MONTREAL MAPP TRAINING SIMULATION MODEL

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ABSTRACT

Simulation is being used in the Montreal Metropolitain Area Postal Plant (MAPP) to train operating and supervisory staff to process the mail. A simulation model developed will initially be used to train the staff for the Letter Processing Plant (LPP) at St. Laurent. With some modifications the same model would be adapted to train staff for other LPP of Canada Post Office (CPO). Subsequently, a version to train the staff for Bulk Mail Facility (BMF) would be developed. It is estimated that a total of over 500 personnel would receive training with the help of this simulation model.

INTRODUCTION

Montreal Metropolitan Area Processing Plant at St. Laurent is a modern postal processing facility equipped with the latest machines to handle the mail. This Letter Processing Plant will employ approximately 1500 persons and will handle more than 2 million pieces of mail per day. The plant has 3 machines to Cull-Face and Cancel (CFC) the mail; 4 Optical Character Readers (OCR) to decipher the post code; 4 Group Desk Suites (GDS) to bar code the uncoded mail and 5 Letter Sorting Machines (LSM).

Working in this plant is a radical departure from the past days of manually handling the mail through various operations. The conveyor belts running through a colossal structure baffle the mind of a first time visitor. The movement of mail in this plant requires mental adjustment for the workers. However, they have to be trained to handle the mail and machines in this environment. It was estimated that more than 500 persons would have to be trained to handle the mail volume and the equipment in the plant. The C.P.O. management decided to develop a simulation model to perform this task.

The trainee sits in front of a computer terminal screen and receives instructions. In addition, he has a booklet and a slide projector providing basic information about mail volume and the availability of resources. Interacting with the model through the terminal, the trainee learns to process mail volume through various postal operations. At the end of a run, he receives a print-out of his performance for an 8 hour shift. This indicates how well he assigned the resources to handle the mail volume during the shift.

MAIL FLOW

In an LPP the mail passes through five basic operations:

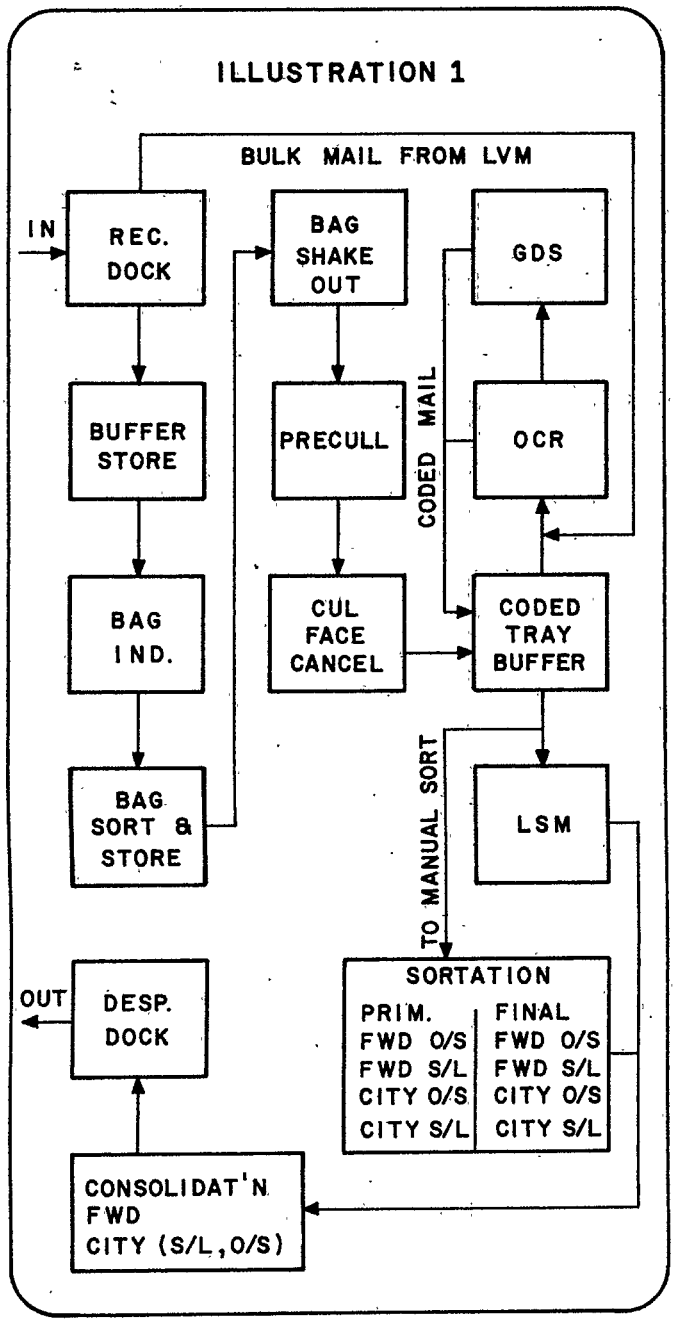
1. Reception
2. Mail Preparation
3. Sortation
4. Consolidation
5. Despatch

