



A technical background and primer about Eclipse Soils' Structural Soil

Overview and Introduction

The greater Perth metropolitan area is undergoing a transformation in the way in which urban landscapes are designed and developed.

There is now considerable momentum in the desire to have many more street trees alongside roads and footpaths. For example, the Mayor of the City of Perth announced recently that the City has launched an ambitious bid to almost double the city's tree canopy by 2050 (West Australian, Wednesday May 10, 2023).

Many other local governments are adopting similar policies.

This shift to a greener streetscape and urban form has developed from an enhanced recognition of the many benefits that a much more tree coverage within the city will create.

These benefits include:

- A reduction in the "urban heat island effect": this refers to the way in which asphalt, concrete and other masonry used to construct roads and pavements absorbs a great deal of heat from the sun, when it is left fully exposed to sunlight for all the hours of sunlight.
- Urban landscapes which have low canopy coverage are much hotter than those with extensive canopy coverage.
- The presence of trees and green areas within our urban environment is known to have public health benefits as well as presenting a more pleasing streetscape.
- Many cities with advanced urban design rules, for example Singapore, specify minimum standards for how much of the built environment must be "greened" with heavily planted streets and living green walls now mandatory.
- As well as cooling the urban environment and softening the often "hard" appearance of new density developments, as well as older established areas, more trees and gardens will reduce the pollutant load in urban

stormwater and will provide more habitat opportunities for native fauna species to re-take a hold in the built environment.

How does Eclipse Structural Soil help

It is not just a simple matter of planting a lot more trees into the new public spaces we create or going back and planting more trees in existing main streets and suburban roads.

Trees will not necessarily grow well in a normally built road and pavement setting.

This is because the normal design parameters are targeted at making the built road and pavement surfaces fit for purpose to withstand load – ie transit of cars trucks and pedestrians over a long service life.

This inevitably results in heavily compacted layers beneath the pavement, a soil structure which is not conducive to good root system development and therefore poor plant growth.

See Figure 1.

For a tree to grow well and be healthy for a long period of time, it must be able to develop a strong root system and be in contact with good quality soil (and to have sufficient available moisture).

The normal standard sub-soil treatments for road and pavement construction, are mostly not conducive to the support of optimal tree growth and vigour.

Eclipse Structural Soil is a bulk construction material specially designed to overcome these issues.

In the first instance, the core ingredient of the product is medium sized pieces of stone, essentially coarse granite aggregate, of about the size used for railway track ballast. Ballast is specifically designed so that the stone pieces lock together with a high level of friction and can bear heavy loads and be structurally stable over time.

See Figure 2.

Within this stony matrix there is about 35 - 40% void space – that is the interstitial air spaces between the solid stone pieces which are locked together by friction.

