RML Newsletter round-up

AUGUST 2015

EARTHWORKS – PART 1

Earthworks are a necessary and fundamental part of most construction projects. In some, such as the construction of new highways and pipelines, they can be a sensitive and possibly the largest element. The mistreating or mishandling of soil has had disastrous consequences on some contracts and has led to huge technical and financial problems as well as public dissatisfaction.

What can go wrong, it is only top soil for goodness sake?

In January I referred briefly to engineers who have developed skills enabling them to work with nature and described how, 'Civil engineers commonly abused a material with which they worked on most days; their abuse actually making site conditions worse, usually much worse than they were to start with, and caused loss of time, money and face'. I was talking about soil, something dubbed 'unsuitable' by engineers but actually a living material that takes millennia to develop. From my early days in civil engineering in the 1960s my view was that soil was maligned and mistreated by engineers.

The 'unsuitable' label was applied to top soil by engineers because it contained organic matter and generally did not respond to compaction or the imposition of loads in a manner that could be forecast. Soil containing organic matter was seen to compress and this boded ill since this behavior would lead to movement and structural damage in the structure which required support. In addition material that contained seeds and the parts of plants which could regenerate posed the risk that damage to engineered structures could result from this source of movement. Vegetation could also lead to increases or decreases in the moisture content of soil to a significant degree.

To add 'insult to the injury', in stripping a site to expose material suited to their purpose, engineers ignored the fact that top soil could be made up of several distinct layers which held a strong relationship one with the other and that the sequence of layers was vitally important in determining how the soil performed. Having ignored or even been unaware of the distinct horizons in the undisturbed soil, engineers then tended to store the stripped soil in a randomly mixed single stockpile and eventually use their 'top soil' as one layer placed on an engineered surface. To the surprise of many engineers this single layer was quite unable to support vegetation successfully and on many occasions simply slipped off the surface of the engineered earthworks.

A great deal had gone wrong.

'Soil structure is easily damaged by handling or cultivation during wet conditions when the soil is weaker'. 'Damaged soil can never be fully restored by cultivation no matter how intensive but there are a range of practices which will reduce the extent of soil damage'.

Source: N.J. Coppin I.G. Richards (2007) Use of vegetation in civil engineering, C708, CIRIA, London (ISBN: 978-0-86017-711-1). www.ciria.org

What would produce a better result? Keep a lookout for the next installment in Earthworks 2.

In the photograph of work on a large pipeline through common land the soil was thin and impoverished and great care was called for in its handling. Top soil, subsoil and trench backfilling material were carefully segregated and stored on a geotextile in the undisturbed part of the 'right of way'. The commoners were pleased with the restoration.

THE BEST TIME TO PLANT A TREE

'When is the best time to plant a tree? - 20 years ago'-so says an old Chinese saying.

There is no need to fret if one hasn't planted a tree for 20 years. I would say that 2015 is a better time to plant a tree than 20 or 30 years ago, but read on.

In many respects the last 20 to 30 years have been a time of learning and challenges as landscape design and practice has moved to sit alongside civil engineering design and practice. At RML we have been involved in stimulating this move which has led to an improvement in practice and results involving the use of vegetation in civil engineering. I would say that there has been no better time than the present to undertake tree planting. These days one can expect a reasonable degree of success.

Much has been learned about performance and responses of new woodland, say, in respect of soil, environment and management, this knowledge is now of great value in planning and executing new planting. The importance of the management and the recording of work done to landscaped areas and its impact are well understood; on highway projects involving significant earthworks for example post-construction management of vegetation is carefully specified, undertaken and recorded.

However by way of a marked contrast trees that have been planted in newly constructed streets in urban areas have been known to suffer poor growth and our studies at RML have indicated that it is principally soil compaction well above densities that allow trees to develop adequate root systems is the main cause of disappointing performance. A secondary problem is providing an adequate supply of water under impervious paved areas. It is something of a great contradiction that whilst trees are recognised as being of vital importance in urban areas the provisions for trees falls way short of what they require if they are to have some significant impact on the environment.

