3DEXPERIENCE®

Mine Production Management

Ben Farquharson:
Vice President GEOVIA, Asia Pacific South

DASSAULT SYSTEMES | The 3DEXPERIENCE® Company

Our Company

a **Scientific** company

Combining **Science, Technology** and **Art** for a sustainable society

13,300 passionate people

- 117 nationalities
- One global R&D / 56 labs
- Game changing **3D**EXPERIENCE solutions

190,000 enterprise customers

- 12 industries in 140 countries
- >10 million on premise users
- >100 million online users

10,000 partners

- Software, Technology & Architecture
- Content & Online Services
- Sales
- Consulting & System Integrators
- Education
- Research

Long-term driven

- Majority shareholder control
- **Revenue**: $3.2 Bn*
- Operating margin: 29.8%*

** Figures as of FY 2014 / Non-IFRS*

Our Clients: Industry leaders at the heart of Innovation

Transportation & Mobility

Aerospace & Defense

Marine & Offshore

Industrial Equipment

High-Tech

Consumer Goods - Retail

Consumer Packaged Goods - Retail

Life Sciences

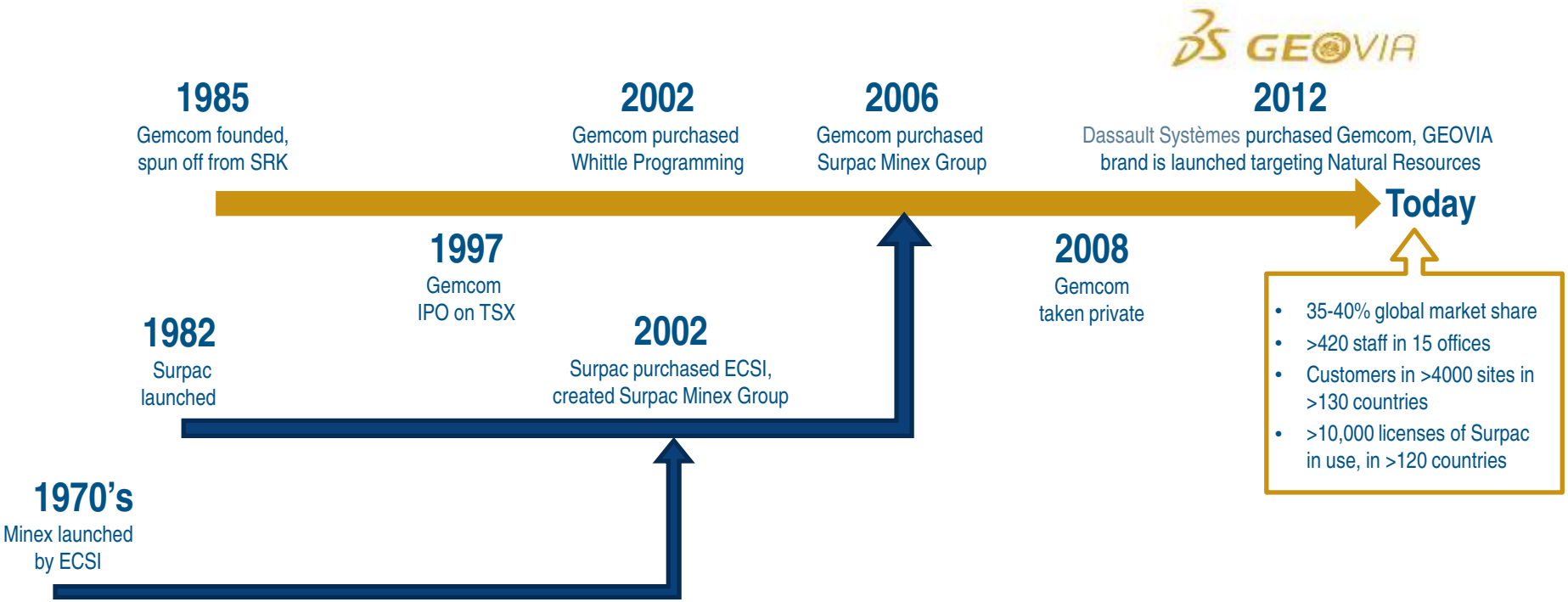
Energy, Process & Utilities

Architecture, Engineering & Construction

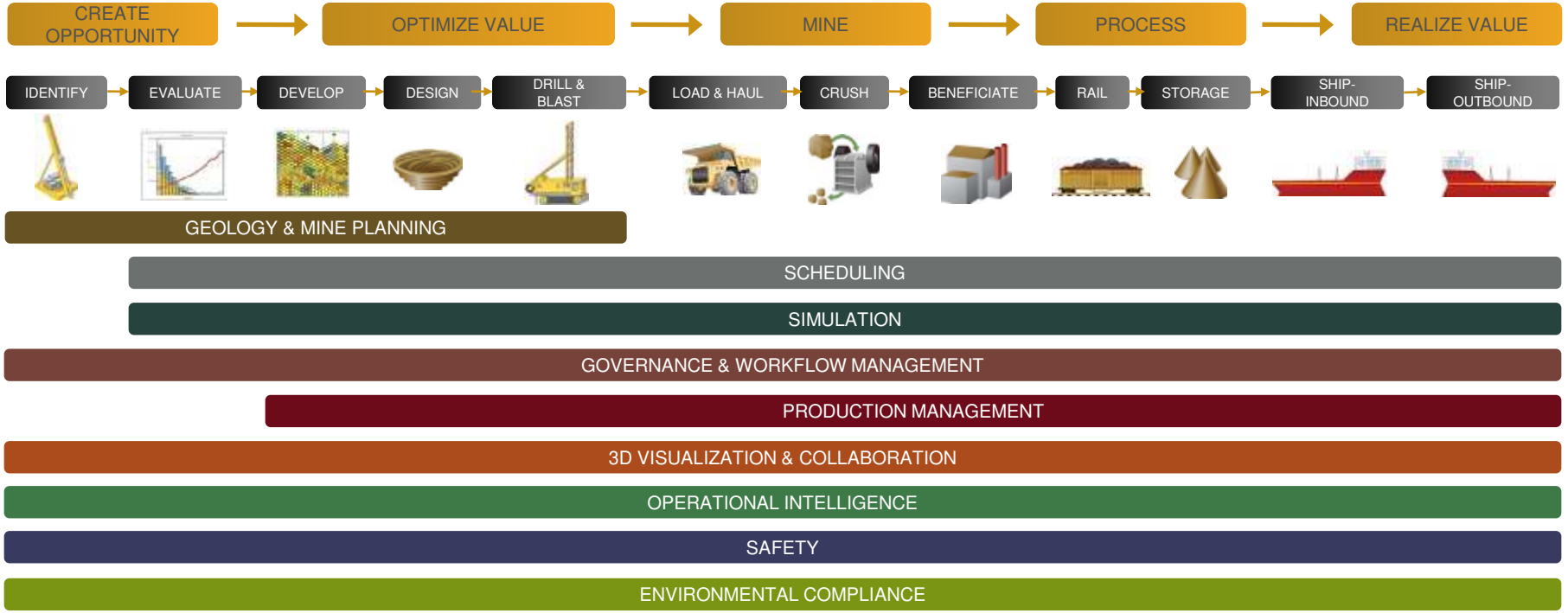
Financial & Business Services

Natural Resources

The Evolution of GEOVIA



Mining Execution Management

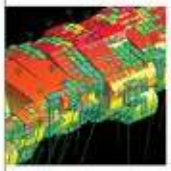


GEOVIA – The Leading Mining Portfolio

EXPLORATION › EVALUATION › PLANNING › ENGINEERING › MINE PRODUCTION MANAGEMENT AND RECONCILIATION

SERVICES

GEOLOGY AND MINE PLANNING



GEOVIA | Surpac

Surpac is the world's most popular geology and mine planning software. It delivers efficiency and accuracy through ease-of-use, powerful 3D graphics and workflow automation.

GEOVIA | GEMS

GEMS provides collaborative geology and mine planning capabilities that support cross-functional teams involved in exploration, modelling, mine design, long-term planning and production scheduling.

GEOVIA | Minex

Minex provides the best geology and mine planning tools for coal and other stratified deposits, ensuring resources are evaluated accurately and mined efficiently.

BLOCK CAVING

GEOVIA | PCBC

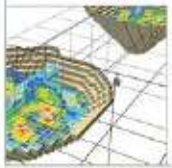
PCBC is used by virtually every major mining company involved in block caving, who rely on its comprehensive functionality to assist with feasibility studies, design and production management.

MINE PRODUCTION MANAGEMENT AND RECONCILIATION

GEOVIA | InSite

InSite collates progress of production activities against the plan. Advanced reconciliation tools allow mining operations to address and understand the cause of variance.

STRATEGIC MINE PLANNING



GEOVIA | Whittle

Whittle is the world's most trusted strategic mine planning software used to determine and optimise the economics of open pit mining projects.

SECURE REMOTE COLLABORATION

GEOVIA | Hub

Hub provides secure remote collaboration that organises, centralises and enables the reliable sharing of exploration, planning, and production data over low-bandwidth connections.

