



City of Seaside ICE Study

Phase 1 Intersection Control Evaluation

June 1, 2020





Prepared by Kimley-Horn & Associates





























































City of Seaside Intersection Control Evaluation Study
Overall Intersection Summary

OVERALL INTERSECTION SUMMARY

















INTERSECTION CONTROL ALTERNATIVE SUMMARY

Eighteen intersections were evaluated in the City of Seaside Intersection Control Evaluation Study. The existing intersection control as well one or two alternative controls were evaluated at each intersection. The legend (right) displays the symbols used throughout this report to represent the existing and proposed control types. The Intersection Control Alternative Summary table (below) is a summary of the alternatives evaluated and resulting recommendations for each intersection.

Legend		
Control Type	Existing	Proposed
Stop Sign		N/A
Traffic Signal		
Rounabout	N/A	

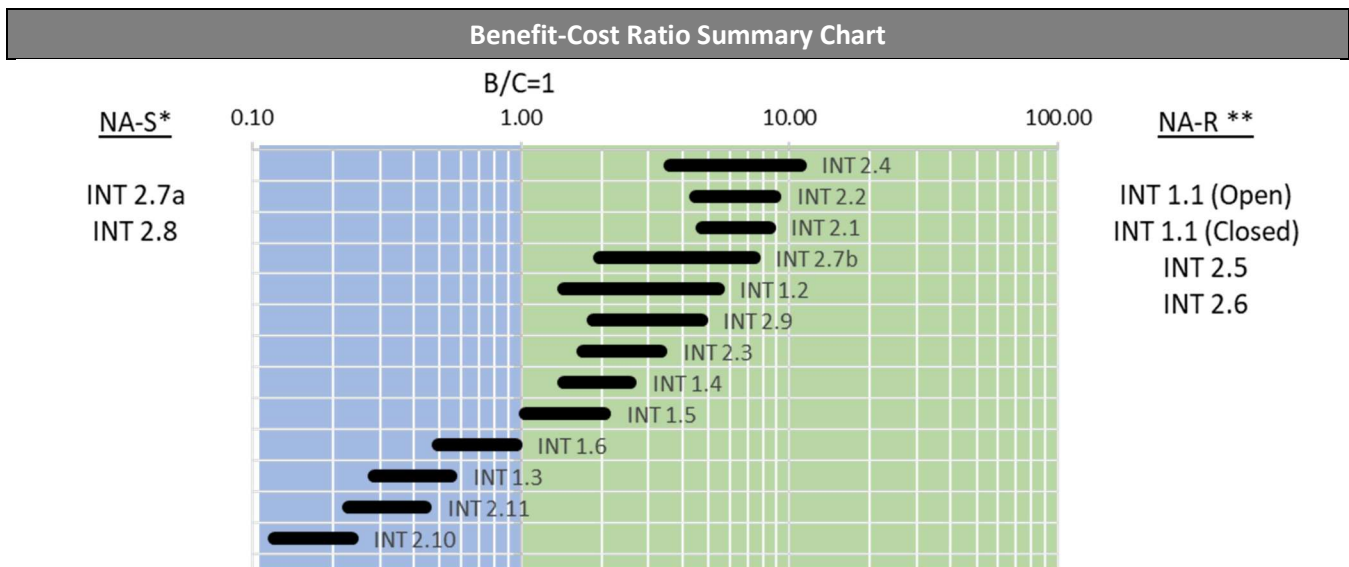
Intersection Control Alternative Summary					
Intersection		Existing Control	Evaluated Alternatives		Recommendation
INT 1.1	Coe Ave at Paralta Ave (Gate Closed)				
INT 1.1	Coe Ave at Paralta Ave (Gate Open)				
INT 1.2	Coe Ave at GJM Blvd				
INT 1.3	Broadway Ave at GJM Blvd				
INT 1.4	La Salle Ave at Yosemite St				
INT 1.5	Sonoma Ave at Yosemite St				
INT 1.6	Broadway Ave at Fremont Blvd				
INT 2.1	Ord Grove at Noche Buena St				
INT 2.2	La Salle Ave at Noche Buena St				
INT 2.3	La Salle Ave at Fremont Blvd				
INT 2.4	Broadway Ave at Noche Buena St				
INT 2.5	Broadway Ave at Yosemite St				
INT 2.6	Military Ave at Noche Buena St				
INT 2.7a	Lightfighter Dr at First Ave				
INT 2.7b	Lightfighter Dr at SR-1 NB Ramps				

**City of Seaside Intersection Control Evaluation Study
Overall Intersection Summary**

Intersection		Existing Control	Evaluated Alternatives		Recommendation
INT 2.8	Lightfighter Dr at Second Ave				
INT 2.9	Mescal St a Yosemite St				
INT 2.10	San Pable Ave at GJM Blvd				
INT 2.11	Hilby Ave at GJM Blvd				

BENEFIT-COST RATIO SUMMARY

Below is a summary of the benefit-cost (B/C) analysis for each intersection. The bars in the graph (logarithmic scale) depict ranges of estimated benefit-cost ratios of roundabouts to traditional intersection controls.



B/C = 1.00: A B/C Ratio of 1.00 is a neutral rating. This indicates that the return on investment for a proposed intersection control type is equal to the existing intersection control type.

B/C < 1.00: A B/C Ratio less than 1.00 indicates that the existing intersection control will provide a better return on investment when compared to the proposed intersection improvement.

B/C > 1.00: A B/C Ratio greater than 1.00 indicates that the proposed intersection control alternative provides a better return on investment when compared to the existing intersection control type.

***NA-S:** Signal Preferred. When the absolute value of the total safety and delay costs for a signal is less than that of a roundabout, the resulting B/C ratio is negative.

****NA-R:** Roundabout Preferred. When the additional initial capital cost of a roundabout is less than the absolute value of the added O&M cost of a roundabout, and the roundabout provides benefit over the traffic signal, a B/C ratio cannot be computed.

City of Seaside Intersection Control Evaluation Study
Overall Intersection Summary

ROUNABOUT BUDGET SUMMARY

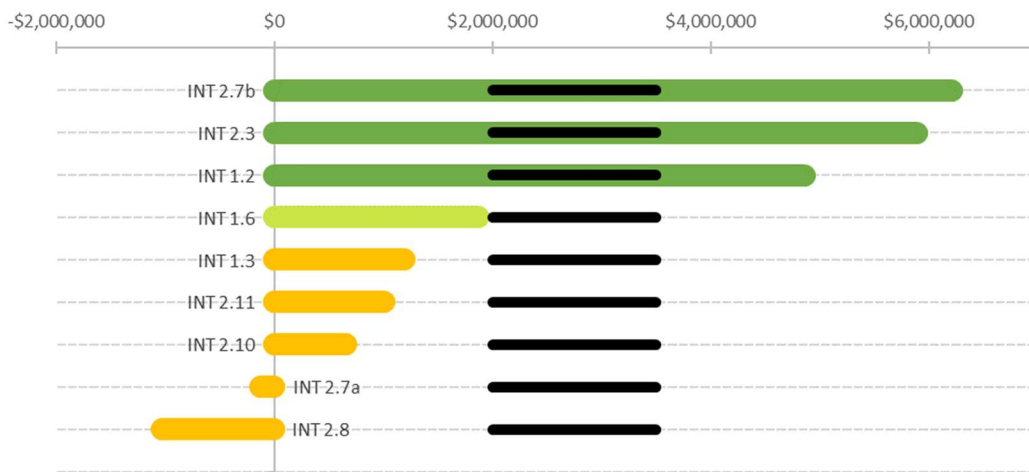
The budget to construct a roundabout while remaining cost effective compared to an alternative traditional intersection control is the Roundabout Budget. The Roundabout Budget is determined by comparing the benefit and cost performance measures for an assumed B/C = 1.0. The Roundabout Budget is defined as:

Roundabout Budget

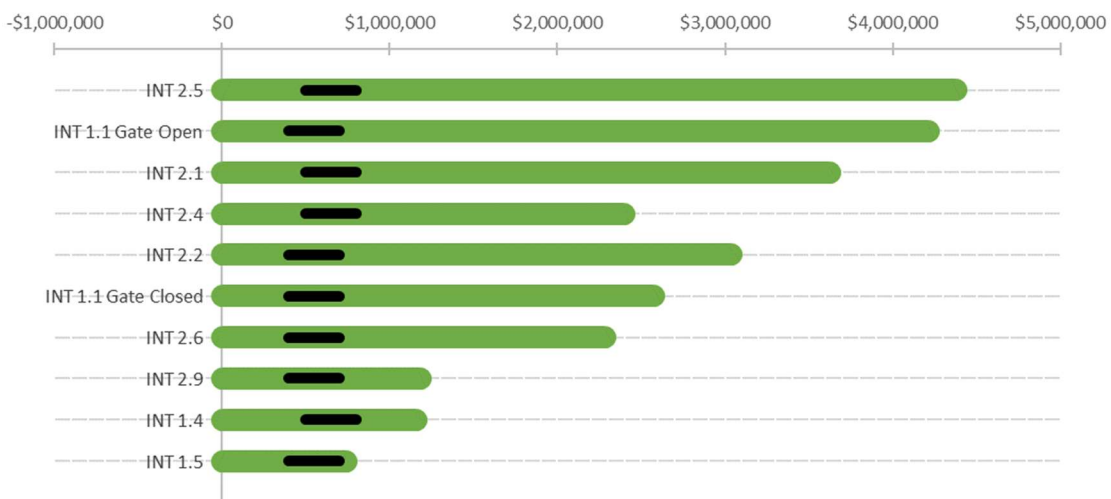
$$= \sum \text{Benefits of a roundabout} - (\text{Added O\&M cost of a roundabout}) + (\text{Initial Capital cost of a signal})$$

Below is a summary of the Roundabout Budget for each intersection.

Multi-Lane Roundabouts



Mini & Elongated Roundabouts



Legend

- Range of Estimated Magnitude Order of Costs
- Roundabout Budget Within the Estimated Costs
- Roundabout Budget Larger than Estimated Costs
- Roundabout Budget Less than the Estimated Costs

**City of Seaside Intersection Control Evaluation Study
Intersection 1.1 – Coe Avenue at Paralta Avenue (Gate Closed)**

INTERSECTION 1.1 – COE AVENUE AT PARALTA AVENUE (GATE CLOSED)

INTERSECTION CONTROL ALTERNATIVES

The two intersection control types analyzed include:

1. Traffic Signal
2. Mini-Roundabout



EXISTING CONDITIONS AND PROJECT CONSTRAINTS

Coe Ave at Paralta Ave is currently controlled by signals. Design constraints at the intersection include:

- | | |
|--|---|
| 1. Bus Stop | 5. Single family residential |
| 2. Proximity to GJM Blvd | 6. Intersection pinch point/Existing Gate |
| 3. Steep slope and grass-lined channel | 7. Water utilities facility |
| 4. Seaside Middle School | 8. Driveway |



QUALITATIVE ASSESSMENT


The following table summarizes qualitative factors that were considered in the design of each alternative.

Qualitative Assessment		Existing Control Feasibility	Roundabout Control Feasibility
INT 1.1	Coe Ave at Paralta Ave (Gate Closed)		
	Urban Environment Focus	N/A	N/A
	Design for Pedestrians	X	X
	Design for Bicyclists	X	X
	Slow Traffic Speeds to Benefit Local Businesses	N/A	N/A
	Minimize ROW Acquisition to Limit Initial Costs	X	
	Minimize Left-Turn Movements to Improve Safety		X

**City of Seaside Intersection Control Evaluation Study
Intersection 1.1 – Coe Avenue at Paralta Avenue (Gate Closed)**

PERFORMANCE MEASURE SUMMARY

Four performance measures were evaluated at each intersection for signal and roundabout control. The table below summarizes the performance measures considered in this study.

Performance Measure	Preferred Alt.	Visual Representation
Benefits		
<p>Safety</p> <p>Safety measures the societal cost associated with the predicted number and severity of collisions. Overall societal costs are based on Caltrans Vehicle Operation Cost Parameters. Injury and Fatality crashes are on average 700-1,000 times more expensive than Property Damage Only accidents.</p>		 <p align="center">Number of Incidents</p>
<p>Delay</p> <p>Delay measures the societal cost associated with the number of person-hours delayed in traffic. Overall societal costs are based on Caltrans Vehicle Operation Cost Parameters.</p>		 <p align="center">Delay (sec/veh)</p>
Costs		
<p>Operations and Maintenance</p> <p>O&M measures the common annualized costs associated with operating and maintaining the intersection.</p>		 <p align="center">Cost (\$)</p>
<p>Initial Capital Cost</p> <p>Measures the Initial Capital Costs (ICC) needed to plan, design, obtain project approvals, acquire right-of-way, and construct the intersection control. This graph (right) depicts the estimated range of Initial capital costs for the signal and roundabout alternatives as well as the roundabout budget.</p>		

City of Seaside Intersection Control Evaluation Study
Intersection 1.1 – Coe Avenue at Paralta Avenue (Gate Closed)

INTERSECTION LIFE CYCLE COST CALCULATIONS

Performance Measure Life Cycle Cost (Net Present Value)					
Safety					
	Existing (AWSC)	Signal	Roundabout		
Annual Cost of Collisions	\$ 124,259	\$ 128,998	\$ 36,427		
Discounted Life Cycle Cost of Collisions	\$ 1,743,253	\$ 1,809,735	\$ 511,044		
Delay					
	Existing (AWSC)	Signal	Roundabout		
Annual Quantity (hours)	11465	1293	698		
Annual Cost	\$ 133,974	\$ 17,085	\$ 9,243		
Total Discounted Life Cycle Cost	\$ 2,947,428	\$ 375,864	\$ 203,351		
O&M					
	Existing (AWSC)	Signal	Roundabout		
Annual O&M Costs	520	9,220	1,920		
Discounted Life Cycle O&M Costs	\$ 7,295	\$ 129,349	\$ 26,936		
Discounted Pavement Rehab Costs	\$ 8,418	\$ 10,750	\$ 10,750		
Total O&M Costs	\$ 15,713	\$ 140,099	\$ 37,686		
Initial Capital					
	Existing (AWSC)	Signal	Roundabout		
High Approximation	\$ 100,000	\$ 1,200,000	\$ 700,000		
Low Approximation	\$ 50,000	\$ 800,000	\$ 400,000		
Life Cycle Benefit Cost Ratio					
	Total Benefits (B)				
	Existing (AWSC)	Signal	Roundabout		
Safety	\$ -	\$ (66,482)	\$ 1,232,209		
Delay	\$ -	\$ 2,571,565	\$ 2,744,077		
Total Benefits	\$ -	\$ 2,505,083	\$ 3,976,286		
	Total Costs (C)				
	Existing (AWSC)	Signal	Roundabout		
O&M	\$ -	\$ 124,386	\$ 21,973		
Budget	\$ -	\$ 925,000	\$ 475,000		
Total Costs	\$ -	\$ 1,049,386	\$ 496,973		
B/C Ratio Compared to Existing	NA	2.39	8.00		

City of Seaside Intersection Control Evaluation Study
Intersection 1.1 – Coe Avenue at Paralta Avenue (Gate Closed)

Benefit-Cost Ratio Calculations							
B/C Target	Capital Cost		Added Cost for Roundabout (c) = (b - a)	Project Constraints		Total Costs (f) = (c + d)	B/C (g) = (e / f)
	Traffic Signal (a)	Roundabout (b)		Added O&M Cost for Roundabout (d)	Total Benefits (e)		
High	\$ 1,200,000	\$ 400,000	\$ (800,000)			\$ (904,746)	NA-R
Low	\$ 800,000	\$ 700,000	\$ (100,000)	\$ (104,746)	\$ 1,471,204	\$ (204,746)	NA-R
Roundabout Budget	\$ 1,000,000	\$ 2,575,949	\$ 1,575,949			\$ 1,471,204	1.00

The high B/C target is calculated assuming the high-end of the traffic signal initial capital costs and the low-end of the roundabout initial capital costs.

The low B/C target is calculated assuming the low-end of the traffic signal initial capital costs and the high-end of the roundabout initial capital costs.

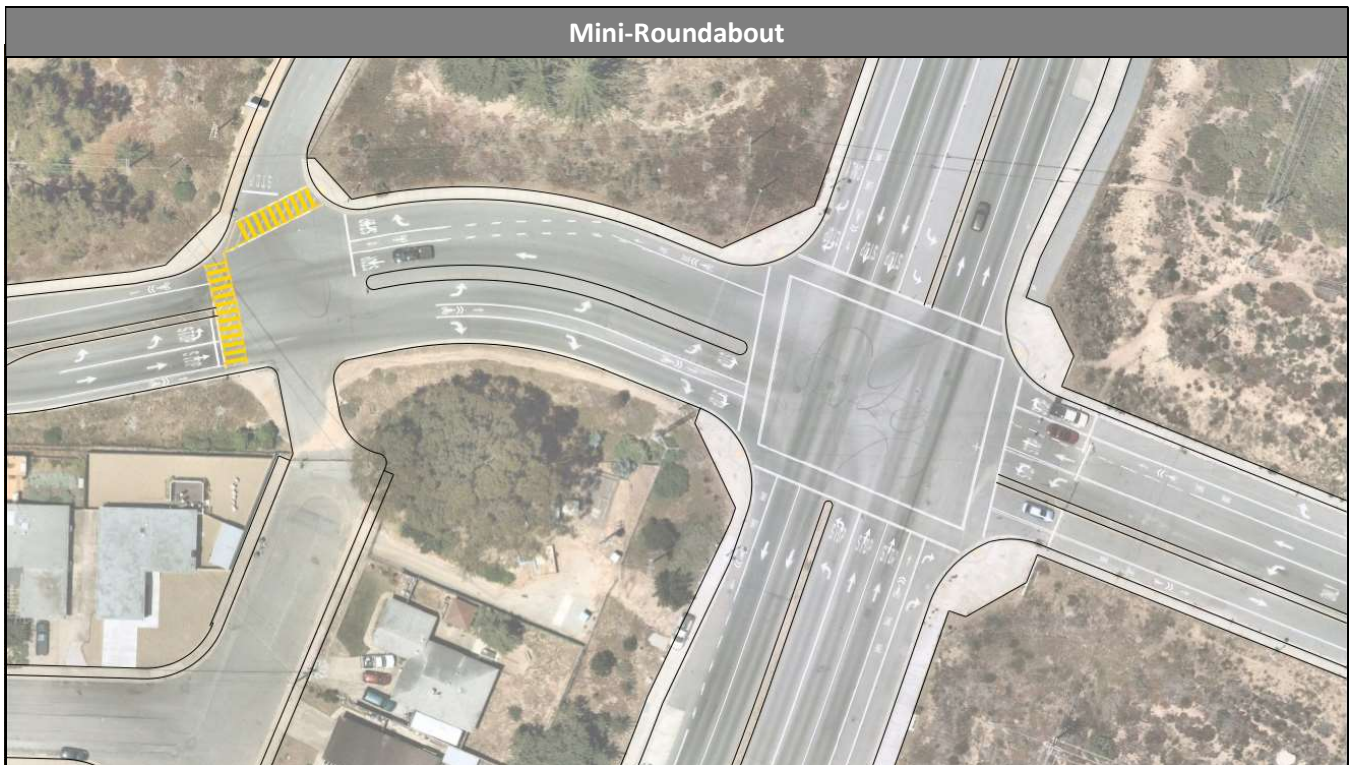
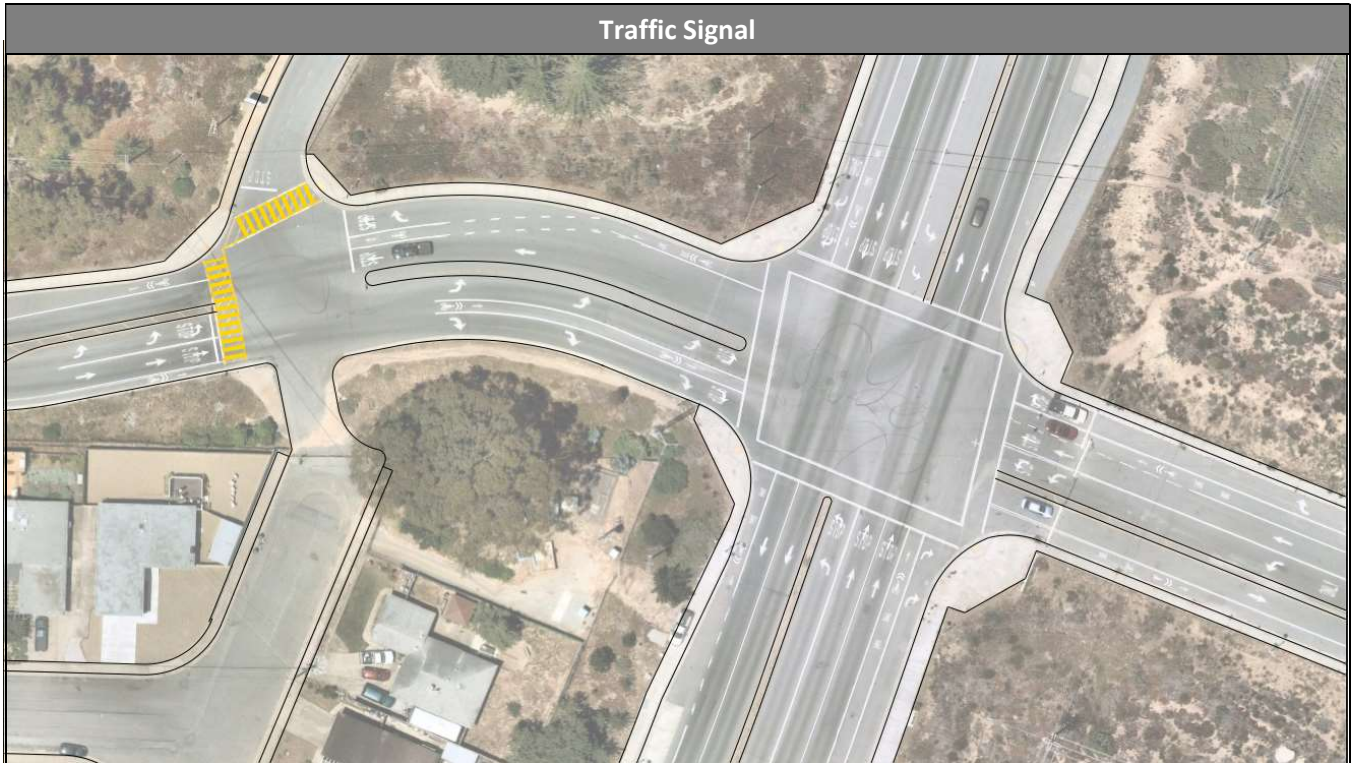
PREFERRED INTERSECTION ALTERNATIVE

The preferred alternative based on B/C ratio for this intersection is roundabout control.



City of Seaside Intersection Control Evaluation Study
Intersection 1.1 – Coe Avenue at Paralta Avenue (Gate Closed)

INTERSECTION CONTROL CONCEPT LAYOUTS



INTERSECTION 1.1 – COE AVENUE AT PARALTA AVENUE (GATE OPEN)

INTERSECTION CONTROL ALTERNATIVES

The two intersection control types analyzed include:

1. Traffic Signal
2. Mini-Roundabout



EXISTING CONDITIONS AND PROJECT CONSTRAINTS

Coe Ave at Paralta Ave is currently controlled by signals. Design constraints at the intersection include:

- | | |
|--|---|
| 1. Bus Stop | 5. Single family residential |
| 2. Proximity to GJM Blvd | 6. Intersection pinch point/Existing Gate |
| 3. Steep slope and grass-lined channel | 7. Water utilities facility |
| 4. Seaside Middle School | 8. Driveway |



QUALITATIVE ASSESSMENT


The following table summarizes qualitative factors that were considered in the design of each alternative.

Qualitative Assessment		Existing Control Feasibility	Roundabout Control Feasibility
INT 1.1	Coe Ave at Paralta Ave (Gate Open)		
	Urban Environment Focus	N/A	N/A
	Design for Pedestrians	X	X
	Design for Bicyclists	X	X
	Slow Traffic Speeds to Benefit Local Businesses	N/A	N/A
	Minimize ROW Acquisition to Limit Initial Costs	X	
	Minimize Left-Turn Movements to Improve Safety		X

City of Seaside Intersection Control Evaluation Study
Intersection 1.1 – Coe Avenue at Paralta Avenue (Gate Open)

PERFORMANCE MEASURE SUMMARY

Four performance measures were evaluated at each intersection for signal and roundabout control. The table below summarizes the performance measures considered in this study.

Performance Measure	Preferred Alt.	Visual Representation
Benefits		
<p>Safety</p> <p>Safety measures the societal cost associated with the predicted number and severity and collisions. Overall societal costs are based on Caltrans Vehicle Operation Cost Parameters. Injury and Fatality crashes are on average 700-1,000 times more expensive than Property Damage Only accidents.</p> <p align="center"></p> <p>— Signal — Roundabout</p>	 <p align="center">Number of Incidents</p>	
<p>Delay</p> <p>Delay measures the societal cost associated with the number of person-hours delayed in traffic. Overall societal costs are based on Caltrans Vehicle Operation Cost Parameters.</p> <p align="center"></p> <p>— Signal — Roundabout</p>	 <p align="center">Delay (sec/veh)</p>	
Costs		
<p>Operations and Maintenance</p> <p>O&M measures the common annualized costs associated with operating and maintaining the intersection.</p> <p align="center"></p> <p>— Signal — Roundabout</p>	 <p align="center">Cost (\$)</p>	
<p>Initial Capital Cost</p> <p>Measures the Initial Capital Costs (ICC) needed to plan, design, obtain project approvals, acquire right-of-way, and construct the intersection control. This graph (right) depicts the estimated range of Initial capital costs for the signal and roundabout alternatives as well as the roundabout budget.</p> <p align="center"></p> <p>— RAB ICC Range — B/C=1 — Signal ICC Range ■ Estimated ICC ●●● RAB Budget</p>	 <p align="center">Traffic Signal Cost</p> <p align="center">Roundabout Cost</p>	

City of Seaside Intersection Control Evaluation Study
Intersection 1.1 – Coe Avenue at Paralta Avenue (Gate Open)

INTERSECTION LIFE CYCLE COST CALCULATIONS

Performance Measure Life Cycle Cost (Net Present Value)			
Safety			
	Existing (AWSC)	Signal	Roundabout
Annual Cost of Collisions	\$ 128,998	\$ 231,355	\$ 38,066
Discounted Life Cycle Cost of Collisions	\$ 1,809,735	\$ 3,245,712	\$ 534,033
Delay			
	Existing (AWSC)	Signal	Roundabout
Annual Quantity (hours)	12,166	2,136	768
Annual Cost	\$ 143,363	\$ 28,243	\$ 10,188
Total Discounted Life Cycle Cost	\$ 3,153,980	\$ 621,343	\$ 224,131
O&M			
	Existing (AWSC)	Signal	Roundabout
Annual O&M Costs	520	9,220	1,920
Discounted Life Cycle O&M Costs	\$ 7,295	\$ 129,349	\$ 26,936
Discounted Pavement Rehab Costs	\$ 10,750	\$ 10,750	\$ 8,418
Total O&M Costs	\$ 18,046	\$ 140,099	\$ 35,354
Initial Capital			
	Existing (AWSC)	Signal	Roundabout
High Approximation	\$ 100,000	\$ 1,200,000	\$ 700,000
Low Approximation	\$ 50,000	\$ 800,000	\$ 400,000
Life Cycle Benefit-Cost Ratio			
	Total Benefits (B)		
	Existing (AWSC)	Signal	Roundabout
Safety	\$ -	\$ (1,435,977)	\$ 1,275,702
Delay	\$ -	\$ 2,532,637	\$ 2,929,849
Total Benefits	\$ -	\$ 1,096,660	\$ 4,205,551
	Total Costs (C)		
	Existing (AWSC)	Signal	Roundabout
O&M	\$ -	\$ 122,054	\$ 17,308
Budget	\$ -	\$ 925,000	\$ 475,000
Total Costs	\$ -	\$ 1,047,054	\$ 492,308
B/C Ratio Compared to Existing	NA	1.05	8.54

City of Seaside Intersection Control Evaluation Study
Intersection 1.1 – Coe Avenue at Paralta Avenue (Gate Open)

Benefit-Cost Ratio Calculations							
B/C Target	Capital Cost			Project Constraints			
	Traffic Signal (a)	Roundabout (b)	Added Cost for Roundabout (c) = (b - a)	Added O&M Cost for Roundabout (d)	Total Benefits (e)	Total Costs (f) = (c + d)	B/C (g) = (e / f)
High	\$ 1,200,000	\$ 400,000	\$ (800,000)			\$ (904,746)	NA-R
Low	\$ 800,000	\$ 700,000	\$ (100,000)	\$ (104,746)	\$ 3,108,891	\$ (204,746)	NA-R
Roundabout Budget	\$ 1,000,000	\$ 4,213,636	\$ 3,213,636			\$ 3,108,891	1.00

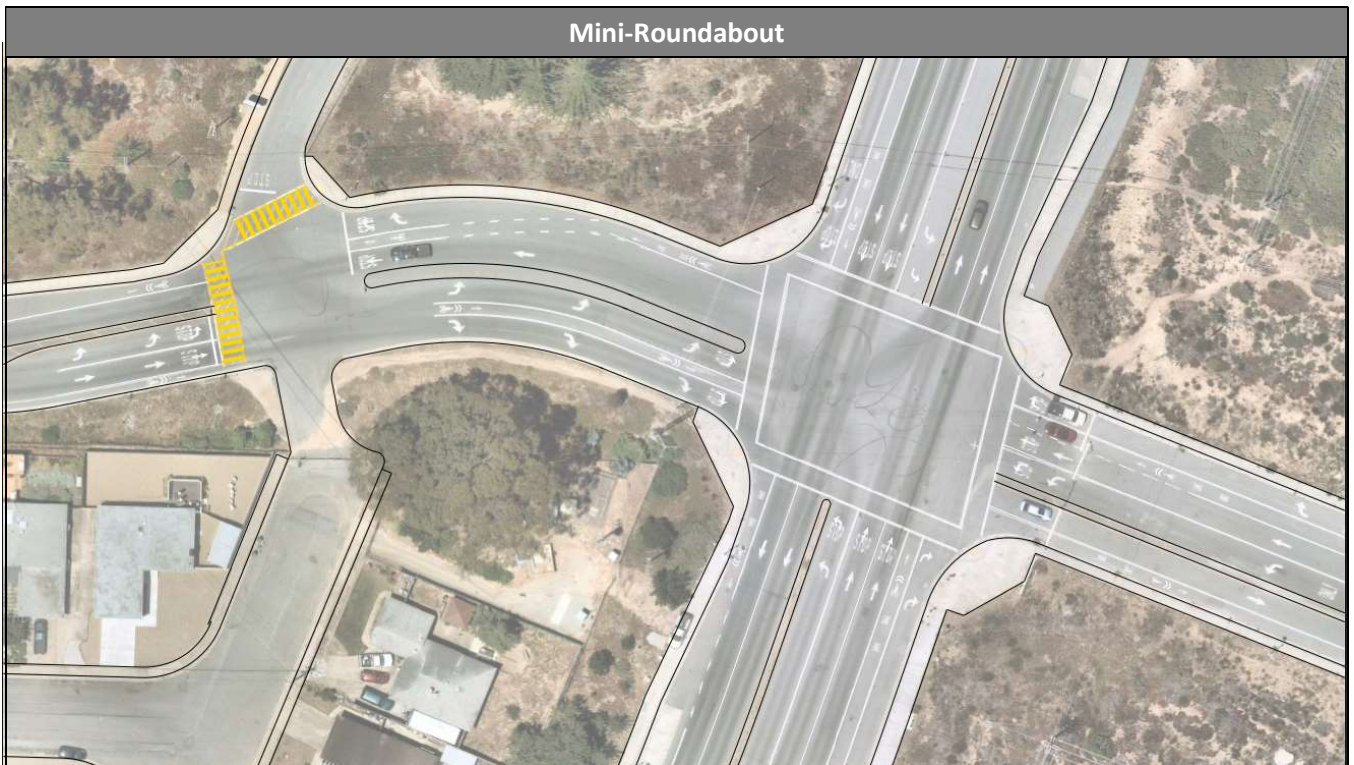
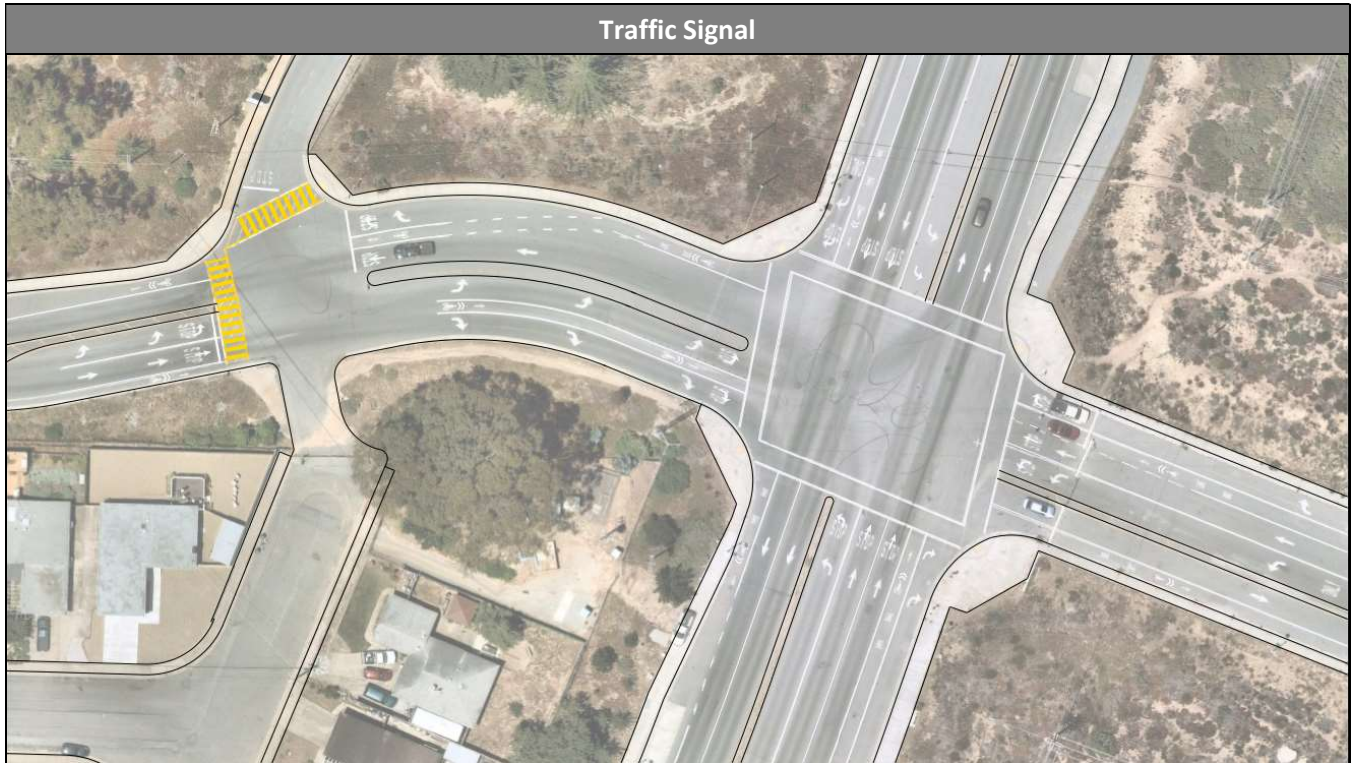
PREFERRED INTERSECTION ALTERNATIVE



The preferred alternative based on B/C ratio for this intersection is roundabout control.

