

ASSESSING AND MINIMIZING PEDESTIRANS' EXPOSURE TO TRAFFIC NOISE WITH SPATIAL ANALYSIS AND WEB GIS:

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Working title

Preliminary methods & results

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QUIET PATH OPTIMIZATION

QUIET PATH OPTIMIZATION

- Shortest path is not always the least cost path
- Dijkstra's algorithm for route optimization
 - Utilizes graph theory: nodes connected by edges
 - Finds the least cost path between two nodes by edge costs
 - If edge cost = length => least cost path = shortest path
 - However, edge cost can be any (numeric) attribute
 - Here, edge cost should also consider traffic noise

CALCULATING ADJUSTED EDGE COSTS

$$C_e = d_e + C_{en}$$

C_e = total edge cost

d_e = length of the edge (m)

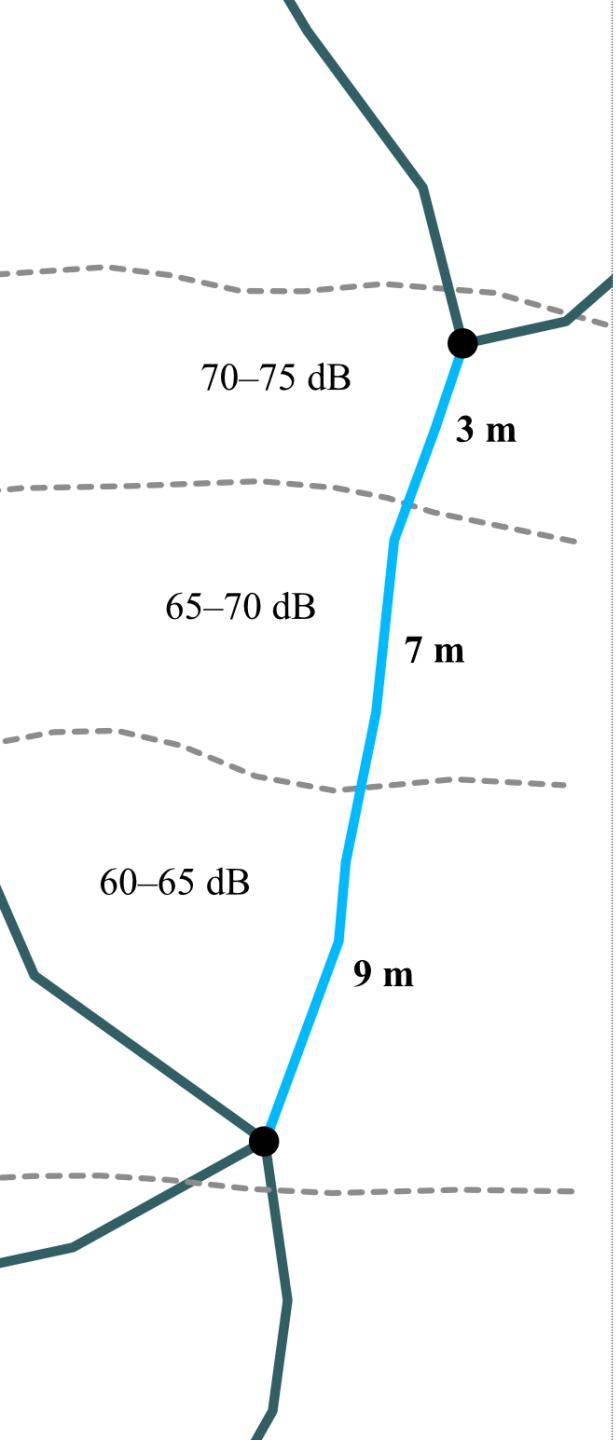
C_{en} = additional noise cost of the edge:

$$C_{en} = \left(\sum_{i=db_{min}}^{db_{max}} d_{dB_i} \times a_{dB_i} \right) \times nt$$

d_{dB_i} = contaminated distance of D_B (e.g. 14 m of 65 dB)

a_{dB_i} = dB-specific noise cost coefficient (between 0.0–1.0)

nt = “personal” noise tolerance coefficient (between e.g. 0.1–20.0)