The mail enters the plant at the reception dock. It is immediately moved to the primary buffer. Until this time the mail is in bags. Then it goes to Mail Preparation. In this operation, bag induction is the first step to take place. This allows the sortation of bags according to the type and priority given to the mail. Bags are thus stored with an identifier and a priority. These bags are then moved to the bag shake out machine. From bag shake out the open mail goes through a pre-cull where mail is unbundled and, also, items of non standards shape and size are removed. Next, the mail is culled for manual or mechanical facing and cancelling. Then it is ready for sortation. Subsequently, it is sorted into four major categories:

a) Local mail - City short and long (City S/L)
b) Outside mail - Forward short and long (Fwd S/L)

c) Local mail - City oversize (City O/S)
d) Outside mail - Forward oversize (Fwd O/S)

After this, the mail is consolidated into trays, bags or bundles going to a destination. It is then despatched out of the plant for delivery. Illustration 1 shows the basic operations of an LPP.



THE MODEL

The model comprises 4 independent modules, each representing a section of the LPP. These modules are:

1. Mail Reception and Despatch
2. Mail Preparation
3. Short and Long Mail
4. Oversize Mail

Since these modules are independent, trainees can be trained to operate the section in which they would work. The operating staff would be required to be trained in one section only. However, the supervisory staff may have to go through more than one section. People transferring within the plant could also be given training on the module representing the section in which they would work in the future.

Each module has up to 9 scenarios. A scenario comprises 8 discrete steps. Within a step the trainee is given the constraints of the availability of men and machines. His task is to assign the available resources in a manner as to maximize the throughput of the mail volume at hand. Thus the end of a step is the completion of an hour on the floor. The end of 8 steps marks the end of a shift. A scenario usually tests the ability of the trainee to handle emergencies such as the breakdown of a machine in the middle of a shift; the reduction or increase in staff level, etc. Learning to cope with these variations is the reality of life in a modern LPP. Having gone through all the 9 scenarios, the trainee learns to handle the off-normal conditions within his area of responsibility. The printout at the end of each scenario contains the allocations of resources by hour. This shows how efficiently the available resources were utilized. Also, a scenario may be repeated many times to allow users to try different ideas and achieve improvement in the throughput of the mail within an 8 hour shift against the set of restrictions provided in the scenario.

OBJECTIVES:

The model is designed to meet the following requirements:

1) Simulate the basic operations of an LPP and the interactions.

2) Simulate critical bottlenecks in each of mail flow. Handle the possibility of equipment failures and other contingencies causing delays in the flow of mail.

3) To vary the throughput of each machine/operation; and provide options of machines/operation being in down-graded modes.

4) In each module, provide variables which can be easily manipulated to create a scenario to begin the exercise.

5) Produce an output showing the through-put volumes based on the resources allocated by the trainee.

INPUT VARIABLES:

Listed below are some of the important input variables:

- Hourly arrival pattern of mail stream
- Despatch time for each stream
- Number of men and machines available at a processing station
- Transit times and distances between operations
- Throughput of operations/machines
- Minimum manpower for each operation and incremental units of manpower to increase capacity of operation by a unit
- Percentage splits caused while culling or sorting
- Bypass or contingency plans to move the mail between adjacent operations
- Capacities of buffers.

SCENARIO

Let us take the case of short and long mail which forms the bulk of the volume in an LPP. The explanation of a scenario of this section would illustrate the capability of the model. A simple scenario of S/L mail may be as follows:

S/L SCENARIO

Hour	Vol. (Bags)	Down	Men. Avail.
1000	500		6
1100			6
1200		OCR3	26
1300			26
1400	500		104
1500			104
1600	500	BS01	143
1700		BS01	143
1800			40

Machine Capacities

OCR	30,000 pph
CFC	26,000 pph
GDS	2,000 per stn.
LSM	24,000 pph
Manual	1,000 pph

This simple scenario starts the first hour with 500 bags and six men available to do bag induction, sortation and storage. It continues through the next hour. However, at 12 noon, when the mail is ready for CFC operation, one of the OCR goes down unexpectedly. Consequently, it would slow down the mail going in Coded Tray-OCR-GDS cycle. At this stage, the trainee does not know what is going to happen at 1300 hours. Fortunately, the breakdown only lasts one hour and no additional mail arrives into the system. A proper utilization of the available 26 men in each hour, can adequately move the mail.

