

**1.011 Project Evaluation** • Carl D. Martland & Lexcie Lu • MIT Center for Transportation Studies  
 Friday, March 21, 2003 • (100 points, 25 of which are essay points)

Quiz #2 – The Northeast Corridor

In 1988, National Railroad Passenger Corporation (Amtrak) was contemplating a northward extension to Boston, Mass. of Pennsylvania Railroad’s experimental high-speed service “Metroliner” between Washington, D.C. and New York, N.Y. The existing railroad between New York and Boston (called the Shore Line) was constructed in segments between 1826 and the 1880s, but was absorbed into New York, New Haven & Hartford System by 1904. Amtrak took over the Shore Line as Conrail auctioned off excess railroad trackage in New England in 1976, and has since been maintaining the railroad for a maximum speed of 79mph.

Although trains are permitted to run at a full 79mph throughout most of the Shore Line, station stops, curvature and drawbridge dynamic loading restrictions mean that the train achieves an average speed of 61mph. Amtrak has determined that higher speeds are needed to compete with the recently completed I-84 corridor, which runs via Hartford, Conn., and has enabled journey times by automobile between Boston and New York of as low as three hours.

You have been asked by the Massachusetts Secretary of Transportation, to evaluate a number of options that engineers are contemplating for upgrading the Shore Line. Installation of cab signals which displays the aspect of the signal ahead right in the engineer’s cab will permit railroad engineers to run trains at 90mph over straight stretches of the track. Installation of automatic train stops, plus additional track work, will allow train operations at 110mph. Other enhancements will ultimately bring the top speed up to 150mph. Because of the need to slow down for stations and severe curves, increasing the top speed by 10mph does not necessarily result in a 10mph increase in average speed. These options have been costed and a summary sheet is given in Exhibit 1.



<b>Top Speed</b> <i>mph</i>	<b>Average Speed</b> <i>mph</i>	<b>Travel Time</b> <i>hours</i>	<b>Capital Costs</b> <i>\$m</i>	<b>Op./Maint Cost</b> <i>\$m/year</i>	<b>Op. Rev</b> <i>\$m/year</i>	<b>Op. Profit</b> <i>\$m/year</i>
79	61	3.951	0	318.5	264.8	-53.7
90	76	3.171	330	335.0	498.7	163.7
110	82	2.939	930	365.0	568.3	203.3
125	85	2.835	1380	387.5	599.4	211.9
150	87	2.770	2130	425.0	619.0	194.0

**Exhibit 1:** Some Hypothetical Operating Performance Data for Amtrak’s Northeast Corridor Shore Line.

This hypothetical case was written by Lexcie Lu for the purposes of classroom discussion, and was not based on any actual events. Any plans and opinions expressed herein do not represent the plans or views of either the U.S. Government, Amtrak, any other companies, or the Massachusetts Institute of Technology.

1. (5 points) Let us assume that both the operating costs and the operating revenue will grow at the average rate of inflation each year (3%). Based on these assumptions, the Massachusetts Bay Intercity Railroad L.L.C. (MBICR) has placed a bid to operate the 79mph service for the next five years. What is the value of the contract?

[Hint: the Value of the Contract is the total amount of money Amtrak would pay MBICR for operating the service, assuming MBICR is responsible for all costs and keeps all revenues.]

<b>Year</b>	<b>Payment</b>
	1
	2
	3
	4
	5
	<u>Total</u>

2. (10 points) MBICR has determined that if Amtrak invests \$330 million immediately before the operations began, it is prepared to operate the service without any subsidy from Amtrak. Is this a good deal for Amtrak?

[Hint: Amtrak is a quasi-public agency, and derives its capital from two sources: it can borrow commercially at 6%, or it can ask Federal government to raise taxes to fund its capital projects. Currently, the taxpayer funds about half of Amtrak’s capital projects. What is Amtrak’s discount rate?]

3. (10 points) Let us assume Amtrak agrees to funding \$330 million of upgrades if MBICR invests \$600 million to bring the entire track structure up to 110mph standards (i.e. the total investment is \$930 million). From MBICR's perspective, should they invest the additional \$600 million?

[Hint: If MBICR invests \$600m today, how much extra money would it earn over the next five years? MBICR is a private company, therefore it raises capital funds by issuing corporate bonds at 7%, and raising money on the stock exchange at 12%. Its current debt-to-equity ratio is 50%.]

4. (10 points) The Finance Department in Amtrak has found that if Amtrak gave MBICR a concession of ten years in duration, MBICR could achieve an internal rate of return of 20% by making the initial \$930 million investment to bring the track up to 110mph standards (without Amtrak assistance). 20% is higher than MBICR's discount rate, so Amtrak argue MBICR ought to be happy with this. MBICR countered that it could achieve an internal rate of return of 57% if it invested only \$300 million and brought the track up to 90mph standard. Who is correct and why?

