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1.4 Theoretical Outline of the “Floating Screed Principle”

The “floating” working tool is the main difference distinguishing a road paver from other construction machinery. In other words, the layer thickness only changes as a result of changes in the screed’s planing angle or changes in the height of the screed tow points. This way, irregularities in the ground are diminished when passed over, without having to intervene through a control system.

Short irregularities in the base are levelled out through the self-levelling property of the Floating Screed.

When passing over long irregularities, the height of the screed tow points changes, thus leading to a change in the layer thickness.

Depending on the screed planing angle, more or less mix is packed under the screed as the paver advances, and the layer thickness gradually changes over a longer distance.

The response of the screed to such changes depends on:

- Pave speed
- Change in height of the screed tow points
- Properties of the mix (compactability, load bearing capacity).

The following rule can be derived from the example of a paver passing over a short irregularity:

Taking into account different lengths (b) (extending over length of screed arm and depth of screed plate) for the different paver types, an average ratio of about 5 : 1 results as far as compensation of a short irregularity in the base is concerned.

Long irregularities in the base can only be levelled out by actively controlling the height of the screed tow points.

\[ h = \frac{H \times a}{b} \]

Note:
The evenness of the pavement must increase with every layer placed. The magnitude of improvement depends on the quality of the layer below.
2.2 Extending Screeds

2.2.4 Set-Up of the Extending Screed

Setting Up the Screed: Prerequisites

1. **Clearance** between sliding blocks and sliding rail has been set and checked (see page 48).
2. **Height adjustment**: Adjusting spindles have been set and checked (see pages 42 onwards).
3. **Screed has been raised** and laid down on locking bolts.
4. Set both tow point rams to identical heights.
5. **Crown** has been set to 0%.
6. **Clamping screw** for height adjustment is released.
7. **Height adjustment** of the extending screed has been set to 0 on the scale.
2.2 Extending Screeds
2.2.4 Set-Up of the Extending Screed

Preparation
- Support the screed on large wooden blocks or pallets to compensate for any unevenness of the ground.
- Flange surfaces must be clean, i.e. free from asphalt.

TIP
Before mounting a bolt-on extension, the tamper shafts of both the screed’s extending unit and the bolt-on extension must be set so that the arrow on the coupling points to the gap in the gearwheel (see photo).

Easy and Fast Attachment with Quick-Fitting Aid
- The bevelled quick-fitting aid makes it possible to raise a bolt-on extension without tightening down the screws. This allows an extension to be fitted even on an uneven base.

TIP
The front and rear eccentric bolts must be set to zero position (uppermost position). This is important later on for aligning the extending unit with the basic screed.

Height Adjustment of the Bolt-on Extension
- The height of the extending unit and bolt-on extension in relation to one another is adjusted via the eccentric bolts so that the trailing edges of the screed plates are flush while the leading edges are between 0.5 and 1mm higher.

Fitting the Braces
- The frames of the screed’s extending unit and of the bolt-on extension must be joined.
- Then fit the braces stabilizing the bolt-on extensions. These braces must be adjusted so that a light downwards pressure is exerted onto the extension.

TIP
The pressure is correct if the brace can be turned slightly. If it cannot, the pressure is too high.
2.5 Special Screed: AB 600 High Compaction Screed in the TP2 Plus Version

In recent years, the AB 600 high compaction screed in the TP2 Plus version has been developed further and perfected to meet the special requirements of “hot on hot” paving. On an InLine Pave contract, it achieves an extraordinarily high degree of precompaction. Depending on the paving material used, the resultant compaction comes very close to the final density.

The AB 600 Extending Screed in the TP2 Plus Version at a Glance

- Uses: for “hot on hot” paving of binder and base courses, as well as thick roadbase packages.
- Maximum pave width 8.5m.
- Supplementary weight for additional compaction.
- Innovative tamper geometry: modified tamper shield so that material is drawn under the screed more effectively.
- Variable tamper speed up to 1,800rpm.
- Special tamper stroke settings 4, 7 or 9mm.
- 2 pressure bars with infinitely variable pressure from 40 to 120 bar each.

