

Notes to Benefit-Cost Analysis

Executive Summary

Project Matrix

Current Status/ Problem to Be Addressed	Change to Baseline	Type of Impacts	Population Affected by Impacts	Economic Benefits	Summary of Results - 20 Year Benefits (Undiscounted)	Page Ref. in BCA
University Avenue not user friendly or safe for cars, pedestrians, bicyclists, or bus riders.	Reduce number and size of lanes, add pedestrian tables / improve crossings/ add roundabout at 28th street, improve bus stops, provide improved streetlighting, landscaped median, bicycle lanes and sidewalks.	Increased commercial real estate investment	Merchants, consumers in the area	Increased property value	\$6,108,450	p.2
		Health Benefits from Increased Activity	Walkers and bicyclists	Monetized value of health benefits	\$9,452,350	p.3
		Air & water quality improvements from addition of greenspace & trees, more aesthetically pleasing street-scape	All living things in the general area, residents, visitors to the area, merchants	Monetized Estimate CO2 / other air pollutant reduction, water quality improvement, aesthetic benefits	\$835,280	p. 3
		Reduced Transportation Costs	Individuals now able to use non-motorized forms of transportation	Reduced costs of owning & operating an automobile	\$20,720,020	p. 4
		Decrease in number / severity of crashes (vehicular and pedestrian)	Drivers, walkers, bus riders, bicyclists	Monetized value of reduced costs from accidents	\$38,822,192	p. 4

Project Costs

One Time Construction Costs	
Construction & Engineering	\$ 12,395,134
ROW	\$1,304,600
Water Line Re-location	\$1,000,000
Annual Maintenance Costs (20 year life), undiscounted	
Electricity for Signals & Streetlights	\$408,000
Landscape Maintenance	\$1,200,000
One-time Maintenance Costs During 20 Year Life, undiscounted	
Asphalt Overlay	\$232,320
Signs and striping	\$ 10,000

Sources and Uses of Funds

Uses of Funds	Amount	Sources of Funds	% of Total	
Construction and Engineering	\$12,395,134	\$2,100,000	14	City of Little Rock
		\$600,000	4	AHTD
		\$9,695,134	66	TIGER Funds
ROW Acquisition	\$1,304,600	\$1,304,600	9	UALR In-Kind Donation
Water line Relocation	\$1,000,000	\$1,000,000	7	Central Arkansas Water
	\$14,699,734	\$14,699,734	100	

Benefits Calculated and Methods

Economic Competitiveness Benefits

The appraised value of the property directly across University Avenue from the UALR campus, an approximately one-half mile stretch, is a mere \$12,216,900.¹ The rent in the Broadmoor Shopping Center, for example, is \$7 per square foot, whereas the rent in the Midtown Shopping Center on North University is \$30 per square foot, so that there is room for much improvement in value.² After Complete Streets projects, the value of real estate typically increases, often dramatically. In one case, the property value increase was 111%; in another 80%. A 50% increase in the value of the property after the University Avenue project is completed is a reasonable expectation based on the literature. The increase is expected to occur over a three to five year period, from a combination of private investments in the property and a natural increase because of better sales performance and a change in tenants. Per *Benefit-Cost Analysis Guidelines*, only the initial increase of \$6,108,450 will be valued at Years 5, 6 & 7 (3 years after project completion), at \$1,108,450, \$2,000,000, and \$3,000,000.

The real estate benefit of the project is probably underestimated because of expected spillover effects to the shopping centers at the Asher / University /Colonel Glenn intersection. However, some of the

¹ www.arcountydata.com. Appraised value as established by Pulaski County Appraiser's Office.

² Information from University District real estate partners.

reinvestment from these centers may also spur development directly along University from Colonel Glenn to 28th.

Health Benefits From Active Transportation

Only 27% of people without safe places to walk ten minutes from home achieve the recommended activity levels, where 43% of people with safe places to walk within ten minutes of home achieve the recommended activity levels.³ For the University Avenue project, this 16% net gain means added health benefits for approximately 3,520 University District residents, students and employees.

Computation: 11,000 UALR Campus + 11,000 University District residents = 22,000 (to account for possible population overlap). 16% of 22,000 = 3,520.

Finding a simple means to quantify the benefits of physical activity is difficult, and the health benefits from the University Avenue project will accrue from both bicycle and pedestrian activity. Krizek, et al. attempted to establish guidelines for conducting benefit / cost analyses of bicycle facilities; these values will be used here.⁴ According to NCHRP Report 552, the annual per capita cost savings from increased physical activity range from \$19 to \$1,175, with a median value of \$128. Applying the median value, the annual benefits (cost savings) for the University District is \$450,560 (\$128 x 3,520). A 0.5% increase annual increase was applied.

