

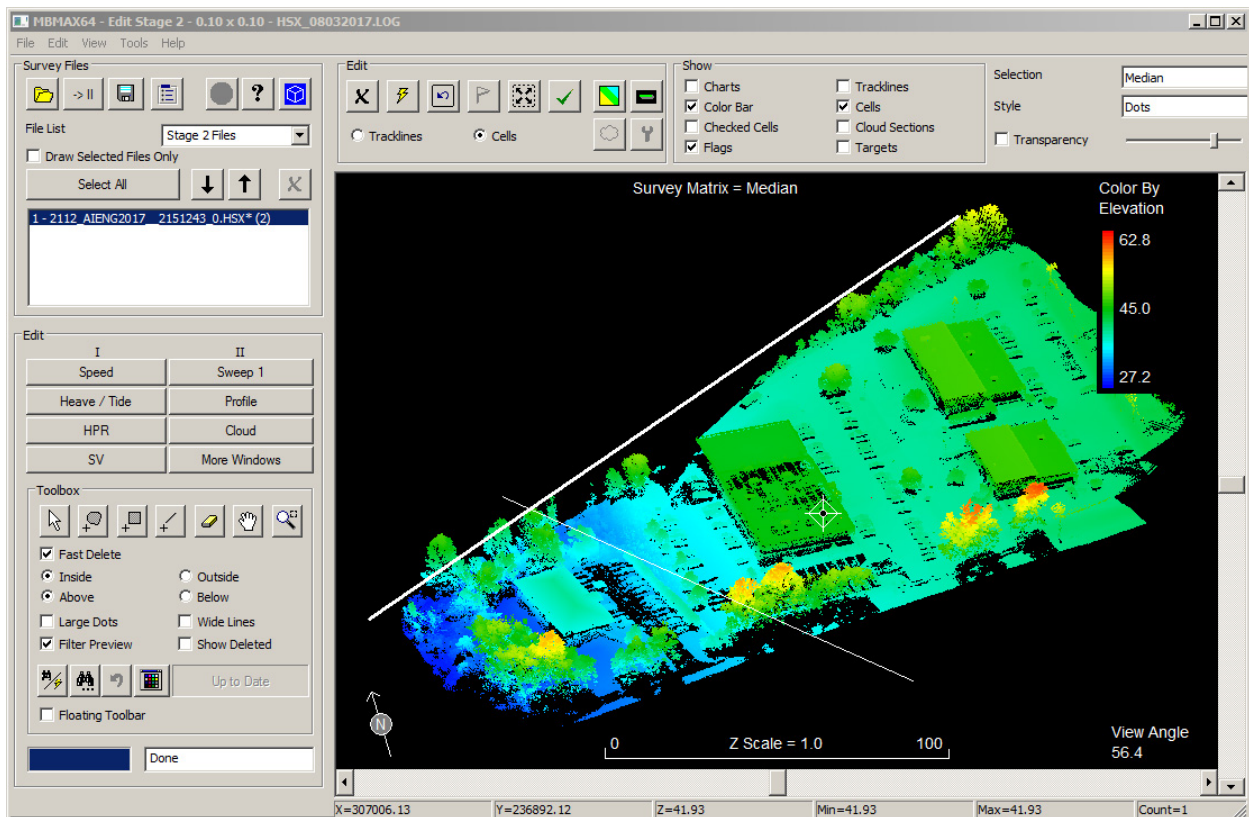


HYPACK
a xylem brand

Sounding Better!

NEXUS Example of Surfaces: A Collection of Real-world Surface Uncertainty

By Jerry Knisley



OVERVIEW

The purpose of this study is to determine the expected uncertainty of the NEXUS-800 using a Velodyne VLP16 at various altitudes over varying surface reflectivity. An important point to understand when evaluating a survey is the uncertainty requirements.

REFLECTIVITY

The following table shows the reflectivity of various common materials. For example, snow reflects 80% of the light that falls on it, which means that it absorbs 20% (80% + 20% = 100%). This also means that if I have 100 watts of light energy falling on the snow, 80 watts will be reflected and 20 watts will be absorbed.

The source used here is designed to show the reflectivity of material using solar radiation.

