Reducing Damage in the Fast Moving Consumer Goods Supply Chain

Examining the results of a UK study in to the causes of damage in the FMCG supply chain. The paper also discusses the potential profit improvement potential of addressing the issue and the current barriers to progress.

Greg Wood
Business Manager Consulting
Pira International

Education: DMS (Kingston Business School), Diploma in Packaging (University of London) *Activities:* Member of the Institute of Packaging, BSI environment committee.

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Case Study - An Examination of the Condition of 1 Litre Drinks Cartons in the Supply Chain
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Pira International

Executive summary

The Aseptic Carton has many qualities. It is a low cost, environmentally friendly packaging material made from renewable resources, which make it attractive to filler manufacturers, retailers and consumers especially for liquid products such as milk and juice. In the United Kingdom several millions of cartons are purchased each year. However, it is also vulnerable to damage in the supply chain if handled inappropriately. The purpose of this study was to compare the different methods by which cartons are collated in bulk and distributed through the supply chain, and to identify the hazards for carton damage in each of those chains.

To achieve this, The Carton User Group[1] (CUG) together with Pira International[2] and the Lean Enterprise Research Centre[3] (LERC) conducted a three-month project commencing in October 2002. The study examined the physical condition at six points in the supply chain of Tetra Brik and Combibloc[4] one litre, "baseline", aseptic drinks cartons, supplied to retail in four formats: Tetra on dollies, Tetra on pallets, Combi on dollies, Combi on pallets.

The report concludes that there are much lower levels of damage present when the pallet or dolly is moved through the chain from manufacturer to store as a single item. However, where the pallet is broken down, either at distribution centres or stores, the amount and seriousness of damage increases significantly. It is suggested that work should be undertaken to investigate this and develop solutions whereby the partners in the chain can collaboratively improve carton quality for the consumer.

Methodology

The condition of 1-litre baseline cartons was audited at six points spread throughout the supply chain, from the point of palletisation (immediately after filling) to the store shelf within the multiple retailer store environment. Four separate product/distribution pack combinations were audited:

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[1] **CUG – (Carton User Group)** an association comprising of materials suppliers and packer/filler businesses in aseptic drinks carton manufacture and supply
[2] **Pira International** is recognised worldwide as a leading independent centre for consultancy and research in packaging
[3] **LERC (the Lean Enterprise Research Centre of Cardiff Business School)** is recognised as a global leader of researching, applying and communicating lean thinking
[4] Although two different carton formats are included in the study **(Tetra and Combi),** examination of their relative performance is not a focus or objective of the work

- Tetra Brik, packed on dollies **1A**
- Combibloc, packed on dollies **1B**
- Tetra Brik, packed on pallets **1C**
- Combibloc, packed on pallets **1D**

With respect to each carton/distribution pack combination, full pallets or dollies were examined, carton-by-carton, at each inspection point.

For a particular product/distribution pack combination, the supply chain process is similar over the course of the year. Therefore by conducting a 'snap-shot' investigation at each inspection point, a quick and not untypical data set was obtained. Percentage damage rates at each inspection point were then analysed.

Finally, a simple easy to apply damage categorization scheme was used which split the level of damage into four categories:

- **Perfect (P)** – No discernable damage
- **Clean Minor (M) -** Small creasing to carton
- **Significant (S)** - More marked creasing at any location leading to some shape deformation
- **Critical (C)** - Sufficient creasing to severely deform the carton out of shape

Results

Any damage

The "background damage rate"[5] for cartons found with any category of damage lay within a range of **0 to 35%**, increasing as the product was moved through the chain.

Minor damage

Minor damage was relatively common such that the 'background damage rate' across all four formats throughout the chain lay within a band from **0 to 28%**.

Significant damage

Significant damage was less common, with the "background damage rate" across all four formats throughout the chain between **0 to 5%** (and less than 3% in the packer/filler part of the chain).

Critical damage

Critical "background damage rate" across all four formats throughout the chain was between **0 to 2%** (and less than 1% in the packer/filler part of the chain).

Discussion

Roll cage use

There was a dramatic increase from the background level of damage to nearly **50%** for minor, **28%** for significant and **8%** for critical for **chain 1C**, after the point the pallet was broken down into roll cages. It is evident from this damage analysis, that from the point a pallet is disturbed and broken down to be distributed further along the supply chain, the opportunities for damage to occur considerably increases. No manual handling took place at the carton or tray level for chains **1A, 1B** or **1D**.

Within the roll cages, trays are stacked higher than they are on pallets (or dollies) and stacking is generally uneven. In addition, trays may be loaded with other heavy items (trays of jars, etc). Under these conditions, damage easily occurs when cages are moved on to the truck at the point of dispatch from the RDC, from cage to cage impacts that occur during cage handling and truck loading, and during cage marshalling at *store.* In addition, trays and cartons easily become damaged when manually removed from the cages during shelf stacking or cage consolidation.

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[5] **Background damage rate** – The background damage rate represents the region within which the damage rate commonly lies throughout the whole chain. Within this damage rate band it is not possible to make firm assertions about the damage rate. This region could be seen as the 'error of measurement' for the audit method. Only when the damage rate suddenly increases (such that it exceeds this background rate) can it be concluded that the true damage rate has significantly increased.

