

Oakland

Smart + Equitable City



Photo: Greg Linhares, City of Oakland

A proposal to conduct a
Smart City Demonstration in Oakland, California

Submitted in response to
U.S. Department of Transportation
Notice of Funding Opportunity Number DTFH6116RA00002
“Beyond Traffic: The Smart City Challenge”

February 2016





Photo: Greg Linhares, City of Oakland

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Photo: Greg Linhares, City of Oakland

I. Vision

This **Oakland: Smart + Equitable City** (OSEC) proposal presents a vision to transform Oakland, California, a mature, multi-cultural city facing rapid change, into the smarter, safer, and more accessible city of the future.

We will get there by engaging the imaginations of the city's hard-working people and youth. We will build on our foundation as the region's transportation hub for transit, cars, trucks and cargo ships. We will make better use of technological resources available all around us; allowing Oakland to emerge as a new and different kind of tech center in the Bay Area, more focused on equity and the environment, with a diverse and millennial style. Finally, we will aim higher, take calculated risks, and embrace experimentation with leading edge technology and innovation.

In our vision of a smart and equitable city, Oakland residents move safely and seamlessly between energy-efficient, convenient travel modes within the city and across the Bay Area region. From all neighborhoods and income levels, they travel by reliable transit, by bicycle, and by using shared mobility platforms to reach high-quality jobs. Oaklanders will live in affordable housing near jobs and transit; engaging in a shared experience of racial and social equity through improved mobility, access and opportunities for all.

In the OSEC vision of our future, technology and data will play a greater role in all parts of a traveler's journey:

- **Make information more powerful:** OSEC will partner with leading mapping and traveler guidance platforms and providers to dynamically recommend alternatives to driving when there is a more convenient or otherwise advantageous mode available. To address Oakland's most congested corridors, OSEC will test the ability of incentives and route guidance to spread traffic demand across all available roadways. OSEC will implement smart parking detection and dynamic pricing to provide drivers more accurate and useful information on the true time and cost of driving and parking, including likely parking search time and distance.
- **Provide better travel choices:** OSEC will provide citizens with new travel options, like electric bicycles and shared scooters; enhance alternate modes, such as adding Vehicle Assist and Automation to the new East Bay Bus Rapid Transit line; and reinvent the experience of transferring between modes by creating new Multi-Modal Mobility Hubs, which will include a fully integrated mobile payment platform.
- **Increase Traffic Safety:** Smart transit vehicles, equipped with Operator Assist and Video Detection will "see" and avoid other vehicles, bicyclists and pedestrians. The parking module of the OSEC Advanced Traveller Information system will reduce distracted driving when searching for a parking space. An Urban Freight Delivery parking management system will reduce hazardous double-parking while helping delivery drivers find the parking they need.
- **Respond to data and the people:** OSEC envisions integrating multiple data sources to better collect, evaluate and actively manage all modes of our transportation system, including data generated by the current regional Clipper Card, the proposed common payment platform, GPS units in buses, usage of Mobility Hubs, smartphone/cellphone data, and vehicle, bicycle and pedestrian counts from traffic signal video detection and other detection equipment. OSEC will build a more responsive City government by analyzing and acting on transportation feedback from social media streams like Twitter and Facebook and from city communication portals such as SeeClickFix and 311.
- **Share the knowledge:** OSEC will share a common, publicly readable dashboard to enable staff, citizens and business owners to see the aggregated data and public feedback. Actionable comments could range from "increase the number of bikeshare bikes at West Oakland Mobility Hub #12" to "adjust Line 18 bus schedule so that Oakland High students can get to class on time" to "allow 3 hour parking in Grand Lake so I can get dinner after the matinee." Aggregated information holds enormous untapped potential to inform not only transportation agencies and the city government, but also local businesses, healthcare providers, and housing developers.
- **Commitment to Transportation Equity:** This OSEC proposal rests on a foundational commitment to social equity; we intend to design our project to benefit Oakland's historically underserved neighborhoods first. A smarter Bus Rapid Transit service will greatly benefit East Oakland riders; shared Mobility Hubs will be piloted in low-income areas; our ITS Port improvements will reduce truck emissions in West Oakland; we will make it easier to park in Chinatown, and we will focus our efforts to reduce traffic injuries and fatalities near our K-12 schools all over town. Both the improvements of public transit and the enhancements of goods movement at the Port hold the promise of employment and business opportunities for residents of Oakland's lower income communities. The development of properties around transit nodes represents a key opportunity to provide affordable housing. Not only will we thoughtfully design our efforts to benefit all of Oakland's residents, but we will evaluate our projects on their ability to provide measurable transportation-related equity. The expansion, through the new technologies described in this proposal, of Oakland's commitment to open data, is another key way in which equity will be advanced, as public policies, budgets and programs become more transparent and residents from all neighborhoods become more engaged in planning and decision-making.

Oakland is at a massive turning point, and the USDOT's Smart City Challenge appears at a critical time. Oakland is experiencing a dramatic infusion of people, jobs, investment, and new industries, and we have strong new political leadership. Among Mayor Libby Schaaf's first actions was to establish a new Oakland Department of Transportation, and she brought on Janette Sadik-Khan of Bloomberg Associates to advise the process.

The OSEC project will be managed and implemented by the Department of Transportation, with assistance from other city departments and through partnerships with a number of other agencies and firms. The Department Director will have direct oversight, and will assign the principal Project Managers. This will be one of the DOT's fast-tracked projects with the ability to waive permit fees, streamline procurements and/or enter into pilot agreements with vendors for expediency. The Director's Office will be the single point of contact for all Department of Transportation Divisions, such as Grants and Funding, Signals, Sidewalks and Engineering, as well as other city departments.

Oakland Smart + Equitable City Projects

Project 1: Smart Transit

Ia Automated Bus Transit- Install operator-assisted vehicle guidance technology in BRT

Ib V2V Connected Bus Transit - Bus to bus communications for headway management

Ic V2I Bus to Signal Communication - Transit Signal Priority and Adaptive signals to speed bus routes

Id Bus Lane Enforcement - Automatic bus lane enforcement with License Plate Recognition detection system

Ie Pay by Mobile Bus Payment - Allow users to pay fare using smart phones (part of Project 2a: Universal Payment Platform)

If Transit-based Wi-Fi - Install free Wi-Fi access points on buses, mobility hubs and bus stops (part of Project 3b: Use of Mode Tracking and Project 4a: Mobility Hubs)

Ig Flex-Bus Pilot: Implement on-demand transit service between transit stops and employment centers (part of Project #4a: Mobility Hubs)

Project 2: Traveler Information and Payment Options

2a Universal Payment Platform - Partner with existing mobile payment vendors to offer common payment platform for all modes of transportation (banked users) and partner with Clipper Card to implement NFC card payment for all modes (unbanked users)

2b Mode Recommendation - Partner with existing mapping and route guidance vendors to 1) include time and cost of parking into vehicle mode recommendations, 2) recommend best route based on user preferences instead of default vehicle mode

2c Dynamic Route Assignment - Partner with existing mapping and route guidance vendors to spread traffic demand to all available routes, and provide incentives for users to take sub-optimal routes.



Photo: Greg Linhares, City of Oakland

Project 3: Data Collection, Analysis and System Management

3a Data Dashboard - Partner with existing traffic management agency or vendor to upgrade management software to streamline data inputs and provide reports

3b Use of Mode Tracking - Partner with transit agencies and bikeshare, carshare, on-demand taxi-service vendors to monitor usage of modes and make adjustments - (part of Project 4a: Mobility Hubs and Project 2: Traveler Information and Payment Options)

3c User Feedback - Collect feedback from users through reporting websites (e.g. SeeClickFix) and work with vendors to analyze social media streams (e.g. Facebook/Twitter) for comments on Oakland transportation.

Project 4: New Modal Options

4a Mobility Hub Pilot - Install mobility hubs in West Oakland, Downtown Oakland, and other areas, to provide seamless transfer between modes like transit, bikeshare, carshare and on-demand taxi service (part of Project 1g: Flex-Bus Pilot, Project 1f: Transit-Based Wi-Fi, Project 2a: Universal Payment Platform)

4b Automated Vehicle Policy - Work with transit providers, federal, state and local regulatory agencies, automated vehicle vendors, labor unions, disabled and safety advocacy groups to establish a working policy for deployment of automated vehicles on Oakland roadways.

Project 5: Urban Delivery and Logistics

5a Port of Oakland ITS and Truck Appointment System - Deploy software and hardware to manage truck arrival, freight distribution, and queuing to minimize waiting time and idling in West Oakland neighborhood streets

5b Off-Peak Delivery Demonstration Program Policy - Provide logistics and monetary incentives for off-peak delivery in demonstration areas

Project 6: Freeway Transformation

Replace of depressed I-980 with surface boulevard with Transbay rail transit tunnel below grade in Downtown Area Plan.

2. Population Characteristics

Situated in the rapidly growing San Francisco Bay Area, Oakland is the county seat and largest city in Alameda County with a population of 413,775, making it the eighth largest city in California. It is the major city and commercial and cultural center of the East Bay Area, and represents 12% of the population of the San Francisco--Oakland Urban Area according to the 2010 Census, but its regional importance far exceeds population numbers. Oakland is growing more rapidly than California as a whole; between 2010 and 2014, Oakland population grew 5.9%, while the state's population grew 4.2%. Oakland is densely populated, with 7004 people per square mile.

Oakland's racial, ethnic, socioeconomic, and age diversity is dramatically shifting. There has been a 24 percent decline in African Americans, a 16.7 percent decline in children, and declining income levels for residents of color during the past decade. Oakland was recently ranked as having the seventh-highest income inequality among cities in the nation. Patterns of housing and transportation access continue to be highly segregated by race, ethnicity and income in Oakland.

Employment

Oakland is a major regional employment center. The city had a reported 190,490 jobs in 2010, the third highest concentration in the region, and this is projected to increase by 45%, adding 85,250 jobs by 2040. Oakland is projected to experience the highest rate of job growth in the San Francisco Bay Area over the next 30 years. This will increase the burden on transportation infrastructure, particularly because the regional nature of the Bay Area job market, jobs-housing imbalances and the nature of Oakland's transportation system, which carries a large amount of regional through-traffic. Currently, just 41,000 residents of Oakland work in the city, while 110,000 Oakland residents travel out of Oakland to their jobs, and 135,000 workers travel from outside to their jobs in Oakland.

Poverty, Housing Affordability, and the Strain on the Transportation System

While the technology and financial boom has been positive for the region, as well as Oakland - the benefits of that growth have been uneven. The median household income in Oakland is \$52,583, well below the regional figure of \$77,887; and 16.7% of Oakland households have annual incomes below the federal poverty level, which is a higher proportion than the national average

“Through transportation, we can help ensure that the rungs on the ladder of opportunity aren’t so far apart—and that the American dream is still within reach for those who are willing to work for it.”

– Secretary Anthony Foxx, US Dept. of Transportation

Poverty results in limited access to mobility for many Oaklanders; 18% of Oakland households do not own a vehicle. According to the Center for Neighborhood Technology, households in Oakland spent about 41% of their income on housing and transportation. As low-to-middle income families and individuals are forced by rapidly rising housing costs to move outside of the city, they face increasing time+money costs of transportation and increase the burden on the transportation system and greenhouse gas emissions.

