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COMPASS INTERNATIONAL INC.

What is Benchmarking & how can it help you with your future estimating / budgeting

Construction Benchmarking utilizes historical engineering and construction cost data to distinguish targets and best practice routines, specific to the performance and project delivery of construction related projects. Benchmarking is in many ways the analysis of what you're up against, how to we measure up or compare to our competitor's business practices and execution practices, in order to enhance the performance of your organizations performance. Used correctly benchmarking can fundamentally improve construction related performance and enhance the return on investment for the organization. Most of the successful construction organizations consistently benchmark their historical & latest performance / execution practices in the effort to improve the organizations standing in their particular market sector.

So what is benchmarking as it applies to construction? Benchmarking is basically investigating & researching historical costs & performance, a benchmark was a master masons datum point or mark on a foundation, wall or building utilized as a specific location / height for determining future heights or lengths needed to successfully complete a future building. .

The benchmarking procedure encompasses the assessment of planned performance data versus actual performance / data achieved from comparable historical accomplished construction related projects.

Benchmarks require need to be validated by a well-defined and concise description of deviations between planned projected performance and the estimated benchmarking low and high ranges that are for the most part indicated in the following sections of this publication.

Compass International's five phase approach to benchmarking is detailed below.

Phase 1: Verify the project goals and established the major benchmark components to be analysed.

Phase 2: Document and compile a list of the major cost / performance drivers, key component and collect performance and specific historical cost data, this could include cost per square foot / square meter, cost of electrical systems compare to comparable projects.

Phase 3: Assemble relevant benchmark data by cooperation with internal team members, conferring with relevant stakeholders on their views and perspectives, contacting professional societies, industry experts, industry associations and data mining via the internet on comparable benchmark norms. This data is essential to accurate and beneficial benchmarking.

Phase 4: Confirm and validate initial benchmark cost and performance data.

Step 5: Finalize benchmark data cost and performance models, develop low and high cost / performance benchmarks and compile benchmark report on project being reviewed.

#	DESCRIPTION	MATERIAL COST	M-H'S	HOURLY RATE	LABOR COST	TOTAL COST
	CONTINUED					
28	Field In-Directs					12,665,926
29	**ENGINEERING / EPC SERVICES**					
30	Detailed Design					3,476,005
31	PM / PC / Procurement					1,087,088
32	HO Support					563,860
33	Start Up / Commissioning					276,000
34	Engineering Fee					575,890
35	Misc. items					86,082
36	Engineering / EPC Services					6,064,925
36	Contingency / Mgmt. Reserve					3,000,000
36	**TOTAL PROJECT COST**					**81,302,865**

Cost / Man-hour Model (7)

