

# MultiMix



**The modular software system  
for optimising loading volume for  
heterogeneous goods**



**Multiscience**  
GmbH

## Modular software for heterogeneous goods logistics



**Multiscience GmbH** has been founded in 1986. It is exclusively concerned with the development of software systems for optimising the use of loading volume and for creating controlling data for automatic palletising systems. The company's very name itself is intended to indicate that even complex situations can be analysed by an interdisciplinary team and provide solutions, which can be

realised in logistic practice and which extend far beyond the programming of mathematical optimisation procedures.

Multiscience offers the software system, MultiMix, for the optimisation of loading heterogeneous packing items and MultiPack for packing items of equal size.

 **MultiMix**

Optimum loading of shipping containers, pallets and HGVs with mixed packing items



A separate brochure describes MultiPack's scope of performance

 **MultiPack**

Loading pallets with packing items of the same size

The **MultiMix**-system modules serve to make optimum use of the loading volume when loading mixed packing items. As far back as the year 1987 the original version of the MultiMix shipping container selection was used for the optimum selection of shipping cartons for book club deliveries by Bertelsmann in Gütersloh. After more than 20 years of continuous development work, many variations of the MultiMix modules for mixed pallet loading and HGV/container loading are in use throughout Europe in addition to the shipping container selection.

MultiMix lays the foundation for efficient logistics by the maximum use of loading volume capacity and the selection of optimum cargo carriers.

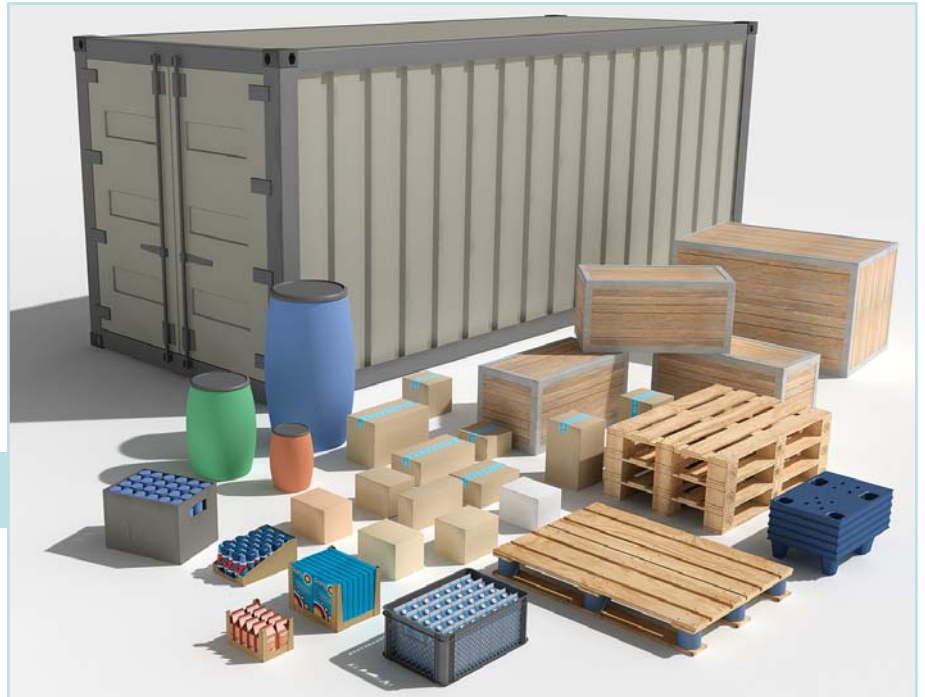
Only the maximum possible utilisation of the loading volume by pallets, receptacles and containers can minimise logistics costs. The three MultiMix basic modules can be combined according to relevant practical demands and can be supplemented by specific additional functions. Controlling data for automatic order picking systems can be created using 'MultiMix for robots'.



## Loading volume optimisation using MultiMix

In order to transport heterogeneous goods, various cargo carriers are used, which must each be loaded in compliance with the most varied of restrictions. With its various modules, MultiMix takes this situation into account.