Race/Ethnicity	Population	%
Black or African American (non-Hispanic)	105,362	26.5%
White (non-Hispanic)	103,603	26.1%
Hispanic	102,090	25.7%
Asian (non-Hispanic)	64,955	16.4%
Some other race (non-Hispanic)	21,001	5.3%
Total	397,011	100.0%



Photo: Greg Linhares, City of Oakland

3. Other Characteristics

Oakland's Transportation System

Oakland is the nexus of the Bay Area's rail, highway and freight networks, making it central to the region's economy. Nine major federal Interstate and state highways, and multiple freight and passenger rail lines, combine with Oakland's 806 miles of streets, 677 signalized intersections, 200 miles of bike facilities, and 1,100 miles of sidewalks and pedestrian pathways.

Public Transportation

All four lines of the Bay Area Rapid Transit System (BART) pass through Oakland, which houses eight of BART's 44 stations. The Alameda-Contra Costa Transit District (AC Transit) provide surface bus service to Oakland which carries 192,000 riders a day, on 586 buses and 140 lines. AC Transit is currently building the East Bay Bus Rapid Transit line between Oakland and San Leandro. The city is also served by Amtrak's Capitol Corridor - Amtrak's 4th busiest route in the nation, the Alameda/Oakland Ferry, and several intercity bus services. The Broadway B Shuttle is a free public shuttle that serves as a last-mile connector between downtown Oakland and the Amtrak Capitol Corridor and Ferry terminals. There are several other employee and medical shuttles, and a growing number of shared mobility providers.

Goods Movement

The Port of Oakland plays a central role in the regional economy as the nation's fifth busiest port, handling 99% of the containerized goods in Northern California and 90% of the trade- such as agriculture, wine, and heavy machinery-that moves from the Bay Area. The Port is a major regional employer supporting an estimated 73,500 direct, induced and indirect jobs. The Oakland International Airport moves over 10.3 million passengers and 1.1 billion pounds of high-value air freight each year.

Travel Trends

Roads and transit systems are operating near capacity, and demand continues to rise steeply. In 2014, the most congested street and highway segments in the city caused 32% more delay than the previous year, as drivers experienced 12,800 hours of vehicle delay every day. Each morning, BART and the other transbay transit agencies operate at 101% of capacity between Oakland and San Francisco, and there is no capacity to add new auto trips on the Bay Bridge.

Shared Mobility

Oakland is preparing to launch a massive expansion of shared mobility services in 2016.

Bikesharing

Oakland City has been working with the Metropolitan Transportation Commission (MTC) to expand the Bay Area Bike Share program, providing 850 bikes to Oakland in 2016 through a public-private partnership with Motivate, the nation's largest bike share operator, at no cost to the taxpayer. Twenty percent of stations will be placed in low-income communities, putting equity at the core of the program's design as it expands throughout the region.

Carsharing

City CarShare has been in Oakland since 2004. Today, ZipCar and City CarShare operate approximately 100 vehicles in Oakland. "P2P" shared vehicle providers include GetAround, RelayRides, and Spinlister (bicycles). The point-to-point carshare provider Car2go is planning to launch operations here in 2016. Car2go uses GPS monitoring of the actual time their cars spends at parking meters, which could be a useful new data stream for parking and transportation demand management in Oakland.

Transportation Network Companies

Transportation Network Companies, primarily Uber and Lyft, have a large and rapidly growing presence in Oakland. Uber recently purchased a historic seven-story building in Uptown Oakland, and will be locating 2,000-3,000 workers here.

Electric Scooter Sharing

Oakland is in talks with Scoot, an electric scooter-sharing firm that currently operates in San Francisco and is seeking to expand here.

Solar Electric Fleet Bicycles

In January, Bike Solar Oakland was launched as a public-private pilot program to test a new electric vehicle, shared mobility concept using solar-power to charge electric bicycles and a networked electric scooter manufactured in the U.S. by Mahindra GenZe. The vehicles are being used by the Jack London Improvement District, and the solar equipment was provided by DC Solar, with support from the California Clean Energy Fund, Sungevity, and others.

Commitment to Open Data

The City of Oakland is committed to making public data broadly accessible and usable by people and machines, free of any technological, legal, or usability barriers. In 2013, Oakland [passed an Open Government resolution](#) introduced by then-Councilwoman and now Mayor Libby Schaaf. The City has published over 200 data sets since 2013. Examples include:

- OpenBudget Oakland
- OpenDisclosure Oakland

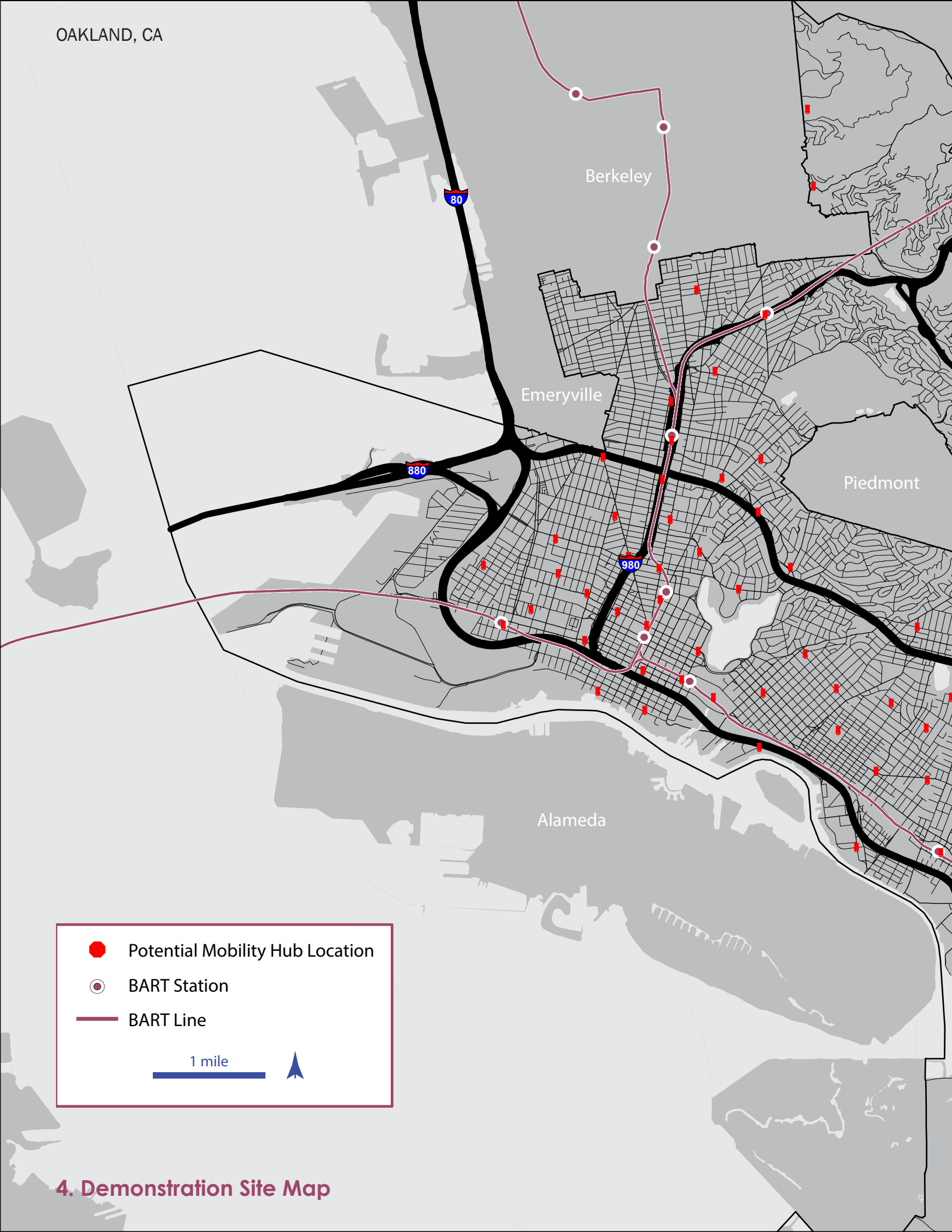
Data in machine readable formats has created new opportunities for information from different sources to be combined and visualized in new and unexpected ways, for niche markets to be identified and developed, and for citizens to browse, interpret and draw attention to trends or issues with greater efficiency.




To make the public reporting of problems and tracking progress easier, Oakland uses SeeClickFix, an online and mobile tool that helps residents report and track non-emergency problems, such as graffiti, illegal dumping or potholes. Citizens can submit a report with a photo, track requests, and monitor resolution. The SeeClickFix-Oakland tool can easily be linked on blogs or websites, so readers can report problems directly from local blogs.


[Oakland's Digital Front Door Project](#) is a partnership with Code for America to improve public access to City information and services and to interact with local government. A digital dashboard enables city staff to monitor website usage in real-time. With attribution to Oakland, Code for America has since deployed this product in San Antonio, Philadelphia, and Pittsburgh. City Council adopted a "Digital First" policy, which requires that Oakland produces all of its information and official documentation in a machine-readable and human-consumable format.

OpenOakland is a nonprofit civic innovation organization that brings together coders, designers, data geeks, journalists, and Oakland city staff to collaborate on solutions to improve the lives of Oaklanders. OpenOakland operates a community-based open-data portal and OaklandWiki, and creates apps that help Oakland citizens chart crime trends, submit FOIA requests, or adopt local storm drains.

