Testing the Reliability and Validity of Area Cost Factors in Hawaii

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Abstract

With the increased use and reliance on computerized construction cost estimating programs, it is important to understand the underlying assumptions of the national databases upon which these programs rely to calculate their results. Too often, it has become easy for the apprentice estimator to pick an item from a database and place it in his estimate without challenging the basis of the cost item he is using and relying on an "Area Cost Factor" (ACF) to adjust this average cost to Hawaii. This paper presents my research of actual costs in Hawaii and tests the reliability and validity of the "Area Cost Factors" reported by two well-known construction cost references, Engineering News Record (ENR) and RSMeans. Additionally, I used the data collected to test the Area Cost Factors published by the U.S. Department of Defense Unified Facilities Criteria (UFC) 3-701-01 "DoD Facilities Pricing Guide".

Introduction

Reliability and validity are two important concepts which are similar in nature but are two separate concepts. Reliability is defined as, “the degree to which an assessment tool produces stable and consistent results”. Validity, on the other hand, “refers to how well a test measures what it is purported to measure”.

The Problem

In my experience, I have seen budgets for capital projects in Hawaii set using national cost databases and adjusted to a locality by use of an area cost factor. In Hawaii, the use of these factors creates significant budget shortfalls when the projects move from concept to design and construction stages. This paper intends to test the reliability and the validity of these cost factors.

Reliability vs. Validity

An essential component in the implementation of a “Metro Area Multiplier*”, “City Cost Index*” or an “Area Cost Factor* (ACF)”, is the confidence that the index or factor is both reliable and valid. An example of “reliability” would be applying a 1.25 ACF multiplier on average costs for Concrete, Wood, Steel, Plumbing and Electrical items and observing consistent results. One could say that the factor is “reliable”. However, one might question the use of the 1.25 ACF broadly over several very disparate products, building elements, labor trades and locations. This would bring into question the “validity” of the results.

I have compared actual raw costs in Hawaii (City & County of Honolulu) to Engineering News Record’s (ENR) “Construction Cost Index” and “Building Cost Index”. Additionally, I have compared the costs of case studies published in ENR and Sweet’s Square Foot Cost Books with similar projects in Hawaii. I have compared selected cost elements from RSMeans’ “2016 Building Construction Cost Data Book, (BCCD)” with my findings of raw local costs. Finally, I have compared the Area Cost Factors published by the U.S. Department of Defense in their UFC 3-701-01 “DoD Facilities Pricing Guide”, ENR and Sweet’s Square Foot Cost Books and RSMeans BCCD to my findings.

**“Metro Area Multiplier”, “City Cost Index” and “Area Cost Factor” may be used interchangeably to mean a factor which is applied to a national average cost to “localize” that average cost to a given area, city or locality.*

Engineering News Record (ENR)

Engineering News Record (ENR) is a weekly publication of McGraw Hill Publishing. ENR's "Construction Cost Index" and its "Building Cost Index" have been continuously updated by their Construction Economists for 50 years by tracking local prices in 20 U.S. cities. They represent a consistent set of labor and material costs as a basis for any research into the same.

ENR Construction Cost Index and Building Cost Index

The ENR Construction Cost Index and Building Cost Index are both based on a few consistent data points. They both use three basic materials; Fabricated Structural Steel, Portland Cement and 2x4's as their basis for the Material Cost component. The difference between the two indices is in the Labor Cost component. The Construction Cost Index uses 200 hours of "Common Labor" and the Building Cost Index uses the average hourly wage of three "Skilled Workers"; Bricklayers, Carpenters and Structural Ironworkers as its basis of labor costs.

I calculated both a Construction Cost Index and a Building Cost Index for Honolulu based upon the same criteria as ENR uses for their indices using actual costs in Honolulu. This data is shown on Tables 1 and 2.

Table 1 – ENR Construction Cost Index

ENR CONSTRUCTION COST INDEX			ENR 20 CITY FEB. 22, 2016		HAWAII		
ITEM	QTY	UNIT	COST	ENR	COST	HAWAII	FACTOR
Common Labor	200	hours	$41.42	$8,284.00	$52.36	$10,472.00	
Fabricated Structural Steel	25	cwt	$49.94	$1,248.50	$85.00	$2,125.00	
Portland Cement	1.128	tons	$114.50	$129.16	$209.14	$235.91	
2x4 Lumber	1.088	mbf	$478.09	$520.16	$851.00	$925.89	
Total				$10,181.82		$13,758.80	1.3513105

(Department of Labor & Industrial Relations, State of Hawaii)

(Engineering News Record)

(Klockener Steel)

(Hawaiian Cement)

(Home Depot)

