



Rijkswaterstaat  
*Ministry of Infrastructure and the  
Environment*

# Systems Engineering

Webinar for GPP 2020

18 September 2014



## announcement

### **GPP 2020 webinar on Systems Engineering and Functional Specifications**

Systems Engineering (SE) is an interdisciplinary approach and enables the realization of complex systems. meeting user needs. SE focuses on defining customer needs and required functionality early in the development cycle. SE documents requirements and facilitates design synthesis and system validation while considering among other operations, cost and performance – all embedded into Green Public Procurement.

In this GPP 2020 webinar Ron Beem from RWS will address some principles of SE in GPP, like user requirements, design and procurement setup. For more information on SE see [www.leidraadse.nl/welcome](http://www.leidraadse.nl/welcome).

GPP 2020 webinar on Systems Engineering and Functional Specifications – 18 September 2014, 10.00 (CET)

# Who am I



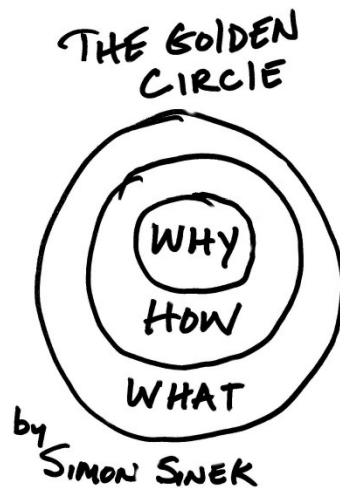
Ron Beem - SE-coördinator Rijkswaterstaat:

*'SE uses not only the system as a basis, but also the process that you require to create the system.'*





# Contents



- Outside in:
  - What is Systems Engineering (SE)
  - How do we do that
  - And why
- Inside out:
  - Why incorporate green public procurement in SE
  - How
  - What do you get



## What is Systems Engineering

‘Systems Engineering is an interdisciplinary approach and means to enable the realization of successful systems. It focuses on defining customer needs and required functionality early in the development cycle, documenting requirements, and then proceeding with design synthesis and system validation while considering the complete problem: operations, cost and schedule, performance, training and support, test, manufacturing, and disposal. SE considers both the business and the technical needs of all customers with the goal of providing a quality product that meets the user needs.’

This is the official definition of Systems Engineering according to INCOSE.

