J.M. Canty Inc._____

**Iron Ore Pellet
Test Report
April 2001**

Sample Identity - The sample material is identified as:

Sample 1: Iron ore Pellet Distribution # 1
Sample 2: Iron ore Pellet Distribution # 2

Purpose:

The Canty Rocksizer was designed to obtain size data for the mining and aggregate industries. It is intended to provide size distribution data for particles that range in size from greater than two inches to less than 1/8 inch and can process material in a consistent manner on a continuous basis.

This report details the particle size distribution testing of iron ore pellets with the Canty Rocksizer in order to validate the system's design and ability to correlate to traditional off-line measurement techniques. The data presented here uses the improved Canty technology to give a full particle size distribution for the samples analyzed.

Setup:

The Rocksizer was used to present the particles to the camera/imaging sensor for capture and subsequent analysis. The Canty system is vision based and self-contained including illumination requirements. Video signal is fed to the Canty Vector where our software performs the appropriate analysis. Vector contains several imaging tools and techniques in the software that allow a full analysis of the particle images. The images presented in this report show a 6-inch by 8-inch view of the iron ore pellets in freefall.

Calibration:

A pixel scale factor of 0.0123917 in/pixel was used for all measurements made. This scaling allows both pellets and small chips that have broken off from pellets to be imaged with no mechanical adjustments to the system.

Results and Discussion:

The CantyVision Vector system allows visual verification of laboratory results. Single snapshots of a measurement process can be taken using the Vector in the Test mode. These images usually contain a manageable number of particles that can be quickly analyzed by the Vector and visually verified by the operator. This helps the operator to ensure that the process will collect appropriate data during run time when thousands of particles may be imaged and measured.

Figure 1 shows a typical test image for sample 1. Figure 2 presents a digitized image of sample 1 after particle thresholding has been achieved and background has been filtered out. Table 1 lists the dimensions of the particles imaged in figure 2. Note that pellets that touch the edges of the field of view are dropped from the image before processing because their size is not completely defined.

Run time data usually consists of measurements made on 1,000 to 10,000 particles that are imaged by a sensor and processed by the Vector. Although a number of different analyses can be performed with the data, the most common output desired is a size distribution for the particles of a given sample. Plots of percent passing by volume vs. particle minor axis size are given in the data sheets below. These plots show the entire spectrum of particles that were imaged by the system. Typical data interpolated from the particle size distributions is also presented in the sample data sheets. This information includes quick comparison tables of the particle sizes at the 10, 50 and 90 % passing ranges for the CantyVision system and screen data as well as characteristic statistics for the samples.
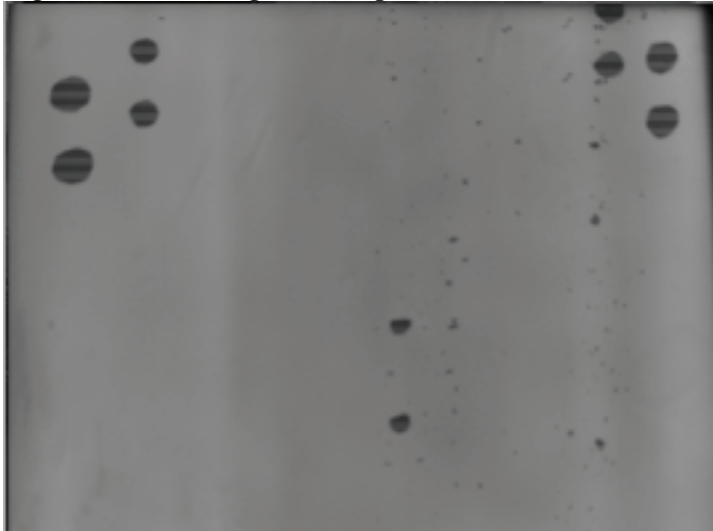
Figure 1: Test Image of Sample 1.
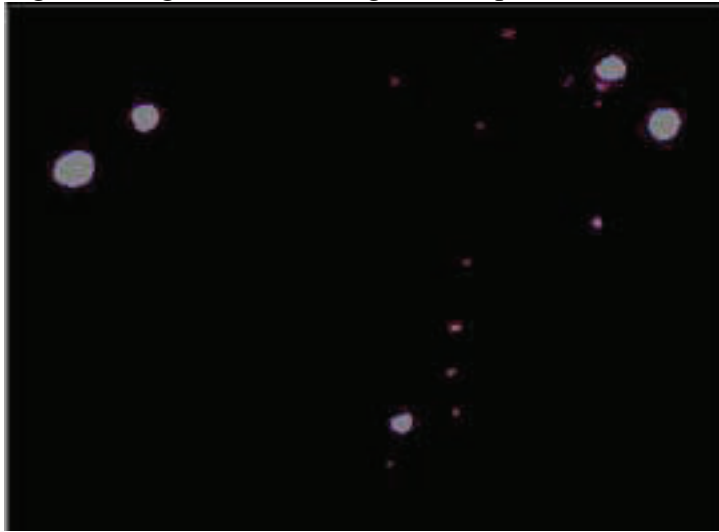
Figure 2: Digitized Test Image of Sample 1.

