

Science City Urban Infrastructure: Benefit Cost Analysis

Final

Submitted to:



COMMONWEALTH OF
PUERTO RICO
Puerto Rico Infrastructure
Financing Authority

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EXECUTIVE SUMMARY

The Puerto Rico Infrastructure Financing Authority (PRIFA) requests \$16.8 million in TIGER funds as part of the \$28 million project for the development of Puerto Rico's Science City (The Science City Urban Infrastructure or SCUI).

The project consists of the construction of two primary roadways (a boulevard and an avenue) and a four-lane multi-use bridge within a 70-acre development district in the remaining underdeveloped area of San Juan, Puerto Rico's capital city. Together, these developments connect pedestrians, vehicles, buses and rail mass transit systems within and around a new "Science City" district. This project will complete a financing package for the major Science City boulevard roadways, which are needed to complete connectivity for the Science City district. The economic benefits of the proposed urban development can be summarized as follows:

Current Status / Baseline	Change to Baseline + or - Savings	Types of Impacts	Population / Drivers Affected	Type of Benefit	Summary of Results (NPV 20 years, mil\$)	Page in Ref.
\$30.86M	+\$44.94M	Land Value Increase	70 acres	Livability / QL	\$14.08	21
2,373 mil/hrs.	- 8.4 million hours	Travel Time Savings	20,531 vpd	Economic Comp.	\$27.39	15
317 million VMT	-37.5 million VMT	Operating Cost Savings	20,531 vpd	Economic Comp.	\$17.81	16
3,865 accidents	-1,891 accidents	Reduced Accidents	20,531 vpd	Safety	\$20.11	18
81,268 ADT	-20,531 ADT	Maintenance & Repairs Savings	20,531 vpd	State of Good Repair	\$1.68	14
460,723 tons CO2	-80,016 tons CO2	Emission Benefits	20,531 vpd	Sustainability	\$3.79	19
0 people walking & biking	+453 people walking & biking	Transit and Bicycle path Benefits	20,531 vpd	Livability / QL	\$1.61	22
81,268 ADT	-20,531 ADT	Noise Pollution Reduction	20,531 vpd	Livability / QL	\$0.17	24
Life-Cycle Benefit (million \$)					\$86.63	

* **vpd** – vehicles per day * **QL** – Quality of Life Benefits * **ADT** – Average Daily Traffic * **VMT** – Vehicle Miles Traveled

The proposed urban development costs can be summarized as follows:

PROJECT COSTS (in thousands of dollars)					
Year	SUBSEQUENT COSTS			TOTAL COSTS (in dollars)	
	Construction	Maint./ Op.	Rehab.	Constant Dollars	Present Value
Construction Period					
1	\$9,333			\$9,333,333	\$9,333,333
2	9,333			9,333,333	8,805,031
3	9,333			9,333,333	8,306,633
Project Open					
1		\$800		\$800,000	\$671,695
2		800		800,000	633,675
3		800		800,000	597,807
4		800		800,000	563,968
5		800		800,000	532,046
6		800		800,000	501,930
7		800		800,000	473,519
8		800		800,000	446,716
9		800		800,000	421,430
10		800		800,000	397,575
11		800		800,000	375,071
12		800		800,000	353,841
13		800		800,000	333,812
14		800		800,000	314,917
15		800		800,000	297,092
16		800		800,000	280,275
17		800		800,000	264,410
18		800		800,000	249,444
19		800		800,000	235,324
20		800		800,000	222,004
Total	\$28,000	\$16,000	\$0	\$44,000,000	\$34,611,549

The Total Life Cycle Cost is the total net present value (NPV) of the construction and maintenance cost of the proposed roads and urban infrastructure. The NPV at 6% of the total life cycle cost for the proposed development is \$34.6 million.

A benefit cost ratio of 2.5 results by dividing the life-cycle benefits from the life-cycle cost of the proposed development. A benefit-cost (BC) ratio greater than 1 implies that the proposed project is beneficial and economically feasible. As of this analysis the proposed urban infrastructure development is beneficial and economically feasible.

INTRODUCTION

Estudios Técnicos Inc., was engaged by the Puerto Rico Infrastructure Financing Authority (PRIFA) to conduct a cost-benefit analysis for the proposed urban infrastructure in the Municipality of San Juan, Puerto Rico. The analysis was completed for PRIFA as a requirement of a discretionary grant application for the TIGER VI program and it was conducted in accordance with the benefit-cost methodology recommended by the US Department of Transportation (DOT) in the Federal Register, OMB Circulars A-4, A-94 and the *2014 Benefit-Cost Analysis Guidance for Tiger Grant*.

PROJECT DESCRIPTION

The Puerto Rico Infrastructure Financing Authority (PRIFA) requests \$16.8 million in TIGER funds as part of \$28 million project for the development of Puerto Rico's Science City (The Science City Urban Infrastructure or SCUl).

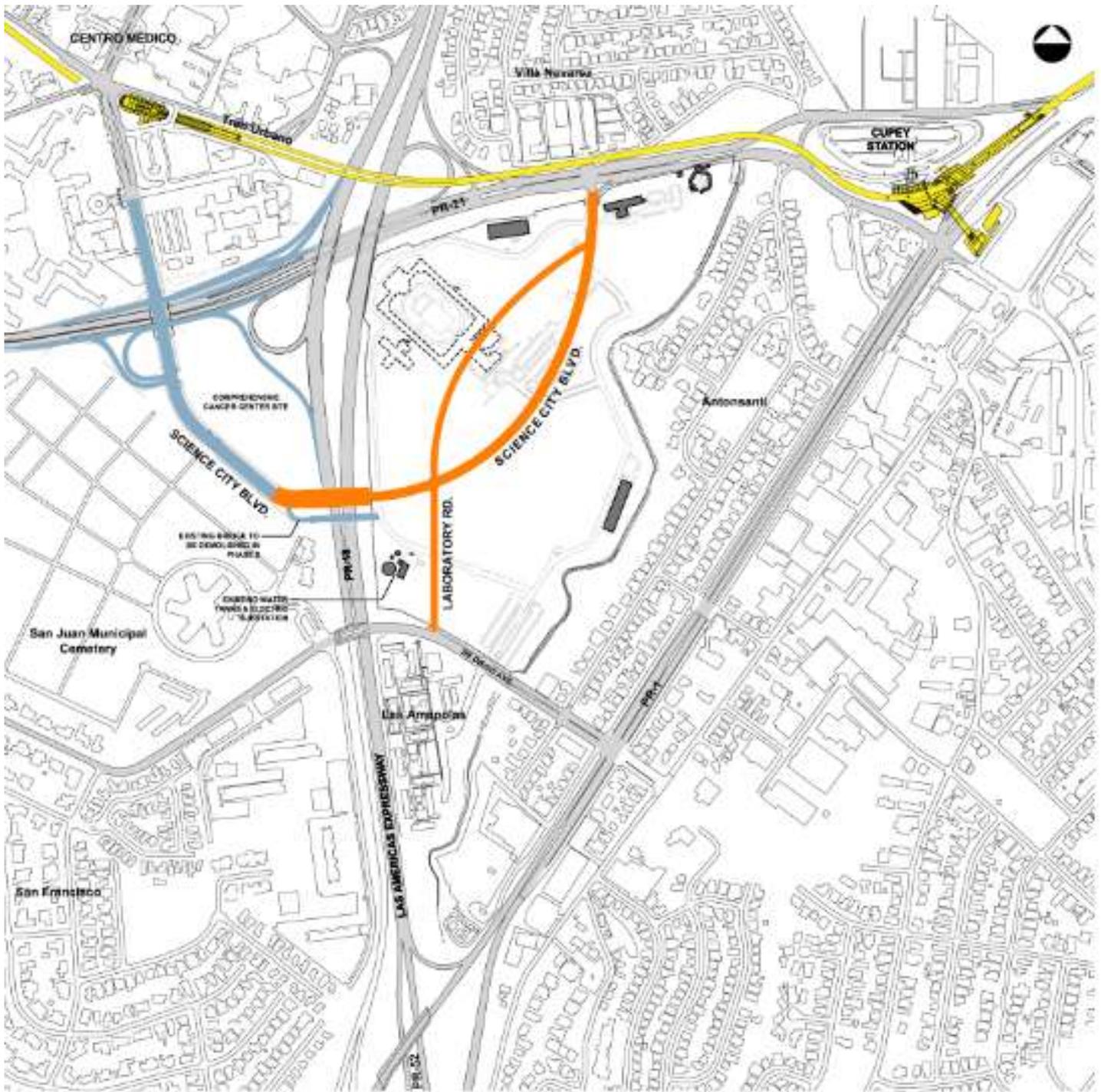
The project consists of the construction of two primary roadways (a boulevard and an avenue) and a four-lane multi-use bridge within a 70-acre development district in the last remaining underdeveloped area of San Juan, Puerto Rico's capital city. Together, these arteries will connect pedestrians, vehicles, and bus and rail mass transit systems within and around a new "Science City" district. This project will complete a financing package for the major Science City boulevard roadways, which are needed to the complete connectivity for the Science City district. This will allow critical access to a significant number of institutional sites destined for or currently used for R&D, health and postsecondary educational uses. In addition, these roads will connect three quadrants that are integral components of San Juan's "Knowledge Corridor" that have been intersected and cut off from each other by the island's major north-south thoroughfare, Las Americas Expressway (PR-18), and the four-lane, east-west José Custodio Avenue (PR-21).

The scope of work of Phase II of the Science City Urban Infrastructure includes:

1. The construction of a half-mile boulevard ("Science City Boulevard") from the new Comprehensive Cancer Center Hospital, west of highway PR-18, to its intersection with highway PR-21.
2. A new 4-lane, 185-foot long bridge spanning the six-lane PR-18, connecting both sides of the boulevard. The bridge will provide additional vehicular capacity and new, shorter routes, for travelers within the 70-acre area, adequate sidewalks and bicycle lanes not currently available anywhere in the area.
3. The construction of a new, 2-lane nearly half mile avenue ("Laboratory Road") from the north end of the boulevard southward to De Diego Avenue, including geometric improvements at that intersection.

The following maps illustrate the proposed project.

Proposed Project – Science City Urban Infrastructure – Phase II



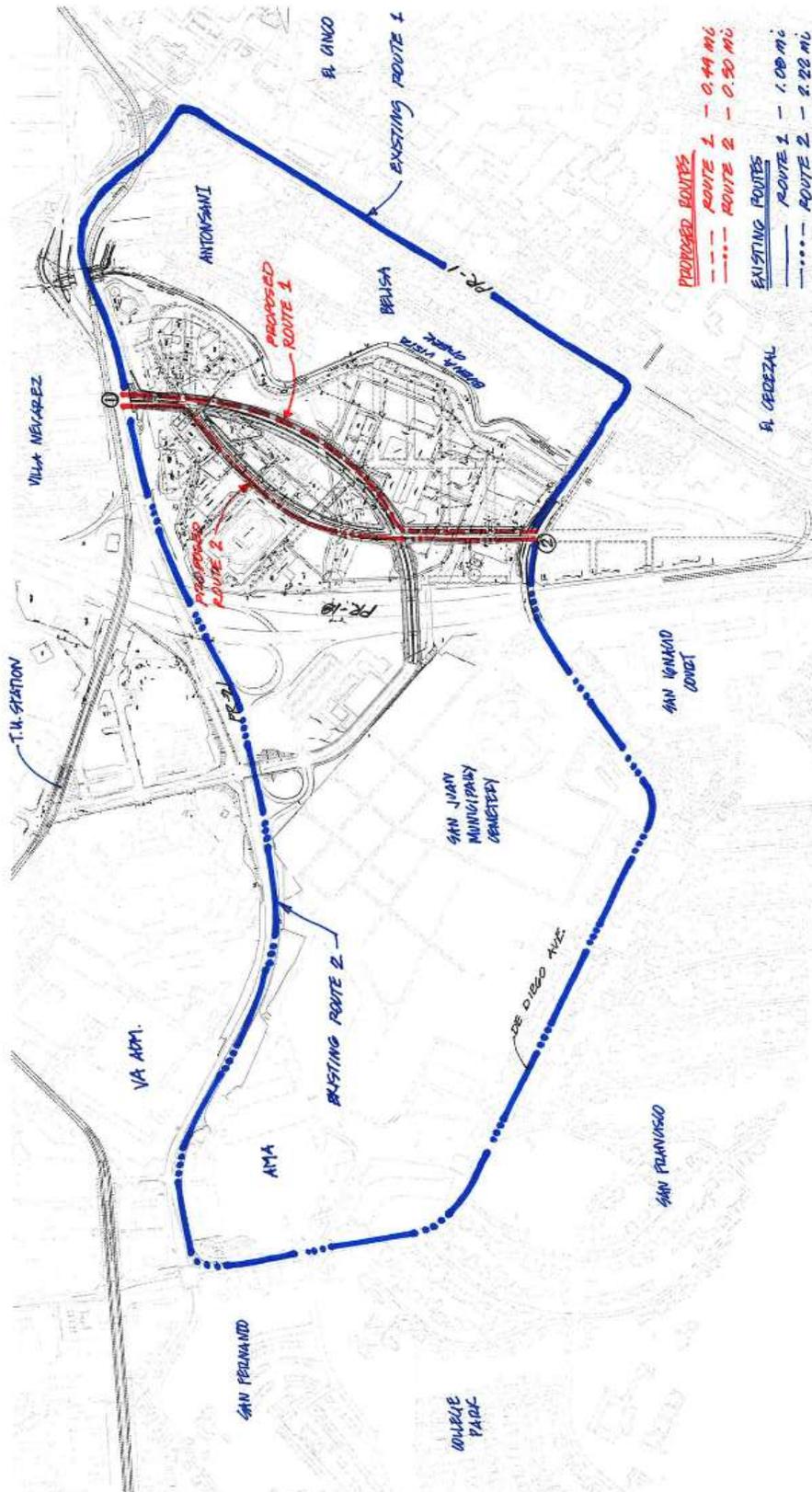
SCIENCE CITY URBAN INFRASTRUCTURE PROJECT

- PHASE I
- PHASE II
- OSO BLANCO STRUCTURES (RUIN) TO BE DEMOLISHED
- EXISTING STRUCTURES
- TREN URBANO

TORO ARQUITECTOS



Science City Urban Infrastructure – Phase II – proposed lengths



This development will provide primary multimodal infrastructure including future connections to secondary roadways, to support long-term development initiatives recommended in the Science City Master Plan adopted by the Puerto Rico Planning Board in 2011.

