

# Coordinated Planning on the Surfliner Corridor

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# Caltrans' Role in Intercity Operations

## State of California Support FY 14/15 Statistics



- Three of the nation's busiest routes
- **Operating Budget: \$119.5M**
- **Ridership: 5.4 million**
- **Fleet: State-owned 102 cars, 17 locos**

# Caltrans' Role in Intercity Operations

## San Joaquin Corridor



- 5th busiest route in the nation
- **Route:** Bakersfield-Sacramento-Oakland
- **Length:** 364 miles
- **Operating Support:** \$42.6M
- **Ridership:** 1.2 million
- **Trips:** 6 roundtrips daily
  - Modeled and designed projects underway for 2 additional roundtrips

# Caltrans' Role in Intercity Operations

## Capitol Corridor



- 3rd busiest route in the nation
- **Route:** San Jose to Auburn
- **Length:** 169 miles
- **Operating Support:** \$32.6M
- **Ridership:** 1.5 million
- **Trips:**
  - 7 roundtrips San Jose to Oakland
  - 11 daily trips Oakland to Sacramento/Auburn

# Caltrans' Role in Intercity Operations

## Pacific Surfliner



- 2nd busiest route in the nation
- **Route:** San Diego to San Luis Obispo
- **Length:** 354 miles
- **Operating Support:** \$44.3M
- **Ridership:** 2.8 million
- **Trips:**
  - 11 roundtrips San Diego to LA
  - 5 LA to Santa Barbara
- **Fleet:**
  - 50 passenger cars (10 State-owned)
  - 14 locomotives

# Pacific Surfliner South - LA to San Diego

Focus Area of Coordinated Planning

## System Constraints



- Freight (LA-San Bernardino)
  - Major trade corridor route
    - Ports of LA and Long Beach project 7% annual growth
    - These ports combined would equal the world's 5th largest seaport
- Intercity/Commuter Service
  - Amtrak (LA-San Diego)
  - Metrolink (LA-Oceanside and LA-San Bernardino)
- Fullerton Junction

# Pacific Surfliner South - LA to San Diego

Focus Area of Coordinated Planning

## Current and Future Capacity



- **Route:** Los Angeles to San Diego
- **Length:** 129 miles
- **Traffic:** Average 100+ daily Freight/Passenger trains
- **Triple Track:** Nearing completion of 15-mile third main track on BNSF
  - Designed for combined 150 Freight/Passenger
  - Current Passenger Trains - 29
  - Future Passenger Trains - 49

# Pacific Surfliner South - LA to San Diego

Focus Area of Coordinated Planning

## Current Operations



- **Five Infrastructure Owners:**
  - LACMTA
  - BNSF
  - OCTA
  - NCTD
  - MTDB
- **Four Operators:**
  - Amtrak/Metrolink/NCTD/BNSF
- **Four Dispatch Handoffs:**
  - Metrolink to BNSF to Metrolink to NCTD



# Status Quo

- Passenger on passenger delays on the corridor
- Discrepancy between contractual run-times and scheduled run-times
- Stop and go operations is consuming valuable capacity when traffic is not flowing

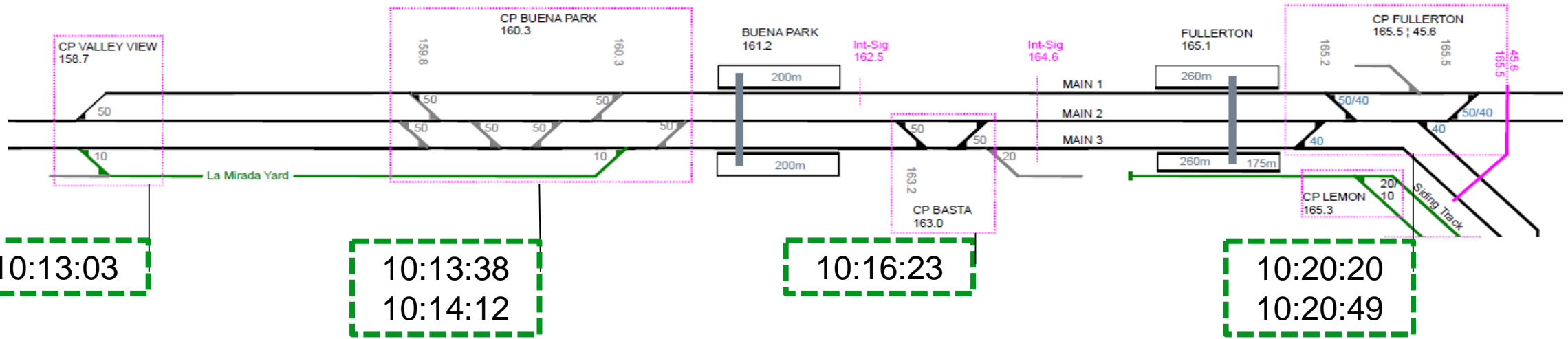


# Objectives of the Study

- Analyze the current operation
- Develop a passenger timetable concept that reduces variability

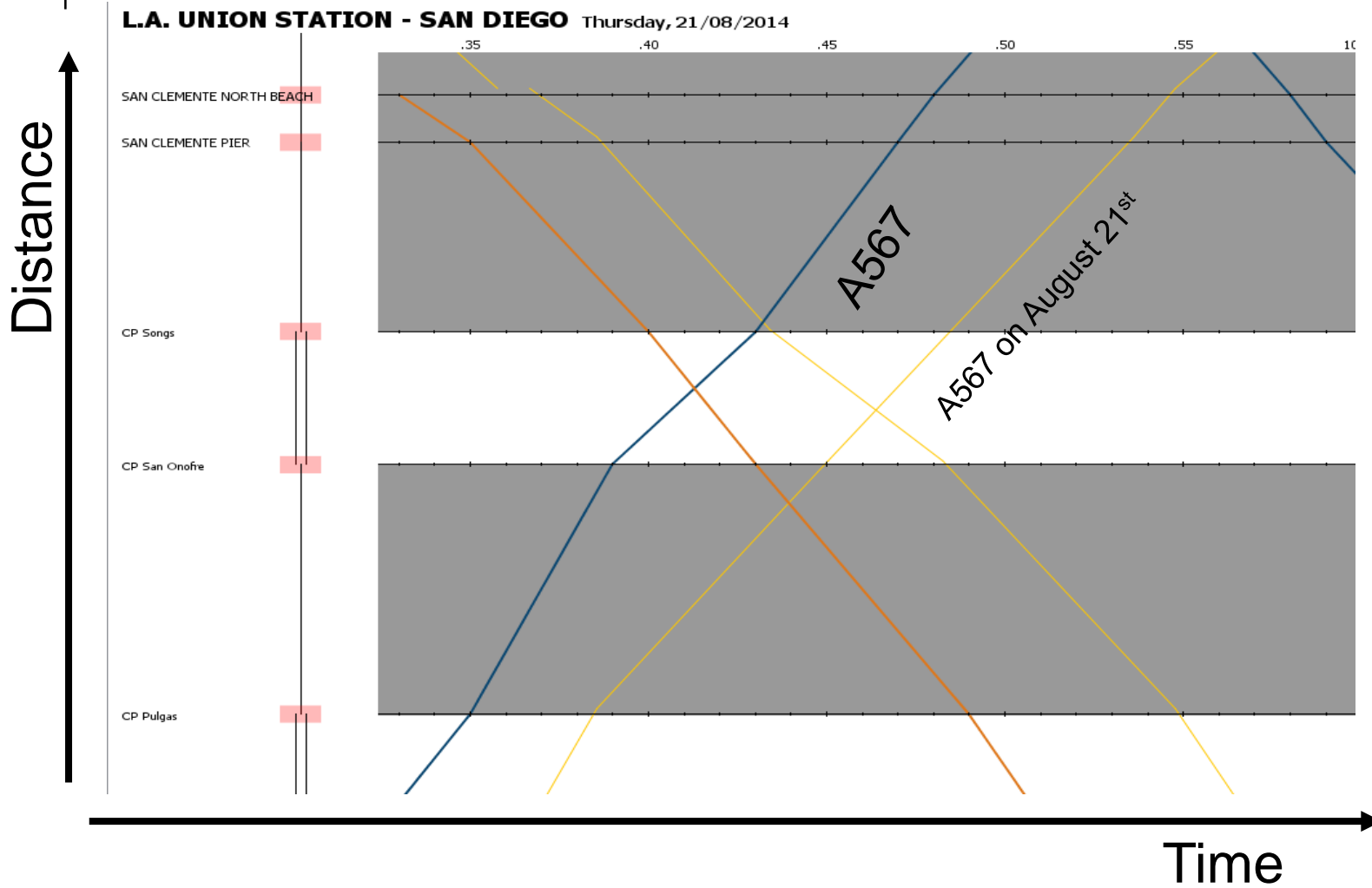
# Data Analysis

Train ID: A 768 1 29  
 Date: July 29, 2014  
 Source: BNSF OS Data

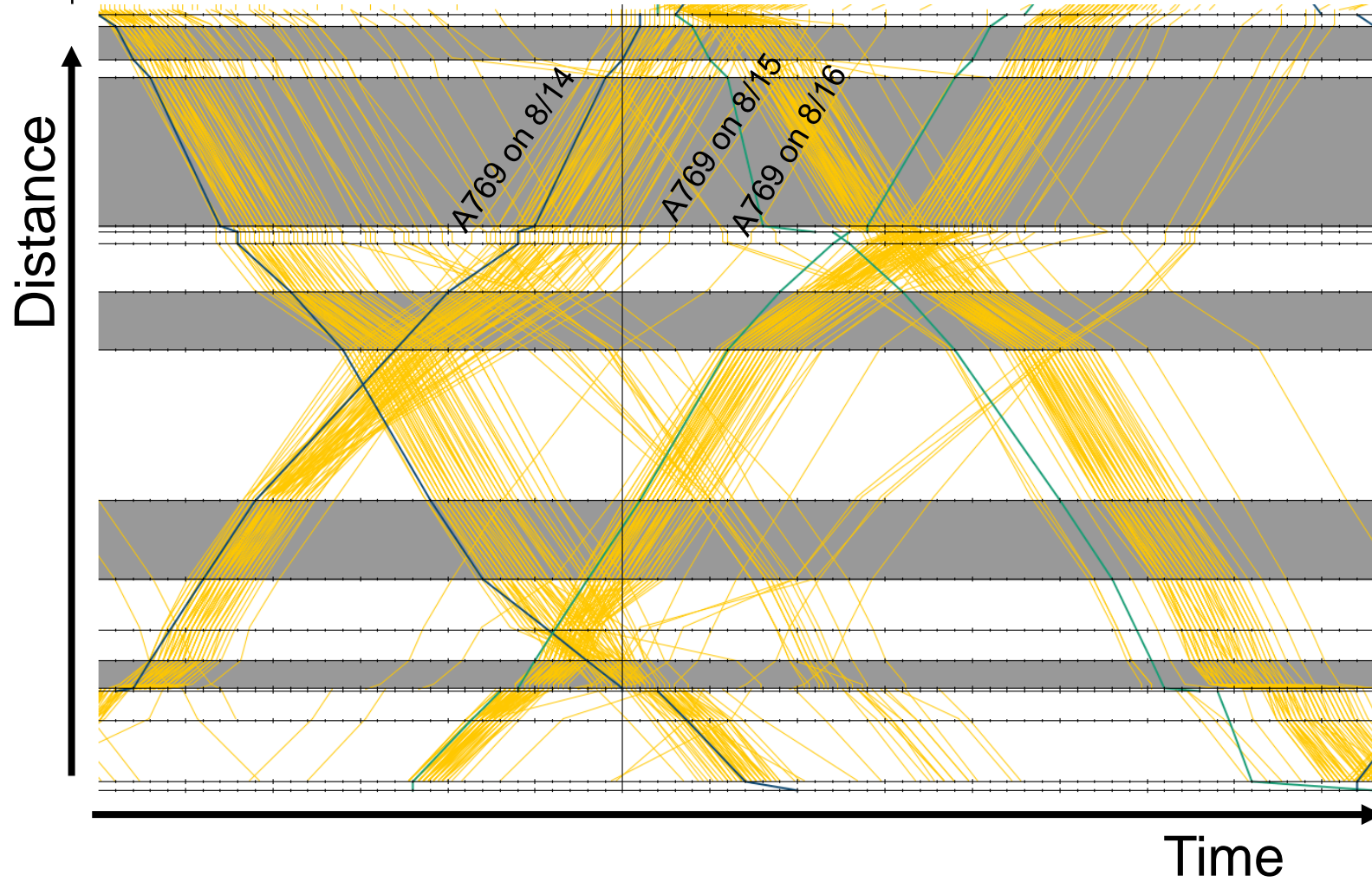


# Visualization

- String Chart:**
- Y-axis= distance
  - X-axis = time
  - Gray area = single track
  - Blue line = planned A567
  - Yellow line = actual run