SCHEDULING

GEOVIA | MineSched

MineSched provides long- and short-term scheduling for surface and underground mines of all sizes and types, improving productivity and profits beyond what's possible in manual scheduling.

SERVICES

GEOVIA | Services

When you don't have the time or in-house resources available, GEOVIA's global Services team can provide geology, engineering, and operations assistance.

3DEXPERIENCE®

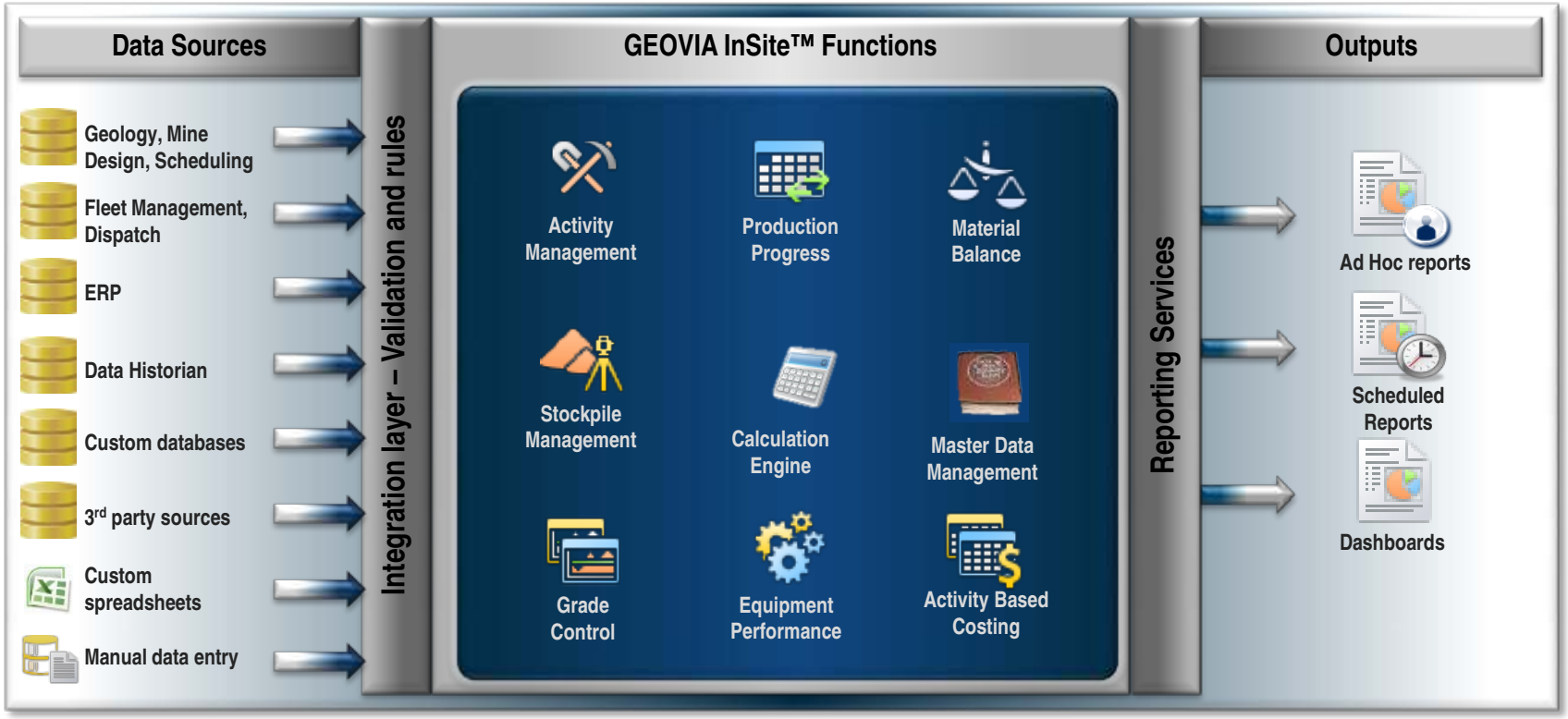
What is GEOVIA InSite™

Introduction

What is GEOVIA InSite™

- Tracks the quality and quantity of materials across your operations
- Manages material stockpiles
- Built for the Mining Industry
- Full auditability
- Transactional database for all activities and movements in near real time
- Material Balance allows variances to be managed with more confidence
- InSite activities can have costs associated (equipment, personnel and consumables)

GEOVIA InSite™ Architecture



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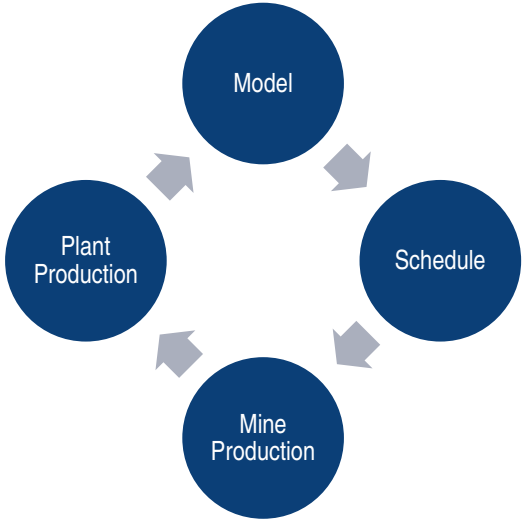
GEOVIA InSite

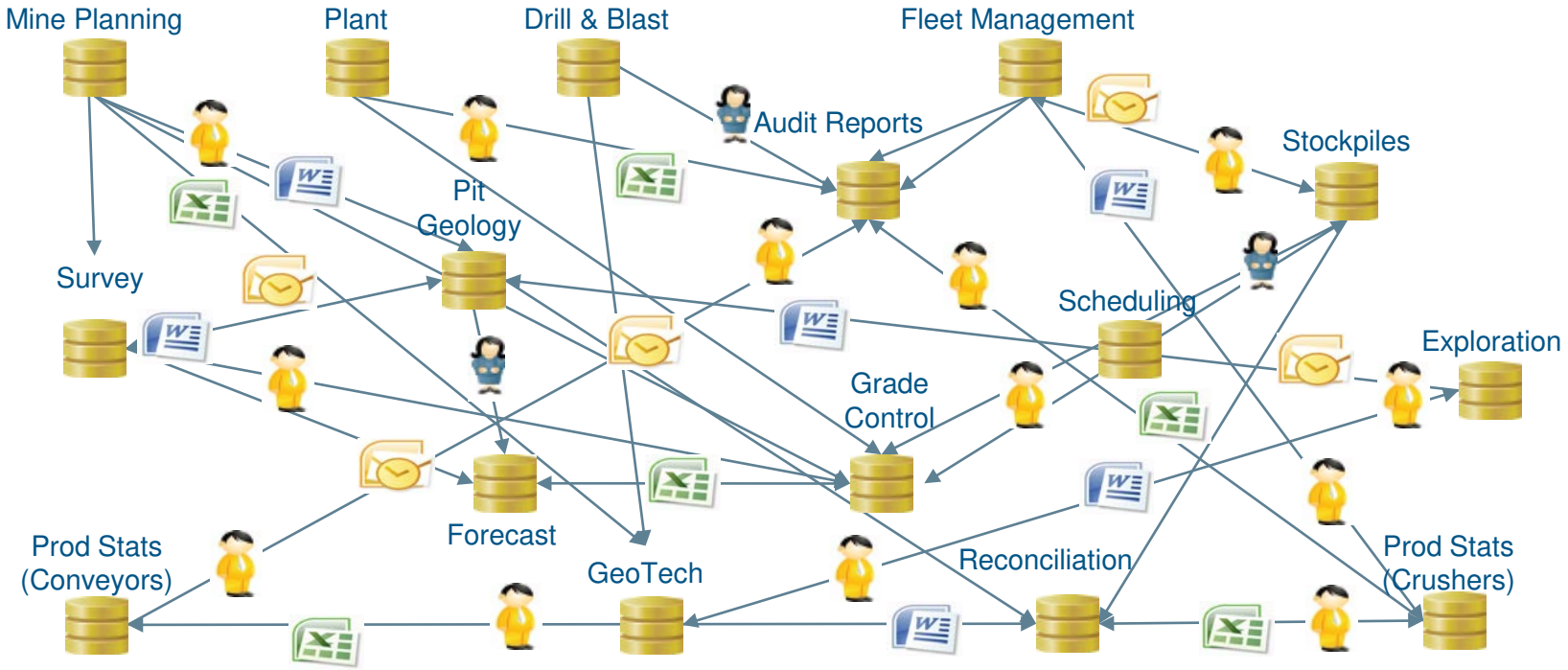
Conformance to Plan

Common problems with existing systems

- Time spent preparing data
- Data confidence
- Managing the discrepancy between claimed and actual
- Understanding where and why there are differences between forecast and actual, and actual and actual