City of Seaside Intersection Control Evaluation Study
Intersection 1.1 – Coe Avenue at Paralta Avenue (Gate Open)

INTERSECTION CONTROL CONCEPT LAYOUTS



INTERSECTION 1.2 – COE AVENUE AT GENERAL JIM MOORE BOULEVARD

INTERSECTION CONTROL ALTERNATIVES

The two intersection control types analyzed include:

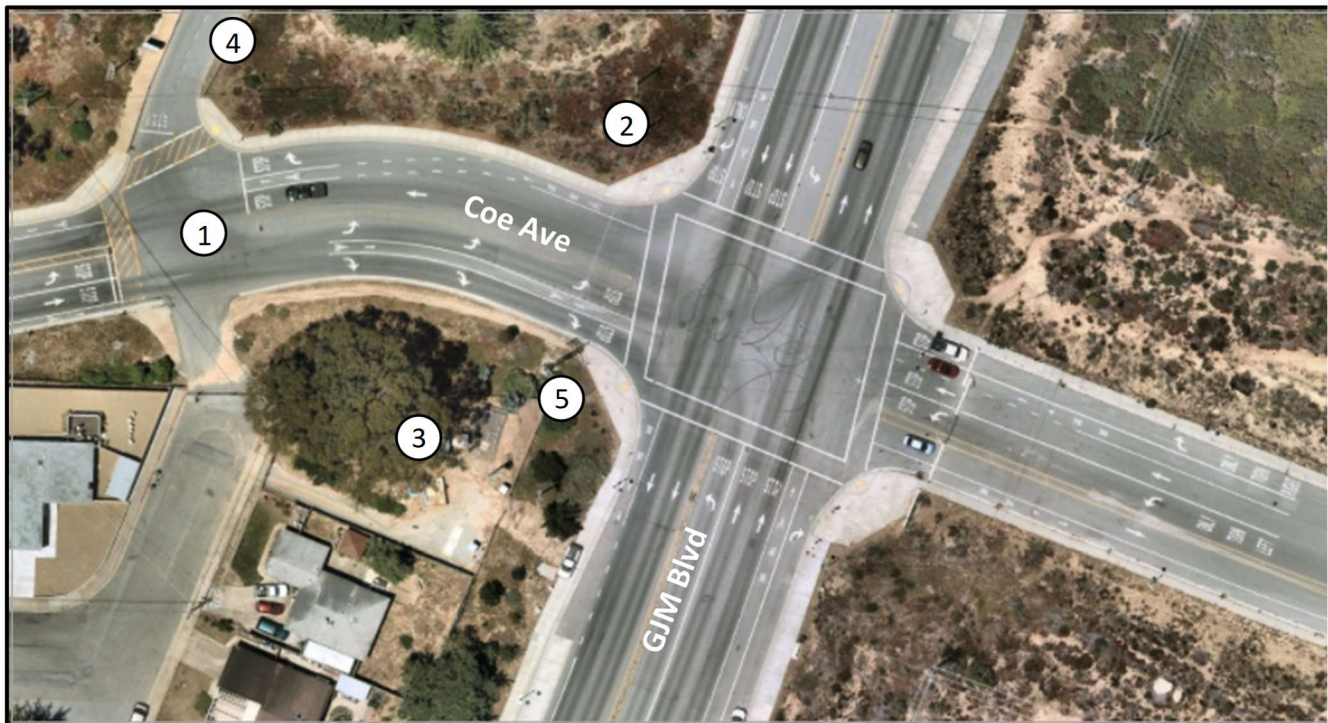
1. Traffic Signal
2. Multi-lane Roundabout



EXISTING CONDITIONS AND PROJECT CONSTRAINTS

Coe Ave at General Jim Moore Blvd is currently controlled by signals. Design constraints at the intersection include:

- | | |
|-----------------------------|--------------------------|
| 1. Proximity to Paralta Ave | 4. Seaside Middle School |
| 2. Steep grade | 5. Telephone Pole |
| 3. Water utilities facility | |



QUALITATIVE ASSESSMENT

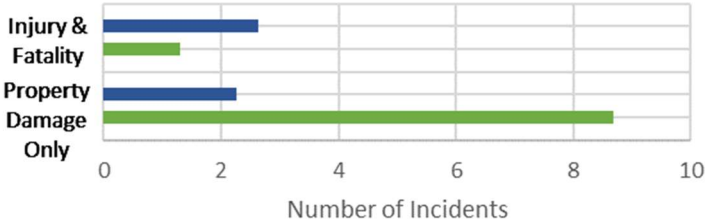
The following table summarizes qualitative factors that were considered in the design of each alternative.

Qualitative Assessment		Existing Control Feasibility	Roundabout Control Feasibility
INT 1.2	Coe Ave at GJM Blvd		
	Urban Environment Focus	N/A	N/A
	Design for Pedestrians	X	X
	Design for Bicyclists	X	X
	Slow Traffic Speeds to Benefit Local Businesses	N/A	N/A
	Minimize ROW Acquisition to Limit Initial Costs	X	
	Minimize Left-Turn Movements to Improve Safety		X

City of Seaside Intersection Control Evaluation Study
Intersection 1.2 – Coe Avenue at General Jim Moore Boulevard

PERFORMANCE MEASURE SUMMARY

Four performance measures were evaluated at each intersection for signal and roundabout control. The table below summarizes the performance measures considered in this study.

Performance Measure	Preferred Alt.	Visual Representation									
Benefits											
<p>Safety</p> <p>Safety measures the societal cost associated with the predicted number and severity and collisions. Overall societal costs are based on Caltrans Vehicle Operation Cost Parameters. Injury and Fatality crashes are on average 700-1,000 times more expensive than Property Damage Only accidents.</p> <p align="center"></p> <p>— Signal — Roundabout</p>		 <table border="1"> <caption>Injury & Fatality, Property Damage Only</caption> <thead> <tr> <th>Measure</th> <th>Signal</th> <th>Roundabout</th> </tr> </thead> <tbody> <tr> <td>Injury & Fatality</td> <td>2.5</td> <td>1.2</td> </tr> <tr> <td>Property Damage Only</td> <td>2.2</td> <td>8.8</td> </tr> </tbody> </table>	Measure	Signal	Roundabout	Injury & Fatality	2.5	1.2	Property Damage Only	2.2	8.8
Measure	Signal	Roundabout									
Injury & Fatality	2.5	1.2									
Property Damage Only	2.2	8.8									
<p>Delay</p> <p>Delay measures the societal cost associated with the number of person-hours delayed in traffic. Overall societal costs are based on Caltrans Vehicle Operation Cost Parameters.</p> <p align="center"></p> <p>— Signal — Roundabout</p>		 <table border="1"> <caption>Delay (sec/veh)</caption> <thead> <tr> <th>Time</th> <th>Signal</th> <th>Roundabout</th> </tr> </thead> <tbody> <tr> <td>AM</td> <td>32</td> <td>15</td> </tr> <tr> <td>PM</td> <td>35</td> <td>18</td> </tr> </tbody> </table>	Time	Signal	Roundabout	AM	32	15	PM	35	18
Time	Signal	Roundabout									
AM	32	15									
PM	35	18									
Costs											
<p>Operations and Maintenance</p> <p>O&M measures the common annualized costs associated with operating and maintaining the intersection.</p> <p align="center"></p> <p>— Signal — Roundabout</p>		 <table border="1"> <caption>Annual and Life Cycle Discounted Costs</caption> <thead> <tr> <th>Measure</th> <th>Signal</th> <th>Roundabout</th> </tr> </thead> <tbody> <tr> <td>Annual</td> <td>\$15,000</td> <td>\$5,000</td> </tr> <tr> <td>Life Cycle Discounted</td> <td>\$250,000</td> <td>\$100,000</td> </tr> </tbody> </table>	Measure	Signal	Roundabout	Annual	\$15,000	\$5,000	Life Cycle Discounted	\$250,000	\$100,000
Measure	Signal	Roundabout									
Annual	\$15,000	\$5,000									
Life Cycle Discounted	\$250,000	\$100,000									
<p>Initial Capital Cost</p> <p>Measures the Initial Capital Costs (ICC) needed to plan, design, obtain project approvals, acquire right-of-way, and construct the intersection control. This graph (right) depicts the estimated range of Initial capital costs for the signal and roundabout alternatives as well as the roundabout budget.</p> <p align="center"></p> <p>— RAB ICC Range — B/C=1 — Signal ICC Range ■ Estimated ICC ● RAB Budget</p>											

City of Seaside Intersection Control Evaluation Study
Intersection 1.2 – Coe Avenue at General Jim Moore Boulevard

INTERSECTION LIFE CYCLE COST CALCULATIONS

Performance Measure Life Cycle Cost (Net Present Value)			
Safety			
	Existing (AWSC)	Signal	Roundabout
Annual Cost of Collisions	\$ 343,848	\$ 383,700	\$ 227,347
Discounted Life Cycle Cost of Collisions	\$ 4,823,902	\$ 5,382,986	\$ 3,189,483
Delay			
	Existing (AWSC)	Signal	Roundabout
Annual Quantity (hours)	52564	10400	4843
Annual Cost	\$ 609,740	\$ 129,777	\$ 58,768
Total Discounted Life Cycle Cost	\$ 13,414,274	\$ 2,855,089	\$ 1,292,895
O&M			
	Existing (AWSC)	Signal	Roundabout
Annual O&M Costs	520	9,220	1,920
Discounted Life Cycle O&M Costs	\$ 7,295	\$ 129,349	\$ 26,936
Discounted Pavement Rehab Costs	\$ 80,628	\$ 80,628	\$ 72,515
Total O&M Costs	\$ 87,924	\$ 209,977	\$ 99,451
Initial Capital			
	Existing (AWSC)	Signal	Roundabout
High Approximation	\$ 100,000	\$ 1,200,000	\$ 3,500,000
Low Approximation	\$ 50,000	\$ 800,000	\$ 2,000,000
Life Cycle Benefit-Cost Ratio			
	Existing (AWSC)	Total Benefits (B)	
		Signal	Roundabout
Safety	\$ -	\$ (559,084)	\$ 1,634,419
Delay	\$ -	\$ 10,559,185	\$ 12,121,379
Total Benefits	\$ -	\$ 10,000,101	\$ 13,755,798
	Existing (AWSC)	Total Costs (C)	
		Signal	Roundabout
O&M	\$ -	\$ 122,054	\$ 11,527
Budget	\$ -	\$ 925,000	\$ 2,675,000
Total Costs	\$ -	\$ 1,047,054	\$ 2,686,527
B/C Ratio Compared to Existing	NA	9.55	5.12

City of Seaside Intersection Control Evaluation Study
Intersection 1.2 – Coe Avenue at General Jim Moore Boulevard

Benefit-Cost Ratio Calculations							
B/C Target	Capital Cost			Project Constraints			
	Traffic Signal (a)	Roundabout (b)	Added Cost for Roundabout (c) = (b - a)	Added O&M Cost for Roundabout (d)	Total Benefits (e)	Total Costs (f) = (c + d)	B/C (g) = (e / f)
High	\$ 1,200,000	\$ 2,000,000	\$ 800,000			\$ 689,879	5.44
Low	\$ 800,000	\$ 3,500,000	\$ 2,700,000	\$ (110,121)	\$ 3,755,697	\$ 2,589,879	1.45
Roundabout Budget	\$ 1,000,000	\$ 4,865,818	\$ 3,865,818			\$ 3,755,697	1.00

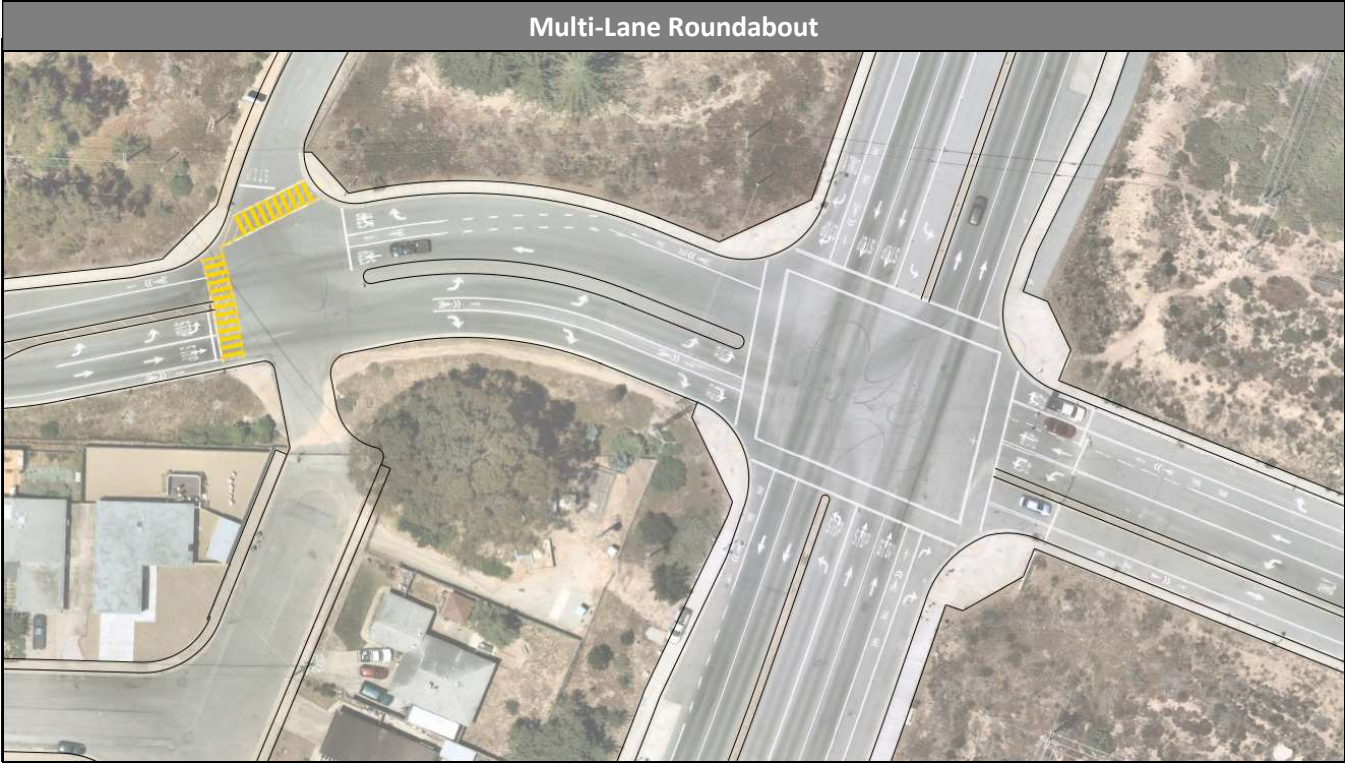
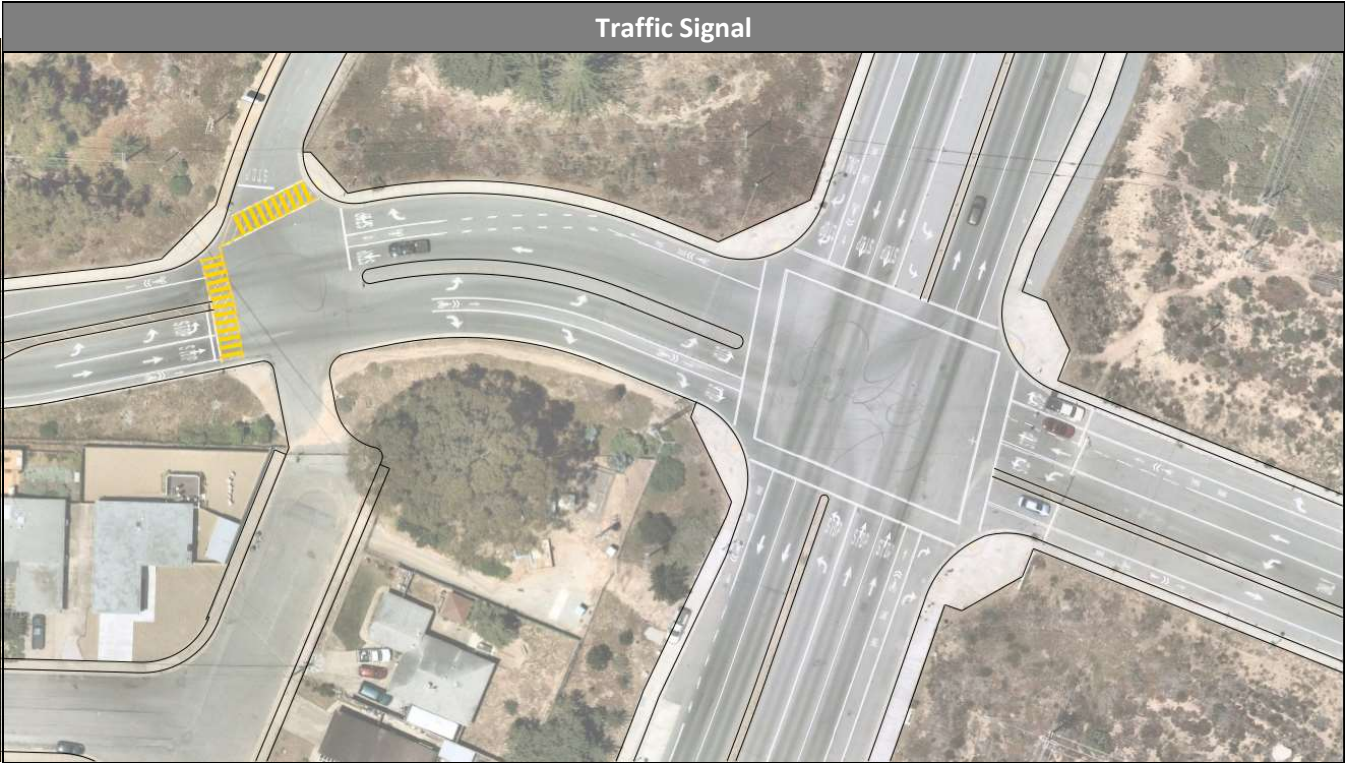
PREFERRED INTERSECTION ALTERNATIVE

The preferred alternative based on B/C ratio for this intersection is roundabout control.



City of Seaside Intersection Control Evaluation Study
Intersection 1.2 – Coe Avenue at General Jim Moore Boulevard

INTERSECTION CONTROL CONCEPT LAYOUTS



INTERSECTION 1.3 – BROADWAY AVENUE AT GENERAL JIM MOORE BOULEVARD

INTERSECTION CONTROL ALTERNATIVES

The two intersection control types analyzed include:

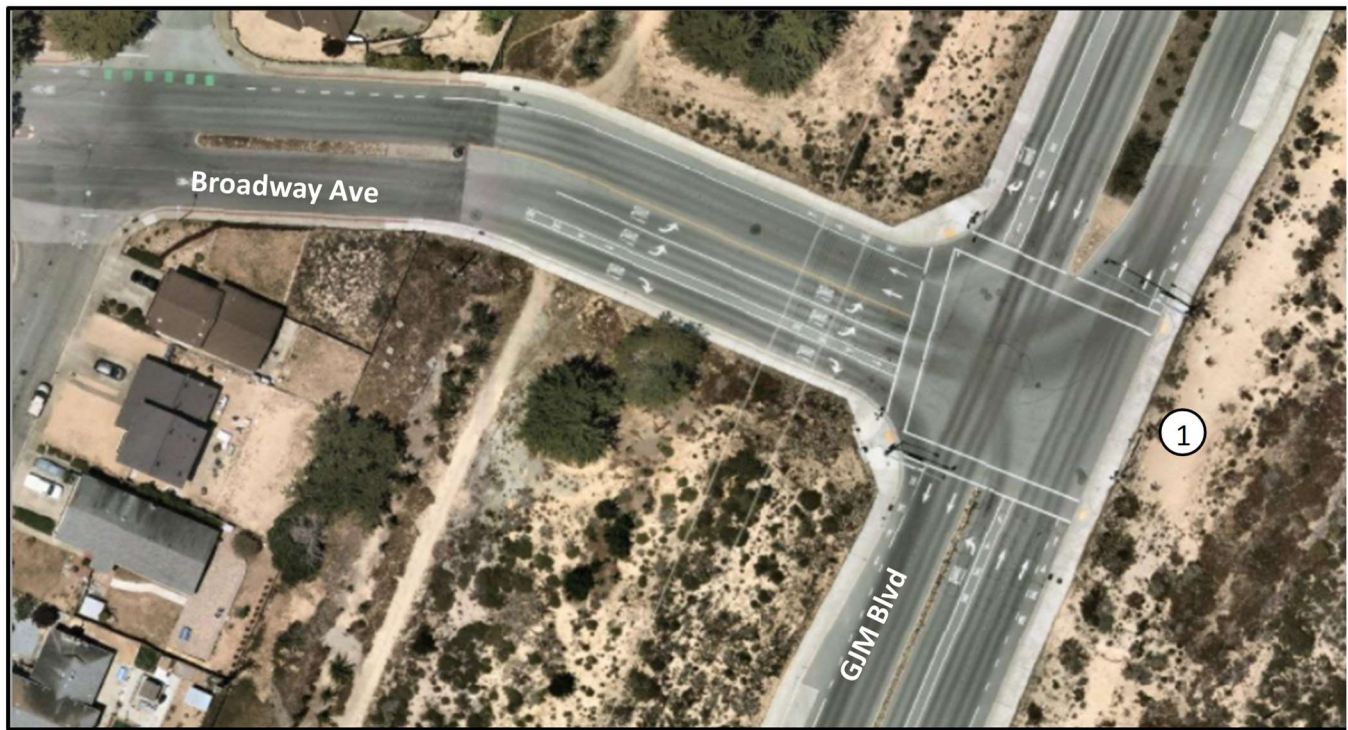
1. Existing Signal with Optimized Signal Timing
2. Multi-lane Roundabout



EXISTING CONDITIONS AND PROJECT CONSTRAINTS

Broadway Ave at General Jim Moore Blvd is currently controlled by signals. Design constraints at the intersection include:

1. Steep uphill grade



QUALITATIVE ASSESSMENT


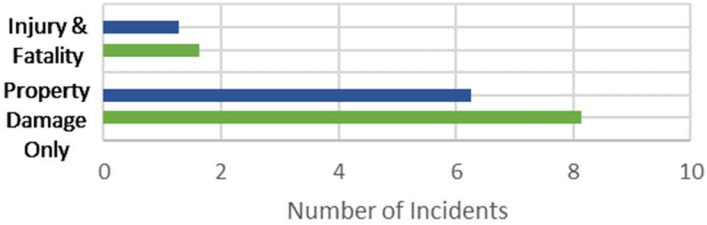

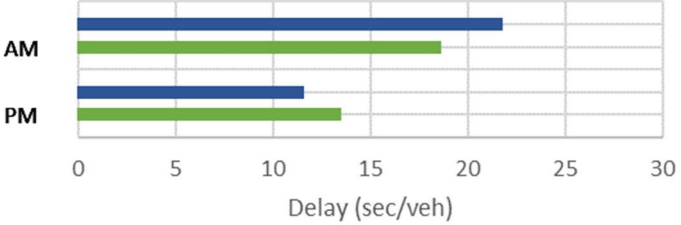

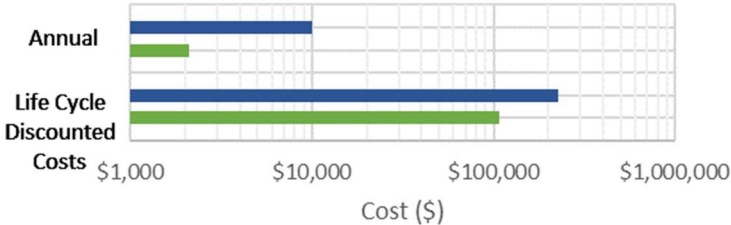

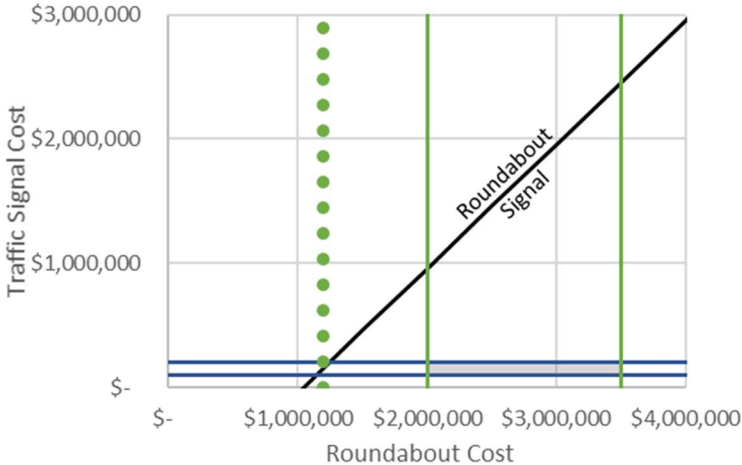
The following table summarizes qualitative factors that were considered in the design of each alternative.

Qualitative Assessment		Existing Control Feasibility	Roundabout Control Feasibility
INT 1.3	Broadway Ave at GJM Blvd		
	Urban Environment Focus		
	Design for Pedestrians	X	X
	Design for Bicyclists	X	X
	Slow Traffic Speeds to Benefit Local Businesses	N/A	N/A
	Minimize Left-Turn Movements to Improve Safety		X

City of Seaside Intersection Control Evaluation Study
Intersection 1.3 – Broadway Avenue at General Jim Moore Boulevard

PERFORMANCE MEASURE SUMMARY

Four performance measures were evaluated at each intersection for signal and roundabout control. The table below summarizes the performance measures considered in this study.

Performance Measure	Preferred Alt.	Visual Representation									
Benefits											
<p>Safety</p> <p>Safety measures the societal cost associated with the predicted number and severity and collisions. Overall societal costs are based on Caltrans Vehicle Operation Cost Parameters. Injury and Fatality crashes are on average 700-1,000 times more expensive than Property Damage Only accidents.</p> <p align="center"></p> <p>— Signal — Roundabout</p>		 <table border="1"> <caption>Injury & Fatality, Property Damage Only</caption> <thead> <tr> <th>Measure</th> <th>Signal</th> <th>Roundabout</th> </tr> </thead> <tbody> <tr> <td>Injury & Fatality</td> <td>~1.5</td> <td>~1.8</td> </tr> <tr> <td>Property Damage Only</td> <td>~6.5</td> <td>~8.5</td> </tr> </tbody> </table> <p align="center">Number of Incidents</p>	Measure	Signal	Roundabout	Injury & Fatality	~1.5	~1.8	Property Damage Only	~6.5	~8.5
Measure	Signal	Roundabout									
Injury & Fatality	~1.5	~1.8									
Property Damage Only	~6.5	~8.5									
<p>Delay</p> <p>Delay measures the societal cost associated with the number of person-hours delayed in traffic. Overall societal costs are based on Caltrans Vehicle Operation Cost Parameters.</p> <p align="center"></p> <p>— Signal — Roundabout</p>		 <table border="1"> <caption>Delay (sec/veh)</caption> <thead> <tr> <th>Time</th> <th>Signal</th> <th>Roundabout</th> </tr> </thead> <tbody> <tr> <td>AM</td> <td>~22</td> <td>~19</td> </tr> <tr> <td>PM</td> <td>~12</td> <td>~14</td> </tr> </tbody> </table> <p align="center">Delay (sec/veh)</p>	Time	Signal	Roundabout	AM	~22	~19	PM	~12	~14
Time	Signal	Roundabout									
AM	~22	~19									
PM	~12	~14									
Costs											
<p>Operations and Maintenance</p> <p>O&M measures the common annualized costs associated with operating and maintaining the intersection.</p> <p align="center"></p> <p>— Signal — Roundabout</p>		 <table border="1"> <caption>Annual and Life Cycle Discounted Costs</caption> <thead> <tr> <th>Measure</th> <th>Signal</th> <th>Roundabout</th> </tr> </thead> <tbody> <tr> <td>Annual</td> <td>~\$10,000</td> <td>~\$5,000</td> </tr> <tr> <td>Life Cycle Discounted</td> <td>~\$200,000</td> <td>~\$100,000</td> </tr> </tbody> </table> <p align="center">Cost (\$)</p>	Measure	Signal	Roundabout	Annual	~\$10,000	~\$5,000	Life Cycle Discounted	~\$200,000	~\$100,000
Measure	Signal	Roundabout									
Annual	~\$10,000	~\$5,000									
Life Cycle Discounted	~\$200,000	~\$100,000									
<p>Initial Capital Cost</p> <p>Measures the Initial Capital Costs (ICC) needed to plan, design, obtain project approvals, acquire right-of-way, and construct the intersection control. This graph (right) depicts the estimated range of Initial capital costs for the signal and roundabout alternatives as well as the roundabout budget.</p> <p align="center"></p> <p>— RAB ICC Range — B/C=1 — Signal ICC Range — Estimated ICC ● RAB Budget</p>		 <p align="center">Traffic Signal Cost vs Roundabout Cost</p>									

City of Seaside Intersection Control Evaluation Study
Intersection 1.3 – Broadway Avenue at General Jim Moore Boulevard

INTERSECTION LIFE CYCLE COST CALCULATIONS

Performance Measure Life Cycle Cost (Net Present Value)			
Safety			
	Existing (Signal)	Proposed Signal	Roundabout
Annual Cost of Collisions	\$ 170,075	\$ 379,933	\$ 157,539
Discounted Life Cycle Cost of Collisions	\$ 2,386,011	\$ 5,330,142	\$ 2,210,145
Delay			
	Existing (Signal)	Proposed Signal	Roundabout
Annual Quantity (hours)	5,682	5,819	5,319
Annual Cost	\$ 70,036	\$ 71,254	\$ 64,308
Total Discounted Life Cycle Cost	\$ 1,540,790	\$ 1,567,599	\$ 1,414,770
O&M			
	Existing (Signal)	Proposed Signal	Roundabout
Annual O&M Costs	9,220	9,220	1,920
Discounted Life Cycle O&M Costs	\$ 129,349	\$ 129,349	\$ 26,936
Discounted Pavement Rehab Costs	\$ 80,628	\$ 80,628	\$ 72,515
Total O&M Costs	\$ 209,977	\$ 209,977	\$ 99,451
Initial Capital			
	Existing (Signal)	Proposed Signal	Roundabout
High Approximation	\$ 100,000	\$ 200,000	\$ 3,500,000
Low Approximation	\$ 50,000	\$ 100,000	\$ 2,000,000
Life Cycle Benefit-Cost Ratio			
	Existing (Signal)	Proposed Signal	Roundabout
		Total Benefits (B)	
Safety	\$ -	\$ (2,944,131)	\$ 175,866
Delay	\$ -	\$ (26,809)	\$ 126,020
Total Benefits	\$ -	\$ (2,970,940)	\$ 301,886
		Total Costs (C)	
O&M	\$ -	\$ -	\$ (110,526)
Budget	\$ -	\$ 75,000	\$ 2,675,000
Total Costs	\$ -	\$ 75,000	\$ 2,564,474
B/C Ratio Compared to Existing	NA	-39.61	0.12

City of Seaside Intersection Control Evaluation Study
Intersection 1.3 – Broadway Avenue at General Jim Moore Boulevard

Benefit-Cost Ratio Calculations							
B/C Target	Capital Cost			Project Constraints			
	Traffic Signal (a)	Roundabout (b)	Added Cost for Roundabout (c) = (b - a)	Added O&M Cost for Roundabout (d)	Total Benefits (e)	Total Costs (f) = (c + d)	B/C (g) = (e / f)
High	\$ 200,000	\$ 2,000,000	\$ 1,800,000			\$ 1,689,879	0.55
Low	\$ 100,000	\$ 3,500,000	\$ 3,400,000	\$ (110,121)	\$ 931,923	\$ 3,289,879	0.28
Roundabout Budget	\$ 150,000	\$ 1,192,044	\$ 1,042,044			\$ 931,923	1.00

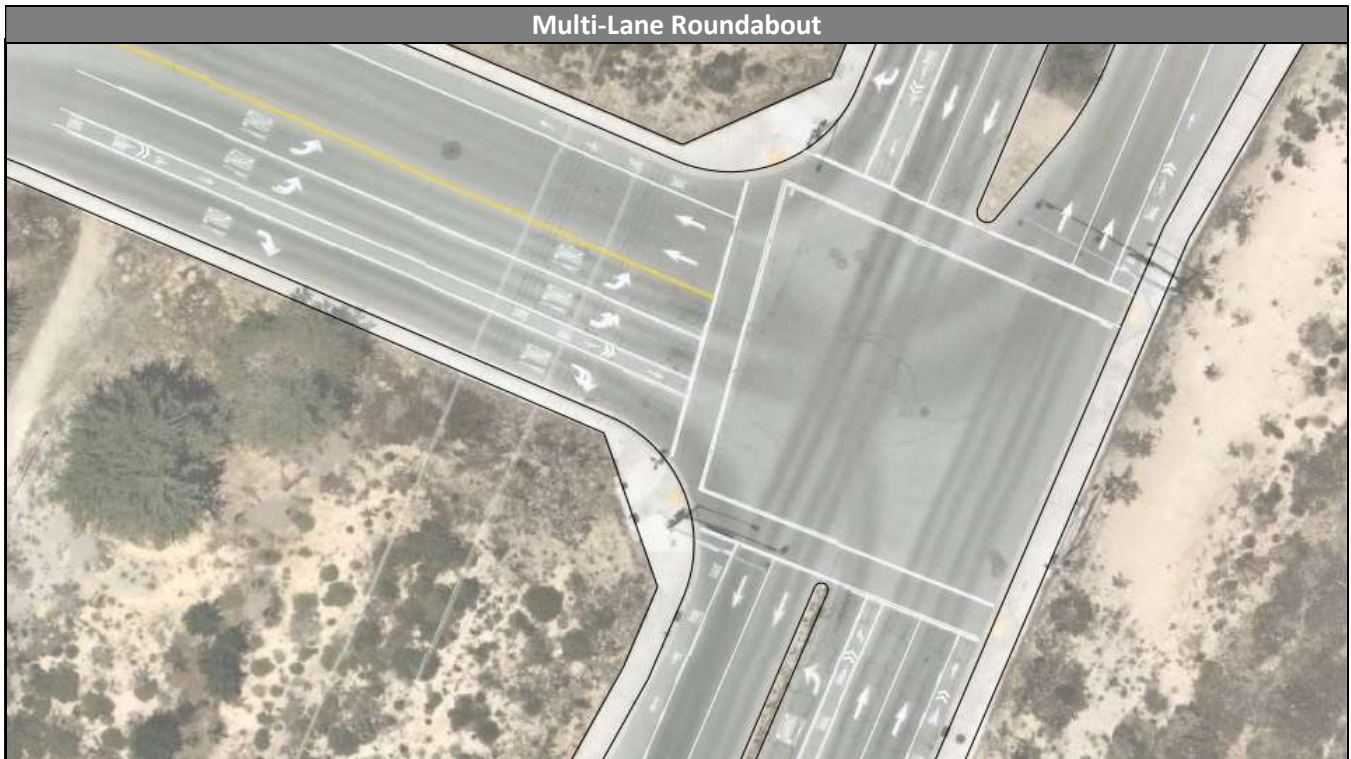
PREFERRED INTERSECTION ALTERNATIVE

The preferred alternative for this intersection is a roundabout based on the added safety and delay benefits a roundabout will provide.



