LADOT

STRATEGIC IMPLEMENTATION PLAN

A Plan to realize the visions outlined in the *Urban Mobility for a Digital Age* and *Blueprint for Autonomous Urbanism* documents

Prepared for the Los Angeles Department of Transportation by Ellis & Associates, Inc.
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Overview

Urban Mobility in a Digital Age and NACTO's *Blueprint for Autonomous Urbanism* paint a future described by a desired outcome: Zero traffic deaths; economic and environmental sustainability and resilience; and equitable access to jobs, opportunities, and education. Critically however, they do not address the tactical elements required to implement this future. This document puts forth a plan, rooted in the values that these documents represent, to define and implement Transportation 2.0 in the City of Los Angeles.

"**The future** is already **here** — it's just not very **evenly distributed**."
– William Gibson

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Introduction

IN THE LAST DECADE, coinciding with the introduction of the smartphone, Los Angeles has seen an explosion in new mobility products and services. Acceleration of shared mobility versus ownership, artificial intelligence and machine learning, electrification and solar power, GPS and big data combined to change the mobility landscape more than in the previous 40 years. Combined with new iterations of often old business models, venture funding, and bold leadership in the private and public sector, we are seeing the groundwork for a next-generation urban mobility system. We refer to this system as Transportation 2.0.

Transportation 2.0 envisions an electric, shared, active, and autonomous mobility system that tackles congestion, enables economic development, provides equitable services, and saves lives. The system encompasses products (hardware, software) and services and is open to new, radical models for delivery and partnership between public, private and non-profit.

The introduction of Transportation 2.0 will impact many entities, products, services, and laws related to or dependent on transportation. Many of the human aspects of the new paradigm are well published and include job displacement and elimination of traffic fatalities due to human error. However, cities must manage disruption to traffic control systems operation, hardscape design, curb management, and system finance.

Mayor Garcetti envisions Los Angeles being the center of Transportation 2.0 in terms of private sector innovation and public-private-partnership to bring bold ideas to the streets in record time over the next decade. From idea incubation, to piloting concepts, aligning new business models with public sector goals, then scaling on city streets, and finally sharing tried and tested products and services to other cities.

Transportation 2.0 must be financially and environmentally responsible. The gas tax, which partially funds the current Los Angeles transportation system, is unsustainable for the future. Electric vehicle technologies and improved fuel economy and emissions programs will improve the environment but erode the source of funding for transportation infrastructure. Implementing and operating Transportation 2.0 requires new sources of revenue that simultaneously reverse the erosion of funding from the declining gas tax, but also fund new infrastructure.

Designing, developing, and delivering Transportation 2.0 is not a business-as-usual affair. The city must augment traditional hardscape and softscape with new digitally-driven products and services provided by new and unique public-private partnerships. We will strengthen traditional traffic studies with real-time data and shift our role from analyst to monitor. Real-time adaptive technologies will augment traffic control systems to maximize use and efficiency of the existing transportation system while accommodating new modes of travel on the surface and in the air.

A Product & Services Agency

LADOT is a product and services agency today. Our product is the transportation system which consists of rights-of-way, roads, walkways, bikeways, bridges, as well as accompanying signs, signals, and paint provided to the public and enabling travel from place to place. The government-granted public rights-of-way allow personal, unfettered access to the entirety of the transportation system which includes freely walking, biking, riding, or driving from Point A to Point B. Among the 42 business lines we deliver, our services include curbside parking, enforcement, and DASH transit.

Key consideration is that we view this product through a "rear view mirror" construct. We are always reacting to historical events in the network rather than real-time events.

In October 2016, LADOT released *Urban Mobility in a Digital Age*[1], outlining in detail our toolbox to manage and invest in technologies that help us meet the Mayor's Sustainable City pLAn, our Vision Zero plan, and our Strategic Plan goals to deliver Transportation 2.0.

Transportation is on the verge of massive transformation that will change the way we conduct business in the public and private sectors. We are at a tipping point where technology advancements in transportation are no longer adding efficiencies to current ways of doing business; they are changing the foundational assumptions of how we build and manage transportation throughout the region.

Urban Mobility in a Digital Age lays out the vision for Transportation 2.0 in Los Angeles (see Figure 1 below). This vision is anchored on the foundation of actively managed electric, shared, autonomous mobility that aims to tackle congestion, enable economic development, achieve racial and socioeconomic equity, and save lives. It responded to recommendations in the *Sustainable City pLAn*[2] and *Mobility Plan 2035*[3], both of which establish a clear policy framework for mobility in Los Angeles.

FIGURE 1. Urban Mobility for Digital Age Framework

1 http://www.urbanmobilityla.com/strategy/
2 http://plan.lamayor.org/
3 https://planning.lacity.org/documents/policy/mobilityplnmemo.pdf
4 http://ladot.lacity.org/sites/g/files/wph266/f/LADOT_Strategic%20Plan_FINAL_web.pdf
5 http://visionzero.lacity.org/wp-content/uploads/2017/04/VisionZeroActionPlan-2017.pdf
6 https://nacto.org/publication/bau/blueprint-for-autonomous-urbanism/

The Urban Mobility document also contemplates an approach for a consumer to engage with Transportation 2.0 as shown in Figure 2.

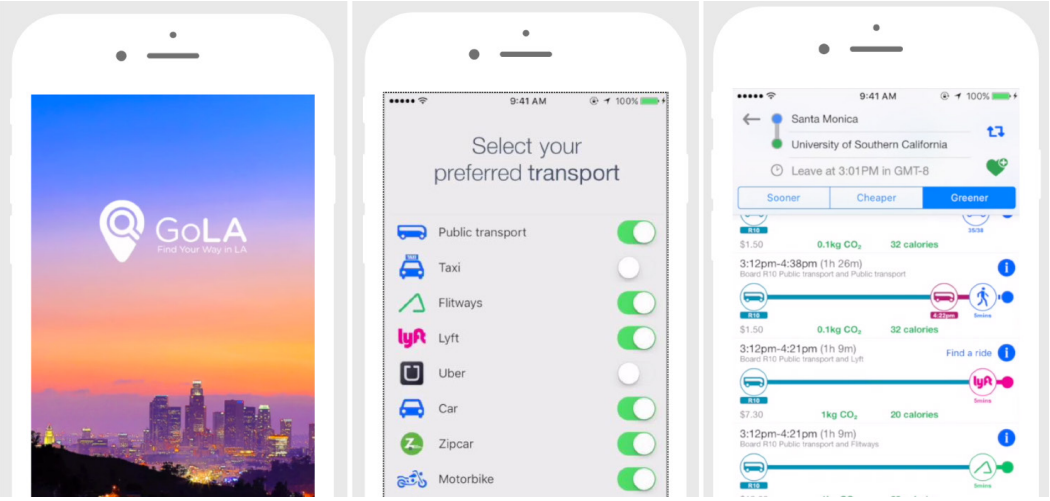


FIGURE 2. Urban Mobility's Proposal for Costumer Interaction

Urban Mobility Deconstructed

A WORD CLOUD ANALYSIS of *Urban Mobility in a Digital Age* highlights the key words in the document (see Figure 3). When these words are arranged together, they form a powerful statement of the type of future our policy framework envisions.

LADOT is now iterating in areas such as autonomy, or datasets from new providers, as these foundational new systems are not just simply improving current processes, but are turning the current system on its head. As such, *LADOT is laying out a new paradigm for the City as a physical and virtual platform for co-creation and collaboration.*

The real question is: can LADOT manage the transportation network similar to a data network or a telecommunications network? Should we consider any vehicle like any other "data packets" that need to transverse across a complex network? Can we use technology to change our first-come, first-served system into a fully managed system using software? The answer to all these questions is yes.

The foundation of Transportation 2.0 is that LADOT will explicity manage the movement of vehicles in the Los Angeles transportation product. Whether a dockless or docked bike, an autonomous car or a package delivery drone, the aim of the new approach is to ensure the safe, reliable and efficient passage of vehicles on, over and through the Los Angeles transportation system. This is a marked departure from the current policy context of managing the movement of people and goods through the system.

The **City** of **LA** can use **Technology** and **Data** as a new type of **Infrastructure** to **Provide Equitable Access** to **Shared Transit** and **Mobility Services** for the **Public**.