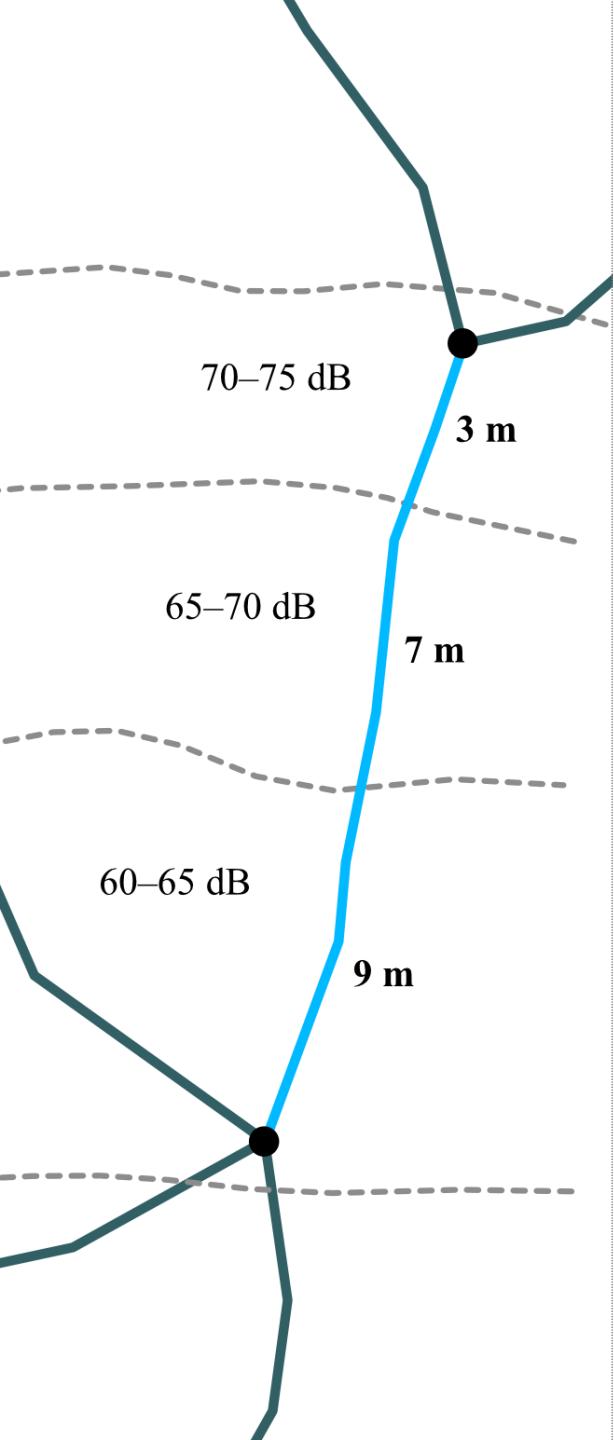


$$C_e = \text{total edge cost} = d_e + C_{en}$$

$$d_e = 3 \text{ m} + 7 \text{ m} + 9 \text{ m} = 19 \text{ m}$$

$$\begin{aligned}
 C_{en} &= \left(\sum_{i=db_{min}}^{db_{max}} d_{dB_i} \times a_{dB_i} \right) \times nt \\
 &= (3 \times 0.4 + 7 \times 0.3 + 9 \times 0.2) \times nt \\
 &= 5.1 \times nt
 \end{aligned}$$

dB	Noise coefficient (a_{dB_i})
45–50	0.0
50–55	0.1
55–60	0.2
60–65	0.3
65–70	0.4
70–75	0.5
75–80	0.6



