Memorandum

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Project: SMX900-2

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Subject: Coleman and Ringwood Avenues Transportation Study – Evaluation Criteria Summary and Findings

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This memorandum summarizes the prioritization criteria and performance metrics used to evaluate the top street design alternatives for Coleman and Ringwood Avenues. The evaluation criteria were developed in the first phase of the study considering priorities and feedback from the community, stakeholders, and the project's advisory committees. Performance measures for the criteria were developed using industry standard operational and safety metrics.

Evaluation Criteria Description

A series of key objectives were identified at the beginning of the Study that were used to guide development of the design alternatives. These objectives reflect the key takeaways from the community engagement efforts that provide a framework for achieving the overarching goal, which is to improve mobility for active modes of transportation and improve safety for all roadway users. The purpose of the evaluation criteria is to measure how well an alternative meets the key objectives and to provide an opportunity to compare the benefits and drawbacks of each of the alternatives. The key objectives that were developed are as follows.

- Improve safety by reducing the frequency and severity of collisions.
- Reduce vehicle travel speeds, especially where different user groups interact or share space.
- Create greater separation of physical space for pedestrians and bicyclists from motor vehicles.
- Improve the level of perceived comfort for pedestrians and bicyclists.
- Provide continuity for pedestrians and bicyclists from one side of the corridors to the other.
- Preserve the character of the neighborhood, including trees, greenery, neighborhood circulation patterns, as well as parking (City segment of Coleman Avenue only).

Based on the key objectives, the following list of evaluation criteria were developed. Descriptions and additional information related to the application of each criterion are summarized in Table 1.

Table 1 – Evaluation Criteria Description

Criterion	Description and Metric
Collision Reduction	The safety benefit of an alternative will be assessed based on the corridor collision history and anticipated effectiveness of countermeasures identified by the Federal Highway Administration (FHWA) and outlined in the Caltrans Local Roadway Safety Manual (LRSM). Alternatives that are better expected to reduce collisions will receive more credit.
Speed Reduction	The effectiveness of traffic calming measures will be estimated using available guidance published by the Institute of transportation Engineers (ITE). Alternatives that are expected to have a greater impact on speed reduction will receive more credit.
Bicycle Comfort	The Bicycle Level of Traffic Stress (BLTS) methodology, as defined by the Mineta Transportation Institute, will be used to quantify the comfort level for cyclists on-street and off-street under each alternative considering factors such as travel speed, traffic volume, number of travel lanes, parking turnover, etc. Alternatives with lower BLTS scores will receive more credit.
Pedestrian Comfort	A Pedestrian Level of Traffic Stress (PLTS) methodology will be used to quantify the comfort level for pedestrians under each alternative. Alternatives with lower PLTS scores will receive more credit.
Tree Preservation	The number of trees that may be impacted for construction of the improvements will be estimated. Alternatives that result in the preservation of more trees will score higher.
Parking Retention (City Only)	The number of existing on-street parking spaces that would need to be removed under each alternative within the City segment of Coleman Avenue will be identified. The alternatives that retain more existing parking spaces will score higher.

Sources and links to additional information:

Caltrans Local Roadway Safety Manual	https://dot.ca.gov/-/media/dot-media/programs/local-assistance/documents/hsip/2022/lrsm2022.pdf
ITE Traffic Calming Fact Sheets	https://www.ite.org/technical-resources/traffic-calming/traffic-calming-measures/
Bicycle Level of Traffic Stress	https://transweb.sjsu.edu/sites/default/files/1005-low-stress-bicycling-network-connectivity.pdf

Each alternative will be evaluated based on how well it supports or meets the evaluation criteria using "Consumer Reports" style ratings, as indicated below. The intent of this exercise is not to simply tally results to identify a preferred alternative, but rather to use the evaluation criteria to help recognize the strengths and weaknesses of each alternative to better inform discussion of potential tradeoffs within the community.

