TRUSCOTT BRINE DAM
TRUSCOTT TEXAS

SOIL CEMENT TEST SECTION
AND
EVALUATION OF VIBRATORY ROLLER FOR COMPACTION OF SOIL CEMENT

United States Army
Corps of Engineers
...Serving the Army
...Serving the Nation

U. S. ARMY ENGINEER DISTRICT, TULSA
CORPS OF ENGINEERS
TULSA, OKLAHOMA

BILL ENGEMOEN

D-230

TRUSCOTT BRINE DAM
TRUSCOTT, TEXAS

SOIL CEMENT TEST SECTION AND EVALUATION OF VIBRATORY ROLLER FOR COMPACTION OF SOIL CEMENT

US ARMY ENGINEER DISTRICT, TULSA
CORPS OF ENGINEERS
TULSA, OKLAHOMA

NOV~~EMBER~~ - DEC~~EMBER~~ 1981

TRUSCOTT BRINE DAM
TRUSCOTT, TEXAS
SOIL CEMENT TEST SECTION
NOVEMBER - DECEMBER 1981

TABLE OF CONTENTS

FIGURES

APPENDIXES

TRUSCOTT BRINE DAM
TRUSCOTT, TEXAS
SOIL CEMENT TEST SECTION

1. Purpose. During the period 20 November to 5 December 1981 a soil cement test section was constructed at the toe of the US slope at elevation 1456 between stations 119+65 and 132+00. The primary purpose of the test section was to evaluate detrimental effects, if any, of the vibratory roller on the lower hardened and semihardened lifts of soil cement. Of secondary concern was the observation and evaluation of the proposed equipment and construction procedures.

2. Equipment. The equipment used during this period consisted of the following items:

a. Vibrating Screen. Kolberg, single deck, vibrating scalping screen.

b. Central Mix Plant. Barber-Greene aggregate feeder bins, conveyor belt and pugmill mixing unit. Shop built scale type cement silo with trailer type storage bin.

c. Dump Trucks. Three 15-cubic yard dump trucks.

d. Front-End Loaders. Caterpillar model No. 966.

e. Crawler Tractor with Spreader Box. John Deere crawler tractor model No. 550 with shop-built push type spreader box attached.

f. Vibratory Roller. Bomag model No. 170 D. (See appendix C for manufacturer's Data.)

g. Pneumatic Roller. Hyster model No. C530A. (See appendix C for manufacturer's Data.)

h. Power Broom. Tractor front-mounted power steel broom.

i. Water Truck. Water truck with power spray for curing.

j. Motor Grader. Caterpillar No. 14 grader for miscellaneous cleaning and dressing.

Photographs of the equipment used are attached in appendix A.

3. Materials.

a. Soil. The soil was excavated by the contractor from an alluvial deposit downstream from the project. The test results for gradation are included in appendix B. Although the specifications for the soil cement slope protection require minus 1" material, the material used for this test section was screened through a 1.25" screen. This discrepancy should have negligible effect on the test section, and the screen has since been replaced with a 1" screen.

b. Cement. The cement used in the soil cement mixture was type II Low Alkali secured from Southwest Cement Co., Bushland, Texas.

c. Water. The water used by the contractor was obtained from a local pond immediately west of the town of Truscott. The water supply is an approved source for construction water, and the results of water quality tests from this source are included in appendix B.

4. Mixing Plant Operation. The mixing plant consisted of an aggregate feeder bin, a cement storage bin ("pig"), a cement feeder bin, a conveyor belt, a water storage tank, and pugmill. Cement from the storage bin was blown into the feeder bin where it was fed by auger onto the conveyor belt. Calibration of the feeder bin was accomplished by monitoring scales which measured the total weight of cement in the bin, and noting the change in weight over a period of time. The aggregate feeder bin was charged with a front-end loader, and calibrated by a meter which measured the percentage of production (700 tons per hour = 100%). Accuracy of the meter was checked by running aggregate only through the plant and checking truck scale weights against the metered weight. The aggregate feeder bin fed aggregate onto the conveyor belt at the same point as the cement feeder bin. The conveyor belt charged the pugmill, where the material was mixed and water was added. The material was dropped from the pugmill into dump trucks. See photographs in appendix A.

5. Construction Procedure. The soil cement mixture was transported by truck from the mixing plant to the placement area where it was temporarily stockpiled in a steel skid box. A front-end loader moved the material from the stockpile and placed it in the spreader box. A crawler tractor pushed the spreader box, which was adjusted to the desired loose lift thickness. After placing the loose lift, a vibratory roller was used to compact the material. The vibratory roller had a fixed amplitude of .055 inches and a variable frequency of 1250-1850 vibrations per minute (vpm), which was controlled by the engine throttle. For the purpose of the test the frequency was maintained at 1850 vpm, full throttle. The roller speed and number of passes were adjusted to produce a varying number of vibrations per lineal foot. The vibratory roller was followed by a pneumatic roller, which was used to seal the transverse cracking caused by the vibratory. A power broom was used to finish the lift, and the material was cured by spraying with water. The outside edge of the lift was flattened by rolling a tire of the front-end loader on it, or by using the tires on the motorgrader. After the initial setting, the motorgrader was used to scrape away the friable outside edge and expose the hardened soil cement beneath. See photographs in appendix A.

6. Test Fill Design. The test fill consisted of a 4' thick section, with lifts placed on 6 separate days. Each lift was approximately 1100' long and 7.25' wide. Loose lift thicknesses of 8", 11", and 14" were placed. The loose lift thickness, speed of the vibratory roller, or number of passes of the vibratory roller was varied approximately every 150' of each lift. One 150' section was compacted using only the pneumatic roller, and one section was compacted using the steel wheel of the vibratory roller with the vibrator turned off. The test section was constructed on a 3.5:1 slope. Figure 1 is a cross section of Truscott Brine Dam, and figure 2 is an

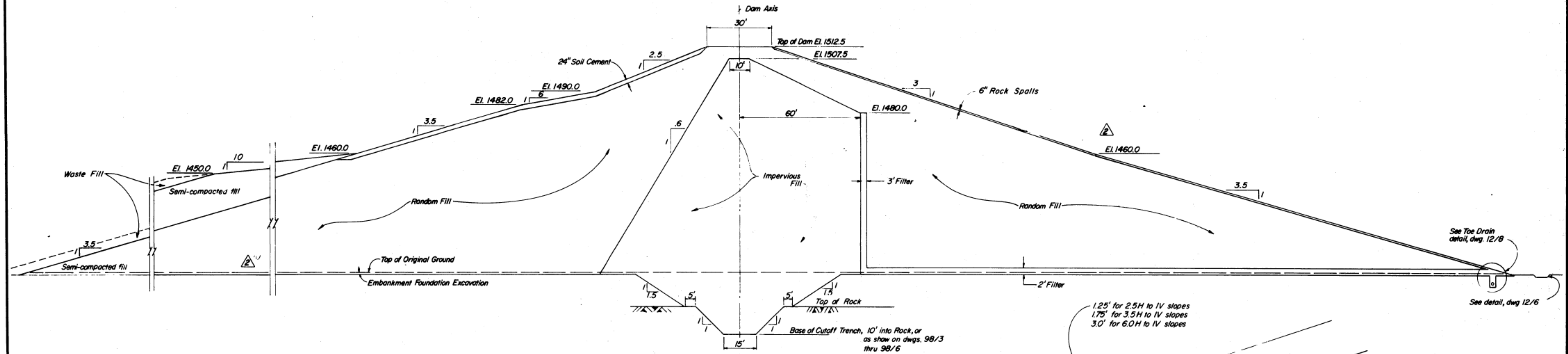
as-built drawing of the test section. Appendix A contains photographs of the test fill.

7. Testing Procedure. Balloon density tests were run to evaluate the compactive effort of the vibratory roller. Three tests were run for each change in a test variable. The results were compared to laboratory Standard Proctor tests, or to Rapid Compaction Method (RCM) tests, and the percentage of lab compaction computed. Results of the density testing were averaged for each section. Compressive strength tests were run for each lift and the 7-day and 28-day strengths were determined. Cement content was determined by titration test daily. Due to an error in the cement content testing procedure, the results were incorrect and are not included in this report. All test results are listed in appendix B.

8. Conclusions. No detrimental effects were noticed due to use of the vibratory roller. After each lift had achieved initial setting (approximately 24 hours), and immediately before placing the subsequent lift, a survey of the hardened lift was made to determine if any crack patterns had developed. No set pattern was noted, and most of the lifts showed no cracking whatsoever. While placing and compacting the overlying lift, approximately 6" of the outside edge of the hardened lift was visible. No cracking was noted in the visible portion of the hardened lift as the vibratory roller passed over. Adequate density was obtained with the vibratory roller, with the steel wheel of the vibratory roller with the vibrator turned off, and with the pneumatic roller alone. However, the pneumatic roller had great difficulty advancing through the soft soil cement material when used as the sole compactor, and was forced to advance with a series of backward and forward motions. The mixing plant performed satisfactorily, and the operator has sufficient control to assure proper proportioning of the materials. The spreader box used for the test fill was not satisfactory. Line and grade were very difficult to control. The contractor's project manager stated that this spreader would be discarded and a new, heavier tow type spreader with better controls would be built prior to spring start-up. A traveling conveyor belt (track-mounted) will be used to charge the spreader when the actual placing operations begin, in lieu of the front-end loader used for the test fill. Adequate density was obtained with loose lift thicknesses of 8", 11", and 14", but the 14" loose lift was difficult to spread and the compacted surface was wavy. Densities obtained with the vibratory roller seemed to vary directly with the total number of vibrations per unit length of fill, regardless of the number of passes (see figure 3).

9. Recommendations. Based on the results of the test fill, it is recommended that the vibratory roller be used to compact the soil cement slope protection at Truscott. To assure adequate coverage of the width of the fill, it is recommended that three passes be made. The vibration frequency should be held constant at 1850 vpm, and the traveling speed of the roller should be no faster than 3.0 ft/sec (2.0 miles per hour). Three passes at this speed should achieve approximately 100 percent lab compaction at optimum moisture (see figure 3). It is recommended that the speed control of the vibratory roller be fixed so that the operator is incapable of exceeding the recommended speed in either forward or reverse positions. Three passes of the pneumatic roller is recommended to seal the transverse cracking caused by the vibratory roller. (See photos, appendix A.) Loose

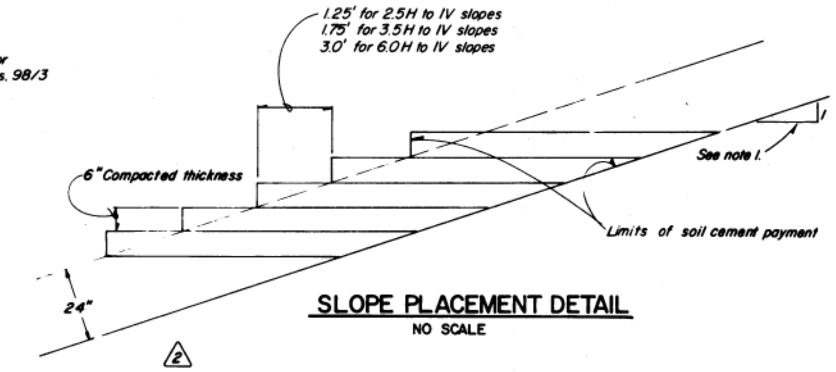
lift thickness of 11" is recommended, and should yield a compacted thickness of 8-1/2" (see figure 4). It is recommended that periodic observation be made of the test fill until such time as the placing operations begin, and that any cracking or distress be reported to the Geotechnical Branch. These recommendations are preliminary and subject to revision pending future observations of the test fill.



