

BENEFIT COST ANALYSIS OF RANDOLPH ROAD: HIGHWAY 87 TO VAIL ROAD TIGER II GRANT APPLICATION

Prepared for:

City of Coolidge, Arizona

August 20, 2010

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EXECUTIVE SUMMARY

TischlerBise has prepared the following Benefit-Cost Analysis (BCA) for the City of Coolidge, Arizona’s TIGER II Discretionary Grant Application for proposed improvements to the intersection of Highway 87 and Randolph Road and upgrading one (1) mile of Randolph Road. The BCA monetizes and discounts the benefits and costs in a common unit of measurement in present-day dollars. This process of comparing expected benefits and costs allows decision-makers to evaluate trade-offs between alternative transportation investments.

The total cost of the proposed project is \$4,400,000. The City is applying for \$3,480,000 and has secured \$650,000 from private sector partners and \$270,000 in Highway Safety Improvement Program (HSIP) funds from the State of Arizona. The project is expected to be complete in 18 months and will improve the safety and efficiency of the City’s transportation network in the area of Highway 87 and Randolph Road. These improvements in safety and efficiency will result in savings to motorists from reduced travel times, increased fuel efficiency, and fewer vehicle accidents. The project will also increase local and regional economic development opportunities along the Randolph Road Corridor.

The total, annual discounted benefits and costs are summarized below. The benefit: cost ratio of this project is calculated to be 40:1.

Figure 1: Benefit: Cost Ratio of Project

<i>Selection Criteria</i>	<i>Discounted Values</i>
Economic Stimulus and Job Creation	
Construction Jobs	\$45,169,485
On-site Jobs	\$108,459,006
Livability	\$53,441
Sustainability	\$68,028
Safety	\$233,701
TOTAL BENEFITS	\$153,983,661
TOTAL COSTS	\$3,843,130
BENEIFT:COST RATIO	40

PROJECT DESCRIPTION

The City of Coolidge, Arizona (hereafter referred to as the “City”) is applying for \$2,800,000 of TIGER II grant monies to improve the intersection of Arizona State Route 87 (Highway 87) and Randolph Road and to pave one (1) mile of Randolph Road to Vail Road (hereafter referred to as the “Project”). The Project will include the following specific improvements:

- Upgrade Randolph Road from two lanes of unpaved roadway to three lanes of paved roadway. The project will encompass 40’ in width and one mile in length.
- Signalization at the intersection of Highway 87 and Randolph Road including turn lanes and deceleration and acceleration lanes.
- Construction of a bus bay at the mid section of Randolph Road for the Coolidge Area Transit System (“Cotton Express”).
- Improvement of the at grade railroad crossing of Union Pacific’s Phoenix rail spur on Randolph Road.
- Construction of turn lanes at the intersection of Randolph Road and Vail Road.

The total cost of the Project is \$4,400,000. In addition to TIGER II funds, the City has also secured \$650,000 from private sector partners and \$270,000 in Highway Safety Improvement Program (HSIP) funds from the State of Arizona.

SELECTION CRITERIA

The United States Department of Transportation (DOT) will use a series of “Primary Selection Criteria” and “Secondary Selection Criteria” to evaluate applications for TIGER II Discretionary Grants. The criteria listed below incorporate the statutory eligibility requirements for the program.

1. Primary Selection Criteria
 - a. Long-term outcomes
 - i. State of Good Repair
 - ii. Economic Competitiveness
 - iii. Livability
 - iv. Environmental Sustainability
 - v. Safety
 - b. Job Creation and Stimulus
2. Secondary Selection Criteria
 - a. Innovation
 - b. Partnership

The following sections discuss how the Project meets each of these selection criteria.

PRIMARY SELECTION CRITERIA

State of Good Repair

Highway 87 is a significant transportation corridor for not only the City of Coolidge, but also Pinal County and the State of Arizona. It is a north-south highway stretching 273 miles in length from Interstate 10 near Eloy, north

through Coolidge to the eastern suburbs of the Phoenix metropolitan area, on toward Payson up the Mogollon Rim to Winslow and Interstate 40.

Randolph Road is planned to be a collector street serving a major employment center for the City and County. The significance of this road and its importance as an economic catalyst has been identified in a number of local and regional plans, including:

- *City of Coolidge General Plan*
- *Small Area Transportation Study*, prepared by Lima Associates for the City of Coolidge
- *Comprehensive Economic Development Strategy (CEDS) for Pinal and Gila Counties*, prepared by the Central Arizona Association of Governments

An August 2009 traffic engineering study prepared by DMA Engineers shows the intersection of Highway 87 and Randolph road currently meets warrants for right and left turn lanes to be installed on Highway 87. Further development along Randolph Road will continue to decrease the efficiency of the regional transportation network without the Project. The section of Randolph Road between Highway 87 and Vail Road is currently unpaved and has significant drainage issues. Without the project, the development of the Randolph Road corridor into an employment center may not be fully realized due to a lack of an adequate and safe transportation network.

