APPENDIX 2

Direct Ridership Model

Includes:

December 21, 2012 Memorandum
February 26, 2013 Memorandum
July 19, 2013 Memorandum

FEHR PEERS

MEMORANDUM

Date: December 21, 2012

To: Tony Sylvester, MRCOG
Aaron Sussman, MRCOG

FROM: Nick VanderKwaak, Fehr & Peers
David Millar, Fehr & Peers

Subject: Ridership Estimates for Paseo del Norte BRT Alternatives

DN11-0307

INTRODUCTION

The purpose of the Paseo Del Norte High Capacity Transit Study is to complete an Alternatives Analysis (AA) of the heavily congested Paseo del Norte corridor that links Northwest Albuquerque/ Southern Sandoval County and activity centers in the Albuquerque metropolitan area. The goal is to produce a locally preferred alternative for a high capacity transportation system.

One of the evaluators for each alternative is ridership. Based on a direct ridership modeling approach previously used on similar projects, Fehr & Peers has completed the initial opening day and 2035 ridership forecasts for the identified alternatives on the Paseo del Norte corridor. Fehr & Peers has completed work in other regions in the United States using direct ridership models to forecast ridership on proposed routes. Staff in these regions, including Los Angeles and Salt Lake City, have reviewed and concurred with the process. Past research has found direct ridership modeling to be much more accurate than other available tools including regional travel demand models, particularly in evaluating stop and route level ridership for enhanced transit systems such as BRT, which are not always specifically coded in travel demand models.

1.0 DESCRIPTION OF METHOD

Traditional methods of forecasting transit ridership often employ regional travel demand models to predict ridership. Such models are relatively unresponsive to changes in station-level land use and transit service characteristics. In the case of Albuquerque, the large sizes of the traffic analysis zones in the metro travel demand model and the unproven ability to properly forecast transit travel patterns preclude detailed transit forecasting. In addition to poor transit travel forecasting, the regional travel demand model has not been tested or validated to forecast Bus Rapid Transit (BRT) ridership. Utilizing the travel demand model for forecasting BRT ridership would require calibration and validation of a new BRT mode of travel in the model in addition to calibration and validation of the existing bus and rail modes. Therefore, for the purposes of the

alternatives analysis (AA) study, the RMRTD travel demand model was not chosen for forecasting ridership on the BRT alternatives on the Paseo del Norte corridor. Instead, a direct ridership model was calibrated and validated to BRT for ridership forecasting. The regional travel demand will still be used in combination with the Direct Ridership Model to calculated overall travel demand between specific origins and destinations.

Direct Ridership Models (DRMs) are directly and quantitatively responsive to land use and transit service characteristics within the immediate vicinity and within the catchment area of transit stations. They can predict ridership at individual stations based on local station area and system characteristics. DRMs are based on empirical relationships found through statistical analysis of station ridership and local station characteristics.

The effects of station-level variables are expected to be highly significant in accurately forecasting BRT ridership. While BRT systems are used for traditional commute trips similar to other buses, our research with transit agencies suggests they provide a better level of service and better user experience than traditional buses. It was expected that individual station-area characteristics greatly affect boardings and overall ridership projections. Recognizing that variables affecting BRT ridership are different than those for regional transit systems, the basis for analysis draws from the characteristics of existing BRT and rapid ride systems in Eugene, Los Angles, Cleveland, Seattle, and the San Francisco Bay Area (AC Transit). These systems were chosen because they are most similar to the proposed Albuquerque BRT system. The model derived from these systems was calibrated to the Albuquerque context by creating an error adjustment equation which adjusts the results to account for trip making characteristics specific to Albuquerque.

1.1 DATA COLLECTION

Ridership data was collected from a variety of BRT and rapid ride systems throughout the country. Data from fully functioning BRT routes was collected from Eugene Emerald Express, LA Orange Line, and Cleveland Healthline BRT systems at the individual station level. In order to measure how varying levels of improvements affect ridership, data was also gathered from rapid ride systems which have varying levels of improvements over traditional bus systems. Data were gathered for rapid ride systems including AC Transit 72R, AC Transit 1R, LA Metro 720, LA Metro 754, LA Metro 761, Seattle Swift 70, and Seattle RapidRide A. Data were gathered for the area within a half mile[1] of the station and included Urban Density (Households + Employment), percent dedicated transit lane, auto transit speed differential, number of intersecting bus routes, daily feeder trains, park and ride spaces, college at the station, and poverty density. Table 1 shows the characteristics of the comparative systems. Table 2 shows data collected at the station area level.

[1] The BRT DRM treats all employment and households within a ½ mile walk equally and does not estimate a capture rate within the ½ walk that decreases by distance from the stop.

TABLE 1 Researched BRT Systems

System	Route Miles	Number of Stations	Daily Boardings	Daily Boardings per Mile
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TABLE 2 Station Level Data Collection

Variables	Definition
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Buses Per Day	Buses per day on the line stopping at the stop
Route Length	Route length, both directions (miles)
Feeder Bus Routes	Perpendicular bus routes with a transfer opportunity at the stop
Parallel Bus Routes	Parallel bus routes sharing the stop
Rapid Bus Routes	Rapid bus routes with a transfer opportunity at the stop
Feeder Rail Routes	Rail routes with a transfer opportunity at the stop
Daily Feeder Trains	Daily trains passing through the station
Residential Density	Household density within 1/2 mile of the stop (hh/acre, 2010 Census)
Employment Density	Employment density within 1/2 mile of the stop (jobs/acre, 2009 LEHD)
Urban Density	Households + total jobs within 1/2 mile of the stop (per acre, 2010 Census, 2009 LEHD)
Park And Ride	Number of park and ride spaces at the stop
Bus Only Lane	Binary variable indicating bus only lane at the stop (1=bus only lane, 0 otherwise)
Pct Transit Only Lane	Percent of route that has a transit only lane
Dist To Nearest Stop	Distance to nearest stop (feet)
College	Binary variable indicating a college is with 1/2 mile of the stop (1=college, 0 otherwise)
Diversity	Job housing diversity within 1/2 mile of the stop
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Variables	Definition
ACC Households	Accessibility to households along the line
ACC Employment	Accessibility to jobs along the line
Peak Frequency	Peak hour frequency (buses per hour)
Span	Daily hours of operation
Speed Ratio	Ratio of auto travel time to bus travel time along corridor

1.2 DIRECT RIDERSHIP FORECASTING

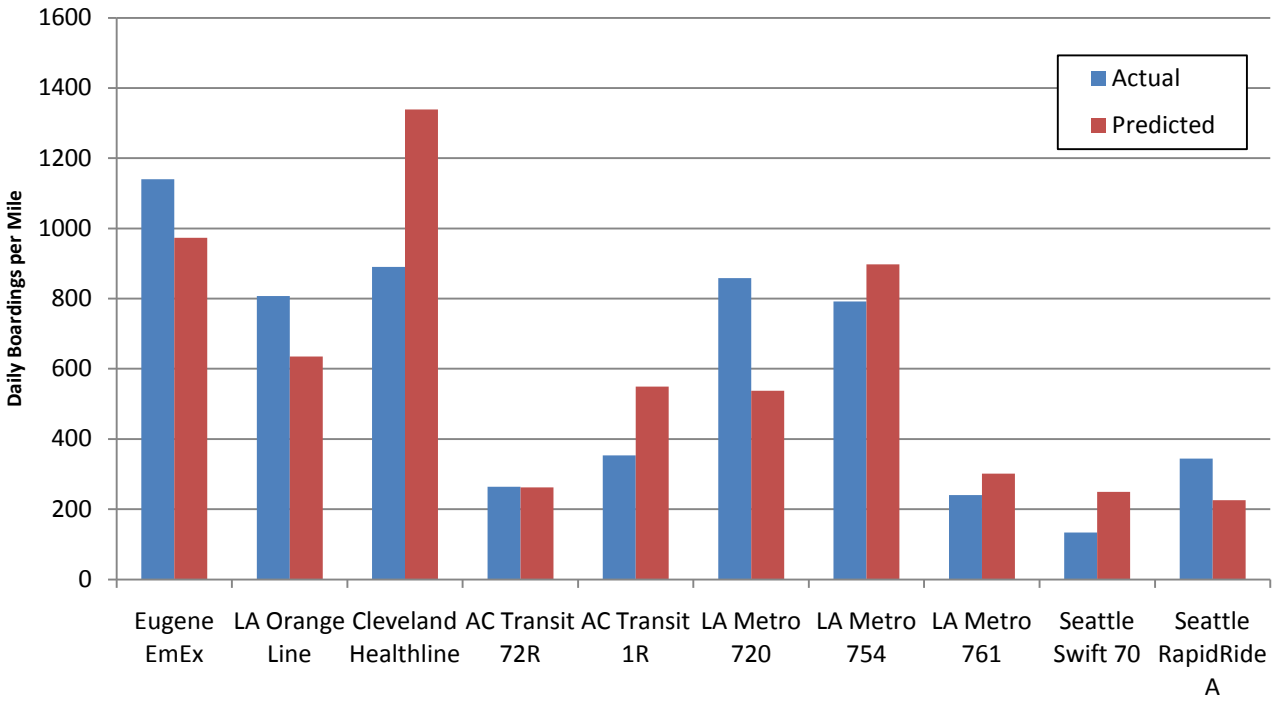
The station level data collected from the BRT and rapid ride systems were used to perform ordinary least squares (OLS) regression analysis to predict daily boardings per station. This analysis is based on empirical relationships found through statistical analysis of station ridership and local station characteristics. Multiple iterations of all collected data were tested in the regression model, but the variables that entered into the direct ridership forecasting (DRF) model as significant were the following:

- *Urban Density* – a measure of employment intensity and residential density of the station area
- *Number of Feeder Trains* – a measure of the magnitude of regional transit connections
- *Percent dedicated transit lane* – this variable is a measure of the percent of the entire route that has dedicated transit lanes
- *Auto transit speed differential* – this is a measure in miles per hour of the average speed difference between an auto and transit vehicle traveling from the beginning of the route to the end of the route
- *Park and ride spaces* – This is a measure of the number of parking spaces located at each station
- *College* – this is a binary variable representing if a college exists at the station area
- *Poverty density* – this is a measure of the percentage of people living in a station area who are below the poverty level
- *Number of Feeder Bus Routes* – this is a measure of how many bus routes intersect the stop location

The R^2 value of the model is 0.52 which represents a fairly high goodness of fit. One of the limits to the model is the limited number of built BRT systems in the US and thus limited data availability. Although intuitively more variables than those included in the model influence ridership, due to the limited data availability statistically significant relationships were unable to be distinguished between all variables. That being said, significant relationships were found between boardings and several station level variables in order to create a statistically significant model with a good fit.

