ASSESSING PEDESTIRANS' EXPOSURE TO TRAFFIC NOISE WITH SPATIAL ANALYSIS:

THE EFFECTS OF ROUTE CHOICE AND HOME LOCATION

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Working title

Preliminary methods & results

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QUIET PATH ROUTE OPTIMIZATION
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QUIET PATH

- Shortest path ≠ least cost path
- Dijkstra's algorithm for route optimization
  - Utilizes graph theory:
    networks (graphs) of nodes & edges
  - Finds the least cost path between two nodes with respect to 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)

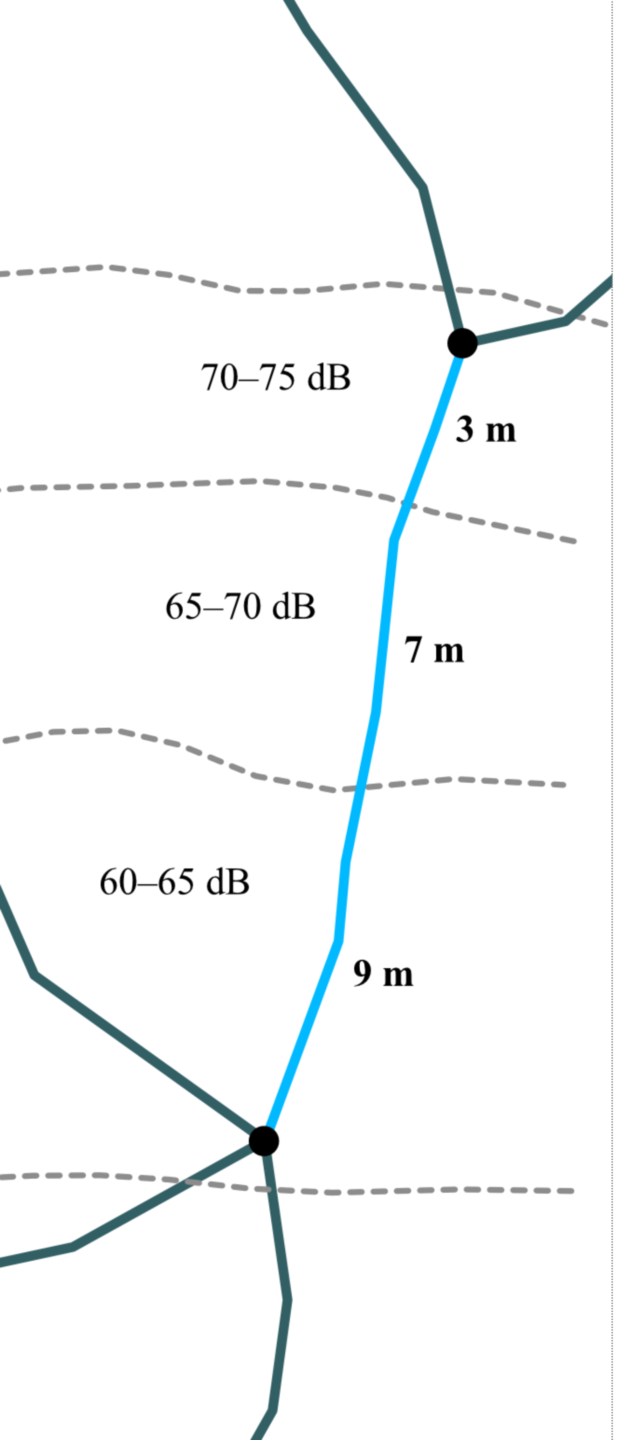
C_{en} = additional noise cost of the edge:

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

d_{dB_i} = contaminated distance of dB_i (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. 0.1–4.0)



