

# Metromover Extensions and Downtown Bus Service in Miami

DENNIS HINEBAUGH AND DANIEL K. BOYLE

The results of survey of feeder bus service in the Miami Central Business District (CBD) serving the elevated Miami Metromover downtown fixed-guideway circulator system are analyzed. Two extension legs of the Metromover (Omni and Brickell) opened in May 1994. The original plans for the Metromover extensions recommended that all CBD-oriented bus routes that operated in proximity to the new extensions be truncated at those locations. According to the original plans, the Metromover would become the major collector and distributor for Metrobus routes serving the CBD, as it currently functions for the Metrorail service. The purpose of this study was (a) to present the current operating characteristics of Metrobus service to and within the Miami CBD, (b) to analyze the impacts on existing bus riders for both travel time and cost introduced by the transfers from bus to mover on the opening of the new extensions, and (c) to set priorities on bus routes for potential truncation. The report's recommendations include an incremental approach for route truncation, with the prioritization process developed in this study as a guide. This process considers ridership, percentage of riders who are elderly or have a physical disability, transfer activity, and differences in travel time. It is also suggested that service kilometers reduced as a result of route truncation be put back into Metrobus service.

This study analyzed the results of a survey of feeder bus service in the Miami Central Business District (CBD) serving the elevated Miami Metromover downtown fixed-guideway circulator system. Two extension legs of the Metromover (Omni and Brickell) opened in May 1994. The original plans for the Metromover extensions recommended that all CBD-oriented bus routes that operated in proximity to the new extensions be truncated at those locations. As a result, a major bus transfer facility was constructed at the Omni Metromover Station, and bus bays were included in the construction of the Brickell Metromover Station shared with a Metrorail (heavy rail) station. According to the original plans, the Metromover would become the major collector and distributor for Metrobus routes serving the CBD, as it currently functions for the Metrorail service.

The purpose of this study was (a) to present the current operating characteristics of Metrobus service to and within the Miami CBD, (b) to analyze the impacts on existing bus riders for both travel time and cost introduced by the transfers from bus to mover on the opening of the new extensions, and (c) to set priorities on routes for potential truncation.

The first section of this paper presents background information regarding the Metromover system, particularly the Omni and Brickell extensions. The second section is a description of the operating characteristics of current Metrobus service into and within the Miami CBD, including the results of an on-board survey of riders

within the Omni and Brickell corridors. The third section contains an analysis of the impacts of truncating CBD bus routes along the new Metromover extensions. Changes in travel time, frequency of transfers, and capacity of the Metromover stations are all included in this section, which concludes with the development of a prioritization process for route truncation. Recommendations are offered in the final section.

The prioritization process summarized in this project may be used when developing long-term corridor alternatives (i.e., railways and busways) in which existing local bus service could be truncated or rerouted. This process follows a logical sequence of data collection and analysis that can be defended at public hearings and presentations to policy making boards. The Dade County experience suggests that the political aspects of the decision making process must be taken into account along with the technical aspects. From a technical perspective, the Metromover's function as the distributor of CBD-bound trips should be maximized to promote the efficient operation of the overall transit system. This perspective strongly supports the truncation of CBD bus routes operating in proximity to the Metromover extensions. Early in this study, however, it became obvious that this action was politically infeasible. The prioritization process is one possible way of blending the two perspectives by identifying the most promising routes to truncate and by presenting an incremental approach that permits adjustments in response to successes or failures of specific actions.

## BACKGROUND

In February 1988, the Metro-Dade Transit Agency (MDTA) in Dade County, Florida, completed the Final Environmental Impact Statement (FEIS) in cooperation with the U.S. Department of Transportation for the extension of the existing Metromover system. In May 1978, the Urban Mass Transportation Administration (UMTA) approved funds for the engineering of the Metromover system under the federally sponsored downtown people mover program. By 1979, a Metromover system alignment had been developed. The project was then separated into two parts. Final design for the initial 3.06-km (1.9-mi) core area loop, including nine stations, was started immediately. The core area loop became operational in April 1986. The remaining segment consisted of two extension legs serving the Omni and Brickell business areas north and south of the core loop. Each extension has six stations. On May 27, 1994, the Omni and Brickell extensions to the Metromover system began operation. Figure 1 details the guideway alignment and station locations for the entire Metromover system.

The Metromover system, including the two extensions, is proposed to continue to operate revenue service during the same hours as the Metrorail system. The proposed span of service is from approximately 5:30 a.m. to midnight daily.

