

Revolutionizing Road Infra with Modern Equipment, Technologies, Sustainable Materials and Policy Guidelines

February 29th - March 1st, 2024, Manekshaw Centre, New Delhi

REVOLUTIONARY DEVELOPMENT FOR COMPACTION

Trans-Asian Techno

Meghdut Guha
Trans Asian Techno Pvt. Ltd.



International Road Federation
India Chapter

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Introduction



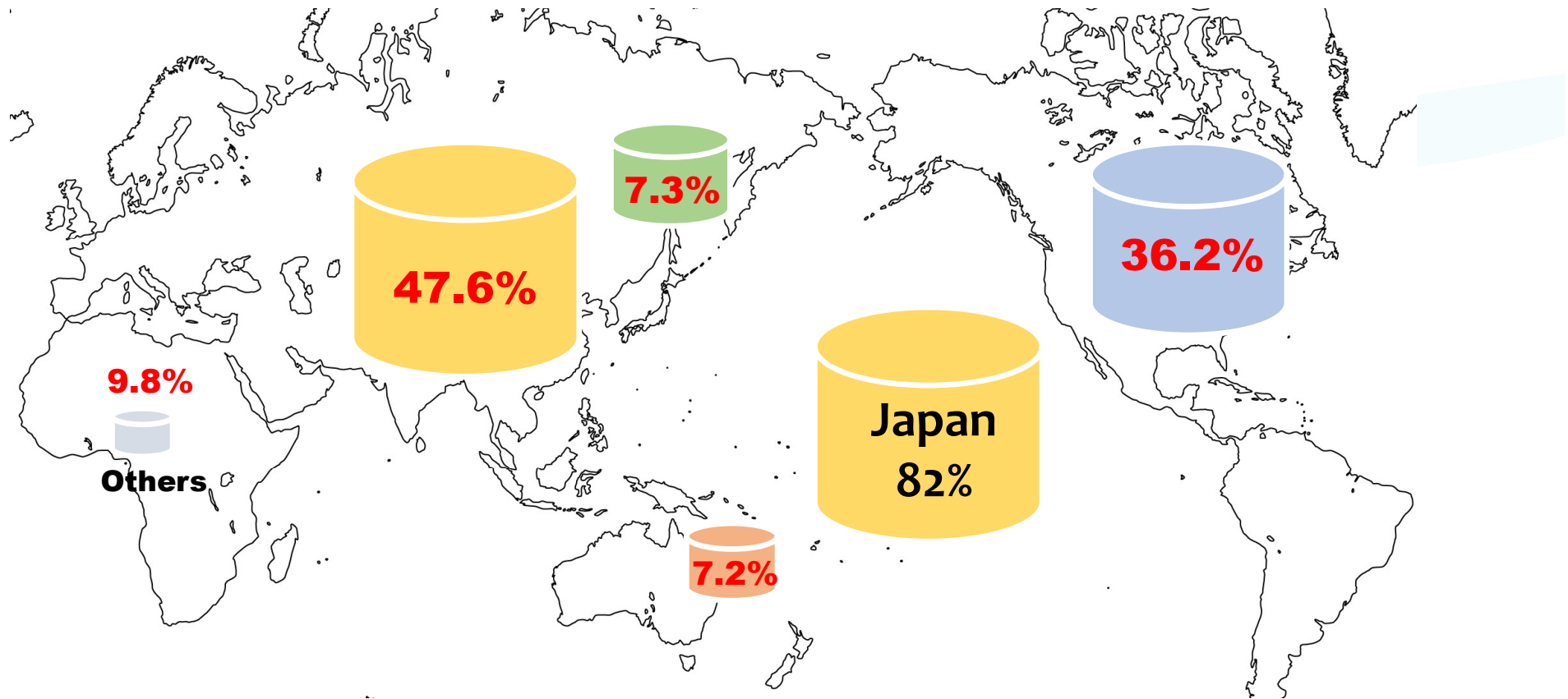
- ❖ Sakai Heavy Industries Ltd was founded in Japan in 1918.
- ❖ They are known as “The Masters of Compaction.”
- ❖ Specialised in Road construction technology & equipment.
- ❖ 105 years old pioneers.
- ❖ About 47.6% market share in Asia and Middle East.
- ❖ About 82% market share in Japan.

Trans-Asian Techno

Trans Asian Techno Pvt. Ltd. are the Technology partners of Sakai in India since 2017



Sakai's presence worldwide



Work place & Workmen's Safety



Guard-man



Fundamentals of Compaction

Amplitude
Frequency
Centrifugal Force

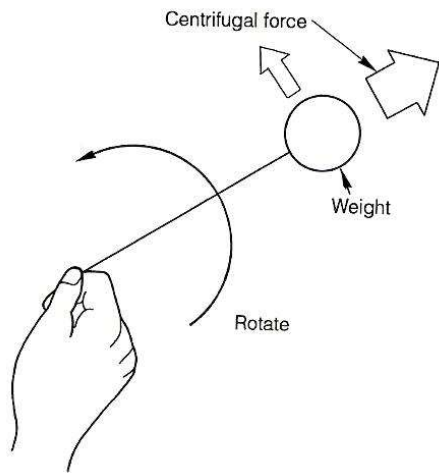


Fig. 32 Centrifugal force

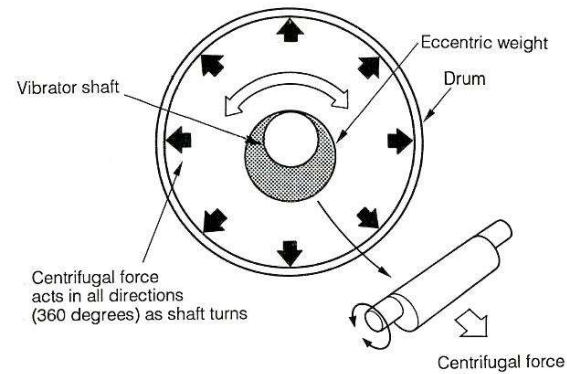
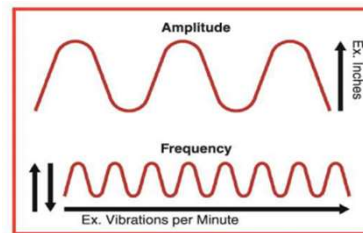
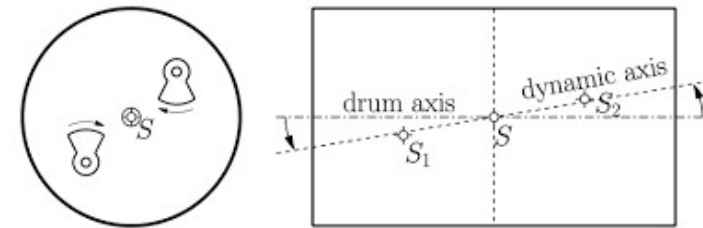


Fig. 34 Directions in which centrifugal force acts



Why ?

THE NEED:

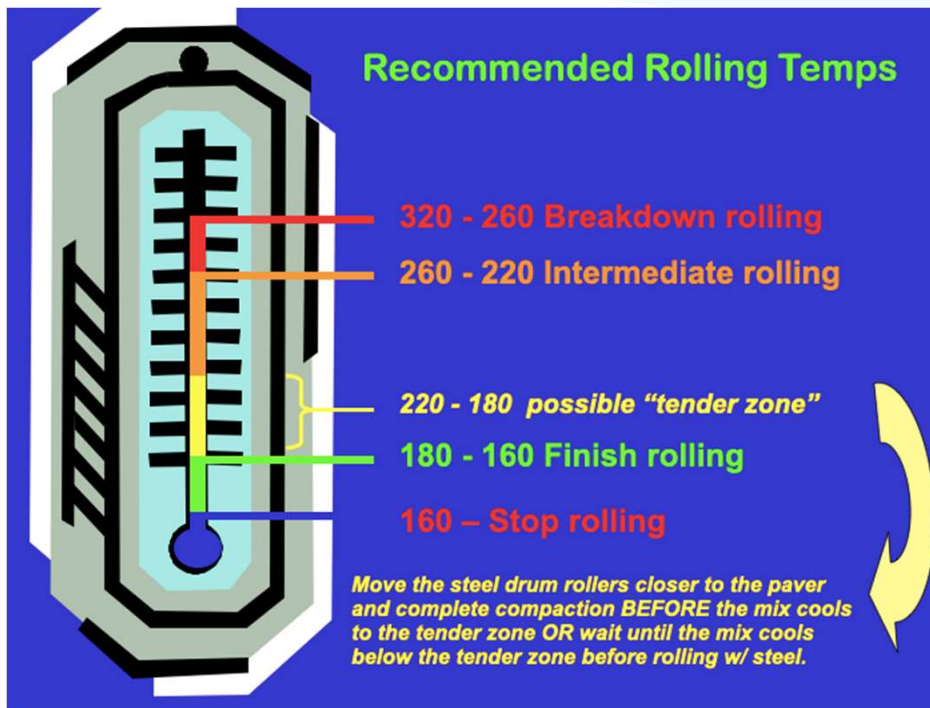
HMA (Hot Asphalt Mix), by default has got some inherent issues and often the contractors do struggle to manage the HMA paving and the rolling.