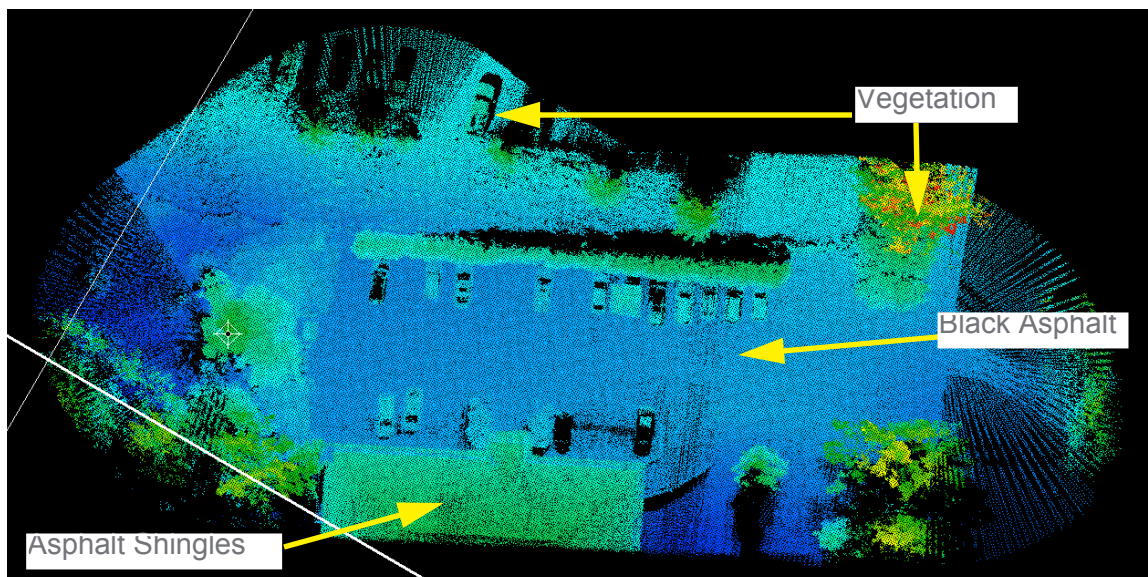
TABLE 1. *Reflectivity Table*

Material	Reflectivity
Snow	80%
White Concrete	78%
Bare Aluminum	74%
Vegetation	50%
Bare Soil	30%
Wood Shingle	17%
Water	5%
Black Asphalt	3%

Source: <https://spacemath.gsfc.nasa.gov/weekly/MMM1.pdf>

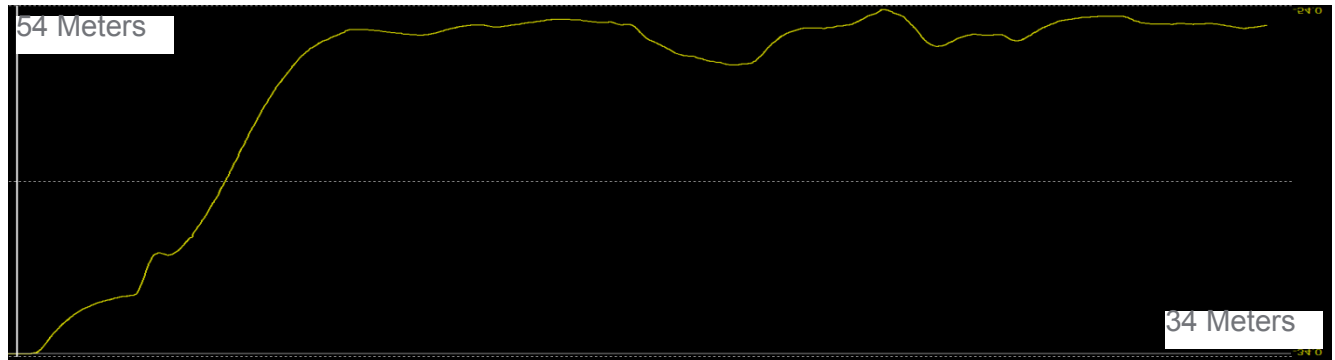
The test site at the HYPACK office has coverage with Black Asphalt, Water, Vegetation and Bare Soil.

