AUTOMATED SYSTEM OF OPTIMAL MANAGEMENT OF MAIL FLOW

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Resume. The article is devoted to the management of logistics flows in the mail processing information system. For operational mail processing, a target dates module has been developed that allows you to fully automate and optimally manage workflow.

Key words: information system, program, management, logistics flows, target dates.

1. Introduction

Currently, online trading is actively developing. Various goods are shipped from around the world to all countries and continents. Moreover, the lion's share of such shipments is occupied by trade in goods from China. Since China first located next to Kazakhstan, a considerable flow of goods, etc., and goes in our country, as well as the same passes through Kazakhstan to other countries. In these conditions, the speed of delivery of goods (shipments) becomes relevant. The speed of parcel delivery is an integral part of any logistics process. In order to correctly organize the management of the logistics flow, it is necessary not only to understand the whole process of goods movement, but also to control the time of its delivery in individual sections of the route in order to be able to respond in a timely manner to any deviations from the specified delivery time [1-8].

Shipment way - the trajectory of the movement of cargo from the place of departure to the destination. It consists of a different number of segments. The start and end point of each segment depends on the direction plan. Thus, the forwarding route is a broken line that is affected by destination plans. Each cargo has a delivery deadline, cargo can be delivered earlier than this time. Shipping ways can be represented in the form of a graph. Figure 1 shows an example of a shipping path graph. Peaks indicate the place of dispatch and destination of cargo. Arcs indicate movement. Cargo can be moved by train, plane, car. Each method of moving cargo has its own parameters - duration in time and cost. The system calculates the optimal path and method of movement, considering the forwarding parameters. At the same time, the minimum cost of delivery is provided within the control deadlines.

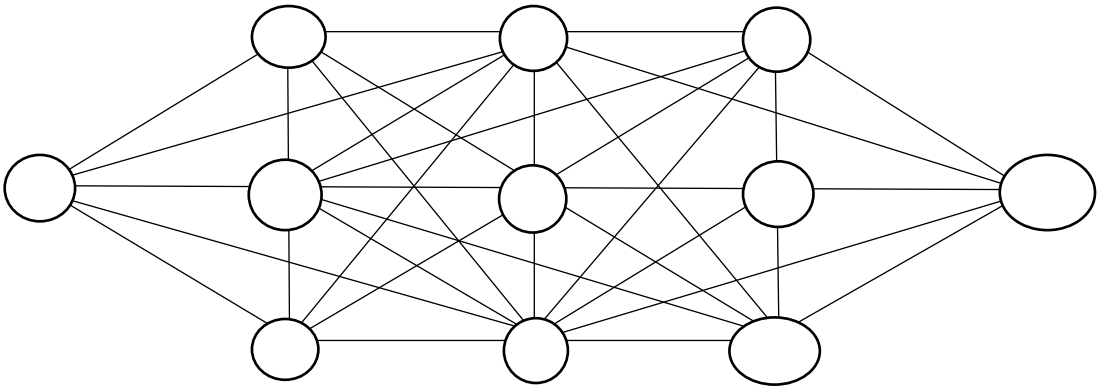

Figure 1 - Graph of shipping routes

To provide timely information about the time spent on a particular section of the route, and to make managerial decisions to optimize the process of delivery of goods, a module "target dates" was developed. The delivery deadlines determine the maximum time during which the entire production process of sending a mail item must be completed from the moment it is sent to the addressee. Thus, the deadline is the total delivery period, which is reported to the sender at the time of sending the mail. For example, that the package will be delivered within 4 days.

2. Optimal mail flow management

2.1 Milestones

Intra-stage time is the time for processing mail items inside production facilities. The control period consists of intra-stage dates, shipment schedules, taking into account destination plans. To calculate the control period, it is necessary to have intra-stage time schedules, referral plans. Intra-stage dates are calculated in minutes and hours, the control period of shipment is in days. The control period is greatly influenced by the path that the postal item will go from the sender to the addressee, which in turn depends on the intra-stage timelines and transport schedules. Thus, the calculation of control dates is a task with a large number of restrictions, each of which has its own impact on the final result, with almost equal weight.

Thus, for the calculation of the control period, the presence of directories is necessary:

- Intra-stage schedules;
- Plans of directions;
- Schedules of mail routes.

The purpose of the calculation module is to calculate the total postage forwarding time.

