
Skills Gap Analysis & Cost of Building Materials in Puerto Rico's Construction Industry

EDA Economic Recovery Support Function 2021 Interagency Reimbursable Work Agreement

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Introduction

At the request of FEMA leadership at the Puerto Rico Disaster Recovery, the Economic Recovery Support Function working under Agreement HSFEHQ-20-IRWA-0093 was asked to work on a study for the purpose of conducting a skills gap analysis of the construction industry workforce in Puerto Rico and an analysis of the costs of building materials. A workforce skills gaps analysis is a tool that can help identify the shortcomings and limitations of the skills a specific labor force may have. It also serves as blueprint for the development of a workforce training program that fills those identified gaps and meets the needs and expectations of a company or industry as it moves forward.

While conducting the research for this report it became apparent that while a skills gap analysis is important in determining whether the local construction industry has a labor force with capable skillsets to meet the Island's reconstruction needs, a more present need could be having readily available workers when the funding for reconstruction projects starts arriving. At the beginning of the 21st century Puerto Rico's construction industry had a workforce that by some industry accounts almost reached 100,000 employees. (www.constructorespr.com, 2021) According to some recent reports this sector now has less than 28,000 workers.

The second component of this report, identifying the costs of building materials was not easy to pinpoint. This data was traditionally collected by entities such as the Puerto Rico Planning Board and the Puerto Rico Department of Consumers Affairs (DACO); however, during meetings with these agencies I was informed that this information has not been collected in recent years. I was notified that the private sector is now collecting these statistics and was able to obtain the most up to date costs associated to local sourcing of building materials. Some interviewees mentioned

that the “basket of construction materials” appears to be facing inflationary pressure from several internal and external factors that will be discussed in this report.

I encounter a few obstacles in producing this report which made it difficult to conduct a skills gap analysis of the construction’s industry workforce. First, the major trade associations representing the construction industry did not respond in time to add their input into this report. Second, those companies I contacted mentioned that the primary obstacle was not related to training needs or skills, but to a lack of workers. One company stated that even though they pay \$15 per hour or more (depending on occupation), they were operating with only 55% of the needed workforce. Another company stated that they were planning to shut operations because they could not find workers. A third problem I encounter was lack of reliable data. One government agency reports construction industry employment at almost twice the employment levels reported by the U.S. Bureau of Labor Statistics (BLS) or what the industry claims. For purposes of this report, I used BLS data, and the numbers reported by construction industry representatives.

As a follow up to this report, I would conduct interviews with companies in the industry: general contractor, subcontractors, engineering and architectural firms, developers and importers of construction materials. Primary sources could be very beneficial in further understanding the state of Puerto Rico’s construction industry.

Present Situation and Historical Information

In the next few years Puerto Rico will see one of the largest influxes of federal funds and transfers as a result of a number of programs related to the reconstruction of the island post Hurricanes Irma-Maria, CDBR-DR assignments (including city revitalization) and Congressional and COVID19 specific stimulus packages. Congress has recently passed a few economic stimulus packages including the 2021 American Rescue Plan Act, the CARES Act and the Coronavirus Relief & Response Supplemental Appropriation Act (CRRSA) which according to a local business journal could see approximately \$44.7 billion impacting the local economy:

Program	Amount
2021 American Rescue Plan Act	\$20,000,000,000
Cares Act	\$17,500,000,000
CRRSA	\$7,000,000,000

Source: (www.sincomillas.com , 2021)

The above mentioned \$44.7 billion does not include the FEMA’s Public Assistance Program funding, CDBG-DR funds and other federal agencies funds. In addition, the Biden Administration proposed \$2 trillion Infrastructure Plan will add to the pipeline of federal funds which will be arriving to help rebuild and upgrade the Island’s infrastructure and economic recovery. It could

be assumed that a good portion of the funding will be used for the reconstruction of Puerto Rico and it will require a substantial number of workers in the construction industry.

