



# Parametrisch ontwerp

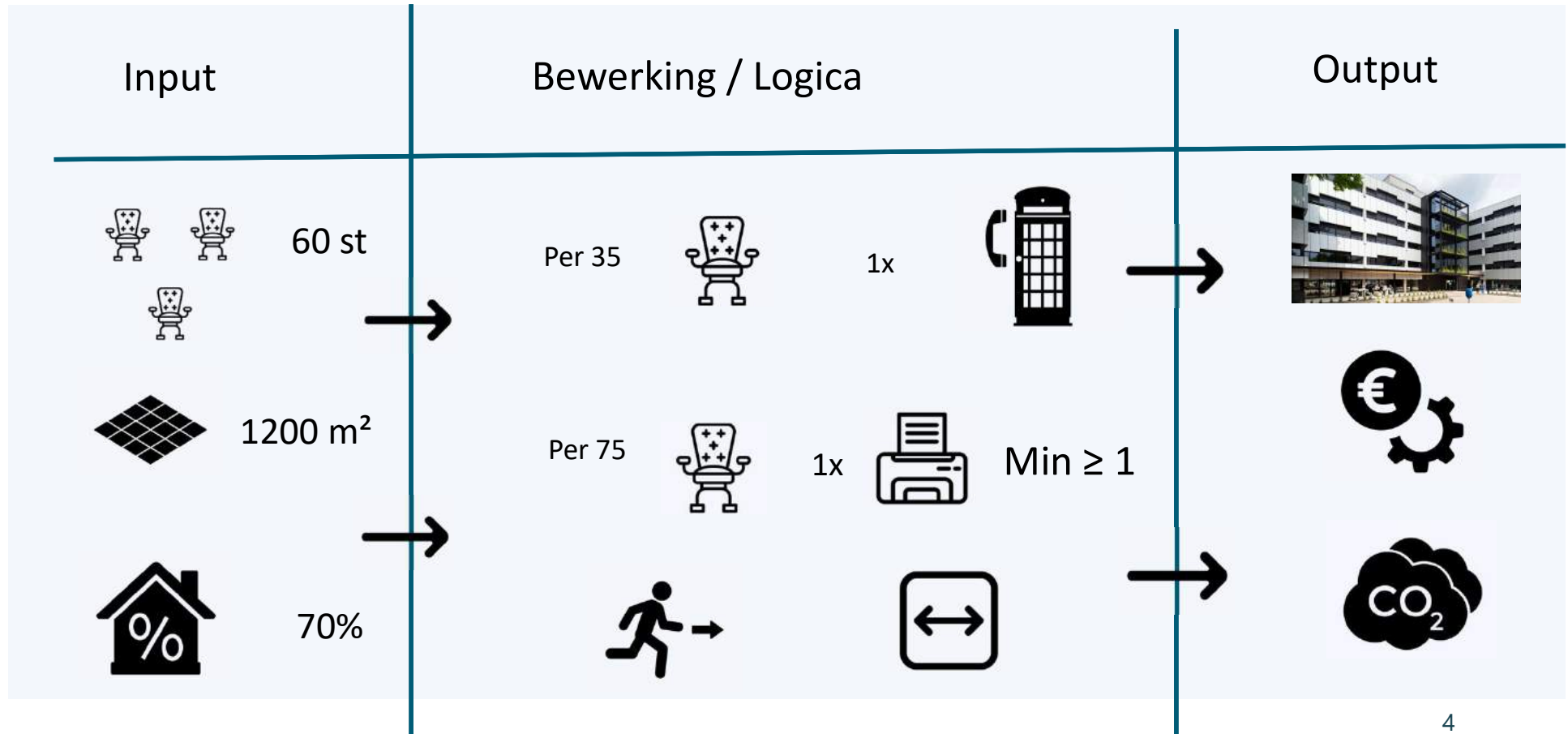
Menno Fousert

## Parametric design – What does it mean?

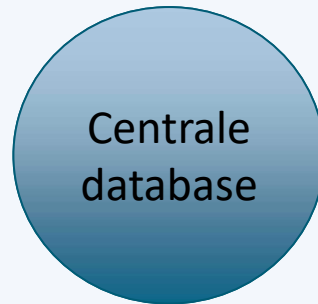
- create a design solely based on a set of parameters
- all disciplines are using the same set of parameters
- automated control of design calculations from the database



