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Guide: Prof. V.P. Bapat

USE OF PLASTICS  
FOR FUTURE HOUSING

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SPECIAL PROJECT

USE OF PLASTICS FOR FUTURE HOUSING

AUGUSTINE SHELKE

GUIDE

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INDUSTRIAL DESIGN CENTRE

INDIAN INSTITUTE OF TECHNOLOGY

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I also thank my friends for their timely suggestions.

AUGUSTINE SHELKE.



## INTRODUCTION

Strictly speaking one cannot predict future. Yet a lot of attempt and effort is made all over the world and specially in U.S. and other leading countries to predict future for many reasons. One of the reasons is curiosity of man to peep into future.

Writers of science fiction and scientists have dealt in this subject of predicting future. The former gives free play to their imaginations and in contrast, latter, try to keep within the limits of nature, the known present day state of affair and then extrapolating to future, this prediction could be made only for a period from 30-70 years.

Though we are not futurologists or experts in this field, we are making an attempt to predict the role of plastics in future housing.

As we see today the trends in 'PLASTICS', one would definitely try to relate this material for varied applications because of its tremendous versatility. Here we are trying to relate to future housing as this material will be best suited for the demands of the future people.



One will have to carefully examine various factors, various human needs which will govern the house of future (population, natural treasures, science and technology, climate, energy sources and govt. policies) give an instinct insight to a material which will take care of the future needs of people, because of interdependence of each other on other, the result is complex and it will be dramatically different image of future housing.



## FACTORS-GOVERNING FUTURE HOUSING

### POPULATION

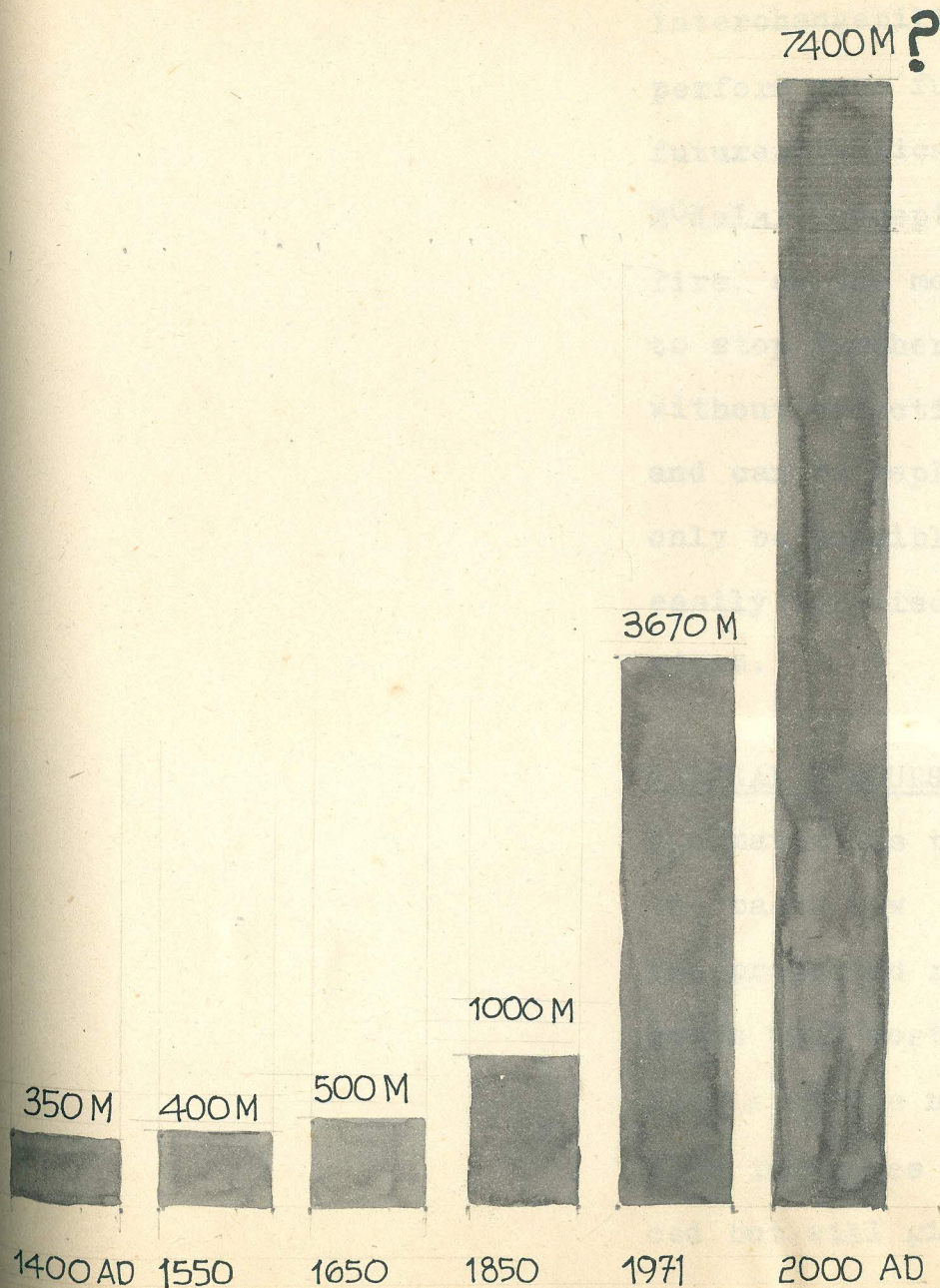
As per the projection made by the U.S. demographrs the population growth rate will be 'doubling' in 15 years as compared to today's population, obviously due to the increase in population there will be increase in the demands for housing. The rate at which houses are required will also be higher.

