SIC User Manual

Version 1 - August 20, 2021

Universidad de los Andes

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Introduction

This manual includes the necessary information for installing and operating the Intelligent Cubing System (ICS) software. This software efficiently solves container loading and packaging problems and allows you to visualize and manipulate the solution obtained. This software will enable one to get the data from Excel or generate the parts in the same software, allows the selection of various standard containers, and even creates customized containers. Loading plans can be subject to the following loading restrictions: rotation specification per axle, maximum weight supported by the sides of each box, and delivery to multiple customers.

The solution provided by the software is presented in the form of a report with the loading plan and the steps to carry out a successful loading process.

SIC step by step

How to install SIC?

To install the SIC executable, go to the GitHub "https://github.com/jcpachon10/SICRepository/tree/main/SIC_Executable" and download all the files inside that folder.

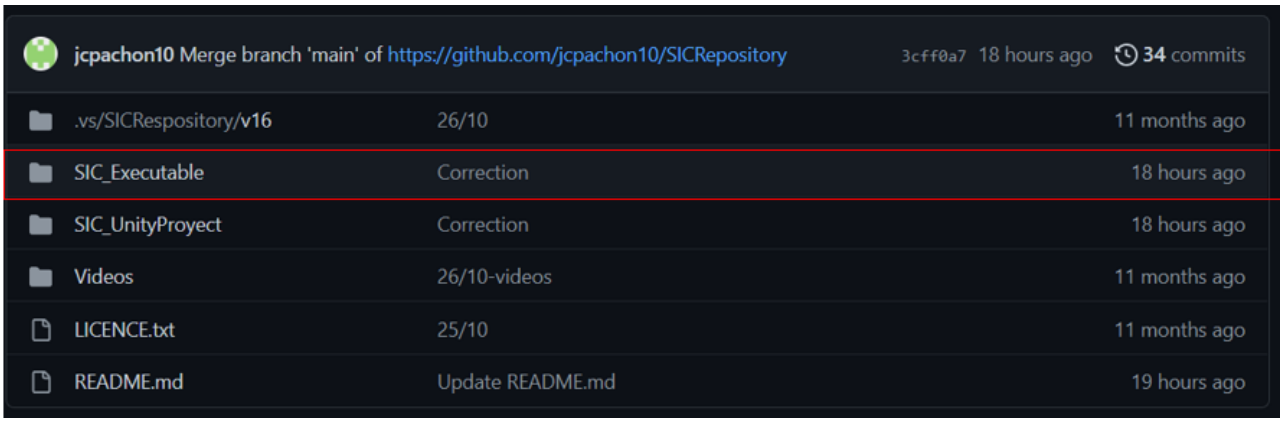


Figure 1. GitHub SIC Executable

Once the folder has been downloaded, you must enter and click on the "SIC.exe" as the Figure 2file, which is the program executable. You will be able to interact with the tool.

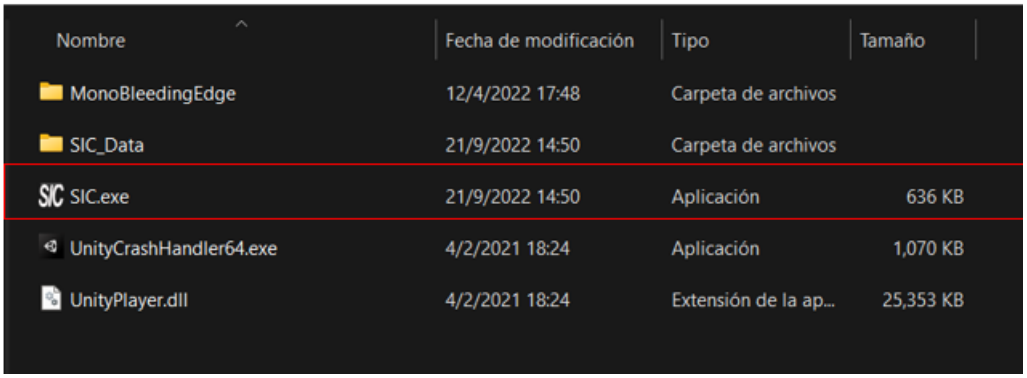


Figure 2. Executable files

How to use SIC?

Sistemas Inteligentes de Cubicaje - SIC has four (4) tabs as seen in Figure 3. Clicking on each of these tabs will display an interface in which you can interact with SIC according to the task performed.

Figure 3. Activate Load tab

Loading tab

By clicking on the "Upload" tab, you can access the tab's main interface, as shown in Figure 8. The "Upload" tab has three (3) menus that will allow you to interact with SIC's packages, containers, and the different packaging and visualization actions. Table 1 describes each button of the "Load" tab and the type of menu it belongs to, according to the labels in Figure 4.

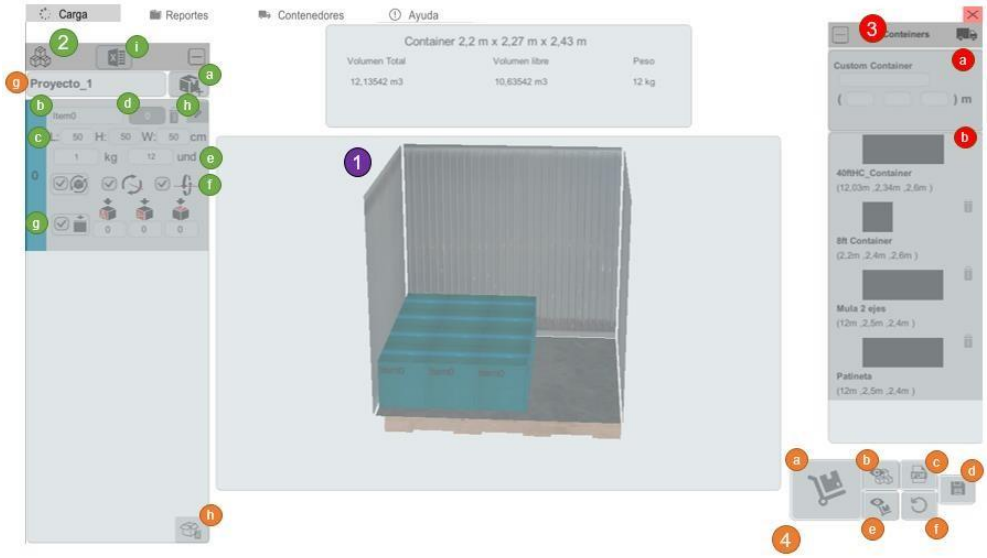


Figure 4. Main interface of the

Buttons	Description
1	**Loading Spaces**
2	**Packages Menu**
a	*"New package type"* button
b	Type package name (e.g. tomatoes, books, etc.)
c	Dimensions of package type length (L), height (H), and width (W) in centimeters
d	Customer ID
e	Weight in kilograms and number of available units of package type
f	Rotation button related to the freedom of rotation of the boxes.
g	*"Package load capacity"* button
h	"*Delete package type*" button
i	*Import data from CSV file"* button
3	**Container Menu**
a	Section to add a new cargo space.
b	Select or delete an already created cargo space
4	**Loading Plan Menu**
a	*"Load package"* button
b	*"Costumer view"* button
c	*"Create pdf"* button
d	*"Save"* button
e	*"Group view"* button
f	*"Reset"* button
g	"*Empty*" button

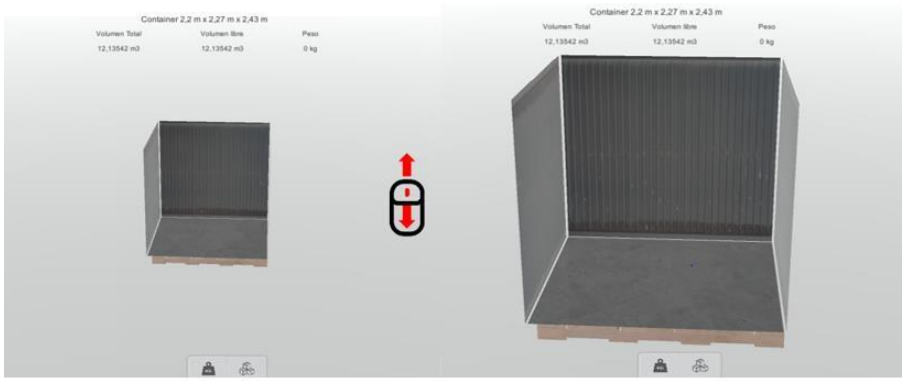
Table 1. Description of SIC menus and buttons

How to move within the cargo space?

