

Delft University of Technology

LECTURE 2009, fall earth

Le Mont Saint-Michel in Normandy, France













Outline of the presentation:

- 0. Introduction
- 1. Earth and ground as design material
- 2. Applications of earth and ground in the design process
- 3. Form, use and meaning of earth and ground
- 4. Representation techniques related to earth and ground in design
- 5. Examples, case-studies and types

- 0. Introduction
 - Goals
 - Terms and
 - definitions
 - earth
 - ground
 - soil
 - Earth sciences; General concepts geology, geomorphology, soil science
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0. Goals of this lecture

> First of all to give some insight into disciplines that deal with the 'land' and how you can make use of that in planning and design

> Get a basic understanding of the main principles of geology, geomorphology and soil science

> Develop your curiosity in the immense richness of these very basic disciplines and hopefully some enthousiasm





Google



). Introduction	Earth	Ground	Soil
- Goals			
- Terms and	Is both	Is concrete in	Is abstract; a
definitions	abstract (the	the sense that	man-made
earth	earth) and	is always	classification
ground	concrete: what	substance	on the basis of
soil	you can put	<pre>matter;</pre>	explicit
- Earth sciences;	your hands in	material	criteria
General concepts	Earth is also		
geology,	referring to		

the planet we



1. Earth and ground as design material 2. Applications of earth and ground in

the design process

geomorphology,

soil science

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5. Examples, casestudies and types Geology Study of the earth, its forces, materials and processes

The central problem of the Earth sciences is to understand how our planet works and how it came to be the way it is. The essential fact emerging from these sciences is that the Earth can be pictured as a set of separate but interconnected cycles.

Geomorphology Study of the form of the earth and the forces that are behind that forms

The main geomorphologic processes are: > epigenous or exogenous processes

> hypogenous or endogenous processes

>

extraterrestria l processes; processes, where landforms are created by "alien" influences Soil science Study of the upper layer of the earth (±1.5 m) that determines the suitability for different types of landuse

The main process in soil science is soil formation. Water movement in the soil because of rain moves particles to deeper parts and thus forming layers; horizons

Geological, geomorphological and soil maps

Utrecht

The study area for part of Holland; roughly the line Amsterdam -

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geological map

geomorphological map LECTURE 2009, fall

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soil map

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General concepts in the earth sciences:

- The cyclical character of the main processes
- The large time scales
- The principle of layered structure; the law of superposition what is on top is younger



General concepts

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THE GEOLOGIC TIME SCALE

Geologists have created a geologic time scale to provide a common vocabulary for talking about past events. The geologic time scale is generally agreed upon and used by scientists around the world, dividing time into eons, eras, periods, and epochs.



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The geological map of Scotland; showing geologically old formations

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Changes in landform in Holland between 4100 BC and 1200 AC; Holland is geologically speaking very 'young' and very dynamic. Landform changes very fast in geological context.

Note specially the coastal development in Holland; it has changed considerably

3 Laat-Atlanticum C14: 5300 j. (is 4100 v. Chr.)





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Surface per elevation and plate tectonics





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5. Examples, casestudies and types General concepts: example in geomorphology

The study of river systems; some examples: a. Zone of erosion and zone of deposition b. Process of erosion and deposition in mean

- b. Process of erosion and deposition in meandering river
- c. Different river patterns/forms due to the interaction between climate, geological material and time











Fig. 5.9 Types of drainage patterns.

Trellis pattern Monterey, Va., guadrangle

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5. Examples, casestudies and types General concepts: example in geomorphology

The study of valley forms; different types of valleys



Fig.12.2A. Verschillende daltypen (1). a: kloofdal; b: V-vormig dal; c: dal met vlakke bodem en vlechtende rivier; d: dal met vlakke bodem en een meanderende rivier; e: dal met accumulatieterrassen; f: dal met erosieterrassen; g: 'Flachtal'; h: dal met convexe dalwanden.



Fig.12.2B. Verschillende daltypen (2). a: gully met 'amphitheater'; b: gully met scherp dal-boveneinde; c: gully met delle; d: secundair asymmetrisch dal; e: primair asymmetrisch dal; f: diep trogdal; g: ondiep trogdal.