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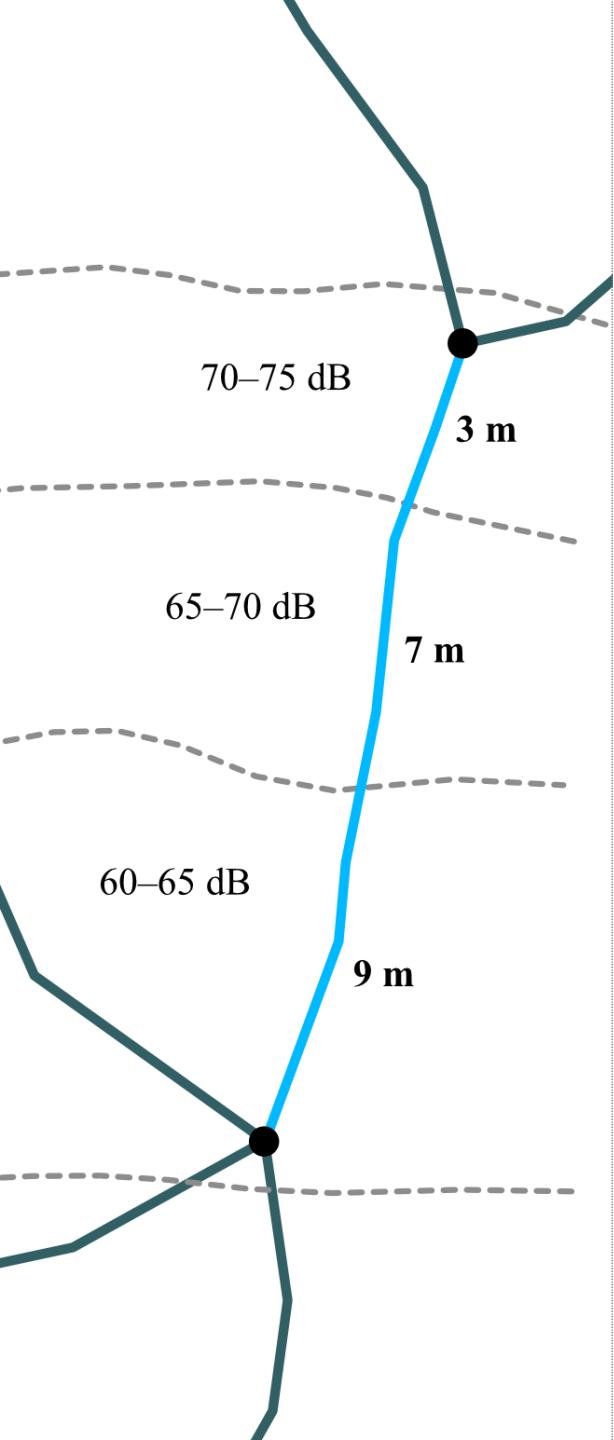
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$$\begin{aligned} C_e &= d_e + C_{en} \\ &= 19 + 5.1 \times nt \end{aligned}$$

What nt ?

e.g. 0.1, 0.15, 0.25, 0.5, 1.0, 1.5, 2.0, 4.0, etc.



