# 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

# 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)

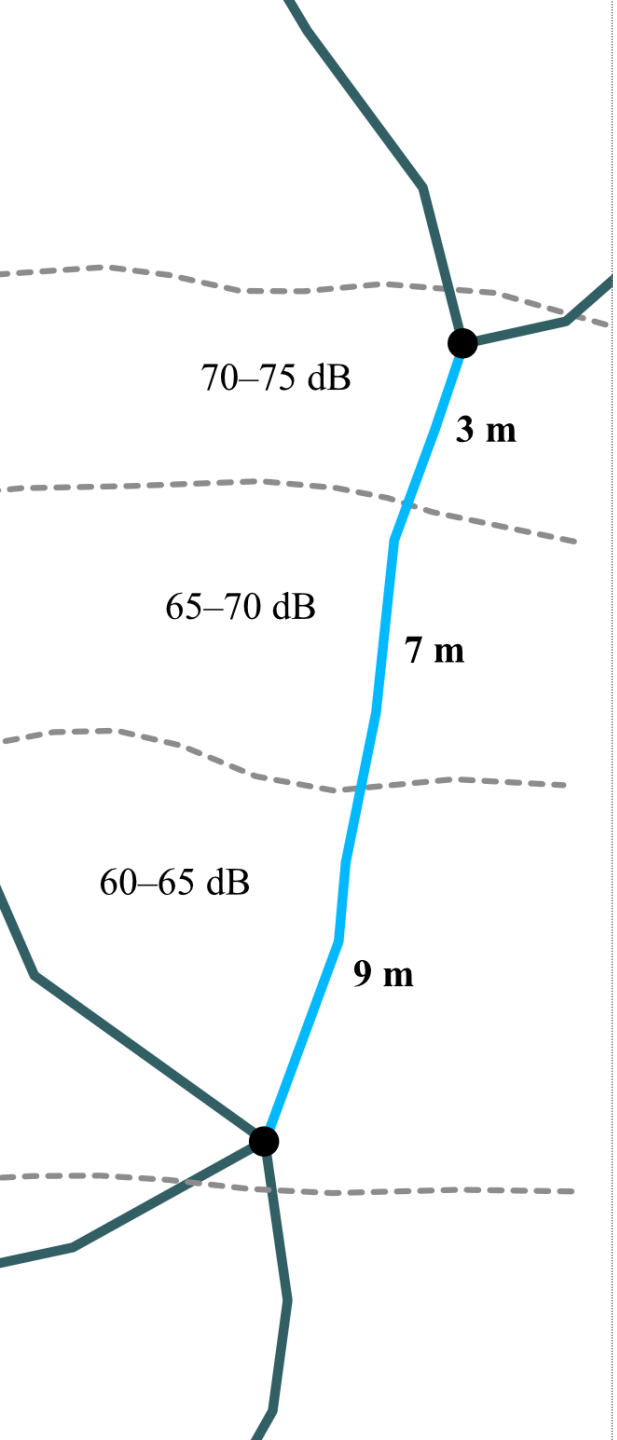
$C_{en}$ = additional noise cost of the edge:

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

$d_{dB_i}$ = 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)




