

CHARACTERISTICS OF A COMPLETE PLANT LAYOUT

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For manufacturing companies, a well-designed layout helps to optimize efficiency and maximizes profits. It provides an ideal work environment for both employees and machines by allowing for quick and easy movement of materials and products.

Designing a factory is a rare privilege that comes only once or twice in a career and the stakes are high. The layout must be developed to maximize value and be closely aligned with your company's strategy, putting the focus on how to make the best use of talent, equipment, space and facilities at minimal capital investment while maintaining quality and safety.

Following a systematic approach decreases the risk of costly mistakes resulting from uncontrolled changes and poor initial planning, thus ensure that no aspect of your design is left out and that the product (and customer) are best served.

Layout strategies create a good working environment and make the best use of talent, equipment, space and facilities at minimal capital investment without compromising quality while remaining flexible, safe, clean.

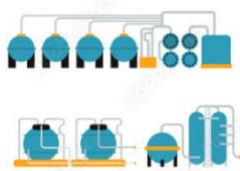
Before committing to pour or break concrete, there are few things that need to be understood before starting any work related to layout planning:



What equipment and furniture is needed? PROCESS
Who is needed where and when? CAPACITY
When does product need to move? FLOW
Where are raw materials coming from? INVENTORY
Why are people working in certain ways? CELL DESIGN

Then, How to put it all together?

PROCESS: Understand how work is inter-connected



Mapping exercises are often an eye-opening to company leadership. They enable a team to visualize the sources of inefficiencies that delay delivery time or cause resource constraints. A structured approach to mapping will provide you with clear, specific and accurate information on where to direct your efforts and expenditures. Either with Value Stream Mapping, activity flow charts, process mapping, or swim lane diagrams, the team can identify the areas needing the most help. The exercise helps the team understand the current state of your manufacturing and business processes, “warts and all”, account for money tied up in the form of Work in Progress

(WIP), and to document long-standing issues preventing the team from performing optimally. Of critical importance, we want to identify all communication barriers between departments and customers so we may create the proper signals for work and establish feedback loops for quality events.

We don't want to carry old baggage to the new building, after all. A plant's design should help create an environment conducive to synergistic activities such as production, testing and innovation.

Take-aways for facility layout:

- Acknowledge all sub-assembly work and special processes.
- Identifying places for automation investments and process improvement.
- Removing redundancies and irrelevant activities that affect productivity.
- Uncover areas that are not compliant with industry regulations.
- Target: 7-plus figure of operational savings to pay for the

CAPACITY: The true amount of work to be done to build your product.

One of the most fundamental considerations before attempting to optimize your factory layout is knowing your production capacity. Capacity is a measure of how much work a facility can achieve. And it starts with PEOPLE.

The true amount of work to be done to build your product is often greater than what MRP or scheduling systems calculate. When key people are away, there's a tendency for the less-experienced employees to cut corners and quality suffers, or work stops altogether when subassemblies are not ready. There are plenty of hidden activities that *somebody* is doing (not for free!) and best find out who and when. Finding those under-staffed activities and reallocating resources to alleviate the workload is one of many ways to show respect for people.

By calculating the *future* capacity needs we can work backwards to create a scaling plan that activates capital equipment purchases and hiring new team members based on volume triggers and customer demand. Computer simulations allows you to see how changing certain factors in your factory layout will affect the efficiency of your production line.

Take-aways for facility layout:

- Scaling plan to present investors
- Footprint and volume requirements to meet demand.
- Reserve space for future equipment installs.
- Identify furniture needs for work and materials for all activities.

- Design the building for growing staffing needs such as personal spaces and training spaces.
- Cost per product family to allocate resources proportionally

FLOW: Orchestrating the proper rhythm of the factory



What do you work on when there is a classic 'pull' system? Whatever is in front of you! So, we want to make sure that work shows up in the right sequence.

But if an operator is caught up at one station, that does not mean that operators must stand idle. Rather we want to give them the option to move to where the work is, either upstream or downstream.

The objective is to design the physical flow of WIP to ensure that product is always moving and keep up with the promised takt time. Long processes may need to be broken up into multiple stations in equally divided task duration. Fast and slow products need to be sequenced optimally so operators don't get stuck with too many "difficult" products that create a delay. Some products may need to wait for specific components before they can be called finished and be staged temporarily or stored until everything is ready.

