Urban planners' control over earthworks can result in remarkable greenhouse gas reduction

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Planning better future

- sustainable city scenarios

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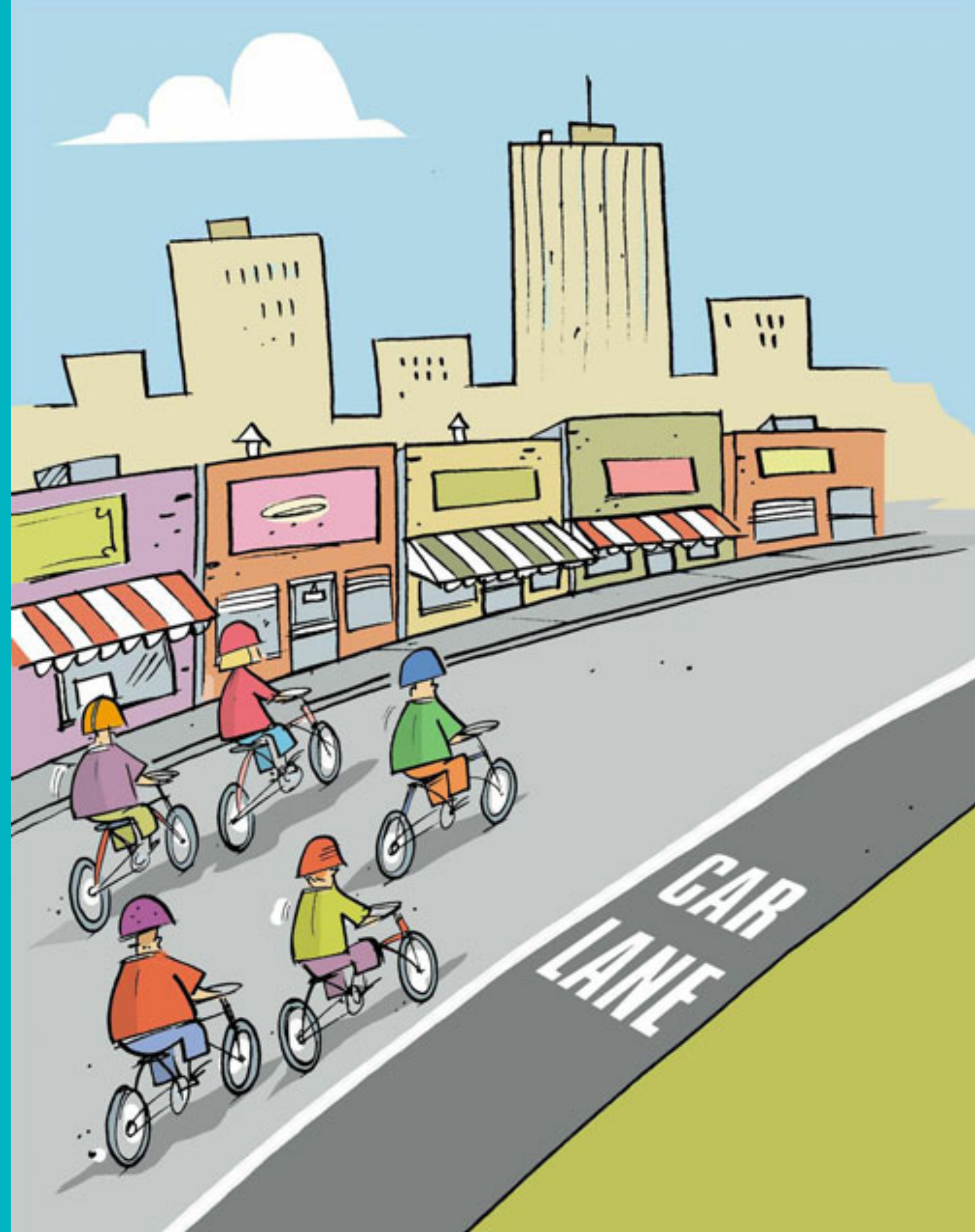

