PRINCE OF SONGKLA UNIVERSITY

FACULTY OF ENGINEERING

Midterm Examination: 2nd Semester — Academic Year: 2014

Date: March 18, 2014. — Time: 13.30 – 16.30

Subject: 235-404 Quarry, Dimension stone and Sand Mining — Room: R201

Minimum Penalty for Exam Cheating

Is a fail in the subject plus a 2 semester suspension

ทุจริตในการสอบ โทษขั้นต่ำคือ ปรับตกในรายวิชาที่ทุจริต และพักการเรียน 2 ภาคการศึกษา

Instructions / Information:

- This is an open book exam. All kinds of documents, needed materials, and stationery are allowed.
- Use of pencils is *not* allowed.
- Talking and direct borrowings are strictly prohibited unless conducted through the exam supervisor(s).
- Write your name and student ID number on top of every page.
- Write your answers in the space provided in the answer sheets. If more space is required, you may continue each answer on its opposite blank page.

❖ All notations / symbols appeared on this exam paper have their usual meanings.

❖ The allocated time is 3 hours.

❖ The total number of pages is 20, not including the cover sheet(s). You should verify this before commencing your task.

❖ There are 6 questions. Points allocated for each question differ. The total allotted points is 100.

❖ This exam constitutes 25% of the whole subject total.

Name_____ Student ID._____

Pongsiri Julapong / Wikhanet Damkhong

Part A - Aj. Wikhanet (45 marks)

1. **(10 marks)** What are the different between Thai Limestone originated in Silurian-Ordovician, Permian and Jurassic-Triassic Period? Please describe.

2. **(5 marks)** What kind of drilling machine that suitable to use in developing sequence in quarry?

3. **(5 marks)** Discussing about the factor affecting drilling speed.

4. **(15 marks)** Determine the blasting pattern from given data below,

   A. Type of Rock: Granite (Use swelling = 60% and DRI = 50 only)

   B. Production: 600 lcm. per hours

   C. Average working: 10 hours a day / 20 days a month

   D. Explosive factor: 0.3 – 0.4 kg/bcm. (Strictly)

   E. Blast hole radius: 38 millimeters

5. **(10 marks)** From Question no.4, calculating the number of Top hammer drilling machine. Eq. to TAMROCK HL600 (Let's Efficiency and Availability = 70 and 95% Respectively)

1. "Thingnhong" is a junior engineer. He want to modify the old crushing plant that was designed by "Keng" as show in Fig.1 and Table 1. The detail below describe the objective of him and the new crushing plant is shown in Fig.2. (55 Marks)

   1.1 He want to remove the soil aggregate, (-1/2 + 3/8") and (-1 ½ + 1") crushed rock from old crushing plant.

   1.2 He want to replace Secondary 6-Jaw crusher by Cone Crusher.

   Use your knowledge to help him for determine *the Number of Secondary Cone crusher and the Capacity, describe the product output of each size in TPH and mass balance of new Crushing plant.* (Please use specific data from Cedarapids that was attached in this exam)

