27 AN INTEGRATED DATABASE FOR REAL-TIME MANAGEMENT OF STOCKYARD "STOCKMAN": A CASE STUDY IN PRECAST CONCRETE PRODUCTS INDUSTRY

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Abstract

This project is a follow up from a stockyard layout planning research conducted by the authors where simulation approach has been used to establish the best stock layout for the efficient storage, loading and dispatch of precast concrete products. It was concluded from the research that a more robust real-time management system should be in place to implement stockyard layout plans and assist production planners and stockyard managers to monitor stock movement to retrieve products in an efficient manner. A real time database system "StockMan" has been designed to manage the stock of concrete products, that is integrated with AutoCAD and simulation model for efficient positioning and visualisation of the stock. The storage locations for the products are determined through the simulation model and actual supply from the production lines (presses). In this paper, database development, integration with planning and forecasting system, information exchange and visualisation are presented. This is a real time management system that is capable of assisting managers with decision making in stock movement and control.

Keywords: *stockyard management, database, simulation, precast concrete products*

INTRODUCTION

The management of stockyard for precast concrete products is very crucial for efficient storage and product retrieval. A simulation model has been developed to integrate production and forecast schedule and study "what if" scenario of stockyard (Dawood and Marasini, 2000; Marasini and Dawood, 2000). An optimal or satisfactory layout is designed using the simulation model, proper routing and loading policies are selected for implementation. Recent studies conducted by the authors shows that for real time implementation, an integrated database is essential. Current industry practices suggest that there are separate channels of communication between the departments (divisions), for example, forecasting division provides sales forecast to production planning (capacity planning system) and production plans are communicated to factory managers. This traditional approach of communication in accordance with functional relationships has major limitations. There is a need for complete information to make decisions. For example, a stockyard manager who requires the future production plans and sales, and wants to see the situation of storage space with time, lacks proper information. This paper is a follow-up paper from the simulation research, and presents a database system that has been developed to manage stock on real time. The stock management is carried out through the central database where different players such as planners, factory managers, stockyard managers within the organisation can interact with the database and use the information as required. Figure 1 shows the information exchange between planning, forecasting, sales, and stockyard management in traditional and proposed central database system. In the proposed structure, all divisions share the same database and update information related to them.

