Metro

Los Angeles County
Metropolitan Transportation
Authority
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Los Angeles, CA

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Board Report

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OPERATIONS, SAFETY, AND CUSTOMER EXPERIENCE COMMITTEE
MAY 16, 2019

SUBJECT:　COUNTDOWN CLOCKS - ARRIVAL PREDICTION INFORMATION

ACTION:　RECEIVE AND FILE

RECOMMENDATION

RECEIVE AND FILE the status report on efforts underway to improve the reliability and accuracy of arrival prediction information and enhance the customer experience on Metro's Bus and Rail fleet.

ISSUE

Providing accurate arrival information is a challenge to all transit agencies. When service is running as scheduled, predicted arrival information is very good. However, service disruptions are each uniquely different and schedule recovery must be addressed on a case-by-case basis, making accurate arrival predictions much more difficult. Metro staff have developed and begun implementing a program for improving predictive arrival accuracy to provide a better customer experience.

BACKGROUND

The public has come to rely on and expect a high level of technology-driven assistance for mobility services such as transportation networking companies, or TNCs (e.g. Uber and Lyft), where they can track their rides on their smart devices. The same expectations are being imposed on transit providers with equal vigor. Metro's challenge is to integrate solutions that can both immediately improve the customer experience and continue to evolve as technology advances in artificial intelligence, 5G bandwidth speed improvements, and autonomous vehicle development.

Transit agencies have taken different approaches to presenting arrival information to the customer. The following are the general options available. Metro has opted for option 1.

1. Arrival predictions - This approach adjusts arrival information to address real-time conditions. This option requires frequent data updates so that delays or changes caused by service disruptions are accounted for in the predictions.

2. Scheduled time arrivals - This option provides arrival information based on the service schedule. It does not adjust for service disruptions or variations.

3. Headway information - This option eliminates the prediction calculation and simply provides

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the time between the next scheduled bus or train (e.g. train arrives every 6 minutes or 12 minutes). It does not adjust for service disruptions and is primarily a time-based display.

Predicting arrival information appears to be a straight-forward endeavor. When service is operating as planned, the predicted arrival information is very good. However, service disruptions impact schedules on a regular basis, and because each situation is unique, the strategies for recovery are difficult to address in a prediction algorithm. In addition, recovery strategies are different for bus and rail.

Countdown Clock Architecture:

At its most basic level, the architecture of an effective arrival prediction system consists of three elements:

1. Vehicle location
2. Data
3. Information Sharing

Vehicle location can be determined through global positioning systems (GPS) for above-ground operations like bus and, in the case of light rail and subway, track circuitry that indicates the presence of a vehicle based on a short circuit of a low voltage current in the track.

Prediction logic aggregates the data and accounts for the location of a vehicle relative to a stop or station and the speed at which the vehicle is traveling. This logic produces calculations based on real-time conditions and adjusts for any disruptions. The resultant information is transmitted as an application program interface (API) for use in customer-facing digital communications.

The API is used to generate customer information that is shared through any variety of platforms, such as digital displays, public announcements, mobile applications, or websites. Part of an enterprise-wide transit passenger information system (TPIS), countdown clocks refer specifically to the digital screens displaying bus or rail arrival time information.

Bus:

Buses operate somewhat independently in that a disruption to a single bus trip does not necessarily impact other buses. Operationally, recovering a disruption to the bus schedule can be done more easily due to the large network of streets and arterials that buses can use as alternate routes when needed.

In March 2017, the Metro Board approved the $7.8 million Connected Bus capital project to support the implementation of cellular technology on Metro's bus fleet. Connecting Metro buses through the public cellular network improves vehicle location information and improve the prediction accuracy of bus arrival times. This is accomplished by increasing the poll rate of vehicle locations every 10 seconds versus the previous rate of every three minutes.

Rail:

Rail service is disrupted daily due to such things as platform disturbances, in-vehicle patron emergencies, construction impacts, and track and signal maintenance. Some of these are momentary and others are more severe. Unlike bus, rail vehicles cannot deviate from the route to avoid a disruption ahead. For this reason, disruptions, however minor, can affect an entire corridor, and in extreme cases, adjacent corridors.

The existing track circuitry that provides rail vehicle location does not generate the level of real-time information needed to improve arrival predictions. In addition, a portion of the rail system is underground, making GPS technology more challenging to adopt as a systemwide strategy. As a result, Metro is exploring potential strategies to integrate gyro and speed data to improve vehicle location in the tunnels.