For each of the BRT and rapid rides systems where data was collected, the ridership model was applied to test how well it predicts ridership on the routes. A graphical depiction of the results is shown in below.

Evaluated Systems Actual Boardings vs Predicted Boardings



Overall the model was a fairly good predictor of ridership on the systems. In some systems, the predicted boardings per mile and actual boardings per mile were different due to variables not being explained by the model. For these specific lines, a calibration to regional conditions could help refine and explain more of the variation.

Data for each of the significant variables were collected for each potential stop along the various alternatives for the Paseo del Norte BRT line. These variables were used to predict daily boardings at each station and were summed for each configuration to estimate daily boardings along the line. The expected system boardings are summarized in Section 3.0.

1.2.1 Urban Density

Urban density is a sum of employment and households within ½ mile of the station. Stations along the proposed alternatives have either high household density or high employment density, but few have both. The areas with the highest household density include Southern & Unser, Northwest Transit Center, Unser & McMahon, PDN & Eagle Ranch, and Central & Yale. The areas with the highest employment density are in the Journal Center, UNMH, and Central & Yale.

1.2.2 Number of Feeder Trains

Number of feeder trains is the daily number of trains on intersecting rail lines with a transfer to a BRT stop. The New Mexico Rail Runner would have a transfer to the proposed BRT line within all alternatives where it intersects Paseo del Norte.

1.2.3 Auto Transit Speed Differential

This is a measure in miles per hour of the average speed difference between an auto and transit vehicle traveling from the beginning of the route to the end of the route. The typical range in the observed systems was from 1 mph where transit is 1 mph slower than an auto traveling the same route to 8 mph where transit is on average 8 mph slower than an auto traveling the same route. This measurement applies to all stations on each route alternative as it is an average speed measurement.

1.2.4 Level of BRT Investment

This variable is a measure of the percent of the entire route that has dedicated transit lanes which is a proxy for the level of BRT investment. A higher percentage of dedicated transit lanes generally improves the time competitiveness of the BRT system which improves ridership, and systems with a high level of dedicated guideways typically have other BRT investments such as improved bus shelters and branding. This measurement applies to all stations on each route alternative as a route measurement.

1.2.5 Number of Feeder Bus Routes

This is a measure of how many bus routes intersect the stop location. An intersecting bus route provides an opportunity for transfers from other routes and indicates a certain level of transit activity that can stimulate ridership.

1.2.6 Number of Park and Ride Spaces

This is a measure of the number of parking spaces located at each station. This measurement allows the model to account for trip origins outside of the immediate station area that arrive to the BRT station via an automobile. Park and ride spaces can be official park and rides provided by the transit agency or they may be unofficial park and ride locations such as a big box parking lot or on street parking located near a BRT station.

In order to properly size Park and Rides at potential stations, the regional travel demand model was used to determine the total trip demand between the northwest side of the region and the Journal Center and UNM/CNM destinations. For University destinations, 10% of the total trip demand was used to size the Park and Ride lots as existing surveys on the blue line indicated a high level of Park and Ride usage between the northwest side and the University. For Journal Center destinations, 5% of total trip demand was used to account for lower Park and Ride modeshare in areas where destinations have an ample supply of free parking. Using these percentages of total trip demand, potential park and ride users were assigned to the closest park and ride for each of the alternative routes. This ratio is a conservative estimate consistent with other park and ride activity as a proportion of total trips in Albuquerque and in other regions. These numbers were utilized in the model to properly size the park and ride lots. If a greater percentage of all trips were made using park and ride access, then this ratio could be adjusted which would require larger park and ride lots and would result in higher ridership on every alternative route. The proportion used to size the park and rides influences ridership on every alternative route at the same ratio, so adjusting up or down would not cause one alternative to perform better or worse than a different alternative.

1.2.5 College

This variable represents if a college exists at the station area or does not exist. It is a binary variable meaning it does not account for size and other specific characteristics of a university. A model calibration process was applied to ensure the impacts of UNM/CNM are reflected in model results.

1.2.5 Poverty Density

This is a measure of the percentage of people living in a station area who are below the poverty level. This level varies throughout the region depending on the total population of an area and the total population below poverty.

1.3 Forecast Year

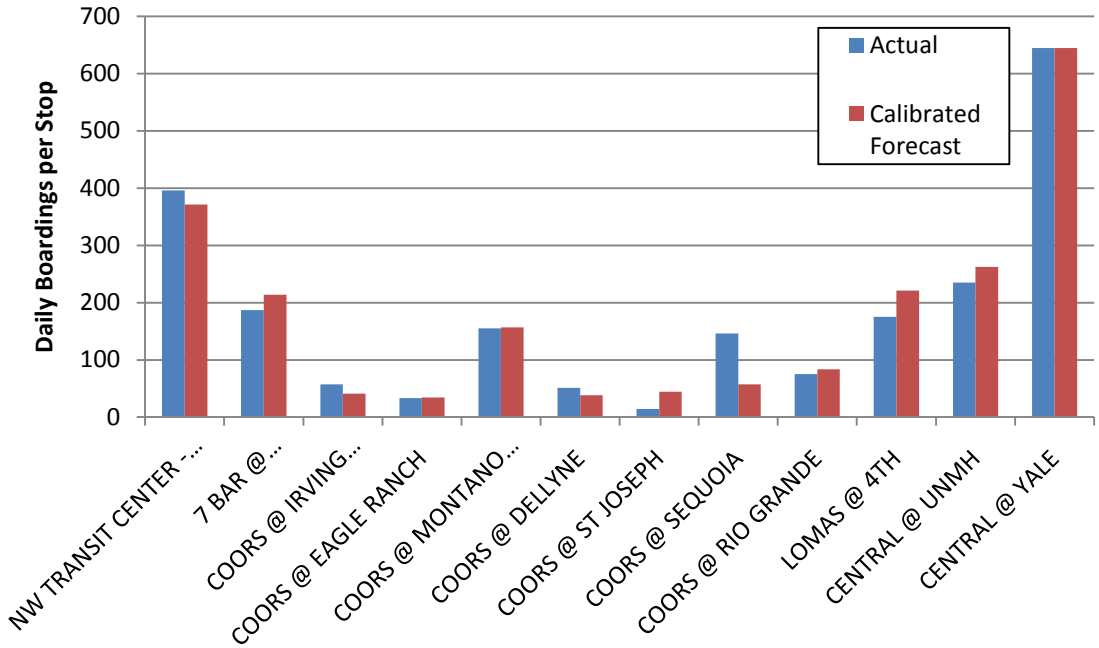
Two forecast years were used to determine what ridership will be on opening day and what it will be in 2035. Since the year for opening day is yet to be determined, Additional development (housing, employment) was not assumed beyond the 2010 date due to the model's use of detailed land use data within a ½ mile walkshed. All other regionally significant transportation projects projected for future years were not included in the model.

1.4 Model Calibration

In order to calibrate the BRT model to the project area in Albuquerque, data was used from the Blue Line Route 790, a rapid bus line currently operating in the project area that services the area between the Northwest Transit Center and UNM/CNM via Coors Blvd. The Blue line was selected due to its similar regional context to the proposed line. Fehr & Peers' BRT model was used to predict ridership on the Blue Line. Stop level data was collected for each stop on the Blue Line, and ridership data collected by RMRTD was utilized to compare actual ridership to projected ridership. An error adjustment equation was then calculated which accounts for the difference between the actual and predicted ridership. This was done by performing OLS regression, using the difference between the actual and predicted boardings per station (the model error) as the dependent variable. The variables used in the BRT model were tested as independent variables in the regression analysis (percent transit only lane, speed difference, feeder bus routes, daily feeder trains, urban density, park and ride spaces, college, and poverty density). The resulting equation captures the magnitude of the variables that have the most significant impact on the error term.

This error term equation demonstrates that ridership in the project area is more sensitive to colleges and less sensitive to feeder bus service than the original BRT model. This error term was added to the ridership estimate for each station to get the final calibrated model estimates. Actual daily system ridership on this route is 2087 daily boardings (April 2011), and approximately 80% of these boardings are associated with UNM.

Blue Line Route 790 Actual Boardings vs Calibrated DRF Forecast Boardings



2.0 Alternatives

Fehr & Peers used the alternatives and stops prepared by Parsons Brinkerhoff to estimate the total daily boardings at each stop, summed to reflect the daily boardings for each line. The alternatives consist of three alternatives on the east side of the Rio Grande River and three alternatives on the west side of the river. Every evaluated alternative shares the portion of the route on Paseo del Norte crossing the Rio Grande. Each alternative could be combined with an alternative from the other side of the river resulting in 9 total alternatives. The nine concept alternatives include the following alignment configurations:

- Pink Route connecting to Jefferson Route
- Pink Route connecting to Combination Route
- Pink Route connecting to Channel Road Route
- Purple Route connecting to Jefferson Route
- Purple Route connecting to Combination Route
- Purple Route connecting to Channel Road Route
- Yellow Route connecting to Jefferson Route
- Yellow Route connecting to Combination Route
- Yellow Route connecting to Channel Road Route

For each concept alternative, the following three varying levels of BRT service were evaluated:

- *Rapid Ride* – has express bus service with a limited number of stops. This level of service is consistent with other routes in Albuquerque such as Blue Line route 790

- *Some BRT Improvements* – has express bus service with a limited number of stops. Some additional improvements such as limited dedicated right of way on the Paseo del Norte bridge across the Rio Grande and some other improvements such as queue jumps and priority access for the buses.
- *Significant BRT Improvements* – has express bus service with a limited number of stops. Significant additional improvements including dedicated right of way on 80% of the corridor and other bus prioritization that makes transit travel time more competitive with auto travel time.