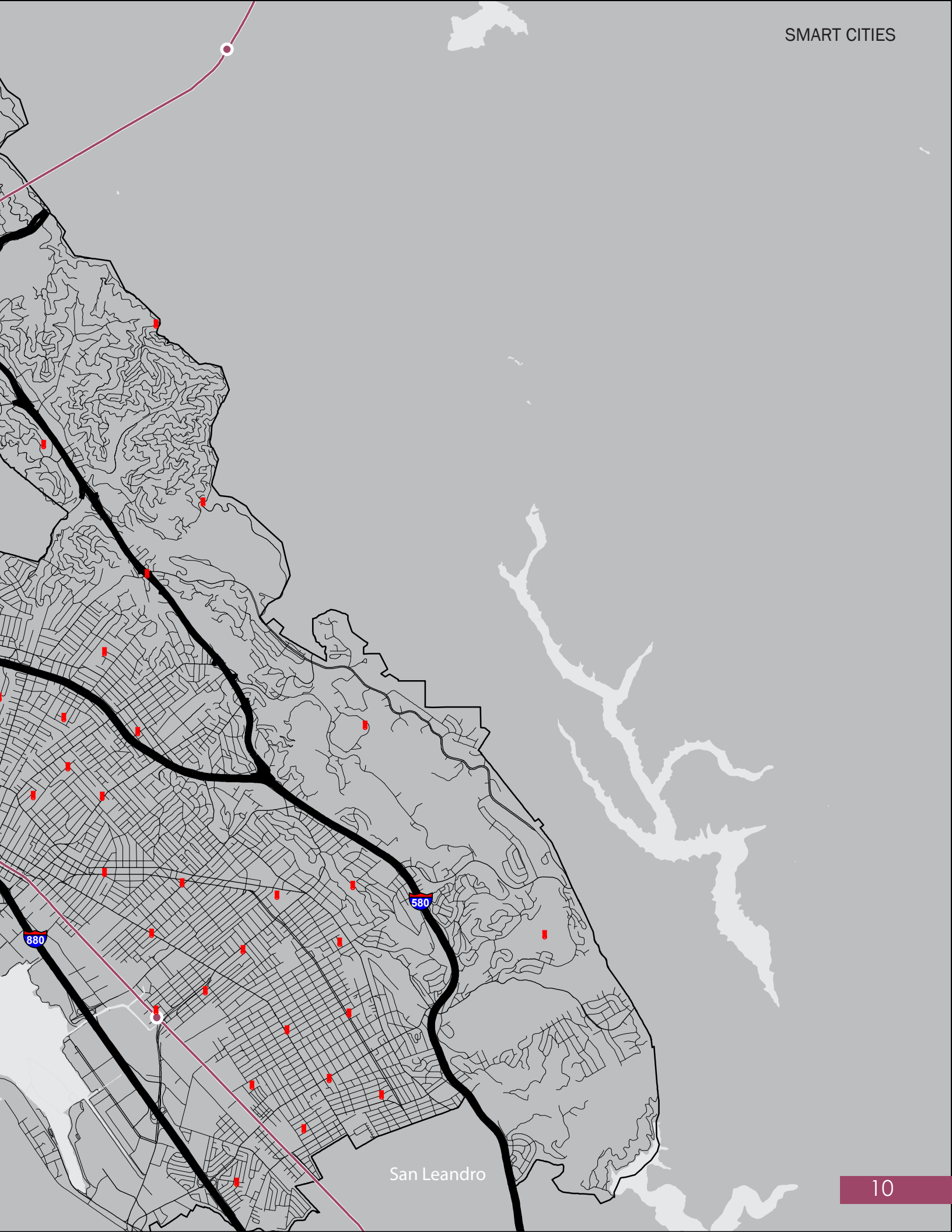
An [interactive](#) Multimodal Mobility Hub site suitability analysis [webmap of Oakland](#) map that emphasizes equity, resiliency, and connectivity was recently developed by UC Berkeley for Oakland. Oakland's Bicycle Program provides an on-line interactive map that organizes and displays bicyclist and pedestrian counts (www.oaklandbikemaps.info) and other spatial data.



-  Potential Mobility Hub Location
-  BART Station
-  BART Line

1 mile 

4. Demonstration Site Map



San Leandro



Photo: Greg Linhares, City of Oakland

5. Project Approach & Alignment to Elements

USDOT Vision Elements Alignment with OSEC Projects

Project	Vision Element											
	1	2	3	4	5	6	7	8	9	10	11	12
Project 1: Smart Transit												
1a Automated Bus Transit	x	x			x		x			x		
1b V2V Connected Bus Transit		x	x		x		x			x		
1c V2I Bus to Signal Communication			x		x							
1d Bus Lane Enforcement			x							x		
1e Pay by Mobile Bus Payment				x	x						x	
1f Transit-based Wi-Fi			x	x	x		x	x		x	x	
1g Flex-Bus Pilot		x			x		x					
1h Electric Bus Conversion								x			x	
Project 2: Traveler Information and Payment Options												
2a Universal Payment Platform				x	x		x		x		x	
2b Mode Recommendation			x	x			x		x		x	
2c Dynamic Route Assignment			x	x			x		x		x	
Project 3: Data Collection, Analysis and System Management												
3a Data Dashboard				x			x			x		
3b Use of Mode Tracking			x	x			x		x		x	
3c Smart Retail			x	x			x		x		x	
3d User Feedback			x	x			x		x		x	
Project 4: New Modal Options												
4a Mobility Hub Pilot		x					x		x			
4b Automated Vehicle Policy	x						x					
Project 5: Urban Delivery and Logistics												
5a Port of Oakland ITS and Truck Appointment System				x		x	x				x	
5b Off-Peak Delivery Demonstration Program Policy						x	x					
Project 6: Removing Barriers												
6a I-980 Freeway Transformation									x			x

Detailed Project Approach

Project 1: Smart Transit

Ia Automated Bus Rapid Transit- Install operator-assisted vehicle guidance technology in BRT

Project 1a: Vehicle Assist and Automation Demonstration on East Bay Bus Rapid Transit

Automated, predictable curb access enables transit buses to achieve rail-like quality of service and improve operational efficiencies through tighter scheduling. VAA can assist bus drivers with a degree of automated steering control and precision bus docking, making it possible for BRT vehicles to dock so precisely at stations that disabled riders using wheelchairs will be able roll on or off the buses with a only very small gap (within 1.5 cm centimeters) between the bus floor and the loading platform at the station. VAA can also offer BRT passengers a smoother, more rail-like ride by improving lateral ride smoothness, providing more even acceleration and deceleration, and ensure more precise stop location within their station area.

Oakland proposes to implement VAA on the East Bay Bus Rapid Transit route in partnership with AC Transit, UC PATH, and US FTA and the ITS Joint Program Office. This project would conduct field operational tests to demonstrate the technical feasibility the VAA system, a magnetic and GPS-based guidance system that allows buses to negotiate docking stations and dedicated right-of-way lanes with precision that adds significant efficiency and quality.

This project would restore a previous partnership between AC Transit, UC PATH, FTA and RITA and relocate it into a complex urban setting. Automatic bus lane enforcement with License Plate Recognition would also benefit BRT operation.

Ib Connected Bus Transit - Bus to bus communications for headway management

Oakland proposes to partner with AC Transit to provide V2V BRT headway management that shares information on headway separation between transit vehicles and bus operators to inform driver decision-making and teamwork on the East Bay BRT transit line.

The program could also provide V2V communication between BRT vehicles and buses on intersecting AC Transit routes to provide real-time, on-board

information for drivers and passengers to improve bus transfers. A “hold bus” message could be sent to operators of connecting local lines to wait for the BRT bus, reducing frustrating missed connections (connection preservation).

Ic Bus to Signal Communication - Transit Signal Priority and Adaptive signals to speed bus routes

The city would implement Transit Signal Priority (TSP) using connected vehicle hardware for AC Transit express bus services on the heavily traveled access routes to the San Francisco-Oakland Bay Bridge, to supplement TSP installations already operating throughout the City. We would augment this with Adaptive Traffic Signals on the same corridors to allow for passive transit priority where possible.

Id Pay by Mobile Bus Payment - Allow users to pay fare using smart phones (also part of Project 2a: Universal Payment Platform)

Communications and payment technology would be put to use for AC Transit passengers by offering a mechanism to pay for transit by phone on bus routes with advanced fare payment. This transit payment module is a part of the Universal Payment Platform for mobile payment and the enhanced Clipper Card discussed in more detail in Project 2a.

Ie Transit-based Wi-Fi - Install free Wi-Fi access points on buses, mobility hubs and bus stops (also part of Project 3b: Use of Mode Tracking and Project 4a: Mobility Hubs)

Installing Wi-Fi on all AC Transit buses and at bus stops and Mobility Hubs would reduce pressure on low income passengers' data plans and eliminate the primary reason why low-income riders are forced to give up their smart phones. The installation of Wi-Fi at transit facilities will help Project 3b, where Wi-Fi points on buses, bus stops and Mobility Hubs could be used to pick out a stream of cellphone/smartphone data to separately analyze transit ridership.

Ig Flex-Bus Pilot: *Implement on-demand transit service between transit stops and employment centers (also part of Project #4a: Mobility Hubs)*

AC Transit seeks to initiate Flex pilots in low density, job-rich industrial areas and provide a phone app to include frequently used languages such as Spanish, Chinese, Tagalog, Korean, Arabic, Russian, Khmer and Vietnamese.

Deployed in connection with Project 2a: Universal Payment Platform and Project 4a: Mobility Hubs, the Dynamic Transit Operations application allows travelers to request trips and obtain itineraries using a handheld mobile device (or computer). This application builds on existing technology systems such as computer-aided dispatch/automated vehicle location (CAD/AVL) systems and automated scheduling software, providing a coordination function within and between transit providers that would dynamically schedule and dispatch or modify the route of an in-service vehicle by matching compatible trips together.

To reduce the costs of deploying the system, AC Transit would seek to partner with and leverage VTA's existing Flex pilot (www.vta.org/flex) operational concepts and applications developed by RideCell (ridecell.com). Software developed by Ridecell automatically routes vehicles to pick up customers along a similar travel route while minimizing travel times.

The platform will also be used to improve paratransit services and reduce costs and improve services. The introduction of Flex service in Oakland would be an effective strategy to serve the low density neighborhoods of Oakland.

Project 2: Traveler Information and Payment Platforms

Oakland is seeking to partner with the public agencies and private vendors in traveler information and payment platforms who have demonstrated good market penetration into all modes. Part of this will be an assessment of the vendors' proposed User Interface (UI) for the OSEC project in terms of simplicity, reliability, "machine learning" of user preferences and an understanding of how users make decisions in planning mode and in stress mode.

2a Universal Payment Platform

The presence of carshare, bikeshare, car2go and Uber/Lyft vehicles is not enough to provide service to users. The final, and perhaps more serious barrier, is payment. Payment is a barrier in terms of both affordability and convenience. Providing multiple mobility services is great, but when users need to transition from one form of payment to another it does not provide the seamless, connected experience to attract sufficient new users.

Oakland would partner with existing mobile payment vendor to create a common payment platform for all modes of transportation (banked users) and partner with Clipper Card to implement NFC card payment for all modes (unbanked users.)

Journey-to Work Support for low-income employees

An enhanced Clipper Card, with NFC technology that works with carshare and bikeshare, will be issued to pilot participants that meet the low-income Journey-to-Work criteria. Mobility hubs will include reader kiosks where users can swipe their enhanced Clipper Card and nearby Uber/Lyft drivers could be notified that a user is ready for their trip from a Mobility Hub to home/work. Participants will only be eligible for subsidized Uber/Lyft service if the trip ends include a mobility hub and home or work. For this, carshare and bikeshare providers must provide their card technology to help build the enhanced Clipper Card - and Uber/Lyft must provide a kiosk that can interact with their reservation system. Clipper must agree to build the enhanced card and communicate usage patterns for analysis.

Free or Subsidized First Mile/Last Mile Travel

For participants that meet a low-income commute to work criteria, travel on any mode of transportation from mobility hubs to home or work will be free or subsidized, using funds from OSEC. Participants will be issued an enhanced Clipper Card for the duration of the pilot, good for travel on any mode at any time. However, the portion of the trip that covers the first or last "mile" or segment of the trip will be free, e.g. the participant's registered work place or home. Participants would be asked to allow their Clipper Card usage to be analyzed (in aggregate) to determine what factors affect the use of each mode. Participants may also be asked to fill out questionnaires before and after the pilot to gather their feedback on the mobility hubs and the ease of use of the payment platform.

