



## Board Report

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**3<sup>rd</sup> REVISED**  
**SYSTEM SAFETY, SECURITY AND OPERATIONS COMMITTEE**  
**JUNE 21, 2018**

**SUBJECT: CRENSHAW/LAX SERVICE PLAN AND BUS/RAIL  
INTERFACE AND PLAN**

**ACTION: RECEIVE AND FILE APPROVE RECOMMENDATIONS**

### **RECOMMENDATION**

#### **CONSIDER:**

- A. RECEIVING AND FILING status report on the service plan for the new Crenshaw/LAX to Green Line rail network and draft bus/rail interface plan for the Crenshaw/LAX rail line to be implemented in the Fall of 2019; and
- B. DIRECTING the CEO to reevaluate the service plan one year prior to the opening of the Green Line extension to Torrance to determine if travel patterns and other relevant factors show a need for a change in service pattern.

### **ISSUE**

The Crenshaw/LAX Transit Project is anticipated to start revenue service in the Fall of 2019. Unlike the recent Gold Line Foothill and Expo Line Santa Monica extensions in which case the rail line was further extended from the end of the line, the Crenshaw/LAX Line will connect with the Green Line at a mid-line location between Mariposa and Aviation Stations. Therefore, operations of both the Green and Crenshaw/LAX Lines must be planned as an integrated network vs. an extension of an existing line.

When Metro opens a new rail service, there are opportunities to make modifications to the existing service network to ensure customers have access to and from the new stations via bus service as a first mile/last mile travel option. In some cases, duplicative bus routes may be modified in recognition of the new rail line.

### **DISCUSSION**

Crenshaw/LAX - Green Line Service Concept

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The Crenshaw/LAX Line will be connected to the existing Green Line mid-line between Mariposa and Aviation Stations. As such, it creates a junction between the two lines, resulting in three distinct route segments extending out from the junction to: 1) the Expo Line, 2) Norwalk Station, and 3) Redondo Beach (RB) Station. The junction also creates complexity in how trains are routed along these three segments, and ultimately how the Crenshaw/LAX and Green Lines operate as one single network.

The following criteria were considered in establishing a service plan that achieves the project goals, right-sizes service levels to demand, and is operationally viable.

- Connection to LAX - One primary goal of the Crenshaw/LAX Transit Project is to provide connectivity to LAX. Therefore, the preferred service concept should ensure that a direct connection is provided between each of the three segments and the Aviation/Century and future 96th Street/AMC Station.
- Consistent Headways - To ensure that customers have an even level of service along the entire Crenshaw/LAX - Green Line network, and passenger loads are even from train to train, both directions of each segment should operate at a consistent headway. Service is anticipated to begin in the Fall of 2019 with 6 minute peak hour headways on all segments with a maximum design headway of 5 minutes.
- Minimize Transfers - The transfer penalty between each segment should be minimized. Optimally, transfers at common stations served by all routes (Aviation/Century and 96th Street Station) should require no more than a 3 minute transfer, or one half of the headway. In addition, transfers will be made at the same center platform to further minimize delays.
- Ridership - It is important to consider current and future ridership along each of the three segments of the network to ensure that the appropriate capacity is provided to match demand. The Green Line currently carries about 33,000 average weekday boardings, with roughly 26,000 boardings on the segment between Norwalk and Aviation, and about 7,000 on the Redondo Beach - Aviation segment. The Crenshaw/LAX and Airport Metro Connector is expected to carry an additional 16,400 new boardings along the extension.

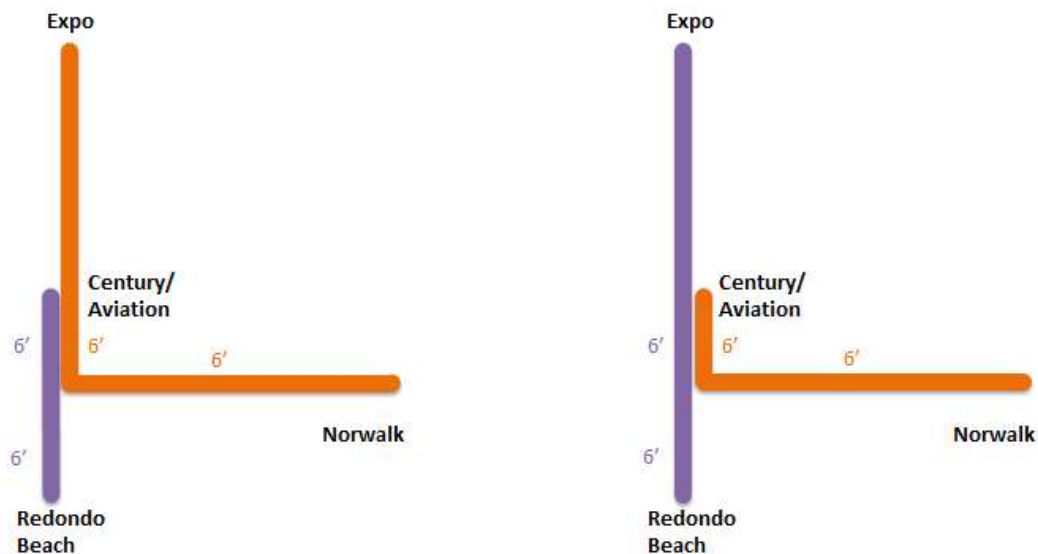
In addition, there is significant transfer activity currently occurring between the Green Line and major north/south bus corridors, such as Vermont Av. Therefore, it is anticipated that many customers will migrate from these bus corridors to the Crenshaw/LAX Line, as experienced on the Expo Line from parallel bus services such as Wilshire Bl and Venice Bl.