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

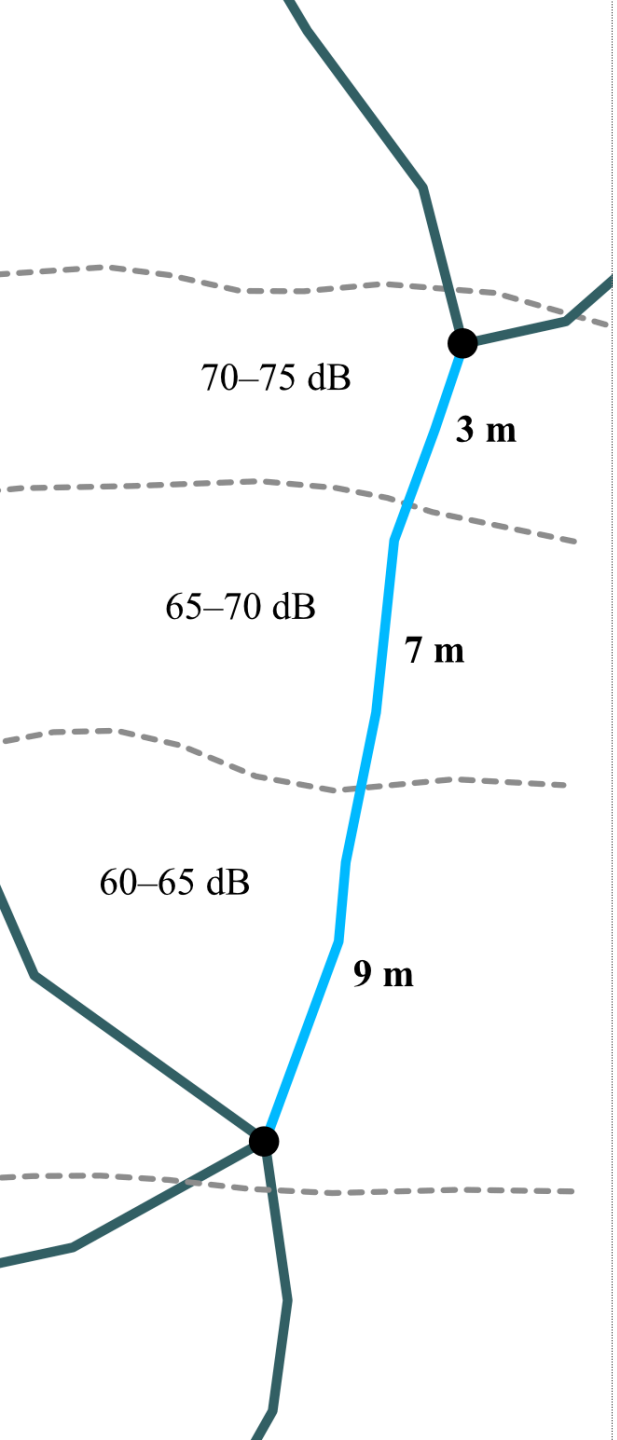
$$d_e = 3\text{ m} + 7\text{ m} + 9\text{ m} = 19\text{ m}$$

