

insulator or to insufficient spacing. In the present instance the insulators (which are duplicated on the long-span towers) are fitted with lead-lined clamps. Any abrasion is, therefore, taken by the soft metal. The spacing between conductors was, after careful tests, fixed at 69 inches.

In this country less attention has been paid to the possibility of improving the physical properties of aluminium *per se* than has been done in Europe; engineers have in general been more attracted by the possibility of reinforcing the aluminium cable by means of a steel core. The view in Fig. 5 shows a 1,000-foot ravine span which is crossed by three steel-reinforced aluminium conductors. (This transmission line was described in the "Electrical News," Vol. XXII., p. 34). The arrangement of a typical steel-core cable size 3/0 is shown in Fig. 6. It has to be remembered in dealing with this class of cable that when the maximum wind and ice stresses come upon

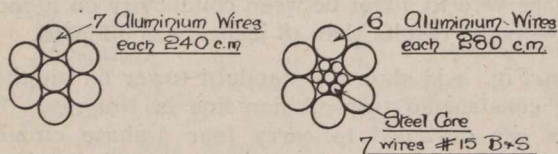


Fig. 6.—3/0 Aluminium Cable and 3/0 Steel-Core Aluminium Cable.

it all the tension will of necessity come upon the steel due to the fact that the aluminium will elongate about three times as much. The core must, therefore, be at least as strong as the rest of the conductor. As, however, the section of the steel is only one-sixth of the aluminium, it must have a tenacity not less than six times as great. A typical specification will be as follows:—

	Aluminium.	Aluminium-Steel.
Size B & S.	3/0	3/0 equiv.
Circular mils (aluminium) ...	167,805	167,805 equiv.
No. Aluminium wires	7	6
Diameter each, inches155	.166
No. of steel wires	—	7
Diameter each, inches	—	.057
Diameter of cable, inches..	.465	.498
Diam. of cable with 1/2" ice.	1.465	1.498
Weight per foot, lbs.155	.216
Weight per ft. with 1/2" ice.	.755	.819
Total loading per foot.....	1.234	1.290

From the above it will be seen that the extra weight and diameter of the steel does not increase the loading to any great extent. The tensile strength of the aluminium may be taken as 28,000 lbs. per sq. in. and that of the steel as 220,000 lbs., the working unit stresses will be safely assumed at one-half these figures respectively. Now, as the area of the steel is one-sixth that of the aluminium, the tensions in the two classes of cable will have the following ratio:

$$\frac{\text{Steel}}{\text{Aluminium}} = \frac{220,000}{28,000} \times \frac{1}{6} = 1.31$$

It is, therefore, possible for the same safety factor to put approximately 31% greater tension on the aluminium-steel cable. This will, in most cases, reduce the sag by 25%, and under certain circumstances would be well worth the extra expense. In most situations, however, the writer is inclined to favor the European principle of manufacturing aluminium cable of the very highest grade and tenacity, so that reinforcing would be unnecessary.

PROPER INSPECTION OF TRACK PAVING.

THE following instructions to inspectors have been developed by Messrs. D. H. Roszel and H. H. George, and adopted by the Public Service Railway Company, of Newark, N.J., upon the recommendation of Mr. Martin Schreiber, Maintenance-of-Way Engineer. The object of these instructions is to secure full compliance with the contract and specifications and the performance of first-class work by the contractors in such minor details as are not generally specifically mentioned, but are implied by the contract and specifications. Those relating to paving inspection are published herewith as outlined in a recent issue of the journal of the American Electric Railway Association.

General Instructions.—The inspector is to make out daily reports on forms provided for the purpose, and also to keep in a field book a detailed record of each day's work, which must contain the following:—

- (a) The date of his assignment to the contract and the date of its actual commencement and completion.
- (b) Detailed force account for each working day and the amount of material used.
- (c) Condition of weather each day.
- (d) Delays, reasons for, and the period of duration.
- (e) Conditions of sidewalks along the line of paving, previous to commencement of work, to forestall any future claim for damages.
- (f) Accidents: date of accident, names of persons concerned and witnesses, cause of accident.
- (g) Any neglect or refusal on the part of the contractor to comply with the contract specifications.
- (h) Damages to persons or property by reason of any act or omission on the part of the contractor.
- (i) Oral instructions or orders received from his superior officer, and all other matters appertaining to the contract that might be worthy of record.
- (j) A record of the various types of paving used (such as new, clipped or unclipped block and their kind, sand, cement or tar and gravel joints, etc.) and the exact terminating points of each type.

The inspector must be present on the work at all times when any work is in progress, unless excused by his superior officer.

It is the duty of the inspector to familiarize himself with the local conditions affecting the contract to which he is assigned, in order that the work at all stages may be so carried on as to cause the least possible inconvenience to the operation of the cars, and to the public generally. The street must not be unnecessarily obstructed, and the contractor must provide temporary passageways at crossings, and wherever else necessary.

The inspector must not permit the contractor to interrupt the trolley traffic during the course of the work, and must see that no materials are permitted on or near the track, that will interfere with the operation of cars or the safety of passengers.

All materials, as they are brought on the street, must be piled compactly and neatly at such points as the inspector shall designate, and in such a way as shall comply with the regulations of the municipal authorities. All loose material, excavated matter, and rejected materials must be removed from the site as soon as possible.

Special care must be taken that no material is piled around city fire hydrants, and that the space in front of same is kept clear at all times, and accessible to the fire apparatus.