- Operating Constraints - The complexity of the junction operation with a double Wye prohibits our ability to provide consistent 6 minute headway on all segments of the network. In addition, it would require very close spacing between trains crossing the junction (a train crossing every 1-2 min) which would amplify the impact of any train delay through the junction.

In addition, the Crenshaw/LAX Transit Project is designed to a minimum headway of 5 minutes. Therefore, assuming service is routed every 6 minutes from both Norwalk and RB to the Crenshaw/LAX rail corridor, only one of the two services can extend north of Aviation/Century and the future 96th Street Stations.

Given the constraints of the junction on branched operations and the minimum design headway of 5 minutes, there are two primary service plan alternatives as shown in Table 1.

Table 1 - REVISED  
Alternative Operating Scenarios



Both of these scenarios adhere to all of the criteria listed above. Therefore, with significantly higher ridership on the Norwalk - Aviation segment, and proven demand between the Green Line and major north/south corridors such as Vermont Av., Crenshaw Bl., and Hawthorne Bl., the optimal service plan is a route between Norwalk and Expo and another between Redondo Beach and Aviation/Century. Transfers would be timed at Aviation/Century to ensure optimal transfers from the same platform to any direction.

Although this route is optimal for the start of revenue service, staff will reevaluate the service plan at least one year prior to the opening of the Green Line extension to Torrance. This evaluation will consider travel demand patterns, operational feasibilities, Title 6 equity considerations and other relevant factors. The Crenshaw/LAX - Green Line service network may be adjusted to reflect the results of this evaluation.

### Crenshaw/LAX Draft Bus/Rail Interface Plan

The Metro Bus/Rail Interface plan is being developed to maximize the benefits and opportunities provided by the Crenshaw/LAX transit project. Guidance for this effort is taken from the 2016 Transit Service Policy (TSP). The TSP specific to Bus/Rail Integration states that “As the Metro Rail system

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expands, adjustments are made to the bus system to improve access to rail stations, take advantage of new transfer facilities, and reduce bus and rail service duplication.” The preliminary plan will be shared with the general public for review and public comment starting with this report and going forward through the end of December 2018. Public input will help to refine the final proposals. and A Title VI Equity Analysis will be completed by Metro staff and brought to the Board for Approval. and Public hearings will be conducted by the Service Councils to receive community additional comments and final approval of the plan prior to implementation.

This Crenshaw/LAX bus/rail interface plan focuses on three main objectives:

- Reduce Duplication
- Simplify Connections
- Provide LAX bus connections at the Aviation/Century Station

### ***Reduce Duplication***

- Line 40 - (Hawthorne/Crenshaw/M.L.King Jr.) - Line 40 Provides service between the South Bay Galleria in Redondo Beach and Downtown LA via a north/south routing along Hawthorne/La Brea corridor, Florence Av, Crenshaw Bl, and an east/west alignment along Martin Luther King Jr. Bl. As such, it duplicates the Crenshaw/LAX line and Line 210 (Crenshaw Bl) along a 5 mile segment of Crenshaw Bl and Florence Av. This proposal eliminates the duplication along Crenshaw Bl, and retains the east/west segment between the Martin Luther King, Jr. Station and Downtown Los Angeles. The north/south segment along Hawthorne/La Brea between the South Bay Galleria and the Downtown Inglewood Station will be connected to Line 212/312 (La Brea Bl). Local service on Crenshaw Bl will continue to be provided by Line 210 (Crenshaw Bl) operating between Hollywood and the South Bay Galleria.
- Line 740 - (Hawthorne/Crenshaw Rapid) - Line 740 provides Rapid service along the north/south segment of Line 40 between the South Bay Galleria and Expo Crenshaw Station. Given the duplication with the Crenshaw/LAX line and the extension of Line 212/312 (La Brea Bl) south along Hawthorne, Line 740 is proposed to be discontinued.

### ***Simplify Connections***

- Line 212/312 (La Brea Bl) - As stated earlier, Line 212/312 is proposed to be extended south along the La Brea/Hawthorne corridor to the South Bay Galleria. This change not only replaces Line 40/740 service along Hawthorne Bl, it rationalizes and clarifies the network by having Line 212/312 provide service along the extent of the La Brea/Hawthorne corridor vs. having to transfer between Line 212/312 and Line 40/740 at Florence Av. to continue along the corridor. The change also eliminates an inefficient one way turn around loop at the Hawthorne/Lennox Green Line Station. Replacement service for Line 212 on Prairie Av from the Hawthorne Green Line Station to downtown Inglewood will be provided mid-day and weekends by an expanded service on Line 211.
- Line 607 (Windsor Hills/Inglewood Shuttle) - Line 607 currently provides one way loop service

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within the broad area of Windsor Hills and Inglewood. This proposed modification would provide a more usable two way shuttle route between the Downtown Inglewood Station and nearby community destinations such as the Faithful Central Bible Church.

