5. The effect of the CSS produces **a composite mattress**, with high flexural stiffness and load support capabilities. This will prevent soil rutting and mechanical root damage by confining the porous infill materials within the CCS.

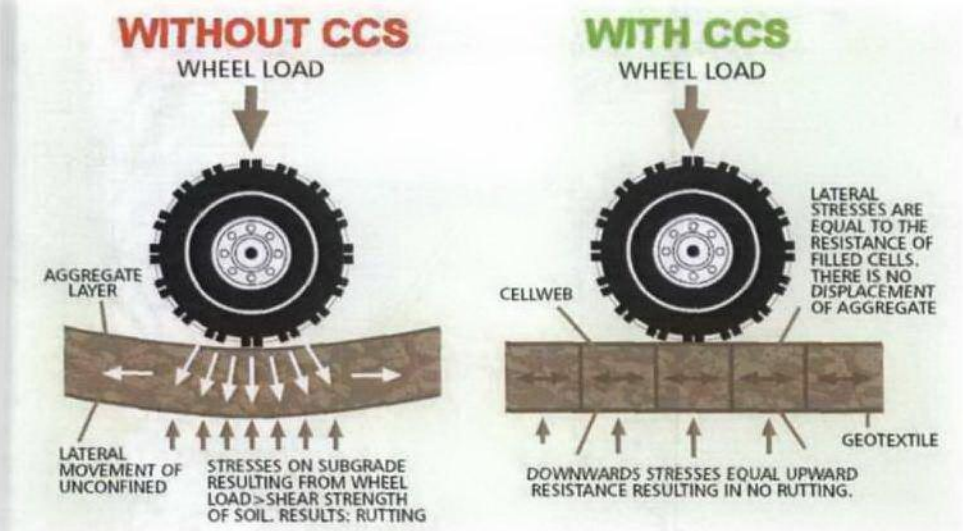


Illustration of Stress Distribution

(Images used with the kind permission of Geosynthetics Ltd, 01455 617139, www,geosyn.co.uk)

6. The use of a non-woven Geotextile beneath the cellular mattress acts as a separation/filtration layer. The CCS should be filled with **no-fines** stone in the 20-40mm range. This operation will be carried out avoiding the use of heavy machinery within the RPA of retained trees. Once filled, the perforated cellular wall structure provides mechanical interlock for infill materials, increasing the shear strength while allowing lateral drainage and gaseous exchange.

7. The system will be used as a permanent base for a wearing course and/or will provide a temporary site access for root protection. The minimum thickness available for CCS material is 75mm and is available up to 300mm thickness; the material required is dependant on the load bearing capacity of the final surface. **A Structural Engineer should design all engineering solutions to surfaces.**

8. A **pre-commencement site meeting** with the appointed Demolition and/or Ground Works Contractor, Site Manager, Arboricultural Consultant, LPA Tree Officer and appointed Engineering Consultant, will agree the stages and specification for the installation of the LIS. A qualified Arboricultural Consultant will supervise any works within the RPA's of retained trees.

Stages for Installation of the LIS (with CCS)

Stage 1 **Erection of Tree Protection Fencing** (see Tree Protection Plan).

Stage 2 **Remove existing vegetation** by using a specific herbicide (as advised by a specialist) or manual removal with hand tools only. Agreed removal of shrubs, saplings or trees, within the RPAs of retained trees are to be cut to or just below ground level rather than grubbed or ground out, which can damage roots of retained trees.

Stage 3 **Remove existing hard surfaces** (paving, tarmac etc.) Machinery operating on existing surfaces or outside the RPAs and tree canopies could, under specialist arboricultural supervision, be used to carefully remove existing wearing surfaces. The sub base of existing surfaces or foundations should be left in situ where possible to avoid unnecessary root disturbance and provide a base for a new LIS).

Stage 4 **Install the non-woven Geotextile** directly over soil grade level (levelled where necessary, by the infill of no-fines gravel, washed aggregate or structural soil (min. 20% sand content) and fix in place.

Stage 5 **Lay the CCS over the Geotextile**, which is secured open under tension during the infill process with steel staples or wooden pegs.

