DECLARATION OF GREGORY ROWANGOULD, PH.D.

Review of the Albuquerque Rapid Transit (ART) Project's Potential Transportation and Environmental Impacts

Prepared:
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ABOUT THIS REPORT

This report was commissioned by Freedman Boyd Hollander Goldberg Urias & Ward P.A. My assignment was to review the technical studies and documentation completed by ABQ Ride and its consultants that evaluated the potential transportation and environmental benefits and impacts of the proposed ART project. My review focuses specifically on transit system performance, traffic impacts and other environmental impacts directly related to changes in travel behavior. ABQ Ride's reports on these topics formed the basis for its assertions in its request for a "Small Starts" grant and in its request for a Categorical Exclusion from NEPA requirements that would otherwise apply, that ART was needed to provide transit along Central Avenue and that the ART project would not have a significant environmental impact. ABQ Ride's studies and documentation cover topics of much of my past research and with which I have 12 years of experience investigating. My report discusses what ABQ Ride's analysis reveals about the proposed ART project's likely transportation and environmental impacts. My report also evaluates to what extent evidence from ABQ Ride's technical studies support specific claims made by ABQ Ride in its application for a categorical exclusion and Small Starts grant.

ABOUT THE AUTHOR

I have been an Assistant Professor in the Civil Engineering Department at the University of New Mexico since 2012. My research at the university has been directed at understanding how we can create more sustainable cities. I focus on the role of transportation, and specifically the development of new modeling approaches and closing knowledge gaps that can lead to more informed, and ideally, more sustainable transportation infrastructure and policy decisions. My current research investigates regional scale air quality and public health concerns related to vehicle emissions, the role of pedestrian and bicycle infrastructure in mode choice decisions, and the integration of land-use and travel forecasting models. I am also interested in freight transportation planning and transportation policy analysis. At UNM I also teach courses in regional transportation planning, travel demand forecasting, the design of sustainable transportation systems and engineering economics.

Locally, I have worked with the Mid Region Council of Governments (MRCOG) to investigate how regional bicycle infrastructure affects bicycle ridership. I have also assisted the U.S. Department of Transportation and MRCOG in modeling options to mitigate greenhouse gas emissions from the transportation sector in Central New Mexico.

Prior to joining UNM, I was a Transportation and Air Quality Science Fellow at the Natural Resources Defense Council (NRDC), working at NRDC's Santa Monica, California office. At NRDC I worked with municipal and regional planning agencies as well as community groups to evaluate options for more sustainable transportation solutions to traffic and freight movement in Southern California and elsewhere. In this role, I also reviewed transportation modeling and analysis conducted for many large transportation projects in an effort to help those concerned about these projects better understand the likely impacts to their community or the environment.

I have a PhD in Civil and Environmental Engineering from the University of California, Davis, with concentrations in Transportation Engineering and Environmental Economics, an MS in Resource Economics and Policy from the University of Maine, and a BS in Chemical Engineering also from the University of Maine. My PhD dissertation research developed new methods for modeling air pollutant emissions from locomotives and investigated the adequacy of data and modeling technology to support publicly funded freight transportation infrastructure projects. My MS thesis research investigated the equity of fuel economy standards and gas taxes as policies for reducing greenhouse gas emissions.

My current CV is attached to the end of this report.

SUMMARY OF MY REVIEW

My review focused on two technical studies completed by ABQ Ride and its consultants that provided most, if not all, of the quantitative data that formed the basis for ABQ Ride's opinions and claims made in its petition for a Categorical Exclusion and its Small Starts grant application to the Federal Transit Administration about the proposed ART project's likely transportation benefits and costs and environmental benefits and costs. These studies included a traffic study completed by Parsons Brinkerhoff[1,2] that was submitted with the petition for a Categorical Exclusion and a travel demand study completed by HRD[3] that was submitted with the Small Starts application. The traffic study investigated ART's likely traffic impacts and also ART performance. The travel demand study investigated how ART would change transit ridership, ART performance, and the amount of vehicle travel.

The validity of the traffic study's and travel demand study's findings are questionable at best due to several critical flaws and limitations in each study. Most importantly, both models were poorly calibrated, with data in each study report demonstrating that they had little, if any, ability replicate actual observed traffic conditions and transit ridership. Models that cannot replicate actual current conditions cannot be expected to predict future conditions. The lack of adequate calibration should have precluded the use of any data derived from these studies. The studies also contained errors in traffic forecasts and unsupported and flawed assumptions about traffic diversion. Furthermore, the scope of both studies were far too limited to understand the wide range of likely environmental impacts that the ART project would have. Most importantly, there was no analysis of traffic impacts to other streets and intersections in the project area that would be caused by traffic diversion as a result of ART's elimination of two of the currently four or six general-purpose traffic lanes and other aspects of its design, there was no evaluation of how the ART would perform relative to continuing to operate the current Rapid Ride, which ART is intended to replace, and there was no evaluation of how the ART would affect the local route 66 bus which would continue to travel in general purpose lanes.

Putting aside the fact that both studies are completely unreliable because of poor model calibration and other errors and flaws, the analysis as completed by ABQ Ride and documented in the traffic study and travel demand study largely fails to support ABQ Ride's main claims regarding the likely transportation and environmental impacts of the project. The traffic study clearly indicates that traffic congestion along Central Avenue will be significantly worse if ART is built. While initial traffic impacts are reported to be relatively small, they are still worse than they would be if the project was not built. In the future, traffic impacts are shown to become increasingly severe. The traffic study itself concludes that, "Under the 2035 Build Conditions, many intersections will perform deficiently due to insufficient capacity or green time for general purpose traffic, or other physical constraints."[4] The report continues by suggesting potential mitigation measures for particularly congested areas that include adding additional traffic lanes to Central Avenue, concluding that no mitigation is possible, or that ART bus only lanes should

[1] References cite Bates numbers in the Administrative Record filed in this case on June 1, 2016.
[2] Technical Supplement #2 – Albuquerque Rapid Transit VISSIM Analysis [ABQ PAR 00205]
[3] Technical Memorandum: Central Avenue ART Ridership Results [ABQ PAR 02678]
[4] Technical Supplement #2 – Albuquerque Rapid Transit VISSIM Analysis, Page 107, Section 5.3 [ABQ PAR 00317]

be removed[5]. Furthermore, while neither study, or any other studies, have compared the performance of ART with continuing to operate the Rapid Ride, my estimations based on data in the traffic study appendices and by comparing the travel demand study's estimates with current Rapid Ride schedules indicates little, if any, travel time or reliability improvements will be achieved if ART is built. In fact, these comparisons indicate the ART may perform worse than the Rapid Ride would.

Furthermore, while not evaluated by ABQ Ride, other negative impacts are likely. Because ART will increase traffic congestion for vehicle traffic, it is likely that there will be significant traffic diversion from Central Avenue to alternative routes. This diverted traffic has the potential to increase traffic congestion along these alternative routes, particularly in the future with the growth in traffic that is expected. While ABQ Ride did assume 200 vehicles would be diverted during rush hour, that number is unsupported, highly questionable, of unknown origin and demonstrably flawed. Furthermore, ABQ Ride did not evaluate where those vehicles may go. The large increase in traffic congestion in general purpose traffic lanes on Central Avenue will also negatively impact the performance of the local route 66 bus which currently carries half of ABQ Ride Central Avenue ridership. Even if ART were to improve transit performance as compared with Rapid Ride, the impact to the local 66 bus may still result in a net negative impact to transit service. Additionally, the differing communities and passengers served by ART/Rapid Ride and the local 66 bus route were not evaluated leaving the project's potential environmental justice impacts unknown.

In conclusion, I believe that public transit is an important component of a sustainable and fair transportation system. However, the ART project as currently designed appears to do more harm than good. The analysis performed so far by ABQ Ride is completely unreliable. Furthermore, it largely fails to show any transportation benefits from ART but it does indicate a wide range of traffic impacts. In my opinion, a trained transportation analyst, reviewing the reports and data submitted by ABQ Ride in support of its Small Starts grant application and its CE application, should have been able to identify the same problems that I have identified in this report. There are also a wide range of alterative options that could be considered for improving public transit along Central Avenue that would likely provide real benefits and fewer negative impacts.

[5] Technical Supplement #2 – Albuquerque Rapid Transit VISSIM Analysis, Page 107 - 108, Table 5-9 [ABQ PAR 00317]

1 INTRODUCTION

The proposed Albuquerque Rapid Transit (ART) project will replace ABQ Ride's current Green Line (777) and Red Line (766) Rapid Ride routes which now provide express, "limited stop" bus service along most of Central Avenue. Central Avenue is also served by ABQ Ride's local 66 bus which provides more frequent stops and has longer service hours than the Rapid Ride routes. ABQ Ride's Blue Line Rapid Ride route also has a stop on Central Avenue at Yale Boulevard near the University of New Mexico's main campus.

According to ABQ Ride, Albuquerque's transit agency, the aims of the proposed ART project are to[6]:

- Improve transit service along Central Avenue,
- Improve access to major activity and employment centers located in the project area,
- And provide a framework for transit oriented development and redevelopment along the corridor.

ABQ Ride also states that the project's merits are[7]:

- Faster and more reliable bus service. Specifically, at least a 15% decrease in travel time and a 25% increase in on-time performance.
- Increased security and cleanliness. Specifically, it is noted that the project includes the following: improved lighting, transit security officers, signalized intersections that allow pedestrian crossing and U-turns.
- A "Main Street" streetscape, described as ART lanes and wider sidewalks that will narrow the street and slow vehicle traffic and create new outdoor space for café seating.
- An improved quality of life created by supporting a pedestrian friendly environment.
- Economic prosperity through new investment, development and jobs along the project area
- Attracting and keeping millennials who are stated to prefer urban settings where they do not need to rely on a car.

The current Rapid Ride and the proposed ART project are both types of bus rapid transit (BRT)[8]. The current Rapid Ride service provides limited stop service (stops placed at about ½ mile intervals) with headways[9] ranging from 16 minutes west of downtown to 8 minutes east of downtown using high capacity articulated[10] buses. The proposed ART project, if built, will generally follow the same routes as the current Green and Red Rapid Ride Lines that it will

[6] ART Project Narrative, Section 4 [ABQ PAR 02671]
[7] ART Project Narrative, Section 5 [ABQ PAR 02671 – 72]
[8] Bus Rapid Transit generally refers an enhanced bus transit service that results in improved performance over traditional bus transit service.
[9] Headway is the time between each bus on a particular bus route. It is a measure of the frequency of bus service.
[10] Articulated buses are a type of high capacity transit bus where two separate bus sections are connected by a flexible joint.

replace and uses similar articulated buses. The main changes to the rapid bus transit service along Central Avenue that will occur with ART are the following:

- ART buses will travel in dedicated (ART bus only) lanes located in the center of the roadway from Coors Boulevard to Louisiana, except through downtown and under the I-25 overpass where buses will travel in regular, mixed flow, lanes. Beyond these limits, ART will operate in regular, mixed flow, traffic lanes just as the current Rapid Ride service does.
- Headways will be decreased from 16 minutes to 7.5 minutes west of downtown, and from 8min to 7.5 minutes east of downtown. The reduction in headways west of downtown is the result of adding additional buses.
- In the project area (between Coors and Louisiana) bus platforms will generally be placed in the center of the roadway and will be elevated. The elevated platforms will eliminate the need to step up into the bus.
- In the project area (between Coors and Louisiana) bus fares will be purchased at station platforms, eliminating the need to pay for fares while boarding the bus. While not discussed in the project documentation, presumably fares will continue to be collected on the bus outside of the project area where ART buses will use existing curbside Rapid Ride stops.
- Traffic signals throughout the project area will implement some unspecified form of transit priority aimed at reducing delay for ART vehicles at signalized intersections.

