

Feasibility Study Danbury Branch Electrification Project No. 302-008



Washington Group International

Integrated Engineering, Construction, and Management Solutions



Task 3:
Ridership Forecasting

FINAL REPORT

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Connecticut Department of Transportation

Feasibility Study Danbury Branch Electrification

Task 3 Report – Ridership Forecasting

Table of Contents

- 1.0 Background
- 2.0 Approach
- 3.0 Summary of Data

Tables

- Table 1 2001 NEW HAVEN LINE WEEKDAY INBOUND STATION BOARDINGS
- Table 2 Preliminary Modeling Results – 2000

Task 3 Ridership Methodology

1.0 Background

Connecticut's Housatonic Valley Region has experienced rapid population growth and significant changes in journey-to-work patterns between 1990 and 2000. Although ConnDOT has incorporated the new Census 2000 demographic data into its state travel demand model (reflecting growth in population and employment and other socio-economic characteristics), some concerns have been raised regarding the model's representation of the region's changing work trip patterns. These concerns would be allayed if the new Census 2000 Journey-to-Work (JTW) information were also incorporated into the model. This would be a rather simple modification if the JTW data were available at the Transportation Analysis Zone (TAZ) level. However, that information will not be available until next year and the JTW information currently exists at the municipality (town) level. When the TAZ level data becomes available, ConnDOT's ridership forecasting group will be using the data to recalibrate the model. While that will be sufficient for Phase II of the Danbury Electrification Feasibility Study, Phase I needs to be completed sooner. To accommodate this, the available town level data was used to adjust the trip tables to ensure that the Phase I ridership forecasts for the Danbury Electrification project reflect the latest information on travel patterns.

2.0 Approach

The approach that was used involved modifying the model's Home-Based Work (HBW) Production-Attraction (P-A) table, which is produced in the Trip Distribution step, to adequately reflect the region's new JTW flows by municipality. ConnDOT provided the Study Team with the HBW P-A table at the TAZ level from its most recent year 2000 model run, as well as a HBW P-A table from a base year 1990 run. ConnDOT also provided the Study Team with a geographic file containing the TAZ structure used in the model. The HBW P-A table from year 2000 will be the one modified to adequately represent the new journey-to-work data from the 2000 Census.

However, because the JTW data is not a precise analog for HBW productions and attractions¹, the town-to-town JTW data needed to be modified. The two matrices (JTW town-to-town and P/A HBW TAZ-to-TAZ) needed to have an equal number of total trips in order to remain consistent. [The town-to-town JTW matrix had a greater number of trips than the HBW P-A matrix.] The total number of trips in each matrix were summed. The JTW town-to-town matrix was adjusted so that its trip totals matched those of the HBW matrix.

The Study Team then used TRANSCAD's tri-proportional routine in conjunction with a doubly-constrained growth factor (Fratar) model routine to update the HBW P-A table. The tri-proportional routine allowed us to constrain aggregated zonal pairs (i.e., town-to-

¹ Journey to work data represents the usual mode to work, while the HBW P-A trip table represents the travel to work on an average weekday.

town flows) in the matrix. We then matched these aggregated zonal pairs to the adjusted 2000 JTW data by municipality. A new HBW P-A table was created as a result, that reflects the travel patterns of the JTW data but maintains consistency with the original total number of trips in the HBW P-A table.

The new HBW P-A table for 2000 was incorporated into the state travel demand model by ConnDOT staff and the remaining steps of the model, mode choice and network assignment, were then run. The modeled rail boardings at the stations and HBW rail station-to-station Origination-Destination (OD) matrix on the Danbury Line branch were contrasted and compared to the old modeled rail HBW station-to-station OD matrix and boardings for the Danbury branch, as well as the Metro-North 2003 ticket sales information (OD patterns) and the 2001 Metro-North station boarding counts. This comparison showed that the adjustment resulted in rail travel that is consistent with the actual recent rail trip data (besides matching the JTW information from 2000). Based on this comparison, ConnDOT determined it was able to use the revised trip table as the basis for Phase I forecasting.

Since the project was evaluated for the horizon year of 2020, it was not the year 2000 trip table that was most important. The Year 2020 trip table is normally generated by running trip generation and trip distribution steps of the model based on 2020 input data. Doing so captures the influences of changes in the transportation network and land uses on the patterns of travel. But this would negate the effect of the adjustments made to the Year 2000 trip table. Another method sometimes used to develop a future trip table is to expand the current trip table into the future using a Fratar procedure to reflect growth in trip ends that have been forecast during the trip generation step while maintaining the . current year trip distribution. This method preserves the adjusted Year 2000 trip distribution. The Study Team ran TRANSCAD's Fratar model routine to create this new future year HBW P-A matrix based on the adjusted Year 2000 trip table and ConnDOT's Year 2020 trip generation results. ConnDOT then ran the mode choice and assignment procedures using this adjusted Year 2020 trip table to obtain the Phase I results. These results were then contrasted with the results obtained using the original 2020 trip table.