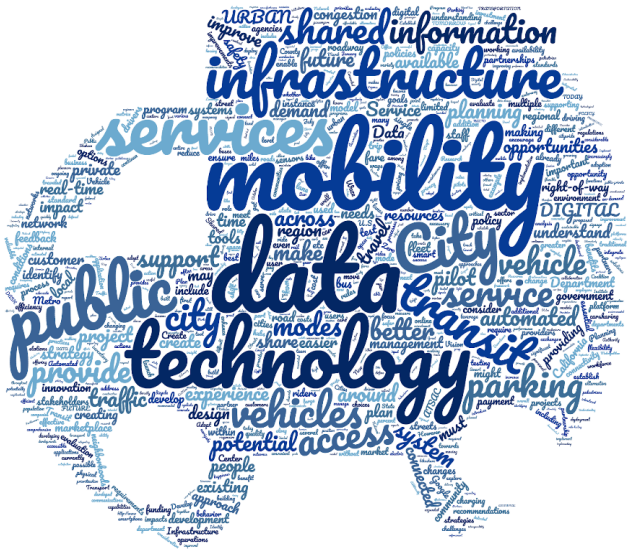


FIGURE 3. Word Cloud Analysis of *Urban Mobility in a Digital Age*

Active Management

THE UNDERLYING PRINCIPLE to construct Transportation 2.0 is to have authority over how autonomous surface and air vehicles route through the network. In other words, the City must set the ground rules for private mobility providers to operate on our streets and serve as the connective tissue that guides the safe movement of goods and people through Los Angeles. Control is a fundamental aspect of today's transportation network and will become even more critical in the future.

LADOT uses its current controls to manage and operate city streets including traffic laws, speed limit signs, traffic signals, and paint signifying lane boundaries to name just a few. LADOT deployed many of the controls in use today to reduce congestion and minimize inefficiencies in the auto-dominated surface system. The processes the city uses to change these controls varies based on the size of the change, but generally result in months if not years before the City deploys any change visible to people traveling through its system.

Figure 4 characterizes how our Department currently makes changes to the physical transportation system. In this example, the change the model contemplates is significant, such as creating a transit-only lane on an existing roadway. The process typically starts with trying to understand the problem, which requires information. LADOT defines a study or, in the case of a significant change, multiple studies, to generate information. LADOT then analyzes the data and turns it into information embodied in a report. City officials read this report, consider the public's opinion regarding the change, and make a decision to fund and construct a project, which may take months or years.

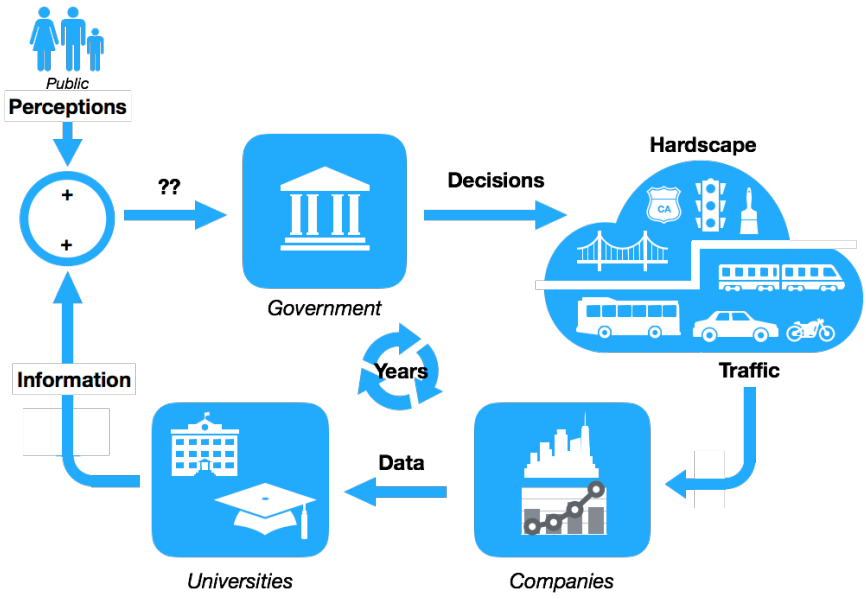


FIGURE 4. Transportation 2.0 Control added to *Urban Mobility in a Digital Age* framework

The challenge with this process is that it takes a long time to complete. The data gathered weeks, if not months, prior has an opportunity to change before the City implements a solution. When considering the idea of using pricing or algorithms to manage routing as introduced in NACTO's *Blueprint for Autonomous Urbanism*, the City needs a radically different and faster approach to control: an approach that changes inputs in seconds, not weeks, months, or years. Transportation 2.0 will have to operate using this new model as shown in Figure 5.

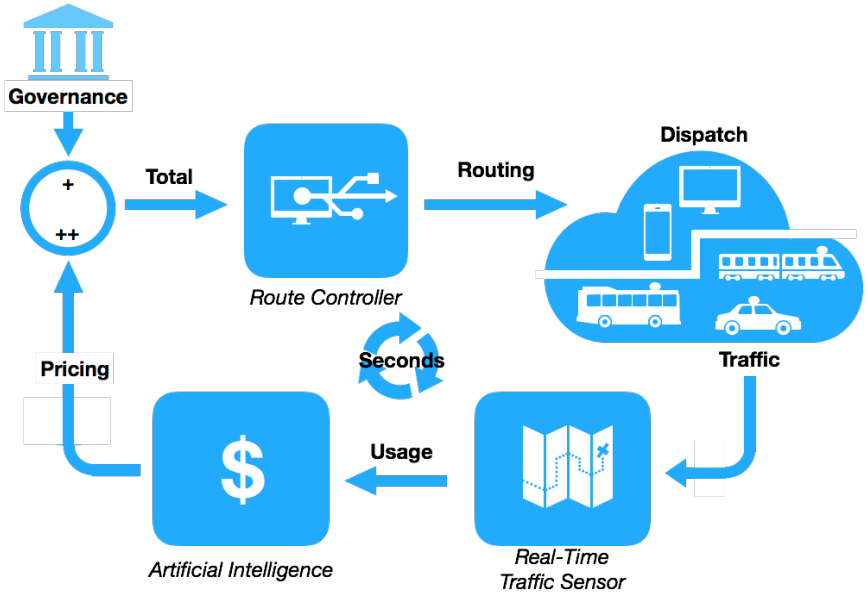


FIGURE 5. Characterization of City Control of Transportation 2.0 System

LADOT will have to undergo a digital transformation and actively engage with its transportation product. Specifically, LADOT will have to develop and deploy a technology platform that enables our Department to actively manage the transportation network in ways we previously have not. Figure 6 illustrates what that technology platform looks like through the *Urban Mobility in a Digital Age* framework. In addition to the technology platform, LADOT will have to incorporate a business model and risk management strategy in the digital transformation.

Moreover, LADOT must ensure that our existing project efforts such as Mobility Hubs and Code the Curb integrate seamlessly into this new paradigm. And last but not least, we must do this all while remaining centered on our goals of safety, health and well-being, and achieving net carbon neutrality by 2050 as outlined by Mayor Eric Garcetti. All of this with a relentless focus on socioeconomic and racial equity.

