

TAKE OFF SHEET NO. / DATE 1/18/88 DESCRIPTION	NO. OF UNITS	LENGTH	WIDTH	DEPTH	EXTENSION	EXTENSION	TOTAL QUANTITY	MATERIAL UNIT PRICE	TOTAL MATERIAL COST	LABOR UNIT PRICE	TOTAL LABOR COST	Loader LABOR HRS/UNIT TOTAL LABOR HOURS	
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MACHINE EXCAVATION					CF		1,243	4.56	5,666	2.92	3,630	0.025	31
AREA A	4	46'-4"	10'-6"	6'-4"	12,317		CY						
B		77'-9"	43'-2"	6'-4"	21,246								
					33,563/27 = 1243CY								

HARD DENSE CLAY - ASSUME SWELL FACTOR = 1.33 (88 MEANS P. 379)
 1 CY HYDRAULIC CRAWLER MOUNTED BACKHOE (M238) 7
 PRODUCTION = 75 CY/HR + 15% FOR LOADING TRUCKS } MEANS 238
 + 60% FOR STIFF CLAY } P. 35
 = 75 / (1.15)(1.60) = 40.8 → 40 CY/50 MIN-HR
 USE 12T TRUCKS, HAUL 7.5 LCY (LOOSE CY) / 1.33 = 5.64 BCY (BANK CY)
 HAUL TO WATERFORD FILL - ESTIMATE HAUL, DUMP, RETURN = 13 MIN.
 LOAD TIME = 5.64 BCY / (40 BCY/50 MIN) = 7.0 MIN
 CYCLE TIME = 13 MIN + 7 MIN = 20 MIN

OF TRUCKS @ BALANCE = $\frac{40 \text{ CY/HR}}{\left(\frac{50 \text{ MIN}}{20 \text{ MIN}}\right)(5.64)} = 2.8 \text{ TRUCKS}$

COST OUT 3 TRUCKS - BACKHOE PRODUCTION CONTROLS @ 40 BCY/HR = 0.025 HR/BCY
 TOTAL HR REQ'D = 1243 CY / (40 CY/HR) + 4 HR SETUP = 31 + 4 = 35 HR < 40 HR WEEK
 (MA08.0150) BACKHOE RENTAL = $\frac{\$1875/\text{WK}}{35 \text{ HR}} = \$53.57/\text{HR}$ 7 DAY = 32 HR
 OPERATING COST = 16.25 °° USE WEEK RATE
 (MA08.5250) 3-12T TRUCKS = $3(775/\text{WK})/31 \text{ HR} = 75.00$
 OPERATING COST = 3(12.50) = 37.50
 HOURLY EQUIP COST = \$182.32/HR
 COST/BCY = $(\$182.32/\text{HR}) / (40 \text{ BCY/HR}) = \$4.56/\text{BCY}$

LABOR COST FOR 3 TRUCKS (SEE APPENDIX FOR RATES)
 1 EQUIP OPERATOR = \$28.22/HR
 1 EQUIP OPERATOR OILER = 24.30
 3 TRUCK DRIVERS @ \$21.42 = 64.26
 HOURLY LABOR COST = \$116.78/HR
 COST/BCY = $(\$116.78/\text{HR}) / (40 \text{ BCY/HR}) = 2.92/\text{BCY}$
 4.56 + 2.92 = \$7.48/BCY < \$8.35/HR, USE 3 TRUCKS
 - BACKHOE SETUP = 4 HR @ 53.57 = \$214 & 4 HR @ (28.22 + 24.30) = \$210
 LEA 214 210 4 HR
 SUBTOTAL THIS PAGE = 5880 3840