While the ART project proposes relatively modest changes to current rapid bus transit service along Central Avenue, the project involves significant changes to the geometric design, landscaping and appearance of Central Avenue as well as Central's traffic capacity. In areas between Coors and Louisiana where general purpose lanes are replaced by bus only lanes, traffic capacity will be reduced by 30% to 50%[11]. The ART project's dedicated lanes will also result in a new prohibition of left turns and pedestrian crossing at un-signalized intersections along Central Avenue.

In support of its application for federal funding for ART, ABQ Ride commissioned a series of studies to evaluate the potential benefits and costs of the proposed ART project. Many of these studies then supported ABQ Ride's application for a categorical exclusion (CE) from NEPA requirements that would otherwise apply and its application for a Federal Transit Administration (FTA) Small Starts grant. The remainder of this report reviews the transportation studies completed by ABQ Ride for the project and discusses what they reveal about the likelihood of the proposed ART project achieving its stated purpose as well the ART project's potential to negatively impact the environment including traffic congestion levels, accessibility to destinations along Central, and air quality.

2 WHAT WAS EVALUATED?

ABQ Ride evaluated the ART project's potential to increase bus ridership along the Central Avenue corridor and decrease travel time over the current Rapid Ride service. ABQ Ride also

[11] This traffic capacity reduction results from replacing 2 general purpose lanes with bus only lanes on roads that currently have either 4 or 6 lanes.

evaluated how ART may impact traffic congestion at intersections along Central Avenue. These evaluations were made in two separate studies that served as the primary source of quantitative data regarding ART's likely impacts[12].

Traffic congestion along Central Avenue with and without the proposed ART project was evaluated in a traffic microsimulation study by Parsons Brinkerhoff, referred to herein as "the traffic study"[13]. The traffic study was included in ABQ Ride's application for a NEPA categorical exclusion as "Technical Supplement # 2". The traffic study uses a traffic microsimulation model that simulates how individual vehicles (e.g., cars, trucks, buses) would likely move through an intersection, street segment or a network of streets and intersections. This type of model is capable of estimating travel times and speeds along a street and delays that may occur at intersections and other bottlenecks, and is commonly used for evaluating alterative street and intersection designs. ABQ Ride's consultant used VISSIM, a very common software platform for traffic microsimulation modeling.

The traffic study evaluates traffic congestion measured as seconds of delay at signalized intersections along the entire ART route for the years 2017, which is the expected opening year, and 2035. Traffic congestion with and without the ART project is evaluated in each of these years. Herein, these two modeling scenarios are referred to as the "build" and "no-build" scenarios, respectively. The no-build scenario assumes the current Rapid Ride service continues operating as it does today in the years 2017 and 2035.

The traffic study yielded two results that form the basis for consideration of ABQ Ride's CE application and Small Starts grant application:

- The estimated change in the performance of intersections along Central Avenue. Intersection performance is evaluated using a metric referred to as level of service (LOS). LOS is evaluated on an A (best) to F (worse) scale based on the average delay vehicles experience at a signalized intersection.
- The estimated ART bus travel time between each bus station and the overall route.

The model used in the traffic study only estimates how quickly a given level of traffic volume is likely to move through a street, intersection or network of streets and intersections. It does not model how a project affects travel patterns, travel mode choices, and the volume of traffic on individual streets.

A second study conducted by HDR[14] for ABQ Ride used FTA's Simplified Trips on Project Software (STOPS) to estimate changes in bus ridership, vehicle travel demand, and ART bus

[12] Other studies conducted or commissioned by ABQ Ride investigated impacts on noise and vibration, endangered species, historical properties, business access (location of lost left turns and example alternative access routes, did not study how this would affect travel patterns or traffic congestion), existing land-uses and land-use plans, station area walk sheds, environmental justice (limited to quantifying the demographics around station areas and the ART route), and economic development potential.
[13] Technical Supplement #2 – Albuquerque Rapid Transit VISSIM Analysis [ABQ PAR 00205]
[14] Technical Memorandum: Central Avenue ART Ridership Results [ABQ PAR 02678]

travel time. Herein, this study is referred to as the "travel demand" study. The travel demand study was included with ABQ Ride's FTA Small Starts application.

The travel demand study used STOPS, which is a simplified, trip-based travel demand model. A typical trip-based travel demand model contains 4 basic steps. The first step called Trip Generation, estimates the number of trips made by each household in the study area and their purposes. The number of trips generated is mainly a function of the number of households and their socioeconomic and demographic profile. The second step, called Trip Distribution, estimates the destination of each trip. Destinations are selected based on their compatibility with the trip's purpose and the destination's accessibility (generally, travel time and cost). The third step, called Mode Choice, estimates the most likely mode by which each trip will be completed. Mode choice decisions are generally a function of travel time and cost. The final step called Route Choice or Traffic Assignment, estimates the specific route that each trip will make from its origin to its destination. Routing is based on travel time, cost and transportation mode. Travel demand models are therefore very useful for understanding how a potential project may affect a wide range of travel behavior including changes in traffic volume, traffic speed, travel time and transit ridership on each roadway segment and transit route. The Mid Region Council of Governments (MRCOG) maintains a detailed and up to date travel demand model of the Albuquerque metropolitan area.

The travel demand modeling study for ART used FTA's simplified STOPS travel demand model rather than MRCOG's more detailed regional travel demand model. It is unclear why HDR and ABQ Ride selected the less detailed model containing less region specific information than MRCOG's travel demand model. The simplified modeling performed in the travel demand study produced the following information that was used in ABQ Ride's FTA Small Starts application:

- Estimated change in bus ridership with the ART project if it had started operating during the year 2015.
- Estimated ART travel time if it had operated during the year 2015.
- Estimated reduction in vehicle travel.

ABQ Ride commissioned and conducted several additional studies in support of the ART project[12]; however, the traffic study and the travel demand study described above provide the quantitative information that the city relied on in is application for a CE and for FTA Small Starts funding, specifically for evaluating the proposed ART project's performance and its impact on traffic congestion and travel.

3 WHAT DID THE TRANSPORTATION STUDIES FIND?

The traffic study and the travel demand study reveal some information about how the ART project may perform and how it may impact traffic congestion along Central Avenue. However, critical flaws and inappropriate assumptions in both studies greatly reduce the validity of estimates and conclusions that city has drawn from them. Furthermore, limitations in the models and the design of both studies limits the range of impacts that were actually considered. In my opinion, they are completely inadequate for understanding ART's likely environmental impacts or substantiating a claimed need for ART.

3.1 The Traffic Study

The main purpose of the traffic study was to investigate the potential traffic congestion impacts of the proposed ART project. The study also estimated the expected ART travel time.

3.1.1 What the study reveals

Figure 1 tabulates the traffic study's findings regarding the impact of the ART project on intersections along Central Avenue. These are data reported in the traffic study[15] that I reorganized here, without alteration, to facilitate an easier comparison. The numbers in each grid cell in Figure 1 are counts of the number of intersections meeting each criterion. Numbers along the diagonal of each matrix shaded in gray show the number of intersections where LOS does not change between the build and no-build scenarios. Numbers above the diagonal in red are intersections that experience a deterioration (reduction) in LOS with the ART project. Numbers below the diagonal in blue are intersections that experience an improvement in LOS with the ART project.

2017 AM Peak Hour

From \ To	A	B	C	D	E	F
A	30	7				
B		19	3			
C		1	12	3		
D			1	1		
E					1	
F						

2017 PM Peak Hour

From \ To	A	B	C	D	E	F
A	15	9	1			
B	2	8	9			
C			3	8		
D			1	4	3	
E						2
F						

2035 AM Peak Hour

From \ To	A	B	C	D	E	F
A	25	6				2
B		18	4		1	
C			9	2		1
D			1	1	3	
E					3	1
F						1

2035 PM Peak Hour

From \ To	A	B	C	D	E	F
A	11	2	3	2	1	1
B	3	12	2	9		
C		1	6	2	1	2
D			2	2	2	1
E	1			1	3	3
F			1			4

Figure 1 Modeled Change in LOS from No-Build to Build Scenario (blue = increasing LOS, red = decreasing LOS)

As shown in Figure 1, the traffic study demonstrates that the LOS of a large number of intersections will be degraded, rather than improved, by the ART project in its first year: LOS at

[15] Data from Figures 4-1, 4-2, 4-5, 4-6, 5-1,5-2, 5-4, and 5-5 in the traffic study [ABQ PAR 00205]

13 intersections will degrade during the AM peak hour and 32 will degrade during the PM peak hour. By the year 2035, intersection LOS in the project area declines for both the build and no-build scenarios because traffic volume is expected to continue growing over 2017 levels. However, the impacts are much worse if the ART is built than if it is not built: 20 intersections during the AM peak hour experience a reduction in LOS and 31 intersections experience reductions during the PM peak. These LOS reductions are also larger than in 2017. For example, in the AM peak period two intersections go from a LOS A without the ART to a LOS F with the ART, meaning that they will have gone from the best possible LOS to the worst. Intersections operating at a LOS of F along a busy corridor such as Central Avenue will likely become significant bottlenecks.

The traffic study also estimated the ART travel time between each of the proposed stops[16] and for trips traveling the entire length of the corridor for 2017[17] and 2035[18]. However, the study did not compare ART travel times with the existing Rapid Ride's travel times under the no-build scenario. The lack of a comparison between the current Rapid Ride and the projected ART system makes it very difficult to understand the potential travel time benefits of the proposed ART project. One way, however, to facilitate this comparison would be by comparing the estimated delay of traffic moving along the proposed ART route in general purpose lanes in the no-build scenario with the estimated delay of ART buses in the build scenario. If ART buses experience less delay than traffic using the general purpose lanes in the no-build scenario, then this would indicate that the ART project likely improves travel time and reliability. But the data does not support this. Table 1 tabulates these data and compares them.

The comparison of delay estimates in Table 1 reveal that according to the traffic study modeling output that in most places and during most times the a Rapid Ride bus traveling in general purpose lanes in the no-build scenario would experience less delay than the ART bus that will be traveling, as planned, in a combination of bus only lanes and general purpose lanes with signal priority. This occurs because the traffic capacity reduction from the ART project results in significant traffic congestion. This traffic congestion creates traffic jams that then block intersections, impeding the movement of both cars and ART buses. This is particularly true where ART buses must pass under the I-25 overpass using general purpose lanes. In other words, the data available from the traffic study demonstrates that ART will not only impose delays on other traffic, it will impose delays on ART itself that will make it slower than the current, Rapid Ride system.