TYPICAL EMBANKMENT SECTION

STA 66+00 to STA139+00 △1

SCALE: 1"=20'



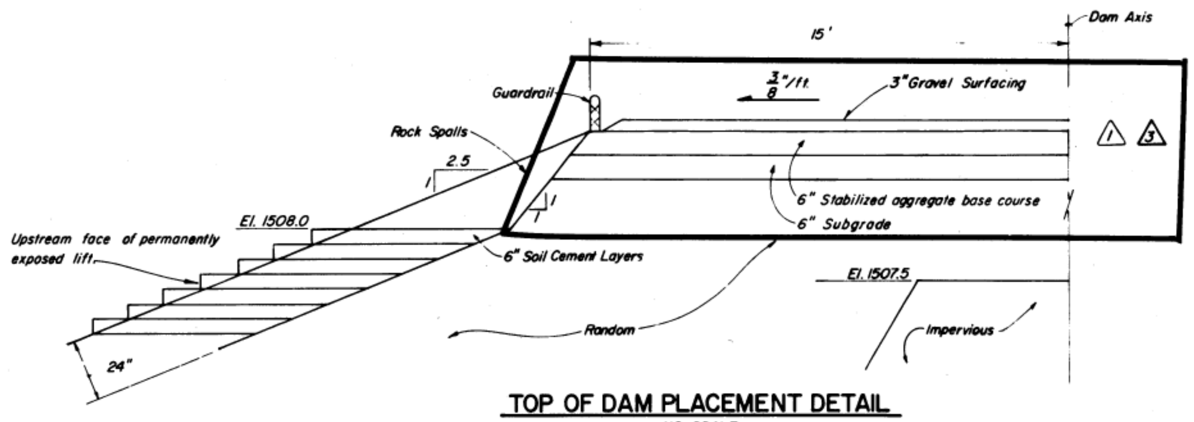
SLOPE PLACEMENT DETAIL

NO SCALE

△2

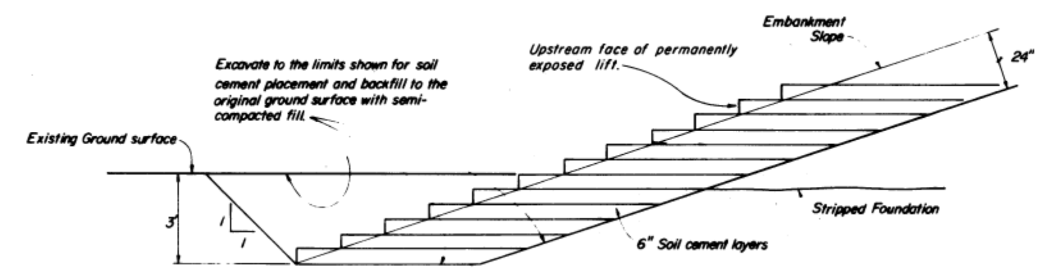
NOTES:

1. Slopes are 2.5H to 1V, 3.5H to 1V, and 6H to 1V.
2. Payment will be for the quantity of soil cement computed within the limits shown and as stated in the specification.



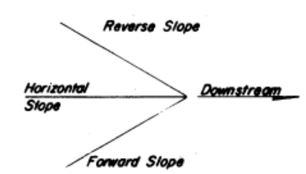
TOP OF DAM PLACEMENT DETAIL

NO SCALE



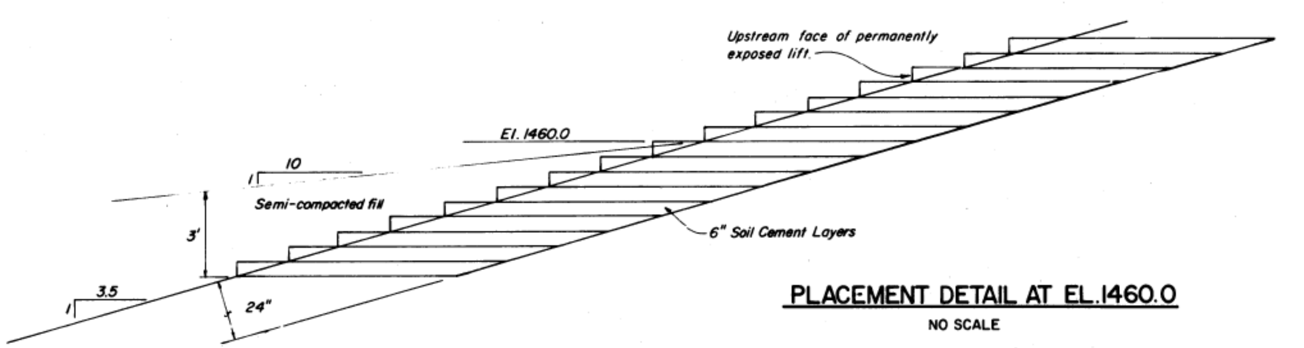
UPSTREAM TOE PLACEMENT DETAIL ABOVE ELEVATION 1460.0

NO SCALE



SLOPE DEFINITION

△2



PLACEMENT DETAIL AT EL.1460.0

NO SCALE

NOTES:

1. Soil cement slope protection for slopes of 2.5H on 1V or steeper may be placed in lifts which are horizontal or with forward slopes no steeper than 10H on 1V. The compacted thickness of each lift will be 6inches.
2. Soil cement slope protection for slopes flatter than 2.5H on 1V shall be placed in lifts which are horizontal or with reverse slopes no steeper than 15H on 1V. Forward sloping lifts will not be permitted in these areas. The compacted thickness of each lift will be 6 inches.
3. The lineal top width of lifts, which vary depending on the embankment slope and slope of the lift, shall be sufficient to achieve a 24" normal thickness.
4. When existing ground elevation exceeds 1460.0 construct base of soil cement as shown above.
5. Forward and reverse slopes are defined as shown above. △2

KEY	DATE	CHANGE	REVISION (INDICATED BY △)	APPR.
3	3-4-80	D.O. #1	Top of Dam Placement Detail 6" lime stabilized soil changed to 6" stabilized aggregate base course on 6" subgrade	
2	8-10-79	Amend #6	Revised slope protection & surfacing details Slope protection detail additions	
1	4-13-79	Amend #1	Horizontal filter thickness revised & "assumed top of rock" changed to "top of rock" on Typical Emb. Section. Top of Dam Placement Detail 3" T.B.S.C. changed to 3" gravel surf'g.	

DEPARTMENT OF THE ARMY
TULSA DISTRICT CORPS OF ENGINEERS
TULSA, OKLAHOMA

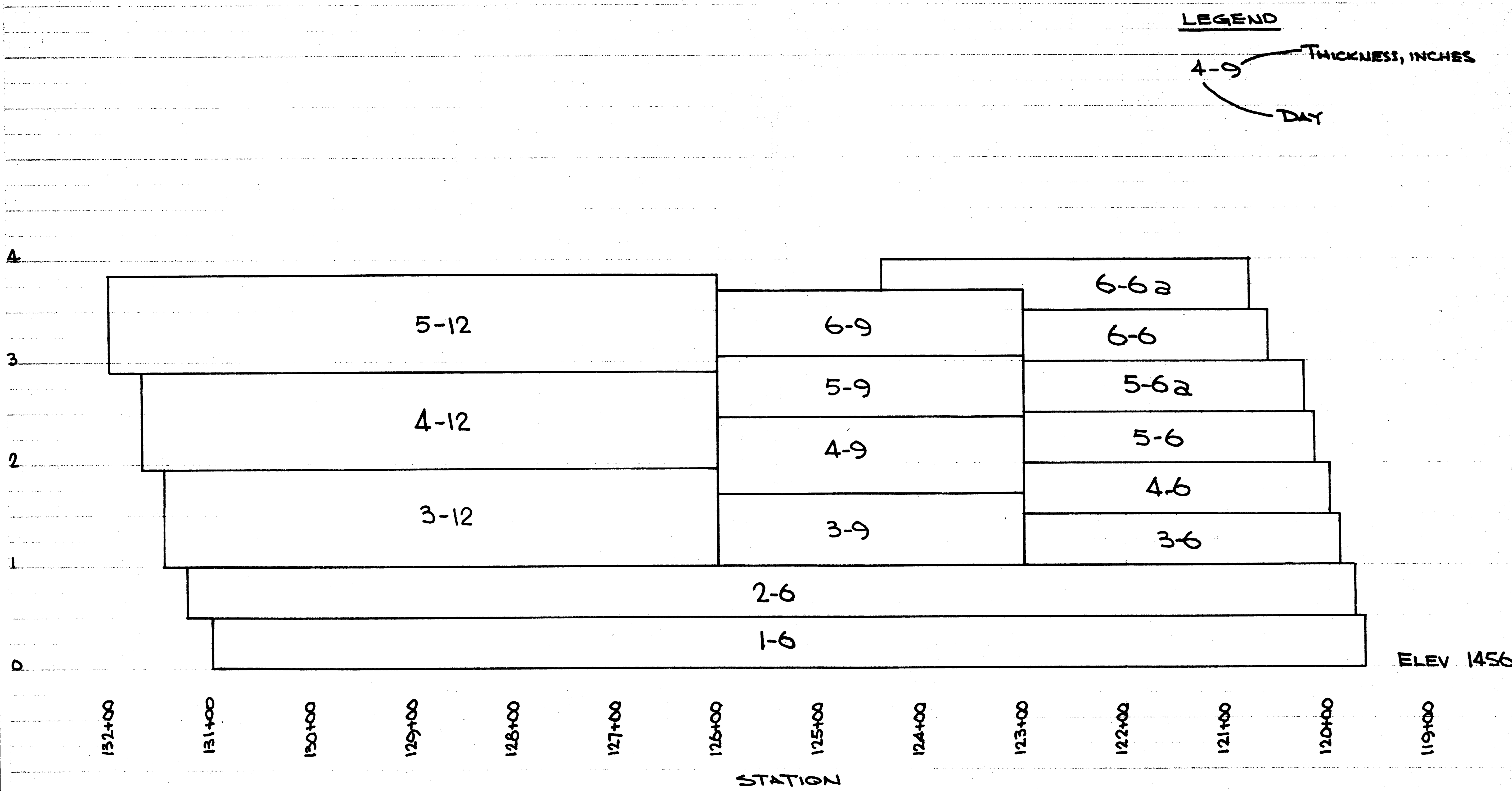
RED RIVER WATERSHED — WICHITA RIVER BASIN, TEXAS

CHLORIDE CONTROL-AREA VIII
TRUSCOTT BRINE LAKE
EMBANKMENT
SOIL CEMENT PLACEMENT DETAILS

DESIGNED BY: Paul W. Erdman
DRAWN BY: [signature]
CHECKED BY: Paul W. Erdman
SUBMITTED: [signature]
CHIEF, SOIL MECH. SECTION
DATE: SEPT., 1978

INVITATION NO. DACW56-79-B-0040
SCALE: AS SHOWN
DRAWING NUMBER ~~BT 008 63-12/10.3~~

FIGURE NO. 1



SCALE: HORIZ 1" = 100'
VERT 1" = 1'

