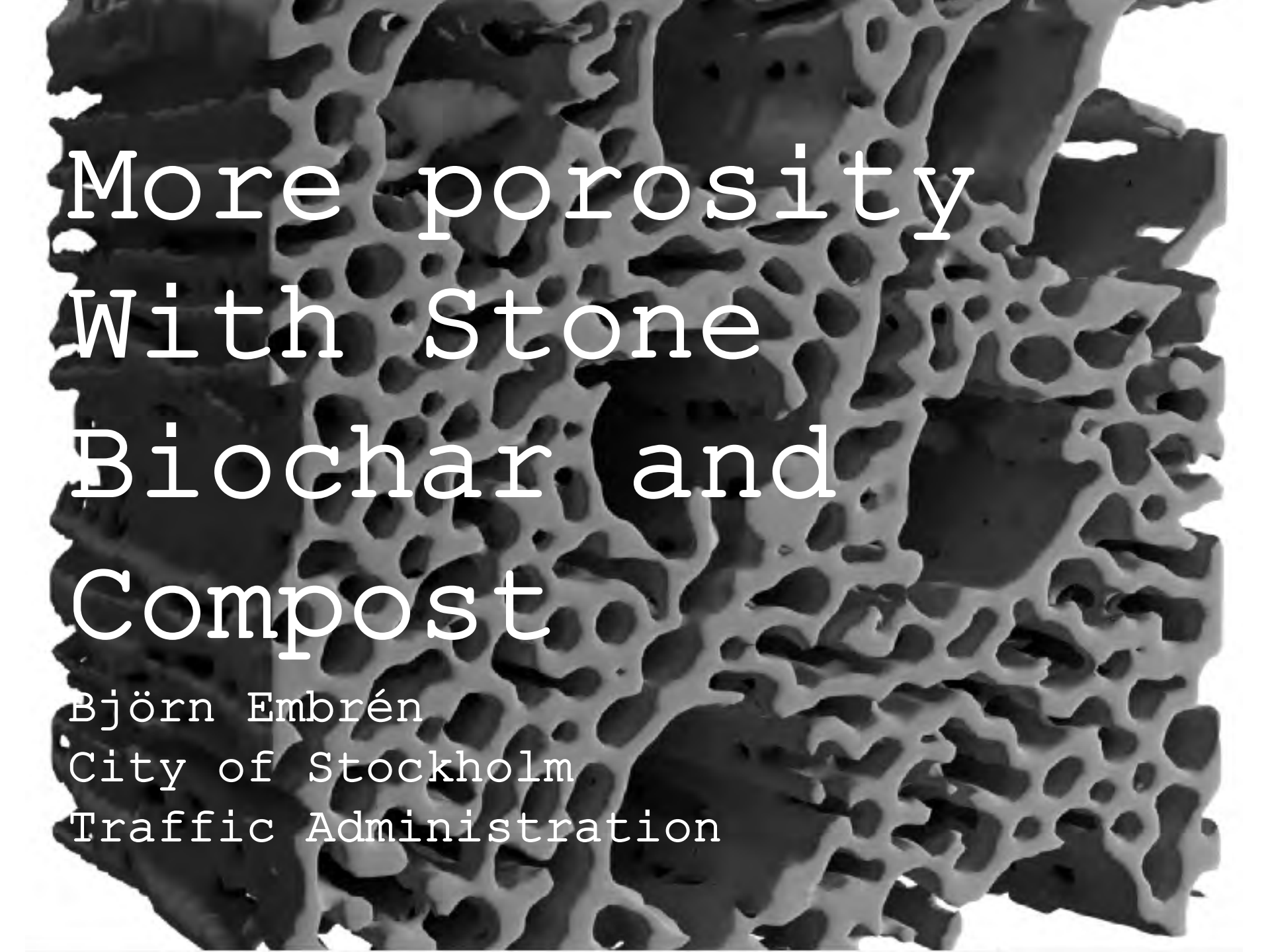
