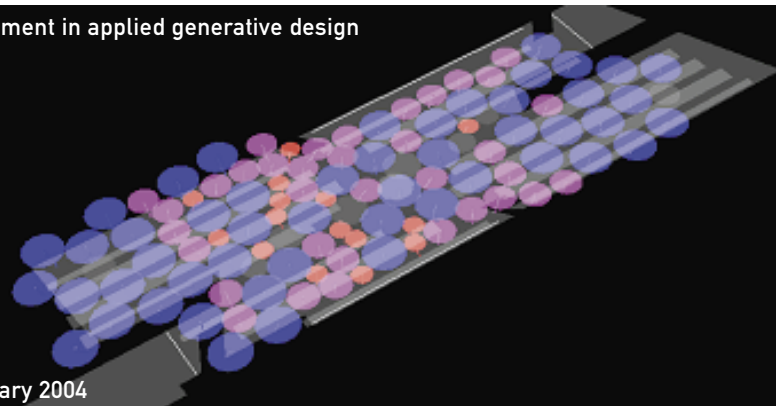


The Groningen Twister

An experiment in applied generative design



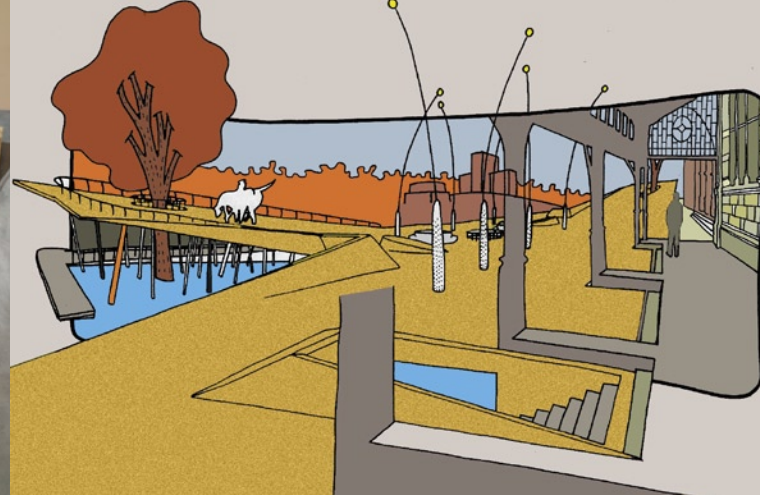
v1.0 January 2004

The Groningen Twister is a collaborative project between the design team of Kees Christiaanse Architects & Planners (KCAP) in Rotterdam, an engineering team of Ove Arup & Partners in Amsterdam and the chair for Computer Aided Architectural Design (CAAD) at the ETH Zurich. The project was initiated in February 2003.

The aim of the project was to develop a CAD-tool which would help the architects of KCAP to solve a complex design task. Underneath a pedestrian area that links the main station to the city center of Groningen/NL, there was a need for parking space for approximately 3000 bicycles. To support the concrete slab of the pedestrian level, the desired design called for more than one hundred columns of different sizes to be placed in a random pattern, but to be then sized and controlled according to structural, functional and aesthetic needs.

To solve this problem, a software was developed at the chair for CAAD that simulates a growth process for the columns. The distribution of the columns is defined by structural rules, provided by ARUP's engineers, as well as functional and design rules provided by KCAP's designers. The results are presented to the user as a three dimensional, dynamically evolving model. At any time during this process the user is able to control the model on the screen interactively. The user can control the process in two distinct ways, on the one hand by directly controlling the placement of single columns, on the other hand by adjusting various parameters that define the properties of the columns and the environment. The system provides real time feedback, as the column distribution tries to adapt to the changed configuration. This allows the user to test various alternative solutions in very short time. After a stable and satisfactory condition is achieved, the resulting column locations can be exported for construction documents in various digital file formats.

