MORE PROFITS THROUGH BETTER MATERIALS HANDLING

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The manner in which a precast concrete plant solves its materials handling problems has an important bearing on the profits the company will make. The author pinpoints possible troublespots in the materials handling aspects of a plant operation and suggests several techniques for improving the materials handling system.

The intent of this paper is not so much to solve specific problems but to stimulate our thinking so that we will question what we are doing in our precast-prestressed concrete plant operations, and then formulate and implement an improved materials handling plan.

Each of us has a different set of variables which we must face in our daily problem solving. The trick is to apply proven solutions along with imagination and to come up with the best and most economical solution to each problem. Some precast-prestressed concrete plants have done much to solve their materials handling problems. However, I have yet to see a plant that could not be improved. If we did not believe this, we would not attend PCI Conventions trying to learn new ideas.

Many plant managers believe they are locked into some of their materials handling systems. But are we really? Would it not pay to junk that old front end loader, concrete mixer, and crane, that is causing numerous delays and also requires so much maintenance? Will not the payback period of investing in new equipment be short enough to more than justify the new capital investment? Would we not like to increase profits one or two percentage points? Of course we would. That is a relatively big increase. How did I arrive at 1 or 2 percent? I believe that from 10 to 20 percent of plant costs involve or are affected by some form of materials handling. By improving 10 percent, which is not an unreasonable percentage, we have added it to our profits. However, this is much easier said than done . . . but let's continue.

The subject of materials handling is certainly a broad one in the precast and prestressed concrete industry. We are in the materials handling business from the beginning to the end, i.e., from the time the raw materials are received at our plants until the finished product is erected, welded, and/or grouted on the building. It is my impression that our industry is beginning to give the subject of materials handling much more attention than it did 10 to 15 years ago. We are getting more help, too, from our Associate Members.

There was a time when I was, as many of us were, more concerned with what cross section of double tee, or single tee, or hollow-core slab to manufacture, or what size of weld plate to use, and similar subjects. Now that many of these items have been standardized, we should be turning our attention to an item that is very significant in cost, particularly in many high production plants, namely, materials handling. Apparently, many producers have already done this but, traveling around the United States, I see evidences of this not being done in old and new, small and large plants.

In my opinion, there are three basic questions to ask ourselves:

1. How many times is the material handled before it changes form or reaches the next station?
2. How long does each materials handling operation take?
3. Are there any delays involved during the materials handling or production process?

The obvious goals are to decrease the number of times that materials are handled in each form, and shorten the time interval as much as practical and economical. The last word is very important. Sometimes we can be misled and spend too much money on improving our materials handling methods that is not justified, or even spend it for the wrong equipment.

In precast-prestressed concrete plants the basic raw materials that we deal with are aggregates, cement, strand, and weld plates/inserts.

Aggregate

Are the aggregates delivered to stockpiles, rehandled into bins or hoppers by front end loaders or drag lines? Why not install drive-over hoppers that

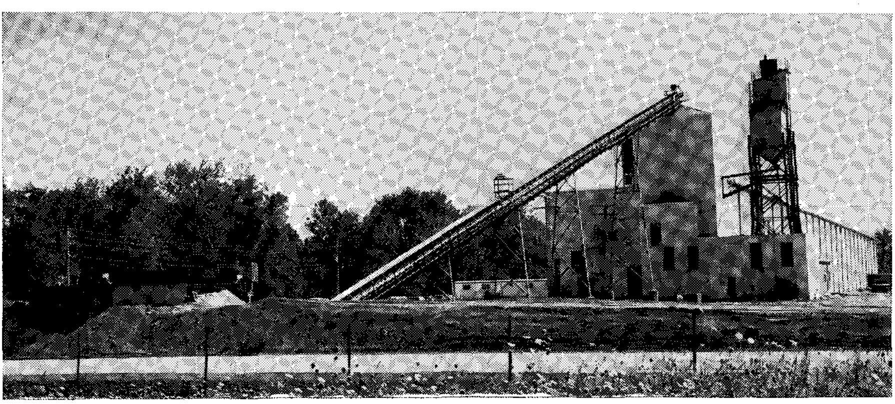

Fig. 1. Exterior view of precast concrete plant for manufacturing hollow-core slabs.