To move within the cargo space, place the mouse pointer over the cargo space, which will be located in the center of the screen where the entire container is displayed (See Figure 5). The following are the movements allowed in the cargo space

Figure 5. Loading Space

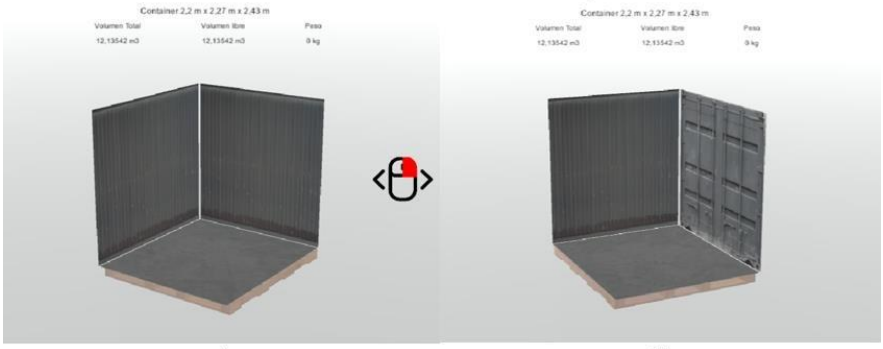
- Zoom in or zoom out of the loading space. You can zoom in or out of the loading space by locating the mouse pointer in the center of the container and scrolling the mouse scroll wheel forward or backward. (Scroll), you can zoom in or out of the cargo space. An example can be seen in Figure 6, whereby you can zoom in on the cargo space by scrolling forward.



a) b)

Figure 6. Zoom in to zoom out the image of the loading space

- Rotation of the loading space: to observe the loading space from different angles, you should right-click and hold down the mouse; by moving the mouse in any direction (right, left, up, or down), the camera will rotate in the opposite direction over the loading space. An example can be seen in Figure 7, where right-clicking, holding down the mouse, and moving it to the right will rotate the loading space to the left.



a) b)

Figure 7. Rotation of cargo space

Packages menu

The packages menu located on the left side of the upload tab interface (green colored labels) will allow you to add, delete and configure the types of packages you wish to have in your upload

plan (See Figure 8). In addition, this menu will allow you to import the information from a Microsoft Excel file.

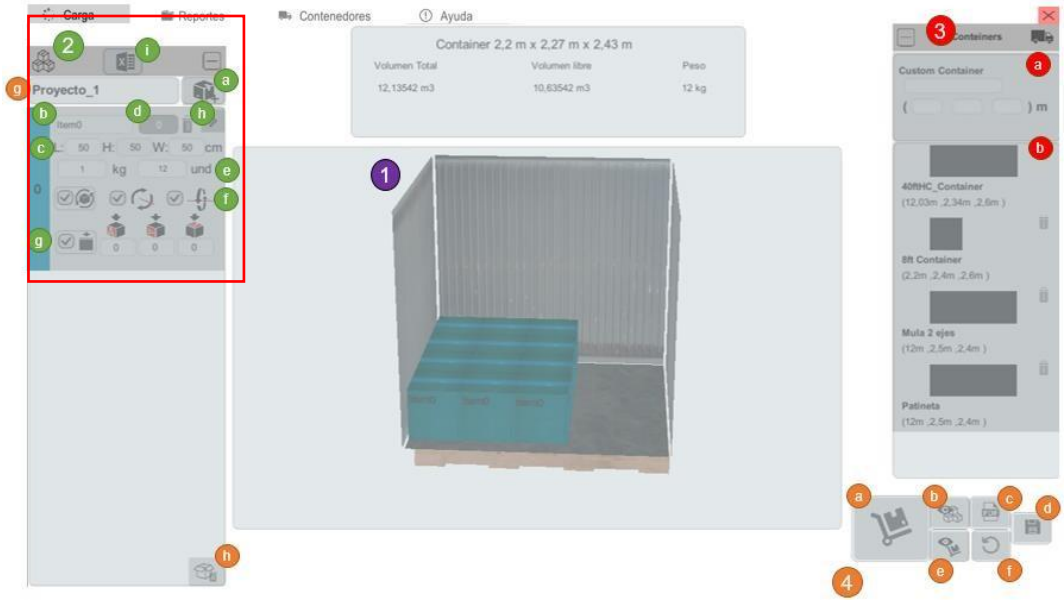


Figure 8. Package menu buttons

How to add and configure a package type?

To add a type of package you must click on the button ( )*"New Package Type"* from the package menu (See Figure 9). A new item type will automatically be created in the items section, and you will be able to enter all the information related to it. In this version of SIC only cube-shaped packages can be created.

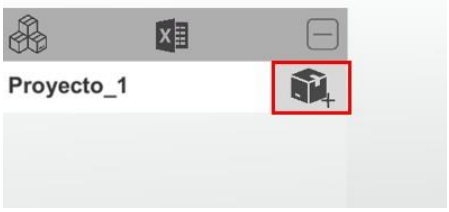


Figure 9. Packages menu - "New package type" button

First, you must enter the name of the package type (see Figure 10. a) without special characters ("""", "%,$,&,/,¿?,¡!"). Then, you should enter the dimensions of the box (length (L), height (H), width (W)) in centimeters; this will adjust the package preview (See Figure 10. b).

In addition, the ID of the customer to which the package type belongs and the number of available units of the same reference must be entered. These two data must be entered as an integer without decimals. For the weight, you can enter decimal values using "," as a decimal separator| (See Figure 11).

