Quonset Point and the Morning Commute: Are There Opportunities for Mass Transit to Quonset Point/Davisville Industrial and Commerce Park?

A feasibility study examining the possibilities of a commuter rail extension to Quonset Point Davisville Industrial and Commerce Park in North Kingstown, Rhode Island based on ridership predictions and annual cost per rider metrics

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This thesis has been accepted in its present form as satisfying the requirements for Honors in the Department of Environmental Studies at Brown University.

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Executive Summary

Quonset Point/Davisville Industrial and Commerce Park (QPD), a 3000-acre decommissioned naval base in North Kingstown, Rhode Island, has been labeled as a key industrial development zone in the State of Rhode Island by state agencies. In 1997, the Rhode Island Economic Development Corporation (RIEDC) released a Draft Master Plan (DMP) for the development of QPD into an industrial park and intermodal load center container port. The employment and traffic levels at "build out" in 2010 proposed in the DMP made the Final Environmental Impact Statement for Improved Access to Quonset Point (FEIS-403) obsolete. This study revisits the Technical Memorandum 8 of the FEIS-403 to determine whether opportunities for commuter rail exist based on projected development levels for QPD.

The FEIS-403 predicted that there would be 12,930 employees and 21,205 daily work trips at QPD in the year 2010. Based on these predictions, 12 different mass transit options were analyzed for QPD and a Transportation Management System (TSM) or vanpool program was determined as the best-fit alternative. However, the DMP predicts that there will be 26,928 employees and 71,671 daily work trips in 2010, a 208% increase in employment and a 338% increase in vehicular traffic over the FEIS-403. Based on these development levels, a commuter rail appears to be the best-fit transportation option to QPD. Commuter rail ridership could range from 1,560 to 3,398 daily trips by the year 2010 and costs per rider could be as low as $460 per year including capital as well as operation and maintenance costs or 40% of the TSM option.

In sum, the FEIS-403 is obsolete and should be reanalyzed for traffic flow based on "build out" projections in the DMP. The full-build alternative for the Freight rail Improvement project should be re-examined since the partial build "Third Track" rail project may be unable to support the projected flow of freight and commuter traffic to QPD. Commuter rail appears to be a commercially viable public transportation option to QPD and requires further analysis. QPD development could be a boon to the State of Rhode Island, but to fail to address traffic problems by providing adequate public transportation options could undermine the overall success of the project.

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DISCLAIMER:

The contents and/or conclusions contained in this paper do not necessarily reflect the views of the Rhode Island Department of Transportation. They are the independent research results of the author.

Acknowledgements

Quonset Point/Davisville Port and Commerce Park is a living, breathing project. This makes for fascinating research, and the ultimate in frustration. At this point, April 1999, the data presented here are the most up-to-date predictions involving QPD. These ridership data may change, but the modeling methodology used in this project remains as a tool for the future. It is robust enough, and hopefully cogent enough, to survive whatever amendments are made to Quonset development plans.

This project became more than a thesis to me. It helped me realize how important transportation and responsible development are to me, as well as what I would like to do for a career. This document is the primary legacy of my work; however, a published Op/Ed piece in the Providence Journal (3/23/1999), language in the Rhode Island State Guide Plan regarding Quonset Point as a key mass transit focus in the state, as well as the submission of a document to the Quonset Stakeholder's Archive lie in its wake. I feel that whatever I produce here will only be a fraction of the information that I've learned, but I know that everyone feels the same way about their personal research.

What this project means to me can be summed up in one snapshot: one week before my thesis defense, Caroline Karp and Brian O'Neill (my two primary advisors) listened to a rehearsal of my presentation. After presenting for 25 minutes, we spent two hours fine-tuning every minute detail of the presentation until it was perfect. It was an incredible high to see that my project received such intense scrutiny and effort from two professors simultaneously, and that all three of us cared enough about the material that we were willing to make the extra effort and spend so much time on the project.

I would like to thank a few people that without whom, this project would be a shadow of its current form. Foremost, I would like to thank Caroline and Brian for the unbelievable amount of time and patience that was invested into the project. I cannot even begin to describe how much it means to me. Moreover, I would like to thank Steve Devine of RIDOT, Walter Slocomb of Rhode Island Department of Administration, and Katherine Trapani of RIEDC, each of whom is reading this document with a professional eye to help it be as strong as possible.

I would also like to acknowledge each of these people who helped me along the way: Barry Schiller of Sierra Club, Jim Hunt of Marine Intermodal/QPP, Kurt Teichert of Brown is Green, Lynn Carlson for her GIS help, Paul Sullivan of New Jersey Transit, Philip Braum of Barton Aschmann Associates, and Timothy Timmermann of EPA. Special thanks go to Patrick Macroy, my thesis buddy in the ES department and all my friends who have listened to me rant and rave about mass transit all year. Lastly, I'd like to thank my father for giving me Lehigh as a middle name (short for Lehigh Valley Railroad) and stressing how mass transit is more than environmentally responsible, it is fun.

Introduction

Purpose

The purpose of this study is to analyze the desirability and feasibility of commuter rail service into Quonset Point/Davisville Industrial and Commerce Park (QPD). It is intended to aid Edwards and Kelcey Inc. in their commuter rail ridership predictions to QPD for the Rhode Island Department of Transportation (RIDOT). The analysis will be divided into these sections:

Background/ Statement of Need

Analysis of Existing and Projected Infrastructure

Feasibility/ Ridership Predictions

Recommendations and Proposed Next Steps

This is an expansion and reexamination of the "Final Environmental Impact Statement for Improved Access to Quonset Point" (FEIS-403) and should be viewed as an addition to the South County Commuter Rail Project (SCCRP). Its ultimate goal is to connect the economic development plans of the Rhode Island Economic Development Corporation (RIEDC) for the vacant industrial land at QPD with RIDOT's statewide transportation plans.

This document revisits the study conducted in the FEIS-403 (1995) and uses RIEDC's growth predictions for the proposed port and Commerce Park to evaluate the desirability of an expanded proposal for commuter rail service to QPD. The number of projected employees at QPD has increased 208% over the FEIS-403 estimation. Moreover, the number of projected work trips has grown by 338% over the 1995 FEIS-

403 figure. The magnitude of the proposed expansion necessitates a reexamination of the public transit data in order to assess the value of commuter rail. It is conducted with the underlying assumption that commuter rail is the most cost effective and time effective public transportation option for the size and scope of the proposed development at QPD.

1. Background/ Statement of Need

Modern History of QPD

On April 17, 1973, the United States Government decommissioned Quonset Point Naval Air Station. In 1974, the Rhode Island Port Authority and Economic Development Corporation (RIPAEDC) was created by the Rhode Island Legislature to spearhead economic development in the State of Rhode Island.[1] "In 1978 and 1979, RIPAEDC acquired 1,286 acres at Quonset" from the Federal Government.[2] By 1994, Davisville had followed Quonset Point and was closed as well. In December 1997, the Draft Master Plan (DMP) for the Quonset Point/Davisville Port and Commerce Park was released by RIEDC to the public, culminating three years of studies and deliberations on the issue of what to do with the industrially zoned and developable land at QPD.

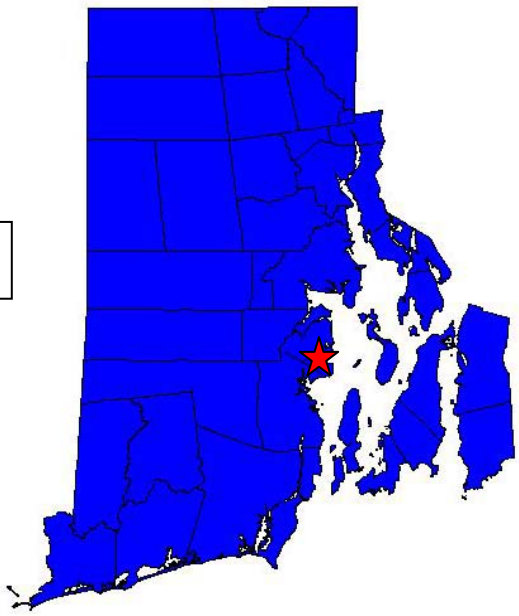
Description of Area

QPD is located approximately in the center of Rhode Island along the western shore of Narragansett Bay (see Map 1). The state-owned industrial park is situated within the township of North Kingstown and exceeds 3,000 acres.[3] Vehicular access is available from Post Road (Route 1 – *north-south*) and Davisville Road (Route 403 - *east-west*). The proposed Quonset Access Freeway (QAF – proposed Route 403 - *east-west*) would create a third roadway into the facility, paralleling Davisville Road. QPD is linked to the NorthEast Corridor (NEC) rail network via the Seaview railway network, which

[1] RIEDC, "Rhode Island and the Quonset Davisville Port and Commerce Park": presentation to stakeholders, September 10, 1998: pp. 6.
[2] Barbara Sokoloff Associates Inc. "Historical Employment at Quonset Point/Davisville" December 21, 1998, draft – pp. 3.

consists of 23 miles of internal track.[4] It also encompasses the Quonset State Airport, which maintains an 8,000-foot main runway, and a 4000-foot secondary runway.