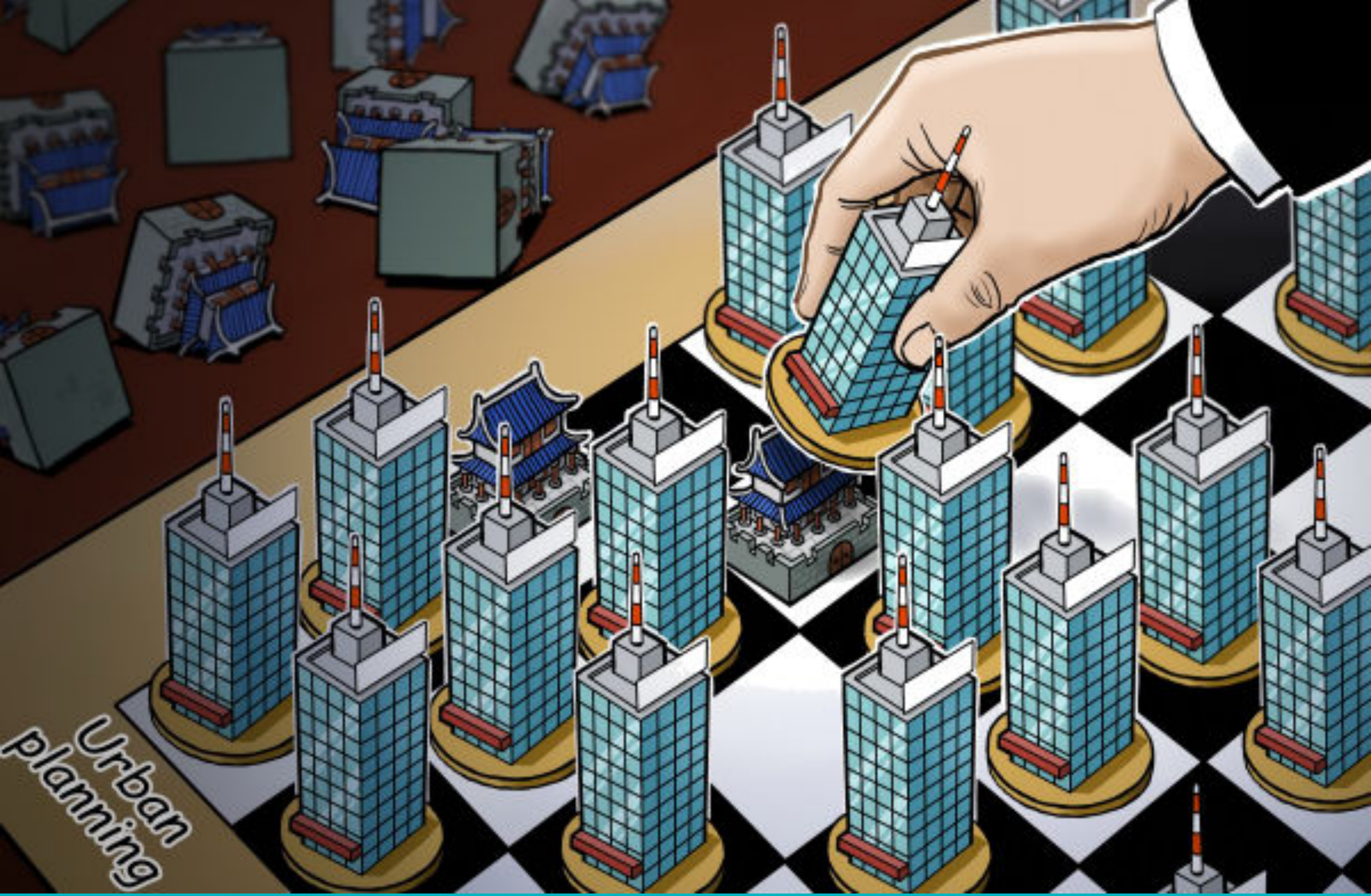

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Climate change mitigation targets

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The immediate development phase

&

the future use phase of the built environment

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Could control over earthworks be a respective part of sustainable urban planning?

- **The magnitude of such contribution to climate change mitigation?**
- **Is the outcome comparable to the achievements of prevalent practices?**

Case Kuninkaantammi: 120 ha wide residential development for 5 000 inhabitants, located in the Northwest corner of Helsinki

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Planning solution 1: Local use of blasted stone

- A 1 km long tunnel was to be excavated into the bedrock to accommodate an extension of a regional bus route
- 250 000 t of blasted stone were to be released and accommodated
- The blasted stone was crushed right outside of the tunnel and used entirely locally for necessary earthworks, within an average distance of 500 m from the tunnel
- Without the coordination, the blasted stone would have been transported away to approximately 25 km distance
- In addition, the rock materials needed for the immediate earthworks would have been imported from approximately 20 km distance

Planning solution 2:
A hill made of surplus clay

- A few meter deep layer of soft clay was to be removed from an area of 10 000 m² and to be replaced with more solid foundation material
- 50 000 t of clay were to be disposed and 300 000 t of rock materials required for earthworks
- The soft clay that was unsuitable for construction was piled into a landscaping hill, in the distance of 100 m
- The most realistic comparison was that the soft clay would have been transported away from the case area
- The closest admittance site for the clay would have been in the distance of approximately 40 km