The VÖGELE high compaction process begins with the pulse generator. It generates high-frequency pressure pulses. The pressure bar(s), in contrast to the beating tamper bar, remain in permanent contact with the material, thus forcing it down for a prolonged period of time.

Thanks to the high density achieved by the pressure bar(s), fewer passes are required for subsequent compaction by rolling.

The pressure bar(s) driven by pulsed flow hydraulics are the core of VÖGELE High-Compaction Technology.

Thanks to this unique technology, VÖGELE High-Compaction Screeds in the TP1, TP2 or TP2 Plus versions bring about the highest degree of density a road paver can achieve.

A separate control is provided for each compacting system installed in a VÖGELE High-Compaction Screed.

Fine control of the pressure for the pressure bar(s) allows VÖGELE High-Compaction Technology to be used for paving surface courses as well.
3.5 Relationship Between Tamper Speed and Pave Speed

While paving, an equilibrium of forces is reached between the screed and the paving material. Any change in the pave speed or the tamper speed immediately results in a change of the screed’s floating behaviour.

Tamper speed and pave speed are very strongly dependent on one another. Any change in pave speed without changing the tamper speed and position of the screed tow point rams will affect precompaction of the mix. If the pave speed is increased without simultaneously increasing the tamper speed, the load bearing capacity of the mix will be reduced and the screed lay a thinner layer at a steeper planing angle.

Paving with Automated Grade and Slope Control

If automated grade and slope control is used for paving, the desired elevation of the screed can be maintained by increasing the planing angle, but precompaction will not remain constant.

After Compaction by Rolling

When the roller passes over the mix, the amount of extra compaction will differ on account of varying precompaction and result in irregularities in the surface.

3.6 Recommended Settings for Paving Parameters

<table>
<thead>
<tr>
<th>Type of Pavement</th>
<th>Material</th>
<th>Layer Thickness (cm)</th>
<th>Pave Speed (m/min.)</th>
<th>Tamper Stroke (mm)</th>
<th>Tamper Speed (rpm)</th>
<th>Vibrator Speed (rpm)</th>
<th>Pressure Bar(s)</th>
<th>Pressure (bar)</th>
</tr>
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<tr>
<td>Asphalt: Base Course</td>
<td>AC 32 T</td>
<td>10 - 60</td>
<td>2 - 4</td>
<td>4 - 7</td>
<td>1,500 - 1,800</td>
<td>2,600 - 3,000</td>
<td>90 - 110</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AC 22 T</td>
<td>6 - 10</td>
<td>2 - 5</td>
<td>4 - 7</td>
<td>1,000 - 1,400</td>
<td>2,100 - 2,400</td>
<td>70 - 100</td>
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<tr>
<td>Asphalt: Binder Course</td>
<td>AC 22 B</td>
<td>6 - 10</td>
<td>2 - 5</td>
<td>4</td>
<td>1,000 - 1,400</td>
<td>2,100 - 2,400</td>
<td>70 - 100</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AC 16 B</td>
<td>4 - 8</td>
<td>2 - 6</td>
<td>4</td>
<td>600 - 1,000</td>
<td>1,800 - 2,100</td>
<td>50 - 80</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AC 11 B</td>
<td>4 - 6</td>
<td>3 - 6</td>
<td>4</td>
<td>600 - 800</td>
<td>1,600 - 1,800</td>
<td>50 - 70</td>
<td></td>
</tr>
<tr>
<td>Asphaltic Concrete: Wearing Course</td>
<td>AC 11 D</td>
<td>4 - 6</td>
<td>3 - 6</td>
<td>4</td>
<td>600 - 900</td>
<td>1,600 - 1,800</td>
<td>50 - 80</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AC 8 D</td>
<td>2 - 4</td>
<td>3 - 6</td>
<td>2 - 4</td>
<td>600 - 900</td>
<td>1,300 - 1,600</td>
<td>50 - 70</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AC 5 D</td>
<td>2 - 4</td>
<td>3 - 6</td>
<td>2 - 4</td>
<td>600 - 900</td>
<td>1,200 - 1,500</td>
<td>Off</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SMA 11</td>
<td>4 - 6</td>
<td>3 - 6</td>
<td>4</td>
<td>600 - 1,500</td>
<td>1,600 - 1,800</td>
<td>50 - 80</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SMA 8</td>
<td>2 - 4</td>
<td>3 - 6</td>
<td>2 - 4</td>
<td>600 - 1,500</td>
<td>1,300 - 1,600</td>
<td>50 - 70</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SMA 5</td>
<td>2 - 4</td>
<td>3 - 6</td>
<td>2 - 4</td>
<td>600 - 1,500</td>
<td>1,200 - 1,500</td>
<td>Off</td>
<td></td>
</tr>
<tr>
<td>Asphalt: Combined Base/ Wearing Course</td>
<td>AC 16 TD</td>
<td>8 - 16</td>
<td>2 - 6</td>
<td>4</td>
<td>1,200 - 1,800</td>
<td>2,200 - 3,000</td>
<td>80 - 110</td>
<td></td>
</tr>
<tr>
<td>Asphalt: Thin Layer</td>
<td>AC 3</td>
<td>1 - 3</td>
<td>3 - 10</td>
<td>2</td>
<td>500 - 1,400</td>
<td>1,000 - 1,200</td>
<td>Off</td>
<td></td>
</tr>
</tbody>
</table>
4.1 Before Starting