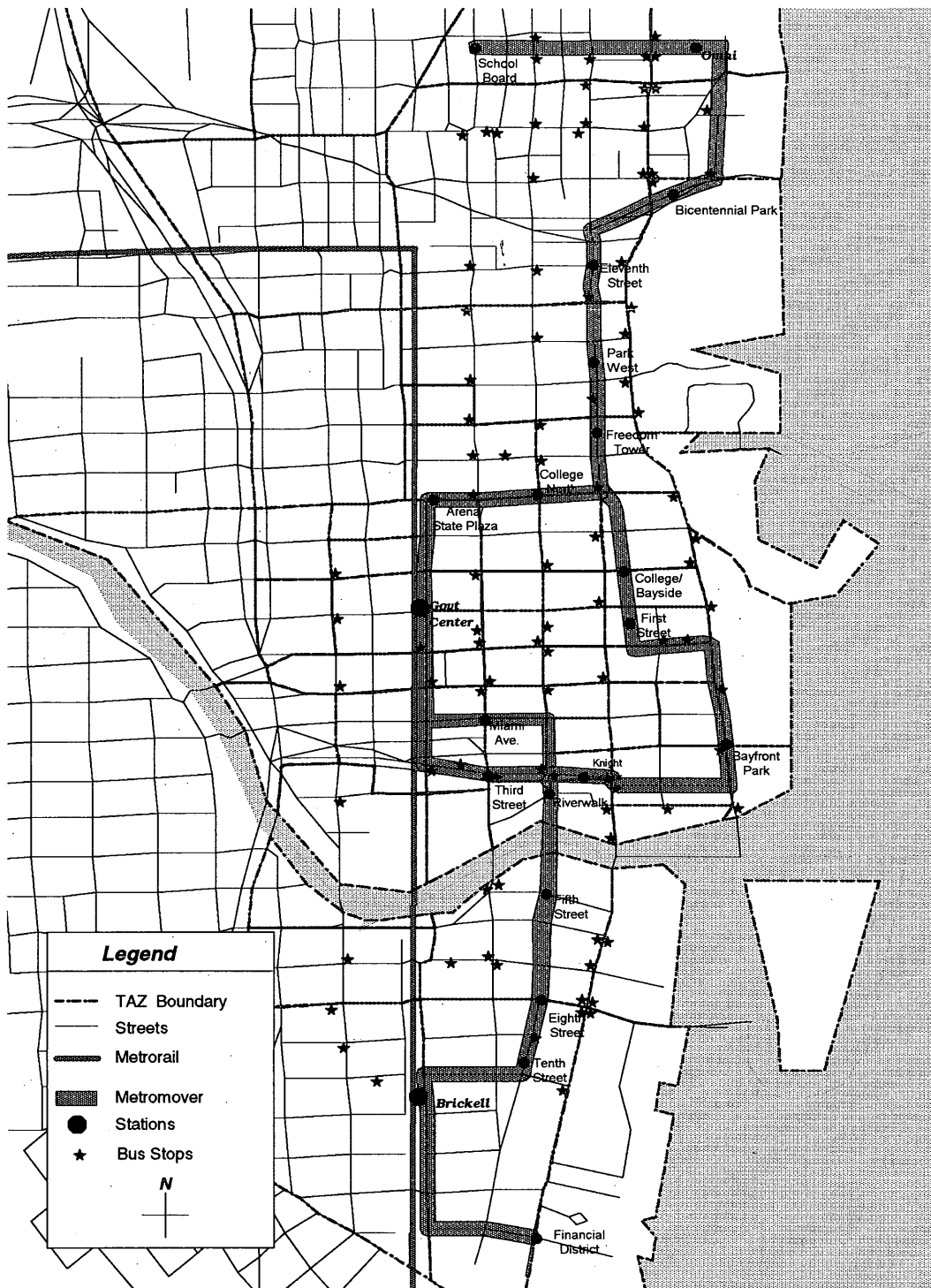


FIGURE 1 Miami CBD.

The existing Metromover system operates an outer loop in a counterclockwise direction and an inner loop in a clockwise direction. The two extension legs use the outer loop portion of the existing system. The Omni extension, starting at the School Board Station, travels through the five remaining extension stations and enters the outer loop at the College North Station. The Omni route then follows the outer loop of the core system, exits the core loop

after serving the College/Bayside Station, and travels north back to the School Board Station. The total Omni outer loop round trip travel time is approximately 27 min.

The Brickell extension, starting at the Financial District Station, traverses through the five remaining extension stations and enters the outer loop of the core system at the Knight Center Station. The Brickell route then continues counterclockwise around the outer

loop and returns to the Brickell extension after serving the Third Street Station. The total round trip running time for the Brickell outer loop is approximately 24.5 min.

The inner loop routing of the core system is not affected by the two extension legs. The inner loop service operates with a 2.2-min headway in the a.m. (7:00 to 9:30 a.m.) and p.m. (3:30 to 7:00 p.m.) peak periods, and a 2.7- to 3.6-min headway at other times. Each extension leg operates on a 3.4-min headway during the a.m. and p.m. peak periods. Service in the midday period (9:30 a.m. to 3:30 p.m.) operates on a 4.2-min headway, whereas service before 7:00 a.m. and after 7:00 p.m. operates on a 5.8-min headway. The combined headway on the outer loop is 1.7 min in the a.m. and p.m. peak periods and 2.1 min in the midday peak period.

The original FEIS plans for the Metromover extensions recommended that all CBD-oriented bus routes that operate in proximity to the Omni and Brickell Metromover stations be truncated at those locations, requiring a transfer to the Metromover system for completion of a trip into the core of the CBD. As a result, bus transfer facilities have been constructed at both of these stations. According to the original plans, the Metromover would become the major collector and distributor for Metrobus routes serving the CBD, as it currently functions for the Metrorail (heavy rail) service.

## CBD METROBUS AND METROMOVER SERVICE

There are currently 21 Metrobus routes serving the Miami CBD. For the purpose of this study, the CBD is defined as the area within 0.40 km (1/4 mi) of the existing Metromover and the Omni and Brickell extensions. Of the 21 routes, 11 fall within the Omni extension corridor, 4 are within the Brickell extension corridor, and 5 enter the CBD from the west. One express bus route has multiple branches and enters the CBD from each of the three corridors. Two routes serve both extensions and are shown in Table 1 under their primary entry corridor.

Table 1 presents the current weekday bus route service levels, including hours of operation and bus trips and screen-line passenger counts by time period for the routes serving the Omni and Brickell corridors. The span of service in the CBD begins as early as 4:39 a.m. and runs as late as 2:14 a.m. Frequency of bus service by route within the CBD ranges from a high of 40 inbound and 40 outbound trips in the midday on Route S, to a low of only one trip in the a.m. peak period on Route 6.

As presented in Figure 1, there are approximately 100 bus stop locations in the Miami CBD and Omni and Brickell downtown corridor areas. In the core of the CBD, most bus routes use the downtown bus terminal at SW 1st Street and SW 1st Avenue across from the federal building as their major destination and transfer point, with the major transfer location in the CBD for other routes in close proximity to the downtown terminal.