Metro has undertaken various proofs-of-concept to evaluate options that are available to improve real-time vehicle location information for rail. While it is desirable to identify one solution that can address both subway tunnel communications as well as street-running light rail, Metro is also willing to consider separate technologies for street-running (LRV- light rail vehicles) and subway (HRV- heavy rail vehicles) operating conditions.

Through the proofs-of-concept, Metro is validating a proposed technology solution that aims to improve tunnel communication on the heavy rail that will also provide a complementary solution for the light rail. The Discussion section below describes the status and progress of these efforts.

DISCUSSION

Metro is using a multi-pronged approach to improve arrival prediction information. The three main elements of this approach and the corresponding elements are described below and depicted in Attachment A:

1. Vehicle Location Improvements
    a. Increase the poll rate of vehicle location data
    b. Develop prediction logic that will improve accuracy based on service disruption updates
2. Data Improvements
    a. Review and update standard operating procedures to improve data quality for service disruptions.
    b. Evaluate the feasibility of integrating crowd sourcing information into prediction algorithms to further improve arrival accuracy.

3. Information Sharing Improvements
    a. Install arrival information displays at rail platforms where they do not currently exist (New Blue).
    b. Improve the electronic sign maintenance and reliability so that arrival information is always available.

Status:

Metro has convened a task force that is working on all the efforts identified above. The following is an update on some of these efforts:

Connected Bus Capital Project:

New buses will already be equipped with the connected bus technology. For this reason, buses that are slated for retirement within the next two years will be upgraded as part of the replacement plan. For the remaining fleet, the installation of cellular devices on the vehicles is being done in phases. As of March 2019, Metro has installed this technology on 1500 of 2348 vehicles (64% of bus fleet), and the current schedule projects full implementation by December 2019.

Predicted Arrival Information for Rail:

A proof of concept to obtain more accurate rail vehicle location updates operating in the tunnel environment is underway. This technology is expected to provide enhanced functionality for future scalability and will be evaluated for possible fleetwide implementation on both the light and heavy rail fleet.

Standard Operating Procedures for Rail Operations are being reviewed and updated to handle service disruptions more consistently and effectively. These procedures will help define ad-hoc service conditions that must be integrated into the prediction logic definition.

Digital Displays:

In the short term, Metro's priority is to ensure that all rail electronic message signs are connected to the network to display arrival information. A software update has also been developed to integrate these signs into the rail network. The following schedule is planned.

- Blue Line Arrival Information: FY19, Q4
- Gold and Green Line Arrival Information: FY20, Q1
- Expo Line Arrival Information: FY20, Q2

In the long term, Metro Marketing's Digital Advertising Program will install new signs on the rail system to display train arrival information. A proof of concept is being developed at 7th/Metro. Depending on the outcome and feasibility of this proof of concept, an enterprise wide implementation plan will be developed that will improve the reliability and availability of arrival information at all rail stations.

FINANCIAL IMPACT

Funding for all proofs-of-concept and operational investigations to improve arrival prediction information is included in the FY19 operating budget of all affected cost centers.

The source of funds for future capital project funding to improve arrival prediction information will come from Federal and local funds. Use of these funding sources maximizes established funding provisions and guidelines.

Impact to Budget

The source of funds for future capital project funding to implement a proposed solution for improved arrival prediction information will come from Federal and local funds. Use of these funding sources maximizes established funding provisions and guidelines.

IMPLEMENTATION OF STRATEGIC PLAN GOALS

Improved Customer Information supports **Metro Vision 2028 Strategic Goal 2: Deliver outstanding trip experiences for all users of the transportation system.**

NEXT STEPS

Staff will continue to implement the initiatives defined above and continue to evaluate other technology applications as they become available to improve predicted arrival information for the customers.
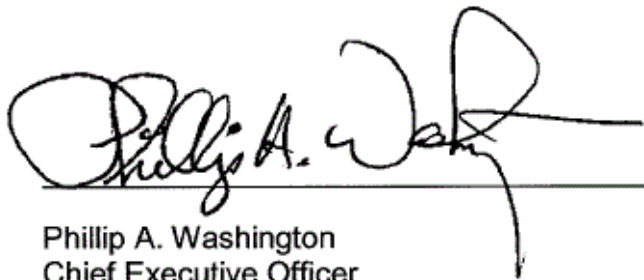
1. Staff will incorporate these initiatives into the Customer Service and Experience Plan going forward.

2. Staff will submit a request to the Board to approve a Capital Project (Life of Project) for the implementation of a Connected Rail project that will enhance the arrival predictions on rail.

ATTACHMENTS

Attachment A - Elements of the Arrival Prediction System

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