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General concepts: example in soil science

- Soil formation based on movement of matter in the soil by water (rain)
 - Soil formation only takes place in the upper 1-1,5 m of the earth



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Earth sciences; geology, geomorphology, soil science The three basic maps of Holland

Similarities

The river system, the coastal area show in headlines great similarities at the geological scale, at the geomorphological map you see differences in the topographic form and at the soil map the different soils become visible







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The geological map of Holland

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The geomorphological map of Holland

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The soil map of Holland

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1. Earth and ground as design material	- at the large scale: cycles like the geological cycle, the hydrological cycle
- Basics, role of	At this large scale designers have to cope with the natural
earth in the natural	conditions; as a designer you cannot influence these forces
system	
- Earth sciences and	- at the structural level: basis for the ecosystem that relates
the urban landscape	geological material, climate, flora and fauna
- Engineering of earth	At this scale designers can intervene in the system at the
and ground	structural level for instance by changing the drainage pattern
- Design process:	
earth, ground and soil	- at the level of materialisation of form, material and (micro)
at different levels of	climate are the determining factors
intervention	At this level the possibilities for design interventions are larger
	think of terracing, creating waterbodies, changing slopes in road
2. Applications of	layout by cut and fill
earth and ground in	
the design process	 Researching the natural system
	Form of topography determines the watershed and the natural drainage
3. Form, use and	system
meaning of earth and	For all design projects, determining the watershed is the very first
ground	to search for in the site analysis. Watershed and hydrological cycle
	form the basis for understanding the watersystem of a site
4. Representation	
techniques related to	The second issue to determine is the soil, that is directly related
earth and ground in	to the geological material
design	
	The third issue is the vegetation and fauna
5. Examples, case- studies and types	

0. Introduction

Earth sciences and the urban landscape

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- Basics, role of earth in the natural system

 Earth sciences and the urban landscape

 Engineering of earth and ground

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Capitoline Hill

(Collis Capitolinus)

Palatine Hill

(Collis Palatinus)

Aventine Hill (Collis Aventinus)

Tiber Island (Insula Tiberina) **Esquiline Hill**

(Collis Esquilinus)

Caelian Hill (Collis Caelius)

Servian Wall

(Murus Servii Tullii)





Subu

Mons Caeline

Forum

Campus Martius

0. Introduction

Earth sciences and the urban landscape The city of Athens in Greece that is dominated by the Parthenon

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5. Examples, casestudies and types Earth sciences and the urban landscape Paris; the river Seine determining urban development in history, that is still visible in the present form of the city

à l'époque préhistorique. Le fleuve décrit une large courbe placée entre le confluent Seine-Marne à l'est et le méandre de Saint-Denis à l'ouest. Amoroti par la déformation tectonique, le creusement de l'ancêtre de la Seine, lié aux changements climatiques, se poursuivit par saccades. Suivant ces mouvements, le fleuve abandonna ses alluvions qui encombrèrent la vallée désormais perchée. Alors que la surface alluviale récente était régulièrement recouverte par les grandes crues, le sol alluvial ancien - une plate-forme de gravier située à 7 mètres au-dessus de l'étiage - demeurait insubmersible. Aujourd'hui on ne distingue plus le support alluvial récent de l'ancien. Cependant, on peut restituer quatre éminences insubmersibles sur lesquelles l'habitat s'est développé en priorité. Un fragment de la plate-forme insubmersible porte par exemple l'abbaye Saint-Germain-des-Prés.

► Restitution de la Seine





Earth sciences and the urban landscape The city of Delft; a true 'watercity' in the every sense of the word



e nederzetting Delft omstreeks de twaalfde eeuw

1 verlandde eb- en vloedkreek De Gantel 2 osvorwallen 3 dwateringskanaal De Delf, Schiekanaal 4 kade 5 Viistlanden 6 oatginning vanuit het Schiekanaal 7 Kloosterwatering 8 laagveeontginning vanuit de strandwal Wateringen-Voorschoten

earth and ground in the design process

3. Form, use and meaning of earth and ground

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De stad Delft en de delftse ommelanden voor de kruitexplosie (1654)



Engineering of earth and ground

'Reading' contourlines is essential for understanding the topography of the land

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Figure 5-5: Ridge and Valley Signature

Figure 5-7: Cut and Fill

0. Introduction Engineering of earth and ground 'Reading' and interpreting maps, map analysis



0. Introduction Engineering of earth and ground

1. Earth and ground as Working with slopes
design material
- Basics, role of
earth in the natural
system
- Earth sciences and
the urban landscape
- Engineering of earth
and ground







Fig. 12.4b A single storey house set on stills leaves the ground relatively undisturbed. The tree can be saved.