### ***Providing Improved Access to LAX***

- **Airport Bus Connections** - Currently, the Aviation Green Line Station serves as the central access point and bus hub for LAX and the surrounding area. With the opening of the Crenshaw/LAX Line, the Green Line Aviation Station will be replaced with the Crenshaw Aviation/Century Station as the main transfer point for airport customers. The LAWA 'G' Shuttle will provide service from this station until 2023 when the people mover is implemented. Line 117 will also serve this station along with Big Blue Bus Lines 3/Rapid 3, Culver CityBus Lines 6/Rapid 6, and Beach Cities Transit Line 109. All three municipal operators will continue to serve the LAX City Bus Center, Aviation/LAX Station and the new Aviation/Century Station.

Outside of the major bus/rail interface changes mentioned above, numerous other bus lines will connect with the Crenshaw/LAX Line. Attachment A provides a station by station listing of all bus lines that will connect with the line.

### **Public Outreach**

Extensive outreach beginning June 2018 will engage existing customers and members of the community. A number of community meetings will be held, including formal public meetings and informal pop-up events at key transportation centers, bus stops, and future Crenshaw Rail stations. Public participation will help staff to develop the final proposals and inform the Service Councils before approving final service change proposals. The public engagement and outreach will culminate in public hearings conducted by the South Bay Service Council and Westside/Central Service Council in early 2019.

### **DETERMINATION OF SAFETY IMPACT**

Service Planning Staff has worked with Metro Rail Construction to ensure buses have safe areas to board and alight customers at rail stations. Where needed, designs were established to ensure buses have safe turning radius for entering and exiting off street stations as well as existing and new bus zones adjacent to stations.

### **FINANCIAL IMPACT**

The operating cost for the Crenshaw/LAX and Green Line rail service will be approved through the FY20 Budget process.

The Crenshaw Bus/Rail Interface Plan, as currently planned, is cost neutral compared to existing bus service and resources included in the FY18 Budget. Final financial impacts of these bus service changes are pending approval by the Service Councils in early 2019.

### **NEXT STEPS**

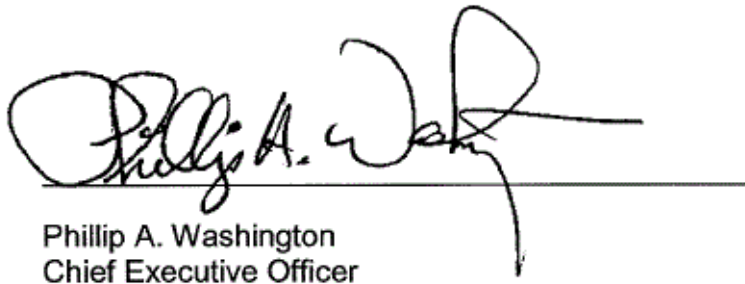
Staff will begin public outreach of the bus/rail interface plan in June, and will continue receiving comments up through a Public Hearing which is expected take place prior to January, 2019. Staff will return to the Board with a presentation of the final plan.

**ATTACHMENTS**

Attachment A - Station by Station Descriptions

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### Station by Station Descriptions

The following section lists the Metro lines and Municipal bus services that are proposed to serve each station. This information is also displayed in Table 1.

Crenshaw/Exposition: Currently served by Lines 210, 710 and the Metro Expo Line. Line 740 will be discontinued. DASH Midtown also serves this station.

Crenshaw/ML King, Jr: Currently served by Lines 40, 105, 210, 705, and 710 plus three DASH Lines. Line 40 and 740 discontinued south of Stocker St (Line 40 service via ML King, Jr Bl to DTLA continues to operate).

Leimert Park: This station at Crenshaw/Vernon is currently served by Lines 102, 105, 210, 705, and 710 plus DASH.

Hyde Park: This station at Crenshaw/Slauson is currently served by Lines 108, 210, 358, and 710 plus DASH Leimert/Slauson. Service by Lines 40, 607, and 740 discontinued.

Fairview Heights: This station on West Bl and is very close to Line 111 stops on Florence Av, just 0.15 miles to the south. Line 110 on Hyde Park Bl is 0.3 miles to the north.

Downtown Inglewood: A new off-street bus hub located on Florence Av just east of La Brea Bl provides layover for Lines 211, 215, 607 and select trips on Line 212/312 and Line 111. Line 212/312 will be extended to replace Line 40/740 service on Hawthorne Bl south of the Metro Green Line to the South Bay Galleria. Mid-day and weekend service on Line 211 will be operated from the Hawthorne Green Line Station north to the downtown Inglewood Station.

Westchester/Veterans: Line 115 stops on Manchester Bl at Hindry St (westbound) and Isis St (eastbound) are approximately 0.2 miles to the south of the station.