2.2 Requirements for the target date module

1. The system implements the functionality of maintaining a reference guide for schedules of control periods.

2. Reference deadlines contain the stages of mail processing (intra-stage deadlines)

3. The name of the schedule is unified: “Schedule of shipment dates at internal stages”

4. The system contains: dates “Start of action”, “End of action”, Index of the supervisor, Index of the structural unit.

5. Each type of mail should have its own deadlines.

Types of postal items:

- Correspondence
- Parcels
- EMS (Express Mail Service)
- Large items
- Printed periodicals

Category (direction) of mail:

- incoming
- outgoing
- transit

8. For each post office, all stages must have their own milestones (intra- milestone milestones)

9. Dates must be calculated by days, hours, minutes

10. Each target date object is generated at the time the RPO (registered postal object) is created and changes throughout the entire life of the RPO

11. The functionality for maintaining a directory of stages of processing mail should be implemented

12. The functionality for displaying information about the passage of RPO stages of forwarding should be implemented

13. Functionality should be implemented for calculating the target date for sending a specific RPI according to the following algorithm:

a. Input data - dispatch index and receipt index, type of shipment, type of shipment, time of receipt of RPO, date - even/odd.

b. According to the cargo parameters, the System finds in the directory of the plan of directions the shipping route of this RPO and for each section takes data on the control period. The passing time counts in days, hours and minutes.

c. Further, the system makes a calculation - according to the internal stages and along the entire forwarding route. At the same time, the calculation is performed in the following way - the summation of time within the milestone dates.

d. In this case, it is taken into account that the time at different stages is indicated in different dimensions.

e. At the system output, the following parameters:

date/time when the RPO should arrive at the final destination.

2.3 Calculation of the optimal route

1. The operator accepts the shipment. The system receives information about the shipment:

- Departure index;
- Destination index;
- Type of departure;
- Date of receipt;
- Time of receipt;

2. The system generates an object - the target date for this shipment, initially assigns it a value of 1; when the date is changed by 1, the check period is added 1. The check period is calculated in days (period from 00:00 to 23:59) - one day;

3. Based on the input data, the system calculates the optimal path and method of movement taking into account the forwarding parameters. To calculate the optimal route and method of moving cargo, the system refers to the directories:

- to the directory of schedules at the internal stages of the current unit and receives information about what time processing should finish at the internal stages;
- to the directory of schedules of the mail route of the current unit, in order to determine which mail route the shipment should be loaded and when this shipment will go to the intermediate point PI;
- to a directory on the internal scheduling stages intermediate point PI and receives information about what time to end processing on the internal stages at an intermediate point PI;
- to the directory of plans for directions of the intermediate point PI to determine which intermediate point PI +1 you need to forward the departure;
- to the directory of schedules of the mail route of the intermediate point PI , in order to determine which mail route the shipment should be loaded on and when this departure will go to the intermediate point PI +1 ;
- to the directory of schedules at the internal stages of the final destination (destination) and calculates when the departure should be delivered.

4. At intervals every six months, the system fills in a table with ways and means of sending all types of items from all units to all units. On these routes in the future, optimal shipping times are calculated.

Figure 2 shows a reference guide for schedules of target dates. Table 1 provides a list of fields and their description.