QUIET PATH OPTIMIZATION

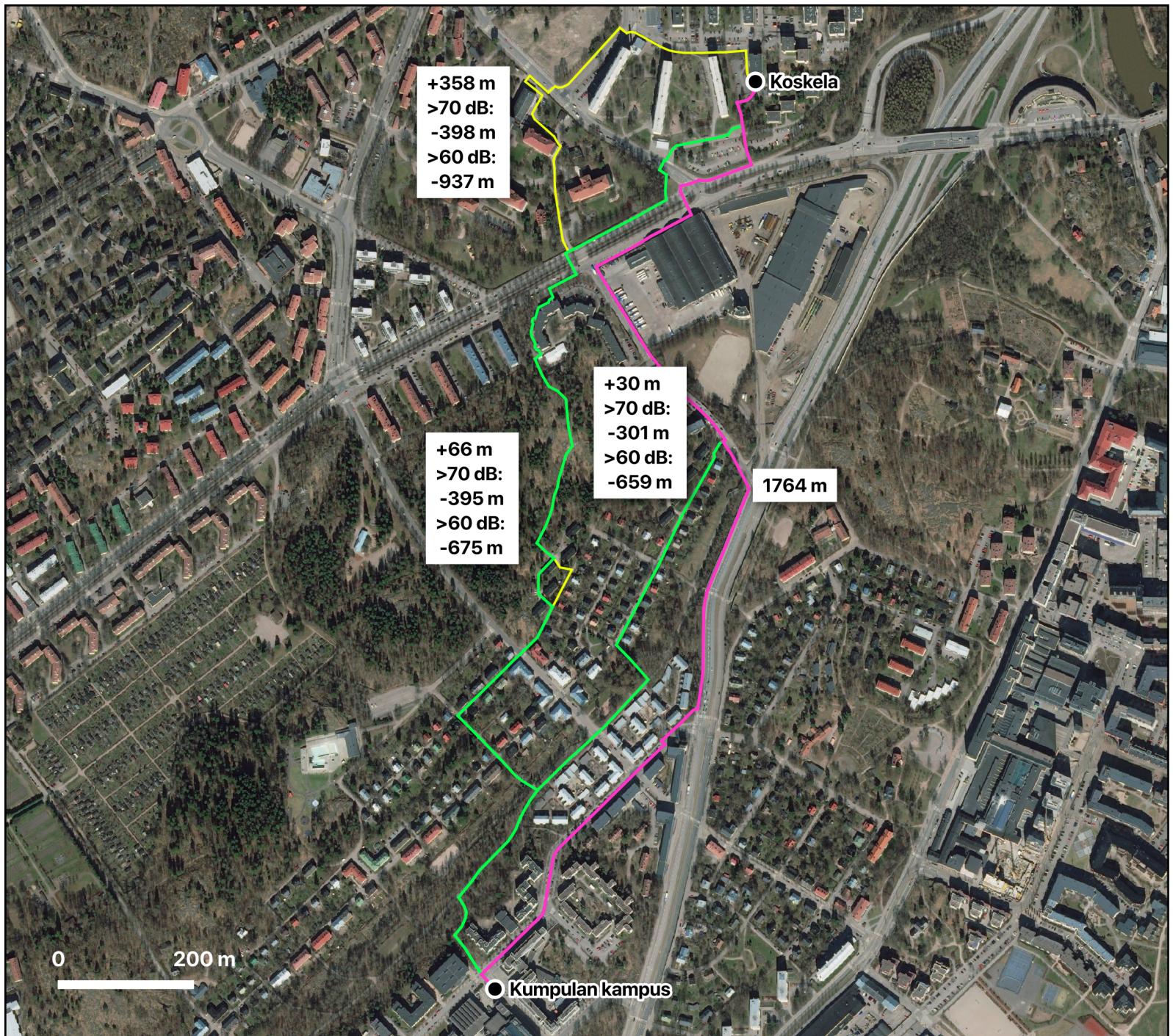
- Several alternative (quiet) paths are calculated with different edge costs per quiet path optimization problem
- Alternative edge costs are calculated with systematically altering nt
 - $C_{en} = (\sum_{i=dB_{min}}^{dB_{max}} d_{dB_i} \times a_{dB_i}) \times nt$
 - E.g. 0.1, 0.15, 0.25, 0.5, 1.0, 1.5, 2.0, 4.0, etc.
- Alternative paths should be compared with respect to:
 - 1) Difference in exposures to high traffic noise levels (m)
 - 2) Difference in total distance of the paths (m)

