Soil Compaction: Providing a Base for Construction

Soil compaction is essential in construction. The failure to displace air from between soil particles when constructing buildings, roads, parking lots, dams, walls, swimming pools, or utility trenches inevitably leads to unwanted soil movement and water penetration into the earth beneath construction projects. Walls will crack and even fail; pipes will crack and leak; roads become potholed and undulating.

Problem
Inattention to compaction can lead to significant problems. Without appropriate compaction control, built structures settle excessively, and often expensive foundations are required to compensate for poor site preparation originally.

Mine haulage roads that are ineffectively compacted increase the need for vehicle maintenance and limit vehicle operation as slower speeds are required. Mine roads made up of rocks of more than a certain size can result in excessive wear or puncturing of tyres, which can cost up to $100,000 each to replace. And landfills that have not been appropriately engineered can result in toxic chemicals leaching into groundwater.

Solution
One approach to this problem is to develop improved techniques for rolling dynamic compaction, rubblising and in situ testing and validation of the compacted space.

Rolling dynamic compaction, in the form of the 4-sided impact roller, enables the ground to be compacted more efficiently than conventional compaction equipment such as vibrating drum and sheepsfoot rollers. Appropriately applied, rolling dynamic compaction can also be used to rubblise rocky materials, creating a smaller particle size and denser ground surface, which is particularly appropriate to mine haulage roads. An impact roller is a potentially efficient compaction method because of its speed and the energy imparted to the ground.

Working together with Broon’s, we are investigating an impact roller with outstanding properties for superior compaction, including its speed and the energy imparted to the ground. Research on the roller has indicated that it will be capable of:

- compacting thicker loose layers (between 0.5 and 1.5m) than conventional rollers (typically 300 mm layers)
- travelling at speeds of 10 - 12 km/h, as compared to traditional rollers which travel at 3 km/h
- compact the ground to greater depths (1 - 4m) as compared to 0.3m, the impact roller, and
- compact ground with a greater range of soil moisture content than conventional equipment which means that the ground requires less

Benefit
The benefits of rolling dynamic compaction are potentially significant. Its rate of application and potential effectiveness as a rubbliser means that it may be more efficient than conventional techniques and produces a better road surface, hence saving money in road haulage applications.