## CBD Metrobus Ridership and Travel Times by Route

Table 1 also presents the results of an MDTA screen-line count of ridership into the CBD from both the Omni and Brickell areas performed in the Spring of 1993. Weekday ridership for the Omni and Brickell corridor routes during the three time periods surveyed totaled 25,003 riders. Ridership by time period ranged from a high of 1,435 on the inbound midday Route S to a low of 20 riders on the inbound a.m. Route 48. The Omni corridor bus routes carried approximately three times as many riders as the Brickell corridor routes.

Table 2 shows average bus travel times by time period along each path within the Omni and Brickell corridors into downtown. This information was derived from actual running times. There are three inbound and three outbound bus travel paths within the CBD for the Omni corridor routes. The Brickell corridor routes travel into and out of the CBD on four different paths. Note that a significant portion of each of the paths is shared with other paths, particularly within the core area of the CBD leading up to the CBD terminal and adjacent stops.

Bus travel times from the Omni Metromover Station area range from a low of 7 min for p.m. outbound service on Routes 9 and 10 to a high of 13 min in the midday period for outbound Routes K and T. Bus travel times from the Brickell Metromover Station range from a low of 5 min for outbound Route 8 in all three time periods to a high of 16 min for Route 8 in the inbound direction of the a.m. and p.m. peak periods. Travel times vary not only because of differing traffic conditions by time period and direction of travel, but also because of the directness of the routings. Some routes loop through the CBD before arriving at or after leaving the downtown terminal.

## Downtown Miami Metrobus User Survey

In December 1993, Center for Urban Transportation Research (CUTR) and MDTA staff conducted a survey of Omni and Brickell corridor bus riders. Surveys were distributed during the a.m. (6:00 a.m. to 9:59 a.m.), midday (10:00 a.m. to 2:59 p.m.), and p.m. (3:00 p.m. to 6:59 p.m.) periods. Different survey forms were used for trips into and out of downtown.

The surveys were randomly distributed on all routes during all time periods and in both directions of travel. Surveyors boarded a bus at random at the Omni or Brickell location and handed out questionnaires to all passengers. In most cases, the surveyor remained on the bus for its outbound trip and continued distributing surveys to all passengers until reaching the Omni or Brickell locations. The surveyors then boarded the next inbound bus and continued the process.

Survey responses were weighted according to the screen-line ridership counts by route, direction, and time of day (see Table 1). The weighted survey frequencies for the three time periods total 25,003 trips.

As shown in Figure 2, 42 percent of the Omni and Brickell corridor bus riders paid their fare in cash, and 27 percent used a Metropass. Twenty-five percent of the passengers paid a discounted fare. According to the on-board survey performed for the entire Metrobus system in 1993, 65 percent of bus passengers pay by cash, and only 14 percent use a monthly Metropass. Therefore, CBD-oriented bus passengers are twice as likely to use a Metropass in comparison with systemwide Metrobus passengers. Passengers traveling to the CBD may have more regular travel patterns related to the work commute than other passengers, making purchase of a Metropass more feasible.

Altogether, 53 percent of downtown Metrobus riders transferred to or from another bus, Metrorail, or Metromover, whereas 44 percent walked to or from the bus. Among the individual categories shown in Figure 2, the most common responses were a transfer to or from another bus (34 percent) and a short walk (34 percent).

Passengers were asked whether they would transfer to or from the new Metromover extensions to complete their trip if the Metromover reduced travel time or if the transfer was free. Figure 2 shows that 77 percent stated they would use the Metromover if it saved time, whereas 67 percent would use Metromover if the transfer was

TABLE 1 Weekday Bus Route Service and Ridership Levels (Omni and Brickell Corridor Routes)

		Weekday Bus Trips			Avg Weekday Ridership
Route	Span of Service	AM (6-10am)	Midday (10am-3pm)	PM (3-7pm)	
OMNI CORRIDOR					
3	4:45am - 1:17am				
inbound		12	15	12	1,221
outbound		12	15	12	1,412
9	4:41am - 11:58pm				
inbound		14	7	14	525
outbound		14	7	14	653
10	5:09am - 12:27am				
inbound		6	9	6	416
outbound		7	8	6	395
16	5:08am - 11:15pm				
inbound		12	15	12	998
outbound		12	15	12	957
C	4:52am - 12:51am				
inbound		12	15	12	934
outbound		12	15	12	605
K	5:08am - 11:25pm				
inbound		12	15	13	961
outbound		12	15	12	587
M	5:39am - 11:24pm				
inbound		8	10	8	600
outbound		8	10	8	244
S (1)	4:51am - 2:14am				
inbound		30	40	32	3,055
outbound		30	40	32	2,471
T	4:52am - 10:08pm				
inbound		11	10	12	858
outbound		11	10	12	674
93	6:00am - 7:08pm				
inbound		11	1	16	740
outbound		15	4	13	596
Total					18,902
BRICKELL CORRIDOR					
8	4:39am - 12:48am				
inbound		28	20	31	1,338
outbound		28	20	31	1,720
24	4:40am - 12:40am				
inbound		16	20	14	819
outbound		16	20	14	1,055
48	5:06am - 8:31pm				
inbound		4	5	3	142
outbound		4	5	3	186
B	5:50am - 8:43pm				
inbound		9	7	10	388
outbound		10	9	9	453
Total					6,101

Source: MDTA 11-07-93 Schedules; Spring 1993 Survey.

free. It should be noted that survey respondents generally overstate their intentions to change their behavior when answering "stated preference" questions. Nevertheless, it is interesting to note that travel time savings induce a greater willingness to use Metromover than a free transfer.

Approximately 15 percent of the survey respondents answered Question 7, which asked riders to specify on a map provided on the back of the survey their final destination or the origin of their trip in downtown Miami. These results were then coded by traffic analysis zone (TAZ).