Map 1



Current Affected Population

According to the 1990 census, 3,664 people who lived in North Kingstown worked in Cranston, Providence, or Warwick.[5] At the same time, 2,339 people who lived in Cranston, Providence, and Warwick worked in North Kingstown.[6] In 1989, there were 6,706 total employees at QPD[7] while 1998 employment figures are somewhere between 5,000 and 5,200 employees for the QPD complex.[8] Average Weekday Traffic volume (AWDT) on Davisville Road in 1993 was 14,700 vehicles per day.[9]

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[3] DMP pp. 1-2. 3,000 acres does not include the 515 acres proposed to be filled for port operations.
[4] RIEDC website. http://www.riedc.com/qpd/qpd%20rail.html .
[5] "1990 Census Data for Transportation Planning" Technical paper #145: Division of Planning of the State of Rhode Island, January 1994: pp. 50.
[6] Ibid. pp. 51. Cranston, Providence and Warwick are used here because they would form the majority of the riders on the proposed service.
[7] FEIS-403 tech mem # 8 pp. 11
[8] RIEDC, "Tenants List for Quonset/Davisville Industrial Park" October 1, 1998
[9] FEIS-403, pp. 6.

Future Affected Population

The FEIS-403 was published in 1995 by the Federal Highway Administration (FHWA). The FHWA estimated 12,930 employees would work at QPD resulting in 21,205 work trips or 22,000 vehicles by the year 2010[10]. The FEIS-403 recommended a Transportation System Management (TSM) or organized vanpooling and shuttle services as the preferred transit option at this level of development.

In the version of the Draft Master Plan (DMP) for the development of QPD that was released in December 1997, RIEDC estimated 26,928 jobs at QPD by 2010.[11] The increase in jobs changed the number of expected daily work trips to 71,671.[12] AWDT is not predicted as yet, however the DMP does provide expected vehicular traffic at specific segments of the highway and interior road network. The DMP does not come forth with any specific plans for public transportation, although a commuter rail station is within the design plans for the proposed intermodal center at QPD.

Table 1-A: Employment Figures at QPD and Vehicular Trips per Day

Year	1989 (FEIS)	2010 (FEIS)	2010 (QPP/RIEDC)
Employment at QPD	6,706	12,930	26,928
Trips per Day	14,700[A]	21,205	71,671

A: 14,700 is AWDT instead of predicted trips because it is known

[10] FEIS-403: pp. 7,11-12.
[11] DMP Table 4-6.
[12] DMP Appendix C.

2. Analysis of Existing and Projected Infrastructure

Existing Public Transportation Alternatives

Currently, public transportation at QPD is almost nonexistent. RIPTA does provide two separate services that go through the town of North Kingstown, but neither one actually enters the QPD complex. The two routes are the #14 bus, which operates from Narragansett to Kennedy Plaza via Post Road, and the #64 bus, which travels from URI to Newport, via the Route 138 Park & Ride. The #14 stops at Post Road where it passes QPD, but it is almost a mile from the actual entrance of the park. There is currently no passenger rail service at QPD.

In 1993, RIPTA operated one bus each workday between Newport and Quonset Point designated the "Quonset Point Service". The bus was specifically for Electric Boat employees working the day shift. It arrived at Electric Boat at 6:45 am and departed at 3:40 PM and averaged about 20 riders per day (round trip). At present, this service no longer operates because of a lack of demand.

Some companies at QPD currently operate TSM services, such as "Quonstrans". "Quonstrans" is a privately funded and operated van service run by Electric Boat, currently the largest employer at QPD. In 1993, there were 42 vans in operation servicing more than 400 employees.[13] The service is partially funded by a RIDOT program that uses federal funds to help finance the purchase of vans. After 48 months, the vans become the property of Electric Boat. Every member of the vanpool helps offset

[13] Tech Mem 8, pp. 3.

the operating and maintenance costs of the program; payment is taken directly out of the riders' paychecks.

Key Assumption

All projections in the FEIS-403 assumed that rail service to Wickford Junction and Westerly would already be in existence as outlined in the SCCRP.[14] The predicted growth of containerized freight generated by the proposed "load center" at QPD is anticipated to surpass the limitations of the "Third Track" by the tenth year of the port's existence.[15] These factors are extremely important to the future opportunities for train service to QPD; it is possible that the opportunities for future train service may be impeded by the development of the port and then the frequency and viability of passenger service may be jeopardized. This issue is addressed in more detail in "Appendix A – Limitations of the Third Track " section of this document

Projected Public Transportation Alternatives

The "Technical Memorandum 8" to the FEIS-403 analyzes 12 possible public transportation alternatives for QPD based on the 2010 projected growth of 21,205 daily work trips. Ridership, capital cost estimates, and cost effectiveness are the three main criteria used to choose the optimal mode of mass transit for QPD. TSM, bus, light rail, commuter rail, ferry and "no action" are each analyzed with and without the existence of the QAF. The "Technical Memorandum 8" recommends the TSM alternative in

[14] FEIS-403, pp. 17. In conversation with Steve Devine of RIDOT, he states that the SCCRP is planned to operate on the two main tracks of the NEC. However, the FRIP states that commuter rail will operate on the third track. If Mr. Devine is correct, then this will not be an issue; however, the author would be remiss to not mention this possibility that freight operations may impede commuter rail service to QPD.
[15] Saul Nadler, "What are the projected impacts of increased truck traffic at Quonset Point Davisville", December, 1998, submitted as final paper for ES201, Brown University – available in QPD stakeholders

combination with construction of the QAF because TSM is the most cost effective per rider of all the transit options considered.[16] TSM, as presented in the FEIS-403, would add an additional 392 riders to the existing (1993 FEIS-403 data) van service operations at QPD.[17]

Table 2-A: FEIS-403 2010 Ridership Estimates & Additional Average Workday Trips[18]

Alternatives	Van	Bus	Rail	Ferry
Without Access Road				
No Transit Action				
TSM	392			
Bus		1,514		
Light Rail			526	
Commuter Rail			948	
Ferry				297
With Access Road				
No Transit Action				
TSM	392			
Bus		1,210		
Light Rail			361	
Commuter Rail			703	
Ferry				268

Why TSM over Commuter Rail?

The FEIS-403 recommends TSM in conjunction with the QAF because it is more cost effective per rider than the other transit options. The methodology used to determine this recommendation is as follows. Ridership for each of the 12 options was determined by modeling operating and maintenance costs (such as drivers or gas for a bus option) as

archive. Also, Email correspondence with James Hunt, Intermodal consultant for QPP, December 15, 1998. For more details, see "Appendix A – Limitations of the Third Track"

[16] This is covered in much greater detail in the “Why TSM over Commuter Rail" section.

[17] Tech Mem 8, pp. 17. This is primarily the "Quonstrans" service of Electric Boat.

