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Commuter Rail Transit Price Elasticity of Demand: An Assessment for the New Mexico Rail Runner

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I. Introduction

The New Mexico Rail Runner (NMRX) has been in operation since July 17, 2006. Current annual operating expenses for NMRX are approximately $24 million. Although the federal Congestion Mitigation and Air Quality (CMAQ) program provided NMRX with $6.8 million in annual funding in FY10, these funds were reduced by $1.2 million in FY12. CMAQ restrictions will phase eliminate these funds by FY13. Due to the need to attain a balanced budget, the Rio Metro Regional Transit District (RMRTD) is exploring a variety of options for raising revenues and reducing operating expenses, including advertising, exploring other state and federal funding sources, schedule changes, fare increases, and using buses for less popular routes. The Bureau of Business and Economic Research (BBER) was asked to assess the potential effects of an increase in fares – and in particular the impact of fare increases on ridership – by conducting a literature review and examining NMRX's peer transit systems.

II. An Applied Summary of the Transportation Cooperative Research Program (TCRP) Report 95, Chapter 12

The report commonly referred to as TCRP Report 95 is the third edition of the "Traveler Response to Transportation System Changes" handbook first published by the U.S. Department of Transportation (DOT) in 1977. Although the entire volume is not yet complete, each third edition chapter is published once finalized. The Introduction and several other chapters were published in 2003, and various additional chapters have been published during the intervening years. It is anticipated that the three remaining chapters (including one regarding Commuter Rail) will be published in 2011. Of the chapters that are currently available, the chapter most relevant to the issue of a potential NMRX fare increase is Chapter 12: Transit Pricing and Fares.

Although fare changes are made for a variety of reasons, increasing revenues is the most common reason. As noted in TCRP Report 95, most data sets that are sufficiently complete to conduct robust elasticity estimates are either relatively or quite old. Although this might seem problematic, recent transit fare elasticity information supports previous findings and thereby suggests that previously derived results are still valid.

Evidence suggests that transit riders' responses to fare changes are inelastic (fall between 0 and -1); a 1 percent fare increase results in a less than 1 percent decrease in ridership.[1] Thus, although a small increase in fares will cause a decline in ridership, the overall effect on revenues will be positive.

Average general fare elasticities[2] for heavy rail transit (HRT) are approximately -0.17 to -0.18, and are based upon studies of the Chicago, London, New York, Paris, and San Francisco systems. Because these systems differ significantly from the NMRX system, it is unclear how applicable the elasticity estimates

[1] Price elasticity captures how travel demand responds to price changes, and is defined as the percentage change in travel demand that results from a 1 percent change in price. If demand is inelastic (elastic), this implies that a 1 percent change in price will result in a less (more) than 1 percent change in travel demand.

[2] Unless otherwise noted, fare elasticities discussed in Chapter 12 are short-run elasticities and reflect changes that occur within 1 to 2 years of a transit fare change.

are to the question of how NMRX revenues might change if fares are increased. The TCRP 95 Report also provides aggregate fare elasticity estimates for four commuter railroad (CRR) systems – Australia, Boston, New York/Long Island, and New York/Metro North – and notes that the values are similar to those for HRT. Although evidence is mixed, it appears that CRR riders are more sensitive to service frequency than fares.[3]

Because the demand for public transit tends to be more price inelastic in larger cities and in areas where public transit has a strong competitive and price position with respect to private automotive use, it is unclear whether general fare elasticity for HRT in the NMRX market will be more or less inelastic than the average elasticity of -0.17 to -0.18 reported in TCRP Report 95.[4] Compared to the HRT systems which produced this elasticity range, a number of characteristics of the NMRX service may tend to increase elasticity, including 1) the smaller population of the NMRX service area, 2) strongly competitive automobile travel, and 3) a more limited supporting transit network. Factors that may support lower elasticities include 1) the relatively low base price of NMRX fares, 2) NMRX peak hour service design, and 3) a high proportion of commuter use. Additional factors that can affect elasticity include service changes, employment level, alternative public transit availability, trip origin and destination locations, congestion, gas prices, and parking costs. Ultimately, TCRP 95 Report indicates that nearly all fare elasticity estimates fall between 0 and -1, which implies that small fare increases will increase revenues. To minimize ridership losses that result from fare increases, discounts can be offered for prepaid fares, such as multi-ride tickets, unlimited passes, etc.

