Winddriven archiventure

AE LAB 07 - Research Thesis

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Studio

Theme:	Architectural Enginering (LAB 07)
Teachers:	J. Engels, S. Groenewold

Graduation project

Title:	Winddriven archiventure in Scheveningen harbor
Theme:	Wind and Smart and Bioclimatic design
Teachers:	H.Plomp, A. van den Dobbelsteen

Prefase

Before you lies the research thesis written in preperation for the P4 presentation, part of the graduation program of the architecture faculty of the Technical University of Delft. In the feeld of architectural engineering, an architectural design is made by researching and intergrating technical fasinations. The technical research done during the gradiation programme is wirten down in this research thesis, and formes the basis and constant checking point for the architectural design that will be further developed in the time to the P4 presentation.

This research will start by explaning the research frame work, by discussing the background, questions and goals of the research. After wich it will continue with an description of the deisn assigment. Next to that you will find an intrododuction to the technical facination; wind, and the windclimate in the Netherlands and scheveningen. After that the research will be ordered by the design.

With tanks to Jan Engels, Suzanne Groenewold, Huib Plomp en Andy van den Dobbelsteen.

Jettie Vernee,
March 2012, Delft

Content

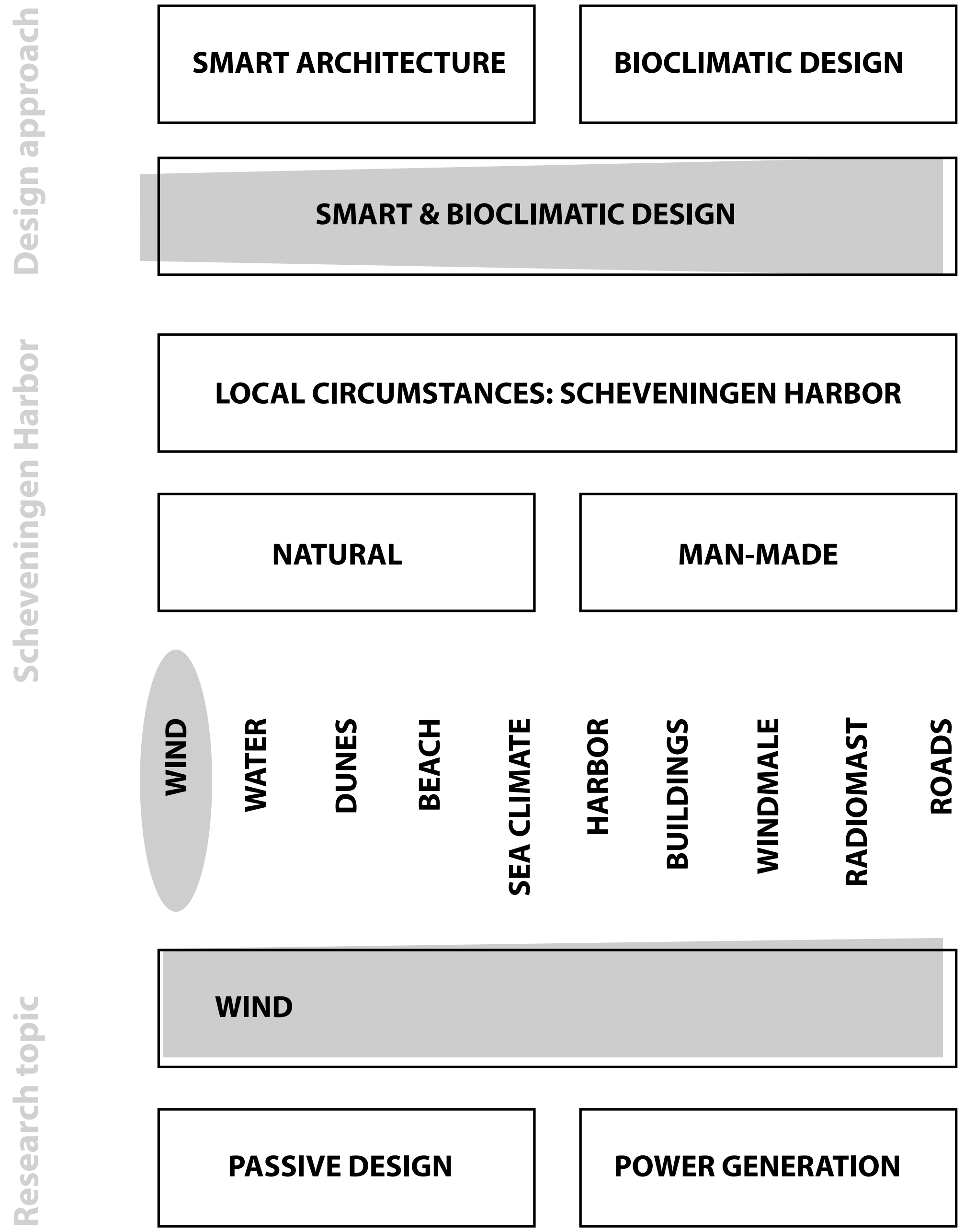
1. Introduction - Research framework

Research background

Smart & Bioclimatic design approach - In architecture we thent to design with the context. A closer look to build enviroment learns us something else. Buildings al over the country and europe look the same, while the context sertainly isn't. Smart & bioclimatic design is a design aproach in wich local circumstances are used to optimilized the sustainable design of buildings and urban plans, that use less energy and surfe users better. The Local circumstances can be natural (climat, seasonal, geomorfolgy, ect.) or man made (landscape, history and culture ect.) Smart & Bioclimatic design has it roots in the research fields in smart design and bioclimatic design. The first one is an design approach that designs buildings taht intellegently interact with there seroundings to make the buildings more sustainable. The second one was first defined by the architect Ken Yean as "the passive low-energy design approach that makes use of the amient engergies of the climate of the locality to create conditions of comford for the users of the building". *(artikel a. Dobbelsteen ea)*

Local circumstances , Harbor of Scheveningen - The natral local circumstance that stand out in the Scheveningen harbor are the beach, the dunes, the mild seaclimate, the wind and the water. These local circumstances are a big part of the design location and the way we experience the place. The man-made local circumstances that stand out in the location are the harbor, that was made in 1904 wherefor the boats where just on the beach. With the Harbor that was made in tree parts, came also the buildings on the quays, the streets, radio scheveningen and later on the windmale from eneco.