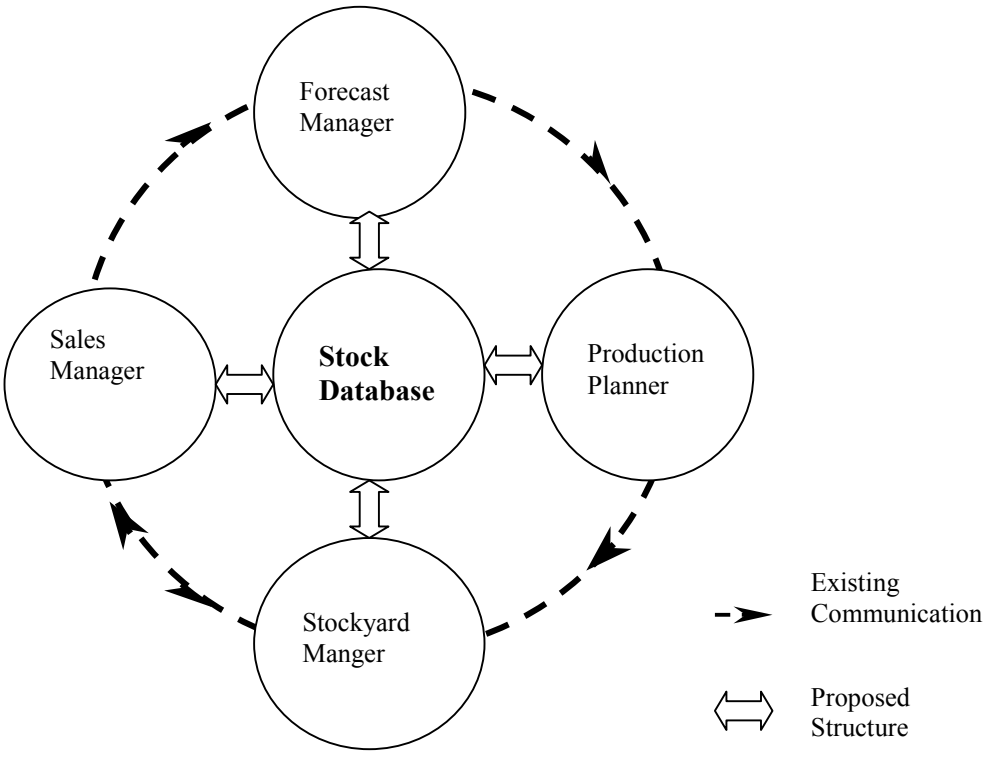

Figure1: Interaction between the different departments

The database is integrated with AutoCAD for monitoring and visualisation of stock information. The actual scenario of stockyard can be visualised at any period and corrective actions can be taken to update production plans and storage space allocations. The data used in this paper were extracted from an industrial case study.

MODEL ARCHITECTURE

The forecasting, capacity planning (Dawood, 1994) and stockyard layout simulation ”SimStock” (Marasini and Dawood, 2000) are integrated with the database system called "StockMan". The information of actual sales and production are linked from main computer to “StockMan” system. The actual space utilisation, inventory of the concrete products are visualised through the AutoCAD and database link. Figure 2 shows the porposed system architecure of the implementaion model of “StockMan”. The production, sales and stock data are then processed to view space status of bays, and status of the products according to inventory management policy. Production planner can study the actual situation of stock, and can take corrective actions and changes in production plans. Stockyard manager utilise production schedules and the actual space available, decide with the storage locations/ bays. Sales manager can use the stock information for the delivery of products.

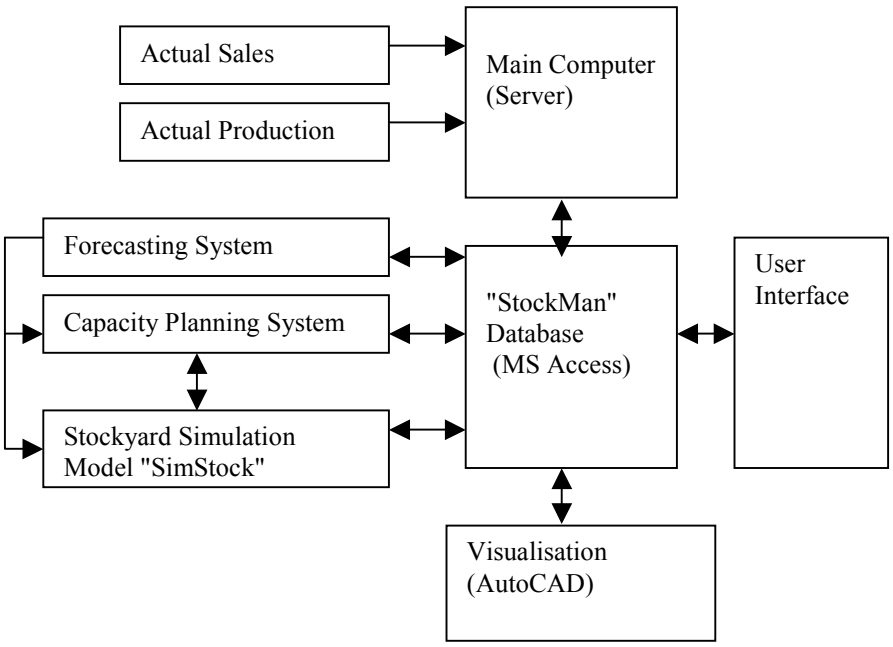

Figure2: Integrated StockMan Model

DATABASE DESIGN

The database includes establishment of bill of materials, product storage locations and bay details with spatial information such as area, co-ordinates of centre points. The details of the data tables and their relationships are shown in figure3. The bill of materials includes the details about stacking, handling equipment, handling quantity etc. Stock table includes the information about the products transported in to the stockyard from the production plants (presses) or from other factory sites and products dispatched (sales) from the stockyard. The situation of bay or products is calculated for monthly, weekly or daily basis depending on the requirements. The data are processed using VBA modules within MS Access. The stock at any period is visualised, decisions about space allocation, change in production plans if necessary are decided.

