TECHNISCHE UNIVERSITÄT DRESDEN

DRESDEN concept

Fakultät Forst-, Geo- und Hydrowissenschaften Institut für Siedlungs- und Industriewasserwirtschaft

Distribution and accumulation of particulate attached Cu, Zn and Cd on impervious urban surface

Jin Zhang

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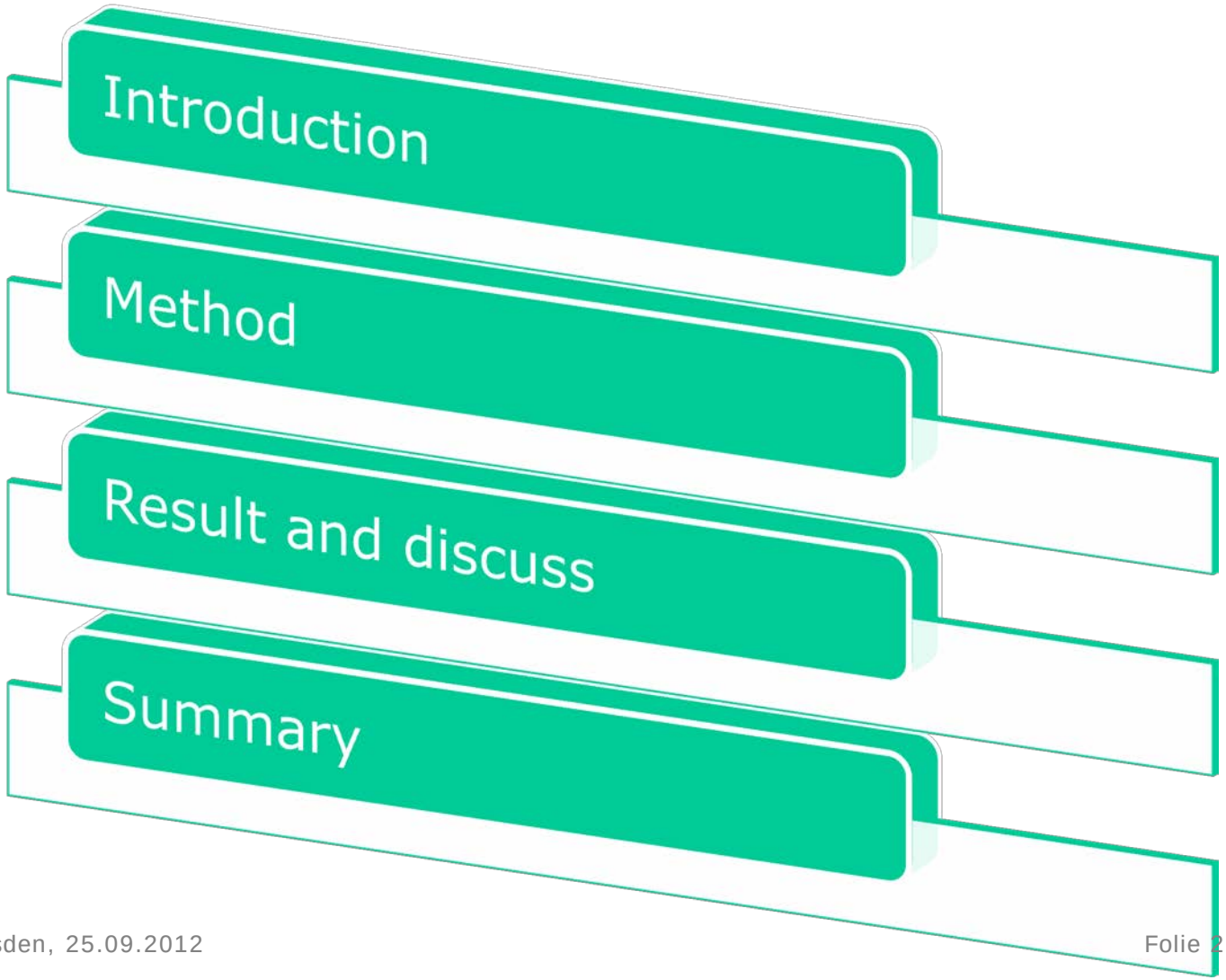
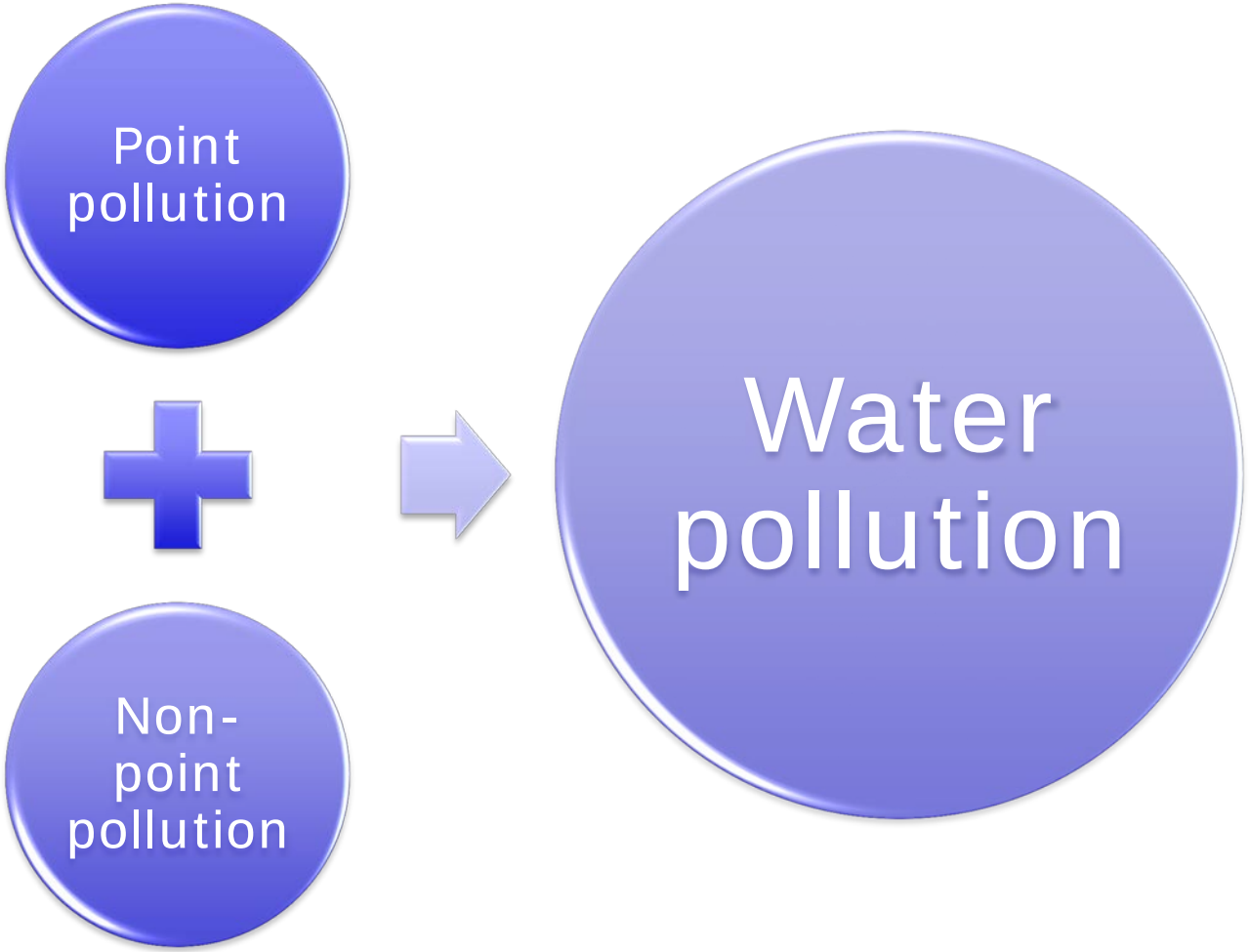
Overview



