

Cellweb® TRP System

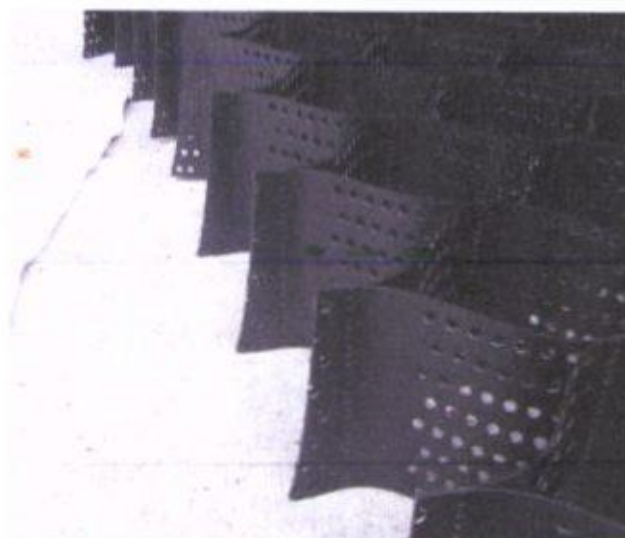
Tree Root Protection System



The Consequences Of Tree Root Damage During Construction

It is an offence to cut down, lop, uproot, top, wilfully damage or destroy a protected tree without authorisation. Trees can be protected under the Town and Country Planning Act 1990 and the Town and Country Planning (Trees) Regulations 1999. Trees are protected when they are the subject of Tree Preservation Orders (T.P.O) or within Conservation Areas, subject to certain exemptions. Retention and protection of trees on development sites is also secured through the use of planning conditions.

On a construction site all trees with a Tree Preservation Orders need to be managed in accordance with BS5837 2005 (Trees in relation to construction); failure to comply with these orders can be a costly affair as many parties have discovered.



Fishponds, Ketton

There are two offences which apply equally to trees protected by Tree Preservation Orders and those within Conservation Areas:

- Firstly, anyone who cuts down, uproots or wilfully destroys a tree, or who lops, tops or wilfully damages it in a way that is likely to destroy it is liable, if convicted in the Magistrates Court, to pay a fine of up to £20,000. If the person is committed for trial in the Crown Court, they are liable on conviction to an unlimited fine. The Courts have held that it is not necessary for a tree to be obliterated for it to be "destroyed" for the purposes of the legislation. It is sufficient for the tree to have been rendered useless as an amenity.
- Secondly, anyone who carries out works on a tree that are not likely to destroy it is liable, if convicted in the Magistrates Court, to a fine of up to £2,500. In addition to directly carrying out unauthorised works on protected trees, it is an offence to cause or permit such works.

Developers and building contractors are often completely unaware that 'compaction of soils within the Root Protection Area (RPA)' constitutes wilful damage to the tree. When vehicular or pedestrian access within the RPA is necessary, either for the construction operation or final site access, the effects of this activity must be addressed and the ground must be protected. When tracked or wheeled traffic movements are involved, the ground protection system should be designed by an engineer and take into account the loading involved.



Shelton Road, Shrewsbury

The Solution:

Geosynthetics Cellweb® TRP System



The Solution According to BS 5837:2012

"Appropriate sub-base options for new hard surfacing include three-dimensional cellular confinement systems"

(BS 5837 2012 section 7.4.2 Note 1)

The Cellweb® TRP Solution

Cellweb® TRP is the market leader in the United Kingdom and Ireland for tree root protection. Cellweb® TRP cellular confinement system protects tree roots from the damaging effects of compaction and desiccation, while creating a stable, load bearing surface for vehicular traffic. Cellweb® TRP complies with BS 5837:2005 and APN 1. It provides a no-dig solution, is tried and tested having been used successfully since 1998. It is the only tree root protection system which has been independently tested and it is the only tree root protection system which is guaranteed for 20 years. See page 6 for the full terms and conditions of the guarantee.



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Field Trials

Geosynthetics Limited are the only company in the UK and Ireland to carry out live, completely independent field tests on the performance of a 3 dimensional cellular confinement system when used in a no-dig tree root protection system application. The results prove that Cellweb® TRP significantly reduces the compaction of sub-soils within the root growth limiting parameters established by K D Coder, 'Soil damage from compaction'. University of Georgia. July 2000. A copy of the report is available upon request.

