END TO END LOGISTICS OPTIMISATION

Department of Industrial and Systems Engineering | IE300R System Design Project AY 2013/2014

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Problem Statement

At IBM's 4 year old server manufacturing and storage facility, accumulation of shipping orders towards year end has placed undue constrain on existing space and resources within the facility. Subsequently,

1. Additional inventory has to be move to an external warehouse, at a cost of about S$ 40 000 annually.

2. More equipment has to be leased and additional manpower hired and trained, which incurs further costs.

Objective

1. Provide space optimisation solutions that has a positive Return of Investment (ROI) over a 10 year period and creates minimal changes to existing facility layout.

2. Make recommendations to optimise shipping process, which can reduce manpower and equipment requirements while meeting target throughput rate of 20 orders/hour.

Methodology

Fishbone Diagram
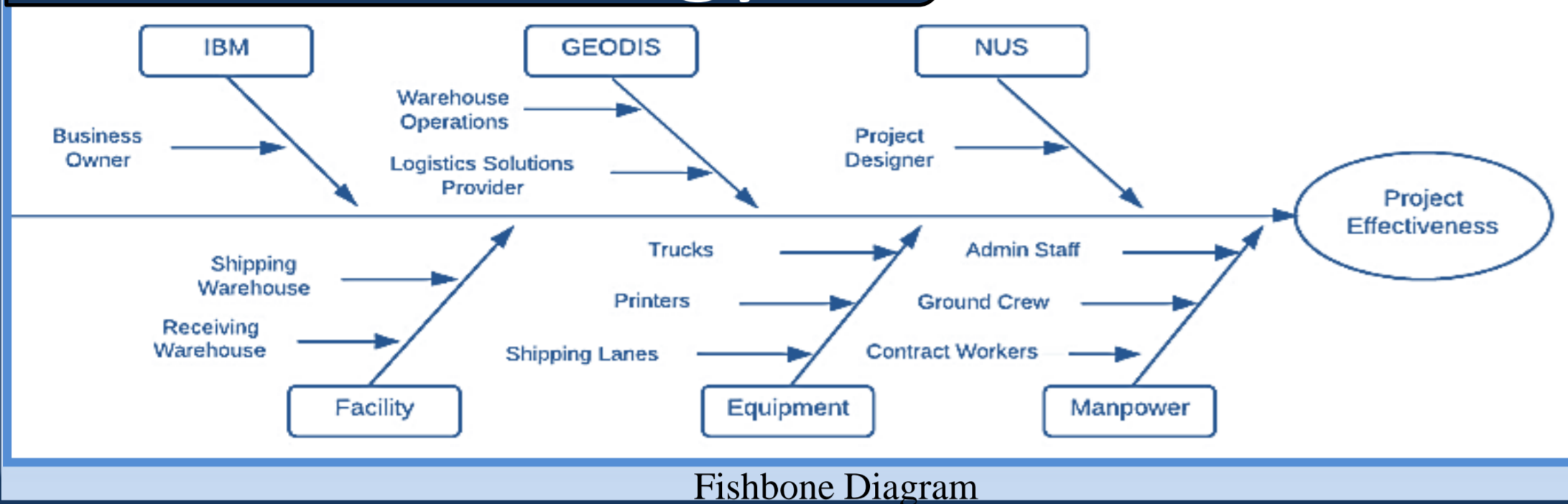
| Existing System Modelling and Analysis	Preliminary Recommendations Feasibility Study	Final Recommendations Impact Analysis
➢ Data collection ➢ System modelling on AUTMOD ➢ Model verification and validation ➢ Model Analysis ➢ Problem Identification	➢ Brainstorm solutions ➢ Discuss feasibility with client ➢ Select recommendations for integration into model	➢ Integrate recommendations into simulation model ➢ Validate and verify model ➢ Study impact of recommendations

