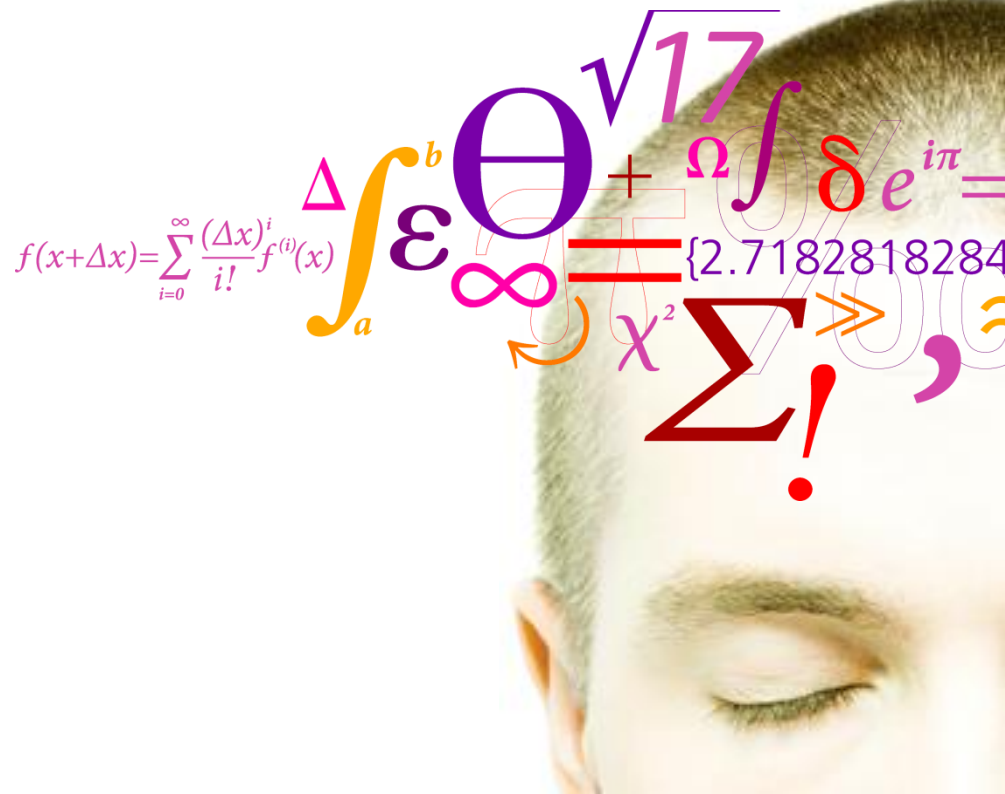
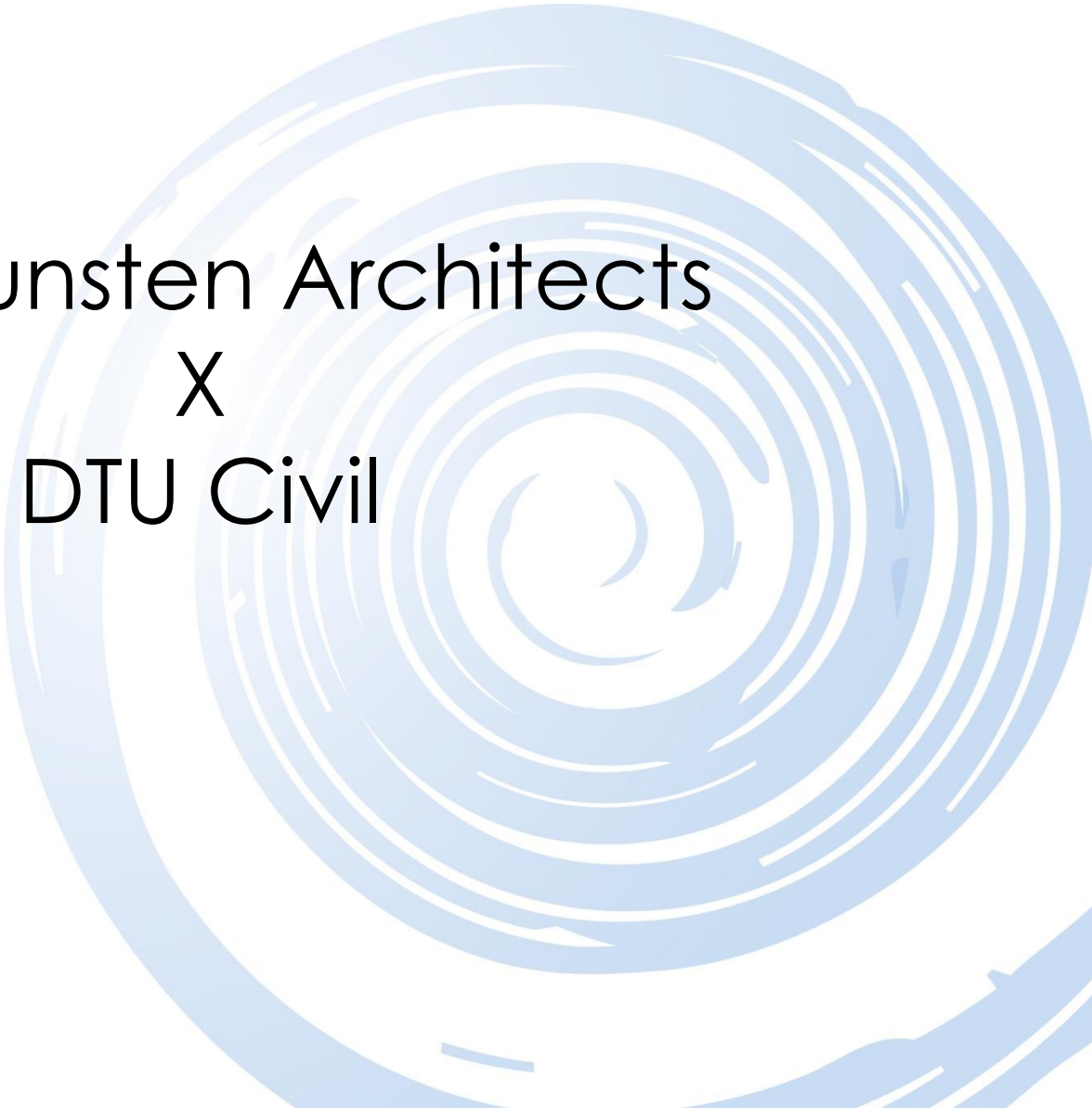