FIGURE 1. *HYPACK Office Test Site*



FLIGHT PROFILE - 20 METERS

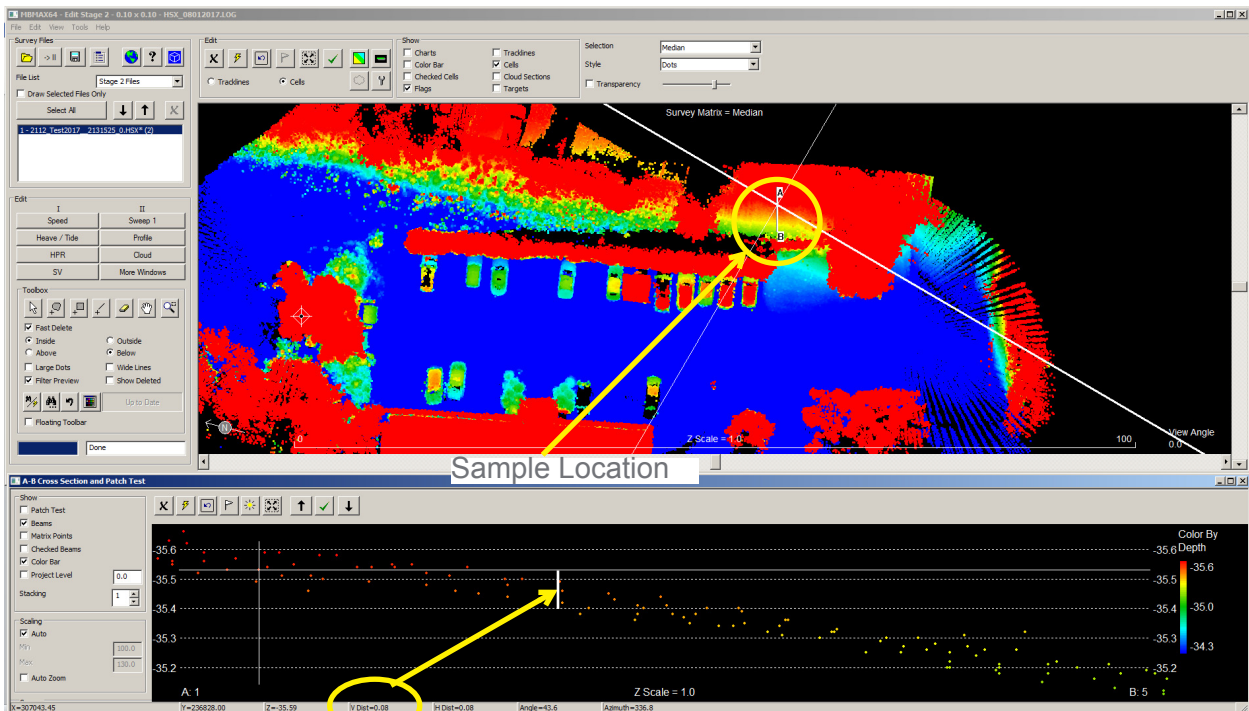
FIGURE 2. Flight Profile – 20 Meters



AREA OF LOW VEGETATION – 20 METERS

Figure 3 shows an area of low vegetation—freshly planted grass and bare soil. Based upon the reflectivity profile, the area should have a reflectivity of between 30-50%, relatively low reflectivity.

