



UNIVERSITAT
POLITÈCNICA
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CAMPUS D'ALCOI

DESIGN OF AN ECOLOGICAL MODULAR

TABLE FOR THE IMPROVEMENT OF TRAIN PASSENGER

COMFORT

MEMORIA PRESENTADA POR:

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Grado de: Ingeniería en Diseño Industrial y Desarrollo de Productos

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Uniwersytet Technologiczno-Przyrodniczy
im. Jana i Jędrzeja Śniadeckich w Bydgoszczy

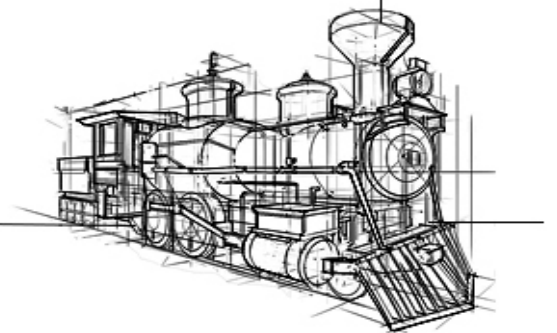


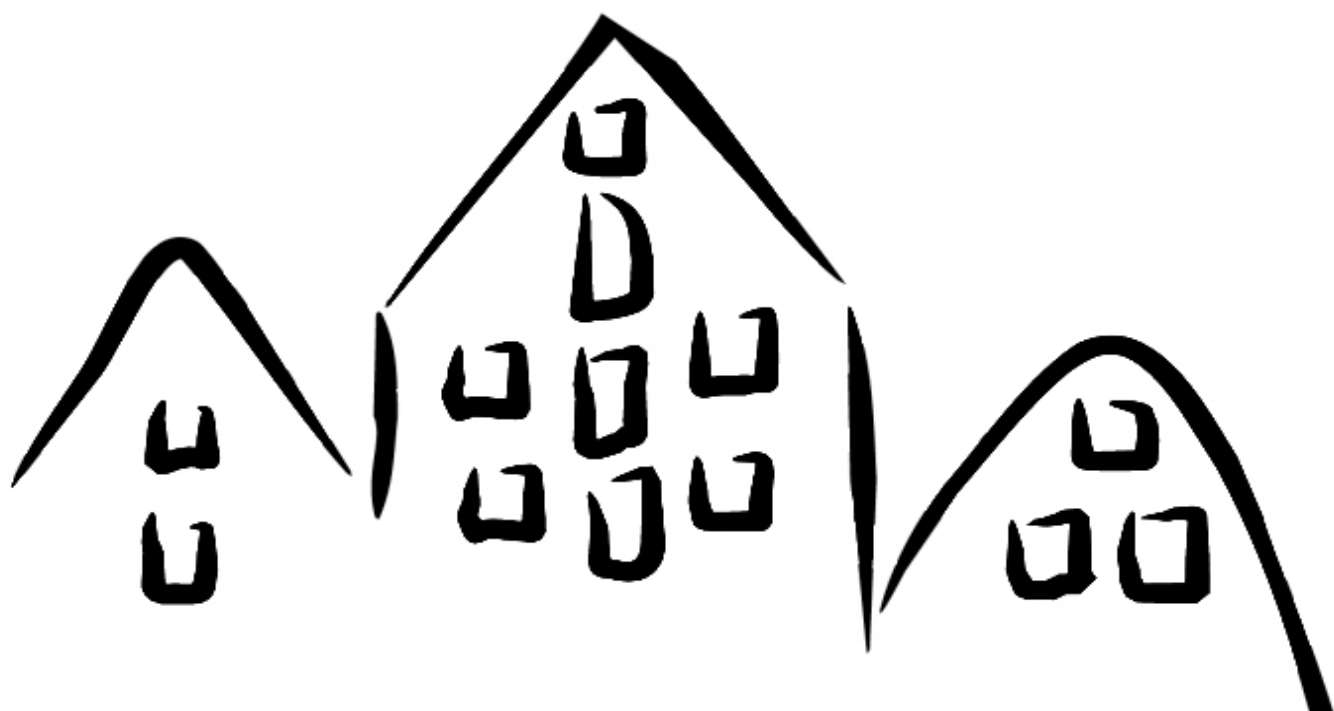
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INDUSTRIAL DESIGN ENGINEERING AND
PRODUCT DEVELOPMENT

RAQUEL CUENCA GARCÍA





BYDGOSZCZ

**TABLE FOR THE IMPROVEMENT OF TRAIN
PASSENGER CONFORT**

Abstract:

With the present End of Degree Work (TFG), the design of a modular train table, specifically for long distance, with the objective of improving the passenger comfort level during its use and at the same time offering a more ecological option.

As for the design that has been carried out, we want to give an innovative aspect, of comfort and lightness. On the other hand, the design must comply with the established regulations approved by the UNE, thus adapting the dimensions of the product to the user by adopting standardized ergonomic recommendations. To this end, the corresponding market studies will be carried out at the same time as different surveys of users of said transport in order to solve all the problems of comfort and accessibility possible.

In conclusion, the main objective of this project is to improve both the materials and the comfort and functionality of the tables of the means of transport, specifically high-speed trains.

Keywords:

TABLE, TRANSPORT DESIGN, ECOLOGICAL, COMFORT, PRODUCT

Resumen:

Con el presente Trabajo Fin de Grado (TFG) se presenta el diseño de una mesa modular de tren, concretamente de larga distancia, con el objetivo de mejorar el nivel de confort del pasajero durante su uso y del mismo modo ofrecer una opción más ecológica.

En cuanto al diseño que se ha llevara a cabo se quiere dar un aspecto innovador, de comodidad y ligereza. Por otro lado, el diseño deberá cumplir con las normativas establecidas aprobadas por la UNE adaptándose de ese modo las dimensiones del producto al usuario adoptando recomendaciones de ergonomía estandarizadas. Para ello se realizaran los estudios de mercado correspondiente a la vez que diferentes encuestas a usuarios de dicho transporte para solucionar de este modo todos los problemas de comodidad y accesibilidad posible.

En conclusión, el objetivo principal de este proyecto es mejorar tanto los materiales como la comodidad y la funcionalidad de las mesas de los medios de transporte concretamente de los trenes de alta velocidad.

Palabras clave:

MESA, DISEÑO DE TRANSPORTE, ECOLOGICO, CONFORT, PRODUCTO

Resum:

Amb el present Treball Fi de Grau (*TFG) es presenta el disseny d'una taula modular de tren, concretament de llarga distància, amb l'objectiu de millorar el nivell de confort del passatger durant el seu ús i de la mateixa manera oferir una opció més ecològica.

Quant al disseny que s'ha duguera a terme es vol donar un aspecte innovador, de comoditat i lleugeresa. D'altra banda, el disseny haurà de complir amb les normatives establides aprovades per la UNEIX adaptant-se d'aqueixa manera les dimensions del producte a l'usuari adoptant recomanacions d'ergonomia estandarditzades. Per a això es realitzaren els estudis de mercat corresponent alhora que diferents enquestes a usuaris d'aquest transport per a solucionar d'aquesta manera tots els problemes de comoditat i accessibilitat possible.

En conclusió, l'objectiu principal d'aquest projecte és millorar tant els materials com la comoditat i la funcionalitat de les taules dels mitjans de transport concretament dels trens d'alta velocitat.

Paraules clau:

MESA, DISSENY DE TRANSPORT, ECOLOGIC, CONFORT, PRODUCTE

DESCRIPTIVE MEMORY



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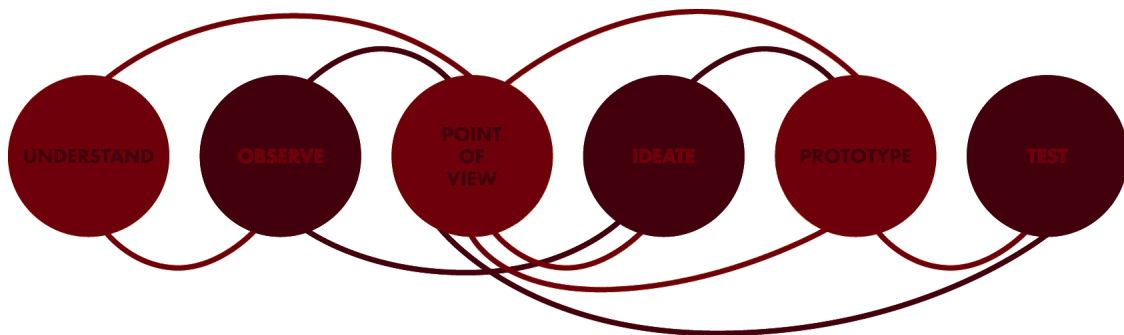
DESCRIPTIVE MEMORY

1. BACKGROUND

Regarding the preparation of this TFG, it has been decided to act with a strategy based on Design Thinking.

It is a method to generate innovative ideas that focuses its effectiveness on understanding and solving the real needs of users. It comes from the way product designers work.

The Design Thinking process consists of five stages. Another of the most important characteristics of this process is that it is not a linear process, so you can go back to the previous and subsequent phases as many times as necessary.



EMPATHIZE: The Design Thinking process begins with a deep understanding of the needs of the users involved in the solution we are developing, and also of their environment. We must be able to put ourselves in the shoes of these people to be able to generate solutions consistent with their realities.

DEFINE: During the Definition stage, we must screen the information collected during the Empathy phase and keep what really adds value and brings us to new interesting perspectives. We will identify problems whose solutions will be key to obtaining an innovative result.

IDEATE: The Ideation stage aims to generate endless options.

PROTOTYPE: In the Prototyping stage we turn ideas into reality. Building prototypes makes the ideas palpable and helps us visualize possible solutions, highlighting elements that we must improve or refine before reaching the final result.

TEST: During the Testing phase, we will test our prototypes with the users involved in the solution we are developing. This phase is crucial, and will help us identify significant improvements, failures to resolve, possible shortcomings. During this phase we will evolve our idea to make it the solution we were looking for.

2. PURPOSE OF THE PRODUCT AND JUSTIFICATION

The development of this project aims to carry out the design and development of a product that solves the deficiencies that exist in terms of passenger comfort when using long-distance trains. To this end, we will carry out different user surveys in order to achieve improvements in the required comfort needs.

Mainly the designed product must be inclusive for all people, for this reason it will have different heights and positions, in order to improve the comfort of all people without inconvenience to their height. For this reason, we will carry out different market studies with the intention of obtaining the necessary information about the problems they experience during a trip.

This work is prepared in conjunction with the UTP University of Science and Technology. Bydgoszcz is a city in which trains are an important part both for long-distance communication with other cities in Poland, and for being an aesthetic feature of the city, since in the center we can appreciate recreation of old wagons in perfect condition and short-distance trains that surround it, thus giving a very characteristic aesthetic to the city. A clear example of this is that of the company Pesa.



2.1 PESA

Pojazdy Szynowe Pesa Bydgoszcz is a railway vehicle manufacturing company based in Bydgoszcz, Poland

Pesa is a successor to the Bydgoszcz PKP Polskie Koleje Państwowe repair shops, the Polish state railways. From the 1950s to 1998, repair shops operated under the name ZNTK Bydgoszcz, Zakłady Naprawcze Taboru Kolejowego, 'Railway Rolling Stock Repair Shop' in Bydgoszcz.

For most of its history, the Bydgoszcz store reviews and repairs steam locomotives and freight cars. After the collapse of the Communist regime in Poland in 1989 the ZNTK Bydgoszcz repair shop was separated in 1991 as an independent company. This led to a rethink of the company's activities, and in 2001 the company was renamed Pojazdy Szynowe PESA Spółka Akcyjna Holding (its current name) and its activities were re-direction contrary to repair, to the construction of new rolling stock railway.



3. COMPETITION IN THE SECTOR-MARKET STUDY

3.1 COMPETENCE IN THE SECTOR

In this work, he has focused above all on the Spanish company Renfe since, as discussed below, this company is continuously innovating, betting on new designers and new projects focused mainly on innovation in its long-distance trains.

However, before talking about it, we will also comment on other companies in the sector.

CONSTRUCTIONS AND AUXILIARY OF RAILWAYS (CAF)

It is a multinational group with more than 100 years of experience offering comprehensive transport systems at the forefront of technology and with high added value in sustainable mobility.

This company offers customers one of the widest and most flexible ranges on the market in rolling stock, components, infrastructure, signaling and services (maintenance, rehabilitation and financial services).

Mainly, the strengths that characterize it are the proximity and understanding of the needs of its customers, technological innovation and high added value products, great flexibility in the design of its solutions, meeting deadlines to guarantee the competitiveness of its customers, the commitment to sustainable mobility, excellence in its products, and of course the great cohesive and committed team that makes it up.

The range of products they offer is:

- High speed trains
- Regional and suburban trains (Diesel and electric)
- Meters - Trams and LRVs
- locomotives
- Axles and components

Furthermore, CAF is one of the companies that has designed for Renfe.



SKODA TRANSPORTATION

Today, Škoda Transportation is focused on vehicles for public transport and railways. Modern products with the Škoda logo are manufactured on a completely new background, which was built for more than two thousand crowns in the traditional complex in Pilsen.

It has several subsidiaries that operate not only in the Czech Republic, but also in Germany, Finland, Russia and Hungary, which are in charge of individual projects.

Škoda Transportation offers a production and development solution for low-floor trams, trolleybuses and hybrid vehicles for green public transport in European cities. The company also focuses on the production of trains of various concepts, or on the production of locomotives.

Another important strategic area for Škoda Transportation is the market for electric trains for long-distance, regional and suburban public transport. For example, the company supplies electrical units from Latvia, Slovakia, Ukraine and, of course, the Czech Republic. Czech railways will receive a RegioPanter low-floor electric unit, which fundamentally increases the comfort level for traveling on key regional routes, and similar trains InterPanter will also soon be used on long-distance tracks.



Long distance train.

In addition, it has become a world leader in the supply of trolleybuses. These are used in dozens of cities in Europe, standing out mainly for hybrid vehicles or electric buses.

BOMBARDIER

Bombardier is a global leader in the transportation industry, creating innovative and game-changing planes and trains. Its products and services provide world-class transportation experiences that set new standards for passenger comfort, energy efficiency, reliability and safety.

Based in Montreal, Canada, Bombardier has production and engineering centers in 28 countries in the Transportation, Business Aircraft, Commercial Aircraft and Aerostructure and Engineering Services segments.

Bombardier Transportation is a leading global mobility solutions provider with the broadest portfolio in the rail industry. They cover all kinds of rail solutions, from trains to subsystems and signaling to complete turnkey transport systems, electronic mobility technology and data-based maintenance services. Regarding railway solutions include:

- Urban: subways, trams and light rail, commuter ...
- Main line: high-speed trains, locomotives, regional and intercity trains ...
- Equipment: equipment for urban vehicles, equipment for main line vehicles.
- Signaling and infrastructure: mass transit signaling, communication-based train control, European rail traffic management system....

Long distance train

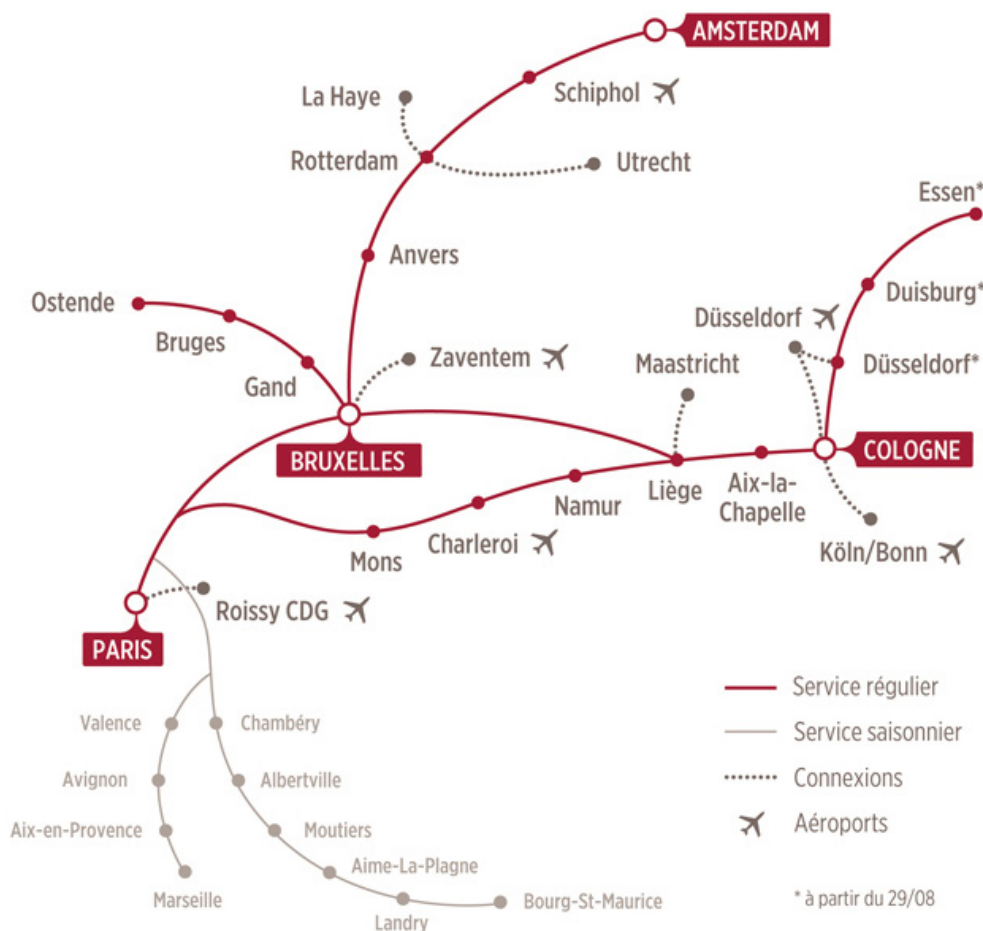


TRAINLINE

Trainline is one of the main sources of buying train or bus tickets in Poland, specifically Bydgoszcz. They offer a unique service for all your train and bus trips. Searching in this way Every day we make available to our customers information on routes, fares and travel schedules from more than 260 train and bus companies in 45 countries, so that our customers can easily buy tickets, saving time and money and avoiding setbacks.

Its main objective is that its client Find information about the station and its services, check train schedules and book your tickets from or to Bydgoszcz Główna.

Trainline operates in 44 countries and sells tickets from more than 207 train and bus companies including Renfe.



RENFE

This seat of transport is one of those that the user in X period of time uses less, but when he does, the journey is long. Therefore, what has been most evaluated are long-distance trains, since they are the ones that spend the most time and need all the comfort possible to have a good trip. Also, it has been investigated how the spaces are distributed within the wagons, the types of seats there are (depending on the route), the type of design (trend) that they follow inside, and of course, to see how the tables and how to improve them.

These are the types of trains that we can find:

CERCANIAS



MEDIA DISTANCIA



TALGO



INTERCITY



AVE



Renfe is currently expanding and betting every time on new design proposals. Above all, we have been able to find great interest in high-budget long-distance train innovation. Among the new proposals we can find more tables in the common areas, specific cars for meetings and improvement of seats.

Therefore, this company will be studied extensively so that the design of our table adapts to its demands and future needs.



S-102

Fabricante	Talgo Bombardier
Puesta en Servicio	2007
Tipo de Material	Autopropulsado
Tracción	Eléctrica
Velocidad Comercial Máxima	330 km/h
Tipo de Composición	Indeformable
Asientos (Club)	39 Club + 6 Sala Club
Asientos (Preferente)	76
Asientos (Turista)	195 (2 PMR)
Asientos Ergonómicos y Reclinables	Sí
Megafonía	Sí
Climatización Frio/Calor	Sí
Zonas de Equipaje	Sí
Audio y Vídeo	Sí



3.2 MARKET STUDY

MODEL

COMPANY
WEB

Nishore

https://www.amazon.es/Nishore-Multiusos-Ordenador-Adolescentes-Inclinable/dp/B0871X5P36/ref=sr_1_10?dchild=1&keywords=ESCRIT+ORIO+para+dibujo&qid=1590422288&sr=8-10

NUMERO DE
SERIE
DIMENSIONS
PRICE
MATERIAL
CHARAT.