Sound loading volume planning in seconds



### A short overview of the modules and the typical cargo carriers and packing items:

Modul	Ladungsträger	Packstücke
<input type="checkbox"/> <b>Shipping container selection</b>	<input type="checkbox"/> Boxes <input type="checkbox"/> Re-usable containers <input type="checkbox"/> Pallet boxes	<input type="checkbox"/> Books <input type="checkbox"/> Folding boxes <input type="checkbox"/> Spares <input type="checkbox"/> Tins <input type="checkbox"/> Bottles
<input type="checkbox"/> <b>Mixed pallet loading</b>	<input type="checkbox"/> Pallets <input type="checkbox"/> Rolling containers	<input type="checkbox"/> Boxes <input type="checkbox"/> Food trays <input type="checkbox"/> Barrels <input type="checkbox"/> Re-usable containers (beverages, fresh foods)
<input type="checkbox"/> <b>HGV/container loading</b>	<input type="checkbox"/> HGVs <input type="checkbox"/> Containers <input type="checkbox"/> ULDs <input type="checkbox"/> Railway wagons	<input type="checkbox"/> Boxes <input type="checkbox"/> Pallets <input type="checkbox"/> Crates <input type="checkbox"/> Barrels

All three modules offer interfaces for data transfer and easy administration of the relevant articles, cargo carriers and customer data necessary for calculation.



## The shipping container selection module

In manufacturing, wholesaling and mail order companies, picked customer orders, whose volume is smaller than the loading capacity of normal pallets, are shipped in standard containers (boxes or reusable containers). As a rule, a relatively small number of various container types is available for a broad spectrum of customer orders.

In the simplest case, the order picker selects the shipping container to be used simply by assessing the article to be packed or by the order packing list. As a rule, he will tend towards selecting a relatively large container to be sure that the extra work involved in repacking due to having selected too small a container is avoided.

A simple IT supported container selection for Pick & Pack order picking is also widely used, taking into account the litre volume and the maximum dimensions of the articles, whereby a fixed guide value of e.g. 70% is used as a basis for the maximum filling level of the containers.

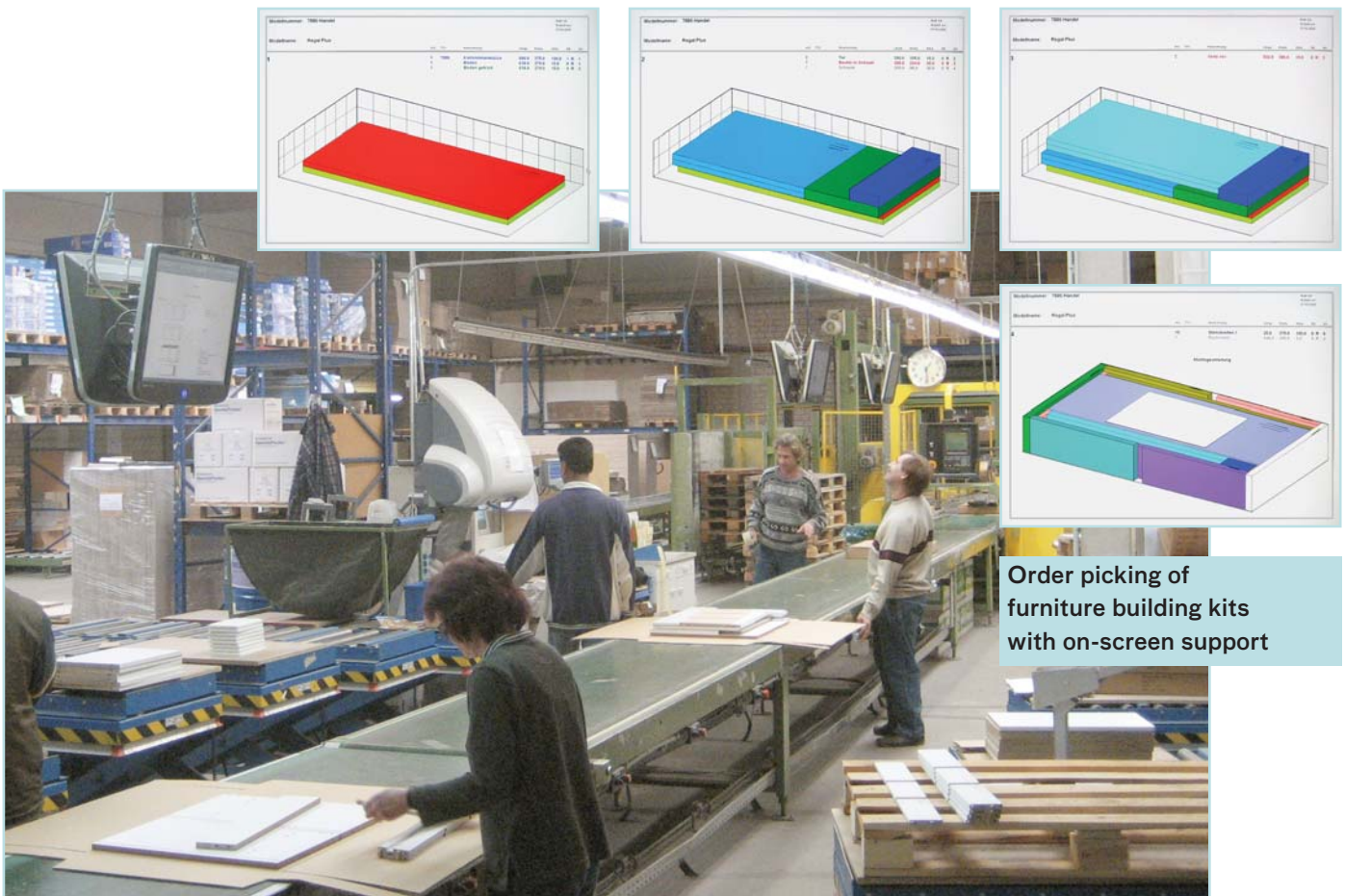
This procedure tends towards choosing containers, which are too large for relatively small articles, whereby in packing larger articles relative to the container size, unsuitable containers are often selected: For example two boxes measuring 250 x 210 x 160 mm do not fit into a box measuring 400 x 350 x 200 mm, although only 60% of the volume would be taken up. In both cases the principle applies that on the one hand repacking due to having selected too small a container cannot be excluded and on the other hand it is relatively unlikely that the order picker will repack the goods already packed into an obviously too large container into a smaller one.

