

CONVEYOR DESIGN SOFTWARE

A fast effective tool to “automate your design process” and reduce costs.

By Mark El Kadi, M.Eng., CET

The following is a typical example where a manager or supervisor has been assigned a certain task to follow up and gather the necessary data before the next meeting with the executives of his company. He/She picks up the phone and calls **your company** and asks for you by name. Lifting the receiver you are suddenly aware that the caller is a client with a degree of urgency in his/her voice.

It becomes very apparent, very quickly that the client needs information fast. The information required is for the ***design, cost, and manufacture*** of several conveyor systems and the ***timetable*** for their delivery. The final product would be set up in a number of the client’s warehouses. The client continues to explain that the major components would be:

- a) A flat table of a certain size and capacity,
- b) A horizontal conveyor [with and without overhangs], of certain dimensions and
- c) An inclined conveyor (checking various angles for an optimum design).

Each conveyor system would be hundreds of feet in length and would be located in several of their plants. Consequently “PRICE” would be a major concern.

The client makes it very clear that another important factor would be the “weight” of the structural components to be handled by his warehouse equipment (mainly Fork-lift Trucks). Consequently it is necessary that the design be extremely safe to handle the load and would necessitate that the lightest components possible be incorporated into the design. This, he/she hopes would help to keep the overall cost of manufacture to a reasonable level. The discussion might continue around the possible use of **HSS** (Hollow Structural Sections) that are available, their delivery time and the impact of their use on the design, price, manufacturing time and final delivery. The client would also like a “Ball Park Figure,” ***there and then***, in order for his/her team to draft a “***Profit – Time Line – Action***” Data Base ready to be presented to the management at their next management meeting. To further complicate the issue, the client might suggest that, in order to reduce the total cost and help reduce the delivery time, that some of the **HSS** in his/her company’s inventory be utilized.

Obviously, the client has no concept of the calculations involved, the additional time required and the added difficulty that using material from “their inventory” would bring to the scheme of things, since this “inventory” of “**HSS in Steel**” must also be checked even before the design stage could begin. (*Going on past experience, records of inventory are often quite inaccurate and the condition of the material stored, over a period of time, might require additional treatment to bring it back to into a usable condition*).

Diplomatically, it is explained to the client that every effort would be made to comply with these requests and that our company has the experience and the expertise to ensure that:

- 1) The design time will be kept to a minimum and that they would be consulted at every important stage of development in order to ensure that their requirements were being interpreted correctly.
- 2) That the requirements for “lightness” of structure, “safety of personnel” and “cost” would be constantly borne in mind by the design team and that they would consider these of paramount importance.
- 3) In addition to these, as requested, the “clearance” heights would be at least 10 feet all along the conveyor lines and that the column spacing would be kept to a “maximum” to allow for the easy passage and maneuverability of their forklift- trucks and product when carried.
- 4) Another difficulty to be considered in the final design is the “**probability**” that maintenance crews might need to walk (or crawl) on the conveyors and therefore he/she needs to know how the number or total weight of maintenance personnel that the system could safely support.
- 5) What the client does not realize is that, with such a ‘**high system**’ and the fact that there are operators and maintenance personnel involved, there is a high degree of “**Safety**” required to be incorporated into such a design.

Just before the client rings off, the client makes the following dreaded request—“*Can you give me some Ball Park figures of how much and what would be your best delivery?*”-- This, the client needs to know there and then, before his/her next meeting with the management.

The above situation happened to me recently and it has to be admitted that for most people in this situation, they would not have been able to give this client an “Educated Guess” right away. Another problem, for many, would be the fact that such an “Educated Guess” would have to include the cost and time needed by a structural engineer (Professional Engineer) in order to ensure that the integrity and safety aspects of the design envisaged were adequately covered. This I had explained, as was required by Canadian Law and therefore it was not an option. Normally, this would have added a considerable amount of time and cost at the design stage after all the calculations had been done and the “client’s Inventory” examined.

This is where my “**23 years of experience and expertise**” in designing such systems came to my aid. He wasn’t aware, of course, that while he was talking and giving me the relevant information I was working on his requirement producing a rough design sketch, and working with a calculator and a computer software. Having given him his answers, he asked if I had used some very special “software”, to which I replied, “Yes, but that even though we had such software in house, the output from the software had to be checked manually especially at critical areas to ensure that all aspects of ‘safety and integrity of design’ were fully covered in my “Educated Guess.”