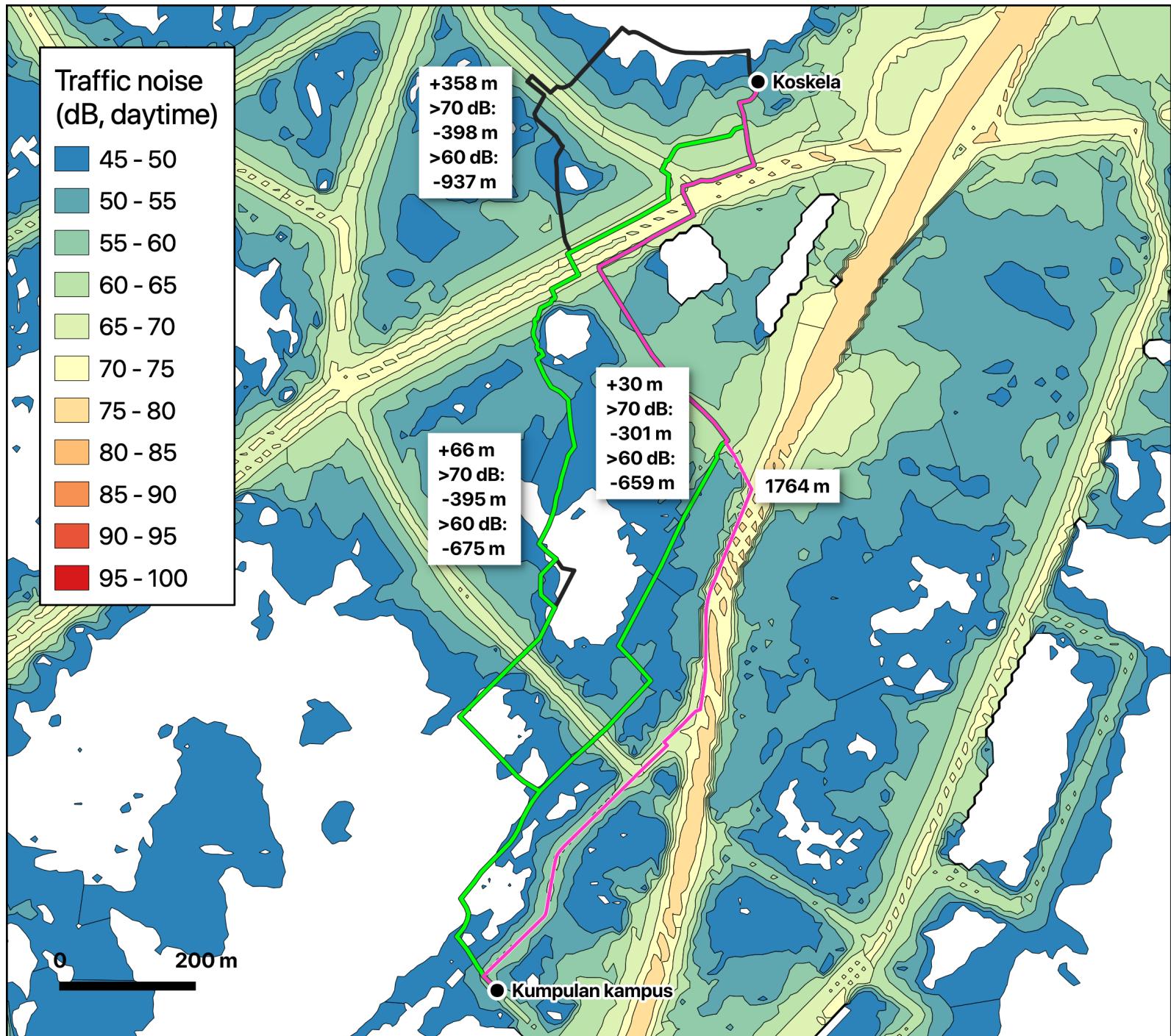
WHAT IS THE BEST PATH ?