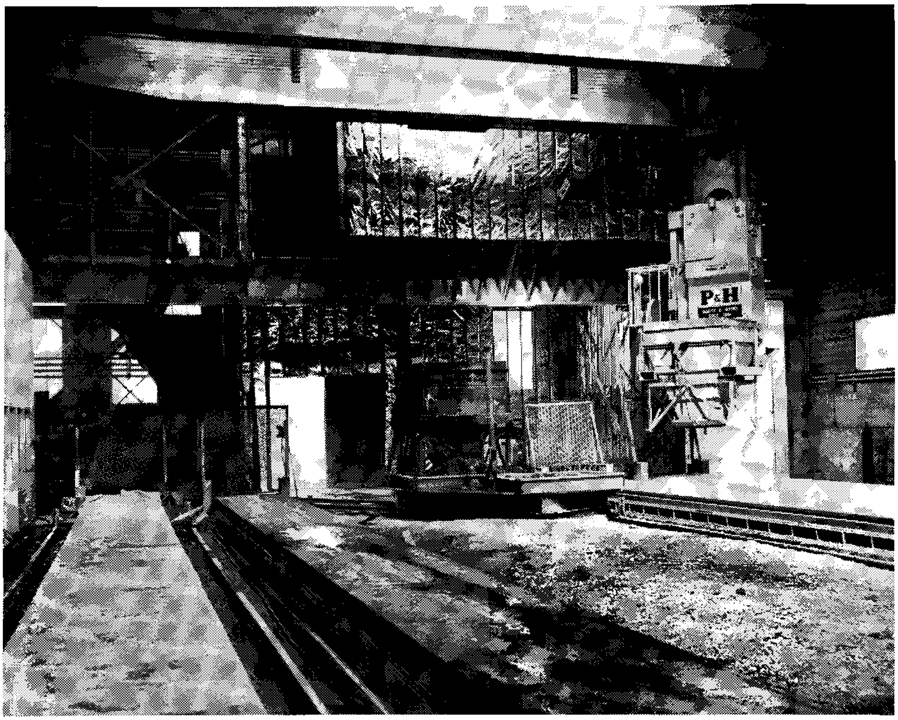

Fig. 2. Interior view of precast concrete plant. From left to right: main control panel, mixer, transfer car, and stacker crane. The 10-ton crane can rotate 360 degrees and lift 15 ft.

trucks can dump full loads directly into and the aggregates can be delivered to the appropriate storage bins or silos by belt conveyors. This technique will eliminate the need for operators on equipment and the required continuous maintenance of this equipment. In areas of freezing and thawing this method also eliminates the problem of frozen aggregate stockpiles.

Fig. 1 shows an exterior view of a hollow-core plant demonstrating the coarse and fine aggregate raw materials handling method. On the left side of the picture is the drive-over hopper into which full truck loads of aggregate are dumped. The aggregate is then conveyed into the storage bins by a belt conveyor. Heaters are installed under these bins to minimize freezing problems during the winter months.

Cement

Is our cement storage sufficient or is there the deadline of getting the cement delivered just in time or even losing production because we ran out of cement?

Do we know what it costs to lose an hour of production time? That is a good number to know. The production cost certainly helps to expedite decision making.

