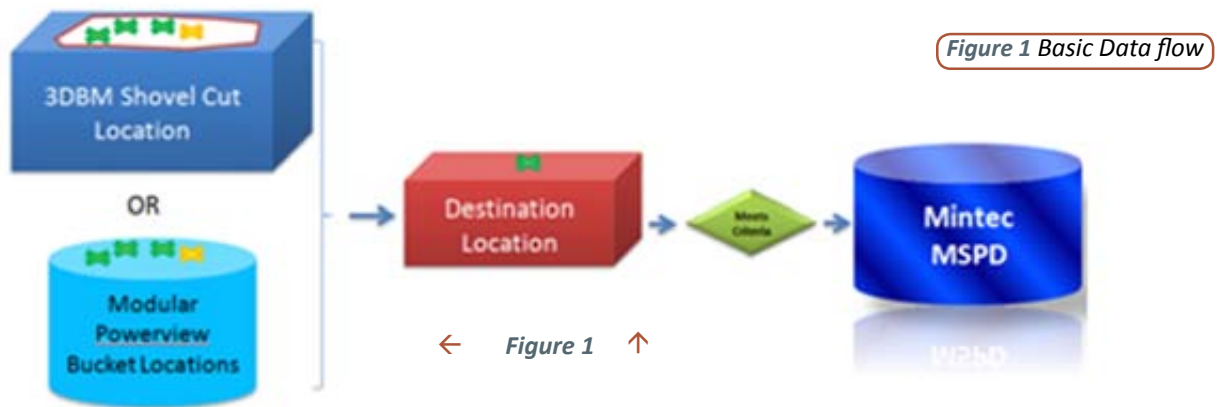




MS3D: Truck/Shovel Fleet Management Data Integration

The Mintec Solutions Group has worked with several clients over the course of 2010 to integrate data from their fleet management systems (FMS) with the information stored in the MineSight 3D block model. This suite of specialized tools tracks material shovel bucket by shovel bucket. It is stored in a MineSight Planning Database (MSPD) as markers attributed with grade and geologic information. Figure 1 shows the basic data flow.

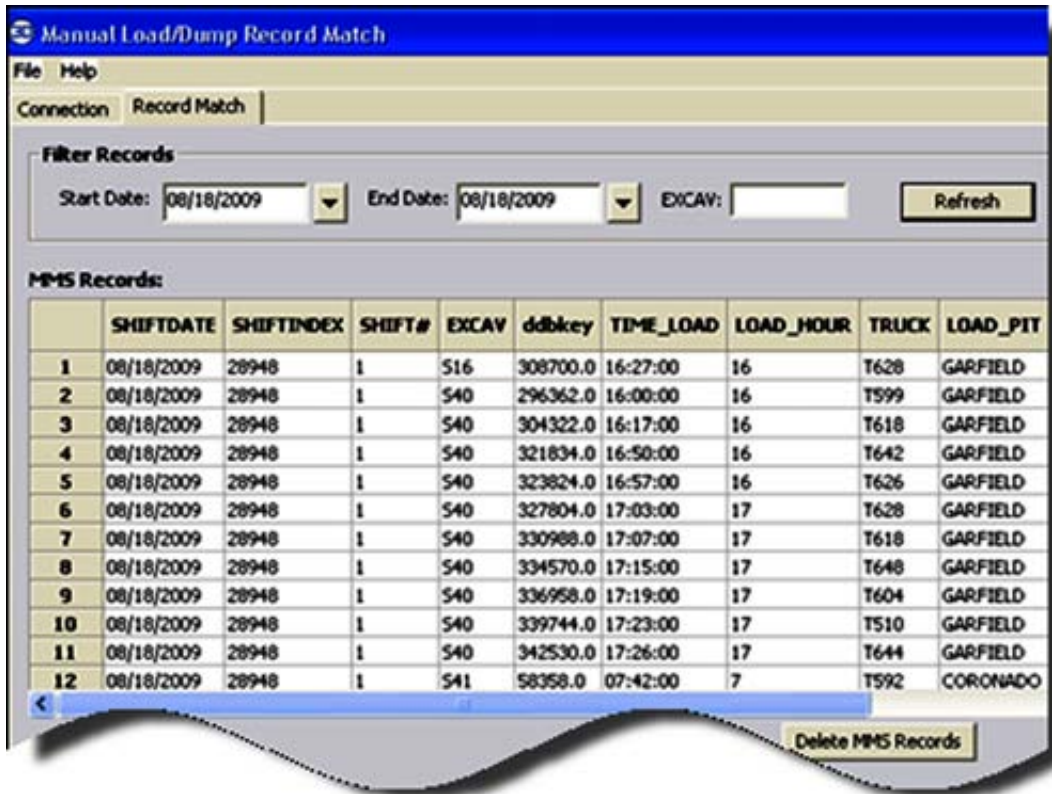


Business rules are applied to ensure the data is correct. The auto record matching utility applies these rules as it processes the data from the fleet management system. Table 1 contains examples of rules applied in certain implementations.