Information Pathways – Before GEOVIA



Common Problems Manual Data Capture – Excel/Paper

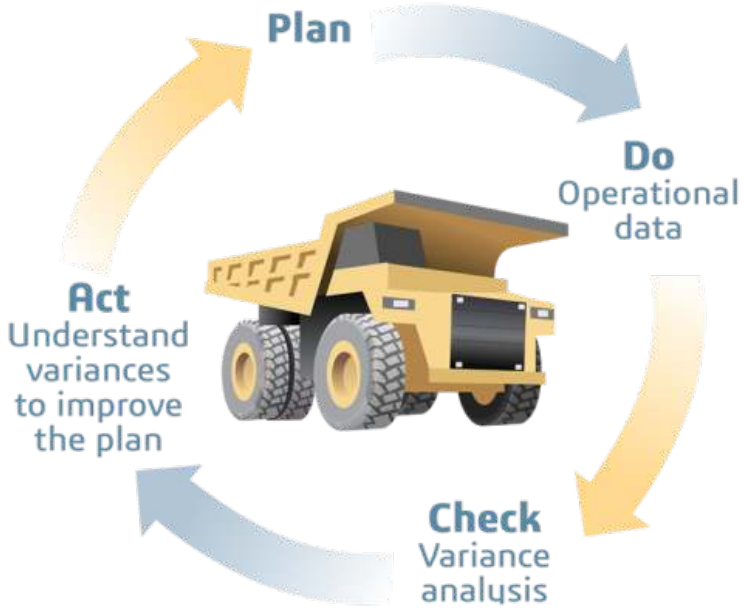
- Data
  - Confidence
  - Validation
  - Accuracy
  - Document control
- Spreadsheets are common
  - Time
  - Sharing
  - Errors

"While people are about 95% to 98% accurate when they make spreadsheet cells entries, they are only about 50% to 80% successful when they attempt to detect if there is an error in a cell" [Panko, 2010b].

http://arxiv.org/ftp/arxiv/papers/1009/1009.2785.pdf

Offering an alternative

- A configurable software solution that can
  - Plan and allocate mining activities at shift level
  - Integrate with automated operations management data sources or collate data manually
  - Monitor current progress of any mining or production activity
- Advanced tools that
  - Compare plan against actual in near real-time
  - Analyse the variance



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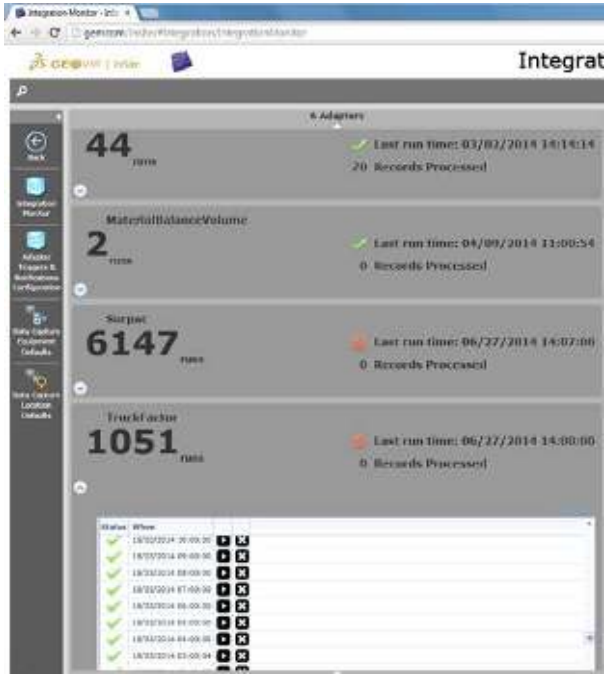
GEOVIA InSite