Aviation/Century: This station becomes the shortest link from Metro Rail to the LAX Terminals, replacing the Metro Green Line Aviation/LAX Station as the main transfer point for airport customers. The 'G' Shuttle will interface with Metro Rail at this station until 2023 when the people mover is implemented. Line 117 will also serve the new Aviation/Century Station; Big Blue Bus Lines 3/Rapid 3 and Culver CityBus Lines 6/Rapid 6 will continue to serve both LAX City Bus Center and the Aviation/Century Station on their routes terminating at Aviation/LAX Station.

A summary of the proposed changes is provided in the table below.

<b>New Metro Rail Station</b>	<b>Metro Bus Routes Serving New Station</b>	<b>Notes (* denotes Major Change)</b>
Crenshaw/Expo	210, 710, 740*	*740 discontinue
Crenshaw/ML King, Jr	40*, 105, 210, 705, 710, 740*	*740 discontinue; Line 40 continues to serve ML King, Jr Bl from DTLA to Crenshaw/Stocker
Leimert Park	40*, 102, 105, 210, 705, 710, 740*	Buses will stop at station entrances.
Hyde Park	40*, 208, 210, 358, 710, 740*	Buses will stop at station entrances near Crenshaw/Slauson.
Fairview Heights	40*, 111	0.13 mile walk link to/from bus stops at Florence/West
Downtown Inglewood	40*, 111, 211, 215, 212*, 312, 607*, 740*	Line 212/312 extended 7.2 miles south of Metro Green Line via Hawthorne Bl to 182 <sup>nd</sup> St; Line 607 two-way improved shuttle route
Westchester/Veterans	115	0.2 mile walk link to/from bus stops on Manchester
Century/Aviation	117	Airport connections made here and at LAX City Bus Center until 2023 when people mover opens





# CRENSHAW/GREEN LINE SERVICE PLAN AND BUS/RAIL INTERFACE PLAN



Expo/Crenshaw Station

JUNE 21, 2018

# SERVICE PLAN CRITERIA



- **Connection to LAX** – Direct connection to Aviation/Century all three directions
- **Consistent Headways** – Consistent headway along each segment to ensure even loads from train to train
- **Minimize Transfers** – Minimize connections by optimizing transfer times at 3 min, half of a 6 min headway, and cross platform transfers
- **Ridership** – Connect segments with similar ridership and travel patterns



# OPERATIONAL CONSTRAINTS



- **Junction Limitations** – Branched operations (e.g. Expo – RB followed by Expo – Norwalk) at a 6 min headway results in uneven headways (e.g. 5 min, then 7 min, then 5 min, etc. vs. an even 6 min headway)
- **Design Capacity** – Design capacity does not allow better than a 5 min headway along the Crenshaw/LAX Line