[18] Tech Mem 8, pp. 17. "Additional" means over existing data such as 400 TSM people in 1993 or 0 train riders in 1993.

well as the capital costs necessary for establishing each of the transportation services.[19] Then, cost effectiveness was determined on a per rider basis by dividing the projected ridership into the projected cost of a project. The longevity of operating costs was annualized in the calculation.[20]

Table 2-B: FEIS Comparison of Transit Options – Cost Estimates [21]

	Capital ($ Million)	Operating ($ Million)	Annualized ($ Million)	Ridership (# per day)	$ per Rider
Without 403					
TSM	$1.20	$0.16	$0.45	392	$1,147.96
Bus	$4.97	$5.87	$6.49	1,514	$4,286.66
Light Rail	$55.31	$1.41	$6.17	526	$11,730.04
Commuter Rail	$15.00	$0.30	$1.59	948	$1,677.22
Ferry	$12.65	$4.02	$5.11	297	$17,205.39
With 403					
TSM	$1.20	$0.16	$0.45	392	$1,147.96
Bus	$4.97	$5.87	$6.49	1,210	$5,363.64
Light Rail	$55.31	$1.41	$6.17	361	$17,091.41
Commuter Rail	$15.00	$0.30	$1.59	703	$2,261.74
Ferry	$12.65	$4.02	$5.11	268	$19,067.16

According to the FEIS-403, "The TSM alternative has the advantages of low capital costs, applicability even at low employment levels, and the flexibility to expand incrementally as employment levels increase. The existing TSM program elements in the area would provide a solid basis for expanded actions."[22] As Table 2-B shows, TSM with the QAF is almost twice as cost effective as commuter rail, the next best option.

The "Technical Memorandum 8" argues that commuter rail is not a good fit for QPD because ridership is not significant enough to justify the capital investment of a fixed route system. "Commuter rail has the disadvantage of requiring a substantial

[19] Such data would include the purchasing of buses for the bus option, or the laying of track and purchasing of rolling stock and locomotives for the commuter rail option.
[20] Tech Mem 8, pp. 25.
[21] Tech Mem 8, pp. 28.

amount of employment to provide adequate ridership. It also has a high capital cost, and, unlike TSM actions, would create an abrupt increase in transportation system capacity and costs with no opportunity for incremental implementation."[23] It is not "cost-competitive" with the TSM option.[24]

"What About the Bus?"

This study does not look at the possibility of extended bus service into QPD for two reasons. First, as the "Technical Memorandum 8" states:

> Expanded bus service has not been shown to be a particularly effective strategy. The need to create long bus routes to reach the residences of employees would make this a relatively expensive solution to mobility needs, compared to the number of riders who would use the service. Specific locations may be appropriate for bus service expansion, but bus service is not recommended as the primary means of providing improved public transportation access to the Quonset Point/Davisville area.

Second, as will be explained in the "Feasibility/Ridership Predictions" section, the QAF may have extensive traffic at both the morning and evening peak hours. If that were the case, unless there were a dedicated bus lane, bus service would be affected by the traffic. This delay in service at the peak hours removes any advantage that public transportation to QPD may possess. Moreover, public transportation ridership decreases as travel times increase so the utility of the bus option is lost. Because of the density of vehicular volume at peak times as well as its expense, extensive bus service is not the best transit option for QPD.

Why Commuter Rail over TSM?

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[22] Tech Mem 8, pp. 35.
[23] Tech Mem 8, pp. 35.
[24] Ibid. pp. 35.

"Any further consideration to commuter rail should be related to employment increases in the Quonset Point/Davisville area."[25] The DMP projects employment levels 208% over those in the FEIS-403. More importantly for predicting mass transit, daily work trips are supposed to increase 338% from the FEIS-403. This extraordinary growth is why commuter rail must be reexamined at QPD.

Increased traffic at QPD will slow down the average speed of all vehicles entering the Commerce Park. The QAF was planned for an AWDT of 22,000;[26] the DMP predicts AWDT within the park of 71,671 with some arterial roads eclipsing 42,000 AWDT. At peak hours, there are parts of the park that expect to filter over 5,000 vehicles per hour through a stoplight. This level of vehicular traffic is well above the level that the FEIS-403 originally analyzed and will result in congestion that reduces the utility of vanpooling. Commuter rail, or any fixed route system, avoids such congestion issues, and is therefore an excellent match for QPD.

Commuter rail does not have a fixed number of passengers that it can handle. Unlike vans in a TSM, commuter rail is capable of expanding on a day to day basis at virtually no operating cost increase.[27] If a train were to operate with a locomotive and 6 cars or a locomotive and 8 cars, it would have virtually the same operating costs. This is extremely useful when peak hours or bad weather affects commuting habits along a corridor. A van, on the other hand, can only take a fixed number of prearranged riders. Moreover, it does not have the flexibility to increase capacity (via standing room) as a fixed route commuter rail does.

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[25] Ibid. pp. 35.
[26] FEIS-403 pp. 7.
[27] This is possible by either the addition of a coach or by the utilization of standing room. It is quite rare to see a train car without sufficient standing room for everyone.

If commuter rail had 1,385 passenger trips instead of 703 as predicted in the FEIS-403, it would be just as cost effective as the TSM option. This increase in ridership seems possible given predicted growth rates for QPD. For example, a straight-line projection of commuter rail trips at QPD based on DMP projections would be 338% of 703, or 2,376 trips per day.[28] This would end up costing $669.19 per rider, or almost twice as cost effective as the TSM option.[29]

Table 2-C: Cost Effectiveness of Commuter Rail Based on DMP Employment Levels

	Annualized (millions)	Ridership	cost effectiveness
TSM	$0.45	392	$1,147.96
Commuter Rail (FEIS-403)	$1.59	703	$2,261.74
Commuter Rail (338% growth)	$1.59	2376	$669.19

Note: Table assumes construction of QAF

It is possible that private companies which plan to utilize the QPD rail network for shipping freight will complete many of the capital upgrades necessary for passenger service. If this were to happen, capital costs would decrease, thereby improving the cost effectiveness of the commuter rail option. However, with increased ridership, more rolling stock and locomotives would be needed, thereby offsetting some of the private sector contributions.

Analysis

The FEIS-403 conclusion that TSM is the preferred transit alternative obfuscates the rationale for mass transit at QPD. Although there would be fewer cars on the QAF because of TSM than if there were no system in place, a frequent network of public transportation to and from QPD would not be established. Vans would have

[28] Ridership is extensively discussed in the Feasibility/Ridership section.

predetermined riders and function solely to move people to and from work. TSM would not be public transportation, but rather organized, private ridesharing. TSM is a positive direction, but not a mass transit solution for a small "city" with a commuting population of almost 30,000 people.

Commuter rail provides a fixed route solution to the question of mass transit at QPD. It is unaffected by traffic, capable of carrying large numbers of people, and would be the most cost efficient transit option at QPD based on projected development levels. At full build out, QPD would become the 5th largest employee center in Rhode Island;[30] yet, under current proposals, there would be no way to get there except in an individual automobile or a vanpool.

Increased van ridership would not improve the per-rider cost effectiveness of the TSM service since, for each additional van that would have to be purchased and operated to accommodate expansion would cost $1,150 per rider per year. At FEIS-403 development levels (12,930 employees and 21,205 AWDT), TSM is more cost effective than commuter rail. However, the DMP proposal (26,928 employees and 71,671 AWDT) dwarfs that of the FEIS-403 and necessitates a more detailed look at the possibilities for commuter rail at QPD.

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[29] Comparatively, the American Automobile Association (AAA) estimates that commuting 10 miles a day costs $1,075.20 per year, and 20 miles a day $2,150.40.

[30] State Planning Guide "census data for transportation planning" pg. 1,50-51. However, as a municipality, North Kingstown would become the 3rd largest employee municipality behind Providence and Warwick.

3. Feasibility/Ridership Predictions

Background

This section will describe the "disutility" model used to predict ridership at QPD. Moreover, it will explain how the new data presented in the DMP necessitates a re-examination of the ridership figures for commuter rail. The ridership predictions given here are constructed exactly the same way that the FEIS-403 conducted its modeling. The figures are not overly sensitive to the different inputs or assumptions of the model, nor are they exact figures. They are shown as an order of magnitude to look at the possible ridership figures to QPD.

Given projected development levels at QPD as well as the limited ways of entering the park (the QAF, old Route 403, and Post Road all convene at the entrance of the park), it is necessary to look into a possible transit option to QPD that does not use the road network in and around QPD. Both a ferry option and a light rail option were dismissed by the FEIS-403 because their annual costs per rider exceeded $10,000, almost 10 times that of the TSM option. However, commuter rail's main drawback was the limited number of potential riders who would utilize the corridor. With the DMP development predictions at 338% over the FEIS-403 levels, it is necessary to review the value of commuter rail. Based on the same methodology used in the FEIS-403, the author has repeated the ridership study of the FEIS-403 using the DMP development

level inputs. Following the same path, the viability of commuter rail to QPD has been reassessed.[31]

Model Background

The model is a "quick response" model for determining possible transit populations along a corridor. It has been used previously to determine the relative public transportation share along a corridor. It was developed by the National Cooperative Highway Research Project and is an often-used model in transportation planning because of its simplicity and applicability.

