Simulation of a Paper Finishing Flexible System with SIMAN

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Title and subtitle

Simulation of a Paper Finishing Flexible System with SIMAN.

Abstract

This project develops a SIMAN model of a paper finishing flexible system. The model is run in a simulation campaign to compare different strategies and performances of a paper finishing flexible system, to try to improve some of them. The parameters in the simulations can be for example the transport destinations at different workshop states or processing times in the machines.

Key words

Flexible production system–simulation–modeling–performance evaluation–paper industry.

Classification system and/or index terms (if any)

Supplementary bibliographical information

Simulation of a paper finishing flexible system with SIMAN

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Brief presentation of the Department of Automatic Control in Grenoble.

The department is divided into two main groups composed by a total of 6 different research teams.

These are :

The Continuous Time Systems group with the research teams :

-Intelligent computer aided design, education and supervision.
-Control and Systems.
-Biosystems.
-Adaptive multivariable control systems and robotics.

The Discrete Event Systems group with the research teams :

-Digital and Discrete event systems.
-Manufacturing systems control.

Courses in Automatic control and Automatics are also given at different levels: Undergraduate courses (same level as in a swedish engineering school), Graduate courses (for Ph.d students).

About 100 persons work at the Department. Among them, 6 Professors, 9 CNRS Researchers (National Scientific Research Organism), about 50 Phd students, 7 university teachers, Research Engineers, Research Assistants and Secretaries.

The Ph.d students in the department come from all over the world for example Marocco, Mexico, Brazil, Tcheckoslovakia, Germany, China ...

Contents

Preface

This project has been carried out in the Department of Automatic Control, E.N.S.I.E.G., in Grenoble France. The purpose is to make a model of a paper finishing flexible system and then compare different strategies and performances in the system to try to improve some of them. The SIMAN software is used to make the model of the system and to simulate it.

Acknowledgement

Sometimes the words "thank you" are to small ...

I would like to thank Professor Pierre Ladet who has welcomed me in his team. Also, I would like to thank all the researchers of the Department of Automatic Control in Grenoble for the time they have spent in discussions with me and for their valuable criticism on the report. A special thank you to Claire Valentin who has guided me through my work and with great patience always has been ready to answer my questions about the French language.

1.Introduction

A paper finishing flexible system is made with several interconnected machines (like papermachines, coaters, calanders, roll winders, ...) linked by means of transport, like travelling cranes, operators and buffers.

The system is flexible because the way through the workshop is not predestinated. Instead the paper being produced is directed to different machines and stocks depending on the actual state of the system.

The goal of this project is to design a SIMAN model of the paper finishing system. Then, simulation campaigns will be lead to compare different strategies and performances of this system to try to improve some of them.

2.The workshop {2}.

2.1.Production in the workshop and the workshop lay-out.

The merchandise produced in the workshop is paper of different types and qualities. Pulp enters the workshop, and after the first machine the pulp has turned into a long sheet of paper, rolled up on a roll.
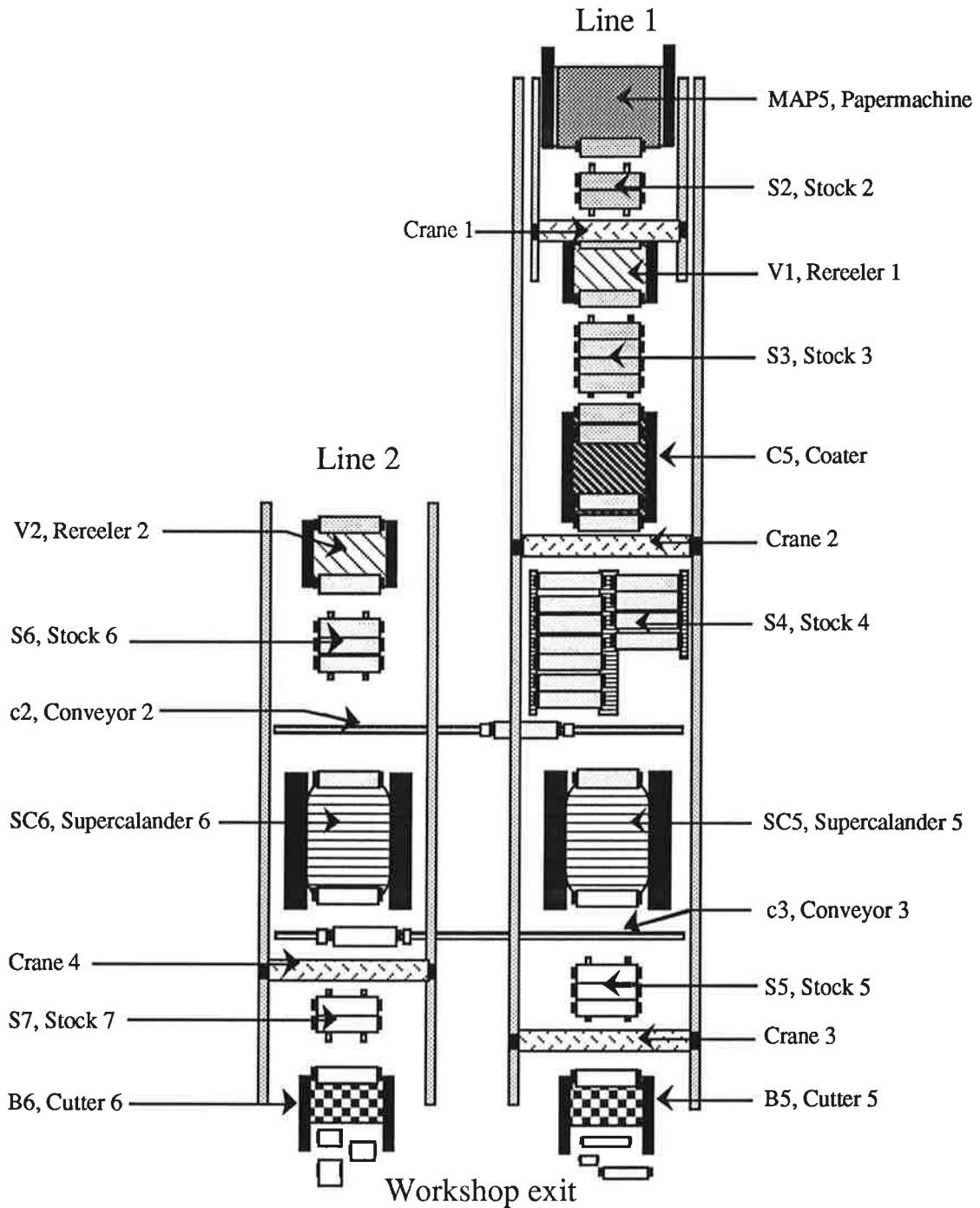
Fig.2.1.The workshop lay-out.

The paper that exits the first machine is of low quality and is to be processed in the downstream machines to obtain the desired characteristics. The workshop has two lines and is composed by eight machines, six stocks, four cranes and two conveyors.

2.2.The products.

The most important parameters in defining the type of paper are the basisweight and the paper quality. The paper types are divided into three main groups A, B and C. In the simulation three basisweights are going to be taken into account which leaves nine different types of paper. The paper type indexes are shown in table 2.1.

Group	A			B			C		
Type	1	2	3	4	5	6	7	8	9
Basisweight	1	2	3	1	2	3	1	2	3

Table 2.1. Paper type indexes.

2.3.The transport means.

A transport can be either from machine to stock, machine to machine or from stock to machine. The cranes 1, 2 and 3 have their working areas in line 1 as shown in fig. 2.2. The only crane in line 2 is crane 4.
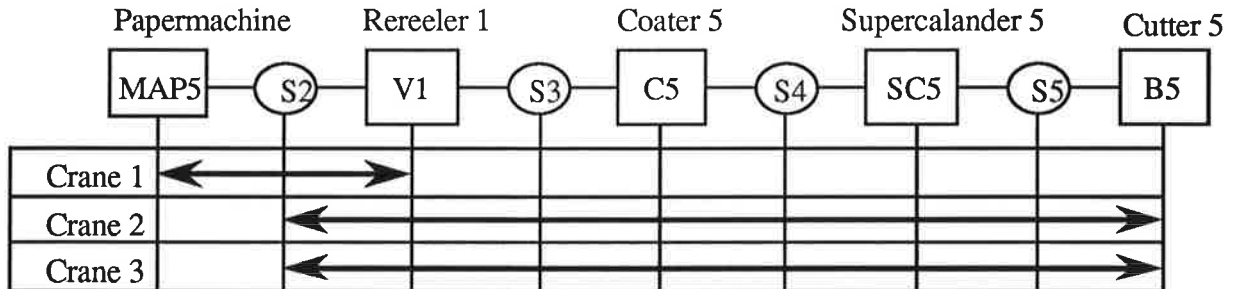
Fig. 2.2. Working areas for cranes in line 1.

2.4.The machines and the stocks.

2.4.1.Machine types, machine states and machine associated events.

There are two types of machines, **continuous** and **discontinuous**.

At the arrival of a roll at a continuous machine, the paper that is processed before the arrival is glued to the paper on the new roll . This means that the machine is processing only one long sheet of paper.

When a continuous machine has finished processing a roll and the state of the workshop does not permit the roll to exit, there is a **temporary storage** of the roll at the machine output. This is to permit the machine to start processing a new roll immediately at its arrival, even if the arrival is before the exit of the previously processed roll.

A discontinuous machine can not start to process a new roll before the exit of the previous roll.

In fig. 2.3. the passage of a roll threw a machine is described. If a machine is still processing the previous roll at a roll arrival to the machine, the crane that is transporting the arriving roll will have to wait with the entrance of the roll in the machine.

After the entrance of a roll in a machine some time is consumed for changing the roll or changing the type of paper.

The **roll changing time** concerns only the discontinuous machines and the **type changing time** concerns only the continuous machines.

The **processing time** in fig. 2.3. depends on the basisweight of the paper being processed.

If a machine has finished processing and there is no roll being transported to the machine the minimum time before a new roll arrives is the transport time. Using the **preview time**, shown in figure 2.3., is an attempt to minimize the time spent by a machine, waiting for a roll arrival when the machine is not processing. That is, a new roll to process is demanded before the machine has finished processing the previous roll.

If the preview time is to long, a roll can arrive to the machine before the previous roll is fully processed.
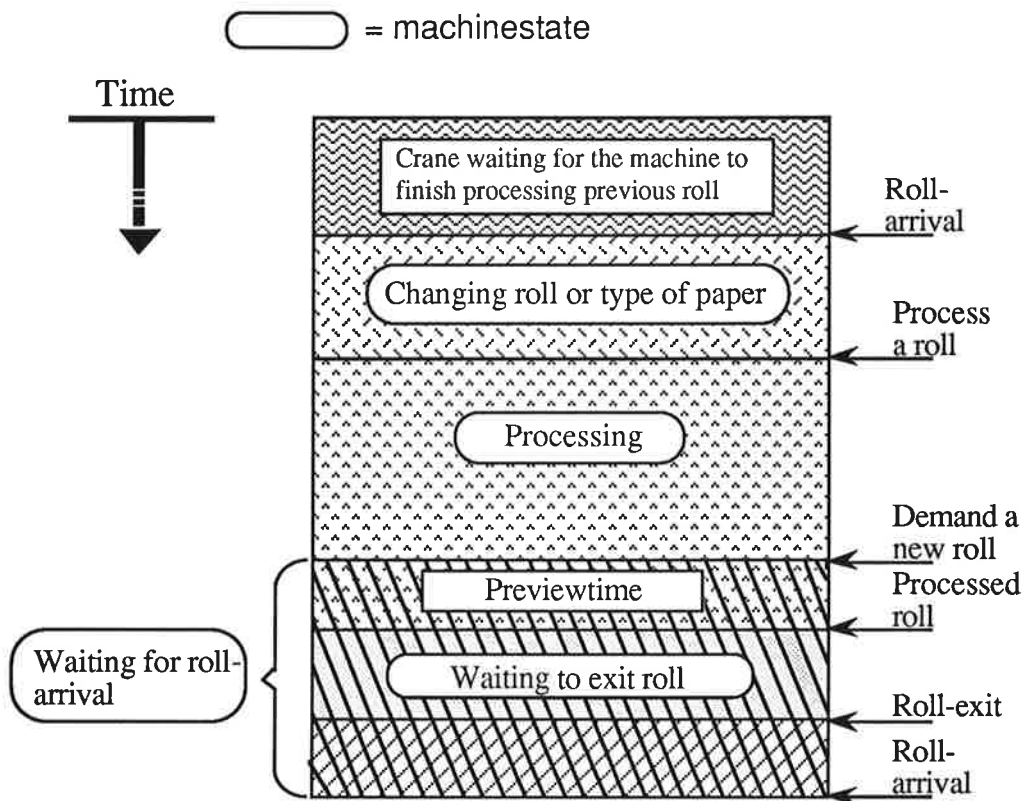
Fig 2.3. Machine states and machine associated events.

Sometimes there are **machine breakdowns** or **paper breakages** which causes the machines to enter the state "machine stopped".

A machine is **busy** when it is processing, changing roll or type of paper and for the discontinuous machines also when waiting to exit a roll.

2.4.2.Specification of the machines.

◊ **The papermachine** is a special case of a continuous machine, as there are no roll arrivals to it. Instead the paper arrives in the form of pulp. It is the first machine in the production process and it produces base paper.

The type changing times in the papermachine are;

- 1. Change of type but no basisweight change.
- 2. Change of basisweight in one step.
- 3. Change of basisweight in two steps.

Times 1 and 2 are equal and 3 is the greatest.

◊ **The coater** is the second of the two continuous machines in the workshop. It puts different kinds of layers on the paper depending on what type of paper it is. The type changing times in the coater are;

- 1. Change of basisweight within a paper type group.
- 2. Change from group A to group B.
- 3. Change from group B to group A.
- 4. Change from or to group C.

Time 1 is short compared to the others and time 4 is very long.

◊ **The rereelers** are of type discontinuous. Their function is to repair wholes and weaknesses in the paper.

◊ **The supercalanders** are of type discontinuous. They improve the paper finish by rolling the paper between cylinders under pressure.

◊ **The cutters** are the last machines in the production process. They are a special case of the discontinuous machine because they exit more than one roll for every arrived roll. Rolls from group C can not be processed in cutter B5.

2.4.3.The stocks.

A stock limit is the maximum capacity of a stock. The stock limits are shown in table 2.2.

Stock	2	3	4	5	6	7
Stock limit	2	4	11	3	3	2

Table 2.2. Stock capacities.

2.5.The manufacturing rules.

1. After the coater, the group C rolls change line as soon as possible because B6 is the only one of the two cutters that can process them.

2. The paper that has passed through rereeler V2 causes less paper breakages in the downstream machines and passes faster through the supercalanders. Thus it is of high priority that as many rolls as possible are processed in V2.

3. The change of basisweight in the papermachine is done in steps of one if possible. A change with two steps at one time, for example basisweight 1 to 3, takes longer time.

4. To avoid large changes of the humidity in the paper that enters the supercalanders and to quickly observe problems in the papermachine the stocks 2,3,4 and 6 are of type last in first out (LIFO).

3. About the modeling of the workshop.

3.1.General aspects.

To investigate the influence of the transport constraints, two models are made, one with and one without the modeling of the transport means.

3.2.The input parameters of the model.

Sometimes there are more than one machine trying to get or exit a roll simultaneously. The order in which this is done is called the **exit- and get-roll priority order**.

The **manufacturing rules** constitute the order for the testing of different cases as from where to get or where to send a roll when a machine tries to get or exit rolls.

The shorter processing time in the supercalanders if the paper has passed through V2 is modeled by using a coefficient called the "**V2 coefficient**". If a roll being processed in SC5 or SC6 has passed V2, the processing time is multiplied with the V2 coefficient.

The input parameters of the model are :

- The stock limits,
- The manufacturing rules,
- The exit- and get-roll priority order,
- The preview times,
- The times for changing type and basisweight,
- The roll changing times,
- The processing times,
- The transport times,
- The V2 coefficient.

3.3.The transport means.

Papermachine   Reeroler 1   Coater 5   Supercalander 5   Cutter 5

```
         A      B        C      D        E   F        G    H
MAP5 ── (S2) ── V1 ── (S3) ── C5 ── (S4) ── SC5 ── (S5) ── B5
                                            c2        c3
```

A	C1 idle	Use C1
B	C1 and C2 idle	Use C1
B	C1 idle ◄———————— C2 busy ————————►	Use C1
B	◄ C1 b► C2 idle	Use C2
C	C2 and C3 idle	Use C2
C	◄— C2 busy —► C3 idle	Use C3
C	C2 idle ◄———————— C3 busy ————————►	Use C2
D	C2 and C3 idle	Use C2
D	◄——— C2 busy ———► C3 idle	Use C3
D	C2 idle ◄———————— C3 busy ————————►	Use C2
E	C2 and C3 idle	Use C2
E	◄——— C2 busy ———► C3 idle	Use C3
E	C2 idle ◄——— C3 busy ———►	Use C2
F	C2 and C3 idle	Use C3
F	◄———— C2 busy ————► C3 idle	Use C3
F	C2 idle ◄— C3 busy —►	Use C2
G	C2 and C3 idle	Use C3
G	◄———— C2 busy ————► C3 idle	Use C3
G	C2 idle ◄ C3 b►	Use C2
H	C3 idle	Use C3
c2	C2 and C3 idle	Use C2
c2	◄———— C2 busy ————► C3 idle	Use C3
c2	C2 idle ◄— C3 busy —►	Use C2
c3	C2 and C3 idle	Use C3
c3	◄———— C2 busy ————► C3 idle	Use C3
c3	C2 idle ◄ C3 b►	Use C2

Fig. 3.1. The states of the cranes 1,2 and 3 and their usage.

Cranes 1,2 and 3 are considered available and are used as shown in fig. 3.1. A-H are the exits from stocks or machines. c2 and c3 are the unloading of conveyors 2 and 3 when they arrive to line 1.

If there is a need for more than one transport with a conveyor at the same time, the transports are lined up to wait for their turn. This situation could for example occur if there is a transport from stock 4 to SC6 and another transport from C5 to V2 at the same time.

To avoid a deadlock situation where conveyors are waiting for cranes and cranes are waiting for conveyors a check is done at the machines to see if there are conveyor transports lined up in the opposite direction than wished. If this is the case the machine waits for a change of the state of the conveyors or tries another possibility.

3.4.The machines.

When a crane arrives at a machine to unload a roll, a check is done to see if the previous roll is fully processed. If this is not the case the crane waits until the machine has finished processing before unloading the roll.

If the temporary storage at MAP5 or C5 is occupied and a roll is just processed and needs to exit, the machines stop until the temporary storage becomes not occupied. This situation can arrive for example when SC5, SC6 and V2 are charged at nearly the same time and stock 4 and 6 are full or when there are few type changes in the papermachine giving a production rate that is higher than the capacity of the rest of the workshop.

The choice at a machine from which stock to get a roll and the destination of a roll that exits a machine is done by trying the different cases in priority order according to the manufacturing rules (see tables 6.1., 6.2. and 6.3.). The case that is finally chosen depends on the state of the workshop.

In the model one can chose to consider only the combined conditions where the combination of the machine states and the crane and conveyor states are tested. For example if the coater has a roll to exit and if the statement "rereeler V2 is waiting for a roll and there are transport means available" is not true, the next case is immediately tested where the coater may try to send the roll to supercalander 6. It is also possible to wait for state changes. In the above example, if V2 is waiting for a roll and the state of the transport resources does not permit the transport to V2, C5 could wait for a change of the state of the transport resources and try the V2 destination again.

A discontinuous machine that is waiting to exit a roll can not start to process another roll before the exit is effectuated.

3.5.The stocks.

When there is a change of group of paper types the LIFO rules of stocks 2 and 3 are not used. To avoid unnecessary type changes in C5, V1 and C5 search their respective upstream stock for rolls of the same type as the last processed. If there are rolls in the upstream stock but not of the same type as last processed, the LIFO rule is used. If there is a change of type and the downstream stock is not empty, MAP5 and V1 send the rolls to their respective downstream stock even if the downstream machine is waiting for a roll. This means that stocks 2 and 3 always will be emptied from rolls of the type being processed in C5 before the type change. Normally the rolls are sent directly from a machine to the downstream machine if the downstream machine is waiting for a roll.

4.About SIMAN {1}.

4.1.Presentation of the SIMAN software.

The modeling and the simulation is done with SIMAN version 3.5.

In the SIMAN modeling framework, a fundamental distinction is stressed between the **system model** and the **experimental frame**. The system model defines the static and dynamic characteristics of the modeled system and the experimental frame defines the experimental conditions under which the model is run. The model and the experimental frame are compiled separately so that many different experimental frames can be used for the same model.

The model is constructed by depicting the functional operations of the modeled system as a **block diagram**. The block diagram is a linear top-down sequence of blocks which represent specific process functions such as time delays and queues.

The block diagram shows the evolution of **entities** through the system. An entity can for example represent a work piece that is being manipulated in different machines. It is the entities that change the state of the modeled system. A typical block sequence is "seize a resource - delay a specified time - release the resource".

4.2.The program structure.

The program code for the model has the structure shown in fig. 4.1.

Definition of the variable names
Machines and stocks
Mesure the workshop production rate
Collect statistics
The transports
Administration of exit- and get-roll priorities
Starting up the simulation

Fig. 4.1. The program structure.

The most important objects in the model are the machines. Get-roll entities are sent from the machines to search the stocks for rolls to process, roll entities exit the machines and entities are sent from the machines to calculate the state of the transport means. It is the exit- and get-roll entities that seize the cranes and the conveyors.

5.About the statistics.

Most of the statistics that originate from the real workshop are given as mean values without standard deviation. In all these cases, except for in V2, the standard deviations are chosen as 5 % of the mean value. In rereeler V2 the transport times are taken into account in the processing times. Therefore the standard deviation for the processing time in V2 is chosen to have the greater value 10 % of the mean.

All the input time values in the simulation are generated by sampling from normal distributions with the given mean values and the estimated standard deviations.

The workshop production rate is both sampled and given as the total number of produced rolls in the simulation together with total simulated time. For the sampled version, the case where B5 an B6 exit rolls at nearly the same time, giving unrepresentative values of the time between rolls is avoided by calculating every two rolls. This divides the number of observations in two but still decreases the variance.

The original values for the transport times, the processing times and the roll changing times are confidential and can not be given. To give an idea about the dynamics of the system, it must be noted that the processing times are around one hour and the transports take between 3 and 20 minutes.

When starting up the workshop the stocks and machines are empty. This gives a transient behavior to the workshop for some time and creates a considerable bias in the statistics if they are collected from the start of the simulation. To avoid this, the collection of statistics starts after a offset time when the state of the workshop can be regarded as stable. The stabilization time is found by examining the sampled version of the production rate and is in the most extreme cases around 25 hours. The offset time is chosen to 66 hours (4000 minutes).

The model is simulated as a non-terminating system. This means that the model is run non-stop until a specified simulation time is reached. The total time that is simulated is 138 days of production 24 hours a day (200000 minutes).

6.The simulation.

6.1.The primary input parameter set.

Here a primary input parameter set is defined for the simulations. If nothing else is said, this input parameter set is used in the different simulations.

Considering the importance of a maximum use of rereeler V2 the exit- and get-roll priority order starts with letting V2 try to exit a roll and then, if waiting for a roll arrival, V2 tries to get a roll. The following priority order is :

-Try to unload roll roll from conveyor 2 and 3 at arrival at line 1,
-Try to unload roll from conveyor at arrival at line 2,
-Try to get a roll for C5,
-Try to exit a roll from C5,
-Try to exit a roll from V1,
-Try to get a roll for V1,
-Try to exit a roll from MAP5,
-Try to exit a roll from SC5,
-Try to get a roll for SC5,
-Try to exit a roll from SC6,
-Try to get a roll for SC6,
-Try to get a roll for B6,
-Try to get a roll for B5.

The exit- and get-roll priority order is the same in the model with and in the model without the modeling of the transport means, with exception for the conveyor priorities which are not used in the model without transport constraints.

The manufacturing rules for the group A and B rolls at roll exits from machines are shown in table 6.1. For the group A and B rolls the downstream machine in the same line is tried first. If this is not possible a machine in the other line is tried. As a last choice of destination for the rolls the stocks are tried.

The group C rolls change from line 1 to line 2 as soon as possible because only B6 can process them. The manufacturing rules for the group C rolls are shown in table 6.2.

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From machine	MAP5	V1	C5	SC5	V2	SC6
DESTINATION First choice	V1	C5	SC5	B5	SC6	B6
Second choice	S2	S3	V2	B6	SC5	B5
Third choice			SC6	S5	S6	S7
Fourth choice			S4		S4	S5
Fifth choice						

Table 6.1. Primary manufacturing rules. Priority order for the testing of possible transport destinations when the roll that exits is not from group C.

From machine	MAP5	V1	C5	SC5	V2	SC6
DESTINATION First choice	V1	C5	V2	B6	SC6	B6
Second choice	S2	S3	SC6	S7	SC5	S7
Third choice			SC5	S5	S6	
Fourth choice			S4		S4	
Fifth choice						

Table 6.2. Primary manufacturing rules. Priority order for the testing of possible transport destinations when the roll that exits is from group C.

The manufacturing rules for the choice from which stock to get a roll are shown in table 6.3. They are chosen so that the group C rolls stay in line 2 if possible.

To machine	V1	C5	SC5	B5	V2	SC6	B6
FROM STOCK First choice	S2	S3	S4	S5	S4	S4	S5
Second choice			S6	S7	S6	S6	S7
Third choice			S4		S6	S6	S7
Fourth choice			S6		S4	S4	S5
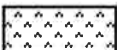
= Not from group c   = From group c   = Any group

Table 6.3. Primary manufacturing parameters. Priority order for the testing of from witch stock to try to get a roll.

The stock limits are set to their real values.

The preview times are set to zero.

The roll changing times, the times for changing type and basisweight, the processing times and the transport times are set to the original given values.

The V2 coefficient is set to 0.95.

6.2.A typical production sequence.

A production sequence is the order in which the changes of paper types is done and the percentage of different paper types. The sequences in the simulations are repeated typical sequences. If nothing else is said the sequence in table 7.4. is used in the simulations.

27.3 % of the rolls belong to group C													
Type	7	8	9	1	4	2	5	3	2	5	7	8	3	2
Produced rolls	8	1	5	16	9	7	6	19	20	4	5	20	16	7

Table 6.4. Typical production sequence.

6.3.The output parameters.

The busy and processing time percentages are the percentage of time spent being busy or processing. The time in system is the time spent from the entrance of a roll in the workshop to the exit. Some of the the output parameters are :

-the busy time percentage,
-the time in system,
-the processing time percentage,
-the waiting for exit time,
-the number of rolls in the workshop,
-the number of transports with change of line
-the number of rolls in the stocks.

7.Simulation campaigns.

7.1.Trying one type at a time.

To investigate the general behavior of the workshop a test series, type by type with group A and C, has been done. Group B would give the same results as group A because there are no type changes in the simulations. The tests are done using the primary input parameter set, with and without the transport constraints taken into account, with stock limits, with no stock limits and with all three basisweights. All together this makes 24 experiments.

