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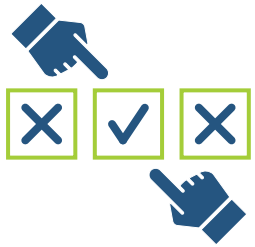
ALTERNATIVES ANALYSIS
WATSONVILLE/PAJARO to SANTA CRUZ

PROJECT OBJECTIVES

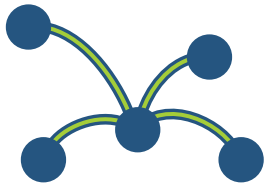
Analyzing Transit Options

The Transit Corridor Alternatives Analysis, or TCAA is evaluating public transit options along the Santa Cruz Branch Rail Line right-of-way from Watsonville/Pajaro to Santa Cruz.



Alternatives Analysis

Alternatives are being evaluated to identify a locally-preferred alternative through a performance-based planning approach based on a triple bottom line sustainability framework.



Creating an Integrated Transit Network

The TCAA will define an integrated transit network with future inter-county and inter-regional connections to Monterey, Gilroy, the San Francisco Bay Area and beyond.

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KEY MILESTONES

MILESTONE 1

Goals/Screening Criteria/ Performance Measures & Initial List of Alternatives

Approved by RTC March 5, 2020

MILESTONE 2

Screen Initial List of Alternatives into Short List of Alternatives

WE ARE HERE

MILESTONE 3

Performance Measures Analysis of Short List of Alternatives to Identify a Locally-Preferred Alternative

JAN FEB MAR APR MAY JUN JUL AUG

2020

See RESOURCES to review Analysis Framework and Initial List of Alternatives handouts.

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MILESTONE 1
PUBLIC ENGAGEMENT

Extensive Outreach on Project Goals, Screening Criteria, Performance Measures and Initial List of Alternatives.

Email blasts and social media posts

Print/Radio advertisements and media coverage

Event tabling, committee and partner agency meetings, focus groups with local community organizations and large public open houses

Online survey and updates to the SCCRTC website

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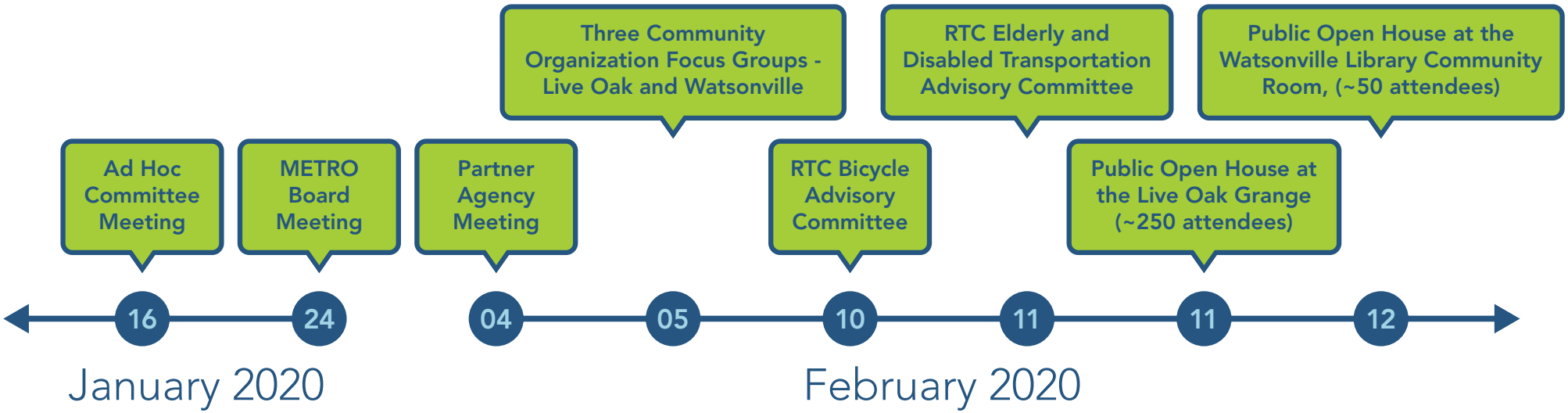
MILESTONE 1
PUBLIC ENGAGEMENT

Meeting Calendar



Attendees participated in several interactive activities to provide valuable input.