Stage 6 **Install kerbs and edgings** directly on top of existing soil grade level. For light structures, a treated peg and board may be acceptable. For more substantial structures, railway sleepers, haunched concrete with road pins, drilled kerbstones or gabians will be appropriate.

Stage 7 **Fill the CCS** ensuring any machinery works only on already filled areas. Typical infill consists of no fines angular granular material 20-40mm, **which will remain uncompacted**.

Stage 8 **Install wearing surface.**

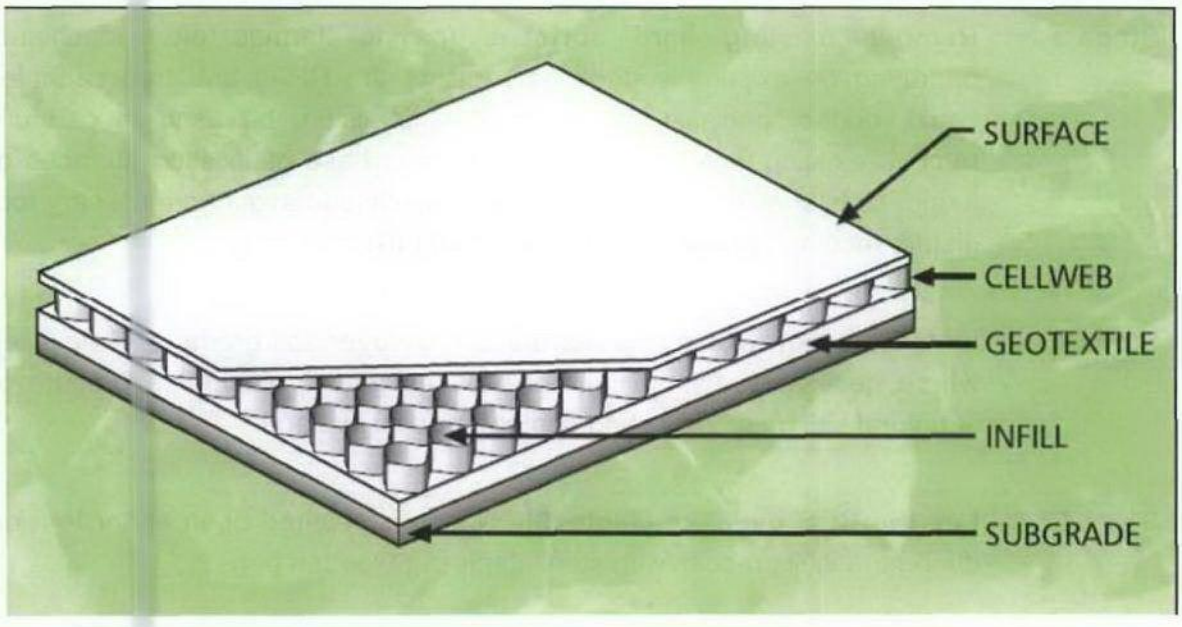
Pervious Surfacing Options

Small Block Paving

- Lay a second layer of Geotextile separation fabric over the infill CCS.
- Lay a sharp sand-bedding layer to recommended depth.
- Place block paviors as per manufacturer's instructions.

Washed Gravel

- Place second layer of Geotextile separation fabric over the infill CCS.
- Place pea shingle/ gravel aggregate to required depth.



