



MOBILITY HUB ADVISORY SERVICES

SITING CRITERIA, SCREENING METHODOLOGY, AND PRIORITIZATION



METROPOLITAN
TRANSPORTATION
COMMISSION



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Contents

Introduction	3
Siting Analysis Approach.....	7
Step One: Establish Baseline Network.....	7
Step Two: Categorize Candidate Locations by Hub Type.....	14
Step Three & Four: Prioritize Regionally Significant Mobility Hubs & Identify those that Advance Equity	15
Step Five: Rank Regionally Significant Mobility Hubs with Implementation Screening Criteria.....	22
Appendix A: Siting Analysis Methodology Overview.....	24
Appendix B: Technical Typology Methodology.....	27
Appendix C: Technical Prioritization Methodology	27
Appendix D: Technical Spatial Analysis Methodology	32
Appendix F: Top 25 Mobility Hubs by Type	34

INTRODUCTION

With transportation services and infrastructure evolving rapidly, mobility hubs present an opportunity to flexibly design and integrate a variety of sustainable transportation options to enhance connectivity across the region. Unprecedented growth, affordability challenges, the climate crisis, and changing travel behaviors resulting from the pandemic show the need to prioritize low emission transportation options that support resiliency, choice, and embrace future changes in technology.

Mobility hubs can integrate public and private mobility services in a way that enhances customer experience and transportation system resiliency. Expanding on initial direction in MTC's Transit Connectivity Report (2005), this program will create implementation guidance and hub typologies, and identify a set of regionally significant mobility hubs.

The mobility hub program is a Climate Initiative Strategy from Plan Bay Area 2040. The primary goal is to reduce greenhouse gas emissions by reducing vehicle miles traveled. The program supports other regional and Plan Bay Area goals of increasing transit access and connectivity, focusing growth, increasing transit-oriented development and providing viable travel options to all Bay Area communities.

Purpose of this Document

This report describes MTC's mobility hubs siting analysis methodology — a framework to identify and rank candidate mobility hub locations for the nine-county Bay Area to help meet regional and Plan Bay Area 2040 goals. The methodology described in this report is a data-driven mobility hubs prioritization process for selecting sites with the highest potential of advancing program and regional goals.

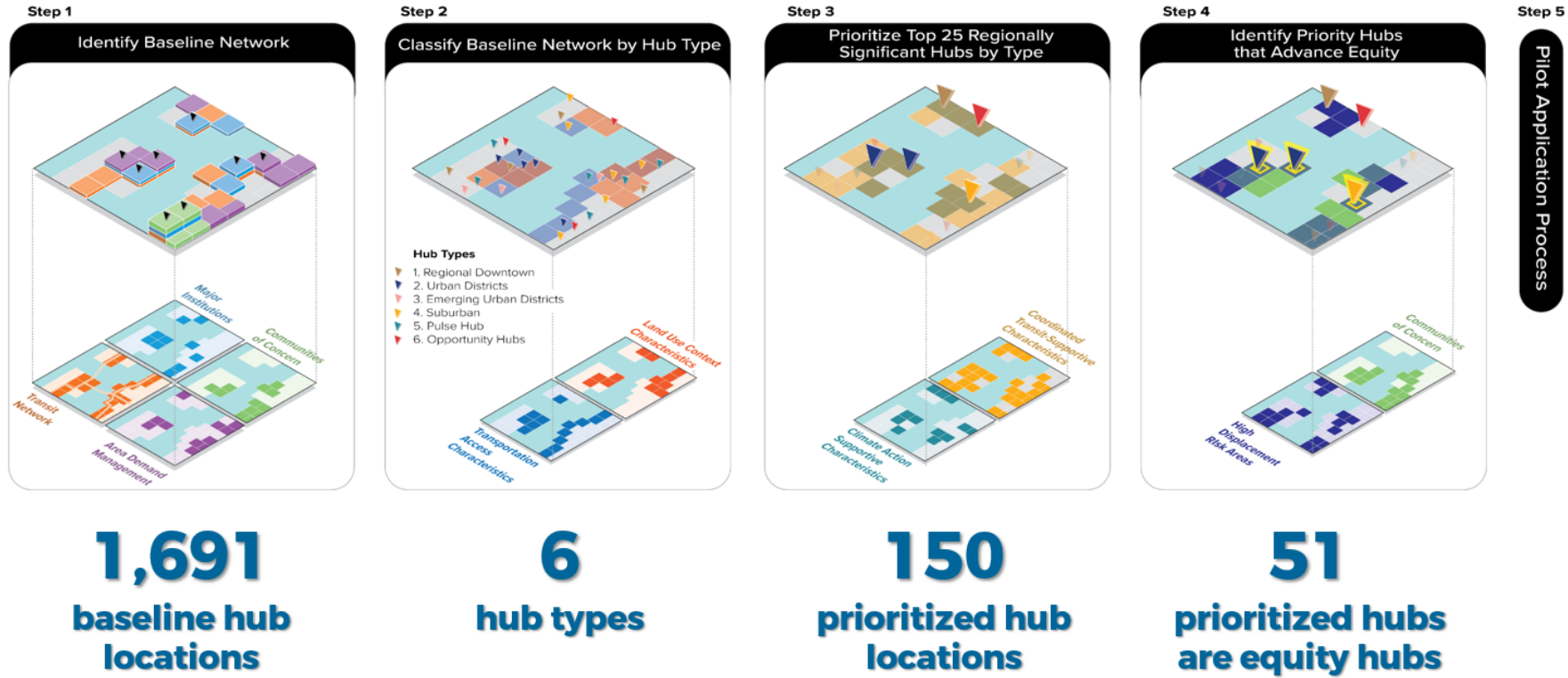
To meet regional and Plan Bay Area 2040 goals, the methodology developed key objectives for the hub sites:

- **Coordinated Mobility:** sites with frequent and interjurisdictional transit service;
- **Climate Action:** potential to convert low-occupancy, solo vehicle trips to other sustainable modes such as transit, shared mobility options, biking, and walking; and
- **Equitable Mobility:** ability to achieve equitable outcomes through need-based mobility and anti-displacement measures.

To meet these objectives, the analysis started with discovering the full universe of hubs based on existing and planned transit connections, major trip generators, and areas of mobility need. The resulting universe of locations were then categorized by hub typology based on the transportation and land use factors surrounding the hub site (see Appendix B for definitions). All locations were then ranked based on factors that included transit connectivity, pedestrian and bicycle access, areas with potential for shift from solo driving trips, and location in Priority Development Areas, MTC Communities of Concern, and communities at high risk of displacement. The next section details the approach and Appendix E lists each of the top 25 scoring hub sites in each typology. Figure 1 provides an overview of the siting analysis methodology. Appendix C provides full detail on the data sources used in each step.

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Figure 1 Siting Analysis Approach Overview



Best Practices and Workshop Input

This siting analysis methodology pulls from leading methods developed for Seattle and Minneapolis, but establishes a unique, flexible framework that is tailored to the region's goals and the data available. The advantages of this siting analysis methodology include:

The baseline network of hub locations is reflective of regional goals and objectives.

The siting analysis is based on a baseline network comprised of locations fundamental to achieving desired outcomes for mobility hubs. The universe of candidate mobility hub locations is based on existing and planned transit connections, major trip generators, and areas of mobility need. This approach both highlights places where mobility hubs will center travel options on the transit network, convert drive-alone trips, and provide mobility options for communities underserved by transit.

In addition to helping meet Plan Bay Area 2040 goals, the hub sites also align with the guiding principles and the Growth Framework developed as part of Plan Bay Area 2050. In particular, the siting methodology supports the Connected guiding principle and performance metrics: *an expanded, well-functioning transportation system connects the Bay Area—fast, frequent and efficient intercity trips are complemented by a suite of local transportation options, connecting communities and creating a cohesive region.*¹

The Regional Growth Framework is the Bay Area's strategy for coordinating housing and job growth to achieved shared goals, and shapes the investments and growth pattern detailed in the Plan. The Framework is comprised of Priority Development Areas, Priority Conservation Areas and Priority Production Areas. Mobility hubs can support growth in these areas by providing a coordinated set of mobility options to reduce vehicle miles traveled and greenhouse gas emissions.

