

Assignment 4

This assignment will be completed in teams of 3 or 4, assigned by the instructor. A single submission should be made by each team, in PDF format. Each student will submit an individual summary of the contributions they and their teammates provided to the assignment.

Problem Description

This assignment focuses on planning and scheduling operations for a hypothetical merger and extension of routes 70 and 70A of the MBTA, as follows:

- Route 70A is eliminated and frequency is raised on route 70. Assume that a minibus or TNC service will replace the north branch of route 70A in Waltham, delivering last mile service to and from the Waltham rail station.
- Route 70 is extended to Kendall Square. Instead of turning right on Landsdowne St., it continues on Massachusetts Avenue, makes a left on Vassar St., a right on Main St., a left on Ames, a right on Broadway, and a U-turn into Main St. There are additional stops at Vassar St with Mass Ave., Vassar St. with Main St., Broadway with Main St., and Kendall Square Station.
- Use a simple elasticity model to account for the expected increase in demand due to higher frequency.
- The fleet size should not exceed what is now allocated to routes 70 and 70A combined, unless high (predicted) crowding justifies an increase in frequency.

Using the data provided (including data from Assignment 3), develop a new operating plan that meets or exceeds the MBTA service delivery policy. The existing span of service should be maintained. Your schedule should use vehicles and drivers efficiently, and must satisfy the terms of the Carmen's Union labor contract, as summarized in the last page of this problem statement. Your task is to develop weekday-only timetables, vehicle schedules, and driver duties.

Tasks

1. Determine running (book) times over the course of the day. In this respect you should not be bound by the time periods specified by the MBTA or, of course, their book times.
2. Determine recovery/layover times over the course of the day.
3. Determine service frequencies over the course of the day.
4. Develop the timetable showing the departure and arrival times at the terminals.
5. Develop bus blocks showing the activities of each bus operating on the route.
6. Determine the driver runs so as to satisfy the contract terms and minimize the driver wage cost. When splitting and recombining bus blocks into driver duties you must proceed within the constraints of the work rules.
7. Determine the total driver pay (per day) for the new operating plan.
8. Evaluate the existing service plan compared with your proposed service plan.

You may assume that all buses assigned to this route are standard 40-foot buses with 39 seats. In addition:

1. All buses start and end their days at Somerville Garage, and the travel time between Cabot and route 1 terminals can be determined from the AVL data provided.
2. Buses cannot be parked anywhere away from the garage except for normal layovers.
3. Drivers may start or end any piece of work at the garage or either terminus, but note clause 8 of the work rules.

Carmen's Union Labor Contract Summary

The wage rate is \$35 per hour for both fulltime and part time drivers.

Full-Time Drivers

1. All full-time drivers are guaranteed 8 hours pay which includes 15 minutes pay for report time: 10 minutes of non-productive time at the start of the first piece and 5 minutes at the start of the second piece.
2. On-duty hours (including report time) can be no more than 8 hours 15 minutes and any time over 8 hours is paid at an overtime rate of 150% of the wage rate.
3. If a full-time driver's assignment (or run) requires clocking off at the end of the day more than a specified number of hours after clocking on at the start, a bonus known as a spread penalty is paid. This results in the driver being paid 1½ times the basic wage rate for time worked in the 11th hour after the run begins and double pay for work in the 12th and 13th hours. No run can have a spread time of greater than 13 hours. The 15-minute report time does not affect spread penalties.
4. No more than 30% of full-time driver runs can have a spread time of greater than 11 hours.
5. Any run with a report time before 5 a.m. must be straight.
6. Any straight shifts must receive a paid meal break of at least 20 minutes and any break less than 30 minutes must be paid.
7. No shift may have more than two pieces (i.e., only one unpaid break is allowed in any run).
8. Any driver who does not start and end each piece of work at the same location is paid a 20 minute swing time bonus for the duty.

Part-Time Drivers

Part-time drivers can work up to 6 hours per day across any spread of hours without receiving any spread penalty pay. Part-timer runs are not subject to a guaranteed minimum length, but can have no more than two parts and must include the 15-minute report time. Clause 8 (above) also applies to part time drivers.

Although this is not included in the labor contract, there is an MBTA policy of part-time drivers being no more than 25% of all operators. You should treat this as a soft constraint for this assignment.

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1.258J / 11.541J Public Transportation Systems
Spring 2017

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