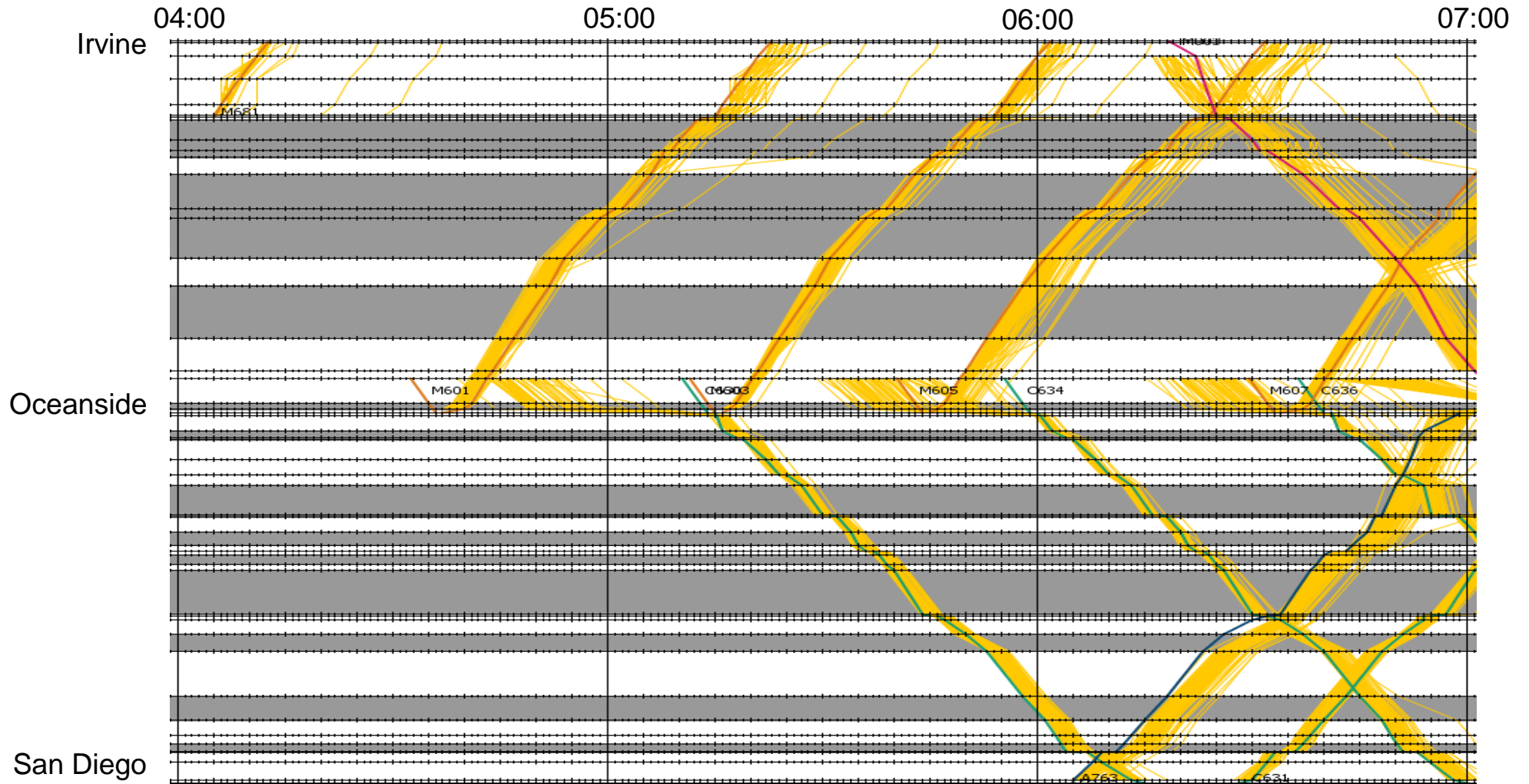


# Visualization



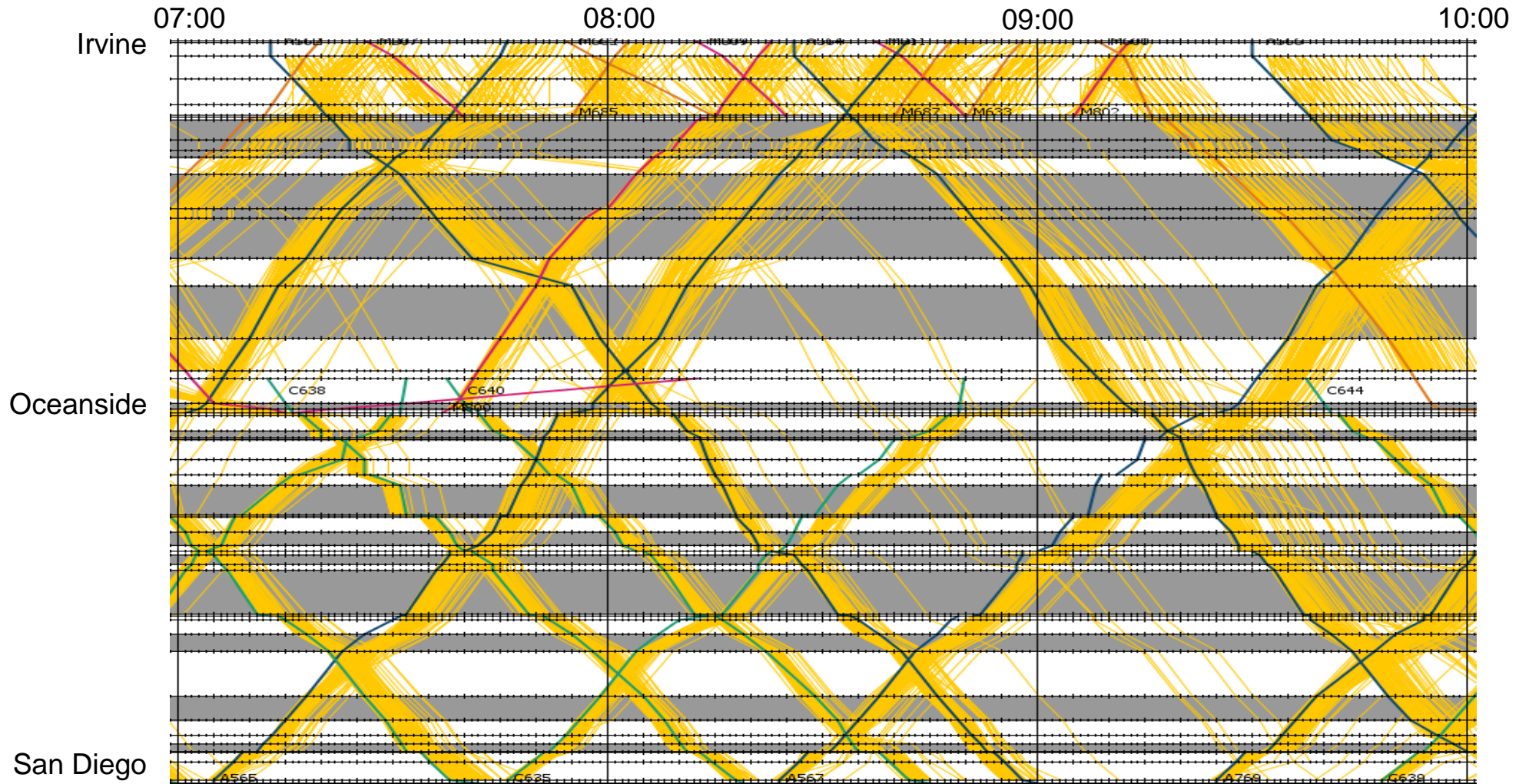
# Analysis Results

Irvine – San Diego | 4:00 AM – 7:00 AM



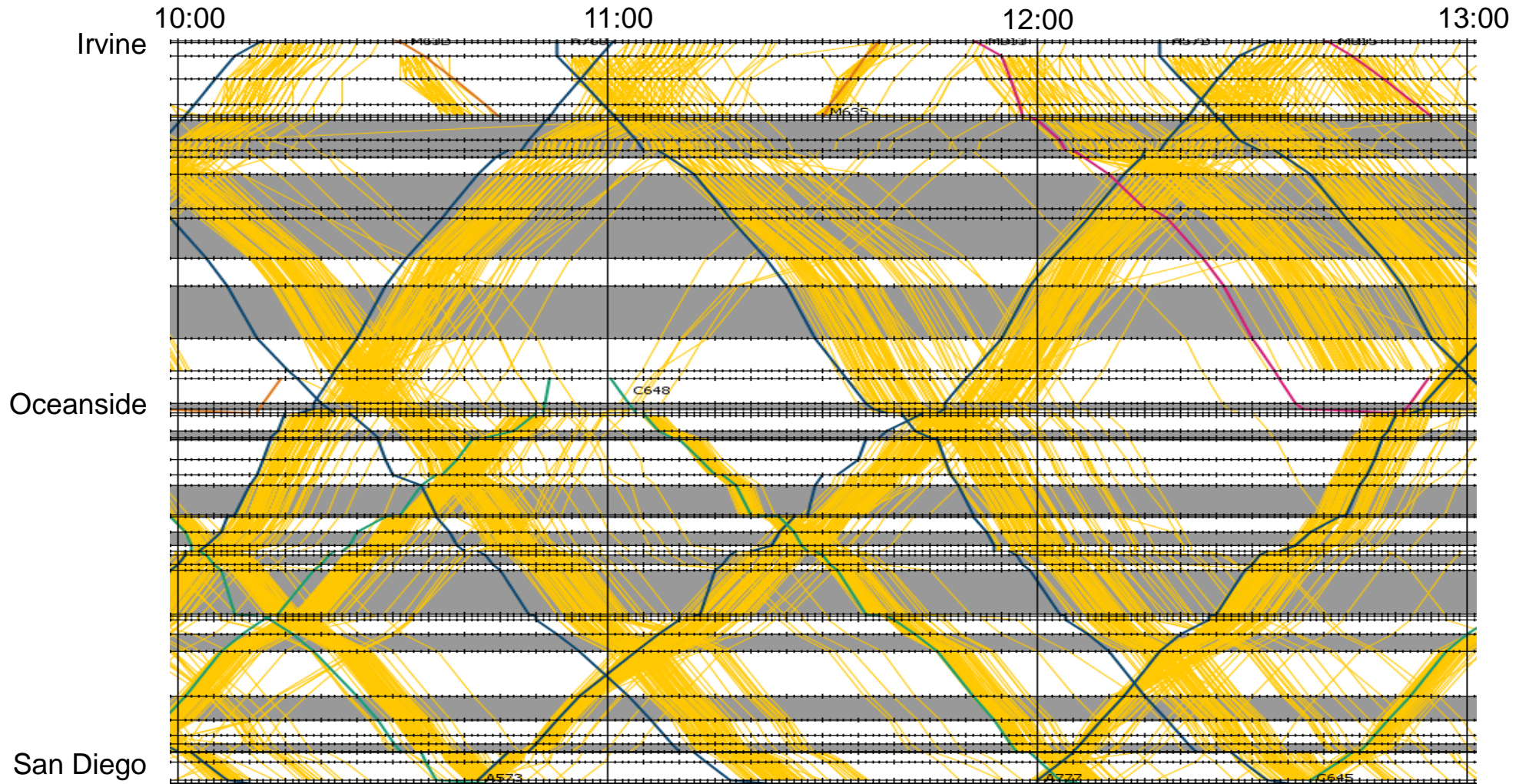
# Analysis Results

Irvine – San Diego | 7:00 AM – 10:00 AM



# Analysis Results

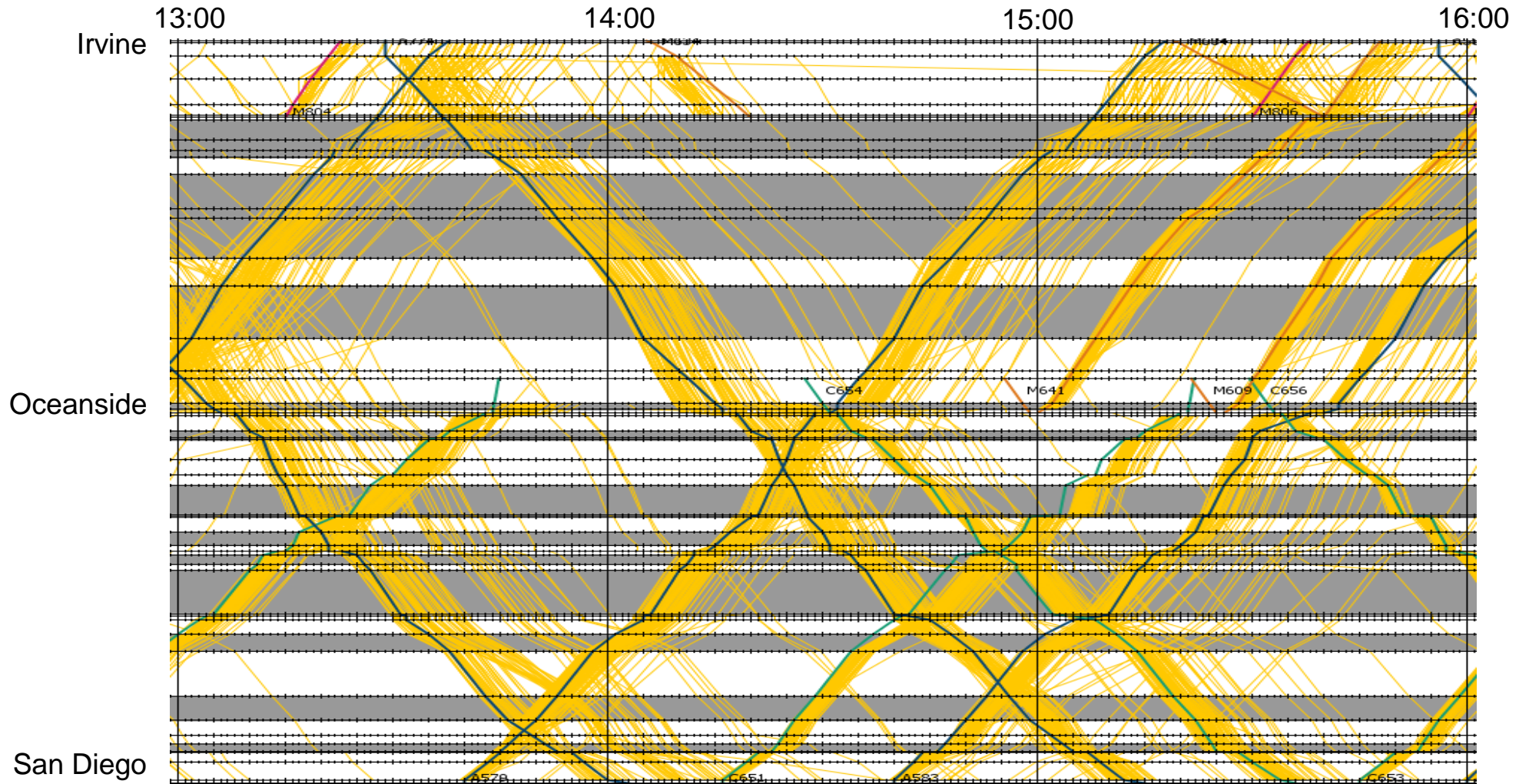
Irvine – San Diego | 10:00 AM – 1:00 PM





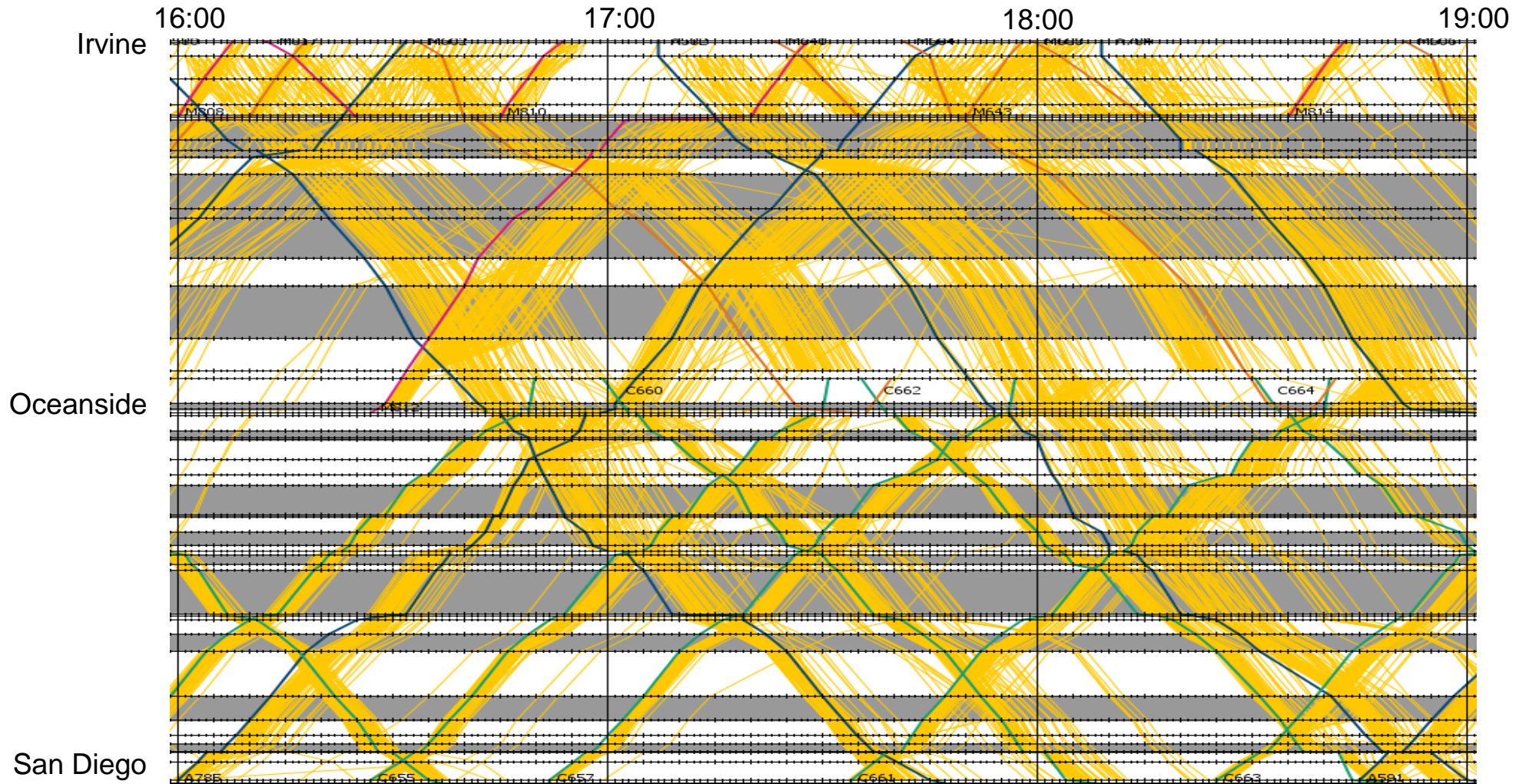
