food carriage system
diploma project
bansal j k
industrial design centre

Food Carriage System

Diploma Project

submitted in partial fulfilment of the requirements for the postgraduate diploma in Industrial Design

by

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Bombay
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Approval Sheet

Diploma project entitled

"Food Carriage System"

by Jai K. Bansal is approved for the

postgraduate diploma in Industrial Design.

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All technical staff and numerous unknown workers who contributed valuable data.

My friends.

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PROBLEM STATEMENT

To design a food carrier for carrying lunch for factory and office workers. These boxes have to be carried in large numbers by a third person from the place of filling to the person who eats.

INTRODUCTION

Any container which is used for carrying food can be called food carrier. There can be various types of food boxes depending on their size, compartmentalisation and their mode of carrying. Under this project the food box which is used for carrying food for industrial and office workers, has been undertaken to redesign. These boxes are transported by a third agency from kitchen place to the site of office or industry.

Problem of food carrying has come more seriously the society after industrial revolution. In Bombay city itself, it is more than 30 years old. In Bombay itself there are more 2 lakhs lunch boxes carried daily.

Lunch should be available to man at his place of work during lunch hours. As many industrial sites are away from main city, good hotels or canteens are not situated near the place of work. This necessitates that worker must arrange for his own food and thus giving rise to the evolution of food carrier. As it is difficult to prepare the food very early in the morning and also it is inconvenient for the worker to carry the food box

early in the morning. This brings in the existence of a third force which transports these boxes from the kitchen place to the site.

There are many makes of food boxes available in the market. But one most commonly used is as shown in the photograph. It has outside container of G.I. sheet and inside it contains four compartments of aluminium. This is taken for analysis. Recently one better food box has come in the market which has the same aluminium containers inside and outside container is made of double walled, High density polythene. There is thermocol packing inside the double wall. This box keeps food hot for 5 hours.

DATA COLLECTION

Existing food box was studied and information was collected from following persons:

1. Person who eats
2. Person who fills the boxes and hotel owner
3. Person who transforts:
   a. bicycle
   b. head or hand
   c. railways
4. Railway authorities
5. Persons travelling in the compartment which carries lunch boxes
6. Dealer
7. Manufacturers
8. Ergonomics

Following points were noted after data collection from above persons and from self-study.

1. According to survey an average man requires following different items and spaces

Chapati	-	4 to 8 nos.
Rice	-	450 cm^3
Curd	-	50 cm^3 to 250 cm^3
Dal	-	200 cm^3 to 400 cm^3
Vegetable	-	150 cm^3 to 300 cm^3
Papad	-	one

Salt, pepper, chatani, butter, ginger, Lamen, salad in small quantities depending on individuals.

2. Food gets cold when it reaches the site.
3. Curd or masala curry erode the aluminium containers of the box.
4. Liquid things spill outside the containers.

5. Outside box gives stinking smell and it is difficult to clean it.
6. There are no plates and spoon in the box.

7. There is no provision for keeping lamen, pickle, chatani, pepper and salad.
8. There is no flexibility to meet the different food habits of people.
9. This box does not provide the soffisticated table ware look much needed by status concious people such as executives.

10. When food compartments are spread over the table they spoil the table.

11. With the present box space in the crate is not utilised efficiently.

12. As the persons who transports are illitrate they use a colour coding system to distinguish the boxes.

13. Mass production techniques can be adopted for manufacture.

14. Present box come in two sizes:

a. diameter - 13.5 cm
   height - 24 cm
   cost - Rs.7.50/unit

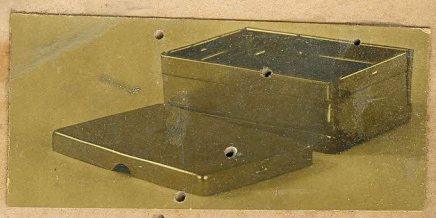
b. diameter - 16.0 cm

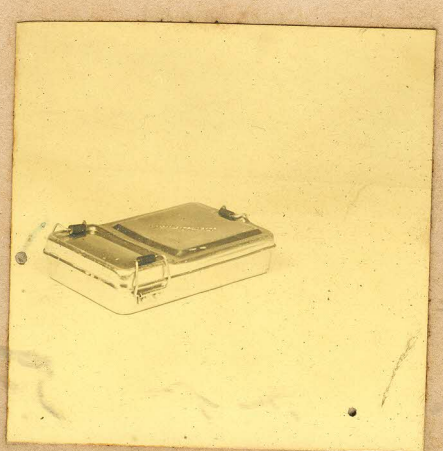
height - 28.0 cm

cost - Rs.9/unit

Other Food Boxes

In metal





In plastics.