# Vandkunsten og DTU Byg ved

Thomas Nybo Rasmussen, Vandkunsten  
Lotte Bjerregaard Jensen, DTU Byg  
Lærke Philipsen, DTU Byg





Vandkunsten Architects  
X  
DTU Civil

Thomas Nybo Rasmussen, Partner at Vandkunsten Architects

Lotte Bjerregaard Jensen, Associate Professor at DTU Civil Engineering

Lærke Philipsen, Researcher at DTU BYG (Now WISE Research Assistant)

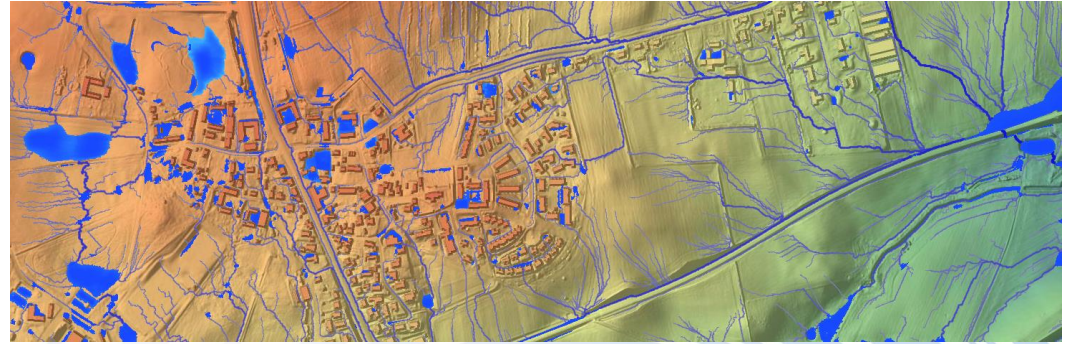
A large, light blue circular graphic with concentric, hand-drawn style lines, resembling a ripple or a stylized 'D', is positioned on the right side of the slide, partially overlapping the text.