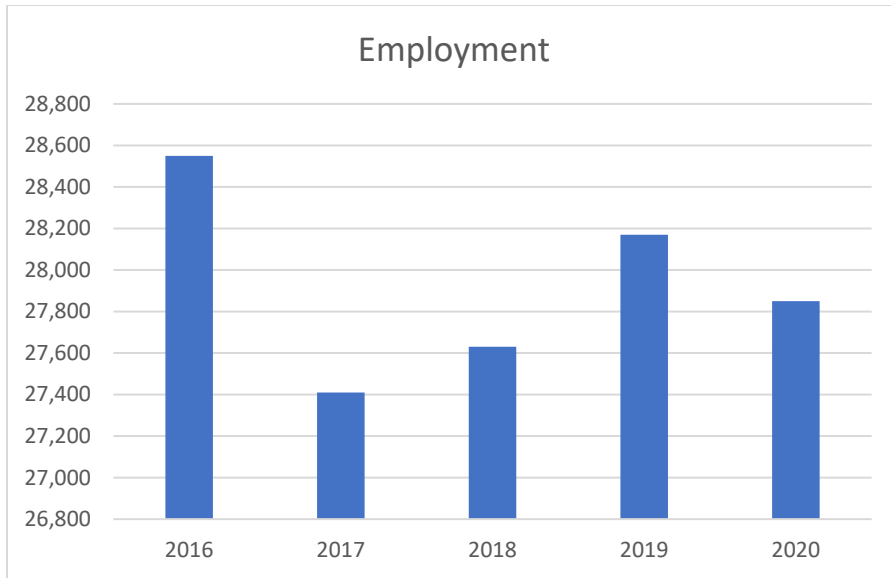
At present, the construction industry is not equipped to handle what could soon be a major construction boom. According to the Puerto Rico Builders Association, a local trade association representing the Island's construction industry, the local construction industry has been in a recession since 2006. Employment in construction went from approximately 100,000 workers in the early 2000s to 27,850 by 2020. (www.bls.gov,2021) The construction industry considers the shortage of workers a key impediment to their future growth and an obstacle to Puerto Rico's reconstruction.

Current State of the Construction Industry Workforce

As previously stated, in recent years employment in the construction industry has been at historical lows. Impacted by a series of events such as the local recession that started in the early 2000s, followed by the Great Recession of 2007 – 2010 which has had long term effects on the local housing market. The industry saw a little reprieve in 2011-13 due to the American Recovery & Reinvestment Act, but hurricanes Irma and Maria in 2017 followed by the earthquakes in southern Puerto Rico plus the recent COVID19 Pandemic exerted a big toll on the construction industry's workforce as projects came to a halt and many local workers moved to the states where the construction industry was benefiting from an economic boom and a shortage of workers. The construction industry is today one of the fastest growing industries in the U.S.

Such was the impact of these events that the *U.S. HUD's 2019 Comprehensive Housing Market Analysis for Puerto Rico*, informed that for 2019 mortgage originations totaled 13,700. That is approximately 85% less than the peak year of 2005 when mortgage originations reached 92,700. (www.Huduser.gov ,2019) In a report to Puerto Rico's Department of Economic Development and Commerce (PRDDEC), a local consulting firm estimated that construction investment as part of the GNP had gone from 14.8% in 2000 to 4.6% by 2015. (Estudios Tecnicos, p.19, 2016) Both publications identify the downfall of the housing market, one of the top sectors in the construction industry and a major employer, as a key reason for the collapse of the construction industry.

As the graph below demonstrates, for the past five years employment in the construction sector has remained low.



Source: U.S. Bureau of Labor Statistics

Job losses in Puerto Rico were a reflection of what was occurring in the states where construction jobs went from 7.7 million in 2006 to 5.4 million by 2011. Many of those who loss their jobs in the construction industry during the Great Recession ended up taking jobs in other industries and did not come back after the resurgence of the construction industry. (Rohner, 2016)

To better understand the present state of the Island’s construction industry’s labor force and its impact on available skilled workers, I have included local employment data based on a sample of key occupations within the sector. The United States Bureau of Labor Statistics (BLS) data below shows the number of employed construction workers by occupation in Puerto Rico for 2020.

**Selected Job Occupations in Puerto Rico’s Construction Industry (2020)
(U.S. Standard Occupational Classification Numbers)**

SOC Number	Occupation Title	Employment	LQ	P.R. Mean Hr. Wages	PR Mean Annual Salary	CONUS Mean Hr. Wages	CONUS Mean Annual Salary
47-0000	Construction & Extraction Occupations	27,850	0.8	\$10.74	\$22,340	\$25.93	\$53,940
47-2021	Brick & Block masons	130	0.36	\$15.78	\$32,970	\$28.69	\$58,420
47-2031	Carpenters	2,070	0.5	\$10.04	\$20,860	\$26.06	\$54,200
47-3012	Carpenter Helper	900	4.94	\$8.61	\$17,910	\$17.00	\$35,360
47-2051	Cement Mason &	650	0.56	\$9.74	\$20,250	\$23.74	\$49,390

