# Successful Compaction using Vibratory Pneumatic Tire Roller

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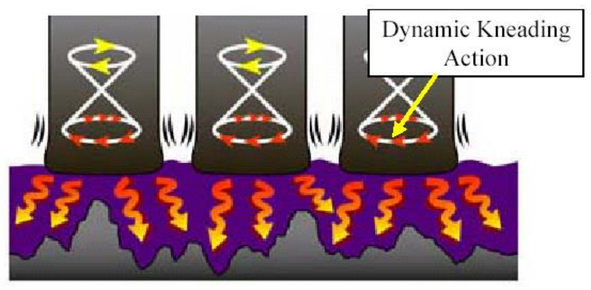
## Introduction

**It is a pavement researcher's distress that good designed pavement does not always show good pavement performance. There is the construction stage between design and performance. In another words, pavement does not show good performance without good construction them. Most important factor of good construction will be good compaction of asphalt mixture. By decreasing 1% air void, the performance of pavement is improved 10% .**

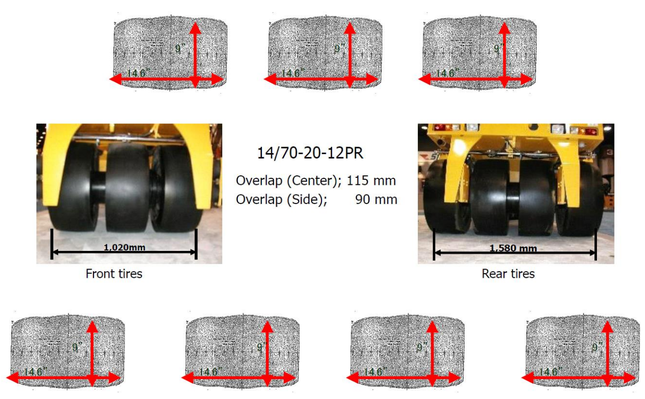
**The contractor must pay severe attention to get the ideal density of the mix that is evaluated and judged as the best proportion at the mix design stage. They must select the best combination of rollers and use them with the appropriate condition**

**New compaction devices such as the high frequency vibratory roller and the vibratory pneumatic tire roller have been developed in order to achieve the required level of density in a more efficient, effective, and economical manner. In this paper the outline of new developed VPT roller and the effectiveness of VPT roller for various type of asphalt mixture or various thickness of pavement lift are described.**

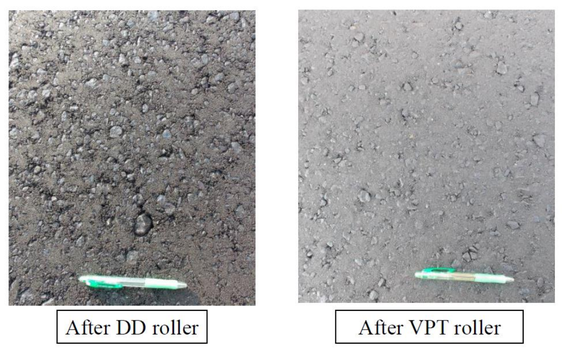



*Kneading Compaction*

*Tight longitudinal Joint*




*Super Flat Pneumatic Tire*




*Comparison of finished Surface*

## OUTLINE of VPT Roller

There is an interaction that takes place between pneumatic tires and compacted materials called the "kneading effect", which is generated by the deformation and compression of the pneumatic tires. This kneading action can be simulated in a testing laboratory by a gyratory compactor compressing a cylindrical specimen while applying both shear and vertical compression force simultaneously . This compaction mode is very effective not only in compacting asphalt mixtures, but also in achieving a smooth surface on those materials

Among the benefits derived from the use of a Vibratory Pneumatic tire roller are the dynamic, instead of static, kneading effect. Conventional rubber tire rollers achieve compaction through a combination of wheel load and inflation pressure. As the wheel load increases with the same tire inflation pressure, the compaction effort is extended deeper into the pavement layer. As the inflation pressure increases with the same wheel load, the compaction effort is also extended deeper into the pavement layer.

"Dynamic Kneading Action" of the VPT roller also achieves tight longitudinal joints without crushing the aggregate, which makes unwanted changes to the gradation of the mix. This is a big plus for contractors who must meet joint density requirements recently introduced by highway and airport agencies.