Take-aways for facility layout:

- Establish visual communication between stations by allocating drop-off and pick-up spots.
- Break up large multi-purpose stations into properly designed specialty areas.
- Decide to add stations to establish a more balanced line.
- Assign additional resources to the bottleneck processes, such as WIP buffers.

CELL DESIGN: Understand the people's needs



Designing a manufacturing cell that considers the needs of the people who will be using it is crucial to ensuring efficient and safe operations. By considering factors such as product drop off and pick up points, material placement, and ergonomics, you can create a safe working space that shows respects for people and meet the needs of the customers in the shortest lead time.

Here one can analyze the cell's activities by the "seven flows" of manufacturing -- raw materials and waste, product and finished goods, people, information, equipment, and change management.

A standardized cell layout helps to overcome differences between the way people do things, leading to a more consistent quality and predictable labor times.

Take-aways for facility layout:

- Ergonomic considerations in equipment selection
- Mechanical assist equipment selection
- Jig and fixture design (footprint)
- Elimination of forklift traffic in the production area

INVENTORY Management- Where's my stuff?



Effective inventory management tracks, controls goods and materials held available in stock, optimizing your productivity and profits. Inventory calculations help you understand what the optimum level of inventory needed to keep production running without outages.

The challenge is to ensure the Seven Rights of supply chain: Have the right materials, at the right time, in the right place, in right quantities, the right container, the right frequency and sequence, all resulting in the right cost of ownership.

Design considerations include: Minimizing materials movement, collection spots for empty materials bins, parts kitting and staging locations, waste management flow, reorder point signals, and cost-conscious policies for total inventory to hold. The ultimate goal is to implement management tools for an inventory system with checks and balances that is *engineered* to keep the shop replenished, not leaving it to chance or whims from supply chain disruptions.

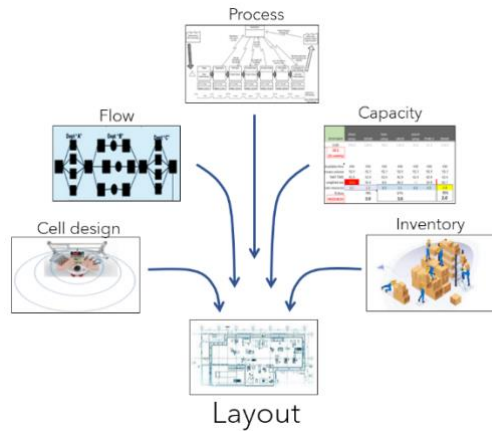
A well-detailed CAD layout plan helps bring a product to life by providing instructions on where the equipment and materials are to be placed before being transported.

Benefit to layout:

- Footprint for raw materials and subassembly supermarkets
- Paths for conveyance devices and material replenishment routes
- Footprint and height requirements for material handling systems
- Footprint for inventory systems that prevent loss from theft, spoilage, and returns

FACILITY LAYOUT: Putting it all together. Measure twice, cut once.

Layout decisions are long-term commitments, and poor layout will cost the company time and money.



The goal of this final component is to incorporate all the previous discoveries and to lay out the facility to optimize the relationships of areas that need to be close to each other and minimize the negative interactions in support of high quality and efficient operations. This is the time to consider safety, communications, utility availability, floor strength, access to windows, doors and docks, air quality, and noise.

During the exercise it is helpful to visualize the flow of people, materials and waste, work in process (WIP) and finished goods, waste, equipment & tools, information.

A verbal or virtual simulation allows to walk through areas of concern, including interference from utilities and services (gas, water, power, heat, light, air, sewage, HVAC, and exhausts), and other structures before any physical equipment is bought or brought into the building. One can drop in equipment footprint files from vendors, integration with campus GIS, or other asset management systems.

Final outputs from a formal layout effort include

- CAD files 2D top view, used for city permitting and contractors.
- Safety restrictions per industry regulations
- Structural specifications for weight, vibration, and air quality criteria.
- Utility drops that meet equipment requirements
- Secure storage locations, and clearly marked testing & holding areas