Strand

The other major raw material, name-

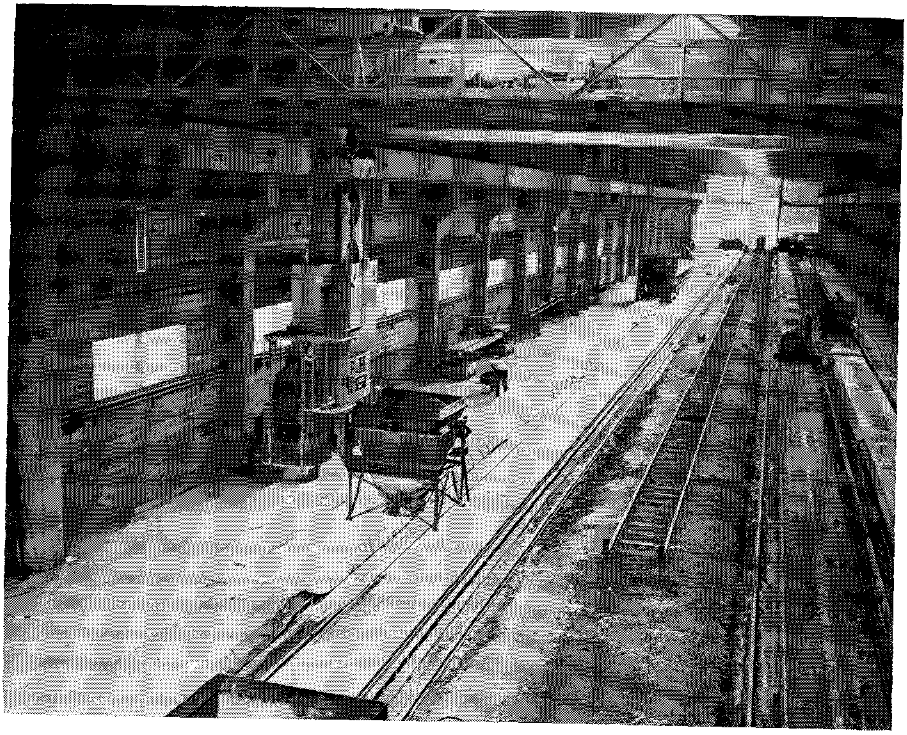

Fig. 3. Left foreground: stacker crane with bucket of no-slump concrete traveling to the two extruders in the background.

ly, strand, is a subject in itself. I will only comment that an annual projection of strand requirements is a must so that we have a steady work flow into the plant. The strand should be stored and handled so that there is no delay waiting for a new pack of strand to be placed in the racks.

Handling of plastic concrete

How about the handling of plastic concrete in the enclosed plant?

How do we get the concrete from the mixer to the point of discharge?

Do we have one of those "super fast" mixers that mixes a cubic yard of concrete every 5 to 10 minutes when our requirements are a cubic yard per minute? That is a problem with an obvious solution, namely, get a new mixer!

Backing up, what is our daily maximum consumption of concrete and at what rate is it consumed?

How long will the storage capacity of our bins last?

These are all very important quantities with which to troubleshoot and base improvements in future operations.

Fig. 2 shows from left to right the main control panel, mixer, transfer car, and stacker crane. The 10-ton stacker crane can rotate 360 degrees and lift 15 ft. The automated plastic concrete materials handling system for this plant is activated by the

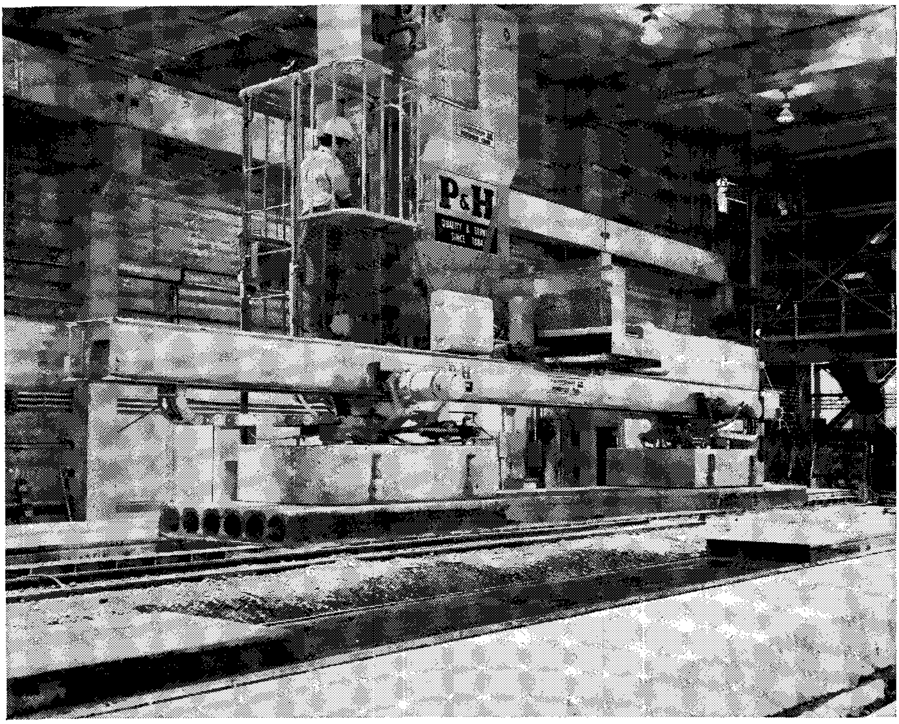

Fig. 4. Stacker crane lifting hollow-core slab with vacuum pads.