As a consequence of selecting containers which are too large, unnecessary additional costs are incurred for packaging material, reusable containers or filling material and damage due to empty space in the container as well as additional costs result from a higher volume requirement in the succeeding levels of the logistics chain.



Software supported selection of the lowest cost shipping containers





Order picking of furniture building kits with on-screen support

Using MultiMix appropriate containers can be selected for every order even before order processing. This means:

- ❑ Costs are minimised
- ❑ Repacking is avoided
- ❑ Separate packing lists are prepared for every container included within an order.
- ❑ The container specification for Pick & Pack order picking is error free
- ❑ Material usage for container and filling material is recorded
- ❑ It is possible to verify completeness by reweighing individual containers within an order
- ❑ The necessary transport capacity can be obtained early
- ❑ The logistic follow-on costs for every order can be precisely calculated
- ❑ The packing process can be graphically supported
- ❑ Controlling data can be created for order picking robots

MultiMix shipping container selection can be expanded and amended to suit special customer requirements. For this purpose, this can include creating interfaces to existing systems or adding specific information to packing lists.

### MixKart: customising product range boxes

The **MixKart** programme is a combination of MultiMix shipping container selection with the MultiPack programme. It enables optimising the dimensions of the product range boxes (e.g. for ranges of sweet goods or furniture building kits), which must be matched both to the content as well as to the transport pallet.



## The mixed pallet loading module

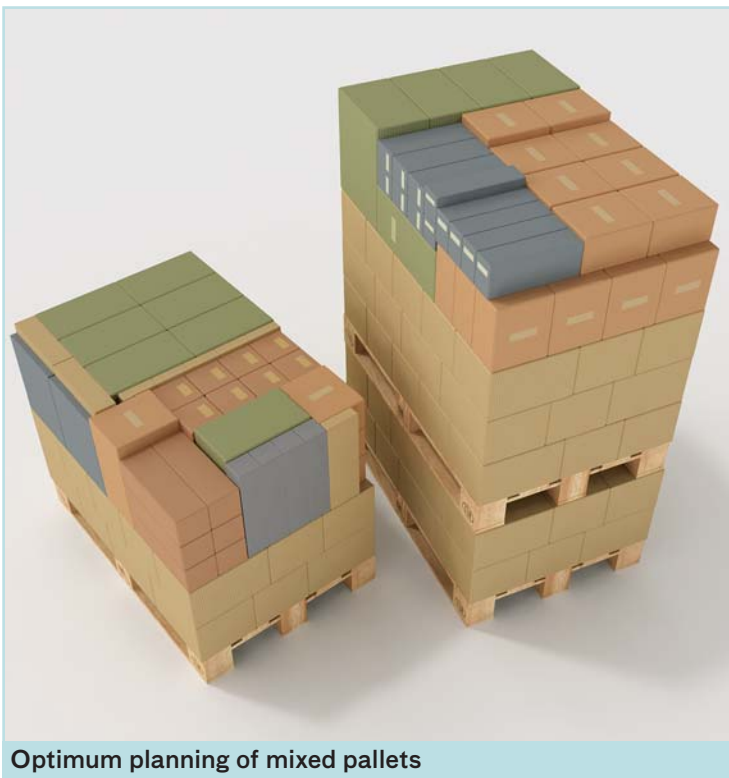
Because the scope and composition of orders for delivery differ greatly as a rule, it is hardly possible to give an exact forecast of the number of pallets required without software support. It is up to the order picker to find the best possible pallet load. The MultiMix module, mixed pallet loading, serves to plan the loading of heterogeneous picking orders on pallets, rolling containers and similar cargo carriers: Customers' orders are broken down into the minimum number of pallet sized loads so that the pallet load volume can be used to its best advantage.

