

Granular Pavement Compaction Enhancing Compaction Procedures

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Presentation Main Topics

- New Zealand - Roading Appreciation
- Status Quo – Premature Rutting
- NDG Instrument
- Compaction Plant
- Roller Selection
- Due Diligence Considerations
- Max. Compaction
- Close



New Zealand – Roading Appreciation

- Highest Rainfall – 18.4 metres (Hokitika West Coast)
 - Rain Days – > 130 + days a year **(Very Significant)**
- Imports Freight(Deloitte Ports & Freight Yearbook)
 - 22,500 000 Tonnes
 - Geometric Growth – 3% Annually (2010-2020)
- Exports Freight(Deloitte Ports & Freight Yearbook)
 - 40,000 000 Tonnes
 - Geometric Growth – 3% Annually (2010-2020)
- Freight Main Mode of Transport
 - Trucks 93%
 - Rail 6%
 - Air 1%
- Inland Manufacturing and logistics not included
- Geology – Subgrades (Volcanic Ash, Pumice, Clay)
 - CBR 2 Quite Common

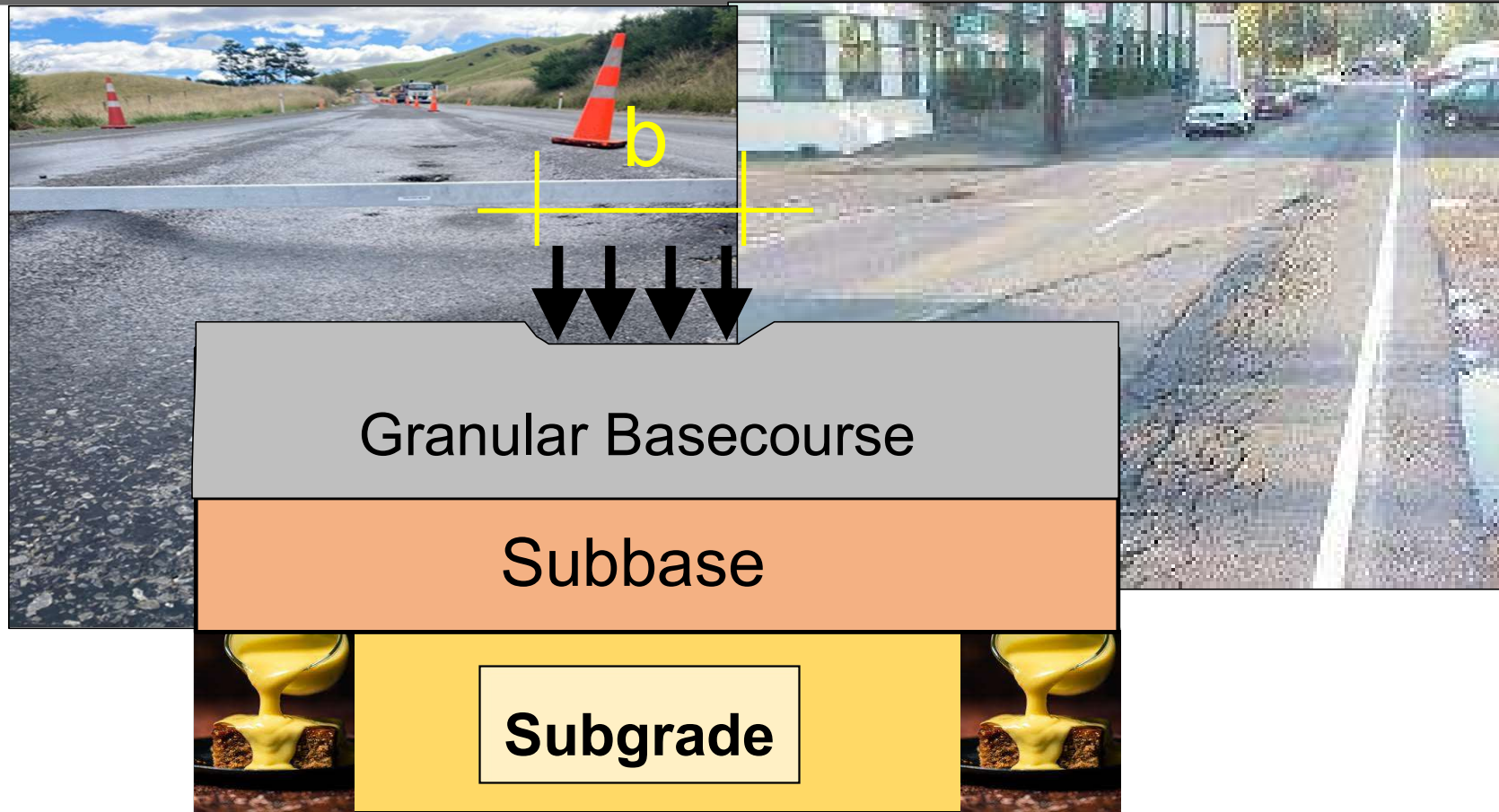


Roading Appreciation – Cont.