ANALYSIS

Structural

Food box consists of three parts,

1. Outer box
2. Lunch container
3. Four wire structure

Outer box:

Material: Galvanised M.S. sheet

Parts

1.1 Cylinder

1.2 Cylinder cover

1.3 Hinge to join cover and cylinder

1.4 Fixture for providing lock

1.5 Two fixtures for handle wire

1.6 Handle wire

1.7 Wooden handle inserted on the wire.

Cylinder is covered on the bottom.. Cover rests on the cylinder with a hinge.

Lunch container

Material: Aluminium

Process: Deep drawing

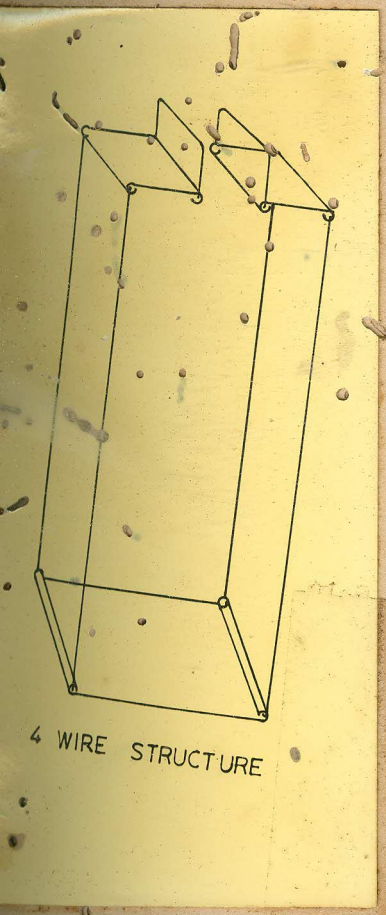
Parts

2.1 Upper container

2.2 Cover

2.3 Two middle containers

2.4 Lower container.



4 WIRE STRUCTURE

Four wire structure

This structure is held around the sub parts of lunch container. It consists of:

3.1 Bottom metal plate

3.2 Two top metal plates

3.3 Connecting wires

Functional

a. Mechanical

1a. To provide protection:

Protection includes chemical and physical both. There should not be any change in the chemical nature of food while transporting. So the material of food container should not have any chemical reaction with the food.

Physical protection means that no tempering should be possible. Also no foreign material should mix with the food.

2a. To retain heat:

Temperature of food kept in the box should remain nearest to the temperature when it was packed. During cooling of the food water droplets condense on the inside wall of outer container. These droplets can mix with the food or hamper the carrying work. In such a case

provision should be made to contain these droplets.

3a. To retain compartmentalisation:

This means that different constituents of food should not mix witheach other. For example curd should not get mix with chapati or rice should not mix with vegetable. Also the different constituents should not spill outside the compartment in which they are packed. So the compartments for liquid things should be tight enough to prevent leakage.

4a. To accommodate complete food:

Box should contain all the necessary food requirements of the person. There being widely different food habits of people it is not possible to meet the requirements of all people. So the box design should a large span of society for which it is meant.

As far as possible box should keep things in a proper and most suitable way. For example chapatis should not be folded many times and lamen should not be pressed inside the chapatis etc.

5a. Portability:

Also stacking the boxes into crates and bags should be possible for transportation. It should be possible to transfer the food boxes to one crate to another rapidly. It should be enough rigid to withstand rough handling.

Ergonomics considerations

Filling:

While filling all the elements of the box have to be kept separate and they occupy too much space making it difficult to move hands freely for filling.

As the bottom of the box is flat there are chances of dust sticking to it if table is not clean. While assembling this dust will mix with the food in another box coming below it.

Four wire structure has plates with sharp edges which can hurt the hand while cleaning.

