insulating joints, and the extensive use of such joints should be encouraged in new work and in making repairs. Precautions are necessary in their use, however, and these are set forth in the discussion.

Taking up the methods applicable to the railway system, there is a very brief reference to the alternating-current system, double-trolley system, the use of negative trolley, and the periodic reversal of trolley polarity. This is followed by a somewhat extended discussion of methods of reducing potential differences in the uninsulated portion of the negative return. These various means comprise: (1) Proper construction and maintenance of way; (2) grounding of tracks and negative bus; (3) use of uninsulated negative feeders; (4) use of insulated negative feeders without boosters; (5) use of insulated negative feeders with boosters; (6) three-wire systems; and (7) proper number and location of power-houses.

The discussion leads to the conclusion that the alternating-current system, the double-trolley system, the use of negative trolley, the periodic reversal of trolley polarity, and the use of uninsulated negative feeders in parallel with the rails, when considered solely as methods of electrolysis mitigation, are either impracticable or else open to the objection that the expense or operation difficulties attending their application are rendered unnecessary because of the fact that there are other adequate methods available for general application which are comparatively cheap to install and which introduce but slight complications into the operating system.

The importance of proper construction and maintenance of track return is emphasized, and the drainage of the roadbed where practicable is urged. Also where the track is laid on private right of way the rails and ties should be kept as far as possible out of direct contact with the earth by the use of good rock ballast.

It is also pointed out that the three-wire system, when viewed solely from the standpoint of electrolysis mitigation, possesses large possibilities. Attention is called to the fact, however, that up to the present time sufficient experience has not been had with this system to determine whether it is practical from the operating standpoint under average conditions of service. It is, therefore, urged that experiments with this system be made under conditions to which it is best adapted.

The most effective methods that have been thoroughly tried out in practice over long periods are the use of insulated negative feeders either with or without boosters, generally the latter. In most cases where the feeding distances are not too long an insulated feeder system without boosters will prove cheapest and at the same time more satisfactory because of its greater simplicity. It is possible, by the proper application of such systems, to reduce the potential gradients in the earth to such low values that in most cases little damage would result. In many cases, however, it may be better, where conditions are favorable, to combine one of these methods with either the insertion of a moderate number of insulating joints in the pipes or with the use of a very limited amount of pipe drainage, provided local conditions are favorable to the use of this method. The insulated feeder system would be applied to reduce the potential gradients throughout the system to very low values, and one or the other of the auxiliary systems used to eliminate largely any residual electrolysis that might still remain.

The last section of the paper is devoted to a discussion of regulations regarding electrolysis mitigation. The subject of what criteria should be used for determining the adequacy of electrolysis conditions is taken up at some length, and it is shown that potential measurements showing a total drop of potential in the railway negative return and also potential gradient measurements throughout the track network are very valuable. It is also shown that all-day average values of these potential readings give a better criterion of the actual danger from electrolysis than any short-time peak value. It is recommended that in fixing voltage limitations some plan analogous to the zone system should be adopted, the voltage limits prescribed for the various zones being determined largely by the degree of development of the underground utilities in the various zones. The voltage drops either in the tracks or in the pipes, and earth may be used as the basis for fixing limitations, but in general the latter is to be preferred. The question of what constitutes a safe limit for voltage drops in the track return is discussed at some length, and the conclusion is reached that for the overall potential drop in the railway tracks a limit of from two to four volts is reasonable and adequate, and the potential gradient should in general be restricted to 0.3 or 0.4 per thousand feet, these figures being all-day average values. Where short-time peak values are used, the figures would, of course, be considerably higher.

In order that ready determination of voltage drops may be made at any time, potential wires should be installed running from some central point to selected points on the railway or pipe networks. These points should include the points of approximately highest and lowest potential and preferably, also, some intermediate points. It is recommended that exemption from any regulations regarding track voltages should be made in special cases as described in the paper where local conditions make it improbable that any serious damage would result. The responsibilities of the owners of underground utilities regarding the mitigation of electrolysis troubles is discussed, and it is recommended that any regulations governing electrolysis mitigation should be made to apply not alone to the railway system, but should also define the responsibilities of the owners of underground utilities, since the latter can often contribute materially to the diminution of the trouble at a practically negligible cost.

PROGRESS ON BLOOR STREET VIADUCT, TORONTO.

The following official figures relating to work completed on the Don and Rosedale sections of the Bloor Street viaduct, Toronto, were recently issued by Mr. R. C. Harris, Commissioner of Works. A comparison is presented of the amounts of excavation and concrete completed up to July 31st, with the total amounts required, *viz.*:—

Don Bridge.

Total excavation required	49,651 cu. yds.
Total excavation completed	33,882 cu. yds.
Total concrete required	43,344 cu. yds.
Total concrete completed	8,971 cu. yds.

Rosedale Bridge.

Total excavation required	31,208 cu. yds.
Total excavation completed	19,800 cu. yds.
Total concrete required	16,748 cu. yds.
Total concrete completed	4,969 cu. yds.