3.0 Summary of Data Provided by CTDOT

- HBW P-A table at the TAZ level from the year 2000 statewide model run
- A geographic file containing the TAZ structure used in the model
- HBW station rail boardings for the Danbury Line Branch from the year 2000 statewide model run
- HBW rail station-to-station OD matrix from the year 2000 model run
- The most recent (Fall 2001) Metro-North on/off station counts for the Danbury Line stations
- Recent (2003) Metro-North ticket sales by station in .xls
- Existing HBW P-A matrix for future year 2020
- Year 2020 trip generation results at the TAZ level

TASK 3 - TABLE 1
2001 NEW HAVEN LINE WEEKDAY INBOUND STATION BOARDINGS (1)

STATION	AM PEAK	WEEKDAY OFF PEAK	TOTAL WEEKDAY
Waterbury	37	68	105
Naugatuck	21	17	38
Beacon Falls	6	1	7
Seymour	16	10	26
Ansonia	14	9	23
Derby Shelton	22	5	27
Danbury	174	52	226
Bethel	172	10	182
Redding	51	8	59
Branchville	182	13	195
Cannondale	112	3	115
Wilton	173	5	178
Merritt-7	94	3	97
New Canaan	914	259	1,173
Talmadge Hill	354	25	379
Springdale	387	59	446
Glenbrook	409	30	439
New Haven	1,347	1,673	3,020
Milford	849	356	1,205
Stratford	761	162	923
Bridgeport (2)	1,868	1,171	3,039
Fairfield	2,113	589	2,702
Southport	181	52	233
Green's Farms	507	42	549
Westport	1,710	616	2,326
East Norwalk	462	69	531
South Norwalk (2)	1,302	651	1,953
Rowayton	463	23	486
Darien	1,021	361	1,382
Noroton Heights	986	148	1,134
Stamford (2)	2,984	3,201	6,185
Old Greenwich	733	222	955
Riverside	541	138	679
Cos Cob	602	223	825
Greenwich	1,718	1,334	3,052
Port Chester	1,377	1,080	2,457
Rye	1,447	856	2,303
Harrison	1,563	644	2,207
Mamaroneck	1,630	810	2,440
Larchmont	2,703	831	3,534
New Rochelle	2,030	1,442	3,472
Pelham	1,854	546	2,400
Mount Vernon	1,253	613	1,866
Fordham	10	23	33
125th Street	8	27	35
TOTAL NEW HAVEN LINE	37,161	18,480	55,641

(1) Calculated by factoring 1996 On/Off Counts based on ticket sales data to reflect 2001 ridership levels.

(2) Station totals include transfers.

TASK 3 - TABLE 2
Danbury Rail Electrification Study
Preliminary Modeling Results - 2000
Revised September 10, 2004

Modal Splits

MODE	ConnDOT Travel Model HBW	Consultant Revised HBW	Change	<u>Station On's & Off's</u> HBW - Inbound (am network)		<u>Metro-North Counts</u>		<u>ConnDOT Travel Model</u> <u>Series 27B</u>		<u>Consultant Revised</u> <u>HBW Trips</u>	
				NODE	Station	ON	OFF	ON	OFF	ON	OFF
ADA	2,032,296	2,015,264	-17,032	9928	Danbury	149	0	247	0	137	0
ASR	597,542	613,831	16,289	9929	Bethel	187	0	195	68	116	2
Bus	56,786	55,703	-1,083	9930	Redding	61	1	61	1	74	1
Rail	51,320	53,133	1,813	9931	Branchville	224	3	218	2	194	1
				9932	Cannondale	156	2	166	1	189	2
				9933	Wilton	252	3	269	8	294	9
				9935	Merritt 7	119	45	118	38	129	27
				9909	S. Norwalk	-	125	-	29	-	38
Total	2,737,944	2,737,943	-1		Total On's	1148	179	1274	147	1133	80

Average Trip Lengths
 Statewide Work Trips
 (minutes)

	ConnDOT Travel Model	Consultant Revised
	17	20
	1990 Census	2000 Census
	21	24