Transport:

Crate length is six feet which is quite big to transport with manual effort. While carrying crate gets tilted on one side, so possibility of hitting other persons increases.

While transferring if handle goes on the side then the side box has to be removed and then only the box can be taken out.

While carrying on head and bicyle the weight on both sides of the body should be balanced and should not exceed 40 kg. In present circumstances it is normally more than 40 kg.

The crate should be so designed that it can be carried in the most convenient manner. It has been found that carrying on back and shoulders is more efficient in comparison with carrying on head which is presently followed. So the crate should be such as to be possible to carry on back with maximum space utilisation. If crate is carried on head, then crate length should not be more than three times the shoulder width.

While carrying on bicycle lunch boxes can be easily carried in box fitted on the back of specially designed bicycle. Also the boxes can be carried on the bicycle on special carriers fitted to the cycle. (The present method of carrying boxes with the help of hooks and mounting the whole crate on carrier is not efficient and also unsafe).

The crate size has also to conform to gate size and inside dimensions of local train

compartment. The present crate does not conform to this size. It is too long ($6\frac{1}{2}$")

Eating:

One cannot carry all things independently e.g. chapatis are kept inside rice and spoon inside vegetable etc. There is not provision for keeping salt and pepper. They are usually kept inside chapatis folded in a paper. This can get mix with chapatis and thus spoil the taste. Chapatis have to be folded a number of times to keep inside the box.

The box get eroded by curd and curry masala. Moreover there is very less flexibility in box as all compartments are of same size.

Formal and visual

Being a domestic product it should have a attractive look. As shown in the photograph it is very rough looking. It is having many rivets seen outside and projections of handle and lock arrangement do not appear good. Lock arrangement is same as used for big trunks. So the whole outside shape does not look well integrated. Four wire arrangement used inside the box is also very rough looking. Three plates used in this part have sharp edges which is used to hold round boxes with round corners.

Look of the box and containers as a whole do not reflect the clean and tasteful qualities of the contents (i.e. food). After sometime outside container gets rusted and even inside containers of aluminium get eroded by acidic contents of the food. This further spoils the look of the box.

As a third party is involved which carried these boxes in larger number from the fillers to the final destination, a method of distinguishing is a must. Usually this third party consists of illitrate villagers and very few litrate people. So this method of distinction has to be very simple and mostly based on numbers and graphic symbols. In the present box there is no specific place provided for this kind of marking. These carriers mark the present box on complete top surface thus spoiling the box.

Social

Every worker require food at or near his place of work at lunch time. Sometime there is no good hotel near his working place. Also he desires to get food of his satisfaction from place of his choice. To solve all these problems some sort of encloser (food box) is required in which food can be packed and trans-

ported in a systematic way. Those who get their food by lunch box they do not have to go outside in lunch time. Workers working at the same place usually sits on the same table and eat. This increase the contacts between them and thus it helps in the formation of more close social groups.

Those who get these boxes they save the time to travel to canteen or hotel. This time is utilised in playing some indoor games, wherever such facility exists. This box is also utilised by executives who want to maintain a status. He desires a sophisticated table ware look when he spreads out the food contents on table. As pointed out earlier, most of the box carrying persons come from villages and they are illitrate. They hanle the boxes very roughly. So these boxes should be strong enough to withstand rough handling.

Also these people have to use a graphic coding system to distinguish the boxes. So there has to be a system of coding which these people can easily understand. Also with lots of illitrate people handling the box carrying system, new organisation problem is created for railway authorities.

India being a poor country and materials like

steel, brass being scarce, boxes made of these materials are easily stolen. So during desing use of these materials should be avoided.

Finally people desire to look on their boxes to prevent tampering with the food. In the present box there is a provision for locking but people usually do not lock because they feel they can loose the key and then they will have to miss their lunch. This problem can be avoided if they use numbered lock which does not require key.

HYPOTHESIS

1. Consumer

1.1 Food should remain hot for nearly five hours inside the box.

1.2 Spilling of liquid things in food should not be there.

1.3 Dust sticking on the bottom of one container should not mix with the food in another containerf.

1.4 Material of the box should not be effected by curd or curry and also it should be suitable for other foods such as pickle, lamen etc.