TAU4518142937185CR

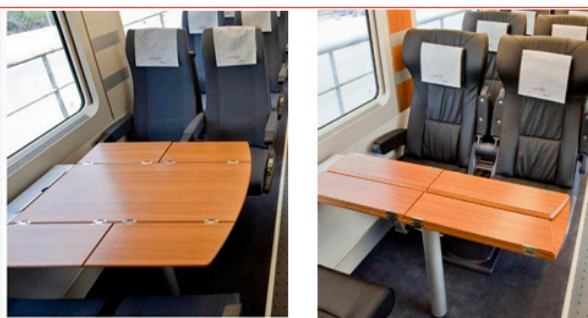
121 x 68 x 9 cm 20,5 Kg

110

Wood and steel structure + chipboard

Our adjustable drafting table, with a large work surface and unique tilt design, will be useful in various environments, such as in homes, offices or studios. The high-quality table surface and its robust anti-corrosion construction is very strong and durable. Thanks to its practical adjustment system, the height of the desk can be adjusted from 58 to 87 cm. And the scratch resistant surface can be tilted as per your preference. This drawing table comes with a storage shelf and a shelf on the side where you can keep tools organized and close at hand. It also has two built-in rulers for easy measurement. Assembly is very easy.

MODEL

COMPANY
WEB

Renfe

<https://compartirtrenmesaave.com/quienes-somos-y-hacia-donde-vamos/>

NUMERO DE
SERIE

Renfe2009

DIMENSIONS
PRICE

125 x 73 x 73 cm 30 Kg

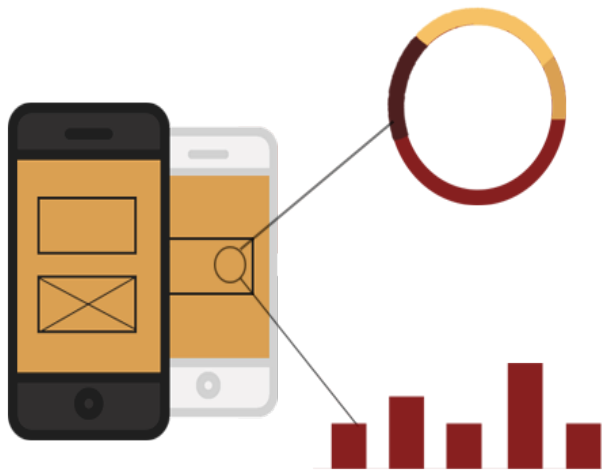
100-270

MATERIAL
CHARAT.

Wood and aluminum structure

Double opening table divided into 4 parts for each user with a lacquered finish and hinges for mobility.

4. SURVEY



A survey of 200 people from different places and ages has been carried out in order to carry out a new design following the mentality of

With the information obtained thanks to the background, the market analysis, the competition and the individual research that has been carried out, we have obtained more precise results of the deficiencies that prevail within the railway means of transport, more specifically in relation to the user with the tables. .

The results obtained are the following:

Most of the users are between the age of 20-30 years who usually travel every month; and for them the price is one of the essential values when traveling, however comfort when doing so is an essential value (61.5%) for which they would be willing to pay a little more.

During the tour, most of our users spend their time listening to music or reading, so having a comfortable space to carry out these activities would be an advance.

Regarding height, we find two majority groups found between 1.60-1.70m and 1.80-2.00m. To which 80% answered YES to the inconvenience at the time of the height of the tables. Therefore, the majority of our users (54%) prefer to sit in individual seats. Another of the most frequent responses obtained in our survey to this question is:

“Because I don’t want to disturb the one next to me, because sometimes I would like to have the table unfolded and the other person doesn’t.”

Finally, the vast majority responded that the quality of the tables when traveling is usually unfavorable.

To improve it, the new design should be able to supply these cadences, fulfilling the demands and proposals of our users and thereby improving comfort within these transports.

However, with this project, a redesign is being prepared to solve those problems related to the tables, especially for those who are traveling long distances.

Therefore, the project will be based on the design of a table for long-distance trains. We will specifically focus on the new Premium train campaign of the Spanish company Renfe, which is betting on innovation with the aim of improving the passenger experience during that tour.

5. FACTORS TO CONSIDER

The comfort.

The most important concept of this product, as previously mentioned in the work, is the improvement of user comfort, so we must first know the definition of comfort.

According to the definition provided by the Royal Spanish Academy, comfort is a word that is related to the comfort and well-being of the body, therefore, it is especially linked to the functions of the body that may be affected, such as hearing , vision, nervous system or joint problems caused by excessive vibrations.

Postural comfort. This type of comfort can be one of the most important in a train, since X time is normally spent inside it and it is necessary that everything that influences body posture during that time is in order. That is, it refers to the ergonomics of the human body.

Vehicle accessibility consists of improving access and mobility within the train by creating universal designs that include all kinds of people: those who are in wheelchairs; with difficulties of a sensory or intellectual nature or with significant difficulties in using a conventional transport service; people with mobility limitations; pregnant people with limbs immobilized, casts or on crutches; people with difficulties in moving; or those who cannot travel on foot without risk to themselves or to third parties.

Ergonomics

The measurements have been obtained from criteria of habitability and accessibility in the design of passenger trains (García, Cillero, Ramos, Puente, Martín; 2016, p45-onwards) in Spain.

The objective of this in the field of design is to create an ergonomic product taking into account who is going to use it.

Seating space is length. The availability of space in length refers to all the distances that affect the traveler in terms of the availability of space in the longitudinal direction (always measured with respect to their own position during the trip). This refers to the free space between seats, the depth of the seat and the longitudinal space between the seats.

Now the modulators that are taken into account are the existence of footrests and that the seat is reclining.

Clearance rules between facing seats: The UIC standard states that “for facing seats, the knee clearance will be measured as the distance between the backrests. When the seats are in the normal position, the distance must be at least 1,450 mm”(UIC File 567 art. C.1, mandatory).

5.1 ANTHROPOMETRY

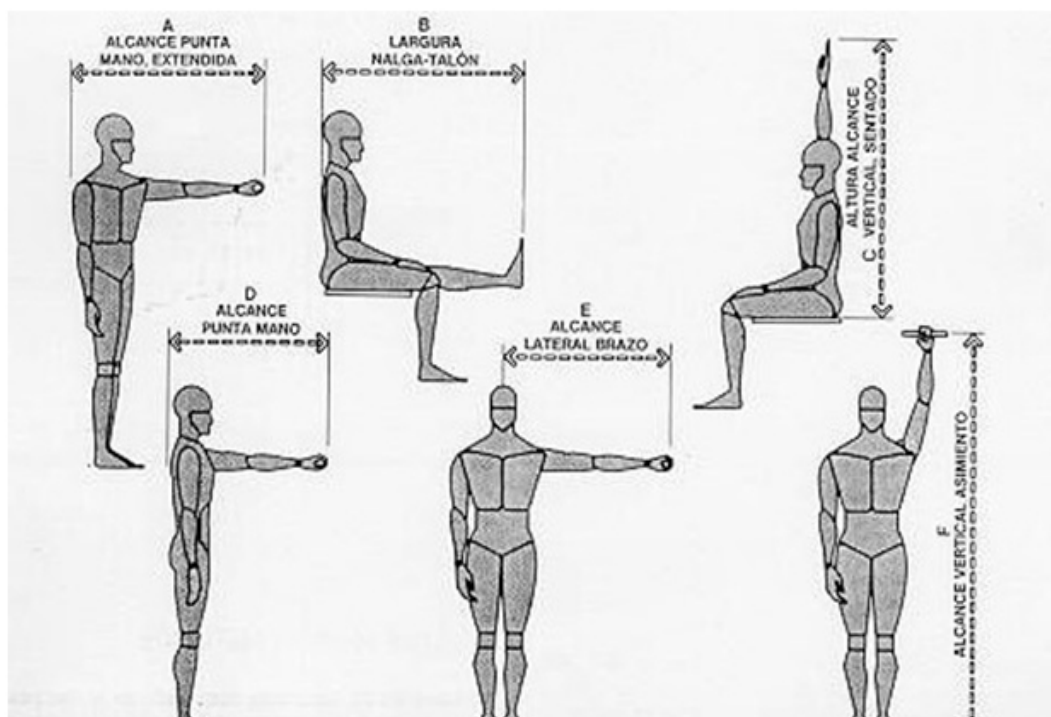
For a better understanding, the anthropometric characteristics of the population will be discussed, in this case from Spain.

For the design of this product, it is very important to take into account the ergonomics of the user, since the product will be in direct contact with the users.

According to the anthropometric tables of the population, both male and female; taking into account the perceivable 95 and 5, the following data can be observed:

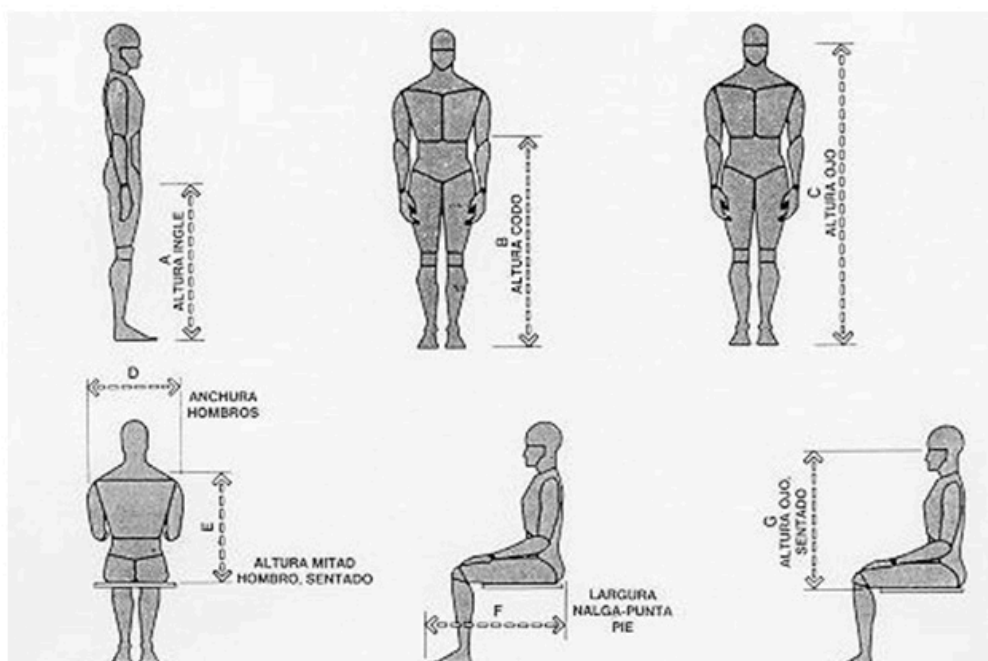
Functional dimensions of the human body of men and women, in centimeters, according to age, sex and selection of percentiles.

	A	B	C	D	E	F
MAN	97.3	117.1	131.7	88.9	86.4	224.8
WOMAN	92.2	124.5	124.7	80.5	96.5	213.4
MAN	82.3	100.1	149.9	75.4	73.7	195.1
WOMAN	75.9	86.4	140.2	67.6	68.6	185.2



Combined structural dimensions of the body of adult men and women, in centimeters, according to age and percentile selection.

		A	B	C	D	E	F	G
95	MAN	91.9	120.1	174.2	52.6	69.3	94.0	86.1
	WOMAN	81.3	110.7	162.8	43.2	62.5	94.0	80.5
5	MAN	78.2	104.9	154.4	44.2	60.2	81.3	76.2
	WOMAN	68.1	98.0	143.0	37.8	53.8	68.6	71.4

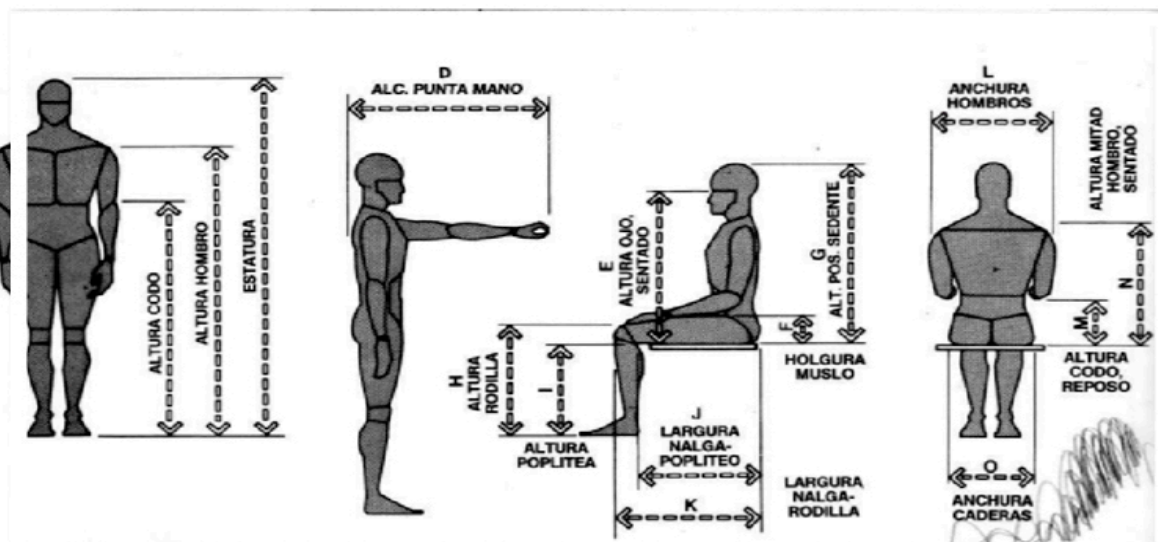


The functional dimensions of the body and the anthropometric data of the Spanish working population have been used to design the measurements of the table in question.

As can be seen, the length of the knee height of a man of the 95th percentile is 60.3 cm and that of a woman of the 54th cm percentile; reason why the height of the table would be correct since the knees do not touch although the legs are crossed. Since the wardrobe has a total height of 74 cm in the lower position.

		PESO	A	B	C	D	E	F	G
95	MAN	97.7	120.9	155.7	188.6	87.4	86.5	19.1	99.0
	WOMAN	74.9	108.7	141.4	172.8	80.6	79.6	14.9	91.5
5	MAN	65.2	105.5	136.5	168.2	74.3	76.4	14.5	88.5
	WOMAN	47.4	96.5	122.9	152.3	67.7	69.5	10.4	81.2

		H	I	J	K	L	M	N	O
95	MAN	60.3	47.8	55.1	65.4	52.9	29.7	69.6	42.2
	WOMAN	54.3	44.2	52.7	62.0	46.8	27.1	63.1	41.6
5	MAN	52.1	40.4	46.4	56.4	44.4	21.0	60.6	34.4
	WOMAN	46.7	37.8	43.7	53.3	38.6	19.2	54.2	35.4



5.2 OTHER PARAMETERS

Another important parameter in seat space is length. The availability of space in length refers to all the distances that affect the traveler in terms of the availability of space in the longitudinal direction (always measured with respect to their own position during the trip). This refers to the free space between seats, the depth of the seat and the longitudinal space between the seats.

Now the modulators that are taken into account are the existence of footrests and that the seat is reclining.

The regulations and recommendations on the free space between seats and on the passage between seats in line are:

Rules on free space between online seats:

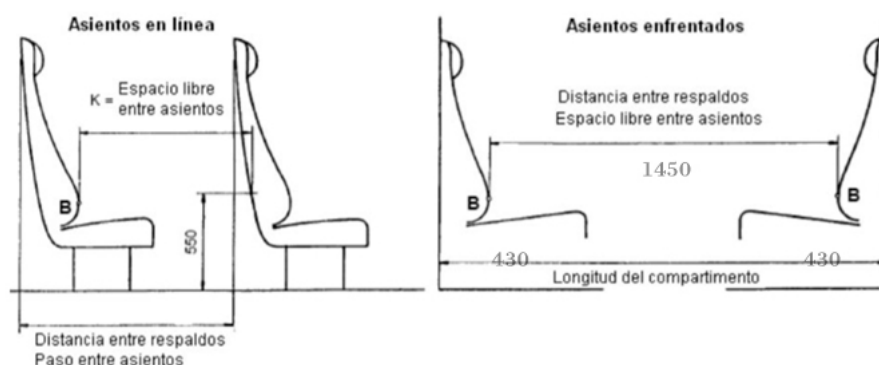
The UIC standard establishes that “the seats must be designed in such a way that, for all the backrest inclinations, the free space k at the knee level is not less than 790 mm in the first class and 700 mm in the second class” (File UIC 567 art. C.2.2, mandatory).

Renfe Viajeros, in its most recent specifications for high-speed trains, sets the minimum distance at 830 mm in economy class and 900 in preferred class, in both cases at 550 mm above the ground.

Clearance rules between facing seats:

The UIC standard states that “for facing seats, the knee clearance will be measured as the distance between the backrests. When the seats are in the normal position, the distance must be at least 1,450 mm” (UIC File 567 art. C.1, mandatory).

Standard regarding the passage between seats: The UIC standard establishes regarding the passage between seats arranged in rows that “the following dimensions are recommended: in first class, at least 1,010 mm; in the second class, at least 940 mm” (UIC file 5raquel del furura 67 art. C.2.1, recommended).

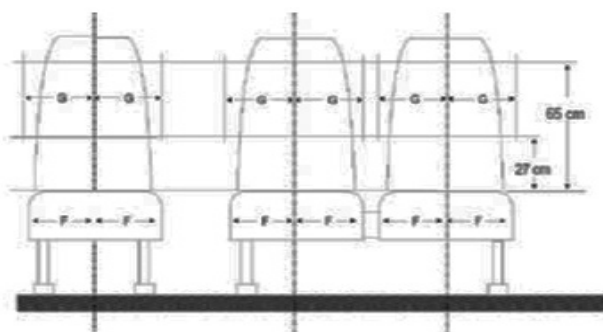


As previously mentioned, the necessary measure for the elaboration of the table. The distance between facing seats will be necessary since when we are in that position is the one that we can have between us our table. The space is 1450 mm from which we have to subtract the length of the seat at each end, which measures each one, as we can see in the diagram below, of the document, criteria of ability and accessibility in the design of the foundation's passenger trains. of the Spanish railways.

$$1450 - (430 + 430) = 590\text{mm}$$

With this measure we would already have the width of our table.

Next to calculate the length of the table we need the width of the seats. As we can see in the attached document below.

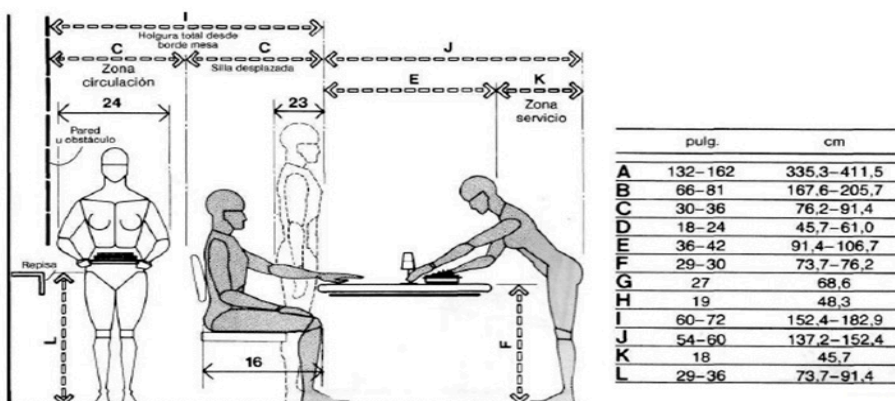


	2xG	
	Asientos agrupados	Asientos individuales
Clase I (urbano)	450	500
Clase II (metropolitano)	450	500
Clase III (interurbano)	450	500

Therefore $450 + 450 + 20$ (of the separation between seats) = 920mm

Finally, the height of our table is adjustable as we can see in the image of the official document of the foundation of the Spanish railways the minimum height is 73.7cm so our table enters between 74-76-78-80 cm its four different heights.

And as we can see in the previous section, these measures fall within the knee height regulations at the 95th percentile (60.3 men and 54.3 women)



6. NORMATIVE

For there to be a guarantee on the final product, it is necessary to take into account and comply with the UNE standards that regulate the quality and correct operation of the same. Next, the application regulations for the collection of tables that are carried out in this project are named:

STANDARD UNE 11-014: 1989. Tables. TEST METHODS TO DETERMINE STRUCTURAL STRENGTH

“This standard describes test methods intended to evaluate the structural resistance of tables, desks and auxiliary tables with wheels, fully assembled and ready for use, regardless of their design, materials used and manufacturing process. The tests described consist of the application, in various parts of the furniture, of loads that simulate the usual stresses to which it is subjected. “

STANDARD UNE 11-015: 1989. Tables. TEST METHODS TO DETERMINE STRUCTURAL STABILITY “

“This standard describes the test methods to determine the stability of any type of table. The tests must be carried out on articles completely assembled and ready for use ”



STANDARD UNE 11-022-1: 1992. Tables for domestic and public use. FUNCTIONAL CHARACTERISTICS AND SPECIFICATIONS. Part 1: Materials and surface finish

“This standard specifies the requirements that must be met by the materials and the finish of the tables depending on the use for which they are intended, regardless of their design and manufacturing process”

STANDARD UNE 11-022-2: 1992. Tables for domestic and public use. SPECIFICATIONS AND FUNCTIONAL CHARACTERISTICS. Part 2: Structural strength and stability

“This standard specifies the structural resistance and stability requirements that tables must meet depending on the use for which they are intended, regardless of their design, materials used and manufacturing process.”

