4.4.2. Accidents

The information relates to 18 "*tunnels complexes*".

Illustration 22 shows the ratio of the annual number of accidents divided by the number of kilometres travelled by vehicles in the tunnel. This ratio is expressed per million vehicles x km, and calculated as follows:

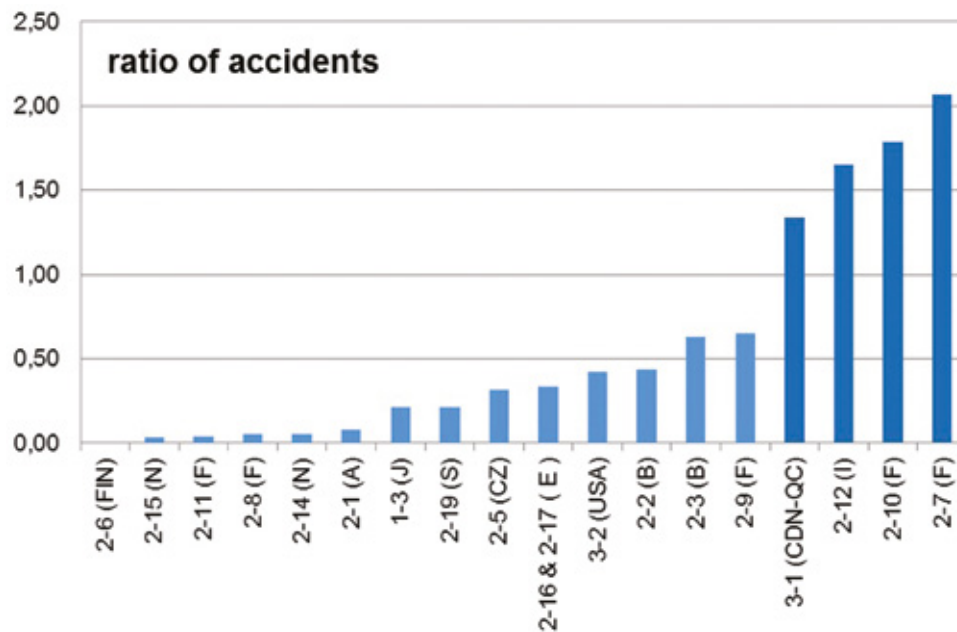(number of accidents) / (yearly traffic volume x tunnel length).

Illustration 22 – number of accidents per million of veh. x km

Generally the values are lower than those for similar open-air infrastructure.

Four complexes are atypical:

- tunnel Courier (F). This is a short tunnel with low traffic. Half of the accidents are due to motor homes drivers not respecting the signs relating to reduced vertical clearance. The other half is due to the winter conditions inside the tunnel (ice and black ice). These accidents are without injury, likely due to the limitation of speed;
- tunnel des Bâtisseurs (F). This is a service tunnel giving access to underground car parks and to the underground levels of activity centres. The value of the ratio results from the short length of the tunnel, low traffic and numerous interfaces. The collisions between vehicles relates only to material damage;
- tunnel Valsassina (I). The ratio is high and no explanation has been founded. 55% of the accidents are without injuries;
- tunnels Ville-Marie and Viger (CDN/QC). The rate of the ratio may result from the loss of control due to sharp curves and reverse curves, as well as the accelerations permitted by the downhill slope's grades. The high rate also results from the numerous entrance and exit ramps and their cumulated length that represents about 85 % of the nominal length of the tunnel.

The location of the accidents inside the tunnels is not always specified. For tunnels where the location has been specified, the following may be noted:

- concentration of accidents in the areas of small radius curves, especially when they are associated with high gradients or slopes;
- for tunnels having a high traffic density, there is an upsurge in accidents on the one hand at the entrances (merging areas), and on the other hand at the exits (tail of jams). This is not the case for tunnels with a medium traffic density for which the location of accidents is more diffuse.

The causes of accidents are attributed mainly to a lack of attention or distraction of the drivers, then to the behaviour (slalom, cut in, etc.), and finally to excessive speeds with respect to the geometric or traffic conditions. For Croix-Rousse tunnel (F), before its renovation and the construction of the multimodal tunnel, 50% of accidents were due to pedestrians, even though their access was forbidden inside the tunnel.

The information related to injuries has been collected for only eight "*tunnels complexes*", which is not representative. Annual averages for these tunnels are as follows:

- tunnels Ville-Marie and Viger (CDN/QC). The yearly average between 1994 and 2013 is 34 injuries for 163 accidents (with 79 % of the accidents inside the eastbound tube). Ten fatalities have been reported during the last twenty years;
- complex A14 / A86 (F) : 0.7 injuries and 0.6 fatalities;
- complex Strahov (CZ) : 4 injuries;
- duplex A 86 (F): 3 injuries;
- Valsassina (I): average of 22 injuries over three years of data;
- no injuries or fatalities for Kehu (FIN), Courier (F) and Voie des Bâtisseurs (F).

4.4.3. Fires

The information relates to 15 "*tunnels complexes*". *Illustration 23* shows the annual average of fires, and the number of tunnels concerned for each frequency range.

- 30% of the tunnels have never been exposed to a fire;
- 40% of the tunnels have been exposed to an average of less than 0.75 fire a year;
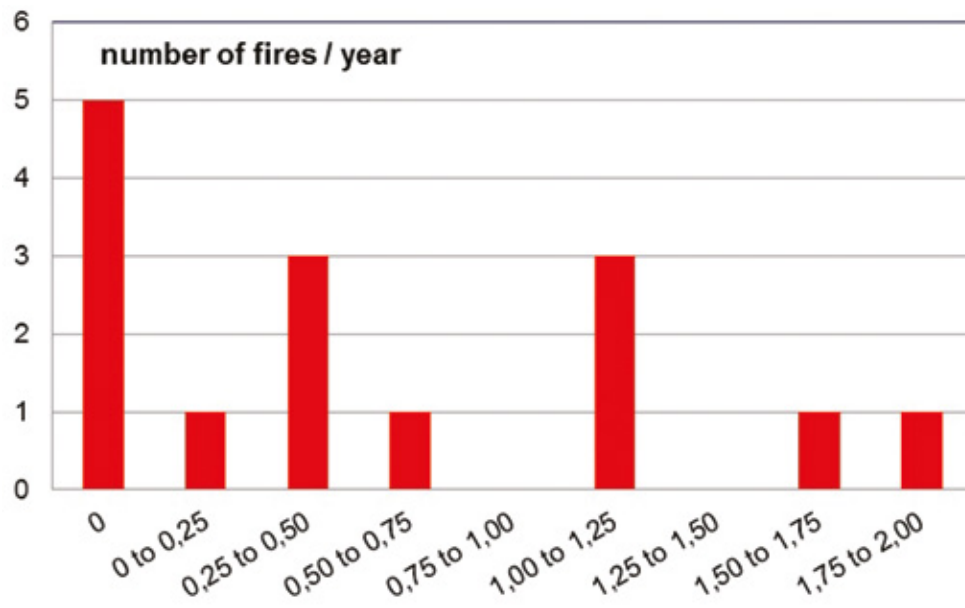- 30% have a frequency more than one fire annually.

Illustration 23 – number of tunnels classified by annual average of fire

These fires resulted in material damage, including several with major damage. No fatality associated with fire has been reported.