The final architectural design, based on the output of the software, has been approved and construction work in Groningen is about to start in mid 2004.



contact



Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

ETH Zurich - Institute of Building Technology
Chair of Computer Aided Architectural Design
Hönggerberg HIL E14.1, CH-8093 Zürich

Fabian Scheurer
scheurer@hbt.arch.ethz.ch
www.caad.hbt.arch.ethz.ch



Kees Christiaanse Architects & Planners
Piekstraat 27
NL-3007 JA Rotterdam

Andy Woodcock
a.woodcock@kcap.nl
www.kcap.nl



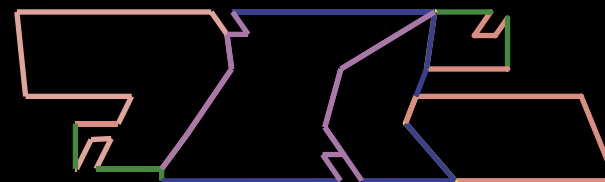
Ove Arup & Partners
Y-Tech Gebouw, van Diemenstraat 194
NL-1013 CP Amsterdam

Arjan Habraken
arjan.habraken@arup.com
www.arup.com

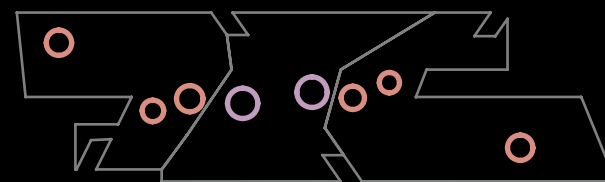
publications

Scheurer, Fabian: *The Groningen Twister - an experiment in applied generative design*, in Soddu, Celestino: *Generative Art 2003, proceedings of the 6th international conference GA2003*, p. 90-99

