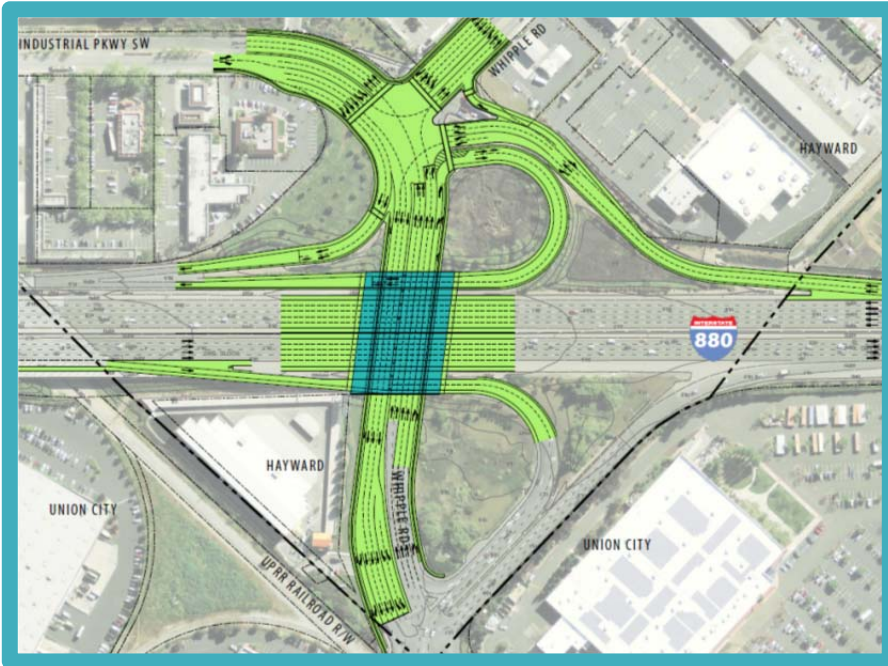


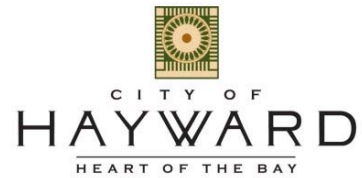
ABSTRACT

The Alameda County Transportation Commission (Alameda CTC) proposes to improve both the I-880 Whipple Road and Industrial Parkway Interchanges in order to relieve freeway and interchange congestion, enhance safety, improve business access and provide routine bicycle and pedestrian accommodations.



I-880/WHIPPLE ROAD – INDUSTRIAL PARKWAY SOUTH WEST AND I-880/ INDUSTRIAL PARKWAY WEST INTERCHANGES

Feasibility Study



PREPARED BY:



May, 2016

EXECUTIVE SUMMARY

The Alameda County Transportation Commission (Alameda CTC) proposes to improve the I-880 Whipple Road – Industrial Parkway South West and Industrial Parkway West Interchanges in order to relieve freeway and interchange congestion, enhance safety, improve business access and provide routine bicycle & pedestrian accommodation. Both the I-880 Whipple Road – Industrial Parkway South West and I-880 Industrial Parkway West interchanges are currently named projects in the Alameda CTC Measure BB Transportation Expenditure Plan (TEP) and have been programmed for interchange improvements. The purpose of this study is to identify potential deficiencies and evaluate viable improvement alternatives geared toward improving safety and traffic operations interchanges, providing bicycle and pedestrian connections through the interchanges, and improving local traffic circulation.

Alternatives developed as part of this feasibility study incorporate the most recent transportation data available from Caltrans, Alameda CTC, and each of the cities located along the corridor. Working in conjunction with the Alameda CTC, the Cities, Caltrans, and other involved agencies, improvements were identified that meet the purpose and need of the project which are summarized in this report. This feasibility study identifies three interchange alternatives for each interchange, and considers right of way, environmental and staging impacts, identifies conceptual construction and support costs, and significant non-standard features requiring design exceptions associated with each alternative. An environmental screening, structures assessment, and traffic operations assessment were performed for each alternative, with more detailed information included in the attachments to this report.

This feasibility report scopes the project in order to allow each interchange to move forward into the Caltrans project development process (PID, PA/ED and PS&E phases) with the intention of beginning construction in 2020.

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Attachments

- Attachment A Vicinity Map
- Attachment B Alternatives
- Attachment C Cost Estimates
- Attachment D Environmental Screening Memo
- Attachment E Traffic Operations Assessment

INTRODUCTION

The Alameda County Transportation Commission (Alameda CTC) proposes to improve the I-880 Whipple Road – Industrial Parkway South West and Industrial Parkway West Interchanges in order to relieve freeway and interchange congestion, enhance safety, improve business access and provide routine bicycle & pedestrian accommodation. It is proposed to reconstruct both interchanges, providing full movements, provide local street improvements, and modernize ramps to include HOV preferential lanes at all on-ramps.

Both the I-880 Whipple Road – Industrial Parkway South West and I-880 Industrial Parkway West interchanges are currently named projects in the Alameda CTC Measure BB Transportation Expenditure Plan (TEP) and have been programmed for interchange improvements. The purpose of this study is to identify potential deficiencies and evaluate viable improvement alternatives geared toward improving safety and traffic operations interchanges, providing bicycle and pedestrian connections through the interchanges, and improving local traffic circulation.

Alternatives developed as part of this feasibility study incorporate the most recent transportation data available from Caltrans, Alameda CTC, and each of the cities located along the corridor. This study collected available data and identified and examined existing recurrent traffic congestion along the I-880 corridor and at the Whipple Road – Industrial Parkway South West and Industrial Parkway West interchanges. Working in conjunction with the Alameda CTC, the Cities, Caltrans, and other involved agencies, improvements were identified that meet the purpose and need of the project which are summarized in this report.

This feasibility study identifies improvements, considers right of way, environmental and staging impacts, identifies conceptual construction and support costs, and significant non-standard features requiring design exceptions associated with each alternative. This report will ultimately scope both projects in order to allow each interchange to move forward into the Caltrans project development process (PID, PA/ED and PS&E phases) with the intention of beginning construction in 2020. A project Vicinity Map can be found in Attachment A.

1 BACKGROUND

In 2009, a Project Initiation Document (PID) to Support the Central Alameda County Local Alternative Transportation Improvement Program (LATIP) was prepared to evaluate improvements along I-880 between Davis Street and Whipple Road, I-238 between I-880 and I-580, I-580 between I-238 and Crow Canyon Road, and SR 92 between Whitesell Street and Industrial Boulevard. The purpose of the study was to define improvements and implementation planning to relieve traffic along the I-880, I-580, and I-238 corridors.

Three separate projects were identified within this project's study area as part of the PID document for the Central Alameda County LATIP:

1. Project E was defined as reconstructing the I-880/Industrial Parkway interchange to a modified partial cloverleaf configuration. The improvements included the addition of a northbound 2-lane off-ramp and an eastbound to northbound loop on-ramp to replace the left turn connection for that movement.
2. Project F added auxiliary lanes in both directions of I-880 between the Industrial Parkway West and Whipple Road– Industrial Parkway South West interchanges, which included the widening of Alameda Creek.
3. Project G improved the northbound on-ramp to I-880 from Whipple road to 2-lanes (1 general purpose + 1 HOV preferential lane) which included widening of the existing Union Pacific Railroad (UPRR) bridge and right of way acquisition.

The Alameda County Transportation Commission (Alameda CTC) is the implementing agency and sponsor for this study, with involvement from the Cities of Union City and Hayward. Caltrans and MTC were engaged through this study to provide input on conceptual alternatives as well as coordination of improvements along the corridor.

1.1 EXISTING FACILITY

Interstate 880 is a north-south freeway that connects San Jose to Oakland. I-880 begins at the I-280/SR 17 interchange in San Jose and terminates at the I-80/I-580 interchange (known as the MacArthur Maze) near the eastern approach of the Bay Bridge, and passes through the Cities of San Jose, Milpitas, Fremont, Union City, Hayward, San Lorenzo, San Leandro, and Oakland.

Northbound and Southbound I-880 consists of 3 mixed flow lanes and one HOV lane in each direction with auxiliary lanes in some locations. Within the study limits, I-880 passes through the Cities of Union City and Hayward. The following is a list of existing bridges on I-880 within the study limits:

- Whipple Road Undercrossings (Bridge No. 33-0245, 33-0245K, and 33-0245S)
- Alquire Road Overhead (Bridge No. 33-0246 and 33-0246S)
- Ward Creek (Bridge No. 33-0251)
- Industrial Parkway Overcrossing (Bridge 33-0398)

The existing Whipple Road– Industrial Parkway South West interchange is a partial cloverleaf (L-9) along Northbound I-880 and a type L-8 interchange along Southbound I-880. The existing Whipple Road under I-880 has 2 through eastbound lanes and 3 westbound lanes (2 through lanes with a right

turn lane to the northbound on-ramp). A sidewalk exists along the north side of Whipple Road. There are currently no striped bike lanes through the interchange.

The existing Industrial Parkway interchange is a partial interchange along northbound I-880 consisting of a diagonal on-ramp, and a partial cloverleaf (L-7) along southbound I-880. The existing Industrial Parkway over I-880 consists of two through lanes in each direction with a raised concrete median. Sidewalks run along Industrial Parkway in both directions and there are currently no striped bike lanes through the interchange.

2 PURPOSE & NEED

2.1 PROJECT PURPOSE

The purpose of this project is to:

- Improve safety and traffic operations at the I-880 Whipple Road – Industrial Parkway South West and I-880 Industrial Parkway West Interchanges.
- Provide safe bicycle and pedestrian connections through the interchanges
- Improve local traffic circulation

2.2 PROJECT NEED

The I-880/Whipple Road ramp intersections currently operate at or over capacity, with a few individual movements experiencing high delays and long queues during the commuters AM and PM peak hours.

The northbound left-turn and eastbound left-turn movements at the northbound ramp intersection operate over capacity. Field observations indicate that the queues for the northbound off-ramp approach at Whipple Road occasionally extend to the mainline. At the Southbound Ramp Terminal Intersection, field observations indicate that vehicular queues at the northbound left-turn and southbound left-turn movements exceed storage capacity and therefore experience delays.

The I-880/Industrial Parkway West ramp intersections currently operate at or below capacity, with a few individual movement experiencing moderate delays and queues during the commuters AM and PM peak hours.

The pedestrian and bicycle facilities at each interchange are minimal. There are currently no striped bike lanes along either Whipple Road or Industrial Parkway at I-880, and both interchanges include high speed free-flowing ramps that are not bicycle or pedestrian friendly. Whipple Road does not have a sidewalk along the south side, and the sidewalk along the north side is narrow. The Whipple Road – Industrial Parkway South West interchange was identified by the Cities as needing bicycle and pedestrian improvements to enhance the connectivity between the east and west sides of I-880. Providing connectivity will enhance access to local businesses and transit facilities in the area.

The pavement condition of Whipple Road within the Caltrans right-of-way is degraded and is in need of a major rehabilitation. As part of this study, the Cities of Union City and Hayward requested that a pavement rehabilitation project be considered as an early-implementation project.

2.3 FORECAST TRAFFIC TRENDS

At the I-880/Whipple Road – Industrial Parkway South West Interchange, traffic volumes are forecasted to grow and the traffic operations at this interchange will worsen. Motorists are likely to divert to other routes, such as Alvarado-Niles Road, Industrial Parkway, and Union City Boulevard to avoid congestion.

Table 2-1 illustrates preliminary traffic forecasts, along with existing volumes at the I-880 ramps.

City of Hayward Circulation Element (adopted on July 1, 2014) projected that operations at the Industrial Parkway southbound ramp intersection would degrade substantially during AM and PM peak

hours in the 2035 conditions. Critical movements that experience increased delays and queues would be southbound right-turn, southbound left-turn, westbound through and eastbound left-turn.

