

The Science behind preparing a cricket wicket

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Fundamentals

- How many days do you need to prepare a wicket
- Why is the soils moisture content so critical to the wicket preparation
- How long should you roll the wicket
- Why is it so important to understand the weather forecast between when you start the preparation and game day
- How does the weight of the roller affect the compaction
- What makes my wicket hard

The Facts

- Soil is made up of Solids, Water and Air (plus organics)
- Density (t/m^3) or compaction (%) is defined as the mass of soil in a given volume
- **Compaction is the forcing together of soil particles under pressure or energy to increase the load bearing capacity of the surface**
- Hardness is not density or compaction
- Soil hardness is a measure of soil strength to resist mechanical disturbance. The higher the pressure required to penetrate through the soil, the harder the soil. Soil hardness is influenced by soil moisture and soil density.
- A soils ability to be compacted, is dependant on the amount of moisture, the weight of the roller and the hardness of the base upon which you are compacting.
- A soil can achieve the highest compaction at a given energy applied only at the Optimum Moisture Content (OMC). The higher the energy used the drier the water content, conversely the lower the energy the higher the water content.



Field Compaction
occurs with rollers



Light roller

200kg - 800kg



Light to medium roller

1100kg - 2200kg



Light to medium roller

860kg – 1660kg

Medium
roller 1320kg
– 2260 kg





Heavy roller 3000kg

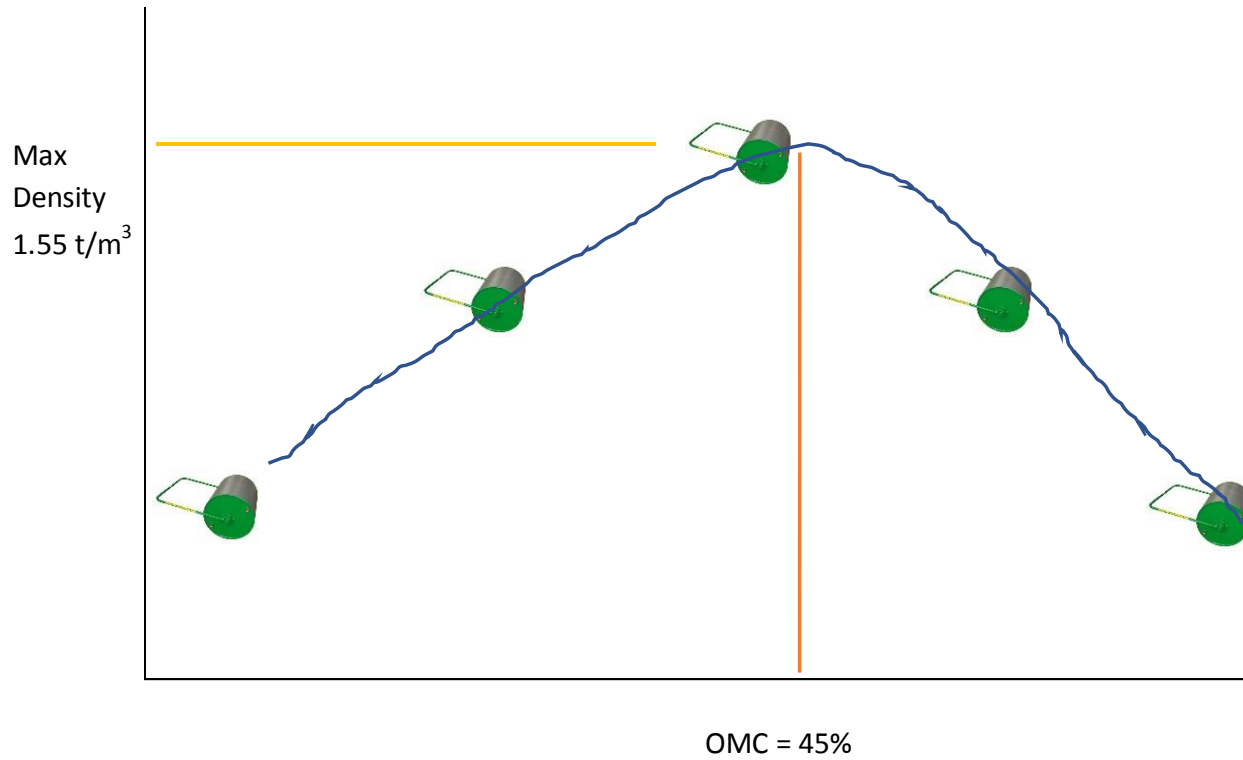


Very Heavy Roller – 4300kg



Laboratory Compaction Testing

- The soil is compacted into a 1 litre metal mould on a concrete block
- The hammer is dropped from a set height using a set mass to achieve compaction
- The soil is compacted at 5 different moisture contents generally at 2% increment changes