The issues are mainly:

1. Thermal segregation
2. Particulate segregation
3. Shorter window for paving and rolling
4. Uniform density in all the layers
5. Number of rollers to be engaged
6. Surface finish
7. Avoiding crack formation in base layer
8. Managing tight longitudinal joints

Time-Temperature-Tamping

Temperature & Time plays the Most crucial role



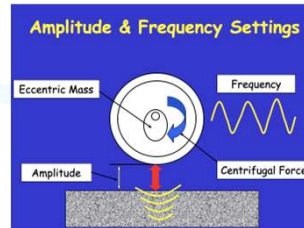
You get hardly 30 minutes



Act in time - before HMA becomes COLD

Asphalt Rolling & Compaction

- Static steel drum
- Vibratory steel drum
- Pneumatic Tire Roller
- Vibratory pneumatic
- Oscillation



Break down and finish
Setting up amplitude
Setting up Frequency
Static mode for finish



Intermediate rolling
Kneading action
Close up surface voids
Close up tension cracks



Vibratory PTR
Combination of
Steel drum and PTR
With variable
Frequency & Amplitude

Fundamentals of Asphalt Compaction



Fundamental of Asphalt Compaction

Reduce volume by removing voids

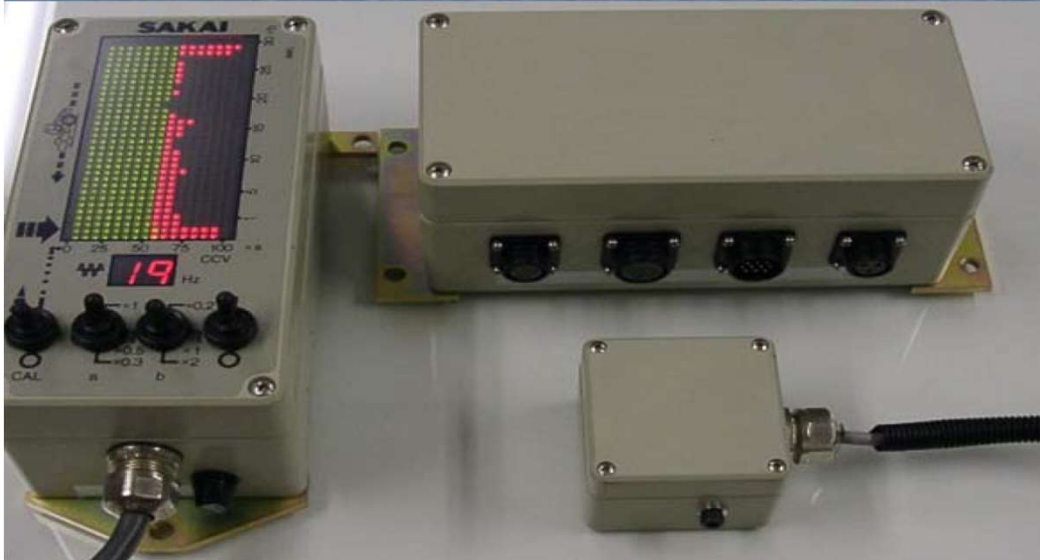
Increase Density

Compact but Don't Crush

- Improve Stability
- Improve Durability
- Prevents Ravelling
- Resists Rutting
- Reduce Moisture Penetration
- Improves Fatigue Resistance

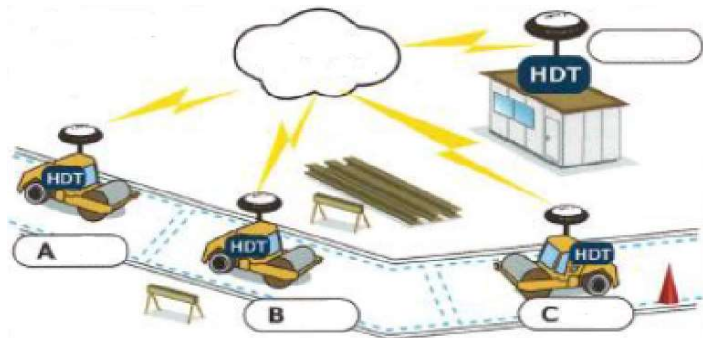
CCV Hardware

CCV Sensor

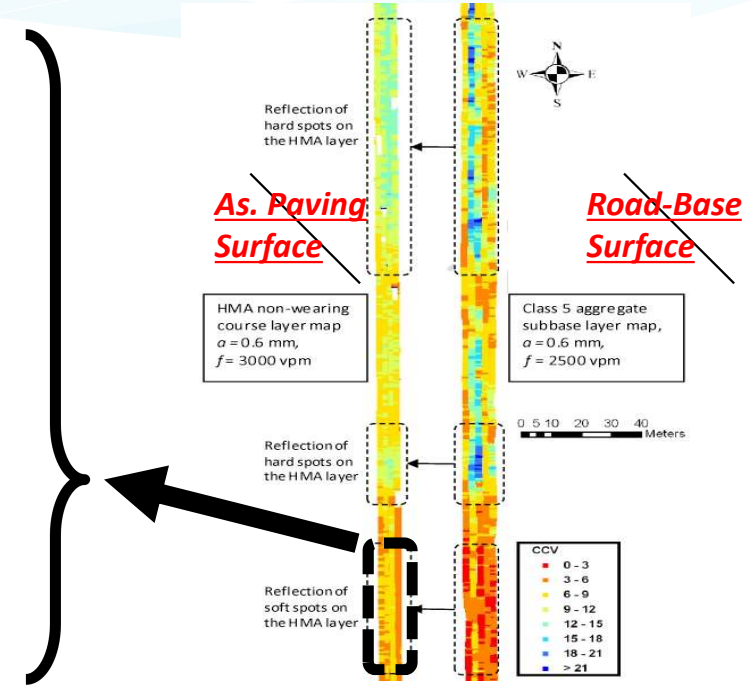


ICT – Intelligent Compaction Technology

Innovative SAKAI Technologies - 3 Compaction Control System



Satellite Positioning System



引用：FHWA/TPF Research Project 「HMA IC Field Demo.MN DoT Final Report」
Nov.2005.1
<http://www.infratech.com/Products/IC/>