Economic Competitiveness

Pinal County is currently designated as an “Economically Distressed Area” under 42 U.S.C. 3161. The unemployment rate for the City of Coolidge was 20.2% in 2009; nearly double the rate for both Arizona and the Country. Randolph Road has been identified as one of the City’s and region’s economic development corridors and is expected to become a major employment center in the future (hereafter referred to as the “Corridor”).

The regional economic development strategy identifies the Randolph Road Corridor as the City’s number one employment center. Future jobs which may be located in the Corridor include high tech industries, plastics and advanced composites, manufacturing, energy-related industries including solar and bio-diesel.

The Corridor currently includes the City’s most recent economic development success story; the construction of a natural gas fired power plant by TransCanada. The project is currently under construction with 300+ construction related jobs and is expected to employ 15 persons upon completion. TransCanada has also indicated it may expand this facility in the future to include solar energy. The City was recently approached about locating a privately built prison along Randolph Road which would result in 300 construction-related jobs and 650 full-time jobs upon completion.

One of the key variables in economic development is having adequate infrastructure capacity to ensure the efficient movement of workers and goods. Additional development in the Corridor will only add to the transportation deficiencies already identified in the Project area. Failure to both correct these existing deficiencies as well as provide capacity for new development will prevent the Corridor from developing into a major employment center for the City and region.

Livability

The intersection at Highway 87 and Randolph Road currently meets warrants for the installation of right and left turn lanes on Highway 87. Currently, the average wait time to turn from Randolph Road to either northbound or southbound Highway 87 during AM and PM peak times is 11 seconds (based on 2009 traffic engineering statement from DMA Engineering). By 2030 under existing conditions, the projected average wait time is expected to double

to 22 seconds without the projected development in the Randolph Road corridor. Providing a traffic signal as well as turn lanes and acceleration/deceleration lanes will reduce congestion and improve the efficiency of the intersection and minimize stop and go traffic. As noted in "Benefits of Retiming Traffic Signals: An Informational Report" prepared by the Institute of Transportation Engineers, properly timed traffic signals "can significantly reduce delays and stops experienced by motorists, which can improve safety and reduce fuel consumption and emissions. Typically, the benefit to cost ratio for signal is about 40 to 1."

To improve economic opportunities for all of the City's residents, the Project includes construction of bus bays on Randolph road for the City's public transit system ("The Cotton Express") which will enhance mobility and livability. Coolidge is the only city within Pinal County that provides its' citizens with public transportation. The Cotton Express buses are completely accessible to the disabled and their drivers are fully trained to render assistance to their special needs passengers. The buses are well maintained and are comfortable to all age groups. The buses are equipped with wheelchair lifts and "built-in" car seats for youngsters under the age of 5.

Environmental Sustainability

Currently, Randolph Road is unpaved from Highway 87 to Vail Road. Pinal County has experienced on-going problems with excessive levels of particulate matter (PM) from dust kicked up by vehicles traveling on roads, construction, agriculture, burning and wind events. The Coolidge area is within the area of Pinal County which has been recommended for inclusion as a PM10 nonattainment area under National Ambient Air Quality Standards (NAAQS) of the Clean Air Act. Paving Randolph Road will help reduce the amount of particulate matter generated in the area.

The Project also supports the City's and County's efforts to coordinate their land use planning and transportation planning efforts. Utilizing an established regional transportation corridor takes full advantage of the existing infrastructure footprint.

Safety

One of the primary goals of the Project is to improve the safety of the Highway 87 and Randolph Road intersection. The lack of turn lanes and increasing volume of traffic has lead to several accidents with injuries at the intersection over the past several years:

Figure 2: Accident History at Intersection of Highway 87 and Randolph Road

<i>Year</i>	<i>Accidents</i>	<i>Notes</i>
2005	2	2 with injuries
2006	1	
2007	4	2 with injuries
2008	0	
2009	3	
2010	2	1 with injuries
TOTAL	12	

Sources: City of Coolidge Police Department and Arizona Department of Transportation.