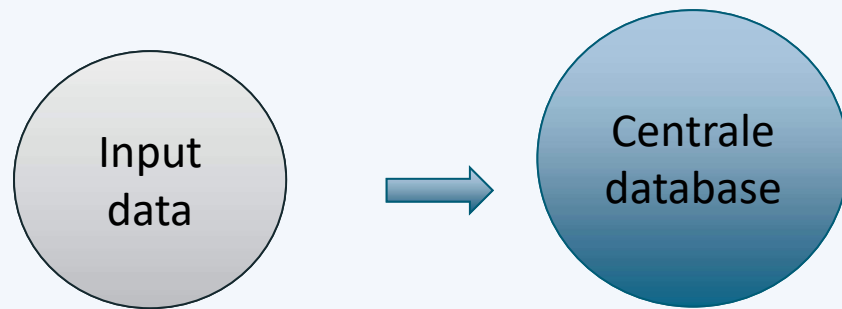
# Parametrisch ontwerpen



## Parametric design – AQD



## AQD in a nutshell



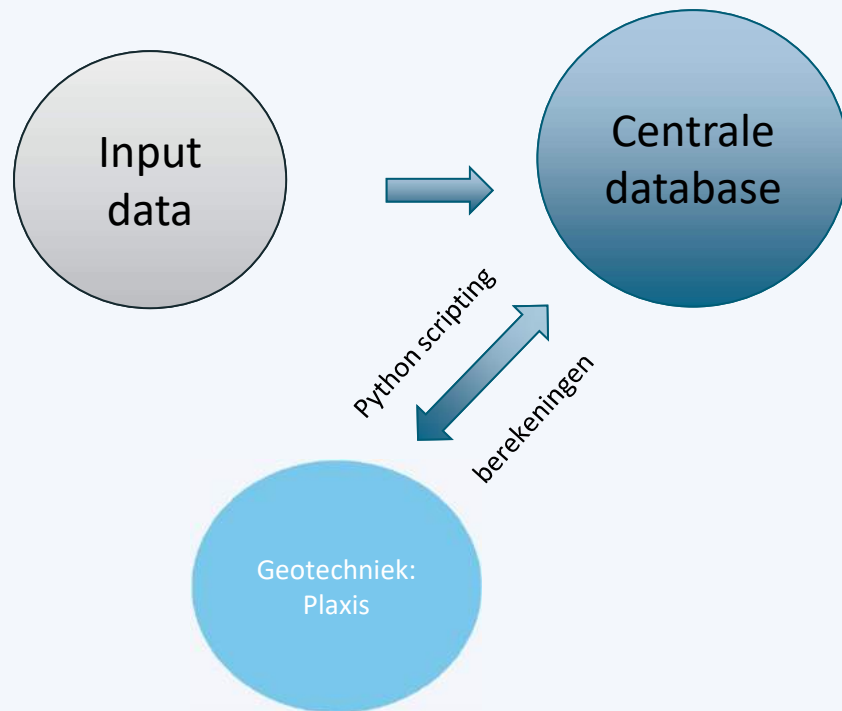
Waterstanden

Belastingen

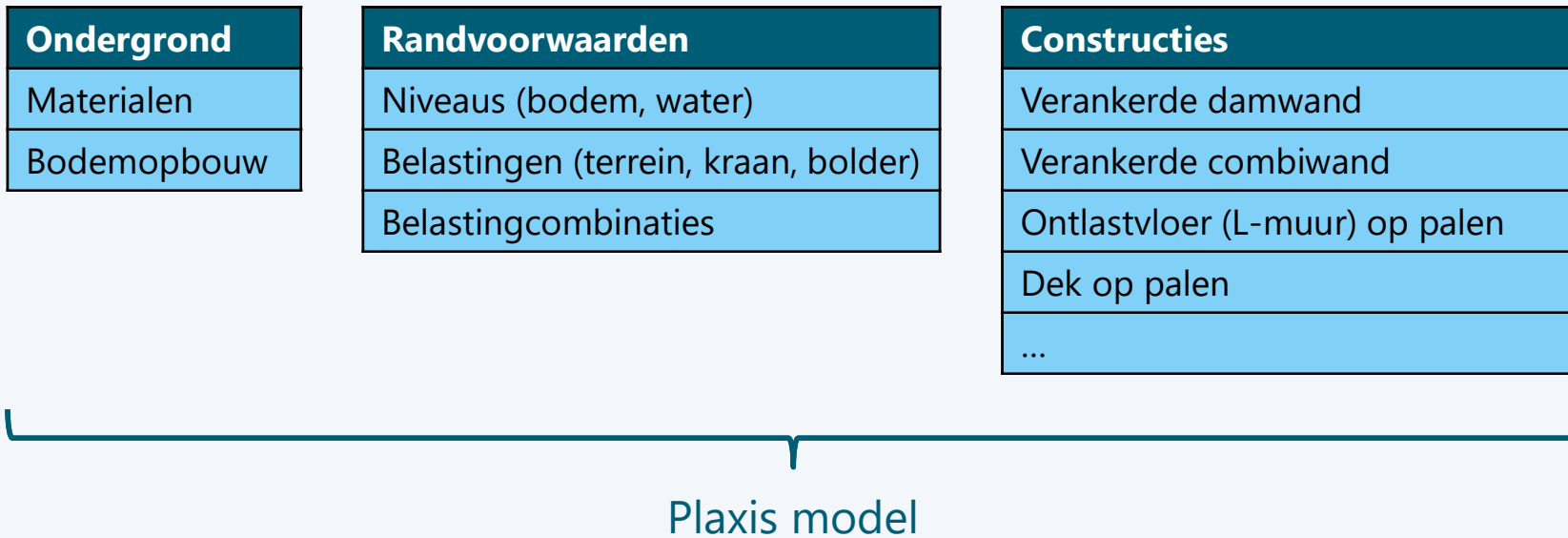
Grondopbouw

Materiaal  
eigenschappen

## AQD in a nutshell



## AQD in a nutshell

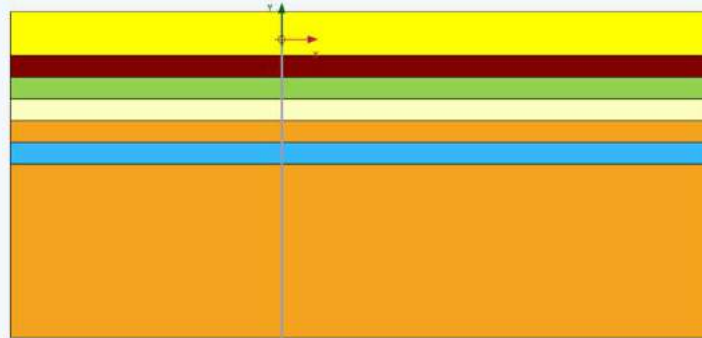




## Subsoil characterisation

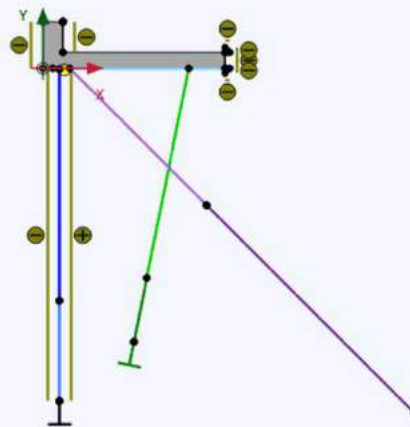
MaterialName	Colour	gammaUnsat	gammaSat	E50ref	Eoedref	Euref	cref	phi	psi	Rinter	OCR
Aanvulzand	RGB(255, 255, 0)	17	19	30000	30000	90000	0.0	30.0	0.0	0.67	1.00
Zand los gepakt	RGB(255, 255, 192)	17	19	30000	30000	90000	0.0	30.0	0.0	0.80	1.00
Zand vast gepakt	RGB(244, 163, 31)	19	21	75000	75000	225000	0.0	35.0	5.0	0.80	1.10
Zand sterk siltig kleiig	RGB(54, 183, 252)	18	20	20000	20000	60000	0.0	27.5	0.0	0.80	1.10
Klei zwak zandig matig	RGB(146, 208, 80)	17	17	4000	2667	12000	5.0	22.5	0.0	0.80	1.00
Veen, matig vast	RGB(128, 0, 0)	11	11	2000	2000	6000	2.0	15.0	0.0	0.10	1.30

