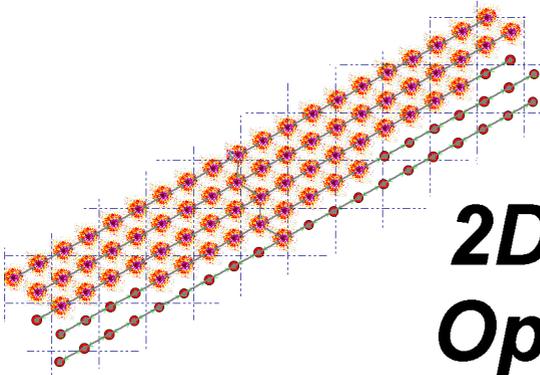


JK *SimBlast*

*blast simulation
evaluation and
management*



**2DBench
Open Cut
Blast Design**

User Manual

SOFT-BLAST
software in blasting

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JKSimBlast is a suite of powerful modular tools for the simulation and management of blasting data. 2DBench, 2DRing, 2DFace, JKBMS, 2DView, TimeHEX, Design Importer, StockView and Units are stand-alone modules of JKSimBlast: 2DBench, 2DRing and 2DFace are used for the design and editing of blasts in mining and related applications; JKBMS is used to organize and display the data associated with blasting; 2DView and TimeHEX are extended analysis programs for JKSimBlast blasting data; Design Importer imports data from text files directly to the blast databases; StockView is for the storage of the specifications of explosives and accessories; and Units is for the management of user-defined systems of measurement. As the program developers do not control data creation, collection, analysis or interpretation, it is the sole responsibility of the user to verify that input data are accurate and appropriate, and that all conditions and outputs are reasonable and comply with any statutory requirements.

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Introduction

Overview

JKSimBlast covers the design, editing, simulation, analysis and management of blasting in mining and related operations. The main modules are 2DBench, 2DRing and 2DFace. These are graphical software programs for the design and editing of blasts: 2DBench applies to bench blasting in surface mines; 2DRing applies to underground ring blasting; and 2DFace applies to underground tunneling and development. The three programs give engineers and blasting personnel the ability to design and optimise the layout and initiation sequence of almost any type of blast used in mining. Each allows the designer to:

- layout a pattern of blastholes
- load explosive decks and other materials in the holes
- install downhole and surface delays, with primer and connection details
- simulate the detonation on screen
- import and export data and print the blast

Individual elements of the blast are defined by the user, including hole dimensions, explosives, delays, connectors and boosters, and can be combined in a variety of blast scenarios.

The design modules include detailed analysis tools to calculate blast properties, summarise quantities and consumables, and interpret blast performance. Other modules in JKSimBlast provide for extended analysis of blast layouts and energy (2DView, Energy and 2DContour) and blast timing (TimeHEX). Data management is

Overview

provided by JKBMS (Blast Management System). Thus JKSimBlast is a framework for a suite of programs for data management in blasting, including design and simulation, analysis, data collection and referencing, performance evaluation, prediction and optimisation. Integration of the modules is achieved through data sharing via Microsoft Access databases. The open framework allows for other third party applications to be developed and incorporated into JKSimBlast, using the same databases for their own purposes. This approach provides the user with a mechanism to maximise the use of the data.

This manual describes the basic and commonly used features of the programs. More detail on JKSimBlast and the modules is contained on the CD and in the various sections of this manual, and in the on-line help with each module.

Conventions

Conventions used in this manual

- [click] click the left mouse button once
- [double click] click the left mouse button twice
- [right click] click the right mouse button once
- [drag] click and hold the left mouse button, move the mouse, then release the left mouse button
- [...] press the key, button or tab shown
do not press [Shift] unless indicated
- [...]+[...] press the keys together
- >*italic* means a menu option

Equipment Requirements

JKSimBlast runs on a personal computer under Microsoft Windows 98 / NT4 / 2000 / XP. The *recommended* minimum requirements for running JKSimBlast are:

Equipment Requirements

- 16 MB of random access memory (RAM)
- CD disk drive (for installation)
- hard disk drive with 65 MB of free space, plus 85 MB of temporary free space for installation
- SVGA graphics (800 x 600 display)
- mouse

The installation program requires about 85 MB of free space for the temporary installation files, which are removed when the installation is completed. The full suite of JKSimBlast program files occupy about 45 MB of disk space, with a further 20 MB taken up by system files, mostly in the Windows System folder. Some of these files may be already present on the computer, so the final disk space requirement may be less than that stated above. Additional space will be required for blast database files created by the user in the operation of the program.