Quantitative hub ranking is tailored based on policy direction.

Candidate mobility hub locations are ranked and prioritized according to two key objectives: Coordinated Transit and Climate Action. These two objectives were prioritized highest by transit agency, county transportation agency, and City staff during MTC's mobility hub framework workshops in June 2020 (additional key outcomes from the workshops are listed in Figure 2). Each objective is comprised of criteria to identify locations with the highest potential to connect people across public transit options (Coordinated Transit), and to convert drive-alone trips (Climate Action). In a parallel process, the criteria to assess the Equitable Mobility objective is applied to all mobility hubs to flag those locations with the highest equity impacts and mobility needs in areas identified by MTC as Communities of Concern.

This approach streamlines the process to rank all mobility hubs based on transportation-centered objectives (Coordinated Transit and Climate Action), and ensure that sites with high equity impacts are identified even if they do not rank high in the Coordinated Transit or Climate Action objectives. This approach balances the functionality and transportation-centered nature of mobility hubs, and the need to provide visibility to sites that otherwise would be left out.

Ranking occurs across all candidate hubs and by hub type.

The candidate mobility hubs were classified using a mobility hub typology allowing candidate locations to be ranked across all hub types or within each hub type. The flexibility afforded by this approach ensures

¹ <https://mtc.ca.gov/our-work/plans-projects/horizon>

that highly urbanized mobility hubs types and suburban hub types with high mode shift potential are both represented. See Step Two for more information on the mobility hub typology.

Figure 2 Workshop Outcomes

Key Outcomes from the Mobility Hub Framework Workshops

In June 2020, regional transit agencies (BART, Caltrain, WETA, etc.), county transportation agencies, local/county transit agencies, large cities, and suburban cities participated in one of five workshops. The objectives of the workshops were to inform the hub site selection methodology, typology development, and implementation assistance needs.

During the workshop, agency participants established several key ideas and positions, which are addressed in this methodology and siting analysis. This includes:

- Prioritizing the Coordinated Transit and Climate Action objective criteria highest;
- Factoring ongoing mobility hubs, on-demand transit, bike share, and transit service enhancements into the siting analysis;
- Considering agencies and geographies with limited transit connectivity and resources;
- Providing insights on implementation readiness factors, like development coordination, property and right-of-way opportunities, station modernization projects, funding availability, greatest potential for mode shift, and partner buy-in; and
- Establishing implementation guidance on community engagement, data sharing, partnerships and contract guidance, curb management, phasing, and operational and maintenance, among others.

SITING ANALYSIS APPROACH

The following description of the three-step siting analysis approach is intended to convey the outcome-based approach to identifying and ranking candidate mobility hub locations in line with regional goals and Plan Bay Area.

Summary of Steps

Step One: Establish Baseline Network

Step Two: Categorize Candidate Hub Locations by Hub Type

Step Three: Prioritize Top 25 Regionally Significant Mobility Hubs by Hub Type

Step Four: Identify Priority Hubs that Advance Equity

Step Five: Rank Regionally Significant Mobility Hubs with Implementation Screening Criteria

STEP ONE: ESTABLISH BASELINE NETWORK

The five-step siting analysis process begins with identifying a universe of candidate mobility hub locations based on baseline network criteria. The baseline mobility hub network is identified using criteria described in Figure 3. This step divides the Bay Area into small equally-sized grid cells. This grid is fundamental to the analysis because it associates a consistent land area with the criteria elements to be evaluated. A common analysis grid also enables a consistent unit to compare across the entire region. Appendix D provides the technical methodology for the grid-based spatial methodology.

Figure 3 Mobility Hub Baseline Network Criteria

Criteria	Data	Source
Transit Network: Current & Planned Transit Connections		
High Capacity Transit Stations	BART, Caltrain, SMART, Muni Metro stations, and San Francisco Bay Ferry Terminals	MTC Open Data Portal Major Transit Stops (2017)
Frequent Transit Connections	Two intersecting frequent transit routes with 15-minute or better service	
Transit Centers	Key Transit Centers (19 total)	MTC Transit Connectivity Report (2005)
Average Daily Transfer Activity	Clipper Transfer Data (October 2018) ²	Procured directly by MTC
Park-and-Ride or Transit Line/Route Terminus	MTC Park and Ride locations	511 SF Bay ³

² Data available only for transfer between high-capacity transit (rail and ferry) and bus.

³ For this project MTC provided a georeferenced files based on the 2019 park and ride data in 511 SF Bay Portal

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Metropolitan Transportation Commission

Criteria	Data	Source
Area Demand Management		
Transportation Management Associations (TMA)	Transit facility within Bay Area TMAs (10 total)	List of TMAs provided by MTC and geocoded
Major Institutions		
Stadiums	Professional and college sport venues with capacity of 4,000 and above (14 total)	Information compiled from the web and digitized
University Campuses	Top 35 universities and colleges (1,000 minimum enrollment)	Information compiled from the web and digitized
Employment Campuses	Employment campuses with 5,000 or more employees (17 total)	California Employment Development Department Major Employers in California
Airports ⁴	Transit facility serving three major Bay Area airports (SFO, OAK, SJC)	KML retrieved from Google Earth
MTC Communities of Concern (2018), not served by frequent transit		
Community of Concern	Hub is within a Community of Concern as defined by MTC ⁵	MTC Open Data Portal Communities of Concern (2018) with ACS 2016 Data
No frequent service	Hub not served by frequent transit service	MTC Open Data Portal Major Transit Stops (2017)

Step One Results

The siting analysis identified 1,691 potential mobility hub locations that offer connections into the local and regional transit network or areas of mobility need with proximity to a potential hub anchor site. Figure 3 maps the universe of potential hub locations throughout the nine county Bay Area region and Figures 4 through 7 illustrate the universe of candidate hub locations in the North Bay, inner East Bay, South Bay and the Peninsula, and San Francisco, respectively. All mobility hub locations can be viewed in the interactive web map located [here](#).⁶

⁴ MTC considers the three international airports in the Bay Area (SFO, OAK and SJC) as mobility hubs as they are key access points to the regional transit network, serve as points of entry to the Bay Area, and generate significant travel demand for a variety of different mobility options (including public transit, private shuttles, pickup and drop off from private autos, taxis, and transportation network companies, rental cars, and more).

⁵ Uses MTC Communities of Concern designated “High,” “Higher,” and “Highest”.

⁶ <https://mtc.ca.gov/mobility-hubs/universe-bay-area-mobility-hubs>

Figure 4 Universe of Bay Area Mobility Hubs



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Figure 5 Universe of Bay Area Mobility Hubs, North Bay



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Figure 6 Universe of Bay Area Mobility Hubs, Inner East Bay



Figure 7 Universe of Bay Area Mobility Hubs, South Bay and Peninsula



Figure 8 Universe of Bay Area Mobility Hubs, San Francisco



STEP TWO: CATEGORIZE CANDIDATE LOCATIONS BY HUB TYPE

Once the universe of candidate mobility hubs was defined, the candidate hub locations in the baseline network were categorized by type according to a mobility hub typology. The goal of this step is to capture the land use context and transportation access characteristics of the candidate hub locations. The hub typology informs the hub design, elements, and mobility options available at each type of mobility hub.

The MTC Mobility Hub Typology consists of the following land use context and transportation characteristics that, in combination, determine the mobility hub type (see a more detailed description of the technical methodology in Appendix B):

Land Use Context

- **Regional Downtown:** Regional central business districts including San Francisco, Oakland, and San Jose each with an established mix and scale of development, multiple destinations, and the highest residential and employment densities of all hub types.
- **Urban District:** Major and local centers of moderate to high residential and employment densities with a mix of uses and inside MTC Priority Development Areas (PDAs).
- **Emerging Urban District:** Areas of moderate and low residential and employment densities with a mix of uses, future development potential, and inside MTC PDAs.
- **Suburban/Rural:** Areas with small neighborhood or dispersed destinations and auto-oriented urban form with the lowest residential and employment densities of all hub types. Being inside a PDA is not a requirement for a hub to be classified as suburban—it is simply a classification. Sites with potential to induce mode shift in suburban areas are prioritized in Step Three.
- **Pulse:** Large trip generators, either spatially or temporally, including airports, stadiums, universities, and major employers as well as Plan Bay Area 2050's Priority Production Areas (PPAs).
- **Opportunity:** An area of high mobility need lacking frequent or high-capacity transit or other mobility services located within a MTC Community of Concern.