Table 2 – ENR Building Cost Index

ENR BUILDING COST INDEX					HAWAII		
ITEM	QTY	UNIT	COST	ENR	COST	HAWAII	FACTOR
Skilled Workers *	68.38	hours	$53.84	$3,681.58	$64.03	$4,378.37	
Fabricated Structural Steel	25	cwt	$49.94	$12,48.50	$85.00	$2,125.00	
Portland Cement	1.128	tons	$114.50	$129.16	$209.14	$235.91	
2x4	1.088	mbf	$478.09	$520.16	$851.00	$925.89	
Total				$5,579.40		$7,665.17	1.3738347
* Skilled Workers							
Bricklayers	$60.57						
Carpenters	$64.86						
Structural Ironworkers	$66.66						
Average	$64.03						

(Department of Labor & Industrial Relations, State of Hawaii)

(Engineering News Record)

(Klockener Steel)

(Hawaiian Cement)

(Home Depot)

This exercise shows that a theoretical "Area Cost Factor" to adjust ENR's Construction Cost Index to Hawaii is 1.3513. This is derived by dividing the Total Hawaii costs by the ENR costs, ($13,758.80/$10,181.82) = 1.3513. To adjust ENR's Building Cost Index to Hawaii, the factor is 1.3738. This is derived by dividing the Total Hawaii costs by the ENR costs, ($7,665.17/$5,579.40) = 1.3513. Use of a limited data set such as these would yield consistent or "reliable" results from year to year or from location to location. Yet, because of its limited number of data points, one should question the validity of any conclusions drawn by the exercise of comparing the ENR Construction Cost Index or the ENR Building Cost Index to actual costs.

Engineering News Record Material Costs

ENR regularly reports on the cost of several building materials from 20 major U.S. cities. Table 3 (See Appendix) compares Hawaii costs with ENR's 20 City Average cost of the same materials which include; Lumber, Plywood, Drywall, Insulation, Metals, Masonry, Concrete, Paving, Aggregates and Pipes. Table 3 (See Appendix) shows that material price factors in Hawaii range from 0.771 to 7.966 when compared to the

20-City average costs. The overall average factor, derived by the sum of all the material price factors in Hawaii divided by the total number of items sampled is 2.038.

Engineering News Record Labor Costs

I researched the prevailing wage rates of the 22 construction trades which are included in ENR's 20 City average wage rates, 3rd Quarter 2014. The results are shown on Table 4. The data shows that the overall average factor of Hawaii labor costs over the ENR 20-city average rates, derived by the sum of all the labor rate factors in Hawaii divided by the total number of labor categories sampled is 1.210.

Table 4 - ENR 20-City Average Wages to Hawaii Wages – September 2014

TRADE CLASSIFICATION	HAWAII	20 CITY AVG.	FACTOR
Bricklayer	$60.57	$51.05	1.186
Carpenter	$63.21	$52.55	1.203
Cement Finisher	$60.42	$46.99	1.286
Electrician	$74.27	$56.07	1.325
Elevator Construction Mechanic	$78.88	$67.46	1.169
Glazier	$61.39	$47.84	1.283
Insulator	$62.05	$57.91	1.071
Ironworker (Reinforcing)	$67.46	$53.58	1.259
Ironworker (Structural)	$67.46	$56.21	1.200
Laborers, Building	$45.66	$41.44	1.102
Laborers, Heavy and Highway	$48.26	$41.94	1.151
Millwrights	$63.21	$52.89	1.195
Crane Operators	$69.21	$52.33	1.323
Heavy Equipment	$67.90	$52.90	1.284
Small Equipment	$65.96	$48.89	1.349
Painter	$60.65	$44.97	1.349
Pipefitter	$62.96	$58.24	1.081
Plasterer	$61.11	$47.22	1.294
Plumber	$62.96	$57.65	1.092
Roofer	$55.23	$44.99	1.228
Sheetmetal Worker	$61.80	$57.20	1.080
TEAMSTER	$45.66	$40.52	1.127
Average			1.210

(Department of Labor & Industrial Relations, State of Hawaii)

(ENR Construction Economics)

It is important to note that these factors are the result of a purely objective comparison of local wage rates to a national average and do NOT reflect productivity or other economic measures. This is important when attempting to explain evidence of actual costs that are different than mathematically derived factors and indices.

Engineering News Record Square Foot Costbooks

ENR publishes an annual "Square Foot Costbook" and the Sweet's "Architect's Square Foot Cost Book". These publications include Case Studies of recently constructed projects, In-Place Unit Costs and Metro Area Multipliers.

These two books show the Metro Area Multiplier for Hawaii as 1.38 over the 20 City Average Costs. The following are my findings of the costs of a few recent projects in Hawaii and their comparison to the Locally Adjusted ENR and Sweet's Square Foot Cost Books' Case Studies of similar building typologies. The following are comparisons of Building Types and are not intended to portray or investigate detailed comparisons of building systems.

Student Housing

In the "Sweet's Architect's Square Foot Cost Book", a student apartment complex in Maryland was constructed which consisted of 107 units totaling 153,338 s.f.. The resulting square foot cost for this complex equals the total cost of the complex divided by the total square footage:

$14,338,654.00/153,338 s.f. = $93.51/s.f..