STANDARD UNE 11-019: 1990. “Test methods in wood furniture finishes. SURFACE RESISTANCE TO MECHANICAL DAMAGE

“This test method is part of a series of tests whose purpose is to assess the characteristics of the finishes in wooden furniture. More specifically, it is intended for the evaluation of the resistance that wooden furniture finishes present to mechanical impact and scratches. It is a method with which different finishes can be compared, and useful to check if certain products meet the specifications detailed on the label or in any other document ”

STANDARD UNE-EN 12299: 2010 UNE. Status: Current / 2016-07-27. Railway applications. Travel comfort for passengers. Measurement and evaluation.

UNE-EN ISO 15785 STANDARD: Technical drawings. Representation and symbolic expression of glued, folded and pressed joints. This international standard establishes rules for the expression and symbolic representation in technical drawings of glued, folded and pressed joints.

7. DESIGN REQUIREMENTS

VALUE ANALYSIS OF A HIGH-SPEED TRAIN TABLE

A list of the needs proposed by the designer is made and a list of functions that the product must have and that cover the proposed needs is proposed.

NEEDS	FUNCTIONS
That it can move	<i>Be mobile</i>
Different heights	<i>Be dimmable</i>
	<i>Support capacity</i>
Lightweight	<i>Be light</i>
Pussycat space	<i>To be little bulky</i>
Comfort	<i>Be ergonomic</i>
Security	<i>Provide stability</i>
Multifunctional	<i>Be multi-functional</i>
Economic	<i>Be economical</i>
	<i>Have modularity</i>
Durability	<i>Be durable</i>
Novel aesthetics	<i>Be aesthetically innovative</i>

Contribution of the function to satisfy the need. Values between 5 and 0 will be weighted
To simplify the explanation of the exercise, the number of needs and functions is reduced as well as their names

CORRELATION MATRIX

	F1	F2	F3	F4	F5	
N1	5	1	0	1	1	
N2	1	5	3	3	1	
N3	0	3	5	0	0	
N4	0	3	0	5	0	
N5	1	3	0	1	5	
Total	7	15	8	10	7	47
%	15	32	16	22	15	100%

With the results obtained and prioritizing the main deficiencies, the following requirements will be established:

- Ergonomics: both the different heights and the regulation of the table will be improved to make the trip much more comfortable and thus avoid bad posture.
- Spaces: more spaces will be created between them, individualized and adapted to each type of person. Since with the different heights and with the possibility of adapting the inclination of the top of the table, it gives greater comfort and a new feeling of intimacy.
- Technology: they will have the necessary electronics to make a more enjoyable and productive trip. As previously mentioned, the mechanism of said table is adapted to be able to work during the journey. For this reason, it will have usb ports and electrical plugs on the legs. Depending on the model, we can find variations, since for Premium companies there are versions with led light on the top of the table individually, and we can also find such devices in the area of the seats.
- Materials: The material used for its construction must be wood, properly treated and with an optimal finish. The characteristics of the material used will be taken into account at all times. Rigidity, stability, hardness, etc. They will be recyclable as much as possible
- Design: the design will be innovative and unique, based on a minimalist and functional style.
- Objective: Focused on an audience between 20 and 60 years old, with a medium-high economy
- Multifunction: it is possible to give other uses or functions.
- Aesthetic aspects: it is possible to paint or lacquer wood. Thus adapting to the aesthetics of the different railway companies.

The target audience for this design will be anyone who uses this type of transport, always trying to favor those with mobility problems, but adaptable to any type of person, from adolescents to the elderly. It will be a totally inclusive design.

8. DEFINITION AND SEGMENTATION OF THE USER

According to the segmentation, within the millennial generation, we can find different profiles. We can find people between 20 and 39 years old, and each one has a way of behaving according to the personality and the moment of her life in which she finds herself. Because of this, it is necessary to better define the profile that best suits the product to be designed.

First, demographic segmentation has been defined. Since we are talking about a generally more expensive luxury company, the user will have to have more economic capacity. People generally start working and are therefore financially independent around the age of 30. For this reason, the user will be in a group of people between 30 and 35 years old. During these years, young people become independent from their parents and begin to make their own decisions regarding the responsibilities of the home. Among them is the option of moving either for leisure or work. Therefore, it makes them an ideal user for the product to be designed, since, as previously discussed. In addition, economically the user feels comfortable, since he can afford to invest a little more to earn travel quality.

Turning to demographic segmentation, the user will be from Spain, since it is a country where people begin to be interested in these products. In addition, as it has been analyzed, it can be seen that sales of this type of transport are growing in recent years. Therefore, it can be said that it is a trend that will grow.

Finally, the most important segmentation is psychographic. The user follows the values of the brand and appreciates well-being and adaptation. To start, the user is interested in the environment and is aware of the environmental problem that our way of life generates, so the material is made in an ecological way. Therefore, you make decisions regarding the products you choose to try to reduce impact and recycle as much as you can.

As for the choice, it prefers those transports that invest and evolve their products with the aim of creating others that are less polluting.

In addition, she is interested in the benefits that each brand of transport and therefore the comparison between them. She is also socially aware and knows that organic products come from fairer productions and that they promote the local economy.

In addition, he likes social networks very much and generally likes to follow different Instagram or Facebook profiles that provide information about travel and comfort before them. In addition, she likes to publish interesting activities that she does during the day, where you can find photos of her trips between them.

8.1 PEOPLE



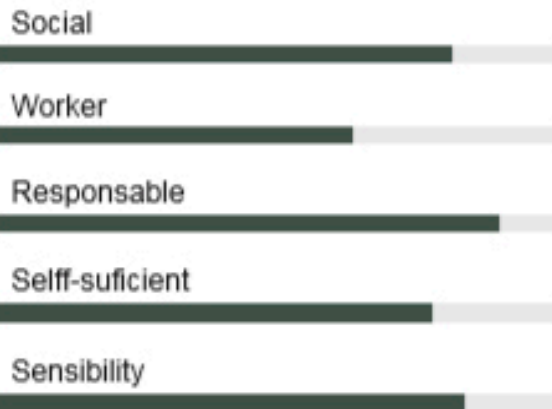
Alba Monge Perez

30 yaers, Bilbao, Spain

She is a young woman who has recently become independent from her parents and now lives with her friend. She is a graduate in biochemistry and works 8 hours a day in the laboratory during the week.

She likes to take care of herself and for this she does exercise and takes care of her diet. Chooses to buy organic products because she wants her meals to be nutritious. She also cares about the environment and opts for those products that pollute less.

PERSONALITY



MOTIVATIONS

- Health
- Ecology
- Travel
- Social conscience
- Sport

FRUSTATIONS

- Current environmental problem
- Find no products that are more ecofriendly

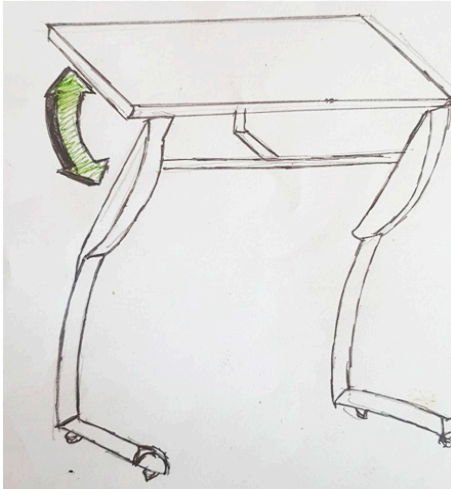
OBJECTIVES

- Have the best possible comfort when traveling
- Be able to work while traveling

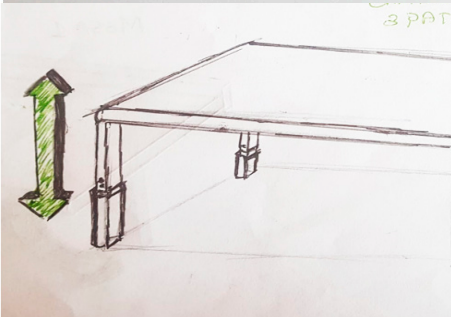
FAVORITE BRANDS



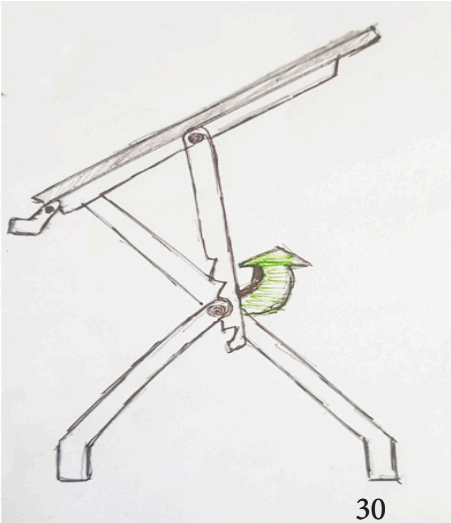
8. IDEATION



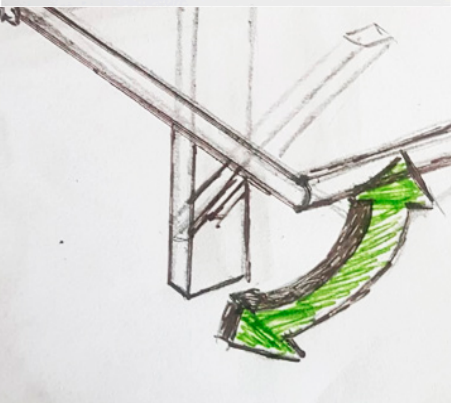
OPTION A
TO HAVE THE OPTION TO LEAN AS THE
DRAWING TABLES



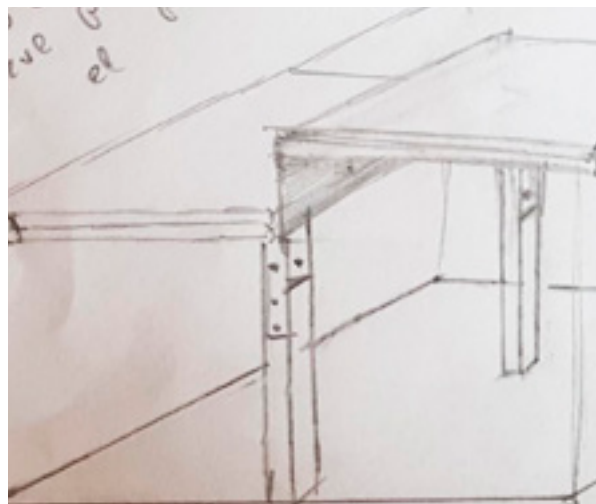
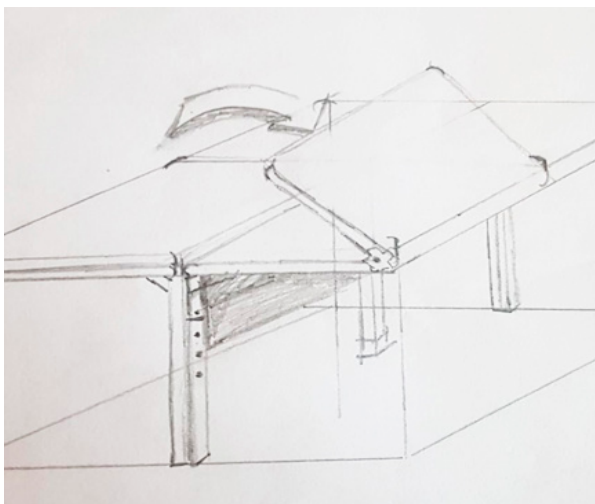
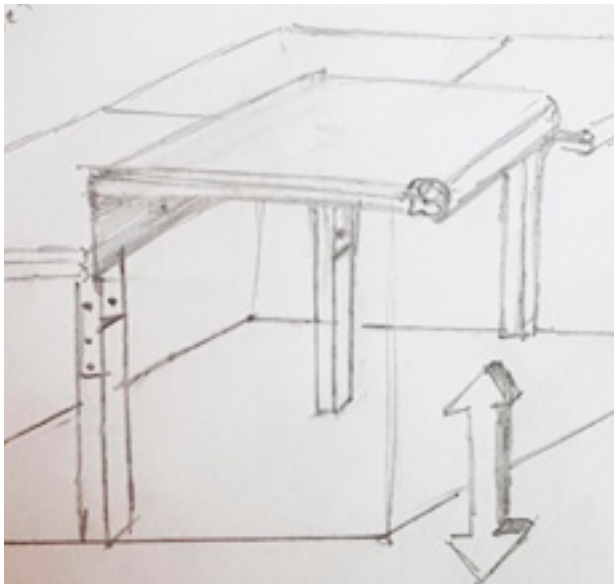
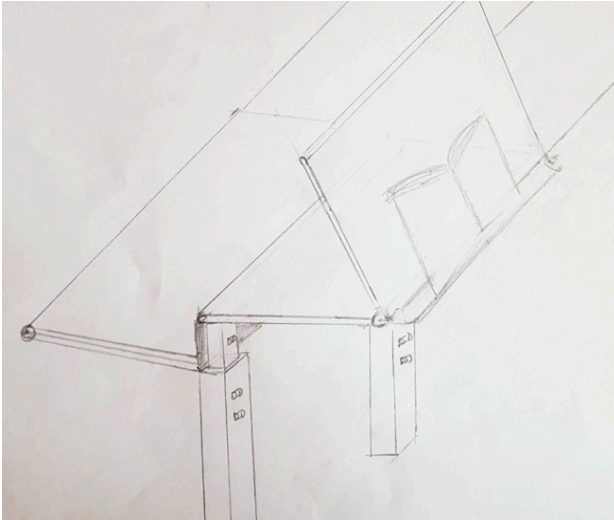
OPTION B
THAT HAS VARIATION OF HEIGHTS FOR THE
DIFFERENCE OF HEIGHT OF PERSON



OPTION D
DIFFERENT HEIGHT AND SLOPE TO WORK



OPTION E
SAVE QUICKLY



OPTION C
FINAL RESULT, YOU CAN GRADUATE THE
HEIGHT, AND TILT TO BE ABLE TO WORK
EASILY OR ENJOY YOUR LEISURE

9. VTP

VTP	IMPORTANCIA	A	B	C	D	E
Esthetic	10	10 100	9 90	7 70	8 80	7 70
Simple shapes	7	9 63	9 63	8 56	7 49	7 49
Minimum elements	6	7 42	7 42	7 42	6 36	7 42
Suitable dimensions	10	8 80	8 80	8 80	7 70	7 70
Wood material	8	6 48	7 56	8 64	10 80	6 48
Light	6	6 36	7 42	8 48	6 36	9 54
Proper finish	10	10 100	9 90	9 90	9 90	8 80
Easy to clean	8	7 56	6 48	8 64	6 48	6 48
Price	9	6 54	7 63	8 72	7 63	7 63
Functional	10	8 80	8 80	9 90	8 80	7 70
TOTAL	84	559	654	676	632	602
VTP	-	0,665	0,778	0,805	0,752	0,717

Finally, as indicated in the table above, the option with the highest VTP is solution C, with a value of 0.805

10. MATERIALS

The material selected to manufacture the set will be wood and aluminum.

Wood is a renewable, biodegradable and recyclable resource, in addition to being economical and very easy to work with. It is the lightest, strongest and easiest to work construction material. The base of our table will be made of chipboard for the bottom table and DM chipboard for the top, due to the characteristics mentioned below:

Chipboard is a relatively ecological and economical material, made with wood chips from the remains of other woods. Softwoods are generally used, although a proportion of hardwoods and burned fire are sometimes incorporated. The particles are joined by resins that respect the environment and are then pressed to form the board.

A current standard chipboard is manufactured in various thickness densities, the interior being of finer particles, which gives less density and lightens the total weight of the plate.

- Smooth and homogeneous surface.
- Resistant to high temperatures and humidity.
- Optimal behavior in the subsequent transformation.
- Specific for indoor furniture in a dry environment.

The chipboard DM: It is a board formed by dry pressed wood particles, very uniform, very easy to work with and very resistant to changes in temperature.

Usually its color is medium dark brown and perfect for lacquering or painting. .

Repelled chipboard: It is a three-layer chipboard that has been glued on its faces with natural wood veneer. It is the most expensive to use natural wood to cover it.

The veneered chipboard in two different finishes, Walnut and Oak, 11 mm thick, has been chosen for the main surface.



Ricardo Tejero,
Director de Organización Leroy Merlin España

Hemos iniciado un proyecto piloto con ESADE para estudiar la conversión de nuestros subproductos en pellets para energía. Dada la escasa viabilidad económica que ha presentado esta iniciativa, seguimos buscando una forma de aprovechar esa madera, investigando su posible utilización en paneles de aislamiento térmico para los hogares.

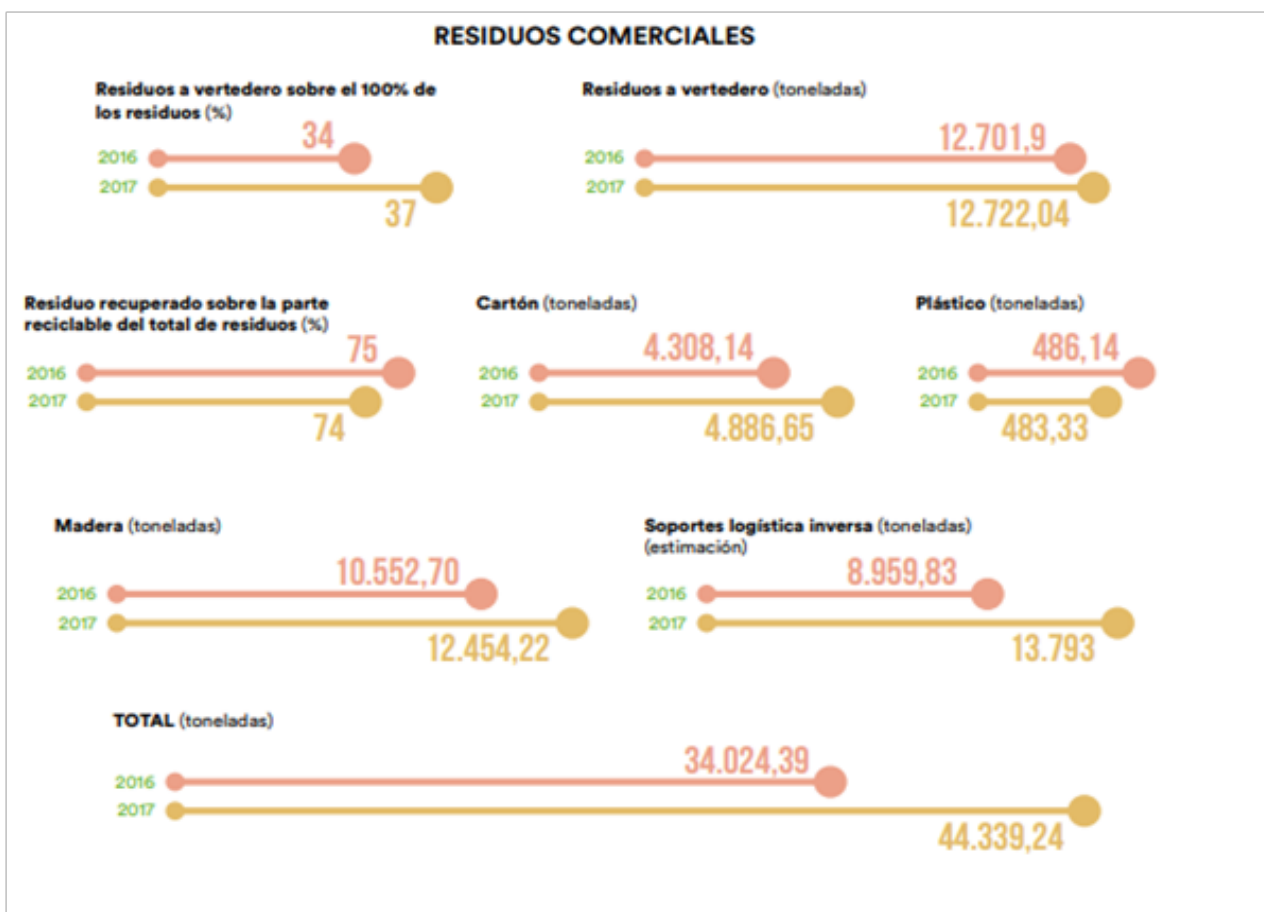


Gestión de residuos 2017: resultados
RESIDUOS COMERCIALES

The Spanish company Ikea and Leroy merlin also follow this ecological wooden model when it comes to making their products.

According to studies, the company Leroy Merlin has produced 10,552.7 tons of wood waste in 2016 and with an upward trend, for 2017, 12,454.22 tons. If these wood residues are used to manufacture the proposed design, a circular economy is achieved, saving resources and costs.