The most common origin and destination zones were Zones 640 and 644. The Metro-Dade Cultural Center, which contains the main county library, is located in Zone 640. Other high-frequency desti-

nations and origins are in or adjacent to a corridor bounded by East Flagler Street and SE 1st Street.

## IMPACTS OF BUS ROUTE TRUNCATION

### Downtown Miami Metrobus Transfer Analysis

In January 1994, MDTA collected transfers from operators of CBD-oriented bus routes. Between 30,000 and 40,000 transfers were collected. Nearly 15,000 transfers occurred between the CBD-oriented routes, as well as between these routes and Metro-rail. There were 10,320 bus-to-bus transfers. The greatest number

**TABLE 2 Weekday Bus Route Travel Times (Omni and Brickell Corridor Routes)**

Path from Omni/Brickell Station Area	Route Number(s)	Minutes		
		AM (6-10am)	Midday (10-3pm)	PM (3-7pm)
OMNI CORRIDOR				
Inbound from Omni Station area to Biscayne Blvd to Flagler St to CBD Terminal.	3, 16, 93X C, M, S	10	12	12
Inbound from Omni Station area (NE 2nd Ave and NE 14th St) to NE 1st St to SW/NW 1st Ave (CBD Terminal).	9, 10	8	11	10
Inbound from Omni Station area to NE 2nd Ave to Flagler St to SW/NW 1st Ave (CBD Terminal).	K, T	9	12	11
Outbound from CBD Terminal to SW/SE 1st St to Biscayne Blvd to Omni Station area.	3, 16, 93X C, M, S	10	10	10
Outbound from CBD Terminal to SW/SE 1st St to NE 1st Ave to NE 14th St.	9, 10	8	12	7
Outbound from CBD Terminal to SW/SE 1st St to NE 1st Ave to NE 14th St to Omni Station area.	K, T	9	13	8
BRICKELL CORRIDOR				
Inbound from Brickell Station to SW 8th St to S. Miami Ave to SE 4th St to NE 1st Ave to NE 6th St to Miami Ave to Flagler St.	8	16	15	16
Inbound from Brickell Station area (SW 13th St and SW 2nd Ave) along SW 13th St to Brickell Ave to SE 4th St to SE 3rd Ave to SE 2nd St to SW 1st Ave to SW/SE 1st St.	24	12	14	12
Inbound from SE 13th St and Brickell Ave along Brickell Ave to SE 4th St to SE 3rd Ave to SE 2nd St to SW 1st Ave to SW/SE 1st St.	48	10	10	10
Inbound from Brickell Station area along SW 1st Ave to SW 13th St to Brickell Ave to SE 4th St to SE 3rd Ave to SE 2nd St to SW 1st Ave to SW/SE 1st St.	B	13	11	9
Outbound from Miami Ave and Flagler St along Miami Ave to SW 1st Ave to Brickell Station.	8	5	5	5
Outbound from SW/SE 1st St and SW 1st Ave along SW/SE 1st St to SE 2nd Ave to Brickell Ave to SW 13th St to SW 2nd Ave.	24	7	10	11
Outbound from SW/SE 1st St and SW 1st Ave along SW/SE 1st St to SE 2nd Ave to Brickell Ave to SW 13th St.	48	7	7	8
Outbound from SW/SE 1st St and SW 1st Ave along SW/SE 1st St to SE 2nd Ave to Brickell Ave to SW 13th St to SW 2nd Ave to SW 11th St to SW 1st Ave and into the Brickell Station.	B	11	11	9

Source: Section 15 Ridechecks, 1993-94; 11-07-93 Rotary Schedules. (Note that Routes 24, 48, and B travel times and paths are prior to temporary rerouting for Brickell Bridge reconstruction.)

of transfers was from Metrorail (2,318), and the second greatest was from Route S (1,788).

There were 1,419 transfers occurring from an Omni bus route to a Brickell bus route. This represents 13.8 percent of the total CBD bus-to-bus transfers reported. The highest volume of transfer activity through the CBD from Omni routes to Brickell routes occurs from Routes S to 8, 3 to 8, and S to 24. There were 1,925 transfers from Omni routes to a westbound route, representing 18.7 percent of the total bus-to-bus transfers in the CBD.

There were 2,331 transfers occurring from a Brickell route to an Omni route. This represented 22.6 percent of the total CBD bus-to-bus transfers. The highest volume of transfers from Brickell routes to Omni routes occurred from Routes 8 to S and from 24 to S. A

total of 263 transfers occurred from a Brickell route to a westbound route, representing only 2.3 percent of the total reported CBD bus-to-bus transfers.

The transfer analysis suggests that significant numbers of transferring bus riders would be affected by route truncation. These riders would have additional transfers (bus to Metromover to Metromover to bus, as opposed to the current bus to bus).

### Station Capacity

The Omni bus terminal adjacent to the Omni Metromover Station opened in May 1994. The terminal consists of 10 sawtooth bus bays