‘Functional specifications’ is included in this definition

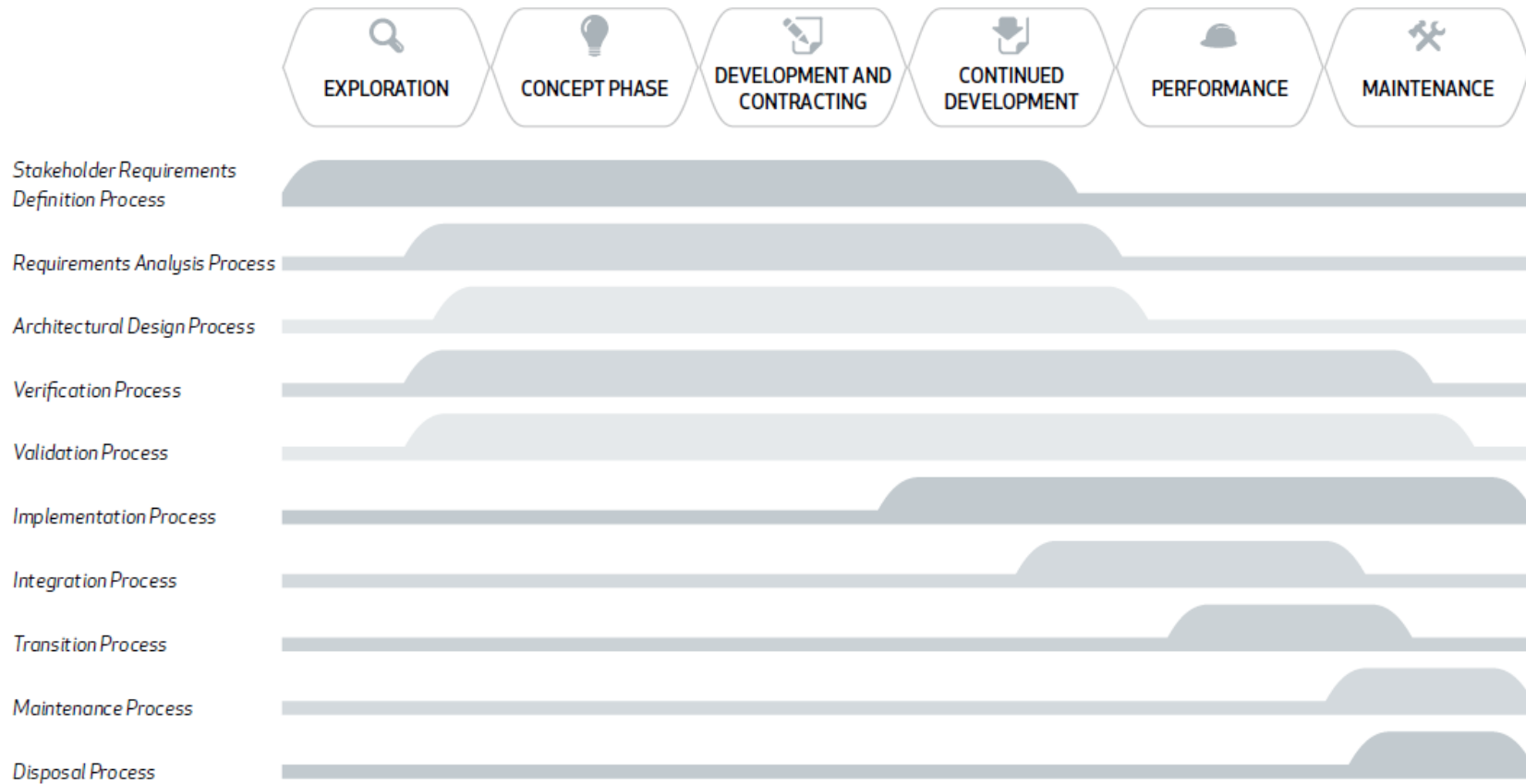


## What is Systems Engineering, part 2

- Systems Engineering = Systems + Engineering
- Systems = object                      physical, but also spatial
- Engineering = processes              project management, configuration management, procurement management, integration processes, validation processes etc

