

DESIGN METHODOLOGY OF PAPER CORRUGATED PACKING BOXES

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Abstract

Since long the paper corrugate boxes are popularly and extensively used for industrial and domestic goods packaging. These are of different sizes, thickness and strengths depending on the goods to be packed. The main aim of this project how this product can have further improvements and / or how productivity can be increased looking into the effects of changing environmental conditions. Besides this a study in details if the cost and the wastage can be further curtailed is also one of the objectives. One more purpose of this project is to protect and enhance the eco friendliness and pollution free manufacturing process.

The manufacturing process involves a series of operations and the machines, tools and tackles used are user friendly and safe to handle. Sequence of process can be made easier by placing different machines & tools by a very meticulous work and motion study to avoid unnecessary wastage or over use of energy, time and manpower.

Introduction:

The title of the chapter itself is self explanatory. It covers the analysis of effect of environment on the productivity & time cycle per unit production. The analysis is done on the basis of several readings and physical observations done for two samples of the product. The references and the basic idea of the project is inspired by the research work on the similar problem done by Dr. S.G. Mahakalkar through his papers published under the caption. M/s Nagpur Carbon Pvt. Ltd. had been of great help to me to enable to complete this partial fulfillment.

The dissertation work also summarizes about the production process, objective besides analysis of the ambient effects. Manufacturing process of corrugated sheet box industries is a unique phenomenon. Swift actions and movements of the workers and synchronization of the process sequence is commonly seen alike majority of industries. Corrugated sheet boxes are packaging products which are used worldwide for a very obvious reason. Manufacturing of these boxes involves inseparable activities between man and machine. Manufacturing units for such products range from a cottage to large scale industry but in most of the cases a poor housekeeping. The production of corrugated sheet boxes is influenced by several factors of industrial importance. To sum up, some of them are machines, tools, work stations, environment, operators, skill set and management perspective. It is an objective of every industrialist to maximize the productivity & protect economical norms. A perfect blend of resources, management policies, economy, labour availability and environmental conditions do affect the productivity. And most of these objects are looked into the study of this project. The parameters used in the present rework is discussed in the section study of independent and dependent parameters. The section on measuring devices and their use illustrates various instruments used to measure the identified parameters to carry out the analysis. This part of the dissertation focuses on identification of work place, study of the

manufacturing process, identification of workstations, identification of independent and response variables and environmental effects on productivity. Formulation of Mathematical Model by Regression Analysis using SPSS Software should be done.

Design of Experiments

The design of experiments is the design of any task that aims to describe or explain the variation of information under conditions that hypothesized to reflect the variation. The term is generally associated with true experiment in which the design introduces the conditions that directly affect the variation, but may also refer to the design of original product. In its simplest form an experiment aims at predicting the outcome by introducing a change of the precondition which is reflected in a variable called Predictor. The change in predictor is generally hypothesized to result in a change in the second variable hence commonly called outcome variable.

Experimental design involves not only the selection of suitable predictor and outcomes but planning delivery of the experiment under statistically optimal conditions given the constraints of available resources. Main concerns in experimental design include the establishment of validity, reliability, and replicability. Optimal designs for Regression models:- Charles Price also contributed the first English language publication on an optimal design for Regression models in 1876. A pioneering optimal design for polynomial and regression model.

The use of sequences of experiments where the design of each may depend on the results of previous experiments, including the possible decision to stop experimenting is within the scope of sequential analysis of a field that was pioneered by the Arabian world. Discussion topic when setting up an experimental design.

- How many factors does the design have and are the levels of this factor fixed or random.
- Are control conditions needed and what should they be.
- Manipulation checks, did the manipulation really work.
- What are the background variables.

What is the relevance of interactions between factors.

Study of Parameters Under Investigation :

The parameters to be measured in field experimentation are to be studied thoroughly. The various parameters include

- Data related to specification of product
- Data related to environment conditions
- Data related to cycle time

This is achieved through the evaluation and design of workplaces, environments, job tasks, equipment, and processes at the workplace. Every possible time there should be a change in the workplace (new employees, new chair, new desk), are required. It is important that all furniture (chairs, desks) and other accessories are adjustable in order to meet individual worker's needs, for no two people are alike. Environmental variations cover the entire work area, including issues regarding the ambient temperature, humidity, air conditioning, and workers' comfort with respect to their ability to give more productivity. Lighting (illumination) is another factor which can have an adverse or favourable effect on the productivity & in terms of profitability. Effective measures taken to cope up with environmental changes will assist in maintaining high levels of productivity.

