A Post-Conference Trip to the Transbaikalia Region

Following the TICOP conference Jim and Flo Rooney and Ray and Lee Ann Kreig traveled to the Transbaikalia region for an area tour. They also had the opportunity to visit and review a number of permafrost, frost heave, and major icing sites. The trip was initiated by a long-standing invitation from Valentin Kondratiev and was prompted by the early TICOP announcement of a post-conference Transbaikalia field trip that was subsequently dropped. Mr. Kondratiev then offered to honor a long-standing invitation that allowed the Rooney's to return to some of the areas visited in May, 1992 and it also provided a first time visit for the Kreigs. While we visited many very interesting places along our travels, this trip report is focused only on our opportunities to view and relate to common permafrost and associated technical issues.

The trip included traveling from Moscow to Chita by air, on to Chara by air, then along the BAM by rail to Severobaykalsk, continuing by air from nearby New Archangel south to Ulan Ude. We then headed westward by vehicle around the south end of Lake Baikal on into the Tunkinsky valley to Arshan and then headed north to Irkustk. This was followed by a trip south from Irkustk on the Trans-Siberian Railroad back to Slyudyanka for a day trip on "The Circum-Baikal Railroad" (traveling along the southwestern portion of Lake Baikal). Accommodations were provided in local hotels and in a rail car along the BAM route.

Photo 1. Trans Siberian Highway (Route 55). July, 2012 view of upslope area exhibiting frost boils and area of major winter icing conditions.

After departing Moscow and arriving in Chita, we had the opportunity to visit several locations experiencing embankment thaw settlement and railroad electrical transmission pole support frost heave impacts to the Trans Siberian Railway system. In spite of these adverse impacts, we could not help but be impressed by the large amount of rail traffic on

this dual track electrified system. We then visited a very large, significant thawing permafrost induced landslide that is occurring along a feeder road from Chita to the Trans Siberia Highway (Route 55).

The following day allowed us to travel along the Trans Siberian Highway from the Chita origin point eastward for over 220 km. We were able to observe several points of technical interest that included; 1) a major side-hill cut area involving winter icing, 2) an upslope area of a recent development of frost boils exhibiting large exposed ice growth and causing roadway winter icing conditions (PHOTO 1), and 3) a major embankment failure that is continuing because of thawing of underlying permafrost degradation (PHOTO 2). The condition of this highway location has been addressed in prior papers by Kondratiev.

Photo 2. Trans Siberian Highway (Route 55). July, 2012 view of continuing major embankment failure resulting from underlying foundation permafrost degradation.

The trip then continued with a flight to Chara and the Chara Basin. This included a unique opportunity to review current conditions along the now abandoned Chara-Chena railway route to a proposed major mine development site (PHOTO 3).

The partially constructed railway route was abandoned in 2002 and thus provided some special insights into permafrost related thawing ground subsidence since its closure. The route ascends from the Chara Basin upward into mountain terrain and traverses many natural and man-made obstacles. Some ground subsidence locations exposed hanging rail and ties at locations experiencing permafrost thawing (PHOTO 4).

Photo 3. July, 2012 view of abandoned Chena-Chara Railway ascending from the Chara Basin toward the Chena mine site. Project started in 1999 and shut down in 2002.

Photo 4. Abandoned Chena-Chara Railway. July, 2012 view of segment exhibiting significant thaw settlement since closure in 2002.

The following several days were spent traveling along the BAM railroad route, starting from Nova Chara moving westward with an ultimate end in Serverobaykalsk at the north end of Lake Baikal. We were able to observe route segments exhibiting continued ground subsidence resulting from thawing permafrost and some areas of significant winter icing events. Along this route segment, we also visited Severomuysk, where a very major effort was expended to extend the BAM route through a tunnel in order to reduce the much

longer high pass route to a much shorter distance. The tunnel effort started in 1977 and, because of so many difficulties involving crossing large faults and major ground water impacts, was eventually completed in 2003 (PHOTOS 5&6).