Introduction



Pollution transportation

Urban surface

Precipitation

Runoff pollution

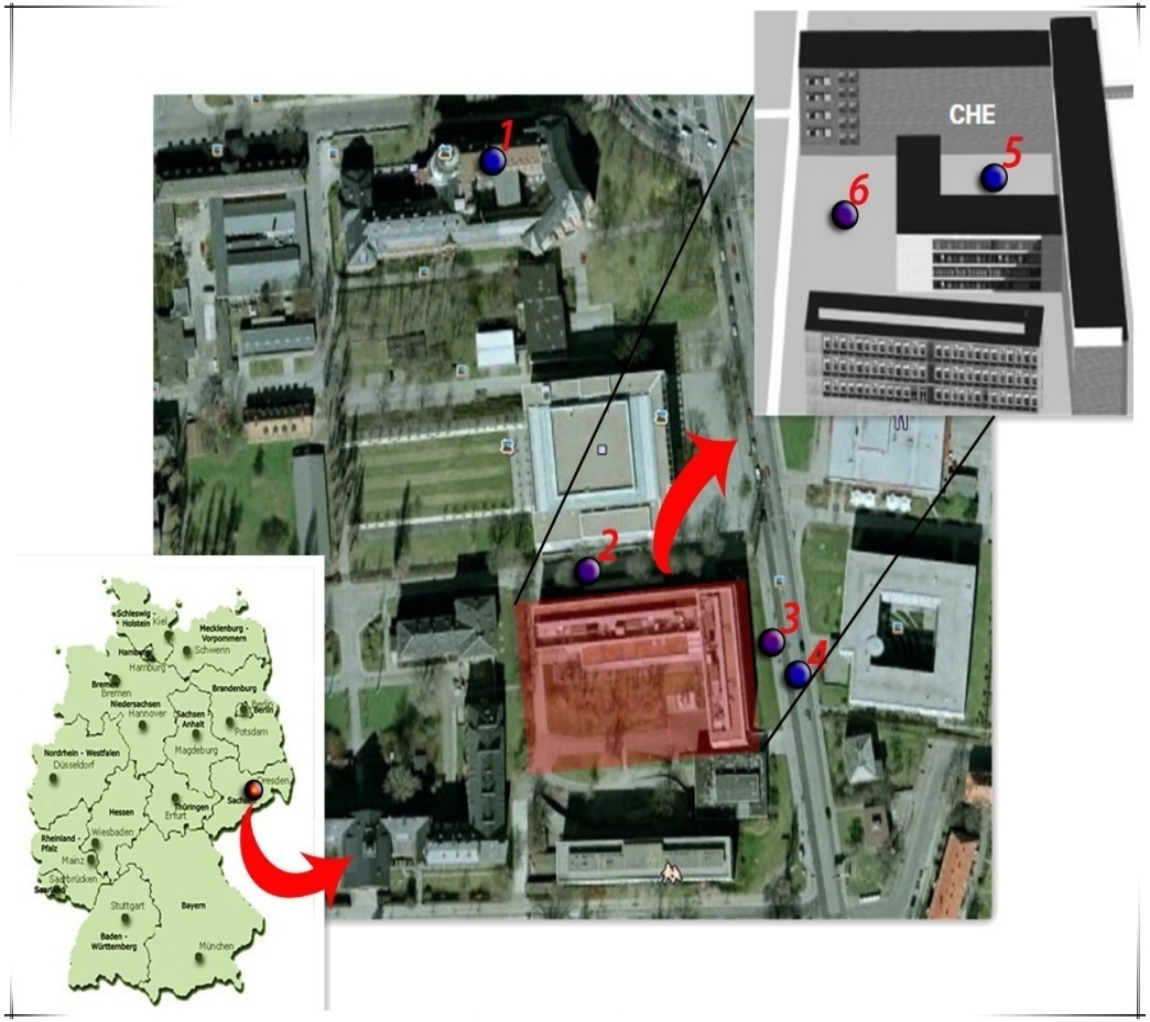
Heavy metals

- Acutely toxic, carcinogenic and widely distributed
- One of the greatest single emitter - urban surfaces (UBA 2010).
- Particulate attached
- Transportation and pollution potential

Influential parameters

- Climatic condition
- Land-use type
- Traffic volume
- Ground surface material

Method



1. Roof
2. Natural stone paved pedestrian path
3. Brick paved pedestrian path
4. High traffic loading road
5. Courtyard
6. Low traffic loading road

Different surface characteristics

1. Roof
2. Natural stone paved pedestrian path
3. Brick paved pedestrian path
4. High traffic loading road
5. Courtyard
6. Low traffic loading road

Sample collection

- (Sansalone et al. 1998) found that 70% of the mass of particles transported in highway runoff were less than 1000 µm.
- (Lau and Stenstrom 2005) reported that street particles whose size larger than 900 µm could be efficiently removed by conventional street sweepers.
- Vacuum sweeper was proved to be more sufficiently in removing small materials within a typical pavement structure.
- wet condition is able to enhance sample collection and retention efficiency.

Trace element

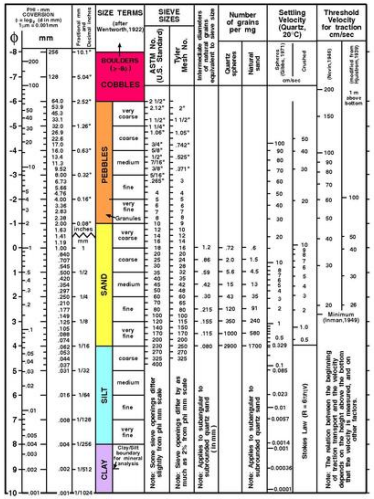
Copper

Zinc

Cadmium

Particle size fraction

- 1000µm
- 400µm
- 100µm
- 63µm
- 0.45µm



Wentworth grain size chart (Source :United States Geological)