Urban elements (e.g., benches, bollards, luminaries, trolley stops, etc.) will be proportionately provided and will be complemented in the future with developer-provided elements as the parcels on the Science City site are sold or leased. Pre-approved points of connection, on-site, for water, sewer, power and telecommunications for easing the permitting process and implementation will be provided for world-class laboratories, health facilities, mixed use buildings, a civic/educational building and an urban park for public use. The proposed project provides the basic framework to initiate development activities at Science City district, which will be at the heart of San Juan's "Knowledge Corridor", a \$1.7 billion investment that is being implemented over a 20-year period that began in 2005. The Knowledge Corridor, extends from Centro Médico (PR Medical Center) to the University of Puerto Rico (UPR) in Río Piedras

Expected Users of the Project

The Science City Boulevard will link postsecondary educational institutions, hospitals and medical centers, R&D sites, and publicly-owned, potential development sites for life science industries, technology R&D, and new lifestyle neighborhoods. Students, faculty, employees, business owners, hospital visitors, neighboring residents and the public at large are the projected users of these newly developed roadways.

Below are the expected principal tenants of the San Juan Knowledge corridor that will be primary and secondary beneficiaries of Science City.

1. Centro Médico (PR Medical Center), San Juan's medical complex,
2. University of Puerto Rico (UPR) Comprehensive Cancer Center (CCC),
3. Puerto Rico Science, Technology & Research Trust,
4. The Veteran's Administration Medical Center (VAMC),
5. UPR Medical Sciences Campus,
6. UPR Molecular Science Laboratories,
7. International Institute of Tropical Forestry (IITF Botanical Gardens and Herbarium),
8. Metropolitan University (UMET),
9. UPR Río Piedras Campus,
10. Private Retail Stores and Residential properties to be developed.

The Science City Master Plan – Distribution of Land by Use



The Science City Master Plan and the efforts of the Puerto Rico Science, Technology & Research Trust provided the planning, design and infrastructure framework to establish the facilities of the Comprehensive Cancer Center. The Master Plan allowed for an increase in the amount of land that can be developed for the Center. In addition the Plan called for a transportation network that fully binds the former with the Centro Medico and the Science City district through a new infrastructure typology inclusive of bicycle lanes, ample shaded sidewalks and a sustainable and environmentally sensitive design concept. The Science City development Master Plan & Breakdown follows:

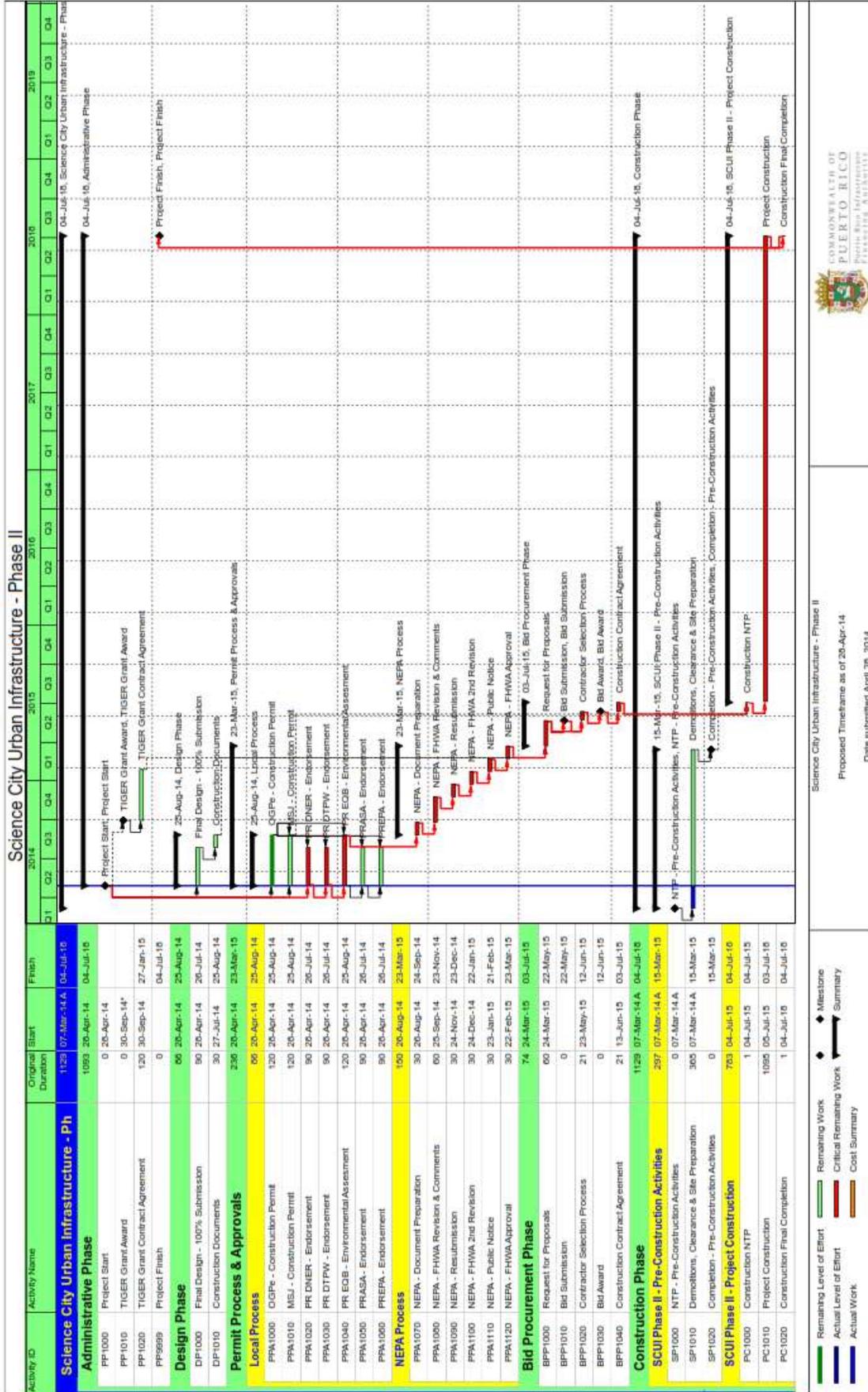
Distribution of Land

# ID	Type of Use	Square meters	Sq. Ft. of Construction	Parking
B1	Commercial	9,226	330,500	407
B2	Commercial	10,364	330,000	408
B3	Commercial	9,475	380,000	585
B4	Commercial	8,389	275,000	285
B5	Commercial	12,461	580,000	828
C1	Laboratory	13,674	250,000	260
C2	Laboratory	13,799	250,000	260
C3	Hotel	20,338	746,050	380
C4	Laboratory	13,728	250,000	260
C5	Laboratory	13,406	250,000	260
E3	Commercial & Office	14,697	370,000	1,258
C6	Educational	7,079	90,000	80
D1	HD Residential	7,575	170,000	180
D2	HD Residential	6,344	157,000	145
D3	HD Residential	6,978	210,000	230
D4	HD Residential	8,634	26,000	278
D5	HD Residential	9,772	335,000	300
D6	HD Residential	7,777	370,000	300
E1	HD Residential	12,716	638,000	364
E2	HD Residential	4,753	16,000	150
C7	Park & Greens	23,294	NA	NA
R1	Park & Greens	1,582	NA	NA
R2	Park & Greens	10,577		
	Roads	28,490		
Total		275,128	6,023,550	7,218

**Proposed Developments -
Science City in San Juan**

Type of Development	square feet
Laboratories	1,000,000
Hotel (100 Rooms)	94,550
Convention Center	60,000
Residential Units	2,655 units
Office Space	396,000
Commercial Space	280,000
School of Science (K-8)	50,000
Civic Center	40,000

The schedule of completion of phase II of the Science City Urban Infrastructure is as follows.



Science City Urban Infrastructure - Phase II
 Proposed Timeframe as of 20-Apr-14
 Date submitted April 26, 2014

█ Remaining Level of Effort
█ Actual Level of Effort
█ Critical Remaining Work
█ Cost Summary
◆ Milestone
▬ Summary

ASSUMPTIONS

The Benefit/Cost ratio is computed by dividing the increase in benefits by the increase in costs of construction and land acquisition. Thus, the B/C ratio shows the incremental benefits or costs for the build scenario in comparison to the "no-build" scenario. Some of the assumptions used in the benefits calculations include:

Traffic Generation Model

As per the information provided the consulting firm Steer Davies Gleave (SDG) the Actual Average Daily Traffic (ADT) in the adjacent intersections of the roads to build is of 56,662 for PR-21 and of 18,605 ADT for De Diego avenue, for a total actual ADT of 75,267. It is assumed that actual average travel speeds in adjacent roads is 15.36 mph.

The demand projection model performed by SDG resulted in the following 20-year traffic forecasts if the urban infrastructure development was built or not built.

- **No Build Scenario** – Traffic increase of 1% each year, overpassing capacity in each adjacent road and creating an ADT of 69,657 in PR-21 and an ADT of 28,710 for the Diego avenue, for a total ADT of 98,367.
- **Build Scenario** – Traffic in adjacent roads weaves 20% to new development and roads creating an ADT of 53,959 in PR-21 and an ADT of 23,877 for the Diego avenue, for a total ADT of 77,836. This assumes that the new roads to be constructed will have an ADT of 20,531. Also, the traffic decongestion assumes that average speeds in PR-21 will increase to 18.36 mph and that it creates a savings of 0.6 miles of vehicle miles traveled (VMT).

Traffic projections were estimated based on the calculations published by the Trip Generation Manual, 7th Edition by ITE, and the transit generation program TRICS. For more details regarding the traffic estimates, projections and benefits please refer to the traffic study of the proposed project (Science City Urban Infrastructure development) performed by SDG on July 2008.

Economic Assumptions

To evaluate the local economic benefits and the present value of the costs the following were considered:

1. **Evaluation Periods:** A construction period of three years and an evaluation period of 20 years after the project is completed.
2. **Economic Update Factor:** Based on the historical price index of Gross Domestic Product (GDP) growth for Puerto Rico an economic update factor of 2.5% each year or 1.64 economic index factor (1.025^{20}) is assumed. GDP and Growth information was acquired from the Puerto Rico Planning Board in their publication *Economic Report to the Governor 2013*. To reflect Puerto Rico's economic reality an average discount rate of 6% was used to calculate the present value.
3. **Average Hourly Wage:** an average wage of \$13.12 per hour in Puerto Rico for 2014 was obtained from Puerto Rico's Department of Labor.
4. **Average Fuel Price:** historic and average fuel prices of \$3.51 per gallon for regular gasoline were obtained from Puerto Rico Department of Consumer Affairs (DACO). Diesel fuel prices were not used because it is assumed that trucks will be limited in the proposed roads of the Science City Urban Infrastructure
5. **Sales and Fuel Taxes:** State tax rate of 5.5% and average local sales tax rate of 1.5% for San Juan was obtained from the Puerto Rico Department of Treasury (Hacienda).
6. **Cost of Highway Accidents and Fatalities:** were based on Federal averages and the TIGER BCA Resource Guide 2014 that suggest values of injuries by type of AIS level. The suggested values by accident were adjusted to Puerto Rico economy by applying the ratio of personal income between Puerto Rico and the United States, and by taking into account Puerto Rico's inflation trends. The adjustment factor considered in cost per injury was of 38.8% since Puerto Rico's personal income per capita is 38.8% below the United States.

COST PER INJURY

AIS Level	Description	US	PR
AIS 6	Unsurvivable	\$ 9,200,000	\$ 5,630,932
AIS 5	Critical	\$ 5,455,600	\$ 3,339,141
AIS 4	Severe	\$ 2,447,200	\$ 1,497,802
AIS 3	Serious	\$ 966,000	\$ 591,228
AIS 2	Moderate	\$ 432,400	\$ 264,569
AIS 1	Minor	\$ 27,600	\$ 16,887
AIS 0	No Injury - PDO	\$ 2,816	\$ 1,723

Source: FHA, FHWA, TIGER BCA Resource Guide 2014

7. **State Highway Accident Rates:** Accident rates were obtained from the historical statistics of Puerto Rico's Department of Highway and Transportation.
8. **Project Design and Project Costs:** were provided by the client (PRIFA).
9. **Emission Rates / Tables:** emission rates were obtained from the California Air Resources Board, EMFAC 2011. Below the emission tables:

Emissions Tables

EMISSIONS FACTORS (g/mi)							
Year 1							
Mode	Speed	CO	CO ₂	NO _x	PM ₁₀	SO _x	VOC
Auto	0	5.2339	79.62	0.3731	0.0044	0.0000	0.7131
	5	5.7109	1200.44	0.4530	0.0640	0.0122	0.6503
	10	4.7606	891.61	0.3940	0.0575	0.0091	0.4751
	11	4.6222	850.74	0.3852	0.0567	0.0087	0.4539
	12	4.4838	809.87	0.3764	0.0559	0.0083	0.4326
	13	4.3453	769.00	0.3677	0.0551	0.0079	0.4114
	14	4.2069	728.13	0.3589	0.0543	0.0075	0.3901
	15	4.0685	687.26	0.3502	0.0535	0.0071	0.3689
	16	3.9674	659.79	0.3438	0.0531	0.0068	0.3558
	17	3.8664	632.31	0.3373	0.0526	0.0065	0.3428
	18	3.7653	604.84	0.3309	0.0521	0.0063	0.3298
	19	3.6643	577.36	0.3245	0.0516	0.0060	0.3168
	20	3.5632	549.88	0.3181	0.0512	0.0057	0.3038
	21	3.4877	531.23	0.3134	0.0509	0.0055	0.2958
	22	3.4122	512.58	0.3087	0.0506	0.0053	0.2878
	23	3.3367	493.93	0.3040	0.0503	0.0051	0.2798
	24	3.2612	475.28	0.2993	0.0500	0.0050	0.2718
	25	3.1857	456.63	0.2947	0.0497	0.0048	0.2638
	30	2.9010	393.55	0.2781	0.0487	0.0041	0.2387
	35	2.6883	351.97	0.2672	0.0481	0.0037	0.2231
	40	2.5368	326.63	0.2609	0.0477	0.0034	0.2142
	45	2.4427	314.51	0.2589	0.0475	0.0033	0.2104
	50	2.4093	314.17	0.2609	0.0474	0.0033	0.2111
	60	2.5851	350.18	0.2774	0.0476	0.0037	0.2270
	70	3.2311	418.75	0.3038	0.0481	0.0044	0.2647
	80	4.4902	420.01	0.3079	0.0482	0.0044	0.3186

EMISSIONS FACTORS (g/mi)							
Year 20							
Mode	Speed	CO	CO ₂	NO _x	PM ₁₀	SO _x	VOC
Auto	0	1.3628	80.38	0.0771	0.0049	0.0000	0.2019
	5	1.3760	1208.90	0.1323	0.0584	0.0122	0.1693
	10	1.2511	898.02	0.1160	0.0534	0.0091	0.1286
	11	1.2273	856.86	0.1135	0.0528	0.0087	0.1235
	12	1.2034	815.71	0.1109	0.0523	0.0083	0.1185
	13	1.1796	774.55	0.1084	0.0517	0.0079	0.1135
	14	1.1558	733.40	0.1058	0.0511	0.0075	0.1085
	15	1.1320	692.24	0.1033	0.0505	0.0071	0.1035
	16	1.1120	664.57	0.1014	0.0502	0.0068	0.1005
	17	1.0920	636.90	0.0994	0.0499	0.0065	0.0975
	18	1.0721	609.23	0.0975	0.0495	0.0062	0.0944
	19	1.0521	581.56	0.0955	0.0492	0.0060	0.0914
	20	1.0322	553.89	0.0936	0.0488	0.0057	0.0884
	21	1.0154	535.11	0.0921	0.0486	0.0055	0.0865
	22	0.9985	516.34	0.0906	0.0484	0.0053	0.0847
	23	0.9817	497.56	0.0891	0.0482	0.0051	0.0828
	24	0.9649	478.79	0.0876	0.0480	0.0049	0.0809
	25	0.9481	460.01	0.0862	0.0478	0.0048	0.0791
	30	0.8774	396.50	0.0806	0.0472	0.0041	0.0734
	35	0.8188	354.67	0.0767	0.0468	0.0037	0.0701
	40	0.7716	329.19	0.0740	0.0465	0.0034	0.0686
	45	0.7362	317.03	0.0726	0.0464	0.0033	0.0685
	50	0.7144	316.79	0.0723	0.0463	0.0033	0.0699
	60	0.7293	353.35	0.0750	0.0464	0.0037	0.0780
	70	0.9173	422.99	0.0806	0.0468	0.0044	0.0984
	80	1.6204	425.77	0.0828	0.0469	0.0044	0.1463

Source: California Air Resources Board, EMFAC 2011

Notes: 1) Zero mph corresponds to starts, 2) Other emissions factors include idling emissions and exclude diurnal and evaporative emissions, 3) Five mph is best estimate for idling

Benefits such as travel time savings, operating costs, accident reductions, and Emission Costs and factors were calculated using the formulas in the Cal-B/C model v5.0¹. The model was modified to account for Puerto Rico's economic factors (discount rates, update factor, value of time / hourly rate, gasoline price, accident costs) as previously discussed. All other benefits and costs were estimated by Estudios Técnicos, Inc. using FHA parameters. Based on these parameters we can calculate the economic benefits of the proposed urban infrastructure.