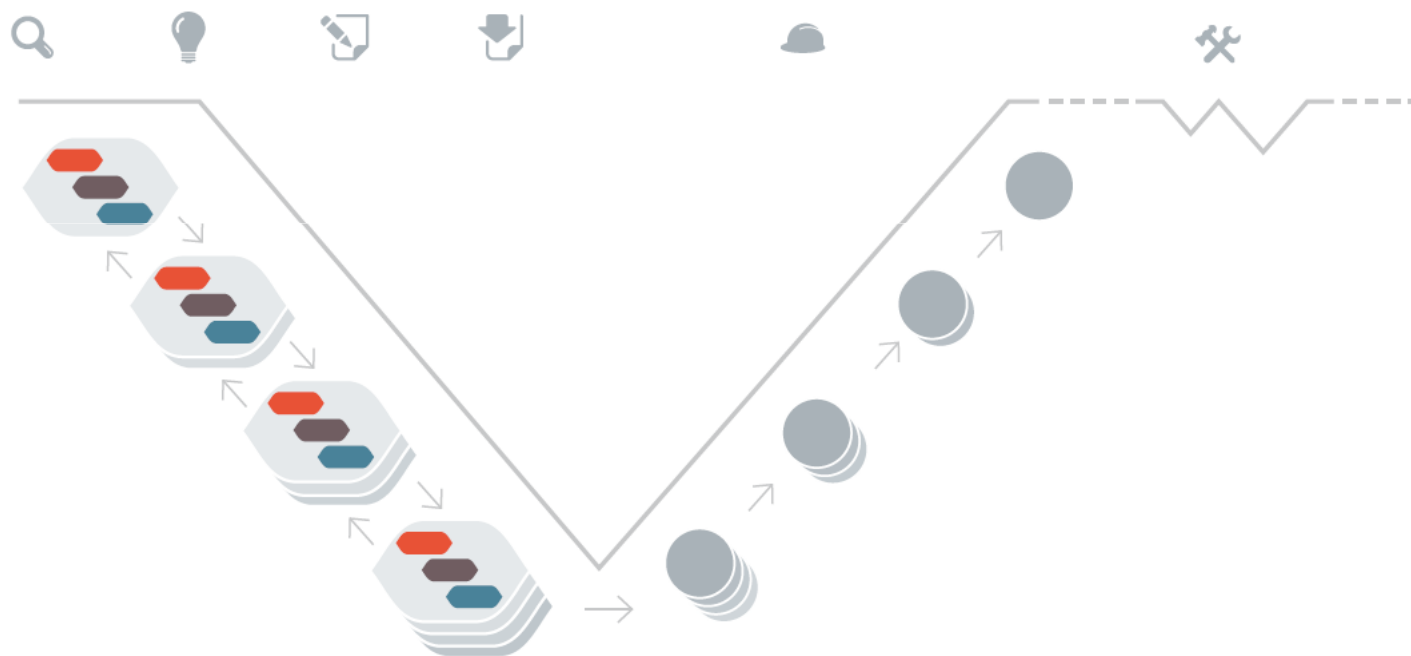


# Systems Engineering: how?





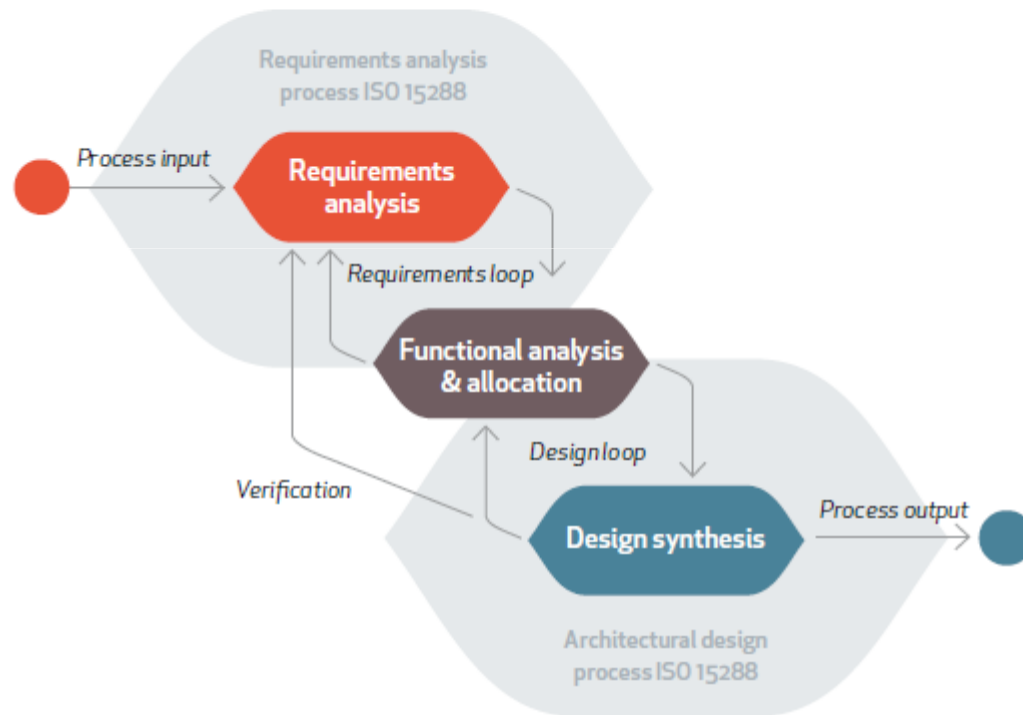
## How, part 2: the V-model







## How, part 3: the iterative nature of specifying





# Why Systems Engineering

- It's all about cohesion: guideline for Systems Engineering within the Civil Engineering sector in the Netherlands v3, [www.leidraadSE.nl/welcome](http://www.leidraadSE.nl/welcome)

- Together:

**ProRail**

Patrick Buck ProRail  
(the Dutch Rail Infrastructure Manager)



Jan Hendrik Dronkers Rijkswaterstaat  
(the Directorate-General for Public Works and Water Management)



Peter van der Linde Vereniging van Waterbouwers  
(the associated Dutch Hydraulic Engineering firms)

**NL**INGENIEURS

Ed Nijpels NLingenieurs  
(the associated Dutch engineering firms)

**UNETO VNI**

Titia Siertsema Uneto VNI  
(the Dutch electronic installation industry)



Maxime Verhagen Bouwend Nederland  
(the Dutch construction industry)

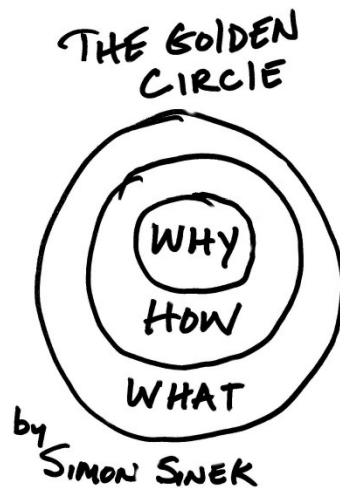
## Why SE, part 2 guiding principles



Giving customer demand a central position.	Centre stage is given not to the technical solution to the problem, but to the requirements of interested parties during the life cycle of the system (the stakeholders).
Providing room for design freedom.	A problem definition also needs a solution scope. Design freedom is desirable to allow for better use of the creativity of market parties.
Thinking in systems (systematic thinking).	All parties in the sector approach projects from the system as a whole. This means that they take into account the complete system, as part of a larger system, its life span and all parties involved in the chain.
Achieving transparency.	Application of SE leads to transparent decision-making, traceable information and demonstrable work processes during the entire life cycle of the system.
Improving efficiency.	Use of the right methods and techniques from the SE palette and smart reuse of technology and knowledge reduce the (chances of) failure costs during the entire life cycle.