	Concrete Finishers						
47-2061	Construction Laborers	7,030	1.23	\$9.20	\$19,130	\$20.67	\$43,000
47-2073	Construction Equipment Operator	1,460	0.61	\$10.42	\$21,670	\$26.58	\$55,280
47-2081	Drywall & Ceiling Tile Installer	240	0.41	\$9.35	\$19,260	\$24.97	\$51,930
47-2111	Electricians	1,580	0.41	\$13.49	\$28,050	\$29.59	\$61,550
47-3013	Electricians Helpers	1,380	3.17	\$9.93	\$20,650	\$17.04	\$35,440
47-2141	Painters, Construction Maintenance	580	0.45	\$10.52	\$21,890	\$22.33	\$46,460
47-2152	Plumbers, Pipefitters	740	0.3	\$10.70	\$22,260	\$29.37	\$61,100
47-3015	Plumbers, Pipefitters Helpers	290	0.89	\$12.35	\$25,690	\$16.82	\$34,990
47-2171	Reinforcing Iron & Rebar Workers	60	0.53	\$9.89	\$20,580	\$26.30	\$54,700
47-2211	Sheetmetal Workers	290	0.38	\$10.74	\$22,350	\$26.60	\$55,320
47-2221	Structural Iron & Steel Workers	290	0.69	\$11.56	\$24,040	\$28.20	\$58,650
47-2181	Roofers	540	0.71	\$13.07	\$27,180	\$22.60	\$45,010
47-4051	Highway Maintenance Workers	3,290	3.73	\$8.76	\$18,220	\$20.77	\$43,200
47-4021	Elevators & Escalator Installers, Repairs	140 (a)	0.84(a)	\$11.41	\$23,760	\$41.44	\$86,200

Source: U.S. BLS (2021)

A few things can be observed from the chart above:

- Local employment in some occupations are very low
- Location Quotient for many occupations within this chart are below 1, which means a low concentration for these occupations in comparison to concentration Nationwide

- Wage differentials between Puerto Rico and the Continental U.S. are considerable. This could have a significant impact on efforts to retain skilled construction workers in Puerto Rico when the cost of a plane ticket could be the difference for a carpenter between making \$21,000 versus \$54,000 a year. Continental U.S. construction industry is also facing a labor shortage, which means that they are willing to pay higher wages.
- Hard to entice back workers who left Puerto Rico with a proposed \$15 pr/hr. minimum wage when mean hourly wages in CONUS are much higher than the proposed minimum wage. Foreign workers (H1B visas) could be a possible short-term solution.

The following chart compares the construction industry 2020 occupational employment data from the BLS with the Rand Corporation’s 2019 study estimating the employees needed by selected occupations for Puerto Rico’s recovery:

Occupation	Rand Study Numbers	BLS 2020 Employment Data
Construction laborer	6,060	7,030
Carpenters	4,200	2,070 *
Electricians	3,400	1,580 *
Plumbers, pipefitters	2,500	740 *
Construction Equip. Operators	1,700	1,466
Painters	1,300	580
Cement masons & Concrete	1,200	650

Source: BLS (2021), HSOAC/Rand Corporation (2019)

The previous chart does not include employment numbers for carpenter helpers (900), electrician helpers (1,380) nor plumber helpers (290). Even with recent signs of a recovery in the construction industry, BLS occupational employment data demonstrates that the local industry could still be short of the projected needs for reconstruction. (Wenger, Dworsky, p.22, 2019)

Efforts to Address Skills Gaps & Workforce Training Initiatives

One of the major concerns expressed by construction industry representatives in the local media is the shortage of skilled workers needed to meet the market demands (Fajardo & Garofalo, 2021). They have asked the state government and general assembly to develop a plan of action to address this labor shortage. One of those trade associations demanding action from the government is the Puerto Rico Construction & Infrastructure Cluster (PRCIC). Among the concerns brought up by PRCIC is the disruption created by the Pandemic Unemployment Assistance program (PUA). Under the recent PUA benefits unemployed individuals receive an additional \$300 on top of the weekly unemployment check. According to construction industry trade associations these federal aids are discouraging individuals from returning to work. (www.efe.com, 2021)

The industry is asking the government to reform the aid packages in a way that recipients are not penalized by losing the aid packages just because they have decided to go back to work. A second request is for local government to work with industry to develop a workforce training program that addresses the desired skills and needs of the construction industry. (Fajardo & Garofalo, 2021)

Industry efforts to make sure that the local construction industry can be ready, or at the very least start the process of building up to better respond to the demand for skilled workers through workforce training initiatives have been infrequent. A few initiatives have been implemented by the industry and organizations representing construction industry workers. However, some of these initiatives have been short lived and may require a more concerted effort by both industry, government and academic institutions in order to address the labor shortage and gaps in industry specific skills.