Problem Analysis and Model Building

Space Optimization

#### Phase 1: Analysis on Demands and Resources
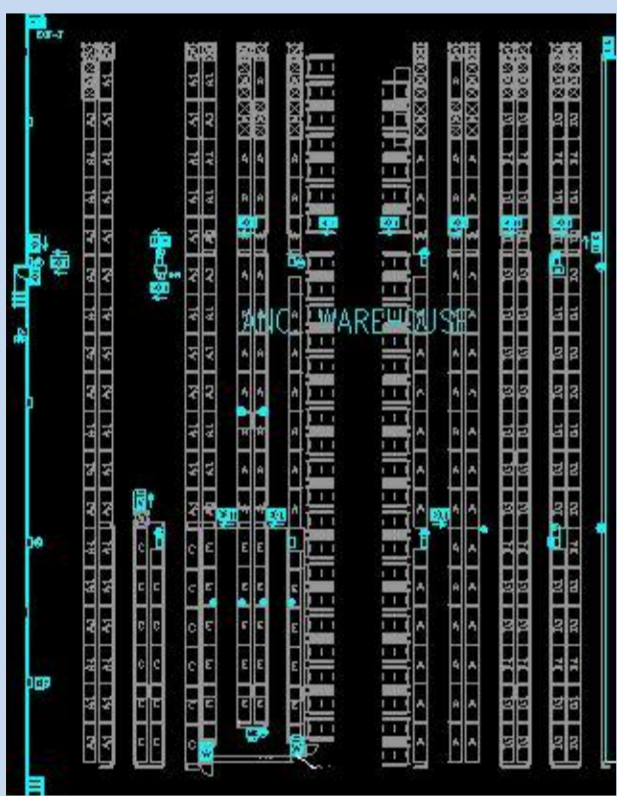
Receiving Warehouse Layout

➢ During year end, there is a space deficit for storing approximately 150 ARBO's and cover kits each.

➢ ARBO's and cover kits require transportation by Reach Trucks, whose turning radius is 4 meters, whereas distance between racks in current warehouse is only 2.8 m

➢ Vacant and underutilized spaces in the warehouse were identified and studied for introduction of new racking.

Phase 2: Racking Plan

PLAN1

➢ Shift first 11 racks of the second line of racks from the left, and build 10 new racks along the wall.

➢ Creates storage space for 12 ARBO'S and 116 cover kits, an overall space increase of 14.4%.
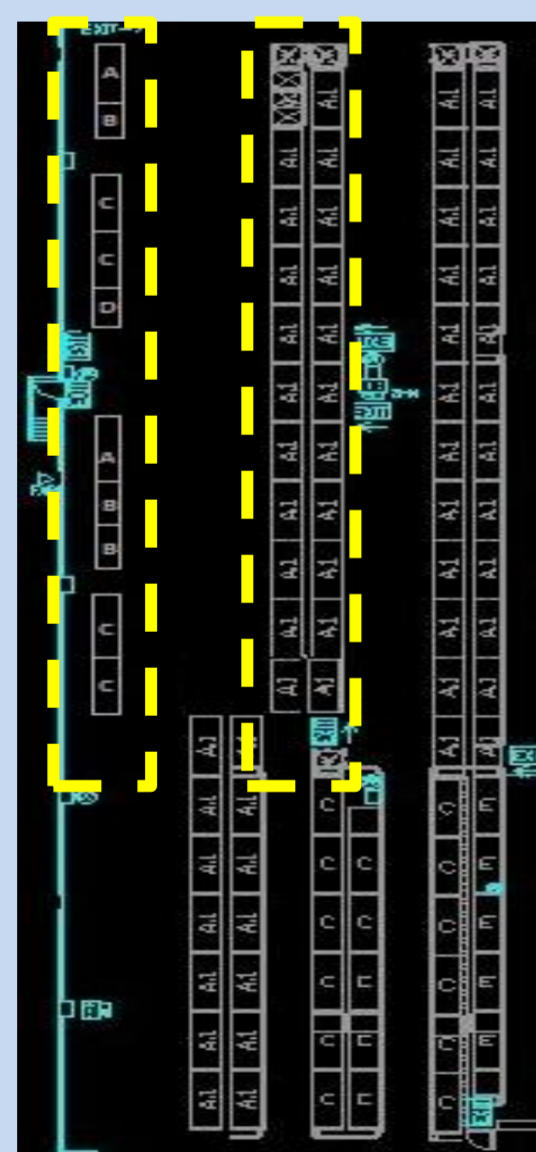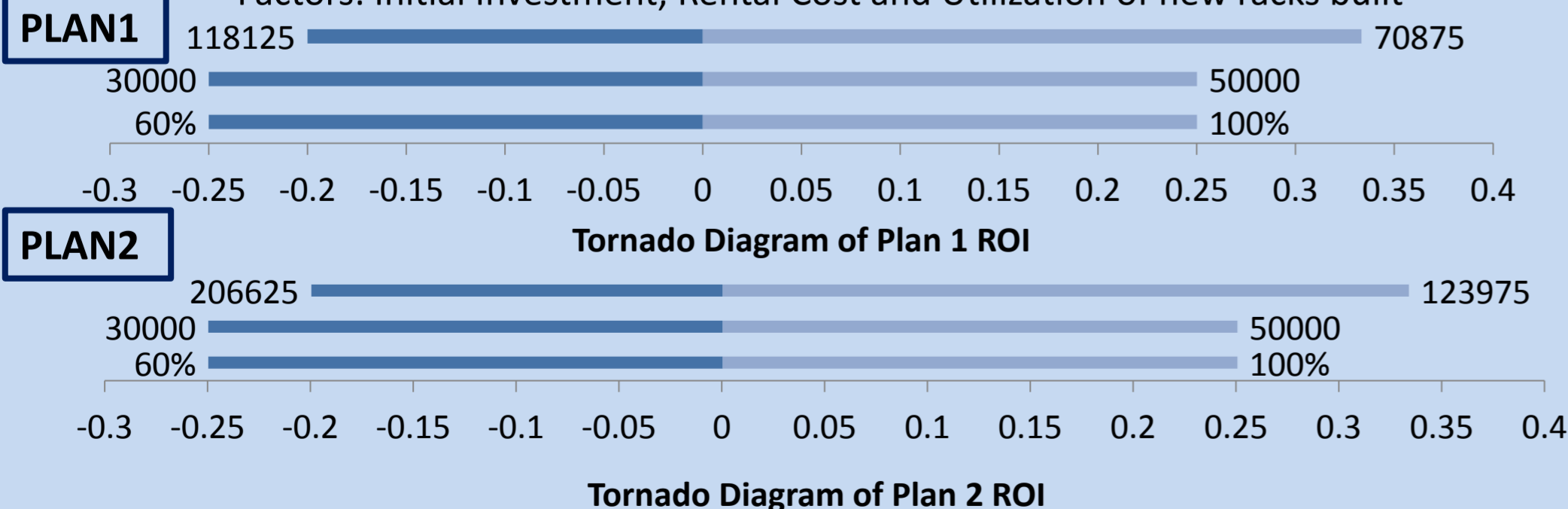