Planning solution 3: Minimal refurbishment of a pond

- A few meter deep pond contained 200 000 t of assorted earth and biomasses, part of them contaminated soil, and was to be refurbished
- Instead of emptying the entire pond, only the top layer was replaced
- The contaminated soils were separated and transported to treatment, in the distance of 50 km, and the rest was restored into the pond
- Some additional materials were needed for the new structure, the transportation distances being 0,5 km, 20 km and 25 km
- If the pond had been entirely emptied, as suggested initially, the transportation distances would have been approximately 25 km for the earth to be disposed and 20 km for the earth to be imported

MELI HEL (version 2.0)

- An Excel-based life cycle inventory analysis program, which is an updated and tailored application of the Finnish life-cycle impact assessment procedure for earth constructions (MELI)
- Developed by VTT Technical Research Centre of Finland (Eskola et al. 1999; Mroueh et al. 2001)
- The environmental burdens of earth construction materials and unit operations and the related traffic exhaust emissions and energy consumption from a database
- Only the type, dimensions and materials of each earth construction structure and transportation distances were required as case specific input data
- Transportation distances were divided into urban and country mileages
- The analysis included the production and processing of materials, their placement in or removal from the earth structures, and transportation
- Only the direct consumption of fuel and only the direct atmospheric emissions from the use of vehicles and machinery were considered, i.e. the manufacture and maintenance were not included


JOKEN
AUTO

Results:
certain & *immediate* effect

- 25 000 TRUCKS

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- 400 kg

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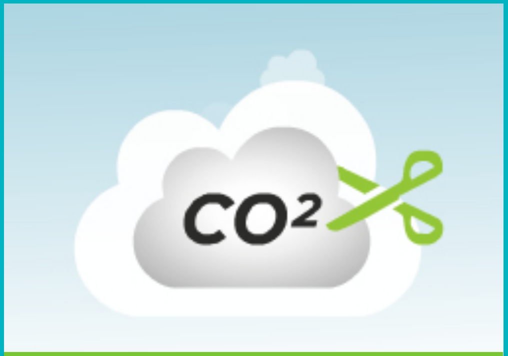
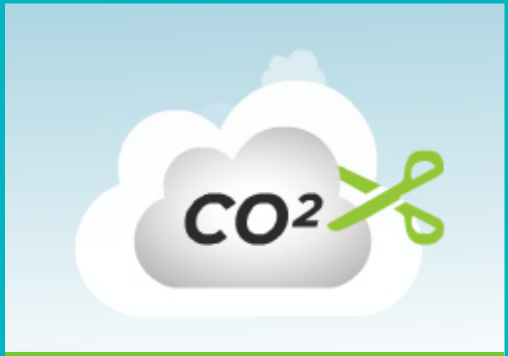


- 2400 t

- 25 000 TRUCKS

- 400 kg

Results:
certain & *immediate* effect



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COMPARISON:

- 260 (10 years)