300+
Attendees to the Meetings

200+
Surveys Received

75
Comment Cards, Letters and Emails

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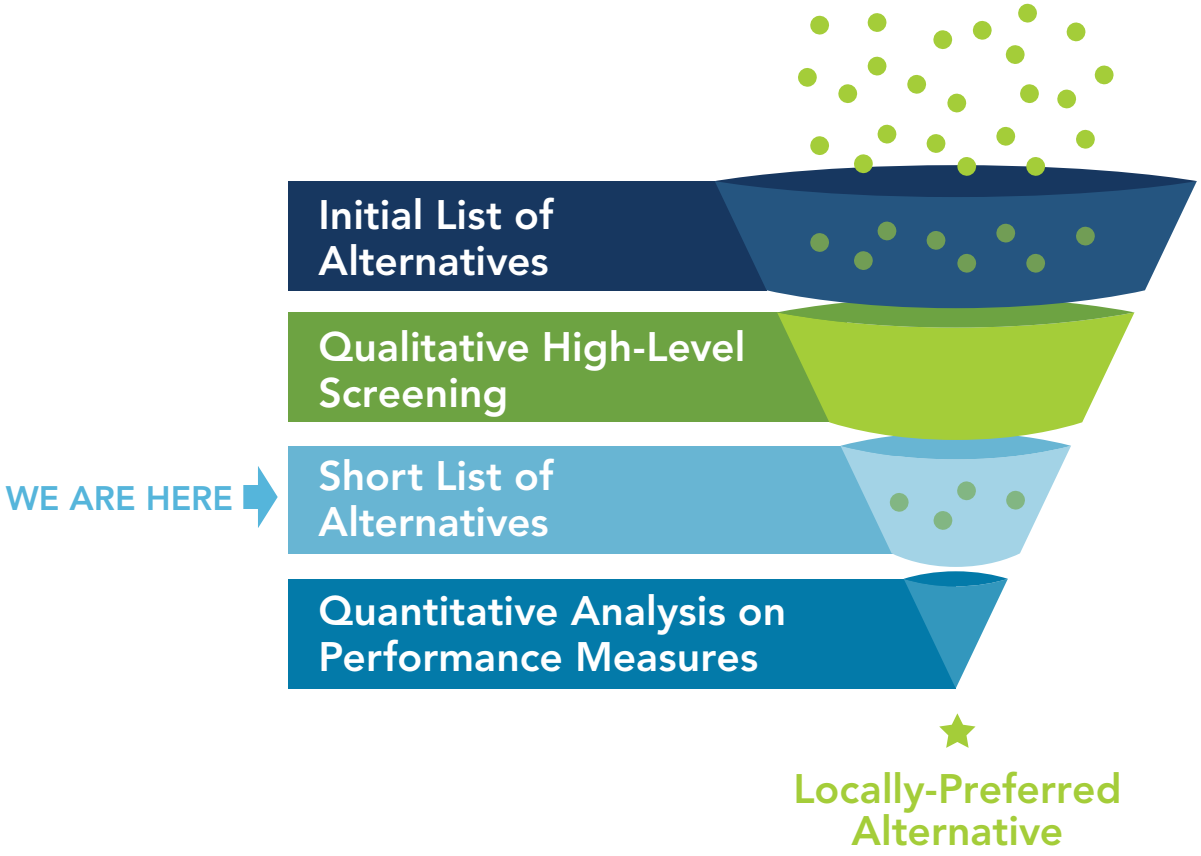
EVALUATION FRAMEWORK

PROJECT GOALS FOCUS ON "TRIPLE BOTTOM LINE" APPROACH BASED ON:

- Economy
- Equity
- Environment

ALTERNATIVES ANALYSIS PROCESS



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TRIPLE BOTTOM LINE FRAMEWORK

ECONOMY

Alternatives assessed for fiscal feasibility and ability to develop a well-integrated transportation system that supports economic vitality.