¹ Latest model available at Caltrans http://www.dot.ca.gov/hq/tpp/offices/eab/LCBC_Analysis_Model.html

ECONOMIC BENEFITS

The following identifies and groups the benefits that are included in the Benefit Cost analysis for the Science City Urban Infrastructure development.

State of Good Repair

Maintenance and Repair Savings – Reduction in Pavement Damage

Pavement damage is caused by automobile traffic for each mile they travel. Since the urban infrastructure development will reduce traffic and Vehicle Miles Traveled (VMT), these costs to society will be reduced. Overall, there will be less damage to the highways and roads adjacent to the proposed urban infrastructure development, and the overall roadway system will remain in better conditions.

This analysis uses the U.S. Federal Highway Administration's Federal Highway May 2000 Addendum to the 1997 Federal Highway Cost Allocation Study, table 13², which states that automobiles in urban highways and roads incur a marginal cost to pavement of 0.1 cents per vehicle-mile traveled (VMT). This rate was adjusted to the first operational year after three years of construction. If we take into consideration that the new routes save each vehicle 0.6 miles and that the vehicles impacted will be 20,531 each day, then we can estimate that the NPV benefit of future maintenance and repairs of developing the proposed urban infrastructure will be of \$1.68 million dollars for a 20-year period. This benefit considers the present value, an increase in ADT and pavement marginal cost of 1% each year.

² Addendum to the 1997 Federal Highway Cost Allocation Study Final Report U.S. Department of Transportation Federal Highway Administration May 2000 - <https://www.fhwa.dot.gov/policy/hcas/addendum.htm>

Pavement Maintenance & Repairs Savings

Operational Year	Reduced ADT	VMT saved	Marginal Cost per VMT	Constant Dollars	Present Value Benefits
1	20,531	0.6	0.0260	\$ 116,904	\$ 98,154
2	20,736	0.6	0.0270	\$ 122,614	\$ 97,122
3	20,944	0.6	0.0280	\$ 128,427	\$ 95,968
4	21,153	0.6	0.0290	\$ 134,343	\$ 94,707
5	21,365	0.6	0.0300	\$ 140,366	\$ 93,351
6	21,578	0.6	0.0310	\$ 146,495	\$ 91,913
7	21,794	0.6	0.0320	\$ 152,733	\$ 90,402
8	22,012	0.6	0.0330	\$ 159,081	\$ 88,830
9	22,232	0.6	0.0340	\$ 165,540	\$ 87,205
10	22,454	0.6	0.0350	\$ 172,113	\$ 85,535
11	22,679	0.6	0.0360	\$ 178,801	\$ 83,829
12	22,906	0.6	0.0370	\$ 185,606	\$ 82,094
13	23,135	0.6	0.0380	\$ 192,528	\$ 80,335
14	23,366	0.6	0.0390	\$ 199,571	\$ 78,560
15	23,600	0.6	0.0400	\$ 206,735	\$ 76,774
16	23,836	0.6	0.0410	\$ 214,022	\$ 74,981
17	24,074	0.6	0.0420	\$ 221,435	\$ 73,187
18	24,315	0.6	0.0430	\$ 228,974	\$ 71,395
19	24,558	0.6	0.0440	\$ 236,642	\$ 69,609
20	24,804	0.6	0.0450	\$ 244,440	\$ 67,833
Total Benefits				\$ 3,547,369	\$ 1,681,785

Economic Competitiveness

Travel Time Savings

The benefits in saving time are calculated by:

1. Using the base and future-year ADT projections we estimate future annual ADTs, without and with the improvement project, assuming straight-line growth.
2. The estimated annual ADTs are then multiplied by the affected length (old vs. new routes) and then divided by the traffic speed to find the total travel time for both scenarios, BUILD and NO BUILD.
3. The annual travel time savings (the difference between total travel time with and without building) is then multiplied by the value of time (average hourly wage) and average vehicle occupancy rate of 1.03 for peak times and 1.65 for non-peak times to convert travel time savings into dollar values.
4. Then the dollar values of travel time savings are discounted to estimate their present value.

The table below recaps the formulas used in the Time Travel Savings calculation.

Formulas:

$$\text{Avg. Annual Volume} = \frac{\text{Avg. Daily Traffic} \times \text{Number of Days in Model Year}}{\text{vehicles / yr}}$$

$$\text{Travel Time} = \frac{\text{AVO} \times \text{Avg. Annual Volume} \times \text{Affected Length}}{\text{vehicle-hrs / yr} \quad \text{vehicles / yr} \times \text{miles} \quad \text{miles/hour}}$$

$$\text{TT Savings} = \frac{\text{Travel Time Reduction} \times \text{Avg. Value of Time}}{\$ / \text{year} \quad \$ / \text{hour}}$$

$$\text{Avg. Value of Time (varies by vehicle type)}$$

$$\text{Induced} = \text{Change in Trips} \times \text{Change in Travel Time} \times 0.5$$

SUMMARY OF TRAVEL TIME BENEFITS

Year	Present Value of Travel Time Benefits	Constant Dollars	Total Per-Hrs of Time Saved
1	\$2,007,989	\$2,391,547	365,122
20	\$871,268	\$3,139,648	479,336
2	\$1,923,537	\$2,428,421	370,751
3	\$1,842,412	\$2,465,562	376,422
4	\$1,764,496	\$2,502,972	382,133
5	\$1,689,679	\$2,540,652	387,886
6	\$1,617,849	\$2,578,605	393,680
7	\$1,548,899	\$2,616,832	399,516
8	\$1,482,725	\$2,655,335	405,395
9	\$1,419,227	\$2,694,117	411,316
10	\$1,358,306	\$2,733,179	417,279
11	\$1,299,867	\$2,772,523	423,286
12	\$1,243,817	\$2,812,151	429,336
13	\$1,190,067	\$2,852,065	435,430
14	\$1,138,530	\$2,892,267	441,567
15	\$1,089,123	\$2,932,760	447,750
16	\$1,041,763	\$2,973,544	453,976
17	\$996,372	\$3,014,623	460,248
18	\$952,875	\$3,055,999	466,565
19	\$911,197	\$3,097,673	472,927
Total	\$27,389,998	\$55,150,475	8,419,920

Source: Formulas and Calculations from Edited Cal B/C Model and ETI Estimates

The results of the travel time benefits are about 8.4 million hours of time saved over a 20-year period or an average of 420,996 hours of time saved per year. These savings would only apply to the affected drivers, which are estimated at more than 20,500 a day, that would take the roads to be developed under the Science City Urban Infrastructure, phase II. Time savings translate into a net present value (NPV) savings of \$27.4 million dollars over a 20 year period.

Vehicle Operating Cost (VOC) Savings

Another benefit of constructing the proposed set of roads is that it would create savings in vehicle operating costs (fuel use, vehicle wear and tear, etc. due to improved speed). These benefits are calculated as follows:

1. Using the base and future-year ADT projections we multiply the affected segment length to find annual VMT (Vehicle-Miles-Traveled) in scenarios, BUILD and NO BUILD, as well as the difference (VMT savings).
2. Then, annual VMT savings are multiplied by the fuel consumption and the unit fuel cost to find the dollar value for fuel VOC savings. Annual VMT savings are multiplied by unit non-fuel VOC to find the dollar value of non-fuel VOC savings. Fuel rates used where \$3.51 per gallon for regular gasoline. It is assumed that trucks will not take the proposed roads in the Science City Urban Infrastructure.
3. Future annual values of VOC savings are discounted to obtain their present value.

The table below recaps the formulas used in the Vehicle Operating Cost Benefits calculation.

Formulas:			
$\text{Vehicle-Miles Traveled} = \text{Affected Length} \times \text{Avg. Annual Volume}$		$\text{Non-Fuel Cost} = \text{VMT} \times \text{Cost Per Mile}$	
veh-miles/yr	miles	vehicles/yr	dollars
$\text{Fuel Cost} = \text{VMT} \times \text{Fuel Consumption} \times \text{Fuel Price}$		$\text{Benefit} = \text{Existing Cost} - \text{New Cost}$	
dollars	gallons/mile	\$/gallon	\$/miles

SUMMARY OF VEHICLE OPERATING COST BENEFITS

Year	Peak Non-HOV	Non-Peak Non-HOV	Present Value of Veh Op Cost Benefits	Constant Dollars
1	\$0	\$374,547	\$374,547	\$446,091
20	\$311,338	\$712,811	\$1,024,149	\$3,690,560
2	\$46,772	\$441,833	\$488,605	\$616,853
3	\$88,249	\$500,302	\$588,551	\$787,614
4	\$124,880	\$550,737	\$675,617	\$958,376
5	\$157,082	\$593,859	\$750,941	\$1,129,137
6	\$185,238	\$630,334	\$815,573	\$1,299,899
7	\$209,704	\$660,778	\$870,482	\$1,470,660
8	\$230,806	\$685,755	\$916,561	\$1,641,422
9	\$248,848	\$705,788	\$954,636	\$1,812,183
10	\$264,107	\$721,356	\$985,463	\$1,982,945
11	\$276,842	\$732,900	\$1,009,742	\$2,153,706
12	\$287,289	\$740,826	\$1,028,114	\$2,324,468
13	\$295,666	\$745,506	\$1,041,172	\$2,495,229
14	\$302,174	\$747,283	\$1,049,457	\$2,665,991
15	\$306,998	\$746,471	\$1,053,469	\$2,836,753
16	\$310,308	\$743,355	\$1,053,664	\$3,007,514
17	\$312,260	\$738,201	\$1,050,461	\$3,178,276
18	\$312,996	\$731,249	\$1,044,246	\$3,349,037
19	\$312,649	\$722,719	\$1,035,368	\$3,519,799
Total	\$4,584,207	\$13,226,611	\$17,810,817	\$41,366,513

Source: Formulas and Calculations from Edited Cal B/C Model and ETI Estimates

The present value of the vehicle savings in operating cost benefits are of \$17.8 million over a 20-year period, which average a saving of \$890,541 each year.

Safety Benefits

Accident Cost Savings

The benefits of accident cost savings are calculated as follows:

1. The aggregated accident cost (per million miles) is determined by multiplying the accident rate by accident cost for each type of accident and adding the results. Transit accident cost savings are calculated similarly, except that the aggregate accident cost is calculated by accident event (i.e. fatality, injury, property damage) rather than accident type.
2. Annual VMT (in million miles) is multiplied by aggregate accident cost (established in the parameters) to result in the annual cost of accidents for both scenarios, BUILD and NO BUILD.
3. The difference (BUILD minus NO BUILD, change in accident cost) is discounted to find the present value of future safety benefits.

The table below recaps the formulas used in the Accident Reduction Benefits calculation.

Formulas:	
$\frac{\text{Vehicle-Miles Traveled}}{\text{veh-miles/yr}} = \frac{\text{Affected Length}}{\text{miles}} \times \frac{\text{Avg Volume}}{\text{vehicles/yr}}$	$\text{Transit Acc Cost} = \text{Veh-Miles} \times \text{Acc Cost/Mile}$
$\text{Hwy Acc Cost} = (\text{VMT} \times \text{Rate} \times \text{Cost/Mile}) \text{ by Acc Type}$	$\text{Transit Acc Cost/Mile from PARAMETERS}$

SUMMARY OF ACCIDENT REDUCTION BENEFITS

Year	Peak Non-HOV	Non-Peak Non-HOV	Present Value of Accident Benefits	Constant Dollars
1	\$442,960	\$856,043	\$1,299,003	\$1,547,133
20	\$246,294	\$475,975	\$722,269	\$2,602,722
2	\$432,893	\$836,588	\$1,269,481	\$1,602,691
3	\$422,546	\$816,593	\$1,239,139	\$1,658,248
4	\$411,984	\$796,181	\$1,208,165	\$1,713,805
5	\$401,264	\$775,463	\$1,176,727	\$1,769,362
6	\$390,437	\$754,540	\$1,144,977	\$1,824,920
7	\$379,551	\$733,501	\$1,113,051	\$1,880,477
8	\$368,645	\$712,426	\$1,081,071	\$1,936,034
9	\$357,759	\$691,387	\$1,049,146	\$1,991,592
10	\$346,923	\$670,447	\$1,017,370	\$2,047,149
11	\$336,168	\$649,662	\$985,831	\$2,102,706
12	\$325,519	\$629,083	\$954,602	\$2,158,263
13	\$314,999	\$608,751	\$923,750	\$2,213,821
14	\$304,626	\$588,706	\$893,332	\$2,269,378
15	\$294,419	\$568,979	\$863,398	\$2,324,935
16	\$284,391	\$549,600	\$833,991	\$2,380,493
17	\$274,555	\$530,591	\$805,146	\$2,436,050
18	\$264,921	\$511,974	\$776,895	\$2,491,607
19	\$255,498	\$493,764	\$749,262	\$2,547,164
Total	\$6,856,353	\$13,250,254	\$20,106,607	\$41,498,550

Source: Formulas and Calculations from Edited Cal B/C Model and ETI Estimates

The present value of Accident Reduction benefits are of \$20.1 million over a 20-year period.