1.5 Provision for keeping plate and spoon inside the box should be there.

1.6 There should be space in the lunch box for keeping lamen, pickle, chatani, salt, pepper and salad in the box.

1.7 It should be easy to clean the box.

1.8 Food box should provide some flexibility to meet the food habits of different people.

1.9 Box should provide better table ware look.

2. Transportation and dealer.

2.1 It should be possible to store efficiently inside rectangular crates or boxes.

2.2 It should be easy to carry on person, on bi-cycle and by railways.

2.3 It should not have any sharp edges.

2.4 Box should not be made of any costly material to reduce stealing during transport (brass, steel are usually stolen).

2.5 Trolleys and other system for transport should be very cheap because of least buying power of transporters.

2.6 There should be proper space for putting the coding, on boxes to distinguish them.

3. Manufacturers

3.1 Raw material should be easily available.

3.2 Processes involved in production should be easily available.

3.3 Introduction in the market should be easy. It should be possible to introduce in the market with least risk.

SYNTHESIS

Synthesising the different problems relating to;

1. Consumer

1.1 By keeping insulation packing with outside container food can remain hot for more than five hours. For this purpose outside container has to be made of double wall. Insulation can be either thermocol, glasswool or saw-dust. Of these thermocol gives maximum insulation in minimum thickness.

1.2 Spilling can be prevented of there are tight lids covering the compartments. Also by proper pressure from top on the lid can also minimise spilling.

1.3 By having seperate lids for each compartment dust on bottom of one compartment will not mix with the food in the other compartment.

1.4 If we use anodised aluminium, plastics or ceramics then curd or any other acidic food will not be spoiled.

1.5 Plate and spoon can be accommodated by increasing the size of the box slightly.

1.6 For keeping salt, pepper and salad one compartment can be seperately designed

for this purpose.

1.7 Easy cleaning requires that generous curves should be there with no sharp edges.

1.8 For internal flexibility all compartments should not be of same size. They can be made in two or three different sizes.

1.9 Better table ware look can be achieved by giving proper shape and choosing plastics or ceramics for containers.

2. Transportation and dealer

2.1 For efficient storing in rectangular boxes, box should have rectangular shape

2.2 For easy carrying boxes should be light. For lightness we should avoid ceramics and also metals like steel, brass etc. Also different boxes when packed in bag or a crate, should not create noise. This can be avoided with rectangular shpae as written in 2.1.

2.3 In the present box there are sharp corners in the four wire structure part no.3. This can be avoided by opening the box on the side thus eliminating the need for this wire structure.

2.4 As metals like brass and steel are scarce boxes made of these metals are stolen very easily. So we should not use the above metals.

2.5 As the box carrying persons are very poor they cannot afford to buy costly trolleys and other things for transport. So trolleys have to cheap and simple.

3. Manufacturers

3.1 To ensure easy availability of raw material use of imported and scarce material such as stainless steel, copper etc. should be avoided.

3.2 For easy processibility and mass production plastics are best suitable.

3.3 If it is possible to make the box initially by vacuum forming or by some cheap process, it can be introduced with less risk.

DESIGN DEVELOPMENT AND DECISION.

Heat insulation

To provide heat insulation either the different compartments can individually insulated and then all compartments clamped in a outer frame or a outside container can be used which will provide insulation and also protection to all compartments. Also it will act as outer frame with handle and lock. In the former idea big size of the plate and spoon will not be possible to accommodate. Considering these points it has been decided to go in for seperate outside container for the compartments. This container is double walled and has thermocol packing inside.

Shape

As already pointed out in hypothesis that for better space utilisation and efficient transportation, box should have rectangular shape. The shape of the box has been decided rectangular of size 12 x 14 x 22 cm with 12 x 14 cm as base. If we choose more base and less height then number of boxes stored in a single layer in crate will be less and transport boys store in single layers only for easy exchange of boxes at

junction points.

Side opening

Outside container opens on the side so that it becomes easy to take out different food compartments and also it provides slight pressure from side and top so as to minimise the spilling. Handle and lock are integrated with the box itself.