City of Seaside Intersection Control Evaluation Study
Intersection 1.3 – Broadway Avenue at General Jim Moore Boulevard

INTERSECTION CONTROL CONCEPT LAYOUTS



INTERSECTION 1.4 – LA SALLE AVENUE AT YOSEMITE STREET

INTERSECTION CONTROL ALTERNATIVES

The two intersection control types analyzed include:

1. Existing All-Way Stop Control
2. Elongated Roundabout



EXISTING CONDITIONS AND PROJECT CONSTRAINTS

La Salle Ave at Yosemite St is currently controlled by signals. Design constraints at the intersection include:

- | | |
|------------------------------|----------------------------------|
| 1. Offset intersection | 3. Ord Terrace Elementary School |
| 2. Single family residential | 4. Driveway |



QUALITATIVE ASSESSMENT


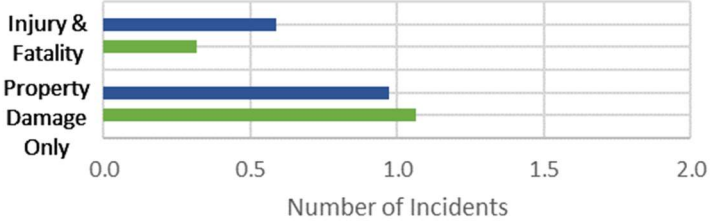

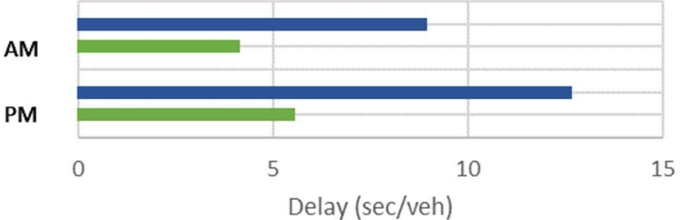



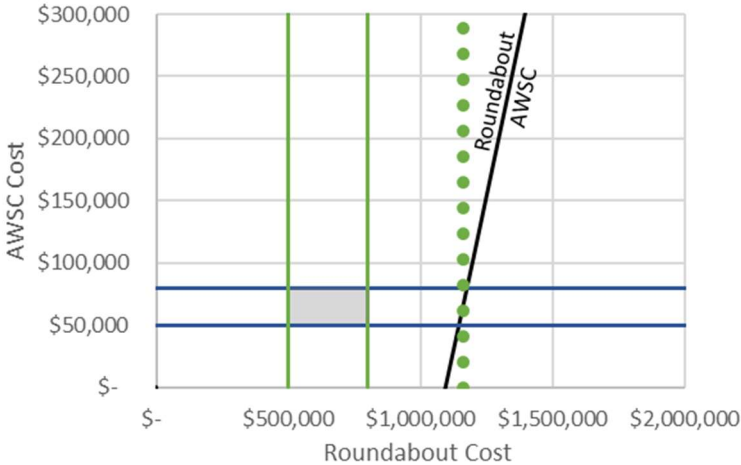
The following table summarizes qualitative factors that were considered in the design of each alternative.

Qualitative Assessment		Existing Control Feasibility	Roundabout Control Feasibility
INT 1.4	La Salle Ave at Yosemite St		
	Urban Environment Focus	X	X
	Design for Pedestrians	X	X
	Design for Bicyclists	X	X
	Slow Traffic Speeds to Benefit Local Businesses		X
	Minimize ROW Acquisition to Limit Initial Costs	X	X
Minimize Left-Turn Movements to Improve Safety		X	

**City of Seaside Intersection Control Evaluation Study
Intersection 1.4 – La Salle Avenue at Yosemite Street**

PERFORMANCE MEASURE SUMMARY

Four performance measures were evaluated at each intersection for stop control and roundabout control. The table below summarizes the performance measures considered in this study.

Performance Measure	Preferred Alt.	Visual Representation									
Benefits											
<p>Safety</p> <p>Safety measures the societal cost associated with the predicted number and severity and collisions. Overall societal costs are based on Caltrans Vehicle Operation Cost Parameters. Injury and Fatality crashes are on average 700-1,000 times more expensive than Property Damage Only accidents.</p>		 <table border="1"> <caption>Injury & Property Damage Only Incidents</caption> <thead> <tr> <th>Measure</th> <th>Roundabout</th> <th>Stop Control</th> </tr> </thead> <tbody> <tr> <td>Injury & Fatality</td> <td>~0.3</td> <td>~0.6</td> </tr> <tr> <td>Property Damage Only</td> <td>~1.1</td> <td>~0.9</td> </tr> </tbody> </table>	Measure	Roundabout	Stop Control	Injury & Fatality	~0.3	~0.6	Property Damage Only	~1.1	~0.9
Measure	Roundabout	Stop Control									
Injury & Fatality	~0.3	~0.6									
Property Damage Only	~1.1	~0.9									
<p>Delay</p> <p>Delay measures the societal cost associated with the number of person-hours delayed in traffic. Overall societal costs are based on Caltrans Vehicle Operation Cost Parameters.</p>		 <table border="1"> <caption>Delay (sec/veh)</caption> <thead> <tr> <th>Time</th> <th>Roundabout</th> <th>Stop Control</th> </tr> </thead> <tbody> <tr> <td>AM</td> <td>~4.5</td> <td>~9.0</td> </tr> <tr> <td>PM</td> <td>~6.0</td> <td>~13.0</td> </tr> </tbody> </table>	Time	Roundabout	Stop Control	AM	~4.5	~9.0	PM	~6.0	~13.0
Time	Roundabout	Stop Control									
AM	~4.5	~9.0									
PM	~6.0	~13.0									
Costs											
<p>Operations and Maintenance</p> <p>O&M measures the common annualized costs associated with operating and maintaining the intersection.</p>		 <table border="1"> <caption>Annual and Life Cycle Discounted Costs</caption> <thead> <tr> <th>Measure</th> <th>Roundabout</th> <th>Stop Control</th> </tr> </thead> <tbody> <tr> <td>Annual</td> <td>~\$2,000</td> <td>~\$2,000</td> </tr> <tr> <td>Life Cycle Discounted</td> <td>~\$40,000</td> <td>~\$30,000</td> </tr> </tbody> </table>	Measure	Roundabout	Stop Control	Annual	~\$2,000	~\$2,000	Life Cycle Discounted	~\$40,000	~\$30,000
Measure	Roundabout	Stop Control									
Annual	~\$2,000	~\$2,000									
Life Cycle Discounted	~\$40,000	~\$30,000									
<p>Initial Capital Cost</p> <p>Measures the Initial Capital Costs (ICC) needed to plan, design, obtain project approvals, acquire right-of-way, and construct the intersection control. This graph (right) depicts the estimated range of Initial capital costs for the signal and roundabout alternatives as well as the roundabout budget.</p>		 <p>Legend: — RAB ICC Range — AWSC ICC Range ■ Estimated ICC ● RAB Budget — B/C=1</p>									

**City of Seaside Intersection Control Evaluation Study
Intersection 1.4 – La Salle Avenue at Yosemite Street**

INTERSECTION LIFE CYCLE COST CALCULATIONS

Performance Measure Life Cycle Cost (Net Present Value)			
Safety			
		Existing (AWSC)	Roundabout
Annual Cost of Collisions	\$	130,413	\$ 48,325
Discounted Life Cycle Cost of Collisions	\$	1,829,590	\$ 677,952
Delay			
		Existing (AWSC)	Roundabout
Annual Quantity (hours)		1,440	624
Annual Cost	\$	18,963	\$ 8,199
Total Discounted Life Cycle Cost	\$	417,189	\$ 180,368
O&M			
		Existing (AWSC)	Roundabout
Annual O&M Costs		520	1,920
Discounted Life Cycle O&M Costs	\$	7,295	\$ 26,936
Discounted Pavement Rehab Costs	\$	10,750	\$ 8,418
Total O&M Costs	\$	18,046	\$ 35,354
Initial Capital			
		Existing (AWSC)	Roundabout
High Approximation	\$	80,000	\$ 800,000
Low Approximation	\$	50,000	\$ 500,000

Benefit-Cost Ratio Calculations								
B/C Target	Capital Cost			Project Constraints		Total Benefits (e)	Total Costs (f) = (c + d)	B/C (g) = (e / f)
	AWSC (a)	Roundabout (b)	Added Cost for Roundabout (c) = (b - a)	Added O&M Cost for Roundabout (d)				
High	\$ 80,000	\$ 500,000	\$ 420,000				\$ 430,615	2.56
Low	\$ 50,000	\$ 800,000	\$ 750,000	\$ 10,615	\$ 1,104,086		\$ 760,615	1.45
Roundabout Budget	\$ 65,000	\$ 1,158,472	\$ 1,093,472				\$ 1,104,086	1.00

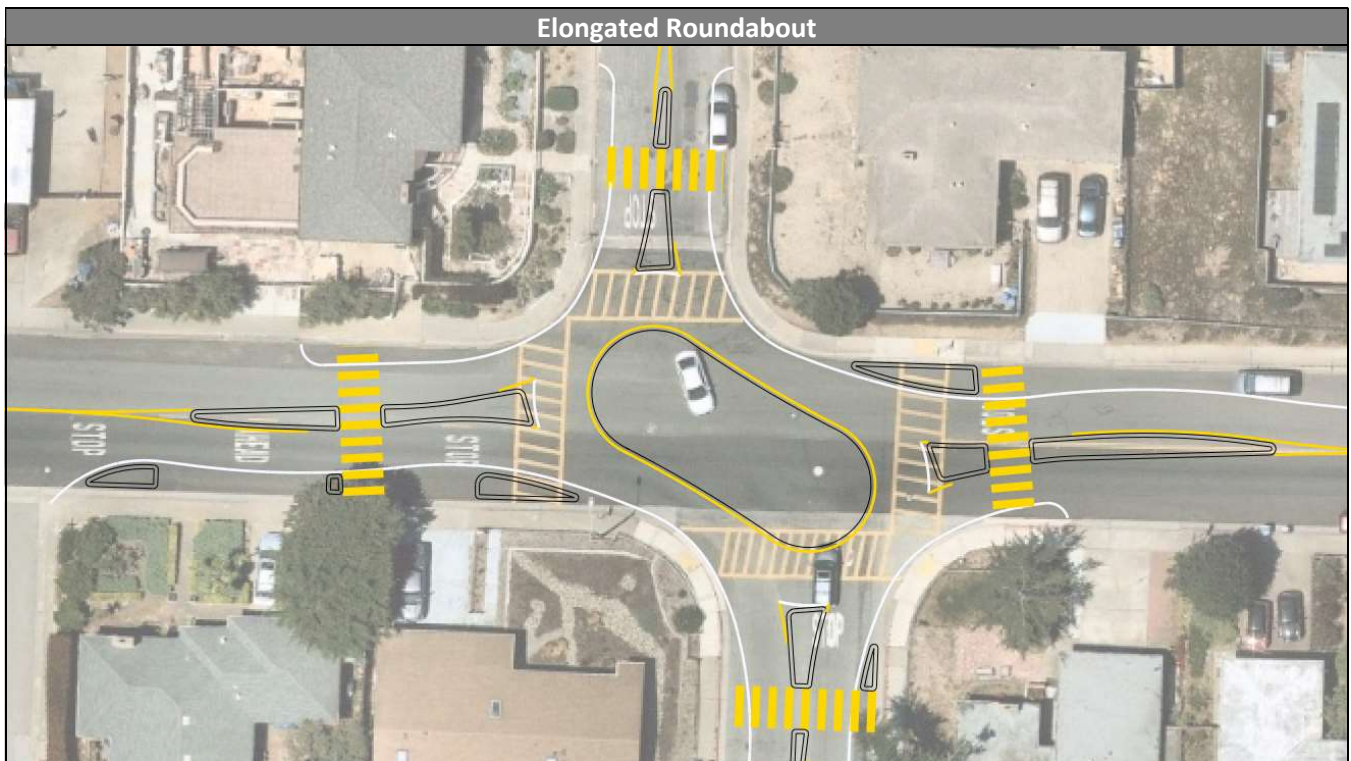
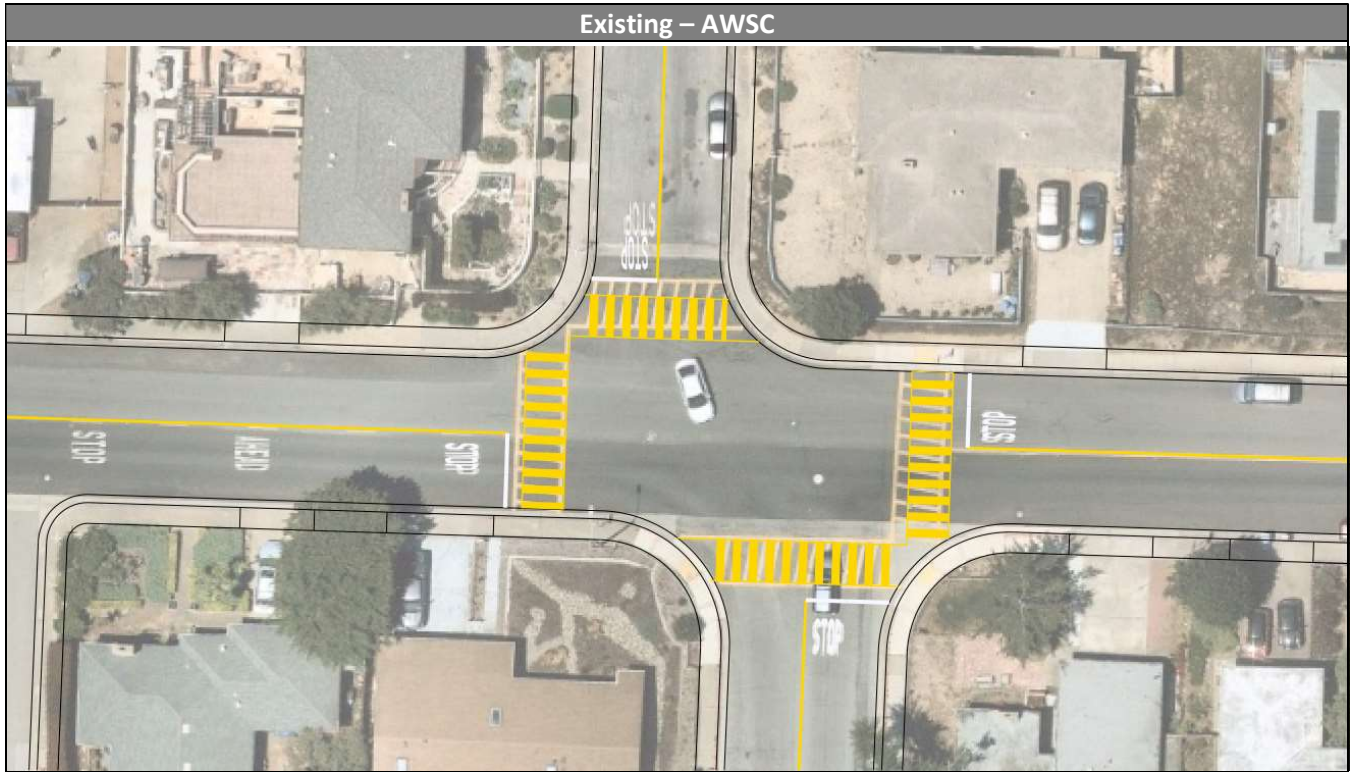
PREFERRED INTERSECTION ALTERNATIVE

The preferred alternative based on B/C ratio for this intersection is roundabout control.



*City of Seaside Intersection Control Evaluation Study
Intersection 1.4 – La Salle Avenue at Yosemite Street*

INTERSECTION CONTROL CONCEPT LAYOUTS



INTERSECTION 1.5 – SONOMA AVENUE AT YOSEMITE STREET

INTERSECTION CONTROL ALTERNATIVES

The two intersection control types analyzed include:

1. Existing All-Way Stop Control
2. Mini-Roundabout



EXISTING CONDITIONS AND PROJECT CONSTRAINTS

Sonoma Ave at Yosemite St is currently controlled by signals. Design constraints at the intersection include:

- | | |
|-------------------------------|------------------------------|
| 1. Highland Elementary School | 4. Multi-family residence |
| 2. Single family residential | 5. Driveway |
| 3. Bus Stop | 6. Right-of-way encroachment |



QUALITATIVE ASSESSMENT


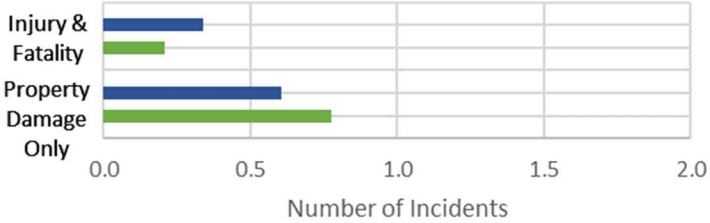

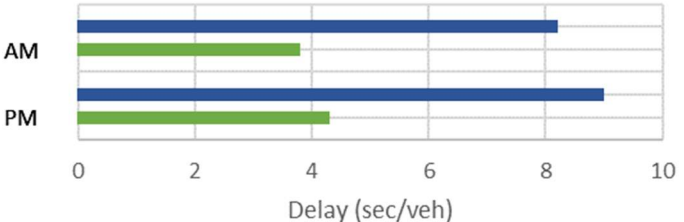

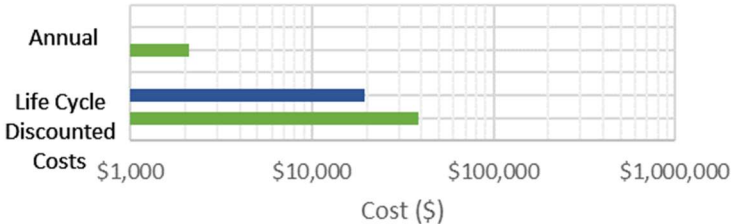

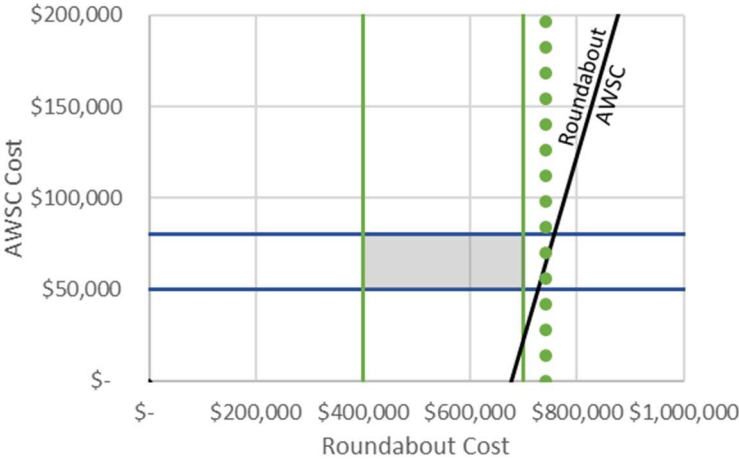
The following table summarizes qualitative factors that were considered in the design of each alternative.

Qualitative Assessment		Existing Control Feasibility	Roundabout Control Feasibility
INT 1.5	Sonoma Ave at Yosemite St		
	Urban Environment Focus	X	X
	Design for Pedestrians	X	X
	Design for Bicyclists	X	X
	Slow Traffic Speeds to Benefit Local Businesses		X
	Minimize ROW Acquisition to Limit Initial Costs	X	X
Minimize Left-Turn Movements to Improve Safety		X	

**City of Seaside Intersection Control Evaluation Study
Intersection 1.5 – Sonoma Avenue at Yosemite Street**

PERFORMANCE MEASURE SUMMARY

Four performance measures were evaluated at each intersection for stop control and roundabout control. The table below summarizes the performance measures considered in this study.

Performance Measure	Preferred Alt.	Visual Representation									
Benefits											
<p>Safety</p> <p>Safety measures the societal cost associated with the predicted number and severity and collisions. Overall societal costs are based on Caltrans Vehicle Operation Cost Parameters. Injury and Fatality crashes are on average 700-1,000 times more expensive than Property Damage Only accidents.</p>		 <table border="1"> <caption>Injury & Property Damage Only Incidents</caption> <thead> <tr> <th>Measure</th> <th>Roundabout</th> <th>Stop Control</th> </tr> </thead> <tbody> <tr> <td>Injury & Fatality</td> <td>~0.2</td> <td>~0.4</td> </tr> <tr> <td>Property Damage Only</td> <td>~0.8</td> <td>~0.6</td> </tr> </tbody> </table>	Measure	Roundabout	Stop Control	Injury & Fatality	~0.2	~0.4	Property Damage Only	~0.8	~0.6
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Property Damage Only	~0.8	~0.6									
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Measure	Roundabout	Stop Control									
Annual	~\$2,000	~\$10,000									
Life Cycle Discounted	~\$30,000	~\$15,000									
<p>Initial Capital Cost</p> <p>Measures the Initial Capital Costs (ICC) needed to plan, design, obtain project approvals, acquire right-of-way, and construct the intersection control. This graph (right) depicts the estimated range of Initial capital costs for the signal and roundabout alternatives as well as the roundabout budget.</p>		 <p>The graph plots AWSC Cost (y-axis, \$0 to \$200,000) against Roundabout Cost (x-axis, \$0 to \$1,000,000). A vertical line at approximately \$400,000 represents the RAB ICC Range. A shaded area between \$400,000 and \$750,000 represents the Estimated ICC. A diagonal line represents the Roundabout AWSC. A vertical line with dots at approximately \$750,000 represents the RAB Budget B/C=1.</p>									

**City of Seaside Intersection Control Evaluation Study
Intersection 1.5 – Sonoma Avenue at Yosemite Street**

INTERSECTION LIFE CYCLE COST CALCULATIONS

Performance Measure Life Cycle Cost (Net Present Value)			
Safety			
		<u>Existing (AWSC)</u>	<u>Roundabout</u>
Annual Cost of Collisions	\$	72,797	\$ 30,321
Discounted Life Cycle Cost of Collisions	\$	1,021,279	\$ 425,378
Delay			
		<u>Existing (AWSC)</u>	<u>Roundabout</u>
Annual Quantity (hours)		636	299
Annual Cost	\$	8,456	\$ 3,973
Total Discounted Life Cycle Cost	\$	186,038	\$ 87,400
O&M			
		<u>Existing (AWSC)</u>	<u>Roundabout</u>
Annual O&M Costs		520	1,920
Discounted Life Cycle O&M Costs	\$	7,295	\$ 26,936
Discounted Pavement Rehab Costs	\$	10,750	\$ 8,418
Total O&M Costs	\$	18,046	\$ 35,354
Initial Capital			
		<u>Existing (AWSC)</u>	<u>Roundabout</u>
High Approximation	\$	80,000	\$ 700,000
Low Approximation	\$	50,000	\$ 400,000

Benefit-Cost Ratio Calculations							
B/C Target	Capital Cost			Project Constraints			
	AWSC (a)	Roundabout (b)	Added Cost for Roundabout (c) = (b - a)	Added O&M Cost for Roundabout (d)	Total Benefits (e)	Total Costs (f) = (c + d)	B/C (g) = (e / f)
High	\$ 80,000	\$ 400,000	\$ 320,000			\$ 337,308	2.06
Low	\$ 50,000	\$ 700,000	\$ 650,000	\$ 17,308	\$ 694,538	\$ 667,308	1.04
Roundabout Budget	\$ 65,000	\$ 742,230	\$ 677,230			\$ 694,538	1.00

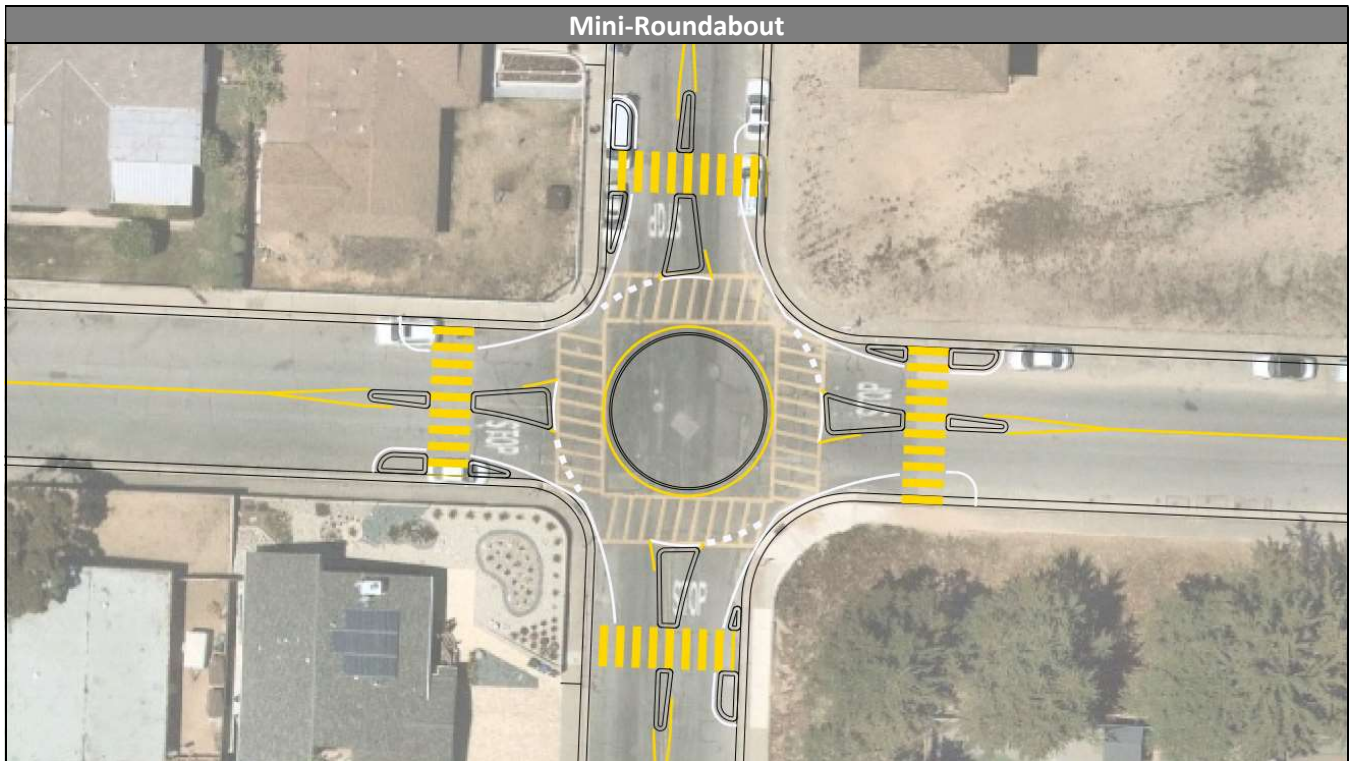
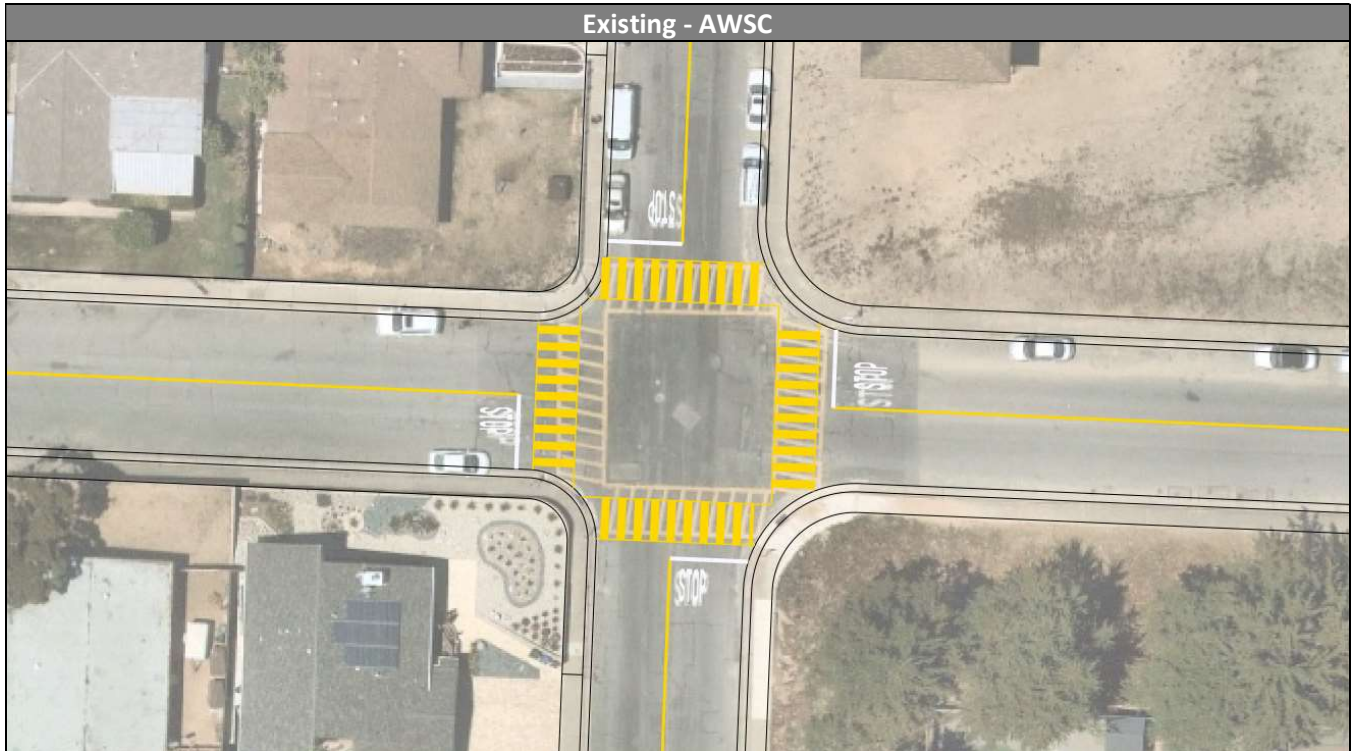
PREFERRED INTERSECTION ALTERNATIVE

The preferred alternative based on B/C ratio for this intersection is roundabout control.



*City of Seaside Intersection Control Evaluation Study
Intersection 1.5 – Sonoma Avenue at Yosemite Street*

INTERSECTION CONTROL CONCEPT LAYOUTS



INT 1.6 – BROADWAY AVE AT FREMONT BLVD

INTERSECTION CONTROL ALTERNATIVES

The two intersection control types analyzed include:

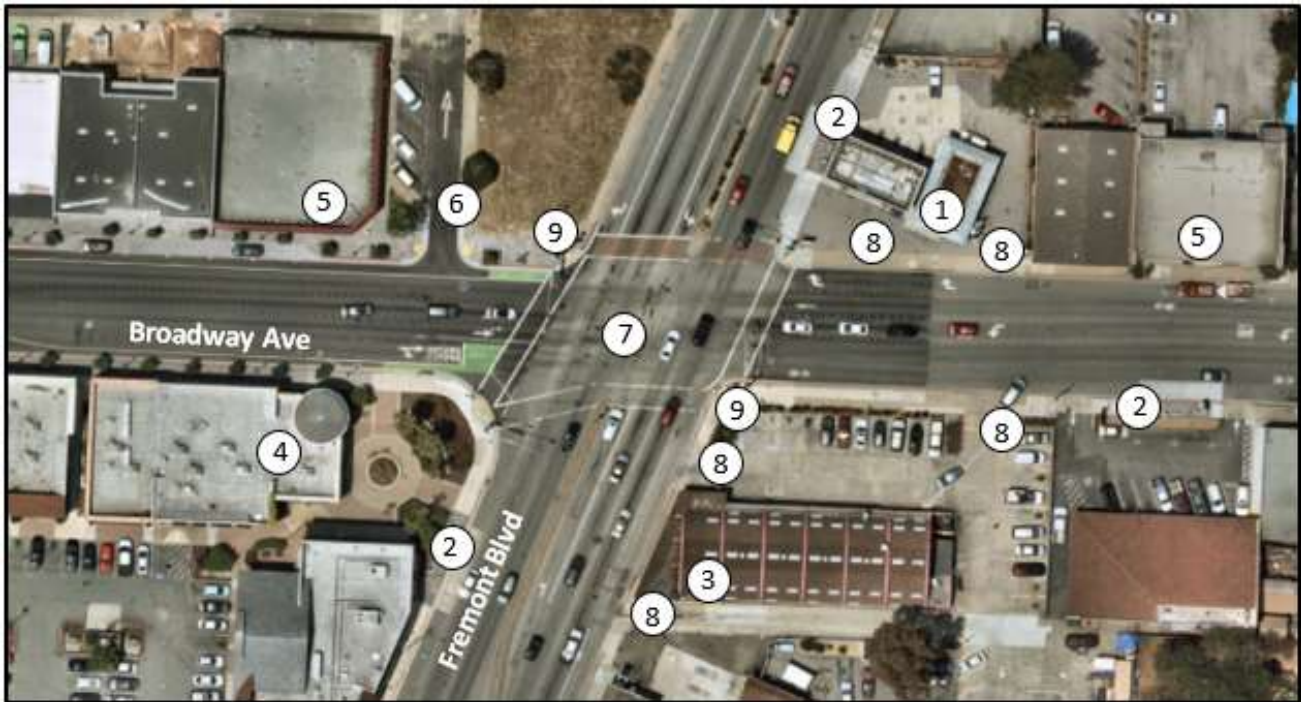
1. Existing Signal with Optimized Signal Timing
2. Multi-lane Roundabout



EXISTING CONDITIONS AND PROJECT CONSTRAINTS

Broadway Ave at Fremont Blvd is currently controlled by signals. Design constraints at the intersection include:

- | | |
|------------------|----------------------------------|
| 1. Gas Station | 6. Proximity to Santa Barbara St |
| 2. Bus Stop | 7. Skewed Intersection Geometry |
| 3. Grocery Store | 8. Driveways |
| 4. Restaurant | 9. Right-of-way encroachment |
| 5. Retail Store | |



QUALITATIVE ASSESSMENT

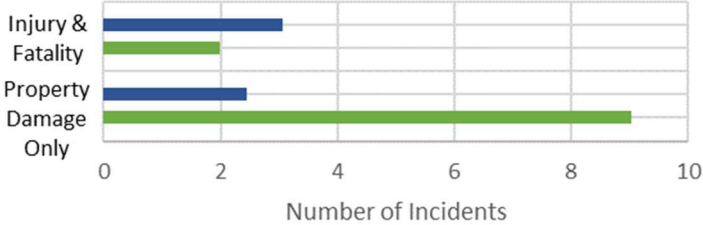

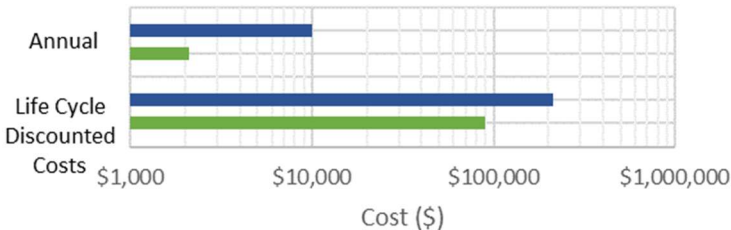

The following table summarizes qualitative factors that were considered in the design of each alternative.