The adjusted square foot cost in Hawaii would be derived by multiplying the calculated square foot cost by the Metro Area Multiplier for Hawaii:

$93.51 x 1.38 = $129.04/s.f..

A new dormitory was constructed at the University of Hawaii Hilo for 300 students and cost $27.850 million. The actual square foot cost in 2013 equals the total cost of the facility divided by the total square footage:

$27,850,000/119,883 s.f. = $232.31.

I calculated the multiplier for this facility by dividing the Actual Square Foot Cost by the Calculated Square Foot Cost:

$232.31/$93.51 = 2.48.

Parking Garage

In the "ENR 2015 Square Foot Cost Book", a 743 stall, 287,068 s.f. parking garage was constructed for $11,904,749. The resulting square foot cost for this parking garage equals the total cost of the garage divided by the total square footage:

$11,904,749.00/287,068 s.f. = $41.47/s.f..

The adjusted square foot cost in Hawaii is derived by multiplying the calculated square foot cost by the Metro Area Multiplier for Hawaii:

$41.47 x 1.38 = $57.23/s.f..

A new 429 stall, 217,905 s.f. parking garage is under construction on Oahu for $29,330,000. The actual square foot cost equals the total cost of the facility divided by the total square footage:

$29,330,000/217,905 s.f. = $134.60/s.f..

I calculated the multiplier for this facility by dividing the Actual Square Foot Cost by the Calculated Square Foot Cost:

$134.60/$41.47 = 3.25.

Tire Store

In the "Sweet's Architect's Square Foot Cost Book", a Tire Retail Store was constructed which totaled 6,100 s.f.. The resulting square foot cost for this store equals the total cost of the store divided by the total square footage:

$432,795.00/9,100 s.f. = $70.95/s.f..

The adjusted square foot cost for Hawaii is derived by multiplying the calculated square foot cost by the Metro Area Multiplier for Hawaii:

$70.95 x 1.38 = $97.91/s.f..

We are currently working on a new 21,965 square foot full service car care center whose estimated cost is $10,767,000 for the building portion. The actual estimated square foot cost equals the total cost of the facility divided by the total square footage:

$10,767,000/21,965 s.f. = $490.18.

We calculated the multiplier for this facility by dividing the Actual Square Foot Cost by the Calculated Square Foot Cost:

$490.18/$70.95 = 6.91

The significant differences in the costs of similar building types represented in national publications to the costs of actual, similar building types in Hawaii questions the validity of the Metro Area Multipliers published by ENR. If the Construction Cost Index, the Building Construction Index and the Material and Labor cost

factors are within the 1.38 Metro Area Multiplier cited by the two ENR/Sweet's Square Foot Cost Books, what are the circumstances that contribute to the significantly higher real world factors when comparing case studies to similar projects in Honolulu?

RSMeans

RSMeans is recognized in the industry as an authority on construction cost data. They research and publish annual Cost Data Books and provide soft copies of their databases that work with several of the more popular construction cost estimating programs. With their databases working with your estimating program, you have access to thousands of unit prices and assemblies. Ideally, applying an Area Cost Factor to the estimate should "localize" the pricing.

Material Costs

Material costs from 30 major metropolitan areas, plus a few from other significant markets are gathered to create RSMeans' Material costs. Bare material costs are marked up by 10% for profit but not for overhead or sales tax.

I researched and compared the local costs of the 65 items which make up the R.S. Means Key Materials List. This data is found on Table 5 (See Appendix) and shows that material price factors in Hawaii range from 0.610 to 23.245 when compared to the same 65 items in the R.S. Means Key Materials List. These factors were calculated by dividing the material costs in Hawaii by the National Average cost of the same item shown in the R.S. Means Key Materials List. The overall average factor, derived by the sum of all the material price factors in Hawaii divided by the total number of items sampled is 2.026. This factor, based on actual, researched material costs in Hawaii, contrasts with the RSMeans City Cost Index for Materials in Honolulu of 1.250. The difference between the factor derived from actual research into local costs and the RSMeans City Cost Index for Materials in Honolulu is significant and brings into question the validity of the RSMeans factor.

Labor Costs

The Labor rates used by RSMeans are an average of labor rates in 30 different cities across the United States. Direct labor rates include fringe benefits and carry markups for both profit and overhead. I compared the National Average rates with Hawaii's rates on Table 6. The overall average factor, derived by the sum of the 18 Labor Rates in Hawaii divided by the total number of items sampled is 1.254. The RSMeans City Cost Index for Labor is 1.197. Like the ENR Labor Factor, the factor is an objective sampling of labor rates and

includes no accounting for productivity or other economic impacts. This was verified by Mr. Bob Mewis, CCP, an Engineering Manager with RSMeans.