Material selection

For proper material to be used following qualities are required,

1. No chemical reaction with food
2. Light
3. Easy availability
4. Cost
5. Suitable for mass production.

Considering the first requirement only, any one of the following materials can be used:

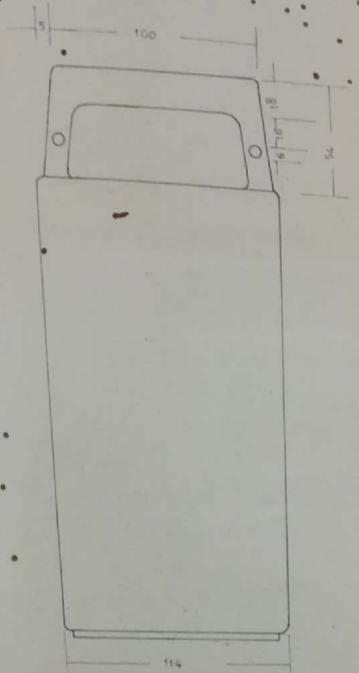
M1. Stainless steel
M2. Plastics
M3. Anodised aluminium
M4. Aluminium with plastisol coating
M5. Ceramic
M6. Double container, outside container of metal and inside of polystyrene.

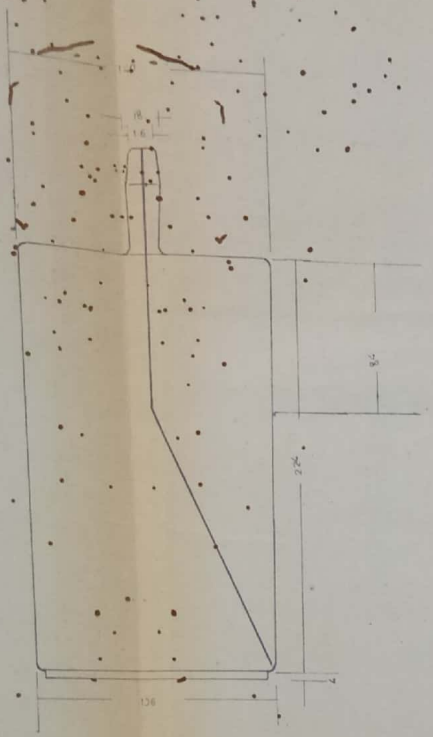
Considering the rest four requirements plastics seem to be most suitable. Among plastics, polythene, or polystyrene, or polyproplene, or melamine can be used for food packing. Melamine is very costly and polystyrene develop cracks very easily. Choosing among H.D. polythene and polyproplene, latter is better in strength and ageing properties. Also H.D.P. is comparatively very poor in abrasion so it starts collecting dust in surface fibres after some time. So polyproplene is the most suitable material for the box.

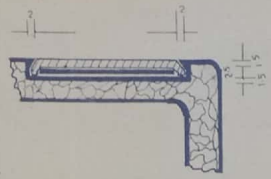
Inditial introduction

Initial introduction requires minimum risk on experimental basis. Initially outer containers can be made in metal with double wall and insulation in between. It does not require any investment in dies and special tools. Also it will require very slight change in design viz. hinge and handle.

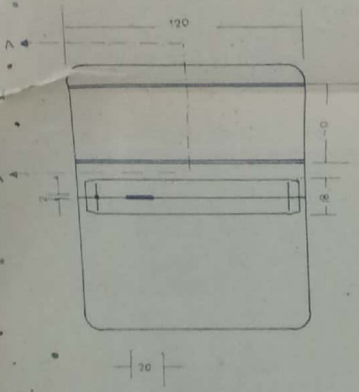
Inside containers can be made by vacuum forming requiring very less initial investment.







