

ADULT AND ELDERLY & DISABLED CASH FARE ELASTICITY ANALYSIS FOR
THE GREEN BAY TRANSIT SYSTEM

BROWN COUNTY PLANNING COMMISSION
MAY, 2000

Methodology

In May of 2000, Green Bay Transit asked Brown County Planning Commission staff to estimate how transit patrons would react if the Adult cash fare is increased from \$1.00 to \$1.25 or \$1.50 per trip and the Elderly and Disabled (E&D) cash fare is increased from \$.50 to \$.65 or \$.75 per trip. To do this, elasticity figures were calculated for the Adult and E&D cash fare categories. These figures, which are based on passenger reactions to the most recent fare structure changes, were used to estimate the willingness of passengers to ride the bus following changes to the current fare structure.

The most recent fare increase occurred in March of 1998. To calculate the elasticities for this analysis, trip data from the twelve months prior to the fare increase were compared to data from the twelve months after the increase (see Appendix 1 for details). These data were used because the system's characteristics during these periods closely resemble the system's current characteristics. The elasticities and elasticity calculations for the Adult and E&D cash fare categories can be found in Appendix 2.

Once the elasticities were calculated, the following two scenarios were studied to estimate the impacts fare increases would have on the Adult and E&D cash fare categories:

Scenario 1

<u>Fare Category</u>	<u>Current Fare</u>	<u>New Fare</u>	<u>Assumed Implementation</u>
Adult Cash	\$1.00	\$1.25	January, 2001
E&D Cash	\$.50	\$.65	January, 2001

Scenario 2

<u>Fare Category</u>	<u>Current Fare</u>	<u>New Fare</u>	<u>Assumed Implementation</u>
Adult Cash	\$1.00	\$1.50	January, 2001
E&D Cash	\$.50	\$.75	January, 2001

The new fares were used to estimate the ridership and revenue changes that would occur for each passenger category if this proposal is implemented. These calculations can be found in Appendix 3.

Scenario 1 Findings

Based on the reaction to the 1998 cash fare increases, the number of passengers that pay a cash fare to ride the bus would likely decrease significantly if the Adult fare is increased to \$1.25 and the E&D fare is increased to \$.65:

Table 1: Estimated Annual Cash Ridership Changes – Scenario 1

	<u>Adult</u>	<u>E&D</u>
Cash passengers before increase	214,990	66,881
Est. cash passengers after increase	185,106	63,650
Difference	-29,884	-3,231
Percent difference	-13.9	-4.8

In spite of these significant ridership decreases, overall cash fare revenue would likely increase under this scenario:

Table 2: Estimated Annual Cash Revenue Changes – Scenario 1

	<u>Adult</u>	<u>E&D</u>
Passenger revenue before increase	\$214,990	\$33,440
Est. revenue after increase	\$231,382	\$41,373
Difference	\$16,392	\$7,933

Percent difference	7.6	23.7
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The analysis suggests that the implementation of this cash fare structure would reduce the number of Adult and E&D cash fare trips by 33,115 and increase farebox revenue by \$24,325 annually.

Scenario 2 Findings

The results of this analysis suggest that the number of passengers that pay a cash fare to ride the bus would plummet if the Adult fare is increased to \$1.50 and the E&D fare is increased to \$.75:

Table 3: Estimated Annual Cash Ridership Changes – Scenario 2

	<u>Adult</u>	<u>E&D</u>
Cash passengers before increase	214,990	66,881
Est. cash passengers after increase	155,223	61,497
Difference	-59,767	-5,384
Percent difference	-27.8	-8.1

In spite of these very significant ridership decreases, overall cash fare revenue would likely increase under this proposal as well:

Table 4: Estimated Annual Cash Revenue Changes – Scenario 2

	<u>Adult</u>	<u>E&D</u>
Passenger revenue before increase	\$214,990	\$33,440
Est. revenue after increase	\$232,834	\$46,122
Difference	\$17,844	\$12,682
Percent difference	8.3	37.9

The analysis suggests that the implementation of this cash fare structure would reduce the number of Adult and E&D cash fare trips by 65,151 and increase farebox revenue by \$30,526 annually.