FIGURE 1

CROSS SECTION OF TYPICAL COMPACTED SOIL PROFILE IN STREETScape

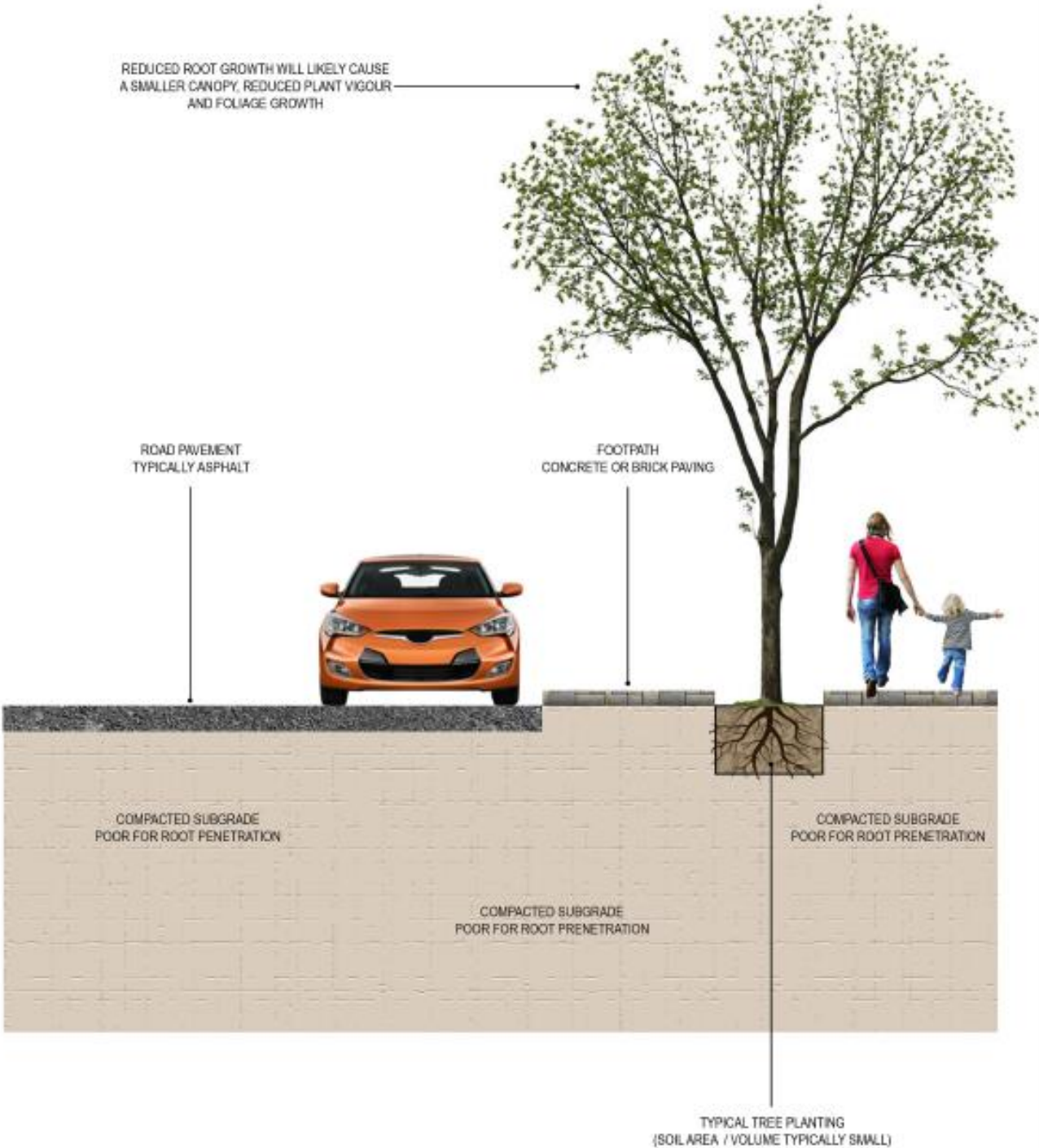
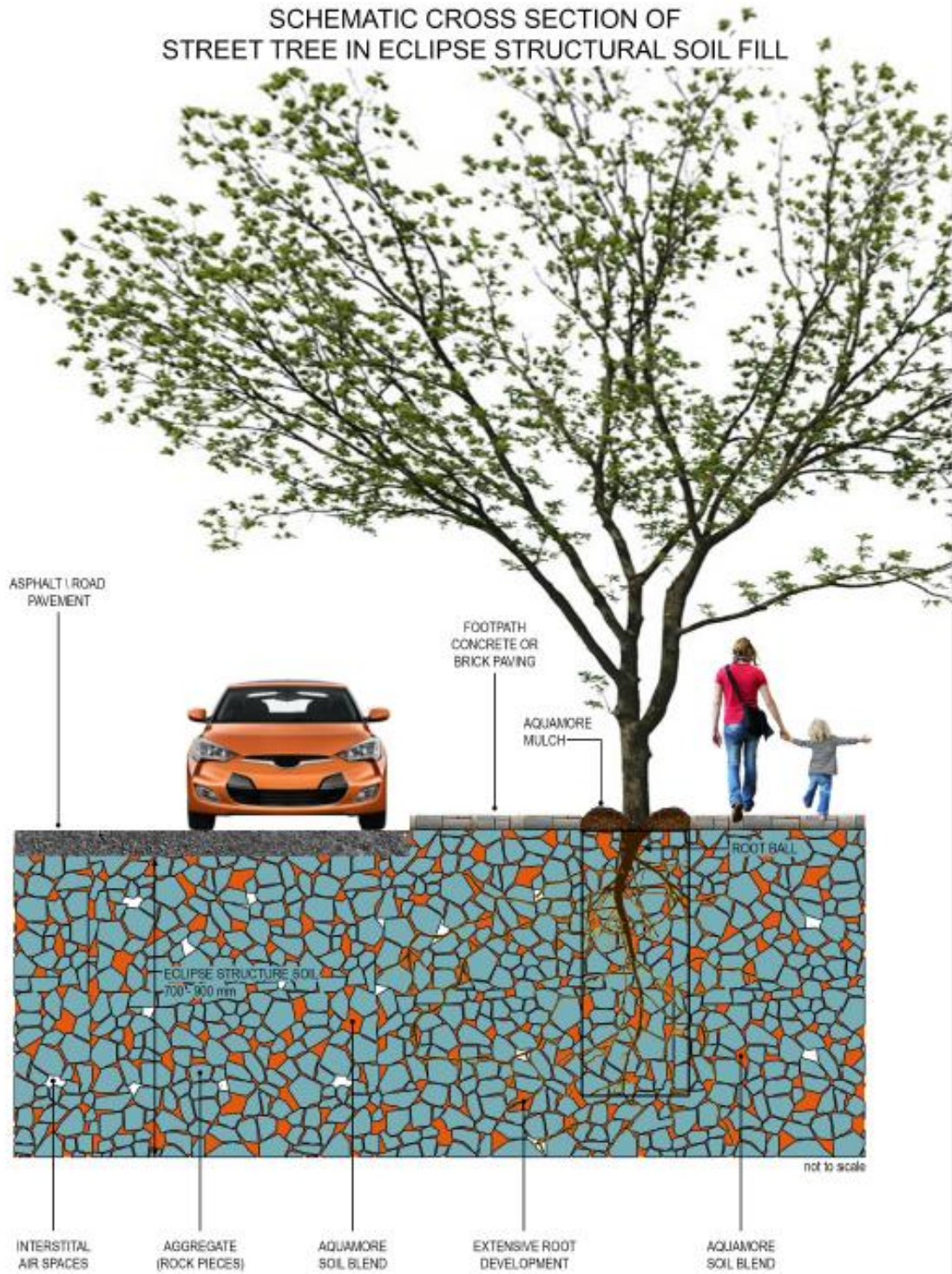


