SOIL: CONSIDERATIONS IN MODEL STRUCTURES

I have an extensive model railway layout based in my garden. Unlike a layout inside a house, the structures of an external layout are based on the ground – on soil. The soil of course presents a problem which must be considered in the design of the structures. The following two photos show two portions of the layout.

001: Arches

002: Bridges

The problem faced is, of course, ground movement of the soil. This must be accounted for as even very small movements can cause misalignment of the running track, both vertical and horizontal, with consequent derailment of trains.

The soil involved is the natural soil at the suburban location supplemented with the addition of purchased garden loam and mulch. Accordingly it is not possible to give any definitive classification of the soil other than it is mildly reactive and prone to swelling and shrinking. A close up of the soil at a column base is shown.

003: Soil at Column base - Typical

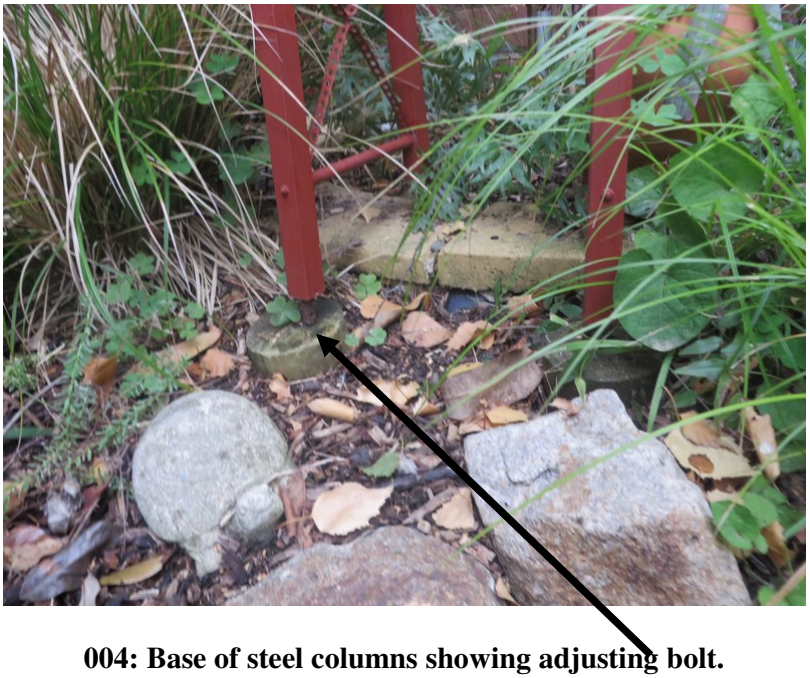
The problem is exacerbated by being garden soil. Not only is it subjected to rain but also to garden watering. Water changes the moisture content of the soil and this can result in swelling and shrinkage (on drying) of the soil. A further problem, possibly the major one in this context, is a problem not faced by the designers of real bridges with massive foundations. I refer to movements caused by plant growth, particularly the root systems. It is amazing what forces a single root can exert as it grows from a fine thread to even a root of pencil thickness.

To cope with these potentially disruptive movements, two strategies have been adopted: depth and an adjustment mechanism.

All structures are based on a brick, the top of which is about 200 mm below surface level. This is the depth in which most shrinkage and swelling will take place. Being founded at this depth moisture based movements are eliminated or minimised. But root movements can still take place more so from tree roots of trees in adjacent properties.

For the more solid structures, the arches and the major bridge piers (see photo) the columns extend down to the brick foundation; between the pier and the brick are located wedges. These wedges provide an opportunity to adjust the level – either up or down – if they are moved by roots.

For the more flexible structures (the circular loop in pix 002), a different approach has been used. A short timber post (treated pine) is once again based on a brick set about 200 mm below the surface. This timber post terminates just above ground level. Between the top of the timber and the underside of the steel a threaded rod is positioned. This rod runs into a nut set in the base of the steel column so that the bolt can be adjusted up or down to compensate for vertical movements in the foundation. This arrangement is shown in the photo on the next page.



004: Base of steel columns showing adjusting bolt.

Conclusion

Ground movement is a problem with all types of construction but in particular with models. This is because the foundations are not massive and the supported weight is very low. Both these reasons make the footings prone to movement by moisture variations or root egress. The measures outlined above indicate some means of conveniently making some provision to compensate for any movement.

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