

## TRANSIT CORRIDOR ALTERNATIVES ANALYSIS



# MILESTONE 1 & 2 RESOURCES



## TRANSIT CORRIDOR ALTERNATIVES ANALYSIS ANALYSIS FRAMEWORK

The Transit Corridor Alternatives Analysis: Watsonville/Pajaro to Santa Cruz (TCAA), will use a triple-bottom line, performance-based planning approach for evaluating future investment decisions. The Triple Bottom Line Approach is a consistent analysis tool applied by the Santa Cruz County Regional Transportation Commission to identify and prioritize transportation policies, program, and projects in the County. An alternatives analysis will be performed to examine the performance of various transit options for the rail right-of-way and how well they advance the goals of the project. The following describes the analysis framework designed to evaluate the performance benefits of the alternatives in this planning process. The TCAA will identify a Locally-Preferred Alternative that best meets the Economy, Environment and Social Equity needs of the County.

### Triple Bottom Line Approach to Alternatives Analysis



This Analysis Framework will build from the Triple Bottom Line goals of Economy, Environment and Social Equity. A two phase approach will be used as described:

1. Phase 1: Initial high-level screening using the screening criteria to narrow the universe of alternatives to a smaller set of alternatives for detailed analysis.
2. Phase 2: More detailed and data-driven alternatives analysis using the performance measures, designed to differentiate performance benefits between the smaller set of alternatives and support the identification of the Locally-Preferred Alternative.

The following tables present the proposed Economic, Environmental, Social Equity and Other Goals that supports the Triple Bottom Line Approach with descriptions of supporting Evaluation Metrics, Phase 1 Screening Criteria and Phase 2 Performance Measures.



# SUPPORTS ECONOMY

Goals	Evaluation Metric	Description	Phase 1 Screening (A=Most Desirable B=Moderately Desirable C=Least Desirable)	Phase 2 Performance Measure
Fiscally feasible	Capital cost	How does capital cost compare to other projects?	A, B, C	Capital Cost Capital Cost/Rider Capital Cost/Passenger Mile
	O&M costs	Is project relatively more expensive to maintain and operate?	A, B, C	O&M Costs O&M Cost/Rider O&M Cost/Passenger Mile
	Funding	How much funding will likely be available?	A, B, C	% funding likely from existing sources % funding likely from future sources
Results in a well-integrated transportation system supporting economic vitality	Transit Oriented Development	Will the project increase development along the corridor?	A, B, C	A, B, C
	Jobs	Will project support job growth – near term through construction, longer term through O&M activity?	A, B, C	A, B, C
	Freight and other rail businesses	What is the impact on freight rail operators, shippers and other rail businesses including Santa Cruz Big Trees and Pacific Railway?	A, B, C	Freight Rail Volume A, B, C Big Trees access to Boardwalk A, B, C Big Trees access to Pajaro A, B, C
	Transportation corridor utilization and preservation	What is the level of risk that the corridor will not remain continuous? Will alternative best utilize rail corridor and preserve future options?	A, B, C	Risk Level A, B, C





# SUPPORTS EQUITY

Goals	Evaluation Metric	Description	Phase 1 Screening (A=Most Desirable B=Moderately Desirable C=Least Desirable)	Phase 2 Performance Measure
Promotes active Transportation	Active transportation	Does project include features that support active transportation and promotes health?	A, B, C	<ul style="list-style-type: none"> <li>- Bicycle capacity on transit/every 30 minutes during peak period</li> <li>-Ability for level boarding for bicyclists</li> <li>- Effects on MBSST and California Coastal Trail</li> </ul>
Supports safer transportation for all modes	Safety	Does project support public safety including safety for trail users?	A, B, C	<ul style="list-style-type: none"> <li>-Annual Collisions by mode</li> <li>-Total Annual Collisions</li> <li>-Annual Cost of Collisions</li> </ul>
Provides accessible and equitable transportation system that is responsive to the needs of all users	Access	Does project provide universal access to all ages, abilities, and income and minimize the cost to rider?	A, B, C	<ul style="list-style-type: none"> <li>- Location relative to transportation disadvantaged populations</li> <li>- Transit passenger capacity miles traveled</li> <li>- Transit Fare</li> <li>- Mobility device capacity on transit every 30 minutes during peak period</li> <li>-Independent accessibility for all ages and abilities including level boarding</li> </ul>
Offers reliable and efficient transportation choices that serve the most people	Travel time	Does project improve transportation travel time during peak periods?	A, B, C	<ul style="list-style-type: none"> <li>- Transit travel time during peak periods</li> <li>- Auto travel time on Hwy 1</li> <li>- Impacts at grade crossings</li> <li>- Regional connectivity</li> </ul>
	Reliability	Does project improve transportation reliability?	A, B, C	Travel time reliability during peak periods