The result of the run with only type 2, no transport constraints and no stock limits are displayed in appendix A.6.

Results and analysis :

-1.One notices that the stocks are in general used more and, as one could expect, the production rate is a little bit smaller when the transport means are taken into account.

-2.The waiting to exit times at the machines are zero or close to zero for group A in the model without transport constraints and increase a little when introducing the transport constraints. They are significant in all experiments with group C. The longer waiting to exit times for the group C rolls is natural considering that only cutter B6 can process the group C rolls, which causes an overloaded workshop if the group C sequence is long.

-3.In the group C experiments some times SC6 gets blocked and stock 7 is full during long time periods. This could be a combination of an overloaded workshop and the exit-roll priority order for the supercalanders, SC5 before SC6.

-4.The most significant observation is a bottle neck between MAP5 and V1. In for example the experiment with only type 2 rolls, no transport constraints and no stock limits (Appendix A.6), the average number of rolls in stock 2 is 55.19.

-5.The simulations with only type 2 rolls, no transport constraints and no stock limits give the highest production rate of all simulations done, which could be expected as type 2 has basisweight 2 and basisweight 2 has the shortest processing time in the paper machine.

-6.The experiments with the type 2 rolls in the model without the transport constraints should give an indication of the maximum capacity for the workshop.

7.2.Introducing the typical production sequence.

Here the workshop model is run with the typical production sequence described in §6.2.

The first four simulations are done :

-with no transport constraints and with stock limits,
-with no transport constraints and with no stock limits.
-with transport constraints and with stock limits,
-with transport constraints and with no stock limits,

The results of these experiments are shown in appendix A.2. to A.5.

Observations and analysis :

-1.A very high value for the maximum time in system for the run with the transport constraints taken into account is noticed.

-2.One notices also a strong decrease in the average and maximum time in system when having no stock limits in the model with the transport constraints taken into account.

-3.Another observation is a very clear difference in the average and maximum values for the number of rolls in stock 4 when comparing the experiments with and without stock limits. The values are lower without stock limits.

-4.A comparison between the run with and the run without stock limits shows that the main storage of rolls is moved from stock 4 and 6 to stock 7 in the run without stock limits.

-5.One notices that in the simulations <u>without stock limits</u> the storage of rolls in stock 7 reaches its maximum when the dominating storage is of rolls from group C. The maximum number of stored rolls in stock 7 is 11 both in the runs <u>with</u> and in the runs <u>without the transport constraints</u> (The stock 7 capacity is 2). And the average storage in stock 7 is close to or greater than the stock 7 capacity in the simulations with <u>no stock limits</u> .

-6.The average number of rolls in the workshop decreases when running the the workshop model <u>without stock limits</u>.

-7.It is also observed that in all four experiments the busy and processing time percentages are greater for B6 than for B5.

This difference depends mostly on longer processing times in B6 than in B5. But the many possibilities for the group A and B rolls to change line from 1 to 2 together with the manufacturing rules for V2 could also have some effect. In the manufacturing rules for V2 the first choice of destination for the group A and B exit rolls is SC6.

An experiment has been done to try to balance the usage of the cutters. The manufacturing rules for the rereeler V2 are changed so that the group A and B rolls that exit V2 are directed in preference to SC5 instead of to SC6, and the exit roll choice for the group A and B rolls from C5 to SC6 is not used. This experiment shows no good results. It balances the usage of the cutters a little, but at the same time the production rate is decreased.

An experiment is also done, letting C5 wait with the exit of a roll if V2 is waiting for a roll and the state of the cranes and conveyors do not permit this transport to be effectuated. This is done to try to increase the processing time percentage for V2 but shows no particular change.

7.3.Introducing the preview times.

In reality the preview times are limited by the possibility to predict the remaining processing times for the rolls. Here it is assumed that they can be chosen as desired.

To investigate their importance the workshop is simulated <u>with preview times</u> and <u>with the transport means</u> taken into account.

The preview times are set to the average of the transport times to the machines except for V2. The transport times to rereeler V2 are zero in the primary input parameter set because the transport times are taken into account in its processing time. In this experiment the preview time is set to 3 minutes for V2.

The results are displayed in appendix A.7.

Results and analysis :

A comparison of this experiment with the experiment taking the transport constraints into account and the primary input parameter set unchanged, shows the following main differences :

- A small increase of the production rate,
- The average time in system is divided by 1.65,
- The maximum time in system is divided by 2.86,
- The average number of rolls in the workshop is divided by 1.62,

- The maximum number of rolls in the workshop decreases from 25 to 18,
- The average number of rolls in stock 4 is decreased from 6.6 to 1.0,
- The maximum number of rolls in stock 4 decreases from 11 to 7.

One notices that the main differences are all increases of the workshop performance.

7.4.The exit- and get-roll priorities.

Different experiments, for example letting the machines try to get rolls before trying to exit rolls or letting the conveyors have the lowest priority values, show no significant differences in the output parameters.

8.Conclusions.

The experiments with one type at a time (§7.1.) show results that could be expected. They validate the workshop model and indicate that it can be used for further experiments.

The bottle neck between MAP5 and V1 (§7.1.) shows that the papermachine can have a greater production rate then the capacity of the rest of the workshop when only one type of paper is produced.

As in the one type experiments (§7.1.) the transport constraints decrease the performance of the workshop also when introducing the typical production sequence (§7.2.). This indicates that the transport resources could be to small.

The results and analysis in §7.2 strongly indicate that the distribution of the storing capacity of the workshop is unbalanced. Simulating without stock limits, the average storage in stock 7 is close to or greater than the stock 7 capacity and the main storage is moved to stock 7 from stock 4 and 6. This indicates that an increase of the storing capacity of stock 7 with 1 or 2 could help to balance the distribution of the storing capacity and thereby increase the flexibility of the workshop.

The strategy using preview times increase the performance of the workshop. One notices especially a strong decrease for the average and maximum time in system and a strong decrease in the average and maximum number of rolls in the workshop. This indicates that the flexibility and the capacity of the workshop increases when the preview times are introduced.

Simulating with different exit- and get-roll priority orders shows very small and non-significant differences. This indicates that the exit- and get-roll priority order is not very important.

9.References.

1. C. DENNIS PEGDEN. Introduction to SIMAN. Systems Modeling Corporation, Sewickley, Jan 1989.

2. Correspondence between C Valentin, Laboratoire d'Automatique de Grenoble, E.N.S.I.E.G., and a paper mill (Confidential).

10.Appendix.

A.Some experiment results.

A.1.The output variables in the simulations.

There are three different types of output variables in the simulations :

-the **tally variables,**
-the **discrete change variables,**
-the **counters.**

The tally variables are not time-persistant. This means that two simulations with exactly the same sequence order of state changes in a modeled system would give the same tally variable values even if the events occur at different simulated times in the two simulations. A tally variable is mesured only when an entity arrives at the tally block in the model.

The discrete change variables are time-persistant which means that the average of a variable over time is mesured. They mesure predefined SIMAN variables like the number of entities in a queue or the number of busy units of a resource.

The counters are increased every time an entity arrives at the count block in the model.

Stocks 4 to 7 are modeled with two queues each. One of the two queues contains the group C rolls and the other queue contains the group A and B rolls. Thus the discrete change variables for the queues 4 to 6 do not give information about the maximum number of rolls in the stocks. To mesure the maximum number of rolls in stocks 4 to 7 the sum of the number of entities in the two queues modeling a stock is tallied every time there is a state change in the stock. Thus the tally variables for stock 4 to 7 give the maximum values and the discrete change variables give information about the average number of rolls in the stocks.

The tables.

In the tables for the output results, X means group A and B and Y means group C.

PRODUCTIONRATE is given in rolls per hour.

Tally variables 3 to 7 are accumulated values for every roll that exits the workshop divided by time in system for the roll.

Tally variables 10 to 16 are accumulated values divided by the actual simulated time. They are mesured every time a machine has finished processing.

Tally variables 18 to 21 are the number of rolls in the stocks. They are mesured every time there is a state change in the stocks.

WAITFOREXITTIMEV2 is given in minutes.

A.2. RUN USING PRIMARY INPUT PARAMETER SET, NO TRANSPORT CONSTRAINTS
      AND TYPICAL PRODUCTION SEQUENCE

SIMAN SUMMARY REPORT.   RUN ENDED AT TIME   0.2000E+06

TALLY VARIABLES

	IDENTIFIER	AVERAGE	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
1	PRODUCTIONRATE	0.79530	0.15827	0.38749	1.13091
2	ROLLSINWORKSHOP	12.06806	3.17421	6.00000	20.00000
3	TYPECHANGETIME	0.00406	0.01538	0.00000	0.12580
4	T_IN_STOCKS	0.22387	0.21132	0.00000	0.87365
5	TIMEINTRP	0.08572	0.03009	0.01245	0.14368
6	ROLLCHANGETIME	0.09486	0.02838	0.01276	0.14272
7	PROCTIME	0.58221	0.16786	0.08767	0.79488
8	WTFORXTTIME	0.00440	0.03432	0.00000	0.47680
9	T_IN_SYSTEM	964.18	656.45	475.66	5049.33
10	SUMPROCTMAP5	0.98677	0.00321	0.98144	0.98798
11	SUMPROCTV1	0.75534	0.00301	0.73244	0.75834
12	SUMPROCTC5	0.69648	0.00339	0.67035	0.71071
13	SUMPROCTSC5	0.74220	0.00955	0.68846	0.74826
14	SUMPROCTB5	0.44600	0.01565	0.32121	0.45781
15	SUMPROCTV2	0.82306	0.01369	0.75143	0.83336
16	SUMPROCTSC6	0.66540	0.00947	0.60045	0.67599
17	SUMPROCTB6	0.65117	0.01326	0.57053	0.65854
18	STOCK4	2.75072	2.07210	0.00000	9.00000
19	STOCK5	0.18222	0.38605	0.00000	1.00000
20	STOCK6	0.94727	0.77069	0.00000	2.00000
21	STOCK7	0.80439	0.85475	0.00000	2.00000
22	WAITFORXTTIMEV2	0.00000	0.00000	0.00000	0.00000

DISCRETE CHANGE VARIABLES

	IDENTIFIER	AVERAGE	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
1	TEMPSTORAGEC5	0.00	0.00	0.00	0.00
2	STOCK2	0.27	0.48	0.00	2.00
3	STOCK3	0.08	0.27	0.00	1.00
4	STOCK4X	1.78	1.91	0.00	8.00
5	STOCK4Y	0.56	1.13	0.00	5.00
6	STOCK5X	0.03	0.16	0.00	1.00
7	STOCK5Y	0.06	0.23	0.00	1.00
8	STOCK6X	0.28	0.46	0.00	2.00
9	STOCK6Y	0.56	0.80	0.00	2.00
10	STOCK7X	0.02	0.15	0.00	1.00
11	STOCK7Y	0.61	0.85	0.00	2.00
12	WAITINGTOENTERV1	0.00	0.00	0.00	0.00
13	WAITINGTOENTERC5	0.00	0.00	0.00	0.00
14	WAITINGTOENTRSC5	0.00	0.00	0.00	0.00
15	WAITINGTOENTERB5	0.00	0.00	0.00	0.00
16	WAITINGTOENTERV2	0.00	0.00	0.00	0.00
17	WAITINGTOENTRSC6	0.11	0.31	0.00	1.00
18	WAITINGTOENTERB6	0.00	0.00	0.00	0.00
19	BUSYTIMEMAP5	1.00	0.00	1.00	1.00
20	BUSYTIMEV1	0.88	0.32	0.00	1.00

```
21   BUSYTIMEC5              0.73      0.44      0.00      1.00
22   BUSYTIMESC5             0.92      0.28      0.00      1.00
23   BUSYTIMEB5              0.62      0.48      0.00      1.00
24   BUSYTIMEV2              0.96      0.20      0.00      1.00
25   BUSYTIMESC6             0.93      0.25      0.00      1.00
26   BUSYTIMEB6              0.87      0.33      0.00      1.00
27   TEMPSTORAGEMAP5         0.00      0.00      0.00      0.00
```

COUNTERS

```
NUMBER IDENTIFIER          COUNT       LIMIT
---------------------------------------------
     1 WORKSHOPEXITS         2501    INFINITE
     2 STAYSINLINETRPTS     15659    INFINITE
     3 CHANGEOFLINETRPS      2836    INFINITE
     4 INTOSTOCK2            1910    INFINITE
     5 INTOSTOCK3            1280    INFINITE
     6 INTOSTOCK4X           1586    INFINITE
     7 INTOSTOCK4Y            524    INFINITE
     8 INTOSTOCK5X            268    INFINITE
     9 INTOSTOCK5Y            176    INFINITE
    10 INTOSTOCK6X            594    INFINITE
    11 INTOSTOCK6Y            400    INFINITE
    12 INTOSTOCK7X            284    INFINITE
    13 INTOSTOCK7Y            449    INFINITE
    14 INTOMAP5              2509    INFINITE
    15 INTOV1               2508    INFINITE
    16 INTOC5               2506    INFINITE
    17 FRTOGRCCHANGEC5         69    INFINITE
    18 INTOSC5              1328    INFINITE
    19 XINTOB5              1087    INFINITE
    20 YINTOB5                 0    INFINITE
    21 XINTOV2               662    INFINITE
    22 YINTOV2               339    INFINITE
    23 INTOSC6              1176    INFINITE
    24 XINTOB6               739    INFINITE
    25 YINTOB6               677    INFINITE
```

A.3. RUN USING PRIMARY INPUT PARAMETER SET WITH NO STOCK LIMITS,
      NO TRANSPORT CONSTRAINTS AND TYPICAL PRODUCTION SEQUENCE.

SIMAN SUMMARY REPORT. RUN ENDED AT TIME   0.2000E+06

TALLY VARIABLES

	IDENTIFIER	AVERAGE	STANDARD	MINIMUM	MAXIMUM
1	PRODUCTIONRATE	0.80210	0.17551	0.37426	1.08586
2	ROLLSINWORKSHOP	10.83320	3.37766	6.00000	20.00000
3	TYPECHANGETIME	0.00464	0.01706	0.00000	0.12548
4	T_IN_STOCKS	0.22080	0.21848	0.00000	0.85093
5	TIMEINTRP	0.08495	0.02906	0.01652	0.14526
6	ROLLCHANGETIME	0.09651	0.02790	0.01701	0.14705
7	PROCTIME	0.59310	0.16621	0.11405	0.81099
8	WTFORXTTIME	0.00000	0.00000	0.00000	0.00000
9	T_IN_SYSTEM	865.37	383.95	468.38	3768.75
10	SUMPROCTMAP5	0.98664	0.00000	0.98118	0.98783
11	SUMPROCTV1	0.75530	0.00360	0.72652	0.75790
12	SUMPROCTC5	0.69520	0.00437	0.66135	0.70200
13	SUMPROCTSC5	0.70749	0.00549	0.66765	0.71103
14	SUMPROCTB5	0.44903	0.01672	0.31673	0.45958
15	SUMPROCTV2	0.74974	0.00312	0.72631	0.75691
16	SUMPROCTSC6	0.71108	0.00755	0.66738	0.71588
17	SUMPROCTB6	0.64782	0.01185	0.57735	0.65518
18	STOCK4	0.22413	0.42571	0.00000	2.00000
19	STOCK5	0.15738	0.36419	0.00000	1.00000
20	STOCK6	0.42312	0.55022	0.00000	2.00000
21	STOCK7	3.21559	3.21905	0.00000	11.00000
22	WAITFORXTTIMEV2	0.00000	0.00000	0.00000	0.00000

DISCRETE CHANGE VARIABLES

	IDENTIFIER	AVERAGE	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
1	TEMPSTORAGEC5	0.00	0.00	0.00	0.00
2	STOCK2	0.25	0.47	0.00	3.00
3	STOCK3	0.07	0.26	0.00	1.00
4	STOCK4X	0.08	0.28	0.00	2.00
5	STOCK4Y	0.00	0.00	0.00	0.00
6	STOCK5X	0.09	0.29	0.00	1.00
7	STOCK5Y	0.00	0.00	0.00	0.00
8	STOCK6X	0.13	0.33	0.00	1.00
9	STOCK6Y	0.14	0.37	0.00	2.00
10	STOCK7X	0.72	1.55	0.00	8.00
11	STOCK7Y	1.86	2.80	0.00	11.00
12	WAITINGTOENTERV1	0.00	0.00	0.00	0.00
13	WAITINGTOENTERC5	0.00	0.00	0.00	0.00
14	WAITINGTOENTRSC5	0.00	0.00	0.00	0.00
15	WAITINGTOENTERB5	0.00	0.00	0.00	0.00
16	WAITINGTOENTERV2	0.00	0.00	0.00	0.00
17	WAITINGTOENTRSC6	0.00	0.00	0.00	0.00
18	WAITINGTOENTERB6	0.00	0.00	0.00	0.00
19	BUSYTIMEMAP5	1.00	0.00	1.00	1.00
20	BUSYTIMEV1	0.88	0.32	0.00	1.00
21	BUSYTIMEC5	0.73	0.44	0.00	1.00

22	BUSYTIMESC5	0.87	0.34	0.00	1.00
23	BUSYTIMEB5	0.63	0.48	0.00	1.00
24	BUSYTIMEV2	0.87	0.34	0.00	1.00
25	BUSYTIMESC6	0.87	0.33	0.00	1.00
26	BUSYTIMEB6	0.87	0.34	0.00	1.00
27	TEMPSTORAGEMAP5	0.00	0.00	0.00	0.00

COUNTERS

NUMBER	IDENTIFIER	COUNT	LIMIT
1	WORKSHOPEXITS	2499	INFINITE
2	STAYSINLINETRPTS	14271	INFINITE
3	CHANGEOFLINETRPS	3376	INFINITE
4	INTOSTOCK2	1889	INFINITE
5	INTOSTOCK3	1290	INFINITE
6	INTOSTOCK4X	818	INFINITE
7	INTOSTOCK4Y	0	INFINITE
8	INTOSTOCK5X	368	INFINITE
9	INTOSTOCK5Y	0	INFINITE
10	INTOSTOCK6X	596	INFINITE
11	INTOSTOCK6Y	706	INFINITE
12	INTOSTOCK7X	409	INFINITE
13	INTOSTOCK7Y	654	INFINITE
14	INTOMAP5	2506	INFINITE
15	INTOV1	2505	INFINITE
16	INTOC5	2504	INFINITE
17	FRTOGRCCHANGEC5	69	INFINITE
18	INTOSC5	1246	INFINITE
19	XINTOB5	1094	INFINITE
20	YINTOB5	0	INFINITE
21	XINTOV2	648	INFINITE
22	YINTOV2	257	INFINITE
23	INTOSC6	1256	INFINITE
24	XINTOB6	730	INFINITE
25	YINTOB6	677	INFINITE

A.4.   RUN USING PRIMARY INPUT PARAMETER SET, TRANSPORT CONSTRAINTS
        AND TYPICAL PRODUCTION SEQUENCE

SIMAN SUMMARY REPORT. RUN ENDED AT TIME   0.2000E+06

TALLY VARIABLES

	IDENTIFIER	AVERAGE	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
1	PRODUCTIONRATE	0.78093	0.14035	0.39154	1.06268
2	ROLLSINWORKSHOP	17.49215	2.73722	9.00000	25.00000
3	TYPECHANGETIME	0.00351	0.01385	0.00000	0.12240
4	T_IN_STOCKS	0.31376	0.25550	0.00000	0.95703
5	TIMEINTRP	0.08435	0.03644	0.00543	0.15746
6	ROLLCHANGETIME	0.08218	0.03186	0.00537	0.14020
7	PROCTIME	0.50444	0.19088	0.03031	0.76292
8	WTFORXTTIME	0.00839	0.02817	0.00000	0.49467
9	T_IN_SYSTEM	1391.12	1600.21	483.78	12037.25
10	SUMPROCTMAP5	0.98442	0.00207	0.98095	0.98641
11	SUMPROCTV1	0.75307	0.00246	0.72856	0.75646
12	SUMPROCTC5	0.69409	0.00344	0.66511	0.69969
13	SUMPROCTSC5	0.73602	0.00861	0.68230	0.74106
14	SUMPROCTB5	0.45769	0.02072	0.30790	0.47290
15	SUMPROCTV2	0.82165	0.01046	0.73002	0.82648
16	SUMPROCTSC6	0.66001	0.01653	0.56930	0.67417
17	SUMPROCTB6	0.62876	0.01309	0.54839	0.63720
18	STOCK4	6.84858	2.37902	0.00000	11.00000
19	STOCK5	0.14060	0.35933	0.00000	2.00000
20	STOCK6	1.65246	0.54494	0.00000	2.00000
21	STOCK7	0.61240	0.82370	0.00000	2.00000
22	WAITFORXTTIMEV2	1.11748	3.24256	0.00000	23.14062

DISCRETE CHANGE VARIABLES

	IDENTIFIER	AVERAGE	STANDARD	MINIMUM	MAXIMUM
1	TEMPSTORAGEC5	0.02	0.15	0.00	1.00
2	STOCK2	0.36	0.57	0.00	2.00
3	STOCK3	0.34	0.52	0.00	3.00
4	STOCK4X	5.41	2.99	0.00	11.00
5	STOCK4Y	1.27	2.01	0.00	9.00
6	STOCK5X	0.02	0.16	0.00	1.00
7	STOCK5Y	0.05	0.23	0.00	2.00
8	STOCK6X	0.84	0.83	0.00	2.00
9	STOCK6Y	0.80	0.79	0.00	2.00
10	STOCK7X	0.02	0.15	0.00	2.00
11	STOCK7Y	0.49	0.79	0.00	2.00
12	WAITINGTOENTERV1	0.00	0.00	0.00	0.00
13	WAITINGTOENTERC5	0.00	0.00	0.00	0.00
14	WAITINGTOENTRSC5	0.00	0.00	0.00	0.00
15	WAITINGTOENTERB5	0.00	0.00	0.00	0.00
16	WAITINGTOENTERV2	0.00	0.00	0.00	0.00
17	WAITINGTOENTRSC6	0.00	0.00	0.00	0.00
18	WAITINGTOENTERB6	0.00	0.00	0.00	0.00
19	BUSYTIMEMAP5	1.00	0.00	1.00	1.00
20	BUSYTIMEV1	0.90	0.30	0.00	1.00
21	BUSYTIMEC5	0.73	0.44	0.00	1.00

22	BUSYTIMESC5	0.31	0.29	0.00	1.00
23	BUSYTIMEB5	0.65	0.48	0.00	1.00
24	BUSYTIMEV2	0.96	0.20	0.00	1.00
25	BUSYTIMESC6	0.90	0.30	0.00	1.00
26	BUSYTIMEB6	0.84	0.37	0.00	1.00
27	TEMPSTORAGEMAP5	0.00	0.06	0.00	1.00

COUNTERS

NUMBER	IDENTIFIER	COUNT	LIMIT
1	WORKSHOPEXITS	2488	INFINITE
2	STAYSINLINETRPTS	15118	INFINITE
3	CHANGEOFLINETRPS	3875	INFINITE
4	INTOSTOCK2	1969	INFINITE
5	INTOSTOCK3	1767	INFINITE
6	INTOSTOCK4X	2126	INFINITE
7	INTOSTOCK4Y	671	INFINITE
8	INTOSTOCK5X	218	INFINITE
9	INTOSTOCK5Y	122	INFINITE
10	INTOSTOCK6X	275	INFINITE
11	INTOSTOCK6Y	349	INFINITE
12	INTOSTOCK7X	119	INFINITE
13	INTOSTOCK7Y	405	INFINITE
14	INTOMAP5	2501	INFINITE
15	INTOV1	2500	INFINITE
16	INTOC5	2499	INFINITE
17	FRTOGRCCHANGEC5	69	INFINITE
18	INTOSC5	1326	INFINITE
19	XINTOB5	1126	INFINITE
20	YINTOB5	0	INFINITE
21	XINTOV2	627	INFINITE
22	YINTOV2	363	INFINITE
23	INTOSC6	1166	INFINITE
24	XINTOB6	687	INFINITE
25	YINTOB6	677	INFINITE

A.5. RUN USING PRIMARY INPUT PARAMETER SET WITH NO STOCK LIMITS,
      TRANSPORT CONSTRAINTS AND TYPICAL PRODUCTION SEQUENCE.

SIMAN SUMMARY REPORT. RUN ENDED AT TIME   0.2000E+06

TALLY VARIABLES

	IDENTIFIER	AVERAGE	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
1	PRODUCTIONRATE	0.79793	0.17105	0.41255	1.09677
2	ROLLSINWORKSHOP	11.29055	3.39864	6.00000	21.00000
3	TYPECHANGETIME	0.00456	0.01690	0.00000	0.12601
4	T_IN_STOCKS	0.24550	0.21179	0.00000	0.83399
5	TIMEINTRP	0.08568	0.03087	0.01774	0.16729
6	ROLLCHANGETIME	0.09249	0.02661	0.02018	0.14069
7	PROCTIME	0.56896	0.15920	0.12410	0.79489
8	WTFORXTTIME	0.00254	0.00500	0.00000	0.03886
9	T_IN_SYSTEM	903.49	410.06	467.11	3654.61
10	SUMPROCTMAP5	0.98521	0.00329	0.98160	0.98590
11	SUMPROCTV1	0.75235	0.00294	0.72486	0.75522
12	SUMPROCTC5	0.69276	0.00483	0.65344	0.69692
13	SUMPROCTSC5	0.71678	0.00544	0.66712	0.72215
14	SUMPROCTB5	0.45371	0.01707	0.31493	0.46482
15	SUMPROCTV2	0.76576	0.00519	0.72153	0.77151
16	SUMPROCTSC6	0.69690	0.00724	0.65051	0.70122
17	SUMPROCTB6	0.63966	0.01278	0.56166	0.64737
18	STOCK4	0.32842	0.51839	0.00000	3.00000
19	STOCK5	0.15526	0.37579	0.00000	2.00000
20	STOCK6	0.56807	0.64923	0.00000	3.00000
21	STOCK7	3.15335	3.24154	0.00000	11.00000
22	WAITFORXTTIMEV2	0.90018	2.49595	0.00000	18.04688

DISCRETE CHANGE VARIABLES

	IDENTIFIER	AVERAGE	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
1	TEMPSTORAGEC5	0.00	0.05	0.00	1.00
2	STOCK2	0.30	0.50	0.00	2.00
3	STOCK3	0.23	0.42	0.00	2.00
4	STOCK4X	0.18	0.40	0.00	3.00
5	STOCK4Y	0.00	0.05	0.00	1.00
6	STOCK5X	0.09	0.30	0.00	2.00
7	STOCK5Y	0.00	0.03	0.00	1.00
8	STOCK6X	0.25	0.47	0.00	2.00
9	STOCK6Y	0.18	0.43	0.00	3.00
10	STOCK7X	0.67	1.54	0.00	8.00
11	STOCK7Y	1.85	2.75	0.00	11.00
12	WAITINGTOENTERV1	0.00	0.00	0.00	0.00
13	WAITINGTOENTERC5	0.00	0.00	0.00	0.00
14	WAITINGTOENTRSC5	0.00	0.00	0.00	0.00
15	WAITINGTOENTERB5	0.00	0.00	0.00	0.00
16	WAITINGTOENTERV2	0.00	0.00	0.00	0.00
17	WAITINGTOENTRSC6	0.00	0.00	0.00	0.00
18	WAITINGTOENTERB6	0.00	0.00	0.00	0.00
19	BUSYTIMEMAP5	1.00	0.00	1.00	1.00
20	BUSYTIMEV1	0.89	0.31	0.00	1.00
21	BUSYTIMEC5	0.73	0.44	0.00	1.00

22	BUSYTIMESC5	0.88	0.33	0.00	1.00
23	BUSYTIMEB5	0.63	0.48	0.00	1.00
24	BUSYTIMEV2	0.89	0.32	0.00	1.00
25	BUSYTIMESC6	0.86	0.35	0.00	1.00
26	BUSYTIMEB6	0.86	0.35	0.00	1.00
27	TEMPSTORAGEMAP5	0.00	0.03	0.00	1.00

COUNTERS

NUMBER	IDENTIFIER	COUNT	LIMIT
1	WORKSHOPEXITS	2494	INFINITE
2	STAYSINLINETRPTS	14800	INFINITE
3	CHANGEOFLINETRPS	3463	INFINITE
4	INTOSTOCK2	1911	INFINITE
5	INTOSTOCK3	1668	INFINITE
6	INTOSTOCK4X	1140	INFINITE
7	INTOSTOCK4Y	15	INFINITE
8	INTOSTOCK5X	351	INFINITE
9	INTOSTOCK5Y	2	INFINITE
10	INTOSTOCK6X	615	INFINITE
11	INTOSTOCK6Y	647	INFINITE
12	INTOSTOCK7X	337	INFINITE
13	INTOSTOCK7Y	659	INFINITE
14	INTOMAP5	2502	INFINITE
15	INTOV1	2500	INFINITE
16	INTOC5	2499	INFINITE
17	FRTOGRCCHANGEC5	69	INFINITE
18	INTOSC5	1262	INFINITE
19	XINTOB5	1107	INFINITE
20	YINTOB5	0	INFINITE
21	XINTOV2	667	INFINITE
22	YINTOV2	256	INFINITE
23	INTOSC6	1236	INFINITE
24	XINTOB6	712	INFINITE
25	YINTOB6	677	INFINITE

A.6. RUN USING PRIMARY INPUT PARAMETER SET WITH NO STOCK LIMITS,
NO TRANSPORT CONSTRAINTS AND PRODUCTION SEQUENCE
WITH ONLY TYPE 2 ROLLS.