[16] Technical Supplement #2 – Albuquerque Rapid Transit VISSIM Analysis, Appendix G [ABQ PAR 00819 - ABQ PAR 00820] and Appendix H [ABQ PAR 00900 – ABQ PAR 00901]
[17] Technical Supplement #2 – Albuquerque Rapid Transit VISSIM Analysis, Tables 4-8 and 4-9 [ABQ PAR 00292 – ABQ PAR 00293]
[18] Technical Supplement #2 – Albuquerque Rapid Transit VISSIM Analysis, Tables 5-7 and 5-8 [ABQ PAR 00314]

Table 1 Intersection Delay with and without ART (minutes)

			East Bound		West Bound	
Peak Hour	Year	Section	No-Build[a]	ART [b]	No-Build	ART
AM	2017	West	4.9	4.5	4.8	4.5
AM	2017	East	4.5	5.4	4.4	6.3
AM	**2017**	**Total**	**9.3**	**9.9**	**9.2**	**10.9**
AM	2035	West	8.8	5.5	6.0	4.5
AM	2035	East	5.0	8.4	4.9	6.8
AM	**2035**	**Total**	**13.9**	**13.9**	**10.8**	**11.3**
PM	2017	West	5.0	4.6	5.5	5.4
PM	2017	East	6.2	8.4	6.3	6.8
PM	**2017**	**Total**	**11.2**	**13.0**	**11.8**	**12.2**
PM	2035	West	6.2	5.2	22.0	11.9
PM	2035	East	6.2	10.4	7.6	15.1
PM	**2035**	**Total**	**12.4**	**15.6**	**29.6**	**27.0**

[a]Delay in general purpose travel lanes following the current Rapid Ride route from the traffic study Appendices F [ABQ PAR 00737 – ABQ PAR 00744, ABQ PAR 00755 – ABQ PAR 00763], G [ABQ PAR 00765 – ABQ PAR 00786]and H [ABQ PAR 00821 – ABQ PAR 00858.
[b]ART delays from traffic study Tables 4-7 and 5-6 [ABQ PAR 00290 – ABQ PAR 00292, ABQ PAR 00311 – ABQ PAR 00313].

3.1.2 Validity of the Study Findings

The validity of the traffic study's stated findings, however, are highly questionable for two reasons. First, the traffic microsimulation model is demonstrated to be incapable of estimating intersection level traffic changes. Second, the traffic volume forecasts used in the 2017 microsimulation modeling do not account for expected traffic growth in the project area.

The traffic microsimulation model must be "calibrated" before it can be used for modeling. Calibration is achieved by adjusting various model parameters until mode outputs are shown to replicate a set of actual, observed traffic conditions within a reasonable level of accuracy. In other words, if the model's outputs replicate known traffic conditions at particular places and times, it is more likely to accurately predict conditions in those same places in the future. In this case, calibration was determined by comparing the microsimulation model's traffic volume estimates at each intersection and travel time estimates between each intersection with actual observations made along the project route during 2014.

The traffic **volume** calibration results[19] are found to be adequate; however, this criterion is easily achieved in an uncongested network such as Central Avenue during 2014. The more stringent criterion, and the one most applicable to the traffic study, is how well the model replicates travel **times**. If the model cannot accurately replicate travel times between each intersection today, then

[19] Technical Supplement #2 – Albuquerque Rapid Transit VISSIM Analysis, Tables 3-14 and 3-15 [ABQ PAR 00246 – ABQ PAR 00249]

it cannot be expected to accurately predict future travel times including the seconds of delay at intersections, which are the basis for the LOS estimates made in the traffic study.

However, the travel **time** calibration results[20] indicate that the microsimulation model is poorly calibrated, despite the claims made by the traffic study consultants. The observed and modeled travel times for most roadway segments vary from each other by a large (up to 189%) and unacceptable amount. While the traffic study consultant believes that FHWA guidelines suggest that adequate calibration is achieved when travel time estimates are within ± 15% or 1 minute of observed travel times[21], the consultant has apparently misunderstood or misused the referenced FHWA report[22].

The FHWA report does not provide official calibration guidelines. The FHWA report states[23] :

> *The objective of model calibration is to obtain the best match possible between model performance estimates and the field measurements of performance. However, there is a limit to the amount of time and effort anyone can put into eliminating error in the model. There comes a point of diminishing returns where large investments in effort yield small improvements in accuracy. The analyst needs to know when to stop. This is the purpose of adopting calibration targets for the model.*
>
> *Calibration targets are developed based on the minimum performance requirements for the microsimulation model, taking into consideration the available resources.* ***The targets will vary according to the purpose for which the microsimulation model is being developed and the resources available to the analyst.*** *(Emphasis added)*

The FHWA report then offers an example of calibration targets used by the Wisconsin Department of Transportation in a study of Milwaukee area **freeways[23]**:

> *Table 4 provides an example of calibration targets that were developed by Wisconsin DOT for their Milwaukee freeway system simulation model. They are based on guidelines developed in the United Kingdom.[18]*

Table 4 in the FHWA report is the source of the ± 15% or 1 minute calibration criteria used in the ART traffic study for travel times. Table 4 is only an example and not guidance. Furthermore, it is an example for a fundamentally different type of roadway that is not applicable

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[20] Technical Supplement #2 – Albuquerque Rapid Transit VISSIM Analysis, Tables 3-16 through 3-23 [ABQ PAR 00251 – ABQ PAR 00267]

[21] Technical Supplement #2 – Albuquerque Rapid Transit VISSIM Analysis, Page 16 [ABQ PAR 00226]

[22] Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software. (2004), Federal Highway Administration, PUBLICATION NO. FHWA-HRT-04-040 Available (6/7/2016) at http://ops.fhwa.dot.gov/trafficanalysistools/tat_vol3/vol3_guidelines.pdf

[23] Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software. (2004), Federal Highway Administration, PUBLICATION NO. FHWA-HRT-04-040, Page 63.

to the ART study; a highway system, not an urban arterial. It should also be noted that these criteria were originally developed for a 1992 study of **highways** in the United Kingdom, and not for **arterial** city **streets** such as Central Avenue.

While the ± 15% criterion may be reasonable, using the 1 minute criterion produces misleading and inaccurate results, is deeply flawed and entirely unacceptable for determining if the traffic model used in the ART project is adequately calibrated and therefore capable of studying the project's likely traffic impacts, which are key to determining whether it should be built as designed or not. Many roadway segments in the project area are very short, with observed travel times around 1 minute or less (some as short as 5 seconds). Applying the 1-minute calibration criterion to these short segments provides a false indication of calibration because the criterion is not germane for shorter roadway segments that can often be traveled more quickly, rather than long highway segments. A one minute discrepancy between actual and modeled travel time for a roadway segment that takes five minutes to travel is an error of 20%, while the same one minute discrepancy for a roadway segment that takes 30 seconds to travel is an error of 200%. An error of 200% is well beyond any reasonable definition of an accurate prediction, and yet by the 1-minute calibration criteria this 200% error would be considered acceptable.

The majority of roadway segments evaluated for calibrating the model failed to meet the ± 15% criteria but were all assumed to reflect proper calibration because they were shown to meet the 1 minute criteria, which has no relevance to short segments. For example, the calibration results in Table 3-22 for roadway segment #8 indicates an observed travel time of 52 seconds and a modeled travel time of 10 seconds. The travel time difference is 42 seconds or 80.6% (with the actual travel time being more than 400% greater than the modeled travel time) yet this roadway segment is still considered to be acceptably modeled, within the calibration criteria, because the 42 second difference is "less than 1 minute". This calibration criterion is wholly inappropriate for an urban arterial with very short roadway segments. Under these conditions and criteria, the model can often be off by 50% to 200% and still be considered to reflect proper calibration and as therefore accurately predicting real world traffic. This is clearly not the case. The 1 minute criterion shown in the example by FHWA may have been appropriate for application to a highway project with longer roadway segments, but is certainly not applicable to very short roadway segments such as those being evaluated in the ART project.

The poor model calibration means that the intersection LOS estimates could be significantly higher or lower and ART travel time estimates between stops could be much longer or shorter than what is reported. While the calibration results do show that the overall end to end travel times between the western terminus of Central Avenue and downtown and downtown and the eastern terminus of Central Avenue are close to observations, that is irrelevant as a calibration criterion since the purpose of the traffic study, and its use in supporting the CE and Small Starts grant applications, was to evaluate intersection level impacts, and few trips that people would make in a car or on a bus would be along the entire length of those portions of Central Avenue.

The validity of the traffic study is also negatively impacted by a flawed approach to estimating year 2017 traffic volumes along Central Avenue. Intersection traffic counts (the number of cars entering and existing each intersection through each approach) were made through observation of intersections along Central Avenue during 2014 and used for developing and calibrating the

microsimulation model. Because the ART project is not expected to begin operating until 2017, the 2014 traffic counts should have been, but were not adjusted to the expected 2017 traffic volumes.

The traffic study relied on traffic volume forecasts provided by MRCOG for the year 2012 and 2035 to adjust the 2014 traffic counts[24]. These forecasts were made by MRCOG using their travel demand model for the region's 2035 Metropolitan Transportation Plan. The traffic study states that average annual growth rates between 2012 and 2035 were used to adjust the 2014 traffic counts at intersections west of Rio Grande Boulevard upwards by 2% to 8% annually[24] . The traffic study report then states that no adjustments were made to Central Avenue east of Rio Grande (the report actually says "west" but clearly intended to say "east") through downtown and the eastern terminus of Central Avenue. While the traffic study seems to have relied on MRCOG traffic volume forecasts for adjusting traffic volumes on the western portion of Central Avenue, the traffic study consultants simply assume no traffic growth to the east because they believe the area has no additional development potential[24]:

> *The areas west of Rio Grande Boulevard throughout the downtown Albuquerque are well developed, traffic volumes are not forecasted to increase in 2017.*

The argument that there will be no traffic growth along most of the project area is flawed. First, if this were true, then there would be little or no justification for any new BRT project. There is little to no congestion on Central Avenue today, and if that is not expected to change in some very significant way, then there is no justification for a new transit project aimed at avoiding delays caused by growing traffic congestion. Second, the 2035 modeling results contradict these assumptions. Third, ABQ Ride's ART Economic Development study that was submitted as part of its Small Starts application states that there is a "significant" amount of development opportunity along the "entire length" of the project area which is demonstrated in part by recent and planned development projects[25].

The 2035 modeling scenarios adjusted the 2014 traffic counts with MRCOG's 2035 traffic volume forecasts[26]. The 2035 modeling assumed significant traffic volume growth along all portions of Central Avenue. This can be seen by comparing the traffic volume demand at each intersection between 2014 and 2035 in the traffic study appendix I[27] It is unclear how the 2035 MRCOG traffic volume forecasts could have been used to assume no growth in 2017 east of Rio Grande Boulevard and yet significant growth by 2035 since no intermediate year forecasts were provided.

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[24] Technical Supplement #2 – Albuquerque Rapid Transit VISSIM Analysis, Section 4.1.1 [ABQ PAR 00273]

[25] ART Small Starts Application - Economic Development Report, Section B [ABQ PAR 01196]

[26] Technical Supplement #2 – Albuquerque Rapid Transit VISSIM Analysis, Section 5.1.1 [ABQ PAR 00295]

[27]Technical Supplement #2 – Albuquerque Rapid Transit VISSIM Analysis, Appendix I existing [ABQ PAR 00903 – ABQ PAR 00904, ABQ PAR 00909 – ABQ PAR 00910] and year 2035 [ABQ PAR 00907 – ABQ PAR 00908] traffic volumes input into the VISSIM model for each scenario at each intersection are shown.

Even more concerning is that 2014 traffic counts west of the Rio Grande were not adjusted based on the average annual traffic volume growth between 2012 and 2035 as the traffic study report indicates in Section 4.1.1[24]. Appendix E implies that growth rates of 6% to 26% (corresponding to 2% to 8% annual growth) were applied mainly to the second north bound left turn lane of each roadway intersecting Central Avenue[28]. This traffic lane does not actually exist at most of the intersections along this portion of Central Avenue or in the traffic simulation model. As a result, the growth factors were not actually applied to most of the intersections. This can be verified by comparing the modeling inputs shown in Appendix I[29]. The percentage change between 2014 traffic volumes and 2017 traffic volumes for each turning movement at intersections west of Rio Grande boulevard are mostly zero, while a few intersections have small percentage increases, and in some cases, decreases in traffic volume.

