Polymer modified-asphalt (PMA) is normally produced using a “wet” process where the polymer is added to asphalt in a high shear mixer and delivered in a tank. However, it is cumbersome for asphalt mix producers to switch tanks between the straight asphalt and PMA for different projects, particularly for a small project in a remote location where a limited amount of PMA is needed. Therefore, the pelletized SBS-based compound was developed, which can be added directly into the pugmill mixer using a “dry” process along with asphalt and aggregates. The SBS-based compound differs from a typical PMA where it is formulated to melt and blend with asphalt quickly during a batch mixing process. The main objectives of this study are to (1) build asphalt pavement using asphalt mixtures with SBS-based compound added using a “dry” process at the batch plant and (2) evaluate its performance under heavy traffic and severe weather conditions in Greenland. Based on the initial set of strain data collected under the slow-moving loader right after construction, the highest strain value was observed from the test section with the highest amount of SBS-based compound. The increased amount of SBS-based compound seemed to affect the asphalt mix to become more flexible under the heavy loads. By adding SBS-based compound to asphalt mixtures using a “dry” process, it is expected that the pavement would become more resistant to rutting than a typical asphalt mixture used in Greenland while enduring its arctic weather.