PLAN2

➢ Shift the entire second line of racks from the left, and build 16 new racks along the wall.

➢ Creates storage space for 26 ARBO's and 198 cover kits.

Phase 3: ROI Analysis

Factors: Initial Investment, Rental Cost and Utilization of new racks built

PLAN1

Tornado Diagram of Plan 1 ROI

PLAN2

Tornado Diagram of Plan 2 ROI

Process Optimization

#### Phase 1: Building Simulation Model of Existing System

➢ Identify the principal activities in the shipping process and the resources involved.

➢ Build and validate a simulation model that reflected current warehouse operation.

Pick up and consolidate → Label all cases → Complete all paperwork → Load orders onto truck

Main activities in shipping process in order of conduct

Phase 2: Improvement by Manpower Reduction

➢ Target throughput rate of 20 order/hr for shipping process for duration of whole day (set by IBM) was calculated to require a total of 33 crews

➢ In actuality, this throughput rate only hits 20 orders/hr at certain periods during the day.

➢ Based on this, with replenishment carried out during off peak periods, 33 crews could be reduced to 24 to meet the target of 20 order/hr.

Labor Hour Required by Activities
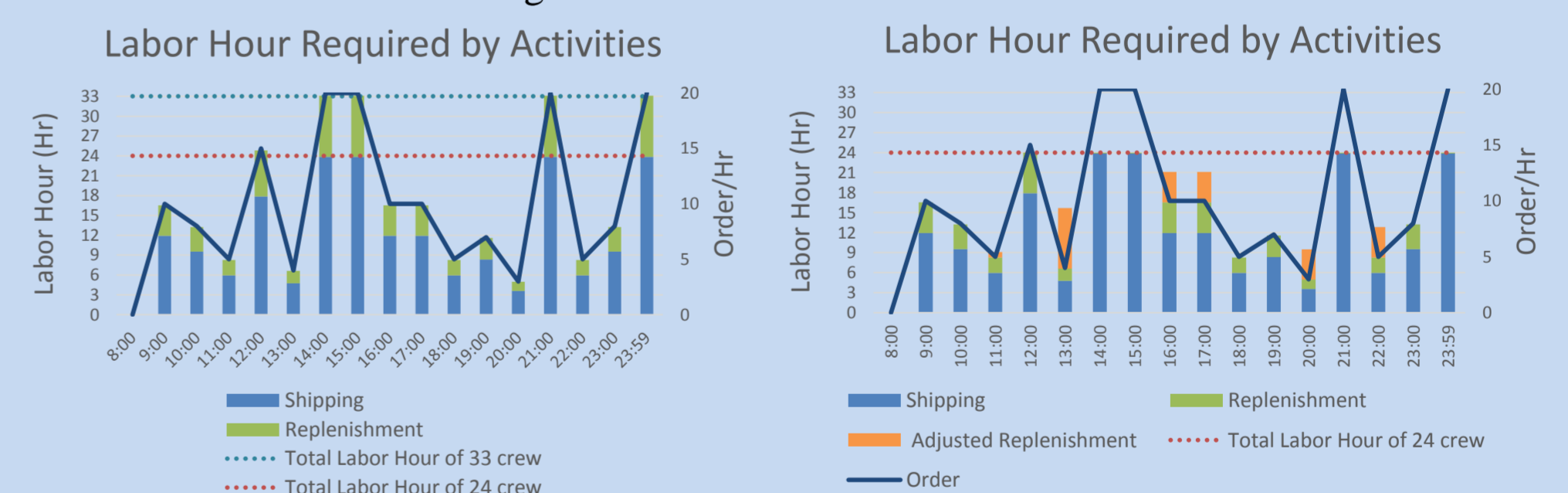
Phase 3: Improvement by Order Based Storage (OBS)