Table 2-1. Existing and Forecasted Traffic Volumes

I-88o Direction	Interchange	Ramp	Existing Volumes		2035 Volumes with Industrial Parkway West Off-Ramp	
			AM	PM	AM	PM
Northbound	Whipple Rd	Diag Off	1240	1050	1,140	1,030
		Loop On	190	240	300	350
		Diag On	300	240	640	500
	Industrial Pkwy	Diag Off	NA	NA	1,210	1,020
Diag On		620	690	980	1,080	
Southbound	Industrial Pkwy	Diag Off	1020	680	1,260	950
		Loop On	350	520	620	890
	Whipple Rd	Loop Off	620	710	1,190	1,400
		Diag On	540	970	700	1,500
Source: City of Hayward Circulation Element (adopted on July 1, 2014)						

3 CORRIDOR & SYSTEM COORDINATION

This study included coordination with statewide, regional, and local planning effort, including MTC, Caltrans, and the Cities of Union City and Hayward.

A coordination meeting with the Metropolitan Transportation Commission (MTC) I-880 Express Lanes was held in February of 2016 to discuss project improvements. It is anticipated that the express lanes will be open to the public in 2019. The Electronic Toll System plans and Accident Analysis information was provided for review and incorporation into this study. The express lane project proposes toll gantries and median improvements within the project limits that may be affected by this project.

The Whipple Road Widening Project is planned between the I-880 interchange and Mission Boulevard led by the City of Hayward. A conceptual study is planned to study upgrading Whipple Road to 3 lanes in each direction with bicycle and pedestrian accommodations.

There is a development that is going through the approval process on the east side of I-880 at the Whipple Road/Industrial Parkway intersection. Information from their study was included in this feasibility study.

The project will be consistent with the City of Hayward Bicycle Master Plan, which currently identifies both Whipple Road and Industrial Parkway as existing class III bicycle facilities. The City wishes to provide additional connectivity through the interchanges. They are in the process of updating their master plan to include bicycle and pedestrian accommodations at both interchanges.

The project will be consistent with the City of Union City Bicycle Master Plan, which currently includes bicycle and pedestrian improvements along Whipple Road and Dyer Street. They are in the process of updating their master plan to include bicycle and pedestrian accommodations that would provide connectivity through I-880 at several locations.

4 ALTERNATIVES

Alternatives were developed that include improvements that address the project's purpose and need. Three interchange alternatives were developed for each interchange, which can be found in Attachment B. The following sections include a description of the improvements with pros and cons. The following general improvements are proposed:

- Auxiliary Lane or optional hard shoulder running lane for peak hours on Northbound I-880 between the Alvarado Niles Road On-Ramp and the Whipple Road – Industrial Parkway South West Off-Ramp. This would be achieved by re-striping the existing pavement and would require approval of non-standard 5 foot outside shoulder and horizontal clearance.
- Northbound and Southbound auxiliary lanes between Whipple Road– Industrial Parkway South West and Industrial Parkway West interchanges.
- Widen the Ward Creek Bridge.

4.1 I-880/WHIPPLE ROAD– INDUSTRIAL PARKWAY SOUTH WEST INTERCHANGE

4.1.1 Alternative 1 – Modify Existing Interchange

This alternative would preserve the 3 existing Whipple Road Undercrossing structures and the general configurations of the existing interchange and local roads.

Improvements would include the following:

- Widen the existing Northbound Diagonal Off-Ramp to Whipple Road to 2 lanes, and widen from 3 existing to 5 proposed lanes at the ramp terminus.
- Widen Northbound Loop On-Ramp from Whipple Road to 2 lanes (1 general purpose lane + 1 HOV preferential lane). Re-align ramp terminus to be squared up at Whipple Road to improve pedestrian and bicyclist safety.
- Widen Northbound Diagonal on-ramp to 2 lanes (1 general purpose lane + 1 HOV preferential lane).
- Restripe Whipple Road near the Industrial Parkway Southwest Intersection to improve left turn movements from Eastbound Whipple Road to Northbound Industrial Parkway SW.
- Widen Industrial Parkway Southwest to 6 lanes at the Whipple Road intersection.

The existing sidewalk along the north and south side of Whipple Road would be widened to accommodate pedestrians and bicycles on a shared path. Both paths would be completely separated from traffic and require retaining walls to be constructed at the abutments of the existing Undercrossing structure.

4.1.2 Alternative 2 – Replace UC Structure

This alternative would replace all 3 existing Whipple Road Undercrossing structures with one large new Undercrossing structure.

Improvements would include the following:

- Widen the existing Northbound Diagonal Off-Ramp to Whipple Road to 2 lanes, and widen from 3 existing to 5 proposed lanes at the ramp terminus.
- Widen Northbound Loop On-Ramp from Whipple Road to 2 lanes (1 general purpose lane + 1 HOV preferential lane). Re-align ramp terminus to be squared up at Whipple Road to improve pedestrian and bicyclist safety.
- Widen Northbound Diagonal on-ramp to 2 lanes (1 general purpose lane + 1 HOV preferential lane).
- Widen Whipple Road between Industrial Parkway Southwest and Dyer Street to 8 lanes (3 westbound lanes and 5 eastbound lanes).
- Widen Industrial Parkway South West to 6 lanes at the Whipple Road intersection.

New shared pedestrian and bicycle paths will be constructed along the north and south side of Whipple Road. Both paths will be completely separated from traffic.

4.1.3 Alternative 3 – Replace UC Structure & Realign Whipple Road

This alternative would replace all 3 existing Whipple Road Undercrossing structures with one large new Undercrossing structure.

Improvements would include the following:

- Widen the existing Northbound Diagonal Off-Ramp to Whipple Road to 2 lanes, and widen from 3 existing to 5 proposed lanes at the ramp terminus.
- Widen Northbound Loop On-Ramp from Whipple Road to 2 lanes (1 general purpose lane + 1 HOV preferential lane). Re-align ramp terminus to be squared up at Whipple Road to improve pedestrian and bicyclist safety.
- Widen Northbound Diagonal on-ramp to 2 lanes (1 general purpose lane + 1 HOV preferential lane).
- Widen Whipple Road between Industrial Parkway Southwest and Dyer Street to 8 lanes (3 westbound lanes and 5 eastbound lanes).
- Re-align intersection of Industrial Parkway South West at Whipple Road to better align the major traffic movements between Industrial Parkway South West and Dyer Street.
- New shared pedestrian and bicycle paths will be constructed along the north and south side of Whipple Road. Both paths will be completely separated from traffic.

4.2 I-880/INDUSTRIAL PARKWAY WEST INTERCHANGE

4.2.1 Alternative 1 – Modify Existing Interchange

This alternative would preserve the existing Industrial Parkway Overcrossing structure and the general configurations of the existing interchange with the exception of the addition of the northbound off-ramp.

Improvements would include the following:

- Construct a new single-lane Northbound diagonal off-ramp with 3 lanes at the ramp terminus at Industrial Parkway. This would require a new bridge structure over Ward Creek and retaining walls along the ramp.

- Realign the Northbound diagonal on-ramp to a new entrance at Industrial Parkway to line up at an intersection with the new off-ramp. This would include the installation of a new traffic signal.
- Widen the Southbound off-ramp to include dual left turn lanes and a right turn lane to Industrial Parkway.
- Widen the southbound loop on-ramp to 3 lanes (2 general purpose + 1 HOV preferential lane). Modify the existing abutment and construct a new retaining wall to accommodate the additional lane under the overcrossing.
- Widen Industrial Parkway east of I-880 to provide dual left turn lanes to the southbound loop on-ramp.
- Remove existing raised concrete median and restripe Industrial Parkway to provide wide shared outside lanes (class III bicycle facility)

4.2.2 Alternative 2 – Tight Diamond (L-1)

This alternative would realign Industrial Parkway and replace the existing Industrial Parkway Overcrossing structure with a new structure to the north. The northbound and southbound ramps would be reconfigured to a tight diamond (L-1) interchange.

Improvements would include the following:

- Construct a new single-lane Northbound diagonal off-ramp with 3 lanes at the ramp terminus at Industrial Parkway. This would require a new bridge structure over Ward Creek which would connect to the new overcrossing structure.
- Realign the Northbound diagonal on-ramp to line up at an intersection with the new off-ramp. This would include the installation of a new traffic signal.
- Widen and realign the existing southbound off-ramp. Provide dual left turn lanes to eastbound Industrial Parkway and a single right turn lane to westbound Industrial Parkway.
- Construct a new diagonal on-ramp with 3 lanes (2 general purpose + 1 HOV preferential lane)
- Construct a new structure to accommodate 7 lanes with bike lanes and sidewalks in both directions.

4.2.3 Alternative 3 – NB Tight Diamond (L-1) & SB Partial Cloverleaf (L-9)

This alternative would realign Industrial Parkway and replace the existing Industrial Parkway Overcrossing structure with a new structure to the north. The northbound ramps would be reconfigured to a tight diamond (L-1) interchange. The southbound ramps would be reconfigured to a partial cloverleaf (L-9) interchange.

Improvements would include the following:

- Construct a new single-lane northbound diagonal off-ramp with 3 lanes at the ramp terminus at Industrial Parkway. This would require a new bridge structure over Ward Creek which would connect to the new overcrossing structure.
- Realign the Northbound diagonal on-ramp to line up at an intersection with the new off-ramp. This would include the installation of a new traffic signal.
- Widen and realign the existing southbound off-ramp. Provide dual left turn lanes to eastbound Industrial Parkway and a single right turn lane to westbound Industrial Parkway.
- Construct a new diagonal on-ramp with 3 lanes (2 general purpose + 1 HOV preferential lane)

- Widen the southbound loop on-ramp to 3 lanes (2 general purpose + 1 HOV preferential lane).
- Construct a new structure to accommodate 7 lanes with bike lanes and sidewalks in both directions.

4.3 STRUCTURES ASSESSMENT

A structures assessment was performed for the improvements along the mainline of I-880 and at each interchange. The mainline improvements include widening of the Ward Creek Bridge at I-880 which will need a 12 foot widening to accommodate an additional southbound auxiliary lane. The existing bridge is a cast-in-place concrete Tee beam structure, which can be widened.

Below is a discussion of the structural implications and feasibility of each alternative at the I-880/Whipple – Industrial Parkway South West and I-880 Industrial West interchanges.

4.3.1 I-880/Whipple Road – Industrial Parkway South West Interchange

Alternative 1. Pedestrian & bike paths are proposed to be added to spans 1 and 3 in the Whipple Road Undercrossing. This would require removal of the existing slope paving and adding tie-back walls in front of the abutments to allow addition of the paths in spans 1 and 3. The existing Whipple Road Undercrossing is a three span structure with a combination of cast-in-place and precast girders due to a couple of widening projects. Vertical clearance is a non-standard 15 feet at this existing structure. There is limited potential to lower the pavement on Whipple Road, since the foundations at columns 5 & 6 are only buried 15”.

Alternative 2. The Whipple Road Undercrossing replacement structure would also be a precast/prestressed girder type to avoid falsework over the traffic on Whipple Road. The replacement structure could be constructed with multiple stage construction and lane shifting on I-880 and potentially temporary short term traffic closures on Whipple Road. The substructure would be similar to the existing multicolumn bent. To gain required soffit clearance the new structure depth will be kept to the minimum possible. Alternative may allow for greater vertical clearance by lowering Whipple Road profile after replacement of structure.

Alternative 3. The Whipple Road Undercrossing replacement structure would also be a precast/prestressed girder type to avoid falsework over the traffic on Whipple Road. The replacement structure could be constructed with multiple stage construction and lane shifting on I-880 and potential temporary short term traffic closures on Whipple Road. The substructure would be similar to the existing multicolumn bent. To gain required soffit clearance the new structure depth will be kept to the minimum possible. Southbound ramp could be accommodated with the required soffit clearance.

