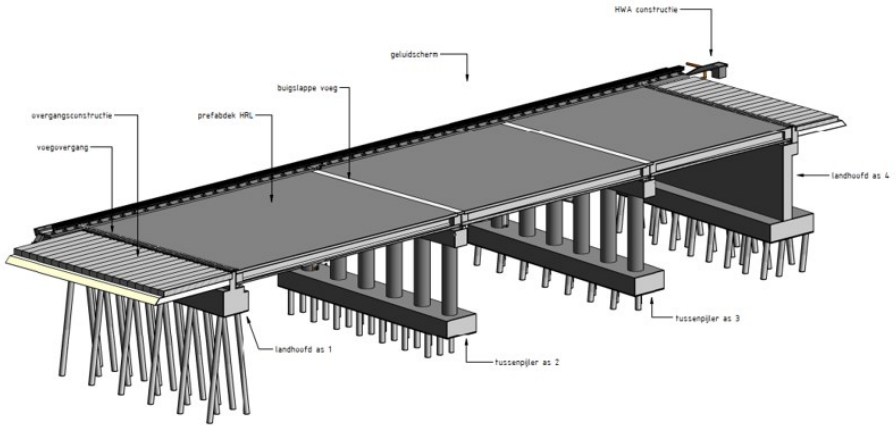
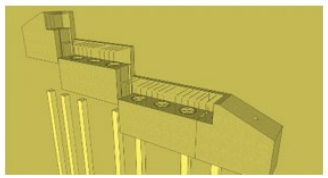
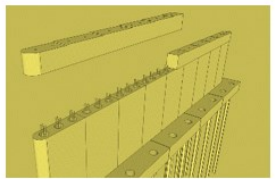
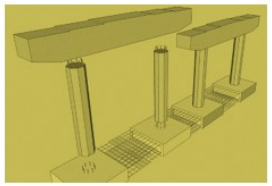
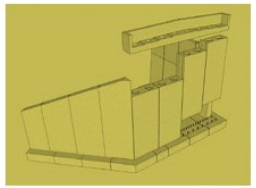