Research topic , Wind - On of the most important natural local circumstances in the Harbor of Scheveningen is Wind. Not only is it very important to the way we experience the Harbor and the beach, everytime in a different way, but is also very important for the working of the Harbor and it seroundings. The dunes are formed by the wind, but undergo constant treath of the wind too. In the early years of the harbor the wind was necessary for the boats to sail and enter the harbor, but when wind was to strong they couldn't. Nowaday the recreational sailing boats still face the same problems. On the otherside we generate power by use of a windmale on the location.
A lot of local building traditions evolve wind in there practise. The use of wind can be devided in to fields. The passive-low energy use of windflows and the use of wind for the gain of energy. In high wind earas we mostly see, next to the need for protection against wind, the use of wind for the gain of wind engery. In more modest wind earas we mostly see the use of windflows for controling the climate in and around buildings.*(smartarchitecture.org)* The field of using windflows in passive-low energy design, with research topics such as natural ventilation, heating and cooling and draft, this fields conect the most to the field of Smart& Bioclimatic Design.



Problem statement

Global scale

Global warming - Trough the use of CO_2 we amplify the proces of global warming. Although scientist still argue if we can do something about it, brining the CO_2 production down is something we must do now, before the effects are irreversable.

Exhaust of natural sources- An other thing we cause by producing and building the way we do know, is exhausting natural sources. The fact is though that we need this sources to make the transition to a more sustainable way of living. Therefore we need to make this transition now we still have the resources to do so.

Building play a big part in the proces of global warming, as well as exhasusting the natural sources. Not only in the process of building, but also in the proces of using. If we use more sustainable materials to build, and make the uses of our buildings take less CO_2, we could make a contribution to the problems on the global scale.

Building Practice

Lost of local building traditions - With the industrial revolution the globalisation of the world, we got lost of a lot of local building traditions. Wherase these local building traditons make better use of local characteristics to create conditions of comford of comfort for the users. And most of the time these traditions are a lot sustainabler too.