● = Alternative fully meets criterion

◕ = Alternative mostly meets criterion

◑ = Alternative partially meets criterion

◔ = Alternative minimally meets criterion

○ = Alternative does not meet criterion

Evaluation Criteria Results

This section summarizes the results of evaluation criteria that were applied to the two alternatives for each corridor that received the most support within the community. These results were reviewed and refined based on input from the community and the project's advisory committees.

Coleman Avenue (Menlo Oaks)

The evaluation criteria findings for the County segment of Coleman Avenue are summarized in Table 2 and further discussed below.

Table 2 – Evaluation Criteria Results for Coleman Avenue (Menlo Oaks)

Design Alternative	Collision Reduction	Speed Reduction	Bicycle Comfort (On -Street)	Bicycle Comfort (Off-Street)	Pedestrian Comfort	Tree Preservation
Retain Existing Conditions	○	◔	◔	○	○	●
Alternative 1 Bike Lanes with Narrower Off-Street Pathway	●	◕	◕	◕	●	◑
Alternative 2 Bike Boulevard with Wider Off-Street Pathway	◕	●	◑	●	◕	◔

Collision Reduction

Crash Reduction Factors (CRFs) were the metric used to assess this criterion. CRFs are values associated with countermeasures (i.e., new bike lanes, enhanced pedestrian crossing, streetlighting, etc.) that estimate the percentage reduction in crashes that a given facility would experience after implementation of a countermeasure. For the purposes of this assessment, CRFs developed by the Federal Highway Administration (FHWA) as outlined in the *Local Roadway Safety Manual* (LRSM), Caltrans, 2022, were applied. It's important to note that CRFs are specific to collisions that would be corrected by an individual improvement measure so the total percentages are not cumulative.

The existing condition on this segment of Coleman Avenue has limited safety features; therefore, an empty circle was used as the baseline. Both of the top alternatives include numerous improvement measures with associated CRFs as indicated below; the percentage reduction in crashes relevant to each measure is shown in parenthesis.

- Install new intersection lighting (40%)
- Install/upgrade intersection warning signs (15%)
- Upgrade intersection pavement markings (25%)
- Upgrade existing pedestrian crossings (35%)
- Install new uncontrolled pedestrian crossing (25%)
- Improve sight distance to intersection (20%)
- Install new sidewalk/pathway (80%)
- Install bike lanes (35%) – Alternative 1 Only

Both of the top design alternatives would be expected to result in a substantial safety benefit to the corridor over existing conditions. As Alternative 1 includes the installation of Class II bike lanes and Alternative 2 requires cyclists to share the travel lanes with motorists Alternative 1 was given a full circle and Alternative 2 three-quarters of a circle.

Speed Reduction

The average speed reduction for various traffic calming measures, as published by the Institute of Transportation Engineers (ITE) in their traffic calming fact sheets, was used as the metric to assess this criterion. Traffic calming measures are highly context-specific and as a result their benefits are difficult to quantify. The effectiveness of a given measure depends on a variety of factors so is typically expressed as a range of expected percentage reduction in average travel speed.

The existing condition on the County segment of Coleman Avenue has limited speed reduction measures, including roadside parking in several locations and mini traffic circles, so a quarter circle was used as the baseline condition. However, both of the top alternatives include numerous traffic calming measures including the following: the expected reduction in average travel speed is shown in parenthesis for those measures that have published data.

- Narrower travel lanes
- Speed tables (20 to 25%)
- Enhancing the traffic circles protecting trees
- Centerline and edge line striping
- Speed feedback signs
- Speed reduction markings
- Tighter turning radii

Both of the top design alternatives include a package of traffic calming improvements that would be expected to result in reduced travel speeds, though Alternative 1 would result in the widening of the existing paved area for the installation of bike lanes whereas Alternative 2 retains the existing street width so Alternative 1 was given three-quarters of a circle and Alternative 2 a full circle.