TAKE OFF SHEET NO. 2 DATE 1/18/88 DESCRIPTION	NO. OF UNITS	LENGTH	WIDTH	DEPTH	EXTENSION	EXTENSION	TOTAL QUANTITY	MATERIAL UNIT PRICE	TOTAL MATERIAL COST	LABOR UNIT PRICE	TOTAL LABOR COST	LABOR HRS/UNIT	TOTAL LABOR HOURS
<u>MACHINE EXCAVATION (CONT.)</u>													
COST OUT 2 TRUCKS - (2 LOADS) (5.64 BCY/LOAD) (50 ^{MIN} /HR) = 28.2 BCY/HR													
TRUCK PRODUCTION = 20 MIN													
TOTAL HR REQ'D = 1243 BCY / (28.2 BCY/HR) + 4 HR = 44.1 + 4 = 48.1 ⇒ 48 HR = 1 WEEK + 1 DAY													
<u>EQUIPMENT COST</u>													
BACKHOE RENTAL = (1,875/WK + 630/DAY) / 48.1 = \$52.08/HR													
OPERATING COST = 16.25													
2 TRUCKS = 2 (775/WK + 260/DAY) / 44.1 = 46.94													
OPERATING COST = 2 (12.50) = 25.00													
HOURLY EQUIP COST \$140.27/HR													
COST/BCY = (\$140.27/HR) / (28.2 BCY/HR) = \$4.97/BCY													
<u>LABOR COST</u>													
1 EQUIP OPERATOR = \$28.22/HR													
1 EQUIP OPERATOR OILER = 24.30													
2 TRUCK DRIVER @ \$21.42 = 42.84													
HOURLY LABOR COST = \$95.36/HR													
COST/BCY = (\$95.36/HR) / (28.2 BCY/HR) = \$3.38/BCY													
2 TRUCKS = 4.97 + 3.38 = \$8.35/BCY > \$7.48/BCY OF 3 TRUCKS													
<u>HAND EXCAVATION</u>													
SHT AA FOOTINGS	12	4'-3"	4'-3"	0'-8"	144.6 CF		12.0 CY	32.50	390	63.54	762	2	24
" WALL	-	120'	3'-0"	0'-6"	180.4								
325 CF / 27 = 12.0 CY													
LOAD 1 TRUCK WITH 2 LABORERS @ 2 (1 CY/2 HR) = 1 CY/HR FOR CREW													
LABOR COST 2 LABORERS @ \$21.06 = \$42.12/HR													
1 TRUCK DRIVER @ \$21.42 = 21.42/HR													
COST/BCY = (\$63.54/HR) / 1 CY/HR = \$63.54/CY													
EQUIP/BCY = 1 TRUCK @ \$260/8 HR = (260) / (8) (1 CY/HR) = \$32.50/CY													
ASSUME OTHER WORK FOR LABORERS & TRUCK													
SUBTOTAL THIS PAGE													
390 762													