Fig. 1 Old crushing plant

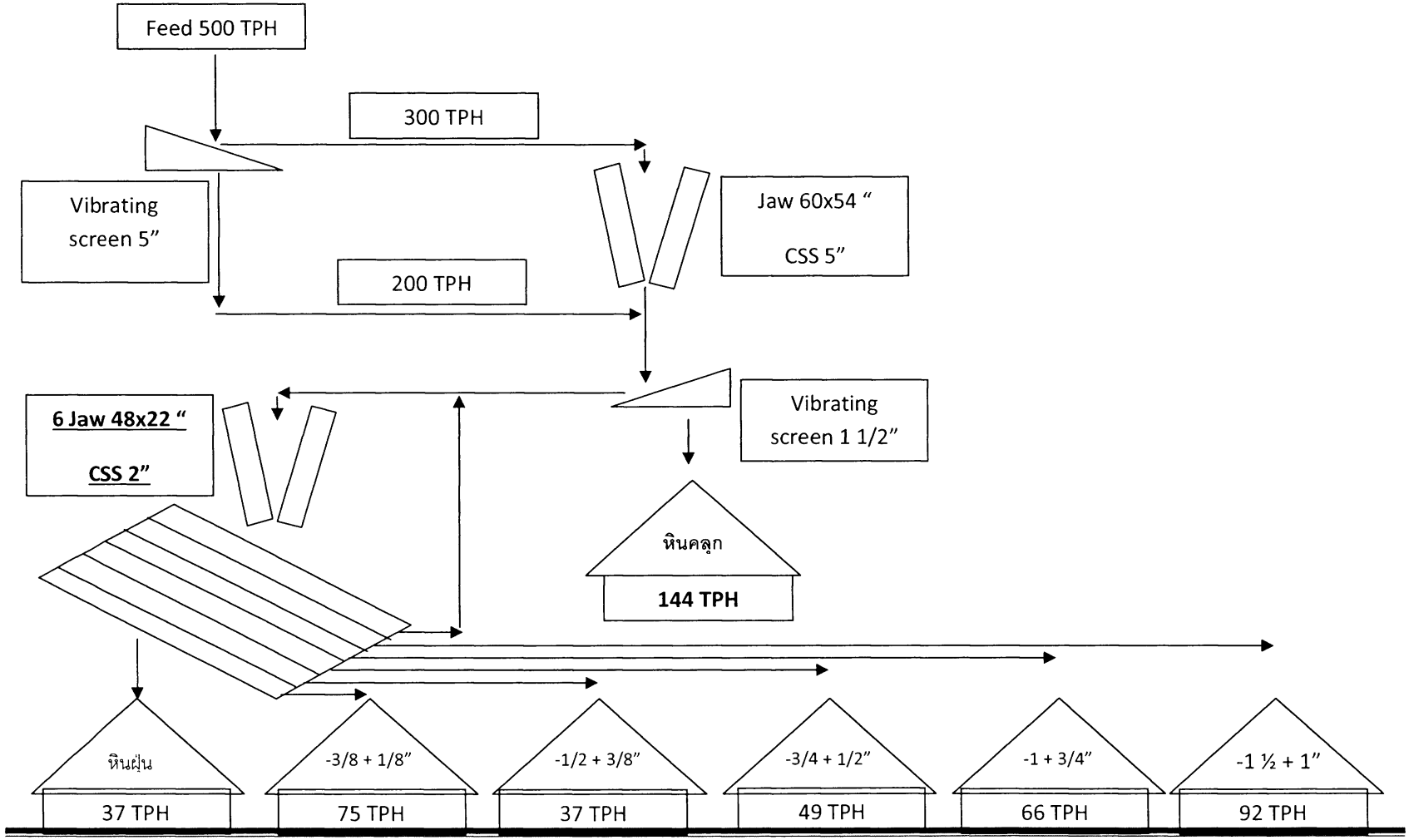
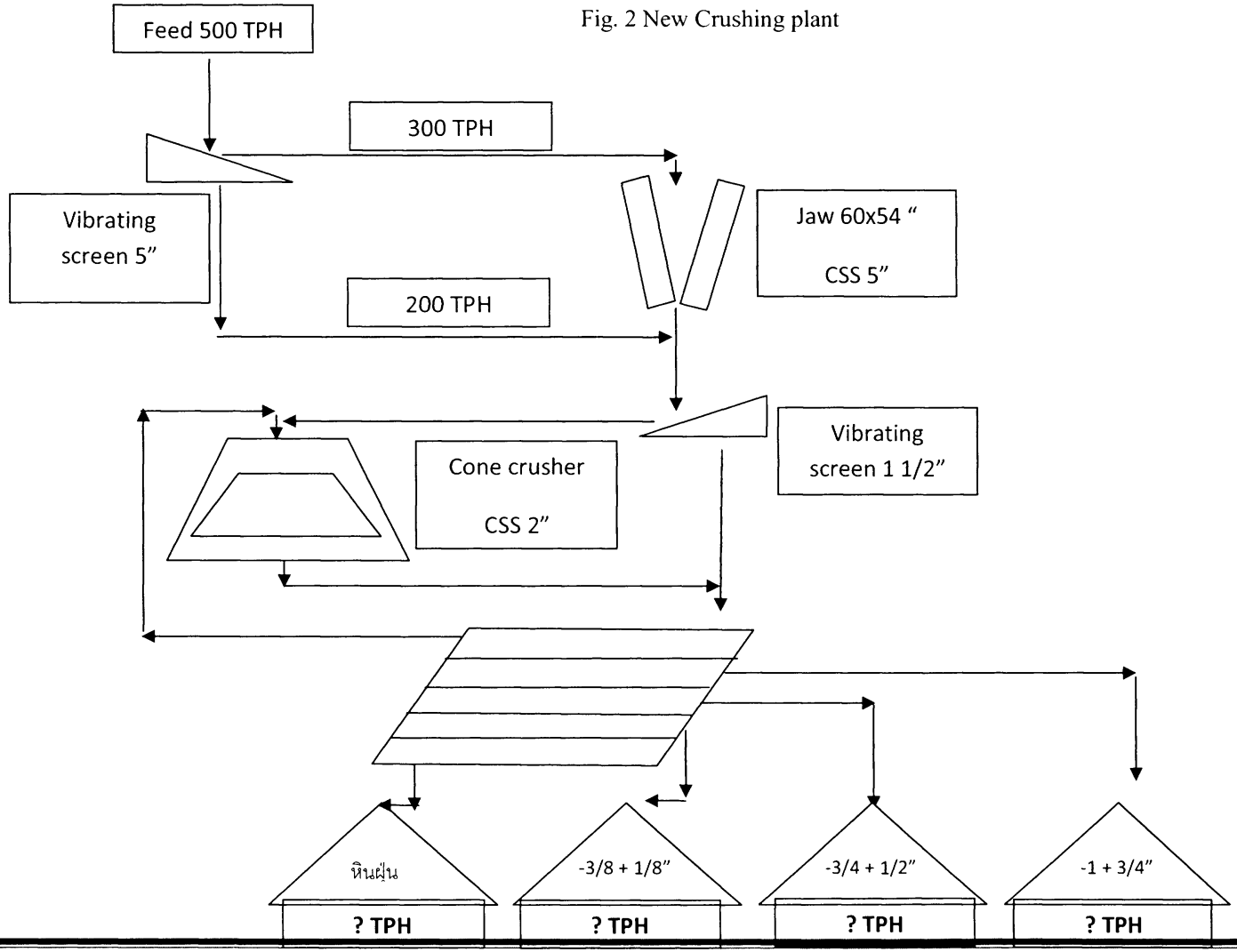