1.50 MILLION TON PER YEAR USA GULF COAST ETHYLENE FACILITY

#	COST CATEGORIES	QTY	UOM	MATERIAL	M-H'S	M-H RATE	LABOR COST	TOTAL
1	**MAJOR EQUIPMENT (M.E.)**							
2	Columns c/w trays	74	EA	411,083,852	43,475	44.90	1,951,952	413,035,803
3	Drums / Vessels	70	EA	23,248,825	36,650	44.90	1,645,523	24,894,348
4	Pumps	103	EA	20,507,850	18,837	44.90	845,744	21,353,594
5	Compressors / Fans / Blowers	26	EA	112,070,264	137,319	44.90	6,165,348	118,235,613
6	Heat Exchangers	96	EA	24,444,292	17,404	44.90	781,394	25,225,685
7	Tanks	7	EA	17,045,486	3,890	44.90	174,664	17,220,150
8	Material Handling	4	EA	19,115,295	4,914	44.90	220,629	19,335,924
9	Water Treatment	11	EA	5,889,824	2,594	44.90	116,443	6,006,267
10	Miscellaneous Equipment	20	EA	65,495,758	20,953	44.90	940,737	66,436,494
11	Electrical Equipment	30	EA	17,654,253	7,849	44.90	352,393	18,006,646
12	Instrumentation Devices (Tagged)	5,670	EA	20,703,120	176,085	44.90	7,905,864	28,608,984
13	Freight		ALLOW	22,718,782	-			22,718,782
14	Vendor Assistance		ALLOW	1,827,224	-			1,827,224
15	Total Major Equipment (M.E.)			761,804,823	469,970		21,100,691	782,905,514
16	Removals / Demolition		ALLOW	8,955,009	79,950	41.56	3,322,762	12,277,771
17	Site Earthmoving / Improvements	1,230,000	CY	35,175,206	799,500	41.56	33,227,620	68,402,826
18	Piling	6,150	LF	8,846,992	159,900	41.56	6,645,524	15,492,516
19	Buildings	61,500	SF	8,846,992	239,850	41.56	9,968,286	18,815,278
20	Concrete	86,100	CY	47,332,250	186,550	41.56	7,753,111	55,085,361
21	Refractory / Fireproofing	-	ALLOW	6,423,583	7,995	41.56	332,276	6,755,859
22	Structural Steel / Platforms	9,225	TON	38,829,629	319,800	41.56	13,291,048	52,120,677
23	Piping systems	799,500	LF	221,753,872	3,997,500	41.56	166,138,099	387,891,971
24	Insulation	-	ALLOW	53,220,460	63,960	41.56	2,658,210	55,878,670

#	CONSTRUCTION CATEGORY	SF	$ / SF	$ TOTAL	MATERIAL %	LABOR %	TOTAL %
	CONTINUED						
37	OTHER COSTS						
38	General Conditions			14,851,000			
39	Field Support Labor			9,345,990			
40	Construction Equipment			4,855,000			
41	Consumables / Small Tools			3,470,000			
42	Early Engineering Studies			2,362,700			
43	Detailed Design / PM / PC - Procurement			37,956,000			
44	Field Engineering Support (site based)			1,698,880			
45	Construction Management			17,698,000			
46	Temporary Field Offices / Warehouse (existing)			1,636,700			
47	Sales Tax (Partial Exemption)			16,445,000			
48	Commissioning			1,780,000			
49	Owner Engineering / Consultants / Admin			8,940,000			
50	Spare parts			4,570,000			
51	New Warehouse lay down area			572,450			
52	**OTHER COSTS TOTAL**			**126,181,720**			
53	**TOTAL $ COST / SF / M2**			**$583,152,185**	**$2,205**	**$23,723**	

Cost / Man-hour Model (16)

SUPER COMPUTER CENTER NORTH WEST USA
122,400 SF 11,375 M2 60' FFL TO UNDERSIDE OF ROOF
7,344,000 CUBIC FEET: 18,540 SF RAISED FLOOR: 3,560 SF MEZZANINE FLOOR:
14 ACRE GREEN FIELD FLAT WOODED SITE
START OF DETAILED DESIGN 3/2017
START OF CONSTRUCTION 7/2017 FINISH CONSTRUCTION 12/2018
PEAK CONSTRUCTION MAN-POWER 175
60 - 70 OPERATING STAFF

DIVISION #	DESCRIPTION	$ COST PER SF	%
1	General Requirements / Preliminaries	$44.16	8.3
2	Site Construction (including roads, parking area, retention basin & & fencing)	$37.77	7.1
3	Concrete	$40.43	7.6
4	Masonry	$18.09	3.4
5	Metals	$32.45	6.1
6	Wood & Plastics	$44.69	8.4
7	Thermal & Moisture Protection	$38.84	7.3
8	Doors & Windows	$33.52	6.3
9	Finishes	$54.80	10.3
10	Specialties	$9.04	1.7
11	Equipment	$11.70	2.2
12	Furnishings	$9.04	1.7
13	Special Construction	$5.85	1.1
14	Conveying Systems	$9.58	1.8

General Buildings & Facilities (Shopping Centers, Offices, Logistic Centers, Hotels)

