Problem 01
Spaced Out

SCHOOL OF ENGINEERING

Facilities Planning and Design

- Facilities planning is a complex and broad subject that cuts across several engineering disciplines - civil, electrical, industrial, mechanical, etc.

- Examples of facilities planning applications:
  - Building a new hospital
  - Layout a production line
  - Retrofitting an existing warehouse
  - Designing the baggage department of an airport

- Facilities planning determines how physical assets support the facility objective.

Objectives of Facilities Planning

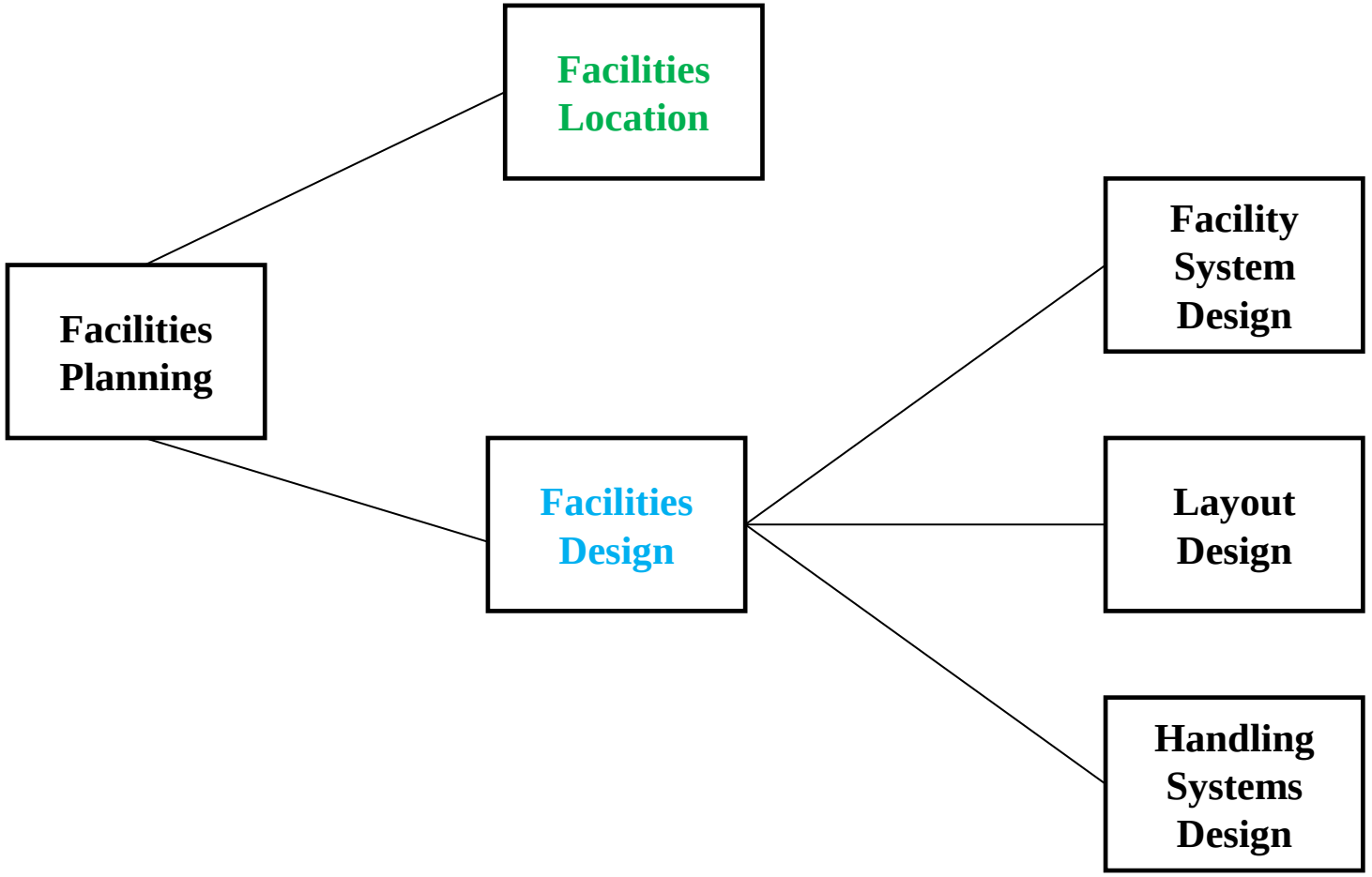
- Effectively utilizing people, equipment, space, energy
- Provide for continuous improvement throughout facility life cycle
- Promote user safety and satisfaction
- Facilitate productivity gains and cost reduction
- Promote ease of maintenance

Motivations for Facility Planning

- Productivity gains and cost savings in areas of material handling, personnel and equipment utilization, inventory levels.
- Employee health and safety
- Energy conservation
- Community considerations
- Fire protection
- Security
- … etc.