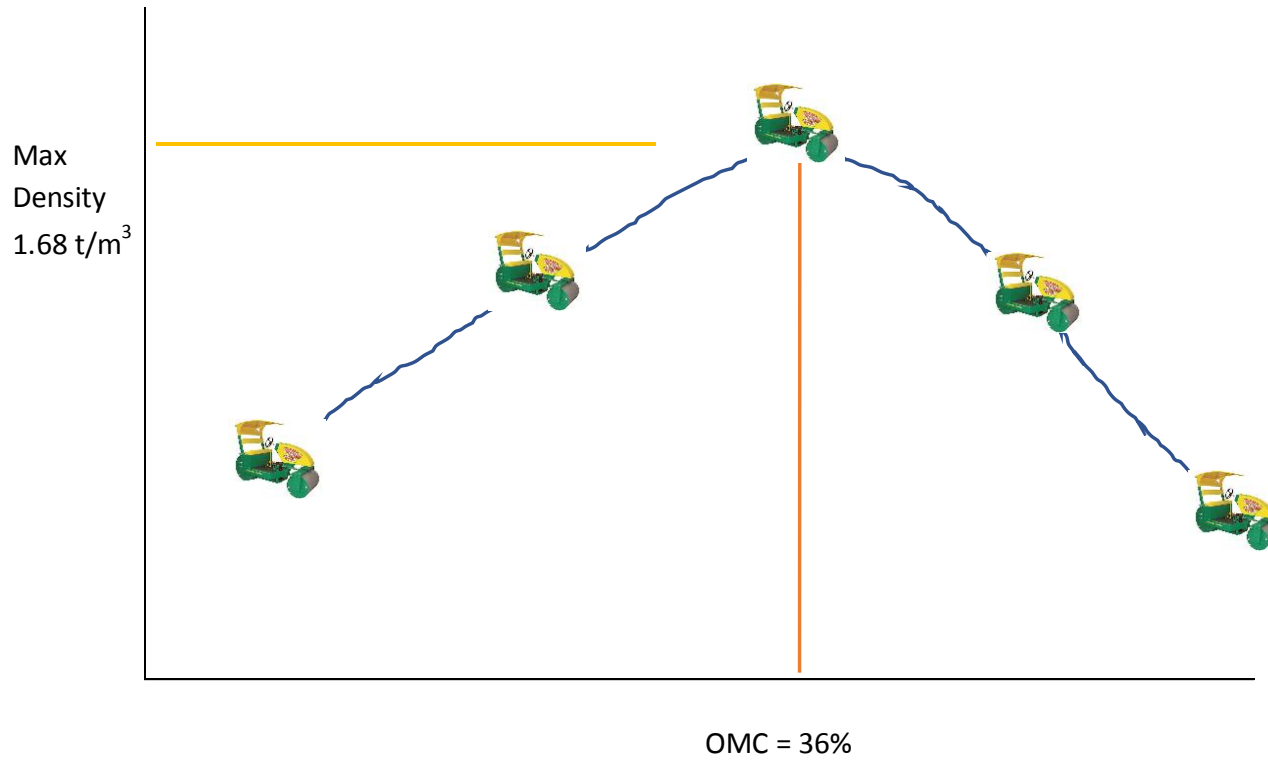
Light Roller - compaction curve

Light roller

Sample A



11. 4. 2002



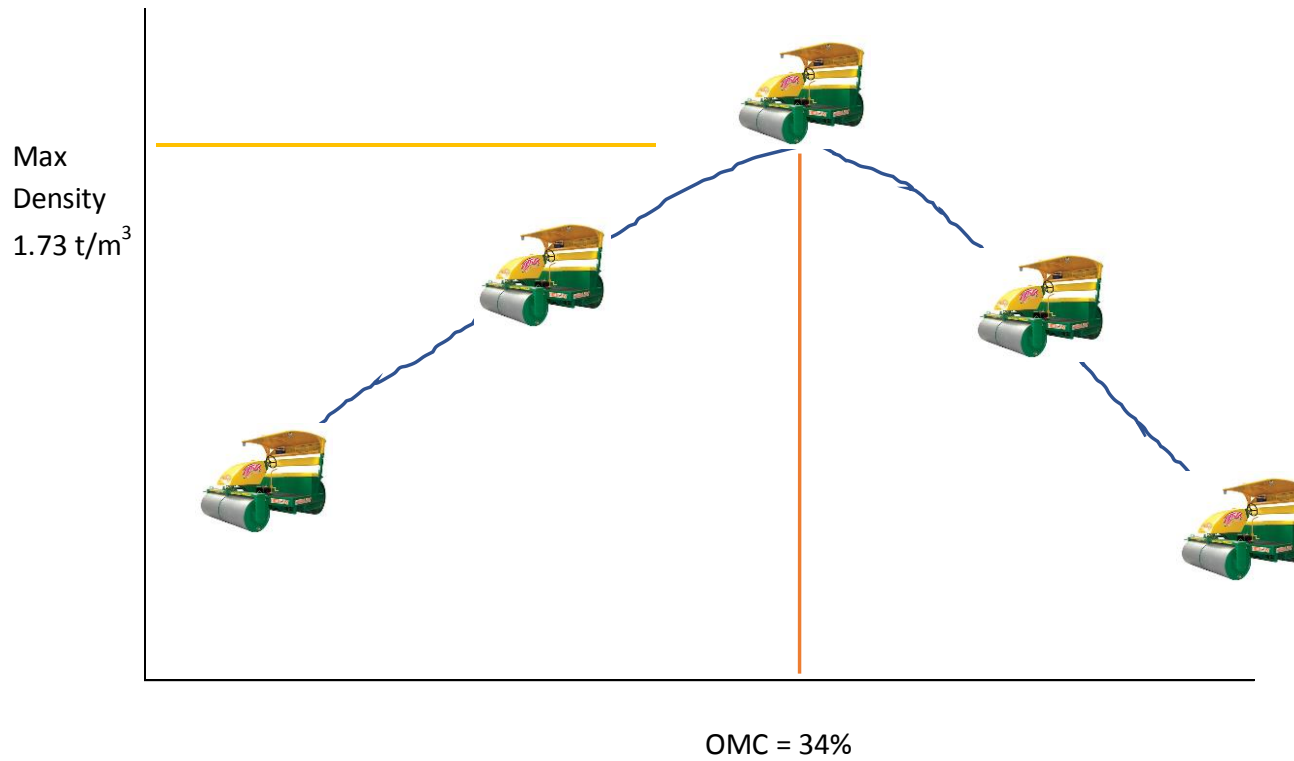