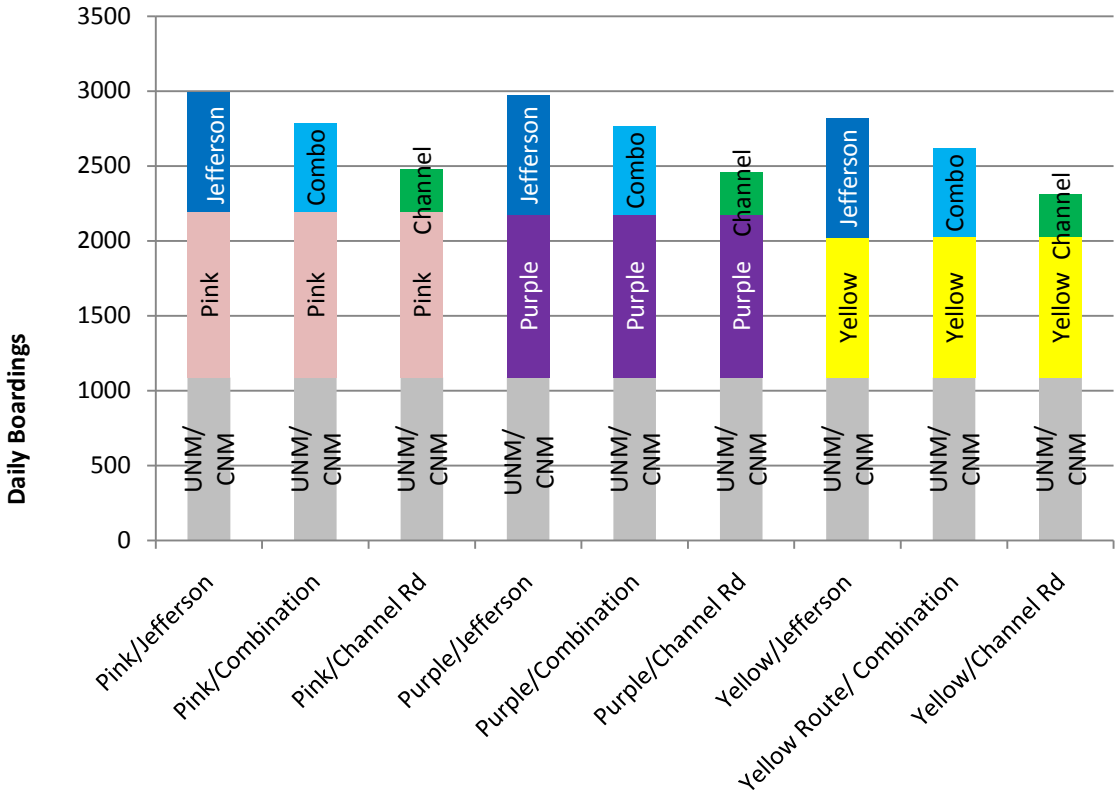
3.0 Results and Discussion

The results of the DRF vary significantly based on the level of investment in the corridor and the level of expected congestion along the corridor. Daily ridership was forecasted for opening day and for 2035 to show the impacts of population and employment growth on the northwest side and increased congestion along Paseo del Norte and other areas along the alternative routes.

Opening Day Ridership

Opening day ridership estimates were calculated assuming some BRT investment. The forecasts assume slightly better service than existing rapid ride lines with some improvements to travel time through portions of dedicated guideway. The results from each of the nine alternatives are shown below. The total ridership number is broken down to show which portion of the entire route riders are boarding.

Opening Day Boardings for Alternatives with some BRT Improvements



Overall, the purple and pink alignments are forecasted to have the nearly the same ridership on the northwest side while the yellow alignment generates slightly fewer boardings. On the Journal Center side, the Jefferson alignment is forecasted to have the most riders followed by the Combination alternative and the Channel Road alternative. All routes benefit from an equal number of riders from the continuation of the route to UNM/CNM. The Purple plus Jefferson alignment and the Pink plus Jefferson alignment are both projected to generate the highest boardings when combining the alternatives. This is due to better access to major trip generators such as direct job access in the Journal Center and more population closer to stations.

A few factors influencing ridership are jobs and households within ½ mile walk of a stop. While the Yellow alternative captures a somewhat larger market area than the pink and purple alternatives, the areas around the station areas are less built and have less activity that captures people for ridership. If land use around station areas are increased, ridership in these areas will also increase. Park and Rides also have a large influence on ridership, so additional spaces or relocating spaces to other station areas would influence the levels and distribution of ridership among stations. Increasing the number of spaces will increase ridership to a certain extent as long as demand for the spaces exists, but increasing lots beyond demand will not result in ridership increases.

Transit demand on the Journal Center and University side of the river represents trip ends for the majority of transit trips. When calculating ridership for the entire line which connect two of the alternatives, the transit demand for each side of the river needs to be evaluated separately as a large transit demand on one side of the river with a small transit demand on the other side of the river would only produce enough trips to satisfy the smaller of the two demands. Ideally, the transit demand for each side will be roughly equal to maximize ridership.

Another major factor in the difference in ridership can be explained by the number of stops on each alternative. The higher the number of stops (assuming the stop is located near factors that influence ridership) the ridership will generally increase. Each stop that is added will also decrease overall travel time which will negatively influence ridership. The stop spacing on the evaluated Paseo del Norte alternatives is generally further apart than stop spacing on other BRT systems.

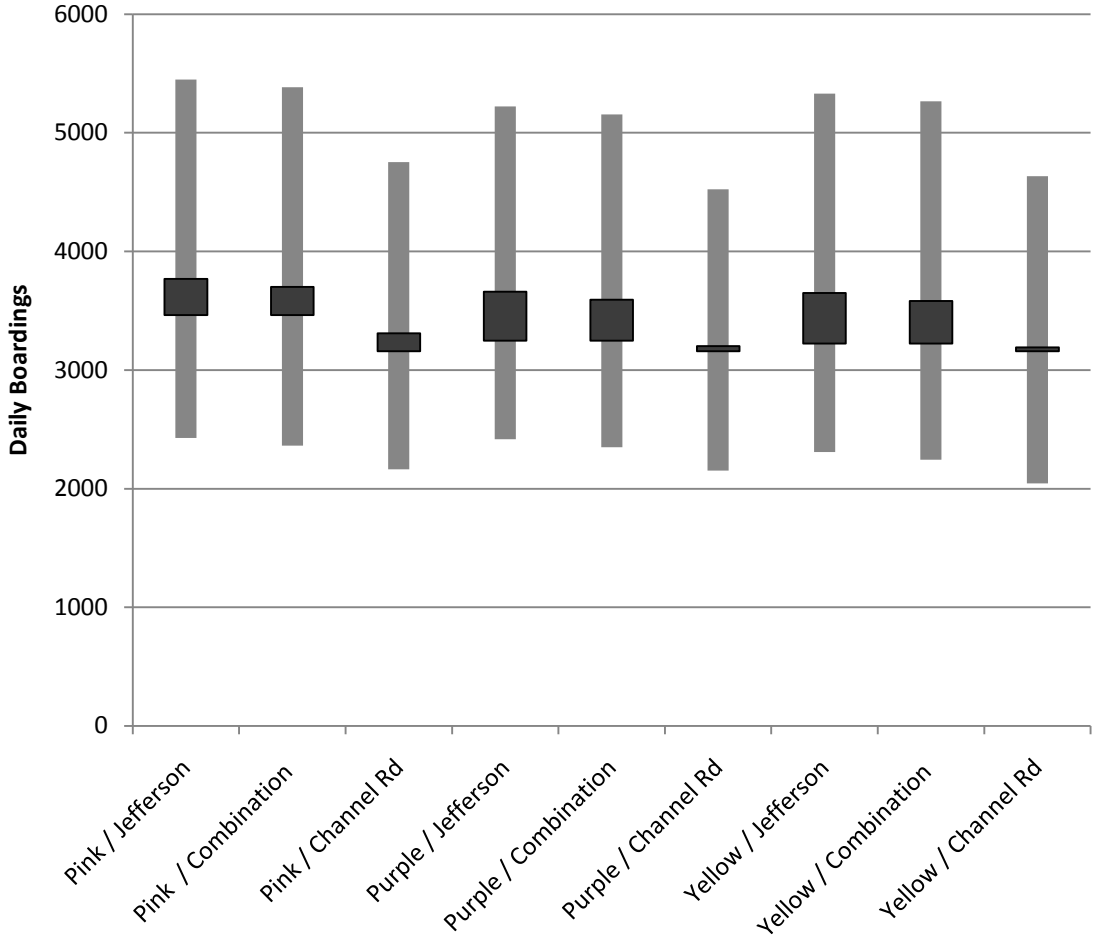
2035 Ridership

When looking more than 20 years into the future, the forecasted transit ridership is extremely variable to factors such as level of land use change at station areas and other areas in the region, level of congestion along major corridors, fuel price fluctuations, and other behavioral changes that might influence riders to utilize transit. Because ridership will fluctuate significantly with each of these factors, a range of ridership has been calculated instead of exact numbers to demonstrate what levels of ridership could be expected.

Several assumptions were made in this forecast including the level of roadway improvements and changes in land use. It was assumed there were no other bridge capacity improvements outside of the BRT investment that would decrease congestion. Land use estimates projected by MRCOG for 2035 were used for activity around stations and for Park and Ride sizing.

The ridership range for 2035 ridership is shown in the chart shown below. The light gray scale indicates the range of ridership from a minimum baseline rapid ride investment in bus routes at the bottom to a modern BRT system with dedicated right of way on the majority of the system and other improvements such as queue jumping, enhanced buses, pre-paid boarding, and other branding improvements to enhance the ridership experience. The dark gray range on top of the light gray bar shows the refined ridership range for each particular alternative reflecting a medium level of investment and increased congestion.