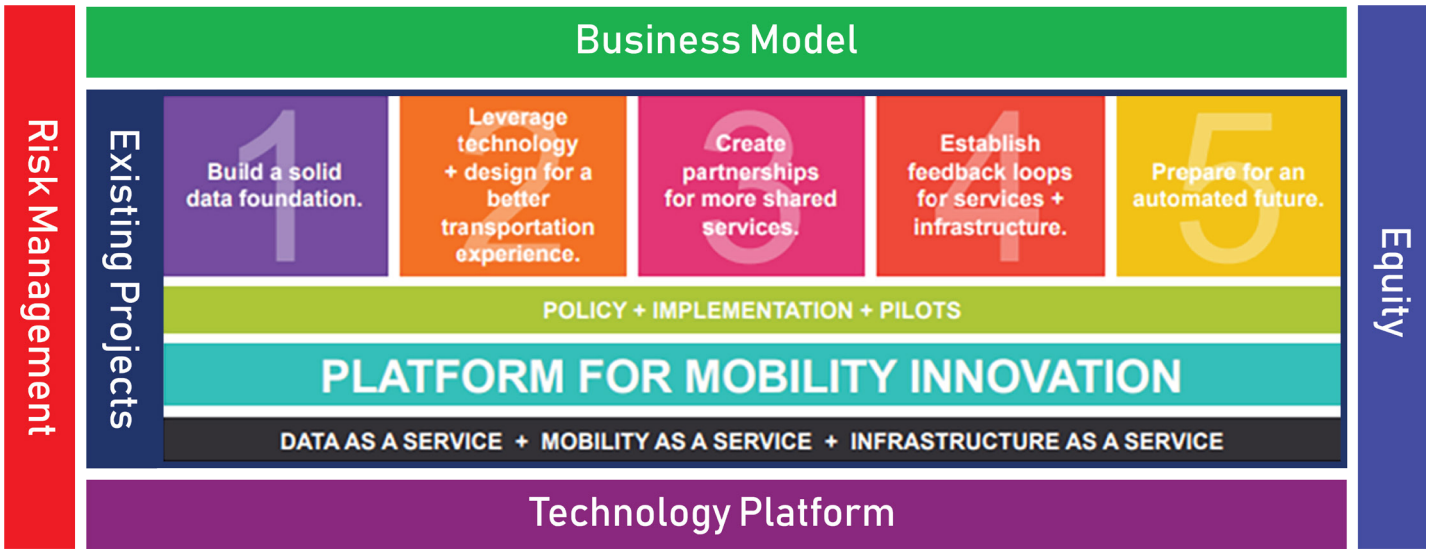


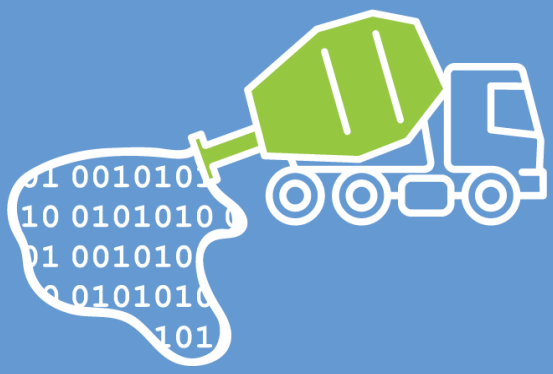
FIGURE 6. Transportation 2.0 Control added to Urban Mobility in a Digital Age framework

Behaving Like a Product Company

For over 100 years, cities have built hardscape systems and mirrored with internal processes and regulations to build, manage and maintain the system. This has resulted in a legacy system defined by layers of code, processes, and competencies to deliver infrastructure. New transportation technologies and business models are disrupting the legacy systems. As part of its digital transformation, our Department is reinventing its processes to deliver new products and services to the public. A 21st century DOT will behave more like a product company rather than simply a hardscape delivery agency. One of the key digital products we will offer is routes.

Routes are defined ways to move in the Transportation system in any vehicle by road, water, or air. To deliver the route product, LADOT's Transportation 2.0 system envisions using the control loop as seen previously in Figure 5. LADOT will use routing to manage the transportation system and real-time pricing to provide safe, healthy, enjoyable and equitable routing products for Mobility-as-a-Service companies. With safety as the foundation for decision making, LADOT will offer route products based on distance, time, and least-cost route, as well as transportation happiness.

There are two distinguishing and value-added features of these LADOT route products. The first is LADOT route products will take into consideration the vast amounts of fixed movement within the Los Angeles transportation system that are outside the control of LADOT including Metro bus and train movements. The second feature of the LADOT route products is trip chaining which is an important component in addressing those parents whose primary reason for traveling within the Los Angeles transportation system is related to raising and caring for their children.[7]



Code is the New Concrete

In our cities, streets and roads are living organisms. Whether they are constructed of concrete, signs, signals, or paint, the roads are either in a state of creation or decay. This well-known fact led to the creation of the modern public Departments of Transportation to operate and manage the state of the system while a network of private and public construction organizations builds and maintains the hardscape. While this is how the transportation system currently works for hardscape, the Transportation 2.0 system will be different.

7 https://www.fhwa.dot.gov/ohim/womens/chap8.pdf

Innovation Today

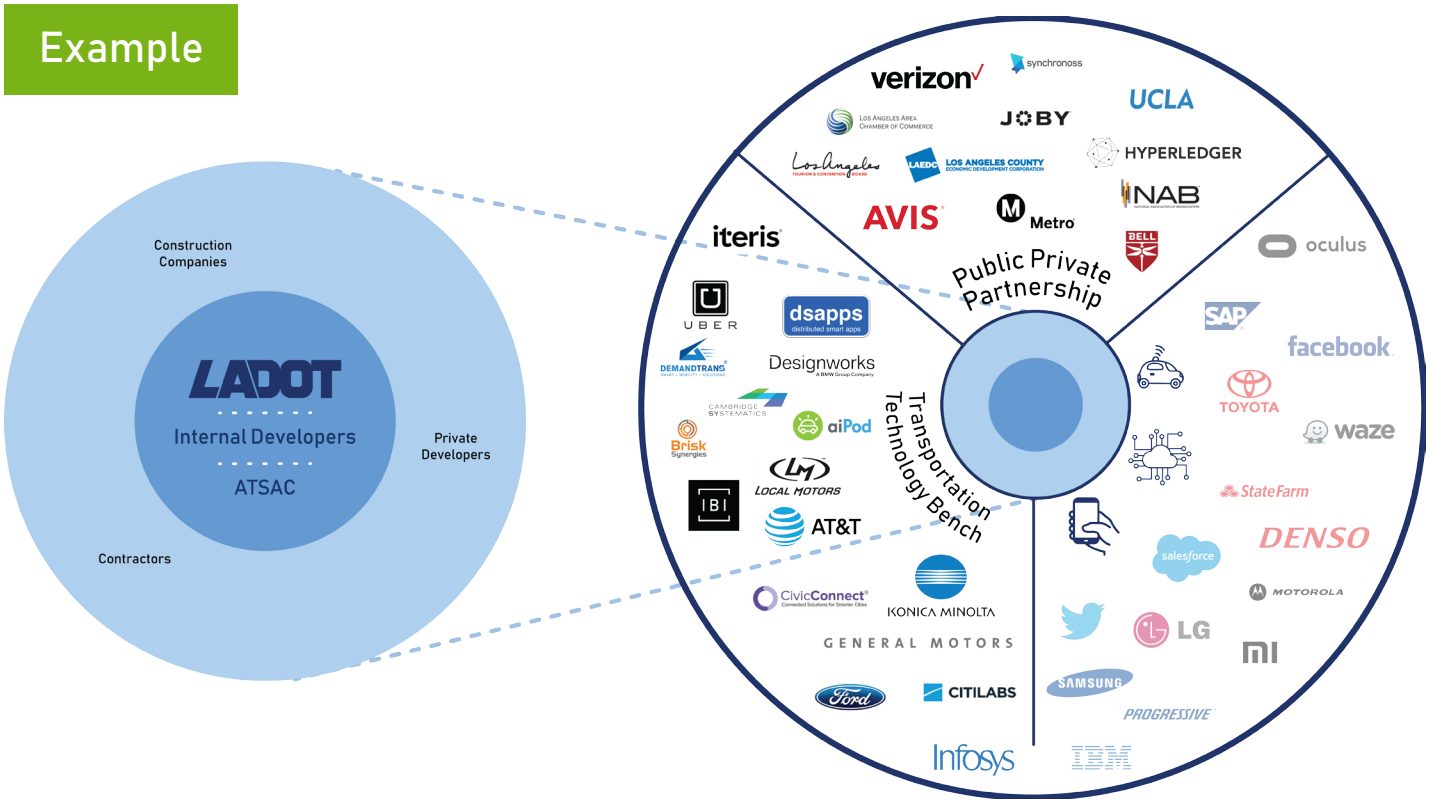
TODAY, a closed group of large-scale organizations (with financing from the LADOT) are innovating around a specific set of known problems, typically in the physical realm.

This group is almost exclusively comprised of automotive and real estate interests and a small group of public sector advocates.

Innovation Tomorrow

TOMORROW, an innovation program with open data, services, and infrastructure will enable innovators and developers as well as community based organizations —large and small, from a broad range of unrelated industries and backgrounds—to explore and co-create new ways for connected transportation systems to benefit individuals, businesses, and governments.