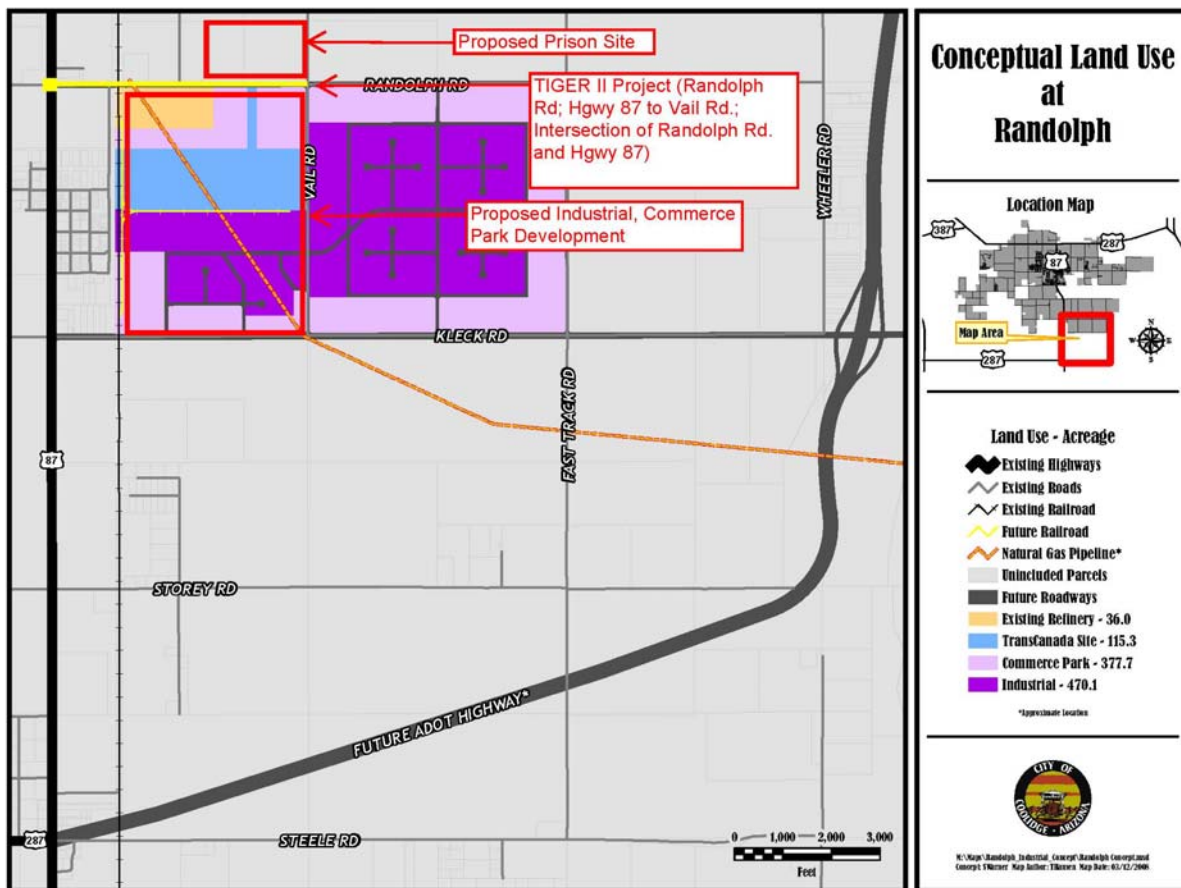
The Project will improve the safety of this intersection with addition of a traffic signal and dedicated turn lanes.

Job Creation and Stimulus

The \$3,500,000 Project will be completed in 18 months. Based on Table 5 from the May 2009 memorandum “*Estimates of Job Creation from the American Recovery and Reinvestment Act of 2009*”, \$92,000 of government spending creates one job-year. Of this, 64% of the job-year estimates is considered direct and indirect effects with the remaining 36% representing induced effects. Based on these figures, the Project is projected to add 48 job-years, of which 31 are direct and indirect and 17 are induced.

Upon completion of the Project, a total of 735 acres will be made available for development in the Randolph Road Corridor which is projected to be built out within fifteen years of completion of the Project. The Corridor is bordered by the Union Pacific railroad tracks on the west, Randolph Road on the north, Vail Road on the east, and Kleck Road to the south. The proposed prison site at the northwest corner of Randolph Road and Vail Road is also included. The Corridor is highlighted on the map below:

Figure 3: Projected Land Uses in the Randolph Road Corridor



The Project will promote job creation and stimulus for both existing and future employers. Western Emulsions and TransCanada currently occupy 151 acres in the Corridor. Western Emulsions currently employs 15 persons and expects to double its workforce in the near future to 30 employees. TransCanada is currently constructing its natural gas fired electric plant. There are 300 construction jobs currently on-site with a projected 15 permanent jobs when the project is operational. Additionally, TransCanada has indicated plans to expand its current facility to an additional 228 acres to construct a solar facility which would employ an additional 300 construction jobs and 10 permanent jobs at full operations. The expansions of these existing businesses are anticipated to occur in the next five years.

Future development in the Corridor includes a 250 acre prison complex which would employ 300 construction jobs and 650 permanent jobs at full operation in the next five years. The City's Conceptual Plan for the Randolph Road site indicates the remaining 106 acres would be a 50-50 mix of industrial land uses (53 acres) and commerce park land uses (53 acres). It is projected that these properties would be built out over between 2016 and 2026. Based on the number of acres, floor-to-area (FAR) ratios, and employee densities, TischlerBise calculates these properties will employ an additional 300 construction jobs and 1,888 permanent jobs over the ten year period.

In total, the 735 acres on the Site will employ a projected 2,593 jobs, of which 2,563 will be new jobs. The figure below summarizes the total land use and number of permanent jobs at the site.