Separate loading lists and plans are prepared for each individual pallet. Based on this information an efficient pallet loading process (e.g. by Pick & Pack order picking) and the early, well founded scheduling of the required transport capacity can be organised.

The number of errors in order picking is reduced and easier monitoring of completeness, both by the loader as well as by the recipient, is ensured by means of precise delivery documentation at pallet level. MultiMix can take into account customer and packing item specific physical restrictions in the optimisation of pallet loading:

- maximum total pallet weight
- pallet type and load height specifications
- fragility and overloading
- demands on the stability of the load
- pallet loading sequence according to the optimum order picking method
- combining product groups or partial product ranges
- taking into account interim pallets e.g. for separating product groups

Additional customer specific restrictions can be integrated into MultiMix mixed pallet loading by Multiscience as required.



Optimum planning of mixed pallets

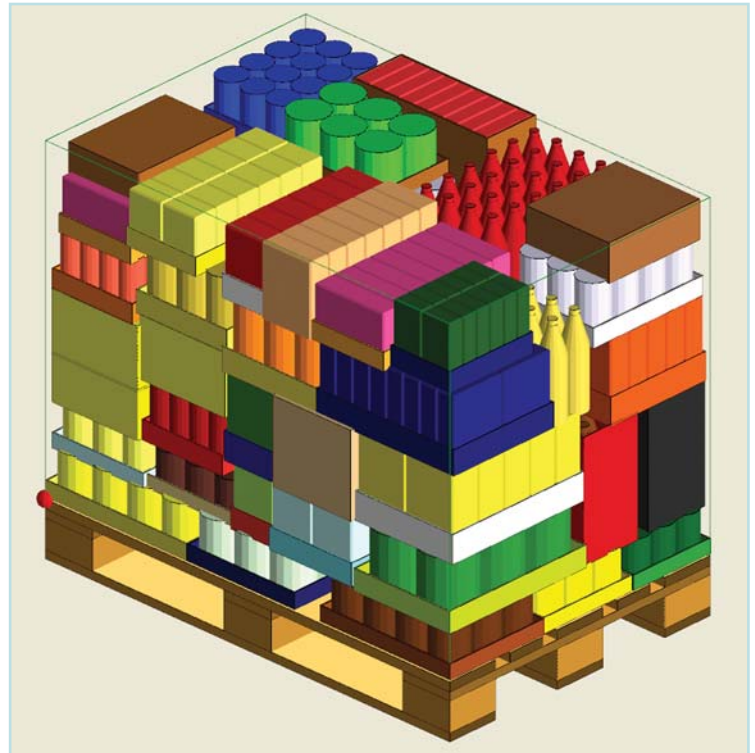


In accordance with the relevant loading strategy, various optimisation algorithms are available. Dependent upon the structure of the orders to be planned and the user's preference, MultiMix chooses between different packing strategies such as e.g. layering with tied stacking for homogeneous partial cargo, tower forming and three dimensional nested models.

### Robots in order picking

In mixed palletising with the aid of robots, exact load planning is essential in order to achieve a stable load. This makes an ex-ante calculation of the order picking pallets indispensable.

In recent years, the first products were realised for various systems providers allowing controlling data for robot controlled loading of heterogeneous packing items to be created with the aid of MultiMix mixed pallet loading. To this effect, the most varied of packing algorithms and data interfaces were implemented in accordance with the hardware and software concepts of the relevant systems providers.