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

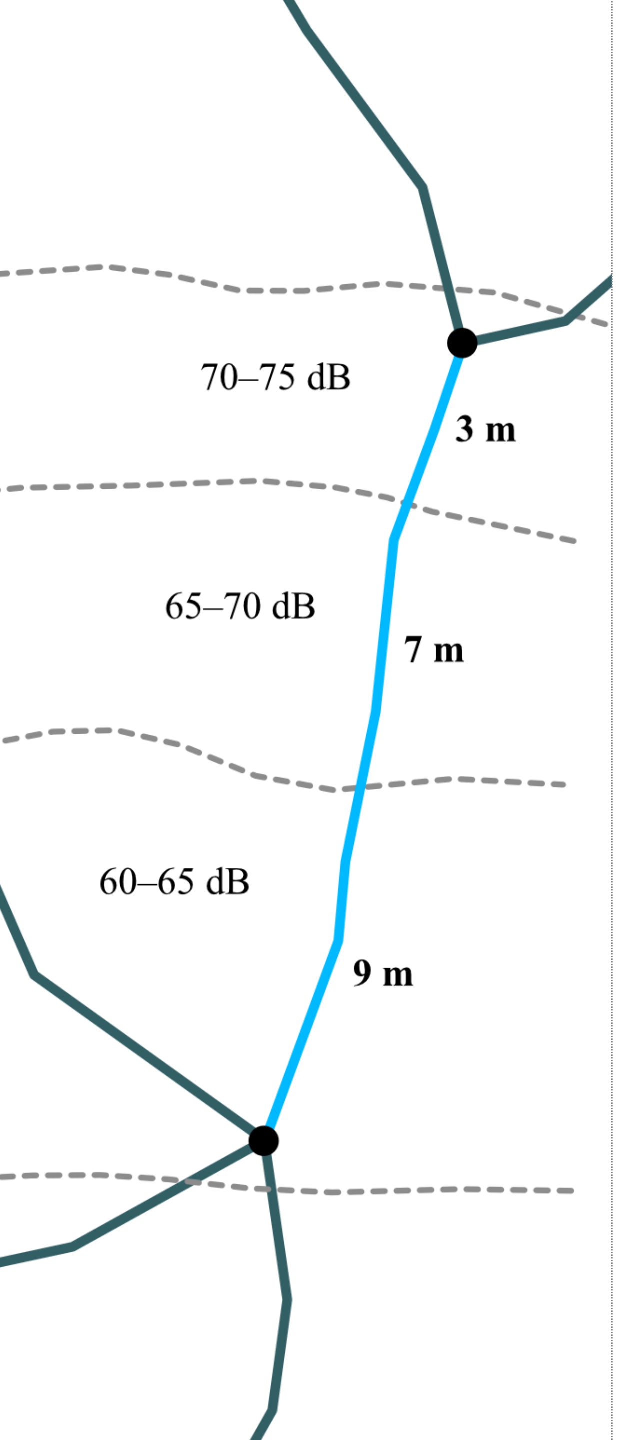
$$d_e = 3\text{ m} + 7\text{ m} + 9\text{ m} = 19\text{ m}$$

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

$$= (\, 3 \times 0.4 \; + 7 \times 0.3 \; + 9 \times 0.2 \,) \times nt$$

$$= 16.1 \times nt$$

dB	Noise coefficient (a_{dB_i})
45–50	0.0
50–55	0.05
55–60	0.1
60–65	0.2
65–70	0.3
70–75	0.4
75–80	0.6