I interviewed a Construction Superintendent who has experience across the United States and asked his opinion of the productivity of the local workers compared to his national experience. His answer was that he only got *half* the productivity he had come to expect through his years of experience. It is important to note that 50% productivity equals *double the cost.* Even if this information was somewhat exaggerated, the fact that the RSMeans Labor Factor does not capture local productivity is significant.

I also queried the General Superintendent of a large Public Works project about his assessment of construction labor costs in Hawaii. His observation was that the "Boom and Bust" cycles of the local construction market along with our relatively small market do not provide consistent opportunities for tradesmen to gain skills and experience compared to their counterparts on the mainland. This has significant impact on output and productivity.

While the difference between the factor derived from actual research into local costs and the RSMeans City Cost Index for Labor in Honolulu is relatively small, 1.254 vs. 1.197, anecdotal evidence suggests that there is a larger spread. Perhaps productivity and other economic factors needs to be studied and added to these factors to increase their accuracy and validity.

Table 6 - R.S. Means 30 City Average Labor Costs to Hawaii

LABOR GROUP	HAWAII	RSMeans	FACTOR
		20 CITY AVG.	
Boilermaker	$63.63	$61.65	1.032
Carpenter	$65.11	$48.45	1.344
Cement Finisher	$63.73	$45.65	1.396
Electrician	$70.27	$55.10	1.275
Elevator Construction Mechanic	$84.28	$79.10	1.065
Glazier	$63.15	$46.70	1.352
Insulator	$63.15	$53.40	1.183
Laborer I	$51.86	$37.90	1.368
Lather	$65.11	$47.30	1.377
Mason, Bricklayer	$60.32	$46.25	1.304
Painter	$32.77	$40.35	0.812
Plasterer	$64.87	$44.90	1.445
Plumber	$65.08	$59.20	1.099
Roofer	$56.38	$41.70	1.352
Sheetmetal Worker	$64.68	$57.25	1.130
Terrazzo	$60.57	$44.60	1.358
Tile Setter	$60.57	$44.50	1.361

Truck Driver	$69.31	$43.20	1.604
AVERAGE	$62.49	$49.84	1.254

(Hawaii DILR)

(RSMeans Building Construction Cost Data)

Equipment Costs

RSMeans gathers equipment rental rates from numerous sources throughout North America. I created a list of 18 pieces of typical construction equipment to compare to the equipment rental costs in the RSMeans BCCD. This list is on Table 7. I found an adjustment factor of 1.084 over the rental rates found in the RSMeans BCCD.

Table 7 - Equipment Costs, R.S. Means, and Hawaii

DESCRIPTION	RSMEANS	ACTUAL HAWAII	FACTOR
"Whirlybird" Gas Powered Trowel	$20.00	$55.00	2.750
Mixer, 10 c.f., 25HP	$143.00	$72.00	0.503
Excavator, Diesel Hydraulic, Crawler, 1cy Capacity	$695.00	$825.00	1.187
Excavator, Diesel Hydraulic, Crawler, 3-1/2cy Capacity	$2,150.00	$3,150.00	1.465
Backhoe/Loader 80HP, 1-1/4cy Capacity	$315.00	$200.00	0.635
Backhoe/Loader 112HP, 1-1/2cy Capacity	$640.00	$375.00	0.586
Vibratory Compactor, 125 HP	$725.00	$525.00	0.724
Compactor, 2 Drum Walk Behind, 7.5HP	$210.00	$240.00	1.143
Dozer, Diesel, 80HP	$400.00	$355.00	0.888
Dozer, Diesel, 410HP	$2,225.00	$2,410.00	1.083
Front End Loader, 1-1/2cy, 95HP	$300.00	$360.00	1.200
Front End Loader, 3-1/2cy, 185HP	$535.00	$780.00	1.458
Skid Steer Loader, 10cf, 30HP	$150.00	$165.00	1.100
Aerial Lift, Scissor Type, 25' Ht., 2,000 lb Capacity	$68.50	$75.00	1.095
Telescoping Boom, 45' Ht., 500 lb. Capacity	$365.00	$240.00	0.658
Forklift, 21' lift, 5,000 lb., 4WD	$250.00	$355.00	1.420
Hydraulic Crane, Rough Terrain, 25 Ton	$660.00	$875.00	1.326
Hydraulic Crane, Rough Terrain, 50 Ton	$870.00	$1,255.00	1.443

(U.S. Army Corps of Engineers, EP 14R10 M11 Eq. 2014 Region 10)

(RSMeans Building Construction Cost Data)

The RSMeans City Cost Index for Hawaii is 1.226. If one applies this factor directly to the Unit Prices published in the RSMeans BCCD, I predict that the result will be severely short of the actual costs in Hawaii. Similar to the ENR data sets, these indices are *Mathematical Constructs* which contain objectively gathered and measured facts about relatively small sets of construction cost data. Several important measures such as productivity, the level of competition, access to skilled and trained labor pools, the cost of living and other economic elements are not captured in the RSMeans Factors.