It is important to note that the model is more often used for order of magnitude rather than for exact calculations. Therefore, if the difference between two transit options were $50 on the annual cost per rider metric, they should be viewed as comparable options. However, if one transit option were to be twice as cost effective as another, then it should be viewed as being "better" than the other transit option, even if they remain within the same order of magnitude.[32]

Disutility Model - Overview

The model used in the FEIS-403 predicts the proportion of total trips that will be taken by public transportation from a given municipality based on the costs and the trip length of commuting by car or public transportation from that particular community. The cost and the time are combined into a measure of "utility" – the longer a trip is and the more expensive it is, the lower its utility. Based on the comparative utility of the driving

[31] Frequency of service might be an issue because of proposed freight rail traffic, however, this will not be included here. See Appendix A.
[32] This assessment is based on conversations with Walter Slocomb of the RI department of administration and from the description of the model as it appears in the NCHRP paper #187.

and public transportation option, the percent of trips that will be made by public transportation can be determined and predicted.

Disutility Model – Specifics

The FEIS-403 uses a "disutility model" for determining the Public Transportation Share (PTS) of a given transit corridor. Normally, a utility value is understood to mean that as a utility goes up, it is more useful. The term "disutility" is used in this model because as a "utility" value goes up, it becomes less useful. PTS is the percent of trips from point A to point B that would be taken using public transportation. PTS, as its name suggests, implies that there is both a vehicular and transit option between two points. Based on the PTS, ridership can be determined from different municipalities to a destination to estimate future usage of a transit alternative.[33] The possible transit alternatives are compared on the annual cost per rider metric to determine the merit of a possible mass transit option.

Who Would Take Commuter Rail?

In order to determine who would take commuter rail to QPD and at what volumes, it is necessary to have a sample population on which to run the model. The FEIS-403 created a sample population for future QPD employment based on a 1991 survey of employee demographics at Electric Boat. It mapped the zip codes of every employee to a Rhode Island municipality. The data were then extrapolated to 2010 development levels following the same demographic breakdown.[34]

[33] For a more in depth look at the modeling procedure, from its construction to the raw data produced, see "Appendix B – Predicted Ridership for QPD Commuter Rail".
[34] This demographic breakdown is available in "Appendix C"

Based on this approach, the 11 towns of Central Falls, Cranston, East Cranston, East Greenwich, East Providence, Johnston, North Providence, Pawtucket, Providence, Warwick and West Warwick make up the potential employee population that would take commuter rail to QPD.[35] These 11 municipalities lie alongside the path of the NorthEast Corridor (NEC) as it traverses through Rhode Island, north of QPD. It is assumed that the Southern Rhode Island municipalities of South Kingstown, Hopkinton, Charlestown and Westerly would not comprise a substantial percentage of the QPD employee population since they account for less than 6% of the Electric Boat employee population and were not included in the possible ridership studies in either the FEIS-403 or this document.[36]

To the west of QPD lies Kent County, which is predicted to receive a good percentage of the future QPD employees. Coventry, which is due west of QPD, is one of the top three municipalities for people who work at Electric Boat. The commuter rail studies in the FEIS-403 and herein do not address the possible extension of a trunk line to Kent County. In this case, it is because the capital costs for creating a new rail spur could not be calculated in the scope of this project. Moreover, although Coventry does possess a large percentage of Electric Boat workers, the nature of Kent County is less dense than the sample population and a fixed route mass transit system does not appear to be a good match with the characteristics of the area. However, it is important that some form of mass transit be available from the West as well as the South.

[35] See Appendix C – Demographic Charts and Population Breakdown
[36] The number of projected employees who would live in these South County municipalities, based on the 1991 Electric Boat demographic study, would be insignificant. See Appendix C for demographic breakdown.

Disutility Model Reconstruction

In order to look into future ridership at QPD, this study re-created the disutility model of the FEIS-403 to see how DMP development levels would affect ridership of the varied mass transit options. By re-creating the model, different sensitivity levels and various changed inputs could be addressed involving the FEIS-403 study. The re-creation of the model changed the FEIS-403 from a static to a dynamic study.

The model was reconstructed based on an appendix in the FEIS-403 Technical Memorandum #8. The model used here did not reproduce the figures reported in the original document. For example, instead of 703 passengers predicted by the FEIS-403, the new model predicted 461 possible rail passengers. This smaller result may be because some information was calculated incorrectly in the original assessment, or perhaps, the number of work trips and actual passengers was confused. However, after many months of work, the exact difference could not be gleaned. Therefore, to be conservative, only predictions based on the 461 result have been reported and therefore, ridership predictions may be up to 30% low.

Table 3-A: Daily Commuter Rail Trips 2010

	Ridership W/ QAF	Ridership W/O QAF	DMP Model
Daily Commuter Rail Trips	703	948	461

QPD Port and Ridership Projections

The ridership prediction in the FEIS-403 concludes that with existing road conditions, ridership in 2010 for a commuter rail to QPD would be 948 trips per day from

the 11 municipalities that comprise the sample population.[37] However, if the QAF is built, 703 riders would utilize commuter rail.[38] The model predicts a reduction in ridership because the QAF would reduce the highway utility (because people could travel faster on the new highway), which would lower PTS.

Proposed development at QPD would obviously increase ridership on commuter rail. The PTS would not change per municipality; instead, the number of overall people coming from each of the affected municipalities would increase. Therefore, because worker trips would increase from 21,205 to 71,671 trips per day, a straight-line extrapolation of the original data would yield figures 338% greater than the FEIS-403. Using this methodology, 2,376 daily commuter rail trips would be expected in 2010. Because Phase I of the QAF has been funded in the 1999 Transportation Improvement Project (TIP), future calculations will assume that the QAF will exist.[39]

Table 3-B: Daily Commuter Rail Trips 2010 - (QPP/RIEDC Figures)

	Ridership Projection
Daily Commuter Rail Trips	703 * 338% = **2,376**

Assumes straight-line projection from FEIS-403 total.

Modeling Results

The disutility model is neither a linear or aggregate model. This is important to note because when different scenarios are combined within the model, it does not simply add up the results between the two options. The three scenarios discussed later in the

[37] Tech mem 8, pp. 17
[38] Ibid. pp. 17.

Sensitivity to Alternative Assumptions section, a $1.00 increase to the cost of driving, a 30% decrease to the cost of public transportation, and a 5 minute increase to the time for driving will each be reported here, as well as the aggregate of all three. These three scenarios are shown to show the sensitivity of the model to different input changes; moreover, there are possibilities that each of these three scenarios could happen within the scope of QPD. Finally, when the aggregate scenario is reported, it should be noted that it is not the percentage addition of all three scenarios, even though they do comprise the changes involved in the model.

The FEIS-403 methodology, when applied to DMP development levels in the re-created model, would mean a ridership of **1,560** daily commuter rail trips at full build out of QPD. Even though 338% of 703 is 2,376 rider trips (as explained in the QPD Port and Ridership projections section above), because the re-creation of the model underestimates the FEIS-403 results by 30%, it is necessary to use the lower figures because they are the direct results of the model. It is important to remember that the model may underestimate future ridership and that the numbers presented herein may underestimate as well.

Table 3-C: Daily Commuter Rail Trips - 2010 (Model Output)

Option	Annualized Costs	Daily Trips	Annual Cost per Rider
FEIS-403 Rail	$1,590,000	703	$2,261.74
TSM (vanpool)	$450,000	392	$1,147.96
Rail (DMP 2010)	$1,590,000	1,560	$1,019.32
Rail (+ 5 minutes)	$1,590,000	1,816	$875.34
Rail (- 30%)	$1,590,000	1,970	$806.96
Rail (+ $1.00)	$1,590,000	2,475	$642.32

[39] The re-created model returns only 1,560 riders for the straight-line EDC calculation. Except for the rhetorical purposes of this passage, it has not been included within analysis section of the text.