According to industry representatives recently interviewed these are the occupations in highest demand (Fajardo & Garofalo, 2021):

- Carpenters
- Rod settlers/installers (varilleros in Spanish)
- Bricklayers
- Heavy equipment operators

Workforce Training Initiatives

To attract new workers and meet the demand for those needed skills, organizations such as P.R. Builders Association, P.R. General Contractors Association, PRCIC and LiUNA have implemented some programs to address the situation. The following is a brief description of these endeavors.

The Construction Industry Training & Laboratory Center

The Puerto Rico Construction & Infrastructure Cluster started this program as a response to a need for trained construction laborers. Characteristics of the program are:

- A free certification program to train applicants in those skills in high demand
- Short-term courses and workshops given by construction industry experts in fields such as carpentry, masonry, heavy equipment operation, plumbing
- Trainers will come from local construction companies
- PRCIC will work with local contractors and subcontractors to place trainees in jobs within the industry (www.prcic.org , 2021)

The goal of this initiative is to work in conjunction with companies to determine which are the training needs and skills in high demand. I spoke to Wilson Nazario of PRCIC about the Center, but it seems that they are still working on enrolling candidates for the workshop. Mr. Nazario will contact me with a date for a conference call.

P.R. Department of Education's Occupational and Technical Education Secretariat

This was a government – industry effort coordinated in 2019 between the P.R. Department of Education, the PR Builders Association and the PR General Contractors Association to train high school students in basic construction trades, based on the National Center for Construction Education and Research's (NCCER) *Construction Craft Laborer* basic course. This course trained over 800 local high school students in the construction trades. Once these students graduate from high school, they received a NCCER completion certification and jobs in construction which start at \$15 per hour. (Notiseis 360, 2019) The course curriculum offered the following topics:

- Safety rules and guidelines (OSHA)
- How to read construction plans
- Basic math concepts
- Proper use of manual and electrical tools
- Construction materials management

Construction Trades Training and Education Academy, Inc. (Academia de Entrenamiento Y Educación en la Construcción, Inc.)

Working with the P.R. Department of Labor and Casa Dominicana, a community-based organization in the San Juan area, LiUNA developed a general construction and OSHA safety certification program. These courses were open for skilled and unskilled workers. Those completing the program were offered jobs starting at \$15 per hour. (www.noticel.com , 2019) According to online newspaper Noticel, the program graduated approximately 40 students. Efforts to reach Casa Dominicana or LiUNA to obtain more details have not been successful. The Puerto Rico Chapter of LiUNA was dissolved in 2020, calls to Edison Severino, local director, and visits to their local office were unsuccessful. LiUNA's local office looks empty.

Finally, I reviewed the **Puerto Rico Unified State Plan for 2020**. This is a workforce development strategic report required by the Workforce Opportunity and Innovation Act of 2014 (WIOA) that defines the government's vision and objectives with regards to workforce development and economic development. The 2020 Report covers very briefly the employment situation in the construction industry but does not suggest a roadmap to develop workforce training programs that addresses the issues in the construction industry. (www.ddec.pr.gov , 2020)

Models to Consider

While efforts in Puerto Rico seem to be sporadic and mostly limited to programs offered by post-secondary academic institutions, other jurisdictions have been successful in addressing the need to bring new workers and narrowing the skills gaps through partnerships between the construction industry, academic and community organizations. One of the most successful models are the efforts led by the Philadelphia General Building Contractors Association (GBCA).