stacker crane operator shown at right in this picture. By pushing a selection of three buttons he can start the cycle, recycle, or stop the cycle. The recycle button is pushed by the operator after he has placed the empty concrete bucket on the transfer car and picked up the full bucket. The transfer car then returns to the fill position under the mixer and at the same time the pre-batched concrete raw materials are dropped into the mixer. Another batch is then weighed and held until discharged. As soon as the mixing cycle is completed the concrete is deposited into the concrete bucket below, and the transfer car will move out from under the mixer to the position where the stacker crane operator can pick up the full bucket.

Transportation of plastic concrete

Do you transport your plastic concrete from the mixer to the placing point by the same equipment that you remove your finished product from the molds? If so, this means that we can only do one operation at a time. This is another very questionable operation.

Fig. 3 shows in the left foreground a stacker crane with a bucket of no-slump concrete traveling to the two extruders in the background. The stacker crane carries the full bucket of no-slump concrete to the extruders and discharges the concrete into the hopper. It then returns to pick up a full bucket and starts the cycle again.

I feel that the development of a

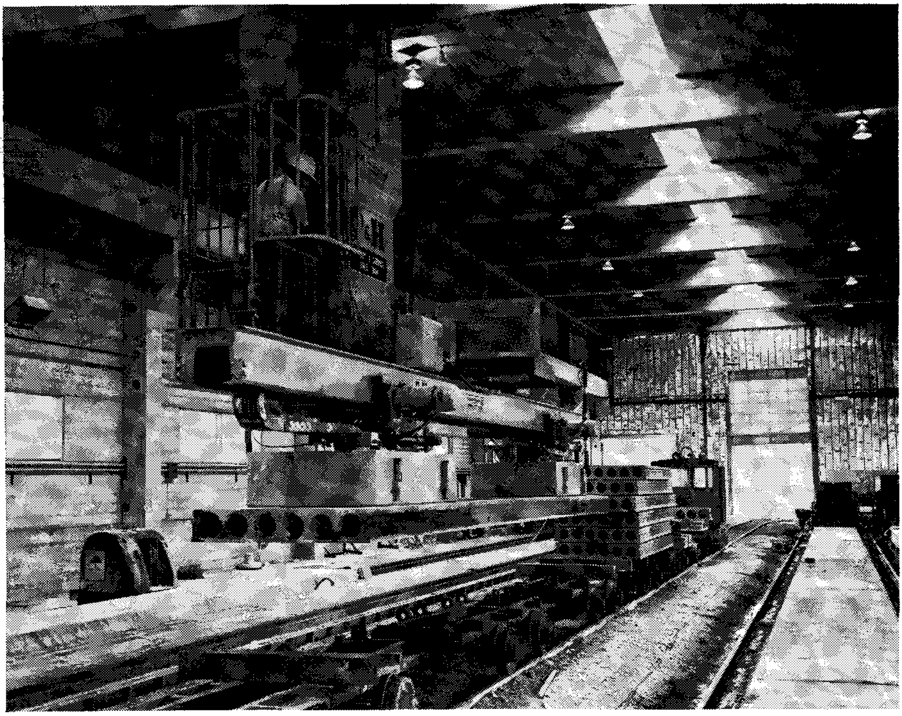

Fig. 5. Hollow-core slab being loaded onto railroad car with stacker crane.

piece of equipment to economically transport concrete within the plant has been neglected. Much more has been done for the outdoor operation in concrete transportation. This is easier, of course, and there are more "outside" plants and applications than "inside." This ratio is changing. As more and more one-product, high-volume plants are built, such as hollow-core plants, we will see a large increase in enclosed plants with more automation and more attention paid to materials handling in the future.

Handling finished product

Now that the finished product is made, what are we going to do with it? This is a situation where there is much confusion in some cases.

