Stacking Identical Product in Containers / Trailers on Pallets or Slipsheets?

If so you certainly need SLIPSHEET MANAGER -

Do you transport products in shipping containers or trailers using 'blocks' of identical product stacked on pallets, slipsheets or as free-standing stacks? If so this new, unique and innovative software product can help you pack more efficiently and cut your storage and transportation costs.

The software focuses of maximising the amount of <u>identical</u> product which can be packed into a container or trailer in stacks - if you have **mixed** products in a container, or you load products by hand without block stacking then you need **CARGOMANAGER** - see the **back page of this guide** for details.

SLIPSHEET MANAGER was developed so that companies could load cargo more efficiently using slipsheets (a pallet alternative), but the techniques used have proved equally effective when tackling problems where pallets (or stacks of product) are to be loaded into trailers / containers. It allows you to:

- Determine how optimal utilisation of standard pallets or the use of slipsheets of a similar size can cut your distribution costs.

- Calculate what additional savings can be achieved by using custom slipsheet (or pallet) sizes, which take account of both product case sizing and the selected container / trailer size.

- Determine the efficiency gains which may be achieved when using slipsheets rather than pallets.

- Display the range of optimal stacking plans which might be used in the stacking of cases onto standard and non-standard sized slipsheets and pallets.

- View the optimal load plan for loading the stacks into the container / trailer - taking account of physical loading constraints.

- Save the stacking / container plans to disk for printing / viewing / email.

1.1 Introduction.

Standard pallet sizes are often used as a basis for loading containers or trailers, but this can prove inefficient in a number of ways:

- The placement of product on the pallet so as to maximise space utilisation (maximum volume of product / pallet) is often not achieved.

- Standard pallet sizes do not fit efficiently into most container / trailer sizes resulting in wasted space.

- Allowance has to be made for pallet platform height (wasted load height) and pallet weight within the container / trailer load.

For these reasons, and others, the use of slip-sheets (a sheet based pallet replacement) or alternatively the use of custom sizes of pallet is being increasingly seen as both a practical and cost effective route forwards.

1.2 Basis of Operation.

Given any given product / case size there are a number of software products available to determine volume efficient and practical stacking plans for loading a given fixed load area (e.g. a 1200*1000 pallet / slip-sheet). These include our own **PALLETMANAGER** software (www.packyourpallet.com). However, as outlined above, neither a standard UK or US pallet (1200*1000 / 48*40) nor a Europallet (1200*800) provides volume efficient loads within any of the standard sizes of shipping container.

SLIPSHEET MANAGER allows you to achieve **three** key tasks:

- Determine the maximum amount of product that can be packed onto standard pallet / slipsheet sizes.

- Calculates the number of pallets or slipsheets that can fit into the selected container size, and in doing so allows the user to quickly and easily compare the efficiency of using different container sizes.

- Uniquely, it calculates the improvements you could achieve if you were to use non-standard slipsheet or pallet sizes or were to block-stack your product. In doing so it 'matches' your product to the pallet/slipsheet and to the container size. This typically provides **further additional savings of 5%-20%**.

1.3 Data Input.

SLIPSHEET MANAGER requires the user to provide information on (a) the case / product size to be loaded and (b) the container size to be used. In addition it allows users to restrict solutions to those which meet their specific constraints. A typical completed input screen is shown below.

Case details, Container details and constraint information are input below.
Stacks of these cases will be created and loaded into the container in the optimal way. Both standard sizes (e.g. 1200*1000 / 48*40) as well as alternate stack sizes will be considered and ranked on efficiency. Constraint defaults can be edited if required. To change default values see Manual Appendix 1.
** Please ensure you select a Slipsheet/Block Stack **or** Pallet based load using the appropriate tick box.