Environmental Sustainability

Emission Reduction Benefits

The benefits of emission reductions are calculated as follows:

Emissions Reductions Savings

The benefits of highway emission reductions are calculated as follows:

1. The aggregate emissions cost (per mile) is calculated by multiplying the emissions rate (see parameters) by the emissions cost for each type of emission and adding the results.
2. Annual VMT (in miles) is then multiplied by the aggregate emissions cost to result in the annual emissions cost, with and without the project (Build or No Build).

- The difference in scenarios (BUILD minus NO BUILD, change in emissions cost) is discounted to find the present value of future emissions benefits.

The table below recaps the formulas used in the Emissions Reductions Benefits calculation.

Formulas:

Vehicle-Miles Traveled = Affected Length x Avg. Annual Volume veh-miles/yr miles vehicles/yr	Transit Em Cost = (Veh-Miles x Rate x Cost/Mile) by Em Type
Hwy Emissions Cost = (VMT x Rate x Cost/Mile) by Emissions Type	

SUMMARY OF EMISSION REDUCTION BENEFITS

Year	Peak Non-HOV	Non-Peak Non-HOV	Present Value of Emission Benefits	Constant Dollars	ADDITIONAL CO ₂ EMISSIONS	
					tons/yr	PV \$/yr
1	\$0	\$81,897	\$81,897	\$97,540	(1,233)	(\$40,636)
20	\$63,787	\$147,247	\$211,034	\$760,470	(6,771)	(\$107,480)
2	\$13,941	\$104,550	\$118,491	\$149,592	(1,522)	(\$48,269)
3	\$26,425	\$124,616	\$151,040	\$202,126	(1,810)	(\$55,267)
4	\$37,568	\$142,308	\$179,875	\$255,157	(2,099)	(\$61,669)
5	\$47,478	\$157,824	\$205,302	\$308,698	(2,388)	(\$67,509)
6	\$56,257	\$171,347	\$227,604	\$362,766	(2,677)	(\$72,820)
7	\$63,998	\$183,046	\$247,044	\$417,375	(2,966)	(\$77,635)
8	\$42,486	\$125,759	\$168,245	\$301,302	(3,278)	(\$82,564)
9	\$46,193	\$130,786	\$176,979	\$335,959	(3,569)	(\$86,502)
10	\$49,444	\$135,037	\$184,481	\$371,211	(3,860)	(\$90,025)
11	\$52,274	\$138,578	\$190,853	\$407,075	(4,151)	(\$93,160)
12	\$54,720	\$141,471	\$196,191	\$443,569	(4,443)	(\$95,929)
13	\$56,812	\$143,772	\$200,584	\$480,710	(4,734)	(\$98,357)
14	\$58,580	\$145,533	\$204,113	\$518,518	(5,025)	(\$100,465)
15	\$60,051	\$146,803	\$206,855	\$557,012	(5,316)	(\$102,274)
16	\$61,252	\$147,627	\$208,879	\$596,211	(5,607)	(\$103,803)
17	\$62,204	\$148,047	\$210,251	\$636,136	(5,898)	(\$105,072)
18	\$62,931	\$148,100	\$211,031	\$676,806	(6,189)	(\$106,096)
19	\$63,453	\$147,823	\$211,275	\$718,244	(6,480)	(\$106,894)
Total	\$979,854	\$2,812,170	\$3,792,024	\$8,596,479	(80,016)	(\$1,702,427)

Source: Formulas and Calculations from Edited Cal B/C Model and ETI Estimates

The present value of the emission reduction benefits are of \$3.8 million over a 20-year period, which average to approximate savings of \$189,601 each year.

Livability / Quality of Life

Land Value Increase

Another benefit that can be considered is the increase in land value. The proposed development of two roads will cross a 275,128 meter square plot of land that will make possible the development of laboratories, schools, residences, commercial and office spaces. It is estimated that there will be approximately 6 million square feet of future development made possible by the publicly funded roads to be constructed.

As per the last appraisal done by Licensed Appraiser Mr. Guido Picon, the land had an estimated value of \$30,860,000 which results in an estimated value of \$112.17 per square meter of undeveloped land (\$30.86 million/275,128). In order to calculate the estimated increase in value a real-estate analysis was performed by examining value appreciation in comparable land sales in the area. Using the actual land values of comparable properties in the area we can calculate that the value of developed land in the area is of approximately \$212.79 per square meter (Appraisal Value/Lot Area M2). The following table details the comparable properties in the area and its land valuation.

Land Value Increase Calculation - Comparable Land Valuation Method

Block	Street	Municipality	Sale Price	Appraisal Value	Value per M2	Land Value per M2	Lot Area M2	Type of Property	GLA	Date Sold
256-A	JESUS T. PIÑERO AVE.	RIO PIEDRAS	\$ 515,000	\$ 515,000	\$2,076.61	\$213	248.00	Commercial	4,131	8/30/2011
797	25 SE ST.	RIO PIEDRAS	\$ 200,000	\$ 340,000	\$719.77	\$216	472.37	Commercial	5,979	8/20/2012
A-1	ACEROLA (CARMEN) ST.	RIO PIEDRAS	\$ 115,000	\$ 155,000	\$209.65	\$210	739.33	Land	-	11/7/2012
	Proposed Land "AS IS"	RIO PIEDRAS	NA	\$ 30,860,000	\$ 112.17	\$ 112.17	275,128	Land		Actual Appraisal on April 2014
	Land to be Developed	RIO PIEDRAS	NA	\$44,938,236	\$212.79	\$ 212.79	211,185	Land		Estimate from Comparable Values
				Appreciation by developing the land \$ 14,078,236						

Source: Abreu & Associates Historical Sales Report 2014

If we apply the appreciation value of \$212.79 per square meter to the land to be developed of 211,185 square meters³ it can be expected that the value of the land will increase to \$44,938,236. The benefit is the difference between the appreciation and the current value, which is \$14,078,236. This benefit is assumed to be a one-time benefit occurring year 1 of operations for the project.

³ The land to be developed excludes 63,943 square meters of internal roads, green areas and parks to be developed in the 70 acre plot of land.

Walking and Bicycle path benefits

The proposed development will provide a walking and biking path of approximately 1.9 miles. The societal benefits of walking and biking in the proposed paths can be measured in two ways. First, the individual benefits which extend life expectancy by reducing certain health conditions such as heart disease, type II diabetes, and the medical expenses the individual will pay. The other benefit considered is an external benefit at large from the improved health of the individual thus reducing costs in subsidized medical care, emergency room visits, and marginal reductions in group health insurance rates. The following table monetizes these benefits accordingly.

Health Benefits from Walking & Biking

	Walking Benefits	Biking Benefits
Internal Health	25 cents per walking mile	10 cents per biking mile
External Health	25 cents per walking mile	10 cents per biking mile
Total Health Benefit	50 cents per walking mile	20 cents per biking mile

Source: Victoria Transportation Institute

The source of the value of these benefits is the Victoria Transport Policy Institute⁴. To obtain the monetary value of developing the walking and bike trail we estimate that 2% of the people traveling by the proposed roads each day (ADT 20,531) will take the proposed trails. Out of the total of 411 people using these trails per day the first year it is estimated that 90.6% (372) will walk and that the rest 9.4%(39) will use the bike trails. To arrive at the net present value of the 20-year benefit of developing these trails we assume a 1% increase per year in the use of these trails as well as in the increase in health benefits. The following tables detail the benefits of walking and biking through the proposed trails of Science City Urban Infrastructure.

⁴ Victoria Transport Policy Institute <http://www.vtpi.org/tdm/tdm102.htm>

Net Present Value of Health Benefits from Walking

Operational Year	People Walking per day	Miles	Benefits per walking mile	Current Dollars	Present Value of Health Benefits
1	372	1.9	0.5000	\$ 128,991	\$ 108,303
2	376	1.9	0.5050	\$ 131,584	\$ 104,227
3	379	1.9	0.5101	\$ 134,229	\$ 100,303
4	383	1.9	0.5152	\$ 136,927	\$ 96,528
5	387	1.9	0.5203	\$ 139,679	\$ 92,894
6	391	1.9	0.5255	\$ 142,486	\$ 89,398
7	395	1.9	0.5308	\$ 145,350	\$ 86,033
8	399	1.9	0.5361	\$ 148,272	\$ 82,794
9	403	1.9	0.5414	\$ 151,252	\$ 79,678
10	407	1.9	0.5468	\$ 154,292	\$ 76,679
11	411	1.9	0.5523	\$ 157,394	\$ 73,792
12	415	1.9	0.5578	\$ 160,557	\$ 71,015
13	419	1.9	0.5634	\$ 163,784	\$ 68,341
14	423	1.9	0.5690	\$ 167,076	\$ 65,769
15	428	1.9	0.5747	\$ 170,435	\$ 63,293
16	432	1.9	0.5805	\$ 173,860	\$ 60,911
17	436	1.9	0.5863	\$ 177,355	\$ 58,618
18	441	1.9	0.5922	\$ 180,920	\$ 56,412
19	445	1.9	0.5981	\$ 184,556	\$ 54,288
20	449	1.9	0.6041	\$ 188,266	\$ 52,245
Total Benefits from Walking				\$3,137,265	\$ 1,541,521

Net Present Value of Health Benefits from Biking

Operational Year	People Biking per day	Miles	Benefits per biking mile	Current Dollars	Present Value of Health Benefits
1	39	1.9	0.2000	\$ 5,409	\$ 4,542
2	39	1.9	0.2020	\$ 5,518	\$ 4,371
3	40	1.9	0.2040	\$ 5,629	\$ 4,206
4	40	1.9	0.2061	\$ 5,742	\$ 4,048
5	41	1.9	0.2081	\$ 5,857	\$ 3,896
6	41	1.9	0.2102	\$ 5,975	\$ 3,749
7	41	1.9	0.2123	\$ 6,095	\$ 3,608
8	42	1.9	0.2144	\$ 6,218	\$ 3,472
9	42	1.9	0.2166	\$ 6,343	\$ 3,341
10	43	1.9	0.2187	\$ 6,470	\$ 3,216
11	43	1.9	0.2209	\$ 6,600	\$ 3,095
12	44	1.9	0.2231	\$ 6,733	\$ 2,978
13	44	1.9	0.2254	\$ 6,868	\$ 2,866
14	44	1.9	0.2276	\$ 7,006	\$ 2,758
15	45	1.9	0.2299	\$ 7,147	\$ 2,654
16	45	1.9	0.2322	\$ 7,291	\$ 2,554
17	46	1.9	0.2345	\$ 7,437	\$ 2,458
18	46	1.9	0.2369	\$ 7,587	\$ 2,366
19	47	1.9	0.2392	\$ 7,739	\$ 2,277
20	47	1.9	0.2416	\$ 7,895	\$ 2,191
Total Benefits from Biking				\$ 131,563	\$ 64,644

The total benefits of walking and bicycling in the proposed development area estimated at \$1.6 million.

Health Benefits from Walking & Biking

Type of Benefit	Current Dollars	Present Value
From Walking	\$ 3,137,265	\$ 1,541,521
From Biking	\$ 131,563	\$ 64,644
Total Health Benefits	\$ 3,268,827	\$ 1,606,165

Noise Pollution Reduction benefits

The reductions in vehicle miles traveled (VMT) create a more livable environment by creating reductions in noise pollution.

This analysis assumes a cost of noise of \$0.001 per VMT diminishes as expressed by the U.S. Federal Highway Administration's Federal Highway May 2000 Addendum to the 1997 Federal Highway Cost Allocation Study, table 13⁵. This rate was adjusted to 2016 dollars, when the roads to be developed are expected to be operational. If we take into consideration that the new routes save each vehicle 0.6 miles and that the vehicles impacted will be 20,531 each day (increasing 1% each year), then we can estimate that the 20-year benefit of noise reduction by developing the proposed urban infrastructure will be of \$168,178. This benefit considers the present value, an increase in ADT and pavement marginal cost of 1% each year.

⁵ Addendum to the 1997 Federal Highway Cost Allocation Study Final Report U.S. Department of Transportation Federal Highway Administration May 2000 - <https://www.fhwa.dot.gov/policy/hcas/addendum.htm>

Present Value of Noise Pollution Reduction

Operational Year	Reduced ADT	VMT saved	Marginal Cost per VMT	Constant Dollars	Present Value Benefits
1	20,531	0.6	0.0026	\$ 11,690	\$ 9,815
2	20,736	0.6	0.0027	\$ 12,261	\$ 9,712
3	20,944	0.6	0.0028	\$ 12,843	\$ 9,597
4	21,153	0.6	0.0029	\$ 13,434	\$ 9,471
5	21,365	0.6	0.0030	\$ 14,037	\$ 9,335
6	21,578	0.6	0.0031	\$ 14,649	\$ 9,191
7	21,794	0.6	0.0032	\$ 15,273	\$ 9,040
8	22,012	0.6	0.0033	\$ 15,908	\$ 8,883
9	22,232	0.6	0.0034	\$ 16,554	\$ 8,720
10	22,454	0.6	0.0035	\$ 17,211	\$ 8,554
11	22,679	0.6	0.0036	\$ 17,880	\$ 8,383
12	22,906	0.6	0.0037	\$ 18,561	\$ 8,209
13	23,135	0.6	0.0038	\$ 19,253	\$ 8,034
14	23,366	0.6	0.0039	\$ 19,957	\$ 7,856
15	23,600	0.6	0.0040	\$ 20,673	\$ 7,677
16	23,836	0.6	0.0041	\$ 21,402	\$ 7,498
17	24,074	0.6	0.0042	\$ 22,143	\$ 7,319
18	24,315	0.6	0.0043	\$ 22,897	\$ 7,140
19	24,558	0.6	0.0044	\$ 23,664	\$ 6,961
20	24,804	0.6	0.0045	\$ 24,444	\$ 6,783
Total Benefits				\$ 354,737	\$ 168,178

ECONOMIC COSTS

Initial Investment & maintenance

The total initial investment of the proposed urban development is \$28 million. This includes hard and soft construction costs including contingencies (please refer to *appendix 2* for the breakdown of the initial construction costs). This cost is considered the initial investment of the proposed development.

In addition to the construction costs, road maintenance costs of \$800,000 per year are considered in the operation phase of the road for a 20 year period.

The following table details the project initial construction cost as well as the 20 year operational cost.