Cellweb® TRP Product Guarantee

Geosynthetics Limited prides itself on providing a reliable, consistent service; including technical advice, on site support and installation guidance. Geosynthetics Limited provides a 20 year guarantee for the Cellweb® TRP tree root protection system. This guarantee gives the client, the tree officer and arboricultural consultant the confidence that the designed system will perform as intended without damaging the health of the tree.

See page 6 for the full terms and conditions of the guarantee.

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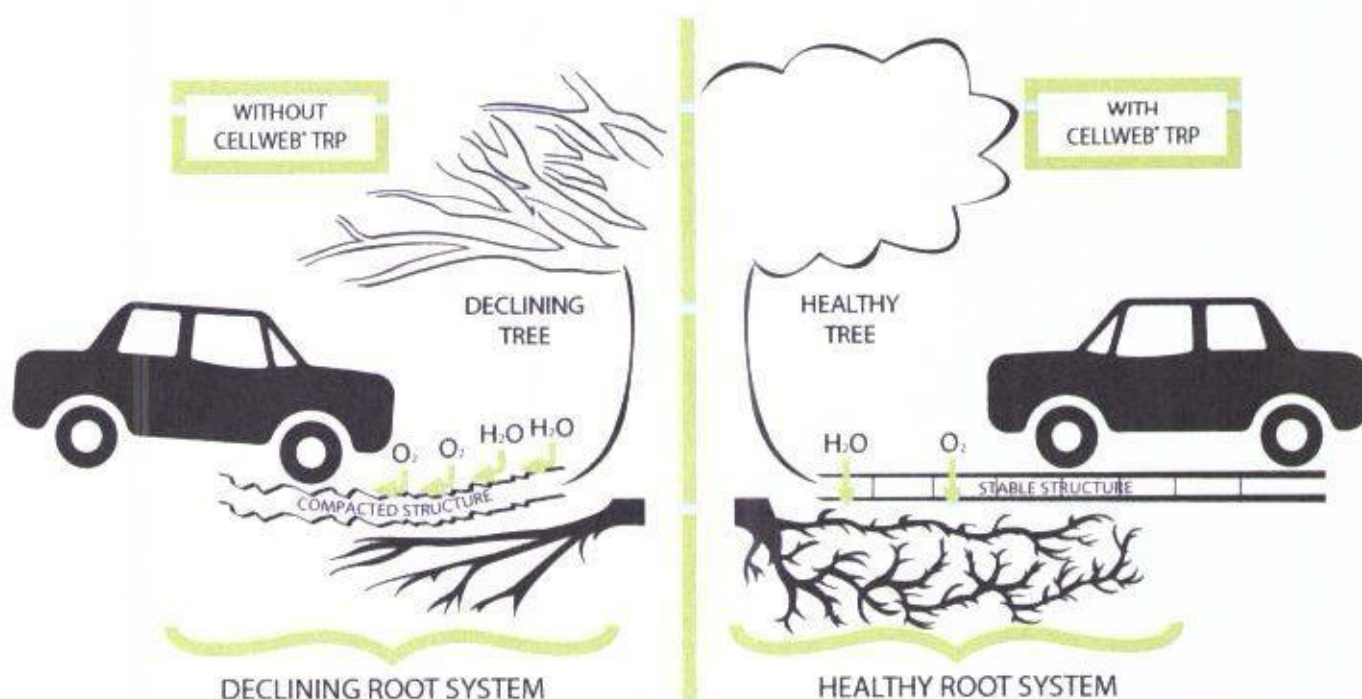
How the System Works



How Cellweb® TRP Works

Cellweb® TRP is a cellular confinement system that confines aggregate materials and makes them stronger, thus increasing the bearing capacity of the sub base materials. Research shows that Cellweb® TRP acts as a stiff raft to distribute wheel loads and reduce their magnitude at the base of the construction, thus maintaining the soil bulk density at levels that are suitable for tree root growth.