Lost of design for location - With the lost of the local building traditions al over the world buildings started looking the same. This gives us more challanges than needed to create a comfortable indoor climate. Therefor we now use more CO_2 to do so than necessary. We could save a lot of CO_2, and create better conditions for users, by designing buildings specifically for the designlocation.

Designing wit the Smart&Bioclimatic Design approach and deploying the local characterictiscs can help us make more sustainable buildings that surve users better.

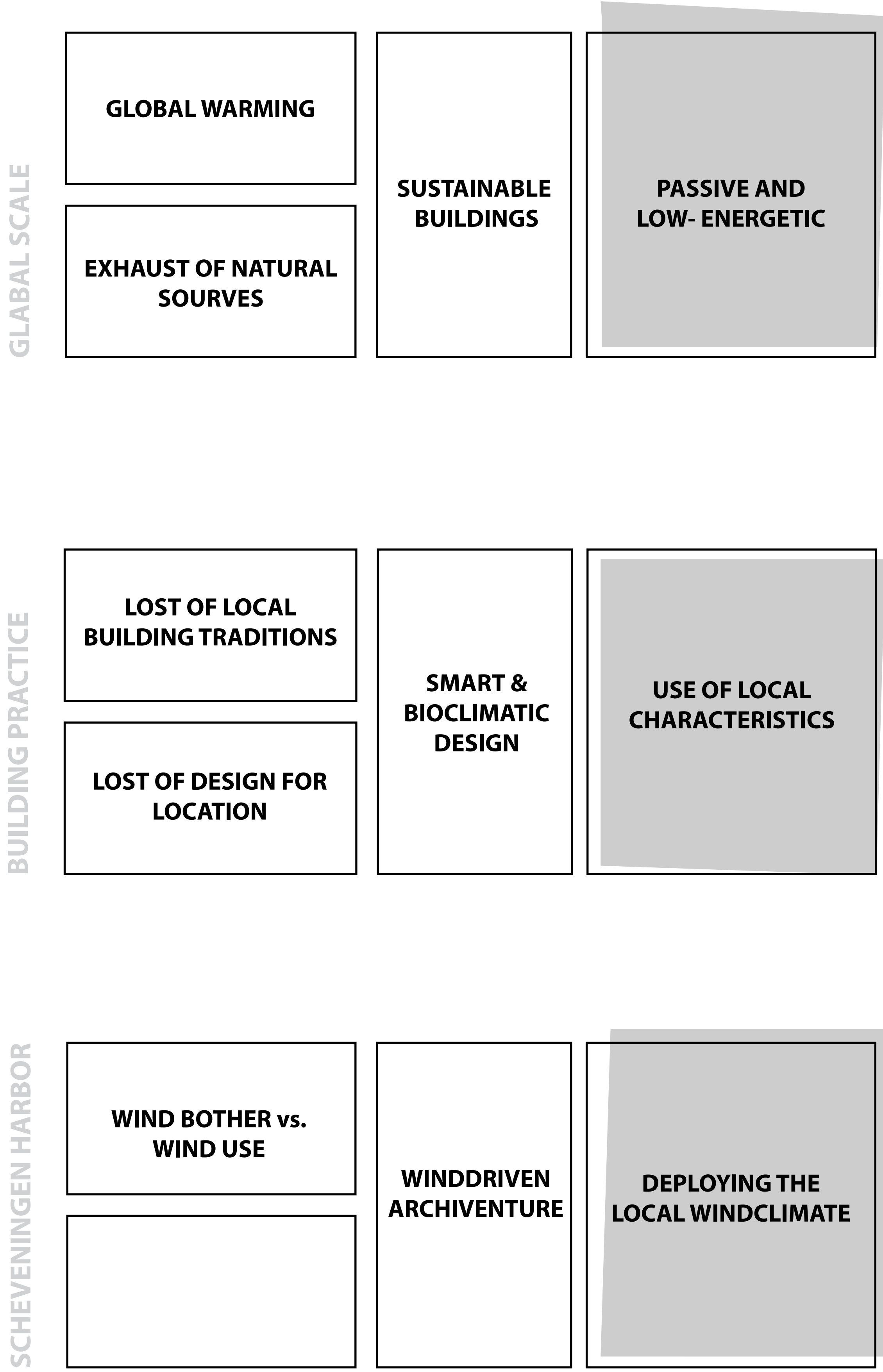
Design location - Scheveningen Harbor

Wind bother vs. Wind use - Scheveningen Harbor is a eara where high wind speeds are not an exeption. This brings windbother for a lot of people and activities, but the boats in the harbor has more than ones profit frrom the wind climate in Scheveningen. Without an good windclimate the Harbor becomes unusable of sailing boats and just like some activities. Every building that will be build in Scheveningen Harbor will influence the local windclimate, a thing that should be taken into account.