Table 1. Mass Balance of Old crushing plant

size(")	Quarry Product		1st Jaw		หินคลุก	จาก Vib. Screen ส่งมา 2nd Jaw CSS 2" (TPH)	2nd Jaw CSS 2"		Circulating
	% Increment	TPH	% Increment	TPH	TPH		%Increment	TPH	
+5"	60	300.0	36	108.0		108	0.0		
-5" +3.5"	5	25.0	16	48.0		73	0.0		
-3.5" +2.5"	8	40.0	11	33.0		73	9.0	52	52
-2.5" +1.5"	13	65.0	12.5	37.5		103	29.0	167	167
-1.5" +1"	4	20.0	6	18.0	38		16.0	92	
-1" + ¾"	2.4	12.0	4.5	13.5	26		11.5	66	
-3/4"+1/2"	1.6	8.0	3.2	9.6	18		8.5	49	
-1/2"+3/8"	2.5	12.5	2.6	7.8	20		6.5	37	
-3/8"+1/8"	1.5	7.5	5.4	16.2	24		13.1	75	
-1/8"+1/30"	1	5.0	1.9	5.7	11		4.5	26	
-1/30"	1	5.0	0.9	2.7	8		1.9	11	
		500		300.0	144	357	575.0	575	219

Fig. 2 New Crushing plant



Rollercone Classic Approximate Weights - lbs & kg

	36"	45"	54"	60"	66"
STD	16,800 lbs 7,620 kg	25,500 lbs 11,565 kg	42,000 lbs 18,145 kg	53,100 lbs 24,086 kg	65,500 lbs 29,438 kg
FH	17,000 lbs 7,710 kg	26,600 lbs 11,795 kg	42,000 lbs 18,145 kg	53,100 lbs 24,086 kg	65,500 lbs 29,438 kg
HP	75 hp 56 kw	125 hp 93 kw	200 hp 149 kw	250 hp 187 kw	300 hp 224 kw

Weights of same size crushers will vary due to differences in major castings.