TRUSCOTT BRINE DAM
SOIL CEMENT
TEST SECTION

FIGURE NO. 2

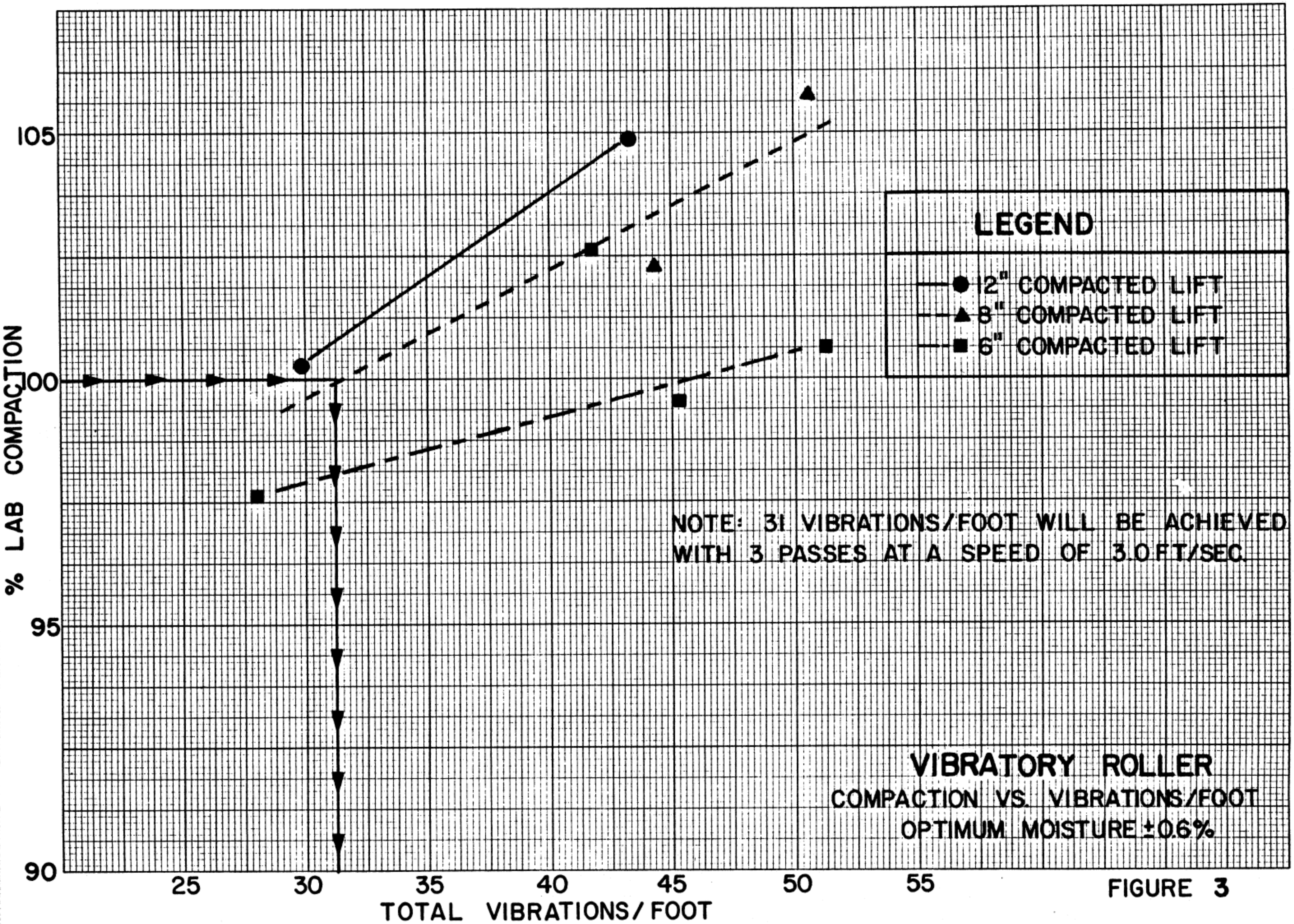

105
100
95
90
% LAB COMPACTION
25
30
35
40
45
50
55
TOTAL VIBRATIONS/ FOOT
LEGEND
12" COMPACTED LIFT
8" COMPACTED LIFT
6" COMPACTED LIFT
NOTE: 31 VIBRATIONS/FOOT WILL BE ACHIEVED WITH 3 PASSES AT A SPEED OF 3.0 FT/SEC.
VIBRATORY ROLLER
COMPACTION VS. VIBRATIONS/FOOT
OPTIMUM MOISTURE ±0.6%

FIGURE 3

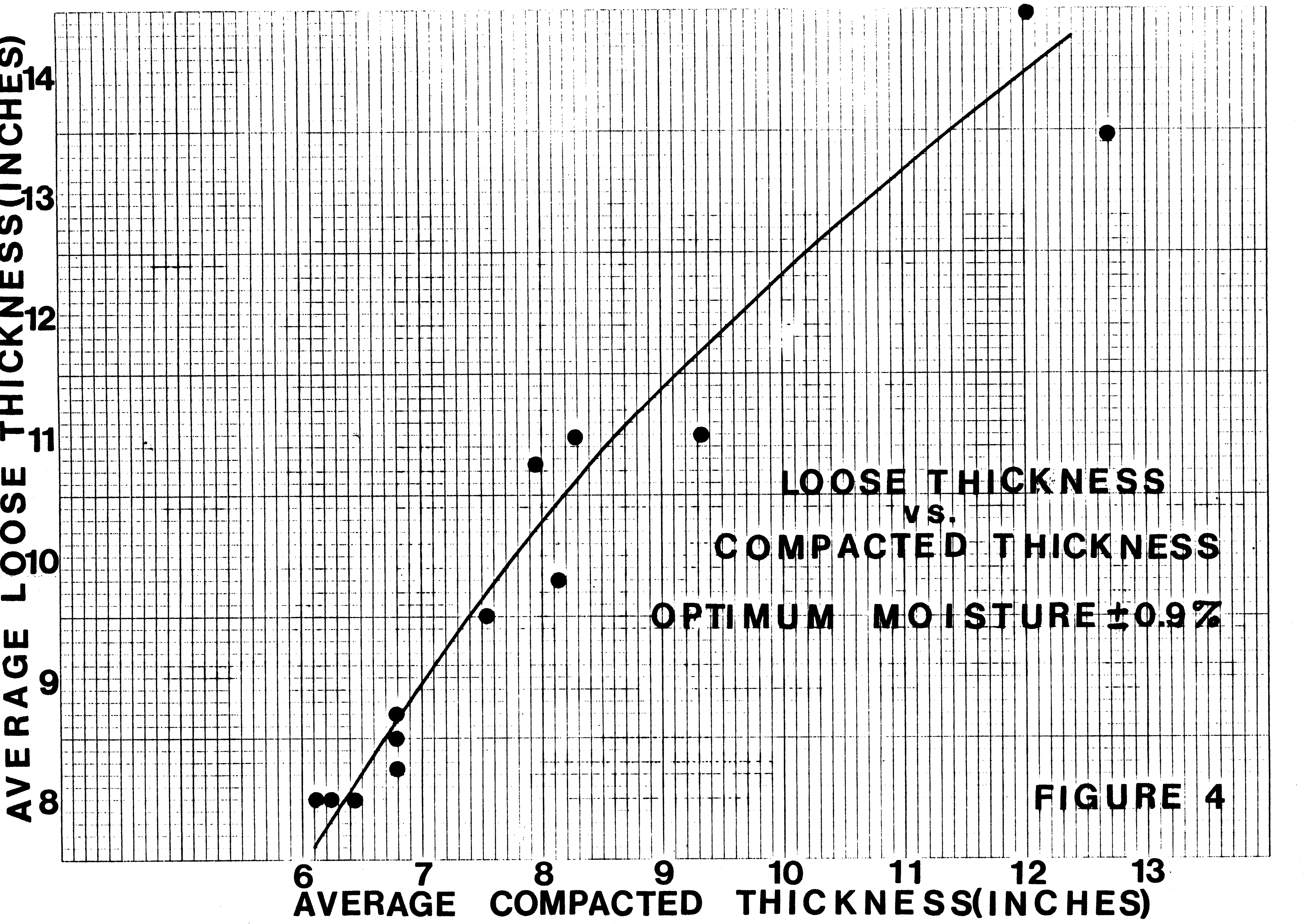
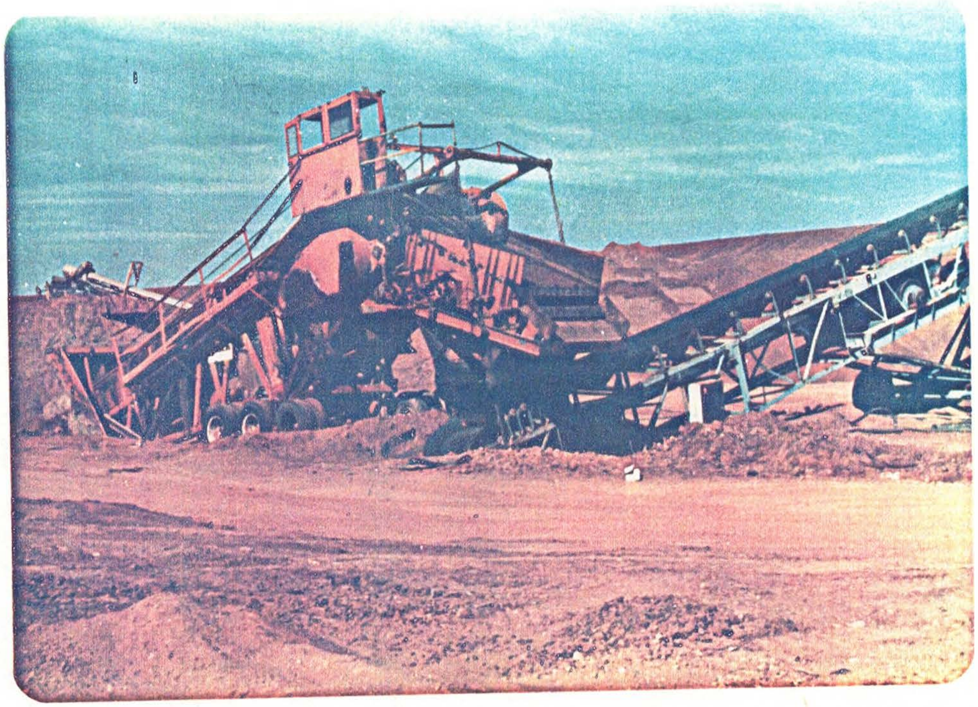

AVERAGE LOOSE THICKNESS (INCHES)
8
9
10
11
12
13
14
6
7
8
9
10
11
12
13
AVERAGE COMPACTED THICKNESS(INCHES)
LOOSE THICKNESS
VS.
COMPACTED THICKNESS
OPTIMUM MOISTURE ±0.9%

FIGURE 4

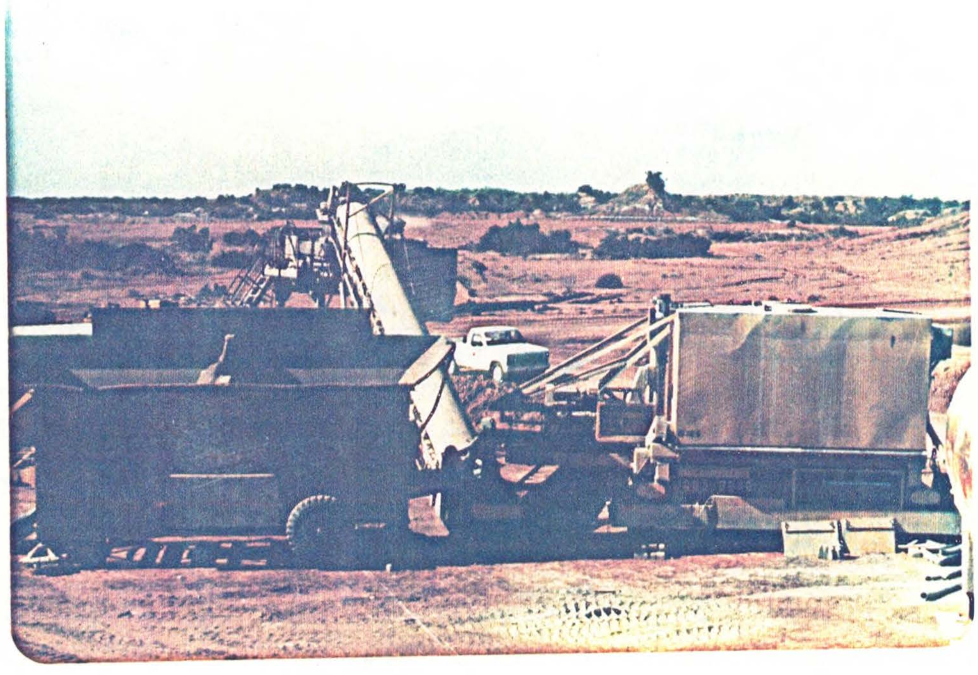
TRUSCOTT BRINE DAM
TRUSCOTT, TEXAS
SOIL CEMENT TEST SECTION
AND
EVALUATION OF VIBRATORY ROLLER FOR
COMPACTION OF SOIL CEMENT