Medium Roller - compaction curve

Medium roller

Sample C



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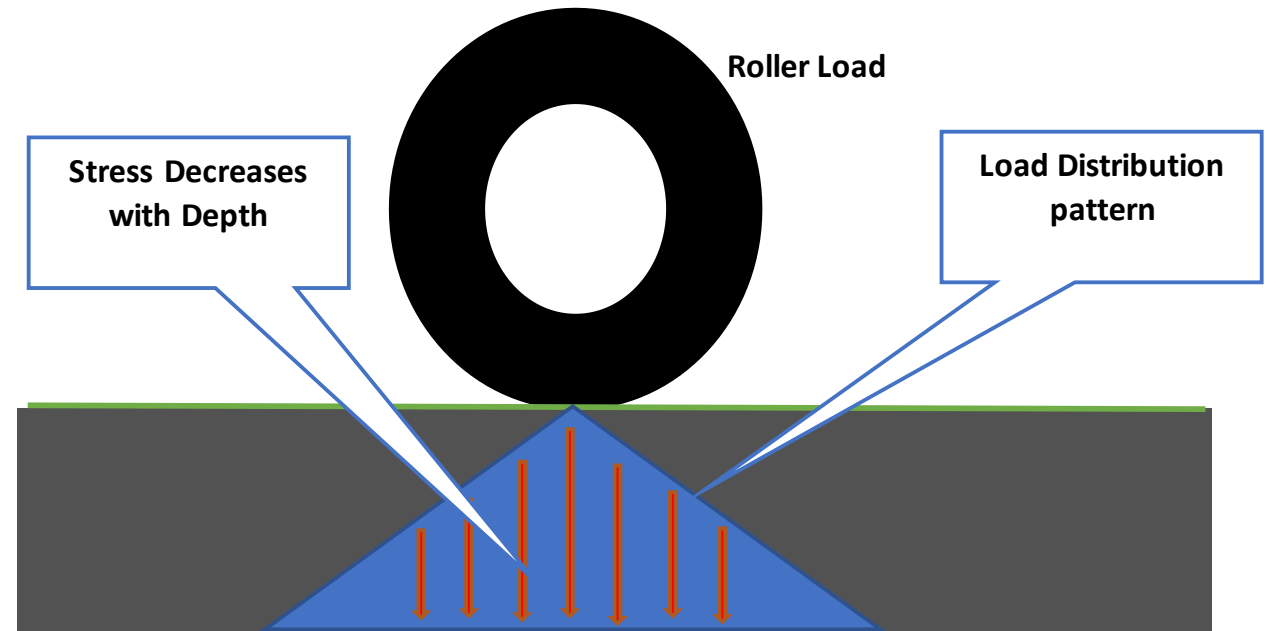