Spread of the urbanizatin due to the growth of the industries might result in growth of new satillite towns. Today as we see vitamins, astrnout's food, artificially flavoured food products are becoming more and more popular to keep human being fit. Tommorow the chemist will have to take care of food production in his laboratory as agricultural land will be occupied by housing and industries.

To cope up with this demand modular system will be the only solution which might switch over to industrially oriented housing to cdepe up the faster rate, even though housing will be oriented. Architects will still have to cope with design and build according to this imagination. Space might be anthoer criterion in future. Bare minimal



# POPULATION EXPLOSION



- GROWTH OF WORLD'S POPULATION IS AT A VERY FAST RATE. ALMOST DOUBLING IN JUST 30 YEARS.
- THERE <sup>FORE</sup> A SEVERE DEMAND FOR HOUSING
- HOUSING AT A FASTER RATE.
- ADOPTION OF MODULAR SYSTEM. IN PLANNING.
- GROWTH OF SATELLITE TOWNS.

• UN. PROJECTION OF WORLD'S POPULATION.



space available will have to be utilized fully, which give rise to the need of flexibility in planning, interchangeability of functions, collapsible in order to perform more functions would be the needs of the near future. Plastics can take care of this need, Modular concept will certainly add advantage during fire, as the module which is on fire can be pulled out to stop further fire spreading in the whole building, without affecting the structural stability of the building and can be replaced by new module of same size. This can only be possible if the module is light in weight and easily for disconnecting in short time from the main structure.