Qualitative Assessment		Existing Control Feasibility	Roundabout Control Feasibility
INT 1.6	Broadway Ave at Fremont Blvd		
	Urban Environment Focus	X	X
	Design for Pedestrians	X	X
	Design for Bicyclists	X	X
	Slow Traffic Speeds to Benefit Local Businesses		X
	Minimize ROW Acquisition to Limit Initial Costs		
Minimize Left-Turn Movements to Improve Safety		X	

City of Seaside Intersection Control Evaluation Study
INT 1.6 – Broadway Ave at Fremont Blvd

PERFORMANCE MEASURE SUMMARY

Four performance measures were evaluated at each intersection for signal and roundabout control. The table below summarizes the performance measures considered in this study.

Performance Measure	Preferred Alt.	Visual Representation																				
Benefits																						
<p>Safety</p> <p>Safety measures the societal cost associated with the predicted number and severity and collisions. Overall societal costs are based on Caltrans Vehicle Operation Cost Parameters. Injury and Fatality crashes are on average 700-1,000 times more expensive than Property Damage Only accidents.</p> <p align="center"></p> <p>— Signal — Roundabout</p>		 <table border="1"> <caption>Number of Incidents</caption> <thead> <tr> <th>Incident Type</th> <th>Signal</th> <th>Roundabout</th> </tr> </thead> <tbody> <tr> <td>Injury & Fatality</td> <td>3.2</td> <td>2.1</td> </tr> <tr> <td>Property Damage Only</td> <td>2.8</td> <td>9.1</td> </tr> </tbody> </table>	Incident Type	Signal	Roundabout	Injury & Fatality	3.2	2.1	Property Damage Only	2.8	9.1											
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Costs																						
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Roundabout Cost (\$)	Signal ICC (\$)	Roundabout ICC (\$)	RAB Budget (\$)																			
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City of Seaside Intersection Control Evaluation Study
INT 1.6 – Broadway Ave at Fremont Blvd

INTERSECTION LIFE CYCLE COST CALCULATIONS

Performance Measure Life Cycle Cost (Net Present Value)		
Safety		
	Existing (Signal)	Roundabout
Annual Cost of Collisions	\$ 425,480	\$ 344,120
Discounted Life Cycle Cost of Collisions	\$ 5,969,123	\$ 4,827,711
Delay		
	Existing (Signal)	Roundabout
Annual Quantity (hours)	13,968	6,274
Annual Cost	\$ 179,511	\$ 80,576
Total Discounted Life Cycle Cost	\$ 3,949,246	\$ 1,772,676
O&M		
	Existing (Signal)	Roundabout
Annual O&M Costs	9,220	1,920
Discounted Life Cycle O&M Costs	\$ 129,349	\$ 26,936
Discounted Pavement Rehab Costs	\$ 65,923	\$ 56,034
Total O&M Costs	\$ 195,271	\$ 82,970
Initial Capital		
	Existing (Signal)	Roundabout
High Approximation	\$ 200,000	\$ 3,500,000
Low Approximation	\$ 100,000	\$ 2,000,000

Benefit-Cost Ratio Calculations							
B/C Target	Capital Cost			Project Constraints			
	Traffic Signal (a)	Roundabout (b)	Added Cost for Roundabout (c) = (b - a)	Added O&M Cost for Roundabout (d)	Total Benefits (e)	Total Costs (f) = (c + d)	B/C (g) = (e / f)
High	\$ 200,000	\$ 2,000,000	\$ 1,800,000			\$ 1,687,699	0.96
Low	\$ 100,000	\$ 3,500,000	\$ 3,400,000	\$ (112,301)	\$ 1,614,978	\$ 3,287,699	0.49
Roundabout Budget	\$ 150,000	\$ 1,877,279	\$ 1,727,279			\$ 1,614,978	1.00

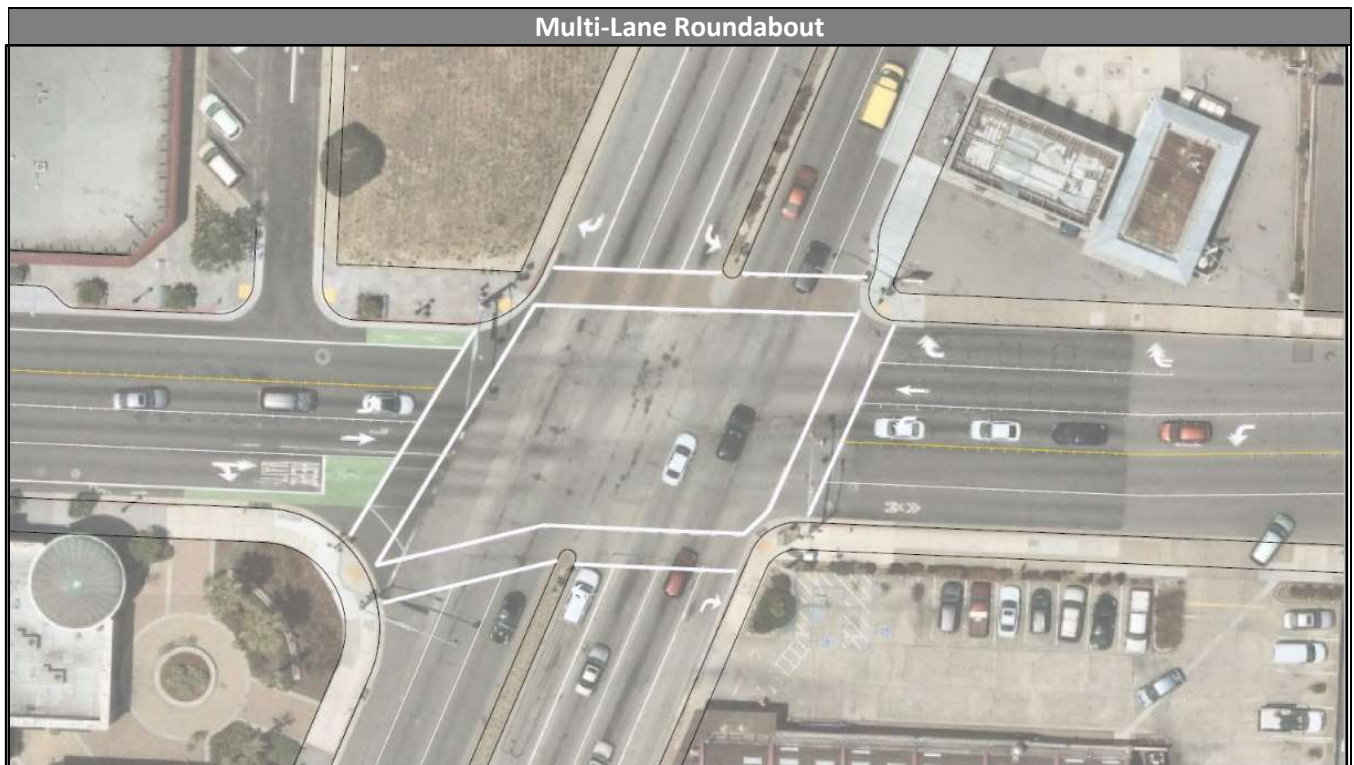
PREFERRED INTERSECTION ALTERNATIVE

The preferred alternative based on B/C ratio for this intersection is roundabout control.



City of Seaside Intersection Control Evaluation Study
INT 1.6 – Broadway Ave at Fremont Blvd

INTERSECTION CONTROL CONCEPT LAYOUTS



INTERSECTION 2.1 – ORD GROVE AVENUE AT NOCHE BUENA STREET

INTERSECTION CONTROL ALTERNATIVES

The two intersection control types analyzed include:

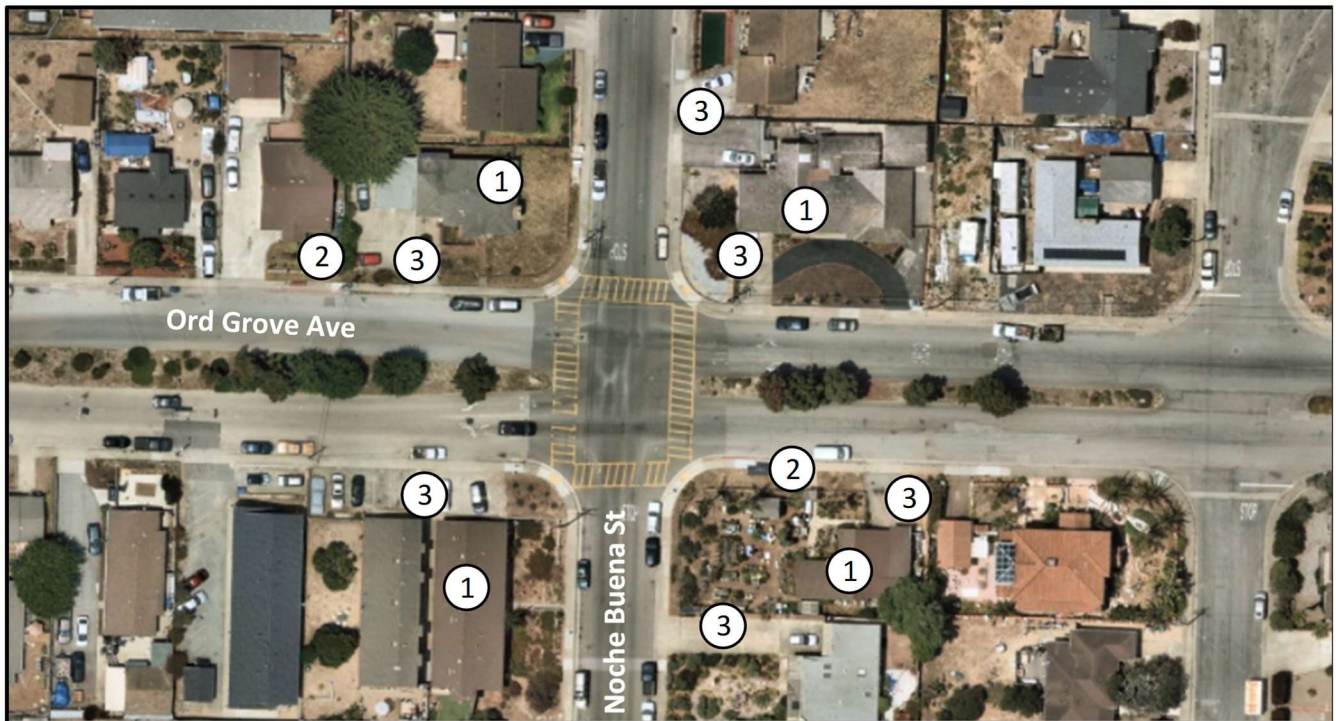
1. Existing All-Way Stop Control
2. Mini-Roundabout



EXISTING CONDITIONS AND PROJECT CONSTRAINTS

Ord Grove Ave at Noche Buena St is currently controlled by signals. Design constraints at the intersection include:

1. Single family residential
2. Bus stop
3. Driveway



QUALITATIVE ASSESSMENT


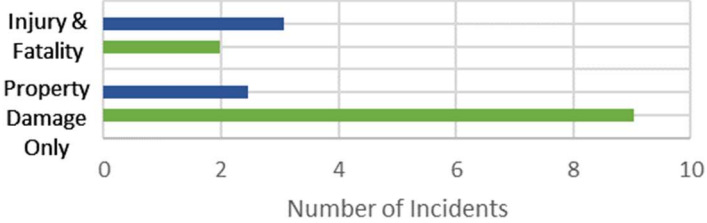

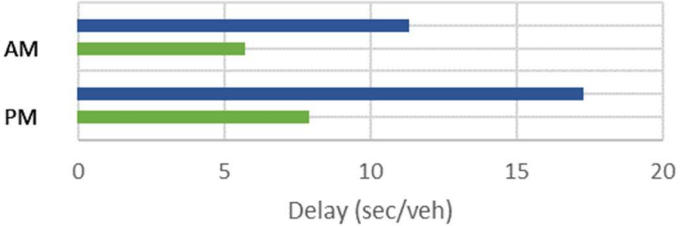



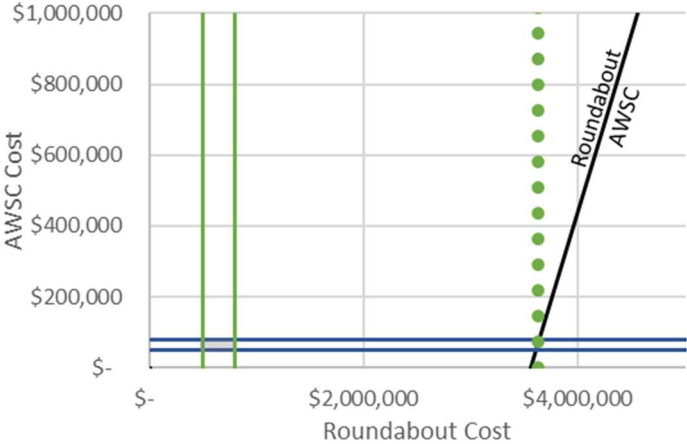
The following table summarizes qualitative factors that were considered in the design of each alternative.

Qualitative Assessment		Existing Control Feasibility	Roundabout Control Feasibility
INT 2.1	Ord Grove at Noche Buena St		
	Urban Environment Focus	X	X
	Design for Pedestrians	X	X
	Design for Bicyclists	X	X
	Slow Traffic Speeds to Benefit Local Businesses		X
	Minimize ROW Acquisition to Limit Initial Costs	X	X
Minimize Left-Turn Movements to Improve Safety		X	

City of Seaside Intersection Control Evaluation Study
Intersection 2.1 – Ord Grove Avenue at Noche Buena Street

PERFORMANCE MEASURE SUMMARY

Four performance measures were evaluated at each intersection for stop control and roundabout control. The table below summarizes the performance measures considered in this study.

Performance Measure	Preferred Alt.	Visual Representation
Benefits		
<p>Safety</p> <p>Safety measures the societal cost associated with the predicted number and severity and collisions. Overall societal costs are based on Caltrans Vehicle Operation Cost Parameters. Injury and Fatality crashes are on average 700-1,000 times more expensive than Property Damage Only accidents.</p> 		
<p>Delay</p> <p>Delay measures the societal cost associated with the number of person-hours delayed in traffic. Overall societal costs are based on Caltrans Vehicle Operation Cost Parameters.</p> 		
Costs		
<p>Operations and Maintenance</p> <p>O&M measures the common annualized costs associated with operating and maintaining the intersection.</p> 		
<p>Initial Capital Cost</p> <p>Measures the Initial Capital Costs (ICC) needed to plan, design, obtain project approvals, acquire right-of-way, and construct the intersection control. This graph (right) depicts the estimated range of Initial capital costs for the signal and roundabout alternatives as well as the roundabout budget.</p> 		

City of Seaside Intersection Control Evaluation Study
Intersection 2.1 – Ord Grove Avenue at Noche Buena Street

INTERSECTION LIFE CYCLE COST CALCULATIONS

Performance Measure Life Cycle Cost (Net Present Value)			
Safety			
		Existing (AWSC)	Roundabout
Annual Cost of Collisions	\$	188,949	\$ 51,343
Discounted Life Cycle Cost of Collisions	\$	2,650,800	\$ 720,299
Delay			
		Existing (AWSC)	Roundabout
Annual Quantity (hours)		2,959	1,351
Annual Cost	\$	38,247	\$ 17,398
Total Discounted Life Cycle Cost	\$	841,440	\$ 382,766
O&M			
		Existing (AWSC)	Roundabout
Annual O&M Costs		520	1,920
Discounted Life Cycle O&M Costs	\$	7,295	\$ 26,936
Discounted Pavement Rehab Costs	\$	10,750	\$ 8,418
Total O&M Costs	\$	18,046	\$ 35,354
Initial Capital			
		Existing (AWSC)	Roundabout
High Approximation	\$	80,000	\$ 800,000
Low Approximation	\$	50,000	\$ 500,000

Benefit-Cost Ratio Calculations							
B/C Target	Capital Cost			Project Constraints			
	AWSC (a)	Roundabout (b)	Added Cost for Roundabout (c) = (b - a)	Added O&M Cost for Roundabout (d)	Total Benefits (e)	Total Costs (f) = (c + d)	B/C (g) = (e / f)
High	\$ 80,000	\$ 500,000	\$ 420,000			\$ 422,501	8.44
Low	\$ 50,000	\$ 800,000	\$ 750,000	\$ 2,501	\$ 3,564,777	\$ 752,501	4.74
Roundabout Budget	\$ 65,000	\$ 3,627,276	\$ 3,562,276			\$ 3,564,777	1.00

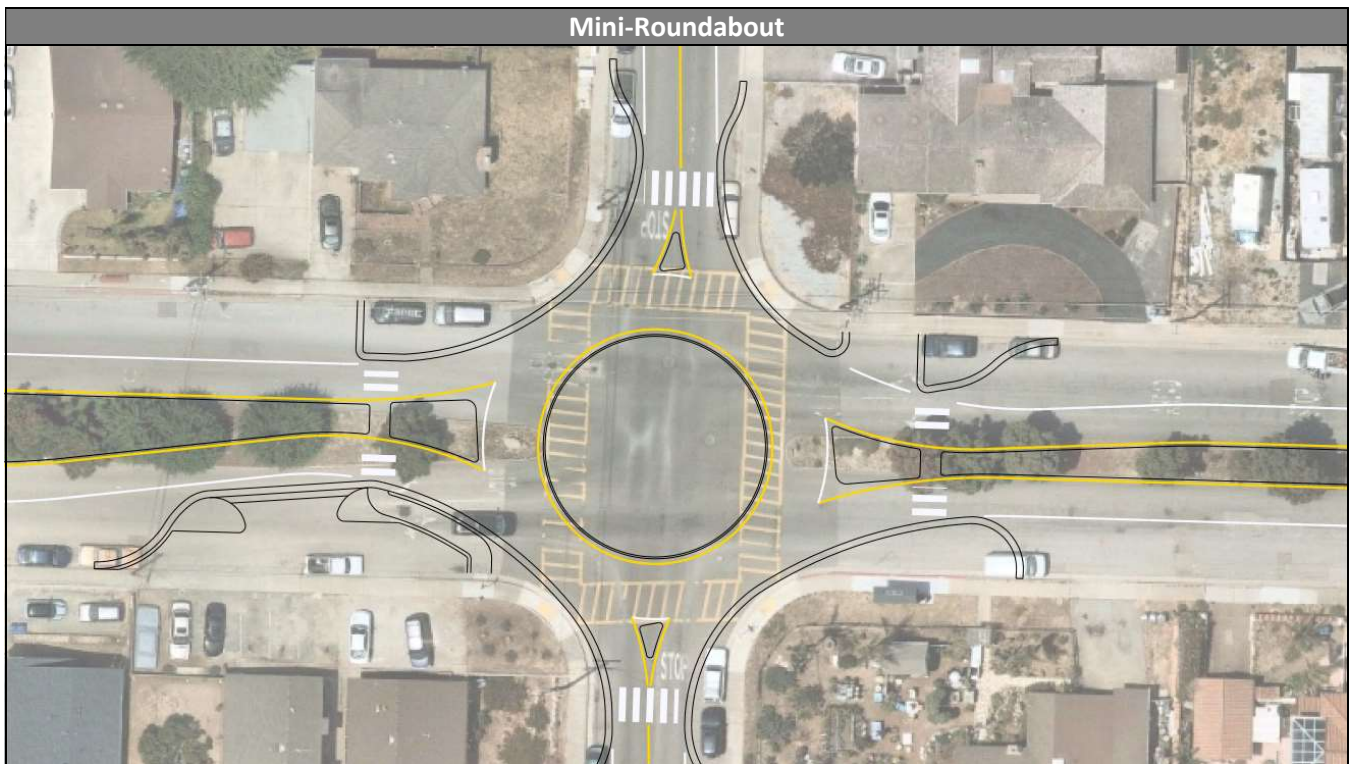
PREFERRED INTERSECTION ALTERNATIVE

The preferred alternative based on B/C ratio for this intersection is roundabout control.



City of Seaside Intersection Control Evaluation Study
Intersection 2.1 – Ord Grove Avenue at Noche Buena Street

INTERSECTION CONTROL CONCEPT LAYOUTS



City of Seaside Intersection Control Evaluation Study
Intersection 2.2 – La Salle Avenue at Noche Buena Street

INTERSECTION 2.2 – LA SALLE AVENUE AT NOCHE BUENA STREET

INTERSECTION CONTROL ALTERNATIVES

The two intersection control types analyzed include:

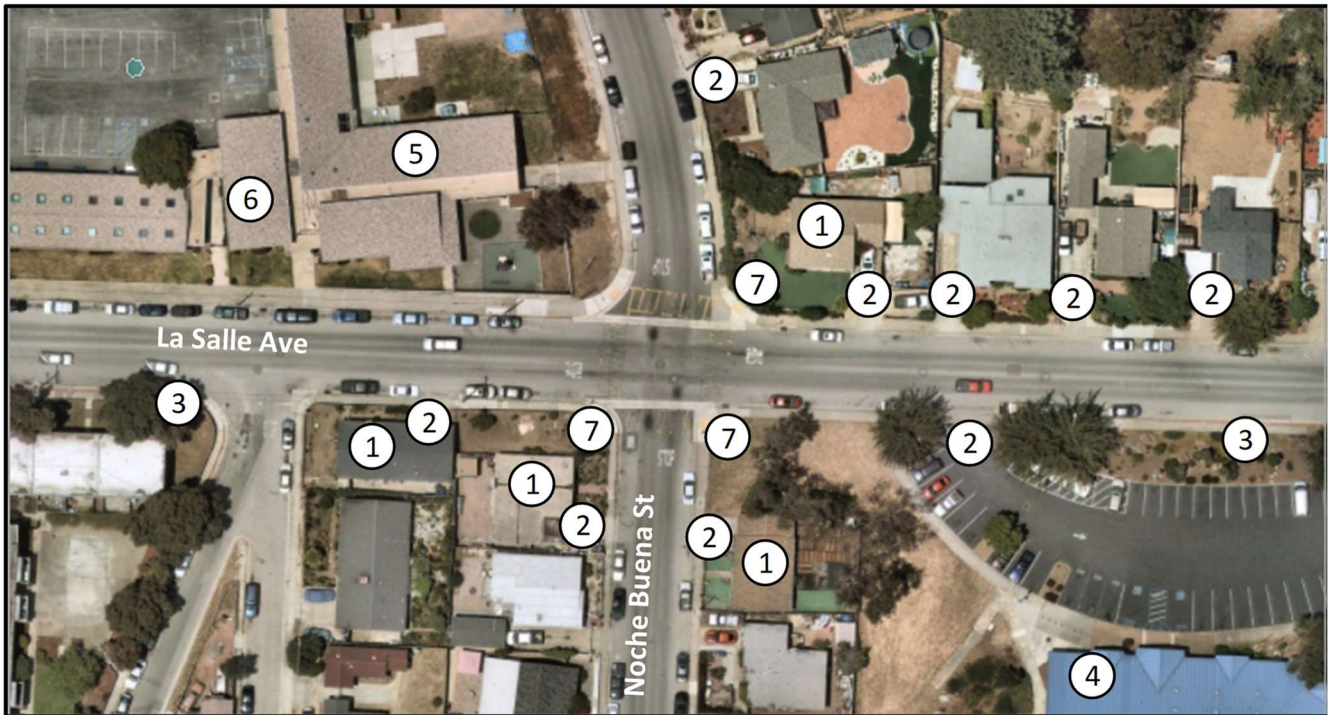
1. Existing All-Way Stop Control
2. Mini-Roundabout



EXISTING CONDITIONS AND PROJECT CONSTRAINTS

La Salle Ave at Noche Buena St is currently controlled by signals. Design constraints at the intersection include:

- | | |
|------------------------------------|------------------------------|
| 1. Single family residential | 5. Preschool |
| 2. Driveway | 6. Adult School |
| 3. Bus Stop | 7. Right-of-way encroachment |
| 4. Boys and Girls Club of Monterey | |



QUALITATIVE ASSESSMENT


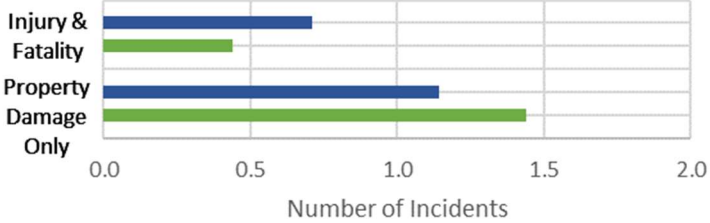

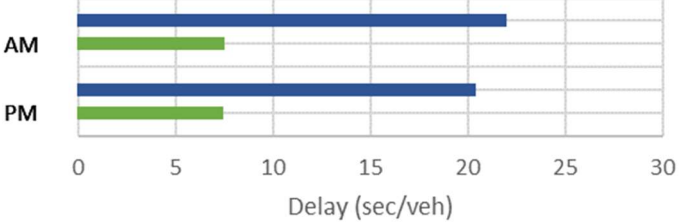

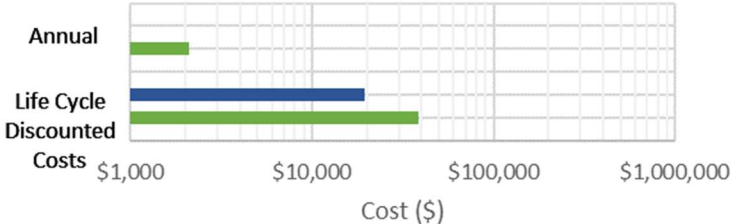

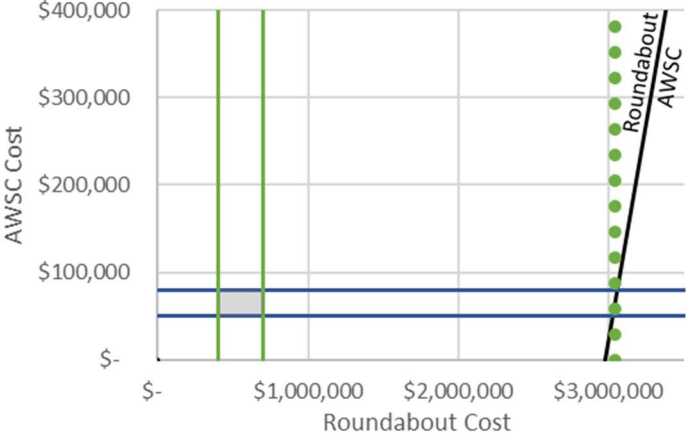
The following table summarizes qualitative factors that were considered in the design of each alternative.

Qualitative Assessment		Existing Control Feasibility	Roundabout Control Feasibility
INT 2.2	La Salle Ave at Noche Buena St		
	Urban Environment Focus	X	X
	Design for Pedestrians	X	X
	Design for Bicyclists	X	X
	Slow Traffic Speeds to Benefit Local Businesses		X
	Minimize ROW Acquisition to Limit Initial Costs	X	X
Minimize Left-Turn Movements to Improve Safety		X	

**City of Seaside Intersection Control Evaluation Study
Intersection 2.2 – La Salle Avenue at Noche Buena Street**

PERFORMANCE MEASURE SUMMARY

Four performance measures were evaluated at each intersection for stop control and roundabout control. The table below summarizes the performance measures considered in this study.

Performance Measure	Preferred Alt.	Visual Representation									
Benefits											
<p>Safety</p> <p>Safety measures the societal cost associated with the predicted number and severity and collisions. Overall societal costs are based on Caltrans Vehicle Operation Cost Parameters. Injury and Fatality crashes are on average 700-1,000 times more expensive than Property Damage Only accidents.</p>		 <table border="1"> <caption>Injury & Property Damage Only Incidents</caption> <thead> <tr> <th>Measure</th> <th>Roundabout</th> <th>Stop Control</th> </tr> </thead> <tbody> <tr> <td>Injury & Fatality</td> <td>~0.4</td> <td>~0.7</td> </tr> <tr> <td>Property Damage Only</td> <td>~1.4</td> <td>~1.2</td> </tr> </tbody> </table>	Measure	Roundabout	Stop Control	Injury & Fatality	~0.4	~0.7	Property Damage Only	~1.4	~1.2
Measure	Roundabout	Stop Control									
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Property Damage Only	~1.4	~1.2									
<p>Delay</p> <p>Delay measures the societal cost associated with the number of person-hours delayed in traffic. Overall societal costs are based on Caltrans Vehicle Operation Cost Parameters.</p>		 <table border="1"> <caption>Delay (sec/veh)</caption> <thead> <tr> <th>Time</th> <th>Roundabout</th> <th>Stop Control</th> </tr> </thead> <tbody> <tr> <td>AM</td> <td>~8</td> <td>~22</td> </tr> <tr> <td>PM</td> <td>~8</td> <td>~20</td> </tr> </tbody> </table>	Time	Roundabout	Stop Control	AM	~8	~22	PM	~8	~20
Time	Roundabout	Stop Control									
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Costs											
<p>Operations and Maintenance</p> <p>O&M measures the common annualized costs associated with operating and maintaining the intersection.</p>		 <table border="1"> <caption>Costs (\$)</caption> <thead> <tr> <th>Measure</th> <th>Roundabout</th> <th>Stop Control</th> </tr> </thead> <tbody> <tr> <td>Annual</td> <td>~\$2,000</td> <td>~\$10,000</td> </tr> <tr> <td>Life Cycle Discounted</td> <td>~\$30,000</td> <td>~\$15,000</td> </tr> </tbody> </table>	Measure	Roundabout	Stop Control	Annual	~\$2,000	~\$10,000	Life Cycle Discounted	~\$30,000	~\$15,000
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Annual	~\$2,000	~\$10,000									
Life Cycle Discounted	~\$30,000	~\$15,000									
<p>Initial Capital Cost</p> <p>Measures the Initial Capital Costs (ICC) needed to plan, design, obtain project approvals, acquire right-of-way, and construct the intersection control. This graph (right) depicts the estimated range of Initial capital costs for the signal and roundabout alternatives as well as the roundabout budget.</p>		 <p>Legend: — RAB ICC Range — AWSC ICC Range ■ Estimated ICC ●●● RAB Budget B/C=1</p>									

**City of Seaside Intersection Control Evaluation Study
Intersection 2.2 – La Salle Avenue at Noche Buena Street**

INTERSECTION LIFE CYCLE COST CALCULATIONS

Performance Measure Life Cycle Cost (Net Present Value)			
Safety			
		<u>Existing (AWSC)</u>	<u>Roundabout</u>
Annual Cost of Collisions	\$	157,907	\$ 67,830
Discounted Life Cycle Cost of Collisions	\$	2,215,305	\$ 951,593
Delay			
		<u>Existing (AWSC)</u>	<u>Roundabout</u>
Annual Quantity (hours)		3,902	1,355
Annual Cost	\$	51,489	\$ 17,926
Total Discounted Life Cycle Cost	\$	1,132,750	\$ 394,362
O&M			
		<u>Existing (AWSC)</u>	<u>Roundabout</u>
Annual O&M Costs		520	1,920
Discounted Life Cycle O&M Costs	\$	7,295	\$ 26,936
Discounted Pavement Rehab Costs	\$	10,750	\$ 8,418
Total O&M Costs	\$	18,046	\$ 35,354
Initial Capital			
		<u>Existing (AWSC)</u>	<u>Roundabout</u>
High Approximation	\$	80,000	\$ 700,000
Low Approximation	\$	50,000	\$ 400,000

Benefit-Cost Ratio Calculations							
B/C Target	Capital Cost			Project Constraints			
	AWSC (a)	Roundabout (b)	Added Cost for Roundabout (c) = (b - a)	Added O&M Cost for Roundabout (d)	Total Benefits (e)	Total Costs (f) = (c + d)	B/C (g) = (e / f)
High	\$ 80,000	\$ 400,000	\$ 320,000			\$ 337,308	8.87
Low	\$ 50,000	\$ 700,000	\$ 650,000	\$ 17,308	\$ 2,991,307	\$ 667,308	4.48
Roundabout Budget	\$ 65,000	\$ 3,038,999	\$ 2,973,999			\$ 2,991,307	1.00

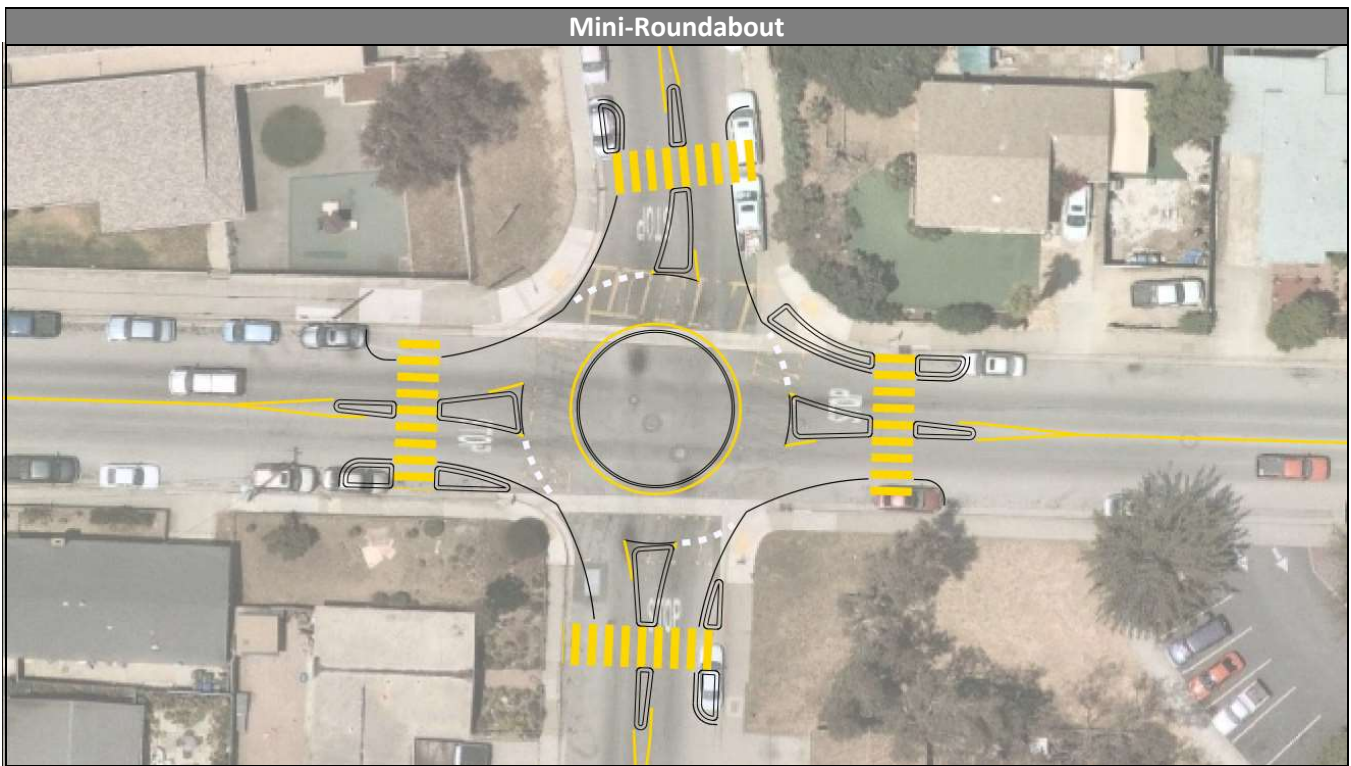
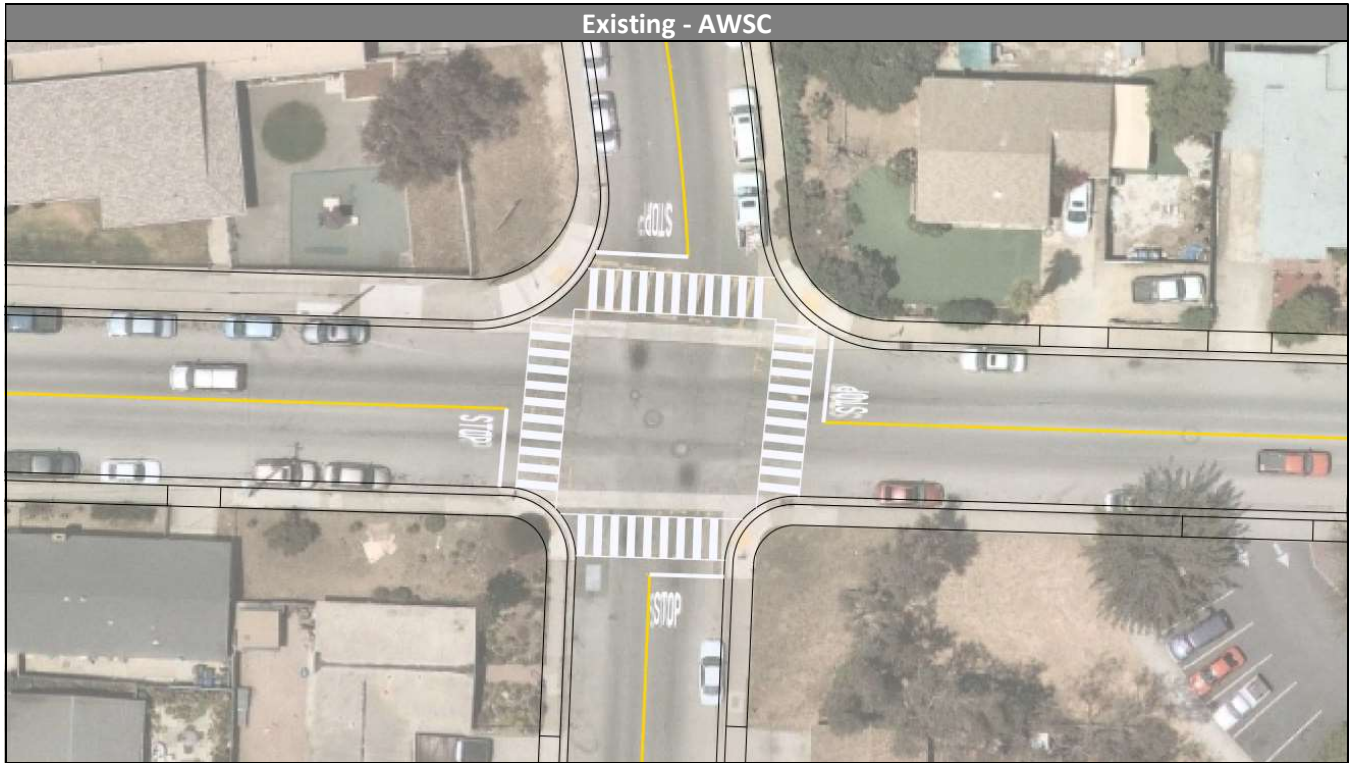
PREFERRED INTERSECTION ALTERNATIVE

The preferred alternative based on B/C ratio for this intersection is roundabout control.