FIGURE 3. Low Vegetation

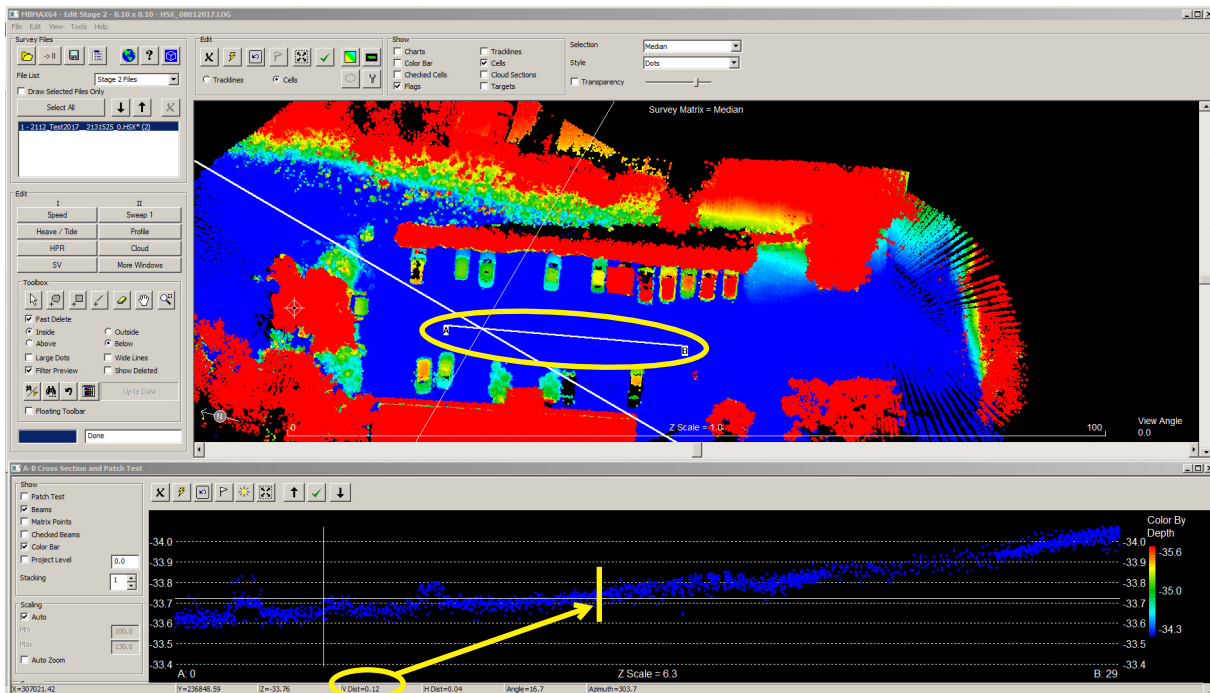


The average vertical uncertainty in this area measures out to 8-10 cm (+/- 5cm). This area was chosen as a low to moderate area of reflectivity with good returns.

AREA OF BLACK ASPHALT – 20 METERS

Figure 4 shows an area of black asphalt. Based upon the reflectivity profile the area should have a very low reflective surface. The measurement of uncertainty is $\sim 12\text{cm}$ ($\pm 6\text{cm}$).