The underestimating of year 2107 traffic volumes has likely underestimated the ART project's opening year traffic impacts. As the traffic study's 2035 results indicate, as traffic volume increases, the ART project's negative traffic impacts will increase over the no-build scenario and present day congestion levels, significantly degrading traffic flow along Central.

Taken together, the poor model calibration and failure to correctly account for expected traffic volume growth makes any conclusions drawn from the study of very doubtful validity.

3.1.3 Study Limitations

In addition to the traffic study's flaws, it also has three serious limitations. It did not and could not estimate the quantity of traffic that may be diverted from Central Avenue if the project is built, identify the locations where such traffic diversion may occur, and assess what impacts traffic diversion may have on other roads and intersections that serve as alternative routes. The traffic study also failed to consider any increase in bus ridership, and the likely impact that would have on traffic volume. Finally, the traffic study failed to evaluate how the ART project would affect ABQ Ride's local route 66 bus which will continue to operate in the general purpose traffic lanes. These failings, in my opinion, are important additional reasons why the study has no value in determining whether to build ART as designed and has no value in determining that ART, if built, would have no significant environmental impact.

The traffic study's evaluation of potential traffic diversion is extremely limited and also flawed. The ART project will result in the replacement of one to two general purpose travel lanes along several busy stretches of Central Avenue in the project area. This will increase traffic congestion in the remaining general purpose lanes. A potential traffic impact, aside from increased traffic congestion on Central Avenue, will be the diversion of vehicle traffic that would have used Central Avenue to less congested parallel routes. The likelihood of traffic diversion appears to be

[28] Technical Supplement #2 – Albuquerque Rapid Transit VISSIM Analysis, Appendix E "2017 Growth Rates" [ABQ PAR 00722 – ABQ PAR 00724]

[29] Technical Supplement #2 – Albuquerque Rapid Transit VISSIM Analysis, Appendix I existing [ABQ PAR 00903 – ABQ PAR 00904, ABQ PAR 00909 – ABQ PAR 00910] and year 2017 [ABQ PAR 00905 – ABQ PAR 00906, ABQ PAR 00911 - 00914], traffic volumes input into the VISSIM model for each scenario at each intersection are shown.

high given the large reduction in Central Avenue's capacity caused by ART and a large projected increase in vehicle travel demand over time.

The potential direct impacts of traffic diversion are:

- A reduction in traffic and congestion on Central Avenue in the build scenario (if ART is built)
- Increased traffic and congestion on parallel and other alternative routes
- Increased traffic and congestion on streets, including those in residential areas, connecting Central Avenue to parallel routes
- To the extent that congestion results in traffic diversion from Central Avenue, trips to businesses along Central Avenue could also be reduced

Inexplicably, the traffic study assumes that 200 vehicles will be diverted from Central Avenue during the PM peak hour if ART is built: 100 east bound vehicles are assumed to turn right onto Edith Boulevard and 100 east bound vehicles turn right on to Locus Street[30]. No data, modeling, discussion or any other evidence is provided to support why this number was selected and why only 200 vehicles would be diverted, or why the diversion would be at only these two specific locations. There is no analysis or discussion of what routes these diverted vehicles would take and therefore no analysis of how they may impact traffic on other streets, including residential streets that connect Central to parallel routes. The analysis does assume that the vehicles reappear at several intersections along the eastern end of Central Avenue; however, there is no data, modeling, discussion or other evidence explaining how the vehicles get to these intersections or why traffic re-enters Central Avenue at these specific locations. The only explanation provided is the following statement which implies that the traffic diversion assumptions were based on the need to improve the modeling results to justify ART rather than a good faith effort to model what is most likely to occur[31]:

> *As in the Opening Year Build scenario, based on the recommendation from the design team, 200 vehicles that were going eastbound through on Central Avenue east of the Broadway Boulevard intersection have been diverted onto the side streets. With this diversion, most of the demand problems were significantly reduced. Traffic diversion assumptions are summarized in Table 5-1.*

Also, note that Table 5-1 does not summarize diversion assumptions; however, Table 4-3 does list the number vehicles assumed to divert at Locust and Edith, and then reappear at locations further east on Central.

While the assumptions that traffic will divert from Central Avenue to Edith Boulevard and Locust Street are unsupported, they are also illogical. Edith Boulevard is a two-lane residential street and does not have a signalized intersection at Lead Avenue, which would make it very difficult for diverted traffic to cross Lead Avenue to reach Coal Avenue where traffic could then

[30] Technical Supplement #2 – Albuquerque Rapid Transit VISSIM Analysis, Table 4-3 [ABQ PAR 00276]
[31] Technical Supplement #2 – Albuquerque Rapid Transit VISSIM Analysis, Section 5.2.1 [ABQ PAR 00303]

continue eastward parallel to Central Avenue. Locust Street at Central Avenue is an on ramp to I-25 South, which is clearly not a logical alterative to traveling eastbound on Central Avenue.

Furthermore, the analysis assumes that in 2035 when traffic volume and congestion levels are expected to be much higher than in 2017, that there will still only be 200 vehicles diverted from Central Avenue during the PM peak period if ART is built, and still only at Edith and Locust. No data, modeling, discussion or other evidence is provided to support this assumption. This assumption is clearly flawed and illogical. As traffic congestion worsens and traffic volume increases, as the traffic analysis indicates, a greater amount of traffic diversion should be expected.

Additionally, the traffic study itself suggests that the amount of traffic diversion is actually unknown as is its potential impact on other streets[32].

> *Another option is to examine the possibility to divert more vehicles to other streets when rapid transit is implemented. If this is a possibility, then we would need to re-run the models with revised volumes to make sure the diversion aids in relieving congestion on Central Avenue. We would also need to ensure that the diversion does not severely deteriorate the operational performance on other streets.*

The above quote from the traffic study demonstrates how little is known about the potential for diversion. The traffic study consultants suggest that the City can simply "divert more vehicles" from central to potentially mitigate ART traffic congestion impacts. In reality, people choose their routes, and not the City; behavior that the traffic simulation model is not designed to consider.

Understanding how much traffic is potentially diverted from Central Avenue, how diverted traffic may affect other streets, and how traffic diversion may increase over time would require a different modeling approach than what has been performed. The microsimulation modeling used a "simplistic" and "static" modeling approach[33] where the model was supplied with traffic volumes entering and exiting central avenue through each intersection. The model then determined the delay at each intersection given the assumed traffic volumes. This modeling approach is typically used to evaluate the performance of an intersection (as noted by the traffic study consultants[33]) but is of little or no use in evaluating a long and complex urban transportation corridor such as Central Avenue.

The traffic study modeling approach does not consider how drivers would likely seek alternative routes to avoid heavily congested areas, diverting through side streets to alterative parallel routes or avoiding Central Avenue all together. The modeling approach used in the traffic study is also incapable of estimating how many individuals making trips in a car may opt to use the local 66 bus, the new ART, walk, or bike to avoid congestion. In fact, the traffic study assumed no additional ridership on the ART over the current Rapid Ride service in either 2017 or 2035.

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[32] Technical Supplement #2 – Albuquerque Rapid Transit VISSIM Analysis, Section 6 [ABQ PAR 00320]

[33] Technical Supplement #2 – Albuquerque Rapid Transit VISSIM Analysis, Section 2.1, Step 3, Number 6 "Routing" [ABQ PAR 00221]

Furthermore, this modeling approach does not consider how drivers may choose alterative destinations (e.g., a different grocery store, restaurant, etc.) for their trips if Central Avenue becomes heavily congested. These questions could have been evaluated using a typical travel demand model such as the one used and maintained by MRCOG, but were not.

In my opinion, the traffic study's assumption that only 200 vehicles will be diverted off Central during only the evening rush hour, and then only at two intersections does not represent a genuine effort to understand the diversion issue and reflects an effort by the City's analysts to deliberately alter results that were not supportive of the ART project. My opinion is based on "200" vehicle diversions appearing to be a made-up number, the selected intersections at which diversions will supposedly only occur are not logical routes to avoid congestion on Central Avenue, and the diversions only occur before a location where ART is expected to be caught up in traffic[34] but not at other locations where drivers will be caught in traffic[35].

The traffic analysis also failed to evaluate how the project would affect the local route 66 bus. The 66 bus route currently carries more passengers than either the Rapid Ride Red or Green lines[36]. It offers a complementary and important bus service, stopping at more locations and operating for a longer period of time each day than the Rapid Ride service or the proposed ART. The Route 66 buses are proposed in the ART plan to continue operating in the remaining general purpose lanes with bus stops located along the outside curb. The Route 66 buses will therefore experience the same traffic congestion as regular vehicle traffic, which will increase if the ART project is built. While the ART project may (though this has not been demonstrated, and the City's data suggests the contrary) improve transit travel time and reliability for passengers who currently use the Rapid Ride, it will significantly degrade service for passengers who currently use the local 66 bus. The overall net benefits of the ART project to transit riders is therefore unknown. Additionally, to the extent that the local 66 bus serves a greater proportion of low income and minority passengers who use the 66 bus to reach destinations near them, the project may also raise significant environmental justice concerns. The City's environmental justice analysis of ART[37] also failed to evaluate ART's impact on local bus service and the passengers that depend on it.

Overall, these limitations result in an incomplete assessment of traffic impacts that will or are likely to occur if the ART is built. The limited and flawed analysis of traffic diversion leaves questions about the ART project's impacts on other roadways and intersections unanswered. It also fails to address how the ART project may result in the diversion of trips away from destinations on Central Avenue, including businesses, shops and restaurants. Finally, the project

[34] Technical Supplement #2 – Albuquerque Rapid Transit VISSIM Analysis, Table 4-7, Intersection # 30 [ABQ PAR 00290], the table shows that ART will experience its largest delay while moving east bound at Locust street during the evening rush hour.
[35] Technical Supplement #2 – Albuquerque Rapid Transit VISSIM Analysis, Tables 4-5 and 4-6 [ABQ PAR 00284 – ABQ PAR 00289] and Tables 5-4 and 5-5 [ABQ PAR 00305 ABQ PAR 00310], these LOS results indicate that vehicle traffic will be significantly delayed in many locations besides Locust and Edith.
[36]Technical Memorandum: Central Avenue ART Ridership Results, Table 2 [ABQ PAR 02687]
[37] Technical Supplement 5: Environmental Justice [ABQ PAR 00972]

will negatively impact the local 66 bus route, degrading the service of ABQ Ride's most used bus route and potentially raising significant environmental justice concerns.

3.2 The Travel Demand Study

The main purpose of the travel demand study was estimating the potential ridership of the ART project. The study was included with ABQ Ride's Small Starts grant application to FTA.

3.2.1 What the study reveals

The travel demand study indicates that ABQ Ride's total ridership will increase by 4.8% over its current ridership[38]. This is mostly the result of a modeled 50% increase in ridership on the ART over the current Rapid Ride Red and Green Line[39] and a 64% decrease in ridership on the local route 66 bus[40]. That is, most of ART's new ridership is supposedly derived from existing trips on the local route 66 bus. The travel demand study does not explain why passengers using the local bus route will suddenly begin using the limited stop, express, ART route when they currently do not use the similar limited stop, express, Rapid Ride route. The two bus services provide for different transportation needs and are not substitutes for each other.