- Existing Network structural Integrity
 - E.g. Waikato Expressway Site
 - FWD D_0 -2.4 mm, 280 mm pavement
 - 3.3×10^7 Equivalent Standard Axles
- Road History
 - Design Approach Geometric, Pavements, Stormwater
 - Material Use Approach, e.g. Cut to Fill Vs import ;
 - Route Determination.
- CETANZ 2023
 - Awareness around Compaction Orchestra
 - Share Fulton Hogan Approach



Status Quo – Premature Rutting



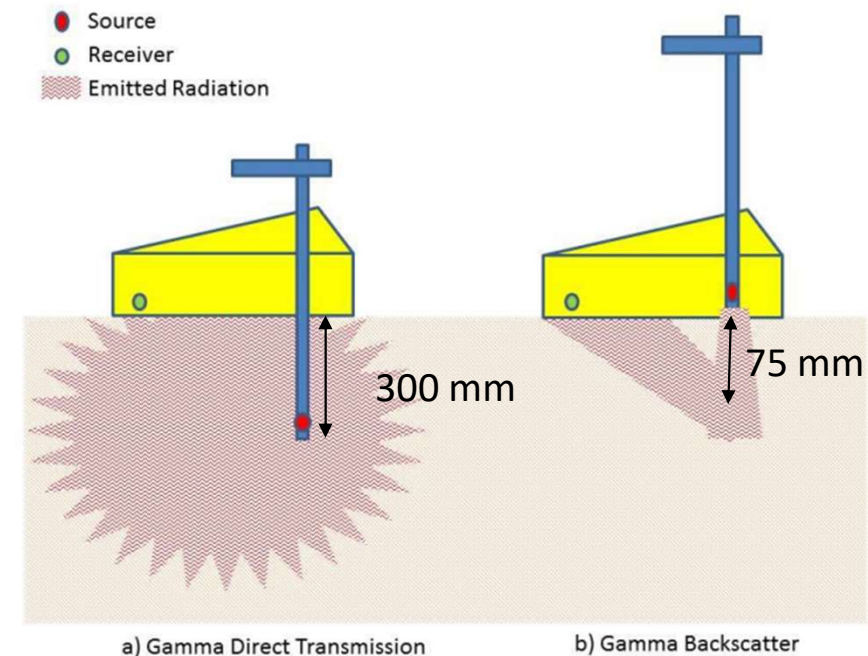
NDG – Instrument

Backscatter Mode

- Probe lowered into contact with surface
- Assesses density of material 50-75mm beneath probe
- NZTA T/23 & 24 allow this mode for compacted granular lifts 100mm or less
- Used in assessing voids in asphalt layers

Direct Transmission

- Hole drilled / driven to ~ 25-50mm below bottom of layer being measured
- Measure average density of material between probe & device
- Probe on most NDMs locks into place at 25 or 50mm increments
- NZTA T/23 & 24 require this mode for compacted granular lifts greater than 100mm