All JKSimBlast modules are designed for SVGA graphics (800 x 600 pixels). Although it will operate in VGA mode (640 x 480), some of the items may be obscured or cut off in the smaller screen area, such as dialog boxes, query windows and status line messages.

JKSimBlast uses an electronic security key, which must be attached to the computer before each module can run. Additional and replacement keys can be obtained from Soft-Blast.

Software Installation

Software Installation

Before proceeding:

For Windows NT, 2000 or XP, you may need Administrator privileges for software installation.

JKSimBlast uses an electronic security key and a matching license file as the license control for the software. You will need both of these items to run the software.

Installing JKSimBlast

The installation program for JKSimBlast is used to install any or all of the modules, plus the drivers for the electronic security key. You have a choice to install either a complete system for Surface Blasting or Underground Blasting, or individual components (see the JKSimBlast overview on the CD for more details).

You will need an appropriate license file to run the main modules of JKSimBlast - JKBMS, 2DBench, 2DRing, 2DFace, 2DView, Energy, 2DContour and TimeHEX. This file is supplied as part of the purchase of the software. Instructions for installing the license file are at the end of the section below. The utility modules StockView, Import and Units do not require a security key or license file in order to operate.

In the installation instructions, [disk]: refers to the drive letter of your CD drive.

1. Start the installation program

To install all of the modules in JKSimBlast, you will need about 150MB of free space on your hard drive. This includes 85MB of temporary space for the install program. Installing only one module, such as 2DBench or 2DRing, requires about 120MB.

To start the installation, run the program

```
[disk]:\install\JKSimBlast\Setup_JKSimBlast_v2.exe
```

Select [Open] or [Run from this location] if the program does not start by itself. Alternatively, you can copy the install program to a hard drive and run it from there.

Once the installation program starts, follow the on-screen instructions.

2. Wait ...

The install program will create a temporary folder on your hard drive to hold the extracted installation files. This is a very large file, so *it could take a few minutes*. For example, on a 500MHz computer running Windows 2000, the extraction can take up to 1½ minutes. Please be patient.

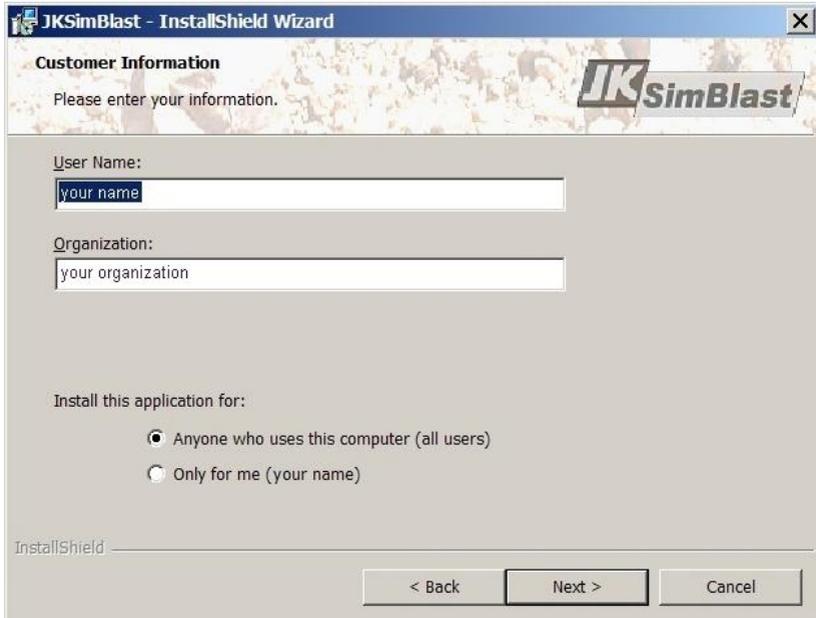
3. License Agreement

[Click] the button to accept the license agreement and proceed. A copy of the license agreement is on the disk, in the JKSimBlast install folder.