SIMAN SUMMARY REPORT.   RUN ENDED AT TIME   0.2000E+06

TALLY VARIABLES

	IDENTIFIER	AVERAGE	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
1	PRODUCTIONRATE	0.78517	0.07337	0.59841	0.97897
2	ROLLSINWORKSHOP	63.05222	29.76185	9.00000	115.00000
3	TYPECHANGETIME	0.00000	0.00000	0.00000	0.00000
4	T_IN_STOCKS	0.08184	0.04794	0.00006	0.61211
5	TIMEINTRP	0.10129	0.02002	0.04722	0.13697
6	ROLLCHANGETIME	0.11484	0.00669	0.04848	0.14021
7	PROCTIME	0.70202	0.03645	0.29220	0.80142
8	WTFORXTTIME	0.00000	0.00000	0.00000	0.00000
9	T_IN_SYSTEM	641.55	110.62	500.92	1348.16
10	SUMPROCTMAP5	1.00000	0.00000	1.00000	1.00000
11	SUMPROCTV1	0.79125	0.00300	0.77788	0.79208
12	SUMPROCTC5	0.72632	0.00355	0.69840	0.72834
13	SUMPROCTSC5	0.73689	0.00543	0.69085	0.73954
14	SUMPROCTB5	0.53936	0.00721	0.48352	0.54351
15	SUMPROCTV2	0.71889	0.00574	0.68534	0.72466
16	SUMPROCTSC6	0.73607	0.00744	0.67215	0.73953
17	SUMPROCTB6	0.59723	0.00868	0.52536	0.60193
18	STOCK4	0.28445	0.45119	0.00000	1.00000
19	STOCK5	0.00054	0.02318	0.00000	1.00000
20	STOCK6	0.25942	0.43835	0.00000	1.00000
21	STOCK7	0.04815	0.21410	0.00000	1.00000
22	WAITFORXTTIMEV2	0.00000	0.00000	0.00000	0.00000

DISCRETE CHANGE VARIABLES

	IDENTIFIER	AVERAGE	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
1	TEMPSTORAGEC5	0.00	0.00	0.00	0.00
2	STOCK2	55.19	29.76	1.00	107.00
3	STOCK3	0.00	0.01	0.00	1.00
4	STOCK4X	0.02	0.15	0.00	1.00
5	STOCK4Y	0.00	0.00	0.00	0.00
6	STOCK5X	0.00	0.00	0.00	1.00
7	STOCK5Y	0.00	0.00	0.00	0.00
8	STOCK6X	0.19	0.39	0.00	1.00
9	STOCK6Y	0.00	0.00	0.00	0.00
10	STOCK7X	0.00	0.03	0.00	1.00
11	STOCK7Y	0.00	0.00	0.00	0.00
12	WAITINGTOENTERV1	0.00	0.00	0.00	0.00
13	WAITINGTOENTERC5	0.00	0.00	0.00	0.00
14	WAITINGTOENTRSC5	0.00	0.00	0.00	0.00
15	WAITINGTOENTERB5	0.00	0.00	0.00	0.00
16	WAITINGTOENTERV2	0.00	0.00	0.00	0.00
17	WAITINGTOENTRSC6	0.00	0.00	0.00	0.00
18	WAITINGTOENTERB6	0.00	0.00	0.00	0.00
19	BUSYTIMEMAP5	1.00	0.00	1.00	1.00

20	BUSYTIMEV1	0.92	0.27	0.00	1.00
21	BUSYTIMEC5	0.73	0.45	0.00	1.00
22	BUSYTIMESC5	0.90	0.30	0.00	1.00
23	BUSYTIMEB5	0.74	0.44	0.00	1.00
24	BUSYTIMEV2	0.83	0.37	0.00	1.00
25	BUSYTIMESC6	0.90	0.30	0.00	1.00
26	BUSYTIMEB6	0.80	0.40	0.00	1.00
27	TEMPSTORAGEMAP5	0.00	0.00	0.00	0.00

COUNTERS

NUMBER	IDENTIFIER	COUNT	LIMIT
1	WORKSHOPEXITS	2587	INFINITE
2	STAYSINLINETRPTS	14863	INFINITE
3	CHANGEOFLINETRPS	2168	INFINITE
4	INTOSTOCK2	2700	INFINITE
5	INTOSTOCK3	1036	INFINITE
6	INTOSTOCK4X	1016	INFINITE
7	INTOSTOCK4Y	0	INFINITE
8	INTOSTOCK5X	3	INFINITE
9	INTOSTOCK5Y	0	INFINITE
10	INTOSTOCK6X	860	INFINITE
11	INTOSTOCK6Y	0	INFINITE
12	INTOSTOCK7X	176	INFINITE
13	INTOSTOCK7Y	0	INFINITE
14	INTOMAP5	2702	INFINITE
15	INTOV1	2594	INFINITE
16	INTOC5	2593	INFINITE
17	FRTOGRCCHANGEC5	0	INFINITE
18	INTOSC5	1296	INFINITE
19	XINTOB5	1295	INFINITE
20	YINTOB5	0	INFINITE
21	XINTOV2	873	INFINITE
22	YINTOV2	0	INFINITE
23	INTOSC6	1295	INFINITE
24	XINTOB6	1294	INFINITE
25	YINTOB6	0	INFINITE

A.7.   RUN USING PRIMARY INPUT PARAMETER SET WITH PREVIEW TIMES,
        TRANSPORT CONSTRAINTS AND TYPICAL PRODUCTION SEQUENCE.

SIMAN SUMMARY REPORT. RUN ENDED AT TIME   0.2000E+06

TALLY VARIABLES

	IDENTIFIER	AVERAGE	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
1	PRODUCTIONRATE	0.80294	0.18516	0.35005	1.15995
2	ROLLSINWORKSHOP	10.56843	2.91163	6.00000	18.00000
3	TYPECHANGETIME	0.00441	0.01636	0.00000	0.12693
4	T_IN_STOCKS	0.15524	0.18600	0.00000	0.82121
5	TIMEINTRP	0.09282	0.03034	0.01464	0.18556
6	ROLLCHANGETIME	0.10101	0.02646	0.02223	0.14997
7	PROCTIME	0.61900	0.15356	0.13710	0.80215
8	WTFORXTTIME	0.01172	0.04225	0.00000	0.53323
9	T_IN_SYSTEM	844.61	451.69	470.23	4206.13
10	SUMPROCTMAP5	0.98458	0.00176	0.98143	0.98760
11	SUMPROCTV1	0.75561	0.00234	0.73730	0.76766
12	SUMPROCTC5	0.69548	0.00292	0.66873	0.71056
13	SUMPROCTSC5	0.75646	0.00993	0.69201	0.76303
14	SUMPROCTB5	0.43411	0.01418	0.31951	0.44492
15	SUMPROCTV2	0.79833	0.00884	0.74321	0.80669
16	SUMPROCTSC6	0.65551	0.00765	0.60286	0.67202
17	SUMPROCTB6	0.66729	0.01198	0.59334	0.67480
18	STOCK4	1.47185	1.54817	0.00000	7.00000
19	STOCK5	0.24516	0.52163	0.00000	3.00000
20	STOCK6	0.82555	0.77233	0.00000	2.00000
21	STOCK7	0.82106	0.86568	0.00000	2.00000
22	WAITFORXTTIMEV2	1.38388	3.50294	0.00000	25.34375

DISCRETE CHANGE VARIABLES

	IDENTIFIER	AVERAGE	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
1	TEMPSTORAGEC5	0.01	0.08	0.00	1.00
2	STOCK2	0.01	0.08	0.00	1.00
3	STOCK3	0.02	0.14	0.00	1.00
4	STOCK4X	0.75	1.18	0.00	6.00
5	STOCK4Y	0.27	0.76	0.00	5.00
6	STOCK5X	0.04	0.20	0.00	3.00
7	STOCK5Y	0.12	0.40	0.00	3.00
8	STOCK6X	0.25	0.49	0.00	2.00
9	STOCK6Y	0.45	0.75	0.00	2.00
10	STOCK7X	0.04	0.22	0.00	2.00
11	STOCK7Y	0.62	0.87	0.00	2.00
12	WAITINGTOENTERV1	0.01	0.07	0.00	1.00
13	WAITINGTOENTERC5	0.00	0.07	0.00	1.00
14	WAITINGTOENTRSC5	0.00	0.04	0.00	1.00
15	WAITINGTOENTERB5	0.00	0.05	0.00	1.00
16	WAITINGTOENTERV2	0.00	0.07	0.00	1.00
17	WAITINGTOENTRSC6	0.03	0.17	0.00	1.00
18	WAITINGTOENTERB6	0.02	0.16	0.00	1.00
19	BUSYTIMEMAP5	1.00	0.00	1.00	1.00

20	BUSYTIMEV1	0.89	0.31	0.00	1.00
21	BUSYTIMEC5	0.73	0.44	0.00	1.00
22	BUSYTIMESC5	0.95	0.22	0.00	1.00
23	BUSYTIMEB5	0.61	0.49	0.00	1.00
24	BUSYTIMEV2	0.93	0.25	0.00	1.00
25	BUSYTIMESC6	0.94	0.23	0.00	1.00
26	BUSYTIMEB6	0.89	0.32	0.00	1.00
27	TEMPSTORAGEMAP5	0.00	0.00	0.00	0.00

COUNTERS

NUMBER	IDENTIFIER	COUNT	LIMIT
1	WORKSHOPEXITS	2496	INFINITE
2	STAYSINLINETRPTS	12933	INFINITE
3	CHANGEOFLINETRPS	2750	INFINITE
4	INTOSTOCK2	770	INFINITE
5	INTOSTOCK3	296	INFINITE
6	INTOSTOCK4X	1235	INFINITE
7	INTOSTOCK4Y	286	INFINITE
8	INTOSTOCK5X	212	INFINITE
9	INTOSTOCK5Y	221	INFINITE
10	INTOSTOCK6X	569	INFINITE
11	INTOSTOCK6Y	541	INFINITE
12	INTOSTOCK7X	204	INFINITE
13	INTOSTOCK7Y	378	INFINITE
14	INTOMAP5	2503	INFINITE
15	INTOV1	2502	INFINITE
16	INTOC5	2500	INFINITE
17	FRTOGRCCHANGEC5	69	INFINITE
18	INTOSC5	1349	INFINITE
19	XINTOB5	1057	INFINITE
20	YINTOB5	0	INFINITE
21	XINTOV2	681	INFINITE
22	YINTOV2	291	INFINITE
23	INTOSC6	1150	INFINITE
24	XINTOB6	763	INFINITE
25	YINTOB6	677	INFINITE