4.1.7 The Optimal Sensor for Every Paving Application

Big MultiPlex Ski

By arranging 3 sonic grade sensors in a row, it is possible to tap the physical reference at several points lying far apart from each other. Based on the values picked up by the sensors, Niveltronic, the VÖGELE System for Automated Grade and Slope Control, calculates a virtual reference. In this way, the system is much more precise for levelling out long irregularities than a single level sensor.

TIP

Ideal for levelling out long irregularities when an absolute reference is not available.

Short Ski

Length 0.3m

TIP

Should only be used for tight bends or for deliberately copying irregularities from the base.

Long Ski

Length 0.8m

TIP

Used when paving large bends or straight sections.

Averaging Beam

Length 7m

TIP

Used when paving surfaces requiring high evenness.
4.2 During the Paving Process

4.2.3 Joints in Asphalt Pavements

Longitudinal Joints

Paving “Hot to Hot”
Paving with two or more pavers working in echelon is ideal for an integral bond between asphalt strips.

Points to be noted:

- The distance between the individual pavers should be kept as short as possible so that the joint face of the first strip is still sufficiently hot.
- The first rollers following each paver should be of the same size. The rollers start rolling towards the joint from the outer pavement edge inwards. Compaction ends approx. 15cm beside the longitudinal joint on either side. The joint is then the last strip to be compacted by the rollers. This way a tight bond between the pavement strips is obtained.

Mix is not spread adequately from the inside outwards, with the result that there is too much mix in front of the screed’s basic unit:

- Reduce conveyor speed.
- Check / adjust position of sensor for augers.

The conveyors do not deliver sufficient mix:

- Increase conveyor speed.
- Fit limiting plates for auger tunnel.
- Check / adjust position of sensor for augers.

Road Axis

Asphalt Wearing Course
Asphalt Binder Course
Asphalt Base Courses

Longitudinal Joint

Joints should be offset in the individual pavement layers and produced with oblique faces.

4.2.2 Head of Mix in Front of the Screed

The head of mix in front of the screed should be uniformly spread over the full pave width. The use of limiting plates for the auger tunnel and of strike-off plates is strongly recommended.

RULES

A joint describes the connecting seam between two adjacent strips (longitudinal joint). Joints are found when working with several pavers in echelon (“hot to hot”) or when placing a single lane alongside an existing lane (“hot to cold”). A transverse joint is produced when resuming work on the previous day’s section or between paving sessions. In all cases, the two areas must be durably connected to prevent surface water seeping into the pavement.