Digital Tools for Landscape Architects: A Case  
Study of *Digital Tools* Used for *Analyzing And  
Screening*  
of *Climate Adaptation Challenges*  
in the *Early Design Phase*

## Objective

- Which **digital tools** are relevant for **architects, landscape architects, and planners** to use when **handling of rain water** of different intensity?
- How can these tools establish a better foundation of **design decisions** in the **early design phase**?
- What features are the **existing tools lacking**?
- And how should such a tool operate in an **optimal perspective**?

# SCALGO Live



The LAR-dimensioning Tool  
by The Water Pollution Committee

<b>Nedbørskarakteristika</b>									Pil ikke - intern beregning		
1	Kommune	Roskilde				Afskærende lednings kapacitet l			4.00E+01		
2						Volumen m³			46		
3						Total opland (m²)			1000		
<b>Designkarakteristika</b>											
4	Gentagelsesperiode (år)	10									
5	Sikkerhedsfaktor (dårlig, fremtidig udbygning, etc)	1.1									
<b>Oplandskarakteristika</b>											
6	Befæstet areal (m²)	7000									
<b>Jord- og nedsvivningskarakteristika</b>											
7	K (Hydraulisk ledningsevne) - se evt måling nederst	1.00E-06									
8											
9											
10											
11											
12											
<b>Faskine</b>											
13	Bredde	2									
14	Højde	1.3									
15	Højdens andel i faskine (Plast 0.95, sten 0.25)	0.95									
16	Udsivning i faskinebund: 0=Nej, 1=ja	0									
17	Længde faskine	263,6									
18	Dræn kapacitet, gennemsnit	3.45E-01									
19											
20											
21											

Indtast blå og røde tal i kolonne B. Derefter tryk på knappen "Beregn"

Beregn

	Beregningstek	Vol m³	Dræn kap l/s	Iterationsafstand	Antal iterationer
Faskine	OK	650,975	0,344946	0,0790%	9
Regobed	OK	691,454	0,35	0,0000%	1
Grøft	OK	701,477	0,4033594	0,0091%	3
Perm. bet.	OK	45,6093	0,4	0,0000%	1

Hjælpesrelser, faskine		Dimensionerende kassereg. Afløbsteknik s. 269	
Opstuvningsvolumen	650,98 [m³]	Vr.k (mm)	77,50
Faskine volumen	685,24 [m³]	Varighed (h)	146,95
Regn, der holdes umiddelbart	93,00 [mm]		
Regn, der siver pr døgn	4,26 [mm/døgn]		
		Karakteristika for dimensionerende kassereg	
Tømmelid	524 timer	1,89E+06 [s]	Samlet nedbar (mm)
Afløbstal	4,93E-01 [l/sek/ha]		Intensitet [l/sek/ha]
			103,59
			1,96

