

The Intersection of Candelaria Road and Rio Grande Boulevard:
A Corrected Evaluation of a Roundabout
versus Protected/Permissive Signal Control

by
Berry Ives

Member of
Rio Grande Boulevard Neighborhood Association
Alvarado Gardens Neighborhood Association

Introduction

Parsons Brinckerhoff (PB) was requested to update their analysis of proposals to improve the intersection at Candelaria Rd and Rio Grande Blvd. In that update, they recommended a protected/permissive signal control as a minor upgrade which had a relatively high cost-effectiveness score.

Unfortunately, there are several serious flaws in their analysis. These flaws compound in their effect to create a great bias against the proposed roundabout. In addition, their use of cost-effectiveness as the yardstick in decision making regarding public investment is inappropriate.

This paper endeavors to correct some of those flaws. What are they?

The Flaws

First, PB used the P.M. peak hour to represent daily conditions of traffic, thereby grossly exaggerating the amount of daily delay. The P.M. peak hour is only one hour out of 24 hours. Their report included in Appendix G delay for the A.M. peak hour and the Mid-day peak hour, but they chose not to use that information. That is corrected below, and in so doing, one extreme bias against roundabouts was eliminated.

Second, PB calculated the value of that delay using the mean wage. But the Federal Highway Administration (FHWA) indicates clearly that 50% of the mean wage is the appropriate value to use in valuing delay. That flaw is corrected below.

Third, PB evaluated the safety benefits of each alternative using 2001 dollars. Since safety benefits are much greater for roundabouts, this creates yet another bias against the roundabout. Below, that flaw is corrected by converting those benefits to 2013 dollars.

Fourth, on the cost side, PB used an estimate of the total construction costs for a roundabout, even though that is not a measure of the cost to the City of going forward with construction. There is still almost \$1 million in federal money ready to be spent on construction of the roundabout.

What the cost to the City will be is unclear. Below, a cost of \$500,000 is used, based on statements by Councilor Meyers.

The value of environmental benefits is not addressed in the PB study. What is called “environmental” is really just fuel costs. Fuel costs were estimated based on the P.M. peak hour, so, again, the results are exaggerated because most of the day is far less congested. It was not possible for us to try to correct the fuel cost estimates because those are output from proprietary software unavailable to us. However, PB should have done that.

Environmental benefits would include such things as air pollution, noise, and aesthetics. There are also intangibles such as the role that a roundabout would serve as a gateway to the Rio Grande Nature Center. This category of benefits is not addressed below.

Delay by Time of Day

Table 1 presents information on delay, calculating it based on conditions during not just the P.M. peak hour, but also information on the A.M. peak hour and mid-day peak hour. Those are just three hours of the day, leaving 21 hours of lesser congestion. In this table, the mid-day peak is used to represent these other 21 hours.

It is not known whether these other 21 hours are more congested or less congested than the mid-day peak hour. But this should be a vast improvement over using only the P.M. peak hour to represent all 24 hours of the day.

One of the advantages of roundabouts is that there is no need to stop if there is no conflicting traffic, as is a common condition during the off-peak hours.

Table 1 shows the result of using time-of-day calculations: the extra cost of delay for the roundabout versus the signal is only \$6,628 per year (depicted in red). The PB result, basing daily delay on P.M. peak hour conditions, was that the roundabout would cause an additional \$232,000 worth of delay daily. Note that part of the difference is due to their using the mean wage rate to value delay, whereas the Federal Highway Department recommends using 50% of the mean wage.

Safety Benefits

The PB results for safety benefits were simply updated to 2013 dollars using the Consumer Price Index (CPI). Those results are presented in Table 2. The CPI adjustment increased the value of safety benefits of the roundabout by 32%, to an impressive \$325,000 per year.

Costs

Table 3 presents the annualized costs of the roundabout compared to the signalized recommendation of the PB report. The roundabout has an annualized cost *to the City* of approximately \$29,000 more than the recommended signal.

Summary of Benefits and Costs

Table 4 brings together the annualized benefits and costs, focusing on the difference between a roundabout and the signal recommended by PB. What stands out is how large the safety benefits are in comparison with the other categories of benefits. The net benefit of the roundabout surpasses the signal by almost \$290,000 per year. Even if the full approximate \$1.6 million cost of the roundabout, including money from all sources and money already spent, were used in this calculation, the net benefits of the roundabout would still exceed signalized control by almost \$220,000 per year in net roundabout benefits.