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ICT is known as CCV @ Sakai

IC Measures Engineering Properties changing from

Density \longrightarrow Modulus

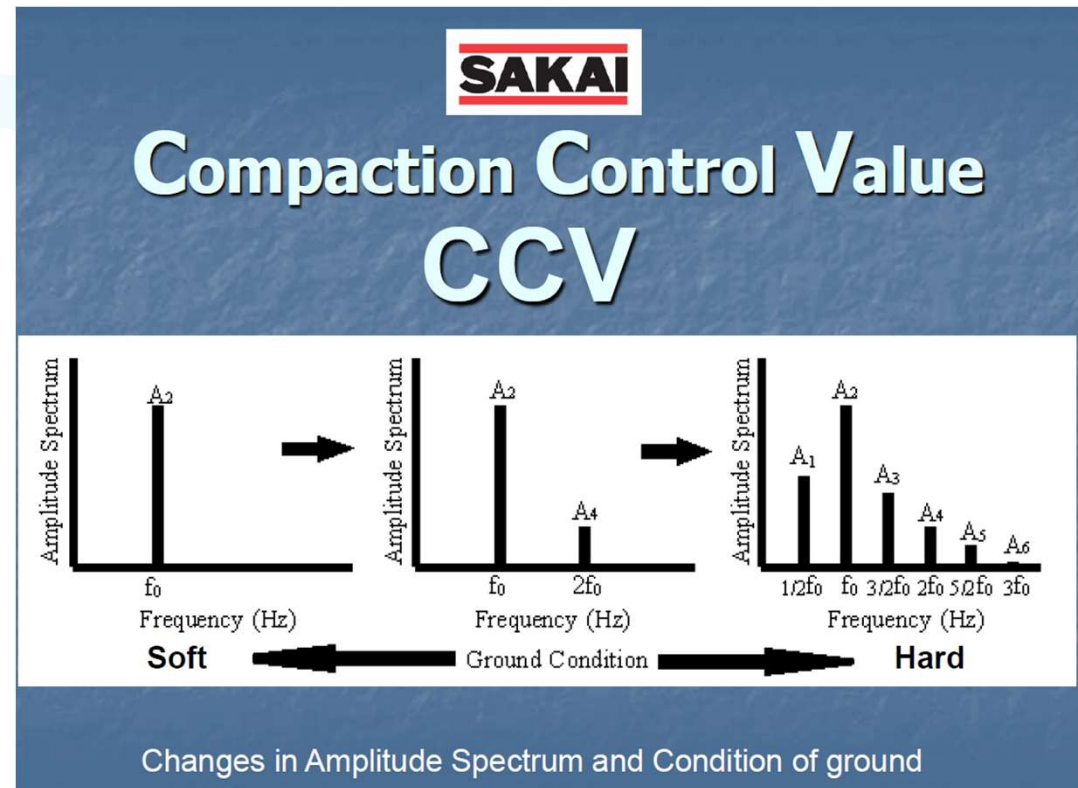
Density

- Mass / Volume
- Proctor Test

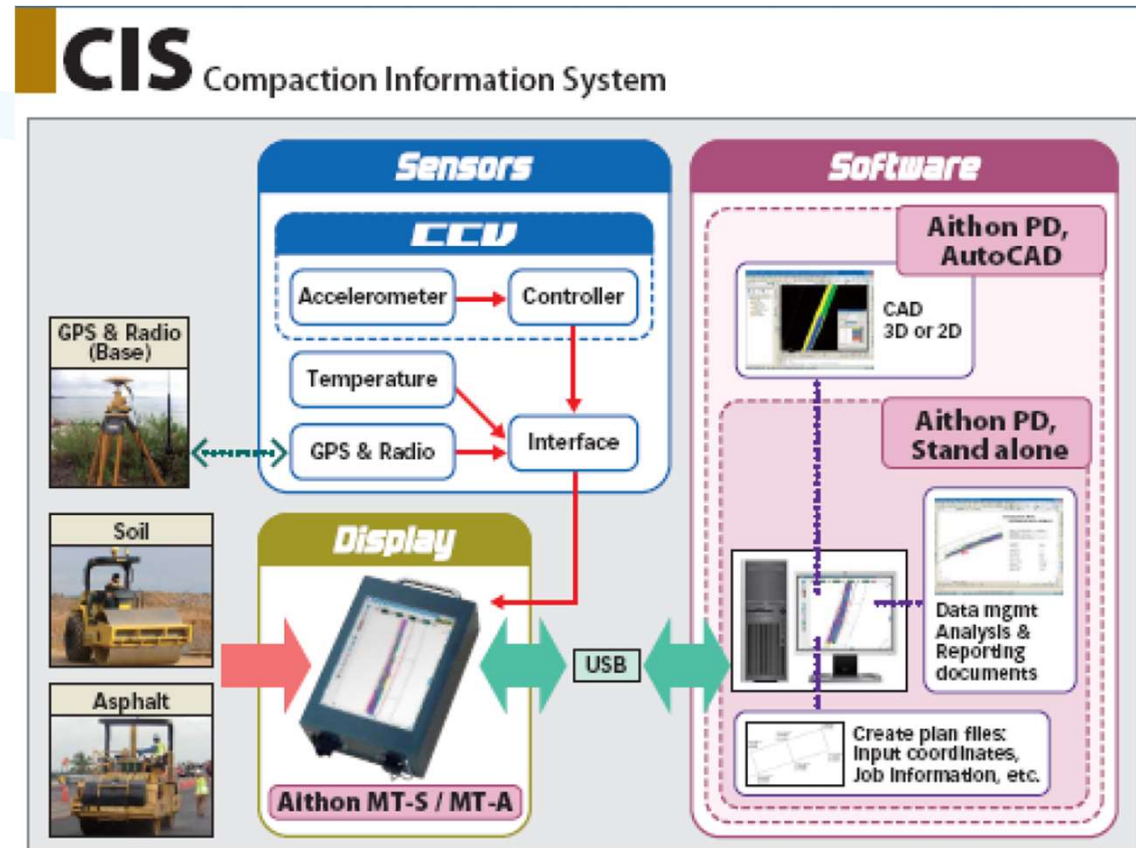
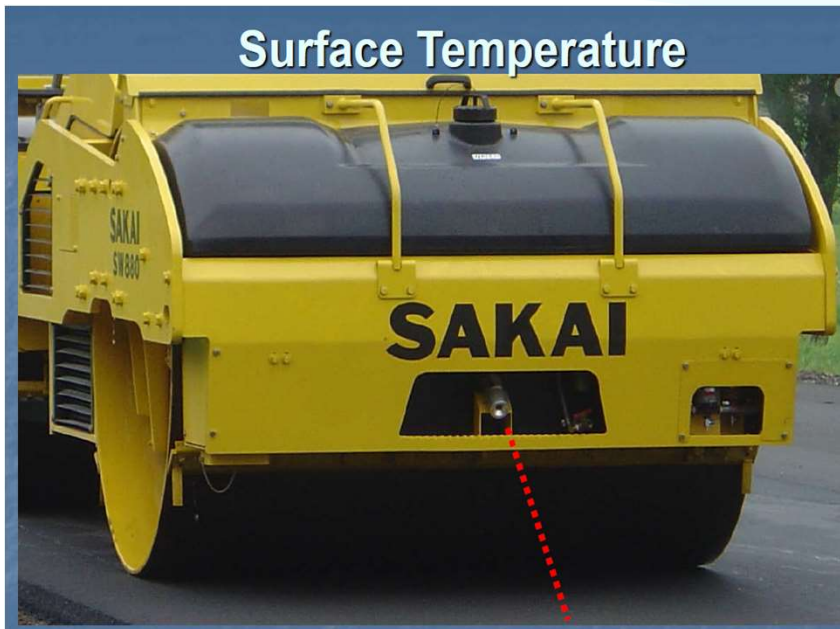
Moisture Control

Stiffness / Modulus

Mechanistic Testing Equipment

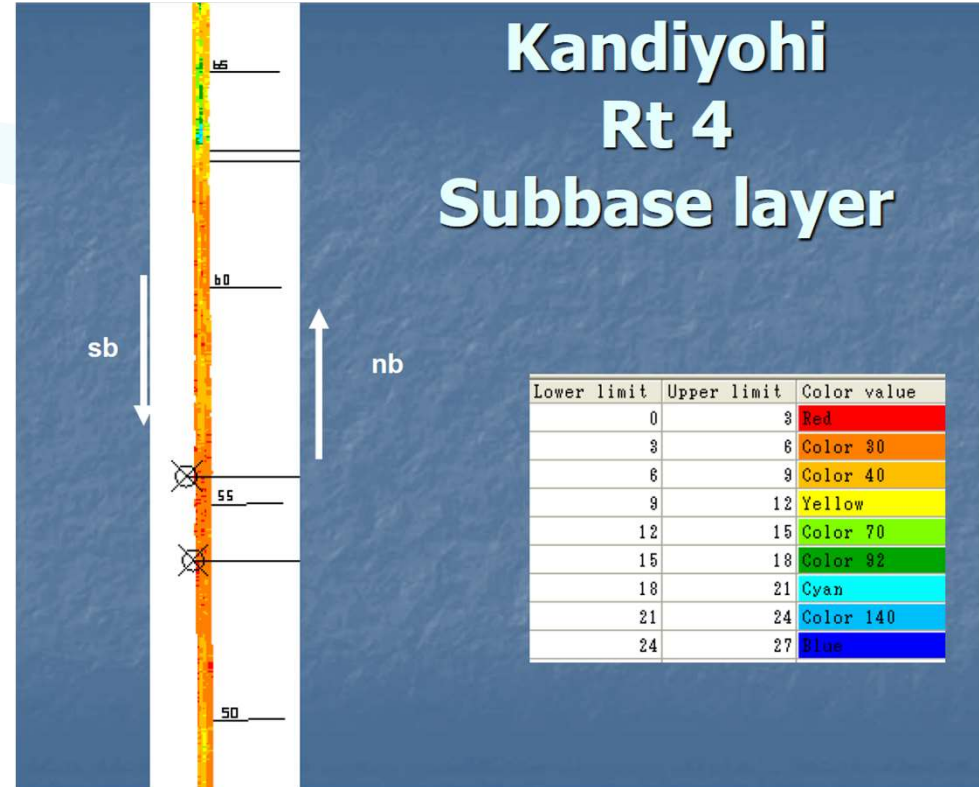


Surface Temperature sensor & CIS



Sub base mapping

IC roller maps subbase



Software: Input-Mapping-Output

Software

"01 Plan AithonPD"

"02 Construction AithonMT"

"03 Analysis/Documentation AithonPD"

① Settings (Office)

Input



② Construction (Roller)