Table 1: Particle Dimensions in the Test Image of Sample 1.

Particle #	Area (inches squared)	Perimeter (inches)	Major Axis (inches)	Minor Axis (inches)
1	0.005843	0.2976	0.1247	0.08313
2	0.08303	1.079	0.3703	0.3251
3	0.003383	0.186	0.07918	0.07232
4	0.004305	0.2852	0.1352	0.05624
5	0.008611	0.3844	0.1538	0.1012
6	0.002768	0.1612	0.0744	0.0645
7	0.08518	1.042	0.3563	0.3402
8	0.1126	1.203	0.4117	0.3731
9	0.003075	0.1736	0.0744	0.07196
10	0.1599	1.476	0.5112	0.4309
11	0.01199	0.372	0.1401	0.1304
12	0.00369	0.1984	0.0847	0.07193
13	0.009533	0.3596	0.1419	0.1063
14	0.005535	0.2604	0.1092	0.08075
15	0.003998	0.1984	0.0847	0.07622
16	0.0489	0.8184	0.2877	0.2467
17	0.002768	0.1736	0.07563	0.05601

Vector Particle Sizing Sample Report

Date:	April 2001
Sample #	**Sample 1**
File:	CVClient3D.xls
Description:	Iron ore Pellet Distribution # 1
Company:	Internal Testing
Operator:	CPM
Feeder Setting:	N/A
# Particles	1362