Order picking pallet planned with MultiMix



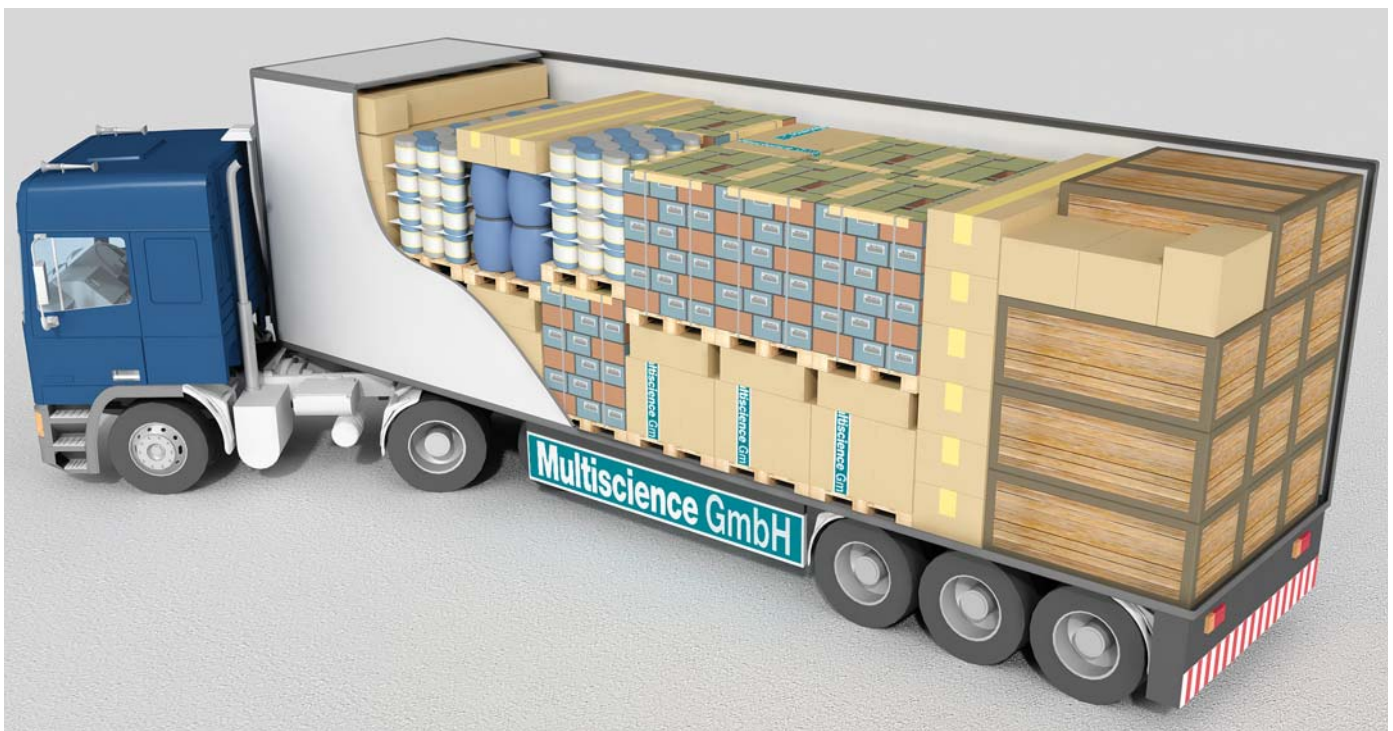


## The HGV/container loading module

In loading HGVs, containers and similar large volume cargo carriers, the problem of maximising the loading volume capacity is encountered in a large number of variants. In connection with the search for suitable cargo carriers for a cargo consisting of one or more customer orders, which can include packing items such as boxes, pallets, barrels, pipes, rollers etc., the following questions are conceivable and can also in part be interdependent:

- ❑ Will the load fit into a specific cargo carrier (HGV/container)?
- ❑ What part of the load will fit into the specified cargo carrier?
- ❑ Can remaining free loading volume be used for additional orders or partial orders?
- ❑ How many cargo carriers of what types are required?
- ❑ Which cargo carrier types (e.g. 20' or 40' containers, different HGVs) should be used for the cargo?
- ❑ Is it possible to realise the unloading sequence of the individual orders specified in the route planning?