U.S. Department of Defense Unified Facilities Criteria

The U.S. Department of Defense publishes UFC 3-701-01, the DoD Facilities Pricing Guide. This UFC is used to support the DoD's annual construction and engineering programs. It is updated frequently through Engineering Technical Letters and PAX Newsletters.

The recent PAX Newsletter, No. 3.2.1, Dated 31 March 2016, revised and updated the DOD Area Cost Factors to be used when preparing program level budgets. The DOD Area Cost Factor for Hawaii, using Joint Base Pearl Harbor Hickam as the basis is 2.26.

The RSMeans City Cost Index predicts that costs in Hawaii are 22.6% greater than their 20 City National Average and the DoD Area Cost Factor for Hawaii is 126%, a prediction of over TWICE the National DoD construction. These indexes predict only the costs of construction in Hawaii *relative to their respective* National Averages.

Conclusion

As objective measures, the ENR Construction Cost Index, Building Cost Index, 20 City Material and Labor Cost Averages, the RSMeans Key Materials and lists of Average Labor rates are *reliable* sources of data. The data is collected in an organized manner and the results can be reliably calculated repeatedly with similar results.

Where these publications fall short is in the validity of the ENR "Metro Area Multiplier" and the RSMeans "City Cost Index" to accurately predict the cost of a construction project in Hawaii. My findings show that material costs in Hawaii are nearly *twice* the national averages. I have also noted that productivity and other economic impacts are not accounted for in the Labor indexes.

A comparison of the Case Studies found in the ENR Square Foot Cost books to real projects here in Hawaii shows how much higher it costs to construct a facility in Hawaii than on the Mainland U.S.. The Department of Defense's Area Cost Factor for Hawaii appears to more closely align with our findings when comparing the ENR Case Studies which shows that costs here in Hawaii are often twice those shown in the Case Studies.

Bibliography

No.	Description
1	McGraw Hill Construction 2015 **Sweet's Architect's Square Foot Costbook**
2	Department of Labor & Industrial Relations, Research & Statistics Office 2014 **Wage Rate Schedule Bulletin No. 484** State of Hawaii: Phyllis Dayao
3	Department of Labor & Industrial Relations, Research & Statistics Office 2016 **Wage Rate Schedule Bulletin No. 487** State of Hawaii: Phyllis Dayao
4	Engineering News Record (ENR) 2006-2015 **Construction Economics Archive** [pdf] Retrieved from http://www.enr.com/economics/current_costs
5	Engineering News Record (ENR) 2014 **3rd Quarterly Cost Report** [pdf] Retrieved from http://www.enr.com/ext/resources/static_pages/Quarterly-Reports/ENR3QCostReport2014.pdf
6	Engineering News Record (ENR) 2016 **Engineering News-Record** [pdf] Retrieved from http://www.enr.com/publications/11/editions/742
7	McGraw Hill Construction 2015 **ENR Square Foot Costbook**

8 RSMeans
2016
RSMeans Building Construction Cost Data

9 US Army Corps of Engineers
2000-2016
PAX Newsletter No. 3.2.1.
DOD Area Cost Factors
Retrieved from http://www.usace.army.mil/Cost-Engineering/Area-Cost-Factors/

Appendix

Table 3 – ENR Material Costs

ITEM	QTY	UNIT	HAWAII	ENR 20 CITY AVG.	FACTOR
2x4 S4S, Common Lumber	1	mbf	$920.00	$466.80	1.971
2x6 S4S, Common Lumber	1	mbf	$905.00	$507.90	1.782
2x8 S4S, Common Lumber	1	mbf	$898.00	$564.09	1.592
2x10 S4S, Common Lumber	1	mbf	$990.00	$627.36	1.578
Plywood, 4' x 8' x 5/8"	1	msf	$1,454.06	$574.13	2.533
Plyform, 4' x 8' x 3/4"	1	msf	$1,707.19	$1,000.48	1.706
Particle Board Underlayment, 4' x 8' x 5/8"	1	msf	$1,324.06	$383.16	3.456
Gypsum Board: Regular, 4' x 8' x 1/2"	1	msf	$468.75	$275.54	1.701
Roofing Insulation, Unfaced	10	sf	$9.70	$7.29	1.331
Wall Insulation, Unfaced	10	sf	$5.90	$6.09	0.969
Structural Steel, "C" Shape, 6" x 8.2 lbs./ft.	1	cwt	$150.00	$49.63	3.022
Structural Steel, "I" Shape, 6" x 12.5 lbs./ft.	1	cwt	$150.00	$51.37	2.920
Structural Steel, "WF" Shape, 8" x 31.0 lbs./ft.	1	cwt	$150.00	$47.87	3.133
Reinforcing Steel, Grade 60, #4	1	cwt	$70.00	$47.10	1.486
Hot Rolled Carbon Steel Plate, 12 Gauge, 48" x 10'	1	cwt	$85.00	$46.33	1.835
Alum. Sheet, 3003H14, 36" x 96"	1	cwt	$350.00	$187.73	1.864
Stainless Steel Sheet, 14 Gauge	1	cwt	$350.00	$166.12	2.107
Stainless Steel Sheet, 16 Gauge	1	cwt	$350.00	$170.25	2.056
Stainless Steel Sheet, 20 Gauge	1	cwt	$350.00	$174.00	2.011
Stainless Steel Plate, Type 304, 1/4", 72" x 240"	1	cwt	$350.00	$194.10	1.803
Stainless Steel Plate, Type 316, 1/4", 96" x 140"	1	cwt	$350.00	$249.52	1.403
Steel Piling, H-Pile, HP10 x 42	1	cwt	$100.00	$32.79	3.050
Asphalt Paving, PG 58	1	Ton	n/a	$399.76	
Asphalt Paving, Cutback, MC800	1	Ton	n/a	$377.20	
Asphalt Paving, Emulsion, RAPID SET	1	Ton	n/a	$353.94	
Asphalt Paving, Emulsion, SLOW SET	1	Ton	n/a	$366.52	
Portland Cement, Type I	1	Ton	$185.41	$114.50	1.619
Masonry Cement, 70-lb	1	Bag	$13.30	$8.56	1.554
Crushed Stone, Base Course	1	Ton	$40.15	$10.38	3.868