PHOTOGRAPHS

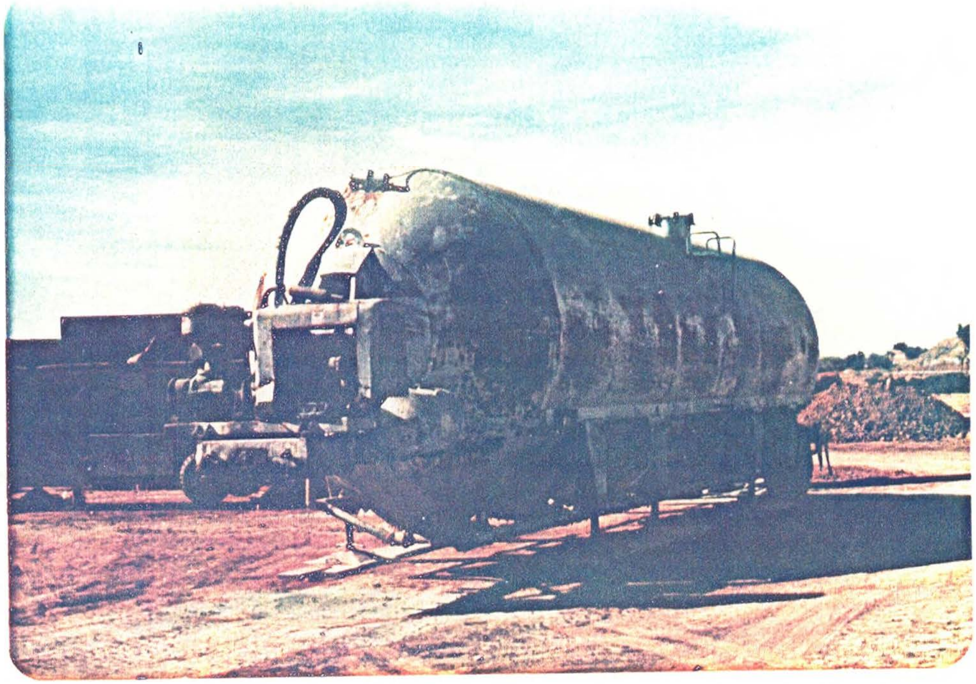
APPENDIX A



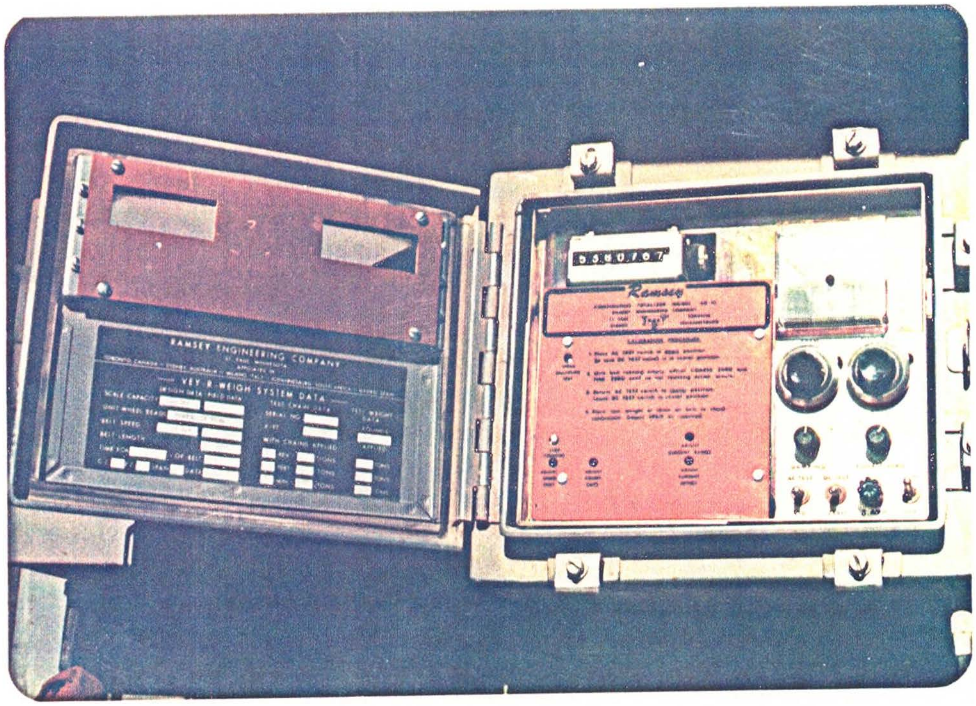
1. Kolberg, single deck, vibrating scalping screen.



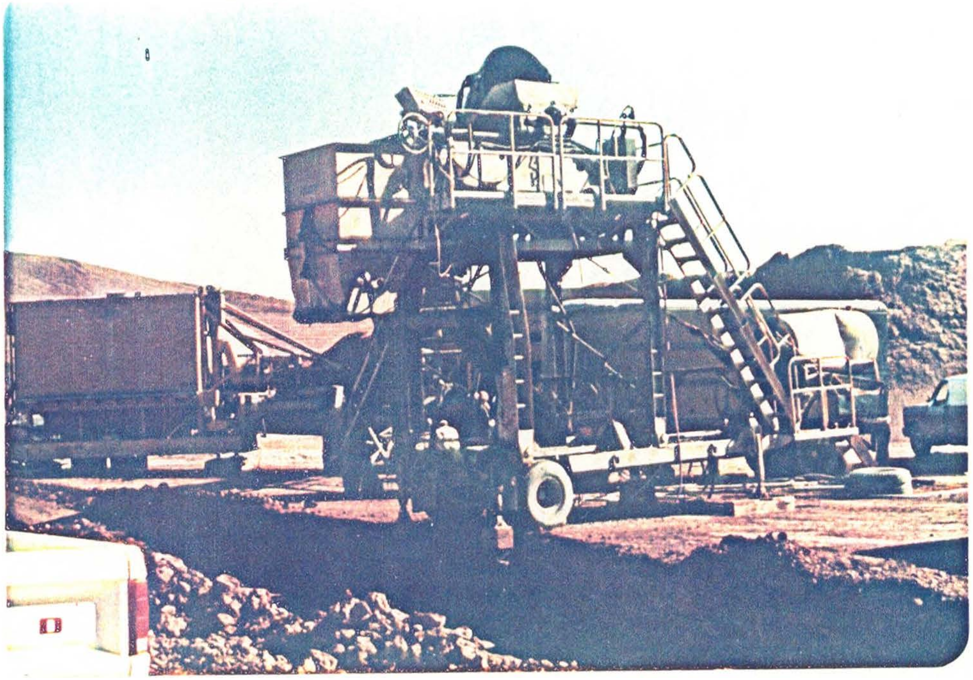
2. Central Mixing Plant, Aggregate feeder bin on left, cement feeder bin on right, conveyor belt in center leading to pugmill on top.



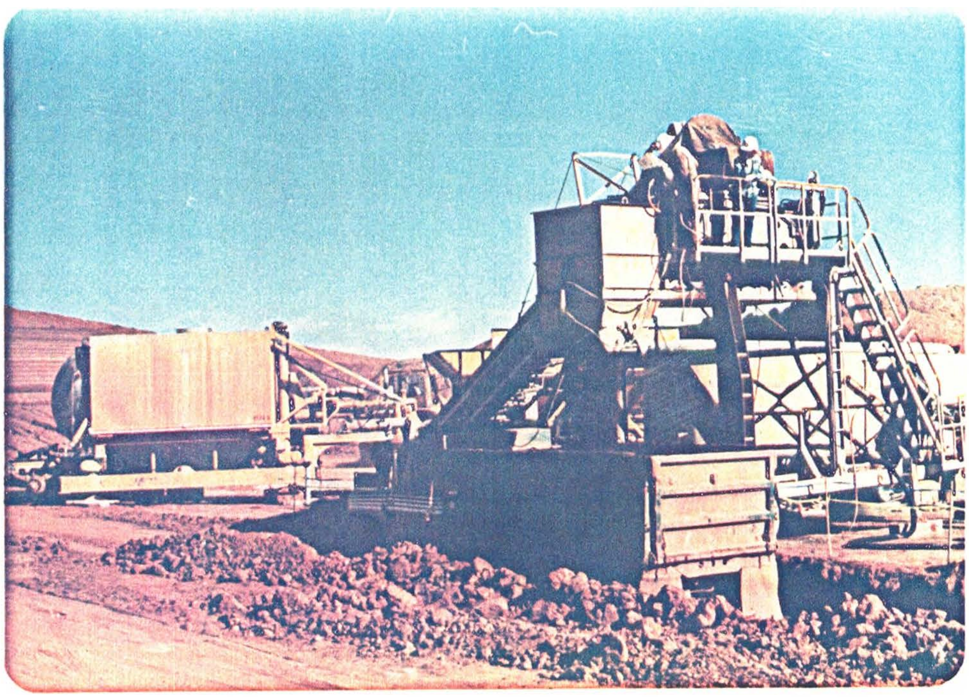
3. Cement storage bin("pig") used to store cement and charge the feeder bin.



4. View of conveyor belt controls. Meter at top left reads total tonnage and guage at top right reads percentage of maximum production.



5. Pugmill. Note water storage tank in right center (with crease).



6. Central Mix Plant in operation, dump truck receiving a load of mixed soil cement.

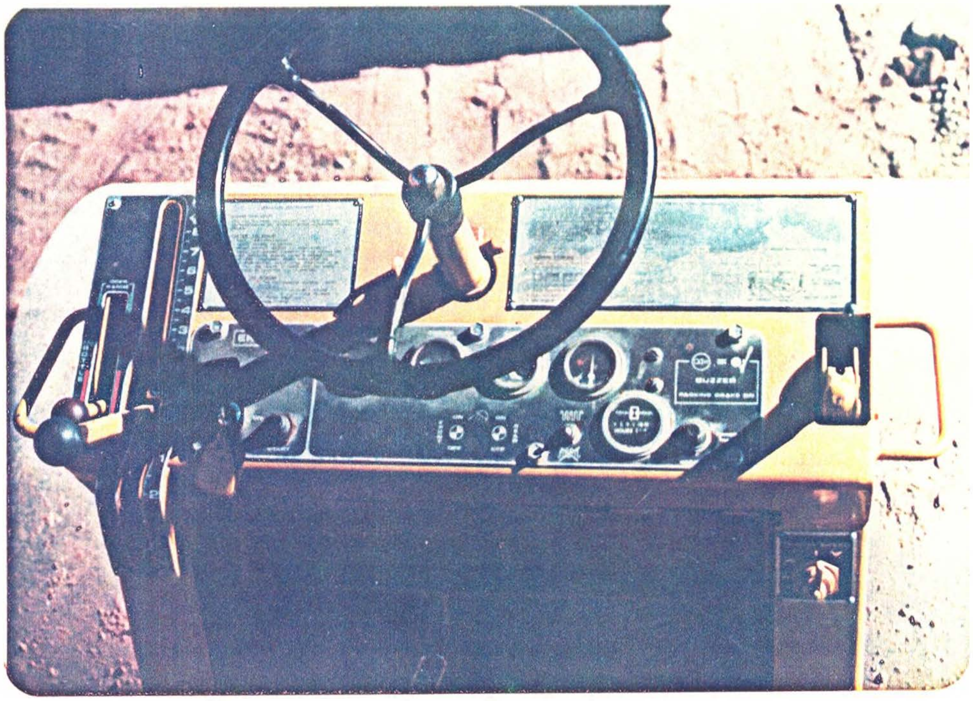
7. Steel skid box used for remporarily stockpiling mixed soil cement.

8. Crawler tractor with shop-built spreader box.

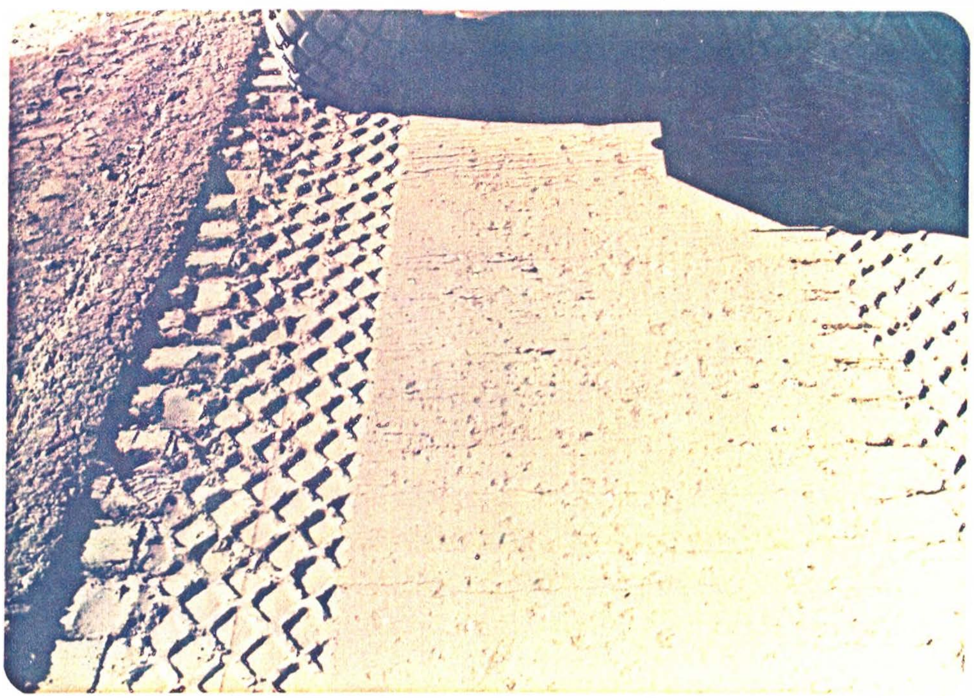
TRUSCOTT BRINE DAM
SOIL CEMENT TEST SECTION
November-December 1981

