magnolia neighborhood as well as new development at Terminal 91.

During a Magnolia Bridge closure, Magnolia traffic that normally utilizes the Magnolia Bridge would divert to either W Dravus St or W Emerson St, and users would likely choose the crossing that minimizes out-of-direction travel and travel time. Diversion patterns were estimated using existing AM and PM peak hour turning movement counts. Based on existing travel patterns, approximately 75% of the traffic utilizing the Magnolia Bridge during the morning peak hour is expected to divert to W Dravus St and the remaining 25% to W Emerson St. During the afternoon peak hour, 70% of the existing traffic is expected to divert to W Dravus St and 30% to W Emerson St. The relatively small number of vehicles using the western Magnolia Bridge ramps to reach the Elliott Bay Marina/Smith Cove Park would need to use a temporary surface route through Terminal 91. For the purpose of this analysis, it was assumed that the Elliott Bay Marina/Smith Cove Park route would connect to 20th Ave W along the west side of Terminal 91 and also use W Dravus St. Port-related traffic on those ramps was assumed to use the Galer Flyover. The traffic volumes with a full closure of the Magnolia Bridge are shown on Figures 9 and 10 for the AM and PM peak hours, respectively.

If the bridge is closed, transit would be rerouted to "snow" routes, which use Thorndyke Ave W and W Dravus St. Pedestrian and bicycle traffic would also need to divert to W Dravus St.

3.2 Traffic Operations with Bridge Closed

Level of service (LOS) analysis was conducted for the study area intersections for the AM and PM peak hour conditions. Level of service is a qualitative measure used to characterize traffic operating conditions. The quality of traffic conditions is defined by six LOS designations, "A" through "F". LOS A and B represent the fewest traffic slow-downs, and LOS C and D represent intermediate traffic flow with some delay. LOS E indicates that traffic conditions are at or approaching congested conditions and LOS F indicates that traffic volumes are at a high level of congestion with unstable traffic flow. Appendix A presents the level of service criteria for signalized and unsignalized intersections.



MAGNOLIA BRIDGE
SHORT-TERM CLOSURE
TRANSPORTATION PLAN

Figure 9
Existing Traffic Volumes Rerouted for Magnolia Bridge Closure AM Peak Hour

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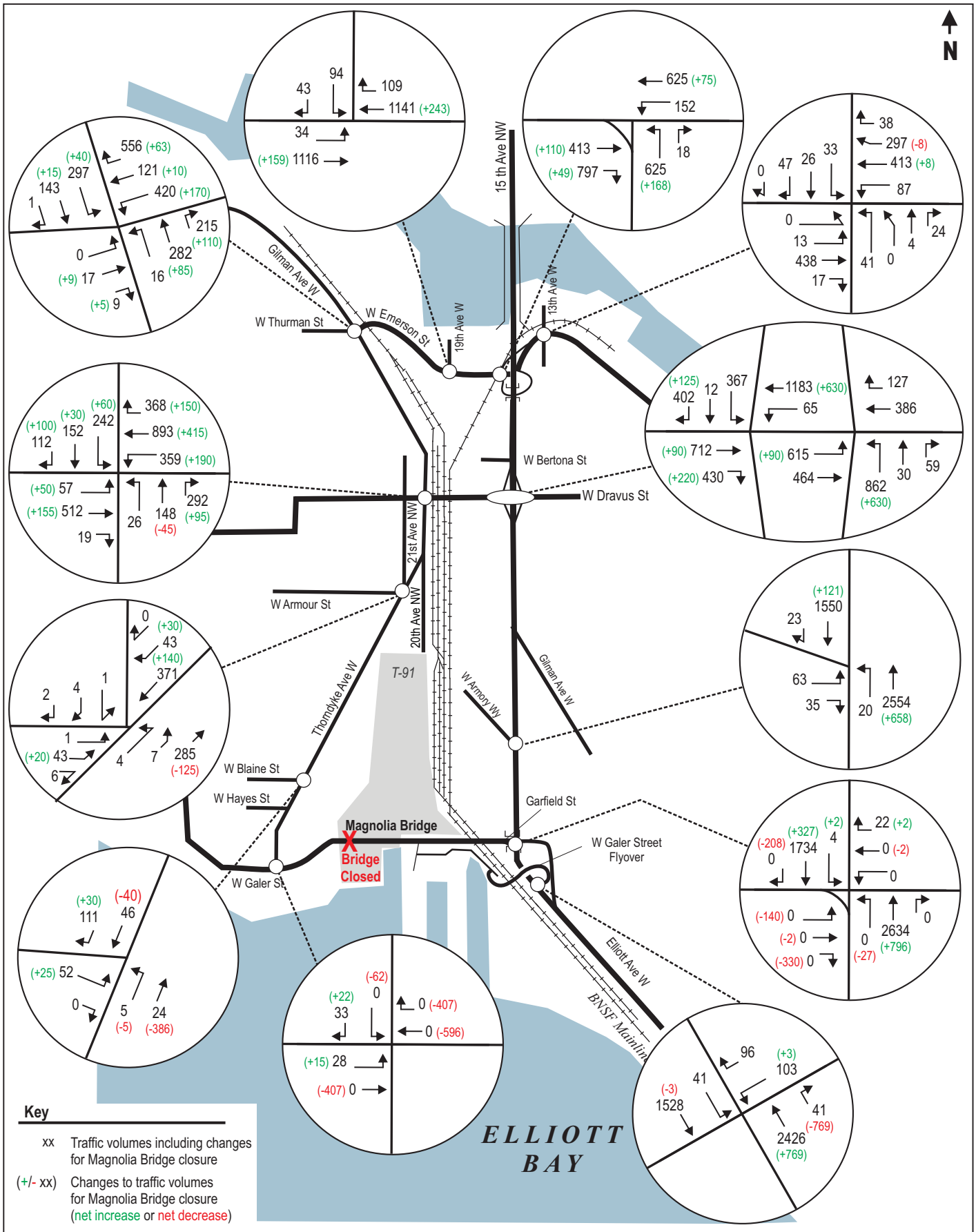

MAGNOLIA BRIDGE
SHORT-TERM CLOSURE
TRANSPORTATION PLAN

Figure 10
Existing Traffic Volumes Rerouted for Magnolia Bridge Closure
PM Peak Hour

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Level of service analysis was performed for study area intersections for the existing conditions and assuming that existing traffic is rerouted due to a closure of the Magnolia Bridge. A detailed traffic operations model was prepared using the Synchro 9.1 software. The existing conditions reflect existing roadway geometry, traffic control, traffic signal operating parameters and other factors. These results were field verified to ensure the models reflect driver experience. The intersection configurations and traffic operations at the intersection of W Dravus St/20th Ave W and W Emerson ST/W Thurman St/Gilman Ave W assume the soon-to-be completed protected bicycle lane (PBL) located along the east side of the corridor. This project will change the signal phasing at the W Dravus St/20th Ave W intersection to provide a protected southbound left turn movement that can be separated from bicycle movements on the PBL. Traffic volumes with the Magnolia Bridge closed were entered into the model and the signal timings were optimized in Synchro 9.1, but no additional signal phasing changes were made. The following analysis was used to identify congestion hotspots to address if the bridge were closed. The results are summarized in Table 2.

Table 2. Level of Service - Existing and With Magnolia Bridge Closed – No Improvements

	AM Peak Hour				PM Peak Hour			
	Existing [1]		With Magnolia Bridge Closed [2]		Existing		With Magnolia Bridge Closed	
Signalized Intersections	LOS [3]	Delay [4]	LOS	Delay	LOS	Delay	LOS	Delay
Galer Flyover / Elliott Ave W	A	5.4	A	8.0	B	14.0	D	40.7
W Garfield St / 15th Ave W	A	3.8	A	5.8	A	8.1	B	11.0
W Armory Way / 15th Ave W	A	6.1	B	19.8	A	5.4	B	11.4
W Dravus St / 15th Ave W NB Ramp	B	18.6	C	32.9	D	38.5	F	135.1
W Dravus St / 15th Ave W SB Ramp	C	26.4	C	26.0	C	26.7	F	95.3
W Dravus St / 20th Ave W [5]	C	27.9	E	75.0	C	31.5	E	77.8
W Nickerson St / 13th Ave W	B	18.5	B	11.7	A	9.2	A	9.7
W Emerson Pl / 19th Ave W	B	13.1	C	27.7	B	14.9	C	22.9
Stop-Controlled Intersections	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
W Emerson St / W Nickerson St Ramp [6]	C	17.0	D	29.5	C	23.8	F	87.3
W Emerson St / W Thurman St / Gilman Ave W [6 7]	F	69.3	F	154.6	F	139.8	F	292.7
W Galer St / Thorndyke Ave W (overall) [8]	A	6.6	A	7.3	A	1.5	A	7.8
Eastbound Left Turn	A	7.7	A	7.3	A	8.8	A	7.3
Southbound Movements	F	52.1	N/A	N/A	D	29.6	N/A	N/A
W Blaine St / Thorndyke Ave W (overall) [8]	A	2.2	A	5.3	A	1.0	A	2.9
Eastbound Left Turn	B	11.6	A	9.8	B	14.1	A	9.8
Northbound Left Turn	A	7.9	A	7.5	A	7.6	A	7.6
W Armour St / Thorndyke Ave W (overall) [8]	A	1.8	A	3.1	A	0.8	A	1.2
Northbound Left Turn	A	7.8	A	7.8	A	7.8	A	8.4
Eastbound Left Turn	B	12.2	C	16.0	B	14.4	C	16.6

Source: Heffron Transportation, Inc., September 2017.