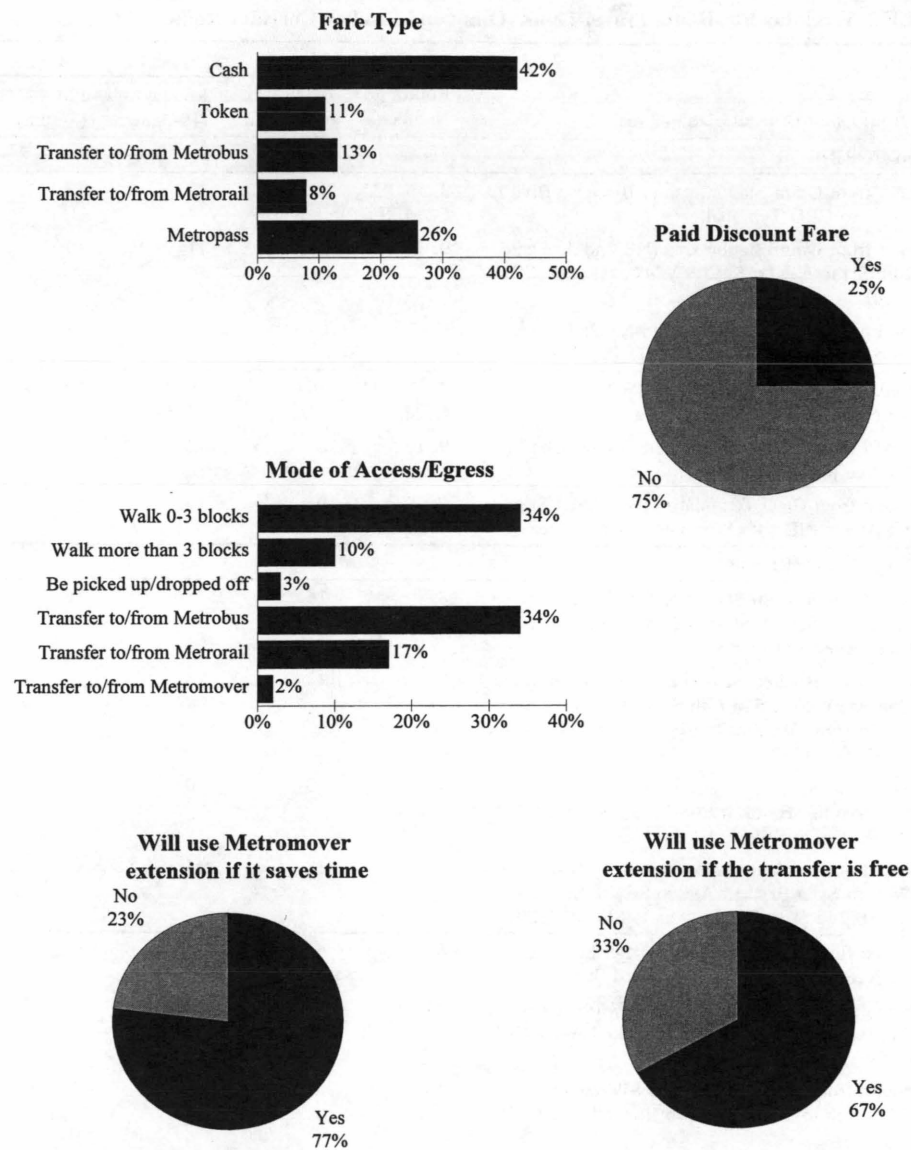


FIGURE 2 Downtown Miami Metrobus user survey.

surrounding an island with shelters and benches. This facility also includes restrooms for the drivers and a public information booth. Passengers must cross a bus-only roadway inside the terminal to enter the Omni Metromover Station.

Table 3 presents the weekday bus route volumes for the Omni and Brickell corridor routes that will directly serve the stations during the a.m., midday, and p.m. periods. If no routes are truncated, there would be a total of 919 bus trips into the Omni bus terminal in the three time periods combined. As bus routes are truncated, only the outbound trips entering the terminal would be eliminated. The highest number of bus trips (85) occurs in the p.m. peak hour. This number represents 8.5 buses per bus bay in the p.m. peak hour, or one bus entering a bus bay approximately every 7 min.

If all the corridor routes were truncated, then only the 459 inbound bus trips would come through the bus terminal, with a high of only 42 buses per hour in the p.m. peak hour. This number represents 4.2 buses per bus bay in the peak hour, or one bus entering

a bus bay approximately every 14 min. This number appears reasonable for 10 bus bays.

With 12 routes scheduled to use the Omni bus terminal, the following issues were identified as essential to effective operation until major route truncation occurs.

- Proper signage is needed to distinguish between inbound and outbound bus routes.
- Layover or recovery time could interfere with the productive use of the bus bay. The on-street bay on 15th Street has been designated for layover buses. MDTA's schedule policy of minimizing layover time in the CBD ameliorates this potential problem.
- Procedures for the *quick removal of a broken-down bus* must be developed to avoid affecting the flow of buses in the terminal.

Although some Metrobus passengers whose destination is immediately to the south of the Omni terminal may elect to walk to their

TABLE 3 Weekday Bus Route Service Levels (Omni and Brickell Corridor Routes)

Route	Weekday Bus Trips <sup>a</sup>					
	AM (6:00am-9:59am)		Midday (10:00am-2:59pm)		PM (3:00pm-6:59pm)	
	Total	Peak Hour	Total	Peak Hour	Total	Peak Hour
<b>OMNI CORRIDOR</b>						
CBD Routes						
inbound	129	35	142	28	140	36
outbound	134	36	144	27	135	37
Through Routes (Routes F, Flagler Max)						
inbound	20	6	8	1	20	6
outbound	19	7	8	2	20	6
Total						
inbound	149	41	150	29	160	42
outbound	153	43	152	29	155	43
Total (in & outbound)	302	84	302	58	315	85
<b>BRICKELL CORRIDOR</b>						
CBD Routes						
inbound	57	16	52	11	58	16
outbound	58	16	54	10	57	16
Total (in & outbound)	115	32	106	21	115	32

<sup>a</sup>Peak hour for each time period is 7:30am-8:30am; 12:00pm-1:00pm; and 4:30pm-5:30pm.

Source: MDTA 11-07-93 Rotary Schedules.

destination if Omni corridor bus routes are truncated, approximately 1,000 passengers per hour are expected to transfer to the Metro-mover in the a.m. peak period. The anticipated level of service for the Omni leg of the Metromover is a 3.4-min headway operating with single-car trains with a crush-load capacity of 96 passengers per car. The projected 1,000 passengers per hour, therefore, correlates to 57 passengers per train. This represents a load factor of 59 percent of crush load for each train. This is an average for the a.m. peak period; the peak hour load factor will be higher. The Metromover system is capable of running two-car trains should ridership warrant the extra service.

