

MULTISTORY-BLOCPLAN for Windows

Introduction

BLOCPLAN is a facility layout system that has been developed at the Industrial Engineering Department of the University of Houston for PC personal computer systems.

The existing version called BLOCPLAN-WIN is for single story problems. The version that will be discussed in this manual handles problems where the departments are assigned to different sites. We will refer to this version as BLOCPLAN-MS. Much of the data input is the same as it was in BLOCPLAN-WIN.

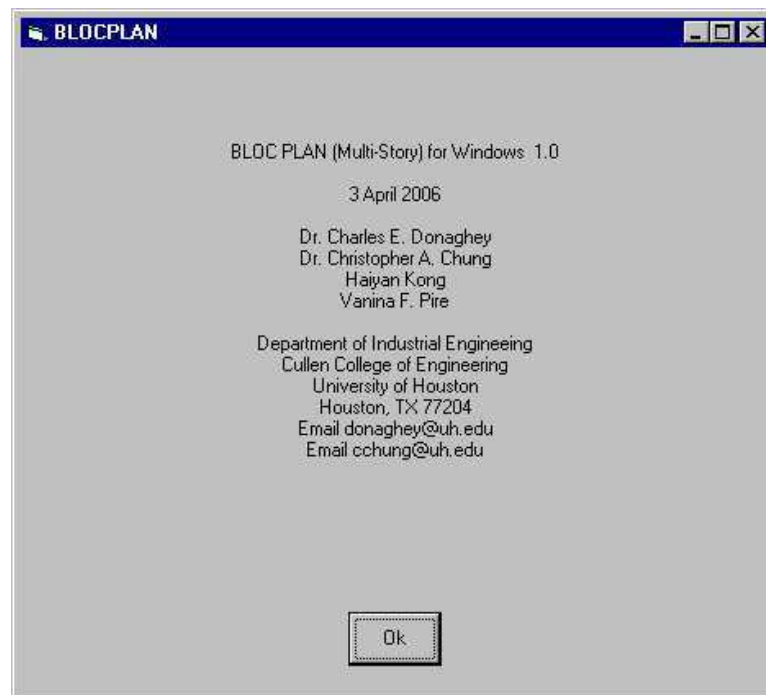


Figure 1. – Credits Screen for BLOCPLAN-MS

This program assigns departments and evaluates layouts where departments are assigned to different sites in response to user supplied data.

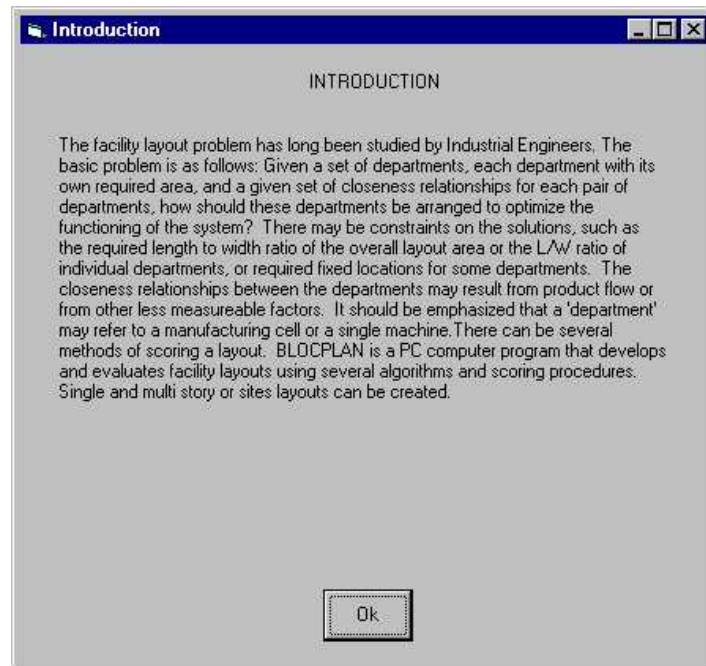


Figure 2. – Introduction Screen

BLOCPLAN Main Menu

The menu of choices in the Main Menu is shown in Figure 3. There are six menu options available to the user. The user clicks on the selection choice to cause execution of the proper option. The user may return to this Main Menu a number of times when working on a layout. It allows him/her to introduce a new problem, to modify data on the current problem, to examine single story layouts, to examine multi-story layouts, to save the data on the current problem, or to exit from BLOCPLAN. After a selection is made from the Main Menu, the user will be presented with new menus and information that pertain to the selection that has been made.