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

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

$$= 5.1 \times nt$$

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

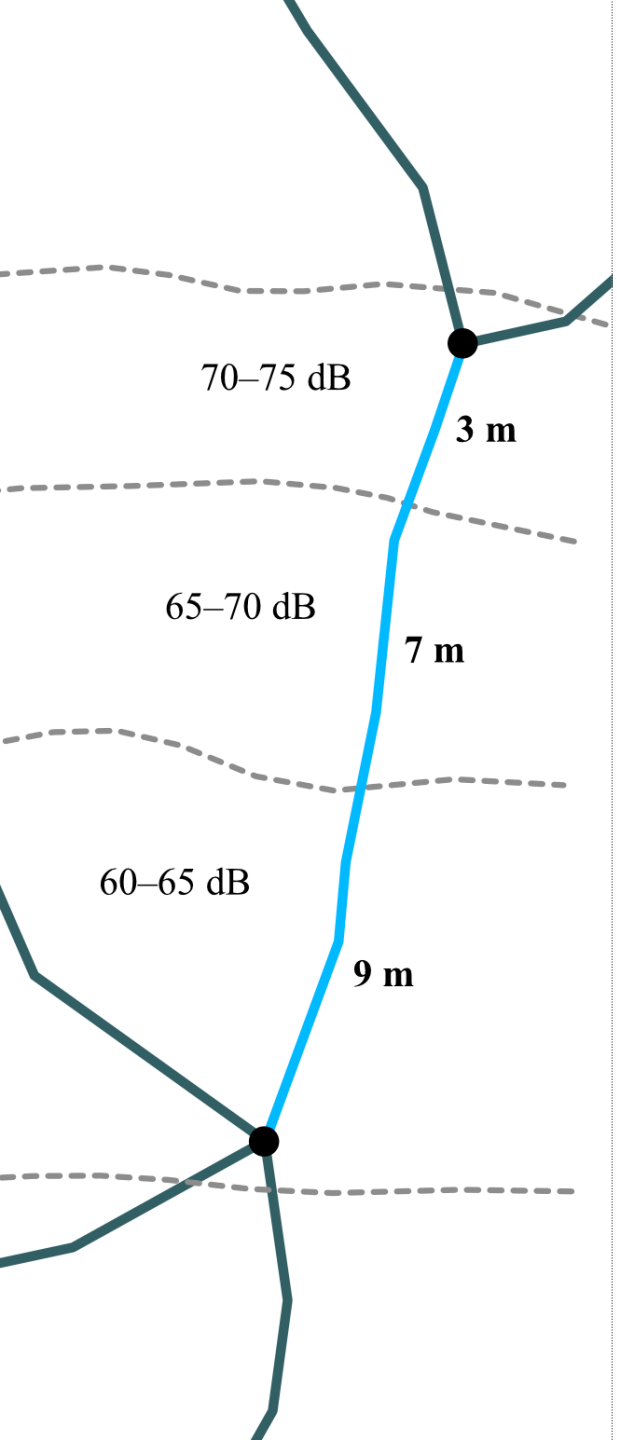
$$= 5.1 \times nt$$

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

$$= 19 + 5.1 \times nt$$

**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*
  - $C_{en} = (\sum_{i=dB_{min}}^{dB_{max}} d_{dB_i} \times a_{dB_i}) \times nt$
  - 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 | *nt* | Length (m) | Length diff (m) | Length diff (%) | Diff. >60 dB (m) | Diff. >70 dB (m) |
|---|---|---|---|---|---|---|
| short | 0 | 1764 | 0 | 0 | 0 | 0 |
| quiet | 0,15–0,50 | 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 |