9. Spreader box being charged by frond-end loader.

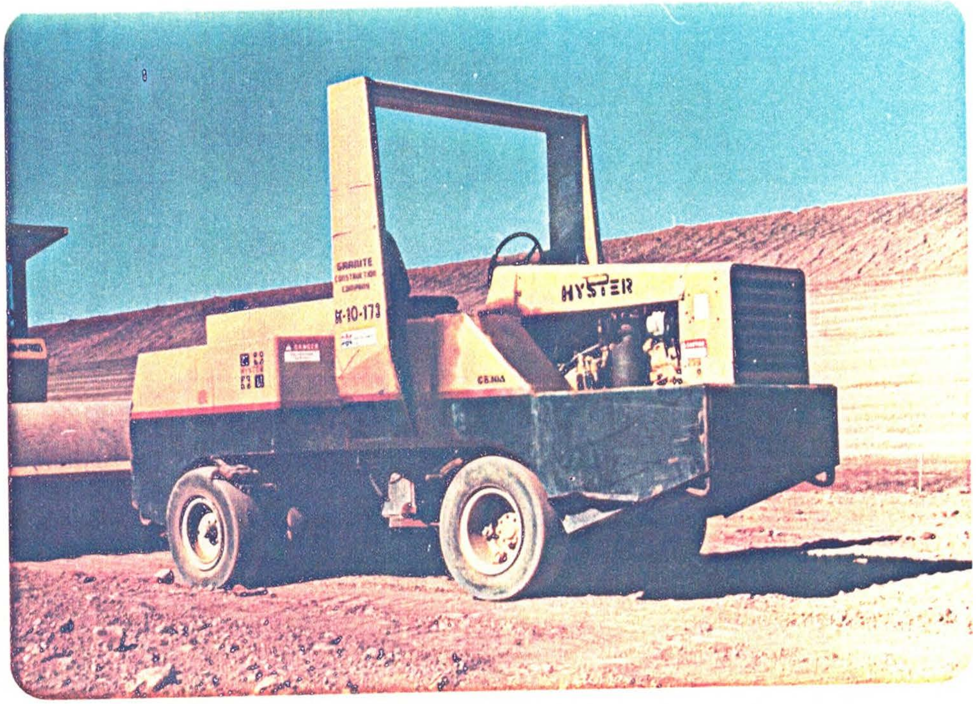
10. Vibratory Roller in operation.



11. Controls of vibratory roller. Vibration is controlled by throttle at far left and forward and backward speed is controlled by the handle immediately to the right of the vibration control.



12. Note transverse cracking caused by vibratory roller.



13. Pneumatic Roller.

14. Pneumatic Roller in operation.

15. Density tests were conducted as soon as possible after compaction.

16. Tractor mounted power broom used to finish the lift.

TRUSCOTT BRINE DAM
TRUSCOTT, TEXAS
SOIL CEMENT TEST SECTION
AND
EVALUATION OF VIBRATORY ROLLER FOR
COMPACTION OF SOIL CEMENT

LABORATORY RESULTS

APPENDIX B

TRUSCOTT BRINE DAM
SOIL CEMENT TEST SECTION
AVERAGE TEST RESULTS

DATE	LIFT NO.	STATION BEGIN	STATION END	VIBRATORY ROLLER NO. PASSES	VIBRATORY ROLLER SPEED	VIBRATORY ROLLER VPF	PNEUMATIC ROLLER NO. PASSES	LOOSE THICKNESS (IN)	COMPACTED THICKNESS (IN)	AVG % COMPACTED
20 Nov 81	1-6	119+65	121+50	3	1.83ft/sec	50.5	3		8.0	105.7
	"	121+50	123+00	5	3.70	41.7	3		6.0	102.6
	"	123+50	124+50	3			3			
	"	124+50	126+00	5	3.07	50.2	3		6.25	96.3
	"	126+50	127+50	3			3		5.5	101.8
	"	127+50	131+00	5			3			
1 Dec 81	2-6	119+75	121+50	3			3	7.25	5.9	95.5
	"	121+50	123+00	5			3	7.0	4.75	102.5
	"	123+00	124+50	3			3	8.0	5.7	100.9
	"	124+50	126+00	5			3	8.0	6.0	100.4
	"	126+00	127+50	0			3	7.75	5.75	98.7
	"	127+50	131+25	0			3	7.7	7.1	98.1
2 Dec 81	3-6	119+90	121+50	3			3	8.0	6.1	104.8
	"	121+50	123+00	5			3	8.5	6.0	106.2
	3-9	123+00	124+50	3			3	11.2	8.6	102.2
	"	124+50	126+00	5			3	12	7.9	103.2
	3-12	126+00	127+50	3			3	13	10.0	104.0
	"	127+50	131+47	5			3		10.7	104.3
3 Dec 81	4-6	120+00	121+50	3			3	8.4	6.75	101.0
	"	121+50	123+00	5	3.88	39.7	3	8.7	6.75	100.0
	4-9	123+00	124+50	3	2.91	31.8	3	9.8	6.7	100.8
	"	124+50	126+00	5	3.29	46.9	3	11.0	6.7	99.6
	4-12	126+00	127+50	3	3.30	28.0	3	13.2	10.0	99.8
	"	127+50	131+69	5	3.65	42.2	3	13.5	10.3	103.5

TRUSCOTT BRINE DAM
SOIL CEMENT TEST SECTION
AVERAGE TEST RESULTS
(CONTINUED)

DATE	LIFT NO.	STATION BEGIN	STATION END	VIBRATORY ROLLER NO. PASSES	VIBRATORY ROLLER SPEED	VIBRATORY ROLLER VPF	PNEUMATIC ROLLER NO. PASSES	LOOSE THICKNESS (IN)	COMPACTED THICKNESS (IN)	AVG % COMPACTED
4 Dec 81	5-6	120+15	121+50	3	3.33	27.8	3	8.0	6.2	97.5
	"	121+50	123+00	5	3.41	45.2	3	8.25	6.75	99.5
	5-9	123+00	124+50	3	3.33	27.8	3	9.8	8.1	99.7
	"	124+50	126+00	5	3.49	44.2	3	10.75	7.9	102.3
	5-12	126+00	128+37	3	3.11	29.7	3	14.5	12.0	100.2
	"	128+37	132+00	5	3.57	43.2	3	13.5	12.7	104.9
	5-6a	120+25	121+50	3			3	9.5	7.5	100.8
	"	121+50	123+00	5	3.01	51.2	3	8.0	6.4	100.6
5 Dec 81	6-6	120+60	121+50	3			3	8.7	6.75	102.2
	"	121+50	123+00	5			3	8.5	6.75	102.3
	6-9	123+00	124+50	3			3	11.0	9.3	100.9
	"	124+50	126+10	5			3	11.0	8.25	102.8
	6-6a	120+78	124+38	3*			0	8.9	6.0	98.8

* Vibrator off, compaction with steel wheel only.

TRUSCOTT BRINE DAM
SOIL CEMENT TEST SECTION
LABORATORY TEST RESULTS

DATE	TEST NO.	STATION	LIFT NO.	FIELD DENSITY	W.C.	LAB DENSITY	W.C.	% COMPACTION	DEPTH (IN)	REMARKS
20 Nov 81	1	121+75	1-6	132.3	10.1	128.9	7.7	102.6	6	
	2	121+10	"	134.8	9.1	"	"	104.6	8	
	3	120+65	"	137.5	8.8	"	"	106.7	8	RCM
	4	126+00	"	124.1	6.8	"	"	96.3	6.25	
	5	126+50	"	127.9	7.1	"	"	99.2	5.5	
	6	127+00	"	134.6	8.1	"	"	104.4	5.5	
1 Dec 81	1	120+50	2-6	120.1	6.9	128.4	7.6	93.5	6.75	
	2	120+10	"	123.6	7.3	"	"	96.2	5.5	
	3	121+00	"	124.1	7.0	"	"	96.7	5.5	
	4	122+25	"	130.1	6.2	"	"	101.3	4.75	RCM
	5	122+75	"	133.2	7.3	"	"	103.7	4.75	
	6	123+25	"	129.9	7.2	"	"	101.2	5	
	7	123+65	"	126.7	6.9	"	"	98.7	5.75	
	8	124+35	"	132.0	7.3	"	"	102.8	6.25	
	9	124+75	"	125.0	7.4	"	"	97.4	6.5	
	10	125+25	"	129.7	7.7	"	"	101.0	5.75	
	11	125+85	"	132.1	7.4	"	"	102.8	5.75	
	12	126+50	"	125.4	8.2	"	"	97.7	5.5	
	13	126+80	"	127.5	7.4	"	"	99.3	5.75	
	14	127+15	"	127.3	8.1	"	"	99.1	6	
	15	127+90	"	123.0	7.2	"	"	95.8	7	
	16	128+37	"	126.1	8.2	"	"	98.2	7.25	
	17	129+00	"	128.7	7.4	"	"	100.2	7	
	18									

TRUSCOTT BRINE DAM
SOIL CEMENT TEST SECTION
LABORATORY TEST RESULTS
(CONTINUED)

DATE	TEST NO.	STATION	LIFT NO.	FIELD DENSITY	W.C.	LAB DENSITY	W.C.	% COMPACTION	DEPTH (IN)	REMARKS
2 Dec 81	1	120+35	3-6	132.7	8.7	127.7	9.3	103.9	6.75	
	2	120+65	"	133.9	8.7	"	"	104.9	6	
	3	121+30	"	134.5	8.8	"	"	105.3	5.5	
	4	121+70	"	136.7	7.9	"	"	107.0	6	
	5	122+40	"	134.5	7.9	"	"	105.3	5.5	
	6	122+60	"	147.3	7.5	"	"	115.3	6.5	
	7	123+20	"	132.5	8.5	"	"	103.8	8.25	RCM
	8	123+70	"	130.5	8.0	"	"	102.2	8.75	
	9	124+20	3-9	133.5	7.9	"	"	104.5	8.75	
	10	124+70	"	133.3	8.5	"	"	104.4	7.75	
	11	125+25	"	132.6	8.3	"	"	103.8	7.25	
	12	125+60	"	129.3	8.2	"	"	101.3	8	
	13	126+25	3-12	137.0	7.2	"	"	107.3	-	
	14	"	"	131.9	8.3	"	"	103.3	10.7	
	15	126+70	"	130.1	8.3	"	"	101.9	-	
	16	"	"	133.2	8.8	"	"	104.3	9.5	
	17	127+30	"	132.4	8.5	"	"	103.7	-	
	18	"	"	132.1	8.7	"	"	103.4	9.75	
	19	128+00	"	129.8	8.9	"	"	102.6	-	
	20	"	"	135.0	9.0	"	"	104.9	10.25	
	21	128+50	"	134.0	7.4	"	"	104.9	-	
	22	"	"	136.3	8.8	"	"	106.7	11	
	23	129+60	"	133.3	8.1	"	"	104.4	-	
	24	"	"	131.6	8.6	"	"	103.1	10.75	

TRUSCOTT BRINE DAM
SOIL CEMENT TEST SECTION
LABORATORY TEST RESULTS
(CONTINUED)

DATE	TEST NO.	STATION	LIFT NO.	FIELD DENSITY	W.C.	LAB DENSITY	W.C.	% COMPACTION	DEPTH (IN)	REMARKS
3 Dec 81	1	120+25	4-6	130.2	6.5	128.7	9.6	101.2	6.75	
	2	120+75	"	125.8	8.4	"	"	97.7	7.25	RCM
	3	121+20	"	133.8	8.2	"	"	104.0	6	
	4	121+60	"	126.2	7.6	"	"	98.1	6.75	
	5	122+10	"	124.8	7.7	"	"	97.0	6.5	
	6	122+55	"	135.1	7.8	"	"	105.0	7	
	7	123+25	4-9	126.2	8.1	"	"	98.1	6.5	
	8	123+75	"	131.7	8.0	"	"	102.3	7	
	9	124+20	"	131.1	8.2	"	"	101.9	6.5	
	10	124+65	"	123.8	7.2	"	"	96.2	7	
	11	125+15	"	131.0	8.1	"	"	98.2	7	
	12	125+50	"	134.3	8.0	"	"	104.4	6	
	13	126+60	4-12	129.1	7.7	"	"	99.7	-	
	14	"	"	123.1	4.1	"	"	95.6	-	
	15	127+00	"	131.1	8.3	"	"	101.9	-	
	16	"	"	126.0	8.1	"	"	97.9	-	
	17	127+30	"	129.2	8.5	"	"	100.4	-	
	18		"	133.2	8.8	"	"	103.5	10	
	19	127+75	"	131.6	7.6	"	"	102.3	-	
	20	"	"	136.8	8.7	"	"	106.3	11.75	
	21	128+30	"	135.6	8.6	"	"	105.4	-	
	22	"	"	127.5	8.6	"	"	99.1	9.5	
	23	128+60	"	135.5	8.3	"	"	105.3	-	
	24	"	"	131.5	8.5	"	"	102.3	9.75	

