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Planning of Container Terminals in Ports Using Reservoir Analogy

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Abstract

Turkey whose target is to catch up the World ‘s Standards by container transport shows great developments in recent years. The utilization of mathematical models in planning and designing of marine structures holds forth on gradually, as in other branches of civil engineering. The first aim of modeling is to determine the system characteristics. This stage is called "diagnosis". The information obtained from diagnosis studies related to system-behavior and its internal structure submits new horizons to the planning, designing and application studies.

With this study, an approach model for the determining of net container storage area is proposed by considering the local operation habits, and the pavement design of the container terminals is criticized for Turkey’s conditions. The proposed model is inspired from "reservoir theory". An analogy is established between the useful reservoir volume and net container storage area. For this purpose, the "Sequent-Peak Algorithm" is selected which is one of the various approach models for determining of the useful (or active) reservoir volume of the water structures.

With the proposed model, daily in and out-traffic volumes in TEU (=twenty equivalent unit) are considered for Mersin Port. The analysis of the available data is performed stochastically, their mathematical models are built up and probability distribution functions of those are investigated. Based on the built-up models and considering the local conditions, various sets of synthetic data may be driven, and by using of these data and with the help of sequent-peak algorithm, the different net container storage areas may be found. These areas may be optimized using the minimum point of the superimposed curve obtained from "costs for berth occupancy time of ships" and "port amortization costs" curves. The economical analysis for the optimum solution has not included to the scope of work because of insufficient appropriate data.

The virtual input and output series in length of 365 days and in TEU obtained from arithmetical averaging of the 1994-1995-1996. Input data of Mersin Port fits to Weibull and output to Logistic distribution function. Daily input and output traffic volumes are symbolized as a combination of a linear trend model, "7 days" seasonally and ARIMA (1,0,1) process with a confidence level of 95%. The available averaged daily in and out container numbers of the years 1994-1995-1996 of Mersin Port are evaluated with the stochastic methods, their mathematical models established, driven 30 sets of synthetic

data in length of 365 days, and using these data and sequent-peak algorithm, various size of net container areas (=reservoir volumes) and their optimal probability distribution function are found. Using the characteristics of annual data, like mean, standard deviation and coefficient of variation, the net container storage areas for different years in future have been predicted.

The synthetic series (30 sets of 365 days) are driven, the net container storage areas are found using the cited algorithm, and their probability distribution function has been fixed as Erlang (8, 500). Utilizing the annual growth-rate equation, assuming constant coefficient of variation and with the help of a reverse transformation, the requirements of net one-row container areas for a certain future years of Mersin Port have been computerized.