

## GENERAL.

*Elevated Tanks.*—Tank-stands need heavy bracing. The tanks should be well tied to the stand, as the movement of the contained water has a heavy overturning moment. It is advisable to have the top completely open. Several fatalities resulted from the collapse of tanks.

The policy of incorporating tank-supports in a building-frame is objectionable for obvious reasons.

The horizontal ties of reinforced-concrete tank-stands serve primarily to reduce the unsupported length of column, and invariably show signs of severe strain unless used in combination with diagonal bracing.

The several local examples of small tanks on well-braced steel towers are all in sound condition.

*Roads, &c.*—On the local road system subsidence occurred at bridge-approaches, embankments, and culvert sites. On original ground no damage was sustained by the bitumen or concrete surfacing. Expansion joints in the latter type occur on an average at intervals of approximately 50 ft. In a number of instances incipient spalling and buckling is apparent in continuous kerbing and concrete footpaths.

*Water-mains, &c.*—The water-mains are of cast-iron pipe with lead-run joints, or spirally riveted pipe with bolted flange and rubber gasket. Apart from subsidence at bridges and at two recent fillings, no appreciable damage occurred to the system. Joints appear to be satisfactory.

The sewerage system is laid with concrete and glazed earthenware pipe at depths varying from a few feet to 12 ft. This, again, suffered no appreciable damage.

*Conclusion.*—Perhaps the most striking fact that impresses itself upon one's notice, in even a cursory examination of damaged structures in this area, is the evident inadequacy or total lack of competent supervision during construction. Omission of minor details in plans and departure from recognized standard practice in building-construction have resulted in serious and unnecessary damage. Proper adherence to the canons of sound construction, both as to workmanship and design, coupled with sane engineering judgment, would have averted the serious loss of life and considerably mitigated the structural damage.

In conclusion, it is recommended that, for all structures of a business, public, or industrial character, the plans and specifications be submitted for qualified checking and approval, and that it be insisted a competent clerk of works supervise the construction.

Efforts to arrive at a value of the accelerations in the earthquake have met with no success. The results have been too variable and untrustworthy. Relevant to this is the following extract from *Engineering News Record* of the 26th April, 1928, page 652: "The overturning of small structures such as stone monuments, by the earthquake has been utilized to compute the accelerations necessary for overthrow. The latter method of estimation is likely to result in errors of considerable amounts."

The case of a suspended electric light smashing against the ceiling gives a value of the period of the waves over a few seconds. The waves of the earthquake must have synchronized with the swing of the lamp for sufficient time to build up a wide movement. The lamp (repaired) made forty complete oscillations in one minute.

(NOTE.—This general report was based on a detailed analysis of the damage sustained by a large number of individual buildings. Full particulars of his detailed investigations, illustrated by photographs and plans, were forwarded to the Committee by Mr. Brodie.)

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