Percent Passing by Volume
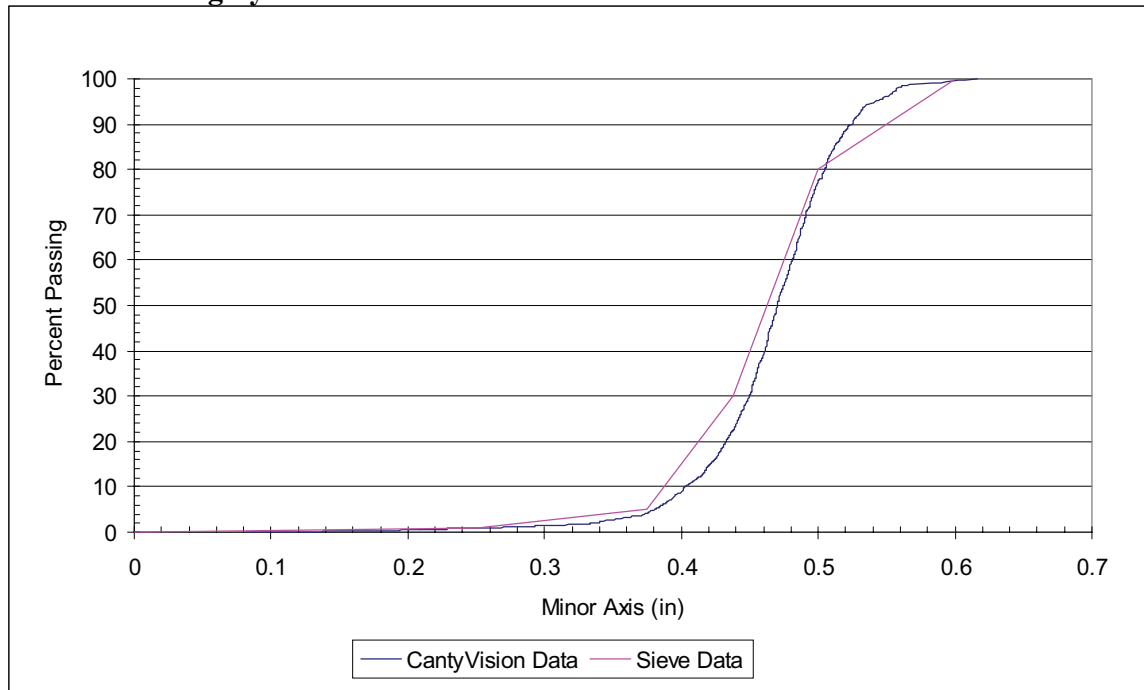
Summary of Percent Passing Data:

	10%		50%		90%	
	Vector	Sieve	Vector	Sieve	Vector	Sieve
Canty Data	0.403	0.388	0.470	0.463	0.524	0.550

% Difference in Vector and Sieve Size Measurements:

All Data	3.476
Center 80%	2.343

Pseudo-Bin Plot: (Volume of particles at a given size)
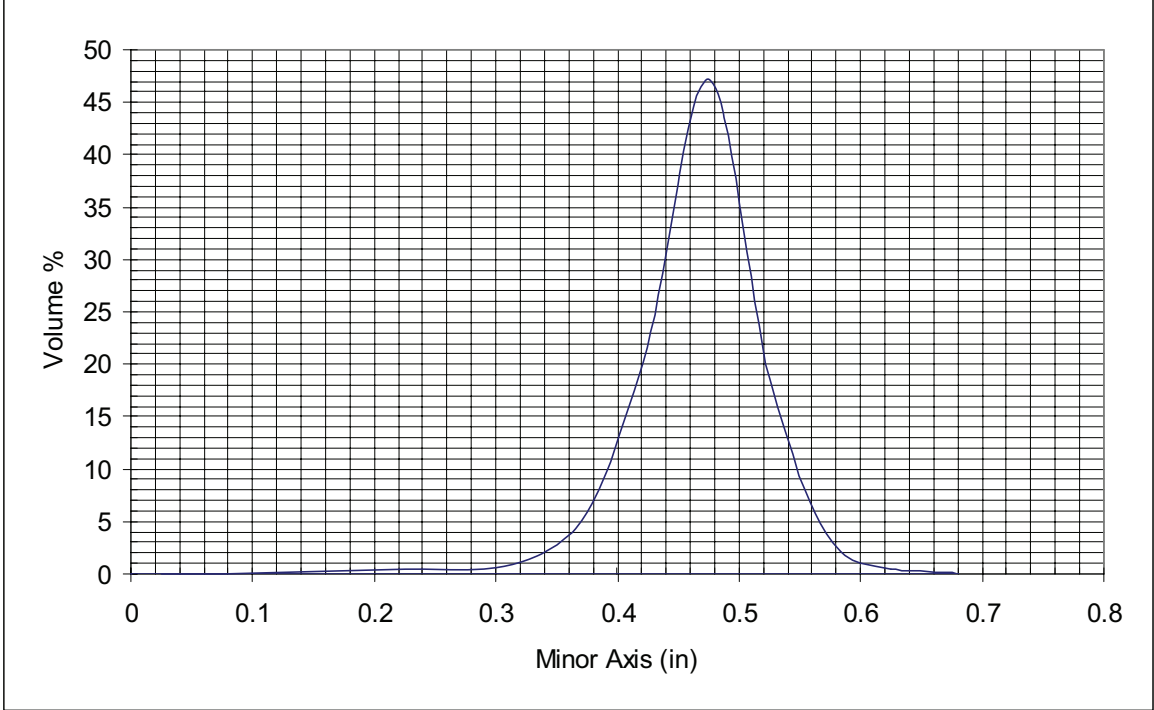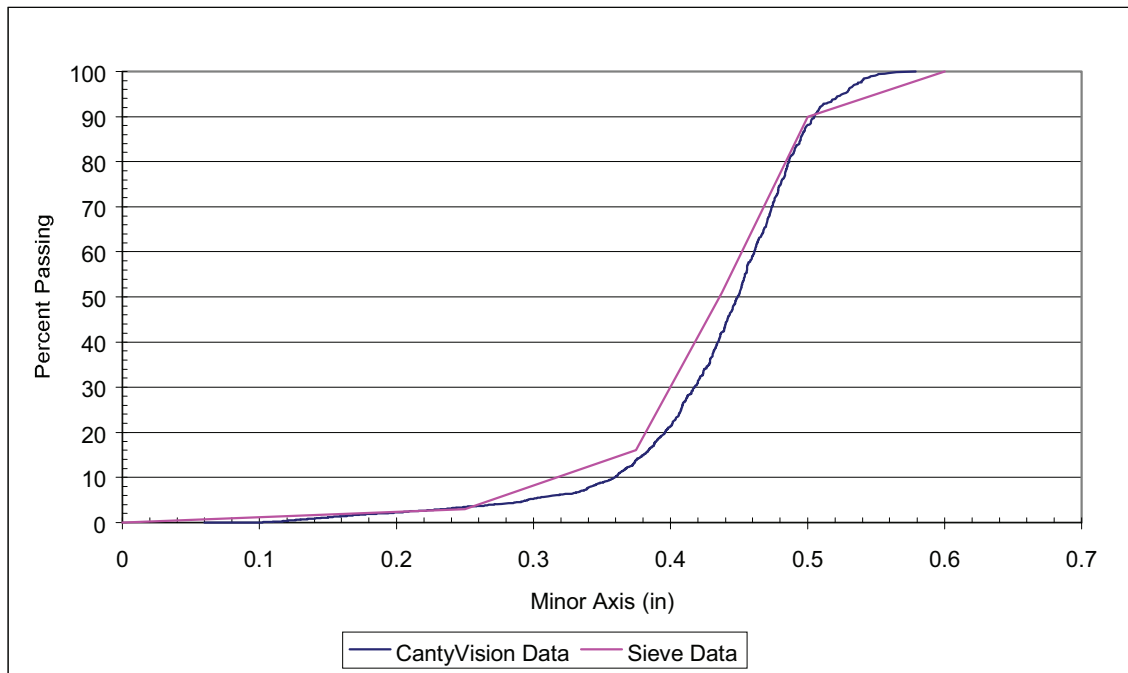

Statistical Data: (Interpolated from Volume Data)

Mean: 0.466
S.D.:   0.055
Median: 0.451

Vector Particle Sizing Sample Report

Date:	April 2001
Sample #	**Sample 2**
File:	CVClient3D.xls
Description:	Iron ore Pellet Distribution # 2
Company:	Internal Testing
Operator:	CPM
Feeder Setting:	N/A
# Particles	2191

Percent Passing by Volume

Summary of Percent Passing Data:

	10%		50%		90%	
	Vector	Sieve	Vector	Sieve	Vector	Sieve
Canty Data	0.359	0.317	0.449	0.436	0.505	0.500