Example



"Not every innovation in transportation is going to come from government or even a large enterprise."[1]

– Anthony Foxx

Former U.S. Transportation Secretary

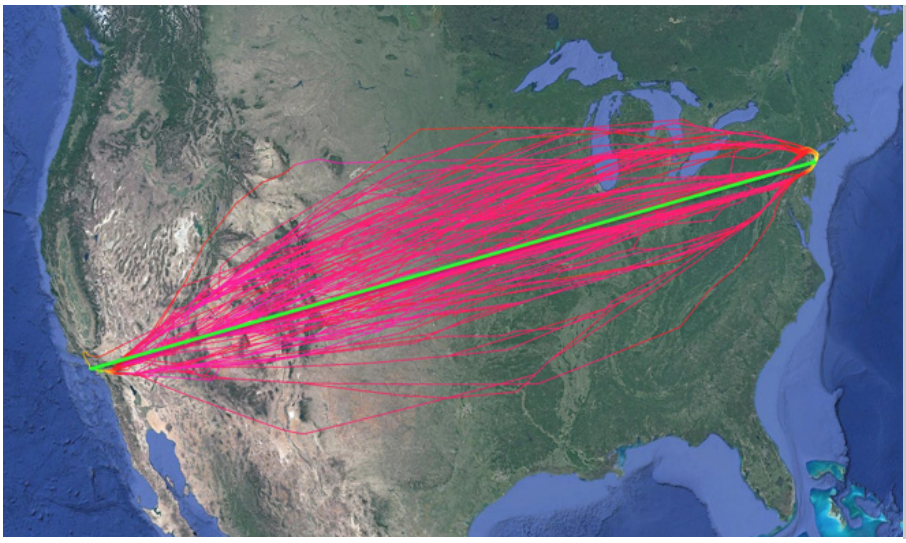
1 Salter, C. "The Future of America's Roads: Smart Streets, Cars that Communicate." Fast Company. May 30, 2014.

Building the LADOT Transportation 2.0 Technology Platform

In preparation for the 1984 Olympics, LADOT installed its Automated Traffic Surveillance and Control (ATSAC[8]) system to increase the efficiency and overall effectiveness of traffic control devices around the city. These advancements culminated with Adaptive Signal Timing, Transit Priority, and Leading Pedestrian Intervals (LPI). In the future, this will evolve into a centrally controlled, fully adaptive network of interconnected and dynamically timed intersections.

The introduction of the Mobility-as-a-Service (MaaS) business model has dramatically shifted the trajectory of transportation towards shared mobility, which will exponentially grow at an unprecedented level through the implementation of Autonomous Vehicle (AV) technology. This disruption will add new dimensions to the types of control mechanisms LADOT will require to manage the transportation system.

As our Department considers its future role, it is worth considering how the Federal Aviation Administration (FAA)[9] manages the National Airspace ensuring millions of flights a year with zero casualties in the US since 2009 and zero casualties worldwide in calendar year 2017 all while handling ever increasing flight and passenger loads (Figure 7). This line of thinking opens up several opportunities to optimize the current hardscape along with several new business models that address short and long-term sustainability.



AMERICAN FLIGHT 133

Over a six-month period, AA133 was routed from the ideal path based on traffic, weather, and other factors.

FIGURE 7. Visualization of FAA routing impact for AA133 over a six-month period

8 http://trafficinfo.lacity.org/about-atsac.php
9 https://www.faa.gov/

Culture

One cannot speak of technology change without also recognizing the profound cultural change that always follows the adoption of new technology. The creators and adopters of new technologies almost never anticipate the far reaching cultural impact of their ideas.

Consider the Electronic Revolution (1850 to 1900s), marked by the invention and convergence of the rotary press, electricity, the telegraph, and the photograph. These innovations completely dissolved and reconstituted communication structures and the culture of the West giving rise to industries that never existed before (news, celebrity, film, television, etc.). However, the rate of change back then appears glacial by today's standards, occurring over half a century. Today, the rate of change is measured in months, even weeks.

Like the Electronic Revolution, Transportation 2.0 is an umbrella term that encapsulates the creation and convergence of dozens of disruptive technologies. Taken together, we believe this ultimately represents a better future. However, we are equally aware of the unintended ways this will change our culture and world at large.

In order to navigate this change, our Department will need significant cultural transformation to be prepared. We are particularly aware of the need to navigate the challenges this brings to people's shifting roles, competency, sense of belonging, and sense of purpose on our team.

In the 1960's, Neil Postman coined the term "Future Shock" (later popularized by Alvin Toffler in a book by the same name) to describe the traumatic psychological experience of "too much change, too fast." Future Shock is now accelerating and we must respect the emotional impact of this condition. There is a growing fatigue around the rate of change. This is the condition we are facing both within the LADOT and the broader popular culture outside our Department.

Culture is a vague term that is expressed more specifically and concretely in our language (the words we use to create meaning of our experience), values (the things we decide matter most to us), and behaviors (the actions we can expect of one another). By understanding this more specific articulation, we are better able to create culture, not just name it.

The epicenter of preparing for this change starts with the culture of the LADOT. An essential component of our success is to take seriously the human transformation required to make this work.

This involves several key elements required in order to navigate and lead well through this change.

1. Creating a new shared *language*;
2. Leveraging existing *values* that we want to bring forward;
3. Reaching for new *values* we will need for the future;
4. Naming the behaviors that concretely express our values; and
5. A change process that respects the emotional journey of our team

The importance of the change process cannot be underestimated. The technical, political, and structural aspects of this change are momentous, but so is the human emotional one. Some will embrace this change with vigor and passion, only later to be disillusioned by a reality they didn't expect. Others will want to self-select out because the change required is simply a bridge too far for them. Many will go through the stages of grief as they confront the loss of a world they didn't want to see go away, struggling to see the benefit of the new world in its place. All of these emotional paths will require intelligent and conscious support.

All the while, our Department will be diligently soliciting and digesting input on this future from stakeholders ranging from city council members to community-based organizations, to individual citizens in their community. We must teach, and learn in tandem for the right set of outcomes.