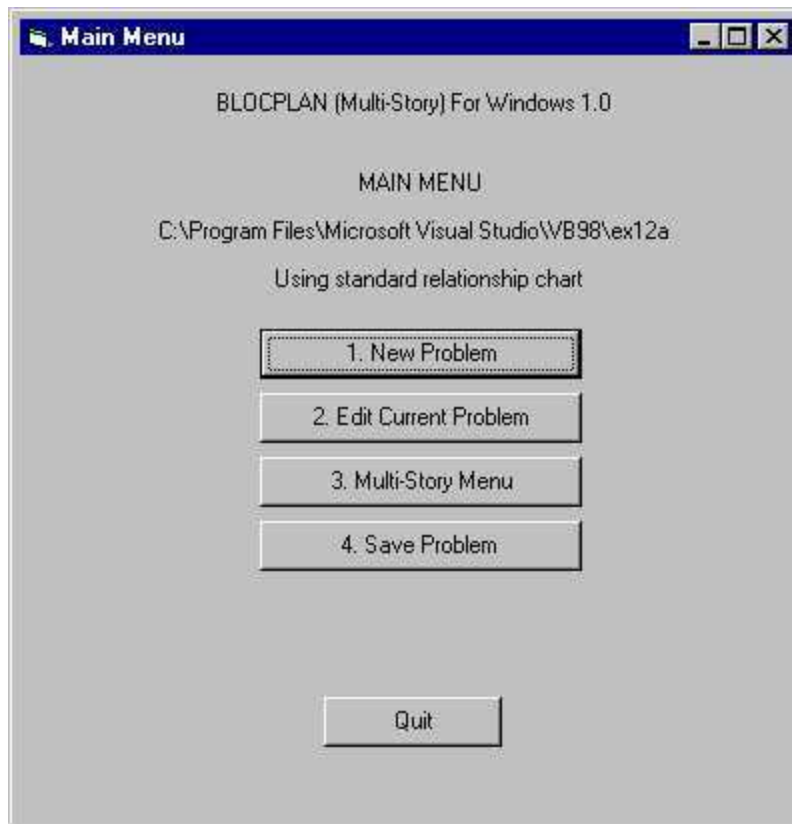


Figure 3. – BLOCPLANMS Main Menu selections.

New Problem (Main Menu Selection #1)

If the user wants to introduce a new problem to BLOCPLAN he/she uses Main Menu selection 1. The BLOCPLAN system will respond with the message given in Figure 4.

If the user indicates the problem is one that has been stored on the disk, he/she is given a list of the previously stored problems and the user makes the choice of the problem to be entered. The system is asking how the new problem is to be entered. The user makes the appropriate response and the problem data is entered. The steps in data entry are the same as previously discussed beginning on page 1. If the new problem is from disk, the problem data is entered and displayed before the Main Menu is again shown.

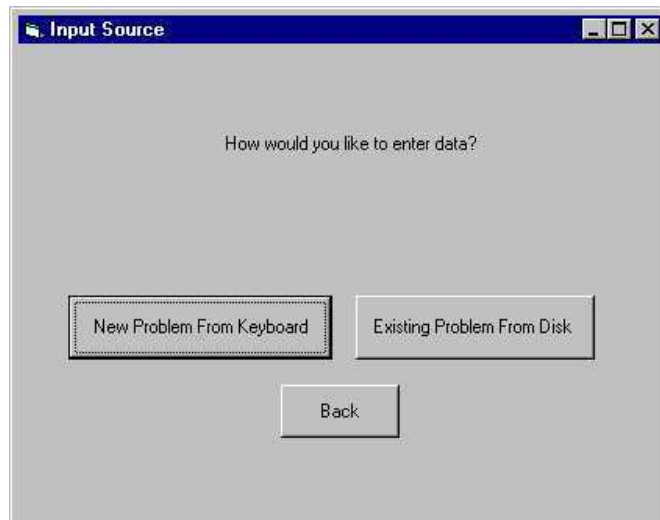


Figure 4. – Problem Source Screen

The user will click on his/her choice. If an existing problem choice is made, a list of the saved problems will be shown, and the user will click on the problem name, and the data concerning the saved problem will then be entered.