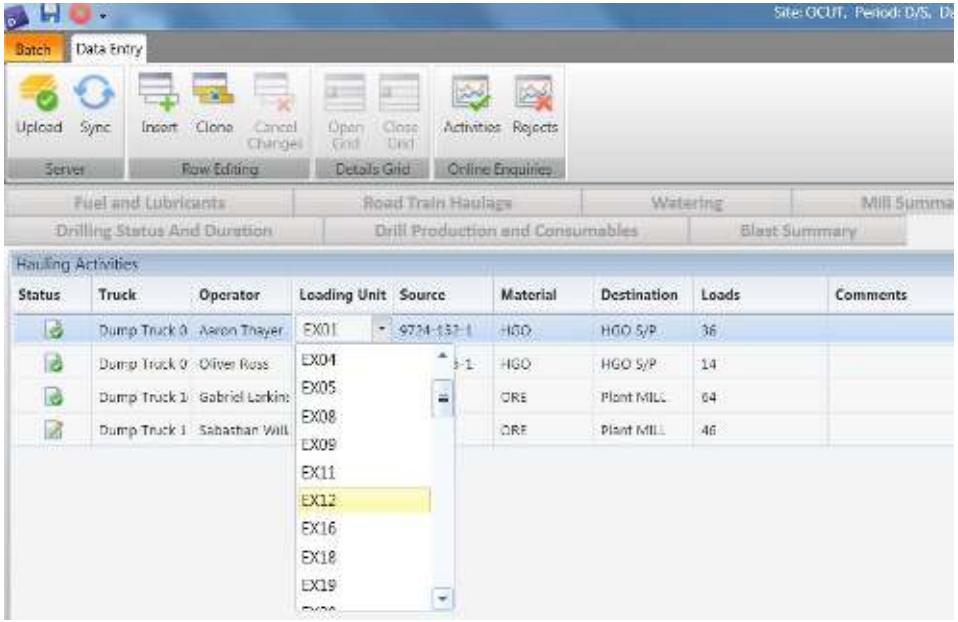
Conformance to Plan

Types of Data Acquisition

Automatic



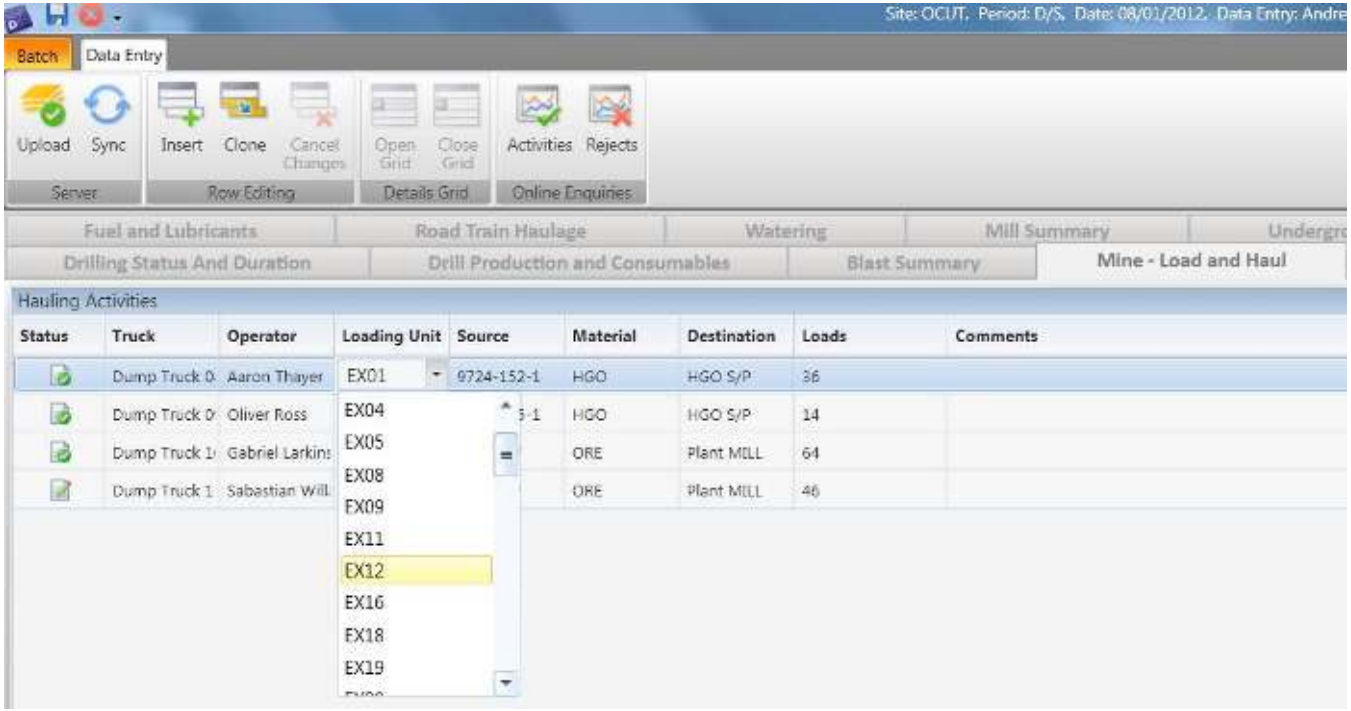
Manual



Data Entry

Data Entry

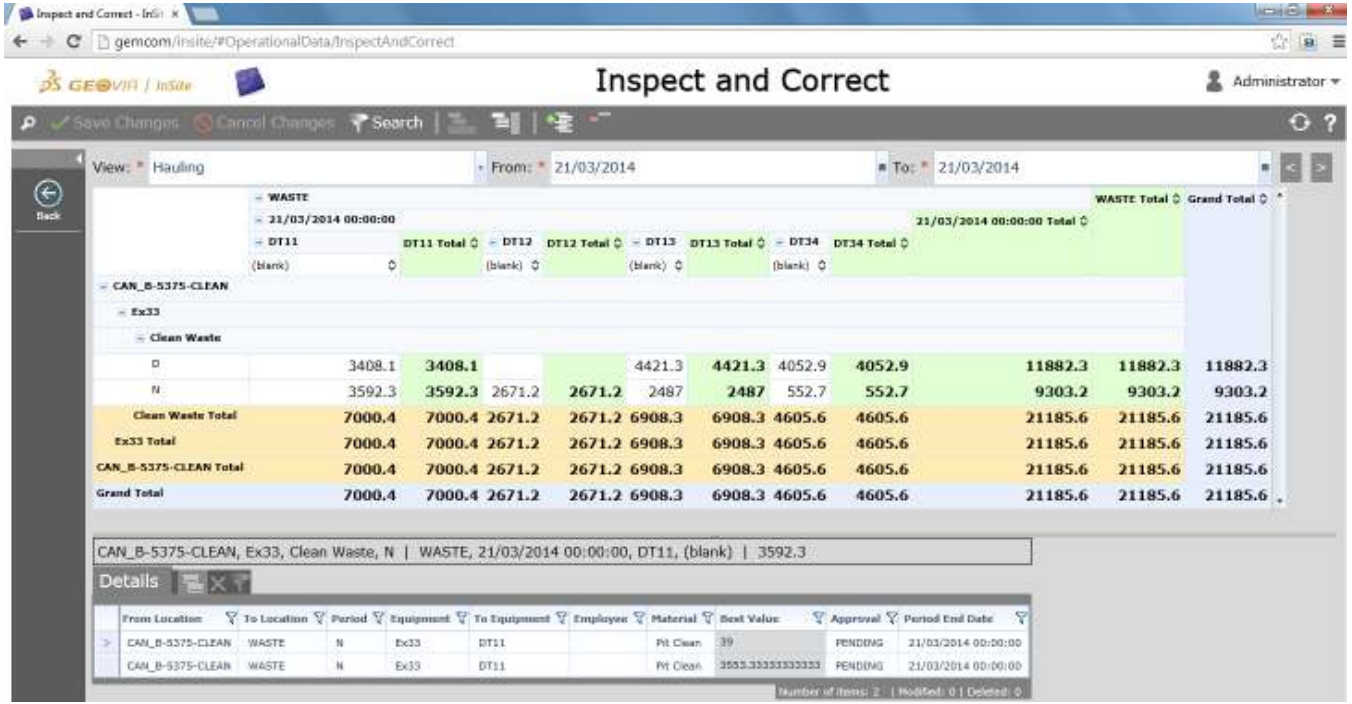
- Replaces spreadsheets with fast and easy interface
- Record data when electronic data unavailable
- Accurate and validated data



Inspect and Correct

Inspect and Correct

- Analysis tool to query data captured.
- Highlights any compromised validated data
- Allows users to make the changes
- All changes are audited including from & to values



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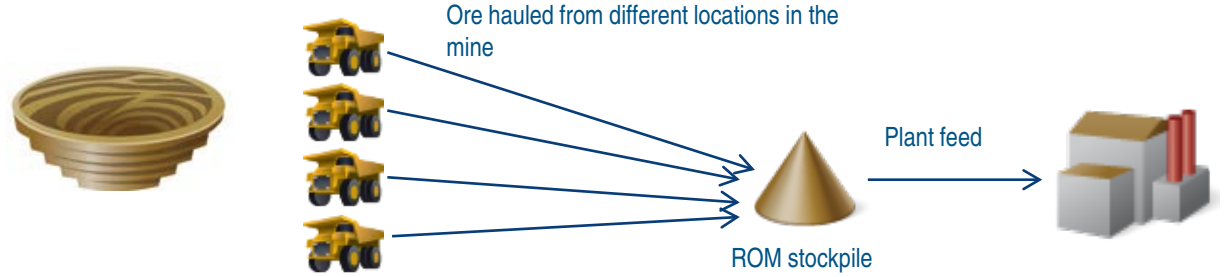
GEOVIA InSite

Production Inventory Accounting (PIA)

Production Inventory Accounting

Mining Problem	How InSite helps
• Set up of complex algorithms difficult to maintain	• Accurate view of stockpile mass and grade • Stockpiles updated with accurate surveyed volumes
• Is assay data entered accurately	• Confidence in data – Validation rules and manual data entry validated
• Reconciliation details not auditable	• Quality provided Automatically or Manually • Stockpile data linked with materials balance

Stockpile Management

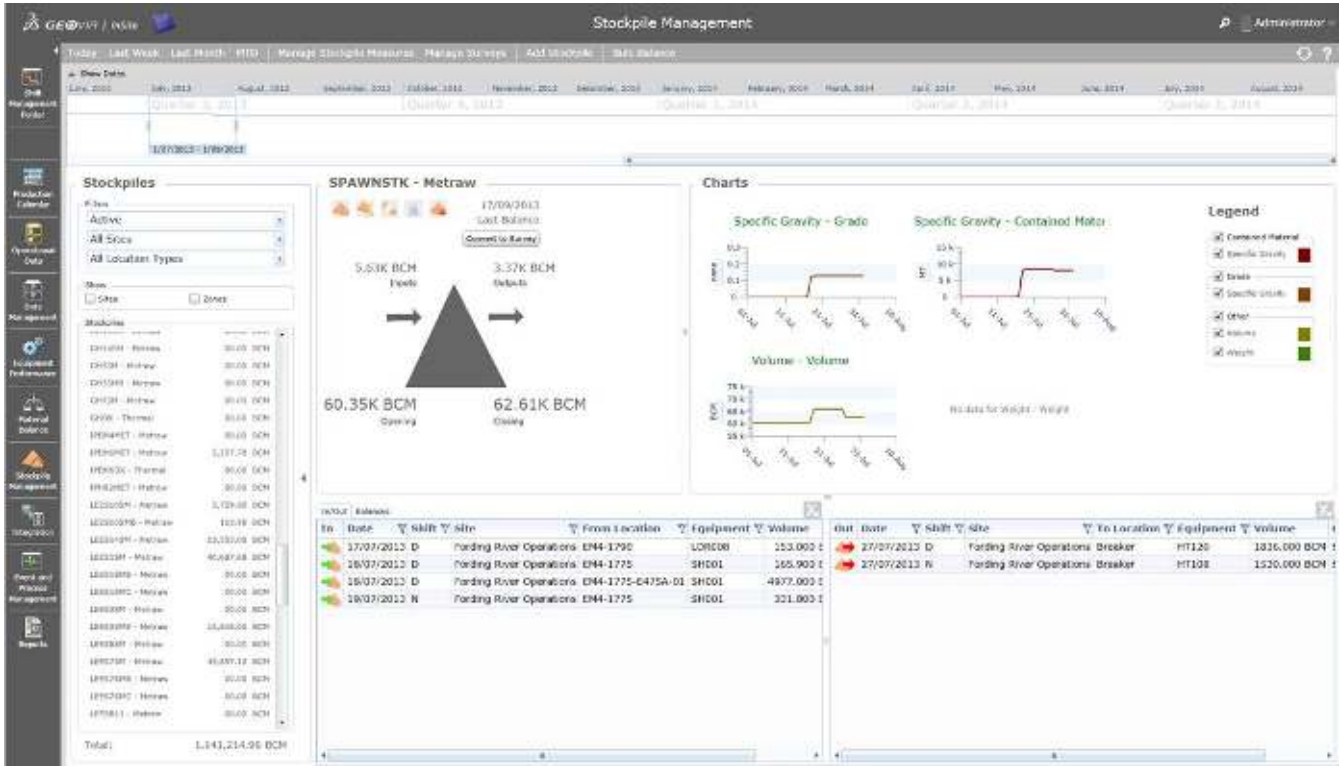


- Stockpile management is required because:
  - To accurately report monthly mine production, material held in stocks must be accounted for
  - Plant performance requires predictable feed of ore at known tonnes and grade
- Tonnes in a stockpile is automatically calculated based on the sum of material movements.
- Grade is calculated using either FIFO, LIFO or weighted average
- Due to measurement inaccuracy, regular surveys are performed to adjust calculated stocks