Facilities Planning Hierarchy

- Facilities planning covers both facilities location and facilities design.



Facilities Planning Process

- Applying the engineering design approach:

Steps

1. Define the problem
   - Define (or redefine) the objective of the facility
   - Specify the primary and support activities to be performed in accomplishing the objective
2. Analyze the problem
   - Determine the inter-relationships among all activities
3. Determine the space requirements for all activities
   - Generate alternative facilities plans

Facilities Planning Process

4. Evaluate the alternatives
   - Evaluate alternative facilities plans
5. Select the preferred design
   - Select a facilities plan
6. Implement the design
   - Implement the facilities plan
   - Maintain and adapt the facilities plan
   - Redefine the objective of the facility (if needed)

Facilities Location

- Facilities location refers to the place with respect to customer, suppliers and other facilities with which it interfaces.

- Some factors influencing location:
  - Proximity to raw material source
  - Customer markets
  - Transportation system
  - Economic development (financial) incentives

Facilities Design

- Facilities design consists of the facility systems, layout and handling system:
  - Facility systems – structural, atmospheric, enclosure, lighting, electrical, communications, safety and sanitation systems
  - Layout – equipment, machinery, furnishings and fittings within the facility envelope
  - Handling system – the mechanisms needed to satisfy the required movements within the facility

- Material handling is important to the facility design activity. The choice of material handling equipment will greatly influence the suitability of the facility design.

Facilities Design

- Dimensions for Improvement:
  - Physical factors – fittings, equipment, layout, furnishings, human factor interactions
  - Time factor – traffic flows, ingress, egress
  - Safety aspect – security, hazard avoidance

P01 Sample Solution

Sample Solution

There is no unique, best solution to this problem,

only many good ones!

Sample Solution

Visual Art Gallery

Purpose: Showcase art pieces for visitors

Effectiveness- Location: Good- visible

Effectiveness- Systems Design: Good- adequate humidity control

Alternative 1 (Visual emphasis)

Physical: Ample lighting on the art pieces for viewing

Time: Use colors to identify different zones of different type of art pieces.

Safety: Art pieces may need to be secure. There should be a mark out zone.

Alternative 2 (Functional emphasis)

Physical: Need to cater space in front of the art pieces for viewing.

Time: Clear direction flow to highlight important art piece.

Safety: Differentiate emergency signs from the surroundings

Sample Solution

Facilitation/Conference rooms

Purpose: Area for discussion and meeting sessions

Effectiveness- Location: Good - accessible

Effectiveness- Systems Design: Well equipped with facilitation equipment

Alternative 1 (Visual emphasis)

Physical: Long table to be at centre of the room. Good lighting for room.

Time: Use colors to identify exit and entrance to room

Safety: All exposed ceilings should be covered. Ample ventilation in the room.

Alternative 2 (Functional emphasis)

Physical: Layout the tables for discussions. Accessible to white board.

Time: Change table design to allow easier movements and discussion

Safety: Increase to two doors for each class to provide emergency exits

Ensure free access for facilitation/conference room at all times

Sample Solution

A video library

Purpose: Place for video storage and retrieval of art and culture material and discussion

Effectiveness- Location: Good- Spacious, visible, accessible

Effectiveness- Systems Design: Opportunity to explore other alternatives

Alternative (Functional emphasis)

Physical: Discussion tables at the video library section

Newspaper racks should to be located at Level 1 instead

Time: Use colors to differentiate different section (eg. Reference, Video)

Indicates the direction to other parts of the facilities clearly

Safety: Mark out ‘emergency exit’ doors clearly

Indicates locations of safety equipment clearly

Sample Solution

A cafeteria

Purpose: Area for food and drink consumption.

Effectiveness- Location: Good – Accessible, ventilated.
Effectiveness- Systems Design: Opportunity to explore other alternatives

Alternative (Functional emphasis)

Physical: Install ventilators
Ensure good lighting and space at each tables
Change door swing orientation for toilets

Time: Ensure all toilets are available at any time
More prominent directions/ signage to the toilets

Safety: Remove swinging doors at the toilets

Learning Objectives

- Identify different design components of a facility (location, types of physical systems)
- Recognize different physical systems in a facility and how they functions
- Know the objectives of planning and laying out a facility

Before you leave the class…

- Install "Autodesk Mechanical Desktop 2010" from “Run Advertise Programs”
- Try launching the program after installing to make sure the program can run before next lesson by below path:

Start/Startup > All Program > Autodesk> Autodesk Mechanical 2010 > AutoCAD 2010

Note: AutoCAD can only run within RP.