016 | Material and Equipment

016 400 Equipment Rental		UNIT	HOURLY OPER. COST.	RENT PER DAY	RENT PER WEEK	RENT PER MONTH	CREW EQUIPMENT COST	
406	3300 6 x 6, 285 H.P., 12 C.Y., rear discharge	Ea.	25	930	2,800	8,375	760	406
	3400 Front discharge	"	25	930	2,800	8,375	760	
408	0010 EARTHWORK EQUIPMENT RENTAL Without operators							408
	0040 Aggregate spreader, push type 8' to 12' wide	Ea.	.80	75	225	675	51.40	
	0050 Augers for truck or trailer mounting, vertical drilling							
	0060 4" to 36" diam., 54 H.P., gas, 10' spindle travel	Ea.	9	425	1,275	3,825	327	
	0070 14' spindle travel		11.90	475	1,425	4,275	380.20	
	0080 Auger, horizontal boring machine, 12" to 36" diameter, 45 H.P.	(13)	5.05	335	1,000	3,000	240.40	
	0090 12" to 48" diameter, 65 H.P.	(17)	7.20	480	1,450	4,325	347.60	
	0100 Backhoe, diesel hydraulic, crawler mounted, 1/2 C.Y. cap.		8.05	395	1,200	3,575	304.40	
	0120 1/2 C.Y. capacity		11.40	365	1,100	3,300	311.20	
	0140 3/4 C.Y. capacity		11.20	445	1,325	4,000	354.60	
	0150 1 C.Y. capacity		16.25	630	1,875	5,650	505	
	0200 1-1/2 C.Y. capacity		19.25	745	2,225	6,700	599	
	0300 2 C.Y. capacity		27	890	2,675	8,000	751	
	0320 2-1/2 C.Y. capacity		33	1,400	4,200	12,600	1,104	
	0340 3-1/2 C.Y. capacity		45	2,250	6,750	20,300	1,710	
	0350 Gradall type, truck mounted, 3 ton @ 15' radius, 1/2 C.Y.		17.75	680	2,025	6,100	547	
	0370 1 C.Y. capacity		21	840	2,525	7,550	673	
	0400 Backhoe-loader, wheel type, 40 to 45 H.P., 1/2 C.Y. capacity		5.30	165	500	1,500	142.40	
	0450 45 H.P. to 60 H.P., 3/4 C.Y. capacity		6.15	195	580	1,750	165.20	
	0460 80 H.P., 1-1/4 C.Y. capacity		9.40	305	910	2,725	257.20	
	0500 Brush chipper, gas engine, 6" cutter head, 35 H.P.		2.95	90	270	810	77.60	
	0550 12" cutter head, 130 H.P.		9.30	135	405	1,225	155.40	
	0600 15" cutter head, 165 H.P.	(17)	11.55	140	420	1,250	176.40	
	0750 Bucket, clamshell, general purpose, 1/2 C.Y.		.60	53	160	475	36.80	
	0800 1/2 C.Y.		.70	61	185	550	42.60	
	0850 3/4 C.Y.		.85	71	215	640	49.80	
	0900 1 C.Y.		.90	76	230	685	53.20	
	0950 1-1/2 C.Y.		1.25	110	325	970	75	
	1000 2 C.Y.		1.45	125	370	1,125	85.60	
	1010 Bucket, dragline, medium duty, 1/2 C.Y.		.25	28	83	250	18.60	
	1020 3/4 C.Y.		.40	39	115	350	26.20	
	1030 1 C.Y.		.40	45	135	405	30.20	
	1040 1-1/2 C.Y.		.60	54	160	485	36.80	
	1050 2 C.Y.		.65	73	220	660	49.20	
	1070 3 C.Y.		1.10	95	285	855	65.80	
	1200 Compactor, roller, 2 drum, 2000 lb., operator walking		1.35	80	240	720	58.80	
	1250 Rammer compactor, gas, 1000 lb. blow		.30	32	96	290	21.60	
	1300 Vibratory plate, gas, 13" plate, 1000 lb. blow		.35	26	78	235	18.40	
	1350 24" plate, 5000 lb. blow		.50	45	135	405	31	
	1370 Curb builder, 14 H.P., gas, single screw		2.75	88	265	800	75	
	1390 Double screw	↓	2.50	105	310	930	82	
	1750 Extractor, piling, see lines 2500 to 2750							
	1800							
	1860 Grader, self-propelled, 25,000 lb.	Ea.	11.15	500	1,500	4,500	389.20	
	1910 30,000 lb.		12.65	620	1,850	5,600	471.20	
	1920 40,000 lb.		13.85	635	1,900	5,725	490.80	
	1930 55,000 lb.		27	1,150	3,425	10,300	901	
	1950 Hammer, pavement demo., hyd., gas, self-prop., 1000 to 1250 lb.		12.55	305	920	2,750	284.40	
	2000 1300 to 1500 lb.	(13)	6.95	340	1,025	3,050	260.60	
	2050 Pile driving hammer, steam or air, 4150 ft.-lb. @ 225 BPM		1.35	175	525	1,575	115.80	
	2100 8750 ft.-lb. @ 145 BPM		2.35	300	905	2,725	199.80	
	2150 15,000 ft.-lb. @ 60 BPM		2.25	310	925	2,775	203	
	2200 24,450 ft.-lb. @ 111 BPM	↓	3.55	450	1,350	4,075	298.40	
	2250 Leads, 15,000 ft.-lb. hammers	L.F.		1	4	12	.80	
	2300 24,450 ft.-lb. hammers and heavier	"	.02	1.33	4	12	.95	
	2350 Diesel type hammer, 22,400 ft.-lb.	Ea.	4.55	380	1,125	3,400	261.40	