Material	Top
Aanvulzand	5.1
VeenMatigVast	-3
KleiZwakZandigMatig	-7
ZandLosGepakt	-11
ZandVastGepakt	-15
ZandSterkSiltigKleiig	-19
ZandVastGepakt	-23

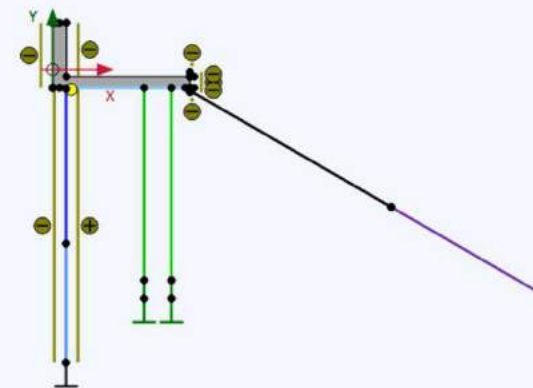


## Structural elements

Property	case1	case2
Lmuur_zvloerok	0	-2
Lmuur_dwand	2.2	1.5
Lmuur_dvloer	1.75	1.25
Lmuur_Bvloer	20	15
combiwand_D	1420	1420
combiwand_t	21	21
combiwand_planktype	PU28	PU32
combiwand_nrplanken	3	3
combiwand_bottom	-36.5	-32
drukpaal_x	16	13
drukpaal_nr	1	2
drukpaal_hohx	-3	-3
drukpaal_hoh	2.882	2.882
drukpaal_schoor	5	99
drukpaal_poskleef	-23	-23
drukpaal_bottom	-30	-25
drukpaal_D	609	609
drukpaal_t	10	10
drukpaal_Tskin	225	225
drukpaal_Fbottom	6250	6250
mvpaal_hoek	45	30
mvpaal_hoh	2.882	2.882
mvpaal_poskleef	-15	-15
mvpaal_L	55	45
mvpaal_profiel	HEB600	HEB600
mvpaal_Tskin	205	205
mvpaal_xstart	None	14.5



Case 1



Case 2

# boundary conditions

DesignApproach	terrein lmuur	terrein achter	bolder	kraan	gamma	stiffness	c	phi	psi
HBK_BGT_Terrein	1	1	0	0					
HBK_BGT_Terrein_Bolder	1	1	0.7	0					
HBK_BGT_Bolder_Terrein	0.7	0.7	1	0					
HBK_BGT_Terrein_Bolder_Kraan	1	1	0.7	0.7					
HBK_BGT_Bolder_Terrein_Kraan	0.7	0.7	1	0.7					
HBK_BGT_Kraan_Terrein_Bolder	0.6	0.6	0.6	1					
HBK_UGT_Kraan_dominant	0.9	0.66	0.78	1.5			1.45	1.25	
HBK_UGT_Terrein_dominant	1.5	1.1	0.91	1.05			1.45	1.25	
HBK_UGT_Bolder_dominant	1.05	0.77	1.3	1.05			1.45	1.25	
HBK_UGT_Kraan_Kraan	0	0.66	0.78	1.5			1.45	1.25	
HBK_UGT_Kraan_Terrein	0	1.1	0.91	1.05			1.45	1.25	
HBK_UGT_Kraan_Bolder	0	0.77	1.3	1.05			1.45	1.25	

Load	Case 1
surface_between	40
surface_behind	60
crane_vert	2000
crane_hor	40
crane_width	32
bollard	400
bollard_ecc	0.5

Design approaches

Identification

- HBK\_BGT\_Terrein
- HBK\_BGT\_Terrein\_Bolder
- HBK\_BGT\_Bolder\_Terrein
- HBK\_BGT\_Terrein\_Bolder\_Kraan
- HBK\_BGT\_Bolder\_Terrein\_Kraan
- HBK\_BGT\_Kraan\_Terrein\_Bolder
- HBK\_UGT\_Kraan\_dominant
- HBK\_UGT\_Terrein\_dominant
- HBK\_UGT\_Bolder\_dominant
- HBK\_UGT\_Kraan\_Kraan
- HBK\_UGT\_Kraan\_Terrein
- HBK\_UGT\_Kraan\_Bolder

Loads | Materials

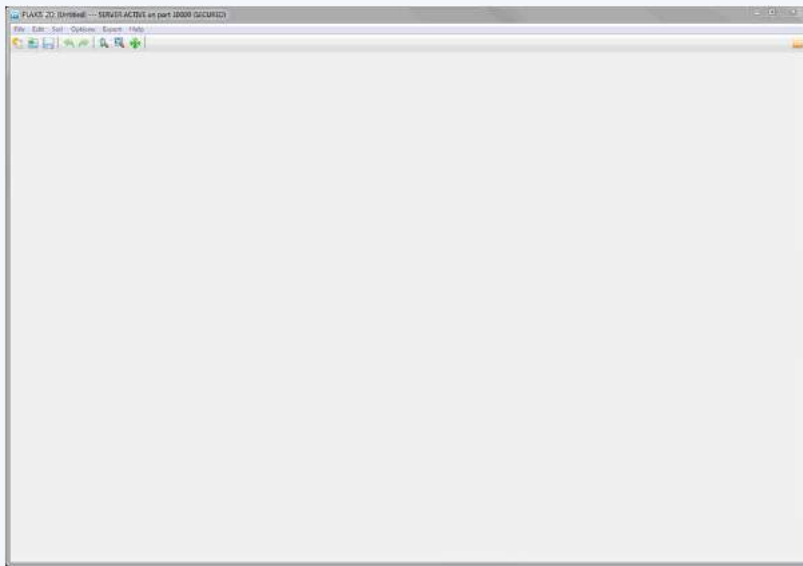
#	Description	Factor
1	terrein_lmuur	1.0000
2	terrein_achter	0.770000
3	bolder	1.3000
4	kraan	1.0500