4. Customer Information

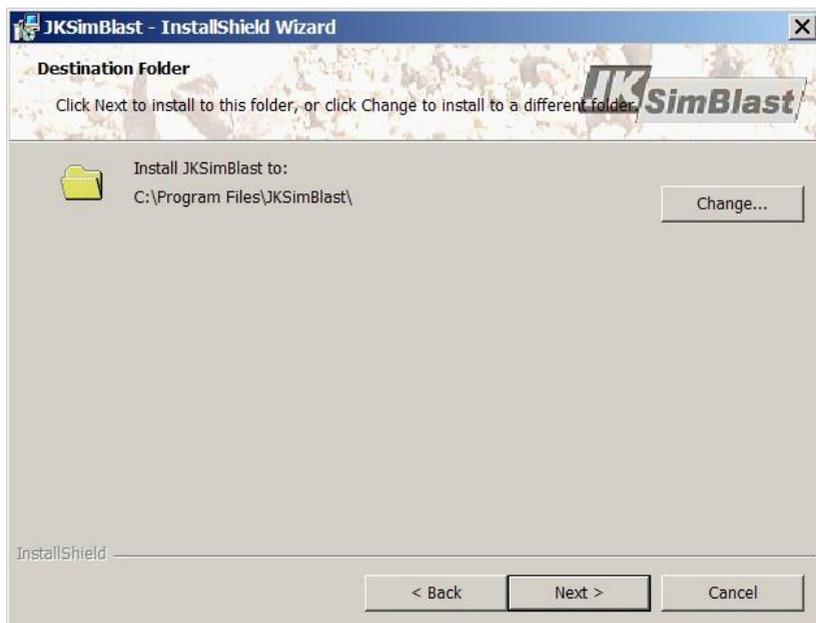
Enter your name and organisation, if they are not already shown. This is internal information only, for the operating system.



The screenshot shows a Windows-style dialog box titled "JKSimBlast - InstallShield Wizard". The dialog has a blue title bar with a close button (X) in the top right corner. The main content area has a light beige background with a subtle pattern. At the top left, it says "Customer Information" in bold. Below that, it says "Please enter your information." and the "JK SimBlast" logo is on the right. There are two text input fields: "User Name:" with the text "your name" and "Organization:" with the text "your organization". Below these is a section titled "Install this application for:" with two radio button options: "Anyone who uses this computer (all users)" (which is selected) and "Only for me (your name)". At the bottom left, it says "InstallShield". At the bottom right, there are three buttons: "< Back", "Next >", and "Cancel".

5. *Destination Folder*

Either accept the default installation folder, or click [Change] to select a new folder.



6. Setup Type

Select the type of installation:

- option 1: JKSimBlast for Surface Blasting
- option 2: JKSimBlast for Underground Blasting
- option 3: custom setup for all others, including *JKSimBlast for Tunnel Blasting*



7. Custom Setup

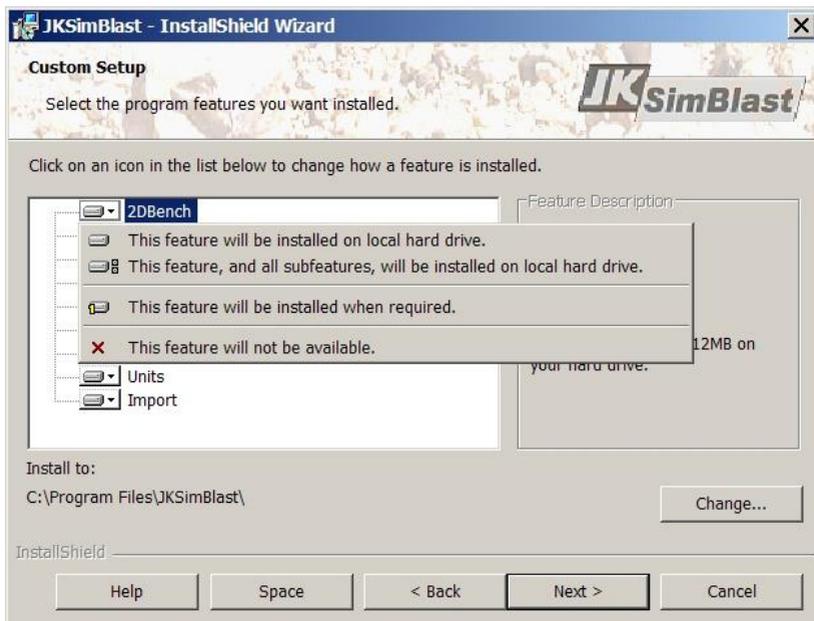
Use the Custom Setup to install individual components. Note that the components StockView, Import and Units are always installed.