2035 Range of Boardings for Alternatives



If auto congestion along the corridor increases in areas where the BRT system has dedicated right of way, the travel time competiveness of BRT will increase which will increase overall ridership. The variation of ranges shown in dark gray between the different alternatives has to do with how balanced the ridership on one side of the river is with the other side. If both sides of the river produce a similar level of ridership the system is balanced, but if one side of the river produces a lot more riders than the other then overall ridership may be in the lower range. As the majority of riders will be traveling to Journal Center destinations and UNM/CNM destinations, a more balanced system results in a higher confidence in ridership projections.

The route alternatives vary depending on land use and the market served, but the biggest variation in ridership will occur depending on the level of investment in the route and the level of congestion present on the roadways. Transit travel time and travel time variability competitiveness with auto will produce the greatest ridership gains in all alternatives. While route choice is important to ridership, the type of investment made on each of the routes will be the biggest driver to ridership.

FEHR PEERS

MEMORANDUM

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Ridership is a key performance metric for each study alternative. Based on a direct ridership modeling approach previously used on similar projects, Fehr & Peers has completed the initial opening day and 2035 ridership forecasts for the identified alternatives on the Paseo del Norte corridor. Fehr & Peers has completed work in other regions in the United States using direct ridership models to forecast ridership on proposed routes. The forecasts prepared using the DRM tool are included in approved Alternatives analysis prepared for projects in Salt Lake City and Los Angeles. Past research has found direct ridership modeling to be much more accurate than other available tools including regional travel demand models, particularly in evaluating stop and route level ridership for enhanced transit systems such as BRT, which are not always specifically coded in travel demand models.

1.0 DESCRIPTION OF METHOD

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calibration and validation of the existing bus and rail modes. Therefore, for the purposes of the alternatives analysis (AA) study, a combination of the RMRTD travel demand model and a direct ridership model were chosen for forecasting ridership on the BRT alternatives on the Paseo del Norte corridor. The regional model was used to identify total person trip demand between origins and destinations along the study corridor for park and ride demand. A direct ridership model was calibrated and validated for BRT ridership forecasting at the station level. The strengths of each tool were used based on the scale and level of validation.

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- *College* – this is a binary variable representing if a college exists at the station area
- *Poverty density* – this is a measure of the percentage of people living in a station area who are below the poverty level
- *Number of Feeder Bus Routes* – this is a measure of how many bus routes intersect the stop location

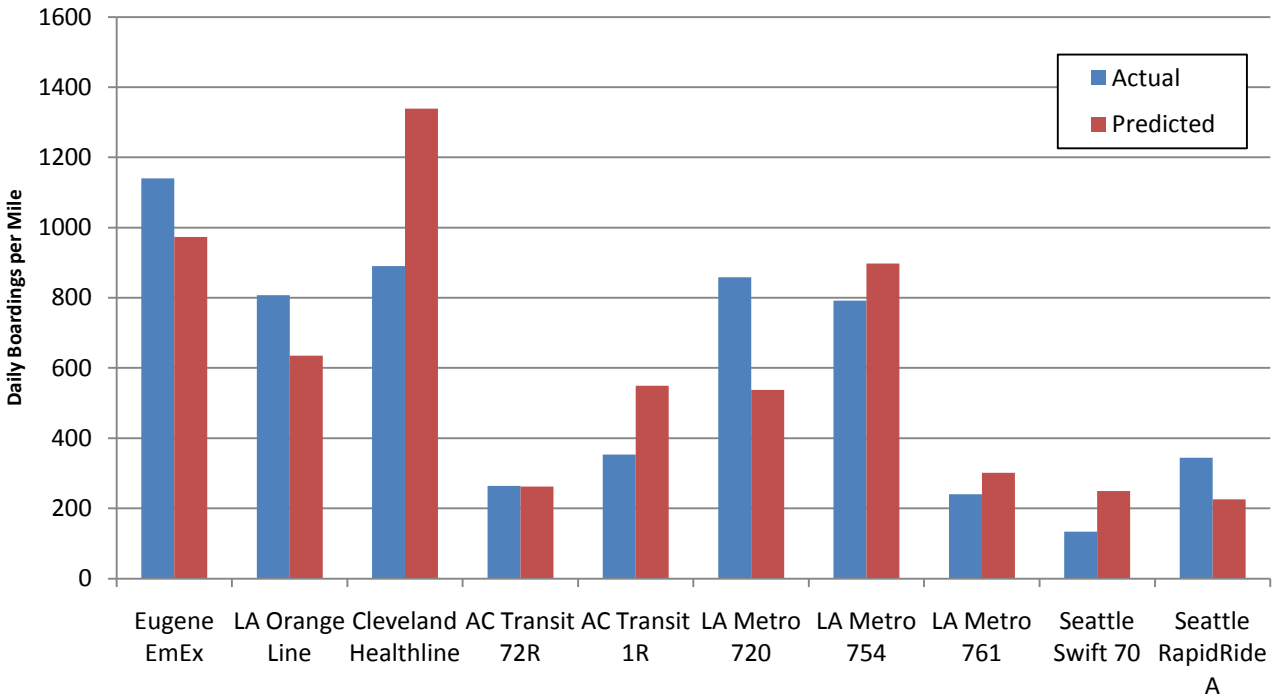
The R^2 value of the model is 0.52 which represents a fairly high goodness of fit. One of the limits to the model is the limited number of built BRT systems in the US and thus limited data availability. Although intuitively more variables than those included in the model influence ridership, due to the limited data availability statistically significant relationships were unable to be distinguished between all variables. That being said, significant relationships were found between boardings and the station level variables listed in the above bulleted list in order to create a statistically significant model with a good fit. The specific model coefficients are listed in Table 3. Each coefficient is the increase of boardings at the station for each unit of change in the variables, and the variables in the model are measured in varying units. Each coefficient cannot be evaluated alone and needs to be evaluated in combination with all variables at the station area.

TABLE 3 BRT Direct Ridership Model Coefficients

Variable	Coefficient
Constant	-77
Urban Density	2.5
Number of Feeder Trains	2.0
Percent dedicated transit lane	184
1/(LN (Auto transit speed differential))	79.65
Park and ride spaces	.84
College	195
Poverty density	72
Number of Feeder Bus Routes	44
R Squared	.53
Adjusted R Squared	.52

For each of the BRT and rapid rides systems where data was collected, the ridership model was applied to test how well it predicts ridership on the routes. A graphical depiction of the results is shown in below.

Evaluated Systems Actual Boardings vs Predicted Boardings



Overall the model was a fairly good predictor of ridership on the systems. In some systems, the predicted boardings per mile and actual boardings per mile were different due to variables not being explained by the model. For these specific lines, a calibration to regional conditions could help refine and explain more of the variation.

Data for each of the significant variables were collected for each potential stop along the various alternatives for the Paseo del Norte BRT line. These variables were used to predict daily boardings at each station and were summed for each configuration to estimate daily boardings along the line. The expected system boardings are summarized in Section 3.0.

1.2.1 Urban Density

Urban density is a sum of employment and households within ½ mile of the station. The employment and household data were measured using MRCOG DASZ datasets, with proportional averages taken where zones fall partially inside the ½ mile radius of the station. Stations along the proposed alternatives have either high household density or high employment density, but few have both. The areas with the highest household density include Southern & Unser, Northwest Transit Center, Unser & McMahon, PDN & Eagle Ranch, and Central & Yale. The areas with the highest employment density are in the Journal Center, UNMH, and Central & Yale.

1.2.2 Number of Feeder Trains

Number of feeder trains is the daily number of trains on intersecting rail lines with a transfer to a BRT stop. The New Mexico Rail Runner would have a transfer to the proposed BRT line within all alternatives where it intersects Paseo del Norte.

1.2.3 Auto Transit Speed Differential

This is a measure in miles per hour of the average speed difference between an auto and transit vehicle traveling from the beginning of the route to the end of the route. The typical range in the observed systems was from 1 mph where transit is 1 mph slower than an auto traveling the same route to 8 mph where transit is on average 8 mph slower than an auto traveling the same route. This measurement applies to all stations on each route alternative as it is an average speed measurement. Within the model, this variable a log transformational equation was calculated to represent a better fit for ridership response to speed differential. This transformation equation is 1 / (ln Auto Transit Speed Differential).

1.2.4 Level of BRT Investment

This variable is a measure of the percent of the entire route that has dedicated transit lanes which is a proxy for the level of BRT investment. A higher percentage of dedicated transit lanes generally improves the time competitiveness of the BRT system which improves ridership, and systems with a high level of dedicated guideways typically have other BRT investments such as improved bus shelters and branding. This measurement applies to all stations on each route alternative as a route measurement. This variable and auto transit speed differential need to be thought about in tandem as each potentially influences the other.

1.2.5 Number of Feeder Bus Routes

This is a measure of how many bus routes intersect the stop location. An intersecting bus route provides an opportunity for transfers from other routes and indicates a certain level of transit activity that can stimulate ridership.

1.2.6 Number of Park and Ride Spaces

This is a measure of the number of parking spaces located at each station. This measurement allows the model to account for trip origins outside of the immediate station area that arrive to the BRT station via an automobile. Park and ride spaces can be official park and rides provided by the transit agency or they may be unofficial park and ride locations such as a big box parking lot or on street parking located near a BRT station.

In order to properly size Park and Ride facilities at the planned BRT stations, the regional travel demand model was used to determine the total person trip demand between the northwest side of the region and the Journal Center and UNM/CNM destinations. To determine the number of park-and-ride spaces that should be provided for each alternative for both the opening day and 2035 horizon years, estimates of both the BRT capture rate and the portion of those trips that would access stations via the park-and-ride mode were developed. The number of park-and-ride spaces needed increases as overall BRT ridership increases.