Rollercone® Classic Setting & Capacity Charts

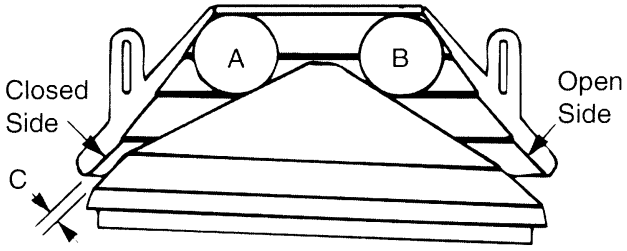
The charts on the following pages show the average capacities in igneous rock (basalt, granites, etc.).

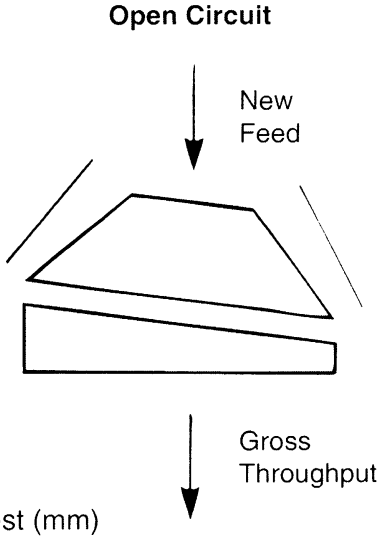
Feed openings are based on new manganese and ideal screening conditions. Due to the wear pattern, it is not possible to maintain a constant feed opening as take-up for wear occurs.

Under some conditions, when setting is too close, "pancakes" will form and the bowl will float. If this condition exists, the setting must be increased until bowl float is eliminated.

Data is offered as a guide only. Crushing characteristics of various rock and crusher operation will affect results. Capacities based on material weight on 100 lbs/ft^3 (1,602 kg/m^3)

Note: Charts are to be used as guides only to proper mantle and liner selection. Cedarapids offers standard (as shown) and other special liner configurations. Consult factory for details.





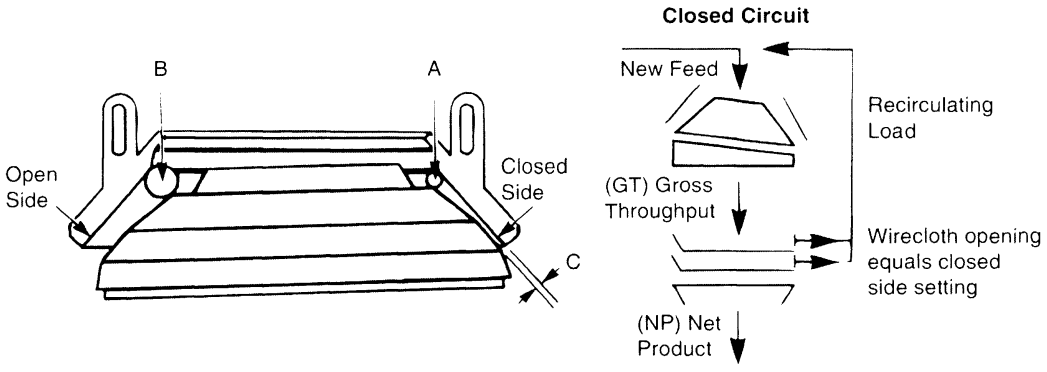
Standard Head Settings in inches & nearest (mm)