Cost / Man-hour Model (1)

SHOPPING MALL 285,000 SF C/W PARKING 360,000 SF: MARYLAND USA: 2017 COST BASIS: OPEN SHOP CONSTRUCTION: 2 # BIG BOX STORES 80,000 - 100,000 SF EACH & 10 TO 20 # SMALLER STORES / BANK / RESTAURANTS, EXCLUDES FIT-OUT SCOPE:

#	DESCRIPTION	SQUARE FEET (FOOTPRINT)	$ / SF LOW	$ / SF HIGH	$ TOTAL AVERAGE
1	Site Clearance / Site Work / Utilities	645,000	1.65	2.25	1,257,750
2	Shopping Mall (Building Shell / Roof / External Walls / Windows & Doors	285,000	55.25	62.50	16,779,375
3	Flooring	285,000	2.75	3.25	855,000
4	Ceilings	285,000	2.35	2.60	705,375
5	Racks / Fixture / Shelving Displays / Check Out Points	285,000	0.65	0.95	228,000
6	Power / Distribution / Phone / Internet / Security / Sound System	285,000	1.15	1.65	399,000
7	Lighting	285,000	3.15	3.85	997,500
8	Cold Storage / Bally Boxes	285,000	1.05	1.35	342,000
9	HVAC / AHU's	285,000	3.05	3.85	983,250
10	Fire Protection / O.S. Fire Loop	285,000	1.65	2.05	527,250
11	Signage internal / external	285,000	1.45	2.25	527,250
12	Parking Blacktop & Signs (700 to 1,000 cars)	360,000	2.75	3.65	1,152,000
13	**SUB TOTAL**		**76.90**	**90.20**	**24,753,750**
14	Building Cost 285,00 SF		72.50	84.30	
15	Site Work / Utilities & Parking 645,000 SF		4.40	5.90	
16	**TOTAL CONSTRUCTION COST**				**24,753,750**
17	Architectural / Engineering / Detailed Design Program Management Cost 6%				1,485,225
18	Construction Management Cost 3.5%				866,381
19	**TOTAL FACILITY COST**				**27,105,356**
20	**TOTAL FACILITY COST PER SF (285,000 SF)**				**95.11**
21	**TYPICAL SF $ COST RANGE**				**90- 115**
	REMARKS: • Detailed Design & Procurement = 26 weeks • Construction = 44 weeks • Excludes land purchase • Values include General Conditions / Preliminaries • Excludes Owner Costs				

COST / MAN-HOUR MODEL (4)

USA CITY LOCATION (CALIBRATION) FACTORS: for Industrial / Commercial construction facilities. The following values are calibration or location factors for adjusting values from Washington D.C. to a specific USA: Location factors are based on 50% - 50% split of labor and materials applicable for both process plants and buildings. An example of this is as follows; assume that you have estimated a building or facility utilizing this publication. The value you estimate was $6,745,700, that value would be based on costs for Washington D.C. if the project was to be built in Anniston Alabama the cost would be $6,745,700 X .85 = $5,733,845

Cost / Man-hour Model (4)

USA CITY LOCATION (CALIBRATION) FACTORS:

STATE		LOCATION FACTOR
ALABAMA		
	Anniston	.85
	Birmingham	.87
	Decatur	.85
	Dothan	.85
	Huntsville	.86
	Mobile	.88
	Montgomery	.85
ALASKA		
	Anchorage	1.25
	Fairbanks	1.24
	Juneau	1.22
ARIZONA		
	Flagstaff	.86
	Mesa	.85
	Phoenix	.92
	Prescott	.86
	Tucson	.87
ARKANSAS		
	Bentonville	.83
	Fort Smith	.82
	Little Rock	.83
	Jonesboro	.82
	Pine Bluffs	.82
CALIFORNIA		
	Anaheim	1.06
	Bakersfield	1.06
	Eureka	1.06
	Fresno	1.07
	Long Beach	1.08
	Los Angeles	1.14
	Oakland	1.10