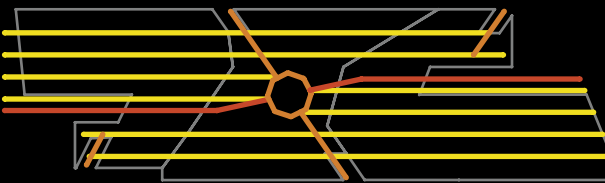
habitat



slab edges and expansion joints

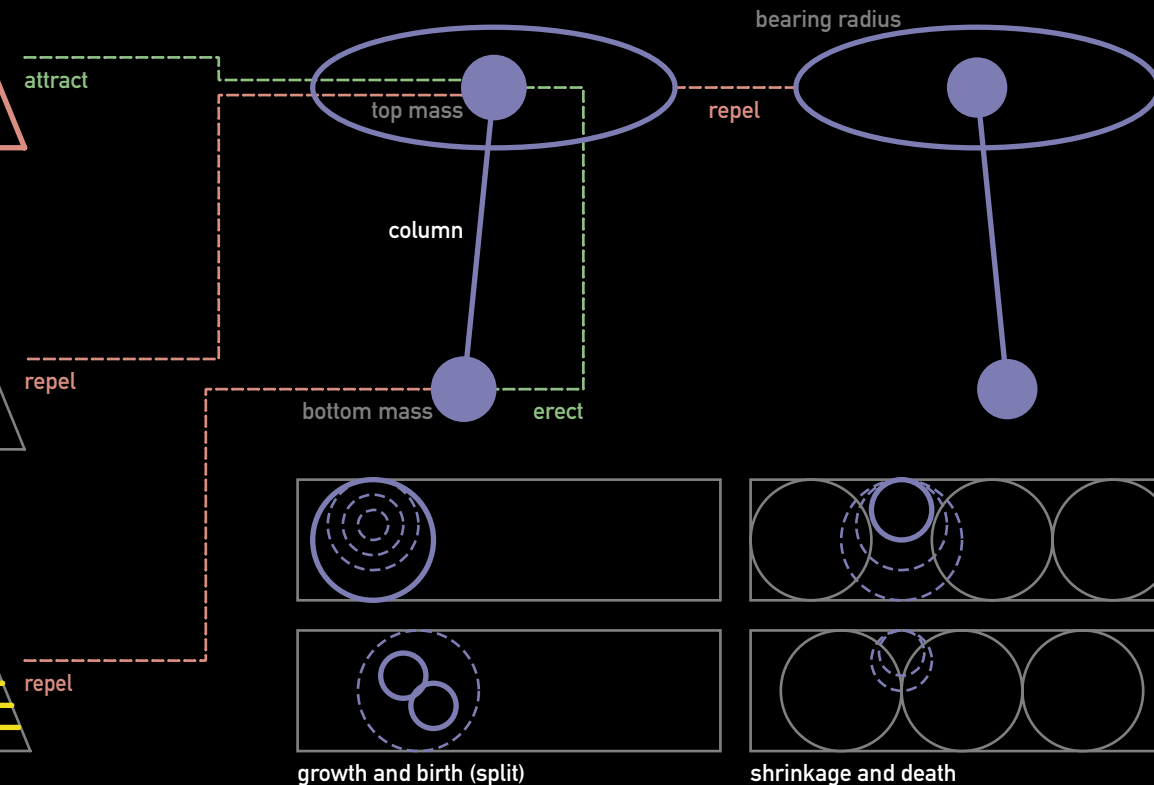


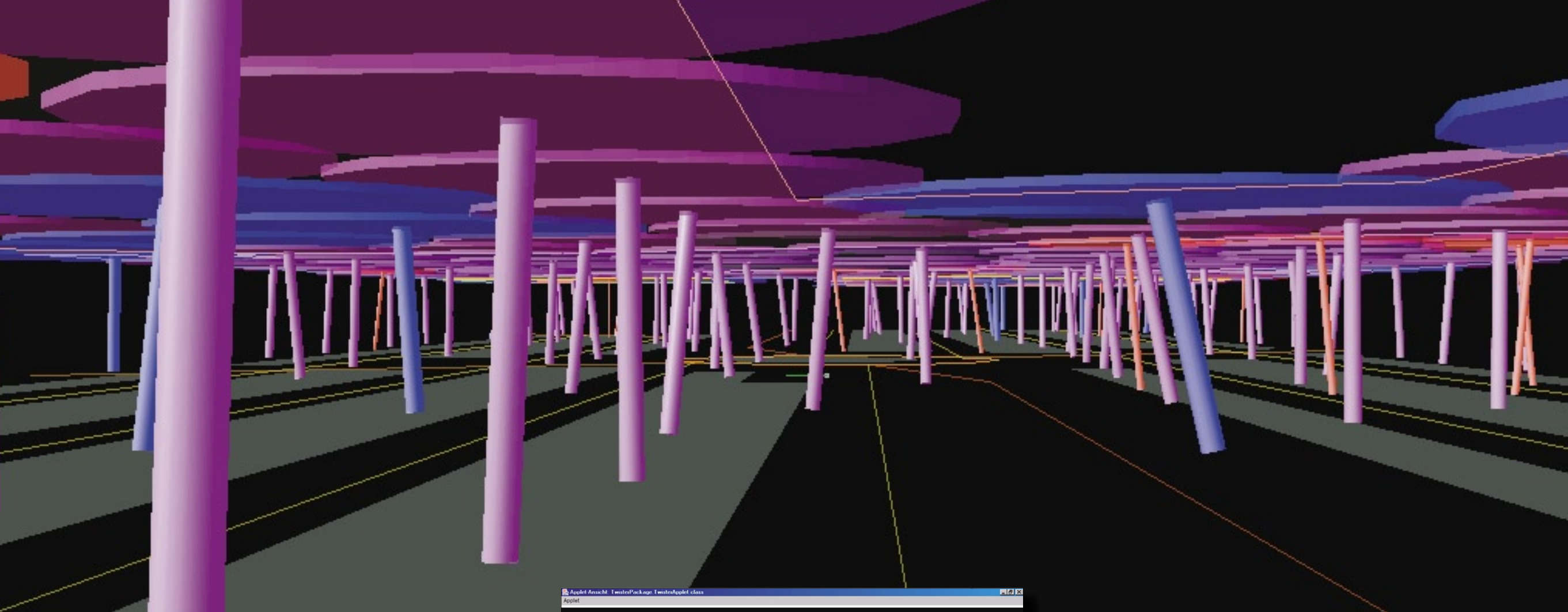
holes



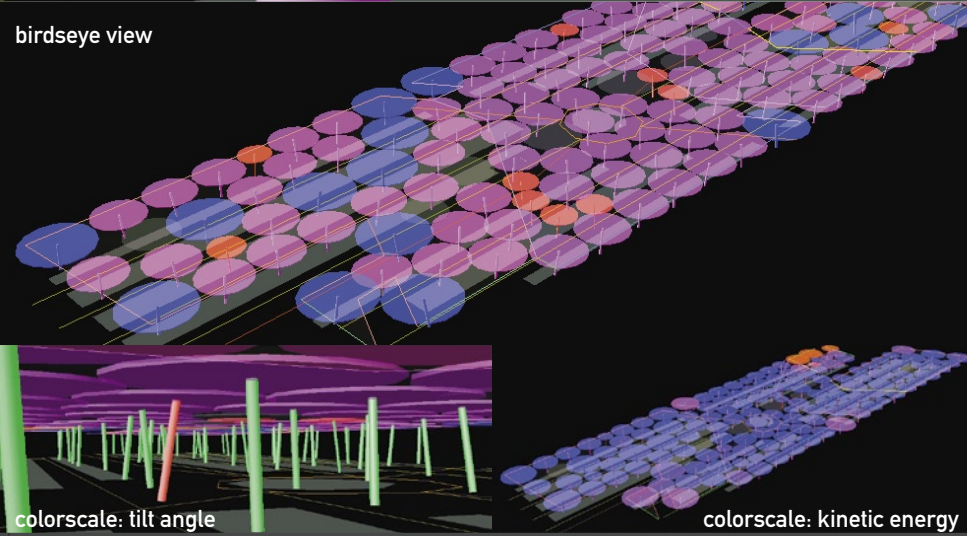
bicycle and foot paths

organism





birdseye view



colorscale: tilt angle

colorscale: kinetic energy

Applet Ansicht: I_waltesPackage: I_waltesApplet.class
Applet

column type (nr)	radius (bearing/col)	friction (top/bottom)	mass (top/bottom)	tilt angle (min./max.)	verticality	shrink/grow threshold	opt. color
1	radius: 0.00 / 0.150	friction: 0.20 / 0.20	mass: 0.500 / 1.500	tilt angle: 0 / 0	verticality: 0 / 2000	shrink/grow: 0.2700 / 0.000	opt. color: column