On the other hand we find the legs, for which we will use Aluminum, because it is a relatively light, resistant material and provides a very good finish. Both for the exterior and the interior of each of them, however, the exterior will be covered with a paint to improve its steric.



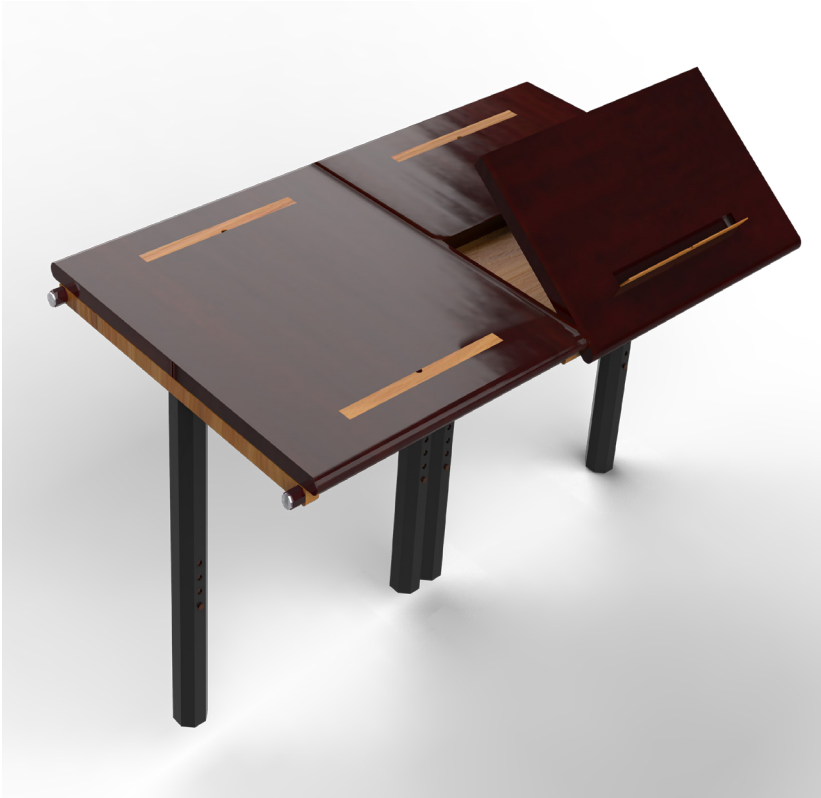
11. FINAL PROPOSAL



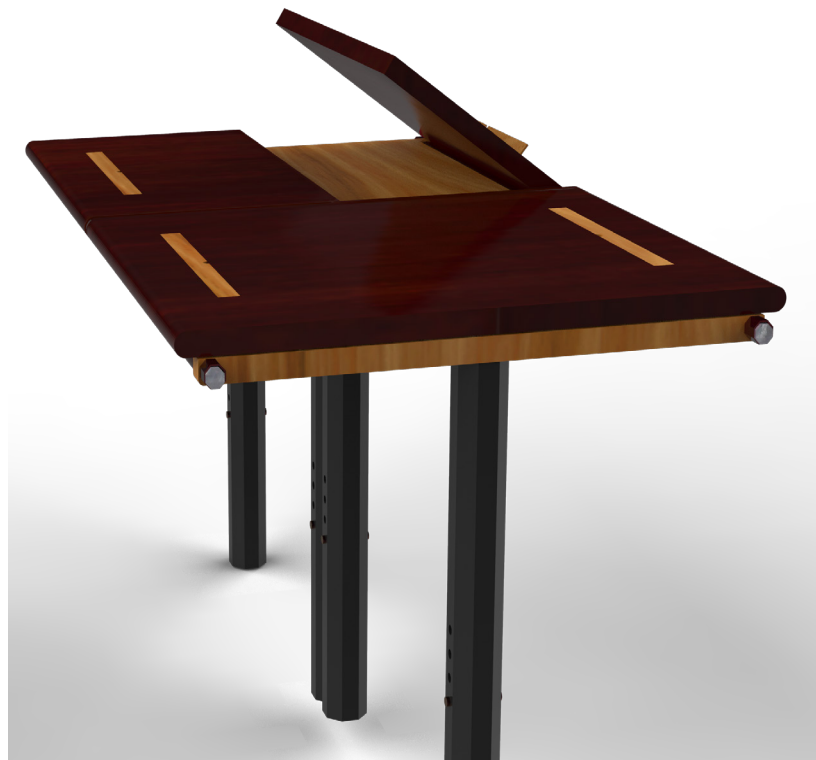
POSITION 1:

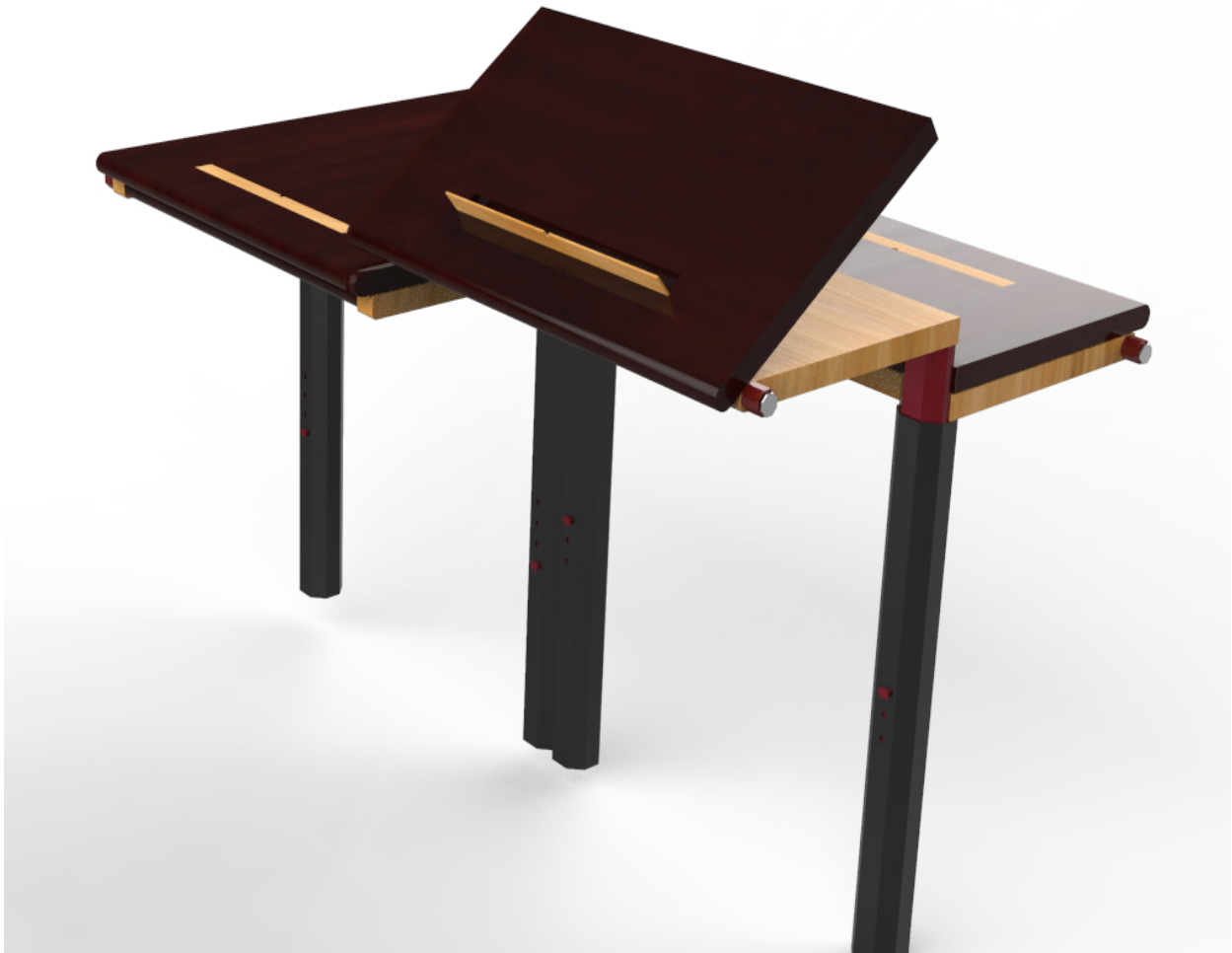
Standard table, with the company's own design and finish, and its different individualized parts that will be shown below





POSITION 2:
Inclination of the upper part of the table for its improvement when working





POSITION 3:
Adaptation capacity at the user's height

REPRESENTATION OF HOW IT FITS IN A TRAIN CAR

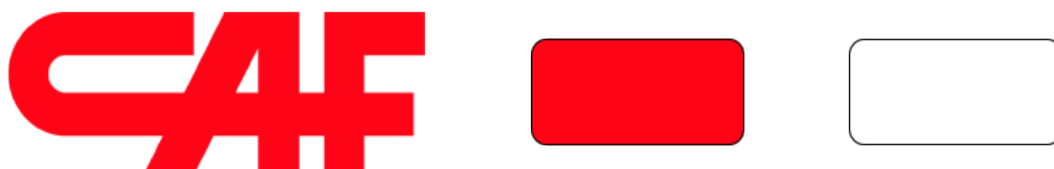




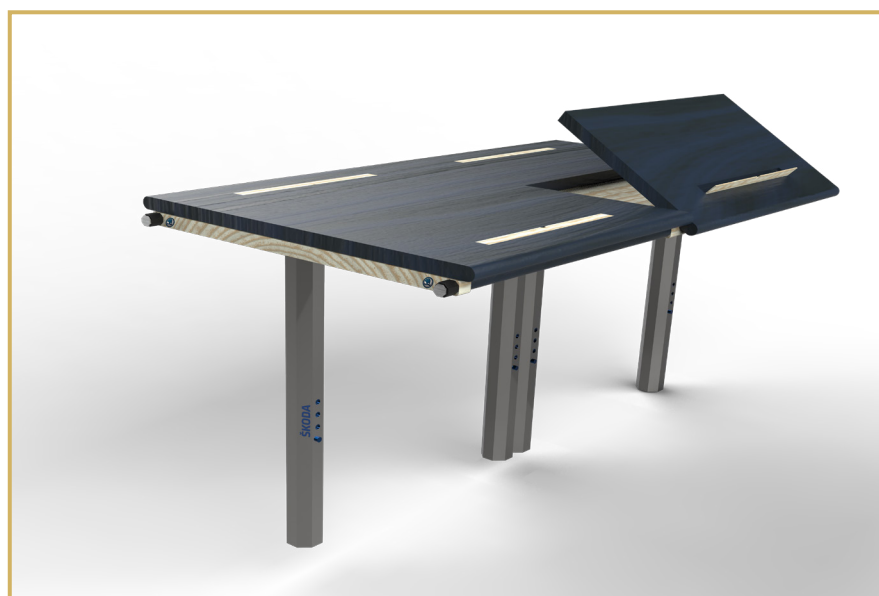
12. COMBINATIONS ACCORDING TO COMPANY

It is planned to manufacture the set in different finishes, seeking to adapt the product to different companies. Each subset will be available in different colors and can be combined to suit the buyer.

CONSTRUCCIONES Y AUXILIAR DE FERROCARRILES (CAF)

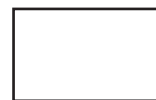


SKODA TRANSPORTATION



BOMBARDIER

BOMBARDIER



Trainline

trainline
DESIGN & CONSTRUCTION



RENFE

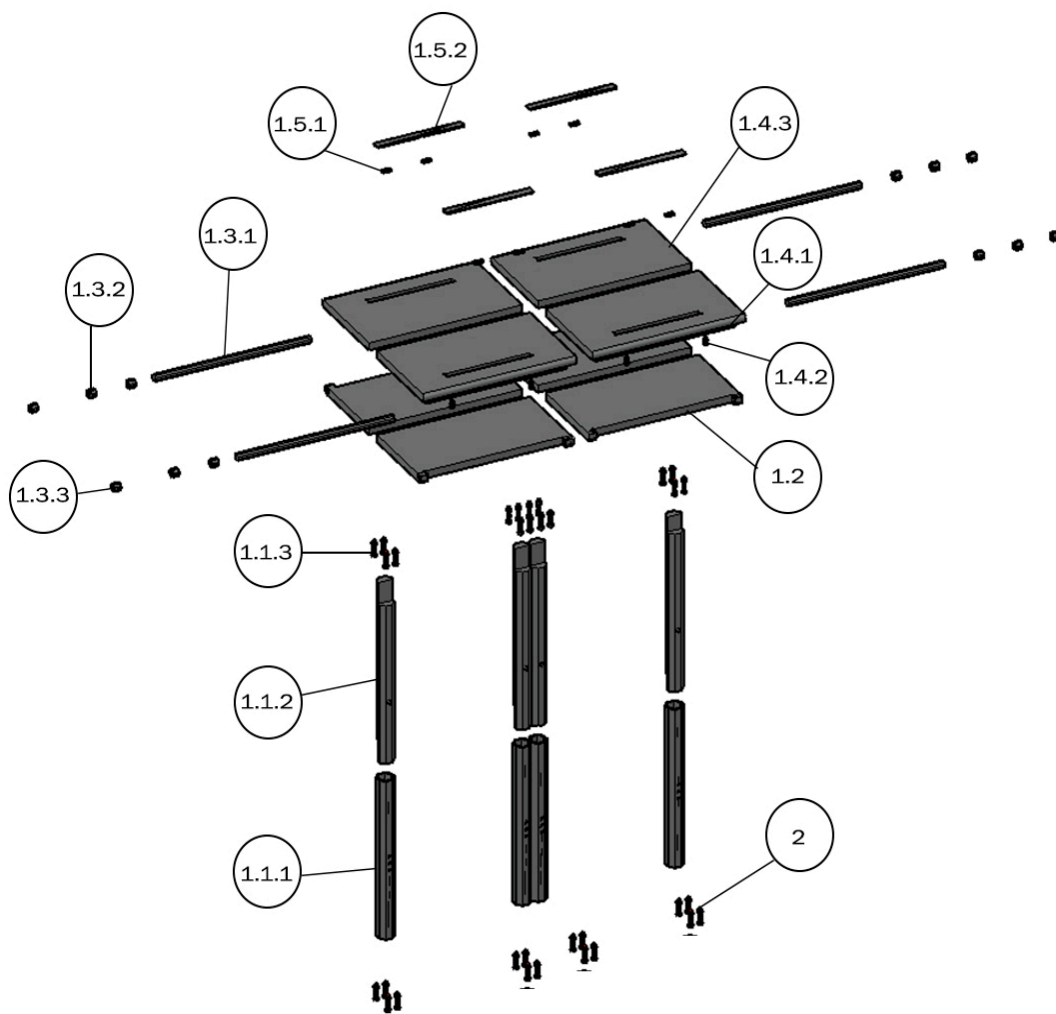
renfe



RENFE-TURISMO DE LUJO



13. EXPLODED



MARK	NAME	UNITS
1.1.1	EXTERNAL LEG	4
1.1.2	INNER LEG	8
1.1.3	SCREW FOR HOLDING LEGS TO THE LOWER BOARD "CELO" Ref. RA 82 30 X15	16
1.2	LOWER BOARD	4
1.3.1	ROTATION INTERIOR STEEL BAR	4
1.3.2	UNION CIRCULAR RUBBER	8
1.3.3	MAGI ROTATING PROTECTION	4
1.4.1	ROTATION WOOD TUBE	4
1.4.2	HEXAGONAL HEAD SCREW UNION WOOD ROTATION TUBE WITH BOTTOM BOARD M10 X1.5	8
1.4.3	UPPER BOARD	4
1.5.1	HINGE	8
1.5.2	COMPLEMENTARY SHEET	4
2	LEG FIXING SCREW TO SURFACE "CELO" Ref. RA 82 30 X15	16

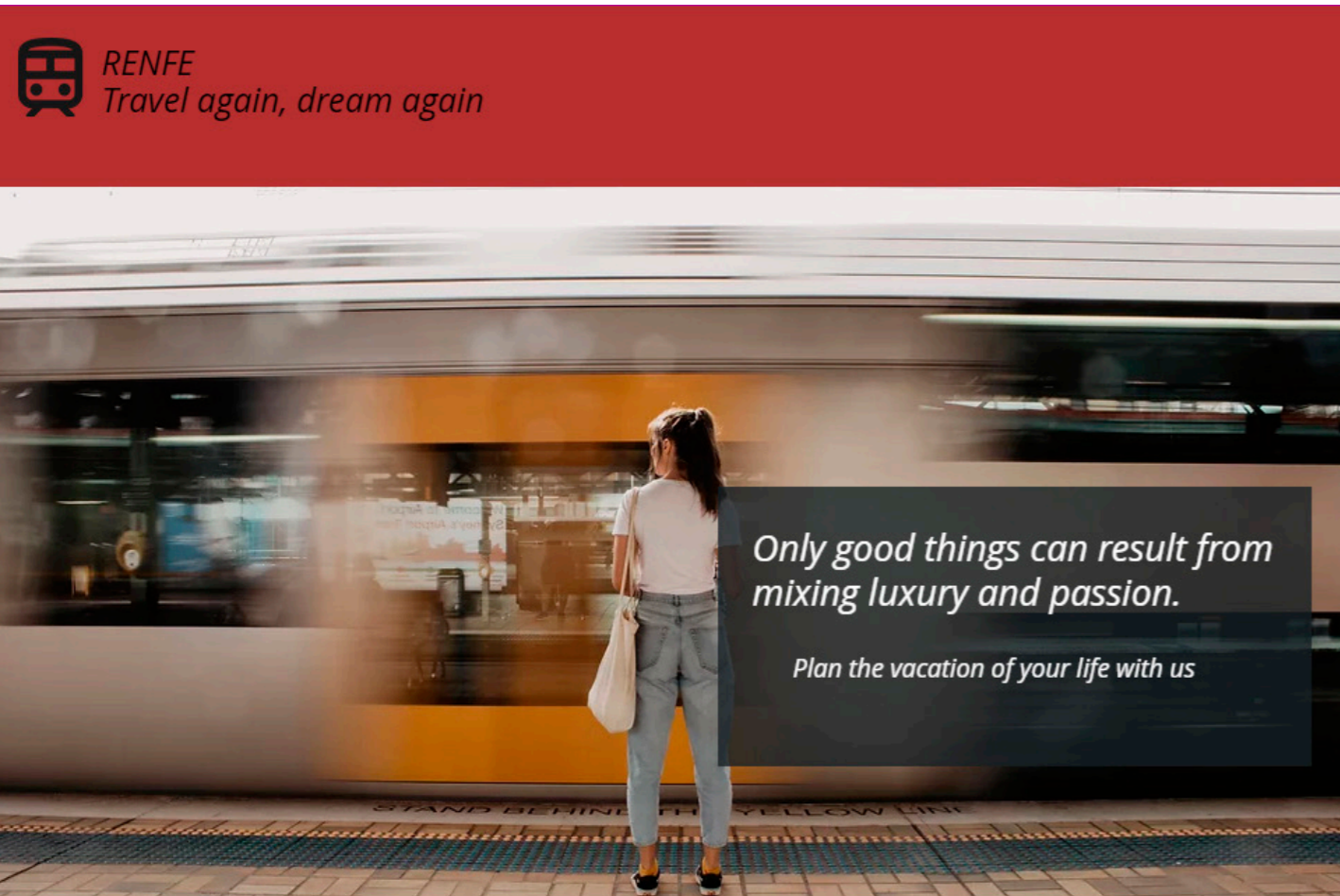
14. MOODBOARD

The moodboards are excellent for consolidating a theme or concept for an interior space. It is an excellent way to test ideas before executing them. Here are some ideas:





5. WEB PAGE



 Destinations

Bydgoszcz

Bydgoszcz is a city located in northern Poland, near the Brda and Vistula rivers, with a population of 356,177 inhabitants in 2010. With a surface area of 175.98

IMPROVEMENTS IN OUR TRAINS

LUXURY TABLE

Enjoy our latest news with the comfort of the LUXURY TABLE which adapts to your desired height and allows greater comfort when