SECTION AT A-A



ITEM	DESCRIPTION	MATERIAL	NO-OFF
1	OUTER BOX	POLYPROPLENE	1

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OUTER CONTAINER

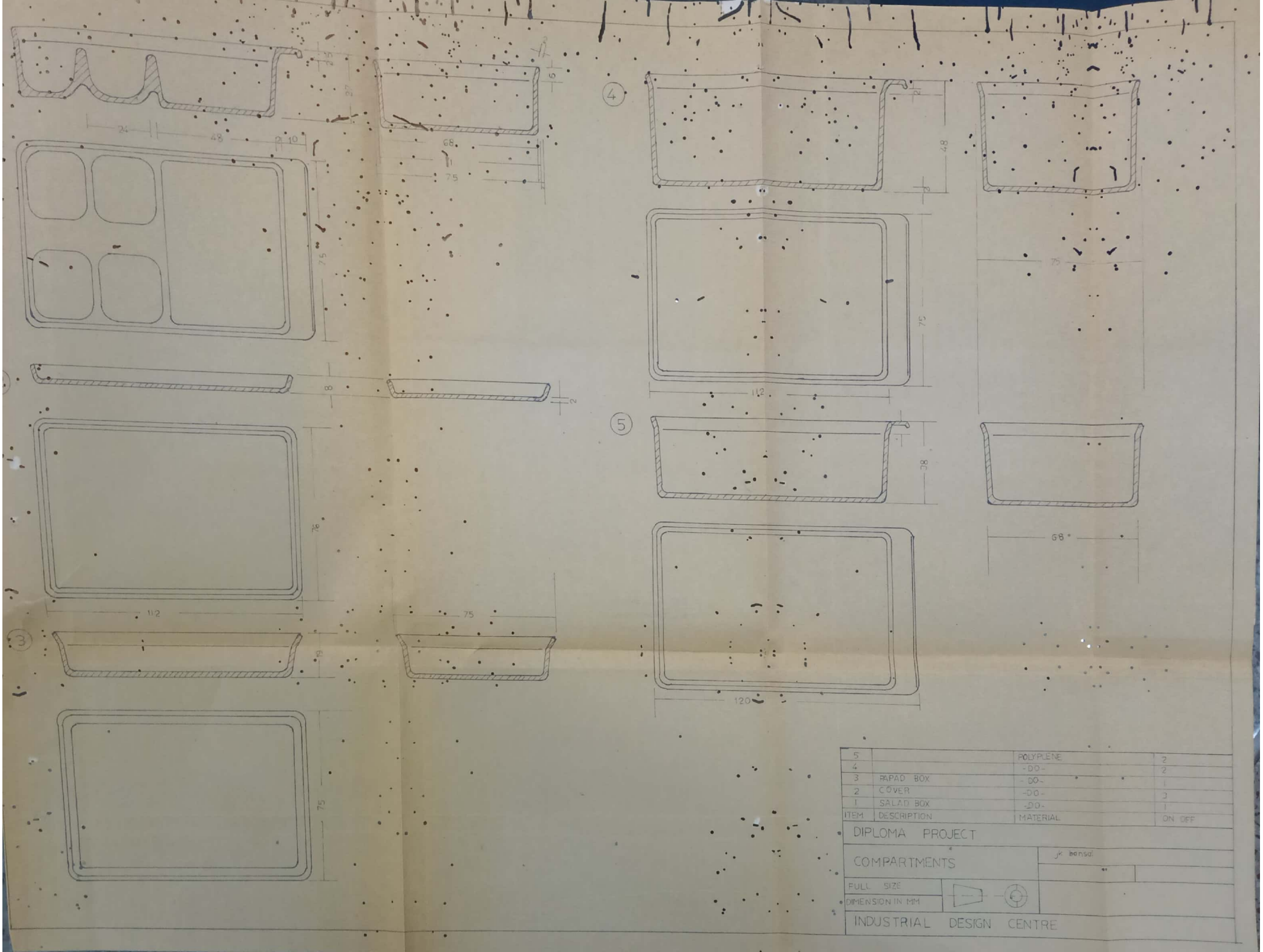
JK [illegible]