The selection of suitable cargo carriers for small orders can only be solved satisfactorily by a drawn out trial and error process but the optimum solution is unlikely to be achieved. For larger orders, the complexity of the problem cannot be assessed as a rule. Only a rough estimate can be made of the cargo carrier requirement. The type and number of required HGVs or containers are known only upon completion of loading and therefore a maximum load capacity usage is of course impossible.



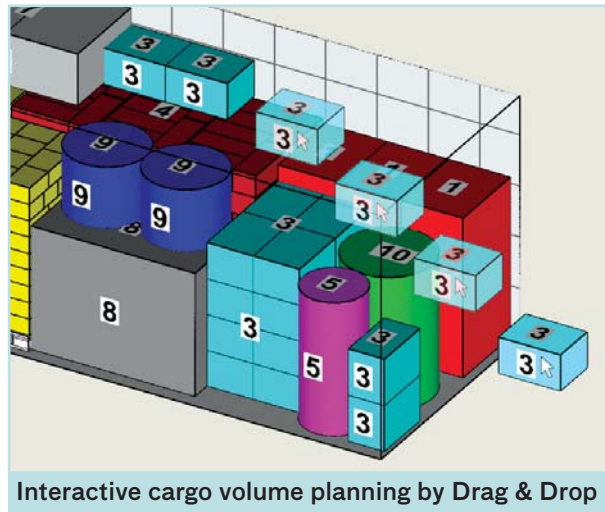
Exact load capacity scheduling through optimum load planning





With the aid of the HGV/container loading module, even complex problem combinations can be illustrated and optimum solutions found. For example, the following restrictions (individually or in combination) can be taken into account:

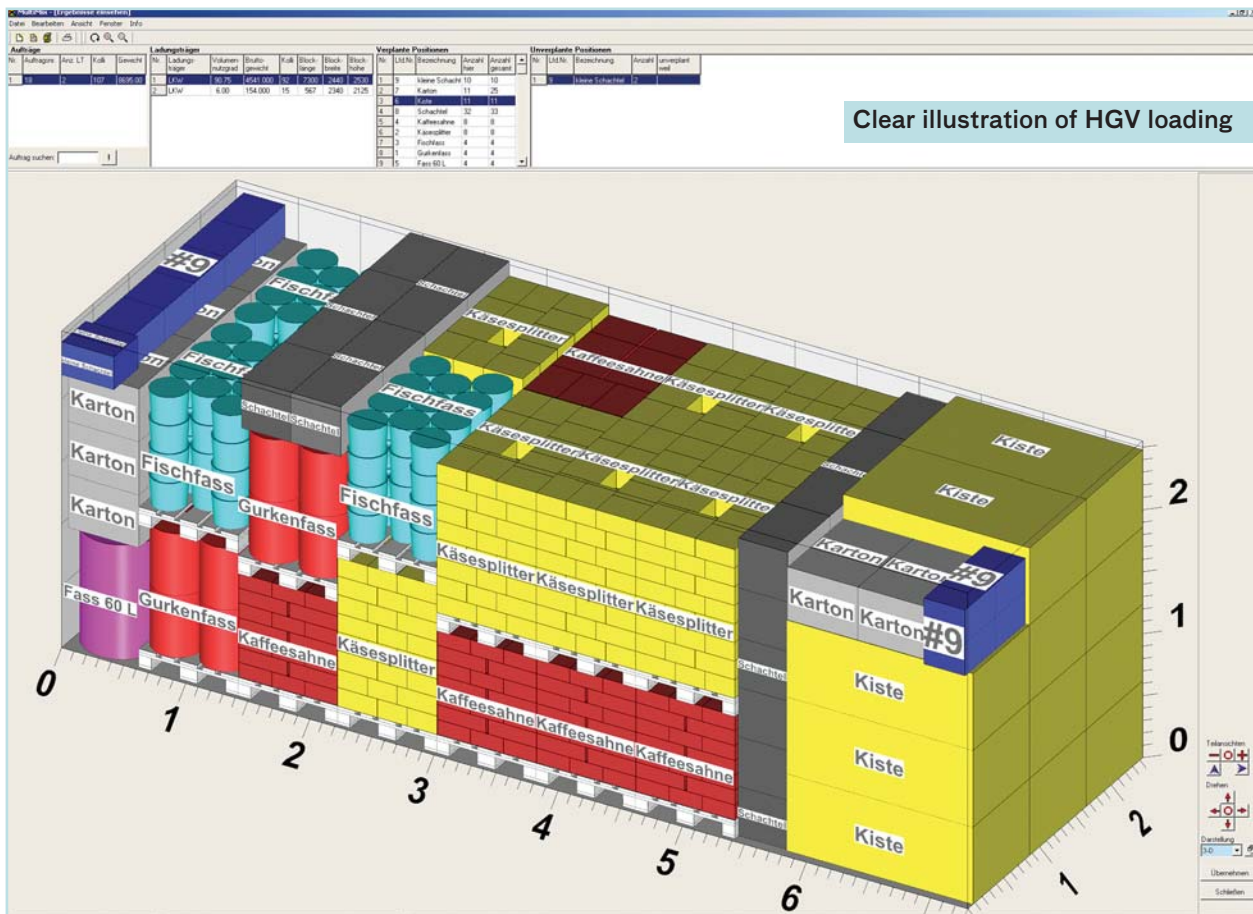
- Compliance with the maximum gross weight of the cargo carrier
- Weight distribution inside the cargo carrier, i.e. the centre of gravity of the cargo
- Possibility of overloading packing items
- Restrictions on mixing loads in case of dangerous goods
- Prescribed loading or unloading sequences for individual packing items or individual orders within the cargo