To install *JKSimBlast for Tunnel Blasting*, select the components 2DFace, TimeHEX, 2DView and JKBMS.



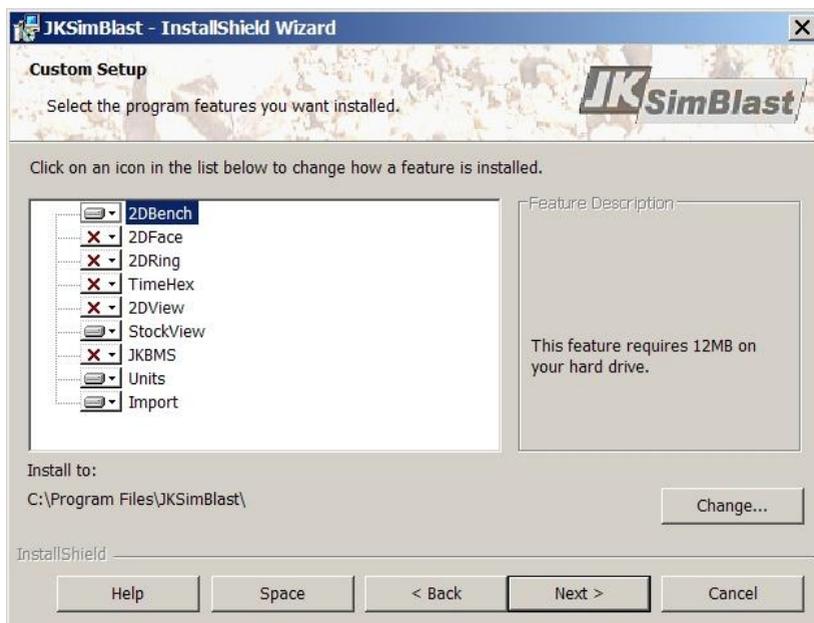
Introduction

Select how and when to install each component - typically, always select the first option ...



Introduction

For example, to install only 2DBench, the screen should look like this ...



8. Ready to install

The software is now ready to install. Check the details, and click [Install] to continue.



Electronic Security Key

Electronic Security Key

All of the main JKSimBlast modules require an electronic security key to operate. The drivers for running either a USB key or an LPT key (for the parallel printer port) are installed with the program.

The Hardlock drivers can also be installed independently, if required, by running the program *hldrv32.exe* from the *Hardlock* folder on the CD.

License File

License File

To complete the installation, copy the license file *license.nfo* to the main JKSimBlast folder (typically *C:\Program Files\JKSimBlast*). The license file contains details of the modules that are permitted to run with each electronic security key.

The license file should either be on the CD in the JKSimBlast folder, or supplied by email as an attachment. If you do not have a license file, contact Soft-Blast. Include the name of your organisation, contact person and the serial number of your electronic security key.

Once the license file is in place, plug in the security key and start the software.

Fast Program Start

The programs JKBMS, 2DBench, 2DRing and 2DFace may take a long time to start at the first run, but should start almost immediately on subsequent runs. At the first run, the programs search internally for details of the electronic security key. These details are then stored in an initialisation file in the program folder, and are used in subsequent runs to enable faster start-up.

Fast Program Start

If a program does take a long time to start, a fast start can be forced by modifying the shortcut to the program. Select *>Help >About*, and note the code in square brackets at the bottom of the form, e.g. [G123]. [Right click] on any shortcut for starting the program (including the Start menu), and select Properties from the pop-up menu. At the end of the Target line, add /local=G123. For example:

"C:\Program Files\JKSim...2DBench.exe" /local=G123

Close the Properties, then restart the program from the shortcut. It should start almost immediately.

For a network license, the code is in the form [Nnnn], and the startup command is /net=Nnnn.