Bicycle Comfort (On-Street)

The Bicycle Level of Traffic Stress (BLTS) methodology, as defined by the Mineta Transportation Institute, was used to quantify the comfort level for cyclists within the street under each alternative considering factors such as travel speed, traffic volume, number of travel lanes, parking turnover, etc. This methodology scores facilities as having stress levels ranging from 1 to 4, with higher-stress facilities translating to a higher score. Definitions of the stress levels are provided in Plate 1. The breakpoints for the scoring are summarized in Table 3 and Table 4.

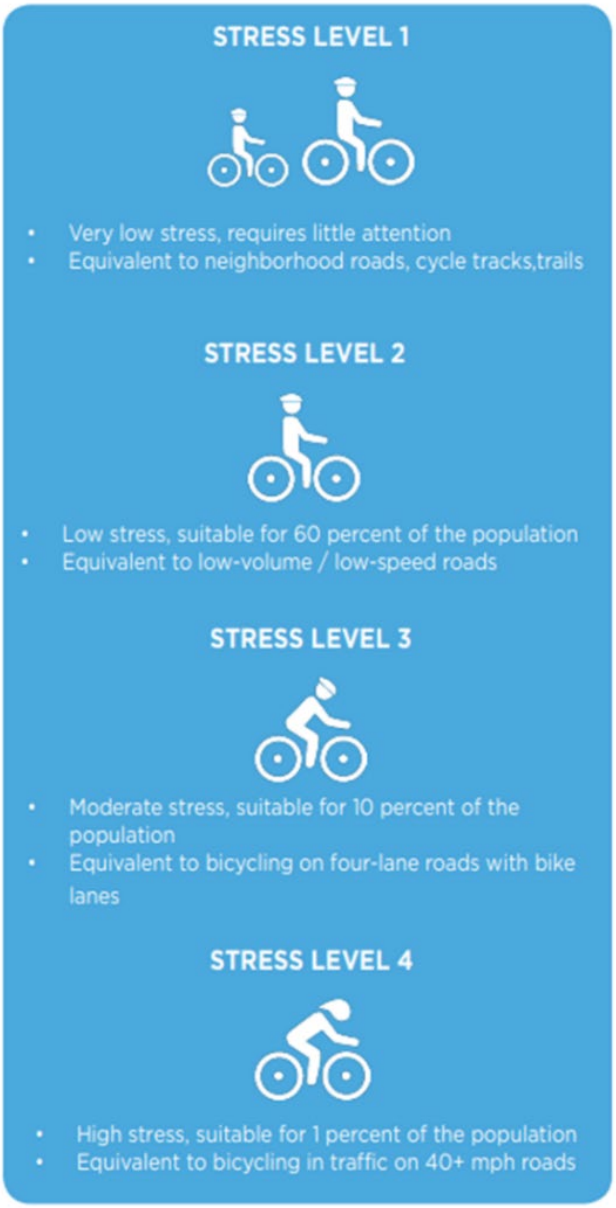

Plate 1 Bicycle Level of Traffic Stress

Table 3 – Bicycle Level of Traffic Stress - Mixed Traffic Criteria

Number of Lanes	Average Daily Traffic (ADT)	85th Percentile Speed (mph)						
		0-23.5	23.5-28.5	28.5-33.5	33.5-38.5	38.5-43.5	43.5-48.5	48.5+
2-way street with no centerline	0-750	1	1	2	2	3	3	3
	751-1,500	1	1	2	3	3	3	3
	1,501-3,000	2	2	2	3	3	4	4
	3,001+	2	2	3	3	4	4	4
2-way with 1 lane per direction and centerline, or wide* 1-way, 1-lane	0-1,000	1	1	2	2	3	3	3
	1,000-1,500	2	2	2	3	3	4	4
	1,501+	2	3	3	3	4	4	4
2 thru lanes per direction	0-8,000	3	3	3	3	4	4	4
	8,001+	3	3	4	4	4	4	4
3 thru lanes per direction	Any ADT	3	3	4	4	4	4	4

Notes * A one-way street is "narrow" if its width is less than 30 ft with parking on both sides, less than 22 ft with parking on one side, or less than 15 ft with no parking. Otherwise, it is "wide." 85th percentile speed is used to set speed limits and is the speed at which 85 percent of the users drive at or below.