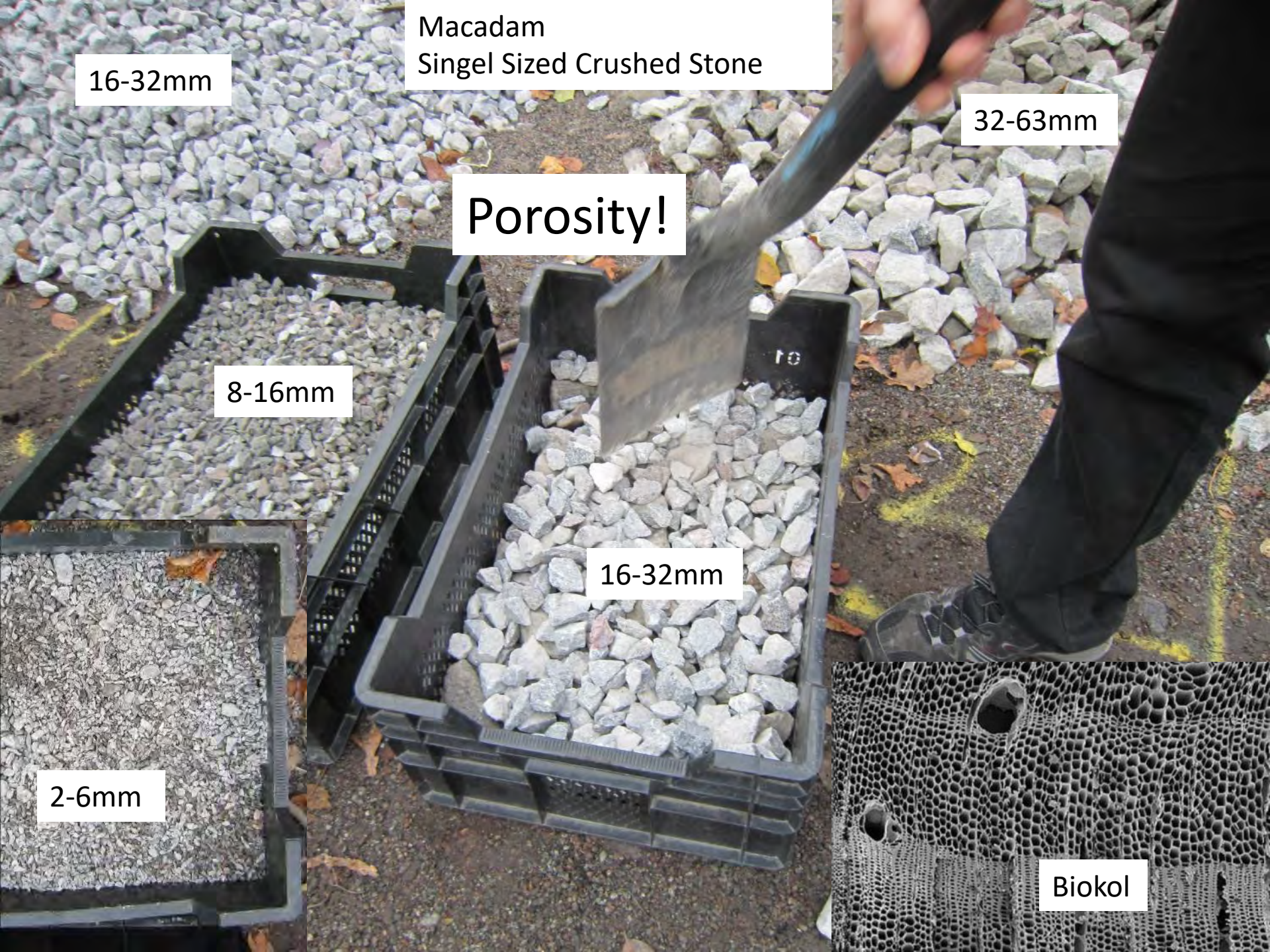