Stockpile Management

Stockpile Management

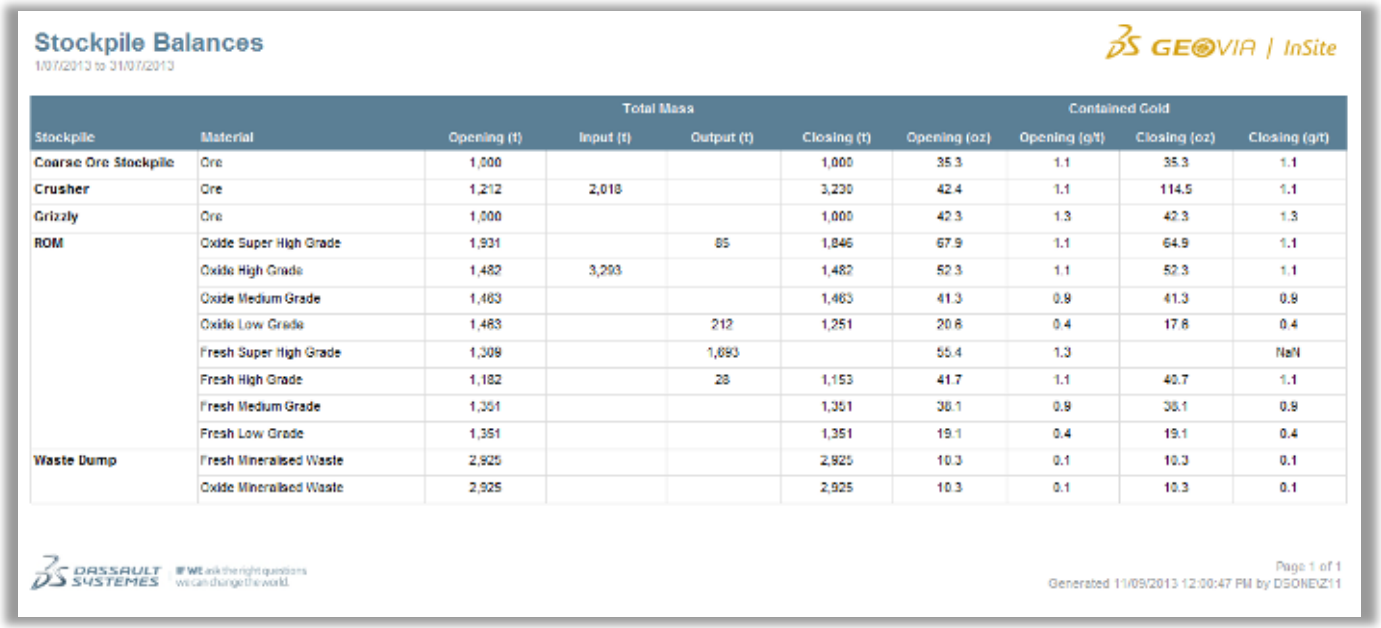
- Confidence in reported tonnes and grades
- Integrates directly with materials balance
- Calibrate stockpiles with survey data whenever it is available



Stockpile Management

Stockpile Balances Report

- Provides a summary of balances and movement to and from stockpiles.
- Includes opening and closing balances for the selected period.
- Includes movements to and from the stockpile.
- Includes tonnes and grades.



Stockpile Balances

1/07/2013 to 31/07/2013

GEOVIA | InSite

		Total Mass				Contained Gold			
Stockpile	Material	Opening (t)	Input (t)	Output (t)	Closing (t)	Opening (oz)	Opening (g/t)	Closing (oz)	Closing (g/t)
Coarse Ore Stockpile	Ore	1,000			1,000	35.3	1.1	35.3	1.1
Crusher	Ore	1,212	2,018		3,230	42.4	1.1	114.5	1.1
Grizzly	Ore	1,000			1,000	42.3	1.3	42.3	1.3
ROM	Oxide Super High Grade	1,931		85	1,846	67.9	1.1	64.9	1.1
	Oxide High Grade	1,482	3,293		1,482	52.3	1.1	52.3	1.1
	Oxide Medium Grade	1,463			1,463	41.3	0.9	41.3	0.9
	Oxide Low Grade	1,463		212	1,251	20.8	0.4	17.8	0.4
	Fresh Super High Grade	1,309		1,693		55.4	1.3		NaN
	Fresh High Grade	1,182		28	1,153	41.7	1.1	40.7	1.1
	Fresh Medium Grade	1,351			1,351	38.1	0.9	38.1	0.9
	Fresh Low Grade	1,351			1,351	19.1	0.4	19.1	0.4
Waste Dump	Fresh Mineralised Waste	2,925			2,925	10.3	0.1	10.3	0.1
	Oxide Mineralised Waste	2,925			2,925	10.3	0.1	10.3	0.1

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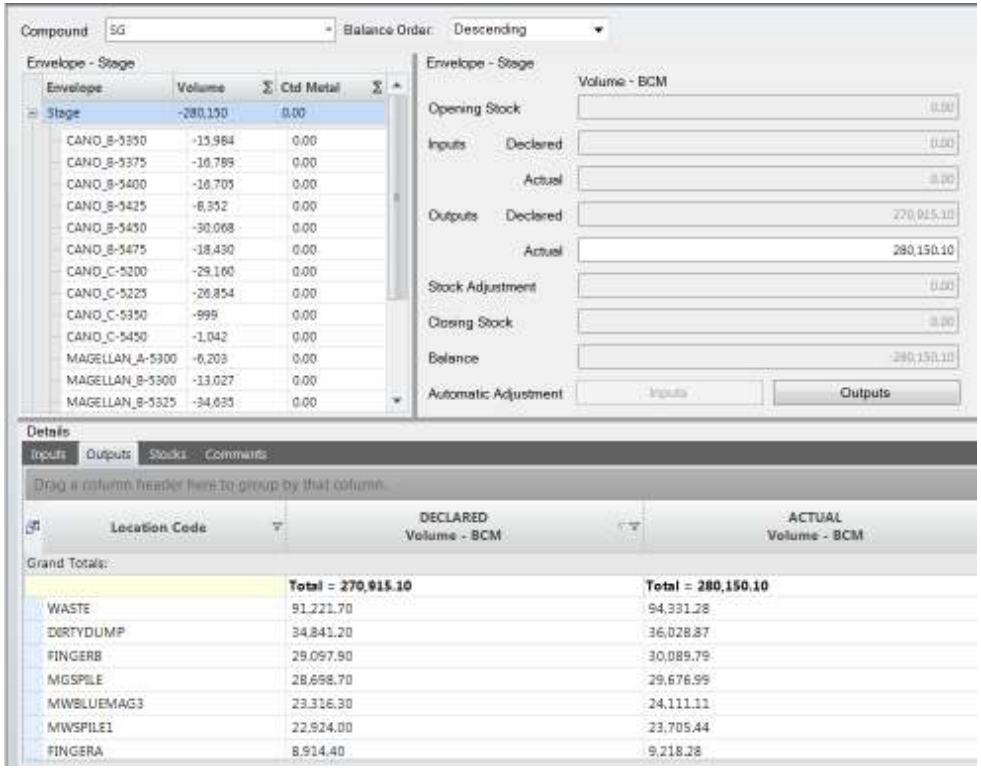
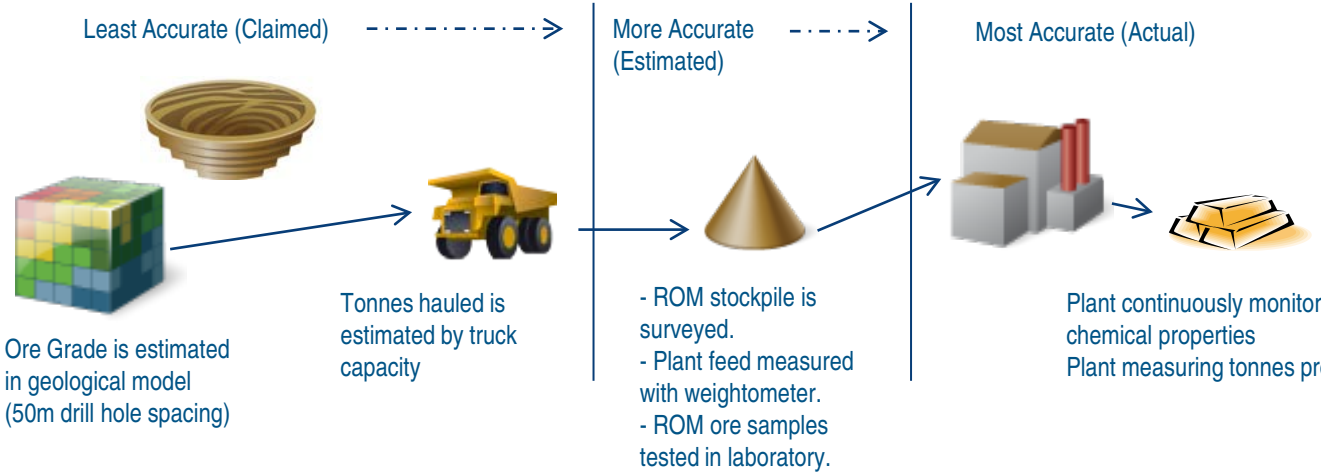
Material Balance

Material Balance

- Reduce variance in planned vs actual
- Direct link with stockpile + production data
- Compare factors with reality, modify with evidence