% Difference in Vector and Sieve Size Measurements:

All Data	4.797
Center 80%	2.841

Pseudo-Bin Plot: (Volume of particles at a given size)

Minor Axis (in)
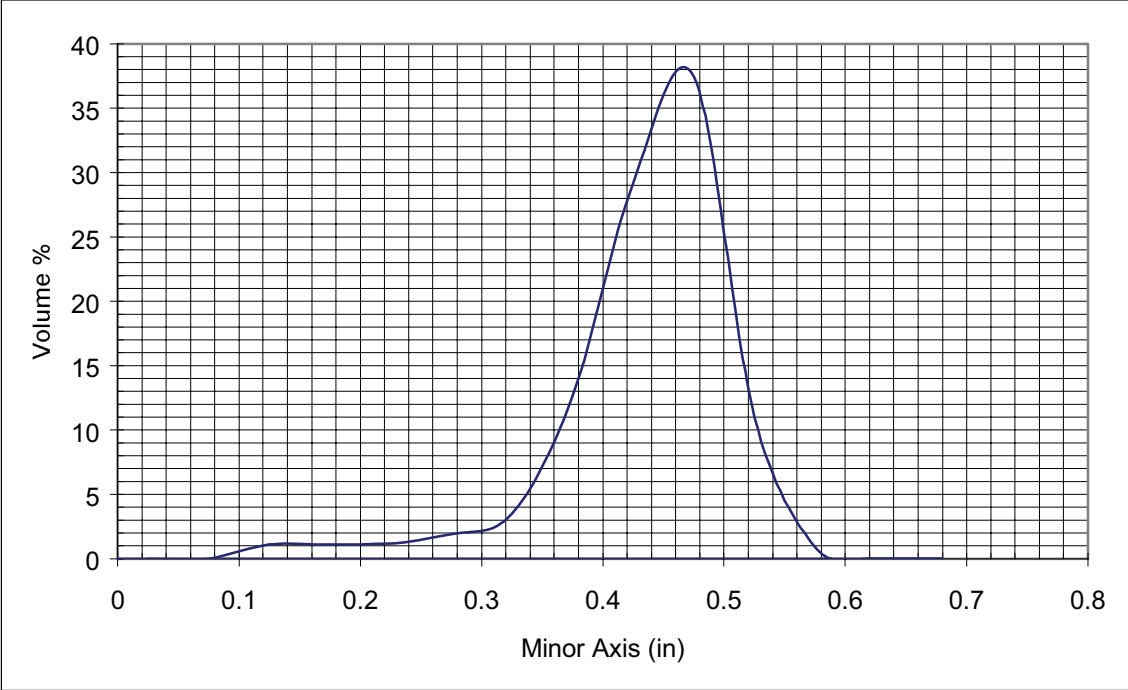
Statistical Data: (Interpolated from Volume Data)

Mean:	0.435
S.D.:	0.073
Median:	0.382

Conclusions:

The Canty Rocksizer will provide consistent measurements of particles for pellet and rock distributions. It provides full particle size distributions that are in close agreement with traditional measurement techniques for both small and large particles. The system is usable both as an analytical tool for QC/QA and as an in-stream size analyzer and in that regard can provide measurement results in a matter of minutes on a continual basis.

The primary features of the Canty system are accuracy and repeatability. Accuracy is obtained thru the software measurement techniques and algorithms that are able to delineate particle boundaries on a high-resolution image field, and consistency is derived from the nature of the physical system. Because the measurement is non-contact, there is no source of wear on the measurement instrument (camera). In addition, since the camera is pre set for the field of view and particle range, the calibration does not change for different particle distributions, nor does it have any drift over time and is therefore in calibration indefinitely. This eliminates the variable of operator control and allows for more reliable measurement results that are consistent over long periods of time.

Further Information:

For further information on the Canty Rocksizer, please contact us at the address on this report or feel free to email us at sales@jmcanty.com.