016 | Material and Equipment

016 400 Equipment Rental		UNIT	HOURLY OPER. COST.	RENT PER DAY	RENT PER WEEK	RENT PER MONTH	CREW EQUIPMENT COST		
408	2400	41,300 ft.-lb.	Ea.	7.65	610	1,825	5,500	426.20	408
	2450	141,000 ft.-lb.		15	1,175	3,525	10,550	825	
	2500	Vib. elec. hammer/extractor, 200 KW diesel generator, 34 H.P.		7	525	1,575	4,725	371	
	2550	80 H.P.		13.60	830	2,475	7,450	603.80	
	2600	150 H.P.		21	1,250	3,775	11,300	923	
	2700	Extractor, steam or air, 700 ft.-lb.		.95	140	415	1,250	90.60	
	2750	1000 ft.-lb.		1.35	205	620	1,850	134.80	
	3000	Roller, tandem, gas, 3 to 5 ton		3.55	96	288	865	86	
	3050	Diesel, 8 to 12 ton		5.20	190	560	1,690	153.60	
	3100	Towed type, vibratory, gas 12.5 H.P., 2 ton		1.90	95	285	850	72.20	
	3150	Sheepsfoot, double 60" x 60"		2.30	130	390	1,175	96.40	
	3200	Pneumatic tire diesel roller, 12 ton		4.15	250	745	2,225	182.20	
	3250	21 to 25 ton		13.80	335	1,000	3,000	310.40	
	3300	Sheepsfoot roller, self-propelled, 4 wheel, 130 H.P.		15.20	505	1,500	4,525	421.60	
	3320	300 H.P.		22	670	2,000	6,000	576	
	3350	Vibratory steel drum & pneumatic tire, diesel, 18,000 lb.		8.25	325	975	2,925	261	
	3400	29,000 lb.		8.75	395	1,200	3,575	310	
	3450	Scrapers, towed type, 7 to 9 C.Y. capacity		1.50	55	165	495	45	
	3500	12 to 17 C.Y. capacity		3.30	170	510	1,525	128.40	
	3550	Self-propelled, 4 x 4 drive, 2 engine, 14 C.Y. capacity		44	1,425	4,300	12,900	1,212	
	3600	1 engine, 24 C.Y. capacity		50	1,700	5,100	15,300	1,420	
	3650	Self-loading, 11 C.Y. capacity		17.90	600	1,800	5,400	503.20	
	3700	22 C.Y. capacity		24	805	2,425	7,250	677	
	3850	Shovels, see Cranes division 016-460							
	3860	Shovel front attachment, mechanical, ½ C.Y.	17	.65	60	180	540	41.20	
	3870	¾ C.Y.		2.60	95	285	855	77.80	
	3880	1 C.Y.		2.80	145	435	1,300	109.40	
	3890	1-½ C.Y.		3.05	165	490	1,475	122.40	
	3910	3 C.Y.		5.70	305	910	2,725	227.60	
	4110	Tractor, crawler, with bulldozer, torque converter, diesel 75 H.P.		6.55	280	845	2,550	221.40	
	4150	105 H.P.		9.90	450	1,350	4,025	349.20	
	4200	140 H.P.		13.15	595	1,775	5,350	460.20	
	4260	200 H.P.		21	880	2,650	7,925	698	
	4310	300 H.P.		29	865	2,600	7,800	752	
	4360	410 H.P.		33	1,250	3,725	11,100	1,009	
	4380	700 H.P.		69	2,700	8,125	24,400	2,177	
	4400	Loader, crawler, torque conv., diesel, 1-½ C.Y., 80 H.P.		8.90	395	1,200	3,550	311.20	
	4450	1-½ to 1-¾ C.Y., 95 H.P.		11.35	435	1,300	3,925	350.80	
	4510	1-¾ to 2-¼ C.Y., 130 H.P.		13.55	445	1,325	3,975	373.40	
	4530	2-½ to 3-¼ C.Y., 190 H.P.		20	710	2,125	6,375	585	
	4560	4-½ to 5 C.Y., 275 H.P.	17	31	1,050	3,175	9,500	883	
	4610	Tractor loader, wheel, torque conv., 4 x 4, 1 to 1-¼ C.Y., 65 H.P.		6.55	240	720	2,150	196.40	
	4620	1-½ to 1-¾ C.Y., 80 H.P.		8.55	340	1,025	3,050	273.40	
	4650	1-¾ to 2 C.Y., 100 H.P.		9.55	385	1,150	3,450	306.40	
	4710	2-½ to 3-½ C.Y., 130 H.P.		12.05	475	1,425	4,300	381.40	
	4730	3 to 4-½ C.Y., 170 H.P.		15.85	610	1,825	5,500	491.80	
	4760	5-¼ to 5-¾ C.Y., 270 H.P.		28	1,000	3,025	9,050	829	
	4810	7 to 8 C.Y., 375 H.P.		44	1,250	3,725	11,175	1,097	
	4870	12-½ C.Y., 690 H.P.		90	2,275	6,825	20,450	2,085	
	4880	Wheeled, skid steer, 10 C.F., 30 H.P. gas		3.50	83	250	745	78	
	4890	1 C.Y., 78 H.P., diesel		5.20	290	870	2,600	215.60	
	4900	Trencher, chain, boom type, gas, operator walking, 12 H.P.		2.90	57	170	510	57.20	
	4910	Operator riding, 40 H.P.		4.35	130	395	1,200	113.80	
	5000	Wheel type, diesel, 4' deep, 12" wide		10.25	360	1,125	3,400	307	
	5100	Diesel, 6' deep, 20" wide		11	570	1,700	5,125	428	
	5150	Ladder type, diesel, 5' deep, 8" wide		6.90	270	815	2,450	218.20	
	5200	Diesel, 8' deep, 16" wide		12.85	445	1,325	4,000	367.80	
	5250	Truck, dump, tandem, 12 ton payload		12.50	260	775	2,350	255	