More porosity With Stone Biochar and Compost

Björn Embrén
City of Stockholm
Traffic Administration


Macadam
Singel Sized Crushed Stone
16-32mm
32-63mm
Porosity!
8-16mm
16-32mm
2-6mm
Biokol

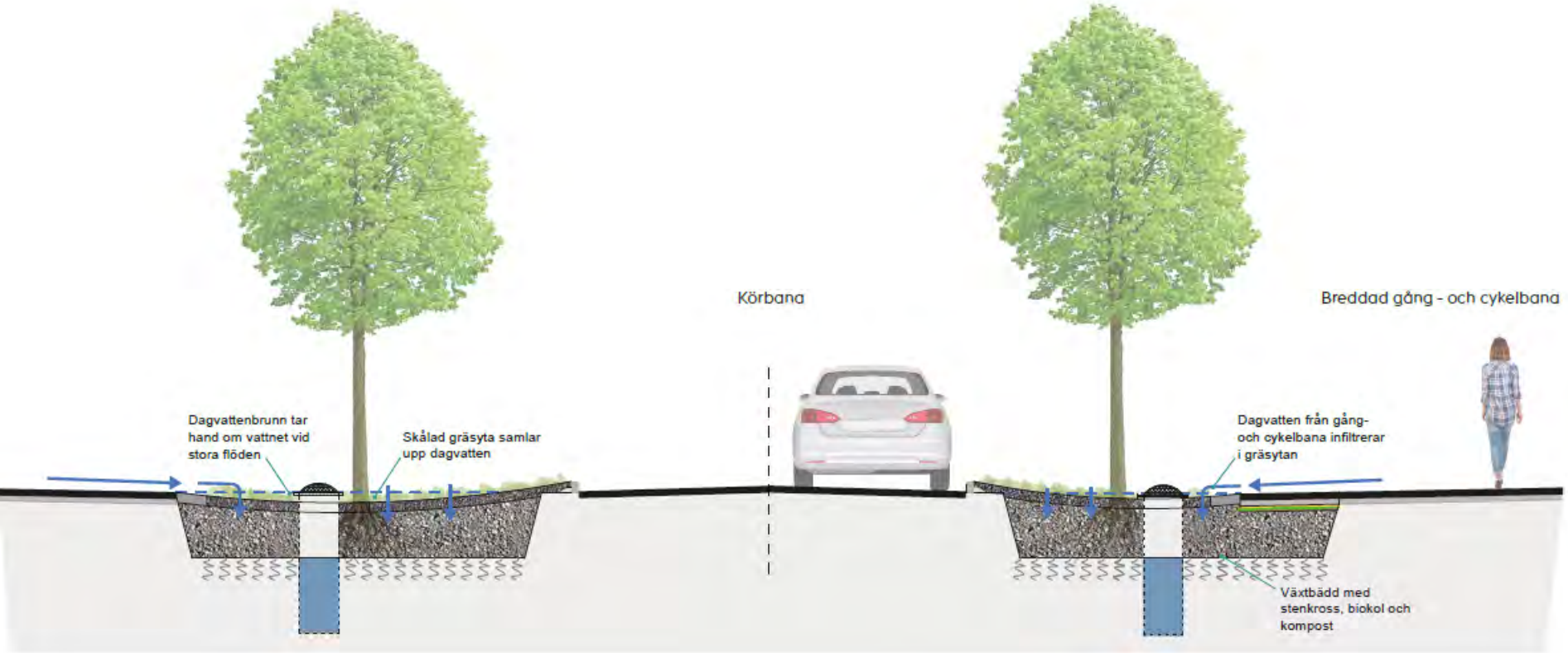
Biochar and stone chips = crushed granite 3/4 (2-6mm) and nutrient-enriched charcoal 1/4. volume