Material Balance

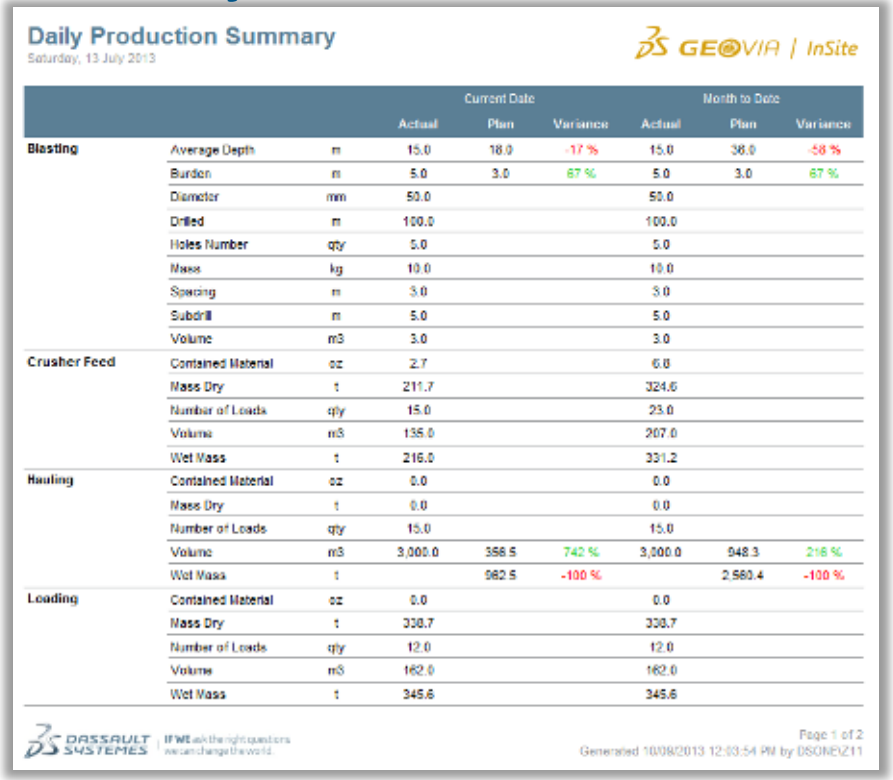


- In a mine production process, the same data is measured several times with different accuracy. Accounting for inaccuracy is a key concept in mine production management and reporting
- Measurements are typically more accurate later in the production process (in the plant)
- Material balance divides the production process into “envelopes”. Material movements between envelopes must balance.
- Material movements from more accurate envelopes will adjust measurements from less accurate envelopes so that they balance

Daily Production Summary

Daily Production Summary

- Provides a summary of all information captured on a *daily* basis and structured by activity.
- Includes daily and month to date data.
- Includes planned and actual values and calculates variance from plan.



Daily Production Summary

Saturday, 13 July 2013

GEOVIA | InSite

			Current Date			Month to Date		
			Actual	Plan	Variance	Actual	Plan	Variance
Blasting	Average Depth	m	15.0	18.0	-17 %	15.0	36.0	-58 %
	Burden	m	5.0	3.0	67 %	5.0	3.0	67 %
	Diameter	mm	50.0			50.0		
	Drilled	m	100.0			100.0		
	Holes Number	qty	5.0			5.0		
	Mass	kg	10.0			10.0		
	Spacing	m	3.0			3.0		
	Subdrill	m	5.0			5.0		
	Volume	m3	3.0			3.0		
Crusher Feed	Contained Material	oz	2.7			6.8		
	Mass Dry	t	211.7			324.6		
	Number of Loads	qty	15.0			23.0		
	Volume	m3	135.0			207.0		
	Wet Mass	t	216.0			331.2		
Hauling	Contained Material	oz	0.0			0.0		
	Mass Dry	t	0.0			0.0		
	Number of Loads	qty	15.0			15.0		
	Volume	m3	3,000.0	358.5	742 %	3,000.0	948.3	216 %
	Wet Mass	t		562.5	-100 %		2,580.4	-100 %
Loading	Contained Material	oz	0.0			0.0		
	Mass Dry	t	338.7			338.7		
	Number of Loads	qty	12.0			12.0		
	Volume	m3	162.0			162.0		
	Wet Mass	t	345.6			345.6		

DASSAULT SYSTEMES | IF WE ask the right questions we can change the world.

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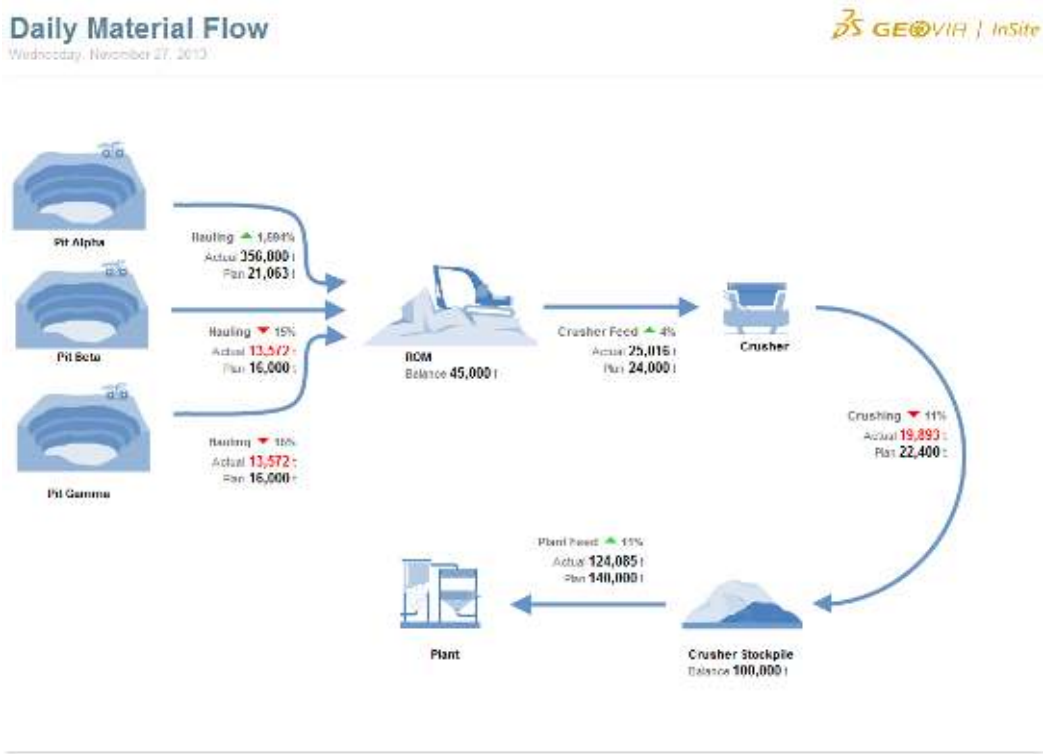
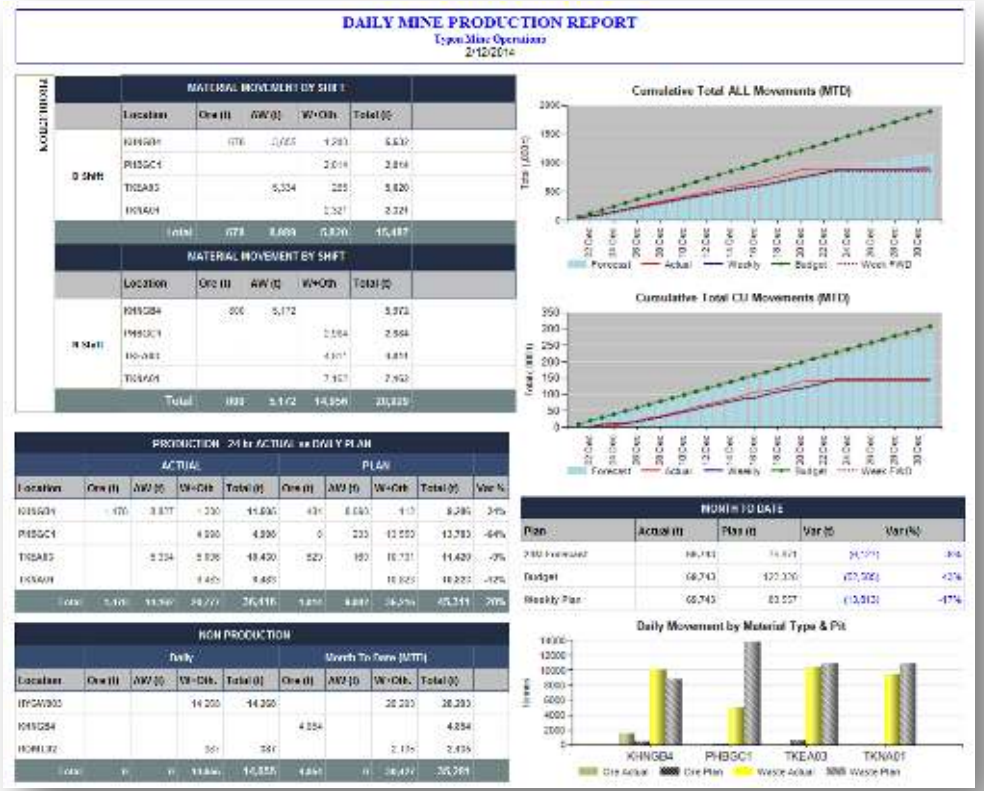
Material Flow Dashboard

Material Flow Dashboard

- Provides a visual overview of the material moved.
- Includes daily data for hauling, crusher feed, crushing and plant feed.
- Includes planned and actual values and calculates variance from plan.