Fig. 12.4c A single storey house set on conventional foundations requires considerable cut and fill resulting in steeper slopes at each side of the lot.



Fig. 12.4d A split-level house with retaining walls maintains shallow slopes at each side of the lot and the tree can be saved. The house is closely related to the form of the landscape.

1. Earth and ground as design material

> Natural Opening In Tree Cover Affords UP

Good Views; Has Potential for Homesite

Dense Understory

Visual Barrier

Creates Punctuated

Existing Meadow Is a

Potential Site for Home

View out through Understory

to Natural Vegetation of

or Septic System

Adjacent Site

- Basics, role of earth in the natural system

- Earth sciences and the urban landscape - Engineering of earth and ground - Design process: earth, ground and soil

at different levels of intervention

2. Applications of earth and ground in the design process

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5. Examples, casestudies and types

Design process: the first step Site analysis before engineering of earth and ground S.E. Summer Breezes Evaporatively Views to Natural Cool Site as They Cross Edge Across Pond Winter Winds Pond Allemand Partially Deflected by Trees and Understory View in to Site Across Pond

manne

Drainage

Existing Drainage Swale

.....



Earth Embankment

Impermeable Soils on

"Flat" Slopes Create

Poor Drainage

Throughout Site

Views out through Openings

in Understory to Street

and Natural Vegetation

Views in through Openings in

Understory to Meadow Beyond

2001

NORTH Scale Figure 15-15: Site Analysis

STREET



0. Introduction Different examples of techniques related to earth and ground

1. Earth and ground as design material

> Preparing a site for development There are basically two fundamentally different approaches in preparing a site for development.

2. Applications of earth and ground in the design process - Techniques related to earth and ground - Earth and ground in design, planning, construction, maintenance - Design techniques

3. Form, use and meaning of earth and ground

4. Representation techniques related to earth and ground in design

5. Examples, casestudies and types - Making any site fit for a specific use Technically, any site can be prepared for any type of development. It does not make optimal use of sites but sometimes it is needed

a. Vitgangssituatie: a < 0.70 à 1.00m. 0 b. Drainage : a > 0.78 à 1.00m. c.Polderpeil verlaging : a > 0.70 & 1.00 m. d Ophogen : h+g >0.78 & 1.00 m.

- Searching the best site for a certain type of development identifying the site to be developed is dependent on the site characteristics. This approach can be more ecologically sound.

The role of site analysis

0. Introduction Different examples of techniques related to earth and ground

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Preparing a site for development; in this case the new motorway A2 close to Utrecht

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5. Examples, casestudies and types Different examples of techniques related to earth and ground; preparing a site for new urban extensions in Leidsche Rijn



Different examples of earth and ground in design, planning, construction, maintenance

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5. Examples, casestudies and types Watershed management; defining the watershed in the beginning of the design process





Figure 5-15: Watersheds and Surface Flow

0. Introduction Design techniques

1. Earth and ground as design material

Researching site, location, exposition: working with models in sand; in this case models 1:100

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cross-sections

H. Beekdalen





en met Oude

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Representation techniques related to earth and ground in design

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massen; E. dal mar

block diagrams





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5. Examples, casestudies and types as 3D-maps; here the southern part of the Paris region



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5. Examples, case-studies and types

> Making use of the (geomorphological) form of the land; the design of layout plans for settlements. Examples from Utzon in Helsingør, Denmark



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> Giving form to environmental pollution; the plan for the Volgermeer polder in North Holland designed by the office of VISTA Landscape architects



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ook y Holland

OVERFLAKKEE

design

5. Exam

studies 🐃

> A regional approach for landscape development in the river landscape of Holland by H+N+S landscape architects



RTOGENBOSCH



E INGREEP, ONTWERP 1:25.000 ODIEVAAR



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as > Parc de Sceaux in the southern part of Paris; making use of the natural topography to create waterbodies

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Plan of Sceaux







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1. Earth and ground as > Buttes Chaumont, Paris; a former quary transformed into an urban
design material park



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as > Land use defined by soil and hydrological conditions; the forest plantations in the Oostelijke Flevopolder

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· descionation

> The gardens of the 'Villa d'Este' in the city of Tivoli (near Rome) that make use of the very steep slope