FIGURE 2

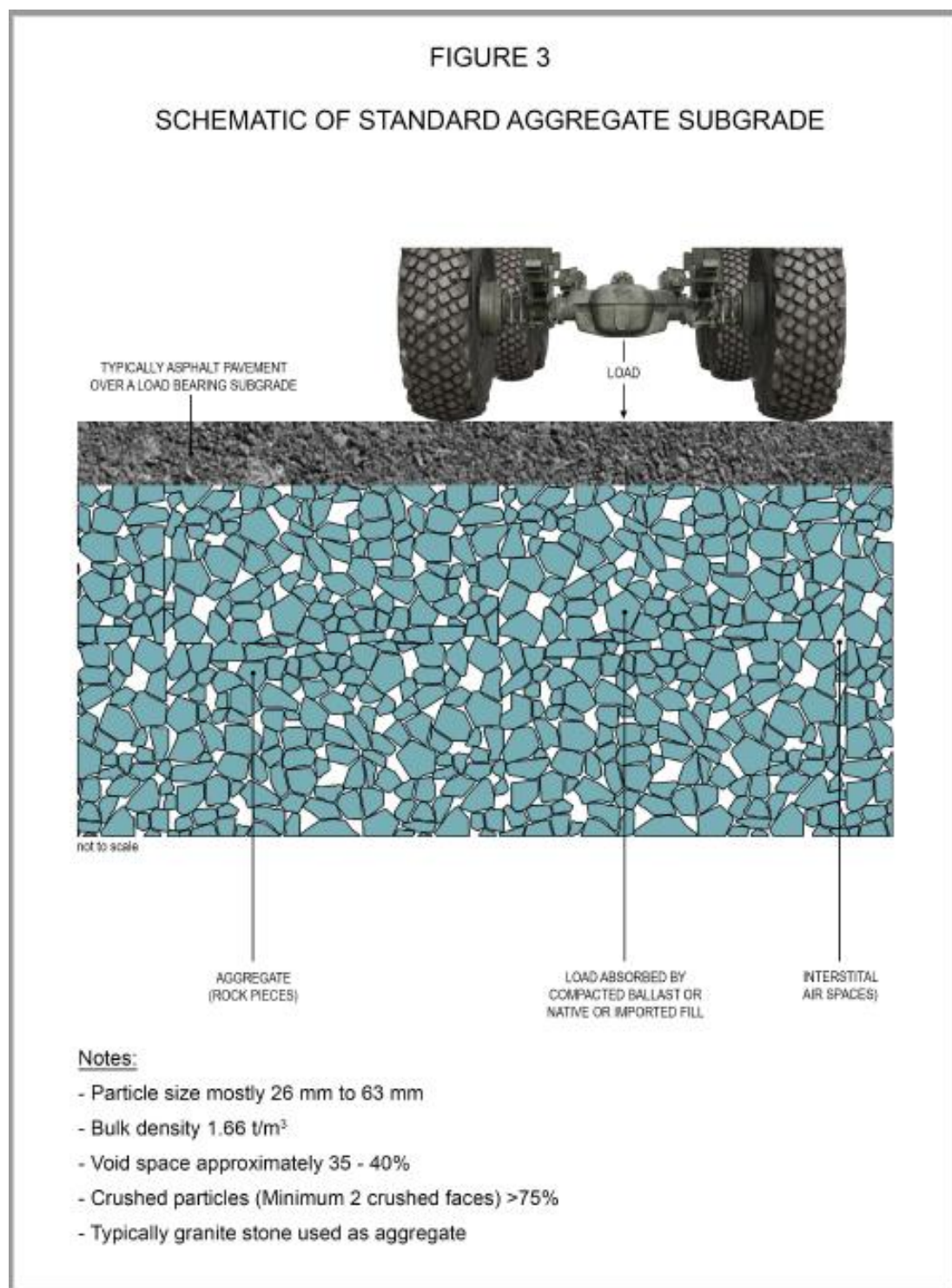
SCHEMATIC CROSS SECTION OF
STREET TREE IN ECLIPSE STRUCTURAL SOIL FILL



The Eclipse innovation uses this pore space adding a good quality soil and thus partially filling the voids with soil. Aquamore Soil Blend is mixed with the coarse aggregate to form the Eclipse Structural Soil.