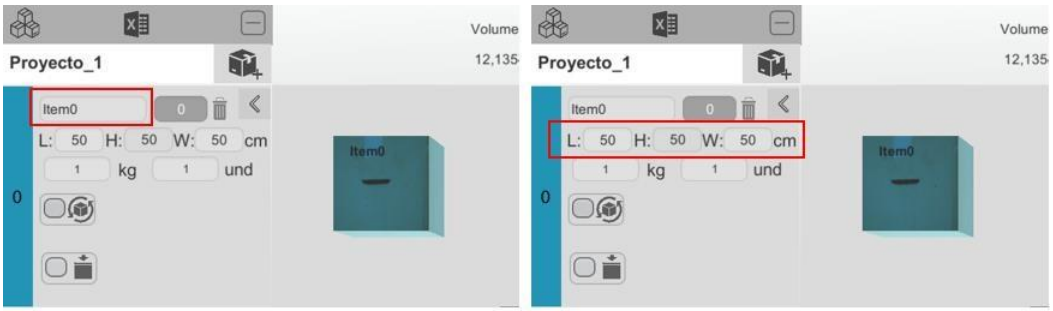


Figure 10. Name and dimensions of package type

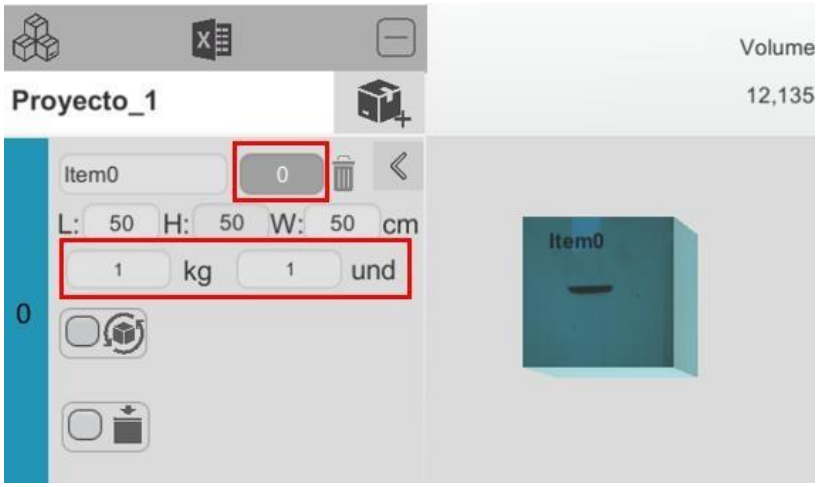


Figure 11 Customer ID, weight in kg and available units of package type

To activate the configuration related to the freedom of rotation of the boxes, you must activate the ( ) "Rotation" button by clicking on it with the mouse, as shown in Figure 12.a. Clicking on the ( ) "Rotation" button will display the possible orientations allowed in the loading space for the type of package you are creating (See Figure 12.b). You must select the type of orientation according to the maneuverability of the box.

The SIC allows you to configure two types of rotations by clicking on the respective button: the rotation on the "z" ( ) axis, which refers to the rotation by the width of the package and the rotation on the "x" ( ) axis, which refers to the rotation by the length of the package. In case you do not activate the "Rotation" button (,) or uncheck both options (,), the SIC will use the rotation on the "y" axis by default. It will rotate the packages only by their height. In Figure 13, you can see examples of the three types of rotations that SIC handles.

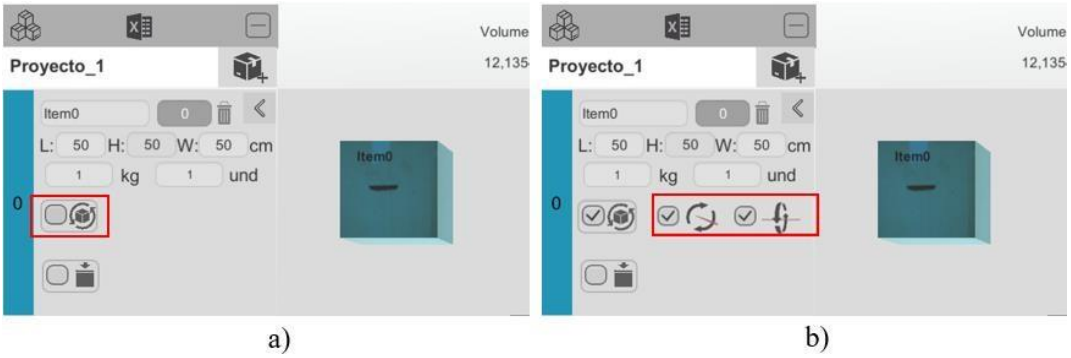


Figure 12. Activation and modification of package type rotation

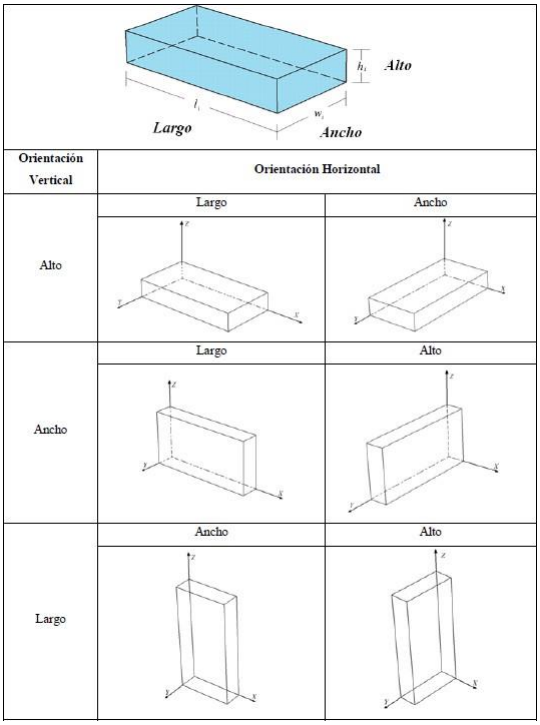


Figure 13. Possible rotations of a package.

Following this, to activate the configuration related to the maximum weight limit supported by the different sides of the type of package you are creating, you must activate the button (📦) "Package load capacity" by clicking with the mouse, as shown in Figure 14.a. Clicking on the button (📦) "Package load capacity" will allow you to specify the maximum weight in kilograms (kg) the top side can support that, the top side and the top front side, in that order (See Figure 14.b).

The face with the red letter "A" shown in the three buttons (See Figure 14.b) refers to the location of the front face of the package. In SIC, by default, the maximum weight to be supported on each side has a value equal to zero (0) kilograms, so you must enter the maximum weight according to the characteristics of the package.

Figure 14. Activation and modification of the maximum weight limit allowed for each side of the package type

Once all the package type data has been entered, more types can be added by clicking again on the "New package type" button ( ). By doing so, the data and a thumbnail of the other package types will be displayed with the summarized information and restrictions enabled, as shown in Figure 15.

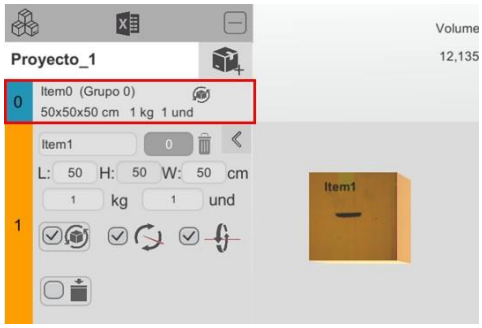


Figure15. Adding more package types and summary of created package types

How to delete a package type?

To remove a package type from the loading plan you must open the package type to be removed and click on the "Remove package type" button ( ) as shown in Figure 16. The selected package type will be automatically deleted.

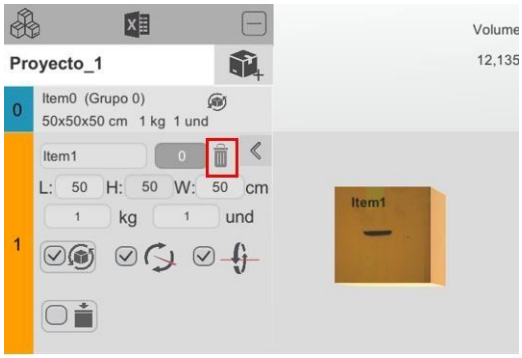


Figure 16. Remove a package type from the load plan

How to import data from Microsoft Excel?

Within the package menu, there is a button ( ) "Import data from CSV" which allows you to import the package information into the current loading plan. The location of the "Import data from CSV" button ( ) is shown in Figure 21.a. Two options will be displayed when clicking on the button ( ), as shown in Figure 17.b.

