Railway Grading with Stiffleg Derrick Draglines

Two ordinary stiff-leg derricks equipped with drag line buckets were employed by the Miami Conservancy District for grading 1½ miles of the line of the Ohio Electric Ry. across the flats of the Mad River Valley, north of Osborn, O. The top soil is loam 1 to 3 ft. deep with gravel below. Water occurs 3 to 4 ft. below the surface. The fill varied from 5 ft. to 19 ft. The use of a plow with wheel scrapers or of an elevating grader with dump wagons would have required a right of 300 to 400 ft. wide, on account of the shallow cut necessary. The use of a dragline, permitting underwater excavation, reduced this width to 200 ft. The total excavation was 65,000 cu. yd. It may be pointed out that it is on such jobs of comparatively small size, where investment in large equipment would be unprofitable, that the adoption has its value.

The following particulars are taken from the Miami Conservancy Bulletin:

The district had two stiff-leg derricks available which had been in use at Osborn, both as derricks and as clam shells with 1-yd. buckets. It was proposed to take these two derricks, equip them with 1½-yd. dragline buckets, and work them as a team side by side, one to a borrow pit, on each side of the embankment to be built.

The two derricks were much alike and the description of No. 1 will be sufficient for both. The machine was mounted on a 30 ft. x 30 ft. base of 12 in. x 12 in. timbers, moving on 8-in. rollers. The mast was of white oak 14 in. x 16 in. by 24 ft. The boom was of yellow pine, 12 in. x 14 in. x 62 ft., equipped with hog rods. The bull wheel was 12 ft. in diameter. The hoist engines were double, 9 in. x 10 in., equipped with 3 drums 16 in. x 30 in. Ropes as follows: ⅝ in. boom-fall, ⅝ in. load cable, ½ in. hoist cable. Swing engines were double, 4½ in. x 5 in., with drum 26 in. x 12 in. The boiler was 48 in. x 8 ft. 6 in., vertical, carrying 100 lb. pressure. This machine was bought by the district in fair second-hand condition for $4,300. No. 2 was slightly smaller and cost $4,000.

Either of these machines could have been transformed into a dragline by substituting a dragline bucket for the clam shell, running the load cable from the breast sheave to the bucket through a mortise cut in the boom, the latter being strengthened on each side opposite the mortise by a 4 in. x 12 in. oak timber 10 or 12 ft. long, bolted through. The district, however, had on hand the stiff-legs from a steel derrick which had been re-equipped, and it was thought better to rebuild these stiff-legs into booms for the dragline derricks, with the hope that it would enable the use of a larger bucket (of 1½-yd. size), thus expediting the work. This was accordingly done. These booms were 20 in. x 20 in. at the center section, 62 ft. long, built of four angle irons 3 in. x 3 in. x ⅜ in., with lattices 5/16 in. x 2½ in. spaced 30 in., and with end plates at the top 4 ft. x 6 ft. x ½ in., carrying two 16-in. sheaves above and three of the same size below. These booms proved entirely satisfactory, although the buckets had to be reduced from 1½ to 1 cu. yd. in size.

The derricks ran on timber ways built up about 18 in. from the ground. This arrangement fitted well with the work of clearing out stumps, several acres of which had to be handled. The trees were sawed off close enough to the ground to permit the draglines to run over them, thus bringing them into the borrow pit, whence they were pulled by the dragline buckets acting as "tooth extractors."

It was the extracting of these stumps which threw the greatest strain on the transformed mechanism and led to the chief troubles in the way of breakages. All the cables had to be made larger, the final sizes adopted being ¾ in. for drag and swing cables and ⅝ in. for boom fall and hoist cables. Experience indicates that for drag cable 1 in. should be used on these size machines. The necessity of adopting ample sizes for cables is emphasized by the fact that the total cable bill on the 65,000-yd. job was $1,405.

Other chief difficulties encountered were due to wear of the sheaves, and breakage of the goose necks connecting the stiff-legs to the top of the mast. Too heavy strain of dragline work also led to rather excessive wear on the pins of the breast sheaves and bottom sheaves. The breast sheaves were 14 in. diameter with 2 in. pins; 16 in. diameter with 3 in. pins are recommended. The bottom sheaves were 16 in. with 2½ in. pins; 24 in. diameter with 3 in. pins are recommended.