4.3.2 I-880/Industrial Parkway West Interchange

Alternative 1. The existing Industrial Parkway Overcrossing will not be modified for this alternative. The retaining wall at abutment 6 will need to be moved closer to the abutment to allow an additional lane for the southbound onramp. The Northbound I-880 Industrial Parkway Off-Ramp required to carry traffic over Ward Creek can be a precast/prestressed girder structure to eliminate the need for falsework over the creek. A straddle bent may be required over the creek to keep columns out of the waterway.

Alternative 2. This alternative proposes an Industrial Parkway Overcrossing Replacement on the north side of the existing overcrossing structure to maintain the existing traffic on the current Industrial Parkway structure. The superstructure would be precast/prestressed girders to avoid falsework over I-880 and to keep the profile structure low. The substructure will be aligned with the existing with the approach span modified to suit onsite features on the west end, whereas at the east end it will require to tailor the on and off ramp attachments.

The NB I-880 Industrial Parkway Off-Ramp that parallels Ward Creek, will require a structural slab type approach on the south end with reverse wingwall and/or retaining walls. The superstructure would be precast/prestressed girders to avoid falsework over the creek. The substructure could be any combination of regular bent caps, C-Bents, or straddle bents. The tie-in structure from ramp to overcrossing superstructure could be a structural transition slab to avoid differential settlement related issues at intersecting Overcrossing structure.

Alternative 3. This alternative, similar to alternative 2, also proposes an Industrial Parkway Overcrossing Replacement on the north side of the existing overcrossing structure to maintain the existing traffic on the current Industrial Parkway structure. The superstructure would be precast/prestressed girders to avoid falsework over Route 880 and to keep the profile structure low. The substructure will be aligned with the existing with the approach span modified to suit onsite features on the west end, whereas at the east end it will require to tailor the on and off ramp attachments. The Southbound I-880 Loop On-Ramp will require a retaining wall to be able to add an additional lane on the ramp.

The NB I-880 Industrial Parkway Off-Ramp that parallels Ward Creek, will require a structural slab type approach on the south end with reverse wingwall and/or retaining walls. The superstructure would be precast/prestressed girders to avoid falsework over the creek. The substructure could be any combination regular bent caps, C-Bents, or straddle bents. The tie-in structure from ramp to overcrossing superstructure could be a structural transition slab to avoid differential settlement related issues at intersecting Overcrossing structure.

4.4 RIGHT OF WAY

The right of way needs were evaluated along the mainline of I-880 and at the I-880/Whipple Road – Industrial Parkway South West and I-880 Industrial Parkway West interchanges. The mainline improvements do not warrant additional right of way, pending approval of the non-standard outside shoulder along northbound I-880 between the Alvarado Niles on-ramp and the Whipple Road off-ramp.

Below is a discussion of the anticipated right of way needs of each alternative at the I-880/Whipple and I-880 Industrial interchanges

4.4.1 I-880/Whipple Road – Industrial Parkway South West Interchange

All 3 of the alternatives require partial right-of-way acquisitions at the northbound off-ramp resulting in removal of a landscaped strip on the private property. Both Alternative 1 and 2 require a sliver partial take from the property located on the northwest corner of Whipple Road and Industrial Parkway South West to accommodate the widening of Industrial Parkway South West to 4 lanes at the intersection (2 right turn lanes and 2 left turn lanes). The right of way acquisition could potentially impact the property's parking along the property line. Alternative 3 requires a larger right of way acquisition from

the property located on the northwest corner of Whipple Road and Industrial Parkway South West due to the proposed realignment of the intersection movements. The right of way acquisition could potentially remove a row of parking along the property line.

4.4.2 I-880/Industrial Parkway West Interchange

Alternative 1 would require right of way acquisition from the private property along northbound I-880 south of Industrial Parkway. There is an existing pump station at the corner of the parcel, and the new diagonal off-ramp is aligned to the east of the pump station through the private property, which would result in loss of parking spaces for the private property. Alternatives 1 and 3 may also require temporary construction easements at the parcel adjacent to the southbound off-ramp. Alternatives 2 and 3 require a partial right of way acquisition along southbound I-880 south of Industrial Parkway to accommodate the new diagonal on-ramp.

4.5 ENVIRONMENTAL DETERMINATION/DOCUMENT

Each of the alternatives present ramp reconfigurations and environmental constraints that would warrant an IS/EA level environmental document. If the I-880/Industrial Parkway West interchange improvements significantly impact and state or federally listed fish species in Ward Creek, it is anticipated that it could be mitigated through BA/BO or permitting requirements; which would maintain an IS/EA level document. There is a low risk of having significant unavoidable impacts to fish species for Industrial Alternatives 2 and 3; resulting in an EIR/EA level document. Refer to the Environmental Screening Memo in Attachment D for more detailed information.

4.6 TRAFFIC OPERATION ASSESSMENT

A summary of qualitative operational evaluation is provided below for each alternative. More refined travel demand forecasts and detail operations analysis should be used in the subsequent project phases to verify adequacy of the proposed geometrics and to inform the geometric elements at this interchange, including length of turn bays. Refer to the Traffic Operation Assessment Memo in Attachment E for more detailed information.

4.6.1 I-880/Whipple Road – Industrial Parkway South West Interchange

Alternative 1. This alternative will add capacity to critical movements at the northbound ramp intersection, northbound off-ramp approach, westbound left-turn and southbound left-turn. With these improvements, vehicular operations would improve; however, vehicular queues on the westbound approach could continue to spillback into the upstream intersection. Adequacy of turn bay storage and intersection spacing would need to be further studied with quantitative operations analysis. Minor improvements proposed at the southbound ramp intersection would improve pedestrian circulation, without negatively affecting vehicular operations.

Alternative 2. This alternative will provide additional storage capacity between northbound and southbound ramp intersections in both directions. With these improvements, vehicular operations would improve, and queues are likely to be accommodated between ramp intersections. Adequacy of turn bay storage and intersection spacing would need to be further studied with quantitative operations analysis. At the southbound ramp intersection, an additional eastbound through lane would reduce through lane queues from blocking turn bays.

Alternative 3. By transforming critical turning movements, i.e. westbound left-turns and southbound right-turns as through movements, this alternative would reduce queuing issues resulting at the northbound ramp intersection. Queues between the ramp intersections are likely to be accommodated within the storage. Adequacy of lane configuration on Whipple Avenue and traffic flows will need to be studied further with quantitative operations analysis. Signal timings and phasing would need careful consideration to avoid conflicts and achieve desired operations.

4.6.1 I-880/Industrial Parkway West Interchange

Alternative 1. Adding a new northbound off-ramp at Industrial Parkway will increase traffic volumes traversing. A portion of this growth can be attributed to traffic diversion from elsewhere in City of Hayward. Some diversions would occur between I-880 northbound and Industrial Parkway West, and I-880 northbound and Hesperian Boulevard or Industrial Parkway North.

On the northbound off-ramp approach, two left-turn lanes and a right-turn lane would provide sufficient capacity to accommodate the forecast volumes. This alternative will provide additional capacity to the critical movements at the southbound ramp intersection: westbound left-turn, and southbound left-turn and right-turn. These intersection modifications are expected to improve traffic operations by reducing delays and queue spillbacks.

Alternative 2. Traffic volumes traversing through this interchange are expected to grow by adding a northbound off-ramp at Industrial Parkway. Further studies will be required to check whether the vehicular queues would be accommodated between northbound and southbound ramp intersections, and southbound ramp intersection and Stratford Road.

On the northbound off-ramp approach, two left-turn lanes and a right-turn lane would provide sufficient capacity to accommodate the forecast volumes. This alternative will provide additional capacity to the critical movements at the southbound ramp intersections: westbound and eastbound Industrial to southbound I-880, and southbound left-turn and right-turn. These intersection modifications are expected to improve traffic operations by reducing delays and queue spillbacks. Providing a diagonal on-ramp and westbound dual left-turn lanes would allow forecast volumes to be accommodated.

Alternative 3. Similar to Alternative 1 and 2, traffic volumes traversing through this interchange are expected to grow significantly due to addition of new northbound off-ramp at Industrial Parkway. On the northbound off-ramp approach, two left-turn lanes and a right-turn lane would provide sufficient capacity to accommodate the forecast volumes. This alternative will provide additional capacity to the critical movements at the southbound ramp intersection: westbound Industrial to southbound I-880, and southbound left-turn and right-turn. These intersection modifications are expected to improve traffic operations by reducing delays and queue spillbacks.

4.7 SUMMARY

Below is a brief summary of the pro's and cons of each alternative, taking into consideration right of way, environmental and staging impacts, order of magnitude construction and support costs, and significant non-standard features requiring design exceptions.

4.7.1 I-880/Whipple Road - Industrial Parkway South West Interchange

Alternative 1. This alternative is the lowest cost alternative and would have the least environmental and right of way impacts of the three alternatives developed for the interchange. Table 4-1 below summarizes the pro’s and con’s of Alternative 1 at the I-880 Whipple Road – Industrial Parkway South West Interchange.

Table 4-1 - I-880/Whipple Road - Industrial Parkway South West Interchange Alternative 1 Summary

Pros	Cons
<ul style="list-style-type: none"> • Low Cost • Simple Stage Construction • Minimal right-of-way acquisition 	<ul style="list-style-type: none"> • Does not allow widening of Whipple Road • Turn pocket lengths under the undercrossing crossing structure will remain as-is • Vertical clearance of 15 feet at the undercrossing would remain • Vehicular queues on the westbound approach could continue to spillback into the upstream intersection

Alternative 2. This alternative would require the replacement of the Whipple Road undercrossing which would result in complicated stage construction and higher cost in comparison with Alternative 1. The benefits of this alternative are that the traffic operations along Whipple Road could be improved by providing required turn pocket storage lengths and auxiliary lanes leading to on-ramps as needed. Table 4-2 below summarizes the pro’s and con’s of Alternative 2 at the I-880 Whipple Road – Industrial Parkway South West Interchange.

Table 4-2 - I-880/Whipple Road - Industrial Parkway South West Interchange Alternative 2 Summary

Pros	Cons
<ul style="list-style-type: none"> • Allows for widening of Whipple Road • Minimal right-of-way acquisition • Improves vertical clearance at the undercrossing • Turn pocket lengths under the undercrossing structure can be improved 	<ul style="list-style-type: none"> • Complicated Stage Construction • High Cost

Alternative 3. This alternative is similar to Alternative 2, with the exception that additional local intersection improvements are included. Table 4-3 below summarizes the pro’s and con’s of Alternative 3 at the I-880 Whipple Road – Industrial Parkway South West Interchange.

Table 4-3 - I-880/Whipple Road - Industrial Parkway South West Interchange Alternative 3 Summary

Pros	Cons
<ul style="list-style-type: none"> • Allows for widening of Whipple Road • Re-aligned intersection will direct main traffic flow between Industrial Parkway South West and Dyer Street. • Improves vertical clearance at the undercrossing • Turn pocket lengths under the undercrossing structure can be improved 	<ul style="list-style-type: none"> • Complicated Stage Construction • High Cost • Additional right-of-way acquisition needed at the intersection of Whipple Road and Industrial Parkway South West

4.7.2 I-880/Industrial Parkway West Interchange

Alternative 1. This alternative is the lowest cost alternative and would have the least environmental impacts of the three alternatives developed for this alternative. Table 4-4 below summarizes the pro’s and con’s of Alternative 1 at the I-880 Whipple Road – Industrial Parkway South West Interchange.

Table 4-4 - I-880/ Industrial Parkway West Interchange Alternative 1 Summary

Pros	Cons
<ul style="list-style-type: none"> • Low Cost • Simple Stage Construction 	<ul style="list-style-type: none"> • Class III bike lanes not preferred • Does not improve lane configuration of Industrial Parkway over I-880 • Right of way acquisition required to construct NB off-ramp • Maintains the existing non-standard vertical clearance • Requires utility encroachment exception for pump

Alternative 2. This alternative would require replacement of the Industrial Parkway overcrossing which would result in complicated stage construction and higher cost in comparison to Alternative 1. The benefits of this alternative include the ability to construct a wider bridge to accommodate bicycle and pedestrian facilities. Table 4-5 below summarizes the pro’s and con’s of Alternative 2 at the I-880 Whipple Road – Industrial Parkway South West Interchange.