B.   PROGRAM CODE.

B.1. THE MODEL WITH TRANSPORT CONSTRAINTS

```
BEGIN;
;********************************************************************
;********************************************************************
;***Model of a paper finishing flexible system**********************
;***Author: Mikael Josephson****************************************
;***Name of program: m3or*******************************************
;********************************************************************
;*                                                                 *
;*     The program blocks are in top-down order:                   *
;*                                                                 *
;* 1. Synonyms statement. Definition of variable names,            *
;*    attribute names,distributions and constants.                 *
;*                                                                 *
;* 2. Workshop with machines and stocks.                           *
;*                                                                 *
;* 3. Mesure the production rate.                                  *
;*                                                                 *
;* 4. Collect statistics.                                          *
;*                                                                 *
;* 5. Calculate the state of the cranes                            *
;*                                                                 *
;* 6. The transport sequences.Transport within same machine line.  *
;*    Transport with change of machine line.                       *
;*                                                                 *
;* 7. Administration of the exit- and get-roll priority order.     *
;*                                                                 *
;* 8. Starting up the simulation.                                  *
;*                                                                 *
;********************************************************************
;********************************************************************
;*                                                                 *
;*     The input parameters are:                                   *
;*                                                                 *
;*   -The stock limits                                             *
;*                                                                 *
;*   -The exit- and get-roll priority order in form of             *
;*    16 constants defined in the experiment frame.                *
;*    The constants are signal codes for the wait blocks           *
;*    at the queues where exit- and get-roll entities can          *
;*    reside waiting for a change of the state in the workshop.    *
;*                                                                 *
;*   -The preview times                                            *
;*                                                                 *
;*   -The times for changing type and basisweight                  *
;*                                                                 *
;*   -The rollchanging times                                       *
;*                                                                 *
;*   -The processing times                                         *
;*                                                                 *
;*   -The transport times                                          *
;*                                                                 *
;*   -The V2 coeficient                                            *
;**                                                                *
;********************************************************************
;********************************************************************
;***Last modification: Sat Feb 29 09:47:57*************************
;********************************************************************
;
SYNONYMS: Y=                              1:        !YES
```

```
N=                                  0:      !NO
                                            !---------
lasttypeMAP5=             X(1):            !LOKAL IN MAP5-MODEL
lwghtMAP5=                X(2):            !       "
                                            !
lasttypeC5=               X(3):            !LOKAL IN C5-MODEL
lgroupC5=                 X(4):            !       "
lastbweightC5=            X(5):            !       "
                                            !
                                            !---------
                                            !w = waiting for a
V1w=                      X(6):            !new roll to be
C5w=                      X(7):            !transported for .
SC5w=                     X(8):            !processing
B5w=                      X(9):            !N=NO, Y=YES
V2w=                      X(10):           !
SC6w=                     X(11):           !
B6w=                      X(12):           !
                                            !---------
                                            !ACCUMULATED
                                            !PROCESSINGTIMES
SUMPROCTMAP5=             X(13):           !
SUMPROCTV1=               X(14):           !
SUMPROCTC5=               X(15):           !
SUMPROCTSC5=              X(16):           !
SUMPROCTB5=               X(17):           !
SUMPROCTV2=               X(18):           !
SUMPROCTSC6=              X(19):           !
SUMPROCTB6=               X(20):           !
                                            !
                                            !---------
FLOWCOUNTER=              X(21):           !COUNTER FOR
                                            !FLOWMESURING-
                                            !ROUTINE
                                            !
NRBEFOREFLOWMESURE=       CO(130):         !CO(i) = CONSTANT
                                            !IN EXP.-FRAME
                                            !NUMBER OF WORKSHOP
                                            !EXITS BEFORE A
                                            !NEW FLOWMESURE
                                            !
MESUREFLOW=               2222:            !A SIGNAL. FLOWCOUNTER HAS
                                            !REACHED NRBEFOREFLOWMESURE
                                            !
                                            !---------
                                            !CRANE available
                                            !VARIABLES
avCS2=                    X(22):           !
avCS3=                    X(22):           !
avCS4=                    X(22):           !
avCS5=                    X(22):           !
avCMAP5=                  X(22):           !
avCV1=                    X(22):           !
avCC5=                    X(22):           !
avCSC5=                   X(22):           !
avCc2=                    X(22):           !c = CONVEYOR.
avCc3=                    X(23):           !WHEN A CONVEYOR
                                            !ARRIVES AT A LINE
                                            !A CRANE IS NEEDED
                                            !FOR TRP FROM CONVEYOR
                                            !TO DESTINATION
                                            !---------
                                            !NUMBER OF ROLLS
                                            !IN THE STOCKS
```

```
RS2=                       X(24):    !A ROLL THAT
RS3=                       X(25):    !IS BEEING TRANSPORTED
RS4=                       X(26):    !TO A STOCK IS ALSO
RS5=                       X(27):    !TAKEN IN TO ACCOUNT
RS6=                       X(28):    !
RS7=                       X(29):    !
                                     !---------
CALCULATEDCRANESTATE=      X(30):    !FOR SYNCRONISATION
                                     !OF EXECUTION
                                     !ORDER OF PROGRAMECODE
                                     !---------
V1DOING=                   X(31):    !
C5DOING=                   X(32):    !
SC5DOING=                  X(33):    !
B5DOING=                   X(34):    !
V2DOING=                   X(35):    !
SC6DOING=                  X(36):    !
B6DOING=                   X(37):    !
                                     !
CHANGING=                     1:     !
PROCESSING=                   2:     !
FINISHED=                     3:     !FINISHED PROCESSING
                                     !
                                     !---------
C5PROCGROUP=               X(41):    !FOR V1 WHEN
                                     !CHECKING IF TO SEND
BESTC5=                    X(42):    !ROLL TO C5.
                                     !
V1PROCGROUP=               X(43):    !FOR MAP5 WHEN
                                     !CHECKING IF TO SEND
BESTV1=                    X(44):    !ROLL TO V1.
                                     !****************************
                                     !
TYPE=                      A(1):     !INDEX 1 TO 9 FOR THE 9
                                     !DIFFERENT PAPERTYPES
                                     !
BWEIGHT=                   A(2):     !BASISWEIGHT. INDEX
                                     !1 TO 3 FOR THE 3
                                     !DIFFERENT BASISWEIGHTS
                                     !
GROUP=                     A(3):     !PAPERTYPEGROUPS A,B,C.
                                     !
A=                            1:     !GROUP A
B=                            2:     !GROUP B
C=                            3:     !GROUP C
                                     !---------
SJLS4X=                    A(5):     !FOR SEARCHING THE
SJLS4Y=                    A(6):     !STOCKS FOR ROLLS THAT
SJLS6X=                    A(7):     !HAVE NOT PASSED V2
SJLS6Y=                    A(8):     !
SAVEJ=                     A(9):     !
                                     !
                                     !---------
ENTRENCETIME=              A(10):    !ENTRENCE IN WORKSHOP
                                     !
A_INDEX_ENTRENCETIME=        10:     !
                                     !---------
                                     !FOR THE TRANSPORT
TRPTYPE=                   A(11):    !ROUTINES
COMMING_FROM=              A(12):    !
DESTINATION=               A(13):    !
TRPTIME=                   A(14):    !
MYCRANE=                   A(15):    !
MYCONVEYOR=                A(16):    !
```

```
TRPLOCATIONLINE1=           A(17):        !
                                          !
wC1=                        X(38):        !w = where is, C = CRANE
wC2=                        X(39):        !
wC3=                        X(40):        !
                                          !LOCATION OF CRANES
MAP5_S2=                         1:       !THIS CONCERNES
S2_V1=                           2:       !ONLY CRANES 1,
V1_S3=                           3:       !2 AND 3
S3_C5=                           4:       !
C5_S4=                           5:       !
S4_SC5=                          6:       !
SC5_S5=                          7:       !
S5_B5=                           8:       !
SC5_B5=                          9:       !
                                          !
c2TOL1=                     NQ(1):        !IF THERE IS
                                          !SOMETHING IN QUEUE
c3TOL1=                     NQ(2):        !1-4 THIS MEANS
                                          !THAT THERE IS
c2TOL2=                     NQ(3):        !GOING TO BE A
                                          !CONVEYORTRANSPORT.
c3TOL2=                     NQ(4):        !c = CONVEYOR
                                          !
                                          !----------
PROCTIMEINDEX=              A(18):        !LOOK-UP-INDEX
                                          !FOR PROCESSINGTIME
                                          !IN EXP.-FRAME
                                          !----------
CHANGETIMEMAP5=             A(19):        !CHANGE OF TYPE
CHANGETIMEC5=               A(19):        !
                                          !----------
                                          !FOR THE STATISTICS.
T_IN_STOCKS=                A(20):        !
AD_TO_T_IN_STOCKS=          A(21):        !
A_INDEX_AD_TO_T_IN_STOCKS=   21:          !
                                          !
TIMEINTRP=                  A(22):        !
AD_TO_TIMEINTRP=            A(23):        !
A_INDEX_AD_TO_TIMEINTRP=     23:          !
                                          !
ROLLCHT=                    A(24):        !
AD_TO_ROLLCHT=              A(25):        !
A_INDEX_AD_TO_ROLLCHT=       25:          !
                                          !
PROCTIME=                   A(26):        !
AD_TO_PROCTIME=             A(27):        !
A_INDEX_AD_TO_PROCTIME=      27:          !
                                          !
TYPECHTIME=                 A(28):        !
AD_TO_TYPECHTIME=           A(29):        !
A_INDEX_AD_TO_TYPECHT=       29:          !
                                          !
WTFORXTT=                   A(30):        !"WAIT FOR EXIT FROM
                                          !A MACHINE"-TIME.
AD_TO_WTFORXTT=             A(31):        !
A_INDEX_AD_TO_WTFORXTT=      31:          !
                                          !
WTXITTV2=                   A(32):        !WAIT FOR EXIT TIME V2
A_INDEX_WTXITTV2=            32:          !
                                          !----------
PASSED_V2=                  A(33):        !Y=YES, N=NO
                                          !
V2COEFF=                    CO(100):      !FOR SHORTER
```

```
                                              !PROCESSINGTIME IN THE
                                              !SUPERCALANDERS
                                              !AFTER PASSING V2
                                              !---------
        SEIZEDLOCKER=              54321:     !A SIGNAL FOR THE
                                              !PRIORITYROUTINES.
                                              !LOCKER IS A RESOURCE
                                              !USED TO SYNCRONIZE THE
                                              !EXECUTION ORDER
                                              !OF THE PROGRAMECODE
                                              !SO THAT ONLY ONE OF
                                              !THE MACHINES AND
                                              !CONVEYORS AT A TIME
                                              !CAN CHANGE THE
                                              !STATE OF THE WORKSHOP
                                              !---------
        STATECHANGE=              12345:      !A SIGNAL. IT IS
                                              !SENT WHEN:
                                              !*A MACHINE
                                              !ENTERS THE STATE
                                              !"waiting FOR A
                                              !ROLL TO BE
                                              !TRANSPORTED FOR
                                              !PROCESSING"
                                              !*A CRANE IS RELEASED
                                              !*A FULL STOCK HAS
                                              !BECOME NOT FULL
                                              !*c2TOL1 OR c3TOL1
                                              !OR c2TOL2 OR
                                              !c3TOL2 HAS CHANGED
                                              !---------
                                              !LOCATION IN
                                              !WORKSHOPMODEL
                                              !MACHINES
        LMAP5=1:LV1=2:LC5=3:LSC5=4:           !
        LB5=5:LV2=6:LSC6=7:LB6=8:             !
                                              !
                                              !STOCKS
        LS2=9:LS3=10:LS4X=11:LS4Y=12:         !X=NOT GROUP C,
                                              !Y=GROUP C.
                                              !STOCK 4 - 7 ARE
        LS5X=13:LS5Y=14:LS6X=15:LS6Y=16:      !MODELED WITH
                                              !2 QUEUES EACH,
        LS7X=17:LS7Y=18:                      !ONE FOR GROUP
                                              !C AND ONE FOR
                                              !GROUP A AND B
                                              !
                                              !---------
                                              !QUEUE-INDEXES.
        WTGQV1=                   103:        !QUEUES IN WICH
                                              !EXITROLL-ENTITIES
        WTGQC5=                   104:        !AND GETROLL-
                                              !ENTITIES CAN
        WTGQSC5=                  105:        !RESIDE WHEN THE
                                              !WORKSHOPSTATE
        WTGQB5=                   106:        !DOES NOT PERMIT A
                                              !TRANSPORT TO
        WTGQV2=                   107:        !BE EFFECTUATED.
                                              !
        WTGQSC6=                  108:        !G= GET A ROLL.
                                              !
        WTGQB6=                   109:        !E= EXIT A MACHINE
                                              !
                                              !c= CONVEYOR
```

```
WTEQMAP5=                        .110:        !(c IS WHEN A
                                              !CONVEYOR NEEDS
WTEQV1=                           111:        !A TRP AFTER
                                              !ARRIVAL TO
WTEQC5=                           112:        !DESTINATED LINE)
                                              !
WTEQSC5=                          113:        !THE QUEUE
                                              !INDEXES ARE ALSO
WTEQV2=                           114:        !SIGNAL CODES IN THE
                                              !EXIT- AND GETROLL
WTEQSC6=                          115:        !PRIORITY ROUTINES
                                              !
WTQc2AR1=                         116:        !
                                              !
WTQc3AR1=                         117:        !
                                              !
WQcAR2=                           118:        !
                                              !-----------
                                              !EXPERIMENTAL
                                              !DISTRIBUTIONS FOR
                                              !THE TRANSPORTTIMES
trptime_MAP5_to_V1=        ED(1):             !
trptime_MAP5_to_S2=        ED(2):             !
                                              !
trptime_S2_to_V1=          ED(3):            !
                                              !
trptime_V1_to_C5=          ED(4):             !
trptime_V1_to_S3=          ED(5):             !
                                              !
trptime_S3_to_C5=          ED(6):             !
                                              !
trptime_C5_to_SC5=         ED(7):             !
trptime_C5_to_V2=          ED(8):             !
trptime_C5_to_SC6=         ED(9):             !
trptime_C5_to_S4=         ED(10):             !
trptime_C5_to_S6=         ED(11):             !
                                              !
trptime_S4_to_SC5=        ED(12):             !
trptime_S4_to_V2=         ED(13):             !
trptime_S4_to_SC6=        ED(14):             !
                                              !
trptime_SC5_to_B5=        ED(15):             !
trptime_SC5_to_B6=        ED(16):             !
trptime_SC5_to_S5=        ED(17):             !
trptime_SC5_to_S7=        ED(18):             !
                                              !
trptime_S5_to_B5=         ED(19):             !
trptime_S5_to_B6=         ED(20):             !
                                              !
trptime_V2_to_SC6=        ED(21):             !
trptime_V2_to_SC5=        ED(22):             !
trptime_V2_to_S4=         ED(23):             !
trptime_V2_to_S6=         ED(24):             !
                                              !
trptime_S6_to_SC6=        ED(25):             !
trptime_S6_to_SC5=        ED(26):             !
trptime_S6_to_V2=         ED(27):             !
                                              !
trptime_SC6_to_B6=        ED(28):             !
trptime_SC6_to_B5=        ED(29):             !
trptime_SC6_to_S5=        ED(30):             !
trptime_SC6_to_S7=        ED(31):             !
                                              !
trptime_S7_to_B6=         ED(32):             !
```

```
trptime_S7_to_B5=          ED(33):        !
                                          !---------
PROCESSINGTIMEB5=          ED(53):        !
                                          !
PROCESSINGTIMEV2=          ED(54):        !
                                          !
PROCESSINGTIMEB6=          ED(58):        !
                                          !
BWEIGHTCHTONESTEPMP5=      ED(69):        !
                                          !
BWEIGHTCHTTWOSTEPSMP5=     ED(70):        !
                                          !
GROUPCHTMP5=               ED(71):        !
                                          !
ROLLCHTIMEV1=              ED(72):        !
                                          !
HOLEREPEARTIMEV1=          ED(73):        !
                                          !
BWEIGHTCHTIMEC5=           ED(74):        !BASISWEIGHT           -
                                          !
GATOGBTIMEC5=              ED(75):        !
                                          !
GBTOGATIMEC5=              ED(76):        !
                                          !
GCCHANGETIMEC5=            ED(77):        !
                                          !
ROLLCHTIMESC5=             ED(80):        !
                                          !
ROLLCHTIMEB5=              ED(81):        !
                                          !
ROLLCHTIMEV2=              ED(82):        !
                                          !
ROLLCHTIMESC6=             ED(84):        !
                                          !
ROLLCHTIMEB6=              ED(85):        !
                                          !---------
CONVTIME=                  ED(90):        !TRP.-TIME FOR CONVEYOR
                                          !---------
Q2=                        NQ(9):         !FOR CALCULATION OF THE
Q3=                        NQ(10):        !STOCK-STATES
Q4X=                       NQ(11):        !NQ(i) = NUMBER OF
Q4Y=                       NQ(12):        !ENTITIESIN QUEUE
Q5X=                       NQ(13):        !NR i
Q5Y=                       NQ(14):        !
Q6X=                       NQ(15):        !
Q6Y=                       NQ(16):        !
Q7X=                       NQ(17):        !
Q7Y=                       NQ(18):        !
                                          !---------
                                          !STOCKLIMITS
LTS2=                      CO(92):        !CO(i) = CONSTANT
LTS3=                      CO(93):        !IN EXP.-FRAME
LTS4=                      CO(94):        !
LTS5=                      CO(95):        !
LTS6=                      CO(96):        !
LTS7=                      CO(97):        !---------
                                          !NR(i) IS THE NUMBER
                                          !OF RESOURCES
                                          !OF RESOURCETYPE i,
                                          !THAT ARE CURRENTLY
                                          !BUSY.0=N=NO,1=Y=YES
                                          !
oC1=                       NR(9):         != on CRANE 1
oC2=                       NR(10):        != on CRANE 2
```

```
              oC3=                        NR(11):        != on CRANE 3
              oC4=                        NR(12):        != on CRANE 4
                                                        !---------
              PREVIEWTIME_V1=             CO(121):       !
              PREVIEWTIME_C5=             CO(122):       !
              PREVIEWTIME_SC5=            CO(123):       !
              PREVIEWTIME_B5=             CO(124):       !
              PREVIEWTIME_V2=             CO(125):       !
              PREVIEWTIME_SC6=            CO(126):       !
              PREVIEWTIME_B6=             CO(127);       !
;
;
;
;***WORKSHOP ENTRENCE********************************************************
;
;===LINE 1: MAP5-S2-V1-S3-C5-S4-SC5-S5-B5================================
;
;---THE PAPERMACHINE. DENOTED RMAP5 OR MAP5 (R=RESOURCE).-----------------
;
MAP5        QUEUE,20;
            SEIZE:RMAP5;
;
            COUNT:14:MARK('A_INDEX_ENTRENCETIME');
            TALLY:2,NC(14)-NC(1);                   !NUMBER OF ENTITIES IN WORKSHOP
;
;---MAP5 IS BUSY---
;
MAP5ON      BRANCH,1:
              IF,'lasttypeMAP5'.EQ.0,JUMPMAP5: !FIRST ARRIVING ENTITY
              IF,'lasttypeMAP5'.EQ.'TYPE',JUMPMAP5:    !SAME TYPE
              IF,'lwghtMAP5'.EQ.'BWEIGHT',GRPCHMP5:    !ONLY CHANGE OF GROUP
              IF,ABS('lwghtMAP5'-'BWEIGHT').EQ.1,ONESTMP5: !BASISWEIGHTCHANGE
              IF,ABS('lwghtMAP5'-'BWEIGHT').EQ.2,TWOSTMP5; !BASISWEIGHTCHANGE
;
GRPCHMP5    ASSIGN:'CHANGETIMEMAP5'='GROUPCHTMP5':NEXT(CHMAP5);
ONESTMP5    ASSIGN:'CHANGETIMEMAP5'='BWEIGHTCHTONESTEPMP5':NEXT(CHMAP5);
TWOSTMP5    ASSIGN:'CHANGETIMEMAP5'='BWEIGHTCHTTWOSTEPSMP5':NEXT(CHMAP5);
CHMAP5      QUEUE,145:MARK('A_INDEX_AD_TO_TYPECHT');
            DELAY:'CHANGETIMEMAP5';
DIDCHMP5    ASSIGN:'TYPECHTIME'='TYPECHTIME'+TNOW-'AD_TO_TYPECHTIME';
;
JUMPMAP5    ASSIGN:'PROCTIMEINDEX'=40+'BWEIGHT';
PROCMP5     QUEUE,156:MARK('A_INDEX_AD_TO_PROCTIME');
PROCMAP5    DELAY:ED('PROCTIMEINDEX');
DIDPMAP5    ASSIGN:'PROCTIME'='PROCTIME'+TNOW-'AD_TO_PROCTIME';
            ASSIGN:'SUMPROCTMAP5'='SUMPROCTMAP5'+TNOW-'AD_TO_PROCTIME';
            TALLY:10,'SUMPROCTMAP5'/TNOW;
;
UPDATMP5    ASSIGN:'lasttypeMAP5'='TYPE';
            ASSIGN:'lwghtMAP5'='BWEIGHT':MARK('A_INDEX_AD_TO_WTFORXTT');
;
BMP5        QUEUE,159;    !IF THERE IS A TEMPORARY STORED ROLL MAP5 WAITS
            SCAN:(NQ('WTEQMAP5')+NR(17)).EQ.0;
            RELEASE:RMAP5:NEXT(EXITMAP5);
;
;---EXIT TRANSPORT PROCEDURES FOR MAP5---
;
EXITMAP5    QUEUE,21;
            SEIZE:LOCKER:NEXT(FRLOCK1);
;
TEMPMAP5    RELEASE:LOCKER;
            QUEUE,'WTEQMAP5';                        !WAITING FOR A CHANGE OF STATE
            WAIT:'WTEQMAP5',1;
;
```

```
            QUEUE,22;
            SEIZE:LOCKER;
            SIGNAL:'SEIZEDLOCKER';
;
;---CHECK IF THERE IS AN EXIT TRP FROM MAP5 AVAILABLE---
;
FRLOCK1     BRANCH,2:ALWAYS,WCALCMP5:ALWAYS,CALCMAP5;  !SEND ENTITY TO CALCULATE
;                                                       !THE CRANE STATE
WCALCMP5    QUEUE,23;
            SCAN:'CALCULATEDCRANESTATE'.EQ.'Y';
            ASSIGN:'CALCULATEDCRANESTATE'='N';
;
            BRANCH,1:
              IF,'avCMAP5'.EQ.0,TEMPMAP5:        !NO AVAILABLE EXIT TRP
;                                                 !WAIT FOR A CHANGE OF STATE
              ELSE,XITMP5;
;
;---THERE IS AN EXIT TRP AVAILABLE FROM MAP5---
;
XITMP5      ASSIGN:'MYCRANE'='avCMAP5';
            BRANCH,1:
              IF,'V1w'.EQ.'Y'.AND.'GROUP'.EQ.'V1PROCGROUP',MAP5TOV1:
              IF,'Q2'.EQ.0.AND.'V1w'.EQ.'Y',MAP5TOV1:
              IF,'RS2'.LT.'LTS2',MAP5TOS2:     !STOCK 2 FULL ?
              ELSE,TEMPMAP5;                   !STOCK 2 IS FULL !
;                                              !WAIT FOR A CHANGE OF STATE
;
;---END PAPERMACHINE------------------------------------------------------------
;
;---STOCK 2---------------------------------------------------------------------
;
S2          RELEASE:CRANE('MYCRANE');
            COUNT:4:MARK('A_INDEX_AD_TO_T_IN_STOCKS');
            BRANCH,2:ALWAYS,STORE2:ALWAYS,SIGN2;
;
STORE2      QUEUE,'LS2':DETACH;
;
SIGN2       QUEUE,24;
S2SCAN      SCAN:NQ('LS2').NE.0:NEXT(SIGNSTCH);
;
;---END STOCK 2-----------------------------------------------------------------
;
;---THE REEROLER 1. DENOTED V1 OR RV1. 2ND IN LINE 1.--------------------------
;
;---TRP ENTRENCE PROCEEDURES V1---
;
V1          BRANCH,1:
              IF,'V1DOING'.EQ.'PROCESSING',WAITPV1:
              IF,'V1DOING'.EQ.'CHANGING',WAITPV1:
              ELSE,DOVI;
;
WAITPV1     QUEUE,25;
            WAIT:2000,1;   !WAIT FOR PREVIOUS ROLL TO BE FULLY PROCESSED
;
DOVI        RELEASE:CRANE('MYCRANE');
            SIGNAL:'STATECHANGE';
PRIO1       COUNT:15;
            QUEUE,26;
            SEIZE:RV1;
;
;---V1 IS BUSY---
;
PV1         ASSIGN:'V1PROCGROUP'='GROUP';        !FOR MAP5 TO KNOW IF TO SEND ROLL
;                                                !DIRECT OR TO STOCK 2 IN CASE OF
```

```
;                                             !A CHANGE OF GROUP
;
              ASSIGN:'V1DOING'='CHANGING':MARK('A_INDEX_AD_TO_ROLLCHT');
CHV1          DELAY:'ROLLCHTIMEV1';
              ASSIGN:'ROLLCHT'='ROLLCHT'+TNOW-'AD_TO_ROLLCHT';
;
              ASSIGN:'V1DOING'='PROCESSING':MARK('A_INDEX_AD_TO_PROCTIME');
HOLEV1        DELAY:'HOLEREPEARTIMEV1';
              ASSIGN:'PROCTIMEINDEX'=43+'BWEIGHT';
              DELAY:ED('PROCTIMEINDEX')-'PREVIEWTIME_V1';
;
SPLITV1       ASSIGN:'V1w'='Y';
              BRANCH,3:
                ALWAYS,CONTV1:
                IF,NQ('WTGQV1').EQ.0,TRYGETV1:
                ALWAYS,SIGNSTCH;
;
CONTV1        DELAY:'PREVIEWTIME_V1';
;
              ASSIGN:'PROCTIME'='PROCTIME'+TNOW-'AD_TO_PROCTIME';
              ASSIGN:'SUMPROCTV1'='SUMPROCTV1'+TNOW-'AD_TO_PROCTIME';
              TALLY:11,'SUMPROCTV1'/TNOW:MARK('A_INDEX_AD_TO_WTFORXTT');
;
              ASSIGN:'V1DOING'='FINISHED';
              SIGNAL:2000:NEXT(TRYEXTV1);       !PROCESSED
;
;---GETTING A NEW ROLL TO PROCESS. TRP PROCEDURES V1---
;
TRYGETV1      QUEUE,27,1;
              SEIZE:LOCKER:NEXT(FRLOCK2);
;
WTGETV1       RELEASE:LOCKER;
              QUEUE,'WTGQV1',1;                  !WAITING FOR A CHANGE OF STATE
              WAIT:'WTGQV1',1;
;
              QUEUE,28,1;
              SEIZE:LOCKER;
              SIGNAL:'SEIZEDLOCKER';
;
;---SEARCH STOCK 2 FOR ROLLS FROM SAME GROUP---
;
FRLOCK2       BRANCH,1:
                IF,'GROUP'.EQ.'A',SRCHAV1:
                IF,'GROUP'.EQ.'B',SRCHBV1:
                IF,'GROUP'.EQ.'C',SRCHCV1;
;
SRCHAV1       SEARCH,'LS2',1,NQ:'GROUP'.EQ.'A';
              ASSIGN:'BESTV1'=J:NEXT(GOGETV1);
SRCHBV1       SEARCH,'LS2',1,NQ:'GROUP'.EQ.'B';
              ASSIGN:'BESTV1'=J:NEXT(GOGETV1);
SRCHCV1       SEARCH,'LS2',1,NQ:'GROUP'.EQ.'C';
              ASSIGN:'BESTV1'=J:NEXT(GOGETV1);
;
;---CHECK IF THERE IS A TRP AVAILABLE FOR TRP FROM S2---
;
GOGETV1       BRANCH,2:ALWAYS,WCALCV1G:ALWAYS,CALCS2;        !SEND ENTITY TO CALCULATE
                                                            !THE CRANE STATE
;
WCALCV1G      QUEUE,29;
              SCAN:'CALCULATEDCRANESTATE'.EQ.'Y';
              ASSIGN:'CALCULATEDCRANESTATE'='N';
;
              BRANCH,1:
                IF,'avCS2'.EQ.0,WTGETV1:           !NO AVAILABLE TRP FROM STOCK 2
;                                                  !WAIT FOR A CHANGE OF STATE
```

```
                    ELSE,GETV1;                      .
;
;---THERE IS A TRP AVAILABLE FOR TRP FROM S2---
;
 GETV1       ASSIGN:'MYCRANE'='avCS2';
             BRANCH,1:
                IF,'V1w'.EQ.'N',MDESTROY:       !THERE IS ALREADY A ROLL ON ITS WAY
                IF,'BESTV1'.NE.0,S2TOV1:
                IF,'Q2'.NE.0,S2TV1:
                ELSE,WTGETV1;                   !NOTHING IN STOCK 2
;                                               !WAIT FOR A CHANGE OF STATE
;
 S2TV1       ASSIGN:'BESTV1'=1:NEXT(S2TOV1);    !NO ROLLS FROM SAME GROUP AS LAST
;                                               !PROCESSED IN STOCK 2.
;                                               !TAKE FIRST ROLL OUT
;
;---EXIT TRANSPORT PROCEDURES V1---
;
 TRYEXTV1    QUEUE,30;                                                  -
             SEIZE:LOCKER:NEXT(FRLOCK3);
;
 WTOUTV1     RELEASE:LOCKER;
             QUEUE,'WTEQV1';                    !WAITING FOR A CHANGE OF STATE
             WAIT:'WTEQV1',1;

             QUEUE,31;
             SEIZE:LOCKER;
             SIGNAL:'SEIZEDLOCKER';
;
;---CHECK IF THERE IS AN EXIT TRP FROM V1 AVAILABLE---
;
 FRLOCK3     BRANCH,2:ALWAYS,WCALCV1E:ALWAYS,CALCV1;    !SEND ENTITY TO CALCULATE
;                                                       !THE CRANE STATE
 WCALCV1E    QUEUE,32;
             SCAN:'CALCULATEDCRANESTATE'.EQ.'Y';
             ASSIGN:'CALCULATEDCRANESTATE'='N';
;
             BRANCH,1:
                IF,'avCV1'.EQ.0,WTOUTV1:   !NO AVAILABLE EXIT TRP
;                                          !WAIT FOR A CHANGE OF STATE
                ELSE,XITV1;
;
;---THERE IS AN EXIT TRP AVAILABLE FROM V1---
;
 XITV1       ASSIGN:'MYCRANE'='avCV1';
             BRANCH,1:
                IF,'C5w'.EQ.'Y'.AND.'GROUP'.EQ.'C5PROCGROUP',V1TOC5:
                IF,'Q3'.EQ.0.AND.'C5w'.EQ.'Y',V1TOC5:
                IF,'RS3'.LT.'LTS3',V1TOS3:!STOCK 3 FULL ?
                ELSE,WTOUTV1;                   !NO POSSIBLE DESTINATION
;                                               !WAIT FOR A CHANGE OF STATE