Natural vs. Man-made - In the harbor of Scheveningen, nature and man-made interventions are in contrast and somethimes meeting eachoter. The man-made interventions are hard and made to protect us, to give us shelter and to make the Harbor function well. The nature can be something we have to protect ourselfs to, but can also be part of our protection. In Scheveningen a balance between nature and man-made interventions seems to be preferable, a building build in this location should take this into accound.

In Scheveningen the relation between nature and man-made interventions is one of pro's and con's. Wind is one of the natural local characteristics that is very important for the experience and the climate in the harbor. By designing with the wind we could not only profit from it, but we can also avoid problems with the wind climate on the location.

Probleme statement - Trough the process of globalisation and internationalisation buildings have become non-sustainable and surfe users non-optimal. Local building traditions got lost in wich the use of local characteristics was a good way of improving buildings. In the harbor of scheveningen the windclimate is very demanding and can cause problems if we don't take it into acound when desinging.



Research Objectives

As earlier written, the technical research will be done in order to gather tools/aspects or design issues for the integral design. The finding of the research will be translated to the design assigment. Aim of the research will thereby be the gathering of knowlegde about research topic earlier subtracted out of the background and the problemstatements

Global scale - Designing a building that is more susatinable by using less CO2 if it is in use. One of the ways we can achieve this is by designing a passive-low energetic building. Hereby the climate constrol is low-energetic. To make the building use less energy for climate control we could optimize natural ventilation.

Building Practise - Using the smart & bioclimatic design approach the designing a passive low-energetic buildings, can be done by designing a building optimized for the design location. Designing a building that deploys the local characteristics of the Scheveningen Harbor itellegently, in order to make the building more sustainable and surfe users better.

Scheveningen Harbor - Designing a building optimized for the location, one of the local characteristics that should be taken into acound is wind or the windclimate. Desiging a building that deploys the local windclimate in the harbor of Scheveningen optimal, in order to make the building more sustainable and create conditions of comfort for the users.

Research Objective - Gathering the knowlegde that is needed to design a building that deploys the windclimate of the Scheveningen Harbor intellengently for the use of natural ventilation in order to make the building more sustainable (in a passive low-energetic way) and create conditions of comford.

Research Questions

To be able to ghater the knowlegde that is needed to design a building that deploys the windclimate of the Scheveningen Harbor intellengently for the use of natural ventilation in order to make the building more sustainable (in a passive low-energetic way) and create conditions of comford, several research questions can be formulated.

Local characteristics

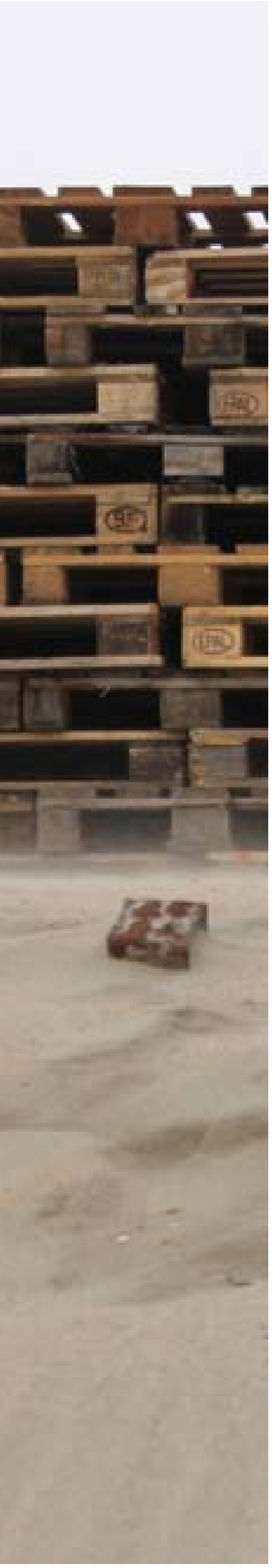
- What are the site characteristics of scheveningen that can play a rol in passive low-energy design?
- How is the windclimat in Scheveningen Harbor?