Crushed Stone, Concrete Course	1	Ton	$34.45	$10.70	3.220
Crushed Stone, Asphalt Course	1	Ton	$34.45	$11.11	3.101
Concrete Sand	1	Ton	$73.45	$9.22	7.966
ITEM	QTY	UNIT	HAWAII	ENR 20 CITY AVG.	FACTOR
Ready Mix Concrete, 3,000 psi	1	cy	$171.75	$108.97	1.576
Ready Mix Concrete, 4,000 psi	1	cy	$178.95	$113.49	1.577
Ready Mix Concrete, 5,000 psi	1	cy	$186.75	$120.16	1.554
Concrete Block, Normal Weight: 8"x 8"x 16"	1	c	$220.00	$144.87	1.519
Concrete Block, Lightweight: 8"x 8"x 16"	1	c	$220.00	$161.88	1.359
Concrete Block, 12"x 8"x 16"	1	c	$319.00	$174.25	1.831
Reinforced Concrete Pipe (RCP), 12" Dia.	1	lf	n/a	$15.84	
Reinforced Concrete Pipe (RCP), 24" Dia.	1	lf	$109.00	$29.22	3.730
Reinforced Concrete Pipe (RCP), 36" Dia.	1	lf	$135.00	$60.26	2.240
Reinforced Concrete Pipe (RCP), 48" Dia.	1	lf	$165.00	$98.86	1.669
Corrugated Steel Pipe (CSP), 12" Dia.	1	lf	$12.11	$10.07	1.203
Corrugated Steel Pipe (CSP), 36" Dia.	1	lf	$35.22	$31.00	1.136
Corrugated Steel Pipe (CSP), 60" Dia.	1	lf	$62.78	$71.51	0.878
Polyethylene Pipe (PE) Underdrain, 4" Dia.	1	lf	$1.81	$1.00	1.806
Polyvinyl Chloride Pipe (PVC), Sewer, 4" Dia.	1	lf	$1.45	$1.54	0.942
Polyvinyl Chloride Pipe (PVC), Sewer, 8" Dia.	1	lf	$5.69	$5.04	1.129
Polyvinyl Chloride Pipe (PVC), Water, 6" Dia.	1	lf	$6.58	$5.62	1.170
Polyvinyl Chloride Pipe (PVC), Water, 8" Dia.	1	lf	$11.35	$9.00	1.261
Polyvinyl Chloride Pipe (PVC), Water, 12" Dia.	1	lf	$24.14	$17.25	1.399
Ductile Iron Pipe (DIP), 6" Dia.	1	lf	$16.44	$18.22	0.902
Ductile Iron Pipe (DIP), 8" Dia.	1	lf	$22.71	$27.72	0.819
Ductile Iron Pipe (DIP), 12" Dia.	1	lf	$35.67	$40.87	0.873
Copper Water Tubing, 1/2" Dia. Type "L" (Soft)	1	lf	$1.45	$1.88	0.771
Copper Water Tubing, 1-1/2" Dia.	1	lf	$6.36	$5.17	1.230
Average Factors = SUM(Hawaii Costs/ENR Average Costs)/Number of Factors =					2.038

(ENR Construction Economics)

(Sandy, Honsador)

(Diane Malinovich, Klockner Steel)

(Karen Howlett, McSweeny Steel)

(Hawaiian Cement)

(Ameron Hawaii)

(Tileco Hawaii)

(Charles Moses, Jensen Precast)

(Bill Sullivan, Pacific Corrugated Steel Pipe)

(Donna Rivera, Ferguson)