Engineering Calculations based on good sound engineering principles are absolutely vital and although I had the use of some “Computer Software” (which was still very much in its “Beta” stage of development), that all the calculations must always be scrutinized and verified by other means, and, where Safety Issues are involved, by a qualified and experienced structural “Professional Engineer”. Fortunately, due to my years of

experience, I was able to make certain “adjustments” to my calculations and cost estimates to allow for the services of such a Professional Engineer having used his services for similar applications quite a number of times in the past.

I gave my client my “Educated Guess” and I told him that I would firm up the price and delivery once his inventory had been checked out and found to be suitable for his conveyor system. He was delighted with my honesty, thoroughness and speed, but he added, that going from his past experience with our company, that he wasn’t surprised and that it was the reason he had contacted us and requested to speak to me in the first place.

He then stated that the figures I had given him were within his budget for the project and he requested that I look into the design in greater detail and get back to him as soon as possible with a more accurate figure for the design, delivery and cost.

The computer software assisted me to take into consideration some of the following information:-

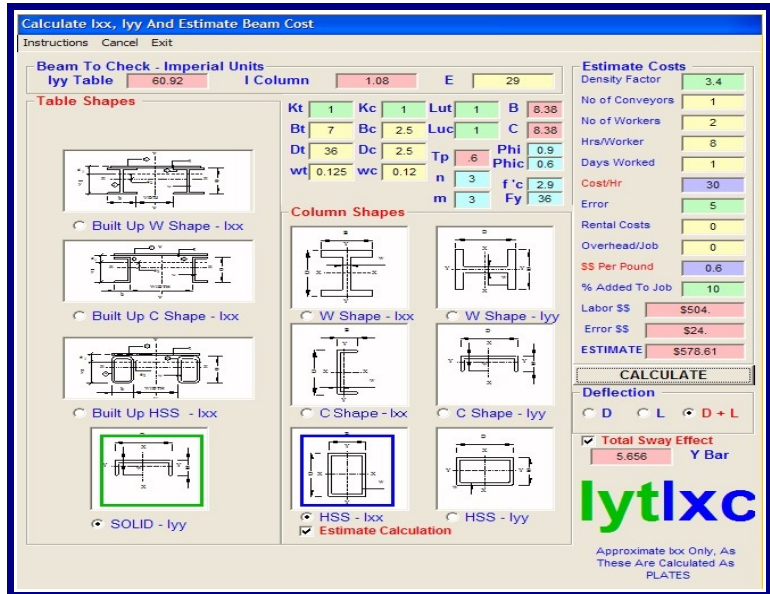
- 1). The total “envelope” into which the system had to fit. (Height, width and length).
- 2). The use of some of his inventory for the “beams and columns etc” with the spacing he had stated.
- 3). A check on accessibility for his forklift trucks and their loads.
- 4). The maximum total weight that this conveyor system could safely handle for a combination of maintenance personnel and material being handled.
- 5). The type of system best suited to his application.

However, having used the software to assist me in my final design considerations, it now necessitated that I involve a much more direct and manual approach to ensure that all aspects of design and safety were covered before offering to our client any kind of “firm figures” for the design, delivery and cost.

As the engineering and plant manager of Power Belt Conveyor Systems Inc. of Woodbridge, Ontario, I am currently involved in the “beta testing” of this relatively low cost “software” [**Case Tools**] that will literally change how people design these types of systems. One must always bear in mind that it is very specific in application, covering only the conveyor designs for which it is designed to cover and is not for general use for conveyor systems **for which it is not applicable**. Once the software is fully verified as being accurate, I will endorse it as an effective tool. It can then be used by designers, managers, technologists and technicians, etc.... This is meant to be used as “educational and checking” software for the initial design and approximation for conveyor systems that will assist in the designing of the steel frame, the steel supports (columns) and steel base plates. **Case Tools** is a very fast and relatively accurate computer tool but is wholly dependent on the **information** entered as “INPUT.”