AT RML some of our landscapes were set down in the 1970s when our principals were engineers, architects and environmental scientists learning their trade. We have the benefit of observing trees that we planted more than 30 years ago and this experience informs us of what we can achieve with today's planting.

Now is a better time than ever to be planting trees on construction projects. How this has come about was discussed in 'Seeing, understanding and reacting' in a May newsletter.

RAINFALL TRENDS AND FUTURE LAND MANAGEMENT

We hear a lot of different statistics and forecasts about the effects of climate change, whether man-made or the result of purely 'natural' causes. As part of a short course on Integrated Catchment Management that I have been following, the likely changes in rainfall patterns were discussed.

The mid-range forecast for the 2050's is that winter rainfall in Wales will be 14% greater than it was in the 1961-1990 baseline period, but summer rainfall will be 17% lower.

These changes in seasonal patterns will not only increase the flow extremes of floods and droughts in our rivers, which will make life tougher both for riverside residents and aquatic wildlife, but it will also make farming for food production and other crops more difficult. Establishing new trees and hedgerows in drier summers will be more risky, getting grass cover sown and grown enough to survive and protect disturbed soils will be a hit and miss affair, and so the list goes on.

In previous articles I have described the importance of soil quality in the root zones of urban trees, but the same principles apply to agricultural soils, forestry and civil engineering projects. Looking after soils is vital if they are to absorb winter rainfall and make it available to the roots of growing plants. The basics of soil cultivation and protection used to be well known by farmers and growers. Increasing reliance on more powerful machines has allowed us to overcome difficult ground conditions, but in doing so we have made conditions worse* AND forgotten why we need to protect the soil rather than fight it.

Unlike 'conventional' flood defence, the practice of Integrated Catchment Management begins at the point where raindrops meet the ground. By maximising infiltration, controlling erosion and holding back water where possible, we can protect downstream communities AND provide some resilience against summer droughts.

Landscape managers work by juggling competing objectives and a wide range of skills and resources within the environment, to find integrated solutions. Given the pressures on our landscape, Integrated Catchment Management will quickly become an important part of our work, I'm sure.

* Powerful machines can get through soft wet ground but cause compaction and destroy soil structure in doing so – see Ivor's comments in Earthworks – Part 1.

SEAGULLS OUTWIT DEMOLITION CONTRACTORS

'Two fake owls brought in to scare seagulls from a former hospital set for demolition have failed to work.

National Resources Wales ruled that because seagulls are nesting on the roof, the demolition must be put on hold until the chicks have flown.

Dummy owls were put on the roof and initially worked, but seagulls returned when they realised they were fake.' (www.bbc.co.uk/news/uk-wales-north-east-wales-32165713)

Amid the recent media fuss over aggressive seagulls stealing ice-creams and chips from holidaymakers, there is a more serious side to the way in which wildlife adapts to its environment.

Birds quickly get used to any new object in their territory if it is static. While plastic owls are cheap and low-maintenance bird scarers, they aren't effective unless frequently moved around the site, and inquisitive or aggressive bird species will investigate or attack threats rather than simply move away.

There are specialists who fly larger birds of prey to scare off gulls and pigeons from public buildings such as football stadia. They have trained real birds which are, or appear to be, natural predators which the gulls and pigeons are scared of. Perhaps the contractors should have consulted specialists before relying on plastic birds. And perhaps we all need to remember that it is not just trees and hedgerows that should be cleared before the nesting season begins. Birds also nest on the ground, on cliffs and rock ledges. To a gull, a building is just another cliff or rock ledge – and in this case it was close to the seafront take-away!

ESTONIAN OIL SHALE – PART 4

Andrew Sumner and Steve Blunt, respectively a principal landscape architect and a principal vegetation manager at RML made several visits to Estonia getting to understand the oil shale industry and the available techniques for mining and restoration. They were shown a site and asked to advise on how it should be restored to productive use following oil shale extraction.