Rail (all 3)	$1,590,000	3,398	$467.88

The $1.00 addition to driving costs would make ridership 59% over the 1,560 level. Ridership levels would increase to **2,475** daily work trips per day. This huge increase is because of two aspects of the commute. The first is that the highway utility is so low for most trips because the operating costs are calculated at $.09 per mile. Because the American public receives so many subsidies on gasoline and does not have to pay the external costs of driving, the costs per mile for commuting in an automobile are minimal. Adding $1.00 to the highway utility ends up raising the overall price of the trip significantly, which increases PTS from a given municipality. Second, the model values time much less than it values money, because that is supposed to reflect the overall belief of a commuter. Because the value of $1.00 is equal to 15.5 minutes in the model, adding $1.00 to the commute is comparable to adding a 15-minute delay to the highway option. Therefore, any significant increase to the highway utility is immediately felt in the overall ridership figures of an option.[40]

Subtracting 30% from the public transportation costs would increase ridership to QPD 26% over the 1,560 level. Ridership levels would increase to **1,970** riders per day. Similar to the $1.00 parking fee, any economic incentive would have a substantial effect on commuting behavior in a corridor. However, the public transportation utility is already so high because it is more expensive and time consuming than driving to work so a comparable economic incentive to the transit side does not affect ridership nearly as much as a driving disincentive.

[40] See Appendix-C.

Adding 5 minutes to the driving time would increase ridership to QPD 16% over the 1,560 level. Ridership levels would increase to **1,816** riders per day. The time increase is not as effective as the two economic incentives because people value money more than time. Because the construction of the model values time at 15.5 minutes to the dollar, this 5 minute delay equates to about a $0.30 disincentive to drive to work. It is no wonder that this option affects ridership the least of the three.

If all three scenarios were employed, the aggregate ridership at QPD would increase 118% over the 1,560. Ridership levels would increase to **3,398** per day. Although 3,398 daily ridership trips is almost five times as many trips as predicted in the FEIS-403 originally, the reason why there is such an large jump is straightforward. First, the RIEDC/QPP proposal increases trips on the roadway by 338% over the FEIS-403. Second, the $1.00 increase, 30% discount, and the 5 minute delay results in a doubling of PTS. Although these inputs seem trivial, the disutility model is extremely sensitive to such changes.

Results – Annual Cost per Rider

Table 3-C has three columns, annualized costs, daily ridership trips, and cost per rider.[41] The previous section detailed each of the ridership predictions, but did not look in depth at the cost per rider metric that is critical to the determination of the value of public transportation options.

Annual cost per rider for the TSM option, the preferred option in the FEIS-403, is fixed no matter what the scale of vanpooling. The cost to an individual rider in a full, 11-person van is $1,147.96 per year, whether or not there are 30 or 300 other vans in

operation. Therefore, vanpooling is more cost effective at lower volumes of employment, but less effective once employment levels rise above a certain point. At QPD, this means that once a certain level of development is reached, vanpooling will no longer be the most cost-effective transit option. However, if future employment is known (as it is at QPD), it may be more advantageous to put a larger mass transit plan into operation before development levels rise to that necessary level.

The ridership predictions that come forth in this study raise provocative questions about mass transit to QPD. Because annual cost per rider is the key metric determining how well a transportation option fits a scenario, the fact that the aggregate ridership scenario may decrease annual cost per rider to 40% of the TSM is critical to the QPD development. It has been stated here that although the model is a "quick response" model and is more suited to order of magnitude predictions than exact figures, a transit option that operates at 40% the cost of a comparable option is definitively a better fit transportation option for that corridor. Based on this metric, commuter rail is a more attractive transit option to QPD than TSM, or anything else for that matter.

Sensitivity to Alternative Assumptions

With any model, some input data must be questioned. The disutility model used in the FEIS-403 makes some assumptions that are obsolete. Although it has an extremely small effect on PTS, on August 17, 1998, RIPTA altered its fare structure to its new "One Rate - Ocean State" policy of $1.25 per person trip. The time and cost of a bus trip from a person's home to their local train station is calculated as part of the model. Therefore, a change in bus fare affects ridership prediction.

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[41] The annualized costs are itemized within the Technical Memorandum 8 of the FEIS-403 and are not

However, some of the input data are less cut and dry. For example, some people who take commuter rail drive to the train station as opposed to riding the bus. Driving to the train station would expedite the trip, which would raise the PTS for that municipality.[42] Similar assumptions that are questionable relate to the expected velocity that passenger cars will travel on arterial roads, limited access freeways, and the QPD road network. The model calculates the average speeds on these three road types at 25, 50, and 20 miles per hour, but these averages do not take into account any traffic that exists during rush hour on Rhode Island roads. PTS would rise if average velocities went down.[43]

This study looks at three possible input changes to the ridership projection model of the FEIS-403. These three possible input changes are explained and justified here. Although the changed inputs shown are to display the sensitivity of the model, it is important to note that each of these three scenarios could happen at QPD.

First, what if RIEDC charged $1.00 for parking at QPD instead of providing it for free? A parking fee would be a positive action because it would help the lessee gain something from the undevelopable land that is lost to parking. Because much of QPD will be new development, there is no precedent of free parking to contend with for the lessee. Moreover, charging $1.00 for parking would encourage people to rideshare in order to minimize parking costs, which would alleviate some amount of congestion on

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elaborated upon here.

[42] Moreover, offering free parking at the commuter rail stations would increase ridership even more. See Appendix-B.

[43] See "Appendix B – Predicted Ridership for QPD Commuter Rail" for more detail.

the QAF. Because the cost of driving is extremely low in the model, ($.09 per mile) a parking fee would increase PTS and elevate ridership significantly.[44]

Second, what if this study recognizes the effect of federal income tax statute *132-F*? *132-F* allows individuals up to $65 per month to purchase public transportation passage free of federal and state income taxes. The statute is part of the Transportation Efficiency Act for the 21st Century (TEA-21) and it is intended to foster the use of public transportation services. In terms of the model, the costs of traveling by public transportation are reduced by 30% to amortize tax brackets and other possible differences in tax benefits that would be applicable. Because it reduces the costs of taking the train, *132-F* increases PTS.

Lastly, the final hypothetical input change to the model, adding 5 minutes to the driving time, could be justified by the average velocity of passenger cars within QPD. The original FEIS-403 inputs are that vehicles within QPD will travel at 20 miles per hour over the 1.5-mile stretch that this entails, which equates to 4.5 minutes of travel time. However, because of the existence of 4 traffic signals within the park and the estimated congestion that will occur at peak hours, the network speed within QPD is altered to 10 miles per hour within the re-creation.

According to the DMP, there will be a stoplight where the QAF will hit the new Davisville Avenue within QPD. During the peak AM rush hour, it is expected that 5,124 vehicles will pass through this intersection traveling inbound.[45] Although Davisville Avenue is a 4-lane roadway, it seems highly unlikely that traffic will flow unimpeded

[44] The author would like to note that if there were a parking fee, it would have to be in the form of a monthly or annual sticker because collection of daily tolls would create tremendous traffic congestion within QPD.
[45] DMP figure 7-4.

through a traffic light at the volume of 2,500 vehicles per hour per lane. Without any rigorous traffic modeling needed, if a traffic light were 40 seconds green and 20 seconds red, that would mean that for 40 minutes or 2400 seconds per hour, the light would be green. If the light were to filter one car per second (which, from a standstill, is highly unlikely) then there would be 4800 vehicles per hour to get through. Because of this logistic, and the relatively small length of roadway (1.5 miles) it is believed that the internal traffic speed is going to be closer to 10 miles per hour rather than 20 as believed within the FEIS-403.

Sensitivity to Cost/Time Assumptions

The cost and time assumptions made in the model are key determinants of PTS. In a sensitivity analysis of some of the constant values (such as 15.5 minutes = $1.00), such constants did not change the resultant PTS by more than 5%. Therefore, how an individual values time versus money is not that important to the model.

The baseline FEIS-403 prediction barely changes when both $1.00 to 10 minute and a $1.00 to 20 minute multiplier is used. This is because the cost constant can more or less be factored out of the equation because it exists in both the nominator and denominator of the UR. However, when other factors are altered such as parking costs or time, the cost constant does have some effect on ridership. For example, the $1.00 parking fee at QPD returns **2,475** riders with the 15.5 cost constant. When using a 10 cost constant, the ridership estimate is **2,260**, and when using 20, the ridership is **2,606**. The sensitivity of the cost constant is relatively small and therefore the assumption of valuing dollars to minutes does not have a tremendous effect on whether or not people would take mass transit to QPD.