### 4.3 After Paving

#### 4.3.4 Cleaning, Daily Maintenance and Completion of the Job Site

**10 Steps after Paving: Time Required 30 Minutes (approx.)**

<table>
<thead>
<tr>
<th>Step</th>
<th>Task Description</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Before the paver is supplied with material from the last feed lorry, switch off screed heating and spray the material hopper and auger with cleaning agent.</td>
</tr>
<tr>
<td>2</td>
<td>Before raising the screed, switch off automatic grade and slope control and set both screed tow point rams to the same height.</td>
</tr>
<tr>
<td>3</td>
<td>Raise the screed and set it down on the locking bolts.</td>
</tr>
<tr>
<td>4</td>
<td>Empty the material hopper and conveyor tunnel.</td>
</tr>
<tr>
<td>5</td>
<td>Extend the screed completely and select operating mode “N” (neutral).</td>
</tr>
<tr>
<td>6</td>
<td>Clean those parts of the tractor unit and screed which cool rapidly (side plates, deflector plates, centre auger box, limiting plates for the auger tunnel and push-rollers).</td>
</tr>
<tr>
<td>7</td>
<td>Select “Positioning” mode and activate “Cleaning”.</td>
</tr>
<tr>
<td>8</td>
<td>Spray all paver parts in contact with the mix with cleaning agent (tamper must be sprayed from the back, pressure bar(s) from above).</td>
</tr>
<tr>
<td>9</td>
<td>Retract the screed’s extending units, switch off the engine and the ignition.</td>
</tr>
<tr>
<td>10</td>
<td>Remove the sensors for grade and slope control, as well as the screed consoles. Put cover onto the paver operator’s console to prevent vandalism.</td>
</tr>
</tbody>
</table>

**TIP**

**After Work on the Job Site**

The following tasks should also be performed when the work on site is complete:

1. **Technical check** of the machine.
2. **Make sure** that the machine has been properly parked.
3. **Protect the machine** against vandalism.
4. **Add up the delivery notes** for mix for the day just ended.
5. **Check that everything has been prepared** on site for the next working day (is sufficient fuel available, has asphalt been ordered from the mixing plant for the next day, etc.).
5.1 Systematic Elimination of Paving Errors

Possibilities for Detecting Paving Errors on the Basis of Descriptions

Formation of Undulations

A) Formation of undulations at irregular intervals over the full width while paving
1. Do the undulations also occur without automated grade and slope control? If not, continue with step 5.
2. Check the sensitivity of Niveltronic and set up Niveltronic anew.
3. Inaccurate reference (wire wrongly tensioned, uneven base).
4. Check the choice of sensors (sonic sensors react to changes in temperature due to wind or rain).
5. Slack in the mechanism for height adjustment of the extending units or in the telescoping tubes?
6. Are the tractor unit / screed arm and fishplate tightly connected?
7. Slack in the torque restraint system?
8. Bolt-on extensions have a negative screed planing angle.
9. Tamper speed is too high for the set pave speed (for approx. 3 m/min = 700rpm, for approx. 5 m/min = 1,000rpm, for approx. 10 m/min = 1,800rpm).
10. Supply of mix is not constant. Have the sensors for the conveyors and augers been set correctly?
11. Pave speed is not constant.
12. Supply of mix is not constant. Have the sensors for the conveyors and augers been set correctly?

B) Formation of undulations at regular intervals over the full width while paving
1. Do the undulations also occur without automated grade and slope control? If not, continue with step 5.
2. Check Niveltronic’s sensitivity and set up Niveltronic anew, if necessary (exchange components).
3. Inaccurate reference (uneven base or wire wrongly tensioned: distance between stakes = 6m).
4. Has the required precompaction been achieved behind the paver or are the undulations due to rolling errors?
5. Slack in the height adjustment mechanism of the extending units or in the telescoping tubes?
6. Slack in the torque restraint system?
7. Bolt-on extensions have a negative screed planing angle.
8. Tamper speed is too high or too low for the set pave speed (for approx. 3 m/min = 700rpm, for approx. 5 m/min = 1,000rpm, for approx. 10 m/min = 1,800rpm).
9. Supply of mix is not constant. Have the sensors for the conveyors and augers been set correctly?
10. Have the braces (horizontal / vertical) been fitted correctly when paving large widths?