Analysis Summary

Assuming that the reactions to these cash fare increases would be similar to the reactions to the 1998 fare increases, the transit system could expect the following results:

1. The number of Adult and E&D passengers that pay a cash fare to ride the bus will significantly decline.
2. The system's overall cash fare revenue will likely increase, but the increase will not significantly offset the system's operating deficit.
3. Based on the reaction to the 1998 fare increases, it is likely that some people will transfer to the pass fare category when the cash fares are raised. However, the number of new pass trips will probably not equal the number of lost cash trips.

The sharp drop in ridership after the 1998 fare increases were implemented was unprecedented, for many people had reacted to previous increases by either transferring to other fare categories or simply paying the higher fare. It is difficult to determine exactly what caused many people to stop riding the bus after the most recent increase, but the sudden passenger decline immediately after the implementation of the new fare structure in March of 1998 strongly suggests that the fare increases were significant factors. Based on this experience, it is reasonable to assume that additional fare increases will result in additional ridership reductions.

Recommendation

Because the transit system's ridership will likely decline significantly and farebox revenue will increase relatively little under either scenario, staff recommends that the transit system not increase the Adult and E&D cash fares.

**APPENDIX 1: ADULT AND E&D RIDERSHIP
12 MONTHS BEFORE AND 12 MONTHS AFTER THE 1998 FARE STRUCTURE
CHANGES**

Adult Cash Fare Rides (Per Month)

12 Months Before Fare Increase (Fare = \$.75)	Adult Cash Passengers	12 Months After Fare Increase (Fare = \$1.00)	Adult Cash Passengers	Ridership Change
March-97	22,426	March-98	19,512	-2,914
April-97	22,680	April-98	18,146	-4,534
May-97	20,477	May-98	17,233	-3,244
June-97	18,437	June-98	17,743	-694
July-97	19,178	July-98	17,055	-2,123
August-97	19,169	August-98	17,637	-1,532
September-97	21,551	September-98	17,175	-4,376
October-97	22,959	October-98	18,440	-4,519
November-97	18,669	November-98	17,440	-1,229
December-97	22,211	December-98	18,465	-3,746
January-98	22,149	January-99	18,033	-4,116
February-98	22,122	February-99	18,111	-4,011
TOTAL	252,028	TOTAL	214,990	-37,038

E&D Cash Fare Rides (Per Month)

12 Months Before Fare Increase (Fare = \$.35)	E&D Cash Passengers	12 Months After Fare Increase (Fare = \$.50)	E&D Cash Passengers	Ridership Change
March-97	6,010	March-98	5,746	-264
April-97	6,704	April-98	5,559	-1,145
May-97	6,754	May-98	5,828	-926
June-97	5,117	June-98	5,015	-102
July-97	5,000	July-98	4,840	-160
August-97	5,190	August-98	4,581	-609
September-97	5,748	September-98	5,477	-271
October-97	6,354	October-98	6,392	38
November-97	5,226	November-98	5,658	432
December-97	5,954	December-98	5,659	-295
January-98	5,930	January-99	5,832	-98
February-98	6,800	February-99	6,294	-506
TOTAL	70,787	TOTAL	66,881	-3,906

APPENDIX 2: ELASTICITY CALCULATIONS

Using the midpoint elasticity formula:

$$E = \frac{\Delta Q / (Q_1 + Q_2) / 2}{\Delta P / (P_1 + P_2) / 2}$$

ΔQ = Passenger difference (before and after fare increases)

ΔP = Fare difference (before and after increases)