PROJECT COSTS (in thousands of dollars)

Year	SUBSEQUENT COSTS			TOTAL COSTS (in dollars)	
	Construction	Maint./ Op.	Rehab.	Constant Dollars	Present Value
Construction Period					
1	\$9,333			\$9,333,333	\$9,333,333
2	9,333			9,333,333	8,805,031
3	9,333			9,333,333	8,306,633
Project Open					
1		\$800		\$800,000	\$671,695
2		800		800,000	633,675
3		800		800,000	597,807
4		800		800,000	563,968
5		800		800,000	532,046
6		800		800,000	501,930
7		800		800,000	473,519
8		800		800,000	446,716
9		800		800,000	421,430
10		800		800,000	397,575
11		800		800,000	375,071
12		800		800,000	353,841
13		800		800,000	333,812
14		800		800,000	314,917
15		800		800,000	297,092
16		800		800,000	280,275
17		800		800,000	264,410
18		800		800,000	249,444
19		800		800,000	235,324
20		800		800,000	222,004
Total	\$28,000	\$16,000	\$0	\$44,000,000	\$34,611,549

RESULTS

The proposed construction of the Science City Urban Infrastructure in San Juan is beneficial with a benefit cost ratio greater than 1.

Benefit Cost Analysis Summary

	Costant - Total for 20 years	NPV	Annual Average
LIVABILITY			
Land Value Increases	\$ 14,078,236	\$ 14,078,236	NA
Transit & Bicycle Path Benefits	\$ 3,268,827	\$ 1,606,165	\$ 80,308
Noise Pollution Reduction	\$ 354,737	\$ 168,178	\$ 8,409
TOTAL	\$ 17,701,800	\$ 15,852,579	\$ 792,629
ECONOMIC COMPETITIVENESS			
Travel Time Savings	\$ 55,150,475	\$ 27,389,998	\$ 1,369,500
Operating Cost Savings	\$ 41,366,513	\$ 17,810,817	\$ 890,541
TOTAL	\$ 96,516,988	\$ 45,200,815	\$ 2,260,041
SAFETY			
Fatalities	\$ 20,962,048	\$ 10,156,395	\$ 507,820
Injuries	\$ 6,821,159	\$ 3,304,943	\$ 165,247
Property Damage	\$ 13,715,344	\$ 6,645,269	\$ 332,263
TOTAL	\$ 41,498,550	\$ 20,106,607	\$ 1,005,330
STATE OF GOOD REPAIR			
Pavement Maintenance & Repair Savings	\$ 3,547,369	\$ 1,681,785	\$ 84,089
TOTAL	\$ 3,547,369	\$ 1,681,785	\$ 84,089
ENVIRONMENTAL			
Emission Benefits	\$ 4,737,095	\$ 2,089,597	\$ 104,480
Savings in CO2 (\$)	\$ 3,859,384	\$ 1,702,427	\$ 85,121
Savings in CO2 (tons)	80,016	80,016	4,001
TOTAL	\$ 8,596,479	\$ 3,792,024	\$ 189,601
Total Benefits - Life Cycle Benefit		\$ 86,633,811	\$ 4,331,691
Initial Investment & Maintenance - Life Cycle Cost		\$ 34,611,549	
Benefit Cost Ratio		2.50	

The following table illustrates de Benefit Cost ratio if the discount rate is changed.

Discount Rate Sensitivity Analysis

Discount Rate	NPV of Life Cycle Cost	NPV of Life Cycle Benefits	B/C Ratio
2.0%	\$ 40,027,759	\$ 130,614,016	3.3
3.0%	\$ 38,411,141	\$ 116,913,315	3.0
4.0%	\$ 36,988,900	\$ 105,230,206	2.8
5.0%	\$ 35,730,704	\$ 95,228,737	2.7
6.0%	\$ 34,611,549	\$ 86,633,811	2.5
7.0%	\$ 33,610,747	\$ 79,219,434	2.4
8.0%	\$ 32,711,121	\$ 72,799,348	2.2

OTHER BENEFITS NOT QUANTIFIED IN B/C ANALYSIS

The proposed construction of the Science City Urban Infrastructure has other benefits that are not previously discussed in the Benefit Cost analysis. These benefits are not included in the analysis because most of these benefits are qualitative benefits for society and are difficult to quantify and monetize. These additional benefits include:

- Improved Economic Productivity – local and national
- Reliability of a multimodal transportation system that serves all users and that improves connectivity with substandard bridges.
- Efficient local mobility
- Community cohesion
- Facilitates the development of the proposed master plan in effect promoting short and long term employment and economic growth in the area
- Promotes transit-oriented development
- Increased landscaping and trees that provide clean air as well as reduce heat.
- Promotes walking within the development with widened sidewalks, enhanced crosswalks, pedestrian refuges, surface treatments, raised medians, traffic calming measures, bicycle lanes and treatment for disabled travelers.
- The construction of the boulevards and the proposed urban infrastructure improvements will allow the prompt development of Science City, as it is proposed by its master plan. The development of the Science City Master plan has the potential to generate:
 - 15,230 jobs in the construction phase and around 10,726 jobs per year for the first 20 years of operations.
 - \$573.23 million in income salaries in the construction phase and an average of \$236.85 million per year in income salaries while in operations for the first 20 years.
 - \$142.2 million in government revenues in the construction phase, and an average of \$18.98 million per year for the first 20 years of operations.
 - Please refer to **appendix 1** for the methodology and the detailed economic impact of the proposed Science City Master Plan.
- The construction will accelerate the completion of the overall Science City master plan, thus attracting biopharmaceutical businesses to the area and Puerto Rico *(For more information please refer to appendix 3)*

APPENDIX 1 – ECONOMIC IMPACT

This appendix illustrates the economic impact that the proposed Science City Urban development would have in Puerto Rico and the municipality of San Juan.

Economic Impacts

Because of the linkages among the economy's components, every economic activity has effects that flow through the whole system. This section aims to quantify these effects for the Science City project.

Economic Impact of the construction phase

The following table presents some assumptions regarding the starting year for construction and operations, as well as the estimated investment amount in 2014 (deflated) dollars.

INVESTMENT COMPONENTS OF THE PROJECT

	Component description	Use category	First year of construction	First year of operation	Unit type	# of units	\$ Investment per unit	Total Investment
1	Laboratories	Laboratories	2018	2021	s/f	500,000	190	95,000,000
2	Hotel	Hotel	2019	2021	rooms	100	240,000	24,000,000
3	Conference Center	Convention Center	2020	2021	s/f	60,000	150	9,000,000
4	Residential	Residential	2019	2020	units	100	260,000	26,000,000
5	Offices	Office	2020	2021	s/f	36,000	150	5,400,000
6	Retail	Retail	2021	2022	s/f	5,000	140	700,000
7	Residential	Residential	2022	2027	units	1,529	260,000	397,540,000
8	Offices	Office	2023	2024	s/f	360,000	150	54,000,000
9	Retail / Commercial Services	Retail	2024	2025	s/f	265,000	140	37,100,000
10	Science School (K-8)	School	2025	2026	s/f	50,000	150	7,500,000
11	Civic Center	Convention Center	2027	2028	s/f	40,000	150	6,000,000
12	Laboratories	Laboratories	2028	2031	s/f	500,000	190	95,000,000
13	Residential	Residential	2029	2033	units	1,026	260,000	266,760,000
14	Retail / Commercial Services	Retail	2030	2031	s/f	30,000	140	4,200,000

Total Investment: \$1,028,200,000

The following Gantt chart depicts this schedule:

CONSTRUCTION SCHEDULE FOR THE PROJECT

Componentes	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Laboratories															
Hotel															
Conference Center															
Residential															
Offices															
Retail															
Residential															
Offices															
Retail / Commercial Services															
Science School (K-8)															
Civic Center															
Laboratories															
Residential															
Retail / Commercial Services															

In the following table the projected investment is translated into current dollars for each year of the construction phase. Because of the effect of the inflation, the total amount to be invested rises from \$1,028 million in constant dollars to \$1,316 million in current dollars.

Construction Investment (\$000)

Millions of dollars	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	Total	Average
Residential			\$27.53		\$91.72	\$94.39	\$97.12	\$99.94	\$102.84			\$93.98	\$96.71	\$99.51	\$102.40	\$906.14	\$85.59
Retail				\$7.8			\$45.32						\$6.09			\$52.19	\$23.05
Hotel		\$13.07	\$12.71													\$25.78	\$12.89
Office		\$5.88			\$64.10											\$69.99	\$34.99
Convention Center		\$9.81							\$7.99							\$17.79	\$8.90
Laboratories	\$32.59	\$34.50	\$33.53								\$43.37	\$44.63	\$45.92			\$234.53	\$36.00
School							\$9.43									\$9.43	\$9.43
Investment in construction	\$32.59	\$63.27	\$73.77	\$7.8	\$91.72	\$158.49	\$142.44	\$109.37	\$102.84	\$7.99	\$43.37	\$138.61	\$148.72	\$99.51	\$102.40	\$1315.85	\$75.15

The table in the next page shows all the economic impacts of the construction phase of Science City, grouped in three categories: 1) jobs, 2) personal income and 3) government revenues.

Jobs Generated by Construction Activity

Number of Annual Jobs	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	Average
Residential	0	0	374	0	1,178	1,178	1,178	1,178	1,178	0	0	988	988	988	988	1,703
Commercial / Retail	0	0	0	10	0	0	550	0	0	0	0	0	62	0	0	311
Hotel	0	183	173	0	0	0	0	0	0	0	0	0	0	0	0	178
Office Space	0	82	0	0	0	800	0	0	0	0	0	0	0	0	0	441
Convention Center	0	137	0	0	0	0	0	0	0	89	0	0	0	0	0	113
Laboratories	469	483	456	0	0	0	0	0	0	0	469	469	469	0	0	704
School	0	0	0	0	0	0	0	111	0	0	0	0	0	0	0	111
Jobs from Construction	469	885	1,003	10	1,178	1,978	1,728	1,289	1,178	89	469	1,457	1,519	988	988	1,385
Construction- Direct jobs (#)	242	457	518	5	609	1,022	893	666	609	46	242	753	785	511	511	715
Construction- Indir & Induced	227	428	485	5	569	956	835	623	569	43	227	704	734	477	477	669

Salary Income Generated by Contruction Activity

Millions of dollars	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	Average
Direct income	\$12.86	\$12.50	\$14.59	\$0.16	\$18.18	\$31.44	\$28.28	\$21.74	\$20.46	\$1.59	\$8.64	\$27.65	\$29.70	\$19.89	\$20.49	\$24.38
Indirect and Induced Income	\$14.63	\$14.22	\$16.60	\$0.18	\$20.68	\$35.76	\$32.17	\$24.73	\$23.27	\$1.81	\$9.83	\$31.46	\$33.79	\$22.63	\$23.31	\$27.73
Income from contruction activity	\$27.50	\$26.72	\$31.19	\$0.33	\$38.85	\$67.20	\$60.45	\$46.46	\$43.73	\$3.40	\$18.48	\$59.11	\$63.49	\$42.52	\$43.80	\$52.11

Revenues to Government Generated by Construction Activity

Millions of dollars	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	Average
State construction permit	\$0.16	\$0.32	\$0.37	\$0.00	\$0.46	\$0.79	\$0.71	\$0.55	\$0.51	\$0.04	\$0.22	\$0.69	\$0.74	\$0.50	\$0.51	\$0.60
Municipal construction taxes	\$0.11	\$0.22	\$0.26	\$0.00	\$0.32	\$0.55	\$0.50	\$0.38	\$0.36	\$0.03	\$0.15	\$0.49	\$0.52	\$0.35	\$0.36	\$0.42
Municipal excise tax	\$1.14	\$2.21	\$2.58	\$0.03	\$3.21	\$5.55	\$4.99	\$3.83	\$3.60	\$0.28	\$1.52	\$4.85	\$5.21	\$3.48	\$3.58	\$4.19
Personal income taxes from Construction	\$1.88	\$1.83	\$2.13	\$0.02	\$2.65	\$4.59	\$4.13	\$3.17	\$2.99	\$0.23	\$1.26	\$4.04	\$4.34	\$2.90	\$2.99	\$3.56
Corporate taxes from Contractors	\$0.49	\$0.95	\$1.11	\$0.01	\$1.38	\$2.38	\$2.14	\$1.64	\$1.54	\$0.12	\$0.65	\$2.08	\$2.23	\$1.49	\$1.54	\$1.79
Sales Taxes from Contractors	\$1.25	\$1.22	\$1.42	\$0.02	\$1.77	\$3.06	\$2.75	\$2.11	\$1.99	\$0.15	\$0.84	\$2.69	\$2.89	\$1.93	\$1.99	\$2.37
Total Government Revenues from Construc	\$5.04	\$6.74	\$7.86	\$0.08	\$9.79	\$16.92	\$15.21	\$11.69	\$10.99	\$0.85	\$4.64	\$14.84	\$15.92	\$10.66	\$10.97	\$12.93
Fiscal Revenue to Municipal Government	\$1.52	\$2.70	\$3.14	\$0.03	\$3.91	\$6.76	\$6.07	\$4.66	\$4.39	\$0.34	\$1.85	\$5.91	\$6.34	\$4.25	\$4.37	\$5.11
Fiscal Revenue to State Government	\$3.51	\$4.05	\$4.72	\$0.05	\$5.88	\$10.16	\$9.14	\$7.02	\$6.61	\$0.51	\$2.79	\$8.92	\$9.58	\$6.41	\$6.61	\$7.81

The full construction of the project will create 7,870 full-time equivalent direct jobs and 7,359 indirect and induced, for a total of 15,229 jobs. This represents an average of 1,385 jobs per year of active construction. Most of these jobs will be generated by the residential component of the project, followed by the laboratories, in direct proportion to their respective investment. Take into account that "direct" does not mean "in site". Some of the direct jobs generated in construction are managerial, office and professional occupations that do not work in the site.

These jobs will earn a salary income of \$573.2 million dollars. From this, \$268.2 million are direct income, or income going to the direct jobs.

It is estimated that the construction of Science City may generate around \$142.2 million in fiscal revenues for the government. A third of these revenues take the form of income tax from employees and corporations, and another third are excise taxes paid to the municipal government of San Juan (\$46 million). The IVU (sale tax) paid on purchases may go to other municipalities also. In total, the central government will collect around \$86 million and the municipal governments \$56 million.

Should there be tax exemptions these figures will change, but it is useful to estimate them since the totals foregone represent an opportunity cost.

To arrive to these conclusions certain assumptions were made that are explained in other sections, as well as the methodology followed for each estimate.

Economic Impact of the construction phase

The operational phase of the project is assumed to begin two year after each investment is made. Thus if, for example, 100 housing units are built each year, it is assumed that after the second year, the first 100 units are occupied. If it involves laboratories, it is assumed that they will be operational two years after construction begins.

The following table presents the assumed first year of operation for each component of the project.

First year of operations on each component

Componente	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Laboratories				■												
Hotel				■												
Conference Center				■												
Residential			■													
Offices				■												
Retail					■											
Residential										■						
Offices							■									
Retail / Commercial Services								■								
Science School (K-8)									■							
Civic Center											■					
Laboratories														■		
Residential															■	
Retail / Commercial Services															■	■

The number of physical units in operations each year is presented, in a summarized way (hiding the middle years), in the following table.