Build enviroment

- How can buildings influence airstreams?
- How can buildings addictions influence airstreams?
- What effects can occure when wind is in the buildenviroment?

Sustainability

- How can we save energy using wind or airstreams?
- How can we benefit from wind, when we design the indoor climate?

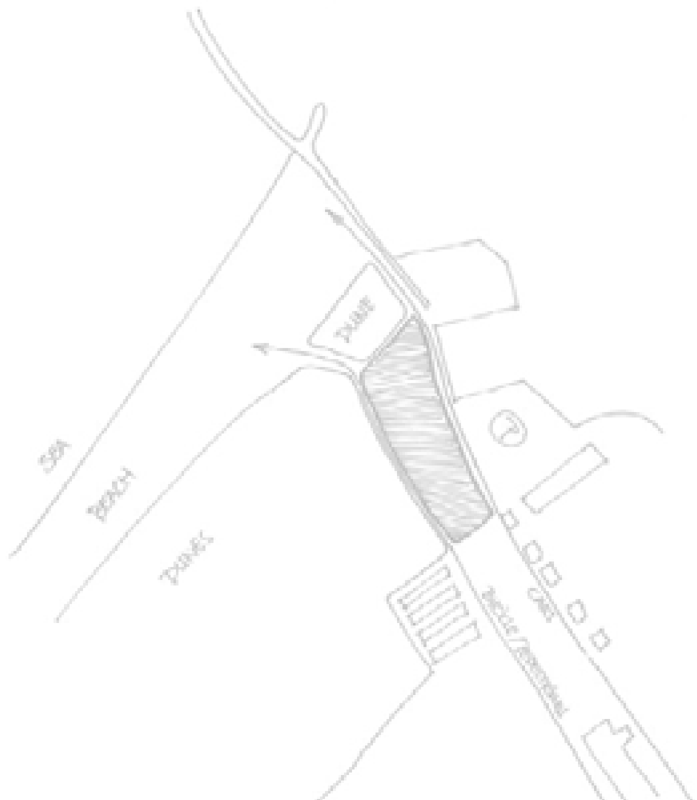


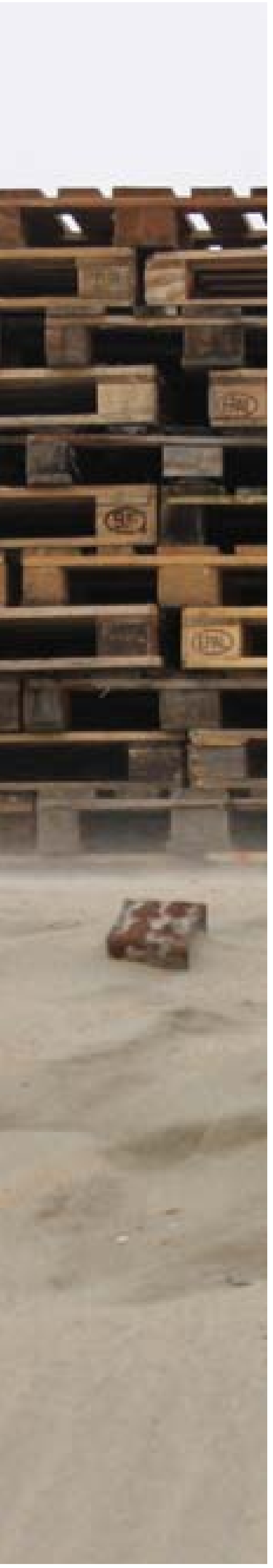
1. Introduction - Design assigment

Location

Choise of location - The location in the origenal assigment was Scheveningen harbor. By the use of the knowlegde that we want to design a building that interact with the wind in the enviroment a high wind location is choose. A location at the dune line is preferable because of the solid windstreams from sea. The hight of the dunes is ideal because we don't aim on making a tower, but want some hight to be able to catch the higher wind speeds. Chosen is the location as markted on the map. Here the dunes can be extended, in cooperation with the buildings. Wind extremes (from high speed, to zero speed) can be formed and the clash between nature and man-made structure is very explicite.

consequences of location - By desiging and building on this location the pedestrian, cycle and carways to the beach are influenced, just like the parking spots and the harbor of northfolke. These will al be included in the design assigment. The ways to the beach, as well as the parking spot will be redesigned an integrated with the building and the extende dune.
starting point will be to inplement windexperience in the ways to the beach. Second starting point will be the conextion between the ways to the beach and the publicfunctions of the building.