Table 4-5 - I-880/ Industrial Parkway West Interchange Alternative 2 Summary

Pros	Cons
<ul style="list-style-type: none"> • Enhances pedestrian and bicycle connectivity • Improves vertical clearance over I-880 	<ul style="list-style-type: none"> • High structure cost • Complicated stage construction • Introduces a curved alignment of Industrial Parkway • Right of Way acquisition required to construct the southbound diagonal on-ramp • Impacts to Ward Creek

Alternative 3. This alternative is similar to Alternative 2 for the northbound direction but includes a type L-9 interchange in the southbound direction which can accommodate higher volumes of traffic. The benefits of this alternative include the ability to construct a wider bridge to accommodate bicycle and pedestrian facilities. Table 4-6 below summarizes the pro’s and con’s of Alternative 3 at the I-880 Whipple Road – Industrial Parkway South West Interchange.

Table 4-6 - I-880/ Industrial Parkway West Interchange Alternative 3 Summary

Pros	Cons
<ul style="list-style-type: none"> • Enhances pedestrian and bicycle connectivity • Improves vertical clearance over I-880 • Improved southbound interchange operations (type L-9) 	<ul style="list-style-type: none"> • High structure cost • Complicated stage construction • Introduces a curved alignment of Industrial Parkway • Right of Way acquisition required to construct the southbound diagonal on-ramp • Impacts to Ward Creek

5 STAKEHOLDER INVOLVEMENT

This study was initiated by Alameda CTC in December of 2015. The Project Development Team consists of Alameda CTC, the City of Hayward, and the City of Union City. The project kick off meeting was held on December 16, 2016, which included a discussion of the study objectives, review of the project scope, and identification of City priorities. Using this information, the draft purpose and need was developed for the project. A workshop review of the draft alternatives took place on January 27, 2016. Several alternatives were presented for each interchange. Comments received from Alameda CTC and the cities of Hayward and Union City were used to prioritize improvements.

In January of 2016, utility companies were contacted to inform them of the project and request facility maps within the project limits. Utility owners of facilities within the project limits include:

- City of Union City
- City of Hayward
- Alameda County Water District
- AT&T
- Comcast
- Alameda County Flood Control & Water Conservation District
- PG&E

Caltrans was engaged once alternatives were developed to discuss the design features, potential environmental impacts, and right-of-way needs. The next steps for project implementation were developed as well. The Metropolitan Transportation Commission (MTC) was engaged to coordinate the project features for the I-880 express lane project with the improvements proposed as part of this study.

Formal public outreach efforts were not conducted as part of this study. It was decided by the PDT to defer outreach efforts to the future PID and PA/ED phases of the project.

The draft final report was reviewed with the Cities of Hayward and Union City in a meeting on April 13, 2016. The three alternatives for each interchange will be discussed in terms of their cost, geometry and impacts. Staff from both cities asked if a fourth alternative (Alternative 4) would be feasible which would combine preserving the existing structures from Alt 1 with the re-aligned intersection from Alt 3. It was agreed that this alternative is feasible and that future studies, such as the PSR, should consider this alternative.

6 FUNDING

A summary of estimated construction costs of the proposed alternatives is presented in the Table 6-1 below. The construction costs were escalated to the year 2021 which is assumed to be the mid-point of construction.

Table 6-1 - Estimated Project Costs

Location		Estimated Cost (in millions)		
		Alternative 1	Alternative 2	Alternative 3
I-880/Whipple Road – Industrial Parkway South West Interchange	Roadway	\$5.5	\$7.2	\$7.9
	Right-of-way	\$1.8	\$2.5	\$2.8
	Structures	\$0.2	\$15.8	\$15.7
	Escalation	\$2.1	\$7.1	\$7.3
	Total Capital Cost	\$9.6	\$32.6	\$33.7
	Support Cost	\$2.3	\$8.8	\$9.1
	Grand Total	\$11.9	\$41.4	\$42.8
I-880/Industrial Parkway West Interchange	Roadway	\$8.7	\$12.6	\$14.3
	Right-of-way	\$4.9	\$9.3	\$9.1
	Structures	\$5.8	\$31.1	\$31.2
	Escalation	\$5.4	\$14.7	15.1
	Total Capital Cost	\$24.8	\$67.7	\$69.7
	Support Cost	\$5.9	\$17.2	\$17.8
	Grand Total	\$30.7	\$84.9	\$87.5

Support cost listed above includes PID-PA/ED phase, Final Design, Construction Support, and Right-of-way engineering/acquisition costs in 2016 dollars. Planning-level cost estimates are included in Attachment C.

Both the I-880 Whipple Road – Industrial Parkway South West and I-880 Industrial Parkway West interchanges are currently named projects in the Alameda CTC Measure BB Transportation Expenditure Plan (TEP) and have been programmed for interchange improvements.

7 DELIVERY SCHEDULE

Table 7-1 below shows the anticipated project milestone schedule. This schedule is subject to change based on environmental/right-of-way impacts, cost, and funding availability.

Table 7-1 - Project Milestone Schedule

Project Milestone	Schedule
Feasibility Study	2016
Project Initiation Document (PID)	2016-2017
Project Approval/Environmental Document (PA/ED)	2017-2018
Final Design	2018-2019
Construction	2020-2022

8 PROJECT REVIEWS

A meeting was held with MTC to review the draft alternatives. Attendees included Lisa Klein and Leo Scott. The I-880 Express Lane Project features were discussed. It is anticipated that the express lanes will be operational prior to this project. This project will need to accommodate the express lane elements in the median and outside shoulders of I-880 in the permanent improvements as well as temporarily during construction.

A meeting was held on March 2, 2016 with Caltrans to review the draft alternatives. Attendees included Michael Nguyen, Sridhar Kidambi, Mort Azim, Julie McDaniel, Celia McCuaig, Mimy Hew and Qin Phu. The project setting was reviewed and potential environmental and right-of-way issues were discussed. It is anticipated that a single PSR-PDS document will be prepared that would cover both interchanges.

9 PROJECT PERSONNEL

The Project Development Team for the feasibility study includes:

- Gary Sidhu, Alameda CTC
- Abhishek Parikh, City of Hayward
- Fred Kelley, City of Hayward
- Morad Fakhrai, City of Hayward
- Tom Ruark, City of Union City
- Mintze Cheng, City of Union City