The GBCA has worked with several organizations in the Philadelphia region and around the state through mentoring, apprenticeship and career technical education (CTE) programs. Partnering with local schools, community-based youth programs and CTE programs to offer younger populations opportunities to develop careers in the construction trades. (Hanan, 2020)

The following programs could be emulated in Puerto Rico to address skills gaps in construction training:

Mercy Career and Technical High School

Mercy High School and GBCA joined efforts to develop career technical education programs to attend the need for skilled workers in the Philadelphia building market. The program is a mixed of classroom and on the job training in the following building trades:

- Carpentry
- Electricity
- Plumbing
- HVAC
- Construction & facilities management

Graduates from the Building Trades Program earn an NCCER certification which allows them to pursue a professional career in the construction industry. (www.mercycte.org , 2021)

YouthBuild of Philadelphia Charter School

This program in collaboration with the Philadelphia General Building Construction Association targets high school dropouts and at-risk youth and gives them a second chance to get a construction trades education that will lead to a high school diploma and a well-paid job after graduation. This program takes after the very successful YouthBuild Model made famous in the Harlem section of New York City in the late 1970s. (www.youthbuildphilly.com , 2021)

The Program offers students on the job training, working on abandon homes and buildings which are converted into affordable housing units for low-income first home buyers.

Building Trade Courses include:

- Advanced construction
- Green building
- Deconstruction

The GBCA also works with local trade unions and other organizations in offering apprentice programs:

1)Construction Apprentice Preparatory Program (CAPP)

2)Carpenters Apprentice Ready Program (CARP)

Both apprentice programs teach the core skills with the CAPP program being a tuition free 15-week program focusing on math skills and preparing candidates for the trade’s union apprentice test. Graduates of the CAPP program can expect to find jobs starting at \$50,000 a year. (www.cappmathprep.com , 2021)

The CARP program is run by the Carpenters Joint Apprentice Training Center of Philadelphia & Vicinities. It offers a range of courses in carpentry and related occupations. Both programs offer mentoring opportunities, life skills and preparation for job interviews. (www.carpentersofphila.com ,2021)

These apprentices and CTE workforce training programs are not common in Puerto Rico, but as the Philadelphia example demonstrates, it helps identify a new generation of workers and brings collaboration between private industry, academia and community organizations. This could be something to consider locally.

Construction Industry Related Course and Training Offerings

As part of the efforts to identify workforce development and training programs to prepare the construction industry’s workforce for the eventual demand due to the upsurge in construction projects, I reached out to 22 university, colleges, technical and vocational schools to identify construction industry related training programs, workshops and class courses. In addition, the Puerto Rico Department of Economic Development and Commerce operates the Workforce Innovation & Opportunity Act Program, and has a list of eligible providers of vocational programs. This is the relevant information from the above-mentioned list:

Course Description	Municipality/s	Course Hours/Credits	Cost	Provider	Employment Rate
Handyman/Utility Person	San Juan	400 hours	\$3,500	Cambridge Technical Institute	78%
Handyman/Utility Person	Barranquitas	400 hours	\$1,800	D'Mart Institute	86%
Handyman/Utility Person	Ponce	300 hours	\$2,400	Instituto Vocacional para el Desarrollo Educativos	80%
Construction Technician (Handyman)	Bayamon Campus	24 Credits	N/A	NUC University	N/A
Bricklaying & Masonry	Juncos, Mayaguez	275 hours	\$3,500	CDE Development, Inc.	70%

Structural, Industrial & Pipe Welding Course	Las Piedras	720 hours	\$7,500	Central Community College	73%
Industrial Welding Technician	Caguas, Ponce	1,200 hrs./ 60 credits	\$14-\$15,000	Mech Tech College, LLC	73%
Electrician	San Juan, Fajardo	1,350 hours/ 36 Credits	\$11,137	Escuela Tecnica de Electricidad, Inc.	70-80%
Plumbing Technician	Bayamon	42 Credits	\$12,226	Professional Technical Institute	70%
Plumbing Technician	Carolina, Fajardo, Moca	900 hours	\$7,100	NUC University	75-80%
Plumbing Technician	Ponce	1,100 hours	\$3,500	Instituto Vocacional para el Desarrollo Educativos	80%

In addition, there are a couple of universities and organizations that offer short-term technical and certification courses to train future employees for the construction industry and address the need to identify younger generations such as high school students. This is critical since one of the key problems affecting the local and national construction industry is an existing workforce with a high median age and the need to identify younger workers to join it.

