

OPTIMAL DRAGLINE OPERATING TECHNIQUES

Volume III: Dragline Simulation Models User's Manual

Final Report

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ABSTRACT

Dragline production is influenced by physical parameters of the operating pit. These parameters include depth and swell of overburden, thickness of coal seam, and stability of consolidated and swelled materials. Production is further influenced by operating parameters such as width of panel, length of digout, placement of spoils and sequence of digging-spoiling operations. While the physical parameters cannot be changed, it is possible to increase production through the operating procedures thus for a given combination of physical parameters, there is some best combination of operating parameters for a particular dragline.

These volumes contain the results from the investigation of single-seam coal mining using draglines. Three different coal mining regions of the United States were visited to obtain data and provide examples of typical mining operations. Four operating mines were computer simulated during the study to determine ways to increase productivity. Results indicate that most operating mines can benefit from computer simulation and subsequent implementation of computer tested optimization procedures.

The Dragline Simulation Model (DPS) was designed to assist the mining engineer in finding an optimal combination of operating parameters for a given combination of physical parameters. The model simulates the digging, spoiling, walking, deadheading, and maintenance actions of a dragline. It works with a three-dimensional representation of the operating pit to reflect the results of digging and spoiling.

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1.1 PURPOSE AND SCOPE

The dragline simulation system was designed to assist a mining engineer in determining operating parameter values which will result in optimum dragline production. The Dragline Simulation Model (DLS), working with a three-dimensional representation of the operating pit, strips panels as defined by the engineer. The results can be used to assess the impact of changes in:

1. Panel width
2. Digout length
3. Sequence of digging operations, such as digging by layers or use of an extended bench
4. Potential changes to dragline operating characteristics
5. Deadheading back to start of next panel, or reversing direction for each panel

Volume 3 of this report, Dragline Simulation Models User's Manual, contains the information and directions needed to use the Dragline Production Simulation (DPS) system. The system was initially designed and developed by Bonner & Moore for operation on Xerox Data System Computers. The system was then converted to operate on Control Data Corporation Computers by Fluor Mining & Metals, and then again converted to operate on International Business Machines Computers by Southern Illinois University, Carbondale and Fluor Mining & Metals. The three versions of the system are identical in terms of the model results and the manner in which the user controls the simulation run. They differ in the mechanical aspects of making runs. These details are described in Appendices D, E and F of Volume 3 and are repeated in Volume 4.

1.2 TYPING CONVENTIONS USED

In this User's Manual certain code words or names are typed in capital letters:

- 'KEYWORD' — capital letters enclosed in single quotation marks
- NAME — capital letters not enclosed in quotation marks.

The DLS control file consists of punched cards or card images. Each card in the file must start with a 'KEYWORD', i.e., with a word that is recognized by the model. The 'KEYWORD' must be punched exactly as written in the text, except that the quotation marks are not punched.

NAMES are used to denote:

1. Models, programs or routines; e.g., PPV refers to the Plot Plan View program
2. Parameters that are set by the user via the control file; e.g., HB is the height of the dragline operating bench
3. Variables calculated by the model; e.g., CYCLE is the cycle time calculated by the model

When a parameter NAME is first used in a chapter, it is followed by a brief explanation and the 'KEYWORD' for the card on which the parameter is set. For example, "The model next calculates the height of the spoil bank, HS, using HB (height of bench) and PW (panel width) from the 'PANEL' card."

Double quotation marks are used in the normal manner to denote words that may be used in a special context. For example, dragline movement times are classed as "deadhead" or "walk" times. The movement to the first position in a panel is classed as "deadhead" time, and all other movements are classed as "walk" times.

1.3 ORGANIZATION OF THIS MANUAL

The User's Manual is organized as a guide for setting up problems for the DLS system. The user should approach a problem by considering the various components in the simulation sequence as they are covered in this manual.

Chapter 2 provides an overview of the system so that the user can place the models and routines in their proper context.

Chapter 3 explains how to convert topographic and isopach maps into elevation data needed by the system.

Chapter 4 explains how to set up a DLS control file. It contains quick reference tables, for describing all DLS control cards. The chapter also discusses the model output. Details of input parameters and model results are covered in the remaining chapters.

Chapter 5 contains instructions for defining the panels to be stripped, and Chapter 6 describes how to control the sequence of digging and spoiling actions within each panel.

Chapter 7 explains digging geometry and how the model adjusts surface elevations to reflect the digging actions.

Chapter 8 explains spoiling geometry and the adjustments to surface elevations resulting from forming spoil banks.

Chapter 9 covers the geometry and logic of coal removal. The model does not simulate the actions of equipment removing coal, but simply adjusts elevations to reflect coal recovery.

The cycle time calculations are described in Chapter 10, and the walking and maintenance calculations in Chapter 11.

Chapter 12 defines controls for obtaining graphic representations developed by the Draw Isometric Surface and Plot Plan View models.

Chapter 13 reviews potential errors, lists all DPS system error messages, and suggests possible causes for the error condition.

Chapter 14 discusses two demonstration cases. The first case illustrates a straightforward, "normal" use of the DLS model, and the other illustrates results of setting option controls and parameters.

Appendix A reproduces the computer printouts obtained when elevation data for the demonstration problems were defined.

Appendix B reproduces the DLS printouts from the "CHOP" Case and Appendix C contains the printouts from the "DEMO" Case.

Appendices D, E and F contain example job control decks for running the programs on the XDS, CDC and IBM computers. This information is repeated again in Volume 4 for user convenience.

2.1 GENERAL

Dragline production is influenced by physical parameters of the operating pit such as depth and swell of overburden, thickness of coal seam, and the stability of consolidated and swelled materials. Production is also influenced by operating parameters such as width of panel, length of digout, placement of spoils (spoil angles), and sequence of digging/spoiling operations. For a given combination of physical parameters, there is some best combination of operating parameters.

The Dragline Simulation (DLS) Model was designed to help a mining engineer find the most desirable combination of operating parameters. It can also be used for obtaining production estimates for a given mining area with given operating parameters. The model simulates the digging, spoiling, walking, deadheading, and maintenance actions of a dragline using a three-dimensional representation of the operating pit. This three-dimensional representation permits an engineer to "see" how the model is performing.

The model calculates cycle times for spoiling and total operating times. It also calculates volumes excavated and spoiled, including any material rehandled, and volume of recovered coal. The final summary presents overall production rate, stripping ratio, and cost figures.

The model simulates coal recovery, but does not simulate the actions of the coal-loading equipment.

The DLS Model, supported by a number of other models and programs comprise the complete DPS system. A complete simulation run involves three steps:

1. Define the surface: The Deposit Description Model (DDM) sequence is followed in this step. The engineer transcribes elevation data from topographic/isopach maps of the pit area to be studied into a deck of punched cards or a file of card images. The sequence differs for "level" and "variable" coal seams. For a level seam, i.e., one which has

constant thickness and is horizontal, the engineer needs only topographic data. For a variable seam, i.e., one which varies in thickness and attitude, both topographic and isopach data are needed.

The DDM sequence reads the elevation data and prepares a "surface array" which is retained in a computer file as a table of elevation data. A detailed explanation of this surface array appears in the later chapters.

2. Make the simulation run: The Dragline Stripping (DLS) Model is used in this step. It processes the surface array that was prepared by the DDM sequence. When the DLS dragline "digs," the model removes material from the surface by decreasing appropriate elevations in the surface array. When the DLS dragline spoils, the model places material on the surface by increasing appropriate elevations in the surface array.

The user controls DLS actions via a "control file" --a deck of punched cards or a file of card images. The control file entries specify the operating characteristics of the dragline and the sequence in which stripping and coal recovery are to be done. The user can "save" the surface array at various stages in the simulated operation. The model transfers each saved surface array to another computer file. A surface saved from one simulation run can be used as the starting surface in a subsequent simulation run.

Before making a simulation run with the DLS Model, a user can obtain a plan view of the area to be stripped with the Plot Plan View (PPV) Model. The plan view can be superimposed on a map of the pit to insure that the panels to be stripped are correctly defined.

3. Make an isometric projection of the mining area: Any surface array filed by either the DDM or DLS Models can be processed by the Draw Isometric Surface (DIS) Model. This model prepares an isometric projection of the mine that permits the user to "see" the results of the stripping operation at different stages of the operation.

2.2 DEFINING ELEVATIONS

The DDM sequence processes a description of the topography and coal seam of the operating pit as it exists at the start of the simulated operation. This description is in the form of a series of x,y,z coordinates. The x,y coordinates measure horizontal distances in feet from a user's specified reference point. The x,y data are read from a grid or coordinate system drawn on the map, with the reference point as the origin.

The z values give elevations in feet from a specified reference plane. If the seam is level, then the reference plane is the bottom of the coal seam, the thickness of the seam is a constant, and only a topographic map is needed for the elevations. If the seam is variable, then the user defines a reference plane, and three z values must be entered for each x,y: surface, top of coal, and bottom of coal.

The user may select any desired grid spacing so long as the model dimensions are not exceeded (explained in Volume 3, Chapter 3). The grid spacing has an effect on model accuracy in the same way that map scale affects the mine planner (see Volume 3, Section 3.9). When the overall mine is considered, a map scale of 400 feet to the inch can be used. For simulation runs of two or three panels, a scale of 100 or 200 feet to the inch is best. The user reads the z values at points of intersection between grid lines and contour lines. The model interpolates to find elevations for each grid intersection. Thus, the surface array can be considered as a table with one row for each x line and one column for each y line, or vice versa.

A grid may have any desired orientation with any of the four corners designated as its origin. The system will correctly process data into the internal organization of the surface array.

The DDM sequence permits the user to describe either a "level" seam or a "variable" seam surface array. The differences lie in the actions taken in this step. The following steps are the same for either type of surface array. The system automatically handles the two types of arrays without any additional input.

2.3 MAKING THE DRAGLINE SIMULATION RUN

The DLS Model is used in this step to simulate the digging, spoiling, deadheading, walking, and maintenance actions of the dragline. The DLS Model processes the surface array developed in the DDM sequence, and continuously modifies

elevation data to reflect digging and spoiling actions. After modifications, surface arrays saved from one DLS run can serve as the starting array for another DLS run.

The user "directs" the simulation run via a control file--a deck of punched cards or a file of card images. The information specified in the control file includes:

1. Dragline physical specifications: boom length, boom angle, dumping radius, bucket size, etc.
2. Dragline operating rates: walk, swing, hoist, lower, payout, and retrieve.
3. Angles of the pit faces formed by digging actions and the angle of repose of the spoil banks.
4. Dragline maintenance schedule.
5. For each panel to be stripped, a series of x,y coordinates are input which define plan view dimensions of the top of the coal seam after overburden has been removed.
6. Instructions specifying the pattern of chopping, keycutting, production bailing, rehandling, spoiling, walking, deadheading, and maintenance.
7. Instructions for removing the uncovered coal. Coal loading is not directly simulated. The model simply adjusts surface elevations to account for coal removal at the end of a panel.

Each panel to be stripped in a run is defined by the user's "COAL LINE" x,y coordinates. A coal line is the intersection of the bottom of highwall with the top of the coal seam. Two coal lines define a complete panel. One line defines the bottom of the highwall being formed in the panel, and the other defines the opposite side of the exposed coal seam. Thus, the two lines define the plan view coordinates of the top of the coal seam after the overburden has been removed.

The user controls the directions in which the dragline and panels advance simply by order of entry for the coal line x,y coordinates. The direction of spoiling can be controlled by specifying spoil angles. Normally, the spoils are cast into the previously excavated panel. The user also has the option of spoiling against the highwall to form an extended bench.

Before making a DLS run, the user can check to see if panels are correctly defined by using the PPV model to process the DLS control file. The PPV program develops a plan view drawing of the panels as specified by the user. Input errors can be detected at this stage.

Each panel is excavated in a series of "digouts." A digout is the excavation made within a panel before the dragline advances a user-defined distance in the long direction of the panel. In a digout any of the following model digging actions can be used:

- o Keycut--forms the keyway
- o Bail without rehandle--finishes the digout
- o Bail with rehandle--finishes the digout and rehandles any spoils that were against the highwall or coal face
- o Chop--excavates overburden ahead and to the side of the dragline down to the dragline bench level

A digout may also include any of the model spoiling actions:

- o Conical spoils--forms spoils in the shape of an inverted cone and simulates the actions of stopping the swing to dump
- o Ridgeline spoils--forms spoils in the shape of an inverted wedge with semi-conical ends, and simulates dumping without stopping the swing. This option is also used to simulate dumping on the swing or "radial casting."
- o Extended-bench spoils--forms spoils against the highwall ahead of the dragline

The model routines move the dragline from one position to the next and calculate walking, deadheading, and maintenance times. They also simulate spoiling to calculate cycle times which are converted to production times based on the volume of excavated overburden, including any rehandle.

At the end of each panel, the model adjusts the surface elevations to account for coal recovery. It then prints average cycle times, volume removed, and time spent for that particular panel. At the end of the project (end of the run), the model calculates the overall stripping ratio and costs of the production in units of dollars/yd³ of overburden and dollars/ton of recovered coal. It also calculates the overall production rate in yd³/hr.

2.4 MAKING ISOMETRIC PROJECTIONS

The Draw Isometric Projection (DIS) Model processes surface arrays developed by either the DDM or the DLS Model and uses a plotter to make an isometric projection of the surface. The model uses one of the two axis systems shown in Figure 2.1.

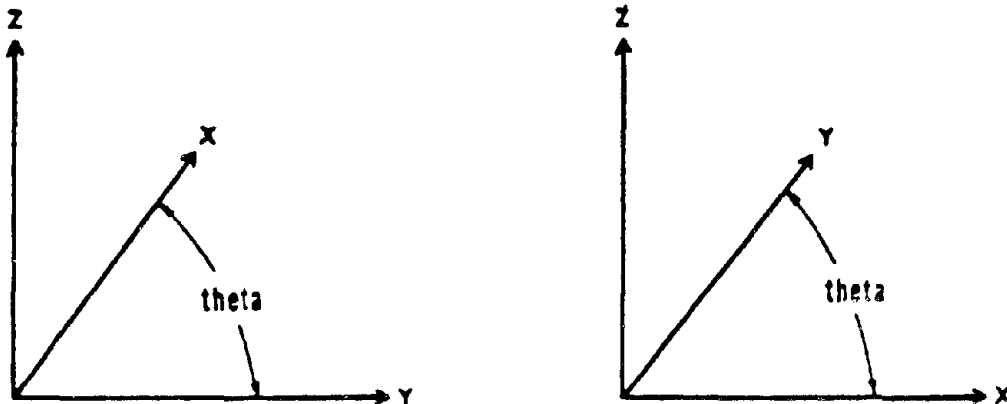


Figure 2.1
Isometric Projection Axes

The vertical axis on the projection is always the z (elevation) axis of the surface. The horizontal axis on the projection will be the surface x or y axis with the other axis projecting into the plane of the paper at the angle theta. The user specifies the angle theta and also the surface axis that will appear as the horizontal axis. The model makes no attempt to suppress "hidden" lines so there will be some "best" combination of horizontal axis and theta for most surfaces. The "best" combination results in a drawing that exhibits the contours of the surface with the least confusion from the "hidden" lines.

The surface definition begins with an x,y grid drawn on a topographic map. Either the northeast, southeast, northwest, or southwest corner is designated as the origin of that grid. When a projection is made, the user specifies the viewer's position as being to the south, north, east, or west. To set the viewer's position for projection, the user should face the topographic map in the viewer's position.

Then the horizontal map axis will correspond to the horizontal projection axis.

The angle theta may range from 0 to 180°. If theta is zero, the x and y axes will coincide. If theta is 90°, the x and y axes will coincide with the z axis, and all lines will be true cross-section lines. If theta is 180°, the x and y axes will project in opposite directions from the origin. Experimentation showed that the "best" projection results from setting theta to 70°. Generally, the clearest projections are obtained when viewed from one end of the panels.

The user also controls the extent of the original surface to be plotted and the number of grid lines to be included. It is possible to draw only a specified portion of the surface and to draw every other grid line. In addition, the user specifies the original map scale factors, and also can have the projections drawn at a reduced scale. In this way the user can focus in on a given area.

2.5 OBTAINING PLAN VIEWS

The Plot Plan View (PPV) program can process a DLS control file to validate the coal line definitions and placement of spoils. The PPV program produces a drawing that can be made to scale and oriented so that it may be superimposed on a map of the mine. This drawing provides a quick visual check of the panels defined for a DLS run.

Each panel to be stripped in a model run is defined by two sets of x,y coordinates: one set defines the highwall to be formed on this panel and the other defines the highwall formed on the preceding panel. In the case of a boxcut panel, this second set defines the face opposite the highwall being formed.

Each x,y pair refers to the intersection of the top of the coal with the bottom of a face. Four pairs define a digout, corresponding to the positions where the four faces intersect the top of the coal.

The spoiling positions are specified by user-set spoil angles. A spoil angle is the angle between two lines projecting from the dragline center of rotation. One line parallels the highwall being formed and the other connects the dragline center with the center of the spoils.

Generally, the x,y coordinates and angles are taken from topographic maps. When the pit has a complicated pattern of panels and digouts, the coordinates and angles can be difficult to correctly read and transcribe. The PPV program reads the DLS input and uses a plotter to draw a plan view of the pit.

Figure 2.2 shows an example of a PPV drawing. Two panels are shown in this figure: the boxcut (lower left) and the first production panel (upper right). Dashed lines in the production panel delimit the keycut and are extended to the dragline center in the keycut position. The dashed lines from the dragline center over the boxcut show the position of the boom when the bucket is over the center of the spoils. The second dashed line (roughly parallel to first) shows the position of the boom when dumping from the bail position. A detailed explanation is contained in Chapter 12 of this volume.

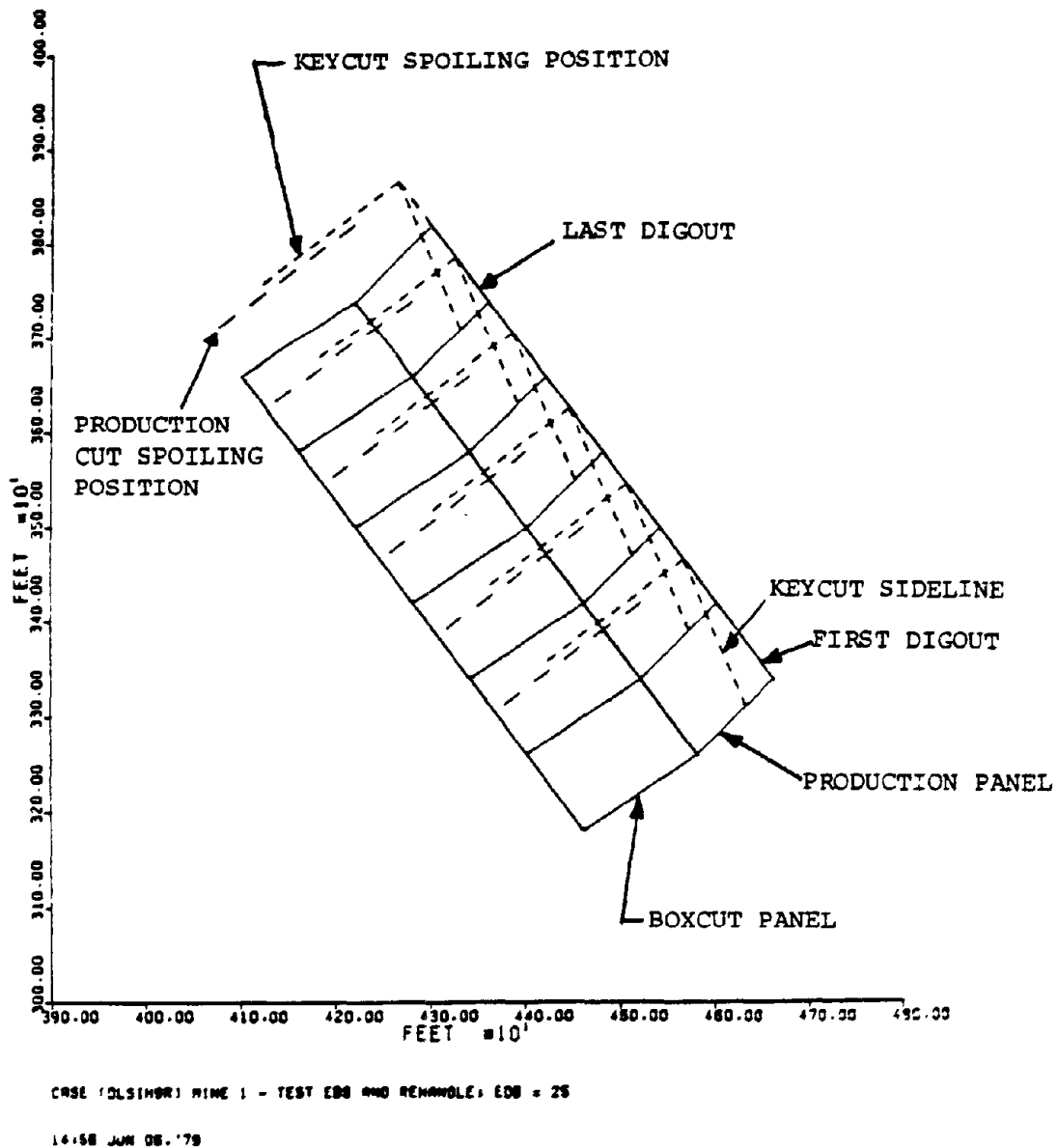


Figure 2.2
Example Plan View Drawing

3.1 DEFINING THE SURFACE ARRAY

Before a DLS run can be made, the user must define the "surface array" that will be processed by the DLS Model. The surface array is a two-dimensional array or table containing elevation data for the portion of the mine that is to be studied by DLS runs. The surface array is created by the DDM sequence and stored in a computer file for processing by the DLS model. The DLS model modifies the array, and can also place the modified array in a file for processing by the DIS model to develop isometric projections of the mine area. An array saved from a DLS run can also be used as the input array to another DLS run.

The array definition begins with a topographic map of the mining area to be studied. The first step is to place a coordinate system on the map, i.e., draw a series of grid lines on the map if the paper does not already have grid lines on it. Figure 3.1 shows a portion of a topographic map which has been drawn on paper with a grid system. The portion to be covered is depicted by making the grid lines darker. To make a coordinate system from the grid lines, the vertical lines are labeled "x", and the horizontal lines are labeled "y". The scale of this map has 20 ft between lines, and the lines are marked with the number of feet from the coordinate system origin. Thus, the x lines range from 0 to 260 and the y lines from 0 to 140.

In the surface array table created from this grid system, the rows contain data from one set of grid lines (i.e., the x lines) and the columns contain data from the other set of grid lines (i.e., the y lines). The grid on Figure 3.1 has 14 x lines and 8 y lines, so the array will contain 14 rows and 8 columns. Each word in the array contains the elevation data for the intersection of an x and a y line. Thus, for this figure, the array (table) contains $8 \times 14 = 112$ words.

For illustration, Figure 3.1 shows only surface elevations sufficient for a uniform coal seam. For a variable coal seam, isopach maps are also needed to obtain elevation data for the top and bottom of the coal seam. For best results, the user should prepare a composite map of 200 feet to the

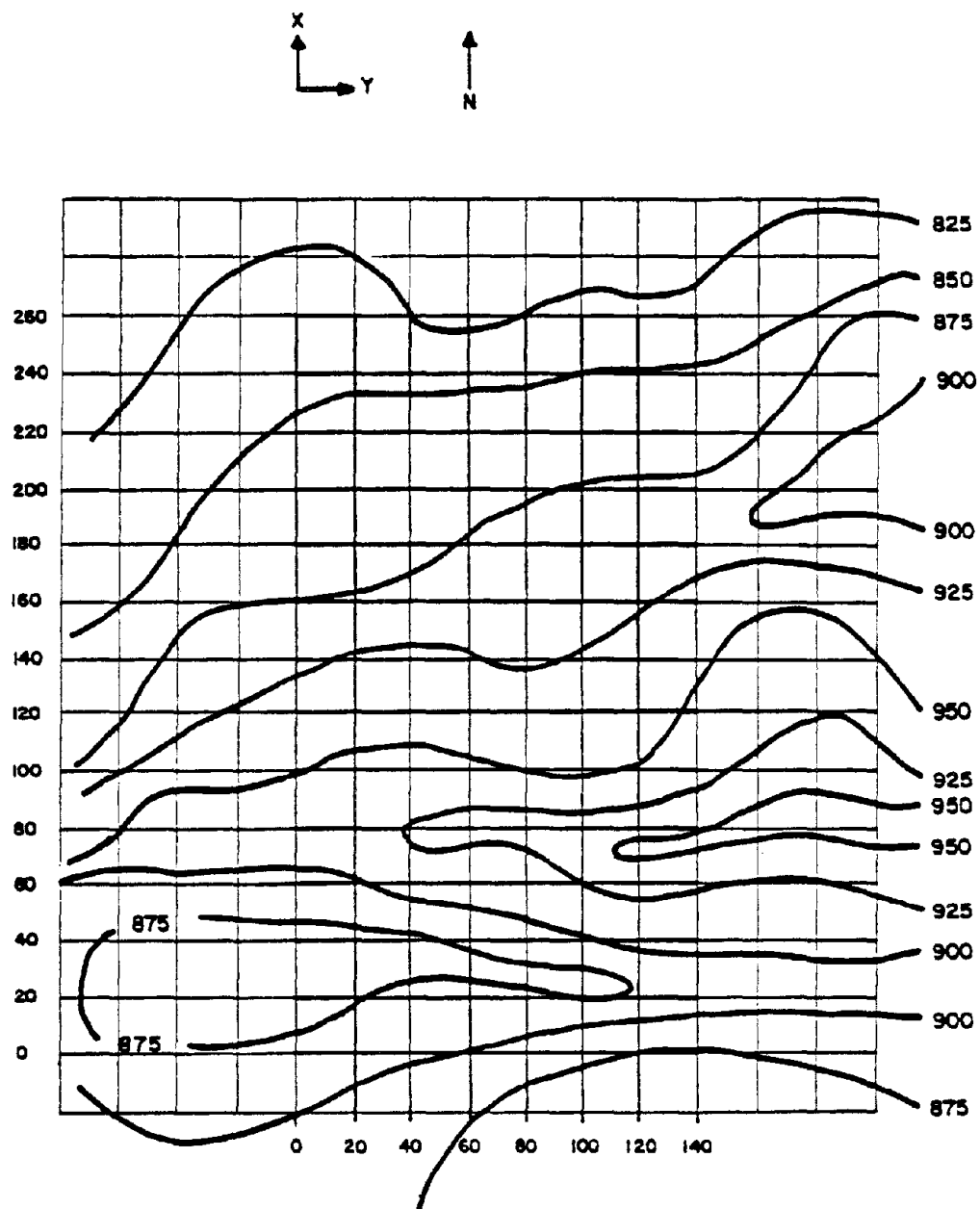


Figure 3.1
Topographic Map With Grid

inch showing surface elevation, overburden thickness, and coal isopachs.

The DDM input file will be created by reading x,y,z values from this map. The elevations will be read at intersections of grid lines and contour/isopach lines. The model will interpolate between user-defined elevations to obtain elevations for each intersection of x and y grid lines. At each intersection, three elevations are required to fully define the surface and the coal seam:

1. EAS - elevation at the surface
2. ETC - elevation at the top of coal
3. EBC - elevation at the bottom of coal

When the coal seam varies in thickness and attitude, all three elevations must be defined in the DDM input. However, when the seam is a level layer of uniform thickness, the input can be simplified. For the level seam, the elevation reference plane is the bottom of the coal seam, and all EBC entries are zero elevations. Since the seam is also of uniform thickness, the ETC values are constant. Therefore, only overburden thickness values are required, with the coal thickness as a constant parameter.

When the input data are processed to form the surface array, the program "packs" elevation data for more efficient use of computer memory. When data are retrieved from the surface array, the elevation data are "unpacked." This packing/unpacking is automatic and concerns the user only in its effect on the precision of the elevation data.

For level seams, each word in the surface array file contains two elevations, EAS and ETC. Each value is rounded to the nearest 0.1 ft before packing.

For variable seams, each word in the surface array file contains three elevations: EAS, ETC, and EBC. Each value is rounded to the nearest 1.0 ft before packing.

The user may wonder why level-seam data are packed if ETC and EBC are constants. Actually, ETC would not be constant if the coal seam pinched out in the area under study. Also, the value of ETC will be modified by the model when the coal is removed.

3.2 THE ARRAY DEFINITION PROGRAMS

When a level-seam array is being developed, the DDM sequence involves two programs:

1. DDM - Deposit Description Model
2. IHC - Insert Height of Coal

The user's input file contains a single elevation entry for each intersection of contour line with grid line. The DDM program interpolates between user-defined entries to develop the surface elevation (EAS) entry for each grid point. At this stage, each word in the surface array contains a single elevation entry. The IHC program then reads the input value of coal thickness and develops an array with two elevations packed into each word. In this process, if the user value of EAS is less than ETC, the program will use EAS as the value of ETC.

When a variable-seam array is being developed, the DDM sequence involves three programs, in the order:

1. BTS - Build Three Sets
2. DDM - Deposit Description Model
3. CSA - Combine Surface Arrays

The input file in this case contains three elevation values (EAS, ETC, and EBC) for each intersection of contour line with grid line. Since the DDM model can read and interpolate only one value, the BTS program is used to create three sets of DDM input. The DDM program creates a surface file containing three surface arrays. The CSA program combines (packs) the three arrays into one array.

3.3 THE ARRAY DEFINITION INPUT FILE

The input data may be in the form of a punched-card deck or a file of card images. For reference, the term "card" is used to denote either a punched card or a card-image record in a file.

Several card types are used. The information on each card depends on the card type, which is determined by column 1 of the card. The card types recognized by the system are:

- o T = Title card
- o L = Log card
- o B = Bias card
- o G = Grid card
- o S = Surface card
- o X = X line card
- o Ø = Elevation card(s) for preceding x line
- o Y = Y line card
- o Ø = Elevation card(s) for preceding y line

Note: The Ø means that column 1 is blank.

The system uses a "free format" for card processing. This means that the numeric values on each card must be separated by one or more blank columns. The following paragraphs define the entries on each card and how the system uses them.*

3.3.1 TITLE CARD (RECOMMENDED)

The title card begins with "T" in card column 1, followed by an appropriate title in columns 2-80. The "T"s basic use is for identification purposes only. For reference, the file name should be included in the title as in the following example:

T(DDM12) MINE B, REGION OF PIT 1A

3.3.2 LOG CARD (OPTIONAL)

The log card has an "L" in column 1. It controls output from the DDM model. When used, only one card may be present and it must physically precede the grid card. The log card sets three control variables to 0 (meaning off), or 1 (meaning on). The card entries are:

L LOGSF LOGIN LOGSD

*IBM version requires the first numeric values to be entered in column 5.

where:

LOGSF = 1 causes creation of the surface file
 = 0 suppresses creation of the surface file

LOGIN = 1 prints the input cards as read
 0 suppresses printing the input cards

LOGSD = 1 causes printing of final elevation data
 0 suppresses this printing

When the log card is not included in the input, all three controls are set to "on" which causes the surface file to be created, the input cards to be printed, and the final elevations to be listed.

For example, the following log card:

L 1 1 0

would create the surface file and print the input, but would not print the final elevations.

3.3.3 BIAS CARD (OPTIONAL)

The bias card with "B" in column 1 specifies bias values for x,y,z. When not included, the three bias values are set to zero. When included, only one bias card is permitted, and it must physically precede the grid card. The card entries are:

B x-bias y-bias z-bias

As the input entries are processed, the appropriate bias value is subtracted from each data entry. Zero is a valid bias entry.

The bias values are used to reduce grid readings or elevation data to a manageable number of digits. When the DLS input is being prepared, the grid values are entered to control the dragline digging and spoiling. If the map grid had seven-digit numbers, the DLS input would be difficult to formulate and read. In this case, the user should enter x-bias and y-bias values so that resulting grid values will have three or four digits.

Also, elevation entries must not exceed 999. Thus, if map elevations refer to sea level, a z-bias is needed to reduce them to the proper range.

For example, the following bias card:

B 45500 56000 3000

would subtract:

45500 from all x values
56000 from all y values
3000 from all z values

3.3.4 GRID CARD (REQUIRED)

The grid card with "G" in column 1 defines the size of the surface array. It must be the first physical data card following the title, log, or bias cards (when they are used).

The entries on the grid card are:

GXX XF XL XS YF YL YS

where:

XX = Origin positions; may be "NE" (northeast), "NW" (northwest), "SE" (southeast), or "SW" (southwest)

XX must be in columns 2 and 3

XF = First x-line value

XL = Last x-line value

XS = Step between x lines (i.e., grid size)

YF = First y-line value

YL = Last y-line value

YS = Step between y lines (i.e., grid size)

Negative x and y values are permissible.

The array size is limited to:

$$(NX)(NY) \leq 24,000$$

where:

$$NX = \frac{XL - XF}{XS} + 1$$

$$NY = \frac{YL - YF}{YS} + 1$$

$$NX \leq 300$$

$$NY \leq 300$$

For example, the following grid card:

GSW 5000 8000 10 1000 2000 10

specifies a grid with origin in the southwest corner, x values ranging from 5000 to 8000 ft in steps of 10 ft, and y values ranging from 1000 to 2000 ft in steps of 10 ft.

3.3.5 SURFACE CARD (REQUIRED)

The surface card contains an "S" in column 1. The surface card must follow the grid card. If the input file defines more than one surface, each set of data cards must be preceded by a surface card.

The entries on the surface card are:

S SN TM DM SM

where:

SN = surface reference number (any four-digit number)

TM = type of material (enter a "1")

DM = density of material in lbs/bank yd³

SM = percentage swell for material, as a decimal fraction

For example, the following surface card:

S 4000 1 3200 .25

creates a surface with the surface number 4000, of material with a density of 3200 lbs/bank yd³, that swells by 25%.

When more than one surface is defined in a run, each set must have a unique number and numbers must be in ascending sequence. If two surfaces were assigned the same number, the program would find only the first one.

The swell percentage given here can be changed where necessary in the DLS model.

3.3.6 ELEVATION DATA CARDS

The elevation data cards contain either "X", "Y", or "Ø" (blank) in column 1.

These cards differ for level-seam and variable-seam arrays. Before discussing the differences, the aspects which are the same are discussed in the following paragraphs.

The user's input consists of elevations read at intersections of grid lines with contour/isopach lines. The arrays contain elevations at intersections of grid lines. Thus, the DDM Model interpolates between user-defined intersections to build an array of grid-line intersections. The user should keep in mind the difference between contour/isopach intersection with map grid lines, and the intersection between the map grid lines themselves. The former may be at random intervals of 100-200 ft, whereas the latter is at regular intervals defined by x and y on the grid card. The model accepts readings from only x lines, from only y lines, or from both. When both are used, all x-line data cards must physically precede all y-line data cards.

The input cards are grouped according to the lines from which the data readings are taken. When reading x lines, an "X" card is used to specify the value of the x line. It is followed by one or more "Ø" cards containing the y and z elevation readings from that line. There will be one group of "X" and "Ø" cards for each x line. Similarly, when reading y lines, a "Y" card is used to specify the value of the line from which the readings are taken. The "Y" card is followed by one or more "Ø" cards containing the x and z entries.

The "X" and "Y" cards contain a single value after the letter for either level- or variable-seam data.

Level-seam "Ø" cards have the following entries:

Øy1 z1 y2 z2 y3 z3 y4 z4 y5 z5
or Øx1 z1 x2 z2 x3 z3 x4 z4 x5 z5.

That is, up to five sets of y,z or x,z entries may be entered on a single card.

Variable-surface "Ø" cards have the following entries:

Øy1 zs1 zt1 zb1 y2 zs2 zt2 zb2
or Øx1 zs1 zt1 zb1 x2 zs2 zt2 zb2

where:

zs = elevation of surface topography
zt = elevation of top of coal
zb = elevation of bottom of coal

That is, one or two sets of entries may be included on a single card.

3.4 DDM INTERPOLATION

The DDM model uses simple linear interpolation between user-defined points and the grid points. As the x-line data are processed, the model interpolates to fill in values for all y's. As the y-line data are processed, the model interpolates to fill in values for all x's. It then averages the values from x lines with values from y lines to obtain the final grid elevations.

When the surface being defined is a relatively flat plain, the model may interpolate correctly from only x data or only y data. When the surface is complex, however, both may be needed for proper interpolation.

When reading x- or y-line elevations, the user should read intersections that are outside or on the limits of the grid. If not, the model will extrapolate from the specified data to find the outside grid elevations. This extrapolation may, in many cases, be correct, but not always.

When two successive readings on any grid line would be the same elevation, the model interpolation will result in a plane between the points of intersection. The user may wish to enter an intervening point based on his judgment of the intervening peak or valley.

3.5 MODEL REPRESENTATION OF A SURFACE

This section discusses the manner in which the model represents surfaces to assist the user in assessing model results.

The way the model represents a surface will depend upon the grid size defined for the surface array. The grid size will also affect model accuracy. In addition, the scale of the maps the engineer works on will affect the manner in which surfaces are represented and the accuracy of the engineering estimates.

When dealing with maps, the engineer can continually increase map size in order to study larger areas at a given scale. However, the model does not have the same capability. The memory capacity of the model is fixed in the present version. The model has been designed for possible extension to file handling procedures which would permit the surface array size to be increased. But in the present version the array size is limited so that:

$$(NX)(NY) \leq 24,000$$

where:

NX is the number of x lines

NY is the number of y lines.

There are no simple rules for relating grid size to model accuracy. The user will have to experiment with the model grid size to determine what is best for solving a problem (refer to Section 3.9). Keep in mind that the model grid size is analogous to the map scale.

Figure 3.2 shows an exaggerated surface profile as it might be represented in the model. The heavy dashed lines represent the surface profile and the solid bottom line represents the reference plane. The tic marks on the reference plane indicate grid points. These figures could represent a profile drawn along an x line, and the tic marks would indicate the y coordinates. Alternatively, the figures could represent a profile drawn along a y line, and the tic marks would indicate the x coordinates. Assume the tic marks in the lower profile are at 10-ft intervals, and those on the top are at 20-ft intervals. That is, the lower grid size is 10 ft, and the upper grid size is 20 ft.

The surface array contains an elevation entry for each tic mark, i.e., for each x,y coordinate. The values in the array are indicated by the horizontal lines. The elevation at a grid point defines a square column of material, which has plan view dimensions equal to the grid size.

Thus, for the 10-ft grid, the columns are 10 ft square, and for the 20-ft grid, the columns are 20 ft square.

Note that the model uses two parameters for the grid:

XS = x grid size or step, i.e., distance in feet
between x lines

YS = y grid size or step, i.e., distance in feet
between y lines

The use of two parameters implies that the two grid intervals do not need to be the same, which is the design intent in building the DLS model. However, the model has not been tested with different XS and YS values. The user will recognize that different x and y scales on a map would result in a confusing picture. However, sometimes dimensions in one direction may require exaggeration for accuracy. The user may wish to experiment with different x and y scales for special problems.

Referring again to Figure 3.2, the horizontal bars represent the elevations at the grid points. On the lower figure, the bar for grid one is at 38 ft. Since the grid step is 10 ft, the cross section for this column is 380 sq ft. The total cross section for the 10-ft grid is 4910 sq ft, and that for the 20-ft grid is 4860 sq ft. Thus, the 10-ft grid appears to have an area 1% greater than the 20-ft grid.

The midpoints of the horizontal lines have been connected to show how the surface would appear on a section diagram drawn by the DIS model. This model simply draws straight lines from the elevation at one grid to the elevation at the next grid. These isometric projection lines show that the finer grid represents the surface better than the coarse grid. However, the area calculations above show that the apparent differences may average out in the model calculations.

3.6 LEVEL VS. VARIABLE COAL SEAMS

It should be emphasized that in the DDM process the user follows different sequences and enters different data for level seams than that for variable seams. Thereafter, the user need not be concerned about this distinction. The DDM programs place code words in the surface arrays to indicate the type of coal seam. The DLS and DIS models read these code words and will correctly process a surface array created by either DDM sequence.

3.7 EXAMPLE OF LEVEL-SEAM DDM SEQUENCE

To illustrate the sequence followed for level-seam arrays, an input file was created from the topographic map shown in Figure 3.1. The input file is listed as input in Figure 3.3. The printout from the DDM program is reproduced in Figure 3.4 and the printout from the IHC program in Figure 3.5.

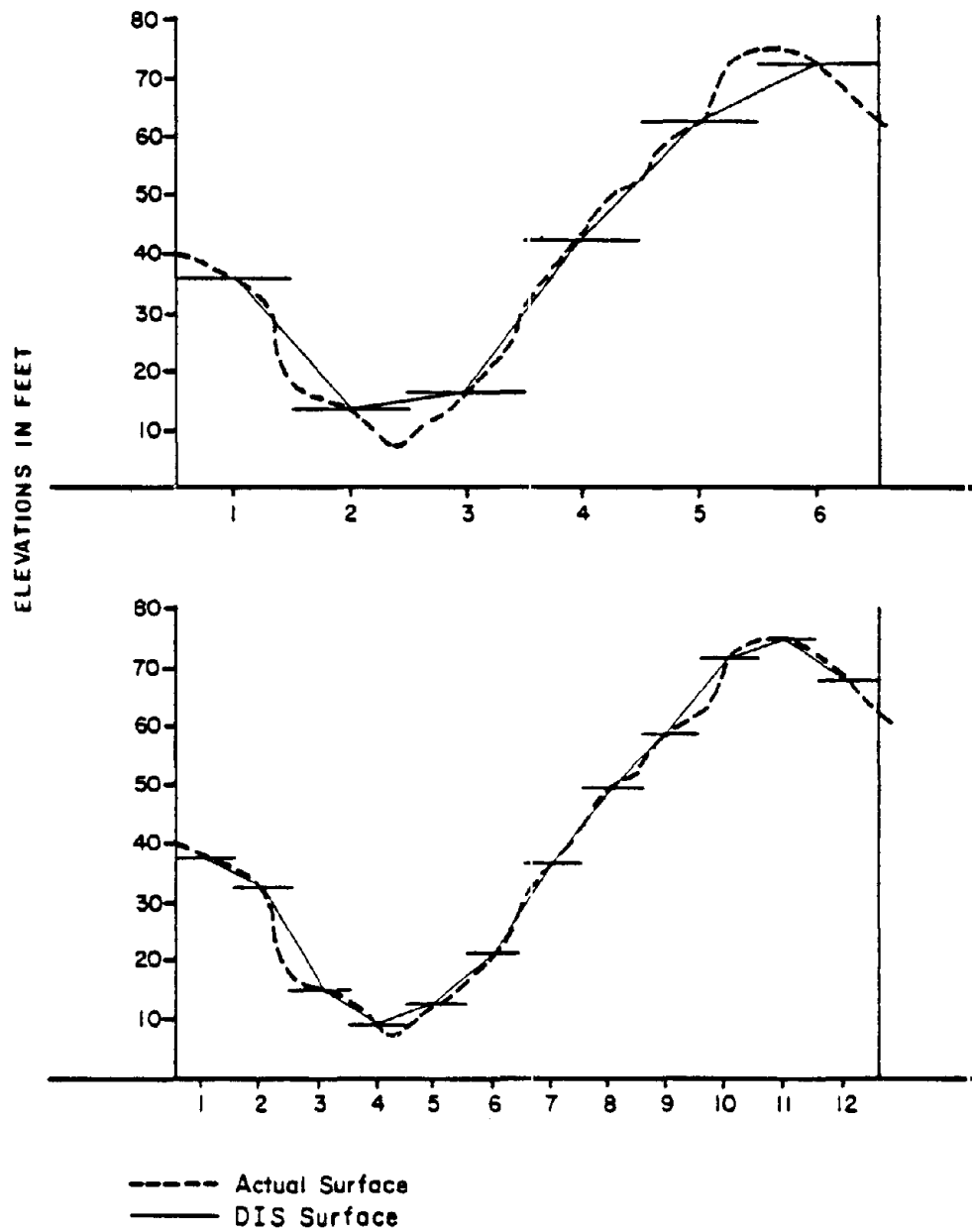


Figure 3.2
Profile of Land as Seen by Model

```

T (DDMEYAN) EXAMPLE BDM INPUT FOR 20-FOOT LEVEL SEAM
L 1 1 1
B 0 0 800
SSM 0 250 20 0 140 20
S 1000 1 2950 .25
X 0
  0 880 55 900 120 875 140 875
X 20
  0 865 24 875 60 800 100 875 140 900
X 40
  0 972 50 875 105 900 140 910
X 60
  0 895 25 900 100 925 140 930
X 80
  -80 950 38 925 140 950
X 100
  0 950 40 955 72 950 150 925
X 120
  -20 925 135 950
X 140
  -50 875 10 925 40 930 80 925 150 950
X 160
  0 875 130 925
X 180
  -45 850 55 875 150 910
X 200
  -30 850 90 875 170 900
X 220
  -10 850 160 875
X 240
  -55 825 100 850 180 875
X 260
  0 835 40 825 60 820 80 825 180 850

```

Figure 3.3
Level Seam - DDM Input File
(1 of 2)


```

Y 0
-20 900 8 875 30 860 45 875 65 900
100 950 130 925 160 875 230 850 285 825
Y 20
-15 900 20 875 40 875 63 900 108 950
143 925 163 875 230 850 280 825
Y 40
-5 900 25 875 43 875 80 925
108 950 145 925 170 875 233 850 260 825
Y 60
0 900 28 875 38 875 52 900 80 925
105 950 143 925 186 875 235 850 255 825
Y 80
-10 875 5 900 25 875 32 875 46 900
75 925 88 925 100 950 135 925 195 875
235 850 260 825
Y 100
-5 875 8 900 20 875 30 875
42 900 60 925 70 940 95 925
85 950 145 925 202 875 240 850 270 825
Y 120
0 875 12 900 25 880 37 900 55 925
70 950 75 950 88 925 105 950 155 925
205 875 243 850 267 825
Y 140
0 875 15 900 22 890 35 900
58 925 72 950 78 950 93 925
128 950 168 925 190 915 205 875
245 850 270 825

```

Figure 3.3
Level Seam - DDM Input File
(2 of 2)

Some lines in the printout (Figure 3.4) begin with a sequence number and others begin with a code word. The sequence-numbered lines are reproductions of input records that the DDM program numbers as it is read.

The lines that begin with code words print values as read from the free-format cards. Thus, the 'L' card is reprinted with the word LOG, the 'B' card with the word BIAS, the 'G' card with the word GRID, and the 'S' card with the word SURFACE. This playback provides the user with an assurance that the input control cards have been correctly processed.

Three information variables are printed after the GRID line. They are:

NOX = 14 (the number of defined x lines)

NOY = 8 (the number of defined y lines), and

NOW = 112 (the number of words in the surface array).

If the value of NOW had exceeded the surface array dimension, the program would have stopped after printing the NOW line.

Since LOGIN = 1 on the 'L' card, the program continues to print all input cards. If LOGIN had been set to zero, the printout would have stopped after the LOG line.

Sheets 1 and 2 of Figure 3.4 list the 62 records that comprise the input file. Since LOGSD = 1 on the 'L' card, the program next lists the final surface elevation data. Sheet 3 of Figure 3.4 lists the INDEX number and x or y VALUE for each line that was explicitly defined in the input. First x values are listed, then y values.

Sheet 4 of Figure 3.4 lists the final elevations from the surface array. The program chooses the order that will result in the least number of pages in this printout. In this example, they are listed by y lines since there are fewer y lines than x lines in the array. If there are fewer x lines than y lines in an array, this listing will be made by x lines.

In this listing, some lines begin with "Y = value"; if the listing order were reversed, these lines would begin with "X = value". These lines print the coordinate of the x or y lines that apply to the data lines which follow. On data lines, the first printed value is the coordinate value, followed by up to 10 elevation values. These elevations apply to 10 grid lines starting with the grid whose value is printed.

```

1 T (DDMEXAM) EXAMPLE DDM INPUT FOR 20-FOOT LEVEL SEAM
2 L 1 1 1
LOG 1 1 1
3 B 0 0 800
BIAS 0. 0. 800.

4 GSM 0 250 20 0 140 20
GRID SW .0 250.0 20.0 .0 140.0 20.0
NX = 14
NY = 8
NDM = 112
5 S 1000 1 2950 .25

SURFACE 1000. 1. 2950. .250

6 X 0
7 0 880 55 900 120 875 140 875
8 X 20
9 0 865 24 875 60 800 100 875 140 900
10 X 40
11 0 972 50 875 105 900 140 910
12 X 60
13 0 895 25 900 100 925 140 930
14 X 80
15 -60 950 38 925 140 950
16 X 100
17 0 950 40 955 72 950 150 925
18 X 120
19 -20 925 135 950
20 X 140
21 -50 875 10 925 40 930 80 925 150 950
22 X 160
23 0 875 130 925
24 X 180
25 -45 850 55 875 150 910
26 X 200
27 -30 850 90 875 170 900
28 X 220
29 -10 850 160 875
30 X 240
31 -55 825 100 850 180 875
32 X 250
33 0 835 40 825 60 820 80 825 180 850

```

Figure 3.4
Level Seam - DDM Printout
(1 of 4)

```

34 Y 0
35   -20 900 8 875 30 860 45 875 65 900
36   100 950 130 925 160 875 230 850 285 825
37 Y 20
38   -15 900 20 875 40 875 63 900 108 950
39   143 925 163 875 230 850 280 825
40 Y 40
41   -5 900 25 875 43 875 80 925
42   108 950 145 925 170 875 233 850 260 825
43 Y 60
44    0 900 28 875 38 875 52 900 80 925
45   105 950 143 925 186 875 235 850 255 825
46 Y 80
47   -10 875 5 900 25 875 32 875 46 900
48    75 925 88 925 100 950 135 925 195 875
49   235 850 260 825
50 Y 100
51   -5 875 8 900 20 875 30 875
52   42 900 60 925 70 940 85 925
53   95 950 145 925 202 875 240 850 270 825
54 Y 120
55    0 875 12 900 25 880 37 900 55 925
56   70 950 75 950 88 925 105 950 155 925
57  205 875 243 850 267 825
58 Y 140
59    0 875 15 900 22 890 35 900
60   58 925 72 950 78 950 93 925
61  128 950 168 925 190 915 205 875
62  245 850 270 825

```

Figure 3.4
Level Seam - DDM Printout
(2 of 4)

ELEVATIONS ENTERED FOR FOLLOWING X VALUES:

INDEX, VALUE	1	.00
INDEX, VALUE	2	20.00
INDEX, VALUE	3	40.00
INDEX, VALUE	4	60.00
INDEX, VALUE	5	80.00
INDEX, VALUE	6	100.00
INDEX, VALUE	7	120.00
INDEX, VALUE	8	140.00
INDEX, VALUE	9	160.00
INDEX, VALUE	10	180.00
INDEX, VALUE	11	200.00
INDEX, VALUE	12	220.00
INDEX, VALUE	13	240.00
INDEX, VALUE	14	260.00

ELEVATIONS ENTERED FOR FOLLOWING Y VALUES:

INDEX, VALUE	1	.00
INDEX, VALUE	2	20.00
INDEX, VALUE	3	40.00
INDEX, VALUE	4	60.00
INDEX, VALUE	5	80.00
INDEX, VALUE	6	100.00
INDEX, VALUE	7	120.00
INDEX, VALUE	8	140.00

Figure 3.4
Level Seam - DDM Printout
(3 of 4)

ELEVATION DATA BY Y LINE FOLLOWS:

Y =	.0										
	.0	116.8	88.6	121.0	94.4	128.1	150.0	130.8	112.5	75.0	64.6
	200.0	58.5	52.5	39.7	35.7						
Y =	20.0										
	.0	88.3	74.2	104.1	97.9	124.2	146.8	136.4	126.3	82.6	67.5
	200.0	60.8	54.1	41.0	32.5						
Y =	40.0										
	.0	95.2	60.4	84.7	101.5	125.2	148.9	138.3	129.2	92.7	71.1
	200.0	63.8	56.3	41.9	25.0						
Y =	60.0										
	.0	99.0	41.1	79.1	109.4	127.7	148.4	139.0	127.2	101.7	79.4
	200.0	68.3	59.0	43.6	19.4						
Y =	80.0										
	.0	91.0	59.4	89.0	115.2	130.1	148.7	138.4	122.9	105.0	85.9
	200.0	72.4	61.3	45.9	25.0						
Y =	100.0										
	.0	83.7	75.0	96.8	125.0	135.1	144.3	140.9	129.8	112.7	92.9
	200.0	77.4	64.7	50.0	31.7						
Y =	120.0										
	.0	75.0	87.6	104.2	130.4	142.7	138.6	145.0	135.9	120.6	99.5
	200.0	82.2	67.1	54.1	33.6						
Y =	140.0										
	.0	75.0	96.4	107.7	129.3	148.3	129.1	147.5	144.5	129.4	112.9
	200.0	89.5	68.8	57.8	37.5						

Figure 3.4
Level Seam - DDM Printout
(4 of 4)

If we interpret the first three lines of Sheet 4 (Figure 3.4), the user should see how to read this data listing. These data apply to the $Y = 0$ grid line. The elevations on the second line apply to grid lines from $X = 0$ through $X = 180$. The data on the third line apply to grid lines from $X = 200$ through $X = 260$. Thus, at grid coordinate 0,0 (x,y), the elevation is 116.8; at 20,0 it is 88.6; at 40,0 it is 121.0; etc.

Figure 3.5 is the printout from the IHC program. The first line reads $HC = 20$; that is, the value for coal seam thickness as specified by the user is 20 ft.

The program then retrieves the surface array that had been created by the DDM program. It prints the surface statistics and the title, 'T', card. The program then packs the top-of-coal elevations into the surface array to create a new level-seam surface array.

From Sheet 4 of Figure 3.4, it can be seen that the elevation at coordinates 260,60 is 19.4 ft. Since this elevation is less than the coal seam thickness, the program will set the top-of-coal elevation to 19.4 ft. Thus, the system requires only that the bottom of a "level" seam be level. The system will correctly process seams in which the top of coal is not a level plane.

3.8 EXAMPLE OF VARIABLE-SEAM DDM SEQUENCE

To illustrate the DDM sequence for variable-seam arrays, we created an isopach map to support the topographic map of Figure 3.1. From these maps, we developed the BTS input file reproduced in Figure 3.6. The difference between this input file and that for the level seam (Figure 3.3) is in the elevation data cards. Two sets of data are entered on each card, consisting of the elevations of the surface, the top of coal, and the bottom of coal.

When this file is processed by the BTS program, it produces a listing of the input records shown in Figure 3.7, with a program-generated sequence number. The last line on Sheet 2 of this figure prints the number of lines and number of data entries in the input. Figure 3.7 shows 22 and 139 - 22 x and y lines, and 139 sets of elevation data.

The BTS program creates a DDM input file which contains three sets of elevation data: for surface, top of coal, and bottom of coal. The 'T', 'L', 'B', and 'G' cards from the input file are reproduced in the output file. Each set of elevation data is preceded by an 'S' card. The three 'S' cards differ only in the TM field, which is 1, 2, and 3, respectively.

HC = 20.0

SURFACE	SNR	TH	DM	SM
	1000.	1.	2950.	.250

SURFACE STATISTICS							
X FIRST	X LAST	X STEP	NO. X	Y FIRST	Y LAST	Y STEP	NO. Y ARRAY SIZE
.0	260.0	20.0	8	.0	140.0	20.0	14 112

LEVEL SEAM T (DDMEXAM) EXAMPLE DDM INPUT FOR 20-FOOT LEVEL SEAM

Figure 3.5
Level Seam - IHC Printout


```

T (DOMEXAM) EXAMPLE DOM INPUT FOR 20-FOOT VARIABLE SEAM
L 1 1 1
B 0 0 800
GSM 0 260 20 0 140 20
S 1001 1 2950 .25
X 0
    .0 880.0 820.0 800.0 55.0 900.0 820.0 800.0
    120.0 875.0 823.0 800.0 140.0 875.0 820.0 800.0
X 20
    .0 865.0 820.0 800.0 24.0 875.0 823.0 800.0
    80.0 800.0 800.0 800.0 100.0 875.0 823.0 800.0
    140.0 900.0 821.0 800.0
X 40
    .0 972.0 819.0 800.0 50.0 875.0 820.0 800.0
    105.0 900.0 819.0 800.0 140.0 910.0 822.0 804.0
X 60
    .0 895.0 820.0 800.0 25.0 900.0 820.0 800.0
    100.0 925.0 828.0 800.0 140.0 930.0 824.0 800.0
X 80
    -60.0 950.0 828.0 800.0 38.0 925.0 828.0 816.0
    140.0 950.0 820.0 800.0
X 100
    .0 950.0 826.0 800.0 40.0 955.0 822.0 800.0
    72.0 950.0 826.0 800.0 150.0 925.0 820.0 800.0
X 120
    -20.0 925.0 828.0 800.0 135.0 950.0 826.0 800.0
X 140
    -50.0 875.0 817.0 800.0 10.0 925.0 828.0 800.0
    40.0 930.0 820.0 800.0 80.0 925.0 828.0 816.0
    150.0 950.0 826.0 800.0
X 160
    .0 875.0 823.0 800.0 130.0 925.0 828.0 800.0
X 180
    -45.0 850.0 820.0 800.0 55.0 875.0 823.0 800.0
    150.0 910.0 820.0 800.0
X 200
    -30.0 850.0 820.0 800.0 90.0 875.0 823.0 800.0
    170.0 900.0 821.0 800.0
X 220
    -10.0 850.0 815.0 800.0 160.0 875.0 823.0 800.0
X 240
    -55.0 825.0 825.0 800.0 100.0 850.0 825.0 800.0
    180.0 875.0 823.0 800.0
X 260
    .0 835.0 820.0 800.0 40.0 825.0 820.0 800.0
    60.0 820.0 820.0 800.0 80.0 825.0 825.0 800.0
    180.0 850.0 820.0 800.0

```

Figure 3.6
Variable Seam - BTS Input
(1 of 2)

Y 0							
-20.0	900.0	820.0	800.0	8.0	975.0	824.0	800.0
30.0	860.0	826.0	800.0	45.0	875.0	823.0	800.0
65.0	900.0	821.0	800.0				
100.0	950.0	826.0	812.0	130.0	925.0	828.0	800.0
160.0	875.0	823.0	806.0	230.0	850.0	825.0	810.0
285.0	825.0	813.0	800.0				
Y 20							
-15.0	900.0	819.0	800.0	20.0	875.0	820.0	800.0
40.0	875.0	823.0	806.0	63.0	900.0	819.0	800.0
108.0	950.0	826.0	800.0				
143.0	925.0	828.0	816.0	163.0	875.0	823.0	806.0
230.0	850.0	825.0	810.0	280.0	825.0	820.0	800.0
Y 40							
-5.0	900.0	820.0	800.0	25.0	875.0	823.0	806.0
43.0	875.0	823.0	806.0	80.0	925.0	826.0	816.0
108.0	950.0	826.0	800.0	145.0	925.0	828.0	800.0
170.0	875.0	820.0	800.0	233.0	850.0	825.0	810.0
280.0	825.0	825.0	800.0				
Y 60							
.0	900.0	819.0	800.0	28.0	875.0	823.0	806.0
38.0	875.0	820.0	800.0	52.0	900.0	820.0	800.0
80.0	925.0	828.0	816.0				
105.0	950.0	826.0	800.0	143.0	925.0	826.0	816.0
186.0	875.0	823.0	800.0	235.0	850.0	825.0	800.0
255.0	825.0	813.0	800.0				
Y 80							
-10.0	875.0	820.0	800.0	5.0	900.0	821.0	800.0
25.0	875.0	823.0	806.0	32.0	875.0	820.0	800.0
46.0	900.0	820.0	800.0				
75.0	925.0	820.0	800.0	88.0	925.0	828.0	800.0
100.0	950.0	826.0	812.0	135.0	925.0	820.0	800.0
195.0	875.0	823.0	800.0				
235.0	850.0	825.0	800.0	260.0	825.0	825.0	800.0
Y 100							
-5.0	875.0	817.0	800.0	8.0	900.0	821.0	800.0
20.0	875.0	820.0	800.0	30.0	875.0	823.0	800.0
42.0	900.0	819.0	800.0	60.0	925.0	826.0	800.0
70.0	940.0	825.0	800.0	85.0	925.0	828.0	800.0
95.0	950.0	826.0	800.0	145.0	925.0	828.0	800.0
202.0	875.0	823.0	806.0	240.0	850.0	820.0	800.0
270.0	825.0	813.0	800.0				
Y 120							
.0	875.0	823.0	800.0	12.0	900.0	819.0	800.0
25.0	880.0	828.0	800.0	37.0	900.0	820.0	800.0
55.0	925.0	828.0	800.0				
70.0	950.0	826.0	812.0	75.0	950.0	826.0	800.0
88.0	925.0	828.0	800.0	105.0	950.0	826.0	800.0
155.0	925.0	828.0	816.0				
205.0	875.0	823.0	806.0	243.0	850.0	820.0	800.0
267.0	825.0	813.0	800.0				
Y 140							
.0	875.0	823.0	800.0	15.0	900.0	819.0	800.0
22.0	890.0	829.0	818.0	35.0	900.0	821.0	800.0
58.0	925.0	828.0	800.0	72.0	950.0	826.0	800.0
78.0	950.0	826.0	800.0	93.0	925.0	820.0	800.0
128.0	950.0	820.0	800.0	168.0	925.0	820.0	800.0
190.0	915.0	820.0	800.0	205.0	975.0	823.0	808.0
245.0	850.0	825.0	810.0	270.0	825.0	813.0	800.0

Figure 3.6
Variable Seam - BTS Input
(2 of 2)

```

T (DDMEXAM) EXAMPLE ODM INPUT FOR 20-FOOT VARIABLE SEAM
2 L 1 1 1
3 B 0 0 800
4 GSW 0 260 20 0 140 20
5 S 1001 1 2950 .25
6 X 0
7      .0 880.0 820.0 800.0 55.0 900.0 820.0 800.0
8      120.0 875.0 823.0 800.0 140.0 875.0 820.0 800.0
9 X 20
10     .0 865.0 820.0 800.0 24.0 875.0 823.0 800.0
11     60.0 800.0 800.0 800.0 100.0 875.0 823.0 806.0
12     140.0 900.0 821.0 800.0
13 X 40
14     .0 972.0 819.0 800.0 50.0 875.0 820.0 800.0
15     105.0 900.0 819.0 800.0 140.0 910.0 822.0 804.0
16 X 60
17     .0 895.0 820.0 800.0 25.0 900.0 820.0 800.0
18     100.0 925.0 828.0 800.0 140.0 930.0 824.0 800.0
19 X 80
20     -60.0 950.0 826.0 800.0 38.0 925.0 828.0 816.0
21     140.0 950.0 820.0 800.0
22 X 100
23     .0 950.0 826.0 800.0 40.0 955.0 822.0 800.0
24     72.0 950.0 826.0 800.0 150.0 925.0 820.0 800.0
25 X 120
26     -20.0 925.0 828.0 800.0 135.0 950.0 826.0 800.0
27 X 140
28     -50.0 875.0 817.0 800.0 10.0 925.0 828.0 800.0
29     40.0 930.0 820.0 800.0 80.0 925.0 828.0 816.0
30     150.0 950.0 826.0 800.0
31 X 160
32     .0 875.0 823.0 800.0 130.0 925.0 828.0 800.0
33 X 180
34     -45.0 850.0 820.0 800.0 55.0 875.0 823.0 806.0
35     150.0 910.0 820.0 800.0
36 X 200
37     -30.0 850.0 820.0 800.0 90.0 875.0 823.0 800.0
38     170.0 900.0 824.0 800.0
39 X 220
40     -10.0 850.0 815.0 800.0 160.0 875.0 823.0 806.0
41 X 240
42     -55.0 825.0 825.0 800.0 100.0 850.0 825.0 800.0
43     180.0 875.0 823.0 800.0
44 X 260
45     .0 835.0 820.0 800.0 40.0 825.0 820.0 800.0
46     60.0 820.0 820.0 800.0 80.0 825.0 825.0 800.0
47     180.0 850.0 820.0 800.0

```

Figure 3.7
Variable Seam - ETS Printout
(1 of 2)

48	Y 0							
49		-20.0	900.0	820.0	800.0	8.0	975.0	824.0
50		30.0	860.0	826.0	800.0	45.0	875.0	823.0
51		65.0	900.0	821.0	800.0			
52		100.0	950.0	826.0	812.0	130.0	925.0	828.0
53		160.0	875.0	823.0	806.0	230.0	850.0	825.0
54		285.0	825.0	813.0	800.0			
55	Y 20							
56		-15.0	900.0	819.0	800.0	20.0	875.0	820.0
57		40.0	875.0	823.0	806.0	63.0	900.0	819.0
58		108.0	950.0	826.0	800.0			
59		143.0	925.0	828.0	816.0	163.0	875.0	823.0
60		230.0	850.0	825.0	810.0	280.0	825.0	820.0
61	Y 40							
62		-5.0	900.0	820.0	800.0	25.0	875.0	823.0
63		43.0	875.0	823.0	806.0	80.0	925.0	828.0
64		108.0	950.0	826.0	800.0	145.0	925.0	828.0
65		170.0	875.0	820.0	800.0	233.0	850.0	825.0
66		260.0	825.0	825.0	800.0			
67	Y 60							
68		.0	900.0	819.0	800.0	28.0	875.0	823.0
69		38.0	875.0	820.0	800.0	52.0	900.0	820.0
70		80.0	925.0	828.0	816.0			
71		105.0	950.0	826.0	800.0	143.0	925.0	828.0
72		186.0	875.0	823.0	800.0	235.0	850.0	825.0
73		255.0	825.0	813.0	800.0			
74	Y 80							
75		-10.0	875.0	820.0	800.0	5.0	900.0	821.0
76		25.0	875.0	823.0	806.0	32.0	875.0	820.0
77		46.0	900.0	820.0	800.0			
78		75.0	925.0	820.0	800.0	88.0	925.0	828.0
79		100.0	950.0	826.0	812.0	135.0	925.0	820.0
80		195.0	875.0	823.0	800.0			
81		235.0	850.0	825.0	800.0	260.0	825.0	825.0
82	Y 100							
83		-5.0	875.0	817.0	800.0	8.0	900.0	821.0
84		20.0	875.0	820.0	800.0	30.0	875.0	823.0
85		42.0	900.0	819.0	800.0	60.0	925.0	820.0
86		70.0	940.0	825.0	800.0	85.0	925.0	828.0
87		95.0	950.0	820.0	800.0	145.0	925.0	828.0
88		202.0	875.0	823.0	806.0	240.0	850.0	820.0
89		270.0	825.0	813.0	800.0			
90	Y 120							
91		.0	875.0	823.0	800.0	12.0	900.0	819.0
92		25.0	880.0	828.0	800.0	37.0	900.0	820.0
93		55.0	925.0	828.0	800.0			
94		70.0	950.0	826.0	812.0	75.0	950.0	826.0
95		88.0	925.0	828.0	800.0	105.0	950.0	826.0
96		155.0	925.0	828.0	816.0			
97		205.0	875.0	823.0	806.0	243.0	850.0	820.0
98		267.0	825.0	813.0	800.0			
99	Y 140							
100		.0	875.0	823.0	800.0	15.0	900.0	819.0
101		22.0	890.0	829.0	818.0	35.0	900.0	821.0
102		58.0	925.0	828.0	800.0	72.0	950.0	826.0
103		78.0	950.0	826.0	800.0	93.0	925.0	820.0
104		128.0	950.0	820.0	800.0	168.0	925.0	820.0
105		190.0	915.0	820.0	800.0	205.0	875.0	823.0
106		245.0	850.0	825.0	810.0	270.0	825.0	813.0
22	139							

Figure 3.7
variable Seam - BTS Printout
(2 of 2)

An earlier discussion contains the admonition that each surface defined in a DDM run must have a unique surface number. That admonition applies when the DDM file will be processed by either the DLS or DIS models, but it does not apply when the DDM file will be processed by CSA, as in this DDM sequence. The CSA model expects that all three surface arrays in the file will have the same surface number, but will have unique TM numbers.

The printout from the DDM model is reproduced in Figure 3.8. Because the log switches, LOGIN and LOGSD, were both set to "1", there can be a lot of output when the DDM processes the three sets of data. There are 6 sheets in this Figure. Sheets 1, 3, and 5 contain the listings of the input data cards. Sheets 2, 4, and 6 list the x and y lines for which data were entered and will always be identical in this DDM sequence. Sheet 2 lists the final elevations from the first data set which apply to the surface. Sheet 4 lists the elevations from the second set — top of coal. Sheet 6 lists elevations for the third set — bottom of coal.

The explanation of the level seam DDM printout given in the preceding section applies to this DDM printout also. However, there is one additional feature that is not demonstrated in that section. When the program reads the second surface card (record 72 on Sheet 1), it interrupts input processing to finish the array and transfer it to the output file. It then checks LOGSD and, since it was "1", it printed the x and y lines and elevation data.

Then the model resumes processing the input. It reprints the surface card (the first line on Sheet 3) to indicate that it was starting to process the data cards for that surface. The same sequence is followed for reading the third surface card.

In the next step in this DDM sequence, the CSA program is run to consolidate the three surface arrays. This printout is reproduced in Figure 3.9. The first line is simply the name of the program followed by the run time and date. The second line prints the surface statistics without headings and the surface title.

The next lines, L = 1, L = 2, L = 3, indicate that the three arrays have been found and processed.

The elevation data are then printed. This format is different from the DDM output because there are three elevations to print at each grid intersection.

DEPOSIT DESCRIPTION MODEL

12:58 NOV 11, '80

```

1 T (DDMEXAM) EXAMPLE DDM INPUT FOR 20-FOOT VARIABLE SEAM
2 L 1 1 1
LOG 1 1 1
3 B 0 0 800
BIAS 0. 0. 800.

4 GSW 0 260 20 0 140 20
GRID SW .0 260.0 20.0 .0 140.0 20.0
NX = 14
NY = 8
NOW = 112
5 S 1001. 1. 2950. .250

SURFACE 1001. 1. 2950. .250

6 X 0.
7 0. 880.0 55. 900.0 120. 875.0 140. 875.0
8 X 20.
9 0. 865.0 24. 875.0 60. 800.0 100. 875.0
10 140. 900.0
11 X 40.
12 0. 972.0 50. 875.0 105. 900.0 140. 910.0
13 X 60.
14 0. 895.0 25. 900.0 100. 925.0 140. 930.0
15 X 80.
16 -60. 950.0 38. 925.0 140. 950.0
17 X 100.
18 0. 950.0 40. 955.0 72. 950.0 150. 925.0
19 X 120.
20 -20. 925.0 135. 950.0
21 X 140.
22 -50. 875.0 10. 925.0 40. 930.0 80. 925.0
23 150. 950.0
24 X 160.
25 0. 875.0 130. 925.0
26 X 180.
27 -45. 850.0 55. 875.0 150. 910.0
28 X 200.
29 -30. 850.0 90. 875.0 170. 900.0
30 X 220.
31 -10. 850.0 160. 875.0
32 X 240.
33 -55. 825.0 100. 850.0 180. 875.0
34 X 260.
35 0. 835.0 40. 825.0 60. 820.0 80. 825.0
36 180. 850.0
37 Y 0.
38 -20. 900.0 8. 975.0 30. 860.0 45. 875.0
39 65. 900.0 100. 950.0 130. 925.0 160. 875.0
40 230. 850.0 285. 825.0
41 Y 20.
42 -15. 900.0 20. 875.0 40. 875.0 63. 900.0
43 108. 950.0 143. 925.0 163. 875.0 230. 850.0
44 280. 825.0
45 Y 40.
46 -5. 900.0 25. 875.0 43. 875.0 80. 925.0
47 108. 950.0 145. 925.0 170. 875.0 233. 850.0
48 260. 825.0
49 Y 60.
50 0. 900.0 28. 875.0 38. 875.0 52. 900.0
51 80. 925.0 105. 950.0 143. 925.0 186. 875.0
52 235. 850.0 255. 825.0
53 Y 80.
54 -10. 875.0 5. 900.0 25. 875.0 32. 875.0
55 46. 900.0 75. 925.0 88. 925.0 100. 950.0
56 135. 925.0 195. 875.0 235. 850.0 260. 825.0
57 Y 100.
58 -5. 875.0 8. 900.0 20. 875.0 30. 875.0
59 42. 900.0 80. 925.0 70. 940.0 85. 925.0
60 95. 950.0 145. 925.0 202. 875.0 240. 850.0
61 270. 825.0
62 Y 120.
63 0. 875.0 12. 900.0 25. 880.0 37. 900.0
64 55. 925.0 70. 950.0 75. 950.0 88. 925.0
65 105. 950.0 155. 925.0 205. 875.0 243. 850.0
66 267. 825.0
67 Y 140.
68 0. 875.0 15. 900.0 22. 890.0 35. 900.0
69 58. 925.0 72. 950.0 78. 950.0 93. 925.0
70 128. 950.0 168. 925.0 190. 915.0 205. 875.0
71 245. 850.0 270. 825.0
72 S 1001. 2. 2950. .250

```

Figure 3.8
Variable Scan - DDM Printout
(1 of 6)

ELEVATIONS ENTERED FOR FOLLOWING X VALUES:

INDEX, VALUE	1	.00
INDEX, VALUE	2	20.00
INDEX, VALUE	3	40.00
INDEX, VALUE	4	60.00
INDEX, VALUE	5	80.00
INDEX, VALUE	6	100.00
INDEX, VALUE	7	120.00
INDEX, VALUE	8	140.00
INDEX, VALUE	9	160.00
INDEX, VALUE	10	180.00
INDEX, VALUE	11	200.00
INDEX, VALUE	12	220.00
INDEX, VALUE	13	240.00
INDEX, VALUE	14	260.00

ELEVATIONS ENTERED FOR FOLLOWING Y VALUES:

INDEX, VALUE	1	.00
INDEX, VALUE	2	20.00
INDEX, VALUE	3	40.00
INDEX, VALUE	4	60.00
INDEX, VALUE	5	80.00
INDEX, VALUE	6	100.00
INDEX, VALUE	7	120.00
INDEX, VALUE	8	140.00

ELEVATION DATA BY Y LINE FOLLOWS*

Y =	.0	.0	116.8	88.6	121.0	94.4	128.1	150.0	130.8	112.5	75.0	64.8
	200.0		58.5	52.5	39.7	35.7						
Y =	20.0											
	.0		88.3	74.2	104.1	97.9	124.2	146.8	136.4	128.9	82.6	67.2
	200.0		60.8	54.1	41.0	32.5						
Y =	40.0											
	.0		95.2	60.4	84.7	101.5	125.2	148.9	138.3	129.2	92.7	71.1
	200.0		63.8	56.3	41.9	25.0						
Y =	60.0											
	.0		99.0	41.1	79.1	109.4	127.7	148.4	139.0	127.2	101.7	79.4
	200.0		68.3	59.0	43.8	19.4						
Y =	80.0											
	.0		91.0	59.4	89.0	115.2	130.1	148.7	138.4	122.9	105.0	85.5
	200.0		72.4	61.3	48.9	25.0						
Y =	100.0											
	.0		83.7	75.0	96.8	125.0	135.1	144.3	140.9	129.8	112.7	92.5
	200.0		77.4	64.7	50.0	31.7						
Y =	120.0											
	.0		75.0	87.6	104.2	130.4	142.7	138.6	145.0	135.9	120.6	99.5
	200.0		82.2	67.1	54.1	33.8						
Y =	140.0											
	.0		75.0	96.4	107.7	129.3	148.3	129.1	147.5	144.5	129.4	112.6
	200.0		89.5	68.8	57.8	37.5						

Figure 3.8
Variable Seam - DDM Printout
(2 of 6)

SURFACE	1001.	2.	2950.	.250				
73 X	0.							
74	0.	820.0	55.	820.0	120.	823.0	140.	820.0
75 X	20.							
76	0.	820.0	24.	823.0	80.	800.0	100.	823.0
77	140.	821.0						
78 X	40.							
79	0.	819.0	50.	820.0	105.	819.0	140.	822.0
80 X	60.							
81	0.	820.0	25.	820.0	100.	828.0	140.	824.0
82 X	80.							
83	-60.	826.0	38.	828.0	140.	820.0		
84 X	100.							
85	0.	828.0	40.	822.0	72.	828.0	150.	820.0
86 X	120.							
87	-20.	828.0	135.	828.0				
88 X	140.							
89	-50.	817.0	10.	828.0	40.	820.0	80.	828.0
90	150.	826.0						
91 X	160.							
92	0.	823.0	130.	828.0				
93 X	180.							
94	-45.	820.0	55.	823.0	150.	820.0		
95 X	200.							
96	-30.	820.0	90.	823.0	170.	821.0		
97 X	220.							
98	-10.	815.0	160.	823.0				
99 X	240.							
100	-55.	825.0	100.	825.0	180.	823.0		
101 X	260.							
102	0.	820.0	40.	820.0	80.	820.0	80.	825.0
103	180.	820.0						
104 Y	0.							
105	-20.	820.0	8.	824.0	30.	826.0	45.	823.0
106	65.	821.0	100.	826.0	130.	828.0	160.	823.0
107	230.	825.0	285.	813.0				
108 Y	20.							
109	-15.	819.0	20.	820.0	40.	823.0	63.	819.0
110	108.	826.0	143.	828.0	163.	823.0	230.	825.0
111	280.	820.0						
112 Y	40.							
113	-5.	820.0	25.	823.0	43.	823.0	80.	828.0
114	108.	826.0	145.	828.0	170.	820.0	233.	825.0
115	260.	825.0						
116 Y	60.							
117	0.	819.0	28.	823.0	38.	820.0	52.	820.0
118	80.	828.0	105.	826.0	143.	828.0	186.	823.0
119	235.	825.0	255.	813.0				
120 Y	80.							
121	-10.	820.0	5.	821.0	25.	823.0	32.	820.0
122	46.	820.0	75.	820.0	88.	828.0	100.	826.0
123	135.	820.0	195.	823.0	235.	825.0	260.	825.0
124 Y	100.							
125	-5.	817.0	8.	821.0	20.	820.0	30.	823.0
126	42.	819.0	60.	820.0	70.	825.0	85.	828.0
127	95.	820.0	145.	828.0	202.	823.0	240.	820.0
128	270.	813.0						
129 Y	120.							
130	0.	823.0	12.	819.0	25.	828.0	37.	820.0
131	55.	828.0	70.	826.0	75.	826.0	88.	828.0
132	105.	826.0	155.	828.0	205.	823.0	243.	820.0
133	287.	813.0						
134 Y	140.							
135	0.	823.0	15.	819.0	22.	829.0	35.	821.0
136	58.	828.0	72.	826.0	78.	826.0	93.	820.0
137	128.	820.0	168.	820.0	190.	820.0	205.	823.0
138	245.	825.0	270.	813.0				
139 S	1001. 3.	2950. .250						

Figure 3.8
Variable Seam - DDM Printout
(3 of 6)

ELEVATIONS ENTERED FOR FOLLOWING X VALUES:

INDEX, VALUE	1	.00
INDEX, VALUE	2	20.00
INDEX, VALUE	3	40.00
INDEX, VALUE	4	60.00
INDEX, VALUE	5	80.00
INDEX, VALUE	6	100.00
INDEX, VALUE	7	120.00
INDEX, VALUE	8	140.00
INDEX, VALUE	9	160.00
INDEX, VALUE	10	180.00
INDEX, VALUE	11	200.00
INDEX, VALUE	12	220.00
INDEX, VALUE	13	240.00
INDEX, VALUE	14	260.00

ELEVATIONS ENTERED FOR FOLLOWING Y VALUES:

INDEX, VALUE	1	.00
INDEX, VALUE	2	20.00
INDEX, VALUE	3	40.00
INDEX, VALUE	4	60.00
INDEX, VALUE	5	80.00
INDEX, VALUE	6	100.00
INDEX, VALUE	7	120.00
INDEX, VALUE	8	140.00

ELEVATION DATA BY Y LINE FOLLOWS:

Y =	.0											
	.0	21.4	22.5	21.5	20.7	25.2	26.0	27.5	26.2	23.0	22.5	
	200.0	22.4	20.1	23.9	19.2							
Y =	20.0											
	.0	19.7	21.2	21.2	19.8	24.8	24.4	27.1	26.6	23.8	22.7	
	200.0	22.7	20.6	24.5	21.0							
Y =	40.0											
	.0	20.2	17.8	21.4	23.4	27.9	24.3	26.9	23.9	23.9	21.7	
	200.0	22.1	20.7	25.0	22.5							
Y =	60.0											
	.0	19.6	10.9	19.9	23.0	27.1	25.4	26.9	25.9	25.7	23.3	
	200.0	22.9	21.3	23.5	15.0							
Y =	80.0											
	.0	20.9	17.0	19.7	22.9	23.9	25.7	24.6	24.1	23.7	22.2	
	200.0	23.0	21.7	25.0	25.0							
Y =	100.0											
	.0	20.3	21.5	19.4	24.0	25.1	22.3	25.2	27.3	26.8	23.3	
	200.0	23.0	20.9	22.5	19.7							
Y =	120.0											
	.0	23.0	23.3	20.8	26.7	24.2	24.4	26.4	27.1	27.6	23.2	
	200.0	22.9	21.5	22.4	19.0							
Y =	140.0											
	.0	21.5	23.6	22.3	25.9	22.8	20.4	23.0	23.1	24.2	20.2	
	200.0	21.9	22.9	24.4	19.9							

Figure 3.8
Variable Seam - DDM Printout
(4 of 6)

SURFACE	1001.	3.	2950.	.250				
140 X	0.							
141	0.	800.0	55.	800.0	120.	800.0	140.	800.0
142 X	20.							
143	0.	800.0	24.	800.0	60.	800.0	100.	806.0
144	140.	800.0						
145 X	40.							
146	0.	800.0	50.	800.0	105.	800.0	140.	804.0
147 X	60.							
148	0.	800.0	25.	800.0	100.	800.0	140.	800.0
149 X	80.							
150	-80.	800.0	38.	816.0	140.	800.0		
151 X	100.							
152	0.	800.0	40.	800.0	72.	800.0	150.	800.0
153 X	120.							
154	-20.	800.0	135.	800.0				
155 X	140.							
156	-50.	800.0	10.	800.0	40.	800.0	80.	816.0
157	150.	800.0						
158 X	160.							
159	0.	800.0	130.	800.0				
160 X	180.							
161	-45.	800.0	55.	806.0	150.	800.0		
162 X	200.							
163	-30.	800.0	90.	800.0	170.	800.0		
164 X	220.							
165	-10.	800.0	160.	806.0				
166 X	240.							
167	-55.	800.0	100.	800.0	180.	800.0		
168 X	260.							
169	0.	800.0	40.	800.0	60.	800.0	80.	800.0
170	180.	800.0						
171 Y	0.							
172	-20.	800.0	8.	800.0	30.	800.0	45.	800.0
173	65.	800.0	100.	812.0	130.	800.0	160.	806.0
174	230.	810.0	285.	800.0				
175 Y	20.							
176	-15.	800.0	20.	800.0	40.	806.0	83.	800.0
177	108.	800.0	143.	816.0	163.	806.0	230.	810.0
178	280.	800.0						
179 Y	40.							
180	-5.	800.0	25.	806.0	43.	806.0	80.	816.0
181	108.	800.0	145.	800.0	170.	800.0	233.	810.0
182	260.	800.0						
183 Y	60.							
184	0.	800.0	28.	806.0	38.	800.0	52.	800.0
185	80.	816.0	105.	800.0	143.	816.0	186.	800.0
186	235.	800.0	255.	800.0				
187 Y	80.							
188	-10.	800.0	5.	800.0	25.	806.0	32.	800.0
189	46.	800.0	75.	800.0	88.	800.0	100.	812.0
190	135.	800.0	195.	800.0	235.	800.0	260.	800.0
191 Y	100.							
192	-5.	800.0	8.	800.0	20.	800.0	30.	800.0
193	42.	800.0	60.	800.0	70.	800.0	85.	800.0
194	95.	800.0	145.	800.0	202.	806.0	240.	800.0
195	270.	800.0						
196 Y	120.							
197	0.	800.0	12.	800.0	25.	800.0	37.	800.0
198	55.	800.0	70.	812.0	75.	800.0	88.	800.0
199	105.	800.0	155.	816.0	205.	806.0	243.	800.0
200	267.	800.0						
201 Y	140.							
202	0.	800.0	15.	800.0	22.	818.0	35.	800.0
203	58.	800.0	72.	800.0	78.	800.0	93.	800.0
204	128.	800.0	168.	800.0	190.	800.0	205.	806.0
205	245.	810.0	270.	800.0				

Figure 3.8
Variable Seam - DDM Printout
(5 of 6)

ELEVATIONS ENTERED FOR FOLLOWING X VALUES:

INDEX, VALUE	1	.00
INDEX, VALUE	2	20.00
INDEX, VALUE	3	40.00
INDEX, VALUE	4	60.00
INDEX, VALUE	5	80.00
INDEX, VALUE	6	100.00
INDEX, VALUE	7	120.00
INDEX, VALUE	8	140.00
INDEX, VALUE	9	160.00
INDEX, VALUE	10	180.00
INDEX, VALUE	11	200.00
INDEX, VALUE	12	220.00
INDEX, VALUE	13	240.00
INDEX, VALUE	14	260.00

ELEVATIONS ENTERED FOR FOLLOWING Y VALUES:

INDEX, VALUE	1	.00
INDEX, VALUE	2	20.00
INDEX, VALUE	3	40.00
INDEX, VALUE	4	60.00
INDEX, VALUE	5	80.00
INDEX, VALUE	6	100.00
INDEX, VALUE	7	120.00
INDEX, VALUE	8	140.00

ELEVATION DATA BY Y LINE FOLLOWS=

Y =	.0	.0	.0	.0	.0	7.5	6.0	2.0	1.0	3.0	4.0
	200.0	.0	4.1	4.9	4.1	2.3					
Y =	20.0	.0	.0	.0	3.0	.4	6.5	.0	2.7	7.3	3.7
	200.0	.0	4.1	5.2	4.0	2.0					
Y =	40.0	.0	.5	2.5	3.0	5.3	15.0	2.3	.0	.0	.0
	200.0	.0	2.4	4.9	3.7	.0					
Y =	60.0	.0	.0	2.1	.0	2.3	14.3	1.6	3.2	11.4	4.8
	200.0	.0	.0	1.2	.0	.0					
Y =	80.0	.0	.0	3.8	.0	.0	4.7	6.0	2.8	8.0	.0
	200.0	.0	.0	1.6	.0	.0					
Y =	100.0	.0	.0	3.0	.0	.0	3.1	.0	.0	5.7	.8
	200.0	.0	2.9	3.3	.0	.0					
Y =	120.0	.0	.0	1.5	.9	2.0	1.6	.0	2.4	9.0	7.5
	200.0	.0	3.5	4.1	.2	.0					
Y =	140.0	.0	.0	6.4	2.0	.0	.0	.0	.0	1.1	.0
	200.0	.0	2.0	6.4	4.8	2.0					.3

Figure 3.8
Variable Seam - DDM Printout
(6 of 6)

BEGIN CSA 12:59 NOV 11, '80
 .0 280.0 20.0 .0 140.0 20.0 8 14 T (DDMEXAM) EXAMPLE DDM INPUT FOR 20-FOOT VARIABLE SEAM
 L = 1
 L = 2
 L = 3

SURFACE NO. 1001, WRITTEN TO FILE

ELEVATION DATA FOR THREE SURFACES

	X	SUR	TOP	BOT	SUR	TOP	BOT	SUR	TOP	BOT	SUR	TOP	BOT	SUR	TOP	BOT	SUR	TOP	BOT
I =	1	Y =	.0																
	1	.0	117	21	0	89	23	0	121	21	0	94	21	0	128	25	7	150	28
	7	120.0	131	28	2	112	28	1	75	23	3	85	22	8	58	22	4	53	20
	13	240.0	40	24	4	38	19	2											
I =	1	2 Y =	20.0																
	1	.0	88	20	0	74	21	0	104	21	3	98	20	0	124	25	7	147	24
	7	120.0	136	27	3	127	27	7	83	24	4	87	23	8	81	23	4	54	21
	13	240.0	41	24	4	33	21	2											
I =	1	3 Y =	40.0																
	1	.0	95	20	1	80	18	3	85	21	3	101	23	8	125	28	16	149	24
	7	120.0	138	27	0	129	24	0	93	24	0	71	22	3	84	22	2	58	21
	13	240.0	42	25	4	25	23	0											
I =	1	4 Y =	60.0																
	1	.0	99	20	0	41	11	2	79	20	0	109	23	2	128	27	14	148	25
	7	120.0	139	27	3	127	28	11	102	26	5	79	23	4	68	23	0	59	21
	13	240.0	44	23	0	19	15	0											
I =	1	5 Y =	80.0																
	1	.0	91	21	0	89	17	4	89	20	0	116	23	0	130	24	8	149	28
	7	120.0	138	25	3	123	24	8	105	24	0	88	22	2	72	23	0	61	22
	13	240.0	46	25	0	25	25	0											
I =	1	6 Y =	100.0																
	1	.0	84	20	0	75	22	3	97	19	0	125	24	0	135	28	3	144	22
	7	120.0	141	25	0	130	27	8	113	27	1	93	23	3	77	23	3	65	21
	13	240.0	50	23	0	32	20	0											
I =	1	7 Y =	120.0																
	1	.0	75	23	0	88	23	1	104	21	1	130	27	2	143	24	2	139	24
	7	120.0	145	28	2	138	27	9	121	28	7	99	23	8	82	23	3	67	21
	13	240.0	54	22	0	34	19	0											
I =	1	8 Y =	140.0																
	1	.0	75	22	0	96	24	8	108	22	2	129	28	0	148	23	0	129	20
	7	120.0	148	23	0	144	23	1	129	24	0	113	20	0	89	22	2	69	23
	13	240.0	58	24	5	38	20	2											

Figure 3.9
 Variable Seam - CSA Printout

The CSA program also lists the elevation data in x- or y-line sequence, whichever results in the least amount of printout. The heading line will print "X" or "Y" as appropriate. The three abbreviations stand for:

SUR - surface
TOP - top of coal
BOT - bottom of coal

Both grid indices and values are printed. Thus, the line I = 1, Y = .0 indicates that the first y line is Y = 0; the line I = 2, Y = 20 indicates that the second y line is Y = 20, etc.

The data lines print first the index, next the grid value, and then up to six sets of elevations. Thus, on the first data line (1,0), the first set of elevations apply to X = 0, the second set to X = 20, the third set to X = 40, etc.

3.9 EFFECT OF GRID SPACING

The modeled area is limited by the number of points allowed in the array file and the grid size. The number of array points is fixed at 24,000 but the grid spacing is variable. In this study, the grid spacing most commonly used was 10 ft; however, 12.5 and 20 ft were also widely used.

Two sets of cases were run to check the effect of 10- and 20-ft grid spacing on volume and coal tons removed. The same data was prepared for each case and then interpolated over 10- and 20-ft grids. The two cases (DLSIV2N and DLSDV2N) were run for a level seam of moderate thickness with relatively flat topography, and for a dipping seam of variable thickness and rising topography. Both pits were curved. Only the second panel, which is in the steady state condition, was used for comparison. The cases also tested the effects of the two different Remove the Coal routines, RTC3, which was developed for thin seams, and RTC4, which was developed for thick seams.

The results shown in Table 3.1 indicate that the percentage difference in bank volume is very small. Rehandle volume shows larger differences, but still within the acceptable range. Remove the Coal Routine 4 (RTC4) gives a more reliable volume for rehandle because the difference is much smaller.

The conclusion to be drawn is that a 20-ft grid can be used in most cases with simple sidecasting and extended bench. RTC4 can be used for seams of moderate thickness 8 through

10 ft as well as for thick seams. For any parameter optimization studies of a particular dragline, the user should not mix grid sizes; i.e., if a 10-ft grid is used for one case, then 10-ft grids should be used throughout.

Table 3.1 Results from 10- and 20-ft Grids

Case (Grid Size)	RTC	Volume Bank Yds	% Dif- fer- ence	Volume Rehandle	% Dif- fer- ence	Coal Tons Removed	% Dif- fer- ence
DLSIV2N (20')	3	280263		20341		54395	
(10')	3	279687	0.2	19995	1.43	54824	7.8
DLSIV2N (20')	4	280263		20828		55697	
(10')	4	279878	0.2	20168	3.27	55624	0.13
DLSDV2N (20')	4	1022221		363337		223651	
(10')	4	1014374	0.8	354233	2.57	236433	5.4

4.1 THE CONTROL FILE FORMAT

The user controls the actions of the model by setting control parameters via the control file. The control file may be either a deck of 80-column punched cards, or a file of card images. In this manual, the terms "record" and "card" are used interchangeably in referring to the control file.

Each record begins with a 'KEYWORD' followed by one or more numeric values. The "keyword" always begins in column 1 of the record, and the first numeric value starts in column $N + 2$, where N is the number of characters in the keyword. When more than one numeric value is entered on a card, each value must be preceded by at least one blank column.*

If the model does not find a recognizable keyword in a record, the record will be printed but all entries on the record will be ignored.

