Extreme weather events in the railway industry
Canada’s railway franchise

About the RAC

Class 1: CN, CP and US carriers

Short line: 50+ across Canada

Passenger: Commuter, Intercity, Tourist

500 rail industry suppliers.
## Our network in Canada

<table>
<thead>
<tr>
<th>Locomotives</th>
<th>Rail Cars</th>
<th>Employees</th>
<th>Customers</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,842</td>
<td>5.2+ M</td>
<td>31,780</td>
<td>+10,000</td>
</tr>
<tr>
<td>in service last year and used to haul, on average 99 cars per train.</td>
<td>originated carloads in Canada.</td>
<td>dedicated railroaders committed to safety and excellence.</td>
<td>companies using our network to compete in domestic and international markets.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Main-track kilometers</th>
<th>Average length haul</th>
<th>Revenue per tonne-klm</th>
<th>Traffic</th>
</tr>
</thead>
<tbody>
<tr>
<td>42,557</td>
<td>1,524</td>
<td>3.16</td>
<td>$310 B</td>
</tr>
<tr>
<td>privately owned, operated and maintained.</td>
<td>kilometers.</td>
<td>cents to move one tonne of freight one kilometer.</td>
<td>in goods handled by our network in Canada.</td>
</tr>
</tbody>
</table>

Source: RAC, Rail Trends 2018
Our portfolio

Freight rail

- Coal: 21%
- Metals & Minerals: 12%
- Agriculture & Food Products: 8%
- Automotive & Manufactured Goods: 6%
- Intermodal: 35%
- Fuel & Chemicals: 6%

Passenger rail

- Commuters (94.6%)
- Intercity Passengers (5.0%)
- Tourist and Excursion (0.4%)

Rail trade profile

$310 B

<table>
<thead>
<tr>
<th>Value of goods</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canadian exports</td>
<td>50%</td>
</tr>
<tr>
<td>Canadian rail traffic is exported</td>
<td>75%</td>
</tr>
</tbody>
</table>

Top Rail Exports

1. Agriculture and food
2. Grain
3. Forest products
4. Coal
5. Fertilizer materials

65% Rail revenues generated by trade

## Severe weather challenges

| High extreme temperatures | • Buckles and breaks  
| • Temperature control failure/overheating  
| • Rail expansion/contraction/sun-kinks  
| • Impacts to shop operations, health and safety  
| • Impacts to operations/mechanical failure |
| Low extreme temperatures | • Ice build up on rail, overhead wires  
| • Public & employee safety hazards  
| • Mechanical failure/air brake failure  
| • Switch heater challenges/failure  
| • Frost penetration/track bed issues |
| High winds | • Risks to rolling stock, falling trees, debris |
| Rain fall intensity, increase flooding | • Culvert failure, bridge stabilization  
| • Scour of embankment material  
| • Roadbed saturation/stability reduction/drainage  
| • Track flooding (mainline shutdowns)  
| • Access to rail yards, operational facilities |
Toronto, Ontario (2013)

Guttenburg, Iowa (March, 2019)

Source: Canadian Pacific, 2019.
Davenport, Iowa (April/May 2019)

Source: Canadian Pacific, 2019.
Call to action

• Improve the ability to assess historical and projected climate probabilities and extreme weather events.
  • Hardening rail infrastructure is good management, and important to maintain operational resiliency – data is key.

• Recognize that not all railways are alike, support for shortlines is required.

• Chicken or egg? Leverage the environmental benefits of rail to reduce emissions in Canada.