Case Code (max 14 characters): 12058-N1
Case Description (max 30 characters): New Design for 12058

Case Details: (External dims.)	Case Length	Case Width	Case Height	Case Weight
	306	100	200	0.25

Container Details: (Internal dims.)	Cont. Length	Cont. Width	Cont. Height	Cont. Wt Limit
Container DB	12035	2350	2393	28800

Case Stack / Slip Sheet limits and allowances:
(Edit default values if required)

	Minimum Value	Maximum Value
Longer dimension of Case Stack:	1000	1400
Shorter dimension of Case Stack:	900	1100
Number of Cases/Layer in Stack:	1	200
Custom Stack Size (Length / Width):	1100	1100

Are you using a Slipsheet/Block Stack or a Pallet?:   ☑ Slipsheet ☐ Pallet

For Slipsheet Loads ONLY apply this Slipsheet Lip Allowance: 50
For Pallet Loads ONLY reduce Container Height by Pallet Ht. of: 162

Quit   Pack

The **Container DB button (centre left of screen) can be used** to select the required container from the database (which can be edited by the user), or dimensions can be directly entered. In the above a case of size 306*100*200 is to be loaded into a 40' standard container.

The analysis with automatically be carried out on standard sizes (e.g. 1200*1000 and 1200*800 for the metric version of the software). In addition stacks of product between the stated length / width (adjustable) limits will be considered. A further Custom Stack Size of 1100*1100 will also be examined - this is explained later.

Towards the bottom of the Input Screen the user can select either **Slipsheet/Block Stack** load or a **Pallet based** load. If **Slipsheet** is selected a small amount of additional space (here 50mm) will always be left along one side of the container to allow for the projection of the loaded slipsheet. If **Pallet** is selected then the loading height available in the container (here 2393mm) will be **reduced** by an amount to account for the pallet base height (here 162mm - Std CHEP). All the above allowances can be changed by the user.

Here we have selected a slipsheet load, but the results discussion below is equally appropriate for a pallet load, though the reduction in height when using a pallet would result in fewer cases / stack. Once the screen is complete the user selects **Pack**.
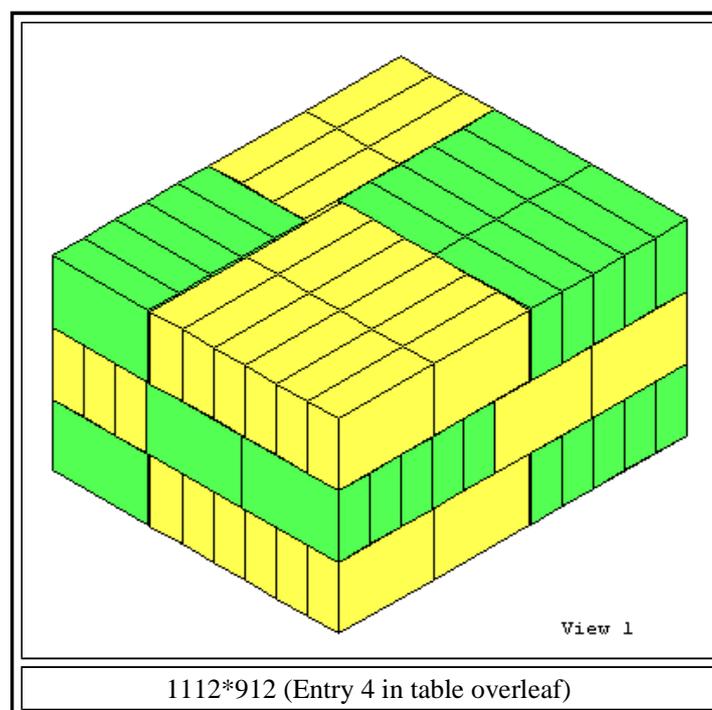
1.4 The Results.

SLIPSHEET MANAGER uses the data provided on the input screen to carry out the following calculations:

Firstly the given product is loaded onto standard slipsheet / pallet sizes (e.g. Metric: 1200*1000 / 1200*800 or Imperial: 48"*40" / 42"*42") in an optimal way. Then these stacks are loaded in the best way into the container / trailer and the total amount of cargo loaded recorded. The Custom Stack Size (1100*1100) is also examined in a similar way.

Second the software determines what other custom stack sizes might be used for the given product. These sizes are derived from the case size input on the above screen. For a given case there may be several hundred potential sizes but **SLIPSHEET MANAGER** will reduce this down by taking account of the size constraints input above.

Each custom stack size will have associated with it one or more patterns which might be used to create the load stack. An example of a possible pattern is shown below. In some instances there may only be a single pattern which might be used, but in other instances there may be several dozen possible optimal patterns. In many cases it will be possible to produce a highly stable stack by rotating alternate layers as shown in the example below. **SLIPSHEET MANAGER** provides you with powerful graphics facilities to achieve this.