Number	Department	Area
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		

Figure 5. – Department and Area Information Screen

For a new problem, the screen shown in Figure 5 will be displayed. The user would then type in the name of each department (8 characters maximum) in the layout, and the area of each of them. BLOCPLAN can handle a maximum of 18 departments. When all departments and their areas have been entered, the user would click on the OK button.

Figure 6 shows this display for an example problem. The total area for all the departments, the average department area, and the standard deviation of the department areas are calculated by the system and displayed

The data in Figure 6 was taken from "Facilities Planning" by Tompkins and White, 1984. The user may change any data in the list of departments by simply changing the data on the screen. the cursor is placed on the screen in the proper position and the data entered.

The screenshot shows the BLOCPLAN software window. On the left, there is a text area with 'A:\manex6' and 'Enter or modify problem data:'. In the center is a table with 18 rows. The first three columns are 'Number', 'Department', and 'Area'. The data for the first seven rows is as follows:

Number	Department	Area
1	RECVING	12000
2	MILLING	8000
3	PRESS	6000
4	SCR. MCH	12000
5	ASSEMBLY	8000
6	PLATING	12000
7	SHIPPING	12000
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		

At the bottom left, there are two input fields: 'Average Area' with the value '10000.0' and 'Std. Dev. Area' with the value '2390.5'. At the bottom right, there is an input field for 'Total Area' with the value '70000'. Below these fields are three buttons: 'Continue', 'Print', and 'Back'.

Figure 6. – Example Problem Data

Relationship Data

BLOCPLAN uses the relationship codes described by Muther in "Systematic Layout Planning", (Muther 1973, CBI Publishing, Boston, Mass). Figure 7 shows the screen display after the user has furnished the codes for each of the departmental relationships. This chart is called a Relationship Chart. The bottom of the screen gives a legend of acceptable codes and their definitions. An "A" indicates that it is absolutely essential that the two departments having this code be adjacent. An "E" indicates that it is essential etc. The "X" code indicates that it is undesirable. BLOCPLAN uses adjacencies for one type of layout analysis.

RELFORM

RELATIONSHIP CHART

		2	3	4	5	6	7
1	RECVING	A	O	I	O	U	U
2	MILLING		U	E	I	I	U
3	PRESS			U	U	O	U
4	SCR. MCH				I	U	U
5	ASSEMBLY					A	I
6	PLATING						E
7	SHIPPING						

Enter or change code A = Absolutely Essential I = Important U = Unimportant
E = Essential O = Ordinary X = Undesireable

Continue Print

Figure 7. – Relationship Chart

Figure 8 gives the numeric worth of each of these codes. The user can change any of these values

A screenshot of a software window titled "Score Vector". It contains a table with two columns: "Code" and "Score". The table lists six relationship codes with their corresponding scores. At the bottom of the window are three buttons: "Continue", "Restore Defaults", and "Print".

	Code	Score
Absolutely Essential	A	10
Essential	E	5
Important	I	2
Ordinary Importance	O	1
Unimportant	U	0
Undesireable	X	-10

Continue Restore Defaults Print

Figure 8. – Numeric Values For Relationship Codes

Figure 9 displays the department scores based on the relationship chart and the numeric values for each of the adjacency codes.

A screenshot of a software window titled "Score Vector". It contains a table with three columns: "Number", "Department", and "Score". The table lists seven departments with their corresponding scores. At the bottom of the window are two buttons: "Continue" and "Print".

