PURPOSE
This section provides information on the key factors effecting coating coverage and costs. Consideration is also given to “stretching” a coating with thinner, and comparing costs per litre.

INTRODUCTION
The purchaser of protective coatings is responsible for selecting the most economic coating available which is suitable to achieve the required protection. The coatings field is complex and knowledge of coating calculation techniques and interpretation of data is required in order to make the appropriate choice.

VOLUME SOLIDS
Most liquid coatings contain a solids portion and a volatile portion. The solids portion consists of the binder, normally oil or resin, together with colouring and functional pigments, extenders and additives. The volatile portion is the solvent or thinner that merely liquefies the solids sufficiently to carry them onto the surface being coated. The solvent then evaporates, leaving behind the dried film of solids, which provides protection and decoration. The coating user is most concerned with this remaining film volume or thickness because it is this, which provides the desired hiding, gloss, weather resistance, colour etc.

When selecting a coating the key is how much area will the solids cover per litre after the volatiles have evaporated?

SOLIDS CONTENT BY VOLUME OF SURFACE COATINGS
Solids content is a theoretical calculation based on certain assumptions concerning the densities of the raw materials used in paints. In practice, the solids content obtained can vary greatly from its theoretical value because of change in the following:

- Densities
- Temperature effects
- Small differences in the physical condition of the paint
- The methods and conditions of application

In addition, film contraction, solvent-retention and volatility of low molecular weight polymers can all contribute error. The determination of volume solids by AS/NZS 1580.301.2, is difficult to calculate and large variations have been observed in practice. For these reasons the volume solids values given in this manual are determined by a method which corresponds to ASTM method D2697 and ISO 3233 with a slight modification for use at practical film thickness and with usual curing and hardening requirements.

The calculations obtained are generally higher than the theoretical calculated volume solids, but the method approximates the spreading rates obtained under ideal conditions. Volume solids should not be used to gauge practical spreading rate as so many other variables have to be taken into account. For this purpose please use the data provided later in this section.

“STRETCHING” A COATING WITH THINNER IS A MYTH
Adding solvent or thinner to the liquid coating adds nothing to the hiding or spreading rate of the coating solids as the extra solvent evaporates. Instead, extra solvent merely increases the coating cost by the price of the thinner and increases application costs by the additional labour time required to mix the thinner into the coating. In the case of baking systems, the cost is increased by the greater amount of oven heating required to remove the thinner.

Adequate volume solids, not thinners, are the key to proper coverage by a coating.

COMPARING LITRE COSTS
Often buyers tend to select a coating strictly on a cost per litre basis without considering the volume solids of the paint. The user of a coating should be interested in the cost of finishing a given unit area and not the price per litre.

In the long run the coating user receives value only from that portion of the litre that remains as dried coating film after the volatile solvent or thinner has been released. Volume solids are the key factor in determining coating economies and not weight solids.
THEORETICAL SPREADING RATE

The theoretical spreading rate is a calculation of the amount of coating on average applied to a surface, assuming no losses or penetration into the substrate. It can be calculated as follows:

\[
\text{Theoretical Spreading Rate (m}^2/\text{L)} = \frac{\text{Volume Solids (\%)} \times 10}{\text{Dry Film Thickness (in microns)}}
\]

Example (i): A primer has a volume solids of 55% and needs to be applied at a dry film thickness of 75 microns. What is the theoretical spreading rate?

\[
\text{Theoretical Spreading Rate (m}^2/\text{L)} = \frac{55 \times 10}{75} = 7.33m^2/L
\]

Example (ii): If 10% thinner was required to thin the coating to application viscosity and a dry film thickness of 75 microns is still required. The calculation would be as follows:

\[
\text{Theoretical Spreading Rate (m}^2/\text{L)} = \frac{55 \times 10}{75} \times \frac{100\%}{(100\% + 10\%)} = 6.67m^2/L
\]

PRACTICAL SPREADING RATE

Except under closely controlled conditions, Theoretical Spreading Rates are hardly ever achieved, therefore in estimating coating requirements and costs, allowance must be made for losses which occur during application due to such factors as surface roughness, application method and application conditions. An empirical relationship which may be used to calculate Practical Spreading Rate as follows:

Practical Spreading Rate = Theoretical Spreading Rate \times Coverage Efficiency

The guide (table) below shows the approximate coverage efficiencies expected for various surfaces and application conditions.