Transportation Access

- **Integrated Multimodal:** Major transit hub served by multiple transit lines, including current and planned high capacity transit stations and transit centers served by multiple frequent routes and multi-jurisdictional service.
- **Transit-Serving:** Transfer point within the regional transit network, or locations where two or more frequent and/or multi-jurisdictional transit routes intersect.
- **Auto-Oriented:** Park and rides and transit route termini that are primarily accessed by low occupancy vehicle and limited feeder bus connections.
- **Limited Mobility Access:** Areas not served by frequent transit.

Given the interdependent nature of the land use and transportation access characteristics, the mobility hub typology categorization process requires metrics from both spheres. Because mobility hubs primarily serve a transportation function, the hub types are primarily defined by their transit network characteristics—even though the mix of transit services is often determined by the land use mix and development intensity near the hub.

Typology assignment is a data-driven process. However, due to the inability to perfectly capture the nature of a place through standardized and regionally available data, initial Step Two results were reviewed to ensure the assigned hub type matches reality. The primary focus of this human review process is to investigate hubs classified as Opportunity Hubs; to maintain the mobility-need nature of

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these sites, any sites originally classified as Opportunity Hubs that are indeed served by high-capacity or high-frequency transit were reclassified to an appropriate type based on land use characteristics. Details on the technical approach to classify the hubs into types and a summary of the results is provided in Appendix B. Typology classifications are provided within Step Three results below.

STEP THREE & FOUR: PRIORITIZE REGIONALLY SIGNIFICANT MOBILITY HUBS & IDENTIFY THOSE THAT ADVANCE EQUITY

After identifying the universe of mobility hub candidate locations based on the baseline network criteria (n=1,691), Step Three ranks candidate locations using prioritization criteria centered on the mobility hub objectives. Ranking is intended to elevate candidate hub locations that best align with mobility hub objectives. Figure 16 in Appendix C provides a detailed account of each objective, its associated criteria and data sources, and weighting applied across criteria to score and rank candidate mobility hub locations by objective.

- *Coordinated Transit:* Highly ranks candidate hub locations with the most mobility options and connections including transit and mobility services to facilitate seamless interagency, interjurisdictional, and public to private mobility connections.
- *Climate Action:* Highly ranks candidate hub locations near major trip generators, in areas with high walking and bicycling network connectivity, or in areas where vehicle trips are most likely to be converted to sustainable modes.
- *Equitable Mobility:* Highly ranks candidate hub locations in MTC Communities of Concern and communities at high risk of displacement (see more information below). This provides an opportunity for collaboration with trusted community leaders on how mobility hubs could be tailored to meet mobility needs of communities underserved by transit and lacking mobility options.

The Equitable Mobility objective is evaluated for all hubs in a parallel process to the Coordinated Transit and Climate Action objectives ranking. The Equitable Mobility objective is processed separately from the Coordinated Transit and Climate Action objectives ranking to ensure that sites located in areas designated as MTC Communities of Concern with limited mobility options are not penalized for limited regional transit connectivity (and therefore left out of potential investments). This is operationalized by identifying the hub candidates with a high score on the Equitable Mobility objective that are not in the top candidates for Coordinated Transit and Climate Action objectives. Scoring as high as 100 points, the Equitable Mobility objective is composed of 60 points if the hub is located within an MTC Community of Concern and 40 points if it is located within a High Displacement Risk Area (HDRA). Hence, the “equity hubs” scoring highest will be located within both an MTC Community of Concern and an HDRA. HDRAs are defined in the CASA Equity Analysis that investigated the geographic impacts of the CASA Compact—Committee to House the Bay Area (2018).⁷ Areas with high displacement risk are where greater than 39% of the households in the Census tract are considered low-income and are undergoing displacement or are experiencing advanced gentrification. Equity hubs are anchored to a small site within the MTC Community of Concern area using employment density by block to identify the block with highest employment density to site the hub.

The candidate mobility hubs within MTC Communities of Concern and areas with high displacement risk will trigger equitable mobility hub design and engagement processes. This might include collaboration

⁷ CASA Compact (2018) <https://mtc.ca.gov/our-work/plans-projects/casa-committee-house-bay-area>

with trusted community leaders and residents to understand how mobility hubs can meet unique mobility needs, provide affordable mobility options where they are lacking, and create community assets that are designed with the community.

Step Three & Four Results

After screening the universe of mobility hub candidates, this process assigns a score to every individual hub site. In many parts of the region, some high scoring hub locations are surrounded by or near other similar hub locations. To reflect the functionally integrated nature of these proximate hubs, hub locations that effectively co-operate are clustered into a singular hub location, keeping the highest score assigned to the cluster. Prime examples of this are along Market Street in San Francisco and along the BART spine in the inner East Bay.

After the clustering exercise, the number of cluster hub sites are reduced to **866 cluster sites—including 232 equity hub clusters that exhibit transportation disadvantage and mobility demand**. Over one-third of the regionally significant hubs are classified as Urban District Hubs, followed by 30% as Suburban/Rural Hubs, 14% as Emerging Urban District, 11% as Opportunity Hubs, and 4% as Regional Downtown Hubs. Pulse Hubs make up only 3% of regionally significant hub sites.

To further refine the mobility hub clusters that advance to Step 3 for implementation-readiness screening and prioritization, the top 25 scoring mobility hub clusters in each mobility hub type are screened. Therefore, **only 150 regionally significant cluster hub locations advance to Step Five.**⁸ Figures 10 illustrates the location of regionally significant mobility hub clusters (n = 150) by hub type. Figures 11 through 14 illustrate the regionally significant hub cluster locations in the inner East Bay, South Bay and the Peninsula, and San Francisco. The top 25 mobility hub locations by type can be viewed in the interactive web map located [here](#) and are listed by rank, unique cluster ID, hub name, city, and hub type in Appendix E.⁹

⁸ To ensure an equitable distribution and spread of limited investments throughout the Bay Area, San Francisco Hubs in the Urban District Hub Type are capped at 6 cluster hubs max in the top 25 list. This limit is consistent with San Francisco's all-type hubs share of 25% in the overall clusters. There are 218 hubs in San Francisco out of the 866 total clusters in the region.

⁹ <https://mtc.ca.gov/mobility-hubs/top-25-hub-clusters>

Figure 9 Regionally Significant Mobility Hub Clusters by Hub Type



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Figure 10 Regionally Significant Mobility Hub Clusters by Hub Type, North Bay