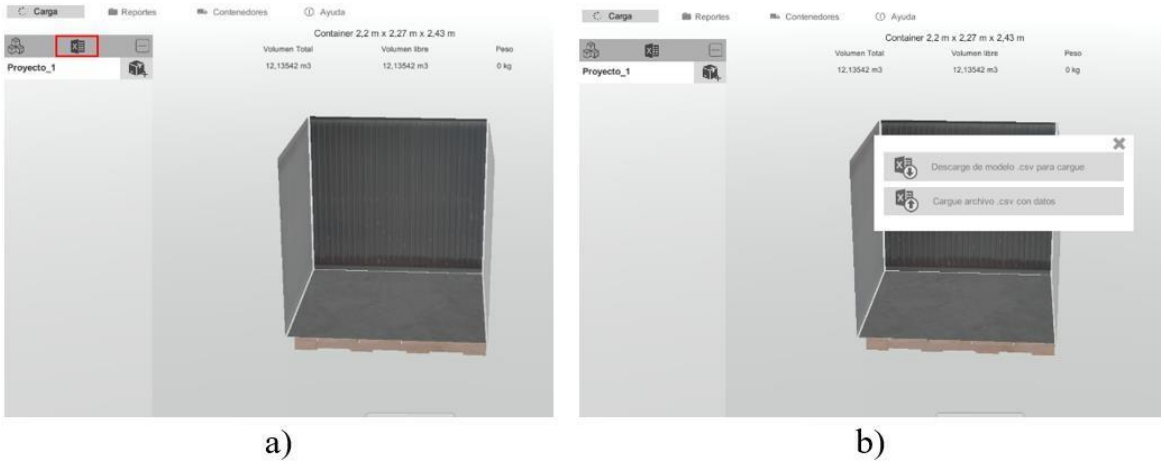
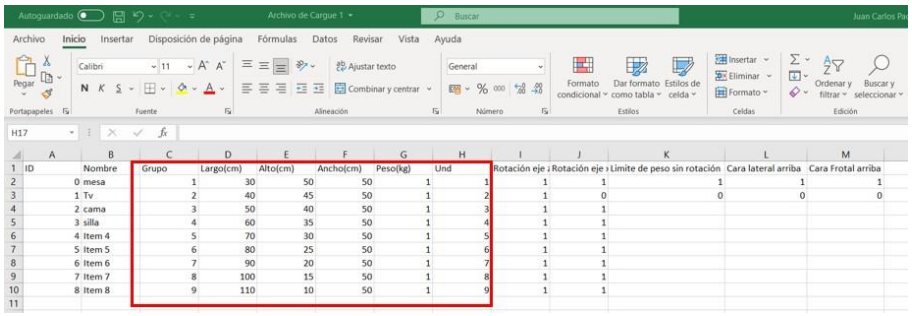


Figure 17. Import package information from Microsoft Excel

As shown in Figure 18, clicking on the option "Download model.csv for upload" will download the format for entering the package information into the CIS through a Microsoft Excel file. The model.csv file should be opened, and the fields should be filled in with the respective package information.

Figure 18. Options for importing data from Microsoft Excel

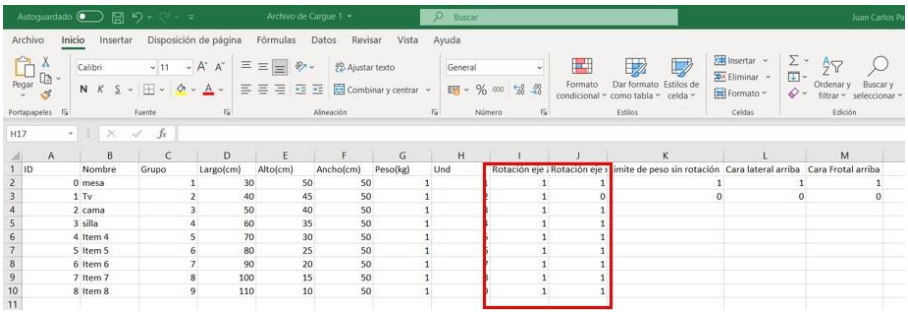
When you open the model.csv file, you will find nine (9) columns indicating the respective information for each of them. Each file row corresponds to a package type in the upload plan. You must fill in the number of packages you wish to load and, if necessary, add or subtract values to the "ID" column. Fill in "Weight" as a decimal and "Group", "Length", "Width", "Height", and "units" of the package with an integer, as shown in Figure 19.



	A	B	C	D	E	F	G	H	I	J	K	L	M
1	ID	Nombre	Grupo	Largo(cm)	Alto(cm)	Ancho(cm)	Peso(kg)	Und	Rotación eje z	Rotación eje x	Límite de peso sin rotación	Cara lateral arriba	Cara Frotal arriba
2	0	mesa	1	30	50	50	1	1	1	1	1	1	1
3	1	Tv	2	40	45	50	1	2	1	0	0	0	0
4	2	cama	3	50	40	50	1	3	1	1			
5	3	silla	4	60	35	50	1	4	1	1			
6	4	Item 4	5	70	30	50	1	5	1	1			
7	5	Item 5	6	80	25	50	1	6	1	1			
8	6	Item 6	7	90	20	50	1	7	1	1			
9	7	Item 7	8	100	15	50	1	8	1	1			
10	8	Item 8	9	110	10	50	1	9	1	1			
11													

Figure 19. Initial information to be entered from the packages in the Excel file.

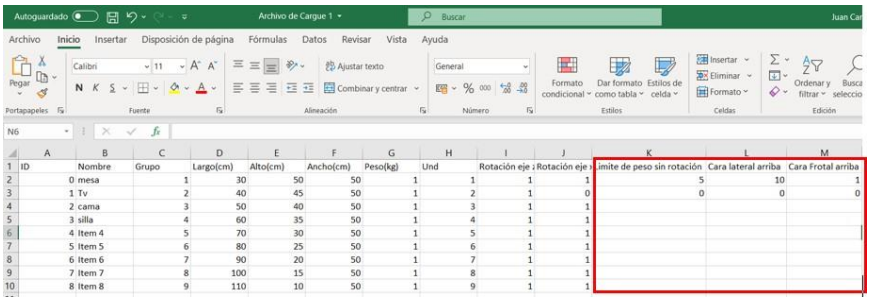
The columns "Rotation z-axis" and "Rotation x-axis" presented in Figure 20 refer to rotation by width and length, respectively. You must enter a value of one (1) if you want to allow the respective rotation or zero (0) otherwise.



	A	B	C	D	E	F	G	H	I	J	K	L	M
1	ID	Nombre	Grupo	Largo(cm)	Alto(cm)	Ancho(cm)	Peso(kg)	Und	Rotación eje z	Rotación eje x	Límite de peso sin rotación	Cara lateral arriba	Cara Frotal arriba
2	0	mesa	1	30	50	50	1		1	1	1	1	1
3	1	Tv	2	40	45	50	1		1	0	0	0	0
4	2	cama	3	50	40	50	1		1	1			
5	3	silla	4	60	35	50	1		1	1			
6	4	Item 4	5	70	30	50	1		1	1			
7	5	Item 5	6	80	25	50	1		1	1			
8	6	Item 6	7	90	20	50	1		1	1			
9	7	Item 7	8	100	15	50	1		1	1			
10	8	Item 8	9	110	10	50	1		1	1			
11													

Figure 20. Specification of the desired rotation for the package.

Figure 21 shows the columns related to the maximum weight in kilograms that the top face can support, side faces up, and front face up. These should only be filled in if the weight restriction applies, and the weight should be entered as a whole number.



	A	B	C	D	E	F	G	H	I	J	K	L	M
1	ID	Nombre	Grupo	Largo(cm)	Alto(cm)	Ancho(cm)	Peso(kg)	Und	Rotación eje z	Rotación eje x	Límite de peso sin rotación	Cara lateral arriba	Cara Frotal arriba
2	0	mesa	1	30	50	50	1	1	1	1	5	10	1
3	1	Tv	2	40	45	50	1	2	1	0	0	0	0
4	2	cama	3	50	40	50	1	3	1	1			
5	3	silla	4	60	35	50	1	4	1	1			
6	4	Item 4	5	70	30	50	1	5	1	1			
7	5	Item 5	6	80	25	50	1	6	1	1			
8	6	Item 6	7	90	20	50	1	7	1	1			
9	7	Item 7	8	100	15	50	1	8	1	1			
10	8	Item 8	9	110	10	50	1	9	1	1			

Figure 21. Specification of package weight capacity.