Rijkswaterstaat
Ministerie van Infrastructuur en Waterstaat

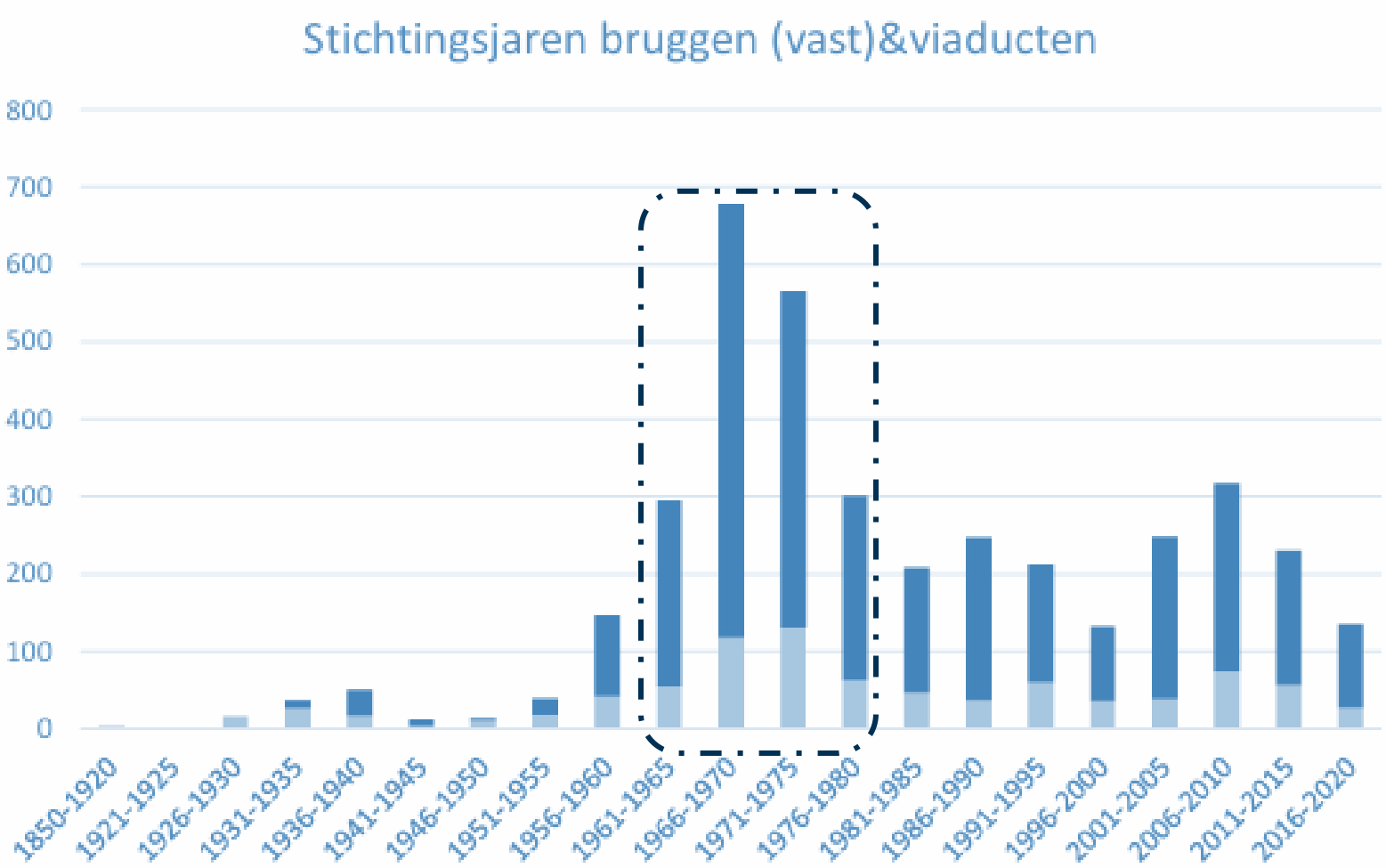
Standaardisatie viaducten

(modulair, gestandaardiseerd en losmaakbaar)

Edwin Thie

4 april 2025

Historie



Figuur-2

Historie

1966

A28 brug over de Arkervaart

1964

A2 Zaltbommel

Historie

1951

Pannerden

1963

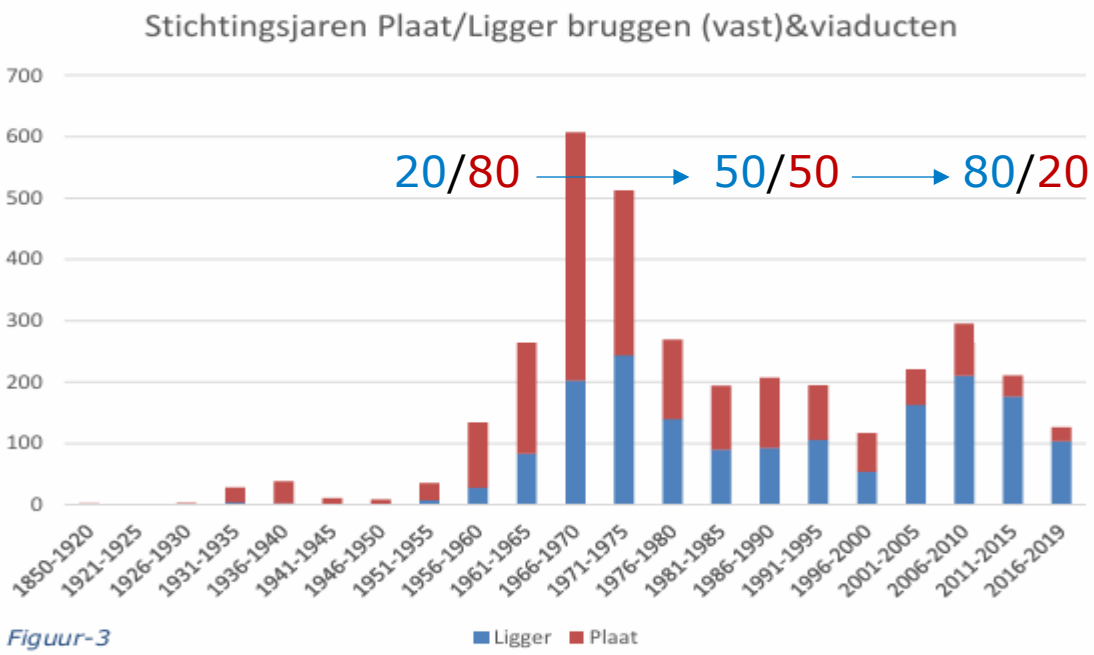
Brienenoord

Er is veel veranderd in 50 jaar?

Jaren ‘70

Jaren ‘20

Is er veel veranderd?



Figuur-3

Aandeel liggers

Aandeel plaat

Is er veel veranderd?

Experimenteren met circulaire viaducten

1ste circulaire viaduct 2019

Oogsten van liggers, 2024

Er is verandering op komst!

Versnellen

Voorspelbaarder

Verduurzamen

Ons antwoordt hierop is standaardisatie

Versnellen

Modulair Gesteld staan voor grotere bouwopgave

Voorspelbaarder

Vaste set producten Effectiever met beperkte capaciteit

Verduurzamen

Losmaakbaar Zorgdragen dat de toekomst circulair is

Rijkswaterstaat
Ministerie van Infrastructuur en Waterstaat

Standaardisatie viaducten

Het principe

Strategie standaardisatie viaducten

Van maatwerk oplossingen naar prêt-à-porter, klaar om te dragen.