C) Undulations only form under the left or right extending units
1. Do the undulations also occur without automated grade and slope control? If not, continue with step 5.
2. Check Niveltronic’s sensitivity and set up Niveltronic anew, if necessary (exchange components).
3. Inaccurate reference on one side (uneven base or wire wrongly tensioned: distance between stakes = 6m).
4. Are the hydraulic ram for raising / lowering the screed, the Screed Float valve and the shutoff valves working properly?
5. Slack in the mechanism for height adjustment of the extending units or telescoping tubes?
6.8 Emulsion Types

Overview of Emulsion Types for Noise Absorbing Thin Overlay

The type and handling of bitumen emulsion used is a matter of great importance when paving thin overlay. Among other things, it is important to ensure that the emulsion is applied constantly at the required rate over the entire surface so that the water contained in the emulsion can evaporate. For this reason, a semi-permeable asphalt is normally used when paving thin overlay, as it allows the remaining moisture to escape through the asphalt’s open structure after paving. In this way, water is extracted from the emulsion, leaving only a film of bitumen. Professionals refer to this process as "emulsion breaking".

<table>
<thead>
<tr>
<th>Type of Emulsion</th>
<th>Nominal Content Bitumen in % by Weight</th>
<th>Breaking Class</th>
<th>On Contact with the Base</th>
</tr>
</thead>
<tbody>
<tr>
<td>C60BP1-S</td>
<td>60</td>
<td>1</td>
<td>breaks rapidly</td>
</tr>
<tr>
<td>C40BF1-S</td>
<td>40</td>
<td>1</td>
<td>breaks rapidly</td>
</tr>
<tr>
<td>C67BP5-DSH-V</td>
<td>67</td>
<td>5</td>
<td>breaks very rapidly</td>
</tr>
</tbody>
</table>

C67BP5-DSH-V is a cationic polymer-modified bitumen emulsion with class 5 breaking effect, meaning that the emulsion breaks very rapidly when it comes into contact with the base. The breaking effect and high bitumen content make this emulsion ideal for paving thin overlay on spray seal, hot to hot (DSH-V).

What happens when bitumen emulsion “breaks”?

When heating the bitumen emulsion to 70 - 80 °C and spraying it onto the base, the majority of the water contained in the emulsion evaporates. The remaining water evaporates spontaneously when the emulsion comes into contact with asphalt heated to more than 100 °C. In this way, the emulsion “breaks” when using SprayJet technology from VÖGELE.

1. Prepared base: milled surface or freshly laid binder course.

2. Hot bitumen emulsion at a temperature between 70 and 80 °C is applied by the spray paver.

3. Paving of a binder or surface course. The bitumen emulsion "breaks" immediately as the hot asphalt causes the water to evaporate, leaving a firmly adhering film of bitumen.

4. Any water still remaining in the emulsion evaporates through the “open pores” of the asphalt overlay.
7.1 Spray Technology

The spray nozzles are opened and closed pneumatically. A compressed air system is integrated into the SprayJet module for this purpose.

The nozzles do not spray the emulsion continuously, but operate instead in pulsed mode. The frequency of the spray pulses is adjusted automatically as a function of the selected rate of spread, pave speed and pave width. The particularly high quality of the spray nozzles guarantees perfect spraying.

A very low spray pressure of no more than 3 bar allows absolutely uniform spreading of bitumen emulsion and a clean result when spraying along kerbs.

The SUPER 1800-3(i) SprayJet is equipped with five spray bars. The front spray bar has six spray nozzles and is located between the machine’s crawler tracks right behind the push-rollers. An articulated spray bar installed on each side of the paver comes with 7 nozzles per side. Finally, a short spray bar with two nozzles is provided right behind each crawler track. This arrangement of the spray bars allows full coverage of the existing surface with emulsion, even when the pave width varies. The rate of spread can be selected accurately within the range of 0.3 and 1.6kg/m².

The SprayJet nozzles do not spray the emulsion continuously, but operate instead in pulsed mode. The frequency of the spray pulses is adjusted automatically as a function of the selected rate of spread, pave speed and pave width. As a result, complete coverage of the existing surface with a uniform film of emulsion is achieved, without any overlaps.

Emulsion is applied at an exceedingly low spray pressure of no more than 3 bar. In combination with the high-quality spray nozzles, this allows the emulsion to be sprayed cleanly and without burdening the environment.