TRUSCOTT BRINE DAM
SOIL CEMENT TEST SECTION
LABORATORY TEST RESULTS
(CONTINUED)

DATE	TEST NO.	STATION	LIFT NO.	FIELD DENSITY	W.C.	LAB DENSITY	W.C.	% COMPACTION	DEPTH (IN)	REMARKS
4 Dec 81	1	120+50	5-6	126.0	9.9	129.7	11.2	97.1	7	
	2	120+80	"	126.1	9.4	"	"	97.2	5.5	
	3	121+20	"	127.5	10.0	"	"	98.3	6	
	4	121+60	"	128.9	10.2	"	"	99.4	7	
	5	122+00	"	130.0	9.8	"	"	100.2	6.25	
	6	122+50	"	128.3	9.9	"	"	98.9	7	
	7	123+10	5-9	129.4	10.1	"	"	99.8	7.5	
	8	123+50	"	128.7	10.1	"	"	99.2	8.25	
	9	123+75	"	127.9	10.3	"	"	100.0	8.5	
	10	124+60	"	133.4	10.0	"	"	102.9	7.75	
	11	125+15	"	132.7	9.1	"	"	102.3	7.5	
	12	125+50	"	131.9	9.7	"	"	101.7	8.5	RCM
	13	127+45	5-12	128.5	10.2	"	"	99.0	-	
	14	"	"	131.8	9.9	"	"	101.6	10.5	
	15	127+65	"	130.9	9.4	"	"	100.9	-	
	16	"	"	126.5	10.5	"	"	97.5	13	
	17	128+00	"	129.7	10.0	"	"	100.0	0	
	18	"	"	132.3	9.5	"	"	102.0	12.5	
	29	129+00	"	130.6	6.0	"	"	100.7	0	
	20	"	"	133.3	10.0	"	"	102.8	12	
	21	129+45	"	133.5	9.1	"	"	102.9	-	
	22	"	"	130.2	8.9	"	"	100.4	13.5	
	23	130+00	"	133.3	9.6	"	"	102.7	-	
	24	"	"	132.2	9.5	"	"	102.0	12.5	
	25	120+60	5-6a	128.6	9.9	"	"	99.1	7.5	

TRUSCOTT BRINE DAM
SOIL CEMENT TEST SECTION
LABORATORY TEST RESULTS
(CONTINUED)

DATE	TEST NO.	STATION	LIFT NO.	FIELD DENSITY	W.C.	LAB DENSITY	W.C.	% COMPACTION	DEPTH (IN)	REMARKS
4 Dec 81	26	121+00	5-6a	131.4	9.9	129.7	11.2	101.3	7.5	
	27	121+30	"	132.2	9.8	"	"	101.9	7.5	
	28	121+60	"	129.0	10.9	"	"	99.5	6	
	29	122+15	"	133.0	9.5	"	"	102.5	6.25	
	30	122+50	"	129.3	9.8	"	"	99.7	7	
5 Dec 81	1	120+75	6-6	130.7	9.8	128.7	9.6	101.6	7	NO RCM
	2	121+15	"	132.9	8.5	"	"	103.3	6.5	
	3	121+40	"	131.0	9.3	"	"	101.8	6.75	
	4	121+60	"	130.6	8.6	"	"	101.5	6.25	
	5	122+00	"	132.6	9.2	"	"	103.0	6.75	
	6	122+60	"	131.7	9.0	"	"	102.3	7.25	
	7	123+20	6-9	128.7	8.9	"	"	100.0	10.5	
	8	123+50	"	133.2	9.1	"	"	103.5	9	
	9	124+00	"	127.6	9.2	"	"	99.1	8.5	
	10	124+60	"	129.4	11.6	"	"	100.5	8.25	
	11	125+15	"	134.6	8.8	"	"	104.6	8	
	12	125+70	"	132.9	9.0	"	"	103.3	8.5	
	13	121+60	6-6a	-	-	"	"	-	-	NO TEST
	14	122+00	"	127.7	9.0	"	"	99.2	6	
	15	122+50	"	126.7	9.3	"	"	98.4	6	

TRUSCOTT BRINE DAM
SOIL CEMENT TEST SECTION

COMPRESSIVE STRENGTH TEST RESULTS

DATE	Average 7 Day Strength (PSI)	Average 28 Day Strength (PSI)
1 Dec 81	981	2197
2 Dec 81	1130	1941
3 Dec 81	1212	1108
4 Dec 81	864	1185
5 Dec 81	1742	2079
Overall average	1186	1702

Note: 70% of the 28 day strength was obtained in 7 days.

TRUSCOTT BRINE DAM
SOIL CEMENT TEST SECTION
November-December 1981

WATER QUALITY TEST

Sample Date: 21 Nov 81

Test Date: 23 Nov 81

Chloride: 20 PPM

Sulfate: Less than 20 PPM

Tests performed by: Environmental Resources Section, Tulsa District

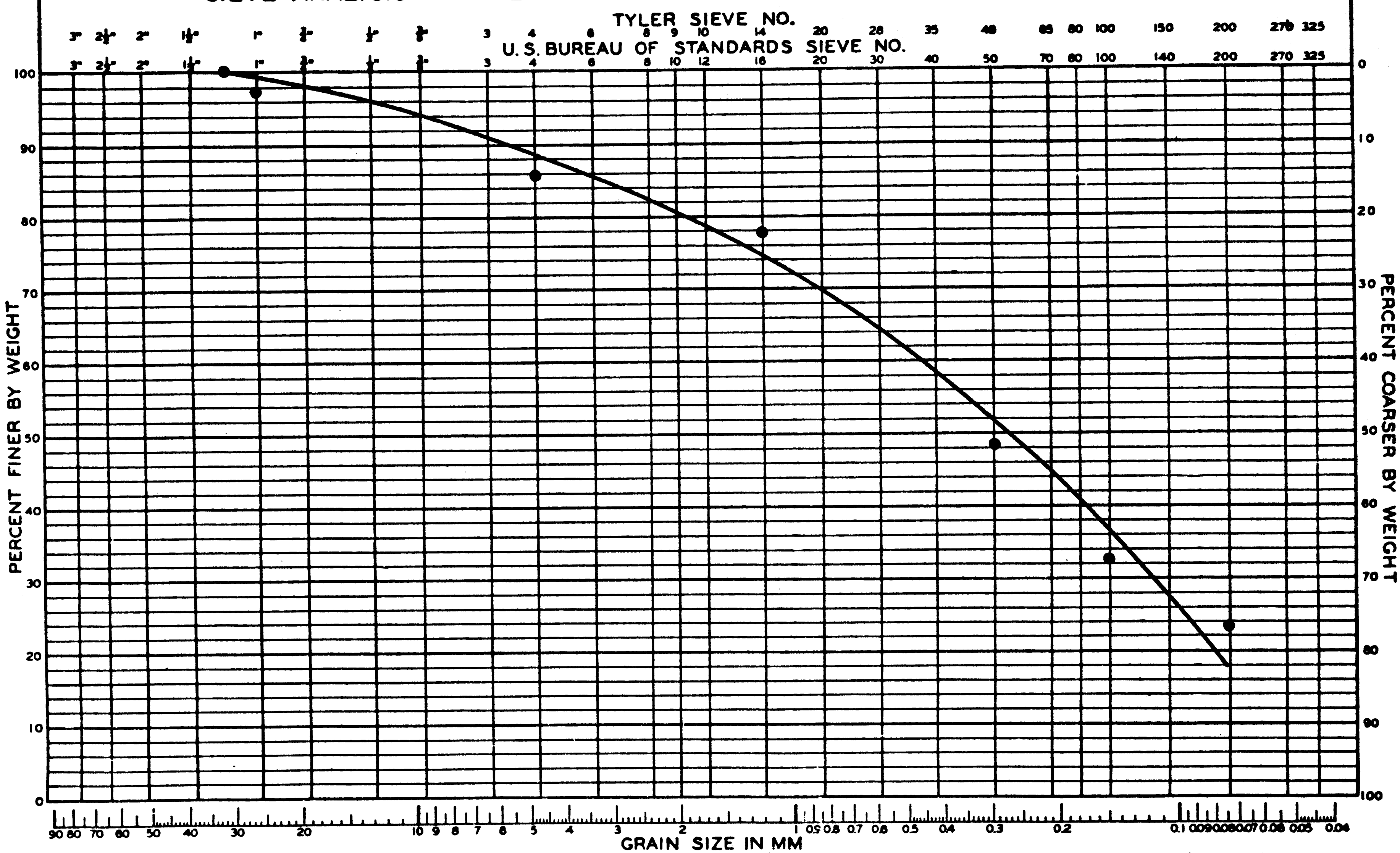
SWP Form 239-J
2 Mar 59

WORK SHEET ONLY

WAR DEPARTMENT

CORPS OF ENGINEERS, U.S. ARMY

SIEVE ANALYSIS – MIXED AGGREGATES AND FLEXIBLE BASE MATERIALS



TYPICAL GRADATION–SOIL FROM TAPP PIT–SCREENED OVER 1-1/4" SCALPING SCREEN

DRY TEST	
WASH TEST	X

SITE TRUSCOTT BRINE DAM

SAMPLE NO. ______ RUNWAY ______

STATION ______ RANGE ______

LABORATORY – U. S. ENGINEER OFFICE, TULSA, OKLAHOMA

TRUSCOTT BRINE DAM
TRUSCOTT, TEXAS
SOIL CEMENT TEST SECTION
AND
EVALUATION OF VIBRATORY ROLLER FOR
COMPACTION OF SOIL CEMENT