Van viaducten met een 100 jaar levensduur naar producten met 100+ jaar levensduur.

Van robuuste viaducten naar robuuste producten en flexibele viaducten

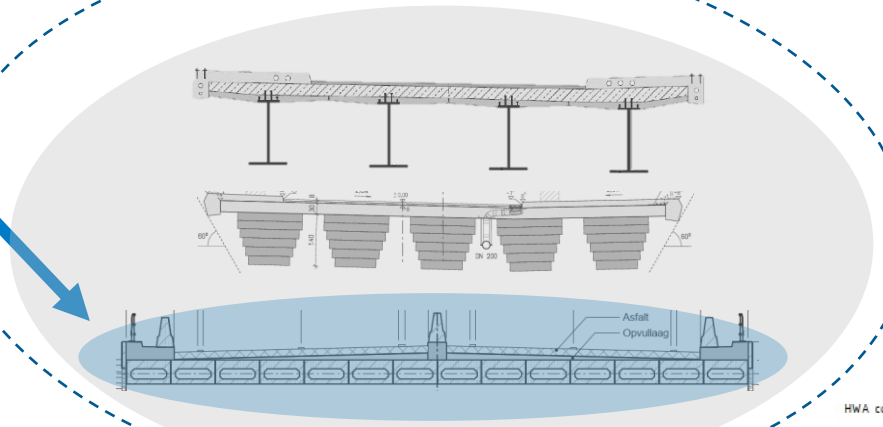
Toekomst visie; Standaard producten catalogus