 Destinations

Bydgoszcz

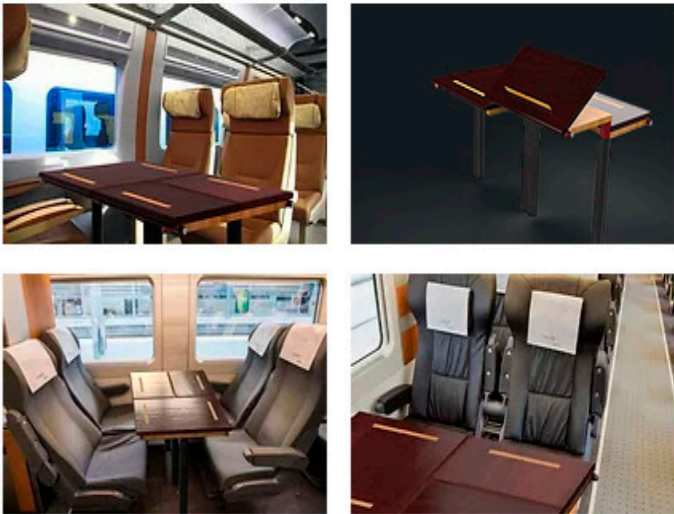
Bydgoszcz is a city located in northern Poland, near the Brda and Vistula rivers, with a population of 356,177 inhabitants in 2010. With a surface area of 175.98 km², it has a population density of 2,032 inhabitants / km²; it is the capital of the Cuyavia and Pomeranian Voivodeship

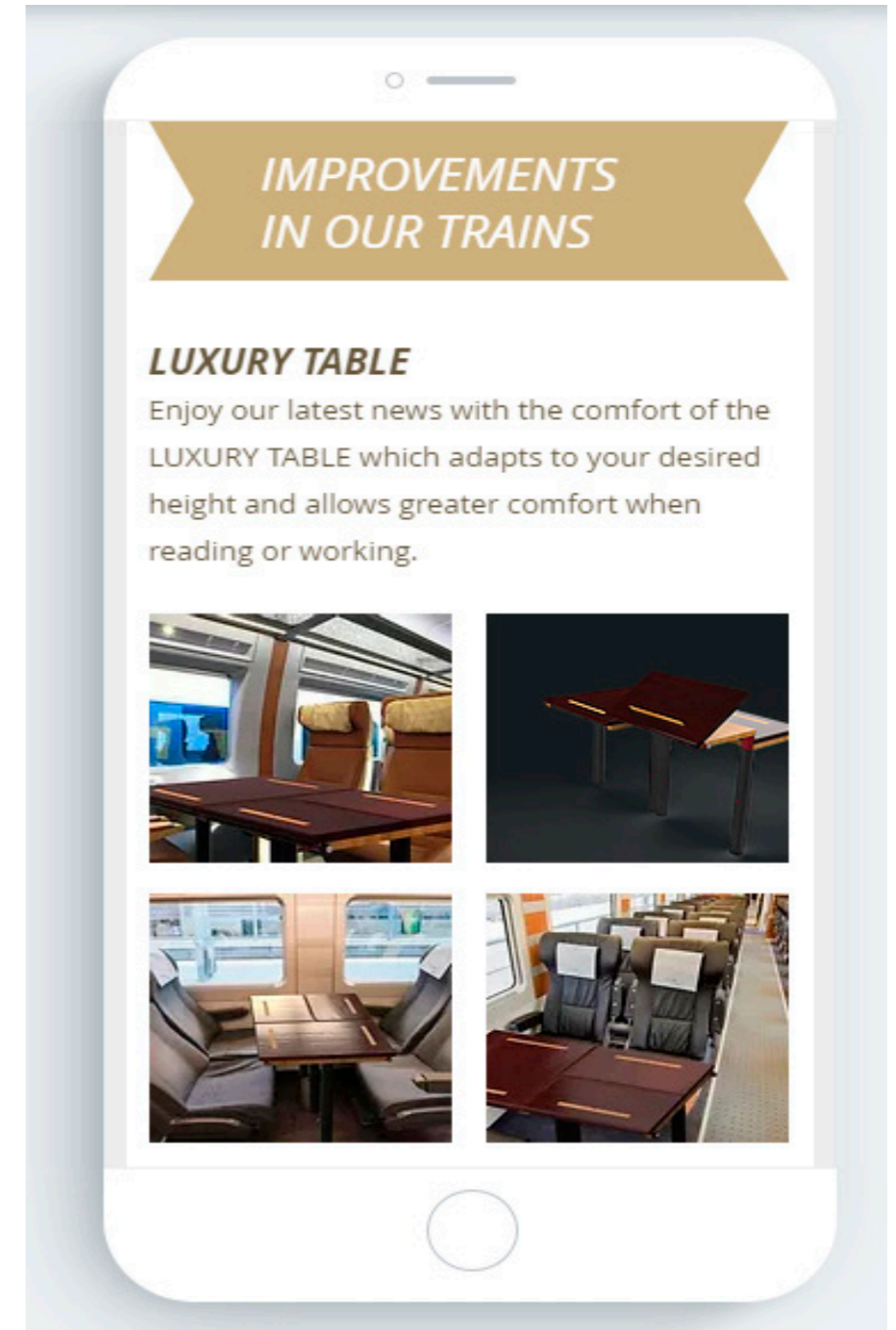
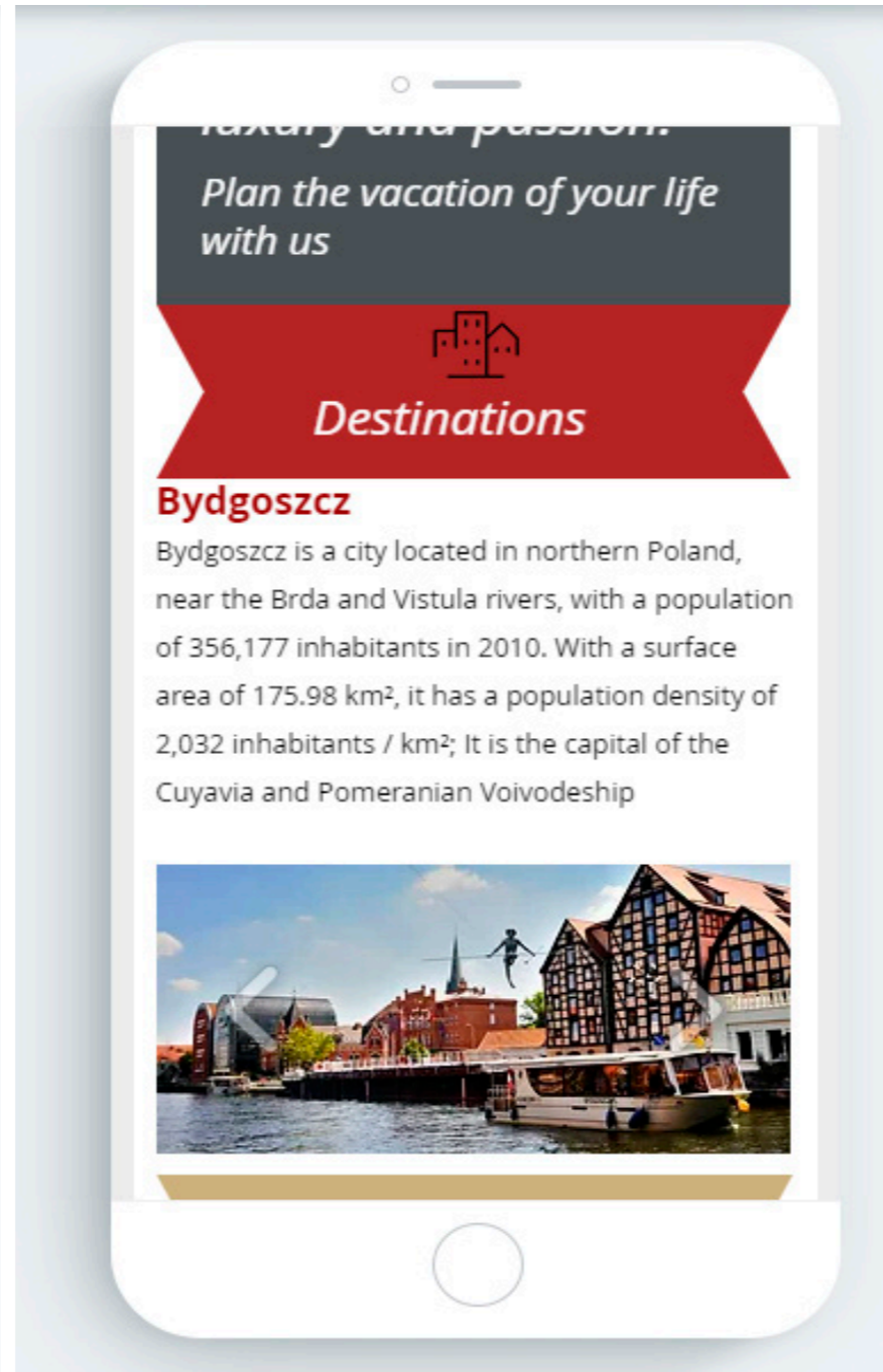
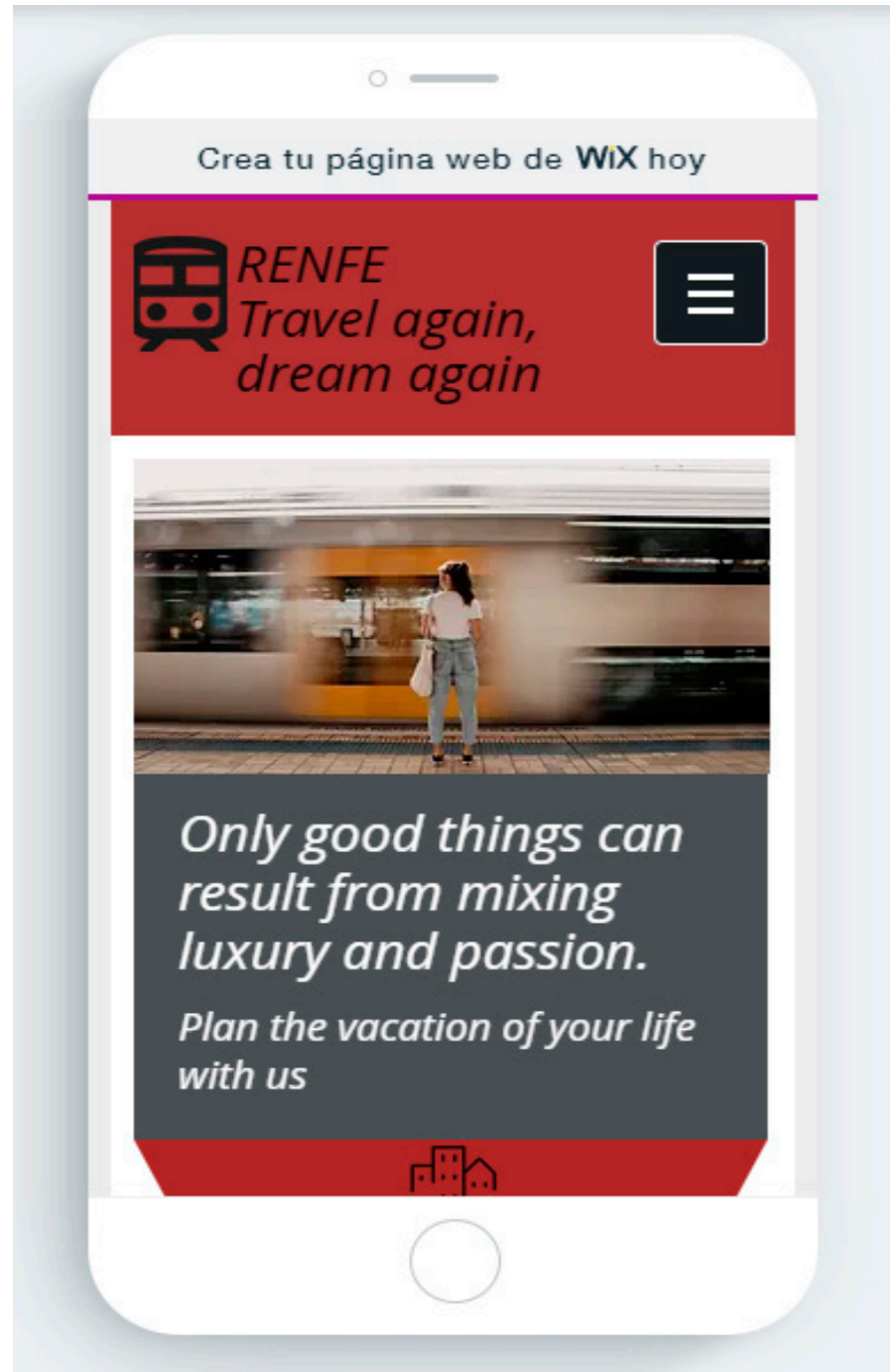


IMPROVEMENTS IN OUR TRAINS

LUXURY TABLE

Enjoy our latest news with the comfort of the LUXURY TABLE which adapts to your desired height and allows greater comfort when reading or working.





ANNEXES



Uniwersytet Technologiczno-Przyrodniczy
im. Jana i Jędrzeja Śniadeckich w Bydgoszczy

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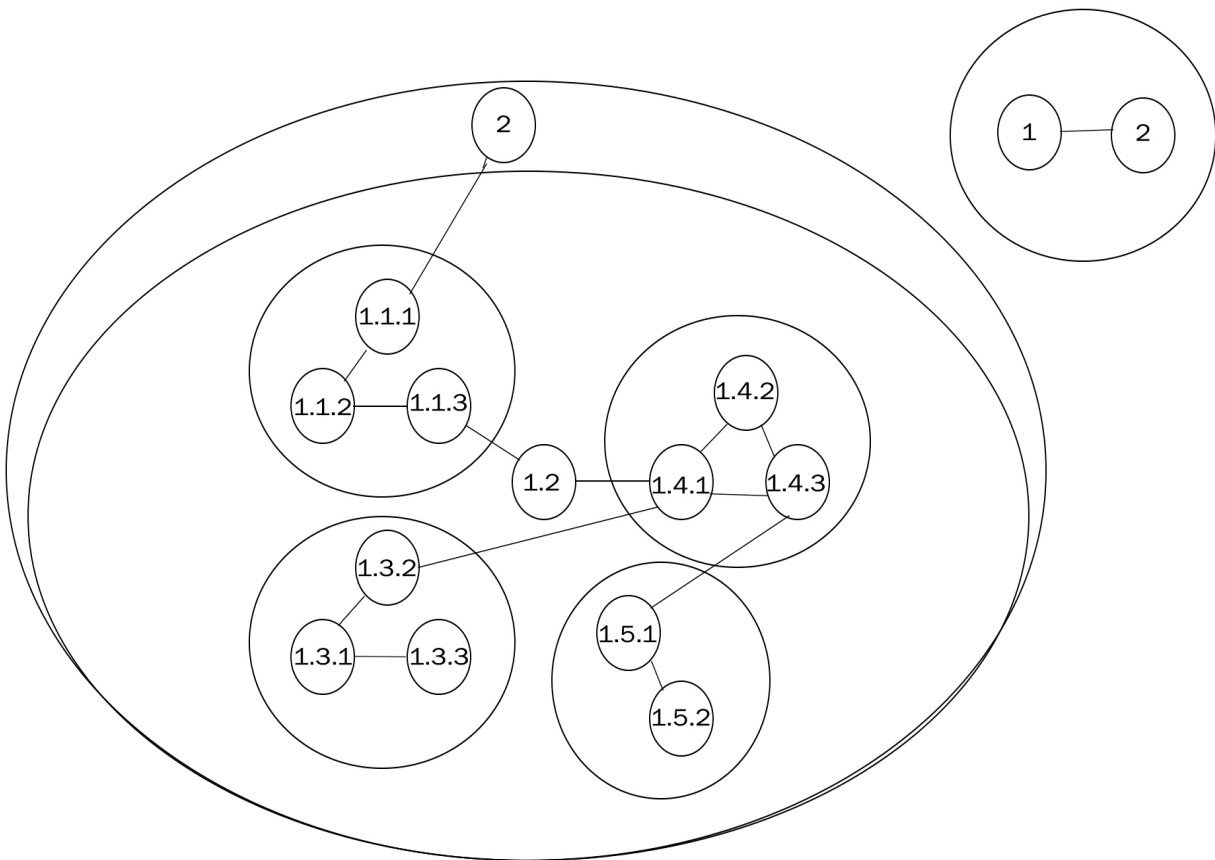
PLAN

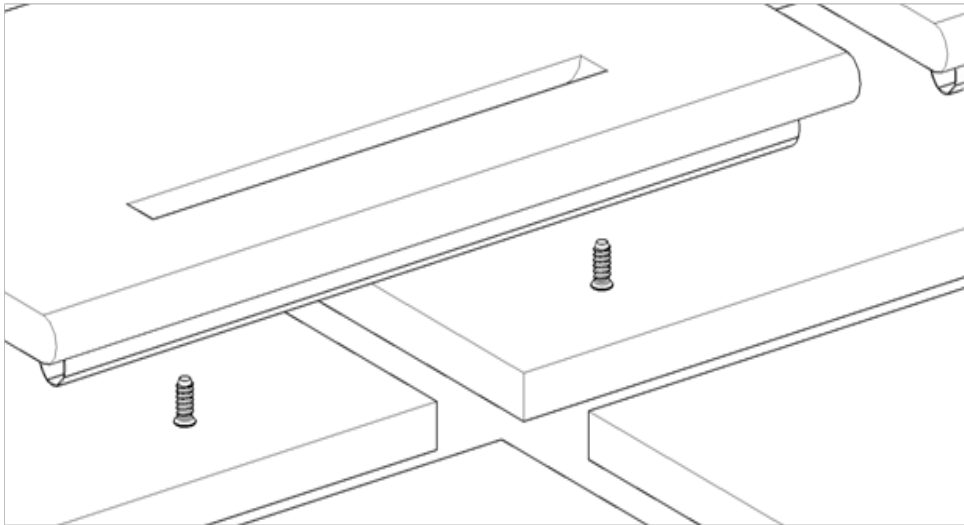
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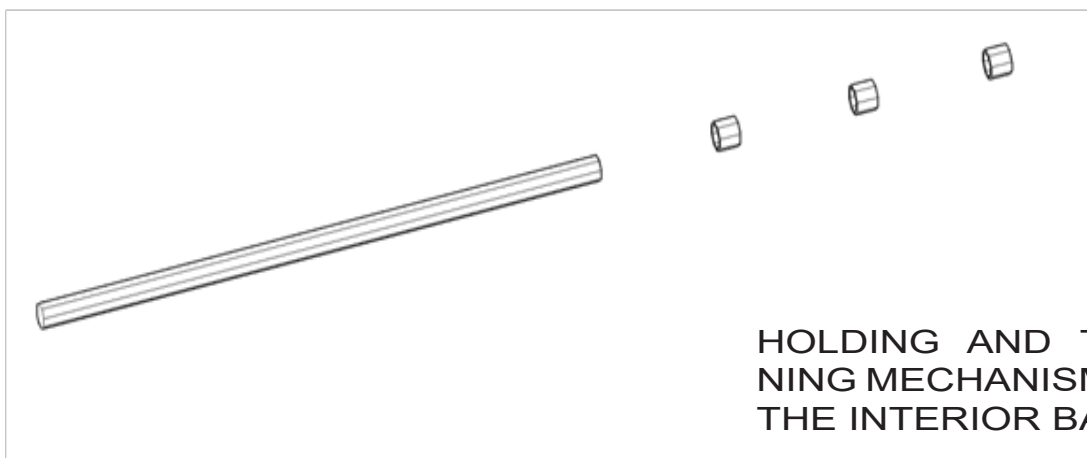
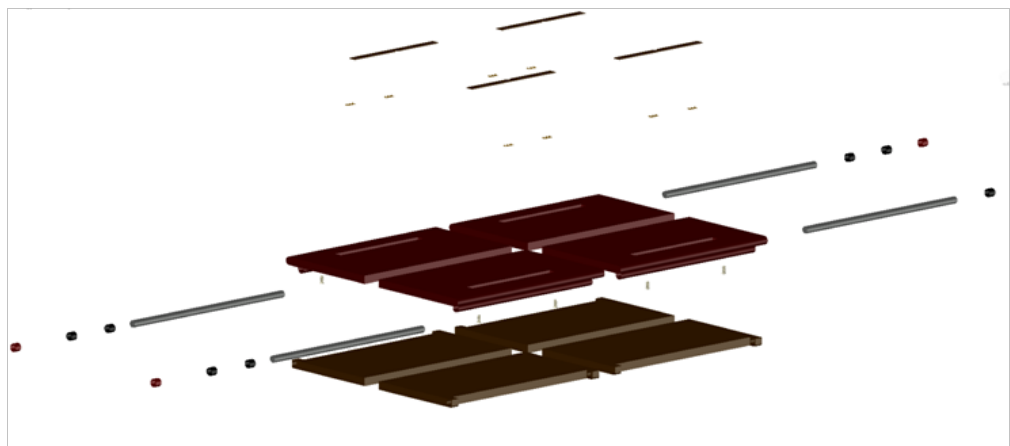
ANNEXES

1. SYSTEMIC DIAGRAM








DETAILS OF THE
CONSTRUCTION OF
OUR TABLE



HOLDING AND TUR-
NING MECHANISM OF
THE INTERIOR BAR

2. MARKET STUDY

MODEL	
COMPANY	Rocada
WEB	https://www.amazon.es/DIBUJO-ROCADA-RD-190-ARMAZON-TAMA%C3%91O/dp/B07CQS5TGS/ref=pd_sbs_201_2/261-4776570-9098920?encoding=UTF8&pd_rd_i=B07CQS5TGS&pd_rd_r=2a114e63-e369-40e9-b197-81b05a3b6cda&pd_rd_w=sapBE&pd_rd_wg=YE3ej&pf_rd_p=8e0d0316-fa0d-4a75-b68c-17be1e5e1b5a&pf_rd_r=TYA69HYQGZ9D7YFD7J8W&psc=1&refRID=TYA69HYQGZ9D7YFD7J8W
NUMERO DE SERIE	234524
DIMENSIONS	Tamaño 90x81 cm.
PRICE	122.50
MATERIAL	Metal y plastico
CHARAT.	Mesa de dibujo de la marca Rocada para estudiantes. Estructura de metal para trabajar con tableros o tecnigrafos pequeños. El tablero se puede regular en altura gracias a que incorpora un nivelador. No incluye el tablero.
MODEL	
COMPANY	 TALENT
WEB	https://www.actiu.com/es/muebles/mesas/talent/
DESIGNER	Actiu
DIMENSIONS	121 x 68 x 9
PRICE	248.50
MATERIAL	Todos nuestros tableros de melamina incorporan de serie una certificación 0% formaldehído
CHARAT.	Talent es un sistema de mesas móviles, abatibles y elevables que aporta una gran versatilidad a espacios polivalentes. Su calidad y seguridad está respaldada por la certificación alemana GS (Geprüfte Sicherheit).