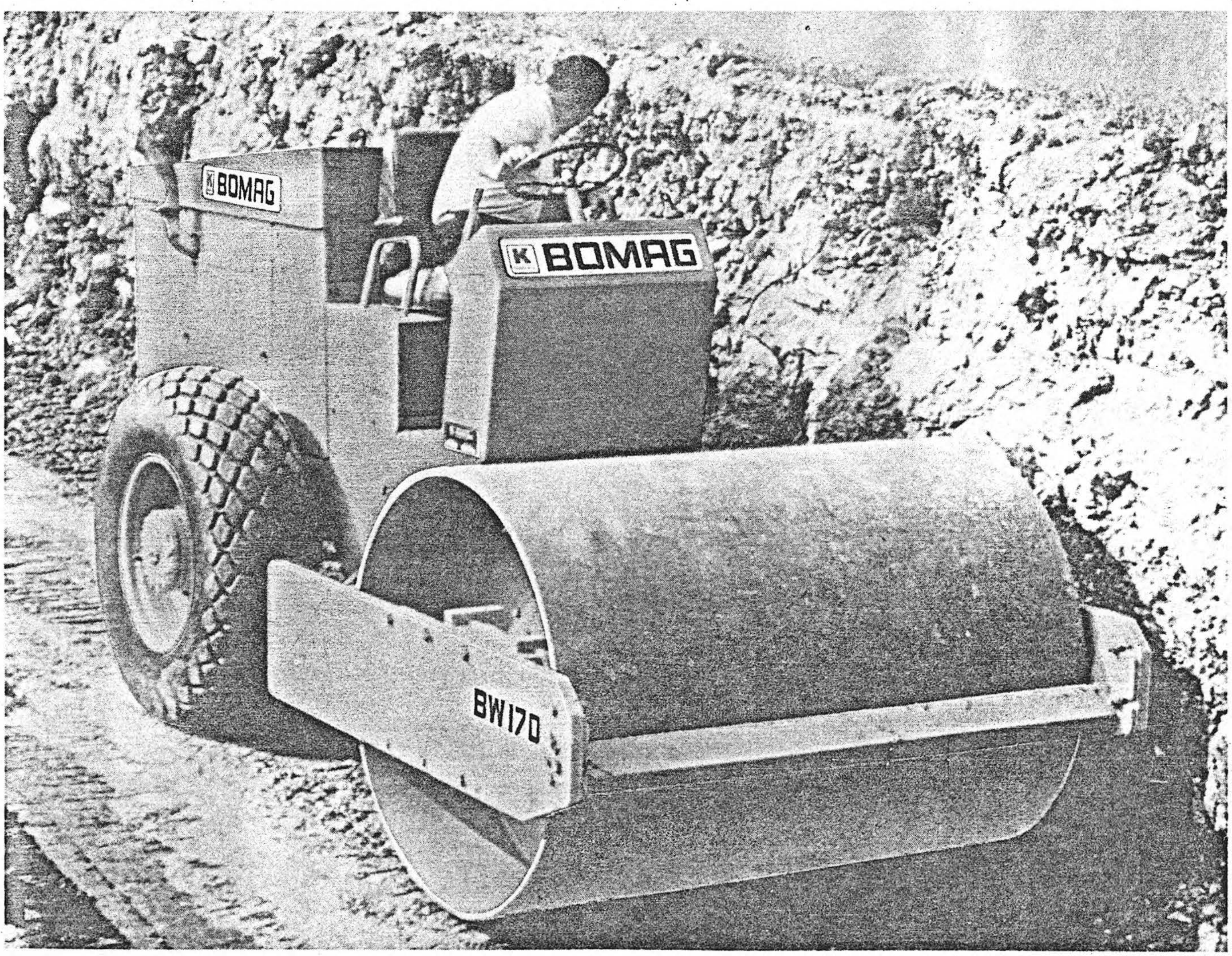
MANUFACTURER'S DATA

APPENDIX C

KOEHRING®

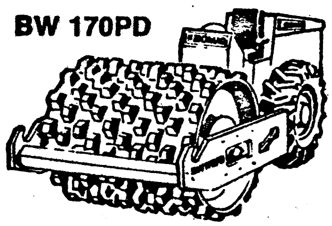
BOMAG

BW 170
vibratory roller

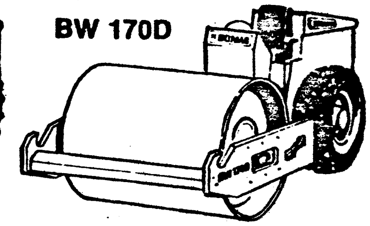


BW 170
vibratory roller

BW 170PD



BW 170D



FEATURES:

OPTIMUM JOB VERSATILITY
- Effective on a wide range of granular and semi-cohesive soils
- Applicable to driveways, shoulders, parking lots, building foundations, pipelines, etc.,—all medium size job requirements
- Works close to obstructions and buildings
- Compacts flush to radii and straight curbs
- Drive wheels track within drum width, tire sidewalls clear obstacles
- Hydrostatic limited slip action unique in BW 170's drive train

HIGH PRODUCTION
- Vibration Frequency infinitely variable 1250-1850 VPM
- Highest VPM in its class allows faster compaction speeds
- Powerful compactive blows produced by high fixed amplitude
- Infinitely variable speeds—with power to match tough job conditions
- Properly sized for applications which make larger machines uneconomical

ENGINEERED FOR LOW COST MAINTENANCE
- Hydrostatically driven planetary wheel ends replace numerous mechanical drive components
- Hydraulic component life lengthened by full flow oil filtration
- Vibratory and drum bearings run in oil bath
- Minimal grease fittings grouped for accessibility
- Clustered hydraulic test ports reduce troubleshooting time

ECONOMICAL, SAFE, SIMPLIFIED OPERATION
- Unique "Z" slot forward-reverse control provides positive neutral selection
- Single lever forward-reverse control provides speed, service braking, and vibratory control on one lever
- Designed for excellent visibility
- Disc-type emergency braking
- Totally enclosed and sound-deadened engine compartment

BW 170D/BW 170PD
- Drum drive for excellent traction under adverse job conditions and higher gradability
- BW 170D applicable to loose, deep lifts of granular soils
- BW 170PD applicable to semi-cohesive and cohesive soils

SPECIFICATIONS: (BW 170)

DIMENSIONS

Operating Weight	11,050 lbs. (5011 kg)
Width (Shipping & Operating)	72½" (1842 mm)
Overall Length	14'8" (4483 mm)
Height	6'9½" (2070 mm)
Drum Diameter	48" (1219 mm)
Drum Width	66" (1676 mm)
Turning Radius (inside)	8'11" (2718 mm)
Wheelbase	7'4" (2235 mm)
Curb Clearance	16" (406 mm)
Side Clearance	3¼" (82.6 mm)
Oscillation	± 12°

ENGINE OPTIONS

GM 3-53	75 hp (SAE) @ 2200 rpm
Deutz F4L912	66 hp (Net) @ 2200 rpm
Air Cleaner	Heavy duty dry type
Electrical System	12 volt
Fuel Tank Capacity	32 gal. (121 l)

DRIVE TRAIN
• Hydrostatic drive with single-lever control • Independent hydrostatic motor planetary wheel end drive to each wheel • Limited slip action thru hydrostatic system • Full flow hydraulic filtration

Gradeability .... Max 64%, Field 32%

SPEEDS

	Forward	Reverse
	0-8 MPH (0-13 km/h)	0-3.6 MPH (0-6 km/h)

BRAKING
Service—Hydrostatic thru drive system
Emergency and Parking—15″ disc brake at each wheel

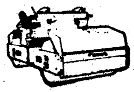
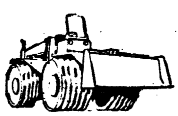
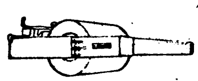
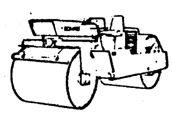
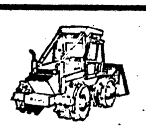
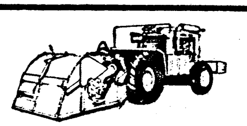
STEERING
Full power steering, center articulated

TIRES
14.9 x 24 6 ply "All Weather"

VIBRATORY COMPACTION DRUM
Hydrostatically driven — automatic and manual control

Weight at Drum	6,055 lbs. (2746 kg)
Dynamic Force	22,500 lbs. (100 kN)
Frequency	1250 to 1850 VPM (20.8 to 30.8 Hz)
Amplitude (nominal)	0.055" (1.4 mm)

INSTRUMENTATION
• Engine Temperature, Battery Charge, Hydraulic Oil Temperature, and Engine Oil Pressure Indicators • Automatic Vibration Control • Horn • Engine Hour Meter • Tool Box.


KOEHRING®
COMPACTION AND GENERAL EQUIPMENT GROUP
SPRINGFIELD, OHIO 45501
MISSISSAUGA, ONTARIO, CANADA L4W 1B7

CGE-2657-4

Litho in U.S.A.

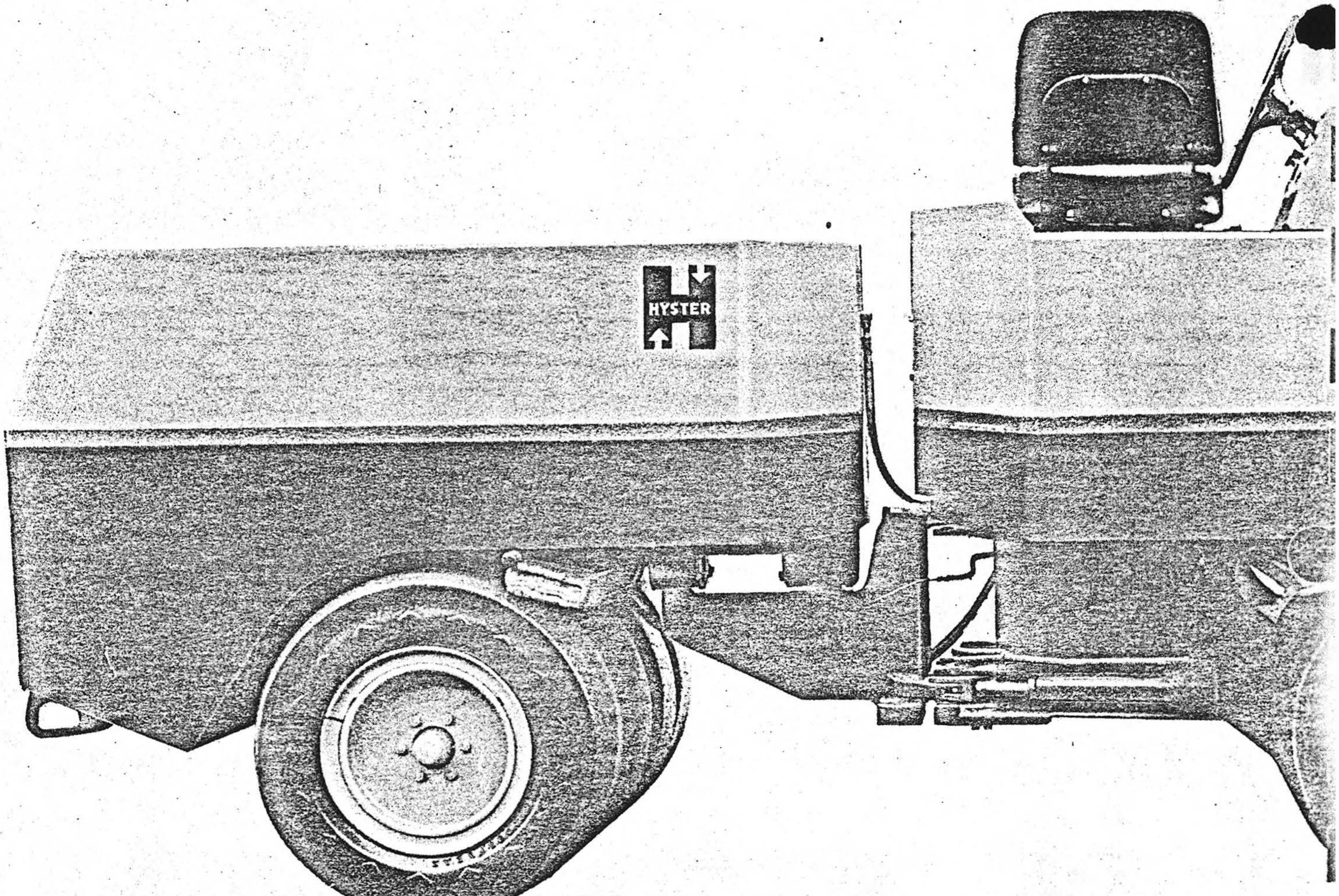
HYSTER

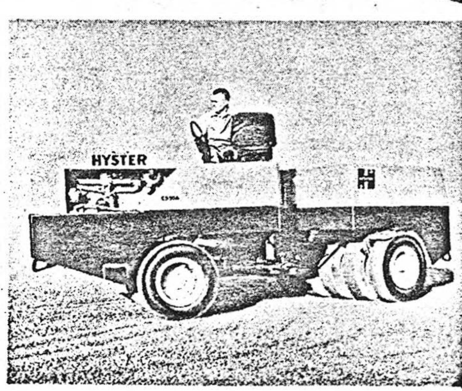
C530A PNEUMATIC COMPACTER

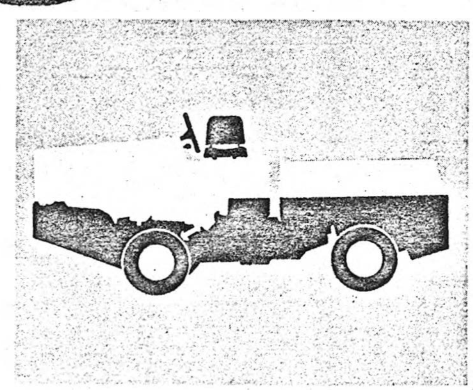
HYSTER COMPANY • CONSTRUCTION EQUIPMENT OPERATIONS