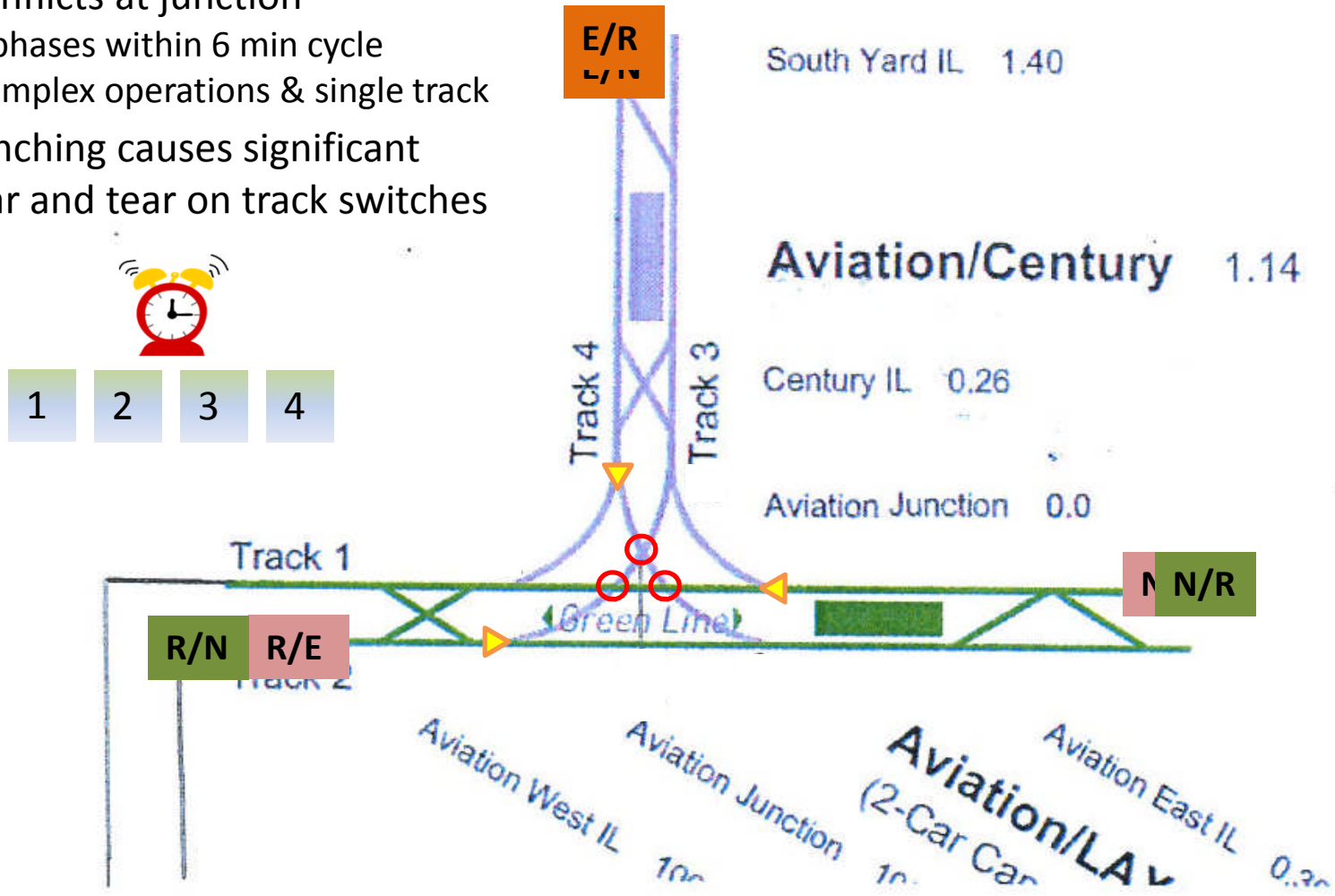


# JUNCTION OPERATIONS

## Branch Operations



- 3 conflicts at junction
  - 4 phases within 6 min cycle
  - Complex operations & single track
- ▲ Branching causes significant wear and tear on track switches

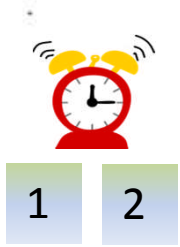
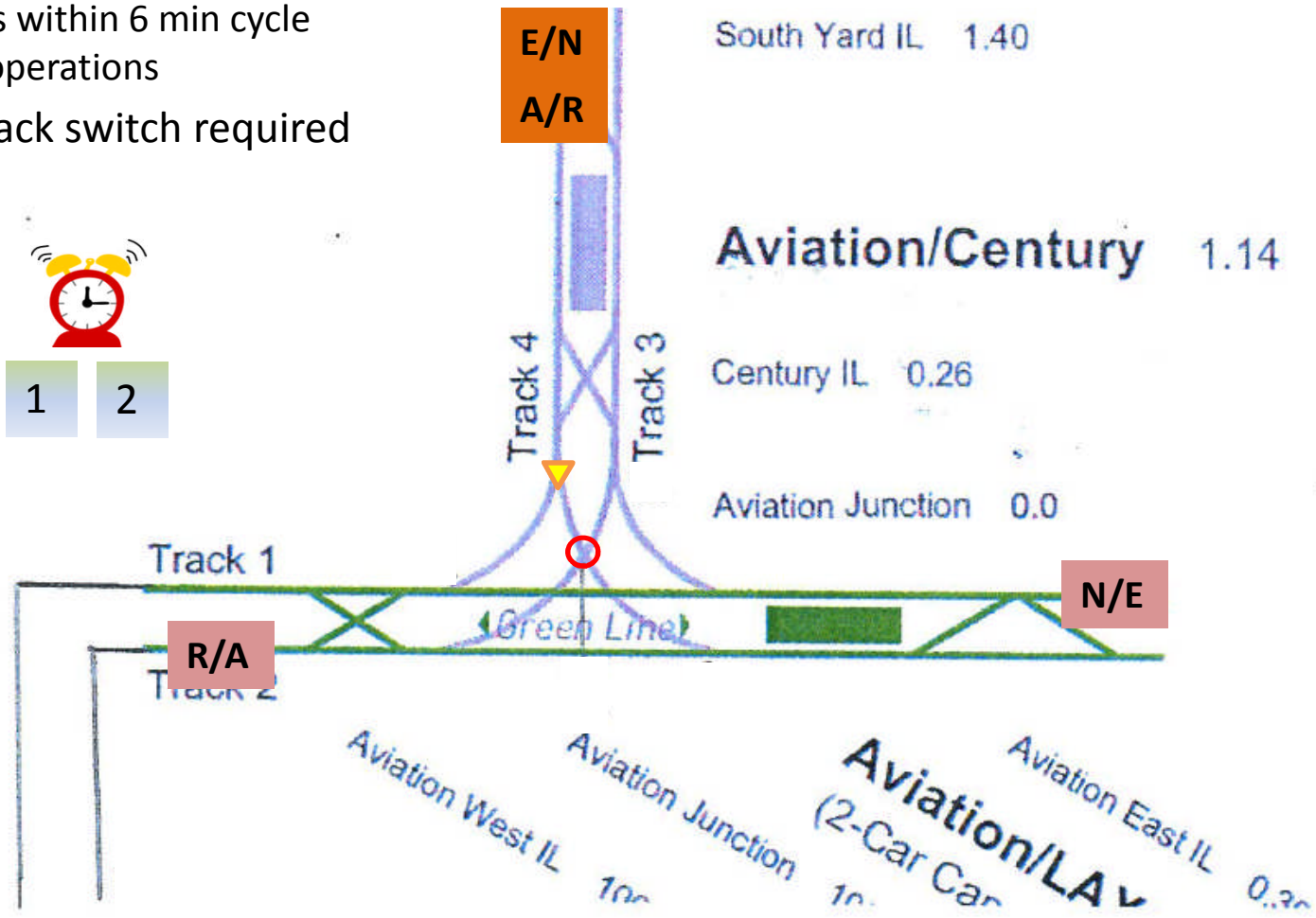