1. *Reflects existing traffic volumes in 2017. No modifications to existing signal timings, unless otherwise noted.*
2. *Assumes all traffic now using the Magnolia Bridge is rerouted to alternative routes. Signal cycle lengths and timings optimized using the Synchro 9.1 software, but the signal phasing remains unchanged from the existing condition.*
3. *LOS = Level of service.*
4. *Delay = Average seconds of delay per vehicle.*
5. *Assumes the intersection has been reconfigured to accommodate a PBL on the east side of 20th Ave W in all conditions and the signal timing has been updated to allow a westbound through left turn.*
6. *All-way stop-controlled; based upon average delay for all vehicles traveling through the intersection.*
7. *Assumes the intersection has been reconfigured to accommodate a PBL on the east side of Gilman Ave W and the south side of W Emerson St in all conditions.*
8. *Two-way stop-controlled; operations for stop-controlled movements and average through intersection are shown.*

4. Emergency Closure Plan

An Emergency Bridge Closure Plan was developed to guide the movement of people and goods between the Magnolia neighborhood and 15th Ave W corridor immediately following a catastrophic event damaging one or all the bridges serving Magnolia. Safety priorities in order of importance are life safety, incident stabilization, reuniting families, and property/environmental conservation. The plan was presented in the Executive Summary of this report.

5. Potential Short-Term Improvements

The traffic operations analysis summarized in Table 2 identified several locations where extreme congestion could occur if the Magnolia Bridge were closed to traffic, and the other routes to/from Magnolia had to accommodate all of the traffic diverted from the bridge. The following sections describe potential improvements at four congestion hot spots:

- W Dravus St / 15th Ave W ramp intersections
- W Dravus St / 20th Ave W
- W Emerson St / Gilman Ave W
- W Emerson St / W Nickerson St

5.1 Hot Spot Improvements

5.1.1. W Dravus St / 15th Ave W ramp intersections

Currently, ramps connect 15th Ave W to the W Dravus St overpass that crosses over 15th Ave W. Two intersections regulate these ramps: the western intersection controls access to and from southbound 15th Ave W, while the eastern intersection controls access to and from northbound 15th Ave W. The existing lane configuration is shown on Figure 11. The two intersection signals are "clustered", meaning they operate as a unit. The analysis determined that both ramp intersections would operate at a very poor LOS F condition if the Magnolia Bridge is closed and the majority of traffic using that bridge is detoured to W Dravus St. Operations are constrained by the "tight-diamond" interchange configuration for which there are no low-cost opportunities to widen the ramps or bridge across 15th Ave W. During past Magnolia Bridge closures, northbound off-ramp traffic experienced very long queues that extended beyond the 850-foot off-ramp and affected mainline traffic on 15th Ave W. Temporary police control was used during prior closures so that both lanes on the northbound off-ramp could turn left onto W Dravus St (e.g., a dual left-turn). This helped lessen congestion and reduce the queues during peak times. SDOT prefers to find a more permanent solution that can be implemented without police control, since emergency responders may not be available for traffic control if there is a catastrophic event.

Detailed analysis of five potential improvements at this intersection was conducted, and is presented in Appendix B. This included analysis of various turn prohibitions as well as changing the lane configuration within the existing street width, which is constrained by the Dravus St bridge over 15th Ave W and the width of the existing ramps. (Note that the results in Appendix B were modeled using the SimTraffic 9.1 microsimulation program, which was applied to assess operations at the closely-spaced, interconnected intersections, and to determine queuing conditions. The simulation results differ from the results presented in Table 2, which were evaluated using Synchro 9.1). All of the options retain pedestrian crossings at the intersections. Based on the analysis the following changes are recommended, shown on Figure 11.

Implement in advance of Magnolia Bridge closure:

- Upgrade the existing traffic signal equipment at the W Dravus St/15th Ave W ramp intersections including a new controller (and cabinet), signal detections, and connection to the 15th Ave W communications spine.
- Prepare signal plans that can be quickly implemented in the event of a Magnolia Bridge closure. The with-closure signal phasing should have a very long clearance phase for eastbound traffic to eliminate traffic queued on the bridge and allow for a dual left turn movement. The signal phasing and timing for this condition is shown in Appendix B.
- Design lane configuration changes for the northbound ramps to accommodate a dual left turn movement. This operation may be possible using the signals to clear the queue, and by adding striping to indicate the turning paths of vehicles. Signage could be added to inform general-purpose drivers that trucks may utilize both lanes to make left turns. Use a modified MUTCD[3] R3-B sign that allows an inside left only lane and a curb lane with left ok through, and right movements. Engineering for striping and signage changes should be completed in advance of a closure event so that they can be quickly implemented when and if needed.

Implement when Magnolia Bridge is closed to traffic:

- Reconfigure the northbound off-ramp to provide a dual left turn lane as described above.
- Close the W Dravus St southbound off-ramp from 15th Ave W to general-purpose traffic that is destined to locations east and west of the W Dravus St interchange, and redirect that traffic to W Bertona St and 17th Ave W. Local traffic that needs to access businesses on the west side of ramp would be able to make a right-turn only at W Dravus St. Additionally, transit would be allowed to cross W Dravus St to access the RapidRide stop on the southbound on-ramp.
- Retain the pedestrian crossing on the west leg of the W Dravus St/15th Ave W southbound off-ramp intersection. The pedestrian signal serving this crossing would be triggered with a pushbutton and the southbound transit through movement could run concurrently with the pedestrian crossing.
- Implement the "Magnolia Bridge Closed" traffic signal plan described above in the *Advance of Bridge Closure* section.

The changes recommended for the northbound off-ramp to W Dravus Street are consistent and compatible with recommendations in the Seattle Freight Master Plan. The *2018 – 2022 Freight Implementation Plan*[4] recommends *15th Ave W Spot Improvements at W Dravus St and W Emerson St* (Project 7). Part of the project description states, "W Dravus St is used by trucks of all sizes, including over- legal vehicles unable to pass underneath the bridge on 15th Ave W. Northbound trucks have particular difficulty turning left onto W Dravus St from the off-ramp. This component of the project includes upgrading signal timing and hardware at the ramp terminals to ensure vehicle queues on the bridge clear to allow trucks adequate space to turn at the intersection."

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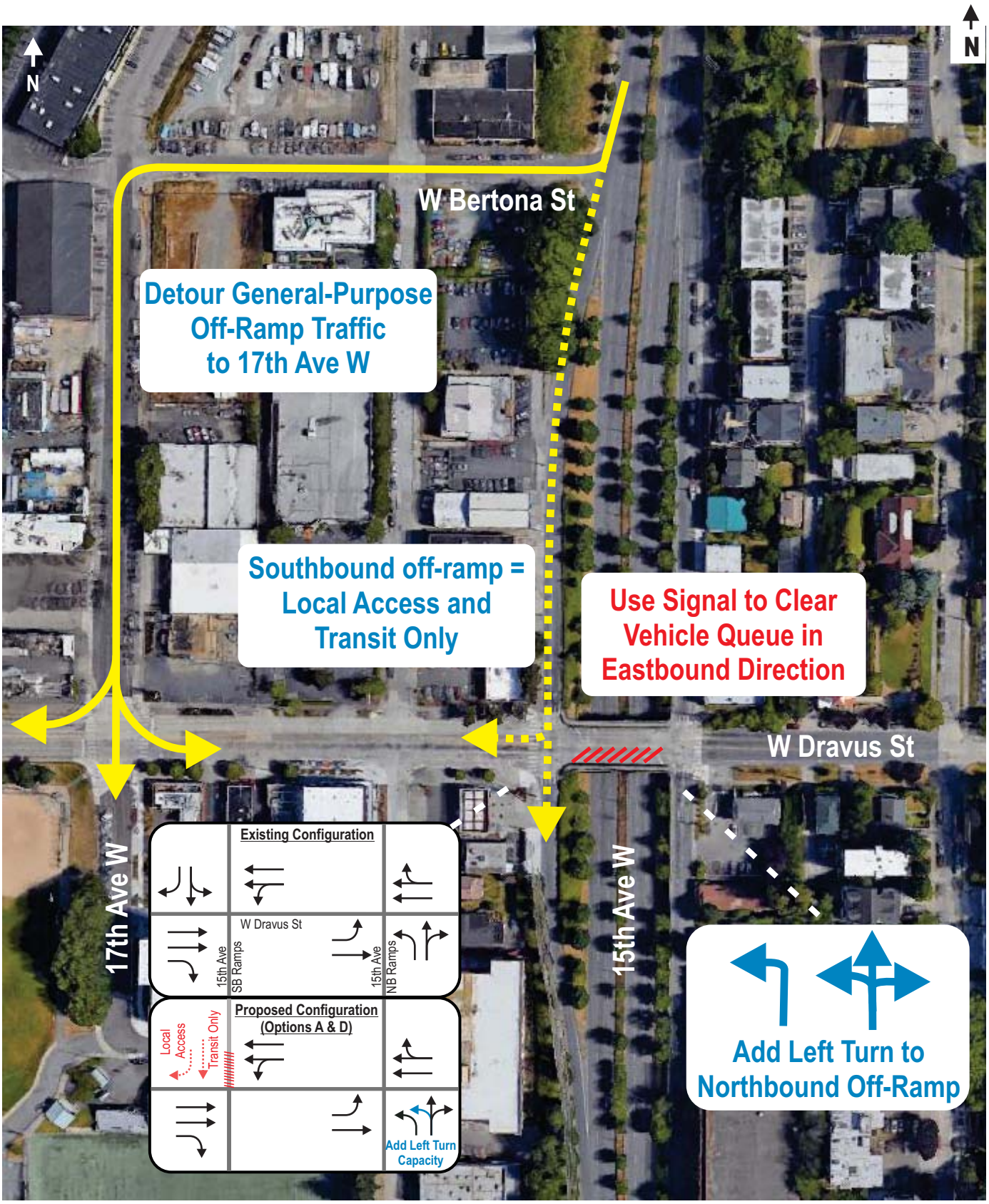
3 Manual of Uniform Traffic Control Devices.

