

a concrete-steel retaining wall, a section of which is to be seen at page 448 of the N. Y. "Engineering Record" for November 10, 1900. The thickness of this wall at base is less than one-sixth its height, and a simple glance at the figure will show, without resorting to any calculation of strains or resistances, that, unless the back-filling be self-supporting, such a wall can not continue for any length of time to stand the pressure of any ordinary back-filling against it without it tending to bend over or give way. The stiffening ribs of the iron or steel screen behind the wall are not nearly deep enough to act as efficient buttresses. They should for this purpose reach much further into the backing. The rod tying the base of screen to the foundation can have no effect in preventing it from tilting forward. For this purpose the tie rod should have been attached to screen at say two-thirds of its height, and reached out far back to some unyielding pile or concrete anchorage.

The subject of retaining walls would not be complete without an allusion to wooden walls instead of masonry for the same purposes. The author in his time has had occasion to build and rebuild at Quebec, thousands of feet lineal of street supporting structures *et al.*, of this kind, as well along the St. Lawrence and St. Charles water frontages as along the side hills of the city. The respective lives of these walls may be taken at from 15 to 20 years average for spruce, and 25 to 30 years for pine timber; while the portions under water, and even those extending to a few feet above low water, may endure indefinitely as far as material is concerned; but these walls, even though secured by cross ties running or tailing deep into the back filling, or to a depth, for the upper ones, fully equal to height of wall or wharf, give in course of time with the earth pressure and frost from behind, and thus gradually loose their batter (generally of 1 to $1\frac{1}{2}$ in 12) by about a quarter or half an inch per annum, becoming vertical, and then begin to over-plumb, and about the time they are decayed to an extent to require repairing or rebuilding, the over-plumb reaches such a figure that they are ready to topple forward—that is, their fronts or timbered facings, which become torn away from the ties that head into them, as the outer ends of these ties or portions exposed to wind, water and weather also decay, thus allowing the front timbers to be thrust forward, whilst such portions of the ties as are buried in the back filling continue to endure and can outlive the outer timbers for years thereafter.

On the rebuilding of the facings, short ties may be thus used by spiking them to the remaining portions of the old ties, and when on a slope or side hill with tendency to slip forward, it is a good and even necessary precaution to bolt and, better still, to fox-bolt the ties to the adjoining or nearest rock, or attach them to piles or suitable pickets driven deeply into the subsoil; and this pre-