An Economic Examination of a New National High Speed Rail System for Trucks

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Introduction

I am unfamiliar with the economics of modern railroads. The following information was gathered from a short search of the internet

In 2003 an Australian railroad covering 1420 km was built for A$1.3 billion. This amounts to $1.3 million/mile. In Canada agricultural land goes for about C$89,000/ha. For a 60 foot right of way this would amount to about $243,000/mile.

Based on these numbers and allowing for a more expensive situation in the United States, assume a cost of $2.5 million/mile for a single track, or $10 million/mile for 4 tracks.

In 1990 a new boxcar cost $60,000. In 2006 it was about $80,000. So assume a railcar cost of $100,000.

The cost of operating a freight hauling truck is somewhere around $1.50/mile. Of this, assume $.50/mile for fuel and maintenance, $.50/mile for driver and the rest for other things.

The Model

The following variables can be used to provide a crude analysis of the economics of the proposed railroad network:

L	A representative length of the railroad between two dockyards in miles. Assume 500 mi.
E_Y	Number of employees per dockyard. Assume 100.
E_T	Number of employees per train. Assume 10.
N_T	Number of trucks carried by the average train. Assume 60.
W	Average wages per employee. Assume $20/hour.
V	Average speed of each train. Assume 100mi/hr.
S	Fuel and maintenance savings when a truck rides on the railroad. This is the maximum price the railroad can charge. Assume $.50/mile.
T_T	Trip time. This is the time for the train to travel between dockyards $= L/V$. For this model this is 5hr.
T_0	Train turnaround time. Assume 2hr.
T_I	Time interval between trains. Thus, $1/T_I$is the number of trains per hour in one direction. Assume 30min.

The total savings for one truck for the 500mi trip would be

$$Savings/truck - trip = SL + (WL/V) = SL + WT_T$$

The first term represents the fuel and maintenance savings. The second term represents the cost of the driver, which assumes the driver isn't paid for accompanying the truck. For the entire train,

$$Savings/train - trip = N_T(SL + WT_T)$$

Factoring in the number of trains departing per hour, the total hourly savings resulting from running trains in both directions at the prescribed interval would be

$$Total\ Hourly\ Savings = 2(Savings/train - trip)/T_I = 2N_T(SL + WT_T)/T_I$$

The number of operating trains that would be required to keep everything moving at this pace in both directions would be

$$Number\ Of\ Operating\ Trains = 2\frac{T_0 + T_T}{T_I}$$

The employee cost per train would be

$$Labor\ Cost/train - trip = E_T W(T_T + T_0)$$

Given the number of trains departing per hour in both directions, the total hourly labor cost for operating the trains would be

$$Hourly\ Train\ Labor\ Cost = 2E_T W\frac{T_0 + T_T}{T_I}$$

The hourly labor cost for operating the two dockyards would be

$$Dockyard\ Labor\ Cost = 2E_Y W$$

Thus the total labor cost for operating the railroad would be

$$Total\ Labor\ Cost = 2W(E_Y + E_T\frac{T_0 + T_T}{T_I})$$

Assume the railroad's fuel and maintenance costs equal the labor costs. Then the total operating cost would be

$$Hourly\ Total\ Operating\ Cost = 4W(E_Y + E_T\frac{T_0 + T_T}{T_I})$$

Results

The Cost of Building the Railroad

At a cost of \$10 million per mile, the cost of building this railroad would be

$$Building\ Costs = 500mi \times \$10,000,000/mi + 2 \times Cost\ Of\ Dockyard + Cost\ Of\ Rolling\ Stock$$

Let's just take a wild guess and assume each dockyard costs \$200 million to construct.

The cost of the railcars would be \$100,000 each. This needs to be multiplied by the number of cars per train times the number of trains:

$$Cost\ Of\ Railcars = \$100,000 \times N_T \times 2\frac{T_0 + T_T}{T_I} = \$100,000 \times 60 \times 28 = \$168\ million$$

Adding in the cost of locomotives, coaches and auxiliary railcars, let's put the total cost of rolling stock at \$200 million. Then

$$Building\ Costs = \$5\ billion + \$0.4\ billion + \$0.2\ billion = \$5.6\ billion$$

Even if these figures are off considerably, it is evident that the major cost is the building of the rail lines. The rolling stock would not be a large factor even at two or three times the estimated cost.

The Cost of Operating the Railroad

Plugging into the formula gives the hourly operating cost:

$$Hourly\,Total\,Operating\,Cost = 4W(E_Y + E_T\frac{T_0 + T_T}{T_I}) = \$80/hr(100 + 10 \times 14) = \$19,200/hr$$

Suppose the railroad operates at full capacity for 16 hours per day, 5 days per week and is not operating the rest of the time. Then the annual operating cost would be

$$Annual\,Operating\,Cost = \$19,200/hr \times 16hr/day \times 5days/week \times 52weeks/year = \$79,872,000$$

The Revenue Flow

Assume that the maximum amount that the trucking companies can be charged is their savings from riding the railroad.

$$TotalHourlySavings = 2(Savings/train{-}trip)/T_I = 2N_T(SL{+}WT_T)/T_I = 120(\$0.50/mi{\times}500mi{+}\$20/hr{\times}5hr)/0.5hr = \$$$

Suppose the railroad operates at full capacity for 16 hours per day, 5 days per week and is not operating the rest of the time. Then the total annual revenue flow would be

$$Total\,Annual\,Revenue = \$84,000/hr \times 16hr/day \times 5days/week \times 50weeks/year = \$336,000,000$$

Analysis

The annual profit from this model would be

$$Annual\,Profit = Total\,Annual\,Revenue - Annual\,Operating\,Cost = \$256,128,000$$

Without factoring in interest costs, this would give a payback time on the order of

$$Payback\,Time = \frac{\$5.6\,billion}{\$256\,million} = 22\,years$$