# SUPPORTS ENVIRONMENT

Goal	Evaluation Metric	Description	Phase 1 Screening (A=Most Desirable B=Moderately Desirable C=Least Desirable)	Phase 2 Performance Measure
Promotes a healthier environment	Transit ridership	Will project substantially increase transit ridership for commute and recreational trips and for students, residents and visitors ?	A, B, C	Transit ridership (local, regional, weekday, weekend, corridor, countywide) - Transit capacity/peak period
	Emissions reduction	Does project support the goal of minimizing emissions? How long will the project take to implement?	A, B, C	- Auto vehicle miles traveled - Greenhouse gas emissions (total and per passenger mile) - Length of time to implement - Criteria pollutants
	Climate adaptation	Can the project resiliently adapt to climate change?	A, B, C	A, B, C
	Biological, visual, noise, and vibration	Are there effects of the project on biological resources, visual, noise and vibration?	A, B, C	A, B, C
	Energy usage	Does project support the goal of minimizing energy usage?	A, B, C	A, B, C



# OTHER GOALS

Goal	Evaluation Metric	Description	Phase 1 Screening (A=Most Desirable B=Moderately Desirable C=Least Desirable)	Phase 2 Performance Measures
Addresses project-specific concerns	Technical feasibility	Is project technically feasible?	Yes/No	
	Consistent with other planning	Is project consistent with other local, state and federal planning efforts?	A, B, C	A, B, C
	Consistent with regulatory requirements	Is project consistent with local, state, and federal regulatory requirements?	A, B, C	A, B, C
	Integration	Does project integrate into existing multimodal transportation infrastructure?	A, B, C	A, B, C
	Ability to Adapt to New Technology	Does the project have ability to adapt to future technology?	A, B, C	A, B, C
	Right-of-way	How easily can project be integrated into existing right-of-way?	A, B, C	% of corridor where additional right of way is required



## TRANSIT CORRIDOR ALTERNATIVES ANALYSIS INITIAL LIST OF ALTERNATIVES

In support of the Transit Corridor Alternatives Analysis: Santa Cruz to Watsonville, the universe of alternatives for the rail right-of-way will be identified for evaluation. This universe will be categorized into core and connector services.

- Core services will utilize the rail right-of-way for the majority of its available length and to its fullest extent possible.
- Connector services are those that minimally run along the corridor or offer links/transfers to the core services.

### CORE SERVICES

Core services, characterized as high capacity transit options for the rail right-of-way, will leverage the characteristics of the dedicated corridor and be a key component of an integrated transportation network in the County.

Characteristics of core services include:

- Service Model
  - Local Service
  - Commuter/Express
  - Intercity
- Fuel/Propulsion
  - Diesel
  - Electric – Battery, Fuel Cell/Hydrogen, Overhead Catenary
  - Compressed Natural Gas (CNG)
  - Hybrid
- Form Factor and Capacity, with the following ranges of passengers:
  - Up to 4 passengers seated
  - 5 to 9 passengers seated
  - 10 to 20 passengers seated
  - 20 to 40 passengers seated
  - 40 to 50 passengers seated
  - 90 to 100 passengers seated/standing
  - 101+ passengers seated/standing
- Guideway
  - Open/Mixed Traffic
  - Exclusive
  - Guided Exclusive
- Driver
  - Human-driven
  - Automated/Connected





## CORE SERVICE ALTERNATIVES: BUS SERVICES

1



**Local Bus & Right-of-way Bus\*** – Large vehicles designed to carry passengers, usually along a fixed route according to a schedule. Local bus routes make frequent stops, linking neighborhoods with urban centers and providing connections within and between communities.

2



**Commuter Express Bus\*** – Fixed route bus, usually operating for longer distance trips with limited stops during peak commuting periods, operating on local streets and arterials as well as dedicated rights of way.

3



**Arterial & Right-of-way Bus Rapid Transit (BRT)\*** – A high-quality bus-based transit system that delivers fast and efficient service that may include some combination of dedicated lanes, traffic signal priority, off-board fare collection, elevated platforms, and enhanced stations. BRT often uses dedicated busways, guideways, or other exclusive ROWs to operate faster and more efficiently than traditional BRT systems.

4



**Autonomous Road "Train" (on pavement with rubber tires)\*** – An emerging vehicle technology that combines the capacity and form-factor of a traditional streetcar with rubber-tire operation. Manufacturers are planning for the incorporation of advanced autonomous and connected technology, essentially providing a rail-type service, without the cost associated with rail infrastructure.

5



**Dual Rail and Bus Vehicles\*** – An emerging technology that provides the versatility of a bus and the speed of light rail with vehicles that operate on both roadways and fixed guideways.

6



**Micro-shuttles\*** – Smaller passenger autonomous vehicles (12-15 persons operating at low speed and fixed routes. Manufacturers have been developing fully autonomous versions, with several deployed in the United States and California.

7



**Shuttle (Light Duty, Van, Electric Vehicle)** – A small public or private bus that travels back and forth over a particular route, especially a short-route or one that provides connections

\* Per California Air Resources Board mandate, all transit agencies must have 100% zero-emission fleets by 2040. The core bus services shown above will consider electric propulsion in the TCAA.



between transportation systems, employment centers, and other locations.

