# Ambush Avoidance

W is the weight of each category

1. **Strategic Importance:**   
   How significance is the road that the bridge is part of?  
   Major highways, for example, can be considered more strategically important. In OSM data, roads are classified into types (e.g., motorway, trunk, primary, secondary, etc). Assign a numerical score to each road type indicating its strategic importance (higher for more significant roads).

NBI has data for number of bridge lanes, bridge length, traffic intensity.

Mathematically, this could be represented as:

Strategic Importance Score = W \* RoadTypeScore

1. **Alternatives (Possibly expensive):**   
   How many alternate routes are there within a certain radius?   
   By calculating the Euclidean distance (straight-line distance) between each pair of bridges and count how many are within a certain distance.

Mathematically, this could be represented as:

Alternative Score = W / (1 + NumberOfNearbyBridges)

Gives a higher score (indicating higher risk) to bridges with fewer nearby alternatives.

– Worse time using loops  
 – Best time using queries and spatial data structures (KD-Tree or R-Tree)

Isochrone and Isodistance in Valhalla  
 Specify time or distance.

1. **Convoy Suitability:**   
   Is the bridge suitable for the convoy due to weight or size limitations? Pretty self-explanatory. Options are separate stats (weight, length, etc) or a universal MLC

Mathematically, this could be represented as:

Suitability Score = W1 \* abs(ConvoyWeight - BridgeWeightLimit) + W2 \* abs(ConvoySize - BridgeSizeLimit)

W is separated out into W1 and W2 in case size importance differs from weight importance

1. **Bridge Size (Might not needed due to nature of “game”):**   
   How long is the bridge? Is this data available in the NBI data? Otherwise, calculate it using curvature of the earth formula. Longer bridges can be considered to pose a higher risk.

Mathematically, this could be represented as:

Size Score = W \* BridgeLength

1. **Time To Cross? (Might not needed due to nature of “game”):**   
   Can the convoy pass the bridge in a short amount of time? Length of bridge, speed limit data of the bridge, and max speed of convoy is needed.

Mathematically, this could be represented as:

Time To Cross Score = W \* (Bridge Length / Convoy Speed)

The overall risk score for a bridge could then be the sum of these four scores:

Risk Score = Strategic Importance Score + Alternative Score + Size Score + Suitability Score + Time To Cross Score

# Node Network

* Random Sampling + Delaunay Triangulation
  + Random Sampling not well suited for this type of planning as routes don’t avoid dangerous areas
* Uniform Sampling + 8-connected grid
  + Most accurate and computationally expensive
  + Combine this with selecting highway roads to reduce expensive nature.
* Uniform Sampling + Delaunay Triangulation​
  + A mix of efficient and accurate (jack of all trades)

**App:**

**Look into new pathfinding (instead of Valhalla)**

**Osm-redis-processor (pre-load osm data to DB for faster retrieval)**

Current goal: Grade different routes based on criteria

Next step, start thinking about intelligent attacker:

1. How likely is the attacker to take out a specific bridge.
2. What would an attacker think when looking at this information and how would you respond?

**Thesis:**

Why did we choose these 4 criteria and why did we weight them as we did?

Good introduction

Good theoretical background

10 sources

Explain half of what you have done and what you are going to do.

Results – How will I verify what I done (and how will I know when it’s done)