PRODUCTIVE INTELLIGENT SYSTEM OF GOODS CONVEYANCE FOR LOGISTICS SITES

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Abstract: To satisfy consumer demands for goods and services, and not only, has it been developed a better system of planning and organization of goods supply, and sell-off, respectively of distribution and conveyance facilities. In this case, for a more efficiently goods conveyance from supplier to customer, logistics sites have emerged, including modern storage premises, as components of an effective logistics system. Site logistics concept has been proposed to eliminate as much as possible the traffic congestion, from backbone road transport and urban distribution system of goods and also to reduce energy consumption and pollutant effects. This paper presents a simulation model for a design/sizing of a logistic site in conjunction with the particularity of activities taking place within such a site.

Key-words: facilities, logistics sites, planning, transport process simulation, goods, distribution, backbone road transport, flow sheet diagram, pollution, sustainable development

1. INTRODUCTION

In the last three decades, managers have faced to more difficult problems, due to advances in science and technology, of markets globalization and increasing of world-class competitors, organizations need to rapidly improve their activity to be competitive.

Starting to 2000, the manufacturing facilities have been improved continuously, and managers have realized that to satisfy the consumers, they need to be taken into account the services and materials inputs and also the goods and services outputs. This has led to a greater emphasis placed on planning and organization of supply, disposal and distribution facilities. Thus, managers were convinced that the

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creation of a product is not enough and to achieve it by the consumers, being a good or a service, when, where, how and how much, at optimal cost-effective way, was a new type of challenge to provide necessary facilities and to satisfy these consumers [1], [3].

Planning and organizing the facilities of transport - handling - storage - distribution system is a key issue in the cost – effectiveness balance, being an assumption for solving the problem and designing a network flow diagram for stock, materials, components and finished products for example, in terms of spatial and temporal [2], [5], [6].

In terms of space, to design such a flow sheet refers to the geographical settlement of facilities (plants, warehouses, retail stores, etc.), number, size and their location is settled to satisfy consumer needs and requirements, but also the cost needs for stock maintenance of transport, storage, handling, etc.

In terms of temporal, the problem of network planning is to ensure the product availability such as satisfying the consumer needs. This availability can be achieved by a response time to the order of purchasing the product or providing a particular stock near the consumer, as a consequence this time of satisfying the consumers needs to considerably influence the location of facilities.

The concept of business logistics site is proposed as an important component of an intelligent conveyance system, implemented in the flow diagram necessary both within the premises of goods producing and storage and beyond outside of it, to a buffer storage zone for sale to consumers in an area located in the urban system, which ensures the transfer of goods from production place, from the supplier, to the customer.

Need of premises/logistics areas is the result of more efficient distribution process, by arrangement and centralization of transport facilities, handling and storage on small areas and using the same car park, the same terminal or the same information system.

The design of such logistic site requires complex studies in terms of location and size of warehouse facilities, applied technologies, and the part that the managers and authorities should have in promoting and functioning within the premises. Of all these requirements, the following part it will be considered the sizing of storage area from the logistics site located in a premise near an urban system.

2. BUSINESS LOGISTIC SITE – FACILITIES OF THE CONVEYANCE SYSTEM AND PREMISES OF A SUSTEINABLE DEVELOPMENT OF THE STANDARD AREA

If within the premises of a goods production factory, the problem of loading, handling, transport and unloading of goods for storage in their locations is generally solved by using the specific routes and agents, the warehouses located in urban areas, transport of goods will be done using the same infrastructure as well as cars and other vehicles, this aspect getting to the inevitable congestion, parking spaces occupancy, reducing traffic safety, air and sonic pollution etc.