The user may put "comments" cards in a control file simply by leaving the first four columns blank; leaving four blank columns insures against a comment accidentally beginning with a keyword and causing errors.

*The IBM version requires the first numeric values to be entered in column 13. The first 12 columns are reserved for "keywords"

Table 4.1 'KEYWORDS' and Table References

'KEYWORD'	Table No.
ANGLES	4.2
BAIL	4.3
BENCH*	
BOXCUT	4.4
CASE	4.5
CAS2	4.5
CHOP	4.6
COAL LINE	4.7
DIGOUT	4.8
DOZER*	
DRAGLINE1	4.9
DRAGLINE2	4.10
END PANEL	4.11
FACTOR	4.12
INPUT***	
KEYCUT	4.13
LAYER	4.14
MAINTENANCE	4.15
MINE COAL	4.16
PANEL	4.17
PLAN**	12.3
PLOT**	12.4
RADIAL	4.18
RATES	4.19
REFERENCE	4.20
REHANDLE	4.21
RERUN	4.22
SURFACE	4.23
SWELL	4.24
TANGENTS	4.25
WALK	4.26

* Not used in present model

** Used by Plot Plan View Program

*** Must not be used

4.2 'KEYWORDS'

Table 4.1 lists all valid keywords.

The 'BENCH' and 'DOZER' cards are not used in the present model; they are included for future expansion.

The 'INPUT' card is provided for the system programmer. If included in a control file, the model will enter a special read operation that permits the programmer to obtain special debugging printouts. Since the output would have no meaning to the user, that output is not explained in this manual. This keyword is listed here to warn the user against entering a comments card with 'INPUT' in the first column.

The 'PLOT' and 'PLAN' cards are used by the Plot Plan View program and explained in Chapter 12.

With the exception of 'DRAGLINE1' and 'DRAGLINE2', the first four characters of the keywords uniquely identify the keyword. In fact, the model checks only columns 1-4 to determine the keyword. In the case of the 'DRAGLINE' cards, the model also checks the number following the word DRAGLINE to identify these cards. In this manual, these two keywords are always written with no space between the letter E and the number 1 or 2.

Even though the model only checks columns 1-4 of the input records, the user SHOULD ALWAYS SPELL THE 'KEYWORD' COMPLETELY on the records. The model skips N columns, where N is the number of characters in the keyword, to find the first numeric value.

4.3 MODEL CONTROL PARAMETERS

The number of parameters associated with each keyword depends on the functions being controlled. Parameter names NEVER appear in the control file. The user enters only the values to be assigned to parameters in the control cards. The model assigns values to parameters according to the sequence in which the values are punched on the card. All DLS keyword cards are summarized in Tables 4.2 through 4.26. These tables list the parameters that are set on the keyword card, and the sequence in which they are listed in these tables is the sequence to be followed in entering values on the cards.

These tables are provided for reference. The parameters are explained in detail in appropriate chapters. The Control Parameter (CP) listing (explained in Section 4.6) provides

the user with a complete reference for parameters and value sequencing. A CP listing of the 'KEYCUT' card is reproduced below.

KEYCUT	LOK	LOSK	RLK	LSK
	1	0	.0	1

The first line prints the keyword followed by the parameter names, and the second lines prints the current values. The sequence on these lines is the correct sequence for the values on control cards. After learning the details of the model, the user can easily create an input file simply by using the CP listing as a guide.

In most cases, the number of values on a card will equal the number of parameters associated with the keyword. The exception occurs when parameters listed on the right are not being used. For example, in the above card, if the first parameter was zero, the remaining parameters would not be used by the model. In this case, the card could read

KEYCUT

The keyword is followed by blanks. All 'KEYCUT' parameters would be set to zero by this card.

If a parameter is not used and is not shown on the right, then an entry must be made to hold the proper sequence of values. A zero can be used to hold the sequence, except on the 'ANGLES' or 'TANGENTS' cards (the tangent of zero is infinity). The card line below shows the use of zeros as place holders for parameters LOSK and RLK.

KEYCUT 3 0 0 99

The string of numbers that specify a numeric value must occupy contiguous columns; an embedded blank would result in two numbers rather than one. Negative values may be entered in some cases by preceding the first number with the sign (-). A decimal point must be punched to enter fractional values, but need not be punched for integer values.

Table 4.2 'ANGLES' Card Parameters

Name	Value	Meaning
AABF	A*	Angle of current highwall, the AB face
ABCF	A*	Angle of current dragface, the BC face
ACDF	A*	Angle of wall opposite current highwall, the CD face
ADAF	A*	Angle of wall opposite current dragface, the DA face
ACFD	A*	Angle of coal face
ASRD	A*	Angle of spoils
ASSD	A*	Angle of steepened spoils
CHFA	A*	Angle of chop face
DZFA	A*	Angle of dozer face (not used)

* Enter the angle (in degrees) measured from horizontal.

Note: Either 'ANGLES' or 'TANGENTS' cards may be used. If coal face angle (ACFD) is vertical, use 89.5° for the input value instead of 90°.

Table 4.3 'BAIL' Card Parameters

Name	Value	Meaning
LOB	0	Do not bail
	3	Normal bail
	4	Bail using rehandle bail routine
LOSB	0	Do not spoil
	1	Spoil forming conical spoils
	2	Spoil forming ridgeline spoils
	3	Spoil forming extended bench
RLB	Feet	Ridgeline length; used only when LOSB = 2
LSB	N	Save surface after every Nth bail
	0	Do not save surface arrays
	99	Save after final digout in panel
LBP		Not used
XBP		Not used
YBP		Not used

Note: LOB = 1, LOB = 2 same as LOB = 3
 RLB may be needed for chop (see Table 4.6)

Table 4.4 'BOXCUT' Card Parameters

Name	Value	Meaning
LOBC	N	No. of panels to be treated as boxcut panels

Note: LOBC is normally 0 or 1,
 0 When first panel is not a boxcut
 1 When first panel is boxcut

Table 4.5 'CASE' and 'CAS2' Card Parameters

Name	Value	Meaning
		These cards enter title information
		They may contain any desired characters in columns 5-80
		Titles may be replaced as often as necessary

Table 4.6 'CHOP' Card Parameters

Name	Value	Meaning
LCC	0	Do not chop
	1	Chop before keycut, using chop face angle to form the chop face
	11	Chop before keycut, but do not use chop face angle
	2	Chop after bail, using chop face angle to form the chop face
	12	Chop after bail, but do not use chop face angle
LCS	0	Do not spoil
	1	Spoil forming conical spoils
	2	Spoil forming ridgeline spoils
	3	Spoil forming extended bench
LCPL	N	When layer digging, chop from layer N
LCSS	N	Save surface after every nth chop action
CHLF	Feet	Chop limit, forward
CHLS	Feet	Chop limit, sideward
CHAST	Sec	Additional spot time when chopping
CHBFF	Decimal Fraction	Bucket fill factor when chopping

Note: When LCS = 2, RLK from 'KEYCUT' or RLB from 'BAIL' is used to set ridgeline length.

Table 4.7 'COAL LINE' Card Parameters

Name	Value	Meaning

The 'COAL LINE' card contains no parameter values. It precedes data cards which enter values*

Data cards contain one of following codes in column 1:

X	Defines panel parallel to X axis
Y	Defines panel parallel to Y axis
R	Redefines dragface coordinates
Blank	Defines dragface coordinates*
E	Indicates end of coal line data

The following parameters are entered on the data cards:

XC		X coordinate for current coal line
YC		Y coordinate for current coal line
XP		X coordinate for previous coal line
YP		Y coordinate for previous coal line
ASK	Degrees	Spoil angle for keycut or chop before keycut
DBFK	Decimal Fraction	Bucket fill factor for keycut
DOEK	Decimal Fraction	Efficiency factor for keycut
ASB	Degrees	Spoil angle for bail or chop after bail
DBFB	Decimal Fraction	Bucket fill factor for bail
DOEB	Decimal Fraction	Efficiency factor for bail
DOL	Feet	Digout length
NDOL		No. of digouts

* CDC version requires five blank spaces before the values of XC, YC, etc. In the XDS and IBM version either 'COAL LINE' or 'COALLINE'. The CDC version requires 'COALLINE'. The XDS version permits X,Y coordinates starting in column 2; the CDC version requires X,Y coordinates starting in column 6; the IBM version requires X, Y coordinates starting in column 13.

Table 4.8 'DIGOUT' Card Parameters

Name	Value	Meaning
NDIGO	N	No. of digouts to be made before reading additional parameter cards
LOD	1	Normal digouts
	2	Layer digouts without dragline movements
	3	Layer digging with radial casting
	4	Layer digging with dragline movements
	5	Rehandle digging, but with rerun
	6	Layer digging with advance onto extended bench
LOGCP	0	Do not print CP listing
	1	Print the CP listing
LOGDLS	0	Do not print detail listing
	1	Print the detail listing

Note: When this card is printed in the CP listing, the value of NDIGO will be current digout number.

Table 4.9 'DRAGLINE1' Card Parameters

Name	Value	Meaning
DSA	Feet	Boom length
DSB	Degrees	Boom angle
DSD	Feet	Boom foot to ground distance
DSE	Feet	Boom foot to center distance
DSF	Feet	Dumping height
DSG	Feet	Dump bucket clearance
DSH	Feet	Dumping radius
DSI	Feet	Digging depth

Table 4.10 'DRAGLINE2' Card Parameters

Name	Value	Meaning
DSM	Feet	Length of step
DSN	Mph	Walking speed
DSS	Feet	Distance from top of dragface to dragline center
DSV	Feet	Fairlead to ground distance
DSW	Cubic Yards	Bucket capacity
DSY	Feet	Base diameter
DCS	\$/Hr	Total operating and ownership cost

Table 4.11 'END PANEL' Card Parameters

Name	Value	Meaning
	The 'END PANEL' card contains no parameter values	
	It is used to initiate end-of-panel operations	

Note: As CDC version does not allow embedded blanks in keywords use
'END'

Table 4.12 'FACTOR' Card Parameters

Name	Value	Meaning
DTF	Decimal Fraction	Downtime factor Unscheduled downtime = DTF times total working time
WEB	Feet	Width of extended bench

Note: WEB controls extended bench spoiling actions

Table 4.13 'KEYCUT' Card Parameters

Name	Value	Meaning
LOK	0	Do not keycut
	3	Form keycut
LOSK	0	Do not spoil
	1	Spoil forming conical spoils
	2	Spoil forming ridgeline spoils
	3	Spoil forming extended bench
RLK	Feet	Ridgeline length; used only when LOSK = 2
LSK	N	Save surface after every nth keycut
	0	Do not save surface arrays
	99	Save after final digout in panel

Note: LOK = 1, LOK = 2 same as LOK = 3
 RLK may be needed for chop (see Table 4.6)

Table 4.14 'LAYER' Card Parameters

Name	Value	Meaning
DOD	Feet	Depth of digout. Depth to which dragline will dig on any digout. When option does not call for layer digging, model will estimate DOD. When layer digging is specified, model will dig this amount on each layer
NSPL	N	Number of steps taken between layers when digout option is 4 or 6.

Note: Layer parameters are used with options that specify layer digging. Model calculates number of layers to cut as:

$$NLTC = \text{INT} \left(\frac{HB}{DOD} + 0.3 \right)$$

Table 4.15 'MAINTENANCE' Card Parameters

Name	Value	Meaning
LOM	0	Do not calculate maintenance times
	1	Schedule TFMH hours of maintenance every TBMH hours of working time, or wait for coal loadout when walk option is 2
	2	Maintenance time is FMT times total working time in this operation
TBMH	Hours	Time between maintenance periods
TFMH	Hours	Time (duration) of maintenance periods
FMT	Decimal Fraction	Percentage of total working time spent in scheduled maintenance

Note: When LOM = 1, enter both TBMH and TFMH
When LOM = 2, enter only FMT

Table 4.16 'MINE COAL' Card Parameters

Name	Value	Meaning
LOC	0	Do not remove coal
	1, 2 or 3	Remove coal using option 3 routine (RTC3)
	4	Remove coal using option 4 routine (RTC4)
LSC	N	Save surface array control. Will save surface after every nth coal removal
DCBTY	N	Density of coal bank tons/yard
ECR	Decimal Fraction	Expected in-pit coal recovery factor. Used to calculate residual coal, FRC, which will be left in pit. $FRC = HC (1 - ECR)$, where HC is thickness of coal seam
NCDF	N1	No. of first coal digout
NCDL	N2	No. of last coal digout

Note: As CDC version does not allow embedded blanks in keywords use 'MINECOAL'.

Model removes coal from the N1 digout through the N2 digout. If N1 = 0 and N2 = 0, model will remove coal from all digouts defined by the 'COAL LINE' data. N2 may be set to 99 to indicate removing coal to end of panel.

Coal removal always occurs at the end of a panel.

Table 4.17 'PANEL' Card Parameters

Name	Value	Meaning
HB	Feet	Height of dragline bench Used in cross-section geometry to find approximate spoil height Used to define depth of dig for chopping and for layer digging
HC	Feet	Height (thickness) of coal seam Used to develop residual coal, FRC; $FRC = HC (1 - ECR)$
PW	Feet	Panel width (approximate) Used in cross section geometry to find approximate spoil height
PWK	Feet	Width of keyway at bottom of dragface
DOL		Not used
SWDH	Feet	Safe working distance from crest of high-wall (distance of edge of dragline base from highwall). Used to position dragline for bailing, and for rerunning with digout option 5.

Note: DOL may be used in defining 'COAL LINE' cards. In which case, the value of DOL will be printed for the 'PANEL' card in the CP listing.

Table 4.18 'RADIAL' Card Parameters

Name	Value	Meaning
ASBD	Degrees	Delta angle for bail spoiling
ASKD	Degrees	Delta angle for keycut spoiling
NSS		Not used

Note: When layer digging with radial casting (digout option 3), angle of spoiling is changed between layers. These values specify the overall change between the first and last layer.

Table 4.19 'RATES' Card Parameters

Name	Value	Meaning
DTA	Sec	Delay for acceleration. Applies to swing, hoist, and retrieve actions. When time on clock is less than DTA, the effective rates will be: $\text{Rate} = \text{Rate} / \text{DTA}$
DT	Sec	Time increment
DHR	Ft/Min	Hoist rate
DPR	Ft/Min	Payout rate
DSR	Rev/Min	Swing rate
DLR	Ft/Min	Lower rate
DRR	Ft/Min	Retrieve rate
TDRAG	Sec	Time to drag and fill
TDUMP	Sec	Time to dump
TSPOT	Sec	Time to spot bucket before drag

Table 4.20 'REFERENCE' Card Parameters

Name	Value	Meaning
KREF	0	Use approximate elevation for top of coal when digging
	1	Find reference elevation for top of coal when digging

Note: Used only with a variable seam array.
 Model sets KREF to zero when processing a level-seam array.

Table 4.21 'REHANDLE' Card Parameters

Name	Value	Meaning
RHAST	SEC	Additional spot time
RHBFF	Decimal	Bucket fill factor
RHSC	Feet	Spoil clearance
		Required distance between toe of coal and toe of spoils
RHCFH	Feet	Coal fender height (vertical height)

Note: These parameters are used only with bail option 4 (LOB = 4);
 rehandle bail.

Table 4.22 'RERUN' Card Parameters

Name	Value	Meaning
KRRN	0	Do not rerun rehandle bail
	1	Rerun rehandle bail when spoils appear to encroach on coal
KRNP		Not used

Note: Rerun applies only to digout option No. 5 (when LOD = 5 on digout card).

Table 4.23 'SURFACE' Card Parameters

Name	Value	Meaning
SNR		Requested surface number
SND		Increment for surface number when surface arrays are saved
LOGSF	0	No surface arrays will be saved
	1	Surface arrays will be saved according to save-surface controls on 'KEYCUT', 'BAIL', 'CHOP' and 'MINE COAL' cards

Note: SNR must refer to surface number that is in the surface file.
SND usually set to 1 or 10.

Table 4.24 'SWELL' Card Parameters

Name	Value	Meaning
SM	Decimal Fraction	Swell percentage. Volume of swelled material is volume of bank material times (1 + SM)

Note: If SM is set to zero, model uses value from DDM surface card.
A non-zero value resets SM.

Table 4.25 'TANGENTS' Card Parameters

Name	Value	Meaning
TANAB	Ratio*	Tangent of current highwall; the AB face
TANBC	Ratio*	Tangent of current dragface; the BC face
TANCD	Ratio*	Tangent of wall opposite current highwall, the CD face
TANDA	Ratio*	Tangent of wall opposite current dragface, the DA face
TANC	Ratio*	Tangent of coal face
TANS	Ratio*	Tangent of spoils
TANSS	Ratio*	Tangent of steepened spoils
TANCH	Ratio*	Tangent of chop face
TANDZ	Ratio*	Tangent of dozer face (not used)

* Enter the ratio of vertical/horizontal distances

Note: Either 'ANGLES' or 'TANGENTS' cards may be used.

Table 4.26 'WALK' Card Parameters

Name	Value	Meaning
LOW	0	Do not calculate movement times
	1	Calculate movement times. Move to first position in any panel is deadheading; all other moves are walking
	2	Calculate movement times. When deadheading, wait WTH hours for coal loadout and if maintenance option is 1, calculate maintenance time also
XPP, YPP	Surface Coordinates	X and Y coordinates of position of dragline at start of simulation run. Used only for first move; model updates thereafter
WANG	Degrees	Angle at which dragline can walk away from dragface
WMF	Decimal Fraction	Walk time multiplication factor
WAF	Minutes	Walk time addition factor
WTH	Hours	Wait time for coal loadout
DHMF	Decimal Fraction	Deadhead time multiplication factor
DHAF	Minutes	Deadhead time addition factor

4.4 CARD SEQUENCE

The model places a few logical restrictions on the sequence of records within the control file, and the operation being simulated will place other logical restrictions on this sequence. The following general rules should be followed when setting up the control file.

1. The 'SURFACE' card MUST precede the first 'DIGOUT' card.
2. The order in which parameters are set is not important as long as all parameters that pertain to a given digout option are set before the 'DIGOUT' card which invokes the option.
3. The order of cards in the 'COAL LINE' set defines the sequence of dragline advance.
4. The order in which sets of 'COAL LINE' data are entered specifies the sequence of panel advance.

The correct sequencing of input records will become evident as the various routines and model actions are explained in following chapters.

4.5 PRINTOUT CONTROLS

The model output can print many pages as evidenced by the Appendices in this report. However, there are controls to suppress the bulk of the printouts.

The model prints four different pages (or reports):

1. Surface Page - this page is always printed.
2. Control Parameter Listing - these pages can be suppressed on the 'DIGOUT' cards via parameter LOGCP (log control parameters).
3. Detail Page for each digging/spoiling action - these pages can be suppressed on the 'DIGOUT' cards via LOGDLS (log details).

The Detail Page for coal removal is always printed.

4. Summary Listing - this report is always printed.

The surface page is described in Chapter 14. The other pages are described in the following sections.

DLSS - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)

DATE 12:50 NOV 10.'80

CASE (DLSDMO)	DEMONSTRATE	DL5	OPTIONS FOR USER'S	MANUAL	PANEL NO. 2 DIGOUT NO. 1					
THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN										
DRAGLINE1	DSA	DSB	DSO	OSE	DSF	DSG	DSH	DSI		
	261.0	30.0	12.0	32.5	100.0	39.5	258.0	157.0		
DRAGLINE2	DSM	DSN	DSS	DSV	DSW	DSY	DCS			
	5.0	.15	42.0	12.0	60.0	56.0	200.00			
PANEL	HB	HC	PW	PWK	DOL	SWOH				
	65.0	20.0	100.0	20.0	100.0	20.0				
CHOP	LCC	LCS	LCPL	LCSS	CHLF	CHLS	CHAST	CHBFF		
	11	3	0	1	150.	125.	3.000	.800		
KEYCUT	LOK	LOSK	RLK	LSK						
	1	1	.0	1						
BAIL	LOB	LOSB	RLB	LSB	LBP	XBP	YBP			
	1	1	.0	1	0	.0	.0			
REHANDLE	RHAST	RHBFF	RHSC	RHCFH						
	3.000	.800	20.	0.						
ANGLES	AABF	ABCF	ACDF	ADAF	ACFD	ASRD	ASSD	CHFA	DZFA	
	69.677	45.000	69.677	45.000	84.289	40.365	40.365	40.365	40.365	
TANGENTS	TANAB	TANBC	TANCD	TANDA	TANC	TANS	TANSS	TANCH	TANDZ	
	2.700	1.000	2.700	1.000	10.000	.850	.850	.850	.850	
	.370	1.000	.370	1.000	.100	1.176	1.176	1.176	1.176	
RATES	DTA	DT	DHR	DPR	DSR	DLR	DRR	TDRA	TDUMP	TSPOT
	3.0	.5	480.	860.	1.100	1100.	610.	15.0	5.0	3.0
MINE COAL	LOC	LSC	ECR	DCBTY	NCDF	NCOL				
	4	1	.800	1.050	2	99				
MAINTENANCE	LOM	TBMH	TFMH							
	1	10.0	2.0							
WALK	LOW	XPP	YPP	WANG	WMF	WAF	WTH	DHMF	DMAF	
	2	983.6	574.8	60.0	1.200	.0	8.00	2.500	3.0	
FACTOR	DTF	WEB								
	.400	20.								
RERUN	KRRN	RNP								
	0	.0								
BOXCUT	LOBC									
	1									
REFERENCE	KREF									
	0									
SWELL	SM									
	.250									
RE-DEF	XC	YC	XP	YP	ASK	DBFK	DOEK	ASB	DBFB	DOEB
1 0	200.	200.	200.	300.	70.	.800	.900	90.	.700	.800
2 0	300.	200.	300.	300.	70.	.800	.900	90.	.700	.800
3 0	400.	200.	400.	300.	70.	.800	.900	90.	.700	.800
4 0	500.	200.	500.	300.	70.	.800	.900	60.	.700	.800
5 0	600.	200.	600.	300.	70.	.800	.900	70.	.700	.800
6 0	700.	200.	700.	300.	70.	.800	.900	90.	.700	.800
7 0	800.	260.	800.	360.	80.	.800	.900	100.	.700	.800
8 0	900.	340.	900.	440.	0.	.000	.000	0.	.000	.000
DIGOUT	NDIGO	LOO	LOGCP	LOGDLS						
	1	1	1	1						

Figure 4.1
Control Parameter (CP) Listing

4.6 THE CONTROL PARAMETER (CP) LISTING

When the LOGCP parameter is set to 1 on a 'DIGOUT' card, the model will print the CP listing before the digout action is started. The CP listing shows the current values of the control parameters.

When a 'DIGOUT' card calls for more than one digout, and LOGCP is set to 1, the CP listing will print before each digout. Since the values of parameters would not change between digouts, the user would simply get a number of redundant pages. To suppress the redundant pages, two 'DIGOUT' cards can be used:

1. LOGCP = 1 and calls for 1 digout
2. LOGCP = 0 and calls for the rest of the digouts

A sample CP listing from the demonstration problem is reproduced in Figure 4.1. The first line on this page and on all output pages identifies the model as DLS5 - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM), followed by the time and date of the actual computer run. The line will read ... (VARIABLE COAL SEAM) when the model is processing a variable coal seam surface array.

The next printed line reproduces the 'CASE' card, followed by PANEL NO. P DIGOUT NO. D, where P and D are the numbers for the digout to be made following this listing. The next printed line reproduces the 'CAS2' card without printing the keyword. If these title cards are omitted, the two title lines will be blank, except for the panel and digout numbers.

The control cards and control parameter values are listed after the title lines. There are two printed lines for each card: the first line prints the keyword, followed by the control parameter names, and the second line prints the current parameter values.

Since parameters and keywords are fully explained in the appropriate chapters, this discussion only comments briefly on each listing.

Both the 'ANGLES' and 'TANGENTS' cards are printed, even though the control file normally will contain only one of the two. The 'TANGENTS' lines are followed by lines listing the cotangents of the angles. Thus, all face angles are printed in three forms: as angles, as vertical/horizontal ratios, and as horizontal/vertical ratios.

DLSS - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)

DATE 12:50 NOV 10, '80

CASE (DLSDemo) DEMONSTRATE DLS OPTIONS FOR USER'S MANUAL
THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN

PANEL NO. 2 DIGOUT NO. 2

KEYCUT								O			
E	F	G	H	I	J	K	L	M	N	P	
300.	400.	400.	400.	300.	300.	502.	414.	502.	502.	502.	
200.	200.	220.	300.	300.	240.	200.	442.	230.	488.	300.	
EF	FH	HI	IE	KG	KL	MN	HO				
0.	90.	180.	270.	169.	110.	90.	0.				

DIRECTION OF ROTATION IS -1

BEGIN KEYCUT OPTION NO. 3 - SPOIL ANGLES 70. 110. DIG LIMIT .0 FT. ABOVE COAL

XQF, XQL, YQF, YQL	XMIN, XMAX, YMIN, YMAX
200.0 500.0 140.0 320.0	
310.0 460.0 180.0 250.0	

DRAGLINE CENTER X,Y,Z = 502.0 200.0 85.0

BANK CUBIC YARDS = 11585.2

SWELLED CUBIC YARDS = 14481.5

BEGIN WALK TIME ROUTINE

XFP	YFP	XTP	YTP	X-DIS	Y-DIS	D-DIS
407.0	227.9	502.0	200.0	95.0	-27.9	99.0
WALKING	STEPS	FEET	MIN.	HRS.		
	20	99.3	9.1	.15		

BEGIN SPOIL OPTION NO. 2 - RIDGE-LINE SPOIL SHAPE

SPOIL CONE CENTER X,Y,Z = 400.0 440.0 98.9 13.8

SWELLED CUBIC YARDS = 13710.8

DELTA PERCENT = -5.3

XQF, XQL, YQF, YQL	XMIN, XMAX, YMIN, YMAX
230.0 590.0 260.0 620.0	
270.0 650.0 340.0 470.0	

BEGIN PRODUCTION TIME CALCULATION

BUCKET START X, Y, Z	BUCKET DUMP X, Y, Z	BUCKET RETURN X, Y, Z
380.0 210.0 62.5	410.0 440.0 103.9	320.0 220.0 40.0

AV. SWING ANGLES - H&S, R&L -64.3 62.8

TIMES IN SEC.	DRAG	H&S	DUMP	R&L	SPOT	CYCLE
15.0	13.5	5.0	12.0	3.0	48.5 H S	

MAINTENANCE TIME IN HOURS .24

NP	ND	DO	SO	VSBY	H&S	R&L	CYCLE	NOS	D.H.	LAY	MAIN	WALK	DIG	TOTAL	TONS	VRBY
2	2	1	2	11585.	13.5	12.0	48.5	302	.00	.00	.2	.15	4.62	4.81 H S	0.	0.

SURFACE NO. 113. WRITTEN TO FILE XMIN, XMAX, YMIN, YMAX 270.00 550.00 0 470.00

Figure 4.2
A Detail Page

Some control cards may not be printed on this page depending upon the digout option. The 'LAYER' card is printed only when the option specifies layer digging. The 'RADIAL' card is printed only when the option specifies radial casting.

The 'END PANEL' card, if used, would not be printed since it specifies the end of the digouts.

The 'MAINTENANCE' card will show one or two parameters according to the control option.

Note that the 'COAL LINE' and 'E' cards are not printed, only the coal line data. If many digouts are entered in the 'COAL LINE' data, the listing may overflow to a second page. The normal titles will not print on the continuation page. In the coal line data listing, two numbers are printed under the title "RE-DEF". The first number is the coal line index number explained in Chapter 5. The second number is 1 for 'R' (redefinition) or 0 for all others.

4.7 DETAIL PAGE

The details of the model actions are printed on the Detail Page when LOGDLS = 1 on 'DIGOUT' cards. If the digout option calls for several digging and spoiling actions, the Detail Page is printed for each action. If the options specify Chop, Keycut, and Bail, three Detail Pages are printed. If the option also calls for layer digging, the pages would print for each layer, with the exception of the details on chop, which would appear only once.

An example of a detail page is shown in Figure 4.2. There are several groups of information on this page; one group is printed for each of the routines. The following subsections discuss interpretation of the information.

BEGIN PRODUCTION TIME CALCULATION

BUCKET START X, Y, Z 4420.0 1290.0 36.5
 BUCKET DUMP X, Y, Z 4580.0 1380.0 82.2
 BUCKET RETURN X, Y, Z 4420.0 1240.0 27.1

AV. SWING ANGLES - H&S, R&L 78.8 -83.4

TIMES IN SEC. DRAG 11.5 H&S 11.0 DUMP 5.0 R&L 10.5 SPOT 7.0 CYCLE 43.1 H S

NP	ND	DO	SO	VSBY	H&S	R&L	CYCLE	NOS	D.H.	LAY	MAINT	WALK	DIG	TOTAL	TONS
2	3	7	1	4674.	11.0	10.5	43.1	233	.00	.00	.00	.02	4.57	4.59 H S	0.
KEYCUT		4	3339.12		4166.18										
KEYCUT		4	3720.11		4681.58										
BAIL		4	951.850		1149.72	.000000									
BAIL		4	4753.79		5922.10	152.323									
KEYCUT		5	3346.23		4175.40										
KEYCUT		5	3669.22		4602.72										
BAIL		5	905.740		1108.73	.000000									
BAIL		5	4787.55		5909.87	278.680									
KEYCUT		6	3383.93		4227.25										
KEYCUT		6	3720.11		4705.30										
BAIL		6	871.851		1072.42	.000000									
BAIL		6	4846.32		6052.32	244.848									
KEYCUT		7	3411.63		4271.44										
KEYCUT		7	3669.22		4598.38										

4.28

Figure 4.3
 Printout When Detail is Suppressed

When LOGDLS = 0, the detail is not printed and the routines print only a single line for each digging and spoiling action, as illustrated in Figure 4.3. This figure shows a portion of the Detail Page obtained for digout 3 in panel 2 of a DLS run. The next 'DIGOUT' card in the input file called for layer digging and set LOGDLS = 0.

The single line of printout has one of the following forms:

CHOP D VSBY VSSY

KEYCUT D VSBY VSSY

BAIL D VSBY VSSY VRBY

where:

D = the digout number

VSBY = volume excavated in bank yd³

VSSY = volume of spoils in swelled yd³

VRBY = volume of rehandle material in bank yd³

The value of VSBY includes VRBY. VRBY is always zero when the normal bail without rehandle is used.

Figure 4.3 shows that each digout consists of two keycuts followed by two bails. This printout continued onto the next page of the output, but that continuation is not included in the figure.

DLSS - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)

DATE 12:50 NOV 10,'80

CASE (DLSDMO) DEMONSTRATE DLS OPTIONS FOR USER'S MANUAL
THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN
SUMMARY

PANEL NO. , 2 DIGOUT NO. 7

NP	ND	DO	SO	VSBY	H&S	R&L	CYCLE	NDS	D.H.	LAY	MAINT	WALK	DIG	TOTAL	TONS	VRBY
1	1	1	0	42552.	.0	.0	.0	0	1.44	.00	.00	.00	.00	1.44	0.	0.
1	1	2	0	44042.	.0	.0	.0	0	.00	.00	.00	.08	.00	.08	0.	0.
1	2	1	0	20868.	.0	.0	.0	0	.00	.00	.00	.17	.00	.17	0.	0.
1	2	2	0	26998.	.0	.0	.0	0	.00	.00	.00	.08	.00	.08	0.	0.
1	3	7	0	45848.	.0	.0	.0	0	.00	.00	.00	.15	.00	.15	0.	12135.
1	4	7	0	43473.	.0	.0	.0	0	.00	.00	.00	.15	.00	.15	0.	9759.
1	5	7	0	50412.	.0	.0	.0	0	.00	.00	.00	.17	.00	.17	0.	16698.
1	6	2	0	66706.	.0	.0	.0	0	.00	.00	.00	.15	.00	.15	0.	0.
1	7	2	0	66390.	.0	.0	.0	0	.00	.00	.00	.16	.00	.16	0.	0.
1	7	4	0	0.	.0	.0	.0	0	1.44	.00	.00	1.11	.00	2.54	49840.	0.
2	1	6	3	2504.	23.5	18.5	68.0	66	2.05	3.95	2.00	.00	1.39	9.39 S \$	0.	0.
2	1	1	1	23979.	18.5	12.0	53.5	625	.00	.00	2.00	.00	10.32	12.32 S L	0.	0.
2	1	2	1	17317.	16.5	15.0	54.5	516	.00	.00	2.00	.05	9.78	11.81 H \$	0.	0.
2	2	1	2	11585.	13.5	12.0	48.5	302	.00	.00	.24	.15	4.52	4.91 H \$	0.	0.
2	2	2	2	16803.	17.0	15.0	55.0	500	.00	.00	.48	.05	9.55	10.07 S \$	0.	0.
2	2	6	2	7800.	31.5	23.5	81.0	233	.00	.00	.33	.00	8.55	8.88 S \$	0.	0.
2	3	1	2	10370.	15.5	12.0	50.5	270	.00	.00	.22	.16	4.21	4.59 H \$	0.	0.
2	3	7	2	25382.	18.0	15.0	57.4	708	.00	.00	.71	.05	14.12	14.87 S \$	0.	12991.
2	4	7	1	24203.	20.0	10.0	53.2	714	.00	.00	.67	.15	13.19	14.01 H \$	0.	1928.
2	4	7	1	13053.	24.5	11.0	61.5	340	.00	.00	.36	.03	7.26	7.66 H \$	0.	13053.
2	5	7	1	31931.	20.5	14.5	58.7	922	.00	.00	.95	.17	18.78	19.90 S \$	0.	7932.
2	6	1	1	9843.	15.5	12.0	50.5	257	.00	.00	.21	.16	4.01	4.37 H \$	0.	0.
2	6	1	1	4631.	20.5	12.0	55.5	121	.00	.00	.10	.02	2.07	2.20 H \$	0.	0.
2	6	7	1	10516.	18.5	16.0	58.8	295	.00	.00	.31	.09	6.03	6.42 S \$	0.	5058.
2	6	7	1	9372.	23.0	15.5	62.3	270	.00	.00	.29	.02	5.84	6.18 H \$	0.	2780.
2	7	1	1	15333.	20.5	13.5	57.0	400	.00	.00	.36	.15	7.04	7.55 H \$	0.	0.
2	7	7	1	10097.	20.5	17.0	61.8	285	.00	.00	.31	.09	6.11	6.51 S \$	0.	4577.
2	7	7	1	8696.	26.0	17.0	66.7	251	.00	.00	.29	.02	5.81	6.13 S \$	0.	2288.
2	7	4	0	253413.	19.8	14.0	57.3	7075	2.05	3.95	11.83	1.36	136.57	155.75	36836.	50601.
2	7	5	0	253413.	19.8	14.0	57.3	7075	2.05	3.95	11.83	1.36	136.57	155.75	36836.	50601.
UNSCHEDULED DOWN TIME														62.78		
TOTAL SCHEDULED HOURS														218.61		

219. SCHEDULED HOURS	200.00 \$/HR	43702. \$
137. DIGGING HOURS		
253413. BANK CU.YDS. OVERBURDEN	1160. CY/HR	.172 \$/CY
36836. TONS ROM COAL	169. T/HR	1.186 \$/TON
STRIPPING RATIO	6.080	
50601. BANK CU.YDS. REHANDLE	20. %	

Figure 4.4
Summary Page

4.8 SUMMARY PAGE

After stripping the last panel, the model prints the Summary Page. A Summary Page is reproduced in Figure 4.4. The abbreviations used on this page are explained in Table 4.27.

There are two parts to the Summary Page: the first part prints a single summary line for each digging/spoiling action, and the second part prints the project totals.

The title line and the single summary line also appear on the Detail Page. Given the explanations of Table 4.27, the summary lines should be self-explanatory, with the following additional comments.

When the spoil options are set to zero, all values related to digging/spoiling will be zero on the summary lines. When the spoil option is not zero and cycle times are calculated, two letters are printed to the right of the TOTAL column. The first letter applies to the hoist and swing action and the second to the return and lower action, as explained in Chapter 10.

The TONS column will be zero for all lines except the total lines since coal is recovered only during the end-of-panel processing.

Note that a zero is printed in the VSBY column on the total line for the first panel. That panel was designated as a boxcut panel, and its totals are not carried into the project totals.

The VRBY column will contain zeros except when the rehandle bail option is used for a digout and there is rehandle material.

The H&S, R&L, and CYCLE values printed on total lines are averages rather than totals.

The second part of this page prints the project totals. The UNSCHEDULED DOWN TIME is DTF (down time factor from 'FACTOR' card) times the TOTAL from the final summary line, i.e., times total working hours. TOTAL SCHEDULED HOURS equal total working time plus UNSCHEDULED DOWN TIME.

The DCS (total operating and ownership costs from the 'DRAGLINE2' card) times the SCHEDULED HOURS equals the total cost (the dollar figure on the SCHEDULED HOURS line).

When rehandle does occur, the volume and percentage will be printed. This volume is included in BANK CU. YDS. OVERBURDEN.

Table 4.27 Summary Page

Name	Value	Meaning
NP		Panel number
ND		Digout number
DO	1	Keycut
	2	Bail without rehandle
	3	Not used
	4	Totals for the panel
	5	Project totals
	6	Chop
	7	Bail with rehandle
SO	0	No spoiling
	1	Conical spoils
	2	Ridgeline spoils
	3	Extended bench spoils
VSBY	Bank Cubic Yards	Volume of overburden
H&S	Sec	Hoist and swing time
R&L	Sec	Return and lower time
CYCLE	Sec	Total cycle time
NOS		Number of swings (cycles)
D.H.	Hrs	Deadheading time
LAY	Hrs	Layover for coal loadout time
MAINT	Hrs	Maintenance time
WALK	Hrs	Walking time
DIG	Hrs	Digging/spoiling time
TOTAL	Hrs	Total time in this digout
TONS	Tons	Recovered coal
VRBY	Bank Cubic Yards	Volume of rehandle overburden

4.9 IDENTIFICATION OF COMPUTER RUNS

Due to the large number of computer runs that may have to be made, the identification of the different runs as well as identification of different parts of the run becomes important. A variety of options are available to the user which may be used separately or in combination. These are:

1. CASE and CAS2 cards
2. COAL LINE or COAL cards
3. Insertion of Comment cards in the input

4.9.1 CASE AND CAS2 CARDS

The CASE and CAS2 cards act as title cards for the run and are printed on every page of output. They can generally be placed in any position in the input deck as many times as required. However, customarily they have been used at the beginning of the input deck. All computer runs in this study had the seven alphanumeric identifiers for the computer run placed in the CASE card. The user may set up a code system which will identify the computer run and some of its parameters/characteristics by simply glancing at the 7 alphanumeric characters. The system most often used in the study was 4 alphanumerics preceded by DLS. The first letter refers to a mine/case, the second is a code for grid size, the third refers to the number of panels in a run, and the fourth is a number or a letter to identify that particular run.

Example: In CASE DLSDV3B, D stands for Mine D, V stands for a 10-ft grid, 3 is the number of panels (2 production and 1 boxcut), and B is the case identifier.

4.9.2 COAL LINE OR COAL CARDS

These can be used to identify the panel parameters, such as Panel Width and Digout Length. The user inputs the suitable identification desired after the words COAL LINE. The COAL LINE cards can be placed only before 'X', 'Y' or 'Z' cards. These are specially useful for identifying different parts of the run in the input.

4.9.3 COMMENT CARDS

The input program checks only the first four columns on the input card. If they are blank, it simply prints out the card and takes no other action.

COAL LINE DATA - PANEL DEFINITION

5.1 PANELS AND DIGOUTS

In DLS terminology, a "coal line" is the line of intersection between the bottom of the highwall and the surface of the coal seam. Two coal lines define a panel; one (current) defines the line at the bottom of the highwall being formed on the panel, and the other (previous) defines the line of the highwall formed on the preceding panel. Of course, when the panel is a boxcut panel, the previous line defines the bottom of the face being formed opposite the highwall. The engineer plans the stripping operation by drawing these coal lines on a map of the pit.

In mine planning, the engineer draws the two coal lines for a panel and specifies that the operator should advance a specified number of steps (or a distance specified in feet) between digouts. In the DLS model, each digout must be explicitly defined with four sets of x,y coordinates.

Consider the plan view of a panel shown in Figure 5.1. The panel consists of four digouts with the direction of advance from the bottom toward the top of the page. The four corners of each digout are labeled A1, B1, C1, and D1 for the first digout; A2, B2, C2, and D2 for the second, etc.

In this panel, spoils are cast toward the right, therefore the left line represents the current highwall being formed on this panel, and the right line represents the previous highwall formed on the preceding panel. In the figure, line A2-D2 is the same as line B1-C1; A3-D3 is the same as B2-C2; etc.

By using only the letters, we can now assign faces to lines:

<u>Line</u>	<u>Face</u>
A-B	Current Highwall
B-C	Current Dragface
C-D	Previous Highwall
D-A	Previous Dragface

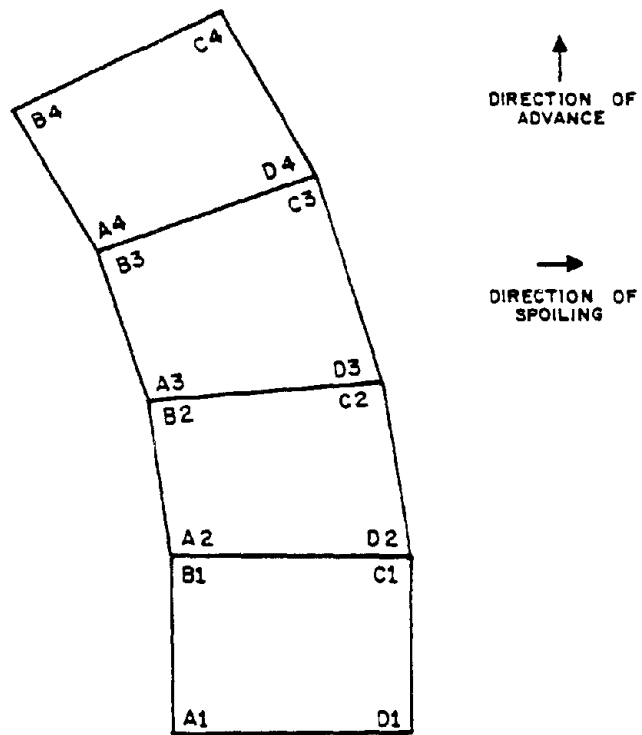


Figure 5.1
Plan View of a Panel

At this point, the user must learn a change in naming conventions that occurred during model development. When the first coal lines were drawn, the four corners of each digout were labeled A, B, C, and D as shown below. The parameter names for the angles or tangents that apply to these faces were defined as:

<u>ANGLE</u>	<u>TANGENT</u>	<u>FACE</u>
AABF	TANAB	Current Highwall
ABCF	TANBC	Current Dragface
ACDF	TANCD	Previous Highwall
ADAF	TANDA	Previous Dragface

These names apply to the four faces of a keycut as well as of the bail, and to boxcuts as well as production panels. Thus, the 'ANGLES' card specifies angles for all four faces, and the 'TANGENTS' card specifies slopes for all four faces. The type of digging does not alter the names of the faces.

Later in the model development, it became necessary to identify 12 points for each digout, so a new convention was devised. In this new convention, letters E through P identify the 12 points. The sections of this manual that explain digging shapes and the model detail listing both use the revised convention. The old and new letters correspond as follows:

<u>Old</u>	<u>New</u>
A	E
B	F
C	H
D	I

To define the EF face angle, the user would set the AB face angle as AABF.

5.2 COAL LINE DATA CARDS

The panel is defined by a set of data cards introduced by the 'COAL LINE' card, and terminated by an 'E' card. That is, the first card of the set must have the keyword, COAL LINE, punched in columns 1-9. The remaining columns of this card are ignored and may contain comments if desired. The final card in the set must have an 'E' in column 1 and blanks in columns 2-80. The 'COAL LINE' cards are summarized in Table 4.7.

The data cards between 'COAL LINE' and 'E' are identified by the character in column 1 as follows:

<u>Col. 1</u>	<u>Card Defines</u>
X	Panel that is parallel to x axis
Y	Panel that is parallel to y axis
Ø (blank)	Explicit coordinates of a dragface
R	Redefined dragface coordinates

Starting in column 2, (CDC version requires starting in column 6) each of these cards will contain a series of numeric values with each numeric string separated from the preceding string by at least one blank column.

The numeric values on the data cards specify the following model parameters:

XC	-	x coordinate of point on current highwall line
YC	-	y coordinate of point on current highwall line
XP	-	x coordinate of point on previous highwall line
YP	-	y coordinate of point on previous highwall line
ASK	-	angle for keycut spoiling
DBFK	-	bucket fill factor for keycut overburden
DOEK	-	efficiency factor for keycutting
ASB	-	angle for bail spoiling
DBFB	-	bucket fill factor for bail overburden

DOEB - efficiency factor for bailing

DOL - digout length in feet (only on 'X' or 'Y' cards)

NOD - number of digouts (only on 'X' or 'Y' cards)

As the data cards are processed, the data entries from the cards are stored in an internal coal line array for later use in model logic. The coal line array is dimensioned to 75 rows and 11 columns. The columns contain the entries from each card. The first column in the array holds a flag for redefinition (explained later), and columns 2-11 contain the values from the data cards in the order listed above. The values of DOL and NOD are used to construct the array but are not retained in the array.

We can explain the indexing to the rows in this array by reference to Figure 5.1. The data pertaining to line A1-D1 is contained in row 1; data for line A2-D2 (or B1-C1) is in row 2; data for line B2-C2 (or A3-D3) is in row 3; etc. Since the diagram has five lines, the array would contain five rows of data values, and these five rows would define four digouts. Thus, the user must always define one line more than the number of digouts.

The following sections describe how the four data card types can be used to specify the coal lines for a panel. Each subsection describes a single card type, but the user can combine the card types as required for panel definition. The model is designed to correctly process combinations; however, it has not been possible to actually test all combinations. Therefore, the user is advised to experiment with the model for unusual situations. The PPV program can be used effectively to see that 'COAL LINE' data are actually interpreted in the expected manner.

To correctly advance the dragline through all digouts in a panel, two indexing systems are used: one keeps track of the digout number and the other keeps track of the rows to be used from the coal line array. When the digout index is 1, the coal line index refers to row 1 for the coordinates of line A-D and to row 2 for the coordinates of line B-C. When the digout index is 2, the row index for line A-D is 2 and that for line B-C is 3, etc. Thus, when the digout index is N, the line A-D row index is also N, and the line B-C row index is N + 1.

The angles, fill factors, and efficiency factors from digout N will be taken from array row N.

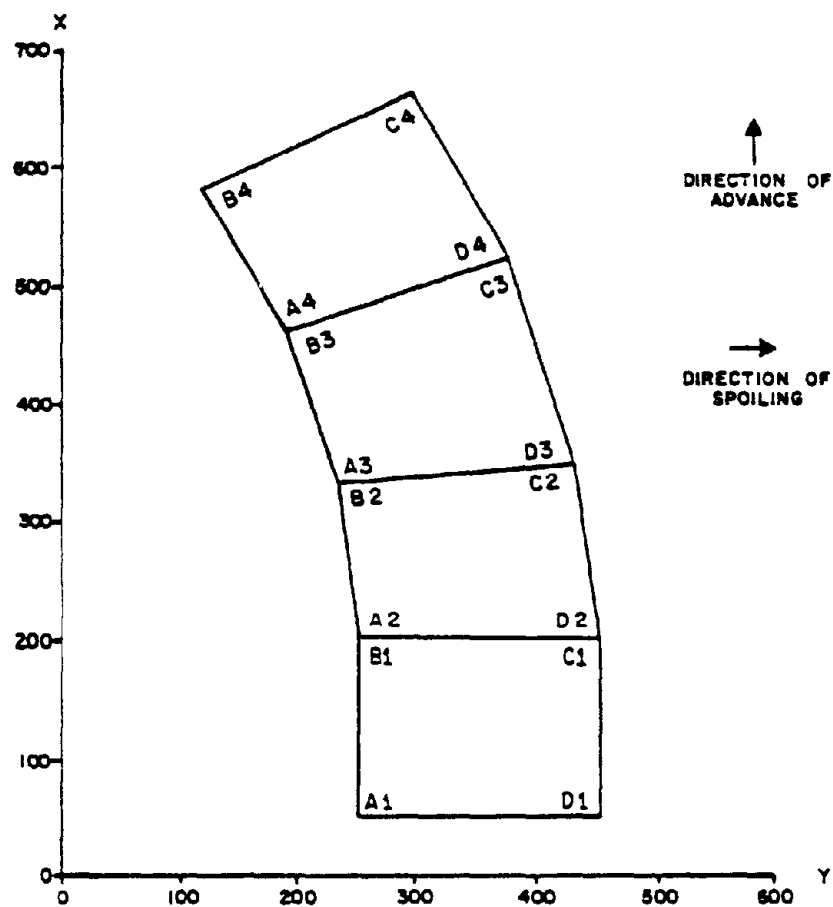


Figure 5.2
A Panel Using Explicit Data Cards

5.2.1 'Ø' COAL LINE DATA CARDS

Data cards with 'Ø' (blank) in column 1 explicitly define the coordinates of a dragface. These cards must be used to define panels which are not parallel to the x or y axis or in which digouts are not uniform. The plan view in Figure 5.1 is an example of a panel that would be defined with 'Ø' data cards.

When column 1 is 'Ø' the XC and YC coordinates apply to point A - A1 from the first card, A2 from the second card, etc. The values of XP and YP apply to point D - D1 from first card, D2 from second card, etc.

The plan view of the panel from Figure 5.1 has been redrawn in Figure 5.2 along with an x,y coordinate system. The coordinates were read from this figure and the following data cards were punched to define this panel.

COAL LINE DATA CARDS FOR FIGURE 5.2

50	250	50	450	80	.8	.7	90	.8	.7
200	250	200	450	80	.8	.7	90	.8	.7
330	230	350	430	80	.8	.7	90	.8	.7
460	190	525	375	80	.8	.7	90	.8	.7
570	120	660	295	80	.8	.7	90	.8	.7

E

From these data cards we can extract the coordinates of the points on the Figure 5.2. The coordinates of point A1 are 50,250 and of D1 they are 50,450 (from the first card). The coordinates for B1 (and A2) are 200,250 and for C1 (and D2), they are 200,450. The user can use this coordinate definition for the rest of the digouts in the panel.

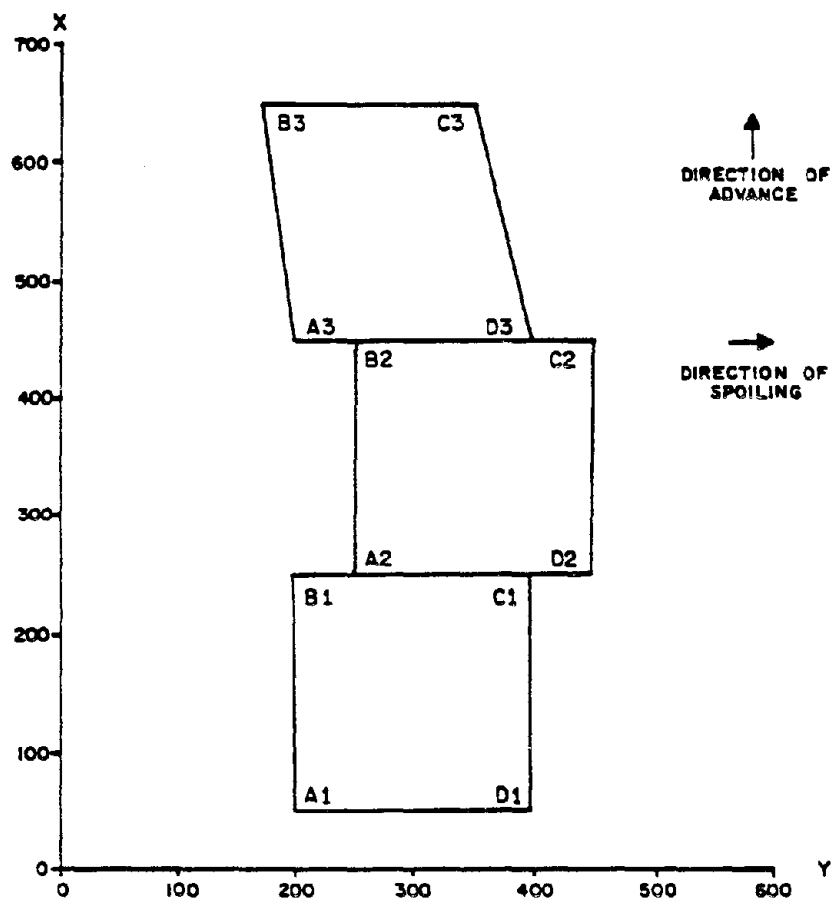


Figure 5.3
A Panel Using 'R' Data Cards

5.2.2 'R' COAL LINE DATA CARDS

Coal line data cards with an 'R' in column 1 are used when discontinuities occur in a panel. Consider, for example, the panel shown in Figure 5.3. Three digouts are shown and each is offset from the preceding digout. While this diagram may be exaggerated to demonstrate the use of the 'R' card, offsets are common in dragline pits.

This case shows that the coordinates for line A2-D2 are not the same as those for B1-C1. Therefore, line A2-D2 must be "redefined" by using the 'R' data card. The following cards were punched to define this panel.

COAL LINE DATA CARDS FOR FIGURE 5.3

```
    50    200    50    400    80    .9    .8    90    .9    .7
    250    200    250    400
R   250    250    250    450    80    .9    .8    90    .9    .7
    450    250    450    450
R   450    200    450    400    80    .9    .8    90    .9    .7
    650    170    650    350
E
```

The 'R' card has the effect of correctly augmenting the coal line array row index to refer to the proper set of data for a digout. With this set of data, the model would use rows 1 and 2 for the first digout. The 'R' in card 4 would cause the model to correctly use rows 3 and 4 for the second digout. The 'R' in card 6 would cause the model to use the data from rows 5 and 6 for the third digout.

To emphasize the way the model extracts the angles and factors from these cards, the data values are punched only in cards 2, 4 and 6. When the user prepares a DLS control file, he will usually find it easier to punch the angles and factors in all cards rather than selectively as was done here. The presence or absence of these factors in cards 3, 5, and 7 of this example would not affect model operations.

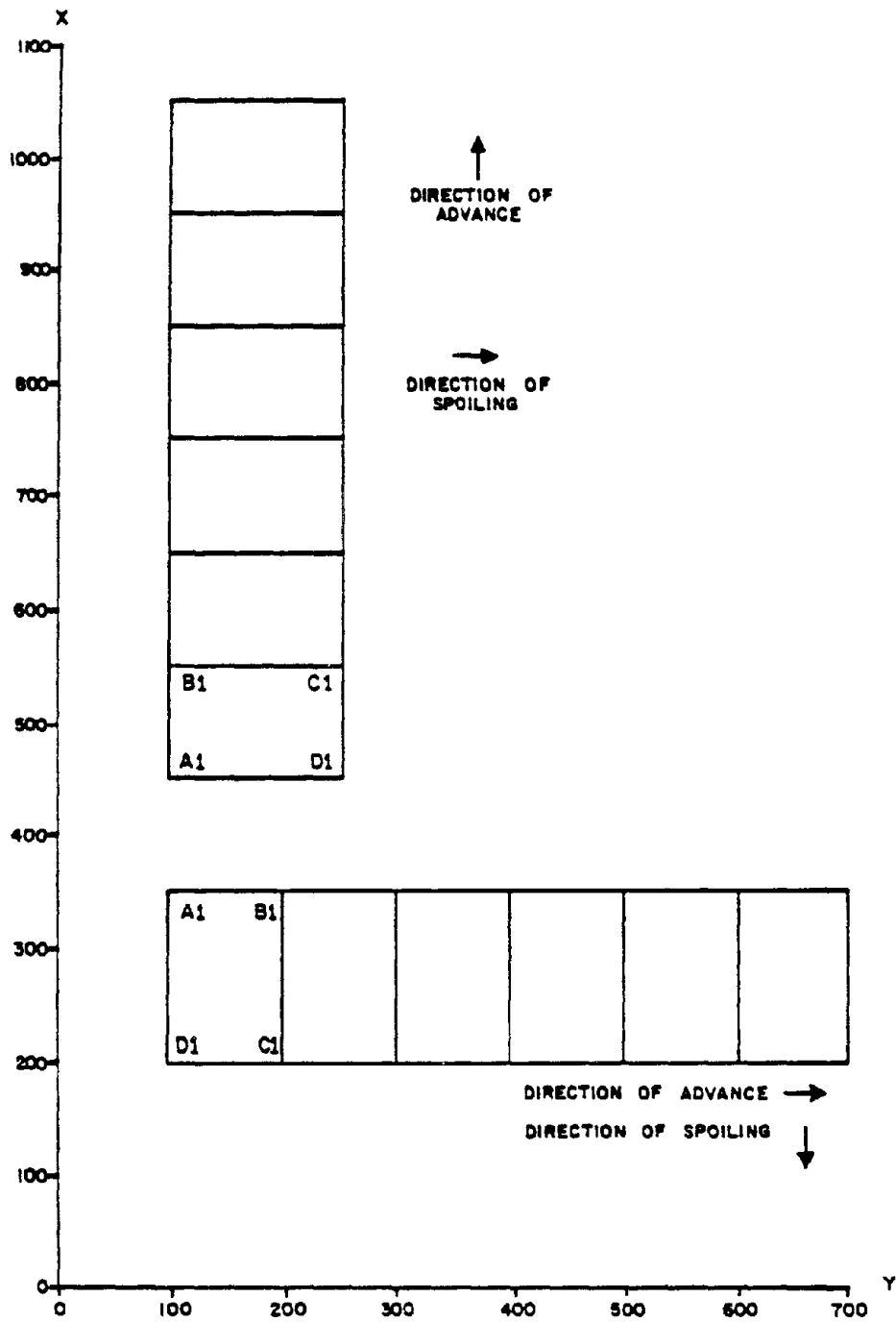


Figure 5.4
Panels Using 'X' and 'Y' Data Cards

5.2.3 'X' COAL LINE DATA CARDS

Data cards with an 'X' in column 1 may be used to simplify panel definition when the panel is parallel to the x axis of the user's axis system, and the digout lengths are uniform. In this case, two additional parameters, DOL (digout length, in feet) and NOD (number of digouts) must follow the value of DOEB (bail efficiency factor) on the 'X' card.

A single 'X' card will generate a series of coal line array entries to define NOD digouts with DOL feet between successive dragfaces. The following cards were punched to define the panel that is parallel to the x axis on Figure 5.4.

```
COAL  LINE  DATA  FOR  PANEL  PARALLEL  TO  X  AXIS
X    450 100 450   250   80 .7  .8 90 .8  .7   100 6
E
```

5.2.4 'Y' COAL LINE DATA CARDS

Data cards with a 'Y' in column 1 may be used to simplify panel definition when the panel is parallel to the y axis of the user's axis system, and the digout lengths are uniform. As with the 'X' card two additional parameters, DOL (digout length, in feet) and NOD (number of digouts), must follow the value of DOEB (bail efficiency factor) on the 'Y' card.

A single 'Y' card will generate a series of coal line array entries to define NOD digouts with DOL feet between successive dragfaces. The following cards were punched to define the panel that is parallel to the y axis on Figure 5.4.

```
COAL  LINE  DATA  FOR  PANEL  PARALLEL  TO  Y  AXIS
Y 350   100   200   100   80 .7  .8 90 .8  .7   100 6
E
```

A. Data For Figure 5.2

RE-DEF		KC	YC	KP	YP	ASK	DBFK	DOEK	ASB	DBFB	DOEB
1	0	50.	250.	50.	450.	80.	.800	.700	90.	.800	.700
2	0	200.	250.	200.	450.	80.	.800	.700	90.	.800	.700
3	0	330.	230.	350.	430.	80.	.800	.700	90.	.800	.700
4	0	460.	190.	525.	375.	80.	.800	.700	90.	.800	.700
5	0	570.	120.	660.	295.	80.	.800	.700	90.	.800	.700

B. Data For Figure 5.3

RE-DEF		KC	YC	KP	YP	ASK	DBFK	DOEK	ASB	DBFB	DOEB
1	0	50.	200.	50.	400.	80.	.900	.800	90.	.900	.700
2	0	250.	200.	250.	400.	0.	.000	.000	0.	.000	.000
3	1	250.	250.	250.	450.	80.	.800	.800	90.	.900	.700
4	0	450.	250.	450.	450.	0.	.000	.000	0.	.000	.000
5	1	450.	200.	450.	400.	80.	.900	.800	90.	.900	.700
6	0	650.	170.	650.	350.	0.	.000	.000	0.	.000	.000

C. Data For Figure 5.4 (Parallel to X axis)

RE-DEF		KC	YC	KP	YP	ASK	DBFK	DOEK	ASB	DBFB	DOEB
1	0	350.	100.	200.	100.	80.	.700	.800	90.	.800	.700
2	0	350.	200.	200.	200.	80.	.700	.800	90.	.800	.700
3	0	350.	300.	200.	300.	80.	.700	.800	90.	.800	.700
4	0	350.	400.	200.	400.	80.	.700	.800	90.	.800	.700
5	0	350.	500.	200.	500.	80.	.700	.800	90.	.800	.700
6	0	350.	600.	200.	600.	80.	.700	.800	90.	.800	.700
7	0	350.	700.	200.	700.	80.	.700	.800	90.	.800	.700

D. Data For Figure 5.4 (Parallel to Y axis)

RE-DEF		KC	YC	KP	YP	ASK	DBFK	DOEK	ASB	DBFB	DOEB
1	0	450.	100.	450.	250.	80.	.700	.800	90.	.800	.700
2	0	550.	100.	550.	250.	80.	.700	.800	90.	.800	.700
3	0	650.	100.	650.	250.	80.	.700	.800	90.	.800	.700
4	0	750.	100.	750.	250.	80.	.700	.800	90.	.800	.700
5	0	850.	100.	850.	250.	80.	.700	.800	90.	.800	.700
6	0	950.	100.	950.	250.	80.	.700	.800	90.	.800	.700
7	0	1050.	100.	1050.	250.	80.	.700	.800	90.	.800	.700

Figure 5.5
Detail Listing of Coal Line Data

5.3 COAL LINE DETAIL PRINTOUT

When the coal line data are printed on the CP listing, the 'COAL LINE' and 'E' cards are not printed; only the results from processing the data cards are printed. The detail output for the four sets of data cards in the preceding sections is reproduced as Figure 5.5.

Two numbers are printed under the heading RE-DEF: the first number is the internal reference number, and the second is either 0 for non-'R' cards or 1 for 'R' cards. Thus, in group A, the second numbers are all 0, but in group B, the second numbers on lines 3 and 5 are both 1.

Groups C and D resulted from the use of the 'X' and 'Y' cards. In the input cards for these data, DOL = 100 and NOD = 6, therefore, six cards were developed by the model to add to the one input card. In all, seven cards are needed to define the six digouts.

6.1 INTRODUCTION

In most dragline pits, the first operation in removing a block of overburden is the keycut. The keycut is made to form the highwall, and the dragline is positioned in line with the highwall so that a straight face can be formed. After completing the keycut, the dragline is walked toward the highwall to the production bail position (sometimes called the face cut position). The remainder of the block is removed from the bail position. The dragline may chop in the direction of advance to form the next bench and/or in the direction of panel advance to form the bench for deadheading. The dragline is then moved to the keycut position for the next "digout." In DLS terminology, a "digout" consists of all actions taken to remove a block of overburden.

At the start of a simulation run, the dragline is moved to the keycut position for the first digout. The digout is made and the dragline advances to the next digout. When all digouts in a panel are completed, the dragline moves to the first digout in the next panel.

Digouts and panels are defined by 'COAL LINE' data, described in Chapter 5. This chapter explains how the dragline moves from one digout to the next and the different digging modes it performs in response to the controls specified by the 'DIGOUT' card.

The 'DIGOUT' card sets four model parameters:

- LOD - Digout option No. (controls digging mode).
- N - No. of digouts to be made under conditions defined by current values of model parameters.
- LOGCP - The current values of model parameters will be printed at the start of the digout when this control parameter is set to 1.
- LOGDLS - The details of each dig will be printed when this control parameter is set to 1.

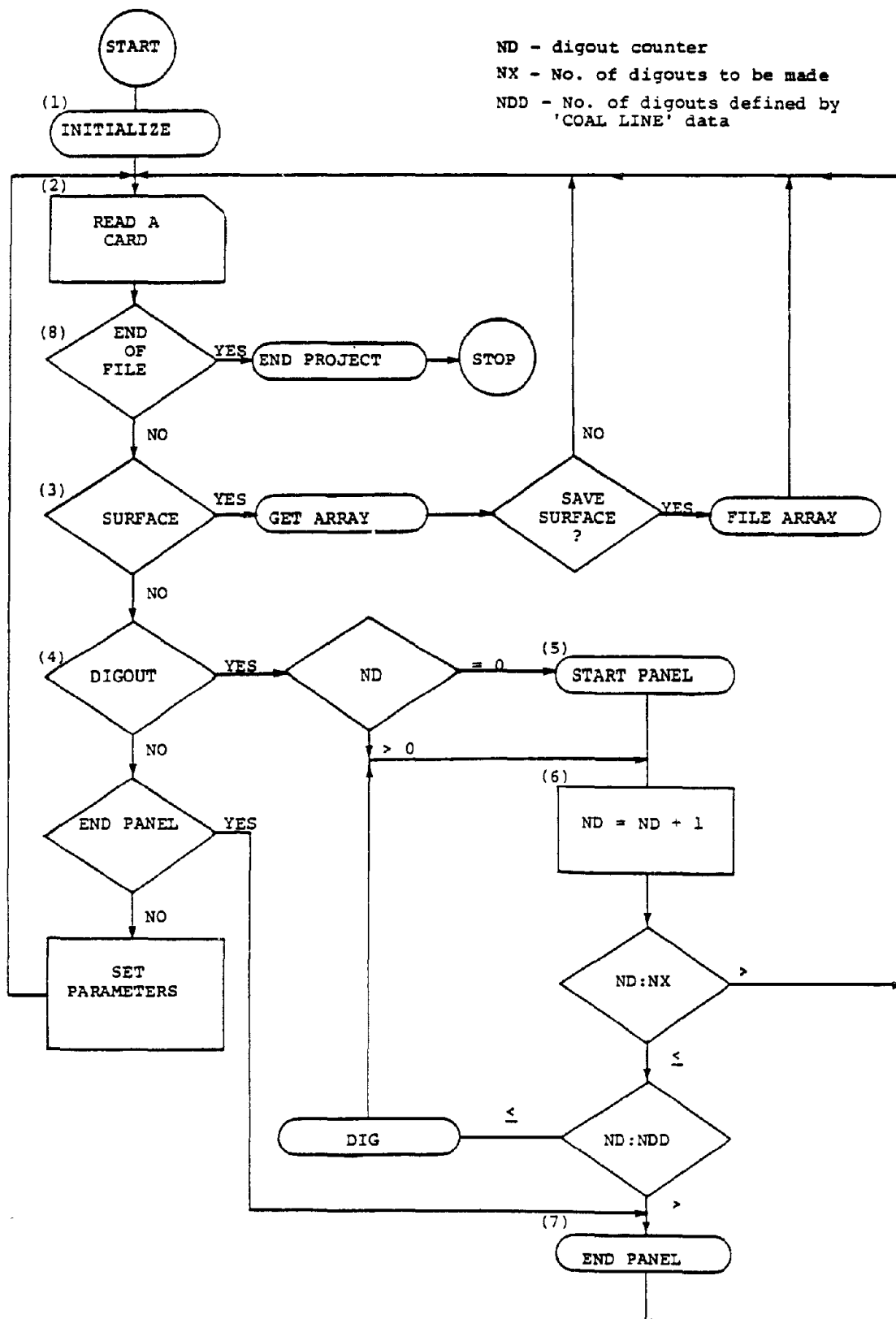


Figure 6.1
 Simplified DLS Logic

6.2 MAIN PROGRAM LOGIC

A simplified logic chart for the main program is shown in Figure 6.1 illustrating the relationship between card reading and simulations. There are many counters and control parameters involved, but only three are germane to this discussion:

- ND - Digout counter. This parameter "counts" digouts and is used to control logic. The parameter is set to zero whenever 'COAL LINE' data cards are processed to indicate starting a new panel.
- NX - Number of digouts to be made. This counter is set on the basis of N from the 'DIGOUT' cards. It also is set to zero when 'COAL LINE' data cards are processed. When a 'DIGOUT' card is read, the value of N from the card is added to NX so that NX indicates the number of digouts to be made before returning to card processing.
- NDD - Number of digouts defined. The model sets this parameter when the 'COAL LINE' data cards are processed. It reflects the number of digouts defined by the data.

The following paragraphs describe the model actions shown in Figure 6.1. The step numbers correspond to the numbers in the figure.

1. Initialize: All model counters and controls are cleared to zero.
2. Read a Card: The input routine is called to read cards. The flow chart shows that this read operation is followed by a number of tests to determine if the end of the file or one of three keyword cards has been read. If none of these special conditions is encountered, the model simply sets parameters according to the keyword on the card. Of interest to this discussion is the fact that NDD will be set when the 'COAL LINE' data are processed. It will reflect the number of digouts defined by the data.
3. Surface Card: When the 'SURFACE' card is read, the model searches the input surface file to find the requested array. The array is transferred from the file to the internal surface array. The model tests the parameter LOGSF (save surface file control) from the 'SURFACE' card to see if surface arrays are to be saved. If LOGSF = 1, the array

is transferred to the output surface file; otherwise it is not. The model prints the surface page (see section 14.4.2) and returns to reading cards.

4. Digout: When the 'DIGOUT' card is read, the value of N from this card is added to NX so NX reflects how many digs remain to be made. Then the actual simulation begins.
5. Start Panel: The current value of ND (Digout No.) is tested. If ND is still zero, the model starts the panel. Several steps are taken to start a panel. The 'COAL LINE' data for the previous highwall are extended one digout by extrapolation because the model requires an additional highwall to correctly position the dragline for the bail in the last digout. Generally this extrapolation works well, but the user might wish to define an extra digout to control this dragline position on the last digout. The 'END PANEL' card and NCDL from the 'MINE COAL' card can be used to control dragline placement and prevent the model from stripping the last digout when it is entered, as explained in step 7.

The cross-section geometry is solved to calculate HS and SB as described in Section 8.1. The value of residual coal (FRC) is calculated for removing coal as described in Section 9.2.

The panel counter is checked. If the counter is zero, the digout to be made is the first digout in the first panel. In this case, the model transfers the values of XPP and YPP (starting dragline position) from the 'WALK' card to its internal FROM position for walking as described in Chapter 11. The panel counter is increased by 1.

6. Dig: When ND is not zero, or when the start panel calculations are completed, the model augments the digout counter, ND.

The value of ND is compared with the current value of NX. If ND is greater than NX, the model has performed the specified number of digouts and it returns to reading input cards. When ND is equal to or less than NX, ND is compared with NDD. When ND is greater than NDD, the model has advanced to the end of the panel, and it performs the end panel processing (see Step 7).

When ND is less than or equal to NDD, the model calls its dig subroutine to perform the digout. After completing the digout, the counter is advanced and tested to see if another digout is to be made or if more cards should be read.

7. End Panel: The model enters its end-of-panel processing in response to one of two conditions: the digout counter ND has reached the end of the defined panel, or an 'END PANEL' card is read. As explained in Step 5, the user might wish to define one "dummy" digout to control dragline placement for the last digout. To do this the model would normally advance and dig the final dummy digout. The 'END PANEL' card can be used to "force" the model to end panel processing before the dummy digout is reached.

At the end of the panel, the model checks the values of LOC (mine coal option) from the 'MINE COAL' card. If it is not zero, the model uses the specified remove-the-coal routine to modify the surface to account for coal recovery. One use of the parameter NCDL (number of last coal digout) can be explained by continuing the preceding discussions of a dummy digout for dragline placement on the last digout. Suppose the user wishes to strip 10 digouts and control the last position; he would specify 11 digouts in the 'COAL LINE' data. The value of NCDL would be set to 10 on the 'MINE COAL' card and the 'END PANEL' card would be placed after the 'DIGOUT' card calling for the tenth digout. The dummy digout would then be ignored except for dragline positioning.

At the end of the panel, the model checks the value of LOBC (boxcut control) with the panel number. If panel number is less than or equal to LOBC, this panel is considered to be a "boxcut" and the totals from this panel will not be accumulated into the project total counters. When the panel number is greater than LOBC, all panel totals are added to the project counters. The model then returns to card reading.

In dragline operations, the first panel in a pit is a "boxcut." The DLS model is used most frequently to simulate actions on panels that are not adjacent to the original opening (boxcut) panel. The user could attempt to represent the excavated panel into which the spoils will be cast by adjusting the elevation data used to define the surface

array. Such representations, however, are difficult to do from most topographic maps. Therefore, the DLS user generally forms the previous panel by defining the first panel in a simulation run as a boxcut panel. This boxcut panel is formed with the model controls, but the spoils are not cast onto the surface, and information from the boxcut is not to be carried into the totals used to measure the simulation results. Thus, LOBC is normally set to 1. In effect, the boxcut simulation is just an excavation for placement of the next panel's spoils.

8. End of File: After all cards in the input file have been read, the model will read the end of file. When the end of the file is reached, the model executes its END PROJECT processing (described later in this chapter).

The user should note the sequence of comparing ND with NX and NDD as shown on the flow chart. If the user enters 'DIGOUT' cards such that NX never exceeds the value of NDD, the model will not enter its end-of-panel processing for the panel. If the user wishes to strip to the end of the panel and enter the end-of-panel processing, then the last 'DIGOUT' card should enter a large value for N (e.g., 99).

The user could take advantage of this feature to simulate special situations, such as leaving a berm on the top of the coal seam. The user would first define the panel to remove overburden from the full coal panel. He would specify 'DIGOUT' values such that NX equals NDD. The user would then enter a new set of 'COAL LINE' cards to define the area of coal to be removed. The 'COAL LINE' data set would be followed by an 'END PANEL' card to force the model to its end-of-panel processing.

6.3 THE DIG ROUTINE

The dig routine is the main control routine in the DLS model. A simplified flow diagram of the routine is shown in Figure 6.2. The following paragraphs describe the actions of the dig routine. The step numbers correspond to the numbers in Figure 6.2.

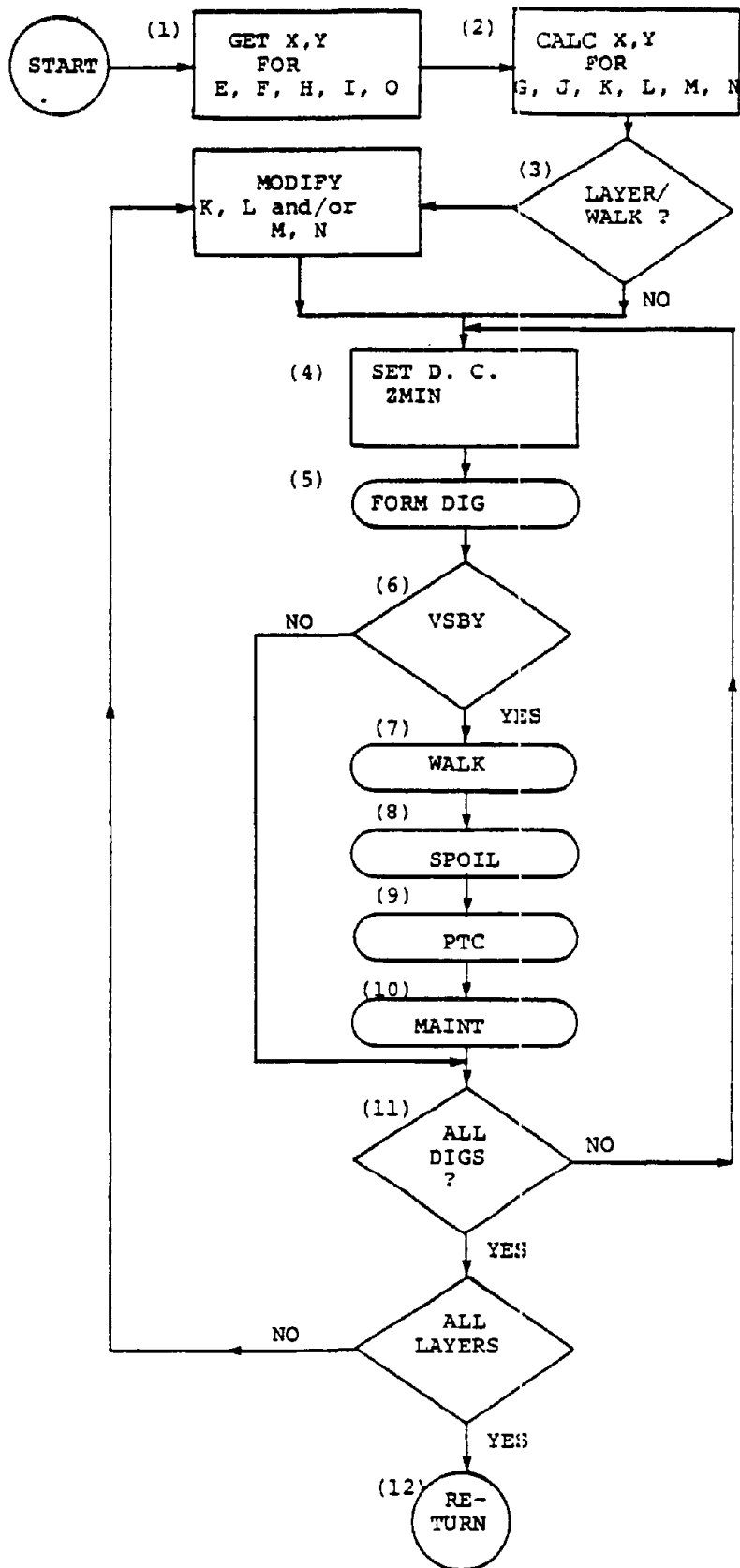


Figure 6.2
Simplified Dig Routine Logic

1. Get x,y: The model retrieves the user's coordinates for points E, F, H, I, and O from the 'COAL LINE' data. As explained in Chapter 7 (Figure 7.1), points E, F, H, and I define the four corners of the digout, and point O defines the position of the existing highwall for the next digout.
2. Calc x,y: The model calculates the coordinates for points G, J, K, L, M, and N. Points G and J define one side of the keycut. Points K and M define the dragline positions for keycut and bail, respectively, and points L and N define the corresponding spoil points. Point P is a construction point used to locate point M.
3. Layer/Walk: The digout option is checked to see if layer/walking is specified for this digout. If so, the model modifies points K and L and/or M and N as appropriate. This modification is explained in detail later in this chapter.
4. Set D.C.: The model sets its digging controls (D.C.) for the user-specified options. The value of ZMIN is set to control the depth of digging for chopping and/or layer-cutting.
5. Form Dig: The appropriate digging routine is called to form the specified shape.
6. VSBY: The volume of spoils from this digging action (VSBY) is checked. For keycut or bail, VSBY must be greater than zero; for chop, VSBY must be greater than 500 yd³. If VSBY fails to meet these requirements, the model skips the remaining routines. For keycut and bail, if VSBY = 0, the simulation then comes to a stop; however, for chop it continues.
7. Walk: The walk routine is called, except when the walk option is turned OFF.
8. Spoil: The appropriate spoil routine is called, except when the spoil option is turned OFF.
9. PTC: The PTC (Production Time Calculation) routine is called, except when the spoil option is turned OFF.
10. Maint.: The maintenance routine is called, except when the maintenance option is turned OFF, or when maintenance has been calculated by the walk routine.

11. All Digs?: The dig and layer controls are tested next. The flow chart shows dig controls being tested before layer controls. Actually, the model may test either first according to the user's options. In some options, the dragline position is changed between layers and the digging action repeated. In other options, the sequence is repeated with a different digging action for each layer.
12. Return: When all layers and all digging actions are completed, the dig routine returns control to the main program to advance to the next digout or panel as required.

6.4 DIGOUT OPTIONS

The 'DIGOUT' card is summarized in Table 4.8. The digout option control, LOD, specifies which of six programmed digging/walking sequences to follow in response to 'DIGOUT' cards. The options are summarized below and described in detail in the following paragraphs. The options are illustrated in Figures 6.3 through 6.8, showing both plan view and longitudinal sections of a digout.

DIGOUT OPTION SUMMARY

<u>LOD</u>	<u>Type of Digging</u>	<u>Dragline Movement</u>
1	Normal	Key/bail
2	Layer	Key/bail for each layer
3	Radial/layer	Key/bail with changing spoil angles between layers
4	Layer/walk	Key/key/key for each layer, followed by bail/bail/bail for each layer with dragline moving toward drag-face between layers.
5	Rerun	Key/bail, but rerun bail when spoils on coal.
6	Layer with bail walking	Key then bail/bail/bail for each layer with dragline moving onto extended bench between layers.

NOTE: "Key" means move to keycut position and keycut, and "bail" means move to bail position and bail. The chop will be done from either key or bail position as specified by chop option (LCC).

To simplify the drawings, the section diagrams in Figure 6.3 through 6.8 show a level surface over a level coal seam. Of course, if the model has been used to chop ahead, then the surface will be level and HB feet above the coal seam. If chop is not done and/or the coal seam is not level, then HB is a user-defined approximation of the overburden depth.

When layer cutting is specified, the model uses the value of HB to determine the number of layers to cut:

$$NLTC = INT (HB / DOD + 0.3)$$

where:

NLTC = Number of layers to cut

HB = Bench height from 'PANEL' card

DOD = Depth of dig from 'LAYER' card

INT = Means that the calculated value will be truncated to an integer after adding 0.3. This has the effect of adding a bottom layer when it would be at least 70% of HB.

When the model begins layer cutting, it sets ZMIN (minimum elevation) to:

$$ZMIN = HB - DOD$$

For each layer thereafter,

$$ZMIN = ZMIN - DOD$$

If ZMIN becomes negative, it is set to zero.

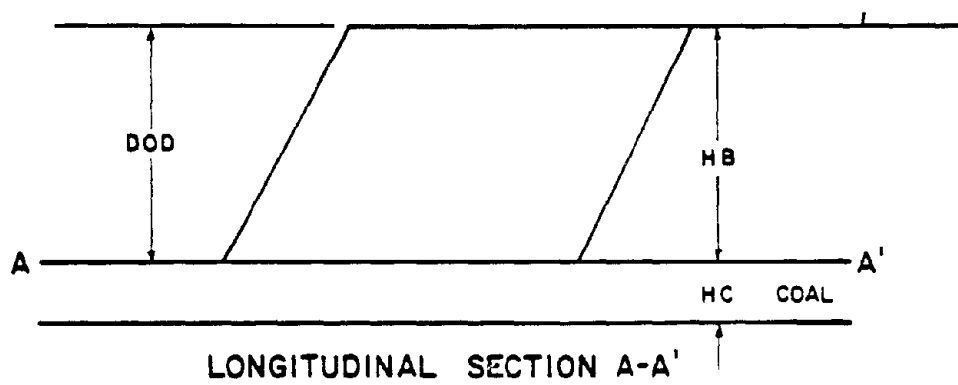
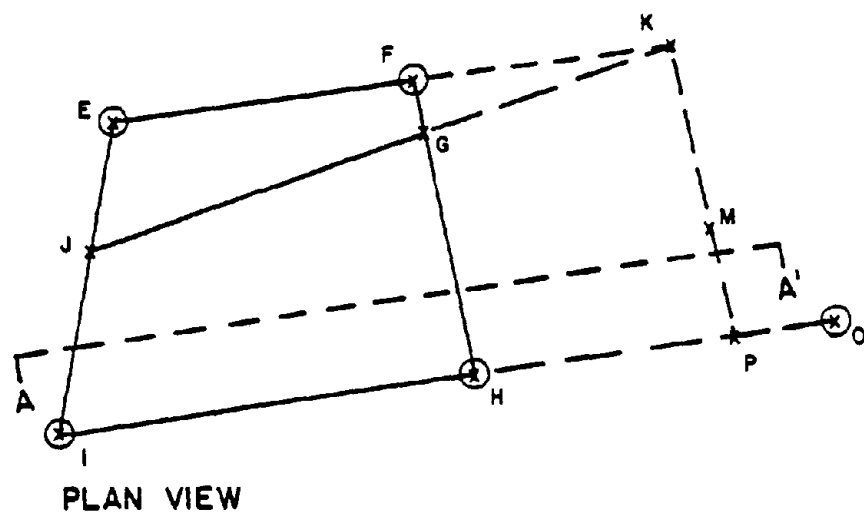


Figure 6.3
Digout Option 1

6.4.1 OPTION 1 - NORMAL DIGGING

Figure 6.3 applies to this option. The dragline is moved to position K. Then the chop option is tested, if set to chop from keycut, the chop sequence is executed. The keycut option is tested and, if on, the keycut sequence is executed. The dragline is then moved to position M. The bail option is tested and, if on, the bail sequence is executed. The chop option is tested again and, if set for chop from bail, the chop sequence is executed.

The spoil positions are not shown on this diagram to simplify the presentation.

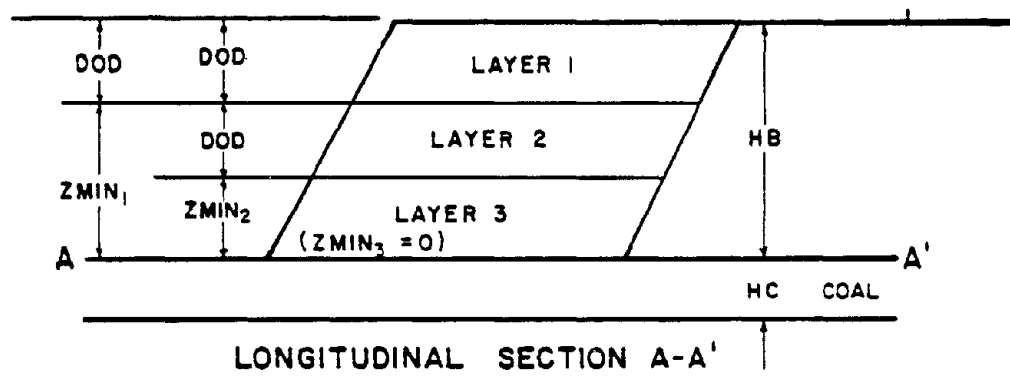
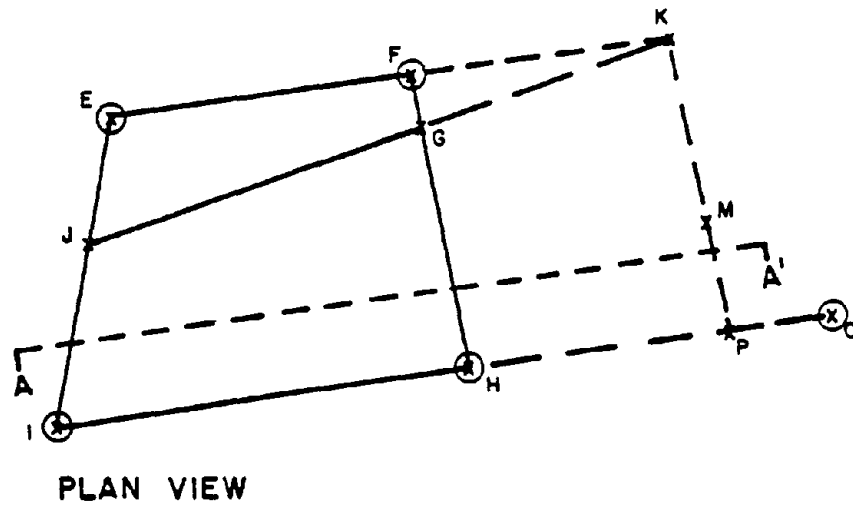


Figure 6.4
Digout Option 2

6.4.2 OPTION 2 - LAYER DIGGING WITHOUT KEY/BAIL MOVEMENT

Figure 6.4 applies to this option. As in Option 1, the dragline positions are K and M (L and N, the spoiling positions, are not shown to reduce clutter). This option calls for layer digging so the number of layers will be calculated as explained before. For each layer, the model makes the full set of tests described under Option 1. It tests option controls and executes sequences in the order chop, keycut, bail, and chop. If chopping is specified, the model uses LCPL to chop from the proper layer. Thus, the model makes a partial keycut, then a partial bail, then the next level of keycut, the next level of bail, etc.

This option was designed for testing the effects of a full keycut on cycle time. When the full keycut is made in deep overburden, the cycle times may be increased because the operator must delay the swing until the bucket clears the keyway. With layer digging, there will not be a deep keyway, and cycle time may be improved.

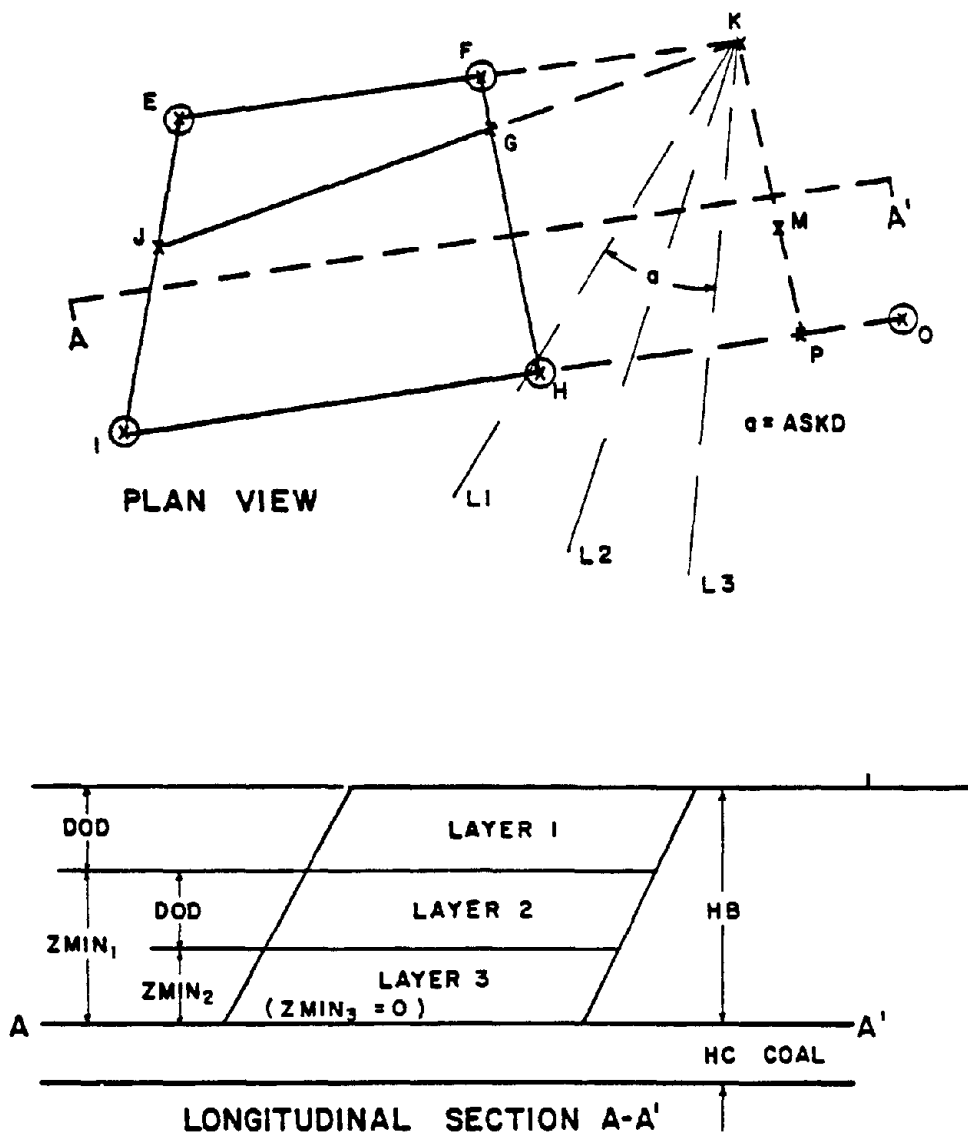


Figure 6.5
Digout Option 3

6.4.3 OPTION 3 - LAYER DIGGING WITH RADIAL CASTING

Figure 6.5 applies to this option. Layer digging is done as with Option 2, alternating between keycut and bail. However, the spoil angles are altered between each layer.

The diagram shows three spoil points, L1, L2 and L3, for the keycut spoils from each layer. A similar set of points applies to the bail spoils, but they are not shown in order to reduce clutter on this diagram. The option is explained by referring to the keycut, and the user should be able to extend the explanation to the bail.

The spoil position L3 is determined by the model on the basis of ASK (spoil angle) from the 'COAL LINE' data for this digout. The model then uses ASKD (delta spoil angle) from the 'RADIAL' card to determine L1; the angle included between L1 and L3 lines is ASKD. The increment for the spoil angle is calculated as:

$$INC = \frac{DELTA}{NLTC - 1}$$

Before each layer is dug, the model increases the spoil angle by INC so that on the final layer the spoil angle will be ASK.

This option was designed to test a spoiling procedure that should have a marked effect on overall production. The first layer of overburden is spoiled with a relatively small spoil angle. Each succeeding layer is cast with an increased angle, so that the spoil will be cast to the "back side" of the preceding spoils. If the dragline is swing critical, the smaller spoil angles will result in reduced cycle times with a corresponding increase in production.