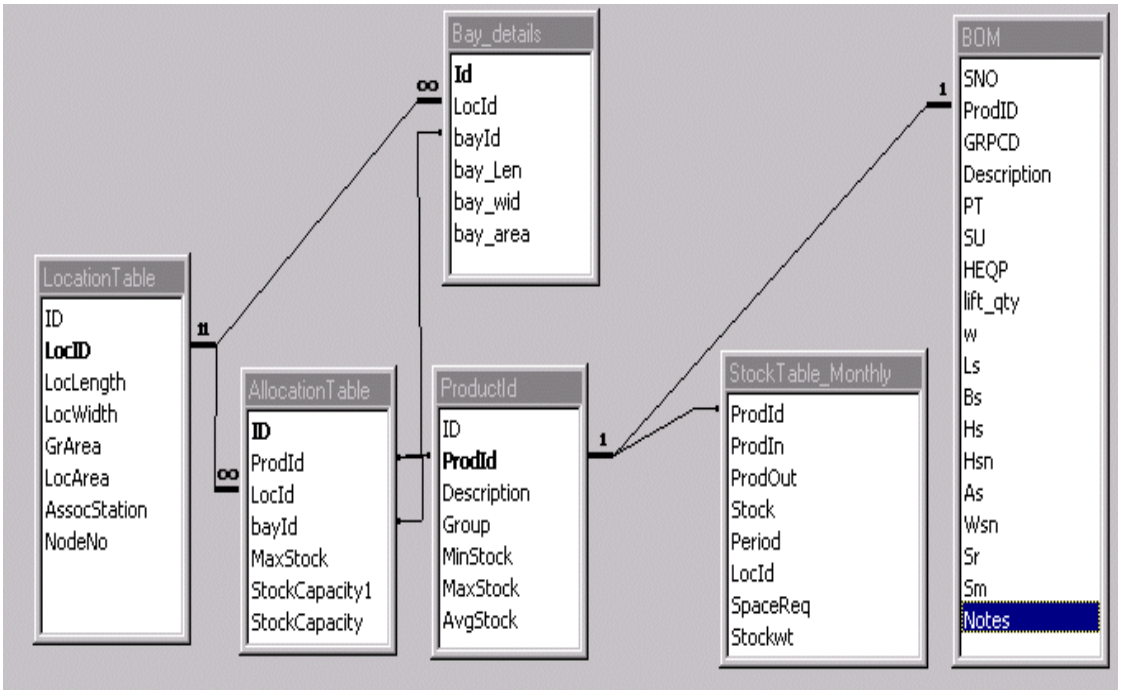

Figure 3: Database Tables and Relationships

DATA VISUALISATION

The objective of visualisation is to present space occupation and inventory details to the users. The space status of the storage locations and inventory of each product is visualised in Access using forms. The data are visualised in AutoCAD graphically, which provides simpler interface to understand. In figure3, the spread sheet displays the details about the bays such as allocated product(s), inventory (stock) of products stored, area required to store the products and space utilisation ratio, which is a ratio of total space required to available space. By evaluating the ratio, the status of a bay is reported as full, partial or empty. The chart in the form (figure 3) displays the area available and area required accommodating the stock the allocated product on a bay.