Operations of Physical units constructed by year

Type	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	Total
Laboratories	166,667	166,667	166,667													500,000
Hotel		50	50													100
Convention Center			60,000													60,000
Residential		100														100
Office			36,000													36,000
Retail				5,000												5,000
Residential					306	306	306	306	306							1,529
Office						360,000										360,000
Retail							265,000									265,000
School								50,000								50,000
Convention Center										40,000						40,000
Laboratories											166,667	166,667	166,667			500,000
Residential												257	257	257	257	1,026
Retail														30,000		30,000

The table in the following page shows the projected economic impact from operations.

In summary, the operation of the Science City is projected to generate around 10,726 full time equivalent direct jobs. Most of them will be in Commercial spaces, 3,387 jobs, and laboratories, with 2,732 jobs every year.

Summary of Annual Jobs for Science City

Type of Industry	20 year average
Direct Residential Jobs	985
Indirect and Induced Residential Jobs	1,182
Housing jobs.- Total	2,167
Commercial - Direct Jobs	1,210
Commercial - Indirect & induced	2,178
Commercial Direct, Total	3,387
Office- Direct jobs	1,151
Office - Indirect & induced jobs	921
Office jobs.- Total	2,072
Hotel- Direct Jobs	116
Hotel- Indirect & induced	85
Hotel Direct, Total	201
School - Direct Jobs	16
School - Indirect & induced	7
School- Total	23
Convention Center.- Direct Jobs	83
Convention Center .- Indirect & induced	60
Convention Center Total	143
Laboratory Jobs.-Direct	1,821
Laboratory Jobs.-Indirect and induced	911
Laboratories Center Total	2,732
Total Direct Jobs	5,382
Total Indirect & Induced Jobs	5,344
TOTAL ANNUAL JOBS IN SCIENCE CITY	10,726

Regarding the personal income generated by these jobs, it is estimated that the operation of Science City will generate on average \$237 million per year, including the direct as well as the indirect and induced income.

Regarding fiscal revenues, the following page presents a detailed projection of the fiscal revenues generated by each component of the project. Should some of the sources be exempted, the results will obviously change. Again, they are presented as in a non-exempted activity, since exemption represents an opportunity cost.

Fiscal Impact During the Operational Phase

Millions of dollars	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	Average
Hotel Revenues																							
Room Tax (11% of room revenues)	\$36	\$72	\$75	\$77	\$79	\$81	\$84	\$86	\$88	\$91	\$94	\$96	\$99	\$102	\$105	\$108	\$111	\$114	\$118	\$121	\$125	\$128	\$95
Hotel Property Taxes (90% exempt)	\$00	\$00	\$00	\$00	\$00	\$00	\$00	\$00	\$00	\$00	\$00	\$00	\$00	\$00	\$00	\$00	\$00	\$00	\$00	\$00	\$00	\$00	\$00
Hotel Personal Income Taxes (from employees)	\$27	\$55	\$55	\$55	\$55	\$55	\$55	\$55	\$55	\$55	\$55	\$55	\$55	\$55	\$55	\$55	\$55	\$55	\$55	\$55	\$55	\$55	\$53
Hotel Net Income	\$48	\$95	\$98	\$101	\$104	\$107	\$110	\$113	\$116	\$120	\$123	\$127	\$130	\$134	\$138	\$142	\$146	\$151	\$155	\$159	\$164	\$169	\$125
Hotel Corporate taxes	\$00	\$01	\$01	\$01	\$01	\$01	\$01	\$01	\$01	\$01	\$01	\$01	\$01	\$01	\$01	\$01	\$02	\$02	\$02	\$02	\$02	\$02	\$01
Total Fiscal Revenues by Hotel	\$112	\$223	\$228	\$233	\$238	\$244	\$249	\$255	\$261	\$267	\$273	\$279	\$286	\$292	\$299	\$306	\$314	\$321	\$329	\$337	\$345	\$354	\$275
Commercial Space Revenues																							
Municipal excise tax	\$00	\$00	\$00	\$01	\$01	\$29	\$30	\$30	\$31	\$32	\$33	\$38	\$39	\$40	\$41	\$42	\$44	\$45	\$46	\$48	\$49	\$50	\$30
Real property tax	\$06	\$06	\$06	\$06	\$07	\$07	\$07	\$06	\$06	\$05	\$05	\$05	\$05	\$05	\$05	\$09	\$08	\$08	\$07	\$10	\$10	\$09	\$06
Personal income taxes (from employees)	\$06	\$06	\$06	\$06	\$07	\$391	\$414	\$438	\$464	\$492	\$520	\$612	\$648	\$687	\$727	\$770	\$815	\$863	\$914	\$967	\$1024	\$1085	\$539
Commercial Space Net Income	\$06	\$06	\$06	\$06	\$06	\$337	\$346	\$356	\$367	\$377	\$388	\$444	\$457	\$470	\$484	\$498	\$512	\$527	\$542	\$558	\$574	\$591	\$357
Corporate income taxes	\$01	\$01	\$01	\$01	\$01	\$32	\$33	\$33	\$34	\$34	\$35	\$42	\$43	\$44	\$45	\$47	\$48	\$50	\$51	\$52	\$54	\$56	\$34
Total Fiscal Revenues by Retail	\$13	\$14	\$14	\$14	\$14	\$795	\$829	\$865	\$902	\$942	\$984	\$1141	\$1192	\$1246	\$1307	\$1365	\$1427	\$1492	\$1561	\$1636	\$1711	\$1791	\$965
Office Revenues																							
Municipal excise tax	\$00	\$00	\$00	\$00	\$03	\$03	\$03	\$03	\$03	\$03	\$03	\$03	\$03	\$03	\$04	\$04	\$04	\$04	\$04	\$04	\$04	\$04	\$03
Real property tax	\$06	\$06	\$06	\$06	\$05	\$05	\$05	\$04	\$04	\$04	\$04	\$03	\$03	\$03	\$06	\$05	\$05	\$05	\$05	\$04	\$04	\$04	\$04
Personal income taxes (from employees)	\$34	\$34	\$34	\$34	\$376	\$376	\$376	\$376	\$376	\$376	\$376	\$376	\$376	\$376	\$376	\$376	\$376	\$376	\$376	\$376	\$376	\$376	\$312
Net Income	\$18	\$18	\$18	\$19	\$213	\$219	\$225	\$232	\$238	\$245	\$252	\$260	\$267	\$275	\$283	\$291	\$300	\$308	\$317	\$327	\$336	\$346	\$227
Corporate income taxes	\$00	\$00	\$00	\$00	\$03	\$03	\$03	\$03	\$03	\$03	\$04	\$04	\$04	\$04	\$04	\$04	\$04	\$04	\$04	\$04	\$05	\$05	\$03
Total Revenues by Office Space	\$59	\$58	\$59	\$59	\$59	\$605	\$611	\$618	\$625	\$631	\$639	\$646	\$653	\$661	\$672	\$680	\$689	\$697	\$706	\$715	\$725	\$735	\$549
Residential Revenues																							
Real property tax	\$02	\$02	\$09	\$15	\$20	\$25	\$30	\$29	\$27	\$31	\$33	\$36	\$35	\$33	\$32	\$31	\$30	\$29	\$28	\$26	\$25	\$25	\$25
Personal income taxes (from employees)	\$18	\$18	\$18	\$18	\$78	\$140	\$203	\$269	\$336	\$398	\$461	\$526	\$593	\$661	\$727	\$793	\$859	\$926	\$993	\$1060	\$1127	\$1194	\$357
Residential Net Income	\$13.59	\$13.59	\$13.59	\$13.59	\$13.59	\$13.59	\$13.59	\$13.59	\$13.59	\$13.59	\$13.59	\$13.59	\$13.59	\$13.59	\$13.59	\$13.59	\$13.59	\$13.59	\$13.59	\$13.59	\$13.59	\$13.59	\$13.59
Total Revenues by Residential	\$13.61	\$13.61	\$13.86	\$13.92	\$14.57	\$15.24	\$15.92	\$16.56	\$17.23	\$17.93	\$18.64	\$19.39	\$20.14	\$20.89	\$21.64	\$22.39	\$23.14	\$23.89	\$24.64	\$25.39	\$26.14	\$26.89	\$17.42
Convention Center Revenues																							
Personal income taxes (from employees)	\$01	\$01	\$01	\$01	\$01	\$01	\$01	\$01	\$02	\$02	\$02	\$02	\$02	\$02	\$02	\$02	\$02	\$02	\$02	\$02	\$02	\$02	\$01
Convention Center Net Income	\$04	\$04	\$04	\$04	\$05	\$05	\$05	\$05	\$09	\$09	\$09	\$09	\$09	\$10	\$10	\$11	\$11	\$11	\$12	\$12	\$12	\$13	\$08
Corporate income taxes	\$02	\$02	\$02	\$02	\$02	\$02	\$02	\$02	\$04	\$04	\$04	\$04	\$04	\$04	\$04	\$05	\$05	\$05	\$05	\$05	\$05	\$05	\$03
Total Revenues by Convention Center	\$07	\$07	\$07	\$07	\$07	\$08	\$08	\$08	\$14	\$14	\$15	\$15	\$16	\$16	\$17	\$17	\$18	\$18	\$19	\$19	\$20	\$20	\$13
School Revenues																							
Real property tax	\$02	\$02	\$02	\$02	\$02	\$02	\$02	\$02	\$02	\$02	\$02	\$02	\$02	\$02	\$04	\$04	\$04	\$04	\$04	\$04	\$04	\$04	\$01
Personal income taxes (from employees)	\$24	\$23	\$21	\$20	\$19	\$18	\$17	\$16	\$22	\$27	\$31	\$29	\$28	\$26	\$25	\$23	\$22	\$21	\$21	\$22	\$23	\$25	\$25
Real property tax	\$24	\$23	\$21	\$20	\$19	\$18	\$17	\$16	\$22	\$27	\$31	\$29	\$28	\$26	\$25	\$23	\$22	\$21	\$21	\$22	\$23	\$25	\$25
Personal income taxes (from employees)	\$2.25	\$2.25	\$2.25	\$2.25	\$2.25	\$2.25	\$2.25	\$2.25	\$3.37	\$4.49	\$4.49	\$4.49	\$4.49	\$4.49	\$4.49	\$4.49	\$4.49	\$4.49	\$4.49	\$4.49	\$4.49	\$4.49	\$3.52
Total Revenues by Laboratories	\$2.49	\$2.47	\$2.46	\$2.45	\$2.44	\$2.42	\$2.41	\$2.40	\$2.46	\$3.63	\$4.80	\$4.79	\$4.77	\$4.75	\$4.74	\$4.72	\$4.71	\$4.70	\$4.88	\$4.86	\$4.84	\$4.82	\$3.77

In summary, the Science City project (the phases considered in this Study) will generate \$19 million in income for the government each year. Most of this income (\$16 million) is in the form of personal income taxes that the central government will get the biggest share of it. The municipal governments will receive revenues of \$1 million annually generated by these operations.

Government Revenues from Operations of Science City

Millions of dollars	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	Average
Room Tax (11% of room revenues)	\$36	\$72	\$75	\$77	\$79	\$81	\$84	\$86	\$88	\$91	\$94	\$96	\$99	\$102	\$105	\$108	\$111	\$114	\$118	\$121	\$125	\$128	\$95
Municipal Excise Tax	\$0.00	\$0.00	\$0.01	\$0.01	\$0.03	\$0.32	\$0.32	\$0.33	\$0.34	\$0.35	\$0.36	\$0.41	\$0.42	\$0.44	\$0.45	\$0.46	\$0.48	\$0.49	\$0.50	\$0.52	\$0.53	\$0.55	\$0.33
Property Taxes	\$26	\$31	\$36	\$40	\$44	\$57	\$59	\$57	\$61	\$68	\$75	\$76	\$72	\$69	\$73	\$69	\$66	\$63	\$80	\$80	\$76	\$72	\$61
Municipal Sales Tax		\$0.00		\$0.00	\$0.10	\$0.10	\$0.10	\$0.11	\$0.11	\$0.11	\$0.11	\$0.13	\$0.13	\$0.14	\$0.14	\$0.15	\$0.15	\$0.15	\$0.16	\$0.16	\$0.17	\$0.17	\$0.10
State Sales Tax (IVU)		\$0.01		\$0.01	\$0.01	\$0.36	\$0.37	\$0.38	\$0.39	\$0.40	\$0.42	\$0.48	\$0.49	\$0.50	\$0.52	\$0.53	\$0.55	\$0.57	\$0.58	\$0.60	\$0.62	\$0.63	\$0.38
Personal income taxes (from employees)	\$2.52	\$3.14	\$3.38	\$3.38	\$7.40	\$11.86	\$12.73	\$13.67	\$14.61	\$16.00	\$17.42	\$18.95	\$19.94	\$20.98	\$22.05	\$22.48	\$22.93	\$23.41	\$23.92	\$24.46	\$25.03	\$25.63	\$16.18
Corporate taxes	\$0.00	\$0.03	\$0.04	\$0.04	\$0.07	\$0.38	\$0.39	\$0.40	\$0.43	\$0.44	\$0.45	\$0.51	\$0.52	\$0.54	\$0.55	\$0.57	\$0.59	\$0.60	\$0.62	\$0.64	\$0.66	\$0.68	\$0.41
Total Government Revenues	\$3.15	\$4.22	\$4.53	\$4.61	\$8.74	\$14.39	\$15.35	\$16.32	\$17.37	\$18.90	\$20.45	\$22.20	\$23.23	\$24.30	\$25.49	\$25.96	\$26.47	\$27.00	\$27.76	\$28.39	\$29.01	\$29.67	\$18.98
Destination of fiscal revenues																							
State government - Fiscal revenues	\$2.89	\$3.90	\$4.16	\$4.20	\$8.27	\$13.42	\$14.33	\$15.31	\$16.31	\$17.76	\$19.22	\$20.90	\$21.95	\$23.04	\$24.17	\$24.66	\$25.18	\$25.72	\$26.30	\$26.91	\$27.55	\$28.22	\$17.93
Municipal government - Fiscal revenues	\$0.26	\$0.32	\$0.37	\$0.41	\$0.48	\$0.98	\$1.02	\$1.00	\$1.06	\$1.14	\$1.23	\$1.30	\$1.28	\$1.26	\$1.32	\$1.30	\$1.29	\$1.27	\$1.46	\$1.48	\$1.46	\$1.44	\$1.05

Methodological approaches and assumptions

The methodology and assumptions used for the construction phase is as follows:

- 1) compute the number of direct jobs generated during the construction phase by dividing the annual investment in dollar by a ratio of construction investment to jobs; this ratio was adjusted by the projected inflation in construction that in this case was 2.9%;
- 2) Compute the number of indirect and induced jobs by multiplying the number of direct jobs determined above by a Type II employment multiplier as published by the PR Planning Board, and projected into the present at 1.94.
- 3) compute the direct personal income by multiplying the number of direct jobs by a projected average salary per employee for each industry, projected into the future using a general level of inflation that, in this case was 3% annually
- 4) The indirect and induced income generated by each direct income dollar was estimated applying the Type II income multiplier of 2.14, projected also from the official multipliers.