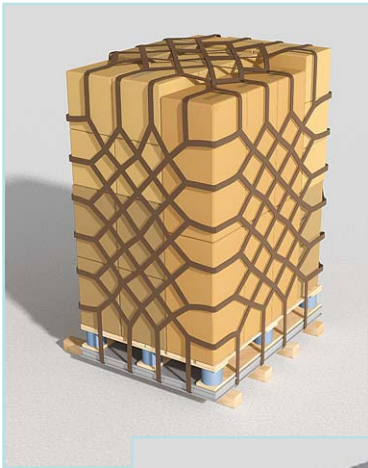
Interactive cargo volume planning by Drag & Drop

- Permitted orientation within the loading area, i.e. only upright or only upright at right angles

Costs can also be recorded so that MultiMix is able to calculate the lowest cost cargo carrier or a cargo carrier combination offering the minimum cost respectively.



Clear illustration of HGV loading



Cargo carriers for  
HGV/container loading

An early and precise loading plan calculation reduces loading times and increases load security. MultiMix compiles loading lists with additional information such as total weight, volume usage level, location of the centre of gravity etc. for each of the cargo carriers to be employed. The graphic illustration of the loading can be viewed step by step forwards and backwards from various angles on the monitor. A phased printout of the loading plans is possible according to user requirements. The integrated loading plan editor allows interactive modifi-

cation of the loading plans, i.e. individual packing items or blocks of packing items can be moved, turned, deleted or inserted using the mouse.

The loading of specialised cargo carrier types, such as two tier loading platforms with variable intermediate floors, open top or flat containers, gooseneck containers, air freight containers or railway wagons can also be optimised using MultiMix. Interfaces can be integrated in order to accept data from other systems.



## Printouts of customised packing instruction forms

As standard, the printouts from the MultiMix modules comprise a graphic illustration of the load and a packing or loading list. Supplementary information can also be printed out according to customer requirements.

The original data and results of optimisation are archived by MultiMix. Loading plans can also be archived in popular graphic formats – e.g. for sending by email.

Art.	Bezeichnung	Länge	Breite	Höhe	Netto	Brutto
1	...	110,0	110,0	110,0	...	...
2	...	...	...	...	...	...
3	...	...	...	...	...	...
4	...	...	...	...	...	...
5	...	...	...	...	...	...
6	...	...	...	...	...	...

Nr.	Artikel	Bezeichnung	Länge [mm]	Breite [mm]	Höhe [mm]	Stückzahl [Pkg]	Anzahl
4	10	10 Einzelverpackung	100	100	77	8,67	2
14	22	22 Einzelverpackung	100	100	100	1,00	2
14	27	27 Einzelverpackung	100	100	100	1,00	2
14	18	18 Einzelverpackung	100	100	100	1,00	2
9	24	24 Einzelverpackung	100	100	77	8,67	2
12	36	36 Einzelverpackung	100	100	100	1,00	2
18	42	42 Einzelverpackung	100	100	142	8,68	2
18	28	28 Einzelverpackung	100	100	82	8,68	2

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18	42	42 Einzelverpackung	100	100	142	8,68	2
18	28	28 Einzelverpackung	100	100	82	8,68	2

Practical loading plans are quickly calculated and documented

## An overview of MultiMix's scope of performance

Sound scheduling of transport capacities

Avoidance of repacking processes

Exact data basis for final costings

Optimisation of load capacity usage for heterogeneous goods

Selection of the most efficient cargo carrier combination

Rapid loading by means of individual loading instructions for each cargo carrier



Indispensable for efficient load volume planning.