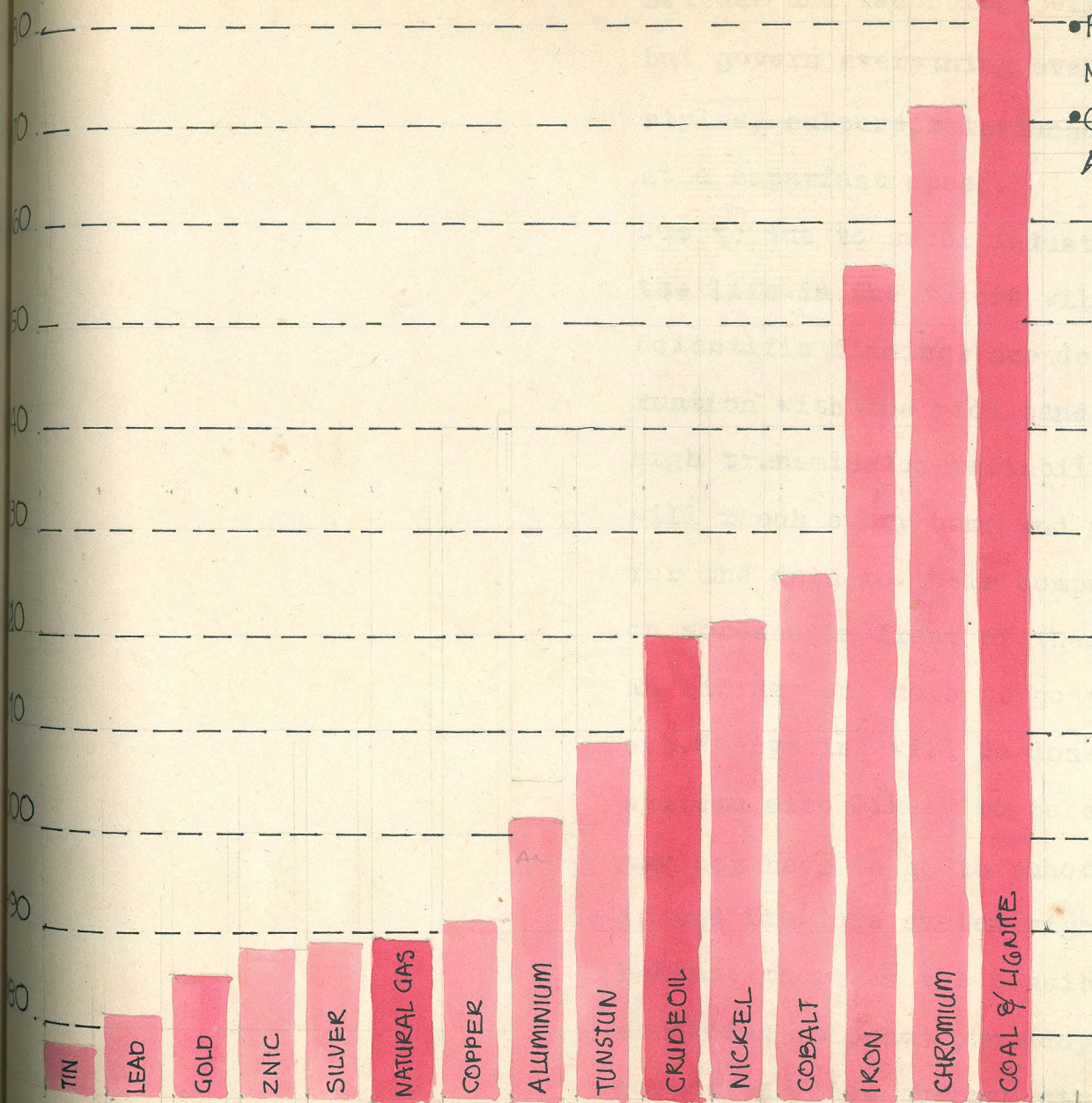
#### NATURAL RESOURCES

The materials to be used for housing will also depend on the basic raw material availability in that period. The projected resources of the metals in future by U.S. seems that most of the metals will run out before the middle of the next century.

This indicates that use of metals for future will be reduced but will give rise to replace metals.



# NATURAL RESOURCES



- MOST OF THE METALS ARE RUNNING OUT BEFORE THE MIDDLE OF NEXT CENTURY.
- PLASTICS CAN BE PREPARED BY NATURAL GAS, CRUDE OIL, COAL.
- COAL & LIGNITE SEEMS TO BE MAXIMUM AVAILABLE.

- U.N PROJECTION OF OUR FUTURE RESERVES OF METALS.



## SCIENCE AND TECHNOLOGY

Science and technology will not only govern future housing but govern everything, even human behaviour, human life - styles, culture, relationships, and this factor is advancing at a suparfast speed.

Due to due to super industrializations and computerisation the life in the future will undergo sudden change.