In such circumstances, the fundamental objective of sustainable development of an area or region, optimizing the location of a storage premises and development of goods transportation systems must be in close accordance with reducing of air pollution, noise and energy consumption by optimizing the infrastructure and implementation of a logistics and appropriate administrative instruments. Accordingly, business logistics sites, as concentrated storage space, should represent parts of the distribution system in which there are transportation activities of goods, warehousing, assembly, sorting and grouping them for dispatch them to the customer.
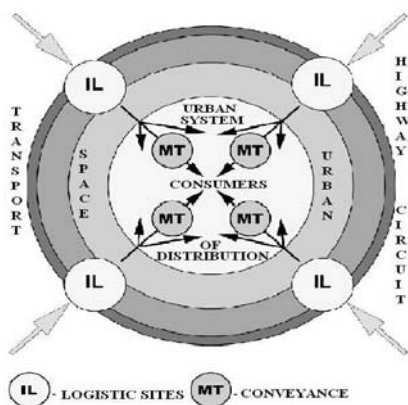

Fig. 1. Make of a conveyance system with logistic sites/premises

Logistic sites may be located at connection points between the highway circuit, which can be auto, rail, sea, air and urban transport system (fig. 1).

Results using such system with logistic areas, are represented by reducing the number of vehicles needed for the services, at least the same quality, increase the use of transport capacity and reducing the distance of transport. On principle, the logistic areas have the advantage to incorporate small firms whose specific storage premises can give an efficient planning of transport processes.

3.   CONSTRUCTION PLAN FOR LOGISTIC AREAS

From the design objectives of the logistic areas for storage of goods, logistics, the optimization of distribution and conveyance processes is highlighted and the reducing of social costs arising from these processes. Logistic facilities ensures the transfer between high-capacity highway transport (fig. 1) and the urban system of goods distribution, where the large capacity vehicles (aircraft, trucks, trains) get the same category goods directly from suppliers. The goods arrived in such large cargo units (containers, swap bodies) or bulk, are unloaded, stored and packaged in small units of cargo for marketing and distribution to consumers. Depending on consumer demands, the goods are stored in batches, grouped for one of the potential customer.

If parcels sizes are smaller than the carrying capacity of vehicles which are involved in urban distribution, then, depending on the geographical location of customers, parcels will be group and send out by the same transportation. Problem that requires to be further studied is to determine the space needed for storage of goods.

Conformable to the specific distribution and conveyance process which takes place at a storage logistics premises, goods arrive from suppliers in a specific size parcels, being sent in smaller parcels, consisting in several categories. In this case, the problem of sizing these premises can be solved by using simulation models.

Such a simulation model for transit capacity assessment of logistics premises is designed, based on the following assumptions [1], [2], [5], [6]:

- storage of goods is considered in two categories;
- for each category, the goods are stored in the same quantities q_1 and q_2;
- for each category, the input flow corresponds to Poisson distribution, intensity α_1 and α_2;
- storage area is divided into two parts, each part is specific to a category of goods. Zones are divided into sections, having a storage area necessary for the received parcels (fig. 2);
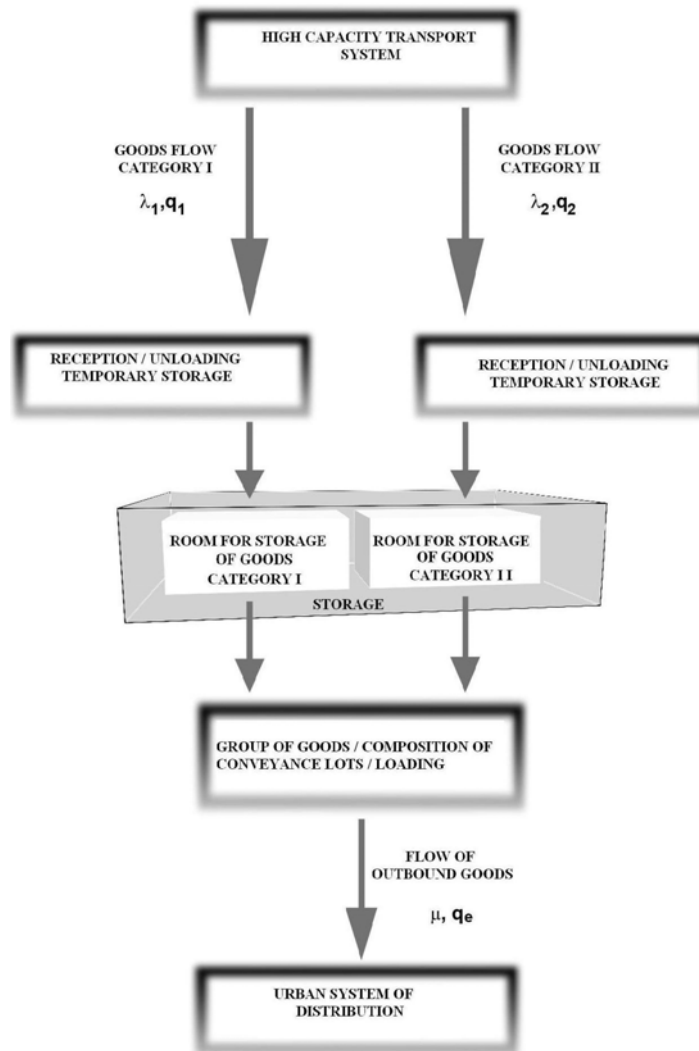