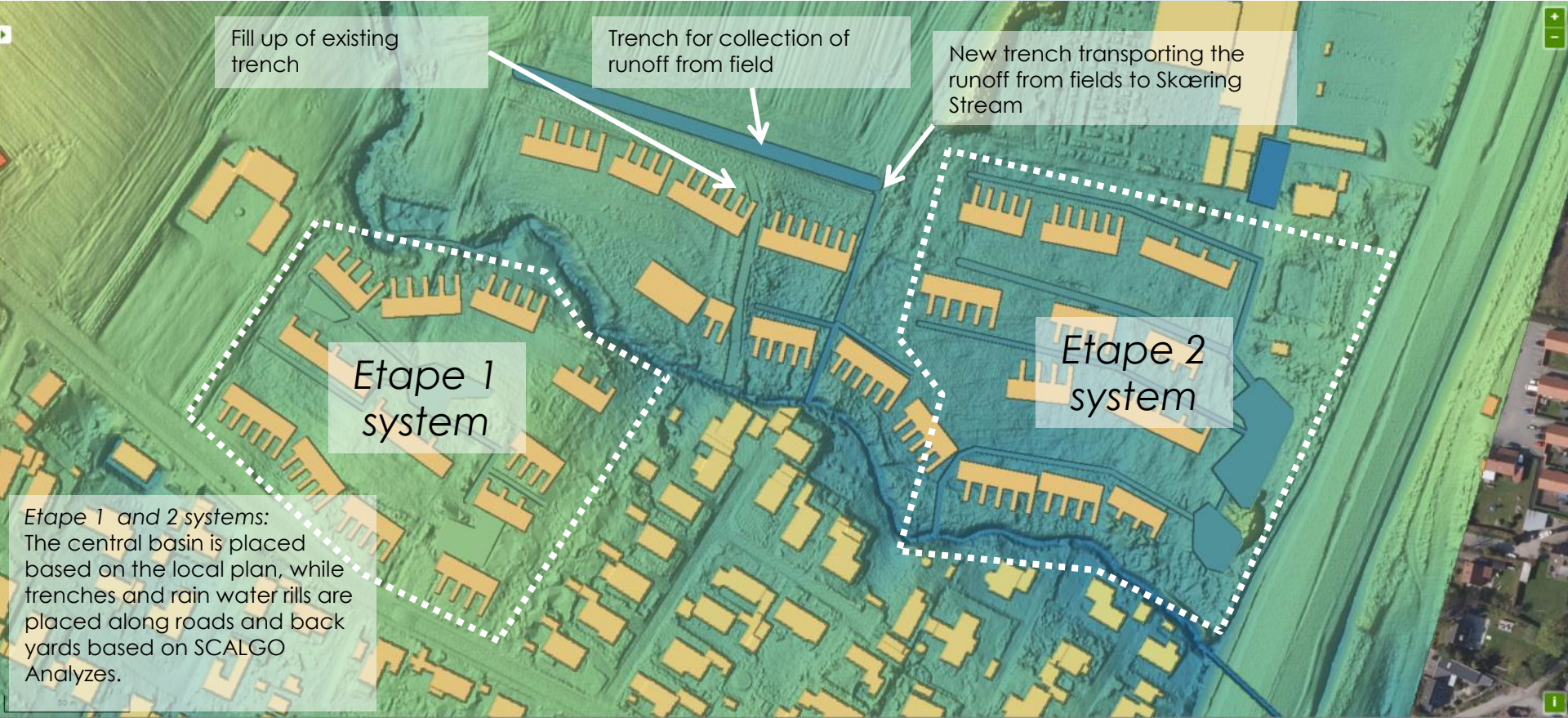
LAR-Potential  
A spreadsheet tool developed by DTU Environment

<b>Inputs</b>											
1	Antal	stk	0								
2	Areal per enhed	m2	0								
3	tages fra befæstet areal?	0/1	1=ja; 0=nej								
4											
<b>Mellemregninger</b>											
5	Dybde	cm	30								
6	Samlet areal	m2	0								
7	Samlet oplandsareal	m2	0								
8	absolut volumen	m3	0								
9	relativ volumen	mm	0								
10	arealforhold	m2/m2	0,0								
11	arealforhold	%	0%								
12											
<b>Resultater</b>											
13	gentagelsesperiode for overløb	år	0,00								
14	ledigt volumen per event - V	mm	0								
15	årlig volumen der nedsviver	%	0								