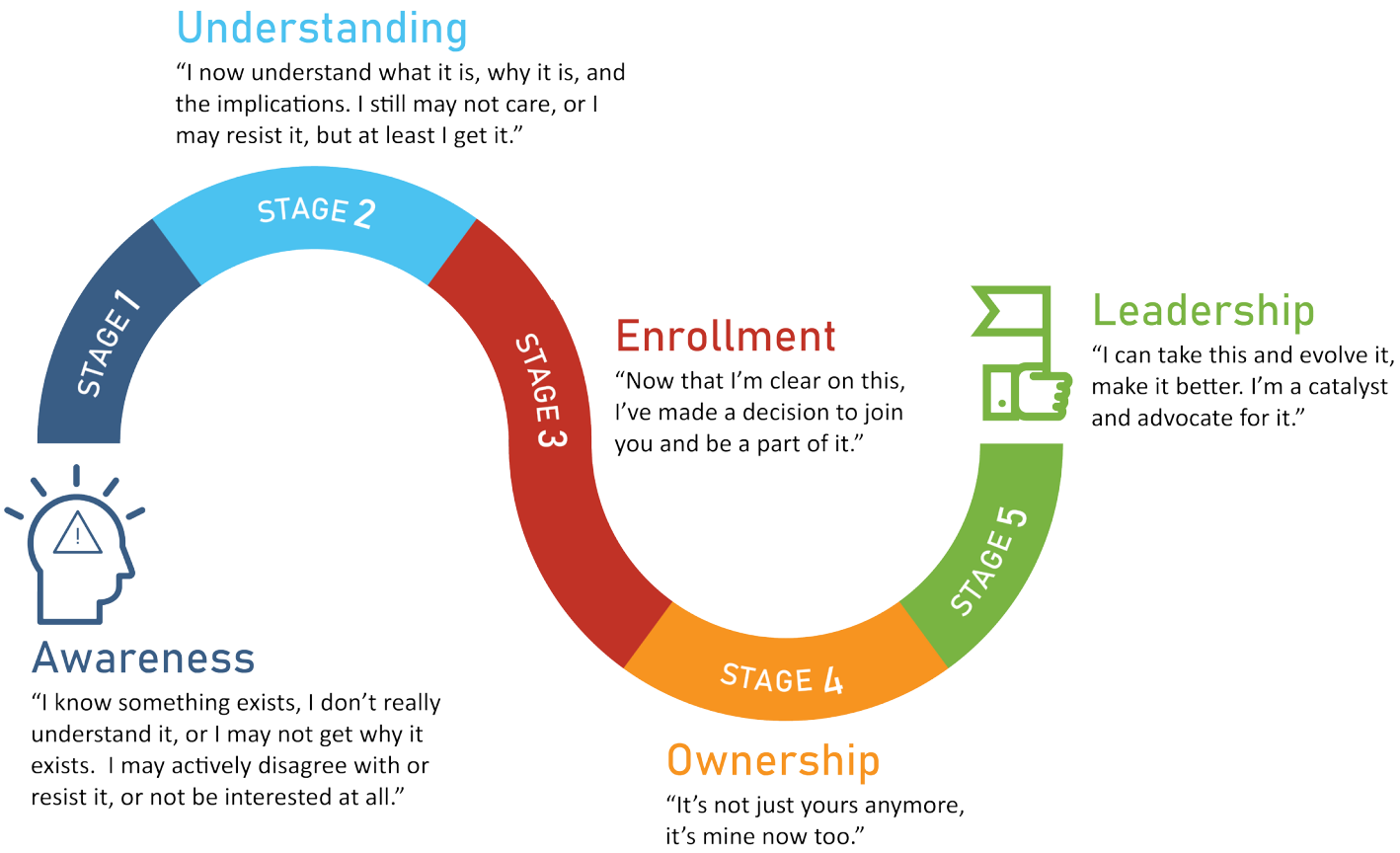


FIGURE 8. Stages of the Culture Change Process

Change management is pain management. This mantra will guide our process. It will be critical to stage the process in a way that the emotional path is respected. That means people (and their organizations) will make their way through a series of transitions, represented in Figure 8.

Our goal is to achieve the Enrollment stage in our cultural journey in this technology transformation. This allows us to plan the emotional path for transformation and buy-in to what is coming.

The most basic task before us involves performing an assessment to get clear on exactly what defines the core elements of the LADOT culture today. From there we must imagine what the future culture must look like in order to respond to the demands of Transportation 2.0.

We aim to evolve existing culture, not dismiss it. We will leverage the strengths of existing culture, while also reaching into a future state to generate the cultural elements we most need. Then, the task is to define a path between these two points.

Today, with consumers' and citizens' increasing adoption of digital lifestyles, every business and government agency must change how it operates and interacts with its customers and citizens every day. LADOT is no different. Long-term strategies must be tempered by flexibility in real time, recognizing that change is constant.

In line with our Strategic Plan goals and core values, we endeavor to map a solution and timeline that complements our culture and continues to make LADOT a great place to work. Without the involvement, cooperation, and feedback of the LADOT workforce, any digital transformation will struggle to maintain its momentum.

It takes time to develop a digital culture. The sooner LADOT acts, the more quickly it will be able to deliver on the promises of Transportation 2.0.

The bottom line is clear: Culture is the most important enabler of digital transformation. Without people, tools will not make any difference.

Task Order Solicitation Process

LADOT will use the Task Order Solicitation (TOS) process to develop the necessary digital pieces to design, build, and deliver the Technology Platform product. **Appendix A** is the first issued TOS to the Transportation Technology bench for a Transportation 2.0 Program Manager. The Program Manager provides strategic direction, convenes creative partnerships, and leverages the full range of available tools to guide LADOT as we endeavor to deliver Transportation 2.0. Furthermore, the Program Manager will have demonstrated experience in product design/development and system design/engineering, a comprehensive understanding of the current state of play in connected and autonomous vehicles and related ecosystem services including financing mechanisms, a proven ability to guide scenario and future planning, and a track record of facilitating partnerships across different disciplines.

Tables 1 and 2 on pages 14-16 summarizes all of the proposed Task Orders LADOT anticipates developing in 2018.

Next Steps

The material presented in this Strategic Implementation Plan is radical, significant, and daunting. Because of this, LADOT chose to develop the Transportation 2.0 Program Manager role as the first Task Order Solicitation (see previous section). The Program Manager will take ownership of this Implementation Plan. In close coordination with LADOT leadership and a diversified, multifunctional team. This Plan will evolve as the Program Manager architects the Transportation 2.0 Technology Platform. There will be versions of this Plan published approximately every quarter over the next few years as LADOT works through its digital transformation and delivers the full benefits of Transportation 2.0.

In addition to technical and service task order solicitations, LADOT needs to develop a task order solicitation focused on organizational culture change. As previously discussed, Transportation 2.0 will only achieve sustainability with the full support of the LADOT organization.

Appendices

Appendix A is the first issued TOS to the Transportation Technology bench for a Transportation 2.0 Program Manager.

Appendix B is a second example of a complete Task Order scope which highlights the depth of thinking expected to underline each TOS that LADOT will issue to the bench.

Appendix C is the proposed Task Orders for building the Transportation 2.0 platform.

Appendix D is the proposed Task Orders for building and delivering the Transportation 2.0 services. LADOT anticipates developing these TOSs along with others throughout the remainder of 2018 and into 2019 and releasing them to the Transportation Technology Bench for bid and development.

Table 1. Transportation 2.0 Technology Platform Task Orders*

	Est. Cost	Est. Complexity	Description
1. Least-Cost Routing Engine	Medium	Medium	An application to take varying pricing data from the city and use it to optimize requested routes by autonomous vehicles. In this example, we use the term "cost" to describe the optimization variable. Examples of "cost" include dollar price, time, distance.
2. Micro-settlement Engine	Medium	Large	A software application used to provide per-trip and per-mile payments from MaaS operators to the city and various vendors within the system.
3. Real-Time Traffic API	Medium	Large	Define an open API to transfer real-time data into the system. The architecture of the API will be open for any provider or consumer to use.
4. Street Status API	Medium	Medium	Define an open API that allows LADOT to publish the status of a street. Example status could include open, restricted, or closed.
5. Real-Time Metric for Safe Curb Usage	Large	Large	This metric will allow a city to determine whether a curb is safe to drop-off and pickup MaaS passengers. The metric should consider the vehicle drop-off/pickup's effect on surrounding traffic, and the safety of the passengers.
6. Pricing of Curb Access	Medium	Large	Determine a safe and equitable way to price curb access for uses like farmers markets, freight delivery, vehicle storage, etc.
7. Use-fee Rate Table	Medium	Medium	The rate table should take into account what a modern gas tax rate table should look like. The rate table should take into account for differing types of vehicles, what fuel they burn, gross weight and other variables.
8. End-User License Agreement	Medium	Medium	Develop an EULA that governs the use of the system by Mobility-as-a-Service providers.
9. Import Real-Time Geo-Located Weather Data	Small	Small	Integrate all known weather data services to give Transportation 2.0 system the best information for planning routes and movement of goods and people through the system.
10. Curb Pricing	Medium	Medium	Develop a policy framework for curb pricing in the city. Include the role of ticketing and parking enforcement.
11. Transportation 2.0 Dashboard	Large	Very Large	Develop a web-based Transportation 2.0 dashboard and management console that provides real-time view and control of the Transportation 2.0 system. Leverage open source network management tools such as TeemIP, Node-RED, ProcessMaker, Atom, Webmin, and WireShark.
12. Speed Control API	Large	Large	Develop an API to deliver a speed limit value for a given geo-fence coordinate. This API will be used by autonomous vehicles to learn the speed limit in effect on a given route.
13. Request route	Medium	Medium	Develop an API to deliver a route for a given set of start/end points. This API will be used by all autonomous vehicles (e.g. surface, air).
14. Developer Website	Medium	Medium	Develop a landing page and online presence for LADOT/ATSAC similar in scope and functionality as any one of developer.google.com, developer.amazon.com, developer.Salesforce.com.

*This is meant to be an illustrative rather than exhaustive list of all the TOSs for the Transportation 2.0 technology platform.

