E-commerce studies at RISE

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Unit: Packaging Performance
Summarized reports

During the last few years, RISE has made a number of scientific studies about e-commerce. This presentation compiles four of them.
Comparative study on packaging in e-commerce logistics – Part 2: heavy product

E-commerce packages with robotic lawn mowers

Field study – sent from Germany to a private customer in Sweden

Laboratory test – ISTA 6 Amazon - Ships in Own Container (SIOC)
Field study – sent from Germany to a private customer in Sweden

Parcel A: Compressed/deformed on the outside of the box and the inserts were compressed/deformed. The handle was broken. The product was in perfect condition.

Parcel B: Minor compression on the outside of the box and minor compression on the inserts. The product was in perfect condition.

Parcel C: Minor compression on the outside of the box and minor compression on the inserts. Handle was broken. The product was in perfect condition.
Parcel D: Only some indentation at a few corners after the drop sequences. However, the handles were not tested in ISTA test schedule.

Parcel E (different insert material): Much more damaged box due to fixation issues of the product with the new insert material. Cracks on one edge after the first sequence of drops. Handles were not tested.
Analysis of mechanical stresses on packages at sorting terminals and in-between transports

Deeper analysis of the data recorded during the field study and the simulated laboratory transport test

The severity of the package handling was different in different terminals

Ranking of terminals is possible with the method of having logged parcels addressed to customers.

To get a good ranking estimate of the mechanical handling, several packages of different size and weight could be logged over time.
## Analysis of mechanical stresses on packages at sorting terminals and in-between transports

<table>
<thead>
<tr>
<th>Terminals/ Transport</th>
<th>Distance from start (km)</th>
<th>Duration (h. m)</th>
<th># of signal triggered events</th>
<th>Mean of 25 highest G values</th>
<th>Mean of 25 highest Grms levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Ulm, GE</td>
<td>0</td>
<td>1.22</td>
<td>123</td>
<td>5.30</td>
<td>0.456</td>
</tr>
<tr>
<td>2. Transport</td>
<td>193</td>
<td>2.42</td>
<td>39</td>
<td></td>
<td>0.193</td>
</tr>
<tr>
<td>3. Nürnberg, GE</td>
<td>5.37</td>
<td>76</td>
<td>9.43</td>
<td></td>
<td>0.639</td>
</tr>
<tr>
<td>4. Transport</td>
<td>695 (502)</td>
<td>8.03</td>
<td>317</td>
<td></td>
<td>0.195</td>
</tr>
<tr>
<td>5. Langenhagen, GE</td>
<td>17.38</td>
<td>133</td>
<td>13.07</td>
<td></td>
<td>0.852</td>
</tr>
<tr>
<td>6. Transport</td>
<td>1151 (456)</td>
<td>7.00</td>
<td>1078</td>
<td></td>
<td>0.211</td>
</tr>
<tr>
<td>7. Gløstrup, DK</td>
<td>3.53</td>
<td>109</td>
<td>3.18</td>
<td></td>
<td>0.282</td>
</tr>
<tr>
<td>8. Transport</td>
<td>1491 (340)</td>
<td>54.43</td>
<td>39</td>
<td></td>
<td>0.149</td>
</tr>
<tr>
<td>9. Jönköping, SE</td>
<td>2.25</td>
<td>9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>10. Transport</strong></td>
<td><strong>1514 (23)</strong></td>
<td><strong>11.36</strong></td>
<td><strong>1504</strong></td>
<td></td>
<td><strong>0.548</strong></td>
</tr>
<tr>
<td><strong>Summary</strong></td>
<td><strong>1514</strong></td>
<td><strong>6d, 2h, 28m</strong></td>
<td><strong>2872</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Most demanding terminal.**
- May be due to mechanical handling equipment used, organization of the goods flow in the terminal and the motivation and education of the personnel.

- Last-mile distance: 23 km
- Duration: > 11 hours
Drop Performance of Dangerous Goods Packages in the Aspect of Parcel Delivery Standards

Important to choose relevant test sequences and the order of them

The height of drop is not the strongest influencing factor of the damages, rather the number of drops.

Different materials and package constructions have different damage mechanisms
Literature study on topics or concerns on packaging intended for e-commerce logistics

Less automated supply chain, plenty of touch points, high return rate

A typical product in the e-commerce logistic chain will experience between 20–30 touches before it reaches the consumer

Return rates for e-commerce packages are 20–30 % compared to 8–9 % for retail sales

Increased hazard rate due to that multiple items are consolidated into one shipping unit

Anna Broodh
Takeaways from the studies

The e-commerce logistic chain is complex

Drop tests are tough

Different materials and package constructions have different damage mechanisms

The severity of the package handling is different in different terminals

Vibration profiles mimicking different kinds of vehicles travelling at different locations in the world are essential for laboratory simulations
The remaining question

Is there an existing standard that simulate what e-commerce packages are exposed to during their distribution chain good enough to be appointed as the e-commerce standard to use when evaluating packages for the e-commerce distribution chain?
What are the differences in logistics around the world and how should one take this into account?

• Different climate
• Different vibrations due to different road infrastructures
• Different vibrations and stresses due to different vehicles used
• The severity of the package handling is different in different terminals
How to test for e-commerce

- Climate test
- Few drops but several drop sequences instead of several drops divided into only one or two drop sequences
- Drop test at varying drop heights
- Vibration profiles should be different for different parts of the world as the road quality and infrastructure differs
- Also of importance:
  - Test carrying handles and perforations
  - Test for co-packing
<table>
<thead>
<tr>
<th>E-commerce &lt; 20 kg</th>
<th>National</th>
<th>National</th>
<th>International</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Truck</td>
<td>Truck + air</td>
<td>Truck + air</td>
</tr>
<tr>
<td>Open any existing handles</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Climate (required)</td>
<td>Choose from chart (+ alternative for boat shipment)</td>
<td>Choose from chart (+ alternative for boat shipment)</td>
<td>All climate zones from chart, including boat</td>
</tr>
<tr>
<td>Drop</td>
<td>5 drop (height 1)</td>
<td>5 drop (height 1)</td>
<td>5 drop (height 1)</td>
</tr>
<tr>
<td>Vibration with top load</td>
<td>Truck National</td>
<td>Truck National + Air</td>
<td>Truck International + Air</td>
</tr>
<tr>
<td>Drop</td>
<td>5 drop (height 2)</td>
<td>5 drop (height 2)</td>
<td>5 drop (height 2)</td>
</tr>
<tr>
<td>Vibration without top load (incl. last-mile?)</td>
<td>Truck National</td>
<td>Truck National + Air</td>
<td>Truck International + Air</td>
</tr>
<tr>
<td>Drop</td>
<td>5 drop (height 3)</td>
<td>5 drop (height 3)</td>
<td>5 drop (height 3)</td>
</tr>
<tr>
<td>Low pressure</td>
<td>60 min</td>
<td>60 min</td>
<td></td>
</tr>
<tr>
<td>Drop on hazard</td>
<td>height 4</td>
<td>height 4</td>
<td>height 4</td>
</tr>
<tr>
<td>Carrying handle/perforation</td>
<td></td>
<td></td>
<td></td>
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</table>
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