Adding value.	The focus is on the solution that creates the greatest value for the stakeholders, taking the entire life cycle into consideration.
Smart systems for organising information and making it accessible.	It is important that all relevant information is available to the parties involved during the life cycle of a system. SE provides a key contribution to the organisation and recording of information. This provision of information is also called a BIM (Building Information Model).
Focus on attitude and behaviour.	Competences in the field of attitude and behaviour, also called 'soft skills' – such as asking more specific questions, being able to think creatively and working explicitly – are important to staff and within teams and organisations. Apart from the technical skills, which are obviously crucial, these competences determine the quality of the final product.



# Contents



- Outside in:
  - What is Systems Engineering (SE)
  - How do we do that
  - And why
- Inside out:
  - Why incorporate green public procurement in SE
  - How
  - What do you get

# Why incorporate green public procurement in SE



Giving customer demand a central position.	If management supports Green Public Procurement (GPP), the objectives can be formulated in terms of customer requirements
Providing room for design freedom.	As long as GPP objectives are not formulated as solutions, SE can deal with them very well
Thinking in systems (systematic thinking).	This guiding principle enforces life cycle thinking
Achieving transparency.	Not so much to do with GPP, but does not interfere with it either
Improving efficiency.	This can be read as reuse of knowledge of GPP
Adding value.	This principle allows to rate different GPP variants in terms of value (Value Engineering)
Smart systems for organising information and making it accessible.	Not so much to do with GPP, but does not interfere with it either
Focus on attitude and behaviour.	This is a challenge: bringing together the worlds of GPP and SE