2	radius: 0.00 / 0.125	friction: 0.20 / 0.20	mass: 0.200 / 1.500	tilt angle: 0 / 0	verticality: 0 / 2000	shrink/grow: 0.200 / 0.000	opt. color: column
3	radius: 0.00 / 0.075	friction: 0.20 / 0.20	mass: 0.200 / 1.500	tilt angle: 0 / 0	verticality: 0 / 2000	shrink/grow: 0.220 / 0.010	opt. color: column

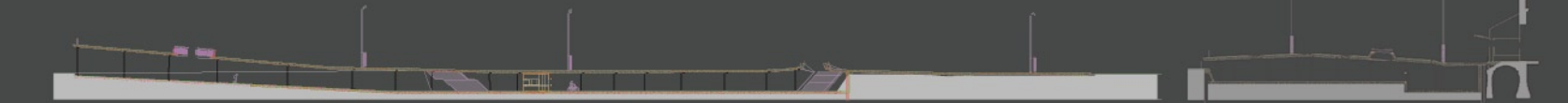
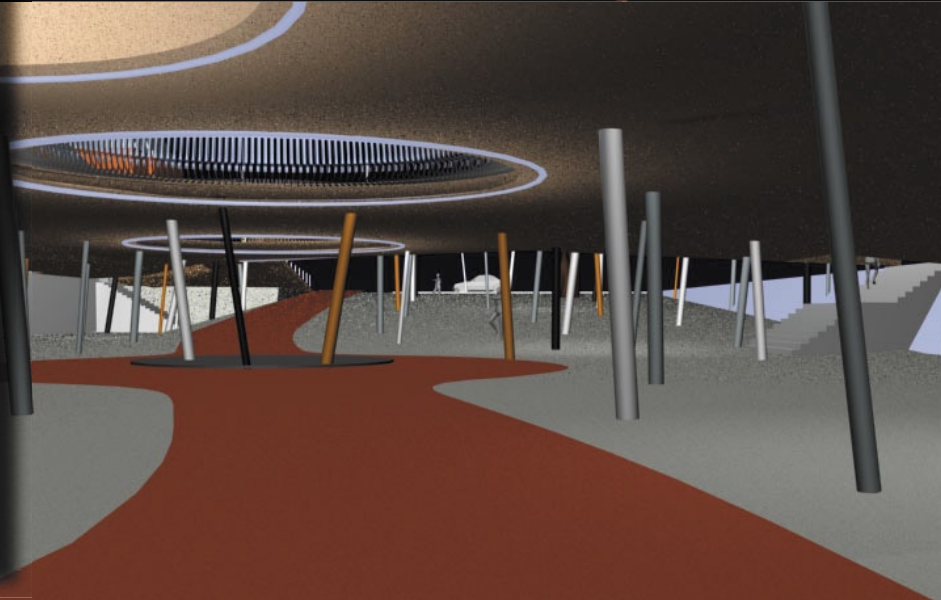
col: min. dist. (top/bottom) max. dist. (top/bottom) slope (top/bottom) force (push/pull)

path: min. dist. (top/bottom) max. dist. (top/bottom) slope (top/bottom) force (push/pull)

slab: min. dist. (top/bottom) max. dist. (top/bottom) slope (top/bottom) force (push/pull)

caad:arch:ethz

Applet gestartet



sections of final design

rendering of final design