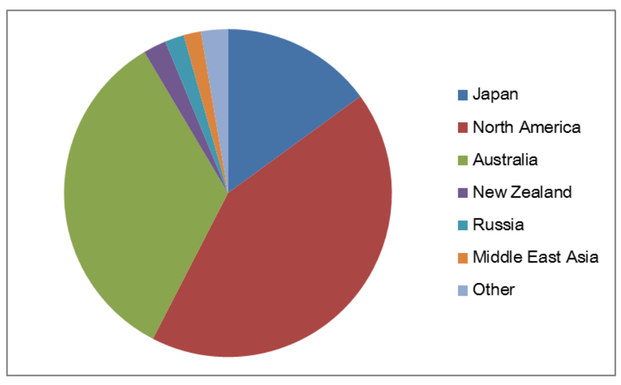
The developed super-flat tires of the VPT roller provide uniform contact pressure. They achieve smoother finished pavement surfaces compared to conventional rounded pneumatic tires. The comparison of finished surface of the VPT roller and the conventional double drum roller is shown.


*Vibratory Pneumatic Tire Roller*

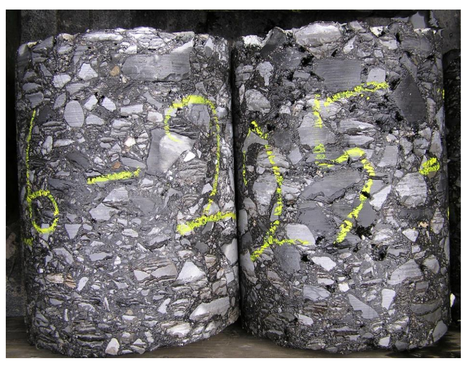
## APPLICATION of VPT Roller

The VPT roller is used all over the world. The Total amount of Japan, North America (U.S.A. and Canada) and Australia comes to more than 90 % of sales. But the application of each district is somewhat different. In North America, the VPT roller is used to obtain higher uniform density of asphalt mixture in the case of incentive/disincentive payment. Another unique application in North America is for the compaction of thick lift asphalt mixture or compaction of dense asphalt mixture to reduce the roller train. In Japan the VPT roller is used for the compaction of special asphalt mixture like stone mastic asphalt (SMA), porous asphalt or epoxy asphalt that are difficult to obtain high compaction ratio. In Australia where asphalt sealing pavements are widely applied, the VPT roller is used for the compaction of thin layer like the chip seal to avoid the cracking of aggregate and increase the bonding between asphalt and aggregate to protect fretting of aggregates.

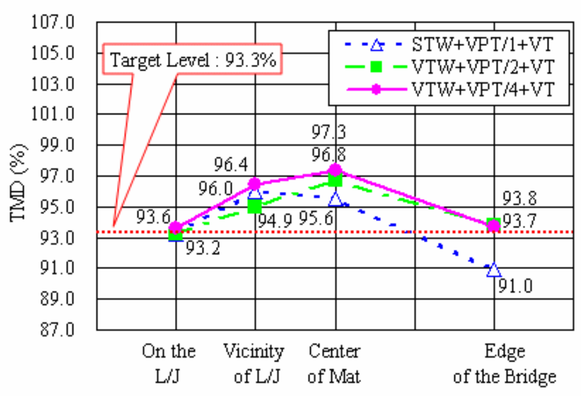
Of course these are the typical application, there are the example of chip seal in Canada and thick lift in Australia also.




*District of VPT Roller Sales*



*Comparison of cutting core (Thick Lift)*




*Result of SMA Compaction*

*Compaction of Chip Seal Australia*

## Conclusions

The mechanical features of the VPT roller is described in this paper, and based on the worldwide construction examples using the VPT roller, following conclusions can be made.

1)The VPT roller is used for not only thick lift, but also thin lift successfully. Furthermore it is effective to compact various types of asphalt mixture like stone mastic or so.

2)The combination of vibratory roller in oscillatory mode in the breakdown and the VPT roller in the finish is the best option to achieve the required density and tighter surface. It will assure durable and long lasting asphalt pavements.

3) A new roller train using only two rollers, a DDV roller and a VPT roller, easily achieved the required level of density of the asphalt mixture. This results means that the contractor can construct in lower operating costs using two rollers instead of three.

4)The strong point using the VPT roller is the possibility of covering various applications from middle size to large size Pneumatic Tire Roller. The VPT roller is equivalent to 10t, 14t, 18t, 23t, and 28t not using or using vibration. Another strong point is making smoother surface because of the wide-flat tires and avoiding the cracking of the aggregates.

ROADS OF THE FUTURE EMBRACING DISRUPTION

AUSTRALIAN ASPHALT PAVEMENT ASSOCIATION

*Source: 2017 AAPA Conference*

SAKAI Masters of Compaction