<table>
<thead>
<tr>
<th>Application Method</th>
<th>Surface</th>
<th>Brush/Roller</th>
<th>Airless Spray/Interior</th>
<th>Airless Spray/Exterior</th>
<th>Airless Spray/Windy Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Smooth Steel</td>
<td>0.87</td>
<td>0.78</td>
<td>0.68</td>
<td>0.49</td>
<td></td>
</tr>
<tr>
<td>Blast Cleaned Steel</td>
<td>0.83</td>
<td>0.74</td>
<td>0.65</td>
<td>0.46</td>
<td></td>
</tr>
<tr>
<td>Power Tool Cleaned Steel</td>
<td>0.79</td>
<td>0.70</td>
<td>0.61</td>
<td>0.44</td>
<td></td>
</tr>
<tr>
<td>Blasted Steel – lightly pitted</td>
<td>0.79</td>
<td>0.70</td>
<td>0.61</td>
<td>0.44</td>
<td></td>
</tr>
<tr>
<td>Blasted Steel – heavily pitted</td>
<td>0.74</td>
<td>0.70</td>
<td>0.58</td>
<td>0.41</td>
<td></td>
</tr>
<tr>
<td>Rough Concrete or Masonry</td>
<td>0.61</td>
<td>0.66</td>
<td>0.47</td>
<td>0.34</td>
<td></td>
</tr>
</tbody>
</table>

Example (i): An application had a coating with a theoretical spreading rate of 4.0m²/L and intended to airless spray lightly pitted steel, with only light winds. Calculate the practical spreading rate:

\[
\text{Practical Spreading Rate (m}^2/\text{L)} = 4.0 \times 0.61 = 2.44m^2/L
\]
CONVERSION OF SPREADING RATES TO USAGE RATES
It is sometime necessary to convert from spreading rates expressed in m²/L to a usage rate in L/m². This is gives the amount of
paint required to coat a square metre of surface:

Usage Rate (L/m²) = \( \frac{1}{\text{Spreading Rate (m²/L)}} \)

Example (i): A coating has a spreading rate of 2.5m²/L. What is the usage rate in L/m²?

Usage Rate (L/m²) = \( \frac{1}{2.5} \) = 0.4L/m²

DRY AND WET FILM THICKNESS
It is often necessary to convert between a wet film thickness and a dry film thickness. This calculation assumes that a perfect film
is laid and that after evaporation of the solvents there is no air or solvent trapped in the film. This calculation is not accurate for
inorganic zinss that have a porous silicate matrix:

Dry Film Thickness (microns) = \( \frac{\text{Wet Film Thickness} \times \text{Volume Solids} \, \%}{100} \)

Example (i): A coating has a wet film thickness of 100 microns and volume solids of 60%. What would you expect the dry
film thickness to be?

Dry Film Thickness (microns) = \( \frac{100 \times 60}{100} \) = 60 microns (DFT)

Wet Film Thickness (microns) = \( \frac{\text{Dry Film Thickness} \times 100}{\text{Volume Solids} \, \%} \)

Example (ii): A coating has a dry film thickness of 100 microns and volume solids of 80%. What would you expect the wet
film thickness to be?

Wet Film Thickness (microns) = \( \frac{100 \times 100}{80} \) = 125 microns (WFT)

MATERIAL COST PER SQUARE METRE
To determine the material cost per square metre we must know the coverage rate at the film thickness specified:

Material Cost ($/m²) = \( \frac{\text{Cost per litre ($/L)}}{\text{Spreading Rate (m²/L)}} \)

Example: A primer has a spreading rate of 6.0 m²/L at 75 microns dry film thickness. The cost of the coating is
$9.00/L. What is the material cost of the coating, assuming no losses?