Do we just take it "out back" on a truck and store it?

How many times is the finished product handled before we get it in the storage pile?

I was in one very large new plant that handled hollow-core slabs at least four times and involved 10 people almost full time just to get the slabs into storage. I would say that here was a case which needed some study on materials handling.

Fig. 4 shows a hollow-core slab being removed from the steel pallet by the stacker crane, using vacuum pads attached to a load beam. These pads can be moved electrically by the operator to allow for varying lengths of slabs. One pad can be moved to the center to handle very short slabs. A word of cau-

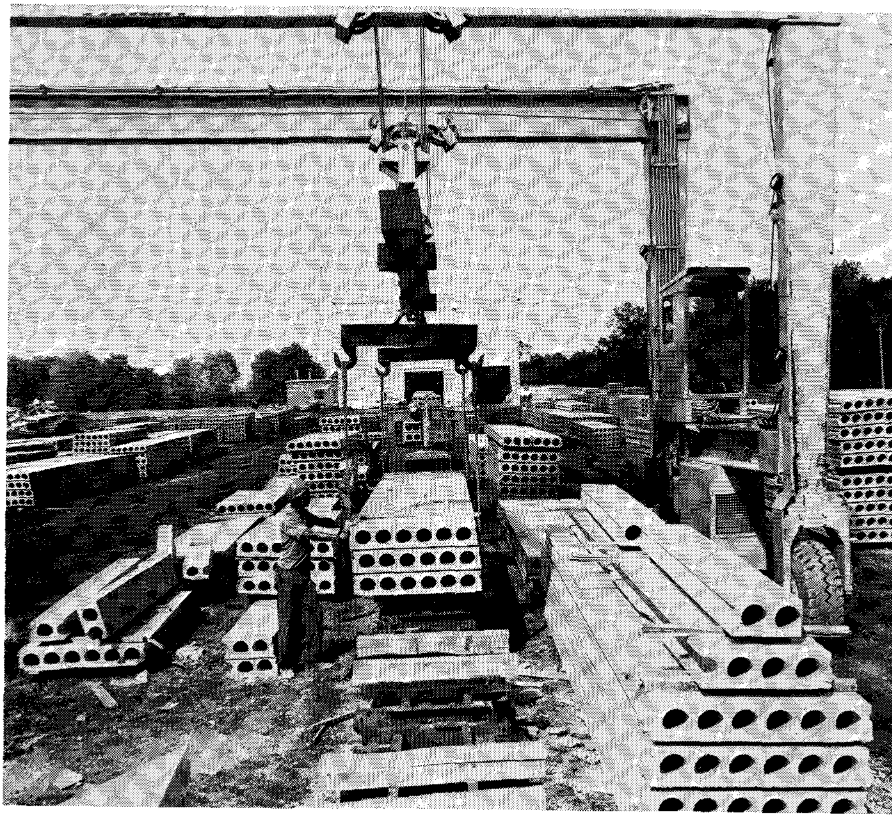

Fig. 6. A stack of hollow-core slabs being removed from the train to storage by a straddle carrier.

tion: If the concrete slab surface is porous, this method of handling with a vacuum is not recommended.

In the case of hollow-core slabs, do we remove them from their beds and stack them in truck load lots before removing them from the plant? Then do we *not* unstack them until they get to the job site to be erected. We certainly should do this with all the products that we can!

Rail system for transporting products

Why not install a rail system so that a full product line of finished products can be taken to a storage area by one man rather than a truck, crane, or straddle carrier. This method gives a much lower first cost as well as a far lower daily cost of operation.

Fig. 5 shows a hollow-core slab being loaded on to a railroad car with stacker crane. The slab has now been moved from the steel pallet by the stacker crane and is being placed on the rail cars in predetermined stacks for proper truck loading in the future. The train can take the full production of one shift out to the storage area with only one trip.