Table 2. Transportation 2.0 Service Task Orders*

	Est. Cost	Est. Complexity	Description
1. Promise Zone Microtransit	Medium	Medium	Identify and launch a microtransit service in LA's first Promise Zone service area.
2. DTLA Autonomous Transit	Low	Low	Launch a one-year pilot of autonomous transit in DTLA.
3. Transit for Universal Access to Play	Low	Low	Identify and launch a service to assist Department of Recreation and Parks with efforts to transport recreation teams to and from games; give kids in low-income communities regular opportunities to access major recreation amenities such as Griffith Park; and offer summertime transportation to public pools.
4. Shared Mobility Pilot Evaluation and Expansion Planning Technical Support	Medium	Medium	To provide support to existing EV Car Share Pilot, including pilot evaluation, strategic planning around expansion opportunities and funding mechanisms, and support ongoing equity framework for shared mobility services. Technical support will also include integration of existing shared mobility options.
5. EV Taxi Implementation, Vehicles and Infrastructure	Medium	Medium	Study a feasible approach to offer subsidy and/or rebate program for electric vehicle purchase and develop strategy for providing supporting infrastructure.
6. Third Party Universal Taxi Dispatch App connected with Multimodal Trip Planning App	Large	Medium	Develop a universal taxi dispatch app that would incorporate entire permitted taxi fleet and provides users with real-time information for convenient and seamless trip planning, reservation, and/or payment, maximizing taxi's utility to users.
7. Universal Dispatch App for Wheelchair Accessible Vehicles	Large	Medium	Develop a dispatch app that would incorporate entire universally/ wheelchair accessible fleet, including taxis, inspected vehicles from Transportation Network Companies, and paratransit to offer users with real-time information for convenient and seamless trip planning, reservation, and/or payment.
8. Concierge Service	Large	Large	Service would deliver a user experience engagement versus destination engagement. For example. What if, instead of selecting a destination, a person could select a task: "Today I want to meet friends and discover somewhere new in the City," or "Today I need an inspiring meeting space for five, with wifi and great snacks."
9. Visual requirements for travel in LA	Medium	Large	Document all the areas of visual interaction for each type of travel mode within Los Angeles. Develop best practices for the design of AVs and multi-modal transportation for visually-impaired passengers.
10. Design Guidelines for Digital Infrastructure	Medium	Medium	With the potential proliferation of new digital infrastructure, the sensors and communications technology necessary to capture and relay real-time transportation data, the City of Los Angeles would set standards for well-designed equipment that integrates into existing infrastructure and/or is complementary. Much in the existing marketplace of sensors and communications infrastructure has been developed with little consideration for aesthetics. However, as potentially the largest market, the City and region of Los Angeles would request well-designed equipment to be installed in the public right-of-way. LADOT would be an advocate for better aesthetics and establish a mechanism to ensure that the proliferation of pole attachments and other equipment does not contribute to urban visual blight.

*This is meant to be an illustrative rather than exhaustive list of all the TOSs for the Transportation 2.0 technology platform.

Table 2. Transportation 2.0 Service Task Orders*

	Est. Cost	Est. Complexity	Description
11. Design Guidelines for Autonomous Rights of Way	Medium	Large	Building on the National Association of City Transportation Officials Blueprint for Autonomous Urbanism, the City aims to create a set of initial working design guidelines for autonomous infrastructure and rights of way both on the ground and in the sky. In the next five years, as fleets of driverless cars and drones appear, the City needs to give careful thought to the implications for setting parameters and requirements for future vertiports, organizing curbspace, and ensuring that placemaking, culture, and community are integral parts of new mobility.

*This is meant to be an illustrative rather than exhaustive list of all the TOSs for the Transportation 2.0 technology platform.

TASK ORDER SOLICITATION ZERO – PROGRAM MANAGER

BACKGROUND

Los Angeles came of age at the dawn of the automobile, embracing this once new technology with much fervor and little expectation of consequences. We designed our entire urban landscape with it in mind. After nearly one hundred years of increasing strain, this design no longer serves us. Los Angeles is now in the alpha stage of building a new transportation network. Our subways are getting more useful with each passing year. A bicycle culture has taken root in earnest. And autonomous vehicles are right around the corner.

Urban Mobility in a Digital Age lays out the vision for Transportation 2.0 in Los Angeles. This vision is anchored on the foundation of actively managed electric, shared, autonomous mobility that aims to tackle congestion, enable economic development, achieve racial and socioeconomic equity, and save lives.

The recent introduction of ride-hailing providers into cities demonstrates what happens when the public sector fails to adequately understand and anticipate major technology shifts. The reactions have varied widely, with most regulators and policymakers unable to thoroughly analyze pros and cons to reach a thoughtful approach.

Given its position as the largest, densest metropolitan region in the US, the City of Los Angeles stands to reap the most benefits or possibly suffer the greatest negative effects of the arrival of disruptive transportation technologies.

The introduction of Transportation 2.0 will impact many entities, products, services and laws related to or dependent on transportation. Many of the human aspects of the new paradigm are well published and include job displacement and elimination of human-caused automotive fatalities. However, cities will have to manage disruption to traffic control systems operation, hardscape design, curb management, and system finance.

The City of Los Angeles and LADOT in particular have realized that designing, developing and delivering Transportation 2.0 is not a business-as-usual affair. We must augment traditional hardscape and softscape with new digitally driven products and services provided by new and unique public/private partnerships. We must augment traditional traffic studies with real-time data, shifting our role from analyst to monitor. Real-time adaptive technologies will augment traffic control systems to maximize use and efficiency of the existing transportation system while accommodating transportation modalities on the surface and in the air.

In addition, the Transportation 2.0 must be financially and environmentally responsible. The gas tax, which funds the current Los Angeles transportation system, is unsustainable for the future. Electric vehicle technologies and improved fuel economy and emissions programs will improve the environment but erode the source of funding for transportation infrastructure. Implementing and operating

Transportation 2.0 requires new sources of revenue that simultaneously reverse the erosion of funding from the declining gas tax, but also fund new infrastructure.

In October 2016, Los Angeles released *Urban Mobility in a Digital Age*, outlining in detail LADOT's toolbox to manage and invest in technologies that help us meet our Strategic Plan goals and deliver Transportation 2.0. As part of this effort, LADOT created a bench of product and consulting firms to partner with us as we endeavor to meet our goals.

While the city has been able to build expertise and knowledge in many key areas, working directly with product companies to collaboratively design, deploy and actively manage the Transportation 2.0 system is an emerging area.

Given the challenges ahead, LADOT has recognized the need for a program manager to guide its work on existing and future projects with companies on the bench and through other partnerships initially over the next three years.

SCOPE OF WORK

Task 0: Transportation 2.0 Program Manager

The Transportation 2.0 Program Manager will be responsible for architecting and specifying the system in accordance with the LADOT Strategic Plan, *Urban Mobility in a Digital Age*, the Sustainable City pLAn, and other guiding policy documents.

Deliverables: The following deliverables will be required for this task and are to be considered living deliverables as opposed to fixed assets: Business Model, System Architecture and Specification, API definitions, Application Classes, Licensing & Legal, and Service Contract Ownership. Following are the definitions for each of these deliverables.

1. **Business Model**
    - **a.** The Transportation 2.0 Program Manager will have the responsibility of developing and owning[10] the business model of the Transportation 2.0 system. The business model must be both economically viable and sustainable for the City of Los Angeles. This includes a self-funding model to replace revenues lost from the anticipated declining gas tax revenues.
2. **System Architecture and Specification**
    - **a.** The Transportation 2.0 Program Manager will have the authority and responsibility of architecting and specifying the Transportation 2.0 system. The majority of this system is expected to be made up of private-sector provided products, however LADOT, through the Transportation 2.0 Program Manager,

[10] The use of the terms "own" or "ownership" is done to convey the level of accountability and delivery expected from the Transportation 2.0 Program Manager. The Transportation 2.0 Program Manager will be subject and bound by the City of Los Angeles' provisions of ownership and Intellectual Property.

will be responsible for how these technologies interact with one another through the definition and management of specifications of Application Program Interfaces (API) and Application Classes.