022 Earthwork

	022 200 Excav, Backfill, Compact	CREW	DAILY OUTPUT	MAN-HOURS	UNIT	BARE COSTS				TOTAL	
						MAT.	LABOR	EQUIP.	TOTAL	INCL O&P	
234	3500				Ea.	1.60			1.60	1.76	234
	3700				Lb.	1.20			1.20	1.32	
	3900				Ea.	37			37	41	
	4000					21			21	23	
	4200	A-6	2.40	6.670			125		125	190	
	4300	"	1.35	11.850			225		225	335	
	4500	A-8	25,200	.001	S.F.		.02		.02	.03	
	4600	"	15,100	.002	"		.04		.04	.06	
238	0010	EXCAVATING, BULK BANK MEASURE Common earth piled									238
	0020	For loading onto trucks, add								15%	15%
	0050	For mobilization and demobilization, see division 022-274									
	0100	For hauling, see division 022-266									
	0200	B-12A	600	.027	C.Y.		.53	.84	1.37	1.71	
	0250	B-12B	800	.020			.40	.75	1.15	1.41	
	0260	B-12C	1,040	.015			.31	.72	1.03	1.25	
	0300	B-12D	1,620	.010			.20	1.06	1.26	1.45	
	0310	B-12E	240	.067			1.33	1.27	2.60	3.35	
	0360	B-12F	360	.044			.89	.99	1.88	2.39	
	0500	B-12G	160	.100			2	2.32	4.32	5.50	
	0550	B-12H	280	.057			1.14	1.55	2.69	3.38	
	1000	B-12I	280	.057			1.14	1.33	2.47	3.15	
	1050	B-12P	520	.031			.61	1.16	1.77	2.18	
	1200	B-10N	560	.021			.42	.56	.98	1.24	
	1250	B-100	760	.016			.31	.49	.80	1	
	1300	B-10P	1,040	.012			.23	.56	.79	.96	
	1350	B-10Q	1,620	.007			.15	.55	.70	.82	
	1500	B-10R	360	.033			.66	.55	1.21	1.57	
	1550	B-10S	640	.019			.37	.43	.80	1.02	
	1600	B-10T	800	.015			.30	.48	.78	.96	
	1650	B-10U	1,480	.008			.16	.56	.72	.85	
	1800	B-12J	240	.067			1.33	2.28	3.61	4.47	
	1850	B-12K	360	.044			.89	1.87	2.76	3.36	
	3700	B-12L	440	.036			.73	.84	1.57	1.99	
	3750	B-12M	680	.024			.47	.63	1.10	1.38	
	3800	B-12N	960	.017			.33	.51	.84	1.05	
	3850	B-12O	1,280	.013			.25	.54	.79	.96	
	3900	B-12T	2,000	.008			.16	.50	.66	.78	
	4000	For soft soil or sand, deduct								15%	15%
	4100	For heavy soil or stiff clay, add								60%	60%
	4200	For wet excavation with clamshell or dragline, add								100%	100%
	4250	All other equipment, add								50%	50%
	4400	B-12H	160	.100			2	2.71	4.71	5.90	
	4450	"	60	.267			5.30	7.25	12.55	15.80	
242	0010	EXCAVATING, BULK, DOZER Open site									242
	2000	B-10L	460	.026	C.Y.		.52	.48	1	1.29	
	2200		230	.052			1.03	.96	1.99	2.58	
	2400		120	.100			1.98	1.85	3.83	4.95	
	3000	B-10W	700	.017			.34	.50	.84	1.05	
	3200		310	.039			.77	1.13	1.90	2.37	
	3300		140	.086			1.70	2.49	4.19	5.25	
	4000	B-10B	1,400	.009			.17	.50	.67	.80	
	4200		595	.020			.40	1.17	1.57	1.88	
	4400		310	.039			.77	2.25	3.02	3.61	
	5040	B-10M	1,025	.012			.23	.73	.96	1.15	
	5400	"	470	.026			.51	1.60	2.11	2.51	
246	0010	EXCAVATION, BULK, SCRAPERS									246
	0100	B-33F	690	.020	C.Y.		.41	1	1.41	1.70	

For expanded coverage of these items see Means Site Work Cost Data 1988

CIRCLE REFERENCE NUMBERS

17 Excavating Equipment (Div. 022-238)

The table below lists THEORETICAL hourly production in C.Y./hr. bank measure for some typical excavation equipment. Figures assume 50 minute hours, 83% job efficiency, 100% operator efficiency, 90° swing and properly sized hauling

units, which must be modified for adverse digging and loading conditions. Actual production costs in the front of the book average about 50% of the theoretical values listed here.