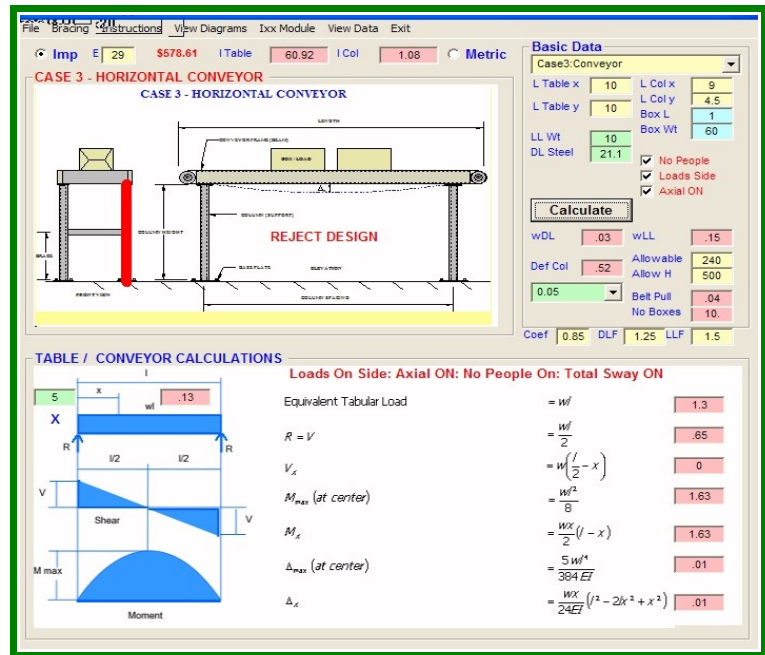
Case Tools is a relatively low priced **design software** that will be available to any firm, large or small, involved in the design of such systems. Moreover, the software has the added capability of assisting in the design of a horizontal steel table or platform, with and without overhang (i.e. cantilevered). It will design in imperial units (and can be upgraded

for use with the metric system of units). It has the versatility of being able to consider the use of hot rolled or cold rolled sections.



Case Tools incorporates a database of a wide range of structural steel shapes that can be easily selected but also allows the user to enter specific steel shapes, which might be readily available in their inventory or in a supplier's stock. All that is needed is to simply select and input the desired parameters such as height and column spacing, etc.. and to select the type and size of steel required. Depending on the computer system used, the answer can be given in a very short time.

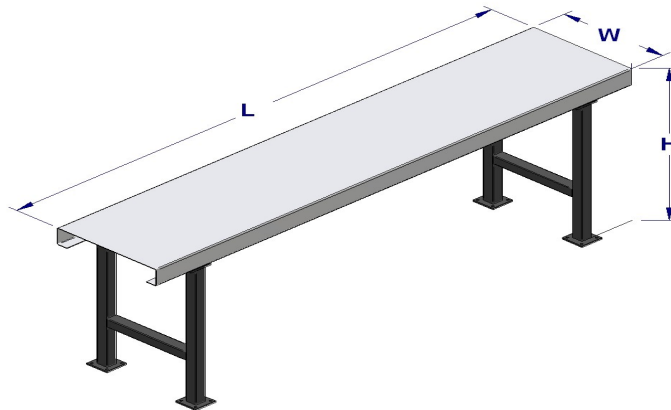
The software is so designed that the operator is instantly alerted of any design and structural problems by turning the affected members to "red" in colour.



The software is also designed that further progress cannot take place until that “alerted member” is changed to a more acceptable configuration (size or weight). This is usually done by simply selecting another shape, or entering different criteria.

The software automatically checks the final design against the required codes.

Case Tools software is an **added value design tool and a computer aid** to all competent and experienced conveyor designers and engineers. By using good engineering judgment and conveyor design experience, users can quickly arrive at a design for the conveyor system and the furnished results will produce the necessary “column size, frame/beam size and base plate design”.



As has been mentioned above, when and where “**Public Safety**” is an issue to be considered, it is mandatory by Canadian Law that an experienced professional engineer specializing in structural engineering verify all calculations, data and final designs. In most cases, it may only be necessary to supply the structural engineer with the design specifications, data and verified calculations. However, in some instances, the specification may demand a more intensive, “hands on” approach by such a structural engineer from the beginning.

The **Case Tools** software is of great assistance here, in that it can produce “print out data and designs” than can assist the structural engineer to assess the integrity of design and/or make recommendations. In this way time and cost can be saved. The cost outlay for the software is quickly recoverable in the considerable time that can be saved at the design stage with the added advantage that it can also be used by the structural engineer to fine tune the design, if he/she can see additional cost savings or improved safety benefits. Thus it can minimize the design time and optimize the finished product.

Where public safety is not an issue and the services of a structural engineer is not required, then even a relatively inexperienced individual will be able to use the software, provided the technical requirements and data are fully understood by that individual. In general, the software is designed to allow the end user to give a client some 'quick' answers in a relatively short time depending on his/her acquired skills and experience.

For further information on this product, please contact the author at melkadi@powerbeltconveyors.com

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