Fig. 2. Logistic site composition

- it is known the time between deliveries and the empirical distribution of delivery intervals;
- each parcel is delivered from a consisting group of certain quantities of goods from the two categories, the total delivered quantity is the same.

Listed assumptions are necessary because of the complexity of distribution and conveyance processes taking place in the logistics premises, which simulation would require an extremely complex logic structures.

4.   COMPOSITION OF SIMULATION MODEL

The developed model to simulate the process of goods distribution and conveyance from the two categories is structured in three modes, namely: *data entry, simulation, processing /display results.*

Input Mode includes the reading of input data, including data processing.

For each category of goods, the following information is inserted [5], [6]:

- the average intensity of input flows, λ_1 (λ_2);
- the size of a received parcel, q_1 (q_2);
- maximum amount that can be stored per unit area;

Also, in **Data Input** mode are determined the allowed expectances by the refusal of some parcels in each incoming class of goods. Based on the input data, the initial numbers of storage divisions are set for storage of goods in both categories.

To characterize the outflow is required the following data:

- average time between two items;
- empirical distribution of times between two successive deliveries;
- size of a delivered parcel, q_e;
- types of groups from categories I and II;

Simulation Mode, as a basic mode which simulates the transit activity from the warehouse is designed for a particular period of time (usually 6 months).

Using this mode it can be simulated, to the level of known sections, the storage and delivery activity of goods, after each simulation, being possible to forecast the refusal probability, making an analysis of stock changes.

If the probability of overload is higher than the initial set one by **Input Data Mode**, it is increment the number of sections and the simulation is resumed.

Variables data for the warehouse during the simulation, like the final simulation reports are presented/displayed by **processing/display results mode**. This mode contains the procedures:

- condition of section availability, by showing the status of each of them (free or busy), time of storage and the existing quantity;
- flow of arrived goods, presenting the number of parcel and arrival time;
- flow of arrived parcels (number, quantity of goods in each category, delivery time);
- waiting list of storage parcels (number, time of arrival);
- list of parcels which have been sent due to lack of stock (the quantity of

goods in each category, the scheduled time for delivery).

5. CONCLUSIONS

Over time, the manufacturing facilities have been improved continuously and the managers realized that is important to improve the flow of goods distribution and conveyance for the customer's demands, in terms of services and materials inputs and the output of goods and services.

In terms of space, to design a technology flow network for the customer's needs, in terms of ensuring the cost - effective balance for the maintenance of stocks, transport, storage and handling of goods, refers to the geographical placement of facilities, especially of plants, warehouses and retail stores.

As an efficient measure for the distribution and conveyance process of goods, the need of logistic storage site as an important component of effective logistics system, implemented in the flow scheme was imposed as a requirement for grouping and concentrating the transportation, handling facilities and storage on spaces as small as possible, using the same parking area, terminals and the same informational system.

Choosing the area and the arrangement of logistic storage sites become effective in the vicinity of junction between the highway roads and the main urban transport, the estimated effects can be assessed by comparing the indicators that take into account transport costs, congestion and environmental factors.

Sizing the logistics site requires the use of simulation models, using a specific number of assumptions, because the large amount of resources needed to perform a complex logical configuration, able to carry out a detailed simulation of logistics processes within a site.

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