The travel demand study also estimates ART travel times[41]. Like the traffic study, the travel demand study, fails to compare these travel times to expected Rapid Ride travel times in a "no-build" scenario. It is therefore difficult to understand how, if at all, ART may improve travel time. Table 2 compares current Rapid Ride travel times as shown in ABQ Ride's current bus schedule[42] and Google Maps transit times with estimates for the ART project provided in the travel demand study[43]. This comparison reveals that the ART project may result in slightly shorter or longer travel times, depending on the travel time and direction. The STOPS model was calibrated with AM peak travel times, and therefore PM travel times are not modeled and therefore not available for comparison.

The travel demand modeling study also states that the increased bus ridership will result in 5,882 fewer vehicle miles traveled per day[44]. To place this number in perspective, according to MRCOG's most recent long range transportation plan[45], 20,335,265 vehicle miles were traveled each day in 2012 in the Albuquerque metropolitan area. **The ART project will therefore result in a 0.003% decrease in regional vehicle travel.**

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[38] Technical Memorandum: Central Avenue ART Ridership Results, Table 7 [ABQ PAR 02693]
[39] Technical Memorandum: Central Avenue ART Ridership Results, Table 6 [ABQ PAR 02693]
[40] Technical Memorandum: Central Avenue ART Ridership Results, unlabeled appendix table [ABQ PAR 02707]
[41] Technical Memorandum: Central Avenue ART Ridership Results, Table 3, [ABQ PAR 02689]
[42] Current schedule available at this URL (6/7/2016): http://data.cabq.gov/transit/Maps/766%20wkday.pdf/view
[43] Technical Memorandum: Central Avenue ART Ridership Results, Table 3, [ABQ PAR 02689], values in Table 2 were computed from the values in this table.
[44] Technical Memorandum: Central Avenue ART Ridership Results, Table 7 [ABQ PAR 02682]
[45] Mid Region Council of Governments 2040 Metropolitan Transportation Plan. Available at: http://www.mrcog-nm.gov/images/stories/pdf/transportation/travel_model/travel-survey-final-report-07012014.pdf

Table 2 Comparison of Estimated ART Travel Times and Current Rapid Ride Travel Times.

West Section[a]	Time	ART - STOPS	Rapid Ride Schedule
Unser to 1st Street	AM	18	20
Unser to 1st Street	PM	-	18
1st Street to Unser	AM	18	18
1st Street to Unser	PM	-	22
East Section[b]			
Broadway to Tramway	AM	26	25
Broadway to Tramway	PM	-	33
Tramway to Broadway	AM	29	25
Tramway to Broadway	PM	-	28

[a] Rapid Ride travel times from current (as of 6/2016) ARQ Ride bus schedule
[b] Rapid Ride travel times from Google Maps transit routing tool

3.2.2 Validity of Study Findings

The validity of the travel demand study's findings also suffer from two major flaws. Like the model used in the traffic study, the travel demand model used in the travel demand study is also incorrectly calibrated. The travel demand modeling study also incorrectly, and for completely unjustifiable reasons, adjusts upward estimated ridership forecasts in the ART scenario.

The model is shown to be incorrectly calibrated to existing conditions. Table 2 in the travel demand study[46] shows the calibrated model's Central Avenue bus ridership estimated by transit route. This table shows that the model overestimates Rapid Ride Red Line ridership by 20%, overestimates Rapid Ride Green Line ridership by 28%, and underestimates local route 66 ridership by 23%. The "significance" of these differences is also noted in the caption on Table 2 in the travel demand study. The travel demand study consultants then argue that the model is adequately calibrated because the **sum** of the modeled ridership for the two Rapid Ride routes and the local 66 bus route are within 1% of the aggregate observed ridership of these routes. However, this criterion for calibration is very misleading since the primary purpose of the model and the travel demand study is to predict ridership on individual bus routes, specifically the proposed ART that will replace the current Rapid Ride service, but not the route 66 service, so that they can be *compared.*

In summary, the model is highly inaccurate in estimating ridership on the 66 "local" service and highly inaccurate in estimating ridership on Rapid Ride, which ART would replace. If the model cannot accurately model ridership on the current Rapid Ride system, it certainly cannot provide accurate ridership forecasts for the proposed ART system or any other ABQ Ride route.

[46] Technical Memorandum: Central Avenue ART Ridership Results, Table 2 [ABQ PAR 02687]

The travel demand study report itself also includes comments on the importance of a well calibrated model[47]:

> *The existing transit scenario is a critical element of the ridership estimation process because it builds the foundation for all future model runs.*

The problem is that the existing transit scenario does not even come close to replicating actual existing transit service and it therefore forms no foundation at all. It also appears that many of the travel demand model's base year estimates for various ABQ Ride routes shown in an unlabeled appendix table[48] are highly inaccurate when compared with ABQ Ride's 2014 ridership report[49].

Importantly, the changes in ridership discussed in the travel demand study report, are changes from the modeled 2014 and 2015 "no-build" conditions and not actual ridership. That is, the 63% decrease in local route 66 bus service is from the already grossly underestimated actual route 66 bus ridership. Similarly, the 50% increase in ART ridership is from baseline ridership estimates that are grossly overestimated. In summary, the results of the travel demand modeling study are completely unreliable, providing little evidence about how the proposed ART project may affect transit ridership. These inaccurate results are referred to throughout ABQ Ride's Small Starts application to justify ART[50].

Further challenging the validity of the travel demand study, the travel demand study consultants incorrectly concluded that modeled ART boardings at stops near UNM were too low, and therefore should be "adjusted" upwards. The study consultants believed that STOPS was under-predicting trips to and from UNM because the STOPS model was not calibrated with local data about trips that UNM students would likely make. Trips made to UNM by students are modeled as "home-based other" trips. The consultants seemingly confirmed their suspicion about the underestimated student trips by comparing the number of "home-based other" trips predicted by STOPS near UNM with those from a 2012 MRCOG transit survey. The survey indicated that there should have been 31% more "home-based other" trips attracted to UNM stops than STOPS had predicted. Therefore, the ridership estimates at UNM area ART stops were adjusted upward by 31%.

It was an error to make this adjustment. While it may be true that STOPS is not well suited for estimating student ridership, the adjustment method is highly flawed. Recall that the STOPS model was previously calibrated to match observed ridership. The calibration results shown in Table 1[51] indicate that the STOPS model matched the estimated and observed aggregate transit ridership (Rapid Ride and local route 66) in the UNM area nearly perfectly. Of all locations checked for calibration, the UNM area was the most well calibrated. Despite this, 750 additional

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[47] Technical Memorandum: Central Avenue ART Ridership Results, page 7 [ABQ PAR 02648]
[48] [ABQ PAR 02707]
[49] Report available from ABQ Ride at: https://www.cabq.gov/transit/documents/abq-ride-ridership-statistics-by-route-fiscal-year-2014.pdf
[50] For example, the data are the basis for many benefit calculations in the Small Starts project description template [ABQ PAR 02605]
[51] Technical Memorandum: Central Avenue ART Ridership Results, Table 1 [ABQ PAR 02686]

trips were added to UNM areas stops. The adjustments were also only made to the ART scenario, even though both the build and no-build scenarios would have had the same presumed difficultly modeling UNM student trips. The adjustment for UNM students had the effect of significantly inflating the ART ridership forecasts over the no-build scenario.

The travel demand study should have compared estimated boardings at UNM area stops with observed boardings (data they actually had readily available) and not the MRCOG transit survey that had information for a different year (2012) and did not specifically detail boardings by students. Furthermore, had a valid calibration method revealed that the model was underestimating ridership at UNM area stops, but not underestimating ridership overall, the additional ridership added to UNM area stops should have come at the expense of ridership somewhere else on the transit system. There should not have been new trips, but simply a reallocation of the previously calibrated number of trips. Any adjustment made should also have been applied to both the build and no-build scenarios. These inappropriate adjustments made on top of a very poorly calibrated model only further invalidate any conclusions drawn from the travel demand study.

3.2.3 Study Limitations

The travel demand study also has two other, critical limitations. As previously mentioned, it did not estimate travel time for the Rapid Ride buses or the local 66 bus in the no-build scenario. This makes it at least difficult, if not impossible, to understand the potential improvements in transit service that ART might provide. Additionally, the travel demand study only estimated ridership changes and travel times for the year 2015. It does not consider how the ART may perform in the year it is expected to begin operating (2017) or how it may perform in the future.

4 WHAT CAN BE CONCLUDED ABOUT THE PROPOSED ART PROJECT?

The technical transportation analysis that has been completed by ABQ Ride and submitted with its applications for a CE and FTA Small Starts grant provides very little useful information about the project's potential benefits or its negative impacts. This is the result of both flawed analysis methods and modeling approaches that are too limited for answering the questions most relevant to the proposed project. This section evaluates claims made by ABQ Ride in its CE and Small Starts applications.

4.1 Small Starts Application

The following specific claims are made in the FTA Small Starts application narrative[52]:

1. **Claim: The efficiency of service is hampered by traffic and delays at intersections.** [ABQ PAR 02670].

   Rebuttal: In fact, Central Avenue currently has very little traffic congestion. The current Rapid Ride bus service likely experiences little or no delay due to traffic congestion. The existing conditions intersection LOS estimates shown in the traffic study[53] indicate that

[52] ART Project Narrative [ABQ PAR 02667]

[53] Technical Supplement #2 – Albuquerque Rapid Transit VISSIM Analysis, Tables 3-24 and 3-25 [ABQ PAR 00269 – ABQ PAR 00272]

most intersections are operating at a high LOS. The traffic study also states that all intersections are currently operating at an acceptable LOS and there are no significant queue spillbacks (i.e., traffic backups at intersections)[54].

2. **Claim: ABQ Ride Buses at peak hours are nearly at capacity: 95% for route 66 and 90% for the Rapid Ride routes**. [ABQ PAR 02670].

   Rebuttal: ABQ Ride has likely under estimated the capacity of its buses. ABQ Ride assumes that a bus is at capacity if there are 50% more passengers than seats on the bus. However, the bus's actual capacity is likely much greater than that. For example, the new New Flyer Xcelsior 40 foot transit buses that ABQ ride recently purchased[55] have 40 seats and can hold an additional 43 standees according to the manufacture's specifications[56]. All of ABQ ride's buses are New Flyer buses of various models, and likely have similar seat to standee capacities.

   Additionally, ART is not a substitute for the local route 66 bus. The ART project will therefore not alleviate potential capacity constraints on route 66 buses which are shown to be the closest to capacity.

3. **Claim: Short-term benefits: faster more reliable bus service, specifically a minimum 15% improvement in travel time and 25% increase in on-time performance** [ABQ PAR 02671].

   Rebuttal: Neither the traffic study, the travel demand study or any other study made available by ABQ Ride or included with ABQ Ride's Small Starts application support the claimed improvements in travel time and on-time performance. No study has directly compared estimated Rapid Ride travel times and reliability with estimated ART travel times and reliability. A comparison of no-build delay estimates with ART delay estimates provided in the traffic study (see Table 1 of this report) indicate that the ART may perform **worse** than the Rapid Ride in both 2017 and 2035 and, presumably, during the years in between. Comparing 2015 ART travel time estimates from the travel demand study with ABQ Ride's current Rapid Ride schedule (see Table 2 of this report) also indicates that the ART will likely perform similar to the Rapid Ride, if not worse.