;
;---END REEROLER--------------------------------------------------------------
;
;---STOCK 3-------------------------------------------------------------------
;
 S3          RELEASE:CRANE('MYCRANE');
             COUNT:5:MARK('A_INDEX_AD_TO_T_IN_STOCKS');
             BRANCH,2:ALWAYS,STORE3:ALWAYS,SIGN3;
;
 STORE3      QUEUE,'LS3':DETACH;
;
 SIGN3       QUEUE,33;
 S3SCAN      SCAN:NQ('LS3').NE.0:NEXT(SIGNSTCH);
```

```
;
;---END STOCK 3---------------------------------------------------------------
;
;---THE COATER. DENOTED C5 OR RC5. 3'D IN LINE 1-----------------------------
;
;---TRP ENTRENCE PROCEDURES C5---
;
C5          BRANCH,1:
              IF,'lasttypeC5'.EQ.0,DOEC5:            !FIRST ARRIVING ENTITY
              IF,'C5DOING'.EQ.'CHANGING',WAITPC5:
              IF,'C5DOING'.EQ.'PROCESSING',WAITPC5:
              IF,'C5DOING'.EQ.'FINISHED',DOEC5:
              ELSE,BADC5;
;
WAITPC5     QUEUE,34;
            WAIT:3000,1:NEXT(DOEC5);   !WAIT FOR PREVIOUS ROLL TO
;                                        !BE FULLY PROCESSED
;
BADC5       COUNT:27; LIMITED
;
DOEC5       RELEASE:CRANE('MYCRANE');
            SIGNAL:'STATECHANGE';
PRIO2       COUNT:16;
            QUEUE,35;
            SEIZE:RC5;
;
;---C5 IS BUSY---
;
C5ON        ASSIGN:'C5PROCGROUP'='GROUP';            !FOR V1 TO KNOW IF TO SEND ROLL
;                                                     !DIRECT OR TO STOCK 3 IN CASE OF
;                                                     !A CHANGE OF GROUP
;
            BRANCH,1:
              IF,'lasttypeC5'.EQ.0,JUMPC5:            !FIRST ARRIVING ENTITY
              IF,'lasttypeC5'.EQ.'TYPE',JUMPC5:    !NO CHANGE
              IF,'lgroupC5'.EQ.'GROUP',BWCHC5:      !CHANGE OF BASISWEIGHT
              IF,'lgroupC5'.EQ.'A'.AND.'GROUP'.EQ.'B',GATOGBC5:
              IF,'lgroupC5'.EQ.'B'.AND.'GROUP'.EQ.'A',GBTOGAC5:
              ELSE,GCCHC5;
;
BWCHC5      ASSIGN:'CHANGETIMEC5'='BWEIGHTCHTIMEC5':NEXT(DOC5);
GATOGBC5    ASSIGN:'CHANGETIMEC5'='GATOGBTIMEC5':NEXT(DOC5);
GBTOGAC5    ASSIGN:'CHANGETIMEC5'='GBTOGATIMEC5':NEXT(DOC5);
GCCHC5      ASSIGN:'CHANGETIMEC5'='GCCHANGETIMEC5':NEXT(CDOC5);
;
CDOC5       COUNT:17; !COUNT CHANGES FROM OR TO GROUP C
DOC5        ASSIGN:'C5DOING'='CHANGING':MARK('A_INDEX_AD_TO_TYPECHT');
CHANGEC5    DELAY:'CHANGETIMEC5';
DIDCHC5     ASSIGN:'TYPECHTIME'='TYPECHTIME'+TNOW-'AD_TO_TYPECHTIME';
;
JUMPC5      ASSIGN:'PROCTIMEINDEX'=46+'BWEIGHT';
PROCC5      ASSIGN:'C5DOING'='PROCESSING':MARK('A_INDEX_AD_TO_PROCTIME');
            DELAY:ED('PROCTIMEINDEX')-'PREVIEWTIME_C5';
;
SPLITC5     ASSIGN:'C5w'='Y';
            BRANCH,3:
              ALWAYS,CONTC5:
              IF,NQ('WTGQC5').EQ.0,TRYGETC5:
              ALWAYS,SIGNSTCH;
;
CONTC5      DELAY:'PREVIEWTIME_C5';
DIDPRC5     ASSIGN:'C5DOING'='FINISHED';
            SIGNAL:3000;    !PROCESSED
            ASSIGN:'PROCTIME'='PROCTIME'+TNOW-'AD_TO_PROCTIME';
```

```
                ASSIGN:'SUMPROCTC5'='SUMPROCTC5'+TNOW-'AD_TO_PROCTIME';
                TALLY:12,'SUMPROCTC5'/TNOW;
;
C5UPDATE        ASSIGN:'lasttypeC5'='TYPE';
                ASSIGN:'lastbweightC5'='BWEIGHT';
                ASSIGN:'lgroupC5'='GROUP';
;
                ASSIGN:'MYCONVEYOR'=2:MARK('A_INDEX_AD_TO_WTFORXTT');
;               !c2 FOR TRP FROM C5 TO LINE 2
BC5             QUEUE,160;
                SCAN:(NQ('WTEQC5')+NR(17)).EQ.0; !IF THERE IS A TEMPORARY STORED
;                                                !ROLL C5 WAITS
                RELEASE:RC5:NEXT(TRYEXC5);
;
;---GETTING A NEW ROLL TO PROCESS. TRP PROCEDURES C5---
;
TRYGETC5        QUEUE,36,1;
                SEIZE:LOCKER:NEXT(FRLOCK4);
;
WTGETC5         RELEASE:LOCKER;
                QUEUE,'WTGQC5',1;                !WAITING FOR A CHANGE OF STATE
                WAIT:'WTGQC5',1;
;
                QUEUE,37,1;
                SEIZE:LOCKER;
                SIGNAL:'SEIZEDLOCKER';
;
;---CHECK IF THERE IS A ROLL IN STOCK 3 FROM THE---
;---SAME GROUP-------------------------------------
;
FRLOCK4         BRANCH,1:
                  IF,'GROUP'.EQ.'A',SRCHAC5:
                  IF,'GROUP'.EQ.'B',SRCHBC5:
                  IF,'GROUP'.EQ.'C',SRCHCC5;
;
SRCHAC5         SEARCH,'LS3',1,NQ:'GROUP'.EQ.'A';
                ASSIGN:'BESTC5'=J:NEXT(GOGETC5);
SRCHBC5         SEARCH,'LS3',1,NQ:'GROUP'.EQ.'B';
                ASSIGN:'BESTC5'=J:NEXT(GOGETC5);
SRCHCC5         SEARCH,'LS3',1,NQ:'GROUP'.EQ.'C';
                ASSIGN:'BESTC5'=J:NEXT(GOGETC5);
;
;---CHECK IF THERE IS A TRP AVAILABLE FOR TRP FROM S3---
;
GOGETC5         BRANCH,2:ALWAYS,WCALCC5G:ALWAYS,CALCS3;       !SEND ENTITY TO CALCULATE
;                                                             !THE CRANE STATE
WCALCC5G        QUEUE,38;
                SCAN:'CALCULATEDCRANESTATE'.EQ.'Y';
                ASSIGN:'CALCULATEDCRANESTATE'='N';
;
                BRANCH,1:
                  IF,'avCS3'.EQ.0,WTGETC5:       !NO AVAILABLE TRP FROM STOCK 3
;                                                !WAIT FOR A CHANGE OF STATE
                  ELSE,GETC5;
;
;---THERE IS AN AVAILABLE TRP FROM STOCK 3---
;
GETC5           ASSIGN:'MYCRANE'='avCS3';
                BRANCH,1:
                  IF,'C5w'.EQ.'N',MDESTROY: !ROLL ALREADY ON ITS WAY FROM V1
                  IF,'BESTC5'.NE.0,S3TOC5:
                  IF,'Q3'.NE.0,S3TC5:
                  ELSE,WTGETC5;                  !NOTHING IN STOCK 3
;                                                !WAIT FOR A CHANGE OF STATE
```

```
;
S3TC5        ASSIGN:'BESTC5'=1:NEXT(S3TOC5);  !NO ROLLS FROM SAME GROUP AS LAST
;                                             !PROCESSED IN STOCK 3.
;                                             !TAKE FIRST ROLL OUT
;
;---EXIT TRANSPORT PROCEDURES C5---
;
TRYEXC5      QUEUE,39;
             SEIZE:LOCKER:NEXT(FRLOCK5);
;
TEMPC5       RELEASE:LOCKER;
             QUEUE,'WTEQC5';  !WAITING FOR A CHANGE OF STATE.TEMPORARY STORAGE
             WAIT:'WTEQC5',1;
;
             QUEUE,40;
             SEIZE:LOCKER;
             SIGNAL:'SEIZEDLOCKER';
;
;---CHECK IF THERE IS AN EXIT TRP FROM C5 AVAILABLE---
;
FRLOCK5      BRANCH,2:ALWAYS,WCALCC5E:ALWAYS,CALCC5;      !SEND ENTITY TO CALCULATE
;                                                        !THE CRANE STATE
WCALCC5E     QUEUE,41;
             SCAN:'CALCULATEDCRANESTATE'.EQ.'Y';
             ASSIGN:'CALCULATEDCRANESTATE'='N';
;
             BRANCH,1:
                IF,'avCC5'.EQ.0,TEMPC5:     !NO AVAILABLE EXIT TRP
;                                           !WAIT FOR A CHANGE OF STATE
                ELSE,XITC5;
;
;---THERE IS AN EXIT TRP AVAILABLE FROM C5---
;
XITC5        ASSIGN:'MYCRANE'='avCC5';
             BRANCH,1:
                IF,'GROUP'.EQ.'C',YXITC5:
                ELSE,XXITC5;
;
XXITC5       BRANCH,1:
                IF,'SC5w'.EQ.'Y',C5TOSC5:
                IF,'V2w'.EQ.'Y'.AND.'c2TOL1'.EQ.'N',C5TOV2:
                IF,'SC6w'.EQ.'Y'.AND.'c2TOL1'.EQ.'N',C5TOSC6:
                IF,'RS4'.LT.'LTS4',C5TOS4X:
                ELSE,TEMPC5;                     !NO POSSIBLE DESTINATION
;                                                !WAIT FOR A CHANGE OF STATE
;
YXITC5       BRANCH,1:
                IF,'V2w'.EQ.'Y'.AND.'c2TOL1'.EQ.'N',C5TOV2:
                IF,'SC6w'.EQ.'Y'.AND.'c2TOL1'.EQ.'N',C5TOSC6:
                IF,'SC5w'.EQ.'Y',C5TOSC5:
                IF,'RS6'.LT.'LTS6'.AND.'c2TOL1'.EQ.'N',C5TOS6Y:
                IF,'RS4'.LT.'LTS4',C5TOS4Y:
                ELSE,TEMPC5;                     !NO POSSIBLE DESTINATION
;                                                !WAIT FOR A CHANGE OF STATE
;
;---END COATER-------------------------------------------------------------------
;
;---STOCK 4----------------------------------------------------------------------
;
S4           TALLY:18,'RS4';
             RELEASE:CRANE('MYCRANE'):MARK('A_INDEX_AD_TO_T_IN_STOCKS');
             BRANCH,2:ALWAYS,STORE4:ALWAYS,SIGN4;
STORE4       BRANCH,1:
                IF,'GROUP'.EQ.'C',S4Y:
```

```
                ELSE,S4X;
;
S4X             COUNT:6;
                QUEUE,'LS4X':DETACH;
;
S4Y             COUNT:7;
                QUEUE,'LS4Y':DETACH;
;
SIGN4           QUEUE,42;
S4SCAN          SCAN:NQ('DESTINATION').NE.0:NEXT(SIGNSTCH);
;
;---END STOCK 4---------------------------------------------------------
;
;---THE SUPERCALANDER 5. DENOTED SC5 OR RSC5. 4TH IN LINE 1.-----------
;
;---TRP ENTRENCE PROCEEDURES SC5---
;
SC5             BRANCH,1:
                  IF,'SC5DOING'.EQ.'PROCESSING',WAITPSC5:
                  IF,'SC5DOING'.EQ.'CHANGING',WAITPSC5:
                  ELSE,DOESC5;
;
WAITPSC5        QUEUE,43;
                WAIT:4000,1;   !WAIT FOR PREVIOUS ROLL TO BE FULLY PROCESSED
;
DOESC5          RELEASE:CRANE('MYCRANE');
                SIGNAL:'STATECHANGE';
;
PRIO3           QUEUE,44;
                SEIZE:RSC5;
                COUNT:18;
;
;---SC5 IS BUSY---
;
PSC5            ASSIGN:'SC5DOING'='CHANGING':MARK('A_INDEX_AD_TO_ROLLCHT');
CHANGSC5        DELAY:'ROLLCHTIMESC5';
                ASSIGN:'ROLLCHT'='ROLLCHT'+TNOW-'AD_TO_ROLLCHT';
;
INBRSC5         ASSIGN:'SC5DOING'='PROCESSING':MARK('A_INDEX_AD_TO_PROCTIME');
                ASSIGN:'PROCTIMEINDEX'=49+'BWEIGHT';
                BRANCH,1:
                  IF,'PASSED_V2'.EQ.'Y',DECSC5:
                  ELSE,DDECSC5;
DDECSC5         DELAY:ED('PROCTIMEINDEX')-'PREVIEWTIME_SC5':NEXT(SPLITSC5);
DECSC5          DELAY:ED('PROCTIMEINDEX')*'V2COEFF'-'PREVIEWTIME_SC5';
;
SPLITSC5        ASSIGN:'MYCONVEYOR'=2;    !FOR TRP FROM STOCK 6 TO SC5
                ASSIGN:'SC5w'='Y';
                BRANCH,3:
                  ALWAYS,CONTSC5:
                  IF,NQ('WTGQSC5').EQ.0,TRYGTSC5:
                  ALWAYS,SIGNSTCH;
;
CONTSC5         DELAY:'PREVIEWTIME_SC5';
                ASSIGN:'SC5DOING'='FINISHED';
                SIGNAL:4000;    !PROCESSED
                ASSIGN:'MYCONVEYOR'=3:MARK('A_INDEX_AD_TO_WTFORXTT');
;               !c3 FOR TRP FROM SC5 TO LINE 2
                ASSIGN:'PROCTIME'='PROCTIME'+TNOW-'AD_TO_PROCTIME';
                ASSIGN:'SUMPROCTSC5'='SUMPROCTSC5'+TNOW-'AD_TO_PROCTIME';
                TALLY:13,'SUMPROCTSC5'/TNOW:NEXT(TRYEXSC5);
;
;---GETTING A NEW ROLL TO PROCESS. TRP PROCEDURES SC5---
;
```

```
TRYGTSC5    QUEUE,45,1;
            SEIZE:LOCKER:NEXT(FRLOCK6);
;
WTGETSC5    RELEASE:LOCKER;
            QUEUE,'WTGQSC5',1;                          !WAITING FOR A CHANGE OF STATE
            WAIT:'WTGQSC5',1;
;
            QUEUE,46,1;
            SEIZE:LOCKER;
            SIGNAL:'SEIZEDLOCKER';
;
;---CHECK IF THERE IS A TRP AVAILABLE FOR TRP FROM S4---
;
FRLOCK6     BRANCH,2:ALWAYS,WCALSC5G:ALWAYS,CALCS4;     !SEND ENTITY TO CALCULATE
;                                                        !THE CRANE STATE
WCALSC5G    QUEUE,47;
            SCAN:'CALCULATEDCRANESTATE'.EQ.'Y';
            ASSIGN:'CALCULATEDCRANESTATE'='N';
;
;---TRY TO GET A ROLL TO PROCESS---
;
GETBRSC5    BRANCH,1:
              IF,'SC5w'.EQ.'N',MDESTROY:!ANOTHER MACHINE HAS ALREADY SENT ONE
              IF,'Q4X'.NE.0.AND.'avCS4'.NE.0,S4XTSC5:
              IF,'Q6X'.NE.0.AND.'c2TOL2'.EQ.'N'.AND.'oC4'.EQ.'N',S6XTSC5:
              IF,'Q4Y'.NE.0.AND.'avCS4'.NE.0,S4YTSC5:
              IF,'Q6Y'.NE.0.AND.'c2TOL2'.EQ.'N'.AND.'oC4'.EQ.'N',S6YTSC5:
              ELSE,WTGETSC5; !NO TRP OR NOTHING IN STOCKS OR NEITHTER
;                             !WAIT FOR A CHANGE OF STATE
;
S4XTSC5     ASSIGN:'MYCRANE'='avCS4':NEXT(S4XTOSC5);
S4YTSC5     ASSIGN:'MYCRANE'='avCS4':NEXT(S4YTOSC5);
S6XTSC5     ASSIGN:'MYCRANE'=4:NEXT(S6XTOSC5);
S6YTSC5     ASSIGN:'MYCRANE'=4:NEXT(S6YTOSC5);
;
;---EXIT TRP PROCEEDURES SC5---
;
TRYEXSC5    QUEUE,48;
            SEIZE:LOCKER:NEXT(FRLOCK7);
;
WTOUTSC5    RELEASE:LOCKER;
            QUEUE,'WTEQSC5';                            !WAITING FOR A CHANGE OF STATE
            WAIT:'WTEQSC5',1;
;
            QUEUE,49;
            SEIZE:LOCKER;
            SIGNAL:'SEIZEDLOCKER';
;
;---CHECK IF THERE IS AN EXIT TRP FROM SC5 AVAILABLE---
;
FRLOCK7     BRANCH,2:ALWAYS,WCALSC5E:ALWAYS,CALCSC5;!SEND ENTITY TO CALCULATE
;                                                       !THE CRANE STATE
WCALSC5E    QUEUE,50;
            SCAN:'CALCULATEDCRANESTATE'.EQ.'Y';
            ASSIGN:'CALCULATEDCRANESTATE'='N';
;
            BRANCH,1:
              IF,'avCSC5'.EQ.0,WTOUTSC5:                !NO AVAILABLE EXIT TRP
;                                                        !WAIT FOR A CHANGE OF STATE
              ELSE,XITSC5;
;
;---THERE IS AN EXIT TRP AVAILABLE FROM SC5---
;
XITSC5      ASSIGN:'MYCRANE'='avCSC5';
```

```
          BRANCH,1:                          .
            IF,'GROUP'.EQ.'C',YXITSC5:
            ELSE,XXITSC5;
;
XXITSC5   BRANCH,1:
            IF,'B5w'.EQ.'Y',SC5TOB5:
            IF,'B6w'.EQ.'Y'.AND.'c3TOL1'.EQ.'N',SC5TOB6:
            IF,'RS5'.LT.'LTS5',SC5TOS5X:
            ELSE,WTOUTSC5;                   !NO POSSIBLE DESTINATION
;                                            !WAIT FOR A CHANGE OF STATE
;
YXITSC5   BRANCH,1:
            IF,'B6w'.EQ.'Y'.AND.'c3TOL1'.EQ.'N',SC5TOB6:
            IF,'RS7'.LT.'LTS7'.AND.'c3TOL1'.EQ.'N',SC5TOS7Y:
            IF,'RS5'.LT.'LTS5',SC5TOS5Y:
            ELSE,WTOUTSC5;                   !NO POSSIBLE DESTINATION
;                                            !WAIT FOR A CHANGE OF STATE
;
;---END SUPERCALANDER 5-------------------------------------------------------
;
;---STOCK 5-------------------------------------------------------------------
;
S5        TALLY:19,'RS5';
          RELEASE:CRANE('MYCRANE'):MARK('A_INDEX_AD_TO_T_IN_STOCKS');
          BRANCH,2:ALWAYS,STORE5:ALWAYS,SIGN5;
STORE5    BRANCH,1:
            IF,'GROUP'.EQ.'C',S5Y:
            ELSE,S5X;
;
S5X       COUNT:8;
          QUEUE,'LS5X':DETACH;
;
S5Y       COUNT:9;
          QUEUE,'LS5Y':DETACH;
;
SIGN5     QUEUE,51;
S5SCAN    SCAN:NQ('DESTINATION').NE.0:NEXT(SIGNSTCH);
;
;---END STOCK 5---------------------------------------------------------------
;
;---THE CUTTER 5. DENOTED B5 OR RB5. 5'th IN LINE 1--------------------------
;
;---TRP ENTRENCE PROCEDURES B5---
;
B5        BRANCH,1:
            IF,'B5DOING'.EQ.'PROCESSING',WAITPB5:
            IF,'B5DOING'.EQ.'CHANGING',WAITPB5:
            ELSE,DOEB5;
;
WAITPB5   QUEUE,52;
          WAIT:5000,1;   !WAIT FOR PREVIOUS ROLL TO BE FULLY PROCESSED
;
DOEB5     RELEASE:CRANE('MYCRANE');
          SIGNAL:'STATECHANGE';
PRIO4     QUEUE,53;
          SEIZE:RB5;
;
;---B5 IS BUSY---
;
          BRANCH,1:
            IF,'GROUP'.EQ.'C',CONTCB5:
            ELSE,CNTB5;
;
CONTCB5   COUNT:20:NEXT(CHANGEB5);
```

```
CNTB5       COUNT:19:NEXT(CHANGEB5);
;
CHANGEB5    ASSIGN:'B5DOING'='CHANGING':MARK('A_INDEX_AD_TO_ROLLCHT');
            DELAY:'ROLLCHTIMEB5';
            ASSIGN:'ROLLCHT'='ROLLCHT'+TNOW-'AD_TO_ROLLCHT';
;
            ASSIGN:'B5DOING'='PROCESSING':MARK('A_INDEX_AD_TO_PROCTIME');
PROCB5      DELAY:'PROCESSINGTIMEB5'-'PREVIEWTIME_B5';
;
SPLITB5     ASSIGN:'MYCONVEYOR'=3;      !FOR TRP FROM STOCK 7 TO B5
            ASSIGN:'B5w'='Y';
            BRANCH,3:
              ALWAYS,CONTB5:
              IF,NQ('WTGQB5').EQ.0,TRYGETB5:
              ALWAYS,SIGNSTCH;
;
CONTB5      DELAY:'PREVIEWTIME_B5';
            ASSIGN:'PROCTIME'='PROCTIME'+TNOW-'AD_TO_PROCTIME';
            ASSIGN:'SUMPROCTB5'='SUMPROCTB5'+TNOW-'AD_TO_PROCTIME';
            TALLY:14,'SUMPROCTB5'/TNOW;
            ASSIGN:'B5DOING'='FINISHED';
            SIGNAL:5000;     !PROCESSED
;
            RELEASE:RB5:NEXT(FLOWMES);
;
;---GETTING A NEW ROLL TO PROCESS. TRP PROCEDURES B5---
;
TRYGETB5    QUEUE,54,1;
            SEIZE:LOCKER:NEXT(FRLOCK8);
;
WTGETB5     RELEASE:LOCKER;
            QUEUE,'WTGQB5',1;                          !WAITING FOR A CHANGE OF STATE
            WAIT:'WTGQB5',1;
;
            QUEUE,55,1;
            SEIZE:LOCKER;
            SIGNAL:'SEIZEDLOCKER';
;
;---CHECK IF THERE IS A TRP AVAILABLE FOR TRP FROM S5---
;
FRLOCK8     BRANCH,2:ALWAYS,WCALCB5G:ALWAYS,CALCS5;    !SEND ENTITY TO CALCULATE
;                                                      !THE CRANE STATE
WCALCB5G    QUEUE,56;
            SCAN:'CALCULATEDCRANESTATE'.EQ.'Y';
            ASSIGN:'CALCULATEDCRANESTATE'='N';
;
;---TRY TO GET A ROLL TO PROCESS---
;
GETBRB5     BRANCH,1:
              IF,'B5w'.EQ.'N',MDESTROY: !ANOTHER MACHINE HAS ALREADY
;                                       !SENT A ROLL
              IF,'Q5X'.NE.0.AND.'avCS5'.NE.0,S5XTB5:
              IF,'Q7X'.NE.0.AND.'oC4'.EQ.'N'.AND.'c3TOL2'.EQ.'N',S7XTB5:
              ELSE,WTGETB5; !NO TRP OR NOTHING IN STOCKS OR NEITHTER
;                          !WAIT FOR A CHANGE OF STATE
;
S5XTB5      ASSIGN:'MYCRANE'='avCS5':NEXT(S5XTOB5);
S7XTB5      ASSIGN:'MYCRANE'=4:NEXT(S7XTOB5);
;
;---END CUTTER B5----------------------------------------------------------------------
;
;===END LINE 1: MAP5-S2-V1-S3-C5-S4+SC5-S5-B5==========================================
;
;===LINE 2: V2-S6-SC6-S7-B6============================================================
```

```
;
;---REEROLER 2. DENOTED V2 OR RV2. 1ST IN LINE 2----------------------------
;
V2          BRANCH,1:
               IF,'V2DOING'.EQ.'PROCESSING',WAITPV2:
               IF,'V2DOING'.EQ.'CHANGING',WAITPV2:
               ELSE,DOEV2;
;
WAITPV2     QUEUE,57;
            WAIT:6000,1;   !WAIT FOR PREVIOUS ROLL TO BE FULLY PROCESSED
;
DOEV2       RELEASE:CRANE('MYCRANE');
            SIGNAL:'STATECHANGE';
;
PRIO5       QUEUE,58;
            SEIZE:RV2;

            ASSIGN:'PASSED_V2'='Y';

            BRANCH,1:
               IF,'GROUP'.EQ.'C',CONTCV2:
               ELSE,CNTV2;
;
CONTCV2     COUNT:22:NEXT(PV2);
CNTV2       COUNT:21:NEXT(PV2);
;
;---V2 BUSY---
;
PV2         ASSIGN:'V2DOING'='CHANGING':MARK('A_INDEX_AD_TO_ROLLCHT');
CHV2        DELAY:'ROLLCHTIMEV2';
            ASSIGN:'ROLLCHT'='ROLLCHT'+TNOW-'AD_TO_ROLLCHT';

            ASSIGN:'V2DOING'='PROCESSING':MARK('A_INDEX_AD_TO_PROCTIME');
PROCV2      DELAY:'PROCESSINGTIMEV2'-'PREVIEWTIME_V2';
;
SPLITV2     ASSIGN:'MYCONVEYOR'=2;   !FOR TRP FROM STOCK 4 TO V2
            ASSIGN:'V2w'='Y';
            BRANCH,3:
               ALWAYS,CONTV2:
               IF,NQ('WTGQV2').EQ.0,TRYGETV2:
               ALWAYS,SIGNSTCH;
;
CONTV2      DELAY:'PREVIEWTIME_V2';
            ASSIGN:'PROCTIME'='PROCTIME'+TNOW-'AD_TO_PROCTIME';
            ASSIGN:'SUMPROCTV2'='SUMPROCTV2'+TNOW-'AD_TO_PROCTIME';
            ASSIGN:'MYCRANE'=4:MARK('A_INDEX_AD_TO_WTFORXTT'); !V2 EXIT TRP
            TALLY:15,'SUMPROCTV2'/TNOW:MARK('A_INDEX_WTXITTV2');
            ASSIGN:'V2DOING'='FINISHED';
            SIGNAL:6000:NEXT(TRYEXV2);   !PROCESSED
;
;---GETTING A NEW ROLL TO PROCESS. TRP PROCEDURES V2---
;
TRYGETV2    QUEUE,59,1;
            SEIZE:LOCKER:NEXT(FRLOCK9);
;
WTGETV2     RELEASE:LOCKER;
            QUEUE,'WTGQV2',1;                    !WAITING FOR A CHANGE OF STATE
            WAIT:'WTGQV2',1;
;
            QUEUE,60,1;
            SEIZE:LOCKER;
            SIGNAL:'SEIZEDLOCKER';
;
;---SEARCH STOCK 4 AND 6 FOR ROLLS THAT HAVE---
```

```
;---NOT PASSED V2---------------------------------------
;
FRLOCK9     SEARCH,'LS4X',1,NQ:'PASSED_V2'.EQ.'N';
            ASSIGN:'SJLS4X'=J;
            SEARCH,'LS4Y',1,NQ:'PASSED_V2'.EQ.'N';
            ASSIGN:'SJLS4Y'=J;
            SEARCH,'LS6X',1,NQ:'PASSED_V2'.EQ.'N';
            ASSIGN:'SJLS6X'=J;
            SEARCH,'LS6Y',1,NQ:'PASSED_V2'.EQ.'N';
            ASSIGN:'SJLS6Y'=J;
;
;---CHECK IF THERE IS A TRP AVAILABLE FOR TRP FROM S4---
;
            BRANCH,2:ALWAYS,WCALCV2G:ALWAYS,CALCS4;      !SEND ENTITY TO CALCULATE
;                                                        !THE CRANE STATE
WCALCV2G    QUEUE,61;
            SCAN:'CALCULATEDCRANESTATE'.EQ.'Y';
            ASSIGN:'CALCULATEDCRANESTATE'='N';
;
;---TRY TO GET A ROLL TO PROCESS---
;
GETV2       BRANCH,1:
            IF,'V2w'.EQ.'N',MDESTROY: !A ROLL ALREADY ON ITS WAY
            IF,'SJLS4Y'.NE.0.AND.'avCS4'.NE.0.AND.'c2TOL1'.EQ.'N',VS4YTOV2:
            IF,'SJLS6Y'.NE.0.AND.'oC4'.EQ.'N',VS6YTOV2:
            IF,'SJLS6X'.NE.0.AND.'oC4'.EQ.'N',VS6XTOV2:
            IF,'SJLS4X'.NE.0.AND.'avCS4'.NE.0.AND.'c2TOL1'.EQ.'N',VS4XTOV2:
            ELSE,WTGETV2; !NO TRP OR NOTHING IN STOCKS OR NEITHER
;                          !WAIT FOR A CHANGE OF STATE
;
VS4XTOV2    ASSIGN:'MYCRANE'='avCS4';
            ASSIGN:'SAVEJ'='SJLS4X':NEXT(S4XTOV2);
VS4YTOV2    ASSIGN:'MYCRANE'='avCS4';
            ASSIGN:'SAVEJ'='SJLS4Y':NEXT(S4YTOV2);
VS6XTOV2    ASSIGN:'MYCRANE'=4;
            ASSIGN:'SAVEJ'='SJLS6X':NEXT(S6XTOV2);
VS6YTOV2    ASSIGN:'MYCRANE'=4;
            ASSIGN:'SAVEJ'='SJLS6Y':NEXT(S6YTOV2);
;
;---EXIT TRP PROCEEDURES V2---
;
TRYEXV2     QUEUE,62;
            SEIZE:LOCKER:NEXT(FRLOCK10);
;
WTOUTV2     RELEASE:LOCKER;
            QUEUE,'WTEQV2';                      !WAITING FOR A CHANGE OF STATE
            WAIT:'WTEQV2',1;
;
            QUEUE,63;
            SEIZE:LOCKER;
            SIGNAL:'SEIZEDLOCKER';
;
;---CHECK IF THERE IS AN EXIT TRP FROM V2 AVAILABLE---
;
FRLOCK10    BRANCH,1:
            IF,'oC4'.EQ.'N',XITV2:
            ELSE,WTOUTV2;                        !NO AVAILABLE EXIT TRP FROM V2
;                                                !WAIT FOR A CHANGE OF STATE
;
;---THERE IS AN EXIT TRP AVAILABLE FROM V2---
;
XITV2       BRANCH,1:
            IF,'GROUP'.EQ.'C',YXITV2:
            ELSE,XXITV2;
```

```
;
XXITV2      BRANCH,1:
              IF,'SC6w'.EQ.'Y',V2TOSC6:
              IF,'SC5w'.EQ.'Y'.AND.'c2TOL2'.EQ.'N',V2TOSC5:
              IF,'RS6'.LT.'LTS6',V2TOS6X:
              IF,'RS4'.LT.'LTS4'.AND.'c2TOL2'.EQ.'N',V2TOS4X:
              ELSE,WTOUTV2;              !NO POSSIBLE DESTINATION
                                         !WAIT FOR A CHANGE OF STATE
;
;
YXITV2      BRANCH,1:
              IF,'SC6w'.EQ.'Y',V2TOSC6:
              IF,'SC5w'.EQ.'Y'.AND.'c2TOL2'.EQ.'N',V2TOSC5:
              IF,'RS6'.LT.'LTS6',V2TOS6Y:
              IF,'RS4'.LT.'LTS4'.AND.'c2TOL2'.EQ.'N',V2TOS4Y:
              ELSE,WTOUTV2;              !NO POSSIBLE DESTINATION
                                         !WAIT FOR A CHANGE OF STATE
;
;---END REEROLER 2.-----------------------------------------------------------
;
;---STOCK 6-------------------------------------------------------------------
;
S6          TALLY:20,'RS6';
            RELEASE:CRANE('MYCRANE'):MARK('A_INDEX_AD_TO_T_IN_STOCKS');
            BRANCH,2:ALWAYS,STORE6:ALWAYS,SIGN6;
STORE6      BRANCH,1:
              IF,'GROUP'.EQ.'C',S6Y:
              ELSE,S6X;
;
S6X         COUNT:10;
            QUEUE,'LS6X':DETACH;
;
S6Y         COUNT:11;
            QUEUE,'LS6Y':DETACH;
;
SIGN6       QUEUE,64;
S6SCAN      SCAN:NQ('DESTINATION').NE.0:NEXT(SIGNSTCH);
;
;---END STOCK 6---------------------------------------------------------------
;
;---THE SUPERCALANDER 6. DENOTED SC6 OR RSC6. 2ND IN LINE 2.------------------
;
;---TRP ENTRENCE PROCEEDURES SC6---
;
SC6         BRANCH,1:
              IF,'SC6DOING'.EQ.'PROCESSING',WAITPSC6:
              IF,'SC6DOING'.EQ.'CHANGING',WAITPSC6:
              ELSE,DOESC6;
;
WAITPSC6    QUEUE,65;
            WAIT:7000,1;   !WAIT FOR PREVIOUS ROLL TO BE FULLY PROCESSED
;
DOESC6      RELEASE:CRANE('MYCRANE');
            SIGNAL:'STATECHANGE';
;
PRIO6       QUEUE,66;
            SEIZE:RSC6;
            COUNT:23;
;
;---SC6 IS BUSY---
;
PSC6        ASSIGN:'SC6DOING'='CHANGING':MARK('A_INDEX_AD_TO_ROLLCHT');
CHANGSC6    DELAY:'ROLLCHTIMESC6';
            ASSIGN:'ROLLCHT'='ROLLCHT'+TNOW-'AD_TO_ROLLCHT';
;
```

```
INBRSC6    ASSIGN:'SC6DOING'='PROCESSING':MARK('A_INDEX_AD_TO_PROCTIME');
           ASSIGN:'PROCTIMEINDEX'=54+'BWEIGHT';
           BRANCH,1:
             IF,'PASSED_V2'.EQ.'Y',DECSC6:
             ELSE,DDECSC6;
;
DDECSC6    DELAY:ED('PROCTIMEINDEX')-'PREVIEWTIME_SC6':NEXT(SPLITSC6);
DECSC6     DELAY:ED('PROCTIMEINDEX')*'V2COEFF'-'PREVIEWTIME_SC6';
;
SPLITSC6   ASSIGN:'SC6w'='Y';
           ASSIGN:'MYCONVEYOR'=2;     !FOR TRP FROM STOCK 4 TO SC6
           BRANCH,3:
             ALWAYS,CONTSC6:
             IF,NQ('WTGQSC6').EQ.0,TRYGTSC6:
             ALWAYS,SIGNSTCH;
;
CONTSC6    DELAY:'PREVIEWTIME_SC6';
           ASSIGN:'SC6DOING'='FINISHED';
           SIGNAL:7000;      !PROCESSED
;
           ASSIGN:'MYCONVEYOR'=3:MARK('A_INDEX_AD_TO_WTFORXTT');
           !c3 FOR TRP FROM SC6 TO LINE 1
           ASSIGN:'MYCRANE'=4;    !SC6 EXIT TRP
           ASSIGN:'PROCTIME'='PROCTIME'+TNOW-'AD_TO_PROCTIME';
           ASSIGN:'SUMPROCTSC6'='SUMPROCTSC6'+TNOW-'AD_TO_PROCTIME';
           TALLY:16,'SUMPROCTSC6'/TNOW:NEXT(TRYEXSC6);
;
;---GETTING A NEW ROLL TO PROCESS. TRP PROCEDURES SC6---
;
TRYGTSC6   QUEUE,67,1;
           SEIZE:LOCKER:NEXT(FRLOCK11);
;
WTGETSC6   RELEASE:LOCKER;
           QUEUE,'WTGQSC6',1;                          !WAITING FOR A CHANGE OF STATE
           WAIT:'WTGQSC6',1;
;
           QUEUE,68,1;
           SEIZE:LOCKER;
           SIGNAL:'SEIZEDLOCKER';
;
;---CHECK IF THERE IS A TRP AVAILABLE FOR TRP FROM S4---
;
FRLOCK11   BRANCH,2:ALWAYS,WCALSC6G:ALWAYS,CALCS4;        !SEND ENTITY TO CALCULATE
;                                                         !THE CRANE STATE
WCALSC6G   QUEUE,69;
           SCAN:'CALCULATEDCRANESTATE'.EQ.'Y';
           ASSIGN:'CALCULATEDCRANESTATE'='N';
;
;---TRY TO GET A ROLL TO PROCESS---
;
GETBRSC6   BRANCH,1:
             IF,'SC6w'.EQ.'N',MDESTROY: !ANOTHER MACHINE HAS
;                                        !ALREADY SENT A ROLL
             IF,'Q4Y'.NE.0.AND.'avCS4'.NE.0.AND.'c2TOL1'.EQ.'N',S4YTSC6:
             IF,'Q6Y'.NE.0.AND.'oC4'.EQ.'N',S6YTSC6:
             IF,'Q6X'.NE.0.AND.'oC4'.EQ.'N',S6XTSC6:
             IF,'Q4X'.NE.0.AND.'avCS4'.NE.0.AND.'c2TOL1'.EQ.'N',S4XTSC6:
             ELSE,WTGETSC6;      !NO TRP OR NOTHING IN STOCKS OR NEITHER
;                                !WAIT FOR A CHANGE OF STATE
;
S4XTSC6    ASSIGN:'MYCRANE'='avCS4':NEXT(S4XTOSC6);
S4YTSC6    ASSIGN:'MYCRANE'='avCS4':NEXT(S4YTOSC6);
S6XTSC6    ASSIGN:'MYCRANE'=4:NEXT(S6XTOSC6);
S6YTSC6    ASSIGN:'MYCRANE'=4:NEXT(S6YTOSC6);
```

```
;
;---EXIT TRP PROCEEDURES SC6---
;
TRYEXSC6   QUEUE,70;
           SEIZE:LOCKER:NEXT(FRLOCK12);
;
WTOUTSC6   RELEASE:LOCKER;
           QUEUE,'WTEQSC6';                        !WAITING FOR A CHANGE OF STATE
           WAIT:'WTEQSC6',1;
;
           QUEUE,71;
           SEIZE:LOCKER;
           SIGNAL:'SEIZEDLOCKER';
;
;---CHECK IF THERE IS AN EXIT TRP FROM SC6 AVAILABLE---
;
FRLOCK12   BRANCH,1:
             IF,'oC4'.EQ.'N',XITSC6:
             ELSE,WTOUTSC6;                      !NO AVAILABLE TRP
                                                 !WAIT FOR A CHANGE OF STATE
;
;
;---THERE IS AN EXIT TRP FROM SC6 AVAILABLE---
;
XITSC6     BRANCH,1:
             IF,'GROUP'.EQ.'C',YXITSC6:
             ELSE,XXITSC6;
;
XXITSC6    BRANCH,1:
             IF,'B6w'.EQ.'Y',SC6TOB6:
             IF,'B5w'.EQ.'Y'.AND.'c3TOL2'.EQ.'N',SC6TOB5:
             IF,'RS7'.LT.'LTS7',SC6TOS7X:
             IF,'RS5'.LT.'LTS5'.AND.'c3TOL2'.EQ.'N',SC6TOS5X:
             ELSE,WTOUTSC6;                       !NO POSSIBLE DESTINATION
                                                  !WAIT FOR A CHANGE OF STATE
;
;
YXITSC6    BRANCH,1:
             IF,'B6w'.EQ.'Y',SC6TOB6:
             IF,'RS7'.LT.'LTS7',SC6TOS7Y:
             ELSE,WTOUTSC6;                       !NO POSSIBLE DESTINATION
                                                  !WAIT FOR A CHANGE OF STATE
;
;---END SUPERCALANDER 6--------------------------------------------------------
;
;---STOCK 7--------------------------------------------------------------------
;
S7         TALLY:21,'RS7';
           RELEASE:CRANE('MYCRANE'):MARK('A_INDEX_AD_TO_T_IN_STOCKS');
           BRANCH,2:ALWAYS,STORE7:ALWAYS,SIGN7;
STORE7     BRANCH,1:
             IF,'GROUP'.EQ.'C',S7Y:
             ELSE,S7X;
;
S7X        COUNT:12;
           QUEUE,'LS7X':DETACH;
;
S7Y        COUNT:13;
           QUEUE,'LS7Y':DETACH;
;
SIGN7      QUEUE,72;
S7SCAN     SCAN:NQ('DESTINATION').NE.0:NEXT(SIGNSTCH);
;
;---END STOCK 7----------------------------------------------------------------
;
;---THE CUTTER 6. DENOTED B6 OR RB6. 3D IN LINE 2------------------------------
```

```
;
;---TRP ENTRENCE PROCEDURES B6---
;
B6          BRANCH,1:
               IF,'B6DOING'.EQ.'PROCESSING',WAITPB6:
               IF,'B6DOING'.EQ.'CHANGING',WAITPB6:
               ELSE,DOEB6;
;
WAITPB6     QUEUE,73;
            WAIT:8000,1;   !WAIT FOR PREVIOUS ROLL TO BE FULLY PROCESSED
;
DOEB6       RELEASE:CRANE('MYCRANE');
            SIGNAL:'STATECHANGE';
;
PRIO7       QUEUE,74;
            SEIZE:RB6;
;
            BRANCH,1:
               IF,'GROUP'.EQ.'C',CONTCB6:
               ELSE,CNTB6;
;
CONTCB6     COUNT:25:NEXT(PB6);
CNTB6       COUNT:24:NEXT(PB6);
;
;---B6 IS BUSY---
;
PB6         ASSIGN:'B6DOING'='CHANGING':MARK('A_INDEX_AD_TO_ROLLCHT');
CHANGEB6    DELAY:'ROLLCHTIMEB6';
            ASSIGN:'ROLLCHT'='ROLLCHT'+TNOW-'AD_TO_ROLLCHT';
;
            ASSIGN:'B6DOING'='PROCESSING':MARK('A_INDEX_AD_TO_PROCTIME');
PROCB6      DELAY:'PROCESSINGTIMEB6'-'PREVIEWTIME_B6';
;
SPLITB6     ASSIGN:'B6w'='Y';
            ASSIGN:'MYCONVEYOR'=3;     !FOR TRP FROM STOCK 5 TO B6
            BRANCH,3:
               ALWAYS,CONTB6:
               IF,NQ('WTGQB6').EQ.0,TRYGETB6:
               ALWAYS,SIGNSTCH;
;
CONTB6      DELAY:'PREVIEWTIME_B6';
            ASSIGN:'PROCTIME'='PROCTIME'+TNOW-'AD_TO_PROCTIME';
            ASSIGN:'SUMPROCTB6'='SUMPROCTB6'+TNOW-'AD_TO_PROCTIME';
            TALLY:17,'SUMPROCTB6'/TNOW;
;
            ASSIGN:'B6DOING'='FINISHED';
            SIGNAL:8000;     !PROCESSED
;
            RELEASE:RB6:NEXT(FLOWMES);
;
;---GETTING A NEW ROLL TO PROCESS. TRP PROCEDURES B6---
;
TRYGETB6    QUEUE,75,1;
            SEIZE:LOCKER:NEXT(FRLOCK13);
;
WTGETB6     RELEASE:LOCKER;
            QUEUE,'WTGQB6',1;                         !WAITING FOR A CHANGE OF STATE
            WAIT:'WTGQB6',1;
;
            QUEUE,76,1;
            SEIZE:LOCKER;
            SIGNAL:'SEIZEDLOCKER';
;
;---CHECK IF THERE IS A TRP AVAILABLE FOR TRP FROM S5---
```

```
;
FRLOCK13   BRANCH,2:ALWAYS,WCALCB6G:ALWAYS,CALCS5;        !SEND ENTITY TO CALCULATE
;                                                          !THE CRANE STATE
WCALCB6G   QUEUE,77;
           SCAN:'CALCULATEDCRANESTATE'.EQ.'Y';
           ASSIGN:'CALCULATEDCRANESTATE'='N';
;
;---TRY TO GET A ROLL TO PROCESS---
;
GETBRB6    BRANCH,1:
             IF,'B6w'.EQ.'N',MDESTROY: !ANOTHER MACHINE HAS
                                       !ALREADY SENT A ROLL
             IF,'Q5Y'.NE.0.AND.'avCS5'.NE.0.AND.'c3TOL1'.EQ.'N',S5YTB6:
             IF,'Q7Y'.NE.0.AND.'oC4'.EQ.'N',S7YTB6:
             IF,'Q7X'.NE.0.AND.'oC4'.EQ.'N',S7XTB6:
             IF,'Q5X'.NE.0.AND.'avCS5'.NE.0.AND.'c3TOL1'.EQ.'N',S5XTB6:
             ELSE,WTGETB6;        !NO TRP OR NOTHING IN STOCKS OR NEITHTER
;                                 !WAIT FOR A CHANGE OF STATE
;
S5XTB6     ASSIGN:'MYCRANE'='avCS5':NEXT(S5XTOB6);
S5YTB6     ASSIGN:'MYCRANE'='avCS5':NEXT(S5YTOB6);
S7XTB6     ASSIGN:'MYCRANE'=4:NEXT(S7XTOB6);
S7YTB6     ASSIGN:'MYCRANE'=4:NEXT(S7YTOB6);
;
;---END CUTTER B6-------------------------------------------------------------
;
;===END LINE 2: V2-S6-SC6-S7-B6==============================================
;
;***END WORKSHOP*************************************************************
;
;***MESURING THE PRODUCTION RATE*********************************************
;
FLOWMES    COUNT:1;     !COUNT THE ROLLS THAT EXIT THE WORKSHOP
           ASSIGN:'FLOWCOUNTER'='FLOWCOUNTER'+1;
           TALLY:2,NC(14)-NC(1);                          !NUMBER OF
;                                                          !ENTITIES IN WORKSHOP
;
FLOWBR     BRANCH,1:
             IF,'FLOWCOUNTER'.EQ.'NRBEFOREFLOWMESURE',DOMESURE:
             ELSE,ENCORE;
;
DOMESURE   SIGNAL:'MESUREFLOW':NEXT(ENCORE);
;
MES        CREATE,1;                                       !MESURER
WAITMES    QUEUE,78:MARK(1);
           WAIT:'MESUREFLOW',1;
           ASSIGN:A(2)=TNOW-A(1);
           TALLY:1,'FLOWCOUNTER'/(A(2)/60);               !ROLL PER HOUR
           ASSIGN:'FLOWCOUNTER'=0:NEXT(WAITMES);
;
;***END MESURING THE PRODUCTION RATE*****************************************
;
;***COLLECT STATISTICS******************************************************
;
ENCORE     ASSIGN:A(5)=TNOW-'ENTRENCETIME';
;          !A(5) IS NOW TIME SPENT FROM ENTRENCE
;          !IN TO THE WORKSHOP TILL THE EXIT
;
           TALLY:9,A(5); TIME IN SYSTEM
;
           TALLY:3,'TYPECHTIME'/A(5);
           TALLY:4,'T_IN_STOCKS'/A(5);
           TALLY:5,'TIMEINTRP'/A(5);
           TALLY:6,'ROLLCHT'/A(5);
```

```
                    TALLY:7,'PROCTIME'/A(5);      ·
                    TALLY:8,'WTFORXTT'/A(5):DISPOSE;
;
;***END COLLECT STATISTICS***********************************************
;
;***CALCULATION OF AVAILABLE CRANES IN LINE 1***************************
;
;---MAP5OUT---
;
CALCMAP5    BRANCH,1:
              IF,'oC1'.EQ.'N',P1MP5OUT:
              ELSE,NOMP5OUT;                    ·  ·
;
P1MP5OUT    ASSIGN:'avCMAP5'=1:NEXT(DIDCALC);
NOMP5OUT    ASSIGN:'avCMAP5'=0:NEXT(DIDCALC);
;
;---S2OUT---
;
CALCS2      BRANCH,1:
              IF,'oC1'.EQ.'Y'.AND.'oC2'.EQ.'Y',NOS2OUT:
              IF,'oC1'.EQ.'N'.AND.'oC2'.EQ.'N',P1S2OUT:
              IF,'oC1'.EQ.'N'.AND.'wC2'.GE.'V1_S3',P1S2OUT:
              IF,'oC2'.EQ.'N'.AND.'wC1'.LE.'MAP5_S2',P2S2OUT:
              ELSE,NOS2OUT;
;
P1S2OUT     ASSIGN:'avCS2'=1:NEXT(DIDCALC);
P2S2OUT     ASSIGN:'avCS2'=2:NEXT(DIDCALC);
NOS2OUT     ASSIGN:'avCS2'=0:NEXT(DIDCALC);
;
;---V1OUT---
;
CALCV1      BRANCH,1:
              IF,'oC2'.EQ.'Y'.AND.'oC3'.EQ.'Y',NOV1OUT:
              IF,'oC2'.EQ.'N'.AND.'oC3'.EQ.'N',P2V1OUT:
              IF,'oC2'.EQ.'N'.AND.'wC3'.GE.'S3_C5',P2V1OUT:
              IF,'oC3'.EQ.'N'.AND.'wC2'.LE.'S2_V1',P3V1OUT:
              ELSE,NOV1OUT;
;
P2V1OUT     ASSIGN:'avCV1'=2:NEXT(DIDCALC);
P3V1OUT     ASSIGN:'avCV1'=3:NEXT(DIDCALC);
NOV1OUT     ASSIGN:'avCV1'=0:NEXT(DIDCALC);
;
;---S3OUT---
;
CALCS3      BRANCH,1:
              IF,'oC2'.EQ.'Y'.AND.'oC3'.EQ.'Y',NOS3OUT:
              IF,'oC2'.EQ.'N'.AND.'oC3'.EQ.'N',P2S3OUT:
              IF,'oC2'.EQ.'Y'.AND.'wC2'.LE.'V1_S3',P3S3OUT:
              IF,'oC3'.EQ.'Y'.AND.'wC3'.GE.'C5_S4',P2S3OUT:
              ELSE,NOS3OUT;
;
P2S3OUT     ASSIGN:'avCS3'=2:NEXT(DIDCALC);
P3S3OUT     ASSIGN:'avCS3'=3:NEXT(DIDCALC);
NOS3OUT     ASSIGN:'avCS3'=0:NEXT(DIDCALC);
;
;---C5OUT---
;
CALCC5      BRANCH,1:
              IF,'oC2'.EQ.'Y'.AND.'oC3'.EQ.'Y',NOC5OUT:
              IF,'oC2'.EQ.'N'.AND.'oC3'.EQ.'N',P2C5OUT:
              IF,'oC3'.EQ.'Y'.AND.'wC3'.GE.'S4_SC5',P2C5OUT:
              IF,'oC2'.EQ.'Y'.AND.'wC2'.LE.'S3_C5',P3C5OUT:
              ELSE,NOC5OUT;
;
```

```
P2C50UT     ASSIGN:'avCC5'=2:NEXT(DIDCALC);
P3C50UT     ASSIGN:'avCC5'=3:NEXT(DIDCALC);
NOC50UT     ASSIGN:'avCC5'=0:NEXT(DIDCALC);
;
;---S40UT---
;
CALCS4      BRANCH,1:
            IF,'oC2'.EQ.'Y'.AND.'oC3'.EQ.'Y',NOS40UT:
            IF,'oC2'.EQ.'N'.AND.'oC3'.EQ.'N',P3S40UT:
            IF,'oC3'.EQ.'Y'.AND.'wC3'.GE.'SC5_S5',P2S40UT:
            IF,'oC2'.EQ.'Y'.AND.'wC2'.LE.'C5_S4',P3S40UT:
            ELSE,NOS40UT;
;
P2S40UT     ASSIGN:'avCS4'=2:NEXT(DIDCALC);
P3S40UT     ASSIGN:'avCS4'=3:NEXT(DIDCALC);
NOS40UT     ASSIGN:'avCS4'=0:NEXT(DIDCALC);
;
;---SC50UT
;
CALCSC5     BRANCH,1:
            IF,'oC2'.EQ.'Y'.AND.'oC3'.EQ.'Y',NOSC50UT:
            IF,'oC2'.EQ.'N'.AND.'oC3'.EQ.'N',P3SC50UT:
            IF,'oC3'.EQ.'Y'.AND.'wC3'.GE.'S5_B5',P2SC50UT:
            IF,'oC2'.EQ.'Y'.AND.'wC2'.LE.'S4_SC5',P3SC50UT:
            ELSE,NOSC50UT;
;
P2SC50UT    ASSIGN:'avCSC5'=2:NEXT(DIDCALC);
P3SC50UT    ASSIGN:'avCSC5'=3:NEXT(DIDCALC);
NOSC50UT    ASSIGN:'avCSC5'=0:NEXT(DIDCALC);
;
;---S50UT---
;
CALCS5      BRANCH,1:
            IF,'oC2'.EQ.'Y'.AND.'oC3'.EQ.'Y',NOS50UT:
            IF,'oC2'.EQ.'N'.AND.'oC3'.EQ.'N',P3S50UT:
            IF,'oC2'.EQ.'Y'.AND.'wC2'.LE.'SC5_S5',P3S50UT:
            ELSE,NOS50UT;
;
P3S50UT     ASSIGN:'avCS5'=3:NEXT(DIDCALC);
NOS50UT     ASSIGN:'avCS5'=0:NEXT(DIDCALC);
;
;---TRP FROM CONVEYOR 2 IN LINE 1---
;
CALCc       BRANCH,1:
            IF,'oC2'.EQ.'Y'.AND.'oC3'.EQ.'Y',NOPc2:
            IF,'oC2'.EQ.'N'.AND.'oC3'.EQ.'N',P2c2:
            IF,'oC3'.EQ.'Y'.AND.'wC3'.GE.'SC5_S5',P2c2:
            IF,'oC2'.EQ.'Y'.AND.'wC2'.LE.'C5_S4',P3c2:
            ELSE,NOPc2;
;
P2c2        ASSIGN:'avCc2'=2:NEXT(CCALCc);
P3c2        ASSIGN:'avCc2'=3:NEXT(CCALCc);
NOPc2       ASSIGN:'avCc2'=0:NEXT(CCALCc);
;
;---TRP FROM CONVEYOR 3 IN LINE 1---
;
CCALCc      BRANCH,1:
            IF,'oC2'.EQ.'Y'.AND.'oC3'.EQ.'Y',NOPc3:
            IF,'oC2'.EQ.'N'.AND.'oC3'.EQ.'N',P3c3:
            IF,'oC2'.EQ.'Y'.AND.'wC2'.LE.'S4_SC5',P3c3:
            IF,'oC3'.EQ.'Y'.AND.'wC3'.GE.'S5_B5',P2c3:
            ELSE,NOPc3;
;
P2c3        ASSIGN:'avCc3'=2:NEXT(DIDCALC);
```

```
P3c3        ASSIGN:'avCc3'=3:NEXT(DIDCALC);
NOPc3       ASSIGN:'avCc3'=0:NEXT(DIDCALC);
;
DIDCALC     ASSIGN:'CALCULATEDCRANESTATE'='Y':DISPOSE;
;
;***END CALCULATION OF CRANESTATE***********************************************
;
;***THE TRANSPORT SEQUENCES*****************************************************
;
MAP5TOV1    ASSIGN:'TRPTIME'='trptime_MAP5_to_V1';
            ASSIGN:'TRPLOCATIONLINE1'='S2_V1';
            ASSIGN:'COMMING_FROM'='LMAP5';
            ASSIGN:'DESTINATION'='LV1':NEXT(TRANSPRT);
;
MAP5TOS2    ASSIGN:'RS2'='RS2'+1;
            ASSIGN:'TRPTIME'='trptime_MAP5_to_S2';
            ASSIGN:'TRPLOCATIONLINE1'='MAP5_S2';
            ASSIGN:'COMMING_FROM'='LMAP5';
            ASSIGN:'DESTINATION'='LS2':NEXT(TRANSPRT);
;
S2TOV1      REMOVE:'BESTV1','LS2',S2THING:DISPOSE;
S2THING     ASSIGN:'RS2'='RS2'-1;
            BRANCH,2:IF,'RS2'.EQ.('LTS2'-1),SIGNSTCH:ALWAYS,PRIO8;
PRIO8       ASSIGN:'TRPTIME'='trptime_S2_to_V1';
            ASSIGN:'TRPLOCATIONLINE1'='S2_V1';
            ASSIGN:'COMMING_FROM'='LS2';
            ASSIGN:'DESTINATION'='LV1':NEXT(TRANSPRT);
;
V1TOC5      RELEASE:RV1;
            ASSIGN:'TRPTIME'='trptime_V1_to_C5';
            ASSIGN:'TRPLOCATIONLINE1'='S3_C5';
            ASSIGN:'COMMING_FROM'='LV1';
            ASSIGN:'DESTINATION'='LC5':NEXT(TRANSPRT);
;
V1TOS3      RELEASE:RV1;
            ASSIGN:'RS3'='RS3'+1;
            ASSIGN:'TRPTIME'='trptime_V1_to_S3';
            ASSIGN:'TRPLOCATIONLINE1'='V1_S3';
            ASSIGN:'COMMING_FROM'='LV1';
            ASSIGN:'DESTINATION'='LS3':NEXT(TRANSPRT);
;
S3TOC5      REMOVE:'BESTC5','LS3',S3THING:DISPOSE;
S3THING     ASSIGN:'RS3'='RS3'-1;
            BRANCH,2:IF,'RS3'.EQ.('LTS3'-1),SIGNSTCH:ALWAYS,PRIO9;
PRIO9       ASSIGN:'TRPTIME'='trptime_S3_to_C5';
            ASSIGN:'TRPLOCATIONLINE1'='S3_C5';
            ASSIGN:'COMMING_FROM'='LS3';
            ASSIGN:'DESTINATION'='LC5':NEXT(TRANSPRT);
;
C5TOSC5     ASSIGN:'TRPTIME'='trptime_C5_to_SC5';
            ASSIGN:'TRPLOCATIONLINE1'='S4_SC5';
            ASSIGN:'COMMING_FROM'='LC5';
            ASSIGN:'DESTINATION'='LSC5':NEXT(TRANSPRT);
;
C5TOSC6     ASSIGN:'TRPTIME'='trptime_C5_to_SC6';
            ASSIGN:'TRPLOCATIONLINE1'='S4_SC5';
            ASSIGN:'COMMING_FROM'='LC5';
            ASSIGN:'DESTINATION'='LSC6':NEXT(TRANSPRT);
;
C5TOV2      ASSIGN:'TRPTIME'='trptime_C5_to_V2';
            ASSIGN:'TRPLOCATIONLINE1'='S4_SC5';
            ASSIGN:'COMMING_FROM'='LC5';
            ASSIGN:'DESTINATION'='LV2':NEXT(TRANSPRT);
;
```

```
C5TOS4X    ASSIGN:'RS4'='RS4'+1;                  .
           ASSIGN:'TRPTIME'='trptime_C5_to_S4';
           ASSIGN:'TRPLOCATIONLINE1'='C5̄_S4̄';
           ASSIGN:'COMMING_FROM'='LC5';
           ASSIGN:'DESTINATION'='LS4X':NEXT(TRANSPRT);
;
C5TOS4Y    ASSIGN:'RS4'='RS4'+1;
           ASSIGN:'TRPTIME'='trptime_C5_to_S4';
           ASSIGN:'TRPLOCATIONLINE1'='C5̄_S4̄';
           ASSIGN:'COMMING_FROM'='LC5';
           ASSIGN:'DESTINATION'='LS4Y':NEXT(TRANSPRT);
;
C5TOS6X    ASSIGN:'RS6'='RS6'+1;
           ASSIGN:'TRPTIME'='trptime_C5_to_S6';
           ASSIGN:'TRPLOCATIONLINE1'='S4̄_SC5̄';
           ASSIGN:'COMMING_FROM'='LC5';
           ASSIGN:'DESTINATION'='LS6X':NEXT(TRANSPRT);
;
C5TOS6Y    ASSIGN:'RS6'='RS6'+1;
           ASSIGN:'TRPTIME'='trptime_C5_to_S6';
           ASSIGN:'TRPLOCATIONLINE1'='S4̄_SC5̄';
           ASSIGN:'COMMING_FROM'='LC5';
           ASSIGN:'DESTINATION'='LS6Y':NEXT(TRANSPRT);
;
SC5TOB5    RELEASE:RSC5;
           ASSIGN:'TRPTIME'='trptime_SC5_to_B5';
           ASSIGN:'TRPLOCATIONLINE1'='SC5̄_B5̄';
           ASSIGN:'COMMING_FROM'='LSC5';
           ASSIGN:'DESTINATION'='LB5':NEXT(TRANSPRT);
;
SC5TOB6    RELEASE:RSC5;
           ASSIGN:'TRPTIME'='trptime_SC5_to_B6';
           ASSIGN:'TRPLOCATIONLINE1'='SC5̄_S5̄';
           ASSIGN:'COMMING_FROM'='LSC5';
           ASSIGN:'DESTINATION'='LB6':NEXT(TRANSPRT);
;
SC5TOS5X   RELEASE:RSC5;
           ASSIGN:'RS5'='RS5'+1;
           ASSIGN:'TRPTIME'='trptime_SC5_to_S5';
           ASSIGN:'TRPLOCATIONLINE1'='SC5̄_S5̄';
           ASSIGN:'COMMING_FROM'='LSC5';
           ASSIGN:'DESTINATION'='LS5X':NEXT(TRANSPRT);
;
SC5TOS5Y   RELEASE:RSC5;
           ASSIGN:'RS5'='RS5'+1;
           ASSIGN:'TRPTIME'='trptime_SC5_to_S5';
           ASSIGN:'TRPLOCATIONLINE1'='SC5̄_S5̄';
           ASSIGN:'COMMING_FROM'='LSC5';
           ASSIGN:'DESTINATION'='LS5Y':NEXT(TRANSPRT);
;
SC5TOS7X   RELEASE:RSC5;
           ASSIGN:'RS7'='RS7'+1;
           ASSIGN:'TRPTIME'='trptime_SC5_to_S7';
           ASSIGN:'TRPLOCATIONLINE1'='SC5̄_S5̄';
           ASSIGN:'COMMING_FROM'='LSC5';
           ASSIGN:'DESTINATION'='LS7X':NEXT(TRANSPRT);
;
SC5TOS7Y   RELEASE:RSC5;
           ASSIGN:'RS7'='RS7'+1;
           ASSIGN:'TRPTIME'='trptime_SC5_to_S7';
           ASSIGN:'TRPLOCATIONLINE1'='SC5̄_S5̄';
           ASSIGN:'COMMING_FROM'='LSC5';
           ASSIGN:'DESTINATION'='LS7Y':NEXT(TRANSPRT);
;
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```
V2TOSC5    RELEASE:RV2;
           ASSIGN:'TRPTIME'='trptime_V2_to_SC5';
           ASSIGN:'TRPLOCATIONLINE1'='S4_SC5';
           ASSIGN:'COMMING_FROM'='LV2';
           ASSIGN:'DESTINATION'='LSC5':NEXT(TRANSPRT);
;
V2TOSC6    RELEASE:RV2;
           ASSIGN:'TRPTIME'='trptime_V2_to_SC6';
           ASSIGN:'COMMING_FROM'='LV2';
           ASSIGN:'DESTINATION'='LSC6':NEXT(TRANSPRT);
;
V2TOS4X    RELEASE:RV2;
           ASSIGN:'RS4'='RS4'+1;
           ASSIGN:'TRPTIME'='trptime_V2_to_S4';
           ASSIGN:'TRPLOCATIONLINE1'='S4_SC5';
           ASSIGN:'COMMING_FROM'='LV2';
           ASSIGN:'DESTINATION'='LS4X':NEXT(TRANSPRT);
;
V2TOS4Y    RELEASE:RV2;
           ASSIGN:'RS4'='RS4'+1;
           ASSIGN:'TRPTIME'='trptime_V2_to_S4';
           ASSIGN:'TRPLOCATIONLINE1'='S4_SC5';
           ASSIGN:'COMMING_FROM'='LV2';
           ASSIGN:'DESTINATION'='LS4Y':NEXT(TRANSPRT);
;
V2TOS6X    RELEASE:RV2;
           ASSIGN:'RS6'='RS6'+1;
           ASSIGN:'TRPTIME'='trptime_V2_to_S6';
           ASSIGN:'COMMING_FROM'='LV2';
           ASSIGN:'DESTINATION'='LS6X':NEXT(TRANSPRT);
;
V2TOS6Y    RELEASE:RV2;
           ASSIGN:'RS6'='RS6'+1;
           ASSIGN:'TRPTIME'='trptime_V2_to_S6';
           ASSIGN:'COMMING_FROM'='LV2';
           ASSIGN:'DESTINATION'='LS6Y':NEXT(TRANSPRT);
;
SC6TOB5    RELEASE:RSC6;
           ASSIGN:'TRPTIME'='trptime_SC6_to_B5';
           ASSIGN:'TRPLOCATIONLINE1'='SC5_B5';
           ASSIGN:'COMMING_FROM'='LSC6';
           ASSIGN:'DESTINATION'='LB5':NEXT(TRANSPRT);
;
SC6TOB6    RELEASE:RSC6;
           ASSIGN:'TRPTIME'='trptime_SC6_to_B6';
           ASSIGN:'COMMING_FROM'='LSC6';
           ASSIGN:'DESTINATION'='LB6':NEXT(TRANSPRT);
;
SC6TOS5X   RELEASE:RSC6;
           ASSIGN:'RS5'='RS5'+1;
           ASSIGN:'TRPTIME'='trptime_SC6_to_S5';
           ASSIGN:'TRPLOCATIONLINE1'='SC5_S5';
           ASSIGN:'COMMING_FROM'='LSC6';
           ASSIGN:'DESTINATION'='LS5X':NEXT(TRANSPRT);
;
SC6TOS5Y   RELEASE:RSC6;
           ASSIGN:'RS5'='RS5'+1;
           ASSIGN:'TRPTIME'='trptime_SC6_to_S5';
           ASSIGN:'TRPLOCATIONLINE1'='SC5_S5';
           ASSIGN:'COMMING_FROM'='LSC6';
           ASSIGN:'DESTINATION'='LS5Y':NEXT(TRANSPRT);
;
SC6TOS7X   RELEASE:RSC6;
           ASSIGN:'RS7'='RS7'+1;
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              ASSIGN:'TRPTIME'='trptime_SC6_to_S7';
              ASSIGN:'COMMING_FROM'='LSC6';
              ASSIGN:'DESTINATION'='LS7X':NEXT(TRANSPRT);
;
SC6TOS7Y      RELEASE:RSC6;
              ASSIGN:'RS7'='RS7'+1;
              ASSIGN:'TRPTIME'='trptime_SC6_to_S7';
              ASSIGN:'COMMING_FROM'='LSC6';
              ASSIGN:'DESTINATION'='LS7Y':NEXT(TRANSPRT);
;
S4XTOSC6      REMOVE:1,'LS4X',S4THING1:DISPOSE;
S4THING1      ASSIGN:'RS4'='RS4'-1;
              BRANCH,2:IF,'RS4'.EQ.('LTS4'-1),SIGNSTCH:ALWAYS,PRIO10;
PRIO10        ASSIGN:'TRPTIME'='trptime_S4_to_SC6';
              ASSIGN:'TRPLOCATIONLINE1'='S4_SC5';
              ASSIGN:'COMMING_FROM'='LS4X';
              ASSIGN:'DESTINATION'='LSC6':NEXT(TRANSPRT);
;
S4YTOSC6      REMOVE:1,'LS4Y',S4THING2:DISPOSE;
S4THING2      ASSIGN:'RS4'='RS4'-1;
              BRANCH,2:IF,'RS4'.EQ.('LTS4'-1),SIGNSTCH:ALWAYS,PRIO11;
PRIO11        ASSIGN:'TRPTIME'='trptime_S4_to_SC6';
              ASSIGN:'TRPLOCATIONLINE1'='S4_SC5';
              ASSIGN:'COMMING_FROM'='LS4Y';
              ASSIGN:'DESTINATION'='LSC6':NEXT(TRANSPRT);
;
S4XTOSC5      REMOVE:1,'LS4X',S4THING3:DISPOSE;
S4THING3      ASSIGN:'RS4'='RS4'-1;
              BRANCH,2:IF,'RS4'.EQ.('LTS4'-1),SIGNSTCH:ALWAYS,PRIO12;
PRIO12        ASSIGN:'TRPTIME'='trptime_S4_to_SC5';
              ASSIGN:'TRPLOCATIONLINE1'='S4_SC5';
              ASSIGN:'COMMING_FROM'='LS4X';
              ASSIGN:'DESTINATION'='LSC5':NEXT(TRANSPRT);
;
S4YTOSC5      REMOVE:1,'LS4Y',S4THING4:DISPOSE;
S4THING4      ASSIGN:'RS4'='RS4'-1;
              BRANCH,2:IF,'RS4'.EQ.('LTS4'-1),SIGNSTCH:ALWAYS,PRIO13;
PRIO13        ASSIGN:'TRPTIME'='trptime_S4_to_SC5';
              ASSIGN:'TRPLOCATIONLINE1'='S4_SC5';
              ASSIGN:'COMMING_FROM'='LS4Y';
              ASSIGN:'DESTINATION'='LSC5':NEXT(TRANSPRT);
;
S4XTOV2       REMOVE:'SAVEJ','LS4X',S4THING5:DISPOSE;
S4THING5      ASSIGN:'RS4'='RS4'-1;
              BRANCH,2:IF,'RS4'.EQ.('LTS4'-1),SIGNSTCH:ALWAYS,PRIO14;
PRIO14        ASSIGN:'TRPTIME'='trptime_S4_to_V2';
              ASSIGN:'TRPLOCATIONLINE1'='S4_SC5';
              ASSIGN:'COMMING_FROM'='LS4X';
              ASSIGN:'DESTINATION'='LV2':NEXT(TRANSPRT);
;
S4YTOV2       REMOVE:'SAVEJ','LS4Y',S4THING6:DISPOSE;
S4THING6      ASSIGN:'RS4'='RS4'-1;
              BRANCH,2:IF,'RS4'.EQ.('LTS4'-1),SIGNSTCH:ALWAYS,PRIO15;
PRIO15        ASSIGN:'TRPTIME'='trptime_S4_to_V2';
              ASSIGN:'TRPLOCATIONLINE1'='S4_SC5';
              ASSIGN:'COMMING_FROM'='LS4Y';
              ASSIGN:'DESTINATION'='LV2':NEXT(TRANSPRT);
;
S5XTOB5       REMOVE:1,'LS5X',S5THING1:DISPOSE;
S5THING1      ASSIGN:'RS5'='RS5'-1;
              BRANCH,2:IF,'RS5'.EQ.('LTS5'-1),SIGNSTCH:ALWAYS,PRIO16;
PRIO16        ASSIGN:'TRPTIME'='trptime_S5_to_B5';
              ASSIGN:'TRPLOCATIONLINE1'='S5_B5';
              ASSIGN:'COMMING_FROM'='LS5Y';
```

```
                    ASSIGN:'DESTINATION'='LB5':NEXT(TRANSPRT);
;
S5YTOB5     REMOVE:1,'LS5Y',S5THING2:DISPOSE;
S5THING2    ASSIGN:'RS5'='RS5'-1;
            BRANCH,2:IF,'RS5'.EQ.('LTS5'-1),SIGNSTCH:ALWAYS,PRIO17;
PRIO17      ASSIGN:'TRPTIME'='trptime_S5_to_B5';
            ASSIGN:'TRPLOCATIONLINE1'='S5_B5';
            ASSIGN:'COMMING_FROM'='LS5Y';
            ASSIGN:'DESTINATION'='LB5':NEXT(TRANSPRT);
;
S5XTOB6     REMOVE:1,'LS5X',S5THING3:DISPOSE;
S5THING3    ASSIGN:'RS5'='RS5'-1;
            BRANCH,2:IF,'RS5'.EQ.('LTS5'-1),SIGNSTCH:ALWAYS,PRIO18;
PRIO18      ASSIGN:'TRPTIME'='trptime_S5_to_B6';
            ASSIGN:'TRPLOCATIONLINE1'='SC5_S5';
            ASSIGN:'COMMING_FROM'='LS5X';
            ASSIGN:'DESTINATION'='LB6':NEXT(TRANSPRT);
;
S5YTOB6     REMOVE:1,'LS5Y',S5THING4:DISPOSE;
S5THING4    ASSIGN:'RS5'='RS5'-1;
            BRANCH,2:IF,'RS5'.EQ.('LTS5'-1),SIGNSTCH:ALWAYS,PRIO19;
PRIO19      ASSIGN:'TRPTIME'='trptime_S5_to_B6';
            ASSIGN:'TRPLOCATIONLINE1'='SC5_S5';
            ASSIGN:'COMMING_FROM'='LS5Y';
            ASSIGN:'DESTINATION'='LB6':NEXT(TRANSPRT);
;
S6XTOV2     REMOVE:'SAVEJ','LS6X',S6THING1:DISPOSE;
S6THING1    ASSIGN:'RS6'='RS6'-1;
            BRANCH,2:IF,'RS6'.EQ.('LTS6'-1),SIGNSTCH:ALWAYS,PRIO20;
PRIO20      ASSIGN:'TRPTIME'='trptime_S6_to_V2';
            ASSIGN:'COMMING_FROM'='LS6X';
            ASSIGN:'DESTINATION'='LV2':NEXT(TRANSPRT);
;
S6YTOV2     REMOVE:'SAVEJ','LS6Y',S6THING2:DISPOSE;
S6THING2    ASSIGN:'RS6'='RS6'-1;
            BRANCH,2:IF,'RS6'.EQ.('LTS6'-1),SIGNSTCH:ALWAYS,PRIO21;
PRIO21      ASSIGN:'TRPTIME'='trptime_S6_to_V2';
            ASSIGN:'COMMING_FROM'='LS6Y';
            ASSIGN:'DESTINATION'='LV2':NEXT(TRANSPRT);
;
S6XTOSC6    REMOVE:1,'LS6X',S6THING3:DISPOSE;
S6THING3    ASSIGN:'RS6'='RS6'-1;
            BRANCH,2:IF,'RS6'.EQ.('LTS6'-1),SIGNSTCH:ALWAYS,PRIO22;
PRIO22      ASSIGN:'TRPTIME'='trptime_S6_to_SC6';
            ASSIGN:'COMMING_FROM'='LS6X';
            ASSIGN:'DESTINATION'='LSC6':NEXT(TRANSPRT);
;
S6YTOSC6    REMOVE:1,'LS6Y',S6THING4:DISPOSE;
S6THING4    ASSIGN:'RS6'='RS6'-1;
            BRANCH,2:IF,'RS6'.EQ.('LTS6'-1),SIGNSTCH:ALWAYS,PRIO23;
PRIO23      ASSIGN:'TRPTIME'='trptime_S6_to_SC6';
            ASSIGN:'COMMING_FROM'='LS6Y';
            ASSIGN:'DESTINATION'='LSC6':NEXT(TRANSPRT);
;
S6XTOSC5    REMOVE:1,'LS6X',S6THING5:DISPOSE;
S6THING5    ASSIGN:'RS6'='RS6'-1;
            BRANCH,2:IF,'RS6'.EQ.('LTS6'-1),SIGNSTCH:ALWAYS,PRIO24;
PRIO24      ASSIGN:'TRPTIME'='trptime_S6_to_SC5';
            ASSIGN:'TRPLOCATIONLINE1'='S4_SC5';
            ASSIGN:'COMMING_FROM'='LS6X';
            ASSIGN:'DESTINATION'='LSC5':NEXT(TRANSPRT);
;
S6YTOSC5    REMOVE:1,'LS6Y',S6THING6:DISPOSE;
S6THING6    ASSIGN:'RS6'='RS6'-1;
```

```
                    BRANCH,2:IF,'RS6'.EQ.('LTS6'-1),SIGNSTCH:ALWAYS,PRIO25;
PRIO25              ASSIGN:'TRPTIME'='trptime_S6_to_SC5';
                    ASSIGN:'TRPLOCATIONLINE1'='S4_SC5';
                    ASSIGN:'COMMING_FROM'='LS6Y';
                    ASSIGN:'DESTINATION'='LSC5':NEXT(TRANSPRT);
;
S7XTOB5             REMOVE:1,'LS7X',S7THING1:DISPOSE;
S7THING1            ASSIGN:'RS7'='RS7'-1;
                    BRANCH,2:IF,'RS7'.EQ.('LTS7'-1),SIGNSTCH:ALWAYS,PRIO26;
PRIO26              ASSIGN:'TRPTIME'='trptime_S7_to_B5';
                    ASSIGN:'TRPLOCATIONLINE1'='SC5_B5';
                    ASSIGN:'COMMING_FROM'='LS7X';
                    ASSIGN:'DESTINATION'='LB5':NEXT(TRANSPRT);
;
S7YTOB5             REMOVE:1,'LS7Y',S7THING2:DISPOSE;
S7THING2            ASSIGN:'RS7'='RS7'-1;
                    BRANCH,2:IF,'RS7'.EQ.('LTS7'-1),SIGNSTCH:ALWAYS,PRIO27;
PRIO27              ASSIGN:'TRPTIME'='trptime_S7_to_B5';
                    ASSIGN:'TRPLOCATIONLINE1'='SC5_B5';
                    ASSIGN:'COMMING_FROM'='LS7Y';
                    ASSIGN:'DESTINATION'='LB5':NEXT(TRANSPRT);
;
S7XTOB6             REMOVE:1,'LS7X',S7THING3:DISPOSE;
S7THING3            ASSIGN:'RS7'='RS7'-1;
                    BRANCH,2:IF,'RS7'.EQ.('LTS7'-1),SIGNSTCH:ALWAYS,PRIO28;
PRIO28              ASSIGN:'TRPTIME'='trptime_S7_to_B6';
                    ASSIGN:'COMMING_FROM'='LS7X';
                    ASSIGN:'DESTINATION'='LB6':NEXT(TRANSPRT);
;
S7YTOB6             REMOVE:1,'LS7Y',S7THING4:DISPOSE;
S7THING4            ASSIGN:'RS7'='RS7'-1;
                    BRANCH,2:IF,'RS7'.EQ.('LTS7'-1),SIGNSTCH:ALWAYS,PRIO29;
PRIO29              ASSIGN:'TRPTIME'='trptime_S7_to_B6';
                    ASSIGN:'COMMING_FROM'='LS7Y';
                    ASSIGN:'DESTINATION'='LB6':NEXT(TRANSPRT);
;
;
;---STATISTICS---
;
TRANSPRT            QUEUE,79:MARK('A_INDEX_AD_TO_TIMEINTRP');
;
                    BRANCH,1:
                       IF,'COMMING_FROM'.EQ.'LV2',TALLXTV2:
                       ELSE,CFTHING;
;
TALLXTV2            ASSIGN:'WTXITTV2'=TNOW-'WTXITTV2';
                    TALLY:22,'WTXITTV2';
;
CFTHING            BRANCH,1:
                       IF,'COMMING_FROM'.GE.9,FRSTOCK:
                       ELSE,FRMACHIN;
;
FRSTOCK            ASSIGN:'T_IN_STOCKS'='T_IN_STOCKS'+TNOW-'AD_TO_T_IN_STOCKS';
                    TALLY:18,'RS4';
                    TALLY:19,'RS5';
                    TALLY:20,'RS6';
                    TALLY:21,'RS7':NEXT(WANTBRAN);
;
FRMACHIN           ASSIGN:'WTFORXTT'='WTFORXTT'+TNOW-'AD_TO_WTFORXTT';
;
;---IF THE TRANSPORT IS DESTINATED TO A MACHINE----
;---THE MACHINESTATE "waiting FOR A TRP OF A NEW---
;---ROLL TO PROCESS" IS CHANGED TO "NOT WANTING"---
;
```

```
WANTBRAN    BRANCH,1:
            IF,'DESTINATION'.EQ.'LV1',TO2TRP:
            IF,'DESTINATION'.EQ.'LC5',TO3TRP:
            IF,'DESTINATION'.EQ.'LSC5',TO4TRP:
            IF,'DESTINATION'.EQ.'LB5',TO5TRP:
            IF,'DESTINATION'.EQ.'LV2',TO6TRP:
            IF,'DESTINATION'.EQ.'LSC6',TO7TRP:
            IF,'DESTINATION'.EQ.'LB6',TO8TRP:
            ELSE,SEIZP;
;
TO2TRP      ASSIGN:'V1w'='N':NEXT(SEIZP);
TO3TRP      ASSIGN:'C5w'='N':NEXT(SEIZP);
TO4TRP      ASSIGN:'SC5w'='N':NEXT(SEIZP);
TO5TRP      ASSIGN:'B5w'='N':NEXT(SEIZP);
TO6TRP      ASSIGN:'V2w'='N':NEXT(SEIZP);
TO7TRP      ASSIGN:'SC6w'='N':NEXT(SEIZP);
TO8TRP      ASSIGN:'B6w'='N':NEXT(SEIZP);
;
;---SEIZE CRANE('MYCRANE'). IF THE TRANSPORT---
;---STARTS IN LINE 1, MOVE CRANE TO JOB--------
;
SEIZP       BRANCH,1:
            IF,'MYCRANE'.EQ.1,SZP1TRPT:
            IF,'MYCRANE'.EQ.2,SZP2TRPT:
            IF,'MYCRANE'.EQ.3,SZP3TRPT:
            IF,'MYCRANE'.EQ.4,SZP4TRPT;
;
SZP1TRPT    ASSIGN:'wC1'='TRPLOCATIONLINE1';
            QUEUE,80;
            SEIZE:CRANE(1):NEXT(STARTL);
;
SZP2TRPT    ASSIGN:'wC2'='TRPLOCATIONLINE1';
            QUEUE,81;
            SEIZE:CRANE(2):NEXT(STARTL);
;
SZP3TRPT    ASSIGN:'wC3'='TRPLOCATIONLINE1';
            QUEUE,82;
            SEIZE:CRANE(3):NEXT(STARTL);
;
SZP4TRPT    QUEUE,93;
            SEIZE:CRANE(4):NEXT(STARTL);
;
;---FIND OUT WHAT KIND OF TRANSPORT IT IS GOING TO BE---
;
STARTL      BRANCH,1:
            IF,'MYCRANE'.EQ.4,STARTL2:
            ELSE,STARTL1;
;
STARTL1     BRANCH,1:
            IF,'DESTINATION'.GE.6.AND.'DESTINATION'.LE.8,TOLINE2:
            IF,'DESTINATION'.GE.15,TOLINE2:
            ELSE,STAYSINL;
;
STARTL2     BRANCH,1:
            IF,'DESTINATION'.LE.5,TOLINE1:
            IF,'DESTINATION'.GE.9.AND.'DESTINATION'.LE.14,TOLINE1:
            ELSE,STAYSINL;
;
;***TRANSPORT WITHIN SAME LINE***
;
STAYSINL    COUNT:2;
            RELEASE:LOCKER;
            DELAY:'TRPTIME':NEXT(DESTINAT);
;
```

```
;***END TRANSPORT WITHIN SAME LINE***
;
;***TRANSPORT WITH CHANGE OF LINE***
;
;---EX: c2TOL1 = "CONVEYOR 2 IS GOING TO-----
;---BE USED FOR A TRP TO LINE 1"------------
;
TOLINE1    BRANCH,1:
               IF,'MYCONVEYOR'.EQ.2,C2THING:
               IF,'MYCONVEYOR'.EQ.3,C3THING;
;
TOLINE2    BRANCH,1:
               IF,'MYCONVEYOR'.EQ.2,LC2THING:
               IF,'MYCONVEYOR'.EQ.3,LC3THING;
;
C2THING    ASSIGN:'TRPTYPE'=1;
           BRANCH,2:ALWAYS,Lc2TOL1:ALWAYS,STTRP;
C3THING    ASSIGN:'TRPTYPE'=2;
           BRANCH,2:ALWAYS,Lc3TOL1:ALWAYS,STTRP;
LC2THING   ASSIGN:'TRPTYPE'=3;
           BRANCH,2:ALWAYS,Lc2TOL2:ALWAYS,STTRP;
LC3THING   ASSIGN:'TRPTYPE'=4;
           BRANCH,2:ALWAYS,Lc3TOL2:ALWAYS,STTRP;
;
Lc2TOL1    QUEUE,1:DETACH;          !THE NQ(i) VARIABLES GIVE THE NUMBER
;                                   !OF ENTITIES IN QUEUE NR i.
Lc3TOL1    QUEUE,2:DETACH;          !IF THERE IS AN ENTITY IN QUEUE 1 - 4
;                                   !THERE IS GOING TO BE A CONVEYOR TRP.
Lc2TOL2    QUEUE,3:DETACH;          !THIS IS USED TO CALCULATE THE
;                                   !POSSIBILITY OF A TRP AT THE MACHINES
Lc3TOL2    QUEUE,4:DETACH;          !EX: c3TOL2 = NQ(4)  (SEE SYNONYMES)
;
DID        ASSIGN:X(50)=1:DISPOSE;
;
;---TRP TO CONVEYOR---
;
STTRP      RELEASE:LOCKER;
           COUNT:3;
           DELAY:('TRPTIME'/2-'CONVTIME');
;
;---SEIZE CONVEYOR---
;
SZc        BRANCH,1:
               IF,'MYCONVEYOR'.EQ.2,SZc2:
               IF,'MYCONVEYOR'.EQ.3,SZc3;
;
SZc2       QUEUE,94;
           SEIZE:CONVEYOR(2):NEXT(cTRP);
;
SZc3       QUEUE,95;
           SEIZE:CONVEYOR(3):NEXT(cTRP);
;
;---CONVEYOR SEIZED---------------------
;---RELEASE TRANSPORTING CRANE AND TRP---
;---TO OTHER LINE-----------------------
;
cTRP       RELEASE:CRANE('MYCRANE');
           SIGNAL:'STATECHANGE';
           DELAY:'CONVTIME':NEXT(ARRL);
;
;---CONVEYOR ARRIVED AT OTHER LINE---
;---SEIZE A CRANE--------------------
;
ARRL       BRANCH,1:
```

```
                IF,'MYCRANE'.EQ.4,TRYARR1:
                ELSE,TRYARR2;
;
WTFORPc2    RELEASE:LOCKER;
            QUEUE,'WTQc2AR1';                        !WAITING FOR A CHANGE OF STATE
            WAIT:'WTQc2AR1',1;
;
            QUEUE,96;
            SEIZE:LOCKER;
            SIGNAL:'SEIZEDLOCKER':NEXT(FRLOCK14);
;
WTFORPc3    RELEASE:LOCKER;
            QUEUE,'WTQc3AR1';                        !WAITING FOR A CHANGE OF STATE
            WAIT:'WTQc3AR1',1;
;
            QUEUE,97;
            SEIZE:LOCKER;
            SIGNAL:'SEIZEDLOCKER':NEXT(FRLOCK14);
;
TRYARR1     QUEUE,98;
            SEIZE:LOCKER;
;
FRLOCK14    BRANCH,2:ALWAYS,WCALCc:ALWAYS,CALCc;        !SEND ENTITY TO CALCULATE
;                                                       !THE CRANE STATE
WCALCc      QUEUE,99;
            SCAN:'CALCULATEDCRANESTATE'.EQ.'Y';
            ASSIGN:'CALCULATEDCRANESTATE'='N';
;
            BRANCH,1:
               IF,'MYCONVEYOR'.EQ.2,LC2TING:
               IF,'MYCONVEYOR'.EQ.3,LC3TING;
;
LC2TING     BRANCH,1:
               IF,'avCc2'.NE.0,SZPc2AR1:
               ELSE,WTFORPc2;
;
LC3TING     BRANCH,1:
               IF,'avCc3'.NE.0,SZPc3AR1:
               ELSE,WTFORPc3;
;
TRYARR2     QUEUE,100;
            SEIZE:LOCKER:NEXT(FRLOCK15);
;
WTFORP4c    RELEASE:LOCKER;
            QUEUE,'WQcAR2';                          !WAITING FOR A CHANGE OF STATE
            WAIT:'WQcAR2',1;
;
            QUEUE,101;
            SEIZE:LOCKER;
            SIGNAL:'SEIZEDLOCKER';
;
FRLOCK15    BRANCH,1:
               IF,'oC4'.EQ.'N',SEIZP4c:
               ELSE,WTFORP4c;
;
SZPc2AR1    ASSIGN:'MYCRANE'='avCc2':NEXT(SEIZFORc);
SZPc3AR1    ASSIGN:'MYCRANE'='avCc3':NEXT(SEIZFORc);
SEIZP4c     ASSIGN:'MYCRANE'=4:NEXT(SEIZFORc);
;
;---THERE IS NOW A CRANE FOR THE CONVEYOR---
;---SEIZE IT--------------------------------
;
SEIZFORc    BRANCH,1:
               IF,'MYCRANE'.EQ.2,SZP2ARR:
```

```
                  IF,'MYCRANE'.EQ.3,SZP3ARR:
                  IF,'MYCRANE'.EQ.4,SZP4ARR;
;
SZP2ARR     ASSIGN:'wC2'='TRPLOCATIONLINE1';
            QUEUE,102;
            SEIZE:CRANE(2):NEXT(FINISHTP);
;
SZP3ARR     ASSIGN:'wC3'='TRPLOCATIONLINE1';
            QUEUE,119;
            SEIZE:CRANE(3):NEXT(FINISHTP);
;
SZP4ARR     QUEUE,120;
            SEIZE:CRANE(4):NEXT(FINISHTP);
;
;---TRP FROM CONVEYOR TO DESTINATION---
;
FINISHTP    RELEASE:CONVEYOR('MYCONVEYOR');
HLAST       REMOVE:NQ,'TRPTYPE',DID;
HHLAST      QUEUE,121;
            SCAN:X(50).EQ.1;
            ASSIGN:X(50)=0;
            ASSIGN:'TRPTYPE'=0;
            SIGNAL:'STATECHANGE';
LAST        RELEASE:LOCKER;
PRIO31      DELAY:('TRPTIME'/2-'CONVTIME'):NEXT(DESTINAT);
;
;---ROUTE TO DESTINATION---
;
DESTINAT  ASSIGN:'TIMEINTRP'='TIMEINTRP'+TNOW-'AD_TO_TIMEINTRP';
;
            BRANCH,1:
               IF,'DESTINATION'.EQ.'LV1',V1:
               IF,'DESTINATION'.EQ.'LC5',C5:
               IF,'DESTINATION'.EQ.'LSC5',SC5:
               IF,'DESTINATION'.EQ.'LB5',B5:
               IF,'DESTINATION'.EQ.'LV2',V2:
               IF,'DESTINATION'.EQ.'LSC6',SC6:
               IF,'DESTINATION'.EQ.'LB6',B6:
               IF,'DESTINATION'.EQ.'LS2',S2:
               IF,'DESTINATION'.EQ.'LS3',S3:
               IF,'DESTINATION'.EQ.'LS4X',S4:
               IF,'DESTINATION'.EQ.'LS4Y',S4:
               IF,'DESTINATION'.EQ.'LS5X',S5:
               IF,'DESTINATION'.EQ.'LS5Y',S5:
               IF,'DESTINATION'.EQ.'LS6X',S6:
               IF,'DESTINATION'.EQ.'LS6Y',S6:
               IF,'DESTINATION'.EQ.'LS7X',S7:
               IF,'DESTINATION'.EQ.'LS7Y',S7;
;
;***END TRANSPORT SEQUENCES*********************************************
;
;***ADMINISTRATION OF EXIT- AND GET-ROLL PRIORITY ORDER********************
;
;---AT THE STATECHANGES: RELEASE OF TRP, A MACHINE ENTERS THE STATE------
;---waiting FOR A ROLL TO PROCESS, A ROLL IS TAKEN OUT OF A FULL STOCK---
;---AND WHEN THE "CONVEYOR TO LINE" VARIABLES ARE CHANGED, AN ENTITY-----
;---IS SENT TO THE LABEL SIGNSTCH OR A STATECHANGESIGNAL IS SENT.--------
;---THE CONVEYORS AND MACHINES CAN BE WAITING TO EXIT A ROLL AND THE-----
;---MACHINES CAN BE WAITING TO GET A ROLL. THIS SECTION ADMINISTRATES----
;---IN WHAT ORDER THIS IS TO BE DONE------------------------------------
;
SIGNSTCH  SIGNAL:'STATECHANGE':DISPOSE;
;
            CREATE,50;
```

```
;
HEREPRIO    ASSIGN:A(1)=CO(101);        !CO(i) = CONSTANT NR i
            ASSIGN:A(2)=CO(102);        !IN EXPERIMENT FRAME
            ASSIGN:A(3)=CO(103);
            ASSIGN:A(4)=CO(104);
            ASSIGN:A(5)=CO(105);
            ASSIGN:A(6)=CO(106);
            ASSIGN:A(7)=CO(107);
            ASSIGN:A(8)=CO(108);
            ASSIGN:A(9)=CO(109);
            ASSIGN:A(10)=CO(110);
            ASSIGN:A(11)=CO(111);
            ASSIGN:A(12)=CO(112);
            ASSIGN:A(13)=CO(113);
            ASSIGN:A(14)=CO(114);
            ASSIGN:A(15)=CO(115);
            ASSIGN:A(16)=CO(116);
;
BACKPRIO    QUEUE,122;
            WAIT:'STATECHANGE',1;
            BRANCH,2:ALWAYS,BACKPRIO:ALWAYS,DOPRIO;
;
DOPRIO      QUEUE,123,1;
            SEIZE:SYNC;
;
            BRANCH,1:
              IF,'oC1'+'oC2'+'oC3'+'oC4'.EQ.4,PDESTROY: !ALL CRANES BUSY
              IF,NQ(A(1))+NQ(A(2))+NQ(A(3))+NQ(A(4)).EQ.0,JUMPTO5:
              IF,NQ(A(1)).NE.0,DOSIGN1:
              ELSE,JUMPTO2;
DOSIGN1     SIGNAL:CO(101);
            QUEUE,124;
            WAIT:'SEIZEDLOCKER',1;
JUMPTO2     BRANCH,1:
              IF,NQ(A(2)).NE.0,DOSIGN2:
              ELSE,JUMPTO3;
DOSIGN2     SIGNAL:CO(102);
            QUEUE,125;
            WAIT:'SEIZEDLOCKER',1;
JUMPTO3     BRANCH,1:
              IF,NQ(A(3)).NE.0,DOSIGN3:
              ELSE,JUMPTO4;
DOSIGN3     SIGNAL:CO(103);
            QUEUE,126;
            WAIT:'SEIZEDLOCKER',1;
JUMPTO4     BRANCH,1:
              IF,NQ(A(4)).NE.0,DOSIGN4:
              ELSE,JUMPTO5;
DOSIGN4     SIGNAL:CO(104);
            QUEUE,127;
            WAIT:'SEIZEDLOCKER',1;
JUMPTO5     BRANCH,1:
              IF,NQ(A(5))+NQ(A(6))+NQ(A(7))+NQ(A(8)).EQ.0,JUMPTO9:
              IF,NQ(A(5)).NE.0,DOSIGN5:
              ELSE,JUMPTO6;
DOSIGN5     SIGNAL:CO(105);
            QUEUE,128;
            WAIT:'SEIZEDLOCKER',1;
JUMPTO6     BRANCH,1:
              IF,NQ(A(6)).NE.0,DOSIGN6:
              ELSE,JUMPTO7;
DOSIGN6     SIGNAL:CO(106);
            QUEUE,129;
            WAIT:'SEIZEDLOCKER',1;
```

```
JUMPTO7     BRANCH,1:
            IF,NQ(A(7)).NE.0,DOSIGN7:
            ELSE,JUMPTO8;
DOSIGN7     SIGNAL:CO(107);
            QUEUE,130;
            WAIT:'SEIZEDLOCKER',1;
JUMPTO8     BRANCH,1:
            IF,NQ(A(8)).NE.0,DOSIGN8:
            ELSE,JUMPTO9;
DOSIGN8     SIGNAL:CO(108);
            QUEUE,131;
            WAIT:'SEIZEDLOCKER',1;
JUMPTO9     BRANCH,1:
            IF,NQ(A(9))+NQ(A(10))+NQ(A(11))+NQ(A(12)).EQ.0,JUMPTO13:
            IF,NQ(A(9)).NE.0,DOSIGN9:
            ELSE,JUMPTO10;
DOSIGN9     SIGNAL:CO(109);
            QUEUE,132;
            WAIT:'SEIZEDLOCKER',1;
JUMPTO10    BRANCH,1:
            IF,NQ(A(10)).NE.0,DOSIGN10:
            ELSE,JUMPTO11;
DOSIGN10    SIGNAL:CO(110);
            QUEUE,133;
            WAIT:'SEIZEDLOCKER',1;
JUMPTO11    BRANCH,1:
            IF,NQ(A(11)).NE.0,DOSIGN11:
            ELSE,JUMPTO12;
DOSIGN11    SIGNAL:CO(111);
            QUEUE,134;
            WAIT:'SEIZEDLOCKER',1;
JUMPTO12    BRANCH,1:
            IF,NQ(A(12)).NE.0,DOSIGN12:
            ELSE,JUMPTO13;
DOSIGN12    SIGNAL:CO(112);
            QUEUE,135;
            WAIT:'SEIZEDLOCKER',1;
JUMPTO13    BRANCH,1:
            IF,NQ(A(13))+NQ(A(14))+NQ(A(15))+NQ(A(16)).EQ.0,PDESTROY:
            IF,NQ(A(13)).NE.0,DOSIGN13:
            ELSE,JUMPTO14;
DOSIGN13    SIGNAL:CO(113);
            QUEUE,136;
            WAIT:'SEIZEDLOCKER',1;
JUMPTO14    BRANCH,1:
            IF,NQ(A(14)).NE.0,DOSIGN14:
            ELSE,JUMPTO15;
DOSIGN14    SIGNAL:CO(114);
            QUEUE,137;
            WAIT:'SEIZEDLOCKER',1;
JUMPTO15    BRANCH,1:
            IF,NQ(A(15)).NE.0,DOSIGN15:
            ELSE,JUMPTO16;
DOSIGN15    SIGNAL:CO(115);
            QUEUE,138;
            WAIT:'SEIZEDLOCKER',1;
JUMPTO16    BRANCH,1:
            IF,NQ(A(16)).NE.0,DOSIGN16:
            ELSE,PDESTROY;
DOSIGN16    SIGNAL:CO(116);
            QUEUE,139;
            WAIT:'SEIZEDLOCKER',1;
;
PDESTROY    RELEASE:SYNC:DISPOSE;
```

```
;
;***END ADMINISTRATION OF EXIT- AND GET-ROLL PRIORITY ORDER*****************
;
;***STARTINGUP THE SIMULATION*********************************************
;
INIT        CREATE,1;                  !INITIATE MACHINE STATES
            ASSIGN:'V1w'='Y';          !w = waiting FOR A ROLL TO BE TRANSPORTED
            ASSIGN:'C5w'='Y';          !FOR PROCESSING
            ASSIGN:'SC5w'='Y';
            ASSIGN:'B5w'='Y';
            ASSIGN:'V2w'='Y';
            ASSIGN:'SC6w'='Y';
            ASSIGN:'B6w'='Y':DISPOSE;
;
            CREATE,8,0:15,20:NEXT(SEVEN);        !PRODUCTION SEQUENCE
            CREATE,1,1:15,20:NEXT(EIGHT);
            CREATE,5,2:15,20:NEXT(NINE);
            CREATE,16,3:15,20:NEXT(ONE);
            CREATE,9,4:15,20:NEXT(FOUR);
            CREATE,7,5:15,20:NEXT(TWO);
            CREATE,6,6:15,20:NEXT(FIVE);
            CREATE,19,7:15,20:NEXT(THREE);
            CREATE,20,8:15,20:NEXT(TWO);
            CREATE,4,9:15,20:NEXT(FIVE);
            CREATE,5,10:15,20:NEXT(SEVEN);
            CREATE,20,11:15,20:NEXT(EIGHT);
            CREATE,16,12:15,20:NEXT(THREE);
            CREATE,7,13:15,20:NEXT(TWO);
;
ONE         ASSIGN:'TYPE'=1;
            ASSIGN:'GROUP'='A';
            ASSIGN:'BWEIGHT'=1:NEXT(MAP5);
;
TWO         ASSIGN:'TYPE'=2;
            ASSIGN:'GROUP'='A';
            ASSIGN:'BWEIGHT'=2:NEXT(MAP5);
;
THREE       ASSIGN:'TYPE'=3;
            ASSIGN:'GROUP'='A';
            ASSIGN:'BWEIGHT'=3:NEXT(MAP5);
;
FOUR        ASSIGN:'TYPE'=4;
            ASSIGN:'GROUP'='B';
            ASSIGN:'BWEIGHT'=1:NEXT(MAP5);
;
FIVE        ASSIGN:'TYPE'=5;
            ASSIGN:'GROUP'='B';
            ASSIGN:'BWEIGHT'=2:NEXT(MAP5);
;
SIX         ASSIGN:'TYPE'=6;
            ASSIGN:'GROUP'='B';
            ASSIGN:'BWEIGHT'=3:NEXT(MAP5);
;
SEVEN       ASSIGN:'TYPE'=7;
            ASSIGN:'GROUP'='C';
            ASSIGN:'BWEIGHT'=1:NEXT(MAP5);
;
EIGHT       ASSIGN:'TYPE'=8;
            ASSIGN:'GROUP'='C';
            ASSIGN:'BWEIGHT'=2:NEXT(MAP5);
;
NINE        ASSIGN:'TYPE'=9;
            ASSIGN:'GROUP'='C';
            ASSIGN:'BWEIGHT'=3:NEXT(MAP5);
```

```
;
;***END STARTINGUP THE SIMULATION**************************************************
;
MDESTROY   RELEASE:LOCKER:DISPOSE;   !FOR THE GET-ROLL ENTITIES WHEN TRYING TO
;                                    !GET A ROLL AND FINDING THAT ANOTHER
;                                    !MACHINE HAS ALREADY SENT ONE
;
END;
```

