## E-commerce studies at RISE

Thomas Trost, Elin Åkerlund

Unit: Packaging Performance







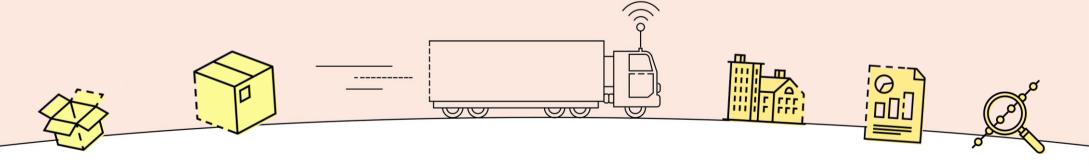




### **Summarized reports**

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

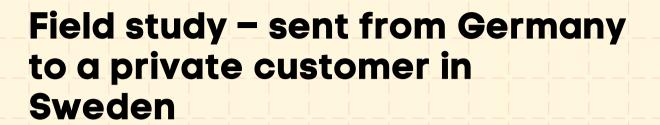
E-commerce packages with robotic lawn mowers

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

Laboratory test – ISTA 6 Amazon - Ships in Own Container (SIOC)



Thomas Trost Maria Sundin

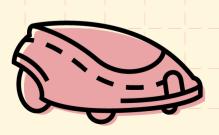




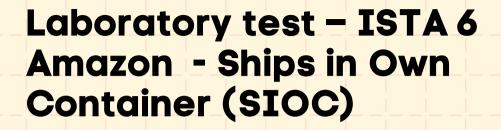
Parcel A: Compressed/deformed on the outside of the box and the inserts were compressed/deformed. The handle was broken. The product was in perfect condition.

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 inbetween 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

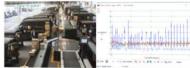
Ranking of terminals is possible with the method of having logged parcels addressed to customers.

To get a good ranking estimate of the mechanical handling, several packages of different size and weight could be logged over time.



**BIOECONOMY** 





Analysis of mechanical stresses on packages at sorting terminals and in-between transports.

**Thomas Trost** 

RISE Bioeconomy Report No: 123

Research Programme 2018–2020, RP 18 - Improving Corrugated Board Performance, AOR Transport Packaging Performance

Restricted distribution until 2020.Dec. 31

**Thomas Trost** 





## Analysis of mechanical stresses on packages at sorting terminals and in-between transports

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



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

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#### Drop Performance of Dangerous Goods Packages in the Aspect of Parcel Delivery Standards

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Abstract: Requirements for dangerous goods packaging are well known, whatever version are used. The testing circumstances are strictly defined for each transportation method (rota, rat, air, sea). Bit nowadays it is becoming a practice that courier express operators transport dangerous goods as single package. This parcel delivery enthod means a higher risk for all find of logistics participants. By this service the packages are delivered fast, but handled more roughly than in comparison to LTL data in truckhoad or FITL (full truck load), Naturally, he parcel delivery sector uses its own suitability lesting methods, which are also well defined. These procedures coming from various standards such as ACTM, ISTA or copporate (Fedfer) standards. This paper computes the most common parcel delivery using conditions concerning the dop test requirements of DCR (Dangerous Goods Regulation) using packaging such as paper hag, corrugated fibrebourd box, steel drum and plastic pertycan, respectively. Then the ster testils were analyzed to present the difference.

Keywords: package testing, dangerous goods, parcel delivery, drop test, corrugated

#### 1 Introduction

The packaging industry and their customers seek to reduce costs and environmental impact of packaging. A general trend for packaging is that the amount of material is being reduced. The dominating material for transport packaging is corrugated board of various qualities and grammages. The average grammage in Europe has been reduced from 558 g/m² in 1997 [11] to 515 g/m² in 2016 [23]. Today the proportion of recycled fibres is also quite high in corrugated products. Of the total consumption of raw materials in 2016, 28 % was testimer [23]. This often means a lower quality of the corrugated board compared to the use of kraftliner made from virgin fibres.

While the material reduction continues, the packaging has to fulfil its duties. The products must be protected from humidity, dirt, shocks and vibrations. New demands are introduced with the heavily increased amounts of single packages direct to consumers due to e.g., the increased e-commerce. This has led organisations such as ISTA to develop special test schedules such as the ISTA 6-series/Amazon test [3].

Several studies have been performed measuring drop heights with electronic data recorders, e.g. Singh et al reports around 70 cm drops occurs for 95 % of the packages with weight 6.8 kg shipped between Michigan and California in USA. The results naturally had a variation for the three different postal services studied (DHL, UPS and FeedEy). The reality for the large flow packages today is that they are handled both manually during collection and delivery and on large high-speed conveying and sorting equipment at hubs 41.

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# 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



BIOECONOMY Papermaking and Packaging



Literature study on topics or concerns on packaging intended for e-commerce logistics

Anna Broodh

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Anna Broodh





### Take aways 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

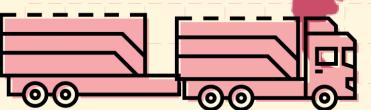
Few drops but several drop sequences instead of several drops divided into only one or two drop sequences Drop test at varying drop heights

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



E-commerce < 20 kg	National	National	International
	Truck	Truck + air	Truck + air
Open any existing handles			
Climate (required)	Choose from chart (+ alternative for boat shipment)	Choose from chart (+ alternative for boat shipment)	All climate zones from chart, including boat
Drop	5 drop (height 1)	5 drop (height 1)	5 drop (height 1)
Vibration with top load	Truck National	Truck National + Air	Truck International + Air
Drop	5 drop (height 2)	5 drop (height 2)	5 drop (height 2)
Vibration without top load (incl. last-mile?)	i iriica Mational		Truck International + Air
Drop	5 drop (height 3)	5 drop (height 3)	5 drop (height 3)
Low pressure		60 min	60 min
Drop on hazard	height 4	height 4	height 4
Carrying handle/perforation			





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