The ridgeline spoil routine is normally used with radial casting.

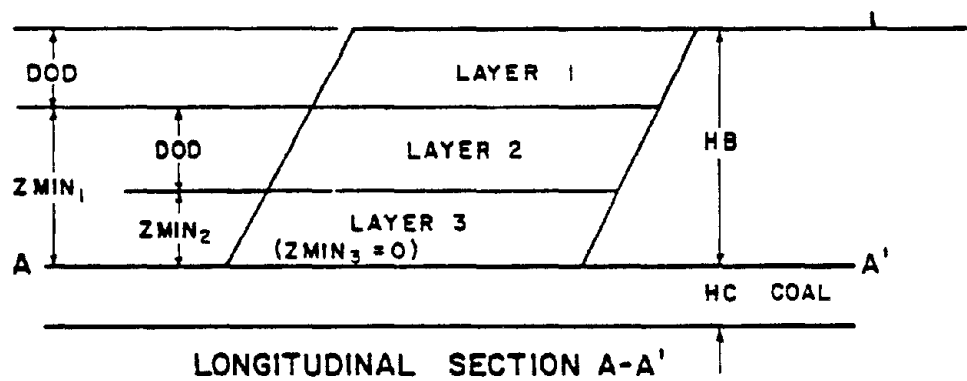
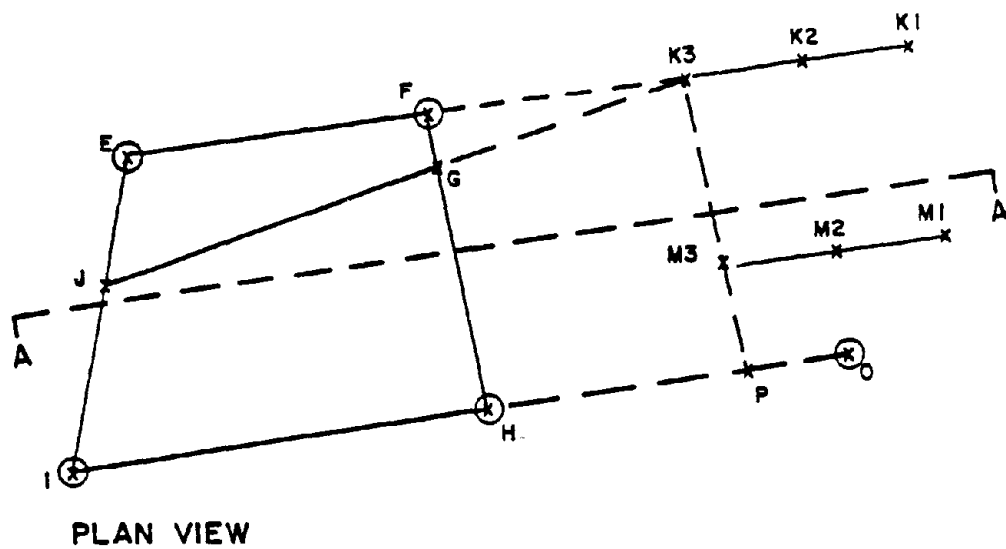


Figure 6.6
Digout Option 4

6.4.4 OPTION 4 - LAYER DIGGING AND WALKING

Figure 6.6 applies to this option. Digging is done by layers with the number of layers as defined before. However, for this option, the keycut is completed and then the bail is completed. This diagram shows three layers removed from three keycut positions, K1, K2, and K3, and three bail positions, M1, M2, and M3. The dragline walks forward towards the dragface after each position to excavate a deeper layer, e.g., K1 excavates layer 1, K2 excavates layer 2, etc. The six spoil positions are not shown, in order to reduce clutter. However, each spoil position is related to each digging position by using ASK and ASB (spoil angles for keycut and bail) from the 'COAL LINE' data for this digout.

The first layer of the keycut is dug from position K1, the second from K2, and the third from K3. Similarly, the first bail layer is from M1, the second from M2, and the third from M3. The distance the dragline moves between layers is specified by NSPL (No. of steps per layer) from the 'LAYER' card and DSM (feet/step or step length) from the 'DRAGLINE2' card. Note that K1, K2, and K3 lie on an extension of the highwall coal line, and M1, M2, and M3 lie on a line parallel to the highwall coal line.

This option is designed to simulate draglines that cannot form the complete dragface while positioned close to the dragface. It also tests the effect of the positioning of the dragline to dig in a layer fashion.

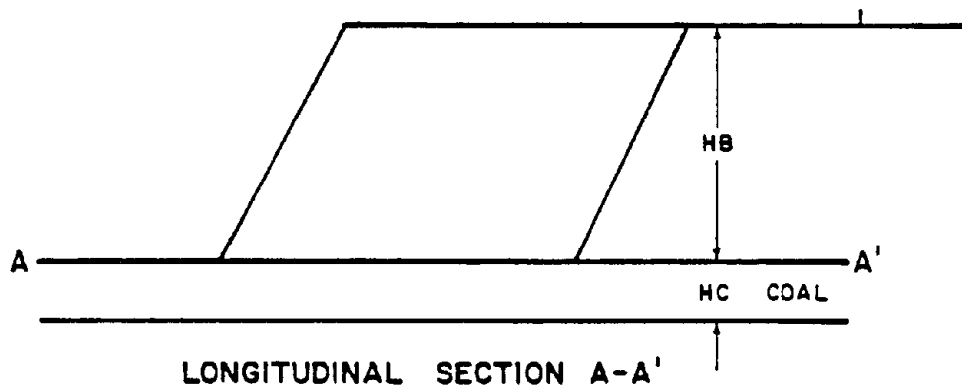
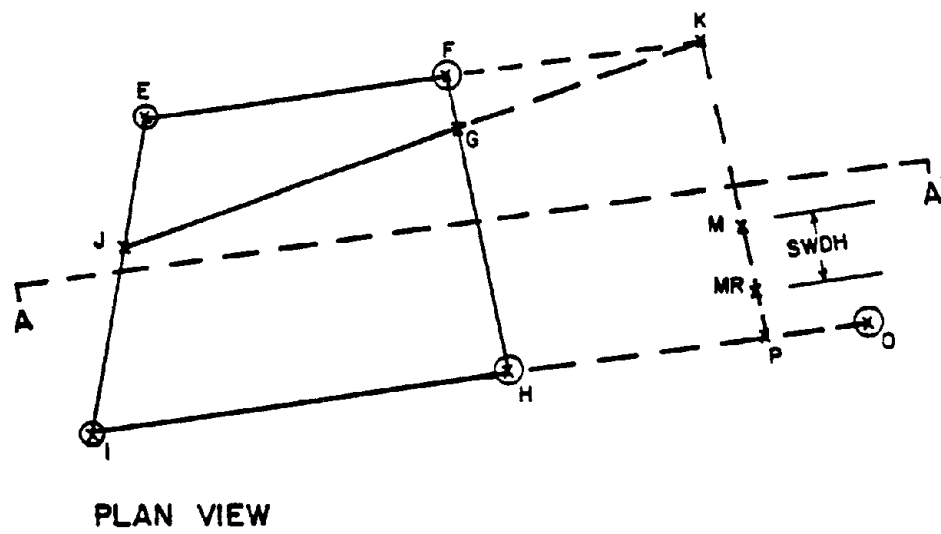


Figure 6.7
Digout Option 5

6.4.5 OPTION 5 - RERUN REHANDLE BAIL

Figure 6.7 applies to this option. The full keycut and bail are made from positions K and M as in the normal digging option No. 1. However, the model will check for need to rerun the rehandle bail routine. This check involves comparing the x,y coordinate limits of the dig shape with those of the spoil shape. When the two sets of points overlap, the model assumes that spoils are laid on the coal face and reruns the bail routine.

For the rerun, the model moves the dragline to MR. The M-MR distance equals the value of SWDH (safe working distance from highwall) from the 'PANEL' card. This movement of the bail position will result in a corresponding move of the spoil position. Thus, if rehandle spoils are dug on the rerun, they will be cast to the back of the preceding spoils.

This option is designed to simulate those operations where rehandle is needed to clear the coal face, but the bench is not extended. If the model has formed an extended bench, then the dragline could be moved onto the bench for the rerun, as in the following option.

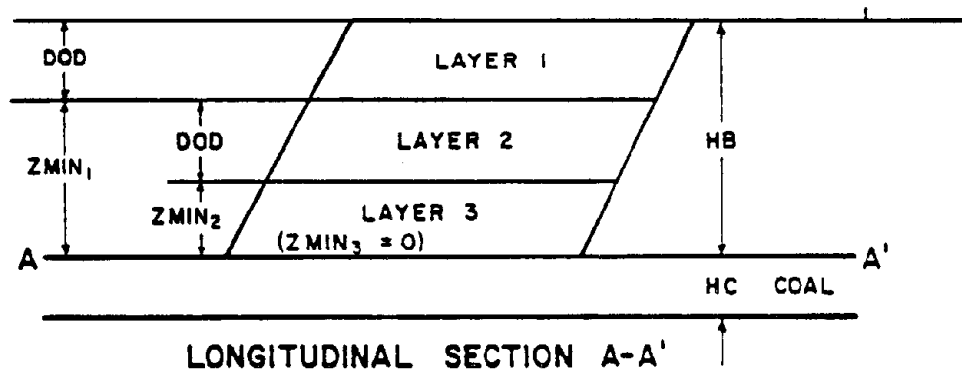
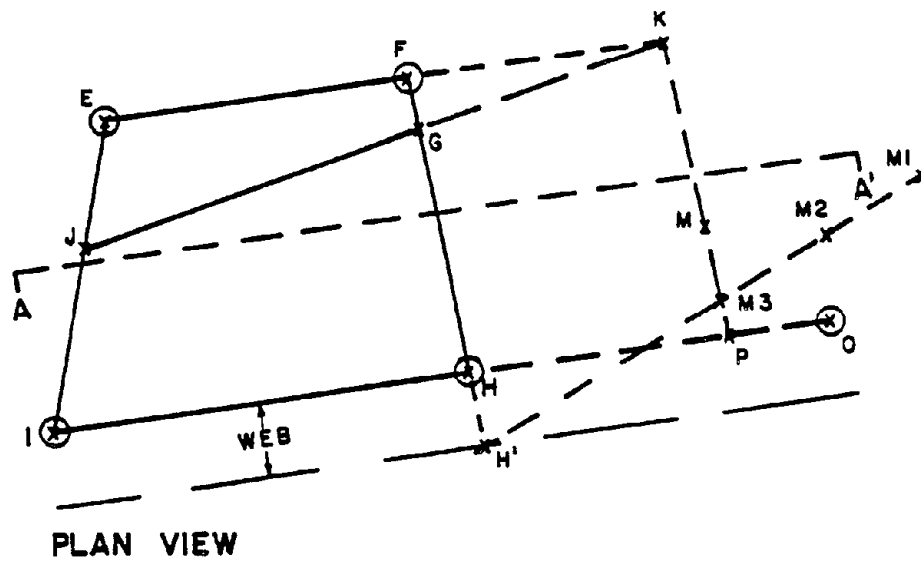


Figure 6.8
Digout Option 6

6.4.6 OPTION 6 - LAYER DIGGING WITH BAIL MOVEMENT

Figure 6.8 applies to this option. The model makes the normal keycut from position K. For the bail, it follows the layer digging sequence with the number of layers calculated as defined above. The plan view of Figure 6.8 shows three bail positions, M1, M2, and M3. While it also shows that the bench has been extended, extended-bench spoiling is not mandatory for this option.

The bail positions are determined as follows. First, the normal bail position, M, is determined. The point M3 is placed on the line from K to P, WEB (width of extended bench) feet from M. The line F-H is extended the same distance to define point H'. A line from H' through M3 is the locus for points M2 and M1. The distance between points M1, M2, and M3 is defined by NSPL from the 'LAYER' card, and by DSM (feet/step) from the 'DRAGLINE2' card.

The model uses the parameter WEB for this option and also for specifying the bench extension to be made by the extended-bench spoil routine. However, under Option 6 the model does not check to see if an extended bench was actually formed on the highwall of this digout. Thus, the user can set WEB to a value greater than zero for this option, without using the extended-bench spoil routine.

Exercise care in setting SWDH for Option 5 and WEB for Option 6. Before the spoiling routines are called, the model normalizes the position of the spoils to a grid intersection. It was determined in early test runs with the model that this normalization increases the accuracy of the spoils routines but does not significantly alter the operation being simulated. Now consider the case where spoils run back onto the coal and the model reruns the rehandle bail routine to clear the coal face. If the rerun spoils were cast to the same spoil location, the model would simply reform the original spoil banks and the spoils would run back onto the coal. In contrast, if the spoil position were changed so that the rehandle spoils were cast to the "back" side of the previous spoils, the previous spoils would act as a dam and prevent the runback. Thus, the user should set SWDH and/or WEB so that the rerun action will be effective.

7.1 KEYCUT, BAIL, AND BAIL WITH REHANDLE DIGGING

7.1.1 BASIC DIGGING GEOMETRY

Since the geometry and logic of these three digging routines are similar, the descriptions are combined in this section. The geometry of the fourth digging routine is different and is discussed in Section 7.2.

In this section the basic geometry and logic of the three digging routines are discussed first, followed by a discussion of the unique aspects of the rehandle routine. The figures in this section do not show the x and y axis system which the user sets up, because the geometry is independent of the user's system. That is, the user may label the vertical axis on the map as the x axis and the horizontal axis as the y axis or vice versa. The model will always re-orient the user's coordinates into an internal coordinate system that enables it to solve the geometry of the digging.

The user's panels need not be oriented in the manner shown in the figures in this manual. They may be mirror images of our diagrams or they may be rotated as required to impose the panels on the topography.

When the model is ready to make a digout, it retrieves certain x,y coordinates from the user's 'COAL LINE' data. It uses these coordinates plus a number of other parameters to define the basic geometry of the digout to be formed. The basic geometry is shown in Figure 7.1 which is a plan view of the digout superimposed on the surface of the coal seam. Points on this diagram are labeled with letters from E through P. Points E, F, H, I and O (indicated by an x enclosed in a circle) are taken from the 'COAL LINE' data; the remaining points (indicated by an x without a circle) are calculated. The solid lines on the figure are explicitly defined by the 'COAL LINE' data, and the dashed lines are construction lines.

First, one should recall from Chapter 5 how the 'COAL LINE' values are stored internally and retrieved for setting up this geometry.

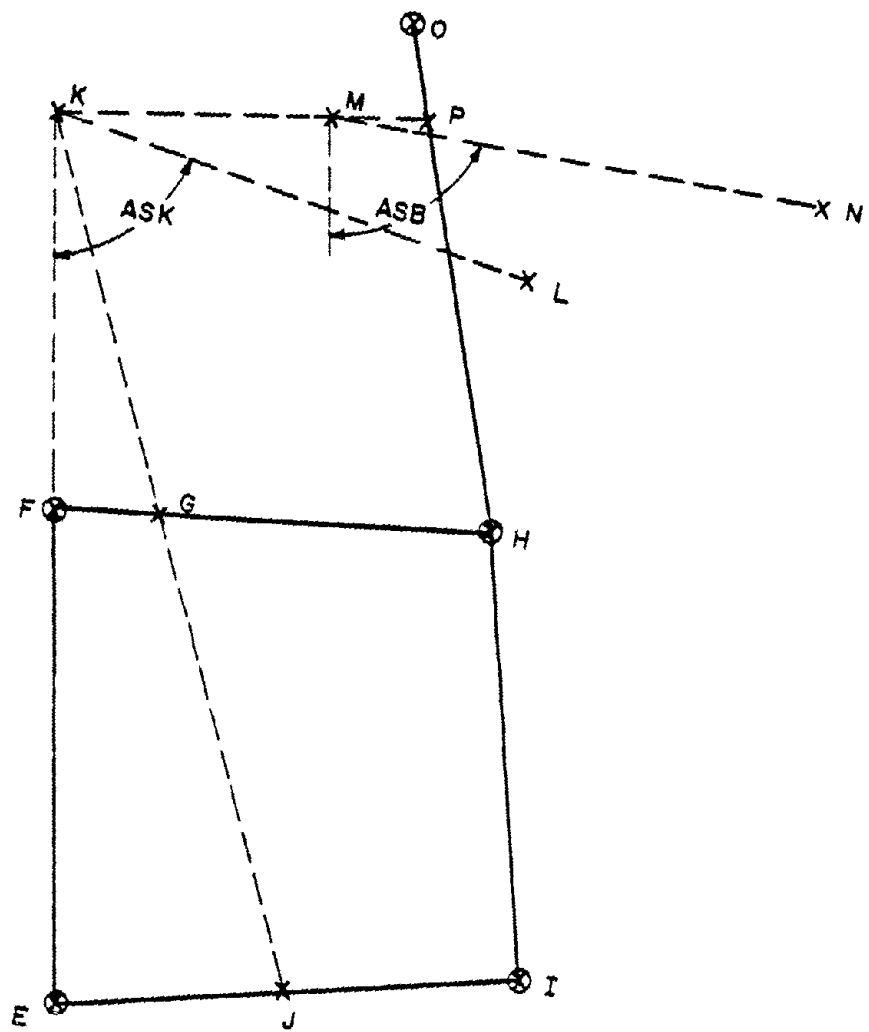


Figure 7.1
Geometry of a Digout

The data from two cards are used for each digout. When the digout number is 1, the data from the first card define points E and I on Figure 7.1, data from the second card define points F and H, and data from the third card define point O. When the model is ready for digout N (i.e., the last digout), the data from Card N define points E and I and that from the (N + 1) card defines points F and H. In this case, there is no (N + 2) record to define point O; the model extrapolates from points I and H to find point O.

The model now has coordinates for the five circled points and can draw the five solid lines on Figure 7.1. It then begins to develop the construction lines. First, the current highwall line EF is extended as the locus for point K. The distance from point F to point K is calculated as:

$$FK = (HB)(COTBC) + DSS$$

where:

HB - Height of bench from 'PANEL' card

COTBC - Horizontal/vertical ratio for the dragface, as specified by ABCD from 'ANGLES' card or by TANBC from 'TANGENTS' card

DSS - Distance from top of the dragface to the dragline center as specified by DSS from 'DRAGLINE2' card

The model next determines points G and J (points E, F, G, and J define the keycut). The distance from F to G is specified by PWK (panel width of keyway) from the 'PANEL' card. A line is then drawn from K through G until it intersects line EI, which defines J.

The model then determines point P. Point P is the point of intersection between line HO and a line from K parallel to line FH. Line KP is the locus of the dragline center for bailing. The distance from P to M is calculated as:

$$PM = (HB)(COTAB) + \frac{DSY}{2} + SWDH$$

where:

HB - Height of bench from 'PANEL' card

COTAB - Horizontal/vertical ratio specified for the highwall, i.e., as specified by angle AABD from 'ANGLES' card or TANAB from 'TANGENTS' card

DSY - Dragline base diameter from 'DRAGLINE2' card

SWDH - Safe working distance from highwall from
'PANEL' card

The next step is determining points L and N from K and M, respectively. The distances KL and MN are specified by DSH (dumping radius) from the 'DRAGLINE1' card. The angles ASK (angle to spoil, keycut) and ASB (angle to spoil, bail) are taken from the "COAL LINE" data. When the model is working on digout N, the angles are taken from record N.

The line KL is drawn so that the angle enclosed by LKF is the angle ASK. The line MN is drawn so that the angle between line MN and a line parallel to KF is the angle ASB.

The points K, L, M, and N as calculated apply to the basic digout option (i.e., LOD = 1 on "DIGOUT" card). These positions may be adjusted to account for other digout options, as described in Chapter 6. However, the dragline positions do not alter the basic geometry of the digout shape.

The coordinates developed for this geometry are printed on the Detail Page when LOGDLS = 1 on the 'DIGOUT' card. If several digging/spoiling actions are printed, the coordinates will appear only on the first page. An example of that detail is reproduced below.

E	F	G	H	I	J	K	L	M	N	O	P
300.	400.	400.	400.	300.	300.	502.	414.	502.	502.	500.	502.
200.	200.	220.	300.	300.	240.	200.	442.	230.	488.	300.	300.
EF	FH	HI	IE	KG	KL	MN	HO				
0.	90.	180.	270.	169.	110.	90.	0.				

Direction of Rotation is -1

The first line prints the letter identifiers, the second line prints the x coordinates, and the third line prints the y coordinates. The fourth line prints the two-letter identifiers of the lines, and the fifth line prints the angles which these lines make in a clockwise direction from the internal north.

Thus, the coordinates of point E are 300,200 and 400,200 for point F. Line EF is zero degrees from north.

The direction of rotation is +1 for clockwise spoiling or -1 for counterclockwise spoiling.

When any of the digging routines are used, the model attempts to impose the basic geometric shape onto the existing surface. The logic is designed so that each shape can be imposed on the surface whether or not the surface has been modified by

a previous digging action. As shown on Figure 7.1, the bottom of the keyway is defined by points E, F, G, and J and the bottom of the bail is defined by points E, F, H and I. That is, the bail shape includes the keyway shape. Therefore, if the keycut has not been made, the bail cut will correctly form the digout. However, the logic is designed so that no double accounting will take place if the keyway has already been formed. Consider the boxcut panel. When the keyway is formed, the four lines on Figure 7.1 define the intersections between the walls of the keyway and the top of the coal seam, as follows:

- Line EF - Bottom of current highwall
- Line FG - Bottom of current dragface
- Line GJ - Bottom of face opposite to the highwall
- Line JE - Bottom of face opposite to the dragface

When the bail shape is being formed, four lines define the four intersections as follows:

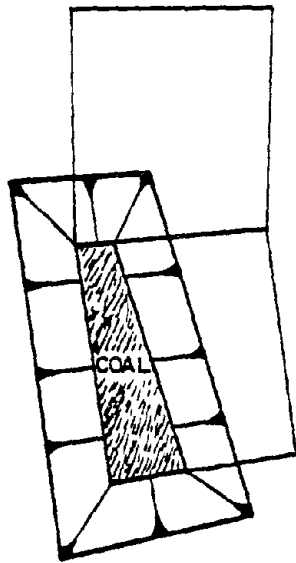
- Line EF - Bottom of current highwall
- Line FH - Bottom of current dragface
- Line HI - Bottom of face opposite the highwall
- Line IE - Bottom of face opposite the dragface

The user has specified angles for each of these faces on the 'ANGLES' card or angles on the 'TANGENTS' card, as follows:

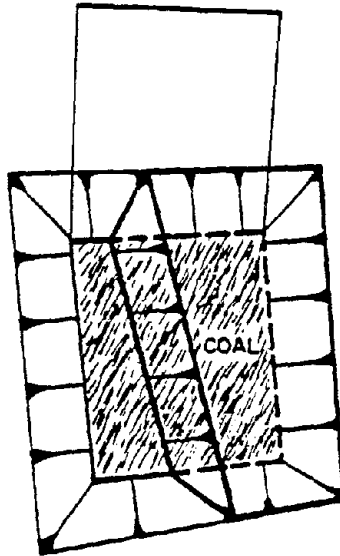
<u>Keyway Line</u>	<u>Bail Line</u>	<u>Angle</u>	<u>Tangent</u>
EF	EF	AABF	TANAB
FG	FH	ABCF	TANBC
GJ	HI	ACDF	TANCD
JE	IE	ADAF	TANDA

Now consider the four diagrams on Figure 7.2 which depict the first two digouts of a boxcut panel in which a keycut does precede the bail. Diagram A shows the pit shape after the first keycut, diagram B after the first bail, diagram C after the second keycut, and diagram D after the second bail.

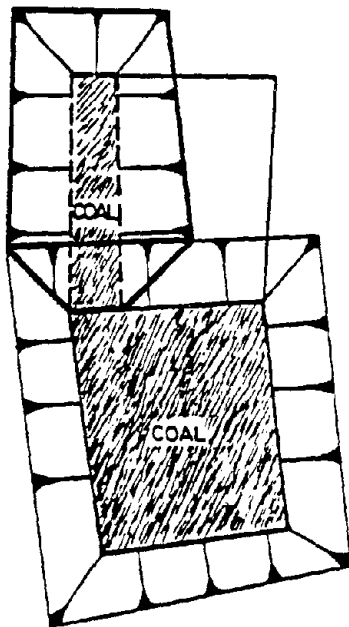
Diagram A shows that the first keycut did, in fact, form four faces. The first bail formed the face opposite the highwall, finished forming the dragface and its opposing face, and eliminated the face that had been one side of the keyway.



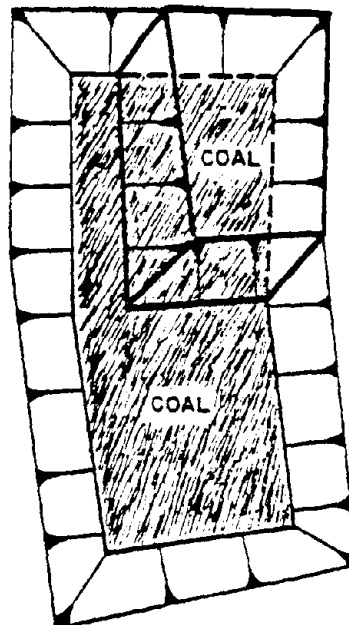
A. 1st KEYCUT



B. 1st BAIL



C. 2nd KEYCUT



D. 2nd BAIL

Figure 7.2
Engineer's Drawings - Boxcut Panel

When the second digout was made, the keycut formed three faces and removed the old dragface. The second bail removed the old dragface and the face opposing the highwall, and finished forming the new dragface and the face opposing the highwall.

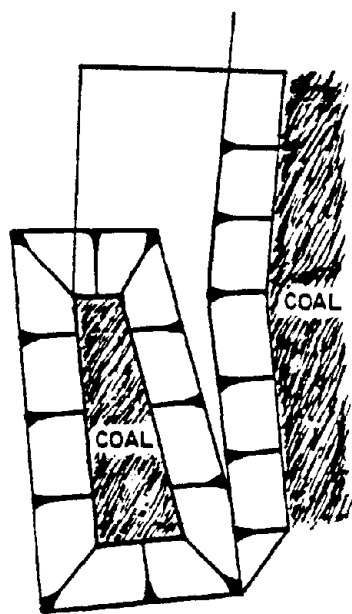
The shapes shown in Diagrams C and D can be considered "steady-state" shapes; i.e., they continue to apply to all digouts for the remainder of the boxcut panel.

Figure 7.3 shows four diagrams that apply to the production panel. The analysis made above for Figure 7.2 also applies to Figure 7.3.

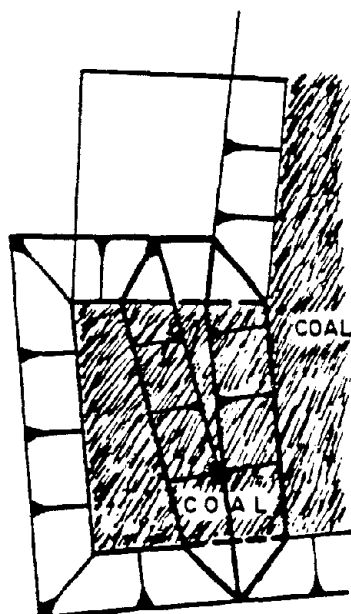
Figure 7.4 shows four isometric projections of a mining area after being modified by the DLS model. The four projections in this figure correspond to the four diagrams in Figure 7.2. Figure 7.5 shows four isometric projections corresponding to the four diagrams on Figure 7.3.

It should be evident from these figures that the bail routine could have been used without the preceding keycut, and the shapes shown in Diagrams B and D would still apply.

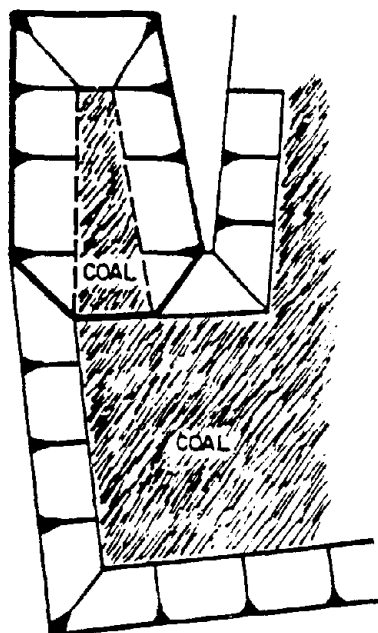
It is now possible to explain the logic of the digging actions. The model begins by setting up the basic geometry as shown in Figure 7.1. Then it uses the values of the user-set face angles to determine the geometry for each face to be formed above the coal seam. The shapes shown in Diagram A or B of Figure 7.2 are used for keycut and bail for ALL digouts. The value of HB (height of bench) from the 'PANEL' card and the cotangents of the face angles (from 'ANGLE' or 'TANGENTS' cards) are used to calculate the horizontal extensions of each face. These extensions are added to the four lines of the figure to obtain the four corners at the top of the shape.



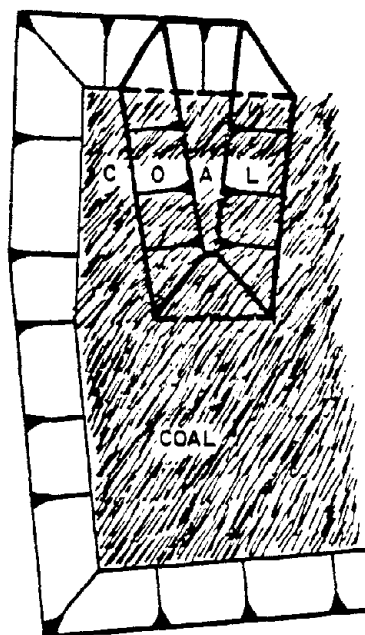
A. 1st KEYCUT



B. 1st BAIL

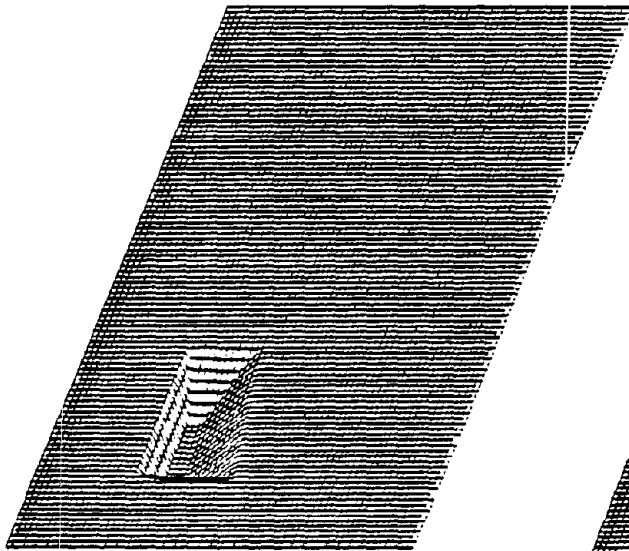


C. 2nd KEYCUT

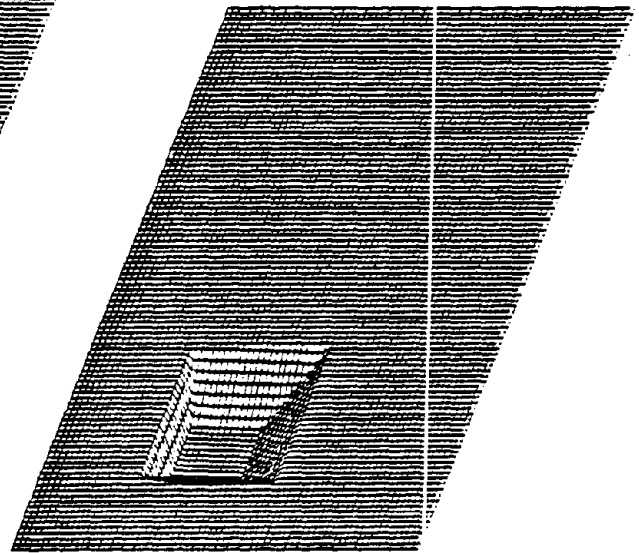


D. 2nd BAIL

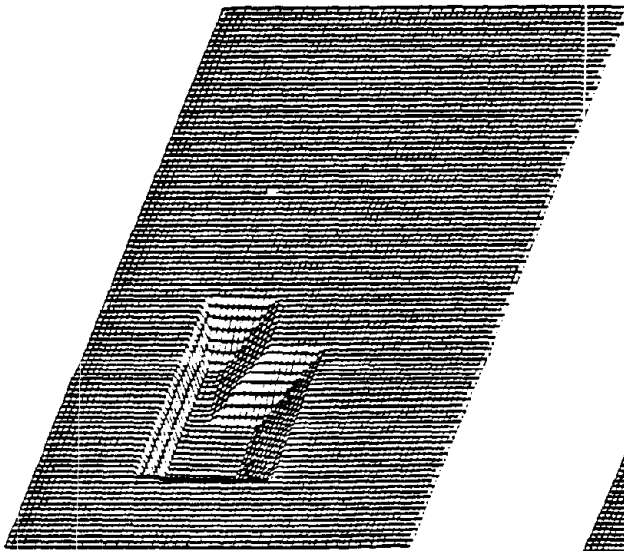
Figure 7.3
Engineer's Drawings - Production Panel



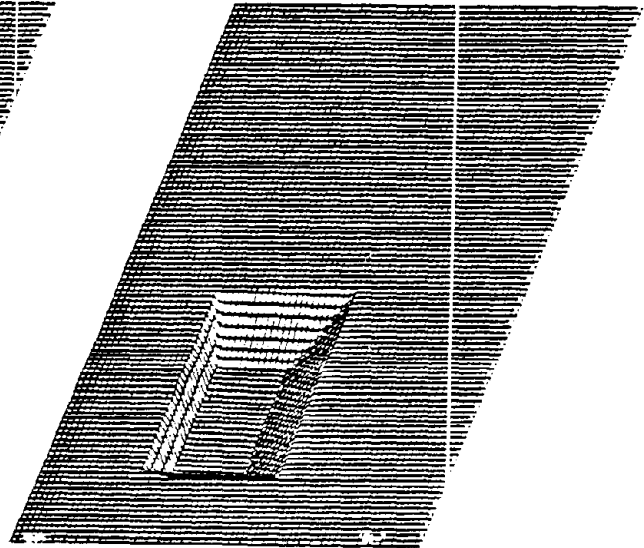
A. 1st Keycut



B. 1st Bail

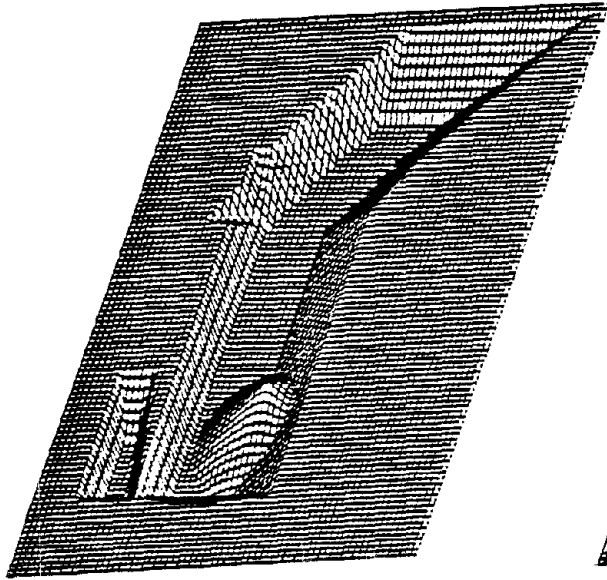


C. 2nd Keycut

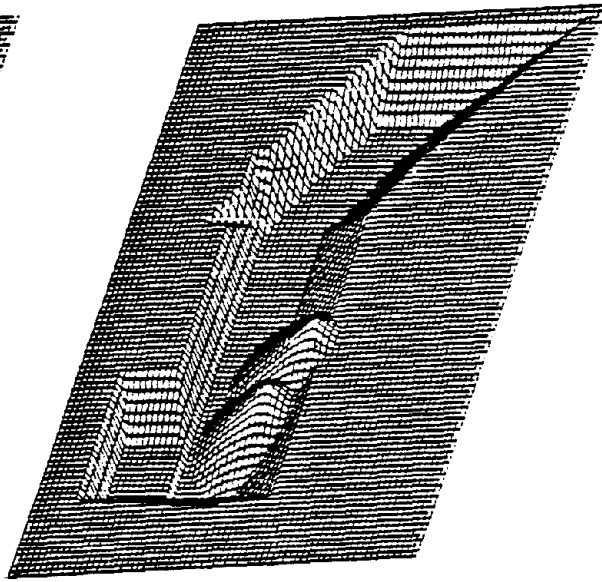


D. 2nd Bail

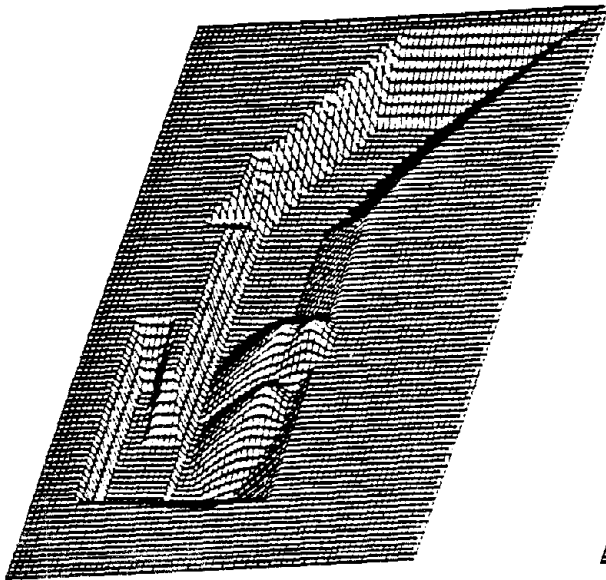
Figure 7.4
Isometric Projections - Boxcut Panel



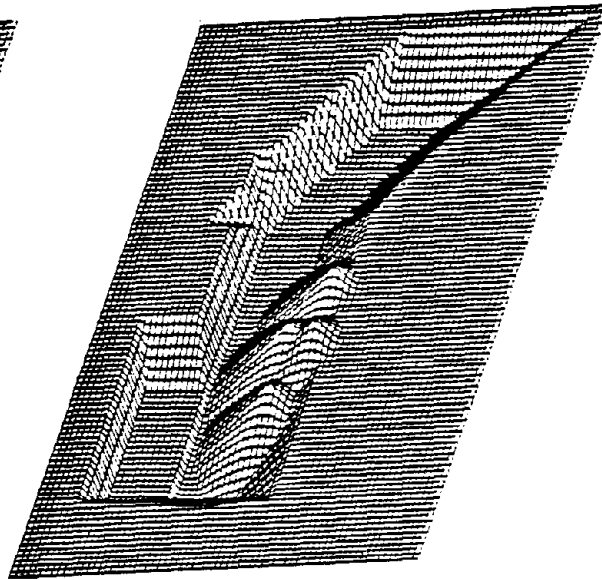
A. 1st Keycut



B. 1st Bail



C. 2nd Keycut



D. 2nd Bail

Figure 7.5
Isometric Projections - Production Panel

Since HB is only an approximation of the overburden depths, the model actually extends the four faces a distance equal to four grid lines in each direction. This ensures that the model search area will cover the entire area that might be altered by the digging. The search area is defined as starting with the lowest x coordinate through the highest x coordinate, and from the lowest y coordinate to the highest y coordinate.

At each x,y point within the search area, the model calculates a theoretical elevation for that point assuming the shape is being imposed on the surface of the coal seam. The model then compares the theoretical elevation to the actual elevation at that point. If the theoretical elevation is equal to or greater than the actual, then the actual surface is below the shape being imposed, and no digging takes place. However, when the theoretical elevation is less than the actual, the model replaces the surface elevation with the theoretical elevation. The difference between the two elevations is the amount of material (in ft) removed at that point. The model sums all delta elevations to obtain the total amount of material removed in forming this shape.

Based on the grid size and the swell factor for overburden, the summation is converted to bank and swelled yd³ as follows:

$$VSBY = (SUM) (XS) (YS) / 27$$

$$VS = VSBY (1 + SM)$$

where:

VSBY - Volume of spoils in bank cubic yards

VS - Volume of spoils in loose cubic yards

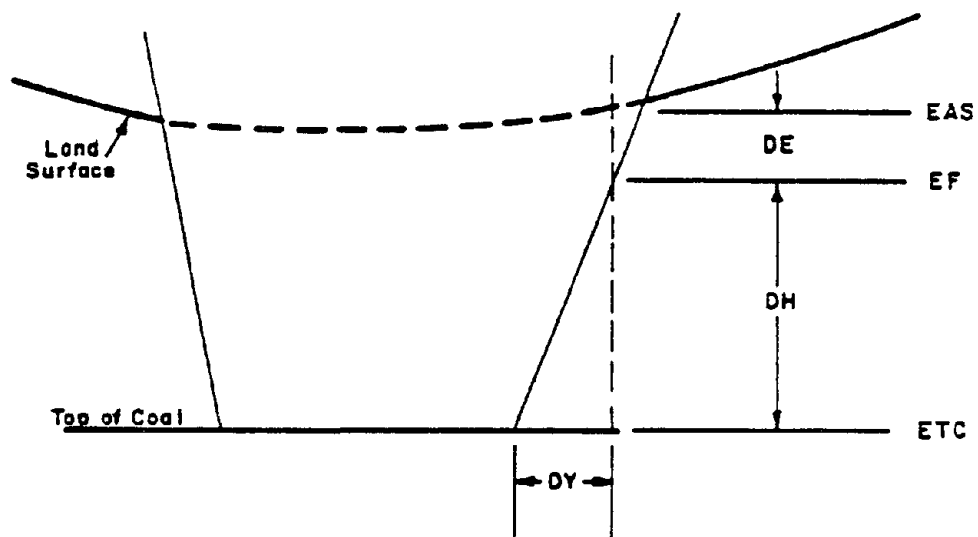
SUM - Summation of delta elevations

XS - X grid size in ft

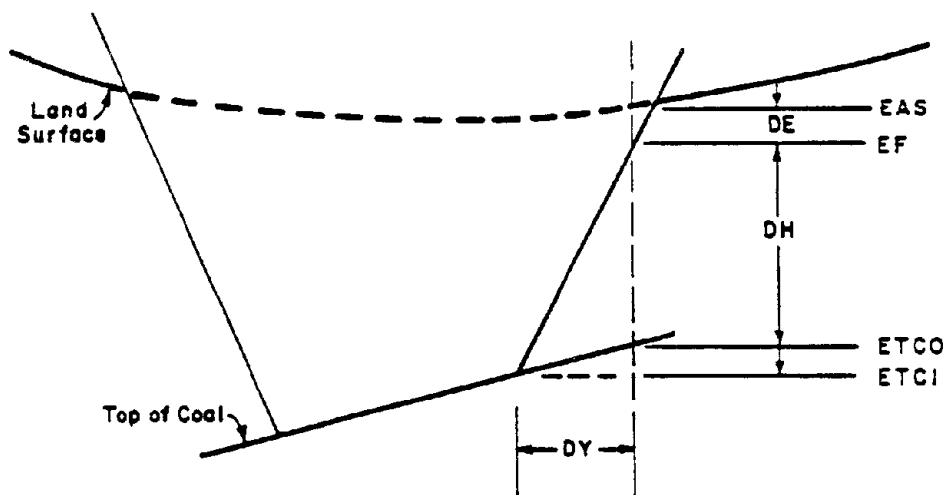
YS - Y grid size in ft

SM - Swell factor for overburden

(XS, YS, and SM were specified when the surface was defined.)



A. LEVEL COAL SEAM



B. VARIABLE DIPPING COAL SEAM

Figure 7.6
Digout Section Diagrams

7.1.2 DETERMINING ELEVATIONS

The calculations involved in determining elevations for the digging actions can now be explained using Figure 7.6. This figure shows two cross sections of a digout: Diagram A applies to a level coal seam and Diagram B to a variable dipping coal seam.

The single vertical line shown in these sections denotes the x,y grid point that is being evaluated. The first model step is to determine the orientation of the grid point relative to the shape being formed. The point may intersect one of the four possible faces or lie within the bottom of the pit. The line intersects the face on the right side of the diagrams. For discussion, assume this is the dragface. The slope of the face is defined by the angle ABCD or tangent TANBC. The model determines the straight-line distance between the grid point and the line representing the bottom of the dragface. This distance is shown on the diagrams as DY. The height of the triangle, DH, is calculated as:

$$DH = (DY) (\text{TANCB})$$

Referring to Diagram A, the elevations for this grid point at the top of coal (ETC) and land surface (EAS) are shown. The elevation of the face is:

$$EF = ETC + DH$$

The value of EF can now be compared with the value EAS to determine if material is removed or not from this point. In the illustration, EF is below EAS and the amount of material removed from the surface is shown as DE.

For the variable coal seam shown in Diagram B, the calculation may be more complex and is controlled by the parameter KREF (reference control) from the 'REFERENCE' card. Two elevations are shown for the top of coal: ETCO is the elevation at the grid point under consideration, and ETC1 is the elevation at the bottom of the face being formed. When KREF = 0, the model calculates EF as though the coal seam were level, i.e., as though ETCO = ETC1. However, when KREF = 1, the model first calculates the coordinates of the grid point nearest the bottom of the face. It then looks up that grid point in the surface array to find ETC1, which is then used to calculate EF.

A margin of error will be introduced when ETCO is used rather than ETC1. However, the magnitude of the error may be small, particularly when the seam is nearly level. The user may wish to experiment with the KREF control to see its effect on related problems.

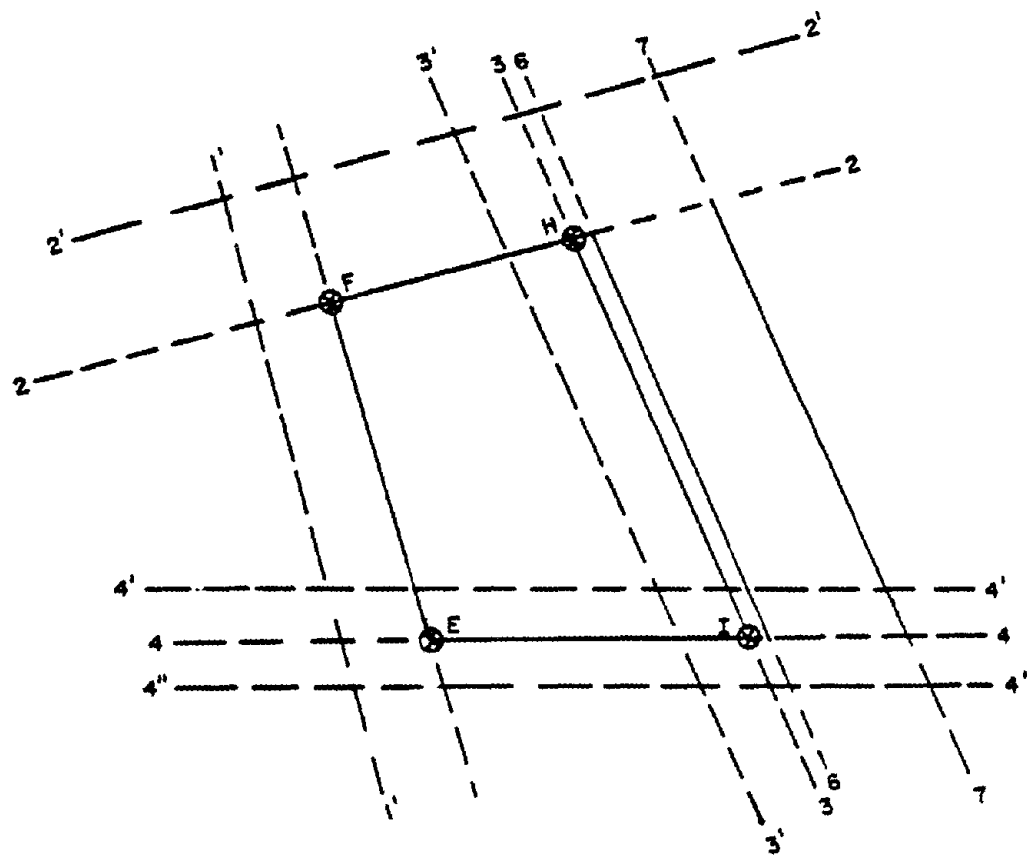


Figure 7.7
Rehandle Bail Geometry

When material is removed from a grid point, the model adds the value of DE to its SUM counter (used as explained earlier), sets the value of EAS to the calculated value of EF, and stores the new value in the surface array. As each point within the search area is then processed, the model adjusts the surface array elevation data to reflect the digging action.

The diagram illustrates that when the grid line is moved toward the right, the value of EF will continue to increase until it exceeds EAS and the digging action effectively stops. If the point is moved toward the left, the value of EF will continually decrease until it reaches the value of ETC. In this case, the new value for EAS is ETC and $DE = EAS - ETC$. As the grid continues to move to the left, it will form the left-hand face.

The user should be able to see that if a coordinate system were placed on these diagrams, the vertical axis would be the z axis. The horizontal axis could be either x or y. Thus, these figures apply equally as cross sections or as longitudinal sections.

7.1.3 REHANDLE GEOMETRY

The complex geometry of the rehandle routine is shown in Figure 7.7 and in the cross sections shown in Figure 7.8. These sections show that an extended bench has been formed and must be rehandled. The lined area, when removed, will be considered by the model as consolidated overburden. The cross-hatched area will be considered as swelled (or spoiled) material that is being rehandled.

In the plan view on Figure 7.7, each of the four user-defined points of the digout is indicated by a circled x and labelled E, F, H, or I. These four points are connected with solid lines denoting the bottoms of the four faces of the digout; these lines have been extended and labeled 1, 2, 3, and 4. Associated with each of these lines is a dashed line labeled 1', 2', 3', 4', or 4". These lines represent the tops of the faces. The four faces can be identified as:

<u>Line</u>	<u>Face</u>
1	Highwall being formed on this digout
2	Dragface being formed on this digout
3	Highwall formed on preceding panel
4	Either the opening cut face (4") or the dragface formed on preceding digout (4')

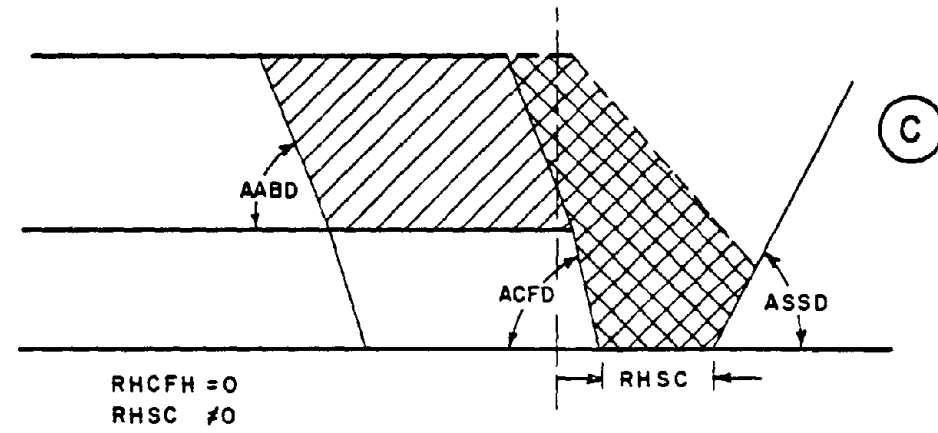
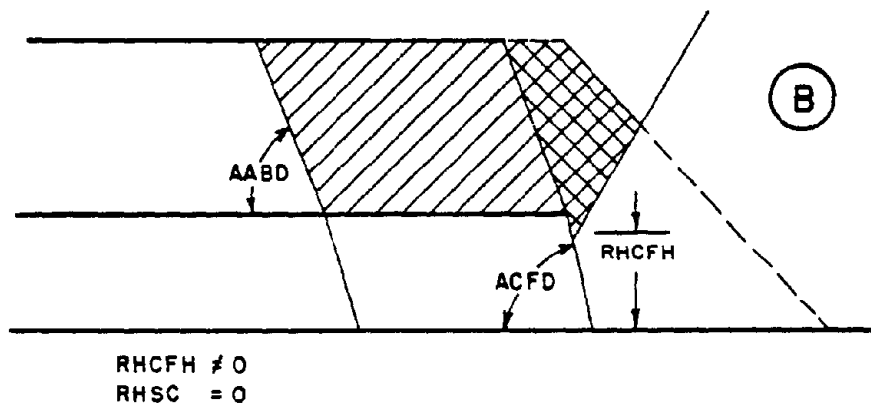
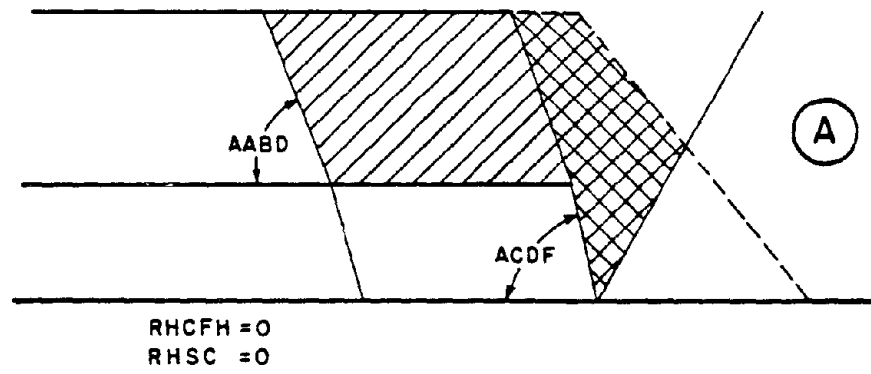


Figure 7.8
Rehandle Section Diagrams

Two additional lines are shown:

Line 6 - Bottom of coal face

Line 7 - Bottom of spoil face after steepening

The cross sections in Figure 7.8 show how the user-set parameters RHCFH (coal fender height) and RHSC (spoil clearance) from the 'REHANDLE' card alter the logic along the highwall. In Diagram A, both are set to zero, and the model lets the spoils just reach the coal face. In Diagram B, a coal fender has been specified with no spoil clearance and spoils will be left against the coal face. In Diagram C, spoil clearance without fender has been specified and the model will clear the coal face. If both parameters are non-zero, the result is intermediate between Diagrams B and C.

The calculations and logic for determining theoretical elevations and amounts of material removed from the surface are as described in preceding paragraphs. The distinction in this routine is in the manner of accounting for the material removed. Consider the single dashed line on the section in Figure 7.8. It represents a grid x,y point under evaluation. The model will remove material from the top of the bench to the top of the coal face. The material above the highwall is rehandled material and that below the highwall is consolidated material.

7.2 CHOP ROUTINE

The chop routine is designed to simulate the formation of forward and side benches. The chopping will be done from either the keycut or bail position as the user specifies by the chop controls. The user can set chop limits so that the chop action will form the forward bench, form the side bench, or form both benches. The parameters specified on the 'CHOP' card are summarized in Table 4.6.

When the chop sequence is executed on a given digout, (e.g. digout N), the dragline is presumed to be sitting over digout N + 1. The chop limits will be defined by the actual dragline position and by the 'COAL LINE' data for digout N + 1. The elevation to which the dragline chops is defined by HB (height of bench) from the 'PANEL' card, and by the elevation at ETC (top of coal) at the center of digout N + 1.

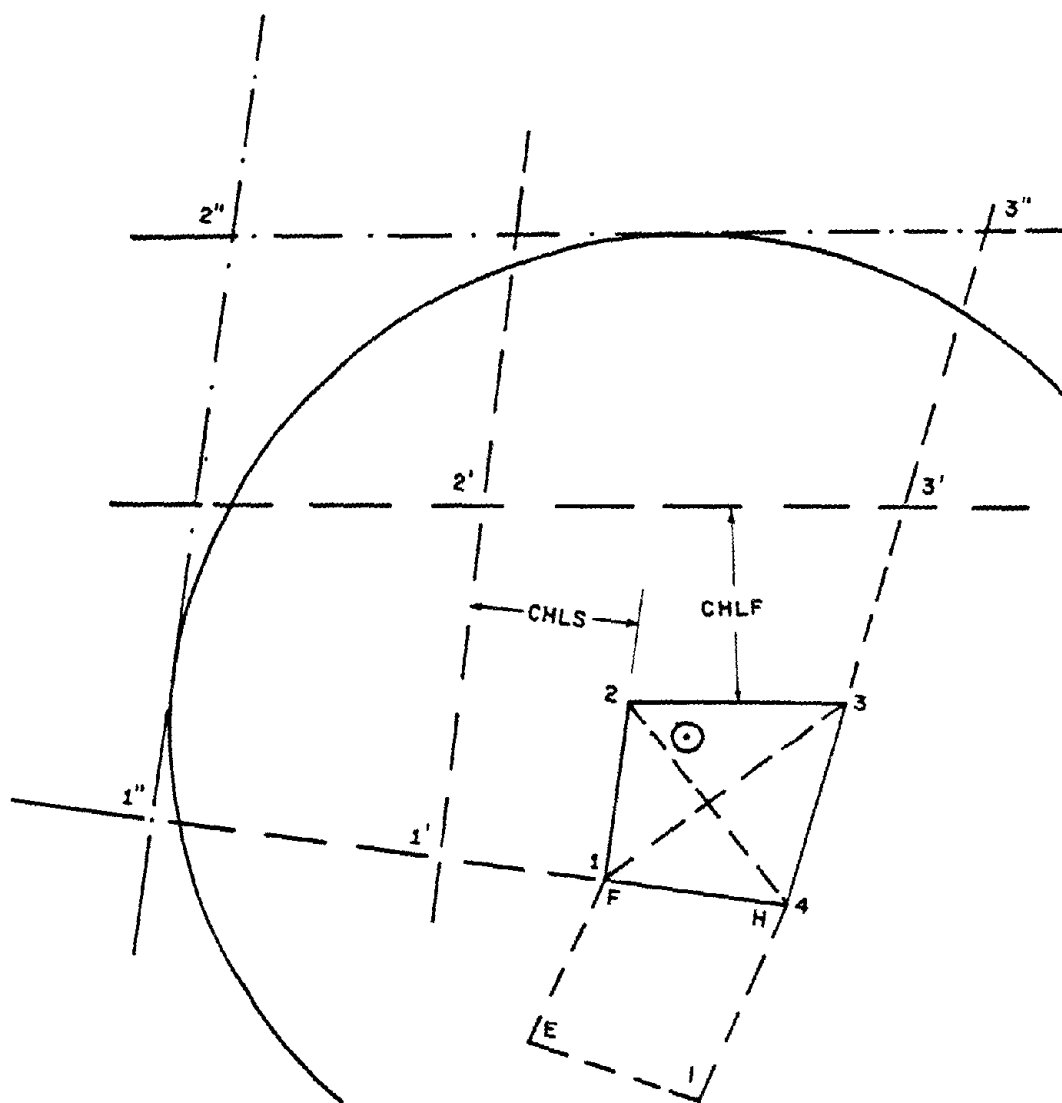


Figure 7.9
Chop Geometry

Since the model requires 'COAL LINE' data for the next digout when chopping, the model will not execute the chop sequence for the last digout in a panel. If the user wishes to chop ahead of the last digout, then he must define a "dummy" digout at the end of the panel. Chapter 6 explains how the model executes its digging/spoiling sequences and how a dummy digout is used.

The Figures 7.9 and 7.10 are plan views of the portion of the dragline pit affected by chopping. Figure 7.10 shows an engineer's drawing of chopping from the keycut position whereas Figure 7.9 shows the model construction lines and geometry. The dashed lines on 7.9 represent the current digout with points labeled E, F, H, and I. The solid lines with points labeled 1, 2, 3, and 4 represent the digout on which the dragline is presumed to be sitting. The dragline position is shown as a dot inside of a circle. It is placed at random on this figure since the actual position is controlled by the parameters. The dragline may or may not be inside of the figure bounded by points 1, 2, 3, and 4, depending upon the model parameters. Even though the placement of the dragline affects the area chopped, it can be considered an independent variable.

This figure has been rotated so that the line 1-2 is parallel to the x axis. This is done by the model so that it knows the panel orientation. The rotation need not concern the user except in-so-far as it is necessary to explain the chopping geometry and logic. After making this rotation, any panel will be oriented either as shown in this figure or as the mirror image of this figure.

The dragline dumping radius, set by parameter DSH from the 'DRAGLINE1' card, is represented by a circle in Figure 7.9.

The way to set the chop limits can be explained from this figure. For the side limit, a line 1'-2' is shown as being CHLS (side chop limit) feet from line 1-2. If the value of CHLS is large and the line would lie outside of the boom-point circle, the model defines the side chop limits as shown by line 1"-2". Similarly the forward chop limit is shown by line 2'-3' which is CHLF (forward chop limit) feet from line 2-3. If this line lies outside of the boom-point circle, the line is redefined to be tangential to the circle as shown by line 2"-3". Since the two lines are defined independently, the user can set these limits to effectively form the forward bench, the side bench, or both.

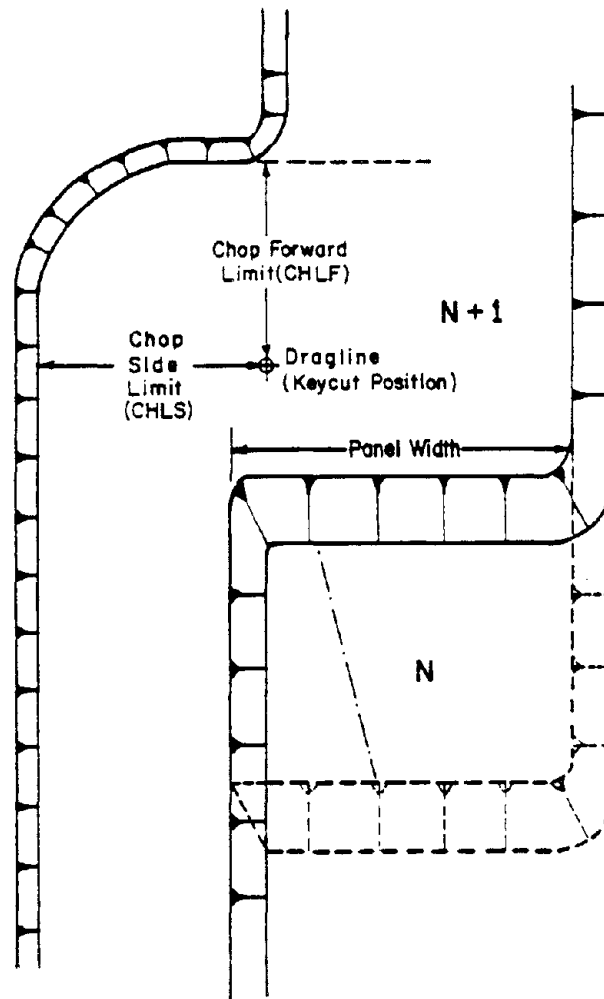


Figure 7.10
Plan View of Chop

The limits of chop on the spoiling side are determined by extending the bottom of the previous highwall. That is, the line 4-3 is extended to point 3' or 3" as appropriate. The limits to chopping on the dragface side are determined by extending the bottom of the dragface. That is, line 4-1 is extended to 1' or 1".

The model searches the surface array to consider all points within the four-sided figure 1-2-3-4, where 1, 2, and 3 will be the single or double-prime points as appropriate.

Before starting the search, the model determines the value of ZMIN (minimum elevation for chopping). The model finds the center of the digout, as defined by lines 1, 2, 3, and 4. At this point the elevation for ETC (top of coal) is retrieved and the value of ZMIN is:

$$ZMIN = ETC + HB$$

where:

HB is bench height as specified on the 'PANEL' card.

For every grid point within the search area, the model first determines the position of the point on the figure. If the point lies outside of either the chop limit lines or the boom point, no chopping takes place. If the point is within the chop limits, the model determines TE (theoretical elevation) that cannot be less than ZMIN. The theoretical elevation is compared with EAS (actual surface elevation) at this grid point. If TE is equal to or greater than EAS, no action is taken. When TE is less than EAS, the model replaces EAS with TE, and DE (difference in elevations) is added to the SUM counter. When all grid points within the search area have been tested, the value of SUM (total feet of material removed) is converted to YARDS:

$$YARDS = \frac{(SUM) (XS) (YS)}{27}$$

where:

XS and YS are grid step sizes defined for this surface.

The way to determine TE depends on the value of LCC (the option control). When LCC is 1 or 2, the model will extend a line from the dragline center through the x,y point being tested to the intersection with the circle inscribed by the boom point. EABP (elevation of the surface at the boom point) is retrieved from the surface array. The model then determines DIST (distance) between the x,y under consideration and the end of the boom. The theoretical elevation is:

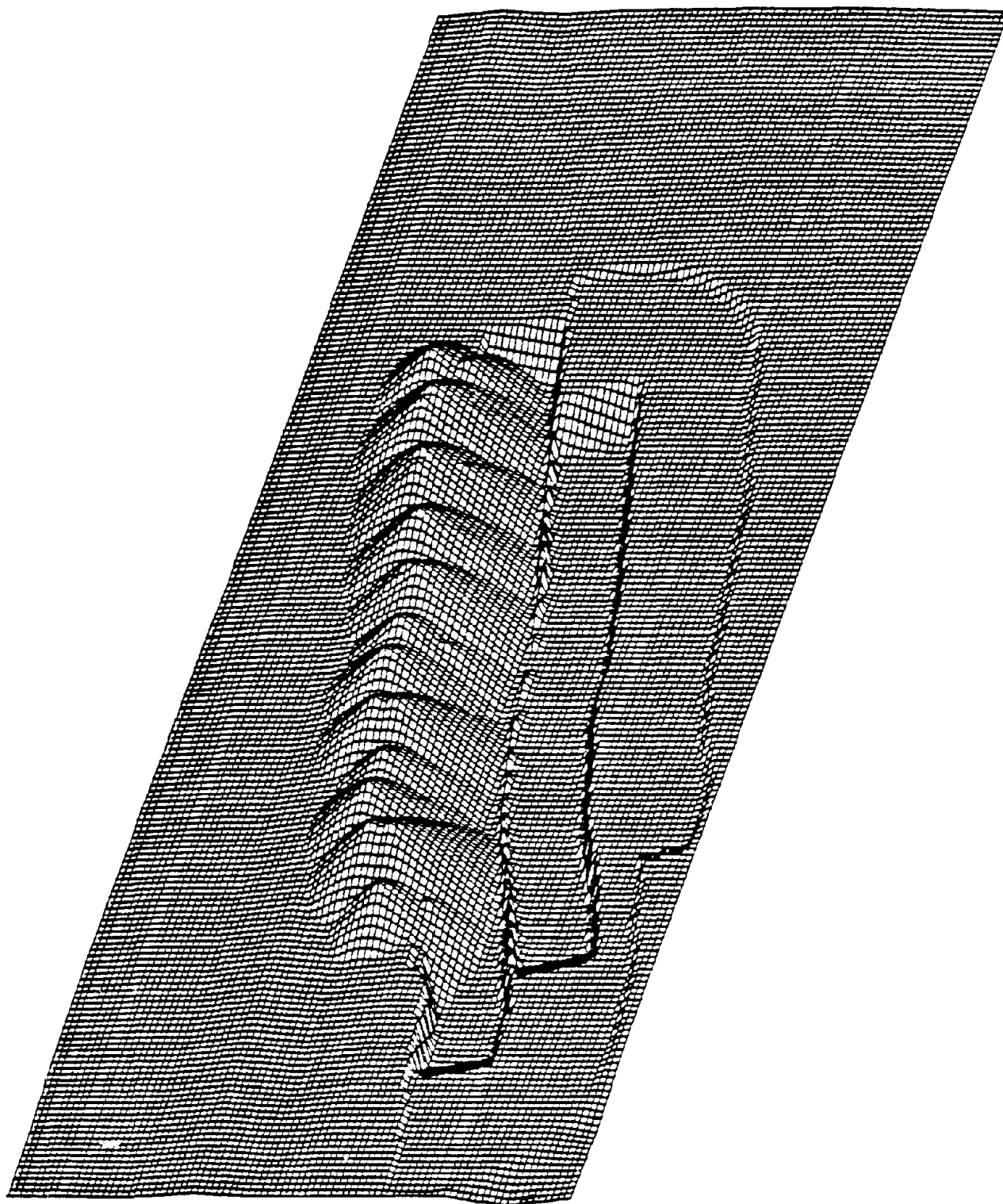


Figure 7.11
Isometric Projection of Chop Option 2

$$TE = EABP - ((DIST) (TANCH))$$

where:

TANCH is the tangent of the chop face from the 'TANGENTS' or 'ANGLES' card. TE cannot be less than ZMIN.

In contrast, when LCC is set to 11 or 12, any point within the chop limits will be chopped to ZMIN.

The chop face may be more correctly formed when the model calculates TE on the basis of distance from the boom point. However, when the amount of chopping is small or the grid is relatively large, the second method is accurate. Suppose the model is chopping 10 ft of overburden, and the chop face angle is set to 45°. The horizontal distance under the chop face would be 10 ft. If the surface grid size was 20 ft, the horizontal extension of 10 ft would not be detected by the model. However, if the grid size was 10 ft and the average chop depth was 20 ft or more, the horizontal projection could be detected. Thus, when deep chopping and a fine grid are involved, the user may want to set chop options to 1 or 2, rather than 11 or 12. Also, when the model simulates chopping many digouts, the computer execution time will be greatly increased with chop options 1 or 2. The user may wish to experiment to determine which option to use.

Figures 7.11 and 7.12 are isometric projections illustrating the different chop faces that result from chop options 2 and 12. The chop face in Figure 7.12 is steeper (1 grid step wide) than that in Figure 7.11.

7.3 DETAIL PRINTOUT FROM DIGGING ROUTINES

When LOGDLS = 1 in the 'DIGOUT' cards, each digging routine prints some details about the digging action. To illustrate and explain these details, we have abstracted the pertinent lines from the demonstration run in Figures 7.13 through 7.16. These figures reproduce the 'KEYWORD' cards which apply to the digout and the detail from the routines used in the digout.

In Figure 7.13, four 'KEYWORD' cards are printed to show that the options specified:

- o Chop before keycut

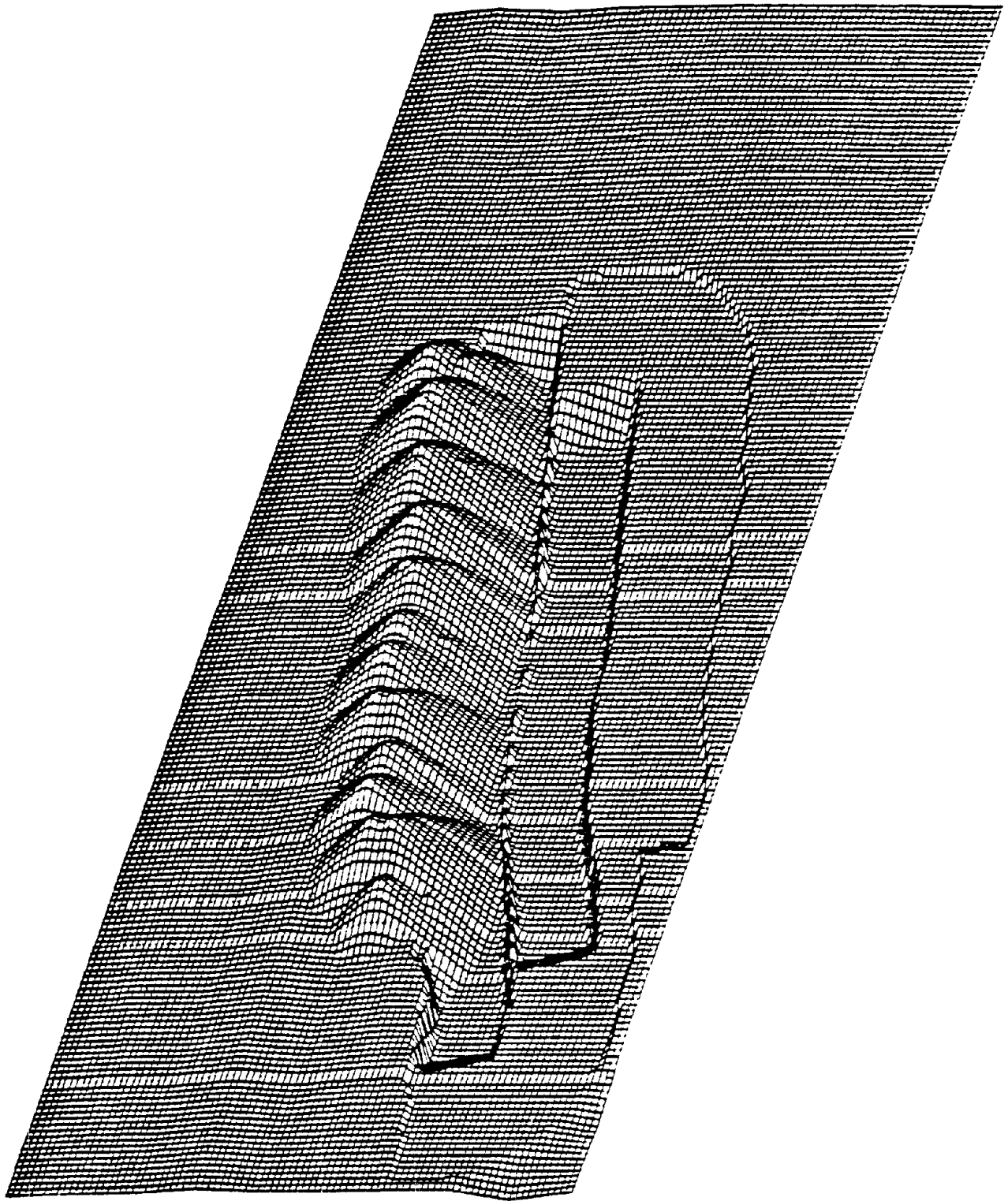


Figure 7.12
Isometric Projection of Chop Option 12

- o Keycut
- o Bail without rehandle
- o Normal digout

Figure 7.13 shows three sets of detail from each of the digging actions.

Each set of detail lines starts with the word BEGIN on the line which prints the name of the routine and selected data. Two values follow the word ANGLES:

- o User-specified spoil angle
- o Angle as measured from internal north

The chop routine prints:

BENCH ELEVATION E

where:

E is the elevation to which overburden will be removed.

The other routines print:

DIG LIMIT N FT. ABOVE COAL

where:

N is zero when the action digs to the top of the coal seam.

The value will be greater than zero during layer digging until the last layer is reached.

The lines that begin with XQF and XMIN are explained in Chapter 13 and Section 13.2.

Each routine prints the x,y,z coordinates of the dragline and the volumes of overburden in bank and swelled cubic yards. An anomaly in the z values appears in Figure 7.13. The dragline chopped before keycutting to 85 ft, yet the dragline elevation is 86.7 ft for the keycut and 87.7 ft for the bail.

This anomaly occurs because of the sequence of model actions and user controls. In this run, we did not side chop while forming the boxcut, so no bench was prepared for the second panel. The model solves the digout geometry and finds the dragline elevations for keycut and bail before calling the digging routines. Thus, for this first digout in the second

CHOP	LCC	LCS	LCPL	LCSS	CHLF	CHLS	CHAST	CHBFF
	11	3	0	1	150.	125.	3.000	.800
KEYCUT	LOK	LOSK	RLK	LSK				
	1	1	.0	1				
BAIL	LOB	LOSS	RLB	LSB	LBP	XBP	YBP	
	1	1	.0	1	0	.0	.0	
DIGOUT	NOIGO	LOD	LOGCP	LOGDLS				
	1	1	1	1				

BEGIN DRAGLINE CHOP - SPOIL ANGLES 70.0 110.0 BENCH ELEVATION 85.0

XBF, XBL, YBF, YBL					300.0	550.0	100.0	370.0
XMIN, XMAX, YMIN, YMAX					300.0	550.0	150.0	270.0

DRAGLINE CENTER X,Y,Z = 407.0 200.0 85.0
 BANK CUBIC YARDS = 2503.64
 SWELLED CUBIC YARDS = 3129.55

BEGIN KEYCUT OPTION NO. 3 - SPOIL ANGLES 70. 110. DIG LIMIT .0 FT. ABOVE COAL

XBF, XBL, YBF, YBL					90.0	410.0	140.0	320.0
XMIN, XMAX, YMIN, YMAX					140.0	360.0	180.0	270.0

DRAGLINE CENTER X,Y,Z = 407.0 200.0 86.7
 BANK CUBIC YARDS = 23878.7
 SWELLED CUBIC YARDS = 29973.3

BEGIN P. BAIL OPTION NO. 3 - SPOIL ANGLES 90. 90. DIG LIMIT .0 FT. ABOVE COAL

XBF, XBL, YBF, YBL					100.0	410.0	140.0	350.0
XMIN, XMAX, YMIN, YMAX					150.0	360.0	230.0	290.0

DRAGLINE CENTER X,Y,Z = 407.0 227.9 87.7
 BANK CUBIC YARDS = 17317.4
 SWELLED CUBIC YARDS = 21646.7

Figure 7.13
Digging Detail - Example 1

CHOP	LCC	LCS	LCPL	LCSS	CHLF	CHLS	CHAST	CHSFF
	12	2	0	1	150.	150.	3.000	.800
KEYCUT	LOK	LOSK	RLK	LSK				
	1	2	80.0	1				
BAIL	LOB	LOSB	RLB	LSB	LBP	XBP	YBP	
	1	2	80.0	1	0	.0	.0	
DIGOUT	NDIGO	LOD	LOGCP	LOGOLS				
	2	1	1	1				

BEGIN KEYCUT OPTION NO. 3 - SPOIL ANGLES 70. 110. DIG LIMIT .0 FT. ABOVE COAL

XGF, XGL, YGF, YGL	200.0	500.0	140.0	320.0
XMIN, XMAX, YMIN, YMAX	310.0	460.0	180.0	250.0

DRAGLINE CENTER X,Y,Z = 502.0 200.0 85.0
BANK CUBIC YARDS = 11585.2
SWELLED CUBIC YARDS = 14481.5

BEGIN P. BAIL OPTION NO. 3 - SPOIL ANGLES 90. 90. DIG LIMIT .0 FT. ABOVE COAL

XGF, XGL, YGF, YGL	200.0	500.0	140.0	350.0
XMIN, XMAX, YMIN, YMAX	310.0	460.0	230.0	320.0

DRAGLINE CENTER X,Y,Z = 502.0 229.8 85.0
BANK CUBIC YARDS = 16802.5
SWELLED CUBIC YARDS = 21003.2

BEGIN DRAGLINE CHOP - SPOIL ANGLES 90.0 90.0 BENCH ELEVATION 80.0

XGF, XGL, YGF, YGL	400.0	650.0	100.0	360.0
XMIN, XMAX, YMIN, YMAX	400.0	650.0	100.0	300.0

DRAGLINE CENTER X,Y,Z = 502.0 229.8 80.0
BANK CUBIC YARDS = 7799.93
SWELLED CUBIC YARDS = 9749.91

Figure 7.14
Digging Detail -- Example 2

CHOP	LCC 0	LCS 0	LCPL 0	LCSS 0	CHLF 0.	CHLS 0.	CHAST .000	CHBFF .000
KEYCUT	LOK 1	LOSK 2	RLK 80.0	LSK 0				
BAIL	LOB 4	LOSB 2	RLB 80.0	LSB 1	LBP 0	XBP .0	YBP .0	
REHANDLE	RHAST 3.000	RHBFF .800	RHSC 20.	RHCFH 0.				
RERUN	KRRN 1	RRNP .0						
DIGOUT	NDIGO 3	LOD 1	LOGCP 1	LOGDLS 1				

BEGIN KEYCUT OPTION NO. 3 - SPOIL ANGLES 70. 110. DIG LIMIT .0 FT. ABOVE COAL

XGF, XGL, YGF, YGL	300.0	500.0	140.0	320.0
XMIN, XMAX, YMIN, YMAX	410.0	550.0	180.0	250.0

DRAGLINE CENTER X,Y,Z =	602.0	200.0	80.0
BANK CUBIC YARDS =	10370.0		
SWELLED CUBIC YARDS =	12562.5		

BEGIN REHANDLE BAIL OPTION NO. 4 - SPOIL ANGLES 90. 90. DIG LIMIT .0 FT. ABOVE COAL

XGF, XGL, YGF, YGL	300.0	590.0	140.0	420.0
XMIN, XMAX, YMIN, YMAX	350.0	550.0	230.0	420.0

DRAGLINE CENTER X,Y,Z	602.0	229.8	80.0
VOLUMES	OVERBURDEN	REHANDLE	TOTAL
BANK CUBIC YARDS	12350.	12991.	25382.
SWELLED CUBIC YARDS	15488.	16239.	31727.

BEGIN REHANDLE BAIL OPTION NO. 4 - SPOIL ANGLES 90. 90. DIG LIMIT .0 FT. ABOVE COAL

XGF, XGL, YGF, YGL	300.0	590.0	140.0	420.0
XMIN, XMAX, YMIN, YMAX	001536.000	1536.000	1536.000	1536.0

DRAGLINE CENTER X,Y,Z	602.0	249.8	80.0
VOLUMES	OVERBURDEN	REHANDLE	TOTAL
BANK CUBIC YARDS	0.	0.	0.
SWELLED CUBIC YARDS	0.	0.	0.

Figure 7.15
Digging Detail - Example 3

CHOP	LCC	LCS	LCPL	LCSS	CHLF	CHLS	CHAST	CHBFF
	0	0	0	0	0.	0.	.000	.000
KEYCUT	LOK	LOSK	RLK	LSK				
	1	1	80.0	0				
BAIL	LOB	LOSB	RLB	LSB	LBP	XBP	YBP	
	4	1	80.0	99	0	.0	.0	
REHANDLE	RHAST	RHBFF	RHSC	RHCFH				
	3.000	.800	20.	0.				
RERUN	KRRN	RRNP						
	1	.0						
DIGOUT	NDIGO	LOD	LOGCP	LOGDLS				
	6	4	1	1				

BEGIN KEYCUT OPTION NO. 3 - SPOIL ANGLES 70. 141. DIG LIMIT 30.0 FT. ABOVE DIAL

XGF, XGL, YGF, YGL	600.0	900.0	100.0	380.0
XMIN, XMAX, YMIN, YMAX	650.0	870.0	150.0	330.0

DRAGLINE CENTER X,Y,Z =	900.3	320.2	90.7
BANK CUBIC YARDS =	9842.93		
SWELLED CUBIC YARDS =	12303.7		

BEGIN KEYCUT OPTION NO. 3 - SPOIL ANGLES 70. 141. DIG LIMIT .0 FT. ABOVE DIAL

XGF, XGL, YGF, YGL	600.0	900.0	100.0	380.0
XMIN, XMAX, YMIN, YMAX	680.0	820.0	180.0	290.0

DRAGLINE CENTER X,Y,Z =	887.5	312.5	90.3
BANK CUBIC YARDS =	4630.73		
SWELLED CUBIC YARDS =	5788.41		

BEGIN REHANDLE BAIL OPTION NO. 4 - SPOIL ANGLES 90. 121. DIG LIMIT 30.0 FT. ABOVE COAL

XGF, XGL, YGF, YGL	600.0	890.0	100.0	550.0
XMIN, XMAX, YMIN, YMAX	670.0	870.0	170.0	480.0

DRAGLINE CENTER X,Y,Z	900.3	367.5	92.3
VOLUMES	OVERBURDEN	REHANDLE	TOTAL
BANK CUBIC YARDS	5461.	5055.	10516.
SWELLED CUBIC YARDS	6826.	6319.	13145.

BEGIN REHANDLE BAIL OPTION NO. 4 - SPOIL ANGLES 90. 121. DIG LIMIT .0 FT. ABOVE COAL

XGF, XGL, YGF, YGL	600.0	890.0	100.0	550.0
XMIN, XMAX, YMIN, YMAX	680.0	820.0	190.0	420.0

DRAGLINE CENTER X,Y,Z	887.5	359.7	92.0
VOLUMES	OVERBURDEN	REHANDLE	TOTAL
BANK CUBIC YARDS	6593.	2780.	9372.
SWELLED CUBIC YARDS	8241.	3475.	11715.

Figure 7.16
Digging Detail - Example 4

panel, it puts the dragline in place before the bench is formed. By specifying chopping for the boxcut panel, the user can avoid this anomaly.

Figure 7.14 differs from 7.13 in that the chop option specifies chopping after bail. This figure shows that the dragline is at the proper elevation.

One aspect of spoil angles can be seen by comparing Figures 7.13 and 7.14. When the model chops before keycut, the spoil angle for chopping is the spoil angle specified for keycutting. When it chops after bail, the angle is that specified for the bail.

Figures 7.15 and 7.16 illustrate the output from the rehandle bail routine when used with the rerun control (KRRN) on. Three additional control cards appear in these figures:

'REHANDLE'

'FACTOR'

'RERUN'

Notice that the rehandle bail routine prints both overburden and rehandle volumes. The rehandle bail detail is printed twice on these figures because KRRN = 1 and the model thinks spoils are encroaching on the coal. The word "thinks" is the appropriate word in this set of conditions. To determine if spoils overlap the coal, the model compares the extreme values of XMIN, XMAX, YMIN and YMAX from the digging routine with those of the spoil routine (not printed on these figures). If an X or Y value from the spoils lies within the range of the MIN and MAX from the bail, the model considers that spoils lie on coal, but they may not. When the dragline is casting to 90°, the spoils may flow back along the current digout without actually overlapping the coal.

In any event, when the model thinks spoils overlap the coal and KRRN is on, the model reruns the rehandle bail to clear the coal. Since LOD = 1, the model uses the value of WEB from the 'FACTOR' card as the distance to move the dragline before rerunning. In this example, it was moved 20 ft in the y direction. The XMIN line in the detail from the rerun (the second set), prints strange numbers and the volumes are zeros. The spoils really did not overlap the coal so there was no volume to move. Strange numbers appear on the XMIN line because when there is no digging, the limits remain at the large numbers used in finding the limits.

In contrast, the spoils did cover coal in the digouts shown on Figure 7.16. Both 'OVERBURDEN' and 'REHANDLE' volumes resulted from the rerun. The way the routine differentiates between compacted and rehandle material is explained in preceding sections.

8.1 CONICAL AND RIDGELINE SPOIL ROUTINES

The model spoiling routines are called by setting the spoil option parameter on 'CHOP' (LCS), 'KEYCUT' (LOSK), or 'BAIL' (LOSB) cards. The option number may be:

- 0 - No spoiling
- 1 - Conical spoils
- 2 - Ridgeline spoils
- 3 - Extended bench spoils

The extended bench routine is described in a separate section. The conical and ridgeline routines are described in this section since they have similar logic and geometry.

The conical spoil shape is simply an inverted cone. The ridgeline spoil shape is two half cones separated by a wedge.

The spoiling logic can be explained by reference to Figure 8.1, which shows two sections for the conical shape. The bottom section would apply when spoils are cast against another spoil bank, and the upper would apply if spoils were cast onto the bench above the highwall. The tic marks on the pit floor line indicate grid points, either x or y, since this shape applies as a cross section and as a longitudinal section.

The height of the spoil bank is shown on this diagram as HS; the radius of the spoil base (not shown) is SB. When the coal seam is level, as in this illustration, the value of HS is actually the elevation of the cone tip. However, when the seam is not level, the model calculates the true elevation by adding HS to the elevation of the bottom of the coal seam at this coordinate.

The coordinates of the center of this cone have been defined by the position of the dragline center, the dragline dumping radius, and the user-set spoil angle. The model first uses standard cross-section geometry to determine the theoretical values of HS and SB.

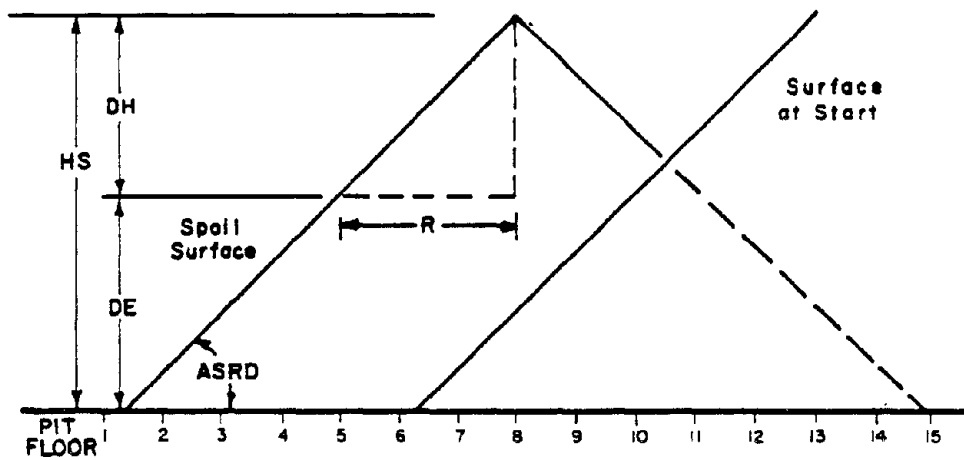
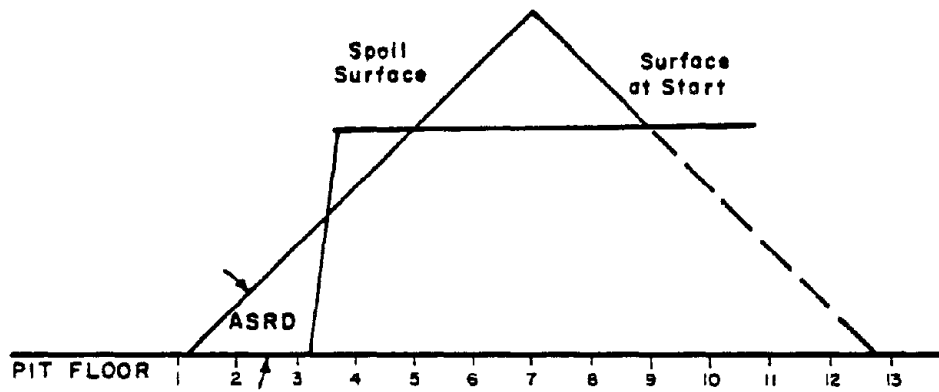


Figure 8.1
Spoil Cross Sections

The equations are:

$$HS = HB (1. + SM) + 0.25 (PW) (TANS)$$

$$SB = HS (COTS)$$

where:

HB - Bench height from 'PANEL' card

SM - Swell factor from surface definition data (DDM) or from 'SWELL' card

PW - Panel width from 'PANEL' card

TANS - Tangent of spoil angle from 'TANGENTS' or 'ANGLES' card

COTS - Cotangent of spoil angle

If the dragline pit had only two dimensions, the problem would be solved with the calculation of HS and SB. However, the DLS model works with a three-dimensional representation, and the model must place a specified volume of spoils on the surface. The digging routine that precedes this spoil routine calculates the volume to be spoiled (VS).

The model uses an iterative procedure to find a value of HS that will result in VS yd³ of material being placed on the surface. Actually, the iterative procedure is controlled by a tolerance on the value of HS rather than on the volume. The model first assumes a starting trial value for HS and calculates the spoil volume placed on the surface from a cone of that height. It then uses an interpolation routine to find a new value of HS that would move the calculated volume toward the desired volume. If the new trial value of HS differs from the previous trial by more than two ft, the model makes another iteration determining a new volume.

During the iterations, the model does not modify the surface array data so that the value of HS may either increase or decrease as required. When a new HS trial value is within two feet of the previous, the model uses the new value as the final value. It then calculates the final volume and modifies the elevation data in the surface array.

Before starting the iterations, the model first determines the grid area that might be covered by the spoils. The value of SB is added to the x,y coordinates for the spoil center to find the limits of the cone. Since the value used to calculate SB is only an approximation, the model actually extends the search area four grid lines in each direction. The search area is from the lowest to the highest x and y.

For discussion, assume the 15 tic marks on the pit floor in Figure 8.1 represent 15 grid points to be tested in the search area. Also assume that the section is drawn through the center of the cone. The tip of the spoil cone coincides with grid mark 8, and HS is shown as the trial elevation at the start of each iteration. Now assume the model is testing grid number 5. The radius of the cone at grid 5 is shown as R, i.e., R is the distance between the grid being tested and the center of the cone. The value of DH (delta height) is simply R times TANS (tangent of ASRD angle of spoil response) from the 'ANGLES' or 'TANGENTS' card. The theoretical elevation TE at this grid is:

$$TE = HS - DH$$

The value of TE can be compared with the surface elevation (EAS) at this grid point. Since TE is greater than EAS, DE (TE - EAS) ft of spoils can be placed at this point. Consider the search and testing to be moving from grid 1 through grid 15. Grid point 1 is outside of the cone area so no spoils would be placed there. Spoils would be placed on grid points 2 through 10. Grid points 11 through 14 would not be modified since the calculated values of TE would be less than the actual values of EAS. Point 15 would be rejected since it is outside of the cone area.

During the iteration, the model sums all positive DE values into a counter, SUM. After all points in the search area have been tested, SUM is converted to YARDS (yd³ of volume placed on the surface) by:

$$YARDS = \frac{(SUM) (XS) (YS)}{27}$$

where:

XS and YS are the grid step sizes.