# Analysis Results

Irvine – San Diego | 1:00 PM – 4:00 PM



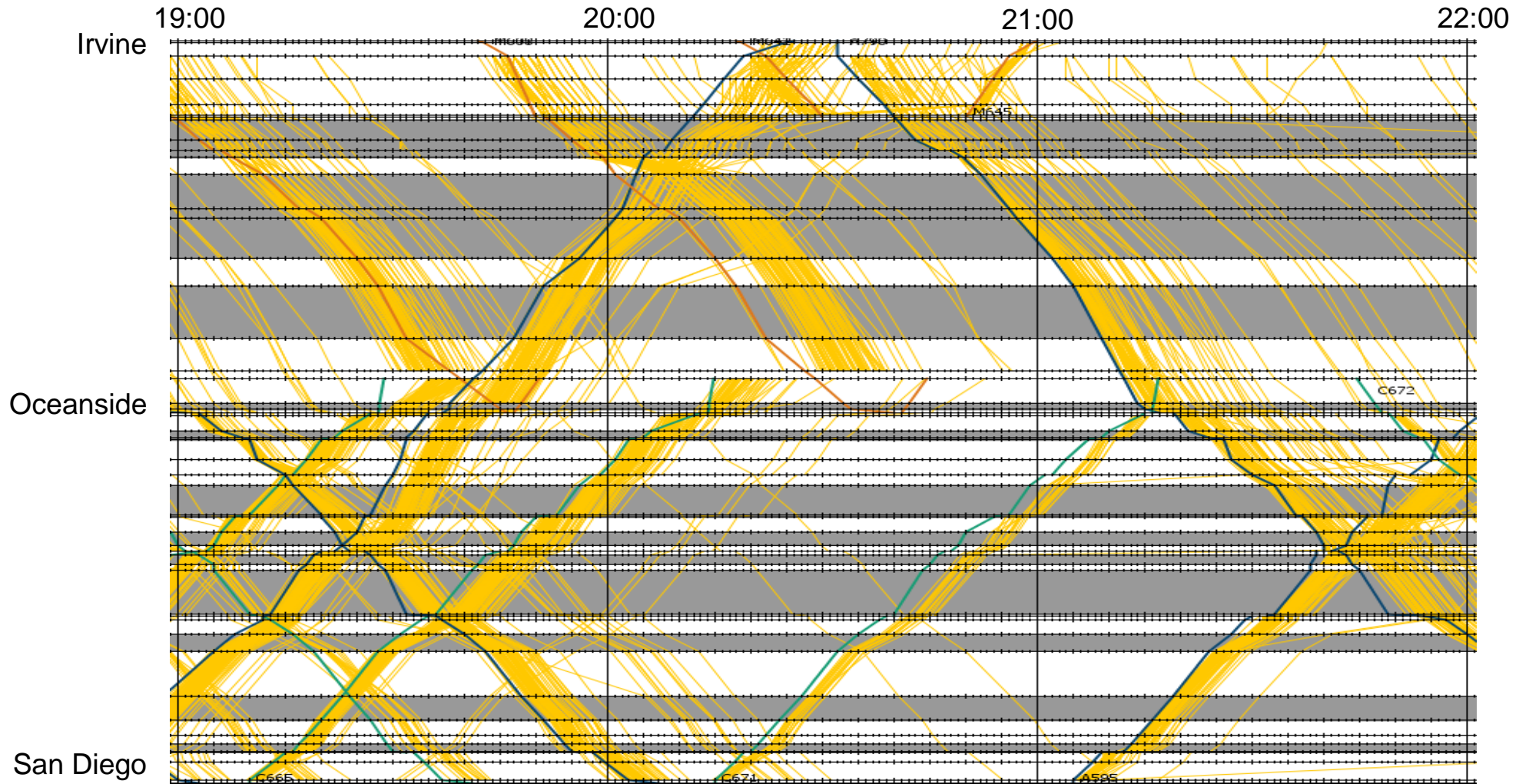
# Analysis Results

Irvine – San Diego | 4:00 PM – 7:00 PM



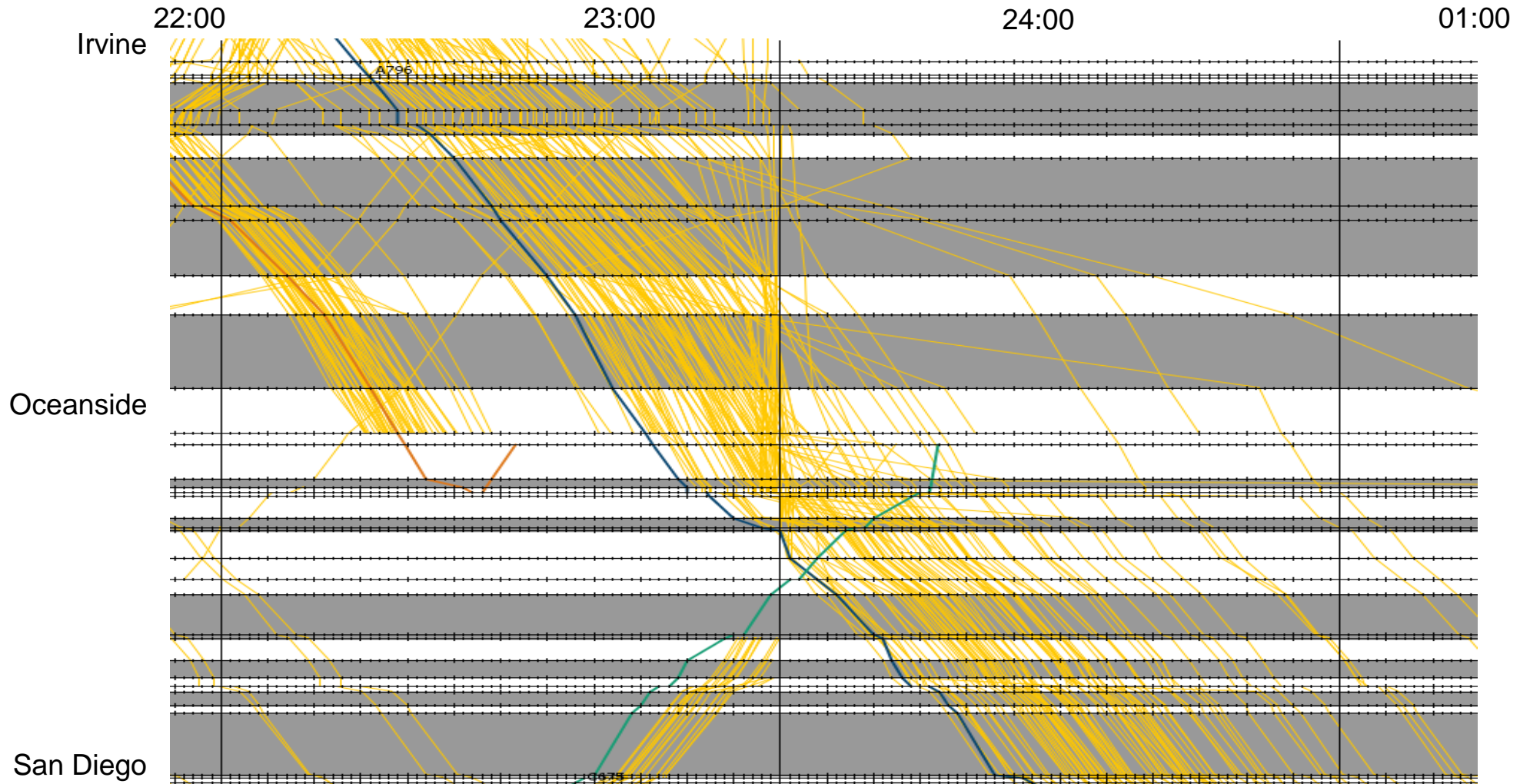
# Analysis Results

Irvine – San Diego | 7:00 PM – 10:00 PM

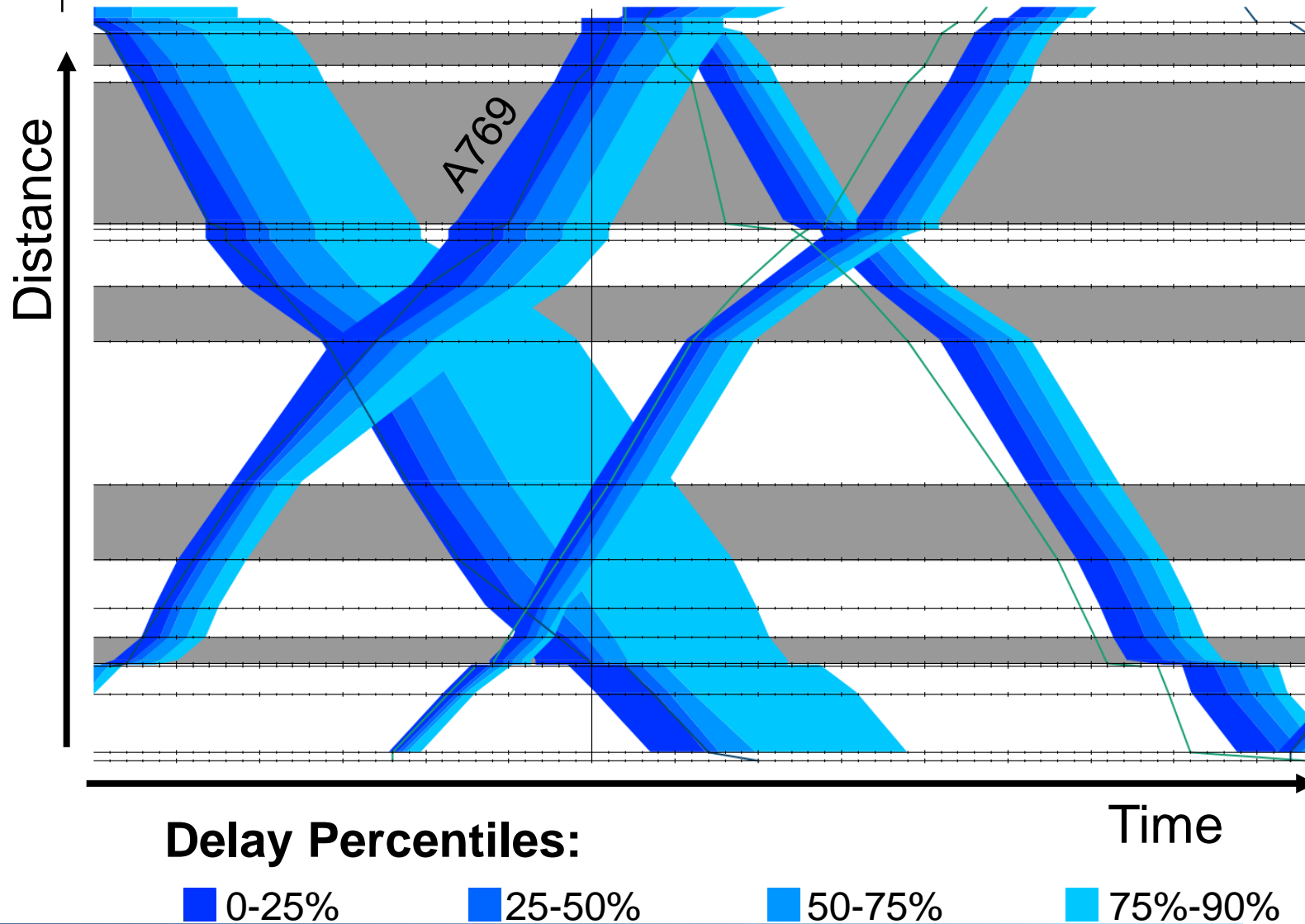


# Analysis Results

Irvine – San Diego | 10:00 PM – 1:00 AM

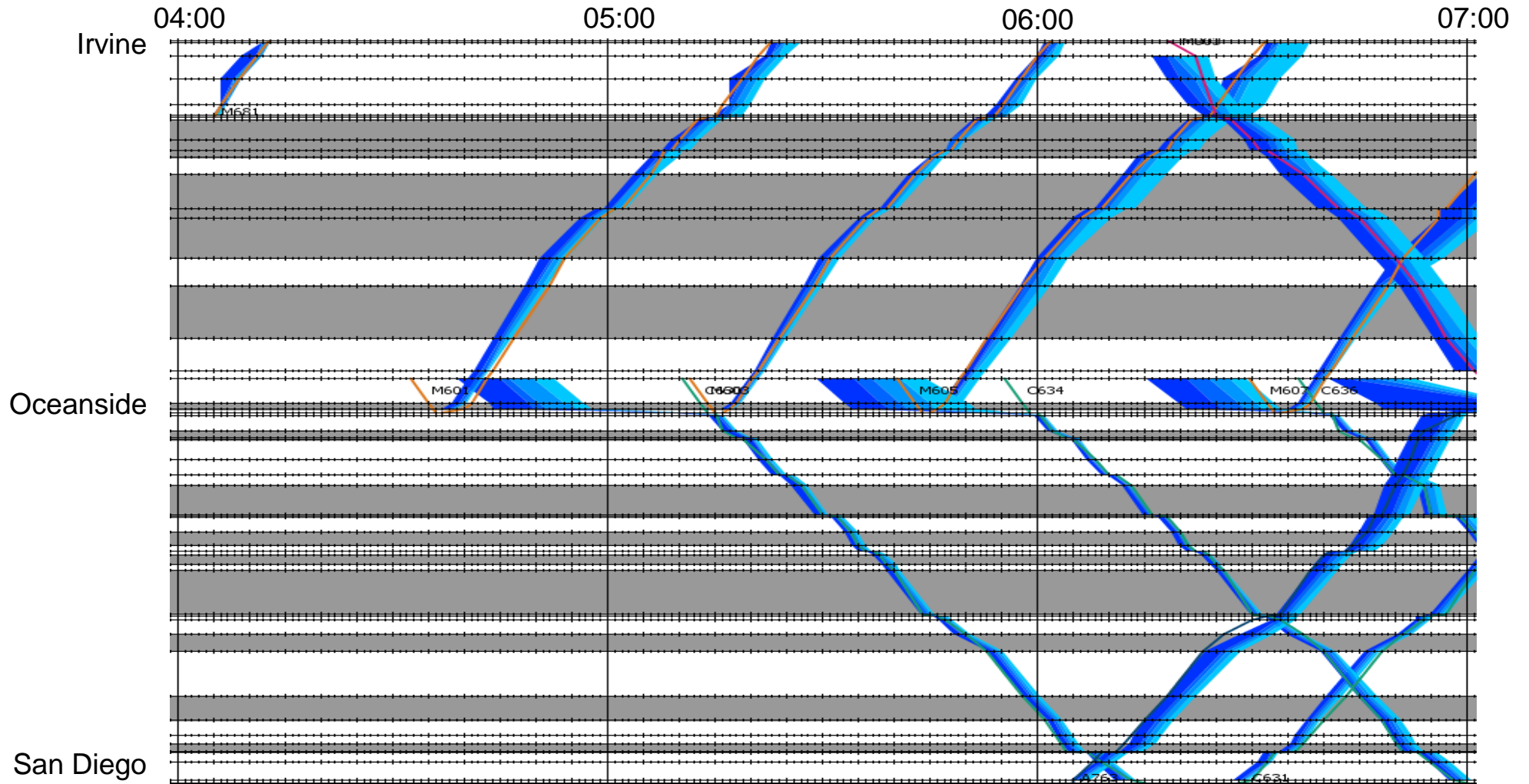