Multipliers for the Construction Phase

Employment Coefficients (Jobs per million \$ in investment, 2006 dollars)	
Coefficient of direct employment	10.49
Coefficient of direct & indirect employment	16.09
Coefficient of direct, indirect & induced employment	20.29
Year of employment coefficient construction	2006
Income Multipliers for Construction	
Direct & indirect income multiplier (Type I)	1.73
Direct, indirect & induced income multiplier (Type II)	2.14
<hr/>	
Construction salary in the first year of construction	\$21,570

- 5) The fiscal revenues were computed by applying, to the amount invested in construction, the tax rates of the Municipality of San Juan, or the most current state rates applicable, as presented in the table below.

Assumptions on Tax Revenues

Average rate of corporate tax	15.0%
Tax Rates for Construction	
Construction permit cost (\$5.00 per \$1,000 construction invest.)	0.50%
Municipal construction patents (\$5.00 per \$1,000 construction invest.)	0.35%
Municipal Construction Excise Tax	3.50%
Profit margin before taxes	10.0%
% of construction expenditures paying sale tax (IVU)	65.0%

For the operational phase of Science City, the approach is parallel to the one followed in the construction phase:

- 1) The direct jobs generated by the operations are estimated by multiplying the total number of physical units in operation in a given year, by a ratio of employment per physical unit, depending on the type of use, as presented in the tables below.
- 2) The indirect and induced jobs are then calculated by multiplying the number of direct jobs each year by the corresponding (depending on the industry segment) type II employment multiplier, projected also from the Planning Board multipliers.
- 3) The personal incomes generated by the operations are assumed to consist entirely of salaries, disregarding the business profits. For this, the number of jobs in each year is multiplied by the projected average salary in each industry, using the general inflation as the growth rate.
- 4) The indirect and induced income is determined by applying the income multiplier to the direct income figure.
- 5) To estimate fiscal revenues from operations, it was necessary to project some rough estimate of operational revenues by type of use: room revenues for the hotel, rent revenues for the office and convention center, sales revenues for the

residential component. The school and the laboratories are assumed to be non-profit operations that will not generate taxes, except from the income taxes paid by employees.

- 6) Profit margins were estimated to generate corporate income taxes as well as the sales and use taxes (IVU), likely to be collected from the establishments in this operation.

The following table presents the exact parameters used in the estimation of the economic impacts of the operation.

Assumptions for Operation Phase

Average corporate tax rate	9.4%
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Assumptions on Housing

Employment Multipliers

Direct & Indirect (Type I)	1.22
Direct, Indirect & Induced (Type II)	2.20

Income Multipliers

Direct, indirect & induced	3.30
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Direct Employment in Operational Phase

Housing related employment (# of jobs per housing unit)	0.36
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Direct Salary in Operational Phase

Real Estate Operations	13,497
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Assumptions on the Real Estate Property Tax for Housing

Percent of houses considered as 1st homes	70%
Annual Increase in the Value of Housing	2.0%
Average Price per Housing Unit on Construction Year 1	296,241
Net income in housing operations (% of revenues)	10.0%
Exemption of Property Tax for the main residence unit (\$/year)	\$15,000

Assumptions on Retail

Employment Multipliers

Direct & Indirect (Type I)	2.20
Direct, Indirect & Induced (Type II)	1.80

Income Multipliers

Direct, indirect & induced	1.93
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Direct Employment in Operational Phase

Retail Sales (employment per million \$ of revenue)	13.91
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Direct Salary in Operational Phase

Retail	\$18,299
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Assumptions on Revenues and Income

Total annual sales per square foot (\$)	\$310
NIBT (net income before tax)	4.1%
Percent of sales paying sales and use tax (IVU)	80.0%

Hotel

Employment Multipliers

Direct & Indirect (Type I)	1.34
Direct, Indirect & Induced (Type II)	1.73

Income Multipliers

Direct, indirect & induced	2.07
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Direct Employment in Operational Phase

Hotel (employee per room)	1.19
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Direct Salary in Operational Phase

Hotel	\$27,143
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Assumptions on Revenues and Income

Average Room Rate	\$294
Average occupancy rate	75%
NIBT (net income before tax)	12.0%
Average corporate tax rate (90% exempt)	1.0%
Property tax exemption for hotels	90.0%
Growth in room rate	1.0%

Convention Center	
Employment Multipliers	
Direct & Indirect (Type I)	n/a
Direct, Indirect & Induced (Type II)	1.80
Income Multipliers	
Direct, indirect & induced	2.07
Direct Employment in Operational Phase	
Convention Center- jobs per 1000 sq ft	1.00
Direct Salary in Operational Phase	
Convention Center	\$27,143
Assumptions on Revenues and Income	
Gross Revenue per square foot	\$6.00
Salaries as % of Convention Center Revenues	45.00%
NIBT (net income before tax)	10.00%
Laboratories	
Employment Multipliers	
Direct, Indirect & Induced (Type II)	1.50
Income Multipliers	
Direct, indirect & induced	1.90
Direct Employment in Operational Phase	
Laboratory Jobs per 1,000 sq ft of construction space	3.5
Average Salary per Laboratory employee	\$35,935
Year of the average laboratory salary figure	2,005
Schools	
Employment Multipliers	
Direct & Indirect (Type I)	
Direct, Indirect & Induced (Type II)	1.50
Income Multipliers	
Direct, indirect & induced	1.90
Direct Employment in Operational Phase	
Jobs (academic and non-academic) per 1,000 sq ft	0.43
Average Salary per School employee	\$21,000
Year of the School Salary figure	2008

APPENDIX 2 – CONSTRUCTION COSTS

SCIENCE CITY URBAN INFRASTRUCTURE - PHASE II
 Application for US DOT TIGER VI Discretionary Grant Funds
 Sources and Uses of Project Funds
 Monday, April 28, 2014

Uses of Funds (Components, Locations and Characteristics)		Sources of Funds			Totals	
		Federal	Non-Federal Match			
#	Component	Tiger VI Grant Funds	PRSTRT	PRIFA	Total Funds	As %
1	Bid Process for Construction Project	\$ 15,000.00	\$ -	\$ 10,000.00	\$ 25,000.00	0.09%
2	Architects/Engineers Supervision during Construction	\$ 270,000.00	\$ 180,000.00	\$ -	\$ 450,000.00	1.61%
3	Construction Management and Grant Administration	\$ 240,000.00	\$ 70,000.00	\$ 90,000.00	\$ 400,000.00	1.43%
4	Inspection Services during Construction	\$ 648,000.00	\$ 432,000.00	\$ -	\$ 1,080,000.00	3.86%
5	Insurances	\$ 330,000.00	\$ 220,000.00	\$ -	\$ 550,000.00	1.96%
6	Project's Construction Cost	\$ 13,275,000.00	\$ 8,850,000.00	\$ -	\$ 22,125,000.00	79.02%
7	Contingency	\$ 2,022,000.00	\$ 1,348,000.00	\$ -	\$ 3,370,000.00	12.04%
Total		\$ 16,800,000.00	\$ 11,100,000.00	\$ 100,000.00	\$ 28,000,000.00	100.00%
As %		60.00%	39.64%	0.36%	100.00%	
			\$ 11,200,000.00			
			Non Federal Match		40.00%	

**SCIENCE CITY - URBAN INFRASTRUCTURE PHASE II
PROJECT DETAILED COST
April-14**

ITEM #	DESCRIPTION	Quantity	Unit	Unit Price	Total Amount
1	<u>BID PROCESS</u>				
1.1	Bid Procurement Specialist (AFI In-Kind)	200	Hrs	\$ 25.00	\$ 5,000.00
1.2	Bid Procurement Specialist (AFI In-Kind)	200	Hrs	\$ 25.00	\$ 5,000.00
1.3	Bid Evaluation Committee	80	Hrs	\$ 35.00	\$ 2,800.00
1.4	Bid Evaluation Committee	80	Hrs	\$ 35.00	\$ 2,800.00
1.5	Bid Evaluation Committee	80	Hrs	\$ 35.00	\$ 2,800.00
1.6	Bid Document Preparation	1	Ls	\$ 5,000.00	\$ 5,000.00
1.7	Bid Process Final Notification	64	Hrs	\$ 25.00	\$ 1,600.00
	Total Bid Process				\$ 25,000.00
2	<u>A&E SUPERVISION</u>				
2.1	A&E Firm Supervision	36	Month	\$ 12,500.00	\$ 450,000.00
	Total A&E Supervision				\$ 450,000.00
3	<u>CONSTRUCTION MANAGEMENT & GRANT ADMINISTRATION</u>				
3.1	AFI Management (In-Kind)	36	Month	\$ 2,500.00	\$ 90,000.00
3.2	Construction Management Firm	40	Month	\$ 7,750.00	\$ 310,000.00
	Total CM & Grant Adm.				\$ 400,000.00
4	<u>INSPECTION</u>				
4.1	Inspection Firm	36	Month	\$ 30,000.00	\$ 1,080,000.00
	Total Inspection				\$ 1,080,000.00
5	<u>INSURANCE</u>				
5.1	OCIP Insurance	1	Ls	\$550,000.00	\$ 550,000.00
	Total Insurance				\$ 550,000.00

**SCIENCE CITY - URBAN INFRASTRUCTURE PHASE II
PROJECT DETAILED COST
Apr-14**

ITEM	DESCRIPTION	Quantity	Unit	Unit Price	Total Amount
6	<u>CONSTRUCTION COST</u>				
I	<u>Earthwork</u>				
1	Clearing and Grubbing	15	Cdas	4,000	\$ 60,000
2	Unclassified Excavation	28,059	CuM	12.00	\$ 336,708
3	Removal of Unsuitable Material	20,000	CuM	22.00	\$ 440,000
4	Borrow Class "A"	50,490	CuM	18.00	\$ 908,820
	Total Earthwork				\$ 1,745,528
II	<u>Soil Erosion and Water Pollution Control</u>				
5	Construction Entrance / Exit	2	Each	3,500	\$ 7,000
6	Straw Bales	790	Each	15	\$ 11,850
7	Silt Fence	300	LnM	12	\$ 3,600
	Total Soil Erosion and Water Pollution Control				\$ 22,450
III	<u>Roadway</u>				
8	Mobilization(2%)	1	Ls	439,600	\$ 439,600
9	Sub-base Course	9,151	CuM	18	\$ 164,718
10	Aggregate Base Course	2,290	CuM	31	\$ 70,990
11	Lean Concrete Base (0.40m)	150	SqM	65	\$ 9,750
12	Portland Cement Concrete Sidewalk	6,940	SqM	35	\$ 242,900
13	Concrete Curb, Type "D"	9,112	LnM	51	\$ 464,712
14	Concrete Curb, Type "F"	925	LnM	65	\$ 60,125
15	Seeding (With Mulch)	60	Units	80	\$ 4,800
16	Construction Signs	60	SqM	190	\$ 11,400
17	Drums	250	Each	90	\$ 22,500
18	Temporary Pavement Marking	250	LnM	3	\$ 625
19	Temporary Concrete Barrier	210	LnM	85	\$ 17,850
20	Furnishing & Placing Loamy Topsoil	600	CuM	9	\$ 5,400
21	Right of Way Marker	45	Each	100	\$ 4,500
22	Chain Link Fence, Type "A"	220	LnM	90	\$ 19,800
23	Temporary Chain Link Fence	160	LnM	75	\$ 12,000
24	Jute Mesh	250	SqM	4	\$ 1,000
25	Type "C" CPW	42	SqM	40	\$ 1,680
26	Bed Course Material	7	CuM	40	\$ 280
27	Project ID Signs	6	Each	3,000	\$ 18,000
28	Field Office & Laboratory	25	Mths	5,300	\$ 132,500
	Total Roadway				\$ 1,705,130

IV	<u>Asphalt Pavements</u>				
29	Hot Plant-Mix Bituminous Pavement mix S-1	1,952	Tons	120	\$ 234,240
30	Hot Plant-Mix Bituminous Pavement mix B-1	5,856	Tons	120	\$ 702,720
31	Hot Plant-Mix Bituminous Pavement mix L-2	142	Tons	115	\$ 16,330
32	Cold Milling of Bituminous Concrete Pavement	2,205	CuM	130	\$ 286,650
	Total Asphalt Pavements				\$ 1,239,940
V	<u>Drainage System</u>				
33	Type "A" Manhole	8	Each	7,500	\$ 60,000
34	Type "4" Inlet	67	Each	3,100	\$ 207,700
35	Type "4A" Inlet	43	Each	4,500	\$ 193,500
36	Type "2" Inlet	1	Each	2,520	\$ 2,520
37	Type "1" Modified Inlet	44	Each	3,000	\$ 132,000
38	18 inch Reinforced Concrete Pipe, Class III	1,140	LnM	100	\$ 114,000
39	24 inch Reinforced Concrete Pipe, Class III	325	LnM	165	\$ 53,625
40	30 inch Reinforced Concrete Pipe, Class III	130	LnM	230	\$ 29,900
41	Trench Excavation, Unclassified	5,274	CuM	18	\$ 94,932
42	Type "B" Headwall	4	Each	1,125	\$ 4,500
43	Existing Inlets to be Removed	36	Each	1,000	\$ 36,000
44	Conversion of Inlets/Manholes	2	Each	2,300	\$ 4,600
	Total Drainage System				\$ 933,277
VI	<u>Traffic Signing & Pavement Marking</u>				
45	Thermoplastic Pavement Marking - White	8,592	LnM	4.25	\$ 36,516
46	Thermoplastic Pavement Marking - Yellow	2,592	LnM	4.25	\$ 11,016
47	Thermoplastic Pavement Marking - Symbols & Letters	24	Each	90.00	\$ 2,160
48	Painting Concrete Curb	538	LnM	15	\$ 8,070
49	Reflective Raised Pavement Markers	418	Each	4.00	\$ 1,672
50	Traffic Sign Assembly Codes	56	Each	750	\$ 42,000
	Total Traffic Signing & Pavement Marking				\$ 101,434
VII	<u>Traffic Signal System</u>				
51	Master/Local Traffic Signal Controller Assembly	2	Each	12000.00	\$ 24,000
52	Standard Traffic Signal Head Type 3-S-V Mast Arm Mounted With LED Configuration	14	Each	860.00	\$ 12,040
53	Standard Traffic Signal Head Type 3-L-V Mast Arm Mounted With LED Configuration	2	Each	785	\$ 1,570
54	Standard Traffic Signal Head Type 3-R-V Mast Arm Mounted With LED Configuration	1	Each	900	\$ 900
55	Pedestrian Push Button Detector	12	Each	655	\$ 7,860
56	Pedestrian Signal Head Type P-18-16 Countdown LED Configuration	12	Each	1,030	\$ 12,360

