The impact of climate hazards related to water, wind and solid masses on railway infrastructure

epsf — établissement public de sécurité ferroviaire

IMPACT STUDY

Key to climate hazards

Temperature

- Drought — Increasing periods of drought
- Extreme temperature — Increase in extreme temperature values
- Heatwave — Heatwave/prolonged high temperatures
- Fire — Forest fires in the vicinity of tracks
- Cold/frost — Cold snap/frost
- Thunderstorm/lightning — Lightning

Water

- Rain/snow/hail — Increasing periods of drought
- Flooding — Increasing periods of drought
- Marine submersion — Rise in sea level

Wind

- Strong wind — High winds, cyclones, tornadoes
- Snowstorm — High winds, snow and ice
- Sandstorm — High winds and sand

Solid mass movement

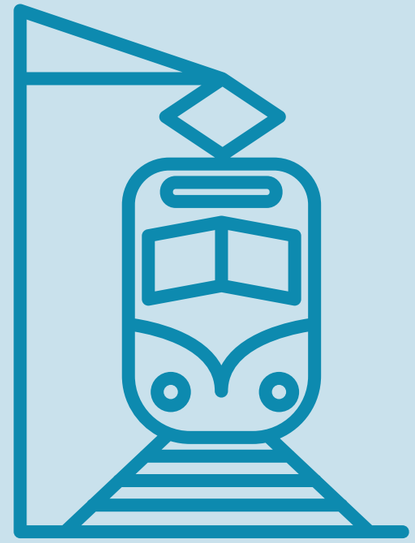
- Solid mass movement — Avalanches, landslides, landslips, mudslides, rockfalls, subsidence

Type of impact

Impact with **LONG-TERM CONSEQUENCES**

Impact with **MEDIUM-TERM CONSEQUENCES** on network operations: adaptive measures needed to keep trains running (e.g. TSR), and if nothing is done, traffic will inevitably come to a halt

Impact with **IMMEDIATE MAJOR CONSEQUENCES** for network operations (e.g. stopping traffic)



Overhead lines

- Malfunction due to humidity
- Structural damage
- Structural damage — Cable tearing
- Formation of solid ice — Freezing of the whole system
- Destruction

Surroundings = earthworks + vegetation

- Lack of visibility due to vegetation growth — Long-term instability — Saturated soil (erosion, soil swelling, run-off, etc.)
- Destruction — Creation of obstacles to traffic
- Instability — Creation of obstacles to traffic
- Long-term degradation (freeze-thaw, snow melt)
- Weakening of stability — Destruction

Engineering structures

- Flooding — Destruction of the structure — Erosion — Damage to electrical equipment (tunnel) + ground instability
- Fragility of the structure (bridge) — Signal dislodging (tunnel)
- Overloading of the structure — Breaching (bridge) — Damaged equipment (ice in the tunnel)
- Destruction — Obstruction of openings (tunnel)

Signalling

- Loss of insulation — Sudden re-powering of circuits — Reduced visibility
- Loss of direct operating capacity
- Structural damage — Fog: reduced visibility
- Equipment malfunction due to snow — Poor visibility
- Equipment malfunction due to sand
- Destruction

Track

- Soil saturation — Loss of mechanical properties — Loss of ballast resistance
- Stagnant water — Damage — Track circuit failure — No access to tracks
- Accumulation of ice on conductor rails and points — Blocked or ruptured tracks
- Projection of obstacles to traffic — Collision
- Creation of obstacles to traffic — Instability — Sinkholes — Destruction

Signalling centre

- Loss of insulation — Sudden re-powering of circuits
- Loss of direct operating capacity
- Structural damage
- Equipment malfunction due to snow
- Equipment malfunction due to sand
- Destruction

Power supply • Cables

- Loss of insulation — Sudden re-powering of circuits
- Loss of direct operating capacity
- Rupture due to tearing out of an overhead line
- Equipment malfunction due to snow
- Equipment malfunction due to sand
- Malfunction — Breakage — Erosion: exposure of buried cables and earthing resistance

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