Number	Department	Score
1	RECVING	14
2	MILLING	19
3	PRESS	2
4	SCR. MCH	9
5	ASSEMBLY	17
6	PLATING	18
7	SHIPPING	7

Continue Print

Figure 9. – Department Scores

Edit/Adjust Data Menu (Main Menu Selection #2)

When the user selects Main Menu Option 2, it indicates that he/she wishes to change the data that pertains to the current problem. An Edit/Adjust Data Menu will then be presented that contains the options that are available. Figure 10 shows this menu. A user may examine and/or change the department areas, the relationship information, the length to width ratio of the layout area, and the material handling information. He/she can also ask for a relationship chart that is based solely on material handling information, and he/she can restore the original relationship chart when needed. The current L/W ratio and the dimensions of the layout outline are shown in the lower right hand corner of the menu. The number of previously saved layouts is also shown for the problem. If the problem has been loaded from disk, the assigned name of the problem is also shown

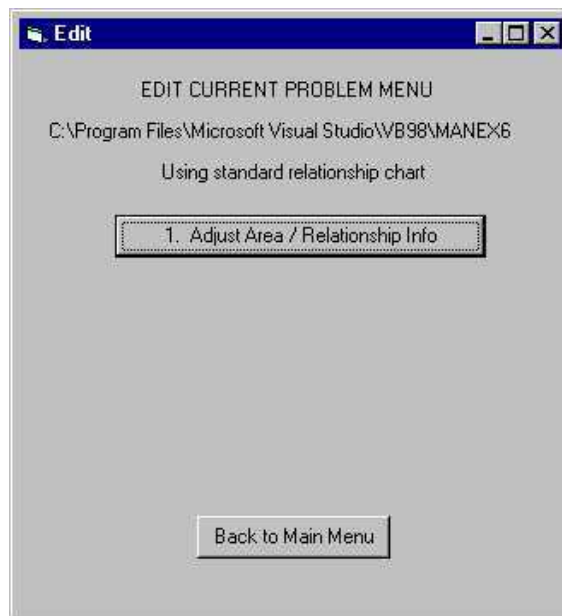


Figure 10. – Edit/Adjust Data Menu

Adjust Area/Relationship Data (Edit/Adjust Data Menu Selection #1)

Selection 1 from the Edit/Adjust Data Menu allows the user to change the area and/or the relationship information currently in effect. After this option is selected, the display of Figure 6 appears, and the user is allowed to change any of the department areas. This is followed by the screen displays allowing for changes in the relationship data and the score vectors. When all the required changes are made the display shown in Figures 7, 8, and 9 will be given. When this sequence is complete, the Edit/Adjust Data Menu is returned to the screen. It should be noted that all layouts that have been previously saved may now be reviewed under this new set of area and/or relationship parameters.

Multistory Layout Menu (Main Menu Selection #3)

If the user wants to investigate the multistory mode (Ref 2,4), for the solution to a problem, he/she should respond with this selection to the Main Menu. The display that will then be given is shown in Figure 11.

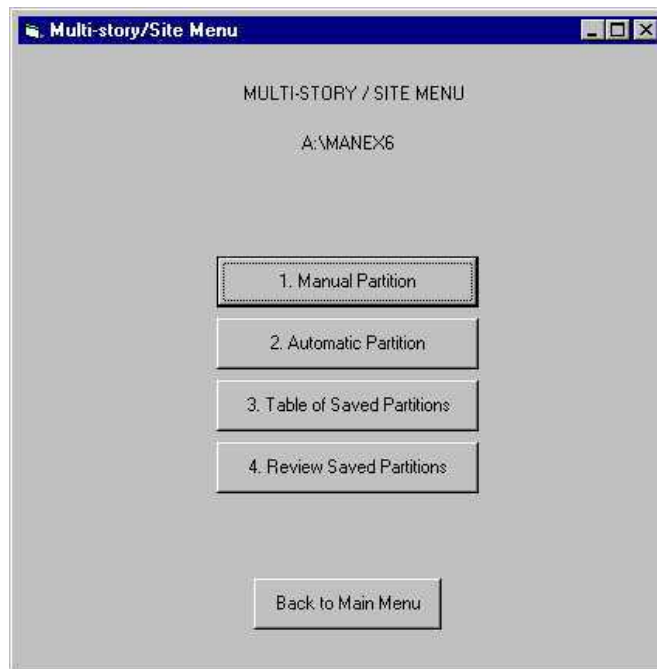


Figure 11 – Multistory Layout Menu (Main Menu Selection #3)

Manual Partition (Multistory Menu Selection #1)

When a user places BLOCPLAN in multistory mode he/she is examining layouts where all of the departments are not required to be on the same level. When the Manual Partition selection is made the first prompt will be:

NUMBER OF STORIES (2-6) ?