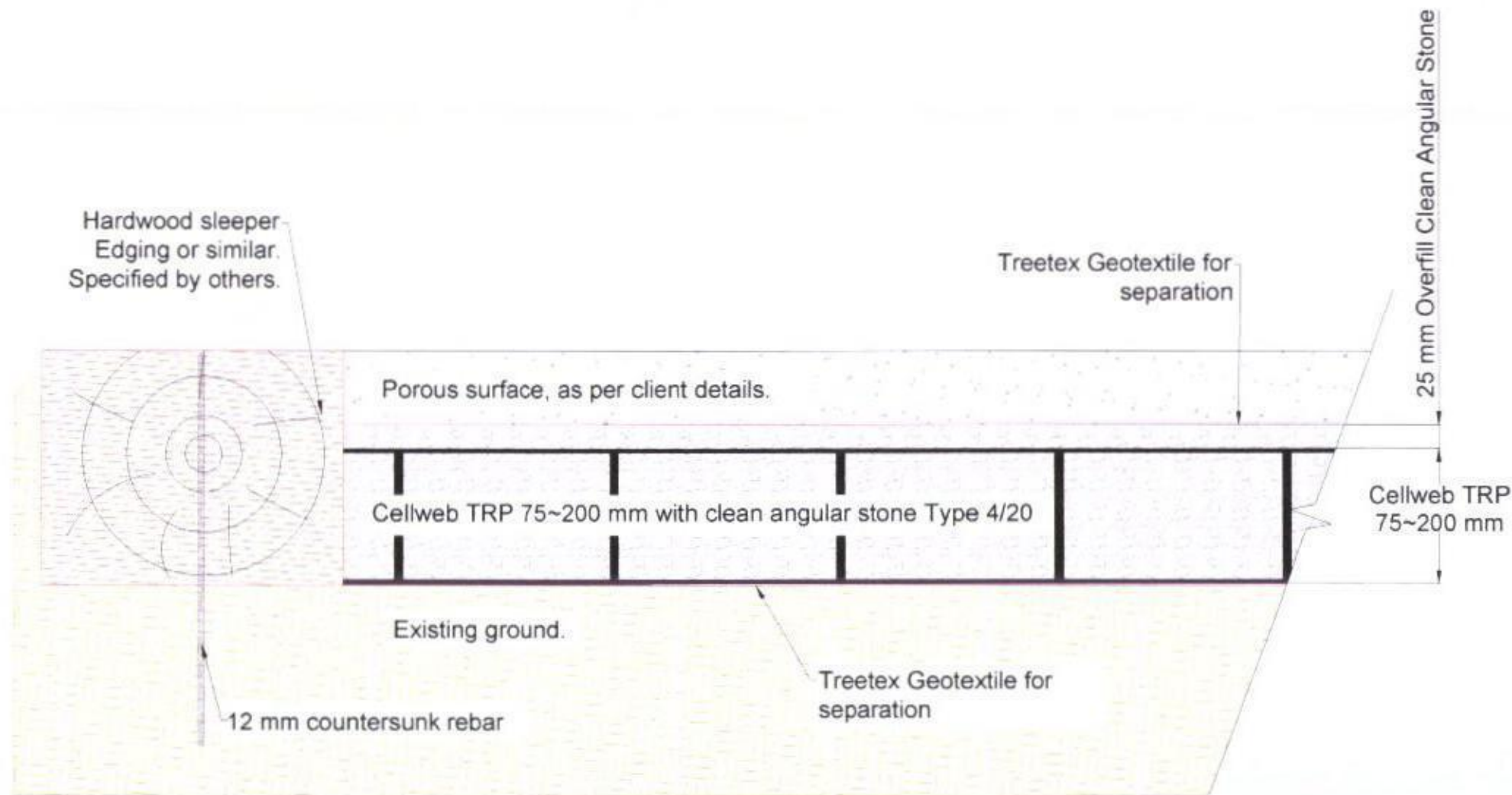
Cellweb® TRP is used around the world to provide cost effective hard surface construction over tree roots and is the system of choice for Tree Officers and Arboriculturists. For more information on this subject see Cellweb® TRP Fact Sheet No 1.



Water and Oxygen Transfer Through the Cellweb® TRP System

The Cellweb® TRP system is constructed using open aggregate infill and Cellweb® TRP has perforated cell walls. The pore spaces between the aggregate particles are greater than 0.1mm in diameter. This open structure is far more permeable than typical soils and allows the free movement of water and oxygen so that supplies to trees are maintained.

For more information on this subject see Cellweb® TRP Fact Sheet No 2.



Note: Subbase could be required depending on the existing ground CBR % and the type of traffic on the surface.



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Project: Cellweb 75~200mm Hardwood
sleeper Standard details

Description:

Drawn By:
PVB
Ref:

Scale:
NTS
Version:
V1

Date:
15/05/15
Sheet:
Hardwood Sleeper

Checked By:

Tree Root Protection Using Cellweb TRP®

Fact Sheet 1: Use of Cellweb TRP® in Root Protection Areas (RPA's)



Introduction

Cellweb TRP® is a cellular confinement system that confines aggregate materials and makes them stronger. This behaviour allows the depth of pavement construction to be reduced. It also minimises compaction of soils below road pavements constructed using the Cellweb TRP® tree root protection system. Cellweb TRP® is used around the world to provide cost effective road and railway construction, as well as Tree Root Protection.