5. Project Approach & Alignment to Elements

Universal Mobile Payment Platform (Banked Users)

For users who do have access to smartphones and apps and registered credit cards, Oakland plans to partner with vendors who offer a common payment platform and have existing relationships with transit providers and private companies that provide carshare, bikeshare, etc such as the Mobility Marketplace offered by Xerox, or upgrades to Google Wallet or ApplePay.

The platform would allow for “virtual” mobility hubs by providing real-time match-making between mobility supply (existing mobility services) and demand (trip requests). This would mean that any location within, and **outside city limits**, could become a transfer point from one mode to another. Xerox’ Mobility Marketplace, for example, also takes into account user preferences and constraints to provide more personalized suggestions.

The successful vendor would provide a User Interface (UI) that emphasizes simplicity, reliability, “machine learning” of user preferences and an understanding of how users make decisions, as well as a commitment to the security standards to protect the users’ personal information. The web-based common payment platform would allow users to send signals to companies like Lyft and Uber as they near the mobility hub on transit, ensuring less waiting time at the hub itself.

2b Mode Recommendation

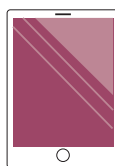
Oakland seeks to partner with existing mapping and route guidance vendors to 1) include time and cost of parking into vehicle mode recommendations, 2) recommend best route based on user preferences instead of default vehicle mode. Technology can do a better job to provide the most complete information for travelers to make the best decision at two key points: 1) Before their trip starts and 2) Once their trip is underway. We are confident that better information will lead some travelers to make choices that spread the transportation load across the entire system.

Our goal is to encourage users to consider alternatives by presenting alternatives in a simple way that highlights the benefits. The application could be based on Google or Bing! and would allow selection of transit, cycling and walking, and provide estimated travel time and distance with information on current traffic conditions, transit schedules and best cycling/walking routes.

For the OSEC project, Oakland will work with MTC and their connected vehicle program to pilot the next generation of a route-finding and map service, like Google/Waze, Bing!, HERE, Garmin, or TomTom, to develop a web and smartphone enabled application. We will partner with an existing vendor that delivers reliable data with good market penetration and value.

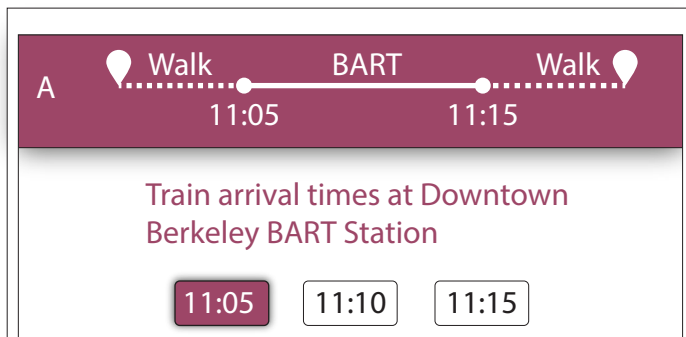
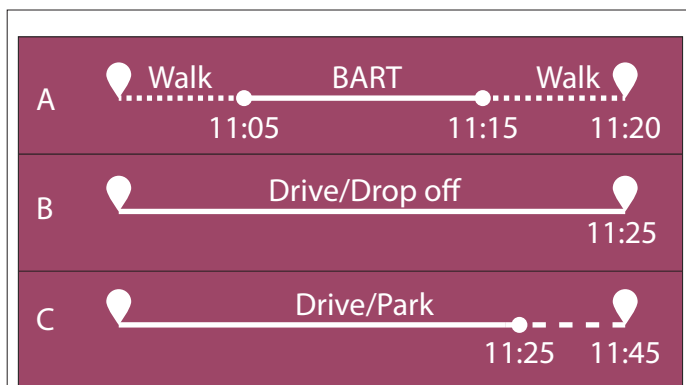
When customized for the Oakland Smart City specification, the upgraded vendor application might be used as illustrated in the following example:

Scenario 1:



Start:

End:



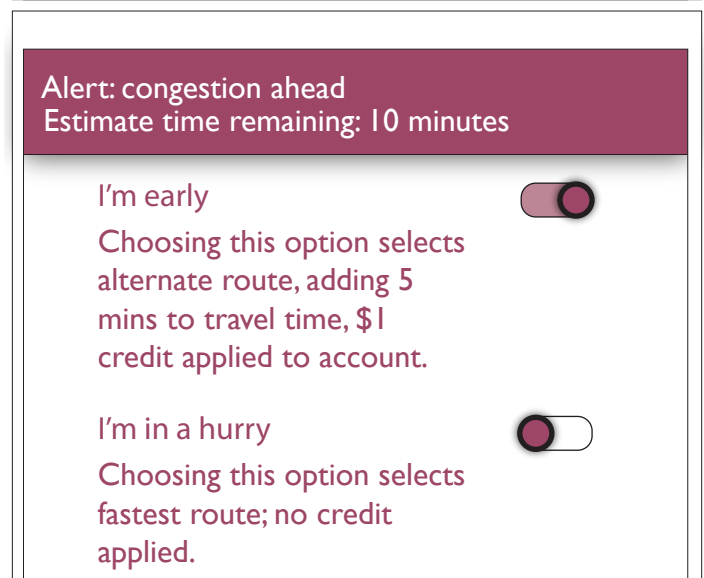
In the preceding scenario, three features may result in reduced congestion:

- 1) The application computes travel time for all modes and **actively recommends the mode with the shortest travel time, instead of defaulting to the auto drop-off mode** and only providing information for other modes if they are selected. *We do expect that auto will often be the fastest mode.* It is important that the application provides value to the user or it will not be used. The fact that auto is often the fastest mode is important feedback for the City of Oakland and its partner agencies such as BART, AC Transit and bikeshare to make strategic improvements that will lead to a user making a different decision next time.
- 2) **The application features true travel time which includes parking, one of the most important factors in the decision to drive.** Searching for parking and the walk from parking to the ultimate destination can be a significant portion of the trip - and the most frustrating. The application can also provide information on the cost of that parking space, and the time limits associated with it. This is often a hidden cost of driving that could sway users from driving altogether. The lack of information about parking is frustrating to drivers who have no choice but to deal with parking once they have made the decision to drive. It's important to present this information BEFORE the decision is made to drive.
- 3) **The application will work hand-in hand with Oakland's smart parking program** that will set rates and time limits to ensure a target availability per block and 20% availability in off-street city garages/lots. While demand-based parking pricing has been shown to improve parking availability, studies in New York and Berkeley have shown that approx. 50% of parkers are not aware of the parking rate they have paid. This application will make the choice of parking location, rate and duration explicit and simple.

2c Dynamic Route Assignment - Partner with existing mapping and route guidance vendor to spread traffic demand to all available routes, and provide incentives for users to take sub-optimal routes

Map and routing services that collect data from cell phones, such as Google/Waze and Streetlight, have the ability to calculate many different routes for the same origin and destination points, but only present the one with the fastest travel time. This is because this provides the best value to the user. However, it makes poor use of all available roadway capacity. The OSEC project seeks to make use of all the available capacity by providing choices and incentives to drivers. During the demonstration, participants for the routing application would sign up for the "Take Your Time Program". This is envisioned as the same application discussed above.

Scenario 2:



5. Project Approach & Alignment to Elements

In the preceding scenario, two features may result in reduced congestion:

- 1) The application uses **monetary incentives to spread traffic to all available capacity which results in the least amount of congestion overall.** The best distribution of traffic over the network that leads to the least amount of delay for the whole system inevitably means that a few drivers will be sent on routes that are not optimal. Especially in a city like Oakland that does experience uneven traffic demand and congestion, a redistribution of traffic could have significant impacts. This approach recognizes that and allows drivers to self-select sub-optimal routes in return for a pay-off. The demonstration will test how many drivers select this option and what effect it has on overall congestion and travel time.
- 2) The application **navigates the driver to the next available parking space, taking the uncertainty and the distracted driving out of the search for parking.** Some studies estimate that 30% of drivers in Downtown areas are searching for a parking space. This application navigates them to their best chance of finding a parking space, reducing the act of “circling”. The benefit of the turn-by-turn navigation in the application is a more alert and safer driver who is able to observe cyclists, pedestrians and other vehicles, instead of focusing on looking for the empty space. Oakland staff has observed that drivers who are looking for parking are distracted drivers.

Sample parking interface:

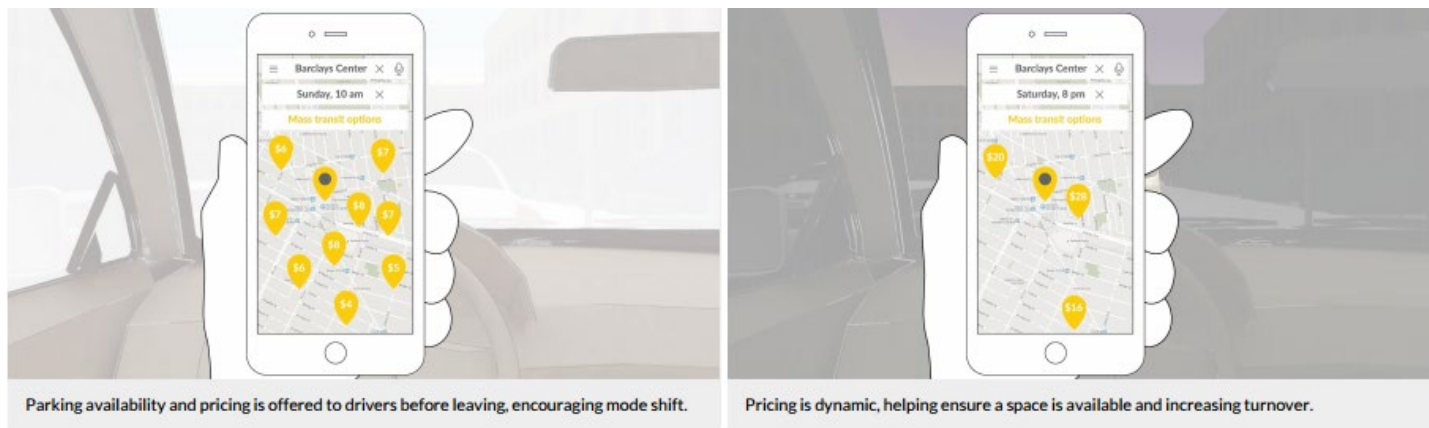


Image courtesy of Sidewalk Labs

Project 3: Data Collection, Analysis and System Management

The OSEC projects will generate, and collect, multiple streams of data, including the low-cost, and potentially game-changing data source of cellphone/smartphone data which has the ability to provide travel time and location information across ALL modes. The sub-projects below are the focal point where each of the OSEC projects come together for city management to monitor the system and respond.

3a Data Dashboard - Partner with existing traffic management agency or vendor to upgrade management software to streamline data inputs and provide reports.