Compost 1/8
Biochar (0-10mm) 1/8
Macadam(2-6mm) 6/8

Biochar and stone chips = crushed granite **6/8 volume parts** (2-6mm) and nutrient-enriched biochar **1/8 volume parts**
+ compost **1/8 volume parts**

Biochar and stone chips = crushed granite (32-63 mm) and nutrient-enriched charcoal 15%. volume


Stockholms stad
Vi byter ut träd och renoverar växtbäddar på Sockenvägen
Klart december 2018
stockholm.se/sockenvagen-trad
Vid frågor:
stockholm.se/tycktillapp
alt. Byggledare 070-088 86 43
Tyck till
I samarbete med:
NCC


Körbana
Breddad gång - och cykelbana
Dagvattenbrunn tar hand om vattnet vid stora flöden
Skålad gräsyta samlar upp dagvatten
Dagvatten från gång- och cykelbana infiltrerar i gräsytan
Växtbädd med stenkross, biokol och kompost


Haukadalsgatan Stockholm
Makadam med 25% biokol/kompost
Nya träd och buskplantering
Första växtsäsong 2017


Andra växtsäsongen2018 aug.

Kolonivägen 2016-2017
Magnolias, Cersis, Prunus.
1 part biochar 0-10mm och 3 parts macadam 4-8 mm 600mm.

Magnus Ladulåsgatan Stockholm
Biochar with infiltration of stormwater

- Image # 1. Plant bed renovation a block of Magnus Ladulåsgatan where we follow our drawing ‘structural soil with biochar’.
- The stone and biochar, Concrete box where the tree is planted,

FHK 150311

Stockholms stad

Structural soil with biochar

A method for building with stability and to create good growing conditions for trees in paved areas with the use of stormwater and the added value of decreasing the risk of roots damaging paving or underground pipes

1. Paved surface with dished stormwater gutters
2. Geotextile
3. Leveling layer (crushed rock 8-16 mm) – also used for concrete bunker and water/air inlet.
4. Aerated bearing layer (crushed rock 32-63 mm)
5. Structural soil (crushed rock 100-150 mm) with fertilized biochar hosed into the structural volume
6. Pure biochar on terrace
7. Concrete bunker
8. Surface grid
9. Crushed rock with fertilized biochar
10. Inlet for air and water supply


NCC

Granit size 90-150mm

Concrete box to hold the paved surface around the tree in place

Compacting befor soil is washed in to the voids

The stone shall fall into the box to get a stabel construction


90-150mm macadam
And biochar compost 50/50
flushed down betwen the stones
provides the strongest structure
for heavy loads

Flushing the soil into the structure

Ventilation chamber and inlet of surface water

Layer for infiltration of rain water on top off the structural soil

Important with geotextile connection against curbs inlets concrete boxes etc.so that no fine material could run into the airy base course


Koelreuteria paniculata second growing season
VÄSTGÖTAGATAN 5

Koelreuteria paniculata second growing season

Nybrogatan Stockholm
Biochar with infiltration of stormwater

- Plant bed renovation a block of Nybrogatan where we follow our drawing ‘structural soil with biochar’. Some of the old trees were saved.
- The stone and biochar are mixed before the material is laid down, 15% by volume biochar.
- Closest to the roots of saved trees added a mixture of crushed granite and 25% manured biochar.
- Concrete box where the tree is planted,