Since the iterative procedure test is on HS rather than volumes, the resulting value of YARDS will not usually equal the value of VS. For example, consider the detail for the following bail/spoil sequence reproduced from the demonstrated problem.

```
BEGIN P. BAIL OPTION NO. 3 - SPOIL ANGLES  90. 90. DIG LIMIT  .0 FT. ABOVE COAL

XQF, XQL, YQF, YQL                60.0  440.0  100.0  400.0
XMIN, XMAX, YMIN, YMAX            160.0  360.0  240.0  280.0

Dragline Center X, Y, Z =          407.0  227.9  87.3
Bank Cubic Yards =                17161.5
Swelled Cubic Yards =              21451.8
```

BEGIN SPOIL OPTION NO. 1 - CONICAL SPOIL SHAPE

Spoil Cone Center X, Y, Z = 400.0 480.0 122.6 51.6
Swelled Cubic Yards = 21229.1
Delta Percent = -1.0

XQF, XQL, YQF, YQL	160.0	640.0	240.0	720.0
XMIN, XMAX, YMIN, YMAX	320.0	500.0	380.0	500.0

The swelled cubic yards removed from the surface were 21,452, the volume of spoils placed on the surface was 21,229, and the DELTA PERCENT is -1.0. That is, the volume placed on the surface was one percent less than the volume removed from the surface. The equation for delta percent is:

$$\text{DELTA PERCENT} = \frac{(\text{YARDS} - \text{VS}) (100)}{\text{VS}}$$

The section view on the top of Figure 8.1 illustrates a potential problem that can occur if the model is used to cast spoils above an existing highwall. In this view, 13 numbered grid points are shown. Consider the actions as the model tests points 1 through 13. Point 1 would be rejected since it is outside of the cone area. Points 2 and 3 would receive spoils since the calculated values of TE would be greater than the values of EAS. Points 4 and 5 would not receive spoils. Points 6 through 8 would receive spoils, and points 9 through 13 would not. The model has no mechanism by which it could detect that spoils should not be placed on grids 2 and 3. The result is that the highwall appears to be transparent and spoils can simply "flow" through the wall.

This anomaly will not occur when spoils are cast against other spoil banks unless the user alters the specified angle for spoil repose between panels. The anomaly could occur when spoils are cast into a boxcut unless the angle of the chop face (ACDF) is essentially the same as the spoil angle (ASRD).

The three views shown on Figure 8.2 depict the geometry of the ridgeline spoil routine. The procedure for ridgeline spoiling resembles that for conical spoiling with some differences. The model x,y coordinates for the "spoil center" define the midpoint of the ridgeline. The ridgeline length parameters, RLK (from 'KEYCUT' cards) or RLB (from 'BAIL' cards) define the ridgeline length. As each point in the search area is tested, the model must first determine where the point is in relation to the parts of the shape. That is, a grid point may lie outside the area, inside one of the half-cones, or inside the wedge. After making this determination, the model can calculate values of R, DH, DE and TE as described before.

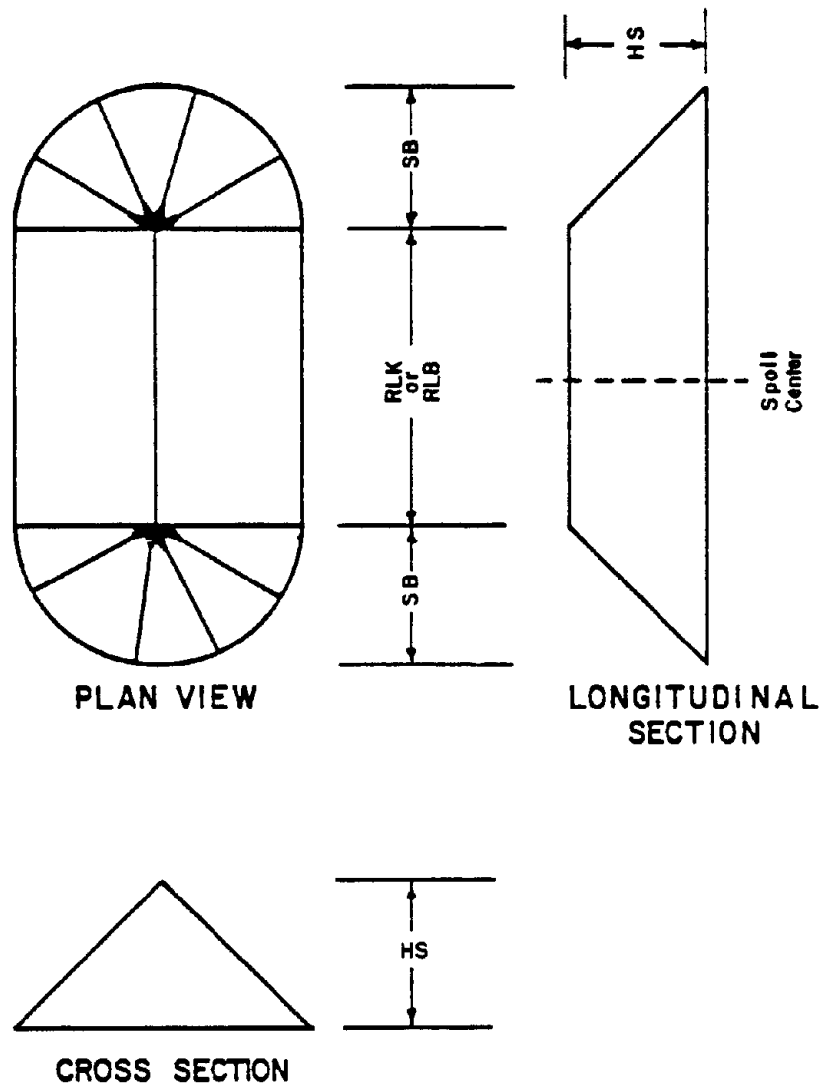


Figure 8.2
Ridgeline Spoil Views

For the preceding descriptions, we assumed the section diagrams were drawn through the x,y coordinates of the spoil center. It may also have been implied that the sections were drawn parallel to either the x or the y axis. Actually, the model geometry and logic have the effect of redefining the sections so that each applies to a plane passing through the spoil center and the grid point being tested. Thus, the spoil routines are independent of the orientation of the user's axis system.

Examples of the two spoil shapes are shown in the isometric projections contained in Appendix C.

These two routines simulate different dumping actions. When the swing is stopped before the bucket is dumped, the resulting spoils will be conical. When the swing is not stopped for dumping, the resulting spoils will be ridgeline in shape, and the ridge will be roughly tangential to the arc of the boom point. The method for determining cycle times is described in Chapter 10. However, while describing the two spoiling routines, it is pertinent to note that the different spoiling actions would probably affect the dumping time. Since dumping time is a user-set parameter, the user should ensure that dumping time is consistent with the spoiling action. A special use of ridgeline spoiling is radial casting in which a series of ridgeline spoils are formed over a short arc.

8.2 EXTENDED-BENCH SPOIL (EBS) ROUTINE

The extended-bench spoil (EBS) routine is designed to cast spoils against an existing highwall. The routine is invoked by specifying spoil option 3 on 'KEYCUT', 'BAIL', or 'CHOP' cards. The parameter names for the spoil option controls are LOSK, LOSB, and LCS, respectively.

The topography of the action is shown in the three views of a pit in Figure 8.3. The relation between the digging and spoiling actions shows in the plan view. When the dragline is excavating digout "n", the machine is assumed to be sitting over digout "n + 1", and the spoils are being cast alongside the highwall of digout "n + 2". The placement of spoils by EBS differs from the placement of the other two spoil options. Normally, a dragline dumps under its boom point. However, when an extended bench is formed, the support dozer levels and spreads the spoils along the highwall. Thus, for this spoil option only, the position for the dump is assumed to be at the mid point of the line defining the top of the existing highwall of digout "n + 2".

As shown in the longitudinal section of Figure 8.3, the bench is leveled the full length of the digout. The spoils

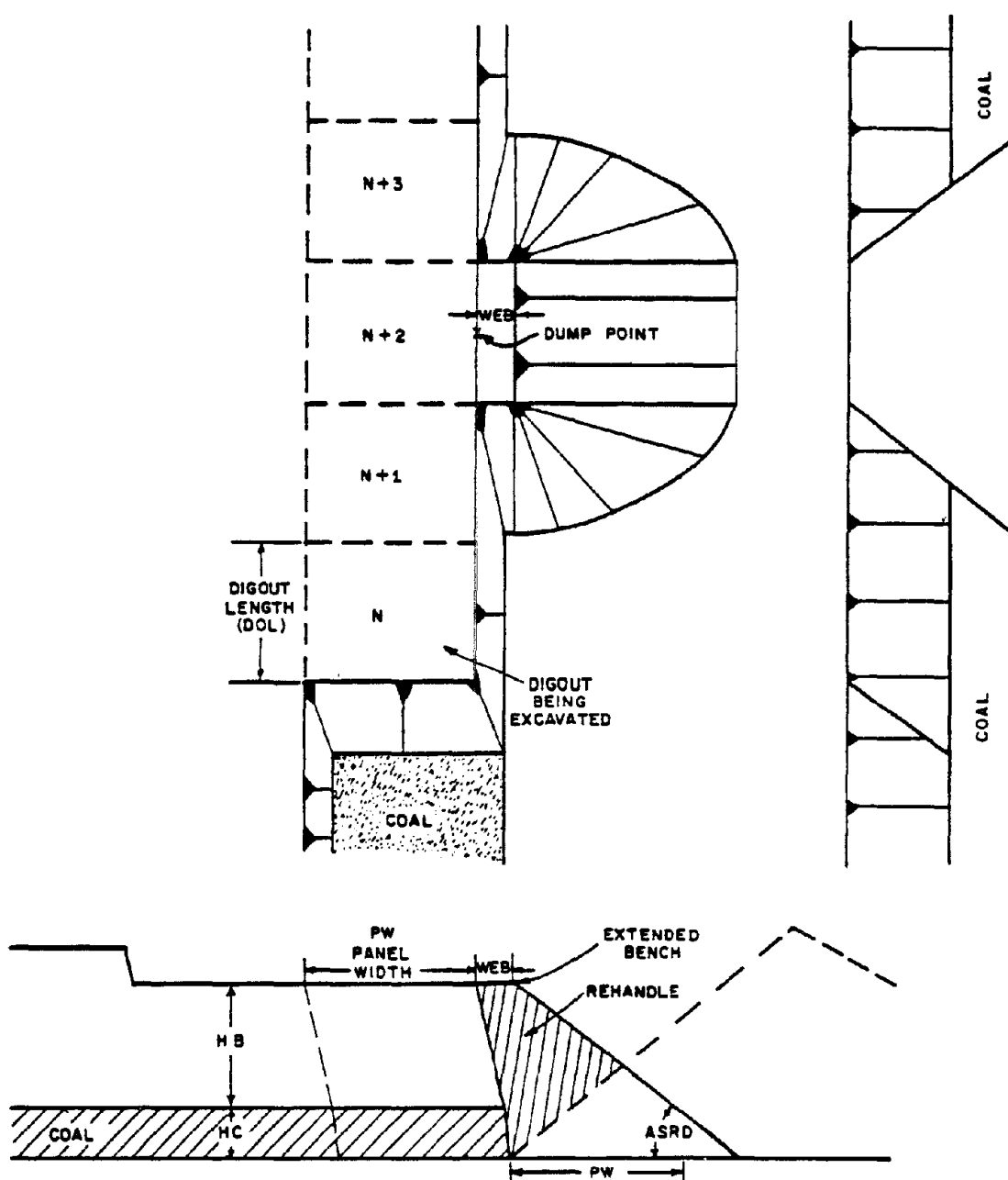


Figure 8.3
Extended Bench Topography

are assumed to flow outward at the ends at angle ASRD (angle of spoil repose from 'ANGLES' card). As seen from the cross section on this figure, the bench is also leveled outward from the highwall for the full width of the extended bench. The spoils flow outward from the bench at right angles to the highwall, also at angle ASRD.

Figure 8.4 is a cross-section view with parameters used by the routine. The "R" parameters are horizontal dimensions calculated by the model based on user-set parameters, HB (height of bench), HC (height or thickness of coal), AABF (angle of highwall), ACFD (angle of coal face), and ASRD from 'PANEL' and 'ANGLES' cards. To convert HB and HC to actual elevations, the model uses the elevations at the center of the digout as the reference point. The parameter RST is set to 2 ft by the model; it represents the smallest possible extended bench. This limit is set to be consistent with the iterative tolerance as explained later. The "R" parameters determine which of three sections can be used to represent the extended bench.

Figure 8.5 shows one possible cross section for the extended bench. In this case, RY (width of bench) is greater than RST, and RS1 (the width of the bench on the pit floor) is greater than or equal to RSOT. This cross section is used when there are sufficient spoils to form the extended bench at the working level of the dragline bench.

Figure 8.6 shows another possible cross section. In this case, there are insufficient spoils to form the section of Figure 8.5. The calculated value of RS1 is less than RSOT and greater than or equal to RSCT.

Figure 8.7 shows the third possible cross section. In this case, the spoils do not even cover the coal face. The value of RS1 for this case is less than RSCT and equal to or greater than RST. This condition HAS NOT BEEN TESTED since it requires a very small volume of spoil combined with a thick coal seam.

If the amount of available spoils will not fit one of the cross sections shown on Figures 8.5, 8.6, and 8.7, the model will stop with an error message. This condition is unlikely to occur unless one or more user-set parameters are set incorrectly.

To understand the spoiling routine, consider first the shape of a spoil bench (Figure 8.3) if it were formed on a level surface (e.g., the pit bottom), and the existing highwall were not present. The shape would be a rectangular column of material with height equal to HB + HC. The width of the rectangle would be 2 times RY and the length would be equal to the coal line defining this side of the digout. The four

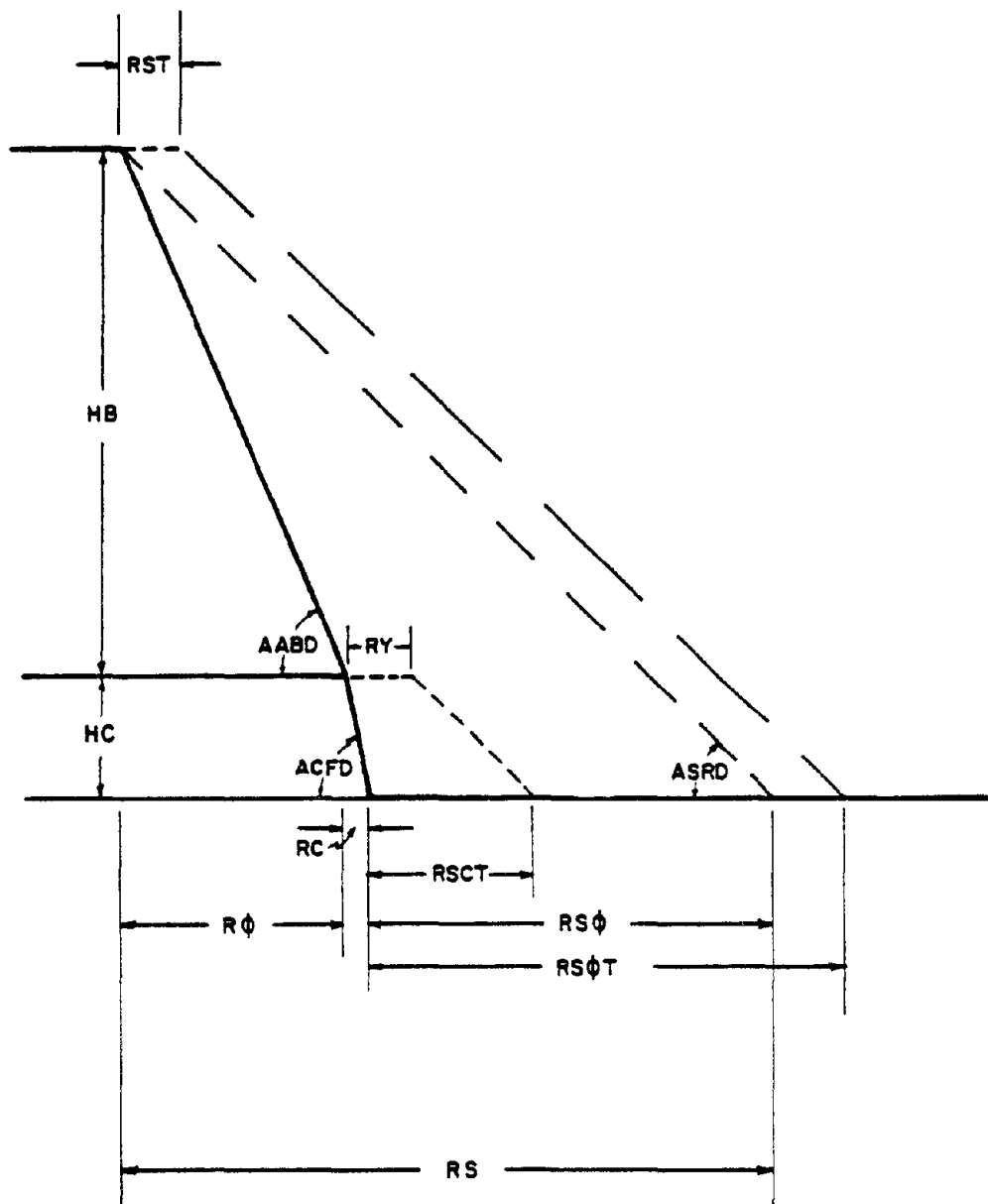
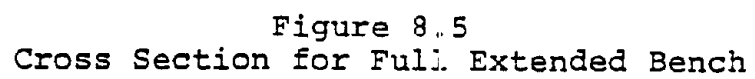


Figure 8.4
Basic Cross Section for EBS



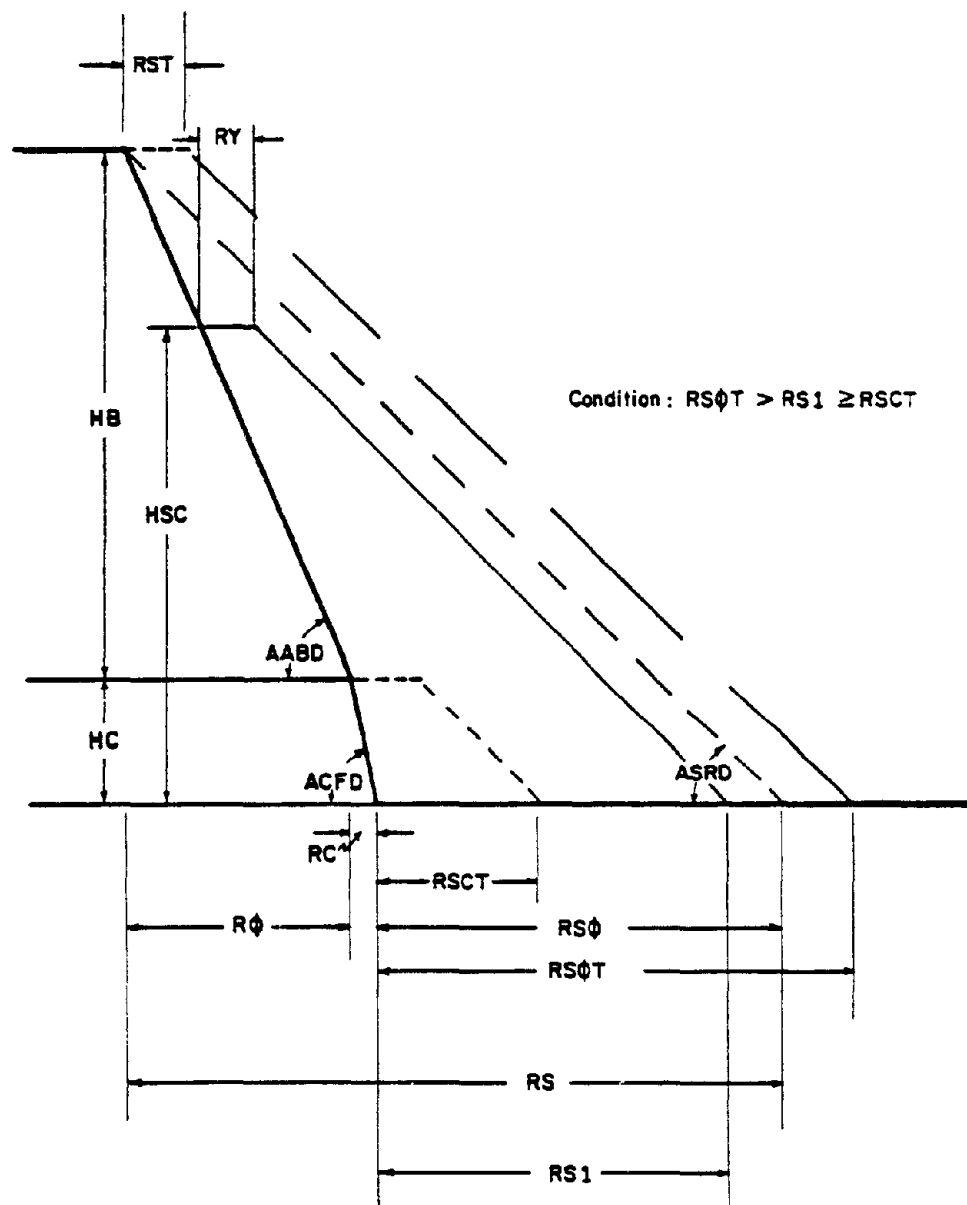


Figure 8.6
Cross Section for Spoils Against Highwall

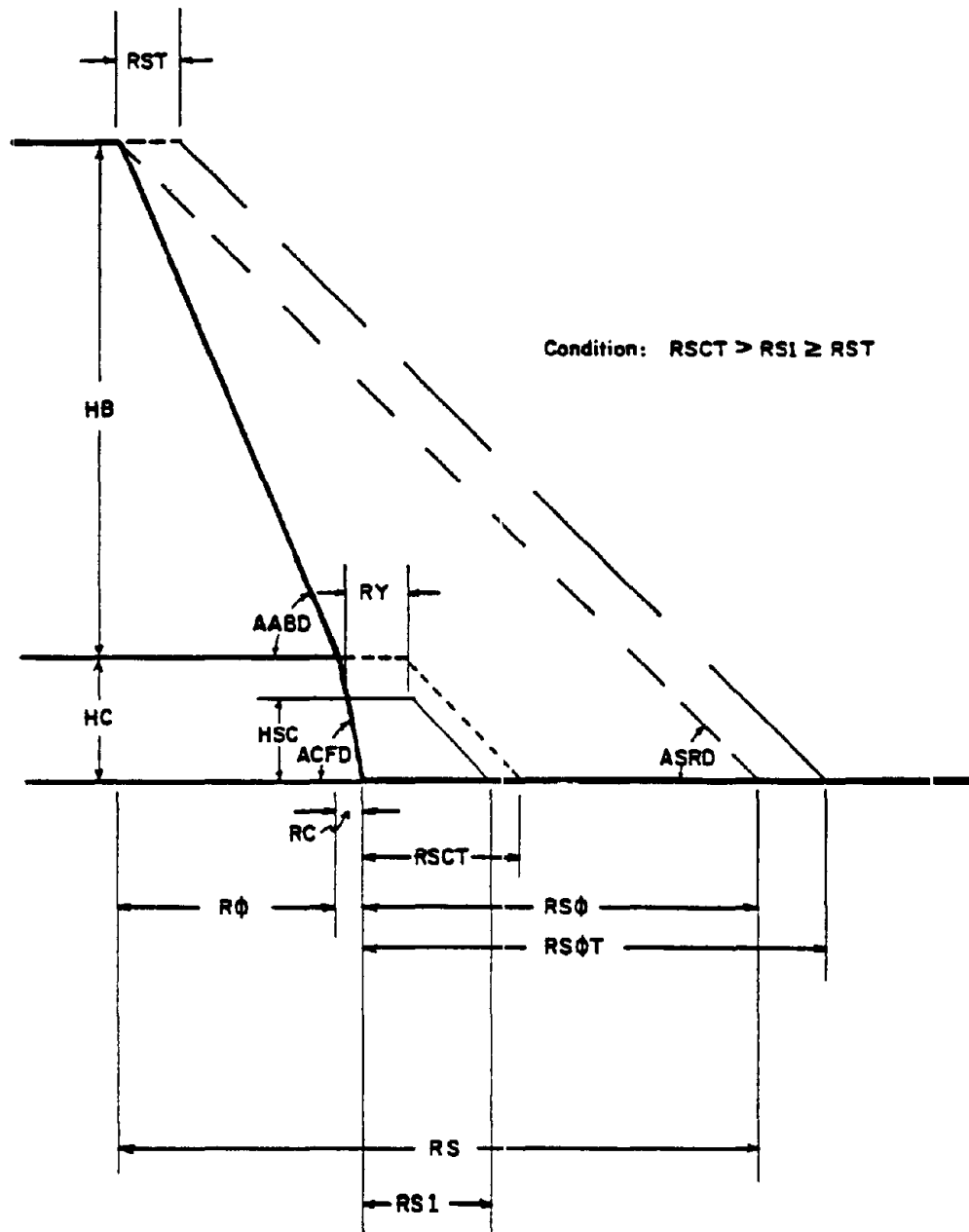


Figure 8.7
Cross Section for Spoils Against Coal Face

sides would be wedge-shaped, and the four "corners" would be sections of a cone. The slope angle for the sides and the cones is the angle ASRD. This figure would be symmetrical about the midpoint of the highwall.

Since the spoils are formed against an existing highwall and the pit bottom may or may not be clear of previous spoils, this symmetrical shape must be modified to fit the existing surface. The model then calculates a theoretical elevation at each grid x,y within the symmetrical shape. The theoretical elevation is compared with the actual elevation at that x,y . When the theoretical elevation is greater than actual, spoils may be placed on the surface at this point. The amount of spoils is equivalent to the difference between the two elevations. However, when theoretical elevation is equal to or less than actual elevation, no spoils can be put on this point.

Two parameters control the actions of EBS: VS (volume to be spoiled), as calculated by the digging routines, and WEB (width of extended bench) from the 'FACTOR' card. When $WEB = 0$, the model determines which cross section to use and forms the bench so that the volume of spoils placed on the surface will be close to VS. An iterative procedure is used in which parameter RS1 is varied by an interpolation routine. On each trial, the new value of RS1 is compared to the previous value. When the difference between the new and old values is 2 ft or less, the procedure uses the new value of RS1 to calculate actual volume placed on the surface.

When $WEB > 2$, the model uses the section shown in Figure 8.5. It sets $RY = WEB$ and $RS1 = RSOT + WEB$. Then it modifies the surface and calculates the amount of spoils placed on the surface.

The actual volume of spoils placed on the surface (required volume) will not necessarily equal the amount available (variable VS). The SPLCF (spoil carry-forward) routine will be used by the model whenever the EBS routine is used. After the EBS routine, the model calls the SPLCF routine to calculate the difference between required and actual volumes. Then before the next spoil action is taken by the model, the SPLCF routine is called again to adjust VS. Thus, when the user sets $WEB > 2$, the model adjusts the spoils for the next digging/spoiling action to account for any excess or shortage. This treatment is consistent with actual stripping operations. The model actions are described in the following steps:

1. The internal spoil index is set to the current digout index plus 2. That is, the spoil will be placed two digouts ahead of the current digout. If the spoil index exceeds the index to the last dragface in the user's 'COAL LINE' data, the routine makes no spoiling actions.

2. The cotangents of user-set angles AABF (angle of previous highwall), ASRD (angles of spoil repose), and ACFD (angle of coal face) are checked to ensure that the expected geometry can be used. For example, if ASRD were greater than the angle from the top of the highwall to the bottom of the coal face, none of the sections shown in our figures could be used. In this case, the model prints "EBS SKIPPED, INVALID COTANGENTS" and makes no spoiling actions.
3. The coordinates for the four corners of the spoil digout are found in the 'COAL LINE' x,y data. The center of the digout is determined and its elevations retrieved from the surface array. The working bench elevation, ZDL, is calculated as HB plus the elevation of the top of coal at the center.
4. The horizontal projections $R\emptyset$, RC, RS, $RS\emptyset$, $RS\emptyset T$, and RSCT (Figure 8.4) are calculated based on user-set values for HB, HC, AABF, ASRD and ACFD.
5. A trial value for RS1 is calculated and the iteration control set to ON or OFF based on the value of WEB. When $WEB = 0$, RS1 is set to RSOT and the control is turned ON. When $WEB > 0$, RS1 is set to $RSOT + WEB$ and the control is turned OFF.
6. Using the current value of RS1, the model determines which cross section to use.
7. The appropriate cross section is converted to a symmetrical shape about the mid point of the highwall. The limits of search are determined by finding the highest and lowest x and y values that could be included in the symmetrical shape.
8. The model examines all x,y coordinates within the search limits. It calculates the theoretical elevation for the point and compares theoretical with actual. When theoretical is greater than actual, the model assumes spoils can be placed on the surface. The model keeps track of the summation of the differences between theoretical and actual elevations for all such points. When theoretical is equal to or less than actual, no spoils are placed on this point. In this step, the surface array is not modified when the iterative control is ON. It is modified only when the control is OFF.

9. After all points within the search area have been tested, the model checks the iteration control. If ON, the bench has been formed and model goes to step 10. If OFF, the model calls an interpolation routine to find a new trial value for RS1. If the new and old values of RS1 differ by more than 2 ft, the model returns to step 6 with the control still ON. If the difference is 2 ft or less, the model turns the iteration control OFF before returning to step 6.
10. The model prints the spoil statistics line and returns. The model stores the value of RY, which is the width of the bench in the appropriate position in array EBSDY. This non-zero value will be used in the main program to position the dragline for production bailing when this digout is reached.

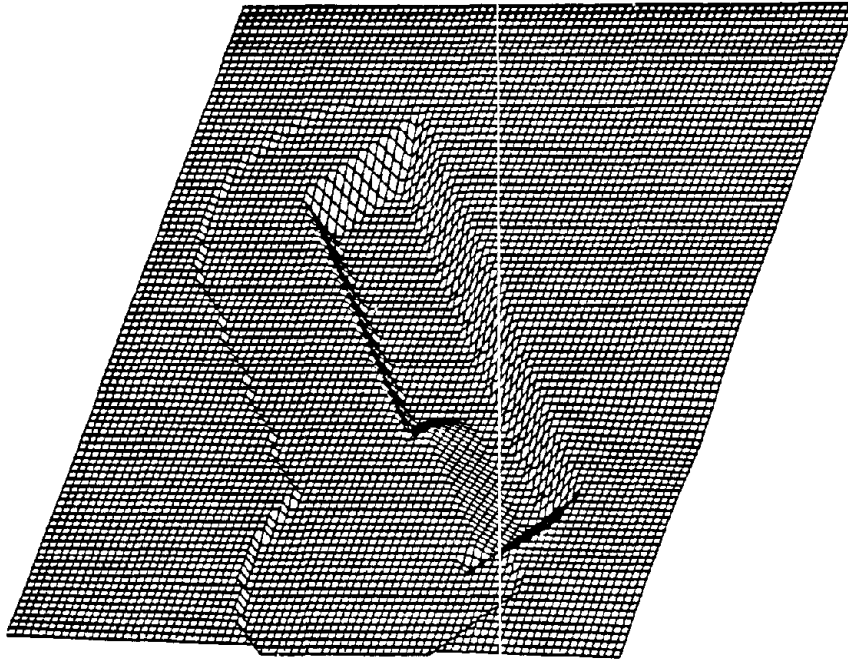
Figure 8.8 shows two isometric projections of a pit where the extended bench has been formed. In Surface No. 1002, the dragline has started the first production panel after the boxcut panel. The direction of dragline advance is from the southwest toward the northeast. When the boxcut was made, the dragline had side-chopped to form the bench for the production panel. To obtain spoils for the extended benches on the first two digouts of this panel, the dragline has continued to side-chop. The bench in this view has been extended along the highwall for digouts 1 and 2 of this second panel.

In Surface No. 1003 in Figure 8.8, the dragline has made the first digout of the panel. The side-chop material has been used to extend the bench along the third digout highwall. The keycut and production bail have been made. The spoils from the bench have been rehandled and the slope has been steepened in an attempt to clear the coal face. It can be seen that the amount of spoils is too much to completely clear the coal face.

8.3 SPOIL ROUTINES - DETAIL PRINTOUTS

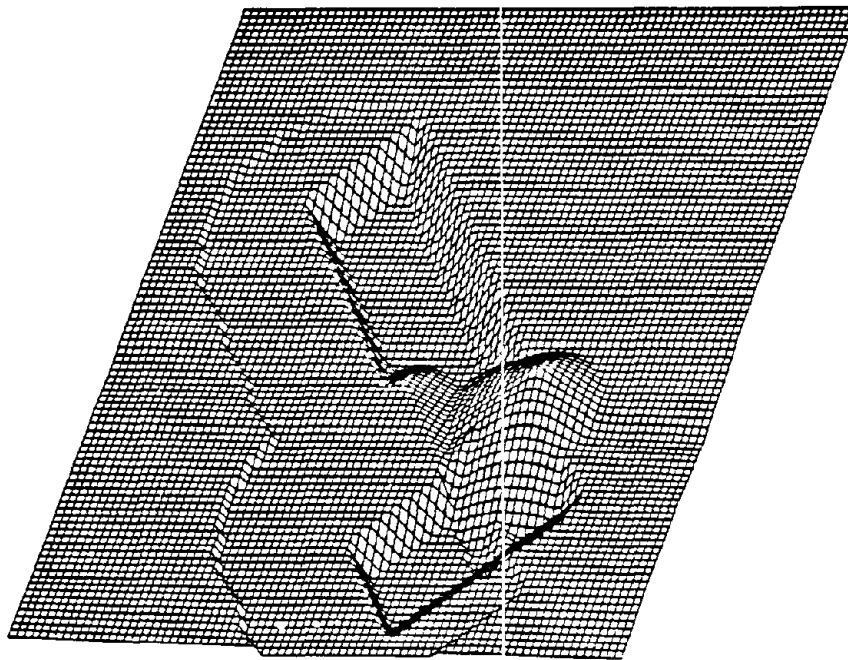
Five sets of detail printout are reproduced in Figure 8.9:

1. From spoil option 1 - conical spoils
2. From spoil option 2 - ridgeline spoils
3. From chop option 11 - chop from keycut position forming an extended bench
4. From spoil option 3 - extended bench spoils



CASE 1H9 SUR NO 1002. - SOUTH

08:05 JUN 26.'79



CASE 1H9 SUR NO 1003. - SOUTH

08:05 JUN 26.'79

Figure 8.8
Isometric Projections of
Extended Bench Spoiling

```

      BEGIN SPOIL OPTION NO. 1 - CONICAL SPOIL SHAPE
      SPOIL CONE CENTER X,Y,Z =      410.0   490.0   127.6   48.1
      SWELLED CUBIC YARDS =          21975.5
      DELTA PERCENT =                1.5
      XOF, XOL, YOF, YOL                                230.0   590.0   310.0   870.0
      XMIN, XMAX, YMIN, YMAX                            230.0   530.0   370.0   520.0

      BEGIN SPOIL OPTION NO. 2 - RIDGE-LINE SPOIL SHAPE
      SPOIL CONE CENTER X,Y,Z =      410.0   440.0   98.8   13.8
      SWELLED CUBIC YARDS =          13710.8
      DELTA PERCENT =               -5.3
      XOF, XOL, YOF, YOL                                230.0   590.0   260.0   820.0
      XMIN, XMAX, YMIN, YMAX                            270.0   550.0   340.0   470.0

      BEGIN DRAGLINE CHOP - SPOIL ANGLES      70.0   110.0 BENCH ELEVATION      85.0
      XOF, XOL, YOF, YOL                                300.0   550.0   100.0   370.0
      XMIN, XMAX, YMIN, YMAX                            300.0   550.0   180.0   270.0

      DRAGLINE CENTER X,Y,Z =      407.0   200.0   85.0
      BANK CUBIC YARDS =          2503.64
      SWELLED CUBIC YARDS =          3129.55

      BEGIN EXTENDED BENCH SPOILING ON DIGOUT NO.      3
      SPOIL BENCH CENTER X,Y,Z =      450.0   300.0   85.0 DIMENSIONS      100.0   20.0   93.9
      SWELLED CUBIC YARDS =          29975.6
      DELTA PERCENT =          857.8
      XOF, XOL, YOF, YOL                                300.0   800.0   180.0   400.0
      XMIN, XMAX, YMIN, YMAX                            310.0   590.0   280.0   390.0

      BEGIN KEYCUT OPTION NO. 3 - SPOIL ANGLES      70.    110. DIG LIMIT      .0 FT. ABOVE COAL
      XOF, XOL, YOF, YOL                                90.0   410.0   140.0   320.0
      XMIN, XMAX, YMIN, YMAX                            140.0   360.0   180.0   270.0

      DRAGLINE CENTER X,Y,Z =      407.0   200.0   86.7
      BANK CUBIC YARDS =          23978.7
      SWELLED CUBIC YARDS =          29973.3
      SPOIL VOLUME ADJUSTED (SWELLED CU. YDS) -28846.0

```

Figure 8.9
Spoil Routines - Detail Printouts

5. From the keycut (Option 3) on the digout following the formation of the extended bench

The details differ in the information printed on the "SPOIL" line, as follows (values taken from Figure 8.9):

1. SPOIL CONE CENTER X, Y, Z = 410.0 490.0 127.8 48.1

The center of the cone is at X = 410 and Y = 490. The elevation of the top is 127.8 ft, which is 48.1 ft above the surface on which the spoil bank was placed.

2. SPOIL CONE CENTER X, Y, Z = 410.0 440.0 98.9 13.8

The center of the ridgeline is at X = 410 and Y = 440. The elevation of the ridge is 98.9 ft, which is 13.8 ft above the surface on which the spoil bank was placed.

3. SPOIL BENCH CENTER X, Y, Z = 450.0 300.0 85.0

The midpoint of the highwall against which the spoils were cast is at X = 450 and Y = 300 and the bench elevation is 85 ft (as specified by HB from the 'PANEL' card). This line also prints:

DIMENSIONS 100.0 20.0 93.9

The bench is 100 ft long and 20 ft wide at the top and the final value of RS1 is 93.9 ft.

The details from the chopping action which preceded and the keycut action which followed the extended bench spoiling are shown in Figure 8.9 to illustrate the spoil "borrowing" logic. The chop produced only 3,130 yd³ of spoils, but 29,976 yd³ were needed to form the 20-ft extended bench. The model "borrowed" the needed 26,846 yd³ from the following keycut as shown by the line:

SPOIL VOLUME ADJUSTED (SWELLED CU. YDS) -26846.0

in the keycut detail.

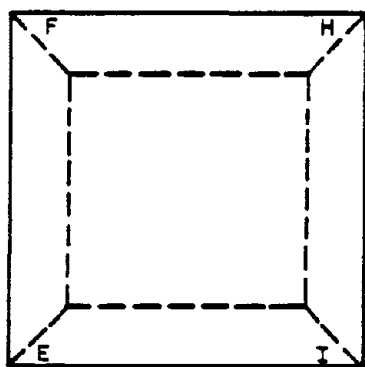
9.1 BASIC GEOMETRY

The DLS model has two routines for removing coal. These routines adjust the surface elevations to account for coal that would be loaded out after stripping is completed. The routines calculate the volume and tons of recovered coal for the economic summary. The model does not take into account time or costs associated with coal recovery. It simply adjusts the surface as required.

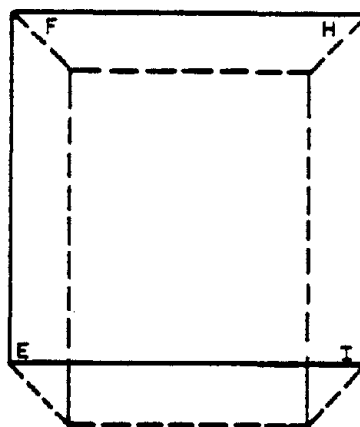
The user can suppress coal removal, but does not control when the coal removal occurs. The model executes the specified coal removal routine as a part of the end-of-panel processing. The end-of-panel processing is done when the model has advanced to the end of the panel, or in response to an 'END PANEL' card. The use of the 'END PANEL' card is described in Chapter 6.

The following parameters are specified on the 'MINE COAL' card:

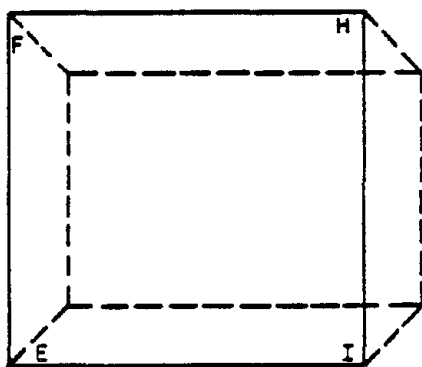
<u>Parameter</u>	<u>Value</u>	<u>Action</u>
LOC	0	Do not remove coal
	1, 2, or 3	Remove coal with RTC3
	4	Remove coal with RTC4
LSC	0	Do not save surface array after RTC
	1	Save surface array after RTC
ECR	decimal fraction	Expected in-pit coal recovery factor
DCBTY	tons/bank yd ³	Density of coal
NCDF	n	Coal recovery starts at digout n
NCDL	m	Coal recovery ends at digout m



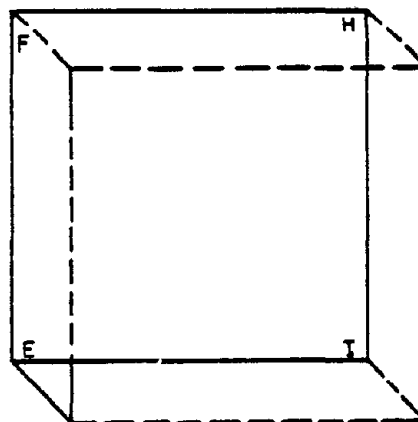
A. BOXCUT PANEL
DIGOUT 1



B. BOXCUT PANEL
DIGOUTS 2 THRU N



C. PRODUCTION PANEL
DIGOUT 1



D. PRODUCTION PANEL
DIGOUTS 2 THRU N

Figure 9.1
Plan Views for Coal Removal

NOTE: NCDF = 0 and NCDL = 0 indicates remove coal from all digouts in the panel. NCDL = 99 means remove coal to end of panel.

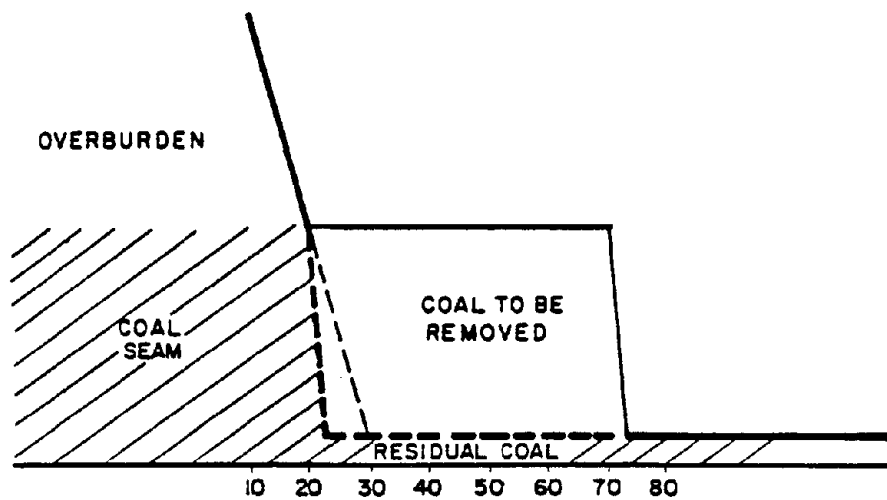
When an RTC routine is called, it removes coal a digout at a time. The actual number of digouts from which coal is removed is controlled by the parameters, NCDF and NCDL (first and last digouts for coal removal). Generally, these parameters are set to zero to indicate coal removal from all digouts in the panel. They can be set to other values for special situations. In this section, assume the parameters are set to zero and coal will be removed from all digouts.

Figure 9.1 shows four plan views that apply to coal removal. The solid lines represent the top of the coal seam and the dashed lines represent the bottom of the coal seam. In all diagrams, the four points from the 'COAL LINE' data are labeled E, F, H, and I. These four diagrams depict square digouts for simplicity. The digout shapes do not need to be square, nor even rectangular.

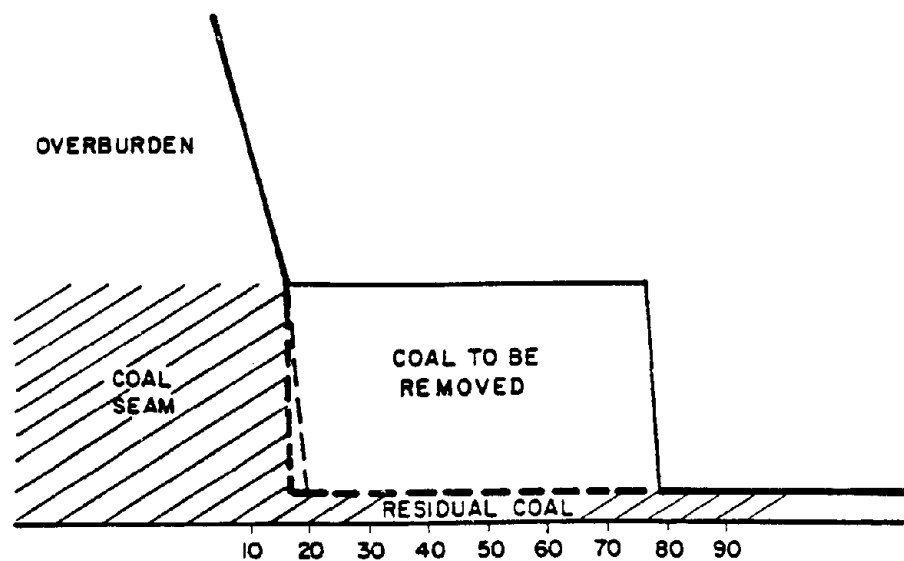
For illustration, we have exaggerated the horizontal distance between the top and the bottom of the coal faces. Diagram A applies to the first digout in a boxcut panel. In this diagram, all faces slope inward and an overburden face stands above each coal face. Diagram B applies to the remaining digouts in a boxcut panel. In this case, the EI face slopes outward and corresponds to the FH face that was formed when coal was removed from the preceding digout.

Diagram C applies to the first digout in a production panel. Face IH slopes outward and corresponds to the EF face formed when coal was removed from the preceding panel. Diagram D applies to the remaining digouts in a production panel. Two faces, EI and IH, slope outward because they were formed on the preceding digout or panel.

The RTC4 routine actually attempts to form these shapes; the RTC3 routine does not. Note that the RTC3 routine was developed when the model was being used to simulate mines working thin coal seams. With thin seams, the coal face is practically vertical and could not be detected in most DLS surface grids. The geometry shown in Figure 9.1 could not be modeled without placing an impractical requirement on grid size. Therefore, RTC3 attempts to simulate the coal faces by logic rather than geometry. The RTC4 routine was developed for use with thick seams, where a thick coal seam and a shallow face angle could result in detectable coal faces that could be modeled with the geometry shown in Figure 9.1. However, even when the coal seam is thick, the



A. COAL LINE COINCIDES WITH GRID



B. COAL LINE NOT COINCIDENT WITH GRID

Figure 9.2
Coal Seam Cross Sections

model may not make a rigorous solution. The problems faced in coal removal can be illustrated by the section diagrams in Figure 9.2.

In both diagrams, the solid lines represent the theoretical surface at the start of coal removal and the heavy dashed lines represent the surface after coal removal. The thin dashed lines show the model projection of the final surface.

In Diagram A, the specified coal lines coincide with grid lines. At the 10 ft grid, the model would not modify the surface; this point is outside of the panel. The 20-ft grid coincides with the coal line, and is considered by the model to be inside of the panel. However, the model logic would indicate that an overburden face stands above this point as shown in the diagram. The model logic says that coal cannot be removed from under an overburden face, so the elevation at this grid would not be modified. Grid lines 30 through 70 are clearly inside the panel, so the surface would be modified to reflect coal removal. The final elevations for the surface and the top of coal would be set to represent the residual coal left in place by the model.

In Diagram B, the coal line does not coincide with a grid line. Again, the 10-ft grid line is outside the panel and would not be modified. The 20-ft line is inside the panel and coal would be removed. Coal would also be removed from grid lines 30 through 70.

In Diagram B, coal was removed from the 20-ft line, but was not in diagram A. The difference in recovered coal would be 360 ft². Since this section applies for the full panel length, this cross-section area would be multiplied by the panel length to obtain coal volume. Thus, condition A would recover considerably less coal than condition B.

When the panels are parallel to one of the axes, the user can control the situation by placement of the coal lines. He can make coal lines coincide with grids to force treatment A, or not coincide to force treatment B. However, when the coal lines are not parallel with grid lines, both conditions will apply as the model moves along the panel, and the distance between the coal line and the nearest inside grid line can vary from 0 to the grid size.

The model makes an arbitrary test of this distance to determine which treatment to apply. In RTC3, if the distance is less than 0.5 times the grid size, condition A is assumed. In RTC4, if the distance is less than 0.4 times the grid size, condition A is assumed.

The user can call either routine for coal removal, and should experiment with the model to determine which performs to his satisfaction.

The following sections discuss each routine in detail.

9.2 RESIDUAL COAL

When coal is removed from the surface array, the model leaves residual coal in place unless the user has set ECR (estimated coal recovery factor) to 1. When a panel is started, the model calculates FRC (feet of residual coal), as follows:

$$FRC = HC (1. - ECR)$$

where:

HC is height of coal from the 'PANEL' card.

ECR is expected in-pit coal recovery factor from the 'MINE COAL' card.

The value of FRC is rounded to the nearest foot for variable coal seams, and to the nearest 0.1 ft for level coal seams.

Before coal is removed from a grid point, the model compares the elevation of the surface with the elevation of the top of coal. If they are not equal, material lies on top of the coal and coal cannot be removed from that point. The thickness of coal, TC, at a grid from which coal can be removed is the difference between the top-of-coal and bottom-of-coal elevations. The feet of coal removed is $(TC - FRC)$, and the top-of-coal elevation is set to the bottom-of-coal elevation plus FRC. Thus, the DLS model leaves residual coal in the pit when the value of ECR is not 1. Therefore, the value assigned to ECR for the DLS model will not be the same as the overall recovery factor for a mine in most cases.

The model then calculates the tons of recovered coal (TONS) as:

$$TONS = \frac{(SUM) (XS) (YS) (DCBTY)}{27}$$

where:

SUM - summation of the feet of coal removed

XS - x grid step size from the surface definition
YS - y grid step size from the surface definition
DCBTY - density of coal in tons/bank yd³ from the
 'MINE COAL' card

9.3 LOST COAL

The model detects lost coal resulting from one of two conditions:

1. A grid point is inside the area defined for a digout, but the surface elevation is greater than the top-of-coal elevation. When the digging routines process a grid point that is inside the digout area, the surface elevation is set to the top-of-coal elevation, i.e., the model routines dig to the top of the coal seam. Thus, if the remove coal routine encounters a point within the digout where the surface elevation is greater than the top-of-coal elevation, the model assumes spoils have been placed on this grid. This grid point elevation will not be modified. However, the model will calculate feet of spoils on coal and feet of coal lost for reporting. The feet of spoils on the coal is the difference between the surface and top-of-coal elevations. The amount of coal lost is the difference between top-of-coal and bottom-of-coal elevations minus the value of FRC since residual coal is not recoverable.
2. A grid point is on or near line HI (i.e., the spoil side of the digout) and the elevation values for nearby points indicate that spoils encroach on the coal face. This testing is different for the two routines, and is discussed in later paragraphs. Even though the tests are different, the results of spoils encroaching on coal will be the same from both routines. That is, the elevations at the grid point will not be modified, and the model will calculate the coal lost at this grid point as described in the preceding paragraph.

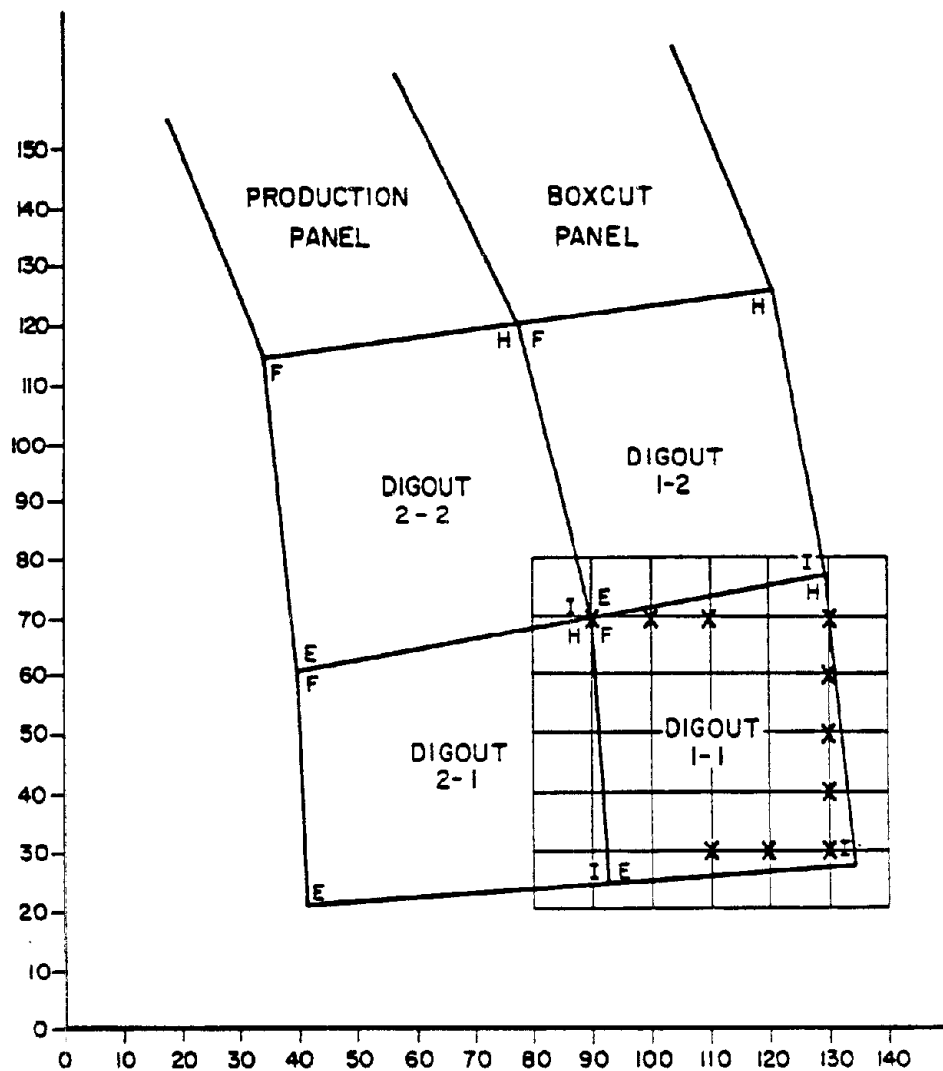


Figure 9.3
Plan View for RTC3

When a digout in which coal has been lost is completed, the model will print:

```
P D VALUE1 CUBIC YARDS SPOIL ON VALUE2 TONS  
RECOVERABLE COAL
```

where:

P - panel number

D - digout number

VALUE1 - yd³ of spoils

VALUE2 - tons of coal

VALUE1 will be 0, when no coal is lost under condition 1. above.

9.4 REMOVE THE COAL - OPTION 3 (RTC3)

The logic of RTC3 can be explained using Figure 9.3, which shows a plan view of a portion of two panels. Two digouts are shown in each panel. The digouts are identified by numbers, P-D, where P is the panel number and D is the digout number. This routine tests the model panel and digout counters to determine which digout is being made. The first digout in a panel is different from the remaining digouts in that EI represents the bottom of the face being formed on the digout; whereas, in all subsequent digouts, line EI represents the bottom of the dragface formed on the preceding digout. The boxcut panel differs from the production panels in the line HI, which represents the bottom of a face being formed; whereas, in production panels, line HI represents the bottom of the highwall formed on the preceding panel.

When RTC3 is processing digout 1-1, it recognizes that overburden faces stand above all four lines. Therefore, the coal under the faces cannot be removed. However, since the coal lines do not coincide with grid lines, the model must test each grid point to see if condition A or B applies as shown in Figure 9.2. The grid points marked with an X on Figure 9.3 indicate points that are inside the digout shape, but sufficiently close to coal lines so that coal would be left in place.

When RTC3 moves to digout 1-2, it assumes that only three digout lines define lines of overburden faces. Line EI, which defines the dragface formed on the preceding digout, is subjected to special testing in attempts to recover coal from grid points such as 70,100 and 70,110. When those grids were tested in digout 1-1, they were less than half a grid step from line FH so that coal was not removed. On digout 1-2, similar points will be tested again. This test compares the surface elevation with the top-of-coal elevation. If the two values are the same, the model will remove coal from these points. If the surface elevation is greater than the top-of-coal elevation, then spoils have been placed on the point and the coal is treated as lost coal.

The RTC3 routine recognizes that it is processing a production panel when the panel counter is greater than 1. When the digout counter is 1, the routine assumes it is processing the first digout in the panel, e.g., digout 2-1 in Figure 9.3. In this digout, overburden faces stand above three of the digout lines: EF, FH and EI. Line HI represents the spoil side of the digout. Points that lie on or within one-half grid step from line HI are tested to determine if:

1. Spoils are so close to the coal that the coal should not be recovered, or
2. Spoils clear the coal but the point is outside of digout and close enough so that coal was not removed on the preceding panel.

Suppose the point being tested for potential coal removal is called P. The model examines the four adjacent grid points to find the nearest grid which is on the spoil side of the digout line HI; call this point PA. The distance between line HI and point PA is used to calculate the elevation that PA would have if the toe of the spoils coincided with the toe of the coal; call this elevation EPA. The model retrieves the actual surface elevation for the PA point; call this elevation EAS. If the value of EPA is less than the value of EAS, the model assumes spoils encroach on the coal face, and coal at point P is considered as lost coal. However, if EPA is equal to or greater than EAS, the model assumes the spoils clear the coal face and coal can be recovered from point P.

When both the panel and the digout counters are greater than 1, the routine assumes it is processing a digout such as digout 2-2 in Figure 9.3. In this steady-state digout, overburden faces stand above two coal lines, EF and FH. Points on or near line EI (the preceding dragface), are tested as described above under the discussion of digout 1-2.

Points on or near line HI are tested as described above for digout 2-1. For example, the point at 70,90 would have been rejected in preceding actions since it was under an overburden face. Coal would now be recovered from this point.

The user should be able to examine all grids on Figure 9.3 and determine those points from which coal would not be recovered. They would be all points within one-half grid step of the EI lines in the first digout of each panel; all points within one-half grid step of the HI lines on the boxcut panel; all points within one-half grid step of the EF lines for the last production panel of the run; all points within one-half grid step of the FH lines for the last digout in each panel.

9.5 REMOVE THE COAL - OPTION 4 (RTC4)

The four geometric shapes that RTC4 attempts to form are shown in Figure 9.1. This routine uses a different logic for determining which shape should be applied for a given digout. The model determines two reference grid points as a basis for the logic. One grid point (RS) is on the spoil side of the digout; it will be at least one grid step away from line HI and equidistant from points H and I. The other reference point (RC) will be at least one grid line away from line EI and equidistant from points E and I. Thus, point RS will lie under the face opposite the highwall for a boxcut panel or in the spoils area for a production panel. The point RC will be under the face opposite the dragface for the first digout of a panel or will be inside the digout area of the preceding digout for the remainder of the panel.

Some general characteristics of elevation data need to be understood for this logic. At any grid point, the model can read three elevations:

EAS - Elevation of the surface

ETC - Elevation of the top of coal

EBC - Elevation of the bottom of coal

If the seam is level, then the bottom of coal is the elevation reference plane and EBC is always 0. If the seam is variable, then EBC is a true elevation.

The depth of overburden (DO) and thickness of the coal seam (TC) can be calculated:

$$DO = EAS - ETC$$

$$TC = ETC - EBC$$

The model has also calculated the thickness of residual coal (FRC) as explained earlier. The "history" of any grid point can be determined from the following table:

<u>TEST CONDITION</u>	<u>HISTORY</u>
TC > FRC	Coal has not been removed
TC = FRC	Coal has been removed
DO > 0	Material lies above coal
*DO > 0 and TC > FRC	Point has not been modified
DO = 0 and TC = FRC	Overburden and coal have been removed
DO > 0 and TC = FRC	Overburden and coal have been removed, but spoils have been placed on residual coal
DO = 0 and TC > FRC	Overburden has been removed, but coal has not

* The results of this test can be ambiguous since the conditions would also apply if the overburden were removed and spoils placed back on top of the coal surface. However, as applied in RTC4, the test results should not lead to conflicts.

The actual thickness of a coal seam at any given grid point could be exactly equal to the model calculated value of FRC. In such a case, the model tests would fail. When the user prepares the input to build the surface array, he should be able to foresee such an occurrence and adjust the elevation data so that the pinched-out seam would be less than FRC feet thick.

The two test grid points are examined to determine the history of the point. If point RS indicates no modification, then the panel is considered a boxcut panel. If point RC indicates no modification, then the digout is considered to be the first in the panel.

The RTC4 logic for detecting lost coal can be explained using Figure 9.4, which shows three different situations that could apply to cross sections of a thick coal seam. For this illustration, the coal face angle was set shallow (60°) to emphasize the coal face. The spoil angle was set at 45° . The coal seam on this scale is about 25 ft thick. The section applies to the spoil side of a production panel. For simplicity only four grid lines are shown.

As in all section diagrams, the reader should understand that this explanation would apply to x points on a y line, or y points on an x line, and the section could be the mirror image of these figures. Also, only one section can apply on a given x line or y line. For testing along the coal face, the model first selects as a reference the nearest grid point that is in the spoil area. In this example, the 40-ft line is the reference line.

In all other section diagrams in this manual, the reference line is the bottom of coal. In these diagrams, the reference line is the top of coal after coal has been removed. In other words, the reference line is FRC feet above the bottom of the coal, or the above the pit floor.

These diagrams have also been drawn with level, uniform-thickness coal seams to simplify the presentation. The routines will recognize variations in thickness and attitude when the model is used with a variable coal seam.

Diagram A shows the first model test at the 10-ft grid. This grid is at least one full grid step from the coal lines. The routine calculates two test elevations to apply to the reference grid. The first test elevation (TSEH - test spoil elevation, high) is found by drawing a line at the spoil angle from the point where the grid intersects the top of coal to the point of intersection with the reference grid. The second test elevation (TSEL - test spoil elevation, low) is found by drawing a line at the angle of the coal face from the bottom of the grid to the top of coal, and then a second line at the spoil angle from this intersection on the coal surface to the point of intersection with the reference grid line. The actual elevation (EAS) of the surface at the reference grid is retrieved and compared to TSEH and TSEL.

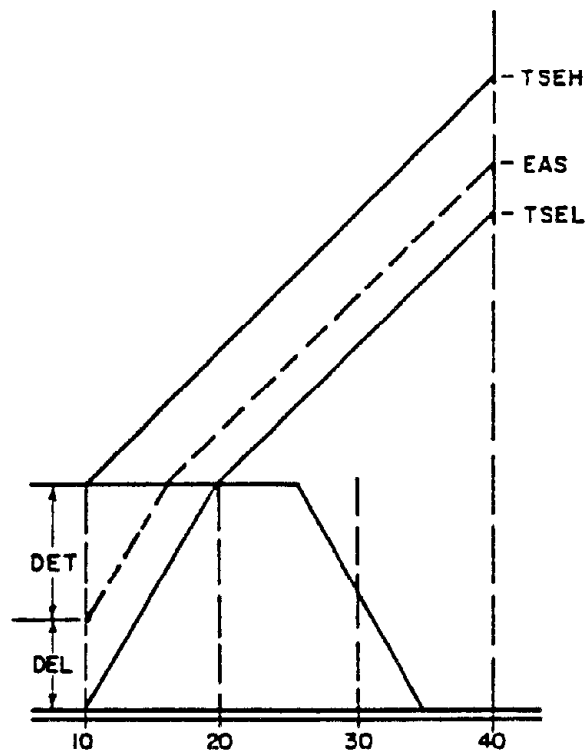


DIAGRAM A

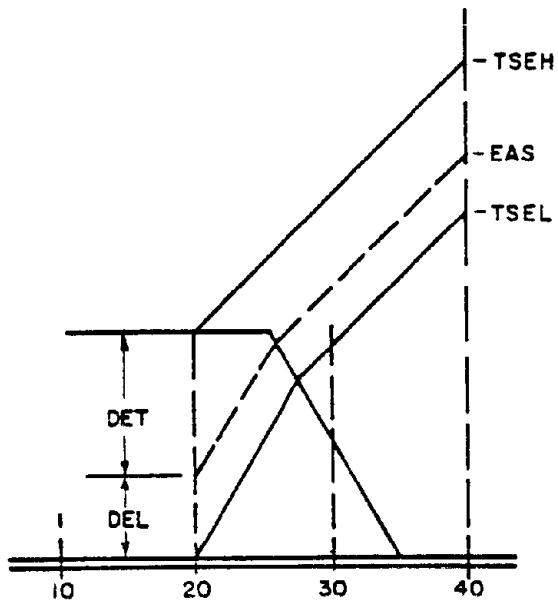


DIAGRAM B

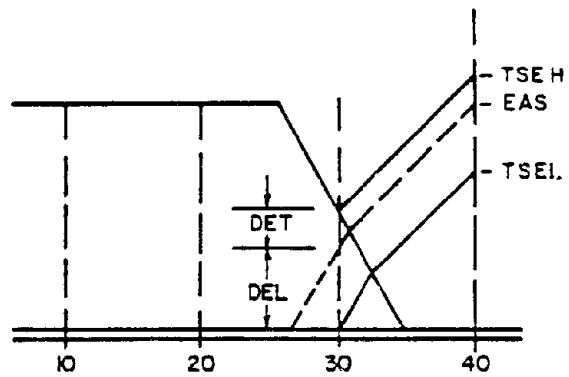


DIAGRAM C

Figure 9.4
Lost Coal Geometry for RTC4

If EAS were greater than TSEH, this point would be covered by spoils and would be rejected by earlier tests. Thus, EAS cannot be greater than TSEH. If EAS is less than TSEL, then the spoils do not interfere with this grid, and the coal would be removed. However, when EAS is between TSEH and TSEL, some portion of the coal at this grid would have to be left in place to support the spoils. The amount of coal to leave is shown by the dashed lines, which were drawn from EAS at the spoil angle to the top of coal, and then from this point at the coal angle to the intersection with the 10-ft grid. The amount of coal that can be removed is DET (delta elevation, taken) and the amount that is left is DEL (delta elevation, left).

The model then makes the second test at the 20-ft line as shown in Diagram B. Again projection lines are drawn to find TSEH and TSEL, and EAS of the reference grid is compared with TSEH and TSEL. This situation differs from the preceding in that the lines to find TSEL pass through the coal face rather than the top of coal. Otherwise, the logic is as described in the preceding paragraph.

The model then makes the third test at the 30-ft grid line as shown in Diagram C. The logic is the same as described before, except that all projection lines pass through the coal face.

While the logic of these diagrams is the same, the geometry that the model solves is not, as shown by the figures.

9.6 COAL FENDERS

The RTC3 routine cannot directly simulate a coal fender; the RTC4 routine can. The height of the fender is specified by RHCFH (rehandle coal fender height) from the 'REHANDLE' card. The RTC4 routine will leave a wedge of coal along the spoil side (i.e., along line HI) when the coal face angle and grid size are such that the routine can recognize the face. Otherwise, the routine will simply leave RHCFH feet of coal at the grids which are closest to the line. When coal is left because RHCFH is not 0, the amount of coal left in place will be considered lost coal.

When the coal seam is variable, the value of RHCFH is compared with the actual thickness of the seam at each grid on line HI. If the specified fender height is greater than the actual thickness, the model will leave an amount equal to the thickness of coal. If the specified height is less than the thickness, the amount left will equal the specified fender height.

DLSS - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)

CASE (DLSDEMO) DEMONSTRATE DLS OPTIONS FOR USER'S MANUAL
THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN

DATE 15:46 OCT 29, '80

PANEL NO. 1 DIGOUT NO. 7

BEGIN REMOVE THE COAL - OPTION 3

XQF, XQL, YQF, YQL	200.0	900.0	300.0	580.0
XMIN, XMAX, YMIN, YMAX	210.0	890.0	310.0	560.0

NOMINAL COAL DIMENSIONS IN FEET 106.4 125.7 20.0 7
RECOVERABLE TONS 54755. 959. 1199

PANEL NO. 1 49840. TONS OF COAL REMOVED FROM SURFACE.

SURFACE NO. 109. MINIMA & MAXIMUM XMIN, XMAX, YMIN, YMAX 210.00 890.00 310.00 560.00

TOTAL COAL TONS & STRIP RATIO 49840. .00
VK = 63420.0
VKS = .000000
VB = 343869.
VBS = .000000
VCS = .000000
VCSS = .000000
VR = 38591.5

Figure 9.5
RTC3 Detail Page

9.7 RTC DETAIL PRINTOUT

The format of the printout from the two RTC routines is the same, but the information may differ due to the differences in the logic. An example page from RTC3 is shown as Figure 9.5 and an example page from RTC4 is shown as Figure 9.6.

The panel and digout numbers remain as set for the last digout. In these figures, RTC3 was called after digout 7 of the first panel, and RTC4 after digout 7 of the second panel. The first detail line prints:

BEGIN REMOVE THE COAL - OPTION (3 or 4)

The text lines print the limits of the search area, XQF, XQL, TQF, and YQL and the limits of modification, XMIN, XMAX, YMIN, and YMAX. In both cases, the modification limits are inside of the search limits, which is normal.

The text NOMINAL COAL DIMENSIONS IN FEET is followed by four values:

- o Average width of digouts
- o Average length of digouts
- o Average thickness of the coal seam
- o Number of digouts from which coal was removed

The "width" and "length" values correspond to panel width and digout length, but which corresponds to which depends on the orientation of the panel relative to the model's x,y system.

The product of length times width times thickness times recovery factor times density (tons/cy) equals RECOVERABLE TONS. The model prints two values after the recoverable tons value CNT and IJCNT. IJCNT is the total number of grid intersections subject to testing, and CNT is the number inside the coal lines. These values simply indicate the number of tests made by the model, but have no real meaning to model results. They also give an indication of the percentage of area modeled which is affected by coal removal.

In the run which developed these figures, LSC = 1 but LOGSF = 0 so the next lines show surface MINIMA & MAXIMA.

The line TOTAL COAL TONS & STRIPPING RATIO prints the tons of coal removed by the routine, and also the ratio of total bank yd³ of overburden from the panel divided by the tons of recovered coal.

DL55 - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)
CASE (DLSDemo) DEMONSTRATE DLS OPTIONS FOR USER'S MANUAL
THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN

DATE 15:46 OCT 29, '80

PANEL NO. 2 DIGOUT NO. 7

BEGIN REMOVE THE COAL - OPTION 4

2	4	3. CUBIC YARDS SPOIL ON	124. TONS RECOVERABLE COAL				
XQF,	XQL,	YQF,	YQL	298.0	900.0	200.0	441.0
XMIN,	XMAX,	YMIN,	YMAX	310.0	890.0	210.0	430.0

NOMINAL COAL DIMENSIONS IN FEET 107.4 100.0 20.0 6
RECOVERABLE TONS 37333. 596. 880

PANEL NO. 2 36836. TONS OF COAL REMOVED FROM SURFACE.

SURFACE NO. 118. MINIMA & MAXIMUM XMIN, XMAX, YMIN, YMAX 310.00 890.00 210.00 430.00

TOTAL CU. YDS. SPOILS ON COAL = 3. TOTAL RECOVERABLE TONS LOST = 124.

NP	ND	DO	SO	VSBY	H&S	R&L	CYCLE	NOS	D.H.	LAY	MAINT	WALK	DIG	TOTAL	TONS	VRBY
2	7	4	0	253413.	19.6	14.0	57.3	7075	2.05	3.95	11.83	1.36	136.57	155.75	36836.	50601

TOTAL COAL TONS & STRIP RATIO 36836. 6.88
INCLUDES REHANDLE (BANK CUBIC YARDS) 50601.
VK = 75740.0
VKS = 66898.1
VB = 167370.
VBS = 208330.
VCS = 10303.6
VCSS = 38818.1
VR = 50601.4

NP	ND	DO	SO	VSBY	H&S	R&L	CYCLE	NOS	D.H.	LAY	MAINT	WALK	DIG	TOTAL	TONS	VRBY
2	7	5	0	253413.	19.6	14.0	57.3	7075	2.05	3.95	11.83	1.36	136.57	155.75	36836.	50601

Figure 9.6
RTC4 Detail Page

Two additional lines appear on Figure 9.6:

2	4	3.	CUBIC YARDS SPOIL ON	124.	TONS RECOVERABLE COAL

TOTAL CU. YDS. SPOILS ON COAL =	3.	TOTAL RECOVERABLE TONS LOST = 124.

This indicates that some spoils covered coal in the fourth digout of the second panel.

Also, two Summary lines are printed on Figure 9.6 but not on Figure 9.5. The Summary line is not printed for a boxcut panel. Since there were only two panels in this run, two lines appear on Figure 9.6 corresponding to the totals for the panel and the totals for the project.

Also, since there was rehandled material on the second panel, the amount is printed as:

INCLUDES REHANDLE (BANK CUBIC YARDS) 50601.

Finally, there are a number of panel summations printed with model variable names as follows:

VK	- Bank yd ³ from keycutting
VKS	- Swelled yd ³ from keycutting
VB	- Bank yd ³ from bailing
VBS	- Swelled yd ³ from bailing
VCS	- Bank yd ³ from chopping
VCSS	- Swelled yd ³ from chopping
VR	- Bank yd ³ of rehandled material

Note that these values print on both figures, i.e., they print for boxcuts also. The values present totals which may be useful since they are not available elsewhere.

10.1 PRODUCTION TIME CALCULATION (PTC) ROUTINE

The model calls the Production Time Calculation (PTC) routine after a spoiling action is completed. When the model parameters call for digging without spoiling, the routine is not called. The routine is also not called where the digging action results in no volume to be spoiled.

The PTC routine determines the cycle time and calculates the number of dragline cycles and total time required for the spoiling action.

The parameters for determining cycle time are specified on the 'RATES' card, as follows:

- DTA - Delay time for acceleration, seconds
- DT - Delta time or time increment, seconds
- DHR - Hoist rate, ft/min
- DPR - Payout rate, ft/min
- DSR - Swing rate, rev/min
- DLR - Lower rate, ft/min
- DRR - Retrieve rate, ft/min
- TDLAG - Drag and fill time, seconds
- TDUMP - Dump time, seconds
- TSPOT - Spot time, seconds

Two other parameters may be used:

- CHAST - Chop; additional spot time, seconds
- RHAST - Rehandle; additional spot time, seconds

The production calculations involve the following parameters:

- DSW - Bucket capacity from 'DRAGLINE2' card
- VSBY - Volume of overburden in bank yd³, as determined by the digging routine
- VRBY - Volume of rehandle material in bank yd³, as determined by the rehandle bail routine
- SM - Swell percentage for overburden from the surface definition or 'SWELL' card (expressed as a decimal fraction)
- DBFK,DBFB - Bucket fill factors from 'COAL LINE' data
- CHBFF - Bucket fill factor from 'CHOP' card
- RHBFF - Rehandle bucket fill factor from 'REHANDLE' card
- DØEK,DØEB - Efficiency factors from 'COAL LINE' data

The digging routines determine three sets of x,y coordinates for bucket positions used by PTC, as follows:

- XBS, YBS - Bucket start position at end of drag and start of hoist and swing
- XBD, YBD - Bucket dump position over center of spoil shape
- XBR, YBR - Bucket return position after return and lower and start of drag

The dump position is determined by the dragline position, its dumping radius, and the user-specified spoil angle or by the extended-bench spoiling routine. The start and return positions are determined differently for chopping than for other digging routine actions.

The chop routine determines the x,y coordinates for the intersection of the two lines; one defines the forward chopping limit and the other defines the side chopping limit. A line is then drawn between this intersection and the dragline center. The bucket positions are placed on this line; start is 1/4 of the distance away from the dragline and return is 3/4 of the distance away from the dragline.

For the other digging actions, the model determines the x,y coordinates of the center of the coal surface to be exposed. A triangle is then formed with the dragface as the base and the center as the apex; the start position is the center of this triangle. Another triangle is formed using the face opposite the dragface as the base and the center as the apex; the return position is the center of this triangle. The model determines cycle times made up of 5 elements (all measured in seconds):

TDRAG - Dragtime; user-set constant

H&S - Hoist and swing time; determined by PTC

TDUMP - Dump time; user-set constant

R&L - Return and lower time; determined by PTC

TSPOT - Spot time; user-set constant

The value of TSPOT will be augmented by the values of CHAST and/or RHAFT when appropriate.

The model first determines the hoist and swing (H&S) time by moving the bucket from the start to the dump position. It then determines the return and lower (R&L) time by moving the bucket from the dump to the return position.

The user-set rates are in units of ft/min or rev/min and are converted to ft/second and degrees/second. The model sets its internal clock to 0 and uses DT as the time increment. As long as the time on the clock is less than DTA (delay for acceleration), the rates are adjusted by dividing by DTA. For each increment on the clock, the movements are determined by multiplying the appropriate rate times DT. During H&S, if the elevation of the bucket is less than the elevation of the surface at the bucket coordinates, the swing motion is stopped. This permits hoist and payout to move the bucket away from the obstruction. During R&L, if the bucket falls below the surface, the clock is stopped and the hoist cable is retracted to its last position. If this does not clear the bucket, the hoist is retracted to another position, etc., until the bucket is clear. Then the clock is restarted and the R&L continued.

The variables involved in PTC are illustrated in Figures 10.1 (cross section) and 10.2 (plan view). The bottom section in Figure 10.1 shows a dragline in position and illustrates the dragline specification data used by the model. The top view shows two of the PTC control variables:

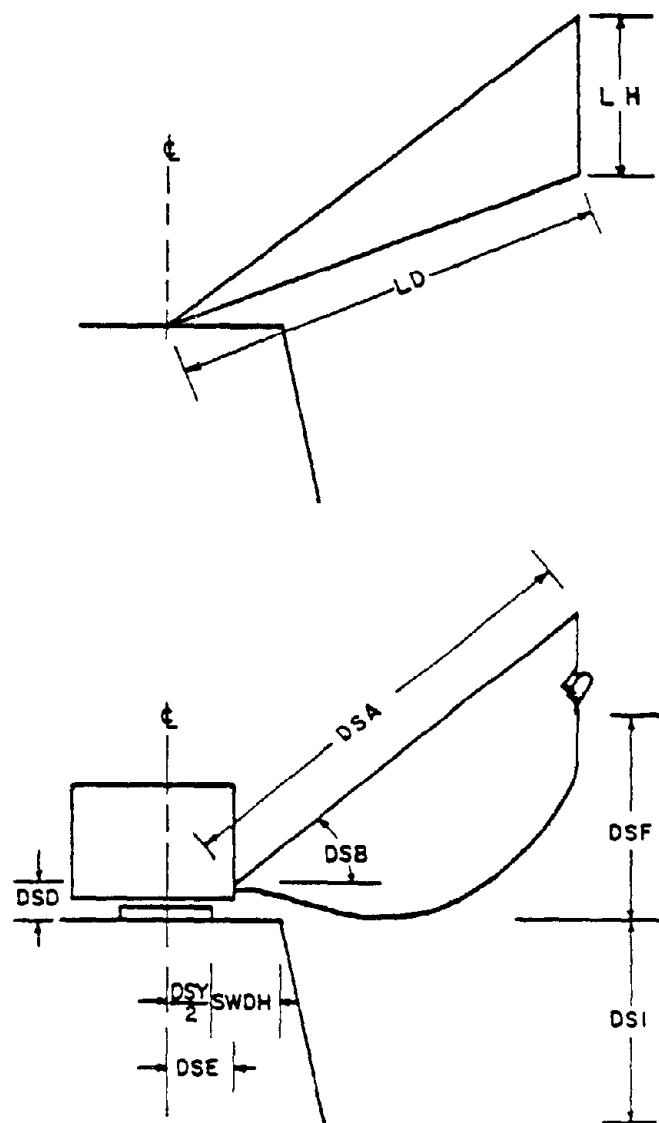


Figure 10.1
PTC Cross Sections

LH - Length of the hoist cable

LD - Length of the drag cable, measured as a straight line to the center of dragline rotation

Figure 10.2 shows a dragline and the starting and dumping position imposed on the plan view of a digout. This figure illustrates the two angles used by the model:

ASB - User-set angle to spoil for bail

AV. SWING - Angle through which the model moves the boom

For this discussion, variable AB measures the angular movement of the boom.

Four sets of x,y,z coordinates are used by the routine:

Dragline center

Bucket start

Bucket dump

Bucket return

The model translates all x,y,z values to a coordinate system with its origin at the point of intersection between the dragline center of rotation and the dragline bench.

The first action compares the bucket start and return positions with the digging depth (DSI) and the dump position with dumping height (DSF). If either of these limits is exceeded, the model prints one of the following messages:

DUMP HEIGHT EXCEEDED P D

DIG DEPTH EXCEEDED P D

where:

P is the panel number and D the digout number.

The model then calculates the cycle time based on the average cycle time for preceding digouts in the panel. If no preceding digouts were timed, the spoiling time is not calculated and the model returns to the main program.

If neither limit is exceeded, the model then calculates values for AP, LH, and LD for the three bucket positions. The H&S position moves the bucket from the start position to the dump position, and the R&L portion moves it from the dump

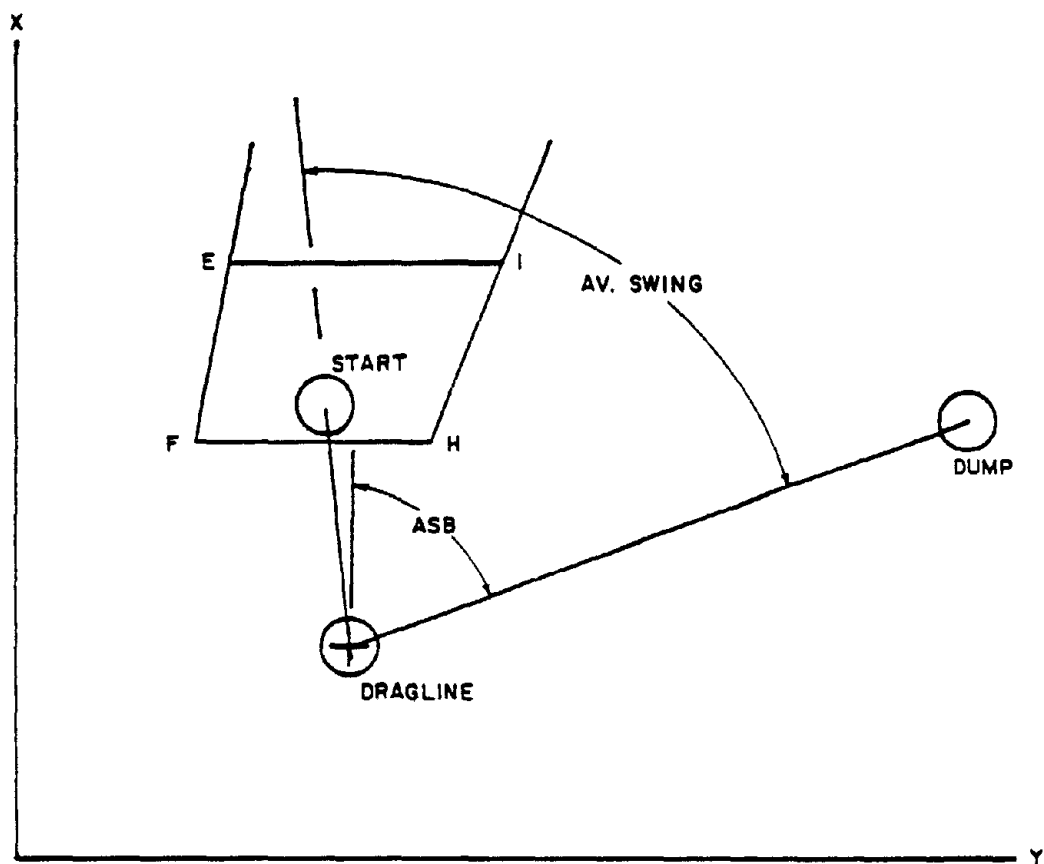


Figure 10.2
PTC Plan View

position to the return position. At each time increment, the model calculates new values of AB, LH, and LD, and compares these values with the calculated ending values.

When one of the variables reaches its limit, the clock for that variable is stopped. When the last of the three reaches its limit, the current value on the clock is the H&S or R&L time. The last motion to reach its end value is said to be the "critical" motion. The model prints two letters on the line with the cycle times (see Chapter 4) to indicate the critical motion. The two letters refer to H&S and R&L, respectively, and will have values as follows:

S - Swing critical

H - Hoist critical

P - Payout critical

L - Lower critical

R - Retrieve critical

The summation of two model-determined times, H&S and R&L, plus the three user-set times, TDRAG, TSPOT, and TDUMP, is the total cycle time in seconds (CTS). The model next determines the volume of material moved on this spoiling action. The total volume removed from the surface is VSBY and the volume of rehandle included, if any, is VRBY. Two spoil volumes are calculated:

$$VR = VRBY (1 + SM)$$

$$VN = (VSBY - VRBY) (1 + SM)$$

where:

VR - Rehandle volume

VN - Normal volume (bank or in-situ volume)

The total volume, VS, is the sum of VR + VN.

The bucket capacity DSW is adjusted by using the appropriate fill factor:

$$CN = (DSW) (BFF)$$

$$CR = (DSW) (RHBFF)$$

where:

CN - Capacity for VN (bank material)

CR - Capacity for VR (rehandle material)

BEGIN PRODUCTION TIME CALCULATION						
BUCKET START	X, Y, Z	280.0	210.0	63.5		
BUCKET DUMP	X, Y, Z	320.0	440.0	66.5		
BUCKET RETURN	X, Y, Z	220.0	220.0	63.6		
AV. SWING ANGLES - H&S, R&L		-65.6	64.0			
TIMES IN SEC.	DRAG	H&S	DUMP	R&L	SPOT	CYCLE
	15.0	18.5	5.0	12.0	3.0	53.5 S L

Figure 10.3
PTC Detail Printout

BFF - Fill factor from the 'KEY', 'BAIL', or 'CHOP' cards as appropriate to the digging

RHBFF - Rehandle bucket fill factor from 'REHANDLE' card

The model also uses two cycle times:

CTSN - Cycle time with normal spot time

CTSR - Cycle time augmented by rehandle additional spot time

The number of dragline swings (cycles) to move the material is:

$$\text{NOSN} = \text{VN} / \text{CN}$$

$$\text{NOSR} = \text{VR} / \text{CR}$$

$$\text{NOS} = \text{NOSR} + \text{NOSN}$$

The total spoiling time in hours, TSH, is:

$$\text{TSH} = \frac{(\text{NOSN}) (\text{CTSN}) + (\text{NOSR}) (\text{CTSR})}{(3600) \text{ DOE}}$$

where:

DOE is appropriate efficiency factor (DOEK or DOEB) from the 'COAL LINE' data

The model also determines a weighted-average cycle time for the action:

$$\text{CTS} = \frac{(\text{CTSN}) (\text{NOSN}) + (\text{CTSR}) (\text{NOSR})}{\text{NOS}}$$

10.2 PTC DETAIL PRINTOUT

An example of the detail from the PTC routine is shown in Figure 10.3.

The model first prints the x,y,z coordinates of the three bucket positions:

- o Bucket Start - End of filling, start of hoist and swing
- o Bucket Dump - Center of spoils
- o Bucket Return - At end of return and lower, and start of drag.

The angles the bucket were moved through are printed as follows:

AV. SWING ANGLES - H&S, R&L -65.6 64.0

The user set spoil angle was 70°, but the model moved the bucket through 65.6° for H&S and 64° for R&L. The negative sign before the 65.6 simply indicates that the direction of rotation was counterclockwise.

The model then prints the five times that make up the total cycle time. The values are followed by the two letters that indicate which motion was critical. In this case, the swing (S) and lower (L) actions were critical.

10.3 CYCLE TIME CALCULATION - INPUT DATA

The Production Time Calculations are based on a number of user-set rates, and time constants. The values for these constants come from manufacturers' specification data or field observations, and must be tempered by engineering judgment. This section describes the data sources and calculations used in the field trials of the DLS model.

Cycle times for the dragline are broken up into 5 separate segments, three of which are constant and two variable. Units are in seconds. The segments are:

Fill time for bucket (TDRAG)	- Constant
Swing to dump	- Variable
Dump time (TDUMP)	- Constant
Swing to return	- Variable
Spot bucket time (TSPOT)	- Constant

The constant times are obtained from field observations and input separately on the 'RATES' card in the program. The variable times are calculated by the simulator from data input as to the hoist (DHR), swing (DSR), payout (DPR), lowering speeds (DLR), and return (DRR) on the 'RATES' card.

For chopping and rehandle, the cycle time can be increased by the constant values CHAST and RHAST from the 'CHOP' and 'REHANDLE' cards.

The data are obtained from manufacturers' curves and suitably adjusted where experience and field observations deem it necessary. The methods of calculation were obtained from the dragline manufacturers and from assessment of the needs of the program.

10.3.1 DELAY TIME FOR ACCELERATION (DTA) (SECONDS)

This value is based on the fact that the different motions such as swing and hoist start from a 0 value and then accelerate to reach their average speeds. Thus there is a certain amount of delay time. This delay time is dependent on a variety of factors such as motor size, moment of inertia, type of motor, etc. The delay for swing is generally the largest; however, for purposes of simplicity, the delay time is considered the same for all motions and the swing rpm (revolutions per minute) calculation suitably adjusted.

A range of 1.5-3 seconds is recommended for DTA values. In general, the smaller machines tend to have a faster response time due to their lower moment of inertia. However, this is not a general rule and values assigned should be checked in the field if possible.

10.3.2 HOIST RATE (DHR) (FT/MIN)

The rate of hoist of the bucket is determined from the Bail Pull vs. Bail Speed (Hoist) curve in (Figure 10.4). First find the rated suspended load for the machine. This is obtained from a notation on the above mentioned curve or from the dragline specification sheet. Locate that value on the Bail Pull axis. Go vertically from that point to the intersection with the curve. From the intersection point, read across horizontally to the vertical curve (Bail Speed) to find the hoist speed in ft/min.

Example: In Figure 10.4 using a suspended load value of 380,000 lbs the hoist speed for Dragline X is found to be 540 ft/min. This would then be used as the input hoist speed (DHR) for that particular dragline.

10.3.3 LOWERING RATE (DLR) (FT/MIN)

The bucket lowering speed is calculated as:

$$\text{Lowering Rate} = (1.8) (\text{Hoist Rate})$$

In actuality the bucket falls by gravity and would, in fact, fall faster than the "Lowering Rate" if not inhibited by the hoist motors release rate.

Example: Lowering Speed for Dragline X is:
 $(1.8) (540) = 972 \text{ ft/min}$

This would then be used as input lowering speed (DLR) for that particular dragline.