JohnsonDiversey, Münchwilen/Thurgau (Schweiz): Containerbeladung • Elfotec AG, Moenchaltorf (Schweiz): Mischpalettenbeladung • Ferrero Deutschland GmbH, Stadthallendorf: Mischpalettenbeladung • Haco AG, Gümligen (Schweiz): Containerbeladung • Karl Meyer Textilmaschinenfabrik GmbH, Offenbach/Main: Containerbeladung • Koch, Neff & Oetinger Verlagsauslieferung GmbH, Stuttgart: Versandbehälterauswahl • Kühne & Nagel (AG & Co.) KG, Bremen: LKW/Containerbeladung • Manner AG, Wien (Österreich): Containerbeladung • Mars Austria, Breitenbrunn (Österreich): Containerbeladung • Megamat GmbH, Neuburg: LKW/Containerbeladung • Miele & Cie. KG, Gütersloh: LKW-, Bahnwaggon- und Containerbeladung und Versandbehälterauswahl • Nordgetreide GmbH & Co. KG, Lübeck: Containerbeladung • Prowell GmbH & Co. KG, Offenbach/Queich: LKW-Beladung • Gerth Medien GmbH, Aslar: Versandbehälterauswahl • Tetra GmbH, Melle: Mischpalettenbeladung • CORONET

**MultiMix is used in many companies and in a variety of sectors throughout Europe for solving a multitude of loading problems:**

International GmbH & Co. KG, Wald-Michelbach: Containerbeladung • Vestel A.S., Manisa (Türkei): Containerbeladung • Voith Paper Automation GmbH & Co. KG, St. Pölten (Österreich): LKW- und Containerbeladung • ZF Sachs AG, Schweinfurt, Mischpalettenbeladung • Waldemar Behn GmbH & Co. KG, Eckernförde: Mischpaletten- und Containerbeladung • bofrost\* Dienstleistungs GmbH & Co. KG, Straelen: Versandbehälterauswahl • Carlsberg A/S, Kopenhagen (Dänemark): Kommissionierung von Getränken • Carstens GmbH, Hollern-Twelenflieth: Containerbeladung • Centrotec AG, Brilon: Mischpalettenbeladung • Dr. Schaer GmbH, Burgstall (Italien): Containerbeladung • Eppendorf AG, Hamburg: Versandbehälterauswahl • Teutofracht Spedition GmbH, Georgsmarienhütte: LKW-Beladung • Held Küchen Möbelfabrik GmbH, Porta Westfalica: Konstruktion von Umverpackungen für Möbelbausätze • hülsta-werke Hüls GmbH & Co. KG, Stadthlohn: Konstruktion von Umverpackungen für Möbelbausätze • Karl Otto Braun GmbH & Co. KG, Wolfstein: Containerbeladung • Henry Lambertz GmbH & Co. KG, Aachen: Containerbeladung • speaker trade, Solingen: Containerbeladung • Muehlhens GmbH & Co. KG, Köln: Versandbehälterauswahl • Milch-Union Hocheffel eG, Pronsfeld: Containerbeladung • Rauch Möbelwerke GmbH, Freudenberg: Containerbeladung • Red Bull GmbH, Fuschl am See (Österreich): Containerbeladung • Riedel Tiroler Glashütte Ges.m.b.H., Kufstein (Österreich): Containerbeladung • Schildmeyer Möbelproduktion GmbH, Bad Oeynhausen: Konstruktion von Umverpackungen für Möbelbausätze • Schüco International KG, Bielefeld: Versandbehälterauswahl • Star Service Center, Bremen: Containerbeladung • Stieffhofer GmbH, Bassenheim: Containerbeladung • Themex Möbel GmbH & Co. KG, Themar: Konstruktion von Umverpackungen für Möbelbausätze • Unilin Decor N. V., Izegem (Belgien): Konstruktion von Umverpackungen für Möbelbausätze

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