Heavy Roller - compaction curve

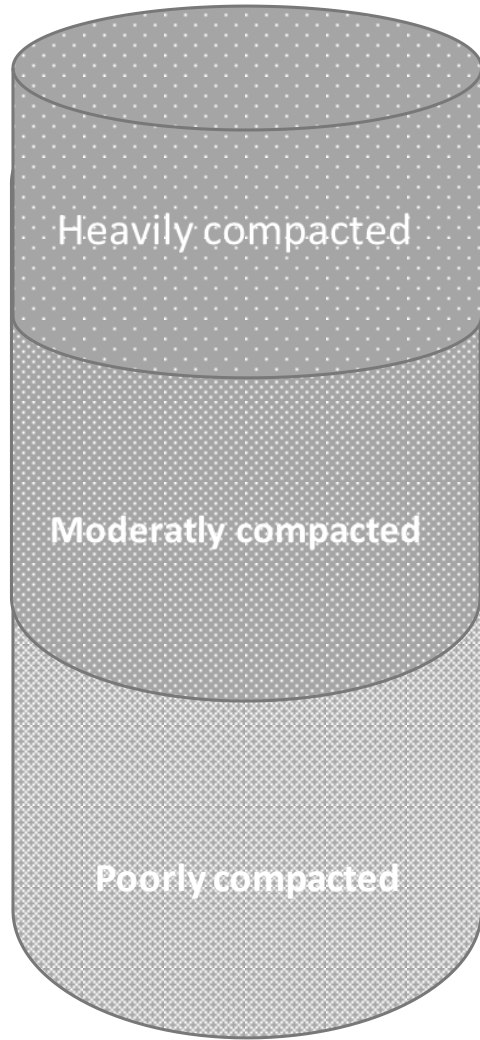
Heavy roller



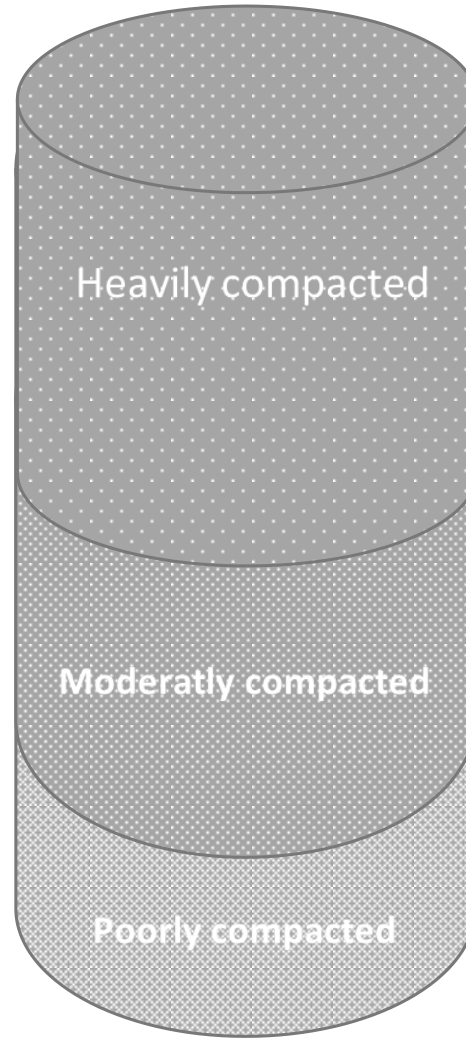
Fundamentals of load distribution



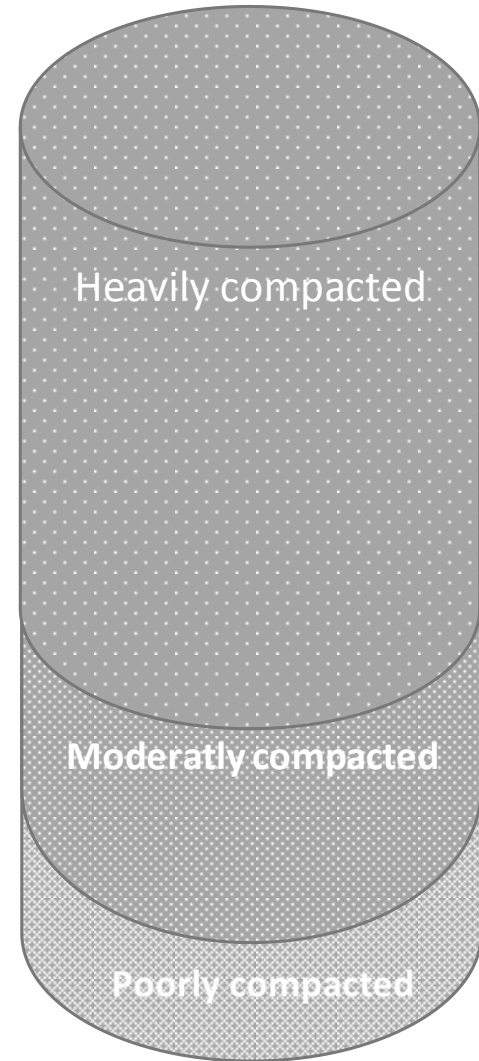
Light Roller




Medium Roller



Heavy Roller







Compaction summary

Weight of roller	Estimated Optimum Moisture	Estimated Maximum Wet Density t/m ³
200 kg	42%	1.55
800 kg	38%	1.59
1200 kg	35%	1.63
2000 kg	32%	1.68
3000 kg	30%	1.73
4000 kg	29%	1.75

- Optimum Moisture for achieving compaction is different for every weighted roller and soil type.
- Also: The higher the clay content, the higher the optimum.