Limitations of NDM

- Warning for lime, cement & bitumen stabilised materials –requires NDM Moisture Correction
- Measuring in trenches – trench walls affect NDM readings
- Regular Calibration – NDMs must be calibrated regularly
- Licensed – radiation source



Lime



Cement



Water



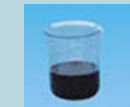
Foamed Bitumen



Water



Cement



Foamed Bitumen



Water

Compaction Plant Awareness

Padfoot



**Smooth Drum
(Double Drum)**



**Smooth Drum
(Single Drum)**



Pneumatic Tyre Roller (PTR)

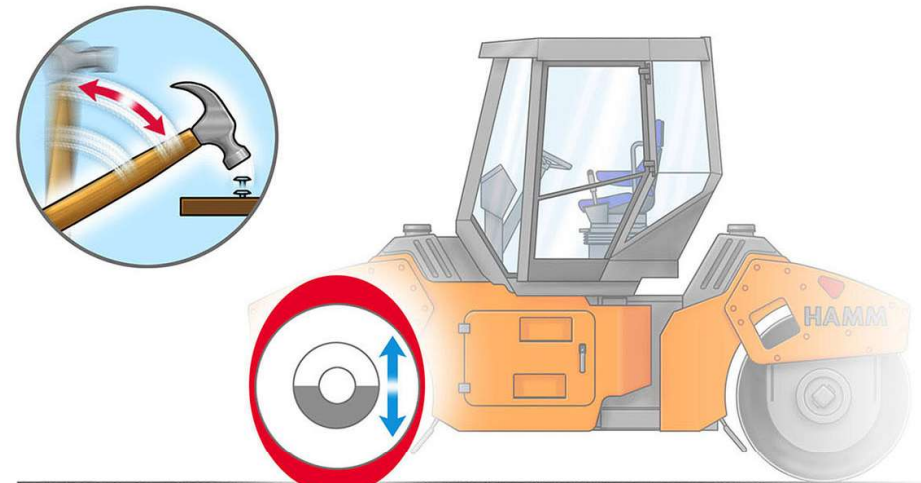
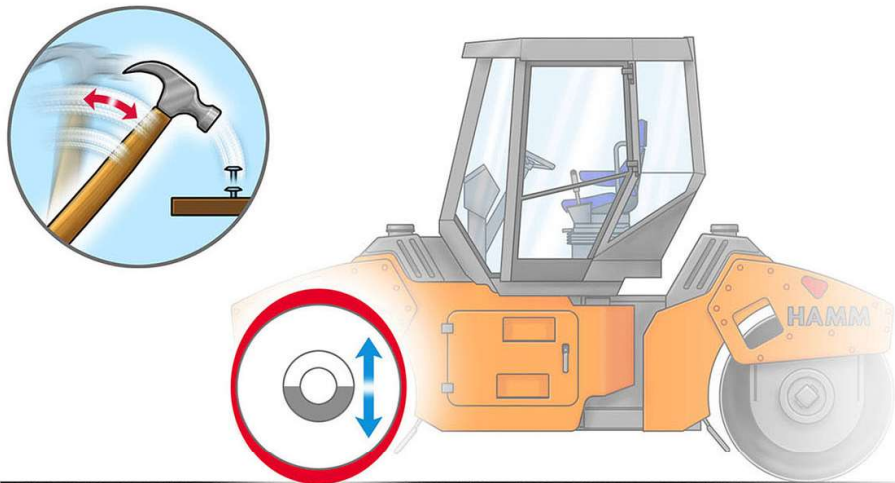
Primary Compaction