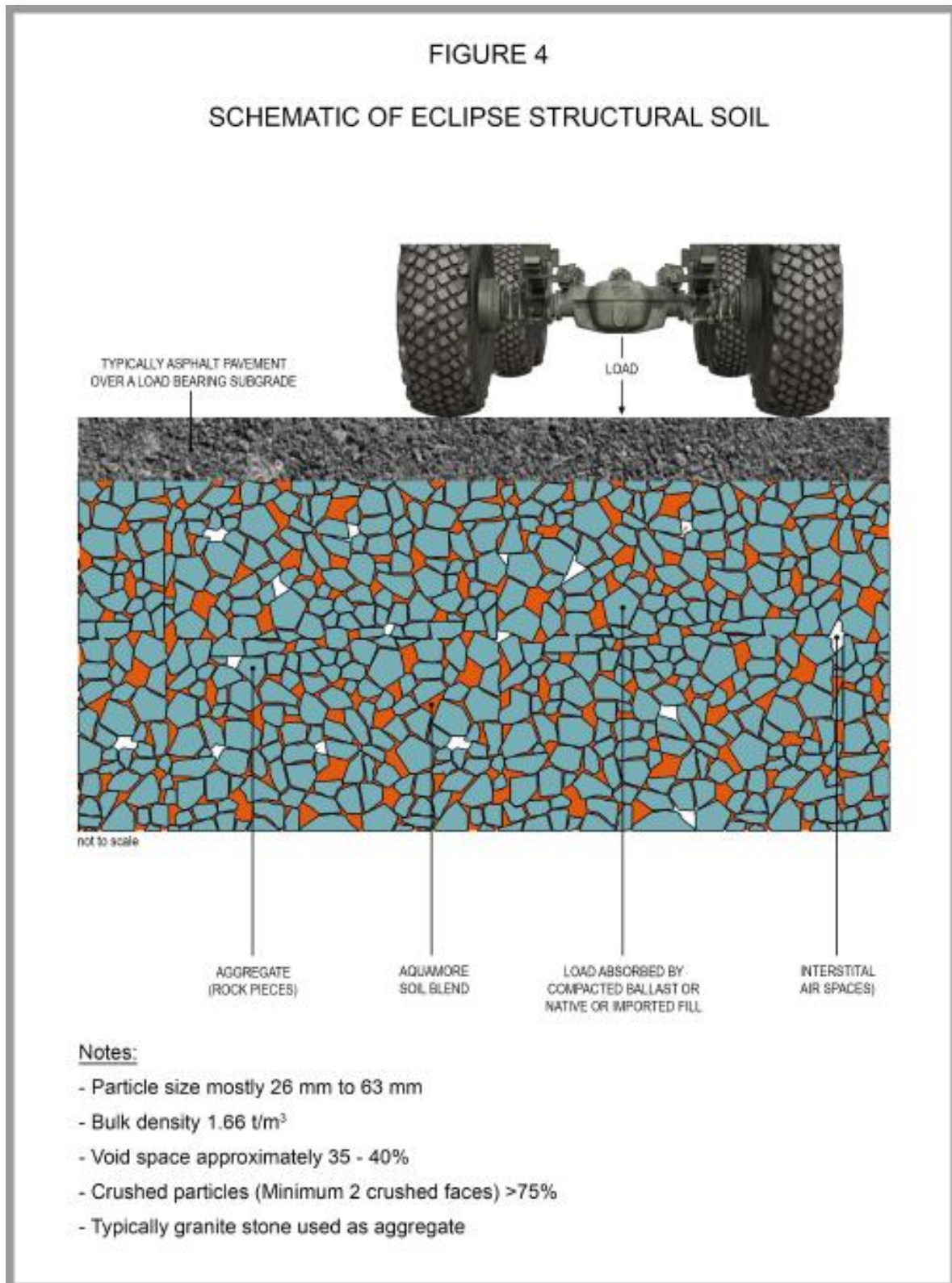
Importantly, in regard to tree growth, the product also contains a proportion of good quality water retentive growing soil, which partially fills the large pore spaces between the pieces of stone.

See Figure 3.



In this way, not only does the product have load bearing properties which meet engineering specifications, but it also contains a good quality soil which can support healthy root development and therefore healthy vigorous plant growth.

See Figure 4.



Engineering Validation of the Product

To validate the engineering properties of the Eclipse Structural Soil product, the company engaged specialist geotechnical engineers Talis Consultants to carry out the testing necessary to confirm the structural properties of the product.

Talis constructed a test pad of the material at Eclipse's Abercrombie Road Resource Recovery facility in Kwinana. The pad was used to undertake Falling Weight Deflectometer (FWD) testing on the completed pavement.

Three 300 mm deep layers of product were installed, with each layer compacted to approximately 250 mm deep using an 11-tonne vibratory roller and a Nuclear Density meter in back scatter mode used to assess the density of the layer after each pass or number of passes until a constant reading was found.

On completion, a 150mm layer of limestone was placed and compacted over the test pad, to create a surface suitable for the FWD testing.

The tests led Talis to conclude that the Eclipse Structural Soil product is suitable for use as subgrade under road pavements. A CBR value of 10% would be safe for design purposes when applying the empirical method of the Austroads standard.

The interpretation of the testing also recommended preparation by the laying then compaction of 300mm layers, then settlement under rolling to 250mm using 10 passes of an 11-tonne self-propelled smooth drum roller.

Eclipse Soils can further discuss the engineering properties of Eclipse Structural Soil on request.