RCRMS SINGLE ROUTE RISK ANALYSIS

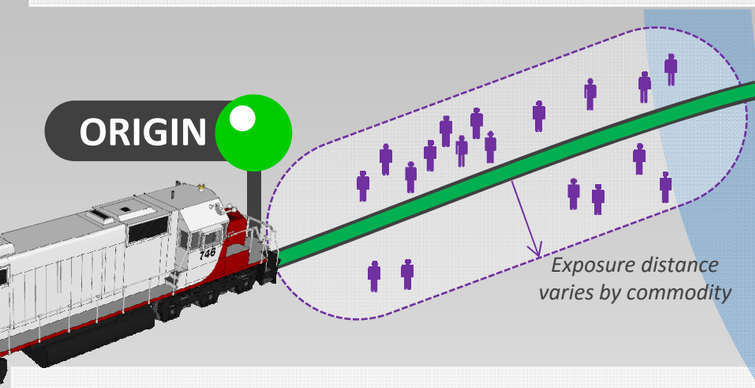
The Rail Corridor Risk Management System (RCRMS) is a government and industry-vetted methodology and geospatial information system that assists short line rail operators with both managing hazardous material commodity flow information and analyzing the safety and security risks of single routes. Rail carriers use this tool to help comply with Pipeline & Hazardous Materials Safety Administration regulations HM-232E and HM-251.

RAILROAD RESEARCH FOUNDATION

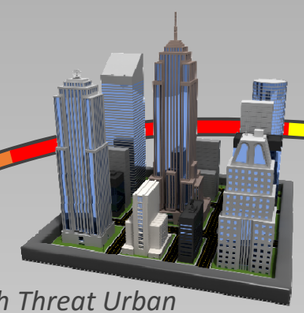
1 PROVIDE SIMPLE INPUTS

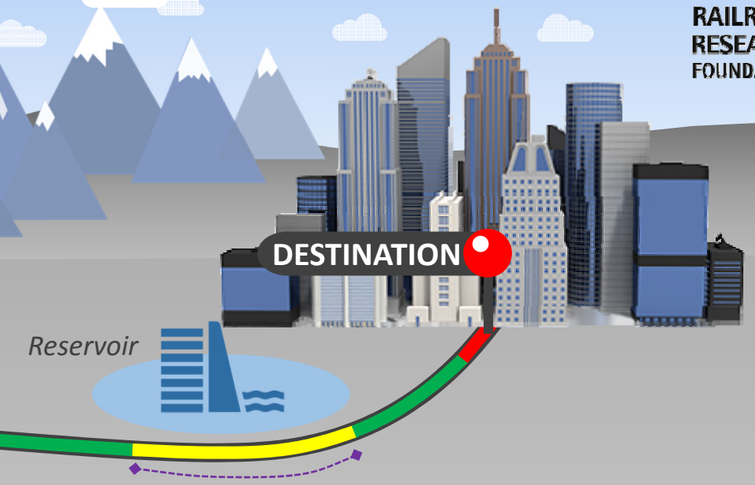
Set up a one-route analysis by following these 3 easy steps:

1. Specify an origin & destination
2. Select a commodity, container type, & enter annual flow
3. Review/update operating speeds & track characteristics



POPULATION EXPOSURE ESTIMATE
Population potentially affected based on chemical properties and census data



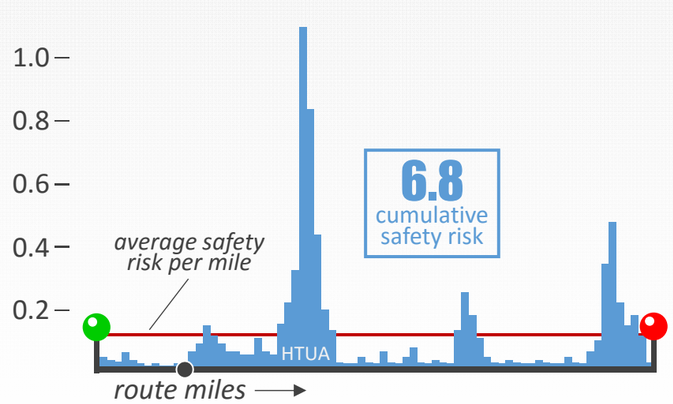


ENVIRONMENTAL EXPOSURE ESTIMATE
Measure of track miles within 0.1 miles of environmentally sensitive areas