The Small Starts Application Project Description Worksheet[57] also includes the ART ridership estimates from the travel demand study[58]. As discussed above in this report, that study is deeply flawed and unreliable. The ridership estimates are also the basis for numerous benefit calculations in the Worksheet. Cost effectiveness is measured as the estimated cost per

[54] Technical Supplement #2 – Albuquerque Rapid Transit VISSIM Analysis, page 2 [ABQ PAR 00212]
[55] https://www.cabq.gov/transit/news/it2019s-a-new-look-for-abq-ride/
[56] http://www.newflyer.com/index/xcelsior_specifications
[57] FTA Small Starts Project Description Worksheet [ABQ PAR 02605]
[58] FTA Small Starts Project Description Worksheet, Trips on Transit table [ABQ PAR 02609]

passenger trip[59]. The worksheet also calculates the value of benefits from reduced vehicle traffic as a result of increased transit ridership including fewer air pollutant emissions, less energy use, and fewer traffic fatalities and injuries[60]. Each of these benefit estimates is therefore just as unreliable as the ART ridership forecast.

4.2 Categorical Exclusion

ABQ Ride completed FTA's categorical exclusion worksheet[61] which asked a series of questions about potential environmental impacts. Underlined text below is taken from the Worksheet that ABQ Ride submitted:

> **Section I: Reason for the proposed project.**
>
> *Collectively, Routes 66, 766, and 777 accounted for approximately 41% of the total annual ridership on ABQ RIDE in FY 2014. While these routes are heavily used, the efficiency of service is hampered by traffic and delays at intersections. In addition, dwell times are excessive due to on-board fare collection and slow boarding times, especially for mobility impaired riders and riders transporting bicycles. Sample data collected to evaluate current peak load factors show 95% for Route 66, 90% for Route 766, and 83% for Route 777. These estimates are based on an assumed vehicle capacity of 1.5 times the number of seats*.[ABQ PAR 00003]

In fact, Central Avenue currently has very little traffic congestion. The current Rapid Ride bus service likely experiences little or no delay due to traffic congestion. The existing conditions intersection LOS estimates shown in the traffic study[62] indicate that most intersections are operating at a high LOS. The traffic study also states that all intersections are currently operating at an acceptable LOS and there are no significant queue spillbacks (i.e., traffic backups at intersections)[63].

ABQ Ride has likely under estimated the capacity of its buses. ABQ Ride assumes that a bus is at capacity if there are 50% more passengers than seats on the bus. However, the bus's actual capacity is likely much greater than that. For example, the new New Flyer Xcelsior 40 foot transit buses that ABQ ride recently purchased[64] have 40 seats and can hold an additional 43 standees according to the manufactures specifications[65]. All of ABQ ride's buses are New Flyer buses of various models, and likely have similar seat to standee capacities.

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[59] FTA Small Starts Project Description Worksheet, Trips on Transit table [ABQ PAR 02610]
[60] FTA Small Starts Project Description Worksheet, [ABQ PAR 02614 – ABQ PAR 02616, ABQ PAR 02616, ABQ PAR 02616 – ABQ PAR 02617].
[61] Federal Transit Administration – Region 6 Categorical Exclusion Worksheet [ABQ PAR 00003]
[62] Technical Supplement #2 – Albuquerque Rapid Transit VISSIM Analysis, Tables 3-24 and 3-25 [ABQ PAR 00269 – ABQ PAR 00272]
[63] Technical Supplement #2 – Albuquerque Rapid Transit VISSIM Analysis, page 2 [ABQ PAR 00212]
[64] https://www.cabq.gov/transit/news/it2019s-a-new-look-for-abq-ride/
[65] http://www.newflyer.com/index/xcelsior_specifications

Additionally, ART is not a substitute for the local route 66 bus. The ART project will therefore not alleviate potential capacity constraints on route 66 buses which are shown to be the closest to capacity.

Section II: Will the project significantly impact the natural, physical, social, and/or economic environment?

ABQ Ride's response is "no". The following explanation is provided:

> *Traffic capacity will be reduced in some segments as a result of traffic lane reductions; however, adequate capacity will remain on Central Avenue and in parallel corridors to accommodate existing and projected traffic demand.*[ABQ PAR 0008]

The project is very likely to have a significant impact of traffic congestion and travel patterns. The project will reduce traffic capacity from 30% to 50% where general purpose lanes are replaced by new bus only lanes. This is a significant reduction in capacity, that when combined with only a small projected increase in transit ridership and a large increase in vehicle traffic represents a significant potential for increased traffic congestion.

The ABQ Ride traffic study itself indicates that the ART project will significantly increase traffic congestion so it is difficult to understand how ABQ Ride could have answered "no" to this question. The traffic study finds that the ART project would cause deterioration in LOS at 13 intersections during the AM peak hour and 32 during the PM peak hour in its first year of operation. By 2035 intersection LOS in the project area declines for both the build and no-build scenarios because traffic volume is expected to continuing growing over 2017 levels; however, the impacts are much worse if the ART is built: 20 intersections during the AM peak hour experience reduced LOS and 31 intersections during the PM peak. These LOS changes are also larger than in 2017. For example, in the AM peak period two intersections go from LOS A without the ART, but to LOS F with the ART (see Figure 1 of this report).

Sections 5.3 and 6 of the ABQ Ride traffic study also conclude that the ART project will have a significant impact on traffic congestion:

> *Under 2035 Build Conditions, many intersections will perform deficiently due to insufficient capacity or green time for general purpose traffic, or other physical constraints.* [ABQ PAR 00317]

> *Overall, this analysis concludes that in the Build Condition, the operational performance at several intersections would be deteriorated. Several segments would have diminished operational performance, thereby increasing queuing and congestion along the Central Avenue corridor. This can clearly be attributed to the reduction in capacity of the general purpose lanes along the majority of the corridor.*[ABQ PAR 00320]

Section 5.3 then continues with a list of potential mitigation measures that would require additional analysis. One of the most frequently suggested mitigation measure for areas expected

to face significant congestion are *removal of the ART bus only lanes*[66]*, the main feature of the proposed ART project*. Other mitigation measures include adding additional general purpose and turning lanes to Central Avenue and mitigations that would "impact right of way". There is no explanation of how ART can exist and additional travel lanes also be added to Central.

Furthermore, as discussed above, the traffic study failed to evaluate the potential for traffic diversion and its potential impacts on other roads and intersections. There is no evidence to support the claim that the project will not affect traffic congestion on roads and intersection in the project area.

> *Impacts to community cohesion, neighborhood access, or other community impacts are not anticipated. The project will provide enhanced transit service to access jobs, schools, and services for transit dependent populations, low income households, and minority populations.*
>
> *The rapid vehicle lanes will have limited access to other vehicles. Thus, access to the businesses and other development on Central Avenue will be less than currently exists. Reasonable access to all businesses will be maintained with left turn/U-turn access provided at signalized intersections. In general, left-turn/U-turn access is spaced.* [ABQ PAR 00317]

The project is very likely to negatively impact neighborhood and business access and produce other community impacts. Neighborhood access will be reduced by the elimination of left turns at many intersections throughout the corridor. While the city proposes that access can be maintained by allowing U-turns at signalized intersections, the number of potential U-turns and their impact on traffic congestion was not evaluated in the traffic analysis. A large number of U-turns will likely further increase traffic congestion. Additionally, the bus only lanes will reduce the number of legal pedestrian crossings. Currently pedestrians can legally cross Central Avenue at any intersection. The ART project will result in legal crossings being consolidated to signalized intersections. This will result in longer distances and travel times for pedestrians, including those who walk to Central Avenue businesses or use transit.

Additionally, the traffic study indicates that the ART project will significantly increase congestion along many areas of Central Avenue. Excessive traffic congestion may result in the diversion of trips away from Central Avenue, impacting traffic in residential neighborhoods and other arterial roads and also potentially diverting traffic away from businesses along Central Avenue. No analysis was completed to assess or study these impacts.

Furthermore, the ART project will negatively impact the performance of the local route 66 bus that will continue to use the remaining general purpose lanes which will become more congested because of the ART project. The local route 66 bus currently accounts for half of ABQ Ride's Central Avenue ridership[67], providing access to many local destinations not directly served by the limited stop, express, Rapid Ride and proposed ART.

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[66] Technical Supplement #2 – Albuquerque Rapid Transit VISSIM Analysis, Table 5-9 [ABQ PAR 00318]

[67] Technical Memorandum: Central Avenue ART Ridership Results, Table 2 [ABQ PAR 0268y]

Section II: Will the project have disproportionately high and adverse impacts on minority/low income populations?

ABQ Ride's response is "no". This is followed by some explanation.

> *The census tracts proximate to the project area have minority and low income populations that are higher than state and county averages for these groups. The project will provide improved job, school, and service access to these populations; therefore, the impacts of the project are positive and not adverse.*[ABQ PAR 00008]

The project does run through some of Albuquerque's most disadvantaged areas and the ART project may provide improved transit service to some destinations, for an unknown number of riders. However, the ART project will also negatively impact the local route 66 bus. It is currently unclear what the net impact on low income and minority communities would be, although this could have been evaluated by surveying current transit passengers using the Rapid Ride and local bus services.

Section IV Traffic: Describe potential parking/traffic impacts, if any?

ABQ Ride implies that there will be few, if any traffic impacts. ABQ Ride summarizes the 2017 results from the traffic study and states that during the AM peak hour *no* intersections will operate worse under the build scenario when compared to the no-build scenario[68]. This is simply untrue. The traffic study indicates that 13 intersections will operate at a lower LOS under the build scenario. This claim is not made for the PM peak where even more intersections will operate at a lower LOS (see Figure 1 of this report).

The largest flaw in ABQ Rides response however is what is omitted. ABQ Ride makes no mention of the 2035 traffic study results that show significant negative traffic impacts from the ART project[69]. Furthermore, ABQ ride suggests that it can mitigate any traffic impacts that may arise as design of the project continues. However, the traffic study suggests that many of the expected traffic impacts cannot easily be mitigated[70]; they would require right of way acquisition or somehow adding more traffic lanes to Central Avenue. Nine of the mitigation measures also involve eliminating ART's bus only lanes, which is the essence of the design of the project.

[68] Federal Transit Administration – Region 6 Categorical Exclusion Worksheet [ABQ PAR 00015]
[69] Technical Supplement #2 – Albuquerque Rapid Transit VISSIM Analysis, Section 5.2.2 5.2.3 [ABQ PAR 00303 – ABQ PAR 00316]
[70] Technical Supplement #2 – Albuquerque Rapid Transit VISSIM Analysis, Table 5-9 [ABQ PAR 00318]

Section IV Environmental Justice: Indicate whether the project will have disproportionately high and adverse impacts on minority/low-income populations?

ABQ Ride states that there will be no disproportionately high or adverse impact on minority and low income populations because the project will improve transit service and accessibility[71]. The project does run through some of Albuquerque's most disadvantaged communities and the ART project may provide improved transit service to some destinations for some people living in these communities. However, the ART project will also negatively impact the local route 66 bus which currently accounts for half of ABQ Ride's Central Avenue ridership. It is currently unclear which populations use each of the existing bus services and who is mostly like to use the proposed ART. Low income and minority communities along Central will likely be negatively impacted from the degradation of the local 66 bus service, but its nature and extent is unknown because ABQ Ride has not evaluated it.

Section IV Air Quality: Describe any impacts to air quality resulting from the project?
ABQ Ride states that since the ART project is a congestion mitigation measure and is intended to reduce traffic, adverse air quality impacts are not anticipated[72]. However, the traffic study indicates that the ART project is likely to increase traffic congestion while the travel demand study indicates only a small increase in transit ridership. The relatively small reduction in vehicle traffic could easily be offset by increased vehicle emissions as a result of increased traffic congestion. Gram per mile vehicle emission rates increase under congested conditions. Emissions could also be increased if diversion of trips away from Central Avenue results in longer average trip distances.