Suddenly, at 1400 another lump of 500 bags arrives. By this time, most of the operations have mail being fed into them. This is the reason for unusually large (104) availability of men. At 1600, one of the bag shake-out machines breaks down. The breakdown persists for two hours. At 1800, the available manpower drops to 40. The processing capacities of the machine are given as a part of the scenario. A more complicated scenario can be constructed from this one by introducing volume changes and variations in machine capacities from hour to hour. After the trainee allocates resources for each hour, he can get an output showing the result of his chosen strategy. Finally, at the conclusion of an 8 hour shift, he gets a final report similar to the one in the following:

S/L FINAL REPORT

Proc.	Vol. (000 pcs)	Man Hours Avail.	Lost	Eff. %	PCS/ MHR
OCR	658	64	0	100	10,281
GDS	450	305	0	100	1,477
LSM	609	105	0	100	5,800
FSORT	429	456	0	100	940
LSORT	0	0	0		0
TOTAL	2,146	930	0		2,300

In this batch there was no local mail for local sort (LSORT). All of the mail processed went to forward sort (FSORT). Since no manhours were lost, it is obviously a very good allocation. The

number of pieces processed per manhour is the standard against which performance is measured. However, it is very rare in practice to achieve such a performance in all the operations.

SYSTEMS ENVIRONMENT

The simulation program is written in Fortran. This was necessary because the system will go through several modifications before reaching stability. Also, the high level language (Fortran) gives it portability. Thus, it is possible to carry the system from one computer to another.

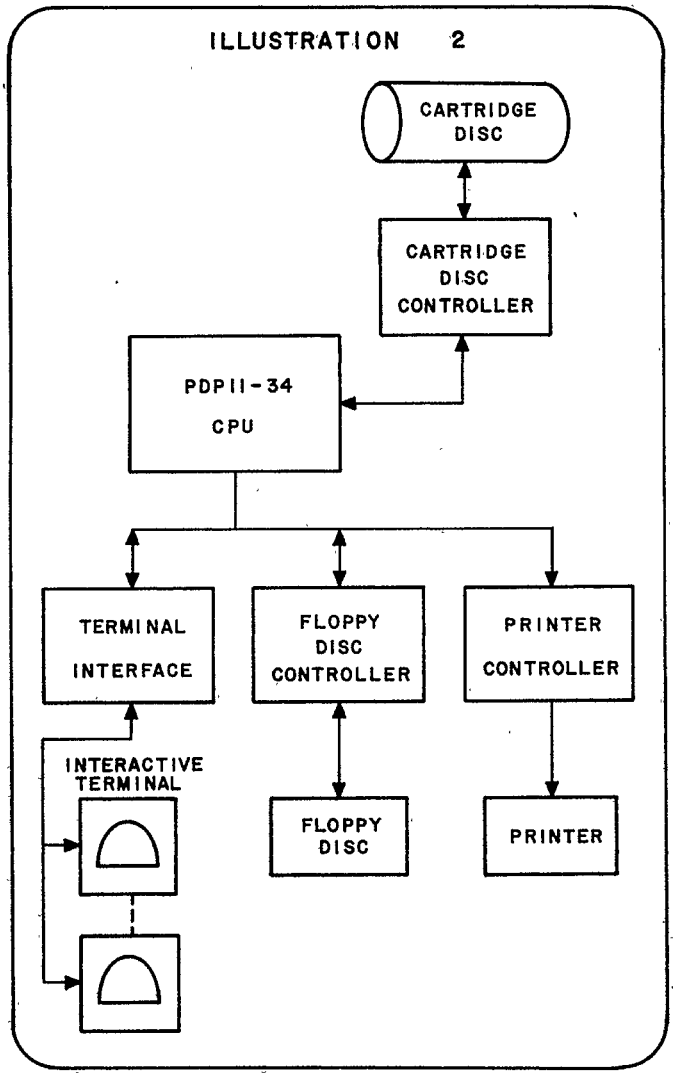
The programme operates interactively, i.e. creating a situation; giving multiple choice to handle the situation; accepting the student response and making a move to the next logical operation. The student, at the termination of a session, gets the print-out and discovers the areas where he made inappropriate decisions. Another feature of the system is modularity. The input data, the operations simulation, and the output are separate components. This facilitates the modification to a component, thus minimizing the changes to other components. The output report is easy to read and relates to the operations of the LPP. Thus, the print-out can be used to train personnel as well as to evaluate staff in handling operational emergencies. Illustration 2 shows the configuration of the system.

CONCLUDING REMARKS

Montreal MAPP management views this simulation as a very efficient and useful training device. They hope to train the operational staff on this model before the assignment. What makes this device really useful is the fact that once implemented there is no concern over training the new staff. The turnover in some sections is fairly high. It is, therefore, envisaged that this training program would also satisfy the ongoing need of training the new staff.

The model is written in Fortran for a dedicated PDP 11-34. The model takes up most of the 64K core. The management is planning to use a modified version of this model for the Centre-Ville LPP plant. Subsequently, a similar approach would be used to train the personnel for Parcel Processing Plant. But this would require some modifications to the existing model as the processing functions of Parcel Processing Plant are more labour intensive and less machine intensive than those of an LPP.

ILLUSTRATION 2



GLOSSARY

CFC - Cull Face and Cancel

CPO - Canada Post Office

GDS - Group Desk Suite

LPP - Letter Processing Plant

LSM - Letter Sorting Machine

LVM - Large Volume Mailers

MAPP - Metropolitan Area Processing Plant

OCR - Optical Character Reader

S/L - Short and Long Mail

O/S - Oversize Mail