Scientific findings are doubling every decade, this information with the wide band communication channels of high transmission reliability and high speed computers will reach every home and people will just have to ask for the data to their computer and these will be projected on screens in front of them, people might not have to sit in library any more to go through huge journals catalogues etc. Everything will be done by retrieval machines, educational systems<sup>is</sup> also likely to be changed drastically. Students may not have to go to school or college everyday travelling to and fro. This system might work out to be beneficial because there is the possibility of individual development according to one's own adoptibility and progress, self education. Video phones entry will also cause a tremendous change in life style of people. One might not go to office for attending conferences as it could be possible by video



phone, Therefore it might reflect on <sup>their</sup> working patterns. Most of the time spent by travelling to and fro from the office/ school/ college will be spent in house. This might certainly bring healthy environment in families as lot of hard tussel may not occur. One might question whether the family system itself will exist? or will there be communal living? Or each independent living separately, as the trends in west are undergoing radical changes. But this <sup>might</sup> certainly affect the size <sup>of the house</sup> in future. Because of the constantly new and more sophisticated and the quest for more and more improved technology people will find a great difficulty in adjusting to it. Citizen of tomorrow's super industrial world will have temporary relationships with things so as to cope up this change and to prove economically feasible. Throw away society might result according to futurologists.

All these changes will reflect on him and his needs, and therefore on housing. Instead of a study room, which he has now, the computer room will be essential for tomorrow's house.



A house which will not be permanent for many years but a house which can be dismantled after a decade very easily and by using latest technology he will build another house which will be more economical to maintain rather than having the same old house and repairing it or maintaining it which will other wise prove costlier.

#### CLIMATE:

Due to increase in pollution as we see frequent gas leaks today, tommorow it may increase to such a extent that every house will also need a air tight room and gas protecting equipments (Masks etc) to protect or save himself. Building rules may demand such a provision.

Natural calamities like floods due to very heavy rains may require a house which can float in water with out effecting the life inside. A house which can take care of earthquakes, tremors and impact without affecting the life. This might be possible with plastics, a capsule which breaks on impact and give out foam at a very great force instananeously against impact to resolve it.

Similar kind of capsule is tried out with car dashboard to save driver from accidental injuries.



### ENERGY SOURCES:

At present we use Petroleum ,electridity,coal,wood as our prime energy sources.But thise will not be sufficient as the demand doubles. Tommorows requirement will be different and energy from sun,wind,sea waves will prove to be more economical and more sophisticated.Recently a car which can run on water has been designed and developed which is pollution free and economical.

Energy sources will have impact on housing,for lighting and different gadgets for domestic purpose it is most likely to use solar energy.Therefore provision will be made somewhere in the building to capture solar energy and distribute to all houses,or for individual hoses. nuclear power also be used for better purposes.

### GOVERNMENT POLICIES:

Government Policies will play a vital role in developing future society.Nothing much can be predicted about this factor but certainly it will have a good hold over the housing as such.



The Human Needs for future housing can be classified separately which will give an insight to the material.

1. Fast rate of constructing houses
2. Total number of housing requirement will be very high.
3. Maximum utility of space.
4. Multipurpose, flexible internal systems light in weight, changeable panel(walls) because of small space available per house.
5. Computer space, video phone space.
6. A air tight room with facility to protect against disasters.
7. A house which will not be permanent for many years, but can be very easy to disassemble and easy to reconstruct or erect new house with modifications without much effort and time.
8. Provision to collect sun's energy (individual houses or group houses)
9. <sup>Should</sup> Facilitate mass construction with high accuracy and reduce site construction hours to prove economical.
10. Possibilities of new forms and shapes as desired by Architects and Designers.

Modular Concept  
will be adopted in order to  
satisfy these  
needs.