EQUITY

Alternatives assessed for ability to provide an accessible, equitable, reliable, safer, and more efficient multimodal transportation system.

ENVIRONMENT

Alternatives evaluated for how well they promote a healthier environment addressing key elements such as greenhouse gas emissions, climate adaptation, ridership and other potential environmental impacts.

OTHER GOALS

Alternatives evaluated for technical feasibility, ability to integrate into existing system and meet regulatory requirements and minimize additional right-of-way needs.

See RESOURCES to review Analysis Framework handout.

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ALTERNATIVES

MILESTONE 1 identified transit alternatives categorized into core and connector services

CORE SERVICES

Utilizes rail right-of-way for majority of its available length and to its fullest extent possible

BUS ALTERNATIVES:

Passenger-carrying vehicles with rubber tires running on pavement with capacity generally greater than 10 persons

RAIL ALTERNATIVES:

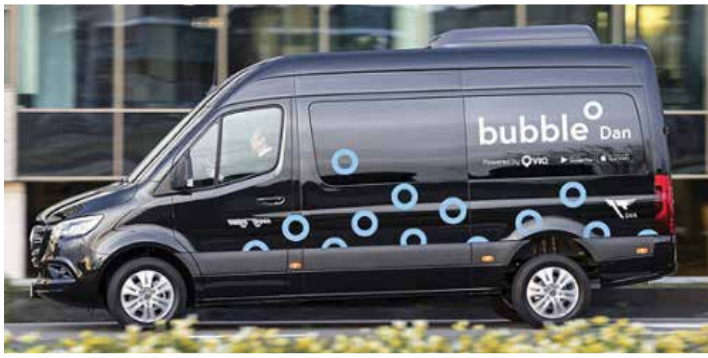
Passenger-carrying service with fixed steel rails, fixed stops and using exclusive guideway

OTHER ALTERNATIVES:

Progressive and innovative transit services designed to meet unique transportation needs more regularly in many communities

CONNECTOR SERVICES

Offers connections between core services and destinations



See RESOURCES to review full Alternatives handout.

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ALTERNATIVE EVALUATION AND SCREENING FRAMEWORK

Each goal: ***Economy***, ***Equity***, ***Environment*** and ***Other*** contain ***metrics*** that alternatives were measured against. Each metric contains unique ***Scoring Criteria*** for that metric that can be seen on the top rows in the following tables.

A = Most Desirable

B = Moderately Desirable

C = Less Desirable

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ALTERNATIVES ANALYSIS

ALTERNATIVE SCORING RESULTS: ECONOMY

ECONOMY

Goal:	Is Fiscally Feasible			Results in a well-integrated transportation system that supports economic vitality			
Metric:	**CAPITAL COSTS**	**OPERATIONS & MAINTENANCE COSTS**	**FUNDING**	**TRANSIT ORIENTED DEVELOPMENT (TOD)**	**JOBS**	**FREIGHT & OTHER RAIL BUSINESSES**	**TRANSPORTATION CORRIDOR UTILIZATION & PRESERVATION**
A = Most Desirable	Capital cost/mile less than $20M/mile.	O&M less than $1/passenger mile.	Funding readily available to support these alternatives.	Transit service with fixed infrastructure or infrastructure that suggests permanence.	High capital expenditures and a high likelihood of TOD.	Co-mingling with freight allowed.	Rail has least risk of losing continuity of corridor from loss of rail easements.
B = Moderately Desirable	Capital cost/mile - $20M/mile to $40M/mile.	O&M is $1.01-$2.00/ passenger mile.	Traditional transit core services implemented nationally in numerous communities. Funding available through variety of public and private sources.	Transit service that may or may not be designed to suggest permanence.	Moderate capital expenditures and/or likelihood of TOD.	Temporal separation from freight allowed. Elevated alternative, may be compatible with freight rail but will be dependent upon design.	Alternative uses entire corridor but is not rail.
C = Least Desirable	Capital cost/mile greater than $40M/mile and/or technology uncertain.	O&M is greater than $2.00/ passenger mile.	Non-traditional core services not implemented nationally in variety of communities. Funding may or may not be available to support these alternatives.	Transit service with non-fixed infrastructure that does not suggest permanence or alternatives with limited capacity.	Low capital expenditures and low likelihood of TOD.	Incompatible with freight.	Alternative other than rail and uses less of the right-of-way as is likely with bus/shuttle options.
Local Bus & Right-of-Way Bus	A	B	B	C	B	C	C
Arterial & Right-of-Way Bus Rapid Transit	A	B	B	B	A/B	C	C
Dual Rail & Bus Vehicles	B/C	B/C	B/C	A/B	A/B	C	B
Commuter Express Bus	A	A	B	C	B	C	C
Autonomous Road "Train" (on pavement w/ rubber tires)	B	C	B/C	A	A/B	C	B
Micro-shuttles	A	B	B	C	B	C	C
Shuttles (Light Duty, Van, Electric Vehicle)	A	A	B	C	B	C	C
Intercity Rail	C	A	B	A	B	A	A
Light Rail/Electric Multiple Unit	B	A	B	A	A/B	B	A
Monorail/Automated People Mover	C	C	C	B	B/C	B	A
Commuter Rail/Electric Multiple Unit	B	A	B	A	A/B	A	A
Light Rail/Diesel Multiple Unit	B	A	B	A	A/B	B	A
Tram/Trolley/Streetcar	B	B	B	A	A/B	B	A
Personal Rapid Transit	C	C	C	C	C	C	B
Inverted/Elevated Personal Rapid Transit	C	C	C	C	C	B	B
Hyperloop	C	C	C	C	C	C	B
Gondola	B	C	C	C	B/C	B	B
String Rail	C	C	C	C	C	B	B