At the request of MRCOG and in an attempt to assess the potential impacts of a proposed NMRX fare increase of approximately 20 percent, we applied the HRT elasticity estimate (provided in Chapter 12 of TCRP Report 95) to NMRX ticket sales data. Results include projected ticket sales and revenues (Table 1). However, we provide the following cautions regarding this approach. First, because TCRP Report 95 elasticity estimate was based upon three New York City studies and four additional studies conducted in Chicago, London, Paris, and San Francisco, the applicability of the elasticity estimate to the NMRX market is suspect. Second, although fare information is provided by both the type of pass (i.e., one-way pass, day pass, etc.) and number of zones, ticket sales information is detailed only by type of pass. Applying an elasticity estimate therefore requires calculation of an “average” fare for each type of pass. Lacking information to the contrary, we have assumed an equal distribution across the number of zones for each pass type. Third, the elasticity estimate provided in TCRP Report 95 reflects the impact of a change in fares on *ridership* rather than the effect of a change in fares on ticket sales.

In addition to assessing the impact of the proposed fare change on ticket sales and revenues, MRCOG requested that we consider the impact on ridership. Doing so presents an additional challenge, as ridership numbers are only available by month and are broken down neither by pass type nor number of zones. The TCRP HRT elasticity estimate is a logarithmic arc elasticity. Accurately calculating the impact of a price change on ridership numbers using the TCRP elasticity estimate requires the formula

[3] TCRP 95 Report, Chapter 9.
[4] If the NMRX market is more (less) inelastic, the travel demand response will be smaller (larger) than suggested by the average price elasticity value of -0.17 to -0.18.

$$Q_2 = 10^{\eta\,(\log\ P_2 - \log\ P_1) + Q_1}$$

where η denotes elasticity and Q_2, Q_1, P_2, and P_1 denote ridership levels and prices before and after the fare change, respectively. However, because ridership data is not delineated by pass type or number of zones, the relevant prices (P_2 and P_1) are unclear and the formula cannot be used. To approximate the impact on ridership we therefore assume each 1 percent increase in fares will result in a 0.18 percent decrease in ridership. This assumption suggests that the proposed 20 percent fare increase will decrease ridership from 1,219,111 (FY11 ridership) to 1,175,965.

Table 1. Proposed fare change and impacts on tickets sales and revenues

	Average Fare			Ticket Sales				Revenues					
								FY11	Estimated FY11				
	Current	Proposed	% Increase	FY11	Projected[1]	Change	% Change	(actual)[2]	$	% error	Projected[4]	Change[5]	% Change
One Way Pass	4.83	6.17	27.59%	110,670	105,922	(4,748)	-4.29%	518,791	534,905	3.11%	653,184	118,279	22.11%
Day Pass	5.67	7.17	26.47%	165,853	158,988	(6,865)	-4.14%	929,134	939,834	1.15%	1,139,416	199,583	21.24%
Monthly Pass	75.83	83.67	10.33%	10,682	10,495	(187)	-1.75%	723,625	810,052	11.94%	878,052	68,001	8.39%
Annual Pass	758.33	834.17	10.00%	10	10	0	-1.70%	7,820	7,583	-3.03%	8,200	616	8.13%
D-One Way Pass	2.33	3.33	42.86%	102,061	95,714	(6,347)	-6.22%	227,728	238,142	4.57%	319,048	80,906	33.97%
D-Day Pass	4.17	5.50	32.00%	77,667	73,881	(3,786)	-4.87%	333,454	323,613	-2.95%	406,346	82,733	25.57%
D-Monthly Pass	37.67	41.83	11.06%	6,170	6,055	(115)	-1.87%	175,705	232,403	32.27%	253,283	20,880	8.98%
D-Annual Pass	376.67	414.33	10.00%	20	20	0	-1.70%	8,130	7,533	-7.34%	8,146	612	8.13%
Total			21.29%	473,133	451,084	473,133	-4.66%	2,924,387	3,094,065	4.97%	3,665,675	571,610	17.07%

[1] Projected ticket sales are calculated assuming a logarthmic arc elasticity of -0.18 (TCRP Report 95, Chapter 12).

[2] FY11 revenues as reported by MRCOG.

[3] To provide a meaningful revenue comparison, and because projected (post fare increase) revenues are based upon projected zone-indescriminate fares, we estimate FY11 revenues using current zone-indescriminate fares.

[4] Projected revenues are the product of the proposed average fare and projected ticket sales.

[5] The change in revenues is calculated as the difference between calculated FY11 revenues and projected revenues.