# Visualization



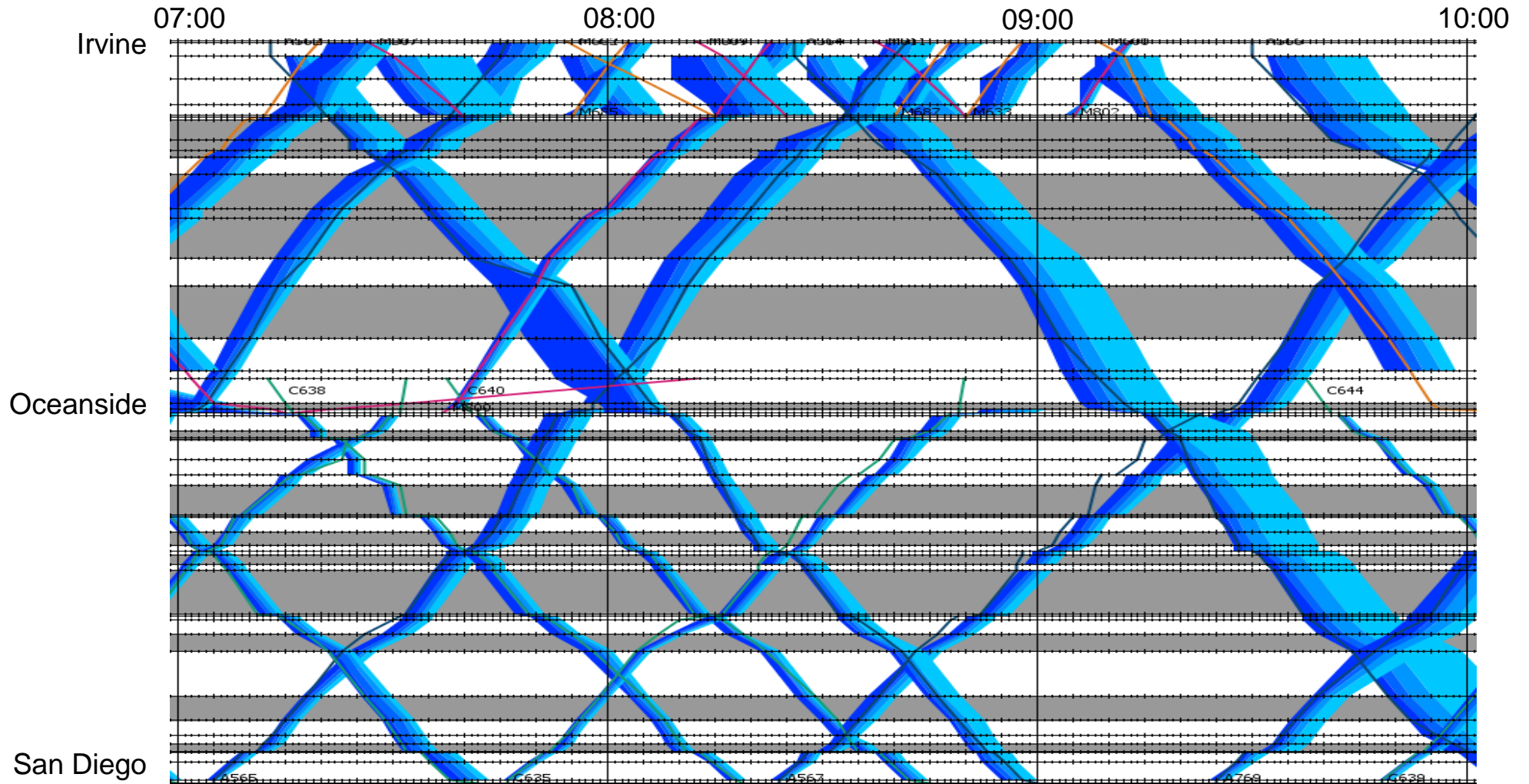
# Analysis Results

Irvine – San Diego | 4:00 AM – 7:00 AM



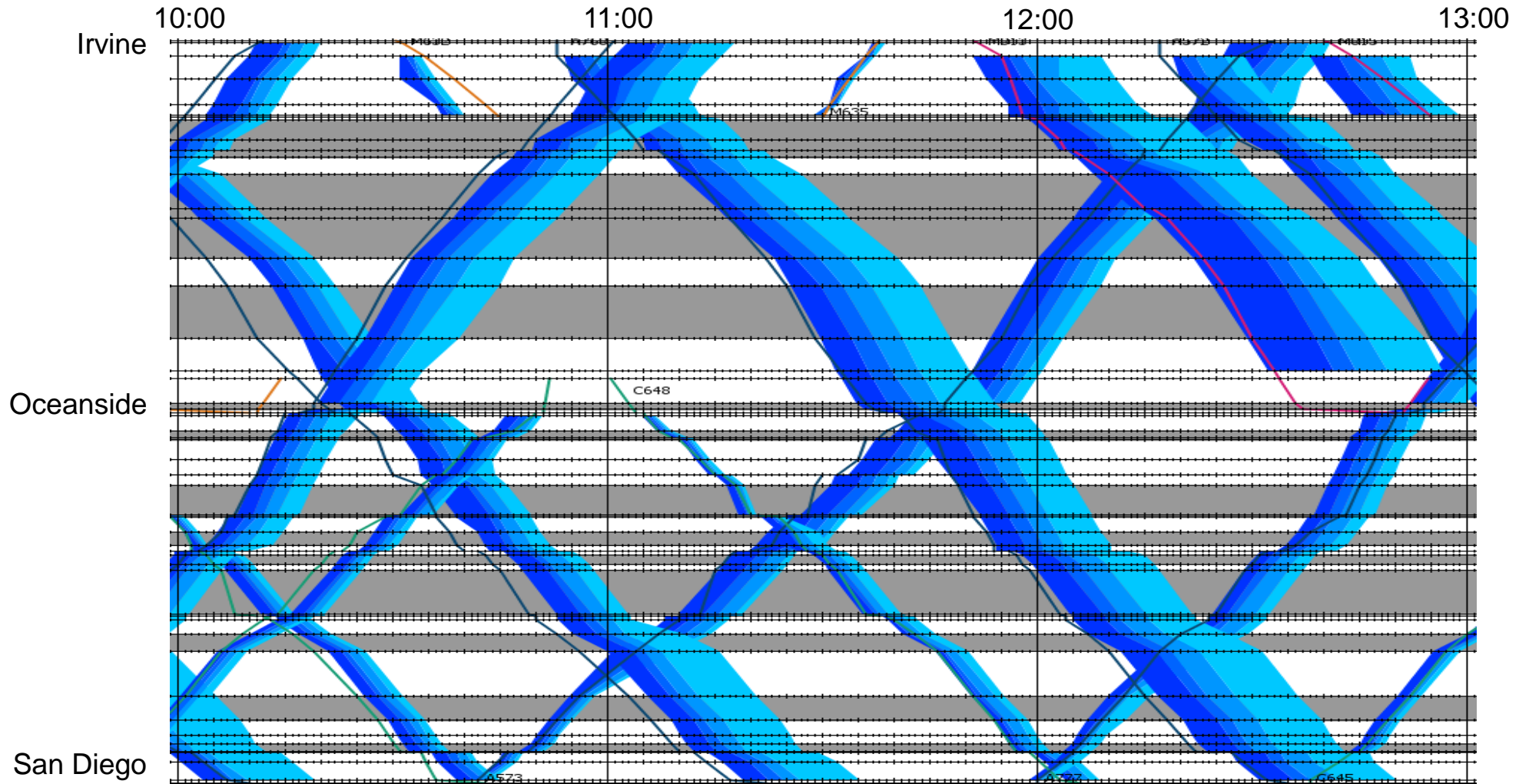
# Analysis Results

Irvine – San Diego | 7:00 AM – 10:00 AM



# Analysis Results

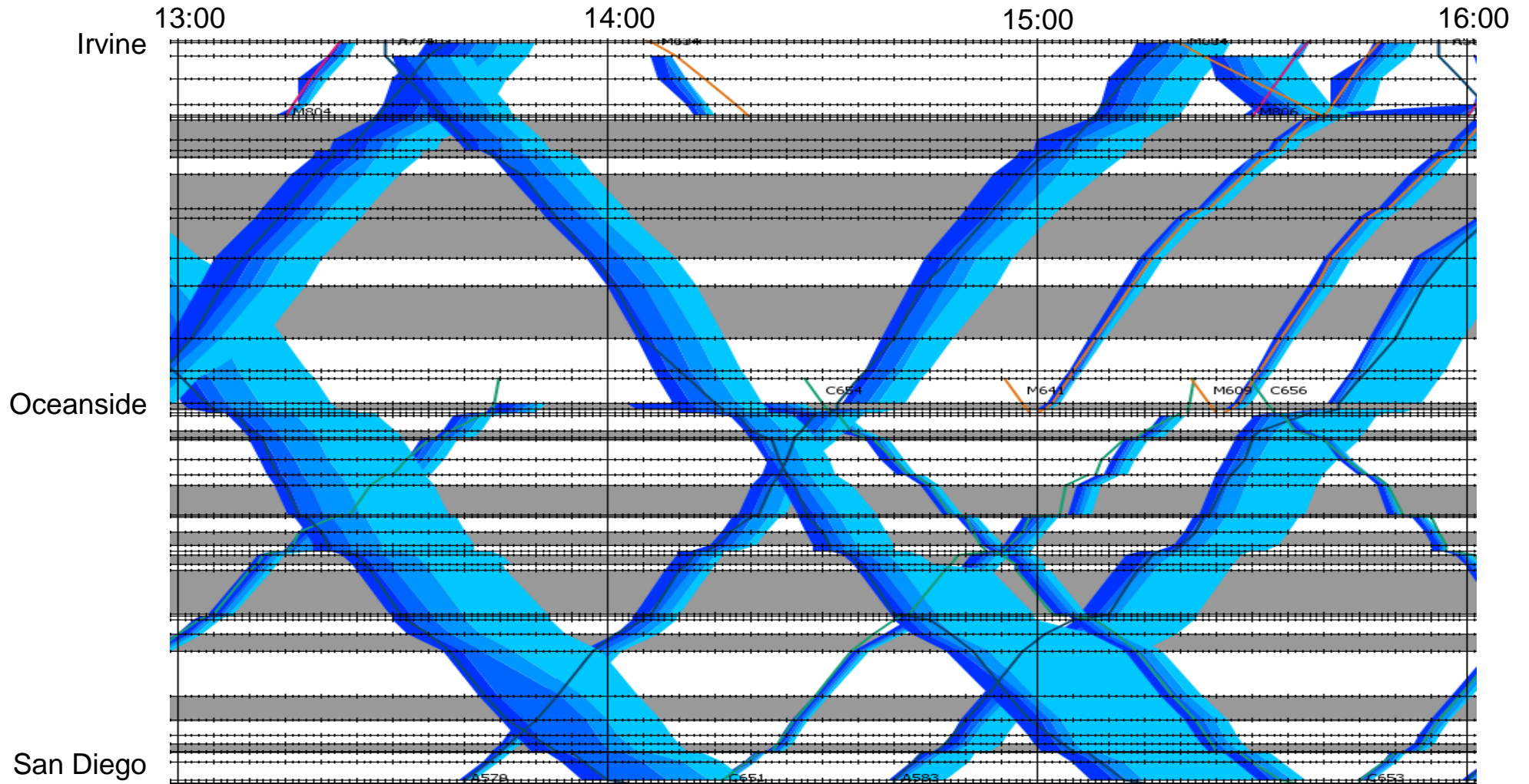
Irvine – San Diego | 10:00 AM – 1:00 PM





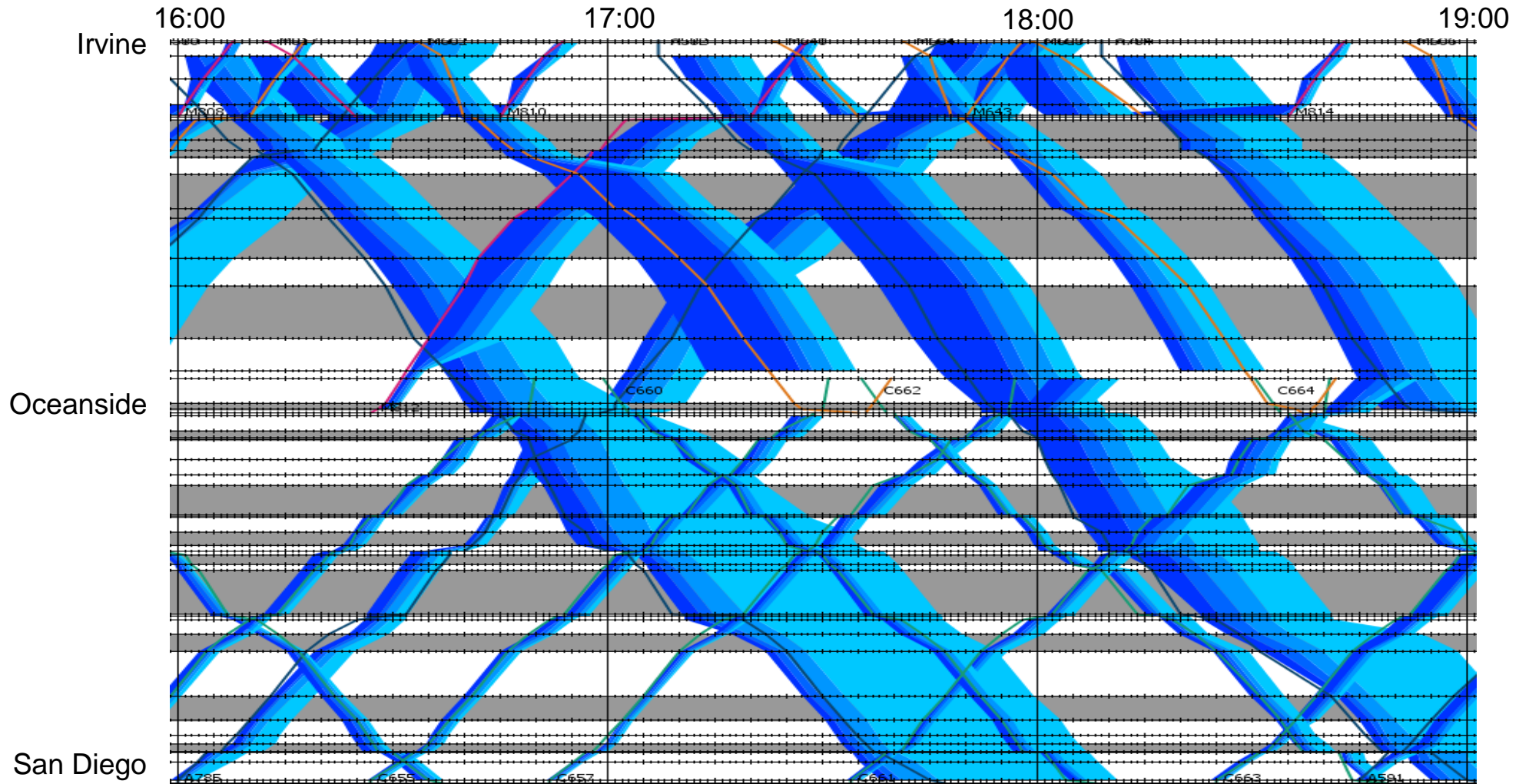