Phases explorer

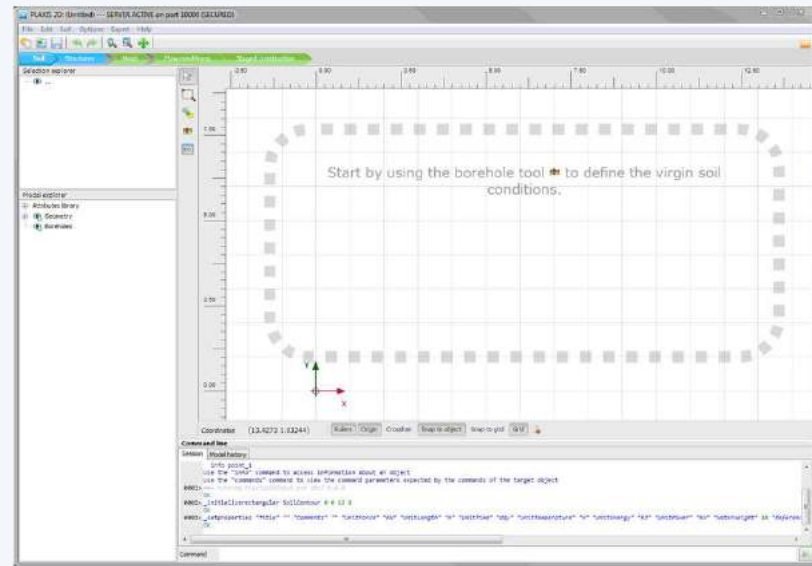
- HBK\_BGT\_Terrein [Phase\_6]
- HBK\_BGT\_Terrein\_Bolder [Phase\_7]
- HBK\_BGT\_Bolder\_Terrein [Phase\_8]
- HBK\_BGT\_Terrein\_Bolder\_Kraan [Phase\_9]
- HBK\_BGT\_Bolder\_Terrein\_Kraan [Phase\_10]
- HBK\_BGT\_Kraan\_Terrein\_Bolder [Phase\_11]
- HBK\_UGT\_Kraan\_dominant [Phase\_12]
- HBK\_UGT\_Terrein\_dominant [Phase\_13]
- HBK\_UGT\_Bolder\_dominant [Phase\_14]
- HBK\_UGT\_Kraan\_Kraan [Phase\_15]
- HBK\_UGT\_Kraan\_Terrein [Phase\_16]
- HBK\_UGT\_Kraan\_Bolder [Phase\_17]