*City of Seaside Intersection Control Evaluation Study
Intersection 2.2 – La Salle Avenue at Noche Buena Street*

INTERSECTION CONTROL CONCEPT LAYOUTS



INTERSECTION 2.3 – LA SALLE AVENUE AT FREMONT BOULEVARD

INTERSECTION CONTROL ALTERNATIVES

The two intersection control types analyzed include:

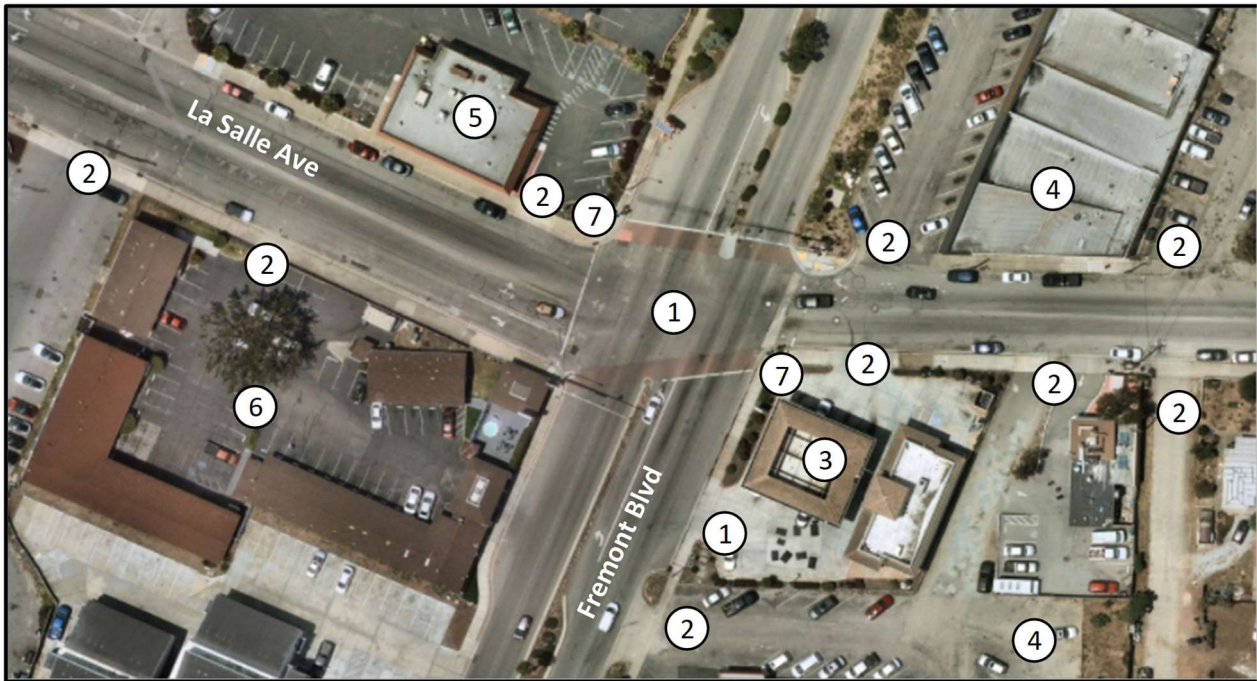
1. Existing Signal with Optimized Signal Timing
2. Multi-lane Roundabout



EXISTING CONDITIONS AND PROJECT CONSTRAINTS

La Salle Ave at Fremont Blvd is currently controlled by signals. Design constraints at the intersection include:

- | | |
|---------------------------------|------------------------------|
| 1. Skewed intersection geometry | 5. Restaurant |
| 2. Driveway | 6. Hotel |
| 3. Gas Station | 7. Right-of-way encroachment |
| 4. Shopping Center | |



QUALITATIVE ASSESSMENT


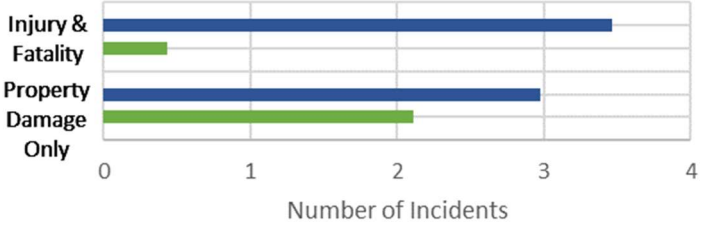

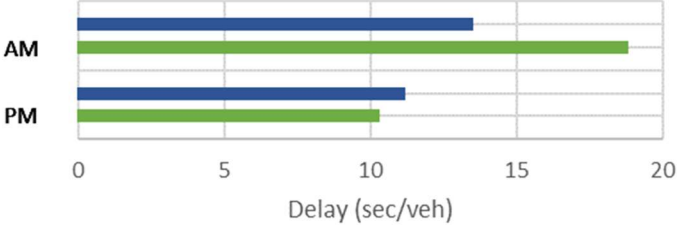

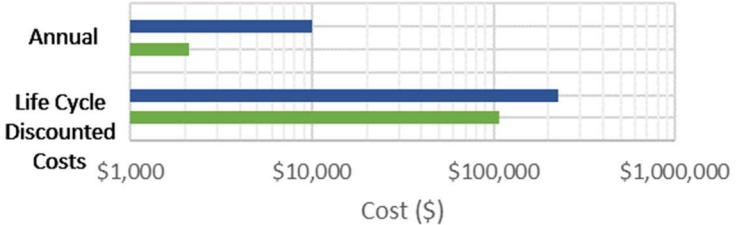

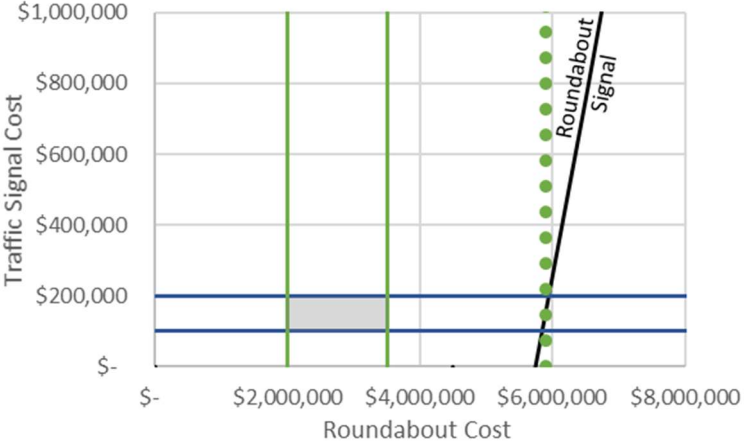
The following table summarizes qualitative factors that were considered in the design of each alternative.

Qualitative Assessment		Existing Control Feasibility	Roundabout Control Feasibility
INT 2.3	La Salle Ave at Fremont Blvd		
	Urban Environment Focus	X	X
	Design for Pedestrians	X	X
	Design for Bicyclists	X	X
	Slow Traffic Speeds to Benefit Local Businesses		X
	Minimize ROW Acquisition to Limit Initial Costs	X	
Minimize Left-Turn Movements to Improve Safety		X	

**City of Seaside Intersection Control Evaluation Study
Intersection 2.3 – La Salle Avenue at Fremont Boulevard**

PERFORMANCE MEASURE SUMMARY

Four performance measures were evaluated at each intersection for signal and roundabout control. The table below summarizes the performance measures considered in this study.

Performance Measure	Preferred Alt.	Visual Representation
Benefits		
<p>Safety</p> <p>Safety measures the societal cost associated with the predicted number and severity and collisions. Overall societal costs are based on Caltrans Vehicle Operation Cost Parameters. Injury and Fatality crashes are on average 700-1,000 times more expensive than Property Damage Only accidents.</p>		 <p>Injury & Fatality</p> <p>Property Damage Only</p> <p>Number of Incidents</p>
<p>Delay</p> <p>Delay measures the societal cost associated with the number of person-hours delayed in traffic. Overall societal costs are based on Caltrans Vehicle Operation Cost Parameters.</p>		 <p>AM</p> <p>PM</p> <p>Delay (sec/veh)</p>
Costs		
<p>Operations and Maintenance</p> <p>O&M measures the common annualized costs associated with operating and maintaining the intersection.</p>		 <p>Annual</p> <p>Life Cycle Discounted Costs</p> <p>Cost (\$)</p>
<p>Initial Capital Cost</p> <p>Measures the Initial Capital Costs (ICC) needed to plan, design, obtain project approvals, acquire right-of-way, and construct the intersection control. This graph (right) depicts the estimated range of Initial capital costs for the signal and roundabout alternatives as well as the roundabout budget.</p>		 <p>Traffic Signal Cost</p> <p>Roundabout Cost</p>

**City of Seaside Intersection Control Evaluation Study
Intersection 2.3 – La Salle Avenue at Fremont Boulevard**

INTERSECTION LIFE CYCLE COST CALCULATIONS

Performance Measure Life Cycle Cost (Net Present Value)		
Safety		
	Existing (Signal)	Roundabout
Annual Cost of Collisions	\$ 477,940	\$ 62,866
Discounted Life Cycle Cost of Collisions	\$ 6,705,102	\$ 881,964
Delay		
	Existing (Signal)	Roundabout
Annual Quantity (hours)	3,727	4,409
Annual Cost	\$ 49,699	\$ 58,537
Total Discounted Life Cycle Cost	\$ 1,093,370	\$ 1,287,811
O&M		
	Existing (Signal)	Roundabout
Annual O&M Costs	9,220	1,920
Discounted Life Cycle O&M Costs	\$ 129,349	\$ 26,936
Discounted Pavement Rehab Costs	\$ 50,710	\$ 43,103
Total O&M Costs	\$ 180,059	\$ 70,039
Initial Capital		
	Existing (Signal)	Roundabout
High Approximation	\$ 200,000	\$ 3,500,000
Low Approximation	\$ 100,000	\$ 2,000,000

Benefit-Cost Ratio Calculations							
B/C Target	Capital Cost			Project Constraints			
	Traffic Signal (a)	Roundabout (b)	Added Cost for Roundabout (c) = (b - a)	Added O&M Cost for Roundabout (d)	Total Benefits (e)	Total Costs (f) = (c + d)	B/C (g) = (e / f)
High	\$ 200,000	\$ 2,000,000	\$ 1,800,000			\$ 1,689,879	3.33
Low	\$ 100,000	\$ 3,500,000	\$ 3,400,000	\$ (110,121)	\$ 5,628,697	\$ 3,289,879	1.71
Roundabout Budget	\$ 150,000	\$ 5,888,818	\$ 5,738,818			\$ 5,628,697	1.00

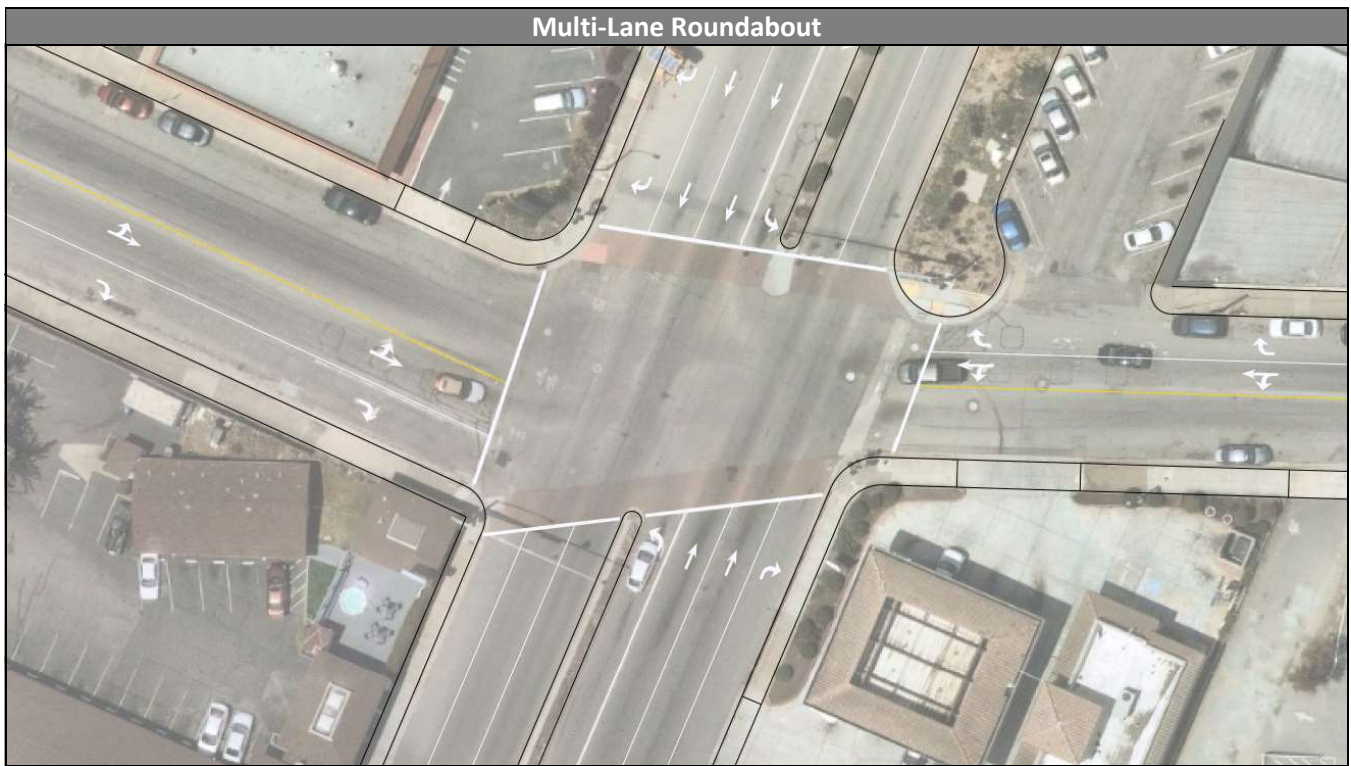
PREFERRED INTERSECTION ALTERNATIVE

The preferred alternative based on B/C ratio for this intersection is roundabout control.



*City of Seaside Intersection Control Evaluation Study
Intersection 2.3 – La Salle Avenue at Fremont Boulevard*

INTERSECTION CONTROL CONCEPT LAYOUTS



INTERSECTION 2.4 – BROADWAY AVENUE AT NOCHE BUENA STREET

INTERSECTION CONTROL ALTERNATIVES

The two intersection control types analyzed include:

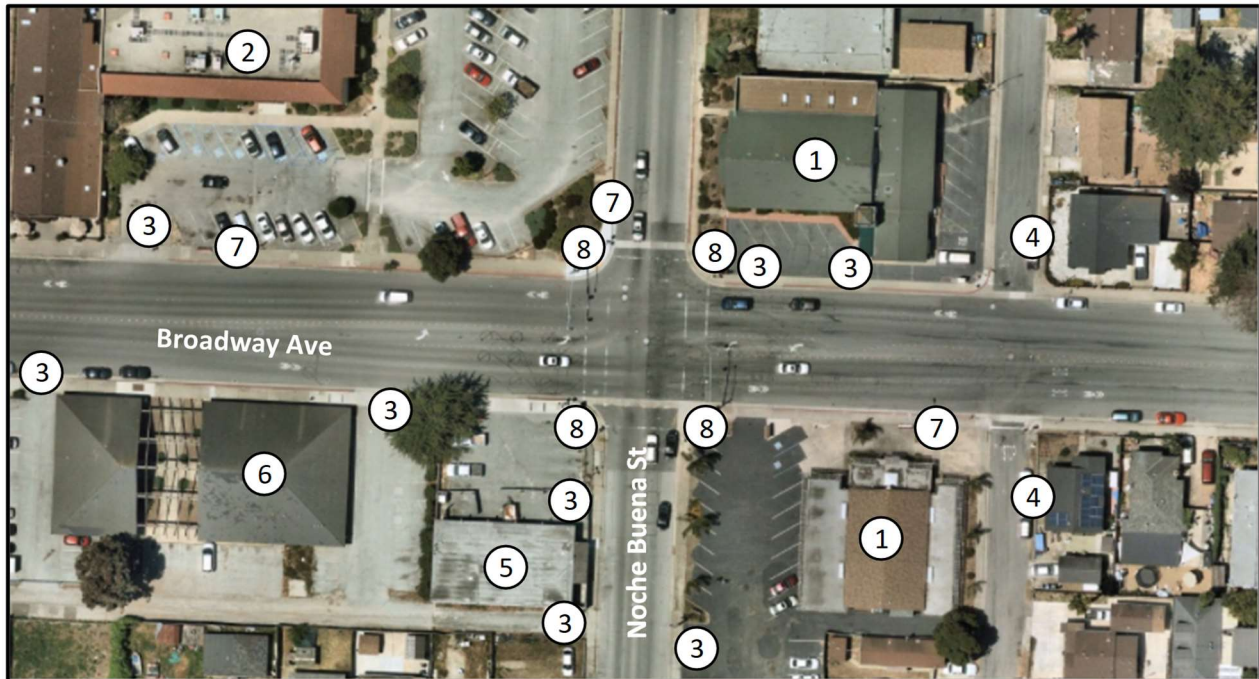
1. Existing Signal with Optimized Signal Timing
2. Mini-Roundabout



EXISTING CONDITIONS AND PROJECT CONSTRAINTS

Broadway Ave at Noche Buena St is currently controlled by signals. Design constraints at the intersection include:

- | | |
|------------------------------------|------------------------------|
| 1. Place of Worship | 5. Liquor Store |
| 2. Monterey County Social Services | 6. Preschool |
| 3. Driveway | 7. Bus stop |
| 4. Proximity to Kenneth St | 8. Right-of-way encroachment |



QUALITATIVE ASSESSMENT





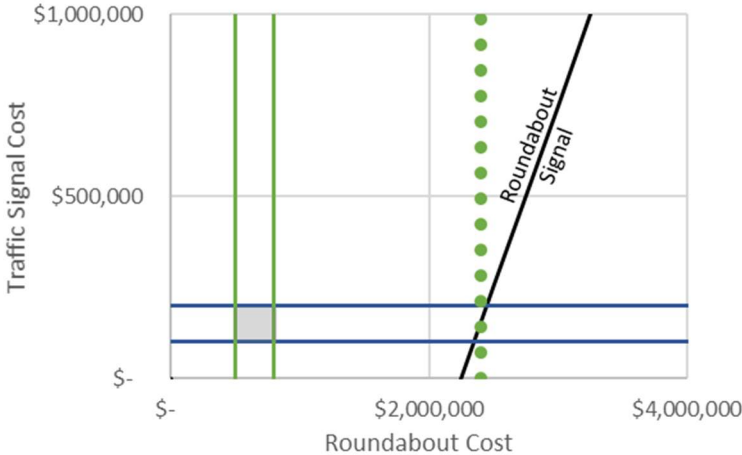
The following table summarizes qualitative factors that were considered in the design of each alternative.

Qualitative Assessment		Existing Control Feasibility	Roundabout Control Feasibility
INT 2.4	Broadway Ave at Noche Buena St		
	Urban Environment Focus	X	X
	Design for Pedestrians	X	X
	Design for Bicyclists	X	X
	Slow Traffic Speeds to Benefit Local Businesses		X
	Minimize ROW Acquisition to Limit Initial Costs	X	X
Minimize Left-Turn Movements to Improve Safety		X	

City of Seaside Intersection Control Evaluation Study
Intersection 2.4 – Broadway Avenue at Noche Buena Street

PERFORMANCE MEASURE SUMMARY

Four performance measures were evaluated at each intersection for signal and roundabout control. The table below summarizes the performance measures considered in this study.

Performance Measure	Preferred Alt.	Visual Representation
Benefits		
<p>Safety</p> <p>Safety measures the societal cost associated with the predicted number and severity and collisions. Overall societal costs are based on Caltrans Vehicle Operation Cost Parameters. Injury and Fatality crashes are on average 700-1,000 times more expensive than Property Damage Only accidents.</p>		 <p>Injury & Fatality</p> <p>Property Damage Only</p> <p>Number of Incidents</p>
<p>Delay</p> <p>Delay measures the societal cost associated with the number of person-hours delayed in traffic. Overall societal costs are based on Caltrans Vehicle Operation Cost Parameters.</p>		 <p>AM</p> <p>PM</p> <p>Delay (sec/veh)</p>
Costs		
<p>Operations and Maintenance</p> <p>O&M measures the common annualized costs associated with operating and maintaining the intersection.</p>		 <p>Annual</p> <p>Life Cycle Discounted Costs</p> <p>Cost (\$)</p>
<p>Initial Capital Cost</p> <p>Measures the Initial Capital Costs (ICC) needed to plan, design, obtain project approvals, acquire right-of-way, and construct the intersection control. This graph (right) depicts the estimated range of Initial capital costs for the signal and roundabout alternatives as well as the roundabout budget.</p>		 <p>Traffic Signal Cost</p> <p>Roundabout Cost</p> <p>B/C=1</p> <p>Estimated ICC</p>

City of Seaside Intersection Control Evaluation Study
Intersection 2.4 – Broadway Avenue at Noche Buena Street

INTERSECTION LIFE CYCLE COST CALCULATIONS

Performance Measure Life Cycle Cost (Net Present Value)			
Safety			
	<u>Signal</u>	<u>Roundabout</u>	
Annual Cost of Collisions	\$ 192,639	\$ 93,748	
Discounted Life Cycle Cost of Collisions	\$ 2,702,565	\$ 1,315,209	
Delay			
	<u>Signal</u>	<u>Roundabout</u>	
Annual Quantity (hours)	6,851	4,131	
Annual Cost	\$ 89,197	\$ 54,775	
Total Discounted Life Cycle Cost	\$ 1,962,332	\$ 1,205,050	
O&M			
	<u>Signal</u>	<u>Roundabout</u>	
Annual O&M Costs	9,220	1,920	
Discounted Life Cycle O&M Costs	\$ 129,349	\$ 26,936	
Discounted Pavement Rehab Costs	\$ 25,862	\$ 21,983	
Total O&M Costs	\$ 155,211	\$ 48,919	
Initial Capital			
	<u>Signal</u>	<u>Roundabout</u>	
High Approximation	\$ 200,000	\$ 800,000	
Low Approximation	\$ 100,000	\$ 500,000	

Benefit-Cost Ratio Calculations							
B/C Target	Capital Cost			Project Constraints			
	Traffic Signal	Roundabout	Added Cost for Roundabout	Added O&M Cost for Roundabout	Total Benefits	Total Costs	B/C
	(a)	(b)	(c) = (b - a)	(d)	(e)	(f) = (c + d)	(g) = (e / f)
High	\$ 200,000	\$ 500,000	\$ 300,000			\$ 195,254	10.98
Low	\$ 100,000	\$ 800,000	\$ 700,000	\$ (104,746)	\$ 2,144,638	\$ 595,254	3.60
Roundabout Budget	\$ 150,000	\$ 2,399,383	\$ 2,249,383			\$ 2,144,638	1.00

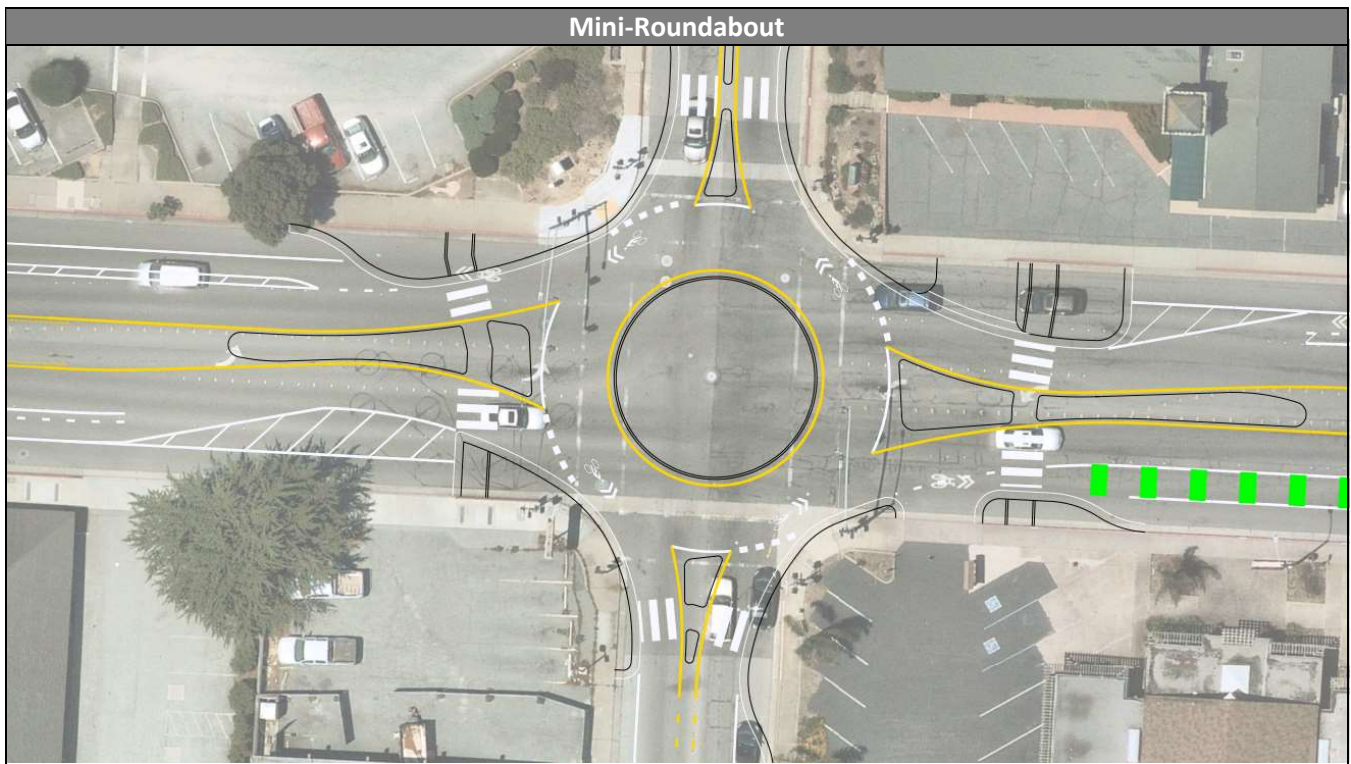
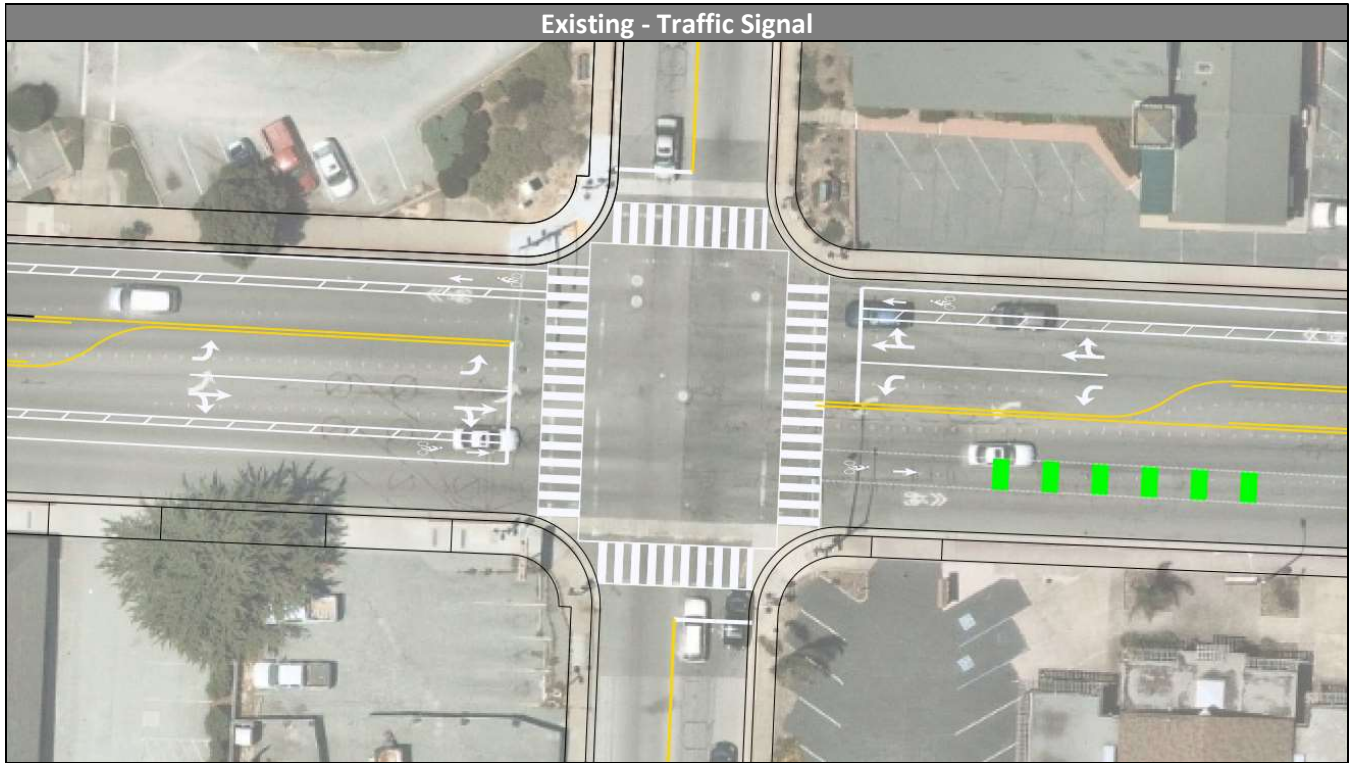
PREFERRED INTERSECTION ALTERNATIVE

The preferred alternative based on B/C ratio for this intersection is roundabout control.