MODEL



COMPANY

Fashion long tables

WEB

<https://es.aliexpress.com/item/32435786324.html>

DESIGNER

C100-W

DIMENSIONS

1800x800x745mm

PRICE

644.50

MATERIAL

Solid wood

CHARAT.

Fashion long tables folding conference table desk office desk
multifunctional mobile conference tables training tables

MODEL



COMPANY

NRS Healthcare

WEB

https://www.amazon.es/NRS-Healthcare-M66832-regulable-inclinable/dp/B00CU8JPH4/ref=sr_1_51?dchild=1&keywords=mesa+regulable+altura&qid=1590422629&sr=8-51

NUMERO DE

M66832

SERIE

DIMENSIONS

16 x 16 x 53 cm ; 12 Kg

PRICE

109.81

MATERIAL

Madera y acero

CHARAT.

Mesa central inclinable, operada por mecanismo simple con barra de soporte para mantener las cosas en su lugar
2 mesas laterales pequeños, desmontables
Equipado con 4 ruedas con freno para mayor estabilidad

MODEL	
COMPANY	Queraltó Easy
WEB	https://www.amazon.es/auxiliar-ruedas-plegable-color-madera/dp/B072BR57TK/ref=sr_1_17?dchild=1&keywords=mesa+regulable+altura&qid=1590422629&sr=8-17
NUMERO DE SERIE	B072BR57TK
DIMENSIONS	40 x 60 x 70/105 cm
PRICE	43.78
MATERIAL	Madera y aleación de aluminio
CHARAT.	El tablero permite una regulación en altura, longitud en inclinación de hasta 45° para adaptarse a cualquier situación de descanso. Esta mesa auxiliar está compuesta por materiales de gran calidad que aportan resistencia y permiten un uso diario de la misma

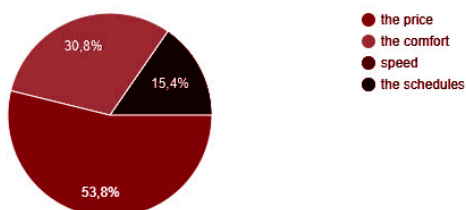
MODEL	
COMPANY	whitelong
WEB	https://decofilia.com/blog/mesas-comedor-decoracion/W07263747GL
NUMERO DE SERIE	
DIMENSIONS	2000x800x700mm
PRICE	252.47
MATERIAL	Plastico y madera
CHARAT.	Estas mesas se extienden arrastrando los extremos y sacando de su interior las piezas que completarán la mesa, que en ocasiones vienen sueltas para colocar sobre la estructura y en otras tienen incorporados sistemas flexibles que se adaptan al hueco de extensión.

MODEL

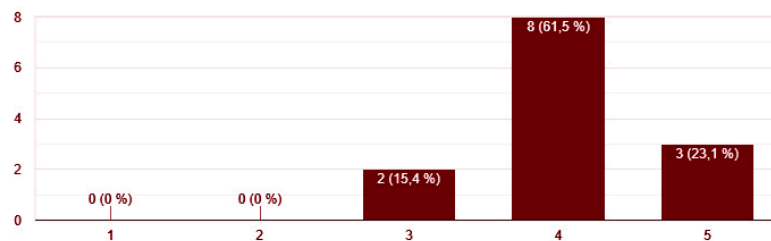
COMPANY	Compesedtable
WEB	https://decofilia.com/blog/mesas-comedor-decoracion/
NUMERO DE SERIE	2350BWY
DIMENSIONS	2000x800x700mm
PRICE	453.48
MATERIAL	Madera reutilizada
CHARAT.	Ideales para espacios pequeños o pisos donde sus habitantes no comen en mesa de comedor (sino en un sofá, por ejemplo), estas consolas-mesa permiten ahorrar espacio la mayor parte del tiempo, abriéndolas únicamente cuando se tienen invitados. Curiosamente, con este tipo de mesas la extensión puede llegar a ser larguísima, consiguiendo hasta 2,40m de media.

3. SURVEY OBJECTIVE DATA

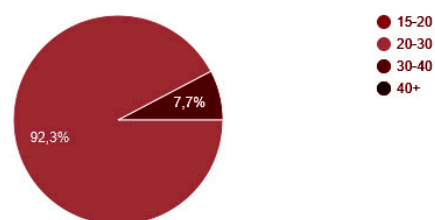
WHEN ARE YOU GOING TO TRAVEL WHAT IS THE REASON FOR WHICH YOU DECIDE THE MEANS OF TRANSPORT?



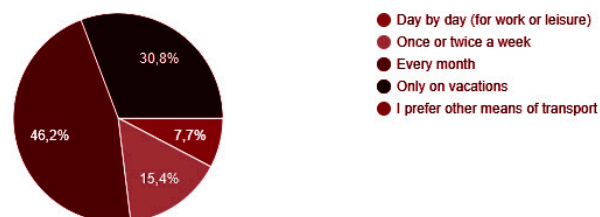
Is comfort an essential aspect of your trip?



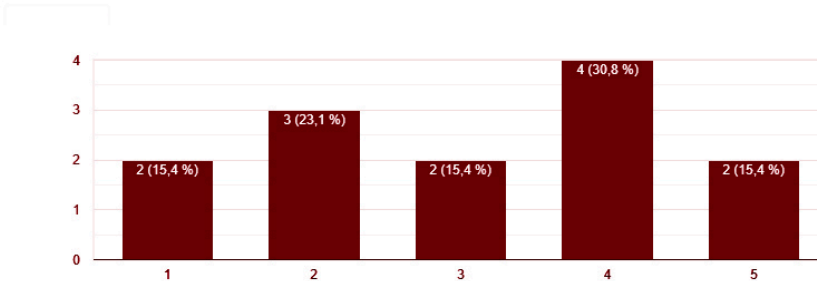
How old are you?



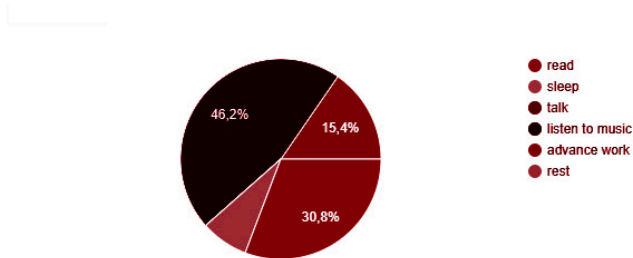
How often you travel by train?



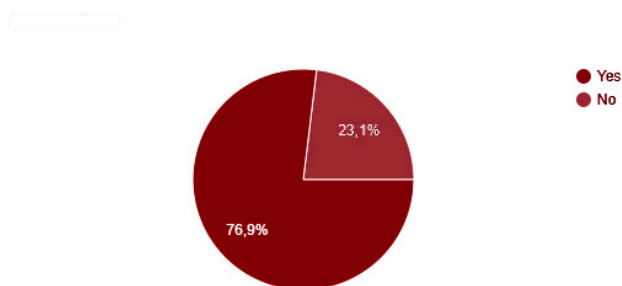
If comfort were better in one form of transport than another, would you mind paying a little more for that comfort?



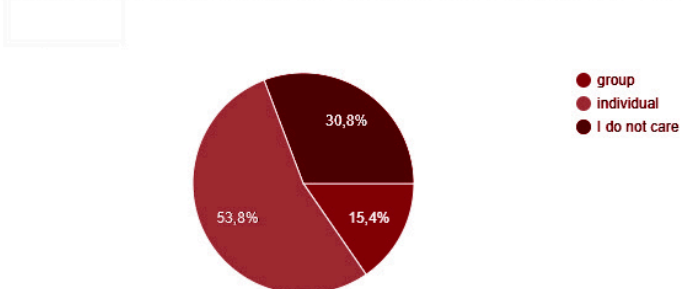
what do you usually do during long distance rides?



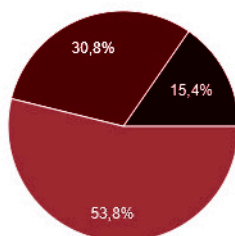
Have you ever been bothered by the height of public transport tables (due to their height, size or mobility)?



When you travel by train, do you prefer seating with a group or individual table?

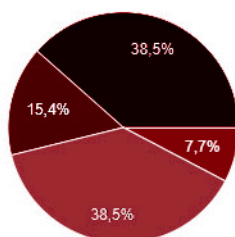


If you need to sleep during the journey, how do you do it?



- I have a travel pillow
- Leaning on the window
- Leaning on the seat
- On the table
- I don't like sleeping on trips

How tall are you?



- 1.50m-1.60m
- 1.60m-1.70m
- 1.70m-1.80m
- 1.80m-2.00m
- 2.00m+

4. MACHINES FOR MANUFACTURE

Tools:

Electric drill

Mace

10mm Wood

Drill Bit Chisel

Drill foot

Sander

keyhole saw

Electric brush

Sheet for wood

Paint gun



4.1 STEP BY STEP

Step 1

The first thing we are going to do is mark the dowels on the ends of the crossbars, using the pencil. This tool is widely used in carpentry to draw parallel cutting lines in reference to an edge or a surface. In the event that you do not have this tool, you can draw the outline of the spikes on the ends, with the help of a square and a pencil.

Step 2

Next, we make the necessary cuts until all the pins are removed. To carry out this task, we will follow the lines marked with the jigsaw and a special blade for wood. We will work more comfortably if we hold the piece to the table with a sergeant.

Step 3

After drawing the boxes on the top of the four legs, we made some holes inside with the drill provided with a wood bit. We will also use the drill stand or the tower, to achieve a better result.

Step 4

We will finish emptying the boxes with the help of a chisel and a hammer.

Due to its effectiveness, the chisel should be properly sharpened. Otherwise, we will not be able to remove the wood well.

Step 5

The next step is to cut some wooden blocks, which will serve as reinforcements. We mark the pieces we need on the triangular ribbon, tie it to the table with the clamp and make the cuts, with the jigsaw and wood blade.

Step 6

Now, we attach the vacuum cleaner to the electric brush, to work with cleaning and we pass the latter over the edges, making uniform movements. If you don't have an electric toothbrush, you can do the job with a manual one.

Step 7

To achieve a perfect finish, we will go over the entire pine surface with the orbital sander and a fine-grit sandpaper. Then, we remove the dust that may have been produced by sanding, with a rag or paper.

Step 8

We also clean the work area with the vacuum cleaner and apply a mounting adhesive, with great initial grip, to the joints. We can now insert the dowels in the boxes.

If necessary, remove the excess product with a piece of paper.

Step 9

When we have assembled the structure, we apply adhesive to the reinforcement pieces and put them on the inside of the crossbars, pressing so that they adhere well.

Step 10

Then we firmly tie the assembly with a strap clamp, until the adhesive hardens. If you do not have this accessory, you can hold the frame of the structure with a rope and tighten the string with a stick.

Step 11

After the drying time indicated by the manufacturer, we dilute a sealing primer with 10% water and apply it to the legs with the help of a paint gun. It is convenient to cover the floor with protective paper or plastic, to avoid staining it.

Step 12

We place the worktop on a flat surface and directly apply a filler varnish using the same tool. In this case, it will not be necessary to previously dilute the product in water, since it comes ready to be sprayed with the gun.

Step 13

When the two products have dried, we mix an acrylic enamel, in this case a grapefruit orange tone, with water and we color the pine structure. Thanks to the electric gun, we can paint all kinds of surfaces in a fast and very comfortable way.

Step 14

Likewise, we varnished the slatted board with an interior varnish, in our case, colorless. When applying the product, you must keep the minimum distance indicated by the manufacturer in the instructions. And, now to wait for both the varnish and the enamel to dry.

Step 15

We will finish the work by attaching the worktop to the legs with specialized screws and the incorporation of the rotation bar.

To do this work, we will use the drill driver provided with a suitable tip.

Step 16:

By means of the rotation bar we connect the mobile part of our table with the lower part.

Step 17:

through extrusion process we make the outer and inner parts of the legs, to the outer part the corresponding holes will be made and then its mechanism.

Step 18:

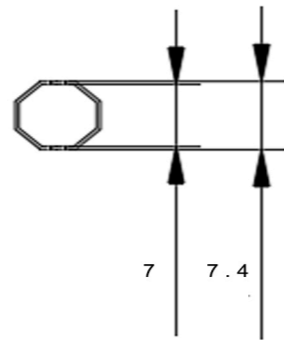
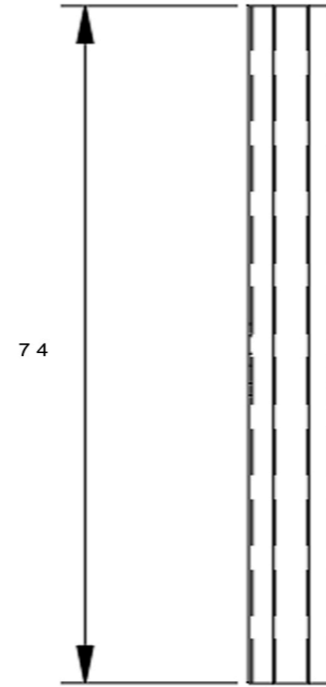
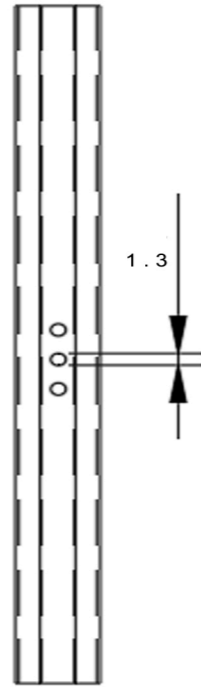
connection of the legs to the ground by means of the corresponding screwing and the inner part of our mechanism to the lower board.