11. Easy and economical to maintain.
12. Less energy required for producing the material.
13. Must satisfy all the other primary needs of the house. (Strength, stability, shelter etc.)
14. Availability of material<sup>should be</sup> in abundance.
15. Recycling of water (available)

Out of the traditional material cement concrete, wood satisfies some of the needs. But a material with so much of potential, is none other than 'PLASTIC'. Plastics has tremendous properties and will be exploited for future housing. To get the correct picture of plastic scientific comparison could be made with traditional building materials. (chart

If we look in to the present situation, plastic has become popular in many fields, and has replaced most of the metals. Chart shows the growth rate of plastic production of leading countries, which also tells us the very well acceptance of this material by masses.

Use of plastics for housing has been experimented in U.S. and other places successfully (See photographs)

The rate of plastics being used in building industries is also increasing. But there were many reasons why the

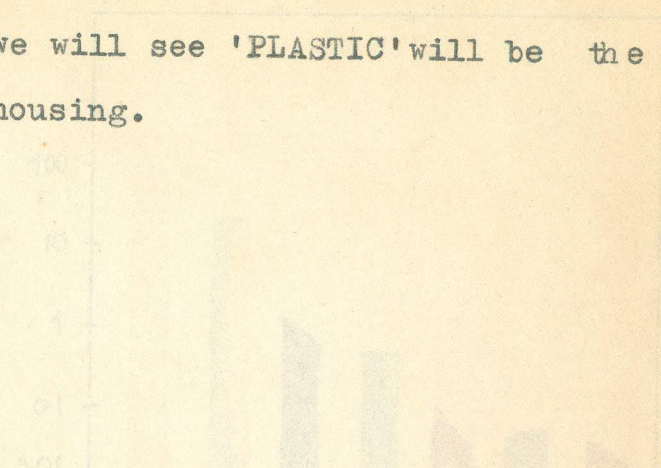
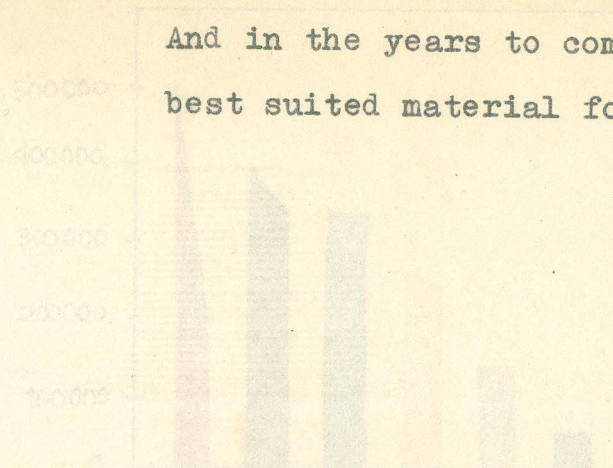
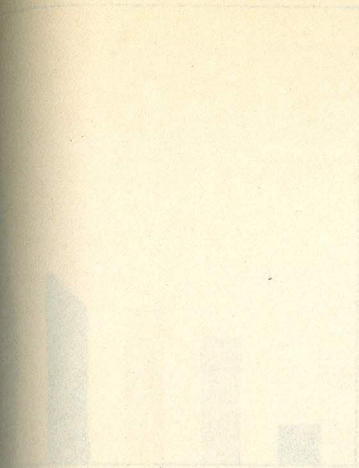


the progress ~~was~~ slow in this feild and faster in other feilds like automobile, aircraft, household products, etc. One reason, that it <sup>was</sup> ~~is~~ very necessary and easy for automobile industry to shift over to new material and new technology because of cut throat competition and changing needs; (for better and high efficiency, low pollution, low cost ). Secondly the industry as a whole existed. Almost all the components were mass manufactured and under one roof. Where as the building industry was a craft oriented (i.e. built on site brick by brick) But in next four or five decades the scene might change and it will be highly industrialised. Thirdly the decision making people involved (Architects, Builders, Contractors, Owners ) were wary of the immense possibilities and the true engineering properties of the material. Engineering Hand Books and Manuals on this Material were rarely published by raw material suppliers and fabricators of plastic component. The chemist, Industrialist and the Building Industry people never had revolutionary interaction between them in this connection. The Architectural , Civil Engineering syllabus in the colleges never stressed on the use of this material. But now the situation is changing at a greater



speed.