in it you can see macadam mixed with 15% biochar

FHK 161108

STRUCTURAL SOIL WITH BIOCHAR

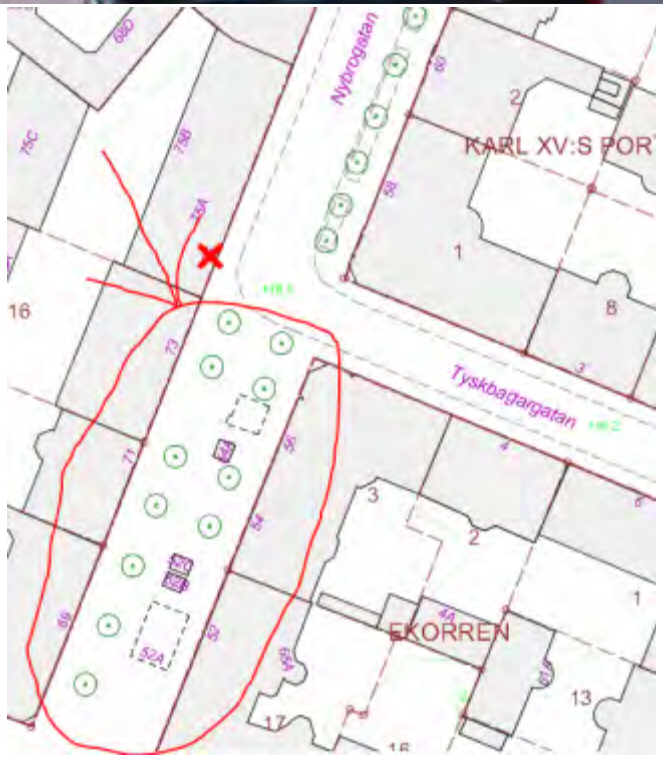
The City of Stockholm have set as a goal to create sustainable and durable plant beds from locally sourced materials. Structural soils with biochar binds carbon from the atmosphere and reduces leaching of nutrients.

1. Paved surface and base course
2. Stormwater gutter
3. Aeration well: inlet for water and oxygen/carbon dioxide exchange
4. Surface grid
5. Stone mulch, crushed rock 4–8 mm
6. Root collar at nursery growing level
7. Crushed rock 4–8 mm with 25 volume-% biochar with added nutrients
8. Concrete bunker
9. Geotextile
10. Leveling layer, crushed rock 8–16 mm
11. Leveling layer, crushed rock 2–4 mm
12. Structural soil with biochar, crushed rock 32–63 mm and 15 volume-% biochar with added nutrients
13. Biochar
14. Crushed rock 32–63 mm (in an aprox. radius of 0,5 m around the perforated section of the aeration well)
15. Gas exchange (oxygen and carbon dioxide)

Stockholms stad

Nybrogatan 2015
Kolmakadam

Plant bed for street trees charcoal and macadam = crushed granite 32-63 mm mixed with 15% nutrient-enriched charcoal, granite can be replaced with recycled concrete with reinforcement (iron)



Nybrogatan 2015
Kolmakadam

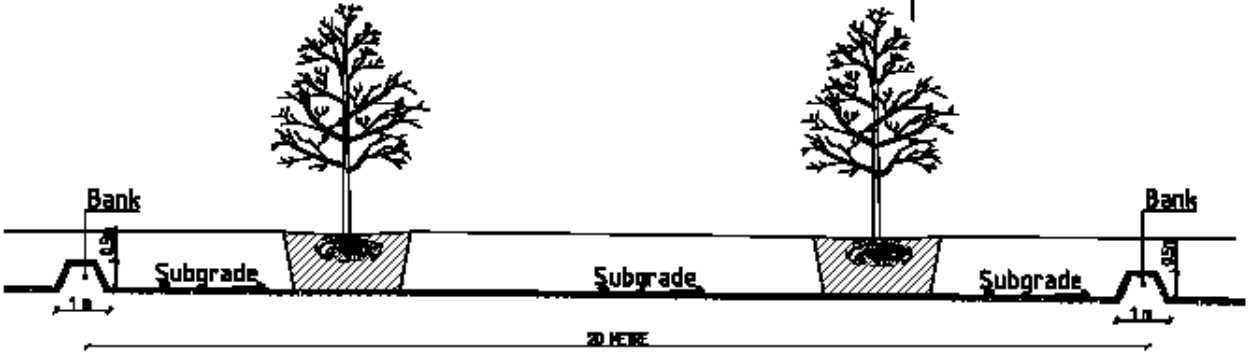
Nybrogatan 2016
Magnolia

Lingvägen

biochar with infiltration of stormwater

- Image # 1. Plant bed renovation a 600 meter by 2m wide and 1 m deep.
- Image # 2. where we follow our drawing ‘tree pit with slanting subgrade’
- Image # 3. The ditch filled with biochar and gravel 8-16mm and a few months after planting