Note that all materials have moved in a straight line and have not changed di-

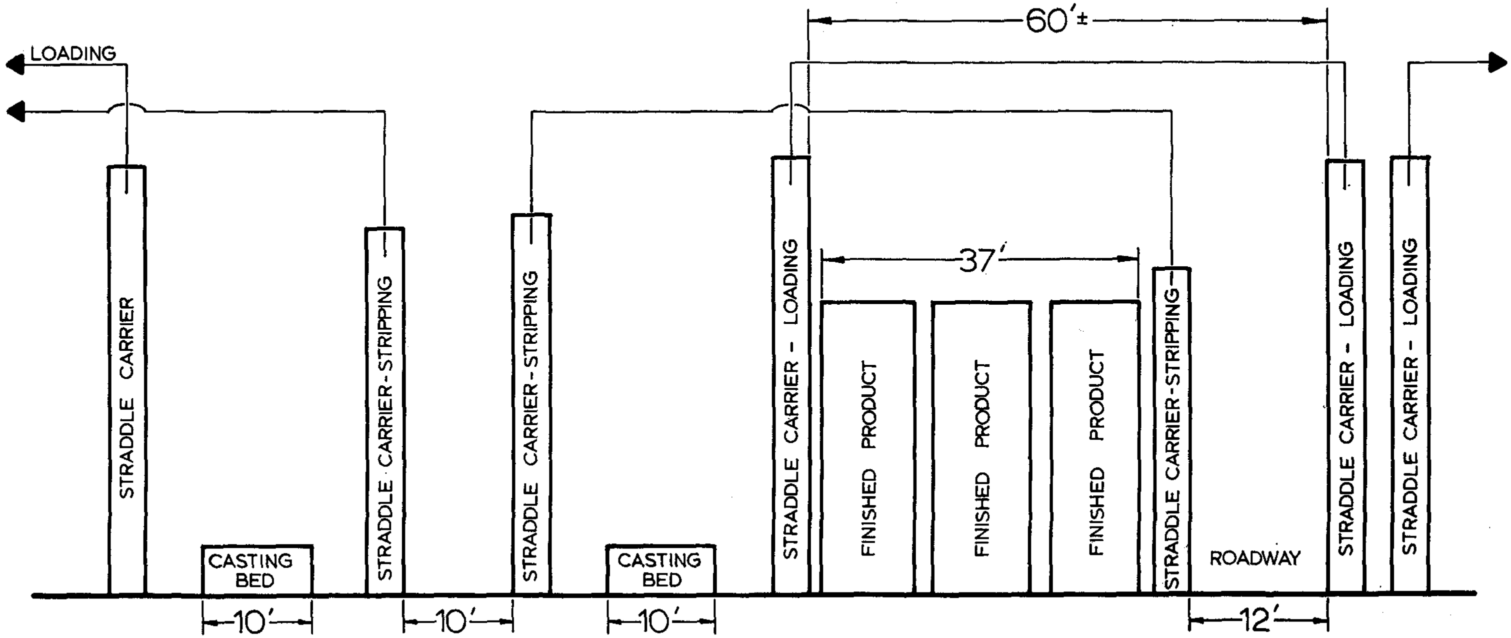

Fig. 7. Typical "outside" plant layout for production and storage.