4. Summary of Findings and Recommendations

Are there opportunities for mass transit to Quonset Point/Davisville Industrial and Commerce Park?

Highway Recommendations

According to the DMP, employment levels will double and vehicle work trips triple at QPD by 2010 over the FHWA-supervised FEIS for the QAF, i.e. the QAF as planned, will not meet the necessary demand to QPD. In other words, RIEDC's release of the DMP in December 1997 made the FEIS-403 obsolete. There are two solutions for this problem – expanding the QAF or supplying substantial mass transit to QPD.

Adding a lane in each direction on the QAF does not appear to be the best solution to congestion in the vicinity of QPD for several reasons. The weak point of the QAF is its interchanges at QPD. Because of the volume of vehicles and the stoplights near the entrance to QPD, getting vehicles on and off the QAF near QPD appears to be a major bottleneck in development plans. Moreover, because Post Road hits QPD in exactly the same place as the QAF, the peak hour traffic volumes around QPD will be well beyond the capacity of the interchange.

Adding another lane would not solve this problem. Although it would increase the capacity of the highway throughout its 4.5 mile length, there would still be bottlenecks in and around the QPD interchange. Moreover, from a policy standpoint, money may be better spent on mass transit options that avoid the roads entirely as opposed to trying to make the roads meet projected demand. If prices on commuter rail were lower, or more trains were operated with the money that could be used to add an extra lane to the QAF, it may end up alleviating more traffic than the extra lane would

because it would get more people on mass transit and off the roads. This is a point that needs further study but it appears that adding an extra lane to the QAF would not alleviate traffic at QPD.

FRIP Recommendations

The FEIS for the FRIP should be reviewed before construction of the "partial build" FRIP begins to avoid creating a rail network that is insufficient for predicted freight and commuter rail demand. Amtrak, which owns and operates the NEC, expects to run between 34 and 52 trains along the NEC by 2010.[46] Since freight operations to and from QPD are expected to reach 21, 8000-foot trains per day by full build-out if the large load center container port option is chosen,[47] commuter and freight trains will not be able to operate at a frequency that maintains their effectiveness[48] with the partial build option.

The value of commuter rail service at QPD will be compromised by the increase in port-related freight-rail traffic. Moreover, the economic viability of the proposed port depends on the ability to move large volumes of containers by rail along the "Third Track"; however, as it currently stands, the FRIP does not allow freight, nor commuter rail for that matter, to operate at a frequency that will make it effective.

Unless the full build alternative is reviewed, the "Third Track" will not meet the demand of QPD. Similar to the FEIS-403, this state funded infrastructure project will not be up to the specifications necessary for the successful operation of the port. With increased Amtrak operations as well as possible commuter rail, this is not a possible scenario with the partial build option. In sum, if QPD is going to reach development

[46] Conversation with Steve Devine, May 1999.
[47] Quonset Davisville Port Alternative Assessment Report, Normandeau Associates, March, 1999.
[48] See Appendix A – Limitations of the "Third Track"

levels beyond 4 to 6 freight trains a day and commuter rail is considered an option for mass transit, the full build FRIP alternative should be reassessed.

Commuter Rail Recommendations

Commuter rail service to QPD appears to be commercially viable given the development levels put forth in the DMP. As reported here, possible ridership levels make the annual costs per rider much more attractive than the TSM alternative outlined in the FEIS-403. Therefore, it is recommended that commuter rail be viewed as the best-fit alternative for mass transit to QPD.

The ridership predictions reported here may underestimate demand to QPD. Before millions of dollars are invested in commuter rail, a more detailed, in-depth and professional analysis of ridership to QPD must be done. This analysis should look not just at commuter rail, but how other transit options fit in to QPD given employee demographics and potential expansion. North Kingstown will be the third largest employee base in the state of Rhode Island given DMP development levels; it is necessary that mass transit to QPD be prioritized as recommended in the FEIS-403, DMP, and State Planning Ground Transportation Guide for 2020.

Proposed Next Steps

A definitive, comprehensive plan for mass transit to QPD must be developed and researched as soon as possible. Such a plan needs to provide a way to get to QPD without using Rhode Island roads. In addition, there should be a publicly available alternative for transit to QPD from the south and west, as well as the commuter rail option from the north.

In addition, a more in-depth study of commuter rail options should be conducted to determine the best way that it could be implemented at QPD. The ridership predictions presented in this study are only the beginning of the story; a thorough plan must be developed that will make commuter rail as efficient as possible. Because the ridership volume appears to be sufficient, the logistics of a service need to be researched and mapped out to foster the development of mass transit to QPD.

The FEIS-403 was conducted to a specific development level; however, the DMP made the FEIS-403 obsolete. Therefore, the conclusion that a TSM is the best-fit public transportation option for QPD is no longer accurate. This study has reviewed the FEIS-403 data and determined that its conclusion no longer fits with the data. With new DMP development levels, a TSM would not be the best form of public transportation to QPD. Commuter rail, because of the potential ridership base, is a better-fit transit form to QPD than TSM and needs further study. QPD development could be a boon to the State of Rhode Island, but to fail to address traffic problems by providing public transportation options could undermine the overall success of the project.

5. Appendices

Appendix A – Limitations of the "Third Track"

Foremost, it must be reiterated that all data herein and in the "FEIS-403 Technical Memorandum Number 8" are dependent on the existence of service south of Providence to Warwick, Westerly, and Wickford. The FEIS-403 states:

> It is emphasized again that the commuter rail alternative for this study assumes commuter rail to be in place on the AMTRAK line (NEC). Under that assumption, the only additional track construction or rehabilitation required is on the Seaview Transportation Company lines serving QP/D. The economic analysis findings regarding commuter rail are clearly dependent on commuter rail already having been extended South from its present terminus in Providence.[49]

With this in mind, it is imperative to acknowledge the limitations of the "Third Track". This is best described by a passage by Saul Nadler within the document "What are the Effects of Increased Truck Traffic at Quonset Point/Davisville"[50]

The RIEDC Draft Master Plan (DMP) for the proposed port and commerce park claims that 70% of the cargo will travel by rail per day, 20% will travel by truck, and the remaining 10% will go by ship or barge per day.[51] This is exemplified by the projection that by full build-out there will be 2060 daily truck movements at QPD.[52] If the 2060 truck movements equate to 20% of the total throughput, then approximately 7000 TEU will travel by rail and almost another 1000 will be moved by transshipment. Annually,

[49] FEIS-403 pp. 17.
[50] Submitted as Final Paper for ES201, Brown University. Also available in Quonset Point Stakeholder Archive on the RIEDC web page: http://www.riedc.com/stakeholders/stakeframe.html .
[51] QPP, "Quonset Davisville Port and Commerce Park: Container Terminal Development Project". QPP Presentation to Stakeholders; August 25, 1998: pp. 6.

this will meet the estimated 3.4 million TEU throughput projected by QPP. Henceforth, the number of 2060 intermodal truck movements will be known as the "existing estimate"

However, there is a substantial error with the "existing estimate"; the QPD rail network can barely handle 30% of the container volume it is proposed to carry. The DMP states: [53]

> *The maximum train length that the P & W can operate to Quonset Davisville would be 4,000 feet long. This limitation is imposed by the length of proposed passing sidings along the Northeast Corridor and other locations north of the Corridor to Worcester. Based on the type of train, assuming two diesel units and some margin for variation, the maximum train lengths for various type trains would be as follows:*
>
> - *General Freight = 55 cars*
> - *Tri-Level Auto = 40 cars*
> - *Container Train = 56-60 platforms = 12 - 5 platform cars or 14 - 4 platform cars*

Thus, assuming that a container train pulls 12 cars, each of which is a double stack container that holds 22 TEU, every train will be able to carry 264 TEU. According to the DMP, "…an estimated 6 container trains per day would be required for the projected container volumes."[54] [55] *In this study, eight double stack container trains a day will be used as the daily volume because it is assumed that two trains per day will be automobile carriers and not container trains. Therefore, based on these factors, approximately 2112*