City of Seaside Intersection Control Evaluation Study
Intersection 2.4 – Broadway Avenue at Noche Buena Street

INTERSECTION CONTROL CONCEPT LAYOUTS



INTERSECTION 2.5 – BROADWAY AVENUE AT YOSEMITE STREET

INTERSECTION CONTROL ALTERNATIVES

The two intersection control types analyzed include:

1. Traffic Signal
2. Elongated Roundabout



EXISTING CONDITIONS AND PROJECT CONSTRAINTS

Broadway Ave at Yosemite St is currently controlled by signals. Design constraints at the intersection include:

- | | |
|---------------------------------|------------------------------|
| 1. Skewed intersection geometry | 6. Bus stop |
| 2. Fire Department | 7. Driveway |
| 3. King Middle School | 8. Single family residence |
| 4. Place of Worship | 9. Right-of-way encroachment |
| 5. Proximity to Highland St | |



QUALITATIVE ASSESSMENT


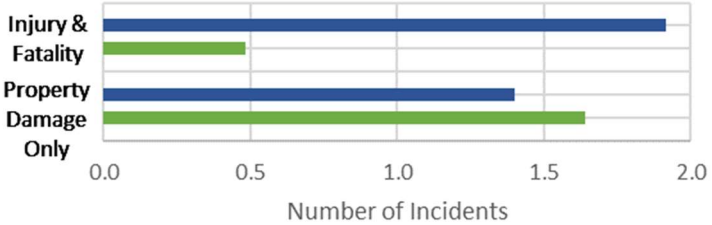

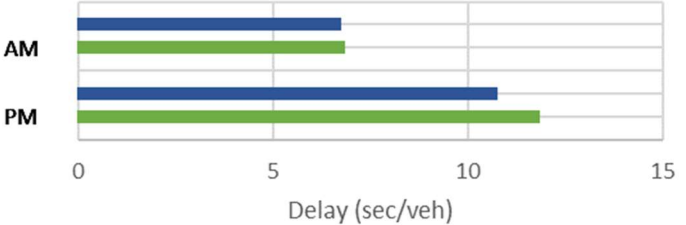


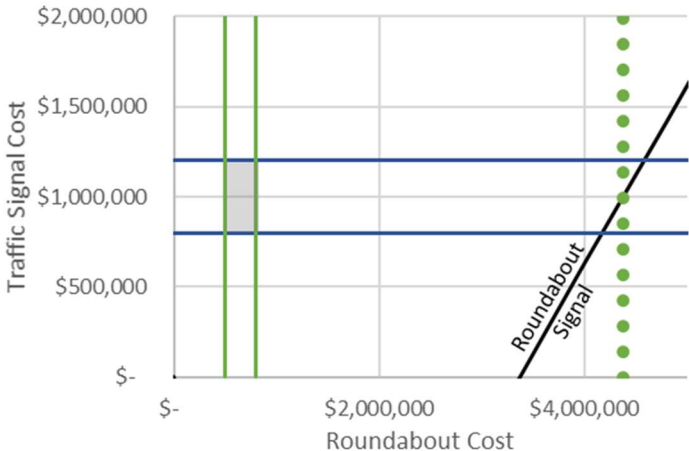
The following table summarizes qualitative factors that were considered in the design of each alternative.

Qualitative Assessment		Existing Control Feasibility	Roundabout Control Feasibility
INT 2.5	Broadway Ave at Yosemite St		
	Urban Environment Focus	X	X
	Design for Pedestrians	X	X
	Design for Bicyclists	X	X
	Slow Traffic Speeds to Benefit Local Businesses	N/A	N/A
	Minimize ROW Acquisition to Limit Initial Costs	X	X
Minimize Left-Turn Movements to Improve Safety		X	

**City of Seaside Intersection Control Evaluation Study
Intersection 2.5 – Broadway Avenue at Yosemite Street**

PERFORMANCE MEASURE SUMMARY

Four performance measures were evaluated at each intersection for signal and roundabout control. The table below summarizes the performance measures considered in this study.

Performance Measure	Preferred Alt.	Visual Representation
Benefits		
<p>Safety</p> <p>Safety measures the societal cost associated with the predicted number and severity and collisions. Overall societal costs are based on Caltrans Vehicle Operation Cost Parameters. Injury and Fatality crashes are on average 700-1,000 times more expensive than Property Damage Only accidents.</p> <p align="center"></p> <p>— Signal — Roundabout</p>		
<p>Delay</p> <p>Delay measures the societal cost associated with the number of person-hours delayed in traffic. Overall societal costs are based on Caltrans Vehicle Operation Cost Parameters.</p> <p align="center"></p> <p>— Signal — Roundabout</p>		
Costs		
<p>Operations and Maintenance</p> <p>O&M measures the common annualized costs associated with operating and maintaining the intersection.</p> <p align="center"></p> <p>— Signal — Roundabout</p>		
<p>Initial Capital Cost</p> <p>Measures the Initial Capital Costs (ICC) needed to plan, design, obtain project approvals, acquire right-of-way, and construct the intersection control. This graph (right) depicts the estimated range of Initial capital costs for the signal and roundabout alternatives as well as the roundabout budget.</p> <p align="center"></p> <p>— RAB ICC Range — B/C=1 — Signal ICC Range ■ Estimated ICC ● ● ● RAB Budget</p>		

**City of Seaside Intersection Control Evaluation Study
Intersection 2.5 – Broadway Avenue at Yosemite Street**

INTERSECTION LIFE CYCLE COST CALCULATIONS

Performance Measure Life Cycle Cost (Net Present Value)				
Safety				
	Existing (AWSC)	Signal	Roundabout	
Annual Cost of Collisions	\$ 218,092	\$ 313,743	\$	78,336
Discounted Life Cycle Cost of Collisions	\$ 3,059,649	\$ 4,401,547	\$	1,098,993
Delay				
	Existing (AWSC)	Signal	Roundabout	
Annual Quantity (hours)	4,393	1,913		2,047
Annual Cost	\$ 57,987	\$ 25,321	\$	27,058
Total Discounted Life Cycle Cost	\$ 1,275,718	\$ 557,062	\$	595,280
O&M				
	Existing (AWSC)	Signal	Roundabout	
Annual O&M Costs	1000	9,220		1,920
Discounted Life Cycle O&M Costs	\$ 14,029	\$ 129,349	\$	26,936
Discounted Pavement Rehab Costs	\$ 18,255	\$ 25,558	\$	16,734
Total O&M Costs	\$ 32,285	\$ 154,907	\$	43,670
Initial Capital				
	Existing (AWSC)	Signal	Roundabout	
High Approximation	\$ 80,000	\$ 1,200,000	\$	800,000
Low Approximation	\$ 50,000	\$ 800,000	\$	500,000
Life Cycle Benefit-Cost Ratio				
		Total Benefits (B)		
	Existing (AWSC)	Signal	Roundabout	
Safety	\$ -	\$ (1,341,898)	\$	1,960,656
Delay	\$ -	\$ 718,657	\$	680,438
Total Benefits	\$ -	\$ (623,242)	\$	2,641,094
		Total Costs (C)		
	Existing (AWSC)	Signal	Roundabout	
O&M	\$ -	\$ 122,622	\$	11,386
Budget	\$ -	\$ 935,000	\$	585,000
Total Costs	\$ -	\$ 1,057,622	\$	596,386
B/C Ratio Compared to Existing	NA	-0.59		4.43

**City of Seaside Intersection Control Evaluation Study
Intersection 2.5 – Broadway Avenue at Yosemite Street**

Benefit-Cost Ratio Calculations							
B/C Target	Capital Cost			Project Constraints			
	Traffic Signal (a)	Roundabout (b)	Added Cost for Roundabout (c) = (b - a)	Added O&M Cost for Roundabout (d)	Total Benefits (e)	Total Costs (f) = (c + d)	B/C (g) = (e / f)
High	\$ 1,200,000	\$ 500,000	\$ (700,000)			\$ (811,439)	NA-R
Low	\$ 800,000	\$ 800,000	\$ -	\$ (111,439)	\$ 3,264,336	\$ (111,439)	NA-R
Roundabout Budget	\$ 1,000,000	\$ 4,375,775	\$ 3,375,775			\$ 3,264,336	1.00

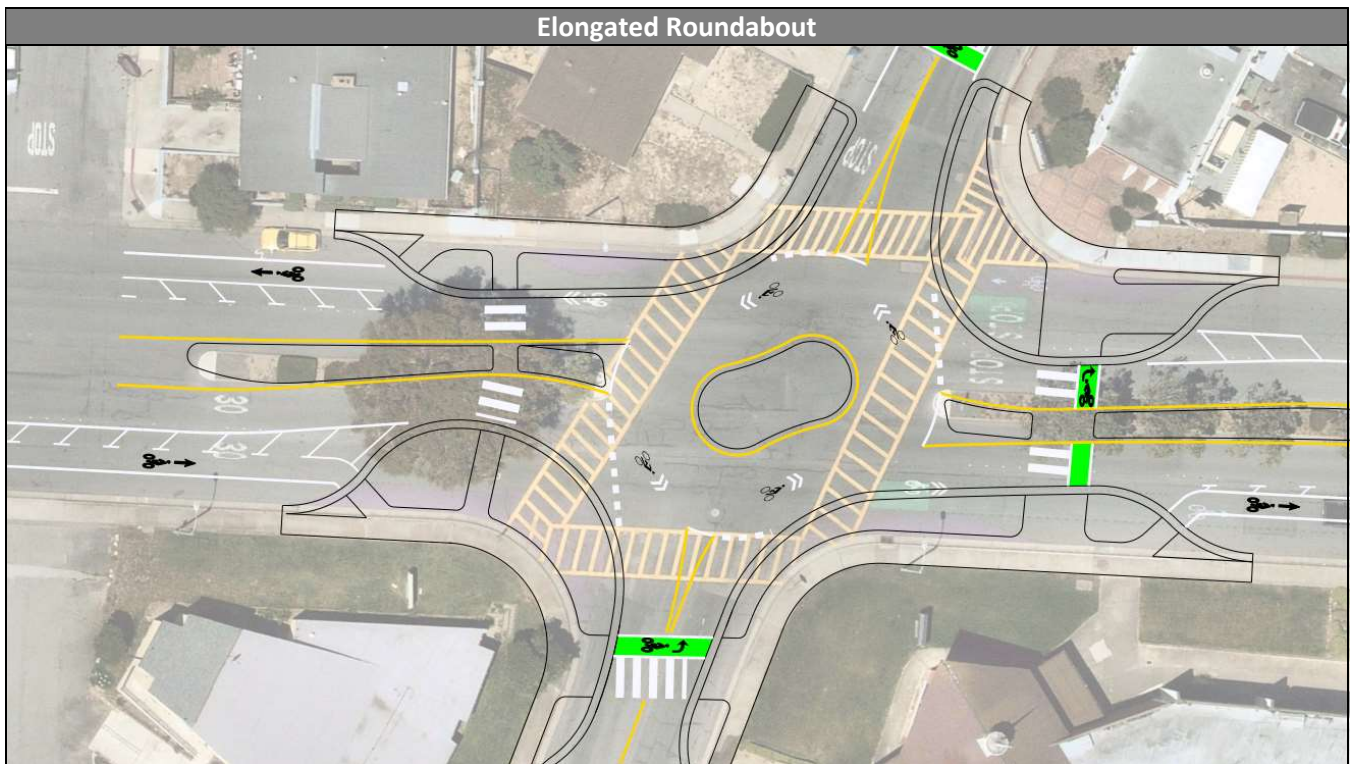
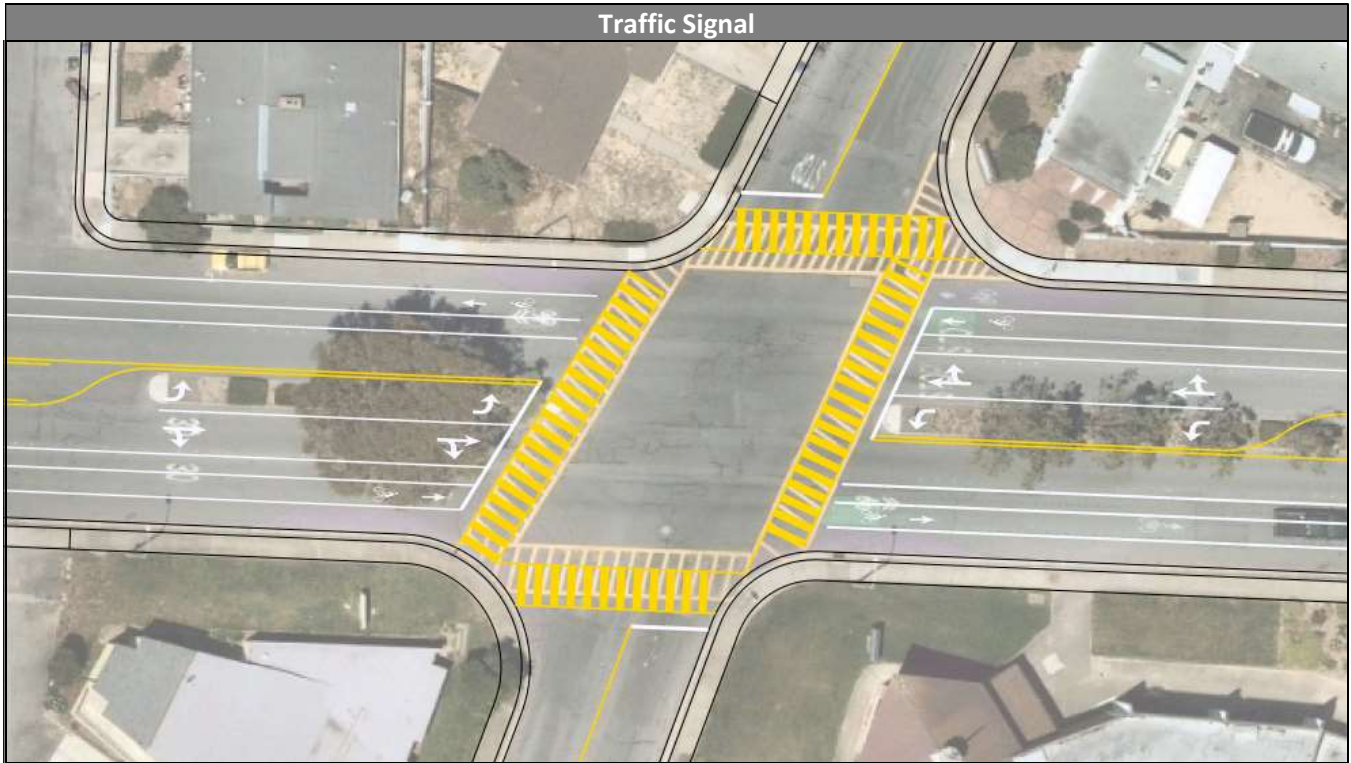
PREFERRED INTERSECTION ALTERNATIVE

The preferred alternative based on B/C ratio for this intersection is roundabout control.



*City of Seaside Intersection Control Evaluation Study
Intersection 2.5 – Broadway Avenue at Yosemite Street*

INTERSECTION CONTROL CONCEPT LAYOUTS



INTERSECTION 2.6 – MILITARY AVENUE AT NOCHE BUENA STREET

INTERSECTION CONTROL ALTERNATIVES

The two intersection control types analyzed include:

1. Traffic Signal
2. Mini-Roundabout



EXISTING CONDITIONS AND PROJECT CONSTRAINTS

Military Ave at Noche Buena St is currently controlled by stop signs on Military Ave. Design constraints at the intersection include:

- | | |
|----------------------------|------------------------------|
| 1. Single family residence | 3. Seaside High School |
| 2. Driveway | 4. Right-of-way encroachment |



QUALITATIVE ASSESSMENT



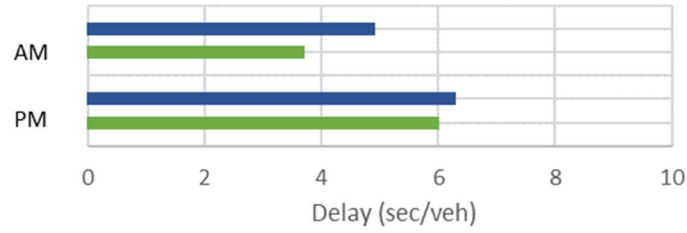

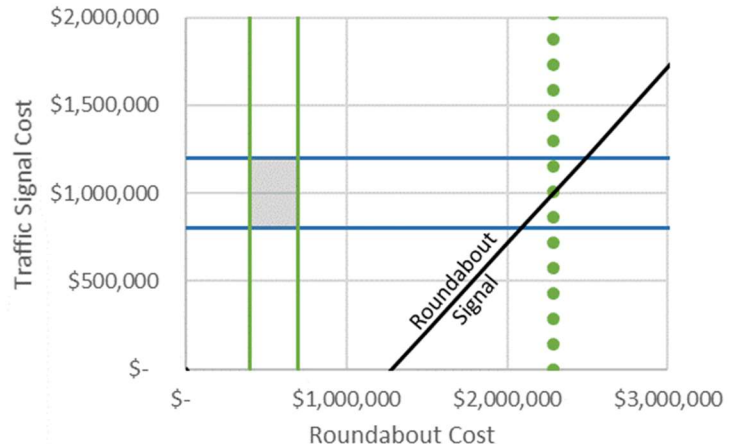
The following table summarizes qualitative factors that were considered in the design of the alternative.

	Existing Control Feasibility	Roundabout Control Feasibility
Qualitative Assessment		
INT 2.6		
Military Ave at Noche Buena St		
Urban Environment Focus	X	X
Design for Pedestrians	X	X
Design for Bicyclists	X	X
Slow Traffic Speeds to Benefit Local Businesses	N/A	N/A
Minimize ROW Acquisition to Limit Initial Costs	X	X
Minimize Left-Turn Movements to Improve Safety		X

**City of Seaside Intersection Control Evaluation Study
Intersection 2.6 – Military Avenue at Noche Buena Street**

PERFORMANCE MEASURE SUMMARY

The following table summarizes performance measures used to calculate the B/C ratio.

Performance Measure	Preferred Alternative	Visual Representation									
Benefits											
<p>Safety</p> <p>Safety measures the societal cost associated with the predicted number and severity of collisions. Overall societal costs are based on Caltrans Vehicle Operation Cost Parameters. Injury and Fatality crashes are on average 700-1,000 times more expensive than Property Damage Only accidents.</p>		 <table border="1"> <caption>Injury & Fatality and Property Damage Only</caption> <thead> <tr> <th>Category</th> <th>Signal</th> <th>Roundabout</th> </tr> </thead> <tbody> <tr> <td>Injury & Fatality</td> <td>~0.6</td> <td>~0.3</td> </tr> <tr> <td>Property Damage Only</td> <td>~0.9</td> <td>~1.1</td> </tr> </tbody> </table>	Category	Signal	Roundabout	Injury & Fatality	~0.6	~0.3	Property Damage Only	~0.9	~1.1
Category	Signal	Roundabout									
Injury & Fatality	~0.6	~0.3									
Property Damage Only	~0.9	~1.1									
<p>Delay</p> <p>Delay measures the societal cost associated with the number of person-hours delayed in traffic. Overall societal costs are based on Caltrans Vehicle Operation Cost Parameters.</p>		 <table border="1"> <caption>Delay (sec/veh)</caption> <thead> <tr> <th>Time Period</th> <th>Signal</th> <th>Roundabout</th> </tr> </thead> <tbody> <tr> <td>AM</td> <td>~5.0</td> <td>~3.5</td> </tr> <tr> <td>PM</td> <td>~6.5</td> <td>~6.0</td> </tr> </tbody> </table>	Time Period	Signal	Roundabout	AM	~5.0	~3.5	PM	~6.5	~6.0
Time Period	Signal	Roundabout									
AM	~5.0	~3.5									
PM	~6.5	~6.0									
Costs											
<p>Operations and Maintenance</p> <p>O&M measures the common annualized costs associated with operating and maintaining the intersection.</p>		 <table border="1"> <caption>Operations and Maintenance Costs (\$)</caption> <thead> <tr> <th>Category</th> <th>Signal</th> <th>Roundabout</th> </tr> </thead> <tbody> <tr> <td>Annual</td> <td>~\$10,000</td> <td>~\$2,000</td> </tr> <tr> <td>Life Cycle Discounted</td> <td>~\$200,000</td> <td>~\$40,000</td> </tr> </tbody> </table>	Category	Signal	Roundabout	Annual	~\$10,000	~\$2,000	Life Cycle Discounted	~\$200,000	~\$40,000
Category	Signal	Roundabout									
Annual	~\$10,000	~\$2,000									
Life Cycle Discounted	~\$200,000	~\$40,000									
<p>Initial Capital Cost</p> <p>Measures the initial capital costs needed to plan, design, obtain project approvals, acquire right-of-way, and construct the intersection control. This graph (right) depicts the estimated range of Initial capital costs for the signal and roundabout alternatives as well as the roundabout budget.</p>											

City of Seaside Intersection Control Evaluation Study
Intersection 2.6 – Military Avenue at Noche Buena Street

INTERSECTION LIFE CYCLE COST CALCULATIONS

Performance Measure Life Cycle Cost (Net Present Value)				
Safety				
	Existing (TWSC)	Signal	Roundabout	
Annual Cost of Collisions	\$ 143,140	\$ 133,396	\$ 50,162	
Discounted Life Cycle Cost of Collisions	\$ 2,008,139	\$ 1,871,436	\$ 703,733	
Delay				
	Existing (TWSC)	Signal	Roundabout	
Annual Quantity (hours)	2,413	650	612	
Annual Cost	\$ 35,279	\$ 8,779	\$ 8,300	
Total Discounted Life Cycle Cost	\$ 776,131	\$ 193,137	\$ 182,601	
O&M				
	Existing (TWSC)	Signal	Roundabout	
Annual O&M Costs	520	9,220	1,920	
Discounted Life Cycle O&M Costs	\$ 7,295	\$ 129,349	\$ 26,936	
Discounted Pavement Rehab Costs	\$ 10,750	\$ 10,750	\$ 8,418	
Total O&M Costs	\$ 18,046	\$ 140,099	\$ 35,354	
Initial Capital				
	Existing (TWSC)	Signal	Roundabout	
High Approximation	\$ 80,000	\$ 1,200,000	\$ 700,000	
Low Approximation	\$ 50,000	\$ 800,000	\$ 400,000	
Life Cycle Benefit-Cost Ratio				
		Total Benefits (B)		
	Existing (TWSC)	Signal	Roundabout	
Safety	\$ -	\$ 136,703	\$ 1,304,405	
Delay	\$ -	\$ 582,993	\$ 593,530	
Total Benefits	\$ -	\$ 719,696	\$ 1,897,935	
		Total Costs (C)		
	Existing (TWSC)	Signal	Roundabout	
O&M	\$ -	\$ 122,054	\$ 17,308	
Budget	\$ -	\$ 935,000	\$ 485,000	
Total Costs	\$ -	\$ 1,057,054	\$ 502,308	
B/C Ratio Compared to Existing	NA	0.68	3.78	

**City of Seaside Intersection Control Evaluation Study
Intersection 2.6 – Military Avenue at Noche Buena Street**

Benefit-Cost Ratio Calculations							
B/C Target	Capital Cost		Added Cost for Roundabout (c) = (b - a)	Project Constraints		Total Costs (f) = (c + d)	B/C (g) = (e / f)
	Traffic Signal (a)	Roundabout (b)		Added O&M Cost for Roundabout (d)	Total Benefits (e)		
High	\$ 1,200,000	\$ 400,000	\$ (800,000)			\$ (904,746)	NA-R
Low	\$ 800,000	\$ 700,000	\$ (100,000)	\$ (104,746)	\$ 1,178,239	\$ (204,746)	NA-R
Roundabout Budget	\$ 1,000,000	\$ 2,282,984	\$ 1,282,984			\$ 1,178,239	1.00

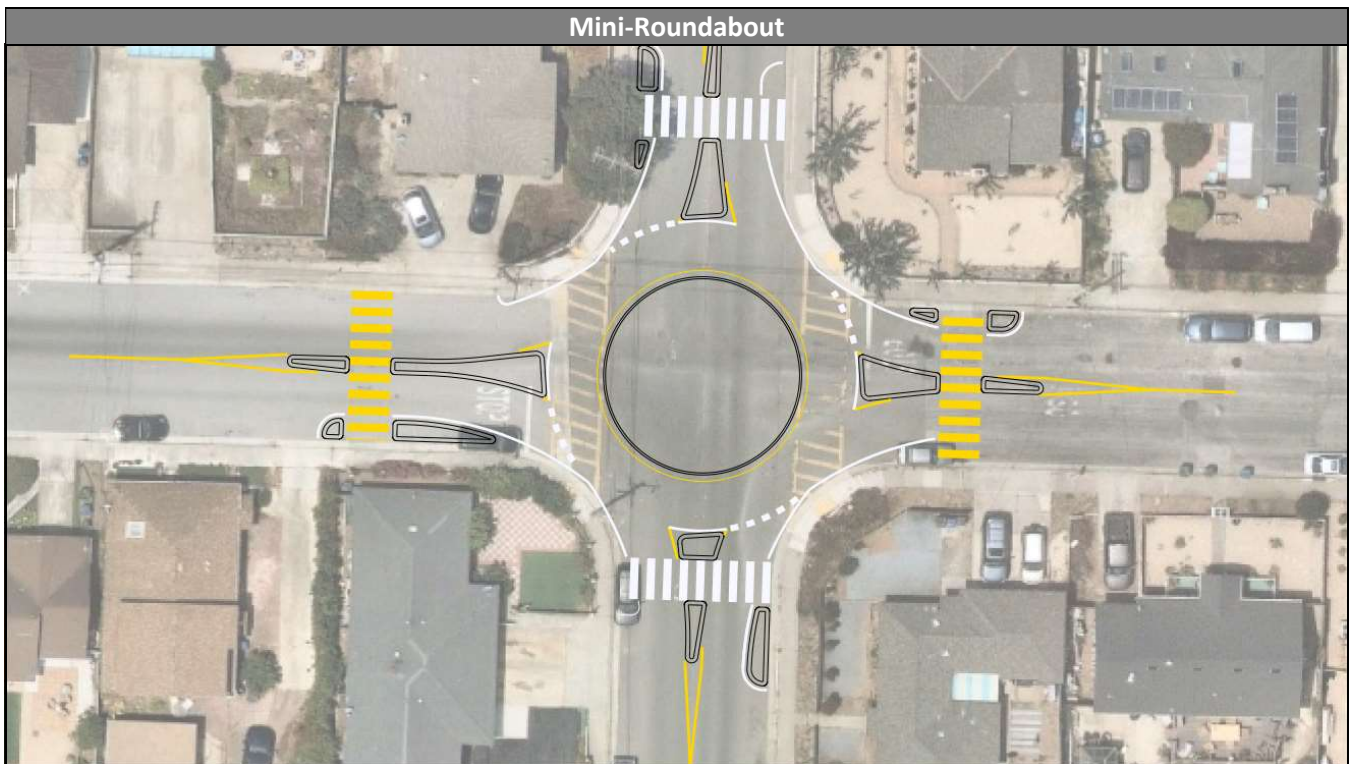
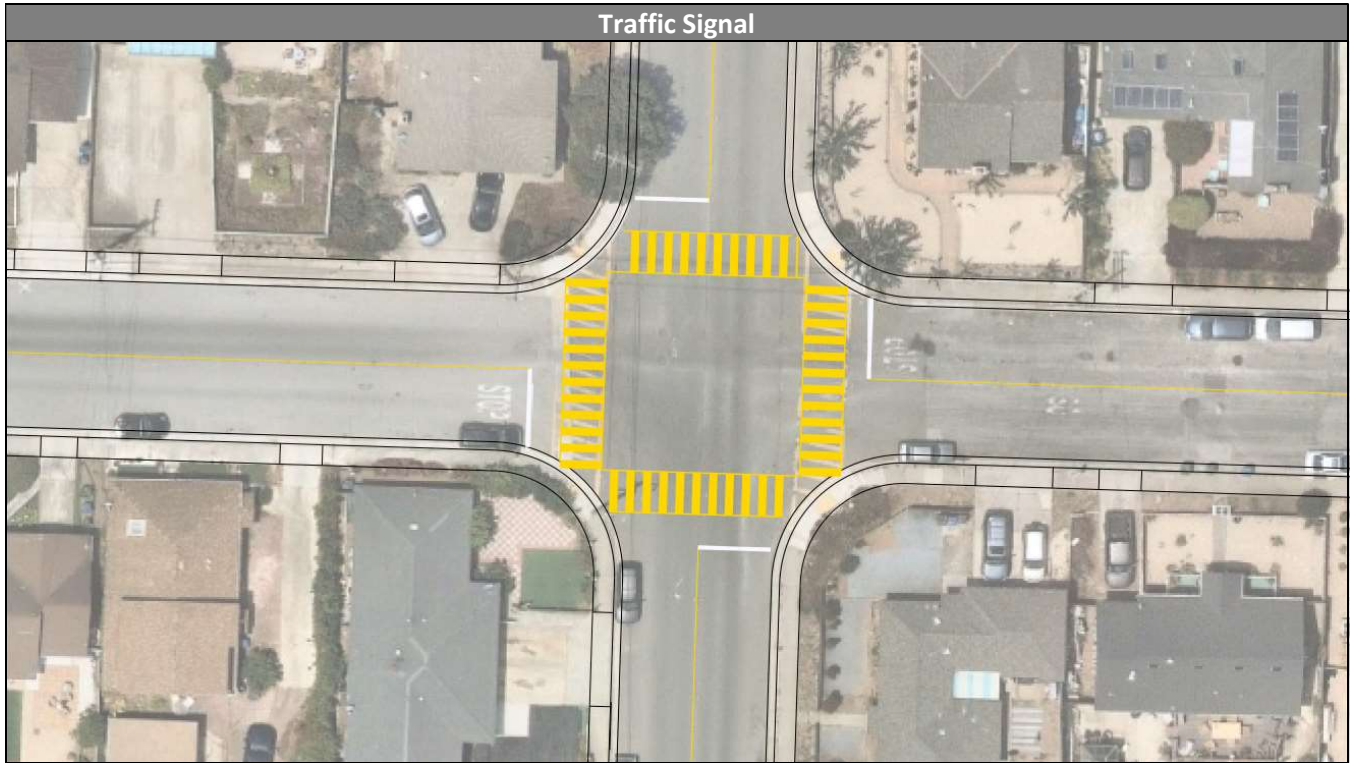
PREFERRED INTERSECTION ALTERNATIVE

The preferred alternative based on B/C ratio for this intersection is roundabout control.



*City of Seaside Intersection Control Evaluation Study
Intersection 2.6 – Military Avenue at Noche Buena Street*

INTERSECTION CONTROL CONCEPT LAYOUTS



INTERSECTION 2.7A – LIGHTFIGHTER DRIVE AT FIRST AVENUE

INTERSECTION CONTROL ALTERNATIVES

The two intersection control types analyzed include:

1. Existing Signal with Optimized Signal Timing
2. Multi-lane Roundabout



EXISTING CONDITIONS AND PROJECT CONSTRAINTS

Lightfighter Dr at First Ave is currently controlled by signals. Design constraints at the intersection include:

1. SR-1 NB on-ramp
2. SR-1 NB off-ramp
3. One-Way traffic
4. Ord Community Commissary
5. Right-of-way encroachment



QUALITATIVE ASSESSMENT


The following table summarizes qualitative factors that were considered in the design of each alternative.

Qualitative Assessment		Existing Control Feasibility	Roundabout Control Feasibility
INT 2.7a	Lightfighter Dr at First Ave		
	Urban Environment Focus	N/A	N/A
	Design for Pedestrians		
	Design for Bicyclists	X	X
	Slow Traffic Speeds to Benefit Local Businesses	N/A	N/A
	Minimize ROW Acquisition to Limit Initial Costs	X	
	Minimize Left-Turn Movements to Improve Safety		X

**City of Seaside Intersection Control Evaluation Study
Intersection 2.7a – Lightfighter Drive at First Avenue**

PERFORMANCE MEASURE SUMMARY

Four performance measures were evaluated at each intersection for signal and roundabout control. The table below summarizes the performance measures considered in this study.

