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INFRASTRUCTURE

## GOTTHARD INFRASTRUCTURAL LANDSCAPE

Matthias Vollmer, Johannes Rebsamen

“Gotthard Landscape: The Unexpected View” was the name of an exhibition held in 2014 at the Architecture Biennale in Venice by the Chair of Landscape Architecture of Christophe Girot at ETH Zurich. The title referred to an ambitious research project which aimed to create a point cloud model of the entire route through the Gotthard Pass from Erstfeld to Bodio. The landscape of the most famous Alpine crossing is permeated by infrastructures built into the mountain in different eras. Originally started as a Swiss National Science Foundation research project in 2010, the project was expanded

in stages before it was finally exhibited in 2022 as “Gotthard Landscape: A Digital Journey through the Alpine Massif.”

The challenge of creating such a point cloud model arises from the sheer size of the area of the Gotthard Massif reproduced in the digital model, which has constantly demanded new solutions. No fewer than nine billion points were combined from different data sets. Information from the swissALTI3d and swissSURFACE3d models, available as open government data, form the basis of the topography; data of the railway lines came from survey of the Swiss Federal Railways; a campaign by the Institute for Landscape and Urban Studies in cooperation with Artescan provided LiDAR data of the roads; and scientists from the Chair of Landscape Architecture took terrestrial laser scans at strategic locations to condense the most important nodes. In addition to the spatially surveyed model, sound recordings and 3D soundfield recordings were taken to complement the auditory component of the landscape. These recordings enhance spatial understanding and orientation, and convey the natural and cultural-historical elements in the dimension of time. The project shows how technology, when pushed to the limits, can create a completely new perception of a region and help discover and understand the spatial relationship between a variety of landscape elements. The invisible layer of tunnels and their unusual forms, for example, become present in the landscape and create a strong

contrast to the natural shapes of the mountains and valleys.

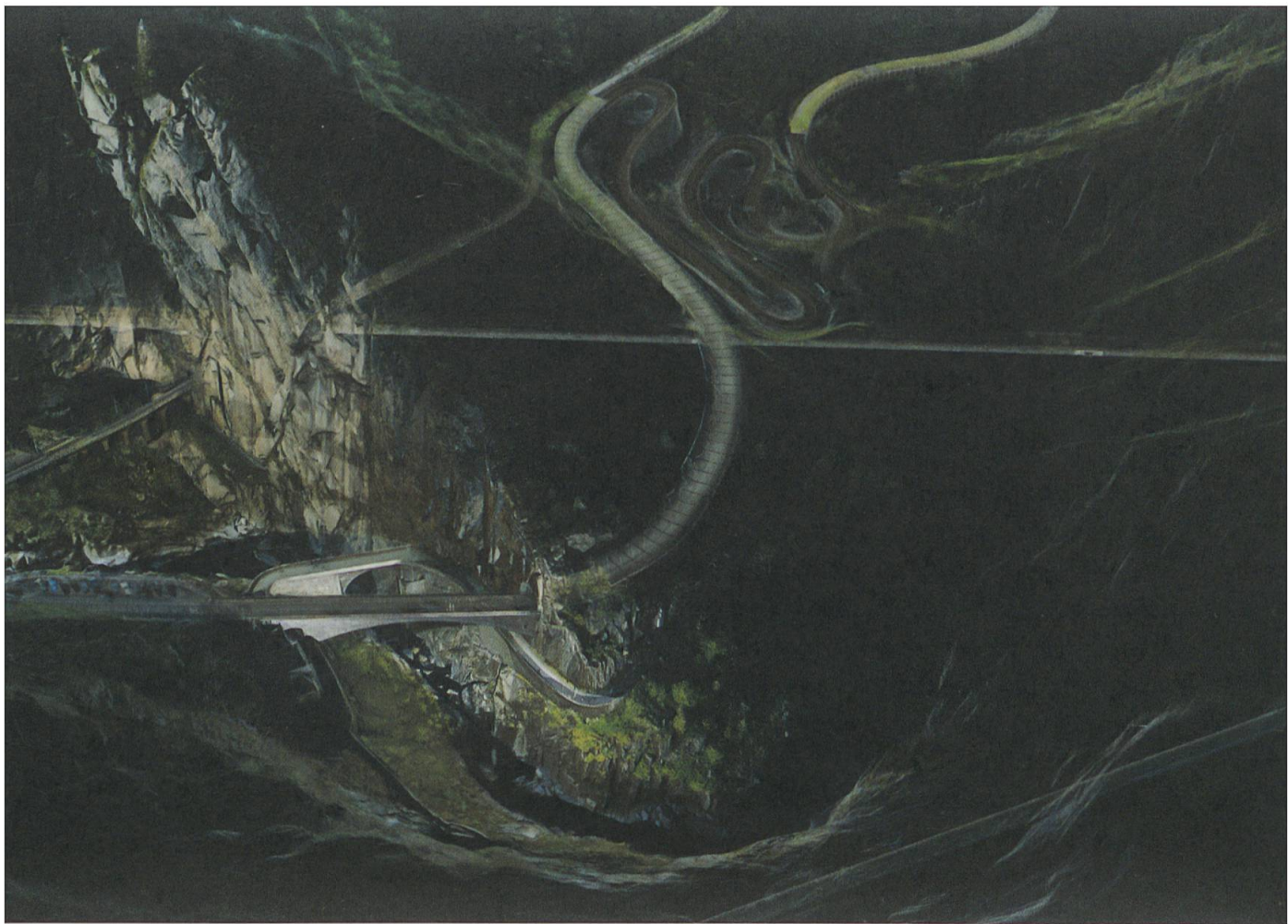
The result is a model that not only has fantastic aesthetics, but also makes it possible to experience the

most important infrastructures of the Alpine crossing in relation to the topography in an audiovisual way, thus enabling a completely new understanding of the Gotthard region.



View onto the helical tunnels near Giornico, on the south side of the Gotthard Pass: on the upper right the Gotthard Base Tunnel, on the lower left the highway bridge crossing the cantonal road





View onto the Devil's Bridge in the Schöllenen Gorge with layered infrastructures from different periods in a single image: paved historical bridge, cantonal road bridge, and gallery; highway and railway tunnels underneath

Data sets visible in the images:

- swissALTI3D2019 colored with swissimage1m, 861 million points
- swissurface3d\_2019 colored with swissimage\_dop10\_2021, 6380 million points
- highway and cantonal road mobile scans by Artescan, Portugal, 2011, 517 million points
- SBB railway mobile scans by iNovitas 2019, 173 million points
- MGB Schöllenenbahn mobile scans by iNovitas 2022, 26 million points
- Riegl VZ-1000 colored with Nikon D700, 2011/2017/2022, 1080 million points by members of the Institute of Landscape and Urban Studies, ETH Zurich

► Follow this link to digitally travel over the Gotthard pass.<sup>1</sup>

<https://youtu.be/DIICtbIVgRQ>

<sup>1</sup> Johannes Rebsamen et al., "Gotthard Landschaft: Eine digitale Reise durch das alpine Massiv, 20. September–30. September 2022," point

clouds recorded at the Gotthard Massif, Switzerland, 2022, MP4 video, 03:15, ETH Zurich, <https://doi.10.3929/ethz-b-000600286>.