Q_1 = Passengers before fare increase

Q_2 = Passengers after fare increase

P_1 = Fare before increase

P_2 = Fare after increase

Adult cash fare increases

Most Recent Fare Increase: \$.75 to \$1.00

Adult cash fare riders bet. March '97 & Feb. '98 (before increase): 252,028

Adult cash fare riders bet. March '98 & Feb. '99 (after increase): 214,990

$$\frac{252,028 - 214,990 / (252,028 + 214,990) / 2}{.75 - 1.00 / (.75 + 1.00) / 2}$$

$$\frac{37,038 / 233,509}{-.25 / .875}$$

$$\frac{.159}{-.286}$$

$$E = -.556$$

Elderly & disabled cash fare Increases

Most Recent Fare Increase: \$.35 to \$.50

E&D cash fare riders bet. March '97 & Feb. '98 (before increase): 70,787

E&D cash fare riders bet. March '98 & Feb. '99 (after increase): 66,881

$$\frac{70,787 - 66,881 / (70,787 + 66,881) / 2}{.35 - .50 / (.35 + .50) / 2}$$

$$\frac{3,906 / 68,834}{-.15 / .425}$$

$$\frac{.057}{-.353}$$

$$E = -.161$$

APPENDIX 3: RIDERSHIP AND REVENUE CALCULATIONS

Cash fare elasticity figures (based on reactions to the 1998 fare increases)

Adult	E&D
-.556	-.161

Cash fare increases

Scenario 1: Adult increase from \$1.00 to \$1.25 and E&D increase from \$.50 to \$.65

Adults: \$1.00 to \$1.25

$$-.556 \times .25 \text{ (percentage of fare increase)} = -.139$$

$$-.139 \times 214,990 \text{ (March '98 – Feb. '99 adult cash ridership)}$$

= 29,884 fewer adult cash fare riders per year if fare raised to \$1.25

$$\text{Estimated number of passengers after fare increase: } 214,990 - 29,884 = 185,106/\text{yr}$$

$$\text{Adult cash revenue before fare increase: } \$1.00 \times 214,990 = \$214,990/\text{yr}$$

$$\text{Estimated adult cash revenue after fare increase: } \$1.25 \times 185,106 = \$231,382/\text{yr}$$

Estimated revenue change = +\$16,392 per year

E&D: \$.50 to \$.65

$$-.161 \times .30 \text{ (percentage of fare increase)} = -.0483$$

$$-.0483 \times 66,881 \text{ (March '98 – Feb. '99 E&D cash ridership)}$$

= 3,231 fewer E&D cash fare riders per year if fare raised to \$.65

$$\text{Estimated number of passengers after fare increase: } 66,881 - 3,231 = 63,650/\text{yr}$$

$$\text{E&D cash revenue before fare increase: } \$.50 \times 66,881 = \$33,440/\text{yr}$$

$$\text{Estimated E&D cash revenue after fare increase: } \$.65 \times 63,650 = \$41,373/\text{yr}$$

Estimated revenue change = +\$7,933 per year

Scenario 2: Adult increase from \$1.00 to \$1.50 and E&D increase from \$.50 to \$.75

Adults: \$1.00 to \$1.50

$$-.556 \times .50 \text{ (percentage of fare increase)} = -.278$$

$$-.278 \times 214,990 \text{ (March '98 – Feb. '99 adult cash ridership)}$$

= 59,767 fewer adult cash fare riders per year if fare raised to \$1.50

$$\text{Estimated number of passengers after fare increase: } 214,990 - 59,767 = 155,223/\text{yr}$$

$$\text{Adult cash revenue before fare increase: } \$1.00 \times 214,990 = \$214,990/\text{yr}$$

$$\text{Estimated adult cash revenue after fare increase: } \$1.50 \times 155,223 = \$232,834/\text{yr}$$

Estimated revenue change = +\$17,844 per year

E&D: \$.50 to \$.75

$$-.161 \times .50 \text{ (percentage of fare increase)} = -.0805$$

$$-.0805 \times 66,881 \text{ (March '98 – Feb. '99 E&D cash ridership)}$$

= 5,384 fewer E&D cash fare riders per year if fare raised to \$.75

$$\text{Estimated number of passengers after fare increase: } 66,881 - 5,384 = 61,497/\text{yr}$$

$$\text{E&D cash revenue before fare increase: } \$.50 \times 66,881 = \$33,440/\text{yr}$$

$$\text{Estimated E&D cash revenue after fare increase: } \$.75 \times 61,497 = \$46,122/\text{yr}$$

Estimated revenue change = +\$12,682 per year