Mapping

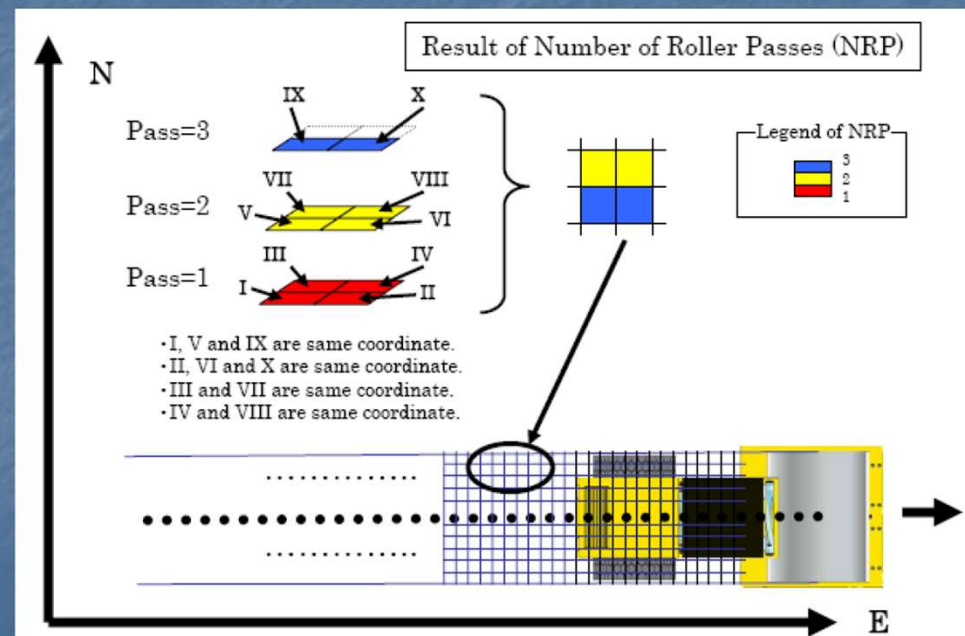


③ Analysis and Documentation

Output

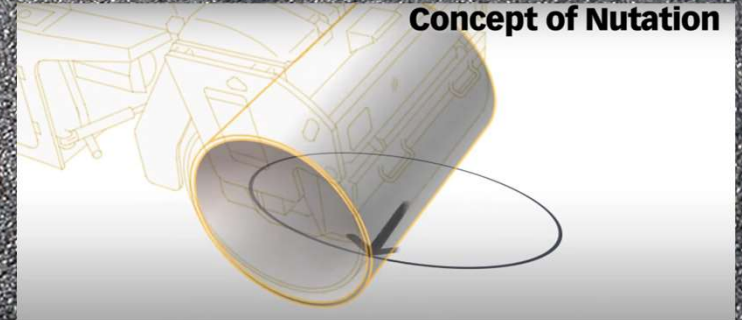


How mesh data is recorded

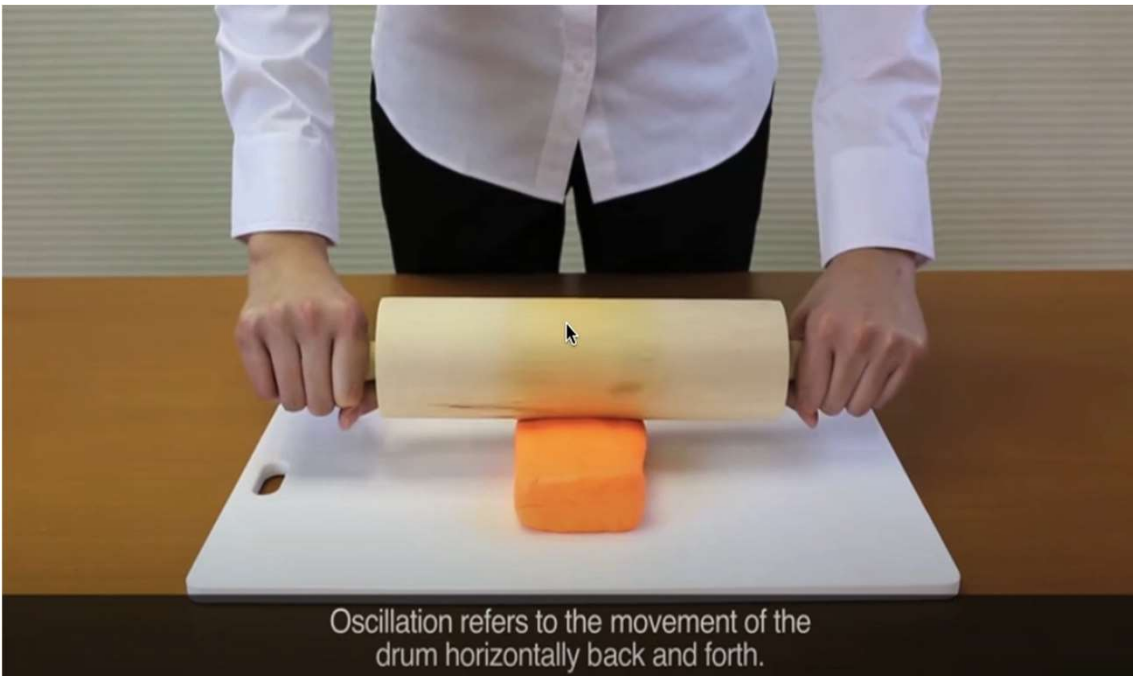


NUTATION ROLLER

Patented optimizing system for amplitude in the dual drums



Oscillatory Vibro Roller 4000 VPM

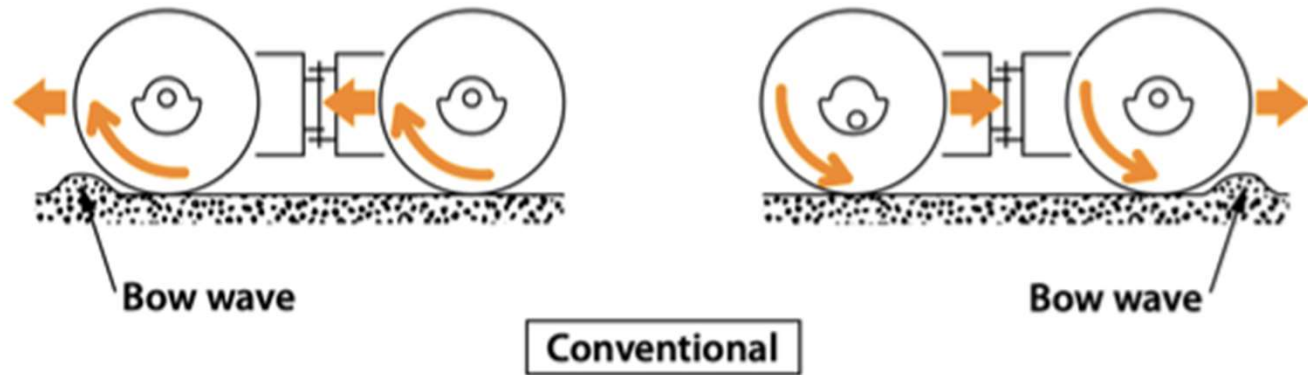


Cracks photo



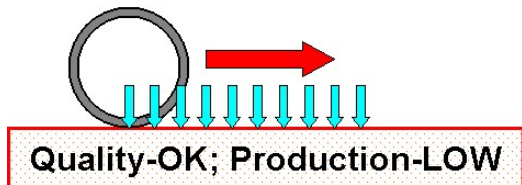
Cracks after removing asphalt layer by milling-Actually it was created during co

Flattening Bow Waves with extra amplitude

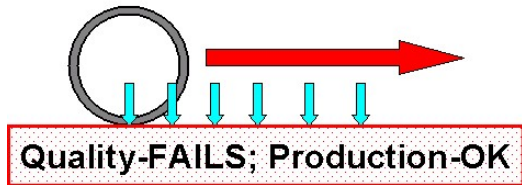


Dual Drum Oscillation- Horizontal compaction

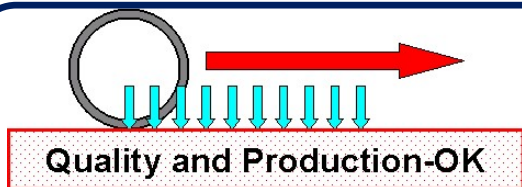
Pick up Features – Double Drum Roller



2,500 vpm, 4.5 km/h
Low Frequency + Low Speed



2,500 vpm, 7.2 km/h
Low Frequency + High Speed



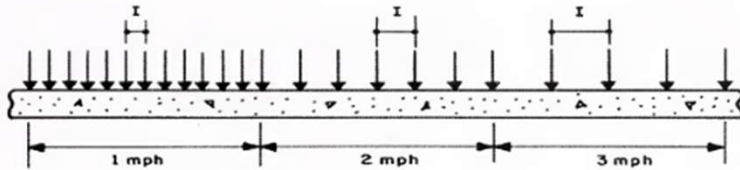
4,000 vpm, 7.2 km/h
High Frequency + High Speed



IRC:SP:97:2013

Impact Spacing

$$\text{Impact Spacing (I)} = \frac{\text{Roller Speed, fps}}{\text{Frequency, Hz}}$$



Note : 1mph = 1.61 km/h

Fig. 21 Effect of Travel Speed

4.3.2 Difference between conventional and new generation roller

S.No.	Conventional Roller	New Generation Roller
1. a)	Conventional roller is a Static three wheeled Roller.	Vibratory road roller and its improved versions are known as new generation rollers.
b)	In case of conventional, the compactive effort is applied through static pressure only	Vibratory roller exerts compactive effort through dynamic force caused by vibration, in addition to static pressure. The dynamic force may be varied by changing the frequency and amplitude of vibration as per materials to be compacted, to achieve the best results.
c)	Compression starts from top of the surface	Vibratory road rollers, their improved version and intelligent compactors are beneficial from several considerations, like: <ul style="list-style-type: none"> a) Optimum compaction can be achieved with a minimum number of passes. b) Compaction can be done up to greater depths and in a uniform manner. c) Output is more than conventional roller d) Compaction starts from bottom of surface.