➢ Storing all cases in an order at the same location beforehand means orders can be directly loaded onto trucks.

➢ With 24 crews, the implementation of order based increased throughput to 28.6 orders/hr.

	Normal Lane	OBS lane	Total
No of Lanes	8	1	9
Throughput	22.3	6.3	28.6
Throughput per lane	2.8	6.3	-

Order Process Time: Normal Lane VS OBS Lane
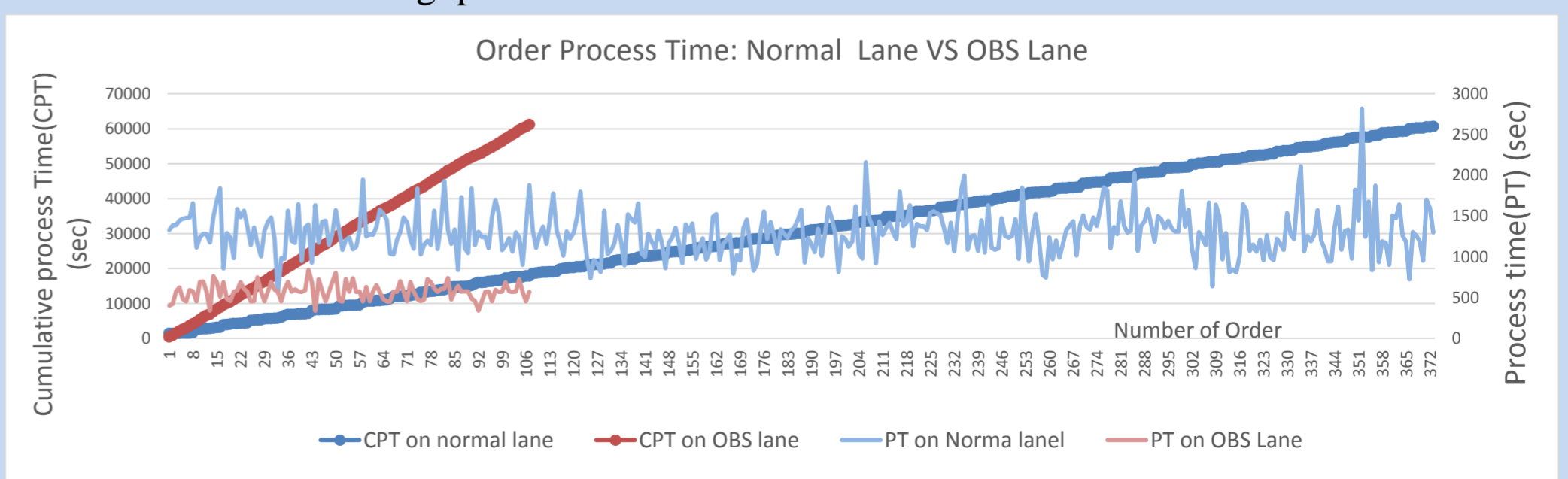
Recommendations and Conclusion

Space Optimization

1. Both Plan 1 and Plan 2 will bring about satisfactory ROI's with a reasonable initial investment, if the current storage space demand and external rental cost avoids large fluctuations.

2. While it does not dramatically increase overall storage capacity, Plan 2 offers a greater flexibility in storage at the price of higher initial investment cost.

Process Optimization

1. It is proven by the model that the crew capacity of 33 is beyond what is required by the system and can be reduced.

2. Reduction in manpower to 24 crews would generate a throughput of 22.7 orders/hr which would still fulfill the target of 20 orders/hr.

3. Implementation of order-based storage (OBS) on top of reduced manpower would generate a throughput 28.6 orders/hr, a significant increase from target.