2DBench

Overview

Overview

2DBench is a graphical program for the design and analysis of blasts in benching operations, typically for open cut mines and quarries.

The blast is laid out in a 2D plan view, consisting of blast holes, decks, and downhole and surface delays and connections. The blast area can be further described by lines, polygons and labels (collectively known as strings). Both strings and blast holes can be imported from text files, either as designs or actual data.

Once the blast layout is complete, a detonation simulation can be run on-screen. Basic analyses include volume, tonnage, powder factor, component and total costs and first detonation contours. Advanced analyses include maximum instantaneous charge, energy distribution, PPV contours, dynamic burden relief, and fragmentation.

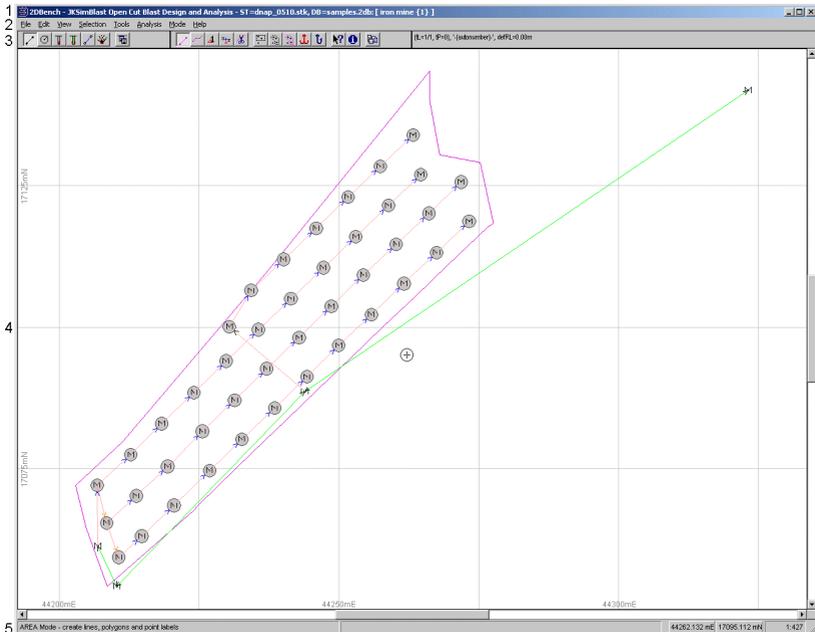
Although the blast is viewed in 2D plan, all data is created and stored with full 3D coordinates (east, north, level) in Microsoft Access databases. Added to this are component details (hole parameters of dip, bearing, diameter, length, burden, spacing), properties of explosives, detonators, primers and connectors, and Monte Carlo detonation timing information.

The data from 2DBench can be further analysed in 2DView (in section and oblique views) for contouring of hole-related data and energy distribution and in TimeHEX (blast timing vs holes and explosives) for arrival times and cumulative effect. 2DBench blasts and any related data can be organized and viewed in JKBMS (Blast Management System).

Appearance

Appearance

1. title bar
stocks database, blast database, blast name / scenario
2. menus
display, selection, tools, options, shortcuts
>*Edit* – mode specific, >*Tools* – user definable
3. toolbars
design modes, mode tools, global tools, parameter summary
4. design area
limitless window, scroll bars, view options
5. status bar
mode, action, cursor E/N, bearing & length (line, anchor), view scale



Design Modes

Design Modes

A blast is divided into five components, created in the various modes in the program. Each mode has specific tools and functions, plus there are several other tools for global editing, query, input and output functions.



Area draw and edit lines and polygons (called ‘strings’), text labels



Drill drill and edit blast holes and nodes



Load insert decks – explosive and inert



Downhole insert down hole delays and boosters



Surface insert delays between holes and nodes



Detonation simulate detonation and analyse timing

General Features

General Features

Toolbar

The first group of buttons on the toolbar are the blast modes: Area (lines, polygons, labels), Drill, Load, Downhole Delays, Surface Delays, and Detonation Simulation. The next button is the global parameter dialog – press this button in any mode to display the parameters dialog for that mode. The remaining buttons are tools for the selected mode tools and global tools. The last section is a summary of the parameters in the selected mode.