The percentage of park-and-ride trips using Blue Line Route 790, a local rapid bus service that serves an area with similar characteristics to the Paseo Del Norte corridor, was the starting point used to determine the number of parking spaces that would need to be supplied for the alternatives. Existing surveys on the blue line indicated a high level of Park and Ride usage between the northwest side and the University. Therefore, for University destinations, 10% of the total trip demand calculated with the regional travel demand model was assumed to use the BRT via park and ride. For Journal Center destinations, 5% of total trip demand was assumed. This accounts for lower BRT/Park and Ride mode share in areas where destinations have an ample supply of free parking.

Using these percentages of total trip demand, potential park and ride users were assigned to the closest park and ride for each of the alternative routes. The numbers calculated from the park and ride catchment areas were utilized in the model to properly size the park and ride lots. The size of the park and ride lots was adjusted using an iterative process as improvements were modeled in the system. If a greater percentage of all trips were made using park and ride access, then the park and ride capture ratios could be adjusted which would indicate a greater demand and require larger park and ride lots. This would result in higher ridership on every alternative route. The proportion used to size the park and ride lots influences ridership on every alternative route at the same ratio, so adjusting up or down would not cause one alternative to perform better or worse than a different alternative.

1.2.5 College

This variable represents if a college exists at the station area or does not exist. It is a binary variable meaning it does not account for size and other specific characteristics of a university. A model calibration process was applied to ensure the impacts of UNM/CNM are reflected in model results.

1.2.5 Poverty Density

This is a measure of the percentage of people living in a station area who are below the poverty level. This level varies throughout the region depending on the total population of an area and the total population below poverty.

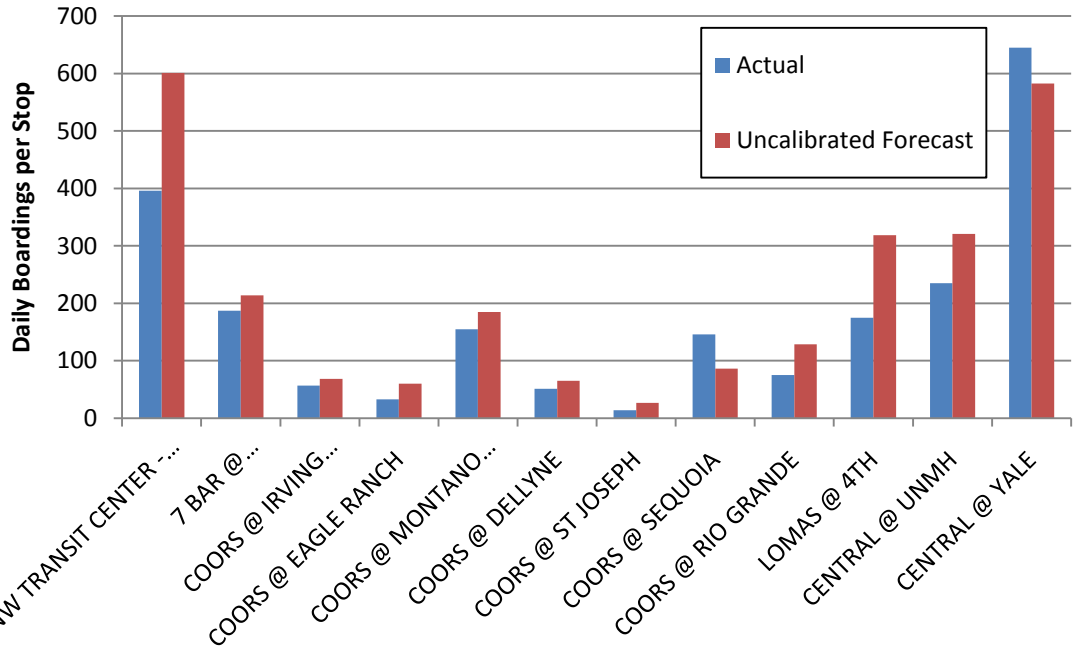
1.3 Forecast Horizon Years

Ridership forecasts are developed for both the opening day and 2035 horizon years. Opening day forecasts are based on year 2008 and 2010 land use data in the metro travel demand model and US Census sources, since the year for opening day is yet to be determined. Additional development (housing, employment) was not assumed beyond the 2010 date due to the model's use of detailed land use data within a ½ mile walkshed. All other regionally significant transportation projects projected for future years were not included in the model.

1.4 Model Calibration

In order to calibrate the BRT model to the project area in Albuquerque, data was used from the Blue Line Route 790, a rapid bus line currently operating in the project area that services the area between the Northwest Transit Center and UNM/CNM via Coors Blvd. The Blue line was selected due to its similar regional context to the proposed line. The Fehr & Peers' BRT direct ridership model was used to estimate (i.e., "backcast") ridership on the Blue Line to determine whether any adjustments should be made to the DRM to reflect local conditions. Stop level data was collected for each stop on the Blue Line, and current ridership data collected by RMRTD was utilized to compare actual ridership to estimated ridership. The total Uncalibrated Forecast for the Blueline is 2,657. The figure below shows how the uncalibrated model predicts ridership on the Blue Line for each station.

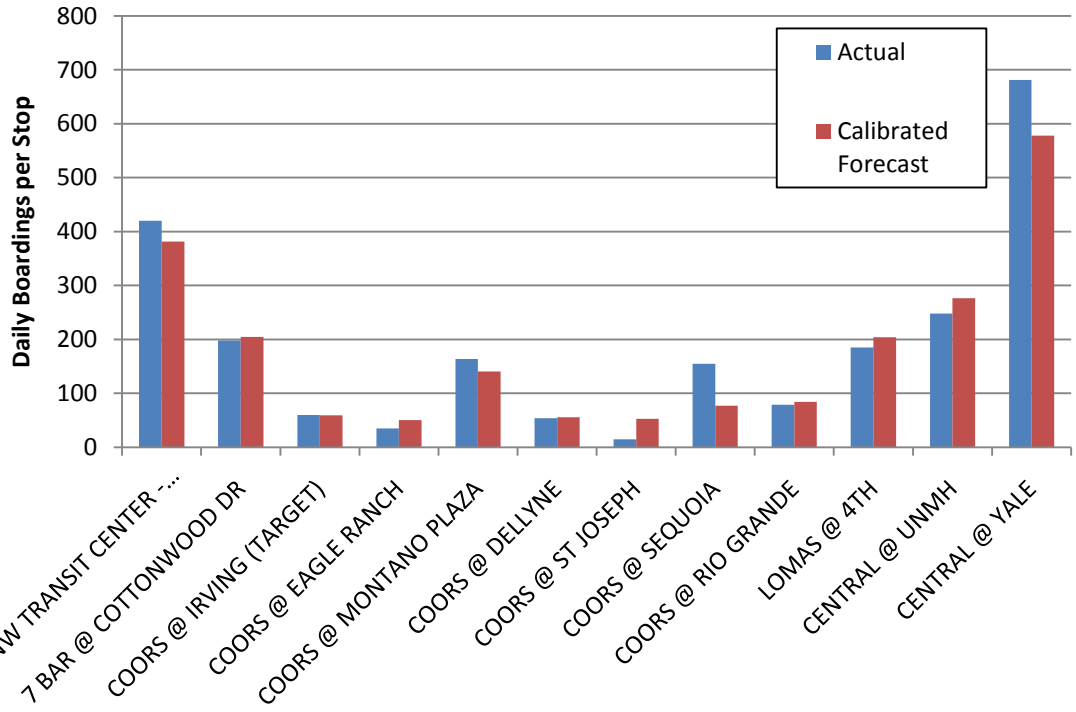
Blue Line Route 790 Actual Boardings vs Un Calibrated DRF Forecast Boardings



An error adjustment equation was then calculated which accounts for the difference between the actual and predicted ridership. This was done by performing OLS regression, using the difference between the actual and predicted boardings per station (the model error) as the dependent variable. The variables used in the BRT model were tested as independent variables in the regression analysis (percent transit only lane, speed difference, feeder bus routes, daily feeder trains, urban density, park and ride spaces, college, and poverty density). The resulting equation captures the magnitude of the variables that have the most significant impact on the error term.

This error term equation demonstrates that ridership in the project area is more sensitive to colleges and less sensitive to feeder bus service than the original BRT model. This error term was added to the ridership estimate for each station to get the final calibrated model estimates. Actual daily system ridership on this route is 2087 daily boardings (April 2011), and approximately 80% of these boardings are associated with UNM. The total Calibrated Forecast for the Blue Line is 2,164. The comparison showing the calibrated DRF forecast to actual boardings for each station is shown below.

Blue Line Route 790 Actual Boardings vs Calibrated DRF Forecast Boardings



2.0 Alternatives

Fehr & Peers used the alternatives and stops prepared by Parsons Brinkerhoff to estimate the total daily boardings at each stop, summed to reflect the daily boardings for each line. The alternatives consist of three alternatives on the east side of the Rio Grande River and three alternatives on the west side of the river. Every evaluated alternative shares the portion of the route on Paseo del Norte crossing the Rio Grande. Each alternative could be combined with an

alternative from the other side of the river resulting in 9 total alternatives. The nine concept alternatives include the following alignment configurations:

- Pink Route connecting to Jefferson Route
- Pink Route connecting to Combination Route
- Pink Route connecting to Channel Road Route
- Purple Route connecting to Jefferson Route
- Purple Route connecting to Combination Route
- Purple Route connecting to Channel Road Route
- Yellow Route connecting to Jefferson Route
- Yellow Route connecting to Combination Route
- Yellow Route connecting to Channel Road Route

For each concept alternative, the following three varying levels of BRT service were evaluated:

	Limited Stop Express Bus Service	**Dedicated ROW on Select Segments of PDN Corridor**	**Queue Jumps and Priority Bus Access at Key Intersections**	**Dedicated ROW on 80% of the Route**
Rapid Ride	X			
Some BRT Improvements	X	X	X	
Significant BRT Improvements	X	X	X	X

The Rapid Ride level of service is consistent with other routes in Albuquerque such as Blue Line route 790. The some BRT Improvements scenario has a bigger impact on travel time competitiveness depending on the level of forecasted congestion on the corridor, so future scenarios show a larger ridership gain with the same level of improvements. The same applies for significant BRT improvements scenario as the level of improvement has a bigger impact in congested corridors.