Function

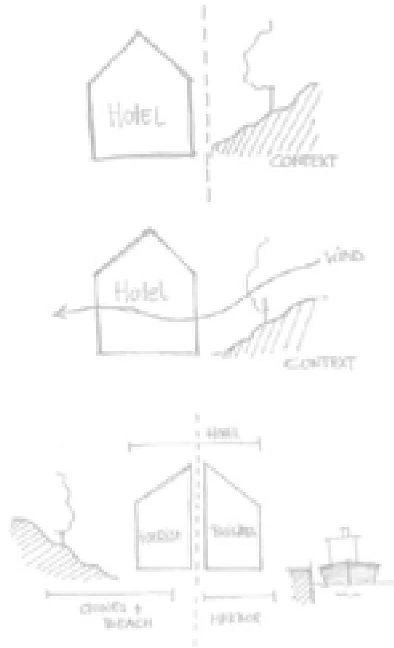
Choise of function - The smart and bioclimatic design appraoch is focus on the use of local circumstances to make the building more stutainable and serve users betters. In most of the hotels we see, that we want to make everybody feel at home, and thereby disconnect from the location, the aim will be to design a hotel that is connects users to the design location by using the local circumstance wind. Thereby the location has a very explicite clash between the soft nature and the hard man-made harbor side. In hotels we see the same kind of clash between the use of the building by buisness man and the use by tourist.

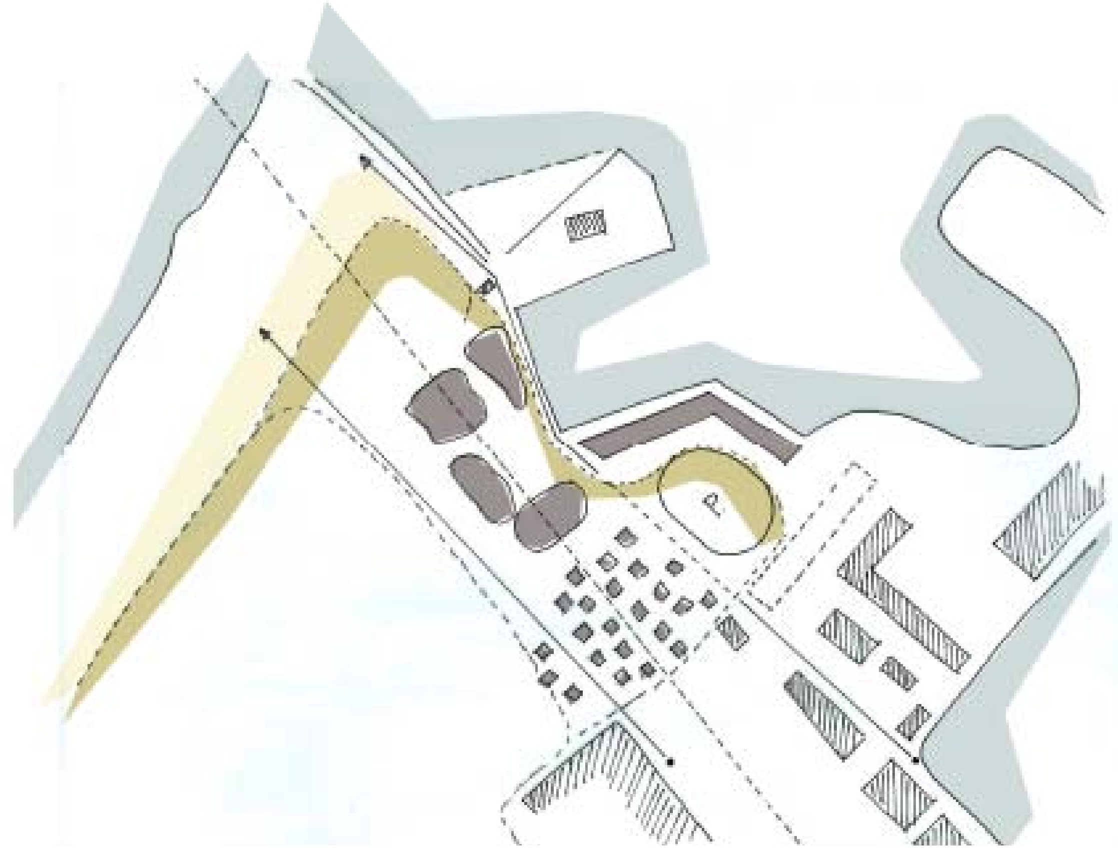
consequences of function - Desiging an hotel that uses wind and natural ventilation to make the building more sustainable and make the useres connect with the context, means a lot of different requierments. First there is the requirement of being accessible, for tourist and businesspeople. The mixed use, makes the building requirements varie a lot. Aim is to make the building usable for tourist, businesspeople, staff and short visters.