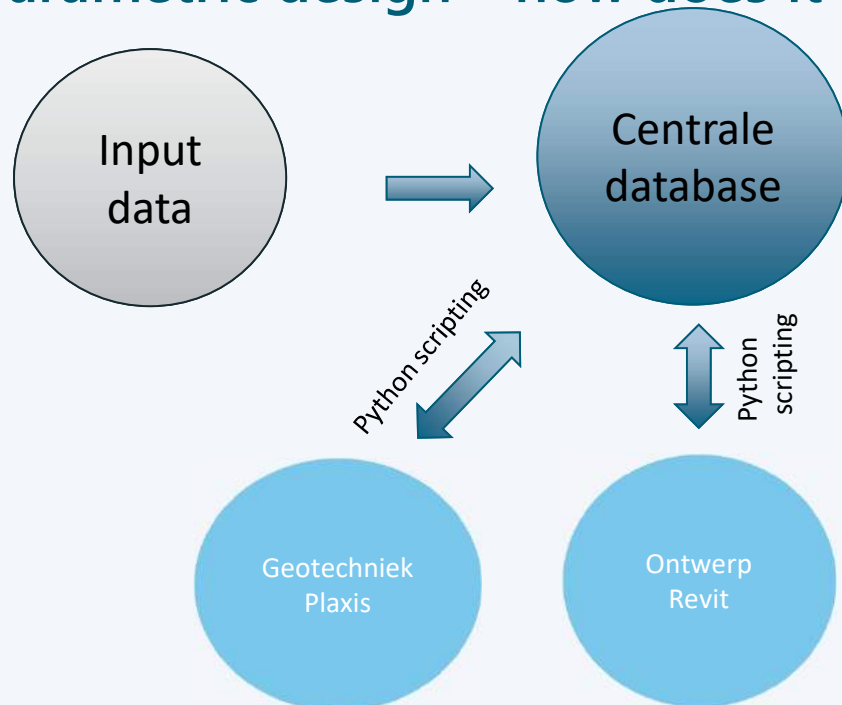
# Case 1



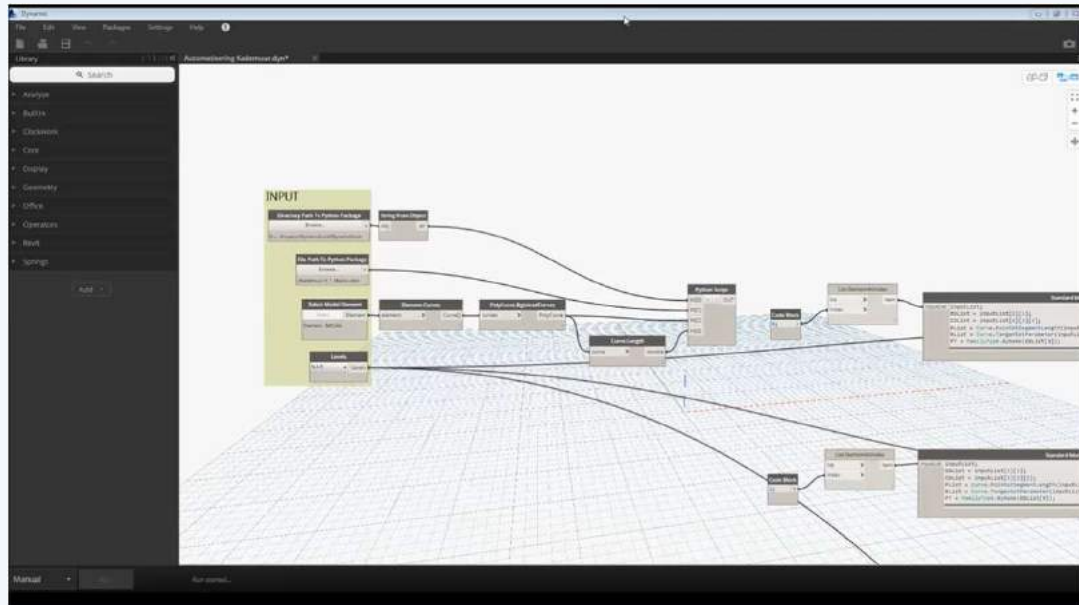
# Case 2



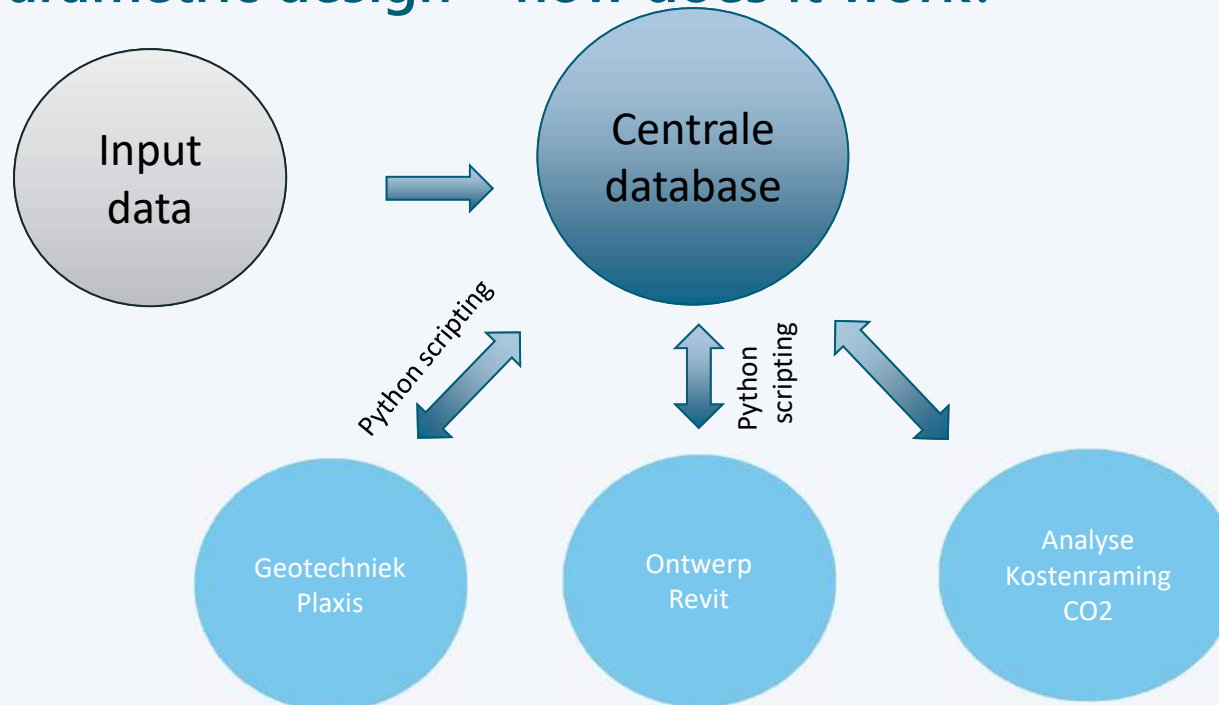
## Parametric design – how does it work?