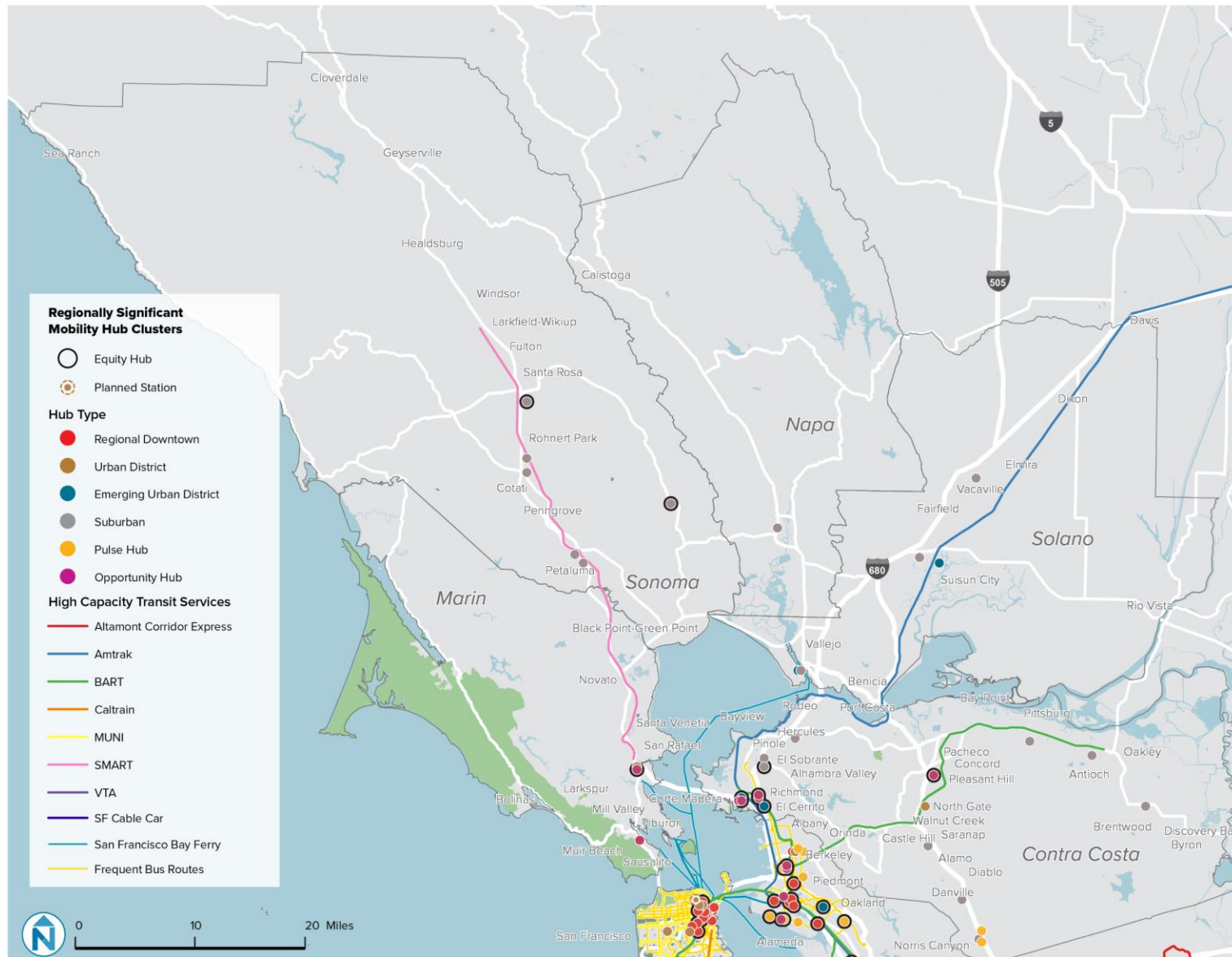


Figure 11 Regionally Significant Mobility Hub Clusters by Hub Type, Inner East Bay

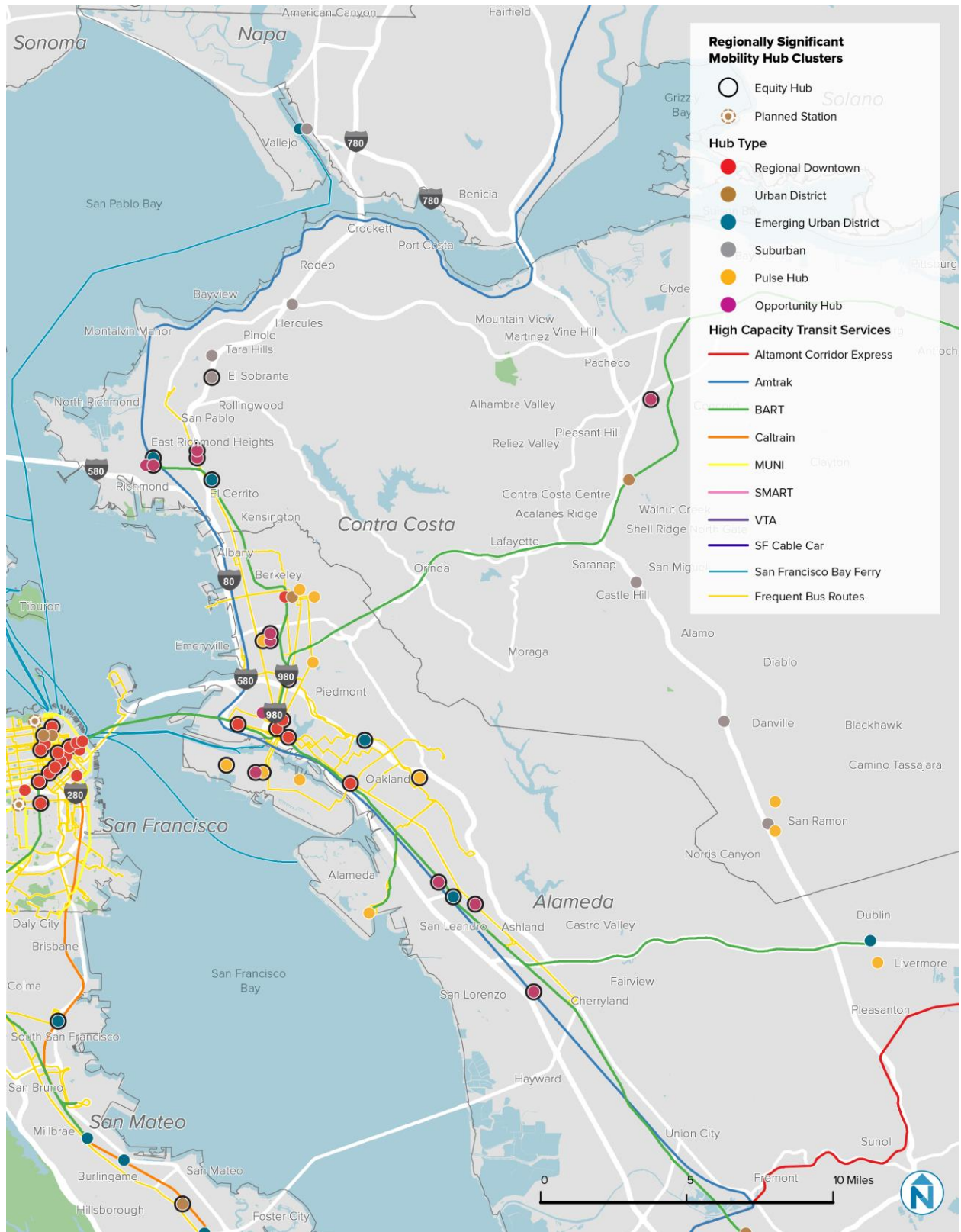
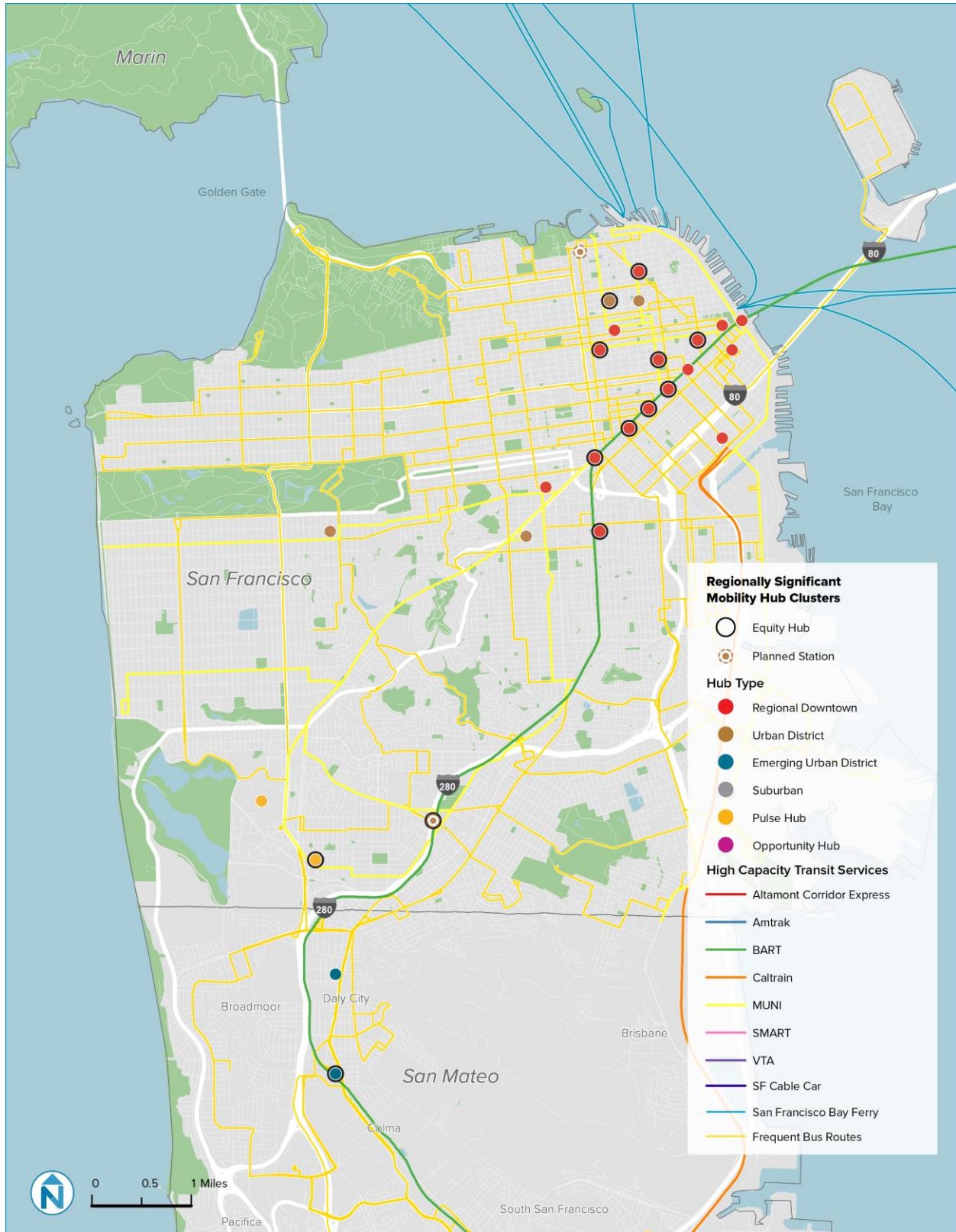