Test stainless-steel sieves

Particle size fraction

- 1000µm
- 400µm
- 100µm
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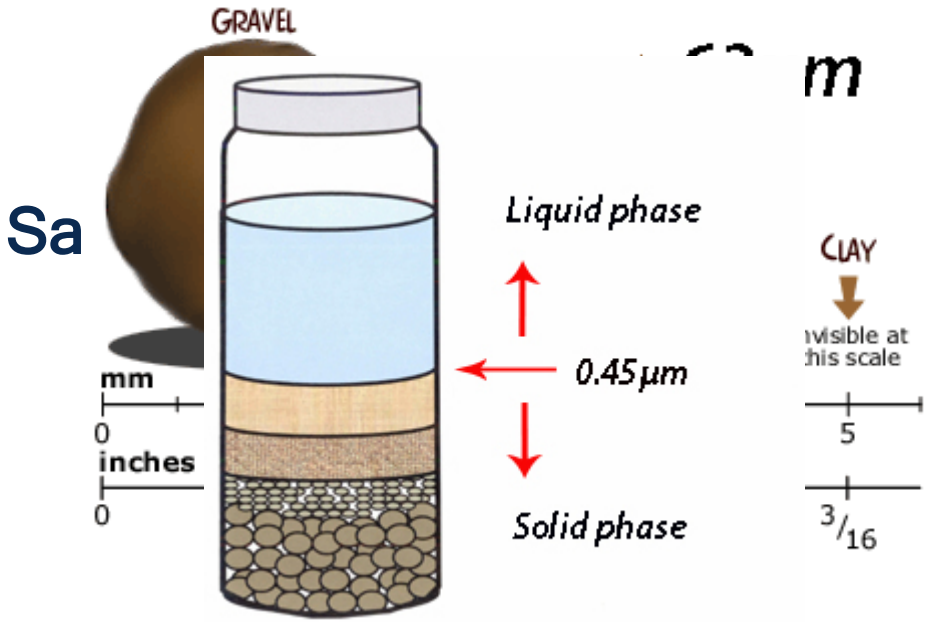
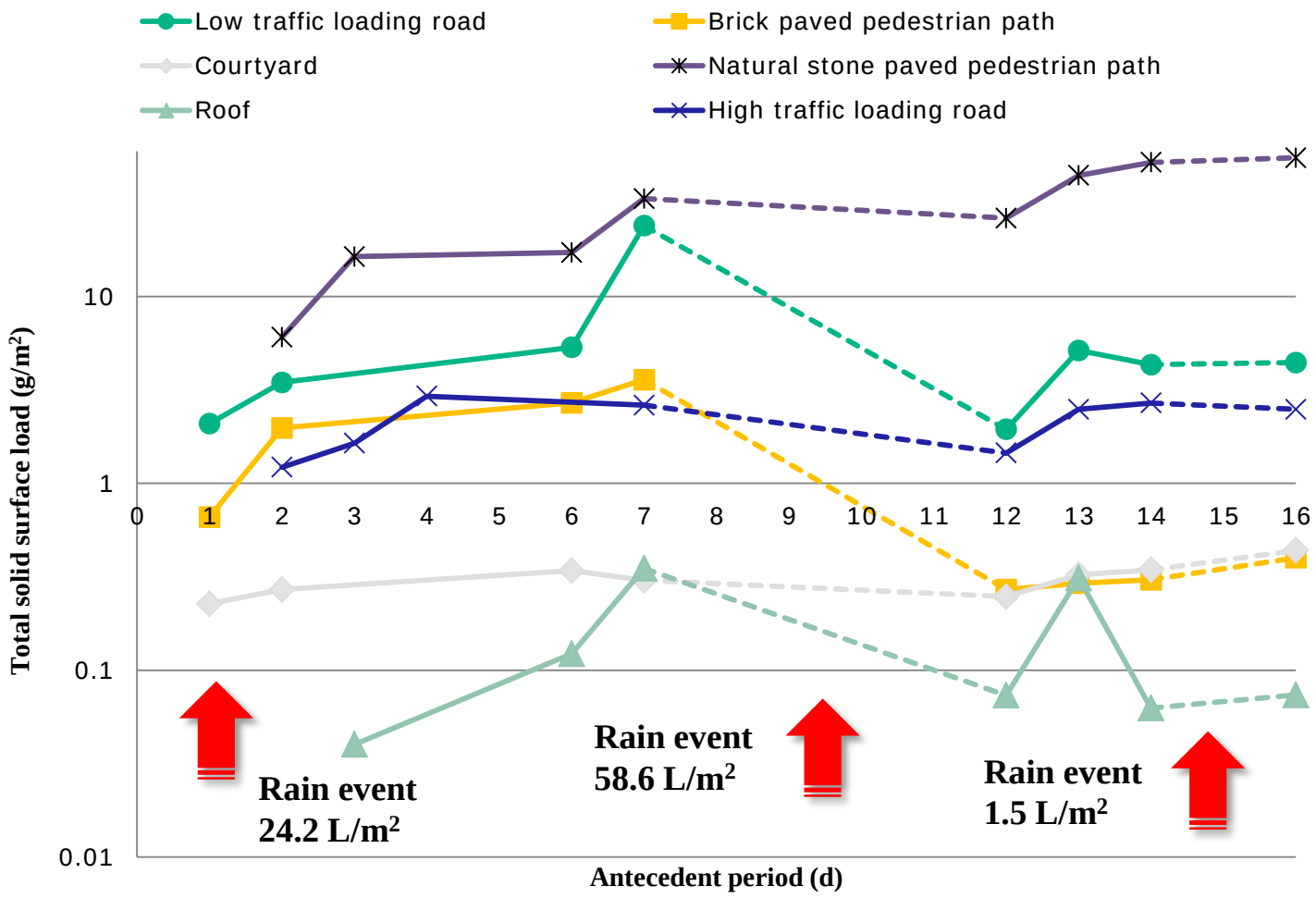
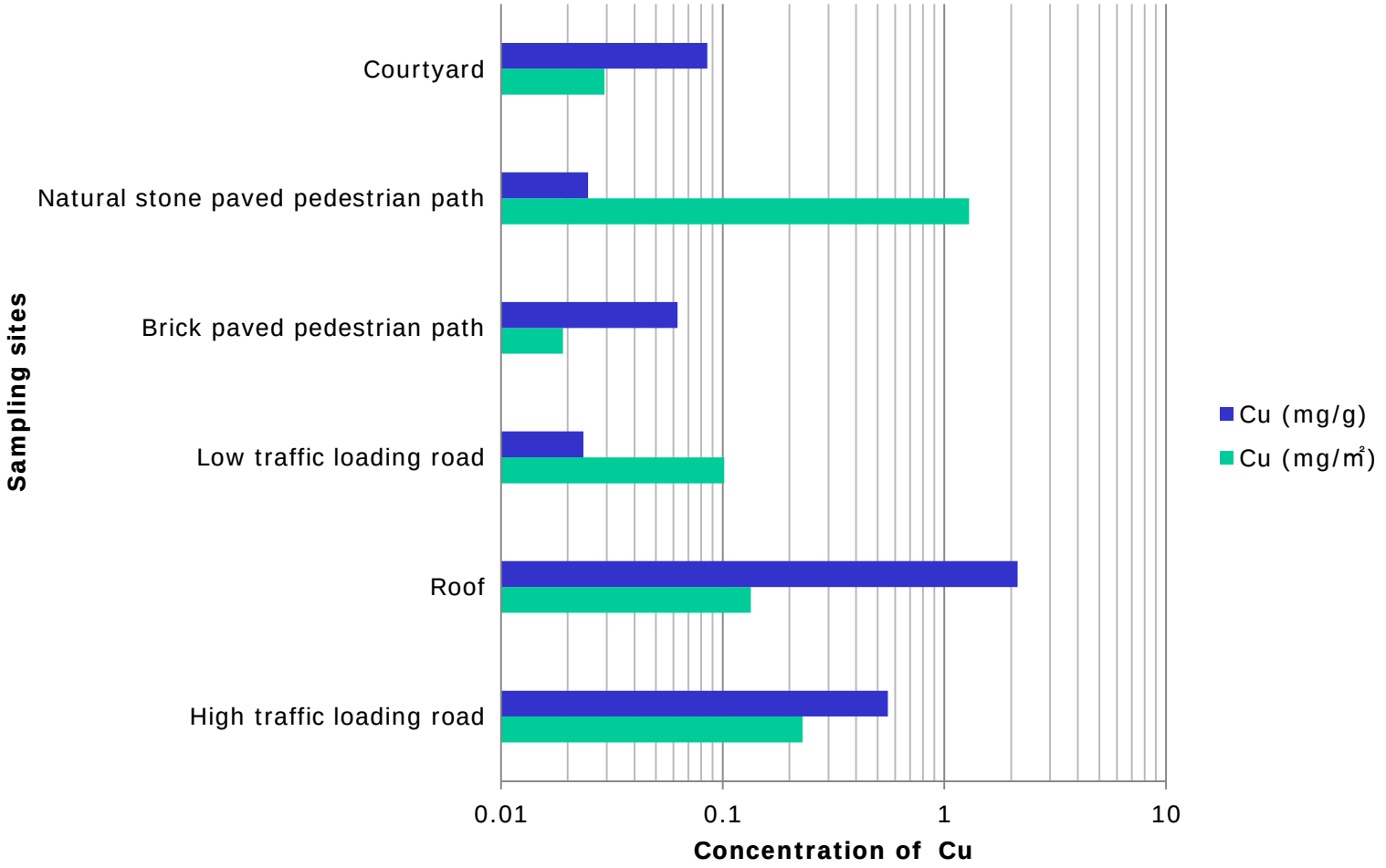
- 0.45µm