## CORE SERVICE ALTERNATIVES: RAIL SERVICES

8



**Intercity Rail** – Train systems that travel between many cities, regions of a county, sometimes cross several counties or states, and are compatible with freight rail.

9



**Commuter Rail / Electric Multiple Unit** – Passenger train operations (includes, Diesel Multiple Unit -DMU) between a central city, its suburbs and/or another central city. It is characterized by multi-trip tickets, specific station-to-station fares, with usually only one or two stations in the central business district, and are compatible with freight rail.

10



**Light Rail / Electric Multiple Unit** – Light Rail/EMUs are popular on commuter and suburban rail networks around the world due to their fast acceleration and pollution-free operation. Being quieter than diesel multiple units or locomotive hauled trains, EMUs require no separate locomotive, as electric traction motors are incorporated within one or a number of the carriages, and are compatible with freight rail. Light rail transit (LRT) usually relies on overhead wires for power.

11



**Light Rail / Diesel Multiple Unit** – A rail transit line that can operate in a variety of settings including dedicated ROW, , or mixed on-street traffic. Light rail transit (LRT) is designed for heavily traveled corridors where the stop needs do not support heavy rail transit, and are typically not compatible with freight rail.

12



**Monorail / Automated People Mover (APM)** – An electric railway that is suspended from or straddles a guided roadway formed by a single beam or rail, and are not compatible with freight rail.



13



**Tram / Trolley / Streetcar** – Typically an electric railway with a “light volume” traffic capacity compared to heavier rail. The system may use shared or exclusive ROW, high or low platform loading, and multi-car trains or single cars, and are not compatible with freight rail.

## CORE SERVICE ALTERNATIVES: OTHER SERVICES

14



**Personal Rapid Transit (PRT)** – Personal Rapid Transit (PRT) are systems of small vehicles that operate on a demand-responsive basis, and work to move travelers directly from origin to destination along a fixed route. Several systems have been built, with the most notable in Morgantown, WV.

15



**Inverted (or Elevated) PRT** – Similar in concept to traditional PRTs, but using an inverted rail and smaller cars. This system is generally sold as a solution in urban areas, with space at a premium in which the system can be built over the top of an existing right of way.

16



**Gondola** – Also known as aerial tramways, these systems are a type of cable car pioneered for ski resorts, but have been deployed in urbanized areas to avoid the issues related to surface infrastructure. Passenger capacity can range from four passengers up to 100 per car, and the systems will typically have only a few stops.

17



**String Rail** – A future concept using rigid overhead rails to transport passenger pods of various sizes. Unlike PRT, these systems would operate similar to traditional transit, and board at every stop. No functioning system has yet to be fully deployed for commercial or public use at this time.

18



**Hyperloop** – Started as a concept released by Elon Musk, a Hyperloop is a future transport system that uses evacuated tubes to move multi-passenger vehicles at speeds up to 700 mph. Several companies are currently developing prototypes, and planning has been started to deploy the systems in routes in several key markets within the U.S.



## CONNECTOR SERVICES

Connector services will augment the core services represented above by providing connecting services for the beginning and end (“first and last mile”) of each transit trip. The connector services considered here could be implemented as part of development of an integrated transit system for Santa Cruz County. Certain alternatives considered above under core services can also be independently considered as connector services. Additional first and last mile connector services will be implemented at the discretion of the commuter such as human powered – walk, bicycle, scooter; micromobility – Segway, electric bicycle, electric scooter; and mini-/low capacity urban transport – automobiles, motorcycles, employer vans. Future technologies such as private air taxis may provide additional connection services that could be utilized by travelers in the future. Station planning and design will require consideration for the many types of connector services that could be utilized in the future.

The potential connector services that will be evaluated in the Transit Corridors Alternatives Analysis as part of an integrated transit system for Santa Cruz County are provided below.

19



**Local Bus & ROW Bus** – Large vehicles designed to carry passengers, usually along a fixed route according to a schedule. Local bus routes make frequent stops, linking neighborhoods with urban centers and providing connections within and between communities.

20



**Micro-shuttles** – Smaller passenger autonomous vehicles (12-15 persons) that operate at low speed and navigate fixed routes or on-demand point-to-point routes in the future. Manufacturers have been developing fully autonomous versions, with several deployed in the United States and California.

21



**Shuttle (Light Duty, Van, Electric Vehicle)** – A public or private bus that travels back and forth over a particular route or an on-demand point-to-point route, especially a short route or one that provides connections between transportation systems, employment centers, etc.



22



**Tram / Trolley / Streetcar** – Typically an electric railway with a “light volume” traffic capacity compared to heavier rail. The system may use shared or exclusive ROW, high or low platform loading, and multi-car trains or single cars, and are not compatible with freight rail.

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24



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25



**Bikeshare** – Bikeshare, as well as other micromobility options, has grown in popularity in recent years and continues to receive more widespread adoption. This service allows users to rent bikes for a short period of time using an app on mobile devices and travel shorter distances around cities, often to or from another mode of transportation (i.e. bus or train).