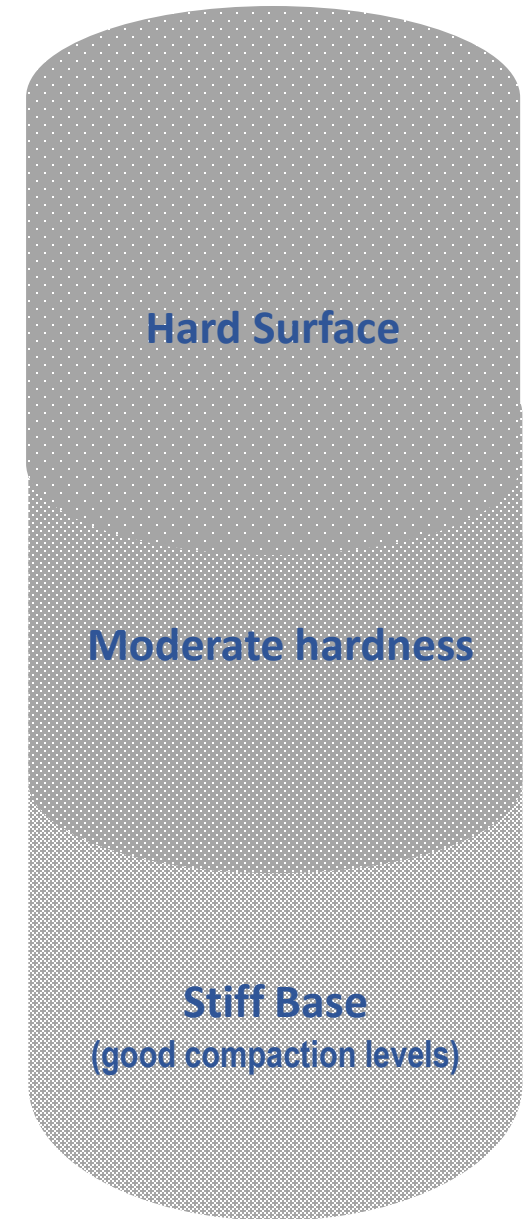
What happens when we use the incorrect roller

- We compact the top 20mm, while the lower depths remain poorly compacted. The surface may crust over and become drier, preventing our ability to close up the air spaces at depth
- Having a hard base to hit against is the key to achieving deep compaction which in turn provides for a harder wicket
- If we roll a wetter soil with a heavier roller we may displace the soil and create waves



What happens when we DO use the correct sequence of rollers at the correct moisture content

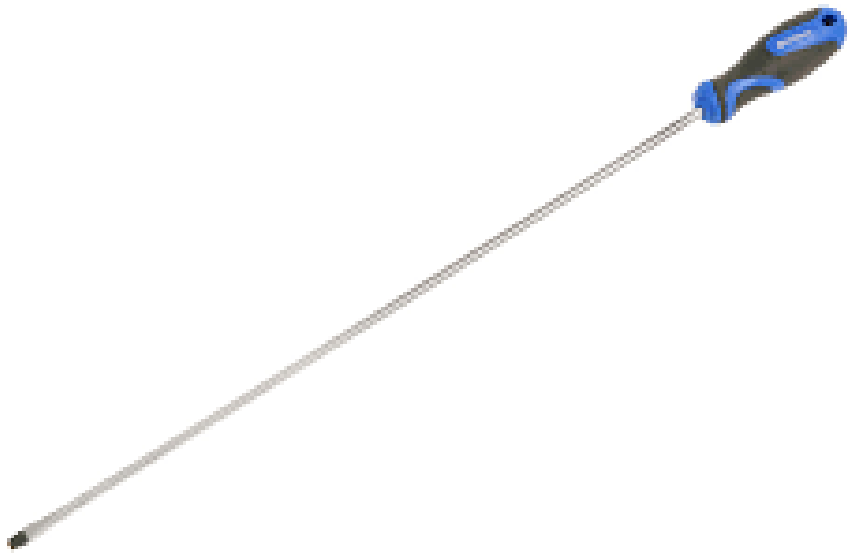
- We are able to achieve higher compaction through the profile, which in turn may give us a harder wicket – conditions permitting
- A highly compacted wicket will limit the amount of cracking that will occur



How do we measure the soils changing conditions

- Basic tools include a pushing spike and a moisture probe
- Intermediate tools would include a Clegg hammer
- Advanced tools would include a Nuclear Density/ Moisture gauge

Soil Strength Probe



Moisture probe



Clegg Hammer




Nuclear Density / Moisture gauge



Expectations Versus Reality

- The players expect a wicket to provide; bounce, carry, spin, wickets and runs.
- A curator can only produce a wicket using; the roller/s available, the time allocated, the soil type, the accumulation of organics and has to deal with what nature provides in the way of sun and heat or rain.