7 VARIATIONS



ND VARIATION 7

Oscillation+Oscillation
Oscillation+Static
Static+Oscillation
Vibration+Vibration
Vibration+Static
Static+Vibration
Static+Static

The ND models with an oscillatory and vibratory system can operate in seven different modes.



Vibratory Pneumatic Tire Roller

SAKAI
MASTERS OF COMPACTION

SUCCESSFUL COMPACTION USING A VPT ROLLER



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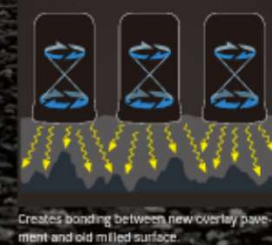
Vibratory Pneumatic Tire Roller



The World's First and the only
Vibratory Pneumatic Tire Roller

DYNAMIC KNEADING ACTION

- Four (4) amplitude settings to achieve the required density.
- High productivity on both large and small projects with the ability to maneuver in tight spaces on city streets, parking lots and cul-de-sacs.
- Density results achieved by the 9 ton GW753 are equal or higher than those of a 25 ton static tire roller.



Creates bonding between new overlay pavement and old milled surface.

Why Vibratory Pneumatic Tire Roller

Compaction and Performance

Recent U.S. Research shows that 10% decrease in pavement life for each 1% increase in air voids.

Pavement Life

- 10 percent decrease in pavement life for each 1 percent increase in air voids
- Multiple researchers have confirmed



Masters of compaction

ROADS OF
THE FUTURE
EMBRACING
DISRUPTION

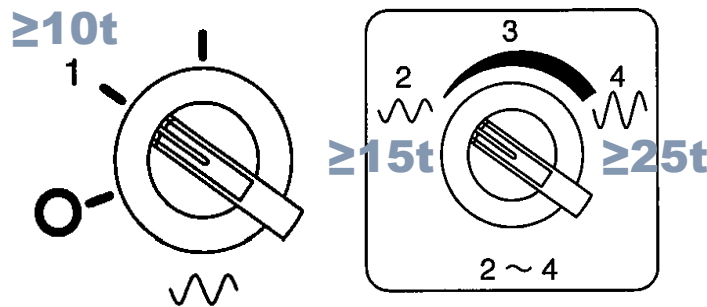
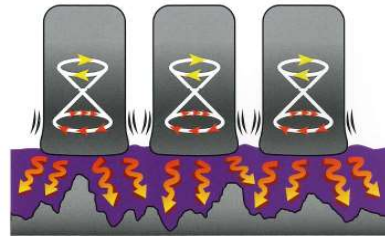
AAPA
AUSTRALIAN ASPHALT
PAVEMENT ASSOCIATION



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GW- 750/751/752/753/754



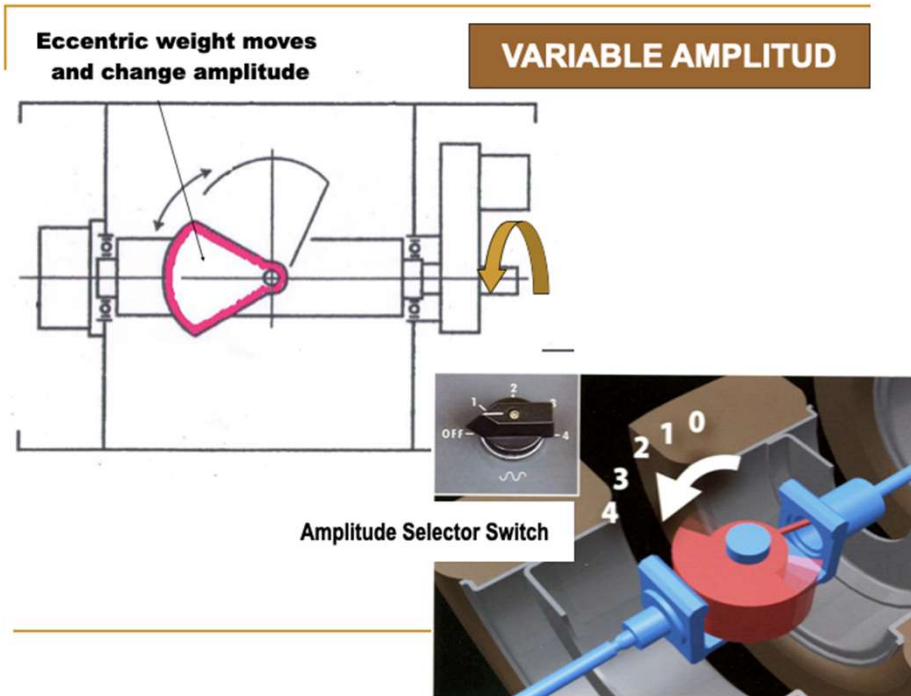
Vibrator Switch

PATENTED



Uniform Compaction result

Vibratory Pneumatic Tire Roller



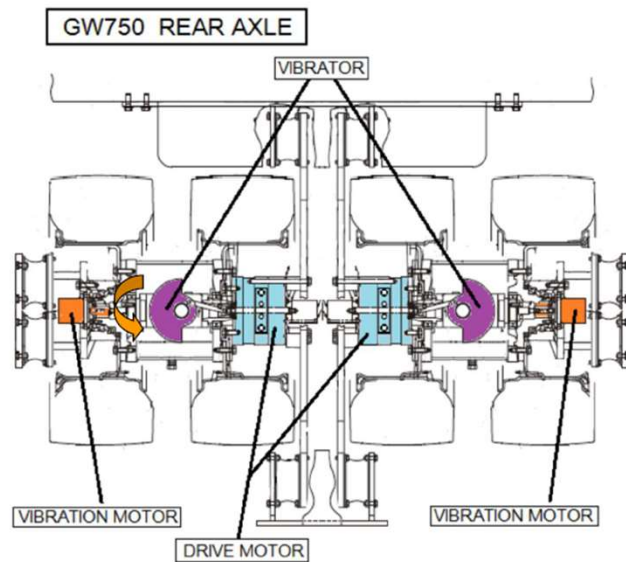
Variable Amplitude



Variable Amplitudes

Vibrating Tires

- Variable Amplitude (4 preset settings)

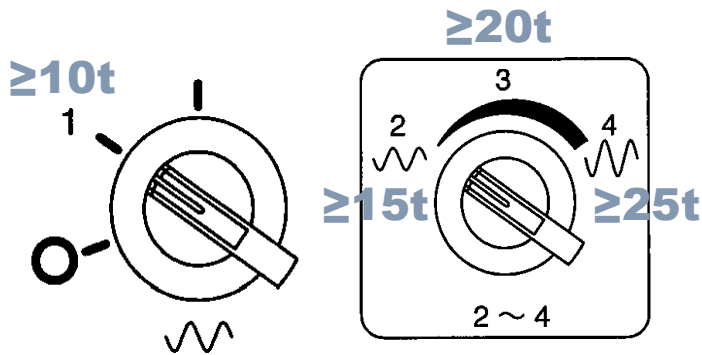


Vibratory Pneumatic Tire Roller

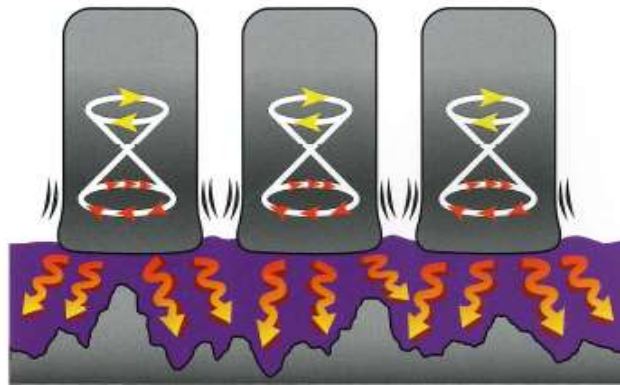
Equivalent to 25_{ton} Static Tire Roller

