Mini Project 1

Modifying an existing local bus line to Bus Rapid Transit (BRT)

The Geary transit corridor has one of the highest transit riderships in San Francisco. Current service on Geary Boulevard has high scheduled frequencies, but is plagued by poor reliability due to conflicts from operating in mixed traffic, high dwell times at bus stops, excessive signal delays and other difficulties.

In this project you will examine the current situation on Geary Blvd. during the evening rush, as well as the benefits that can be obtained through the introduction of BRT and a hierarchy of service.

Route Characteristics

The route consists of a 1.5 mile section in the CBD and 5 miles in the residential area. During a round trip, the bus currently stops at 84 relatively evenly spaced stops along the route including terminals at both ends (thus in each direction there are 41 stops plus the terminal) and the round trip of a bus is 120 min. 50% of this time is spent cruising, 25% loading and unloading (including loss time due to accelerating and decelerating), and 25% of the trip is caused by signal delay. You can assume a fixed loss time of 10 sec per stop due to acceleration and deceleration, and that buses do not skip stops. Users take 4 times as long to board as to alight and we will assume that at each stop boarding and alighting movements occur in sequence. Users access bus stops by walking at a speed of 2mph. Muni has budgeted 40 buses for the route, giving a headway of 3 minutes.

Standards for LOS

You will be analyzing 3 types of users for this project:

1. Residential to Residential (R→R)
2. CBD to Residential (C→R)
3. Residential to CBD (R→C)

Data

The boarding and alighting demand density (PM rush) per hour per mile for service in both directions is shown in Figure 1.

Using these data, you are to perform the following tasks. Some assumptions are deliberately left for you to make, and you are expected to explain your assumptions.

i. What is the commercial and cruising speed of a bus? What is the boarding time and alighting time per passenger served? What is the optimal stop spacing in the residential area for R→R passengers? What is the optimal stop spacing in the CBD and in the residential area for C→R passengers? Reconcile the two conflicting optimal values, and find the optimal stop spacing for each zone for all users. Discuss why the actual spacing on the route may differ from the optimal ones calculated.

ii. By implementing several features of BRT, service can be improved. Converting a lane to bus service (only) will allow buses to cruise 50% faster. Transit Signal Priority (TSP) will cut the time spent at signals by 50%. What is the new cycle time? With these new data what is the optimal stop spacing for each zone? Compare these values to part I and discuss the effect upgrading to BRT has on the stop spacing.

iii. Service can be improved further by introducing a hierarchy of service such that local buses are available in the residential section only and express buses run the entire length of the route. For worst case analysis you can assume R→R users will use local service, C→R users will board an express bus and transfer to a local bus at the express stop closest to their destination, R→C users will board a local bus and transfer to an express bus at the express stop closest to their origin (Express and local schedules are not coordinated.) Determine the optimal headway and the optimal stop spacing for each zone, and for each bus type. Remember you only have 40 buses to be split between local and express service. Since this is a complex optimization problem you may solve it numerically (using Excel or a similar program)

You are to submit a formal report describing your tasks and your findings. For the discussion of part iii you should quantify and discuss the costs of switching from a continuum approximation solution to a real-world solution as well as what constraints are imposed when implementing the latter solution. You may work in small groups of up to 3 people and submit a group report.

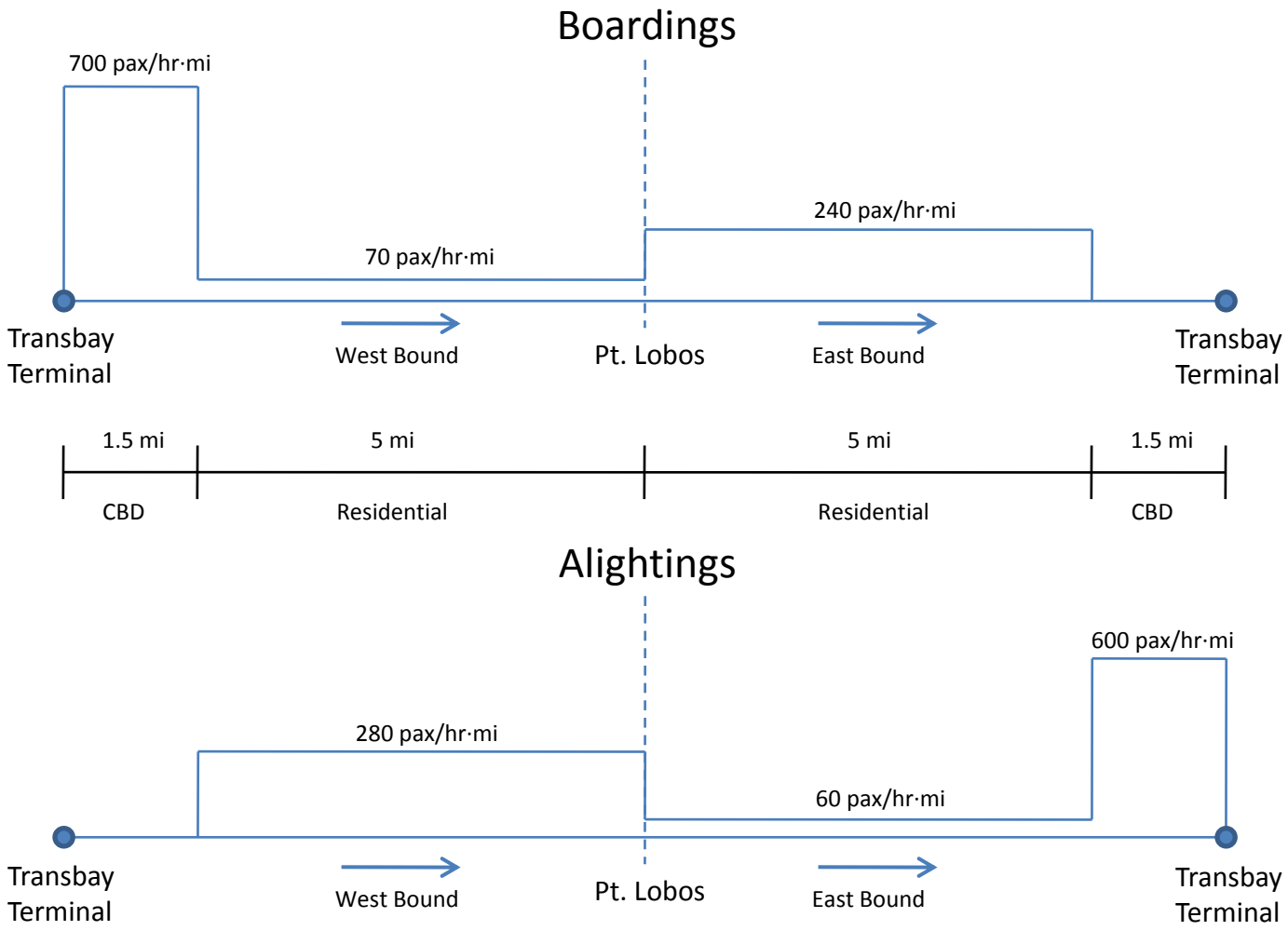

Figure 1. Boarding & Alightings vs. Route Location

Geary 38 Route