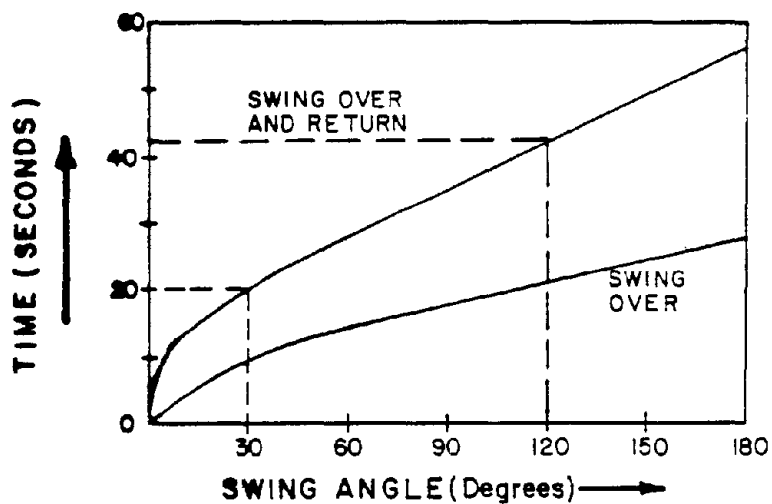
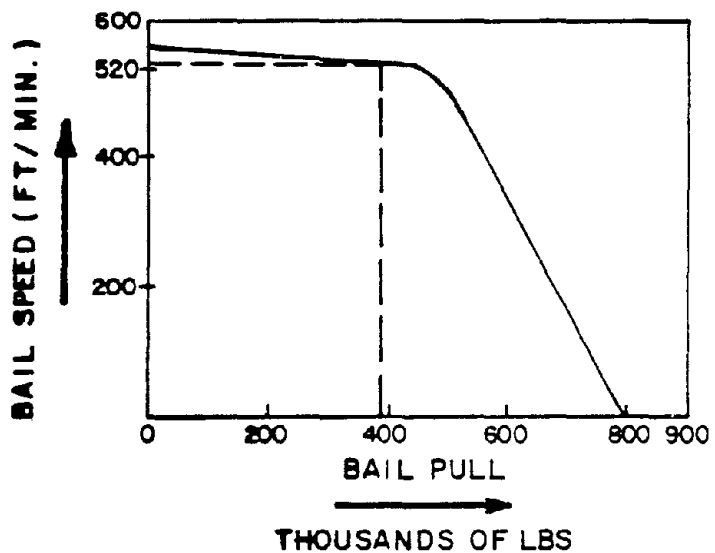
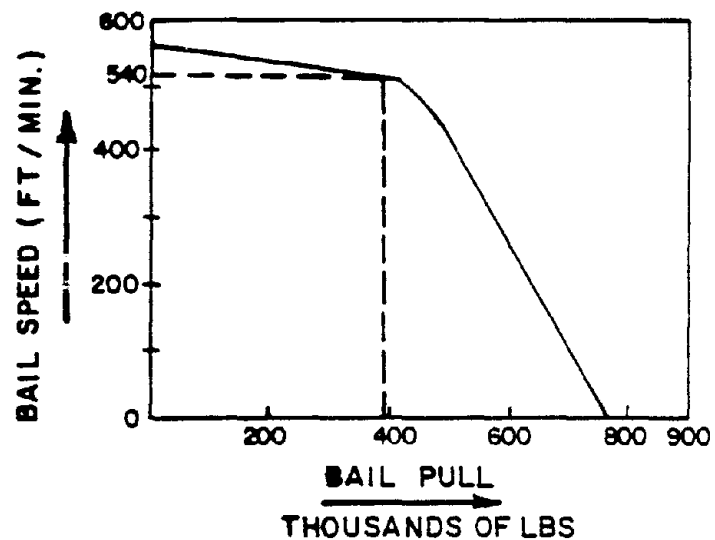


FIGURE 10.4
Machine Rate Curves

10.3.4 PAYOUT RATE (DPR) (FT/MIN)

Payout rate refers to the rate the bucket is let out after filling, as controlled by the drag ropes. It is determined in a similar manner to Hoist Rate from the Bail Pull vs. Bail Speed (Drag) curve, (Figure 10.4). Find the value of suspended load. Locate it on the Bail Pull axis. Go vertically from that point until it intersects the curve. From the intersection point, read across horizontally to the Bail Speed axis. The value obtained is then multiplied by 1.8; generally, a limit of 800 ft/min is considered desirable.

Example: For dragline X
Suspended load 380,000 lbs gives a speed of
529 ft/min
Payout rate = $529 \times 1.8 = 952$ ft/min
However, limit of 800 ft/min is applied so
payout rate (DPR) is 800 ft/min.

10.3.5 RETRIEVE RATE (DRR) (FT/MIN)

This retrieve rate refers to the retrieval of the bucket, i.e., the pulling in of the bucket towards the filling point. The retrieve rate is considered as equal to the payout rate.

10.3.6 SWING RATE (DSR) (RPM)

The calculation for this value has to consider the following points:

- o The input value used has to consider the effect of empty and loaded buckets on swing rate.
- o Due to the high moment of inertia, the largest delay in acceleration of all the motions is that of the swing rate.

The swing rate can be calculated from swing curves obtained from the manufacturers or by observations in the field. Different types of swing curves are available. The one recommended for use is the "Swing Over and Return," which shows the full segment of the swing from start to 180°. The calculations are based on a difference in time over a difference of angle. Generally, an angular value should be taken which is an even divisor of 360° and should include portions of both the straight and curved segments of the curve, e.g., 120°, 180°. The recommended value is 120°.

For a swing over and return curve, the following formula is used:

Revolutions per minute (RPM)

$$= 1 \div \frac{\text{Time difference (seconds)}}{60 \text{ sec}} \times \frac{360}{(\text{Angle difference}) (2)}$$

Fig. 10.4 shows both "swing over and return" and "swing over" curves. Two points are selected for the angular difference on the horizontal axis. The time difference is found on the vertical axis and the rpm calculated as below:

<u>Angle</u>		<u>Time</u>
30°	—	20 seconds
120°	—	42 seconds
Difference 90°		22 seconds

$$\begin{aligned} \text{RPM} &= 1 \div \left[\left(\frac{22}{60} \right) \left(\frac{360}{(90) (2)} \right) \right] \\ &= 1.36 \end{aligned}$$

For the "swing over" curve, the following is used:

$$\text{RPM} = 1 \div \frac{\text{Time difference (seconds)}}{60 \text{ sec}} \times \frac{360}{(\text{Angle difference})}$$

The third method would use actual field observation when the dragline bucket is in pure swing motion. By using a stopwatch and estimating swing angles, an RPM value can be determined.

WALK AND MAINTENANCE (W&M) ROUTINES

11.1 W&M OPTIONS AND PARAMETERS

In an operating pit, dragline maintenance is usually scheduled at regular intervals, such as the day shift on Friday. In the DLS model, this schedule can be simulated by scheduling maintenance to occur after a specified number of operating hours. In the model, operating hours include time spent walking, deadheading, and spoiling. A simulation run may cover a small time period where the total number of operating hours would not result in correct accounting for maintenance time. To account for maintenance in such cases, maintenance time can be calculated as a fraction of operating hours.

When the direction of dragline advance reverses for each panel, the dragline must wait at the start of the new panel for coal to be loaded from the last digouts in the preceding panel. In this case, maintenance is usually scheduled to occur while the dragline is in the wait mode. This scheduling can also be simulated in the DLS model.

The 'MAINTENANCE' card is summarized in Table 4.15 and the 'WALK' card in Table 4.28. The actions of the routines are summarized in the following paragraphs with more detail given in following sections.

The walk option, LOW, may be set to 0, 1, or 2; 0 means "do not calculate movement times" and 1 or 2 means "do calculate movement times." The difference between LOW = 1 and LOW = 2 is that maintenance time will be calculated also when LOW = 2 and LOM = 1.

The maintenance option, LOM, may be set to 0, 1, or 2; 0 means "do not calculate maintenance times" and 1 or 2 means "do calculate maintenance times." When LOM = 1, the model will "schedule" (i.e., calculate) TFMH (time for maintenance in hours from the 'MAINTENANCE' card), hours of maintenance after every TBMH (time between maintenance periods in hours from the 'MAINTENANCE' card), hours of operating time. When LOM = 1 and LOW = 2, the model will schedule TFMH hours of maintenance at the start of a panel, regardless of the number of operating hours.

Walk option 1 is normally used when the direction of advance remains the same for the new panel as for the previous panel. Option 2 is normally used when the direction of advance reverses, the dragline deadheads to its new position, schedules TFMH hours of maintenance, and then waits for coal to be loaded out of the panel. The total time to wait (WTH - wait time in hours from the 'WALK' card) is adjusted by the time required for deadheading and maintenance.

With either walk option, the model accumulates movement times under one of two categories:

- o Deadheading - Time to move to the first position in a panel
- o Walking - Time for any other movement

11.2 W&M CALCULATIONS

The model uses several counters to collect the several categories of time (all in hours). The times are printed on the summary lines which are described elsewhere. For this discussion, we will call the time counters by the headings under which they are printed on the summary, as follows:

- LAY - Layover; time waiting for coal loadout
- D.H. - Deadhead; time for deadheading movements
- MAINT - Maintenance; time for maintenance
- WALK - Walk; time for walking movements
- DIG - Digging/spoiling; time for the spoiling operation

When a dragline moves from one position to another, it walks. The time for movement may be accounted for as "walking" time or "deadheading" time. The definition of these terms is not uniform in the industry. In the DLS model, they are defined as follows:

- o Deadhead time is time required to move to the first position in a panel
- o Walk time is the time required for any other movement

The W&M options control the manner in which walking and maintenance times are calculated. They have no effect on dragline movements. The model will move the dragline between digging operations regardless of the settings of these options.

The logic for determining moving distance can be explained from the plan view in Figure 11.1. Three dragline positions shown on this view are labeled: A, B, and C. Two potential walking patterns are shown, one from A to B and the other from A to C. The parameter WANG is also shown on this figure. It defines the angle between two lines drawn from the dragline center of rotation; one line is parallel to the dragface, and the other is WANG degrees away. The parameter is intended to specify the angle at which the dragline would normally move away from the dragface.

The diagrammed move from A to B might be from a bail position to the next keycut position. The machine would move at the angle, WANG, until over the coal line for the highwall and then move back the required distance from the new dragface. The diagrammed move from A to C might be a move to a new position but not to the next digout.

When the walk routine is called, it is given two sets of x,y coordinates: one defines the FROM position and the other defines the TO position. The model calculates the angle included between the line parallel to the dragface and the line from A to C in the figure. If the calculated angle is less than WANG, the distance moved will correspond to the A-C line; otherwise the distance will correspond to the A-B line.

The parameters, XPP and YPP, from the 'WALK' card specify the position of the dragline at the start of a simulation run. These coordinates are used by the model for the first movement made in the run. When the first panel is a boxcut, these parameters can be set to 0, since times involved in a boxcut are not included in project totals. Also, the parameters can be set to 0 when the walk option (LOW) is set to 0. However, when the first panel is not a boxcut and the option is not 0, the values of XPP and YPP define the coordinates of the A position in Figure 11.1.

After the first move is made, the model will keep track of the dragline positions and properly define the FROM and TO positions for dragline movements.

After determining the distance for a move, the model calculates the time required to make the move as follows:

$$NSTEP = \frac{INT (DIST + .999)}{DSM}$$

$$TIME = \frac{(NSTEP) (DSM)}{(DSN) \frac{(5280)}{(60)}}$$

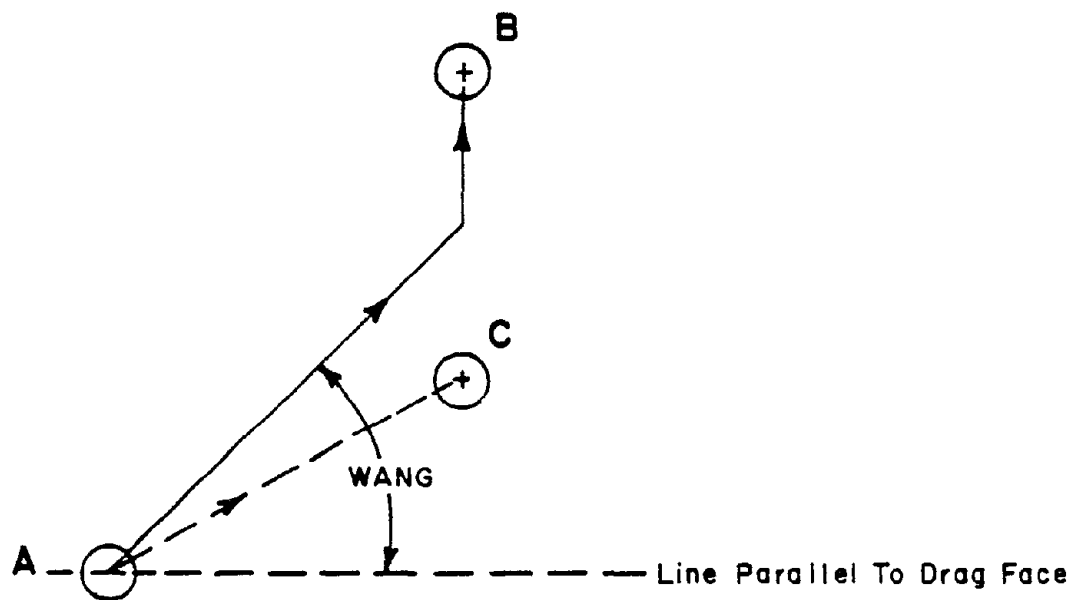


Figure 11.1
Walk Plan View

where:

- NSTEP - Number of steps (rounded up to the next integer)
- DIST - Move distance in ft
- DSM - Step length in ft from the 'DRAGLINE2' card
- DSN - Walking speed in mph from the 'DRAGLINE2' card
- 5280/60 - Converts mph to ft/min
- TIME - Movement time in minutes

If this is the first move in the panel, the time is called deadhead time:

$$D.H. = \frac{(TIME) (DHMF) + DHAF}{60}$$

Alternately, the time is called walk time:

$$WALK = \frac{(TIME) (WMF) + WAF}{60}$$

WMF and DHMF are reciprocal efficiency factors used to relate the dragline's rated walking speed with actual speeds noted in the field. When walking in the digout, most draglines achieve up to 60-75% of the rated speed. These correspond to WMF factors of $1/0.6 = 1.67$ or $1/.75 = 1.33$. If deadheading the actual speed (including all delays) varies from 10 to 30% of rated speed, this corresponds to DHMF of $1/.1 = 10$ or $1/.3 = 3.33$. The walk time addition factor WAF and DHAF can be used as the time lost in initial setups. For example, if 1 minute is lost before walking in the digout starts, $WAF = 1$.

When the movement is to start a new panel, the model checks the setting of LOW and LOM. If $LOW = 2$, layover is to be scheduled. The model will set the current value of $LAY = WTH - D.H.$. If $LOM = 1$, maintenance time will be calculated as $MAINT = TFMH$, and LAY will be decreased by the same amount.

When the maintenance routine is called, the model checks the value of LOM. If LOM = 0, no action takes place. If LOM = 1 and maintenance has already been calculated for this move, no action takes place. However, when LOM = 1 and maintenance has not been calculated, the model determines if it is time for a maintenance period. The model uses an internal counter HSLM (hours since last maintenance) for this calculation. At the start of the simulation run, and at any time when maintenance is scheduled, this counter is set to 0. Thereafter, this counter always contains the summation of WALK, D.H., and DIG times. If the current value of HSLM is greater than TBMH (time between maintenance periods), maintenance is scheduled, and MAINT = TFMH (time for maintenance period). Then the counter is reset to zero.

The DLS model moves the dragline to its digging position, makes the dig, and then calculates the walking and maintenance times. This is done to be sure the model does its accounting correctly when chopping is involved in a simulation run. If the surface is variable, chopping may not be necessary for one or more digouts. Actually, the model calls its chopping routine to make a digout, and then learns that there is no material to chop. In this case, the model simply moves to the next action specified by the user's controls. If the walk time had been calculated prior to the chopping, the model would have made an unnecessary move and the accounting would be incorrect.

11.3 W&M DETAIL PRINTOUTS

In the normal simulation run, the W&M options are set once for the entire run. Even when the first panel is a boxcut, it is convenient to set the options at the start, rather than set them off for the boxcut and reset them for the production panels. Since the calculations made for a boxcut are not included in the project totals, the extra calculations resulting from this procedure have no effect on the final answers.

For illustration, a case was set up that uses all of the options. Selected portions from that output are reproduced and explained in the following paragraphs. The reproductions include, first, the 'MAINTENANCE' and 'WALK' lines from the CP listing, and then the printouts from the walk and maintenance routines.

MAINTENANCE	LOM	TBMH	TFMH
	1	10.0	2.0

WALK	LOW	XPP	YPP	WANG	WMF	WAF	WTH	DHMF	DHAF
	1	.0	100.0	60.0	1.200	.0	4.00	2.500	3.0

BEGIN WALK TIME ROUTINE

XFP	YFP	XTP	YTP	X-DIS	Y-DIS	D-DIS
.0	100.0	407.0	427.9	407.0	327.9	522.7

DEADHEAD	STEPS	FEET	MIN.	HRS.
	92	457.7	90.1	1.50

The lines above apply to the first move in the boxcut panel. Since LOW = 1, the movement time is called DEADHEAD time. Even though LOM = 1, there is no maintenance time in this set because the total working time so far is only 1.5 hrs and the value of TBMH is 10 hrs.

The values of XPP and YPP are the coordinates that were entered on the 'WALK' card, since this is the first move in the simulation run.

MAINTENANCE	LOM	TBMH	TFMH
	1	10.0	2.0

WALK	LOW	XPP	YPP	WANG	WMF	WAF	WTH	DHMF	DHAF
	1	707.0	427.9	60.0	1.200	.0	4.00	2.500	3.0

BEGIN WALK TIME ROUTINE

XFP	YFP	XTP	YTP	X-DIS	Y-DIS	D-DIS
707.0	427.9	407.0	327.9	-300.0	-100.0	316.2

DEADHEAD	STEPS	FEET	MIN.	HRS.
	64	315.5	63.6	1.06

MAINTENANCE TIME IN HOURS 4.00

The lines above apply to the first digout in the second panel. The options remain at 1. The movement time is again DEADHEAD time. The dragline has been moved from the end of the preceding panel (coordinates 707, 427.9) to the start of this panel (coordinates 407, 327.9). The values of XPP and YPP are current values rather than those which were entered on the 'WALK' card. Unlike the previous boxcut panel where no spoiling took place, the model has spoiled this digout and is able to calculate maintenance time. We can assume from the maintenance time of 4 hrs, that the total working time in this digout was more than 20 hrs, since the model schedules 2 hrs maintenance after every 10 working hrs.

MAINTENANCE	LOM	TBMH	TFMH
	1	10.0	2.0

WALK	LOW	XPP	YPP	WANG	WMF	WAF	WTH	DHMF	DHAF
	1	607.0	327.9	60.0	1.200	.0	4.00	2.500	3.0

BEGIN WALK TIME ROUTINE

XFP	YFP	XTP	YTP	X-DIS	Y-DIS	D-DIS
607.0	327.9	707.0	327.9	100.0	.0	100.0

WALKING	STEPS	FEET	MIN.	HRS.
	20	100.0	9.1	.15

MAINTENANCE TIME IN HOURS 2.00

The above lines apply to a digout in the production panel.
The option numbers remain at 1. The differences between this
set and the previous are that the movement time is classed as
WALKING time and the maintenance is only 2 hrs.

MAINTENANCE	LOM	TBMH	TFMH
	2	10.0	2.0

WALK	LOW	XPP	YPP	WANG	WMF	WAF	WTH	DHMF	DHAF
	1	707.0	327.9	60.0	1.200	.0	4.00	2.500	3.0

BEGIN WALK TIME ROUTINE

XFP	YFP	XTP	YTP	X-DIS	Y-DIS	D-DIS
707.0	327.9	393.0	227.9	-314.0	-100.0	329.5

DEADHEAD	STEPS	FEET	MIN.	HRS.
	66	329.5	65.6	1.09

COAL LOADOUT LAYOVER AND MAINT. -HRS. .91 2.00

The lines above apply to the first digout in the third panel. In this case, the direction of advance was reversed from the preceding panel, and the walk option was set to 2. This calls for 4 hrs waiting for coal loadout with 2 hrs of maintenance. The actual time for layover is shown as 0.91 hrs since 1.09 hrs were used for deadheading and 2 hrs used for maintenance.

MAINTENANCE	LOM	FMT							
	2	.05							
WALK	LOW	XPP	YPP	WANG	WMF	WAF	WTH	DHMF	DHAF
	1	293.0	227.9	60.0	1.200	.0	4.00	2.500	3.0
BEGIN WALK TIME ROUTINE									
	XFP	YFP	XTP	YTP	X-DIS	Y-DIS	D-DIS		
	293.0	227.9	193.0	227.9	-100.0	.0	100.0		
WALKING	STEPS	FEET	MIN.	HRS.					
	20	100.0	9.1	.15					
MAINTENANCE TIME IN HOURS				0.97					

The above lines apply to a later digout in the third panel. The maintenance option has been changed to 2 to illustrate the use of the maintenance multiplier. In this illustration, the user has specified 3 minutes of maintenance (FMT = .05) for every working hour, and the result is .97 maintenance hrs.

Two programs or models in the DLS system can use a plotter to prepare graphic representations of the DLS problem. The graphics models are:

1. Draw Isometric Projection (DIS), which processes a surface array to develop an isometric projection of the surface. The projection may represent the starting surface, or the surface after modification by the DLS model.
2. Plot Plan View (PPV), which draws a plan view of the panels to be stripped in a DLS run.

12.1 DRAW ISOMETRIC SURFACE (DIS) CONTROLS

This model processes surface arrays from files created by the DDM Sequence or a DLS run. Isometric projections can be made of any or all surfaces contained in the file, and several projections may be made from each surface array.

The plotter diagram has two dimensions, while the surface array has three. The model translates the three dimensions into the two by projecting one axis "into" the paper using one of the following axis systems:

The vertical axis on the projection is always the z (elevation) axis from the surface array. The horizontal axis will be the surface x or y and the other will be projected into the page.

When the user sets up the input to the DDM Sequence, he specifies the origin of the grid as being at the NE, NW, SE, or SW corner of the map. When the projection is made, the user specifies a desired viewpoint, i.e., from the side of the grid where he wants to view the projection. The model will correctly orient the drawing for this viewpoint.

The user also specifies the extent of the surface array included in the projection. To do so, he specifies the coordinates of the first and last x lines to be drawn and the coordinates for the first and last y lines. In this specification, "first" means lowest and "last" means highest; the model will print the lines from high to low or low to high as appropriate to the specified origin and viewpoint.

The user also specifies the desired interval between lines included in the projection so that the diagram can show every line, every other line, or every third line, etc.

The user specifies the value of THETA, which can vary from 0° through 180°. When THETA is 90°, the projection viewpoint is from the midpoint of the horizontal axis, and every line is a true cross-section line. As THETA varies on either side of 90°, the effect is to move the viewer along the axis either right or left of the midpoint.

Finally, the user specifies the desired scale factors to convert surface feet to diagram inches. Three factors are provided so that the x,y,z data can be scaled independently. Of course, different factors for x and y would likely be more confusing than helpful, but a smaller factor for elevations would exaggerate the topography and could be useful.

In addition to the ft/in scale factors, the user can set an overall multiplier, PFACT. The coordinate scale factors control the projection size, but not the size of the lettering on the diagram. PFACT alters letter size also.

12.2 DIS CONTROL PARAMETERS

The single DIS control card is summarized in Table 12.1, and the parameters are described in the following paragraphs. This card, except for columns 1-6, is a free-format card like the DLS control cards. Briefly, the numeric values are

Table 12.1 The DIS Control Card*

Name	Value	Meaning
ID		Four-character diagram identifier - Must be in Columns 1-4
KVP		Position of viewer - Must be in Column 6
	S	View from south
	N	View from north
	W	View from west
	E	View from east
SNR		Requested surface number
XF		Coordinate of first desired x line
XL		Coordinate of last desired x line
XS		Desired interval between x lines
YF		Coordinate of first desired y line
YL		Coordinate of last desired y line
YS		Desired interval between y lines
FC	Ft	Offset for z elevations
SCLA	Ft/in	Scale factor for y lines
SCLB	Ft/in	Scale factor for x lines
SCLC	Ft/in	Scale factor for elevations
THETA	Degrees	Projection angle
KAXIS	0	Do not draw axis on diagram
	1	Do draw axis on diagram
PFACT		Multiplier to alter diagram size

*For IBM version all alpha input must be enclosed in quotes e.g. 'S'

entered in the order in which they are listed in Table 12.1 and are separated by one or more blank columns. The CDC version does not allow free format. The DIS control card inputs must conform to the following format: A4, 1X, A1, 12F5.0, 15, F5.0.

The ID must be in columns 1-4 and KVP must be in column 6.

The control file consists of one control card for each desired projection. The control cards must refer to surfaces in the same sequence in which the surface arrays were placed in the file, by either the DDM Sequence or the DLS model.

If more than one projection is made from one surface array, the control cards must be consecutive, i.e., control cards with higher surface numbers should follow control cards with lower surface numbers.

1. ID - Diagram identifier

The ID may be any four characters and is used to identify the diagram.

2. KVP - Viewpoint

The viewpoint must be N, E, S, or W.

3. SNR - Requested surface number

The surface number must refer to a surface array in the surface file. Both the DDM Sequence programs and the DLS model print the surface number when a surface array is written to a file.

4. XF, XL, XS - X coordinates and interval

The coordinates of the first (lowest) x line is XF and of the last (highest) is XL. These values need not be precise since the model will find the lines which are closest to the specified values. This permits the use of -9999 and 9999 as XF and XL to call for all lines. To determine the number of lines to be drawn, the model calculates two step intervals

$$JBS = XS / XS \text{ (DDM)}$$

$$IAS = YS / YS \text{ (DDM)}$$

where:

XS (DDM) and YS (DDM) refer to the steps that were specified in the DDM Sequence. Both IAS and JBS

are integer numbers so that any fractional part of the result is lost. Thus, the quotients cannot be less than 1.

5. YF, YL, YS - Y coordinates and interval

The discussion in the preceding paragraph applies to these values for the y lines.

6. FC - Offset for elevations

The position of the diagram relative to the diagram origin depends on the magnitude of the elevations and scale factors. The user can reduce the distance between diagram and origin by making an appropriate entry for FC. For example, if the lowest surface elevation in an array is 800 ft, the user might set FC = 750.

7. SCLA, SCLB, SLCC - Scale factors

The units of these scale factors are desired surface feet to diagram inches, e.g., 400 would mean 400 ft/in. It should be noted that the three factors apply to y,x,z in that order; the x and y are reversed from the normal sequence.

8. THETA - Projection angle

THETA may range from 0° through 180°. The user may need to experiment with different THETA values to find the projection that is most satisfactory.

9. KAXIS - Axis control

A 0 entry will suppress the axes and an entry of 1 will print them.

10. PFACT - Plot factor

The plot factor is an overall multiplier. A "normal" size diagram is drawn when PFACT = 1. The diagram will be reduced if PFACT is less than 1, and expanded if PFACT is greater than 1. PFACT alters both the diagram size and the letters printed along the axis and used as titles. The user may wish to experiment with scale and plot factors to find the desired diagram size.

```

DRAW ISOMETRIC SURFACE
11:01 NOV 07,'80

      8      14      1      14      1      8      1      112      4      118      43
      .0 140.0 20.0      .0 260.0 20.0 1.0 -1.0 1.0 0.
      0.      800.
KVP PSN XF XL XS
S 1000. YF YL YS FC
      .0 140.0 20.0 .0
      SCLA SCLB SCLC THETA KAXIS
      50.0 50.0 100.0 70.0 1 1.00

IAS = 1
JBS = 1
FA = .000000
FB = .000000
DA = 1.00000
DB = 1.00000
KPSW = 1
CASE 12.1 SUR NO 1000. - SOUTH
IZ = 1
JZ = 1
Z = 118.800
YZ = 1.16800
XN = .000000
XX = 4.57851
YN = .750000
YX = 5.26140
PFACT = 1.00000
XORG = .000000
YORG = .000000

```

Figure 12.1
DIS Model Printout

12.3 DIS MODEL PRINTOUT

The printout from the DIS model is illustrated in Figure 12.1. Normally this printout is of no value to the user since the projection presents the real picture. The printout is useful when the user makes an error in a control card.

The first three lines print a series of numbers with no titles. The system programmer can interpret these values if the user is unable to understand why a DIS run is not successful.

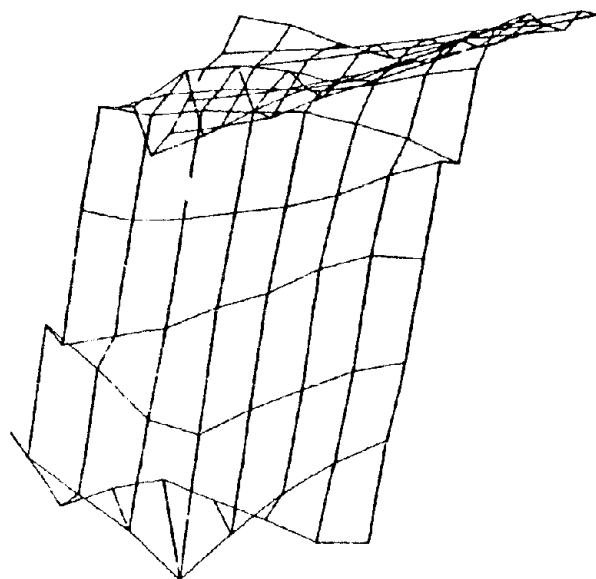
The next lines reprint the information from the control card with the code names printed above the values. The names are not lined up with the values, but the values can be read by the sequence in which names and values are printed.

One line prints the ID, surface number, and viewpoint as follows:

CASE 12.1 SUR NO 1000. - SOUTH

The rest of the printout consists of variable names followed by values, as follows:

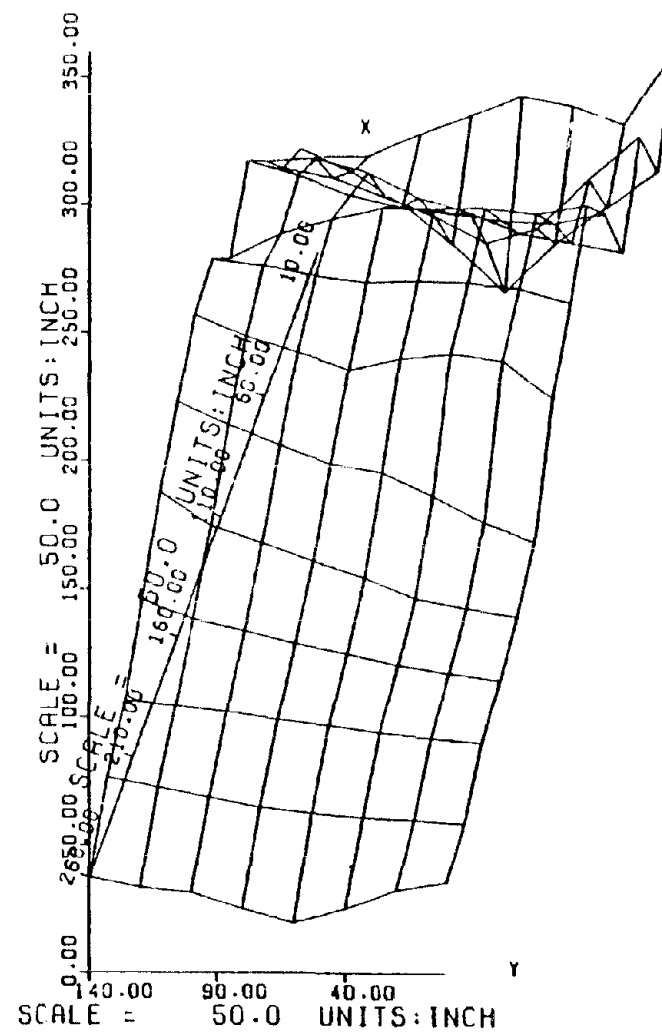
IAS	- Interval for y lines
JBS	- Interval for x lines
FA	- Y coordinate of the diagram origin
FB	- X coordinate of the diagram origin
KPSW	- 1, if surface x is horizontal axis, and 2 if y is the horizontal axis
IZ, JZ	- Indices of surface x,y coordinates at the diagram origin
Z	- Elevation at IZ, JZ
YZ	- Elevation in diagram inches
XN, XX	- Low and high values in inches for horizontal axis
YN, YX	- Low and high values in inches for vertical axis
PFACT	- Final plot factor (see paragraph below)
XORG, YORG	- Diagram origin in inches



CASE 12.1 SUR NC 1000. - SOUTH

14:42 NOV 07, '90

12.1 S 1000 0 260 20. 0 140 20. 0 50 50 50 70 0 1.0



CASE 12.2 SUR NO 1000. - NORTH

14:42 NOV 07, '90

12.2 N 1000 0 260 20. 0 140 20. 0 50 50 50 70 1 1.0

Figure 12.2
Isometric Projection - Example 1

The PFACT value is reprinted since it might be adjusted by the model. If the user defines scale and plot factors so that the diagram exceeds the paper size, the model will reset PFACT to fit the page.

12.4 EXAMPLES OF DIS CONTROLS AND PROJECTIONS

Isometric projections made from surfaces modified by the DLS model are contained in other chapters and in Appendix C. This section contains projections made from the topographic surface shown in Figure 5.1. These examples are included to show the results of using different values for KVP (the viewpoint), THETA (the projection angle) and KAXIS (the axis control).

All figures show that the program prints three lines below the projection (taken from Figure 12.2):

1. CASE 12.1 SUR NO 1000 - SOUTH

The case ID is 12.1, the surface number is 1000, and the viewpoint is from the south.

2. 14:42 Nov 07, '80

The program was executed at 14:42 hours on November 7th.

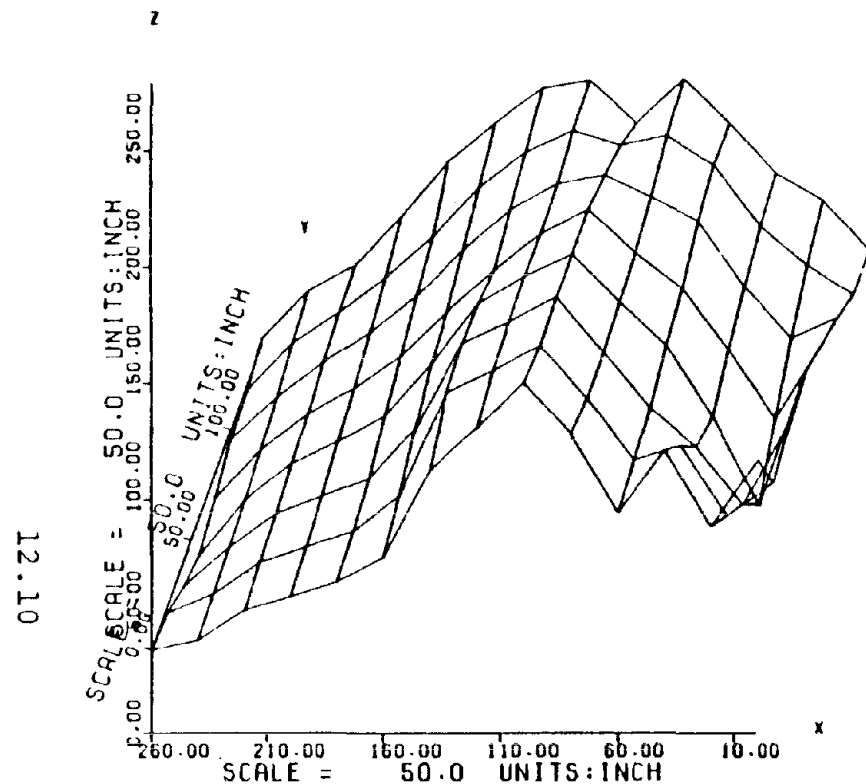
3. 12.1 S 1000 1000 0 260 20. 0 140 20. 50 50 50 70 0
1.0

The input control card is printed for reference. Normally, this line is cut from the diagrams. It is useful to know the values that were specified on the control card for a figure.

In all of these projections, the scale factors were set to 50 ft/in, and PFACT was set to 1; however, the diagrams were reduced to 64% full-size for reproduction.

The viewpoint is from the north and south in Figure 12.2 and from the west and east in Figure 12.3. The axes were drawn on all projections except the one from the south. The axes tend to over-complicate the diagram; therefore, they are normally suppressed.

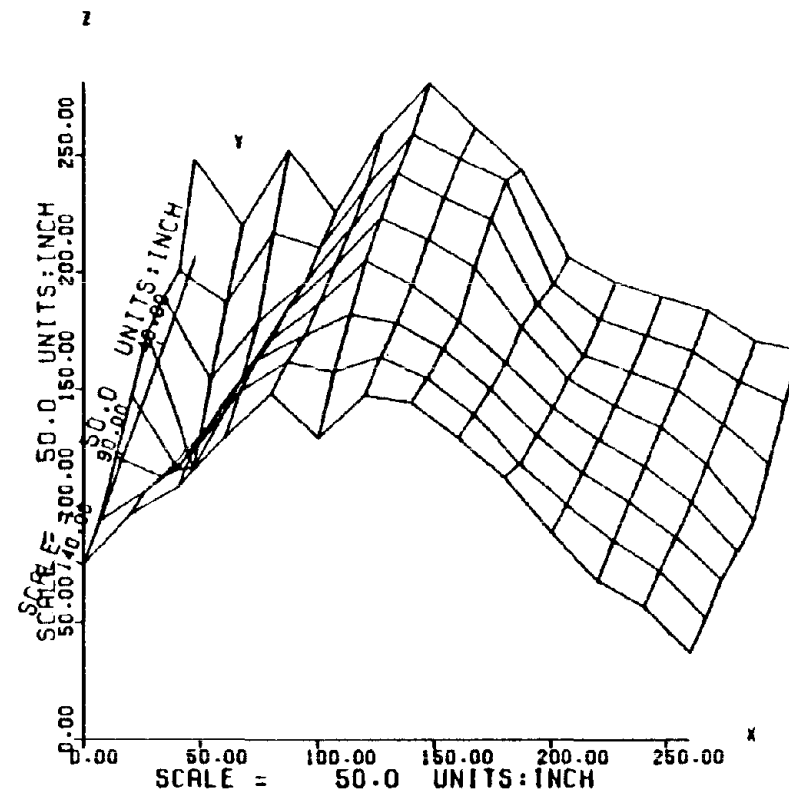
Figure 12.4 and 12.5 illustrate setting THETA to 0° (CASE 12.6), 90° (CASE 12.5), and 180° (CASE 12.7). For this particular surface, the "cross section" projection (CASE 12.5) is clear of hidden lines, but that would not be the usual case for a DLS modified surface.



CASE 12.3 SUR NO 1000. - WEST

14:42 NOV 07. '80

12.3 W 1000 0 260 20. 0 140 20. 0 60 60 60 70 1 1.0



CASE 12.4 SUR NO 1000. - EAST

14:42 NOV 07. '80

12.4 E 1000 0 260 20. 0 140 20. 0 60 60 60 70 1 1.0

Figure 12.3
Isometric Projection - Example 2

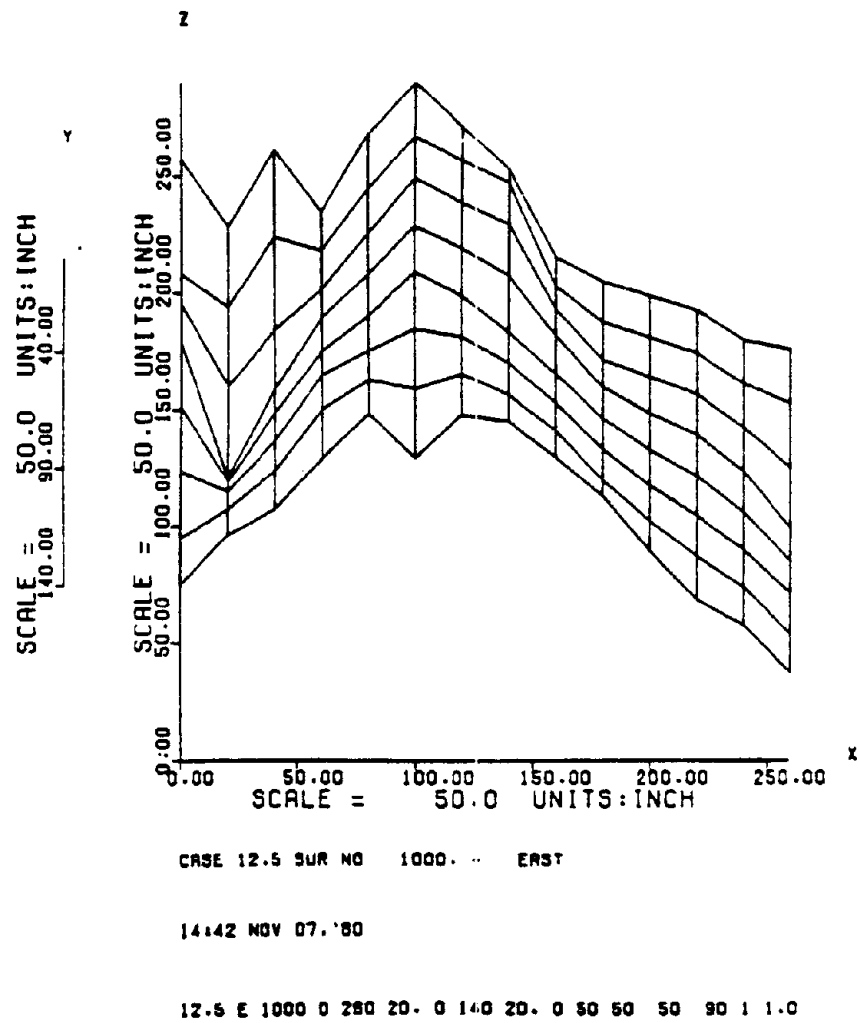
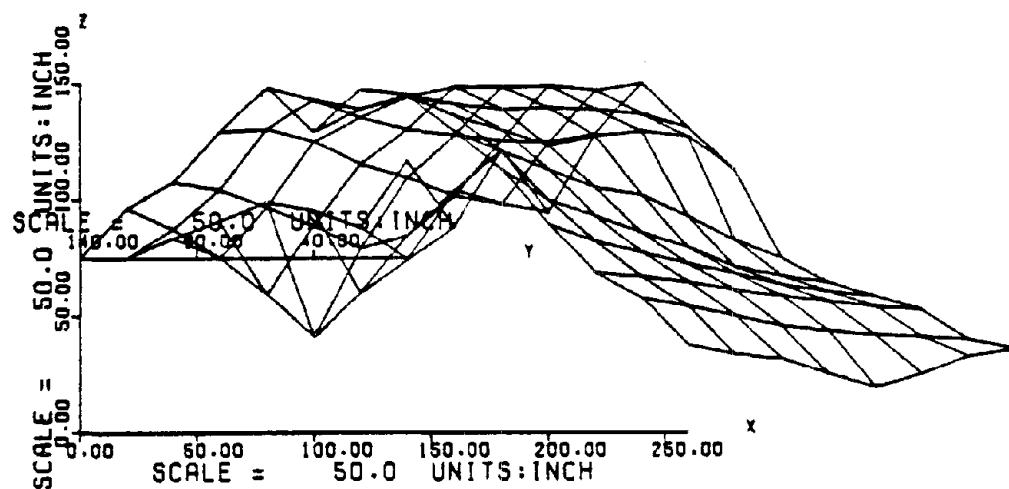


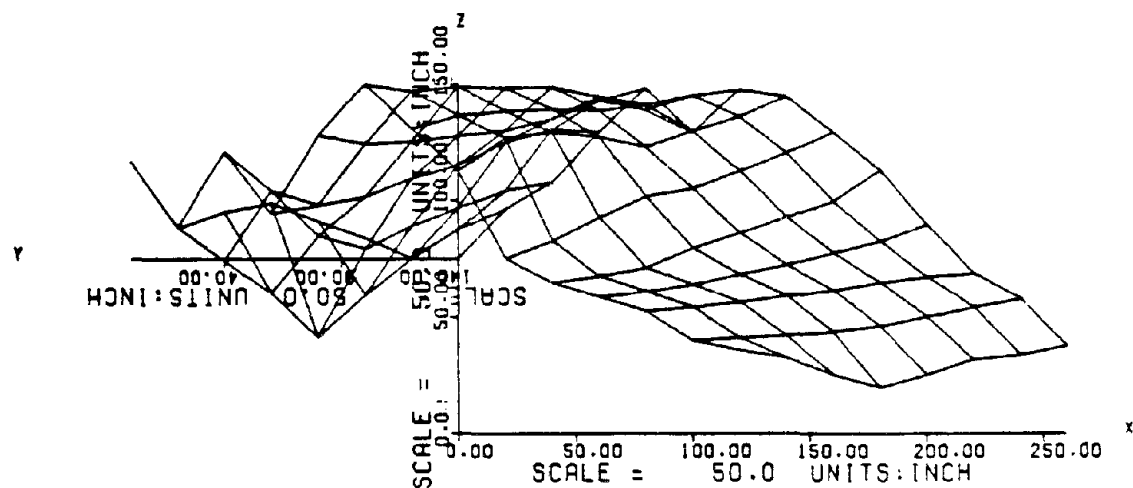
Figure 12.4
Isometric Projection - Example 3



CASE 12.6 SUR NO 1000. - EAST

14:42 NOV 07.'80

12.6 E 1000 0 260 20. 0 140 20. 0 50 50 50 0 1 1.0



CASE 12.7 SUR NO 1000. - EAST

14:42 NOV 07.'80

12.7 E 1000 0 260 20. 0 140 20. 0 50 50 50 180 1 1.0

Figure 12.5
Isometric Projection - Example 4

These projections illustrate the controls. The user should experiment to see how these controls alter the projections of the simulated dragline pit.

12.5 PLOT PLAN VIEW (PPV) PROGRAM MODEL

The Plot Plan View (PPV) program was designed to assist the user in verifying the coordinates of the panels and digouts. It uses a plotter to develop a plan view of the panels defined in a DLS control file. The user needs to add 'PLOT' and 'PLAN' cards to the DLS control file for processing by PPV.

The PPV controls are explained in the following sections, with an overview in this section. The 'PLOT' card contains parameters that set plotter characteristics, such as the page and letter size.

The 'PLAN' card defines the axes to be drawn on the plan view figure. The vertical axis of the diagram is always the user's y, and the horizontal axis is always the user's x. The user controls orientation of the panels by defining the axes.

The user specifies PXF and PYF, the coordinates of the diagram origin, and PXL and PYL, the high values for the axes. Both plot and scale factors are provided to control the size.

The PPV model processes the control file in the same fashion as the DLS model, i.e., 'KEYWORDS' are recognized and control parameters set until one of the "action" 'KEYWORD' cards is processed. The four action cards for PPV are:

- o 'SURFACE' - When this card is read, the program prints the run title information. It does not retrieve a surface array.
- o 'PLAN' - When this card is read, the model sets up and draws the axes on the diagram. If a second 'PLAN' card is encountered, the model moves to a clean place and draws a new axis. This feature allows the user to combine a number of DLS control files and create a series of plan views in a single PPV run.
- o 'COAL LINE' - After processing a set of coal line coordinates, the model draws the lines in the long direction of the panel. It then draws a cross line for the face opposite the first dragface.

- o 'DIGOUT' - When a digout card is read, the model draws in the current dragface line. If the keycut option is ON for this digout, the model draws in dashed lines to outline the keyway. These lines are extended to the dragline position. If the keycut spoil option is also ON, a dashed line is drawn from the dragline to the spoil cone center.

If both the bail option and the spoil option are ON for this digout, the model draws a dashed line from the dragline bail position to the bail-spoil center.

If the chop option is ON and the LOGDIS control is 1, the model draws a rough circle corresponding to the path of the boom point.

The model draws all digouts specified by the NDIGO parameter and then returns to processing the input file. The LOD (digout option) parameter is not used by PPV; however, it must be specified as a place holder. PPV uses LOGCP to control printing of the Current Parameter listing.

In most cases, the printout from PPV is of no interest since the plan view presents the real picture. The printout will be of interest when the plan view shows an error, or if the program terminates with an error message.

12.6 PPV CONTROL PARAMETERS

Many DLS control parameters are not used by PPV. The following DLS 'KEYWORD' cards are ignored by PPV:

ANGLES
BOXCUT
END PANEL
FACTOR
LAYER
MAINTENANCE
MINE COAL
PANEL
RADIAL
RATES
REFERENCE
REHANDLE
RERUN
SWELL
TANGENTS
WALK

The parameters from the remaining cards are used in PPV as they are used in DLS. In addition, PPV requires 'PLOT' and 'PLAN' cards. These cards are summarized in Table 12.2 and 12.3. The use of the parameters is explained in this section.

Only one 'PLOT' card is required. More than one can appear in a PPV control file; however, the 'PLOT' parameters must have the same values on all cards.

The plotter parameters are defined in the following paragraphs.

1. PSIZE - Page size in inches

PSIZE is the length of plotter paper measured along its Y direction.

2. PXINC - Horizontal separation distance in inches.

If several diagrams are made in one run, the model will leave PXINC inches between diagrams.

3. PYINC - Vertical separation distance in inches

When more than one diagram is made, the model moves in the vertical direction first until it would exceed the page size, then it moves in the horizontal direction. The model will leave PYINC inches between diagrams on the up move.

4. PHT - Plotter text height in inches

The plotter system controls the size of letters used on the axes. PHT controls the size of all other printing on the plot.

5. PDSH - Length of dashes in inches

The dashes in dashed lines will be PDSH inches long.

The 'PLAN' card initializes a plan-view diagram. The first step is to set up the diagram axes from the 'PLOT' parameters. Since PPV does not read a surface file, it cannot handle the viewpoint orientation as the DIS model does. The user must enter appropriate values for the plan view parameters to orient the diagram as desired. Without appropriate values, a mirror image appears.

The values of PXF and PYF are used as the diagram origin. The value of PXL is used as the upper limit of the horizontal axis, and PYL as the upper limit of the vertical axis. Thus, the values of the two axes can range independently from low to high or high to low.

The parameters on the 'PLAN' card are:

1. PXF - X coordinate for diagram origin, in ft
2. PXL - X coordinate for the end of the diagram horizontal axis, in ft
3. PYF - Y coordinate for diagram origin, in ft
4. PYL - Y coordinate for the end of the diagram vertical axis in ft
5. PSCL - Diagram scale factor, in ft/in

Table 12.2 'PLAN' Card Parameters

Name	Value	Meaning
YFIRST		Y coordinate for diagram origin
YLAST		Coordinate for high end of Y axis
XFIRST		X coordinate for diagram origin
XLAST		Coordinate for high end of X axis
PSCL	Ft/in	Scale factor for converting surface data to plotter paper
PFACT		Multiplier to adjust overall diagram size
LOGDIS		Controls drawing of chop circles
	0	Circle not drawn
	1	Circles are drawn

NOTE: 'PLAN' card is used by PPV program, and ignored by DLS model.

Table 12.3 'PLOT' Card Parameters

Name	Value	Meaning
PSIZE	Inches	Size of plotter paper
PXINC	Inches	Horizontal distance between diagrams
PYINC	Inches	Vertical distance between diagrams
PHT	Inches	Height of text
PDSH	Inches	Length of dashes

NOTE: 'PLOT' card is used by PPV program, and ignored by DLS model.

6. PFACT - Overall diagram multiplier, as a decimal fraction. PFACT operates as explained in Section 12.2.

12.7 PPV FRINTOUT

The printout from a PPV run will be used only when the diagram shows errors in coal-line coordinates, or the run terminates with an error message.

The CP listing from PPV looks like the CP listing from DLS and the explanation given in Section 4.6 applies. The PPV CP listing does print one "card" that is not input, such as the following example:

CALC	YINCH	XINCH
	6.0	7.0

This indicates that the Y axis is 6 in long and the X axis is 7 in long.

There is no Detail Page from PPV; instead, the model prints the diagram coordinates in inches for each line that it draws. The output appears as in the following example, which applies to the example in Section 12.8.

1	PLTCL	1	.500000	4.50000		
2	PLTCL	2	2.00000	4.50000		
3	PLTCL	3	3.50000	4.30000		
4	PLTCL	4	5.25000	3.75000		
5	PLTCL	5	6.60000	2.95000		
6	PLTCL	1	.500000	2.50000		
7	PLTCL	2	2.00000	2.50000		
8	PLTCL	3	3.30000	2.30000		
9	PLTCL	4	4.60000	1.90000		
10	PLTCL	5	5.70000	1.20000		
11	PLTDF	.500000	2.50000	.500000	4.50000	
12	PLTDF	2.00000	2.50000	2.00000	4.50000	
13	PLTDF	3.30000	2.30000	3.50000	4.30000	
14	PLTDF	4.60000	1.90000	5.25000	3.75000	
15	PLTDF	5.70000	1.20000	6.60000	2.95000	

The line numbers in the above listing were not printed by the model, but were added for reference. Two codes are used:

PLTCL - Plot coal line

PLTDF - Plot dragface

Lines 1-5 present the diagram Y and X coordinates, in inches, for the current highwall. Lines 6-10 present them for the previous highwall. Lines 11-15 present Y,X "from" and Y,X "to", i.e., the line is drawn from the previous highwall to the current highwall.

No attempt was made to make complete formatted printouts from the PPV model since the object is to draw a diagram that will show any discrepancies. If the plan view shows the data are correct, the next step is to run the DLS model to produce the needed reports.

12.8 EXAMPLES OF PPV DRAWINGS

The use of the PPV model to verify the coordinates of a DLS run is illustrated in Chapter 14. To illustrate the controls, a special DLS control file was created to draw plan views of the figures used in Chapter 5 to describe entering coal line coordinates.

The example control file is listed in Figure 12.6, with sequence numbers added for reference. The basic control cards for this example were taken from the demonstration case so the file includes control cards needed by DLS, but not used by PPV.

Record 3 is the 'PLOT' card that specifies a 30-in page, 3-in between diagrams, and 0.1-in letters and dashes. Three 'PLAN' cards appear in this file to develop three plan views. Record No. 4 specifies that the x axis is from 0 to 700 ft, and the y axis is from 0 to 600 ft. The scale factor is 100 ft/in, but PFACT = .77 so the diagrams will be the same size as the figures in Chapter 5. The first set of 'COAL LINE' data is that used in Figure 5.2. The resulting plan view is shown in Figure 12.7. For reference, the 'PLOT' and 'PLAN' lines from the CP listing have been printed above the diagram.

Record 26 is the second 'PLAN' card. It has the same values as Record 4, but is needed here to initialize a new diagram. Records 27-34 are the 'COAL LINE' data which apply to Figure 5.3. The resulting plan view is shown in Figure 12.8.

```

1. CASE DEMONSTRATE PPV FOR FIGURE 5.2
2. SURFACE 100 1 0
3. PLOT 30 3 3 0.1 0.1
4. PLAN 0 700 0 600 100 .77
5. MAINTENANCE 1 10 2
6. WALK 1 0 100 60 1.2 0 4 2.5 3
7. MINE COAL 1 1 0.8 1.05
8. PANEL 65 20 100 20 100 20
9. KEYCUT 0 0
10. BAIL 0 0
11. BOXCUT 1
12. REHANDLE 3 0.8 0 20
13. DRAGLINE1 261 30 12 32.5 100 39.5 258 157
14. DRAGLINE2 5 0.15 42 12 60 56 200
15. TANGENTS 2.7 1 0.85 1 10 0.85 0.85 0.85 0.85
16. RATES 3 0.5 480 860 1.1 1100 610 15 5 3
17. COAL LINE DATA CARDS FOR FIGURE 5.2
18. 50 250 50 450 80 .8 .7 90 .8 .7
19. 200 250 200 450 80 .8 .7 90 .8 .7
20. 330 230 350 430 80 .8 .7 90 .8 .7
21. 460 190 525 375 80 .8 .7 90 .8 .7
22. 570 120 660 295 80 .8 .7 90 .8 .7
23. E
24. DIGOUT 99 1 1 1
25. CASE DEMONSTRATE PPV FOR FIGURE 5.3
26. PLAN 0 700 0 600 100 .77
27. COAL LINE DATA CARDS FOR FIGURE 5.3
28. 50 200 50 400 80 .9 .8 90 .9 .7
29. 250 200 250 400 80 .9 .8 90 .9 .7
30. R 250 250 250 450 80 .9 .8 90 .9 .7
31. 450 250 450 450 80 .9 .8 90 .9 .7
32. R 450 200 450 400 80 .9 .8 90 .9 .7
33. 650 170 650 350
34. E
35. DIGOUT 99 1 1 1
36. CASE DEMONSTRATE PPV FOR FIGURE 5.4
37. PLAN 0 1100 0 700 100 .77
38. COAL LINE DATA FOR PANEL PARALLEL TO Y AXIS
39. Y 350 100 200 100 80 .7 .8 90 .8 .7 100 6
40. E
41. DIGOUT 99 1 1 1
42. COAL LINE DATA FOR PANEL PARALLEL TO X AXIS
43. X 450 100 450 250 80 .7 .8 90 .8 .7 100 6
44. E
45. DIGOUT 99 1 1 1

```

Figure 12.6
A DLS Control File for PPV

PLAN	YFIRST	YLAST	XFIRST	XLAST	SCALE	FACTOR	
	.0	600.0	.0	700.0	100.0	.770	0

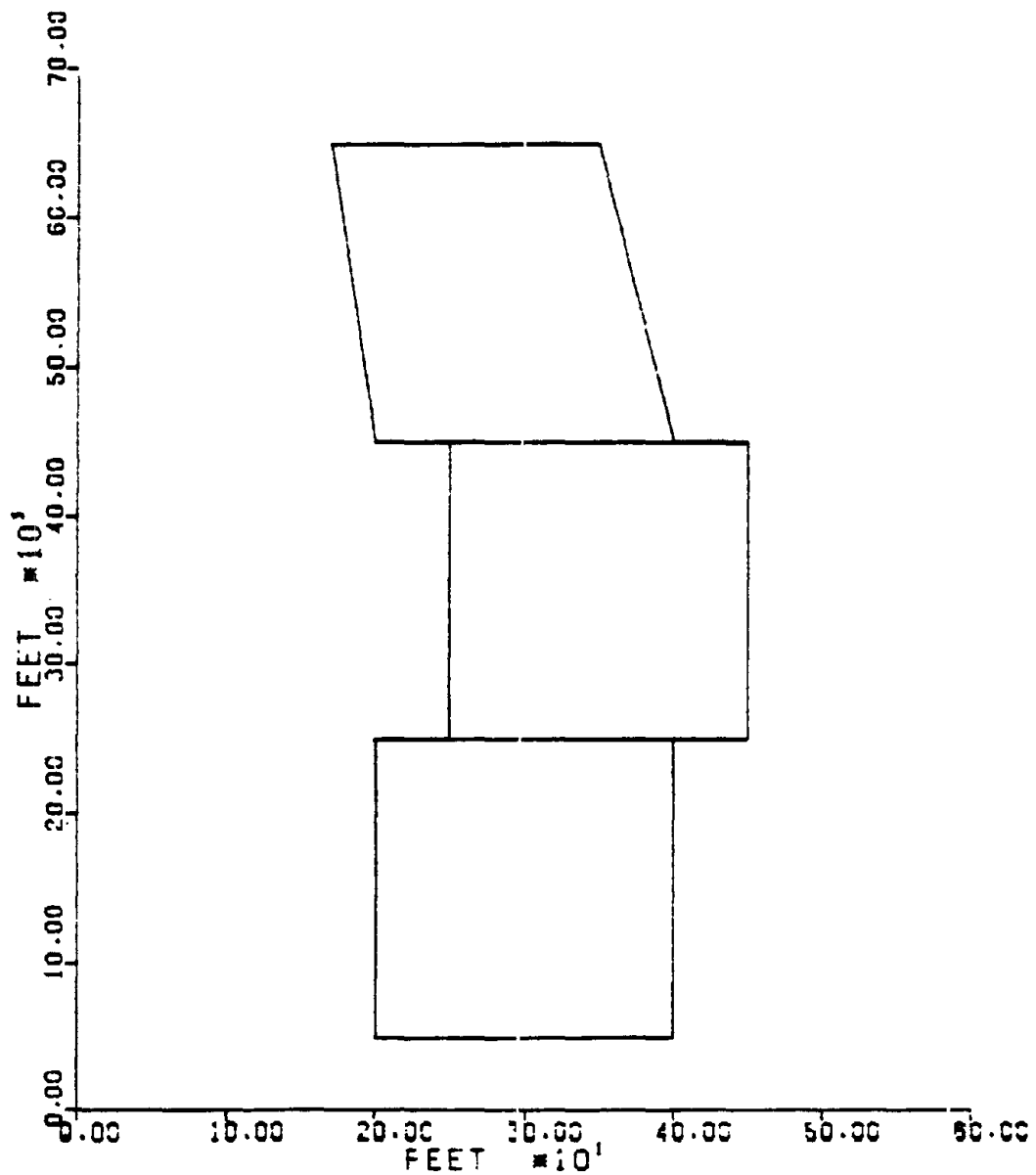


CASE DEMONSTRATE PPV FOR FIGURE 5.2

10:15 NOV 06.'80

Figure 12.7
PPV Drawing for Figure 5.2

PLAN	YFIRST	YLAST	XFIRST	XLAST	SCALE	FACTOR	
	.0	600.0	.0	700.0	100.0	.770	0



CASE DEMONSTRATE PPV FOR FIGURE 5.3

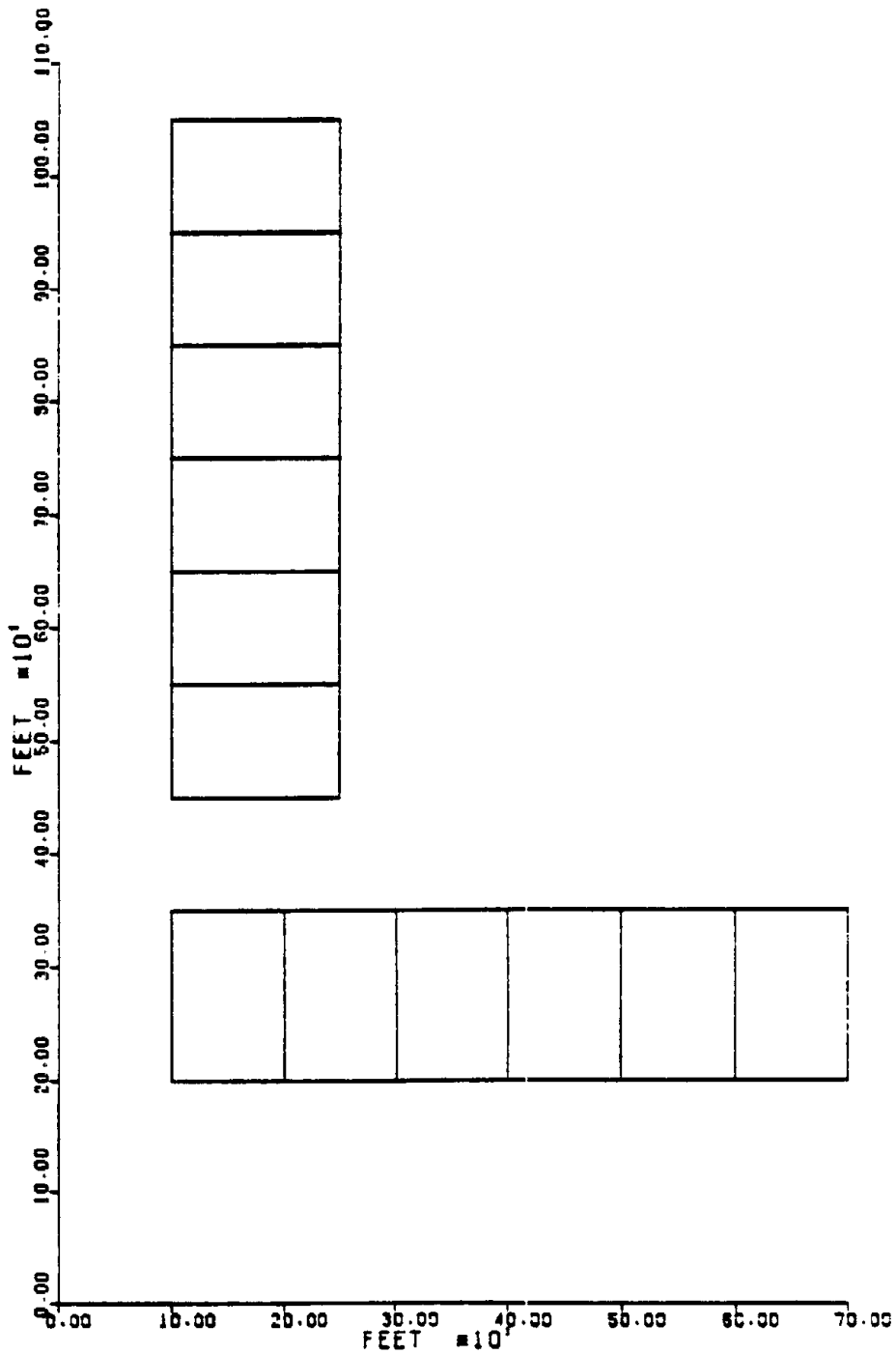
10:15 NOV 06. 80

Figure 12.8
PPV Drawing for Figure 5.3

Record 37 initializes a new diagram with different x,y values to correspond to Figure 5.4. The 'COAL LINE' data are records 39-40 and 42-44. The resulting plan view is Figure 12.9. The two independent plan views were made on the same diagram by entering two sets of 'COAL LINE' data after one 'PLAN' card.

Normally, the user places a single 'PLOT' and a single 'PLAN' card in a DLS control file, and all panels are included in a single diagram. The user can create a series of diagrams in a single PPV run by combining the DLS files with appropriate 'PLOT' and 'PLAN' cards in each set.

PLAN	YFIRST	YLAST	XFIRST	XLAST	SCALE	FACTOR	
	.0	700.0	.0	1100.0	100.0	.770	0



CASE DEMONSTRATE PPV FOR FIGURE 5.4

10:15 NOV 06.'80

Figure 12.9
PPV Drawing for Figure 5.4

Errors result from inconsistencies in the user-set parameters - numbers incorrectly read from maps, numbers transcribed incorrectly, and/or a card missing from an input file. Since there are many parameters entered in the complete sequence of a simulation run, it is not possible to detect every error or omission. Some parameters must be specified for some options, but need not be specified for other options. Therefore, the fact that a parameter is not specified in an input file is not a sufficient condition to assume an error has been made. When a parameter must be non-zero for an option, the programs do test the parameter value and will terminate the run if it is zero.

13.1 TYPES OF ERRORS

Inconsistencies can result in three types of errors:

1. Errors that do not stop the DLS programs. Some inconsistencies lead to incorrect results but cannot be detected by the programs. For example, if a run is to form a 20-ft extended bench, but the value is incorrectly entered as 2, the program would operate normally and solve the wrong problem. The program printouts are designed to assist the user find this type of inconsistency, as discussed in Section 13.2 and in preceding chapters.
2. Errors that do stop the DLS programs. When the programs detect an error that would preclude successful completion of a run, they print an error message and terminate the run at that point. These error messages and conditions are discussed in Section 13.3.
3. Errors detected by the computer system. The computer system detects and processes certain types of errors; one example would be a letter punched in a field that should contain only numbers. The system processes the error, prints an error message, and may terminate the run at that point. Different computers handle errors differently.

If an error message is not self-explanatory, or is not discussed in Section 13.3, the user will have to consult the system programmer/analyst for an explanation.

13.2 AIDS TO DETECTING ERRORS

As explained in the preceding section, the user can make mistakes in the input parameters which the models will not be able to detect. The user must review the model results to be sure they are reasonable. The most frequent error is made in reading and transcribing the x,y coordinates of the coal lines. The best way to find these errors is by using the PFV program explained in Chapter 12.

Another frequent error is to place the panels too close to the edge of the surface that was defined in the DDM sequence described in Chapter 3. The model will stop with an error message if the spoil center is outside of the surface limits. It will not stop, however, if the portion of a digout or a spoil bank would be outside of the surface. The digging, spoiling and coal removal routines treat the limits of the surface array as though the limiting line is a wall. The digging routines cannot dig through the wall and the spoil routines would pile spoils against the wall.

To assist the user in this area, these routines print the limits of the search and the limits of the modification. An example of this printout is reproduced below.

XQF, XQL, YQF, YQL	90.0	410.0	140.0	320.0
XMIN, XMAX, YMIN, YMAX	140.0	360.0	180.0	270.0

The "Q" array is the model's internal array where all modifications take place. When a routine completes the modifications in the "Q" array, it updates the surface array. The manner in which the limits of search are calculated is explained in the appropriate chapters. The search limits coordinates are printed on the line with the titles.

XQF, XQL, YQF, YQL

where:

XQF = First x line in the search area

XQL = Last x line in the search area

YQF = First y line in the search area

YQL = Last y line in the search area

As the model modifies elevations in the "Q" array, it keeps track of the extreme coordinates that are printed on the line.

XMIN, XMAX, YMIN, YMAX

where:

XMIN = Lowest x line to be modified

XMAX = Highest x line to be modified

YMIN = Lowest y line to be modified

YMAX = Highest y line to be modified

In most cases, the following relations should be true:

$XQF < XMIN$

$XQL > XMAX$

$YQF < YMIN$

$YQL > YMAX$

When an equality occurs in any of the above relations, the model may have been restricted by the limits of the surface array. However, an equality does not necessarily mean an error in the calculations. For example, if the top of a highwall, or the opposite face coincides with the edge of the surface, the practical limit of modification is the same as the search limit imposed by the surface array.

The limits of modification are also printed whenever the controls specify that a surface is to be saved. That line takes one of two forms depending on the setting of LOGSF (save surface control from the 'SURFACE' card).

SURFACE NO. 111. MINIMA & MAXIMUM	XMIN,	XMAX,	YMIN,	YMAX
	140.00	380.00	180.00	450.00
SURFACE NO. 118. WRITTEN TO FILE	XMIN,	XMAX,	YMIN,	YMAX
	320.00	880.00	220.00	420.00

The min, max values on these are extremes of modification for all actions that took place since the preceding save operation. If the surfaces are saved only after coal removal, then these extremes apply to the entire panel.

The DLS model also makes an attempt to confirm that the dragline dumping radius and the digout lengths are consistent. Figure 7.1 shows the geometry that applies to a digout. Point K is the dragline position for key cutting, and points I and J define the line at the far end of the keyway, i.e., the bottom of the dragface on the preceding digout. The dragline is moved to

position M for the bail, and points J and E define the bottom of the dragface on the preceding panel. The dragline can make a complete digout only if the bucket can be placed over points I and J from position K and over J and E from position M.

The model calculates these distances and compares them with the dumping radius (DSH from 'DRAGLINE1' card) including a 10-ft tolerance. If any of the 4 distances is greater than the dumping radius plus 10 ft, the model prints the values in its DIST (distance) array, as follows:

```
DIST = 271.115
      265.245
      257.000
      261.451
```

The values are distances on lines MI, MJ, KE, AND KJ, respectively.

13.3 TERMINATION ERRORS

When a routine or program detects an inconsistency that precludes successful completion of a run, the routine prints an error message and stops the run at that point.

The first line of the error message will be:

RUN TERMINATED BECAUSE:

The second line will be one of the messages used as paragraph headings in the following discussion. To assist the user in finding a message, the paragraphs are arranged in alphabetic sequence on the first words in the print line.

The names of the routines that can write the message are included in the paragraph titles in parentheses.

Note that error-trapping logic was included in the programs during development. Some error traps are based on program logic, i.e., "If the program reaches this point, something must be wrong with the input."

Other error traps were added when mistakes that were made in setting up over one hundred test cases caused abnormal termination of the runs.

Some of the program logic error conditions have not been encountered as noted in the following discussions. For others the user should call on the system programmer for assistance.

1. ASKD OR ASBD IS ZERO; INVALID FOR RADIAL (DLS)

Check that the 'RADIAL' card is present in the control file, and contains two non-zero entries after the word 'RADIAL'.

2. CANNOT FIND CIRCLE INTERSECTIONS (CHOP)

This can only happen when the chop option is 1 or 2 since the circle logic is bypassed when the option is 11 or 12. The chop routine extends a line from the dragline center through the grid point being tested. It then finds the intersections between this line and the circle enscribed by the boom point. Check that the coordinates of the current and next digout are consistent with each other and with the dumping radius.

3. DIGOUT LINES DO NOT INTERSECT (RHNDL, RTC4)

If the four points of a digout define a closed, concave, four-sided figure, the lines must intersect. Check the coordinates of the digout.

4. DIGOUT OPTIONS MUST BE 1, 2, 3, 4, or 6 (DLS)

5. DOD CANNOT BE ZERO FOR THIS DIGOUT OPTION (DLS)

6. ELEVATION ERROR AS PRINTED ABOVE (BTS)

As BTS processes the elevation data to prepare the three sets of DDM input, it checks the three elevations specified for each intersection. The surface elevation must be greater than or equal to the top of coal elevation, which must be greater than or equal to the bottom of coal elevation. The incorrect entries would have been printed before this error message. The program does not stop when the first error is encountered. It continues to process all input in case there might be more than one set of data points in error.

7. EXPECTED G CARD NOT FOUND (DDM)

The 'GRID' card must precede all other cards, except the 'TITLE', 'BIAS', and/or 'LOG' Cards.

8. EXPECTED S CARD NOT FOUND (DDM)

A 'SURFACE' card must follow the 'GRID' card. If more than one surface is defined, a 'SURFACE' card must precede each set of data cards.

9. LOGIC ERROR; CALL PROGRAMMER (DLS, RHNDL)

The model is unable to translate and rotate the digout shape as required by the model geometry. This error has never occurred, and we cannot even suggest what inconsistencies would cause it. Discussion with the system programmer should lead to corrections.

10. MORE THAN 100 POINTS FOR A LINE (DDM)

Check that correctly punched 'X' or 'Y' cards precede the elevation data cards. If more than 100 points are needed to enter the elevation data, the grid step is probably too small, or the system must be re-dimensioned and re-complied.

11. MORE THAN 100 X or Y LINES NEEDED FOR SEARCH (SPL1, SPL2)

The digging routines extend the four faces up to the surface and add a distance equal to four grid steps to find the limits of search for digging. The spoil routines solve the cross-section geometry to develop an expected spoil diameter and add a distance equal to four grid steps to find the limits of search for spoiling. This error suggests that one of the parameters involved in finding the search limits is incorrectly set. If not, the user's grid step is too small. If such a small grid step is required, the programs need to be re-dimensioned and re-complied.

12. MORE THAN 300 Y LINES (DDM)

Check that the 'GRID' card is correctly punched. If a grid with more than 300 y lines is really needed, the system must be re-dimensioned and re-complied.

13. MORE THAN 300 X LINES (DDM)

Check that the 'GRID' card is correctly punched. If a grid with more than 300 x lines is really needed, the system must be re-dimensioned and re-complied.

14. MORE THAN 75 'COAL LINE' DATA CARDS (IO, PIO)

Check the 'COAL LINE' data cards. If more than 74 digouts in a panel are needed, the system must be re-dimensioned and re-complied.

15. NLTC IS 0; CHECK LAYER, RADIAL CARDS (DLS)

The value of NLTC (number of layers to cut) is the quotient of HB (height of bench from the 'PANEL' card) divided by DOD (depth of digging from the 'LAYER' card). Check the values entered on these cards.

16. NO VOLUME FROM KEYCUT (DLS)

Check the 'COAL LINE' data to be sure this digout does not coincide with one previously made. If there is no overburden, the user must bypass that portion of the pit or turn off the digging routines for that digout.

17. NO VOLUME FROM BAIL (DLS)

Check the 'COAL LINE' data to be sure this digout does not coincide with one previously made. If there is no overburden, the user must bypass that portion of the pit or turn off the digging routines for that digout.

18. NOW GREATER THAN 24,000 (DDM)

Check that the 'GRID' card is correctly punched. If not, the grid step size is too small for the model dimensions. See the discussion of limits in Chapter 3.

19. ORIGIN MUST BE NE, NW, SE, OR SW (DDM)

Check columns 2-3 of the 'GRID' card; they must contain one of the sets, NE, NW, SE, or SW.

20. PARAMETERS DO NOT FIT PROGRAMMED GEOMETRY (EBS)

This error condition has never been encountered. We suggest checking the values of HB (height of bench) and HC (thickness of coal seam) from the 'PANEL' card, WEB (width of extended bench) from the 'FACTOR' card, and the volume that was excavated by the digging routine.

21. PXS LT XS OR PYS LT YS (DIS)

Check that the DIS control card is correctly punched. PXS and PYS are the desired grid steps and XS and YS are the grid step defined in the DDM sequence. Both quotients, PXS / XS and PYS / YS , must be greater than one.

22. ROUTINE CANNOT CONVERGE (EBS, SPL1, SPL2)

This error condition has not been encountered, and we are unable to suggest what inconsistencies might lead to its appearance.

23. THE E CARD IS MISSING (IO, PIO)

The 'COAL LINE' data cards must be followed by a card with an E in column 1 and blanks in columns 2-80.

24. SPOIL CENTER IS OUTSIDE OF SURFACE ARRAY (SPL1, SPL2)

The digout is too close to a surface limit, or the spoil angles and dumping radius are incorrect.

25. SURFACE NUMBER IS NOT IN SURFACE FILE
(CSA, DIS, IHC, DLS)

Check that the proper surface file is being referenced, and that the 'SURFACE' card is correctly punched.

26. UNEXPECTED SEQUENCE IN THE INPUT FILE (DDM)

The input file to the DDM model is mixed up in some fashion and the program is unable to continue.

27. VIEWPOINT IS NOT N, E, S, OR W (DIS)

Check column 6 of the DIS control file; it must contain one of the letters, N, E, S, or W.

28. WEB CANNOT BE ZERO FOR THIS OPTION (DLS)

Check that the 'FACTOR' card is present and has a non-zero entry for WEB (width of extended bench); alternatively, the 'DIGOUT' card may specify the wrong option number.

29. WRONG SURFACE FILE (CSA, DIS, IHC, DLS)

When a surface array is written to a file, the program inserts record counts. The counts are wrong which indicates that an incorrect file is specified as the starting surface array file.

30. X OR Y CARD MUST FOLLOW S CARD (DDM)

Check the DDM input for the indicated sequence.

14.1 GENERAL

This section discusses two cases set up to demonstrate use of the DLS model.

1. CHOP - This case uses the model in a straight-forward manner. It strips one boxcut and one production panel, with seven digouts in each. The sequence in the production panel is chop from keycut, keycut, and bail without rehandle.
2. DEMO - This case demonstrates the results of different parameter and option settings. It also strips two panels of seven digouts, but the sequence is altered frequently to demonstrate certain features, so the run makes no sense as a simulation run.

14.2 DDM SEQUENCE FOR DEMONSTRATION CASES

Both cases use the same surface array called "TEST". The surface covers an area of 1000 ft (x) by 800 ft (y). The elevations are uniform in the x direction and slope upwards at about 3% in the y direction. The elevations of the surface range from 83.3 ft at y = 100 to 106.7 ft at y = 800. The coal seam is 20-ft thick.

The printouts from the DDM and IHC program runs are reproduced in Appendix A. Since there was no log card in the file, all three controls were set to ON. The DDM program listed the input (Page A.3), created the surface array file, and listed the final elevations (Pages A.4 through A.17). The printout from the IHC program is on Page A.18.

The input file is not printed separately because the DDM printout should be sufficient. Since the surface being described is a plane, only four sets of elevation data, one at each grid corner, are needed to completely define the surface array. The DDM program interpolates to fill in all elevations for the array.

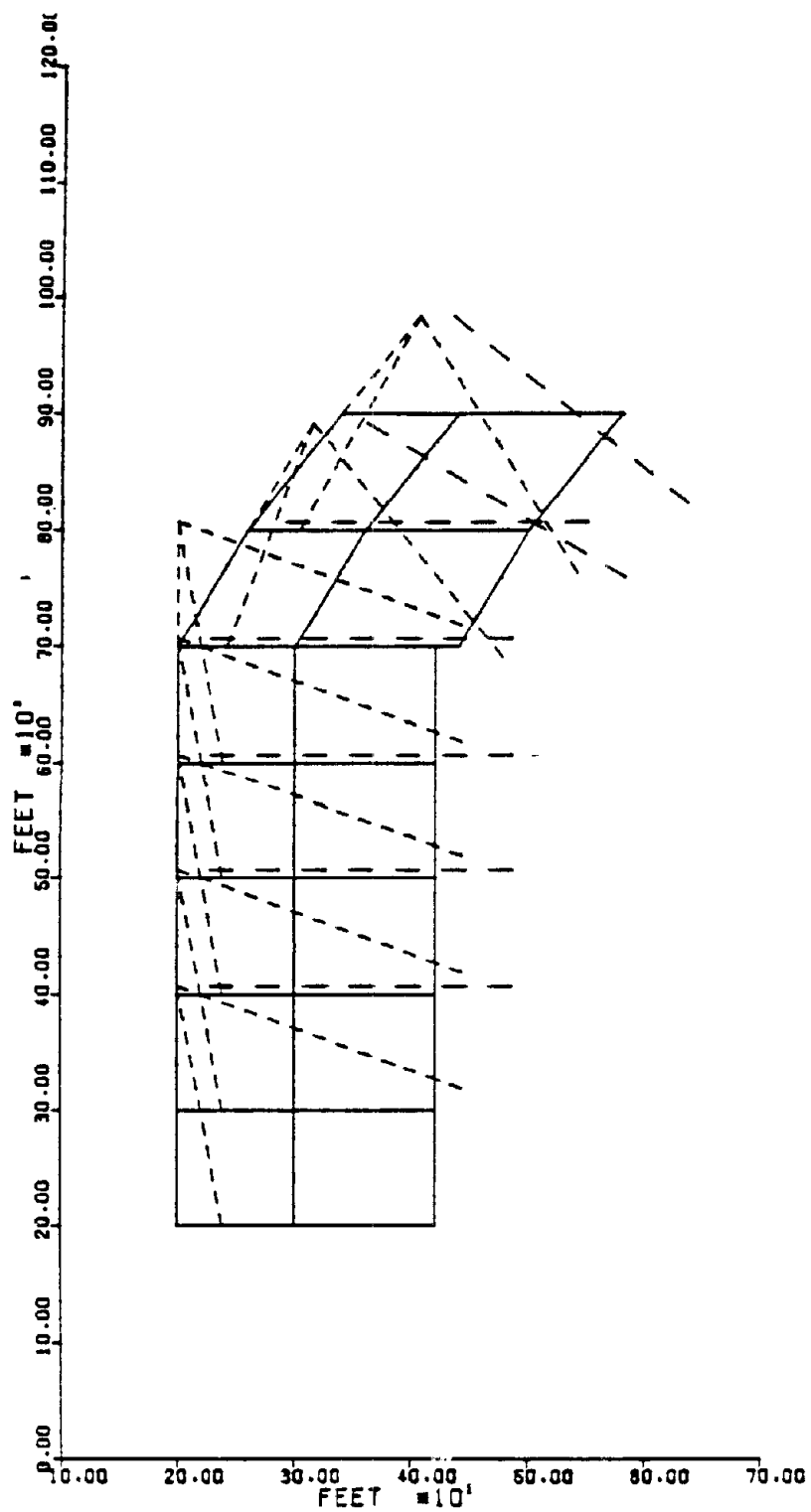


Figure 14.1
Plan View of "CHOP" Case

14.3 "CHOP" DEMONSTRATION CASE

14.3.1 THE "CHOP" PROBLEM

The plan view of the problem setup for this demonstration is shown in Figure 14.1. Two panels are defined; the first is a boxcut and the second a production panel. The panels are parallel to the x axis for five digouts, and then turn for the last two digouts.

The spoil angles have been set to 70° and 90°, and the plan view shows that the spoil centers will be crowded at the turn. Normally, the spoil angles would be increased for one or two digouts to provide more spoil room. However, in this demonstration, there are not enough digouts to permit that simulation. Therefore, the boxcut panel has been widened at the turn to provide more spoil room.

14.3.2 "CHOP" BOXCUT PANEL

The DLSCHOP file is reproduced in Figure 14.2, with sequence numbers added for reference. Portions of the file are also reproduced in the text as appropriate.

The model reads the following input records:

1. CASE (DLSCHOP) FIRST DEMONSTRATION CASE FOR USER'S
MANUAL
2. CAS2 STANDARD MINING WITH CHOPPING FROM KEYCUT
POSITION
3. SURFACE 100 1 1

It retrieves the surface array from the file, and prints the Surface Page (Page B.3). The 'PLOT' and 'PLAN' cards are printed on this page to notify the user that DLS does not recognize these 'KEYWORDS'. This is quite normal since the two cards are in the file for use by the PPV model.

The model returns to reading cards, and processes the following records:

4. PLOT 30 3 3 0.1 0.1
5. PLAN 0 1200 100 700 100 1.0 1
6. MAINTENANCE 2 0.05
7. WALK 1 0 0 60 1.2 0 4 2.5 3
8. MINE COAL 4 1 0.8 1.05
9. PANEL 65 20 100 20 100 20
10. KEYCUT
11. BAIL 1 0 0 0
12. BOXCUT 1
13. FACTOR 0.4 20

1. CASE (DLSCHOP) FIRST DEMONSTRATION CASE FOR USER'S MANUAL
2. CAS2 STANDARD MINING WITH CHOPPING FROM KEYCUT POSITION
3. SURFACE 100 1 1
4. PLOT 30 3 3 0.1 0.1
5. PLAN 0 1200 100 700 100 1.0 1
6. MAINTENANCE 2 0.05
7. WALK 1 0 0 60 1.2 0 4 2.5 3
8. MINE COAL 4 1 0.8 1.05
9. PANEL 65 20 100 20 100 20
10. KEYCUT
11. BAIL 1 0 0 0
12. BOX CUT 1
13. FACTOR 0.4 20
14. REHANDLE 3 0.8 20 0
15. DRAGLINE 1 261 30 12 32.5 100 39.5 258 157
16. DRAGLINE 2 5 0.15 42 12 60 56 200
17. TANGENTS 2.7 1 0.85 1 10 0.85 0.85 0.85 0.85
18. RATES 3 0.5 480 860 1.1 1100 610 15 5 3
19. COAL LINE FOR BOX CUT PANEL
20. X 200 300 200 420 0 0 0 0 0 0 100 5
21. R 700 300 700 440
22. 800 360 800 500
23. 900 440 900 580
24. E
25. DIGOUT 1 1 1 1
26. DIGOUT 99 1
27. COAL LINE FOR PRODUCTION PANEL
28. X 200 200 200 300 70 .8 .9 90 .7 .8 100 2
29. 500 200 500 300 70 .8 .9 90 .7 .8
30. 600 200 600 300 70 .8 .9 90 .7 .8
31. 700 200 700 300 70 .8 .9 90 .7 .8
32. 800 260 800 360 70 .8 .9 90 .7 .8
33. 900 340 900 440
34. E
35. TANGENTS 2.7 1 2.7 1 10 0.85 0.85 0.85 0.85
36. CHOP 11 1 0 0 150 125 3 0.8
37. KEYCUT 1 1 0 0
38. BAIL 1 1 0 0
39. DIGOUT 1 1 1 1
40. DIGOUT 5 1
41. CHOP
42. DIGOUT 99 1

Figure 14.2
DLS File for "CHOP" Case

```

14. REHANDLE 3 0.8 20 0
15. DRAGLINE 1 261 30 12 32.5 100 39.5 258 157
16. DRAGLINE 2 5 0.15 42 12 60 56 200
17. TANGENTS 2.7 1 0.85 1 10 0.85 0.85 0.85 0.85
18. RATES 3 0.5 480 860 1.1 1100 610 15 5 3
19. COAL LINE FOR BOXCUT PANEL
20. X 200 300 200 420 0 0 0 0 0 0 100 5
21. R 700 300 700 440
22. 800 360 800 500
23. 900 440 900 580
24. E
25. DIGOUT 1 1 1 1

```

All necessary model parameters are set for the boxcut panel, which is used to simulate the existing panel in the operating pit. The keycut is turned OFF since the bail will form the complete digout. Also, making the keycut would simply increase computer run time without altering the shape of the boxcut panel.

The 'DIGOUT' options specify one digout with the log switches turned to ON. The CP listing is reproduced on Page B.4, and the Detail Page for bail is on Page B.5.

The model reads the following record:

```

26. DIGOUT 99 1

```

This 'DIGOUT' card specifies normal digouts to the end of the panel with the log switches turned OFF. The single lines printed from each bail appear on Page B.5.

The model has now stripped to the end of the panel, and it checks LCC (mine coal option from the 'MINE COAL' card) which is record No. 8. It specifies coal removal with the RIC4 routine. The printout from this action is on Page B.6.

14.3.3 "CHOP" PRODUCTION PANEL

The model now reads the following records:

```

27. COAL LINE FOR PRODUCTION PANEL
28. X 200 200 200 300 70 .8 .9 90 .7 .8 100 2
29. 500 200 500 300 70 .8 .9 90 .7 .8
30. 600 200 600 300 70 .8 .9 90 .7 .8
31. 700 200 700 300 70 .8 .9 90 .7 .8
32. 800 260 800 360 70 .8 .9 90 .7 .8
33. 900 340 900 440
34. E
35. TANGENTS 2.7 1 2.7 1 10 0.85 0.85 0.85 0.85
36. CHOP 11 1 0 0 150 125 3 0.8
37. KEYCUT 1 1 0 0

```

38. BAIL 1 1 0 0
39. DIGOUT 1 1 1 1

The coordinates of the production panel are entered. The 'TANGENTS' card is re-entered to reset the slope of the face CD - the face opposite the highwall. It had been set to the slope for spoils to simulate the presence of spoil banks that would normally have been present in the panel we label the boxcut. The chop option is set to chop before keycutting, and the keycut option is set to ON. Thus, the sequence in this production panel will be chop, keycut, and bail. Again, a single digout is specified with the log switches ON. The CP listing printed before the digout is on Page B.7. The printout from the three digging actions of the first digout are on Pages B.8, B.9, and B.10.

The model now reads the next record:

40. DIGOUT 5 1

This 'DIGOUT' card specifies making five normal digouts with the printouts turned OFF. The single lines from these digouts are on Page B.10 and B.11. The next records processed are:

41. CHOP
42. DIGOUT 99 1

The chop is turned off and normal digouts until the end of the panel are specified. It can now be seen why record 40 called for only 5 digouts. If it had specified 99 digouts (meaning to continue to the end of the panel) the chop would have been done for the last digout in the panel. This sequence resulted in turning off the chop for the last digout. The single lines from the final digout appear on Page B.11.

Having reached the end of the panel, the model observes the 'MINE COAL' option, and calls RTC4. The printout is reproduced on Page B.12.

14.3.4 "CHOP" SUMMARY

The summary page is reproduced on Page B.13. The summary shows why the maintenance option was set to 2 to calculate maintenance time as a fraction of working time. The total scheduled time with 40% downtime is 166 hrs, or about 20 shifts. That is not a long enough period for option 1 to work correctly.

While this case is a simple case, there are a number of comments that can assist the user making similar runs. For example, during the boxcut, the chop was turned off. Actually

it might have been more correct to have chopped on this first panel. In the operating pit when chopping is needed, it is usually done for all panels.

Considerable spoil crowding can occur at the end of panels both in the model runs and in the operating pit. In this example, spoil crowding is increased because of the turn just before the end. However, the dragline had enough reach so that the crowding did no harm. In cases where the dragline has less reach, special steps may be needed to avoid crowding or to measure the crowding when the simulation and the pit both reach the end of a panel. When the digouts being simulated are in the "middle" of a panel, the user can avoid the model crowding by making more digouts in the boxcut than in the production panel. In this example we might have stripped nine digouts rather than seven, as was done.

The boxcut is made to simulate the presence of a previously excavated panel. By appropriate settings of angles, the user can form the slope of the previous panel to be the same as the slope of the existing spoil banks; however, he cannot easily form the actual banks. Thus, the slope is correctly represented, but the height of the spoils is not. This will have some effect on the model accuracy. The effects will be most pronounced on the first production panel, and less pronounced on later panels. In summary, it will usually be better to simulate more than two panels.

14.4 "DEMO" DEMONSTRATION CASE

14.4.1 THE "DEMO" PROBLEM

This section discusses the demonstration run which is reproduced in Appendix C.

This DLS case is not a simulation of an operating dragline pit; it has been designed to use as many of the model options as possible in a single run. The sequence has been designed to illustrate and provide a framework for discussing methods of model use. This example and discussion should assist the user in setting up runs to simulate actual operations.

The following discussion is organized by digout and refers to the model output by Appendix C page numbers. The Appendix reproduces all output and has plots interspersed as required for discussion. The DLSDEMO control file is reproduced in Figure 14.4. Portions of the input and output are reproduced in the text; however, the spacing on some printout lines is not identical with that of the actual output. The full computer print line would have to be reduced too much to fit the 8½-inch page.

The plan view plot, Figure 14.3, shows two panels: the boxcut on the right and the production panel on the left. The printer output from the PPV run is not reproduced since the plan-view picture should be sufficient.

The first five digouts in both panels are parallel to the x axis. The boxcut panel is 120 ft wide for the first five digouts. The dragface was redefined for digout 6 to increase the boxcut panel width to 140 ft. The panels turn at this point to about 45°.

For digout 5 in the production panel, no keycut was made and the bail spoil angle was reduced in an attempt to increase spoil crowding on this digout.

14.4.2 THE DLS RUN START (PAGE C.3)

The first model action is to read the input data records until the 'SURFACE' card is read. Thus, the following input records are read:

1. CASE (DLSDEMO) DEMONSTRATE DLS OPTIONS FOR USER'S
MANUAL
2. CAS2 THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE
RUN
3. SURFACE 100 1 1

This set illustrates normal input record sequencing, i.e., the title cards precede the 'SURFACE' card so that the appropriate titles will be printed on the first model output page.