Environmental Factors :

Corrugated cardboard is very sensitive to atmospheric condition; especially the effect of moisture is very obvious on the mechanical behavior of the corrugated cardboard. Corrugated sheet paper is a mat of cellulose fibers arranged in criss-cross fashion and held together by hydrogen bonds and other secondary forces. The extent and speed of water absorption, depends upon ambient relative humidity and ambient temperature. Corrugated sheet are hygroscopic in nature, i.e. cellulose does absorb or desorb moisture from / to the ambient atmosphere to attain equilibrium with it. The absorption/desorption of moisture from atmosphere results in the change in properties of corrugated sheet as it is believed that water absorption/desorption results in changes in the secondary forces. Similarly the temperature variations also alter the equilibrium and believed to result in property changes which in turn change the physical and mechanical properties of corrugated sheet. In country like India wide variations in climatic conditions are prevalent in different parts of the country at a given time and hence, it is desirable that corrugators and users of the boxes have firsthand knowledge of likely property variations of raw materials.

Different environmental conditions

Environment Code Env. Code	Periods
Env1	(Summer) March to May
Env2	(Rainy) June to September
Env3	(Winter) December to February
Env4	(Spring) October to November

Independent Variables :

Sr. No.	Description of Variables	Depiction	Symbol	Unit of Measurement
1	Length	X1	L	mm
2	Breadth	X2	B	mm
3	Thickness	X3	T	mm
4	Part weight	X4	Part_Wt	kg
5	Bursting strength	X5	Bs	Kg/cm ²
6	Bursting factor	X6	Bf	dimensionless
7	Volume of box	X7	V	cm ³
8	Noise level without operation	X8	dB	dBA
9	Noise level with operation	X9	dBopr	dBA
10	Illumination at work table	X10	Iwt	Lux
11	Illumination sight range (average)	X11	Isr	Lux
12	Dry bulb temperature	X12	DBT	°C
13	Wet bulb temperature	X13	WBT	°C

Dependent Variables

Sr. No.	Description of Variables	Depiction	Symbol	Unit of Measurement
1	Cycle time	YeCtime	Cytime	Seconds

Sampling Readings of the Product

Code			Data related to Specification of the Product							Data related to Environmental Condition					CYCLE TIME		
Preode	Wscode	Envcode	L	B	T	Part_Wt	Bs	Bf	V	dB	dBopr	Iwt	Isr	DBT	WBT	Ye (Ct)	Yc (Ct)
			X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	Y1	
Pr1	Ws1	ENV 1	390	315	5	0.562	9	18	23342	61	83	19	16	35	29	7	
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Pr1	Ws1	ENV 3	390	315	5	0.562	9	18	23342	59	80	25	20	29	23	7	
Pr1	Ws1	ENV 3	390	315	5	0.562	9	18	23342	59	80	25	20	29	23	7	
Pr1	Ws1	ENV 3	390	315	5	0.562	9	18	23342	59	80	25	20	29	23	8	
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Pr1	Ws1	ENV 4	390	315	5	0.562	9	18	23342	61	83	19	16	32	26	7	
Pr1	Ws2	ENV 1	390	315	5	0.562	9	18	23342	64	80	32	28	34	28	26	
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Pr1	Ws4	ENV 1	390	315	5	0.562	9	18	23342	58	81	30	19	35	29	9	
Pr1	Ws4	ENV 1	390	315	5	0.562	9	18	23342	58	81	30	19	35	29	10	
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Pr1	Ws5	ENV 1	390	315	5	0.562	9	18	23342	57	80	38	58	36	29	9	
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Pr1	Ws6	ENV 1	390	315	5	0.562	9	18	23342	56	82	31	51	36	29	9	
Pr1	Ws6	ENV 2	390	315	5	0.562	9	18	23342	56	80	31	51	33	27	9	
Pr1	Ws6	ENV 2	390	315	5	0.562	9	18	23342	56	80	31	51	33	27	9	
Pr1	Ws6	ENV 2	390	315	5	0.562	9	18	23342	56	80	31	51	33	27	10	
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Pr1	Ws7	ENV 4	390	315	5	0.562	9	18	23342	66	87	21	52	32	26	15	

CONCLUSION

It is concluded after going through various papers & dissertation works published on this project & other making an independent study for the same, that there are options open for boringly about the desired results.

The alternatives suggested in the project with well illustrated calculations support the objective of the Project.

After studding the various parameter as independent variable which used in mathematical model to calculate the cycle time which increases the productivity.

It conclude that cycle time depends upon independent variable.

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