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ALTERNATIVES ANALYSIS

ALTERNATIVE SCORING RESULTS: EQUITY

EQUITY

Goal:	Promotes active transportation	Supports safer transportation for all modes	Provides accessible and equitable transportation system that is responsive to needs of all users	Offers reliable and efficient transportation choices that serve the most people	Offers reliable and efficient transportation choices that serve the most people
Metric:	**ACTIVE TRANSPORTATION**	**SAFETY**	**ACCESS**	**TRAVEL TIME**	**RELIABILITY**
A = Most Desirable	Alternative can transport relatively more bicycles.	National statistics report fatalities and inquiries per 100 million miles traveled with collision costs of < $100 million.	Level boarding is typically a component of system allowing independent accessibility for most users.	Less than 45 minutes in travel time between Pajaro and Westside Santa Cruz.	Alternative primarily remains on rail corridor as a dedicated facility for greater reliability.
B = Moderately Desirable	Can transport a minimal number of bicycles, depending on space.	National statistics report fatalities and inquiries per 100 million miles traveled with collision costs between $100 - $200 million.	Level boarding is typically a component of system but access point is elevated requiring use of elevator.	Between 45-70 minutes in travel time between Pajaro and Westside Santa Cruz.	Alternative remains on only a portion of the rail corridor as a dedicated facility for relatively less reliability.
C = Least Desirable	Bicycles cannot be transported on vehicle and/or vehicle is relatively small. Elevated systems are less desirable as access requires elevator.	National statistics report fatalities and injuries per 100 million miles traveled with collision costs greater than $200 million.	Level boarding is not typically a component of system and not likely to have independent accessibility.	Greater than 70 minutes in travel time between Pajaro and Westside Santa Cruz.	Alternative is not on a significant portion of the rail corridor as a dedicated facility and thus is the least reliable.
Local Bus & Right-of-Way Bus	B	A	C	C	B
Arterial & Right-of-Way Bus Rapid Transit	A/B	A	A	B	B
Dual Rail & Bus Vehicles	B	A	C	B	B
Commuter Express Bus	B	A	C	B	B
Autonomous Road "Train" (on pavement w/ rubber tires)	A	A/B	A	B	A
Micro-shuttles	C	A/B	C	C	B
Shuttles (Light Duty, Van, Electric Vehicle)	C	A	C	C	B
Intercity Rail	A	A	A	A	A
Light Rail/Electric Multiple Unit	A	B	A	B	A
Monorail/Automated People Mover	B/C	A	B	B	A
Commuter Rail/Electric Multiple Unit	A	A	A	A	A
Light Rail/Diesel Multiple Unit	A	B	A	B	A
Tram/Trolley/Streetcar	A/B	B	A	C	A
Personal Rapid Transit	C	A	A	A	A
Inverted/Elevated Personal Rapid Transit	C	A	B	A	A
Hyperloop	C	A	B	A	A
Gondola	C	A	B	C	B
String Rail	C	A	B	A	A