# JUNCTION OPERATIONS

## Consistent Route Operations



- 1 conflicts at junction
  - 2 phases within 6 min cycle
  - Simple operations
- ▲ Only 1 track switch required



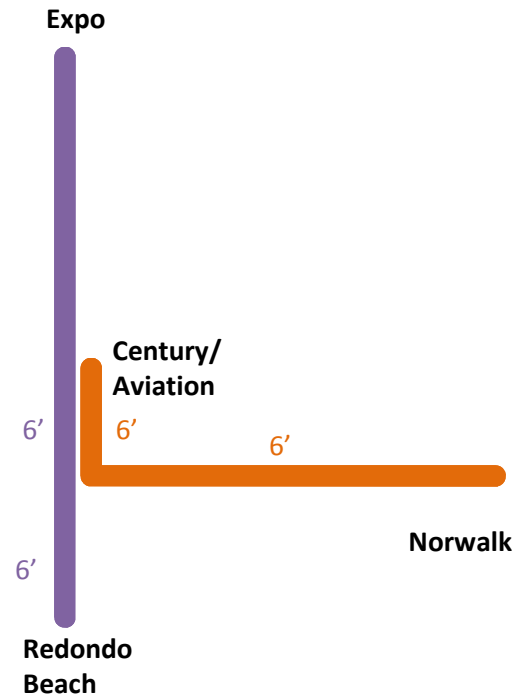
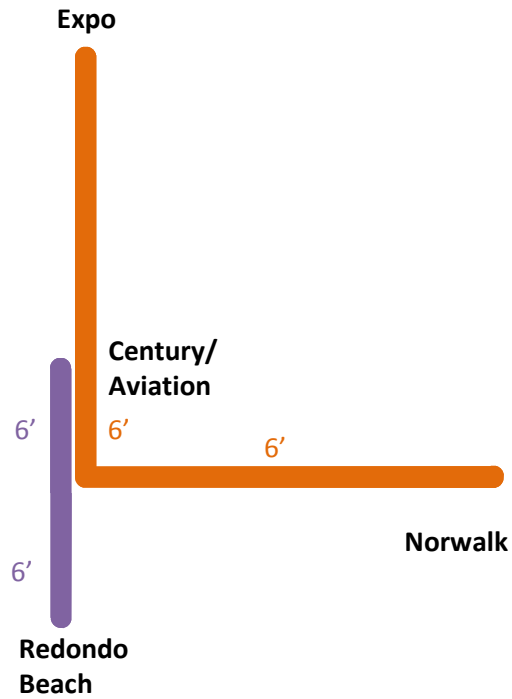