Case Example: Skæring Bæk



Case Example: Skæring Bæk

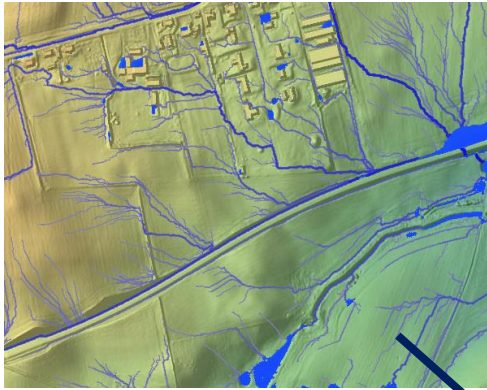




Case Example: Skæring Bæk



The Need for a New Tool



Flow paths  
Terrain model  
Graphical interface  
Quick and intuitive

# Future Tool

	A	B	C	D	E	F	G
1	<b>Nedbørskarakteristika</b>						
2	Kommune	Roskilde					
3	<b>Designkarakteristika</b>						
5	Gentagelsesperiode (år)		10	år			
6	Sikkerhedsfaktor (ulima, fremtidig udbygning, etc)		1,1				
7	<b>Oplandskarakteristika</b>						
8	Befæstet areal (m <sup>2</sup> )		7000	m <sup>2</sup>			
10	<b>Jord- og nedsvingskarakteristika</b>						
11	K (Hydraulisk ledningsevne) - se evt måling nederst		1,00E-06	m/s			
14	<b>Faskine</b>						
15	Bredde		2	m			
16	Højde		1,3	m			
17	Hulrums andel i faskine (Plast: 0,95, sten: 0,25)		0,95	0-1			
18	Udsivning i faskinebund: 0=Nej; 1=ja		0				
19	<b>Længde faskine</b>		263,6	m			
20	Års kapacitet, gennemsnit		3,45E-01	l/s			

Indtast blå og røde tal i kolonne B. Derefter tryk på knappen "Beregn"

Beregn

	Beregningsstet	Vol. m <sup>3</sup>
Faskine	OK	650,975
Regnbed	OK	691,454
Grøft	OK	701,477
Perm. bel.	OK	45,6093

Hjælpes størrelser, faskine	
Opstuvningsvolumen	650,98
Faskine volumen	685,24
Regn, der holdes umiddelbart	93,00
Regn, der siver pr døgn	4,26
Tømmetid	524 timer
Afløbstal	1,89E+06
	4,93E-01

Specific volumes  
Few data inputs

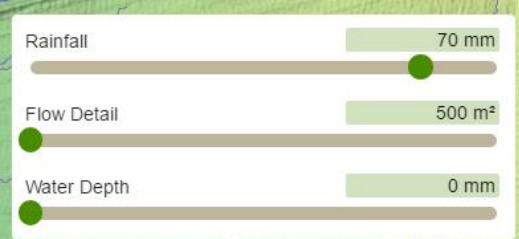
	A	B	C	D	E	F	G	H	I	J	K	L	M	N
2	<b>Inputs</b>													
3	Antal	stk	0											
4	Areal per enhed	m <sup>2</sup>	0											
5	tages fra befæstet areal?	0/1		1=ja; 0=nej										
7	<b>Mellemregninger</b>													
8	Dybde	cm	30											
9	samlet areal	m <sup>2</sup>	0											
10	samlet oplandsareal	m <sup>2</sup>	0											
11	absolut volumen	m <sup>3</sup>	0											
12	relativ volumen	mm	0											
13	arealforhold	m <sup>2</sup> /m <sup>2</sup>	0,0											
14	arealforhold	%	0%											
16	<b>Resultater</b>													
17	gentagelsesperiode for overløb	år	0,00											
18	ledigt volumen per event - V	mm	0											
19	årlig volumen der nedsviver	%	0											