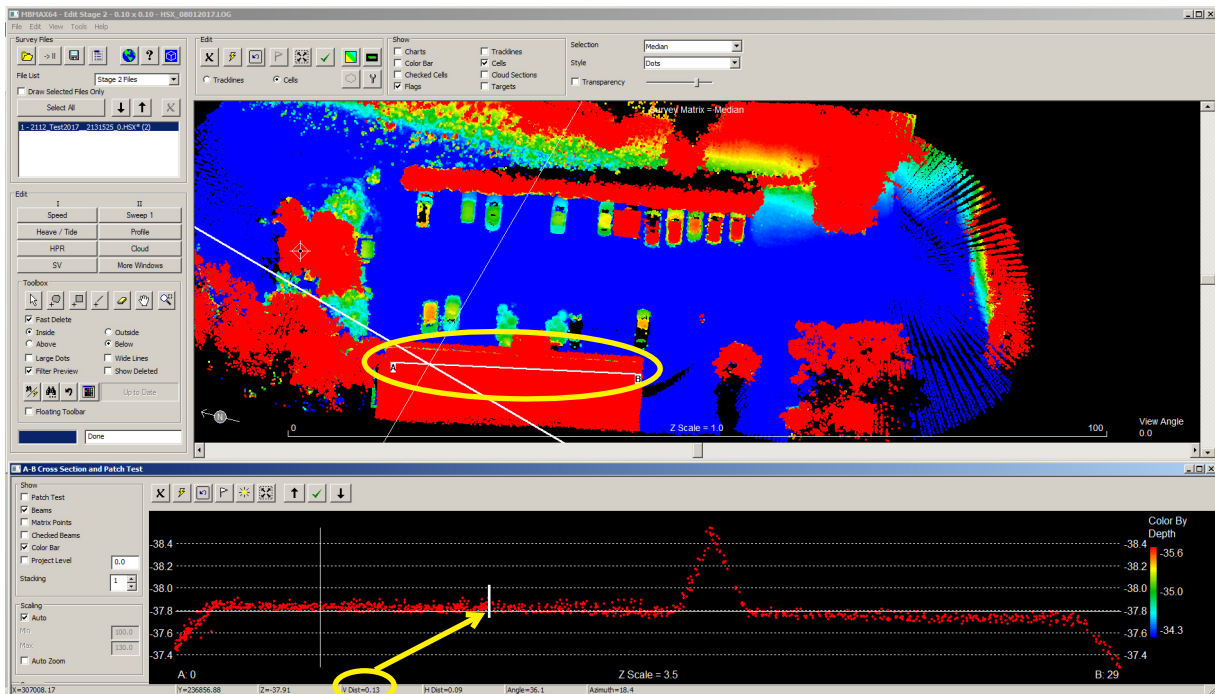
FIGURE 4. Area of Black Asphalt



AREA OF ASPHALT SHINGLES – 20 METERS

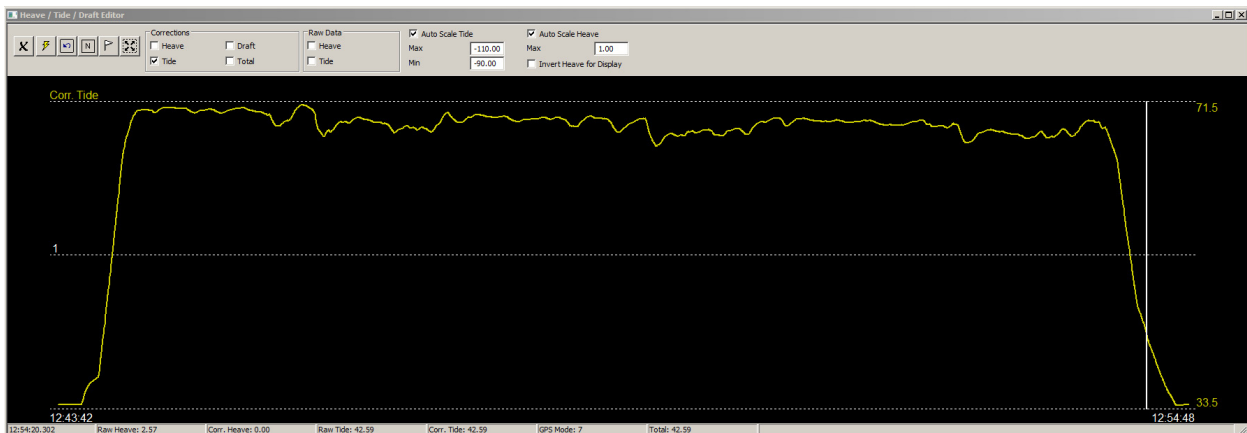
Figure 5 shows an area of Asphalt Shingles. Based upon the reflectivity profile the are should have a low to moderate reflectivity. The measurement of uncertainty is $\sim 13\text{cm}$ ($\pm 6.5\text{ cm}$).