3.0 Results and Discussion

The results of the DRF vary significantly based on the level of investment in the corridor and the level of expected congestion along the corridor. Daily ridership was forecasted for opening day and for 2035 to show the impacts of population and employment growth on the northwest side and increased congestion along Paseo del Norte and other areas along the alternative routes. Specific focus was placed on the Some BRT Improvement scenario as it requires a much lower level of financial investment than a full BRT build out and has a large impact on ridership in congested areas along Paseo del Norte.

Opening Day Ridership

Opening day ridership estimates were calculated assuming some BRT investment. The forecasts assume slightly better service than existing rapid ride lines with some improvements to travel time through portions of dedicated guideway. The results from each of the nine alternatives are shown below. The total ridership number is broken down to show which portion of the entire route riders are boarding.

Opening Day Boardings for Alternatives with some BRT Improvements

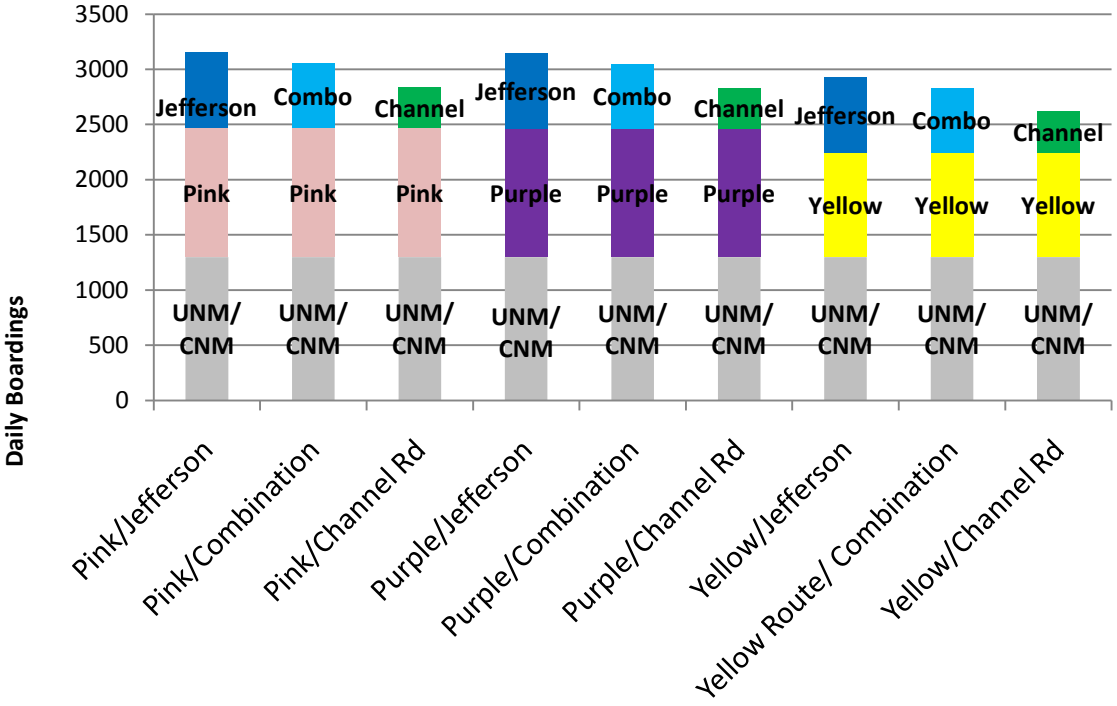


Table 4 shows opening day boardings in Table format.

TABLE 4 Opening Day Boardings for Alternatives with some BRT Improvements

Alternative Combination	Northwest Alternative	Journal Center	UNM/ CNM	Total
Pink/Jefferson	1,169	683	1,297	**3,149**
Pink/Combination	1,169	446	1,297	**3,051**
Pink/Channel Rd	1,169	371	1,297	**2,838**
Purple/Jefferson	1,166	683	1,297	**3,146**
Purple/Combination	1,166	446	1,297	**3,048**
Purple/Channel Rd	1,166	371	1,297	**2,835**
Yellow/Jefferson	950	683	1,297	**2,930**
Yellow Route/ Combination	950	446	1,297	**2,831**
Yellow/Channel Rd	950	371	1,297	**2,619**

Overall, the purple and pink alignments are forecasted to have the nearly the same ridership on the northwest side while the yellow alignment generates slightly fewer boardings. On the Journal Center side, the Jefferson alignment is forecasted to have the most riders followed by the Combination alternative and the Channel Road alternative. All routes benefit from an equal number of riders from the continuation of the route to UNM/CNM. The Purple plus Jefferson alignment and the Pink plus Jefferson alignment are both projected to generate the highest

boardings when combining the alternatives. This is due to better access to major trip generators such as direct job access in the Journal Center and more population closer to stations.

A few factors influencing ridership are jobs and households within ½ mile walk of a stop. While the Yellow alternative captures a somewhat larger market area than the pink and purple alternatives, the areas around the station areas are less built and have less activity that captures people for ridership. If land use around station areas is increased, ridership in these areas will also increase. Parking demand calculations for opening day ridership utilized park and ride capture rates documented in the "Park and Ride Users Survey: Summary Report" published by Rio Metro. Park and Rides also have a large influence on ridership, so additional spaces or relocating spaces to other station areas would influence the levels and distribution of ridership among stations. Increasing the number of spaces will increase ridership to a certain extent as long as demand for the spaces exists, but increasing lots beyond demand will not result in ridership increases. Estimated parking demand which was calculated using the MRCOG travel demand model is summarized in Table 5.

TABLE 5 Opening Day Park and Ride Requirements

Location	Yellow Route	Pink Route	Purple Route
528/Westside	-	-	100
Northwest Transit Center	-	100	100
PDN/Coors	200	300	300
PDN/Unser	200	-	-
Unser/Southern	100	100	100
Total Spaces	**500**	**500**	**600**

Transit demand on the Journal Center and University side of the river represents trip ends for the majority of transit trips. When calculating ridership for the entire line which connect two of the alternatives, the transit demand for each side of the river needs to be evaluated separately as a large transit demand on one side of the river with a small transit demand on the other side of the river would only produce enough trips to satisfy the smaller of the two demands. Ideally, the transit demand for each side will be roughly equal to maximize ridership. Another major factor in the difference in ridership can be explained by the number of stops on each alternative. The higher the number of stops (assuming the stop is located near factors that influence ridership) the ridership will generally increase. Each stop that is added will also decrease overall travel time which will negatively influence ridership. The stop spacing on the evaluated Paseo del Norte alternatives is generally further apart than stop spacing on other observed BRT systems.

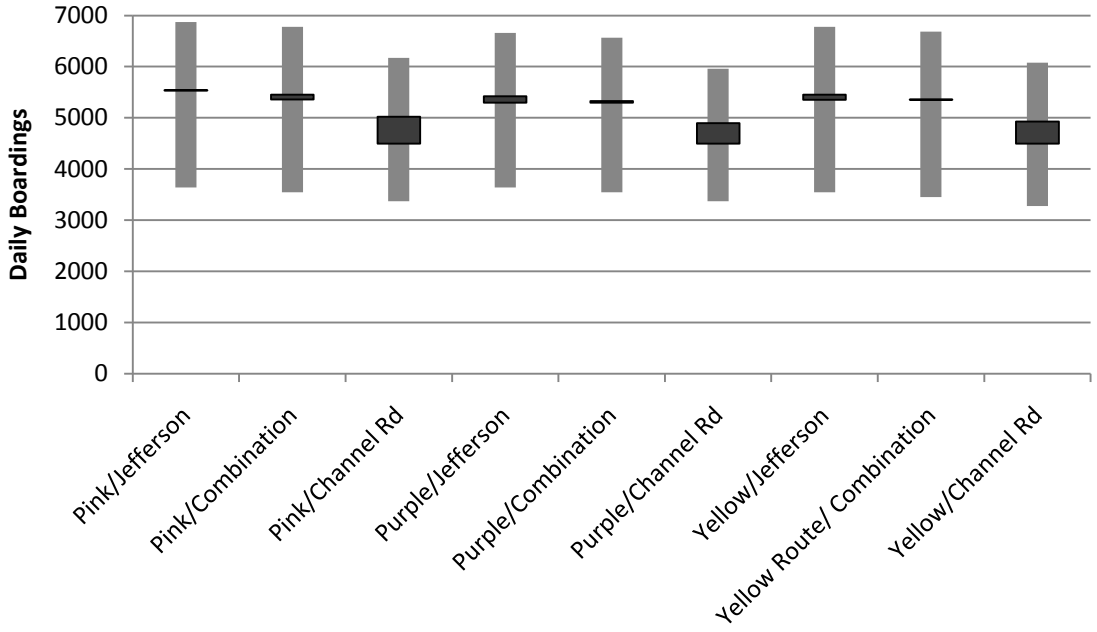
2035 Ridership

When looking more than 20 years into the future, the forecasted transit ridership is extremely variable to factors such as level of land use change at station areas and other areas in the region, level of congestion along major corridors, fuel price fluctuations, and other behavioral changes that might influence riders to utilize transit. Because ridership will fluctuate significantly with each of these factors, a range of ridership has been calculated instead of exact numbers to demonstrate what levels of ridership could be expected. Several assumptions were made in this

forecast including the level of roadway improvements and changes in land use. It was assumed there were no other bridge capacity improvements outside of the BRT investment that would decrease congestion. Land use estimates projected by MRCOG for 2035 were used for activity around stations and for Park and Ride sizing.

The ridership range for 2035 ridership is shown in the chart shown below. The light gray scale indicates the range of ridership from a minimum baseline rapid ride investment in bus routes at the bottom to a modern BRT system with dedicated right of way on the majority of the system and other improvements such as queue jumping, enhanced buses, pre-paid boarding, and other branding improvements to enhance the ridership experience. The dark gray range on top of the light gray bar shows the refined ridership range for each particular alternative reflecting a medium level of investment with some BRT improvements and increased traffic congestion on the roadways. These investments include dedicated right of way on the PDN bridge crossing and some other key congested areas of the corridor as well as some bus top improvements and branding of buses.