Photo 5. Baikal Amur Mainline (BAM) Railway. July, 2012 photo of monument commemorating the initial tunnel construction that began in 1977.

Photo 6. Baikal Amur Mainline (BAM) Railway. July, 2012 photo of the monument commemorating completion of the tunnel in 2003. Tunnel portal is visible behind and just left of the monument. This project encountered major ground water, fault systems and geothermal impacts on construction efforts.

While in Severomuysk, we also were able to revisit an area with the most significant major thawing permafrost slope induced failure impact along the BAM railway system. The multi-track conditions during a site visit in June 1992 is shown in Photo 7. The initially planned multi-track short segment encompasses all of the most adverse impacts that can be encountered in frozen ground terrain and has now reduced the multi-track passage down to a single track with a 25 km/hr restricted passage (PHOTOS 8 & 9).

Photo 7. Baikal Amur Mainline (BAM) Railroad at Severomuysk. View of multi-track conditions during a site visit in June, 1992.

The failure conditions appear to involve both thawing permafrost as well as major subsurface and surface water flow that appear to be causing both subsidence and downslope movement. All prior applications of thermopiles, deep drainage infiltration interceptors, and more recently applied ACE rock treatments, appear to have had limited effectiveness.

We then traveled to Ulan-Ude by air and had the occasion to meet the primary contractor involved with the Chara-Chena railway, as well as gain insights into his current business activities that now include both major horizontal and vertical construction. From Ulan-Ude, we traveled westward to Slyudyanka at the south end of Lake Baikal and further west into the Tunkinsky Valley along Highway Route A-164 for a stay in Arshan. We continued on the same route westward to the Mondy region, less than 5 km from the Mongolian border and only point of road access to the north end of Mongolian Lake Hovsgol Nuur. Aside from observing some roadway settlement resulting from apparent thawing permafrost, this area does have issues with winter icing events and we were taken to a site of a major icing (PHOTO 10).

Photo 8. Baikal Amur Mainline (BAM) Railway at Severomuysk. View of a very large continuing major slope instability area that has reduced travel through this segment to one track and maximum speed of 25 km/hr. Application of heat pipes, groundwater interception and recent air convection rock slopes has failed to stabilize this area.

Photo 9. Baikal Amur Mainline (BAM) Railroad at Severomuysk. This original four-track station area now operates on a single line at reduced speed.

Photo 10. View of remnants of a major icing area adjacent to Highway Route A-164 and the Irkutsk River in the Tunkinsky Valley. This icing condition was stated to have developed in very recent time.

We were told this condition had only begun to occur in recent years. An additional stop was made to view a large side-hill road cut into bedrock and glacial overburden. Slope raveling and sloughing was actively occurring and was requiring heavy maintenance and will involve a major remediation effort.

Our final Transbaikalia excursion did not involve permafrost issues but did provide an opportunity to travel from Irkutsk on the Trans Siberian Railway back to Slyudyanka, and then we traveled northward along what is now known as "The Circum-Baikal Railroad" extending along the southwestern portion of the original Trans Siberian Railway route skirting the Lake Baikal shoreline. This segment of the route was constructed with support from imported Italian and Albanian stonemasons during the first part of the 1900's. For us, we could not help but reflect back on the Copper River Railway in Alaska and on Kennicott mining development and construction issues that occurred during this same time period.

For all of us, this trip provided an exceptional opportunity for us to review continuing concerns with our exposure to permafrost ground warming impacts on constructed infrastructure sites. When considering all these concerns, it is difficult to understand why we have such limited efforts in evaluating performance of our existing Alaskan infrastructure when such information would allow better insights for future design and construction.

Aside from the isolated problems addressed above, it appears that the visited projects are performing rather well, in spite of the continuing global warming issues. There are many similarities in Alaskan, Canadian and Russian road and railway experiences.