Cellular confinement was developed by the US Army Corps of Engineers during the 1970s to allow construction of roads for military equipment quickly and easily using whatever local soil material was available (especially across beaches). Since then the method has been developed and it is now routinely used in road and rail construction as well as in tree root protection. There is an extensive research base that demonstrates the performance of cellular confinement and it is a method of pavement construction that is recognised by the US Federal Highways Administration.

Characteristics of Cellweb TRP®

Pokharel et al (2009) stated that about one fifth of pavement failures in the US occur due to either weak subgrades or inefficient load transfer from the sub-base. Cellweb TRP® can improve the strength of road pavement construction to deal with these problems. It is a three dimensional interconnected honeycomb of cells made from HDPE. The cells are filled with aggregate sub-base and laterally confine the material when it is loaded, thus increasing the bearing capacity of the layer. This results in a thinner layer of aggregate being required to achieve the same performance.

It also allows uncompacted open graded aggregate to be used in the sub-base construction which is a vital part of any tree root protection system.

Cellweb TRP® is available in a range of height and aspect ratios to suit different load applications.

Use of Cellweb TRP® in RPAs

The use of Cellweb TRP® tree root protection system for building roads, car parks and other vehicular pathways includes a sub-base infill material of clean angular stone which does not need to be compacted. This immediately provides a layer of material that will absorb compaction energy applied to the top of materials placed over it. Compaction of soils by construction machinery does not extend to a great depth. This is the reason why earthworks materials are normally placed in thin layers because compaction only occurs in the top few hundred mm at most. With the lightweight compaction plant used on most development sites the maximum depth that compaction will extend to is between 150mm and 200mm. Thus, if an 80mm layer of asphalt is placed over a 150mm deep Cellweb TRP® system the compaction reaching the base of the construction and the natural soil will be minimal. This effect was demonstrated by Lichter and Lindsey (1994) where a trial area was trafficked by a front-end loader and only suffered significant compaction of the soil to a depth of 100mm.

The use of Cellweb TRP® also spreads the wheel loads from traffic. There has been extensive research published on the performance of these systems from the original work by the US Army Corps of Engineers (Webster 1981) to more recent studies such as that by Emersleben and Meyer (2008).



Figure 1 - in situ density test prior to construction of pavement

The research shows that Cellweb TRP® acts as a stiff raft to distribute wheel loads and reduce their magnitude at the base of the construction by 30% to 36% (without any asphalt or other surfacing). Once the surface is taken into account, the pressure applied by traffic to soil below roads or pavements constructed using no-dig methods will be significantly reduced and thus compaction will also be reduced. Note, compaction is not prevented but it is reduced, thus maintaining the soil bulk density at levels that are suitable for tree root growth.

The effectiveness of the Cellweb TRP® no-dig construction in reducing soil compaction has been demonstrated in trials carried out by the Environmental Protection Group Limited. Two parking bays were constructed over a fine sand soil, one with a Cellweb TRP® cellular confinement sub-base. The parking bays were surfaced with asphalt and then used by cars for four weeks on a daily basis. It is well known that compaction of soils occurs in the first few passes of a vehicle, so the maximum adverse effects on compaction of soil below the pavement should have been achieved. In situ density tests were carried out on the sand below the pavement before and after construction (Figure 1).



Tree Root Protection Using Cellweb TRP®

Fact Sheet 1: Use of Cellweb TRP® in Root Protection Areas (RPA's)



Figure 2 - Cellweb TRP® in construction



Figure 3 - In situ density tests post-trafficking

The results in Figure 4 show that compaction of the soil below the Cellweb TRP® pavement was noticeably lower than that below the normal pavement. The increase in compaction below the normal pavement is similar to the increase found on a number of construction sites by Alberty et al (1984).