Provider	Course Title	Municipality/s	Hours/Credits	Program Information
Ana G Mendez University	Architectural Draftsman Certification Program	Carolina, Barceloneta, Cabo Rojo, Santa Isabel Campuses	50 Credits/ 2 yr. Program	Certification Program
Interamerican University - INTERTEC	Construction Industry Technician	San German Campus	27 Credits	Targets recent H.S. Graduates & GED candidates
Interamerican University - INTERTEC	Electrical Technician w/ PLC & Renewable Energy Certificate Program	Bayamon & San German Campus	38 Credits	Targets recent H.S. Graduates & GED candidates

Gypsum Board Art Institute: Drywall and Construction School	NCCER accredited courses in: Gypsum Board Installer Reading Construction Plans & Cost Estimates	San Juan Caguas	Varies	NCCER certification program
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Some of the most successful models that address the shortage of employment in the construction industry are focused on drawing younger adults and the at-risk teens/high school dropout population. This could be part of a solution for Puerto Rico’s situation and one that could be explored as a possible pipeline for bringing new well-trained employees into the construction industry.

Costs of Construction Materials

In recent years, the costs of construction materials have been going up globally because of several factors. Most construction materials are shipped to Puerto Rico by ocean transport. Except for cement, Puerto Rico does not produce or manufacture construction materials, thus we do not control pricing on most materials. Some factors affecting cost of construction materials:

- Trade wars have increased tariffs on imported materials
- Short supply of steel
- Demand for materials created by natural disasters in Texas, Louisiana, California, Florida, USVI and the Southeast
- Construction boom in the Continental US and now in Puerto Rico is pushing up prices
- Effects of COVID19 on international transportation costs; the cost of shipping a container from China to Los Angeles or European market is now \$10K per container (Ramos, 2021)
- Recent increase inland transportation (Puerto Rico specific)
- Recent proposed increases container services at the Port of San Juan (PR specific)
- Local municipal inventory tax that varies from around 6.33% to 10.33%
- Increase in oil prices affecting the cost of transportation

The data for this report is collected from the construction cost of materials index generated by Bids PR. Bids PR is the source of the data collected below. The list of materials below is a sample, a more detailed list can be produced upon request.

Segments to be included are:

1. Concrete and related products
2. Masonry
3. Metals: steel, stainless steel, aluminum, bronze
4. Wood products & plastics
5. Roofing materials and water protection coating
6. Windows and doors
7. Finishes

Construction Materials

Legend

LF	Lineal feet
SF	Square feet
BF	Board foot
CYD	Cubic Yard
M+L	Materials & Labor

Concrete and Related Products

Materials Description	Quantity Unit	Average Cost
Concrete mix materials		
2,000 psi	CYD	\$98.41
2,500 psi	CYD	\$100.55
3,000 psi	CYD	\$103.35
4,000 psi	CYD	\$111.15
5,000 psi	CYD	\$124.90
Water repellent additive	CYD	\$9.00
Corrosion additive	CYD	\$23.86
Color additive	CYD	\$102.00
Topping	CYD	\$21.00
Use of river sand	CYD	\$8.35
Fly ash additive	CYD	\$22.67
Reinforcing Steel		
Material (foreign)	lbs.	\$0.55

Material (U.S.)	lbs.	\$0.75
Wire Mesh Reinforcement	sf.	\$.47 to \$.80

Masonry

Material Description	Quantity Unit	Average Cost
Masonry Blocks		
4-inch blocks	each	\$0.81
6-inch blocks	each	\$0.87
8-inch blocks	each	\$1.25
12-inch blocks	each	\$2.14
Glass Blocks		
4" x 6" x 6"	each	\$5.81
4" x 8" x 8"	each	\$8.63
4" x 12" x 12"	each	\$14.25
Insulated Materials for blocks		
4"	sf	\$1.19
6"	sf	\$1.38

Metals

Material Description	Quantity Unit	Average Cost
Sheet metal material		
Gauge 22	sf	\$2.19
Gauge 24	sf	\$2.00
Gauge 26	sf	\$1.73
Stainless Steel Pipes		
1/2 "	lf	\$9.25
3/4"	lf	\$10.45
1"	lf	\$14.45
2"	lf	\$39.35
4"	lf	\$71.31
6"	lf	\$125.40
SS Bolts, nuts, washers		
1/2 x 2"	each	\$3.59
1/2" x 4"	each	\$5.55
1/2" x 6"	each	\$7.59

