Outline

Night vs. Day compaction
Roller Design Specs affecting compaction
External factors affecting compaction
4 Key Elements of night compaction
Summary
Night vs. Day Compaction

All Basic Compaction Principles apply the same to **BOTH**
Key Roller Design Specifications Affecting Compaction
Key roller design specifications affecting compaction

- Amplitude
- Frequency
- Static weight
- Rolling speed
- Drum diameter
- Drum activation controls
- Drum water & scrapers
Amplitude

Low

High

- Unfixed Imbalanced Weight
- Fixed Imbalanced Weight

Effective direction of fixed imbalance weight
Effective direction of unfixed fixed imbalance weight

Resulting Direction
Frequency

Speed can kill

3000 VPM

3000 VPM
The animation will show the relation between
Eccentric frequency – roller travel speed – impact spacing

Frequency + forward speed = (impact spacing)

Forward speed of 3.0 mph
3200 vpm

Approx. 1”
(12 impacts / linear foot)
For the **SAME** eccentric rotation of 3200 vpm, if I **ACCELERATE** to 4.0mph the **IMPACT SPACING** will now **INCREASE** to ...

- **4.0 mph**
  - 1.33”
  - (9 impacts / linear foot)

- **3.0 mph**
  - 1”
  - (12 impacts / linear foot)
“WARNING”

Best practices dictate that you should **REDUCE** your rolling speed **NEVER TO INCREASE** impact spacing over 1.2”

Or

**NOT TO GO LOWER** than 12 impacts / linear foot

---

**Optimal**

12 impacts / linear foot
# Frequency & Rolling Speed

## Drum Impact Spacing Chart

### Rolling Speeds

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<th>1</th>
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<th>3</th>
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### Notes:

- **OK**: Indicates the rolling speed is acceptable.
- **To Fast**: Indicates the rolling speed is too fast.

- **Standard**: 1,500 - 2,500 MPH
- **High Freq.**: 2,700 - 4,200 MPH

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**Drum Impact Spacing Chart**
## Frequency & Rolling Speed

### Maximum Rolling Speed in Miles Per Hour (MPH) to Achieve Desired Impacts Per Foot

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<th>Impacts per Linear Foot</th>
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Larger drum diameters ...

Provide for more UNIFORM mat contact
Are LESS prone to mat marking
Are LESS prone to bow waves

The effects may be MORE visible on THICK asphalt layers
Pressurized water system

High pressure water system ensures full coverage to drum surface.
Dual scrapers per drum

**Top scraper**
Mainly to build a water trough

**Bottom scraper**
Mainly to clean drum surface
External Factors Affecting Compaction
• Don’t go blaming the roller...

• Fact is, it’s rarely the rollers fault!
External Factors Affecting Compaction:

- Mix design
- Mix temperature
- Paver issues
- Operator Issues
- Ambient temperature
- Base Conditions
Compaction “starts”
When hot mix can support rollers

Compaction “stops”
When asphalt is too stiff to move
Cooling rate = rolling time

Software has been developed to estimate the temperature window for rolling time.
Cooling rate = rolling time

Software has been developed to estimate the temperature window for rolling time

MultiCool V2.0

Can run from Computer

Android App Only no iPhone App
Temperature ranges can dictate the “roller train” set up

<table>
<thead>
<tr>
<th>Breakdown</th>
<th>Intermediate</th>
<th>Finish</th>
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</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>310 – 240 °F</td>
<td>240 – 200 °F</td>
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<tr>
<td>Distance</td>
<td>Up to 200 ft</td>
<td>Up to 200 ft</td>
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</table>
Cooling rate affected by...

- Mat lift thickness
- Ambient & base temperature
- Asphalt mix lay down temperature
- Wind velocity
Temperature

Monitoring system

Constant temperature readout

Display & warning controller

Infrared temperature sensor
Monitoring system

Operator can set the temperature parameters

Temp. high: 300 °F
Temp. low: 240 °F
The Ten Commandments for Roller Operators

1) Roll as closely as possible behind the paver
2) When compacting, always begin at the lower edge
3) Compact the seams first (if next to a hot mat)
4) Deactivate vibration before reversing
5) Always change the rolling speed gently
6) Move forwards and backwards in the same track
7) Change the roller track on the cold side
8) Roll in parallel tracks
9) Water the drums sufficiently
10) Never leave the roller on the hot asphalt
11) Your eyes should be on the drums
12) Your eyes should be on the mat...front and back
13) Be consistent
Key Factors Affecting Rolling Patterns
Key factors affecting pattern