The Brickell bus staging area consists of five sawtooth bus bays located on SW 1st Avenue adjacent to the east side of the Brickell Metrorail Station. The Brickell Metromover Station is approximately 122 m (400 ft) south of the bus bays. The on-street bus bays do not have bus shelters or seats.

As shown in Table 3, if no Brickell corridor routes are truncated at the Brickell Metromover Station there will be a total of 336 bus trips into the on-street bus bays in the three peak periods combined. The highest average peak hour number of bus trips is 32, which occurs in both the a.m. and p.m. peak periods. This number represents 6.4 buses per hour per bus bay, or approximately one bus using a bus bay every 9.5 min. The current five bus bays should have no problem handling the current level of service, and on truncation of Brickell corridor bus routes they should be able to operate very efficiently.

A total of 239 Metrobus passengers per hour are expected to transfer to the Metromover in the midday period. The anticipated level of service for the Brickell leg of the Metromover is a 3.4-min headway operating with single-car trains. Based on a Metromover crush-load car capacity of 96 passengers, the 239 passengers per hour in the Midday correlates to 14 passengers per car or a load factor of 15 percent. The load factor for the single busiest hour in the midday period will be higher but well within the capacity of the Metromover system.

## Travel Time

The a.m. peak period inbound total travel times to the core CBD TAZs via Metrobus or Metromover were developed. The Metro-mover travel times are derived from computer simulation runs before the opening of the two extension legs. The Metrobus travel times are actual preopening times. All travel times include transfer time, wait time, and walk time. Wait time is equal to one-half of the headway time for the particular route or mode. The total travel times are to the centroid of a TAZ from either the nearest bus stop or Metromover station. Walk times were calculated using a speed of 4.0 km (2.5 mi) per hour. Many Metromover travel times included either a transfer to the other Metromover extension leg, or a transfer to the inner loop if such a transfer would result in a travel time savings. It is assumed that passengers traveling to the College/ Bay-side, First Street, or Bayfront Park stations from the Omni leg would transfer to the inner loop at the College North Station. Similarly, passengers traveling to the Miami Avenue or Government Center stations from the Brickell extension would transfer to the inner loop at the Knight Center Station.

In all but two TAZs of the Omni corridor and eight in the Brickell corridor, the total travel time for Metrobus is less than Metromover in travel to the zone centroid. The difference in travel time between Metrobus and Metromover is accounted for by the walk time from Metrobus to the station platform, the wait time for the next Metromover train, and the egress walk time to street level from the platform.

Table 4 presents the AM peak period through trip travel times for Metrobus passengers before the opening of the Metromover extensions. This information was taken from 1992-1993 MDTA Section 15 ride-check reports. For comparison with the Metromover through trip travel time, these times are in-bus travel time only and do not include the wait time in transferring from one route to another. Total travel time from the Omni terminal to the Brickell

TABLE 4 Morning Peak Period Travel Time via Bus (Current Conditions)

Route Numbers	Minutes				Total Travel Time
	Omni to CBD Terminal	CBD Terminal to Brickell <sup>a</sup>	Brickell to CBD Terminal Area	CBD Terminal Area to Omni <sup>b</sup>	
3, 16, 93X, C, M, S	10	7	-	-	17
9, 10	8	7	-	-	15
K, T	9	7	-	-	16
8	-	-	16	9	25
24	-	-	12	9	21
48	-	-	10	9	19
B	-	-	13	9	22
Transferring from western routes	-	7	-	-	7
2, 7, 11, 21, 77	-	-	-	9	9

<sup>a</sup>Average AM peak period outbound travel time for Brickell corridor routes.

<sup>b</sup>Average AM peak period outbound travel time for Omni corridor routes.

(Note that, for comparison to Mover travel times presented in Table 5, neither table contains wait time for transfer to bus.)

terminal ranges from 15 to 17 min. Total travel time from the Brickell bus stop area to the Omni terminal ranges from 19 to 25 min. As noted in the table, the travel time from the CBD terminal to Omni or Brickell represents an average for the routes serving those corridors in an outbound direction. Table 4 is derived from information presented previously in Table 2.

Table 5 presents the a.m. peak period through trip travel time via the Metromover system. Total travel time is presented for the six possible bus and Metromover trip paths. Travel times range from a low of 16.8 min for the trips from the Omni terminal to the CBD bus terminal and from the CBD bus terminal to the Brickell bus stop, to a high of 26.4 min from the Brickell bus stop to the Omni

TABLE 5 Morning Peak Period Travel Time via Metromover

Trip Path	Minutes				Mover to Mover Transfer Time	Mover Travel Time	Walk Time to Bus	Total Travel Time
	Walk Time to Mover	Wait Time for Mover	Mover Travel Time	Walk Time to Bus				
OMNI BUS TO CBD BUS (Bus to Omni Mover to Government Center to CBD Bus Terminal)	2.0	1.7	9.1	4.0	n/a	n/a	n/a	16.8
OMNI BUS TO BRICKELL BUS (Bus to Omni Mover to Third St Station to Brickell Mover to Brickell to Bus)	2.0	1.7	11.2	n/a	1.7	5.7	4.0	26.3
BRICKELL BUS TO CBD BUS (Bus to Brickell Mover to Knight Center Station to Inner Loop to Government Center to Bus)	4.0	1.7	5.6	n/a	1.1	3.1	4.0	19.5
BRICKELL BUS TO OMNI BUS (Bus to Brickell Mover to College Station to Omni Mover to Omni to Bus)	4.0	1.7	10.0	n/a	1.7	7.0	2.0	26.4
CBD BUS TO BRICKELL BUS (Bus to CBD Bus Terminal to Government Center to Mover to Brickell Mover to Brickell Bus Stop)	4.0	1.7	7.6	4.0	n/a	n/a	n/a	17.3
CBD BUS TO OMNI BUS (Bus to CBD Bus Terminal to Government Center to Inner Loop to College/Bayside Station to Omni Mover to Omni to Bus)	4.0	1.1	3.2	n/a	1.7	7.2	2.0	19.2
(Metromover to Metrorail)	Minutes							Total Travel Time
	Walk Time to Mover	Wait Time for Mover	Mover Travel Time	Walk Time to Metrorail				
OMNI BUS TO METRORAIL (Bus to Omni Mover to Government Center to Metrorail)	2.0	1.7	9.1	1.0				13.8