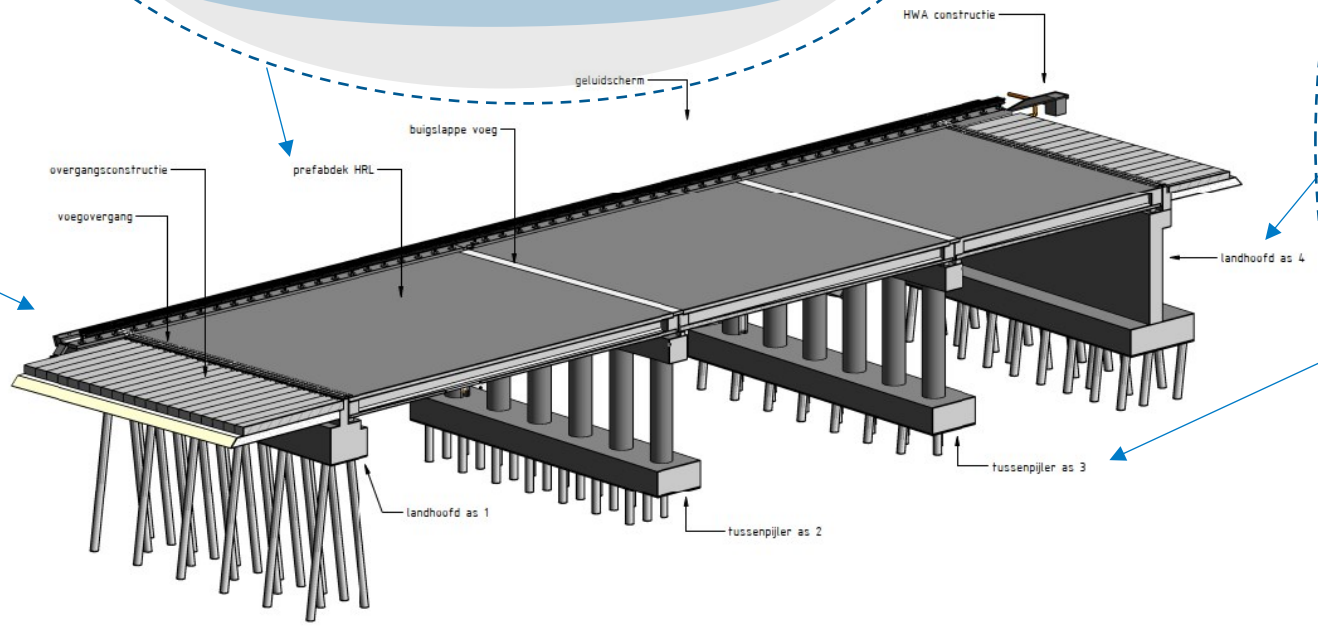
RTD 1035,
stap 1, Kokerliggers

Overige elementen

Dek type

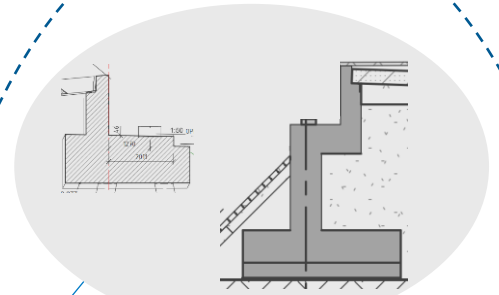
Dekconstructie



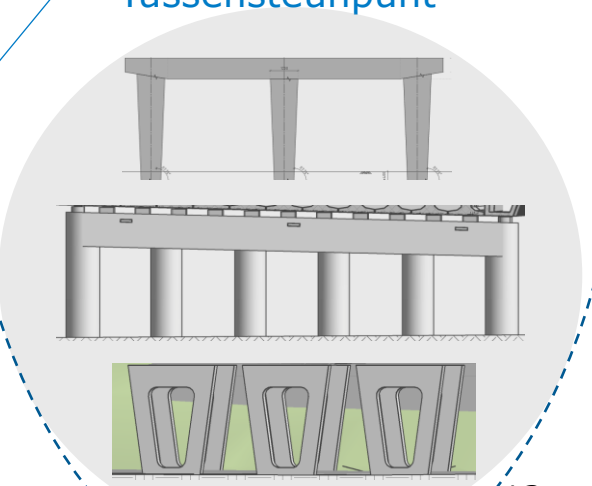


Steunpuntconstructie

Landhoofd



Tussensteunpunt



Basisprincipes voor gestandaardiseerd bouwen

Hijsbaar

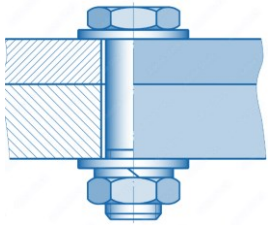
Vaste maten

Koppelbaar

Ruimtelijke kwaliteit

Lange levensduur

Materiaal efficiënt



Losmaakbaar

Transporteerbaar

Product Catalogus

KIT ESTRUTURAL MOLA 3

MOLA STRUCTURAL KIT 3

Na observação de uma estrutura real, é difícil perceber os fenômenos físicos envolvidos em seu comportamento. Suas deformações e seus deslocamentos geralmente não podem ser detectados a olho nu, o que torna o assunto muito abstrato e de difícil compreensão.

As peças do Mola foram projetadas com materiais específicos, para permitir a visualização desses fenômenos. A ideia é simular o comportamento das estruturas, de maneira tátil e visual, tornando, então, o assunto mais concreto e intuitivo.

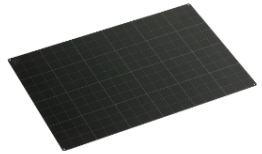
O Kit Estrutural Mola 3 é compacto, versátil e fácil de usar. As peças são conectadas por meio de magnetismo ou encaixes, e cada uma representa um ou mais elementos de uma estrutura.

While observing a real structure, it is difficult to visualize the physical phenomena involved in its behavior. Its deformations and displacements usually cannot be detected by the naked eye, which makes it a very abstract and difficult subject to understand.

Mola parts were designed with specific materials to allow the visualization of these phenomena. The idea is to simulate the behavior of structures in a tactile and visual way, making the subject more concrete and intuitive.

Mola Structural Kit 3 is compact, versatile and easy to use. All parts are connected by magnetism or fittings, and each one represents one or more elements of a real structure.

A Placa de Base **(G – Ground)** representa o solo onde a estrutura será construída. Apresenta, em um dos lados, marcação de eixos estruturais, para facilitar o posicionamento das peças e a montagem das estruturas.



The Ground Plate ***(G – Ground)*** *represents the ground where the structure will be built. It presents, on one side, markings of structural axes to facilitate the positioning of the parts and the assembly of the structures.*

As molas **(B – Bar)** representam os elementos de barra de uma estrutura, como pilares e vigas.

The springs ***(B – Bar)*** *represent the bar elements of a structure, such as columns and beams.*

Os canudos plásticos **(BS – Bar Stiffener)** são utilizados como enrijecedores para os elementos de barra (B), evitando efeitos de flambagem quando submetidos a cargas de compressão.

The plastic tubes ***(BS – Bar Stiffener)*** *are used as stiffeners for the bar elements (B), avoiding the buckling effects when subjected to compression loads.*

As Diagonais **(D – Diagonal)** representam os elementos de barra esbeltos de uma estrutura, como tirantes e contraventamentos.

The Diagonals ***(D – Diagonal)*** *represent the slender bar elements of a structure, such as tension members and wind braces.*

As Ligações de Base **(GC – Ground Connection)** representam as fundações da edificação, responsáveis pela ligação da estrutura com o solo. Cada peça conta com 4 marcações de eixo, para facilitar seu posicionamento na chapa de base (G).

The Ground Connections ***(GC – Ground Connection)*** *represent the foundations of the building, responsible for the attachment of the structure to the soil. Each piece has 4 axis markings to facilitate its positioning on the base plate (G).*

As esferas **(C – Connection)** são responsáveis pela conexão entre os elementos estruturais, representando as ligações rotuladas de uma estrutura.