Result and discuss

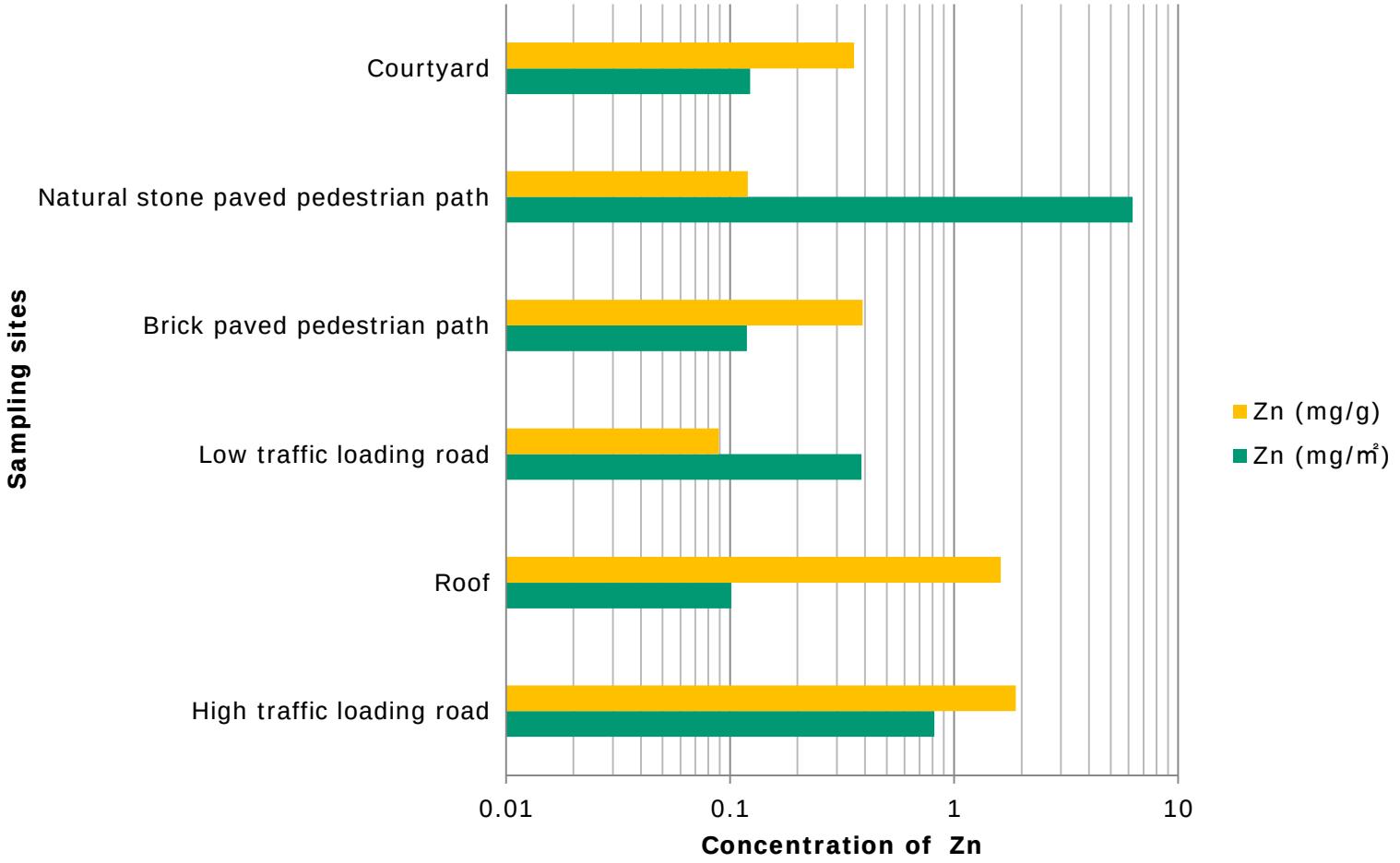


Cu concentration



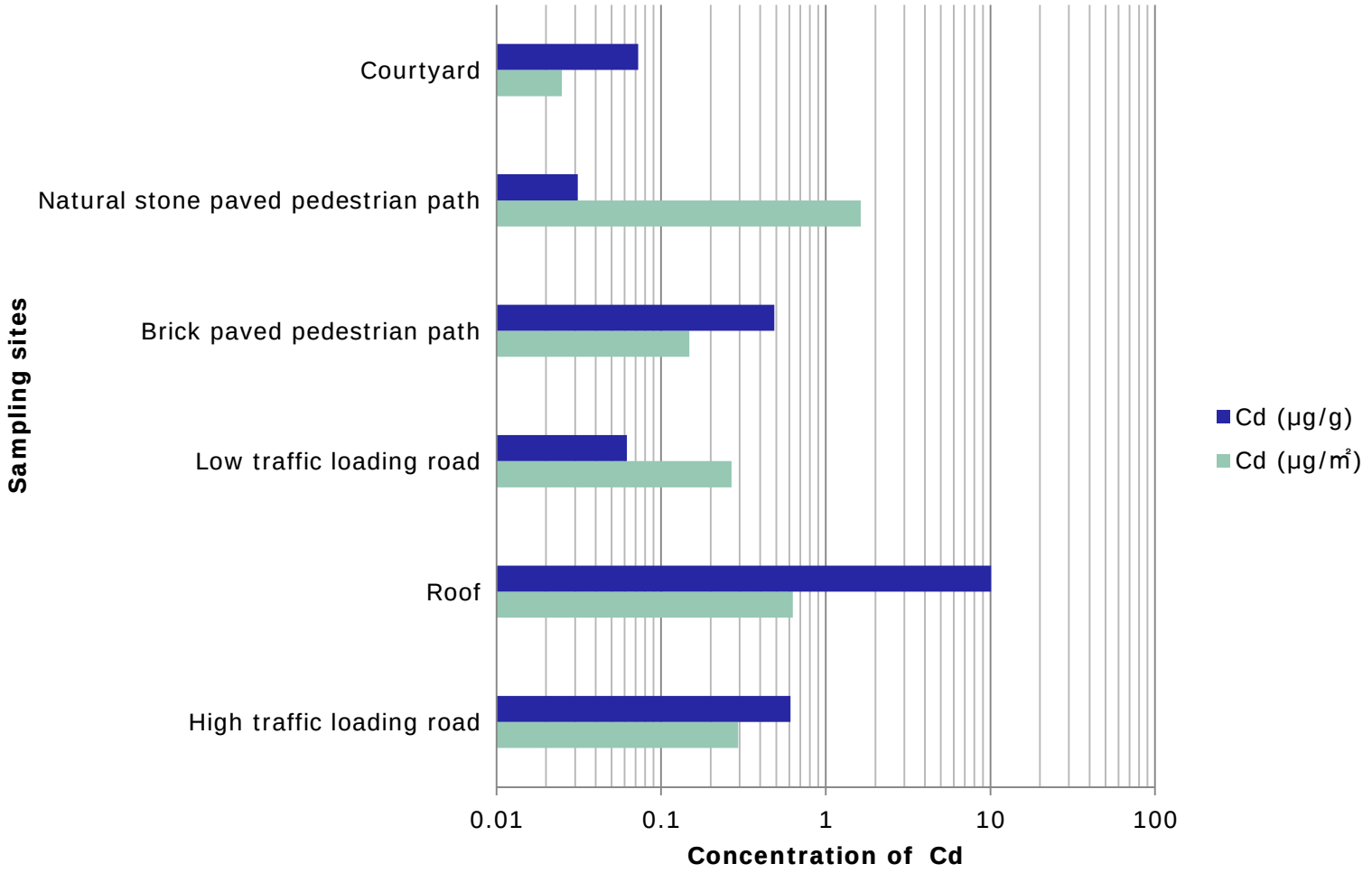
Unit: mg/g – mass Cu pro mass particle (solid phase concentration)
mg/m^2 – mass Cu pro unit area (surface load)