4 Seattle Department of Transportation, June 2017. Project description from SDOT's master spreadsheet, "FMP_FinalProjectList_Draft Implementation_04-25-17.xlsx"



Source: Google Earth, July 2017

MAGNOLIA BRIDGE
SHORT-TERM CLOSURE TRANSPORTATION PLAN

Figure 11
Recommended Improvements at W Dravus St / 15th Ave W Intersection

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5.1.2. W Dravus St / 20th Ave W

The existing conditions for this intersection assume that the intersection and the traffic control have been reconfigured to include a protected bicycle lane (PBL) on the east side of 20th Ave W. As part of the upgrades for the PBL, SDOT will upgrade the signal controller and add detection to provide a protected southbound left turn movement (to separate that movement from bicycle crossings). The proposed phasing also includes a protected-permissive westbound left turn phase. If the Magnolia Bridge is closed to traffic, the W Dravus St/20th Ave W intersection would experience substantial increases in westbound traffic, particularly in the afternoon, as Magnolia residents return home and head to the south end of the neighborhood on Thorndyke Ave W or over the hill on W Dravus St.

To provide future flexibility in intersection operations including accommodating an increase in traffic volumes due to a bridge closure, it is recommended that the traffic signal be upgraded to fully-actuated control with the ability to implement either a protected westbound left turn movement or split east/west phasing. Analysis shows that either phasing option would operate at LOS E condition. This measure will require detection on all legs of the intersection, and left turn signals for the eastbound and westbound approaches.

In the event of a Magnolia Bridge closure, the initial phasing plan should have split eastbound and westbound phasing, which can be implemented without any changes to the lane configuration. The intersection should be monitored after the closure event to determine if a protected westbound left turn phase would provide better operations. If so, a left-turn only lane would need to be created with striping and signage changes.

The following measures are recommended to prepare for a bridge closure.

Implement in advance of Magnolia Bridge closure:

- Upgrade the existing traffic signal equipment at W Dravus St/20th Ave W to provide full actuated control and the ability to implement either a protected westbound left turn movement or split east/west phasing if the Magnolia Bridge is closed. This will require detection on all legs of the intersection, and left turn signals for the eastbound and westbound approaches.
- Retain the existing intersection configuration and traffic control protocols proposed for the addition of a PBL which includes protected-permissive westbound left turn phasing.
- Prepare a signal phasing plan for the "Magnolia Bridge Closed" condition so that it is ready to implement if needed. The initial phasing plan should have split eastbound and westbound phasing, which can be implemented without any changes to the lane configuration.

Implement when Magnolia Bridge is closed to traffic:

- Implement the "Magnolia Bridge Closed" traffic signal plan described above.
- Monitor the intersection performance to determine if additional signal phasing or lane configuration changes are needed.

5.1.3. W Emerson St/Gilman Ave W/W Thurman St

Existing conditions for this intersection assume the Interbay Trail Connection through Magnolia is completed. This includes a two-way PBL on the east side of Gilman Ave W and the south side of W Emerson St. With those changes, the all-way stop intersection is expected to operate at LOS F. Traffic diverted to this street due to closure of the Magnolia Bridge would exacerbate those conditions. The addition of a traffic

signal and converting the west leg of the intersection (W Thurman St) to a one-way westbound (away from the intersection) travel lane could improve operations significantly and make it more responsive to changes in peak direction traffic; however, the intersection is expected to continue to operate at LOS F during the afternoon peak hour. The following measures and timing are recommended:

Planning in advance of Magnolia Bridge closure:

- Monitor traffic conditions at the intersection and determine if a signal would be warranted.

Implement when Magnolia Bridge is closed to traffic:

- Signalize intersection at W Emerson St/Gilman Ave W if traffic increases due to a bridge closure warrants a signal.
- Convert the west leg of the intersection to a one-way westbound travel lane.

5.1.4. W Emerson St / W Nickerson St

This intersection has stop signs that control the eastbound through movement, the northbound left-right movement, and the westbound left turn movement. The westbound through traffic and the eastbound right turns flow freely. With additional traffic due to a Magnolia Bridge closure, the intersection is expected to fail in the afternoon peak hour. Given that this intersection is located on a bridge structure, it would be very difficult and expensive to signalize (estimated at more than $1M); however, a temporary construction-type signal may be possible, and would improve conditions to LOS D.

If signalization is not possible, traffic operations could be improved by diverting some traffic to other routes. One potential option would be to break the existing median on 15th Ave W at W Bertona St to provide another point of access to Magnolia from northbound 15th Ave W.

As a last resort, flaggers could be used to control traffic at the W Emerson St/W Nickerson St intersection during the PM peak periods to help alleviate congestion and reduce the potential for queues from this intersection to back onto 15th Ave W. The following measures are recommended:

Planning in advance of Magnolia Bridge closure:

- Study the feasibility of signalizing the W Emerson St/W Nickerson St intersection.
- Study the feasibility of adding a new signalized intersection at 15th Ave W/ W Bertona St by breaking through the median and restriping 15th Ave W to provide a northbound left turn lane. This will require a survey of the street (and the grade change between northbound and southbound lanes) and a drainage report.

Implement after Magnolia Bridge is closed:

- If feasible and warranted, signalize intersection at W Emerson St/W Nickerson St.
- If a signal cannot be attached to the bridge structure, but breaking the median at 15th Ave W/W Bertona St is possible, implement that change (and direct northbound traffic to use that route.)
- If no physical measure to alleviate congestion is possible, post flagger at the W Emerson St / W Nickerson St intersection during the PM peak period.

5.1.5. W Hayes St / Thorndyke Ave W

A single stop sign currently controls traffic on southbound Thorndyke Ave W, and the other movements (northbound Thorndyke and eastbound W Hayes Street) flow free. With a full closure of the Magnolia Bridge, north-south traffic should flow free and W Hayes Street should be stop-controlled. The following measures and timing are recommended:

In advance of Magnolia Bridge closure:

- No action needed.

Implement when Magnolia Bridge is closed to traffic:

- Change location of the stop sign at the W Hayes St/Thorndyke Ave W intersection.

5.2 Traffic Operations with Improvements

5.2.1. With Closure of the Magnolia Bridge

Traffic operations analysis was performed to show the effect of the recommended improvements on a condition with the Magnolia Bridge closed to traffic. Table 3 summarizes the level of service at key intersections without and with improvements. As shown, all intersections except for the W Emerson St / W Gilman St / W Thurman St intersection are expected to operate at LOS E or better with rerouted traffic and recommended improvements.

Table 3. Level of Service **With Magnolia Bridge Closed** – Without and With Improvements

	AM Peak Hour				PM Peak Hour			
	Without Improvements		With Improvements		Without Improvements		With Improvements	
Signalized	LOS [1]	Delay [2]	LOS	Delay	LOS	Delay	LOS	Delay
Galer Flyover / Elliott Ave W	A	8.0	A	5.9	D	40.7	D	40.7
W Garfield St / 15th Ave W	A	5.8	A	6.7	B	11.0	B	10.0
W Armory Way / 15th Ave W	B	15.8	A	7.5	B	11.4	B	11.4
W Dravus St / 15th Ave W NB Ramp	C	32.9	B	14.6	F	135.1	E	74.3
W Dravus St / 15th Ave W SB Ramp	C	26.0	C	33.8	F	95.3	D	43.1
W Dravus St / 20th Ave W	E	75.0	E	75.0	E	77.8	E	77.8
W Nickerson St / 13th Ave W	B	11.7	B	17.5	A	9.7	A	9.2
W Emerson Pl / 19th Ave W	C	27.7	B	19.1	C	22.9	C	22.9
W Emerson St / W Thurman St / Gilman Ave W [3]	Intersection Stop-Controlled		D	46.0	Intersection Stop-Controlled		F	122.7
W Emerson St / W Nickerson St Ramp	Intersection Stop-Controlled		C	26.3	Intersection Stop-Controlled		D	35.9
Stop-Controlled	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
W Emerson St / W Thurman St / Gilman Ave W [3]	F	154.6	Intersection Signalized		F	292.7	Intersection Signalized	
W Emerson St / W Nickerson St Ramp [4]	D	29.5	Intersection Signalized		F	87.3	Intersection Signalized	
W Galer St / Thorndyke Ave W (overall) [5]	A	7.3	A	7.3	A	7.8	A	7.8
Eastbound Left Turn	A	7.3	A	7.3	A	7.3	A	7.2
W Blaine St / Thorndyke Ave W (overall) [5]	A	5.3	A	6.2	A	2.9	A	2.9
Eastbound Left Turn	A	9.8	A	9.8	A	9.8	A	9.8
Northbound Left Turn	A	7.5	A	7.4	A	7.6	A	7.6
W Armour St / Thorndyke Ave W (overall) [5]	A	3.1	A	2.1	A	1.2	A	1.2
Northbound Left Turn	A	7.8	A	7.6	A	8.4	A	8.4
Eastbound Left Turn	C	16.0	B	15.8	C	16.6	C	16.6

Source: Heffron Transportation, Inc., September 2017. Assumes existing traffic volumes are rerouted for full closure of the Magnolia Bridge.

