

1.258J/11.541J/ESD.226J
Public Transportation Service and Operations Planning

Fall 2003

Assignment #4
Fall 2003

Out: November 6, 2003
Due: December 4, 2003

Scheduling

Notes: This is another group assignment for groups of 3. It is based on the same data set used in Problem Set #2. I have re-named the file containing ride check data, it is now called Assignment4_RideCheck.xls.

This problem set returns you to the MBTA Silver Line for which you designed a data collection program in Problem Set #2. This time the challenge is to use the information you have on the route to develop a new operating plan which meets or exceeds the MBTA Service Policies (recall Problem Set #1). The data includes that for Problem Set #2, but this is augmented by:

- (1) Peak Period Running Time data from the AVL system
(attached, and available electronically on Stellar as RunTime.xls)
- (2) Point check data collected over three days in October
(attached, and available electronically on Stellar as PointCheck.xls)

Your task is to develop a timetable and set of driver duties for the Silver Line satisfying the MBTA Service Policy in terms of passenger crowding and service reliability. These duties must also satisfy the terms of the Carmen's Union labor contract, summarized in Attachment #1.

To accomplish this you will have to do the following:

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 attached work rules.
7. Determine the total driver pay (per day) for the new operating plan.

The general aim is to minimize total driver pay, although major changes from current levels of service should be justified. For those who are ambitious and who have taken (or are taking) 1.224 and are interested in optimization, attached is a sheet describing how to access a solver capable of dealing with MIPs.

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

You may assume that all buses assigned to this route are articulated and have 57 seats.

Additional information important to this assignment is:

1.258J/11.541J/ESD.226J
Public Transportation Service and Operations Planning

Fall 2003

1. All buses start and end their days at Cabot Garage and the time to travel between Cabot and Dudley is 12 minutes, and between Cabot and Temple Place is 10 minutes. Buses cannot be parked anywhere away from the garage except for normal layover time.
2. You may assume that there is no interlining on the Silver Line.
3. Drivers may start or end any piece of work at the garage, at Dudley, or at Temple Place, but don't forget Attachment #1, clause 8.

1.258J/11.541J/ESD.226J
Public Transportation Service and Operations Planning

Fall 2003

Assignment #4
Fall 2003

Attachment #1

The wage rate is \$25 per hour for both full time and part time drivers.

A. 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. Spread penalties: If a 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 1-1/2 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 am 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.

B. Part-Time Drivers

1. Part-time drivers can work up to 6 hours per day across any spread of hours without receiving any spread penalty pay. Part-time 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.