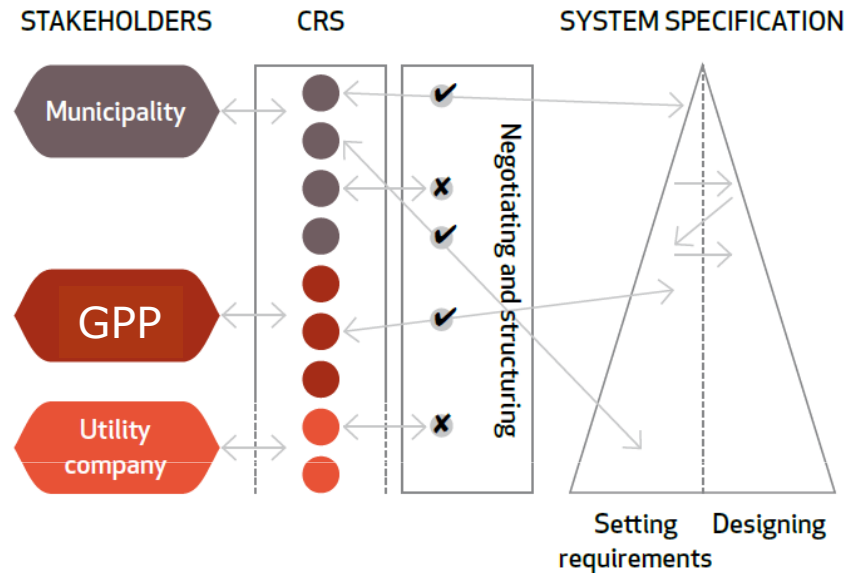
## How to incorporate GPP in SE

- Bridging the gap:
  - GPP'ers should invest in understanding SE
  - SE'ers should take time to ask the right questions

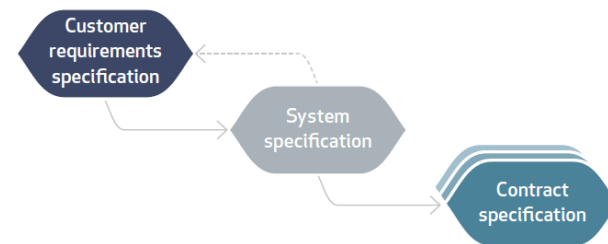
# Incorporating GPP in SE: what do you get?



- A Customer Requirement Specification (CRS)
- Allocation of user requirements to the system
- Agreement on verification and validation of the requirements



- A contract specification with the GPP-requirements in it





## example

- Customer requirement: Municipality XYZ prefers materials with little impact on environment
- Customer requirement specification:

Code	durability	Link to system requirement	CR Initiator
KES-1059	Municipality XYZ prefers sustainable solutions	<Systeemeis nr.>	Municipality XYZ
Status:	Allocate: is part of LCC	Date status:	22-4-2014
validation			
source:	Project meeting municipality XYZ – project team	date:	6 januari 2014
Explanation:			





## Example, part 2

- System Specification:

Req. nr.+rev.	Title	
E-0033100 v1.0	Sustainable construction, wood	
Parent requirements	E-0032363 1.0;	
Underlying requirements		
description	Wood, when applied, needs to be produced sustainable and the principles of sustainable construction need to be met.	
explanation	Sustainable wood, like FSC, PEFC etc. can be found at <a href="http://www.houtdatabase.nl">www.houtdatabase.nl</a>  For sustainable construction CUR 213 is available.	
source	ISE00004d, ISE00034, ISE00063	
Req.initiator	PT-member abc	
Design verification		Document review
Prod. Verification	Inspection	