STATE		LOCATION FACTOR
CALIFORNIA (CONTINUED)		
	Oxnard	1.06
	Riverside	1.06
	Sacramento	1.07
	San Diego	1.07
	San Francisco	1.19
	San Jose	1.12
	San Mateo	1.12
	Santa Rosa	1.11
	Stockton	1.06
	Woody	1.04
	VanNyys	1.06
COLORADO		
	Colorado Springs	.92
	Denver	.94
	Ft Collins	.92
	Gypsum	.90
	Leadville	.91
	Vail	.90
CONNECTICUT		
	Hartford 1.07	
	New Haven	1.06
	New London	1.06
	Stamford	1.06
D.C. CITY of WASHINGTON BASE CITY		
	Washington D.C.	1.00
DELAWARE		
	Dover .	94
	Newark	.95
	Wilmington	.96
FLORIDA		
	Celebration	.93

#	MECHANICAL SYSTEMS WORK	UNIT	LABOR OR MACHINE HOURS (MC HOURS)
	CONTINUED		
85	Ditto 4" dia	LF	0.05 – 0.07 hours
86	Ditto 6" dia	LF	0.10 – 0.14 hours
87	Ditto 8" dia	LF	0.18 – 0.25 hours
88	Ditto 10" dia	LF	0.30 – 0.35 hours
89	Ditto 12" dia	LF	0.33 – 0.37 hours
90	Labor Erecting OSBL Prefab Piping n/e 30' from grade 2" dia schedule 40	LF	0.05 – 0.07 hours
91	Ditto 4" dia	LF	0.05 – 0.07 hours
92	Ditto 6" dia	LF	0.10 – 0.14 hours
93	Ditto 8" dia	LF	0.18 – 0.25 hours
94	Ditto 10" dia	LF	0.28 – 0.33 hours
95	Ditto 12" dia	LF	0.0 – 0.35 hours
96	X Ray 2" dia pipe	EACH	0.50 – 0.85 hours
97	Ditto 4" dia	EACH	0.75 – 1.00 hours
98	Ditto 6" dia	EACH	1.25 – 1.50 hours
99	Ditto 8" dia	EACH	1.75 – 2.00 hours
100	Ditto 10" dia	EACH	2.00 – 2.50 hours
101	Ditto 12" dia	EACH	2.50 – 3.00 hours
102	Dye Penetration / Magnetic Particle 2" dia	EACH	1.00 – 1.25 hours
103	Ditto 4" dia	EACH	1.25 – 1.75 hours
104	Ditto 6" dia	EACH	2.00 – 2.50 hours
105	Ditto 8" dia	EACH	2.50 – 3.00 hours
106	Ditto 10" dia	EACH	3.00 – 3.50 hours
107	Ditto 12" dia	EACH	3.50 – 4.00 hours
108	Pre Heating Butt Welds 2" dia Sch 40	EACH	0.15 – 0.25 hours
109	Ditto 4" dia	EACH	0.50 – 0.75 hours
110	Ditto 6" dia	EACH	0.75 – 1.00 hours
111	Ditto 8" dia	EACH	1.00 – 1.50 hours
112	Ditto 10" dia	EACH	1.50 – 2.00 hours
113	Valve installation 150 # 2" dia	EACH	0.50 – 0.75 hours
114	Ditto 4" dia	EACH	1.25 – 1.75 hours
115	Ditto 6" dia	EACH	1.75 – 2.25 hours
116	Ditto 8" dia	EACH	2.25 – 2.75 hours
117	Valve installation 300 # 2" dia	EACH	0.80 – 1.15 hours
118	Ditto 4" dia	EACH	1.15 – 1.85 hours
119	Ditto 6" dia	EACH	1.85 – 2.75 hours
120	Ditto 8" dia	EACH	2.75 – 3.25 hours