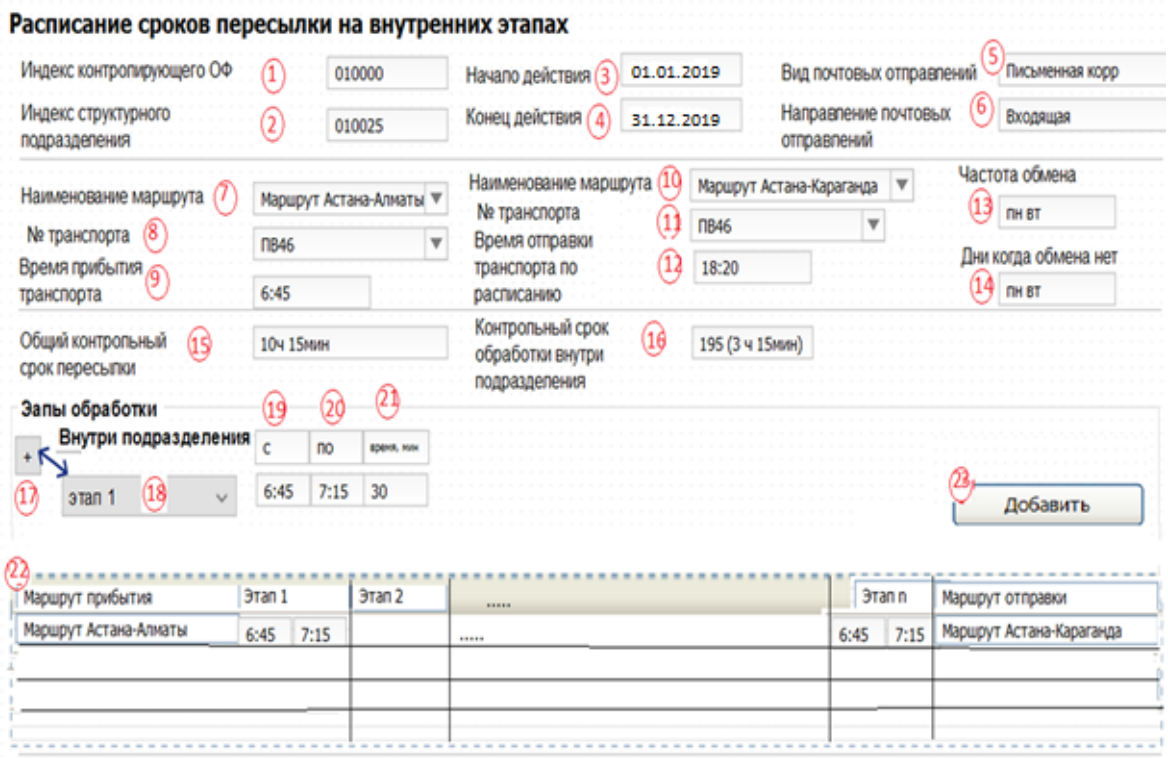

Figure 2 – Checklist of schedule of target dates

Table 1

Description of the fields of the schedule

Таблица 1

Описание полей формы расписаний КС

No. fields	Name	Description	Note
1	Index of the controlling regional branch	Technological index of the regional branch	organize the automatic addition of the value of this field by the value of the field "Index of the structural unit". It is necessary to indicate the regional branch to which this unit belongs
2	Subdivision Index	The technological index of the schedule forming unit	Indicate automatically the index from the value of the user's unit, given the opportunity to edit
3	Start of action	Target dates schedule start date	The date cannot be later than the “end of action” date Start date must be at least one day later than current
4	End of action	Target dates schedule end date	The date cannot be earlier than the date “start of action” Automatically affixed on 31.12. of the year when the beginning of the action can be edited, 12/31 - inclusive
			-
5	Type of mail	Choosing one of the values	- Correspondence - Parcels - EMS - Large items - Printed periodicals

6	Direction of postal items (distribution by directions, orientation by directions, belonging to the direction)	Choosing one of the values	- Inbox - Outgoing - Transit
7	Name of the route of arrival of mail. One route is always indicated for arrival.	Pull from the schedule directory	Directory of routes, the list for choosing a route is pulled up. Only schedules are included in the list, where there is the same structural unit index as in field 2.
8	No. of transport plying on the selected route.	Pull up from reference	Directory of transport, the required field is only for railway and air, for air it is called “flight number” (for several transports merge everything into one schedule, one heading, several time schedules)
9	Arrival time	Pulling from the schedule	1. The time of arrival to the unit indicated in field 2 is displayed. 2. It cannot be later than the time of sending
10	Name of the route for sending mail. Several routes may be indicated for sending	Pull from the schedule directory	Directory of routes, the list for choosing a route is pulled up. Only schedules are included in the list, where there is the same structural unit index as in field 2.
11	No. of transport plying on the selected route.	Pull up from reference	Directory of transport, the required field is only for railway and air, for air it is called “flight number” (for several transports merge everything into one schedule, one heading, several time schedules)
12	Scheduled transport time	Pulling from the schedule	Displays the sending time from the unit specified in field 2 Cannot be earlier than arrival time
13	Exchange rate	Pulling from the schedule	Days of the week of transport plying, indicate the days when it arrives at the unit indicated in field 2 (consider the notes in the route)
14	Days when there is no exchange	Pulling from the schedule	From the note in the route
15	General control date of shipment	Calculate by the formula	difference of time of departure and time of arrival {time of departure} - {time of arrival}
16	Control term for processing within the unit	The sum of the fields 21 by types inside the unit	Only election fields for internal processing steps
17	Adding a Stage	Adding an internal phase - intra-unit phase	In the directory of stages there is a sign - internal / non-internal stage
18	Stage name selection	Select from a list of steps (Step Guide)	The list of stages is filtered by type of unit, for social center - only social center stages are indicated, for offices - only offices
19	from	Stage Start Time	It cannot be later than «by»
20	by	Stage End Time	It cannot be ahead of time «from»
21	Time, min	Time spent on stage	It is calculated by the formula: {field 17} - {field 16} Always > 0
22	Table	All data entered above is entered into this table.	
23	Add button	Adds all the above data to the table (22)	After the data is added to the table, the fields 10,11,12, 15 are cleared

Forwarding Stages - a guide correlated with tracking statuses. The system takes into account the time taken to process the shipment inside the unit. To calculate the time spent on the stages of internal processing in the unit, the allocation of a group of stages of internal processing is implemented.

The list of stages also includes stages that are not registered in the system, for example, stamping, they do not affect the term, and are not summarized anywhere.

3. Conclusion

The module "Target dates" is used to optimize the delivery of mail and provides control over the processing time and delivery of mail. Thanks to timely information, employees can make operational decisions to optimize transportation.

Thanks to summary data for a certain period, it becomes possible to form forecast loads and make long-term decisions on managing logistic flows.

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