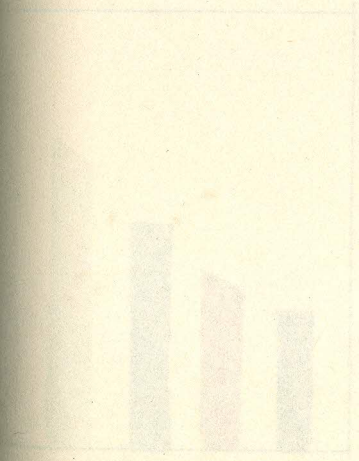
And in the years to come we will see 'PLASTIC' will be the best suited material for housing.



TENSILE STRENGTH/  
WT. RATIO

COMPRESSION STRENGTH/  
WT. RATIO

RELATIVE THERMAL CONDUCTIVITY



RELATIVE RIGIDITY

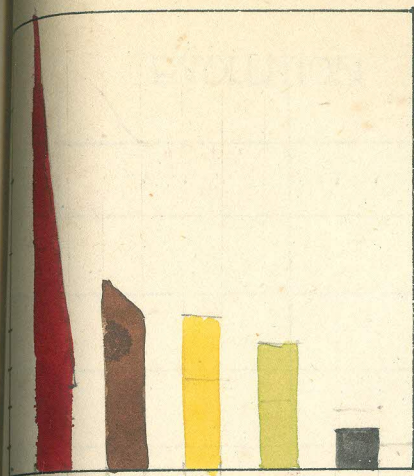
SPECIFIC VOLUME

MAX. SERVICE TEMP.

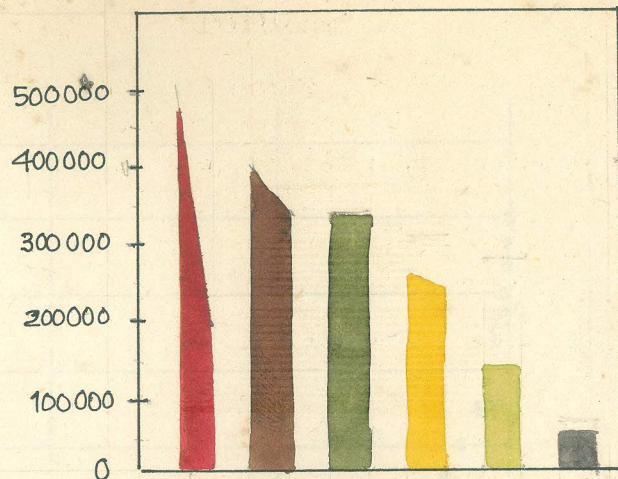
- PLASTIC
- ALUMINUM
- WOOD
- CONCRETE
- GLASS
- CAST STEEL