Architectural Concept

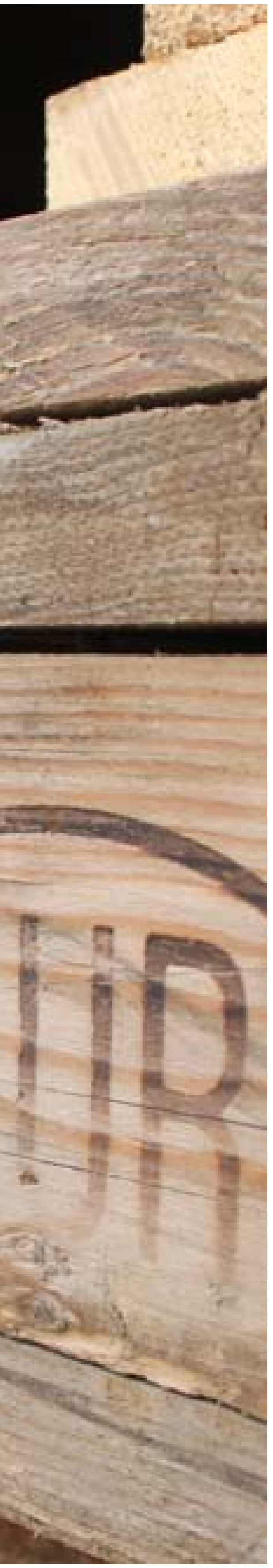
**Choise of concept - ** Aim is to design hotel that uses wind and natural ventilation to make the building more sustainable and make the useres connect with the context. Because of this goal the chosen concept considers natural ventilation as airstreams trough the building, and lett users experience this windstreams. Not only to show in what context the users is situated ,but also to experience constantly what the building does to surve the users. Protecting the users against the high wind enviroments. Not an general design, but the feeling of being comfortable and secure will make the user feel at home.

consequences of concept - concequences of choosing a concept that takes windexperience in the building as one of the main architectural goals, can mean that the norms for airspead in the building will be exceded. Aim is to make a comfortable indoor climate and to make it still possible to experience the wind trough the building.





**First layout of the desing - ** the first layout of the design shows that in order to achieve more connection with the contect, a relatively new hotel typology is worked out. Spreading the functions over the design locations, makes it possible to design this connection more psyfic for each part of the hotel, and makes is possible to create a route between the functions shows the hard interfaces between the low windspeeds that are prescribed for places you stay for a amounth of time.



Enginering and Integration

Goals for enginering - The main goal is to create an comfortable indoor climate, and use wind and airstreams to make the buildning as sustainable as possible. Aim is to use natural ventilation and the use of air for heating and cooling as much as possible. Making the building as passive as possible will also include other naterual sourses and circumstances if needed. This will also mean that if nescerry because to make the building even more sustainable the use of wind for energy gain is not excluded.

Goals for intergration - the orignal assiment is to make technical driven architecture, wich means a high level of integration between architecture and enginering. Aim is to create a buillding in wich architecture and enginering strengthen eachother. for this design this means designing a building in wich architecture and indoorclimate profite from the use of wind.