5. (5 points) Supposing that you sent the engineering specification to an old engineer friend of yours who has retired to Portland, Oregon. He did some calculations and told you that the cost of upgrading to 110mph isn't really \$930 million. He thinks it would be closer to \$530 million. Does that change MBICR's position in Part 4?

6. (5 points) You asked your old friend Lexcie, who is TAing 1.011 at MIT, to perform some analysis on the cash flows. He assumed that the interest rate is 10%. He recommended that Amtrak and MICBR should pursue the 90mph option because it shows the highest NPV. But there is a glaring error in his analysis. What is it?

	A	B	C		D		E		F		G		H		I		J		K		L	
1	i% =	10%	<b>79mph Option</b>		<b>90mph Option</b>		<b>110mph Option</b>		<b>125mph Option</b>		<b>150mph Option</b>											
2	Year	(1+i)^n	Cash Flow	PV	Cash flow	PV	Cash flow	PV	Cash flow	PV	Cash flow	PV	Cash flow	PV	Cash flow	PV	Cash flow	PV	Cash flow	PV	Cash flow	PV
3	0	1.00	0.00	0.00	-300.00	-300.00	-930.00	-930.00	-1380.00	-1380.00	-2130.00	-2130.00										
4	1	1.10	-53.75	-48.86	163.68	148.80	203.29	184.81	211.91	192.65	193.97	176.33										
5	2	1.21	-55.36	-45.75	168.59	139.33	209.39	173.05	218.27	180.39	199.78	165.11										
6	3	1.33	-57.02	-42.84	173.65	130.47	215.67	162.04	224.82	168.91	205.78	154.60										
7	4	1.46	-58.73	-40.11	178.86	122.17	222.14	151.73	231.56	158.16	211.95	144.77										
8	5	1.61	-60.49	-37.56	184.23	114.39	228.81	142.07	238.51	148.10	218.31	135.55										
9	6	1.77	-62.31	-35.17	189.75	107.11	235.67	133.03	245.66	138.67	224.86	126.93										
10	7	1.95	-64.18	-32.93	195.45	100.30	242.74	124.57	253.03	129.85	231.60	118.85										
11	8	2.14	-66.10	-30.84	201.31	93.91	250.02	116.64	260.62	121.58	238.55	111.29										
12	9	2.36	-68.08	-28.87	207.35	87.94	257.53	109.22	268.44	113.85	245.71	104.20										
13	10	2.59	-70.13	-27.04	213.57	82.34	265.25	102.27	276.50	106.60	253.08	97.57										
14	NPV			-369.97		826.76		469.41		78.75		-794.79										
15																						

(If you notice more than one error, list all errors.)

7. (5 points) Supposing that Congress suddenly decided to cut off Amtrak's funding in the present year, and ordered it to liquidate its assets to pay back its debt and cease operating. So Amtrak sold Penn Station for \$2.3 billion to New Jersey Transit Authority, and sold the Shore Line for \$6.4 billion to MBICR, which had already been upgraded to 110mph standards at Amtrak's expense. What would MBICR's taxable income be in the first year, if the asset could be depreciated over fifty years using straight-line depreciation?

8. (5 points) Using the number for taxable income you found in Part 7, if the State Tax Rate in Massachusetts is 11%, and Federal Tax Rate is 26%, what actual profit would you expect MBICR to report in the first year as a shareholder?

9. (5 points) Let us assume that MBICR decided to mortgage the Shore Line for \$4.22 billion at an annual interest rate of 7% over thirty years, now what would MBICR's cash flow be in the first year?

10. (5 points) At MBICR's Initial Public Offering, MBICR offered two hundred million shares at \$11.40 per share, would you buy it? MBICR's prospectus suggested that since the Shore Line is worth \$6.4 billion, and \$11.40 per share would value the company at \$2.28 billion, the IPO price is grossly undervaluing the company and the share price will grow soon after the stock is floated. MBICR's prospectus also suggested that the company fully expect to report a profit in the second year. Would you purchase MBICR's stock? If you would, when would you sell it and why? If you wouldn't, why not?

11. (5 points) Supposing that MBICR's cost allocation system allocates the cost of the infrastructure (i.e. repayment on the \$4.22 billion loan) based on the number of trains operated, plot the average cost per train as a function of number of trains operated. Assume MBICR plans to operate between 500 and 2,000 trains per year, and each train costs \$1,000 to set up and operate.

12. (20 points) Either

(a) You have just read a case study on investing in high-speed rail in the Northeast Corridor. Besides from the issues already raised in the quiz, suggest five ways in which the investment decision model could be improved.

(b) On page 1 of this quiz, you were given the results from a very simple revenue and cost projection model in which the operating costs are solely dependent on the top speed, and operating revenues are solely dependent on the travel time. Suggest five ways as to why this model is an inaccurate representation of reality, and say how you expect the revenue and cost projections to change with your refinement of the model.

13. (5 point) Given your critique of the investment decision model/cost model, critically assess the statement:

*Speed is the Holy Grail of Northeast Corridor Rail Operations.*

End of Quiz #2.