The spheres ***(C – Connection)*** *are responsible for the attachment between the structural elements, representing the pinned connections of a structure.*

As peças de Ligação Rígida **(RC90 – Rigid Connection 90°)** são utilizadas para enrijecer as ligações de 90° entre os elementos estruturais.

The Rigid Connections ***(RC90 – Rigid Connection 90°)*** *are used to tighten the 90-degree connections between structural elements.*

As correntes de bolinhas **(CABLE – Cable)** representam os elementos de cabo de uma estrutura. Diferente das diagonais (D), os cabos são flexíveis e não apresentam resistência à compressão.

The ball chain ***(CABLE – Cable)*** *represents the cable element of a structure. Different from the diagonals (D), cables are very flexible, presenting no resistance to compression loads.*

Além de permitir a conexão dos elementos de cabos com as Ligações (C) da estrutura, as Ligações de Cabos **(CABLE C – Cable Connection)** fazem a função dos esticadores de cabos de uma estrutura. Basta girar uma das partes da peça, para fazer os ajustes finais de montagem, definindo o comprimento exato do cabo (CABLE).

In addition to allowing the connection of the cable element to the Connection elements (C), the Cable Connection ***(CABLE C – Cable Connection)*** *also performs the function of the cable tensioner of a structure. Twist one side of the element to make final adjustments to the cable length.*

O Clip de Cabo **(CABLE CLIP C – Cable Clip Connection)** é uma peça de encaixe muito versátil que permite diferentes tipos de conexões com o cabo (CABLE).

The Cable Clip Connection ***(CABLE CLIP C – Cable Clip Connection)*** *is a very versatile element that allows different types of connections between cables.*

O Clip de Múltiplos Cabos **(M CABLE CLIP C – Multiple Cable Clip Connection)** permite, de maneira bem compacta, a conexão de até 5 cabos em uma única Ligação de Cabo (CABLE C).

The Multiple Cable Clip Connection ***(M CABLE CLIP C – Multiple Cable Clip Connection)*** *allows, in a very compact way, the connection of up to five cables to a single Cable Connection (CABLE C).*

Os Anéis de Cabos **(CABLE R – Cable Ring)** representam os anéis normalmente utilizados em estruturas de cabos, permitindo a conexão de vários cabos, de maneira radial, em um único ponto.

The Cable Rings ***(CABLE R - Cable Ring)*** *represent the rings normally used in cable structures, allowing the connection of several cables, radially, in a single point.*