Attachments

Attachment A Vicinity Map

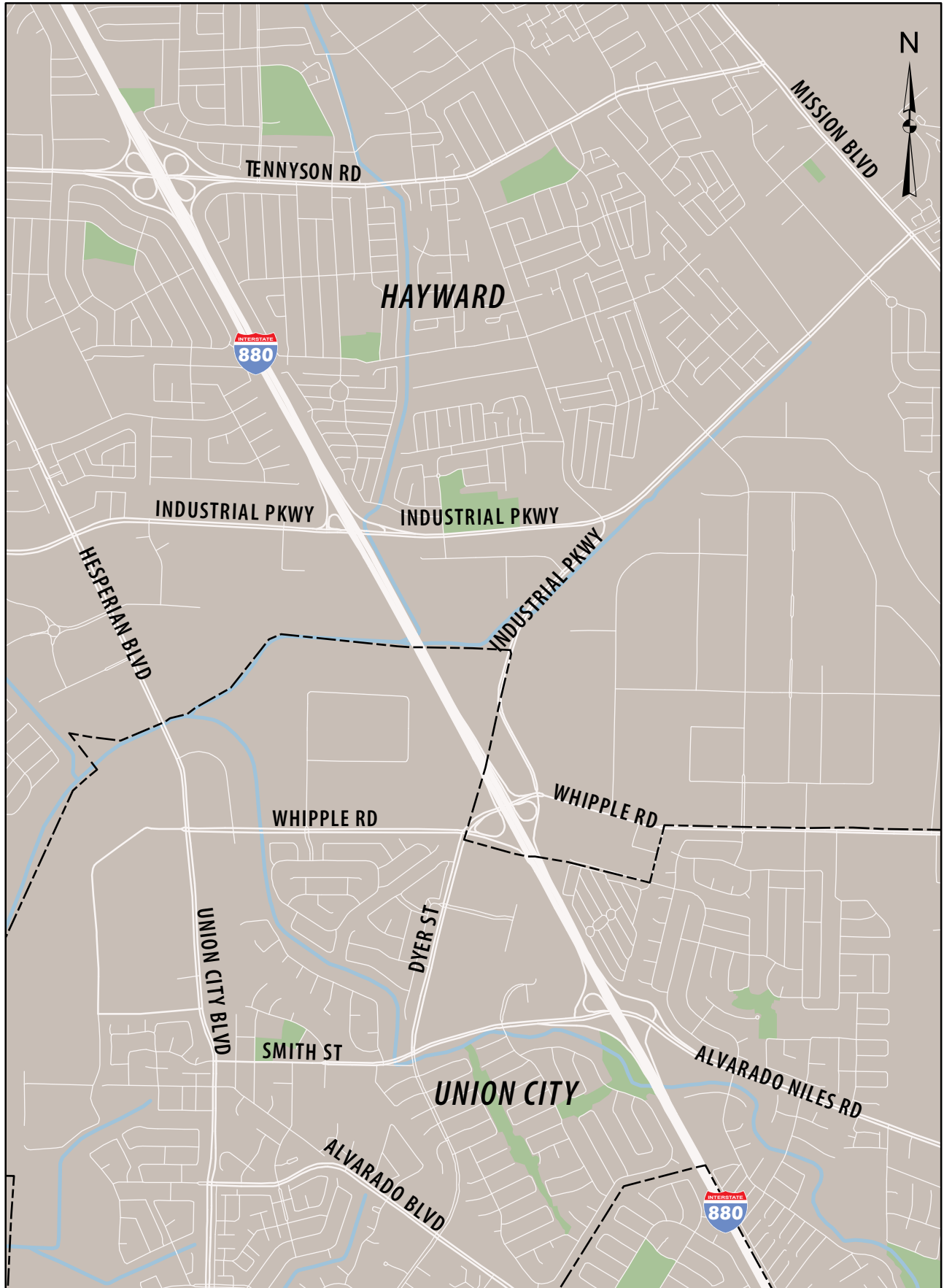
Attachment B Alternatives

Attachment C Cost Estimates

Attachment D Environmental Screening Memo

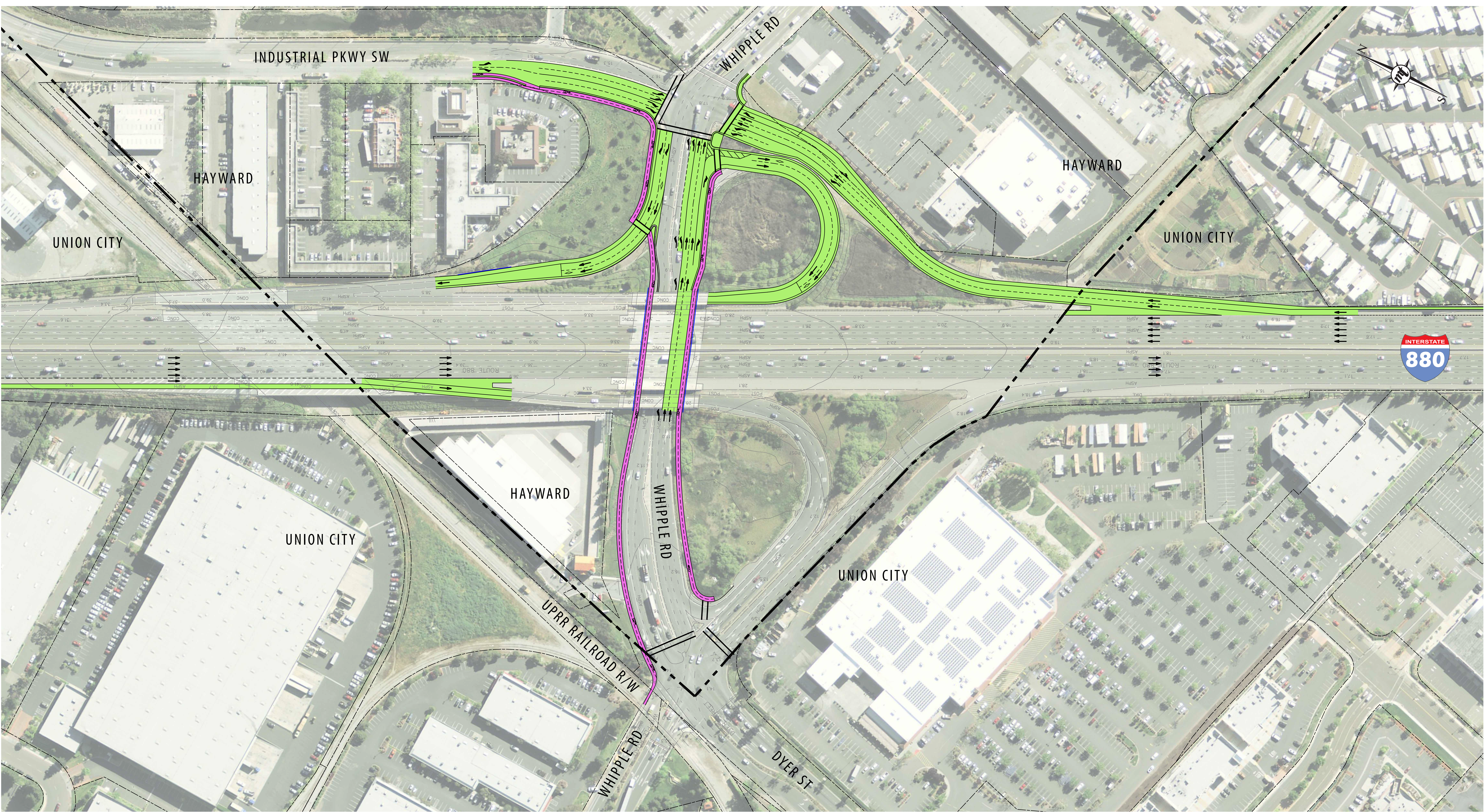
Attachment E Traffic Operations Assessment

ATTACHMENT A
VICINITY MAP

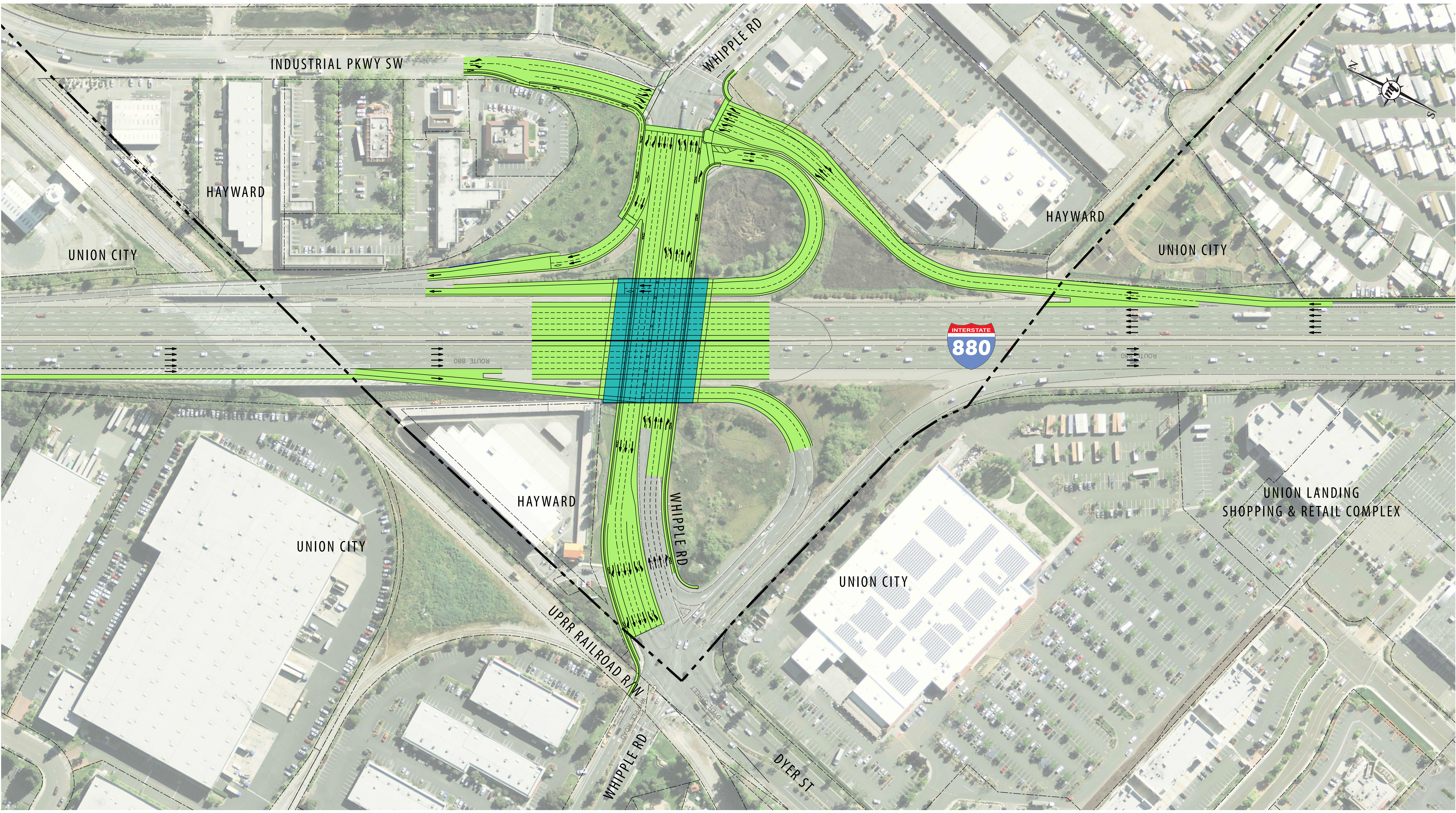


**I-880 / Whipple Rd & Industrial Pkwy
Interchange Improvement Project
Vicinity Map**

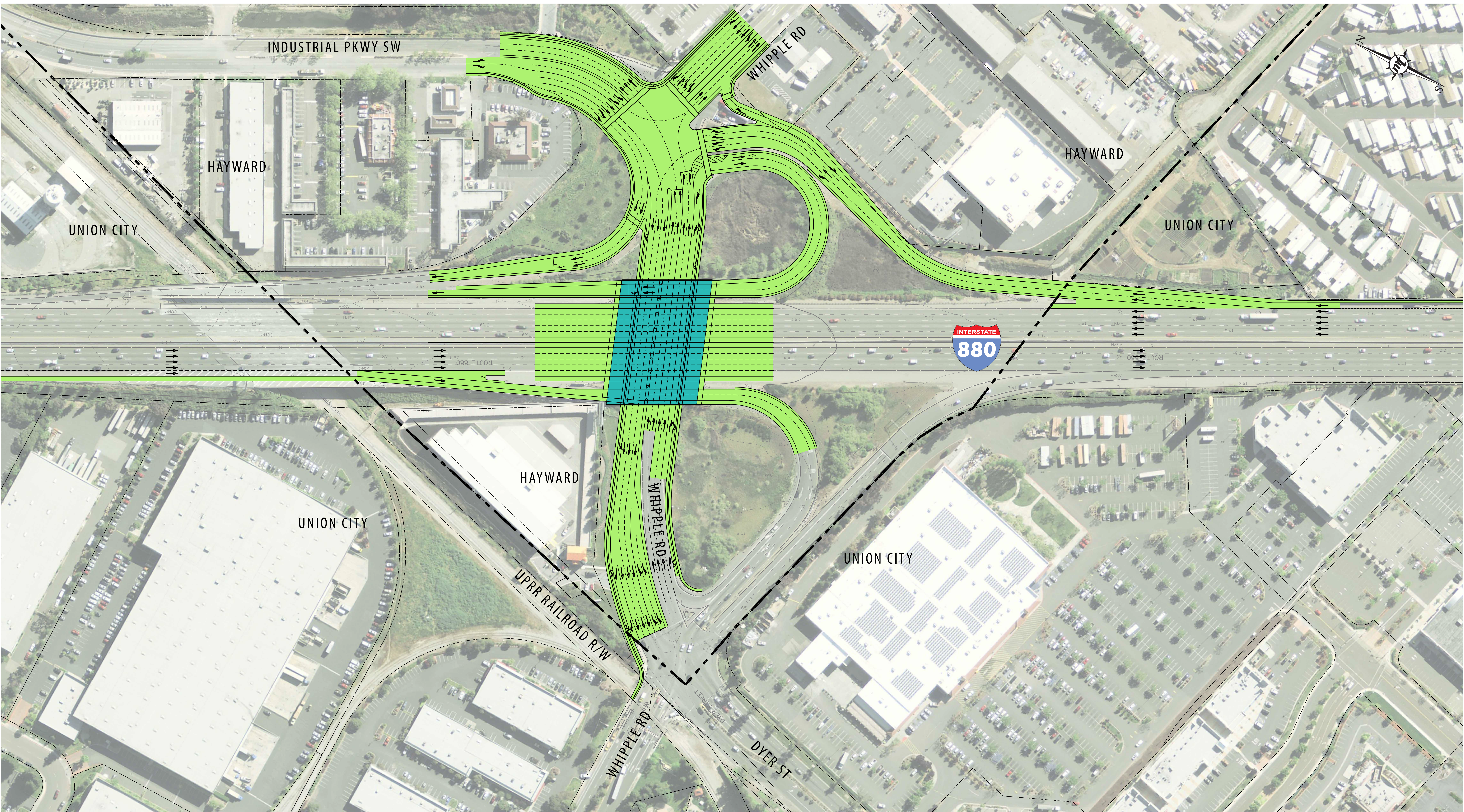
ATTACHMENT B
ALTERNATIVES



WHIPPLE RD ALTERNATIVE 1



**WHIPPLE RD
ALTERNATIVE 2
REPLACE WHIPPLE RD UC STRUCTURE**



**WHIPPLE RD
ALTERNATIVE 3
REPLACE WHIPPLE RD UC STRUCTURE
RE-ALIGN INTERSECTION**



INDUSTRIAL PARKWAY ALTERNATIVE 1



**INDUSTRIAL PARKWAY
ALTERNATIVE 2
NB & SB L-1 TIGHT DIAMOND**



**INDUSTRIAL PARKWAY
ALTERNATIVE 3
NB L-1 TIGHT DIAMOND
SB L-9 LOOP & TIGHT DIAMOND**

ATTACHMENT C
COST ESTIMATES

I-880 Industrial & Whipple Interchange Scoping Project**PLANNING LEVEL COST ESTIMATE****Location: I-880 / Whipple Road - Industrial Parkway SW****Alternative 1 - Modify Existing Interchange**