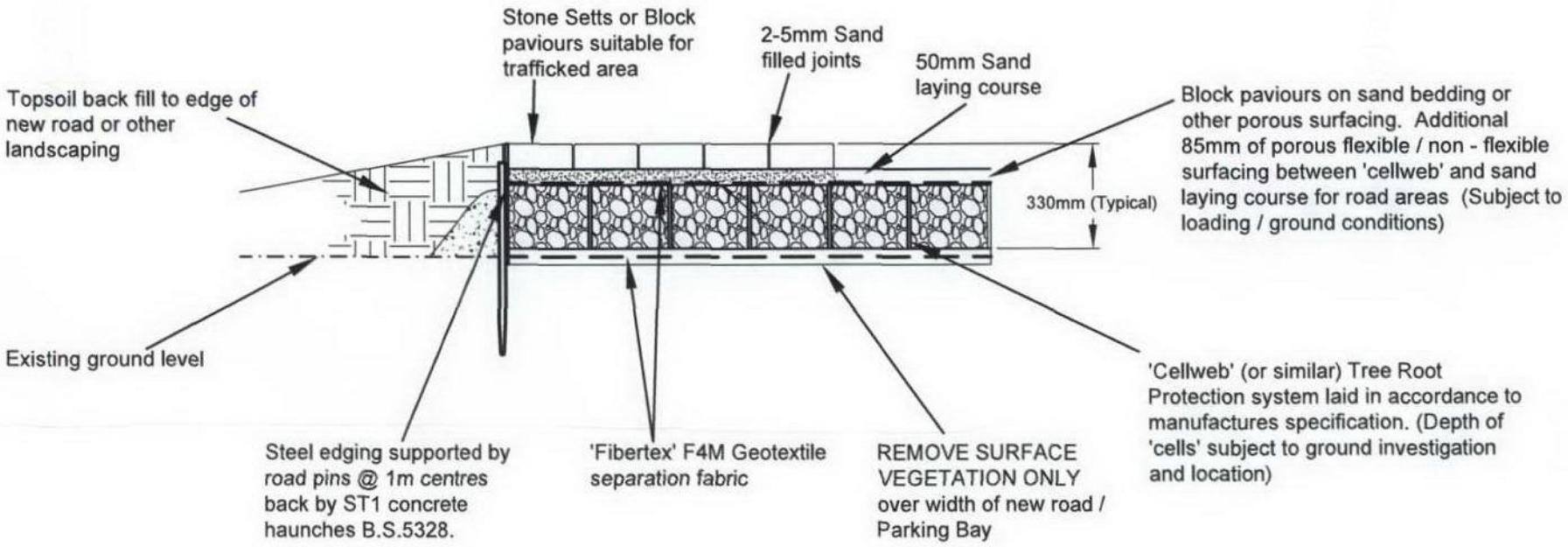
Makeup of Final Surface

(Images used with the kind permission of Geosynthetics Ltd, 01455 617139, www,geosyn.co.uk)

References: 1 – Tree Roots in the Built Environment 2006, Roberts Jackson Smith HSO
2 - Tree Root Growth Requirements, Dr Kim. D. Coder, University of Georgia. July 2000
3 – Arboriculture, Tree Management of Shade Trees and Vines 2004, Harris, Clarke, Matheny

Carriageway Construction Notes

1. All highway works (including highway drainage) subject to adoption shall be constructed in accordance with the DEPARTMENT OF TRANSPORT MANUAL OF CONTRACT DOCUMENTS FOR HIGHWAY WORKS 2002, SPECIFICATION FOR HIGHWAY WORKS with latest additions and amendments where appropriate.



ACS CONSULTING

Stilwell PARTNERSHIP
SAFETY, TRAFFIC & HIGHWAY ENGINEERING CONSULTANTS

MIDAS HOUSE, 37 INVINCIBLE ROAD, FARNBOROUGH, HANTS, GU14 7QU
Tel: 01276 700400, Fax: 01276 700401
E-Mail: info@stilwell-llp.co.uk
Web: www.stilwell-llp.co.uk

PROJECT:	LOW INVASIVE DRIVEWAYS AND ROADS
TITLE:	TYPICAL SURFACE DRIVEWAY AND ROAD CONSTRUCTION
SCALE: NTS	DRAWN: JH
DATE: FEB 08	CHECKED
DWG No:	TSP/ACS/P1757/01

APPENDIX 4

ACS Consulting (London)
Tree Management Consultants
T: 020 8687 1214

GreenTek
GUARANTEED TO DO WHAT IT SAYS
-OR YOUR MONEY BACK!