The OSEC will work with an established vendor to create a thorough and efficient data collection methodology to migrate the City's existing data and resources and ingest new streams of data. The city will start with Oakland's existing Geographic Information System (GIS) data and data from our work on the regional travel model and other research, including the following:

- Existing and planned bicycle and multi-use trail facilities in Oakland.
- Sidewalk coverage
- Caltrans plans for bikeways parallel to state controlled transportation corridors
- Water features (lakes, rivers, and creeks)
- Railroad routes
- Truck routes
- Bridge locations
- Digital elevation model or contour data
- Parcel database containing land use. This data will include schools, parks, libraries, fairgrounds, shopping malls, and other key features
- Collision data
- Roadway centerline data containing Classification,
- Real-time travel speed, Vehicle volumes, Travel lanes, Road surface type

- Intersection control locations (traffic signals and stop sign)
- Demographic data

The complete GIS-based Data Dashboard will allow the City to calculate measures such as Level of Traffic Stress (LTS) in real time. Oakland will utilize an Enterprise GIS system, which integrates GIS server technology and web mapping to provide a comprehensive web-based platform for the sharing, editing, and analysis of spatial data. Oakland's Enterprise GIS will facilitate internal file sharing with a other departments, stakeholders and the project team. Web maps deployed within the enterprise platform enable users to navigate, interact with map elements for additional information, and if desired, provide comment. The system is nimble and customizable allowing for rapid deployment of new applications.

The system will ingest data generated by the OSEC projects, as described in Section 3b below. Ultimately, this Data Dashboard will allow Oakland to perform network analysis, in real time, to examine:

- Route directness analysis between high activity locations and disadvantaged communities to identify the ratio between network travel distance and a straight line. This metric measures how direct travel routes are between origin and destination.
- Connectivity between transit network and job/housing centers, to identify locations that may impede travel and provide opportunities for locating mobility hubs

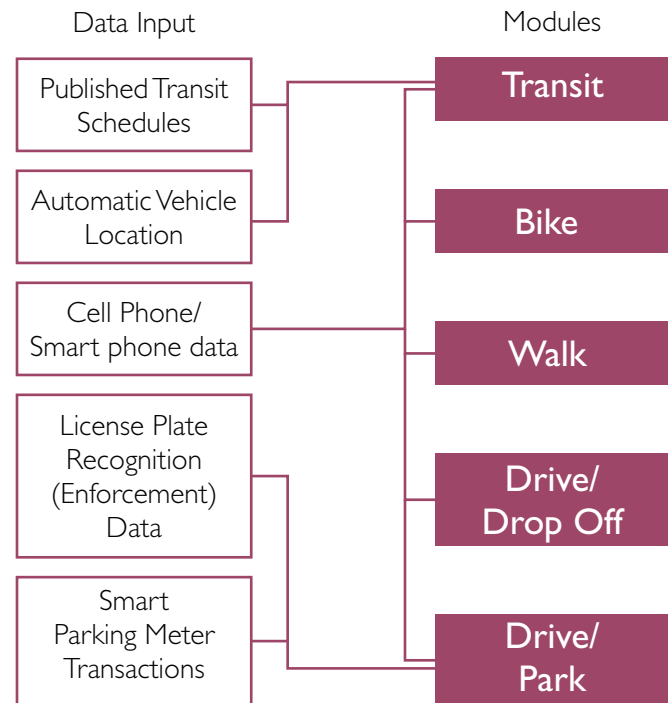
This proposal uses some innovative GIS planning methods and re-tools them to also include real-time data metrics to share with the public. Staff, advocacy groups, or citizens could then analyze the data to propose transportation improvements for low income, disconnected communities or areas with high bike/ped crash rates.

5. Project Approach & Alignment to Elements

3b Use of Mode Tracking - Partner with transit agencies and bikeshare, carshare, on-demand taxi-service vendors to monitor usage of modes and make adjustments - (part of Project 4a: Mobility Hubs and Project 2:Traveler Information and Payment Options)

Cell Phone / Smartphone Data

The Smart Oakland project is in discussion with vendors who collect traffic and parking data, analyze the data and provide the navigation user interface. Potential partners such as Sidewalk Labs (Google/Waze), Xerox and Streetlight have the ability to collect data from cell phone use, and published transit/cycling data, to populate algorithms that calculate travel times. This is a wealth of data that is currently being used to analyze traffic congestion only, when it can be used to also determine parking behavior, transit congestion and behavior and even pedestrian behavior. Oakland considers this to be the best source of data during the Smart City project because of the low cost of data collection / analysis, and its ability to collect data across all modes.



Parking data can be gleaned from cell phone/smart phone usage - as a vehicle approaches its destination and circles and then stops, a parking event can be assumed. However, the City of Oakland seeks a data platform that starts with the currently available cell phone usage and can incorporate other data inputs.

License Plate Recognition and Smart Parking Meter Data

The City of Oakland is about to begin a “Smart Parking” pilot in several of its commercial areas and plans to use the City of Berkeley’s combination of License Plate Recognition (LPR) and smart parking meter data technology to collect data on the availability of parking spaces. The project in Berkeley was sponsored by an FHWA Value Pricing Pilot Program grant.

When the OSEC project begins, the parking module of the application will be fed by a combination of cell phones/LPR/smart parking meters to provide the best possible estimate of parking availability. During a scan, city staff found parking sensors as currently offered by vendors, to be unreliable in accurately detecting parking availability and cost-prohibitive for long-term deployment. For instance, parking sensors in the SF Park pilot are no longer used to detect parking availability, mainly due to maintenance and cost pressures. Other cities that have deployed sensors offered the City of Oakland mixed feedback on reliability and accuracy. However, the successful vendor’s platform will have the ability to ingest any technology that provides an estimate of parking availability. As such, the platform should also accept embedded in-ground parking sensors or in-meter sensors, should that technology prove reliable.

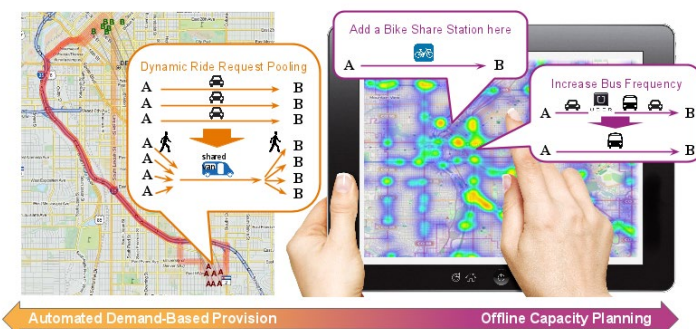


Image courtesy of Xerox State and Local Solutions

The Larger Vision for Data

3c User Feedback - Collect feedback from users through reporting websites (e.g. SeeClickFix) and work with vendors to analyze social media streams (e.g. Facebook/Twitter) for comments on Oakland transportation.

Public participation has always presented somewhat of a problem to transportation planning, as engagement and communication often prove difficult due to the technical aspects of transportation and the long time scales of planning. A potential solution to this problem has presented itself in the form of connectivity provided through the Internet: web-based and social media tools are generating opportunities to supplement and support public engagement through information sharing, and creating new pathways of engagement through the real-time, open dialogue nature of social media. However, the uses and potential of these new tools are not well understood in the transportation planning profession. Public engagement is still often solely

focused around the public meeting or traditional issue reporting or comment systems.

Digital public engagement methods, combined with more traditional public engagement, may provide the best insight to what Oaklanders care about and help the City respond to problems and invest funding where it's needed most. If the City could gauge its work in terms of satisfaction of those most affected by the work, rather than relying solely on metrics such as "potholes filled", "lanes miles paved" or "customer service calls answered", then trust in government starts to build.

In 2015, the City of Oakland and the University of California, Berkeley, mined available social media feeds from Twitter to see what common themes or topics emerged about Oakland's transportation system. From this analysis, the following themes emerged along with how citizens felt:

Topic	Number of Tweets	Percent Positive	Percent Negative
Active Transportation Modes	337	30%	16%
Automobiles and Driving	369	26%	26%
Location	321	21%	20%
Professional Sports Events	140	32%	15%
Transit	859	28%	19%

Project 4: New Modal Options

While Oakland's transit network is sound (including BART, AC Transit Rapid and BRT service), its ability to attract users is hampered by the first mile/last mile problem. In particular, transit is usually the only choice for residents of low-income communities, but getting to the BART or AC Transit stop or station may be too expensive and time-consuming. These residents drive if they have access to a vehicle or look for jobs that don't require long commutes, ignoring the jobs that may be available in the employment centers of Downtown Oakland and San Francisco. In addition, potential solutions to the first mile/last mile problem are rarely

available to low-income communities. Services like Uber and Lyft are cost prohibitive, often requiring a minimum payment of \$5 one-way. Point-to-point carshare, such as Car2Go, and bikeshare/e-bike stations, are rarely installed in low-income communities because of market projections of low demand.

While low-income communities arguably have the most to benefit from shared mobility services, there are a host of structural, informational and financial barriers that keep vulnerable populations from accessing these services. TransForm's Shared Mobility for All Campaign

5. Project Approach & Alignment to Elements

in Oakland will include multilingual outreach and education so that disadvantaged communities are not continually the afterthought of tech-enabled mobility solutions.

4a Mobility Hub Pilot - Install mobility hubs in West Oakland, Downtown Oakland, and elsewhere to provide seamless transfer between modes like transit, bikeshare, carshare and on-demand taxi service (part of Project 1g: Flex-Bus Pilot, Project 1f: Transit-Based Wi-Fi, Project 2a: Universal Payment Platform)

Mobility hubs have the potential to address several notable deficiencies in Oakland’s present transportation system, including poor first- and last-mile access from many areas of the city to key bus and rail transit stations, and long travel times for public transit trips that do not utilize core high-frequency transit services. In 2015, the City of Oakland and the University of California, Berkeley explored the concept of a mobility hub - providing multiple modes of transportation in the same location so that users are able to pick the most appropriate one, recognizing that different modes are more appropriate at different locations.

As illustrated in Figure 1, hubs may include the following modes and infrastructure, depending on location:

1. public transit service, including rail transit stations or bus stops;
2. bike share dock stations;
3. designated white curb space for passenger pickup and drop off for ride share services and taxis;
4. designated parking spots for car share vehicles; and
5. designated parking spots for scooter share vehicles.

Some mobility hubs may simply include a cleared curb for pick-up/drop off of taxi and services like Lyftline or UberPool (or their non-pooled versions). This would be the simplest to implement with perhaps a large impact - currently 30% of Uber and Lyft rides in the Bay Area begin or end at a transit stop.