2ND BATCH

HALF SIZE

DIMENSIONS IN MM

INDUSTRIAL DESIGN CENTRE



ITEM	DESCRIPTION	MATERIAL	ON OFF
5		POLYPLENE	2
4		-DO-	2
3	PAPAD BOX	-DO-	1
2	COVER	-DO-	3
1	SALAD BOX	-DO-	1

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COMPARTMENTS

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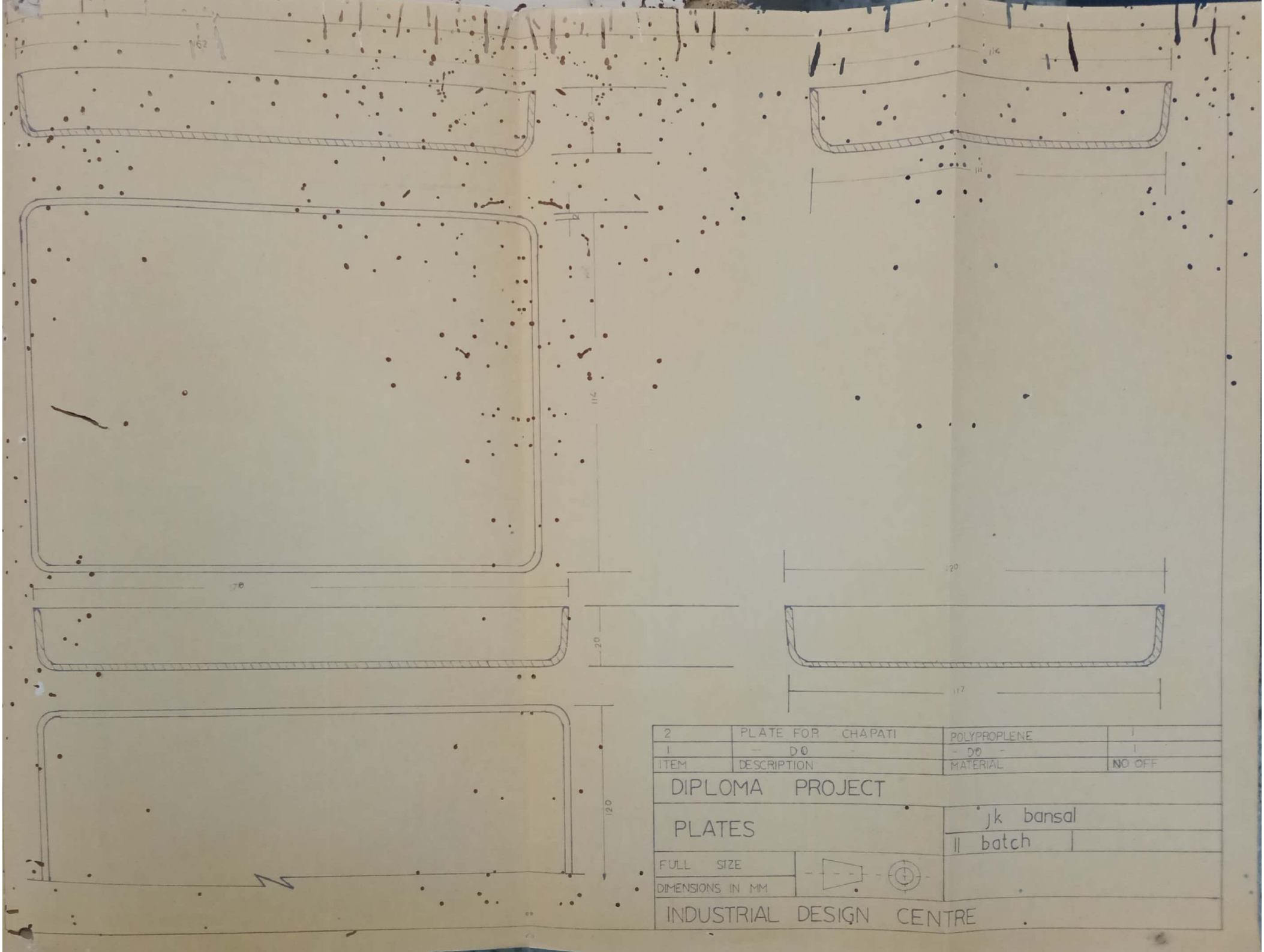
FULL SIZE

DIMENSION IN MM

INDUSTRIAL DESIGN CENTRE



ITEM	DESCRIPTION	MATERIAL	NO OFF
2	PLATE FOR CHAPATI	POLYPROPLENE	1
1	— DO —	— DO —	1

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PLATES

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II batch

FULL SIZE

DIMENSIONS IN MM

INDUSTRIAL DESIGN CENTRE