III. Peer System Fare Changes

Information gathered from peer systems (detailed in Table 2 below) suggests a trend toward decreasing fares and exploring other options for increasing revenues (alternative measures for generating revenues are discussed in the following section). Only two peer systems (Altamont and TriMet Westside) have implemented fare increases and maintained those increases. It is interesting to note that the fare increases imposed by Altamont and TriMet have been small; Altamont imposed a 3.2% fare increase (a CPI adjustment), and all increases implemented by TriMet have been 5 cent increases. Altamont and TriMet have both reported little if any effect on ridership. The UTA FrontRunner and the NCTD Coaster both implemented 17-20% fare increases, only to decrease fares to levels equal to or below the pre-fare increase level. Due to frequent fare changes (seven fare changes have been implemented since service began in January 2008), the effect of fares on FrontRunner ridership cannot be determined. NCTD Coaster personnel indicate that ridership declined only minimally as a result of the July 2006 fare increase, but increased significantly as a result of the January 2011 fare decrease. The Minneapolis Northstar cancelled their single intended fare increase due to low ridership, and Austin's Capital MetroRail implemented a fare decrease after their first year of operation with strong positive effects on ridership.

Table 2. Summary of Peer System Fare Changes

			Fare Change		
Peer System	**Contact(s)**	**Contact Info**	**Description**	**Date**	**Impact**
Altamount Commuter Express Stockton to San Jose, CA	Brian Schmidt, Director of Planning, Programming & Operation, ACE	(209) 944-6241 (209) 649-6403 brian@acerail.com	3.2% increase + additional 3% increase for northern-most train station	October 2008	Schmidt reported no change in ridership. Annual ridership was 752,656 in 2007; 864,597 in 2008; 740,130 in 2009.
Capital MetroRail Leander to Austin, TX	Barney Sifuentes, Revenue and Fares Manager, CMTA Jennifer Govea, Service Analysis Manager, Planning Department, CMTA	(512) 389-7400 barney.sifuentes @capmetro.org (512) 369-6298 jennifer.govea@cap metro.org	50% Fare decrease for one zone travel, 8% decrease for two zone travel. Monthly price pass decrease 11%.	April 1, 2011	Ridership increased 100% YoY[5]. Revenue increased 90% YoY.
FrontRunner Salt Lake City to Ogden, UT	Shaina Quinn, EFC Business Development Consultant, Fare Strategy & Operations, Utah Transit Authority	(810) 673-7702 squinn@rideuta.com	First year: 3 increases totaling 40% Second year: 2 increases totaling 43% Third year: 13% increase	January – December 2008 January – December 2009 January – December 2010	Indeterminate due to frequency of fare changes.

[5] YoY denotes year over year comparisons of corresponding periods of time. All YoY changes discussed here are 4 or 6 month period comparisons, according to the data available.

Peer System	Contact(s)	Contact Info	Fare Change Description	Date	Impact
NCTD Coaster San Diego to Oceanside, CA	Eric Cheng, Data Analyst II, NCTD	(760) 967-2807 echeng@nctd.org	Fare increase of roughly 7%.	January, 2007	Ridership decreased 1% YoY.
	Alex Wiggins, Communications Director, NCTD	(760) 966-6793 awiggins@nctd.org	Fares increase of 25%	January, 2009	Ridership decreased 10%.[6]
			Fares reduced to pre-2009 level.	January, 2010	Ridership increased 17% YoY.
Northstar Big Lake to Minneapolis, MN	Adam Harrington, Assistant Director, Route & System Planning Metro Transit	(612) 349-7089 adam.harrington@ metc.state.mn.us	Scheduled fare increase cancelled due to lack of ridership.		N/A
Shore Line East New Haven to New London, CT	Mark Foran, Transportation Planner, Office of Rail Union Station	(203) 497-3361 j.mark.foran@ct.gov	No data received.	-	-
Sounder Tacoma to Everett - Seattle, WA	Benjamin Smith, Assistant Service Planner, Operations Department, Sound Transit Sarah Lovell Project Manager, Sound Transit	(206) 398-5477 benjamin.smith@ soundtransit.org (206) 398-5405	Fares restructured from zone-based to distance-based. Price of the longest distance (from Tacoma to Seattle) more than doubled.	April, 2007	Little change in ridership. Average seasonal ridership peaked the year after implementation and has declined the last two years, returning to the pre-change average seasonal ridership.

[6] Supporting data has not yet been received from Eric Cheng; 10% decrease based solely upon conversation with Alex Wiggins.