All of this excludes consideration of the economic impact of building the roundabout. If there is an additional \$1 million that would be spent on the roundabout (we do not know the exact amount), compared to signal control, that represents an injection of outside money into the local economy. There is an additional economic stimulus in the economic multiplier effect, commonly assumed to be around 1.4, meaning that \$1 million of stimulus would create a total of \$1.4 million economic impact on the local economy.

Final Remarks

Some have argued that since the intersection of Candelaria Rd and Rio Grande Blvd has recently not had a crash rate that is higher than typical intersections of this type, that there is no need to spend so much to improve the intersection. But that argument assumes that average is good. *Is average good?* If the City can spend \$500,000 to improve an intersection, and get a return of \$290,000 per year due to a reduction in expected crashes and injuries, shouldn't it do so?

It would seem prudent to request that PB address the flaws stated herein. PB should submit a revision that addresses each of these concerns, including fuel costs, which should be estimated using time-of-day congestion levels. The true environmental benefits should be addressed, and where possible, quantified. Also, there should be another public meeting to present those findings and allow for public response.

Table 1. Value of Delay Calculated by Time of Day, Roundabout versus Protected/Permitted Signal

	Roundabout (sec/veh)	Signal (sec/veh)	Turning movement count peak hour approach volume (veh)	Roundabout daily delay (sec)	Signal daily delay (sec)	Roundabout delay vs signal (hr/day)	Annual delay for roundabout vs Signal (hours)	Annual operations cost of delay, roundabout vs signal (\$/yr)
AM peak hour	11.7	9.2	1,178	13,783	10,838	0.82		
MID- DAY peak hour	10.6	11.4	1,153	12,222	13,144	-0.26		
PM peak hour	24.0	13.0	1,540	36,960	20,020	4.71		
OFF- PEAK	10.6	11.4	12,166	128,960	138,692	-2.70		
DAILY			16,037	191,924	182,694	2.56		
ANNUAL value of delay using time of day analysis							641	(\$6,628)
ANNUAL FROM PB REPORT using PM peak for daily							11,238	(\$232,514)

Table 2. Safety Benefit Summary, corrected to 2013 dollars using CPI

	PB Annual Safety Benefit (2001 dollars)	Annual Safety Benefit in 2013 dollars (CPI=1.32)
Roundabout	\$248,459	\$327,966
Permitted/Protected Signal	\$2,102	\$2,775
Extra Benefits, Roundabout vs. Permissive/Protected Signal	\$246,357 (derived from PB Table 17)	\$325,191

Table 3. Cost Summary

	Cost to City of going forward with each alternative	Annualized cost of completing construction (25- yr annualization)	Annual Operations & Maintenance	Annualized Total Costs
Roundabout	\$500,000	\$32,000	\$500	\$32,500
Permissive/Protected Signal	\$10,000	\$640	\$3,000	\$3,640
Cost comparison for roundabout vs Signal				(\$28,860)
Cost comparison using PB analysis				(\$68,233)

Table 4. Summary of Net Benefits of Roundabout Compared to Permissive/Protected Signal

	This analysis	PB Report	Notes
Annual Safety Benefit	\$325,191	\$246,357	This is the amount by which the safety benefits of a roundabout exceed those of the signal recommended by PB
Annual “Environmental” Benefit (PB used fuel costs for this, but real environmental benefits were not considered; PB result derived from their Table 19)	unknown	(\$21,875)	PB did not report fuel costs by time of day (except for the P.M.), which requires the use of proprietary software programs they have. Therefore, it was not possible for us to correct their result.
Annualized Operational Benefits (based on delay)	(\$6,628)	(\$232,514)	This is the value of the extra delay caused by a roundabout.
Annualized Total Costs	(\$28,860)	(\$68,233)	Construction and operation
Total NET Annual Benefits of Roundabout versus Protected/permissive Signal	\$289,704	(\$76,265)	The extra amount spent on the roundabout would return this much extra benefit every year, due to its much greater safety.