WP3 Experts Workshop on Contributory Factors

Skid resistance introductory presentation
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Overview

• The purpose of this introductory presentation is to set the scene for the discussion section that follows.

• It will review briefly what we already know about factors that influence skid resistance
  – So that we have a common starting point for our discussion
  – And avoid re-inventing the wheel!
What do we know?

• To start, we need to distinguish between road/tyre friction and skid resistance

<table>
<thead>
<tr>
<th>Road/tyre friction</th>
<th>Skid resistance</th>
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</thead>
<tbody>
<tr>
<td>▪ Affects <strong>vehicle manouvres</strong></td>
<td>▪ Used to assess the <strong>road surface</strong></td>
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<tr>
<td>▪ Describes the forces generated between a road and a tyre.</td>
<td>▪ A standardised measure of the contribution made by the road to tyre/road friction.</td>
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<tr>
<td>▪ Is unique to a particular situation.</td>
<td>▪ It is assessed using standardised friction measurement techniques.</td>
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<tr>
<td>▪ Under particular local conditions.</td>
<td>▪ Under standardised conditions.</td>
</tr>
<tr>
<td>▪ At a particular time.</td>
<td></td>
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<tr>
<td>▪ In a particular place.</td>
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<td>▪ With a particular vehicle.</td>
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<tr>
<td>▪ With particular tyres.</td>
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<tr>
<td>▪ At a particular speed.</td>
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What do we know?

• In TYROSAFE we are mainly concerned with the road’s contribution
  – i.e. skid resistance
  – and how that is measured and managed.
• But we are also considering optimising this with two other aspects
  – rolling resistance and noise
• So we cannot ignore tyres.
What do we know?

- Skid resistance has been studied at many institutes for over three-quarters of a century.
- Many factors relating to the road surface that influence skid resistance are well known.
  - If not always well understood.
What do we know?

- The tyre industry places considerable emphasis on “wet grip” performance.
- Properties of tyres that influence tyre/road friction are well known within the tyre industry
  - But do not always take account of road surfacing properties.
- Tyre properties are not generally well understood by road engineers.
What do we know?

• Over the years, many devices have been developed to measure skid resistance.
  – TYROSAFE has identified at least 24 currently in use in Europe (deliverable D04 describes them).
    • and there have been others that are now no longer used.
  – Four basic techniques
    • Slider, angled wheel, slipping wheel, locked wheel
    • Test condition range from very low slip speeds through to locked-wheel
  – But difficult to harmonise.
What do we know?

• Using these devices we have learned much about the road and what influences skid resistance.
  – And something about tyres as well.
What do we know?

Road surface
- microtexture
- macrotexture
- particle size
...

friction varies with slip ratio and speed

Tyre properties
- dimensions
- construction type
- inflation pressure
- rubber compound
...

Test conditions
- vertical load
- water film thickness
- temperature
- season
...

Relation: CFL = f(glissement, vitesse)
BBTM 0.6 HS=1.3 PS=2mm Heau=1mm

friction varies with slip ratio and speed
What do we know generally?

- Dry road/tyre friction is high
- Wet road/tyre friction is much less
  - And is affected by speed, decreasing as speed increases.
  - Especially with deep water films or smooth tyres.
- In the braking cycle
  - Friction increases, reaching a peak level as the tyre begins to slip over the road surface.
  - Then decreases to give “sliding friction” when wheel locks or vehicle yaws.
  - So measurement methods are affected by slip ratio
What do we know about the road?

- Microtexture
  - Dominates low-speed friction and important at all speeds
  - Influenced by aggregate
  - Polishing by traffic
  - Seasonal variation
  - Cannot measure directly (yet)
What do we know about the road?

- **Macrotecture**
  - Important to limit decrease in wet friction with increasing speed
  - Too much generates noise and (perhaps) rolling resistance
  - Difficult to measure
    - Current techniques do not provide enough information for all the interaction with the tyre
  - Different texture forms may have same measured depth but different effects on noise and skid resistance
What do we know about the tyre?

• Tyre compound has major influence on friction developed
  – Interaction between adhesion and hysteresis

• Tyre loading has an effect
  – Greater load reduces friction

• Tyre tread can be analogous to road texture
  – Less effective when average depth <2 mm
What do we know about other factors?

- Temperature can affect tyre rubber
  - Hence available friction (and skid resistance measurements)

- Ice and snow?
  - Make roads slippery!
  - Studded tyres
    - Can “retexture” roads to remove effects of summer polishing every year
Aims of the discussion session

• To follow on from this presentation and
  – Identify any other factors that have or may have an influence on skid resistance

• To discuss what we know in order to:
  – Identify gaps in knowledge that could be improved by further study.
  – Identify areas where greater coordination or collaboration would enhance knowledge or application of research.