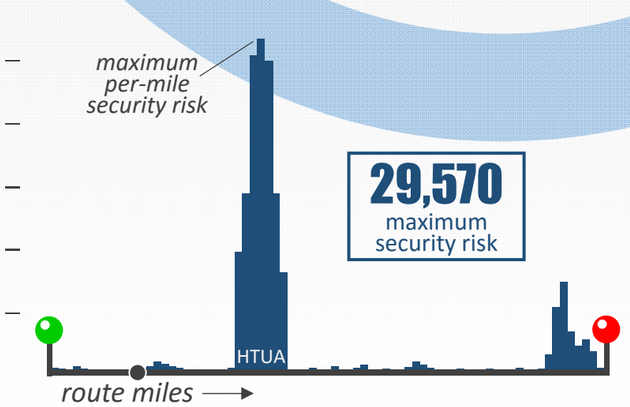
2 RUN QUANTITATIVE ROUTE RISK ANALYSIS

Calculate safety and security risk scores and review per mile risk profiles.

SAFETY RISK PROFILE



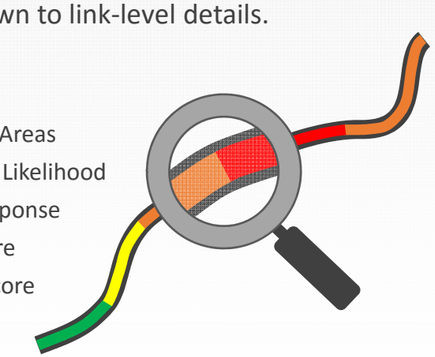
SECURITY RISK PROFILE



3 REVIEW ROUTE RISK DETAILS

Review route characteristics and drill down to link-level details.

- Route Description
- Switching Stations
- Link Description
- Track Information
- Accident Rate
- Operating Speed
- Signals
- Grade Crossings
- Iconic Targets
- Population
- Environmental Areas
- Natural Hazard Likelihood
- Emergency Response
- Safety Risk Score
- Security Risk Score



4 MANAGE RISK

- Make practical risk management decisions
- Comply with government risk analysis requirements

REPORTS ALL **27** risk factors

Low — High
LINK RISK

SWITCHYARD

RCRMS COMPARATIVE ROUTE RISK ANALYSIS

The Rail Corridor Risk Management System (RCRMS) is a government and industry-vetted methodology and geospatial information system that assists rail operators with both managing hazardous material commodity flow information and analyzing the safety and security risks of routes. Rail carriers use this tool to help comply with Pipeline & Hazardous Materials Safety Administration regulations HM-232E and HM-251.