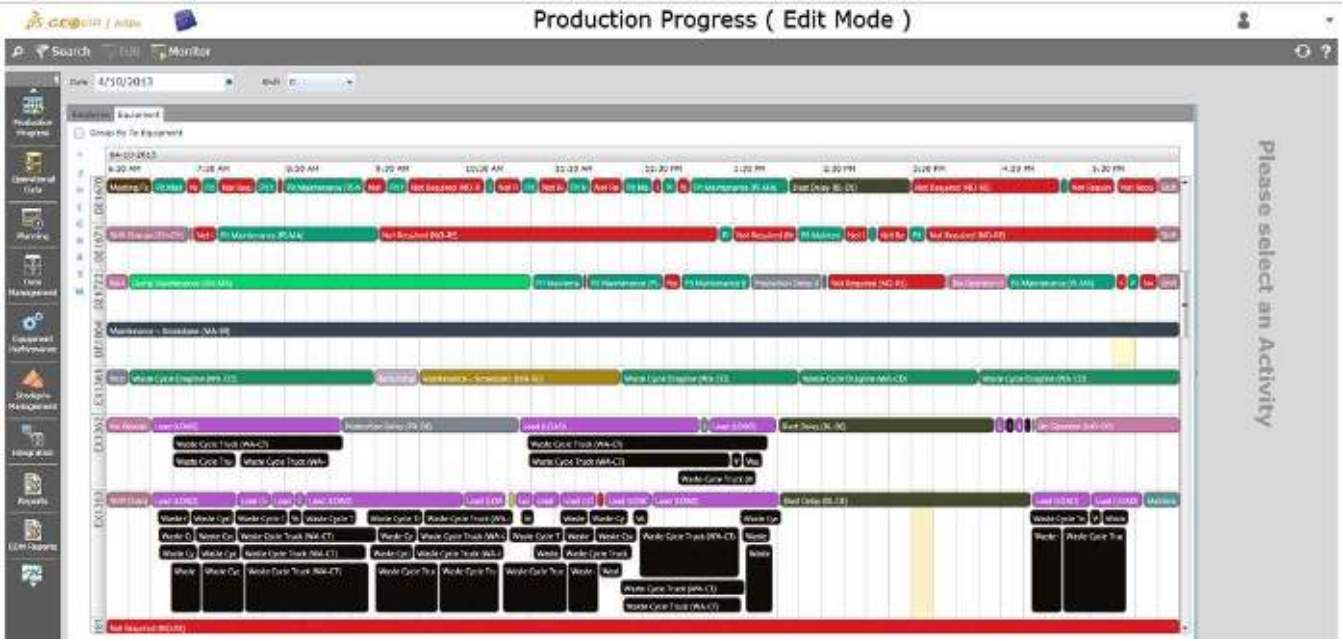
InSite Reporting



Production Progress

Production Progress

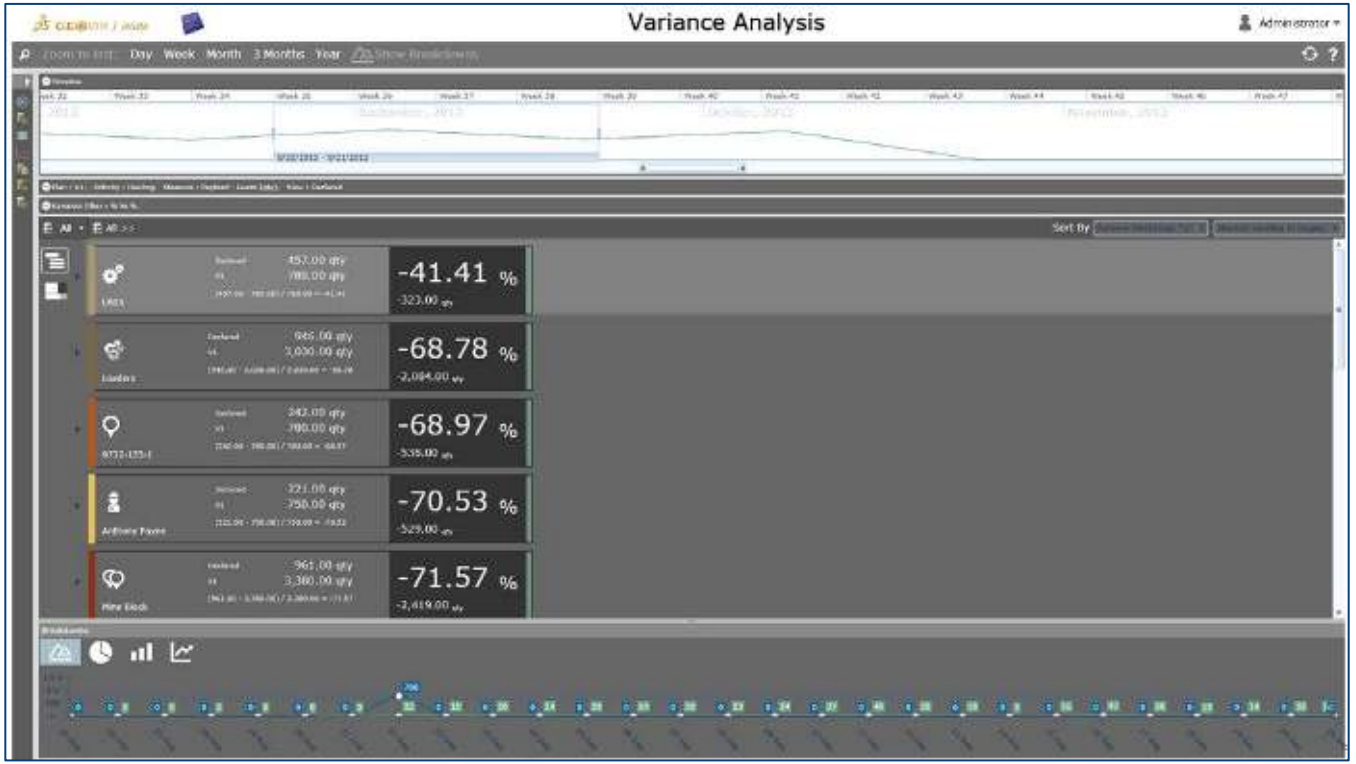
- In shift view of production progress
- Graphical representation of task duration and production progress
- Allows information to be viewed and updated graphically.



Variance Analysis

Variance Analysis

- Graphically represent Plan vs. Actual per activity per shift
- View all Activities in one screen
- Track trend of plan versus actual to pickup trends



Integration Adaptor Configuration

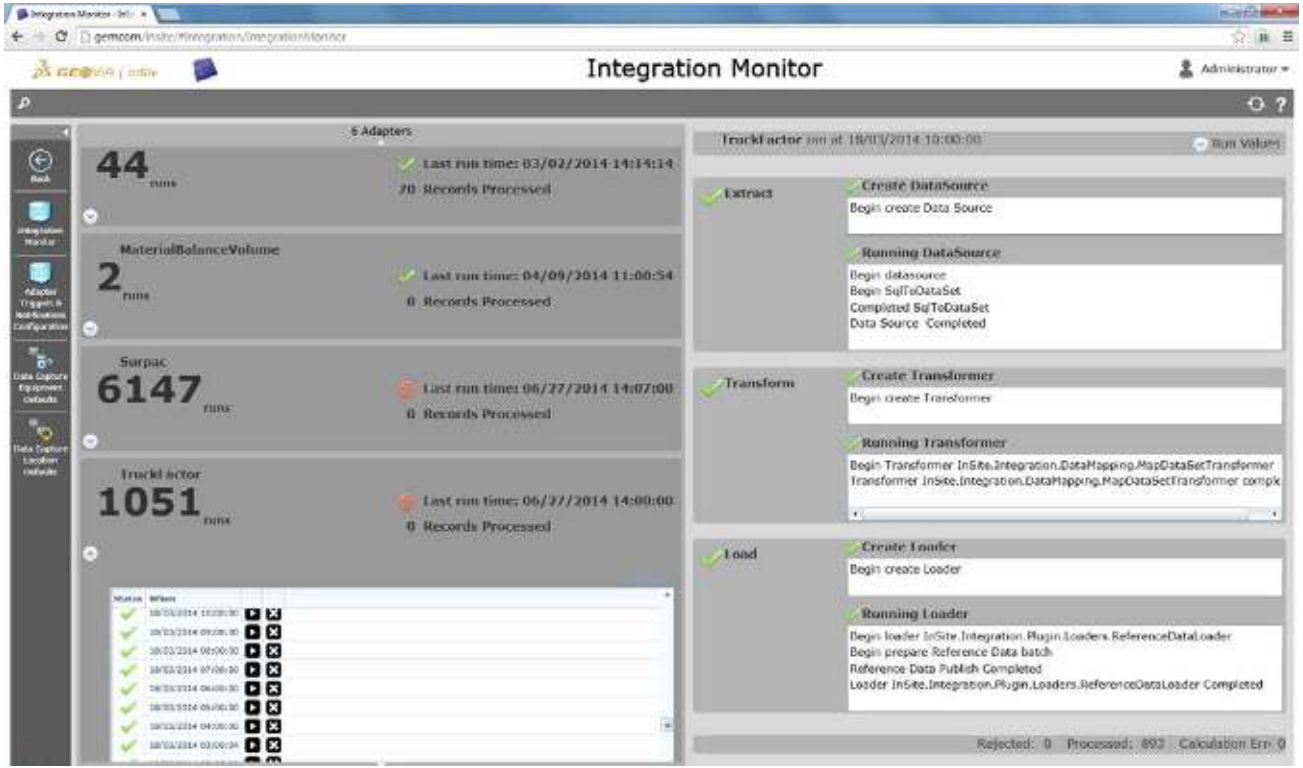
Adaptor Configuration

- Easily to configure within the tool
- Changes can be made by authorised staff
- Allows new data to be mapped easily for integration and loading