Cursor 

The mouse can act as a pointer or cursor. To change to the cursor, put the mouse over the Design Area and [click], [Enter] or [spacebar]. To exit, [right-click] or [spacebar]. You can move the cursor with the mouse or the arrow keys. Its position is shown by the coordinates on the status bar.

Selection Box / Mask

The selection box is a rectangular box; the selection mask is a multi-sided shape. Either is enabled when the toolbar button is “on”. The box and mask are used to mark holes or zoom in on the viewing area. To set the selection box, place the cursor for one corner of the box, then [drag] the cursor to the position of the opposite corner. For the mask, place the cursor and [drag] for the first side, then [click] for each side – close by crossing the first side or [Esc].

Zoom

You can zoom in by pressing [Z] - zoom out by [Shift]+[Z]. The screen will zoom to the box or mask if it is active, otherwise zoom in or out will double or halve the window scale. The scale is shown at the bottom of the screen. [Double-click] the scale to activate a zoom control box.

Blast Parameters

Blast parameters (hole and pattern dimensions, type and amount of explosives and delays, etc) are entered via the parameters dialog. Activate the dialog, enter the values, click [Accept], and create the blast. Click [Save] to write the parameters to an .ini file, and [Recall] to recall the parameters. Click [Close] to close the parameters dialog.

Marking

Selective actions, such as load, copy or delete, are performed on marked holes and nodes, shown by a small M

in the centre of the hole. Mark or unmark holes via the *>Selection* menu, [M] / [U] to mark / unmark the nearest hole to the cursor, or [Ctrl]+[M] / [Ctrl]+[U] to mark / unmark all holes. The number of marked and total holes is shown in the summary bar (e.g. mh 45/50).

Query (information display)

[Click] the information display button at any time to see all data for the current mode on the selected object (usually the nearest to the cursor).

Help

Help is available from the *>Help* menu, or by clicking the [Help] button on the dialogs.

Sample Blasts

Several sample blasts are included with the program in a single 2DBench database, called *samples.2db*. These blasts can be opened, viewed and modified in the program. The sample database file is located in the *data* sub-folder, typically in *C:\Program Files\JKSimBlast\2DBench\data*.

To open a sample blast, select *>File >Open Blast...* to display the Open dialog. Click the [Browse] button, and select the *samples.2db* file from the *data* folder. Then select a blast from the [Name] list, and a scenario number from the [Scenario] list if one is not selected automatically. Click the [Open] button to open the blast in 2DBench.

Tools & Keys

Tools & Keys

[click] = [Enter]

[click] or [Enter] or [space] = enter design area

[right-click] or [space] = exit design area

[right-click] = activate window, no other action

[R] *Redraw* = refresh screen

[Alt+Bksp] *Undo* = one step back

[click-click E/N] *GoTo* absolute, relative, polar, object
[Do Action] use at any time

[Home] = move cursor to: nearest point on string, nearest hole, nearest surface delay

[End] = centre all data (changes scale)

[Ctrl+End] = centre screen at cursor (does not change scale)



[anchor] [right-click] or [space] to exit, [anchor]
OR place cursor, then [*]



[copy picture] set scale, window and view options
(also /File /Save Design Region Picture)

[Backspace] = delete nearest object: string, hole, top deck
in nearest hole, top D/H delay in nearest hole, surface tie

[Delete] = select objects to delete: decks, D/H delays,
surface delays

2DBench Tutorial

Creating a Blast Design

This tutorial will take you through the basic steps for creating a blast design in 2DBench.

Creating a Blast Design

Generally, you create a blast by working through each of the modes, represented by the first six buttons on the toolbar, from left to right. In each mode, several specific tools are available for creating objects on the screen or analysing the data associated with the objects. In almost all cases, the actions defined by the tools are implemented by either [click] on the desired object, or anywhere in the design area for global actions.

This mode is for creating strings: lines, polygons and point labels. These are mainly intended to “draw a picture” of the features around a blast, although both lines and polygons can be used for hole layout, and polygons can be

Lines, Polygons & Labels



used to calculate powder factors. Strings can also be imported from text files, via the menu option *>File >Import*. It is not compulsory to create strings for a blast, so this will be ignored for this tutorial. Consult the on-line help for details on how to create or import lines, polygons and labels.