Size	Type of Cavity	Maximum		
		A	B	C
36" (914)	Med. Fine	4-5/8" (118)	5-3/8" (137)	1-5/8" (41)
	Coarse	7-1/4" (184)	8" (203)	1-3/4" (44)
45" (1143)	Med. Fine	5-7/8" (149)	6-3/4" (171)	2-3/4" (70)
	Coarse	9-5/8" (244)	10-3/8" (264)	2-7/8" (73)
54" (1372)	Med. Fine	6-5/8" (168)	7-5/8" (194)	2-3/4" (70)
	Medium	7-7/8" (200)	9" (229)	2-3/4" (70)
	Coarse	12-1/2" (316)	13-1/4" (337)	2-7/8" (73)
60" (1524)	Med. Fine	8-7/8" (225)	9-7/8" (251)	3-1/2" (89)
	Medium	10-3/8" (264)	11-1/8" (288)	3-1/2" (89)
	Coarse	12-1/2" (318)	13-1/4" (337)	4" (102)
66" (1676)	Med. Fine	10-15/16" (278)	12-1/8" (308)	3-7/8" (98)
	Medium	12-3/4" (324)	13-15/16" (354)	3-7/8" (98)
	Coarse	14-1/8" (359)	14-7/8" (378)	4-1/8" (105)
Size	**Type of Cavity**	**Minimum***		
		A	**B**	**C**
36" (914)	Med. Fine	3" (76)	3-3/4" (95)	3/8" (10)
	Coarse	5-3/4" (146)	6-1/2" (165)	1/2" (13)
45" (1143)	Med. Fine	3-1/2" (83)	4-1/8" (105)	1/2" (13)
	Coarse	7" (179)	7-3/4" (197)	5/8" (16)
54" (1372)	Med. Fine	3-3/4" (95)	4-7/8" (124)	1/2" (13)
	Medium	5" (127)	6-1/8" (156)	1/2" (13)
	Coarse	10" (254)	10-3/4" (254)	3/4" (19)
60" (1524)	Med. Fine	5-1/2" (140)	6-3/8" (162)	5/8" (16)
	Medium	8-1/4" (210)	9" (229)	3/4" (19)
	Coarse	10-3/4" (273)	11-1/2" (292)	7/8" (22)
66" (1676)	Med. Fine	7" (179)	8-1/8" (206)	3/4" (19)
	Medium	9-1/16" (230)	10-1/4" (260)	1" (25)
	Coarse	12-1/4" (311)	13-1/8" (333)	1-1/2" (38)

*Minimum setting is just above the point where the bowl will float under maximum allowable pressure on the tramp iron relief system. This setting can vary widely depending on nature and condition of material being crushed.

Standard Head Open Circuit Capacities - Gross Throughput TPH is US & (metric)

Size	Type of Cavity	Closed Side Discharge Setting in Inches & nearest (mm)										
		3/8" (9)	7/16" (11)	1/2" (13)	5/8" (16)	3/4" (19)	7/8" (22)	1" (25)	1-1/4" (32)	1-1/2" (38)	1-3/4" (44)	2" (51)
36" (914)	Med Fine Coarse	36-42 (33-38)	38-52 (35-47)	44-60 (40-54)	55-70 (50-63)	65-80 (59-73)	72-85 (65-77)	79-94 (72-82)	85-105 (77-95)	91-110 (83-99)		
45" (1143)	Med Fine Coarse			70-87 (63-79)	87-106 (79-96)	105-126 (95-114)	117-144 (106-131)	125-154 (113-140)	135-170 (122-154)	140-180 (127-163)	145-185 (132-168)	150-188 (136-171)
54" (1524)	Med Fine Medium Coarse					170-225 (154-205)	185-240 (168-218)	200-275 (181-250)	225-310 (204-282)	245-340 (222-309)	260-360 (236-328)	270-380 (245-346)
60" (1524)	Med Fine Medium Coarse					235-290 (214-264)	255-315 (232-287)	290-340 (264-309)	325-390 (296-355)	355-425 (323-387)	375-455 (341-414)	390-475 (355-432)
66" (1676)	Med Fine Medium Coarse					300-345 (273-314)	320-375 (291-341)	350-430 (319-391)	400-460 (364-419)	440-525 (400-478)	470-580 (428-528)	490-580 (446-528)



Fine Head Settings in inches & nearest (mm)