Stiffleg Derrick Draglines Building Electric Railway Embankment Across Flats of Mad River Valley, Ohio.

Here again the bill for sheaves on the job—$628—tells the story of the necessity of attention to these details. The goose necks were 2 in. x 10 in. plates bolted to the under sides of the stiff-leg timbers. They were reinforced by 1 in. x 10 in. plates bolted through on the top side of the timber, the bolts being 1¼ in. x 18 in. and six in number. With this change no trouble has been since experienced.

The greatest single delays were due to stoppages necessary to reflue the boilers on both derricks and to repair a badly worn drum pinion. These delays, due to other causes than those characteristic of the dragline job, are not strictly chargeable to this work.

The force of men required for the draglines proper were:

1 foreman.
2 dragline runners.
2 firemen.
1 pumpman.
8 laborers.

In addition to the above 2 to 3 men were kept on the embankment dressing the crown and slopes. The working day was 10 hours, of which a 2-hour loss, due to stoppages for repairs, oiling, moving ahead, etc., was considered normal. The job took about four months. The figures follow.

Original cost of derricks: No. 1, $4,300; No. 2, $4,000. Operating expenses as follows:

Shop repairs	$ 2,407.33
Labor	13,331.14
Materials (cable, coal, etc.)	3,062.80
Field accounting	220.96
Hauling draglines, Osborn to Dayton	216.96
Dayton garage	8.42
Total	$19,247.61

The total material moved was 65,000 cu. yd., giving an operating cost per cubic yard of 29.6 ct. Deducting time lost for retubing boilers and cost of repair of same, these items not being fairly chargeable to the job, reduces the cost to 26.7 ct. This represents a contractor's cost, with materials, repairs and labor obtained in the open market, and no overhead except for field accounting. As an interesting comparison, it may be noted that the contract's bid for the job before the district undertook it by force account, was 35 ct.

It was a great advantage for the use of these draglines here that much of the material could be taken from under water, thus lowering right-of-way cost. An additional advantage of this was that all of the material was put in the bank soaking wet, making an unusually solid structure. The banks were staked for 5 per cent shrinkage only, on this account. The finished structure shows not more than 2½ to 3 per cent.

The idea of the transformation came from Wm. McIntosh, Master Mechanic for the district, but the successful carrying out of the scheme was due in no small degree also to the efficient co-operation of Leslie Wiley, Superintendent, and John Rosite, Foreman on the work.

Exterminating Ground Squirrels by "Gassing"

Mr. Clifford A. Elliott, Cost Engineer, Maintenance-of-way Department, Pacific Elec. Ry., Los Angeles, Calif., writing in the Electric Railway Journal, describes what appears to be the very latest war-time method of fighting ground squirrels. The damage which these rodents do in burrowing into the banks of cuts along the right of way and into the roadbed itself has been a constant source of trouble in maintenance work, the most damage being done in the rainy season, when storm water enters the holes and loosens the cuts, causing landslides. Bridge embankments suffer seriously from the same cause.

In the spring months the squirrels leave the right of way and go into adjoining fields, where growing crops are destroyed.

The damage to the crops on abutting farms each year is very great, and the farmers complain continually of the pests which inhabit the company's right-of-way. Each year the company co-operates with the farmers in carrying on a campaign to eliminate them, and additional aid is given by the State Horticultural Commission of California.

Attempts have been made to exterminate the squirrels by putting out poison-soaked hulled barley. This has done some good, but during the spring season the plan is of no avail, as the ripe, juicy roots of growing grain in the fields are more appetizing, and the rodents refuse to eat the barley that has been scattered for them near their burrows.

The company has recently found in the market an automatic distillate vapor machine for gassing the squirrels in true war-time fashion, and the use of this device has gained excellent results. The squirrels are gassed in their burrows, as are also other small animals, such as rabbits, badgers, snakes, owls, etc., which unfortunately inhabit the same holes as the squirrels.