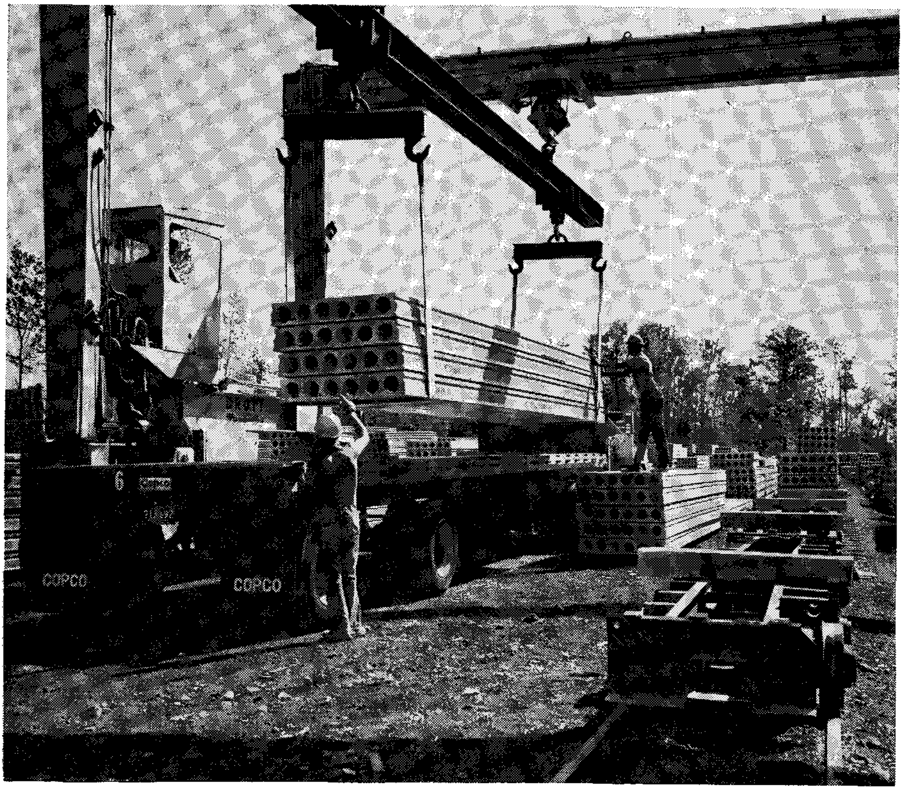

Fig. 8. A stack of hollow-core slabs being loaded onto a truck by straddle carrier. Railroad is on right side.

rection up to this point.

Fig. 6 shows a stack of hollow-core slabs being removed from the train to the storage by a straddle carrier. After the railroad cars have been loaded they are pulled out of the plant to the finished product storage area. They are then lifted in stacks and placed in storage by a straddle carrier.

Outside plant layout

One plan that is seldom used is the spreading out of casting beds. In the case of nonenclosed plants, the products are removed from the bed and moved sideways into storage. This plan locates the beds for production and storage piles over the entire plant area. However, it is still occupying the same amount of space.

Fig. 7 shows a typical "outside" plant layout for production and storage. This is a repeating layout that can be designed for numerous casting beds of varying lengths and product types. The straddle carrier stripping indicates the position of the straddle carrier during stripping. The straddle carrier loading indicates the position of the straddle carrier during truck loading. This leaves the bed free of interruptions from the straddle carrier during loading periods and only requires the straddle carrier over the beds during the stripping period. Generally, the only movement of the finished product required is sideways into storage.

The plan shown in Fig. 7 requires the utility and curing lines to be run a little farther, but this is a relatively small first fixed cost and not an ongoing cost for the life of the plant as, for instance, moving one double tee at a time from the bed to the storage area of the plant with a straddle carrier or other equipment. For the most efficient use of space this "spread out" method requires the wider 60 ft straddle carrier or a portal crane. This will reduce the number of roads required per stack of slabs so one gets more efficiency out of the plant site.

It should be added that we are assuming that the finished product storage area is not arranged in a manner where all stacks are crowded together and the straddle carrier is required to move with the product from a storage pile out to a roadway where the truck is waiting. This, obviously, takes much more time to load and contributes more costs to the materials handling account.

The following may be an academic type statement, but there must be a plan for what happens "out back." In this regard, the following questions might be asked:

1. Where is each job going to be stored?
2. How will it be stored?
3. Can the pieces be loaded in truck load lots with one lift?
4. What lifting devices will be used?
5. What will give the least loading time per truck?

There are many items on the market today to allow us to package our finished products. This advance planning is an area where we really need to do our "homework."

Transportation of finished product to job site

Finally, the erection of the finished product is greatly affected by all of the previous materials handling that has been done. For example, does the product get shipped to the job site on time, in the proper sequence, and with the proper quality finish so that job site finishing is not required or at least is kept to a minimum?

Fig. 8 shows a stack of hollow-core slabs being loaded on to a truck by a straddle carrier. The railroad is on the right side of the picture. The stacks of slabs are lifted from the storage area or the railroad and loaded on to trucks and then hauled to the job site for erection. Normally, the truck is loaded with only one or two lifts depending on the length and the depth of the slabs.

I have one last question on hollow-core slabs: Can all of the grout be pumped into place rather than tie up an expensive crane and crew to bucket it up?

Conclusion

It is obviously impossible to cover every possible facet of materials handling in one short paper. Nevertheless, I hope that I have stimulated some fresh ideas which will improve the efficiency of precast-prestressed concrete plant operations and thereby increase profits.

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