Once you have completed the entire file, save it in an easily accessible folder, do not change the format, and assign a name to the upload, as shown in Figure 22.

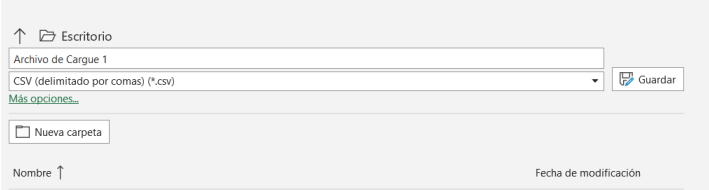


Figure 22. Window to save the file.

Once the file with the package information has been created, go back to the package menu, and click on the button ( ) "Import data from CSV", this time click on the second option "Load .csv file with data" as shown in Figure 23.a. This will display the file menu shown in Figure 23.b, find the document to be loaded, select it and click on "Open".

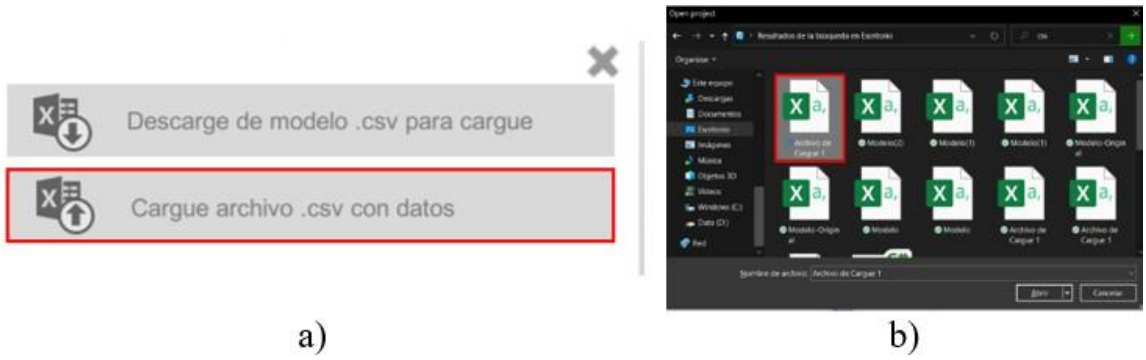


Figure 23. Upload .csv file with load plan data

As a result, the packages described in the .csv file will be loaded and appear directly in the main interface in the packages section (see Figure 24).

Figure 24. Packages imported via .csv file

Container menu

The container menu located on the right side of the loading tab interface (red labels) will allow you to create, select and delete cargo spaces (containers) with the user's preferred characteristics (See Figure 25).

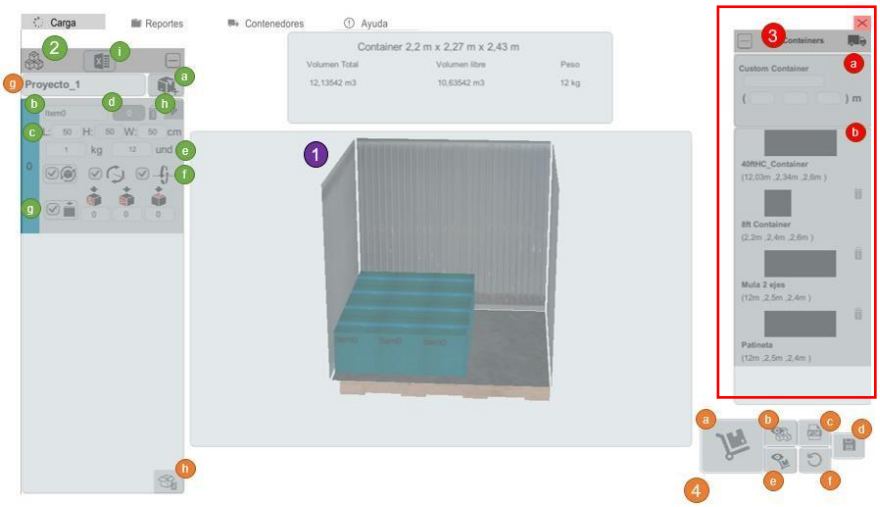


Figure 25 . Botones del menú de contenedores

How to create and select different loading spaces?

To create a new cargo space, you must go to the "Custom container" section, as shown in Figure 26.a. Here, you must fill in the name and the dimensions in meters (m) of the container (length, height, and width). If you require figures with decimals, you must use the decimal separator with a comma (,). To finalize the creation of the new cargo space, click on any point in the "Custom Container" box.

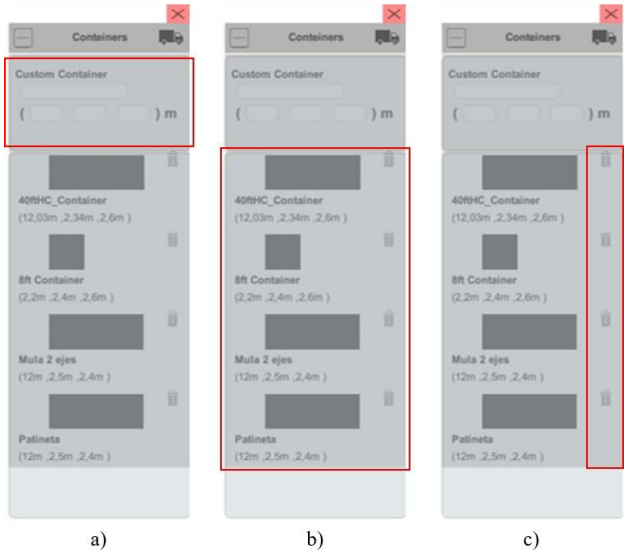


Figure 26. "Contenedor personalizado" sección para agregar un nuevo espacio de carga

To select an already created cargo space, click on the silhouette of the container as shown in Figure 26.b. Finally, to delete a designed cargo space, click on the delete button of the container menu as shown in Figure 26.c.

Load plan menu

The load plan menu at the bottom right of the load tab interface (orange labels) will allow you to load, view, and interact with the SIC-generated load plan. In addition, it will enable you to generate reports and save or update the load plans created (See Figure 27).

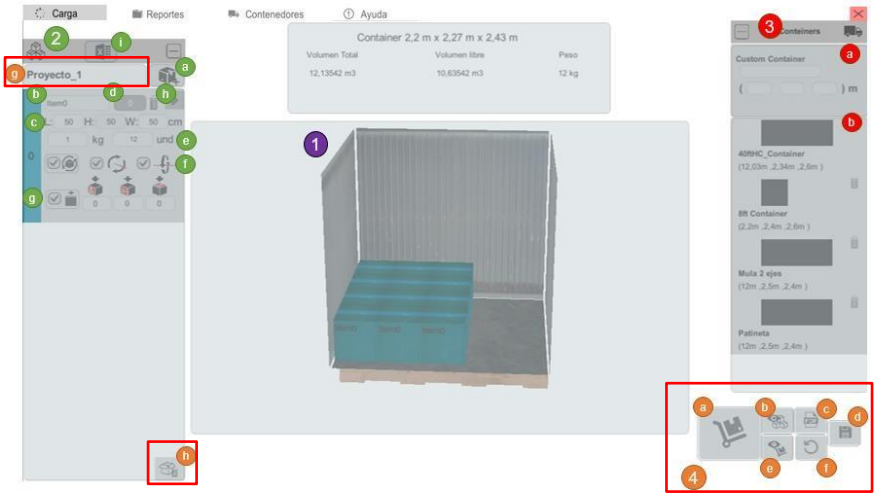


Figure 27. Botones del menú de plan de carga

How to load the objects inside the container?