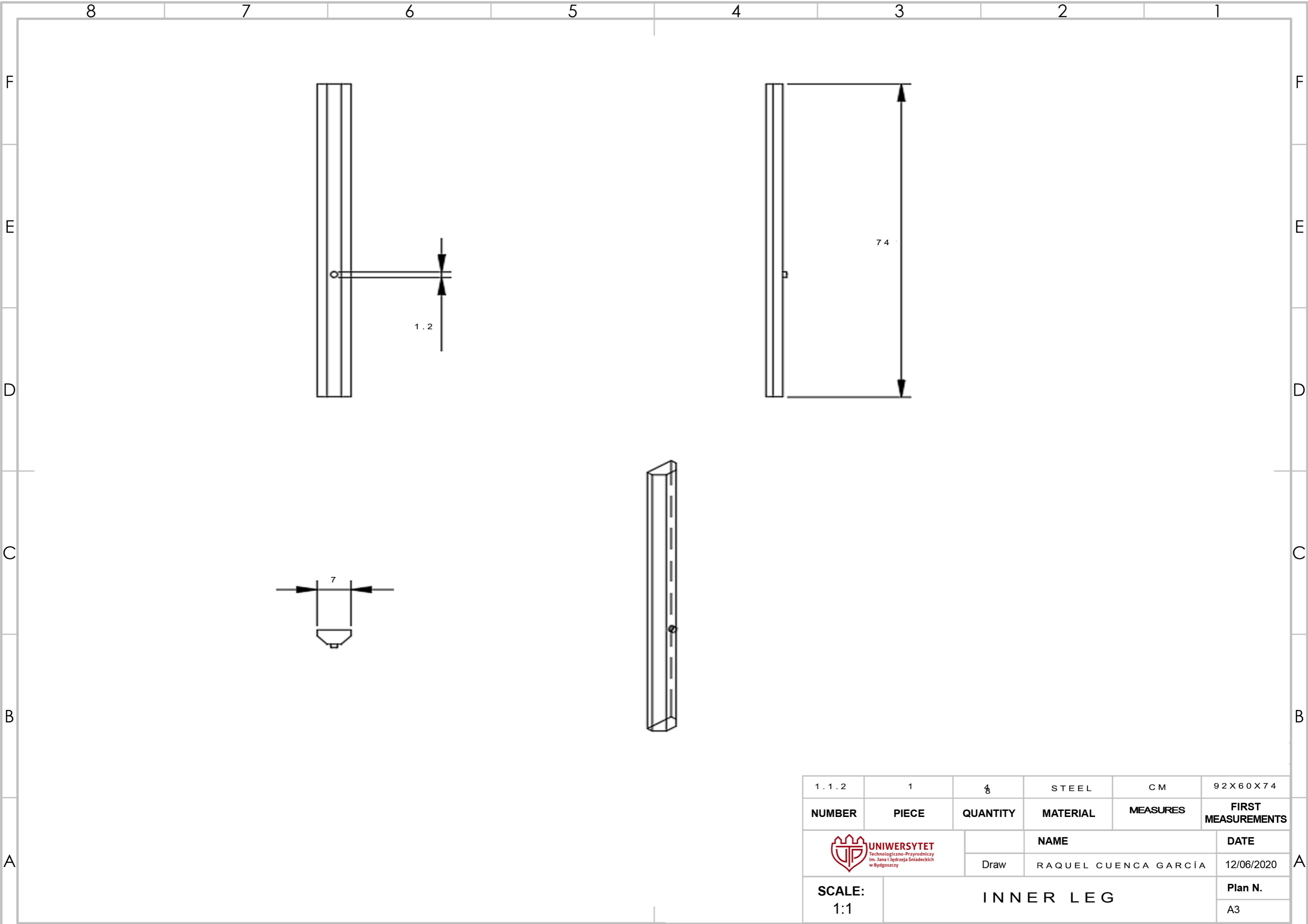
PLANS




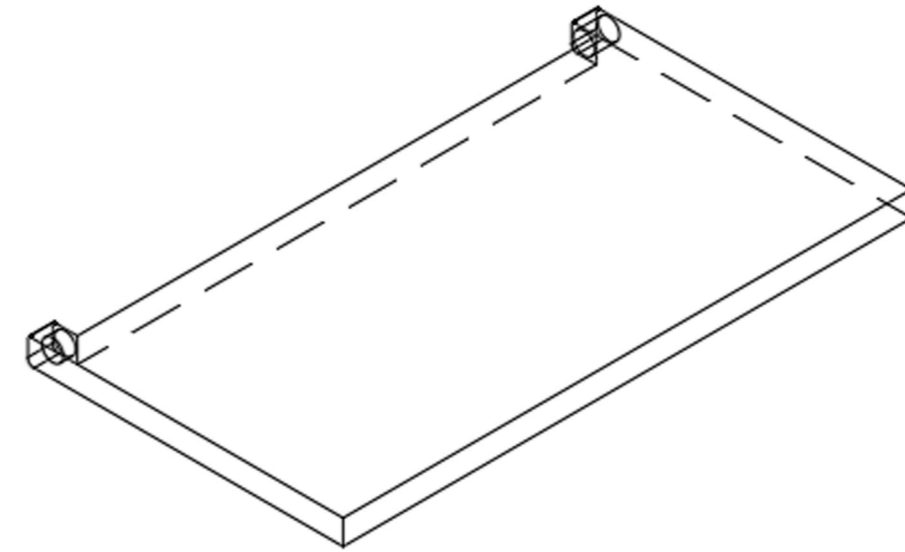
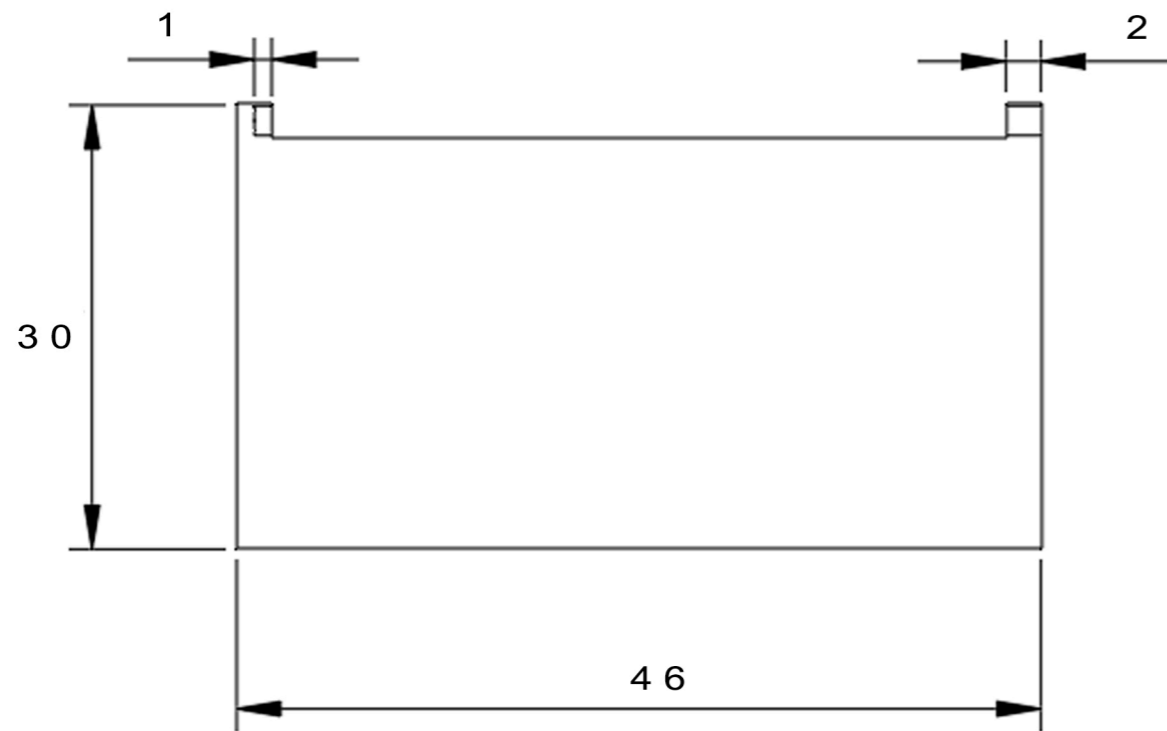
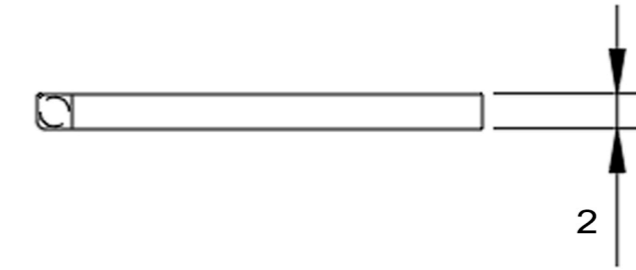
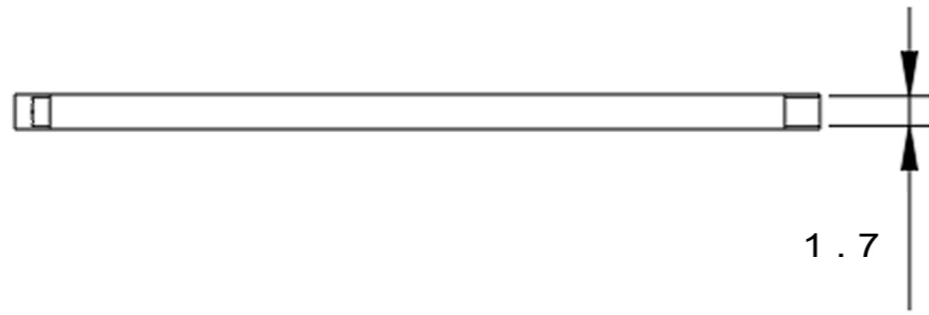
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im. Jana i Jędrzeja Śniadeckich w Bydgoszczy




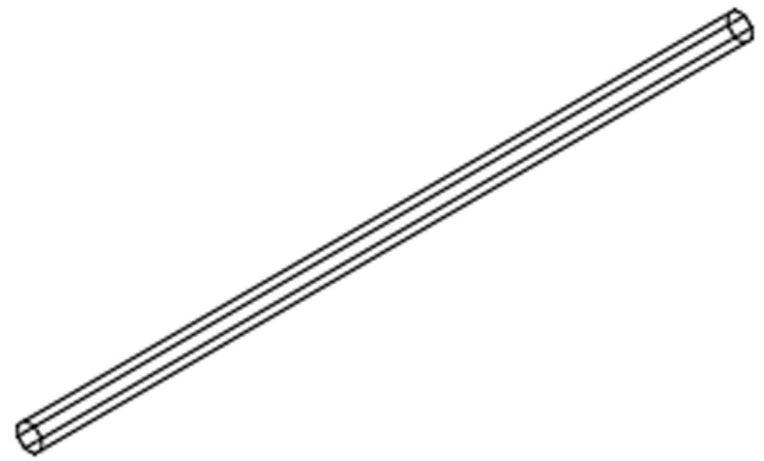
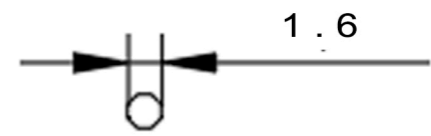
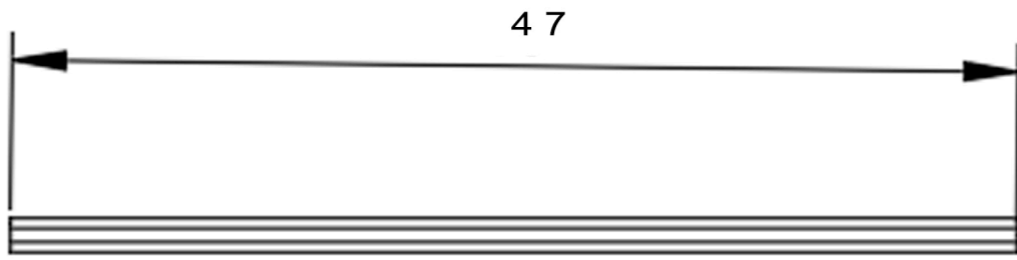
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SCALE: 1:1		EXTERNAL LEG			Plan N. A3




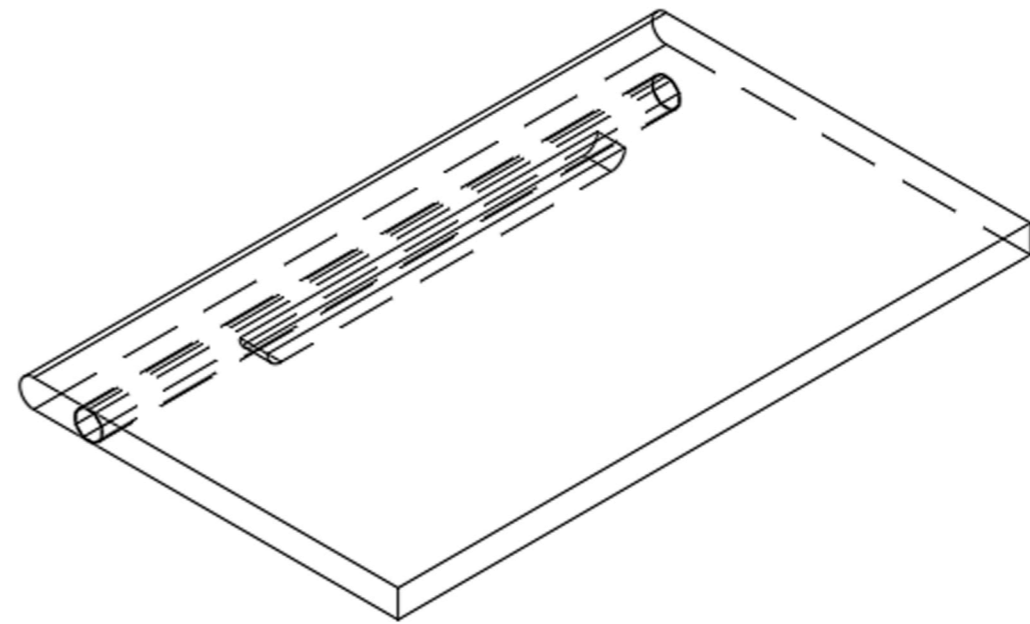
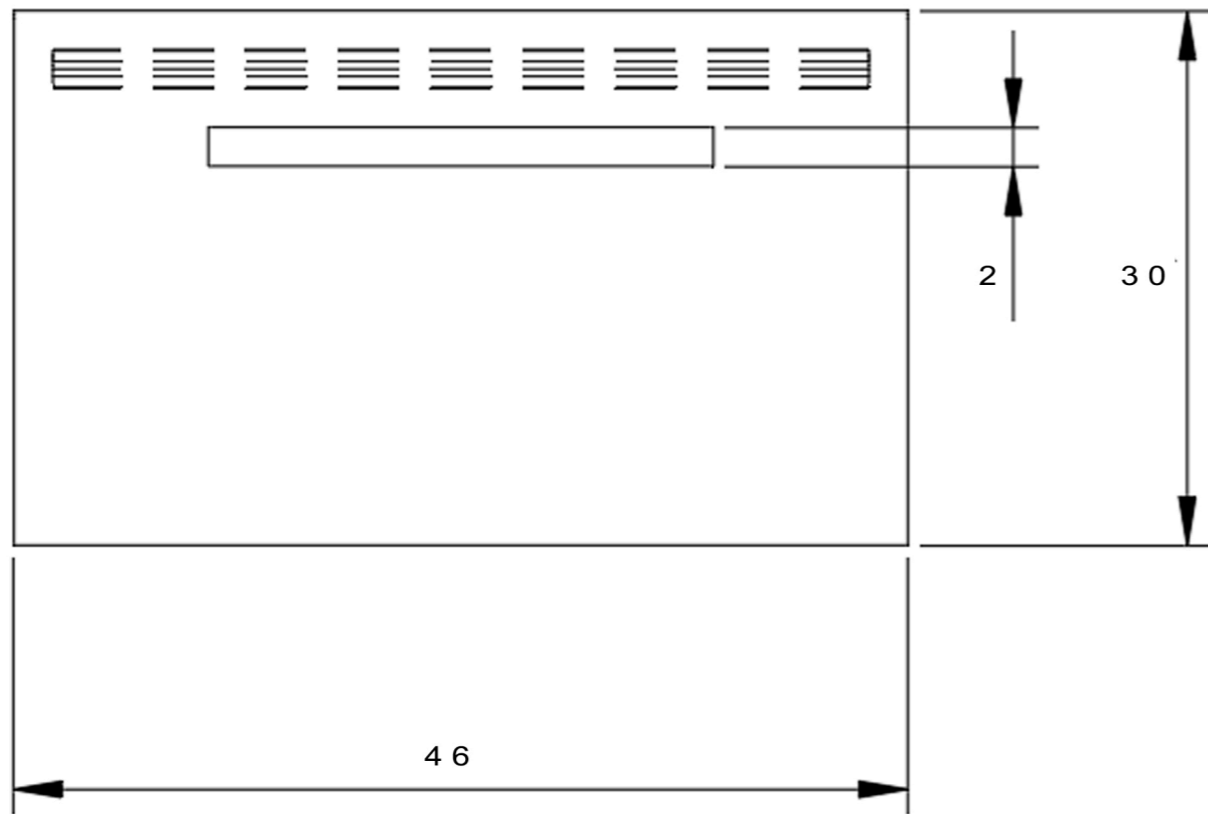
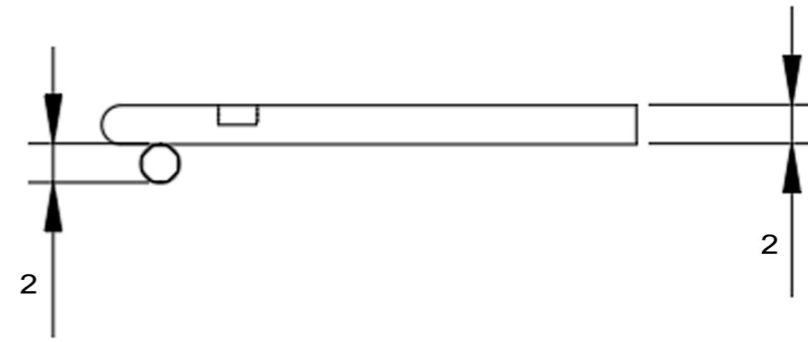
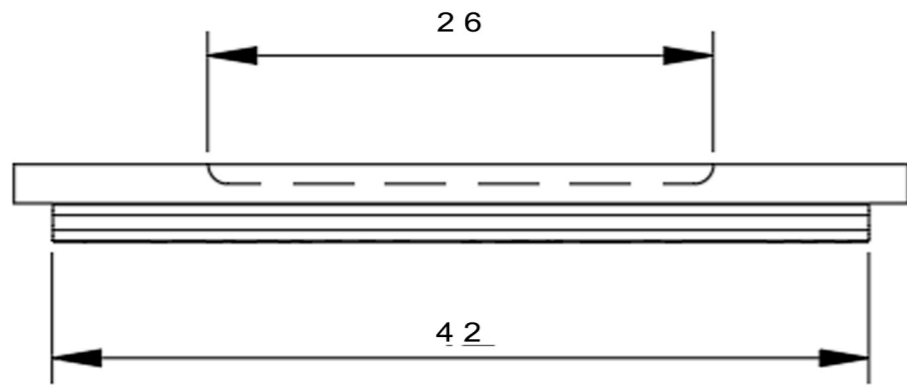
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NUMBER	PIECE	QUANTITY	MATERIAL	MEASURES	FIRST MEASUREMENTS
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			Draw	RAQUEL CUENCA GARCÍA	12/06/2020
SCALE: 1:1		INNER LEG			Plan N. A3




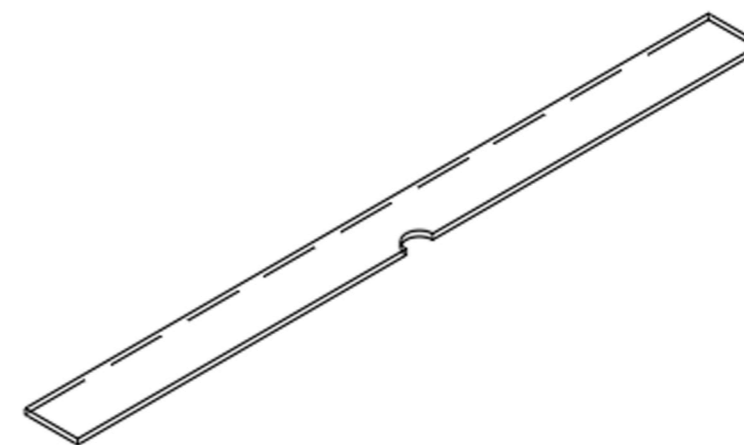
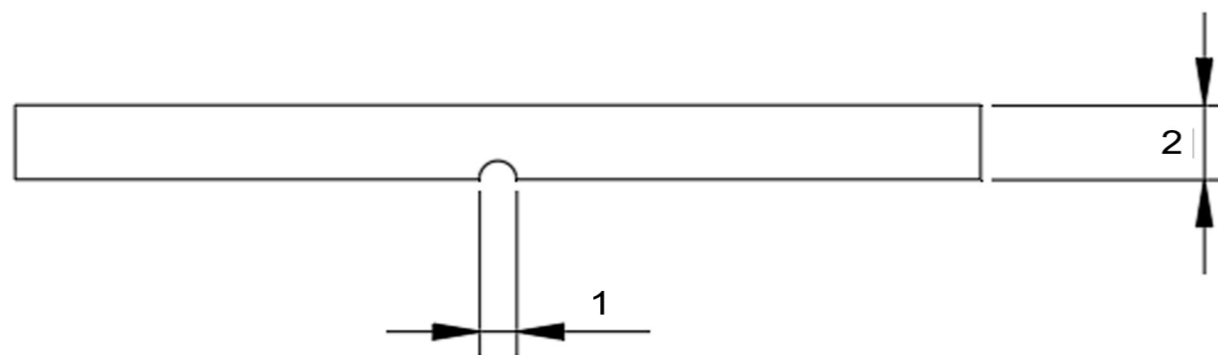
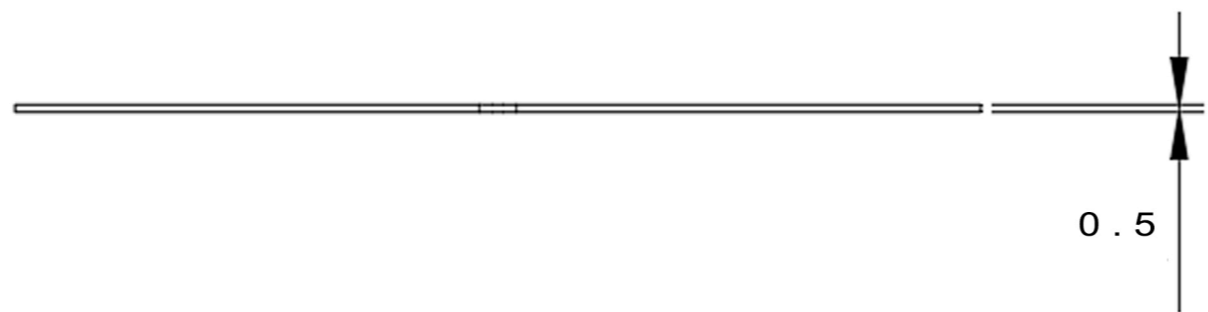
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NUMBER	PIECE	QUANTITY	MATERIAL	MEASURES	FIRST MEASUREMENTS
			NAME		DATE
			Draw	RAQUEL CUENCA GARCÍA	12/06/2020
SCALE: 1:1		LOWER BOARD			Plan N. A3