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[52] QPP Presentation to Stakeholders; August 25, 1998: pp. 9.
[53] RIEDC, "Draft Master Plan: Quonset Davisville Port and Commerce Park". Prepared by Parsons Brinckerhoff Quade & Douglas, Inc. December, 1997 - pp. 7-24 col. 2.
[54] Ibid. 7-24 col. 1.
[55] The specific details of intermodal freight movements are beyond the scope of this study. However, it is the opinion of the author that they are insufficient to meet the 70% rail demand as outlined in the DMP. Some of those details can be seen on page 2-3 of the FRIP which describes the future capacity of the rail lines along the NEC and it is abundantly clear that 10 freight trains per day is near the maximum capacity of the freight lines as planned. This is not including the possibilities of future commuter rail service.

containers will be able to be moved by rail per day at QPD, which is nearly a factor of 3.5 less than the 7,000 TEU proposed to move by rail according to QPP.[56]

There is a large discrepancy between the above capacity of the QPD rail lines and the purported 70% of all containers that are to be moved by rail. Hereafter, the standard of 9,200 TEU per day (total throughput) will be used because it equates to approximately 3.4 million TEU annually, roughly the amount of TEU desired to be handled by the QPD load-center developers by year 20.[57] *Therefore, it would be expected that between 6000 and 7000 containers per day will be moved by train, almost 5000 TEU more than the stated capacity of the rail network (2112 TEU). If trains actually carried 70% of the total TEU predicted at full build-out, over 24 fully loaded, double-stacked trains per day would be needed at QPD.*[58]

Because of the expected demand upon the "Third Track", it is necessary to determine whether or not commuter rail will be able to operate at a frequency that makes the rail service both attractive and economically self sufficient. If the freight operations limit the operation of the commuter rail, the data presented herein is most likely infeasible given berthing constraints along the NEC.

[56] This is assuming that no train brings in any of the containers that will be shipped off. If every train were to bring in 264 TEU to be exported, then there will be 4224 TEU by rail per day, still well below the expected rail volume.
[57] QPP Presentation to Stakeholders; August 25, 1998: pp. 5.
[58] Again, it is reiterated that these calculations are based on trains entering with no containers to export.

Appendix B – Predicted Ridership for QPD Commuter Rail

Functionality

The disutility model used in the FEIS-403 "Technical Memorandum 8" predicts ridership based on the time and costs of public transit versus the time and costs of driving the same destination. Its origin is the "National Cooperative Highway Research Program 187: Quick Response Urban Travel Estimation Techniques" (NCHRP-187). It is a "commonly used model type that has been used in other metropolitan areas".[59]

The disutility model functions by comparing the utility of public transportation versus that of driving. A utility is determined for both the transit and highway options, and then the two of them are inputted into a formula that predicts PTS. All of the inputs used in the model are justified within the FEIS-403.[60]

A Highway Utility (HU) is calculated by adding the utility of the time of driving from home to work to the utility of the costs incurred by the trip. Costs are tabulated by charging $.09 per mile for the out of pocket expenses of driving a car. The cost section is then multiplied by a "cost constant", 15.5, and HU is created.

In order to predict ridership, a public transportation utility (PTU) must be established as well. PTU is calculated by the same formula as HU with a small set of alterations. The disutility model assumes all individuals who use commuter rail take a bus from their home to the train station, the commuter rail to QPD, and then a shuttle bus from the QPD rail station to their place of work. Individuals do not like to be stationary on their trip so at all transportation mode changes, waiting time is multiplied by 2.5.

[59] Tech Mem 8, pp. 13.
[60] For explicit references to model inputs and data, please see the Technical Memorandum #8.

Sample Calculation

Here is an example of calculating HU:

Time	Miles	Costs of Driving	Utility Costs	Highway Utility (HU)
24	14.5	14.5 * $.09 = $1.31	15.5 * $1.31 = $20.23	24 + 20.23 = 44.23

The 24 minutes that it would take to make this trip can be itemized to 2.5 miles at 20 miles per hour, 10 miles at 50 miles per hour, and 2 miles at 20 miles per hour. Our example HU is 44.23.

Here is a sample PTU calculation for the same trip as the HU above:

	Bus	Rail	Shuttle Bus	
Time	10	10	5	
Wait Time	10*2.5	10*2.5	5*2.5	
Fare	$1.25	$2.50	$.50	
Fare * Cost Constant	$19.375	$38.75	$7.75	**PTU**
Total	54.375	73.75	25.25	**153.375**

In order to calculate PTS we will need a utility ratio (UR). The UR is simply the PTU divided by the HU:

$$\mathbf{UR = PTU \div HU = 153.375 \div 44.23 = 3.47}$$

The formula for determining PTS is:

$$\mathbf{PTS = 1 \div ((1+UR)^2)}$$

Therefore, the PTS for this example is:

$$\mathbf{1 + UR = 4.47}$$

$$(1 + UR)^2 = 19.96$$

$$PTS = 1 \div((1+UR)^2) = 1 \div 19.96$$

$$PTS = .05$$

Therefore, if there were 100 people every day that made this specific trip, it would be assumed that 5 of them would take commuter rail. Because **100 *.05 = 5**.

Inputs

The sample population used in the FEIS-403 as well as this document is the 1991 employment roster of Electric Boat, the largest current employer at QPD. Based on these demographics, the sample population for future Quonset ridership from each municipality was determined and factored into the model. These demographics are believed to be consistent with future development at QPD and are similar to those used by the RIEDC in the future demographic calculations of QPD.

However, there are limitations to using such data. First, the nature of the future jobs available at QPD may attract a different demographic worker population than that currently employed at QPD. There may be higher paying jobs available in the future than at present, which could affect where people decide to live. Moreover, it is possible that as people work at QPD for a substantial period of time, they may be more likely to move closer to where they work.

Second, it is unclear if the jobs are going to be filled by current inhabitants of Rhode Island or by emigrants to the state. If it is the latter, they may look to reside in less developed areas (such as South County) instead of the more populated areas of the state. This would affect the commuter rail demographic population because fewer people would live along the commuter rail corridor then anticipated by the FEIS-403.

In general, there is a danger using a sample population because it may not be entirely consistent with the actual demographics of QPD development. However, the demographic used here more or less mirrors that used by EDC as of April 1999.[61] Therefore, it is believed to be as accurate as possible for the time being, and is a valid approximation of what the future QPD demographic will look like.

The NCHRP-187 model makes one assumption that could underestimate ridership significantly. Employees in the model are believed to travel from their home to their local train station by RIPTA bus. Some people will actually commute in this manner, however most people will drive to their local train station and park there. This adds two important elements to the model. If there is substantial free parking at the commuter rail stations in Rhode Island, then people are more likely to take the train. However, if parking at the train stations is a hassle, then people will be more likely to drive because the convenience of driving is not offset by the ease of the train. Second, the bus slows down the commute considerably, which in model terms, raises PTU and lowers PTS: fewer people take commuter rail given this scenario. Therefore, it is important to note that such a policy decision (free parking/ pay parking at stations) could affect ridership to QPD, and providing free parking could considerably affect the possible ridership to QPD.

In a running of the model, having people drive to the train station instead of using the bus resulted in a 20% increase over the **1,560** daily trips ridership prediction of the FEIS-403 methodology with the DMP development levels. This factor could have a substantial effect on peoples' decision to take commuter rail and should not be ignored.

[61] Conversations with Katherine Trapani of RIEDC.