Expectations Versus Reality

season	soil moisture condition	Shrinkage potential
Early summer	Moist and uniform	low
Mid summer	Damp and varied	aggressive
Late summer	Damp to dry	moderate

The way you prepare a wicket in late October, January or March require different considerations as the moisture condition deep in the profile will be very different at each of these calendar periods.

Roller use – Domestic Grounds

Many Domestic Council grounds only have one roller available for use, which is generally a light roller, so how can we meet player expectations.

We can't

We can only produce a wicket to the maximum compaction the roller will allow, but we need to understand;

when

what

and how.

Roller use – Domestic Grounds



WHEN:



We need to commence rolling WHEN we have a reasonable understanding of where the wicket is at, in relation to its moisture.



How far wet or dry of the optimum moisture content is the soil specific to our roller weight.



Rolling the soil too wet will deform the surface and create waves. If the soil is too dry the curator must water the wicket in small regular increments to allow a deep penetration until you have a uniform moist soil.



The challenge is to understand what this looks like and more importantly if you can measure it, then do so.

Roller use – Domestic Grounds



WHAT:



At WHAT speed do we roll. Slow as possible if we are close to OMC, faster if we are wet of OMC and not at all if we are dry of OMC



A roller will only be able to close up the air space within the soil to increase the compaction while the soil is close to its OMC and once those macro air spaces are closed, rolling the soil any more is pointless.



If we are slightly wet of OMC the roller will achieve further compaction for each subsequent roll as the soil dries. This ceases once the soil moves dry of OMC. Unless of course you have a heavier roller.

Light Roller Use – HOW can you achieve the best possible wicket

Prepare a written plan so its not just in your head. Include;

1. No. of days to game day -so you can plan ahead
2. Estimate the variation from OMC at the start of preparation
3. List and review of forecasted weather: temperatures/ rain/ evaporation rate
4. Plan your rolling periods based on point 3
5. Plan hessian and cover use, to slow drying, increase drying, prevent wetting, maintain status quo
6. Monitor the need to add water and understand why and how much is needed
7. Use a probe to gauge hardness based on ease of penetration and review the change as you go deeper into the profile
8. Use a portable moisture probe to understand moisture change
9. Be prepared to alter the plan to react to changes and observations

Light Roller Use – Observations

As you prepare the wicket try to understand what the signs are showing you.

- What affect is rolling having on increasing the compaction
- Is the surface drying – too fast, too slow or as desired
- Are cracks appearing – small, large , uniform
- Do you need to flick the wicket with some light watering to keep the turf alive during hot weather
- Is the whole wicket drying at a uniform rate or are there wet spots
- Are plates or laminations occurring

How do you correct the undesirable elements of your observations

Assumptions

The wicket has great turf cover and is in a healthy state when you start a wicket preparation

You need to maintain the turfs growing activity for as long as you can during the preparation. The turfs ability to transpire will draw moisture out of the wicket while it is alive and active.

If the soils remain too moist below the surface with a hard crust, you are more than likely going to get a dead surface.

International & Premier Grade Wickets

The complexity of producing a one day or test wicket are multi-dimensional

You either require advanced experience and / or all the monitoring tools described previously at your disposal, to assist in understanding what is occurring at any point during the preparation.

Even with monitoring tools, you need the skills to understand what the data is telling you. What is extremely important is to maintain historical records and to define the numbers against the performance of the wicket, only then do you learn how to reproduce a similar wicket.