To create the loading plan having already defined the packages and the container, you must click on the button ( ) "Load packages" as shown in Figure 28.a. SIC will perform the calculations to determine the best packaging pattern for the packages inside the container and will generate the loading plan as shown in Figure 28.b.

Figure 28. Generar el plan de carga

Additionally, SIC will allow you to visualize the loading order by color and export the loading plan in PDF format for efficient sharing with stakeholders.

How to print the loading plan?

To generate the loading plan in pdf format, you must click on the button ( ) "Generate pdf" as shown in Figure 29. This will allow you to generate a report with the specific data of the packages, besides saving the file in your preferred folder.

Figure 29. Generar archivo pdf del plan de carga

In the report, you will find the indicators (total occupied volume, free volume, total weight), photos of the different views of the cargo, a summary of package information, and the step-by-step packing process. An excerpt of the report can be seen in Figure 30.

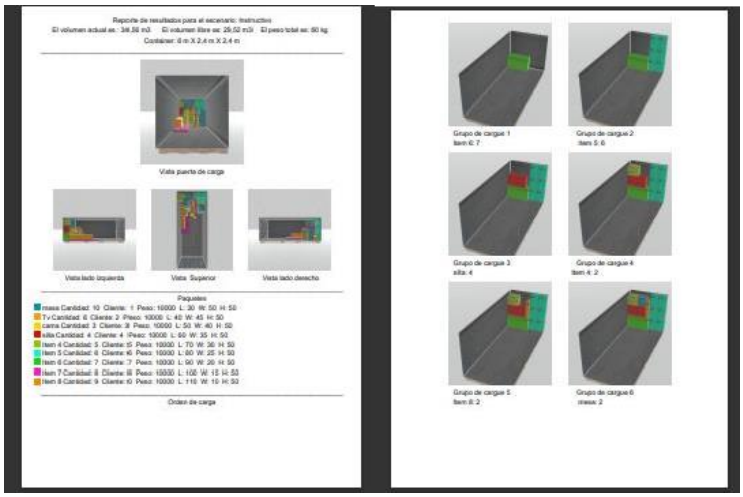


Figure 30. Fragmento del informe del plan de carga

How to observe the load groups in the load plan?

To activate the load group's view, you must click on the button ( ) "Load groups". This will allow you to visualize the different blocks of packages and the order in which they are loaded into the container. An example of the loading group view can be seen in Figure 31. Here you can see the various scenarios with various colors, from red to green. The red packages are the first

packages in the plan to load, and the last ones are green. And the previous packets are in green. To deactivate the load group view, click the "Load groups" button ( ) again, which will automatically be unchecked.

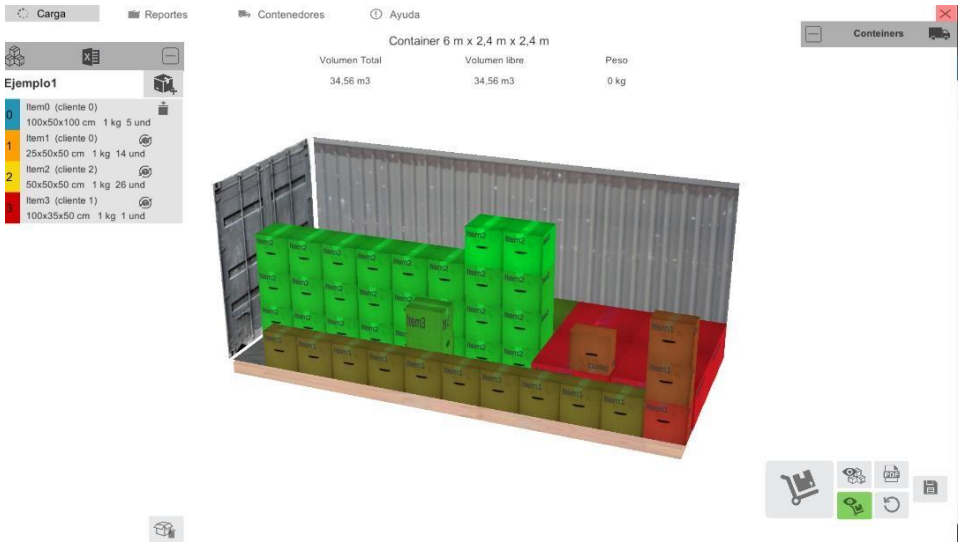


Figure 31. Ejemplo de visualización de grupos de carga

How to observe the packages per customer?

To activate the client view you must click on the button ( ) "Client view", this will allow you to visualize the location of the packages belonging to the same client and the order in which they are loaded into the container. Figure 32 shows an example of the customer view. To deactivate the customer view, click on the "Customer view" button ( ) again, and it will be unchecked automatically.

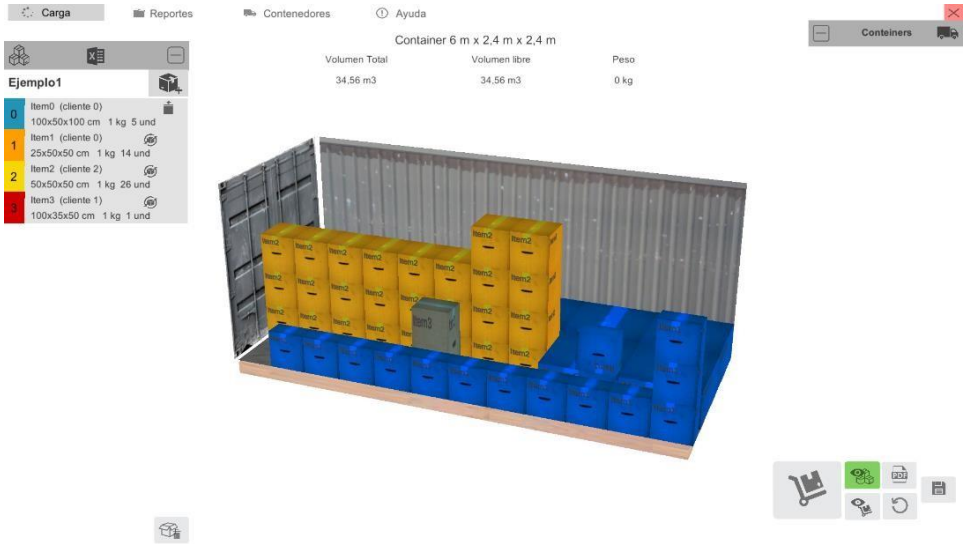


Figure 32. Ejemplo de visualización de vista de clientes

How to save a loading plan? ~

To save the load plan, you must first enter the name of the current load plan by going to the package menu. As shown in Figure 33, you must enter the name of the current load plan.

Figure 33. Agregar nombre al plan de carga actual

Then, once the name has been specified, click the button ( ) "Save upload plan," as shown in Figure 34, and wait for the SIC to notify you that the plan has been successfully saved.

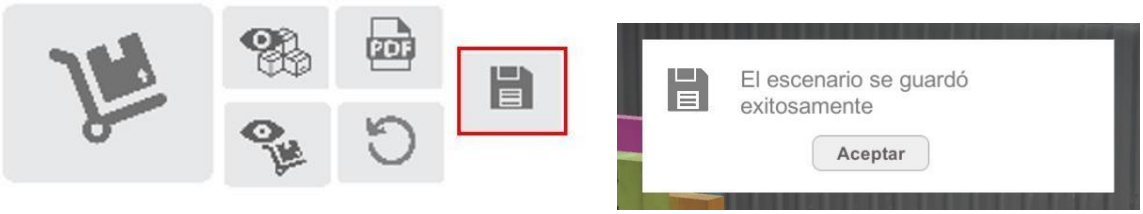


Figure34. Guardar el plan de carga

What happens when all my packages don't fit?