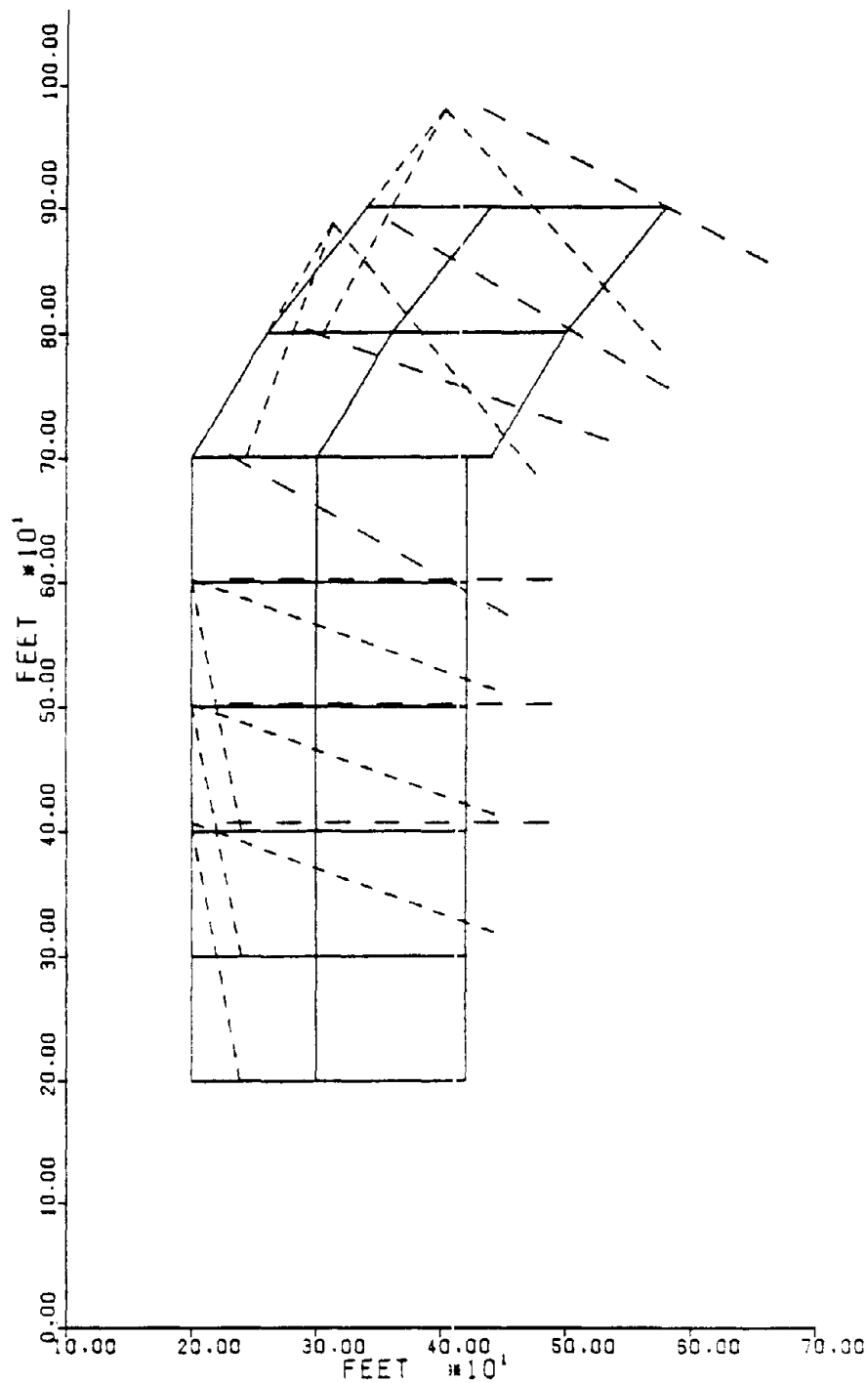
The parameters on the 'SURFACE' card are:

SNR = 100; use surface number 100
SND = 1; when surfaces are filed, increase the number
by 1 for each succeeding surface
LOGSF = 1; surfaces are to be filed.

After the surface array has been retrieved, the model prints a page (C.3) displaying the surface statistics. This page is always printed and is not under a LOG control. This starting surface was transferred to the output file as indicated by the two lines:

SURFACE-FILE HEADER RECORD WRITTEN TO LOGICAL UNIT NO. 4

SURFACE NO. 100 WRITTEN TO FILE XMIN, XMAX, YMIN, YMAX
0 1000 100 800



CASE (OLSDemo) DEMONSTRATE DLS OPTIONS FOR USER'S MANUAL

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Figure 14.3
Plan View of "DEMO" Case

1. CASE (DLSDEMO) DEMONSTRATE DLS OPTIONS FOR USER'S MANUAL
2. CAS2 THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN
3. SURFACE 100 1 1
4. PLOT 30 3 3 0.1 0.1
5. PLAN 0 1200 100 700 100 1.0
6. MAINTENANCE 1 10 2
7. WALK 1 0 100 60 1.2 0 4 2.5 3
8. MINE COAL 1 1 0.8 1.05
9. PANEL 65 20 100 20 100 20
10. KEYCUT 1 0 0 1
11. BAIL 1 0 0 1
12. BOXCUT 1
13. REHANDLE 3 0.8 0 20
14. DRAGLINE 1 261 30 12 32.5 100 39.5 250 157
15. DRAGLINE 2 5 0.15 42 12 60 56 200
16. TANGENTS 2.7 1 0.85 1 10 0.85 0.85 0.85 0.85
17. RATES 3 0.5 480 860 1.1 1100 610 15 5 3
18. COAL LINE FOR BOXCUT PANEL
19. X 200 300 200 420 0 0 0 0 0 0 100 5
20. R 700 300 700 440
21. 800 360 800 500
22. 900 440 900 580
23. E
24. DIGOUT 2 1 1 1
25. KEYCUT
26. BAIL 4 0 0 1
27. DIGOUT 1 1 1 1
28. TANGENTS 2.7 1 0.85 1 10 0.85 0.95 0.85 0.85
29. DIGOUT 1 1 1 1
30. REHANDLE 3 0.8 20 0
31. DIGOUT 1 1 1 1
32. BAIL 1 0 0 99
33. TANGENTS 2.7 1 0.85 1 10 0.85 0.85 0.85 0.85
34. DIGOUT 1 1 1 1
35. DIGOUT 99 1
36. COAL LINE FOR PRODUCTION PANEL
37. X 200 200 200 300 70 .8 .9 90 .7 .8 100 2
38. 500 200 500 300 70 .8 .9 60 .7 .8
39. 600 200 600 300 70 .8 .9 70 .7 .8
40. 700 200 700 300 70 .8 .9 90 .7 .8
41. 800 260 800 360 80 .8 .9 100 .7 .8
42. 900 340 900 440
43. E
44. TANGENTS 2.7 1 2.7 1 10 0.85 0.85 0.85 0.85
45. WALK 2 0 0 60 1.2 0 8 2.5 3
46. FACTOR 0.4 20
47. MINE COAL 4 1 0.8 1.05 2 99
48. CHOP 11 3 0 1 150 125 3 0.8
49. KEYCUT 1 1 0 1
50. BAIL 1 1 0 1
51. DIGOUT 1 1 1 1
52. MAINTENANCE 2 0.05
53. PANEL 60 20 100 20 100 20
54. CHOP 12 2 0 1 150 150 3 0.8
55. KEYCUT 1 2 80 1
56. BAIL 1 2 80 1
57. DIGOUT 1 1 1 1
58. CHOP
59. KEYCUT 1 2 80
60. BAIL 4 2 80 1
61. RERUN 1
62. DIGOUT 1 1 1 1
63. BAIL 4 1 80 99
64. KEYCUT
65. DIGOUT 1 5 1 1
66. DIGOUT 1 5 0 1
67. KEYCUT 1 1 80
68. LAYER 30 3
69. DIGOUT 1 4 1 1
70. DIGOUT 1 6 1 1

Figure 14.4
DLS File for "DEMO" Case

If LOGSF had been 0, the first line would not have printed and the second line would have read:

SURFACE NO. 100 MAXIMA 0 1000 100 800

14.4.3 DIGOUTS 1 AND 2 (PAGES C.4 THROUGH C.10)

The model returns to reading the input records until a 'DIGOUT' card is read; the following input records are read at this time:

```
4. PLOT 30 3 3 0.1 0.1
5. PLAN 0 1200 100 700 100 1.0
6. MAINTENANCE 1 10 2
7. WALK 1 0 100 60 1.2 0 4 2.5 3
8. MINE COAL 1 1 0.8 1.05
9. PANEL 65 20 100 20 100 20
10. KEYCUT 1 0 0 1
11. BAIL 1 0 0 1
12. BOXCUT 1
13. REHANDLE 3 0.8 0 20
14. DRAGLINE1 261 30 12 32.5 100 39.5 258 157
15. DRAGLINE2 5 0.15 42 12 60 56 200
16. TANGENTS 2.7 1 0.85 1 10 0.85 0.85 0.85 0.85
17. RATES 3 0.5 480 60 1.1 1100 610 15 5 3
18. COAL LINE FOR BOXCUT PANEL
19. X 200 300 200 420 0 0 0 0 0 0 100 5
20. R 700 300 700 440
21. 800 360 800 500
22. 900 440 900 580
23. E
24. DIGOUT 2 1 1 1
```

The 'DIGOUT' options are:

N = 2; make two digouts before returning to read more input

LOD = 1; use normal digging sequence

LOGCP = 1; print current parameter values before making the digout

LOGDLS = 1; print the details of the DLS actions

There is no 'CHOP' card in the input which effectively turns chopping off. The 'KEYCUT' and 'BAIL' cards call for:

LOK = LOB = 1; normal keycut and bail

LOSK = LOSB = 0; do not spoil

RLK = RLB = 0; entered as a place holder since ridgeline length is used only for spoil Option 2.

LSK = LSB = 1; save surface after each digging action

The 'BOXCUT' card set LOBC = 1 to indicate that this first panel is a boxcut. The 'TANGENTS' card sets TANCD = TANS = .85 so that the CD face for this cut will have the same slope as a spoil bank. This is done to simulate the condition which would exist when the production panel is actually in the middle of the pit.

The four isometric projections of the surfaces, numbers 101, 102, 103, and 104, resulting from these two digouts are shown on Page C.10.

14.4.4 DIGOUT 3 (PAGES C.11 AND C.12)

The model now reads the following input records:

```
25. KEYCUT
26. BAIL 4 0 0 1
27. DIGOUT 1 1 1 1
```

The keycut has been turned off and the bail option is set to 4 to use the rehandle bail routine for this single digout. Again, the current parameter values and details are to be printed.

The rehandle bail routine is used for this digout to illustrate that, under certain conditions, the rehandle routine will form a shape that is essentially the same as the shape formed by the normal bail. However, the rehandle option SHOULD NOT be used for boxcuts, since it will incorrectly treat some of the overburden as rehandle spoils.

The parameters to set for this comparison are:

```
TANCD = TANS = TANSS
RHSC = 0
RHCFH = Actual height of coal
```

The isometric projection for this digout (Surface No. 105) is shown on Page C.15. The circled area on this figure notes the interface of the dragface and the face opposite to the highwall. The rehandle routine "thinks" there is an existing highwall and any material lying on the highwall is spoils that must be rehandled. Therefore, it tends to alter the dragface at the circled area. This steepening could have been avoided if TANBC had also been set to the value of TANSS.

Even with this difference, the overburden removed from this digout is only about 2% more than was removed from the preceding digout. The following table shows how this comparison can be made:

Table 14.1 Volumes From Keycut/Bail Vs. Rehandle Bail

	Digout 2	Digout 3
Keycut	20868	---
Bail	26998	33713
Rehandle	---	<u>15168</u>
Total	<u>47866</u>	<u>48881</u>

In making this comparison, the rehandled swelled yards have been added to the overburden bank yards for digout 3 to determine the actual material removed on this digout.

14.4.5 DIGOUT 4 (PAGES C.13 THROUGH C.15)

The model now reads the following input records:

```
28. TANGENTS 2.7 1 0.85 1 10 0.85 0.95 0.85 0.85
29. DIGOUT 1 1 1 1
```

The value of TANSS is changed to 0.95 to increase the steepen spoil angle for this next digout. The effect of increasing this angle is shown in the circled area on the isometric projection (Surface No. 106) on Page C.15. This digout illustrates that the rehandle routine uses the value of TANSS rather than the value of TANCD when forming the face opposite the highwall.

14.4.6 DIGOUT 5 (PAGES C.16 THROUGH C.18)

The model reads the following input records:

```
30. REHANDLE 3 0.8 20 0
31. DIGOUT 1 1 1 1
```

The 'REHANDLE' card resets RHSC = 20 and RHCFH = 0 to cause the rehandle routine to leave a 20-ft clearance between the toe of coal and the toe of spoils. The effect is shown on the isometric projection (Surface No. 107) on Page C.13. It appears that the panel has simply been widened, however, the

coal has been cleared. It can be seen on this projection that the interface between the dragface and the face opposite the highwall are not correctly formed. This results from using the rehandle routine in a situation for which is not designed. That interface is formed more correctly when the routine is actually rehandling spoils.

14.4.7 DIGOUTS 6 AND 7 (PAGES C.19 AND C.20)

The model reads the following input records:

```
32.  BAIL 1 0 0 99
33.  TANGENTS 2.7 1 0.85 1 10 0.85 0.85 0.85 0.85
34.  DIGOUT 1 1 1 1
```

The value of TANSS has been reset to 0.85, and the save surface control LOSB has been set to 99. This specifies that surface array is to be saved after the last digout in the panel. The results of this digout are printed on Pages C.19 and C.20.

The model then reads:

```
35.  DIGOUT 99 1
```

which specifies the model is to digout until the end of the panel but the current parameter values and the details are not to be printed. The results of this digout are printed on a single line on Page C.20, which reads:

```
BAIL 7 66390.1 .00000 .0000
```

The seventh digout removed 66390.1 yd³ from the surface, with no spoiling and no rehandle. When LOGDLS = 0, the model prints this single line at the end of each digging/spoiling action to assist the user if problems are encountered. Should the model reach an error stop while moving along a panel, this series of single line entries will indicate which digout contains the error.

The panel was turned and widened for digout 6 and 7 to illustrate some features of 'COAL LINE' data handling. The input records which defined this boxcut panel are:

```
18.  COAL LINE FOR BOXCUT PANEL
19.  X 200 200 200 420 0 0 0 0 0 0 100 5
20.  R 700 300 700 440
21.    800 360 800 500
22.    900 440 900 580
23.  E
```

These records defined the coal lines as shown by the following portion of the current parameter listing.

RE-DEF	XC	YC	XP	YP	ASK	DBFK	DOEK	ASB	DBFB	DOEB
1	0	200.	300.	200.	420.	0.	.000	.000	0.	.000 .000
2	0	300.	300.	300.	420.	0.	.000	.000	0.	.000 .000
3	0	400.	300.	400.	420.	0.	.000	.000	0.	.000 .000
4	0	500.	300.	500.	420.	0.	.000	.000	0.	.000 .000
5	0	600.	300.	600.	420.	0.	.000	.000	0.	.000 .000
6	0	700.	300.	700.	420.	0.	.000	.000	0.	.000 .000
7	1	700.	300.	700.	440.	0.	.000	.000	0.	.000 .000
8	0	800.	360.	800.	500.	0.	.000	.000	0.	.000 .000
9	0	900.	440.	900.	580.	0.	.000	.000	0.	.000 .000

Record 19 has an "X" in Column 1 that indicates that the panel is to be parallel to the x axis. The values of ASK, DBFK, DOEK, ASB, DBFB, and DOEB are all zeros on this record. Since no spoiling is being done on this panel, these parameters do not need to be set. Two values follow the six zeros on this record setting DOL = 100 and NOD = 5, specifying 5 100-ft digouts. This record results in six entries into the coal line arrays, lines 1 - 6 in the parameter listing.

Record 20 contains an "R" in Column 1 to specify redefinition of the dragface coordinates for this (sixth) digout. Line 7 on the parameter list prints a "1" under RE-DEF to indicate this redefinition. The YP value is 440 compared to 420 on the previous record to start widening the panel on this digout.

Records 21 and 22, resulting in Lines 8 and 9, finish the definition of this boxcut.

The user has defined 7 digouts. Normally 7 digouts would result in 8 lines in the coal line arrays. However, because one dragface has been redefined, 9 lines were entered in these arrays. The model internal indexing system will take this redefinition into account.

Because LOSB = 99, the surface was saved after digout 7 and is shown on Page C.22 (Surface No. 108).

14.4.8 RTC3 (PAGES C.21 AND C.22)

Because the model has reached the end of the 'COAL LINE' data, it now observes the controls set by the record 8:

8. MINE COAL 1 1 .8 1.5

The parameters from this record are:

LOC = 1; use RTC3 to remove the coal
LSC = 1; save the surface after recovery
ECR = .8; expected coal recovery factor
DCBTY = 1.05; density of coal in tons/bank yd³

The details of coal removal are always printed and are shown on Page C.21. The isometric projection (Surface No. 109) of the pit after recovery is shown on Page C.22. The effects of the coal removal can be seen by comparing Surfaces 108 and 109 on Page C.22.

Since LOBC = 1, the model does not print messages relative to coal which is left in the ground because it is under the boxcut face. If LOBC = 0, such messages would have been printed. The effect of coal under the boxcut face can be inferred by comparing the recoverable tons in place, 54755, with the amount actually removed, 49840.

The project summary prints volumes of overburden and rehandle from each digging action. If the panel is not a boxcut, the total volumes for each panel are also printed. To assist the user, some other totals are printed on the coal removal page (C.21). They are:

VK - Bank yards of overburden from keycuts
VKS - Swelled cubic yards of spoils from keycuts
VB - Bank cubic yards of overburden from bails
VBS - Swelled cubic yards of spoils from bails
VCS - Bank cubic yards of overburden from chopping
VCSS - Swelled cubic yards of spoils from chopping
VR - Bank cubic yards of rehandle which are included in VB.

The theoretical volume of spoils is the product of the bank cubic yards of overburden times one plus the swell factor. However, the model may not spoil all material from any given digout for one of two reasons: the spoil volume has been adjusted by the spoil carry-forward routine, or the tolerance in the spoiling routines results in some variations. Thus, these totals can be used to gain an overview of the panel.

14.4.9 STARTING THE SECOND PANEL (PAGES C.23 THROUGH C.25)

Having completed the coal removal from the first panel, the model continues processing the input file and reads the following records:

36. COAL LINE FOR PRODUCTION PANEL
37. X 200 200 200 300 70 .8 .9 90 .7 .8 100 2
38. 500 200 500 300 70 .8 .9 60 .7 .8


```

39.      600 200 600 300 70 .8 .9 70 .7 .8
40.      700 200 700 300 70 .8 .9 90 .7 .8
41.      800 260 800 360 80 .8 .9 100 .7 .8
42.      900 340 900 440
43.      E
44.      TANGENTS 2.7 1 2.7 1 10 0.85 0.85 0.85 0.85
45.      WALK 2 0 0 60 1.2 0 8 2.5 3
46.      FACTOR 0.4 20
47.      MINE COAL 4 1 0.8 1.05 2 99
48.      CHOP 11 3 0 1 150 125 3 0.8
49.      KEYCUT 1 1 0 1
50.      BAIL 1 1 0 1
51.      DIGOUT 1 1 1 1

```

This second panel is 100 ft wide with the current highwall line parallel to the previous highwall line. The values of XP and YP for a panel do not need to coincide with the XC and YC values from the preceding panel as they do in this example. When the two lines do not coincide, the model will leave a strip of coal and overburden between the two panels. This feature can be used when the boxcut is made to simulate an existing panel, and a buffer between the old and new mine is needed for stability or to prevent water intrusion.

A word of caution is needed when attempting to leave buffers between panels. The ability of the model to leave a buffer of a given width depends on the grid size and the number of turns in the panel. For example, the model would not correctly form a 10-ft wide buffer with a 20-ft grid. In cases where this feature has been used, the model has performed well, but the user is advised to test the option carefully.

For this demonstration, the bail spoil angles are altered beginning with digout 3. Therefore, more 'COAL LINE' cards are required to define the seven digouts. It may also be noted that there is no redefinition for this panel. The reader should be able to see how records 37-43 result in lines 1-8 on Page C.23.

For the first panel, the walk option is 1 which indicates deadheading to the starting position. For the second panel it is 2, indicating the dragline should deadhead to the next position, schedule maintenance (as per 'MAINTENANCE' options) and wait for up to 8 hours for coal loadout (WTH = 8 for this panel). The dragline position was defined as 0,100 for the first panel, but both values are zero for the second panel. The model uses these coordinates only at the start of the run, and the zeros in record 45 are simply place holders.

From Pages C.5 and C.24, we can extract the pertinent information as follows:

BEGIN WALK TIME ROUTINE						
XFP	YFP	XTP	YTP	X-DIS	Y-DIS	D-DIS
.0	100.0	407.0	300.0	407.0	200.0	453.5
DEADHEAD	STEPS	FEET	MIN.	HRS.		
	88	437.9	86.3	1.44		

BEGIN WALK TIME ROUTINE						
XFP	YFP	XTP	YTP	X-DIS	Y-DIS	D-DIS
983.6	574.8	407.0	200.0	-576.6	-374.8	687.6
DEADHEAD	STEPS	FEET	MIN.	HRS.		
	127	634.5	123.3	2.05		

COAL LOADOUT LAYOVER AND MAINTENANCE - HOURS 3.95 2.00

The walk option has been changed, and the manner of accounting for deadhead vs. walking time can now be described. Compare the two walk records:

```

7   - WALK 1 0 100 60 1.2 0 4 2.5 3
45  - WALK 2 0 0 60 1.2 0 8 2.5 3

```

To relate the values to parameters:

	<u>1st Panel</u>	<u>2nd Panel</u>
LOW	1	2
XPP	0	0
YPP	100	0
WANG	60	60
WMF	1.2	1.2
WAF	0	0
WTH	4	8
DHMF	2.5	2.5
DHAF	3	3

In both cases, the calculated walking time is labeled as "deadhead" time since the dragline is moving to its first digging position on each panel. The second panel, however, shows coal loadout time of 3.95 hrs and layover time of 2 hrs.

The 'CHOP' card has been entered in this set to specify:

```

LCC   = 11; chop from the keycut position
LCS   = 3; use the extended bench spoil routine
LCPL  = 0; a place holder since position is used only
        with layer digging
LCSS  = 1; save the surface after chopping/spoiling
CHLF  = 150; chop to 150 ft from the dragline center
CHLS  = 125; chop to 125 ft on the side bench
CHAST = 3; add three seconds to spot time for chopping
CHBFF = .8; 80% fill factor for chopping

```

The results of the chop and extended bench spoiling are detailed on Page C.24 and shown graphically on Page C.25 (Surface No. 110). The value of HB is 65, but at this position on the property the overburden depth is only slightly more than 60. The result was a very small chop volume (3130 yd³) which is not really discernible on the isometric projection.

However, the 'FACTOR' card set WEB = 20 so the model did form the full extended bench on the digout 3 highwall as can be seen in the projection. The required spoil volume is 29,976 compared to 3130 from the chopping. The deficiency will be taken from the next digging operation.

14.4.10 DIGOUT 1 (PAGES C.26 AND C.27)

This digout is actually a continuation of the first digout after the chop/spoil sequence. The model makes a keycut and bail which are detailed on Pages C.26 and C.27. The projections after these operations are shown on Page C.31 (Surfaces No. 111 and 112).

The results of the spoil carry forward operation are shown on Page C.26 by the lines:

SWELLED CUBIC YARDS = 29973.3
 SPOIL VOLUME ADJUSTED (SWELLED CUBIC YARDS) = -26846.0
 SWELLED CUBIC YARDS = 3104.4

To summarize these lines, most of the keycut spoils were used to form the extended bench. The small volume of spoils from the keycut are discernible on Surface No. 111.

Another result of the carry-forward operation can be seen by comparing the production times for the chop and keycut in this digout. The following table recaps the pertinent data:

Table 14.2 Carry-forward Effect on Digging Time

	VSBY	VS	NOS	DIG
Chop	2504	29976	66	1.39
Keycut	23979	3104	625	10.32

The production time calculations are based on the volume of overburden removed (adjusted for swell) rather than the volume of spoils placed on the surface. This treatment is consistent with actual operations.

The dragline would chop to the required bench height using the spoils to extend the bench. It would then begin the keycut using spoils to finish the bench. When sufficient spoils have been placed against the highwall, the remainder would be spoiled in a normal fashion. Thus, the model accounting makes adjustments to simulate the operations.

This digout also illustrates that some care must be taken in setting parameters, e.g., those which control maintenance. To recap, the maintenance parameters from record 6 are:

LOM = 1; schedule maintenance every TBMH hours for a period of TFMH hours

TBMH = 10; working hours before maintenance

TFMH = 2; number of hours for maintenance

Since maintenance, as controlled by the 'WALK' options, had been performed at the start of this digout, one might expect no further maintenance for some time. However, Page C.26 prints the line:

MAINTENANCE TIME IN HOURS 2.00

since the total time in the chop and keycut was 11.71 hours.

14.4.11 DIGOUT 2 (PAGES C.28 THROUGH C.33)

The model reads the following input records:

```
52. MAINTENANCE 2 .05
53. PANEL 60 20 100 20 100 20
54. CHOP 12 2 0 1 150 150 3 0.8
55. KEYCUT 1 2 80 1
56. BAIL 1 2 80 1
57. DIGOUT 1 1 1 1
```

The 'MAINTENANCE' card sets:

LOM = 2; calculate maintenance as fraction of working time

FMT = 0.05; fraction is 5%

which will cause maintenance to be calculated for each digout until the option is reset. This is perhaps the best way to

handle maintenance when simulating a small number of digouts where the operating time in the panel might not be long enough to require a regular maintenance shift.

The keycut and spoil options are changed to 2 to use the ridgeline spoiling routine. The keycut is detailed on Page C.29 and the resulting isometric projection is Surface No. 113 on Page C.31. The results of the bail are detailed on Page C.30 and shown on Page C.31 (Surface No. 114). The extended bench formed from the first digout was placed against the highwall for Digout 3. However, the spoils flow into the area of Digout 2. It can be seen on Surface 114, that the bench spoils have not been removed; the normal bail routine was used rather than the rehandle bail routine.

The ridgeline aspect of the spoils is difficult to discern on Surface 113 but is evident on Surface 114.

The 'CHOP' card reset the chop option to 12 to cause chopping from the bail position. The 'PANEL' card reset the bench height HB to 60 in an attempt to get more material from the chop. The detail on Page C.32 shows this to be only partially successful. The volume is 7800 yd³ compared to 2504 yd³ from the chop on the first digout.

The results of this chop/spoil operation can be seen by comparing Surface 115 (Page C.33) with 114. The result of setting CHLF = 150 is seen by the straight chop line on Surface 115. If CHLF had been set to 999, that line would have been an arc under the boom point.

14.4.12 DIGOUT 3 (PAGES C.34 THROUGH C.39)

The model reads the following input records:

```
58.  CHOP
59.  KEYCUT 1 2 80
60.  BAIL 4 2 80 1
61.  RERUN 1
62.  DIGOUT 1 1 1 1
```

The chop action was turned off. The 'KEYCUT' options were reset to specify LSK = 0 to stop saving surfaces after keycutting. The 'BAIL' options were reset to specify LOB = 4 to use the rehandle bail option so that the extended bench will be cleared. The 'RERUN' card sets KRRNI = 1 to indicate that the rehandle bail should be rerun if spoils flow back into the coal face.

The details are contained on Pages C.35 through C.38 and the resulting projection is Surface No. 116 on C.39. When the

rerun switch is on and the bench has been extended, the model compares the min/max values for x,y points obtained from the dig with those obtained from the spoiling. If they overlap, the model will rerun the bail routine. In this case, they appeared to overlap but the rerun found no volume (Page C.38).

14.4.13 DIGOUT 4 (PAGES C.40 THROUGH C.42)

For the next digout, the model reads:

```
63.  BAIL 4 1 80 99
64.  KEYCUT
65.  DIGOUT 1 5 1 1
```

The keycut options were turned off, and the save surface control LSB was set to 99 to stop saving surfaces until after the last bail. The spoil option LOSB was set to 1 to begin using the conical spoil routine.

Digout Option 5 can be used to force rerunning even when there is no extended bench. Digging and spoiling are two separate model actions. The model always makes a complete dig, and then forms the spoil banks. The model parameters and volumes can be such that the spoils will flow back into the area which has just been formed. At first, it would seem that this sequence of model actions does not really simulate the dragline operations since the digging and spoiling are done on each dragline swing. However, the operator would most likely make the complete production bail, before beginning to rehandle material which flows back against the coal face. Thus, the model sequence is a reasonable approximation of the dragline sequence.

One other aspect of model actions must be understood relative to rerunning. If the spoils flow back onto the coal face and the model bail routine is rerun, the position for spoil dumping must be altered for the rerun. If the second bail/spoil were done with the same spoil angle and same dragline position, the model would simply reform the spoils in the same position. Thus, the model can effectively rerun and clear the coal only if the dumping position can be redefined for the rerun. This redefinition is done by changing the dragline center for the rerun. If an extended bench has been formed, the dragline can be moved out onto the bench for rerunning. When the bench has not been extended, the user can still move the dragline toward the highwall for rerunning by using Digout Option No. 5. In this option, the dragline center will be moved SWDH (safe working distance from the highwall) toward the highwall.

The model did rerun on digout 4 with volumes as shown on Page C.42.

14.4.14 DIGOUT 5 (PAGES C.43 AND C.44)

The next input card:

66. DIGOUT 1 5 0 1

also uses Option 5, but the current parameter printing is turned off. In this case, the comparison of the min/max values from digging with those from spoiling indicates the need to rerun. However, Page C.44 shows that no spoils were rehandled.

This digout illustrates the reasons why the model calls the walk routine after forming the dig shape. If the walk routine had been called before digging, the dragline would have been moved to the rerun position. But since there was no rerun volume, that movement would have been incorrect.

14.4.15 DIGOUT 6 (PAGES C.45 THROUGH C.49)

The model reads the following input records:

67. KEYCUT 1 1 80
68. LAYER 30 3
69. DIGOUT 1 4 1 1

The keycut was turned back on. The 'LAYER' card sets:

DOD = 30; dig approximately 30 ft in each layer
NSPL = 3; the dragline moves three steps for each layer

The digout option LOD is set to 4. This option specifies layer digging with the dragline moved between layers.

The two keycuts are shown on Pages C.46 and C.47, and the two rehandle bails are detailed on Pages C.48 and C.49. It can be seen that for each first layer, the model dig limit is 30 ft above the coal seam; and for the two second layers, the limit is zero feet above the coal seam.

14.4.16 DIGOUT 7 (PAGES C.50 THROUGH C.53)

The model reads one more input card:

70. DIGOUT 1 6 1 1

which specifies using digout Option 6. This layer digging option specifies a normal keycut followed by layer digging, with the dragline moving between layers.

The keycut detail is given on Page C.51 and the two bail details are on Pages C.52 and C.53. The projection of the pit after this last digout is Surface No. 117 on Page C.55.

14.4.17 RTC4 (PAGE C.54)

Since the model has reached the end of the 'COAL LINE' data, it now removes coal according to the options set on record

```
47.  MINE COAL 4 1 .8 1.5 2 99
```

which sets two parameters differently than had been used for the first panel. They are:

```
LCC = 4; use remove the coal Option 4
NCDF = 2; start coal removal with the second digout
NCDL = 99; end coal removal with the last defined digout
```

The values of NCDF and NCDL were set on this record to illustrate how they can be used. The projection of the surface after coal removal is Surface No. 118 on Page C.54. By comparing the two surfaces on this page, it can be seen that coal has been left in the first digout.

14.4.18 PROJECT SUMMARY (PAGE C.56)

Since there are no more input records, the model now prints the project summary shown on Page C.56. This page is described in Chapter 4 of this manual.

APPENDIX A
PRINTOUTS FROM DDM SEQUENCE
FOR "TEST" SURFACE

DEPOSIT DESCRIPTION MODEL

11:08 NOV 20, '80

```
1 T (DDMT(1)) TEST SURFACE FOR DLS USER'S MANUAL DEMO. CASE
2 B 0 0 300
BIAS      0.      0.      300.

3 GSW 0 1000 10 100 800 10
GRID SW      .0      1000.0      10.0      100.0      800.0      10.0
NX = 101
NY = 71
NOW = 7171
4 S 100 1 2950 0.25

SURFACE      100.      1.      2950.      .250

5 X 0
6 0 380 1200 420
7 X 1000
8 0 380 1200 420
```

ELEVATIONS ENTERED FOR FOLLOWING X VALUES:

INDEX, VALUE 1 .00
INDEX, VALUE 101 1000.00

ELEVATIONS ENTERED FOR FOLLOWING Y VALUES:

ELEVATION DATA BY Y LINE FOLLOWS:

Y =	100.0										
	.0	83.3	83.3	83.3	83.3	83.3	83.3	83.3	83.3	83.3	83.3
	100.0	83.3	83.3	83.3	83.3	83.3	83.3	83.3	83.3	83.3	83.3
	200.0	83.3	83.3	83.3	83.3	83.3	83.3	83.3	83.3	83.3	83.3
	300.0	83.3	83.3	83.3	83.3	83.3	83.3	83.3	83.3	83.3	83.3
	400.0	83.3	83.3	83.3	83.3	83.3	83.3	83.3	83.3	83.3	83.3
	500.0	83.3	83.3	83.3	83.3	83.3	83.3	83.3	83.3	83.3	83.3
	600.0	83.3	83.3	83.3	83.3	83.3	83.3	83.3	83.3	83.3	83.3
	700.0	83.3	83.3	83.3	83.3	83.3	83.3	83.3	83.3	83.3	83.3
	800.0	83.3	83.3	83.3	83.3	83.3	83.3	83.3	83.3	83.3	83.3
	900.0	83.3	83.3	83.3	83.3	83.3	83.3	83.3	83.3	83.3	83.3
	1000.0	83.3									
Y =	110.0										
	.0	83.7	83.7	83.7	83.7	83.7	83.7	83.7	83.7	83.7	83.7
	100.0	83.7	83.7	83.7	83.7	83.7	83.7	83.7	83.7	83.7	83.7
	200.0	83.7	83.7	83.7	83.7	83.7	83.7	83.7	83.7	83.7	83.7
	300.0	83.7	83.7	83.7	83.7	83.7	83.7	83.7	83.7	83.7	83.7
	400.0	83.7	83.7	83.7	83.7	83.7	83.7	83.7	83.7	83.7	83.7
	500.0	83.7	83.7	83.7	83.7	83.7	83.7	83.7	83.7	83.7	83.7
	600.0	83.7	83.7	83.7	83.7	83.7	83.7	83.7	83.7	83.7	83.7
	700.0	83.7	83.7	83.7	83.7	83.7	83.7	83.7	83.7	83.7	83.7
	800.0	83.7	83.7	83.7	83.7	83.7	83.7	83.7	83.7	83.7	83.7
	900.0	83.7	83.7	83.7	83.7	83.7	83.7	83.7	83.7	83.7	83.7
	1000.0	83.7									
Y =	120.0										
	.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0
	100.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0
	200.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0
	300.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0
	400.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0
	500.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0
	600.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0
	700.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0
	800.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0
	900.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0
	1000.0	84.0									
Y =	130.0										
	.0	84.3	84.3	84.3	84.3	84.3	84.3	84.3	84.3	84.3	84.3
	100.0	84.3	84.3	84.3	84.3	84.3	84.3	84.3	84.3	84.3	84.3
	200.0	84.3	84.3	84.3	84.3	84.3	84.3	84.3	84.3	84.3	84.3
	300.0	84.3	84.3	84.3	84.3	84.3	84.3	84.3	84.3	84.3	84.3
	400.0	84.3	84.3	84.3	84.3	84.3	84.3	84.3	84.3	84.3	84.3
	500.0	84.3	84.3	84.3	84.3	84.3	84.3	84.3	84.3	84.3	84.3
	600.0	84.3	84.3	84.3	84.3	84.3	84.3	84.3	84.3	84.3	84.3
	700.0	84.3	84.3	84.3	84.3	84.3	84.3	84.3	84.3	84.3	84.3
	800.0	84.3	84.3	84.3	84.3	84.3	84.3	84.3	84.3	84.3	84.3
	900.0	84.3	84.3	84.3	84.3	84.3	84.3	84.3	84.3	84.3	84.3
	1000.0	84.3									
Y =	140.0										
	.0	84.7	84.7	84.7	84.7	84.7	84.7	84.7	84.7	84.7	84.7

[illegible]

A. 3

[illegible]

[illegible]

A.11

A. 12

[illegible]

Y	1000.0	570.0	387.0	250.0	160.0	100.0	50.0	25.0	12.5	6.25	3.125	1.5625	0.78125	0.390625	0.1953125	0.09765625	0.048828125	0.0244140625	0.01220703125	0.006103515625	0.0030517578125	0.00152587890625	0.000762939453125	0.0003814697265625	0.00019073486328125	9.5367431640625E-05	4.76837158203125E-05	2.384185791015625E-05	1.1920928955078125E-05	5.9604644775390625E-06	2.9802322387695312E-06	1.4901161193847656E-06	7.450580596923828E-07	3.725290298461914E-07	1.862645149230957E-07	9.313225746154785E-08	4.656612873077392E-08	2.328306436538696E-08	1.164153218269348E-08	5.82076609134674E-09	2.91038304567337E-09	1.455191522836685E-09	7.275957614183425E-10	3.637978807091712E-10	1.818989403545856E-10	9.09494701772928E-11	4.54747350886464E-11	2.27373675443232E-11	1.13686837721616E-11	5.6843418860808E-12	2.8421709430404E-12	1.4210854715202E-12	7.105427357601E-13	3.5527136788005E-13	1.7763568394002E-13	8.881784197001E-14	4.4408920985005E-14	2.2204460492502E-14	1.1102230246251E-14	5.5511151231255E-15	2.7755575615627E-15	1.3877787807813E-15	6.9388939039065E-16	3.4694469519532E-16	1.7347234759766E-16	8.673617379883E-17	4.3368086899415E-17	2.1684043449707E-17	1.0842021724854E-17	5.421010862427E-18	2.7105054312135E-18	1.3552527156067E-18	6.7762635780335E-19	3.3881317890167E-19	1.6940658945084E-19	8.470329472542E-20	4.235164736271E-20	2.1175823681355E-20	1.0587911840677E-20	5.2939559203385E-21	2.6469779601692E-21	1.3234889800846E-21	6.617444900423E-22	3.3087224502115E-22	1.6543612251057E-22	8.2718061255285E-23	4.1359030627642E-23	2.0679515313821E-23	1.0339757656911E-23	5.1698788284555E-24	2.5849394142277E-24	1.2924697071138E-24	6.462348535569E-25	3.2311742677845E-25	1.6155871338922E-25	8.077935669461E-26	4.0389678347305E-26	2.0194839173652E-26	1.0097419586826E-26	5.048709793413E-27	2.5243548967065E-27	1.2621774483532E-27	6.310887241766E-28	3.155443620883E-28	1.5777218104415E-28	7.8886090522075E-29	3.9443045261037E-29	1.9721522630519E-29	9.8607613152595E-30	4.9303806576297E-30	2.4651903288148E-30	1.2325951644074E-30	6.162975822037E-31	3.0814879110185E-31	1.5407439555092E-31	7.703719777546E-32	3.851859888773E-32	1.9259299443865E-32	9.6296497219325E-33	4.8148248609662E-33	2.4074124304831E-33	1.2037062152415E-33	6.0185310762075E-34	3.0092655381037E-34	1.5046327690519E-34	7.5231638452595E-35	3.7615819226297E-35	1.8807909613148E-35	9.403954806574E-36	4.701977403287E-36	2.3509887016435E-36	1.1754943508217E-36	5.8774717541085E-37	2.9387358770542E-37	1.4693679385271E-37	7.3468396926355E-38	3.6734198463177E-38	1.8367099231589E-38	9.1835496157945E-39	4.5917748078972E-39	2.2958874039486E-39	1.1479437019743E-39	5.7397185098715E-40	2.8698592549357E-40	1.4349296274679E-40	7.1746481373395E-41	3.5873240686697E-41	1.7936620343349E-41	8.9683101716745E-42	4.4841550858372E-42	2.2420775429186E-42	1.1210387714593E-42	5.6051938572965E-43	2.8025969286482E-43	1.4012984643241E-43	7.0064923216205E-44	3.5032461608102E-44	1.7516230804051E-44	8.7581154020255E-45	4.3790577010127E-45	2.1895288505064E-45	1.0947644252532E-45	5.473822126266E-46	2.736911063133E-46	1.3684555315665E-46	6.8422776578325E-47	3.4211388289162E-47	1.7105694144581E-47	8.5528470722905E-48	4.2764235361452E-48	2.1382117680726E-48	1.0691058840363E-48

[illegible][illegible][illegible]

A.14

A. 16

[illegible]

[illegible]

HC = 20.0

SURFACE	SNR	TM	DM	SM
	100.	1.	2950.	.250

SURFACE STATISTICS

X FIRST	X LAST	X STEP	NO. X	Y FIRST	Y LAST	Y STEP	NO. Y	ARRAY SIZE
.0	1000.0	10.0	71	100.0	800.0	10.0	101	7171

LEVEL SEAM T (DOMTEST) TEST SURFACE FOR DLS USER'S MANUAL DEMO. CASE

APPENDIX B

PRINTOUTS FROM DLS "CHOP" CASE

DLS9 - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)
 CASE (DISCHOP) FIRST DEMONSTRATION CASE FOR USER'S MANUAL
 STANDARD MINING WITH CHOPPING FROM KEYCUT POSITION
 SURFACE SNR SNO LOGSF TM DM SM
 100. 1. 1 1. 2050. .250

DATE 15:11 NOV 19,'80

PANEL NO. 0 DIGOUT NO. 0

SURFACE STATISTICS
 X FIRST X LAST X STEP NO. X Y FIRST Y LAST Y STEP NO. Y ARRAY SIZE
 .0 1000.0 10.0 71 100.0 800.0 10.0 101 7171

LEVEL SEAM 1 (DDMTEST) TEST SURFACE FOR DLS USER'S MANUAL DEMO. CASE

SURFACE-FILE HEADER RECORD WRITTEN TO LOGICAL UNIT NO. 4

SURFACE NO. 100. WRITTEN TO FILE XMIN. XMAX. YMIN. YMAX .00 1000.00 100.00 800.00

PLOT 30 3 3 0.1 0.1
 PLAN 0 1200 100 700 100 1.0

DLSS - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)									
CASE (DLSCOP) FIRST DEMONSTRATION CASE FOR USER'S MANUAL									
STANDARD MINING WITH CHOPPING FROM KEYCUT POSITION									
PANEL NO.	1 DIGOUT NO. 1								
DRAGLINE1	DSA	DSB	DSO	DSE	DSF	DSG	DSH	DSI	
	261.0	30.0	12.0	32.5	100.0	39.5	258.0	157.0	
DRAGLINE2	DSM	DSN	DSV	DSW	DSY	DSZ	200.00		
	5.0	.15	42.0	12.0	60.0	56.0			
PANEL	HB	HC	PW	PWK	DOL	SWDH			
	65.0	20.0	100.0	20.0	100.0	20.0			
CHOP	LCC	LCS	LCPL	LCSS	CHLF	CHLS	CHAST	CH8FF	
	0	0	0	0	0.	0.	.000	.000	
KEYCUT	LOK	LOSK	RLK	LSK					
	0	0	.0	0					
BAIL	LOB	LOSB	RLB	LSB	LBP	XBP	YBP		
	1	0	.0	0	0	.0	.0		
REHANDLE	RHAST	RH8FF	RHSC	RHCFH					
	3.000	.800	20.	0.					
ANGLES	AABF	ABCF	ACDF	ADAF	ACFD	ASRD	ASSD	CHFA	OZFA
	69.677	45.000	40.365	45.000	64.289	40.365	40.365	40.365	40.365
TANGENTS	TANAB	TANBC	TANCD	TANDA	TANC	TANS	TANSS	TANCH	TANDZ
	2.700	1.000	.850	1.000	10.000	.850	.850	.850	.850
	COTAB	COTBC	COTCD	COTDA	COTC	COTS	COTSS	COTCH	COTDZ
	.370	1.000	1.176	1.000	.100	1.176	1.176	1.176	1.176
RATES	DTA	DT	DHR	DRR	DSR	DLR	DRR	DRAG	TDUMP
	3.0	.5	480.	860.	1.100	1100.	610.	15.0	5.0
MINE COAL	LOC	LSC	ECR	DEBTY	NODF	NCDL			TSPOT
	4	1	.800	1.050	0	0			3.0
MAINTENANCE	LOM	FMT							
	2	.050							
WALK	LOW	XPP	YPP	WANG	WMF	WAF	WTH	DHMF	DHAF
	1	.0	.0	50.0	1.200	.0	4.00	2.500	3.0
FACTOR	DIF	WEB							
	.400	20.							
RERUN	KRRN	RRNP							
	0	.0							
BOXCUT	LOBC								
	1								
REFERENCE	KREF								
	0								
SWELL	SM								
	.250								
RE-DEF	XC	YC	XP	YP	ASK	DBFK	DOEK	ASB	DBFB
1	0	200.	300.	200.	420.	0.	.000	.000	.000
2	0	300.	300.	300.	420.	0.	.000	.000	.000
3	0	400.	300.	400.	420.	0.	.000	.000	.000
4	0	500.	300.	500.	420.	0.	.000	.000	.000
5	0	600.	300.	600.	420.	0.	.000	.000	.000
6	0	700.	300.	700.	420.	0.	.000	.000	.000
7	1	700.	300.	700.	440.	0.	.000	.000	.000
8	0	800.	360.	800.	500.	0.	.000	.000	.000
9	0	900.	440.	900.	580.	0.	.000	.000	.000
DIGOUT	NDIG0	LOO	LOGCP	LOGDLS					
	1	1	1	1					

DLSS - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)

DATE 15:11 NOV 19.'80

CASE (DLSCOP) FIRST DEMONSTRATION CASE FOR USER'S MANUAL
STANDARD MINING WITH CHOPPING FROM KEYCUT POSITION

PANEL NO. 1 DIGOUT NO. 1

P. BAIL								O			
E	F	G	H	I	J	K	L	M	N	O	P
200.	300.	300.	300.	200.	200.	407.	149.	407.	149.	400.	407.
300.	300.	320.	420.	420.	339.	300.	300.	348.	348.	420.	420.
FF	FF	HI	IE	KG	KL	MM	HO				
0.	90.	180.	270.	169.	180.	180.	0.				

DIRECTION OF ROTATION IS -1

BEGIN P. BAIL OPTION NO. 3 - SPOIL ANGLES 0. 180. DIG LIMIT .0 FT. ABOVE COAL

XQF, XQL, YQF, YQL				
XMIN, XMAX, YMIN, YMAX	100.0	410.0	240.0	540.0
	130.0	370.0	280.0	510.0

DRAGLINE CENTER X,Y,Z = 407.0 347.9 91.7
BANK CUBIC YARDS = 86603.3
SWELLED CUBIC YARDS = 108254.

BEGIN WALK TIME ROUTINE

XFP	YFP	XIP	YIP	X-DIS	Y-DIS	D-DIS
.0	.0	407.0	347.9	407.0	347.9	535.4
DEADHEAD	STEPS	FEET	MIN.	HRS.		
	93	460.8	91.1	1.52		
MAINTENANCE TIME IN HOURS			.08			

NP	ND	DO	SO	VSBY	H&S	R&L	CYCLE	NOS	D.H.	LAY	MAINT	WALK	DIG	TOTAL	TONS	VRBY
1	1	2	0	86603.	.0	.0	.0	0	1.52	.00	.08	.00	.00	1.59	0.	0.
BAIL		2	47869.2	.000000	.000000											
BAIL		3	47869.2	.000000	.000000											
BAIL		4	47869.2	.000000	.000000											
BAIL		5	47869.2	.000000	.000000											
BAIL		6	67138.9	.000000	.000000											
BAIL		7	66389.0	.000000	.000000											

DIGS - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)
CASE (DLSCHOP) FIRST DEMONSTRATION CASE FOR USER'S MANUAL
STANDARD MINING WITH CHOPPING FROM KEYCUT POSITION

DATE 15:11 NOV 19,'80

PANEL NO. 1 DIGOUT NO. 7

BEGIN REMOVE THE COAL - OPTION 4

XQF, XQL, YQF, YQI	200.0	900.0	300.0	580.0
XMIN, XMAX, YMIN, YMAX	210.0	890.0	310.0	570.0

NOMINAL COAL DIMENSIONS IN FEET	106.4	125.7	20.0	7
RECOVERABLE TONS	54755.	807.	1199	

PANEL NO. 1 50711. TONS OF COAL REMOVED FROM SURFACE.

SURFACE NO. 101. WRITTEN TO FILE XMIN, XMAX, YMIN, YMAX 130.00 980.00 240.00 770.00

TOTAL COAL TONS & STRIP RATIO 50711. .00
VM = .000000
VMS = .000000
VB = 411608.
VBS = .000000
VCS = .000000
VCSS = .000000
VR = .000000

DLSS - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)

DATE 15:11 NOV 19,'80

CASE (DISCHOP) FIRST DEMONSTRATION CASE FOR USER'S MANUAL
STANDARD MINING WITH CHOPPING FROM KEYCUT POSITION

PANEL NO. 2 DIGOUT NO. 1

DRAGLINE1	DSA	DSB	DSO	DSE	DSF	DSG	DSH	DSI		
	261.0	30.0	12.0	32.5	100.0	39.5	258.0	157.0		
DRAGLINE2	DSM	DSN	DS5	DSV	DSW	DSY	DCS			
	5.0	.15	42.0	12.0	60.0	56.0	200.00			
PANEL	HB	HC	PW	PWK	DOL	SWDH				
	65.0	20.0	100.0	20.0	100.0	20.0				
CHOP	LCC	LCS	LCPL	LCSS	CHLF	CHLS	CHAST	CHBFF		
	11	1	0	0	150.	125.	3.000	.800		
KEYCUT	LUX	LSK	RLK	LSK						
	1	1	.0	0						
BAIL	LOB	LSB	RLB	LSB	LBP	XBP	YBP			
	1	1	.0	0	0	.0	.0			
REHANDLE	RHAST	RHBFF	RHSC	RHCFH						
	3.000	.800	20.	0.						
ANGLES	AABF	ABCF	ACDF	ADAF	ACFD	ASRD	ASSD	CHFA	OZFA	
	69.677	45.000	69.677	45.000	84.289	40.365	40.365	40.365	40.365	
TANGENTS	TANAB	TANBC	TANCD	TANDA	TANEC	TANF	TANSS	TANCH	TANDZ	
	2.700	1.000	2.700	1.000	10.000	.850	.850	.850	.850	
	COTAB	COTBC	COTCD	COTDA	COTEC	COTF	COTSS	COTCH	COTDZ	
	.370	1.000	.370	1.000	.100	1.176	1.176	1.176	1.176	
RATES	DIA	DI	DHR	DPR	DSR	DLR	DHR	TDRAG	TDUMP	1SPDT
	3.0	.5	480.	860.	1.100	1100.	610.	15.0	5.0	3.0
MINE COAL	LDC	LSC	ECR	DCBTY	NCDF	NCDL				
	4	1	.800	1.050	0	0				
MAINTENANCE	LOM	FMT								
	2	.050								
WALK	LOW	XPP	YPP	WANG	WMF	WAF	WTH	DHMF	DHAF	
	1	563.6	574.8	60.0	1.200	.0	4.00	2.500	3.0	
FACTOR	DTF	WEB								
	.400	20.								
RERUN	KRRN	RRNP								
	0	.0								
BOXCUT	LOBC									
	1									
REFERENCE	KREF									
	0									
SWELL	SM									
	250									
RE-DEF	XC	YC	XP	YP	ASK	DBFK	DOEK	ASB	DBFB	DOEB
1	0	200.	200.	200.	70.	.800	.900	90.	.700	.800
2	0	300.	200.	300.	70.	.800	.900	90.	.700	.800
3	0	400.	200.	400.	70.	.800	.900	90.	.700	.800
4	0	500.	200.	500.	70.	.800	.900	90.	.700	.800
5	0	600.	200.	600.	70.	.800	.900	90.	.700	.800
6	0	700.	200.	700.	70.	.800	.900	90.	.700	.800
7	0	800.	260.	800.	70.	.800	.900	90.	.700	.800
8	0	900.	340.	900.	0.	.000	.000	0.	.000	.000
DIGOUT	NOIGD	LOO	LOGCP	LOGLS						
	1	1	1	1						

DLSS - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)
CASE (DLSCHOP) FIRST DEMONSTRATION CASE FOR USER'S MANUAL
STANDARD MINING WITH CHOPPING FROM KEYCUT POSITION

DATE 15:11 NOV 19,'80

PANEL NO. 2 DIGOUT NO. 1

DRAG. CHOP

E	F	G	H	I	J	K	L	M	N	O	P
200.	300.	300.	300.	200.	200.	407.	319.	407.	407.	400.	407.
200.	200.	220.	300.	300.	239.	200.	442.	228.	486.	300.	300.
EF	FH	HI	IE	KG	KL	MN	HO				
0.	90.	180.	270.	160.	110.	90.	0.				

DIRECTION OF ROTATION IS -1

BEGIN DRAGLINE CHOP - SPOIL ANGLES 70.0 110.0 BENCH ELEVATION 85.0

XQF, XQL, YQF, YQL				
XMIN, XMAX, YMIN, YMAX	300.0	550.0	100.0	370.0
	300.0	550.0	160.0	270.0

DRAGLINE CENTER X,Y,Z = .407.0 200.0 85.0
BANK CUBIC YARDS = 2503.64
SWELLED CUBIC YARDS = 3129.55

BEGIN WALK TIME ROUTINE

XFP	YFP	XTP	YTP	X-DIS	Y-DIS	D-DIS
983.6	574.8	407.0	200.0	-576.6	-374.8	687.6
DEADHEAD	STEPS	FEET	MIN.	HRS.		
	127	634.5	123.3	2.05		

BEGIN SPOIL OPTION NO. 1 - CONICAL SPOIL SHAPE

SPOIL CONE CENTER X,Y,Z = 320.0 440.0 61.4 24.4
SWELLED CUBIC YARDS = 3098.4
DELTA PERCENT = -1.0
XQF, XQL, YQF, YQL 140.0 500.0 260.0 620.0
XMIN, XMAX, YMIN, YMAX 260.0 380.0 380.0 450.0

BEGIN PRODUCTION TIME CALCULATION

BUCKET START X, Y, Z			
BUCKET DUMP X, Y, Z	440.0	170.0	105.3
BUCKET RETURN X, Y, Z	320.0	440.0	105.3
	510.0	110.0	103.7

AV. SWING ANGLES - H&S, R&L 152.2 -151.1

TIMES IN SEC.	DRAG	H&S	DUMP	R&L	SPOT	CYCLE
	15.0	35.0	5.0	25.0	6.0	86.0 S S

MAINTENANCE TIME IN HOURS .19

NP	NO	DO	SO	VSBY	H&S	R&L	CYCLE	NOS	D.H.	LAY	MAINT	WALK	DIG	TOTAL	TONS	VRBY
2	1	6	1	2504.	35.0	25.0	86.0	66	2.05	.00	.19	.00	1.75	4.00 S S	0.	0.

DIGS - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)
CASE (DUSCHOFF FIRST DEMONSTRATION CASE FOR USER'S MANUAL
STANDARD MINING WITH CHOPPING FROM KEYCUT POSITION

DATE 15:11 NOV 19.'80

PANEL NO. 2 DIGOUT NO. 1

KEYCUT 0

BEGIN KEYCUT OPTION NO. 3 - SPOIL ANGLES 70. 110. DIG LIMIT .0 FT. ABOVE COAL

XQF, XOL, YQF, YOL	90.0	410.0	140.0	320.0
XMIN, XMAX, YMIN, YMAX	140.0	360.0	180.0	270.0

DRAGLINE CENTER X,Y,Z = 407.0 200.0 86.7
BANK CUBIC YARDS = 23978.7
SWELLED CUBIC YARDS = 29973.3

BEGIN WALK TIME ROUTINE

XFP	YFP	XTP	YTP	X-DIS	Y-DIS	D-DIS
407.0	200.0	407.0	200.0	.0	.0	.0
WALKING	STEPS	FEET	MIN.	HRS.		
	0	.0	.0	.00		

BEGIN SPOIL OPTION NO. 1 - CONICAL SPOIL SHAPE

SPOIL CONE CENTER X,Y,Z = 320.0 440.0 111.2 49.8
SWELLED CUBIC YARDS = 30005.3
DELTA PERCENT = .1
XQF, XOL, YQF, YOL 140.0 500.0 200.0 520.0
XMIN, XMAX, YMIN, YMAX 210.0 440.0 320.0 480.0

BEGIN PRODUCTION TIME CALCULATION

BUCKET START X, Y, Z	280.0	210.0	63.5
BUCKET DUMP X, Y, Z	320.0	440.0	116.2
BUCKET RETURN X, Y, Z	220.0	220.0	63.6

AV. SWING ANGLES - H&S, R&L -65.6 64.0

TIMES IN SEC.	DRAG	H&S	DUMP	R&L	SPOT	CYCLE
	15.0	18.5	5.0	12.5	3.0	54.0 S L

MAINTENANCE TIME IN HOURS .52

NP	NO	DO	SO	VSBY	H&S	R&L	CYCLE	NOS	D.H.	LAY	MAINT	WALK	DIG	TOTAL	TONS	VRBY
2	1	1	1	23979.	18.5	12.5	54.0	625	.00	.00	.52	.00	10.42	10.94 S L	0.	0.

DLSS - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)
CASE (DLSCOP) FIRST DEMONSTRATION CASE FOR USER'S MANUAL
STANDARD MINING WITH CHOPPING FROM KEYCUT POSITION

DATE 15:11 NOV 19,'80

PANEL NO. 2 DIGOUT NO. 1

P. BAIL 0

BEGIN P. BAIL OPTION NO. 3 - SPOIL ANGLES 90. 90. DIG LIMIT .0 FT. ABOVE COAL

XQF, XQL, YQF, YQL		100.0	410.0	140.0	360.0
XMIN, XMAX, YMIN, YMAX		150.0	360.0	230.0	290.0

DRAGLINE CENTER X,Y,Z = 407.0 227.9 87.7
BANK CUBIC YARDS = 17317.4
SWELLED CUBIC YARDS = 21646.7

BEGIN WALK TIME ROUTINE

XFP	YFP	XTP	YTP	X-DIS	Y-DIS	O-DIS
407.0	200.0	407.0	227.9	0.0	27.9	27.9
WALKING	STEPS	FEET	MIN.	HRS.		
	6	27.9	2.7	.05		

BEGIN SPOIL OPTION NO. 1 - CONICAL SPOIL SHAPE

SPOIL CONE CENTER X,Y,Z =	410.0	490.0	132.8	53.3
SWELLED CUBIC YARDS =	21210.8			
DELTA PERCENT =	-2.0			
XQF, XQL, YQF, YQL	230.0	590.0	310.0	670.0
XMIN, XMAX, YMIN, YMAX	350.0	530.0	340.0	530.0

BEGIN PRODUCTION TIME CALCULATION

BUCKET START X, Y, Z	280.0	250.0	64.1
BUCKET DUMP X, Y, Z	410.0	490.0	137.8
BUCKET RETURN X, Y, Z	220.0	250.0	50.2

AV. SWING ANGLES - H&S, R&L -80.8 83.9

TIMES IN SEC.	DRAG	H&S	DUMP	R&L	SPOT	CYCLE
	15.0	17.0	5.0	15.0	3.0	55.0 H S

MAINTENANCE TIME IN HOURS .49

NP	ND	DO	SO	VSBY	H&S	R&L	CYCLE	NOS	D.H.	LAY	MAINT	WALK	DIG	TOTAL	TONS	VRBY
2	1	2	1	17317.	17.0	15.0	55.0	516	.00	.00	.49	.05	9.85	10.39 H S	0.	0.
CHOP		2	870.368	986.618												
KEYCUT		2	11565.2	14416.8												
BAIL		2	12508.9	15869.0		.000000										
CHOP		3	850.368	952.504												
KEYCUT		3	11565.2	14428.8												
BAIL		3	12508.9	15612.0		.000000										
CHOP		4	1445.90	2325.56												
KEYCUT		4	11565.2	14371.8												
BAIL		4	12197.8	14947.3		.000000										
CHOP		5	3038.47	4705.63												
KEYCUT		5	11563.0	14383.7												
BAIL		5	11582.6	14439.6		.000000										
CHOP		6	4211.45	5291.77												
KEYCUT		6	13432.6	16722.9												

BAIL	6	11568.9	13922.2	.000000
KEYCUT	7	13284.1	16480.6	
BAIL	7	11201.1	13996.9	.000000

DLS - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)

DATE 15:11 NOV 19,'80

CASE (DLSCHOP) FIRST DEMONSTRATION CASE FOR USER'S MANUAL
STANDARD MINING WITH CHOPPING FROM KEYCUT POSITION

PANEL NO. 2 DIGOUT NO. 7

BEGIN REMOVE THE COAL - OPTION 4

XQF, XQI, YQF, YQI	200.0	900.0	200.0	441.0
XMIN, XMAX, YMIN, YMAX	210.0	890.0	210.0	430.0

NOMINAL COAL DIMENSIONS IN FEET	106.4	100.0	20.0	7
RECOVERABLE TONS	43555.	686.	1001	

PANEL NO. 2 42933. TONS OF COAL REMOVED FROM SURFACE.

SURFACE NO. 102. WRITTEN TO FILE XMIN, XMAX, YMIN, YMAX 140.00 1000.00 140.00 690.00

TOTAL COAL TONS & STRIP RATIO 42933. 4.66
VK = 96953.7
VKS = 120809.
VB = 911115.3
VBS = 109998.
VCS = 14290.2
VCSS = 17440.5
VR = .000000
END OF PANEL NO. 2

DL55 - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)

DATE 15:11 NOV 19, '80

CASE (DLSCOP) FIRST DEMONSTRATION CASE FOR USER'S MANUAL
STANDARD MINING WITH CHOPPING FROM KEYCUT POSITION
SUMMARY

PANEL NO. 2 DIGOUT NO. 7

NP	ND	DO	SO	VSBY	H&S	R&L	CYCLE	NOS	D.H.	LAY	MAINT	WALK	DIG	TOTAL	TONS	VRBY
1	1	2	0	86003.	.0	.0	.0	0	1.52	.00	.08	.00	.00	1.59	0.	0.
1	2	2	0	47869.	.0	.0	.0	0	.00	.00	.01	.15	.00	.16	0.	0.
1	3	2	0	47869.	.0	.0	.0	0	.00	.00	.01	.15	.00	.16	0.	0.
1	4	2	0	47869.	.0	.0	.0	0	.00	.00	.01	.15	.00	.16	0.	0.
1	5	2	0	47869.	.0	.0	.0	0	.00	.00	.01	.17	.00	.18	0.	0.
1	6	2	0	67139.	.0	.0	.0	0	.00	.00	.01	.15	.00	.16	0.	0.
1	7	2	0	66389.	.0	.0	.0	0	.00	.00	.01	.16	.00	.17	0.	0.
1	7	4	0	0.	.0	.0	.0	0	1.52	.00	.12	.94	.00	2.58	50711.	0.
2	1	6	1	2504.	35.0	25.0	86.0	66	2.05	.00	.19	.00	1.75	4.00 S S	0.	0.
2	1	1	1	23979.	18.5	12.5	54.0	625	.00	.00	.52	.00	10.42	10.94 S L	0.	0.
2	1	2	1	17317.	17.0	15.0	55.0	516	.00	.00	.49	.05	9.85	10.39 H S	0.	0.
2	2	6	1	870.	35.0	25.0	86.0	23	.00	.00	.04	.16	.61	.81 S S	0.	0.
2	2	1	1	11565.	16.0	12.0	51.0	302	.00	.00	.24	.00	4.75	4.99 H S	0.	0.
2	2	2	1	12509.	17.5	15.0	55.5	373	.00	.00	.36	.05	7.19	7.60 S S	0.	0.
2	3	6	1	850.	35.0	25.0	86.0	23	.00	.00	.04	.16	.61	.81 S S	0.	0.
2	3	1	1	11565.	15.5	12.0	50.5	302	.00	.00	.24	.00	4.71	4.94 H S	0.	0.
2	3	2	1	12509.	18.5	15.0	56.5	373	.00	.00	.37	.05	7.32	7.73 S S	0.	0.
2	4	6	1	11565.	35.0	25.0	86.0	52	.00	.00	.08	.16	1.36	1.62 S S	0.	0.
2	4	1	1	11565.	15.5	12.0	50.5	302	.00	.00	.24	.00	4.71	4.94 H S	0.	0.
2	4	2	1	12198.	18.0	15.0	56.0	363	.00	.00	.36	.05	7.06	7.46 S S	0.	0.
2	5	6	1	3838.	27.5	19.0	72.5	100	.00	.00	.12	.16	2.24	2.52 S S	0.	0.
2	5	1	1	11563.	14.5	12.0	49.5	302	.00	.00	.23	.00	4.61	4.84 H S	0.	0.
2	5	2	1	11583.	20.5	18.0	61.5	345	.00	.00	.38	.14	7.37	7.89 S S	0.	0.
2	6	6	1	4231.	28.5	25.0	79.5	111	.00	.00	.14	.14	2.72	3.00 S S	0.	0.
2	6	1	1	13433.	20.0	12.0	55.0	350	.00	.00	.30	.00	5.94	6.24 H S	0.	0.
2	6	2	1	11569.	21.0	16.0	60.0	345	.00	.00	.36	.08	7.19	7.63 S S	0.	0.
2	7	1	1	13284.	20.5	12.5	56.0	346	.00	.00	.31	.15	5.98	6.44 H S	0.	0.
2	7	2	1	11201.	23.5	15.5	62.0	334	.00	.00	.36	.05	7.19	7.60 S S	0.	0.
2	7	4	0	200129.	19.2	14.6	57.0	5553	2.05	.00	5.35	1.37	103.60	112.37	42933.	0.
2	7	5	0	200129.	19.2	14.6	57.0	5553	2.05	.00	5.35	1.37	103.60	112.37	42933.	0.
UNSCHEDULED DOWN TIME														53.38		
TOTAL SCHEDULED HOURS														165.76		
166. SCHEDULED HOURS				200.00 \$/HR				33151. \$								
104. DIGGING HOURS																
200129. BANK CU.YDS. OVERBURDEN				1207. CY/HR				.166 \$/CY								
42933. TONS ROM COAL				259. T/HR				.772 \$/TON								
STRIPPING RATIO				4.661												

APPENDIX C

PRINTOUTS FROM DLS "DEMO" CASE

DLSS - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)

DATE 12:50 NOV 10,'80

' CASE (DISDEMO) DEMONSTRATE DLS OPTIONS FOR USER'S MANUAL
THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN

PANEL NO. 0 DIGOUT NO. 0

SURFACE	SNR	SND	LOGSF	TM	LW	SM
100.	1.	1.	1	1.	2950.	.250

SURFACE STATISTICS								
X FIRST	X LAST	X STEP	NO. X	Y FIRST	Y LAST	Y STEP	NO. Y ARRAY	SIZE
.0	1000.0	10.0	71	100.0	800.0	10.0	101	7171

LEVEL SEAM T (DDMTEST) TEST SURFACE FOR DLS USER'S MANUAL DEMO. CASE

SURFACE-FILE HEADER RECORD WRITTEN TO LOGICAL UNIT NO 4

SURFACE NO. 100. WRITTEN TO FILE XMIN, XMAX, YMIN, YMAX .00 1000.00 100.00 800.00

PLOT 30 3 3 0.1 0.1
PLAN 0 1200 100 700 100 1.0

DLSS - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)

DATE 12:50 NOV 10, '80

CASE (DLSDemo) DEMONSTRATE DLS OPTIONS FOR USER'S MANUAL
THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN

PANEL NO. 1 DIGOUT NO. 1

DRAGLINE1	DSA	DSB	DSO	DSE	DSF	DSG	DSH	DSI		
	261.0	30.0	12.0	32.5	100.0	39.5	250.0	157.0		
DRAGLINE2	DSM	DSN	DS5	DSV	DSW	DSY	DCS			
	5.0	.15	42.0	12.0	60.0	56.0	200.00			
PANEL	HB	HC	HW	FWK	DOL	SWDH				
	65.0	20.0	100.0	20.0	100.0	20.0				
CHOP	LCC	LCS	LCFL	LCSS	CHLF	CHLS	CHAST	CHBFF		
	0	0	0	0	0.	0.	.000	.000		
KEYCUT	LOK	LOSK	RLK	LSK						
	1	0	.0	1						
BAIL	LOB	LOSB	RLB	LSB	LBP	XBP	YBP			
	1	0	.0	1	0	.0	.0			
REHANDLE	RHAST	RHBFF	RHSC	RMCTH						
	3.000	.800	0.	20.						
ANGLES	AABF	ABCF	ACDF	ADAF	ACFD	ASRD	ASSD	CHFA	DZFA	
	69.677	45.000	40.365	45.000	84.289	40.365	40.365	40.365	40.365	
TANGENTS	TANAB	TANBC	TANCD	TANDA	TANC	TANS	TANSS	TANCH	TANDZ	
	2.700	1.000	.850	1.000	10.000	.850	.850	.850	.850	
	COTAB	COTBC	COTCD	COTDA	COTC	COTS	COTSS	COTCH	COTDZ	
	.370	1.000	1.176	1.000	.100	1.176	1.176	1.176	1.176	
RATES	DIA	DI	DHR	DPR	DSR	DLH	DRR	DRAG	TOUMP	1SPOT
	3.0	.5	480.	860.	1.100	1100.	610.	15.0	5.0	3.0
MINE COAL	LOC	LSC	ECR	DCBTY	NCDF	NCOL				
	1	1	.800	1.050	0	0				
MAINTENANCE	LOM	TBMH	TFMH							
	1	10.0	2.0							
WALK	LOW	XPP	YPP	WANG	WMF	WAF	WTH	DHMF	DHAF	
	1	.0	100.0	60.0	1.200	.0	4.00	2.500	3.0	
FACTOR	DIF	WEB								
	.000	0.								
RERUN	KRRN	RRNP								
	0	.0								
BOXCUT	LOBC									
	1									
REFERENCE	KREF									
	0									
SWELL	SM									
	.250									
RE-DEF	XC	YC	XP	YP	ASK	DBFM	DOEK	ASB	DBFB	DOER
1 0	200.	300.	200.	420.	0.	.000	.000	0.	.000	.000
2 0	300.	300.	300.	420.	0.	.000	.000	0.	.000	.000
3 0	400.	300.	400.	420.	0.	.000	.000	0.	.000	.000
4 0	500.	300.	500.	420.	0.	.000	.000	0.	.000	.000
5 0	600.	300.	600.	420.	0.	.000	.000	0.	.000	.000
6 0	700.	300.	700.	420.	0.	.000	.000	0.	.000	.000
7 1	700.	300.	700.	440.	0.	.000	.000	0.	.000	.000
8 0	800.	360.	800.	500.	0.	.000	.000	0.	.000	.000
9 0	900.	440.	900.	500.	0.	.000	.000	0.	.000	.000
DIGOUT	NDIGD	LOD	LOGCP	LOGDLS						
	1	1	1	1						

DLSS - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)

DATE 12:50 NOV 10, '80

CASE (DLSDemo) DEMONSTRATE DLS OPTIONS FOR USER'S MANUAL
THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN

PANEL NO. 1 DIGOUT NO. 1

								KEYCUT		O		P	
E	F	G	H	I	J	K	L	M	N	O	P		
200.	300.	300.	300.	200.	200.	407.	149.	407.	149.	400.	407.		
300.	300.	320.	420.	420.	339.	300.	300.	348.	348.	420.	420.		
EF	FH	HI	IE	KG	KL	MN	HO						
0.	90.	180.	270.	169.	180.	180.	0.						

DIRECTION OF ROTATION IS -1

BEGIN KEYCUT OPTION NO. 3 - SPOIL ANGLES 0. 180. DIG LIMIT .0 FT. ABOVE COAL

XQF, XQL, YQF, YQL	90.0	410.0	240.0	480.0
XMIN, XMAX, YMIN, YMAX	130.0	370.0	280.0	440.0

DRAGLINE CENTER X,Y,Z = 407.0 300.0 90.0
BANK CUBIC YARDS = 42552.4
SWELLED CURVE YARDS = 53190.6

BEGIN WALK TIME ROUTINE

XFP	YFP	XTP	YTP	X-DIS	Y-DIS	D-DIS
.0	100.0	407.0	300.0	407.0	200.0	453.5
DEADHEAD	STEPS	FEET	MIN.	HRS.		
	88	437.9	86.3	1.44		

NP	ND	DO	SD	VSBY	H85	R8L	CYCLE	NDS	D.H.	LAY	MAINT	WALK	DIG	TOTAL	TONS	VRBY
1	1	1	0	42552.	.0	.0	.0	0	1.44	.00	.00	.00	.00	1.44	0.	0.

SURFACE NO. 101. WRITTEN TO FILE XMIN, XMAX, YMIN, YMAX 130.00 370.00 280.00 440.00

DLS5 - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)
CASE (DLSDEMO) DEMONSTRATE DLS OPTIONS FOR USER'S MANUAL
THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN

DATE 12:50 NOV 10,'80

PANEL NO. 1 DUGOUT NO. 1

P. BAIL 0

BEGIN P. BAIL OPTION NO. 3 - SPOIL ANGLES 0, 180. DIG LIMIT 10 FT. ABOVE COAL

XQF, XQL, YQF, YQL 100.0 410.0 240.0 540.0
XMIN, XMAX, YMIN, YMAX 130.0 370.0 330.0 510.0

DRAGLINE CENTER X,Y,Z = 407.0 347.9 91.7
BANK CUBIC YARDS = 44042.0
SWELLED CUBIC YARDS = 55052.4

BEGIN WALK TIME ROUTINE

	XFP	YFP	XTP	YTP	X-DIS	Y-DIS	D-DIS
	407.0	300.0	407.0	347.9	-1.0	47.9	47.9
WALKING	STEPS	FEET	MIN.	HRS.			
	10	47.9	4.5	.08			

NP	ND	DD	SD	VSBY	H&S	R&L	CYCLE	NOS	D.H.	LAY	MAINT	WALK	DIG	TOTAL	TONS	VRBY
1	1	2	0	44042.	.0	.0	.0	0	.00	.00	.00	.08	.00	.08	0.	0.

SURFACE NO. 102. WRITTEN TO FILE XMIN, XMAX, YMIN, YMAX 130.00 370.00 330.00 510.00

DLSS - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)

DATE 12:50 NOV 10, '80

CASE (DLSDMO) DEMONSTRATE DLS OPTIONS FOR USER'S MANUAL
THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN

PANEL NO. 1 DIGOUT NO. 2

DRAGLINE1	DSA	DSB	DSO	DSE	DSF	DSG	DSH	DSI		
	261.0	30.0	12.0	32.5	100.0	39.5	258.0	157.0		
DRAGLINE2	DSM	DSN	DSS	DSV	DSW	DSY	DSZ			
	5.0	.15	42.0	12.0	60.0	56.0	200.00			
PANEL	HB	HC	PW	PWK	DOL	SWDH				
	65.0	20.0	100.0	20.0	100.0	20.0				
CHOP	LCC	LCS	LCPL	LCSS	CHLF	CHLS	CHAST	CHBFF		
	0	0	0	0	0	0	.000	.000		
KEYCUT	LOK	LOSK	RLK	LSK						
	1	0	0	1						
BAIL	LOB	LOSB	RLB	LSB	LRP	XBP	YBP			
	1	0	0	1	0	0	0			
REHANDLE	RHAST	RHBFF	RHSC	RHCFH						
	3.000	.800	0.	20.						
ANGLES	AABF	ABCF	ACDF	ADAF	ACFD	ASRD	ASSD	CHFA	DZFA	
	69.677	45.000	40.365	45.000	84.289	40.365	40.365	40.365	40.365	
TANGENTS	TANAB	TANBC	TANCD	TANDA	TANC	TANS	TANSS	TANCH	TANDZ	
	2.700	1.000	.850	1.000	10.000	.850	.850	.850	.850	
	COTAB	COTBC	COTCD	COTDA	COTC	COTS	COTSS	COTCH	COTDZ	
	.370	1.000	1.176	1.000	.100	1.176	1.176	1.176	1.176	
RATES	DTA	DT	DHR	DOR	DSR	DLR	DRR	TDRAG	TDUMP	TSPOT
	3.0	.5	480.	860.	1.100	1100.	610.	15.0	5.0	3.0
MINE COAL	LOC	LSC	ECR	DCBTY	NCDF	NCOL				
	1	1	.800	1.050	0	0				
MAINTENANCE	LOM	TFMH	TFMH							
	1	10.0	2.0							
WALK	LOW	XPP	YPP	WANG	WMF	WAF	WTH	DMMF	DMAF	
	1	407.0	347.9	60.0	1.200	.0	4.00	2.500	3.0	
FACTOR	DTF	WEB								
	.000	0.								
RERUN	KREN	RBNP								
	0	.0								
BOXCUT	LOBC									
	1									
REFERENCE	KREF									
	0									
SWELL	SM									
	.250									
RE-DEF	XC	YC	XP	YP	ASM	DBFM	DOEM	ASB	DBFB	DOEB
1 0	200.	300.	200.	420.	0.	.000	.000	0.	.000	.000
2 0	300.	300.	300.	420.	0.	.000	.000	0.	.000	.000
3 0	400.	300.	400.	420.	0.	.000	.000	0.	.000	.000
4 0	500.	300.	500.	420.	0.	.000	.000	0.	.000	.000
5 0	600.	300.	600.	420.	0.	.000	.000	0.	.000	.000
6 0	700.	300.	700.	420.	0.	.000	.000	0.	.000	.000
7 1	700.	300.	700.	440.	0.	.000	.000	0.	.000	.000
8 0	800.	360.	800.	500.	0.	.000	.000	0.	.000	.000
9 0	900.	440.	900.	580.	0.	.000	.000	0.	.000	.000
DIGOUT	NDIGO	LOD	LOGCP	LOGDLS						
	4	1	1	1						

DLSS - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)

DATE 12:50 NOV 10,'80

*CASE (DLSDMO) DEMONSTRATE DLS OPTIONS FOR USER'S MANUAL
THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN

PANEL NO. 1 DIGOUT NO. 2

KEYCUT								O		P	
E	F	G	H	I	J	K	L	M	N	O	P
300.	400.	400.	400.	300.	300.	507.	249.	507.	249.	500.	507.
300.	300.	320.	420.	420.	339.	300.	300.	348.	348.	420.	420.
EF	FH	HI	IE	IG	KL	MN	HO				
0.	90.	180.	270.	169.	180.	180.	0.				

DIRECTION OF ROTATION IS -1

BEGIN KEYCUT OPTION NO. 3 - SPOIL ANGLES 0. 180. DIG LIMIT .0 FT. ABOVE COAL

XQF, XQL, YOF, YOL	190.0	510.0	240.0	480.0
XMIN, XMAX, YMIN, YMAX	310.0	470.0	280.0	410.0

DRAGLINE CENTER X,Y,Z = 507.0 300.0 90.0
BANK CUBIC YARDS = 20867.5
SWELLED CUBIC YARDS = 26084.4

BEGIN WALK TIME ROUTINE

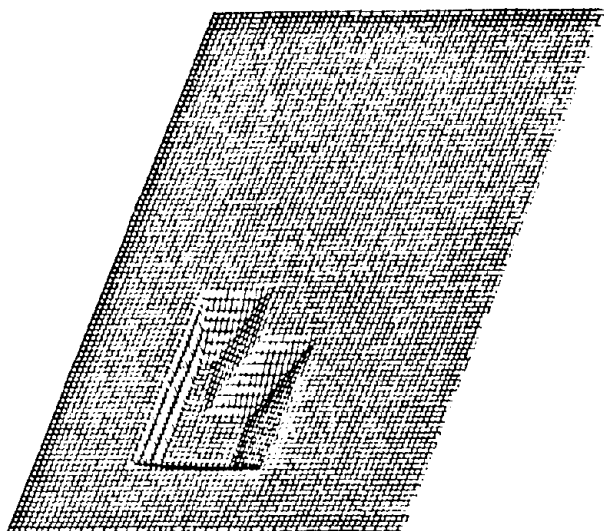
XFP	YFP	ZFP	YTP	X-DIS	Y-DIS	D-DIS
407.0	347.9	507.0	300.0	100.0	-47.9	110.9
WALKING	STEPS	FEET	MIN.	HRS.		
	22	107.4	10.0	.17		

NP	NO	DO	SO	VSBY	H&S	R&L	CYCLE	NOS	D.H.	LAY	MAINT	WALK	DIG	TOTAL	TONS	VRBY
1	2	1	0	20869.	.0	.0	.0	0	.00	.00	.00	.17	.00	.17	0.	0.