# CRENSHAW/GREEN LINE

## Alternative Operating Scenarios

Alt 1: Expo – Norwalk  
Redondo Beach – Aviation/Century

Alt 2: Expo – Redondo Beach  
Norwalk – Aviation/Century



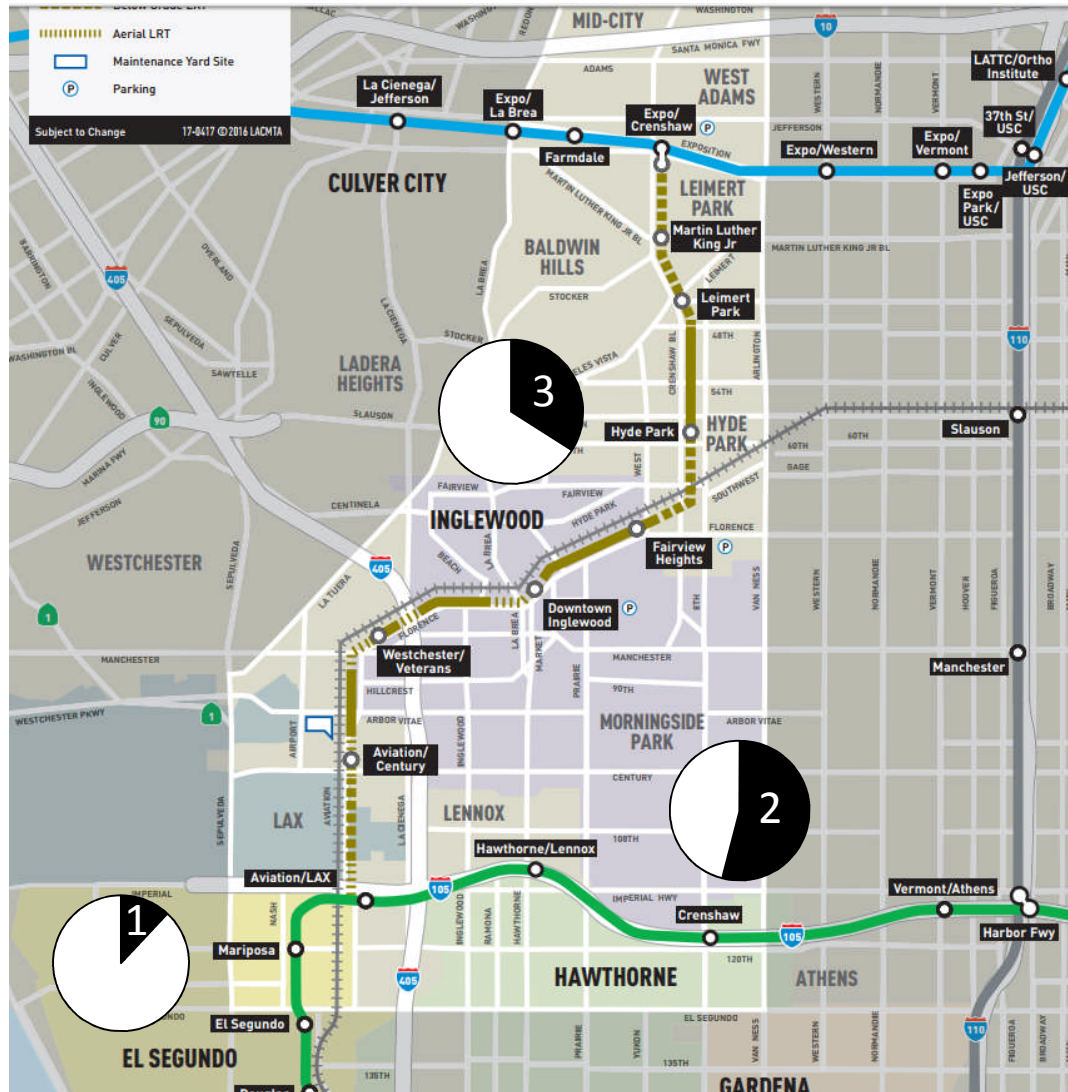
# CRENSHAW/GREEN LINE

## Average Daily Boardings (Weekdays)

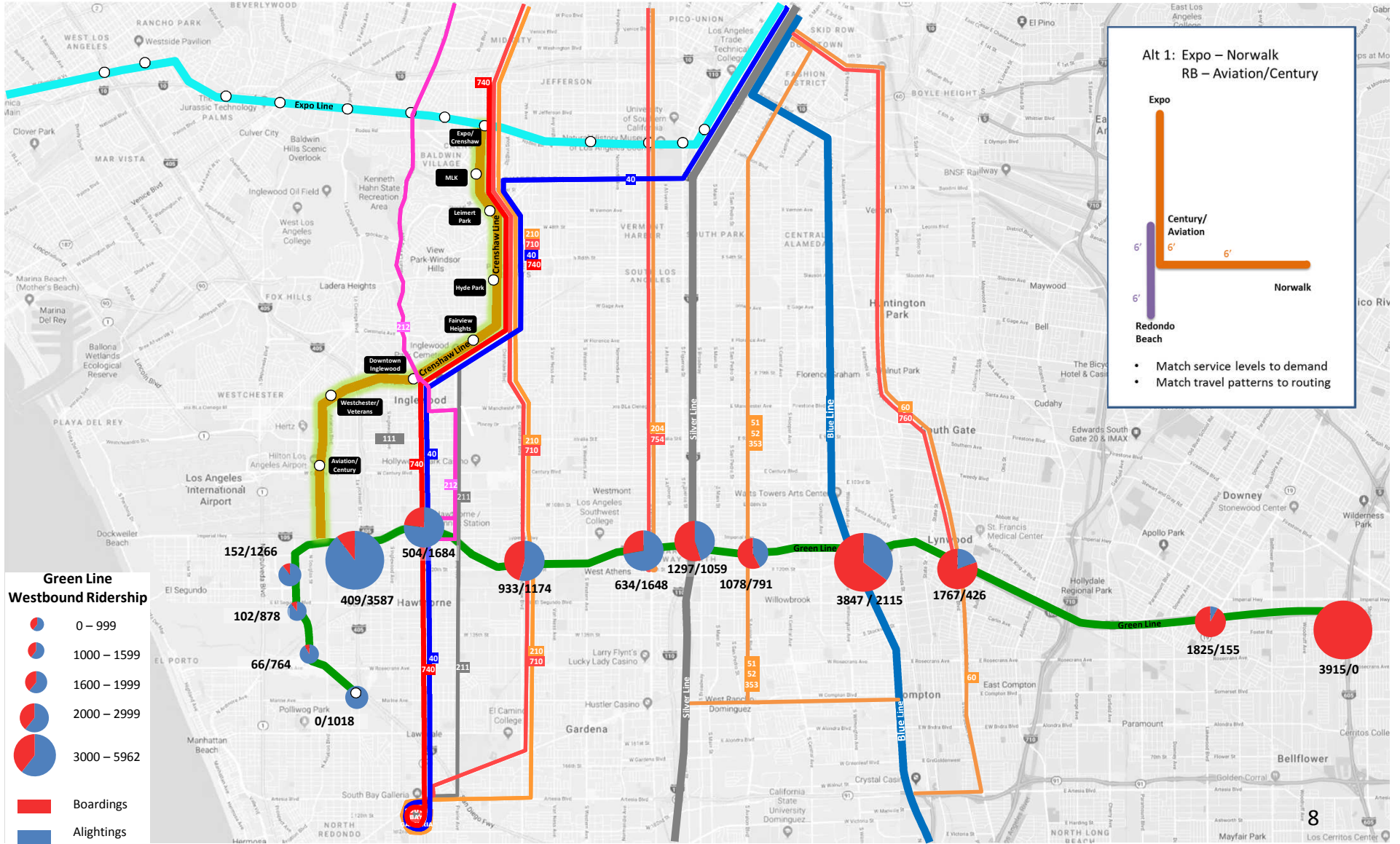