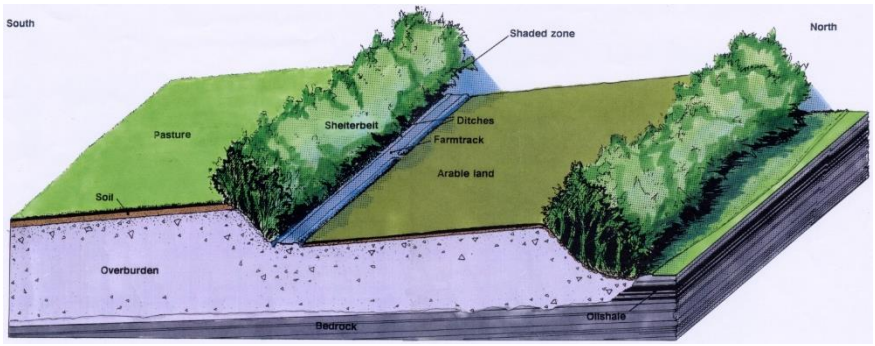
On a warm sunny late September afternoon in 1993 the maples turning wine red and birches butter yellow brightened the journey that Andrew and Steve took from the airport at Tallinn. Andrew takes up the story:

"We drove eastwards almost as far as St Petersburg. Negotiating Tallinn airport had been a challenge with suspicious young security guards, in suits and dark glasses, watching our every move. We were greeted at 'arrivals' by our driver Veyli holding up our names on a cardboard sheet. He spoke no English and we spoke no Estonian. Back in his elderly green Moskvitz we clattered along the highway from Tallinn to Johvi watching abandoned collective farmland pass by, and he offered us small sweet green apples picked from his own trees.

We arrived at our destination after sunset and the air already had an autumnal chill. We were to stay in an apartment block close to the centre of Johvi. Our hostess was a Ukrainian nurse who was determined to feed us well and would not accept anything less than our total commitment to eating all that was laid on.

Arvi Toomik, our guide, met us the next morning. Arvi spoke technically correct English which he had taught himself from mining and engineering text books. He entertained us with his stories and humour and gave us a fascinating insight into the horrors of soviet occupation and the last war. He asked us to help him understand the English use of Metaphor.

The site for the proposed mine extension was as flat as a pancake and adjoined the village of Johvi. Beneath less than 2 metres of overburden lay a deep layer of oil shale. Our plan for the site was to restore the first phase of the mine as a 'model' farm to allow the Estonian miners and farmers to test the effectiveness of our proposed restoration techniques. We also discovered that the Estonians wanted a restored landscape that reflected the traditional local pattern of small fields and dispersed settlements set within a matrix of woodland of the kind that had been lost during the Soviet period.



We proposed a system of replacing overburden to form a series of small fields graded to face south at an angle of 5o, thus providing an opportunity for some soil drainage and actually improving the solar gain significantly and lengthening the growing season. Each field would be edged with a steep slope facing north which would be planted with forest trees as a wind and snow break, and return ground levels to the local average before rising again at 50 in the next south-facing parcel. Access tracks and drainage ditches occupied the less productive shadow zone on the north side of the trees. Stripping, storing and replacing the soil and subsoil would be carefully managed to maximise productivity of the restored land, and surface water drainage was organised to feed ground water reserves.

Our ideas were well received and once the initial trials were complete we were asked to develop a restoration masterplan for the whole of a new 700 acre opencast mine. The leader of the local authority in Kohtla, Mr. Arno Rossman, said that he would like to have the masterplan implemented even without mining of oil shale.

We enjoyed a wonderful welcome among people who, like us, were hungry for experience of the world the other side of the former iron curtain. This was a time when we rubbed shoulders with a US United Nations observer who shouted 'American' as loudly as possible to make himself understood; when we saw the gates that kept in check the red army units still stationed in the town and we saw just how hard life could be in a post-Soviet European state."