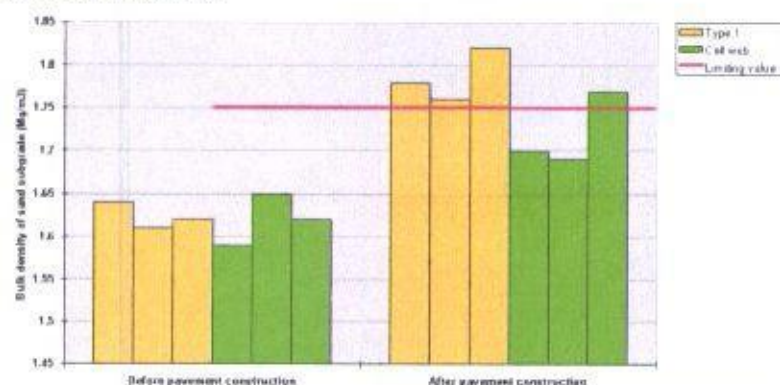


Figure 4 - Comparison of soil compaction below pavements

The use of layers of uncompacted material has also been shown by others to reduce compaction of natural soil by construction plant (Lichter and Lindsay 2004). However, these were temporary layers intended to be removed after construction was finished and they are not suitable for incorporation into a permanent car park surface. Nonetheless, it does demonstrate the effectiveness of no-dig techniques using Cellweb TRP®. It is important to note that the specific properties of cellular confinement systems (eg material type, strength, welding at joints, perforations, etc) will affect how each one behaves in trials such as this. Therefore the results are only applicable to the Cellweb TRP® system.

Note

So called tree root protection systems that use Type 1 sub-base or any similar material that requires compaction will not prevent compaction of soils around the tree roots. Type 1 is also not very permeable to air and water and will limit the availability to roots. Therefore geogrid reinforced Type 1 is not suitable for tree root protection.

References

- Alberty CA, Pellet HM and Taaylor DH (1984). Characterisation of soil compaction at construction sites and woody plant response. *Journal of Environmental Horticulture*, 2, 48-53.
- Lichter J M and Lindsay P A (1994). The use of surface treatments for the prevention of soil compaction during site construction. *Journal of Arboriculture* 20 (4) July 1994.
- Pokharel SK, Han R, Parsons RL, Qian Y, Leshchinsky D and Halahmi I (2009). Experimental study on bearing capacity of geocell-reinforced bases.
- Emersleben A and Meyer N (2008) The Use of Geocells in Road constructions over Soft Soil: Vertical Stress and Falling Weight Deflectometer Measurements. *EuroGeo4*, Edinburgh, Scotland.
- Webster S L (1981). Investigation of beach sand trafficability enhancement using sand-grid confinement and membrane reinforcement concepts. Geotechnical Laboratory, U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, Mississippi. Technical Report GL-79-20(2), February, 1981.



Clean Angular Stone

Type 4/20

Specification for open graded sub-base for use as storage below pervious pavements (also Type C filter material for filter drains and soakaway backfill in accordance with SHW Clause 505) Type 4/20

Material to BS EN 13242 or BS EN 12620

Material to comprise crushed rock, concrete or blast furnace slag or similar approved. Crushed gravel is not permitted.

Properties	Test Method	Value
Grading	BS EN 13242	Grading 4/20 (Preferred) or 4/40, Gc 80/20, GTc 20/15
Fines Content	BS EN 13242	f_4
Shape	BS EN 13242	FI_{20}
Resistance to Fragmentation	BS EN 13242	LA_{30}
Durability:		
- Water absorption to BS EN 1097-6:2000, Clause 7	BS EN 13242	WA_{24}
- For $WA > 2\%$, magnesium sulfate soundness	BS EN 13242	MS_{18}
Resistance to Wear	BS EN 13242	M_{DE}
Acid-soluble sulfate content:		
- Aggregates other than air-cooled blast-furnace slag	BS EN 13242	$AS_{0.2}$
- Air-cooled blast-furnace slag	BS EN 13242	$AS_{0.1}$
Total Sulfur:		
- Aggregates other than air-cooled blast-furnace slag	BS EN 13242	$\leq 1\%$ by mass
- Air-cooled blast-furnace slag	BS EN 13242	$\leq 2\%$ by mass
Volume Stability of blast-furnace and steel slags:		
- Air-cooled blast-furnace slag	BS EN 13242	Free from dicalcium silicate and iron disintegration in accordance BS EN 13242:2002, 6.4.2.2
- Steel slag	BS EN 13242	V_s
Leaching of contaminants	BS EN 13242	Blast furnace slag and other recycled materials should meet the requirements of the Environment Waste Acceptance Criteria for inert waste when tested in accordance with BS EN 12457-3

If compaction is required should be in 150mm layers with 4 passes of a smooth wheeled roller max weight of 1000kg/m width **without vibration**.

Aggregate gradings for sub-base materials to BS EN 12620

Sieve Size (mm)	Percentage Passing (%)	
	Coarse aggregate 4/40	Coarse aggregate 4/20
80	100	-
63	98-100	-
40	90-99	100
31.5	-	98-100
20	25-70	90-99
10	-	25-70
4	0-15	0-15
2	0-5	0-5
1	-	-

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