PATENTED

World's First SAKAI Only



Vibrator Switch



Dynamic Kneading Action

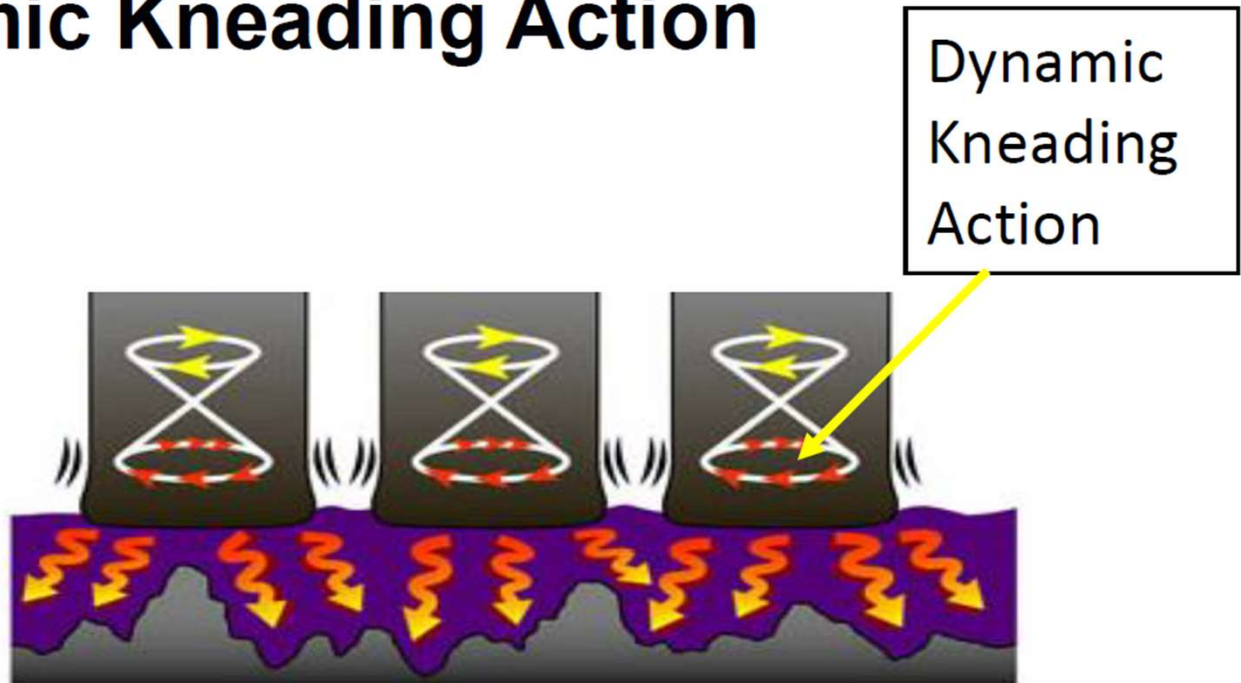


GW750-2 (9 tons)

Dynamic Kneading Actions

Dynamic Kneading Action

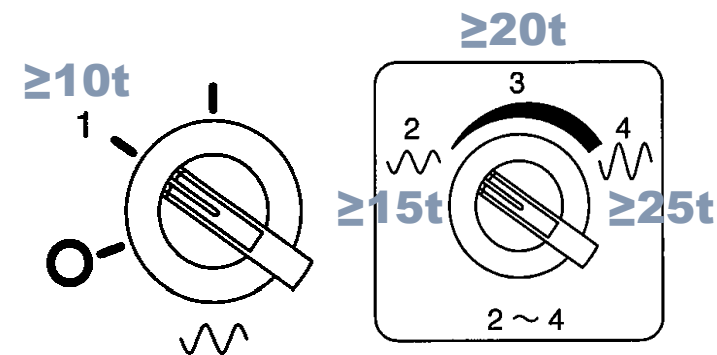
- It kneads (massages) HMA mixes to push mixes into lower spots over milled surface.
- It achieves more uniform density through the layer.



Variable amplitudes

The maximum mass with water capacity of 600 liters is 9,100 kg, and four different kinds of amplitude are available such as 0.2 mm, 0.5mm, 0.7mm, and 1.3mm .

The VPT roller is equivalent to 10t, 14t, 18t, 23t, and 28t not using or using vibration.

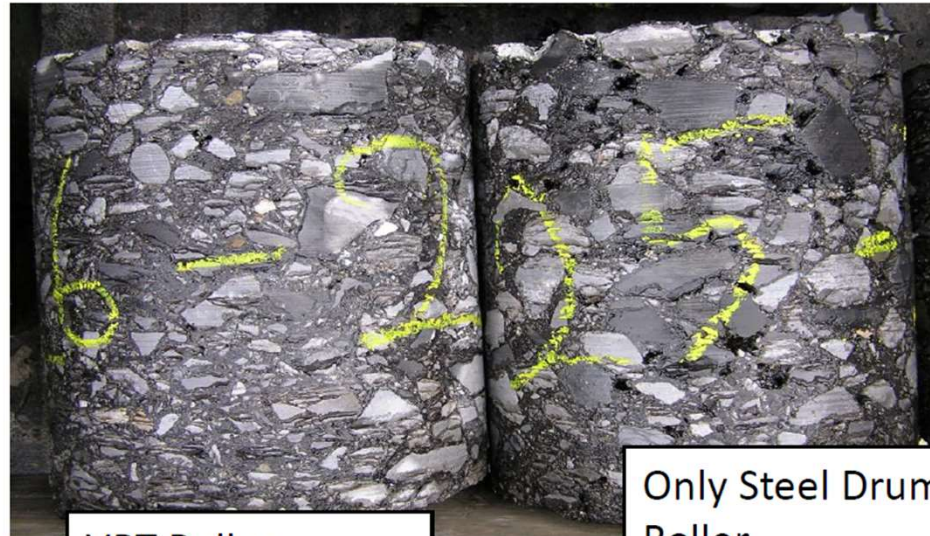


Uniform Compaction

More Uniform Compaction than Steel Drum Vibe Roller (280mm Lift)



280 mm lift after
Laydown

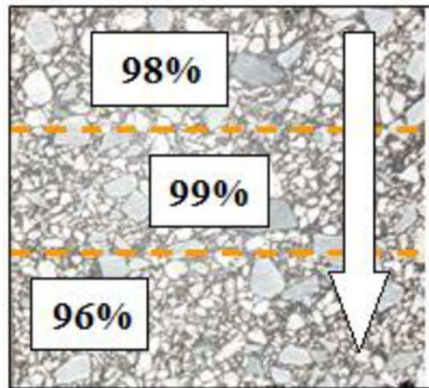


VPT Roller

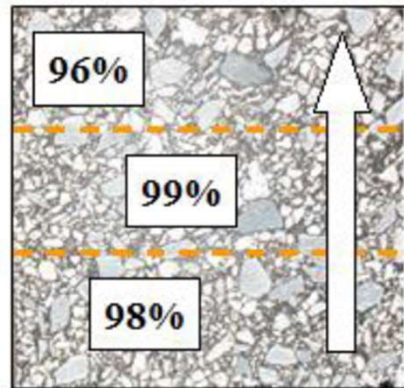
Only Steel Drum Vibe
Roller

Uniform Density Distribution

Density Distribution with Depth using Conventional Rollers

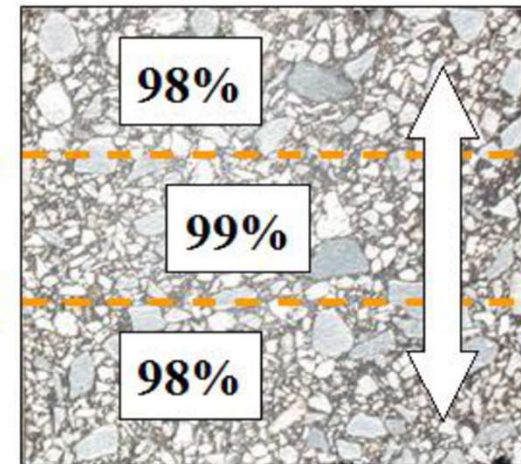


Top down using a double drum vibratory roller



Bottom up using a static pneumatic tire roller

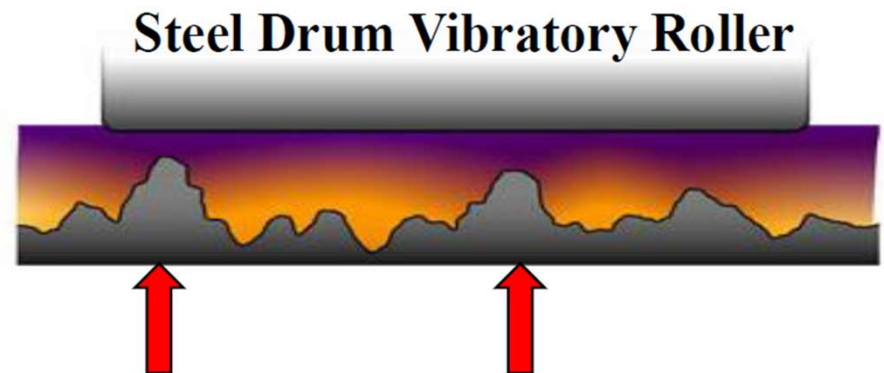
Uniform Density Distribution with Depth using a VPT Roller



Bridging Effects

Eliminate the Bridging Effect

Dynamic kneading will significantly improve bonding of mixes placed over a rough milled surface.