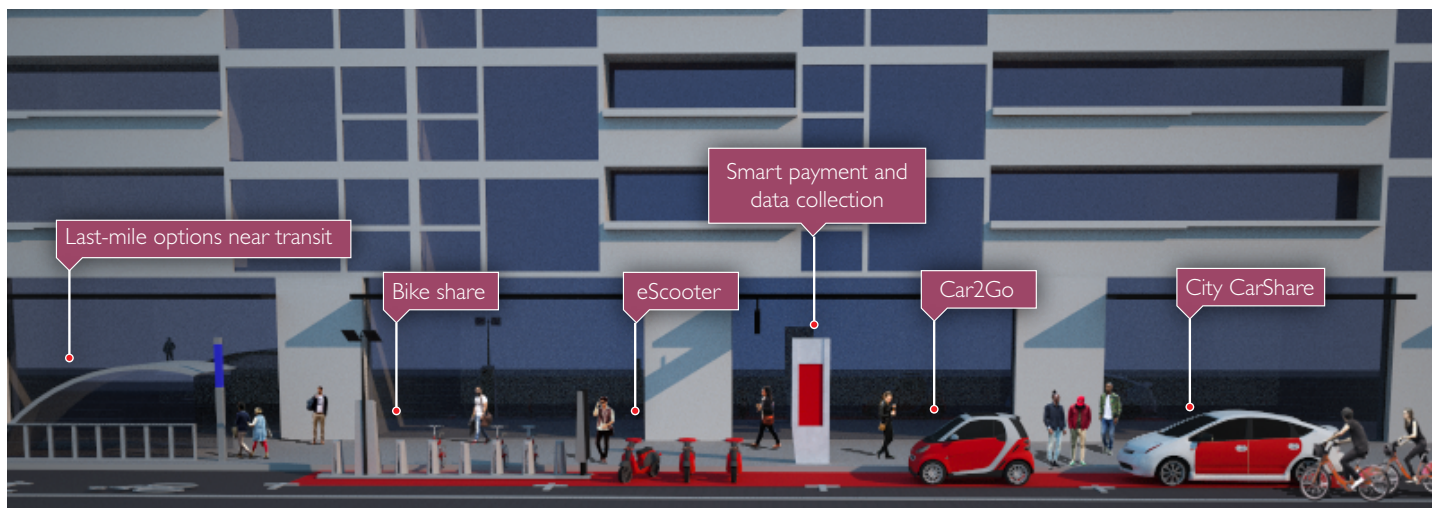


Figure 1: Rendering of a mobility hub on a city street with BART, AC Transit, carshare, scootershare, bikeshare. Note: Vendors are placeholders - no procurement has been performed.

In total, a number of different factors and criteria resulted in the recommendation of 77 mobility hub locations, spaced 0.5-1.0 mile apart, on average. In general, hubs will be located in close proximity to key transportation infrastructure and services, including high-frequency bus and rail transit lines; in areas with high observed land use intensity; and in lower-density residential neighborhoods that currently lack high-quality mobility options.

Mobility Hubs will allow seamless transfer between modes, offering Oakland travelers several attractive alternatives to the automobile, and extending the reach of transit service. The data collected by mobility hubs will be analyzed to understand user trends and needs.

The Smart City Challenge would allow Oakland to test the solution in areas that need it the most i.e. low-income, disadvantaged communities. Normally, these are the last areas to receive upgrades like bikeshare stations or transit improvements because the market analysis predicts that the number of users served will be low. What the market analysis fails to consider is why the number of users is low - that there are inherent barriers to use, including safety, convenience and cost. Oakland is committed to overcoming those barriers through cohesive methods outlined in this application.

4b Automated Vehicle Policy - *Work with transit providers, federal, state and local regulatory agencies, automated vehicle vendors, labor unions, disabled and safety advocacy groups to establish a working policy for deployment of automated vehicles on Oakland roadways.*

In an era of rapid technological changes, many of which promise to profoundly affect urban life, local governments are typically well behind industry. In recognizing the near-term impact of automated and connected vehicles, we are acutely aware that U.S. cities need to be far more active players in creating a nimble regulatory framework for the development and management of this city-changing frontier.

Oakland is prepared to play a leading role with our neighboring cities, CalTrans and others, to work through the many urban and regional policy and operational issues. Oakland would convene an AV/CV Public Policy Working Group with a mandate to consider the safety implications, operations, public involvement

requirements, liability, social equity, and cross-jurisdictional issues that need to be crafted in order for autonomous vehicles to move forward in a significant way. As one example, the Oakland and San Francisco Mayor's Offices have begun discussions of the complex governance issues related to piloting operator-assisted express bus service on the San Francisco Bay Bridge.

This Working Group will work with the private sector on the development of AV/CV demonstration projects in Oakland. The Working Group will develop a review and approval process for project submittals from the AV/CV industry that will enable the use of Oakland public Rights-of-Way. The Working Group will develop the standards for technical specifications, public approval, liability, and reasonable fees.

Demonstration projects will be considered on Port of Oakland, Oakland International Airport, Oakland Army Base, and on city streets. Applications will be invited for freight, transit, urban goods delivery and personal transportation vehicle projects.

Project 5: Urban Delivery and Logistics

Intelligent Freight Transportation Systems are another method for improving the efficiency and reducing the impact of goods movement on residents and communities, especially disadvantaged communities most affected by air quality and truck congestion.

Though it is very important for the business and life of a city, commercial traffic has never been given much attention in the transport planning process. Urban delivery, particularly double parking, has long been vexing to city residents and drivers, but has been largely ignored, even unofficially sanctioned, by policy makers, traffic management and enforcement professionals, and even local businesses, largely because solutions were not apparent.

Traffic congestion, scarcity of loading and unloading areas in city centers, and sub-optimal delivery routes negatively impact system efficiency, the environment, traffic congestion, and safety. Distributors would benefit from more accessible and reliable traffic information, and better and more predictable access to limited resources like loading and unloading zones. Policy strategies, such as breakpoints to enable transfer of goods to smaller vehicles, vehicles on dead-head routes, or overnight delivery programs could help to

5. Project Approach & Alignment to Elements

reduce impacts on urban residents and improve goods movement efficiency. An OSEC project would develop, pilot and evaluate an Urban Freight Deliver Traffic and Curb Management Network to integrate urban traffic management systems with the management of freight and logistics in urban areas.

5a Port of Oakland ITS and Truck Appointment System - Deploy software and hardware to manage truck arrival distribution and queuing to minimize waiting time and idling in West Oakland neighborhood streets

Goods movement plays a critical role in providing employment and economic vitality in Northern California. Goods movement-dependent industries provide over 1.1 million jobs, a third of all employment in the region. More than \$953 billion in freight moved to and from the megaregion in 2012, and this figure is projected to grow to \$2.6 trillion, a 168% increase, by 2040.

This proposal is focused on a Marine Terminal Appointment System, including software and reconfiguration of existing systems to smooth peak congestion for trucks and reducing emissions from queuing. Truck turn times from the entrance gate to exit gate have risen to more than 60 minutes for up to half of all trucks, while outside the gates, truckers are reportedly waiting two to four hours. The project would reduce peak period truck queues using the USDOT's Freight Advanced Traveler Information System (FRATIS). The concept includes integration of a web-based software system that provides terminal operators with a "prenotification" of trucks arriving at the Port for a specific load and allows trucking companies with "automated hand-shakes" to establish specific appointment times. Vehicle sensors would provide continuous queue measurements at each terminal which would be enable a new Port-area traffic operations system to adapt scheduling and recommended truck routing.

Full deployment would eventually include the construction of a Traffic Management Center linkage with the City of Oakland and Caltrans, network backbone, sensors, cameras, signal interconnect, and dynamic message signs.

5b Off-Peak Delivery Demonstration Program Policy - Provide logistics and monetary incentives for off-peak delivery in demonstration areas

This program is modeled after the off-peak delivery program tested in New York City that shifted 20% of deliveries to off peak times at night and saw substantial reductions to city daytime congestion. Simulations of a similar program in Alameda County indicate benefits up to a 10.5% reduction in truck delay, with associated emission reductions.

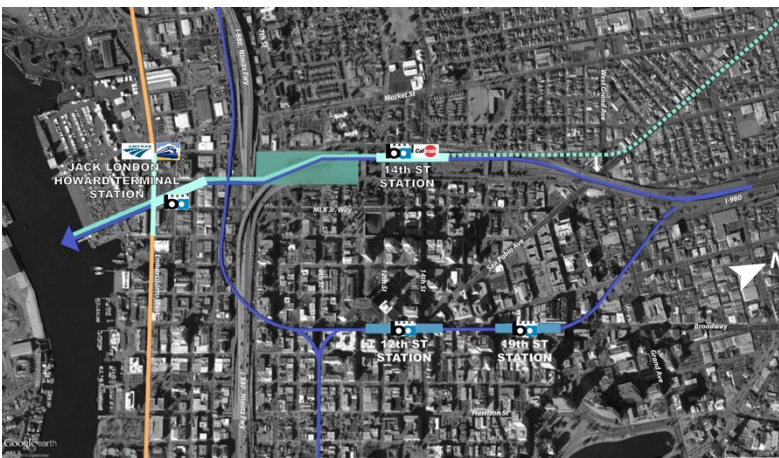
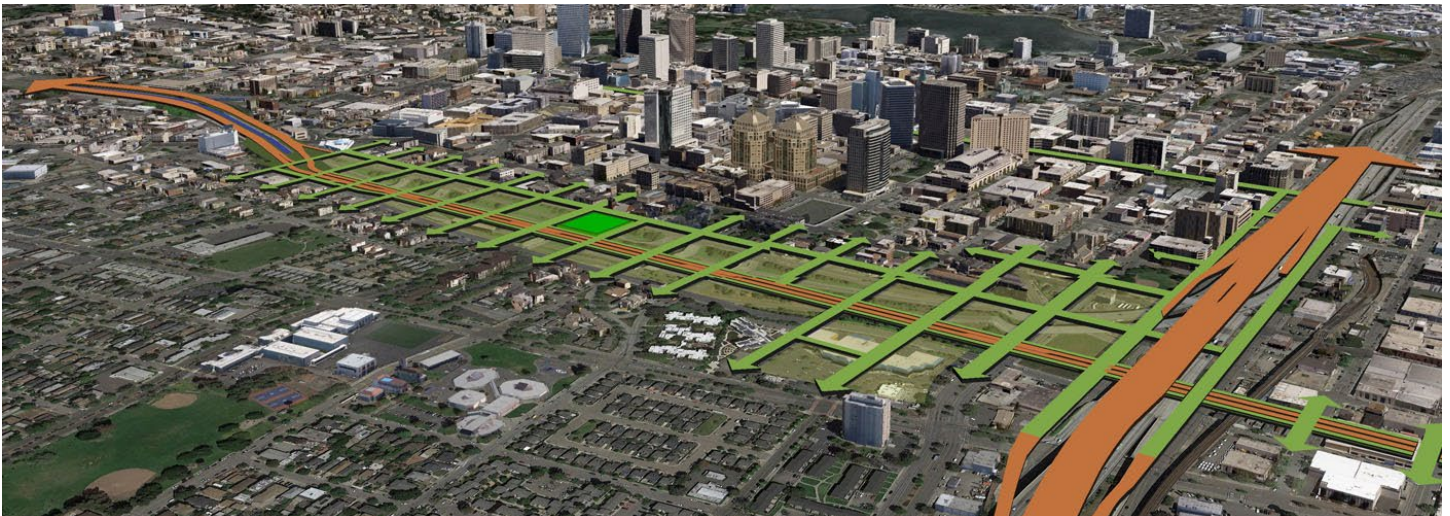
The program would craft local regulations and engage businesses to receive deliveries overnight by providing financial incentives and other support to support the shift to off-peak deliveries. The program would reduce truck traffic and double parking during the day, improving safety and traffic flow. The program promises to reduce time that delivery vehicles spend stuck in traffic and searching for parking, reducing idling, reducing labor hours per delivery, and improving reliability of shipments.