Standaard kokerligger

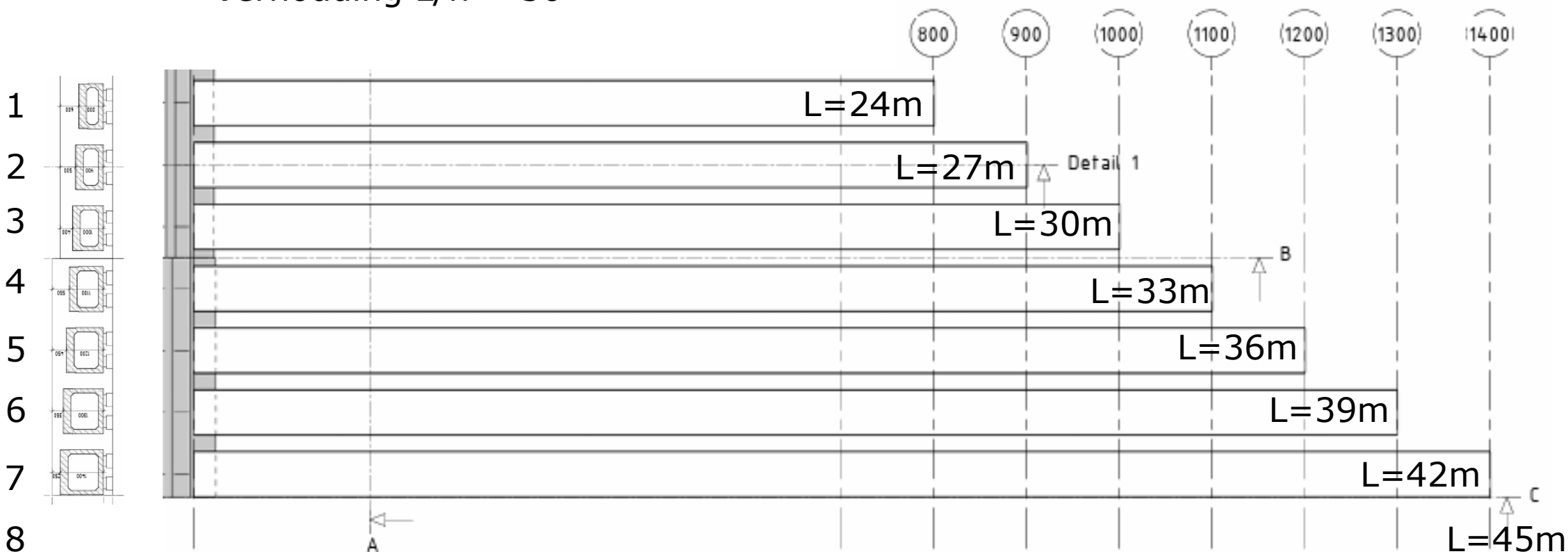
Stap 1; Gestandaardiseerde kokerliggers

Klasse	Breedte [m]	Hoogte [m]	Lengte [m]
1	1,5	0,8	24
2	1,5	0,9	27
3	1,5	1,0	30
4	1,5	1,1	33
5	1,5	1,2	36
6	1,5	1,3	39
7	1,5	1,4	42
8	1,5	1,5	45

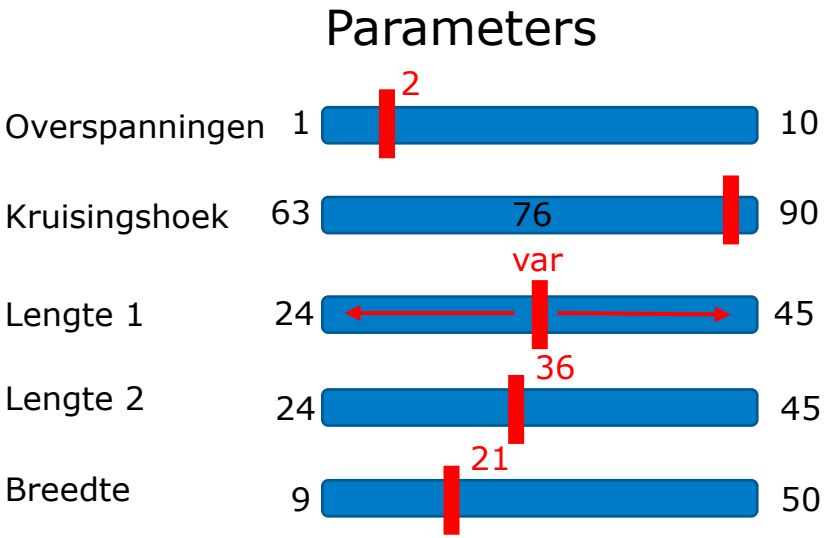
3 kruisingshoeken; 90, 76 en 63 graden

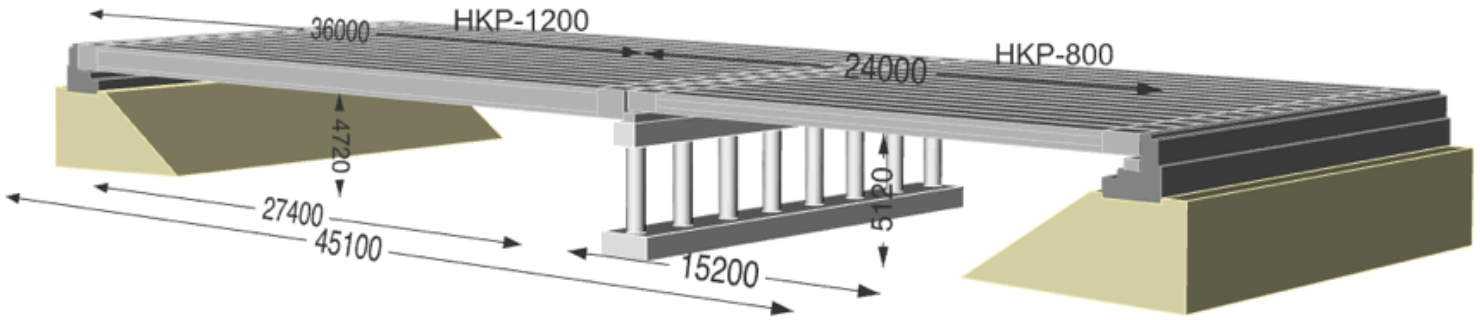
Meerdere lengteklasses, één belastingklasse