2035 Range of Boardings for Alternatives



If auto congestion along the corridor increases in areas where the BRT system has dedicated right of way, the travel time competiveness of BRT will increase which will increase overall ridership. The variation of ranges shown in dark gray between the different alternatives has to do with how balanced the ridership on one side of the river is with the other side. If both sides of the river produce a similar level of ridership the system is balanced, but if one side of the river produces a lot more riders than the other then overall ridership may be in the lower range. As the majority of riders will be traveling to Journal Center destinations and UNM/CNM destinations, a more balanced system results in a higher confidence in ridership projections. Other origins and

destinations along the line may exist on the same side of the river and account for some of the variation.

A more attractive system will gain transit mode share for all types of riders. Gains captured through transfers, walk access, and bike access are captured within the original model inputs. Park and ride levels need to be adjusted to account for large ridership gains caused by the attractiveness of the system. The park and ride lot sizes were iteratively updated in the ridership model to ensure enough park and ride spaces are included in the system to account for the demand. The forecasted park and ride size for each of the park and rides on the systems are shown below in the 2035 Park and Ride Requirements.

TABLE 6 2035 Park and Ride Requirements

Location	Yellow Route	Pink Route	Purple Route
528/Westside	-	-	200
Northwest Transit Center	-	300	100
PDN/Coors	500	700	800
PDN/Unser	600	-	-
Unser/Southern	600	600	400
Total Spaces	**1,700**	**1,500**	**1,600**

The route alternatives vary depending on land use and the market served, but the biggest variation in ridership will occur depending on the level of investment in the route and the level of congestion present on the roadways. Transit travel time and travel time variability competitiveness with auto will produce the greatest ridership gains in all alternatives. While route choice is important to ridership, the type of investment made on each of the routes will be the biggest driver to ridership.

TABLE 7 Opening Day Model Inputs

	Opening Day Model Inputs					
Stop Name	Feeder Bus Routes	Daily Feeder Trains	HH + Jobs Density (per acre)	Park and Ride Spaces	College (0/1)	Poverty Density (per acre)
YELLOW ROUTE						
Southern & Unser PnR 8 acres	4	0	2.03	120	0	0.02
Presbyterian Hospital	1	0	1.33	0	0	0.01
Unser & McMahon	1	0	3.64	0	0	0.02
Paradise & Unser	0	0	2.12	0	0	0.07
Volcano Heights PnR 6 acres	0	0	0.16	169	0	0.00
Golf Course & Paseo del Norte	2	0	4.63	0	0	0.07
Paseo del Norte & Eagle Ranch	1	0	5.66	219	0	0.09
TOTAL	**9**	**0**	**2.80**	**508**	**0**	**0.04**
PINK ROUTE						
Southern & Unser PnR 4.5 acres	4	0	3.66	114	0	0.05
Presbyterian Hospital	1	0	1.33	0	0	0.01
Unser & McMahon	1	0	3.64	0	0	0.02
Golf Course & Paseo del Norte	2	0	4.63	0	0	0.07
Northwest Transit Center	8	0	6.64	114	0	0.20
Cottonwood Mall	3	0	7.83	0	0	0.18
Paseo del Norte & Eagle Ranch	1	0	5.66	256	0	0.09
TOTAL	**20**	**0**	**4.77**	**483**	**0**	**0.09**
PURPLE ROUTE						
Southern & Unser PnR 5.5 acres	4	0	4.86	88	0	0.04
Sara Rd/33rd Circle	0	0	2.54	0	0	0.04
Intel PnR 4 acres	2	0	5.19	86	0	0.13
Northwest Transit Center	8	0	6.64	61	0	0.20
Cottonwood Mall	3	0	7.83	0	0	0.18
Shopping Center at Coors/PDN PnR 4.5 acres	5	0	4.78	258	0	0.06
TOTAL	**22**	**0**	**5.31**	**493**	**0**	**0.11**
JEFFERSON STREET ROUTE						
Los Ranchos / Journal Center Station	2	18	3.34	100	0	0.04
Jefferson and Journal Center Blvd Station	3	0	10.50	0	0	0.02
Jefferson and Hawkins Station	3	0	9.97	0	0	0.02
Jefferson and Presidential Dr Station	2	0	15.12	0	0	0.03

	Opening Day Model Inputs					
Stop Name	**Feeder Bus Routes**	**Daily Feeder Trains**	**HH + Jobs Density (per acre)**	**Park and Ride Spaces**	**College (0/1)**	**Poverty Density (per acre)**
Jefferson and Singer Blvd Station	2	0	16.02	0	0	0.00
Menaul Blvd and University Blvd Station	1	0	6.30	0	0	0.09
Lomas Blvd at UNM Hospital	3	0	33.20	0	1	1.93
Central Ave and Yale Blvd UNM Station	5	0	15.16	0	1	2.96
TOTAL	**21**	**18**	**13.70**	**100**	**1**	**0.64**
CHANNEL ROAD ROUTE						
Los Ranchos / Journal Center Station	2	18	3.34	100	0	0.04
Channel Rd and Masthead St Station	0	0	4.74	0	0	0.19
Singer Blvd and Office Blvd Station	1	0	13.78	0	0	0.00
Menaul Blvd and University Blvd Station	1	0	6.30	0	0	0.09
Lomas Blvd at UNM Hospital	3	0	33.20	0	1	1.93
Central Ave and Yale Blvd UNM Station	5	0	15.16	0	1	2.96
TOTAL	**12**	**18**	**12.75**	**100**	**1**	**0.87**
COMBINATION ROUTE						
Los Ranchos / Journal Center Station	2	18	3.34	100	0	0.04
Jefferson and Journal Center Blvd Station	3	0	10.50	0	0	0.02
Washington St and Hawkins St Station	0	0	7.70	0	0	0.03
Acadamy Parkway and Washing St Station	0	0	9.56	0	0	0.07
Jefferson and Singer Blvd Station	2	0	16.02	0	0	0.00
Menaul Blvd and University Blvd Station	1	0	6.30	0	0	0.09
Lomas Blvd at UNM Hospital	3	0	33.20	0	1	1.93
Central Ave and Yale Blvd UNM Station	5	0	15.16	0	1	2.96
TOTAL	**16**	**18**	**12.72**	**100**	**1**	**0.64**
EXISTING BLUE LINE ROUTE 590						
NW TRANSIT CENTER - BAY A	8	0	6.52	366	0	0.20
7 BAR @ COTTONWOOD DR	2	0	9.16	150	0	0.17
COORS @ IRVING (TARGET)	2	0	4.55	0	0	0.06
COORS @ EAGLE RANCH	2	0	1.91	0	0	0.03
COORS @ MONTANO PLAZA	3	0	4.86	85	0	0.06
COORS @ DELLYNE	2	0	3.81	0	0	0.04
COORS @ ST JOSEPH	1	0	4.41	0	0	0.10
COORS @ SEQUOIA	2	0	8.30	0	0	0.17

	Opening Day Model Inputs					
Stop Name	Feeder Bus Routes	Daily Feeder Trains	HH + Jobs Density (per acre)	Park and Ride Spaces	College (0/1)	Poverty Density (per acre)
COORS @ RIO GRANDE	3	0	5.86	0	0	0.23
LOMAS @ 4TH	5	0	42.88	0	0	0.33
CENTRAL @ UNMH	3	0	33.59	0	1	1.93
CENTRAL @ YALE	4	0	15.34	0	1	2.89
TOTAL	**37**	**0**	**11.77**	**601**	**1**	**0.52**

TABLE 8 2035 Modeling Inputs

	2035 Modeling Inputs					
Stop Name	Feeder Bus Routes	Daily Feeder Trains	HH + Jobs Density (per acre)	Park and Ride Spaces	College (0/1)	Poverty Density (per acre)
YELLOW ROUTE						
Southern & Unser PnR 8 acres	4	0	4.79	568	0	0.02
Presbyterian Hospital	1	0	6.59	0	0	0.01
Unser & McMahon	1	0	6.79	0	0	0.02
Paradise & Unser	0	0	4.84	0	0	0.07
Volcano Heights PnR 6 acres	0	0	16.74	601	0	0.00
Golf Course & Paseo del Norte	2	0	4.25	0	0	0.07
Paseo del Norte & Eagle Ranch	1	0	7.81	532	0	0.09
TOTAL	**9**	**0**	**7.40**	**1701**	**0**	**0.04**
PINK ROUTE						
Southern & Unser PnR 4.5 acres	4	0	5.77	556	0	0.05
Presbyterian Hospital	1	0	6.59	0	0	0.01
Unser & McMahon	1	0	6.79	0	0	0.02
Golf Course & Paseo del Norte	2	0	4.25	0	0	0.07
Northwest Transit Center	8	0	12.35	270	0	0.20
Cottonwood Mall	3	0	11.60	0	0	0.18
Paseo del Norte & Eagle Ranch	1	0	7.81	733	0	0.09
TOTAL	**20**	**0**	**7.88**	**1559**	**0**	**0.09**
PURPLE ROUTE						
Southern & Unser PnR 5.5 acres	4	0	5.62	431	0	0.04
Sara Rd/33rd Circle	0	0	3.36	0	0	0.04
Intel PnR 4 acres	2	0	6.73	217	0	0.13