Figure 12 Regionally Significant Mobility Hub Clusters by Hub Type, South Bay and Peninsula



Figure 13 Regionally Significant Mobility Hub Clusters by Hub Type, San Francisco



STEP FIVE: RANK REGIONALLY SIGNIFICANT MOBILITY HUBS WITH IMPLEMENTATION SCREENING CRITERIA

The final step of the siting analysis is to apply an implementation-readiness filter to the regionally significant mobility hub locations identified in Steps Three and Four. This process will highlight regionally significant locations that are quick-wins, easily implementable, or ripe for partnership.

Due to the lack of available datasets that cover the entire region, the Step Five screening process will primarily occur as part of the mobility hub pilot demonstration application evaluation process. Through a data-driven process, hubs sites with larger potential market sizes—those with the highest number of residents and jobs within a ½-mile and 3-mile radius—will first be identified. Figure 14 describes potential implementation screening pilot application criteria. In a September 2020 workshop, potential implementing partners shared lots of feedback on this initial list. In general, implementing partners need more detail on what is expected to be demonstrated and how to demonstrate candidate sites' ability to meet the screening criteria, and they would like to better understand how proposals will be evaluated. They emphasize the importance of readiness and the coordination between property owners, the sponsor agency, the community, and other local partners.

The criteria described below are undergoing review and will be refined based on data availability and ability to systematize the analysis process across the region.

Figure 14 Implementation Screening Criteria

Objective	Screening Criteria
<p>EXCEPTIONAL EXPERIENCE <i>Create inclusive public spaces and support a high-quality customer experience through people-centered amenities, and integrated wayfinding, travel information, and payment options.</i></p>	<ul style="list-style-type: none"> ▪ Connections to civic centers, parks, and other areas of public life ▪ Commercial areas generating retail activity, cultural amenities, community center and community-based organizations ▪ Priority bicycle network and walking routes, including quality and level of protection ▪ Existing or planned physical public realm enhancements ▪ Existing or planned public realm programming ▪ Regional Wayfinding Tiers 0-5
<p>SAFETY <i>Create a safe environment at mobility hubs, incorporating local and regional Vision Zero policies and improvements within mobility hub areas.</i></p>	<ul style="list-style-type: none"> ▪ Projects that clearly address safety issues related to hub access, including delivery of Vision Zero strategies, project elements, and programming
<p>VALUE <i>Leverage development and partner opportunities, while targeting implementation-ready sites first and demonstrating lessons learned.</i></p>	<ul style="list-style-type: none"> ▪ Completion of or active engagement in a community outreach process (minimum requirements to be developed) ▪ MTC Priority Development Areas ▪ Development coordination and developer agreements ▪ Property and right-of-way opportunities ▪ Transit Priority Areas ▪ Existing pricing and demand management controls or ordinances ▪ Partnership opportunities with community organization, property owners, providers, and other implementation partners ▪ Locations with community-driven designs or community-based initiatives ▪ Sites with a singular landowner ▪ Undeveloped parcels ▪ Areas seeing rapid redevelopment

APPENDIX A: SITING ANALYSIS METHODOLOGY OVERVIEW

STEP 1: IDENTIFY BASELINE NETWORK	
Base Criteria	Data Points
REGIONAL TRANSIT NETWORK	Current and planned major transit stations ^{10,11}
MAJOR INSTITUTIONS	Including stadiums, universities, major employers, and airports
AREA DEMAND MANAGEMENT	Areas managed by a Transportation Management Association (TMA)
AREAS OF MOBILITY NEED	Defined as MTC Communities of Concern (2018) that are not served by frequent transit



STEP 2: CLASSIFY BASELINE NETWORK BY HUB TYPE		
Base Criteria	Land Use Data Points	Transportation Data Points
REGIONAL DOWNTOWNS	N/A	<ul style="list-style-type: none"> High capacity rail service must be present AND high frequency bus service with 2 or more transit agencies Contains a car share location (point) and/or a bike share station¹²
URBAN DISTRICTS	N/A	<ul style="list-style-type: none"> High capacity rail service can be present OR high frequency bus service with 2 or more transit agencies Within car share and/or bike share service areas

¹⁰MTC's definition of a major transit stop in the nine-county San Francisco Bay Area is in line with the California Public Resources Code definition (Section 21064.3). They include an existing rail or bus rapid transit station; a ferry terminal served by either a bus or rail transit service; or the intersection of two or more major bus routes with a frequency of service interval of 15 minutes or less during the morning and afternoon peak commute periods.

¹¹ During initial framing workshops for MTC's mobility hub program, several suburban cities and smaller suburban transit agencies expressed concern that focusing the regional mobility hub baseline network only on locations served by frequent transit (i.e., served by more than two routes with 15-minute headways or less) may reduce opportunities in locations that need better transit connections and more mobility options. To address this potential gap, this methodology classifies all park-and-rides as default mobility hubs and identifies "Areas of Mobility Need"—largely suburban locations that are considered both MTC Communities of Concern and underserved by frequent transit.

¹² Data available and used in this analysis include:

- Zipcar locations (dedicated parking locations) in the nine counties in the Bay Area. Data manually collected from Google Earth as of July 2020.
- GIG Car share Home Zones (area of service) and dedicated parking lots in the Bay Area. Retrieved from GIG Car website as of July 2020.
- Bay Wheels service area and bike share stations. Data retrieved from Bay Wheels website as of July 2020.