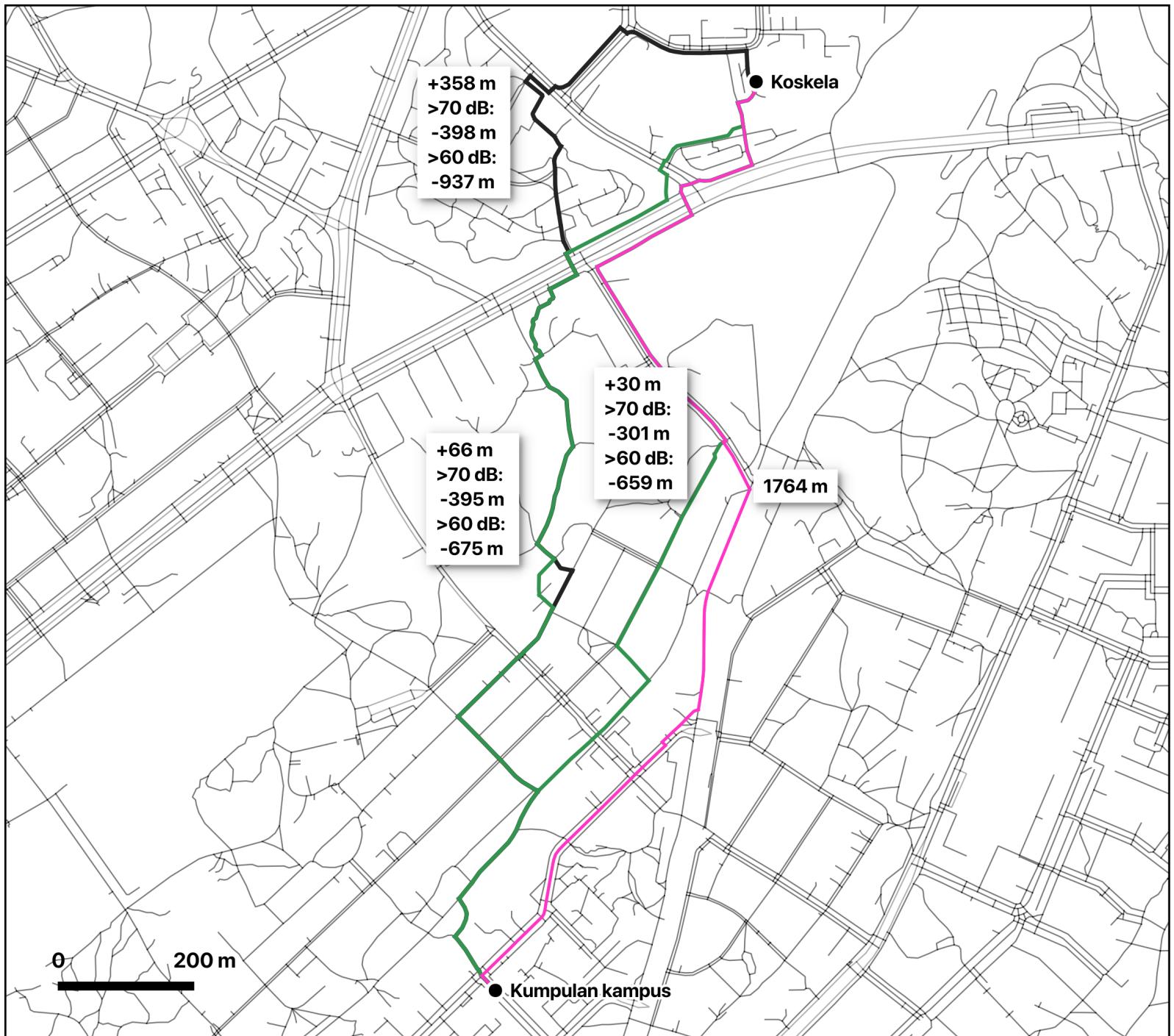
Type	<i>nt</i>	Length (m)	Length diff (m)	Length diff (%)	Diff. >60 dB (m)	Diff. >70 dB (m)
short	0	1764	0	0	0	0
quiet	0,15–0,50	1794	+30	+1,7	-659	-302
quiet	1,00–2,00	1830	+66	+3,7	-675	-395
quiet	4,00–6,00	2123	+358	+20,3	-937	-398

WHAT IS THE BEST PATH ?