The user is being asked to indicate the number of levels (stories) that he/she wants to use in the problem. There is a maximum of six stories that can be used. Using the example problem, if it is assumed that the number of stories has been given as 2, the screen display of Figure 12 would then appear. Suppose the user would like to have RECVING (Dept 1), SHIPPING (Dept 7), and ASSEMBLY (Dept 5), on one floor and the remaining four departments on another. He/she would

respond with the department numbers (1,7,5) to the prompt in Figure 30, to indicate those departments are to be on one level. The legend of the departments is at the bottom of the screen. The department numbers are entered for each floor/site. Figure 13 shows the screen display when the suggested assignments for the two stories have been entered.

Figure 12. – Screen display for example problem. The system is asking for the first partition of departments.

Figure 13. – Screen display showing the assignments for the two stories.

The display of Figure 13 shows the areas of each of the two stories to be 46,000 sq. ft. for story #1, and 24,000 sq. ft. for story #2. BLOCPLAN calculates an Actual Area Difference Factor (ADF) for the layout. The total required area for all the departments in the example is 70,000 sq. ft.. For a two story problem the best possible arrangement of departments would have the area of each story the same. This would be accomplished with each story having an area equal to 70,000/2 or 35,000 sq. ft.. The ADF score that is calculated for a multi-story layout by BLOCPLAN is:

$$ADF = \text{Max} [(S_{\text{Max}} - S_{\text{Mean}}) / S_{\text{Mean}} ; (S_{\text{Mean}} - S_{\text{Min}}) / S_{\text{Mean}}]$$

where:

S_{Mean} = Optimum mean area for each story.

S_{Max} = Maximum story area for layout.

S_{Min} = Minimum story area for layout.

For the example of Figure 13 the value of S_{Max} is 46,000, S_{Min} is 24,000, and S_{Mean} is 35,000. Therefore,

$$ADF = \text{Max} [(46,000 - 35,000) / 35,000 ; (35,000 - 24,000) / 35,000]$$

$$ADF = \text{Max} [.31, .31] = .31$$

The ADF score is a measure of the maximum deviation from the optimal story size.

Another measure of the effectiveness of a multistory layout is given in Figure 13 and is called the Partition Score. The Partition Score uses the current Relationship Chart and is a measure of how well the story assignments satisfy the relationships. It assumes that departments on different stories will not be adjacent, and also assumes that all departments on a story will be adjacent to each other. In the example the Partition Score is .29. The adjacencies on Story #1 are (1,2), (1,3), (1,4), (1,5), (2,3), (2,4), (2,5), (3,4), (3,5), and (4,5). The adjacency on Story 2 is (6,7). The sum of the adjacencies for Story #1 is 23.0. For Story #2, the single adjacency score is 5. The total sum for the two stories is 23+5 or 28. The total of all positive relationships in the REL chart 43. Therefore the normalized score would be 28/43 or .65.

The lower right hand portion of Figure 13, shows the options available to a user when a multistory layout has been developed. The options are "S" for Save, "E" for Exchange, and the return key to get back to the Multistory Menu. If the user enters "S", the partition of departments currently on screen will be saved, and the Multistory menu will again appear on the screen. If the response is "E", the system will ask for the two departments that are to be exchanged. The user supplies the index numbers of a pair of departments to be interchanged and BLOCPLAN will give the same display as shown in Figure 13, only now the places of the two requested departments will be switched. All of the scoring will now reflect the effect of the switch. If the user uses the return key, the Multistory Menu will be returned.

Automatic Partition (Multistory Menu Selection #2)

If the user wants BLOCPLAN to decide on the partitions of departments between stories he/she should use the Automatic Partition selection. The system will then ask for the number of stories desired and Area Difference Factor as illustrated in Figure 14.