Integration Monitor

Integration Monitor

- Easy to review the status of integrations
- Can be configured to alert specified staff
- Allows jobs to be resubmitted where appropriate
- Full history of integration runs



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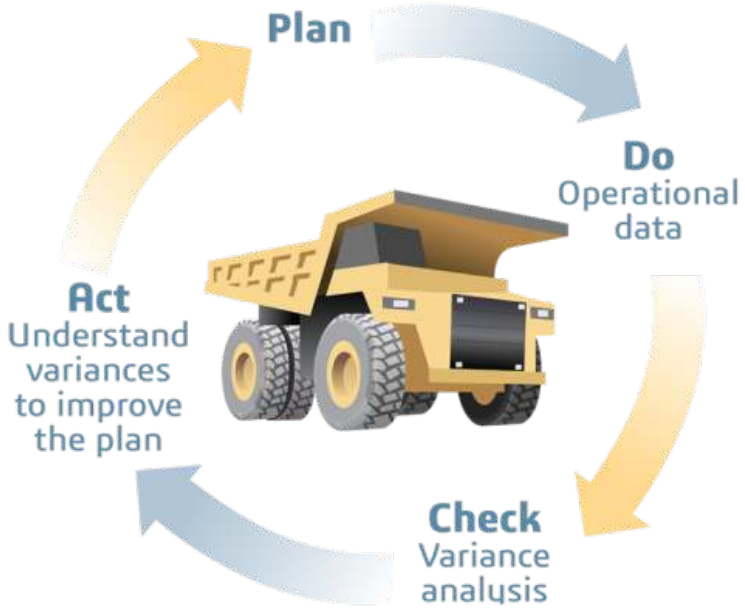
GEOVIA InSite

Asset Utilisation

Offering an alternative

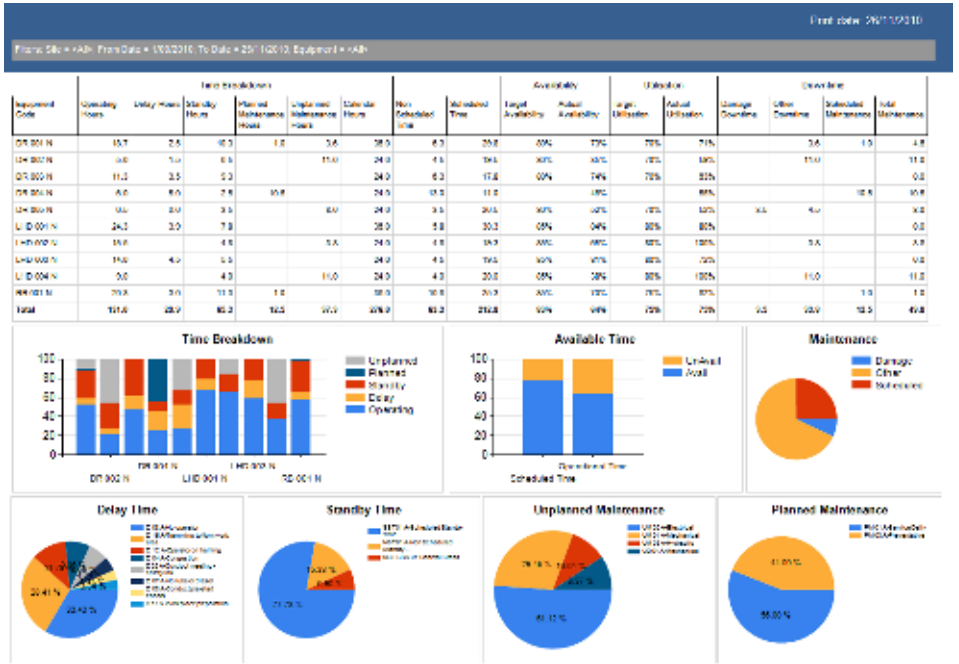
- A configurable software solution that can
  - Integrate with automated operations management data sources
  - Collate data manually
- Reduce IP Risk
- Streamline EOM process through integration & reporting



Equipment Performance

Equipment Performance

- Increase production and equipment utilisation
- Understand equipment usage
- Historical analysis of equipment performance



Activity Based Costing

Activity Based Costing

- Assign cost of equipment, employees and consumables
- Visibility into cost of operation and production
- Trends and changes can be monitored

Equipment Cost

Print date: 12/11/2012

Filters: Month = Year = November - 2012; Site = Generic Site for Equipment

Equipment		Equipment			Operator			Total Cost ($)
		Hours	Rate ($/h)	Cost ($)	Hours	Rate ($/h)	Cost ($)	
Bulldozer	**Bulldozer**	**2,204.09**		**484,154.37**	**2,204.09**		**0.00**	**484,154.37**
	DZ02	524.40	241.00	126,380.40	524.40	0.00	0.00	126,380.40
	DZ03	325.10	213.00	69,246.30	325.10	0.00	0.00	69,246.30
	DZ04	455.99	213.00	97,125.87	455.99	0.00	0.00	97,125.87
	DZ09	135.00	213.00	28,755.00	135.00	0.00	0.00	28,755.00
	DZ12	288.20	213.00	61,386.60	288.20	0.00	0.00	61,386.60
	DZ15	57.00	213.00	12,141.00	57.00	0.00	0.00	12,141.00
	DZ20	323.70	213.00	68,948.10	323.70	0.00	0.00	68,948.10
	DZ21	94.70	213.00	20,171.10	94.70	0.00	0.00	20,171.10
Dump Truck	**Dump Truck**	**16,471.25**		**4,208,281.85**	**16,471.25**		**8,388.09**	**4,216,669.94**
	Dump Truck 08	364.00	236.00	85,904.00	364.00	0.00	0.00	85,904.00
	Dump Truck 09	419.31	236.00	98,957.16	419.31	0.00	0.00	98,957.16
	Dump Truck 10	229.70	261.00	59,951.70	229.70	0.00	0.00	59,951.70
	Dump Truck 11	493.40	261.00	128,777.40	493.40	0.00	0.00	128,777.40
	Dump Truck 12	540.13	261.00	140,973.93	540.13	0.00	0.00	140,973.93
		3.60	261.00	939.60	3.60	63.45	228.42	1,168.02
	Dump Truck 13	542.70	261.00	141,644.70	542.70	0.00	0.00	141,644.70
	Dump Truck 14	491.00	261.00	128,151.00	491.00	0.00	0.00	128,151.00
	Dump Truck 15	55.60	162.00	9,007.20	55.60	0.00	0.00	9,007.20
	Dump Truck 17	20.50	162.00	3,321.00	20.50	0.00	0.00	3,321.00
	Dump Truck 20	339.40	261.00	88,583.40	339.40	0.00	0.00	88,583.40
	Dump Truck 21	458.00	261.00	119,538.00	458.00	0.00	0.00	119,538.00

Consumable Cost

Print date: 03/09/2012

2012; Site = Open Cut

Type	Consumable	Rate ($/unit)	Units	Cost ($)
Boosters	BOOSTER HDP 400 PE SHELL	1.00	3,846.00	3,846.00
Explosives	EMULSION TITON 5070	1.00	545,643.00	545,643.00
Fuel and Lubricants	Fuel Diesel	0.91	1,127,324.20	1,025,865.02
Total				**1,575,354.02**

End of Report

Key InSite Implementations

The Benefits of GEOVIA InSite

- Improved forecasting
  - Understand variance from plan and reforecast faster
- Improved efficiency
  - Free Geologists and Engineers from Excel and allow them to analyse in real-time
  - Manage consumables and unplanned down time
- Increased accuracy in reporting
  - Better data validation, reports & decisions made quicker
- Improved visibility into operations
  - Understand the cost of mining each ounce
  - See correlation between mining and plant production
- Centralising enables Activity level comparison between sites
- Standards
  - Supports Master Data Management
  - Consistent identification and measurement against best practise
- Provide a basis for continuous improvement

Live Demonstration

Contact us at; Dassault Systemes GEOVIA