Suppose SIC determines that it is impossible to load all the packages within the current container. In that case, the thumbnails of the boxes that were not loaded will be displayed in red or yellow depending on whether they cannot be fully or partially loaded, respectively (See Figure 35). Additionally, the number of units of each type of package that could not be loaded is displayed.

Figure 35. Ejemplo de miniaturas de tipos de paquetes que no fueron cargados en su totalidad

To load the remaining packages into a new container, click on the "Add new container" button ( ), as shown in Figure 36. This procedure will save the current scenario and create a new space with the packages that were not loaded, using the same container previously selected at the beginning of the loading plan. This process should be repeated as many times as necessary.

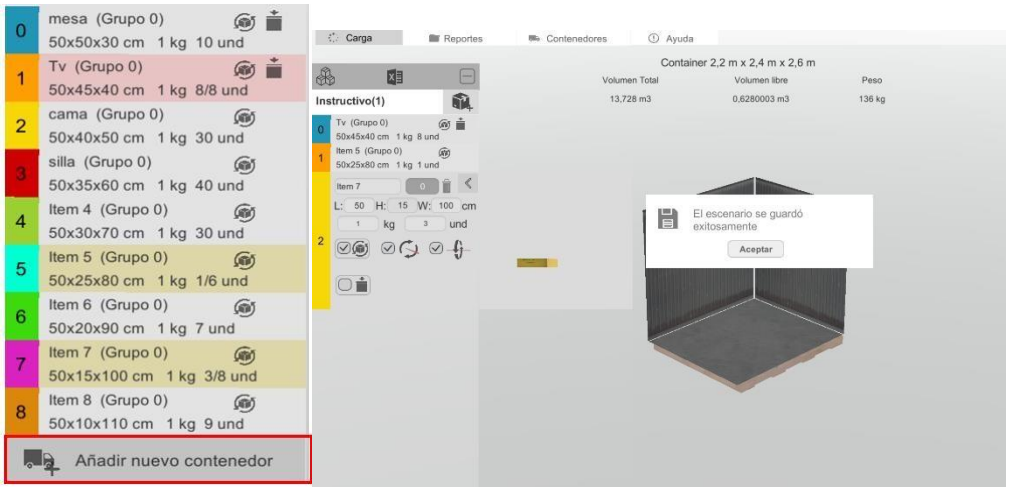


Figure 36. Utilizar un nuevo contener para cargar la carga remanente

How to make manual adjustments to the loading plan?

To make manual adjustments to the loading plan, click on the box you wish to modify. It will be highlighted in green, as shown in Figure 37.

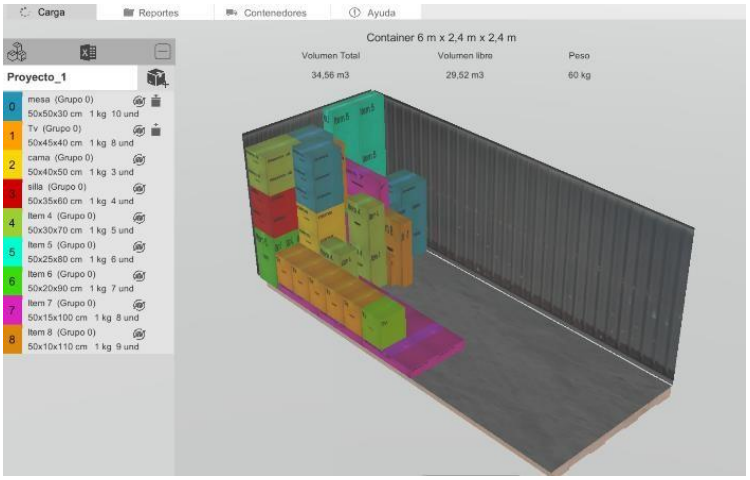


Figure 37. Selección de caja para la modificación de plan de carga

Once the box is selected, to move it, you must keep the left click pressed and move the mouse to the desired location. Once the desired position is found, release the left click, as shown in Figure 38. Remember not to overlap the boxes or move them out of the container. Otherwise, the box will return to its original position and rotation.

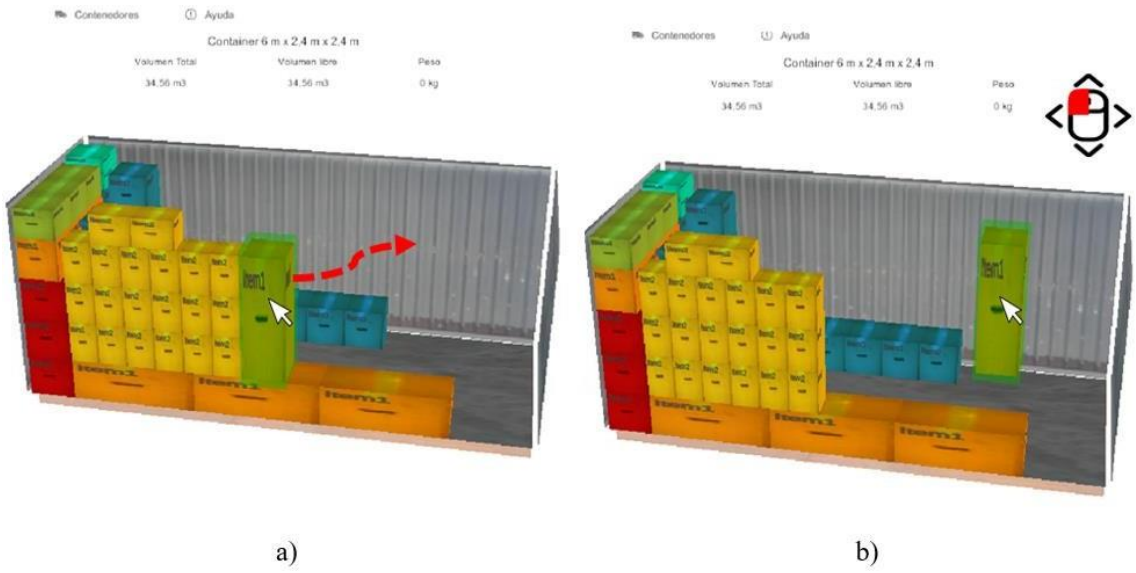


Figure 38. Changing the position of a block of boxes in the loading plan

In turn, you can move the package with the arrow keys. These make the package move in different directions (forward, backward, right, and left), as shown in Figure 39.

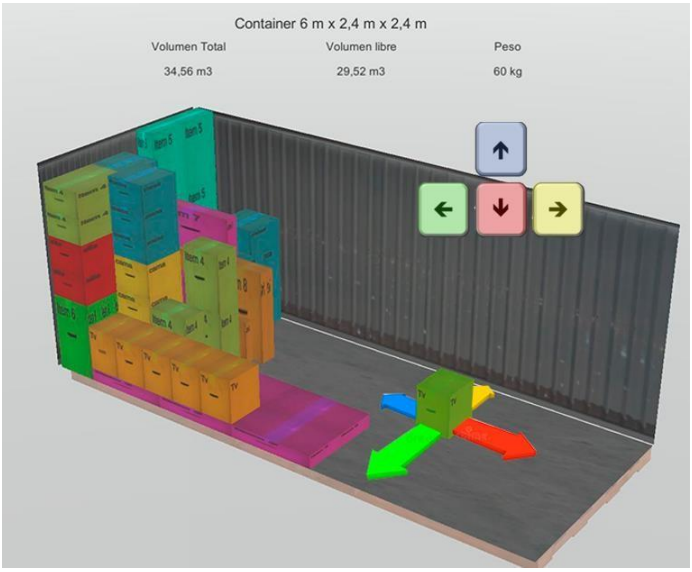


Figure 39. Movement of the package using the arrow keys

To rotate the object, use keys 1 to 6, as shown in Figure 40. Make sure the rotation does not overlap the package or pull the object out of the container. Otherwise, the package will return to its original position. In case you make a mistake in the loading plan, you have the button (↻) "Initial loading plan" which allows you to return to the final loading plan generated by SIC.