View 1

1112*912 (Entry 4 in table overleaf)

In the next stage of the analysis **SLIPSHEET MANAGER** examines the efficiency with which each of the calculated stacks can be loaded into the stated container size. As will be seen from the results table overleaf the efficiency varies greatly with the best solution to the stated problem fitting 9504 cases / container whilst the worst solution (a 1400*912 stack) loads just 7040 cases / container. The first screen of results (top 11 of 79 solutions) for this analysis is shown overleaf.

The top part of the above screen (on a grey background) simply provides the user with a summary of the data which they provided on the opening screen.

SLIPSHEET MANAGER RESULTS - Non-Standard sizes ranked on container footprint efficiency

Case Details: 306.00 * 100.00 * 200.00 - Weight: 0.25
Container : 12035.00 * 2350.00 * 2393.00 - Wt. Limit: 28800.00
Slipsheet/Block Stack in use - Lip allowance: 50.00

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	Case Stack Size		#/layer	Patt.	Stack/Cont.	Layers	Cases/Cont.	Load Wt.
Std1	1200.0	1000.0	36		22	11	8712	2178.0
Std2	1200.0	800.0	28		25	11	7700	1925.0
Cust	1100.0	1100.0	36		20	11	7920	1980.0
1T	1118.0	1000.0	36	NC	24	11	9504	2376.0
2	1118.0	906.0	33	NC	26	11	9438	2359.5
3T	1324.0	906.0	39	NC	22	11	9438	2359.5
4T	1112.0	912.0	33	NC	26	11	9438	2359.5
5T	1312.0	912.0	39	NC	22	11	9438	2359.5
6T	1100.0	918.0	33	C1	26	11	9438	2359.5
7T	1300.0	918.0	39	C1	22	11	9438	2359.5
8T	1324.0	1100.0	47	NC	18	11	9306	2326.5
9T	1112.0	1000.0	35	NC	24	11	9240	2310.0
10	1224.0	1000.0	40	C1	21	11	9240	2310.0
11	1218.0	1006.0	40	C5	21	11	9240	2310.0

The StackView and Contview buttons provide graphical solutions for the highlighted entry
(The left mouse button can be used to cut and paste from graphics screens as required)

| Exit | Back | Print | StackView | ContView |

Below this a scrollable window lists all those solutions which **SLIPSHEET MANAGER** has evaluated. Each line represents a different stack size and associated with each is information about the performance achieved. The top 2 lines always report the performance of the most popular sizes (here the 2 standard European sizes) when used to load the given case size. When first displayed the topmost of these is highlighted (as shown). Line 3 contains the solution for the Custom Size which the user can edit on the Data Input Screen.