# Drawings: Revit

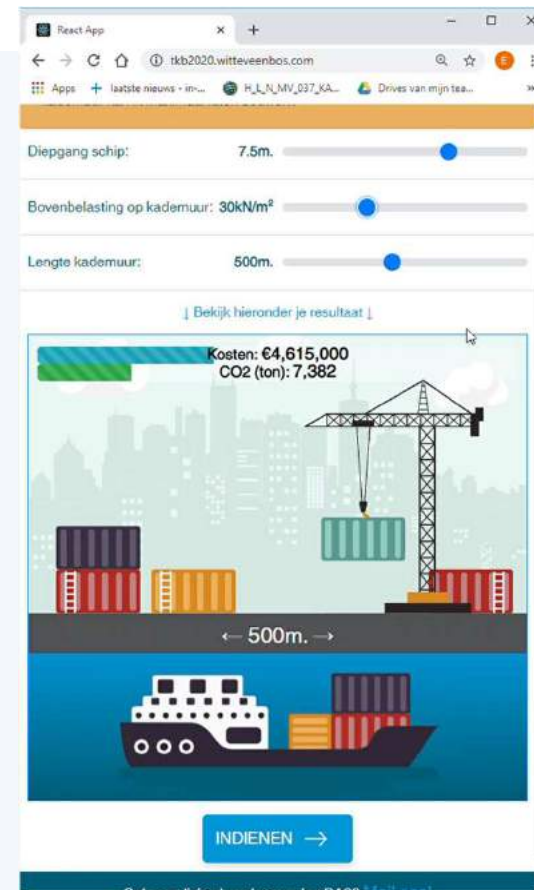


## Parametric design – how does it work?



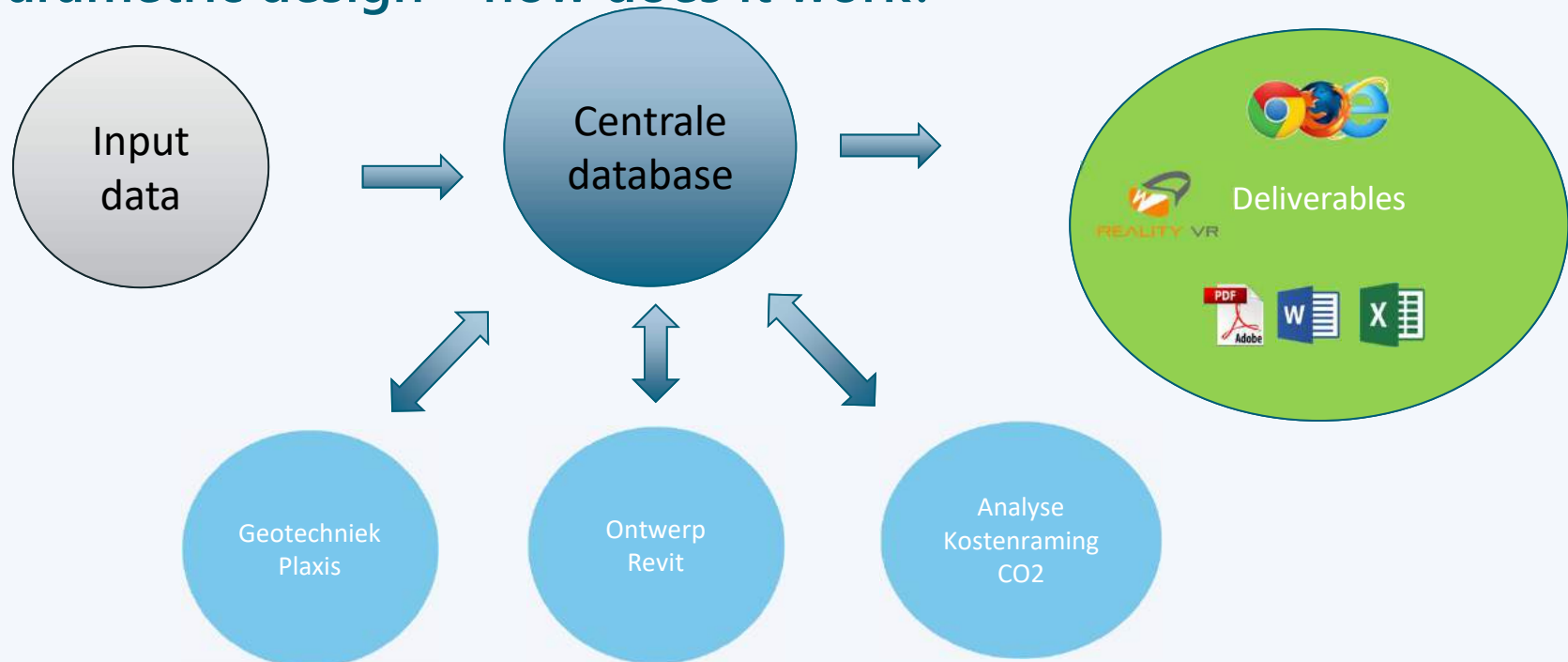
## Costs / CO2

- sliders to change
  - allowable load on quay wall
  - excavation depth
- directly visible:
  - construction cost / m of quay wall
  - CO2 emission