Lingvägen
PÅMINN MIG SENARE
LÄS
Google

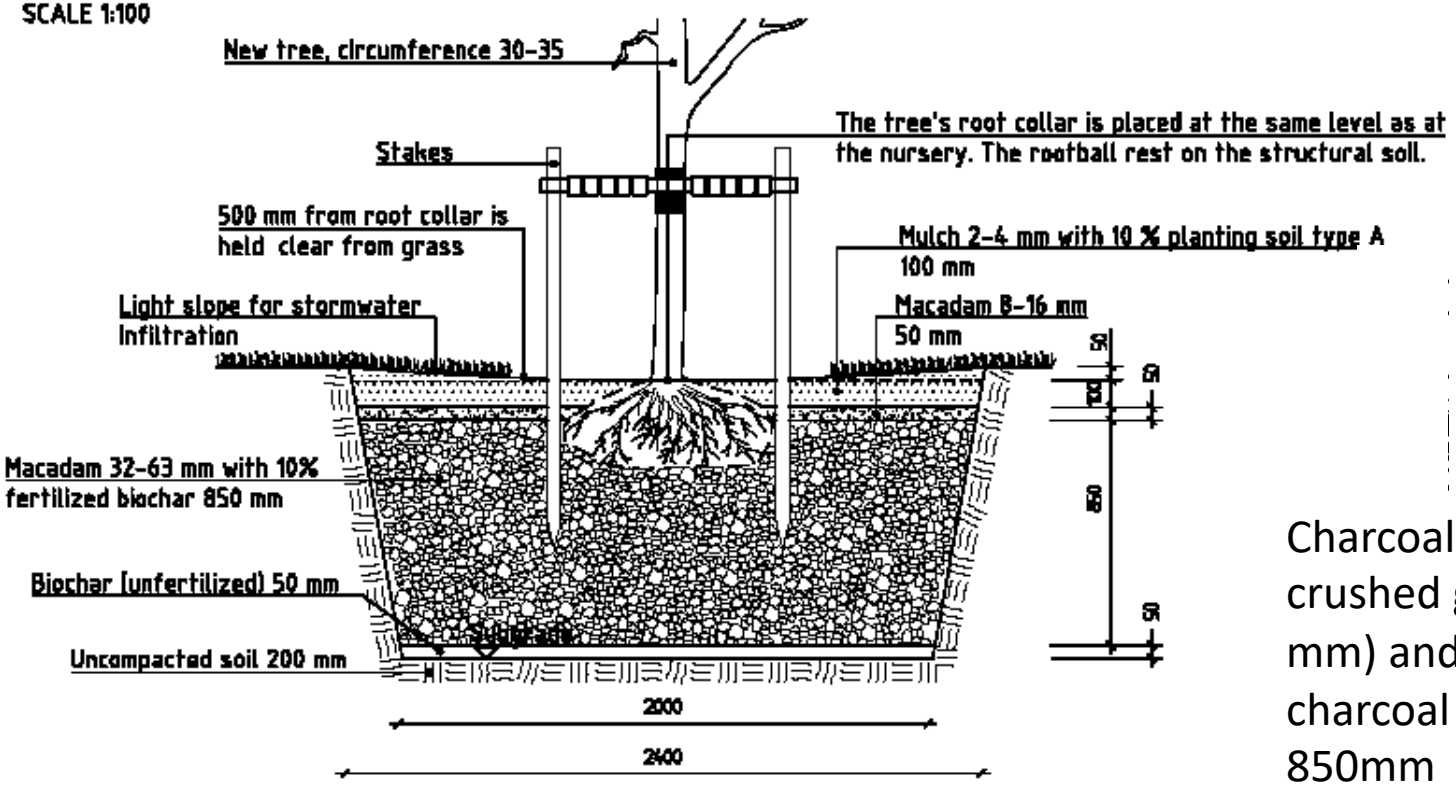


Drawing showing how we build plant bed for trees in the green area along streets and roads to maximize infiltration of storm water through a charcoal filter in the bottom of the plant bed where we catch up nutrients and pollutants.

PLANTING PIT WITH SLANTING SUBGRADE

ELEVATION

SCALE 1:100



Charcoal stone chips = crushed granite (32-63 mm) and nutrient-enriched charcoal 10/1. volume. 850mm

TREE PIT WITH BIOCHAR IN GREEN SPACE, TYPE 2

TYPE SECTION