Rule1	Records must exist for the same SHIFTDATE and SHIFTINDEX
Rule2	Load Records must occur within 5 minutes to be matched via Auto Match Tool.
Rule3	Load Records must share the same EXCAV and TRUCK.
Rule4	If no CAES XYZ exist for the MMSI record, and the MMSI record contains the average XYZ, the MMSI record will be loaded automatically using the single average value for the load
Rule5	If there are >5 Bucket Records for a matching MMSI Load Record, both the MMSI and CAES record will be held in the Holding tables for Manual Matching
Rule6	If there are Matched CAES and MMSI records with <= 5 Bucket records, BUT no DUMPREC or DESTINATION (MMSI), then both the CAES and MMSI records will be held in the Holding tables
Rule7	If XYZ fall in MINED = 1(Model item) area, its coordinates are not considered in the algorithm and are deleted from the holding table
Rule8	If ROUTE value is -1, get defaults from MMSI GRADE column (last character) using this algorithm: charToRoute={'A':21, 'B':22, 'C':23, 'D':1, 'E':15, 'F':14, 'G':16, 'H':2, 'I':10, 'J':11, 'K':12, 'L':3, 'M':17, 'P':24, 'W':13, 'X':4}

Table 1 -Business Logic Rules for Insertion to MSPD

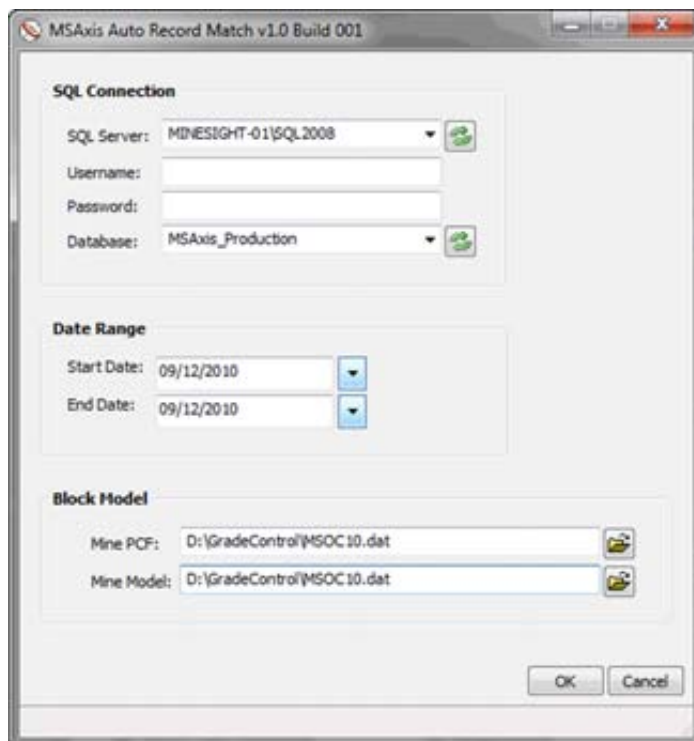
If the data violates any of these rules, the record is written to a holding table in the MSPD for manual review and correction. Figure 6 shows the interface that allows access to the data in the holding table.



← Figure 2

Figure 2 - Questionable Record Holding Table

The auto record matching utility allows multiple 3D block models to be used to determine grades and geologic values. The interface adds new entry fields based on information retrieved from an initialization file on start-up. This is particularly useful when the fleet management system covers an entire property, but the pits are so far apart they need multiple 3D block models. This streamlines the process and eliminates the need for multiple runs of the tool. Figure 3 shows an example of the interface.



← Figure 3

Figure 3 - Auto Record Match-Load Tool

Figure 4 displays the dig points for one shovel in a MS3D geometry view object. Querying a point displays the attribute values for that dig record.