Calculates on systems  
Focus on the area available

Trekroner



Trekroner



## Application Process

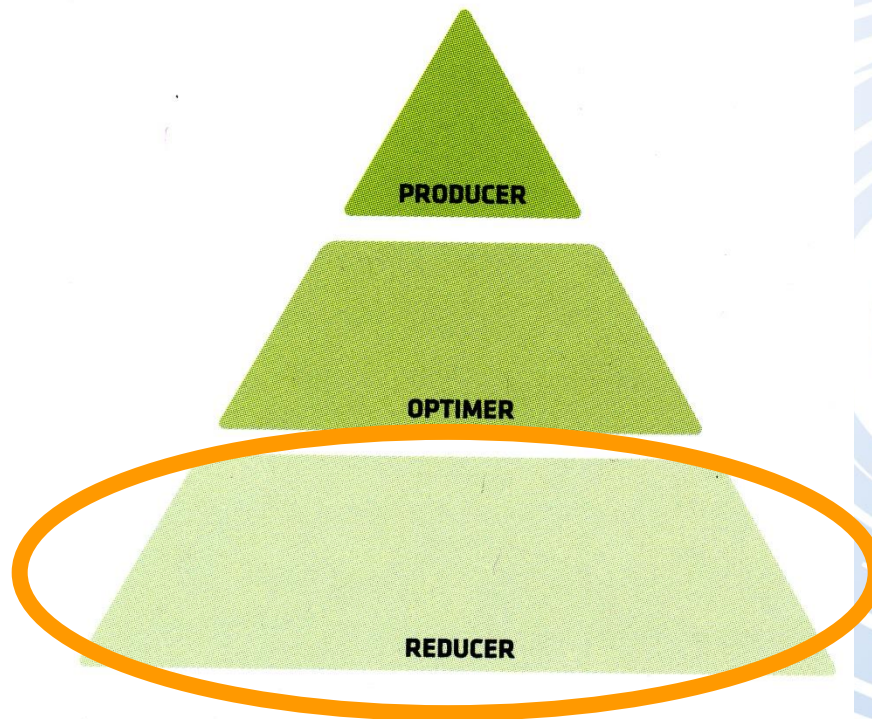
- Background –  
the project came from a collaboration with Vandkunsten in the building scale  
and a collaboration with a collaboration with DTU Environment on how to integrate knowledge of water  
flows in early design phases.  
It evolved naturally into the VIS project.

-the application process was very simple.

By means of Karsten Arnbjergs research we were able to outline the CO<sub>2</sub> emission reduction potential of  
the project.

# Engineering knowledge from first Design day

## HISTORY OF VIS PROJECT



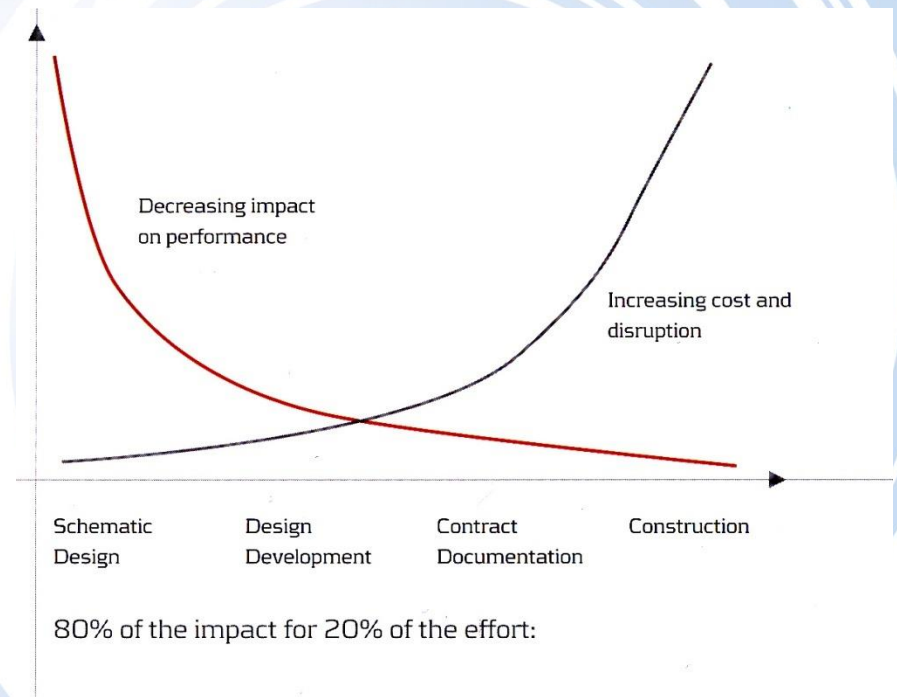
HLA model

# Engineering knowledge from first Design day

A decade of experience with integrated design.