57	Video Detection System Program, Software & Hardware	1	Each	12,000	\$	12,000
58	Pedestrian Signal Post 8 feet	3	Each	1,380	\$	4,140
59	Traffic Signal Support - Single Mast Arm Type 20', Steel Galvanized	4	Each	6,280	\$	25,120
60	Traffic Signal Support - Single Mast Arm Type 30', Steel Galvanized	1	Each	7,020	\$	7,020
61	Traffic Signal Support - Single Mast Arm Type 40', Steel Galvanized	2	Each	7,685	\$	15,370
62	PVC Conduit 4" Diameter	1,090	LnM	35	\$	38,150
63	PVC Conduit 2" Diameter	720	LnM	30	\$	21,600
64	Concrete Pull Box 30" x 30"	16	Each	915	\$	14,640
65	Electrical Conductor No. 14 RHH AWG. 3c Stranded For Push Buttons	460	LnM	5	\$	2,300
66	Electrical Conductor No. 14 RHH AWG. 4c For Pedestrian Signal Heads Type P-18-16	480	LnM	5	\$	2,400
67	Electrical Conductor No. 14 RHH AWG. 5c For Traffic Signals	930	LnM	5	\$	4,650
68	Wireless Video Detection & Communication System	1	Ls	8,760	\$	8,760
69	Maintenance of Existing Traffic Signal System	1	Ls	25,000	\$	25,000
70	Video Detection Camera	7	Each	3,000	\$	21,000
71	Cammera Support Pole For Mounting Brackets	7	Each	500	\$	3,500
72	Video image Processor	7	Each	250	\$	1,750
73	Surge Suppressor For video detection Cameras	7	Each	300	\$	2,100
74	Coaxial and Power Cable	410	LnM	5	\$	2,050
75	Fiber Optic Cable Single Mode 24 Strands	280	LnM	10	\$	2,800
76	Multi-Guard Type PVL Conduit for Fiber Optic Cable 24 Strands	300	LnM	12	\$	3,600
77	Inverter/Charger/Controller	2	Each	1,200	\$	2,400
78	Battery	17	Each	350	\$	5,950
79	Transfer Relay	2	Each	500	\$	1,000
80	Manual By Pass Switch	2	Each	750	\$	1,500
81	TSBBS Cabinet	2	LnM	1,250	\$	2,500
	Total Traffic Signal System				\$	290,030
VIII	<u>PRASA Utilities - Water</u>					
82	Fire Hydrant (PR Type)	9	Each	800	\$	7,200
83	6" Gate Valve	20	Each	550	\$	11,000
84	8" Gate Valve	1	Each	900	\$	900
85	10" Gate Valve	5	Each	1,000	\$	5,000
86	12" Gate Valve	4	Each	1,100	\$	4,400
87	6" Dia. D.I.P. Class 350	208	LnM	75	\$	15,600
88	8" Dia. D.I.P. Class 350	517	LnM	100	\$	51,700
89	10" Dia. D.I.P. Class 350	552	LnM	120	\$	66,240
90	12" Dia. D.I.P. Class 350	250	LnM	150	\$	37,500
91	Trench Excavation (For PRASA), Unclassified	3,210	CuM	18	\$	57,780
	Total PRASA Utilities - Water				\$	257,320

IX	<u>PRASA Utilities - Sanitary Sewer</u>				
92	PRASA Manhole Type "A"	23	Each	2,250	\$ 51,750
93	8" Dia. PVC SDR-35 Pipe	1,062	LnM	60	\$ 63,720
94	Trench Excavation (For PRASA), Unclassified	2,336	CuM	18	\$ 42,048
	Total PRASA Utilities - Sanitary Sewer				\$ 157,518
X	<u>PREPA Utilities</u>				
95	PREPA Utilities	1	LS	2,200,000	\$ 2,200,000
	Total PREPA Utilities				\$ 2,200,000
XI	<u>Lighting System</u>				
96	Type-N2 40', Aluminum Pole, Non-breakaway with 4'-0" Bracket and 200w, 240 Typelll Cutoff Luminaire	10	Each	3,040	\$ 30,400
97	Junction Box Per PRHA Standards Dwg LS-6 (Type F, 30" x 18" x 24")	282	Each	150	\$ 42,300
98	Conductor Cable #2 AWG Copper Stranded XLP, 90° C	57,774	LnM	5	\$ 288,870
99	Conductor Cable #6 AWG Copper Stranded XLP, 90° C	6,418	LnM	3	\$ 19,254
100	2" DB-120 PVC Conduit Concrete Encased	3,525	LnM	35	\$ 123,375
101	2" DB-120 PVC Conduit Sand Encased	17,044	LnM	18	\$ 306,792
102	1-1/4" PVC Coated RGC	972	LnM	50	\$ 48,600
103	New 37.5 kva Substation	3	LnM	8,250	\$ 24,750
104	Novara SAL 150w 20ft High Pole with 4ft Double Arm	3	Each	10,250	\$ 30,750
105	Single Arm at Roadway Side & a 150w 15ft High Short Arm at Pedestrian	248	Each	8,250	\$ 2,046,000
106	Novara 150w at Bridge BR-3	24	Each	8,250	\$ 198,000
107	58w Leccor Light Fixture in Combination with Novara SAL Arm Bridge Mounted	24	Each	2,250	\$ 54,000
	Total Lighting System				\$ 3,213,091
XII	<u>Telecommunication Utilities</u>				
108	Telephone Manholes (4'x4.5'x7')	16	Each	2,600	\$ 41,600
109	4" SCH-40 PVC Conduit Concrete Encased (Tel.)	17,280	LnM	30	\$ 518,400
110	CTV Handholes (30"x48")	18	Each	565	\$ 10,170
111	2" SCH-40 PVC Conduit Concrete Encased (CATV)	4,860	LnM	35	\$ 170,100
	Total Telecommunication Utilities				\$ 740,270

XIII	<u>Retaining Wall - RW5</u>				
112	Class III (Gen. Use)	192	CuM	450	\$ 86,400
113	Reinforcing Steel (GR 60)	36,438	Lbs	1.25	\$ 45,547
114	Drainage Geocomposite	162	SqM	25	\$ 4,050
115	Unclassified Excavation for Structures	1,014	CuM	11	\$ 11,154
116	Foundation Fill	152	CuM	20	\$ 3,040
117	6" dia. Perforated Pipe Underdrain	73	LnM	30	\$ 2,190
118	Sheating	13	CuM	45	\$ 585
119	Select Borrow Embankment	443	CuM	20	\$ 8,860
	Total Retaining Wall - RW5				\$ 161,826
XIV	<u>Bridge BR-3</u>				
120	Class V (Bridge Deck)	542	CuM	750	\$ 406,500
121	Class IV (Gen Use)	223	CuM	600	\$ 133,800
122	Class V (Gen Use)	1,873	CuM	600	\$ 1,123,800
123	Structural Steel (GR 50 & 70)	1,076,172	Lbs	1.25	\$ 1,345,215
124	Reinforcing Steel (GR 60)	730,616	Lbs	1.25	\$ 913,270
125	Unclassified Excavation for Structures	3,476	CuM	11	\$ 38,236
126	Foundation Fill	334	CuM	20	\$ 6,680
127	Sheating	23	CuM	45	\$ 1,035
128	Traffic Railing	138	LnM	150	\$ 20,700
129	Safety Fence (Jakob Webnet)	180	LnM	2,000	\$ 360,000
130	Pedestrian Railing	180	LnM	115	\$ 20,700
131	Name Plate	1	Each	1,000	\$ 1,000
132	Bridge Approach Embankment Material	3,000	CuM	14	\$ 42,000
133	Drainage Geocomposite	688	SqM	25	\$ 17,200
134	6" dia. Perforated Pipe Underdrain	130	LnM	30	\$ 3,900
	Total Bridge BR-3				\$ 4,434,036
XV	<u>Urban Element & Landscaping</u>				
A	<u>Precast Planks</u>				
135	Concrete Footing & Anchor Plates	2,400	CuM	650.00	\$ 1,560,000
136	Precast Planks	900	CuM	650.00	\$ 585,000
	Partial Total Precast Planks				\$ 2,145,000
B	<u>Streetscape Elements</u>				
137	Bus Shelter	3	Ea.	16,000.00	\$ 48,000
138	Bike Racks	255	Ea.	400.00	\$ 102,000
139	Carstop	44	Ea.	300.00	\$ 13,200
140	Bollard	167	Ea.	650.00	\$ 108,550
141	Trash Receptacle	15	Ea.	950.00	\$ 14,250
142	Bench	54	Ea.	1,200.00	\$ 64,800
143	Entrance Graphics	2	Ea.	3,000.00	\$ 6,000
144	Tactile Tiles	240	LnM	250.00	\$ 60,000
	Partial Total Streetscape Elements				\$ 416,800

C	<u>Hardsurfaces</u>				
145	Porous Concrete	800	CuYd	650.00	\$ 520,000
146	Porous Concrete - Metal Joint	680	LnM	130.00	\$ 88,400
147	Exposed Agregate Paver	73	Ea.	200.00	\$ 14,600
148	Exposed Agregate Curb	2,400	LnM	50.00	\$ 120,000
	Partial Total Hardsurfaces				\$ 743,000
D	<u>Landscape & Planting</u>				
149	Structural Soil	8,170	CuYd	75.00	\$ 612,750
150	<i>Samanea saman</i>	56	Ea.	850.00	\$ 47,600
151	<i>Pterocarpus indicus</i>	9	Ea.	550.00	\$ 4,950
152	General Trees	75	Ea.	550.00	\$ 41,250
153	Shrubs	245	Ea.	400.00	\$ 98,000
154	<i>Royal Palms</i>	120	Ea.	600.00	\$ 72,000
155	Corozo Palms	135	Ea.	550.00	\$ 74,250
156	Small Palms	276	Ea.	450.00	\$ 124,200
157	General Palms	60	Ea.	450.00	\$ 27,000
158	<i>Agave lurida</i>	392	Ea.	45.00	\$ 17,640
159	<i>Agave desmettiana</i>	728	Ea.	45.00	\$ 32,760
160	<i>Ficus pumila</i>	160	Ea	20.00	\$ 3,200
161	Plant Scuppers at RW10	44	Ea	2,000.00	\$ 88,000
162	Crushed Stone Mulch	635	Cu Y	450.00	\$ 285,750
163	Top Soil	3,560	Cu Y	25.00	\$ 89,000
	Partial Total Landscape				\$ 1,618,350
	Total Urban Element & Landscaping				\$ 4,923,150
GRAND - TOTAL CONSTRUCTION					\$ 22,125,000
7	<u>CONTINGENCY</u>				
7.1	Contruction Contingency (10%)	1	Ls	\$ 2,212,500	\$ 2,212,500
7.2	Other Contingencies (4.13%)	1	Ls	\$ 1,157,500	\$ 1,157,500
	Total Contingency				\$3,370,000

APPENDIX 3 – THE PHARMACEUTICAL INDUSTRY

The Biopharmaceutical industry has been the leading industrial sector in Puerto Rico's economic development since the mid-seventies. It has generated close to 25% of the Island's GDP in the last four decades and continues to be the main generator of exports, responsible for over two thirds of total manufacturing exports which, in turn, represent close to 98% of total exports. It generates some 90,000 direct and indirect jobs in the Island, 15% of total private sector jobs. The contributions of the research based biopharmaceutical industry go beyond employment and incomes generated. It has had a key role in Puerto Rico's efforts to move to a knowledge based economy.

Recent global trends have made it necessary for the industry to introduce changes in its product pipeline, its R & D activities and in its make-up in terms of the size and nature of its component firms. For jurisdictions such as Puerto Rico, where Bio-Pharma represents a major component of the economy, this has meant refocusing its efforts with respect to the industry, moving from traditional manufacturing to research based manufacturing and strengthening its R & D infrastructure in order to provide an attractive location for research based activity in the Bio-Pharma industry.

The Science City project is a key component of such an infrastructure and will provide much needed support through its research laboratories and linkages to the universities and medical facilities, in maintaining Puerto Rico as a hub of bio-science activity and strengthening Puerto Rico's attraction as a location for the industry, in particular for smaller, second tier, research oriented bio-pharma firms. Typically these need to be located near research facilities since, contrary to the larger established firms with in-house research capabilities, they require proximity to research facilities and universities, where basic scientific research is undertaken. This is also true for start-ups in the sector, another area in which Puerto Rico has focused its economic development efforts. In short, Puerto Rico's promotional efforts are moving away from the traditional manufacturing operations in the pharmaceutical industry to research based activities in bio-sciences where research is a key component. The molecular science building, already in place, and the cancer center, under construction, are both part of this effort.

The TIGER grant is being requested for the construction of two roads within the proposed Science City project and a bridge linking the core of the Science City property to the Cancer Center. Their construction will accelerate the completion of the overall project. In a no-build scenario, the project would be postponed for a number of years. Although the delay would appear to generate minor consequences, in an aggressively competitive environment, where jurisdictions throughout the world are competing for research based activities, it could mean the permanent loss of activity in bio-sciences in Puerto Rico. Should this happen, the U.S. could experience a loss of competitiveness by seeing basic science research capacity in the bio-pharma sector migrate to non U.S. locations.

APPENDIX 4 – ESTUDIOS TÉCNICOS EXPERIENCE

Estudios Técnicos, Inc. (ETI)

The firm was established in 1985 and has since completed a substantial number of major projects. It has a multidisciplinary staff of some 30 professionals. Specifically related to Benefit-Cost Analyses, the firm has completed a number of projects that required BCA related to flood mitigation, new road construction and other projects related to improvement of urban sectors. All had to be approved by federal agencies such as the Army Corps of Engineers, The Federal Transportation Administration and EPA. In 2011 it was responsible for preparing the TIGER funds proposal for the Municipality of Guaynabo, Puerto Rico that received funding. The firm has also done extensive work for EDA on energy and on the Comprehensive Economic Development Strategy (CEDS) for Puerto Rico.

ETI completed the State Housing Plan for HUD and the local Housing Department in 2011 and has been working on its update. It has completed projects for the Science, Technology and Research Trust on Cloud Computing and on the economic viability and impact of the Science City project. For the Department of Natural Resources and Environment (DNRE) it completed the Coastal Zone Management Plan and for a NOAA/DNRE program completed an assessment of the economic value of coral reefs in Eastern Puerto Rico, a path breaking study. With EPA financing, it completed a study on Smart Growth for the Metropolitan University School of Environmental Affairs.

Over the years the firm has worked extensively in transportation issues both at the municipal and island wide level. This includes working on the long range plan for Puerto Rico 2010 – 2035, the feasibility and ridership of the San Juan / Caguas train, the Private Public Partnership for the Luis Muñoz Marín International Airport, the economic feasibility of highway PR-22 extension and many other transportation related projects. For more information regarding our experience and staff please visit our website at: <http://www.estudiostecnicos.com/>