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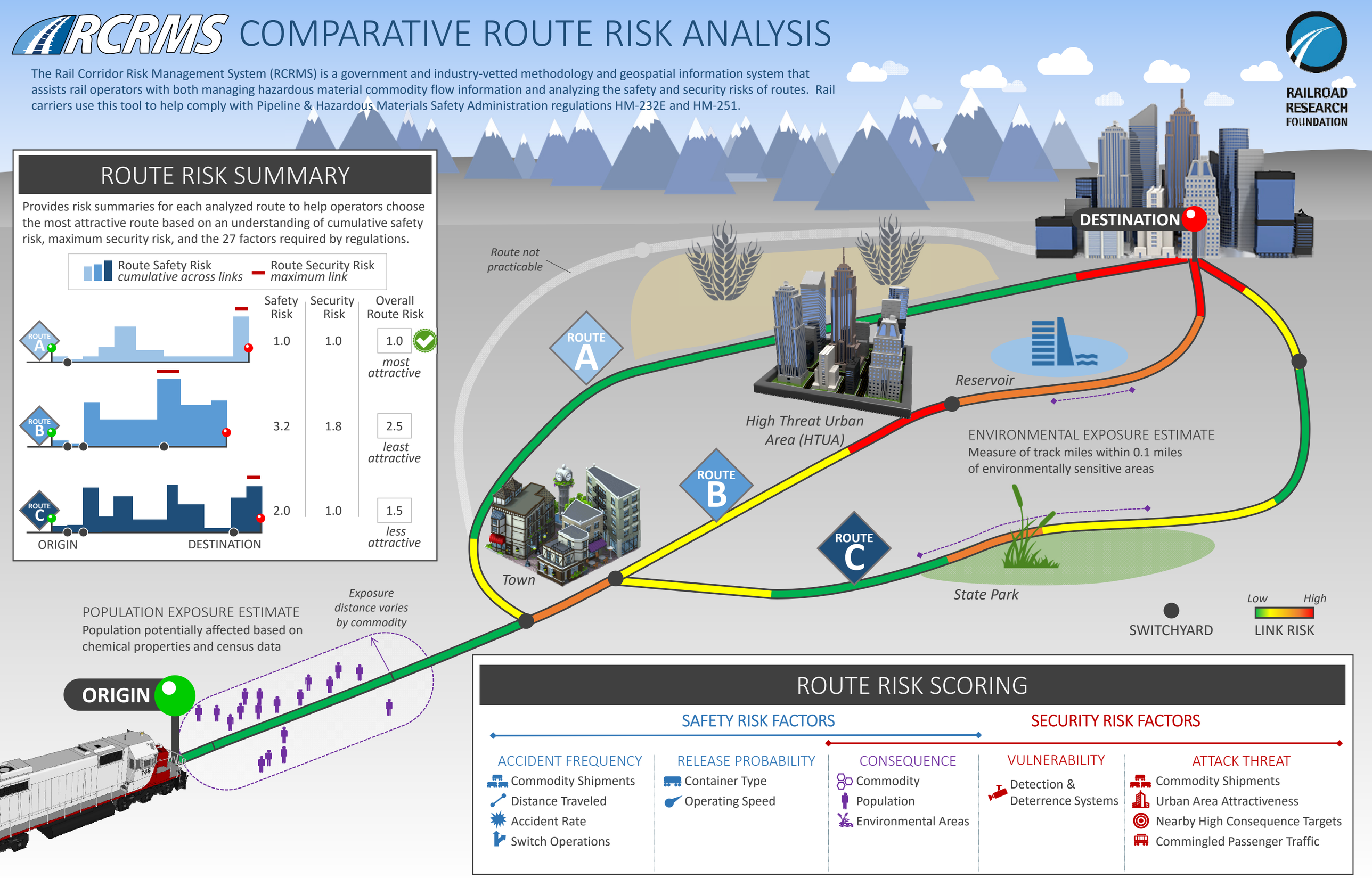
ROUTE RISK SUMMARY

Provides risk summaries for each analyzed route to help operators choose the most attractive route based on an understanding of cumulative safety risk, maximum security risk, and the 27 factors required by regulations.

Route Safety Risk *cumulative across links* — Route Security Risk *maximum link*

	Safety Risk	Security Risk	Overall Route Risk
ROUTE A	1.0	1.0	1.0 *most attractive*
ROUTE B	3.2	1.8	2.5 *least attractive*
ROUTE C	2.0	1.0	1.5 *less attractive*



ROUTE RISK SCORING

SAFETY RISK FACTORS

ACCIDENT FREQUENCY
- Commodity Shipments
- Distance Traveled
- Accident Rate
- Switch Operations

RELEASE PROBABILITY
- Container Type
- Operating Speed

SECURITY RISK FACTORS

CONSEQUENCE
- Commodity
- Population
- Environmental Areas

VULNERABILITY
- Detection & Deterrence Systems

ATTACK THREAT
- Commodity Shipments
- Urban Area Attractiveness
- Nearby High Consequence Targets
- Commingled Passenger Traffic

RCRMS RISK CALCULATIONS

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RCRMS calculates safety, security, and overall route risk scores for chemical rail transport. Risk scoring allows analysts to understand single-route risk and compare risks among commercially-viable alternative routes for a specific commodity.