The metal bar design of the cage-side wall also causes local indentation too, and this is accentuated during roll cage movement.

Mixed pallet operations

Although mixed *pallet* delivery to store was not an audited chain, the manual tray handling and mixed product stacking issues are similar to that of roll cage use

Dolly/flow through pallet use

Damage at all three levels was lower for the chains where the pallet or dolly flowed undisturbed through the chain. Carton damage was caused however, by manual movement of the dollies/pallets. This caused the top layer of cartons to experience lateral compression from pushing/pulling dollies in to position. The general predominance for damage in top layers of dollies was related to this manual interaction and occurred in the RDC and store when electric pallet trucks or pull handles were not used.

Distribution of damage between layers and within layers

Within the packer/filler parts of the chain, damage is relatively evenly distributed between the different layers on pallets and dollies, but with respect to damage location within each layer, damage is more dominant in perimeter packs.

Within the RDC and store, damage becomes more dominant in upper and lower layers. Upper layer damage is generally accounted for by 'exposure' (the upper layer of cartons being most exposed to impact and handling during distribution, and with respect to dollies it is the upper layer that is pushed/pulled as discussed above). Lower layer damage becomes more dominant because the lower layer packs have been under compression for a longer period.

Damp pallets/dollies

Damp wooden pallets were observed within one of the audited chains (**1D**). The increased moisture content of the board led to a reduction in board (collation tray) strength, which allowed carton deformation and significant/critical damage to occur.

Although dollies are not prone to absorption of moisture, the dolly inter-stacking feature can collect water if the dollies are stored exposed to the elements. For one of the dolly chains audited (**1B**), bottom layer trays (and cartons) were wet at positions corresponding to the inter-stacking moulding. On investigation, other dollies awaiting use, exhibited pools of water in this moulding feature.

Strapping of dollies/pallets on trucks

At RDC during truck loading for dispatch, rows of pallets and dollies may be separated and held in place by means of straps, wooden beams or nets. This can be very effective in reducing

movement (and therefore damage) during transit, but subject to the strapping method, may actually introduce damage. There was some evidence of this point loading occurring resulting in carton damage.

Damage levels along the chain

Packer/filler and RDC

In general, damage levels are low within the packer/filler part of the supply chain. There is a low level increase in damage upon receipt at RDC, which is accounted for by loading handling at packer/filler and unloading handling at RDC (dolly to dolly impacts, pushing/pulling dollies, pallet to pallet impacts), and from compression damage that occurs during transit from packer/filler to RDC. Within the RDC environment damage levels do not significantly rise, except where operations include manual handling.

Store

Back of store: With respect to damage potential, the back of store area is the least 'organised' (and possibly the most complex) part of the whole chain. A large inventory of goods is packed in mixed roll cages and on mixed pallets, frequently jammed in to cramped storage areas, and exposed to frequent impact and manual handling hazards. Within the back of store area there is a conflict between speed and care for product, which is exacerbated by lack of space, which contributes to the increase in damage.

Shop floor: Once at shelf, trays are manually handled from their cages/trolleys to the floor or on to a stack of exiting trays. Packs become damaged, dented and deformed from being lifted awkwardly, dropped, leant-on and kneeled-on. Furthermore the store shelves are deep front-to-back and have little clearance. As a result of this, packs are first placed (or dropped) on to the front edge of the packs already in the stack, and then pushed backwards in to the shelf while contacting and resting on the pack below. This 'drop and push' operation introduces damage.

Dolly packed product (chains **1A** and **1B**) and product that is delivered to store on complete pallet as per chain **1D** (whereby the pallet is delivered straight to shelf as a complete unit) suffer far less than roll caged product upon receipt at store and within the store environment.

Conclusions

- Manual handling at the collation tray level causes damage, particularly within roll cage chain stages at RDC and store
- Those formats that do not involve collation tray handling (dolly and unit pallet) exhibit substantially lower damage levels than the manually handled (roll cage) format
- Damage is introduced through irregular and severe stacking within roll cages – this is also true for mixed pallet deliveries from RDC to store

- Although dolly and unit pallet formats are far better at delivering product to shelf in fit condition, direct manual interference (pushing/pulling) between operator and dolly (or unit pallet) causes damage
- Pack compression increases along the distribution chain due to the increasing time period through which lower layer packs are under top-load for 5 layer pallets and dollies
- Various other damage mechanisms were observed, such as the evidence of damp pallet/dolly, or poor truck strapping induced damage, that could be relatively easily eliminated:

This study has highlighted and quantified various damage trends for the supply of 1- litre baseline cartons to multiple retail store shelf. It has identified that damage occurs more predominantly within the store leg of the supply chain and most significantly for mixed order systems using roll cages (or mixed pallets) for delivery to store and far less for flow through formats

The damage levels highlight that there is scope for significant improvement in the appearance of packs at shelf, and improvement therefore in the level of service provided to the consumer. Reducing damage serves to reduce supply chain costs (through reducing direct losses/unsaleables/returns) and serves to improve customer perception of both pack and store (and therefore retailer brand).

Ultimately, resolving damage in the supply chain can be achieved through collaboration and agreement between packer/fillers and retailers, and through recognition within retail (at the highest level) that retailers must share responsibility for damage.