(Rebecca Taoy, Hawaii Pacific Plumbing Supply)

Table 5 – Material Costs, RSMeans & Hawaii

DESCRIPTION	QTY	UNIT	RSMEANS 2016 Q1	HAWAII PRICES	FACTOR
DIVISION 3- CONCRETE					
Plyform, BB, Class 1, OES, 3/4" thick	1	S.F.	$ 1.65	$1.71	1.036
Reinforcing steel, ASTM A615, Grade 60, plain, #5 bars	1	Cwt.	$ 47.73	$70.00	1.467
Welded wire fabric, ASTM A185, sheets, 6x6 - W1.4 x W1.4 (10x10)	1	C.S.F.	$ 14.67	$35.30	2.406
Concrete, ready mix, regular weight, 3000 psi	1	C.Y.	$ 113.56	$171.75	1.512
Precast hollow core planks, 8" thick	1	S.F.	$ 8.45	$13.50	1.598
DIVISION 4- MASONRY					
Masonry cement, ASTM C91, Type N, gray, 70 lb. bags	1	Bag	$ 9.61	$11.41	1.187
Concrete block, ASTM C90, hollow, normal weight, 2000 psi	1	Ea.	$ 1.56	$2.20	1.410
Red face brick, hard, ASTM C216, nominal 4"x2-2/3"x8"	1	M	$ 566.87	$820.00	1.447
DIVISION 5- METALS					
Structural steel, ASTM A992, W-shapes, bolted connections	1	Ton	$ 2,579.77	$3,000.00	1.163
Open web joists, 24K series, horizontal bridging, 30 to 50 foot span	1	Ton	$ 1,665.89	$2,234.60	1.341
Metal decking, Type B wide rib, galvanized, 22 ga., 1-1/2" deep	1	Sq.	$ 158.25	$245.00	1.548
Metal stairs, cement filled metal pans, wall rail both sides, 3'-6" wide	1	Riser	$ 380.00	$305.00	0.803
Pipe railing, steel, 3-rail, galvanized, 1-1/2" pipe diam.	1	L.F.	$ 60.50	$95.00	1.570
DIVISION 6- WOOD, PLASTICS, & COMPOSITES					
Framing lumber, standard & better, kiln-dried, 2x4	1	M.B.F.	$ 618.49	$920.00	1.487
Plywood sheathing, CDX, 4-ply, 1/2" thick	1	S.F.	$ 0.67	$0.82	1.230
Pine boards, #2 pine, S4S, 1x6	1	M.B.F.	$ 1,460.38	$3,022.50	2.070
DIVISION 7 — THERMAL & MOISTURE PROTECTION					
Fiberglass insulation, roll, kraft faced, 3-1/2"X15"	1	S.F.	$ 0.34	$0.50	1.471

Rigid polyisocyanurate insulation board, foil faced 2 sides, 2" thick	1	Sq.	$ 77.96	$200.00	2.565
Bulk asphalt, 100 lb. keg or carton	1	Keg	$ 46.83	$63.75	1.361
Asphalt felt paper, 15 lb./sq., 4 squares per roll	1	Roll	$ 20.49	$39.70	1.938
Fiberglass shingles, standard 3-tab strip, 25 year, 210-235 lb./sq.	1	Sq.	$ 81.00	$100.00	1.235
EPDM roof membrane, 45 mil, 0.28 psf, black	1	S.F.	$ 0.52	$0.82	1.577
Cedar shingles, red, 16", No.1 R&R, 5" exposure	1	Sq.	$ 301.79	$370.00	1.226
DIVISION 8 — OPENINGS					
Structural steel channel door frame, C10x15.3, 10’ x 10’ opening	1	Opng.	$ 803.00	$1,147.50	1.429
Hollow metal door frame, KD, 16 ga., 3’-0" x 7’-0"x 1-3/4", 4-7/8" throat	1	Ea.	$ 132.33	$310.00	2.343
Hollow metal door, flush, 18 ga., 3’-0" x 7’-0" x 1-3/4"	1	Ea.	$ 265.97	$742.00	2.790
Wood door, interior, solid core, flush birch faces, 3’-0" x 7’-0" x 1-3/4"	1	Ea.	$ 170.93	$119.99	0.702
Tubular aluminum for window frames, mill finish, 1-3/4" x 4-1/2"	1	L.F.	$ 16.30	$20.35	1.248
Wood casement window, low E insulating glass, screen, 2’-0" x 3’-0"	1	Ea.	$ 299.00	$257.19	0.860
Cylindrical lockset, med. duty commercial grade, keyed, brushed chrome	1	Ea.	$ 155.60	$135.00	0.868
Float glass, clear, plain, 1/4" thick	1	S.F.	$ 7.04	$9.75	1.385
Insulating glass, 1" thick double glazed, bronze tinted film	1	S.F.	$ 15.06	$25.50	1.693
DIVISION 9 — FINISHES					
Metal studs, galvanized, 20 ga., 3-5/8" wide	1	L.F.	$ 0.55	$1.08	1.964
Gypsum wallboard, standard, 1/2" thick	1	S.F.	$ 0.31	$0.47	1.516
Acoustic ceiling tile, mineral fiber, fissured, white, 2’ x 4’ x 5/8" thick	1	S.F.	$ 0.57	$0.57	1.000
Red oak flooring, T&G, select, unfinished, 3/4" x 2-1/4"	1	S.F.	$ 4.51	$6.10	1.353
Vinyl composition tile, 12"x12"x1/8" thick, Group 1 color	1	S.F.	$ 1.01	$1.29	1.277
Carpet, level loop nylon, action back for direct glue down, 26 oz	1	S.Y.	$ 13.41	$21.06	1.570
Ceramic wall tile, glazed, interior, pastel color, 4-1/4" x 4-1/4"	1	S.F.	$ 2.29	$3.04	1.328