Verhouding L/h = 30



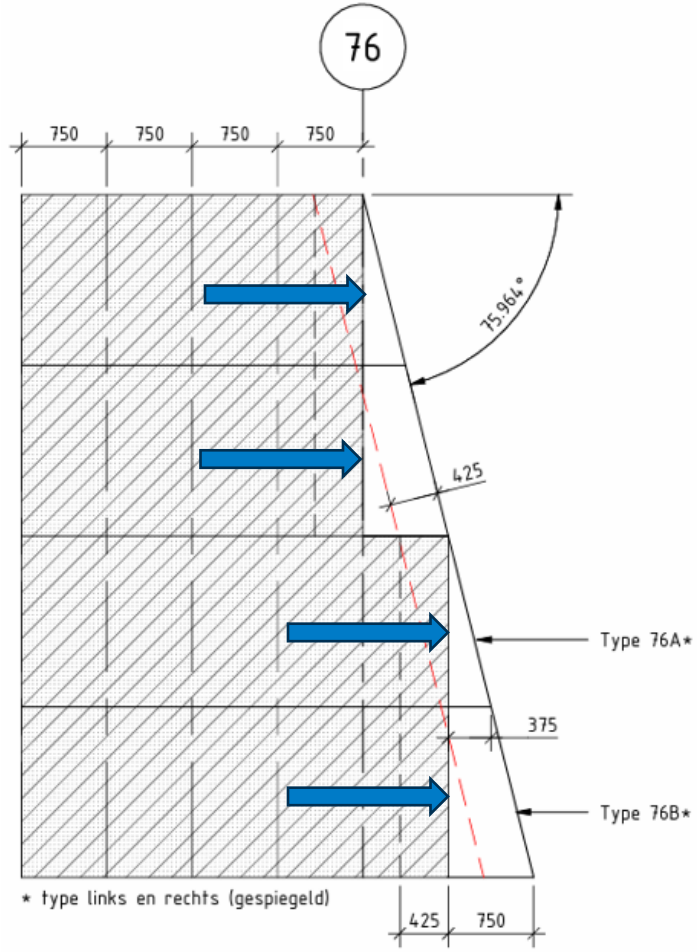
Parametrische Toepassing

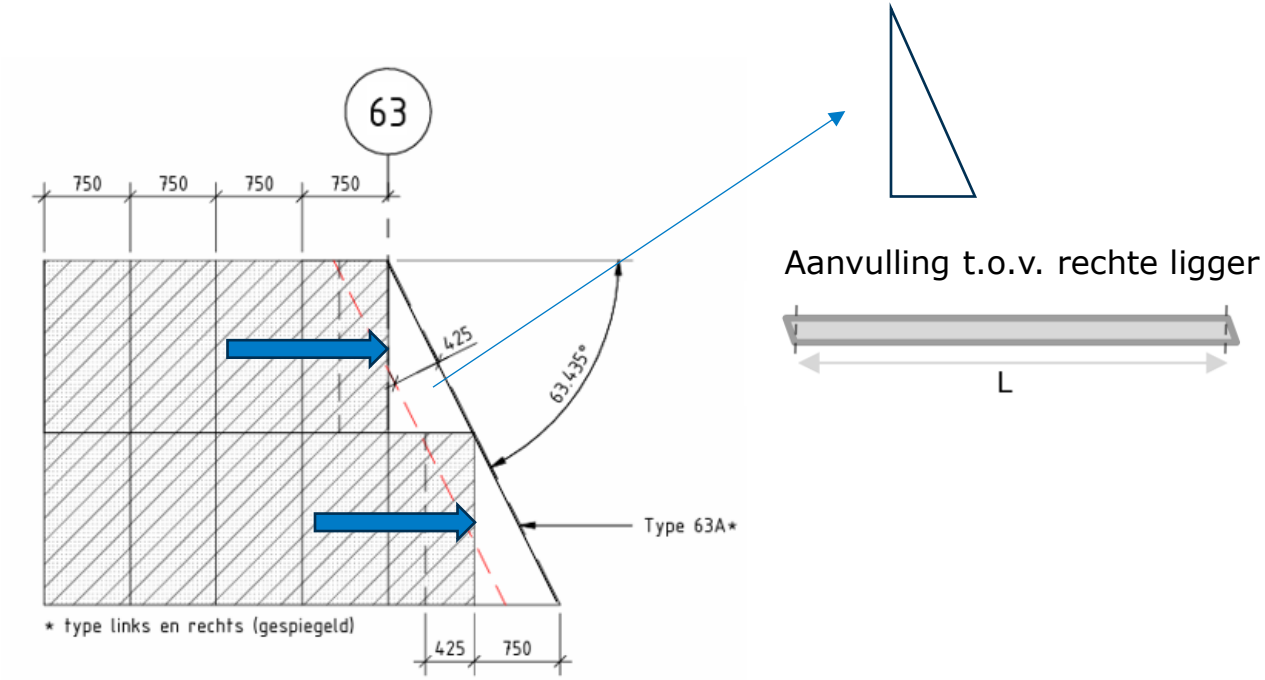




BETON HOEVEELHEDEN
liggers 793 m3
tussensteunpunten 98 m3
opstort 11 m3
eindsteunpunten 146 m3

Kruisingshoek, waarom 76° en 63°?