Figure 4: Economic Development Potential in the Randolph Road Corridor

<i>SOUTH OF RANDOLPH ROAD</i>						
	<i>Existing Acreage</i>	<i>New Acreage</i>	<i>TOTAL Acreage</i>	<i>Existing Jobs</i>	<i>New Jobs*</i>	<i>TOTAL Jobs</i>
Western Emulsions	36	0	36	15	15	30
TransCanada	115.3	228	343.3	15	10	25
Industrial Land Uses	0	52.9	52.9	0	825	825
Commerce Park Land Use	0	52.9	52.9	0	1,063	1,063
Subtotal	151.3	333.7	485	30	1,913	1,943
<i>NORTH OF RANDOLPH ROAD</i>						
Prison	0	250	250	0	650	650
TOTAL	151.3	583.7	735	30	2,563	2,593

* Job estimates for Western Emulsions, TransCanada, and prison were provided by City staff. Future job estimates for industrial and commerce park land uses were calculated by TischlerBise as follows:

Industrial land uses

52.9 acres x 43,560 square feet=2,304,324 square feet of land x 0.20 floor-to-area (FAR)=460,087 square feet of building/558 square feet per employee=825 potential jobs

Commerce Park land uses

52.9 acres x 43,560 square feet=2,304,324 square feet of land x 0.20 floor-to-area (FAR)=460,087 square feet of building/433 square feet per employee=1,063 potential jobs

The rapid impact of the Project on economic stimulus and job creation is summarized in the table below:

Figure 5: Timing of Economic Development Potential in the Randolph Road Corridor

	Short-term						Long-term						TOTAL			
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022		2023	2024	2025
Construction of TIGER II Project	38 jobs															38
Prison																
Construction	300 jobs															300
Operations	650 jobs at full operation															650
Western Emulsions																
Expansion of Current Operations	15 jobs															15
TransCanada Solar Facility																
Construction	300 jobs															300
Operations	10 jobs at full operation															10
Commerce Park Land Uses																
Construction	Projected build out over 10 years (annual average of approx. 15 construction jobs)															150
Operations	Projected build out over 10 years (annual average of approx. 83 jobs)															825
Industrial Land Uses																
Construction	Projected build out over 10 years (annual average of approx. 15 construction jobs)															150
Operations	Projected build out over 10 years (annual average of approx. 106 jobs)															1,063
	Construction Jobs															938
	Permanent, On-site jobs															2,563

See the benefit-cost analysis section below for further analysis of the Project’s job creation and stimulus.

SECONDARY SELECTION CRITERIA

Innovation

The City will make full use of all available technologies in the design and construction of the Project.

Partnership

The total cost of the Project is \$4,400,000. The City has secured has secured \$650,000 from private sector partners and \$270,000 in Highway Safety Improvement Program (HSIP) funds from the State of Arizona. While not required for projects in rural areas, this fulfills the requirements of 20% local matching funds.

BENEFIT-COST ANALYSIS

Per the requirements of the TIGER II Discretionary Grant program, TischlerBise has prepared a benefit-cost analysis (hereafter referred to as “BCA”) to monetize and discount the costs and benefits of the Project in present-day dollars.

BENEFITS

TischlerBise has calculated monetary benefits for the following selection criteria:

- Job Creation and Stimulus
- Livability
- Environmental Sustainability
- Safety

The following sections detail the approach, methodology, data sources, and discounted values for each of these criteria.

Job Creation and Stimulus Benefits

As previously noted in Figures 4 and 5, the Project will promote both short- and long-term creation of jobs from existing and new employers in the Randolph Road corridor by providing efficient and reliable transportation access.

APPROACH

To calculate the job creation and stimulus benefits, TischlerBise used IMPLAN® Version 3 software and IMPLAN® data files. Minnesota IMPLAN Group, Inc (MIG, Inc) is the developer of the IMPLAN® (Impact analysis for PLANning) economic impact modeling system. IMPLAN® is used to create complete, extremely detailed Social Accounting Matrices and Multiplier Models of local economies. MIG, Inc. provides software tools, region-specific data (see Products), and outstanding technical support to enable users to make in-depth examinations of state, multi-county, county, sub-county, and metropolitan regional economies. MIG, Inc. has been developing complex localized databases, conducting IMPLAN® training workshops and distributing IMPLAN® software to public and private organizations since 1993.

IMPLAN® was selected by the United States Department of Agriculture (USDA) to provide a consistent methodology to estimate the potential job creation effects of the American Recovery and Reinvestment Act (ARRA) across all of its agencies receiving stimulus monies. In an April 2009 letter, Acting Administrator John Kort of USDA’s Economic Research Service noted “it (IMPLAN®) is one of the most credible regional impact models used for regional economic impact analysis”.

METHODOLOGY AND DATA SOURCES

TischlerBise entered the job information for both construction and on-site jobs shown in Figure 5 in IMPLAN® to reflect the number, type, and timing of jobs projected in the Randolph Road Corridor. This data was analyzed by IMPLAN® using data files specific to Pinal County. The data files include regional employment, income, value-added, household and government consumption data for the County. Additionally, the data files have an input-output structural matrix and annual trade flow model unique to the area.

Prior to reviewing the results of the analysis, this section provides helpful definitions for IMPLAN® modeling terms, as provided by the Minnesota IMPLAN Group, Inc

Direct Effect. The set of expenditures applied to the predictive model (i.e., I/O multipliers) for impact analysis. It is a series (or single) of production changes or expenditures made by producers/consumers as a result of an activity or policy. These initial changes are determined by an analyst to be a result of this activity or policy. Applying these initial changes to the multipliers in an IMPLAN model will then display how the region will respond, economically to these initial changes.