Size	Type of Cavity	Maximum		
		A	B	C
36" (914)	Fine	2-7/8" (73)	3-7/8" (96)	1-3/4" (44)
	Coarse	4-3/4" (121)	5-5/8" (144)	1-3/4" (44)
45" (1143)	Fine	3-1/8" (79)	4-1/4" (108)	2" (51)
	Coarse	5" (127)	6-1/8" (156)	2" (51)
54" (1372)	Fine	2-7/8" (73)	4-1/4" (108)	1-5/8" (41)
	Coarse	4-5/8" (117)	6" (152)	1-1/2" (38)
60" (1524)	Fine	3" (76)	4-1/4" (108)	1-3/4" (44)
	Coarse	5-7/16" (138)	6-1/2" (165)	3" (76)
66" (1676)	Ex. Fine	2-15/16" (75)	4-3/8" (111)	2" (51)
	Fine	3-15/16" (100)	5-3/16" (132)	2" (51)
	Coarse	5-15/16" (151)	7-5/16" (186)	3-3/8" (86)
	Ex. Coarse	7" (179)	8-1/2" (216)	3-3/8" (86)
Size	**Type of Cavity**	**Minimum***		
		A	**B**	**C**
36" (914)	Fine	1-3/8" (35)	2-3/8" (60)	1/4" (6)
	Coarse	3" (76)	3-3/4" (95)	3/8" (10)
45" (1143)	Fine	1-3/8" (35)	2-1/2" (64)	1/4" (6)
	Coarse	3" (76)	4-1/4" (108)	3/8" (10)
54" (1372)	Fine	1-3/8" (35)	2-3/4" (70)	3/8" (10)
	Coarse	3-1/4" (83)	4-3/4" (121)	1/2" (13)
60" (1524)	Fine	1-1/2" (38)	2-3/4" (70)	1/4" (6)
	Coarse	3-7/16" (87)	4-5/8" (117)	1/2" (13)
66" (1676)	Ex. Fine	1" (25)	2-1/2" (64)	3/16" (5)
	Fine	2" (51)	3-5/8" (92)	5/16" (8)
	Coarse	3-3/4" (95)	5-1/4" (133)	1/2" (13)
	Ex. Coarse	5-1/8" (130)	6-5/8" (168)	3/4" (19)

*Minimum setting is just above the point where the bowl will float under maximum allowable pressure on the tramp iron relief system. This setting can vary widely depending on nature and condition of material being crushed.

Fine Head Open Circuit Capacities - Gross Throughput (GT) and Net Product (NP) in US & (metric)

		Closed Side Discharge Setting in Inches & nearest (mm)							
		1/4" (6)	5/16" (8)	3/8" (10)	1/2" (13)	5/8" (16)	3/4" (19)	7/8" (22)	1" (25)
Recirculating Load		18%	18%	20%	24%	25%	26%	28%	29.5%
36" (914)	GT	37-43 (33-39)	49-55 (44-50)	59-65 (54-59)	72-82 (65-75)	87-93 (79-84)	95-101 (86-92)	104-111 (94-101)	113-123 (103-112)
	NP	30-35 (27-32)	40-45 (36-41)	47-52 (43-47)	55-62 (50-56)	65-70 (59-63)	70-75 (63-68)	75-80 (68-73)	80-87 (73-79)
45" (1143)	GT	57-67 (52-61)	67-79 (61-72)	81-94 (73-85)	108-121 (98-110)	127-153 (115-139)	142-162 (129-147)	160-188 (145-171)	170-206 (154-187)
	NP	47-55 (43-50)	55-65 (50-59)	65-75 (59-68)	82-92 (74-83)	95-114 (86-104)	105-120 (95-109)	115-135 (104-122)	120-145 (109-132)
54" (1372)	GT		90-105 (82-96)	110-138 (100-126)	140-195 (127-178)	190-240 (173-218)	215-285 (196-259)	250-300 (228-273)	270-330 (246-300)
	NP		74-86 (67-78)	88-110 (80-100)	106-148 (97-135)	143-180 (130-164)	159-192 (145-175)	180-216 (164-196)	190-233 (173-212)
60" (1524)	GT		115-128 (105-114)	145-179 (132-163)	205-257 (187-234)	252-302 (229-275)	295-340 (269-309)	312-395 (284-360)	345-420 (314-382)
	NP		94-105 (86-96)	116-143 (106-130)	156-178 (142-162)	189-227 (172-207)	218-252 (198-229)	225-284 (205-258)	243-269 (221-245)
66" (1676)	GT		135-173 (123-157)	182-221 (166-201)	262-310 (238-282)	302-357 (275-325)	352-414 (320-377)	407-415 (370-378)	435-522 (396-475)
	NP		111-142 (101-129)	146-177 (133-161)	199-236 (181-215)	227-268 (207-244)	261-306 (238-279)	293-299 (267-272)	307-368 (279-335)