1. *LOS = Level of service.*
2. *Delay = Average seconds of delay per vehicle.*
3. *Existing all-way stop control replaced with signal when intersection improved for Magnolia Bridge closure. W Thurman Street would be one-way westbound with a signal.*
4. *All-way stop-controlled; based upon average delay for all vehicles traveling through the intersection.*
5. *Two-way stop-controlled; operations for stop-controlled movements and average through intersection are shown.*

5.2.2. Traffic Operations with Improvements under Normal Conditions

It is recommended that improvements along W Dravus St be made in advance of a Magnolia Bridge closure to enhance system resiliency for a catastrophic event. Those improvements would also benefit normal operating conditions. Traffic operations for the intersections at W Dravus St/15th Ave W ramps and W Dravus St/20th Ave W were evaluated under normal conditions (no Magnolia Bridge closure) without and with the improvements. For the W Dravus St/15th Ave W intersections, the recommended signal and lane configuration changes were assumed (dual northbound left turn lane plus long clearance phase to clear the eastbound queue from the bridge), but the southbound off-ramp was assumed to function as it does today with all turning movements. Results are summarized in Table 4. All three intersections would operate at LOS C or better with the improvements.

Table 4. Level of Service – Existing Traffic (No Bridge Closure) Without and With Improvements

	AM Peak Hour				PM Peak Hour			
	Existing		Existing w/ Improvements		Existing		Existing w/ Improvements	
Signalized	LOS [1]	Delay [2]	LOS	Delay	LOS	Delay	LOS	Delay
W Dravus St / 15th Ave W NB Ramp	B	18.6	B	12.9	D	38.5	C	34.6
W Dravus St / 15th Ave W SB Ramp	C	26.4	C	24.1	C	26.7	C	31.6
W Dravus St / 20th Ave W [3]	C	27.9	C	27.9	C	31.5	C	31.5

Source: Heffron Transportation, Inc., September 2017.

1. *LOS = Level of service.*
2. *Delay = Average seconds of delay per vehicle.*
3. *Assumes the intersection has been reconfigured to accommodate a PBL on the east side of 20th Ave W in all conditions. Proposed phasing with the PBL is recommended to remain unless the Magnolia Bridge is closed.*

5.3 Prioritize Transit, HOV and Bicycle Modes of Travel

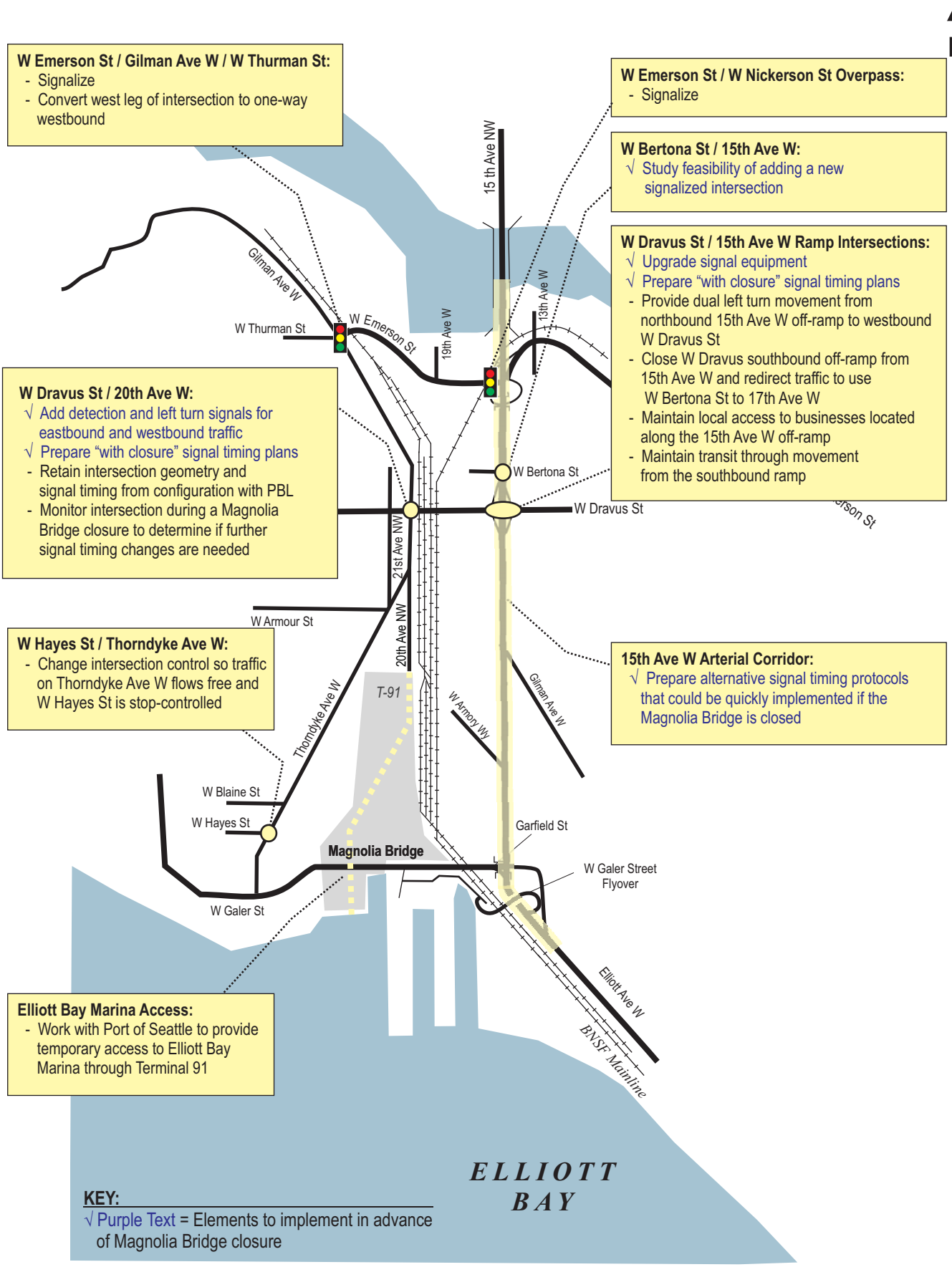
If a catastrophic event affects roadway capacity elsewhere in the Elliott Avenue corridor or the City, then strategies that substantially reduce traffic may be needed. These could include limiting single-occupant vehicle travel and incentivizing carpooling, transit and bicycles modes of travel. Improvements to encourage alternatives to driving could include:

- Establish temporary park-and-ride facilities (e.g., near Interbay Stadium or Fisherman's Terminal).
- Convert general-purpose travel lanes to transit/HOV only. If the intersection at 15th Ave W/W Bertona Street is signalized as a temporary detour measure, then the northbound left turn movement from 15th Ave W could be restricted to transit and HOV use only. Additionally, the curb lane eastbound on W Dravus St could be prioritized for transit and/or HOV use with a queue jump signal that allows them to turn right onto the southbound on-ramp to 15th Ave W (similar to operation on NE Pacific Street at the Montlake Bridge). Finally, if needed, the existing transit lane on the 15th Ave W/Elliott Ave W corridor could be converted to allow for high carpool occupancies (e.g., 3 or 4+ persons per vehicle).
- Facilitate biking by making sure that existing bike trails are cleared of obstructions, and increasing bicycle parking at key transit stops.

6. Recommendations

6.1 Short-Term Closure Improvements

The following is a summary of the stages of improvements needed both now and in the event of a bridge closure. In addition, the table provides preliminary cost estimates of the proposed changes. Please note that cost estimates will be updated as design and planning for the recommendations advances. Additional improvements that would take longer to implement could be evaluated as part of the long-term study of Magnolia Bridge replacement options. Such improvements are listed at the end of this section.



MAGNOLIA BRIDGE
SHORT-TERM CLOSURE
TRANSPORTATION PLAN

Figure 12
Recommended Improvements for Magnolia Bridge Closure

heffron transportation inc

Table 5. Magnolia Bridge Short-Term Closure Plan

Measure	Condition for Measure to be Implemented						Preliminary Cost Estimate
	Implement Now	Advance Planning	Weight Restriction on Magnolia Bridge (No Large Trucks)	Upper Magnolia Bridge is Closed (west of 23rd Ave W)	Full Bridge Closure – Short Duration	Full Closure - Long Duration	
A. Advance Planning and Implementation							
1. Upgrade signal equipment at W Dravus St/ 15th Ave W intersections	√						$100,000
2. Upgrade W Dravus St/ 20th Ave W intersection	√						TBD
3. Prepare detour plans		√					SDOT Staff Time
4. Design lane configuration changes at W Dravus St/15th Ave W northbound ramps		√					SDOT Staff Time
5. Prepare alternative signal timing plans for 15th Ave W corridor, W Dravus St/15th Ave W ramp intersections, and W Dravus St/20th Ave W intersection		√					SDOT Staff Time
6. Identify alternative loading for Anthony's Seafood building		√					SDOT Staff Time
7. Work with BNSF to pre-stage materials for temporary surface crossing		√					SDOT Staff Time
8. Study feasibility of new signal at W Bertona St / 15th Ave W intersection		√					TBD
9. Monitor W Emerson St/Gilman Ave W intersection for traffic signal warrants		√					SDOT Staff Time
B. Implement With Magnolia Bridge Closure							
1. Sign detour plans			√	√	√	√	SDOT Staff Time
2. Reroute transit			√	√	√	√	Metro Staff Time