Table 4 – Bicycle Level of Traffic Stress - Bicycle Lanes not Adjacent to Parking Lane Criteria

Number of Lanes	Bike Lane Width (ft)	85th Percentile Speed (mph)					
		0-28.5	28.5-33.5	33.5-38.5	38.5-43.5	43.5-48.5	48.5+
1 thru lane per direction or contraflow lane	6+ ft	1	1	2	3	3	3
	< 6ft	2	2	2	3	3	4
2 thru lanes per direction	6+ ft	2	2	2	3	3	3
	< 6ft	2	2	2	3	4	4
3+ thru lanes per direction	Any Width	3	3	3	4	4	4

Based on the existing roadway characteristics, travel speeds, and traffic volumes on Coleman Avenue, the segment within the County has a BLTS score of 3. The installation of bike lanes associated with Alternative 1 would result in a BLTS score of 2. While Alternative 2 would also result in a BLTS score of 3 using this methodology, because the alternative includes numerous traffic calming measures not reflected in the methodology, in actuality the alternative would score somewhere in between the existing condition and Alternative 1. As a result, a quarter circle was given for existing conditions, three-quarters of a circle for Alternative 1, and a half circle for Alternative 2.

The BLTS scores for each alternative and street segment are summarized in Table 5.

Table 5 – Bicycle Level of Traffic Stress Assessment

	Existing	Alternative 1	Alternative 2
Coleman Ave (Menlo Oaks)	3	2	3
Coleman Ave (City)	3	3	3
Ringwood Ave	3	1	3

Bicycle Comfort (Off-Street)

The BLTS methodology is mostly applicable to on-street bicycle facilities, but since both design alternatives include an off-street pathway that could be used by cyclists, consideration was also given to the off-street comfort level for cyclists including pathway width, separation from the travel way, and use of the facility by pedestrians. There is no existing off-street bicycle facility on Coleman Avenue so an empty circle was used as the baseline. While both alternatives include a pathway that would largely satisfy this criterion, because the pathway in Alternative 2 would be wider than Alternative 1 it would provide a more comfortable facility for cyclists, especially considering that the space would be shared with pedestrians. A wider pathway would translate to easier passing maneuvers. Therefore, Alternative 1 was given three-quarters of a circle and Alternative 2 was given a full circle.

Pedestrian Comfort

Pedestrian Level of Traffic Stress (PLTS) is less widely used than BLTS, and there is not a methodology that has currently gained widespread acceptance. Part of the challenge in developing a PLTS method is the amount of data that would need to be collected to accurately assess the level of comfort pedestrians experience, particularly at intersections. For the purposes of this study, the PLTS method was generally based on the approach used to evaluate the BLTS and methodologies used by other jurisdictions, focusing on conditions along each segment of roadway that was analyzed.

PLTS was calculated using the following variables:

a) Sidewalks and Pathways – Segments were evaluated based on the presence of:
    1. Complete sidewalks or pathways on at least one side of the street;
    2. At least 50 percent of completed sidewalk or pathway on one side of the street; and
    3. Less than 50 percent of sidewalk or pathway on one side of the street completed.
b) Buffer – Segments were evaluated based on the separation pedestrians have from traffic due to the presence of a planting strip, bike lanes, or a parking lane.
c) Traffic volumes
d) Prevailing vehicle speeds

The application of these variables to generate the PLTS scores is summarized in Table 6.