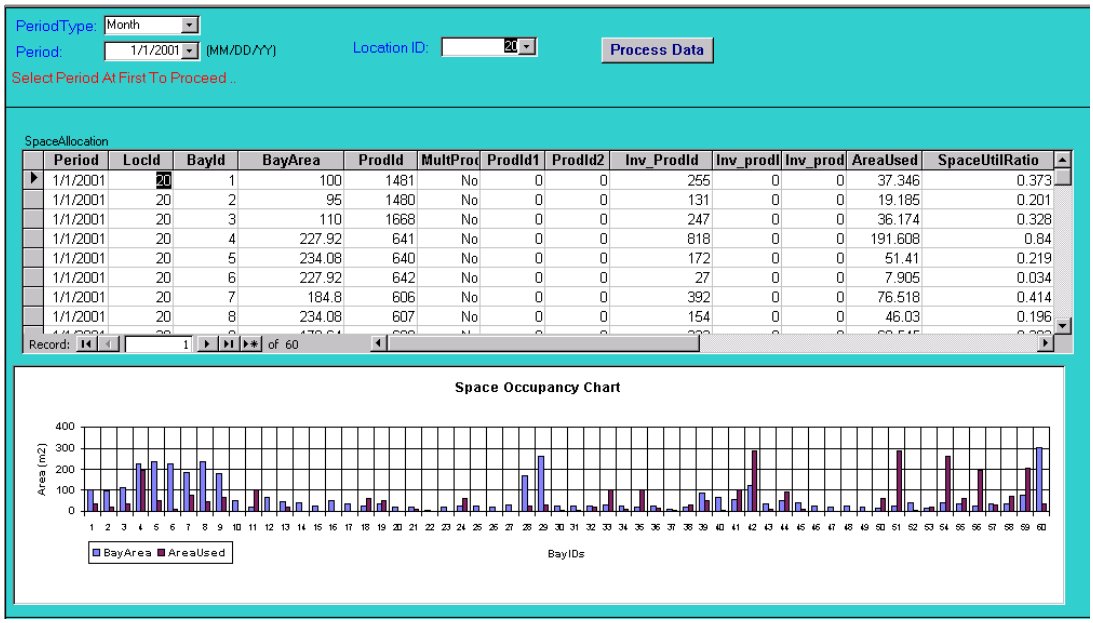

Figure 4: Space Utilisation Form (MS Access)

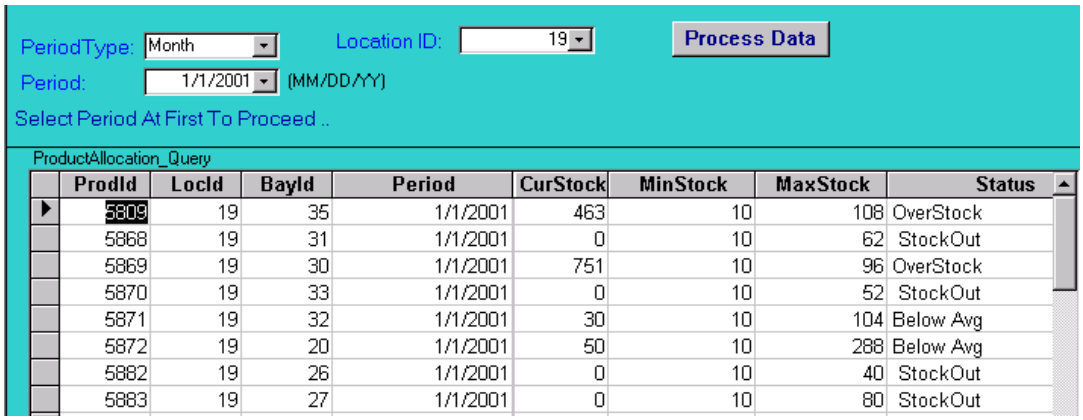

Figure 5: Product status form (MS Access)

The figure 4 shows the details about the stock of a product and reports the status based on stock holding policy. The status of the product is reported as stock out, minimum, average or maximum comparing the stock values at any period with the maximum and minimum values set up for control by the company.