MOBILITY HUB SITING CRITERIA, SCREENING METHODOLOGY, AND PRIORITIZATION
Metropolitan Transportation Commission

EMERGING URBAN DISTRICTS	Within PDA	<ul style="list-style-type: none"> High capacity rail service can be present OR high frequency bus service with 2 or more transit agencies
SUBURBAN SITES	Not in PDA	<ul style="list-style-type: none"> Park and ride present OR Outside car share and bike share service areas
PULSE HUBS	N/A	<ul style="list-style-type: none"> Large trip generators, either spatially or temporally, including airports, stadiums, universities, and major employers.
OPPORTUNITY HUBS		<ul style="list-style-type: none"> No access to multiple frequent transit routes (in addition to being in a MTC Community of Concern)



STEP 3: PRIORITIZE TOP 25 REGIONALLY SIGNIFICANT HUB BY TYPE	
Objective	Data Points
COORDINATED TRANSIT	Average Daily Transfer Activity High Capacity Transit Stations Transit Centers Frequent Transit Connections Park-and-Ride or Transit Line/Route Terminus.
CLIMATE ACTION	Bike Share Service Area and Station Locations Free-Floating Car Share Service Area and Car Share Station Locations Transportation Management Associations (TMA) Pedestrian Network Bicycle Network Census tracts with highest concentration of drive-alone trip origins and destinations Stadiums University Campuses Employment Campuses Airports MTC Priority Development Areas
EQUITABLE MOBILITY	MTC Communities of Concern (COC) High Displacement Risk Areas



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Metropolitan Transportation Commission

STEP 4: IDENTIFY PRIORITY HUBS THAT ADVANCE EQUITY	
Objective	Data Points
EQUITABLE MOBILITY	MTC Communities of Concern (COC) High Displacement Risk Areas



STEP 5: SCREEN PRIORITY SITES FOR IMPLEMENTATION READINESS (in development)	
Objective	Desired Outcome
EXCEPTIONAL EXPERIENCE	Create inclusive public spaces and support a high-quality customer experience through people-centered amenities, and integrated wayfinding, travel information, and payment options.
SAFETY	Create a safe environment at mobility hubs, incorporating local and regional Vision Zero policies and improvements within mobility hub areas.
VALUE	Leverage development and partner opportunities, while targeting implementation-ready sites first and demonstrating lessons learned.

APPENDIX B: TECHNICAL TYPOLOGY METHODOLOGY

Categorizing hub candidates into specific hub types is based primarily on transportation access characteristics with support of land use characteristics (i.e. PDA designation) to refine hub type differentiation (see Figure 15). The criteria selected to define the hub types was constrained by the availability of data and the ability to systematize the analysis process in the future. The variables used to define all hub types except for pulse hubs is listed below.

- If hub is within a MTC's Priority Development Area
- Level of transit service: high capacity transit and/or high frequency bus service with two or more transit agencies serving the hub
- Bike share availability
- Car share availability
- Park and ride availability

Once the metrics to define hub types were defined, each hub candidate was passed through a screen process to evaluate which of the hub type conditions were met and assign a hub type classification. The relation between the hub types and the criteria to define each of them is showed in Figure 15. For instance, if a hub candidate is within a PDA and has a high capacity transit station then it is classified as Emerging Urban District.

The definition of the hub types is an iterative process. The goal is to get the classification in a systematic way; however, some outliers and special hubs might require manual recalibration at the end. The logic behind this definition is to ensure that the transit functionality of each hub described above is captured.

Figure 15 Mobility Hub Typology Criteria

Hub type	Land Use	Transportation Criteria
Regional Downtown	<i>N/A – defined by transportation criteria</i>	<ul style="list-style-type: none"> ▪ High capacity rail service must be present AND high frequency bus service with 2 or more transit agencies ▪ Contains a car share location (point) and/or a bike share station
Urban District	<i>N/A – defined by transportation criteria</i>	<ul style="list-style-type: none"> ▪ High capacity rail service can be present OR high frequency bus service with 2 or more transit agencies ▪ Within car share and/or bike share service areas
Emerging Urban District	<ul style="list-style-type: none"> ▪ Within PDA 	<ul style="list-style-type: none"> ▪ High capacity rail service can be present OR high frequency bus service with 2 or more transit agencies
Suburban	<ul style="list-style-type: none"> ▪ Not in PDA 	<ul style="list-style-type: none"> ▪ Park and ride present OR Outside car share and bike share service areas
Opportunity Hubs	<ul style="list-style-type: none"> ▪ Within a MTC Community of Concern* 	<ul style="list-style-type: none"> ▪ No access to transit or mobility services listed above (i.e. this is an area of mobility need as identified in Step One)
Pulse Hubs	By definition, pulse hubs are located at the following locations: <ul style="list-style-type: none"> ▪ Colleges and Universities ▪ Employer campus ▪ Stadium Venues ▪ Airports ▪ TMAs 	

*Note: Included to complement the lack of access to frequent transit with other needs in this communities.

APPENDIX C: TECHNICAL PRIORITIZATION METHODOLOGY

MTC, with input from regional transit agencies, county transportation agencies, local/county transit agencies, large cities, and suburban cities from the hub workshops, defined the criteria and weights to prioritize hub locations for the Mobility Hubs Pilot Program. See next page.

MOBILITY HUB SITING CRITERIA, SCREENING METHODOLOGY, AND PRIORITIZATION
Metropolitan Transportation Commission

Figure 16 Prioritization Scenarios Based on Mobility Hub Objectives

Mobility Hub Objectives: Criteria and Weights for Ranking ¹³				
Objective	Data Point	Data Source	Scoring Range/Criteria	Weight
Coordinated Transit	Transit Activity			
	Average Daily Transfer Activity*	Clipper Transfer Data (October 2018)	Candidate hub with highest amount of transfer activity = 100 points Candidate hub with lowest amount of transfer activity = 1 point	10%
	Transit Network: Current & Planned Transit Connections			
	High Capacity Transit Stations*	Major Transit Stops (2017)	Candidate hub at high capacity station = 100 points	13%
	Transit Centers*	MTC Report: Key Transit Centers (2005)	Candidate hub at transit center = 100 points	13%
	Frequent Transit Connections*	Major Transit Stops (2017)	Candidate hub served by two frequent transit routes = 100 points	17%
	Park-and-Ride or Transit Line/Route Terminus*	MTC Park and Ride locations	Park-and-Ride or Transit Line/Route Terminus = 100 points	13%
Climate Action	Transit Activity			
	Bike Share Service Area	Bay Wheels stations/ Bay Wheels area of service	Candidate hub within Bay Wheels service area ¹⁴ and/or within ¼ of mile from a Bay Wheel station = 100 points	6%

¹³ Data Points marked with (*) in this table are also used in Step 1 to identify the baseline network. The difference is that Step 1 only checks if at least one of the elements is present in at the candidate hub site (grid cell). If so, it is marked as part of the baseline network. In Step 3 and 4, the elements are weighted, and each hub can be scored for as many elements as it contains.

¹⁴ Removing the mobility service criteria from the Climate Action scenario could isolate candidate hub locations in areas that generate a large number of drive-alone trips and major trip generators but are *not* within mobility service areas. This isolation could highlight candidate hub locations where there are low or no shared mobility options creating a gap in the network. These locations may be good candidates for CARB's Clean Mobility Vehicle Options Grant.

MOBILITY HUB SITING CRITERIA, SCREENING METHODOLOGY, AND PRIORITIZATION
Metropolitan Transportation Commission

Free-Floating Car Share Service Area/ Car Share Station Locations	GIG Car area of service/ Zipcar Locations	Candidate hub with Zipcar locations within ¼ of mile and/or within free-floating car share service area = 100 points	3%
Mobility Networks			
Pedestrian Network ¼ of mile buffer from candidate hub, number of intersections per sq/mile	EPA Smart Location Database	Candidate hub with highest intersection density within 10-minute walkshed = 100 points	5%
Bicycle Network ¼ of mile buffer from candidate hub, connections to regional bikeway network	MTC Regional Bikeway Network (Existing and Planned) ¹⁵	Candidate hub served by existing regional bikeway network = 100 points	5%
Travel Density			
Areas with highest concentration of drive-alone trip origins and destinations	Streelight Data (O-D Pairs Motor Vehicles)	Candidate hub within area of highest density of drive-alone trips = 100 points Candidate hub with lowest density of drive-alone trips = 1 point	5%
Major Institutions/Trip Generators			
Transportation Management Associations (TMA)*	Transit facilities within TMA polygon (10 total)	Candidate hub within TMA area = 100 points	1%
Stadiums*	14 major stadium venues; closest transit facility	Candidate hub within 1-mile of biggest stadium = 100 points Candidate hub within 1-mile of smallest stadium = 1 point	1%
University Campuses*	Top 35 universities and colleges	Candidate hub within 1-mile of largest university = 100 points Candidate hub within 1-mile smallest university/college ¹⁶ : 1 point	1%

¹⁵ In future runs of this analysis as MTC's Mobility Hubs Program advances, MTC will use the MTC Active Transportation Network file instead of the Regional Bikeway Network file, which is being phased out.