3. **Application Program Interfaces (API)**
    - **a.** API's are common ways for disparate software systems to communicate with one another. They commonly define the interfaces between sub-systems or an interface to a software product offered by one company or organization to another. The Transportation 2.0 Program Manager will be responsible for the specification and lifecycle management of these API's as it pertains to the Transportation 2.0 system. Where appropriate, the Program Manager will identify existing industry-standard APIs that are appropriate for the LA Transportation 2.0 system to adopt. The following are provided as example API's that may be needed for the Transportation 2.0 system.
        - **i.** *API for real-time weather data* - Allows third party companies (private or public) to provide weather related data on a real-time basis to the Transportation 2.0 system.
        - **ii.** API for real-time traffic data - Allows third party companies to provide real-time traffic data to the Transportation 2.0 system.
        - **iii.** API for real-time video - Allows for real-time video feeds to be used to measure traffic, identify exceptions in the system, etc.
        - **iv.** API for providing traffic incidents - Allows for geo-coded exceptions to be inputted in the system, such as construction, traffic incidents, special events, etc.
4. **Application Classes**
    - **a.** Application Class definitions allow LADOT and the City of Los Angeles to standardize how data is processed into information and how that information can be converted into actions. The Transportation 2.0 Program Manager will be responsible for defining application classes and will be responsible for their specification and lifecycle. The following are example application classes that may be needed for the Transportation 2.0 system.
        - **i.** Traffic sensors using Video
        - **ii.** Machine addressing Curbs, Roads, and AirSpace
        - **iii.** Definition and Management of Curb-Space
        - **iv.** Definition and Management of AirSpace for drones and air taxis
        - **v.** Definition and Management of Road Space
        - vi. Definition and Management of Community Spaces
        - **vii.** Micro-payment systems
        - **viii.** Least-Cost Routing
        - **ix.** Route planning of multi-modal transportation systems
        - **x.** Dynamic pricing
5. **Licensing & Legal**

   a. The Transportation 2.0 Program Manager will be responsible for identifying and managing the necessary licensing agreements, both proprietary and open source, that govern the Transportation 2.0 system. The Transportation 2.0 Program Manager will also be responsible for the management of legal content contained within the Task Order Solicitations including but not limited to the identification and negotiation of potential contract changes or additions for product companies.

6. **Ownership of Service Contracts**
   a. The Transportation 2.0 Program Manager will be responsible for architecture of specific terms within service contracts between LADOT or the City of Los Angeles and technology providers that are deemed critical to make the Transportation 2.0 system operational. It will be the duty of the Transportation 2.0 Program Manager, with the help of the LADOT General Manager and appropriate staff to ensure economic sustainability of the Transportation 2.0 System.
7. **Risk Management**
   a. The Transportation 2.0 Program Manager will oversee and own any and all risk management strategies and studies related to the deployment of autonomous vehicles within the city of Los Angeles.

Task 1: Existing Projects

As part of the Transportation 2.0 efforts undertaken to date, LADOT has launched a number of projects and initiatives including the following:

1. Mobility Hubs: A project to introduce 13 hubs around the city connecting travelers to a variety of transportation choices aligned with Metro's light rail system.
2. Code the Curb: A project to inventory curbside regulations and make them publicly available.
3. ATSAC 3.0: A project to build out the future home of ATSAC, the city's traffic management center, and evolve it to meet future needs anticipating the arrival of autonomous vehicles.
4. Promise Zone ATCTMD Project: A project to layer two-way communication between traffic signal systems, first responders, and the LADOT transit fleet focused in the neighborhood around Promise Zone in Hollywood and Koreatown areas.
5. Toyota Mobility Foundation video detection project: A project to coordinate with the Toyota Mobility Foundation, ITA, and local universities to improve the ability of existing video cameras to detect, classify, and manage all users in an intersection.

Deliverables: For these existing projects, the Transportation 2.0 Program Manager will:

1. Assess projects against the Transportation 2.0 system architecture and implementation strategy and identify and propose projects that fill in the gap (if any) of elements in meeting the Transportation 2.0 goals;
2. Provide ongoing direction and guidance to staff to ensure projects stay focused on overall goals;
3. Identify and troubleshoot hurdles to delivery of the projects;
4. Provide project briefings to the LADOT General Manager on a regular basis; and

5. Direct the work of two LADOT staff who will execute day-to-day work to: i) create the tracking system; ii) gather and report project updates; and iii) perform supporting tasks as needed and identified by the Transportation 2.0 Program Manager.

Task 2: Strategic Implementation Plan Execution

The Transportation 2.0 Strategic Implementation Plan identifies a series of projects that LADOT would like to release to the recently established transportation technology bench. While LADOT will identify project managers for each project, the Transportation 2.0 Program Manager will: a) guide and track the creation of Task Orders that outline the desired project in sufficient detail for product and consulting companies to deliver against; b) outreach to potential companies on and off the bench for delivery of identified projects and product(s) into the overall Transportation 2.0 system; c) identify and negotiate potential contract changes or additions for consulting and product companies; and d) inform the selection process for Task Order Solicitations.

Deliverables: The deliverables for this task will be a minimum of 5-6 Task Order solicitations released to the bench on an annual basis (contingent on funding by LADOT) and managed in accordance with the expectation and direction of the LADOT General Manager.

Task 3: Partnership Development and Outreach

The Transportation 2.0 Program Manager will assist LADOT in developing, building and managing a transportation ecosystem of product and consulting companies and organizations interested in working with LADOT on product design and delivery to support the city's work preparing for the 2028 Olympics and achieving the Transportation 2.0 product design goals.

Deliverables: The deliverables for this task will include:

1. Curate and manage relationships between LADOT and its key technology partners;
2. Collaborate with key technology partners on system architecture and development of standards;
3. Provide and curate introductions between technology companies working broadly in the transportation technology ecosystem and LADOT and other City of Los Angeles staff as directed by the LADOT General manager;
4. Subject to funding, develop and guide outreach at 2-4 technology shows annually, including CES, Mobile World Congress, and Mobile World Congress Americas; and
5. Deliver public presentations, articles, blogs and other such communications representing LADOT and the work to deliver the Transportation 2.0 system (all such efforts to be done with the explicit approval and oversight of the LADOT General Manager).

Task 4: As-Requested Strategic Advice

At the direction of the LADOT General Manager, the Transportation 2.0 Program Manager will provide advice and support on a not-to-exceed basis each month. Typical tasks may include but are not limited to: i) evaluating new technologies; ii) delivering trainings/brown bags to LADOT and other public-sector stakeholders about the current and future efforts described in the previous tasks; iii) advising on

regulatory matters related to autonomous transportation and rights of way; iv) identifying and, when requested, managing any mandates, regulations or legislation required in order to enable the Transportation 2.0 system; and v) reviewing relevant reports to Los Angeles City Council and Commissions.

Task 5: LADOT Support

The Transportation 2.0 Program Manager will be expected to have a regular and in-person presence at LADOT along with regular weekly check-ins with the LADOT General Manager and other members of the LADOT Executive Team. LADOT will provide a workspace and equipment (if needed). LADOT will also provide two dedicated staff to support and assist the Program Manager as described in **Task 1: Existing Project.**

SOLICITATION TITLE: Dynamic Curb Access

SOLICITATION DESCRIPTION: Demonstrate to LADOT (CITY) a method to dynamically grant dispatched autonomous vehicles access to the curbs within the City of Los Angeles for the purposes of pick-up and drop-off of passengers based on safety metrics.

SERVICE CATEGORY: General Services

BACKGROUND

Approximately XXX people lost their lives and XXX injured due to pedestrian related crashes in 20xx thru 20xx inside the City of Los Angeles. The increase in popularity of ride-hailing within city limits has increased the interaction of people walking and driving, increasing the risk of further injury. Autonomous vehicles will only exacerbate the problem over time as the population transitions from personally owned and operated vehicles to Mobility-as-a-Service (MaaS). To alleviate this problem, some cities have offered ride-hailing companies access to bus stops for pick-up/drop-off[11]. While this may have increased safety, the bus stops are not always located in places that coincide with a passenger's pick-up and drop-off location preferences.

DETAILED DESCRIPTION OF SERVICES / SCOPE OF WORK

LADOT would like a method to improve the safety of the traveling public by dynamically granting access to city curbs for the purposes of pick-up and drop-off. This scope includes three distinct parts:

Part 1: Uniquely identifying a curb

The first part of the scope involves developing a method for uniquely identifying a curb. The identified curb will include both a digital and human readable address. Human readable such that potential MaaS passengers can visually understand where their respective pick-up location may be, and digitally so a computer system can easily read the location in a database and geo-locate it for inclusion on a map, etc.

[11] Need citation

Part 2: Safety Metrics

The second part is to develop an appropriate safety metric calculated in real-time and used to grant access to a curb. This metric will consider such variables as traffic speed, traffic incidents, road closures, and incidents or crashes.

Part 3: Access Granting

The third part is to develop a method for granting access to the curb and interfacing with MaaS operators on a per-trip basis. Access grants for the curb will be dynamic, real-time, and therefore done by an automated system of some kind.