TABLE 6 Morning Peak Period Travel Time Comparisons (Bus/Metromover Extensions)

Trip Path	Minutes		
	Mover Only	Bus Only	Difference
Omni Bus Terminal to Government Center			
- Routes 3, 16, 93X, C, M, S	13.8	13	+0.8
- Routes 9, 10	13.8	11	+2.8
- Routes K, T	13.8	12	+1.8
Omni Bus Terminal to Brickell Bus Terminal			
- Routes 3, 16, 93X, C, M, S	26.2	17	+9.2
- Routes 9, 10	26.2	15	+11.2
- Routes K, T	26.2	16	+10.2
Brickell Bus Bays to Government Center			
- 8	16.2	14 <sup>a</sup>	+2.2
- 24	16.2	15	+1.2
- 48	16.2	13	+3.2
- B	16.2	16	+0.2
Brickell Bus Bays to Omni Bus Terminal			
- 8	25.9	25	+0.9
- 24	25.9	21	+4.9
- 48	25.9	19	+6.9
- B	25.9	22	+3.9

<sup>a</sup>Assumes riders on Route 8 would walk to Government Center from NE 1st Avenue and 1st Street instead of travelling loop to bus terminal.

(Note that this analysis assumes a one minute walk time from the Mover to the ground floor of Government Center and a three minute walk time from the CBD bus terminal to the ground floor of Government Center.)

bus terminal. Also presented in Table 5 is the Metromover to Metro-rail total travel time from the Omni bus terminal to the Government Center Metrorail Station. Total travel time for this trip is projected to be 13.8 min in the a.m. peak period.

Table 6 is a comparison of the Metrobus and Metromover travel times presented in the two previous tables. For comparison, the trip path destined to the CBD assumes the passenger is going to the Government Center. As shown in this table, the Metrobus total trip times are less than the Metromover by 0.2 to 11.2 min. This does not imply that the Metrobus is a faster mode in terms of average speed, only that the total trip times, which include the walk and wait times associated in transferring from bus to Metromover, create an overall longer travel time by Metromover. A patron traveling from Omni to Government Center to transfer to Metrorail can make the trip by Metromover in approximately the same time as by bus.

Given the variations in the bus travel times, and the number of assumptions required for an analysis of this type, a difference of under 2 min is considered marginal.

## RECOMMENDATIONS

Based on the information presented in this paper, the following recommendations are offered about the issue of Metrobus route truncation related to the opening of the Metromover extensions.

### Truncation of Metrobus Service

The FEIS document for the Metromover project assumed the truncation of Metrobus service before entering the CBD. In this

scenario, the Metromover system would be the distributor for Metrobus riders, similar to its current function for Metrorail riders. To lessen the impact of truncating all Metrobus service at once, it is recommended that the service truncations be phased in over an approximate 2-year period after the opening of the Metromover extensions in May 1994.

Table 7 presents a process for setting priorities for the Omni and Brickell corridor bus routes for truncation. Routes are prioritized only within the specific corridor. Factors considered in the prioritization process include total daily ridership, percentage of patrons who are over 65 years old or who have a physical disability, transfers, and difference in travel time between Metromover and bus. Although no single measure is specifically weighted to give it more importance, three measures include transfer activity and two measures include travel time comparisons. Routes were ranked from 1 to 10 (1 to 4 for Brickell corridor routes), and an average ranking was derived from these scores.

As can be seen from Table 7, Routes M, 16, and 93X (Biscayne Max) are ranked in the top third for route truncation in the Omni corridor. Route 48 ranks the highest in the Brickell corridor and Route B the second highest.

Aside from the technical process of ranking the routes for truncation, another factor to be considered in setting priorities for the routes is whether there is other bus service on this particular alignment into the CBD. Initially, this is not an issue for the top three Omni corridor routes or the top two Brickell corridor routes recommended for truncation.

Regarding the issue of whether to truncate all of the Omni and Brickell corridor routes as assumed in the FEIS, it is recommended that MDTA monitor the bus and mover ridership into the CBD and transfer activity after the first phase of truncations to determine the

TABLE 7 Priority Ranking of Route Truncation (Omni and Brickell Corridor Routes)