Tel: 0113 267 6000
Fax: 0113 267 2222

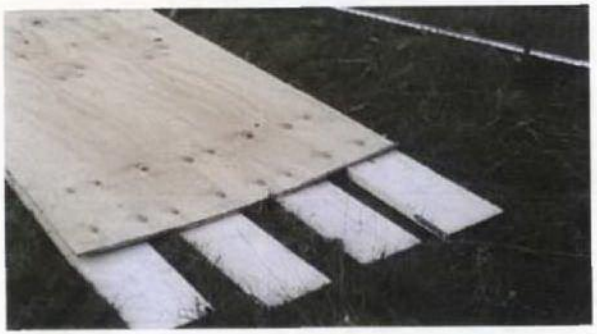
ACS
CONSULTING

Example of ground protection, which is best laid over 50mm of a compressible material such as woodchips or sharp sand for optimum tree root protection.

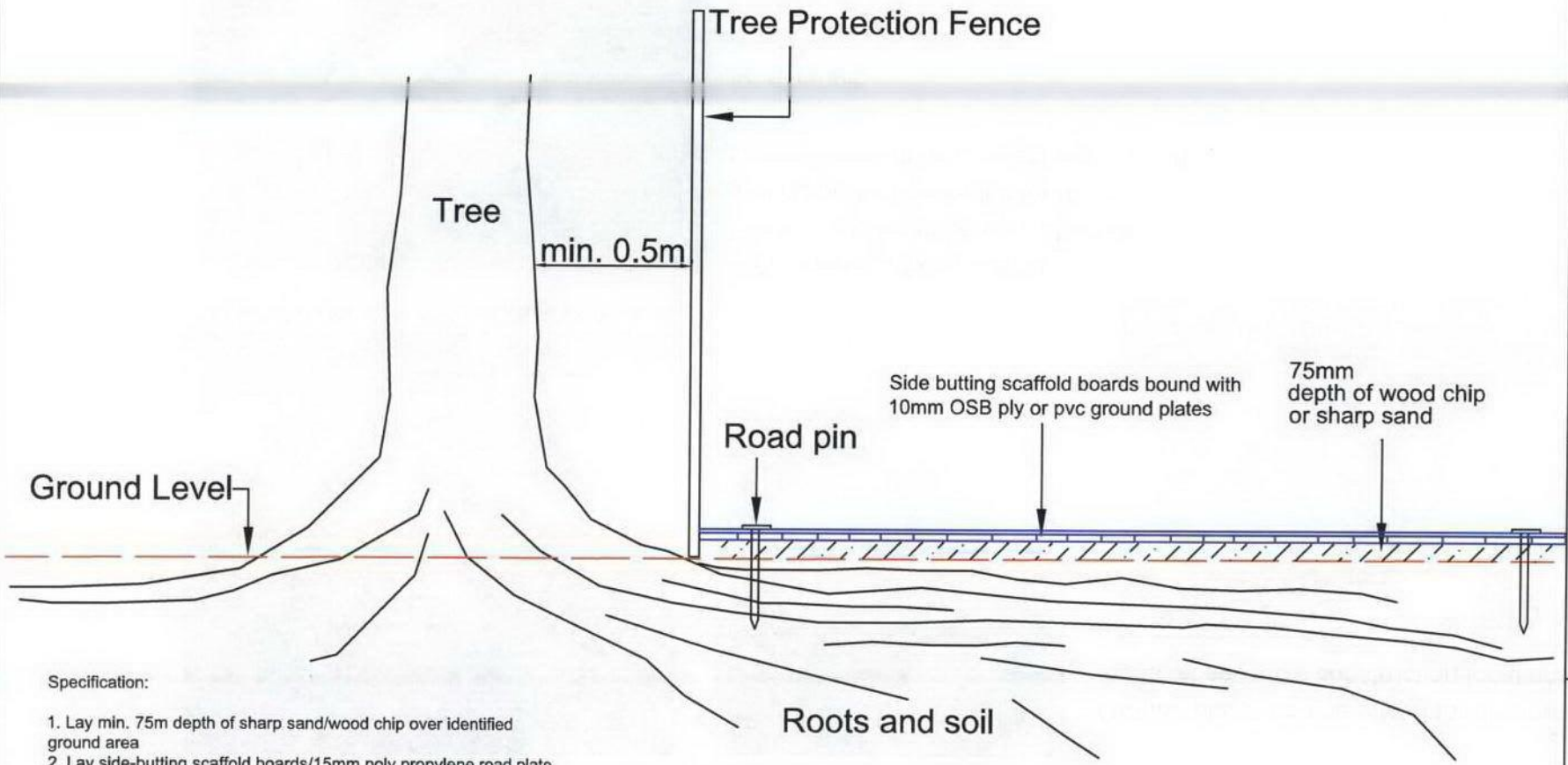
WALK TOP - Ideal for car parks and walk ways.