The lines which follow these 3 sizes report (in ranked order) the performance of other custom sizes. We will firstly explain the results for the standard sizes:
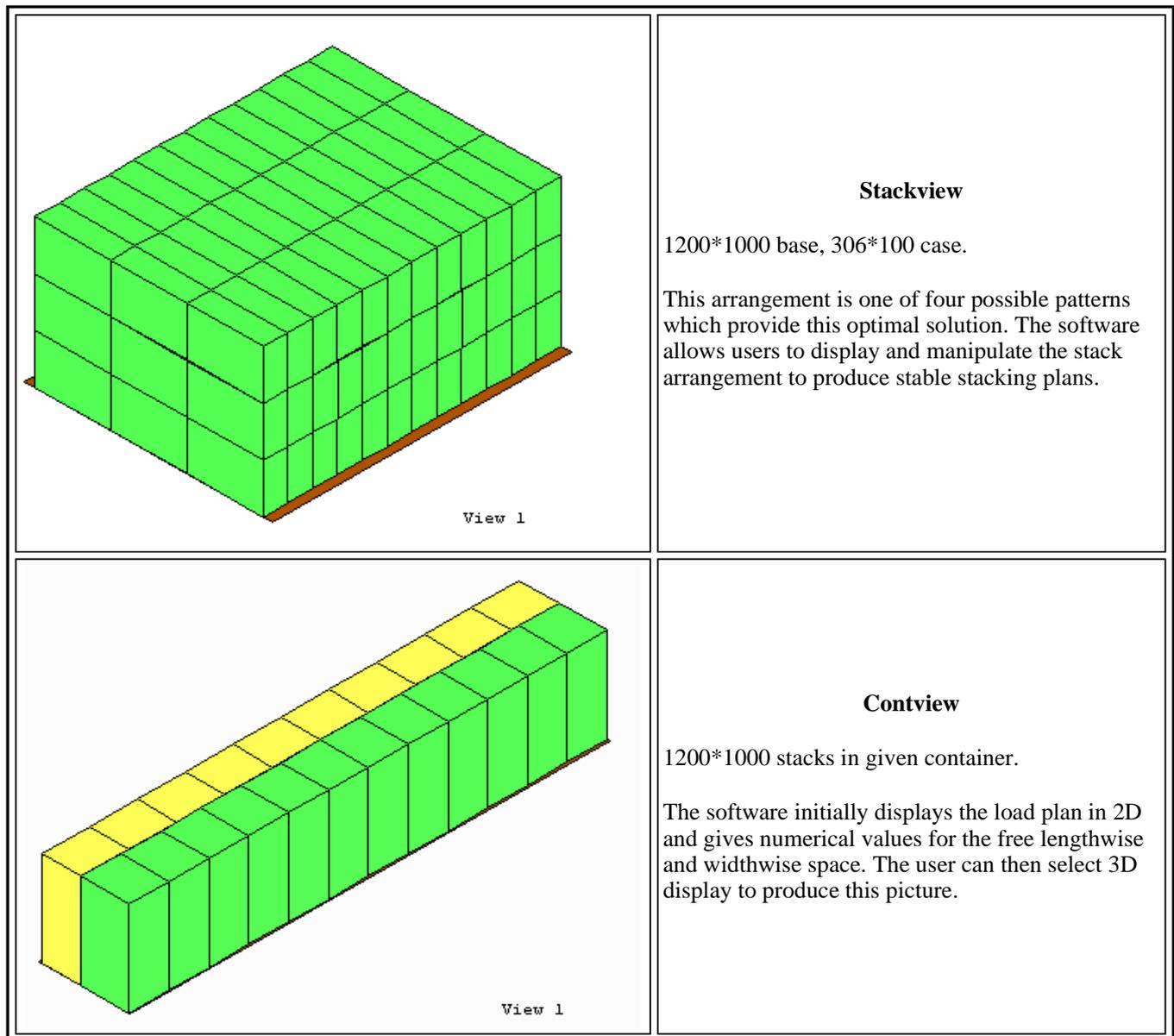
(a) 1200*1000 / 1200*800 Results.

The first 2 lines of the results always present the results for standard slipsheet / pallet sizes when loaded with product of the size input. In the above screen 36 cases each 306*100 fit on each layer of a 1200*1000 stack and a total of 8712 cases fit into the container. In practice the case size wastes space when stacked as a 1200*1000 'block', and as discussed earlier the 1200*1000 dimensions do not fit very well into the container. In fact there is over 20% wasted space - AIR!! - in this container.

Lines 2 and 3 of the results repeat the analysis for the 1200*800 and (custom) 1100*1100 slipsheet / pallet sizes. These prove even worse, and allow far less cargo to be loaded into each container.

With the 1200 *1000 line still highlighted the user can select the **StackView** button to view the possible ways in which the cases could be optimally loaded onto the load area. There are a number of different solutions offered (each of which fits 36/layer), one of which is shown overleaf, but given the (difficult) 306 length dimension of the case there will always be wasted space on the 1200*1000 base.

The **Contview** button can be used to display two and three dimensional views of how the given stacks can

be loaded into the given container. The 3D load picture for the 1200*1000 stacks is also shown below.

Stackview

1200*1000 base, 306*100 case.

This arrangement is one of four possible patterns which provide this optimal solution. The software allows users to display and manipulate the stack arrangement to produce stable stacking plans.

Contview

1200*1000 stacks in given container.

The software initially displays the load plan in 2D and gives numerical values for the free lengthwise and widthwise space. The user can then select 3D display to produce this picture.