It should also be noted that the emission reduction estimates included in the Small Starts Worksheet[73] also apply a constant kg per mile emission rate factor. The constant emission rate factor fails to account for how changes in congestion affect emission rates.

5 CONCLUSIONS

I would strongly support a transit project that would improve transportation in Albuquerque; however, based on the analysis that has been performed so far by ABQ Ride and its consultants the proposed ART project appears to do more harm than good.

The results of the traffic study and travel demand study provide the main source of information that currently describes the ART's expected transit and environmental benefits and its impacts on traffic. The validity of conclusions drawn from either of these studies is questionable at best due to a series of critical flaws and limitations. Both models were shown to be incapable of replicating traffic conditions and transit ridership today and therefore cannot reasonably be expected to accurately forecast future traffic conditions or transit ridership for the current Rapid Ride let alone the proposed ART. Furthermore, the studies failed to compare the performance of

[71] Federal Transit Administration – Region 6 Categorical Exclusion Worksheet [ABQ PAR 00017]
[72] Federal Transit Administration – Region 6 Categorical Exclusion Worksheet [ABQ PAR 00022]
[73] Small Starts Project Description Worksheet [ABQ PAR 02614 – ABQ PAR 02616]

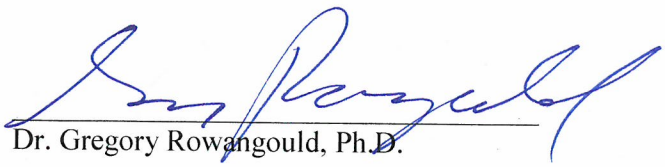
the Rapid Ride to the proposed ART, failed to consider impacts on the local route 66 bus, and failed to consider how traffic congestion as a result of ART may result in traffic diversion from Central Avenue, which could negatively impact traffic on other routes, residential streets and make it more difficult to access Central Avenue businesses.

Despite the serious flaws and limitations of the traffic and travel demand studies, ABQ Ride relied on results from them in its application for a CE and Small Stats grant. However, a complete review of each study's findings reveals that the results generally do not support the claims made by ABQ Ride. The traffic study clearly indicates that traffic congestion will grow worse over time with the ART as compared to a no-build scenario. And both studies fail to show that the ART will improve transit service. In fact, both studies suggest that the ART may perform worse than the Rapid Ride would. Furthermore, the traffic study challenges the purported need for a new transit system running in its own dedicated lanes to avoid traffic congestion, because the traffic study shows that there is currently little, if any, traffic congestion on Central Avenue despite ABQ Ride's claims.

Improved traffic and travel demand studies could more accurately and definitively reveal the proposed ART project's likely benefits and costs. However, in my opinion, an improved study would likely reveal that ART would provide little, if any, improvement over the current Rapid Ride because Central Avenue has very little traffic congestion. Improved studies would also likely continue to reveal significant traffic impacts given the large amount of capacity that would be removed from Central Avenue by the elimination of two general-purpose lanes. Increased traffic congestion would likely result in a significant increase in traffic on other streets in the corridor.

I think that a more fruitful course of action would be the exploration of alternatives that target actual problems. If buses are indeed too full in some areas, ABQ Ride could add more buses to each route. This would add capacity and reduce headways. Similarly, if headways are currently judged to be too long, ABQ Ride could add more buses to each route to reduce them. If congestion is particularly bad in a particular location, ABQ Ride could consider adding bus only lanes (perhaps even peak period bus only lanes) or transit signal priority to just those problem spots – and these improvements could benefit express and local bus service. Fares could be prepaid before boarding for any type of transit system. Platforms providing level boarding could be constructed on median or curbside locations with or without bus only lanes. Furthermore, freeing up right or way from the bus only lanes and median platforms would likely allow space to widen sidewalks, plant street trees and provide bicycle facilities along the entire length of Central Avenue rather than in small and discontinuous spaces that are left over after the bus only lanes are constructed.

I make the foregoing declaration to the best of my knowledge and belief, under penalty of perjury



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EDUCATION

PhD **University of California**, Davis (2010)
Civil and Environmental Engineering: concentration in Transportation
Dissertation: "A Spatially Detailed Locomotive Emission Model and Goods Movement Data Constraints on Public Policy and Planning"

MS **University of Maine**, Orono (2006)
Resource Economics and Policy: concentration in Environmental Economics
Thesis: "A Spatial Analysis of Passenger Vehicle Attributes, Environmental Impact and Policy"

BS **University of Maine**, Orono (2003)
Chemical Engineering

PROFESSIONAL EXPERIENCE

University of New Mexico, Albuquerque, NM (8/2012 – current)
Assistant Professor, Department of Civil Engineering

Natural Resources Defense Council, Santa Monica, CA (7/2010 –7/2012)
Transportation and Air Quality Science Fellow

University of California, Davis, CA (9/2006 – 7/2010)
Research Assistant, Department of Civil & Environmental Engineering

University of California, Davis, CA (3-6/2009, 3-6/2010)
Teaching Assistant, Department of Civil & Environmental Engineering

University of Maine, Orono, ME (9/2004 –8/2006)
Research Assistant, Department of Resource Economics & Policy and the Margaret Chase Smith Policy Center

National Semiconductor, South Portland, ME (5-9/2000, 5-8/2001, 3-8/2004)
Process Engineer, co-op program

Fairchild Semiconductor, South Portland, ME (5/2002-1/2003)
Process Engineer, co-op program

CONSULTING EXPERIENCE

ICF Incorporated, LLC, Fairfax, VA (5/2014 – 12/2014)
Provided consulting services to ICF for a Federal Highway Administration and Centers for Disease Control project to develop a community health risk tool. Project website and tool available at http://www.transportation.gov/transportation-health-tool/indicators

United States Environmental Protection Agency, Anne Arbor, MI (11/2013 – 12/2013)
Consultant, provided a scientific review of a US EPA sponsored air quality research project

Communities for a Better Environment, Huntington Park, CA. (11/2011 – 8/2012)
Provided transportation planning and air quality consulting services to Communities for a Better Environment

The Ride for Roswell, Buffalo, NY (4/2011 - 6/2011)
Pro bono consulting, bicycle traffic modeling and planning for a charitable community bicycle ride

Pew Center on Global Climate Change, Washington, D.C. (12/2008 – 8/2009)
Consultant, developed a research report investigating the GHG mitigation potential for domestic and international marine shipping and aviation

NATIONAL/REGIONAL/LOCAL SERVICE

Air and Waste Management Association Annual Conference, Raleigh, NC (6/24/2015)
Session Chair, Modeling Transportation Emissions

Transportation Research Board Annual Meeting Workshop, Integrated Land-use, Travel Demand, Air Quality & Exposure Modeling: The Future of Regional Transportation Planning? (1/11/2015)
Organizer, Co-Chair and Moderator

National Cooperative Highway Research Program, Transportation Research Board of the National Academies, Washington D.C. (10/2014 – current)
Panel Member, NCHRP Project 08-102 – Bicycle Facility Preferences and Effects on Increasing Bicycle Trips

Sustainable Cities and Society (SCS), Elsevier Ltd. (10/2014 – current)
Member of the Editorial Board
Editor of Special Edition on Transportation (2/1/2016 – current)

Transportation and Air Quality Committee (ADC20), Transportation Research Board of the National Academies, Washington, D.C. (4/2014 – current)
Committee Member & Paper Review Co-Chair

Central New Mexico Climate Change Scenario Planning Project, US Department of Transportation & Mid-Region Council of Governments (11/2013 – 6/2014)
Member, Mitigation Technical Committee

Statewide Public Health, Safety, and Security Working Group, New Mexico Department of Transportation (11/2013 – 10/2015)
Working Group Member

Land-Use Transportation Integration Committee, Mid-Region Council of Governments, Albuquerque, NM
Committee Member (12/2012 – 6/2014)

AWARDS AND RECOGNITION

Young Professional Runner-Up Best Paper Award, Environmental Management Group, Air & Waste

Management Association 108th Annual Conference, Raleigh, NC, June 25, 2015
"A New Approach for Evaluating Regional Exposure to Particulate Matter Emissions from Motor Vehicles"

Best Paper Award, Civil Engineering Department, University of New Mexico, Spring 2015
Rowangould, G. (2015). *A New Approach for Evaluating Regional Exposure to Particulate Matter Emissions from Motor Vehicles,* Transportation Research Part D: Transport and Environment. 34: 307-317.

Young Professional Best Paper Award, Environmental Management Group, Air & Waste Management Association 107th Annual Conference, Long Beach, CA, June 25, 2014
"Regional Long Range Transportation Plan Air Quality and Exposure Analysis"

PEER REVIEWED JOURNAL PAPERS

Rowangould, G. and M. Tayarani* (in press). *The Effect of Bicycle Facilities on Travel Mode Choice Decisions*. ASCE Journal of Urban Planning and Development.

Poorfakhraei, A.* and **G. Rowangould** (2015). *Estimating Welfare Change Associated with Improvements in Urban Bicycling Facilities.* ASCE Journal of Transportation Engineering. 141(11): 04015025.

Rowangould, G. (2015). *A New Approach for Evaluating Regional Exposure to Particulate Matter Emissions from Motor Vehicles.* Transportation Research Part D: Transport and Environment. 34: 307-317.

Rowangould, G. (2013). *Public Financing of Private Freight Rail Infrastructure to Reduce Highway Congestion: A Case Study of Public Policy and Decision Making in the United States*. Transportation Research Part A: Policy and Practice. 57: 25-36.

Rowangould, G. (2013). *A Census of the United States Near-Roadway Population: Public Health and Environmental Justice Considerations*. Transportation Research Part D: Transport and Environment. 2: 59-67.

Gould, G. and D. Niemeier (2011). *Assignment of Emissions Using a New Locomotive Emissions Model*. Environmental Science and Technology. 45(13): 5846- 5852.

Gould, G. and A. Karner (2009). *Modeling Bicycle Facility Operation: a Cellular Automaton Approach*. Transportation Research Record: Journal of the Transportation Research Board of National Academies. 2140: 157-164.

Gould, G. and D. Niemeier (2009). *Review of Regional Locomotive Emission Modeling and the Constraints Posed by Activity Data*. Transportation Research Record: Journal of the Transportation Research Board of the National Academies. 2117: 24-32.

Niemeier, D., **G. Gould,** A. Karner, M. Hixson, B. Bachmann, C. Okma, Z. Lang and D. Heres Del Valle (2008). *Rethinking downstream regulation: California's opportunity to engage households in reducing greenhouse gases*. Energy Policy, 36(9)

*****Students advised by Dr. Rowangould

PEER REVIEWED CONFERENCE PAPERS

Nadafianshahamabadi, R.*, M. Tayarani*, and **G. Rowangould** (January 12, 2016). *Differences in Expertise and Values: Comparing Community and Expert Assessments of a Transportation Project.* Accepted for presentation at the Transportation Research Board 95th Annual Meeting, Washington, D.C.

Moreno, S. A.*, R. R. Gade*, and **G. Rowangould** (January 13, 2016). *Investigating Pedestrian Crash Risk in Albuquerque, New Mexico*. Accepted for presentation at the Transportation Research Board 95th Annual Meeting, Washington, D.C.

Tayarani, M.*, A. Poorfakhraei*, R. Nadafianshahamabadi*, and **G. Rowangould** (January13, 2016). *Large-Scale, High-Resolution Air Quality Modeling Framework to Evaluate Environmental Justice in Long-Range Transportation Planning*. Accepted for presentation at the Transportation Research Board 95th Annual Meeting, Washington, D.C.