B.2. THE EXPERIMENT FRAME.

BEGIN;
PROJECT,m3or,MICK,11/11/11;
;
DISCRETE,6000,35,160;
;
RESOURCES:1,RMAP5:
          2,RV1:
          3,RC5:
          4,RSC5:
          5,RB5:
          6,RV2:
          7,RSC6:
          8,RB6:
          9-12,CRANE:
          13-15,CONVEYOR:
          16,SYNC:
          17,LOCKER;
;
REPLICATE,1,,200000,NO,NO,4000;
;
RANKINGS:9,LIFO:10,LIFO:11,LIFO:12,LIFO:15,LIFO:16,LIFO;
;
DISTRIBUTIONS: 1,RN(1,1):   !trptime_MAP5_to_V1
               2,RN(2,2):   !trptime_MAP5_to_S2
               3,RN(3,3):   !trptime_S2_to_V1
               4,RN(4,4):   !trptime_V1_to_C5
               5,RN(5,5):   !trptime_V1_to_S3
               6,RN(6,6):   !trptime_S3_to_C5
               7,RN(7,7):   !trptime_C5_to_SC5
               8,RN(8,8):   !trptime_C5_to_V2
               9,RN(9,9):   !trptime_C5_to_SC6
               10,RN(10,10):   !trptime_C5_to_S4
               11,RN(11,1):   !trptime_C5_to_S6
               12,RN(12,2):   !trptime_S4_to_SC5
               13,RN(13,3):   !trptime_S4_to_V2
               14,RN(14,4):   !trptime_S4_to_SC6
               15,RN(15,5):   !trptime_SC5_to_B5
               16,RN(16,6):   !trptime_SC5_to_B6
               17,RN(17,7):   !trptime_SC5_to_S5
               18,RN(18,8):   !trptime_SC5_to_S7
               19,RN(19,9):   !trptime_S5_to_B5
               20,RN(20,10):   !trptime_S5_to_B6
               21,RN(21,1):   !trptime_V2_to_SC6
               22,RN(22,2):   !trptime_V2_to_SC5
               23,RN(23,3):   !trptime_V2_to_S4
               24,RN(24,4):   !trptime_V2_to_S6
               25,RN(25,5):   !trptime_S6_to_SC6
               26,RN(26,6):   !trptime_S6_to_SC5
               27,RN(27,7):   !trptime_S6_to_V2
               28,RN(28,8):   !trptime_SC6_to_B6
               29,RN(29,9):   !trptime_SC6_to_B5
               30,RN(30,10):   !trptime_SC6_to_S5
               31,RN(31,1):   !trptime_SC6_to_S7
               32,RN(32,2):   !trptime_S7_to_B6
               33,RN(33,3):   !trptime_S7_to_B5
               34,RN(1,1):35,RN(1,1):36,RN(1,1):37,RN(1,1):
               38,RN(1,1):39,RN(1,1):40,RN(1,1):
               41,RN(41,6):   !PROCESSINGTIMES   MAP5
               42,RN(42,7):   !

```
43,RN(43,8):        !
44,RN(44,6):        !PROCESSINGTIMES          V1
45,RN(45,7):        !
46,RN(46,8):        !
47,RN(47,9):        !PROCESSINGTIMES          C5
48,RN(48,10):       !
49,RN(49,1):        !
50,RN(50,2):        !PROCESSINGTIMES          SC5
51,RN(51,3):        !
52,RN(52,4):        !
53,RN(53,5):        !PROCESSINGTIME           B5
54,RN(54,6):        !PROCESSINGTIMEV2         V2
55,RN(55,7):        !PROCESSINGTIMES          SC6
56,RN(56,8):        !
57,RN(57,9):        !
58,RN(58,10):       !PROCESSINGTIME           B6
59,RN(59,1):60,RN(60,2):61,RN(61,3):
62,RN(62,4):63,RN(63,5):64,RN(64,6):
65,RN(1,1):66,RN(1,1):67,RN(1,1):68,RN(1,1):
69,RN(69,7):        !BWEIGHTCHTONESTEPMP5
70,RN(70,9):        !BWEIGHTCHTTWOSTEPSMP5
71,RN(71,10):       !GROUPECHTMP5
72,RN(72,1):        !ROLLCHTIMEV1
73,RN(73,2):        !HOLEREPEARTIMEV1
74,RN(74,3):        !BWEIGHTCHTIMEC5
75,RN(75,4):        !GATOGBTIMEC5
76,RN(76,5):        !GBTOGATIMEC5
77,RN(77,6):        !GCCHANGETIMEC5
78,RN(78,6):        !DUMMY
79,RN(79,7):        !DUMMY
80,RN(80,8):        !ROLLCHTIMESC5
81,RN(81,9):        !ROLLCHTIMEB5
82,RN(82,10):       !ROLLCHTIMEV2
83,RN(83,1):        !DUMMY
84,RN(84,2):        !ROLLCHTIMESC6
85,RN(85,3):        !ROLLCHTIMEB6
86,RN(86,4):        !DUMMY
87,RN(87,5):        !DUMMY
88,RN(88,6):        !DUMMY
89,RN(89,7):        !DUMMY
90,RN(90,8);        !CONVTIME

;
;
;
PARAMETERS:    1 NOT SHOWN        !trptime_MAP5_to_V1
               2 NOT SHOWN        !trptime_MAP5_to_S2
               3 NOT SHOWN        !trptime_S2_to_V1
               4 NOT SHOWN        !trptime_V1_to_C5
               5 NOT SHOWN        !trptime_V1_to_S3
               6 NOT SHOWN        !trptime_S3_to_C5
               7 NOT SHOWN        !trptime_C5_to_SC5
               8,0,0:             !trptime_C5_to_V2
               9 NOT SHOWN        !trptime_C5_to_SC6
              10 NOT SHOWN        !trptime_C5_to_S4
              11 NOT SHOWN        !trptime_C5_to_S6
              12 NOT SHOWN        !trptime_S4_to_SC5
              13,0,0:             !trptime_S4_to_V2
              14 NOT SHOWN        !trptime_S4_to_SC6
              15 NOT SHOWN        !trptime_SC5_to_B5
              16 NOT SHOWN        !trptime_SC5_to_B6
              17 NOT SHOWN        !trptime_SC5_to_S5
              18 NOT SHOWN        !trptime_SC5_to_S7
              19 NOT SHOWN        !trptime_S5_to_B5
              20 NOT SHOWN        !trptime_S5_to_B6
```

```
21 NOT SHOWN        !trptime_V2_to_SC6
22 NOT SHOWN        !trptime_V2_to_SC5
23 NOT SHOWN        !trptime_V2_to_S4
24 NOT SHOWN        !trptime_V2_to_S6
25 NOT SHOWN        !trptime_S6_to_SC6
26 NOT SHOWN        !trptime_S6_to_SC5
27,0,0:             !trptime_S6_to_V2
28 NOT SHOWN        !trptime_SC6_to_B6
29 NOT SHOWN        !trptime_SC6_to_B5
30 NOT SHOWN        !trptime_SC6_to_S5
31 NOT SHOWN        !trptime_SC6_to_S7
32 NOT SHOWN        !trptime_S7_to_B6
33 NOT SHOWN        !trptime_S7_to_B5
34,0,0:35,0,0:36,0,0:37,0,0:
38,0,0:39,0,0:40,0,0:
41 NOT SHOWN        !PROCESSINGTIMES TIME   MAP5
42 NOT SHOWN        !
43 NOT SHOWN        !
44 NOT SHOWN        !PROCESSINGTIMES TIME   V1
45 NOT SHOWN        !
46 NOT SHOWN        !
47 NOT SHOWN        !PROCESSINGTIMES TIME   C5
48 NOT SHOWN        !
49 NOT SHOWN        !
50 NOT SHOWN        !PROCESSINGTIMES        SC5
51 NOT SHOWN        !
52 NOT SHOWN        !
53 NOT SHOWN        !PROCESSINGTIMEB5
54 NOT SHOWN        !PROCESSINGTIMEV2
55 NOT SHOWN        !PROCESSINGTIMESSC6
56 NOT SHOWN        !
57 NOT SHOWN        !
58 NOT SHOWN        !PROCESSINGTIMEB6
59,0,0:60,0,0:61,0,0:62,0,0:63,0,0:
64,0,0:65,0,0:66,0,0:67,0,0:68,0,0:
69 NOT SHOWN        !BWEIGHTCHTONESTEPMP5
70 NOT SHOWN        !BWEIGHTCHTTWOSTEPSMP5
71 NOT SHOWN        !GROUPECHTMP5
72 NOT SHOWN        !ROLLCHTIMEV1
73 NOT SHOWN        !HOLEREPEARTIMEV1
74 NOT SHOWN        !BWEIGHTCHTIMEC5
75 NOT SHOWN        !GATOGBTIMEC5
76 NOT SHOWN        !GBTOGATIMEC5
77 NOT SHOWN        !GCCHANGETIMEC5
78,0,0:             !DUMMY
79,0,0:             !DUMMY
80 NOT SHOWN        !ROLLCHTIMESC5
81 NOT SHOWN        !ROLLCHTIMEB5
82 NOT SHOWN        !ROLLCHTIMEV2.
83,0,0:             !DUMMY
84 NOT SHOWN        !ROLLCHTIMESC6
85 NOT SHOWN        !ROLLCHTIMEB6
86,0,0:87,0,0:88,0,0:89,0,0:
90 NOT SHOWN        !CONVTIME
91,1000:            !DUMMY
92,2:               !STOCKLIMIT STOCK NR 2
93,4:               !STOCKLIMIT STOCK NR 3
94,11:              !STOCKLIMIT STOCK NR 4
95,3:               !STOCKLIMIT STOCK NR 5
96,2:               !STOCKLIMIT STOCK NR 6
97,2:               !STOCKLIMIT STOCK NR 7
98,0:99,0:
100,0.95:           !V2COEFF
101,114:            !PRIORITY 1   WTGQV1=  103 G=GET ROLL
```

```
                 102,107:            !PRIORITY 2    WTGQC5=          104
                 103,116:            !PRIORITY 3    WTGQSC5=         105
                 104,117:            !PRIORITY 4    WTGQB5=          106
                 105,118:            !PRIORITY 5    WTGQV2=          107
                 106,104:            !PRIORITY 6    WTGQSC6=         108
                 107,112:            !PRIORITY 7    WTGQB6=          109
                 108,111:            !PRIORITY 8    WTEQMAP5=110 E=EXIT ROLL
                 109,103:            !PRIORITY 9    WTEQV1=          111
                 110,110:            !PRIORITY 10   WTEQC5=          112
                 111,113:            !PRIORITY 11   WTEQSC5=         113
                 112,105:            !PRIORITY 12   WTEQV2=          114
                 113,115:            !PRIORITY 13   WTEQSC6=         115
                 114,108:            !PRIORITY 14   WTQc2AR=         116
                 115,109:            !PRIORITY 15   WTQc3AR=         117
                 116,106:            !PRIORITY 16   WQSP4cAR=        118
                 117,0:118,0:119,0:120,0:
                 121,0:              !PREVIEWTIME_V1
                 122,0:              !PREVIEWTIME_C5
                 123,0:              !PREVIEWTIME_SC5
                 124,0:              !PREVIEWTIME_B5
                 125,0:              !PREVIEWTIME_V2
                 126,0:              !PREVIEWTIME_SC6
                 127,0:              !PREVIEWTIME_B6
                 128,0:129,0:
                 130,2;              !NRBEFOREFLOWMESURE
;
;
COUNTERS:1,WORKSHOPEXITS,,NO:
         2,STAYSINLINETRPTS,,NO:
         3,CHANGEOFLINETRPS,,NO:
         4,INTOSTOCK2,,NO:
         5,INTOSTOCK3,,NO:
         6,INTOSTOCK4X,,NO:
         7,INTOSTOCK4Y,,NO:
         8,INTOSTOCK5X,,NO:
         9,INTOSTOCK5Y,,NO:
        10,INTOSTOCK6X,,NO:
        11,INTOSTOCK6Y,,NO:
        12,INTOSTOCK7X,,NO:
        13,INTOSTOCK7Y,,NO:
        14,INTOMAP5,,NO:
        15,INTOV1,,NO:
        16,INTOC5,,NO:
        17,FRTOGRCCHANGEC5,,NO:
        18,INTOSC5,,NO:
        19,XINTOB5,,NO:
        20,YINTOB5,,NO:
        21,XINTOV2,,NO:
        22,YINTOV2,,NO:
        23,INTOSC6,,NO:
        24,XINTOB6,,NO:
        25,YINTOB6,,NO:
        26,BADEND,1,NO:
        27,BADC5,1,NO;
;
;
TALLIES:1,PRODUCTIONRATE:
        2,ROLLSINATELIER:
        3,TYPECHANGETIME:
        4,T_IN_STOCKS:
        5,TIMEINTRP:
        6,ROLLCHANGETIME:
        7,PROCTIME:
        8,WTFORXTTTIME:
```