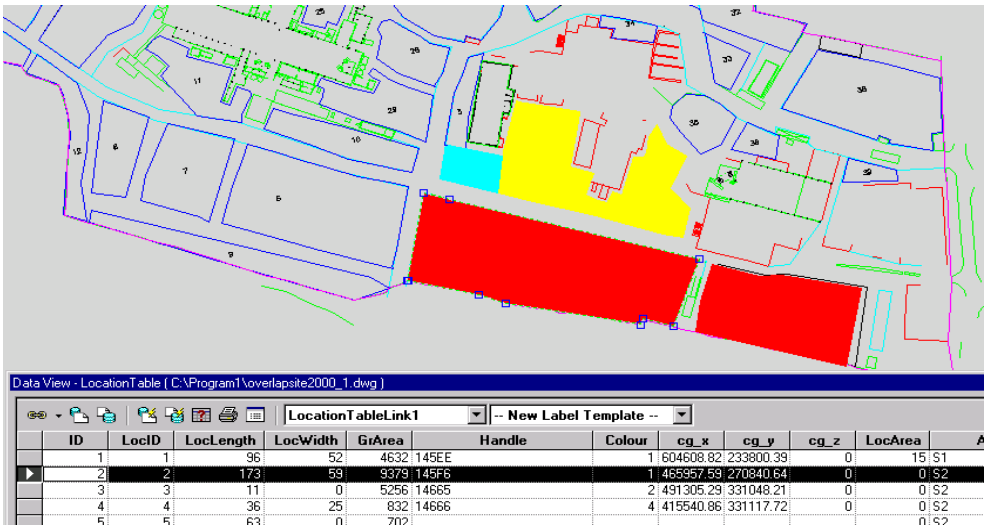

Figure 6: Database linking and stock status display in AutoCAD

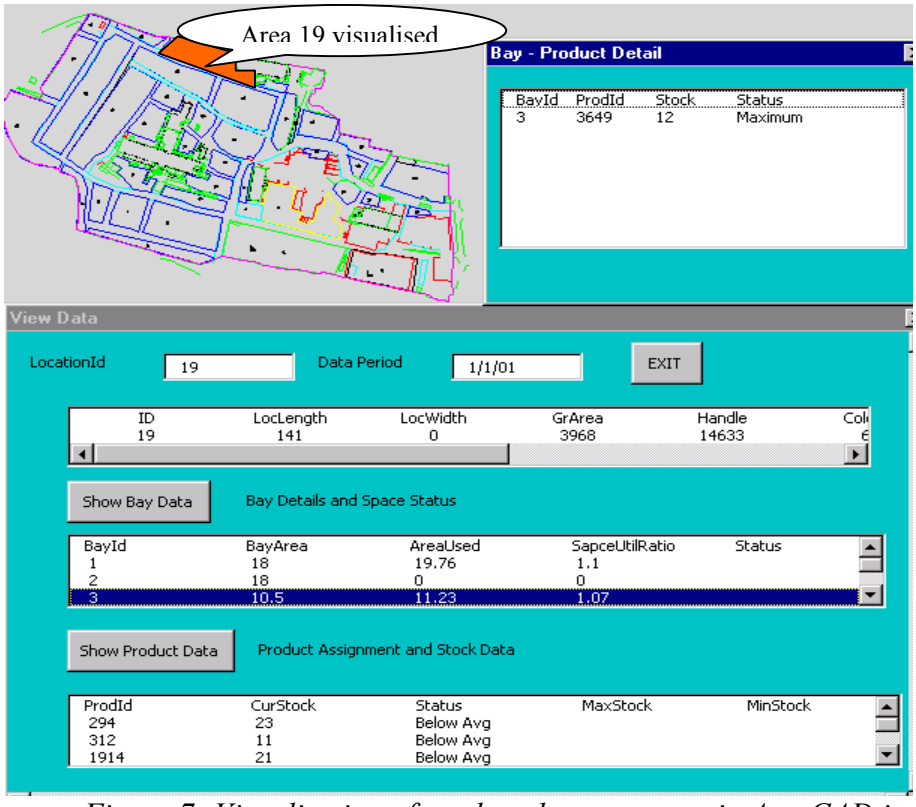

Figure 7: Visualisation of stock and space status in AutoCAD interface

The data can be visualised in AutoCAD (figure 6 and 7), where colours of the areas provide information about the space status of the main storage locations e.g. green for empty, read for full, blue for partial. The storage locations (location table in the database: figure 3, 6) are graphically linked with the database. Using mouse events, such as double clicking on the storage location say area 19, the products stored in each of the storage locations, the stock quantity and situation of each bay is visualised.

FURTHER INVESTIGATIONS

The development and implementation of "StockMan" database is presented, which facilitates decision making process and management of stock using a holistic approach. In order to control the stock and to increase the efficiency of retrieval, the next step in the research is to investigate the automatic identification of products, mainly bar-coding to track the product for loading. A study conducted by Baldwin et al 1994 in make to order manufacturing of concrete products will be extended and tested for standards products as well. An application of GPS system is also being studied, and possibilities of integration of other real time technologies to control the stockyard will be studied.

CONCLUSIONS

From a preliminary study of stock management, it was concluded that a proper real time stock management database is needed to facilitate a proper space allocation and stock management. In this paper an integrated database system for real time management of stock (StockMan) has been presented. The paper has presented the specification and modelling environment for StockMan. The paper also identified the potential of using centralised database system to control and minimise stock and include space as an important resource in production planning of concrete products. The use of information technology will bring competitive advantage to the industry as well as reduction of stock, lean production and efficiency in supply chain of building concrete products.

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