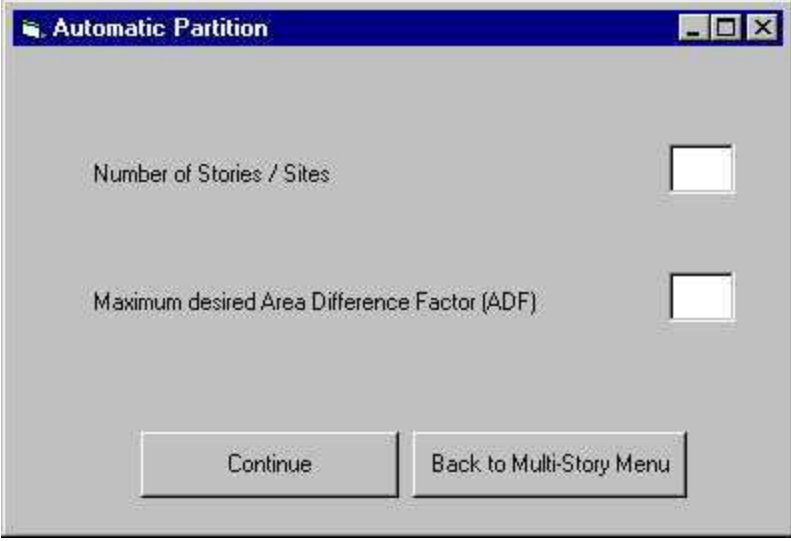
A screenshot of a Windows-style dialog box titled "Automatic Partition". The dialog box has a blue title bar with standard window controls (minimize, maximize, close). The main area is light gray and contains two input fields. The first field is labeled "Number of Stories / Sites" and the second is labeled "Maximum desired Area Difference Factor (ADF)". Both fields are empty. At the bottom of the dialog box, there are two buttons: "Continue" on the left and "Back to Multi-Story Menu" on the right.

Figure 14. Automatic Partition Parameters

The algorithms that are employed by BLOCPLAN use both the areas of the departments and the current REL chart to attempt to come up with a "good" partition of the departments for the stories. In this prompt the user is being asked to assign the maximum ADF score that can be tolerated. In some cases BLOCPLAN may not be able to get an ADF as small as the one requested. BLOCPLAN will then make an assignment of departments using its best ADF score and the REL chart to develop a partition. Figure 15 shows the partition that was obtained for the example problem when two stories were requested with a desired ADF of .10.

The screenshot shows the 'MS Print Partition' window with the following data:

Field	Value
Story Areas	32000, 38000, , , ,
Actual Area Difference Factor	0.09
Desired Area Difference Factor	0.10
Partition Score	0.81 = (35 / 43)

Story / Sites	
Story / site 1.	7 6 5
Story / site 2.	4 2 1 3

Departments					
1. REC'ING	2. MILLING	3. PRESS	4. SCR. MCH	5. ASSEMBLY	6. PLATING
7. SHIPPING					

Buttons: Exchange, Save, Print, Continue

Figure 15. Partition of departments for example problem from Automatic Partition option in Multistory menu. The requested number of stories was two and the desired ADF was .10.

By changing the desired ADF factor, the user may obtain a partition arrangement to place departments in different sites with very different areas.

It can be seen from Figure 15 that the system placed departments 7,6, and 5 on one story and departments 4,2,1, and 3 on another. The actual ADF was .09 and the Partition Score was .81. The user can test the effect of changing the desired ADF on the partitions obtained with the Automatic Partition option. The user can exchange departments between sites by using the "Exchange" option or save the partition by using the "Save" option.

If the Exchange button is pressed the screen in Figure 16 appears. In Figure 16, departments 1 and 7 are to be exchanged.



Figure 16. Exchange Departments

The result of the department exchange is illustrated in Figure 17.