For palletised loads the container loading height specified on the input screen will be automatically reduced to allow for the height of the pallet itself. The pallet would be drawn on diagrams when appropriate. When comparing a pallet and a slipsheet of the same size, slipsheets will typically perform better as they allow an extra layer or two of product to be loaded on each stack. However as we illustrate below, the use of non-standard stack sizes will almost always allow more cargo to be packed into the container - often a 10%-15% improvement.

(b) Other Slip Sheet / Custom Pallet Sizes.

Following the results for the standard sizes, the main set of tabulated results tabulate the load performance achieved when custom stack sizes are used. Each line represents a different stack size and the performance achieved when using this in the given container size. The results are ranked in order of efficiency. The screen shows just the first 11 of the 79 possible stack sizes. Information output includes:

- The length and width of the stack (excluding any slip sheet lip allowances).

- The number of cases which form a single layer in the given stack.

- The type of pattern - see below.

- The number of stacks / container (taking account of any slip sheet lip allowances in the packing of the container), the number of layers and thus the cases / container and the weight of the load.

The results of using the two standard sizes can be bettered using any of the top 33 calculated sizes listed in the remainder of the table, with the best of these achieving 9504 cases / container - a further 9% improvement.

You will also note that each line is numbered and following this number there is quite often a **T** code. Whilst all the results calculated can be successfully packed into the given container size, some solutions (those with a T coding- 'Tight Fit') have a limited amount of additional free space. **SLIPSHEET MANAGER** examines the free space in the load and if this is less than 2% of width or length then a T coding is given. Those without any T coding are therefore a relatively easy cargo to load. Selecting **Contview** for any highlighted entry will immediately display both the load plan and details of the exact amount of free space within the container.

As might be expected those sizes which provide the highest load quantities are more likely to be a tight fit, though there are examples in the above table (e.g. entry 10, a 1224*1000 stack) which are relatively easy to load (no T coding), are just marginally bigger than standard (by just 24mm) and yet fit over 700 more cases / container than that achieved using a 1200*1000 stack (> 8%).

Types of Pattern:

Each stack size which is presented has an associated pattern code (e.g. NC, C1 etc). In many environments the exact load plan forming the stack will be of limited interest. As will be illustrated later the software includes powerful graphics facilities which can be used to display available stacking plans. In other situations some form of clamp truck may be used to transport the load. The suitability of a solution for clamping is shown by codes C1, C2, C3 and C4.

1.5 The Optimum Solution.

The results table presented above is listed according to the efficiency with which the container is utilised. This would still be so if the container weight limit had come into play, but in such situations the number of layers fitted would be adjusted to meet the container load limit.

Users can naturally print out any or all of the table of results and, as illustrated above, it may well be that there are a number of potential sizes which could be used to provide significant improvements in load efficiency. In addition the user can also appreciate how well standard slip-sheet sizes perform compared with any existing palletised solutions, and compare the performance of standard slipsheet or pallet sizes with any of the custom sizes proposed.

SLIPSHEET MANAGER does in addition display graphics of both the way(s) in which the slipsheet stack might be constructed, and the way in which stacks can then could be loaded into the container.

	Case Stack Size		#/layer	Patt.	Stack/Cont.	Layers	Cases/Cont.	Load Wt.
Std1	1200.0	1000.0	36		22	11	8712	2178.0
Std2	1200.0	800.0	28		25	11	7700	1925.0
Cust	1100.0	1100.0	36		20	11	7920	1980.0
1T	1118.0	1000.0	36	NC	24	11	9504	2376.0
2	1118.0	906.0	33	NC	26	11	9438	2359.5
3T	1324.0	906.0	39	NC	22	11	9438	2359.5
4T	1112.0	912.0	33	NC	26	11	9438	2359.5
5T	1312.0	912.0	39	NC	22	11	9438	2359.5
6T	1100.0	918.0	33	C1	26	11	9438	2359.5
7T	1300.0	918.0	39	C1	22	11	9438	2359.5
8T	1324.0	1100.0	47	NC	18	11	9306	2326.5

The mouse (or up/down arrow keys) can be used to highlight any of the entries in the results table, and following this **StackView** or **ContView** selected to display in both two and 3 dimensions the Stack Plan or Container Load Plan.

From a numerical viewpoint the best solution uses a 1118*1000 stack, fitting 36 / stack layer and with 24 such stacks fitting into the container. This gives 9504 cases / container, and given that a 'T' follows the rank number (column 1) we know that it is a somewhat tight fit in the container.