Environmental Benefits

The increased green space provided by the landscaping and trees will help absorb carbon dioxide generated by 35,000 vehicles that travel this corridor each day, as well as provide other environmental and aesthetic benefits as calculated in the table below by New York City Parks. The estimated 200 trees to be planted along both sides of University Avenue will generate the following environmental and economic benefits per tree:

Table 1: Annual Benefits of Street Trees⁵

Annual Benefits	\$/tree
Energy	\$47.63
Air Quality	\$ 9.02
Stormwater	\$61.00
Carbon Dioxide	\$ 1.29
Aesthetic/Other	\$89.88
Total Benefits Per Tree	\$208.82

³ ECU 2004b. Physical Activity Facts and Figures, College of Health & Human Performance, East Carolina University (www.ecu.edu); at www.ecu.edu/picostcalc/pdf_file/FactsandFigures.pdf.

⁴ http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_552.pdf

⁵ Calculating Tree Benefits for New York City, found at http://www.nycgovparks.org/sub_your_park/trees_greenstreets/images/treecount_report.pdf

At \$208.82 per tree, the benefits of street trees to be included in the project equal \$41,764 per year.

Reduced Transportation Costs

It is expected that, in addition to the Complete Streets changes to the University Avenue Corridor, property along the Corridor will be redeveloped over time to be a more complete, walkable neighborhood that reduces the need for car ownership. The *Nonmotorized Transportation Pilot Program (NTPP) (May 2014 Report)* documents the latest results from a pilot study in four communities of how walking and bicycling infrastructure and programs can increase rates of walking and bicycling. To date these communities have experienced a 3.7% annual growth rate in walking, and a 10.5% annual growth rate in bicycling from 2007-2013 (p. 24). These rates are reportedly higher than typical, though. Therefore, a 10% shift to non-motorized forms of transportation that won't kick in until Year 11 (1% per year) is estimated. This shift is expected to allow 5% of the households to reduce their car ownership / transportation costs, as follows:

Per American Community Survey (2009-2013)⁶:

4,224 [number of people who drive to work] x 5% [reduction in need for cars] x \$8,698 [cost of owning / operating a car]⁷ = \$1,837,018.

A 0.5% annual increase was applied to match the expected growth in vehicular traffic.

Safety and Crash Reduction Benefits

The Complete Streets measures used in the project are intended to be used as a system; additionally, computing the safety benefits of the project is a challenge because four modes of transportation are considered. One way to address this problem is to use a single vehicular crash reduction rate. One of the more conservative estimates of benefits for Complete Street-type projects comes from the U.S. Highway Safety Research System, which found a 19% reduction in crash rates in larger city suburban areas. The benefits of Safety Scenario 1 were calculated, using this 19% overall crash reduction rate.

However, Benefit-Cost Analysis Guidelines encourage the separate evaluation of projects that might have independent utility. For this reason, crashes and benefits have been separated, as follows:

1. Comparison of Roundabout benefits versus baseline
2. Comparison of Speed Reduction (5 mph decrease) benefits versus baseline
3. Comparison of Corridor Pedestrian measures versus baseline

Factors used in for the analyses of #1 and #2 were obtained from *NCHRP Report 617: Accident Modification Factors for Traffic Engineering and ITS Improvements*.

The factor used for #3 was a 25% reduction in crashes. This conservative number was selected because of the difficulty in separating the effects of the individual safety measures used. The number was based on the *2012 FHWA Safety Countermeasures*, which found that the presence of a sidewalk on both sides of the street corresponds to an 88% reduction in "walking along road" pedestrian crashes, and that providing pedestrian refuge areas at pedestrian crossings at marked crosswalks provides a 46%

⁶ See Appendix A

⁷ AAA 2015 *Your Driving Costs*.

reduction in pedestrian crashes. Multiple studies show crashes reductions of at least 25% for most measures used (see <http://www.vtpi.org/tdm/tdm4.htm>, for example).

University Avenue has been the scene of one pedestrian death in recent years, and seven pedestrian crashes near the Town and Country / Campus and University Avenue intersection over the same 10 year time period. For this reason, it is estimated that at least one pedestrian death and two pedestrian crashes of each type severity would occur without the safety measures over the twenty year project analysis.