# ADDITIONAL BUILDING MATERIALS & PLASTICS



TENSILE STRENGTH / WT. RATIO



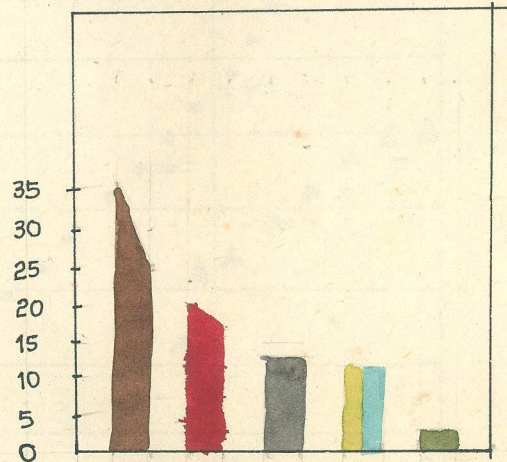
COMPRESSION STRENGTH / WT. RATIO



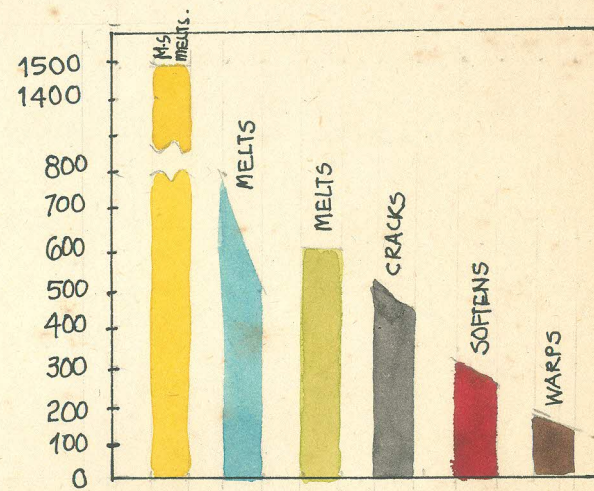
RELATIVE THERMAL CONDUCTIVITY



RELATIVE RIGIDITY

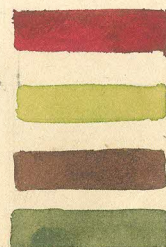


SPECIFIC VOLUMES  $\text{ft}^3/\text{LB} \times 10^3$



MAX. SERVICE TEMP.