Task 23

4 industrial PhD's – civil engineers at architectural studios

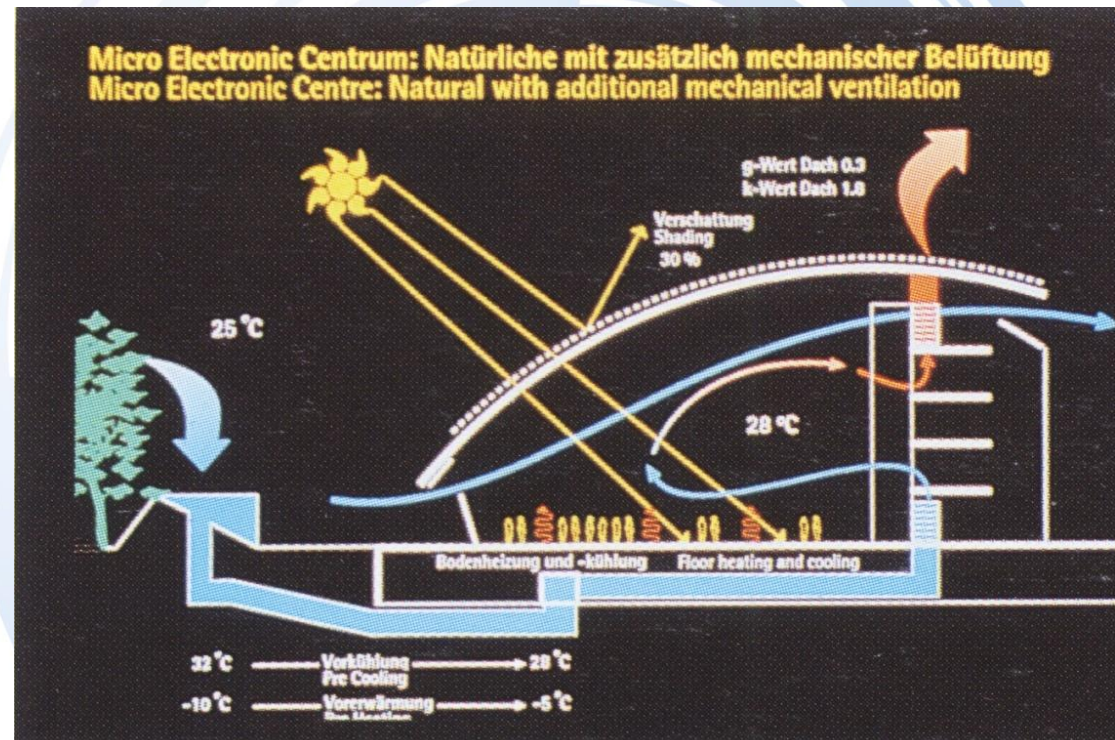


# Engineering knowledge from first Design day

Reducing the energy consumption for the operation of buildings: Daylight instead of electric light.

Passive Solar heating – without overtemperature  
 Natural ventilation instead of mechanical ventilation.

DO THE SAME IN URBAN DESIGN





# Tools for building physics

## Preliminary design

iDBuild

Be06

## Integrated

BSim

IES VE

RIUSKA

IDA ICE

TRNSYS

 **EnergyPlus**

ECOTECH

DOE

ESP-r

ENERGY-10

DEROB-LTH

## Specialized

WUFI

Radiance

MATCH

SIMBAD

HEAT2

# **Tools for cities**

## Preliminary design

Vasari

Miljø Gis

Scalgo?