Reviewing the data

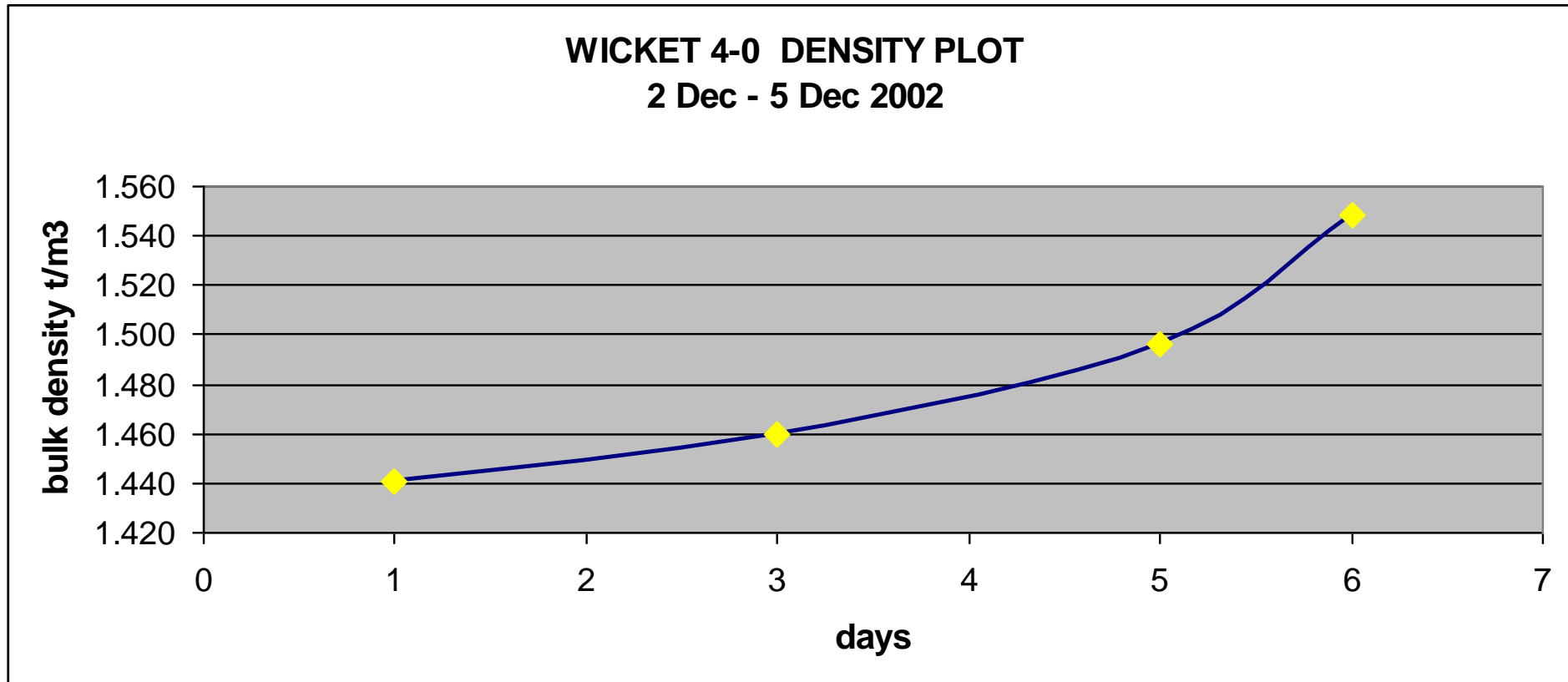
Compaction / Density

You do not want the bulk density to continue to increase up until game day as this indicates you have too much moisture in the wicket

Maximum Density needs to be achieved a few days out or even earlier if weather conditions are unfavourable during the days prior to game day (use of Nuclear Gauge for measurements)

Once maximum density is achieved, the intention is to preserve the compaction while drying the profile to create hardness (use of Clegg hammer).

A 6-day prep which was rated poor



Reviewing the data

Moisture / Drying

- You need to know when the soil is approaching the optimum moisture to ensure you are putting the most work into the soil at this time
- If hot weather is forecast, you need to slow the drying process with the use of covers
- If long periods of cold /wet weather is forecast, you may need to prepare the wicket early and preserve with covers
- Periods of hot weather in early to mid summer, induces cracking due to the variation in stresses within the soil profile. At depth, the soil is moist, while the surface is drying far quicker and the differences creates the cracks.

Summary



Compaction is the forcing together of soil particles under pressure or energy



Compaction or Density is not Hardness



Soil hardness is a measure of soil strength to resist mechanical disturbance. The higher the pressure required to penetrate through the soil, the harder the soil. Soil hardness is influenced by soil moisture and soil density.



A soil's ability to be compacted, is dependant on the amount of moisture, the weight of the roller and the hardness of the base upon which you are compacting.



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THANK YOU