Measure	Condition for Measure to be Implemented						Preliminary Cost Estimate
	Implement Now	Advance Planning	Weight Restriction on Magnolia Bridge (No Large Trucks)	Upper Magnolia Bridge is Closed (west of 23rd Ave W)	Full Bridge Closure – Short Duration	Full Closure - Long Duration	
3. Implement with-closure traffic signal timing plans for the 15th Ave W corridor and W Dravus St/20th Ave W intersection.				√	√	√	SDOT Staff Time
4. Make capacity improvements at the W Dravus ST/15th Ave W intersections				√	√	√	<$10,000
5. Create temporary access to Elliott Bay Marina			√		√	√	TBD
6. Provide alternate loading for Anthony's Seafood building			√		√	√	TBD
7. Change location of stop signs at W Hayes St/Thorndyke Ave W intersection				√	√	√	<$5,000
C. Implement Within 6 Months of Closure							
1. Signalize W Emerson St/Gilman Ave W intersection if warranted					√	√	TBD
2. Install new signal at W Bertona St/ 15th Ave W intersection if feasible						√	TBD
3. Prioritize transit, HOV and bicycle use					√	√	TBD

6.2 Long-Term Improvements to Consider

Through the course of the short-term closure study, many ideas were brought forth by the community and City staff that should be evaluated as part of the long-term improvement plan, the study for which commenced in fall 2017. Potential improvements to evaluate include:

- Reconstruct the W Dravus St/15th Ave W intersection to increase capacity and its ability to accommodate turning trucks.
- Add Intelligent Transportation System (ITS) equipment along the 15th /Elliott Ave W corridor that can monitor traffic conditions, including travel time, and report that information to mobile applications, web-based applications, and dynamic message signs.
- Improve W Dravus St between 15th Ave W and 20th Ave W, including adding capacity over the BNSF railyard and at the W Dravus St/17th Ave W intersection.
- Coordinate with other public investments, particularly the future Sound Transit West Seattle to Ballard Link Light Rail line planned as part of the voter-approved ST3 package.

APPENDIX A
LEVEL OF SERVICE CRITERIA

Levels of service (LOS) are qualitative descriptions of traffic operating conditions. These levels of service are designated with letters ranging from LOS A, which is indicative of good operating conditions with little or no delay, to LOS F, which is indicative of stop-and-go conditions with frequent and lengthy delays. Levels of service for this analysis were developed using procedures presented in the *Highway Capacity Manual* (Transportation Research Board, 2010).

Level of service for signalized intersections is defined in terms of delay. Delay can be a cause of driver discomfort, frustration, inefficient fuel consumption, and lost travel time. Specifically, level of service criteria are stated in terms of the average delay per vehicle in seconds. Delay is a complex measure and is dependent on a number of variables including: the quality of progression, cycle length, green ratio, and a volume-to-capacity ratio for the lane group or approach in question. Table A-1 shows the level of service criteria for signalized intersections from the *Highway Capacity Manual.*

Table A-1. Level of Service Criteria

Level of Service	Average Delay Per Vehicle	General Description
A	Less than 10.0 Seconds	Free flow
B	10.1 to 20.0 seconds	Stable flow (slight delays)
C	20.1 to 35.0 seconds	Stable flow (acceptable delays)
D	35.1 to 55.0 seconds	Approaching unstable flow (tolerable delay—occasionally wait through more than one signal cycle before proceeding.
E	55.1 to 80.0 seconds	Unstable flow (approaching intolerable delay)
F	Greater than 80.0 seconds	Forced flow (jammed)

Source: Transportation Research Board, Highway Capacity Manual, 2010.

For unsignalized two-way-stop-controlled, all-way-stop-controlled, and roundabout intersections, level of service is based on the average delay per vehicle. The level of service for a two-way, stop-controlled intersection is determined by the computed or measured control delay and is defined for each minor movement. Delay is related to the availability of gaps in the main street's traffic flow, and the ability of a driver to enter or pass through those gaps. The delay at an all-way, stop-sign (AWSC) controlled intersection is based on saturation headways, departure headways, and service times. Delay at roundabouts is based on entry flow rates and flow rate capacity. Table A-2 shows the level of service criteria for unsignalized intersections from the *Highway Capacity Manual.*

Table A-2. Level of Service Criteria for Unsignalized Intersections

Level of Service	Average Delay (seconds per vehicle)
A	Less than 10.0
B	10.1 to 15.0
C	15.1 to 25.0
D	25.1 to 35.0
E	35.1 to 50.0
F	Greater than 50.0

Source: Transportation Research Board, Highway Capacity Manual, 2010.

APPENDIX B
ANALYSIS OF W DRAVUS ST / 15TH AVE W INTERSECTIONS

TECHNICAL MEMORANDUM

Project: Magnolia Bridge Closure Short-Term Transportation Plan

Subject: Analysis of W Dravus St /15th Ave W Intersections

Date: November 10, 2017

Author: Robert H. Frankel
Marni C. Heffron

This memorandum evaluates improvements to the W Dravus St/15th Ave W intersections if the Magnolia Bridge must be closed to traffic, which has happened twice in the past 20 years following natural disasters. Under such conditions, substantial additional traffic would be diverted to the W Dravus St corridor, and without improvements, extreme congestion could occur. According to those who experienced the last closures, queues of traffic trying to exit northbound 15th Ave W onto W Dravus St backed up past the Magnolia Bridge during the afternoon commuter peak periods.

Preliminary analysis determined that the existing system can accommodate traffic during the AM peak hour, but would fail during the PM peak hour. If the Magnolia Bridge were closed to all traffic, it is assumed that more than two thirds of the trips currently utilizing the Magnolia Bridge would divert to W Dravus St. All analysis performed herein evaluates the PM peak hour condition with the Magnolia Bridge closed. Existing and with-closure traffic volumes are attached.

1. Options to Improve Operations

Several options for improving operations at the W Dravus St / 15th Ave W interchange during the PM peak hour were considered. The signal timings are optimized in all scenarios other than the baseline condition.

Baseline – Retain existing lane configuration and signal phasing – The existing lane configuration is shown on Figure 1 (attached). The two intersection signals are "clustered", meaning they operate as a unit.

Baseline Optimized – Retain existing lane configuration, signal equipment, and signal phasing, but optimize signal timing – The existing physical configuration and signal phasing were not changed, but the total cycle length and amount of time allocated to each phase were optimized using the *Synchro 9.1* traffic operations analysis software.

Option A – Close W Dravus St southbound off-ramp from 15th Ave W – This option would close the 15th Ave W southbound off-ramp to W Dravus St, and redirect traffic to W Bertona St and 17th Ave W. Traffic destined to the Queen Anne neighborhood east of the interchange were assumed to be detoured through 17th Ave W and then head east again on W Dravus St. Local traffic and transit vehicles that need to access the ramp south of W Bertona St could remain, but local traffic movements would be limited to right-turn only at W Dravus St while transit

vehicles could cross W Dravus St. Removing the majority of traffic from the southbound off-ramp would allow increased green time for the eastbound and westbound movements. The pedestrian crossing of W Dravus St currently associated with the southbound movements would be preserved by including a pushbutton actuated pedestrian crossing. The transit vehicles and pedestrians could cross W Dravus St concurrently. Based on current crossing volumes, it is assumed that the pedestrian phase would trigger approximately every other cycle.

Option B – Prohibit westbound left turns from W Dravus St to the southbound 15th Ave W on-ramp – This option would redirect the westbound left turn to northbound 16th Ave W and then east on W Bertona St to access southbound 15th Ave W.

Option C – Add left turn capacity from northbound 15th Ave W off-ramp to W Dravus St and remove one eastbound lane on W Dravus St – This option would create a dual left turn on the 15th Ave W northbound off-ramp by changing the through-right lane to a left-through-right lane. To provide enough space on the overpass bridge for side-by-side left turn movements, one eastbound through-lane would be removed.

Option D – Add left turn capacity from northbound 15th Ave W to W Dravus St, but preserve two eastbound through travel lanes – This option would create a dual left turn on the 15th Ave W northbound off-ramp by changing the through-right lane to a left-through-right lane. To create space for the side-by-side left turn movements, the eastbound signal phase would need to be extended to allow a longer clearance interval to eliminate the vehicle queue in those eastbound lanes.

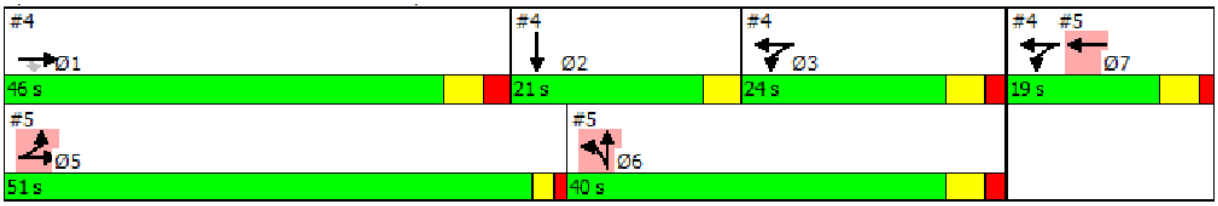
The microsimulation program *SimTraffic 9.1* was used to assess the traffic operations and queue performance for the options described above. The traffic operations results are summarized in Table B-1. Queue lengths are summarized in Table B-2, and both average and 95th-percentile queues are reported.

2. Recommendation

The analysis determined that Options A and D would provide the greatest improvement in overall intersection delay. Combined, they could achieve overall operations of LOS D or better. Although the eastbound and westbound approaches would operate at LOS E, the northbound 95th-percentile queue length of about 500 feet would not exceed the length of the northbound off-ramp (900 feet). The optimized signal phasing and timing is presented below. The recommended lane configuration is shown on Figure B-1 (attached).