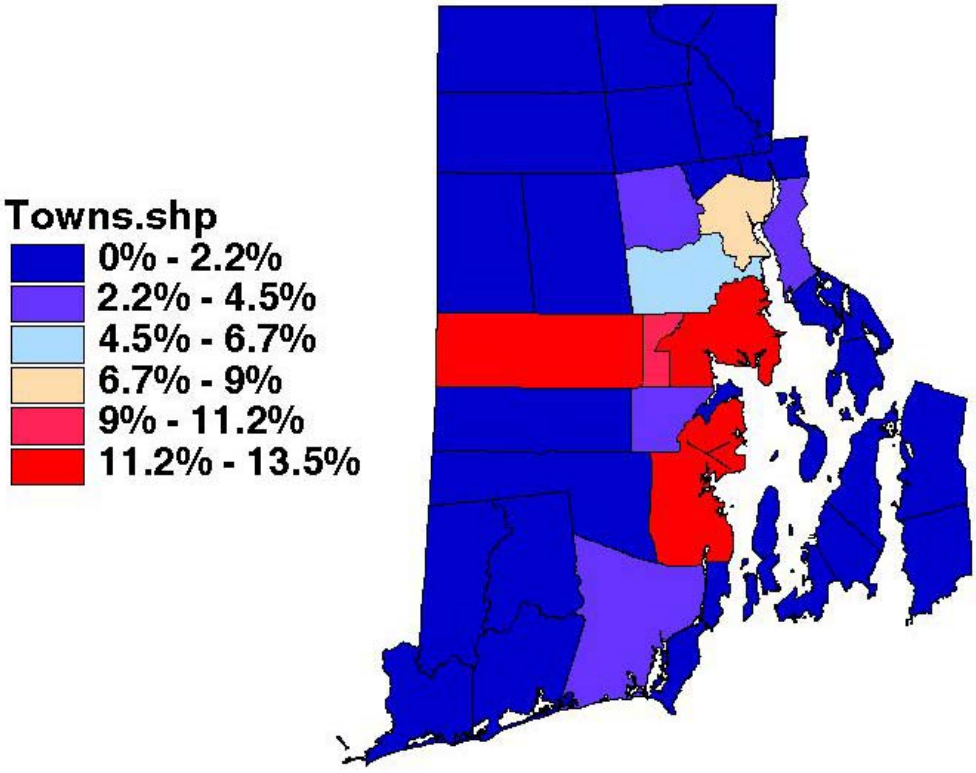
Caveats

The assumption that $1.00 is equal to 15.5 minutes needs to be looked at a little more in-depth. In researching both the NCHRP-187 document and the FEIS-403, no explicit rationale for the 15.5 multiplier has been seen, although it appears that having one minute and $1.00 be equivalent units would be erroneous. The reason is that someone who earns $20,000 a year and someone who earns $80,000 a year do not value $1.00 or 15 minutes in the same way. Therefore, the model has been run for sensitivity purposes to see how different assumptions on the value of money to time affects ridership.

Appendix C – Demographic Charts, Model Results, and Maps

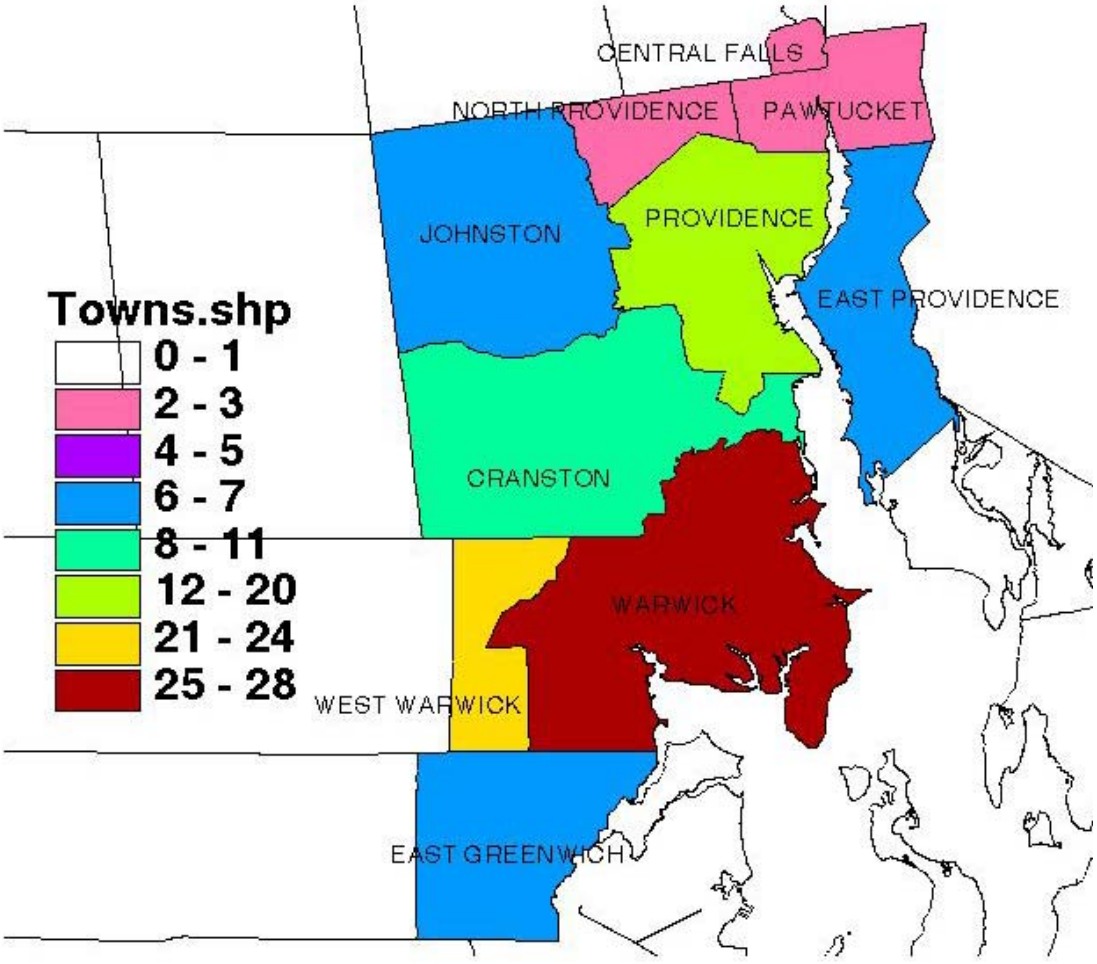
Sample Population Demographic Breakdown by Municipality

Demographic representation of 1991 Electric Boat employee database, by percent. Raw numbers are located in FEIS-403 Technical Memorandum 8, pp. 14 – 15.



Sample Population Demographic Breakdown in 10 Potential Commuter Rail Municipalities

The 10 cities that comprise the sample population for commuter rail in percent form



Sample Spreadsheet of NCHRP-187 Model

Subsample of categories used in model re-creation. This is the **1,560** baseline version which is the FEIS-403 methodology with DMP development plans

City	Highway Utility	Rail Utility	Utility Ratio	PTS	2010 Trips	2010 Riders
PROVIDENCE COUNTY						
Central Falls	65.703	192.15	2.925	0.0649	1,166	76
Johnston	52.6665	210.35	3.994	0.0401	2,075	83
N. Providence	61.749	179.925	2.914	0.0653	649	42
Pawtucket	65.142	190.65	2.927	0.0649	1,166	76
Cranston	42.0885	148.65	3.532	0.0487	1,470	72
E. Cranston	47.3985	139.5	2.943	0.0643	1,450	93
Providence	54.762	169.15	3.089	0.0598	5,016	300
E. Providence	57.117	176.7	3.094	0.0597	2,183	130
KENT COUNTY						
W. Warwick	38.04	158.75	4.173	0.0374	6,902	258
Warwick	36.042	142.375	3.950	0.0408	9,200	375
E. Greenwich	22.5675	118.2	5.238	0.0257	2,119	54
				Total	33,397	1,560

6. Glossary

ACRONYM	FULL NAME
DMP	Draft Master Plan
FEIS-403	Final Environmental Impact Statement for Improved Access to Quonset Point
FHWA	Federal Highway Administration
FRIP	Freight Rail Improvement Project
HU	Highway Utility
NCHRP-187	National Cooperative Highway Research Program 187: Quick Response Urban Travel Estimation Techniques
NEC	NorthEast Corridor
PTS	Public Transportation Share
PTU	Public Transportation Utility
QAF	Quonset Access Freeway
QPD	Quonset Point/Davisville
QPP	Quonset Point Partners
RIDOT	Rhode Island Department of Transportation
RIEDC	Rhode Island Economic Development Corporation
RIPAEDC	Rhode Island Port Authority and Economic Development Corporation
RIPTA	Rhode Island Public Transit Authority
SCCRP	South County Commuter Rail Project
SOV	Single Occupancy Vehicle(s)
TEA-21	Transportation Efficiency Act for the 21st Century
TIP	Transportation Improvement Program
TSM	Transportation System Management
UR	Utility Ratio

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