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ALTERNATIVE SCORING RESULTS: ENVIRONMENT

ENVIRONMENT

Goal:	Promotes A Healthier Environment				
Metric:	**TRANSIT RIDERSHIP**	**EMISSIONS REDUCTION**	**CLIMATE ADAPTATION**	**BIOLOGICAL, VISUAL, NOISE, AND VIBRATION**	**ENERGY USAGE**
A = Most Desirable	Estimated daily ridership relatively high.	Significant ability to reduce GHG emissions because alternative is expected to divert drivers from automobiles.	Alternative is elevated and not prone to sea level rise/climate impacts.	Not elevated so not visually obstructive, least noisy, least likely to cause vibration.	BTUs/passenger-mile less than 1,500.
B = Moderately Desirable	Estimated daily ridership relatively moderate.	Moderately able to reduce GHG emissions because alternative is expected to divert drivers from automobiles.	Alternative may use flood-prone right-of-way but can divert. Travel time would increase but alternative can adapt to flooding (bus).	Alternative may be elevated and visually obstructive, may be relatively noisy or cause vibration, but not all three.	BTUs/passenger-mile <1,500 and <= 3,500 or alternative is rail-like but energy usage is uncertain.
C = Least Desirable	Estimated daily ridership relatively low.	Least able to reduce GHG emissions because alternative is not expected to significantly divert drivers from automobiles.	Alternative is at ground-level and fixed and without adapting design may be prone to sea level rise/climate impacts with no ability to divert.	Alternative is elevated and visually obstructive, is noisy and causes relatively greater vibration than other modes.	BTUs/passenger - mile > 3,500.
Local Bus & Right-of-Way Bus	C	C	B	B	B
Arterial & Right-of-Way Bus Rapid Transit	B	B	B	B	B
Dual Rail & Bus Vehicles	C	C	B	B	B
Commuter Express Bus	C	C	B	B	A
Autonomous Road "Train" (on pavement w/ rubber tires)	A	A	C	B	B
Micro-shuttles	C	C	B/C	A	B
Shuttles (Light Duty, Van, Electric Vehicle)	C	C	B	A	A
Intercity Rail	C	C	C	B/C	B
Light Rail/Electric Multiple Unit	A	A	C	A/B	B
Monorail/Automated People Mover	A	A	A	B/C	B
Commuter Rail/Electric Multiple Unit	A	A	C	B/C	B
Light Rail/Diesel Multiple Unit	A	A	C	B/C	B/C
Tram/Trolley/Streetcar	B	B	C	A/B	A
Personal Rapid Transit	B	C	C	A/B	B
Inverted/Elevated Personal Rapid Transit	B	C	A	B	B
Hyperloop	C	C	C	A	B
Gondola	C	C	A	B/C	B
String Rail	B	A	A	B/C	B

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ALTERNATIVE SCORING RESULTS: OTHER GOALS