Equipment	Soil Type	B.C.Y. Weight	% Swell	1 C.Y.	1½ C.Y.	2 C.Y.	2½ C.Y.	3 C.Y.	3½ C.Y.	4 C.Y.
Hydraulic Excavator "Backhoe" 15' deep cut	Moist loam, sandy clay	3400 lb.	40%	85	125	175	220	275	330	380
	Sand and gravel	3100	18	80	120	160	205	260	310	365
	Common earth	2800	30	70	105	150	190	240	280	330
	Clay, hard, dense	3000	33	65	100	130	170	210	255	300
Power Shovel Optimum Cut	Moist loam, sandy clay	3400	40	170 (6.0)	245 (7.0)	295 (7.8)	335 (8.4)	385 (8.8)	435 (9.1)	475 (9.4)
	Sand and gravel	3100	18	165 (6.0)	225 (7.0)	275 (7.8)	325 (8.4)	375 (8.8)	420 (9.1)	460 (9.4)
	Common earth	2800	30	145 (7.8)	200 (9.2)	250 (10.2)	295 (11.2)	335 (12.1)	375 (13.0)	425 (13.8)
	Clay, hard, dense	3000	33	120 (9.0)	175 (10.7)	220 (12.2)	255 (13.3)	300 (14.2)	335 (15.1)	375 (16.0)
Drag line Optimum Cut	Moist loam, sandy clay	3400	40	130 (6.6)	180 (7.4)	220 (8.0)	250 (8.5)	290 (9.0)	325 (9.5)	385 (10.0)
	Sand and gravel	3100	18	130 (6.6)	175 (7.4)	210 (8.0)	245 (8.5)	280 (9.0)	315 (9.5)	375 (10.0)
	Common earth	2800	30	110 (8.0)	160 (9.0)	190 (9.9)	220 (10.5)	250 (11.0)	280 (11.5)	310 (12.0)
	Clay, hard, dense	3000	33	90 (9.3)	130 (10.7)	160 (11.8)	190 (12.3)	225 (12.8)	250 (13.3)	280 (12.0)
Loading Tractors	Moist loam, sandy clay	3400	40	Wheel Loaders				Track Loaders		
				3 C.Y.	4 C.Y.	6 C.Y.	8 C.Y.	2½ C.Y.	3 C.Y.	4 C.Y.
	Sand and gravel	3100	18	260	340	510	690	135	180	250
	Common earth	2800	30	245	320	480	650	130	170	235
	Clay, hard, dense	3000	33	230	300	460	620	120	155	220
	Rock, well blasted	4000	50	200	270	415	560	110	145	200
					180	245	380	520	100	130

18 Compacting Backfill (Div. 022-222)

Compaction of fill in embankments, around structures, in trenches, and under slabs is important to control settlement. Factors affecting compaction are:

1. Soil gradation
2. Moisture content
3. Equipment used
4. Depth of fill per lift
5. Density required

The costs for testing and soil analyses are listed in Division 014-108. Also, see Division 022 for further backfill, borrow, and compaction costs.

Example:
Compact granular fill around a building foundation using a 21" wide x 24" vibratory plate in 8" lifts. Operator moves at 50 FPM working a 50 minute hour to develop 95% Modified Proctor Density with 4 passes.

Production Rate:

$$\frac{1.75' \text{ plate width} \times 50 \text{ F.P.M.} \times 50 \text{ min./hr.} \times .67' \text{ lift}}{27 \text{ C.F. per C.Y.}} = 108.5 \text{ C.Y./hr.}$$

Production Rate for 4 Passes:

$$108.5 \text{ C.Y.} = 27 \text{ C.Y./hr.} \times 8 \text{ hrs.} = 216 \text{ C.Y./day}$$
 4 passes

Compacting 216 C.Y. with 21" Wide Vibratory Plate	M.H./Day	Hourly Cost	Daily Cost	Unit Price
1 Laborer	8	\$16.55	\$132.40	\$0.61
1 Vibratory Plate Compactor			\$ 31.00	\$0.14
Total for 216 C.Y./day			\$163.40/day	\$0.76/C.Y.