The combined Options A and D were tested further to determine if the timing overlap between the southbound and northbound phases (phases 2 and 6) could be eliminated. When the signal timing is adjusted so that these two phases operate independently, but no other changes are made, overall intersection operations degrade to failing levels. It is noted that the suggested phasing assumes that southbound movements are restricted to right-turns only except transit, which would be allowed to proceed through to the bus stop located on the southbound on-ramp. All southbound left turns would be prohibited, which would eliminate most conflicts in the short distance between the two ramp intersections. If it is determined that the north and south phases must be separated, then eliminating the north-south pedestrian crossing at the western intersection would allow the green time for the southbound phase (phase 2) can be approximately halved, and operations would remain at an acceptable level of service. However, this crossing is used by pedestrians to access the transit stops on the southbound on-ramp.

Splits and Phases: W Dravus St/15th Ave W intersections



Note: Intersection #4 is the west intersection (southbound ramps) and Intersection #5 is the east intersection (northbound ramp). This signal timing plan assumes the recommended turn restrictions associated with Options A and D are in place and only buses can travel southbound through Intersection #4.

It is noted that the recommended operation of the northbound off-ramp—with a dual left turn movement and extended clearance phase—is similar to the peak period operation that was enacted at this interchange during past closures of the Magnolia Bridge, but with police-officer control instead of signal phasing changes. The intent of the recommendation is to automate the change so that police officers would not be needed.

Table B-1. W Dravus St and 15th Ave W Simulation Results – Year 2017 PM Volumes with Short Term Bridge Closure Reroutes

Intersection / Approach	Baseline		Baseline w/ Optimized Signal Timings		Option A		Option B		Option C		Option D		Options A & B		Options A & D	
	LOS [1]	Delay [2]	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
W Dravus St / 15th Ave W NB Ramps	F	494.8	F	294.0	F	166.5	F	256.6	F	206.0	F	84.8	F	138.8	C	32.4
Westbound Approach	D	43.5	E	66.8	E	79.0	E	68.3	E	71.5	E	64.2	E	68.7	E	56.5
Northbound Approach	F	1189.2	F	652.4	F	352.7	F	567.0	F	439.7	F	183.1	F	283.0	D	54.0
W Dravus St / 15th Ave W SB Ramps	C	32.6	F	170.7	F	153.5	F	157.9	F	174.1	F	104.2	F	127.5	D	45.9
Eastbound Approach	D	41.1	F	335.2	F	246.0	F	303.8	F	363.3	F	208.3	F	216.5	E	75.7
Southbound Approach	D	38.4	F	124.4	n/a	n/a	F	132.5	F	104.7	F	95.7	n/a	n/a	D [3]	52.6

Source: Synchro model developed and revised by Heffron Transportation, Inc., September 2017. Levels of service were calculated using the SimTraffic module with an average of 5 model runs.

1. *Level of service.*
2. *Average seconds of delay per vehicle.*
3. *The southbound approach would be for local access and transit only. Local access vehicles would be required to turn right onto W Dravus St, but transit vehicles would be allowed to travel across W Dravus St.*

n/a Not applicable. The southbound approach would be for local access only with no signal control and right-turn only onto W Dravus St.

Table B-2. W Dravus St and 15th Ave W Queue Lengths – Year 2017 PM Volumes with Short Term Bridge Closure Reroutes

Intersection / Approach	Baseline		Baseline w/ Optimized Signal Timings		Option A		Option B		Option C		Option D		Options A & B		Options A & D	
	Avg. Q [1]	95th-% Q [2]	Avg. Q	95th-% Q	Avg. Q	95th-% Q	Avg. Q	95th-% Q	Avg. Q	95th-% Q	Avg. Q	95th-% Q	Avg. Q	95th-% Q	Avg. Q	95th-% Q
W Dravus St / 15th Ave W NB Ramps																
Westbound Approach	113	136	117	132	116	130	117	132	115	126	116	127	116	128	114	124
Northbound Approach	7829	13891	4147	6643	2486	3874	3879	6275	1725	2802	799	1346	2250	2250	326	497
W Dravus St / 15th Ave W SB Ramps																
Eastbound Approach	260	551	1760	3118	1749	2860	1638	3061	2719	4469	1121	1976	1682	2997	689	1258
Southbound Approach	266	421	730	1448	n/a	n/a	791	1282	649	1079	567	943	n/a	n/a	13 [3]	41 [3]

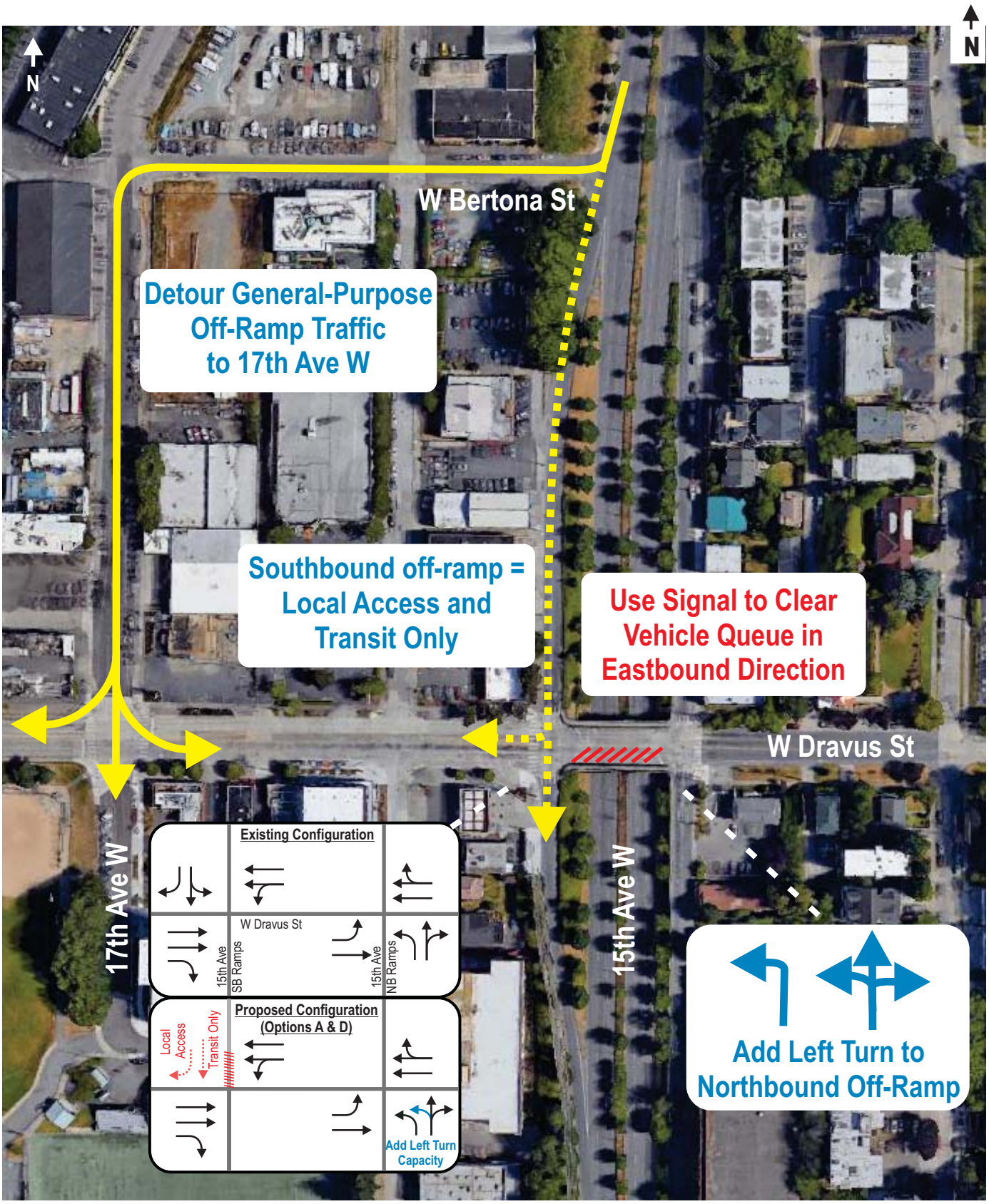
Source: Synchro model developed and revised by Heffron Transportation, Inc., September 2017. Levels of service were calculated using the SimTraffic module with an average of 5 model runs.

1. *Average queue length in feet. Longest queue for each lane on the approach is listed.*
2. *95th-percentile queue length in feet.*
3. *The southbound approach would be for local access and transit only. Local access vehicles would be required to turn right onto W Dravus St, but transit vehicles would be allowed to travel across W Dravus St.*

n/a Not applicable. The southbound approach would be for local access only with no signal control and right-turn only onto W Dravus Street.