Poorfakhraei, A.*, and **G. Rowangould** (January 11, 2016) Evaluating Mobile-Source Air Pollution *Exposure, Equity, and Health Risks in Long-Range Regional Transportation Plans*. Accepted for presentation at the Transportation Research Board 95th Annual Meeting, Washington, D.C.

Rowangould, G., A. Poorfakhraei*, and M. Tayarani* (June 24, 2015). *A New Approach for Evaluating Regional Exposure to Particulate Matter Emissions from Motor Vehicles.* Presented at the Air & Waste Management Association Annual Conference, Raleigh, NC

Poorfakhraei, A.* and **G. Rowangould** (January 14, 2015). *Economic Valuation of Improvements in Urban Cycling Facilities.* Presented at the Transportation Research Board 94th Annual Meeting, Washington, D.C.

Rowangould, G. and M. Tayarani* (January 12, 2015). *The Effect of Bicycle Paths on the Decision to Commute by Bicycle.* Presented at the Transportation Research Board 94th Annual Meeting, Washington, D.C.

Tayarani, M.* and **G. Rowangould** (January 12, 2015). *Quantifying the Air Quality and CongestionBenefits of Bicycle Facilities: A Case Study from Albuquerque New Mexico.* Presented at the Transportation Research Board 94th Annual Meeting, Washington, D.C.

Rowangould, G. (March 3, 2014). *Using AERMOD for Regional Transportation Planning: Exposure Analysis, Environmental Justice, and Pro-Active Hot-spot Analysis.* Presented at the Transportation, Land Use Planning, and Air Quality Conference, Charlotte, NC

Rowangould, G. (June 25, 2014). *Regional Long Range Transportation Plan Air Quality and Exposure Analysis*. Presented at the Air & Waste Management Association 107th Annual Conference, Long Beach, CA

Rowangould, G. and J. Luna (January 2014). *Does Dedicated Bicycle Infrastructure Reduce Motorized Vehicle Trips? Results from the Albuquerque Bicycle Travel Study*. Presented at the Transportation Research Board 93rd Annual Meeting, Washington, D.C.

Gould, G. and S. Contreras* (January 15, 2013). *Regional Scale Dispersion Modeling and Analysis of Directly Emitted Fine Particulate Matter from Highway Vehicles Using AERMOD.* Presented at the Transportation Research Board 92nd Annual Meeting, Washington, D.C.

Gould, G. (January 15, 2013). *A Census of the U.S. Near Roadway Population: Particulate Matter Exposure, Environmental Justice, and Coverage of the Air Quality Monitoring Network.* Presented at the transportation Research Board 92nd Annual Meeting, Washington, D.C.

Gould, G. and D. Niemeier (January 12, 2010). *A Geographically Detailed Locomotive Emission Model*. Presented at the Transportation Research Board 89th Annual Meeting, Washington, D.C.

Gould, G. and A. Karner (January 14, 2009). *Modeling Bicycle Facility Operation: a Cellular Automaton Approach*. Presented at the Transportation Research Board 88th Annual Meeting, Washington, D.C.

Gould, G. and D. Niemeier (January 12, 2009). *Review of Regional Locomotive Emission Modeling and the Constraints Posed by Activity Data*. Presented at the Transportation Research Board 88th Annual Meeting, Washington, D.C.

*Students advised by Dr. Rowangould

PEER REVIEWED REPORTS AND OTHER PUBLICATIONS

McCollum, D., **G. Gould,** and D. Greene (2009). *Greenhouse Gas Emissions from Aviation and Marine Transportation: Mitigation Potential and Policies*. Report prepared for the Pew Center on Global Climate Change, Washington D.C.

OTHER REPORTS AND PUBLICATIONS

Futures 2040: Metropolitan Transportation Plan, Mid Region Council of Governments, Albuquerque, NM. **G. Rowangould** was one of many contributors and co-authors.

Rowangould, G., M. Tayarani*, and A. Poorafakhraei* (April, 2015). *Futures 2040: Metropolitan Transportation Plan - Appendix F: GHG Emissions Reduction Strategies*, Mid Region Council of Governments, Albuquerque, NM.

Lee, S., Tremble, M. Vaivai, J., **Rowangould, G.**, Tayarani, M.*, Poorfakhraei, A.* (March, 2015). *Central New Mexico climate change scenario planning project: final report*. Report prepared for the U.S. Department of Transportation, U.S. Federal Highway Administration and Mid Region Council of Governments.

Lee, S., M. Tremble, J. Vaivai, Herrington, C., R. Gonzalez-Pinzon, M. Stone, and **G. Rowangould** (December, 2014). *Climate Change Effects on Central New Mexico's Land Use, Transportation System and Key Natural Resources.* Report prepared by Ecosystem Management Inc. and the University of New Mexico for the U.S. Department of Transportation VOLPE Center, Cambridge, MA

Rowangould, G., M. Tayarani*, and A. Poorafakhraei* (November, 2014) *Central New Mexico Climate Change Scenario Planning Project: Analysis of Additional Greenhouse Gas Mitigation Strategies.* Report prepared by the University of New Mexico for the U.S. Department of Transportation VOLPE Center, Cambridge, MA

Lee, S., M. Tremble, J. Vaivai, Herrington, C., R. Gonzalez-Pinzon, M. Stone, and **G. Rowangould** (May 2014) *Climate Change Resilience of Land Use, Transportation and Key Natural Resources in Central New Mexico.* Report prepared by Ecosystem Management Inc., Sustainable Systems Research LLC. and the University of New Mexico for the U.S. Department of Transportation VOLPE Center, Cambridge, MA

Gould, G. (2012) *Analysis of Greenhouse Gas Emission Estimates for the Interstate 710 Corridor Project*. Report Prepared for Communities for a Better Environment, Huntington Park, CA.

Gould, G. (2012) *Analysis of the Alternatives Selection Process for the Interstate 710 Corridor Project*. Report Prepared for Communities for a Better Environment, Huntington Park, CA.

Gould, G. (2012) *Physical Separation of the Chicago Area Waterway System: The Economic and Environmental Impact of Barge Traffic Disruption*. NRDC Working Paper.

C. Noblet, **G. Gould**, J. Rubin, D. Innis, and C. Morris (2006). *Sustainable Transportation Funding for Maine's Future*. Report prepared for the Maine Department of Transportation, Augusta, ME.

*Students advised by Dr. Rowangould

INVITED SCHOLARLY PRESENTATIONS

Rowangould, G. (February 2, 2016). *Can Metropolitan Planning Organizations Stop Rising Greenhouse Gas Emissions?* Invited presentation to the New Mexico chapter of the Air and Waste Management Association, Albuquerque, NM.

Rowangould, G. (November 14, 2014). *The Effect of Bicycle Facilities on the Decision to Commute by Bicycle, Congestion and Air Quality: New Evidence from Albuquerque, New Mexico.* Invited seminar talk at the Institute for Transportation Studies, University of California, Davis, CA

Rowangould, G. (May 2, 2014). *Integrating Air Dispersion and Regional Travel Demand Models: Opportunities and limitations.* Invited presentation at the Transdisciplinary Workshop on Transportation and Public Health, McGill University, Montreal, Canada

Rowangould, G. (November 8, 2013). *Sustainable Transportation Systems: 2013 and Beyond*, Invited presentation, Emerging Trends in Sustainable Transportation Performance Measures: An Open Workshop, Santa Fe, NM

Rowangould, G. (April 9, 2013). *Regional Scale Dispersion Modeling and Analysis of Directly Emitted Fine Particulate Matter from Highway Vehicles using AERMOD.* Invited presentation to the United States Environmental Protection Agency, Washington, D.C.

Rowangould, G. (March 8, 2013). *Raising The Grade: Innovative Financing and Technology Practices to Save Our Infrastructure*. Invited panel speaker at the Spring Meeting of the New Mexico Section of the American Society of Civil Engineers, Albuquerque, NM

Gould, G. (October 9, 2009). *Considering Goods Movement: Air Quality and Climate Change Issues in Planning and Policy*. Invited seminar at the School of Economics, University of Maine, Orono, ME.

Gould, G. (December 6, 2005). *A spatial analysis of passenger vehicle attributes, environmental impact and policy*. Invited seminar talk at the Cambridge Center for Climate Change Research, University of Cambridge, Cambridge, UK.

OTHER SCHOLARLY PRESENTATIONS

Tayarani, M., A. Poorfakhraei, and **G. Rowangould** (May 7, 2015). *Increasing Sustainability through Provision of Bicycling Facilities: A Case Study in Albuquerque, New Mexico*. Presented at Transportation for Sustainability – An International Conference, Keck Center of the National Academies, Washington, DC

Rowangould, G. (January 7, 2014). *Public Investment in Private Freight Rail Infrastructure*. Presented at the 51st Paving and Transportation Conference, Albuquerque, NM

Gould, G. (October 25, 2011). *Income, Race, and the Odds of Living Along Busy Roadways: Using Census Data to Consider Equity and Environmental Justice in Regional Transportation Planning*. Presented at the Transportation Research Board Using Census Data for Transportation Conference, Beckman Center of the National Academies, Irvine, CA.

Gould, G. (May 7, 2010). *A Spatially Detailed Locomotive Emission Model and Goods Movement Data Constraints on Public Policy and Planning*. Presented at the Institute of Transportation Studies, University of California, Davis, CA.

Gould, G., D. Niemeier, and A.V. Goodchild (March 17, 2008). *A Cart Before the Horse: Disaggregate Locomotive Models and Data Constraints*. Presented at the Transportation Research Board Data for Goods Movement Impact on Air Quality Conference, Irvine, CA.

Gould, G. (March 17, 2006). *A spatial analysis of passenger vehicle attributes, environmental impact and policy*. Presented at Laval-UMaine Student Research Conference, Department of Agricultural Economics, Laval University, Quebec, Canada.

RESEARCH SUPPORT

U.S. Environmental Protection Agency (1//1/2016 – current)
Science to Achieve Results Research Program - Early Career Award : Evaluating the Timeline of Particulate Matter Exposure from Urban Transportation and Land-Use greenhouse Gas Mitigation Strategies Using a Novel Modeling Framework
Role: PI, Funding: $335,605

U.S. Environmental Protection Agency (8/2015 – current)
Environmental Finance Center Program: Southwest Environmental Finance Center
Role: Key Collaborator; PI: Heather Himmelberger (UNM); Other Key Collaborators: Kerry Howe (UNM), Mark Stone (UNM), Bruce Thomson (UNM)

U.S. Department of Transportation (3/2014 – 12/2014)
Central New Mexico Climate Change Scenario Planning Project
Role: Lead PI for UNM subcontract; CoPIs: Mark Stone (UNM), Ricardo Gonzalez-Pinzon (UNM); UNM Funding: $103,859

Resource Allocation Committee Grant, University of New Mexico (11/2013 – 5/2015)
Albuquerque Bicycle Path Congestion Management and Air Quality (CMAQ) Study
Role: PI, Funding: $7,585

UNIVERSITY SERVICE

UNM Service Learning Advisory Board, UNM
Member, Engaged Department Initiative subcommittee (8/2015–current)

Liberal Arts & Integrative Studies Faculty Advisory Committee, University College, UNM
Member (8/2015–current)

Undergraduate Committee, Dept. of Civil Engineering, UNM
Member (8/2015–current)

Strategic Initiatives Committee, Dept. of Civil Engineering, UNM
Chair, main task: updating the department's strategic plan (8/2014–current)
Member (8/2012–current)

Transportation and Paving Conference, Albuquerque, NM
Member, conference organizing committee (8/2012-current)
Chair and Moderator, "Sekreta Session" (1/2013, 1/2014, 1/2015)