¹⁶ 1,000 minimum student enrollment

MOBILITY HUB SITING CRITERIA, SCREENING METHODOLOGY, AND PRIORITIZATION
Metropolitan Transportation Commission

	Employment Campuses*	Major employer campus facilities	Candidate hub within 1-mile of largest employer = 100 points Candidate hub within 1-mile of smallest major employer = 1 point	1%
	Airports*	Three major Airports; Transit facility serving airport	Candidate hub within 1-mile of major airport = 100 points	1%
	Land Use			
	MTC Priority Development Areas (PDAs) ¹⁷	MTC PDAs (March 2020)	Candidate hub is within a PDA = 100 points	5%
			Total score	100% = 100 points ¹⁸

¹⁷ Including the transit-rich and connected communities PDA designations

¹⁸ Because each individual criteria score is normalized from 1-100, after applying the weighting and adding up each criteria the maximum score is also in the range 1-100.

APPENDIX D: TECHNICAL SPATIAL ANALYSIS METHODOLOGY

This section describes the spatial analysis approach used in steps 1-5 of the siting analysis. It also presents the rationale for the analytical/technical methods selected and provides context on interpreting the results.

Unlike other large urban and transportation infrastructure, mobility hubs cover a relatively small urban area--the surrounding space of a bus stop or transit station, for instance. The spatial analysis goal was to consistently evaluate this small-scale area across all Bay Area contexts. More specifically, the technical approach aimed at:

- Developing a uniform evaluation for the whole region
- Assessing candidate sites efficiently with a data-driven process and using reasonable alternatives when data was limited or unavailable
- Maximizing replicability of the analysis

The spatial analysis can be divided into four technical processes described next.

Process 1. Develop a regional tile grid

This process overlaid a grid (squares) over the Bay Area to divide the region into small, equally sized grid cells. The tile grid enables consistent processing of different spatial data types such as points (like transit stops), lines (such as transit routes), and polygons (such as Priority Development Areas). Each tile represents a 1/4-mile square for all locations except in the region's most dense cities--Oakland, San Francisco, and San Jose. In these cities, the tiles are 520 by 520 feet. Figure 17 shows an example of Lake Merritt's tile overlay in Oakland. With this approach, each tile captures the different characteristics of the area it contains. The regional grid includes more than 50,000 tiles.

Figure 17 Example of grid overlay in Lake Merritt area, Oakland



Process 2. Pass all datasets representing the different site selection criteria (see Appendix A) through the grid

The next process passes each dataset through the grid and associates each grid cell with the features it contains (e.g., the number of bus stops with high-frequency service; the density of pedestrian intersections; whether or not it is located at a university or in a PDA). This process is performed for every criteria used in the baseline network (Step 1), typology assessment (Step 2), and prioritization (Step 3). Each tile's features, combined with definitions and weights, result in each hub's scoring and typology classification. Each grid cell may contain zero, one, or more transit stops.

Process 3. Consolidate adjacent universe hubs into a cluster hub

As described in this document and illustrated in Figures 4-8, the resulting universe of candidate hub sites at this stage was above 1,600. To identify the highest-scoring hubs, it was necessary to consolidate tiles representing the same or very similar characteristics in the vicinity—this is referred to as a “cluster.” Most spatial tools to conduct a cluster analysis work better with point features (like a single bus stop) as opposed to polygons (a tile). Therefore, each tile was transformed to a point feature by locating the tile centroid. Although this is a subtle detail, it is important to highlight that this conversion responds only to processing data. The centroid (point) represents the characteristics of the full grid area, but it appears as a single point on a map that may or may not be located exactly at a transit stop location. With the centroids created, an algorithmic cluster analysis consolidated neighboring points together into one single point.

Process 4. Assign the attributes of the highest-scoring hub within the cluster, and produce the final hub ranking

Each cluster point could contain one or up to 11 original points. Naturally, the original points had different scores, and even though they are located in close physical proximity, some were classified as different typologies. To ensure the best underlying characteristics of the area represented (and also ranked), each clustered hub site was assigned with the type and score of its highest individual hub. Lastly, each cluster hub is ranked by hub type. Figures 9-13 illustrate the top 25 by type.

When viewing the results and particularly the point locations in the maps, it is important to keep in mind that they represent the suitability of the closest surrounding area to become a mobility hub. This explains why some points might look oddly placed. A refinement of the actual hub location (i.e. associating it with the nearest actual bus stop or transit station) is a necessary implementation step.

APPENDIX E: TOP 25 MOBILITY HUBS BY TYPE

The following tables summarize the top 25 regionally significant mobility hub clusters identified in each of the six mobility hub types.

Top 25 Regional Downtown Hub Clusters

Rank	Cluster ID	Hub Description	City
1	778	Transbay Transit Center	San Francisco
2	740	BART/Muni - Civic Center	San Francisco
3	734	Caltrain - 4th & King	San Francisco
4	36	BART/AC Transit - 12th St Oakland City Center	Oakland
5	771	BART/Muni - Montgomery	San Francisco
6	359	BART/AC Transit - Downtown Berkeley	Berkeley
7	759	BART/Muni - Powell Station/Downtown	San Francisco
8	782	Muni - Bush St & Montgomery St	San Francisco
9	789	BART/Muni - Embarcadero	San Francisco
10	804	Muni - Mason St & Filbert St	San Francisco
11	843	VTA - San Antonio Station	San Jose
12	690	BART/Muni - 16Th St Mission	San Francisco
13	750	Muni - Market St & 6Th St	San Francisco
14	7	BART/AC Transit - Fruitvale	Oakland
15	775	Muni - Powell St & Geary Blvd	San Francisco
16	722	Muni - Market St & Gough St	San Francisco
17	790	Multi-agency - SF Ferry Building	San Francisco
18	42	BART/AC Transit - 19Th St	Oakland
19	51	BART/AC Transit - Macarthur	Oakland
20	30	BART/AC Transit - Lake Merritt	Oakland
21	784	Muni - California St & Leavenworth St	San Francisco
22	777	Muni - California St & Van Ness Ave	San Francisco
23	845	VTA - St James	San Jose
24	704	Muni - Duboce Ave & Church St	San Francisco
25	40	BART West Oakland	Oakland

Note: Hubs shaded are defined as Equity Hubs according to the criteria established in this methodology.

MOBILITY HUB SITING CRITERIA, SCREENING METHODOLOGY, AND PRIORITIZATION
Metropolitan Transportation Commission

Top 25 Urban District Hub Clusters

Rank	Cluster ID	Hub Description	City
1	387	BART Pleasant Hill	Contra Costa Centre
2	111	Caltrain - Mountain View Station	Mountain View
3	609**	San Jose Ave & Niagara Ave	San Francisco
4	794	Mason St & Pacific Ave	San Francisco
5	793	Hyde St & Broadway	San Francisco
6	807**	Hyde St & Bay St	San Francisco
7	684	Church St & 18Th St	San Francisco
8	839	ACE - San Jose Station	San Jose
9	841	Convention Center Station	San Jose
10	686	Judah St & 12Th Ave	San Francisco
11	859	Alum Rock Station	San Jose
12	851**	Santa Clara & 26th	San Jose
13	158	Caltrain - Palo Alto Station	Palo Alto
14	829	Bascom Station	San Jose
15	832	Tamien Station	San Jose
16	868	Penitencia Creek Station	San Jose
17	88	Caltrain - Santa Clara Station	Santa Clara
18	826	Caltrain - Capitol Station	San Jose
19	206	Caltrain - San Mateo Station	San Mateo
20	181	Caltrain - Redwood City Station	Redwood City
21	101	Caltrain - Sunnyvale Station	Sunnyvale
22	119	Moffett Park Station	Sunnyvale
23	435	SMART - San Rafael	San Rafael
24	204	BART Fremont	Fremont
25	360	Bancroft Way & Ellsworth St	Berkeley

Note: Hubs shaded are defined as Equity Hubs according to the criteria established in this methodology. San Francisco hubs in this category are limited to the top 6 hubs (approximately 25% of the available spots in the top 25) to ensure an equitable distribution of hubs across other cities in the Bay Area. The 25% limit is based on the share of San Francisco Hubs (218) in all clusters (866) identified in this analysis.