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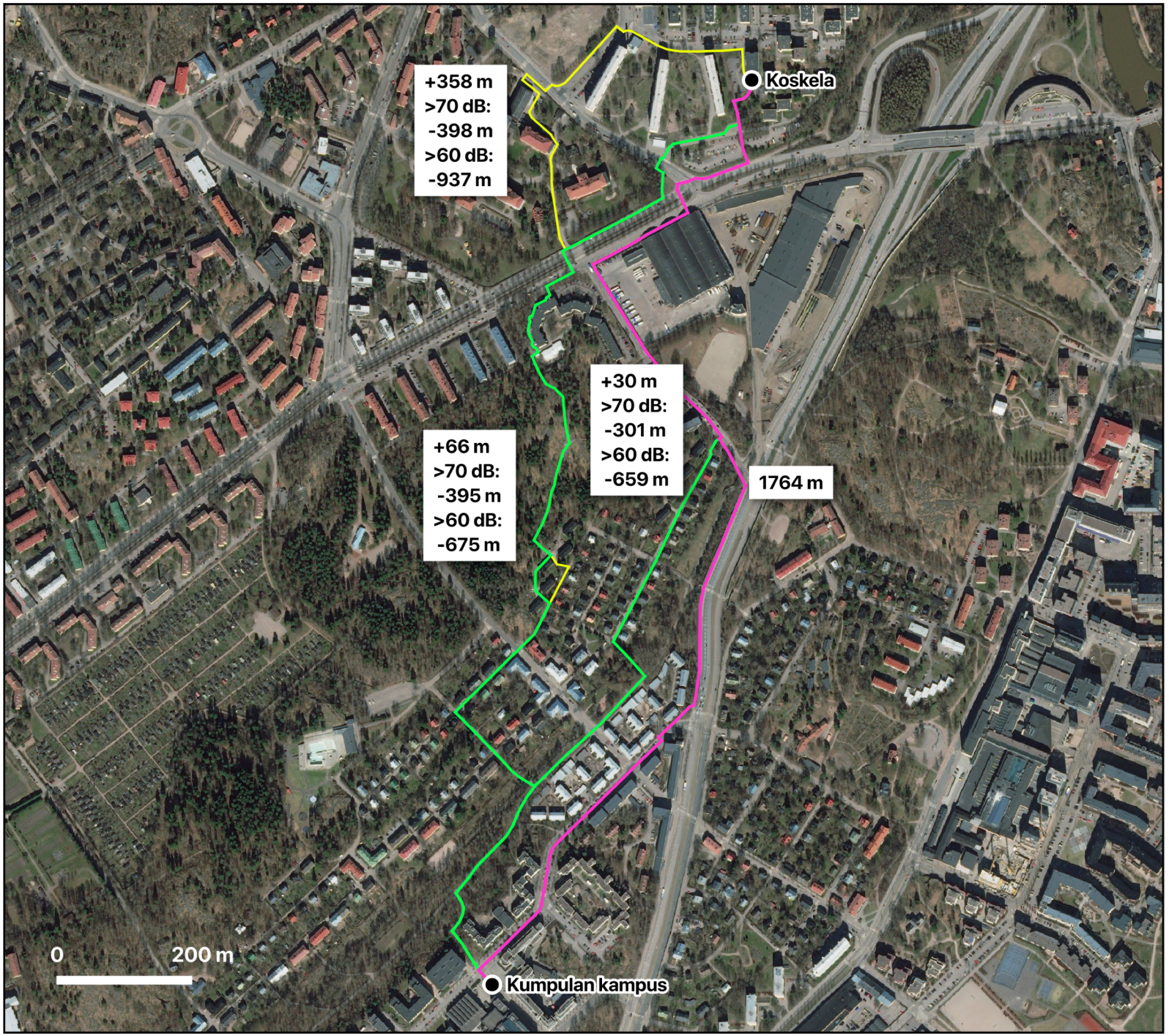
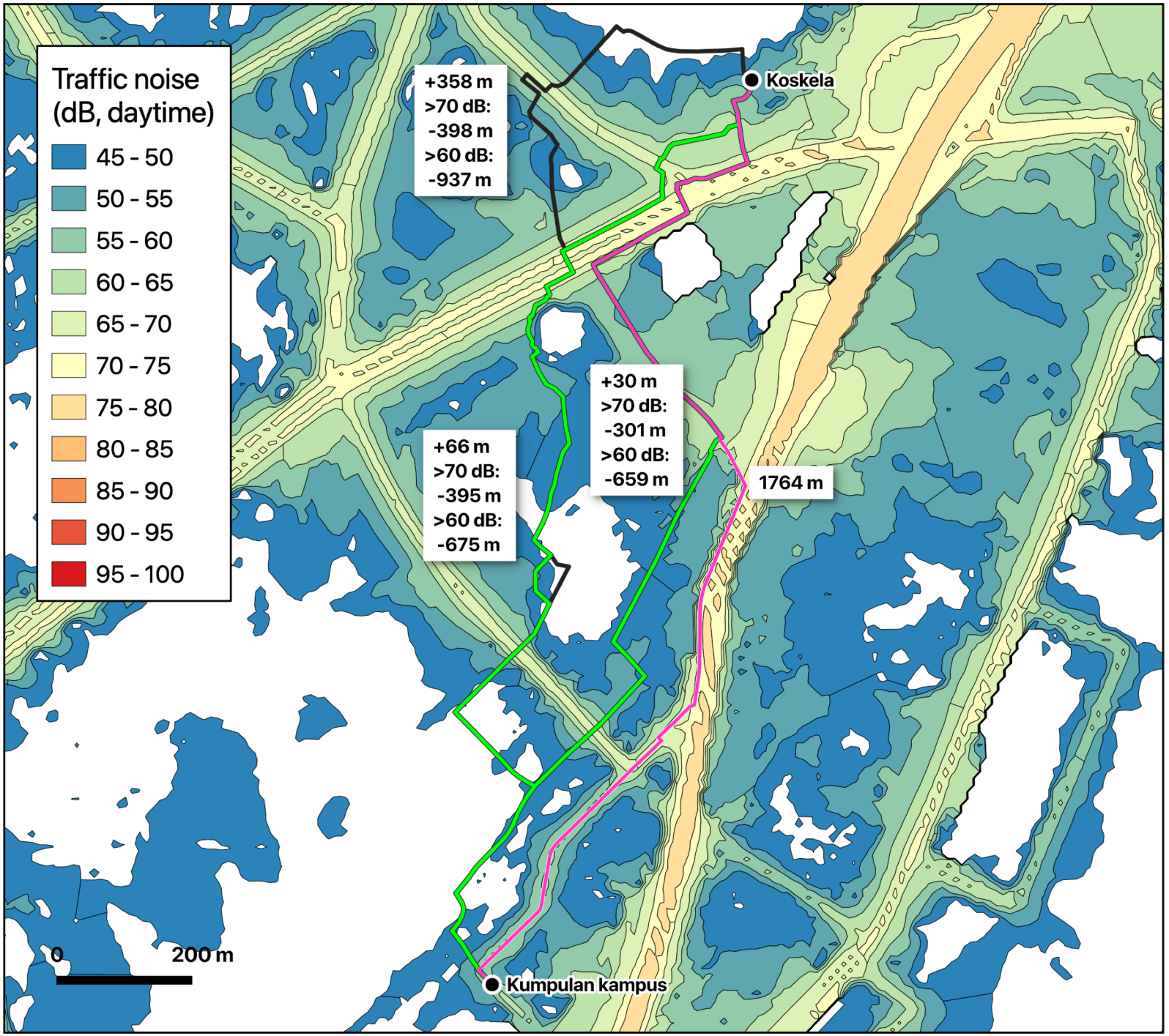