											AM Peak Period Change in Average Travel Time To Government Center, Mover vs. Bus					Final Priority Ranking
Total Weekday Riders				Percent of Transfers from Omni/Brickell Buses												
Route	To/From CBD <sup>a</sup>	Rank	% Seniors or Disabled <sup>b</sup>	Rank	To West- bound Bus	Rank	Between Buses	Rank	To Metrorail	Rank	In-vehicle minutes <sup>c</sup>	Rank	Passenger minutes <sup>d</sup>	Rank		
OMNI CORRIDOR																
3	2,896	9	10%	3	1%	1	9%	8	6%	10	0.8	1	346	4	6	
9	1,296	3	13%	7	3%	7	9%	8	18%	1	2.8	9	963	10	10	
10	892	1	10%	3	3%	7	4%	1	16%	2	2.8	9	638	7	4	
16	2,151	8	7%	1	3%	7	5%	2	8%	5	0.8	1	339	3	3	
C	1,693	6	13%	7	2%	3	11%	10	9%	4	0.8	1	246	2	5	
K	1,703	7	12%	5	2%	3	8%	6	8%	5	1.8	7	706	8	8	
M	928	2	13%	7	1%	1	7%	4	7%	7	0.8	1	176	1	1	
S	6,079	10	18%	10	2%	3	5%	2	7%	7	0.8	1	637	6	7	
T	1,685	5	12%	5	2%	3	8%	6	7%	7	1.8	7	770	9	9	
93X	1,336	4	8%	2	3%	7	7%	4	12%	3	0.8	1	390	5	2	
BRICKELL CORRIDOR																
8	3,364	4	14%	3	3%	1	15%	3	10%	1	2.2	3	950	4	3	
24	2,061	3	13%	1	5%	4	16%	4	1%	3	1.2	2	317	3	4	
48	361	1	13%	1	3%	1	8%	1	3%	2	3.2	4	64	2	1	
B	925	2	16%	4	4%	3	13%	2	1%	3	0.2	1	21	1	2	

<sup>a</sup>Ridership by route from screenline counts for AM, Midday, and PM peak periods, factored up 10 percent for total weekday ridership.

<sup>b</sup>From the 1993 Metrobus On-Board Survey.

<sup>c</sup>Assumes average rider from Omni or Brickell travels to Government Center.

<sup>d</sup>Weighted by multiplying the difference in Mover/Bus "travel time" by total inbound AM peak period ridership.

extent to which patrons of the truncated routes are transferring to the Metromover or to another bus destined to the CBD, and also whether patrons of nontruncated routes are transferring to the Metromover.

Based on the travel behavior of bus and Metromover riders and other efficiency considerations, the decision about which additional routes to truncate can be made at that time.

It is recommended that any service kilometers truncated as a result of the Metromover extensions be put back into Metrobus service. This will improve bus service outside the CBD, reducing headways and decreasing a patron's total travel time. This can help to offset both the added travel time and the inconvenience of transferring to the Metromover at the Omni and Brickell stations.

Currently 10 of the 15 Metrobus routes analyzed operate service into or out of the CBD earlier or later than the proposed operating hours (5:30 a.m. to midnight) for the Metromover system. It is recommended that Metromover's hours of operation be revised to reflect the extended hours of the Metrobus service. If this is not possible, then arrangements must be made to operate these routes into the CBD during the late night and early morning hours.

The incremental approach to bus route truncation is appropriate for the Metromover extensions, given the inconvenience associated with an added transfer requirement and the travel time impacts. For a new light rail or heavy rail system, in which the length of the line-haul trip segment via fixed guideway can produce notable travel time savings, a major realignment of the bus network to feed the new rail line may be more sensible. The ultimate goal in Miami is

to have the Metromover function as the downtown distributor. Over the next several years, the prioritization scheme should allow MDTA to reach this goal in large measure without engendering community opposition.

## DISCUSSION OF PROJECT

Since the completion of the analysis presented in this paper, the Metromover extensions have opened for revenue service. During the first 6 months of operation, Metromover operated with a free fare and ridership averaged 18,500 riders per weekday, ranging between 14,000 and 21,000 riders. Since the recent initiation of the standard fare policy, which charges \$0.25 per trip, ridership has averaged 16,000 per weekday.

Before the opening of the Metromover extensions, public hearings were held in connection with the truncation of bus service into the CBD as recommended in this analysis. On review by the political bodies of Dade County, a decision was made to proceed with the truncation of only one route at that time.

CUTR followed up this original work with an analysis of travel behavior of the riders of the expanded Metromover system. The purposes of this second analysis were to (a) monitor the bus-to-Metromover, bus-to-bus, and Metromover-to-bus transfer activity at both the Omni and Brickell Metromover stations after the opening of the extensions; (b) survey bus and Metromover riders at the Omni and Brickell stations to analyze the impacts of the extension

openings, including transfers and station destination; and (c) continue to update, based on the previous information, the prioritization of Metrobus route truncation.

This report found that riders remaining on the Metrobus routes feeding the new Omni and Brickell station areas did not use the Metromover system because the Metrobus was closer to their origin or took them closer to their final destination in the Miami CBD. The second, related reason was that they perceived the Metromover to take longer for their trip time. A number of riders also indicated that they did not want to transfer. A short walk was the most typical mode of access and egress. Finally, most passengers on the bus routes were traveling to or originating from the Government Center area.

The respondents to the Omni and Brickell stations Metromover survey used the Metromover system because it saved them time and brought them closer to their destinations. Many respondents stated they rode the Metromover because it was more pleasant to ride. As with the bus system, the majority of respondents reported a short walk as their mode of access. Finally, although the Omni Metromover respondents were generally traveling to the Government Center area of the Miami CBD, the Brickell riders were generally only traveling one to three stops north on the Metromover before alighting.

Finally, on the basis of the information presented in the follow-up report, no changes were recommended to the bus route truncation prioritization process and established priorities. Data have shown the importance of travel time and the negative attitudes toward transferring, two major factors of the prioritization process. However, based on the number of patrons gaining access to the Metromover by Metrobus, it is obvious that Omni Metrobus users are much more likely to adjust to route truncation at the Omni Station because of the proximity of the Metromover platform, as opposed to the long walk from the bus stop to the Metromover platform at the Brickell Station. This was recommended as a consideration when choosing between Omni and Brickell Metrobus routes for truncation.

Survey results suggest that passengers are making rational decisions based on their origin or destination within the Miami CBD and their perception of travel times in choosing whether to use Metrobus or Metromover. The more pleasant ride offered by Metromover is a less important factor than convenience and travel time savings. Anecdotal evidence suggests that not all Metrobus riders are aware of the Metromover extensions as an alternative way of getting around downtown.

---

*Publication of this paper sponsored by Committee on Bus Transit Systems.*