Ground plates can be useful for dissipating loads, at sensitive construction locations.

DOUBLE LINK JOINERS - lock Ground-Guards into one large working platform.



OSB boarding fixing scaffold Boards below can be very effective ground protection for lighter traffic such as pedestrians, wheel-barrow and occasional passes with light dumper vehicles for example.



Specification:

1. Lay min. 75m depth of sharp sand/wood chip over identified ground area
2. Lay side-butting scaffold boards/15mm poly propylene road plate over sand/wood chip
3. Fix ground protection cover into place with pins/pegs
4. Erect protection fence (where feasible).
5. Erected scaffolding can act as protection fencing.
6. Remove ground protection upon completion/landscaping only.

ACS Consulting (London)

Urban & Rural Tree Management

Justin Plaza 3
341 London Road
Mitcham
CR4 4BE

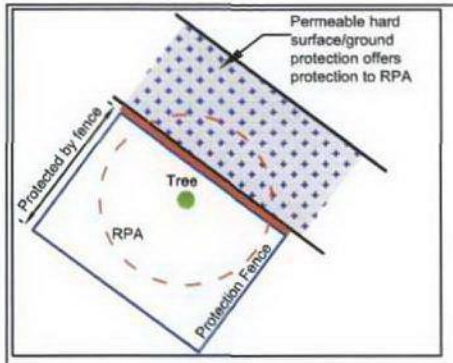
T: 020 8687 1214
F: 020 8687 2456
E: info@treebiz.co.uk

Ground Protection Example

Date:

Ref:

Note: Sketch Plan Only - Not to Scale
Not all site features shown



Protected tree

The red line denotes the position of lateral and verticle protection offered by robust fencing and properly installed low-invasive, permeable hard surfacing or ground protection, respectively.

Protection Fence

Tree tunk centre

Lateral or horizontal protection is offered to the tree by the erection of robust fencing.

The tree's rooting area beneath a low-invavise and porous hard-standing surface (or ground protection), is offered verticle protection by the surface itself.

y mtrs

x mtrs

Ground level

Rooting zone in need of protection

Area protected by fence

Area protected by surface

Note:

In this example, the BS RPA radius of the tree is calculated at x mtrs. A proportion (y mtrs), of the RPA, is covered by new permeable hard surface (or ground protection). Provided that hard standing is constructed in accordace with the principles of BS 5837:2005 para 11.8.1 and having been designed with specialist advice from an engineer and arboriculturalist, **the RPA of the tree is not reduced**.

ACS Consulting (London)

Tree Management Consultants

Justin Plaza 3
341 London Road
Mitcham
CR4 4BE

T: 020 8687 1214
F: 020 8687 2456
E: info@treebiz.co.uk

Title:

Tree/Root Protected Area

Date: Jan 08

Ref:

Note: Sketch Plan Only - Not to Scale
Not all site features shown

APPENDIX 5

ACS Consulting (London)
Tree Management Consultants
T: 020 8687 1214

ACS Consulting
T: 020 8687 1214

Arboricultural Site Supervision

ACS CONSULTING

Site: 1 Hyde Park, London
Inspected By: H .Applevard
Client: RPC
Site Agent: Shaun Clark

Date of Inspection: 15/02/2007
Time of Inspection: 3:30pm

Tree Protective Fencing

Tree protection in correct location

Comments/Action
No action at this time

Effective fencing in position

Agreed Construction Exclusion Zone

No debris within construction exclusion zone

Comments/Action
No action at this time

Amendments to Documentation Required

No amendments required

Comments/Action
Building works outside scope of Method Statement

Fencing with signs

Remedial Works

General Comments

Tree protection and on-site supervsion effective and understood.