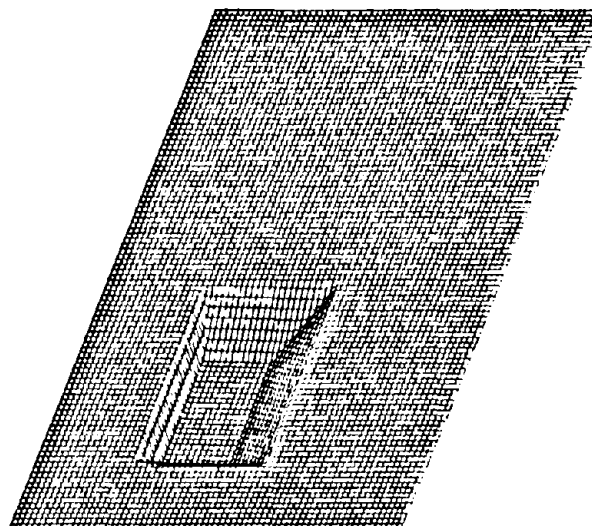
SURFACE NO. 103. WRITTEN TO FILE XMIN, XMAX, YMIN, YMAX 310.00 470.00 280.00 410.00

C.9

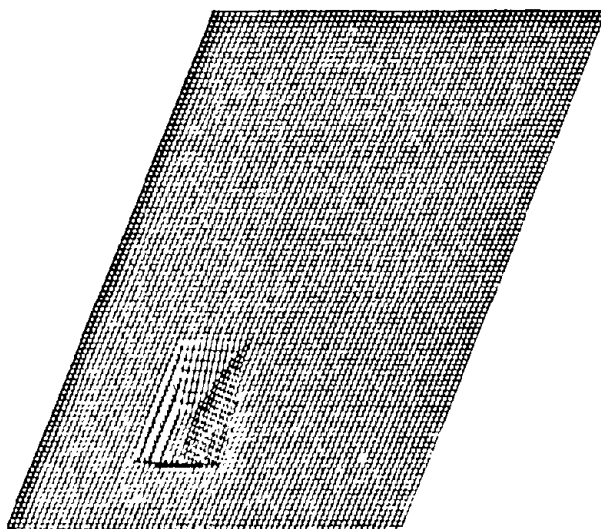
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DL55 - DRAGLINE SHIPPING MODEL (LEVEL COAL SEAM)
DATE 12:50 NOV 10,'80
CASE (DLSDemo) DEMONSTRATE DIS OPTIONS FOR USER'S MANUAL
THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN
PANEL NO. 1 DIGOUT NO. 2
P. BAIL 0
BEGIN P. BAIL OPTION NO. 3 - SPOIL ANGLES 0. 180. DIG LIMIT .0 FT. ABOVE COAL
XOF, XOL, YOF, YOL 200.0 510.0 240.0 540.0
XMIN, XMAX, YMIN, YMAX 310.0 470.0 330.0 510.0
DRAGLINE CENTER X,Y,Z : 507.0 347.9 91.7
BANK CUBIC YARDS = 26997.9
SWELLED CUBIC YARDS = 33747.3
BEGIN WALK TIME ROUTINE
XFP YFP XTP YTP X-DIS Y-DIS D-DIS
507.0 300.0 507.0 347.9 .0 47.9 47.9
WALKING STEPS FEET MIN. HRS.
10 47.9 4.5 .08
NP NO DO SO VSBY H&S R&L CYCLE NOS D.H. LAY MAINT WALK DIG TOTAL TONS VRBY
1 2 2 0 26998. .0 .0 .0 0 .00 .00 .00 .00 .08 0. 0.
SURFACE NO. 104. WRITTEN TO FILE XMIN, XMAX, YMIN, YMAX 310.00 470.00 330.00 510.00
```



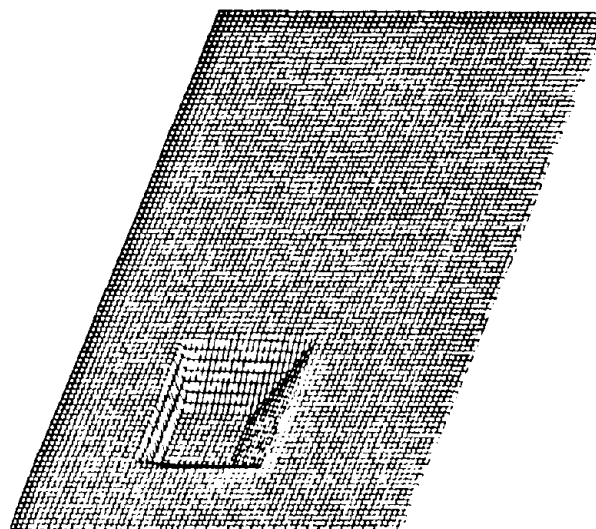
CASE DEMO SUR NO 103 - SOUTH



CASE DEMO SUR NO 104 - SOUTH



CASE DEMO SUR NO 101 - SOUTH



CASE DEMO SUR NO 102 - SOUTH

DLS5 - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)									
DATE 12:50 NOV 10, '80									
CASE (DLSDEMO) DEMONSTRATE DLS OPTIONS FOR USER'S MANUAL									
THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN									
PANEL NO. 1 DIGOUT NO. 3									
DRAGLINE1	DSA	DSB	DSO	DSE	DSF	DSG	DSH	DSI	
	261.0	30.0	12.0	32.5	100.0	39.5	258.0	157.0	
DRAGLINE2	DSM	DSN	DS5	DSV	DSW	DSY	DC5		
	5.0	.15	42.0	12.0	60.0	56.0	200.00		
PANEL	HB	HC	PH	PWH	DGL	SWDH			
	65.0	20.0	100.0	20.0	100.0	20.0			
CHOP	LCC	LCS	LCPL	LCSS	CHLF	CHLS	CHAST	CHBFF	
	0	0	0	0	0.	0.	.000	.000	
KEYCUT	LOK	LOSK	RLK	LSK					
	0	0	.0	0					
BAIL	LOB	LOSB	RLB	LSB	LBP	XBP	YBP		
	4	0	.0	1	0	.0	.0		
REHANDLE	RHAST	RHBFF	RHSC	RHCFH					
	3.000	.800	0.	20.					
ANGLES	AABF	ABCF	ACDF	ADAF	ACFD	ASRD	ASSD	CHFA	DZFA
	69.677	45.000	40.365	45.000	84.289	40.365	40.365	40.365	40.365
TANGENTS	TANAB	TANBC	TANCD	TANDA	TANC	TANS	TANSS	TANCH	TANDZ
	2.700	1.000	.850	1.000	10.000	.850	.850	.850	.850
	COTAB	COTBC	COTCD	COTDA	COTC	COTS	COTSS	COTCH	COTDZ
	.370	1.000	1.176	1.000	.100	1.176	1.176	1.176	1.176
RATES	DTA	DT	DHR	DPR	DSR	DLR	ORR	TDRA	TDUMP
	3.0	.5	480.	860.	1.100	1100.	610.	15.0	5.0
MINE COAL	LCC	LSC	ECR	DCBTY	NCDF	NCOL			
	1	1	.800	1.050	0	0			
MAINTENANCE	LOM	TBMH	TFMH						
	1	10.0	2.0						
WALK	LOW	XPP	YPP	WANG	WMF	WAF	WTH	DHMF	DHAF
	1	507.0	347.9	60.0	1.200	.0	4.00	2.500	3.0
FACTOR	DTF	WEB							
	.000	0.							
RERUN	KRRN	RRNP							
	0	.0							
BOXCUT	LOBC								
	1								
REFERENCE	KREF								
	0								
SWELL	SW								
	.250								
RE-DEF	XC	YC	XP	YP	ASK	DRFK	DOEK	ASB	DBFB
1	0	200.	300.	200.	420.	0.	.000	.000	.000
2	0	300.	300.	300.	420.	0.	.000	.000	.000
3	0	400.	300.	400.	420.	0.	.000	.000	.000
4	0	500.	300.	500.	420.	0.	.000	.000	.000
5	0	600.	300.	600.	420.	0.	.000	.000	.000
6	0	700.	300.	700.	420.	0.	.000	.000	.000
7	1	700.	300.	700.	440.	0.	.000	.000	.000
8	0	800.	360.	800.	500.	0.	.000	.000	.000
9	0	900.	440.	900.	580.	0.	.000	.000	.000
DIGOUT	NOIGO	LOD	LOGCP	LOGDLS					
	3	1	1	1					

DL55 - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM) DATE 12:50 NOV 10, '80

CASE (DLSDMO) DEMONSTRATE DLS OPTIONS FOR USER'S MANUAL PANEL NO. 1 DIGOUT NO. 3

THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN

E	F	G	H	I	J	K	L	M	N	O	P
400.	500.	500.	500.	400.	400.	607.	349.	607.	349.	600.	607.
300.	300.	320.	420.	420.	339.	300.	300.	348.	348.	420.	420.
EF	FH	HI	IE	IG	KL	MN	HO				
0.	90.	180.	270.	169.	180.	180.	0.				

P. BAIL

DIRECTION OF ROTATION IS -1

BEGIN REHANDLE BAIL OPTION NO. 4 - SPDIL ANGLES 0. 180. DIG LIMIT .0 FT. ABOVE COAL

XQF, XOL, YQF, YOL	300.0	600.0	240.0	520.0
XMIN, XMAX, YMIN, YMAX	410.0	580.0	280.0	500.0

DRAGLINE CENTER X,Y,Z	607.0	347.9	91.7
VOLUMES	OVERBURDEN	REHANDLE	TOTAL
BANK CUBIC YARDS	33713.	12135.	45848.
SWELLED CUBIC YARDS	42141.	15168.	57310.

BEGIN WALK TIME ROUTINE

XFP	YFP	XTP	YTP	X-DIS	Y-DIS	D-DIS
507.0	347.9	607.0	347.9	100.0	.0	100.0
WALKING	SIFPS	FEET	MIN.	HRS.		
	20	100.0	9.1	.15		

NP	ND	DO	SD	V\$BY	H&S	R&L	CYCLE	NOS	D.H.	LAY	MAINT	WALK	DIG	TOTAL	TONS	VRBY
1	3	7	0	45848.	.0	.0	.0	0	.00	.00	.00	.15	.00	.15	0.	12135.

SURFACE NO. 105. WRITTEN TO FILE XMIN, XMAX, YMIN, YMAX 410.00 580.00 280.00 500.00

DLSS - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)									
DATE 12:50 NOV 10, '88									
CASE (DLSSDEMO) DEMONSTRATE DLS OPTIONS FOR USER'S MANUAL									
THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN									
PANEL NO. 1 DIGOUT NO. 4									
DRAGLINE1	DSA	DSB	DSO	DSE	DSF	DSG	DSH	DSI	
	231.0	30.0	12.0	32.5	100.0	39.5	258.0	157.0	
DRAGLINE2	DSM	DSN	DSS	DSV	DSW	DSY	DCS		
	5.0	.15	42.0	12.0	60.0	56.0	200.00		
PANEL	HB	HC	FW	FWK	DOL	SWDH			
	65.0	20.0	100.0	20.0	100.0	20.0			
CHOP	LCC	LCS	LCPL	LCSS	CHLF	CHLS	CHAST	CHBFF	
	.0	.0	.0	.0	.0	.0	.000	.000	
KEYCUT	LOK	LOSK	RLK	LSK					
	.0	.0	.0	.0					
BAIL	LOB	LOSB	RLB	LSB	LBP	XBP	YBP		
	.0	.0	.0	.0	.0	.0	.0		
REHANDLE	RHAST	RHBFF	RHSC	RHCFH					
	3.000	.800	.0	20.					
ANGLES	AABF	ABCF	ACDF	ADAF	ACFD	ASRD	ASSD	CHFA	DZFA
	69.677	45.000	40.365	45.000	64.289	40.365	43.531	40.365	40.365
TANGENTS	TANAB	TANBC	TANCD	TANEA	TANF	TANSS	TANCH	TANDZ	
	2.700	1.000	.850	1.000	10.000	.850	.950	.850	.850
	COTAB	COTBC	COTCD	COTDA	COTC	COTSS	COTCH	COTDZ	
	.370	1.000	1.176	1.000	.100	1.176	1.053	1.176	1.176
RATES	DLA	DLB	DLR	DLR	DLR	DLR	DLR	DLR	DLR
	3.0	.5	480.	860.	1.100	1100.	610.	15.0	5.0
MINE COAL	LOC	LSC	ECR	DCBTY	NCDF	NCDL			
	.1	.1	.800	1.050	.0	.0			
MAINTENANCE	LOM	TBMH	TFMH						
	.1	10.0	2.0						
WALK	LOM	XPP	YPP	WANG	WMF	MAF	WTH	DHMF	DHAF
	.1	607.0	347.9	60.0	1.200	.0	4.00	2.500	3.0
FACTOR	DIF	WEB							
	.000	.0							
RERUN	KRRN	RRRN							
	.0	.0							
BOXCUT	LOBC								
	.1								
REFERENCE	KREF								
	.0								
SWELL	SM								
	.250								
RE-DEF	XC	YC	XP	YP	ASK	DBFK	DOEK	ASB	DBFB
1 0	200.	300.	200.	420.	.0	.000	.000	.0	.000
2 0	300.	300.	300.	420.	.0	.000	.000	.0	.000
3 0	400.	300.	400.	420.	.0	.000	.000	.0	.000
4 0	500.	300.	500.	420.	.0	.000	.000	.0	.000
5 0	600.	300.	600.	420.	.0	.000	.000	.0	.000
6 0	700.	300.	700.	420.	.0	.000	.000	.0	.000
7 1	700.	300.	700.	440.	.0	.000	.000	.0	.000
8 0	800.	360.	800.	500.	.0	.000	.000	.0	.000
9 0	900.	440.	900.	580.	.0	.000	.000	.0	.000
DIGOUT	NDIGO	LDD	LOGCP	LOGDLS					
	4	1	1	1					

DLSS - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)

DATE 12:50 NOV 10,'80

CASE (DLSDMO) DEMONSTRATE DLS OPTIONS FOR USER'S MANUAL
THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN

PANEL NO. 1 DIGOUT NO. 4

E	F	G	H	I	J	K	L	M	N	O	P
500.	600.	600.	600.	500.	500.	707.	449.	707.	449.	700.	707.
300.	300.	320.	420.	420.	339.	300.	300.	348.	348.	420.	420.
EF	FH	HI	IE	KG	KL	MH	HO				
0.	90.	180.	270.	169.	180.	180.	0.				

DIRECTION OF ROTATION IS -1

BEGIN REHANDLE BAIL OPTION NO. 4 - SPOIL ANGLES 0. 120. DIG LIMIT .0 FT. ABOVE COAL

XOF, XOL, YOF, YOL	400.0	690.0	240.0	510.0
XMIN, XMAX, YMIN, YMAX	510.0	680.0	280.0	500.0

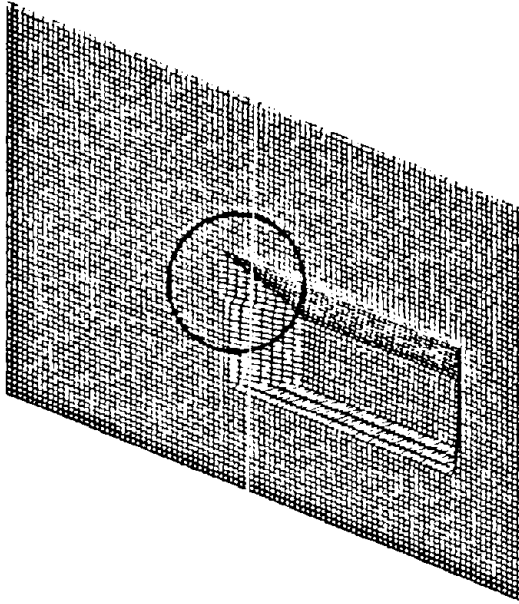
DRAGLINE CENTER X,Y,Z	707.0	347.9	91.7
VOLUMES	OVERBURDEN	REHANDLE	TOTAL
BANK CUBIC YARDS	33714.	9759.	43473.
SWELLED CUBIC YARDS	42143.	12199.	54342.

BEGIN WALK TIME ROUTINE

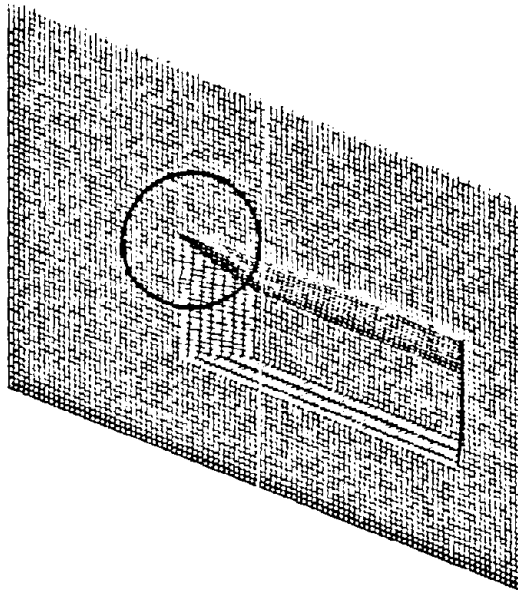
KFP	YFP	XTP	YTP	X-DIS	Y-DIS	D-DIS
607.0	347.9	707.0	347.9	100.0	.0	100.0
WALKING	STEPS	FEET	MIN.	HRS.		
	20	100.0	9.1	.15		

NP	ND	DD	SO	VSBY	H&S	R&L	CYCLE	NOS	D.H.	LAY	MAINT	WALK	DIG	TOTAL	TONS	VRBY
1	4	7	0	43473.	.0	.0	.0	0	.00	.00	.00	.15	.00	.15	0.	9759.

SURFACE NO. 106. WRITTEN TO FILE XMIN, XMAX, YMIN, YMAX 510.00 680.00 280.00 500.00



CASE DEMO SUR NO 105. - SOUTH



CASE DEMO SUR NO 105. - SOUTH

DLSS - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)

DATE 12:50 NOV 10, '80

CASE (DLSDMO)	DEMONSTRATE	DL	OPTIONS	FOR	USER'S	MANUAL	PANEL NO.	1	DIGOUT NO.	8
THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN										
DRAGLINE1	DSA	DSB	DSO	DSE	DSF	DSG	DSH	DSI		
	261.0	30.0	12.0	32.5	100.0	39.5	258.0	157.0		
DRAGLINE2	DSM	DSN	DSS	DSV	DSW	DSX	DSY	DSZ		
	5.0	.15	42.0	12.0	60.0	56.0	200.00			
PANEL	HB	HC	PW	PWK	DOL	SWDH				
	65.0	20.0	100.0	20.0	100.0	20.0				
CHOP	LCC	LCS	LCPL	LCSS	CHLF	CHLS	CHAST	CHBFF		
	0	0	0	0	0.	0.	.000	.000		
KEYCUT	LOK	LOSK	RLK	LSK						
	0	0	.0	0						
BAIL	LOB	LOSB	RLB	LSB	LBP	XBP	YBP			
	4	0	.0	1	0	.0	.0			
REHANDLE	RHAST	RHBFF	RHSC	RHCFH						
	3.000	.800	20.	0.						
ANGLES	AABF	ABCF	ACDF	ADAF	ACFD	ASRD	ASSD	CHFA	DZFA	
	69.677	45.000	40.365	45.030	84.289	40.365	43.531	40.365	40.365	
TANGENTS	TANAB	TANBC	TANCD	TANUA	TANVC	TANSS	TANSS	TANCH	TANDZ	
	2.700	1.000	.850	1.000	10.000	.850	.950	.850	.850	
	COTAB	COTBC	COTCD	COTDA	COTVC	COTSS	COTSS	COTCH	COTDZ	
	.370	1.000	1.176	1.000	.100	1.176	1.053	1.176	1.176	
RATES	DIA	DT	DHR	DRR	DSR	DLR	DRR	TDRA	TDMP	TSPT
	3.0	.5	480.	860.	1.100	1100.	610.	15.0	5.0	3.0
MINE COAL	LOC	LSC	ECR	DEBTY	NCDF	NCOL				
	1	1	.800	1.050	0	0				
MAINTENANCE	LOM	TBMH	TFMH							
	1	10.0	2.0							
WALK	LOW	XPP	YPP	WANG	WMF	WAF	WTH	DHMF	DHAF	
	1	707.0	347.9	60.0	1.200	.0	4.00	2.500	3.0	
FACTOR	DTF	WEB								
	.000	0.								
RERUN	RRRN	RRNP								
	0	.0								
BOXCUT	LOBC									
	1									
REFERENCE	RREF									
	0									
SWELL	SM									
	.250									
RE-DEF	XC	YC	XP	YP	ASK	DBFK	DOEK	ASB	DBFB	DOEB
1 0	200.	300.	200.	.120.	0.	.000	.000	0.	.000	.000
2 0	300.	300.	300.	.120.	0.	.000	.000	0.	.000	.000
3 0	400.	300.	400.	.120.	0.	.000	.000	0.	.000	.000
4 0	500.	300.	500.	.120.	0.	.000	.000	0.	.000	.000
5 0	600.	.00.	600.	.120.	0.	.000	.000	0.	.000	.000
6 0	700.	300.	700.	.120.	0.	.000	.000	0.	.000	.000
7 1	700.	300.	700.	.440.	0.	.000	.000	0.	.000	.000
8 0	800.	360.	800.	.500.	0.	.000	.000	0.	.000	.000
9 0	900.	440.	900.	.500.	0.	.000	.000	0.	.000	.000
DIGOUT	NDIGO	LDD	LOGCP	LOGDLS						
	5	1	1	1						

DLSS - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)

DATE 12:50 NOV 10,'80

CASE (DLSDMO) DEMONSTRATE DLS OPTIONS FOR USER'S MANUAL
THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN

PANEL NO. 1 DIGOUT NO. 5

								P. BAIL		O		P	
E	F	G	H	I	J	K	L	M	N	O	P		
600.	700.	700.	700.	600.	600.	807.	549.	807.	549.	800.	807.		
300.	300.	320.	420.	420.	339.	300.	300.	432.	432.	500.	504.		
EF	FH	HI	IE	KG	KL	MN	HO						
0.	90.	180.	270.	169.	180.	180.	31.						

DIRECTION OF ROTATION IS -1

BEGIN REHANDLE BAIL OPTION NO. 4 - SPOIL ANGLES 0. 100. DIG LIMIT .0 FT. ABOVE COAL

XQF, XQL, YQF, YQL	500.0	790.0	240.0	530.0
XMIN, XMAX, YMIN, YMAX	520.0	770.0	280.0	520.0

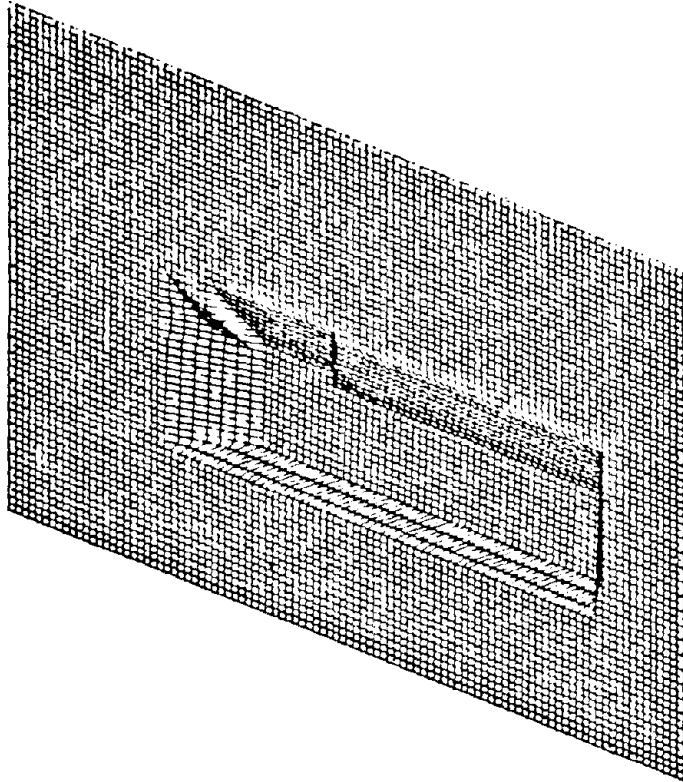
DRAGLINE CENTER X,Y,Z	807.0	432.1	84.2
VOLUMES	OVERBURDEN	REHANDLE	TOTAL
BANK CUBIC YARDS	33714.	16698.	50412.
SWELLED CUBIC YARDS	42143.	20872.	63015.

BEGIN WALK TIME ROUTINE

XFP	YFP	XTP	YTP	X-DIS	Y-DIS	O-DIS
707.0	347.9	807.0	432.1	100.0	84.2	130.7
WALKING	STEPS	FEET	MIN.	HRS.		
	23	113.0	10.5	.17		

NP	ND	DO	SO	V\$BY	M&S	R&L	CYCLE	NOS	D.H.	LAY	MAINT	WALK	DIG	TOTAL	TONS	VRBY
1	5	7	0	50412.	.0	.0	.0	0	.00	.00	.00	.17	.00	.17	0.	16698.

SURFACE NO. 107. WRITTEN TO FILE XMIN, XMAX, YMIN, YMAX 520.00 770.00 280.00 520.00



CASE DEMO SUR NO 107. - SOUTH

DL55 - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)

DATE 12:50 NOV 10, '80

(CASE (DLSDemo) DEMONSTRATE DLS OPTIONS FOR USER'S MANUAL
THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN

PANEL NO. 1 DIGOUT NO. 6

DRAGLINE1	DSA	DSB	DSO	DSE	DSF	DSG	DSH	DSI		
	261.0	30.0	12.0	32.5	100.0	39.5	258.0	157.0		
DRAGLINE2	DSM	DSN	DSS	DSV	DSW	DSY	DCS			
	5.0	.15	42.0	12.0	60.0	56.0	200.00			
PANEL	HB	HC	PW	PWK	DOL	SWDH				
	65.0	20.0	100.0	20.0	100.0	20.0				
CHOP	LCC	LCS	LCPL	LCSS	CHLF	CHLS	CHAST	CHBFF		
	0	0	0	0	0.	0.	.000	.000		
KEYCUT	LOK	LOSK	RLK	LSK						
	0	0	0	0						
TAIL	LOB	LOSB	RLB	LSB	LBP	XBP	YBP			
	1	0	0	99	0	.0	.0			
REHANDLE	RHAST	RHBFF	RHSC	RHCFH						
	3.000	.800	20.	0.						
ANGLES	AABF	ABCF	ACDF	ADAF	ACFD	ASRD	ASSD	CHFA	DZFA	
	69.677	45.000	40.365	45.000	84.289	40.365	40.365	40.365	40.365	
TANGENTS	TANAB	TANBC	TANCD	TANDA	TANCF	TANVS	TANSS	TANCH	TANDZ	
	2.790	1.000	.850	1.000	10.000	.850	.850	.850	.850	
	COTAB	COTBC	COTCD	COTDA	COTCF	COTVS	COTSS	COTCH	COTDZ	
	.370	1.000	1.176	1.000	.100	1.176	1.176	1.176	1.176	
RATES	DTA	DT	DHR	DPR	DSR	DLR	DRR	DRAG	TDUMP	TSPOT
	1.0	5	480	860	1.100	1.100	510.	15.0	5.0	3.0
MINE COAL	LOC	LSC	ECR	DCBTY	NCDF	NCOL				
	1	1	.800	1.050	0	0				
MAINTENANCE	LOM	TBMH	TFMH							
	1	10.0	2.0							
WALK	LOW	XPP	YPP	WANG	WMF	WAF	WTH	DHMF	DHAF	
	1	807.0	432.1	60.0	1.200	.0	4.00	2.500	3.0	
FACTOR	DIF	WEB								
	.000	0.								
RERUN	KRRN	RRNP								
	0	.0								
BOXCUT	LOBC									
	1									
REFERENCE	KREF									
	0									
SWELL	SM									
	.250									
RE-OFF	XC	YC	XP	YP	ASK	DBFK	DOEK	ASB	DBFB	DOEB
1	0	200.	300.	200.	420.	0.	.000	.000	0.	.000
2	0	300.	300.	300.	420.	0.	.000	.000	0.	.000
3	0	400.	300.	400.	420.	0.	.000	.000	0.	.000
4	0	500.	300.	500.	420.	0.	.000	.000	0.	.000
5	0	600.	300.	600.	420.	0.	.000	.000	0.	.000
6	0	700.	300.	700.	420.	0.	.000	.000	0.	.000
7	1	700.	300.	700.	440.	0.	.000	.000	0.	.000
8	0	800.	360.	800.	500.	0.	.000	.000	0.	.000
9	0	900.	440.	900.	580.	0.	.000	.000	0.	.000
DIGOUT	NDIGO	LOD	LOGCP	LOGDIS						
	6	1	1	1						

DLS5 - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)

DATE 12:50 NOV 10, '80

CASE (DLSDEMO) DEMONSTRATE DLS OPTIONS FOR USER'S MANUAL
THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN

PANEL NO. 1 DIGOUT NO. 8

E	F	G	H	I	J	K	L	M	N	O	P
700.	800.	800.	800.	700.	700.	892.	671.	892.	671.	800.	892.
300.	360.	380.	500.	440.	342.	415.	282.	501.	369.	580.	573.
EF	FH	HI	IE	IG	IL	IK	LO				
31.	90.	211.	270.	201.	211.	211.	39.				

DIRECTION OF ROTATION IS -1

BEGIN P. BAIL OPTION NO. 3 - SPOIL ANGLES 0. 211. DIG LIMIT .0 FT. ABOVE COAL

XQF, XQL, YQF, YQL				
600.0	910.0	160.0	700.0	
640.0	880.0	240.0	860.0	

DRAGLINE CENTER X,Y,Z = 891.8 501.3 96.7
BANK CUBIC YARDS = 66706.1
SWELLED CUBIC YARDS = 83382.6

BEGIN WALK TIME ROUTINE

KFP	YFP	XTP	YTP	X-DIS	Y-DIS	D-DIS
807.0	432.1	891.8	501.3	84.8	69.2	109.4
WALKING	STEPS	FEET	MIN.	HRS.		
	20	95.5	9.1	.15		

NP	ND	DO	SO	VSBY	H&S	R&L	CYCLE	NOS	D.H.	LAY	MAINT	WALK	DIG	TOTAL	TONS	VRBY
1	6	0	0	66706.	.0	.0	.0	0	.00	.00	.00	.15	.00	.15	0.	0.
BAIL			7	66390.1	.000000	.000000										

SURFACE NO. 108. WRITTEN TO FILE XMIN, XMAX, YMIN, YMAX 640.00 980.00 240.00 770.00

C.2:

DLSS - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)
CASE (DLSDMO) DEMONSTRATE DLS OPTIONS FOR USER'S MANUAL
THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN

DATE 12:50 NOV 10,'80

PANEL NO. 1 DIGOUT NO. 7

BEGIN REMOVE THE COAL - OPTION 3

XQF, XQL, YQF, YQL
XMIN, XMAX, YMIN, YMAX

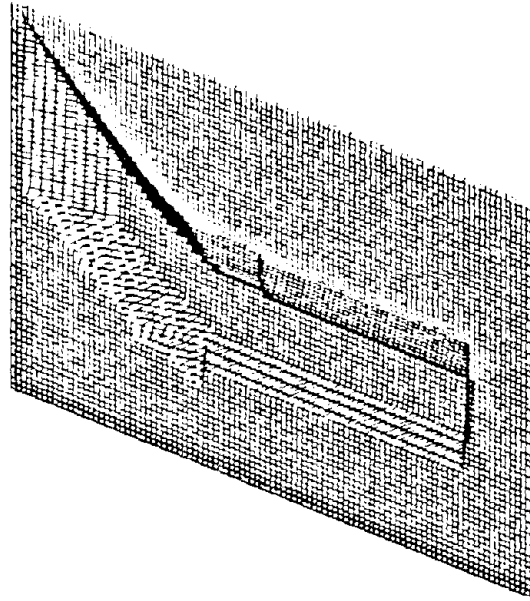
200.0 900.0 300.0 500.0
210.0 890.0 310.0 560.0

NOMINAL COAL DIMENSIONS IN FEET 106.4 125.7 20.0 7
RECOVERABLE TONS 54755. 959. 1129

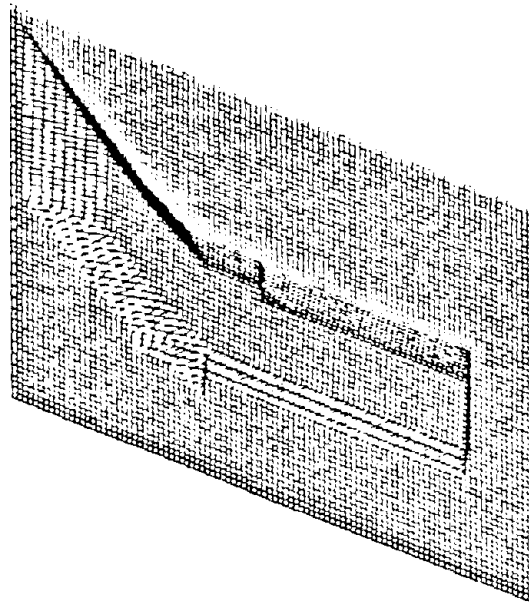
PANEL NO. 1 49840. TONS OF COAL REMOVED FROM SURFACE.

SURFACE NO. 109. WRITTEN TO FILE XMIN, XMAX, YMIN, YMAX 210.00 890.00 310.00 560.00

TOTAL COAL TONS & STRIP RATIO 49840. .00
VK = 63420.0
VKS = .000000
VB = 343069.
VBS = .000000
VCS = .000000
VCSS = .000000
VR = 30531.5



CRSE DEMO SUR NO 109. SOUTH



CRSE DEMO SUR NO 109. SOUTH

DLS5 - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)

DATE 12:50 NOV 10, '80

CASE (DISDEMO) DEMONSTRATE DLS OPTIONS FOR USER'S MANUAL
THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN

PANEL NO. 2 DIGOUT NO. 1

DRAGLINE1	DSA	DSB	DSO	DSF	DSG	DSH	DSI			
DRAGLINE2	261.0	30.0	12.0	32.5	100.0	39.5	258.0	157.0		
	DSN	DSN	DSS	DSV	DSW	DSY	DCS			
	5.0	.15	42.0	12.0	60.0	56.0	200.00			
PANEL	HB	HC	PM	PWK	DOL	SWOH				
	65.0	20.0	100.0	20.0	100.0	20.0				
CHOP	LCC	LCS	LCPL	LCSS	CHLF	CHLS	CHAST	CHBFF		
	11	3	0	1	150.	125.	3.000	.000		
KEYCUT	LCK	LCK	RLK	LSK						
	1	1	.0	1						
BAIL	LOB	LSB	RLB	LSB	LRP	XBP	YBP			
	1	1	.0	1	0	.0	.0			
REHANDLE	RHAST	RHBF	RHSC	RHCF						
	3.000	.800	20.	0.						
ANGLES	AABF	ABCF	ACDF	ADAF	ACFD	ASRD	ASSD	CHFA	OZFA	
	69.677	45.000	69.677	45.000	84.289	40.365	40.365	40.365	40.365	
TANGENTS	TANAB	TANBC	TANCD	TANCA	TANC	TANS	TANSS	TANCH	TANBZ	
	2.700	1.000	2.700	1.000	10.000	.850	.850	.850	.850	
	COTAB	COTBC	COTCD	COTDA	COTC	COTSS	COTCH	COTBZ		
	.370	1.000	.370	1.000	.100	1.176	1.176	1.176	1.176	
RATES	DTA	DT	DHR	DRP	DSR	DLR	DRR	DRAG	TDUMP	
	3.0	.5	480.	860.	1.100	1100.	610.	15.0	5.0	
MINE COAL	LCC	LSC	ECR	DCBTV	NCDF	NCDL				
	4	1	.800	1.050	2	99				
MAINTENANCE	LDM	TBMH	TFMH							
	1	10.0	2.0							
WALK	LWM	XPP	YPP	WANG	WAF	WAF	WTH	DHMF	DHAF	
	2	983.6	574.8	60.0	1.200	.0	8.00	2.500	3.0	
FACTOR	DTF	WEB								
	.400	20.								
RERUN	KRRN	RNP								
	0	.0								
BOXCUT	LOBC									
	1									
REFERENCE	KREF									
	0									
SWELL	SM									
	.250									
RE-DEF	XC	YC	XP	YP	ASK	DBFK	DOEK	ASB	DBFB	DOEB
1 0	200.	200.	200.	300.	70.	.800	.900	90.	.700	.800
2 0	300.	200.	300.	400.	70.	.800	.900	90.	.700	.800
3 0	400.	200.	400.	500.	70.	.800	.900	90.	.700	.800
4 0	500.	200.	500.	600.	70.	.800	.900	60.	.700	.800
5 0	600.	200.	600.	700.	70.	.800	.900	70.	.700	.800
6 0	700.	200.	700.	800.	70.	.800	.900	90.	.700	.800
7 0	800.	260.	800.	900.	80.	.800	.900	100.	.700	.800
8 0	900.	340.	900.	1000.	0.	.000	.000	0.	.000	.000
DIGOUT	NDIGO	LDD	LOGCP	MDLS						
	1	1	1	1						

DIS5 - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)

DATE 12:50 NOV 10, '80

CASE (DISDEMO) DEMONSTRATE DIS OPTIONS FOR USER'S MANUAL
THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN

PANEL NO. 2 DIGOUT NO. 1

DRAG. CHOP

E	F	G	H	I	J	K	L	M	N	O	P
200.	300.	300.	300.	200.	200.	407.	319.	407.	407.	400.	407.
200.	200.	220.	300.	300.	239.	200.	442.	228.	486.	300.	300.
EF	FH	HI	IE	IG	KL	LN	HO				
0.	90.	180.	270.	169.	110.	90.	0.				

DIRECTION OF ROTATION IS -1

BEGIN DRAGLINE CHOP - SPOIL ANGLES 70.0 110.0 BENCH ELEVATION 85.0

XQF, XQI, YQF, YQI	300.0	550.0	100.0	370.0
XMIN, XMAX, YMIN, YMAX	300.0	550.0	100.0	270.0

DRAGLINE CENTER X,Y,Z = 407.0 200.0 85.0
BANK CURVE RADDS = 2507.64
SWEELED CUBIC YARDS = 3129.55

BEGIN WALK TIME ROUTINE

XFP	YFP	XIP	YIP	X-DIS	Y-DIS	D-DIS
383.6	574.9	407.0	200.0	-576.6	-374.8	587.6
HEADHEAD	STEPS	FEET	MIN.	HRS.		
	127	631.5	123.3	2.05		
COAL LOADOUT LAYOVER & MAINT.				HRS.	3.95	2.00

BEGIN EXTENDED BENCH SPOILING ON DIGOUT NO. 3

SPOIL BINCH CENTER X,Y,Z = 450.0 300.0 85.0 DIMENSIONS 100.0 20.0 93.9
SWEELED CUBIC YARDS = 29975.6
DEPTH PERCENT = 857.8
XQF, XQI, YQF, YQI 300.0 600.0 180.0 400.0
XMIN, XMAX, YMIN, YMAX 310.0 590.0 280.0 390.0

BEGIN PRODUCTION TIME CALCULATION

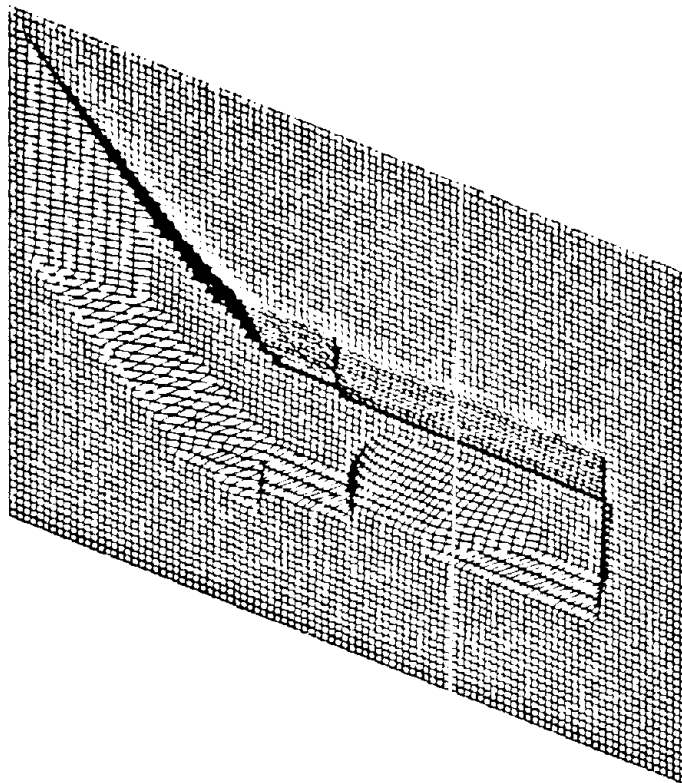
BUCKET START X, Y, Z	440.0	170.0	105.3
BUCKET DUMP X, Y, Z	450.0	300.0	105.3
BUCKET RETURN X, Y, Z	510.0	110.0	103.7

AV. SWING ANGLES HRS, R&L 109.0 -107.9

TIMES IN SEC.	DRAG	H&S	DUMP	R&L	SPOF	CYCLE
	15.0	23.5	5.0	18.5	6.0	68.0 S S

NP	ND	DO	SO	VRBY	H&S	R&L	CYCLE	NOS	D.H.	LAY	MAINT	WALK	DIG	TOTAL	TONS	VRBY
2	1	6	3	2504.	23.5	18.5	68.0	66	2.95	3.95	2.00	1.00	1.39	9.39 S S	0.	0.

SURFACE NO. 110. WRITTEN TO FILE XMIN, XMAX, YMIN, YMAX 100.00 590.00 180.00 390.00



CASE DEMO SUR NO 110. - SOUTH

DLSS - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)
CASE (DLSDEMI) DEMONSTRATE DLS OPTIONS FOR USER'S MANUAL
THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN

DATE 12:50 NOV 10,'80
PANEL NO. 2 DIGOUT NO. 1
KEYCUT 0

BEGIN KEYCUT OPTION NO. 3 - SPOIL ANGLES 70. 110. DIG LIMIT .0 FT. ABOVE COAL

XOF, XOL, YOF, YOL 90.0 410.0 140.0 320.0
XMIN, XMAX, YMIN, YMAX 140.0 360.0 180.0 270.0
DRAGLINE CENTER X,Y,Z = 407.0 200.0 85.7
BANK CUBIC YARDS = 23978.7
SWELLED CUBIC YARDS = 29973.3
SPOIL VOLUME ADJUSTED (SWELLED CU. YDS) -26046.0

BEGIN WALK TIME ROUTINE

	XFP	YFP	XTP	YTP	X-DIS	Y-DIS	O-DIS
	407.0	200.0	407.0	200.0	.0	.0	.0
WALKING	STEPS	FEET	MIN.	HRS.			
	0	.0	.0	.00			

BEGIN SPOIL OPTION NO. 1 - CONICAL SPOIL SHAPE

SPOIL CONE CENTER X,Y,Z = 320.0 440.0 61.5 24.5
SWELLED CUBIC YARDS = 3104.4
DELTA PERCENT = -.7
XOF, XOL, YOF, YOL 140.0 500.0 260.0 620.0
XMIN, XMAX, YMIN, YMAX 260.0 380.0 380.0 450.0

BEGIN PRODUCTION TIME CALCULATION

BUCKET START X, Y, Z	280.0	210.0	63.5			
BUCKET DUMP X, Y, Z	320.0	440.0	66.5			
BUCKET RETURN X, Y, Z	220.0	220.0	63.6			
AV. SWING ANGLES - H&S, R&L	-65.6	64.0				
TIMES IN SEC.	DRAG	H&S	DUMP	R&L	SPOT	CYCLE
	15.0	18.5	5.0	12.0	3.0	53.5 S L
MAINTENANCE TIME IN HOURS	2.00					

NP	ND	DD	SO	VSBY	H&S	R&L	CYCLE	NOS	D.H.	LAY	MAINT	WALK	DIG	TOTAL	TONS	VRBY
2	1	1	1	23979.	18.5	12.0	53.5	625	.00	.00	2.00	00	10.32	12.32 S L	0.	0.

SURFACE NO. 111. WRITTEN TO FILE XMIN, XMAX, YMIN, YMAX 140.00 380.00 180.00 450.00

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DLSS - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)
CASE (DLSDMU) DEMONSTRATE DLS OPTIONS FOR USER'S MANUAL
THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN

DATE 12:50 NOV 10, '80
PANEL NO. 2 DIGOUT NO. 1
P. BAIL 0

BEGIN P. BAIL OPTION NO. 3 - SPOIL ANGLES 90. 90. DIG LIMIT .0 FT. ABOVE COAL
XQF, XQL, YQF, YQL 100.0 410.0 140.0 360.0
XMIN, XMAX, YMIN, YMAX 150.0 360.0 230.0 290.0

DRAGLINE CENTER X,Y,Z = 407.0 227.9 87.7
BANK CUBIC YARDS = 17317.4
SWELLED CUBIC YARDS = 21646.7

BEGIN WALK TIME ROUTINE
XFP YFP XTP YTP X-DIS Y-DIS D-DIS
407.0 200.0 407.0 227.9 -.0 27.9 27.9
WALKING STEPS FEET MIN. HRS.
6 27.9 2.7 .05

BEGIN SPOIL OPTION NO. 1 - CONICAL SPOIL SHAPE
SPOT CONE CENTER X,Y,Z = 410.0 490.0 127.6 48.1
SWELLED CUBIC YARDS = 21975.5
DELTA PERCENT = 1.5
XQF, XQL, YQF, YQL 230.0 590.0 310.0 870.0
XMIN, XMAX, YMIN, YMAX 330.0 530.0 370.0 520.0

BEGIN PRODUCTION TIME CALCULATION
BUCKET START X, Y, Z 280.0 250.0 64.1
BUCKET DUMP X, Y, Z 410.0 490.0 132.6
BUCKET RETURN X, Y, Z 220.0 250.0 50.2
AV. SWING ANGLES - H&S, R&L -80.8 83.9

TIMES IN SEC. DRAG H&S DUMP R&L SPOT CYCLE
15.0 16.5 5.0 15.0 3.0 54.5 H S

MAINTENANCE TIME IN HOURS 2.00

NP ND DO SO VSBY H&S R&L CYCLE NOS D.H. LAY MAINT WALK DIG TOTAL TONS VRBY
2 1 2 1 17317. 16.5 15.0 54.5 516 .00 .00 2.00 .05 9.76 11.81 H S 0. 0.

SURFACE NO. 112. WRITTEN TO FILE XMIN, YMIN, YMAX 150.00 530.00 230.00 520.00

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DLSS - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)

DATE 12:50 NOV 10, '80

CASE (DLSDMO) DEMONSTRATE DLS OPTIONS FOR USER'S MANUAL
THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN

PANEL NO. 2 DIGOUT NO. 2

DRAGLINE1	DSA	DSB	DSO	DSF	DSG	DSH	DSI			
	261.0	30.0	12.0	32.5	100.0	39.5	256.0	157.0		
DRAGLINE2	DSM	DSN	DSV	DSW	DSX	DSY	DSZ			
	5.0	.15	42.0	12.0	60.0	56.0	200.00			
PANEL	HB	HC	HW	PWK	DOL	SWH				
	60.0	20.0	100.0	20.0	100.0	20.0				
CHOP	LCC	LCS	LCPL	LCSS	CHLF	CHLS	CHAST	CHBFF		
	12	2	0	1	150.	150	3.000	800		
KEYCUT	LOK	LOSK	RLK	LSK						
	1	2	80.0	1						
BAIL	LOB	LOSB	RLB	LSB	LBP	XBP	YBP			
	1	2	80.0	1	0	.0	.0			
REHANDLE	PHAST	RH0FF	RH5C	RHCFH						
	3.000	.800	20.	0.						
ANGLES	AABF	ABCF	ACDF	ADAF	ACFD	ASRD	ASSD	CHFA	DZFA	
	69.677	45.000	69.677	45.000	84.289	40.365	40.365	40.365	40.365	
TANGENTS	TANAB	TANBC	TANCD	TANDA	TANEC	TANFS	TANSS	TANCH	TANDZ	
	2.700	1.000	2.700	1.000	10.000	.850	.850	.850	.850	
	COTAB	COTBC	COTCD	COTDA	COTEC	COTFS	COTSS	COTCH	COTDZ	
	.370	1.000	.370	1.000	.100	1.176	1.176	1.176	1.176	
RATES	DIA	DT	DHR	DPR	DSR	DLR	DRR	TORAG	IDUMP	15POT
	3.0	.5	480.	860.	1.100	1100.	610.	15.0	5.0	3.0
MINE COAL	LOC	LSC	ECR	DCBTY	NCDF	NCDL				
	4	1	.800	1.050	2	99				
MAINTENANCE	LOM	FMT								
	2	.050								
WALK	LOW	XPP	YPP	WANG	WMF	WAF	WTH	DHMF	DHAF	
	2	407.0	227.9	60.0	1.200	.0	8.00	2.500	3.0	
FACTOR	DTF	WEB								
	.400	20.								
RRUN	KRRN	RRNP								
	0	.0								
BOXCUT	LOBC									
	1									
REFERENCE	KREF									
	0									
SWELL	SM									
	.250									
RE-DEF	XC	YC	XP	YP	ASK	DBFK	DOEK	ASB	DBFB	DOFB
1 0	200.	200.	200.	300.	70.	.800	.900	90.	.700	.800
2 0	300.	200.	300.	300.	70.	.800	.900	90.	.700	.800
3 0	400.	200.	400.	300.	70.	.800	.900	90.	.700	.800
4 0	500.	200.	500.	300.	70.	.800	.900	60.	.700	.800
5 0	600.	200.	600.	300.	70.	.800	.900	70.	.700	.800
6 0	700.	200.	700.	300.	70.	.800	.900	90.	.700	.800
7 0	800.	260.	800.	360.	80.	.800	.900	100.	.700	.800
8 0	900.	340.	900.	440.	0.	.000	.000	0.	.000	.000
DIGOUT	NOIGO	LOD	LOGCP	LOGOLS						
	2	1	1	1						

DLSS - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)

DATE 12:50 NOV 10, '80

CASE (DLSDMO) DEMONSTRATE DLS OPTIONS FOR USER'S MANUAL
THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN

PANEL NO. 2 DIGOUT NO. 2

								KEYCUT		0	
E	F	G	H	I	J	K	L	M	N	O	P
300.	400.	400.	400.	300.	300.	502.	414.	502.	502.	500.	502.
200.	200.	220.	300.	300.	240.	200.	442.	230.	488.	300.	300.
EF	FM	HI	IE	KG	KL	MN	HO				
0.	90.	180.	270.	169.	110.	90.	0.				

DIRECTION OF ROTATION IS -1

BEGIN KEYCUT OPTION NO. 3 - SPOIL ANGLES 70. 110. DIG LIMIT .0 FT. ABOVE COAL

XQF, XQL, YQF, YQL	200.0	500.0	140.0	320.0
XMIN, XMAX, YMIN, YMAX	310.0	460.0	180.0	250.0

DRAGLINE CENTER X,Y,Z = 502.0 200.0 85.0
 BANK CUBIC YARDS = 11585.2
 SWELLED CUBIC YARDS = 14481.5

BEGIN WALK TIME ROUTINE

XFP	YFP	XIP	YIP	X-DIS	Y-DIS	D-DIS
407.0	227.9	502.0	200.0	95.0	-27.9	99.0
WALKING	STEPS	FEET	MIN.	HRS.		
	20	99.3	9.1	.15		

BEGIN SPOIL OPTION NO. 2 - RIDGE-LINE SPOIL SHAPE

SPOIL CONE CENTER X,Y,Z = 410.0 440.0 98.9 13.8
 SWELLED CUBIC YARDS = 13710.8
 DELTA PERCENT = -5.3

XQF, XQL, YQF, YQL	230.0	590.0	260.0	820.0
XMIN, XMAX, YMIN, YMAX	270.0	550.0	340.0	470.0

BEGIN PRODUCTION TIME CALCULATION

BUCKET START X, Y, Z	380.0	210.0	62.5
BUCKET DUMP X, Y, Z	410.0	410.0	103.9
BUCKET RETURN X, Y, Z	320.0	220.0	40.0
AV. SWING ANGLES - H&S, R&L	-64.3	62.8	
TIMES IN SEC.	DRAG	H&S	DUMP
	15.0	13.5	5.0
			R&L
			12.0
			SPOT
			3.0
			CYCLE
			48.5 H S
MAINTENANCE TIME IN HOURS	.24		

NP	ND	DO	SO	VSBY	H&S	R&L	CYCLE	NOS	D.H.	LAY	MAIN	WALK	DIG	TOTAL	TONS	VRBY
2	2	1	2	11585.	14.4	12.0	48.5	302	.00	.00	.2	.15	4.52	4.91 H S	0.	0.

SURFACE NO. 113. WRITTEN TO FILE XMIN, XMAX, YMIN, YMAX 270.00 550.00 3 470.00

DLSS - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)
CASE (DLSDMO1) DEMONSTRATE DLS OPTIONS FOR USER'S MANUAL
THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN

DATE 12:50 NOV 10, '80
PANEL NO. 2 DIGOUT NO. 2
P. BAIL 0

BEGIN P. BAIL OPTION NO. 3 - SPOIL ANGLES 90. 90. DIG LIMIT 10.0 FT. ABOVE COAL

XQF, XQL, YQF, YQL	200.0	500.0	140.0	360.0
XMIN, XMAX, YMIN, YMAX	310.0	460.0	230.0	320.0

DRAGLINE CENTER X,Y,Z = 502.0 229.0 85.0
BANK CURIC YARDS = 16802.5
SWELLED CUBIC YARDS = 21003.2

BEGIN WALK TIME ROUTINE

	XFP	YFP	XTP	YTP	X-DIS	Y-DIS	D-DIS
	502.0	200.0	502.0	229.0	-1.0	29.0	29.0
WALKING	STEPS		FEET		MIN.	HRS.	
	6		29.0		2.7	.05	

BEGIN SPOIL OPTION NO. 2 - RIDGE-LINE SPOIL SHAPE

SPOIL CONE CENTER X,Y,Z = 500.0 490.0 119.9 40.4
SWELLED CUBIC YARDS = 20979.9
DELTA PERCENT = -1.1
XQF, XQL, YQF, YQL 320.0 680.0 310.0 670.0
XMIN, XMAX, YMIN, YMAX 440.0 650.0 380.0 520.0

BEGIN PRODUCTION TIME CALCULATION

BUCKET START X, Y, Z	380.0	213.0	62.5
BUCKET DUMP X, Y, Z	500.0	410.0	124.9
BUCKET RETURN X, Y, Z	320.0	250.0	40.0

AV. SWING ANGLES - H&S, R&L -80.1 83.2

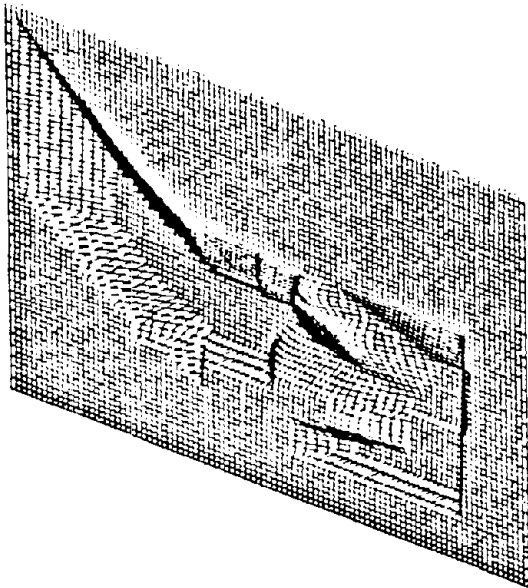
TIMES IN SEC.	DRAG	H&S	DUMP	R&L	SPOT	CYCLE
	15.0	17.0	5.0	15.0	3.0	55.0 S S

MAINTENANCE TIME IN HOURS .48

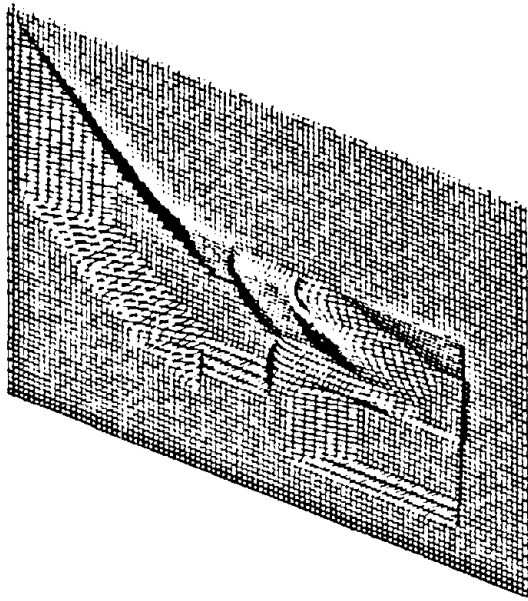
NP	ND	DO	SO	VSRY	H&S	R&L	CYCLE	NOS	D.H.	LAY	MAINT	WALK	DIG	TOTAL	TONS	VSRY
2	2	2	2	16803.	17.0	15.0	55.0	500	.00	.00	.00	.05	9.55	10.07 S S	0.	0.

SURFACE NO. 114. WRITTEN TO FILE MIN, XMAX, YMIN, YMAX 310.00 650.00 230.00 520.00

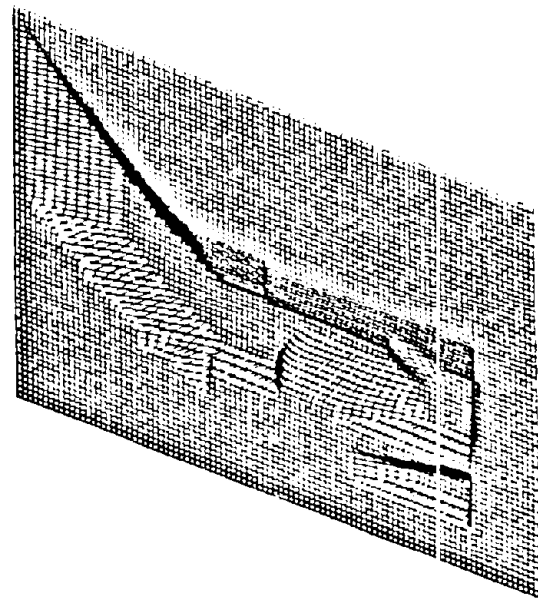
C.30



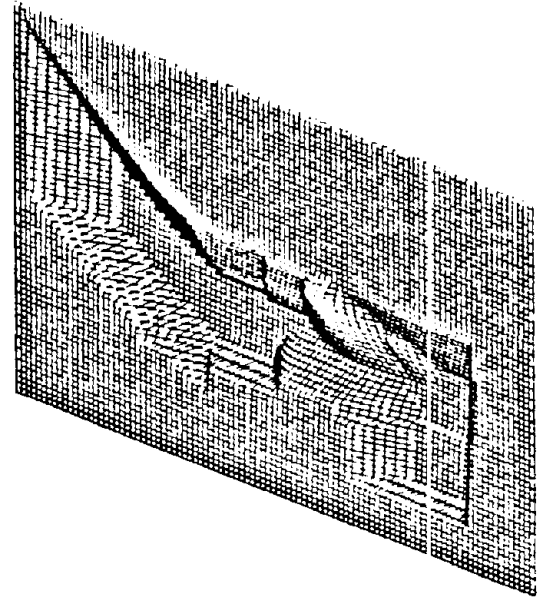
CASE DEMO SUR NO 113 - SOUTH



CASE DEMO SUR NO 114 - SOUTH



CASE DEMO SUR NO 111 - SOUTH



CASE DEMO SUR NO 112 - SOUTH

DLS5 - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)
CASE (DISSEMIN) DEMONSTRATE DLS OPTIONS FOR USER'S MANUAL
THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN

DATE 12:50 NOV 10, '80

PANEL NO. 2 DIGOUT NO. 2

DRAG. CHOP

BEGIN DRAGLINE CHOP - SPOIL ANGLES 90.0 90.0 BENCH ELEVATION 80.0

XOF, XOL, YOF, YOL	400.0	650.0	100.0	360.0
XMIN, XMAX, YMIN, YMAX	400.0	650.0	100.0	300.0

DRAGLINE CENTER X,Y,Z = 502.0 229.8 80.0
BANK CUBIC YARDS = 7799.93
SWELLED CUBIC YARDS = 9749.91

BEGIN WALK TIME ROUTINE

XFP	YFP	XTP	YTP	X-DIS	Y-DIS	D-DIS
502.0	229.8	502.0	229.8	.0	.0	.0
WALKING	STEPS	FEET	MIN.	HRS.		
	0	.0	.0	.00		

BEGIN SPOIL OPTION NO. 2 - RIDGE-LINE SPOIL SHAPE

SPOIL CRNE CENTER X,Y,Z =	500.0	490.0	128.6	8.7
SWELLED CUBIC YARDS =	8842.5			
DELTA PERCENT =	-9.3			
XOF, XOL, YOF, YOL	320.0	680.0	310.0	670.0
XMIN, XMAX, YMIN, YMAX	440.0	660.0	350.0	520.0

BEGIN PRODUCTION TIME CALCULATION

BUCKET START X, Y, Z	540.0	180.0	102.5
BUCKET DUMP X, Y, Z	500.0	400.0	133.6
BUCKET RETURN X, Y, Z	610.0	100.0	101.6

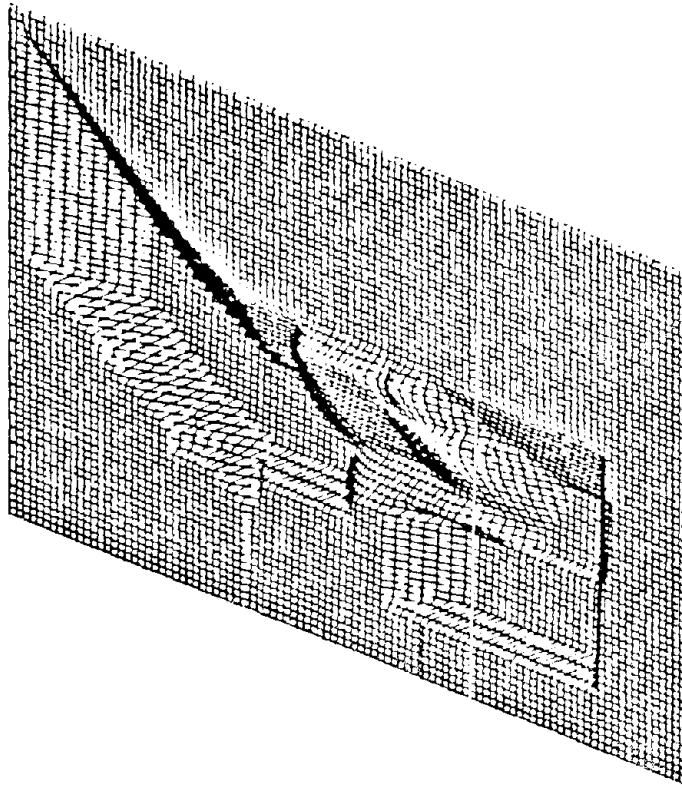
AV. SWING ANGLES - H&S, R&L 143.1 -140.7

TIMES IN SEC.	DRAG	H&S	DUMP	R&L	SPOT	CYCLE
	15.0	31.5	5.0	13.5	6.0	81.0 S S

MAINTENANCE TIME IN HOURS .33

NP	ND	DO	SO	VSBY	H&S	R&L	CYCLE	NOS	D.H.	LAY	MAINT	WALK	DIG	TOTAL	TONS	VRBY
2	2	6	2	7100.	31.5	23.5	11.0	233	.00	.00	.33	.00	6.55	5.88 S S	0.	0.

SURFACE NO. 115. WRITTEN TO FILE XMIN, XMAX, YMIN, YMAX 400.00 660.00 100.00 520.00



CASE DEMO SUR NC 115. - 59.1H

DLS - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)

DATE 12:50 NOV 10, '80

CASE (DLSDEMO)	DEMONSTRATE	DLS	OPTIONS FOR USER'S	MANUAL	PANEL NO.	2	DIGOUT NO.	3
THIS CASE ATTEMPTS TO USE	ALL	OPTIONS	IN ONE	RUN				
DRAGLINE1	DSA	DSB	DSO	DSE	DSF	DSG	DSH	DSI
	261.0	30.0	12.0	32.5	100.0	39.5	258.0	157.0
DRAGLINE2	DSM	DSN	DSS	DSV	DSW	DSY	DCS	
	5.0	.15	42.0	12.0	60.0	56.0	200.00	
PANEL	HB	HC	PW	PWK	DOL	SWDH		
	60.0	20.0	100.0	20.0	100.0	20.0		
CHOP	LCC	LCS	LCPL	LCS	CHLF	CHLS	CHAST	CHBFF
	0	0	0	0	0.	0.	.000	.000
KEYCUT	LOK	LOSK	RLK	LSK				
	1	2	80.0	0				
BAIL	LOB	LOSB	RLB	LSB	LBP	XBP	YBP	
	4	2	80.0	1	0	.0	.0	
REHANDLE	RHAST	RHBFF	RHSC	RHCFH				
	3.000	.800	20.	0.				
ANGLES	AABF	ABCF	ACDF	ADAF	ACFD	ASRD	ASSD	CHFA
	69.677	45.000	69.677	45.000	84.289	40.365	40.365	40.365
TANGENTS	TANAB	TANBC	TANCD	TANDA	TANC	TANS	TANSS	TANCH
	2.700	1.000	2.700	1.000	10.000	.850	.850	.850
	COTAB	COTBC	COTCD	COTDA	COTC	COTS	COTSS	COTCH
	.370	1.000	.370	1.000	.100	1.176	1.176	1.176
RATES	DTA	DT	DHR	DPR	DSR	DLR	DRR	DRAG
	3.0	.5	480.	860.	1.100	1100.	610.	15.0
MINE COAL	LDC	LSC	ECR	DCBTY	NCDL	NCDL		
	4	1	.800	1.050	2	99		
MAINTENANCE	LOM	FMT						
	2	.050						
WALK	LOM	XPP	YPP	WANG	WMF	WAF	WTH	DHMF
	2	502.0	229.8	60.0	1.200	.0	8.00	2.500
FACTOR	DTF	WEB						DHAF
	.400	20.						3.0
RERUN	KRRN	RRNP						
	1	.0						
BOXCUT	LOBC							
	1							
REFERENCE	KREF							
	0							
SWELL	SM							
	.250							
RE-DEF	XC	YC	XP	YP	ASH	DBFK	DOEK	ASB
1 0	200.	200.	200.	100.	70.	.800	.900	90.
2 0	300.	200.	300.	100.	70.	.800	.900	90.
3 0	400.	200.	400.	100.	70.	.800	.900	90.
4 0	500.	200.	500.	100.	70.	.800	.900	60.
5 0	600.	200.	600.	100.	70.	.800	.900	70.
6 0	700.	200.	700.	100.	70.	.800	.900	90.
7 0	800.	260.	800.	100.	80.	.800	.900	100.
8 0	900.	340.	900.	100.	0.	.000	.000	0.
DIGOUT	NDIGO	LOD	LOGCP	LOGS				
	3	1	1	1				

DLSS - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)

DATE 12:50 NOV 10, '80

CASE (DLSDemo) DEMONSTRATE DLS OPTIONS FOR USER'S MANUAL
THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN

PANEL NO. 2 DIGOUT NO. 3

E	F	G	H	I	J	K	L	M	N	O	P
400.	500.	500.	500.	400.	400.	602.	514.	602.	602.	600.	602.
200.	200.	220.	300.	300.	240.	200.	442.	230.	480.	300.	300.
EF	FH	HI	IE	KG	KL	MN	HO				
0.	90.	180.	270.	169.	110.	90.	0.				

DIRECTION OF ROTATION IS -1

BEGIN KEYCUT OPTION NO. 3 - SPOIL ANGLES 70. 110. DIG LIMIT .0 FT. ABOVE COAL

XQF, XQL, YQF, YQL	300.0	600.0	140.0	320.0
XMIN, XMAX, YMIN, YMAX	410.0	550.0	180.0	250.0

DRAGLINE CENTER X,Y,Z = 602.0 200.0 80.0
BANK CUBIC YARDS = 10370.0
SWELLED CUBIC YARDS = 12962.5

BEGIN WALK TIME ROUTINE

XFP	YFP	XTP	YTP	X-DIS	Y-DIS	D-DIS
502.0	229.8	602.0	200.0	100.0	-29.8	104.3
WALKING	STEPS	FEET	MIN.	HRS.		
	21	104.6	9.5	.16		

BEGIN SPOIL OPTION NO. 2 - RIDGE-LINE SPOIL SHAPE

SPOIL CONE CENTER X,Y,Z = 510.0 410.0 110.4 24.3
SWELLED CUBIC YARDS = 12886.3
DELTA PERCENT = -.8

XQF, XQL, YQF, YQL	330.0	690.0	260.0	620.0
XMIN, XMAX, YMIN, YMAX	420.0	660.0	340.0	460.0

BEGIN PRODUCTION TIME CALCULATION

BUCKET START X,Y,Z 480.0 210.0 60.0
BUCKET DUMP X,Y,Z 510.0 440.0 115.4
BUCKET RETURN X,Y,Z 420.0 220.0 40.0

AV. SWING ANGLES - H&S, R&L -64.3 62.0

TIMES IN SEC.	DRAG	H&S	DUMP	R&L	SPOT	CYCLE
	15.0	15.5	5.6	12.0	3.0	50.5 H S

MAINTENANCE TIME IN HOURS .22

NP	ND	DD	SD	VSRY	HK	R&L	CYCLE	NDS	D.H.	LAY	MAINT	K	DIG	TOTAL	TCNS	VRBY
2	3	1	2	10370.	15	12.0	50.5	270	.00	.00	.22	0.	4.21	4.59 H S	0.	0.

DLSS - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)

DATE 12:50 NOV 10,'80

CASE (DLSDemo) DEMONSTRATE DLS OPTIONS FOR USER'S MANUAL
THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN

PANEL NO. 2 DIGOUT NO. 3

								KEYCUT		0	
E	F	G	H	I	J	K	L	M	N	O	P
400.	500.	500.	500.	400.	400.	602.	514.	602.	602.	600.	602.
200.	200.	220.	300.	300.	240.	200.	442.	230.	488.	300.	300.
EF	FH	HI	IE	IG	IL	IM	IO				
0.	90.	180.	270.	169.	110.	90.	0.				

DIRECTION OF ROTATION IS -1

BEGIN KEYCUT OPTION NO. 3 - SPOIL ANGLES 70. 110. DIG LIMIT .0 FT. ABOVE COAL

XQF, XQL, YQF, YQL	300.0	600.0	140.0	320.0
XMIN, XMAX, YMIN, YMAX	410.0	550.0	180.0	250.0

DRAGLINE CENTER X,Y,Z = 602.0 200.0 80.0
BANK CUBIC YARDS = 10370.0
SWELLED CUBIC YARDS = 12962.5

BEGIN WALK TIME ROUTINE

XFP	YFP	XTP	YTP	X-DIS	Y-DIS	D-DIS
502.0	229.8	602.0	200.0	100.0	-29.8	104.3
WALKING	STEPS	FEET	MIN.	HRS.		
	21	104.6	9.5	.16		

BEGIN SPOIL OPTION NO. 2 - RIDGE-LINE SPOIL SHAPE

SPOIL CONE CENTER X,Y,Z = 510.0 440.0 110.4 24.3
SWELLED CUBIC YARDS = 12886.3
DELTA PERCENT = -.6
XQF, XQL, YQF, YQL 330.0 690.0 260.0 620.0
XMIN, XMAX, YMIN, YMAX 420.0 660.0 340.0 460.0

BEGIN PRODUCTION TIME CALCULATION

BUCKET START X, Y, Z	480.0	210.0	60.0
BUCKET DUMP X, Y, Z	510.0	440.0	115.4
BUCKET RETURN X, Y, Z	420.0	220.0	40.0

AV. SWING ANGLES - H&S, R&L -64.3 62.8

TIMES IN SEC.	DRAG	H&S	DUMP	R&L	SPOT	CYCLE
15.0	15.5	5.0	12.0	3.0	50.5 H S	

MAINTENANCE TIME IN HOURS .22

NP	ND	DO	SD	VSBY	H&S	R&L	CYCLE	NDS	D.H.	LAY	MAINT	K	DIG	TOTAL	TONS	VRBY
2	3	1	2	10370.	1%	12.0	50.5	270	.00	.00	.22	6	4.21	4.59 H S	0.	0.

DLSS - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)

DATE 12:50 NOV 10,'80

CASE (DLSDemo) DEMONSTRATE DLS OPTIONS FOR USER'S MANUAL
THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN

PANEL NO. 2 DIGOUT NO. 3
P. BAIL 0

BEGIN REHANDLE BAIL OPTION NO. 4 - SPOIL ANGLES 90. 90. DIG LIMIT .0 FT. ABOVE COAL

XQF, XQL, YQF, YQL	300.0	390.0	140.0	420.0
XMIN, XMAX, YMIN, YMAX	350.0	550.0	230.0	420.0

DRAGLINE CENTER X,Y,Z	602.0	229.8	80.0
VOLUMES	OVERBURDEN	REHANDLE	TOTAL
BANK CUBIC YARDS	12390.	12441.	25382.
SWELLED CUBIC YARDS	15488.	16239.	31727.

BEGIN WALK TIME ROUTINE

XFP	YFP	XTP	YTP	X-DIS	Y-DIS	D-DIS
602.0	200.0	602.0	229.8	-1.0	29.8	29.8
WALKING	STEPS	FEET	MIN.	HRS.		
	6	29.8	2.7	.05		

BEGIN SPOIL OPTION NO. 2 - RIDGE-LINE SPOIL SHAPE

SPOIL CONE CENTER X,Y,Z	600.0	490.0	129.3	51.7
SWELLED CUBIC YARDS	31415.9			
DELTA PERCENT	-1.0			
XQF, XQL, YQF, YQL	420.0	780.0	310.0	670.0
XMIN, XMAX, YMIN, YMAX	550.0	780.0	350.0	520.0

BEGIN PRODUCTION TIME CALCULATION

BUCKET START X, Y, Z	480.0	250.0	60.0
BUCKET DUMP X, Y, Z	500.0	490.0	134.3
BUCKET RETURN X, Y, Z	420.0	250.0	40.0

AV. SWING ANGLES - HAS, R&L -80.1 83.2

TIMES IN SEC.	DRAG	H&S	DUMP	R&L	SPOT	CYCLE
	15.0	18.0	5.0	15.0	6.0	57.4 S S

MAINTENANCE TIME IN HOURS .71

NP	NO	DO	SD	VSBY	H&S	R&L	CYCLE	NOS	D.H.	LAY	MAINT	WALK	DIG	TOTAL	IONS	VRBY
2	3	7	2	25382.	18.0	15.0	57.4	708	.00	.00	.71	.05	14.12	14.87 S S	0.	12991.

SURFACE NO. 116. WRITTEN TO FILE XMIN, XMAX, YMIN, YMAX 350.00 780.00 180.00 520.00

C.38

DL55 - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)
CASE (DLSDMO) DEMONSTRATE DLS OPTIONS FOR USER'S MANUAL
THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN

DATE 12:50 NOV 10,'80

PANEL NO. 2 DIGOUT NO. 3

P. BAIL 0

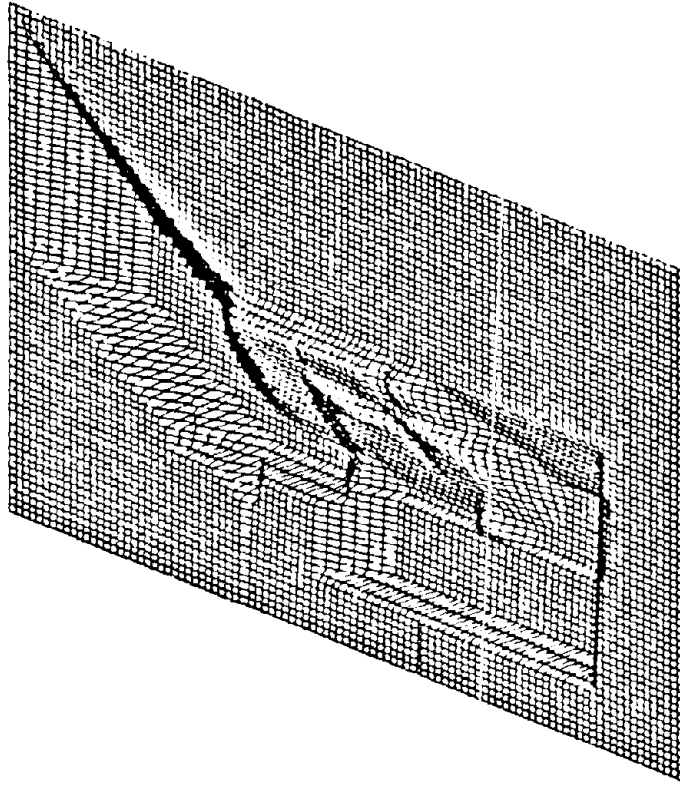
BEGIN REHANDLE BAIL OPTION NO. 4 - SPOIL ANGLES 90.

90. DIG LIMIT .0 FT. ABOVE COAL

XQF, XQL, YQF, YQL
XMIN, XMAX, YMIN, YMAX

300.0 590.0 140.0 420.0
001536.0001536.0001536.0001536.0

DRAGLINE CENTER X,Y,Z	602.0	249.8	80.0
VOLUMES	OVERBURDEN	REHAND: E	TOTAL
BANK CUBIC YARDS	0.	0.	0.
SWELLED CUBIC YARDS	0.	0.	0.



CASE DEMO SUR NO 116. - SOUTH

DLS5 - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)

DATE 12:50 NOV 10, '80

CASE (DLSDEMO) DEMONSTRATE DLS OPTIONS FOR USER'S MANUAL
THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN

PANEL NO. 2 DIGOUT NO. 4

DRAGLINE1	DSA	DSB	DSO	DSE	DSF	DSG	DSH	DSI		
	261.0	30.0	12.0	32.5	100.0	19.1	258.0	157.0		
DRAGLINE2	DSM	DSN	DSV	DSW	DSY		DCS			
	5.0	.15	42.0	12.0	60.0	56.0	200.00			
PANEL	HB	HC	HW	PWK	DOL	SWDH				
	60.0	20.0	100.0	20.0	100.0	20.0				
CHOP	LCC	LCS	LCPL	LCSS	CHLF	CHLS	CHAST	CHBFF		
	0	0	0	0	0.	0.	.000	.000		
KEYCUT	LOK	LOSK	RLK	LSK						
	0	0	0	0						
BAIL	LOB	LOSB	RLB	LSB	LBP	XBP	YBP			
	4	1	80.0	99	0	.0	.0			
REHANDLE	RHAST	RHBFF	RHLC	RHCFH						
	3.000	.800	20.	0.						
ANGLES	AABF	ABCF	ACLF	ADAF	ACFD	ASRD	ASSD	CHFA	DZFA	
	69.577	45.000	69.677	45.000	84.289	40.365	40.365	40.365	40.365	
TANGENTS	TANAB	TANBC	TANCD	TANEA	TANF	TANS	TANSS	TANCH	TANDZ	
	1.700	1.000	2.700	1.000	10.000	.850	.850	.850	.850	
	COTAB	COTBC	COTCD	COTDA	COTF	COTS	COTSS	COTCH	COTDZ	
	.070	1.000	.300	1.000	.160	1.176	1.176	1.176	1.176	
RATES	DIA	DT	DHR	DPR	DSR	DLR	DRR	TDRAQ	TDUMP	1SPOT
	3.0	.5	460.	860.	1.100	1100.	610.	15.0	5.0	3.0
MINE COAL	LCC	LSC	LCR	DCBTY	NCDF	NCDL				
	4	1	1.00	1.050	2	99				
MAINTENANCE	LUM	FMT								
	2	.050								
WALK	LOW	XPP	YPP	WANG	WMF	WAF	WTH	DHMF	DMAF	
	2	502.0	229.8	60.0	1.200	.0	8.00	2.500	3.0	
LAYER	DDO	NSPL								
	60.	0								
FACTOR	DTF	WEB								
	.400	20.								
RERUN	RRRN	RRRP								
	1	.0								
BOXCUT	LGBC									
	1									
REFERENCE	KREF									
	0									
SWELL	SM									
	.250									
RE-DEF	XC	YC	XP	YP	ASK	DBFK	DOEK	ASB	DBFB	DOEB
1	0	200.	200.	200.	70.	.000	.900	90.	.700	.800
2	0	300.	200.	300.	70.	.000	.900	90.	.700	.800
3	0	400.	200.	400.	70.	.000	.900	90.	.700	.800
4	0	500.	200.	500.	70.	.000	.900	60.	.700	.800
5	0	600.	200.	600.	70.	.000	.900	70.	.700	.800
6	0	700.	200.	700.	70.	.000	.900	90.	.700	.800
7	0	800.	0.	800.	80.	.000	.900	100.	.700	.800
8	0	900.	10.	900.	110.	.000	.000	0.	.000	.000
DIGOUT	NDIGO	DD	LOGCP	LOGDLS						
	4	5	1	1						

DIS - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)

DATE 12:50 NOV 10, '80

CASE (DISDEMO) DEMONSTRATE DIS OPTIONS FOR USER'S MANUAL
THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN

PANEL NO. 2 DIGOUT NO. 4

E	F	G	H	I	J	K	L	M	N	O	P
500.	600.	600.	600.	500.	500.	702.	614.	702.	573.	700.	702.
200.	200.	220.	300.	300.	240.	200.	442.	230.	453.	300.	300.
EF	FH	HI	IE	IG	KL	MN	HO				
0.	90.	180.	270.	169.	110.	120.	0.				

DIRECTION OF ROTATION IS -1

BEGIN REHANDLE BAIL OPTION NO. 4 - SPOIL ANGLES 80. 120. DIG LIMIT .0 FT. ABOVE COAL

XQF, XQL, YQF, YQL											
XMIN, XMAX, YMIN, YMAX											
	400.0	690.0	140.0	420.0							
	510.0	660.0	180.0	360.0							

DRAGLINE CENTER X,Y,Z	702.0	229.8	87.7
VOLUMES	OVERBURDEN	REHANDLE	TOTAL
BANK CUBIC YARDS	22278.	1925.	24203.
SWELLED CUBIC YARDS	27847.	2407.	30254.

BEGIN WALK TIME ROUTINE

XFP	YFP	XIP	YIP	X-DIS	Y-DIS	D-DIS
602.0	229.8	702.0	229.8	100.0	.0	100.0
WALKING	STEPS	FEET	MIN.	HRS.		
	20	100.0	9.1	.15		

BEGIN SPOIL OPTION NO. 1 - CONICAL SPOIL SHAPE

SPOIL CONE CENTER X,Y,Z	570.0	450.0	149.1	53.8
SWELLED CUBIC YARDS	29663.1			
DELTA PERCENT	-2.0			
XQF, XQL, YQF, YQL	390.0	750.0	270.0	830.0
XMIN, XMAX, YMIN, YMAX	460.0	710.0	300.0	480.0

BEGIN PRODUCTION TIME CALCULATION

BUCKET START X, Y, Z	580.0	250.0	60.0
BUCKET DUMP X, Y, Z <th>570.0</th> <th>450.0</th> <th>154.1</th>	570.0	450.0	154.1
BUCKET RETURN X, Y, Z <th>520.0</th> <th>250.0</th> <th>40.0</th>	520.0	250.0	40.0
AV. SWING ANGLES - H&S, R&L <td>-49.7</td> <td>52.7</td> <td></td>	-49.7	52.7	
TIMES IN SEC.	DRAG	H&S	DUMP
	15.0	20.0	5.0
			R&L
			10.0
			SPOT
			6.0
			CYCLE
			53.2 H S
MAINTENANCE TIME IN HOURS	1.07		

NP	ND	DO	SO	V&BY	H&S	R&L	CYCLE	NOS	D.H.	LAY	MAJNT	WA	DIG	TOTAL	TONS	VRBY
2	4	7	1	24203.	20.0	10.0	53.2	714	1.00	.00	.67	.	13.10	14.01 H S	0.	1926.

DLSS - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)
 CASE (DLSDFM0) DEMONSTRATE DLS OPTIONS FOR USER'S MANUAL
 THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN

DATE 12:50 NOV 10, '80

PANEL NO. 2 DIGOUT NO. 4

P. BAIL 0

BEGIN REHANDLE BAIL OPTION NO. 4 - SPOIL ANGLES 60. 120. DIG LIMIT 10 FT. ABOVE COAL

XQF, XQL, YQF, YQL
 XMIN, XMAX, YMIN, YMAX

400.0 690.0 140.0 420.0
 480.0 650.0 300.0 420.0

DRAGLINE CENTER X,Y,Z 702.0 249.8 87.7
 VOLUMES OVERBURDEN REHANDLE TOTAL
 BANK CUBIC YARDS 0. 13053. 13053.
 SWELLED CUBIC YARDS 0. 16316. 16316.

BEGIN WALK TIME ROUTINE

	XFP	YFP	XTP	YTP	X-DIS	Y-DIS	D-DIS
	702.0	229.8	702.0	249.8	.0	20.0	20.0
WALKING	STEPS	FEET	MIN.	HRS.			
	4	20.0	1.8	.03			

BEGIN SPOIL OPTION NO. 1 - CONICAL SPOIL SHAPE

SPOIL CONE CENTER X,Y,Z 570.0 470.0 159.3 27.2
 SWELLED CUBIC YARDS 16189.9
 DELTA PERCENT -1.8
 XQF, XQL, YQF, YQL
 XMIN, XMAX, YMIN, YMAX

390.0 750.0 290.0 650.0
 480.0 710.0 310.0 540.0

BEGIN PRODUCTION TIME CALCULATION

BUCKET START X, Y, Z 580.0 250.0 30.0
 BUCKET DUMP X, Y, Z 570.0 470.0 164.3
 BUCKET RETURN X, Y, Z 520.0 270.0 30.0

AV. SWING ANGLES - H&S, R&L -59.0 59.0

TIMES IN SEC.	DRAG	H&S	DUMP	R&L	SPOT	CYCLE
	15.0	24.5	5.0	11.0	6.0	61.5 H S

MAINTENANCE TIME IN HOURS .36

NP	ND	DO	SO	VSRY	H&S	R&L	CYCLE	NOS	D.H.	LAY	MAINT	WALK	DIG	TOTAL	TONS	VRBY
2	4	7	1	13053.	24.5	11.0	61.5	340	.00	.00	.36	.05	7.26	7.66 H S	0.	13053.

DLSS - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)

DATE 12:50 NOV 10, '80

CASE (DLSDMO) DEMONSTRATE DLS OPTIONS FOR USER'S MANUAL
THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN

PANEL NO. 2 DIGOUT NO. 5

E	F	G	H	I	J	K	L	M	N	O	P
600.	700.	700.	700.	600.	600.	802.	714.	802.	714.	800.	802.
200.	200.	220.	300.	300.	240.	200.	442.	291.	533.	360.	381.
EF	FH	HJ	IE	IG	KL	MN	HO				
0.	90.	180.	270.	169.	110.	110.	31.				

DIRECTION OF ROTATION IS -1

BEGIN REHANDLE BAIL OPTION NO. 4 - SPOIL ANGLES 70. 1:0. DIG LIMIT .0 FT. ABOVE COAL

XQF, XQL, YQF, YQL	500.0	790.0	140.0	420.0
XMIN, XMAX, YMIN, YMAX	510.0	780.0	180.0	420.0

DRAGLINE CENTER X,Y,Z	802.0	291.0	89.7
VOLUMES	OVERBURDEN	REHANDLE	TOTAL
BANK CUBIC YARDS	23999.	7932.	31931.
SWELLED CUBIC YARDS	29999.	9915.	39914.

BEGIN WALK TIME ROUTINE

XFP	YFP	XTP	YTP	X-DIS	Y-DIS	D-DIS
702.0	240.0	802.0	291.0	100.0	41.2	108.2
WALKING	STEPS	FEET	MIN.	HRS.		
	22	106.4	10.0	.17		

BEGIN SPOIL OPTION NO. 1 - CONICAL SPOIL SHAPE

SPOIL CONE CENTER X,Y,Z	710.0	530.0	150.3	69.1
SWELLED CUBIC YARDS	39755.5			
DELTA PERCENT	-1.4			
XQF, XQL, YQF, YQL	530.0	890.0	350.0	710.0
XMIN, XMAX, YMIN, YMAX	650.0	880.0	360.0	580.0

BEGIN PRODUCTION TIME CALCULATION

BUCKET START X, Y, Z	680.0	250.0	64.1
BUCKET DUMP X, Y, Z	710.0	530.0	155.3
BUCKET RETURN X, Y, Z	620.0	250.0	40.0

AV. SWING ANGLES - HAS, R&L -87.5 H1.6

TIMES IN SEC.	DRAG	H&S	DUMP	R&L	SPOT	CYCLE
	15.0	20.5	5.0	14.5	6.0	50.7 S S

MAINTENANCE TIME IN HOURS .95

NP	ND	DO	SO	V&BY	H&S	R&L	CYCLE	NOS	D.H.	LAY	MAINT	WALK	DIG	TOTAL	TONS	VRBY
2	5	7	1	31931.	20.	14.5	58.7	922	.00	.00	.95	.17	.78	19.90 S S	0.	7932.

C.44

DLSS - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)
CASE (DLSDemo) DEMONSTRATE DLS OPTIONS FOR USER'S MANUAL
THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN

DATE 12:50 NOV 10, '80

PANEL NO. 2 DIGOUT NO. \$,

P. BAIL 0

BEGIN REHANDLE BAIL OPTION NO. 4 - SPOIL ANGLES 70. 110. DIG LIMIT .0 FT. ABOVE COAL

XOF, XOL, YOF, YOL
XMIN, XMAX, YMIN, YMAX

500.0 790.0 140.0 420.0
001536.0001536.0001536.0001536.0

DRAGLINE CENTER X,Y,Z	802.0	311.0	89.7
VOLUMES	OVERBURDEN	REHANDLE	TOTAL
BANK CUBIC YARDS	0.	0.	0.
SWELLED CUBIC YARDS	0.	0.	0.

DLSS - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)

DATE 12:50 NOV 10, '80

CASE (DLSDMO) DEMONSTRATE DLS OPTIONS FOR USER'S MANUAL
THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN

	DSA	DSB	DSO	DSE	DSF	DSG	DSH	DSI		
DRAGLINE1	261.0	30.0	12.0	32.5	100.0	39.5	258.0	157.0		
DRAGLINE2	DSM	DSN	DSS	DSV	DSW	DSX	DSY	DSZ		
PANEL	5.0	.15	42.0	12.0	60.0	56.0	200.00			
CHO	HB	HC	PD	PWK	DOL	SWON				
KEYCUT	LCC	LCS	LCPL	LCSS	CHLF	CHLS	CHAST	CHBFF		
BAIL	LOK	LDSK	RLK	LSK						
REHANDLE	LOB	LDSB	RLB	LSB	LBP	XBP	YBP			
ANGLES	RHAST	RHBFF	RHSC	RHCFM						
TANGENTS	AABF	ABCF	ACDF	ADAF	ACFD	ASRD	ASSD	CHFA	DZFA	
RATES	69.677	45.000	69.677	45.000	84.289	40.365	40.365	40.365	40.365	
MINE COAL	TANAB	TANBC	TANCD	TANUA	TANVC	TANW	TANX	TANY	TANZ	
MAINTENANCE	2.700	1.000	2.700	1.000	10.000	.850	.850	.850	.850	
WALK	COTAB	COTBC	COTCD	COTDA	COTVC	COTW	COTX	COTY	COTZ	
LAYER	.370	1.000	.370	1.000	.100	1.176	1.176	1.176	1.176	
FACTOR	DTA	DT	DNR	DPR	DSR	DIR	DRR	DRAG	DRUMP	1SPOT
RERUN	3.0	.5	480.	660.	1.100	1100.	610.	15.0	5.0	3.0
BOXCUT	LOC	LSC	ECR	DCBTY	NCDF	NCOL				
REFERENCE	4	1	.800	1.050	2	99				
SWELL	LOM	FMT								
RE-DEF	2	.050								
DIGOUT	LOW	XPP	YPP	WANG	WMF	WAF	WTH	DHMF	DNAF	
	2	802.0	291.0	60.0	1.200	.0	8.00	2.500	3.0	
	DOO	NSPL								
	30.	3								
	DTF	WEB								
	.400	20.								
	KRRN	RRNP								
	1	.0								
	LOBC									
	1									
	KREF									
	0									
	SM									
	.250									
	XC	YC	XP	YP	ASK	DBFM	DOEK	ASB	DBFB	DOEB
1 0	200.	200.	200.	300.	70.	.800	.900	90.	.700	.800
2 0	300.	200.	300.	300.	70.	.800	.900	90.	.700	.800
3 0	400.	200.	400.	300.	70.	.800	.900	90.	.700	.800
4 0	500.	200.	500.	300.	70.	.800	.900	90.	.700	.800
5 0	600.	200.	600.	300.	70.	.800	.900	90.	.700	.800
6 0	700.	200.	700.	300.	70.	.800	.900	90.	.700	.800
7 0	800.	260.	800.	360.	80.	.800	.900	100.	.700	.800
8 0	900.	340.	900.	440.	0.	.000	.000	0.	.000	.000
DIGOUT	NDIGO	LDB	LOGCP	LOGOLS						
	6	4	1	1						

DLSS - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)
CASE (DLSDemo) DEMONSTRATE DLS OPTIONS FOR USER'S MANUAL
THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN

DATE 12:50 NOV 18, '80

PANEL NO. 2 DIGOUT NO. 6

KEYCUT
LAYER NO. 1

E	F	G	H	I	J	K	L	M	N	O	P
700.	800.	800.	800.	700.	700.	900.	700.	887.	755.	900.	887.
200.	260.	260.	360.	300.	243.	320.	483.	360.	581.	440.	430.
EF	FH	HI	IE	IG	KL	MN	HO				
31.	90.	211.	270.	200.	141.	121.	39.				

DIRECTION OF ROTATION IS -1

BEGIN KEYCUT OPTION NO. 3 - SPOIL ANGLES 70. 141. DIG LIMIT 30.9 FT. ABOVE COAL

XOF, XOL, YOF, YOL	XMIN, XMAX, YMIN, YMAX
600.0 900.0 100.0 380.0	
650.0 870.0 150.0 330.0	

DRAGLINE CENTER X,Y,Z = 900.3 320.2 90.7
BANK CUBIC YARDS = 9842.93
SWELLED CUBIC YARDS = 12303.7

BEGIN WALK TIME ROUTINE

XFP	YFP	XTP	YTP	X-DIS	Y-DIS	D-DIS
802.0	291.0	900.3	320.2	98.3	29.2	102.6
WALKING	STEPS	FEET	MIN.	HRS.		
	21	102.8	9.5	.16		

BEGIN SPOIL OPTION NO. 1 - CONICAL SPOIL SHAPE

SPOIL CONE CENTER X,Y,Z = 700.0 480.0 135.8 28.8
SWELLED CUBIC YARDS = 12216.1
DELTA PERCENT = -.7

XOF, XOL, YOF, YOL	XMIN, XMAX, YMIN, YMAX
520.0 880.0 300.0 660.0	
660.0 840.0 330.0 490.0	

BEGIN PRODUCTION TIME CALCULATION

BUCKET START X, Y, Z	780.0 260.0 79.3
BUCKET DUMP X, Y, Z	700.0 480.0 140.8
BUCKET RETURN X, Y, Z	720.0 230.0 50.0

AV. SWING ANGLES - H&S, R&L -65.2 65.2

TIMES IN SEC.	DRAG	H&S	DUMP	R&L	SPOT	CYCLE
	15.0	15.5	5.0	12.0	3.0	50.5 H S

MAINTENANCE TIME IN HOURS .21

NP	ND	DO	SO	VSBY	H&S	R&L	CYCLE	NOS	D.H.	LAY	MAINT	WALK	DIG	TOTAL	TONS	VRBY
2	G	1	1	9H43.	15.5	12.0	50.5	257	.00	.00	.21	.16	4.01	4.37 H S	0.	0.

DLSS - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)
CASE (DLSDMO) DEMONSTRATE DLS OPTIONS FOR USER'S MANUAL
THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN

DATE 12:50 NOV 10,'80
PANEL NO. 2 DIGOUT NO. 8
KEYCUT 0
LAYER NO. 2

BEGIN KEYCUT OPTION NO. 3 - SPOIL ANGLES 70. 141. DIG LIMIT .0 FT. ABOVE COAL

XOF, XOL, YOF, YOL	600.0	800.0	100.0	380.0
XMIN, XMAX, YMIN, YMAX	680.0	820.0	180.0	290.0

DRAGLINE CENTER X,Y,Z = 887.5 312.5 90.3
BANK CUBIC YARDS = 4630.73
SWELLED CUBIC YARDS = 5788.41

BEGIN WALK TIME ROUTINE

XFP	YFP	XIP	YIP	X-DIS	Y-DIS	D-DIS
900.3	320.2	887.5	312.5	-12.9	-7.7	15.0
WALKING	STEPS	FEET	MIN.	HRS.		
	3	14.1	1.4	.02		

BEGIN SPOIL OPTION NO. 4 - CONICAL SPOIL SHAPE

SPOIL CONE CENTER X,Y,Z =	690.0	470.0	138.8	15.1
SWELLED CUBIC YARDS =	5818.2			
DELTA PERCENT =	.5			
XOF, XOL, YOF, YOL	510.0	870.0	290.0	658.0
XMIN, XMAX, YMIN, YMAX	640.0	820.0	320.0	500.0

BEGIN PRODUCTION TIME CALCULATION

BUCKET START X, Y, Z	780.0	260.0	45.0
BUCKET DUMP X, Y, Z	690.0	470.0	143.8
BUCKET RETURN X, Y, Z	720.0	230.0	40.0

AV. SWING ANGLES - H&S, R&L -64.8 64.8

TIMES IN SEC.	DRAG	H&S	DUMP	R&L	SPOT	CYCLE
	15.0	20.5	5.0	12.0	3.0	55.5 H S

MAINTENANCE TIME IN HOURS .10

NP	ND	DO	SO	VSBY	H&S	R&L	CYCLE	NOS	D.H.	LAY	MAINT	WALK	DIG	TOTAL	TONS	VRBY
2	6	1	1	4631.	20.5	12.0	55.5	121	00	00	.10	.02	2.07	2.22 H S	0.	0.

C.47

DLSS - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)
CASE (DLSDEN0) DEMONSTRATE DLS OPTIONS FOR USER'S MANUAL
THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN

DATE 12:50 NOV 10,'80
PANEL NO. 2 DIGOUT NO. 8
P. BAIL 0
LAYER NO. 1

BEGIN REHANDLE BAIL OPTION NO. 4 - SPOIL ANGLES 90. 121. DIG LIMIT 30.0 FT. ABOVE COAL

XOF, XOL, YOF, YOL							
XMIN, XMAX, YMIN, YMAX						800.0	890.0 100.0 550.0
						670.0	870.0 170.0 480.0

DRAGLINE CENTER X,Y,Z	900.3	367.5	92.3
VOLUMES	OVERBURDEN	REHANDLE	TOTAL
BANK CUB' C YARDS	5461.	5055.	10516.
SWELLED CUBIC YARDS	6826.	6319.	13145.

BEGIN WALK TIME ROUTINE

XFP	YFP	XTP	YTP	X-DIS	Y-DIS	D-DIS
887.5	312.5	900.3	367.5	12.9	55.0	56.5
WALKING	STEPS	FEET	MIN.	MRS.		
	12	57.0	5.5	.09		

BEGIN SPOIL OPTION NO. 1 - CONICAL SPOIL SHAPE

SPOIL CONE CENTER X,Y,Z =	770.0	590.0	139.9	44.3
SWELLED CUBIC YARDS =	13102.4			
DELTA PERCENT =	-.3			

XOF, XOL, YOF, YOL	590.0	950.0	410.0	770.0
XMIN, XMAX, YMIN, YMAX	730.0	900.0	470.0	630.0

BEGIN PRODUCTION TIME CALCULATION

BUCKET START X, Y, Z	780.0	300.0	80.0
BUCKET DUMP X, Y, Z	770.0	590.0	144.9
BUCKET RETURN X, Y, Z	720.0	260.0	50.0

AV. SWING ANGLES - HAS, R&L	-88.9	90.4

TIMES IN SEC.	DRAG	H&S	DUMP	R&L	SPOT	CYCLE
	15.0	18.5	5.0	16.0	6.0	58.8 S S

MAINTENANCE TIME IN HOURS	.31

NP	NO	DO	SO	VSBY	H&S	R&L	CYCLE	NOS	D.H.	LAY	MAINT	WALK	DIG	TOTAL	TONS	VRBY
2	6	7	1	10516.	18.5	16.0	58.8	295	.00	.00	.31	.09	6.03	6.42 S S	0.	5055.

DLSS - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)
CASE (DLSDMO) DEMONSTRATE DLS OPTIONS FOR USER'S MANUAL
THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN

DATE 12:50 NOV 10, '80

PANEL NO. 2 DIGOUT NO.

P. BAIL 0
LAYER NO. 2

BEGIN REHANDLE BAIL OPTION NO. 4 - SPOIL ANGLES 90. 121. DIG LIMIT 1.0 FT. ABOVE COAL

XOF, XOL, YOF, YOL	600.0	890.0	100.0	350.0
XMIN, XMAX, YMIN, YMAX	680.0	820.0	190.0	420.0

DRAGLINE CENTER X,Y,Z	887.5	359.7	92.0
VOLUMES	OVERBURDEN	REHANDLE	TOTAL
BANK CUBIC YARDS	6593.	2710.	9372.
SWELLED CUBIC YARDS	8241.	1475.	11715.

BEGIN WALK TIME ROUTINE

XFP	YFP	XTP	YTP	X-DIS	Y-DIS	D-DIS
900.3	367.5	887.5	359.7	-12.0	-7.7	15.0
WALKING	STEPS	FEET	MIN.	HRS.		
	3	14.1	1.4	.02		

BEGIN SPOIL OPTION NO. 1 - CONICAL SPOIL SHAPE

SPOIL CONE CENTER X,Y,Z	750.0	500.0	160.5	39.6
SWELLED CUBIC YARDS	11806.0			
DELTA PERCENT	.8			
XOF, XOL, YOF, YOL	570.0	930.0	400.0	760.0
XMIN, XMAX, YMIN, YMAX	680.0	900.0	430.0	840.0

BEGIN PRODUCTION TIME CALCULATION

BUCKET START X, Y, Z	780.0	300.0	45.0
BUCKET DUMP X, Y, Z	750.0	580.0	165.5
BUCKET RETURN X, Y, Z	720.0	260.0	40.0

AV. SWING ANGLES - H&S, R&L -87.1 00.0

TIMES IN SEC.	DRAG	H&S	DUMP	R&L	SPOT	CYCLE
	15.0	23.0	5.0	15.5	6.0	62.3 H S

MAINTENANCE TIME IN HOURS .20

NP	ND	DD	SO	VSSY	H&S	R&L	CYCLE	NOS	D.H.	LAY	MAINT	WALK	DIG	TOTAL	TONS	VRBY
2	6	7	1	9372.	2.	15.5	62.3	270	.00	.00	.29	.02	5.84	6.18 H S	0.	2780.

DLSS - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)

DATE 12:50 NOV 10,'80

CASE (DLSDMOD)	DEMONSTRATE THIS CASE	DLSS ATTEMPTS TO USE	OPTIONS FOR ALL OPTIONS	USER'S MANUAL IN ONE RUN	PANEL NO.	2 DIGOUT NO.	7			
DRAGLINE1	DSA	DSB	DSO	DSE	DSF	DSG	DSH	DSI		
	261.0	30.0	12.0	32.5	100.0	39.5	258.0	157.0		
DRAGLINE2	DSM	DSN	DSS	DSV	DSW	DSX	DSY	DSZ		
	5.0	.15	42.0	12.0	60.0	56.0	200.00			
PANEL	HB	HC	HD	HE	HF	HG	HH	HI		
	60.0	20.0	100.0	20.0	100.0	50.0	20.0			
CHOP	LCC	LCS	LCPL	LCS	CHLF	CHLS	CHST	CHBF		
	0	0	0	0	0	0	.000	.000		
KEYCUT	LOK	LOSK	RLK	LSK						
	1	1	80.0	0						
BAIL	LOB	LOSB	RLB	LSB	LBP	XBP	YBP			
	4	1	80.0	99	0	.0	.0			
REHANDLE	RHAST	RHBFF	RHSC	RHCFH						
	3.000	.800	20.	0.						
ANGLES	AABF	ARCF	ACDF	ADAF	ACFD	ASRD	ASSD	CHFA	DZFA	
	69.677	45.000	69.677	45.000	84.289	40.365	40.365	40.365	40.365	
TANGENTS	TANAB	TANBC	TANCD	TANEA	TANEC	TANES	TANSS	TANCH	TANDZ	
	2.700	1.000	2.700	1.000	10.000	.850	.850	.850	.850	
	COTAB	COTBC	COTCD	COTEA	COTEC	COTES	COTSS	COTCH	COTDZ	
	.370	1.000	.370	1.000	.100	1.176	1.176	1.176	1.176	
RATES	DTA	DT	DHR	DPR	DSR	DLR	DRR	TDRAG	TDUMP	
	3.0	.5	480.	860.	1.100	1100.	610.	15.0	5.0	
MINE COAL	LOC	LSC	ECR	DEUTY	NCOF	NCDL				
	4	1	.800	1.050	2	99				
MAINTENANCE	LOW	FMI								
	2	.050								
WALK	LOW	XPP	YPP	WAG	WMF	WAF	WTH	DHMF	DHAF	
	2	887.5	359.7	60.0	1.200	.0	8.00	2.500	3.0	
LAYER	DOD	NSPL								
	33.	3								
FACTOR	DTF	WEB								
	.400	20.								
RERUN	KRRN	RRNP								
	1	.0								
BOXCUT	LOBC									
	1									
REFERENCE	KREF									
	0									
SWELL	SM									
	.250									
RE-DEF	XC	YC	XP	YP	ASK	DBFK	DOEK	ASB	DBFB	DOEB
1	0	1200.	200.	200.	70.	.800	.900	90.	.700	.800
2	0	300.	200.	300.	70.	.800	.900	90.	.700	.800
3	0	400.	200.	400.	70.	.800	.900	90.	.700	.800
4	0	500.	200.	500.	70.	.800	.900	60.	.700	.800
5	0	600.	200.	600.	70.	.800	.900	70.	.700	.800
6	0	700.	200.	700.	70.	.800	.900	90.	.700	.800
7	0	800.	260.	800.	80.	.800	.900	100.	.700	.800
8	0	900.	340.	900.	0.	.000	.000	0.	.000	.000
DIGOUT	NDIGO	LOD	LOGCP	LDLS						
	7	6	1	1						

DLSS - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)
CASE (DLSDMO) DEMONSTRATE DLS OPTIONS FOR USER'S MANUAL
THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN

DATE 12:50 NOV 10,'80

PANEL NO. 2 DIGOUT NO. 7

E	F	G	H	I	J	K	L	M	N	O	P
800.	900.	900.	900.	800.	800.	980.	786.	980.	856.	1000.	980.
260.	340.	360.	440.	360.	305.	404.	574.	433.	660.	520.	504.
EF	FH	HI	IE	KG	KL	MH	HO				
39.	90.	219.	270.	209.	139.	119.	39.				

DIRECTION OF ROTATION IS -1

BEGIN KEYCUT OPTION NO. 3 - SPOIL ANGLES 80. 139. DIG LIMIT .0 FT. ABOVE COAL

XQF, XQL, YQF, YQL				
XMIN, XMAX, YMIN, YMAX	700.0	1000.0	100.0	490.0
	760.0	970.0	200.0	420.0

DRAGLINE CENTER X,Y,Z = 979.6 403.7 93.3
BANK CUBIC YARDS = 15332.5
SWELLED CUBIC YARDS = 19165.6

BEGIN WALK TIME ROUTINE

XFP	YFP	XTP	YTP	X-DIS	Y-DIS	D-DIS
887.5	359.7	979.6	403.7	92.2	44.0	102.1
WALKING	STEPS	FEET	MIN.	HRS.		
	20	99.0	9.1	.15		

BEGIN SPOIL OPTION NO. 1 - CONICAL SPOIL SHAPE

SPOIL CONE CENTER X,Y,Z = 790.0 570.0 154.0 28.8
SWELLED CUBIC YARDS = 19162.3
DELTA PERCENT = -.0
XQF, XQL, YQF, YQL 610.0 970.0 390.0 750.0
XMIN, XMAX, YMIN, YMAX 770.0 920.0 410.0 630.0

BEGIN PRODUCTION TIME CALCULATION

BUCKET START X, Y, Z			
BUCKET DUMP X, Y, Z	880.0	340.0	65.8
BUCKET RETURN X, Y, Z	790.0	570.0	159.0
	820.0	300.0	40.0

AV. SWING ANGLES - H&S, R&L -73.8 74.3

TIMES IN SEC.	DRAG	H&S	DUMP	R&L	SPOT	CYCLE
	15.0	20.5	5.0	13.5	3.0	57.0 M S

MAINTENANCE TIME IN HOURS .36

NP	ND	DO	SO	VSBY	H&S	R&L	CYCLE	NOS	D.H.	LAY	MAINT	WALK	DIG	TOTAL	TONS	VRBY
2	7	1	1	15JJJ.	20.5	13.5	57.0	400	.00	.00	.36	.15	7.04	7.55 M S	0.	0.

C.51

DLS5 - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)
CASE (DLSDEMO) DEMONSTRATE DLS OPTIONS FOR USER'S MANUAL
THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN

DATE 12:50 NOV 10,'80
PANEL NO. 2 DIGOUT NO. 7
P. BAIL 0
LAYER NO. 1

BEGIN REHANDLE BAIL OPTION NO. 4 - SPOIL ANGLES 100. 121. DIG LIMIT 30.0 FT. ABOVE COAL

XOF, XOL, YOF, YOL	700.0	990.0	100.0	880.0
XMIN, XMAX, YMIN, YMAX	750.0	970.0	220.0	570.0

DRAGLINE CENTER X,Y,Z	993.0	110.4	95.3
VOLUMES	OVERBURDEN	REHANDLE	TOTAL
BANK CUBIC YARDS	5520.	4577.	10097.
SWELLED CUBIC YARDS	6900.	5721.	12621.

BEGIN WALK TIME ROUTINE

XFP	YFP	XTP	YTP	X-DIS	Y-DIS	D-DIS
979.6	403.7	993.0	460.4	13.3	56.7	58.2
WALKING	STEPS	FEET	MIN.	HR5.		
	12	58.8	5.5	.09		

BEGIN SPOIL OPTION NO. 1 - CONICAL SPOIL SHAPE

SPOIL CONE CENTER X,Y,Z =	860.0	680.0	148.7	46.0
SWELLED CUBIC YARDS =	12600.9			
DELTA PERCENT =	-.2			
XOF, XOL, YOF, YOL	680.0	1000.0	500.0	800.0
XMIN, XMAX, YMIN, YMAX	810.0	950.0	580.0	730.0

BEGIN PRODUCTION TIME CALCULATION

BUCKET START X, Y, Z	880.0	380.0	81.3
BUCKET DUMP X, Y, Z	860.0	680.0	153.7
BUCKET RETURN X, Y, Z	820.0	320.0	34.1

AV. SWING ANGLES - H&S, R&L -94.3 97.9

TIMES IN SEC.	DRAG	H&S	DUMP	R&L	SPOT	CYCLE
	15.0	20.5	5.0	17.0	6.0	61.8 S S

MAINTENANCE TIME IN HOURS .31

NP	ND	DO	SO	VSBY	H&S	R&L	CYCLE	NOS	D.H.	LAY	MAINT	WALK	DIG	TOTAL	TONS	VRBY
2	7	7	1	10097.	20.5	17.0	61.8	285	.00	.00	.31	.09	6.11	6.51 S S	0.	4577.

DLSS - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)
CASE (DLSDMO) DEMONSTRATE DLS OPTIONS FOR USER'S MANUAL
THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN

DATE 12:50 NOV 10,'80

PANEL NO. 2 DIGOUT NO. 7

P. BAIL 0
LAYER NO. 2

BEGIN REHANDLE BAIL OPTION NO. 4 - SPOIL ANGLES 100. 122. DIG LIMIT .0 FT. ABOVE COAL

XOF, XOL, YOF, YOL		700.0	990.0	100.0	860.0
XMIN, XMAX, YMIN, YMAX		780.0	920.0	250.0	500.0
DRAGLINE CENTER X,Y,Z	979.6 453.5 95.0				
VOLUMES	OVERBURDEN REHANDLE TOTAL				
BANK CUBIC YARDS	6409. 2208. 8696.				
SWELLED CUBIC YARDS	8011. 2860. 10870.				

BEGIN WALK TIME ROUTINE

XFP	YFP	XTP	YTP	X-DIS	Y-DIS	D-DIS
993.0	460.4	979.6	453.5	-13.3	-6.9	15.0
WALKING	STEPS	FEET	MIN.	HRS.		
	3	14.4	1.4	.02		

BEGIN SPOIL OPTION NO. 1 - CONICAL SPOIL SHAPE

SPOIL CONE CENTER X,Y,Z *	840.0 670.0 166.2 38.5
SWELLED CUBIC YARDS *	10840.7
DELTA PERCENT *	-1.3
XOF, XOL, YOF, YOL	660.0 1000.0 490.0 900.0
XMIN, XMAX, YMIN, YMAX	770.0 950.0 550.0 740.0

BEGIN PRODUCTION TIME CALCULATION

BUCKET START X, Y, Z	880.0 380.0 45.0
BUCKET DUMP X, Y, Z	840.0 670.0 171.2
BUCKET RETURN X, Y, Z	820.0 320.0 34.0

AV. SWING ANGLES - H&S, R&L -93.6 97.1

TIMES IN SEC.	DRAG	H&S	DUMP	R&L	SPOT	CYCLE
	15.0	26.0	5.0	17.0	6.0	66.7 S S

MAINTENANCE TIME IN HOURS .29

NP	ND	DD	SD	VSBY	H&S	R&L	CYCLE	NOS	D.H.	LAY	MAINT	WALK	DIG	TOTAL	TONS	VRBY
2	7	7	1	8696.	26.0	17.0	66.7	251	.00	.00	.29	.02	5.81	6.13 S S	0.	2288.

SURFACE NO. 117. WRITTEN TO FILE XMIN, XMAX, YMIN, YMAX 460.00 970.00 150.00 740.00

DL55 - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)

DATE 12:50 NOV 10, '80

CASE (DL5DEMO) DEMONSTRATE DLS OPTIONS FOR USER'S MANUAL
THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN

PANEL NO. 2 DIGOUT NO. 7,

BEGIN REMOVE THE COAL - OPTION 4

2	4	3. CUBIC YARDS SPOIL ON	124. TONS RECOVERABLE COAL				
XQF,	XQL,	YQF,	YQL	298.0	900.0	200.0	441.0
XMIN,	XMAX,	YMIN,	YMAX	310.0	890.0	210.0	430.0

NOMINAL COAL DIMENSIONS IN FEET 107.4 100.0 20.0 6
RECOVERABLE TONS 17333. 596. 880

PANEL NO. 2 36836. TONS OF COAL REMOVED FROM SURFACE.

SURFACE NO. 118. WRITTEN TO FILE XMIN, XMAX, YMIN, YMAX 310.00 890.00 210.00 430.00

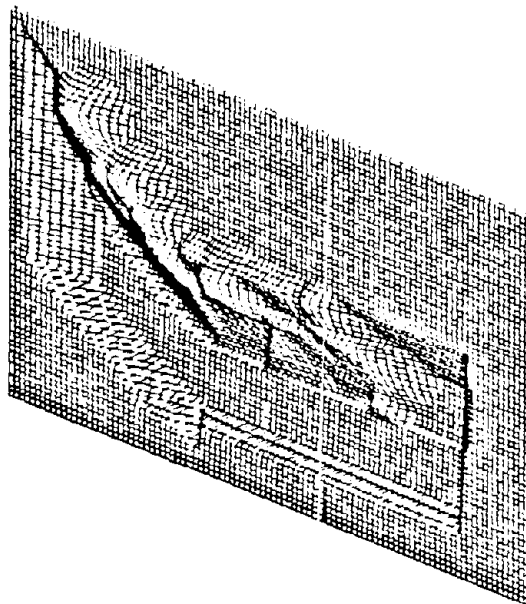
TOTAL CU. YDS. SPOILS ON COAL = 3. TOTAL RECOVERABLE TONS LOST = 124.

NP	ND	DO	SO	VSBY	H&S	R&L	CYCLE	NOS	D.H.	LAY	MAINT	WALK	DIG	TOTAL	TONS	VRBY
2	7	4	0	253413.	19.6	14.0	57.3	7075	2.05	3.95	11.83	1.36	136.57	155.75	36836.	50601.

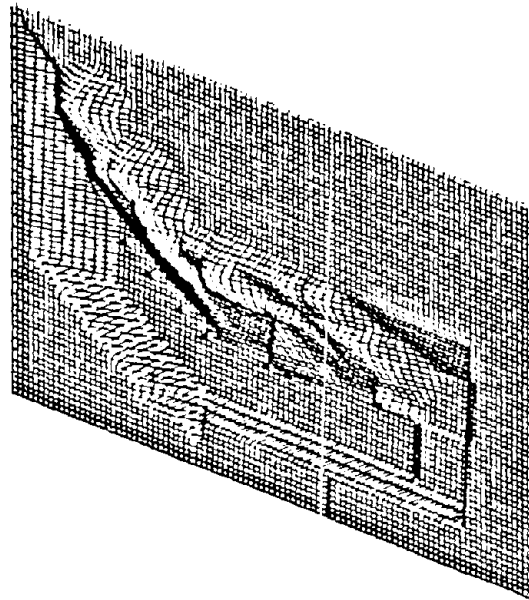
TOTAL COAL TONS & STRIP RATIO 36836. 6.88
INCLUDES REHANDLE (BANK CUBIC YARDS) 50601.

VK = 75740.0
VKS = 66898.1
VB = 167370.
VBS = 208330.
VCS = 10303.6
VCSS = 38818.1
VR = 50601.4

NP	ND	DO	SO	VSBY	H&S	R&L	CYCLE	NOS	D.H.	LAY	MAINT	WALK	DIG	TOTAL	TONS	VRBY
2	7	5	0	253413.	19.6	14.0	57.3	7075	2.05	3.95	11.83	1.36	136.57	155.75	36836.	50601.



CASE DEMO SUR NO 117. SOUTH



CASE DEMO SUR NO 118. SOUTH

DLS - DRAGLINE STRIPPING MODEL (LEVEL COAL SEAM)

DATE 12:50 NOV 10, '80

CASE (DISDEMO) DEMONSTRATE DLS OPTIONS FOR USER'S MANUAL
THIS CASE ATTEMPTS TO USE ALL OPTIONS IN ONE RUN
SUMMARY

PANEL NO 2 DIGOUT NO. 7

NP	NO	DO	SO	MSBY	HSS	R&L	CYCLE	NOS	D.H.	LAY	WASTE	WALK	DIG	TOTAL	TONS	YRBY
1	1	1	0	42552	0	0	0	0	1.24	0.00	0.00	0.00	0.00	1.44	0.	0.
1	1	2	0	41012	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.	0.
1	2	1	0	20868	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.	0.
1	2	2	0	26948	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.	0.
1	3	7	0	45848	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.	12135.
1	4	7	0	43473	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.	3759.
1	5	7	0	50412	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.	16698.
1	6	2	0	66708	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.	0.
1	7	2	0	25340	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.	0.
1	7	4	0	0.	0	0	0	0	1.14	0.00	0.00	1.11	0.00	2.54	45840.	0.
2	1	6	3	2594	23.5	19.5	38.0	56	2.05	3.95	2.00	0.00	4.39	9.09 S S	0.	0.
2	1	1	1	23970	18.5	12.0	54.5	625	0.00	0.00	2.00	0.00	10.32	12.32 S L	0.	0.
2	1	2	1	17317	16.5	15.0	54.5	518	0.00	0.00	2.00	0.00	9.76	11.81 H S	0.	0.
2	2	1	2	11585	13.5	12.0	48.5	302	0.00	0.00	0.24	0.15	4.52	4.31 H S	0.	0.
2	2	2	2	18803	17.0	15.0	55.0	500	0.00	0.00	0.48	0.05	9.55	10.07 S S	0.	0.
2	2	6	2	7109	31.5	23.5	81.0	233	0.00	0.00	0.33	0.00	6.55	6.88 S S	0.	0.
2	3	1	2	19370	15.5	12.0	50.5	270	0.00	0.00	0.22	0.16	4.21	4.59 H S	0.	0.
2	3	7	2	25382	18.0	15.0	57.4	708	0.00	0.00	0.71	0.05	14.12	14.87 S S	0.	12991.
2	4	7	1	24203	20.0	10.0	53.2	714	0.00	0.00	0.67	0.15	13.19	14.01 H S	0.	1946.
2	4	7	1	13053	24.5	11.0	61.5	340	0.00	0.00	0.36	0.03	7.26	7.56 H S	0.	13053.
2	5	7	1	31911	20.5	14.5	58.7	922	0.00	0.00	0.95	0.17	18.78	19.90 S S	0.	7912.
2	6	1	1	9813	15.5	12.0	50.5	257	0.00	0.00	0.21	0.16	4.01	4.37 H S	0.	0.
2	6	1	1	1611	20.5	12.0	55.5	121	0.00	0.00	0.10	0.02	2.07	2.20 H S	0.	0.
2	6	7	1	10516	18.5	15.0	58.8	295	0.00	0.00	0.31	0.09	6.03	6.42 S S	0.	5055.
2	6	7	1	9172	23.0	15.5	62.3	278	0.00	0.00	0.29	0.02	5.84	6.16 H S	0.	2700.
2	7	1	1	15111	20.5	13.5	57.0	400	0.00	0.00	0.36	0.15	7.04	7.55 H S	0.	0.
2	7	7	1	10047	20.5	17.0	61.8	285	0.00	0.00	0.31	0.09	6.11	6.51 S S	0.	4577.
2	7	7	1	3696	26.0	17.0	66.7	251	0.00	0.00	0.29	0.02	5.81	6.13 S S	0.	2208.
2	7	4	0	253413	19.6	14.0	57.3	7075	2.05	3.95	11.83	1.36	136.57	155.75	36836.	50601.
2	7	5	0	253413	19.6	14.0	57.3	7075	2.05	3.95	11.83	1.36	136.57	155.75	36836.	50601.

UNSCHEDULED DOWN TIME
TOTAL SCHEDULED HOURS

62.76
218.31

219. SCHEDULED HOURS	260.00 \$/HR	43702. \$
137. DIGGING HOURS		
253413. BANK CU. YDS. OVERBURDEN	1140. CY/HR	1.72 \$/CY
36836. TONS ROM COAL	1.185 T/HR	1.185 \$/TON
STRIPPING RATIO	6.100	
50601. BANK CU. YDS. REHANDLE	20. %	

APPENDIX D
JOB CONTROL VERSION FOR XDS

XDS SIGMA-7 SYSTEM -----

THE DLS SYSTEM WAS DESIGNED AND DEVELOPED BY BONNER & MOORE FOR EXECUTION ON A XEROX DATA SYSTEMS SIGMA-7 COMPUTER UNDER CP-V. THERE ARE SEVEN MAIN PROGRAMS (MODELS) AND A LARGE NUMBER OF SUBROUTINES CONTAINED IN 21 PROGRAM SOURCE DECKS OF ABOUT 9,800 LINES OF FORTRAN. INITIALLY ALL ROUTINES WERE WRITTEN IN FORTRAN IV; THEN SOME FORTRAN STATEMENTS WERE "COMMENTED OUT" AND REPLACED WITH META SYMBOL CODING TO SPEED UP THE PACKING AND UNPACKING OPERATIONS.

THE FILE NAMING CONVENTIONS ARE AS FOLLOWS;

FSX = FORTRAN SOURCE DECK
BOX = BINARY OUTPUT FROM COMPILATION
LMX = EXECUTION LOAD MODULE
DLSQ = A DLS CONTROL FILE
DISQ = A DIS CONTROL FILE
DDMZ = AN INPUT ELEVATION DATA FILE
ODDMZ = AN OUTPUT SURFACE FILE FROM THE DDM SEQUENCE
ODSLQ = AN OUTPUT SURFACE FILE FROM A DLS RUN

WHERE

X = SYSTEM NAME FOR PROGRAM OR ROUTINE
Q = USER NAME OF DLS CASE
Z = USER NAME OF SURFACE ARRAY FILE

THE STEPS TO BE FOLLOWED IN MAKING A COMPLETE SIMULATION RUN ARE LISTED BELOW. THE USER EXECUTES EITHER STEP 1 OR 2 AS APPROPRIATE, FOLLOWED BY STEP 3.2. STEPS 3.1 AND 4 ARE OPTIONAL, BUT NORMALLY RUN SO THE USER CAN "SEE" THE RESULTS.

- 1.0 DEFINE A LEVEL SEAM WITH THE DDM SEQUENCE - RUN;
 - 1.1 DDM - DEPOSIT DESCRIPTION MODEL
 - 1.2 IHC - INSERT HEIGHT OF COAL PROGRAM
- 2.0 DEFINE A VARIABLE SEAM WITH THE DDM SEQUENCE - RUN;
 - 2.1 BTS - BUILD THREE SETS PROGRAM
 - 2.2 DDM - DEPOSIT DESCRIPTION MODEL
 - 2.3 CSA - COMBINE SURFACE ARRAYS PROGRAM
- 3.0 DEVELOP THE SIMULATION CASES - RUN;
 - 3.1 PPV - PLOT PLAN VIEW MODEL
 - 3.2 DLS - DRAGLINE SIMULATION MODEL
- 4.0 DEVELOP GRAPHIC REPRESENTATION OF THE PIT - RUN;
 - 4.1 DIS - DRAW ISOMETRIC SURFACE MODEL

EXAMPLE SIGMA-7 JOB CONTROL DECKS FOLLOW, USING SUBSTITUTION JCL TO SET:

Q = DLS FILE NAME
Z = DDM FILE NAME
HC = THICKNESS OF COAL SEAM FOR LEVEL SEAM

THE LEVEL SEAM DDM SEQUENCE