SS Plates		
1/16"	sf	\$37.49
1/8"	sf	\$63.95
1/4"	sf	\$169.66

Bronze		
Strip plate for floor finish	lf	\$11.45
Plates	sf	\$715.00

Wood Materials

Material Description	Quantity Unit	Average Cost
Teac	bf	\$18.55
Redwood	bf	\$12.87
Oak	bf	\$12.48
Mahogany	bf	\$11.33
Cedar	bf	\$10.20
Baboon	bf	\$6.41
Pine	bf	\$5.67
Marine Plywood	sf	\$7.28
Rough Plywood		
1/4"	sf	\$1.05
1/2"	sf	\$1.17
3/4"	sf	\$1.40
Finished carpentry & millwork	sf	\$6.35
Counter tops materials + labor included (M+L)		
Average Quality	Lf	\$120.00
Corian tops	Lf	\$296.00
Wall hung Cabinets includes M+L		
Average Quality	Lf	\$240.00

**Roofing &
water
protection
coating**

Material Description	Quantity Unit	Average Cost
Waterproof Membrane Coatings		
20 mils	sf	\$4.10
40 mils	sf	\$4.79
60 mils	sf	\$6.70
Fire Coating (M+L)		
1 hour spray application	sf	\$3.87
2 hr. application	sf	\$5.89
1hr. w/ thermal acoustics	sf	\$6.78
Insulations		
1" Foam	sf	\$1.19
2" Foam	sf	\$1.57
Urethane 1"	sf	\$1.82

Windows and Doors

Material Description	Quantity Unit	Average Cost
Wood Doors		
Baboon	Sf	\$2.74
Brazilian Pine	Sf	\$2.94
Cedar	Sf	\$3.09
Pine	Sf	\$4.85
Mahogany	Sf	\$5.88
Caobilla	Sf	\$2.68
Cedrino-Campara	Sf	\$6.32
Metal Doors		
Hollow Metal (ga.16)	Sf	\$29.17
Hollow Metal (ga.18)	Sf	\$30.95

Stainless Steel	Sf	\$196.27
Roll up doors		
Galvanized steel	Sf	\$37.33
Stainless Steel	Sf	\$71.59

Windows		
Aluminum	Sf	\$9.82
Alum. w/sec. bars	Sf	\$31.59
Alum. & Glass windows sliding (M+L)	Sf	\$36,15

Finishes

Material Description	Quantity Unit	Average Cost
For Wall Finishes		
Cement		
Cement Bag	47lbs.	\$4.39
Cement Plaster		
interior	sf	\$2.00
exterior	sf	\$2.00
Stucco Cement		
interior	sf	\$0.85
exterior	sf	\$0.90
Spray on cement	sf	\$1.12
Gypsum board (M+L)		
standard partition	sf	\$8.35
standard veneer	sf	\$8.05

Source: Bids PR: Procurement Report for Puerto Rico and the Caribbean

Conclusion

Puerto Rico's construction industry will need to address and solve several problems affecting it in order to benefit from the stream of federal funds that will soon be arriving for the island's reconstruction. First and foremost, the shortage in skilled workers. Some possible options to address this problem were previously discussed in this report.

Industry, academia and the government should work together in developing workforce training programs to attract not only out of work laborers, but more importantly a new generation of construction workers that will replace the industry's aging and soon to retire workforce. Career technical education and apprenticeship programs such as those mentioned in this report that target soon to graduate high school students and at-risk youth could be instrumental in adding employees to the sector. These proposed efforts may also address and help resolve any skills gaps that could affect the construction industry due to emerging technologies such as robotics and artificial intelligence.

Third, the impact of federal assistance programs such as the Pandemic Unemployment Assistance programs and others recently passed are disrupting the availability of local labor. The local industry has brought up some proposals addressing this matter that could be worth considering.

Bringing foreign workers to fill the labor shortage through the H1B Visa program while local industry works to build up its workforce through training initiatives could be a short-term solution. The wage differentials between salaries in the States and those in Puerto Rico, even with a proposed increase to \$10.89 or \$15 per hour, could make it difficult to bring back the Puerto Rican laborers who left a few years ago.

Finally, in order to complete this report, I had to reach out to individual construction companies, equipment distributors and transportation companies to better understand the issues affecting the construction labor force and the factors affecting the costs of construction materials. The industry trade associations I reached out to did not respond in time and made it impossible to conduct a skills gap analysis. This is a topic that would benefit from more analysis and in particular primary research via meetings with industry trade associations and companies. The few meetings I had were very informative and helped me better understand how the construction industry is responding this workforce situation.

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