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        9,T_IN_SYSTEM:
        10,SUMPROCTMAP5:
        11,SUMPROCTV1:
        12,SUMPROCTC5:
        13,SUMPROCTSC5:
        14,SUMPROCTB5:
        15,SUMPROCTV2:
        16,SUMPROCTSC6:
        17,SUMPROCTB6:
        18,STOCK4:
        19,STOCK5:
        20,STOCK6:
        21,STOCK7:
        22,WAITFORXTTIMEV2;
;
;
DSTAT:1,NQ(112),TEMPSTORAGEC5:
        2,NQ(9),STOCK2:
        3,NQ(10),STOCK3:
        4,NQ(11),STOCK4X:
        5,NQ(12),STOCK4Y:
        6,NQ(13),STOCK5X:
        7,NQ(14),STOCK5Y:
        8,NQ(15),STOCK6X:
        9,NQ(16),STOCK6Y:
        10,NQ(17),STOCK7X:
        11,NQ(18),STOCK7Y:
        12,NQ(25),WAITINGTOENTERV1:
        13,NQ(34),WAITINGTOENTERC5:
        14,NQ(43),WAITINGTOENTRSC5:
        15,NQ(52),WAITINGTOENTERB5:
        16,NQ(57),WAITINGTOENTERV2:
        17,NQ(65),WAITINGTOENTRSC6:
        18,NQ(73),WAITINGTOENTERB6:
        19,NR(1),BUSYTIMEMAP5:
        20,NR(2),BUSYTIMEV1:
        21,NR(3),BUSYTIMEC5:
        22,NR(4),BUSYTIMESC5:
        23,NR(5),BUSYTIMEB5:
        24,NR(6),BUSYTIMEV2:
        25,NR(7),BUSYTIMESC6:
        26,NR(8),BUSYTIMEB6:
        27,NQ(110),TEMPSTORAGEMAP5:
        28,NQ(159),TWOINTEMPMP5:
        29,NQ(160),TWOINTEMPC5;
;
;
END;
```