Indirect Effect. The impact of local industries buying goods and services from other local industries. The cycle of spending works its way backward through the supply chain until all money leaks from the local economy, either through imports or by payments to value added. The impacts are calculated by applying Direct Effects to the Type I Multipliers.

Induced Effect. The response by an economy to an initial change (direct effect) that occurs through re-spending of income received by a component of value added. IMPLAN's default multiplier recognizes that labor income (employee compensation and proprietor income components of value added) is not a leakage to the regional economy. This money is recirculated through the household spending patterns causing further local economic activity.

Input- Output (I/O) Analysis. A type of applied economic analysis that tracks the interdependence among various producing and consuming sectors of an economy. More particularly, it measures the relationship between a given set of demands for final goods and services and the inputs required to satisfy those demands. (Bureau of Economic Analysis)

Labor Income. All forms of employment income, including Employee Compensation (wages and benefits) and Proprietor Income.

Output. Output represents the value of industry production. In IMPLAN these are annual production estimates for the year of the data set and are in producer prices. For manufacturers this would be sales plus/minus change in inventory. For service sectors production = sales. For Retail and wholesale trade, output = gross margin and not gross sales.

Value Added. The difference between an industry's or an establishment's total output and the cost of its intermediate inputs. It equals gross output (sales or receipts and other operating income, plus inventory change) minus intermediate inputs (consumption of goods and services purchased from other industries or imported). Value added consists of compensation of employees, taxes on production and imports less subsidies (formerly indirect business taxes and nontax payments), and gross operating surplus (formerly "other value added"). (BEA); Gross value added is the value of output less the value of intermediate consumption; it is a measure of the contribution to GDP made by an individual producer, industry or sector; gross value added is the source from which the primary incomes of the SNA are generated and is therefore carried forward into the primary distribution of income account. (SNA)

DISCOUNTED BENEFITS

The IMPLAN® model generated results for both construction jobs and on-site jobs in the Randolph Road Corridor through build out of the Site in 2026. Per the requirements of the TIGER II Discretionary Grant program, the 2026

results must be discounted to 2010 using an annual interest rate of 7%. The discount figures used in the BCA are shown in the figure below:

Figure 6: Discount Factors

<i>Year</i>	<i>Discount Factors*</i>
2010	1.0000
2011	0.9346
2012	0.8734
2013	0.8163
2014	0.7629
2015	0.7130
2016	0.6663
2017	0.6227
2018	0.5820
2019	0.5439
2020	0.5083
2021	0.4751
2022	0.4440
2023	0.4150
2024	0.3878
2025	0.3624
2026	0.3387

* Assuming 7% annual discount rate per guidance of Office of Management and Budget Circulars A-4 and A-94.

The total annual output in 2026 of the 900 direct construction jobs in the Randolph Road Corridor is \$133,347,716. A discount factor of 0.3387 is applied to this figure to yield a total annual output of \$45,169,485 in 2010 dollars.

Figure 7: Discounted Economic Benefits of Construction Jobs

Construction Jobs

	<i>Number of Jobs</i>	<i>Labor Income</i>	<i>Total Value</i>	
			<i>Added</i>	<i>Output</i>
Direct Effect	900.0	\$51,569,004	\$54,670,224	\$131,772,344
Indirect Effect	5.5	\$278,360	\$382,855	\$936,276
Induced Effect	4.6	\$153,260	\$339,542	\$639,096
Total Effect	910.1	\$52,000,624	\$55,392,621	\$133,347,716

Source: TischlerBise analysis of Site build out through 2026 using IMPLAN model.

Discounted Economic Benefits of Construction Jobs

<i>Calender Year</i>	<i>Undiscounted Total Outputs</i>	<i>Discount Factor</i>	<i>Discounted Total Outputs</i>
2026	\$133,347,716	0.3387	\$45,169,485

The total annual output in 2026 of the 2,565 direct on-site jobs in the Randolph Road Corridor is \$320,188,746. A discount factor of 0.3387 is applied to this figure to yield a total annual output of \$108,459,006 in 2010 dollars.

Figure 8: Discounted Economic Benefits of On-site Jobs

On-site Jobs

	<i>Number of Jobs</i>	<i>Labor Income</i>	<i>Total Value</i>	
			<i>Added</i>	<i>Output</i>
Direct Effect	2,565.0	\$100,777,191	\$136,739,084	\$318,066,993
Indirect Effect	5.8	\$239,199	\$383,859	\$895,681
Induced Effect	9.0	\$298,680	\$661,882	\$1,226,072
Total Effect	2,579.8	\$101,315,070	\$137,784,825	\$320,188,746

Source: TischlerBise analysis of Site build out through 2026 using IMPLAN model.