# Analysis Results

Irvine – San Diego | 1:00 PM – 4:00 PM



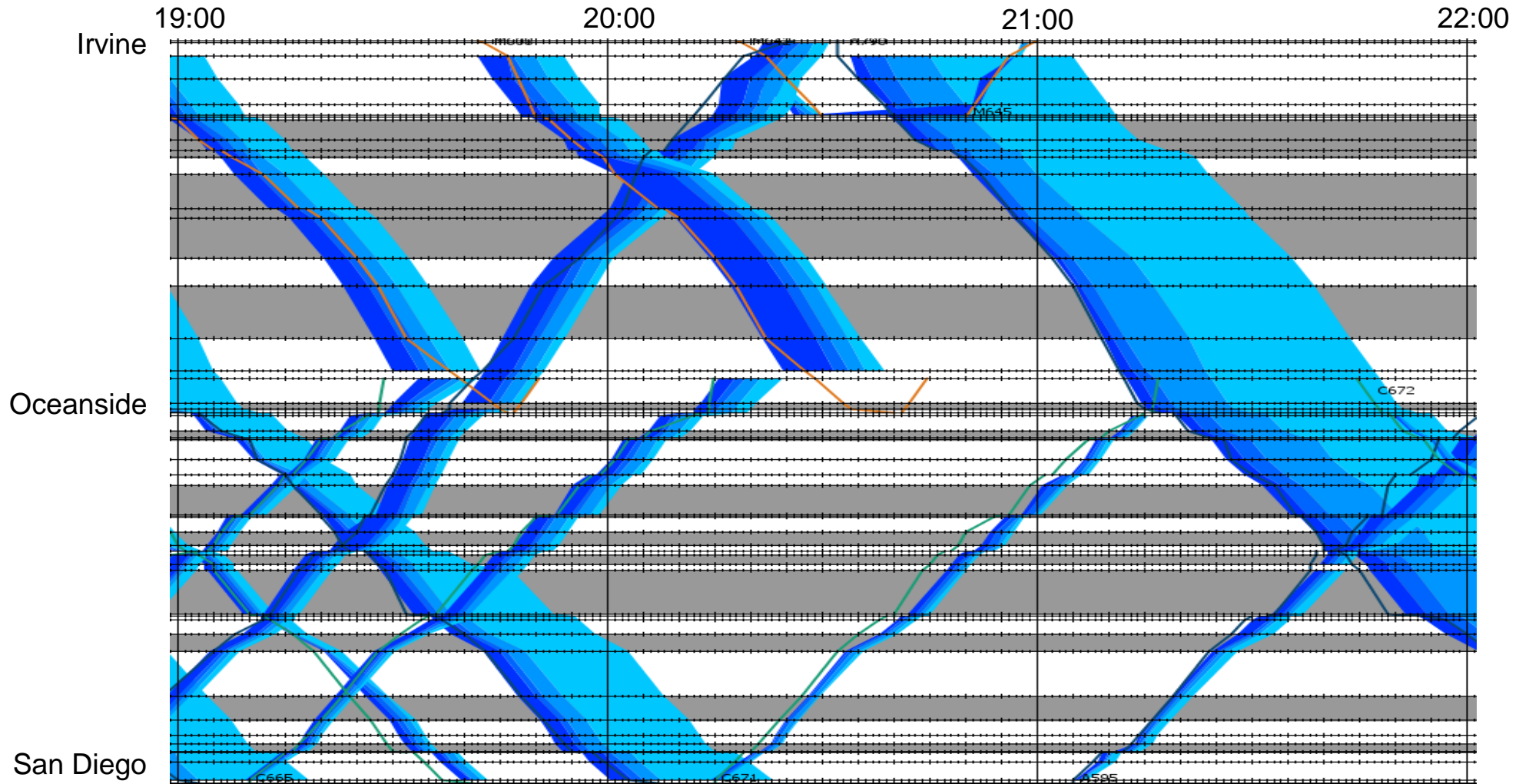
# Analysis Results

Irvine – San Diego | 4:00 PM – 7:00 PM

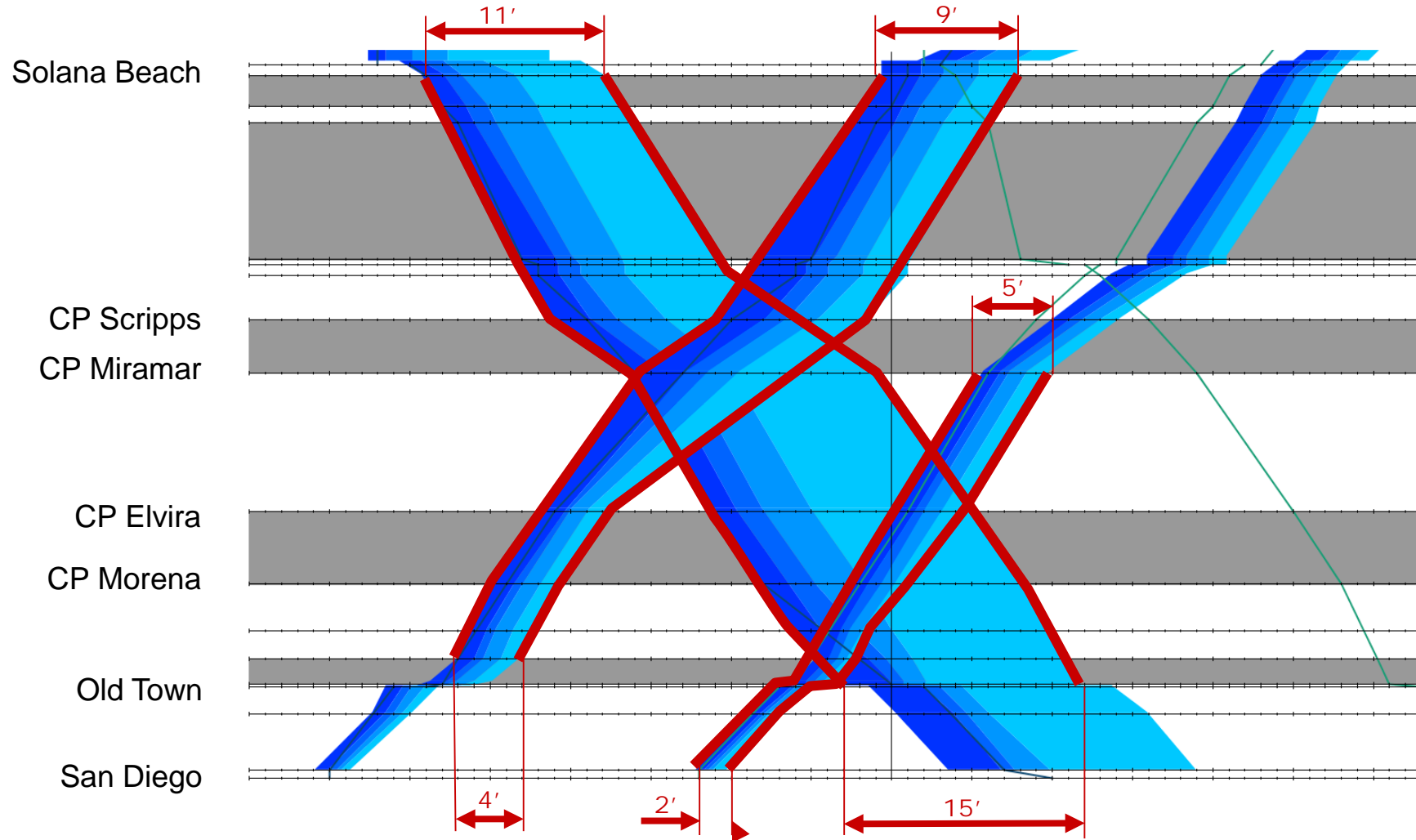


# Analysis Results

Irvine – San Diego | 7:00 PM – 10:00 PM



# Impact of Secondary Delays

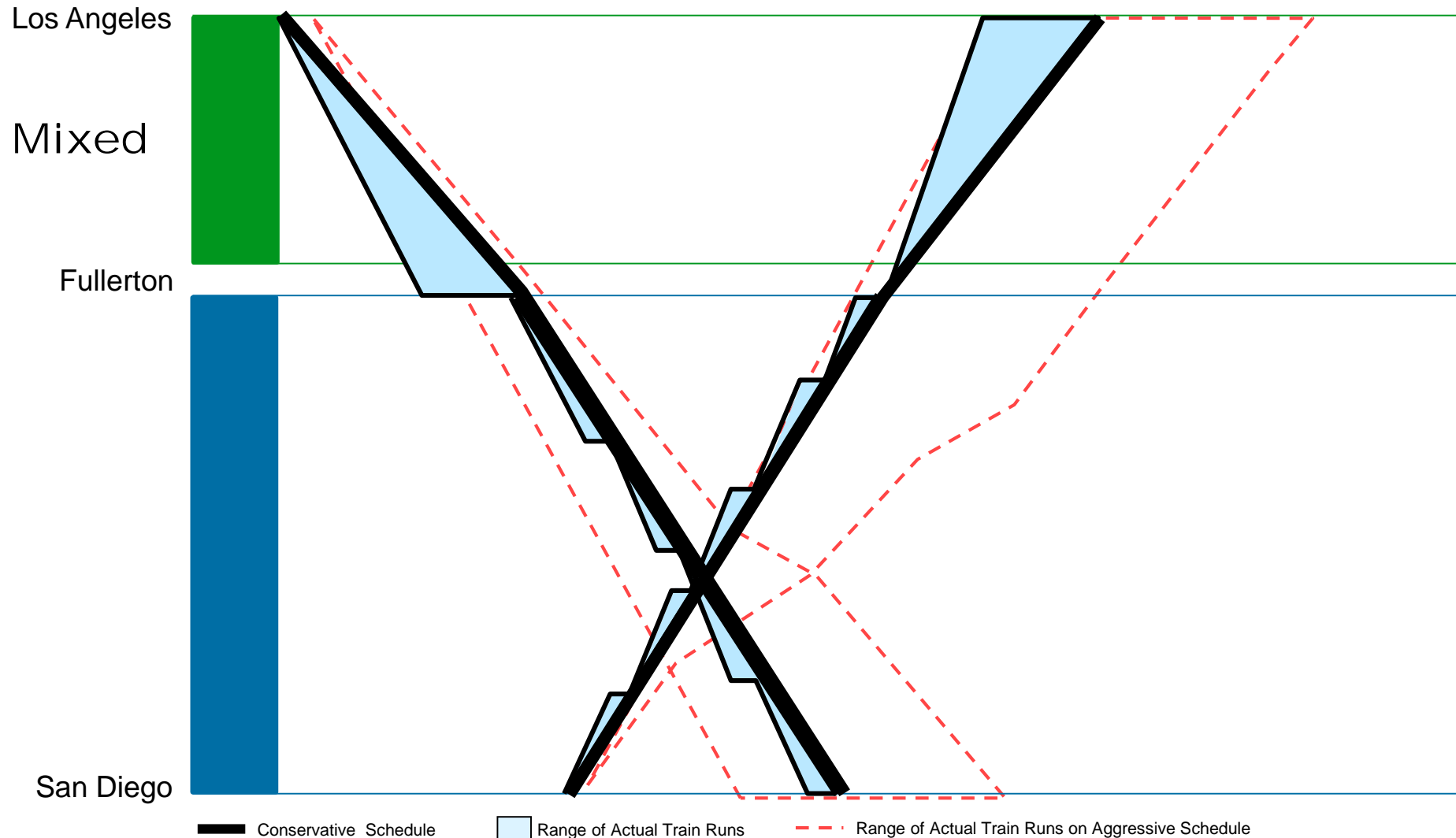


# Conclusions from the Research

## **Variability – a deviation from the plan:**

- Irregular deviations caused by external factors