Stackview allows us to view the 2D patterns which might be used to create such a stack (3 in total) and to select one of these (and space out cases) to form a 3D stack as shown below:

View 1
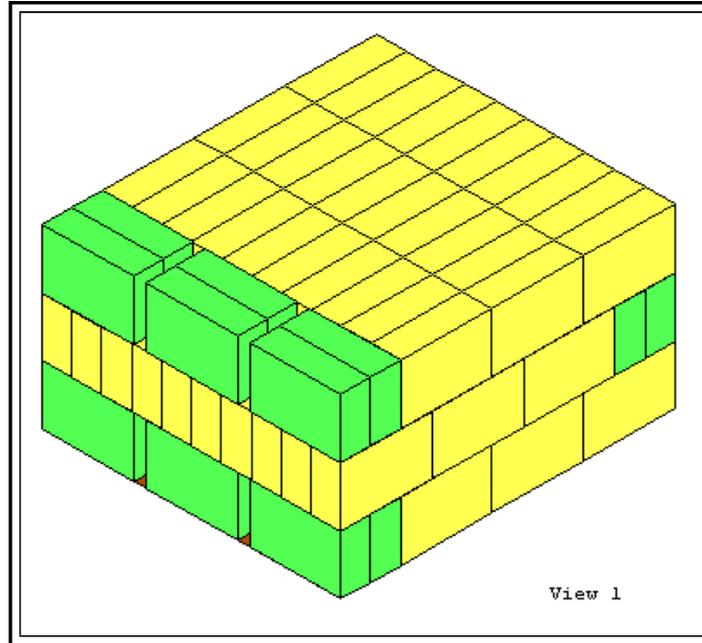
The **ContView** button allows you to view the container load plan in both 2D and 3D. The result for this problem is shown below:

```
(Use left mouse button to mark an area for Cut & Paste)


Ref. No.          1  (Length dimension shown across screen)

Layout No.        1   of    1    (Type    A  )


Underhang on Length :              35

Underhang on Width  :              64
```


As can (just) be seen on the 2D diagram there is a very limited amount of space available within the container (slight shading on the perimeter) - as detailed in the text just 35mm on the container length and 64mm is unused - hence the 'T' coding in column 1 of the results.

It should be noted that for slipsheet based loads the unused space on the width of the container DOES take account of the 50mm slipsheet lip allowance input for this problem. Thus a total widthwise space of 114mm applies for this solution, with 50mm of this being allowance for the slipsheet lip.

As discussed earlier, should you feel that this container load is too tight then you can quickly display the results for any other of the stack sizes. For example result 2 does not have a T coding, and whilst losing out a little in total load, has free space of 257mm and 64mm on length and width in the container.

Printing Results:

A standard print button allows you to print out part or all of the set of tabular results.

The 2/3D display of both slipsheet stacks and container load also have a print function which ***allows you produce detailed 2D/3D reports displayed on both screen and printer, and available in English, French, German and Spanish***.

In addition any of the 2D / 3D graphics displayed can be cut and pasted via the Windows Clipboard to other windows applications: "Position the mouse at one corner of the required region, depress the left mouse button and move the mouse to 'rubber-band' the area required. Then release the mouse and you will be informed that the region has been copied to the clipboard".

Saving results and Sending to Others:

SLIPSHEET MANAGER also include a **Webbase / JPG** file creation / display function.

This allows any reports to be saved to disk in .JPG format. Such files can then:

- Be attached to emails to show others how to load the product
- The Webbase database can be viewed in your default web browser and individual reports can be printed off at any time.
- The Webbase database can be made available to others (who do not have SLIPSHEET MANAGER), and they can view reports, using their own default browser, and once again print these off as required.

For those requiring solutions to problems of loading **mixed product** within a container our **CARGOMANAGER** software is likely to be of interest (www.packyourcontainer.com).

If you wish to tackle pallet loading problems (covering all aspects from product design through to case design and optimal pallet loading) then **PALLETMANAGER** is likely to be of interest (www.packyourpallet.com).

For further information on **SLIPSHEET MANAGER**, **PALLETMANAGER** and **CARGOMANAGER** please see our websites or contact us using the details provided below.

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