DELIVERABLES

A technology demonstration of curb management. The demonstration will give the city the ability to do the following:

1. Identify curbs permitted for Pick-up and drop-off of passengers;
2. Create an exception process to designate curbs as closed for such things as special events, incidents, and crashes; and
3. A dashboard to allow LADOT officials to view curb usage key performance indicators.

MILESTONES

a. Demonstration of application user interfaces / functionality;
b. Demonstration of working prototype using simulated data; and
c. Demonstration of working prototype in test corridor (location TBD).

Transportation 2.0 Technology Platform Proposed Task Orders

1. **Least-Cost Routing Engine**
    a. Description: An application to take varying pricing data from the city and use it to optimize requested routes by autonomous vehicles. In this example, we use the term “cost” to describe the optimization variable. Examples of “cost” include dollar price, time, distance.
    b. Estimated Complexity: Medium
    c. Estimated Cost: Medium
2. **Micro-settlement Engine**
    a. Description: A software application used to provide per-trip and per-mile payments from MaaS operators to the city and various vendors within the system.
    b. Estimated Complexity: Large
    c. Estimated Cost: Medium
3. **Real-Time Traffic API**
    a. Description: Define an open API to transfer real-time data into the system. The architecture of the API will be open for any provider or consumer to use.
    b. Estimated Complexity: Large
    c. Estimated Cost: Medium
4. **Street Status API**
    a. Description: Define an open API that allows LADOT to publish the status of a street. Example status could include open, restricted, or closed.
    b. Estimated Complexity: Medium
    c. Estimated Cost: Medium
5. **Real-Time Metric for Safe Curb Usage**
    a. Description: This metric will allow a city to determine whether a curb is safe to drop-off and pickup MaaS passengers. The metric should consider the vehicle drop-off/pickup's effect on surrounding traffic, and the safety of the passengers.
    b. Estimated Complexity: Large

   c. Estimated Cost: Large

6. **Pricing of Curb Access**
   a. Description: Determine a safe and equitable way to price curb access for uses like farmers markets, freight delivery, vehicle storage, etc.
   b. Estimated Complexity: Large
   c. Estimated Cost: Medium
7. **Use-fee Rate Table**
   a. Description: The rate table should take into account what a modern gas tax rate table should look like. The rate table should take into account for differing types of vehicles, what fuel they burn, gross weight and other variables.
   b. Estimated Complexity: Medium
   c. Estimated Cost: Medium
8. **End-User License Agreement**
   a. Description: Develop an EULA that governs the use of the system by Mobility-as-a-Service providers.
   b. Estimated Complexity: Medium
   c. Estimated Cost: Medium
9. **Import Real-Time Geo-Located Weather Data**
   a. Description: Integrate all known weather data services to give Transportation 2.0 system the best information for planning routes and movement of goods and people through the system.
   b. Estimated Complexity: Small
   c. Estimated Cost: Small
10. **Curb Pricing**
   a. Description: Develop a policy framework for curb pricing in the city. Include the role of ticketing and parking enforcement.
   b. Estimated Complexity: Medium
   c. Estimated Cost: Medium
11. **Dashboard**

a. Description: Develop a web-based Transportation 2.0 dashboard and management console that provides real-time view and control of the Transportation 2.0 system. Leverage open source network management tools such as TeemIP, Node-RED, ProcessMaker, Atom, Webmin, and WireShark.
b. Estimated Complexity: Very Large
c. Estimated Cost: Large

12. **Speed Control API**
    a. Description: Develop an API to deliver a speed limit value for a given geo-fence coordinate. This API will be used by autonomous vehicles to learn the speed limit in effect on a given route.
    b. Estimated Complexity: Large
    c. Estimated Cost: Large
13. **Request route**
    a. Description: Develop an API to deliver a route for a given set of start/end points. This API will be used by autonomous vehicles (surface and air).
    b. Estimated Complexity: Medium
    c. Estimated Cost: Medium
14. **Developer Website**
    a. Description: Develop a landing page and online presence for LADOT/ATSAC similar in scope and functionality as any one of developer.google.com, developer.amazon.com, developer. Salesforce.com.
    b. Estimated Complexity: Medium
    c. Estimated Cost: Medium

Proposed Transportation 2.0 Service Task Orders

1. **Promise Zone Microtransit**
    a. Description: Identify and launch a microtransit service in LA's first Promise Zone service area.
    b. Estimated Complexity: Medium
    c. Estimated Cost: Medium
2. **DTLA Autonomous Transit**
    a. Description: Launch a one-year pilot of autonomous transit in DTLA.
    b. Estimated Complexity: Low
    c. Estimated Cost: Low
3. **Transit for Universal Access to Play**
    a. Description: Identify and launch a service to assist Department of Recreation and Parks with efforts to transport recreation teams to and from games; give kids in low-income communities regular opportunities to access major recreation amenities such as Griffith Park; and offer summertime transportation to public pools.
    b. Estimated Complexity: Low
    c. Estimated Cost: Low
4. **Shared Mobility Pilot Evaluation and Expansion Planning Technical Support**
    a. Description: Would provide support to existing EV Car Share Pilot, including pilot evaluation, strategic planning around expansion opportunities and funding mechanisms, and support ongoing equity framework for shared mobility services. Technical support will also include integration of existing shared mobility options.
    b. Estimated Complexity: Medium
    c. Estimated Cost: Medium

5. **EV Taxi Implementation, Vehicles and Infrastructure**
    a. Description: Would study a feasible approach to offer subsidy and/or rebate program for electric vehicle purchase and develop strategy for providing supporting infrastructure.
    b. Estimated Complexity: Medium
    c. Estimated Cost: Medium
6. **Third Party Universal Taxi Dispatch App connected with Multimodal Trip Planning App**
    a. Description: Develop a universal taxi dispatch app that would incorporate entire permitted taxi fleet and offers users with real-time information for convenient and seamless trip planning, reservation, and/or payment, maximizing taxi's utility to users.
    b. Estimated Complexity: Medium
    c. Estimated Cost: Large
7. **Universal Dispatch App for Wheelchair accessible vehicles**
    a. Description: Develop a dispatch app that would incorporate entire universally/wheelchair accessible fleet, including taxis, inspected vehicles from Transportation Network Companies, and paratransit to offer users with real-time information for convenient and seamless trip planning, reservation, and/or payment
    b. Estimated Complexity: Medium
    c. Estimated Cost: Large
8. **Concierge service**
    a. Description: Service would deliver an user experience engagement versus destination engagement. For example. What if, instead of selecting a destination, a person could select a task: "Today I want to meet friends and discover somewhere new in the City," or "Today I need an inspiring meeting space for five, with wifi and great snacks."
    b. Estimated Complexity: Large
    c. Estimated Cost: Large

9. Visual requirements for travel in LA

a. Description: Document all the areas of visual interaction for each type of travel mode within Los Angeles. Develop best practices for the design of AVs and multi-modal transportation for visual impaired passengers.

b. Estimated Complexity: Large

c. Estimated Cost: Medium

10. Design Guidelines for Digital Infrastructure

a. Description: With the potential proliferation of new digital infrastructure, the sensors and communications technology necessary to capture and relay real-time transportation data, the City of Los Angeles would set standards for well-designed equipment that integrates into existing infrastructure and/or is complementary. Much in the existing marketplace of sensors and communications infrastructure has been developed with little consideration for aesthetics. However, as potentially the largest market, the City and region of Los Angeles would request well-designed equipment to be installed in the public right-of-way. LADOT would be an advocate for better aesthetics and establish a mechanism to ensure that the proliferation of pole attachments and other equipment does not contribute to urban visual blight.

b. Estimated Complexity: Medium

c. Estimated Cost: Medium

11. Design Guidelines for Autonomous Rights of Way

a. Description: Building on the National Association of City Transportation Officials Blueprint for Autonomous Urbanism, the City aims to create a set of initial working design guidelines for autonomous infrastructure and rights of way both on the ground and in the sky. In the next five years, as fleets of driverless cars and drones appear, the City needs to give careful thought to the implications for setting parameters and requirements for future vertiports, organizing curbspace, and ensuring that placemaking, culture, and community are integral parts of new mobility.

b. Estimated Complexity: Large

c. Estimated Cost: Medium

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