OTHER GOALS

Goal:	Technical Feasibility	Consistent with Other Planning Efforts	Consistent with Regulatory Requirements	Integration	Ability to Adapt to New Technology	Right-Of-Way
A = Most Desirable	Tested technology, traditional and technically feasible.	Consistent with greatest number of plans, including SCCRTC Regional Transportation Plan, AMBAG Metropolitan Transportation Plan/Sustainable Communities Strategy, METRO Plans, Unified Corridor Study, CA State Rail Plan.	Consistent with regulations, including GHG emissions, Coastal Commission, Proposition 116.	Traditional bus or rail transit that has shown to easily integrate into the overall transportation system.	More flexible infrastructure and lower vehicle purchase cost/shorter useful life therefore more flexibility to adapt to new technologies.	Right-of-way supports two-way service with single lane and sidings or one-way travel in the right-of-way with reverse on parallel local road network.
B = Moderately Desirable	Infrastructure exists and has been tested buy is not a traditional transit option and may be less technically feasible/is more uncertain.	Consistent with some plans, including those listed above.	Consistent with some regulations, listed above.	Elevated alternative/ non-traditional which may be integrated into the overall transpiration system but few examples exist.	Infrastructure is less flexible and vehicles are relatively more costly/relatively longer useful life therefore less flexibility to adapt to new technologies.	Elevated systems may accommodate two-way transit travel on the right-of-way.
C = Least Desirable	Alternative has either not been build or there are limited examples for distances of 20 miles.	Not consistent with any plans listed.	Not consistent with any regulations, listed above.	Uncertain how alternative will interact with overall transportation system.	Infrastructure and vehicles are often proprietary therefore least flexible to adapt to new technologies.	Accommodating two-way travel on right-of-way may be problematic.
Local Bus & Right-of-Way Bus	A	A	C	A	A	A/B
Arterial & Right-of-Way Bus Rapid Transit	A	A	C	A	A	A/B
Dual Rail & Bus Vehicles	B	C	B	A	B/C	A/B
Commuter Express Bus	A	A	B	A	A	A/B
Autonomous Road "Train" (on pavement w/ rubber tires)	B	B	B	A	B	A
Micro-shuttles	B	C	B	A	A	A/B
Shuttles (Light Duty, Van, Electric Vehicle)	A	C	B	A	A	A/B
Intercity Rail	A	C	A	A	B	A
Light Rail/Electric Multiple Unit	A	A	A	A	B	A
Monorail/Automated People Mover	B	C	B	B	C	B
Commuter Rail/Electric Multiple Unit	A	A	A	A	B	A
Light Rail/Diesel Multiple Unit	A	A	B	A	B	A
Tram/Trolley/Streetcar	A	C	A	A	B	A/B
Personal Rapid Transit	C	C	A	C	C	C
Inverted/Elevated Personal Rapid Transit	C	C	B	B	C	B
Hyperloop	C	C	C	C	C	C
Gondola	B/C	C	C	B	C	B
String Rail	C	C	B	B	C	B

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TOP-RANKED ALTERNATIVES

The initial screening identified seven alternatives that ranked at the top. Of these alternatives, the four in bold are being recommended to move forward for a detailed performance analysis.

- **Commuter Rail/Electric Multiple Unit**
- **Light Rail/Electric Multiple Unit**
- Light Rail/Diesel Multiple Unit
- **Arterial & Right-of-Way Bus Rapid Transit (BRT)**
- Intercity Rail
- **Autonomous Road "Train" (on pavement with rubber tires)**
- Tram/Trolley/Streetcar

The following logic was used to identify four out of the seven alternatives moving into a Quantitative Performance Measure Analysis:

- Clean and green/sustainable alternatives will be considered for the TCAA planning process and thus fossil fuel options have been eliminated.
- Commuter Rail/EMU has similar benefits to Intercity Rail but is better suited to frequent, all-day service with multiple stations.
- Tram/Trolley/Streetcar alternatives implemented in many urban areas typically run on city roadways shared with private vehicles rather than dedicated corridors similar to the Santa Cruz Branch Line. In addition, this alternative typically runs at a slower speed and provides less transit capacity than other alternatives. The Light Rail/EMU alternative could accommodate "streetcar" style vehicles as long as the speeds and capacity meet the definition of this alternative.

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DRAFT ALTERNATIVES SHORT LIST

Arterial & Right-of-Way Bus Rapid Transit (BRT)

A fixed-route bus system that could operate primarily on the Santa Cruz Branch Line as a dedicated right-of-way, as well as on Highway 1 bus on shoulders/auxiliary lanes and the local roadway network. BRT systems typically provide an urban or interurban service. These systems typically have defined passenger stations, short headway bidirectional services for a substantial part of weekdays and weekend days, off-board fare collection to reduce travel times, and separate branding of the service. BRT operations on the Santa Cruz Branch Line could be a combination of two-way and one-way with reverse direction on parallel local streets.

