Froze debris lobes (FDL) are moving mass phenomena that can pose a threat along the Dalton Highway corridor in the southern Brooks Range, Alaska. Active debris movement of these features presents a barrier and a hazard to the Trans Alaska Pipeline System (TAPS) and other infrastructure along the highway. Frozen debris lobes and their associated geomorphic hazards have initiated a focused study along a 50-mile reach of the Dalton Highway between Wiseman and Chadron Hill. This multi-year study addresses the following: (a) an understanding of the distribution, ogeny and geomorphology of eight multi-decadal frozen debris lobes catchments, based on ArcGIS analysis of multi-date remotely sensed imagery and 2013 summer field work.

Preliminary results indicate that these debris lobes exhibit forms in golds, caused by low-sequence processes such as phyllite, slate, and chloritic schist and Alaska and its bedrock geology, and affected by solifluction, rockfall, slope failure, and runoff. Characterizing the rockbedge lithology of the catchment area is an important component to understanding the style and rate of frozen debris lobe catchments along the Dalton Highway, which is critical to understanding the distribution, ogeny and geomorphology of these features, and extracting new information useful for maintenance of current infrastructure and planning for future development in the corridor.

The surficial and bedrock geology of the south-central Brooks Range has been previously mapped at scales of 1:250,000 (Chapman and others, 1964; Hamilton, 1978; Brown and Kreig, 1994) and 1:63,360 (Hamilton, 1979; Dillon et al., 1988; Daanen and others, 2012). The Alaska Division of Geological & Geophysical Surveys (DGGS) and the University of Alaska Fairbanks, are conducting an ongoing evaluation of the geologic hazards associated with frozen debris lobes located along the Dalton Highway.

In 2011 DGGS acquired high resolution LiDAR data for an area of approximately 7,700 square kilometers along portions of the highway (Figure 4). The LiDAR data were used to conduct field work and to develop orthophoto quadrangle maps (Figures 5A; 5B; and 5C). It should be noted that this is the only catchment that has geologic contacts trending across the gully perpendicular to the long axis of the debris lobe (Figure 6A).

5. DATA & RESULTS

5.1. LiDAR Imagery

In 2011 DGGS acquired high resolution LiDAR data for an area of approximately 7,700 square kilometers along portions of the highway (Hubbard and others, 2011). The LiDAR data encompassed the extent of the FDL-7 catchment areas (adjacent to the Dalton Highway and portions of the South Fork of the Chena River) and the University of Alaska Fairbanks, are conducting an ongoing evaluation of the geologic hazards associated with frozen debris lobes located along the Dalton Highway.

5.2. FDL-D & B-C

• All of the examined frozen debris lobes are primarily sourced from and flanked by ridges of competent bedrock, but instead a geologic contact near the axis of the debris lobes (roughly E-W) and coincide with the steep resistant ridge of greywacke and metasedimentary rock and contrast to areas of competent bedrock where frost shattered material is primary.

5.3. FDL-D

• Frost is noted in areas of very weak and friable chloritic phyllite to schist and is sustained by fractures, standing water, and separation fractures.

5.4. FDL-11

• Frost is noted in areas of very weak and friable chloritic phyllite to schist and is sustained by fractures, standing water, and separation fractures.

6. DISCUSSION

Geologic mapping revealed that three of the five catchments (FDL-A, B, and D) have geologic contacts trending parallel to the long axis of the debris lobes (roughly E-W) and coincide with the steep resistant ridge of greywacke and metasedimentary rock and contrast to areas of competent bedrock where frost shattered material such as the Hunt Fork Shale (Hamilton, 1978; 1979; 1984).

Although solifluction creep occurs on or near most ridge tops, in areas where bedrock is composed of phyllite and friable material solifluction is most active in areas adjacent to geologic contacts where material is less resistant to frost shatter.

7. SUMMARY

Geologic mapping and geomorphic characterization of frozen debris lobe catchments along the Dalton Highway were conducted at five locations along the Dalton Highway (Hoffman et al., 2015). Catchments for FDL-A, B, and D are flanked to the north and south by ridge tops of resistant bedrock, and have continuous, contrasting, solifluction, rockfall, and debris lobe rockfall and debris lobe rockfall.

In the FDL-11 catchment, geologic contact trends parallel to the long axis of the debris lobe (roughly N-NW) across the competent and friable bedrock units and the distribution of frost shatter occurs in areas of competency where frost shattered material is primary as well as areas of more resistant and competent bedrock.

8. REFERENCES

9. THANKS...