Discounted Economic Benefits of On-site Jobs

<i>Calendar Year</i>	<i>Undiscounted Total Outputs</i>	<i>Discount Factor</i>	<i>Discounted Total Outputs</i>
2026	\$320,188,746	0.3387	\$108,459,006

Added together, the annual job creation and economic stimulus benefits from construction jobs and on-site jobs total \$153,628,491 (\$45,169,485 + \$108,459,006 = \$153,628,491).

Livability

The intersection improvements will enhance user mobility in the area through the creation of a more efficient transportation network. The Project will improve traffic flow and reduce delays on both Randolph Road and Highway 87. This will result in savings to motorists from reduced travel times.

APPROACH

The intersection of Highway 87 and Randolph Road currently meet warrants for turn lanes. With the development of the Randolph Road Corridor, it is reasonable to assume congestion and delays at this intersection will continue to get worst to the point where the intersection reaches LOS F. The project will reduce delays and travel time savings will be realized. To calculate the benefits from travel time savings, TischlerBise compared “no build” and “build” scenarios. The “no build” scenario assumes build out of the Randolph Road Corridor without construction of the Project and delays at the intersection at Highway 87 reaching LOS F. The “build” scenario assumes build out of the Randolph Road Corridor with construction of the Project and the intersection at Highway 87 operating at LOS D which is consistent with the planning assumptions used in the City’s Small Area Transportation Study.

METHODOLOGY AND DATA SOURCES

Intersection delays and corresponding LOS from the Highway Capacity Manual are shown below.

Figure 9: Intersection LOS Standards

<i>LOS</i>	<i>Signalized Intersection</i>	<i>Unsignalized Intersection</i>
A	10 seconds or less	10 seconds or less
B	10-20 seconds	10-15 seconds
C	20-35 seconds	15-25 seconds
D	35-55 seconds	25-35 seconds
E	55-80 seconds	35-50 seconds
F	80 seconds or more	50 seconds or more

Source: *Highway Capacity Manual*, Transportation Research Board, 2000.

For the “no build” scenario, TischlerBise assumed a 50 second delay for an unsignalized intersection at LOS F. The “build” scenario assumes a signalized intersection operating at LOS D with an average delay of 45 seconds.

To calculate the monetary value of the travel time savings between the two scenarios, the BCA uses “Recommended Hourly Values of Travel Time Savings” data from the US Department of Transportation.

DISCOUNTED BENEFITS

The Project will improve traffic flow on both Highway 87 and Randolph Road. The travel time savings calculations are done for both roads.

The total undiscounted, annual travel time savings in 2026 on Highway 87 are \$80,718.

Figure 10: Undiscounted Travel Time Savings on Highway 87

No Build

11,000 trips per day on Highway 87 (see footnote 1)
50 second delay @ LOS F for unsignalized intersection
550,000 seconds total delay per day
9,167 minutes total delay per day
153 hours total delay per day
55,764 hours total delay per year

Build

11,000 trips per day on Highway 87
45 second delay @ LOS D for signalized intersection
495,000 seconds total delay per day
8,250 minutes total delay per day
138 hours total delay per day
50,188 hours total delay per year

Difference

5,576 hours saved per year on Highway 87
\$14.47 value of travel time savings per hour 2010 \$'s (see footnote 3)
\$80,718 travel time saving per year

(1) Arizona Department of Transportation from Highway Capacity Software (HCS+) Version 5.21, HIGHPLAN Module. 5,500 vehicles per lane mile at LOS D for 2 lane rural arterials at 65 MPH. LOS D is consistent with the City's *Small Area Transportation Study*.

(2) *Highway Capacity Manual*, Transportation Research Board, 2000.

(3) Table 4 (Revision 1), Recommended Hourly Values of Travel Time Savings (local travel for all purposes on surface modes), U.S. Department of Transportation Memorandum (<http://ostpxweb.dot.gov/policy/reports.htm>). Value is \$11.20 in 2000 dollars. Value adjusted to 2010 dollars using GDP deflator rates from gpoaccess.gov.

The total undiscounted, annual travel time savings in 2026 on Randolph Road are \$77,049.

Figure 11: Undiscounted Travel Time Savings on Randolph Road

No Build

10,500 trips per day on Randolph Road (see footnote 1)
 50 second delay @ LOS F for unsignalized intersection (see footnote 2)
 525,000 seconds total delay per day
 8,750 minutes total delay per day
 146 hours total delay per day

 53,229 hours total delay per year

Build

10,500 trips per day on Randolph Road (see footnote 1)
 45 second delay @ LOS D for signalized intersection (see footnote 2)
 472,500 seconds total delay per day
 7,875 minutes total delay per day
 131 hours total delay per day

 47,906 hours total delay per year

Difference

5,323 hours saved per year on Randolph Road
 \$14.47 value of travel time savings per hour 2010 \$'s (see footnote 3)

\$77,049 travel time saving per year

(1) Arizona Department of Transportation from Highway Capacity Software (HCS+) Version 5.21, HIGHPLAN Module. 5,250 vehicles per lane mile at LOS D for 2 lane rural major collectors at 35 MPH. LOS D is consistent with the City's Small Area Transportation Study.

(2) Highway Capacity Manual, Transportation Research Board, 2000.