[Click] the Hole Drilling mode button on the toolbar (second from left).

Drill Holes



There are several drilling methods: single hole, pattern, polygon fill, follow line, and *Baseline* (from the *Tools* menu). You can also place nodes (dummy holes) for connecting surface delays where there is no blast hole. A node is placed in the same manner as a single hole.

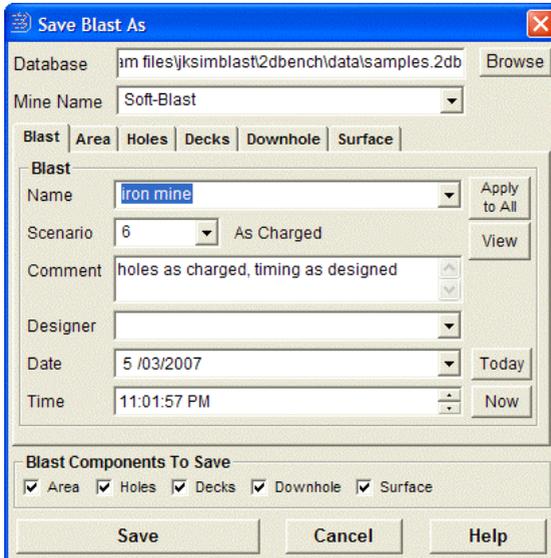
For this example, you can use the default parameters to drill holes or patterns; however, if you want to change them, activate the parameters dialog, enter new values and click [Accept New Values] then [Close].

1. Select pattern drilling. The icon shows a vertical line with several small circles along it, representing a pattern of holes.
2. Place the cursor on the left side of the screen for the location of the first hole (row 1, hole 1) and [click].
3. Set the direction of the front row - move the cursor to the right. The bearing of the row is shown on the status bar. [Click] to set the direction.
4. Set the burden direction by moving the cursor below the front row line and [click]. The blast pattern is created on the screen. (The same technique can be used to set the pattern from the back row – note the [Burden Direction] in the parameters.)
5. Press [End] to centre the blast on the screen.
6. Place the cursor near any hole in the pattern, and [click] the query toolbar button [K?] to show information on the hole. Move the cursor to display a different hole.
7. Single holes and nodes can be placed anywhere in the blast by placing the cursor and [click]. Nodes have the same Bench Level as blast holes.

NOTE: by default, drilled holes are Unmarked and imported holes are Marked.

It is advisable to save the blast regularly. Blasts are saved **Save the Blast** in a MS Access database. One database can hold multiple blasts.

Select *>File > Save Blast* in the menu.



Click [Browse] and select a folder for the blast database. Enter a new file name for the database (e.g. “tutorial”) and click [Open]. Click [Yes] to create a new database called “tutorial.2db”. New databases are created from a template database stored in the Templates folder.

Enter a name for the blast. Select a pre-defined scenario number or accept *-(new)-* to automatically generate a number (10 or higher).

Click [Save]. The name of the database file and the blast will appear in the title bar at the top of the screen. The blast name includes the scenario number.

Load Decks

Select Material Loading mode (third button). Materials are explosives and non-explosives.



Open the parameters dialog, and select a material – in this case, an explosive. Click [Show Details] to see the properties (note: non-explosives have VOD = 0).

Select a quantity method for the amount of explosive to load, and enter an amount. For a deck loaded to x metres from the collar, select [Load to a Length From the Collar] and enter the length below.

Click [Accept New Values]. [Close] the parameters dialog if it is obstructing the blast.

Select [Load all holes] on the toolbar. 

[Click] anywhere in the design area to load the type and amount of explosive in all of the blast holes.

In the parameters dialog, select a stemming material and amount ([Load to a Length From the Collar] and 0 metres), and [Accept...]. [Close] the parameters dialog.

[Click] again in the design area to load the stemming.

Click [↖?] on the toolbar to display details of the nearest hole. [Click] on the hole again or [Page Up / Page Down] to cycle through the charge details.

>File >Save Blast and [Save]. [Yes] to overwrite the holes.

Select Downhole Delay mode (fourth button). In this mode, you insert delays, connectors and primers in the blast holes.

Downhole Delays



Open the parameters dialog, and select a downhole delay (e.g. #20 / 500ms), connector (tube) and primer (any). Click [Show Details] to see the properties.