+358 m
>70 dB:
-398 m
>60 dB:
-937 m
Koskela
+30 m
>70 dB:
-301 m
>60 dB:
-659 m
+66 m
>70 dB:
-395 m
>60 dB:
-675 m
1764 m
0
200 m
Kumpulan kampus


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
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Koskela
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-301 m
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1764 m
+66 m
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-395 m
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0
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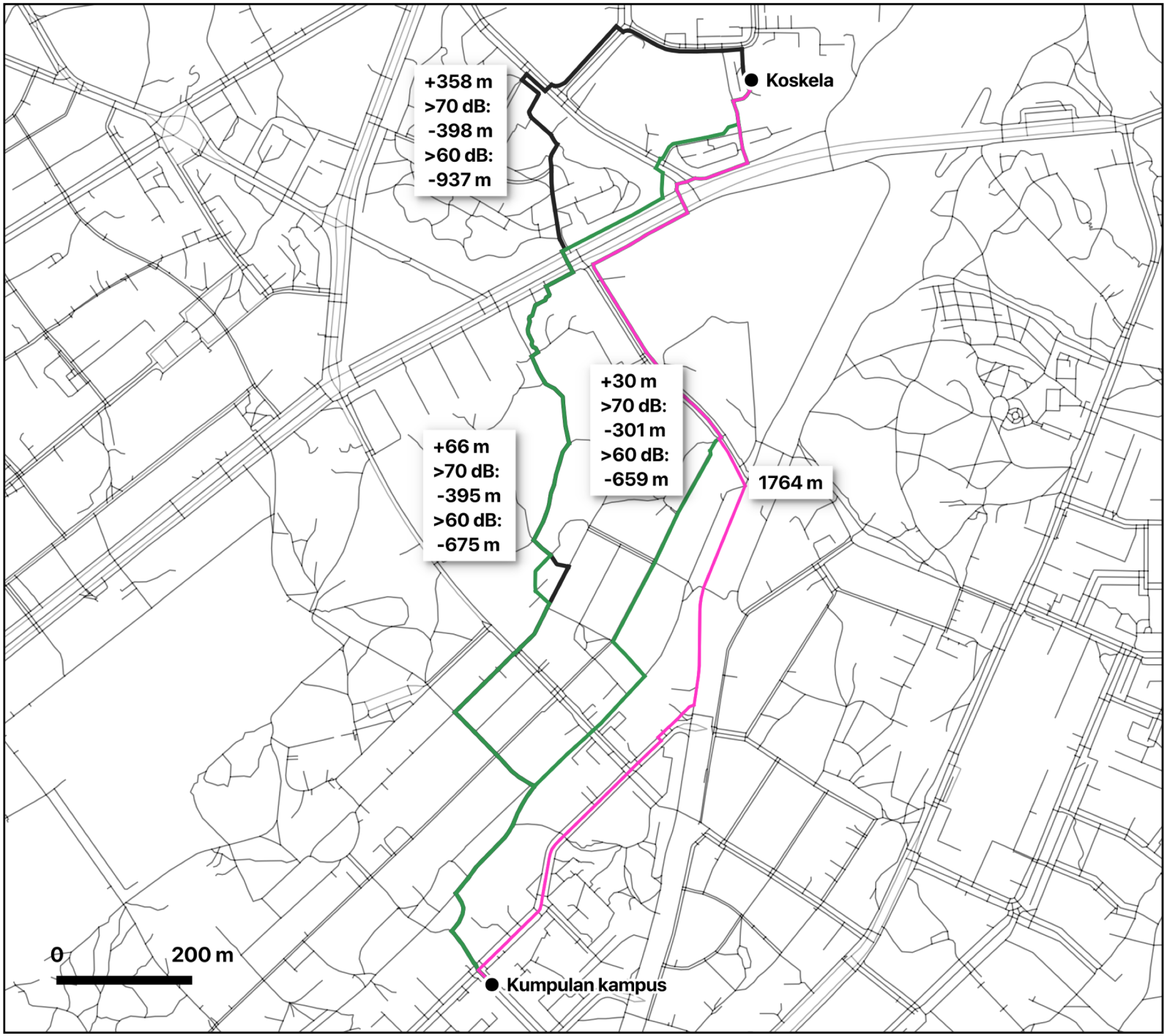
Kumpulan kampus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Kumpulan kampus