(3) Table 4 (Revision 1), Recommended Hourly Values of Travel Time Savings (local travel for all purposes on surface modes), U.S. Department of Transportation Memorandum (<http://ostpxweb.dot.gov/policy/reports.htm>). Value is \$11.20 in 2000 dollars. Value adjusted to 2010 dollars using GDP deflator rates from gpoaccess.gov.

The total annual, undiscounted travel time savings in 2026 is \$157,766 (\$80,718 + \$ 77,049 = \$157,766). A discount factor of 0.3387 is applied to this figure to yield a total annual, discounted savings of \$53,441 in 2010 dollars.

Figure 12: Discounted Livability Benefits of Travel Time Savings

Discounted Livability Benefits			
<i>Calendar</i>	<i>Undiscounted</i>	<i>Discount</i>	<i>Discounted</i>
<i>Year</i>	<i>Total Benefits</i>	<i>Factor</i>	<i>Total Benefits</i>
2026	\$157,766	0.3387	\$53,441

Environmental Sustainability

The construction of the Project will reduce the amount of stop-and-go traffic and improve traffic flow on Randolph Road. Improvements in traffic flow will improve fuel efficiency resulting in fuel savings. Improved fuel efficiency will also reduce greenhouse gas emissions.

APPROACH

With the development of the Randolph Road Corridor, it is reasonable to assume that additional vehicle trips will create congestion and reduce speeds along Randolph Road. The project will be able to accommodate additional vehicle trips which will increase travel speeds. To calculate the benefits of increased fuel efficiency, TischlerBise compared “no build” and “build” scenarios. The “no build” scenario assumes build out of the Randolph Road Corridor without construction of the Project, resulting in an average speed of 25 miles per hour. The “build” scenario assumes build out of the Randolph Road Corridor with construction of the Project and an average speed of 35 miles per hour which is consistent with City speed limits on its collector streets.

METHODOLOGY AND DATA SOURCES

Fuel consumption figures at different speeds are taken from the California Lifecycle Benefit/Cost Analysis Model. The average cost of a gallon of gas in Pinal County is \$2.72.

DISCOUNTED BENEFITS

By allowing a higher average speed on Randolph Road, the Project will result in annual savings of 65,153 gallons of gasoline and undiscounted benefits of \$176,936 in 2026.

Figure 13: Undiscounted Fuel Savings on Randolph Road

Vehicle Miles of Travel	
5,250	vehicle trips per day per lane mile @ LOS D (see footnote 1)
2	lane miles (Randolph Road; Highway 87 to Vail Road)
365	day per year
<hr/>	
3,832,500	VMT per year
Fuel Used	
Build	
0.037	average gallons per vehicle mile at 35 miles per hour (see footnote 2)
141,803	gallons of fuel used per year
No Build	
0.054	average gallons per vehicle mile at 25 miles per hour (see footnote 2)
206,955	gallons of fuel used per year
Fuel Savings	
65,153	gallons of fuel saved per year
\$2.72	average cost per gallon gasoline Pinal County(see footnote 3)
<hr/>	
\$176,936	fuel savings benefit per year

(1) Arizona Department of Transportation from Highway Capacity Software (HCS+) Version 5.21, HIGHPLAN Module. 5,250 vehicles per lane mile at LOS D for 2 lane rural major collectors at 35 MPH.

(2) Table 3-3, *Technical Supplement to Users' Guide*, California Lifecycle Benefit/Cost Analysis Model.

See http://www.dot.ca.gov/hq/tpp/offices/ote/benefit_files/tech_supp.pdf

(3) See gasbuddy.com.

In addition to the benefits of fuel savings, there are benefits from reduced greenhouse gas emissions. These undiscounted benefits total \$23,893 in 2026

Figure 14: Undiscounted Greenhouse Gas Reduction Benefits on Randolph Road

Greenhouse Gas Reductions

65,153	gallons of fuel saved per year
8.8	kilograms of carbon dioxide emissions per gallon of gasoline
573	metric tons of carbon dioxide per year
\$42	value of GHG reduction per metric ton of carbon dioxide in 2010 dollars (see footnote 1)
\$23,893	value of greenhouse gas reduction per year

(1) Table VIII-5 Economic Values for Benefit Computations, Final Regulatory Impact Analysis of the National Highway Traffic Safety Administration's rulemaking on Corporate Average Fuel Economy for MY 2001. Value is \$33 in 2001 dollars. Value adjusted to 2010 dollars using GDP deflator rates from gpoaccess.gov.

The total annual, undiscounted travel time savings in 2026 is \$200,829 (\$176,936 + \$23,893 = \$200,829). A discount factor of 0.3387 is applied to this figure to yield a total annual, discounted savings of \$68,028 in 2010 dollars.

Figure 15: Discounted Environmental Sustainability Benefits on Randolph Road

Discounted Environmental Sustainability Benefits			
<i>Calendar Year</i>	<i>Undiscounted Total</i>	<i>Discount Factor</i>	<i>Discounted Total</i>
2026	\$200,829	0.3387	\$68,028

Safety

One of the main reasons for the Project is to improve safety at the intersection of Highway 87 and Randolph Road and along the Randolph Road Corridor.