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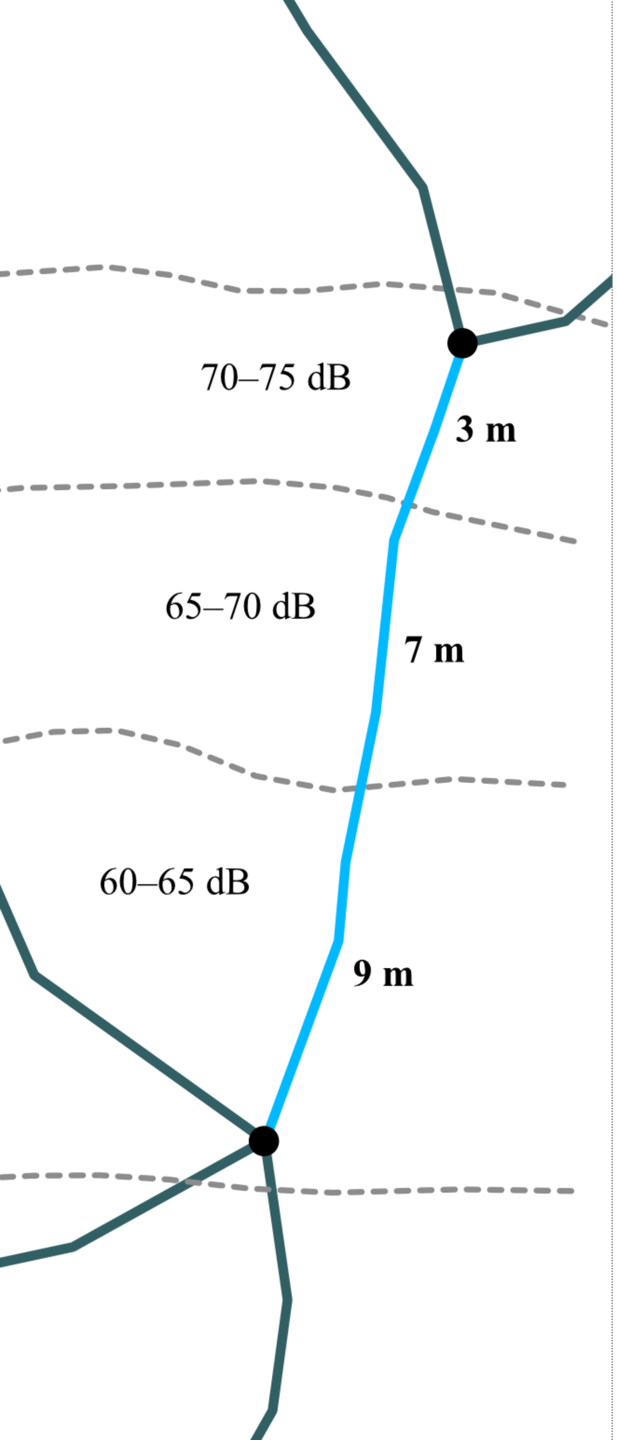
$$= 16.1 \times nt$$

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

$$= 19 + 16.1 \times nt$$

What *nt* ?

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



QUIET PATH ROUTING

- For one routing problem, many alternative (quiet) paths are calculated with different edge costs
- Parallel edge costs are calculated with systematically altering *nt*
  - $C_{en} = \left(\sum_{i=dB_{min}}^{dB_{max}} d_{dB_i} \times a_{dB_i} \right) \times nt$
  - 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	*nt*	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	1794	+30	+1,7	−659	−302
quiet	1,5	1830	+66	+3,7	−675	−395
quiet	6	2123	+358	+20,3	−937	−398

