

# Mechanisation in Construction

## Housing Infrastructure

### Scope, Applicability & Value

We are all a witness to the massive growth in the infrastructure segments. From 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 the process a lot of investment in the form of equipment is under utilized at every project.

Thus there is a need to streamline & get into a direction where the challenges are addressed through the professional approach . The approach should be scientific in approach, The basis should be explainable & should stand the test of the projects through Speed, safety & savings.

We have just touched the tip of the Iceberg. All these exercises should prepare us to face the unprecedented growth when the mass rural & urban housing projects take off.

Scope: 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.

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.

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

Lets come to some terminology on mechanisation at the project sites

Commodities:

(Concrete batching, Rebar cutting & Bending, Testing equipments, Wheel barrows, Builders hoists etc...)

Material handling (Horizontal &



Vertical)



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.

So far mechanisation is addressed in the areas of mass applicability & this is the only way to look at. Concrete batching equipment, steel rebar interms of the core insitu.

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 upto a radius of 30mts.

Will place any equipment within the given radius

Mainly used to carry Steel, Centring 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 centring materials from one floor to the other.

In this cases if we can get an alternative ways of addressing the vertical movement of the steel then we could avoid the investment of the Crane.

(Case study to be discussed with PPT)

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. (Case study to be discussed)

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 structure specific.

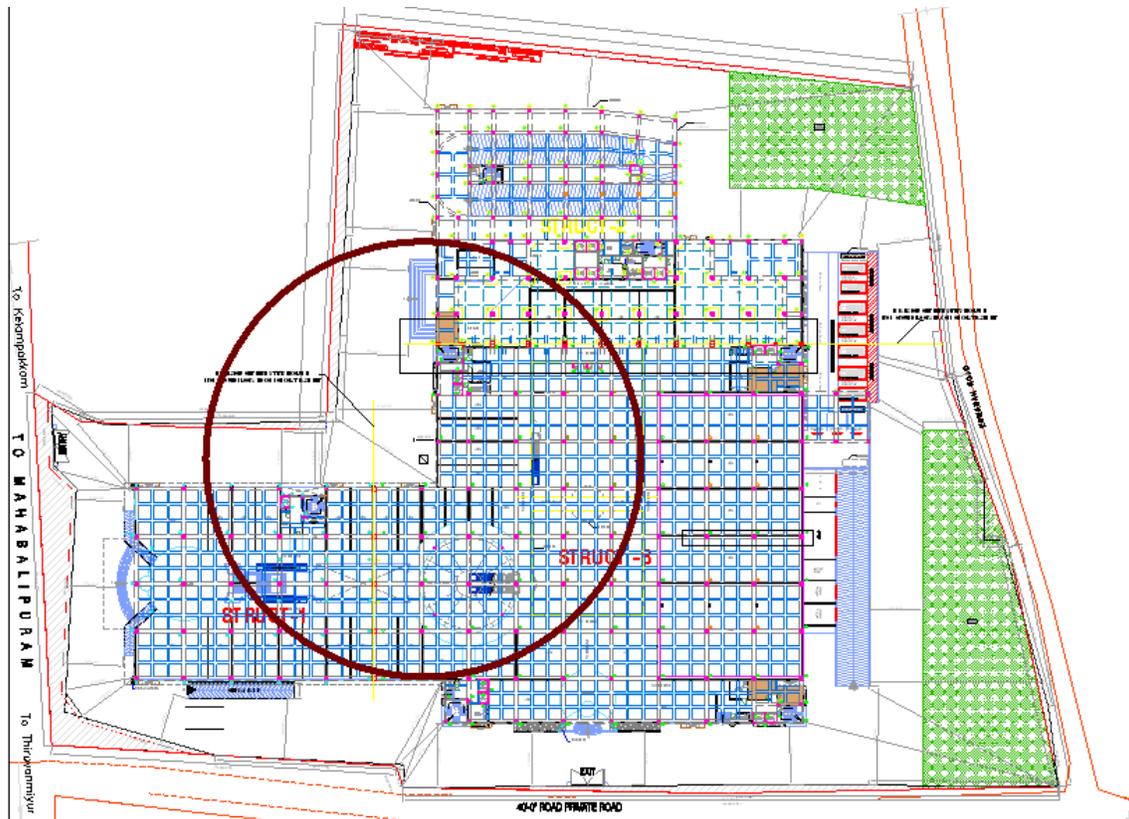
Depending on the horizontal movement on the floor & the quantities for the structure we would chose from the available equipments.

(Refer to the case study)

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 Marg)



## Value:

We have gone through various case studies & the conclusions on the recommended equipment at the sites. These recommendations are mostly based on the value it creates in terms of Speed, Safety, Savings & Strength.

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 can not be quantified? If so what can be the key factor.

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

Lets 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

Total working costs= 653

Cost of the machine	140000	perday
Maintenance @ 3% per annum		8400
interest on investment @12%		33600
total cost for 2 years		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 tonnes  
 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.  
(Case study on the vertical Material handling equipment)