Analysis of Arkansas State Police crash data from 2009-2012 found an average of 120 crashes per year from 28th Street to University / Asher / Colonel Glenn. Because of the difficulties in sorting out specific locations from the crash reports, an unknown number of them are not directly in the University Avenue project area; 25% are estimated to be outside of the project boundaries. Of the remaining number (89.3), vehicular crashes were of the following levels of severity:

Crash Severity	% of Crashes	Average Annual # Crashes Each Type
1 (Fatality)	0	0
2 (Incapacitating Injury)	3%	2.1
3 (Non-Incapacitating Injury)	9%	6.3
4 (Possible Injury)	35%	24.5
5 (No Injury, Property Damage Only)	52%	36.4

To keep from double counting, crashes at 28th Street were removed from the other two analyses. Injuries at 28th street averaged 9.2 per year, at the following levels of severity:

Crash Severity	% of Crashes	Average Annual # Crashes Each Type
1 (Fatality)	0	0
2 (Incapacitating Injury)	2%	0.185
3 (Non-Incapacitating Injury)	18%	1.665
4 (Possible Injury)	24%	2.22
5 (No Injury, Property Damage Only)	56%	5.18

The net benefits from the 3 separate analyses (Safety Scenario 2) were summed and entered into the “Build - Scenario 2 - Safety” spreadsheet. Because the Scenario 2 benefits were less than Scenario 1 benefits, A “Build - Scenario 1 - Safety” spreadsheet was not prepared.

The “Build - Scenario 2 - Safety” spreadsheet is the primary Benefit-Cost spreadsheet.

Travel Time Benefits / Costs

Some reductions in travel time are expected to be generated by the project. Insufficient data is available to accurately compute the benefits for the full Benefit Cost Analysis. However, the Jacobs Study provided the following information:

Segment	2015 Existing	2034 No Build	2034 Build
Southbound	181	251	226
Northbound	167	199	194

A comparison of the travel time costs was computed for the Build / No Build scenarios and for the Existing 2015 versus No Build 2034 scenarios. Additionally, the net benefits were computed for the net benefits that will result in 2034 from the Build versus No Build scenario.

Build/No Build Travel Time Savings	
Southbound	\$572,889
Northbound	\$114,578
Total	\$687,467
2015 No Build Versus 2034 No Build Travel Time Cost	
Southbound	\$1,604,089
Northbound	\$733,298
Total	\$2,337,387

Even though the travel time increases in both 2034 scenarios, the southbound time net cost from the No-Build to Build scenarios = \$572,889.

Costs Calculated and Sources

- Construction costs provided by Jacobs Engineering UALR South University Avenue Corridor Study (April 2015), in Appendix H and throughout body of the text, based on Arkansas Highway Transportation Department 2013 Estimated Cost Per Mile. Two project lengths were used for different analyses--1st Tee Way to 19th Street is 1.69 miles. Asher/Colonel Glenn to 28th Street is .66 miles. Cost was adjusted by CPI factors to 2015 cost.
- ROW Acquisition /UALR Fence as valued by appraisal and architects.
- Water line relocation costs supplied by Central Arkansas Water.
- Street light costs provided by City of Little Rock Public Works.
- Electrical costs for traffic signals and streetlights provided by City of Little Rock Public Works.
- Maintenance costs for landscaping provided by City of Little Rock Parks Department.
- 15 year out overlay/stripping cost provided by City of Little Rock Public Works Department.

Other

Nominal dollars were converted to 2015 dollars using the Consumer Price Index. A conversion chart is found in the "CPI - Deflator Series" spreadsheet.

User Estimates

17,240 Vehicular Users	AADT 10 year average 35,480 ⁸ / 2 trips per day
2,048 Bus Riders	639,001 riders on 5 University District Routes ⁹ / 52 weeks per year / 6 days per week
765 Walkers	% University District residents who walk to work (3.2%) ¹⁰ x (Total Number Residents (11,314) + Number on UALR Campus (12,600))
47 Bicyclists	% University District residents who bike to work (0.2%) x (Total Number Residents (11,314) + Number on UALR Campus (12,600))

MEANS OF TRANSPORTATION TO WORK FOR WORKERS 16 YEARS AND OVER Pulaski County, Arkansas Census Tracts 18,19, and 21.02: 2009-2013			
	Number	Margin of Error	Per Cent
Total	4604	+/-457	
Car, truck, or van	4224	+/-429	91.7
Public transportation (excluding taxicab)	58	+/-58	1.3
Taxicab	12	+/-25	0.3
Motorcycle	9	+/-21	0.2
Bicycle	9	+/-23	0.2
Walked	146	+/-85	3.2
Other means	55	+/-69	1.2
Worked at home	91	+/-71	2.0
			100.0

Source: U.S. Census Bureau, 2009-2013 5-Year American Community Survey

⁸ April 2015, UALR - South University Avenue Corridor Study, Jacobs Engineering

⁹ Data from Rock Region Metro (formerly CATA), year-end statistics for 2014; yearly ridership has remained steady for the last three years.

¹⁰ From ACS 2009-2013 data.