Material Cost ($/m²) = \( \frac{9.00/L}{6.0 \text{m²/L}} \) = $1.50/m²
ESTIMATING PAINT QUANTITIES FOR BOATS

The following table outlines the calculations for paint quantities for boats, an example is provided.

**Boat Area & Quantity Calculation**

<table>
<thead>
<tr>
<th>Spars &amp; Masts</th>
<th>Deck Areas</th>
<th>Topsides</th>
<th>Underwater Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>length X mean circumference = square metres</td>
<td>length overall X beam X 0.75 = square metres</td>
<td>(length overall + beam) X 2 X average freeboard = square metres</td>
<td>length at waterline X (beam + draught) = square metres</td>
</tr>
</tbody>
</table>

**Example:** Calculation of required paint quantity for a boat hull.

An underwater area of a steel vessel 15 metres long at the waterline, draught of 1.5 metres and beam of 4 metres.

The coating to be applied has a theoretical spreading rate of 7m²/Litre and the following application conditions apply:

- Application method = Spray
- Substrate = Blasted steel – lightly pitted
- Location = Exterior – no wind

**Area to be coated**

\[ 15 \times (4 + 15) = 82.5 \text{ m}^2 \]

**Practical Spreading Rate**

\[ 7 \times (0.61) = 4.27 \text{ m}^2/\text{Litre} \]

**Paint quantity required for underwater area**

\[ \frac{82.5 \text{ m}^2}{4.27 \text{ m}^2/\text{Litre}} = 19.32 \text{ Litres} \]

Practical quantity = 20 Litres.

Wattyl is committed to quality in the design, production and delivery of its products and services. Wattyl’s manufacturing facilities quality management systems are certified to ISO9001: 2008.

Wattyl’s research and development facilities are accredited for technical competence with the National Association of Tests Authorities, Australia (NATA) and comply with the requirements of ISO/IEC 17025:2005. Accreditation No.104 (Footscray), 166 (Blacktown) and 931 (Kilburn).

For the most up to date information contact Wattyl Customer Service Hotline or visit the Wattyl Website.

<table>
<thead>
<tr>
<th>CUSTOMER SERVICE HOTLINE</th>
<th>WEBSITE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia 132 101</td>
<td><a href="http://www.wattyl.com.au">www.wattyl.com.au</a></td>
</tr>
<tr>
<td>New Zealand 0800 735 551</td>
<td><a href="http://www.wattyl.co.nz">www.wattyl.co.nz</a></td>
</tr>
</tbody>
</table>

Wattyl is a registered trademark of Wattyl Australia Pty Ltd.

1. This information is important to ensure that the listed Wattyl product(s) perform according to the stated application and uses and must be followed to meet Wattyl’s warranties express and implied. Wattyl advises that you (a) review the Technical Data Sheets (TDS) and Material Safety Data Sheets (MSDS) before you use or handle the product; (b) ensure that the product be used only in accordance with the information provided by Wattyl and the product(s) be transported, stored and handled in accordance with the information on the MSDS and relevant TDS; and (c) thoroughly test the product, using the recommended application method on a sample of intended substrate, before using the product. 2. The information in this TDS was prepared using information gathered during product development. While Wattyl endeavours to update this information and maintain the accuracy and currency of its contents, Wattyl does not warrant that the information provided is current when the product is used or is wholly comprehensive. 3. For all product and non-product related information, Wattyl recommends that you conduct such additional investigations as may be necessary to satisfy yourself of the accuracy, currency and comprehensiveness of the information on which you rely in using and handling the product. If you require further information please contact your nearest Wattyl office before using the product(s). 4. To the full extent permitted by law, Wattyl’s liability for breach of a condition or warranty implied into the contract for sale between Wattyl and you by law is limited at Wattyl’s election to: (a) the replacement of the product; or (b) payment of the cost of replacing the product. If coating rectification is required Wattyl Technical Services shall be contacted prior to commencement. WATTYL AUSTRALIA PTY LTD (ABN 40 000 035 914)