Typical Characteristics:

- Vehicle speeds up to 65 mph maximum
- BRT is incompatible with freight on the same corridor, but BRT could be moved off corridor to preserve freight in Watsonville
- Transit signal priority at roadway crossings
- Frequency of peak period service
  - 8 to 20 minute headways
- Level-platform boarding and non-level boarding at on-street stops
- Propulsion type
  - Electric–hydrogen fuel cell, battery

Benefits:

- Capital costs relatively lower than other modes
- Level boarding allows independent accessibility for mobility devices and space for bicycles
- Integrates easily with overall transportation system
- Greater ability to adapt to new technologies
- Depending on permanence of design, could support Transit Oriented Development

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DRAFT ALTERNATIVES SHORT LIST

Autonomous Road "Train" (on pavement with rubber tires)

An emerging transit mode that combines the benefits of bus rapid transit and light rail with advanced autonomous driving features, providing an urban or interurban service. The system uses rubber tires running on pavement within a dedicated running way. The vehicles resemble light rail vehicles with a similar passenger capacity. The system would use similar infrastructure to a BRT system, including permanent stations, transit signal priority, and offering frequent service. The autonomous road "train" will run solely on the Santa Cruz Branch Line. Operation on a single lane with sidings allows for two-way travel. An autonomous road "train" system has recently been deployed in the city of Yibin, China.

Typical Characteristics:

- Vehicle speeds capable of 40 to 45 mph maximum
- System runs on pavement and thus is incompatible with freight on the same corridor
- Transit signal priority at roadway crossings
- Frequency of peak period service
  - 10 to 30 minute headways
- Level or non-level platform boarding
- Propulsion type
  - Electric–Overhead, hydrogen fuel cell, battery

Benefits:

- Strong transit ridership potential
- Level boarding allows independent accessibility for mobility devices and space for bicycles
- Supports greenhouse gas emission reduction goals
- Greater ability to adapt to new technologies
- Travel time will likely be more reliable
- Supports Transit Oriented Development

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DRAFT ALTERNATIVES SHORT LIST

Light Rail/Electric Multiple Unit

Passenger rail service operating on fixed rails with single or multiple individually-propelled cars typically providing an urban or interurban service with a lighter volume ridership capacity compared to commuter rail. Operations on a single track with sidings that allow for two-way travel.

Typical Characteristics:

- Vehicle speeds capable of 30 to 60 mph maximum
- Vehicle can operate with freight in shared-use corridors only if temporally separated
- Centralized Traffic Control (CTC) or similar signal system only, as light rail is temporally separated from freight operations
- Frequency of peak period service
  - 10 to 30 minute headways
- Level or non-level platform boarding
- Propulsion type
  - Electric–Overhead, hydrogen fuel cell, battery

Benefits:

- Strong transit ridership potential
- Corridor has least risk of losing continuity from loss of easements
- Level boarding allows independent accessibility for mobility devices and bicycles
- Supportive of greenhouse gas emission reduction goals
- Supports Transit Oriented Development

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DRAFT ALTERNATIVES SHORT LIST

Commuter Rail/Electric Multiple Unit

Passenger rail service operating on fixed rails with multiple individually-propelled cars typically providing an interurban or regional service. Commuter rail typically has a higher volume ridership capacity and relatively longer distance between stops compared to light rail. Operations on a single track with sidings allows for two-way travel.

Typical Characteristics:

- Vehicle speeds capable of 30 to 60 mph maximum
- Vehicles can comingle with freight in shared-use corridors
- Centralized Traffic Control (CTC) and Positive Train Control (PTC) is required
- Frequency of peak period service
  - 20 to 30 minute headways
- Level or non-level platform boarding
- Propulsion type
  - Electric – Overhead, hydrogen fuel cell, battery

Benefits:

- Faster travel times and strong transit ridership potential
- Compatible with freight rail
- Corridor has least risk of losing continuity from loss of easements
- Level boarding allows independent accessibility for mobility devices and space for bicycles
- Supportive of greenhouse gas emission reduction goals and Transit Oriented Development

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COMMENT SURVEY

We want your input!

Please follow this link to the ***Survey***.

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