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Mechanisation in Construction Housing Infrastructure Scope, Applicability & Value

We all are a witness to the massive growth in the infrastructure segments. From year 2000 we are witnessing a growth @ 12% consistently. To start with, the golden quadrilateral followed by the rehabilitation of the slums in the major metros. The IT boom has really come as a boon to the Metros. The commercial activity followed by the residential infrastructure boom has caught up. In my opinion we have just touched the tip of the Iceberg.

With the growth in the infrastructure new challenges have definitely emerged in various forms.

- Big sizes of the projects
- Time factors
- Quality & Safety insistence from the promoters
- Sky Rocketing prices of commodities (Steel, Cement, Bricks, Sand etc...)

The intelligentsia in the form of consultants started looking for solutions

Some of them have emerged with

- ❑ Alternative methods in construction
- ❑ Choosing various materials to overcome the scarcity
- ❑ Mechanisation at the sites

A lot is happening at a very hectic pace. The markets are agog with the purchasing spree of whatever the promoters felt right. The corporate contractors went into this with a study & the others have bought what they felt was right. In some cases the contractors are forced to buy what the tender demands or what the structural consultant demands. In the process a lot of investment is under utilized at every project.

With the concept of GLOBAL VILLAGE and exposure to international markets both in terms of construction methodologies and mechanisation, there is a need to streamline & get into a direction where the challenges are addressed through the professional approach. The approach should be scientific; the basis should be explainable & should stand the test of the projects through Speed, safety & savings.

Scope of Mechanisation:

The scaling of operations have changed at least by 200 ~ 300 % if not more.

- ❑ Individual bungalows have grown into gated communities.
- ❑ The size of the communities is spread across from 5 acres to 65 acres of developments. The projects boast of 65 houses to 600 houses.
- ❑ The stand-alone apartments have given way to Condominiums / societies with 85 flats to 800 flats in one compound.

This was seen in the west like Mumbai & Pune. This would be a common site in Bangalore, Hyderabad, Chennai, Delhi & Most likely in Calcutta.

As all of us are well aware, the Scarcity of labour has hit us hard on every front. The volumes & sizes have forced us to look into alternative ways of approach. This has forced us to look at mechanisation of projects

Every promoter is aware of the machines & have placed a lot of orders on batching units, tower cranes, Earth movers etc...

But is that what Mechanisation is all about?

Mechanisation is one of the ways to get the consistency at the sites & also to speed up the work thus reducing the time & the construction costs thereby reducing the need for skilled manpower

Let us come to some terminology on mechanisation at the project sites

- ❑ Concreting equipment
- ❑ Commodities (Rebar cutting & Bending, Testing equipments, Wheel barrows, Builders hoists etc...)
- ❑ Material handling (Horizontal & Vertical)



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- Tailor made equipment for the project specific needs



- Mechanisation in the area of form works is in its advanced phases by various manufacturers from across the globe & the Indian technocrats are not left behind.

How do we identify the scope of mechanisation at various construction processes?

1. It is important to identify the process where the human interface is more, where there is mass applicability and repeatability and quality is at stake. For instance areas like concrete batching, steel rebar.
2. It is important to identify the processes where time and safety are of prime importance. The material handling areas are the major concern today for Builders and also structural consultants.

The widely used equipments are used in the areas of Material handling both Horizontal & vertical.



Working platforms, Rope suspended platforms & platforms on structures are being used for the external works such as brick work, plastering, Painting Glass & aluminum façades etc...

APPLICABILITY

Applicability of the equipments / machines should be determined by various factors viz;

- ❑ Capability of the equipments
- ❑ Site or the project conditions
- ❑ Volume of the project
- ❑ Limitation at the sites
- ❑ Time limits for the project completion

For example lets take the study for the application of the Tower crane.