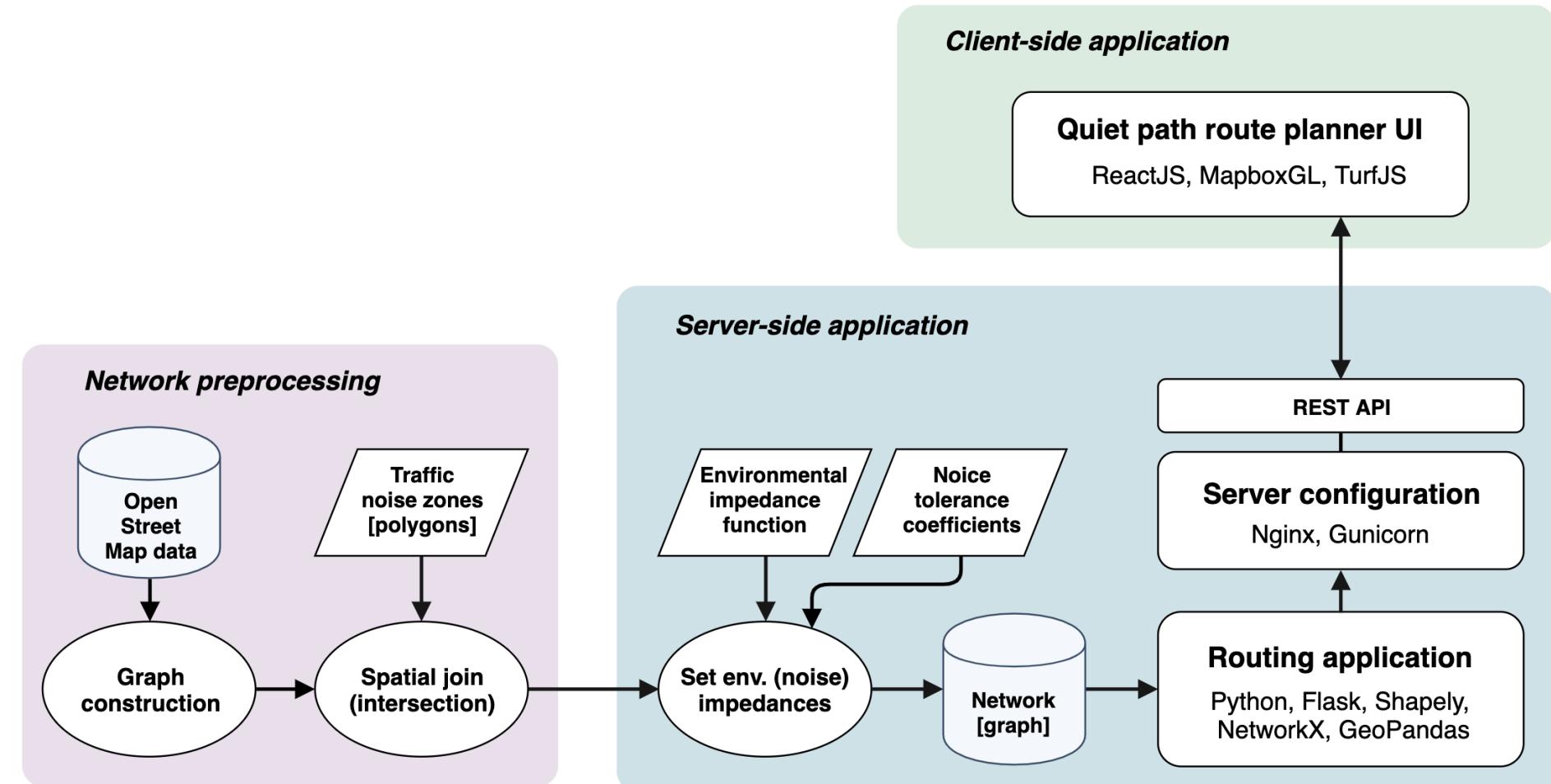
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QUIET PATH PLANNER – WEB APPLICATION



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