Project 6: Smart Land Use - Freeway Transformation - Replacement of depressed I-980 with surface boulevard with Transbay Tunnel rail facility beneath to reconnect West Oakland to Downtown and provide new transit capacity and transit-oriented development opportunities.

This is a bold vision to transform a segment of Interstate 980 into an at-grade boulevard to reconnect West Oakland neighborhoods into the fabric of the City. The construction of the freeway resulted in significant dislocation, effectively sealing off and surrounding West Oakland and its primarily African-American residents with freeways.

The project has the potential to open up approximately 17 net acres of new publicly-controlled land by creating 13 new city blocks for development. The transformation of the freeway into an at-grade multi-way boulevard will reconnect 12 city streets reducing the block-to-block connection distance from 560 feet to a maximum of 132 feet.

The project also provides an alignment and infrastructure for a second Transbay Tunnel rail crossing to meet the region's core capacity needs. The current below-grade I-980 ROW would house a new BART line under the boulevard, with new BART stations at 14th Street, Jack London/Howard Terminal and Alameda Point. It could also connect Caltrain and High Speed Rail to Downtown Oakland and north to Sacramento.



Images provided by Connectoakland.org

5. Project Approach & Alignment to Elements

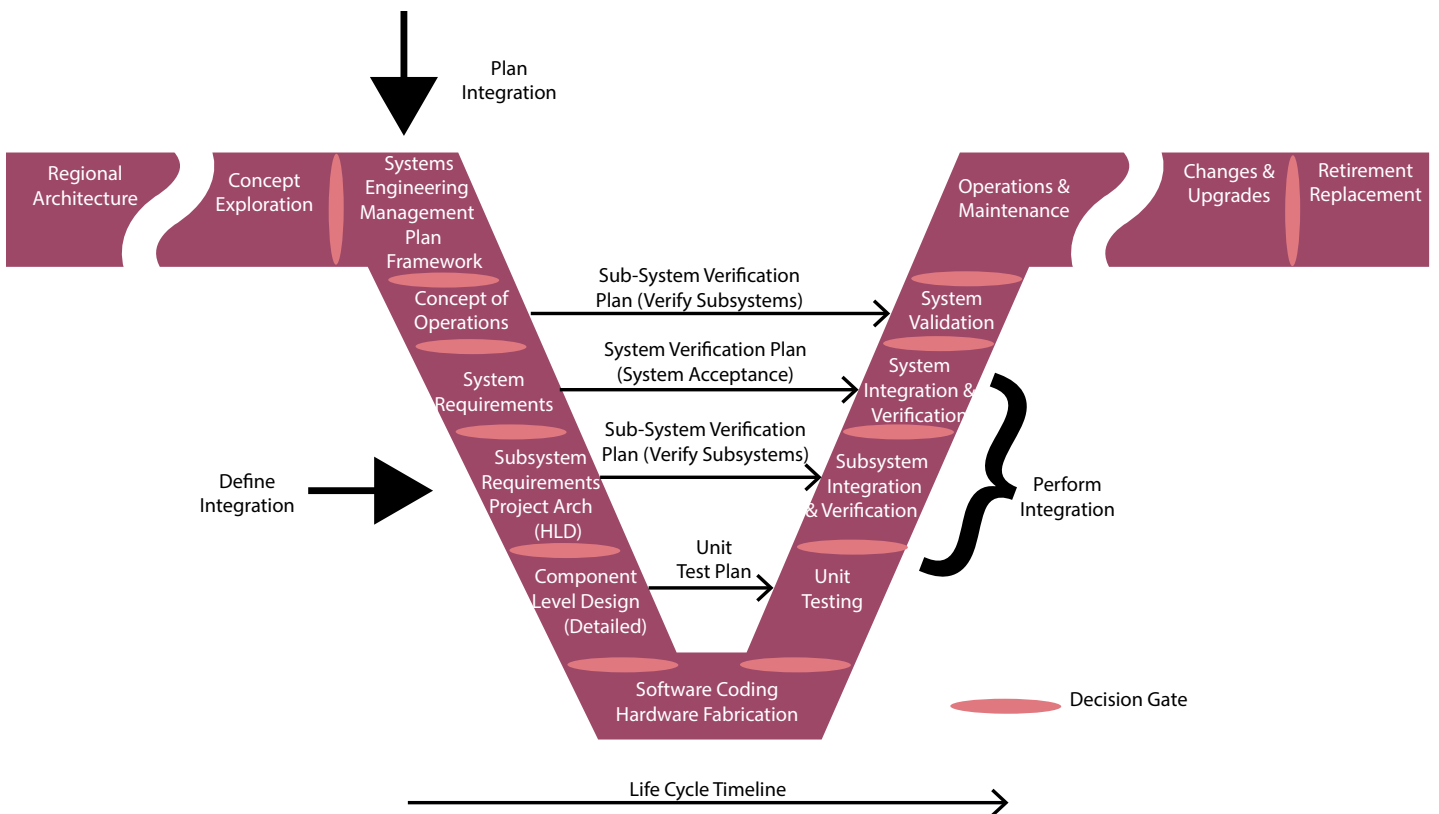
6. Risk Assessment & Mitigation Plans

Any innovative technology project faces a variety of technical risks. However, many of the OSEC Project elements face lower risk because they have already been adopted by policymakers and the public: Bus Rapid Transit, bikesharing, point-to-point carsharing, Clipper Cards, 511 Traveler Information, and Smart Parking have been adopted by the regional agencies and Oakland City Council and presented to the public. The VAA BRT element was already approved for a different route by the AC Transit Board of Directors, in consultation with their drivers' union.

We do recognize more significant risk in the parts of our vision that demonstrate Automated Vehicles, and the many ITS projects. Because we are proposing

multiple project elements with high degrees of innovation, Oakland's proposal fits the definition of "High-Risk ITS". It is also likely that the project would be designated a High Profile Project using the criteria of the FHWA Stewardship and Oversight Agreement.

In order to mitigate the risk of failure and avoid wasting taxpayer funds, Oakland proposes to produce a Project Study Report, submit a Systems Engineering Review Form (SERF), prepare a Concept of Operations, and develop a Systems Engineering Management Plan (SEMP) for USDOT approval to guide the project.



7. Project Partners and Governance Processes

The Smart Oakland Project will be led by the City of Oakland, and will involve Cooperative Agreements and MOUs with key partners. The lists identify likely formal partners, the current status of the partnership and the proposed governance structure to be in place for the duration of the Smart Cities demonstration project period. This is a partial list of potential partners. Oakland will conduct procurement in compliance with all Federal, state and local requirements.

Partners

Public Partnerships

- Port of Oakland
- UC Berkeley PATH
- UC Berkeley
- UC Transportation Center
- UC Berkeley Center for Cities & Schools
- AC Transit
- Metropolitan Transportation Commission
- Alameda County Transportation Commission

Potential Private Partnerships

- 1776 - Transportation Technology Start-Up Incubator
- Google
- Sidewalk Labs
- Motivate
- Ped Sensors
- Big Data Analytics

Potential Non-Profit and Consultant Partnerships

- Bloomberg Associates
- 100 Resilient Cities
- TransForm
- PolicyLink

8. Existing Transportation Infrastructure

Intelligent Transportation Systems (ITS)

Oakland has made significant strategic investments in developing its transportation and ITS network. Oakland developed its first ITS Strategic Plan in 2003, which included the development of goals and objectives which continue to be reinforced today, and the plan was most recently updated in 2014. During that decade, the City successfully delivered several high-profile ITS projects, including the installation of a Traffic Management Center (TMC). Oakland's ITS Network consists of various hubs, project corridors and field elements connected into an integrated system. The TMC operates an NTCIP-compliant central system software (ATMS, now by Trafficware) and Emergency Operations Center (EOC). Field equipment includes Type 2070 traffic signal controllers (many with transit signal priority), cameras (for detection and monitoring), arterial Changeable Message Signs (CMS), and trailblazer signs. In addition to traffic signal coordination plans along key corridors, the City operates Traffic Responsive Coordination plans on Hegenberger Rd and 98th Ave from I-880 to Oakland Airport.

The City operates over 600 traffic signals in Oakland, nearly 200 of which will be connected via high-speed Ethernet to the TMC over miles of 144-strand fiber optic trunk cables. The City also operates nearly 50 cameras (either fixed video or moveable monitoring cameras) from their TMC.

Proposed ITS Network

Regional ITS Infrastructure

Oakland sits in the heart of the San Francisco Bay Area, surrounded by other Cities and Counties with their own ITS projects, all interconnected via a regional ITS Architecture, managed by MTC¹. The Bay Area ITS Architecture is the blueprint for ITS project coordination and integration in the San Francisco Bay Area, and OSEC has no intention of veering from that blueprint. Project development will follow Systems Engineering requirements, as outlined in Section 6.

¹ <http://files.mtc.ca.gov/MTC-ITS/>. Projects are listed at http://files.mtc.ca.gov/MTC-ITS/_projectsarea.htm

9. Data: Collection, Sharing and Security

Security of User Data

During the procurement of project partners, the OSEC project will require the strictest data security standards to protect the 1) privacy of users and 2) ensure the security of user information and protect against theft and fraud.

At a minimum, the vendors and the city will be required to:

- Limit access to, and require authenticization of, users of the Data Dashboard and Common Payment Platforms
- Minimize amount of Personally Identifiable Information (PII) collected / required
- Minimize copies of PII maintained, distributed as little as possible, held by fewest number of entities possible

- Those few copies which must be retained, must be carefully protected in secure systems, meeting standard of the Payment Card Industry Data Security Standard (PCI-DSS) (and other standards as applicable)
- All other data that is collected will be anonymized to the maximum amount possible, e.g. individual trips will be aggregated, individual PII will be disassociated with trips

Data Retention and Use Policy

In addition, the City of Oakland will develop a data storage and access policy that will determine the minimum amount of time that PII can be retained before purging, and maintain strict ownership of data within the City of Oakland, i.e. data collected during the pilot belongs to the City of Oakland and use may be granted to outside parties on a restricted basis and on an aggregated level, only.

10. Cooperative Approach to Demonstration

Standards and Architecture

An underlying theme of OSEC will be standards + flexibility. Oakland knows first hand the rapidly shifting landscape of software, hardware, and the integration thereof. We understand that standards are key to ensuring interoperability, however the underlying standards need to be flexible enough to support hardware and software platforms that replace themselves annually, if not more often.

Our goal of this project is to maintain open and transparent databases; this in no way results in lack of focus on the need to adhere to network and data standards. Regionally, the City will adhere to standards set forth in the regional ITS Architecture to ensure our data can be shared by regional ITS programs such as Integrated Corridor Mobility programs on I-880 and I-80, and the East Bay Smart Corridor. This includes adherence to NTCIP protocols for traffic data transfer and transfer of SPAT data for connected vehicle applications.

The city will leverage key partner participation in and understanding of standards and certification from around the world – with particular use of IEEE 802.11, IEEE 1609 WG, SAE DSRC TC – to ensure that our National Architecture- and CVRIA-compliant and

documented architectures are or can be compliant to existing and proposed standards. OSEC partners have leadership positions in standards development and certification of many of the proposed technologies; this positions us well to collaborate in all aspects of the familiar standards and certification ecosystem to the benefit of our proposed project approach and to the benefit of Connected Vehicle and Smart Cities deployments across the United States.