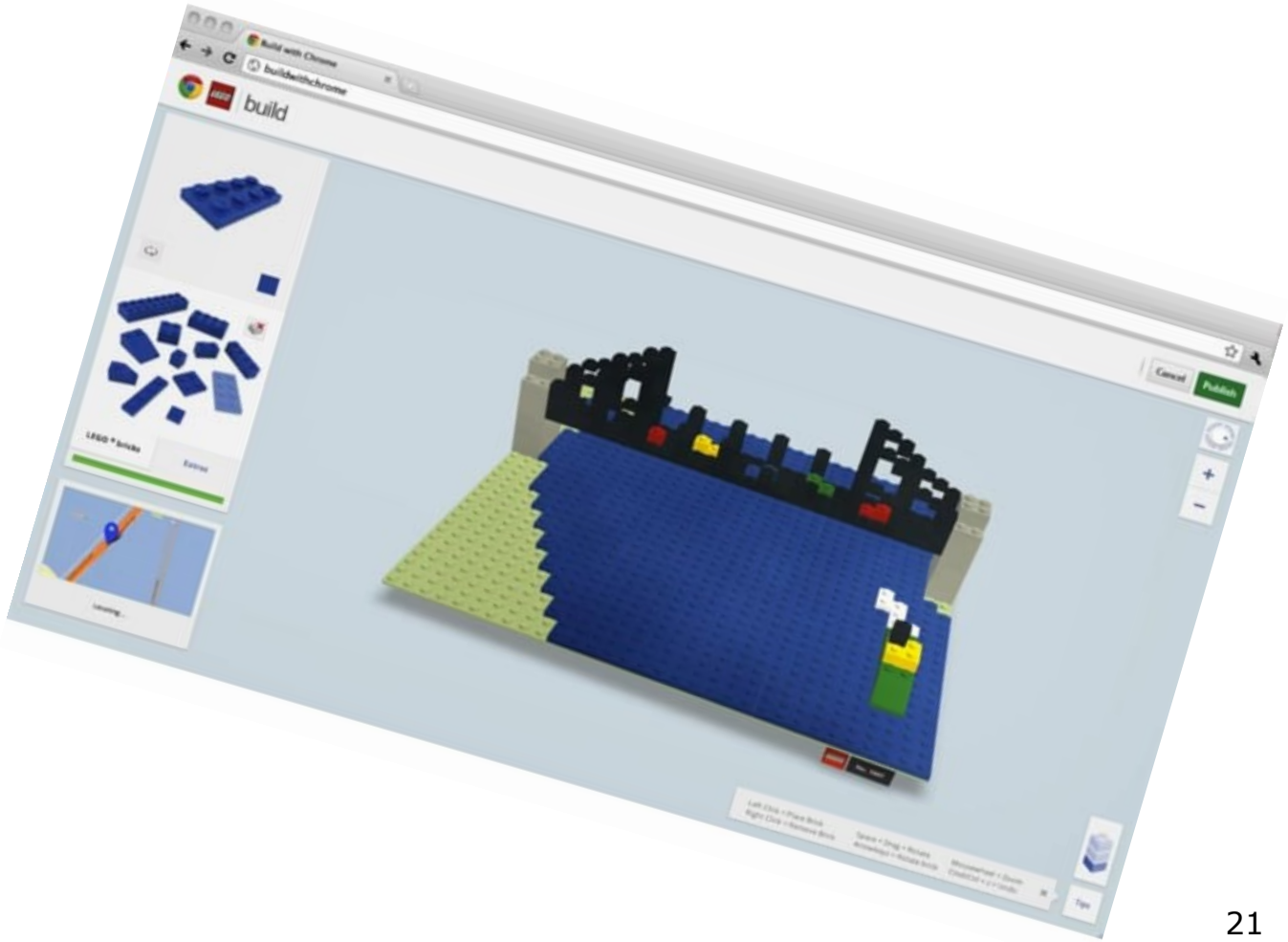


Bovenaanzicht nabij voeg

Toekomst; Configurator App

- Vaste set producten
- Samenstellen Geometrie
- Geen berekening nodig
- Van App naar fabricant

design
to
production



Rijkswaterstaat Technisch Document

Eisen

- Geometrie ligger
- Positie dwarsvoorspanning
- Toleranties
- Levensduur
- Productpaspoort
- etc

Vervolg

- Afronden opname in de werkwijzer van RWS
- Stap 2 wordt het ontwikkelen van losmaakbare liggers met druklaag voor kleinere overspanningen. Zoals prefab betonnen ligger, stalen en houten ligger.
- Zijn er partijen die producten ontwikkelen die passen binnen de basisprincipes?? Laat het ons weten.

Vragen?

edwin.thie@rws.nl

We gaan samen innoveren om de productie
te **verhogen**,
voorspelbaar te maken en te
verduurzamen!

Contact:
Edwin.thie@rws.nl