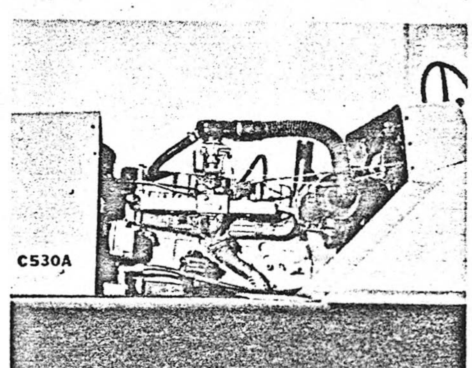
HYSTER C530A PNEUMATIC COMPACTER

FOR FINAL BASE AND ASPHALT COMPACTION







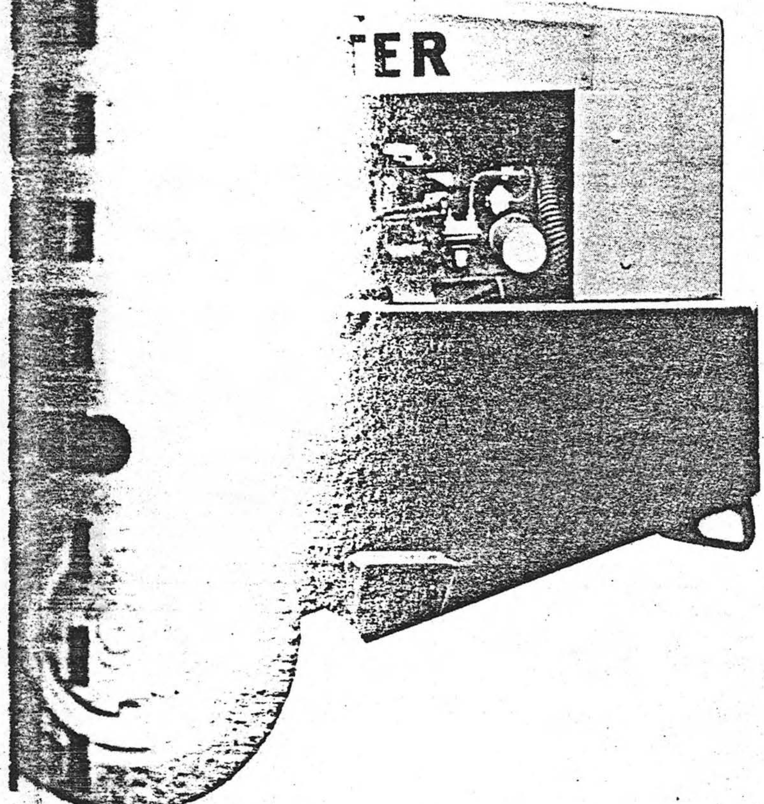


EXCLUSIVE CENTERPOINT STEERING with hydrostatic control provides excellent maneuverability. Inside turning radius is just 9 feet. Centerpoint design maintains full tire coverage on turns—makes curb line rolling easier with fewer passes. Steering is identical in either direction of travel.

ALL GEAR DRIVE provides a dependable, efficient drive train that requires practically no maintenance compared with chain-type drive arrangements.

AMPLE POWER. The C530A, powered by a G.M. 230 industrial engine, develops more than sufficient horsepower to handle the toughest of jobs. The engine delivers 111 H.P. at 2800 R.P.M. and 220 ft./lbs. of torque at 1800 R.P.M.—and it runs on regular gas.

$12\frac{1}{2}$ tons of versatility—unmatched for ...trol, visibility, ... of service ...urability



With the C530A, Hyster introduces big compaction performance in a small, easy to operate machine.

Weighing 25,000 lbs. fully ballasted, it is designed to meet 10 to 15 ton roller requirements—in compaction of highway and road projects, parking lots, housing developments, city street projects and airports. On asphalt it can be used for initial breakdown, intermediate rolling and finish.

The C530A consists of four wheel front and five wheel rear articulated units. The two units are joined by a hitch that permits 70° of articulation for turning and 20° of oscillation between units to accommodate surface changes.

Steering is hydrostatically controlled—retaining both "feel" and "follow-up" of manual steering without the effort.

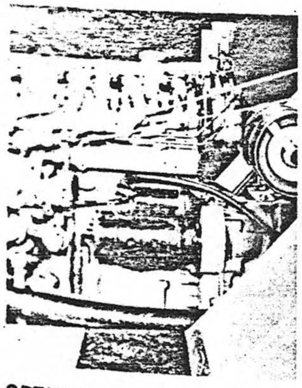
The C530A is powered by a General Motors 230, 6-cylinder, industrial gasoline engine. Optional engines include the Perkins 4-236 engine and the Detroit Diesel 3-53.

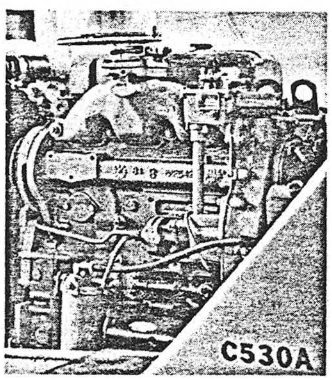
The torque converter, forward-reverse transmission, and 3-speed transmission are all served by a common filtered oil supply.

Brakes are 12" x 2" hydraulic and operate on the 4 outside rear wheels. The parking brake operates on the drive train. Standard tires are 7.50x15—6 ply with 4, 10, 12 and 14 ply tires offered as optional equipment.

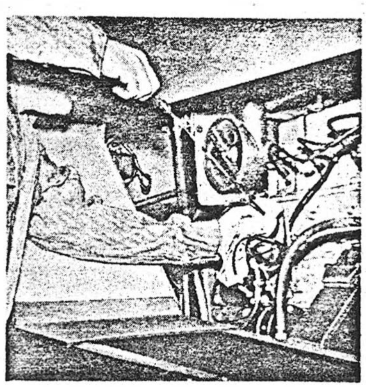
A gravity-fed or pressure sprinkler system with cocoa mats for tire cleaning is offered as optional equipment. The 75 gallon water tank is mounted on the rear unit. Sprinkler system is controlled from the operator's cockpit.

The "human-engineered" cockpit provides the operator comfort and ease of operation. The steering wheel, 3-speed shift lever, and brake pedal are centrally located near each of the dual seats.

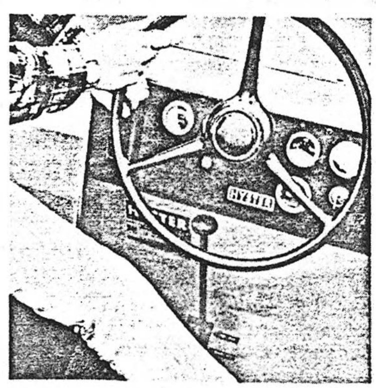




OPTIONAL DIESEL ENGINES. The Perkins 4-236 on the left delivers 88 H.P. at 2800 R.P.M. and 217 ft./lbs. of torque at 1500 R.P.M. On the right the Detroit Diesel 3-53 delivers 97 H.P. at 2800 R.P.M. and 202 ft./lbs. of torque at 1500 R.P.M. Both are dependable engines with fast acceleration and low fuel consumption. Reliable parts and service support.

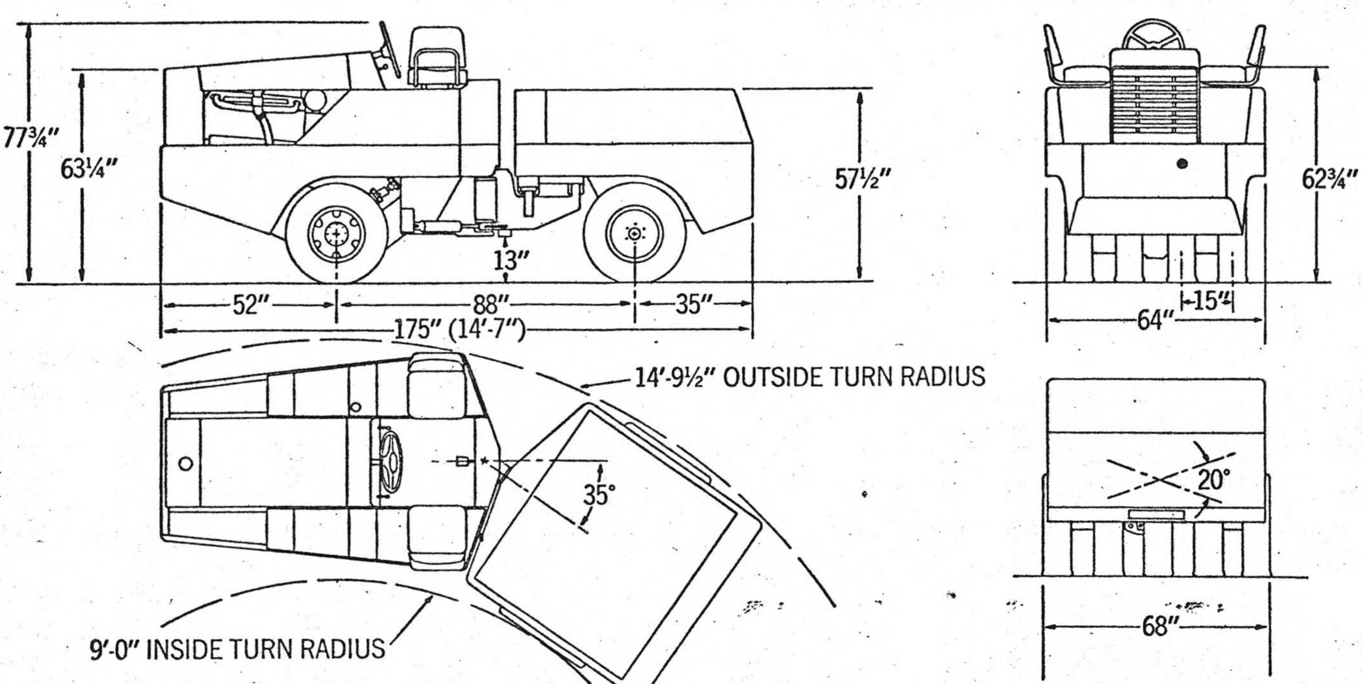


SERVICEABILITY. Most major service items on the C530A can be reached easily while standing on the ground—a real timesaver for daily maintenance. The total number of daily service items has been greatly reduced by incorporation of an oil-bath lubrication system in the all-gear drive train.



DUAL CONTROLS in the C530A's "human-engineered" cockpit allow easy operation from either side. The steering wheel, 3-speed gearshift and foot brake are centrally located—with dual throttle/directional controls serving each of the twin seats.

C530A SPECIFICATIONS



SPECIFICATIONS

Weight (w/o ballast) .... 8,000 lbs.
Weight (w/max. ballast) . 25,000 lbs.
Ballast capacity .... 110 cu. ft.
Gasoline engine .... G.M. 230
HP@RPM .... 111@2800
Fuel capacity .... 30 gal.
Transmission .... 3-speed manual w/powershift forward—reverse

Final drive .... All-gear
Rolling speeds .... 1-17 MPH
Steering .... Centerpoint hydrostatic
Oscillation—drive axle .. Rigid front
—steer axle ... Tilt-rear
—frame ...... 20°
Tires—standard 7.50x15, 6-ply
Brakes—type .... 12"x2" hydraulic
—location .... 4 outside rear

Optional equipment:
Horn
Fuel gauge
Lighting system
Perkins diesel engine ... 4-236
HP @ RPM .... 88 @ 2800
Detroit Diesel engine 3-53
HP @ RPM .... 97 @ 2800

4-ply tires
10-ply tires*
12-ply tires*
14-ply tires*
*includes heavy-duty rims
Tire cleaning system: either gravity-fed or pressure system available; 75 gal. water tank; sprinklers; cocoa mats

TIRE INFLATION PRESSURE P.S.I.				35	50	70	90[1]	110[2]	130[3]
Wheel Loads	Ballast Combinations		Plys	Ground Contact Pressure—P.S.I.					
	Front	Rear							
1250 lbs.	0	3250 lbs. (wet sand)	4 ply	38					
			6 ply	38	45	51*			
			10 ply	39	46	54	60		
			12 ply	39	47	54	63	68	
			14 ply	47	53	59	64	71	78
2300 lbs.	4200 lbs. (wet sand only)	8500 lbs. (wet sand only)	4 ply	44					
			6 ply	44	51	57*			
			10 ply	48	54	62	69		
			12 ply	48	55	63	72	77	
			14 ply	56	61	68	74	81	88
2800 lbs.	6200 lbs. (wet sand and steel)	11,000 lbs. (wet sand) and steel)	4 ply	46					
			6 ply	46	54	60*			
			10 ply	51	58	66	73		
			12 ply	52	58	67	76	81	
			14 ply	59	65	72	78	85	92

35 P.S.I. is maximum tire inflation for 4 ply
*60 P.S.I. is maximum tire inflation for 6 ply

[1] maximum for 10 ply
[2] maximum for 12 ply
[3] maximum for 14 ply

HYSTER COMPANY
CONSTRUCTION EQUIPMENT OPERATIONS
Box 289 • Kewanee, Illinois 61443

Hyster products are subject to change without notice.

Manufactured in: Portland, Oregon • Peoria, Illinois • Kewanee, Illinois • Australia Belgium • Brazil • France • Republic of South Africa • Scotland • The Netherlands

Form 2343B

10-68 Litho in U.S.A.—GAC