Queue distance does not exceed the length of the northbound 15th Ave W off-ramp to W Dravus St (<900 ft)

Queue distance exceeds the length of the northbound 15th Ave W off-ramp to W Drave Us (>900 ft)



Source: Google Earth, July 2017

MAGNOLIA BRIDGE
SHORT-TERM CLOSURE TRANSPORTATION PLAN

Figure B-1
Recommended Improvements at W Dravus St / 15th Ave W Intersection

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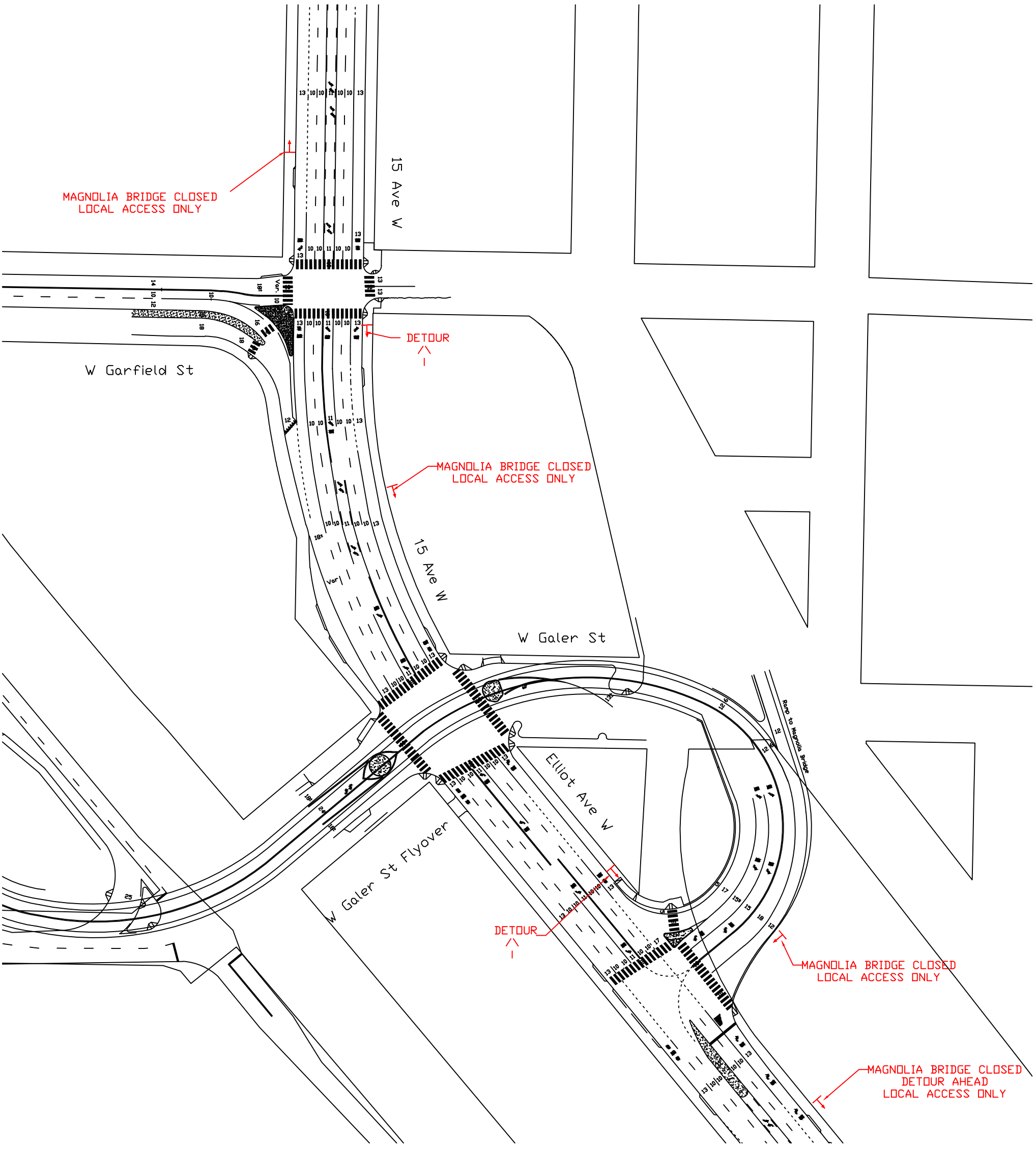
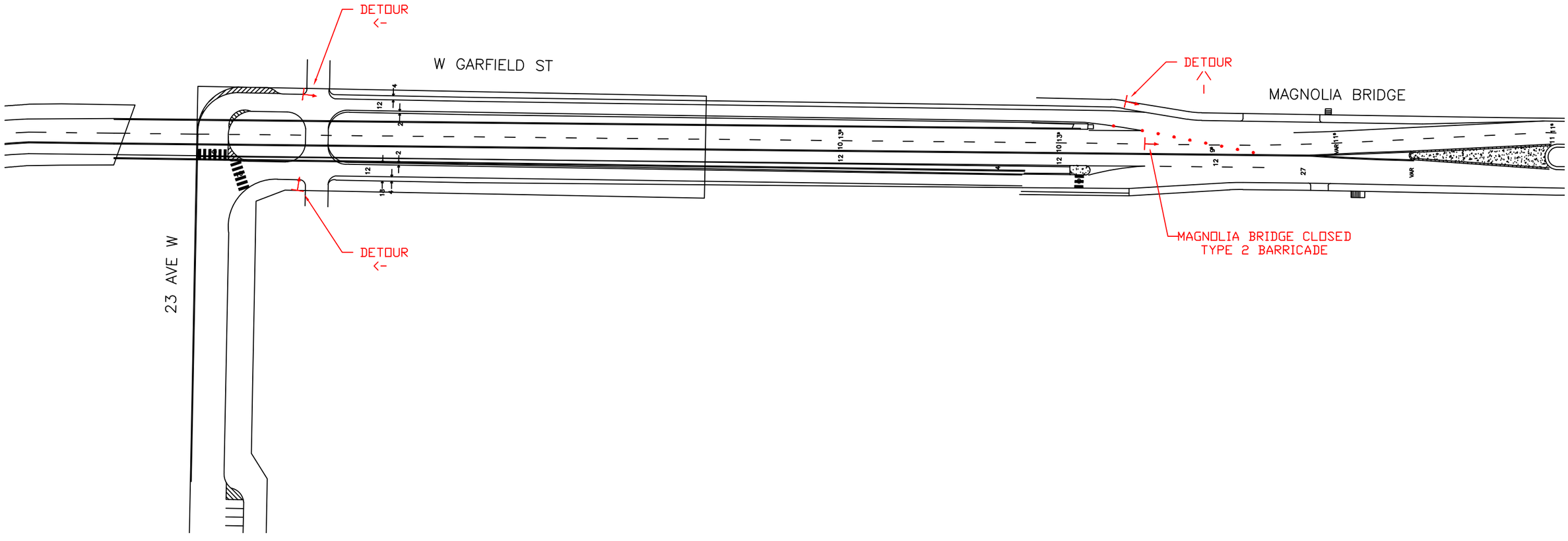
APPENDIX C
DETOUR PLAN WITH MAGNOLIA BRIDGE CLOSURE


W RUFFNER ST
MAGNOLIA BRIDGE CLOSED
DETOUR AHEAD
15 AVE W
15TH AVE W
W BERTONA ST
DETOUR
W DRAVUS ST
22 AVE W
21 AVE W
20 AVE W
17 AVE W
16 AVE W
14 AVE W
W BARRET ST
THORNDYKE AVE W
W ARMOUR ST
W RAYE ST
W HALLADAY ST
W RAY ST
W SMITH ST
W MCGRAW ST
W LYNN PL
W LYNN ST
W BOSTON ST
W CROCKETT ST
W NEWTON ST
W PLYMOUTH ST
W BLAINE ST
W HAYES ST
MAGNOLIA BRIDGE CLOSED
W Galer St
MAGNOLIA BRIDGE CLOSED
DETOUR AHEAD
MAGNOLIA BRIDGE CLOSED
TYPE 2 BARRICADE
DETOUR
W GARFIELD ST
MAGNOLIA BRIDGE
RAMP
PIER 91
MAGNOLIA BRIDGE CLOSED
TYPE 2 BARRICADE
MAGNOLIA BRIDGE CLOSED
LOCAL ACCESS ONLY
W Garfield St
Galer St Flyover
Olson Pl W
MAGNOLIA BRIDGE CLOSED
LOCAL ACCESS ONLY
MAGNOLIA BRIDGE CLOSED
DETOUR AHEAD
LOCAL ACCESS ONLY
W ARMORY WAY
W HOWE ST
W WHEELER ST
MAGNOLIA WAY W
W 30TH ST


MAGNOLIA BRIDGE CLOSED
LOCAL ACCESS ONLY
15 Ave W
W Garfield St
DETOUR
MAGNOLIA BRIDGE CLOSED
LOCAL ACCESS ONLY
15 Ave W
W Galer St
Elliot Ave W
Ramp to Magnolia Bridge
W Galer St Flyover
DETOUR
MAGNOLIA BRIDGE CLOSED
LOCAL ACCESS ONLY
MAGNOLIA BRIDGE CLOSED
DETOUR AHEAD
LOCAL ACCESS ONLY