## Parametric design – how does it work?





VROEG STADIUM  
VEEL INZICHT

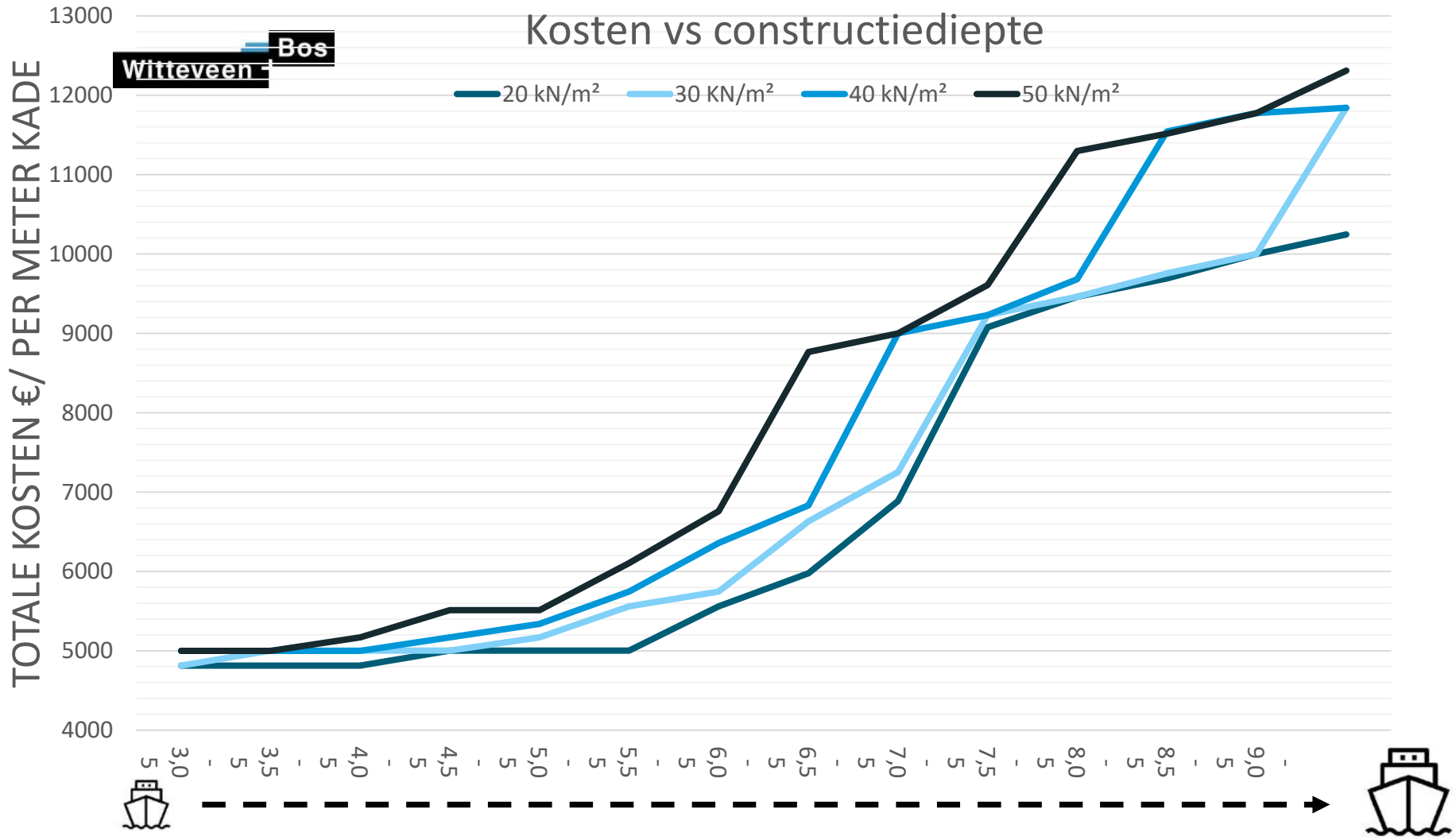


IMPACT VAN  
UITGANGPUNTEN



GEOPTIMALISEERD  
ONTWERP

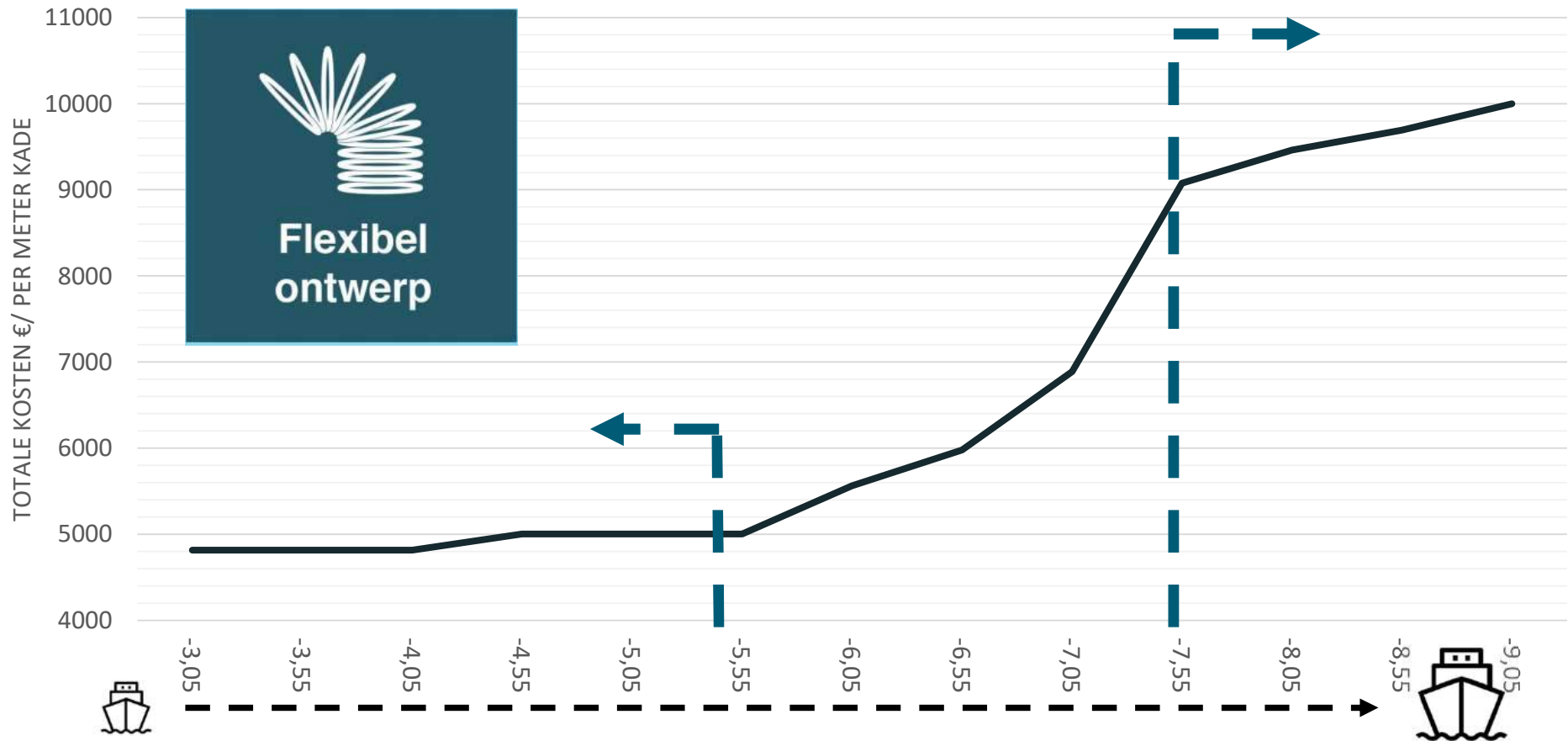
# Kosten vs constructiediepte



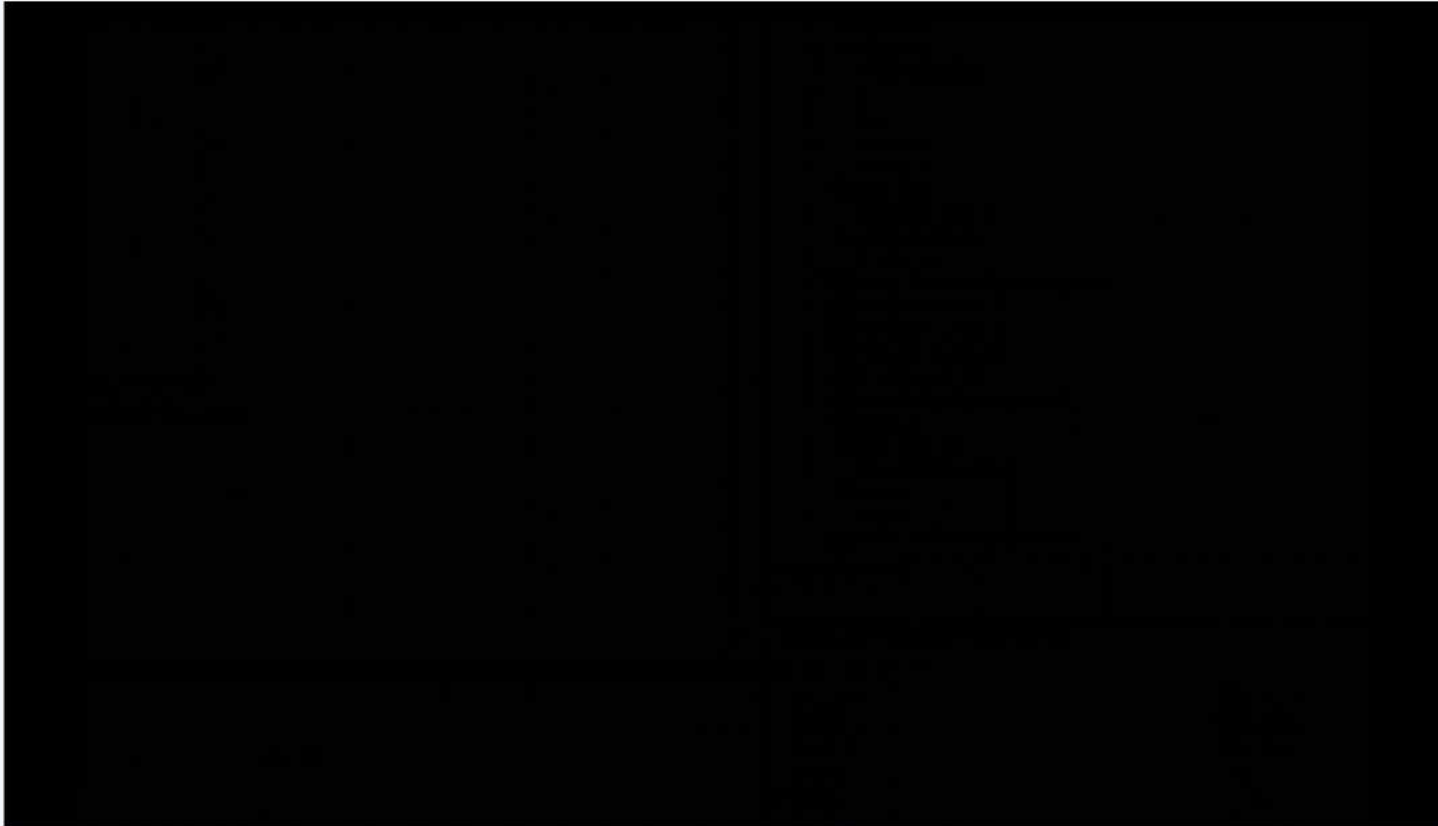
Witteveen + Bos

# Kosten vs constructiediepte

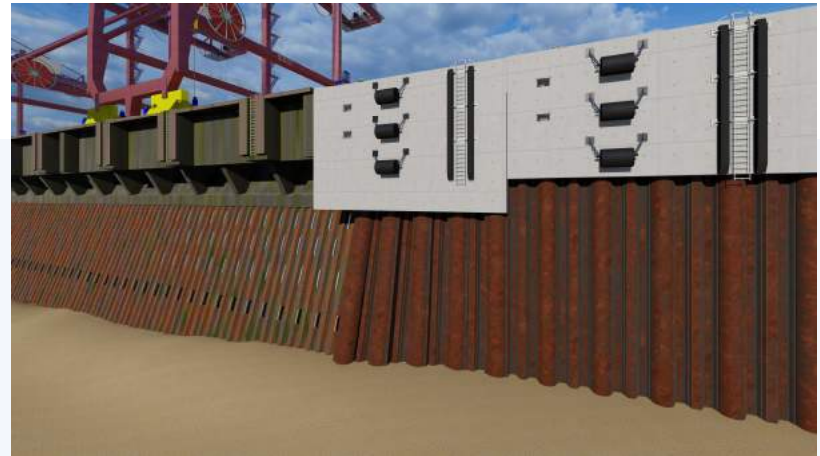
— 20 kN/m<sup>2</sup>



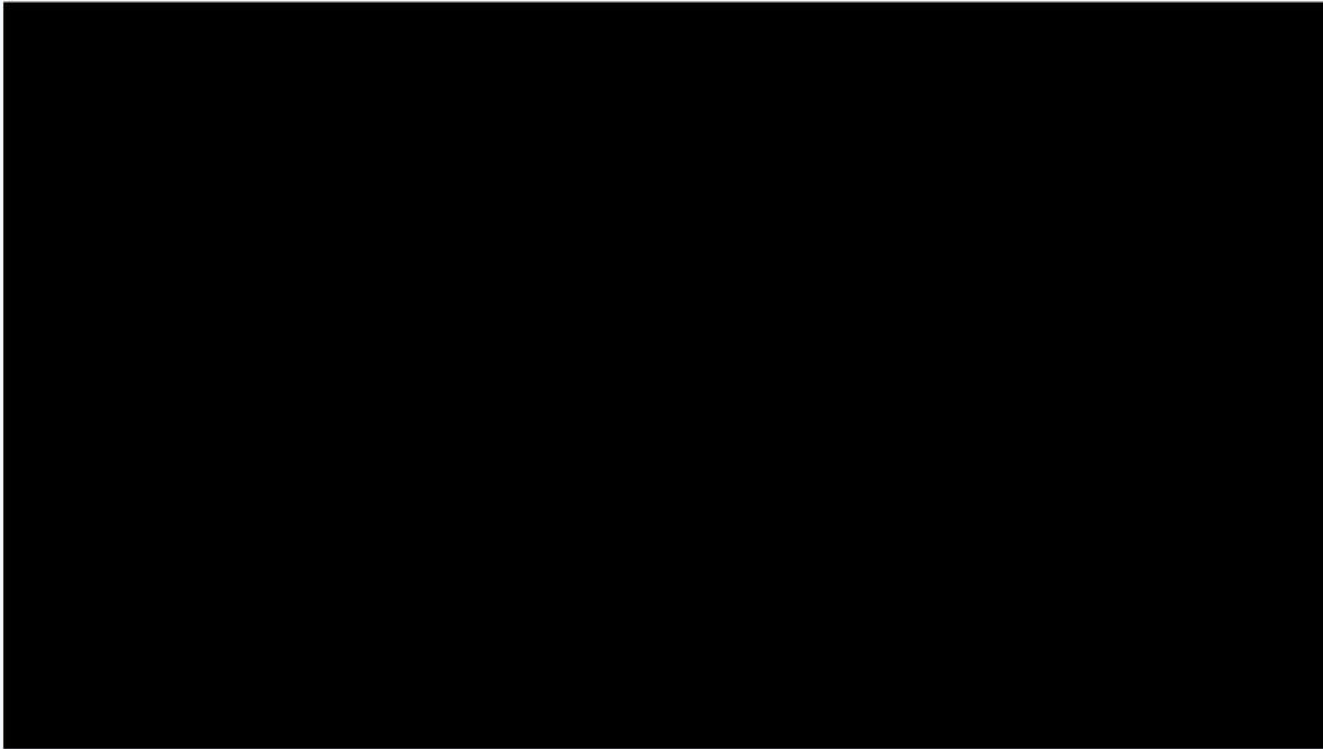
## Automatic design of a river crossing



# Visualisaties



## Datagedreven bestekken genereren



- De voordelen zijn duidelijk, maar er is ook nog veel te verbeteren.
- Het kan nog veel efficiënter:
  - Meer uniformiteit in aanleveren data en uitgangspunten;
  - “missing links” verder automatiseren (b.v. genereren bestekken)
- En er zijn nog dilemma's
  - Hoe bedienen we de klant op een eerder moment?
  - Hoe werken we samen? In een cloud, of via een webapplicatie?
  - Doen we dit alleen met klanten of slaan we de handen ineen?





[www.witteveenbos.com](http://www.witteveenbos.com)