** The score of these hubs is based on a planned transit stop or station. If only the existing frequent transit network is considered, these hubs would score lower.

The planned stations are:

Cluster 609 includes a stop from the planned SFMTA BRT Line

Cluster 807 includes a stop from the planned SFMTA Light Rail extension

Cluster 851 includes a station from the planned BART system extension

MOBILITY HUB SITING CRITERIA, SCREENING METHODOLOGY, AND PRIORITIZATION
Metropolitan Transportation Commission

Top 25 Emerging Urban District Hub Clusters

Rank	Cluster ID	Hub Description	City
1	225	Caltrain - Millbrae Station	Millbrae
2	126	ACE - Great America Station	Santa Clara
3	316	BART San Leandro	San Leandro
4	273	BART Colma	Colma
5	386	BART El Cerrito Del Norte	El Cerrito
6	296	BART Dublin/Pleasanton	Dublin
7	159	Caltrain - Menlo Park Station	Menlo Park
8	394	BART Richmond	Richmond
9	128	Caltrain - San Antonio Station	Mountain View
10	197	Caltrain - Hillsdale Station	San Mateo
11	184	Caltrain - San Carlos Station	San Carlos
12	201	Caltrain - Hayward Park Station	San Mateo
13	825	Capitol Station	San Jose
14	240	Caltrain - S San Francisco Station	South San Francisco
15	216	Caltrain - Broadway Station	Burlingame
16	823	Ohlone-Chynoweth Station	San Jose
17	112	Whisman Station	Mountain View
18	817	Almaden Station	San Jose
19	824	Branham Station	San Jose
20	95	Caltrain - Lawrence Station	Sunnyvale
21	821	Blossom Hill Station	San Jose
22	491	Vallejo Ferry Terminal	Vallejo
23	512	Suisun-Fairfield	Suisun City
24	33	Fruitvale Av & Montana St	Oakland
25	298	Mission St & Westlake Ave	Daly City

Note: Hubs shaded are defined as Equity Hubs according to the criteria established in this methodology.

MOBILITY HUB SITING CRITERIA, SCREENING METHODOLOGY, AND PRIORITIZATION
Metropolitan Transportation Commission

Top 25 Suburban/Rural Hub Clusters

Rank	Cluster ID	Hub Description	City
1	78	Winchester Station	Campbell
2	141	I-880 Station	Milpitas
3	67	Caltrain - San Martin Station	San Martin
4	492	Fitzgerald Dr & Lucky	Vallejo
5	86	Wolfe & Stevens Creek	Cupertino
6	581	Santa Rosa Transit Mall	Santa Rosa
7	373	Walnut Creek	Walnut Creek
8	260	Dublin/Pleasanton	Livermore
9	517	E Washington St & Ellis St	Petaluma
10	467	Pittsburg Center	Pittsburg
11	468	Hercules Transit Center	Hercules
12	324	West Dublin/Pleasanton	San Ramon
13	438	Richmond Pkwy Transit Center (Park & Ride)	Tara Hills
14	336	Danville (Park & Ride)	Danville
15	511	Hwy 101 & Lakeville Hwy	Petaluma
16	389	Antioch	Brentwood
17	436	Hilltop Dr & Park & Ride	Richmond
18	444	Antioch	Antioch
19	553	Vacaville	Vacaville
20	566	Redwood Dr / Commerce Blvd	Rohnert Park
21	514	Amtrak Fairfield	Fairfield
22	562	Rohnert Park Expy Bus Pad	Rohnert Park
23	284	Dublin/Pleasanton	Livermore
24	541	Hwy 12 & Thompson Ave	Sonoma
25	531	West Imola Avenue (Park & Ride)	Napa

Note: Hubs shaded are defined as Equity Hubs according to the criteria established in this methodology.

MOBILITY HUB SITING CRITERIA, SCREENING METHODOLOGY, AND PRIORITIZATION
Metropolitan Transportation Commission

Top 25 Pulse Hub Clusters

Rank	Cluster ID	Hub Description	City
1	600	19Th Ave & Randolph St - San Francisco State University	San Francisco
2	157	TMA - Palo Alto	Stanford
3	325	TMA - Bishop Ranch	San Ramon
4	0	BART Oakland Int'L Airport	Oakland
5	362	Stadium - California Memorial Stadium Berkeley	Berkeley
6	844	University/College - San Jose State University	San Jose
7	346	TMA - Emeryville	Oakland
8	56	University/College - California College of the Arts	Oakland
9	615	University/College - San Francisco State University	San Francisco
10	84	University/College - San Jose City College	San Jose
11	367	University/College - University of California Berkeley	Berkeley
12	331	TMA - Alameda North Waterfront	NA
13	333	University/College - College of Alameda	Alameda
14	334	TMA - Alameda Point	Alameda
15	146	Job Center - Google Llc	Mountain View
16	279	TMA - Hacienda Pleasanton	Pleasanton
17	323	Job Center - Chevron Corp	San Ramon
18	144	TMA - North Bayshore/Mountain View	Mountain View
19	185	Job Center - Western Digital Corp	Fremont
20	302	University/College - Las Positas College	Livermore
21	10	University/College - Mills College Oakland	Oakland
22	836	Stadium - San Jose Municipal Stadium San Jose	San Jose
23	835	Stadium - CEFCU Stadium San Jose	San Jose
24	854	Stadium - Avaya Stadium San Jose	San Jose
25	863	San Jose International Airport	San Jose

Note: Hubs shaded are defined as Equity Hubs according to the criteria established in this methodology.

MOBILITY HUB SITING CRITERIA, SCREENING METHODOLOGY, AND PRIORITIZATION
Metropolitan Transportation Commission

Top 25 Opportunity Hub Clusters

Rank	Cluster ID	Hub Description	City
1	434	San Rafael Transit Center Platform A	San Rafael
2	376	Manzanita Park & Ride Lot	Manzanita
3	347	Market St & 62nd St	Oakland
4	47	Market St & 16th St	Oakland
5	319	Acalanes Dr & Catron Dr	San Leandro
6	830	Winchester & Payne	San Jose
7	332	Pacific Av & 4th St	Alameda
8	175	Woodside Rd & Hess Rd	Redwood City
9	179	El Camino Real & Main St	Redwood City
10	348	Sacramento St & Fairview St	Berkeley
11	391	Harbour Way & Ohio Av	Richmond
12	170	El Camino Real & Northumberland Ave	Redwood City
13	176	El Camino Real & Charter St	Redwood City
14	395	San Pablo Av & I-80 Fwy	Richmond
15	396	San Pablo Av & Clinton Av	Richmond
16	177	Northumberland Ave & Marlborough Ave	North Fair Oaks
17	392	Richmond BART	Richmond
18	82	Winchester & Cadillac	San Jose
19	178	Middlefield Rd & Dumbarton Ave	North Fair Oaks
20	423	Concord	Concord
21	105	Mathilda & California	Sunnyvale
22	315	E 14th St & Blossom Way	San Leandro
23	171	El Camino Real & Oakwood Dr	North Fair Oaks
24	106	Sunnyvale & Central	Sunnyvale
25	254	Meekland Av & Grove Way	Cherryland