Tight Longitudinal Joints

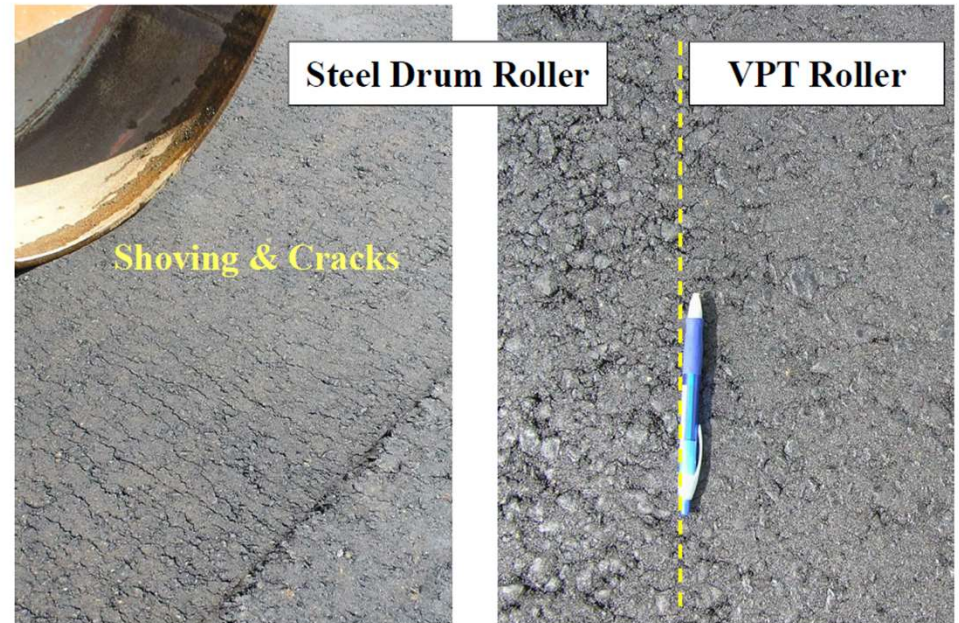
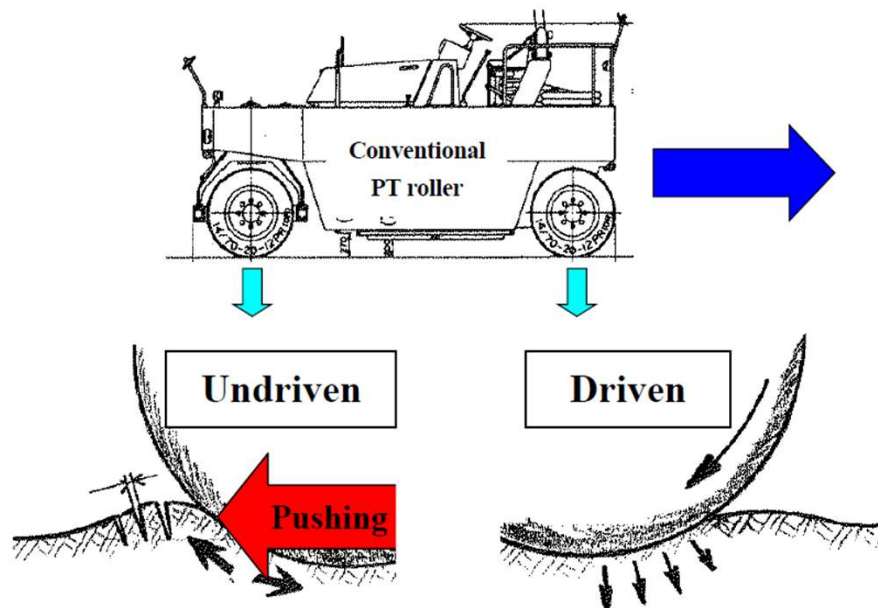
Compaction of Longitudinal Joint Using Steel Drum Vibratory Roller

Tight Longitudinal Joints



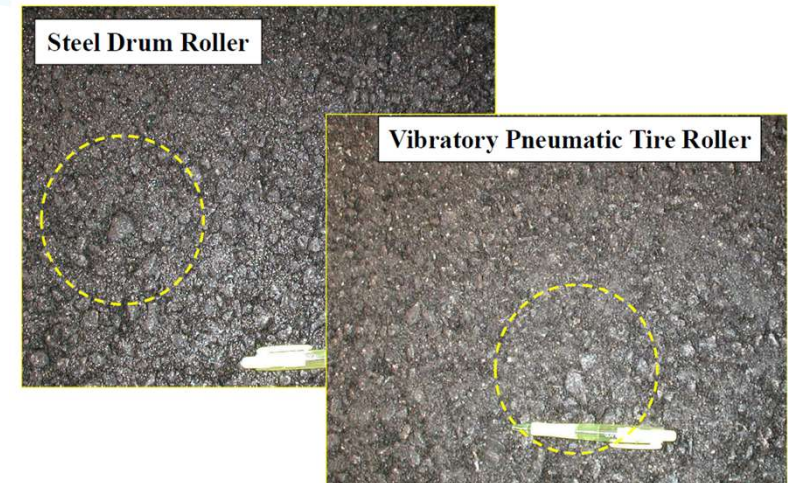
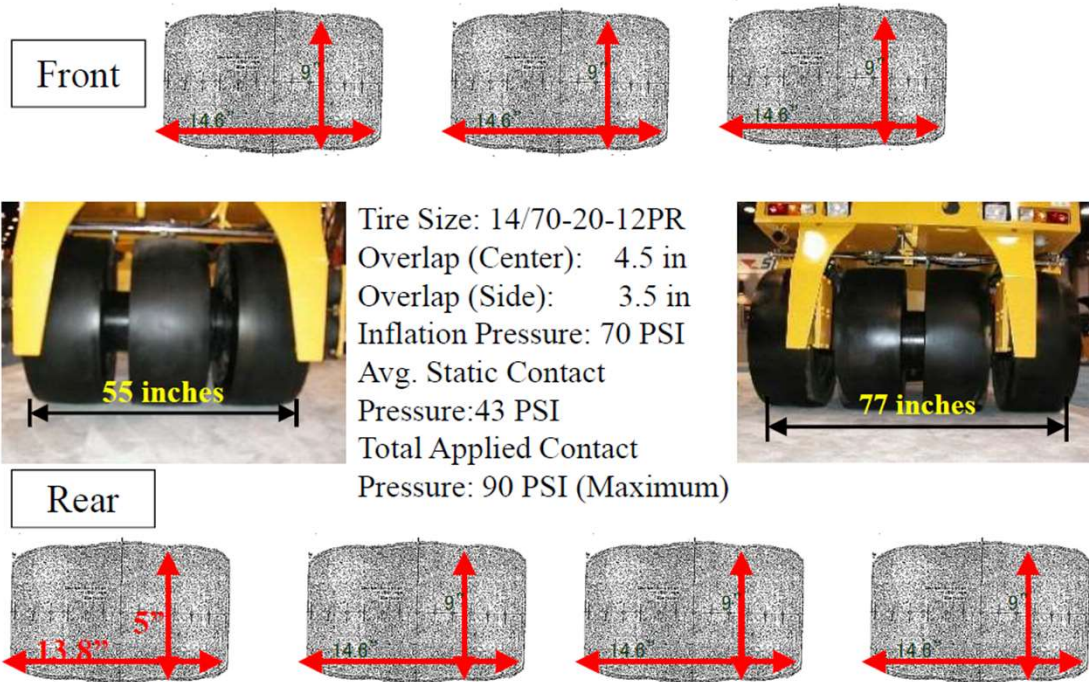
Avoid Shoving effects