### Avg. Daily Boardings

- 1) 5,764 Redondo Segment
- 2) 26,090 Norwalk Segment
- 3) 16,400 Est. Crenshaw + AMC

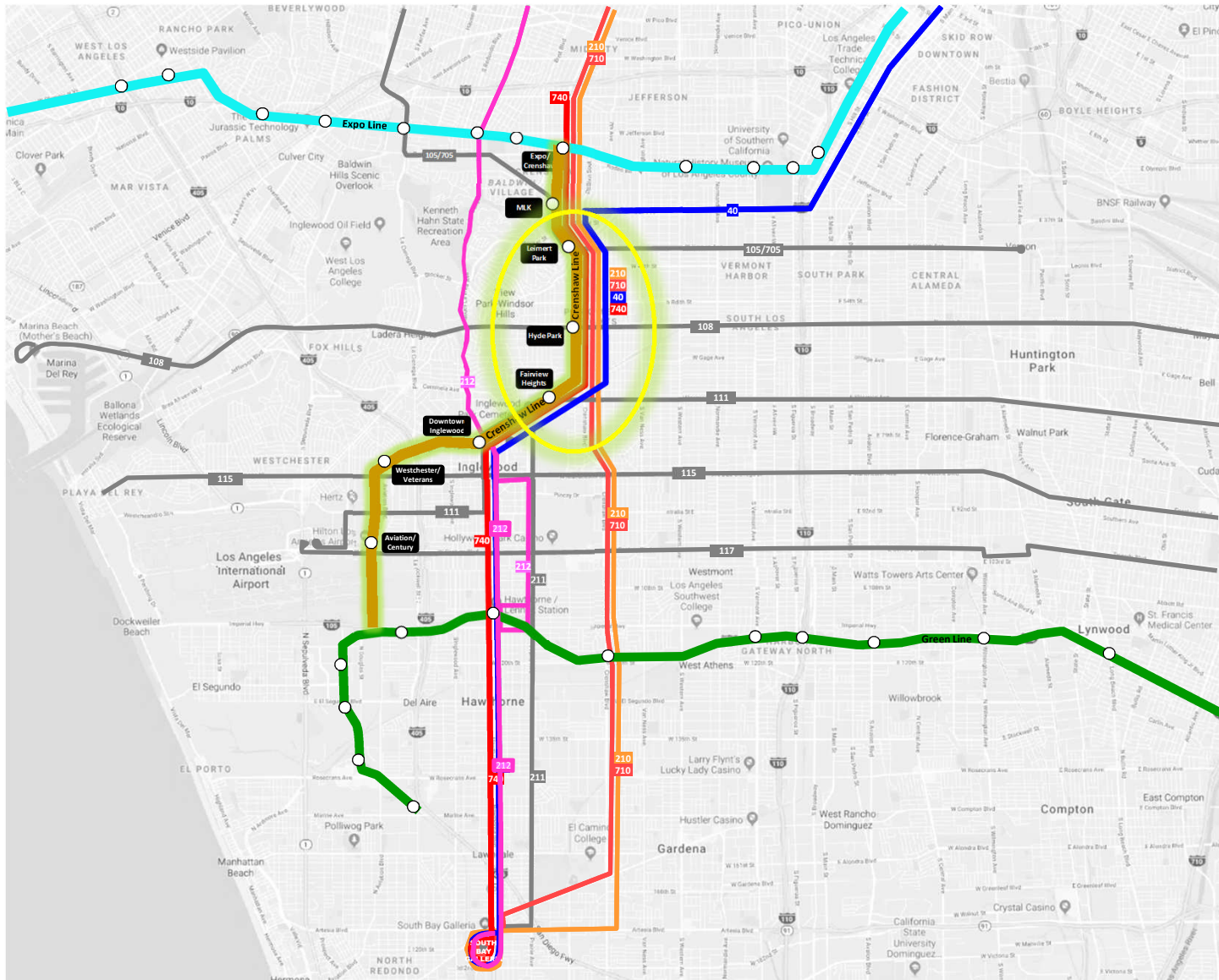


# CRENSHAW/GREEN LINE Optimal Service Plan





# CRENSHAW/GREEN LINE Bus/Rail Interface Plan





**QUESTIONS?**

**Expo/Crenshaw Station**