DETOUR
<-
W GARFIELD ST
DETOUR
MAGNOLIA BRIDGE
23 AVE W
DETOUR
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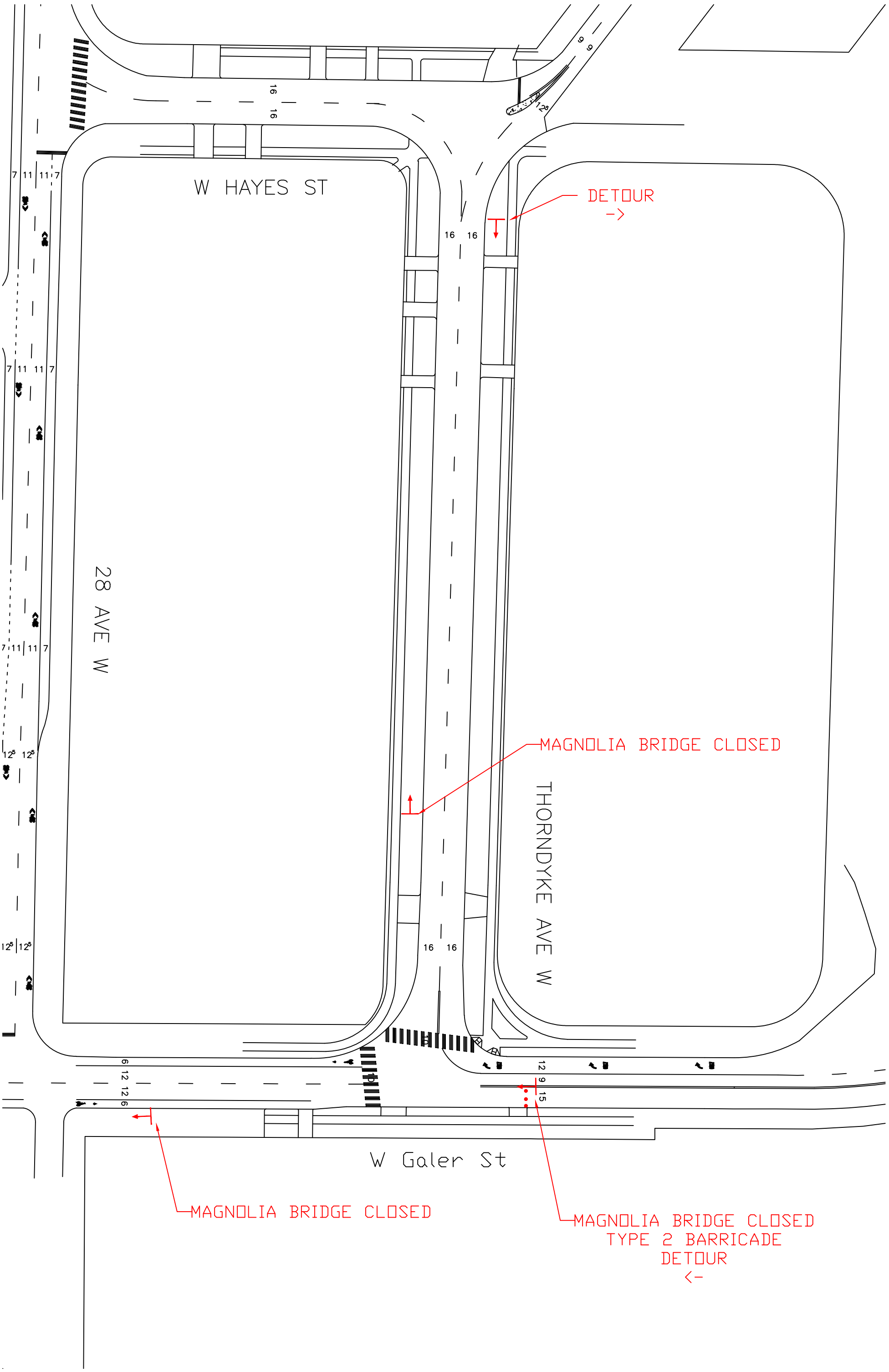
MAGNOLIA BRIDGE CLOSED
TYPE 2 BARRICADE


W HAYES ST
28 AVE W
THORNDYKE AVE W
W Galer St
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MAGNOLIA BRIDGE CLOSED
MAGNOLIA BRIDGE CLOSED
TYPE 2 BARRICADE
DETOUR
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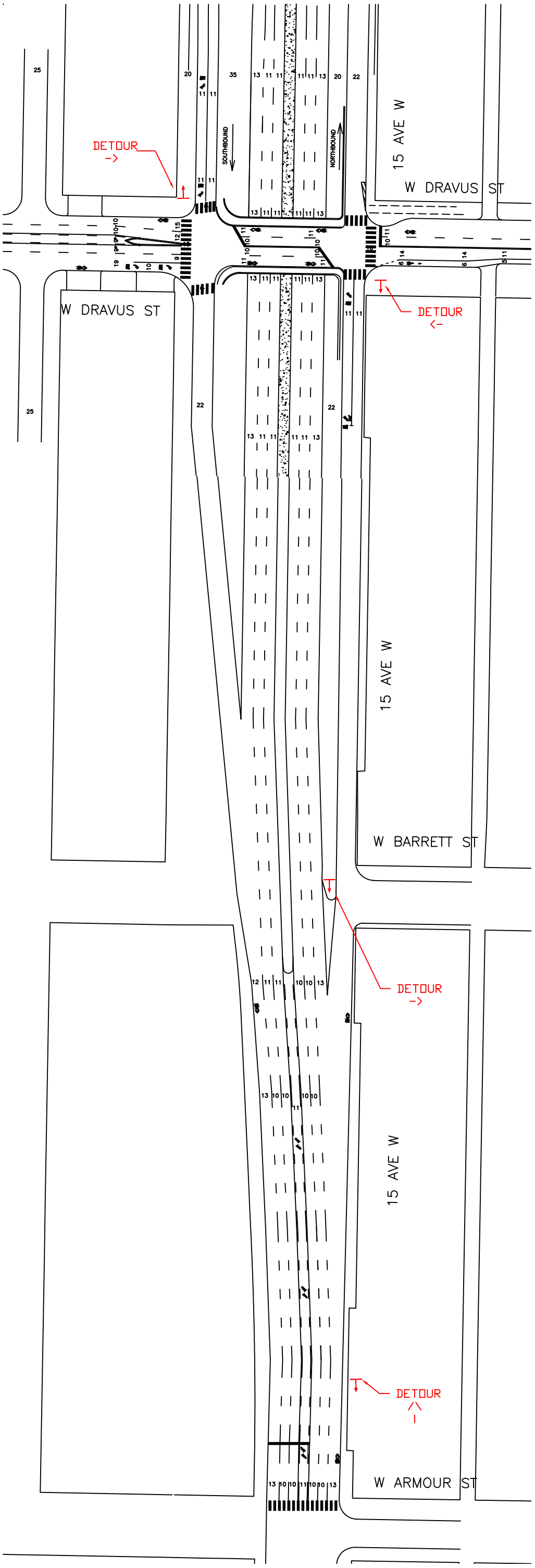
MAGNOLIA BRIDGE CLOSED


DETOUR
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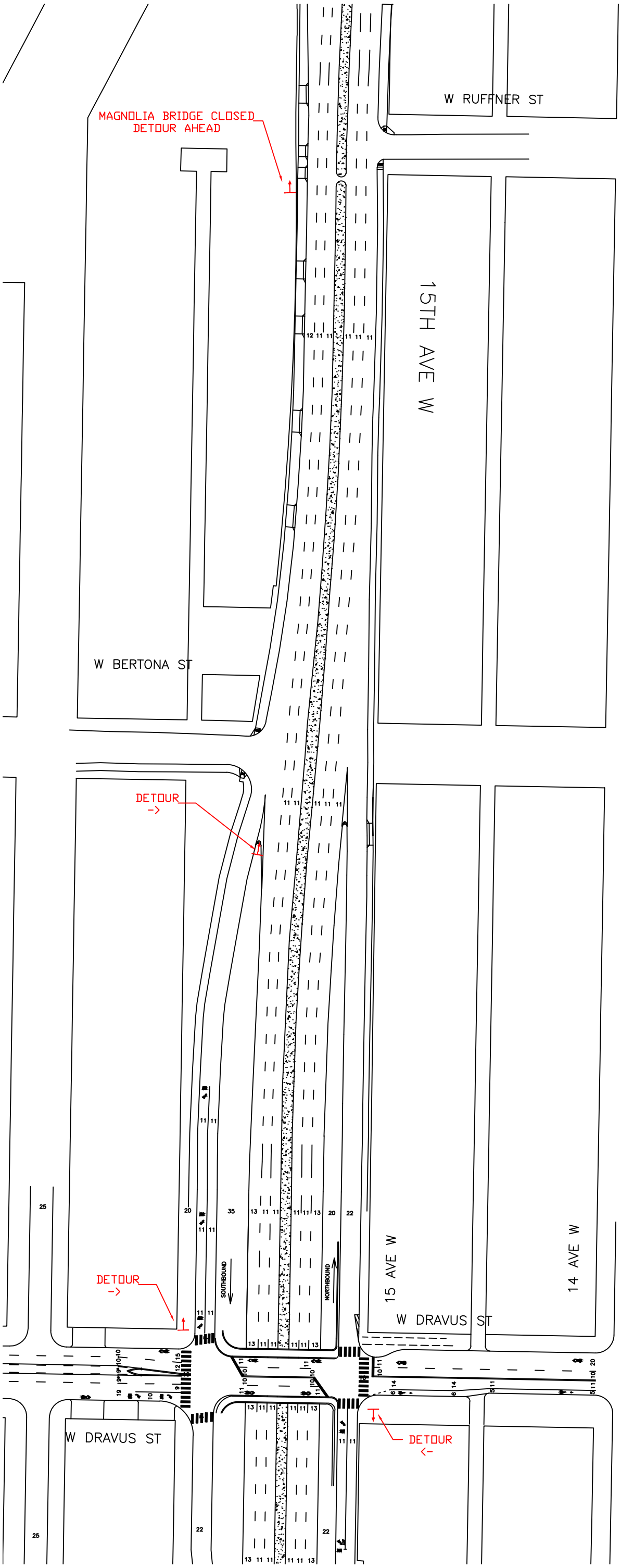
MAGNOLIA BRIDGE CLOSED
DETOUR AHEAD
W RUFFNER ST
15TH AVE W
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SOUTHBOUND
NORTHBOUND
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