Segment Length: 0.8 Mile - From South Project Limit to Alquire Rd OH

NB I-880 Auxiliary Lane: Alvarado Niles Road On-Ramp to Whipple Rd Off-Ramp

Widen Existing Ramps, Add Bike/Ped Paths under Existing Whipple Rd Structure

March 2016 Estimate

Roadway Items:	Quantity	Unit	Unit Cost	Item Total	Total
Clearing and Grubbing	2	AC	\$ 10,000	\$ 20,000	
New Pavement - Mainline ¹	-	SF	\$ 13	\$ -	
New Pavement - Ramp / Local Road ¹	113,000	SF	\$ 10	\$ 1,130,000	
Overlay	120,000	SF	\$ 1	\$ 120,000	
Sound Wall	-	LF		\$ -	
Retaining Wall	4,700	SF	\$ 90	\$ 423,000	
Barrier	300	LF	\$ 100	\$ 30,000	
Landscape/Irrigation	1	LS	\$ 173,000	\$ 173,000	
Ramp Metering	3	EA	\$ 100,000	\$ 300,000	
OH Sign	1	EA	\$ 250,000	\$ 250,000	
Street Lighting	1	LS	\$ 100,000	\$ 100,000	
Traffic Control	1	LS	\$ 382,000	\$ 382,000	
Storm Drain	1	LS	\$ 230,000	\$ 230,000	
WPC / Treatment	1	LS	\$ 138,000	\$ 138,000	
Minor & Misc. Items (15%)	1	LS	\$ 495,000	\$ 495,000	
Roadway Additions (10%)	1	LS	\$ 380,000	\$ 380,000	
Mobilization (10%)	1	LS	\$ 380,000	\$ 380,000	
Contingency (25%)	1	LS	\$ 948,000	\$ 948,000	
Roadway Subtotal					\$ 5,500,000
Structure Items:	Quantity	Unit	Unit Cost	Item Total	Total
Structure	-	SF	\$ 300	\$ -	
Structure Excavation for Bike Path	1	LS	\$ 200,000	\$ 200,000	
Structure Demolition		SF		\$ -	
Structure Subtotal					\$ 200,000
Right of Way Items:	Quantity	Unit	Unit Cost	Item Total	Total
Acquisition costs	14,000	SF	\$ 100	\$ 1,400,000	
Utility Relocation (Est)	1	LS	\$ 100,000	\$ 100,000	
Environmental Mitigation (Est)	1	LS	\$ 250,000	\$ 250,000	
Right of Way Subtotal					\$ 1,750,000
Subtotal "Hard Costs"					\$ 7,450,000
Cost Escalation (5% per year)			Subtotal "Hard Costs"	Escalation	Total
Future Costs (Year 2021)			\$ 7,450,000	\$ 2,060,000	\$ 9,600,000
Soft Costs²	Quantity	Unit	Unit Cost	Item Total	Total
Preliminary Eng/Envir (12%)	1	LS	\$ 684,000	\$ 684,000	
Final Design (10%)	1	LS	\$ 570,000	\$ 570,000	
Construction Administration (13%)	1	LS	\$ 741,000	\$ 741,000	
Construction Staking (2%)	1	LS	\$ 114,000	\$ 114,000	
R/W Engineering/Acquisition (10%)	1	LS	\$ 175,000	\$ 175,000	
Subtotal "Soft Costs"					\$ 2,290,000
Grand Total					\$ 11,900,000

1. New Pavement cost includes roadway excavation cost.

2. Soft cost is percentage of Roadway and Structure Items (2016 dollars) except R/W Engineering which is 10% of R/W Items.

I-880 Industrial & Whipple Interchange Scoping Project**PLANNING LEVEL COST ESTIMATE****Location: I-880 / Whipple Road - Industrial Parkway SW****Alternative 2 - Replace UC Structure**

Segment Length: 0.8 Mile - From South Project Limit to Alquire Rd OH

NB I-880 Auxiliary Lane: Alvarado Niles Road On-Ramp to Whipple Rd Off-Ramp

Widen Ramps

March 2016 Estimate

Roadway Items:	Quantity	Unit	Unit Cost	Item Total	Total
Clearing and Grubbing	2	AC	\$ 10,000	\$ 20,000	
New Pavement - Mainline ¹	30,000	SF	\$ 13	\$ 390,000	
New Pavement - Ramp / Local Road ¹	132,000	SF	\$ 10	\$ 1,320,000	
Overlay	168,000	SF	\$ 1	\$ 168,000	
Sound Wall	-	LF		\$ -	
Retaining Wall	1,300	SF	\$ 90	\$ 117,000	
Barrier	800	LF	\$ 100	\$ 80,000	
Landscape/Irrigation	1	LS	\$ 260,000	\$ 260,000	
Ramp Metering	3	EA	\$ 100,000	\$ 300,000	
OH Sign	2	EA	\$ 250,000	\$ 500,000	
Street Lighting	1	LS	\$ 100,000	\$ 100,000	
Traffic Control	1	LS	\$ 489,000	\$ 489,000	
Storm Drain	1	LS	\$ 346,000	\$ 346,000	
WPC / Treatment	1	LS	\$ 208,000	\$ 208,000	
Minor & Misc. Items (15%)	1	LS	\$ 645,000	\$ 645,000	
Roadway Additions (10%)	1	LS	\$ 495,000	\$ 495,000	
Mobilization (10%)	1	LS	\$ 495,000	\$ 495,000	
Contingency (25%)	1	LS	\$ 1,236,000	\$ 1,236,000	
Roadway Subtotal					\$ 7,170,000
Structure Items:	Quantity	Unit	Unit Cost	Item Total	Total
Structure Whipple Rd UC	50,000	SF	\$ 300	\$ 15,000,000	
Structure Demolition	50,000	SF	\$ 15	\$ 750,000	
Structure Subtotal					\$ 15,750,000
Right of Way Items:	Quantity	Unit	Unit Cost	Item Total	Total
Acquisition costs	14,000	SF	\$ 100	\$ 1,400,000	
Utility Relocation (Est)	1	LS	\$ 200,000	\$ 200,000	
Environmental Mitigation (Est)	1	LS	\$ 1,000,000	\$ 1,000,000	
Right of Way Subtotal					\$ 2,600,000
Subtotal "Hard Costs"					\$ 25,520,000
Cost Escalation (5% per year)			Subtotal "Hard Costs"	Escalation	Total
Future Costs (Year 2021)			\$ 25,520,000	\$ 7,060,000	\$ 32,600,000
Soft Costs²	Quantity	Unit	Unit Cost	Item Total	Total
Preliminary Eng/Envir (12%)	1	LS	\$ 2,751,000	\$ 2,751,000	
Final Design (10%)	1	LS	\$ 2,292,000	\$ 2,292,000	
Construction Administration (13%)	1	LS	\$ 2,980,000	\$ 2,980,000	
Construction Staking (2%)	1	LS	\$ 459,000	\$ 459,000	
R/W Engineering/Acquisition (10%)	1	LS	\$ 260,000	\$ 260,000	
Subtotal "Soft Costs"			\$ -		\$ 8,750,000
Grand Total					\$ 41,400,000

1. New Pavement cost includes roadway excavation cost.

2. Soft cost is percentage of Roadway and Structure Items (2016 dollars) except R/W Engineering which is 10% of R/W Items.

I-880 Industrial & Whipple Interchange Scoping Project**PLANNING LEVEL COST ESTIMATE****Location: I-880 / Whipple Road - Industrial Parkway SW****Alternative 3 - Replace UC Structure & Re-Align Whipple Road**

Segment Length: 0.8 Mile - From South Project Limit to Alquire Rd OH

NB I-880 Auxiliary Lane: Alvarado Niles Road On-Ramp to Whipple Rd Off-Ramp

Widen Ramps, Re-align Industrial Parkway SW to Whipple Rd Intersection

March 2016 Estimate

Roadway Items:	Quantity	Unit	Unit Cost	Item Total	Total
Clearing and Grubbing	2	AC	\$ 10,000	\$ 20,000	
New Pavement - Mainline ¹	30,000	SF	\$ 13	\$ 390,000	
New Pavement - Ramp / Local Road ¹	156,000	SF	\$ 10	\$ 1,560,000	
Overlay	178,000	SF	\$ 1	\$ 178,000	
Sound Wall	-	LF		\$ -	
Retaining Wall	1,300	SF	\$ 90	\$ 117,000	
Barrier	800	LF	\$ 100	\$ 80,000	
Landscape/Irrigation	1	LS	\$ 296,000	\$ 296,000	
Ramp Metering	3	EA	\$ 100,000	\$ 300,000	
OH Sign	2	EA	\$ 250,000	\$ 500,000	
Street Lighting	1	LS	\$ 100,000	\$ 100,000	
Traffic Control	1	LS	\$ 532,000	\$ 532,000	
Storm Drain	1	LS	\$ 394,000	\$ 394,000	
WPC / Treatment	1	LS	\$ 237,000	\$ 237,000	
Minor & Misc. Items (15%)	1	LS	\$ 706,000	\$ 706,000	
Roadway Additions (10%)	1	LS	\$ 541,000	\$ 541,000	
Mobilization (10%)	1	LS	\$ 541,000	\$ 541,000	
Contingency (25%)	1	LS	\$ 1,353,000	\$ 1,353,000	
Roadway Subtotal					\$ 7,850,000
Structure Items:	Quantity	Unit	Unit Cost	Item Total	Total
Structure Whipple Rd UC	50,000	SF	\$ 300	\$ 15,000,000	
Structure Demolition	50,000	SF	\$ 15	\$ 750,000	
Structure Subtotal					\$ 15,750,000
Right of Way Items:	Quantity	Unit	Unit Cost	Item Total	Total
Acquisition costs	16,000	SF	\$ 100	\$ 1,600,000	
Utility Relocation (Est)	1	LS	\$ 200,000	\$ 200,000	
Environmental Mitigation (Est)	1	LS	\$ 1,000,000	\$ 1,000,000	
Right of Way Subtotal					\$ 2,800,000
Subtotal "Hard Costs"					\$ 26,400,000
Cost Escalation (5% per year)			Subtotal "Hard Costs"	Escalation	Total
Future Costs (Year 2021)			\$ 26,400,000	\$ 7,300,000	\$ 33,700,000
Soft Costs²	Quantity	Unit	Unit Cost	Item Total	Total
Preliminary Eng/Envir (12%)	1	LS	\$ 2,832,000	\$ 2,832,000	
Final Design (10%)	1	LS	\$ 2,360,000	\$ 2,360,000	
Construction Administration (13%)	1	LS	\$ 3,068,000	\$ 3,068,000	
Construction Staking (2%)	1	LS	\$ 472,000	\$ 472,000	
R/W Engineering/Acquisition (10%)	1	LS	\$ 280,000	\$ 280,000	
Subtotal "Soft Costs"					\$ 9,020,000
Grand Total					\$ 42,800,000

1. New Pavement cost includes roadway excavation cost.

2. Soft cost is percentage of Roadway and Structure Items (2016 dollars) except R/W Engineering which is 10% of R/W Items.

I-880 Industrial & Whipple Interchange Scoping Project**PLANNING LEVEL COST ESTIMATE****Location: I-880 / Industrial Parkway West****Alternative 1 - Modify Existing Interchange**