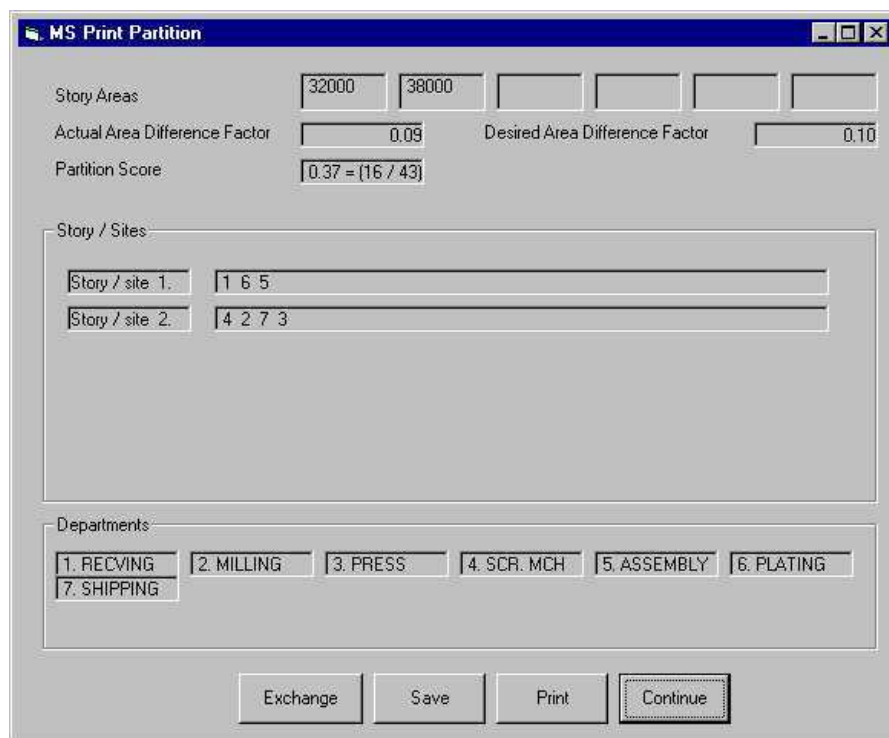


Figure 17. Results of Departments Exchange Between Sites

If the “Save” button is pressed, the screen illustrated in Figure 18 appears.



Figure 18. Save Message

Note that you must still save the problem from the main menu in order to make a permanent record of the configuration.

Table of Saved Partitions (Multistory Menu Selection #3)

Multistory Menu Selection 3 prepares a table of all multistory partitions that are currently saved. Figure 19 shows the format for the resulting display when this option is selected.

A screenshot of a Windows-style dialog box titled "Table of Saved Partitions". The dialog box has a blue title bar with standard window controls (minimize, maximize, close). The main area is light gray and contains a table with five columns: "LAYOUT NO.", "STORIES/SITES", "ADF. DES.", "ADF. ACT.", and "SCORE". The table has four rows of data and several empty rows below. Below the table are two buttons: "Delete Layout" and "Back to Multi-Story Menu".

LAYOUT NO.	STORIES/SITES	ADF. DES.	ADF. ACT.	SCORE
1	2	0.00	0.03	0.33-3
2	2	0.20	0.09	0.81-1
3	5	0.40	0.29	0.07-4
4	2	0.10	0.09	0.37-2

Figure 19. Table of saved partitions.

From Figure 19 it can be seen there were four saved partitions: Three with two stories and one with five stories. The desired and the actual ADF scores are shown. For layouts that were created manually, the desired ADF is not defined and is shown as zero in the display. The user may delete a saved partition by pressing the delete layout button. The program will then ask for the partition number to be removed. The user gives the partition number and presses the delete button. The table then reappears with the partition removed. The user can also return to the multistory menu.

Review Saved Partitions (Multistory Menu Selection #4)

The user can review these partitions by using Multistory Menu Selection 4. When this selection is made, the program will prompt for a starting point as illustrated in Figure 20.



Figure 20. Starting Point For Reviewing Saved Partitions

The user responds with the partition number for the start. For example, assume a user has saved four partitions, and he/she only wants to look at all of them. The response would be "1", to indicate that this is the desired starting point. The system would then place Partition #1 on the screen in the same format as Figure 15.

References:

1. Donaghey, C.E. and Kong, H. "MHAND Users Manual", University of Houston, Industrial Engineering Dept., 1999.
2. Donaghey, C.E. and Pire, V.F. "BLOCPLAN-90 Users Manual", University of Houston Industrial Engineering Dept., 1990.
3. Muther, R., "Systematic Layout Planning", Cahners Books, 1973.
4. Pire, Vanina F. "An Automated Multistory Layout System", M.S. Thesis, Industrial Engineering Dept., University of Houston Industrial Engineering Dept., Houston, Texas, 1989.
5. Tompkins, J. A, White, J.A., Bozer, Y.A., Frazelle, E.H., Tranchoco, J.M.A., Trevino, J., "Facilities Planning", John Wiley & Sons, 1996.