```

!JOB                                .RUN DDM AND IHC
!LIMIT (CORE,32),(TIME,8)
!PCL
DELETE ODDMZ
END
!ASSIGN F:1,(FILE,DDMZ),(IN)        .INPUT ELEVATION FILE
!ASSIGN F:2,(FILE,XZ),(OUT),(SAVE)  .TEMPORARY DDM FILE
!RUN (LMN,LMDDM)                    .EXECUTE DDM MODEL
!ASSIGN F:1,(FILE,XZ),(IN)          .TEMPORARY DDM FILE
!ASSIGN F:2,(FILE,ODDMZ),(OUT),(SAVE) .FINAL SURFACE FILE
!RUN (LMN,LMIHC)                    .EXECUTE IHC PROGRAM
!DATA
HC      (ENTER THE THICKNESS OF THE COAL SEAM ON THIS CARD)
!PCL
DELETE XZ
END

```

THE VARIABLE SEAM DDM SEQUENCE

```

!JOB                                .RUN BTS, DDM AND CSA
!LIMIT (CORE,32),(TIME,8)
!PCL
DELETE ODDMZ
END
!ASSIGN F:1,(FILE,DDMZ),(IN)        .INPUT ELEVATION FILE
!ASSIGN F:2,(FILE,XZ),(OUT),(SAVE)  .TEMPORARY BTS FILE
!RUN (LMN,LMBTS)                    .EXECUTE BTS PROGRAM
!ASSIGN F:1,(FILE,XZ),(IN)          .BTS FILE
!ASSIGN F:2,(FILE,XXZ),(OUT),(SAVE) .TEMPORARY DDM FILE
!RUN (LMN,LMDDM)                    .EXECUTE DDM MODEL
!ASSIGN F:1,(FI,XAZ),(OUTIN),(REL)  .TEMPORARY FILE
!ASSIGN F:2,(FI,XBZ),(OUTIN),(REL)  .TEMPORARY FILE
!ASSIGN F:3,(FI,XCZ),(OUTIN),(REL)  .TEMPORARY FILE
!ASSIGN F:4,(FILE,XXZ),(IN)         .TEMPORARY DDM FILE
!ASSIGN F:5,(FILE,ODDMZ),(OUT),(SAVE) .FINAL SURFACE FILE
!RUN (LMN,LMCSA)                    .EXECUTE CSA PROGRAM
!PCL
DELETE XZ,XXZ,XAZ,XBZ,XCZ
END

```

PLOT PLAN VIEW

```
!JOB .RUN PPV
!LIMIT (CORE,48),(TIME,6),(ORDER),(9T,1)
!MESSAGE - PLOTTER TAPE FOR SN#PLOT - BALLPOINT PEN, PLEASE
!ASSIGN F:1,(FILE,DLSQ),(IN) .DLS CONTROL FILE
!ASSIGN F:2,(DEVICE,NO) .DEBUG FILE
!ASSIGN F:5,(DEVICE,9T),(OUT),(SAVE) .PLOTTER TAPE
!RUN (LMN,LMPPV) .EXECUTE PPV MODEL
!PCL
COPY DLSQ TO LP(K)
END
```

THE DLS SIMULATION RUN

```
!JOB .RUN DLS
!LIMIT (CORE,52),(TIME,20),(ORDER)
!PCL
DELETE ODSQ
END
!ASSIGN F:1,(FILE,DLSQ),(IN) .DLS CONTROL FILE
!ASSIGN F:2,(DEVICE,NO) .DEBUG FILE
!ASSIGN F:3,(FILE,ODDMZ),(IN) .INPUT SURFACE FILE
!ASSIGN F:4,(FILE,ODLSQ),(OUT),(SAVE) .OUTPUT SURFACE FILE
!ASSIGN F:6,(FILE,ZXY),(OUTIN),(REL) .TEMPORARY FILE
!ASSIGN F:7,(DEVICE,NO) .DEBUG FILE
!RUN (LMN,LMDLS) .EXECUTE DLS MODEL
!PCL
COPY DLSQ TO LP(K)
END
```

DRAW ISOMETRIC PROJECTION

```
!JOB .RUN DIS
!LIMIT (CORE,48),(TIME,20),(ORDER),(9T,1)
!MESSAGE - PLOTTER TAPE FOR SN#PLOT - BALLPOINT PEN, PLEASE
!ASSIGN F:105,(FILE,DISQ),(IN) .INPUT CONTROL FILE
!ASSIGN F:3,(FILE,ODLSQ),(IN) .DLS SURFACE FILE
!ASSIGN F:4,(DEVICE,9T),(OUT),(SAVE) .PLOTTER TAPE
!ASSIGN F:5,(DEVICE,NO) .DEBUG FILE
!ASSIGN F:6,(DEVICE,NO) .DEBUG FILE
!RUN (LMN,LMDIS) .EXECUTE DIS MODEL
```


APPENDIX E
JOB CONTROL VERSION FOR CDC

CDC CYBER 174 SYSTEM

*** *****

THE DRAGLINE PRODUCTION SIMULATOR PACKAGE, AS INSTALLED ON THE FLUOR CORPORATION CDC CYBER 174, CONSISTS OF THE SEVEN MAIN PROGRAMS LISTED BELOW AND THEIR ASSOCIATED SUBROUTINES. THE PACKAGE WAS ORIGINALLY DEVELOPED ON A XEROX SIGMA-7 COMPUTER AND SUBSEQUENTLY CONVERTED TO RUN ON THE CDC CYBER 174 COMPUTER. ALL PROGRAMS ARE WRITTEN IN FORTRAN EXCEPT WHERE NOTED OTHERWISE. ALL CORE SIZES ARE OCTAL CENTRAL MEMORY 60-BIT WORDS.

PROGRAM *****	FUNCTION *****	CORE REQUIRED TO LOAD *****	CORE REQUIRED TO EXECUTE *****	FILES USED *****
DDM	BUILD DEPOSIT DESCRIPTION MODEL	153100	134065	TAPE1 - CARD INPUT OUTPUT - PRINT FILE TAPE2 - SURFACE FILE
IHC	INSERT HEIGHT OF COAL	116000	77321	INPUT - CARD INPUT OUTPUT - PRINT FILE TAPE1 - OLD SURFACE TAPE2 - NEW SURFACE
BTS (FLECB)	BUILD THREE SETS	52200	34110	OUTPUT - PRINT FILE TAPE1 - CARD INPUT TAPE2 - AUX, PRINT FILE
CSA	COMBINE SURFACE ARRAYS	126000	107527	OUTPUT - PRINT FILE TAPE1 - SCRATCH FILE TAPE2 - SCRATCH FILE TAPE3 - SCRATCH FILE TAPE4 - OLD SURFACE TAPE5 - NEW SURFACE
PPV (FLECB)	PLOT PLAN VIEW	171700	150665	OUTPUT - PRINT FILE TAPE1 - CARD INPUT TAPE4 - PLOT FILE (QUEUE NAME - DQEPV)
DL3	DRAGLINE SIMULATOR	221100	174155	OUTPUT - PRINT FILE TAPE1 - CARD INPUT TAPE3 - OLD SURFACE FILE TAPE4 - NEW SURFACE FILE TAPE6 - SCRATCH FILE TAPE7 - AUX, PRINT FILE
DIS	DRAW ISOMETRIC SURFACE	153600	133125	OUTPUT - PRINT FILE TAPE3 - SURFACE FILE TAPE4 - PLOT FILE (QUEUE NAME - DQEDIS) TAPE5 - AUX, PRINT FILE TAPE6 - AUX, PRINT FILE TAPE95 - CARD INPUT

PROGRAMS DDM AND IHC ARE USED TO CONSTRUCT A LEVEL SEAM MODEL AND PROGRAMS BTS, DDM, AND CSA ARE USED TO CONSTRUCT A VARIABLE SEAM MODEL. PROGRAM PPV IS USED TO PLOT THE COAL LINES IN PLAN VIEW, PROGRAM DLS IS USED TO SIMULATE THE OPERATIONS OF THE DRAGLINE AND PROGRAM DIS IS USED TO PLOT THE ISOMETRIC SURFACE AS MODIFIED BY DLS.

ALL THE MAIN PROGRAMS ARE STORED IN RELOCATABLE OBJECT CODE FORM IN SEPARATE PERMANENT FILES WITH PERMANENT FILE NAMES OF MN05XXXRBL, WHERE XXX REPRESENTS THE 3-CHARACTER PROGRAM, NAME AND A PERMANENT FILE ID OF FMM111700. ALL SUBROUTINES ARE STORED IN RELOCATABLE OBJECT CODE FORM IN A USER LIBRARY WITH A PERMANENT FILE NAME OF DPSLB AND A PERMANENT FILE ID OF FMM111700.

EXAMPLES OF THE CDC NO5/BE CONTROL CARDS REQUIRED TO PRODUCE LEVEL AND VARIABLE SEAM SURFACE FILES, PLOT THE COAL LINES, RUN A DRAGLINE SIMULATION, AND PLOT THE RESULTS ARE SHOWN BELOW. RESULTS ARE SHOWN BELOW:

BUILDING A LEVEL SEAM SURFACE FILE; (DDM AND IHC)

```

JOB CARD.
JOB NO.
ACCOUNT.
ATTACH(LOG,LOGPRG,ID=UTC,MR=1)
LOG.
ATTACH(DPSLB,ID=FMM111700,MR=1)
LIBRARY(DPSLB)
COPYCR(INPUT,TAPE1)
REWIND(TAPE1)
COPY8BF(TAPE1,OUTPUT)
REWIND(TAPE1)
ATTACH(DDM,MN05DDMRBL,ID=FMM111700,MR=1)
DDM.
REWIND(TAPE2)
RETURN(TAPE1)
COPYBF(TAPE2,TAPE1)
REWIND(TAPE1)
RETURN(TAPE2)
REQUEST(TAPE2,*PF)
ATTACH(IHC,MN05IHCRBL,ID=FMM111700,MR=1)
IHC.
CATALOG(TAPE2,DDMLEVELSURFACEFILE,ID=FMM111700)
7/8/9
CARD INPUT FOR DDM
7/8/9
CARD INPUT FOR IHC
6/7/8/9

```

BUILDING A VARIABLE SEAM SURFACE FILE: (BTS, DDM, AND CSA)

```

-----
JOB CARD.
JOBNO.
ACCOUNT.
ATTACH(LOG,LOGPRG,ID=UTC,MR=1)
LOG.
ATTACH(DPSLB,ID=FMM111700,MR=1)
LIBRARY(DPSLB)
COPYBR(INPUT,TAPE1)
REWIND(TAPE1)
COPYBBF(TAPE1,OUTPUT)
REWIND(TAPE1)
ATTACH(BTS,MN05BTSRBL,ID=FMM111700,MR=1)
BTS.
REWIND(TAPE2)
RETURN(TAPE1)
COPYBF(TAPE2,TAPE1)
RETURN(TAPE2)
REWIND(TAPE1)
ATTACH(DDM,MN05DDMRBL,ID=FMM111700,MR=1)
DDM.
REWIND(TAPE2)
COPYBF(TAPE2,TAPE4)
REWIND(TAPE4)
RETURN(TAPE1,TAPE2)
REQUEST(TAPE5,*PF)
ATTACH(CSA,MN05CSARBL,ID=FMM111700,MR=1)
CSA.
CATALOG(TAPE5,DDMSURFACEFILE,ID=FMM111700)
7/8/9
CARD INPUT FOR BTS
7/8/9
CARD INPUT FOR DDM
7/8/9
CARD INPUT FOR CSA
6/7/8/9

```

PLOTTING THE COAL LINES IN PLAN VIEW: (PPV)

```

-----
JOB CARD.
JOBNO.
ACCOUNT.
ATTACH(LOG,LOGPRG,ID=UTC,MR=1)
LOG.
ATTACH(DPSLB,ID=FMM111700,MR=1)
ATTACH(CALCOMP,CALCOMPX,ID=ENG,MR=1)
LIBRARY(DPSLB,CALCOMP)
COPYCR(INPUT,TAPE1)
REWIND(TAPE1)
COPYBBF(TAPE1,OUTPUT)
REWIND(TAPE1)
ATTACH(PPV,MN05PPVRBL,ID=FMM111700,MR=1)
PPV.
7/8/9
CARD INPUT FOR PPV
6/7/8/9

```

DRAGLINE SIMULATION: (DLS)

JOB CARD,
JOBNO.
ACCOUNT.
ATTACH(LOG,LOGPRG,ID=UTC,MR=1)
LOG.
ATTACH(DPSLB,ID=FMM111700,MR=1)
LIBRARY(DPSLB)
COPYCR(INPUT,TAPE1)
REWIND(TAPE1)
COPY8BF(TAPE1,OUTPUT)
REWIND(TAPE1)
ATTACH(TAPE3,DDMSURFACEFILE,ID=FMM111700)
ATTACH(DLS,MN05DLSRBL,ID=FMM111700,MR=1)
DLS.
CATALOG(TAPE4,DLSMODIFIEDSURFACEFILE,ID=FMM111700)
7/8/9
CARD INPUT FOR DLS
6/7/8/9

PLOTTING RESULTS OF DRAGLINE SIMULATION: (DIS)

JOB CARD,
JOBNO.
ACCOUNT.
ATTACH(LOG,LOGPRG,ID=UTC,MR=1)
LOG.
ATTACH(DPSLB,ID=FMM111700,MR=1)
ATTACH(CALCOMP,CALCOMPX,ID=ENG,MR=1)
LIBRARY(DPSLB,CALCOMP)
COPYCR(INPUT,TAPE95)
REWIND(TAPE95)
COPY8BF(TAPE95,OUTPUT)
REWIND(TAPE95)
ATTACH(TAPE3,DLSMODIFIEDSURFACEFILE,ID=FMM111700,MR=1)
ATTACH(DIS,MN05DISRBL,ID=FMM111700,MR=1)
DIS.
7/8/9
CARD INPUT FOR DIS
6/7/8/9

APPENDIX F

JOB CONTROL VERSION FOR IBM

TEST RUN PROCEDURE

In order to assure the correctness of the series of programs that comprise the "Single Seam Dragline Production Simulator" the following set of tests should be performed. Each step should be successfully completed before proceeding to the next. Please keep notes of file names assigned.

1. Test of a Level Seam

Term USER indicates user input required.

a). TYPE 'DDM' and respond to queries

- (1) USER input file 'DDMTEST DATA'
- (2) USER output file 'DDMTEST SURFACE'
Check "A" disk for output file

b). TYPE 'IHC' and respond to queries

- (1) USER input file 'DDMTEST SURFACE'
- (2) USER output file "'SELECT-A-NAME' SURFACE"
- (3) USER respond to "ELEVATION HEIGHT OF COAL"
-Type 20.0

2. Test a Variable Seam

a). Type 'BTS'

- (1) USER input file 'DDMVAR DATA'
- (2) USER output file "'SELECT-A-NAME' DATA"

b). Type 'DDM'

- (1) USER input file "'SELECT-A-NAME' DATA" (same as 2 a 1)
- (2) output file "'SELECT-A-NAME' SURFACE' generated (same as 2 b 1)

c). Type 'CSA'

- (1) USER input file "'SELECT-A-NAME' SURFACE" (same as 2 b 2)
- (2) USER output file 'SELECT-A-NAME SURFACE'

d) Type 'DLS'

- (1) USER input file 'DLSCHOP DATA'
- (2) USER input file "'SELECT-A-NAME SURFACE'
(same as 1 b 2)
- (3) USER answer to question "CHANGE VALUES?" Type
Ø for no
No screen output to be expected for 4
min.
Take a break then check 'A' disk for
output files

e). Type 'DIS'

- (1) USER answer output print file query with
'SELECT-A-NAME PRT6'
- (2) USER input file 'DLSCHOP SURFACE'
- (3) USER input file 'DISIN'
Go to 'D' disk and rename most current plot
to MNEMONIC NAME (UNIQUE)

f). Type 'PPV'

- (1) USER input file 'DLSCHOP SURFACE'
Go to 'D' disk and rename most current plot
to MNEMONIC NAME (UNIQUE).

Fluor has also implemented the Dragline Production Simulator package on an IBM 4341 under VM/SP with CMS. The Fortran code was converted for Fluor by Southern Illinois University which also provided the EXEC 2 language commands which interactively run the various subsystems in the package. In order to run any of the programs, the three letter name of the appropriate subsystem is typed into the terminal and the ensuing queries are answered. Answer options are specified. For convenience, all data and surface files are expected to reside on the 'A' minidisk except for plot files which can be found on the 'D' minidisk. These conventions can be changed with a minimum amount of effort if a different configuration is desired.

It is strongly recommended that the new user make at least one pass through the Test Run Procedure so as to prove the validity of the programs received and familiarize oneself with the normal run sequence. Then, after having established the correctness of the system, independent case runs may be made.

FILE: DDM EXEC AL VM/SP OPS SL 114

```
&CCNTRCL OFF MSG
&TRACE ALL
*
*
* EXEC TO DRIVE DDM PORTION OF FLUCR
*
*
&IF &$ EQ ? &GOTO -TELL
&TYPE DO YOU WISH A CONSOLE FILE-OF THIS RUN (YES, NO, QUIT)
&READ VARS &ANSR
&IF .&ANSR EQ .QUIT &EXIT
&IF .&ANSR EQ .N &ANSR = NO
&IF .&ANSR EQ .NO &GOTO -AGIN
CP SP CONSOLE TO * CCNT TERM START
CP QUERY TIME
*
* ENTER DATA FILE FOR DDM RUN
*
-AGIN
&TYPE ENTER DATA FILE (FN FT FM) OR 'QUIT'
&READ VARS &FN &FT &FM
&IF .&FN EQ .QUIT &GOTO -CON
&IF .&FT EQ . &FT = DATA
&IF .&FM EQ . &FM = A
STATE &FN &FT &FM
&IF &RETCODE EQ 0 &GOTO -CK1
&TYPE FILE &FN &FT &FM DOES NOT EXIST - TRY AGAIN
&GOTO -AGIN
-CK1
*FILESTAT &FN &FT &FM
*&GOTO -CK2
*IF &FSLPECL EQ 80 &GOTO -CK2
*TYPE &FN &FT &FM NOT IN PROPER FORMAT - UNPACK AND TRY AGAIN
*&GOTO -CON
*-CK2
*
*
* LOAD AND RUN
*
&TYPE LOAD AND RUN DDM? (YES, NO)
&READ VARS &RUN
&IF .&RUN EQ .Y &RUN = YES
&IF .&RUN NE .YES &GOTO -CON
*
* SET FILEDEFS FOR RUN
*
FILEDEF * CLEAR
FILEDEF FT01F001 DISK &FN &FT &FM
FILEDEF FT04F001 DISK SURFACE FILE A
FILEDEF FT02F001 DISK &FN SURFACE A
FILEDEF FT09F001 DISK ENCODE FILE A
LCADMCD DDM
START
ERASE ENCODE FILE A
FILEDEF * CLEAR
*
```


FILE: DDM EXEC A1 VM/SP CMS SL 114

* KEEP CONSOLE RUN?

*

-CCN

&IF .&ANSR EQ .NO &EXIT

&TYPE DO YOU WISH TO KEEP THE CONSOLE FILE? (YES, NO)

&READ VARS &PURGE

&IF .&PURGE EQ .N &PURGE = NO

&IF .&PURGE NE .NO CP SP CCNS NCC NCH TERM STOP CLCSE

&IF .&PURGE EQ .NO CP SP CCNS NCC NCH TERM STOP PURGE

&EXIT

-TELL

&BEGTYPE

THIS EXEC DRIVES THE DDM PORTION OF FLUCR

FORMAT: DDM <?>

THIS EXEC SETS ALL NECESSARY FILEDEF'S AND PROMPTS THE USER FOR ALL NECESSARY FILES. THE USER MAY TERMINATE EXECUTION OF THE EXEC BY ENTERING 'QUIT' WHENEVER QUIT IS LISTED AS AN AVAILABLE OPTION.

WARNING: THE DATA FILE MUST BE IN UNPACKED FORMAT. IF THE FILE IS PACKED, THE EXEC WILL TERMINATE EXECUTION. IF THE FILE DOES NOT EXIST, THE USER WILL BE PROMPTED FOR ANOTHER FILE.

DEFAULT VALUES: DATA FILE

FM - NO DEFAULT VALUE

FT - DATA

FM - A

ENTERING 'DDM ?' WILL PRINT THIS MESSAGE.

EXECS CREATED AT SOUTHERN ILLINOIS UNIVERSITY, CARBONDALE, IL
AND AMENDED BY FLUCR CORPORATION, POB 8012, REDWOOD SHORES, CA,
TO BE COMPATIBLE WITH IBM VM/SP CMS & ISPF.

&END

&EXIT

FILE: IHC EXEC A1 VM/SP CMS SL 114

```
&CCNTRCL OFF NOMSG
*
*
*        EXEC TO DRIVE THE IHC PORTION OF FLUOR
*
*
&IF &$ EQ ? &GCTC -TELL
&TYPE DO YOU WISH TO KEEP A CONSOLE FILE? (YES, NO, QUIT)
&READ VARS &ANSR
&IF .&ANSR EQ .QUIT &EXIT
&IF .&ANSR EQ .N &ANSR = NO
&IF .&ANSR EQ .NO &GCTC -AGIN1
CP SP CONSOLE TO * CCNT TERM START
CP QUERY TIME
*
*        ENTER NECESSARY DATA FILES
*
-AGIN1
&TYPE ENTER FN FT FM OF INPUT SURFACE FILE (OR QUIT)
&READ VARS &FN &FT &FM
&IF .&FN EQ .QUIT &GCTC -CCN
&IF .&FT EQ . &FT = SURFACE
&IF .&FM EQ . &FM = A
STATE &FN &FT &FM
&IF &RETCODE EQ C &GCTC -CK1
&TYPE FILE &FN &FT &FM DOES NOT EXIST - TRY AGAIN
&GCTC -AGIN1
-CK1
*FILESTAT &FN &FT &FM
*&GCTC -AGIN2
*&IF &PSLRECL EQ 8C &GCTC -AGIN2
*&TYPE FILE IS NOT IN PROPER FORMAT - UNPACK AND TRY AGAIN
*&GCTC -CCN
*-AGIN2
&TYPE ENTER FN FT FM OF OUTPUT SURFACE FILE (OR QUIT)
&READ VARS &FND &FTD &FMD
&IF .&FND EQ .QUIT &GCTC -CCN
&IF .&FTD EQ . &FTD = SURFACE
&IF .&FMD EQ . &FMD = A
STATE &FND &FTD &FMD
&IF .&RETCODE NE .C &GCTC -CK2
&TYPE FILE &FND &FTD &FMD ALREADY EXIST - TRY AGAIN
&GCTC -AGIN1
-CK2
*
*        LOAD AND RUN?
*
&TYPE LOAD AND RUN? (YES, NO)
&READ VARS &RUN
&IF .&RUN EQ .Y &RUN = YES
&IF .&RUN NE .YES &GCTC -CCN
*
*        SET FILEDEFS
*
FILEDEF * CLEAR
```

FILE: IHC EXEC A1 VM/SP CMS SL 114

```
FILEDEF FT01F001 DISK &FN &FT &FM
FILEDEF FT02F001 DISK &FN &FTD &FMD
FILEDEF FT05F001 TERM
FILEDEF FT06F001 TERM
FILEDEF FT09F001 DISK
LOADMCD IHC
START
FILEDEF * CLEAR
&TYPE EXECUTION HAS COMPLETED
*
*        TERMINATE CONSOLE FILE IF NECESSARY AND QUIT
*
-CCN
&IF .&ANSR EQ .NO &EXIT
&TYPE DO YOU WISH TO KEEP THE CONSOLE FILE? (YES, NO)
&READ VARS &PURGE
&IF .&PLRGE EQ .N &PURGE = NO
&IF .&PURGE NE .NO CP SP CCNS NCC NOH TERM STOP CLOSE
&IF .&PURGE EQ .NO CP SP CCNS NCC NOH TERM STOP PURGE
&EXIT
-TELL
&BEGTYPE
      THIS EXEC DRIVES THE IHC PORTION OF FLUCR
      FORMAT: IHC <?>
      THE EXEC WILL SET ALL NECESSARY FILEDEF'S AND PROMPT THE
      USER FOR ALL NECESSARY FILES. THE USER MAY TERMINATE EXECUTION
      BY ENTERING 'QUIT' WHENEVER QUIT IS LISTED AS AN OPTION.
      WARNING: THE INPUT SURFACE FILE SHOULD BE IN UNPACKED FORMAT.
              IF THE FILE IS PACKED, THE EXEC WILL TERMINATE
              EXECUTION. IF THE REQUESTED FILE FOR INPUT DOES NOT
              EXIST THE USER WILL BE PROMPTED FOR ANOTHER FILE.
              IF THE REQUESTED OUTPUT FILE CURRENTLY EXISTS, THE EXEC
              WILL PROMPT THE USER FOR ANOTHER FILE NAME.
      ENTER A NULL LINE TO COMPLETE THIS MESSAGE
&END
&READ VARS &CMPLTE
&IF .&CMPLTE NE . &EXIT
&BEGTYPE
      DEFAULT VALUES: ALL INPUT FILES
                      FN - NO DEFAULT VALUE
                      FT - SURFACE
                      FM - A
      ENTERING 'IHC ?' WILL PRINT THIS MESSAGE.

      EXECS CREATED AT SOUTHERN ILLINOIS UNIVERSITY, CARBONDALE, IL
      AND AMENDED BY FLUCR CORPORATION, POB 8012, REDWOOD SHORES, CA,
      TO BE COMPATIBLE WITH IBM VM/SP CMS & ISPF.
&END
&EXIT
```

FILE: BTS EXEC A1 VM/SP CMS SL 114

```
&CCNTRL OFF NCMSG
*
*
* EXEC TO DRIVE THE BTS PORTION OF FLUGR
*
*
&IF &$ EQ ? &GOTO -TELL
&TYPE DO YOU WISH A CONSOLE COPY OF THIS RUN? (YES, NO, QUIT)
&READ VARS &ANSR
&IF .&ANSR EQ .QUIT &EXIT
&IF .&ANSR EQ .N &ANSR = NO
&IF .&ANSR EQ .NO &GOTO -AGIN1
CP SP CONSOLE TC * CCNT TERM START
CP QUERY TIME -
*
* ENTER THE REQUIRED DATA FILES
*
-AGIN1
&TYPE ENTER FN FT FM OF INPUT DATA FILE (OR QUIT)
&READ VARS &FN &FT &FM
&IF .&FN EQ .QUIT &GOTO -CON
&IF .&FT EQ . &FT = DATA
&IF .&FM EQ . &FM = A
STATE &FN &FT &FM
&IF &RETCODE EQ 0 &GOTO -CK1
&TYPE FILE &FN &FT &FM DOES NOT EXIST - TRY AGAIN
&GOTO -AGIN1
-CK1
*FILESTAT &FN &FT &FM
* &GOTO -AGIN2
* &IF &FSLRECL EQ 80 &GOTO -AGIN2
* &TYPE FILE &FN &FT &FM PACKED - UNPACK IT AND TRY AGAIN
* &GOTO -CON
-AGIN2
&TYPE ENTER FN FT FM OF OUTPUT FILE (OR QUIT)
&READ VARS &FNC &FTC &FMC
&IF .&FNC EQ . &FNC = &FN
&IF &FNC EQ QUIT &GOTO -CON
&IF .&FTC EQ . &FTC = DATA
&IF .&FMC EQ . &FMC = A
STATE &FNC &FTC &FMC
&IF &RETCODE NE 0 &GOTO -CK2
&TYPE FILE &FNC &FTC &FMC ALREADY EXISTS - TRY AGAIN
&GOTO -AGIN2
-CK2
*
* LOAD THE PROGRAM
*
&TYPE LOAD AND RUN 'BTS' PROGRAM? (YES, NO)
&READ VARS &ANSR2
&IF &ANSR2 EQ Y &ANSR2 = YES
&IF &ANSR2 NE YES &GOTO -CON
*
* MAKE FILEDEFS
*
```

FILE: BTS EXEC A1 VM/SP CMS SL 114

```
FILEDEF * CLEAR
FILEDEF FT01F001 DISK &FN &FT &FM
FILEDEF FT02F001 DISK &FNC &FTC &FMC (RECFM F LRECL 80
FILEDEF FT06F001 DISK TERM (RECFM FBA LRECL 132 BLOCK 132
FILEDEF FT09F001 DISK
*
LOADMOD BTS
START
*
ERASE FILE FT09F001 A
*
FILEDEF * CLEAR
*
*        KEEP CONSOLE FILE?
*
-CCN
&IF .&ANSR EQ .NO &EXIT
&TYPE DC YOU WISH TO SAVE THE CONSOLE FILE? (YES, NO)
&READ VARS &PURGE
&IF .&PURGE EQ .N &PURGE = NO
&IF .&PURGE NE .NO CP SP CONS NOC NOH TERM STCP CLOSE
&IF .&PURGE EQ .NO CP SP CONS NOC NOH TERM STCP PURGE
&EXIT
-TELL
&BEGTYPE
    THIS EXEC DRIVES THE BTS SECTION OF THE FLUCR PROGRAM.
    FORMAT:    BTS <?>
    THIS EXEC WILL SET ALL NECESSARY FILEDEF'S AND PROMPT USERS FOR ALL
    NECESSARY FILES. THE USER MAY HALT THE EXECUTION OF THE EXEC BY TY
    QUIT WHERE 'QUIT' IS LISTED AS AN AVAILABLE OPTION.
    WARNING: THE INPUT FILE MUST BE IN UNPACKED FORMAT. THE EXEC WILL
              TERMINATE EXECUTION IF THE FILE IS PACKED. IF THE INPUT
              DOES NOT EXIST, THE EXEC WILL TERMINATE EXECUTION.
              THE OUTPUT FILE MUST NOT CURRENTLY EXIST. IF ANEXISTING F
              IS GIVEN AS THE OUTPUT FILE, THE EXEC WILL TERMINATE EX
    ENTER A NULL LINE TO COMPLETE THIS MESSAGE
&END
&READ VARS &CMPLTE
&IF .&CMPLTE NE . &EXIT
&BEGTYPE
    DEFAULT VALUES: INPUT DATA FILE
                      FN - NO DEFAULT VALUE
                      FT - DATA
                      FM - A
              OUTPUT FILE
                      FN - FN OF INPUT DATA FILE
                      FT - DATA
                      FM - A
    ENTERING 'BTS ?' WILL PRINT THIS MESSAGE.

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AND AMENDED BY FLUCR CORPORATION, POB 8012, REDWOOD SHORES, CA,
TO BE COMPATIBLE WITH IBM VM/SP CMS & ISPF.
END
EXIT
```

FILE: CSA EXEC A1 VM/SP CMS SL 114

```
&CCNTRCL OFF NOMSG
*
*
*        EXEC TO DRIVE THE CSA PORTION OF FLUOR
*
*
&IF &$ EQ ? &GOTO -TELL
&TYPE DO YOU WISH TO KEEP A CONSOLE FILE? (YES, NO, QUIT)
&READ VARS &ANSR
&IF .&ANSR EQ .QUIT &EXIT
&IF .&ANSR EQ .N &ANSR = NO
&IF .&ANSR EQ .NO &GOTO -AGIN1
CP SP CONSOLE TO * CCNT TERM START
CP QUERY TIME
-AGIN1
&TYPE ENTER FN FT FM OF SURFACE ARRAY TO BE INPUT (OF QUIT TO EXIT)
&READ VARS &FN &FT &FM
&IF &FN EQ QUIT &GOTO -CCN
&IF .&FT EQ . &FT = SURFACE
&IF .&FM EQ . &FM = A
STATE &FN &FT &FM
&IF &RETCCODE EQ 0 &GOTO -CK1
&TYPE FILE &FN &FT &FM DOES NOT EXIST - TRY AGAIN
&GOTO -AGIN1
-CK1
*FILESTAT &FN &FT &FM
*&IF &FSLRECL EQ 80 &GOTO -AGIN2
*&TYPE &FN &FT &FM IS NOT IN PROPER FORMAT - UNPACK AND TRY AGAIN
*&GOTO -CCN
-AGIN2
&TYPE FN FT FM OF OUTPUT FILE (OR QUIT)
&READ VARS &FNO &FTC &FMC
&IF &FNO EQ QUIT &GOTO -CCN
&IF .&FTC EQ . &FTC = SURFACE
&IF .&FMC EQ . &FMC = A
STATE &FNO &FTC &FMC
&IF .&RETCCODE NE .0 &GOTO -CK1
&TYPE &FNO &FTC &FMC ALREADY EXISTS - TRY AGAIN...
&GOTO -AGIN2
-CK1
*
*        LOAD AND RUN?
*
&TYPE DO YOU WISH TO RUN CSA? (YES, NO)
&READ VARS &RUN
&IF .&RUN EQ .Y &RUN = YES
&IF .&RUN NE .YES &GOTO -CCN
*
*        SET FILEDEFS
*
FILEDEF * CLEAR
FILEDEF FT01F001 DISK TEMP1 FILE A
FILEDEF FT02F001 DISK TEMP2 FILE A
FILEDEF FT03F001 DISK TEMP3 FILE A
FILEDEF FT04F001 DISK &FN &FT &FM
```

FILE: CSA EXEC A1 VM/SP CMS SL 114

FILEDEF FT05F001 DISK &FNC &FTC &FMC

FILEDEF FTC6F001 TERM

*

LCADMCD CSA

START

*

ERASE TEMP1 FILE A

ERASE TEMP2 FILE A

ERASE TEMP3 FILE A

FILEDEF * CLEAR

*

* KEEP CONSOLE FILE?

*

-CCN

&IF ,&ANSR EQ .NO &EXIT

&TYPE DO YOU WISH TO SAVE THE CONSOLE FILE? (YES, NO)

&READ VARS &PURGE

&IF .&PURGE EQ .N &PURGE = NO

&IF .&PURGE NE .NO CP SP CCNS NOC NOH TERM STOP CLOSE

&IF .&PURGE EQ .NO CP SP CCNS NOC NOH TERM STOP PURGE

&EXIT

-TELL

&BEGTYPE

THIS EXEC DRIVES THE CSA SECTION OF THE FLUCR PROGRAM

FORMAT: CSA <?>

THIS EXEC WILL SET ALL NECESSARY FILEDEF'S AND WILL PROMPT THE USER FOR ALL NECESSARY FILE NAMES. THE USER MAY HALT THE EXECUTION OF THE EXEC BY TYPING 'QUIT' WHENEVER QUIT IS LISTED AS AN AVAILABLE OPTION.

WARNING: THE INPUT FILE MUST BE IN UNPACKED FORMAT. IF THE FILE IS PACKED, THE EXEC WILL TERMINATE EXECUTION. IF THE REQUESTED INPUT FILE DOES NOT EXIST, THE EXEC WILL QUERY THE USER FOR ANOTHER FILE NAME.

THE OUTPUT FILE MUST NOT CURRENTLY EXIST. IF THE FILE DOES EXIST, THE EXEC WILL QUERY THE USER FOR A DIFFERENT FILE NAME.

ENTER A NULL LINE TO COMPLETE MESSAGE

&END

&READ VARS &COMPLTE

&IF .&COMPLTE NE . &EXIT

&BEGTYPE

DEFAULT VALUES: INPUT SURFACE

FN - NO DEFAULT VALUE

FT - SURFACE

FM - A

OUTPUT SURFACE

FN - NO DEFAULT VALUE

FT - SURFACE

FM - A

ENTERING 'CSA ?' WILL PRINT THIS MESSAGE.

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AND AMENDED BY FLUCR CORPORATION, P.O. BOX 2012, REDWOOD SHORES, CA,
TO BE COMPATIBLE WITH IBM VM/SP CMS & ISPF.

&END

&EXIT

FILE: DLS EXEC A1 VM/SP CMS SL 114

&CENTRCL OFF NOMSG

*

*

* EXEC TO DRIVE THE DLS PCPTION OF FLUCP

*

*

&IF &\$ EQ ? &GOTO -TELL

&TYPE DO YOU WISH TO KEEP A CONSOLE FILE? (YES, NO, QUIT)

&READ VARS &ANSR

&IF .&ANSR EQ .QUIT &EXIT

&IF .&ANSR EQ .N &ANSR = NO

&IF .&ANSR EQ .NO &GOTO -AGIN1

CP SP CONSOLE TO * CCNT TERM START

CP QUERY TIME

*

* ENTER THE REQUIRED DATA FILE NAMES

*

-AGIN1

&TYPE ENTER NAME OF DATA FILE TO BE USED FOR THIS RUN (OR QUIT TO EXIT)

&READ VARS &FN &FT &FM

&IF &FN EQ QUIT &GOTO -CCN

&IF .&FT EQ . &FT = DATA

&IF .&FM EQ . &FM = A

STATE &FN &FT &FM

&IF &RETCODE EQ 0 &GOTO -CK1

&TYPE FILE &FN &FT &FM DOES NOT EXIST - TRY AGAIN

&GOTO AGIN1

-CK1

&TYPE ENTER NAME OF SURFACE FILE TO BE USED FOR THIS RUN (OR QUIT TO E)

&READ VARS &FNS &FTS &FMS

&IF &FNS EQ QUIT &GOTO -CCN

&IF .&FTS EQ . &FTS = SURFACE

&IF .&FMS EQ . &FMS = A

STATE &FNS &FTS &FMS

&IF &RETCODE EQ 0 &GOTO -CK2

&TYPE FILE &FNS &FTS &FMS DOES NOT EXIST - TRY AGAIN

&GOTO -CK1

-CK2

*FILESTAT &FNS &FTS &FMS

*&IF &FSLRECL EQ 80 &GOTO -CK3

*&TYPE &FNS &FTS &FMS IS NOT IN PROPER FORMAT - UNPACK AND TRY AGAIN

*&GOTO -CCN

-CK3

*

* LOAD AND RUN?

*

&TYPE LOAD AND RUN? (YES, NO)

&READ VARS &RUN

&IF .&RUN EQ .Y &RUN = YES

&IF .&RUN NE .YES &GOTO -CCN

*

* SET FILEDEFS

*

FILEDEF * CLEAR

FILEDEF FT01F001 DISK &FN &FT &FM (LRECL 80 RECFM F

FILE: DLS EXEC A1 VM/SP CMS SL 114

```
FILEDEF FT03F001 DISK &FNS &FTS &FMS
FILEDEF FT02F001 DISK DEBUG OUTPUT A (LRECL 132 BLKSIZE 132 RECFM =
FILEDEF FT04F001 DISK &FN SURFACE A
FILEDEF FT05F001 TERM
FILEDEF FT06F001 DISK DLSRUN PRT6 A
FILEDEF FT07F001 DISK SUMMARY DATA A
FILEDEF FT08F001 DISK XYPLCT DATA A
```

*

LOADMOD DLS

START

*

FILEDEF * CLEAR

ERASE FILE FT09F001 A

*

* KEEP CONSOLE FILE?

*

-CCN

&IF .&ANSR EQ .NO &EXIT

&TYPE DC YOU WISH TO KEEP THE CONSOLE FILE

&READ VARS &PURGE

&IF .&PURGE EQ .N &PURGE = NO

&IF .&PURGE NE .NO CP SP CCNS ACC NOH TERM STOP CLOSE

&IF .&PURGE EQ .NO CP SP CCNS ACC NOH TERM STOP PURGE

&EXIT

-TELL

&BEGTYPE

THIS EXEC DRIVES THE DLS PORTION OF FLUOR

FORMAT: DLS <?>

THIS EXEC WILL SET ALL NECESSARY FILEDEF'S AND WILL PROMPT THE
USER FOR ALL NECESSARY FILES. THE EXEC MAY BE TERMINATED BY
ENTERING 'QUIT' WHENEVER QUIT IS LISTED AS AN AVAILABLE OPTION.
ENTERING 'QUIT ?' WILL PRINT THIS MESSAGE.

CAUTION: ALL INPUT FILES MUST BE IN UNPACKED FORMAT. IF AN INPUT
FILE IS PACKED, THE EXEC WILL TERMINATE EXECUTION.
IF AN INPUT FILE DOES NOT EXIST, THE USER WILL BE
PROMPTED FOR THAT FILE AGAIN.

ENTER A NULL LINE TO COMPLETE THIS MESSAGE

&END

&READ VARS &CMPLTE

&IF .&CMPLTE NE . &EXIT

&BEGTYPE

DEFAULT VALUES: INPUT DATA FILE

FN - NO DEFAULT VALUE

FT - DATA

FM - A

INPUT SURFACE FILE

FN - NO DEFAULT VALUE

FT - SURFACE

FM - A

EXECS CREATED AT SOUTHERN ILLINOIS UNIVERSITY, CARBONDALE, IL
AND AMENDED BY FLUOR CORPORATION, POB 8012, REDWOOD SHORES, CA,
TO BE COMPATIBLE WITH IBM VM/SP CMS & ISPF.

&END

&EXIT

%%CENTROL OFF NCM5G

*

*

* EXEC TO DRIVE THE 'DIS' PORTION OF FLUGR

*

*

IF \$ EQ ? &GOTO -TELL

TYPE DO YOU WISH TO KEEP A CONSOLE FILE? (YES, NO, QUIT)

READ VARS &ANSR

IF .&ANSR EQ .QUIT &EXIT

IF .&ANSR EQ .N &ANSR = NC

IF .&ANSR EQ .NC &GOTO -AGIN1

CP SP CONSOLE TO * CCNT TERM START

CP QUERY TIME-

*

* ENTER THE REQUIRED DATA FILE NAMES

*

-AGIN1

TYPE ENTER NAME OF OUTPUT FILE TO BE USED FOR RUN (OR QUIT TO EXIT)

READ VARS &FNC &FTC &FMC

IF &FNC EQ QUIT &GOTO -CCN

IF .&FTC EQ . &FTC = PRT4

IF .&FMC EQ . &FMC = D

IF &RETCODE EQ 0 &GOTO -CK1

TYPE FILE &FNC &FTC &FMC DOES NOT EXIST - TRY AGAIN

&GOTO AGIN1

-CK1

TYPE ENTER NAME OF SURFACE FILE TO USE FOR THIS RUN (OR QUIT TO EXIT)

READ VARS &FNS &FTS &FMS

IF &FNS EQ QUIT &GOTO -CCN

IF .&FTS EQ . &FTS = SURFACE

IF .&FMS EQ . &FMS = A

IF &RETCODE EQ 0 &GOTO -CK3

TYPE FILE &FN &FT &FM DOES NOT EXIST - TRY AGAIN

&GOTO AGIN1

-CK3

TYPE ENTER NAME OF INPUT DATAFILE TO BE USED FOR RUN (OR QUIT TO EXIT)

READ VARS &FN &FT &FM

IF &FN EQ QUIT &GOTO -CCN

IF .&FN EQ . &FN = &FNS

IF .&FT EQ . &FT = DATA

IF .&FM EQ . &FM = D

IF &RETCODE EQ 0 &GOTO -CK2

TYPE FILE &FN &FT &FM DOES NOT EXIST - TRY AGAIN

&GOTO AGIN1

-CK2

*

* LOAD AND RUN?

*

TYPE LOAD AND RUN? (YES, NO)

READ VARS &RUN

IF .&RUN EQ .Y &RUN = YES

IF .&RUN NE .YES &GOTO -CCN

*

* SET FILEDEFS

FILE: DIS EXEC A1 VM/SP CMS SL 114

```
*
FILEDEF * CLEAR
FILEDEF FT01F001 DISK &FNO &FTC &FMC (LRECL 80 RECFM F
FILEDEF FT03F001 DISK &FNS &FTS &FMS
FILEDEF FT10F001 DISK DISPLCT CUT D
FILEDEF FT05F001 DISK &FN DATA D
FILEDEF FTC6F001 DISK &FN PRT6 D
*
LCADMCD DIS
START
*DIS
*
*FILEDEF * CLEAR
*
*      KEEP CONSOLE FILE?
*
-CCN
&IF .&ANSR EQ .NO &EXIT
&TYPE CC YOU WISH TO KEEP THE CONSOLE FILE
&REAC VARS &PURGE
&IF .&PURGE EQ .N &PURGE = NO
&IF .&PURGE NE .NO CP SP CONS ACC NOH TERM STOP CLOSE
&IF .&PURGE EQ .NO CP SP CONS ACC NOH TERM STOP PURGE
&EXIT
-TELL
&BEGTYPE
    THIS EXEC DRIVES THE DIS PORTION OF FLUCR
    FORMAT: DIS <?>
    THIS EXEC WILL SET ALL NECESSARY FILEDEF'S AND WILL PROMPT THE
    USER FOR ALL NECESSARY FILES. THE EXEC MAY BE TERMINATED BY
    ENTERING 'QUIT' WHENEVER QUIT IS LISTED AS AN AVAILABLE OPTION.
    ENTERING 'QUIT ?' WILL PRINT THIS MESSAGE.
    CAUTION: ALL INPUT FILES MUST BE IN UNPACKED FORMAT. IF AN INPUT
              FILE IS PACKED, THE EXEC WILL TERMINATE EXECUTION.
              IF AN INPUT FILE DOES NOT EXIST, THE USER WILL BE
              PROMPTED FOR THAT FILE AGAIN.
    ENTER A NULL LINE TO COMPLETE THIS MESSAGE
&END
&REAC VARS &CMPLTE
&IF .&CMPLTE NE . &EXIT
&BEGTYPE
    DEFAULT VALUES: INPUT DATA FILE
                        FN - NO DEFAULT VALUE
                        FT - DATA
                        FM - A
                    INPUT SURFACE FILE
                        FN - NO DEFAULT VALUE
                        FT - SURFACE
                        FM - A

    EXECS CREATED AT SOUTHERN ILLINOIS UNIVERSITY, CARBONDALE, IL
    AND AMENDED BY FLUCR CORPORATION, POB 8012, REDWOOD SHORES, CA,
    TO BE COMPATIBLE WITH IBM VM/SP CMS & ISPF.
&END
&EXIT
```

```

&CCNTRL OFF NOMSG
*
*
*      EXEC TO DRIVE THE PPV PORTION OF FLUOR
*
*
&IF &J EQ ? &GOTO -TELL
&TYPE DO YOU WISH TO KEEP A CONSOLE FILE? (YES, NO, QUIT)
&READ VARS &ANSR
&IF .&ANSR EQ .QUIT &EXIT
&IF .&ANSR EQ .N &ANSR = NO
&IF .&ANSR EQ .NO &GOTO -AGIN1
CP SP CONSOLE TO * CCNT TERM START
CP QUERY TIME
*
*      ENTER THE REQUIRED DATA FILE NAMES
*
-AGIN1
&TYPE ENTER NAME OF DATA FILE TO BE USED FOR THIS RUN (OR QUIT TO EXI
&READ VARS &FN &FT &FM
&IF &FN EQ QUIT &GOTO -CCN
&IF .&FT EQ . &FT = DATA
&IF .&FM EQ . &FM = A
STATE &FN &FT &FM
&IF &RETCODE EQ 0 &GOTO -CK1
&TYPE FILE &FN &FT &FM DOES NOT EXIST - TRY AGAIN
&GOTO AGIN1
-CK1
*
*      LOAD AND RUN?
*
&TYPE LOAD AND RUN? (YES, NO)
&READ VARS &RUN
&IF .&RUN EQ .Y &RUN = YES
&IF .&RUN NE .YES &GOTO -CCN
*
*      SET FILEDEFS
*
FILEDEF * CLEAR
FILEDEF FT01F001 DISK &FN &FT &FM (LRECL 80 RECFM F
FILEDEF FT02F001 DISK DEBUG OUTPUT D (LRECL 132 BLKSIZE 132 RECFM F
*FILEDEF FT04F001 DISK PPV PLOT OUT D
FILEDEF FT05F001 TERM
FILEDEF FT06F001 DISK PPV OUT PPT6 D
*
LOADMCD PPV
START
*PPV
*
ERASE FILE FT09F001 A
*
FILEDEF * CLEAR
*
*      KEEP CONSOLE FILE?
*

```

FILE: PPV EXEC A1 VM/SP CMS SL 114

```
-CCN
&IF .&ANSR EQ .NO &EXIT
&TYPE DC YOU WISH TO KEEP THE CONSOLE FILE
&READ VARS &PURGE
&IF .&PURGE EQ .N &PURGE = NO
&IF .&PURGE NE .NO CP SP CCNS ACC NOF TERM STOP CLOSE
&IF .&PURGE EQ .NC CP SP CCNS ACC NOF TERM STOP PURGE
&EXIT
-TELL
&BEGTYPE
    THIS EXEC DRIVES THE PPV PORTION OF FLUCR
    FORMAT: PPV <?>
    THIS EXEC WILL SET ALL NECESSARY FILEDEF'S AND WILL PROMPT THE
    USER FOR ALL NECESSARY FILES. THE EXEC MAY BE TERMINATED BY
    ENTERING 'QUIT' WHENEVER QUIT IS LISTED AS AN AVAILABLE OPTION.
    ENTERING 'QUIT ?' WILL PRINT THIS MESSAGE.
    CAUTION: ALL INPUT FILES MUST BE IN UNPACKED FORMAT. IF AN INPUT
              FILE IS PACKED, THE EXEC WILL TERMINATE EXECUTION.
              IF AN INPUT FILE DOES NOT EXIST, THE USER WILL BE
              PROMPTED FOR THAT FILE AGAIN.
    ENTER A NULL LINE TO COMPLETE THIS MESSAGE
&END
&READ VARS &CMPLTE
&IF .&CMPLTE NE . &EXIT
&BEGTYPE
    DEFAULT VALUES: INPUT DATA FILE
                      FN - NO DEFAULT VALUE
                      FT - DATA
                      FM - A
                      INPUT SURFACE FILE
                      FN - NO DEFAULT VALUE
                      FT - SURFACE
                      FM - A

    EXECS CREATED AT SOUTHERN ILLINOIS UNIVERSITY, CARBONDALE, IL
    AND AMENDED BY FLUCR CORPORATION, POB 8012, REDWOOD SHORES, CA,
    TO BE COMPATIBLE WITH IBM VM/SP CMS & ISPF.
&END
&EXIT
```

FILE: PPV EXEC A1 VM/SP CMS SL 114

&CCNTRCL OFF NCMSG

*

*

* EXEC TO DRIVE THE PPV PORTION OF FLUGR

*

*

IF & EQ ? &GOTO -TELL

TYPE DO YOU WISH TO KEEP A CONSOLE FILE? (YES, NO, QUIT)

READ VARS &ANSR

IF .&ANSR EQ .QUIT &EXIT

IF .&ANSR EQ .N &ANSR = NO

IF .&ANSR EQ .NO &GOTO -AGIN1

CP SP CONSOLE TO * CONT TERM START

CP QUERY TIME

*

* ENTER THE REQUIRED DATA FILE NAMES

*

-AGIN1

TYPE ENTER NAME OF DATA FILE TO BE USED FOR THIS RUN (CP QUIT TO EXIT

READ VARS &FN &FT &FM

IF &FN EQ QUIT &GOTO -CCN

IF .&FT EQ . &FT = DATA

IF .&FM EQ . &FM = A

STATE &FN &FT &FM

IF &RETCCODE EQ 0 &GOTO -CK1

TYPE FILE &FN &FT &FM DOES NOT EXIST - TRY AGAIN

&GOTO AGIN1

-CK1

*

* LOAD AND RUN?

*

TYPE LOAD AND RUN? (YES, NO)

READ VARS &RUN

IF .&RUN EQ .Y &RUN = YES

IF .&RUN NE .YES &GOTO -CCN

*

* SET FILEDEFS

*

FILEDEF * CLEAR

FILEDEF FT01F001 DISK &FN &FT &FM (LRECL 80 RECFM F

FILEDEF FT02F001 DISK DEBUG OUTPUT D (LRECL 132 BLKSIZE 132 RECFM F

*FILEDEF FT04F001 DISK PPVPLCT OUT D

FILEDEF FTC5F001 TERM

FILEDEF FT06F001 DISK PPVOUT PRT6 D

*

LOADMCD PPV

START

*PPV

*

ERASE FILE FTC5F001 A

*

FILEDEF * CLEAR

*

* KEEP CONSOLE FILE?

*

FILE: PPV EXEC A1 VM/SP CMS SL 114

```
-CCN
&IF .&ANSR EQ .NO &EXIT
&TYPE DO YOU WISH TO KEEP THE CONSOLE FILE
&READ VARS &PURGE
&IF .&PURGE EQ .N &PURGE = NO
&IF .&PURGE NE .NO CP SP CCNS ACC NOH TERM STOP CLOSE
&IF .&PURGE EQ .NO CP SP CCNS ACC NOH TERM STOP PURGE
&EXIT
-TELL
&BEGTYPE
    THIS EXEC DRIVES THE PPV PORTION OF FLUCR
    FORMAT: PPV <?>
    THIS EXEC WILL SET ALL NECESSARY FILEDEF'S AND WILL PROMPT THE
    USER FOR ALL NECESSARY FILES. THE EXEC MAY BE TERMINATED BY
    ENTERING 'QUIT' WHENEVER QUIT IS LISTED AS AN AVAILABLE OPTION.
    ENTERING 'QUIT ?' WILL PRINT THIS MESSAGE.
    CAUTION: ALL INPUT FILES MUST BE IN UNPACKED FORMAT. IF AN INPUT
              FILE IS PACKED, THE EXEC WILL TERMINATE EXECUTION.
              IF AN INPUT FILE DOES NOT EXIST, THE USER WILL BE
              PROMPTED FOR THAT FILE AGAIN.
    ENTER A NULL LINE TO COMPLETE THIS MESSAGE
&END
&READ VARS &CMPLTE
&IF .&CMPLTE NE . &EXIT
&BEGTYPE
    DEFAULT VALUES: INPUT DATA FILE
                        FN - NO DEFAULT VALUE
                        FT - DATA
                        FM - A
                        INPUT SURFACE FILE
                        FN - NO DEFAULT VALUE
                        FT - SURFACE
                        FM - A

    EXECS CREATED AT SOUTHERN ILLINOIS UNIVERSITY, CAPECODALE, IL
    AND AMENDED BY FLUCR CORPORATION, POB 8012, REDWOOD SHORES, CA,
    TO BE COMPATIBLE WITH IBM VM/SP CMS & ISPF.
&END
&EXIT
```

FILE: PSE EXEC A1 VM/SP CMS SL 114

%%CONTROL OFF NCMSG

*

*

* EXEC TO DRIVE THE PSE PORTION OF FLUGF

*

*

IF &\$ EQ ? &GOTO -TELL

TYPE DO YOU WISH TO KEEP A CONSOLE FILE? (YES, NO, QUIT)

READ VARS &ANSR

IF .&ANSR EQ .QUIT &EXIT

IF .&ANSR EQ .N &ANSR = NO

IF .&ANSR EQ .NO &GOTO -AGIN1

CP SP CONSOLE TO * CCNT TERM START

CP QUERY TIME

*

* ENTER REQUIRED DATA FILE NAMES

*

-AGIN1

TYPE ENTER FN FT FM OF FILE TO BE PRINTED (OR QUIT)

READ VARS &FN &FT &FM

IF &FN = QUIT &GOTO -CCN

IF .&FT EQ . &FT = SURFACE

IF .&FM EQ . &FM = A

STATE &FN &FT &FM

IF &RETCODE EQ 0 &GOTO -CK1

TYPE FILE &FN &FT &FM DOES NOT EXIST - TRY AGAIN

&GOTO -AGIN1

-CK1

*FILESTAT &FN &FT &FM

*IF &FSLRECL EQ 80 &GOTO -CK2

*TYPE &FN &FT &FM IS NOT IN PROPER FORMAT - UNPACK AND TRY AGAIN

*&GOTO -CCN

*-CK2

*

* LOAD AND RUN?

*

TYPE LOAD AND RUN? (YES, NO)

READ VARS &RUN

IF .&RUN EQ .Y &RUN = YES

IF .&RUN NE .YES &GOTO -CCN

*

* SET FILEDEFS

*

FILEDEF * CLEAR

FILEDEF FT02FO01 DISK &FN &FT &FM

FILEDEF FT05FO01 TERM

FILEDEF FT07FO01 TERM (PERM RECFM FB LRECL 133 BLOCK 133

FILEDEF FT06FO01 DISK PSE PR16 D (PERM RECFM F LRECL 133

*

LOADMOD PSE

START

*PSE

*

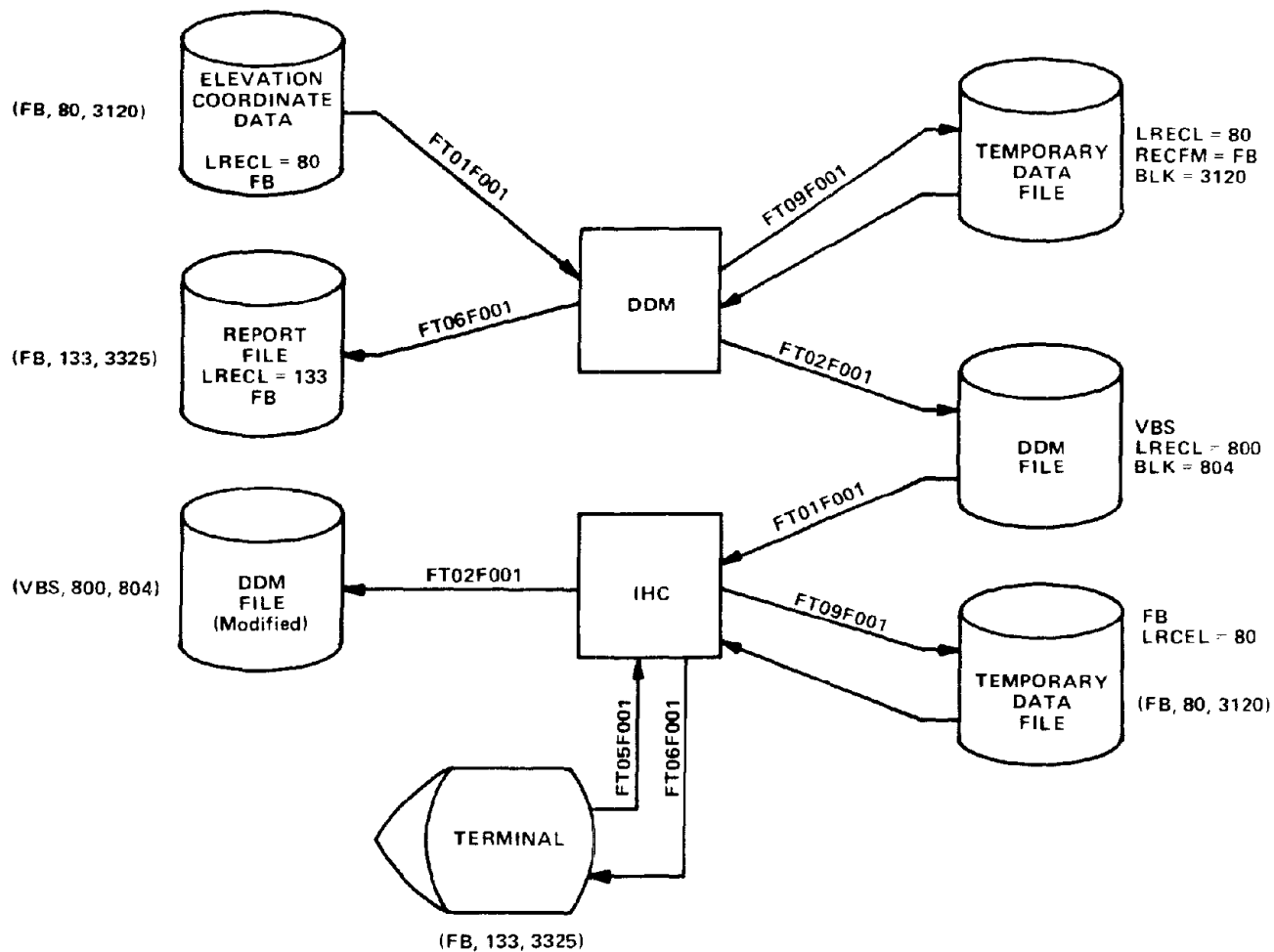
FILEDEF * CLEAR

*

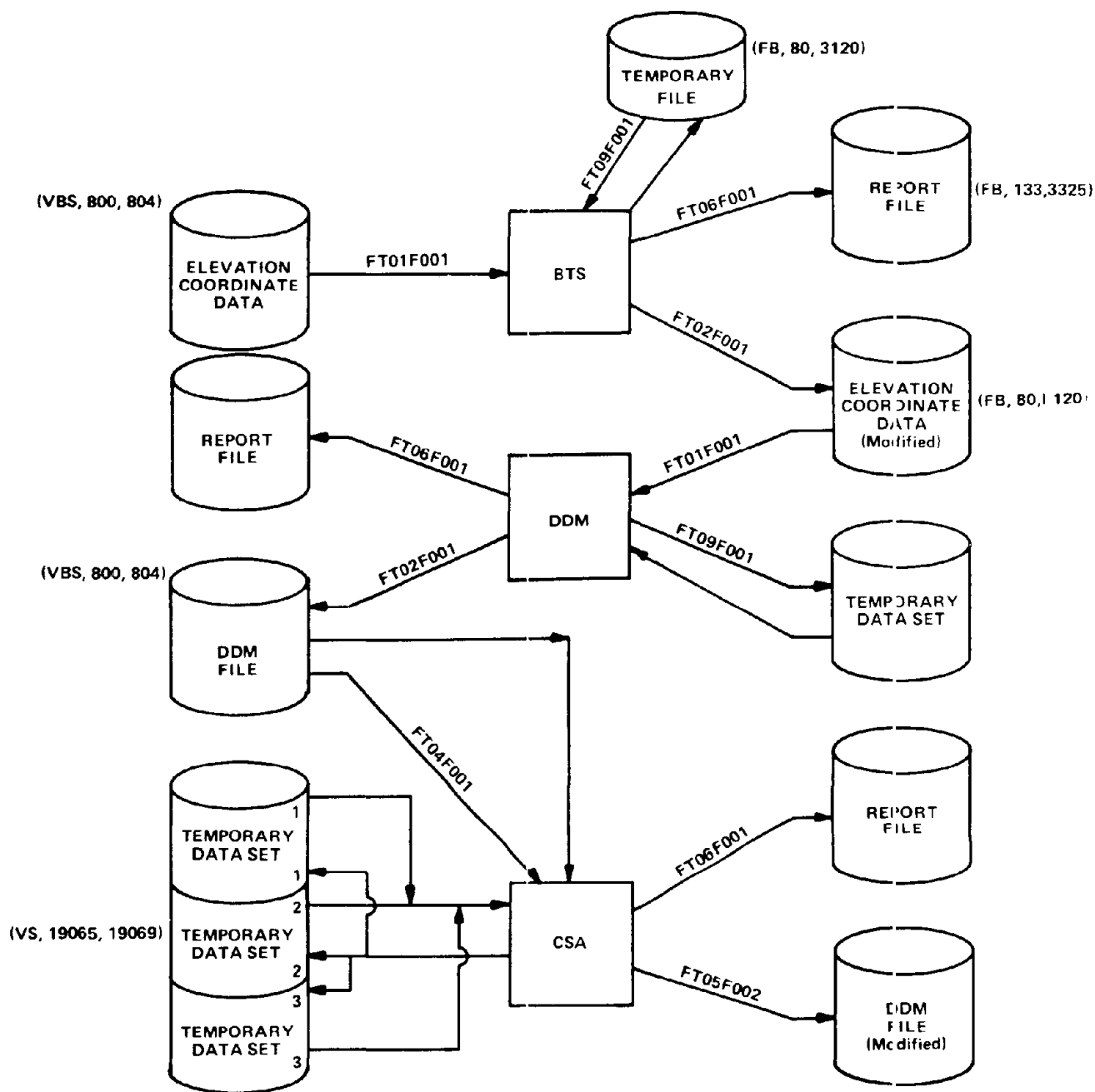
FILE: PSE EXEC A1 VM/SP CMS SL 114

```
*      KEEP CONSOLE FILE?
*
-CCN
&IF .&ANSR EQ .NO &EXIT
&TYPE CC YOU WISH TO KEEP THE CONSOLE FILE? (YES, NO)
&READ VARS &PURGE
&IF .&PURGE EQ .N &PURGE = NO
&IF .&PURGE EQ .NO CP SP CONS ACC NOH TERM STOP PURGE
&EXIT
-TELL
&BECTYPE
    THIS EXEC DRIVES THE PSE PORTION OF FLUCR
    FORMAT: PSE <?>
    THE EXEC SETS ALL NECESSARY FILEDEF'S AND PROMPTS THE USER
    FOR ALL NECESSARY FILES. THE USER MAY TERMINATE EXECUTION
    BY ENTERING 'QUIT' WHENEVER QUIT IS AN AVAILABLE OPTION.
    WARNING: THE INPUT SURFACE FILE MUST BE IN UNPACKED FORMAT. IF
             A REQUESTED FILE IS PACKED, THE EXEC WILL TERMINATE
             EXECUTION. IF A FILE IS REQUESTED WHICH DOES NOT EXIST
             THE EXEC WILL PROMPT THE USER FOR ANOTHER FILE.
    DEFAULT VALUES: INPUT SURFACE FILE
                     FN - NO DEFAULT VALUE
                     FT - SURFACE
                     FM - A
    ENTERING 'PSE ?' PRINTS THIS MESSAGE.

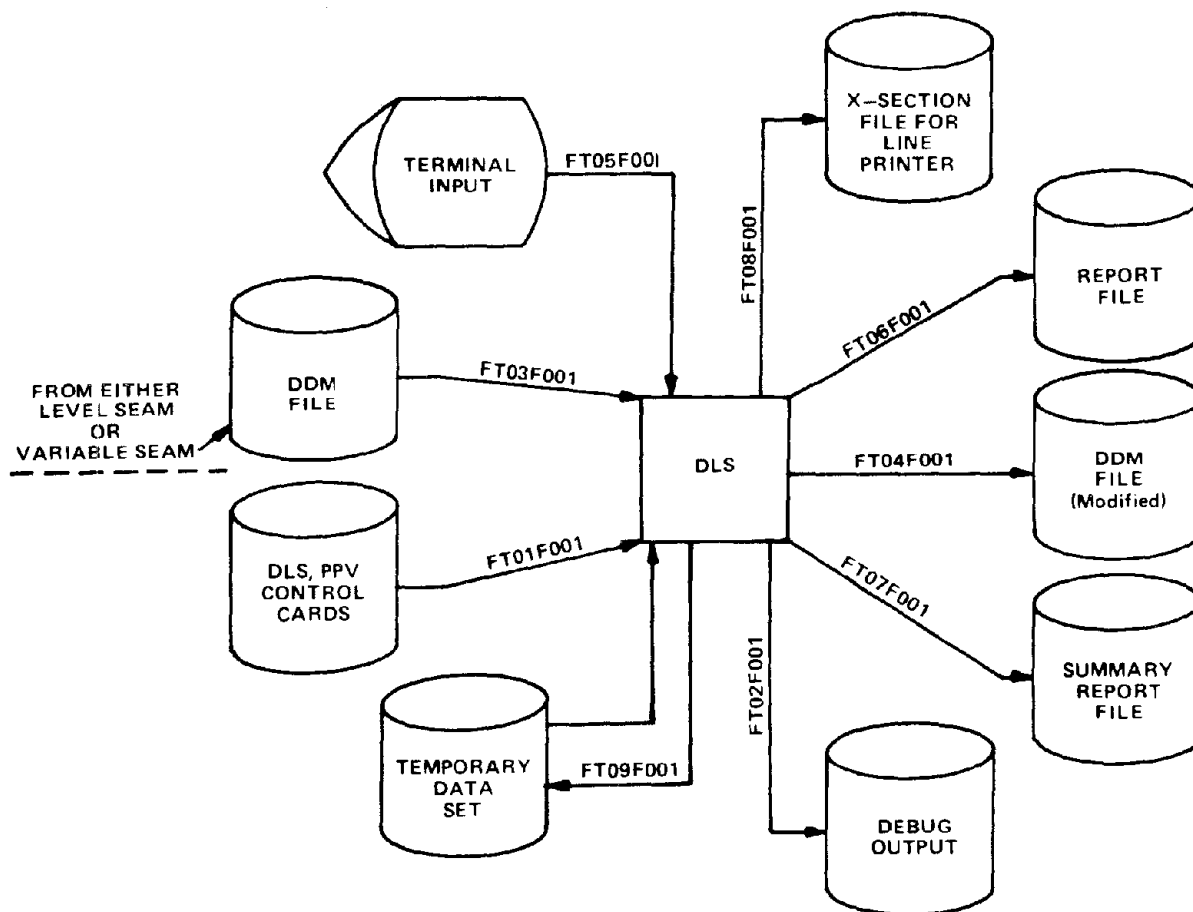
    EXECS CREATED AT SOUTHERN ILLINOIS UNIVERSITY, CARBONDALE, IL
    AND AMENDED BY FLUCR CORPORATION, POB 8012, REDWOOD SHORES, CA,
    TO BE COMPATIBLE WITH IBM VM/SP CMS & ISPF.
&END
&EXIT
```



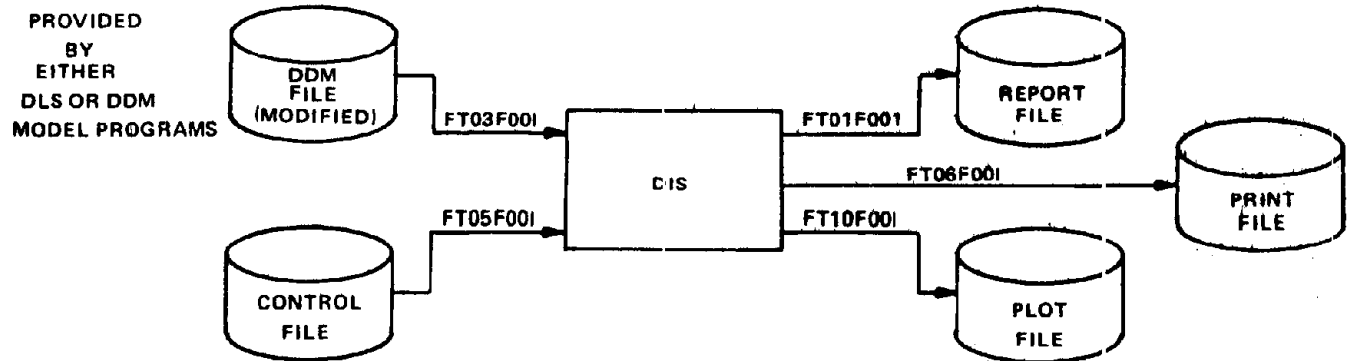
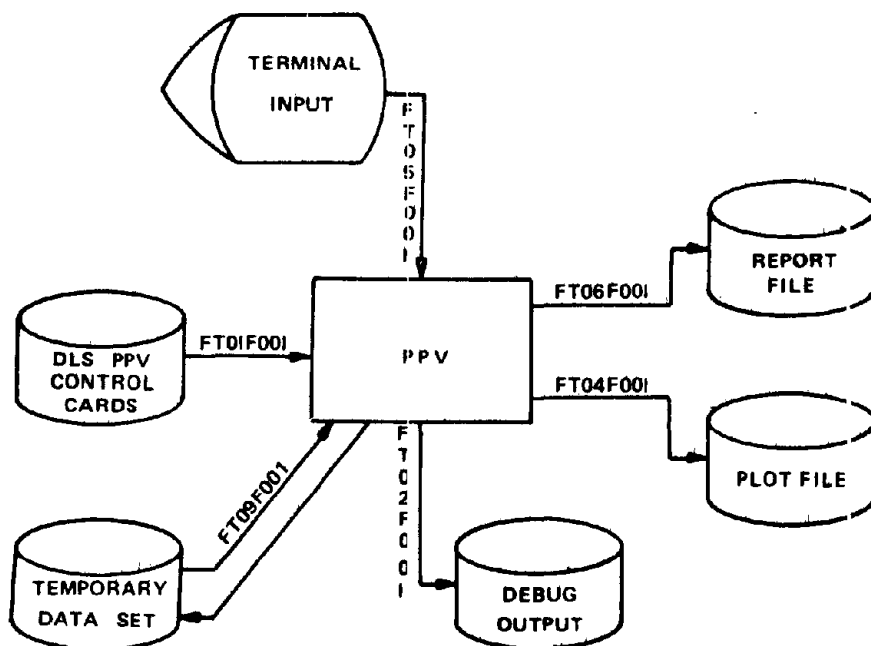
PROGRAM –DATA FILE RELATIONSHIPS FOR A LEVEL
SEAM DEPOSIT DESCRIPTION MODEL (DDM) RUN
– IBM VERSION –



PROGRAM – DATA FILE RELATIONSHIPS FOR A VARIABLE SEAM
DEPOSIT DESCRIPTION MODEL (DDM) RUN
– IBM VERSION –



PROGRAM – DATA FILE RELATIONSHIPS FOR DLS PROGRAM
– IBM VERSION –



PROGRAM - DATA FILE RELATIONSHIPS
FOR PLOTTING PROGRAMS
PPV AND DIS
- IBM VERSION