APPROACH

Fewer vehicle accidents are expected as the Project improves the transportation network in the area. To calculate the safety benefits, TischlerBise compared “no build” and “build” scenarios. The “no build” scenario assumes build out of the Randolph Road Corridor without construction of the Project and higher accident rates per 100 million vehicle miles of travel. The “build” scenario assumes build out of the Randolph Road Corridor with construction of the Project and lower accident rates per 100 million vehicle miles as a result of travel switching from an undivided collector to a collector with partial access controls.

METHODOLOGY AND DATA SOURCES

Accident rates by type and road classification are from the Federal Highway Administration’s *Highway Economics Requirements Technical Report*. Cost data by type of accident are from the *Economic Impact of Motor Vehicle Crashes 2000* report by the National Highway Traffic Safety Administration.

DISCOUNTED BENEFITS

By improving Randolph Road from an undivided rural road to a multilane rural road with partial access control, the Project will result in annual, undiscounted safety savings from fewer of \$689,923 in 2026.

Figure 16: Undiscounted Safety Savings on Randolph Road

Vehicle Miles of Travel

5,250	vehicle trips per day per lane mile @ LOS D (see footnote 1)
2	lane miles (Randolph Road; Highway 87 to Vail Road)
365	day per year
<hr/>	
3,832,500	VMТ per year

Fatal Accidents

5.0	No Build -accidents per 100 million VMТ on rural multilane undivided road (see footnote 2)
2.5	Build -accidents per 100 million VMТ on rural multilane partial access control road (see footnote 2)
2.5	difference in accident rates
0.10	accidents avoided per year
\$4,962,998	average cost of an accident (see footnote 3)
<hr/>	
\$475,517	average annual accident reduction benefit per year

Injury Accidents

200	No Build -accidents per 100 million VMТ on rural multilane undivided road (see footnote 2)
120	Build -accidents per 100 million VMТ on rural multilane partial access control road (see footnote 2)
80	difference in accident rates
3.07	accidents avoided per year
\$65,668	average cost of an accident (see footnote 3)
<hr/>	
\$201,339	average annual accident reduction benefit per year

Property Damage Only Accidents

220	No Build -accidents per 100 million VMТ on rural multilane undivided road (see footnote 2)
130	Build -accidents per 100 million VMТ on rural multilane partial access control road (see footnote 2)
90	difference in accident rates
3.45	accidents avoided per year
\$3,789	average cost of an accident (see footnote 3)
<hr/>	
\$13,068	average annual accident reduction benefit per year

\$689,923 total annual accident reduction benefit per year

(1) Arizona Department of Transportation from Highway Capacity Software (HCS+) Version 5.21, HIGHPLAN Module. 5,250 vehicles per lane mile at LOS D for 2 lane rural major collectors at 35 MPH. LOS D is consistent with the City's *Small Area Transportation Study*.

(2) Accidents rates from *Highway Economic Requirements Technical Report*, Federal Highway Administration, U.S. Department of Transportation, prepared by Jack Faucett Associates, 1991.

(3) Median cost estimate per accident, from *Economic Impact of Motor Vehicle Crashes 2000*, National Highway Traffic Safety Administration, U.S. Department of Transportation, 2002. Values are in 2001 dollars. Value adjusted to 2010 dollars using GDP deflator rates from gpoaccess.gov.

A discount factor of 0.3387 is applied to the annual, undiscounted figure of \$689,923 from 2026 to yield a total annual savings of \$233,701 in 2010 dollars.

Figure 17: Discounted Safety Benefits on Randolph Road

Discounted Safety Benefits				
Calendar Year	Undiscounted Total	Discount Factor	Discounted Total	
2026	\$689,923	0.3387	\$233,701	

COSTS

The total cost of the Project is \$4,400,000 and is expected to be completed in mid-2012. Per the requirements of the TIGER II grant program, the cost of this project has been discounted to reflect 2010 dollars which is shown in the figure below.

Figure 18: Discounted Project Costs

Discounted Costs			
<i>Calendar Year</i>	<i>Undiscounted Total Costs</i>	<i>Discount Factor</i>	<i>Discounted Total Costs</i>
2012	\$4,400,000	0.8734	\$3,843,130

BENEFIT: COST RATIO

Upon build out of the Randolph Road Corridor, the total annual, discounted benefits will total \$153,983,661 compared to discounted costs of \$3,843,310. This results in a benefit: cost ratio of 40:1 (\$153,983,661/\$3,843,310 = 40).

Figure 19: Benefit: Cost Ratio of Project

<i>Selection Criteria</i>	<i>Discounted Values</i>
Economic Stimulus and Job Creation	
Construction Jobs	\$45,169,485
On-site Jobs	\$108,459,006
Livability	\$53,441
Sustainability	\$68,028
Safety	\$233,701
TOTAL BENEFITS	\$153,983,661
TOTAL COSTS	\$3,843,130
BENEFIT:COST RATIO	40