Information Sharing and Collaboration

Our goal with OSEC is to leverage the valuable experience and insight from others working in the same domain. That means, for example, that we share our experiences with regional working groups such as MTC's Next Generation Arterial Operations Program. At the national level, we and our partners will share our experiences with the AASHTO Connected Vehicle Deployment Coalition.² OSEC intends to achieve a world-class Smart City by combining our own innovations with the experiences of others on the front lines of similar efforts.

2 <http://www.transportationops.org/V2I/V2I-overview>

11. Goals & Objectives

Oakland will agree to a set of performance goals and metrics with the USDOT, which will be reported via quarterly progress reports or at the USDOT's request. A critical part of this project will be data collection of statistics and user feedback to allow the city to adjust each element as needed. At minimum, these performance goals and metrics will include:

- Development stage of each element (planning, approvals, design, implementation, monitoring)
- Change in number of users by mode or application (if applicable)
- User satisfaction ratings and feedback (bi-annually)
- Number of stations or lane-miles implemented (if applicable)
- Change in travel time by mode (if applicable)
- Change in VMT (annual)
- Annual GHG reductions
- Multi-modal crash rates (including vehicle, bike, and pedestrian)
- Annual multi-modal trip rates (by survey)
- Housing units and jobs within ½ mile of connected, complete bicycle, pedestrian, and transit networks, with demographic considerations (bi-annual)

12. Commitment and Capacity

The political leadership of Oakland is fully committed to implementing the OSEC proposal, if Oakland is selected as the Finalist. Mayor Libby Schaaf has completed the the first year of her four-year term, and her top four priorities are holistic community safety, equitable jobs and housing, sustainable infrastructure, and responsive, trustworthy government.

Among her first actions, the Mayor established Oakland's first Policy Director for Infrastructure and Transportation in her office, and proposed formation of a new Department of Transportation. The Oakland DOT is being established with the technical assistance from Janette Sadik-Khan and Bloomberg Associates. In early 2016, Bloomberg Associates has begun leading the development of a Strategic Transportation Plan and the search for the Department Director. Oakland is well-positioned politically within regional transportation agencies as well; Mayor Schaaf serves on the Metropolitan Transportation Commission and Vice Mayor Rebecca Kaplan is the Chair of the Alameda County Transportation Commission.

Oakland also has strong, committed transportation leadership in the Alameda County Transportation Commission (ACTC). In 2014, ACTC passed Measure BB, a transportation sales tax extension and

augmentation that will generate an estimated \$8 billion over the next 30 years. Measure BB passed with 70% approval, with Oakland voters as a critical element, as every district voted over 66.6% in favor.

The San Francisco Bay Area Metropolitan Transportation Commission (MTC), the region's MPO, is also a key partner for Oakland's effort. MTC has provided committed, stable leadership in many arenas that combine transportation and technology. Of equal importance is MTC's leadership in Plan Bay Area, the long range planning document for transportation and land use, and their resulting greenhouse gas emissions, in adopting performance goals for improving equity and reducing transportation costs burden for low-income residents.

Capacity

The city has shown the capacity to support and carry out innovative transportation projects, especially in partnership with regional, state, and federal partners. Just a few recent notable efforts include:

- The Oakland Airport Connector, a 3.2-mile BART extension from the Coliseum/Oakland Airport BART Station to the Oakland International Airport, opened in November 2014, providing a seamless passenger rail-air connection with automated, driverless trains.
- Oakland has worked for many years with AC Transit to plan, design, and permit the construction of the \$174 million East Bay Bus Rapid Transit Project, a 9.5-mile full BRT between downtown Oakland and San Leandro. EB BRT will provide 27,000 weekday trips, improve access to jobs, revitalize neighborhoods, and support transit-oriented development. The U.S. DOT has contributed \$81 million from the FTA Capital Investment Grant Program, Bus & Bus Facilities, and CMAQ funds.
- The \$79 million I-80 SMART Corridor Integrated Corridor Mobility project is one of the most comprehensive Intelligent Transportation Systems in the nation. A partnership between FHWA, Caltrans, and local transportation agencies, it includes a network of integrated electronic signs, ramp meters on 44 on-ramps, and other state-of-the-art elements on the region's most congested freeway corridor to enhance motorist safety, improve travel time reliability and reduce accidents and associated congestion. Real-time traffic information allows drivers to make informed decisions in the event of an incident. They are managed from the Traffic Management Center at the Caltrans Bay Area headquarters in Oakland.

“Communities around the country are looking for smart, creative transportation solutions like the East Bay Bus Rapid Transit line to better manage traffic congestion and offer residents a reliable, convenient transit option for getting to work, school, and other opportunities.”

- U.S. Transportation Secretary Anthony Foxx.

- The City of Oakland received approval from FHWA to study an experimental bicycle treatment, using continuous bands of green color pavement (referred to as “Super Sharrows”) in conjunction

In addition, Oakland is dramatically increasing its capacity to deliver routine and innovative transportation projects:

Innovative Bicycle Infrastructure

In 2014, nearly 3.2 miles of new buffered bike lanes were installed to encourage separation between cars and bikes. In 2016, the Telegraph Avenue Complete Streets Implementation Plan will remove one travel lane in each direction and install new buffered bikeways on a 20-block segment, including 9 blocks of Oakland's first “cycle track” or “parking protected” bikeway.

Demand-Responsive Parking & TDM

In 2015, Oakland was awarded a \$1.3 million CMAQ grant by MTC to carry out an ambitious program that combines demand-responsive parking and

Transportation Demand Management. Oakland staff worked previously with an FHWA Value-Pricing Pilot Program grant on the goBerkeley Parking/TDM project. The parking data collection methodology and traveller information elements would be greatly enhanced by the proposed Smart Cities project elements.

Commitment to Transparent Public Involvement: Opensource Proposal Development

When the U.S. Department of Transportation (DOT) issued its Beyond Traffic: The Smart City Challenge notice of funding opportunity on December 7, 2015,

12. Commitment and Capacity

the City of Oakland chose to advance connected communities from the very beginning by opening up the idea generation and proposal development process to everyone. Mayor Libby Schaaf kicked off the initiative with an open invitation to Oakland residents and others by writing, “By using an open-source process, I hope to tap the incredible brilliance and creativity of our whole community. Providing a responsive, trustworthy government is one of my top priorities as Mayor – and crowdsourcing is a great way to ensure transparency and authentic community engagement so that our application represents our best collective vision for Oakland’s transportation future.”

City staff created a blog and shared document at Smart Oakland (www.smartoakland.net). SmartOakland.net partnered with the UC Berkeley Center for Cities and Schools to reach out to Oakland’s youth to help create the vision for their city. Smart Oakland hosted a daylong “Proposal Writing Hackathon” and a series of afternoon sessions that brought dozens of contributors together to reflect on the ideas and comments generated through the Smart Oakland blog. In just 3 weeks. The vision and the projects in proposal are the product of this highly unusual crowdsourced community input.

This initiative indicates the commitment the Mayor and the City of Oakland truly have to engage our citizens through authentic, two-way communications to build an open, trustworthy government. These three short weeks have been an important first step towards a Smart City deployment that can engage our entire community to address our city’s real challenges. We believe that Oakland trust and reliance on our citizen’s collective brilliance offers a process model that can and should be used by other U.S. cities.

Our unusual crowdsourcing effort resulted in tremendous unleashed creativity from citizens, consultants, vendors, and City staff.

A project manager for the crowdsourcing process, Michael Ford, wrote an entire grant submittal in the narrative voice of a future Oakland Mayor; he calls Liberty Cheng. He wrote her “State of the City Address” of 2045 as a look back at USDOT’s 2016 challenge and how it changed Oakland. Some excerpts are included here, and the entire document is available online. It’s an amazing vision - and just one of the inspiring efforts that the US DOT’s Smart City Challenge has already brought to Oakland.

City of Oakland Mayor Liberty Cheng, State of the City Address - October 24, 2045

*“This is an amazing time for Oakland.”
Thirty years ago his week, the Honorable Mayor Libby Schaaf began her first state of the city address with these very words and I have elected to do the same as I begin my own account of where our city stands at this important point in history.*

Today, Oakland is world-renown as a smart, resilient, city that is thriving in the face of adversity...Oakland’s transportation technology advancements, initially funded by a USDOT’s challenge grant, allowed for an open and transparent sharing of raw-sourced data that is actively being used by community organizations, advocacy groups, private technology startups, entrepreneurs, as well as local governments, who use this data to measure topics such as linking childhood health and safety to walking trips to schools, or the success of speed reduction on arterial corridors as the result of installation of (recently- legislated) speed

enforcement cameras, to the seasonal fluctuation of people shopping at the local West Oakland farmers markets, and how to encourage more people to show up during the colder winter months.

For nearly thirty years, Oakland has provided cities around the country with both the leadership and the tools to replicate the its successes. This evening, I would like to take this opportunity to remind each of you and myself how we took advantage of that unique opportunity in our history to make sure that innovation and prosperity were enjoyed by all Oaklanders and to play a leading role in the coming “smart cities revolution”...

...Today, Oakland residents move safely and seamlessly between energy-efficient, convenient travel modes within the city and across the Bay Area region. From all neighborhoods and income levels, they come by reliable transit, by bicycle, and

by using shared mobility platforms to reach high-quality jobs. Oaklanders live in affordable housing near jobs and transit; engaging in a shared experience of racial and social equity through improved mobility, access and opportunities for all...

Thirty years ago, however, it was a different story. Oakland was booming, but the benefits to Oakland residents varied considerably from neighborhood to neighborhood and long-term trends, including declining revenues, were bleak. Fortunately, we had the vision and the wherewithal to respond to those challenges in ways that would stay true to our values and priorities and ultimately benefit not only all Oaklanders but others around the country and around the world.

https://docs.google.com/document/d/1FjfGvm3hajjRiT_ZUCK5rekCegzehhsIDOZ8CQc_aBc/edit#

13. Cost Share, in-kind donations and partnering opportunities

A Smart and equitable Oakland is not possible without developing broad partnerships across an array of vendors, consultants, and other professional groups in order to harness the best ideas but also ensure that the community is invested in the project, figuratively and literally. The following is an incomplete list of firms and vendors that have already offered partnerships and financial support to the OSEC project:

Technology	Partners
Shared Mobility Providers	Lyft, Uber, Zoox
Bikeshare Providers	Swiftmile, Bay Area Bikeshare
Scooter share	Gogoro, Scoot, URB-E
Autonomous vehicle hardware/software	nutonomy, Auro Robotic, EasyMile, MobilEye
Electric Bus	Proterra, WAVE
Transportation Data Aggregation Software	MetroTech, Iteris, INRIX, Streetlight Data
Smart City Platform Software	Sidewalk Labs, OSIssoft, Xerox, Cubic, Assurenet, Esri
Connected Vehicle Hardware/Software	Arada Systems, Savari, Veniam
Sensors and Wireless Hardware	Qualcomm, Sensys, Sentry Control, AMS, 3DR
Mapping / Navigation	Waze, Google, Bing!, HERE, TomTom