Table 6 – Roadway Segment Pedestrian Level of Traffic Stress Methodology

Sidewalks	Buffer	ADT	85th Percentile Speed (mph)					
			≤ 25	30	35	40	45	50+
Complete	Yes	<3,000	1	1	1	2	3	3
		3,001-8,000	1	1	2	3	3	4
		>8,000	1	2	3	3	4	4
	No	<3,000	2	2	3	3	4	4
		3,001-8,000	2	2	3	4	4	4
		>8,000	3	3	4	4	4	4
Gaps up to 50%	Yes	<3,000	2	2	3	3	4	4
		3,001-8,000	3	3	3	4	4	4
		>8,000	3	3	4	4	4	4
	No	<3,000	3	4	4	4	4	4
		3,001-8,000	4	4	4	4	4	4
		>8,000	4	4	4	4	4	4

Table 6 – Roadway Segment Pedestrian Level of Traffic Stress Methodology

Sidewalks	Buffer	ADT	85th Percentile Speed (mph)					
			≤ 25	30	35	40	45	50+
<50% Complete	Yes	<3,000	3	3	3	4	4	4
		3,001-8,000	3	3	4	4	4	4
		>8,000	3	4	4	4	4	4
	No	<3,000	4	4	4	4	4	4
		3,001-8,000	4	4	4	4	4	4
		>8,000	4	4	4	4	4	4

The Menlo Oaks segment of Coleman Avenue contains no existing sidewalks or formal pathways, though unpaved shoulders are present in some locations. These facilities are inadequate in terms of providing pedestrian access as the shoulders are of inconsistent width, with trees at several locations approaching the edge of the roadway. There are also notable drainage issues along the street, and when it rains, shoulders can become inaccessible for pedestrians. The shoulders also do not meet the needs of people with mobility impairments. Together, these factors result in many pedestrians being forced to share the roadway with vehicles. As a result, this segment was evaluated as a sidewalk gap for the existing condition. Based on an 85th percentile speed of 29 miles per hour (mph) and a traffic volume of 3,500 vehicles per day, the PLTS score is 3. The provision of an off-street pathway identified in both alternatives would improve the score to 1 under Alternative 1 due to the buffer of the bike lane between the pathway and the travel lanes and to PLTS 2 under Alternative 2. Further, because Alternative 2 does not include dedicated on-street bike facilities, pedestrians would have to share the pathway with cyclists so a full circle was given to Alternative 1 and three-quarters of a circle to Alternative 2.

The PLTS scoring for all three corridors is summarized in Table 7.

Table 7 – Pedestrian Level of Traffic Stress Assessment

	Existing	Alternative 1	Alternative 2
Coleman Ave (Menlo Oaks)	3	1	2
Coleman Ave (City)	1	1	1
Ringwood Ave	2	1	1

Tree Preservation

It is estimated that up to 19 of the approximately 130 existing trees within the public right-of-way would be impacted under Alternative 1, while up to 27 trees would potentially be impacted under Alternative 2. The actual number of trees that would be impacted would be subject to final design details and the expertise of an arborist. No trees would need to be removed under the no build alternative. As a result, a full circle was used as the baseline, a half circle was assigned to Alternative 1 and a quarter circle was assigned to Alternative 2 since it would result in the removal of roughly twice as many trees as Alternative 1.

Coleman Avenue (City of Menlo Park)

The evaluation criteria findings for the City segment of Coleman Avenue are summarized in Table 8 and further discussed below.

Table 8 – Evaluation Criteria Results for Coleman Avenue (City)

Design Alternative	Collision Reduction	Speed Reduction	Bicycle Comfort (On - Street)	Bicycle Comfort (Off-Street)	Pedestrian Comfort	Tree Preservation	Parking Retention
Retain Existing Conditions	○	○	◔	○	●	●	●
Alternative 1 Bike Boulevard with Raised Concrete Pathway (Parking on one Side)	●	●	◑	●	●	●	◑
Alternative 2 Bike Boulevard (Parking on both Sides)	◕	◕	◑	○	●	●	●

Collision Reduction

The existing condition on the City segment of Coleman Avenue has limited safety features; therefore, an empty circle was used as the baseline. However, both of the top alternatives include numerous improvement measures with associated CRFs as indicated below; the percentage reduction in crashes relevant to each measure is shown in parenthesis.