Performance Measure	Preferred Alt.	Visual Representation										
Benefits												
<p>Safety</p> <p>Safety measures the societal cost associated with the predicted number and severity and collisions. Overall societal costs are based on Caltrans Vehicle Operation Cost Parameters. Injury and Fatality crashes are on average 700-1,000 times more expensive than Property Damage Only accidents.</p> <p align="center"></p> <p>— Signal — Roundabout</p>		 <table border="1"> <caption>Number of Incidents</caption> <thead> <tr> <th>Measure</th> <th>Signal</th> <th>Roundabout</th> </tr> </thead> <tbody> <tr> <td>Injury & Fatality</td> <td>2</td> <td>1</td> </tr> <tr> <td>Property Damage Only</td> <td>2</td> <td>9</td> </tr> </tbody> </table>	Measure	Signal	Roundabout	Injury & Fatality	2	1	Property Damage Only	2	9	
Measure	Signal	Roundabout										
Injury & Fatality	2	1										
Property Damage Only	2	9										
<p>Delay</p> <p>Delay measures the societal cost associated with the number of person-hours delayed in traffic. Overall societal costs are based on Caltrans Vehicle Operation Cost Parameters.</p> <p align="center"></p> <p>— Signal — Roundabout</p>		 <table border="1"> <caption>Delay (sec/veh)</caption> <thead> <tr> <th>Time Period</th> <th>Signal</th> <th>Roundabout</th> </tr> </thead> <tbody> <tr> <td>AM</td> <td>12</td> <td>42</td> </tr> <tr> <td>PM</td> <td>12</td> <td>35</td> </tr> </tbody> </table>	Time Period	Signal	Roundabout	AM	12	42	PM	12	35	
Time Period	Signal	Roundabout										
AM	12	42										
PM	12	35										
Costs												
<p>Operations and Maintenance</p> <p>O&M measures the common annualized costs associated with operating and maintaining the intersection.</p> <p align="center"></p> <p>— Signal — Roundabout</p>		 <table border="1"> <caption>Costs (\$)</caption> <thead> <tr> <th>Category</th> <th>Signal</th> <th>Roundabout</th> </tr> </thead> <tbody> <tr> <td>Annual</td> <td>~\$20,000</td> <td>~\$10,000</td> </tr> <tr> <td>Life Cycle Discounted</td> <td>~\$200,000</td> <td>~\$100,000</td> </tr> </tbody> </table>	Category	Signal	Roundabout	Annual	~\$20,000	~\$10,000	Life Cycle Discounted	~\$200,000	~\$100,000	
Category	Signal	Roundabout										
Annual	~\$20,000	~\$10,000										
Life Cycle Discounted	~\$200,000	~\$100,000										
<p>Initial Capital Cost</p> <p>Measures the Initial Capital Costs (ICC) needed to plan, design, obtain project approvals, acquire right-of-way, and construct the intersection control. This graph (right) depicts the estimated range of Initial capital costs for the signal and roundabout alternatives as well as the roundabout budget.</p> <p align="center"></p> <p>— RAB ICC Range — B/C=1 — Signal ICC Range ■ Estimated ICC ● RAB Budget</p>		 <table border="1"> <caption>Initial Capital Cost Comparison</caption> <thead> <tr> <th>Alternative</th> <th>Cost Range (\$)</th> </tr> </thead> <tbody> <tr> <td>Signal ICC Range</td> <td>~\$500,000 - \$1,000,000</td> </tr> <tr> <td>RAB ICC Range</td> <td>~\$500,000 - \$3,500,000</td> </tr> <tr> <td>RAB Budget</td> <td>~\$500,000 - \$4,000,000</td> </tr> <tr> <td>B/C=1 Line</td> <td>Y = X (Signal Cost = Roundabout Cost)</td> </tr> </tbody> </table>	Alternative	Cost Range (\$)	Signal ICC Range	~\$500,000 - \$1,000,000	RAB ICC Range	~\$500,000 - \$3,500,000	RAB Budget	~\$500,000 - \$4,000,000	B/C=1 Line	Y = X (Signal Cost = Roundabout Cost)
Alternative	Cost Range (\$)											
Signal ICC Range	~\$500,000 - \$1,000,000											
RAB ICC Range	~\$500,000 - \$3,500,000											
RAB Budget	~\$500,000 - \$4,000,000											
B/C=1 Line	Y = X (Signal Cost = Roundabout Cost)											

**City of Seaside Intersection Control Evaluation Study
Intersection 2.7a – Lightfighter Drive at First Avenue**

INTERSECTION LIFE CYCLE COST CALCULATIONS

Performance Measure Life Cycle Cost (Net Present Value)			
Safety			
		<u>Existing (Signal)</u>	<u>Roundabout</u>
Annual Cost of Collisions	\$	318,030	\$ 177,065
Discounted Life Cycle Cost of Collisions	\$	4,461,690	\$ 2,484,073
Delay			
		<u>Existing (Signal)</u>	<u>Roundabout</u>
Annual Quantity (hours)		4,909	14,156
Annual Cost	\$	59,202	\$ 166,524
Total Discounted Life Cycle Cost	\$	1,302,454	\$ 3,663,524
O&M			
		<u>Existing (Signal)</u>	<u>Roundabout</u>
Annual O&M Costs		9,220	1,920
Discounted Life Cycle O&M Costs	\$	129,349	\$ 26,936
Discounted Pavement Rehab Costs	\$	80,324	\$ 72,718
Total O&M Costs	\$	209,673	\$ 99,654
Initial Capital			
		<u>Existing (Signal)</u>	<u>Roundabout</u>
High Approximation	\$	200,000	\$ 3,500,000
Low Approximation	\$	100,000	\$ 2,000,000

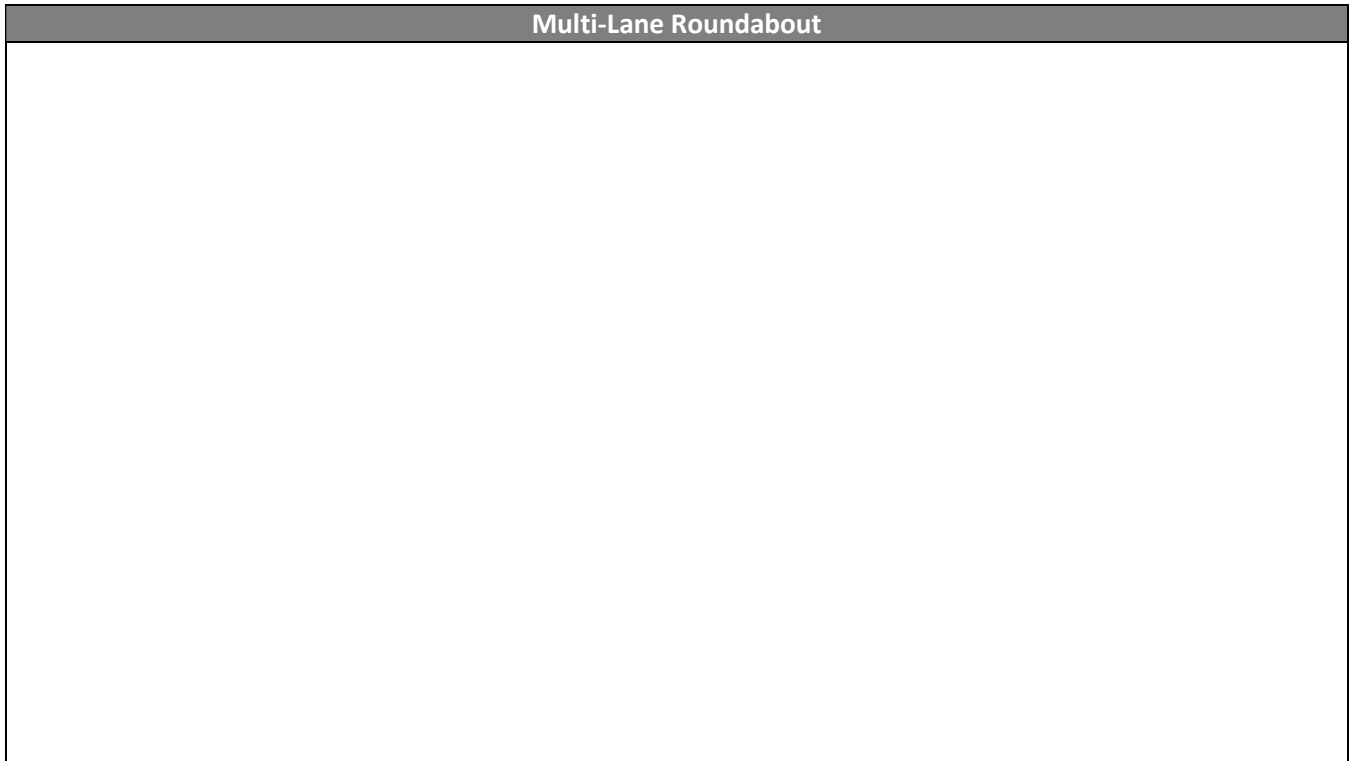
Benefit-Cost Ratio Calculations								
B/C Target	Capital Cost			Project Constraints		Total Benefits (e)	Total Costs (f) = (c + d)	B/C (g) = (e / f)
	Traffic Signal (a)	Roundabout (b)	Added Cost for Roundabout (c) = (b - a)	Added O&M Cost for Roundabout (d)				
High	\$ 200,000	\$ 2,000,000	\$ 1,800,000				\$ 1,689,879	NA-S
Low	\$ 100,000	\$ 3,500,000	\$ 3,400,000	\$ (110,121)	\$ (383,453)		\$ 3,289,879	NA-S
Roundabout Budget	\$ 150,000	\$ (123,332)	\$ (273,332)				\$ (383,453)	1.00

PREFERRED INTERSECTION ALTERNATIVE

The preferred alternative based on B/C ratio for this intersection is traffic signal control.



INTERSECTION CONTROL CONCEPT LAYOUTS



INTERSECTION 2.7B – LIGHTFIGHTER DRIVE AT SR-1 NORTHBOUND RAMPS

INTERSECTION CONTROL ALTERNATIVES

The two intersection control types analyzed include:

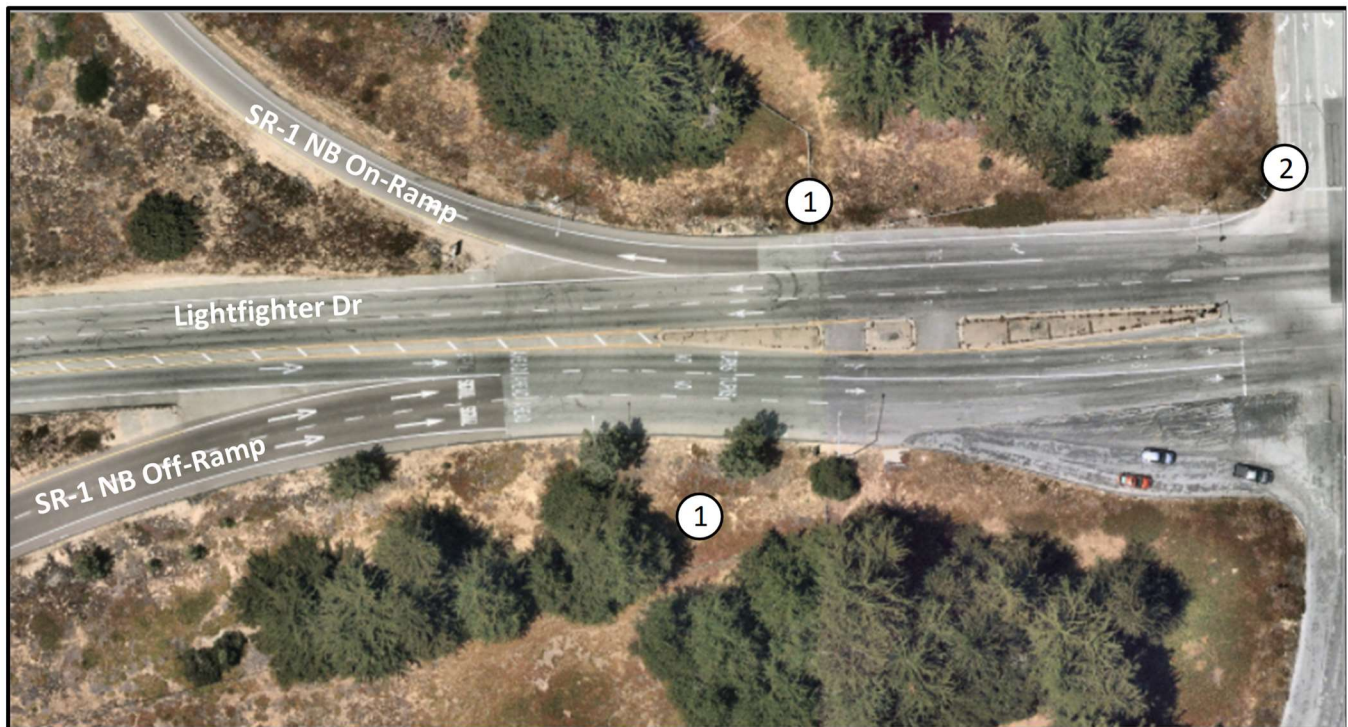
1. Traffic Signal
2. Multi-lane Roundabout



EXISTING CONDITIONS AND PROJECT CONSTRAINTS

Lightfighter Dr at SR-1 Northbound Ramps is currently controlled by signals. Design constraints at the intersection include:

1. Right-of-way encroachment
2. Proximity to First Ave



QUALITATIVE ASSESSMENT




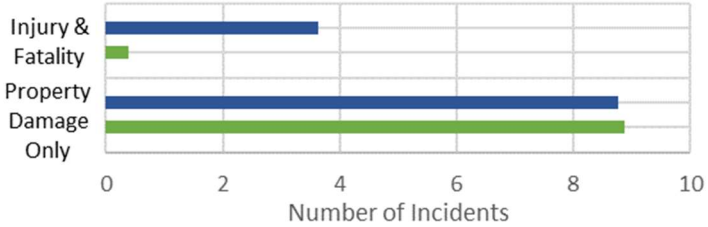



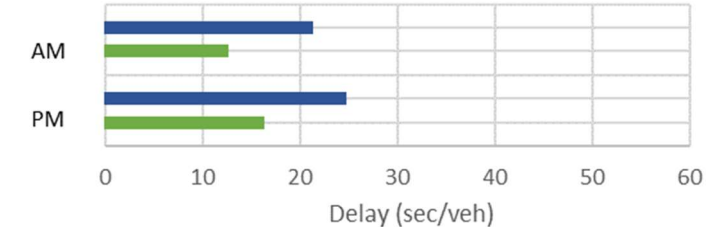



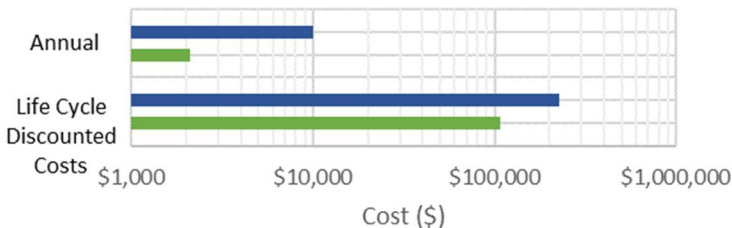


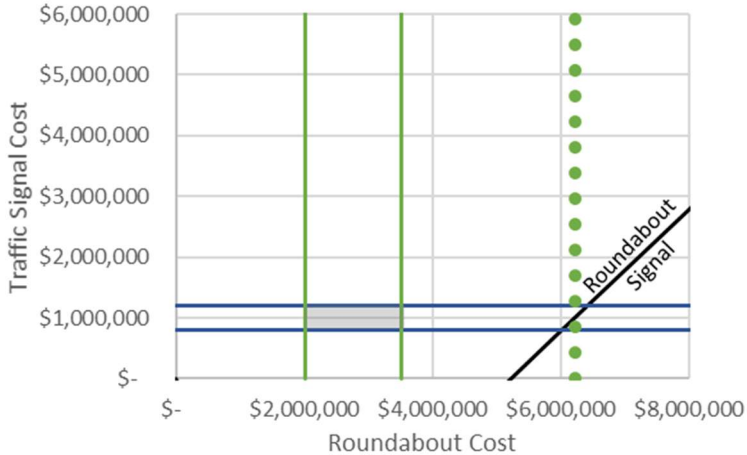
The following table summarizes qualitative factors that were considered in the design of each alternative.

Qualitative Assessment		Existing Control Feasibility	Roundabout Control Feasibility
INT 2.7b	Lightfighter Dr at SR-1 NB Ramps		
	Urban Environment Focus	N/A	N/A
	Design for Pedestrians		
	Design for Bicyclists		
	Slow Traffic Speeds to Benefit Local Businesses	N/A	N/A
	Minimize ROW Acquisition to Limit Initial Costs	X	
	Minimize Left-Turn Movements to Improve Safety		X

City of Seaside Intersection Control Evaluation Study
Intersection 2.7b – Lightfighter Drive at SR-1 Northbound Ramps

PERFORMANCE MEASURE SUMMARY

Four performance measures were evaluated at each intersection for signal and roundabout control. The table below summarizes the performance measures considered in this study.

Performance Measure	Preferred Alt.	Visual Representation
Benefits		
<p>Safety</p> <p>Safety measures the societal cost associated with the predicted number and severity and collisions. Overall societal costs are based on Caltrans Vehicle Operation Cost Parameters. Injury and Fatality crashes are on average 700-1,000 times more expensive than Property Damage Only accidents.</p> <p align="center"> </p> <p>— Signal — Roundabout</p>		<p>Injury & Fatality</p> <p>Property Damage Only</p>  <p align="center">Number of Incidents</p>
<p>Delay</p> <p>Delay measures the societal cost associated with the number of person-hours delayed in traffic. Overall societal costs are based on Caltrans Vehicle Operation Cost Parameters.</p> <p align="center"> </p> <p>— Signal — Roundabout</p>		<p>AM</p> <p>PM</p>  <p align="center">Delay (sec/veh)</p>
Costs		
<p>Operations and Maintenance</p> <p>O&M measures the common annualized costs associated with operating and maintaining the intersection.</p> <p align="center"> </p> <p>— Signal — Roundabout</p>		<p>Annual</p> <p>Life Cycle Discounted Costs</p>  <p align="center">Cost (\$)</p>
<p>Initial Capital Cost</p> <p>Measures the Initial Capital Costs (ICC) needed to plan, design, obtain project approvals, acquire right-of-way, and construct the intersection control. This graph (right) depicts the estimated range of Initial capital costs for the signal and roundabout alternatives as well as the roundabout budget.</p> <p align="center"></p> <p>— RAB ICC Range — Signal ICC Range ●●● RAB Budget</p> <p>— B/C=1 — Estimated ICC</p>		 <p align="center">Traffic Signal Cost</p> <p align="center">Roundabout Cost</p>

City of Seaside Intersection Control Evaluation Study
Intersection 2.7b – Lightfighter Drive at SR-1 Northbound Ramps

INTERSECTION LIFE CYCLE COST CALCULATIONS

Performance Measure Life Cycle Cost (Net Present Value)			
Safety			
	Existing (Ramps)	Signal	Roundabout
Annual Cost of Collisions	\$ 254,637	\$ 362,732	\$ 66,133
Discounted Life Cycle Cost of Collisions	\$ 3,572,346	\$ 5,088,830	\$ 927,785
Delay			
	Existing (Ramps)	Signal	Roundabout
Annual Quantity (hours)	\$ -	\$ 8,425	\$ 4,931
Annual Cost	\$ -	\$ 100,490	\$ 57,941
Total Discounted Life Cycle Cost	\$ -	\$ 2,210,782	\$ 1,274,706
O&M			
	Existing (Ramps)	Signal	Roundabout
Annual O&M Costs	\$ 1,920	\$ 9,220	\$ 1,920
Discounted Life Cycle O&M Costs	\$ 26,936	\$ 129,349	\$ 26,936
Discounted Pavement Rehab Costs	\$ 54,766	\$ 66,531	\$ 56,551
Total O&M Costs	\$ 81,702	\$ 195,880	\$ 83,487
Initial Capital			
	Existing (Ramps)	Signal	Roundabout
High Approximation	\$100,000	\$1,200,000	\$3,500,000
Low Approximation	\$80,000	\$800,000	\$2,000,000
Life Cycle Benefit-Cost Ratio			
	Total Benefits (B)		
	Existing (Ramps)	Signal	Roundabout
Safety	\$ -	\$ (1,516,485)	\$ 2,644,560
Delay	\$ -	\$ (2,210,782)	\$ (1,274,706)
Total Benefits	\$ -	\$ (3,727,266)	\$ 1,369,854
	Total Costs (C)		
	Existing (Ramps)	Signal	Roundabout
O&M	\$ -	\$ 114,178	\$ 1,785
Budget	\$ -	\$ 910,000	\$ 2,660,000
Total Costs	\$ -	\$ 1,024,178	\$ 2,661,785
B/C Ratio Compared to Existing	NA	-3.64	0.51

**City of Seaside Intersection Control Evaluation Study
Intersection 2.7b – Lightfighter Drive at SR-1 Northbound Ramps**

Benefit-Cost Ratio Calculations							
B/C Target	Capital Cost			Project Constraints			
	Traffic Signal (a)	Roundabout (b)	Added Cost for Roundabout (c) = (b - a)	Added O&M Cost for Roundabout (d)	Total Benefits (e)	Total Costs (f) = (c + d)	B/C (g) = (e / f)
High	\$ 1,200,000	\$ 2,000,000	\$ 800,000			\$ 689,879	7.39
Low	\$ 800,000	\$ 3,500,000	\$ 2,700,000	\$ (110,121)	\$ 5,097,120	\$ 2,589,879	1.97
Roundabout Budget	\$ 1,000,000	\$ 6,207,241	\$ 5,207,241			\$ 5,097,120	1.00

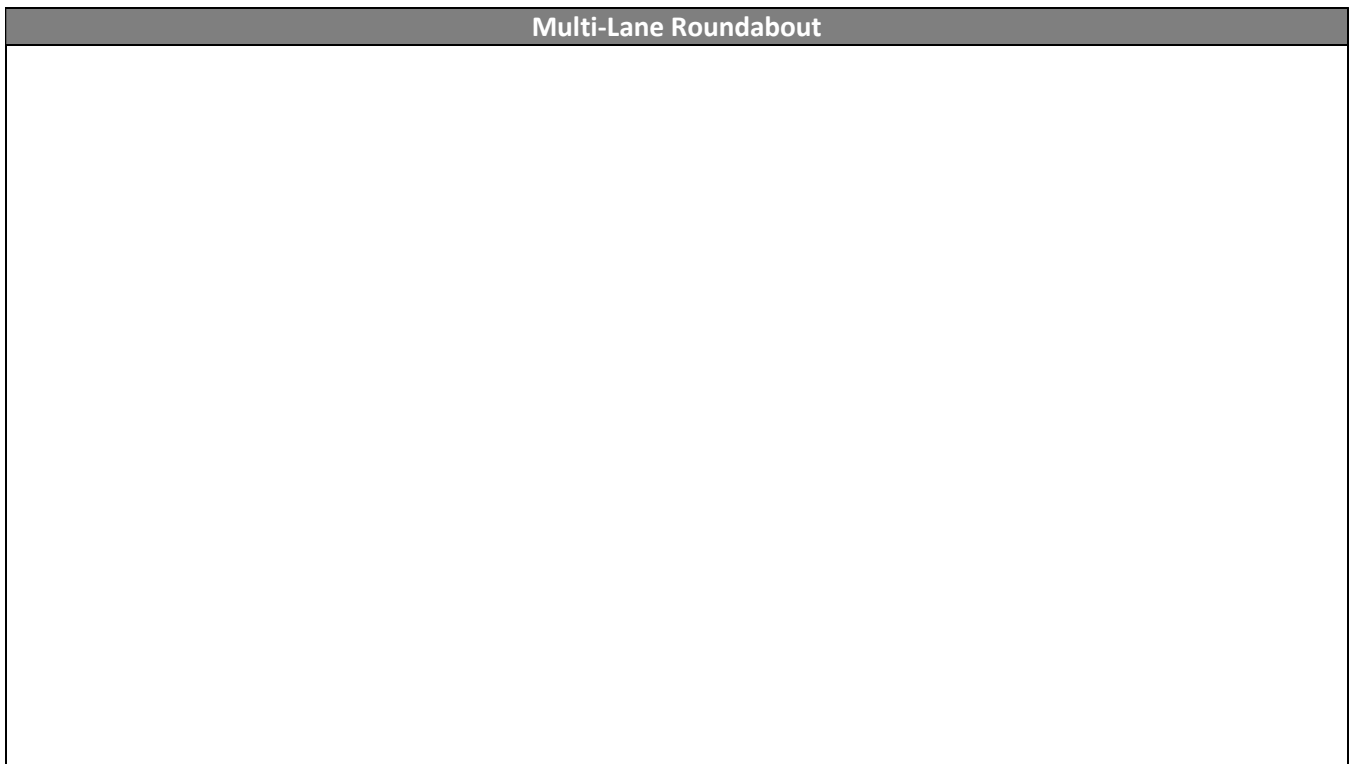
PREFERRED INTERSECTION ALTERNATIVE

The preferred alternative based on B/C ratio for this intersection is roundabout control.



City of Seaside Intersection Control Evaluation Study
Intersection 2.7b – Lightfighter Drive at SR-1 Northbound Ramps

INTERSECTION CONTROL CONCEPT LAYOUTS



INTERSECTION 2.8 – LIGHTFIGHTER DRIVE AT SECOND AVENUE

INTERSECTION CONTROL ALTERNATIVES

The two intersection control types analyzed include:

1. Existing Signal with optimized signal timing
2. Multi-lane Roundabout



EXISTING CONDITIONS AND PROJECT CONSTRAINTS

Lightfighter Dr at Second Ave is currently controlled by signals. Design constraints at the intersection include:

1. Driveway
2. Parking Lot
3. Right-of-way encroachment



QUALITATIVE ASSESSMENT



The following table summarizes qualitative factors that were considered in the design of each alternative.

Qualitative Assessment		Existing Control Feasibility	Roundabout Control Feasibility
INT 2.8	Lightfighter Dr at Second Ave		
	Urban Environment Focus	N/A	N/A
	Design for Pedestrians	X	X
	Design for Bicyclists	X	X
	Slow Traffic Speeds to Benefit Local Businesses	N/A	N/A
	Minimize ROW Acquisition to Limit Initial Costs		
Minimize Left-Turn Movements to Improve Safety		X	

**City of Seaside Intersection Control Evaluation Study
Intersection 2.8 – Lightfighter Drive at Second Avenue**

PERFORMANCE MEASURE SUMMARY

Four performance measures were evaluated at each intersection for signal and roundabout control. The table below summarizes the performance measures considered in this study.

Performance Measure	Preferred Alt.	Visual Representation									
Benefits											
<p>Safety</p> <p>Safety measures the societal cost associated with the predicted number and severity and collisions. Overall societal costs are based on Caltrans Vehicle Operation Cost Parameters. Injury and Fatality crashes are on average 700-1,000 times more expensive than Property Damage Only accidents.</p> <p align="center"></p> <p>— Signal — Roundabout</p>		 <table border="1"> <caption>Number of Incidents</caption> <thead> <tr> <th>Measure</th> <th>Signal</th> <th>Roundabout</th> </tr> </thead> <tbody> <tr> <td>Injury & Fatality</td> <td>2</td> <td>1.5</td> </tr> <tr> <td>Property Damage Only</td> <td>2</td> <td>10</td> </tr> </tbody> </table>	Measure	Signal	Roundabout	Injury & Fatality	2	1.5	Property Damage Only	2	10
Measure	Signal	Roundabout									
Injury & Fatality	2	1.5									
Property Damage Only	2	10									
<p>Delay</p> <p>Delay measures the societal cost associated with the number of person-hours delayed in traffic. Overall societal costs are based on Caltrans Vehicle Operation Cost Parameters.</p> <p align="center"></p> <p>— Signal — Roundabout</p>		 <table border="1"> <caption>Delay (sec/veh)</caption> <thead> <tr> <th>Time</th> <th>Signal</th> <th>Roundabout</th> </tr> </thead> <tbody> <tr> <td>AM</td> <td>30</td> <td>85</td> </tr> <tr> <td>PM</td> <td>35</td> <td>60</td> </tr> </tbody> </table>	Time	Signal	Roundabout	AM	30	85	PM	35	60
Time	Signal	Roundabout									
AM	30	85									
PM	35	60									
Costs											
<p>Operations and Maintenance</p> <p>O&M measures the common annualized costs associated with operating and maintaining the intersection.</p> <p align="center"></p> <p>— Signal — Roundabout</p>		 <table border="1"> <caption>Costs (\$)</caption> <thead> <tr> <th>Measure</th> <th>Signal</th> <th>Roundabout</th> </tr> </thead> <tbody> <tr> <td>Annual</td> <td>\$10,000</td> <td>\$2,000</td> </tr> <tr> <td>Life Cycle Discounted</td> <td>\$100,000</td> <td>\$100,000</td> </tr> </tbody> </table>	Measure	Signal	Roundabout	Annual	\$10,000	\$2,000	Life Cycle Discounted	\$100,000	\$100,000
Measure	Signal	Roundabout									
Annual	\$10,000	\$2,000									
Life Cycle Discounted	\$100,000	\$100,000									
<p>Initial Capital Cost</p> <p>Measures the Initial Capital Costs (ICC) needed to plan, design, obtain project approvals, acquire right-of-way, and construct the intersection control. This graph (right) depicts the estimated range of Initial capital costs for the signal and roundabout alternatives as well as the roundabout budget.</p> <p align="center"></p> <p>— RAB ICC Range — B/C=1 — Signal ICC Range ■ Estimated ICC ● ● RAB Budget</p>		 <table border="1"> <caption>Initial Capital Cost Comparison</caption> <thead> <tr> <th>Measure</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>Signal ICC Range</td> <td>\$1,000,000 - \$1,800,000</td> </tr> <tr> <td>Roundabout ICC Range</td> <td>\$2,000,000 - \$6,000,000</td> </tr> <tr> <td>RAB Budget</td> <td>\$3,500,000</td> </tr> </tbody> </table>	Measure	Value	Signal ICC Range	\$1,000,000 - \$1,800,000	Roundabout ICC Range	\$2,000,000 - \$6,000,000	RAB Budget	\$3,500,000	
Measure	Value										
Signal ICC Range	\$1,000,000 - \$1,800,000										
Roundabout ICC Range	\$2,000,000 - \$6,000,000										
RAB Budget	\$3,500,000										

**City of Seaside Intersection Control Evaluation Study
Intersection 2.8 – Lightfighter Drive at Second Avenue**

INTERSECTION LIFE CYCLE COST CALCULATIONS

Performance Measure Life Cycle Cost (Net Present Value)			
Safety			
	Existing (Signal)	Signal (Add. Lanes)	Roundabout
Annual Cost of Collisions	\$ 310,992	\$ 317,608	\$ 289,905
Discounted Life Cycle Cost of Collisions	\$ 4,362,950	\$ 4,455,774	\$ 4,067,130
Delay			
	Existing (Signal)	Signal (Add. Lanes)	Roundabout
Annual Quantity (hours)	83,624	14,361	27,037
Annual Cost	\$ 969,626	\$ 175,815	\$ 313,394
Total Discounted Life Cycle Cost	\$ 21,331,763	\$ 3,867,940	\$ 6,894,663
O&M			
	Existing (Signal)	Signal (Add. Lanes)	Roundabout
Annual O&M Costs	9,220	9,220	1,920
Discounted Life Cycle O&M Costs	\$ 129,349	\$ 129,349	\$ 26,936
Discounted Pavement Rehab Costs	\$ 80,324	\$ 80,324	\$ 72,718
Total O&M Costs	\$ 209,673	\$ 209,673	\$ 99,654
Initial Capital			
	Existing (Signal)	Signal (Add. Lanes)	Roundabout
High Approximation	\$ 80,000	\$ 1,250,000	\$ 3,500,000
Low Approximation	\$ 50,000	\$ 1,750,000	\$ 2,000,000
Life Cycle Benefit-Cost Ratio			
	Existing (Signal)	Total Benefits (B) Signal (Add. Lanes)	Roundabout
Safety	\$ -	\$ (92,823)	\$ 295,820
Delay	\$ -	\$ 17,463,823	\$ 14,437,100
Total Benefits	\$ -	\$ 17,370,999	\$ 14,732,920
	Existing (Signal)	Total Costs (C) Signal (Add. Lanes)	Roundabout
O&M	\$ -	\$ -	\$ (110,019)
Budget	\$ -	\$ 1,435,000	\$ 2,685,000
Total Costs	\$ -	\$ 1,435,000	\$ 2,574,981
B/C Ratio Compared to Existing	NA	12.11	5.72

**City of Seaside Intersection Control Evaluation Study
Intersection 2.8 – Lightfighter Drive at Second Avenue**

Benefit-Cost Ratio Calculations								
B/C Target	Capital Cost			Project Constraints		Total Benefits (e)	Total Costs (f) = (c + d)	B/C (g) = (e / f)
	Traffic Signal (a)	Roundabout (b)	Added Cost for Roundabout (c) = (b - a)	Added O&M Cost for Roundabout (d)				
High	\$ 1,750,000	\$ 2,000,000	\$ 250,000				\$ 139,879	NA-S
Low	\$ 1,250,000	\$ 3,500,000	\$ 2,250,000	\$ (110,121)	\$ (2,638,080)		\$ 2,139,879	NA-S
Roundabout Budget	\$ 1,500,000	\$ (1,027,959)	\$ (2,527,959)				\$ (2,638,080)	1.00

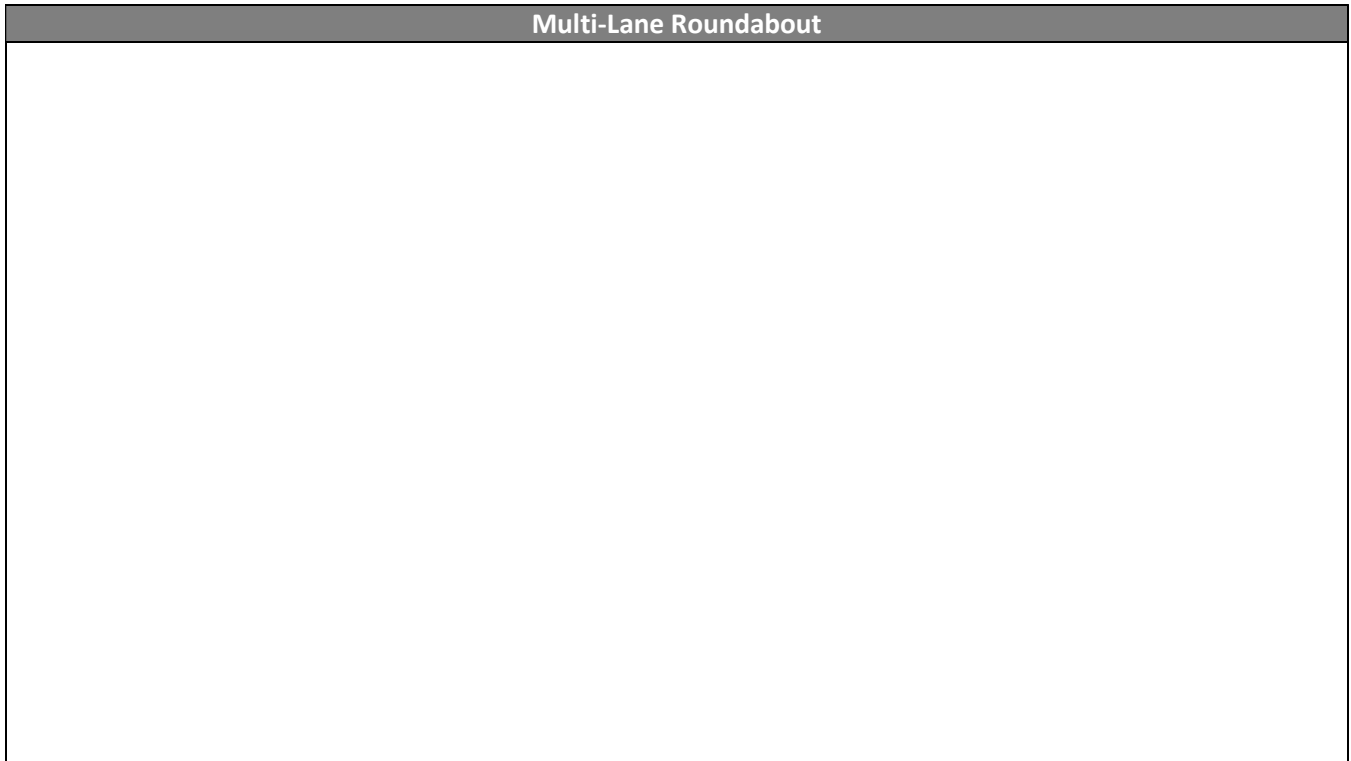
PREFERRED INTERSECTION ALTERNATIVE

The preferred alternative based on B/C ratio for this intersection is mini-roundabout control.