On the [Delay] tab, enter a distance from the collar or the toe for the delay – the depth must be set so that the delay is in the explosive deck (e.g. 1 m from toe).

Click [Accept] and [Close] the parameters dialog.

Select [ALL holes] on the toolbar. 

[Click] anywhere in the design area to load the delays in all of the blast holes. You should see a coloured triangle inside each hole.

Click [F?] on the toolbar to query any hole.

>File >Save Blast and [Save]. [Yes] to overwrite the holes and decks.

Select Surface Delay mode (fifth button). In this mode, you insert delays and connectors between the blast holes.

Surface Delays



For this sample blast, tie a simple pattern along the rows with a single centre line between the rows.

First, mark all of the holes. In this mode, mark the holes via the *Selection* menu, or [Ctrl]+[M] with the cursor inactive.

Open the parameters dialog, and select a detonator and appropriate connector (e.g delay: 17ms; connector: 17). Click [Show Details] to see the properties.

Select bi-directional (for this blast): typically, shock-tube detonators are uni-directional; cord detonators are bi-directional. With bi-directional mode, it does not matter which direction the delays are placed in the blast.

Select Inter-Hole for the delay type (this option allows inter-hole and inter-row delays to be displayed separately – it does not affect their performance).

[Accept] the values, and close the dialog.

Select [Multiple hole tie up].  The holes must be marked for this method.

Place the cursor on the first hole in the front row, and [click].

Move the cursor slightly past the last hole in the row. Note the highlighted holes will be connected. [Click] again to connect all of the marked holes with inter-hole delays.

[Esc] to disconnect from the last hole (or [click] with the cursor on the hole).

Repeat for the other rows.

If you make a mistake, place the cursor near a surface delay and press [Backspace], or mark the relevant holes and select *>Edit >Delete...*

Open the parameters dialog and select an inter-row delay and connector (e.g. 42ms). Select Inter-Row for the delay type. [Accept] and [Close] the dialog.

Select [Hole to Hole delay tie up]. 

Place the cursor on a hole near the middle of the front row and [click].

Place the cursor on a hole in the second row, and [click] again to connect the rows.

Repeat for the third row and so on. [Esc] or [click] on the last hole to disconnect.

Click [F?] on the toolbar to see the details for a delay.

>File >Save Blast and [Save] – [Yes].

Select Detonation Simulation mode (sixth button). In this mode, you run the detonation simulation and calculate times for all objects in the blast.

**Detonation
Simulation**



You can open the parameters dialog if you wish and modify any of the values, but the default values will work fine for this example.

To run the simulation, place the cursor over the middle hole in the first row (where the inter-row delay is connected) and [click]. You will see the surface delays initiating, and then each hole detonating.

While the simulation is running...

[S]	=	stop
[any key]	=	step
[C]	=	continue
[Esc]	=	end

To slow the simulation, enter a pause value in the parameters. Click [⌘?] on the toolbar to query a hole.

[Click] anywhere in the Design Area to run the simulation again from the initiation hole, or select  to run the simulation from the nearest hole to the cursor.

>*File* >*Save Blast* and [Save] – [Yes] to save the detonation times with the blast.

Basic Analyses

Click  to display the first detonation contours.

Click  to show a chart of maximum instantaneous charges (kg per 8ms delay, initial setting). The time window can be varied to any value. Click [⌘?] on the toolbar and then [click] any bar in the chart to see the linked holes. Use the arrow keys to “scroll” through the chart.

To display the detonation times, select >*View* >*Display Options*, then [Visibility] – [Downhole Detonation Delay Labels] and [Apply].

2DBench Tutorial

Select *>Analysis >Blast Summary* for totals, counts and averages of drilling, charging and delays used in the blast. The details from these forms can be copied to the clipboard and pasted into almost any application that can accept text.

Select *>Analysis >Design Factors* for the powder and energy factors for the blast. First, mark the holes you wish to calculate, then select one of the tabs on the dialog for the different calculation methods. (Note: for the polygon method, you need a polygon surrounding the blast to approximate the area broken, and you must enter the correct bench height.) You can enter the rock SG in the form.

Select *>File >Print Blast Window* to print the blast plan, and set the display via *>View >Display Options*.