Vibratory Compaction

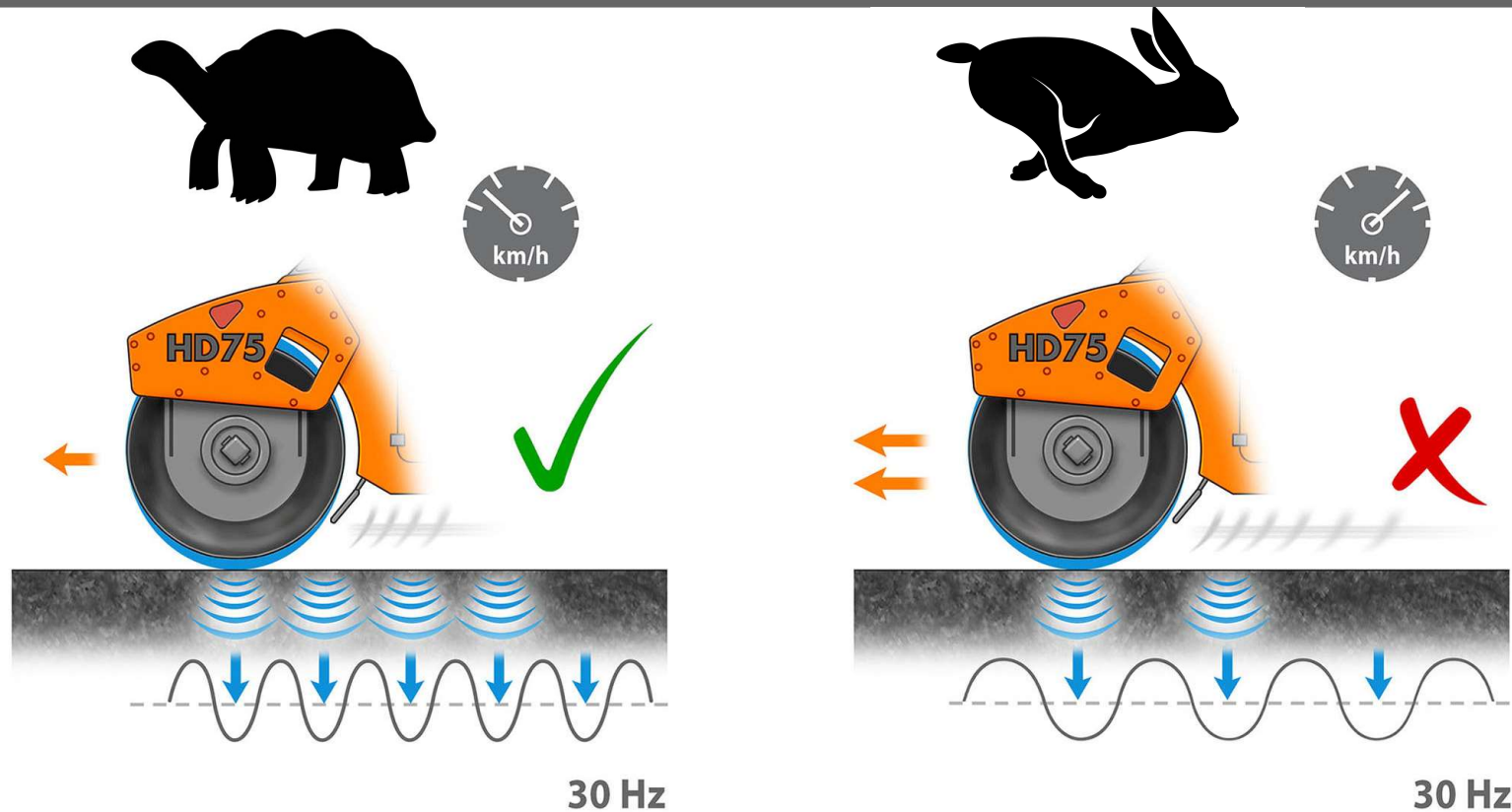
- Initial compaction
- Primary compactors - Vibrate
- Generally, only achieve about 90% of maximum compaction with this alone