SAFETY FREQUENCY FACTORS

Calculates the safety risk for each link and then sums all of the route's link and switching risks.

LINK FACTORS

COMMODITY SHIPMENTS
Commodity flow (# of railcars) *Higher traffic volume = higher accident exposure*

DISTANCE TRAVELLED
Track miles *More distance = higher accident exposure*

MAINLINE ACCIDENT RATE
Accidents by carrier & link *Based on track class, signals, train control systems, & traffic density*

RELEASE PROBABILITY FACTORS

CONTAINER TYPE
Probability of chemical release based tank car construction *More robust railcars =lower probability of railcar breach & chemical release*

OPERATING SPEED
Probability of chemical release based on speed *Higher train speeds = higher probability of railcar breach & chemical release*

SWITCHING FACTORS

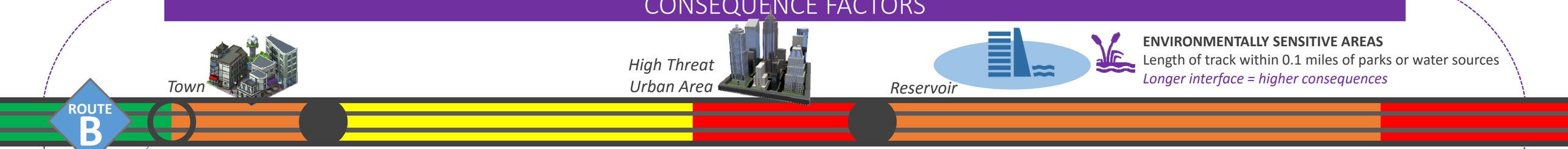
SWITCH ACCIDENT RATE
Accidents per switching operation *Higher accident rates = higher frequency of accidents*

SWITCH OPERATIONS
Annual number of switching operations *More switching operations = higher accident exposure*

LINK ACCIDENT FREQUENCY | RELEASE PROBABILITY | CONSEQUENCE | SWITCHING ACCIDENT FREQUENCY | RELEASE PROBABILITY | CONSEQUENCE

Safety Risk = Sum of [(x x) x f(,) x (+)] + Sum of [(x) x f(,) x (+)]

CONSEQUENCE FACTORS



ENVIRONMENTALLY SENSITIVE AREAS
Length of track within 0.1 miles of parks or water sources
Longer interface = higher consequences

COMMODITY EXPOSURE
Size of exposure zone based on Emergency Response Guidebook for each commodity
Considers toxicity, flammability, explosivity, and water reactivity

ROUTE-SPECIFIC YARD OPERATIONS
● Switching ○ No Switching
Consequence for switching operations only calculated where car switches trains

POPULATION
Maximum number of people within exposure zone
Considers maximum of daytime & nighttime populations

ATTACK THREAT & VULNERABILITY FACTORS

Calculates security risk for each link and the maximum value of any link represents the route's security risk.

THREAT FACTORS

COMMODITY TRAFFIC VOLUME
Annual number of chemical railcars on the link
High volume = higher availability for attack

URBAN AREA ATTRACTIVENESS
Each urban areas adjacent to the link is categorized as:
- High threat urban area (HTUA) *Highest Threat*
- Urban area
- Non-urban area *Lowest Threat*

NEARBY HIGH CONSEQUENCE TARGETS
Number of high consequence targets within 1 mile of the link
Absence of targets reduces area attractiveness

COMMINGLED PASSENGER TRAFFIC
Number of passenger trains per day using the link *Presence of passenger trains increases area attractiveness*

VULNERABILITY FACTOR

DETECTION & DETERRENCE SYSTEMS
Measures to reduce vulnerability of attacks
Vulnerability reduction for areas with specific detection & deterrence systems

THREAT | VULNERABILITY | CONSEQUENCE

Security Risk = Maximum of [f(, , ,) x ( ) x (+)]