Exterior latex paint, white, semi-gloss, 5 gallon pails	1	Gal.	$ 37.75	$29.55	0.783
Interior latex paint, white, semi-gloss, 5 gallon pails	1	Gal.	$ 35.34	$24.97	0.707
DIVISION 12 — FURNISHINGS					
Countertop, plastic laminate, square edged, no backsplash, 25" deep	1	L.F.	$ 29.59	$16.40	0.554
DIVISION 21 FIRE SUPPRESSION					
Sprinkler head, brass, standard spray, 135F - 286F, 1/2" NTP,1/2" orifie	1	Ea.	$ 10.39	$8.00	0.770
DIVISION 22 — PLUMBING					
Copper pipe, Type L, 1/2" diam.	1	L.F.	$ 2.33	$1.45	0.622
Steel pipe, Schedule 40, black, threaded, 2" diam.	1	L.F.	$ 4.77	$5.06	1.061
PVC pipe, Schedule 40, 2" diam.	1	L.F.	$ 2.23	$1.75	0.785
Cast iron soil pipe, lead & oakum joint, 4" diam. X 5'-0" long	1	Ea.	$ 103.85	$90.13	0.868
Gas water heater, 120 MBH, 110 GPH output	1	Ea.	$ 6,942.00	$3,794.50	0.547
Water closet with tank, close coupled, vitreous china, 2-piece, white	1	Ea.	$ 209.33	$288.00	1.376
DIVISION 23 - HEATING, VENTILATING & AIR CONDITIONING					
Aluminum sheet metal ductwork	1	Lb.	$ 1.77	$17.00	9.605
Galvanized steel sheet metal ductwork	1	Cwt.	$ 53.00	$1,120.00	21.132
Cast iron gas boiler, hot water, standard controls, insulated jacket, 320 MBH	1	Ea.	$ 4,995.00	$4,800.00	0.961
Roof top package unit, electric cooling, gas heat, economizer, 20 ton, 360 MBH	1	Ea.	$ 20,782.00	$83,200.00	4.003
DIVISION 26 — ELECTRICAL					
Conduit, electric metallic tubing (EMT), 3/4" diam.	1	C.L.F.	$ 42.18	$39.90	0.946
Electric wire, 600 volt, single copper conductor, stranded, type THWN-THHN, #10	1	M.L.F	$ 187.95	$144.94	0.771
Dry type transformer, single-phase, 240/480V prim, 120/240V sec., 25 kVA	1	Ea.	$ 2,573.00	$2,483.00	0.965
Panel board, 3 ph, 4 wire, main lugs, NQOD, 120/208V, 100A, 24 circuits	1	Ea.	$ 1,645.00	$1,865.00	1.134
Lighting fixture, fluorescent, 2' x 4' lay in, acrylic lens, whip, four 32 watt lamps	1	Ea.	$ 60.64	$56.90	0.938
Drip proof motor, 230/460V, 1800 RPM, 1.15 service factor, 20 HP	1	Ea.	$ 1,935.00	$1,441.00	0.745
DIVISION 31 — EARTHWORK					
Steel sheet piling, PZ27, Grade A328	1	Ton	$ 1,503.53	$2,409.00	1.602

Borrow, bank run gravel, loaded at pit	1	C.Y.	$ 17.25	$31.62	1.833
Crushed stone, 3/4" minus, loaded at pit	1	C.Y.	$ 22.50	$58.17	2.585
Hot mix asphaltic concrete, 3/8" stone, loaded at plant	1	Ton	$ 67.87	$123.00	1.812
Screened loam, loaded at yard	1	C.Y.	$ 27.55	$25.00	0.907
DIVISION 33 — UTILITIES					
Reinforced concrete pipe, ASTM C76, Class 3, with gaskets, 24" diam.	1	L.F.	$ 29.17	$109.00	3.737

(RSMeans Building Construction Cost Data Book)

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(Marites Calad, Norman Wright)

(LoriAnn, Grace Pacific)