- Regular deviations caused by an inaccurate plan
- Self-inflicted deviation caused by delay propagation

# Short-Term Robustness Improvement



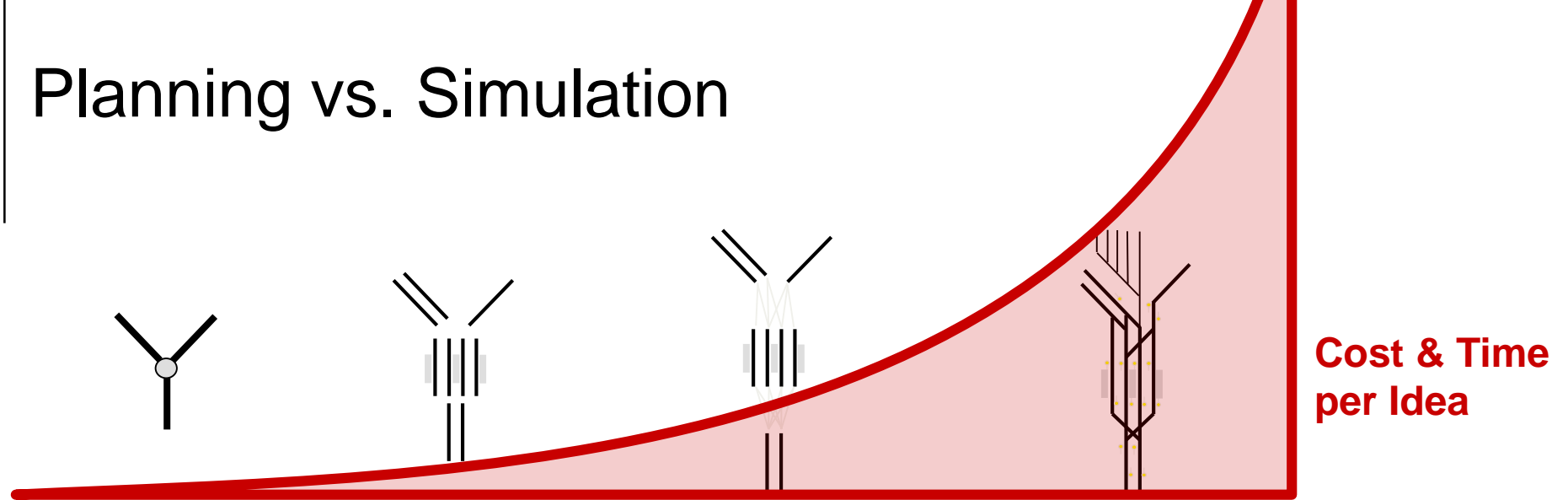
# Planning Goal

## **Gain reliability through schedule optimization:**

- Account for (and reduce) external factors
- Internalize known and regular deviations
- Make plan robust

# Planning vs. Simulation

Level of Detail



## Planning

- Analyze and understand
- Develop strategies
- Work efficiently and simplify
- Technical parameters are starting values, not fixed values

Goal: Show how to improve.

## Simulation

- Replicate today's technology
- Based on fixed parameters
- Induce real-world variability (primary delay)
- Validate planning concepts

Goal: Validation and fine-tuning.