- Install/upgrade intersection warning signs (15%)
- Upgrade intersection pavement markings (25%)
- Upgrade/new enhanced pedestrian crossings (35%)
- Install new uncontrolled pedestrian crossing (25%)
- Install edge lines and centerline (25%)
- Convert intersection to AWSC (40%)
- Install new sidewalk/pathway (80%) – Alternative 1 only

Both of the top design alternatives would be expected to result in a substantial safety benefit to the corridor over existing conditions, though Alternative 1 also includes the installation of an expanded sidewalk area that would function as a shared use pathway and Alternative 2 would require cyclists to share the travel lanes with motorists so Alternative 1 was given a full circle and Alternative 2 three-quarters of a circle.

Speed Reduction

The existing condition on the City segment of Coleman Avenue has limited to no speed reduction measures so an empty circle was used as the baseline condition. However, both of the top alternatives include numerous traffic calming features including the following: the expected reduction in average travel speed is shown in parenthesis for those measures that have published data.

- Narrower travel lanes
- Speed tables (20 to 25%)
- Curb extensions/bulb-outs
- Centerline and edge line striping

Both of the top design alternatives include a package of traffic calming improvements that would be expected to result in reduced travel speeds, though Alternative 1 would result in the narrowing of the existing paved curb-to-curb width whereas Alternative 2 would retain the existing street width so Alternative 1 was given a full circle and Alternative 2 three-quarters of a circle.

Bicycle Comfort (On-Street)

Based on the existing roadway characteristics, travel speeds, and traffic volumes on Coleman Avenue, the segment within the City has a BLTS score of 3. Due to limitations in the methodology that do not account for the presence of traffic calming measures, both alternatives would continue to result in a BLTS of 3; however, the reduction in vehicle travel speeds would result in a more comfortable on-street cycling experience. As a result, a quarter circle was used as the baseline score and both alternatives were given a half circle.

Bicycle Comfort (Off-Street)

There are currently no off-street cycling facilities on Coleman Avenue, nor would any be provided under Alternative 2. However, Alternative 1 includes a new shared use facility on the north side of the corridor that could be used by cyclists who do not want to ride in the street. As a result, an empty circle was applied as the baseline and to Alternative 2, while Alternative 1 was given a full circle.

Pedestrian Comfort

Sidewalks are currently provided on both sides of the street and complete sidewalk or pathway coverage would be provided with both design alternatives. Based on an 85th percentile speed of 29 mph and an ADT of 3,200, the existing condition and both design alternatives would have a PLTS score of 1, therefore, all were given full circles.

Tree Preservation

No trees would need to be removed within the City; therefore, all alternatives were given full circles for tree preservation.

Parking Retention

The no-build alternative and Alternative 2 would retain all existing parking spaces on Coleman Avenue in the City while Alternative 1 includes removal of parking on one side of the street, representing approximately half of the existing parking supply. Therefore, full circles were given to existing conditions and to Alternative 2 and a half circle was given to Alternative 1.

Ringwood Avenue (near Menlo Atherton High School)

The evaluation criteria findings for Ringwood Avenue are summarized in Table 9 and discussed further below. For the purposes of this exercise, the segment near Menlo Atherton High School was evaluated since the design alternatives vary the most near the high school but are largely the same for the rest of the corridor.