*City of Seaside Intersection Control Evaluation Study
Intersection 2.8 – Lightfighter Drive at Second Avenue*

INTERSECTION CONTROL CONCEPT LAYOUTS



INTERSECTION 2.9 – MESCAL STREET AT YOSEMITE STREET

INTERSECTION CONTROL ALTERNATIVES

The two intersection control types analyzed include:

1. Existing All-Way Stop Control
2. Mini-Roundabout



EXISTING CONDITIONS AND PROJECT CONSTRAINTS

Mescal St at Yosemite St is currently controlled by signals. Design constraints at the intersection include:

- | | |
|----------------------------|-------------------------------|
| 1. Single family residence | 4. Proximity to St. Helena St |
| 2. Driveway | 5. Proximity to Seminole Ct |
| 3. Bus Stop | 6. Right-of-way encroachment |



QUALITATIVE ASSESSMENT


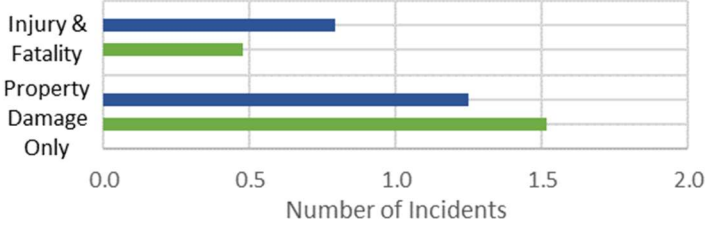



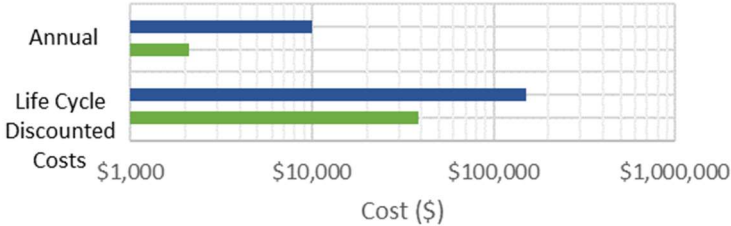

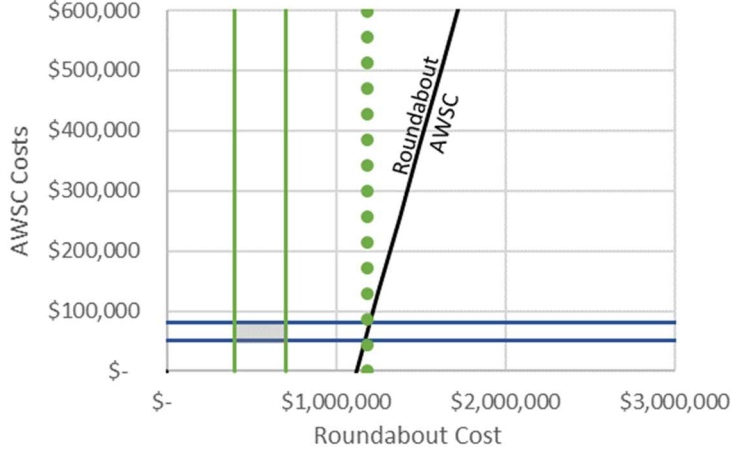
The following table summarizes qualitative factors that were considered in the design of each alternative.

Qualitative Assessment		Existing Control Feasibility	Roundabout Control Feasibility
INT 2.9	Mescal St a Yosemite St		
	Urban Environment Focus	X	X
	Design for Pedestrians	X	X
	Design for Bicyclists	X	X
	Slow Traffic Speeds to Benefit Local Businesses	N/A	N/A
	Minimize ROW Acquisition to Limit Initial Costs	X	X
Minimize Left-Turn Movements to Improve Safety		X	

City of Seaside Intersection Control Evaluation Study
Intersection 2.9 – Mescal Street at Yosemite Street

PERFORMANCE MEASURE SUMMARY

Four performance measures were evaluated at each intersection for stop control and roundabout control. The table below summarizes the performance measures considered in this study.

Performance Measure	Preferred Alt.	Visual Representation
Benefits		
<p>Safety</p> <p>Safety measures the societal cost associated with the predicted number and severity and collisions. Overall societal costs are based on Caltrans Vehicle Operation Cost Parameters. Injury and Fatality crashes are on average 700-1,000 times more expensive than Property Damage Only accidents.</p>		
<p>Delay</p> <p>Delay measures the societal cost associated with the number of person-hours delayed in traffic. Overall societal costs are based on Caltrans Vehicle Operation Cost Parameters.</p>		
Costs		
<p>Operations and Maintenance</p> <p>O&M measures the common annualized costs associated with operating and maintaining the intersection.</p>		
<p>Initial Capital Cost</p> <p>Measures the Initial Capital Costs (ICC) needed to plan, design, obtain project approvals, acquire right-of-way, and construct the intersection control. This graph (right) depicts the estimated range of Initial capital costs for the signal and roundabout alternatives as well as the roundabout budget.</p>		

**City of Seaside Intersection Control Evaluation Study
Intersection 2.9 – Mescal Street at Yosemite Street**

INTERSECTION LIFE CYCLE COST CALCULATIONS

Performance Measure Life Cycle Cost (Net Present Value)			
Safety			
		<u>Existing (AWSC)</u>	<u>Roundabout</u>
Annual Cost of Collisions	\$	128,664	\$ 58,394
Discounted Life Cycle Cost of Collisions	\$	1,805,047	\$ 819,217
Delay			
		<u>Existing (AWSC)</u>	<u>Roundabout</u>
Annual Quantity (hours)		1,614	710
Annual Cost	\$	21,563	\$ 9,480
Total Discounted Life Cycle Cost	\$	474,394	\$ 208,562
O&M			
		<u>Existing (AWSC)</u>	<u>Roundabout</u>
Annual O&M Costs		520	1,920
Discounted Life Cycle O&M Costs	\$	7,295	\$ 26,936
Discounted Pavement Rehab Costs	\$	10,750	\$ 8,418
Total O&M Costs	\$	18,046	\$ 35,354
Initial Capital			
		<u>Existing (AWSC)</u>	<u>Roundabout</u>
High Approximation	\$	200,000	\$ 3,500,000
Low Approximation	\$	100,000	\$ 2,000,000

Benefit-Cost Ratio Calculations								
B/C Target	Capital Cost			Project Constraints		Total Benefits (e)	Total Costs (f) = (c + d)	B/C (g) = (e / f)
	AWSC (a)	Roundabout (b)	Added Cost for Roundabout (c) = (b - a)	Added O&M Cost for Roundabout (d)				
High	\$ 80,000	\$ 400,000	\$ 320,000				\$ 215,254	4.71
Low	\$ 50,000	\$ 700,000	\$ 650,000	\$ (104,746)	\$ 1,013,653		\$ 545,254	1.86
Roundabout Budget	\$ 65,000	\$ 1,183,399	\$ 1,118,399				\$ 1,013,653	1.00

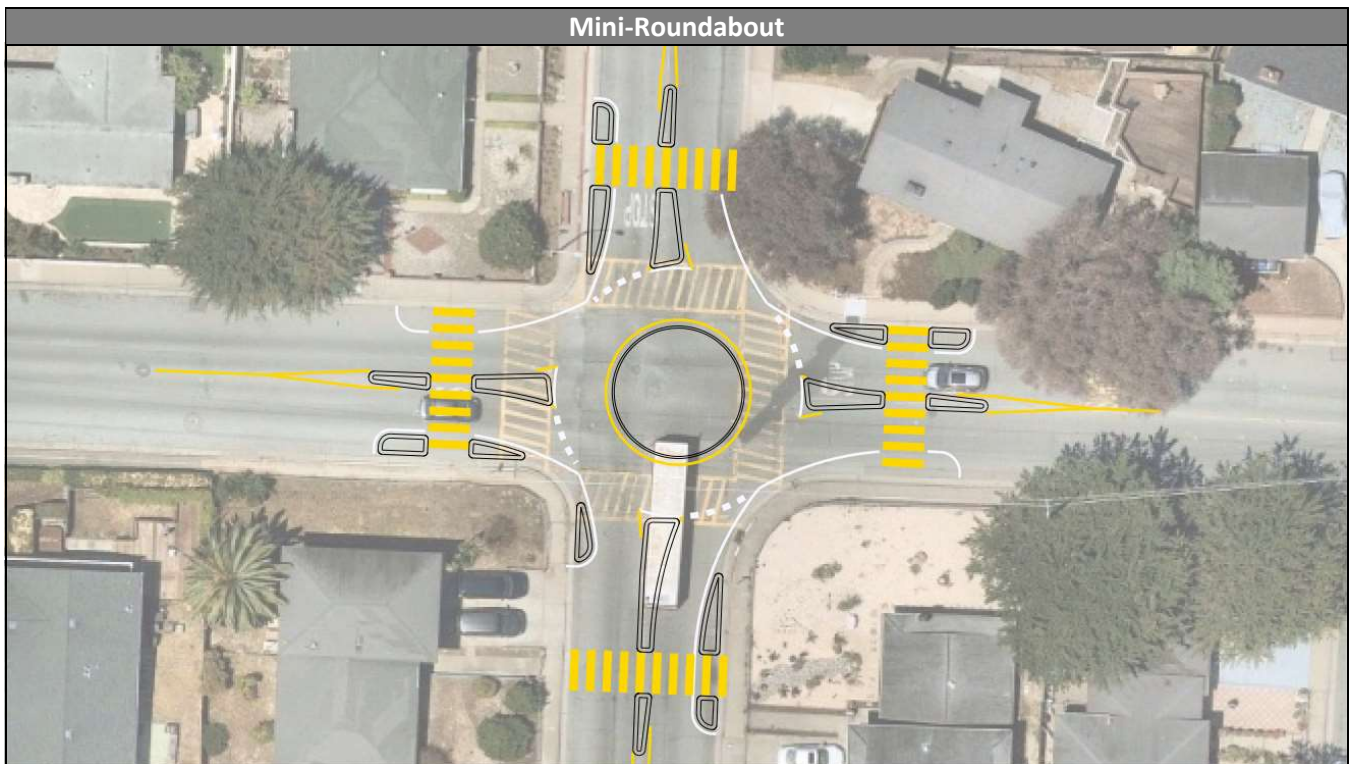
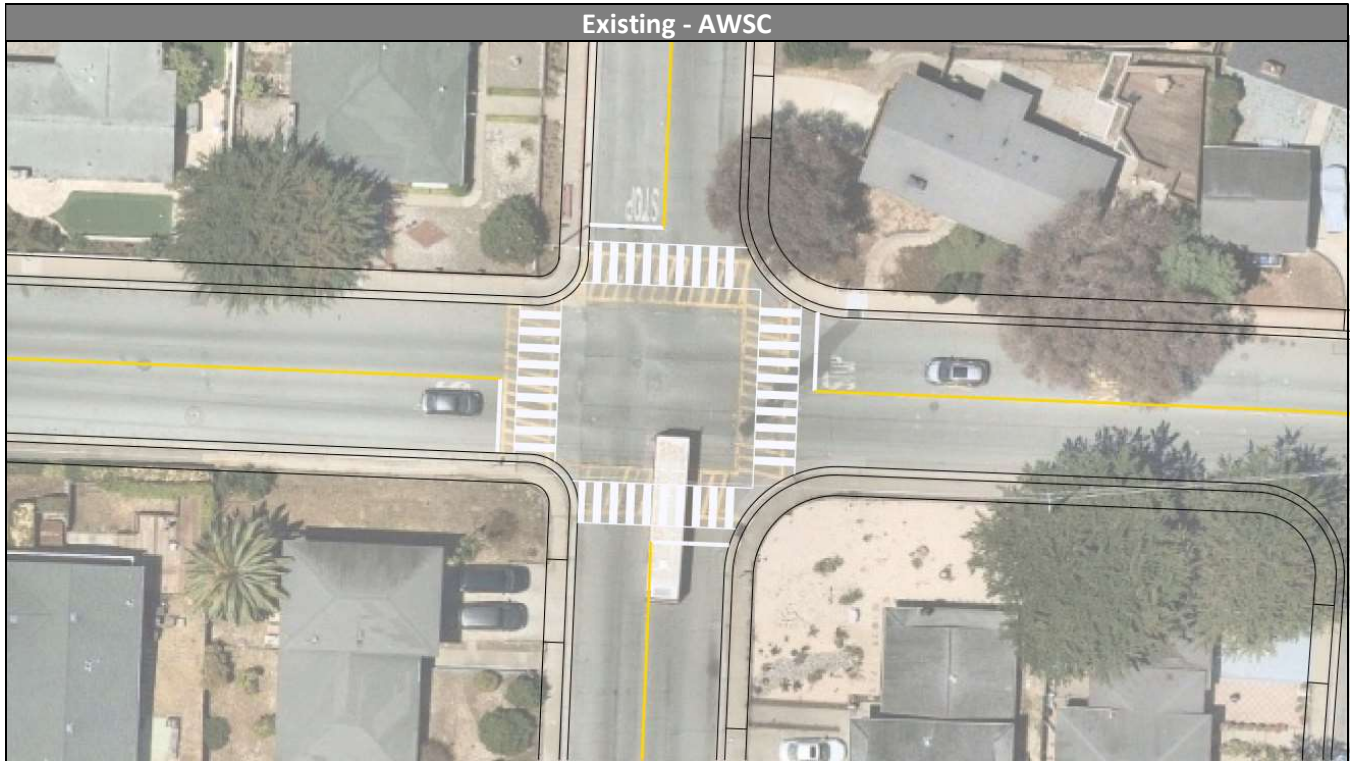
PREFERRED INTERSECTION ALTERNATIVE

The preferred alternative based on B/C ratio for this intersection is mini-roundabout control.



*City of Seaside Intersection Control Evaluation Study
Intersection 2.9 – Mescal Street at Yosemite Street*

INTERSECTION CONTROL CONCEPT LAYOUTS



INTERSECTION 2.10 – SAN PABLO AVENUE AT GENERAL JIM MOORE BOULEVARD

INTERSECTION CONTROL ALTERNATIVES

The two intersection control types analyzed include:

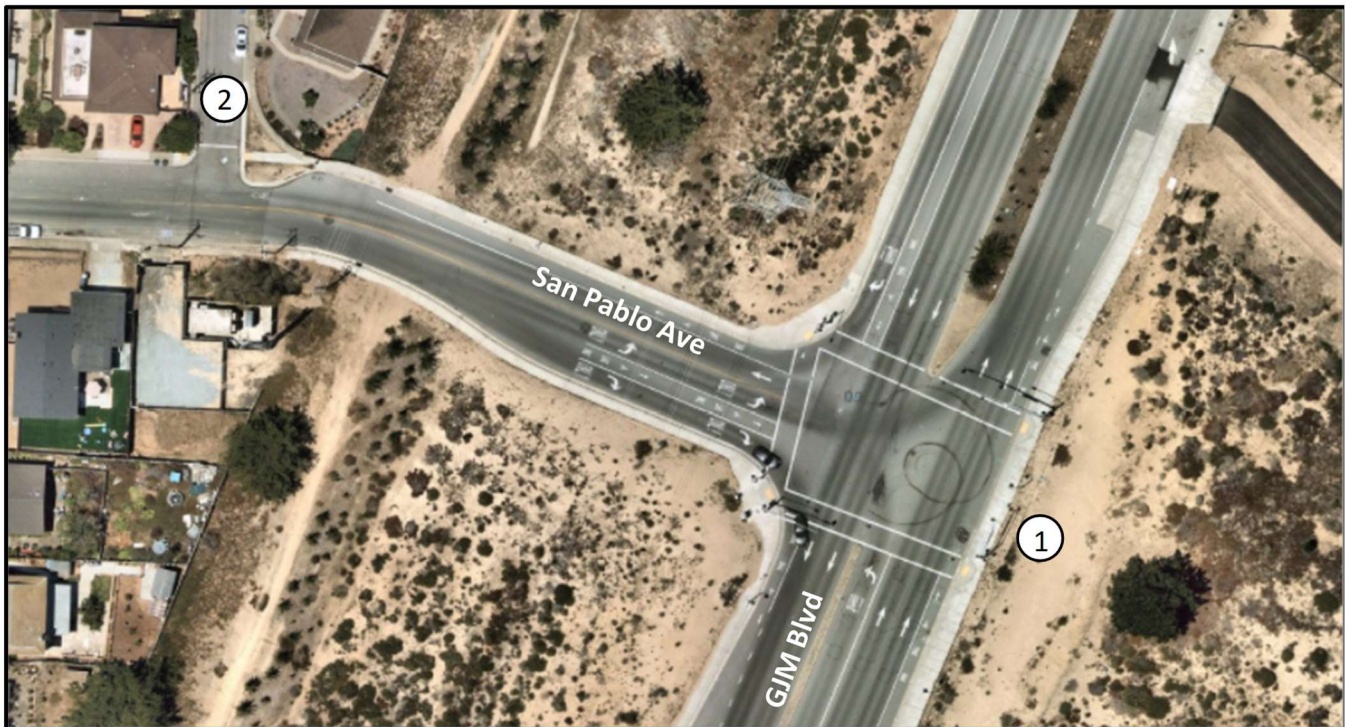
1. Existing Signal with Optimized Signal Timing
2. Multi-lane Roundabout



EXISTING CONDITIONS AND PROJECT CONSTRAINTS

San Pablo Ave at General Jim Moore Blvd is currently controlled by signals. Design constraints at the intersection include:

1. Steep uphill grade
2. Proximity to Mescal St



QUALITATIVE ASSESSMENT


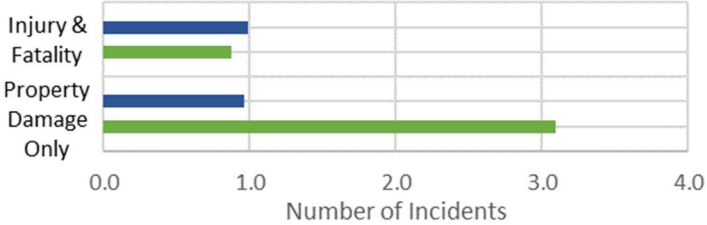

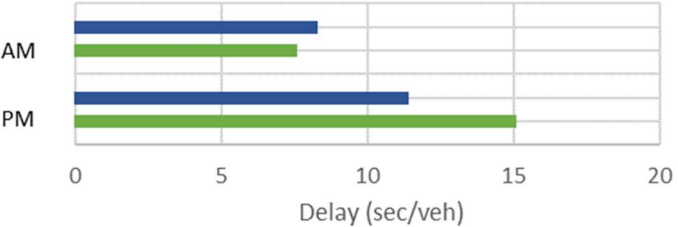

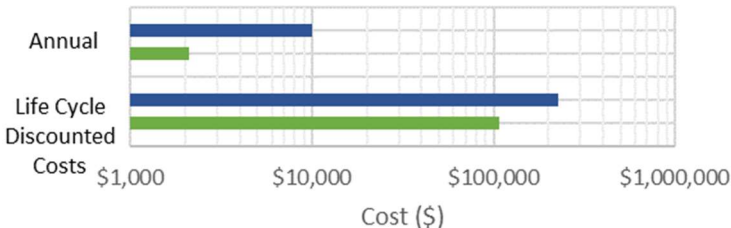

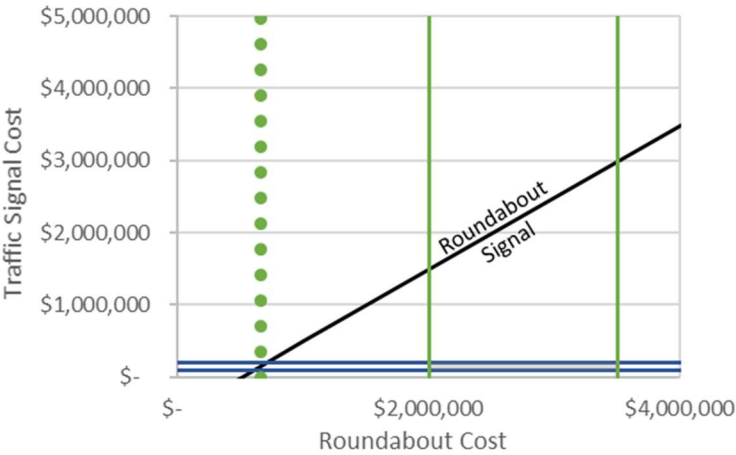
The following table summarizes qualitative factors that were considered in the design of each alternative.

Qualitative Assessment		Existing Control Feasibility	Roundabout Control Feasibility
INT 2.10	San Pablo Ave at GJM Blvd		
	Urban Environment Focus	N/A	N/A
	Design for Pedestrians	X	X
	Design for Bicyclists	X	X
	Slow Traffic Speeds to Benefit Local Businesses	N/A	N/A
	Minimize ROW Acquisition to Limit Initial Costs		
Minimize Left-Turn Movements to Improve Safety		X	

City of Seaside Intersection Control Evaluation Study
Intersection 2.10 – San Pablo Avenue at General Jim Moore Boulevard

PERFORMANCE MEASURE SUMMARY

Four performance measures were evaluated at each intersection for signal and roundabout control. The table below summarizes the performance measures considered in this study.

Performance Measure	Preferred Alt.	Visual Representation										
Benefits												
<p>Safety</p> <p>Safety measures the societal cost associated with the predicted number and severity and collisions. Overall societal costs are based on Caltrans Vehicle Operation Cost Parameters. Injury and Fatality crashes are on average 700-1,000 times more expensive than Property Damage Only accidents.</p> <p align="center"></p> <p>— Signal — Roundabout</p>		 <table border="1"> <caption>Number of Incidents</caption> <thead> <tr> <th>Measure</th> <th>Signal</th> <th>Roundabout</th> </tr> </thead> <tbody> <tr> <td>Injury & Fatality</td> <td>1.0</td> <td>0.8</td> </tr> <tr> <td>Property Damage Only</td> <td>1.0</td> <td>3.2</td> </tr> </tbody> </table>	Measure	Signal	Roundabout	Injury & Fatality	1.0	0.8	Property Damage Only	1.0	3.2	
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Time Period	Signal	Roundabout										
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City of Seaside Intersection Control Evaluation Study
Intersection 2.10 – San Pablo Avenue at General Jim Moore Boulevard

INTERSECTION LIFE CYCLE COST CALCULATIONS

Performance Measure Life Cycle Cost (Net Present Value)			
Safety			
		Existing (Signal)	Roundabout
Annual Cost of Collisions	\$	146,104	\$ 137,659
Discounted Life Cycle Cost of Collisions	\$	2,049,720	\$ 1,931,243
Delay			
		Existing (Signal)	Roundabout
Annual Quantity (hours)		3,395	3,739
Annual Cost	\$	43,104	\$ 46,583
Total Discounted Life Cycle Cost	\$	948,293	\$ 1,024,826
O&M			
		Existing (Signal)	Roundabout
Annual O&M Costs		9,220	1,920
Discounted Life Cycle O&M Costs	\$	129,349	\$ 26,936
Discounted Pavement Rehab Costs	\$	80,426	\$ 72,718
Total O&M Costs	\$	209,774	\$ 99,654
Initial Capital			
		Existing (Signal)	Roundabout
High Approximation	\$	200,000	\$ 3,500,000
Low Approximation	\$	100,000	\$ 2,000,000

Benefit-Cost Ratio Calculations							
B/C Target	Capital Cost		Added Cost for Roundabout (c) = (b - a)	Project Constraints		Total Costs (f) = (c + d)	B/C (g) = (e / f)
	Traffic Signal (a)	Roundabout (b)		Added O&M Cost for Roundabout (d)	Total Benefits (e)		
High	\$ 200,000	\$ 2,000,000	\$ 1,800,000			\$ 1,689,879	0.24
Low	\$ 100,000	\$ 3,500,000	\$ 3,400,000	\$ (110,121)	\$ 398,580	\$ 3,289,879	0.12
Roundabout Budget	\$ 150,000	\$ 658,701	\$ 508,701			\$ 398,580	1.00

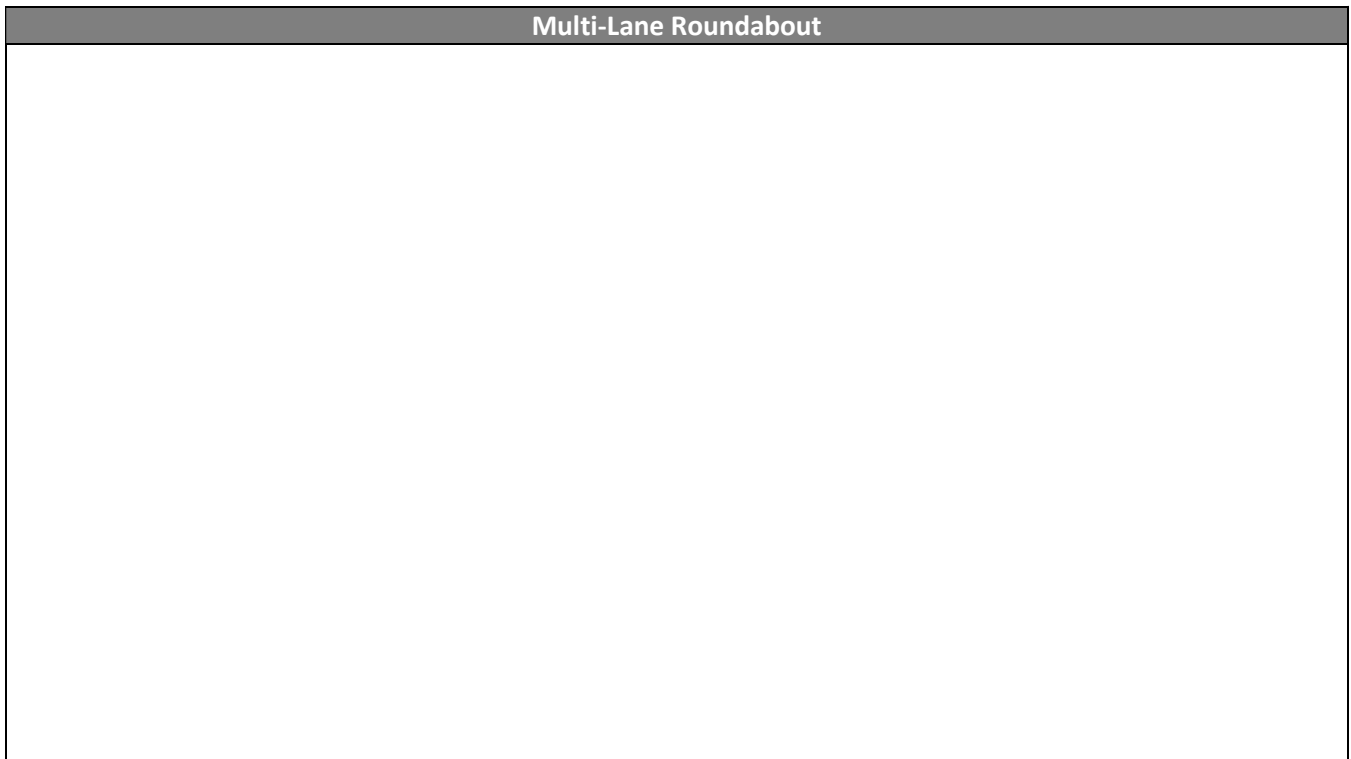
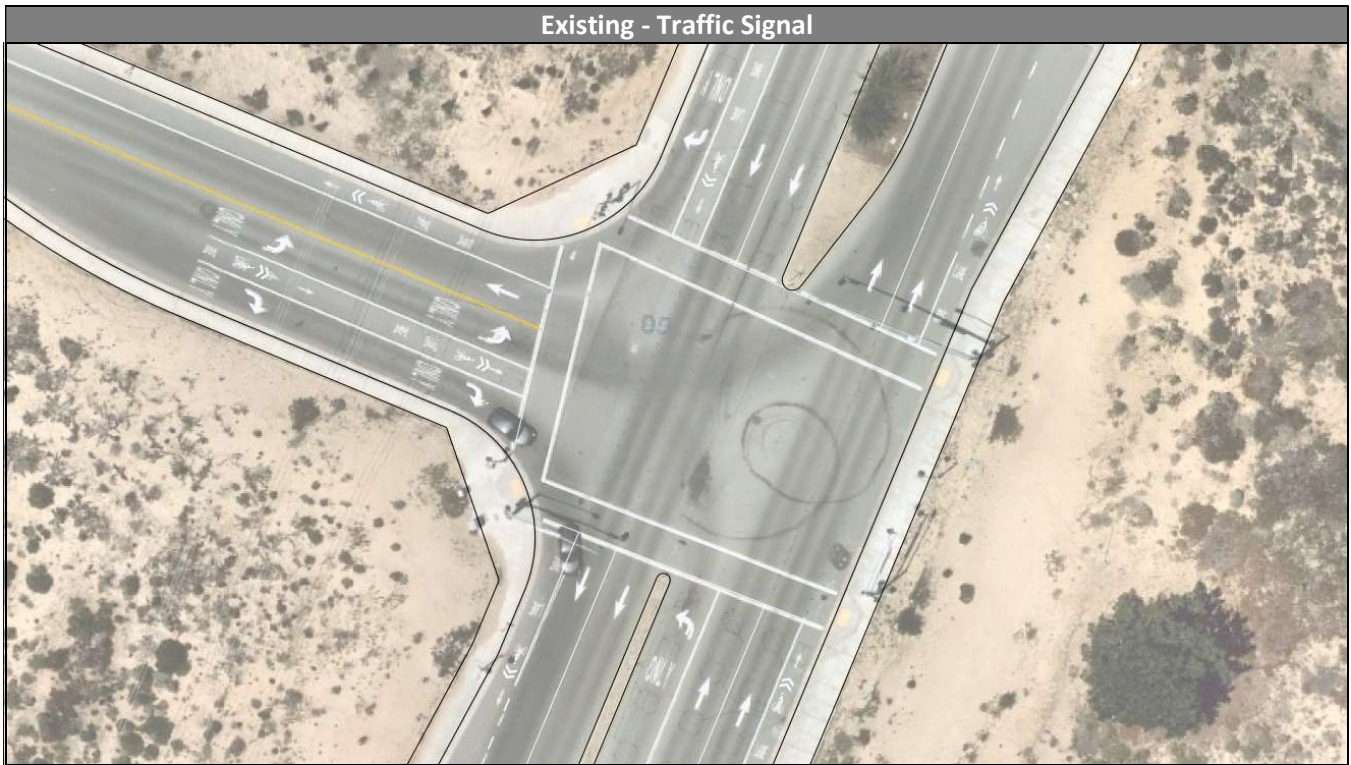


PREFERRED INTERSECTION ALTERNATIVE

The preferred alternative based on B/C ratio for this intersection is existing traffic signal control with optimized signal timing.

City of Seaside Intersection Control Evaluation Study
Intersection 2.10 – San Pablo Avenue at General Jim Moore Boulevard

INTERSECTION CONTROL CONCEPT LAYOUTS



INTERSECTION 2.11 – HILBY AVENUE AT GENERAL JIM MOORE BOULEVARD

INTERSECTION CONTROL ALTERNATIVES

The two intersection control types analyzed include:

1. Existing Signal with Optimized Signal Timing
2. Multi-lane Roundabout



EXISTING CONDITIONS AND PROJECT CONSTRAINTS

Hilby Ave at General Jim Moore Blvd is currently controlled by signals. Design constraints at the intersection include:

1. Proximity to Mescal St
2. Bus stop



QUALITATIVE ASSESSMENT

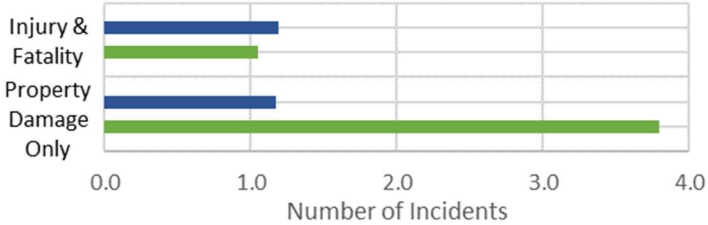

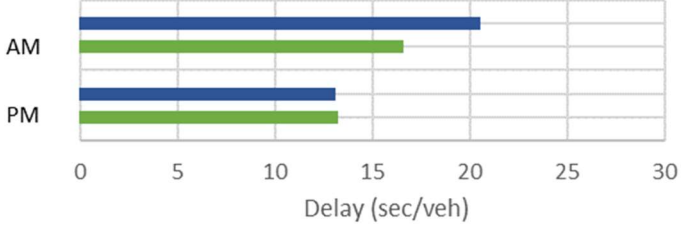

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INT 2.11	Hilby Ave at GJM Blvd		
	Urban Environment Focus	N/A	N/A
	Design for Pedestrians	X	X
	Design for Bicyclists	X	X
	Slow Traffic Speeds to Benefit Local Businesses	N/A	N/A
	Minimize ROW Acquisition to Limit Initial Costs		
	Minimize Left-Turn Movements to Improve Safety		X

City of Seaside Intersection Control Evaluation Study
Intersection 2.11 – Hilby Avenue at General Jim Moore Boulevard

PERFORMANCE MEASURE SUMMARY

Four performance measures were evaluated at each intersection for signal and roundabout control. The table below summarizes the performance measures considered in this study.

Performance Measure	Preferred Alt.	Visual Representation															
Benefits																	
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Roundabout Cost (\$)	Signal Cost (\$)	Roundabout Cost (\$)															
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~\$3,000,000	~\$200,000	~\$3,000,000															
~\$4,000,000	~\$200,000	~\$4,000,000															

City of Seaside Intersection Control Evaluation Study
Intersection 2.11 – Hilby Avenue at General Jim Moore Boulevard

INTERSECTION LIFE CYCLE COST CALCULATIONS

Performance Measure Life Cycle Cost (Net Present Value)			
Safety			
	<u>Existing (Signal)</u>	<u>Roundabout</u>	
Annual Cost of Collisions	\$ 178,403	\$ 168,464	
Discounted Life Cycle Cost of Collisions	\$ 2,502,842	\$ 2,363,402	
Delay			
	<u>Existing (Signal)</u>	<u>Roundabout</u>	
Annual Quantity (hours)	5,399	4,652	
Annual Cost	\$ 65,595	\$ 56,189	
Total Discounted Life Cycle Cost	\$ 1,443,091	\$ 1,236,162	
O&M			
	<u>Existing (Signal)</u>	<u>Roundabout</u>	
Annual O&M Costs	9,220	1,920	
Discounted Life Cycle O&M Costs	\$ 129,349	\$ 26,936	
Discounted Pavement Rehab Costs	\$ 80,426	\$ 72,718	
Total O&M Costs	\$ 209,774	\$ 99,654	
Initial Capital			
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High Approximation	\$ 200,000	\$ 3,500,000	
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Benefit-Cost Ratio Calculations								
B/C Target	Capital Cost		Added Cost for Roundabout (c) = (b - a)	Project Constraints		Total Benefits (e)	Total Costs (f) = (c + d)	B/C (g) = (e / f)
	Traffic Signal (a)	Roundabout (b)		Added O&M Cost for Roundabout (d)				
High	\$ 200,000	\$ 2,000,000	\$ 1,800,000				\$ 1,689,879	0.44
Low	\$ 100,000	\$ 3,500,000	\$ 3,400,000	\$ (110,121)	\$ 746,843		\$ 3,289,879	0.23
Roundabout Budget	\$ 150,000	\$ 1,006,964	\$ 856,964				\$ 746,843	1.00



INTERSECTION CONTROL CONCEPT LAYOUTS

The preferred alternative based on B/C ratio for this intersection is existing traffic signal control with optimized signal timing.

City of Seaside Intersection Control Evaluation Study
Intersection 2.11 – Hilby Avenue at General Jim Moore Boulevard

INTERSECTION CONTROL CONCEPT LAYOUTS