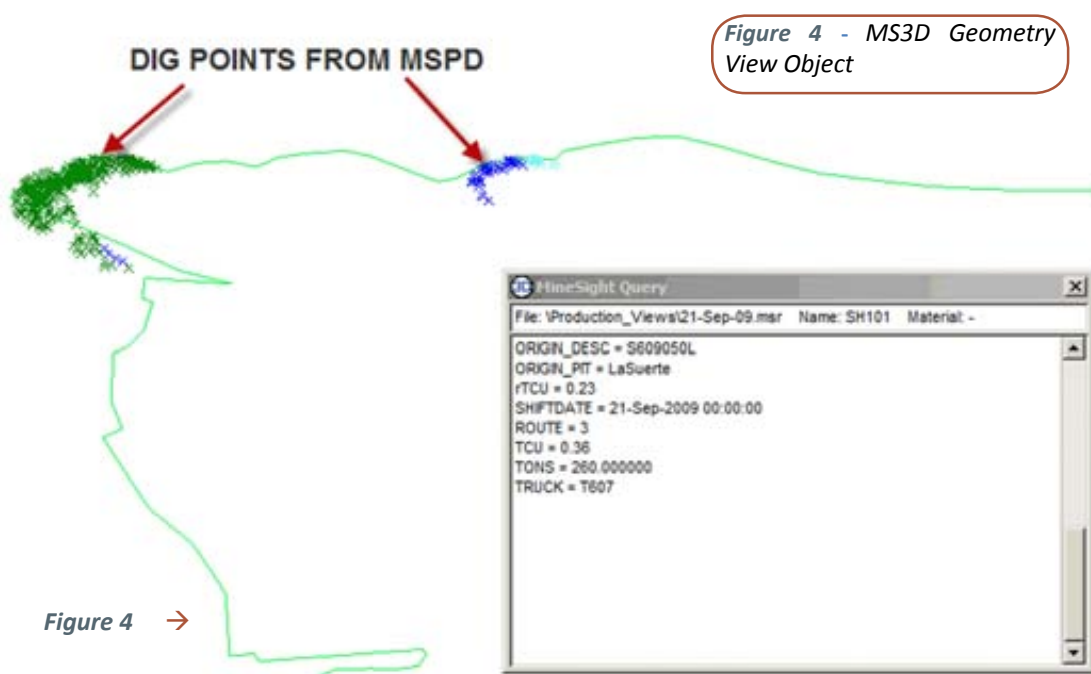


Figure 4 - MS3D Geometry View Object

Knowing the production location and the spatially related attributes (e.g. grade, rock type, etc.) makes it easy to access the web-based reports. Figure 5 illustrates a typical report selection menu from the web server. Figure 6 shows one of those selections.

These reports were built based on specifications provided by the sites, and are accessed using SQL Server Reporting Services (SSRS). They provide for full drill-down capabilities, and can be exported to various formats (e.g. Excel, HTML, PDF, etc.).