Primary Compaction – Feel the Vibe



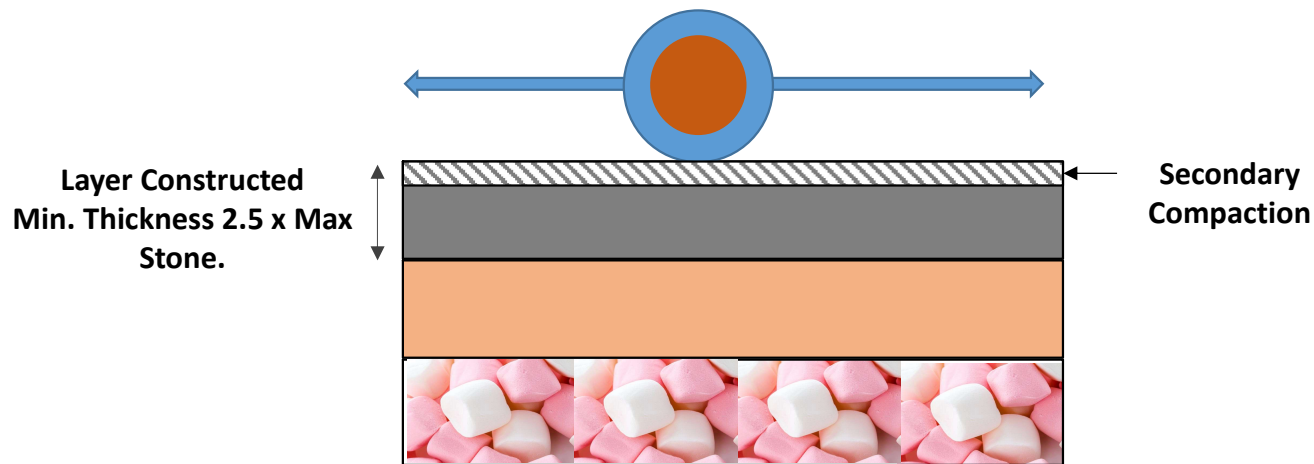
Primary Compaction - Frequency & Speed



!!! Plateau Process – Speed of roller to simulate production rolling

Secondary Compaction – No Vibe

- Rollers are solid steel drums
- Static only (not vibratory)
- Compacts by weight only
- Finishes top part of Layer



Roller Selection – Roller Guide by Mass

Layer Thickness (mm)	Aggregate Material Type					
	Sand	AP 20	AP40	AP65	AP100	
< 100	4-6t	6t	N/A	N/A	N/A	
100-150	10t	10t	12t			
150-200	N/A	12t	15t		N/A	
200-250		N/A	18t			18-20t
250-300			N/A	N/A		20t

- 1) No pavement layers shall be in lifts >300mm
- 2) Lifts are the separate stages a layer is constructed in (e.g. 2x 150mm lifts to build a 300mm AP40 layer)
- 3) Minimum layer depth is 2.5x the stone size (2.5x 40mm, or AP40, is 100mm)
- 4) If building on weak materials (e.g. subgrades), favour thinner first lifts so less compaction required; this will then give you a more robust platform for the next layer

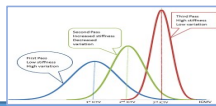
Due Diligence Considerations

Basecourse Overlay Considerations

- Existing Structure/Stiffness
- Non-ideal Compaction Risk



Compaction Risk	Top of Subbase (Building Basecourse)	Top of SIL or Subgrade (Building Subbase)
High Risk	BB ≥ 1.8 mm	BB ≥ 2.5 mm
Medium Risk	1.5 mm ≤ BB ≤ 1.8 mm	2.0 mm ≤ BB ≤ 2.5 mm
Low Risk	BB ≤ 1.5 mm	BB ≤ 2.0 mm



Probability of Compliance

	Basecourse	Subbase	SIL
Avg / Mean (%)	≥ 98	≥ 95	≥ 98*
Minimum (%)	≥ 95	≥ 92	≥ 95*

Waka Kotahi “B-Series” Minimum Requirements for Compaction Compliance

Thank You