No Shoving Using All-Wheel-Drive



Super flat Wide base tires – excellent finish

Super-Flat, Wide Base Tires



Surface Texture

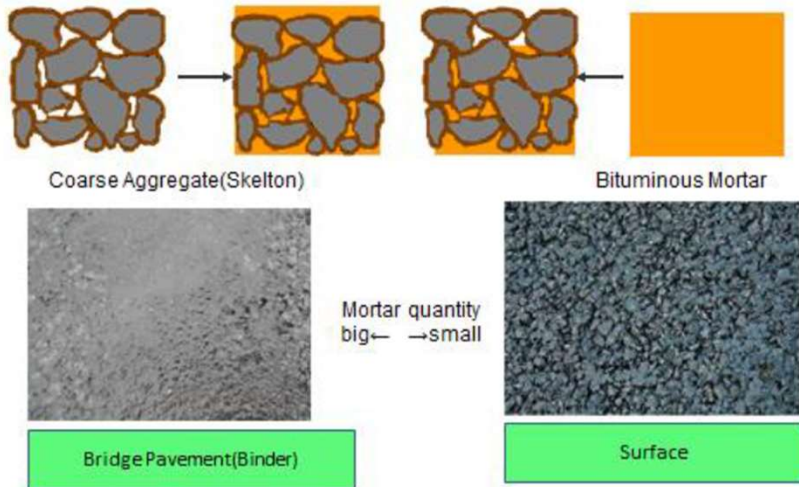
Improvement of Surface Texture



Critical Application SMA

APPLICATION IN JAPAN : Stone Mastic Asphalt

Coarse Aggregate and Bituminous Mortar



Deterioration of SMA because of poor compaction



Reducing Number of Roller passes

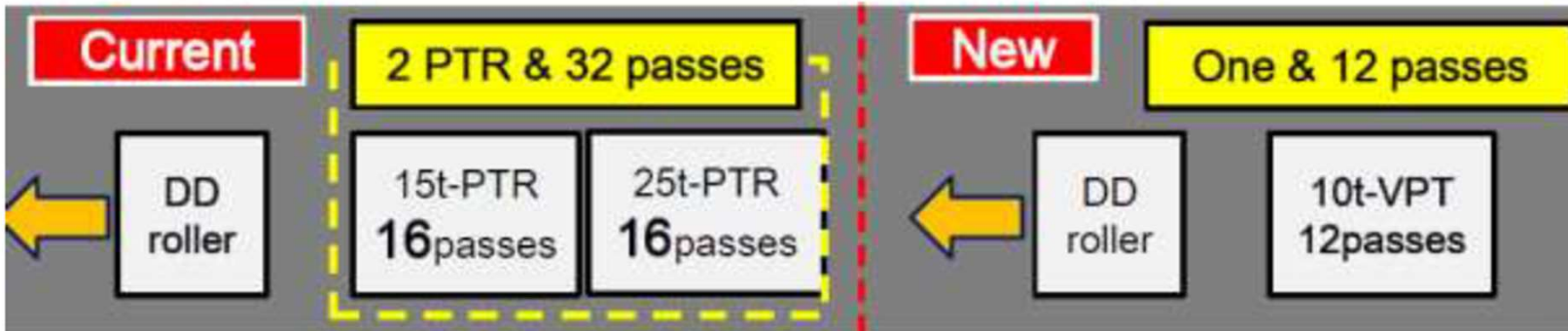
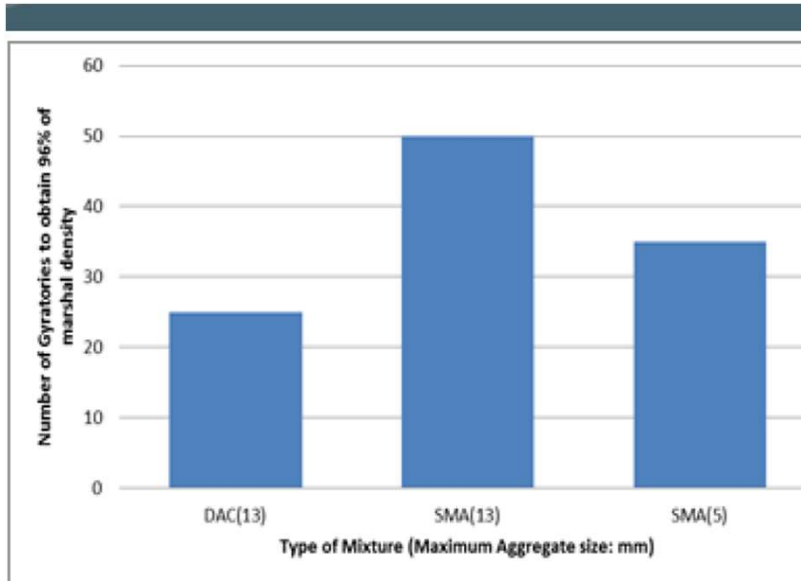


FIGURE15 Typical result of reducing roller train

Usually two static pneumatic tire rollers (PTR) are used. Intermediate(15t) and finish(25t) positions are used, and each of the PTR makes 16 passes. Total of two static PTR passes are 32 with inconsistent roller passes over each point of pavement.

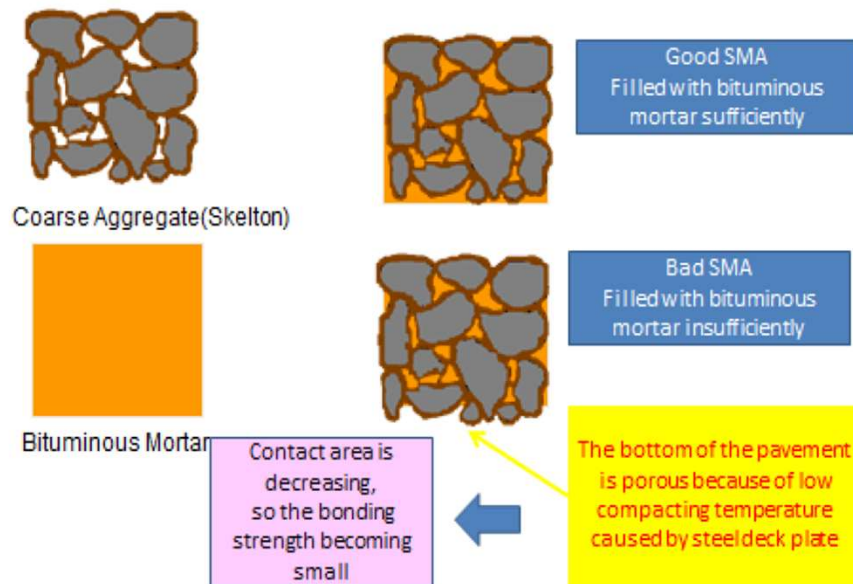
The VPT roller increased the total working efficiency by reducing a number of rollers and its passes. In this case density of 96~97% achieved by the VPT roller is greater than that of 95% by two static PTRs.

Laboratory Test Results- SMA

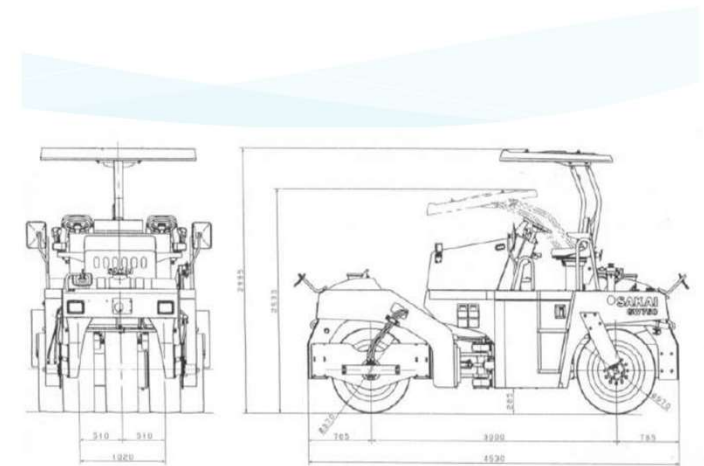
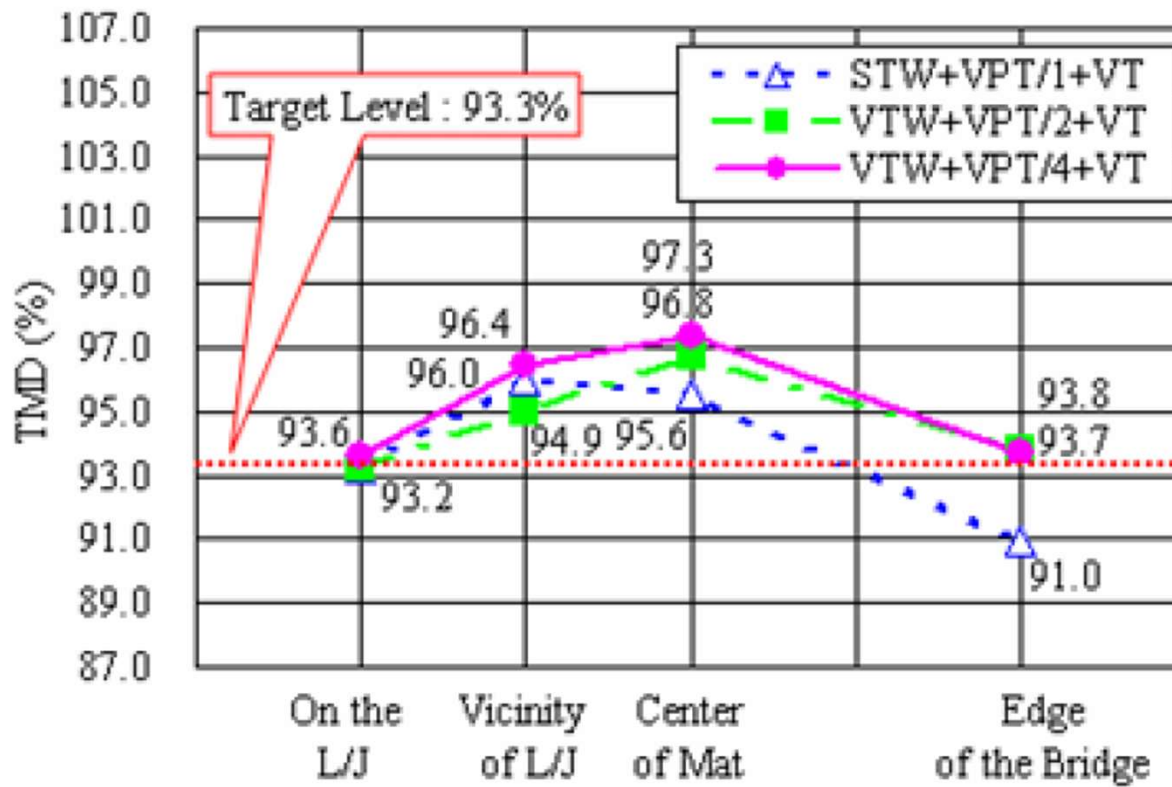


Laboratory test result using Marshall and Gyratory compaction

Reason of failure (lack of bonding)



Field Test Results



The Testimony



Conclusion

1. VPT is a 2 in 1 package
2. Easy to shift
3. No need of Ballasting
4. No need of Tire pressure adjustment
5. Delivers excellent output and performance
6. Uniform density
7. Unmatched pavement quality



We are at your Service

Thank you very much!



Trans-Asian Techno

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