Capabilities of the Crane: (5013) Jib Radius 50Mts Tip loads @1.3 tones

- ❑ Can carry loads from 6 tonnes up to a radius of 30mts.
- ❑ Will place any equipment within the given radius
- ❑ Mainly used to carry Steel, Centering equipments, Concrete through buckets



Advantages:

- ❑ Can carry literally anything to the top of the surface
- ❑ Picks up & places anything anywhere within the given radius
- ❑ Very dependable
- ❑ Exhaustively used during the structure of the project



For example lets take a site say 25 mts by 50 mts with the total height of the structure being Cellar + Ground + 14 floors.

RCC & column concreting would be done by Concrete pumps & the boom placers

In this case the tower crane is merely reduced to carry steel bars & the centering materials from one floor to the other. In these cases if we can get an alternative ways of looking at the vertical movement of the steel then we could avoid the investment of the Crane.



Concreting:

We have batching equipments from one bag millers (3 CuM / hr) up to 120CuM /Hr. Depending on the value & Volumes we have to decide on the equipment to be chosen for the particular project.

Material handling: Broadly we bifurcate them into two categories; Horizontal & Vertical movements. These can be determined by:

- **Site sizes:** Area of the plot

- **Structure sizes:** Area of floor, Height of the structure, limitations if any at the site.

Here the ware housing (Yards for steel, cement & the place of concrete batching) plays a major role.

The usual horizontal movements equipments on the site are Tractors with attachments, Loaders, Site trucks / Tough riders & various trolleys & Wheel Barrows.

The vertical movements are purely structure specific. Depending on the horizontal movement on the floor & the quantities for the structure we would chose from the available equipments.

There are various methods for horizontal movements on the floors, during carpentry & fitting of steel & for concreting of columns as well.

During the super structure & the finishing stages also there are a lot of movements both in terms of horizontal & vertical material handling.

CASE STUDY:

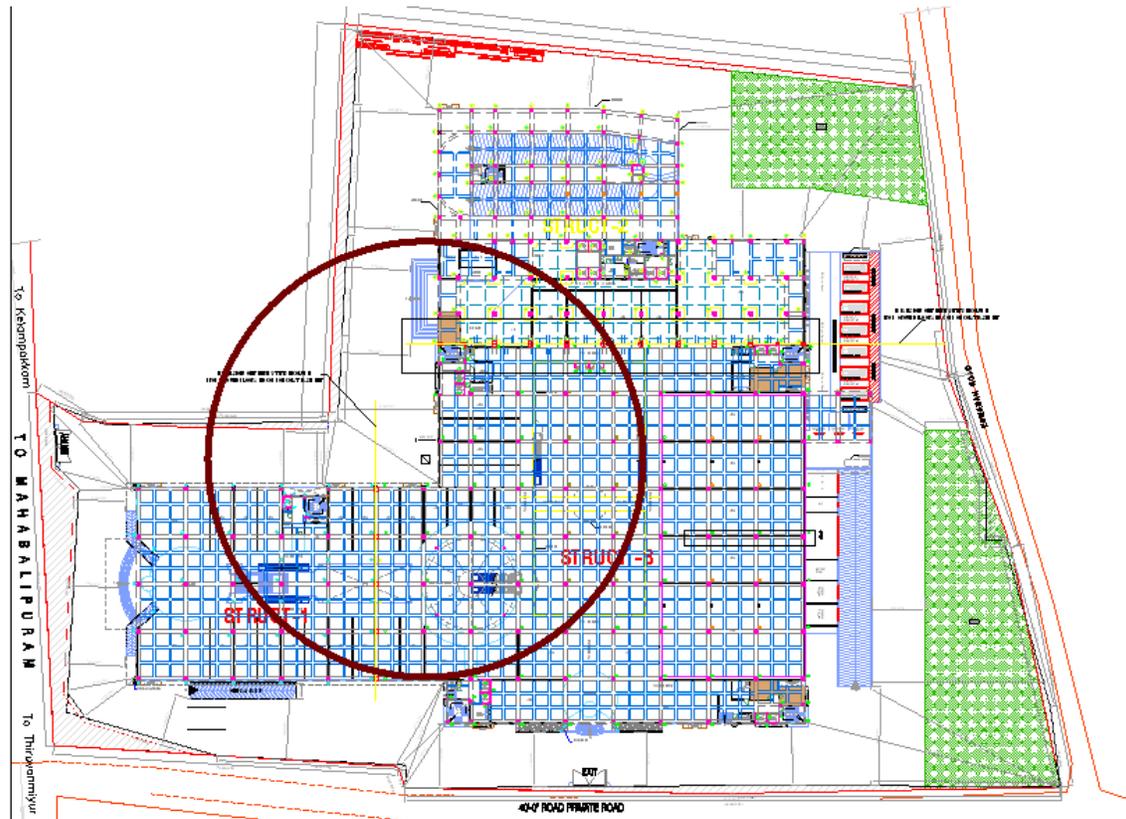
The site at Chennai

Selection of tower crane process happened

Realised the material yards are on the other side of the structure

Then we had to shift the location of the crane thus saving several man hours & resulted in optimum utilizable of the equipment thus speeding of the work.

1.Intital Position



2.Final Position



Value:

The Value that mechanisation can add to the construction process:

Speed: How fast are we going to handle the material?

Safety: Is the safety factor addressed or not

Savings: Technology is the only way to reduce the costs. Does the selected equipment gives the value for money? Is it quantifiable? Are there factors, which cannot be quantified? If so what can be the key factor.

Strength: In this context we should call it as Quality inputs.

Let us do some basic studies for arriving at the Value in some of the basic equipment

Re – bar Cutting & bending machine:

dia /mm	cuts / hr for 8 hrs		75%effic..	cost/ cut	
	32	50	400	300	1.17
	25	70	560	420	0.83
	20	80	640	480	0.73
	18	120	960	720	0.49
	12	140	1120	840	0.42

Considering 3 helpers & one supervisor daily wages at 350

dia /mm	cuts / hr for 8 hrs		90%effic..	cost/ cut	
	32	180	1440	1296	0.50
	25	300	2400	2160	0.30
	20	420	3360	3024	0.22
	18	1200	9600	8640	0.08
	12	1440	11520	10368	0.06

working costs for 2 people @200

Current consumption /day @200

Cost of the machine

Maintenance@ 3% per annum

Interest on investment@12%

Total cost for 2 years

Total working costs= 653

Per day

8400

33600

182000

Cost per Month

7583.333

Cost per day

252.7778

Site truck:

Used for transporting material at the sites
Mostly used to concrete during structures
Every other material during the super structures & the interiors
Load carrying capacity of 1.5 tones
Horizontal speeds of 14 Km/hr
Does the work of almost 360 labourers

Site truck	Capacity 1.5 tonnes	325000	
Life of the machine	3 yrs		
Interest @12% P.A.		39000	
		117000	539500
Maintenance 10% P.A		97500	
Investment cost per day		493	500
Driver & mechanic @8K P.M or	96	320	320
Diesel 5 Lts a day		200	200
The cost of the machine usage per day is Rs		1020	1275 Efficiency of 75%
Work output of the machine we stated was of 360 labourers			
The cost of hiring the labourers @ 90 per day		32400	

The speed of the work multiplies

Intangible benefit is the consistency of operations

Work can be done as planned

The same calculations can be worked out for each & every equipment. Thus the value has to be assessed on every selection.

CONCLUSION:

Mechanisation needs to be taken up as a scientific study and concept:

It can happen only with:

1.Organized approach towards the construction infrastructure.

2.Integrated Approach of various facets of construction: Working separately, architects, engineers, procurement specialists and project managers lack control over finished-build outcomes, and coordination of value-creating ideas is difficult and often not timely. Hence the need for integrated approach.

3.Optimum utilization of **4M's** through **Value Engineering**.

4.Know how of various equipment available world wide for innovative and cost effective mechanisation

5.CHANGE MANAGEMENT

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