Segment Length: 0.9 Mile - From North Project Limit to Alquire Rd OH

NB & SB I-880: Auxiliary Lane from Industrial Pkwy West OC to Whipple Rd UC

SB I-880: Ward Creek Bridge Widening

March 2016 Estimate

Roadway Items:	Quantity	Unit	Unit Cost	Item Total	Total
Clearing and Grubbing	5	AC	\$ 10,000	\$ 50,000	
New Pavement - Mainline ¹	71,000	SF	\$ 13	\$ 923,000	
New Pavement - Ramp / Local Road ¹	68,300	SF	\$ 10	\$ 683,000	
Overlay	137,000	SF	\$ 1	\$ 137,000	
Sound Wall		LF		\$ -	
Retaining Wall	12,000	SF	\$ 90	\$ 1,080,000	
Barrier	3,100	LF	\$ 100	\$ 310,000	
Landscape/Irrigation	1	LS	\$ 249,000	\$ 249,000	
Ramp Metering	1	EA	\$ 100,000	\$ 100,000	
OH Sign	2	EA	\$ 250,000	\$ 500,000	
Street Lighting	1	LS	\$ 50,000	\$ 50,000	
Traffic Control	1	LS	\$ 613,000	\$ 613,000	
Storm Drain	1	LS	\$ 332,000	\$ 332,000	
WPC / Treatment	1	LS	\$ 199,000	\$ 199,000	
Minor & Misc. Items (15%)	1	LS	\$ 784,000	\$ 784,000	
Roadway Additions (10%)	1	LS	\$ 601,000	\$ 601,000	
Mobilization (10%)	1	LS	\$ 601,000	\$ 601,000	
Contingency (25%)	1	LS	\$ 1,503,000	\$ 1,503,000	
Roadway Subtotal					\$ 8,720,000
Structure Items:	Quantity	Unit	Unit Cost	Item Total	Total
Ward Creek Bridge Structure NB	14,700	SF	\$ 300	\$ 4,410,000	
Ward Creek Bridge Widening SB	4,500	SF	\$ 300	\$ 1,350,000	
Structure Demolition		SF		\$ -	
Structure Subtotal					\$ 5,760,000
Right of Way Items:	Quantity	Unit	Unit Cost	Item Total	Total
Acquisition costs	42,000	SF	\$ 100	\$ 4,200,000	
Utility Relocation (Est)	1	LS	\$ 100,000	\$ 100,000	
Environmental Mitigation (Est)	1	LS	\$ 600,000	\$ 600,000	
Right of Way Subtotal					\$ 4,900,000
Subtotal "Hard Costs"					\$ 19,380,000
Cost Escalation (5% per year)			Subtotal "Hard Costs"	Escalation	Total
Future Costs (Year 2021)			\$ 19,380,000	\$ 5,360,000	\$ 24,800,000
Soft Costs²	Quantity	Unit	Unit Cost	Item Total	Total
Preliminary Eng/Envir (12%)	1	LS	\$ 1,738,000	\$ 1,738,000	
Final Design (10%)	1	LS	\$ 1,448,000	\$ 1,448,000	
Construction Administration (13%)	1	LS	\$ 1,883,000	\$ 1,883,000	
Construction Staking (2%)	1	LS	\$ 290,000	\$ 290,000	
R/W Engineering/Acquisition (10%)	1	LS	\$ 490,000	\$ 490,000	
Subtotal "Soft Costs"					\$ 5,850,000
Grand Total					\$ 30,700,000

1. New Pavement cost includes roadway excavation cost.

2. Soft cost is percentage of Roadway and Structure Items (2016 dollars) except R/W Engineering which is 10% of R/W Items.

I-880 Industrial & Whipple Interchange Scoping Project**PLANNING LEVEL COST ESTIMATE****Location: I-880 / Industrial Parkway West****Alternative 2 - Tight Diamond (L-1)**

Segment Length: 0.9 Mile - From North Project Limit to Alquire Rd OH

NB & SB I-880: Auxiliary Lane from Industrial Pkwy West OC to Whipple Rd UC

SB I-880: Ward Creek Bridge Widening

March 2016 Estimate

Roadway Items:	Quantity	Unit	Unit Cost	Item Total	Total
Clearing and Grubbing	9	AC	\$ 10,000	\$ 90,000	
New Pavement - Mainline ¹	71,300	SF	\$ 13	\$ 927,000	
New Pavement - Ramp / Local Road ¹	233,000	SF	\$ 10	\$ 2,330,000	
Overlay	-	SF	\$ 1	\$ -	
Sound Wall	-	LF		\$ -	
Retaining Wall	3,000	SF	\$ 90	\$ 270,000	
Barrier	4,600	LF	\$ 100	\$ 460,000	
Landscape/Irrigation	1	LS	\$ 503,000	\$ 503,000	
Ramp Metering	2	EA	\$ 100,000	\$ 200,000	
OH Sign	3	EA	\$ 250,000	\$ 750,000	
Street Lighting	1	LS	\$ 100,000	\$ 100,000	
Traffic Control	1	LS	\$ 845,000	\$ 845,000	
Storm Drain	1	LS	\$ 670,000	\$ 670,000	
WPC / Treatment	1	LS	\$ 402,000	\$ 402,000	
Minor & Misc. Items (15%)	1	LS	\$ 1,133,000	\$ 1,133,000	
Roadway Additions (10%)	1	LS	\$ 868,000	\$ 868,000	
Mobilization (10%)	1	LS	\$ 868,000	\$ 868,000	
Contingency (25%)	1	LS	\$ 2,170,000	\$ 2,170,000	
Roadway Subtotal					\$ 12,590,000
Structure Items:	Quantity	Unit	Unit Cost	Item Total	Total
Industrial Park OC	60,000	SF	\$ 300	\$ 18,000,000	
Ward Creek Bridge NB Off-Ramp	38,000	SF	\$ 300	\$ 11,400,000	
Ward Creek Bridge SB Widening	4,300	SF	\$ 300	\$ 1,290,000	
Structure Demolition Industrial OC	28,500	SF	\$ 15	\$ 428,000	
Structure Subtotal					\$ 31,120,000
Right of Way Items:	Quantity	Unit	Unit Cost	Item Total	Total
Acquisition costs	73,000	SF	\$ 100	\$ 7,300,000	
Utility Relocation (Est)	1	LS	\$ 200,000	\$ 200,000	
Environmental Mitigation (Est)	1	LS	\$ 1,800,000	\$ 1,800,000	
Right of Way Subtotal					\$ 9,300,000
Subtotal "Hard Costs"					\$ 53,010,000
Cost Escalation (5% per year)			Subtotal "Hard Costs"	Escalation	
Future Costs (Year 2021)			\$ 53,010,000	\$ 14,650,000	\$ 67,700,000
Soft Costs²	Quantity	Unit	Unit Cost	Item Total	Total
Preliminary Eng/Envir (12%)	1	LS	\$ 5,246,000	\$ 5,246,000	
Final Design (10%)	1	LS	\$ 4,371,000	\$ 4,371,000	
Construction Administration (13%)	1	LS	\$ 5,683,000	\$ 5,683,000	
Construction Staking (2%)	1	LS	\$ 875,000	\$ 875,000	
R/W Engineering/Acquisition (10%)	1	LS	\$ 930,000	\$ 930,000	\$ 17,110,000
Grand Total					\$ 84,900,000

1. New Pavement cost includes roadway excavation cost.

2. Soft cost is percentage of Roadway and Structure Items (2016 dollars) except R/W Engineering which is 10% of R/W Items.

I-880 Industrial & Whipple Interchange Scoping Project**PLANNING LEVEL COST ESTIMATE****Location: I-880 / Industrial Parkway West****Alternative 3 - NB Tight Diamond & SB Partial Cloverleaf**

Segment Length: 0.9 Mile - From North Project Limit to Alquire Rd OH

NB & SB I-880: Auxiliary Lane from Industrial Pkwy West OC to Whipple Rd UC

SB I-880: Ward Creek Bridge Widening

March 2016 Estimate

Roadway Items:	Quantity	Unit	Unit Cost	Item Total	Total
Clearing and Grubbing	10	AC	\$ 10,000	\$ 100,000	
New Pavement - Mainline ¹	77,600	SF	\$ 13	\$ 1,009,000	
New Pavement - Ramp / Local Road ¹	249,000	SF	\$ 10	\$ 2,490,000	
Overlay	33,000	SF	\$ 1	\$ 33,000	
Sound Wall	-	LF		\$ -	
Retaining Wall	7,400	SF	\$ 90	\$ 666,000	
Barrier	4,600	LF	\$ 100	\$ 460,000	
Landscape/Irrigation	1	LS	\$ 540,000	\$ 540,000	
Ramp Metering	3	EA	\$ 100,000	\$ 300,000	
OH Sign	3	EA	\$ 250,000	\$ 750,000	
Street Lighting	1	LS	\$ 100,000	\$ 100,000	
Traffic Control	1	LS	\$ 968,000	\$ 968,000	
Storm Drain	1	LS	\$ 720,000	\$ 720,000	
WPC / Treatment	1	LS	\$ 432,000	\$ 432,000	
Minor & Misc. Items (15%)	1	LS	\$ 1,286,000	\$ 1,286,000	
Roadway Additions (10%)	1	LS	\$ 986,000	\$ 986,000	
Mobilization (10%)	1	LS	\$ 986,000	\$ 986,000	
Contingency (25%)	1	LS	\$ 2,464,000	\$ 2,464,000	
Roadway Subtotal					\$ 14,290,000
Structure Items:	Quantity	Unit	Unit Cost	Item Total	Total
Industrial Park OC	60,000	SF	\$ 300	\$ 18,000,000	
Ward Creek Bridge NB Off-Ramp	38,000	SF	\$ 300	\$ 11,400,000	
Ward Creek Bridge SB Widening	4,630	SF	\$ 300	\$ 1,389,000	
Structure Demolition Industrial OC	28,500	SF	\$ 15	\$ 428,000	
Structure Subtotal					\$ 31,220,000
Right of Way Items:	Quantity	Unit	Unit Cost	Item Total	Total
Acquisition costs	70,000	SF	\$ 100	\$ 7,000,000	
Utility Relocation (Est)	1	LS	\$ 200,000	\$ 200,000	
Environmental Mitigation (Est)	1	LS	\$ 1,900,000	\$ 1,900,000	
Right of Way Subtotal					\$ 9,100,000
Subtotal "Hard Costs"					\$ 54,610,000
Cost Escalation (5% per year)			Subtotal "Hard Costs" Escalation		
Future Costs (Year 2021)			\$ 54,610,000	\$ 15,090,000	\$ 69,700,000
Soft Costs²	Quantity	Unit	1715000	Item Total	Total
Preliminary Eng/Envir (12%)	1	LS	\$ 5,462,000	\$ 5,462,000	
Final Design (10%)	1	LS	\$ 4,551,000	\$ 4,551,000	
Construction Administration (13%)	1	LS	\$ 5,917,000	\$ 5,917,000	
Construction Staking (2%)	1	LS	\$ 911,000	\$ 911,000	
R/W Engineering/Acquisition (10%)	1	LS	\$ 910,000	\$ 910,000	\$ 17,760,000
Grand Total					\$ 87,500,000

1. New Pavement cost includes roadway excavation cost.

2. Soft cost is percentage of Roadway and Structure Items (2016 dollars) except R/W Engineering which is 10% of R/W Items.

ATTACHMENT D
ENVIRONMENTAL SCREENING MEMO



March 3, 2016

Sasha Dansky
Mark Thomas & Company, Inc.
3000 Oak Road, Suite 650
Walnut Creek, CA 94597

Via Email: sdansky@markthomas.com

Subject: Constraints summary for I-880 interchange improvements at Industrial Parkway and Whipple Road

Dear Sasha,

Below is a summary of the environmental constraints that should be considered when reviewing preliminary concepts for I-880 interchange improvements at Industrial Parkway and Whipple Road.

Biology

The Don Edwards San Francisco Bay National Wildlife Refuge and Eden Landing Ecological Reserve are located approximately 2 miles west of I-880. The refuge/preserve areas consist of over 10,000 acres of restored salt ponds, adjacent diked marshes, and transitional areas to uplands that are managed for resident and migratory waterbirds and tidal marsh habitats and species. Tidal marsh habitat also acts as a significant nursery habitat for species of anadromous fish such as salmon and steelhead. Because of the refuge/preserve areas' relatively close location to I-880, the California Natural Diversity Database (CNDDDB) listed a substantial number of rare plants and animals with the potential to occur at the Industrial Parkway and Whipple Road interchange areas. However, CNDDDB list is drawn from a larger USGS quadrangle search, and does not account for the actual developed conditions of the immediate interchange areas. Given the existing freeway corridor and urban character of the land uses surrounding interchanges, it is unlikely special-status plant or wildlife species would be affected by the proposed improvements, with the exception of protected fish species in Ward Creek. Preparation of the appropriate biological habitat assessments and field surveys would be required in order to formally eliminate the potential for special status species to occur in the interchange areas.

Industrial Parkway

Because Ward Creek connects with the nearby refuge/preserve areas, there is a high potential for special-status fish species to occur in the segment of the creek that passes under the Industrial Parkway interchange. The following federal and state consultation and certification processes may be required for the Industrial Parkway interchange improvements:

- Sections 401 and 404 of the Federal Clean Water Act (CWA): Ramp alignments with work within Ward Creek would require coordination for CWA Section 401 Certification and CWA Section 404 Permit for impacts to waters of the U.S.
- Section 1602 of the California Fish and Game Code: Ramp alignments with work within Ward Creek would require coordination with the California Department of Fish and Wildlife (CDFW) should the improvements substantially divert, obstruct, or change the natural flow of a river, stream, or lake; substantially change the bed, channel, or bank of a river, stream, or lake; or use material from a streambed.