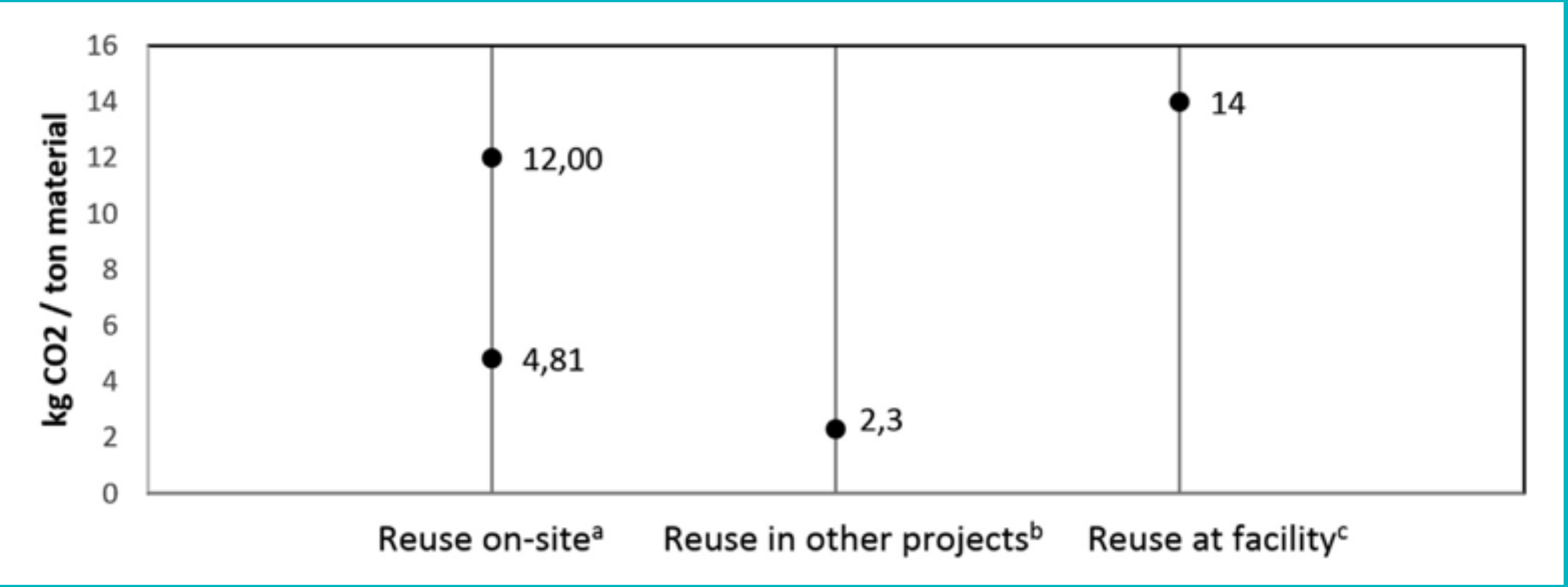
- 400 kg

Energy production today...

..in 20 years?

..in 50 years?

Magnusson et al. (2015): Sustainable management of excavated soil and rock in urban areas – a literature review



CO_2 savings due to excavated soil and rock

Data gathered from: **a**) Chittoori et al. 2012 & Eras et al. 2013; **b**) CL:AIRE 2013; **c**) Blengini & Garbarino 2010

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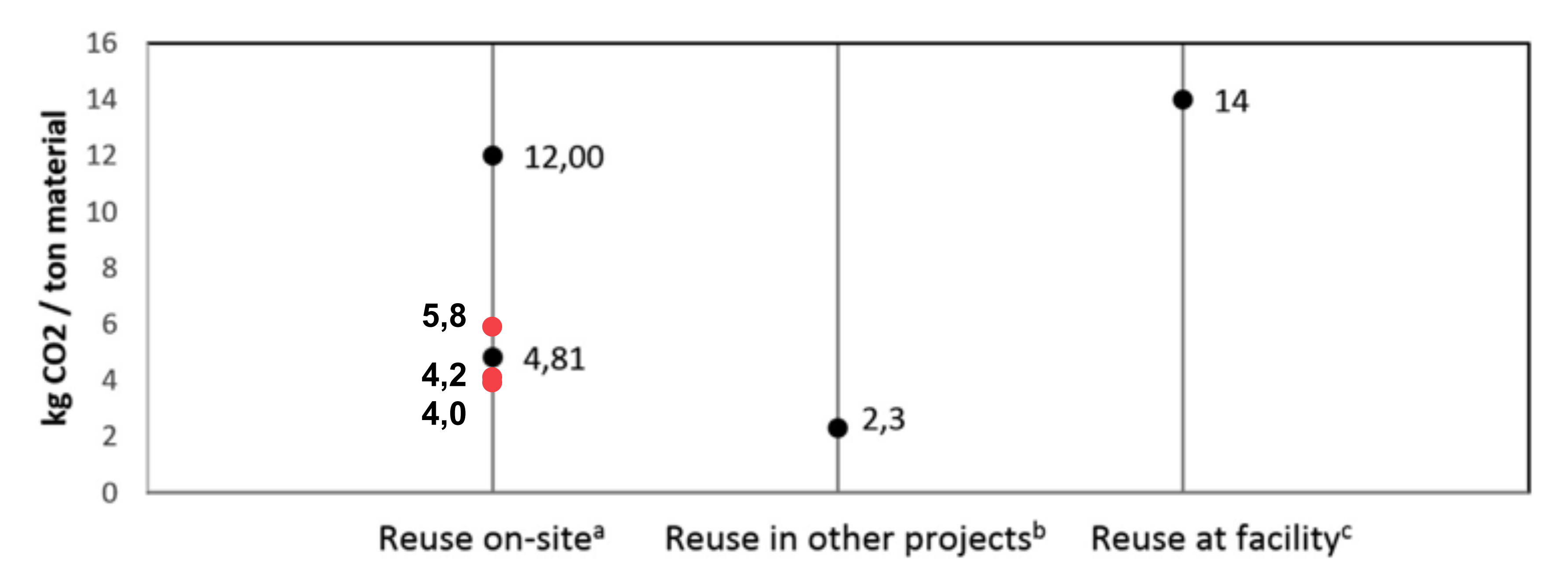

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Contribution:

Magnusson et al. (2015) concluded:

- ***A resource perspective on excavated soil and rock in urban areas is missing.***
- ***The regional management of construction materials and excavated soil and rock could benefit from coordination of construction projects.***
- ***This will need strategic planning at an early stage where the future demand and availability of construction material is assessed.***

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- ***This will need strategic planning at an early stage where the future demand and availability of construction material is assessed.***

➢ **We suggest that control over earthworks could be a respective part of sustainable urban planning**

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