FIGURE 5. Area of Asphalt Shingles



FLIGHT PROFILE – 35 METERS

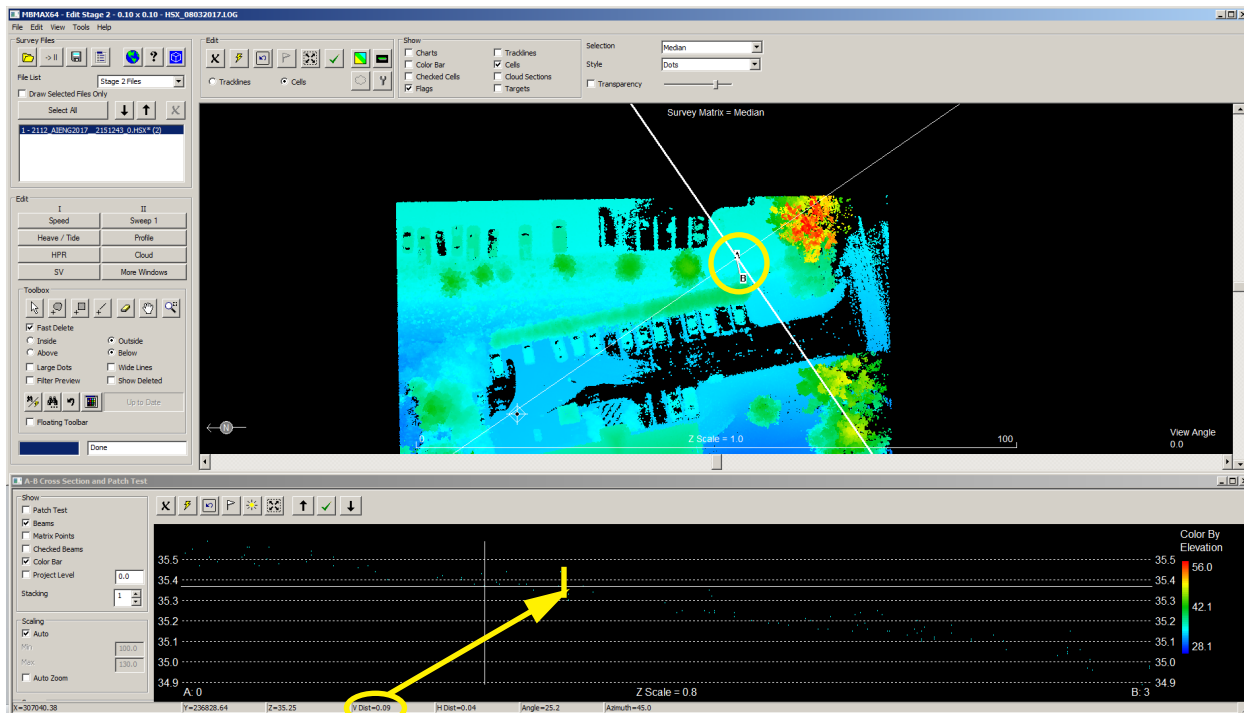
FIGURE 6. Flight Profile – 35 Meters



AREA OF LOW VEGETATION – 35 METERS

Figure 7 shows an area of low vegetation, freshly planted grass and bare soil. Based upon the reflectivity profile the area should have a reflectivity of between 30-50%, relatively low reflectivity.

FIGURE 7. Area of Low Vegetation

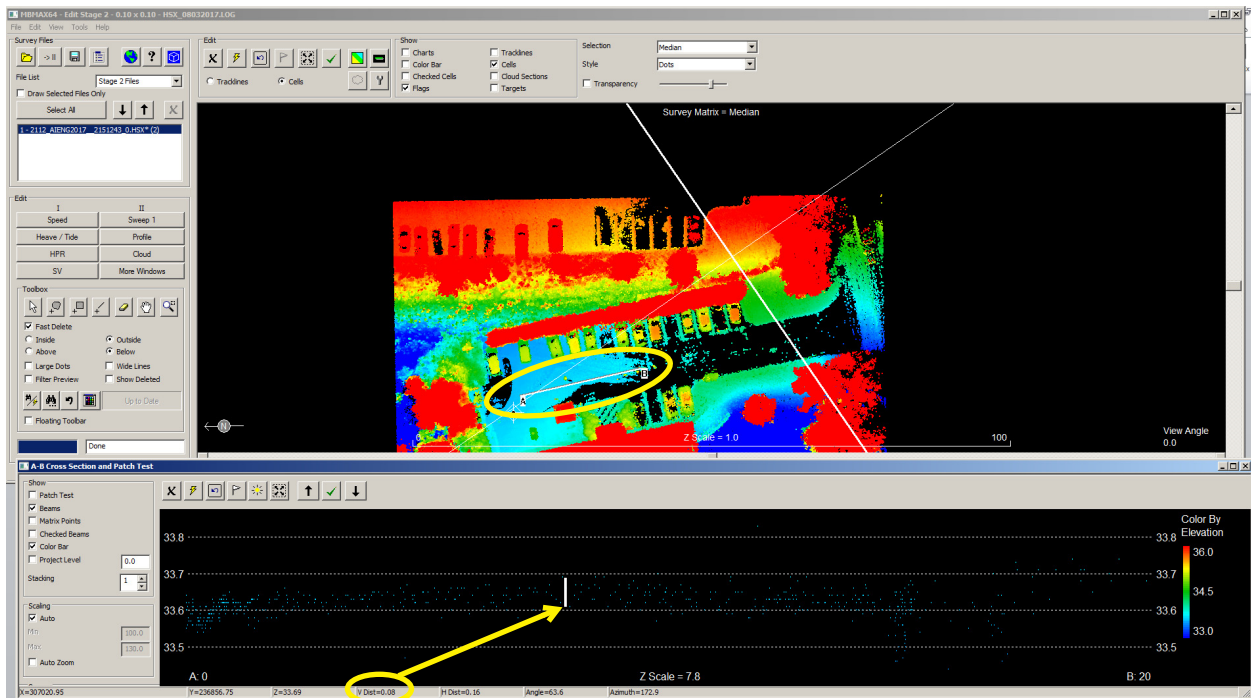


The average vertical uncertainty in this area measures out to 8-10 cm (+/- 5cm). This area was chosen as a low to moderate area of reflectivity with good returns.

AREA OF BLACK ASPHALT – 35 METERS

Figure shows an area of black asphalt. Based upon the reflectivity profile the area should have a very low reflective surface. The measurement of uncertainty is ~8cm (+/- 4cm).

FIGURE 8. Area of Black Asphalt



AREA OF ASPHALT SHINGLES – 35 METERS

Figure 9 shows an area of Asphalt Shingles. Based upon the reflectivity profile the are should have a low to moderate reflectivity. The measurement of uncertainty is ~17cm (+/- 8.5 cm).

FIGURE 9. Area of Asphalt Shingles – 35 Meters