Rollercone Classic Gradation Chart - Percent Passing

Product Size (mm)	Crusher Closed Side Setting					
	5/16" (7.9)	3/8" (9.5)	7/16" (11.1)	1/2" (12.7)	5/8" (15.9)	3/4" (19.1)
4" (102)						
3-1/2" (89)						
3" (76)						
2-3/4" (70)						
2-1/2" (64)						
2-1/4" (57)						
2" (51)						
1-3/4" (44)						
1-1/2" (38)						100
1-1/4" (32)					100	95
1" (25.4)				100	93.5	88
7/8" (22.2)			100	95	88	82
3/4" (19.1)		100	95	89.5	81.5	74
5/8" (15.9)	100	96	91	84	75	65
1/2" (12.7)	98	92	84	76	66	55
3/8" (9.5)	88	80	69	58	48	40.7
5/16" (7.9)	82	70	59	49	41.5	35
1/4" (6.4)	69	57	47	40	35	29.5
4M (4.8)	53	44	37	32	27.8	24.2
5/32" (4.0)	45	38.5	33	29	25	22
8M (2.4)	33	28.5	24.6	21.5	18.6	16.3
10M (1.7)	30.5	26	22.4	19.5	17	14.8
16M (1.0)	22.5	19.2	16.8	14.5	12.5	11
30M (0.55)	15.5	13	11.4	9.8	8.5	7.5
40M (0.4)	13	10.8	9.5	8.1	7.1	6.2
50M (0.3)	10.8	9	7.9	6.7	5.8	5.1
100M (0.15)	7.4	6.1	5.3	4.4	3.9	3.4
200M (0.08)	5	4.1	3.6	3	2.6	2.3

Rollercone Classic Gradation Chart - Percent Passing

Product Size (mm)	Crusher Closed Side Setting					
	7/8" (22.2)	1" (25.4)	1-1/4" (32)	1-1/2" (38)	1-3/4" (44)	2" (51)
4" (102)						100
3-1/2" (89)					100	95
3" (76)				100	95	90
2-3/4" (70)				97.5	92	86
2-1/2" (64)			100	94.5	88	81
2-1/4" (57)			97	91	83	74
2" (51)		100	93.5	86	76	65
1-3/4" (44)	100	95	88	79	66	55
1-1/2" (38)	94.5	89	80	67.5	56	45
1-1/4" (32)	88	81	70	56	46	37.5
1" (25.4)	80	70.5	57.5	45	36	29
7/8" (22.2)	72	61	48	38	30	24.5
3/4" (19.1)	61.5	51	40	31.5	25.5	20.5
5/8" (15.9)	53	44	34	27.5	22	18
1/2" (12.7)	45	37	28.2	23	18.7	15.5
3/8" (9.5)	33.6	27	21.4	17.2	14	11.5
5/16" (7.9)	29.5	24	18.8	15.3	12.5	10.3
1/4" (6.4)	25	20.3	16.2	13	10.5	8.5
4M (4.8)	20.5	17	13.5	10.8	8.6	6.7
5/32" (4.0)	18.7	15.5	12.4	9.8	7.6	5.9
8M (2.4)	14	11.5	9	6.9	5.2	3.8
10M (1.7)	12.7	10.4	8.1	6.2	4.6	3.3
16M (1.0)	9.5	7.7	6	4.3	3.1	2.1
30M (0.55)	6.4	5.2	3.9	2.8	1.8	1.2
40M (0.4)	5.3	4.2	3.2	2.2	1.4	1
50M (0.3)	4.4	3.5	2.6	1.7	1.1	0.8
100M (0.15)	2.9	2.3	1.7	1.1	0.7	0.5
200M (0.08)	2	1.5	1.1	0.7	0.5	0.3