

DANBURY BRANCH IMPROVEMENT PROGRAM TASK 5

ENVIRONMENTAL TECHNICAL MEMORANDUM

STATE PROJECT 302-008



SECTION 4: ENERGY

MAY 2009

SECTION 4. ENERGY

INTRODUCTION

This section describes and quantifies energy consumption associated with the existing Danbury Branch rail passenger service operated by Metro North Commuter Railroad (MNR). Energy consumption associated with the rail service includes the present consumption of diesel fuel by locomotives, used to propel the trains along the corridor, the demand for electricity associated with the stations located along the corridor, and electric usage by signal, communication, and radio systems.

Regulatory Context

At the federal level, the Federal Energy Regulatory Commission (FERC), U.S. Department of Energy (DOE), and the U.S. Environmental Protection Agency (EPA), have no energy regulations and/or policies that apply specifically to this project.

There are presently no state laws pertaining to the use and/or conservation of energy that apply specifically to a rail infrastructure improvement project of this type. Relative to new building construction, which would include new railroad stations, the State of Connecticut does have Leadership in Energy and Environmental Design (LEED) standards and requirements that apply to both private sector and state-funded construction projects. The LEED rating system encourages and accelerates global adoption of sustainable green building and development practices through the creation and implementation of universally understood and accepted tools and performance criteria.

Connecticut Public Act (PA) 07-242 revised the State Building Code to require that (1) buildings costing \$5 million or more built after January 1, 2009 and (2) renovations costing \$2 million or more starting January 1, 2010, meet the LEED Silver Standard or its equivalent. Certification at the LEED silver level requires a building project to earn 33 to 38 points of a possible 69 across six areas of examination: site sustainability; water efficiency; energy and atmosphere; materials and resources; indoor environmental quality; and innovation and design process.

Specific to state-funded projects, PA 02-242 extends the LEED Silver Standard requirements to state facility renovations costing \$2 million or more, approved and funded on or after January 1, 2008. The act also requires these facilities to exceed the current building code energy efficiency standards by at least 20 percent. Requirements may be waived if the cost of compliance significantly outweighs the benefits.

Methods, Coordination, and Data Sources

The analysis of existing energy consumption by trains traveling along the Danbury Branch was based primarily on train schedules and miles traveled by each scheduled train. There are a number of variables that affect fuel efficiency, including track grade (positive or negative), locomotive type, average speed, and number of station starts and stops. For this reason, an average diesel fuel consumption rate of two (2) gallons per mile was used for this analysis. This

consumption rate was communicated to URS Corporation by MNR at a meeting held on January 12, 2009, where baseline train performance modeling was discussed. The two (2) gallons per mile is the average of all MNR diesel operations.

EXISTING CONDITIONS

The overwhelming majority of energy used by the Danbury Branch Line corresponds to the fuel consumed by train operations. A small proportion of energy used is associated with electricity used at the eight (8) existing passenger stations and for signal, communications, and radio systems. Electricity is used at the stations primarily for rail platform, commuter parking lot, and pedestrian walkway illumination, and to operate existing systems such as variable message signs on the platforms, audible train approach messaging, and automated ticketing machines. The signal, communication, and radio systems include highway grade-crossing warning devices, communication node houses, and radio repeaters. Given that no substantive project-related changes to these facilities or their energy use are anticipated, this evaluation focuses on energy consumption associated with the train operations, which are the focus of the project improvements.

It is also noted that the planned Centralized Traffic Control (CTC) signal system on the Branch will have an electrical energy demand. However, the CTC is a separate project and its prior installation is a basic assumption of this study, so its energy demand is not included in the analysis.

Existing Train Operations

Unlike the New Haven mainline and the New Canaan Branch, the Danbury Branch is not electrified. Diesel-electric push-pull locomotives capable of operating on electrified and non-electrified rail lines are used for the service. Typically, the locomotives push the train sets toward the South Norwalk Station and pull them toward the Danbury Station.

Two types of diesel-electric locomotives are used along the Danbury Branch Line, the GE Genesis and the Brookville BL20GH. The GE Genesis locomotives were built between 1992 and 2001. The Brookville BL20GH locomotive is a new single-engine locomotive, delivered in 2008. Both are considered to be very fuel efficient compared to earlier production diesel locomotives.

The current Danbury Branch daily train schedule includes 11 inbound and 11 outbound trains during weekdays and 6 inbound and 6 outbound trains during weekends and holidays. A simplified daily schedule showing the origin, destination, and miles of travel for each weekday and weekend train is shown in Table 1.

Table 1: Danbury Branch Daily Train Schedule

INBOUND	Number of Trains	Origin	Destination	Daily Miles Traveled (all trains)
Weekdays	3	Danbury	Grand Central Terminal	195*
	4	Danbury	Stamford	128 ⁺
	4	Danbury	South Norwalk	72 [^]
Weekends & Holidays	6	Danbury	South Norwalk	144 [^]
OUTBOUND				
Weekdays	3	Grand Central Terminal	Danbury	195*
	2	Stamford	Danbury	64 ⁺
	6	South Norwalk	Danbury	144 [^]
Weekends & Holidays	6	South Norwalk	Danbury	144 [^]

* Trip between Danbury Station and Grand Central Terminal is 65 miles

⁺ Trip between Danbury Station and Stamford Station is 32 miles

[^] Trip between Danbury Station and South Norwalk Station is 24 miles

Note: Schedule for analysis based on project baseline – October 5, 2008 to April 4, 2009

Based on this schedule, during a typical (non-holiday) week, a total of 134 trains currently operate along the Danbury Branch. Of these, 74 trains (50 weekday and 24 weekend) operate between Danbury and South Norwalk. Of the remaining 60 trains, 30 operate weekly between Danbury and Stamford (4 inbound and 2 outbound, 5 days per week), and 30 operate weekly between Danbury and Grand Central Terminal (3 inbound and 3 outbound, 5 days per week).

Fuel Consumption

To calculate weekly diesel fuel consumption by locomotives for the Danbury Branch Line, the total number of miles traveled by all 134 trains must be multiplied by the diesel fuel consumption rate of 2 gallons per mile (provided by MNR). This results in the fuel consumption shown in Table 2.

As shown, the typical weekly diesel fuel consumption by all trains is 9,372 gallons. On an annual basis, this corresponds to 487,344 gallons. Using a conversion of 141,000 British Thermal Units (BTUs) per gallon of diesel fuel, the energy demand associated with the Danbury Branch Line train schedule under existing conditions is 68.7 billion BTUs per year.

Table 2: Existing Weekly Fuel Consumption by Danbury Branch Trains

Trip	Miles	Number of Trains	Fuel Consumption Rate (gallons per mile)	Diesel Gallons Required
Danbury to/from Grand Central Terminal	65	30	2	3,900
Danbury to/from Stamford	32	30	2	1,920
Danbury to/from South Norwalk	24	74	2	3,552
Total Weekly Fuel Consumption (All Trains)				9,372

REFERENCES

http://en.wikipedia.org/wiki/GE_Genesis

URS Corporation. *Meeting minutes from January 12, 2009 meeting with Metro North Railroad.*