- Basic rolling techniques
- Paver speed
- Number of passes
- Number of coverage's
- Joints & edges
Basic rolling techniques

Never STOP on a soft mat
Never VIBRATE standing still
Basic rolling techniques

Overlap passes by approx 6”
Rolling Pattern

Basic rolling techniques

Need for delicate transitions
  - Smooth start
  - Smooth stop

Diagram showing acceleration and deceleration with ramp up and ramp down.
Basic rolling techniques

Always stop at an angle
Basic rolling techniques

Always stop at an angle
Number of passes

- 1 pass = 1 way \textit{up} towards the paver
- 2 passes = 1 way \textit{up} and 1 way \textit{down} on the mat in the same track
- Patterns need to be maintained for consistency
- Each rolling train zone has its own pattern
- Number of passes will always be an odd number

2 pass (UP from paver and back) and 12’
**Number of coverage's**

Coverage = Number of passes to cover the mat once

Number of coverages needed to achieve final density

In this example 2 passes are needed to make 1 coverage.
Basic rolling techniques

Change tracks on the coolest area of asphalt only
Basic rolling techniques

Try not to roll directly on crown line

Crown
• *(Example) staggered 5 pass pattern*

After enough coverages, Reached density, Now step closer to paver:

- **2nd Pass**
- **4th Pass**
- **5th Pass**
Roller Pattern

Basic rolling techniques

Compacting with unsupported edges on both sides
Longitudinal joint (VIBE roller)

1st Pass
off the joint

Roller drum

Cold

Hot

4-6” Creates a confined edge & raised area

2nd Pass
on the joint

Roller drum

Cold

Hot

4-6” Uses Dynamics to build density “pinch the joint”
Longitudinal joint (VIBE roller)

Vibration = risques de destruction des granulats
Longitudinal joint (*Ozzie roller*)

1st Pass
off the joint

2nd Pass
on the joint

- Cold
- Hot

**Roller drum**

4-6” Creates a confined edge & raised area

- Cold
- Hot

**Roller drum**

4-6” Uses Dynamics to build density “pinch the joint”

*Same as Vibratory Roller*
Longitudinal joint *(OZZY roller)*

2\textsuperscript{nd} Pass on the joint

Roller drum

**Cold** | **Hot**

| 4-6” |

Turn front drum off... Oscillation allows for much higher joint densities
Longitudinal joint *(OZZY roller)*

Oscillation = compactage dynamique des joints sans destruction des granulats
Unsupported Edge using offset
Key Elements of Night Compaction

- Safety
- Productivity
- Quality
- Impacts
  - Economic
  - Social
  - Environmental
Rate of traffic accidents at night on a per mile basis is three times higher than during the day.

- Reduced visibility
- Driver drowsiness
- Alcohol
- Reflective gear
- Aware of your surroundings
- Speed of traffic
- Lighting is key
Lighting

Visibility / illumination at night

up to 16 lights
Productivity

Statistics show in asphalt paving about a 23% increase in tonnage placed per hour at night than during the day.

- Longer working hours
- Less interference of traffic

Plan, Plan, Plan

- Ducks in a row

Time management gets tough at night

- No time to recover from mistakes

Everyone has to be a little more vigilant at night
Quality

Does not suffer because of night work
- IC for pass mapping
- If anything there may be a slight increase in quality because of the cooler temperatures and longer working hours
- No room for error
- Most everything else is shut down in the middle of the night
- Self sufficient
Economic

- Reduced cost (road user)
- Reduced business disruptions
- Increased contract prices about 9% for night work
- Increased traffic control
- Lighting
- Worker overtime
Impacts - Social

- 20% workers report sleep-related disorders
- Higher injury rate
- Sometime work is sporadic
- Hard to adjust to time difference
- Sometimes doing double shift
Impact - Environmental

- Environmental
  - Noise pollution
    - More intense at night
  - Vibrations
  - Light pollution (obvious)
- Air Quality
  - Reduced traffic delays
  - Reduced Congestion
Why do we need Compaction?

Design Specs affecting compaction

- Apply to any roller

External Factors

- Temp. is key

4 Key elements of night compaction

- Safety, Productivity, Quality & Impacts (economic, social, environmental)

Compaction Basics
Thank You