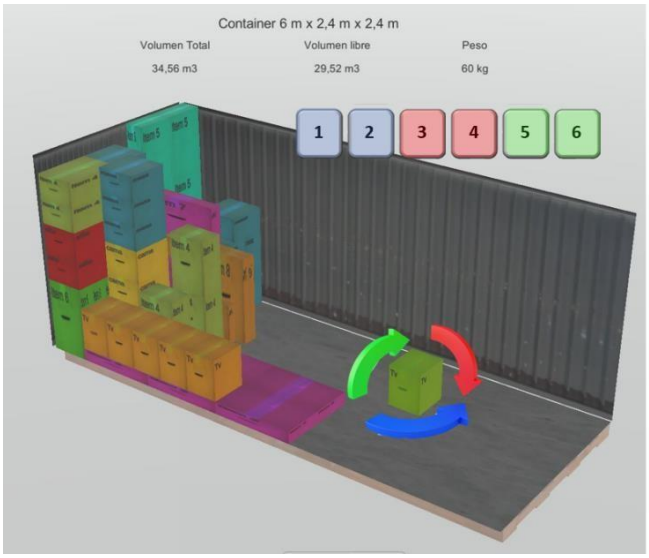


Figure 40. Package rotation using keys 1 - 6

How to restart the charging plan?

To empty the entire package section and the boxes inside the container, you must click on the "Empty" button ( ). Clicking the button will display a panel where you must agree to remove all items by clicking on "OK" (See Figure 41.a). SIC returns the container image and the empty packet section (See Figure 41.b).

Figure 41. Empty the current loading plan

Pestaña de reportes

By clicking on the "Reports" tab you can access the main interface of the tab. As shown in Figure 42.

Figure 42. Activate reports tab

In the "Reports" tab, you can view the previously saved load plans with their respective names and dates (See Figure 43). In addition, you can also re-download the .pdf files that have already been created. .pdf files that have already been created. You will also be able to delete any load

plans, if necessary.

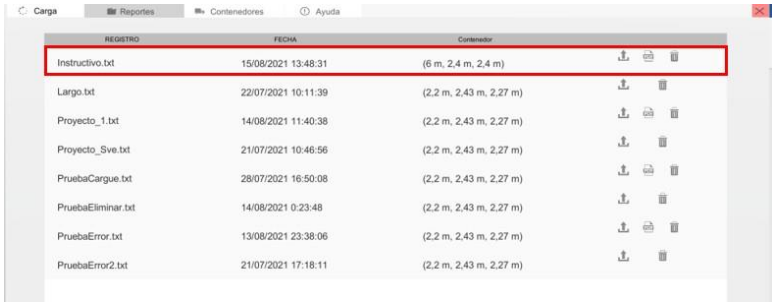


Figure 43. Previously created load plan information

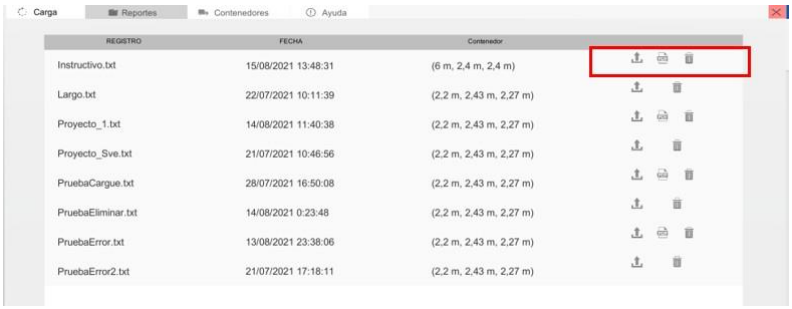


Figure 44. Downloading, viewing or deleting a saved loading plan

Container tab

By clicking on the "Containers" tab you can access the main interface of the tab. As shown in Figure 45.

Figure 45. Activate container tab

In the "Containers" tab, you can view all the cargo spaces created over time with their respective names and dimensions. In the "Include" section, you can choose the cargo spaces you want to be displayed in the container menu. After selecting the different cargo spaces, click update ( ) to display them, as shown in Figure 46.

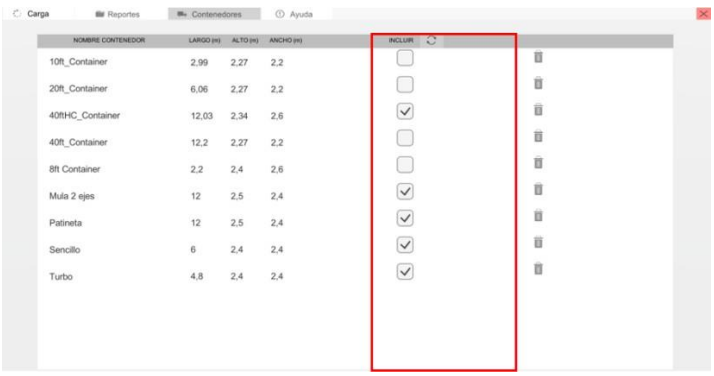


Figure 46. Selection of cargo spaces to appear in the container menu

Help tab

Clicking on the "Help" tab will take you to the main interface of the tab. As shown in Figure 47.

Figure 47. Activate help tab

In the "Help" tab, you will find a brief explanation of the functions within SIC. These are displayed by placing the cursor over the button or menus. By hovering the cursor, an explanatory panel will be displayed for each item with helpful information. Some examples are shown in Figure 48.

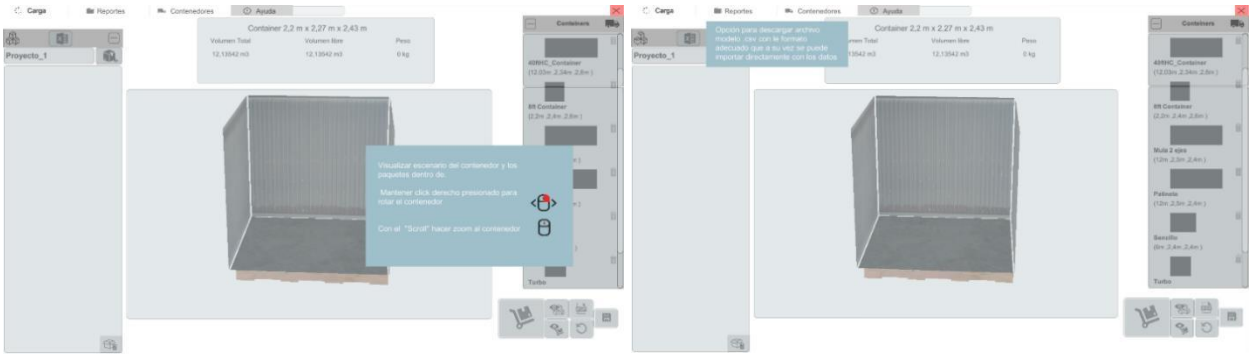


Figure 48. Explanatory examples from the help section

Support

Suppose you have questions about the program or need support. In that case, you can write us an email to SIC atencionacliente@gmail.com with your questions, error information, and your contact details. Our team will contact you and give you an answer as soon as possible.