Ordinary engine distillate is used in the machine, from which is produced a white vapor which is forced into the burrows and effectually disposes of the rodents. Adjacent holes are watched and as soon as any vapor appears from them, the operator's assistant tamps them shut for at least a foot deep. The burrows are filled with vapor and the hole at which the discharge pipe has been operating is then tightly closed by tamping. The best time to gas is said to be just after a rain, when the holes have been opened up by the water. One foreman and four men with two gas machines average 80 main burrows per 10-hour day, with a consumption of 3 gal. of distillate.

Instructions to Construction Foremen for Prevention of Accidents

While the following instructions were prepared primarily for conditions in the steel erection field, they nevertheless contain suggestions that are applicable to many other lines of construction. They are reprinted from a booklet prepared by the Erection Department of the McClintic-Marshall Construction Co.

See that Your Equipment is Sufficiently Strong.—It is your duty to see that the equipment and tools you use for each part of the work are sufficiently strong to handle the same safely.

You should see that the derricks you use are amply strong for the loads to be lifted. The goose neck and gudgeon pin are the critical points of a derrick If you have any doubt about the strength of the goose neck, provide heavy wire guys from gudgeon pin to sill at base of stiff-legs. Don't lift a 10-ton load on a 5-ton derrick. The same thing applies to gin poles and travelers. Don't overload your equipment and don't run any chances where life is endangered. Be careful not to lift any but a light load on a derrick if the length of the boom exceeds 70 times the least width or thickness of the boom: that is, if your boom is 12 in. x 14 in. the least width is 12 in., you should not lift a heavy load on this boom if it is more than 70 ft. in length.

See that travelers are well and carefully framed and erected, well braced and capable of withstanding the greatest wind, and shocks from heaviest loads that are to be lifted.

See that the hooks, shackles and buckets on your blocks are amply strong, and don't allow a gate block to be used without it being closed and hooked. Also see that your cables and chains, as well as the rings and hooks in the same, are amply strong for the loads to be lifted.

Do not use old or worn line when there is any danger to men or material by so doing. Cut out the use of manila line whenever possible. When you are obliged to use it be sure it is amply strong. Use steel cable whenever possible, as it is safer, will last longer and is cheaper in the long run. Be sure that the guy cables for gin poles, derricks, etc., are of sufficient size to withstand the tension to come upon them. Also that the cables are securely fastened by means of a sufficient number of good, strong clamps well fastened, and also that dead men or other anchorage are ample, and watch them when lifting heavy loads to see that guys do not cut dead men in two. Keep gin pole guys as near at right angles to each other as possible, when only four are used.

You should be careful to see that the gas pipe or wooden scaffold you use is of proper size and strength for the span and loads. If there is any question about the strength, test the same by applying several times the load that will come upon it. See that plank you use for scaffolding, etc., is the right kind of wood, preferably white or yellow pine, free from knots and shakes and plenty strong, watching to see that it is thick enough for the span on which it is used.

Do not put heavy loads on light push cars. The frame is not only liable to crush but the shafts, boxes or wheels may bend or break, upsetting the load and injuring the men.

See that Your Equipment is in Order.—In setting up your derricks see that they are plumb, properly guyed and that the splices are brought into contact and bolted with tight-fitting bolts. See that the goose necks fit gudgeon pin closely and are not cracked or bent and that the top of stiff-leg is tied down from the goose neck to the sill to prevent lifting tendency. If the timbers in the mast, boom, stiff-leg or sills are rotten, knotty or wind shaken, do not use them. See that your gudgeon pin and pintle casting are well fastened to the mast, and if the mast is of wood that the wood is not rotten or worn at these points.

You should see that all leads are as straight and direct as possible, as failure to provide good leads reduces the efficiency of your power and equipment, as well as producing heavy wear on the lines and is a frequent cause of accidents. Particular care should be exercised in securing good leads for wire cable on account of liability of breaking the individual wire strands by sharp bends or indirect leads. A broken individual wire is liable to lie across and cut the other wires of the cable.

When you use a wooden traveler see that the timbers are all in good condition and that it is erected plumb and square and the joints properly and securely bolted. More accidents occur from the use of wooden derricks and wooden travelers