## Integrated

Vissim

Small wind  
tunnel

TRNSYS

ECOTEECT

## Specialized

Large windtunnel

MikeUrbanFlood

Flood-2D

WHY? Outdoor spaces with sun and lee are more attractive to human beings.  
+ Water, Snow, Traffic prediction

Criteria for the simulation tools:

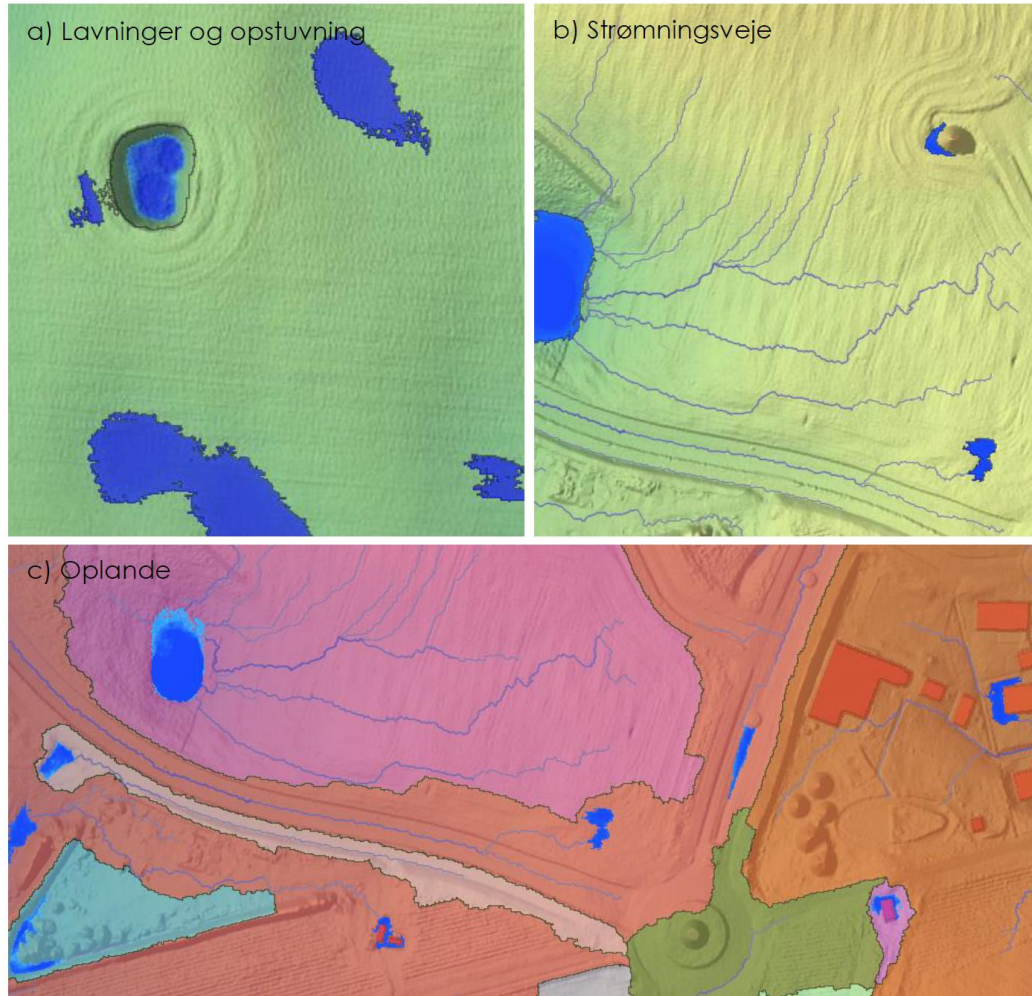
Speed – ‘real time’

Accuracy

Interface with popular drawing software in the industry.

Visual display of results





Figur 5: Tre figurer som viser resultater fra SCALGO. På a) ses indtegnning af lavninger (sort ramme) og opstuvning af regnvand ved 70 mm (blå figurer). På b) ses et kort med indtegnede strømningsveje (blå linjer), som samler sig i en lokal lavning. På c) er oplandene til lavningerne indtegnet med en nedbør på 5 mm. Ved større vandmængder vil oplandene blive større, da de enkelte lavninger vil flyde over til de næste. Baggrundskortet er den digitale højdemodel, som viser højderne i terrænet.

2016/2017  
 EU regional  
 VIS project  
 Using simulation  
 Tools in real  
 projects  
 at architectural  
 Office  
 Vandkunsten