Table 9 – Evaluation Criteria Summary for Ringwood Avenue

Design Alternative	Collision Reduction	Speed Reduction	Bicycle Comfort (On-Street)	Bicycle Comfort (Off-Street)	Pedestrian Comfort	Tree Preservation
Retain Existing Conditions	◔	○	◑	○	◑	●
Alternative 1 Bike Lanes with Raised Separation Device and Asphalt Pathway	●	●	●	●	●	◑
Alternative 2 Combination Bike and Shared Lanes with Asphalt Pathway	◕	●	◕	●	◕	◑

Collision Reduction

The existing condition on Ringwood Avenue has limited safety features, though a Class II bike lane is provided on one side of the street near the high school; therefore, a quarter-circle was used as the baseline. However, both of the top alternatives include numerous improvement measures with associated CRFs as noted below; the percentage reduction in crashes relevant to each measure is shown in parenthesis.

- Install new intersection lighting (40%)
- Install/upgrade intersection warning signs (15%)
- Upgrade intersection pavement markings (25%)
- Upgrade/new enhanced pedestrian crossings (35%)
- Install new uncontrolled pedestrian crossing (25%)
- Install new sidewalk/pathway (80%)
- Install separated bike lanes (45%) – Alternative 1 only

Both of the top design alternatives would be expected to result in a substantial safety benefit to the corridor over existing conditions, though Alternative 1 also includes the installation of protected bike lanes in front of the schools with a raised separation device between the bike lane and travel lanes. Additionally, Alternative 1 would provide a continuous dedicated bike lane all the way to the intersection with Middlefield Road while Alternative 2 would retain the existing right-turn lane at the high school, requiring cyclists to share the travel lane with motorists, so Alternative 1 was given a full circle and Alternative 2 three-quarters of a circle.

Speed Reduction

Ringwood Avenue has either limited or no existing speed reduction measures, so an empty circle was used as the baseline condition. Both of the top alternatives include the following traffic calming measures; the expected reduction in average travel speed is shown in parenthesis for those measures that have published data.

- Narrower travel lanes
- Speed tables (20 to 25%)
- Tighter turning radii
- Speed feedback signs
- Speed reduction markings

Both of the top design alternatives include a package of traffic calming improvements that would be expected to result in reduced travel speeds so both alternatives were given a full circle.

Bicycle Comfort (On-Street)

Based on existing roadway characteristics on Ringwood Avenue, including a Class II bike lane only in the northbound direction, and current travel speeds and traffic volumes, the roadway has a BLTS score of 3 in the southbound direction since there is not currently a bike lane and BLTS 2 northbound. Alternative 1 includes installation of a new protected bike lane southbound and would maintain the existing bike lane northbound so would improve conditions to BLTS 1. Under Alternative 2, cyclists would have to share the travel lanes with motorists near the high school, translating to BLTS 3, though the additional signing and striping would be considered an improvement over the existing condition. As a result, a half circle was used as the baseline score, Alternative 1 was given a full circle and Alternative 2 was given three-quarters of a circle.

Bicycle Comfort (Off-Street)

There are currently no off-street cycling facilities on Ringwood Avenue, though both design alternatives would include a shared use pathway on the west side of the corridor that could be used by cyclists that do not want to ride in the street. As a result, an empty circle was applied as the baseline and both alternatives were given a full circle.

Pedestrian Comfort

The high school frontage was the focus of this assessment. The informal nature of the existing pathway and inconsistency of facility type combined with the fact that a buffer is not provided between the pathway and the street translates to a PLTS of 2. Both of the design alternatives include an off-street pathway with a buffer from the street translating to a PLTS of 1. However, because Alternative 2 does not include a continuous bike lane, more cyclists would be expected to use the pathway translating to a slightly less comfortable experience compared to Alternative 1. As a result, a half circle was given to the existing condition, a full circle to Alternative 1 and three-quarters of a circle to Alternative 2.

Tree Preservation

It is estimated that up to 25 of the approximately 425 existing trees within the public right of way would be impacted under each of the design alternatives, which would have similar tree impacts. As a result, a full circle was used as the baseline and a half circle was assigned to each of the alternatives.