Zn concentration



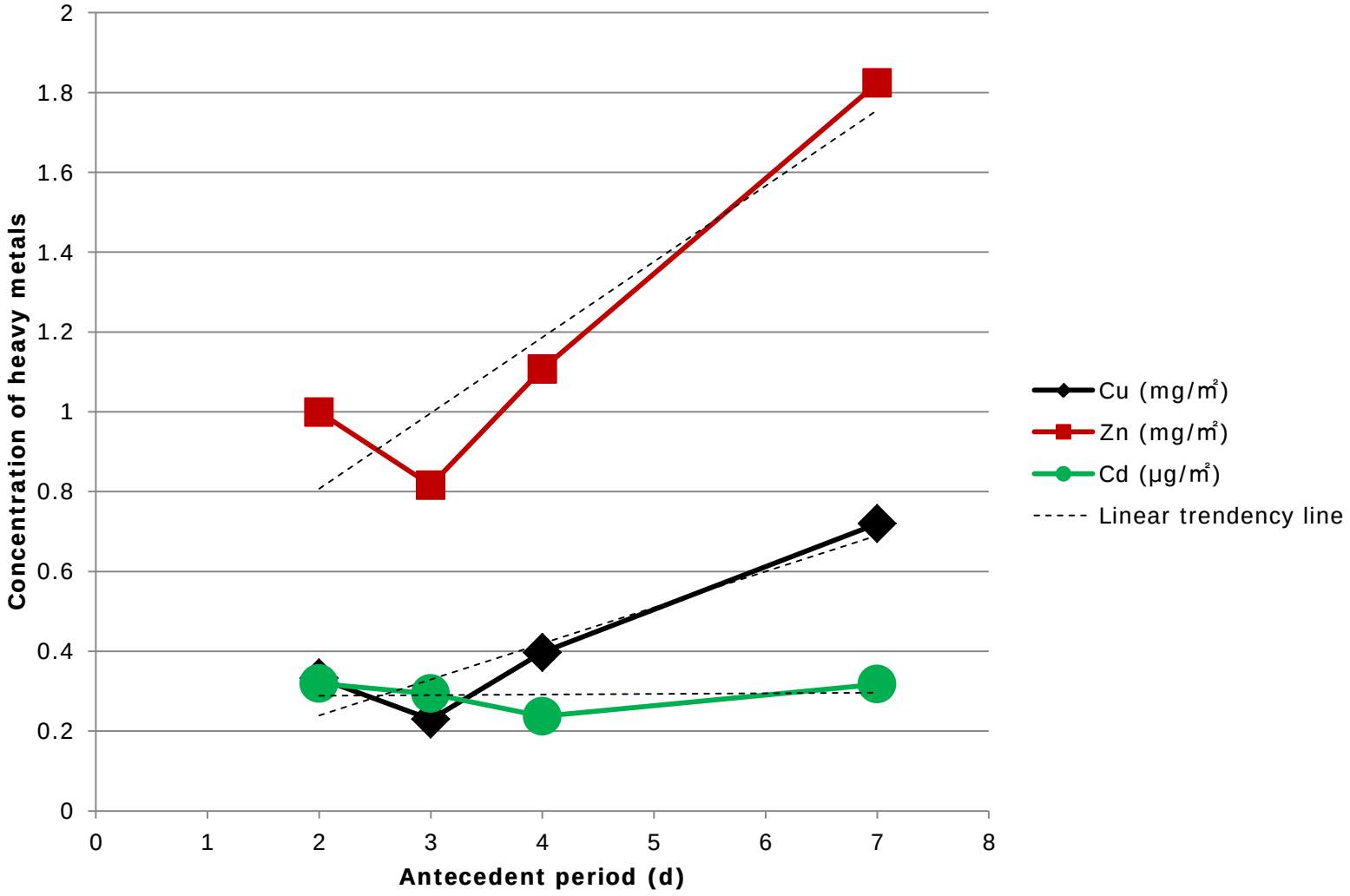
Unit: mg/g – mass Zn pro mass particle (solid phase concentration)
mg/m² – mass Zn pro unit area (surface load)