SCALE 1:20

Plant bed for street trees charcoal macadam = crushed granite 8-16 mm mixed with nutrient-enriched charcoal

2014

Charcoalsoil
2-5 mm granit
depth 100 mm
Charcoalchips
8-16 mm granit
depth 900 mm


2018

Vallhallavägen

onehundred years old avenue of trees get

Biochar and macadam

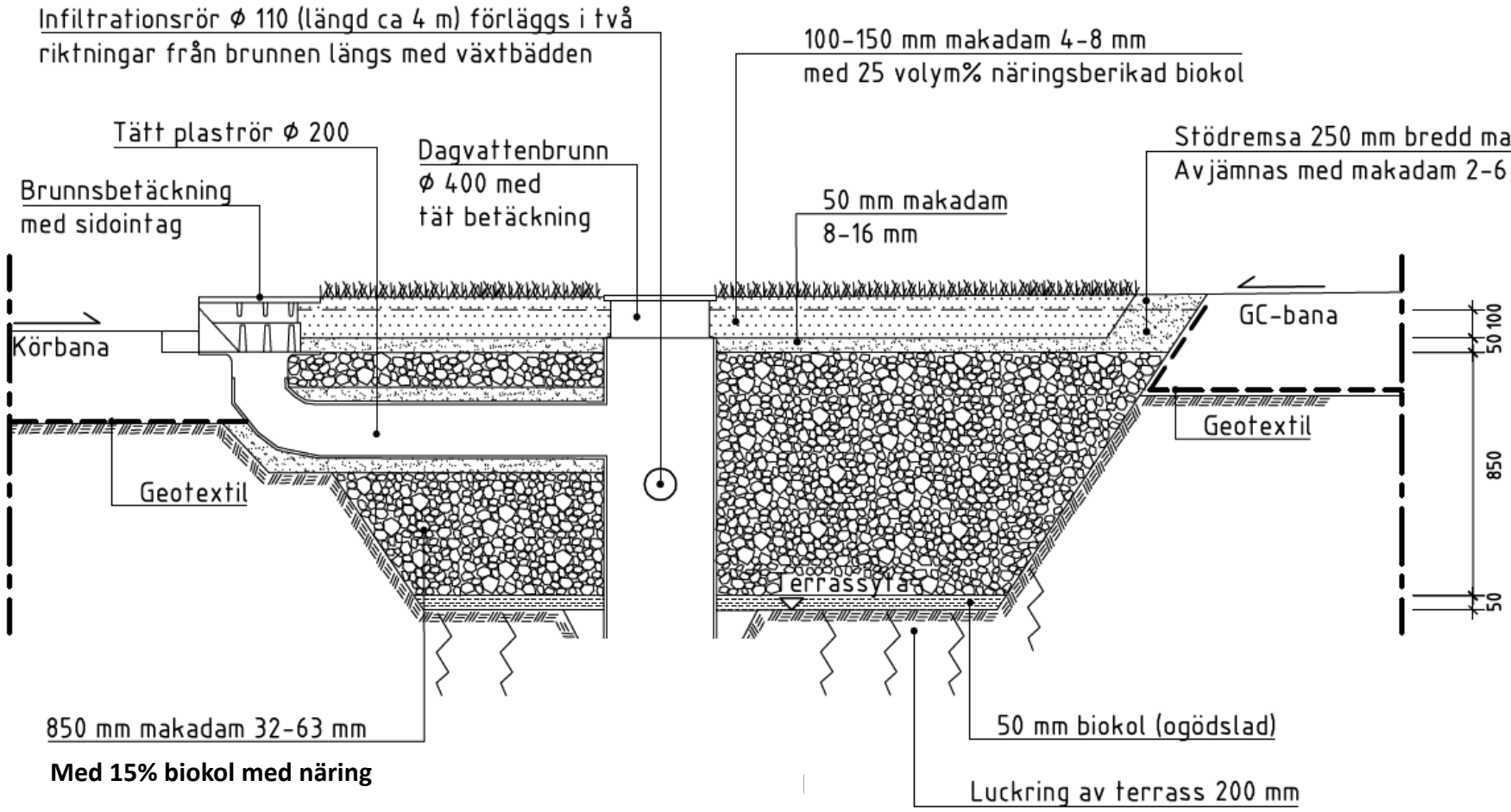
- Compacted soil which is changed to ditch filled with biochar and macadam 32-63mm to save the trees with infiltration of stormwater
- the first time we sow grass on 2-6mm 3 parts 1 part biochar 100mm