- PLASTIC
- ALUMINIUM
- WOOD
- CAST IRON



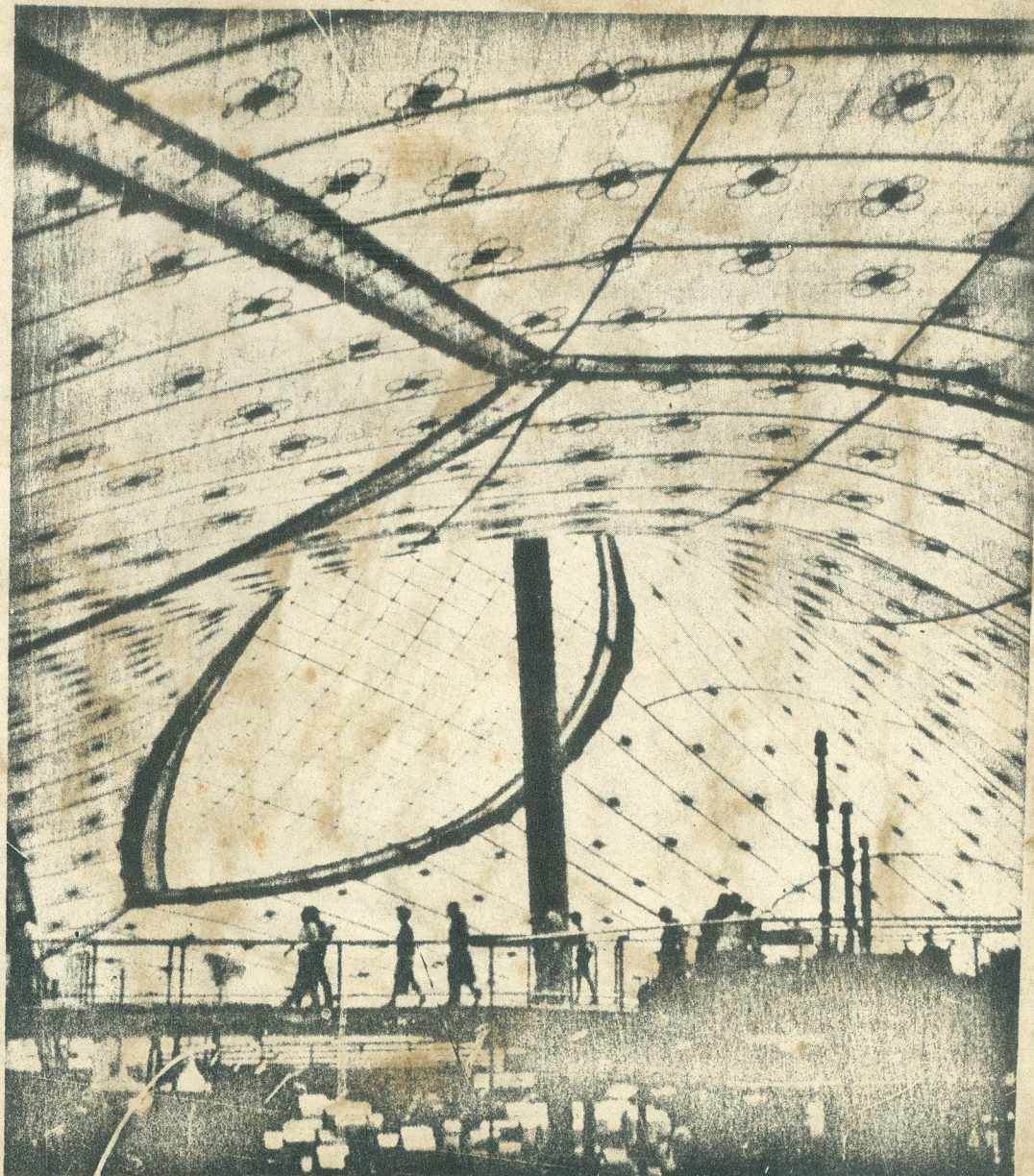
- CONCRETE
- GLASS
- STRUC. STEEL





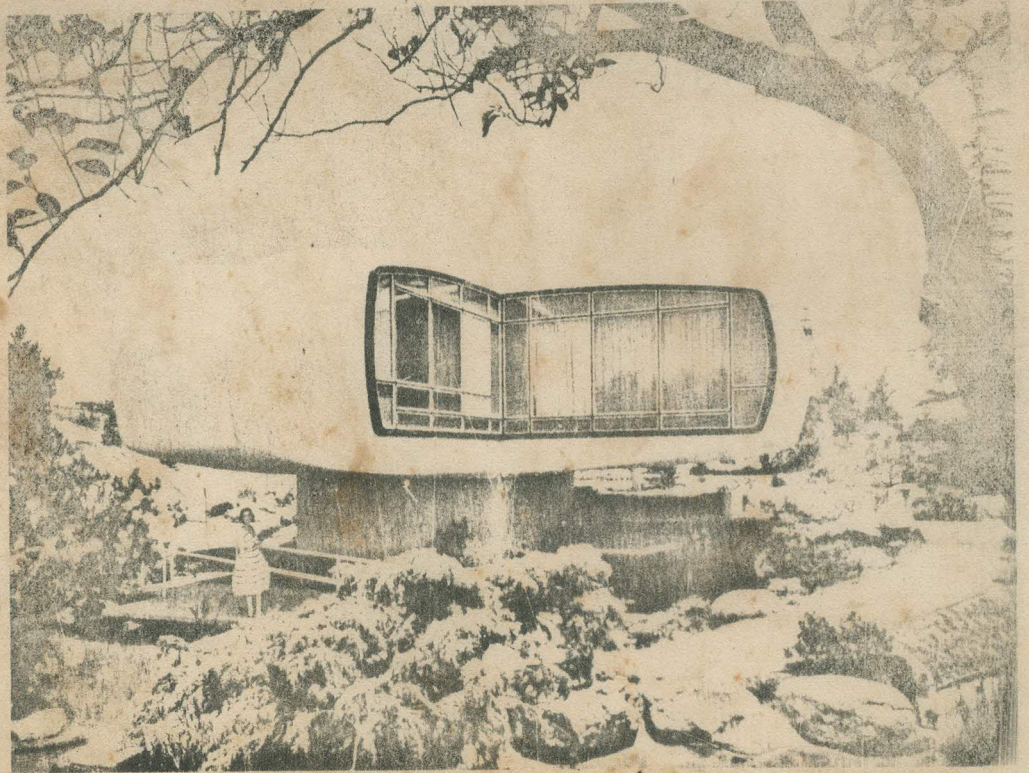
# EXPERIMENTS IN PLASTICS

German  
Pavilion,  
Expo '67  
Montreal





House of  
the Future



Clustered  
Inflated  
Structure







Canopies in  
Place



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