	2035 Modeling Inputs					
Stop Name	**Feeder Bus Routes**	**Daily Feeder Trains**	**HH + Jobs Density (per acre)**	**Park and Ride Spaces**	**College (0/1)**	**Poverty Density (per acre)**
Northwest Transit Center	8	0	12.35	144	0	0.20
Cottonwood Mall	3	0	11.60	0	0	0.18
Shopping Center at Coors/PDN PnR 4.5 acres	5	0	6.65	765	0	0.06
TOTAL	**22**	**0**	**7.72**	**1557**	**0**	**0.11**
JEFFERSON STREET ROUTE						
Los Ranchos / Journal Center Station	2	18	4.80	100	0	0.04
Jefferson and Journal Center Blvd Station	3	0	14.30	0	0	0.02
Jefferson and Hawkins Station	3	0	15.16	0	0	0.02
Jefferson and Presidential Dr Station	2	0	16.18	0	0	0.03
Jefferson and Singer Blvd Station	2	0	19.66	0	0	0.00
Menaul Blvd and University Blvd Station	1	0	8.19	0	0	0.09
Lomas Blvd at UNM Hospital	3	0	29.46	0	1	1.93
Central Ave and Yale Blvd UNM Station	5	0	23.23	0	1	2.96
TOTAL	**21**	**18**	**16.37**	**100**	**1**	**0.72**
CHANNEL ROAD ROUTE						
Los Ranchos / Journal Center Station	2	18	4.80	100	0	0.04
Channel Rd and Masthead St Station	0	0	5.90	0	0	0.19
Singer Blvd and Office Blvd Station	1	0	15.64	0	0	0.00
Menaul Blvd and University Blvd Station	1	0	8.19	0	0	0.09
Lomas Blvd at UNM Hospital	3	0	29.46	0	1	1.93
Central Ave and Yale Blvd UNM Station	5	0	23.23	0	1	2.96
TOTAL	**12**	**18**	**14.54**	**100**	**1**	**0.87**
COMBINATION ROUTE						
Los Ranchos / Journal Center Station	2	18	4.80	100	0	0.04
Jefferson and Journal Center Blvd Station	3	0	14.30	0	0	0.02
Washington St and Hawkins St Station	0	0	11.90	0	0	0.03
Acadamy Parkway and Washing St Station	0	0	13.67	0	0	0.07
Jefferson and Singer Blvd Station	2	0	19.66	0	0	0.00
Menaul Blvd and University Blvd Station	1	0	8.19	0	0	0.09
Lomas Blvd at UNM Hospital	3	0	29.46	0	1	1.93
Central Ave and Yale Blvd UNM Station	5	0	23.23	0	1	2.96
TOTAL	**16**	**18**	**15.65**	**100**	**1**	**0.64**

FEHR PEERS

MEMORANDUM

Date: July 19, 2013

To: Tony Sylvester, MRCOG
Aaron Sussman, MRCOG

FROM: David Millar, Fehr & Peers
Nikki Foletta, Fehr & Peers

Subject: Updates to 2035 Ridership Estimates for Paseo del Norte BRT

DN11-0307

INTRODUCTION

A station area specific land use analysis was conducted as part of the High Capacity Transit Study to forecast employment and dwelling units within several station areas for the year 2035 (referred to as the Alternative Scenario). Our previous ridership analysis used employment and dwelling unit values provided by the Metropolitan Transportation Plan (MTP 2035). Table 1 shows the difference in employment and dwelling units between these two studies.

TABLE 1. 2035 Station Area Employment and Dwelling Units

Station	MTP 2035 Employment	Alternative Scenario Employment	Percent Change in Employment	MTP 2035 Dwelling Units	Alternative Scenario Dwelling Units	Percent Change in Dwelling Units
Southern @ Unser	433	1133	162%	207	141	-32%
Rust Medical Center / Presbyterian Hospital	1205	4884	305%	988	1485	50%
Volcano Heights Town Center	6520	4576	-30%	2056	6765	229%
Paseo del Norte @ Eagle Ranch	1000	968	-3%	44	804	1727%
Journal Center	5757	8500	48%	521	2487	377%

For our revised ridership analysis we increased the employment and dwelling units per station area from our previous estimates by the percent changes listed in Table 1 in order to get revised values for the input variable: *Urban Density*. *Urban Density* is defined as the sum of employment plus households with ½ mile of the stop (per acre). The Journal Center estimates shown in Table 1 cover 5 stops: "Los Ranchos/Journal Center", "Jefferson and Journal Center Blvd Station", "Jefferson and Hawkins Station", "Jefferson and Presidential Dr. Station", and "Jefferson and Singer

Blvd Station". We distributed the additional employment and dwelling units (shown in Table 1) according to the previous distribution of employment and households between the 5 stops.

Another model input is *Poverty Density*, defined as the poverty density within ½ mile of the stop (per acre). The Alternative Scenario analysis did not estimate changes in poverty density. Therefore, we assumed the percent increase poverty density between the MTP 2035 and the Alternative Scenario was the same as the percent increase in dwelling units between the two scenarios, for each stop.

We also assumed that due to the increased population at the Rust Medical Center/Presbyterian Hospital station and the increased employment at the Volcano Heights Town Center station and at the Journal Center, that one additional feeder bus route would be added to each under the "Some BRT Improvements" scenario, and that two feeder bus routes would be added to each under the "Significant BRT" scenario, to account for the fact that transit use would be higher under the latter scenario.

We used the revised values for *Urban Density*, *Poverty* density, and *Feeder Bus Routes* in our ridership model to estimate 2035 boardings per stop for three scenarios: 1) Rapid Ride, 2) Some BRT Improvements, and 3) Significant BRT. The results are shown in Table 2.

TABLE 2. 2035 Station Boarding Estimates

Station	2035 Daily Boardings (Rapid Ride)	2035 Daily Boardings (Some BRT Improvements)	2035 Daily Boardings (Significant BRT)
YELLOW ROUTE			
Southern & Unser PnR 8 acres	576	704	792
Presbyterian Hospital	75	246	379
Unser & McMahon	44	171	260
Paradise & Unser	26	153	242
Volcano Heights PnR 6 acres	570	741	874
Golf Course & Paseo del Norte	57	184	273
Paseo del Norte & Eagle Ranch	522	649	738
Yellow Route Total	1870	2848	3558
JEFFERSON STREET ROUTE			
Los Ranchos / Journal Center Station	196	323	412
Jefferson and Journal Center Blvd Station	128	300	389
Jefferson and Hawkins Station	132	259	392
Jefferson and Presidential Dr Station	124	251	340
Jefferson and Singer Blvd Station	130	257	345
Menaul Blvd and University Blvd Station	54	181	269

Lomas Blvd at UNM Hospital	532	659	748
Central Ave and Yale Blvd UNM Station	623	751	839
Jefferson Route Total	1919	2981	3734
OVERALL TOTAL BOARDINGS	**3789**	**5829**	**7292**

The difference between the previous model estimates and the revised model estimates are shown in Tables 3, 4, and 5.

TABLE 3. Change in 2035 Station Boarding Estimates for Rapid Ride Scenario

Station	Previous 2035 Daily Boardings (Rapid Ride)	Revised 2035 Daily Boardings (Rapid Ride)	Difference
YELLOW ROUTE			
Southern & Unser PnR 8 acres	565	576	11
Presbyterian Hospital	42	75	33
Unser & McMahon	44	44	0
Paradise & Unser	26	26	0
Volcano Heights PnR 6 acres	556	570	14
Golf Course & Paseo del Norte	57	57	0
Paseo del Norte & Eagle Ranch	498	522	24
Yellow Route Total	1788	1870	82
JEFFERSON STREET ROUTE			
Los Ranchos / Journal Center Station	176	196	20
Jefferson and Journal Center Blvd Station	96	128	32
Jefferson and Hawkins Station	98	132	34
Jefferson and Presidential Dr Station	85	124	39
Jefferson and Singer Blvd Station	92	130	38
Menaul Blvd and University Blvd Station	52	54	2
Lomas Blvd at UNM Hospital	532	532	0
Central Ave and Yale Blvd UNM Station	623	623	0
Jefferson Route Total	1754	1919	165
OVERALL TOTAL BOARDINGS	**3542**	**3789**	**247**

TABLE 4. Change in 2035 Station Boarding Estimates for Some BRT Improvements Scenario

Station	Previous 2035 Daily Boardings (Some BRT Improvements)	Revised 2035 Daily Boardings (Some BRT Improvements)	Difference
YELLOW ROUTE			
Southern & Unser PnR 8 acres	692	704	12
Presbyterian Hospital	170	246	76
Unser & McMahon	171	171	0
Paradise & Unser	153	153	0
Volcano Heights PnR 6 acres	683	741	58
Golf Course & Paseo del Norte	184	184	0
Paseo del Norte & Eagle Ranch	625	649	24
Yellow Route Total	2678	2848	170
JEFFERSON STREET ROUTE			
Los Ranchos / Journal Center Station	303	323	20
Jefferson and Journal Center Blvd Station	223	300	77
Jefferson and Hawkins Station	225	259	34
Jefferson and Presidential Dr Station	212	251	39
Jefferson and Singer Blvd Station	219	257	38
Menaul Blvd and University Blvd Station	180	182	2
Lomas Blvd at UNM Hospital	659	659	0
Central Ave and Yale Blvd UNM Station	751	751	0
Jefferson Route Total	2772	2981	209
OVERALL TOTAL BOARDINGS	**5450**	**5829**	**379**

TABLE 5. Change in 2035 Station Boarding Estimates for Significant BRT Scenario

Station	Previous 2035 Daily Boardings (Significant BRT)	Revised 2035 Daily Boardings (Significant BRT)	Difference
YELLOW ROUTE			
Southern & Unser PnR 8 acres	781	793	12
Presbyterian Hospital	258	379	121
Unser & McMahon	260	260	0
Paradise & Unser	242	242	0
Volcano Heights PnR 6 acres	771	874	103
Golf Course & Paseo del Norte	273	273	0
Paseo del Norte & Eagle Ranch	713	738	25
Yellow Route Total	3298	3558	260
JEFFERSON STREET ROUTE			
Los Ranchos / Journal Center Station	392	412	20
Jefferson and Journal Center Blvd Station	312	389	77
Jefferson and Hawkins Station	314	392	78
Jefferson and Presidential Dr Station	301	340	39
Jefferson and Singer Blvd Station	308	346	38
Menaul Blvd and University Blvd Station	268	270	2
Lomas Blvd at UNM Hospital	748	748	0
Central Ave and Yale Blvd UNM Station	839	839	0
Jefferson Route Total	3482	3734	252
OVERALL TOTAL BOARDINGS	**6780**	**7292**	**512**