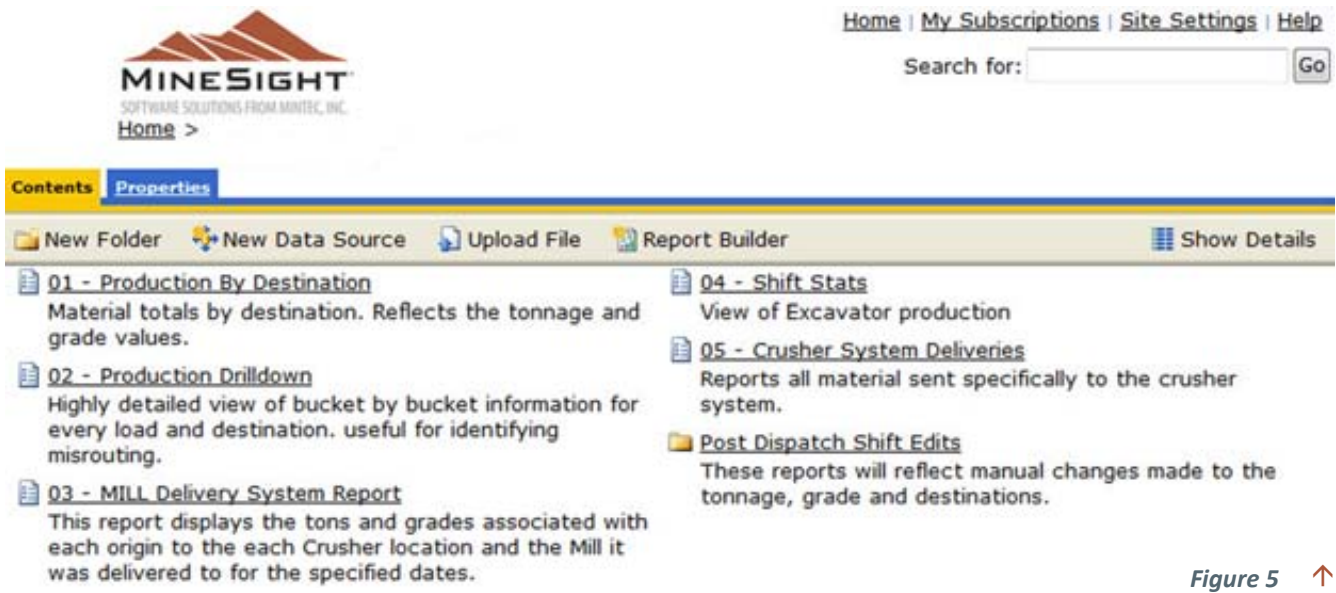


Figure 5 - Typical Report Types and Selection

Crusher System Deliveries SHIFT DATE RANGE : 09/24/2010 to 09/24/2010

SHIFT	DESTINATION	MAT TYPE	TONS	TCU	RSCU	TCU LBS PLACED	RSCU LBS PLACED
1	CR1	DIABASE	234	0.3833	0.0200	1,794.00	93.60
		Total	234	0.3833	0.0200	1,794.00	93.60
		SULFIDE ORE	234	1.2340	0.1040	5,775.12	486.72
		Total	234	1.2340	0.1040	5,775.12	486.72
	Total		468	0.8087	0.0620	7,569.12	580.32
	CR4	DIABASE	2,088	0.3433	0.0188	14,335.20	784.00
		Total	7,836	1.0334	0.0835	161,949.28	13,087.30
			9,924	0.8882	0.0699	176,284.48	13,871.30
		SULFIDE ORE	3,642	1.2690	0.1132	92,431.46	8,244.48
		Total	3,642	1.2690	0.1132	92,431.46	8,244.48
Total		15,566	0.9904	0.0815	268,715.94	22,115.78	
Total		14,034	0.9843	0.0809	276,285.06	22,696.30	
2	CR1	DIABASE	3,978	0.8827	0.0664	70,224.18	5,281.38
		Total	936	0.6161	0.0365	11,533.08	683.28
	Total		4,914	0.8319	0.0607	81,757.26	5,964.66
		SULFIDE ORE	8,070	0.8291	0.0631	133,819.02	10,177.48
		Total	8,334	0.6505	0.0383	108,433.02	6,377.72
	Total		16,404	0.7384	0.0505	242,252.04	16,555.20
		SULFIDE ORE	1,086	0.6723	0.0588	14,603.22	1,277.76
	Total		1,086	0.6723	0.0588	14,603.22	1,277.76
	Total		17,490	0.7343	0.0510	256,855.26	17,832.96
	CR4_STK	DIABASE	1,620	0.8215	0.0635	26,616.86	2,056.24
Total		384	0.6750	0.0400	5,184.00	907.20	
Total		2,004	0.7934	0.0590	31,800.86	2,963.44	
Total		2,004	0.7934	0.0590	31,800.86	2,963.44	
Total		24,408	0.7583	0.0536	370,413.38	26,141.06	
3	CR4		5,580	1.1173	0.0991	124,895.38	11,056.36
		Total	17,154	0.5569	0.0302	191,069.50	10,358.02
	Total		22,734	0.6945	0.0471	315,764.88	21,414.38
		22,734	0.6945	0.0471	315,764.88	21,414.38	
	CR4_STK	384	0.2350	0.0175	1,804.80	134.40	
Total		384	0.2350	0.0175	1,804.80	134.40	

← Figure 6

Figure 6 - Crusher Deliveries Report

These tools use a highly automated method to integrate FMS and 3D block model data. In this article's example, Modular Mining System (MMSI) Dispatch and Caterpillar Computer Aided Earth Movement System (CAES) are linked with the MineSight 3D block model for monitoring material movement. But these tools handle other datasets such as digitized fragmentation data and multiple block models with differing content. Such automation and detailed reporting to stakeholders significantly reduces mistakes in material movement.

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