- Section 7 of the Federal Endangered Species Act (FESA): If federally protected fish species are located within Ward Creek, the Industrial Way ramp improvements would require Section 7 interagency consultation to ensure compliance with the FESA.
- California Endangered Species Act (CESA): If state protected fish species are located within Ward Creek, the Industrial Parkway ramp improvements may require an incidental take permit (ITP) from the CDFW. Impacts requiring an ITP could include direct impacts to the stream bed (i.e. ramp structures placed within the creek) or indirect effects from the shading that would be created by new ramp structures.

In addition to the consultation and certification requirements, there may be seasonal construction restrictions and/or preconstruction survey requirements for special-status bat and bird species using the existing trees as roosting/nesting habitat.

Whipple Road

The Whipple Road interchange area does not contain any waterways that would present the need for resource agency consultation and certification requirements. At most, there may be seasonal construction restrictions and/or preconstruction survey requirements for special-status bat and bird species using the existing trees as roosting/nesting habitat.

Hazardous Materials Releases

Industrial Parkway

Based on a review of the California State Water Resources Control Board Geotracker database, there is only one documented hazardous material release site to the southwest (downgradient) of the I-880/Industrial Parkway interchange. It is unlikely that groundwater contamination exists in this interchange area or would be encountered during construction.

Whipple Road

Based on a review of the California State Water Resources Control Board Geotracker database, nearly all of the properties surrounding the I-880 loop ramps at Whipple Road are listed as unauthorized hazardous materials release sites. Groundwater contamination from these sites is likely to be present under the existing interchange infrastructure and will need to be properly handled and/or disposed of if encountered during construction.

Community Impacts/Sensitive Receptors

Industrial Parkway

The Spanish Ranch Mobile Home Park is located immediately north of the of the northbound I-880 on-ramp from Industrial Parkway and likely qualifies as an environmental justice community (low income/minority). The existing sound wall between northbound I-880 traffic and these residences does not extend the entire length of the property fronting Industrial Parkway. As such, any interchange improvements that realign traffic on Industrial Parkway to the north, towards the mobile home park, could pose localized noise impacts to this community. These residences would also be sensitive to the visual changes of elevating the Industrial Parkway overcrossing structure.

Whipple Road

The Central Park West mobile home park is located immediately to the southeast of the northbound I-880 off-ramp to Whipple Road, and likely qualifies as an environmental justice community (low income/minority). A sound wall extends the entire length of this community, between northbound I-880 traffic and the



residences. Preliminary concepts for the Whipple Road interchange improvements would not extend beyond this existing sound wall. As such, localized noise impacts to this community are not expected to be of concern.

There is a community garden located immediately north of the Central Park West mobile home park that is not protected by any barriers or sound walls. Any interchange improvements that realign the northbound I-880 off-ramp to Whipple Road to the east, towards the mobile home park, could pose localized noise impacts to this community garden.

Cultural Resources

Native soils in the interchange areas have a high potential for discovering unrecorded archaeological resources. As such, there is a high likelihood of identifying subsurface archaeological resources for proposed improvements that would be constructed in areas not previously disturbed by the construction of the existing freeway infrastructure. A literature review, field survey, and consultation with Native Americans (pursuant to AB 52 and Section 106 of the NHPA) would be appropriate next steps to identify and address both potential archaeological and historic architectural resources. There are no conditions or risks specific to one of the interchanges; the likelihood of encountering cultural resources is the same for both areas.

The Circlepoint team thanks you for this opportunity. Please do not hesitate to contact me with any questions regarding this constraints summary. The best number to reach me is (510) 285-6733 or via email at j.gallerani@circlepoint.com.

Sincerely,

A handwritten signature in black ink that reads "Jennifer Marquez". The signature is fluid and cursive.

Jennifer Gallerani Marquez
Project Manager

ATTACHMENT E
TRAFFIC OPERATIONS ASSESSMENT



KITTELSON & ASSOCIATES, INC.

TRANSPORTATION ENGINEERING / PLANNING

155 Grand Avenue, Suite 900, Oakland, CA 94612 P 510.839.1742 F 510.839.0871

TECHNICAL MEMORANDUM

I-880/Whipple/Industrial Interchange Feasibility

Operations Evaluation

Date: March 8, 2016 Project #: 19816
 To: Sasha Dansky, Mark Thomas & Company
 From: Chirag Safi, Brian Ray, Kittelson & Associates
 cc: File

This memorandum summarizes the operations evaluation for project alternatives developed by Mark Thomas & Company at the Whipple Road and Industrial Parkway interchanges with I-880. The memorandum describes existing conditions based on year 2013-2015 traffic data from recently completed traffic studies. The memo summarizes the operational considerations for three alternatives for each interchange.

EXISTING OPERATIONS

Industrial Parkway Interchange

In general, the I-880/Industrial Parkway ramp intersections currently operate at or below capacity, with a few individual movement experiencing moderate delays and queues during the commuters AM and PM peak hours.

Whipple Road Interchange

In general, the I-880/Whipple Road ramp intersections currently operate at or over capacity, with a few individual movements experiencing high delays and long queues during the commuters AM and PM peak hours.

Northbound Ramp Terminal Intersection: The northbound left-turn and eastbound left-turn movements at the northbound ramp intersection operate over capacity. Field observations indicate that the queues for the northbound off-ramp approach at Whipple Road occasionally extend to the mainline.

Southbound Ramp Terminal Intersection: Field observations indicate that vehicular queues at the northbound left-turn and southbound left-turn movements exceed storage capacity and therefore experience delays.

FORECAST TRAFFIC TRENDS

City of Hayward Circulation Element (adopted on July 1, 2014) projected that operations at the Industrial Parkway southbound ramp intersection would degrade substantially during AM and PM peak hours in the 2035 conditions. Critical movements that experience increased delays and queues would be southbound right-turn, southbound left-turn, westbound through and eastbound left-turn.

At the Whipple Road Interchange, traffic volumes are forecast to grow and the traffic operations at this interchange will worsen. Motorists are likely to divert to other routes, such as Alvarado-Niles Road, Industrial Parkway, Union City Boulevard to avoid congestion.

Table 1 illustrates preliminary traffic forecasts, along with existing volumes at the I-880 ramps.

Table 1. Existing and Forecast Traffic Volumes

I-880 Direction	Interchange	Ramp	Existing Volumes		2035 Volumes with Industrial Off-Ramp	
			AM	PM	AM	PM
Northbound	Whipple Rd	Diag Off	1240	1050	1,140	1,030
		Loop On	190	240	300	350
		Diag On	300	240	640	500
	Industrial Pkwy	Diag Off	NA	NA	1,210	1,020
		Diag On	620	690	980	1,080
Southbound	Industrial Pkwy	Diag Off	1020	680	1,260	950
		Loop On	350	520	620	890
	Whipple Rd	Loop Off	620	710	1,190	1,400
		Diag On	540	970	700	1,500

ALTERNATIVES

A summary of qualitative operational evaluation is provided below for each alternative. More refined travel demand forecasts and detail operations analysis will be used in the subsequent project phases to verify adequacy of the proposed geometrics and to inform the geometric elements at this interchange, including length of turn bays.

Industrial Parkway

Forecast volumes for all three alternatives would be accommodated by one-lane entry and exit with I-880.

Alternative 1

The following describes the anticipated operational effect of various design treatments:

- Adding a new northbound off-ramp at Industrial Parkway will increase traffic volumes traversing. A portion of this growth can be attributed to traffic diversion from elsewhere in City of Hayward. Some diversions would occur between I-880 northbound and Industrial Parkway West, and I-880 northbound and Hesperian Boulevard or Industrial Parkway North.
- On the northbound off-ramp approach, two left-turn lanes and a right-turn lane would provide sufficient capacity to accommodate the forecast volumes. This alternative will provide additional capacity to the critical movements at the southbound ramp intersection: westbound left-turn, and southbound left-turn and right-turn. These intersection modifications are expected to improve traffic operations by reducing delays and queue spillbacks.

Alternative 2

Similar to Alternative 1, traffic volumes traversing through this interchange are expected to grow by adding a northbound off-ramp at Industrial Parkway. A further study will be required to check whether the vehicular queues would be accommodated between northbound and southbound ramp intersections, and southbound ramp intersection and Stratford Road.

The following describes the anticipated operational effect of various design treatments:

- On the northbound off-ramp approach, two left-turn lanes and a right-turn lane would provide sufficient capacity to accommodate the forecast volumes.
- This alternative will provide additional capacity to the critical movements at the southbound ramp intersections: westbound and eastbound Industrial to southbound I-880, and southbound left-turn and right-turn. These intersection modifications are expected to improve traffic operations by reducing delays and queue spillbacks.
- Providing a diagonal on-ramp and westbound dual left-turn lanes would allow forecast volumes to be accommodated.

Alternative 3

Similar to Alternative 1 and 2, traffic volumes traversing through this interchange are expected to grow significantly due to addition of new northbound off-ramp at Industrial Parkway. A further study will be required to check whether the vehicular queues would be accommodated between

northbound and southbound ramp intersections, and southbound ramp intersection and Stratford Road.

The following describes the anticipated operational effect of various design treatments:

- On the northbound off-ramp approach, two left-turn lanes and a right-turn lane would provide sufficient capacity to accommodate the forecast volumes.
- This alternative will provide additional capacity to the critical movements at the southbound ramp intersection: westbound Industrial to southbound I-880, and southbound left-turn and right-turn. These intersection modifications are expected to improve traffic operations by reducing delays and queue spillbacks.

Whipple Road

Forecast volumes for all three alternatives would be accommodated by one-lane entry and exit with I-880, except for the northbound off-ramp where a two-lane exit would be warranted.

Alternative 1

The following describes the anticipated operational effect of various design treatments:

- This alternative will add capacity to critical movements at the northbound ramp intersection: northbound off-ramp approach, westbound left-turn and southbound left-turn. With these improvements, vehicular operations would improve; however, vehicular queues on the westbound approach could continue to spillback into the upstream intersection.
- Adequacy of turn bay storage and intersection spacing would need to be further studied with quantitative operations analysis.
- Minor improvements proposed at the southbound ramp intersection would improve pedestrian circulation, without negatively affecting vehicular operations.

Alternative 2

In addition to the improvements featured in Alternative 1, Alternative 2 will provide additional storage capacity between northbound and southbound ramp intersections in both directions.

The following describes the anticipated operational effect of various design treatments:

- With these improvements, vehicular operations would improve, and queues are likely to be accommodated between ramp intersections.
- Adequacy of turn bay storage and intersection spacing would need to be further studied with quantitative operations analysis.
- At the southbound ramp intersection, an additional eastbound through lane would reduce through lane queues from blocking turn bays.

Alternative 3

The following describes the anticipated operational effect of various design treatments:

- By transforming critical turning movements, i.e. westbound left-turns and southbound right-turns as through movements, this alternative would reduce queuing issues resulting at the northbound ramp intersection.
- Queues between the ramp intersections are likely to be accommodated within the storage.
- Adequacy of lane configuration on Whipple Avenue and traffic flows will need to be studied further with quantitative operations analysis.
- Signal timings and phasing would need careful consideration to avoid conflicts and achieve desired operations.

SUMMARY

- Existing operational deficiencies prevail at the I-880 ramp intersections with Whipple Road.
- Forecast traffic is going to exacerbate operational performance at both interchanges.
- The improvement alternatives appear to have significant operational benefits.
- The operational assessment is highly preliminary and additional work will be required to be more definitive.
- An assessment of pedestrian and bicycle activities and facilities would be needed in the subsequent project phases.
- An assessment of affected transit services would be needed in the subsequent project phases.
- Future efforts shall include more detailed forecasting, operational analyses, and possibly microsimulation encompassing larger study area.