Valhallavägen


vacuum cleaned root system
FÄLTÖVERSTEN
EVIDENT CLEAN

Protected vacuum cleaned root system


Green
OSN 639
Bobcat
HL



Med 15% biokol med näring

DAGVATTENFÖRDRÖJNING – GRÄSYTA MED KOLMAKADAM


Valhallavägen
2016
2-6mm 3 parts 1 part biochar
100mm and grass seeds on the
surface
8-16mm
30mm
32-63mm and 15% biochar
600mm


8-16mm 30mm
32-63mm and 15% biochar
800mm


100mm mix of macadam 2-6mm 3 parts, 1 part biochar/compost, and grass seed
8-16mm 30mm


2-6mm 3 parts 1 part biochar
100mm and grass seeds on the
surface

Pilgatan 2014

Biochar with infiltration of stormwater
Magnolias and perennials
1 part biochar 0-10mm and 3 parts crushed granite size 4-8 mm
800mm deep.


2014/12/04

Biochar and stone chips = crushed granite 3/4 (2-6mm) and nutrient-enriched charcoal 1/4. volume


2017 augusti

Helsingborg
Drottninggatan

Uppsala 2017


Göteborg
VOLVO
GLC
MASKIN
T-041/5

Stone trough with alpines

crushed granite **3/4 volume parts** (2-6mm) and nutrient-enriched biochar (50%) + compost (50%) **1/4 volume part**

2017
First potatoes grown in macadam biochar and compost

2018
First carrots grown in macadam biochar and compost

Gives healthy trees with all the positive effects it provides

Reduce the risk of flooding

Reduce the heat island effect

locks down carbon dioxide into the ground with the use of biochar in the planting beds

Reduce the presence of particles and carbon dioxide in the air

Reduce the load on the storm water systems, thereby reducing pollution in Lake Mälaren and the Baltic Sea

http://www.stockholm.se/trad

https://www.youtube.com/watch?v=S7kbSnnJwDI

Remediating Montreal's Tree Pit Soil Applying an Ash Tree-Derived Biochar

https://link.springer.com/article/10.1007/s11270-018-3725-1

referenser