			Fare Change		
Peer System	Contact(s)	Contact Info	Description	Date	Impact
Trinity Railway Express Dallas to Fort Worth, TX	Becky Thorton, Director of Accounting, TRE Mequana Campbell, Administrative Assistant, TRE	(817) 215-8700 (927) 399-8973	Data not received.	-	-
Westside Express Service Beaverton to Wilsonville - Portland, OR	Timothy Kea, Financial Analyst, TriMet Tom Strader, Senior Research Analyst, TriMet	(503) 238-4343 keat@trimet.org (503) 962-6424 stradert@tri-met.org	Annual increase of 5 cents since inception	September, 2009 September, 2010 September, 2011	 Ridership increased 19% YoY.

IV. Additional Means of Increasing Revenues

Rather than instituting fare increases, peer system employees recommended a variety of alternative revenue generating measures:

- **Co-sponsoring events** was mentioned as an effective revenue generator by the NCTD Coaster, CapitalMetro, and Northstar. CapitalMetro (Austin, TX) provided disaggregated data showing that special events accounted for an average of 24% of total ridership on special events days.
- **Change fee type or fee structure** (such as from zonal to distance or flat rate). When the Seattle Sounder implemented this change, annual revenues increased by $682,000 in the year following the change and then began to decline. While we cannot definitely attribute the revenue increase to the fare schedule restructure, TCRP 95 chapter 12 recommends such changes to capture revenues from different markets.
- T**he use of employee partnerships** was identified after speaking with Frontrunner representatives, who suggested that their data might be inapplicable due to the large percentage of their ridership that has employee-provided third party passes.

TCRP report 95 Chapter 12 recommends the following additional revenue raising measures:

- Use or increased use of free fare days to increase ridership
- Free or reduced fares to shift or increase off-peak ridership
- Increase access to alternative transportation modes with free or reduced fares
- Increase the discount for prepaid fares
- Introduce a new fare (such as a ten ride ticket)

Based upon the above recommendations, BBER recommends the following changes to NMRX:

- Introduce another purchase option (such as a ten ride pass) to capture a market not currently served by NMRX.
- Increase co-sponsorship opportunities, particularly for high traffic events such as the Gathering of Nations, Balloon Fiesta, Indian Market, Spanish Market, and the New Mexico State Fair.
- Explore restructuring fares such that off-peak times are discounted and peak time fares are increased.
- Explore offering express commuter trains with increased fares.
- Explore offering discounted annual or monthly pass packages to employers who may be considering offering transit benefits.[7]

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[7] Should employee partnerships are explored as a source of NMRX funding, TCRP Report 107 provides information on how to identify employee partners, the pros and cons of different funding structures, example surveys for gathering data from existing riders for implementing such programs, and information on how to market such programs.

V. Further analysis

A survey of NMRX riders designed to assess willingness to pay (WTP) would provide information regarding which aspects of the NMRX experience riders value most and how best to alter the current product (in terms of both attributes and fares) to better serve customers and improve revenues. Various survey methods exist that may be used to elicit WTP estimates. As discussed in Breidert et al. (2006), such survey methods can be classified as either direct (customer surveys) or indirect (conjoint analysis and discrete choice analysis).[8]

Customer surveys entail asking respondents to state the maximum and minimum prices they would pay for a product. Questions regarding reasonable cheap and reasonable expensive prices might also be asked. However, this survey method has several limitations, including (1) the focus on price can cause respondents to disregard other important product attributes, (2) there is no incentive to reveal true WTP, and (3) WTP does not necessarily relate to true purchasing behavior. Given these and other potential limitations, we recommend an indirect survey method be used.

Conjoint analysis entails presenting respondents with various product profiles consisting of different attribute levels. (For example, NMRX respondents might be presented with product profiles consisting of different service hours, service frequencies, fares, time travel, gas price, parking cost, etc.) Respondents are asked to either rank or rate the various product profiles. Discrete choice analysis is similar to conjoint analysis, but rather than ranking or rating, respondents are asked to choose between alternative product profiles. Respondents can be provided with the option of choosing none of the alternative product profiles, thereby more accurately replicating real world purchasing behavior and addressing one of the weaknesses of conjoint analysis. On the other hand, as a result of differences in survey design, there is usually insufficient data derived from a discrete choice survey to estimate individual preferences; discrete choice data is best used for estimating preferences at an aggregate level. Preference estimation at an individual level is important if the market of interest is assumed to have heterogeneous price sensitivities (likely the case for NMRX riders). Although advances in simulation techniques enable individual preference estimation using discrete choice data, conjoint analysis is more suited to this task.

[8] The discussion regarding the strengths and weaknesses of various survey techniques is based upon: Breidert, Christoph et al. 2006. A Review of Methods for Measuring Willingness-to-Pay. *Innovative Marketing* 2(4): 8-32.