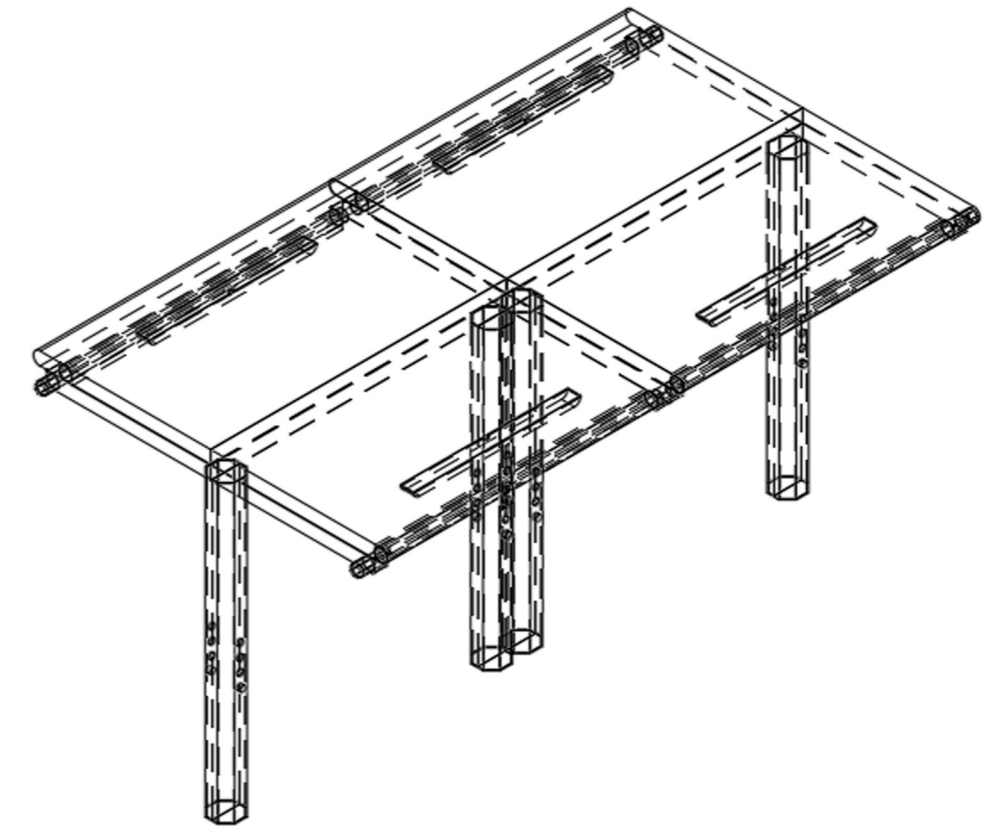
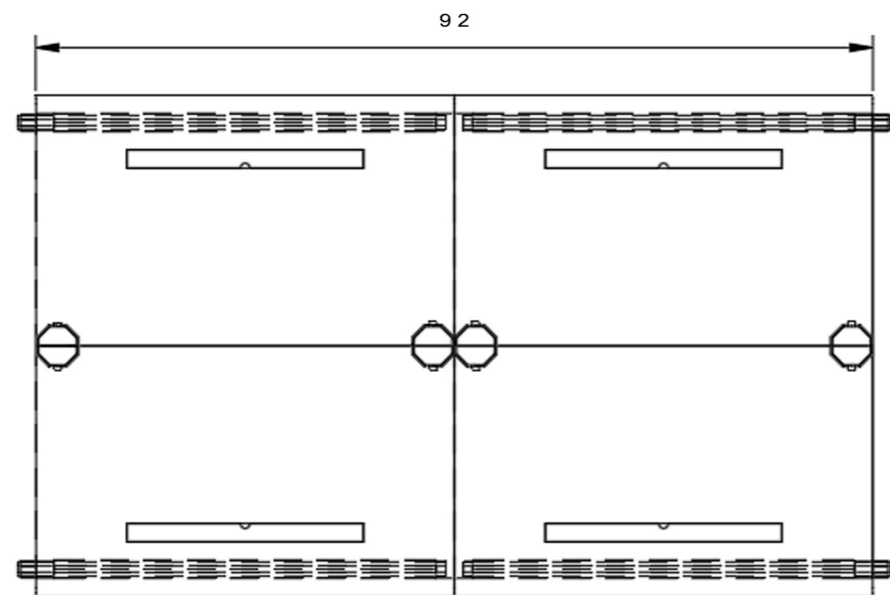
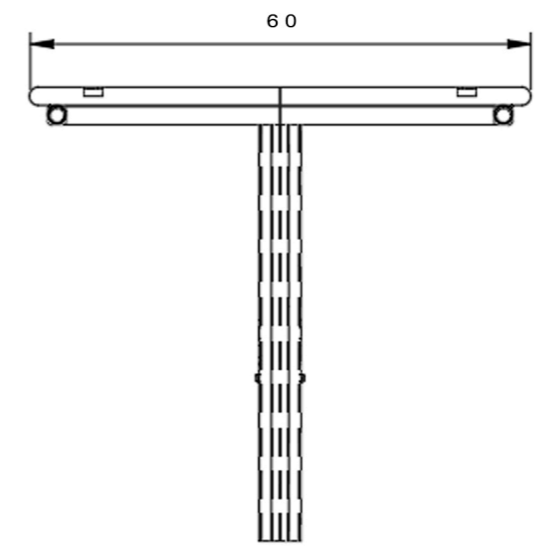
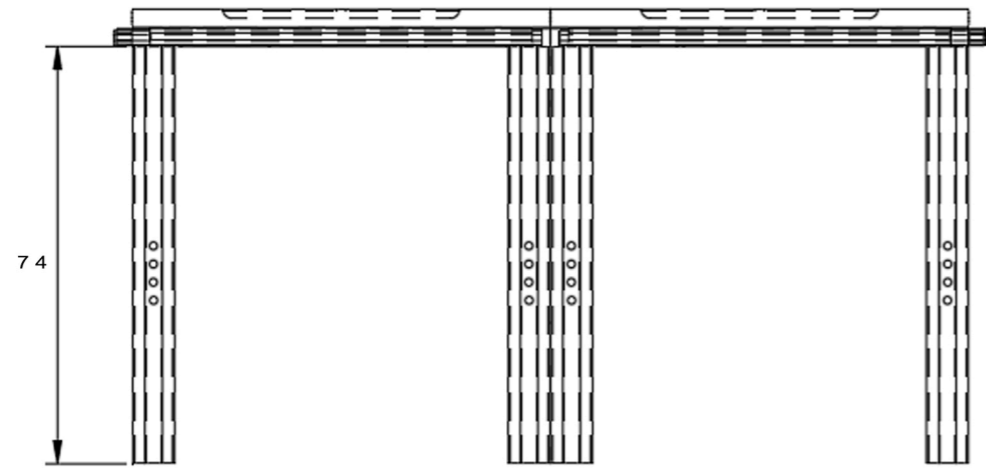
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			Draw	RAQUEL CUENCA GARCÍA	12/06/2020
SCALE: 1:1		ROTATION INTERIOR STEEL BAR			Plan N. A3




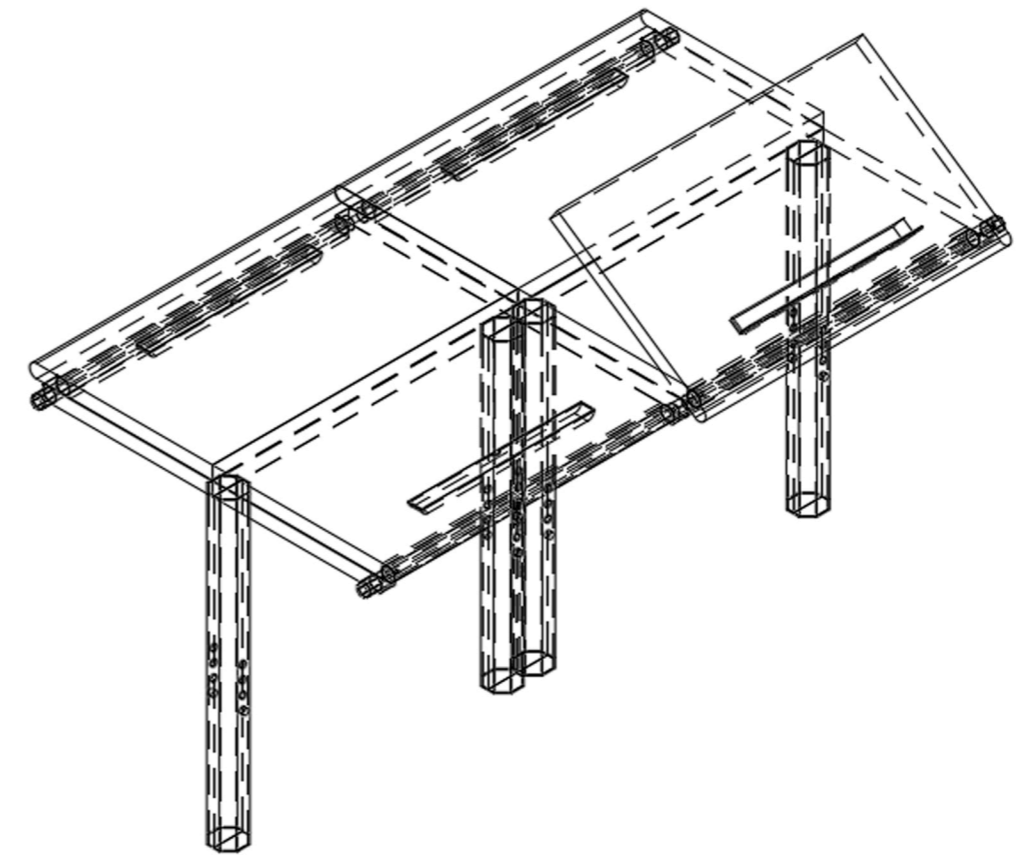
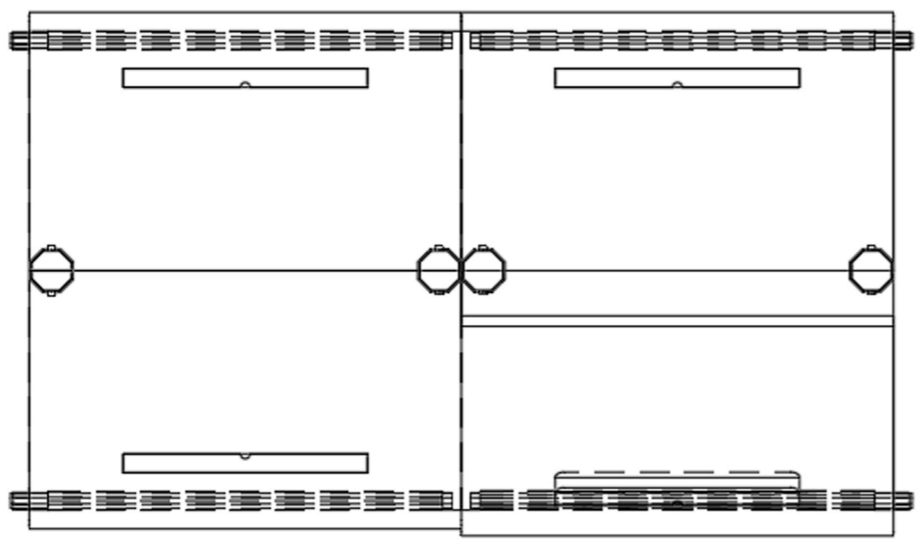
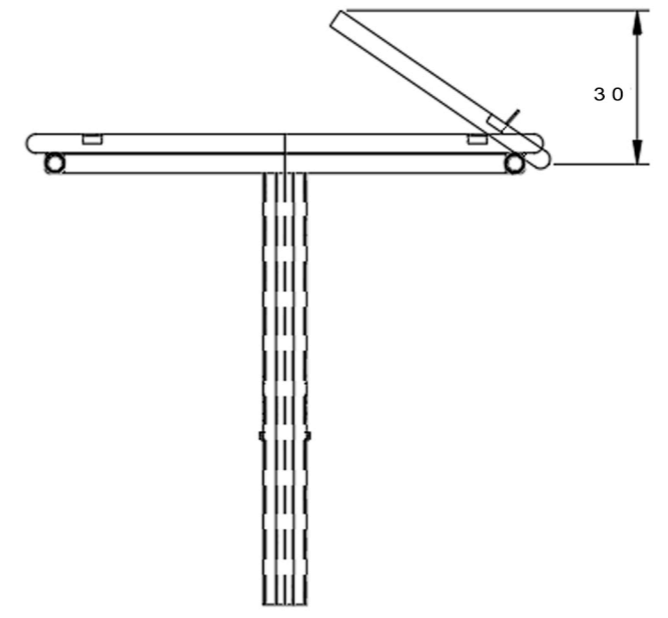
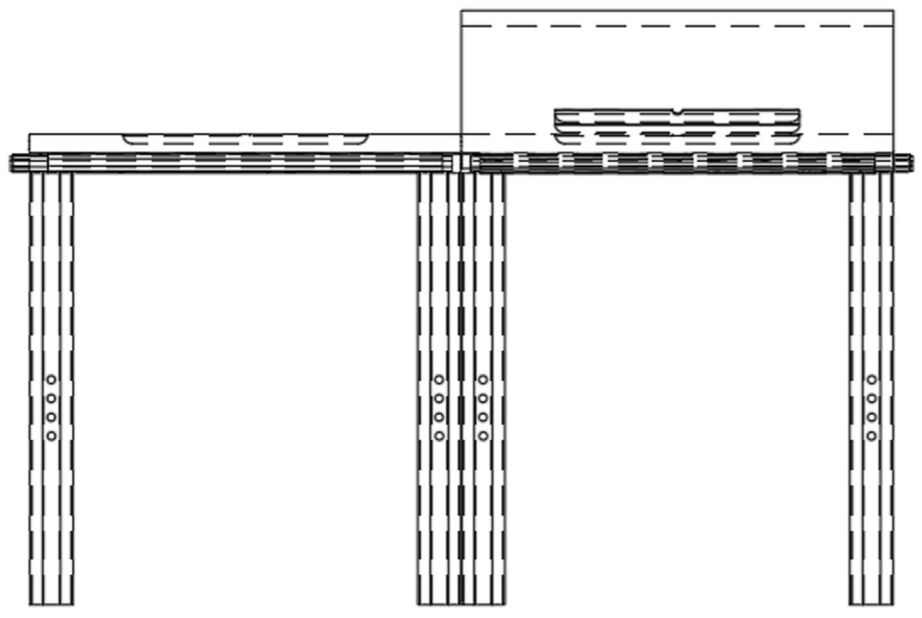
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			NAME	DATE	
			Draw	RAQUEL CUENCA GARCÍA	12/06/2020
SCALE: 1:1	ROTATION WOOD TUBE UPPER BOARD				Plan N. A3




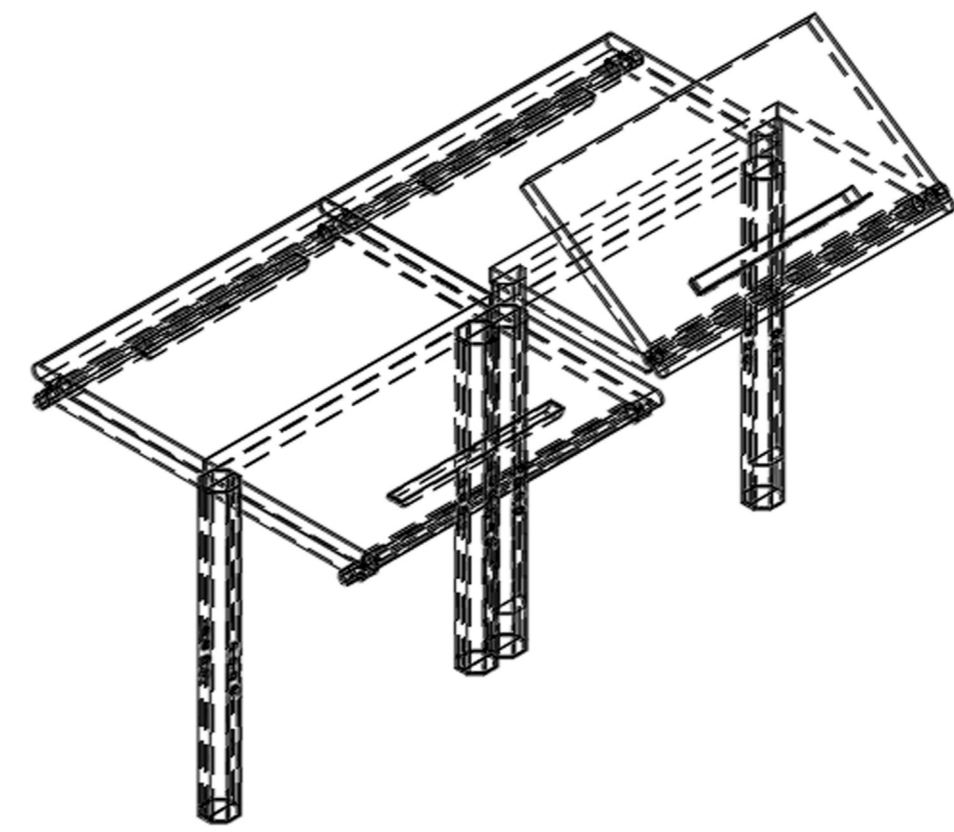
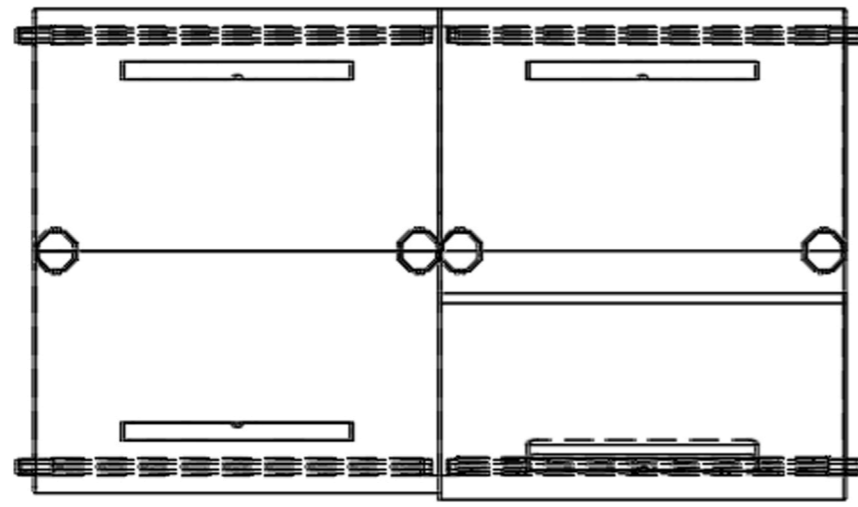
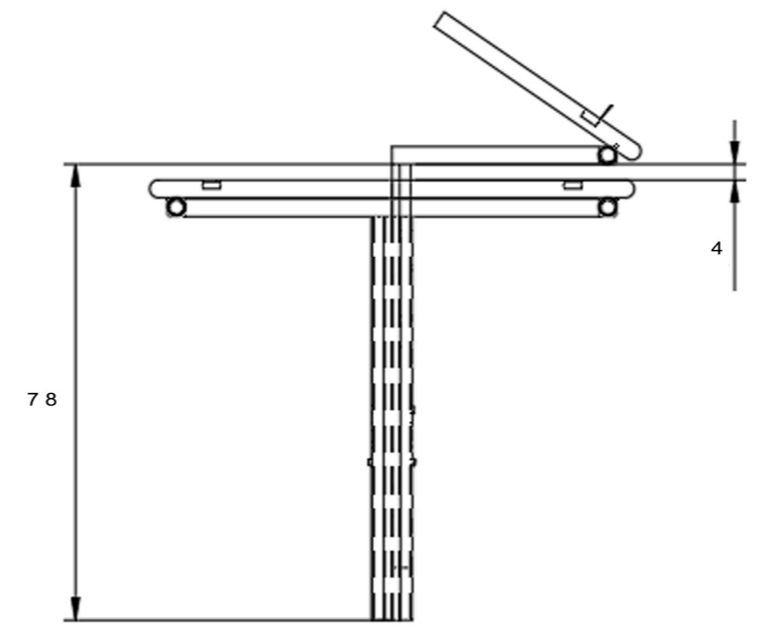
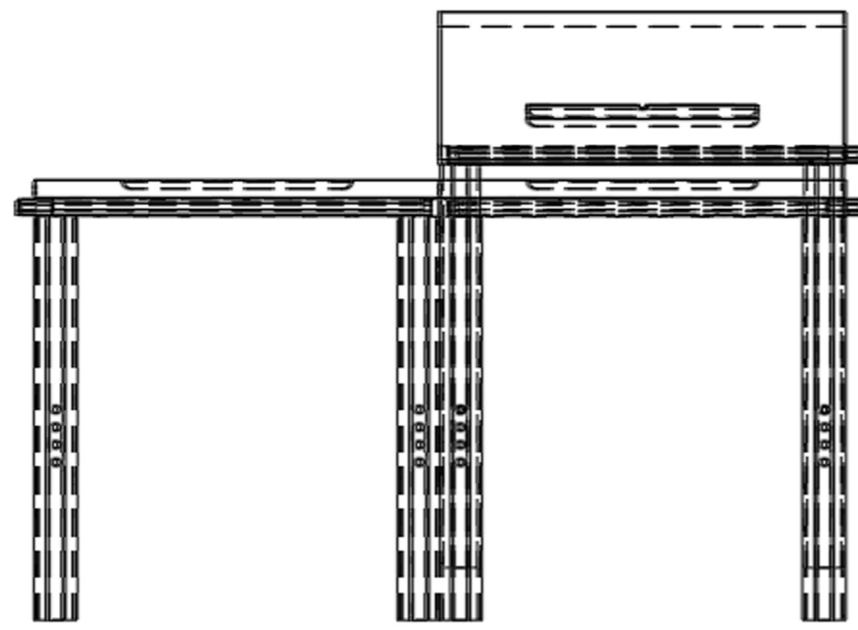
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NUMBER	PIECE	QUANTITY	MATERIAL	MEASURES	FIRST MEASUREMENTS
			NAME		DATE
			Draw	RAQUEL CUENCA GARCÍA	12/06/2020
SCALE: 1:1		COMPLEMENTARY SHEET			Plan N. A3




1	92	1	WOOD AND STEEL	CM	92 X 60 X 74
NUMBER	PIECE	QUANTITY	MATERIAL	MEASURES	FIRST MEASUREMENTS
			NAME		DATE
			Draw	RAQUEL CUENCA GARCÍA	12/06/2020
SCALE: 1:1		TRAIN TABLE POSITION 1			Plan N. A3



2	92	1	WOOD AND STEEL	CM	92 X 60 X 74
NUMBER	PIECE	QUANTITY	MATERIAL	MEASURES	FIRST MEASUREMENTS
			NAME		DATE
			Draw	RAQUEL CUENCA GARCÍA	12/06/2020
SCALE: 1:1		TRAIN TABLE POSITION 2			Plan N. A3



3	92	1	WOOD AND STEEL	CM	92 X 60 X 74
NUMBER	PIECE	QUANTITY	MATERIAL	MEASURES	FIRST MEASUREMENTS
			NAME		DATE
			Draw	RAQUEL CUENCA GARCÍA	12/06/2020
SCALE: 1:1		TRAIN TABLE POSITION 3			Plan N. A3

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