# Planning Parameters

- Run Time
- Dwell Times
- Signal System Performance
- Rolling Stock

# Planning Objectives

## **Provide a plan that works 9 out of 10 times**

- Use realistic planning parameters
- Build in slack, but plan precisely (by track & time)

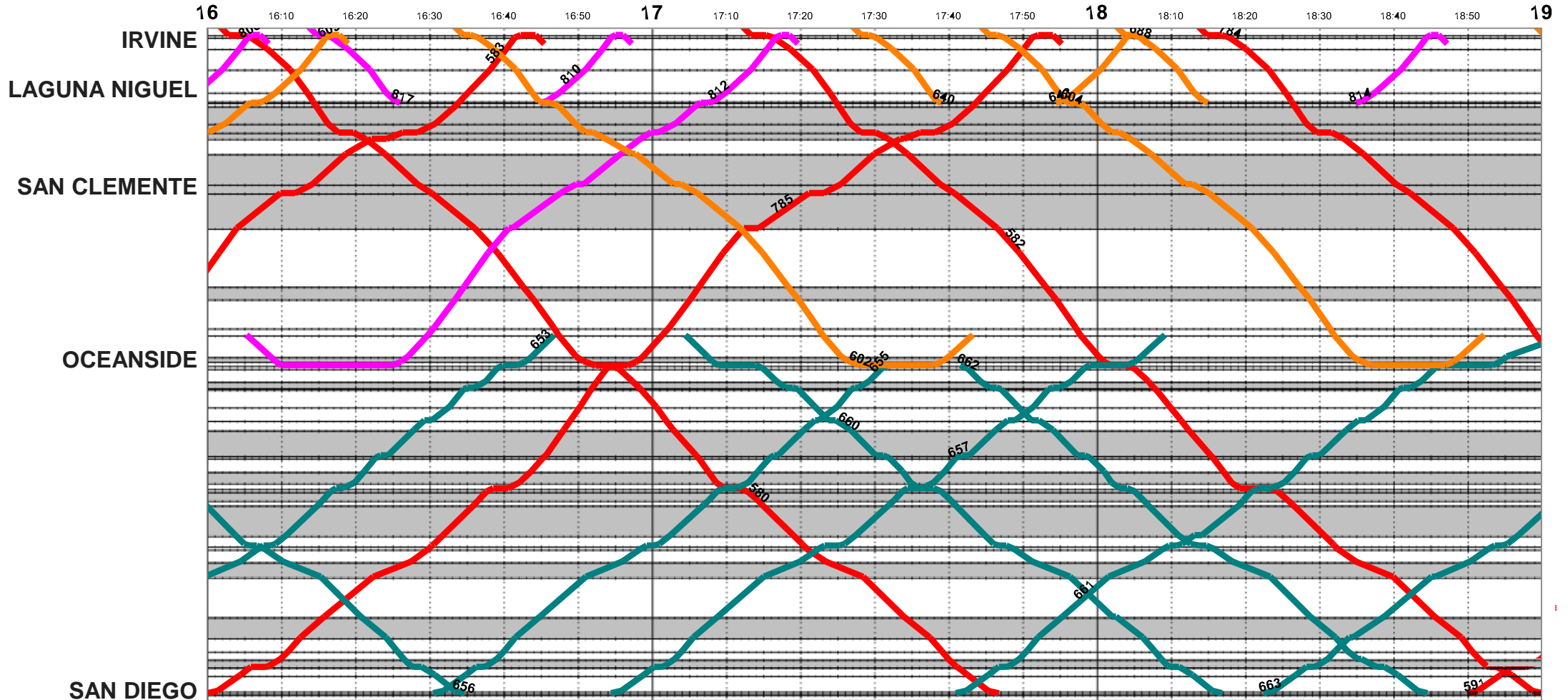
## **Prioritize a stable operation south of Laguna Niguel**

- Design resilient pattern that minimizes risk of delay-propagation
- Make diverging moves and “running-on-color” part of the plan
- Plan with sufficient dwell at station stops

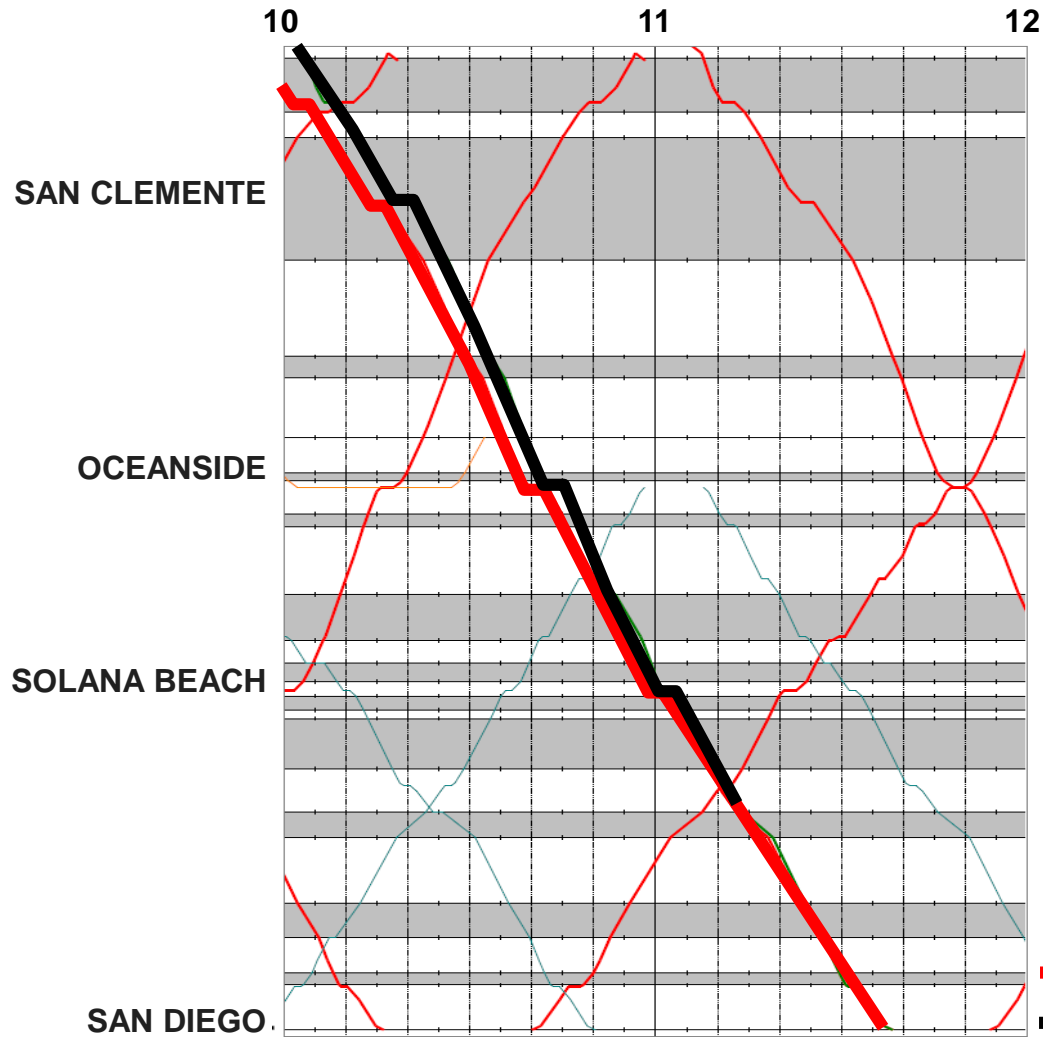
## **Minimize delay carried into single track**

- Reliable and realistic run-times from Los Angeles to Laguna Niguel

# Resulting Robust Schedule Concept



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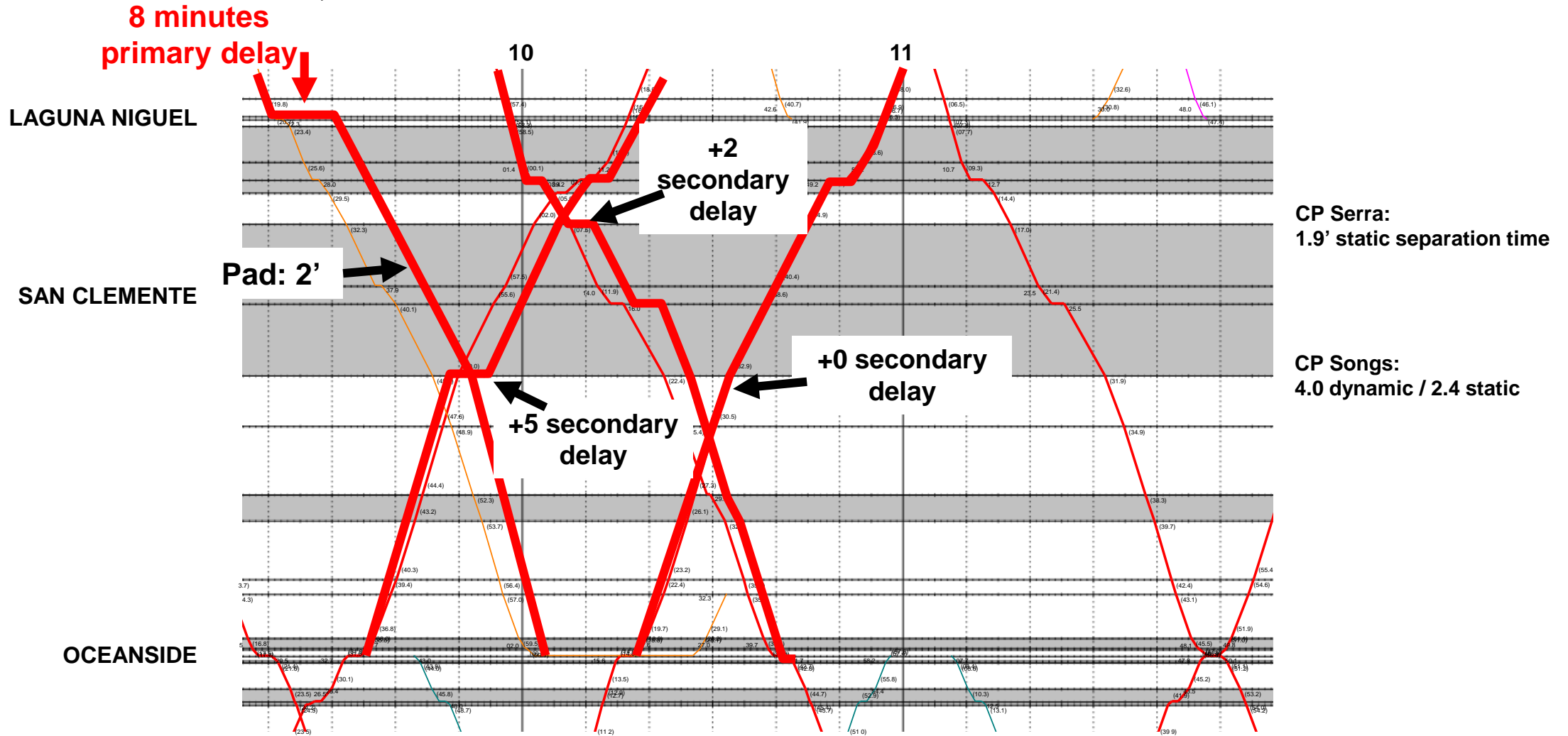


**Decay of 5-Minute Delay**

Location	Scheduled Time	Delayed Time	Delay (min)
Laguna Niguel	09:58.3	10:03.3	<b>5.0</b>
San Juan Capistrano	10:01.4	10:06.3	<b>4.9</b>
San Clemente Pier	10:14.0	10:18.4	<b>4.4</b>
Oceanside	10:39.7	10:42.7	<b>3.0</b>
Solana Beach	10:59.4	11:01.2	<b>2.8</b>
Old Town	11:31.1	11:31.1	<b>0</b>
San Diego	11:38.3	11:38.3	<b>0</b>

**Delay decays because of built-in recovery**

# Resulting Robust Schedule Concept



# THANK YOU

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