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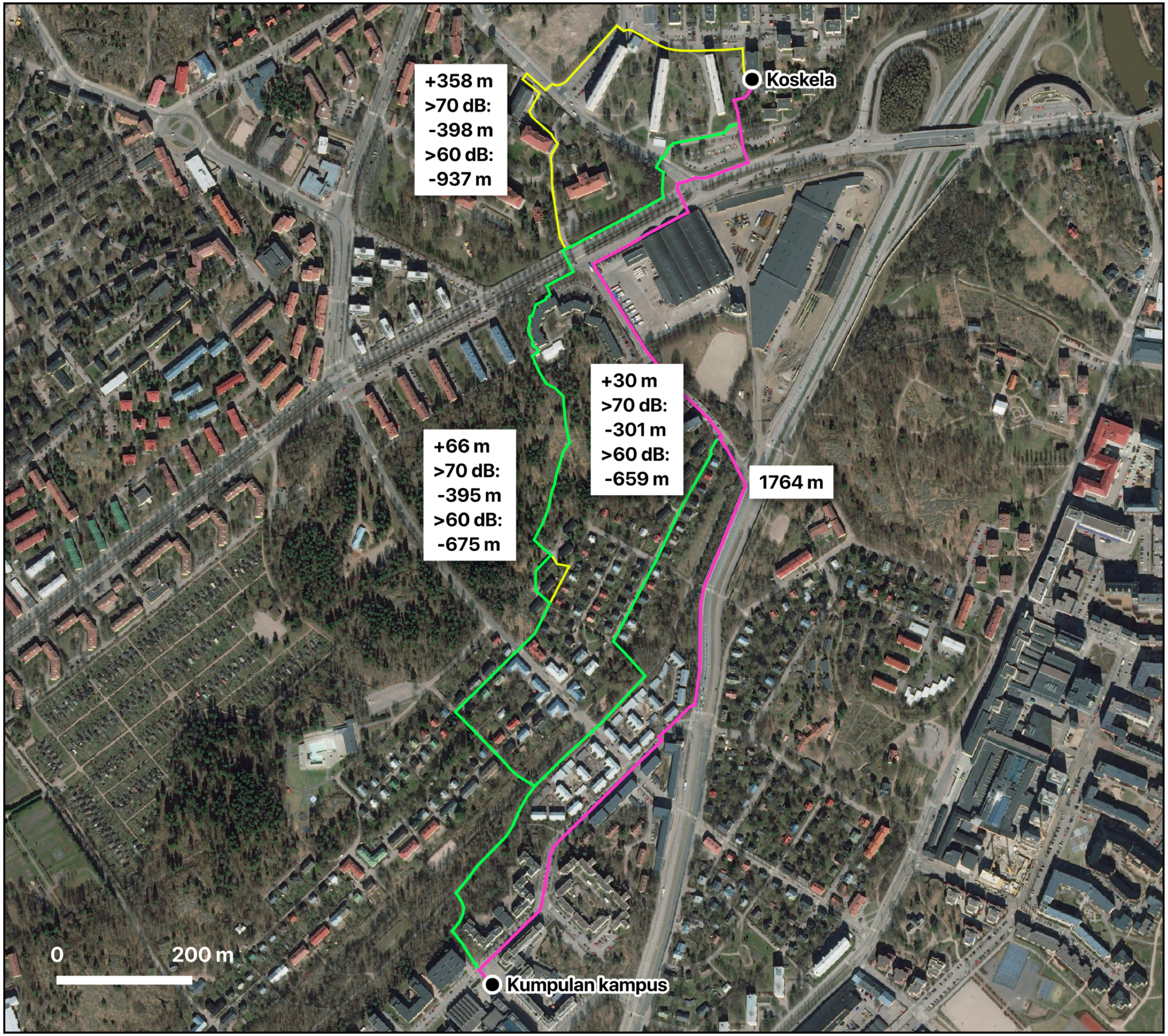
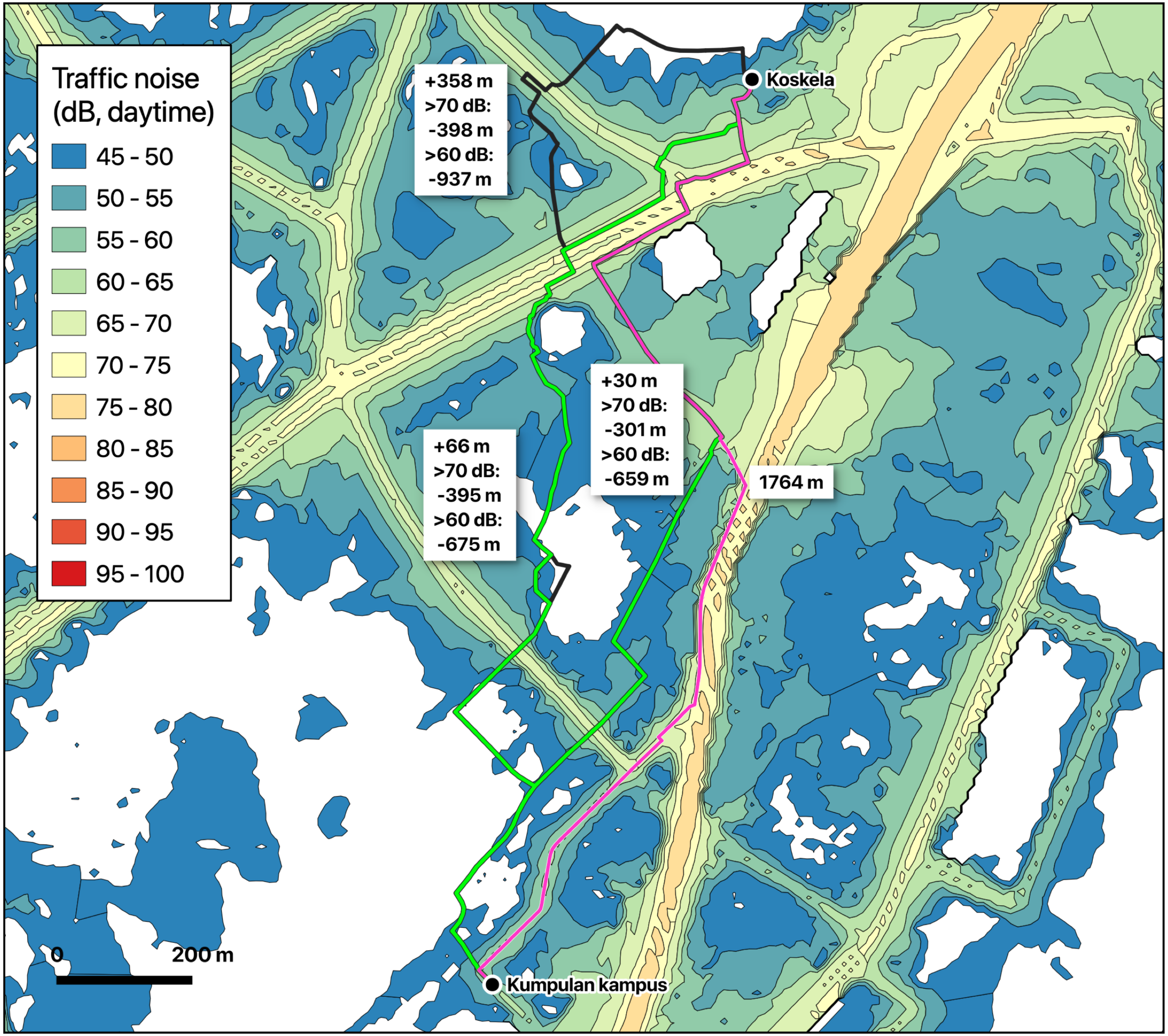
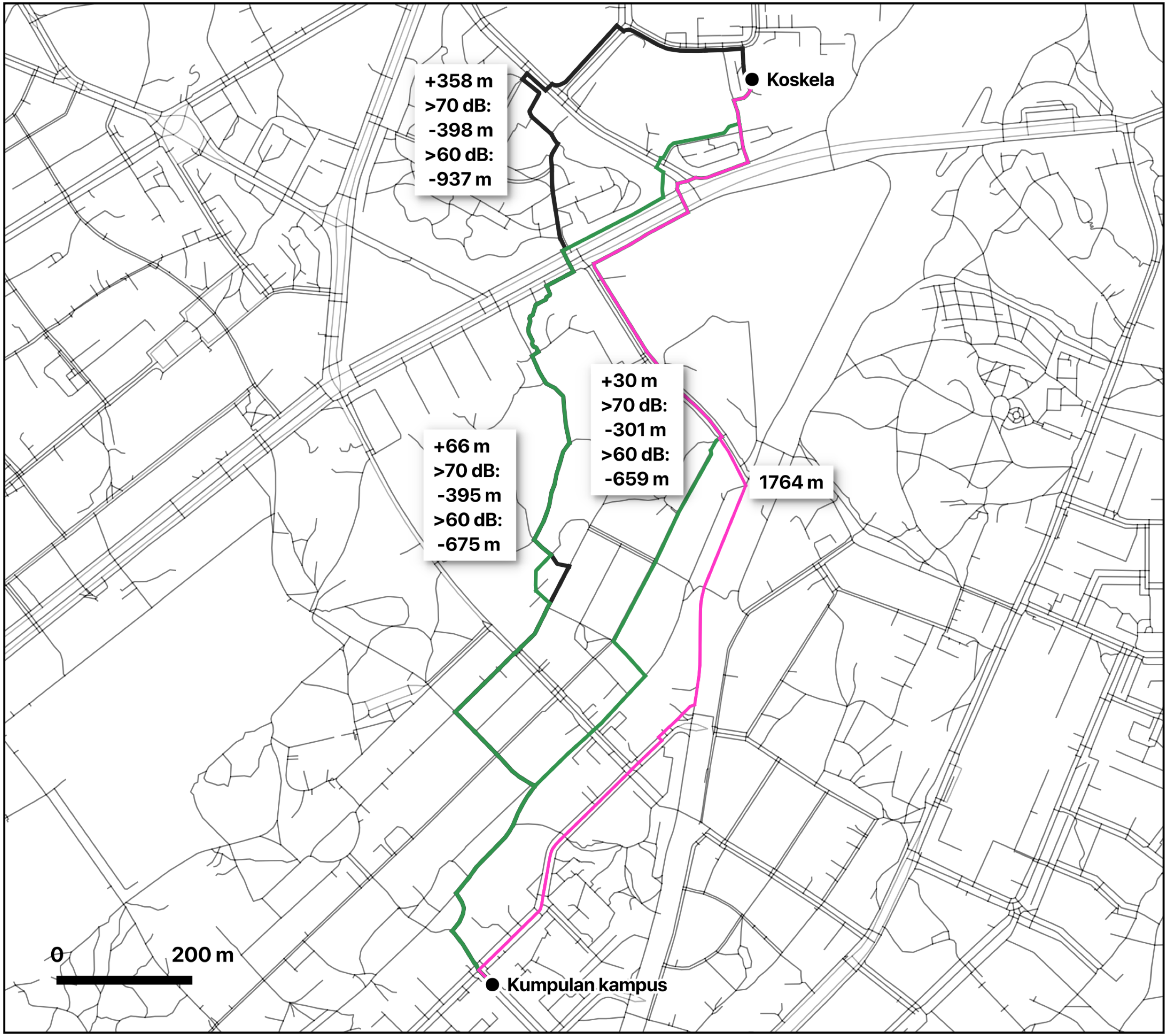

Koskela
+358 m
>70 dB:
-398 m
>60 dB:
-937 m
+30 m
>70 dB:
-301 m
>60 dB:
-659 m
1764 m
+66 m
>70 dB:
-395 m
>60 dB:
-675 m
0
200 m
Kumpulan kampus


Traffic noise (dB, daytime)
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
75 - 80
80 - 85
85 - 90
90 - 95
95 - 100
+358 m >70 dB: -398 m >60 dB: -937 m
Koskela
+30 m >70 dB: -301 m >60 dB: -659 m
+66 m >70 dB: -395 m >60 dB: -675 m
1764 m
0 200 m
Kumpulan kampus



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