

Travel Behavior during the 2021 British Columbia Floods Using De-identified Network Mobility Data

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SUPPLEMENTAL INFORMATION

TELUS Insight data incorporates approximately 9.8 million cellular devices across Canada. A new timestamped record is created when a device:

- a) Makes or receives a phone call;
- b) Sends or receives an SMS/MMS message;
- c) Sends or receives data;
- d) Is dormant for over 30 minutes; or
- e) Moves/connects to a new cell tower.

At a minimum, a non-moving device that is not actively used will generate 48 timestamped records per day, and an average device generates 300 timestamped records per day. Since the data results in 3 billion records per day, TELUS Insight data (de-identified network mobility data) provides absolute results for all TELUS customers.

For this research, the TELUS Insight team confirmed that there were no anomalies in the number of records each day since 2019 (inception of the de-identified network mobility data). However, some changes may exist in the number of customers as people switch carriers. The inability to determine this change is a limitation of the study. Moreover, the number of TELUS customers in a specific area is not available externally due to TELUS Privacy by Design guidelines. However, research by the Government of Canada has determined that TELUS accounts for about 28% of the Canadian market (Canadian Radio-television and Telecommunication Commission, 2022). Within British Columbia, TELUS accounted for 40.6% of subscribers in 2019 and 43.0% of subscribers in 2021 (CRTC, 2023). The following population changes also occurred between 2016 and 2021 (when a census was conducted in the area (Statistics Canada, 2024))

- Hope: 6,181 to 6,686
- Chilliwack: 83,788 to 93,203
- Merritt: 7,139 to 7,051

These population differences do not account for changes in the number of travellers passing through Hope, Chilliwack, and Merritt, who would also be counted in the methodology based on the requirements of the timestamped records above.

Regarding resolution, TELUS Insights data is based on the locations of the cellular towers, and their coverage areas. The spatial granularity is dependent on the cellular coverage in the area. Coverage accuracy is typically below 200 meters in urban areas, between 200 meters and one kilometer in suburban areas, and between one and many kilometers in rural areas (depending on remoteness). The resolution of data for Hope, Merritt, and Chilliwack in the majority of the area is generally within 200 meters to one kilometer, though certain areas might fall within a one to five-kilometer range. In our analysis, we used the entire municipal district (DM) of Hope and the

entire cities (CY) for Merritt and Chilliwack. Regarding overall geography, using straight-line distances and measuring from city center-to-center, Hope is approximately 93 kilometers from Merritt and 44 kilometers from Chilliwack.

For timestamps, the device counts were collected in 60-minute buckets, meaning that each device was counted once and only once if it recorded a timestamp in that 60-minute bucket. The trip terminates in that specific bucket. For routes, since a pass-through location was not included, the device counts factor in all available routes to Chilliwack and Merritt from Hope.

Timeline of Key Events – November 12, 2021 to November 20, 2021

Date	Key Events
Nov. 12, 2021	<ul style="list-style-type: none"> ● Environment Canada issues warnings of extreme rainfall and snow due to the atmospheric river (Little, 2021b). ● No travel advisories are issued at the time for the Remembrance Day long weekend (Schmunk, 2021)
Nov. 13, 2021	<ul style="list-style-type: none"> ● Heavy rainfall begins across the Lower Mainland, increasing in intensity over the day (Schmunk, 2021).
Nov. 14, 2021	<ul style="list-style-type: none"> ● Mudslides and flooding begin blocking highways and roads (Schmunk, 2021), while evacuation alerts begin in Abbotsford (Hopes, 2022). ● HW5 between Hope and Merritt is closed due to a mudslide in the afternoon (DriveBC, 2021) ● Debris fields and mudslides are reported on HW3 and HW7 in the evening (Castanet, 2021).
Nov. 15, 2021	<ul style="list-style-type: none"> ● DriveBC reports significant closures of HW1, HW3, HW5 (Hope-Merritt), HW7 (Hope-Chilliwack), and HW11 (Judd and Michaels, 2021). ● A landslide on HW99 occurs in the morning (Schmunk, 2021). ● Officials issue mandatory evacuation orders in Merritt due to significant flooding (Global News, 2021). ● All major highways connecting the Lower Mainland and Interior B.C. are severed in at least one section and have closures (Judd and Michaels, 2021).
Nov. 16, 2021	<ul style="list-style-type: none"> ● Evacuation orders are issued for parts of Abbotsford and HW1 is flooded in multiple sections in the Lower Mainland (Hopes, 2022). ● Over 1,000 motorists are stranded in Hope, which has become disconnected from the rest of B.C. (Ballard, 2021). ● A section of HW7 toward Chilliwack opens up in the evening with limited capacity to help evacuate people from Hope (Kotyk, 2021).
Nov. 17, 2021	<ul style="list-style-type: none"> ● With some bridges completely collapsed and closed highways, supply chain issues arise (Schmunk, 2021). ● A provincial state of emergency is declared due to the severe flooding and landslides (B.C. Public Safety and Solicitor General, 2021).
Nov. 18, 2021	<ul style="list-style-type: none"> ● Despite ongoing recovery and cleanup, reports suggest that over 17,000 people across B.C. are evacuated from the floods (Schmunk, 2021). ● HW 7 opens for essential travel (B.C. Ministry of Transportation and

	Infrastructure, 2021a).
Nov. 19, 2021	<ul style="list-style-type: none"> ● Canadian Armed Forces are deployed to aid in the disaster (Schmunk, 2021). ● HW 3 opens for essential travel only (B.C. Ministry of Transportation and Infrastructure, 2021b).
Nov. 20, 2021	<ul style="list-style-type: none"> ● HW1 between Chilliwack and Hope opens to a single lane of traffic in both directions (B.C. Ministry of Transportation and Infrastructure, 2021c). ● HW99 is reopened, allowing a connection between the Lower Mainland and the Interior B.C. (B.C. Ministry of Transportation and Infrastructure, 2021d).
Other Events	<ul style="list-style-type: none"> ● HW1 in Abbotsford is opened on December 2, 2021 (Hopes, 2022). ● HW5 reopens commercial traffic on Dec. 20, 2021, and all traffic on Jan. 19 (2022) (B.C. Ministry of Transportation and Infrastructure, 2023).