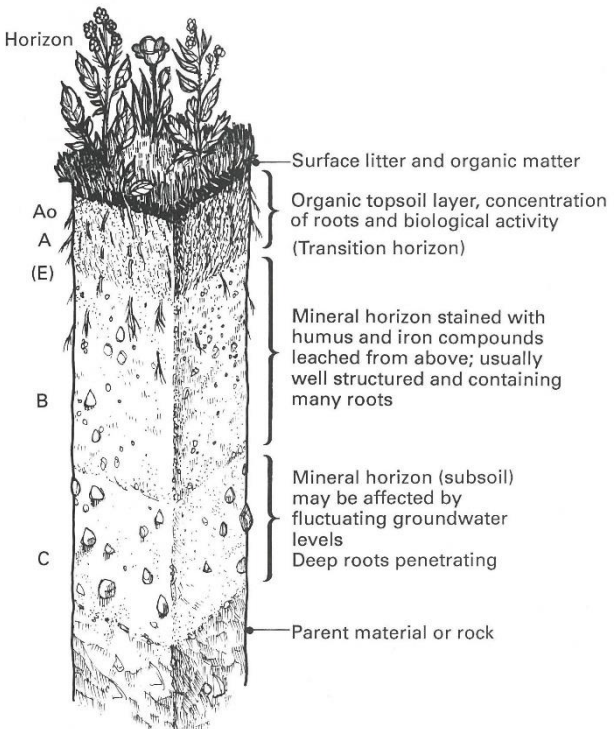
EARTHWORKS – PART 2

I trust that you have read my earlier note in Earthworks 1 in which I discussed past misuse by engineers of soil and why they labelled and treated it as 'unsuitable'.

By 2015 things have changed for the better because most engineers now appreciate the environment in which they work. Big changes in our approach to dealing with this 'unsuitable' material have taken place. A changing attitude was triggered by the publication of the CIRIA report 'Use of Vegetation in Civil Engineering' which was published by Butterworths in 1990. The last 25 years have seen a slow and sometimes grudging acceptance by civil engineers that they had to address and embrace environmental issues if they wanted a future and that a coordinated multidisciplined approach works best.

For the moment I trust that you will allow me to indulge in the letting loose a little emotion; after all you already know that I am a 'back door engineer' and that since the Aberfan disaster I have worked in an environment that was charged with emotion.

The use of the term 'soil', creates an unwelcome confusion between civil engineers and other professionals who now play a key role in managing the environmental issues that surround us in construction. These outsiders have a very different view of what 'soil' is. Since coordination is a word that is frequently heard in project meetings then it is time for change if the multidisciplined team is going to discuss soil without prolonging this confusion.



The extent, nature and properties of each horizon are determined by the soil parent material and the soil development process, under a particular vegetation type and climatic regime. Subsequent management or interference by man will substantially modify the profile.

Source: N.J. Coppin I.G. Richards (2007) Use of vegetation in civil engineering, C708, CIRIA, London (ISBN: 978-0-86017-711-1). www.ciria.org

'Unsuitable' is an old friend to engineers and has been with us a very long time and I do fully accept that for engineering purposes top soil can be found wanting and is therefore unsuitable, there can be no argument about that. Bear with me please, unsuitable is a sad word to apply to a material that has taken millennia to develop and is a living thing for which we should not find a mean purpose but a purpose that enhances our work. I would like to reclaim for today's 'topsoil' the word 'soil'. 'Top soil' is another ugly phrase and is inaccurate as well since 'my soil' can be composed of multiple horizons, much more than just the top layer. What engineers have done is stolen the word 'soil' to describe a geological formation that does sometimes look like soil but has recognizable engineering properties that can be exploited. 'Soil mechanics' is the title for a subject that in my present frame of mind I find to be a misnomer too.

I challenge engineers to find a word or phrase that fits their 'suitable' material and the environment that we find in construction today. Why not 'engineering soil' as suggested in the Manual of Applied geology published by the Institution of Civil Engineers way back in 1976.

We are now a multidisciplined profession. In the name of reconciliation between disciplines and the acceptance that things move on I would plead for engineers to no longer used the word 'soil' to describe a material that is free of organic matter but is only different from rock in not being consolidated into a hard geological formation. I would ask that 'soil' is used to describe the uppermost layers of a profile that contain significant quantities of organic matter in great variety and is understood to contain several distinct layers within it. If this was to happen many of my environmental friends would feel less confused than they do at the moment and it would make an old man happy.

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