Cd concentration

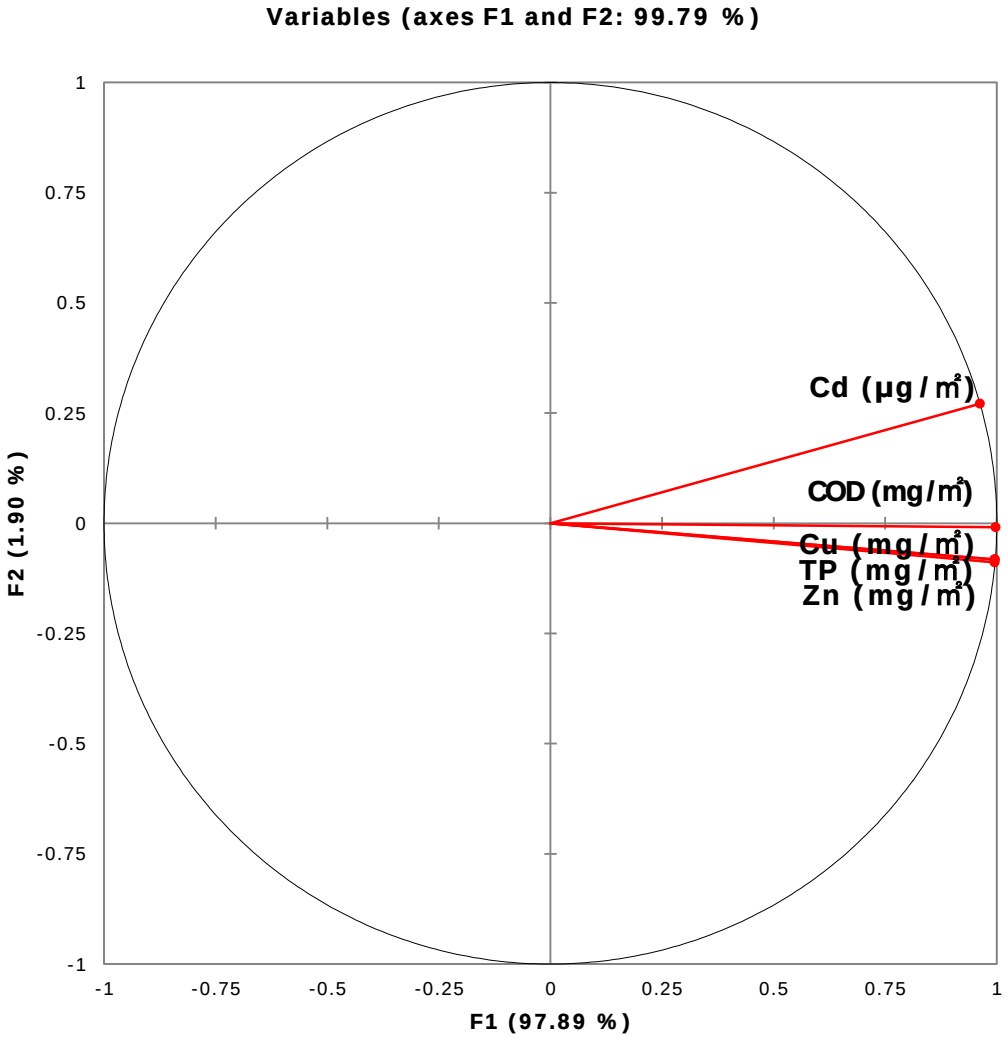


Unit: mg/g – mass Cd pro mass particle (solid phase concentration)
mg/m^2 – mass Cd pro unit area (surface load)

Accumulation on high traffic road



Principal component analysis



Summary

- Except for natural stone paved pedestrian path, the surface load of Cu, Zn, TP and COD frequently occurred in high traffic load road and mainly attached to the smallest particle size class, 0.45-63µm.
- The maximum value, solid-phase concentration, of above parameters frequently occurred in roof.
- A strong positive inter-correlation could be found between Cu, Zn, TP, and COD.
- Cd correlated only moderately with other pollutants.
- Antecedent dry weather periods, surface characteristics and traffic load played crucial roles in pollution accumulation and distribution on urban surface.

Thanks for your listening and attention!

»Wissen schafft Brücken.«

Email: jin.zhang@mailbox.tu-dresden.de