Hotels that are designed to connect to the context



Design: Pir II AS
Year: 2011
Location: Stokkøya, Åfjord, Norway

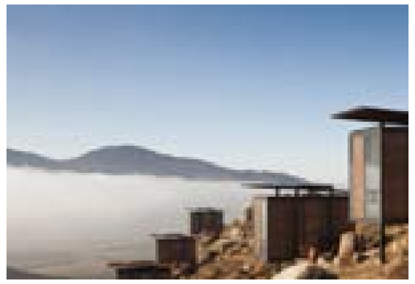
"The clients, a young couple running a small sheep farm on the island of Stokkøya, wanted to do something more with the place they inherited, and perhaps be able to make a living out of it. They wanted to create a resort with a high architectural quality that was not exclusive, but a place where the uniqueness of the location could be experienced by everyone." (www.worldarchitecturenews.com)



Design: Circa Architecture
Year: 2011
Location: Saffire, Coles Bay, Tasmania, Australia

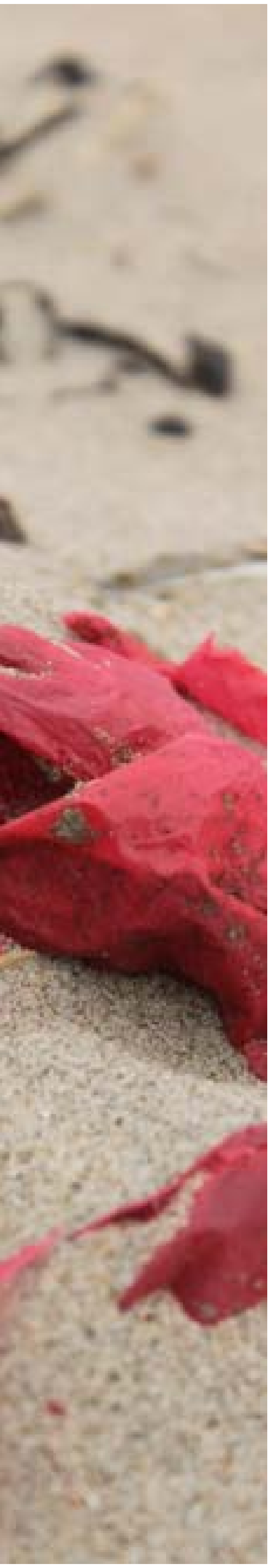
"The desire to create a unique experience and ultimately positive lasting memory of the resort was a key aspiration of the design. With this in mind, the architects shaped the main building as the end point of a continuing journey, in which views of the Hazards Ranges are shielded and revealed and finally presented inside the building as a panoramic overview of Great Oyster Bay." .... "The guests' journey is a deliberately extended special sequence in which guests move from the monumental resort building, through the site, to the private space of the suites." (www.worldarchitecturenews.com)





Design: Graciastudio, Arq. Jorge Gracia
Year: 2011
Location: Valle de Guadalupe, Ensenada, Mexico

"Located in Valle de Guadalupe «Mexico's Wine Country», Baja California,Endémico Resguardo Silvestre is a set of twenty independent rooms of twenty square meters each, operated by Grupo Habita, a Design Hotels member" ..."One of the principal premises was not to interfere directly the land, as part of the philosophy of the project is to respect nature in every possible way" ... "The approach of the design of the room comes from the concept of a "deluxe" camping house, covering the guest's basic needs, being in contact with nature and the environment. " (archdaily.com)



2. Wind - Introduction

Forces on air

Based on the book of J.Wieringa, we will first discus how wind is formed and wich forces are determine the main characteristics of the wind.

ρ

Wind can be discribed as the movement of air. This movement of air is primarly caused by presure differences in the admosfeer, wich thereby creates wind. These presure differences arise maily form horizontal temprature differences. Hot ar is less dense than cool air and thereby forms lowpressure fields, also called depressions. The presure defferecences cause the "gradient force" to push the air in the directon of low pressure field. When we take P for presure and for the density we can calculate the aceleration by the gradient force;

$$G = -\frac{1}{\rho}\frac{dP}{dx} \ \text{ms}^{-2}$$

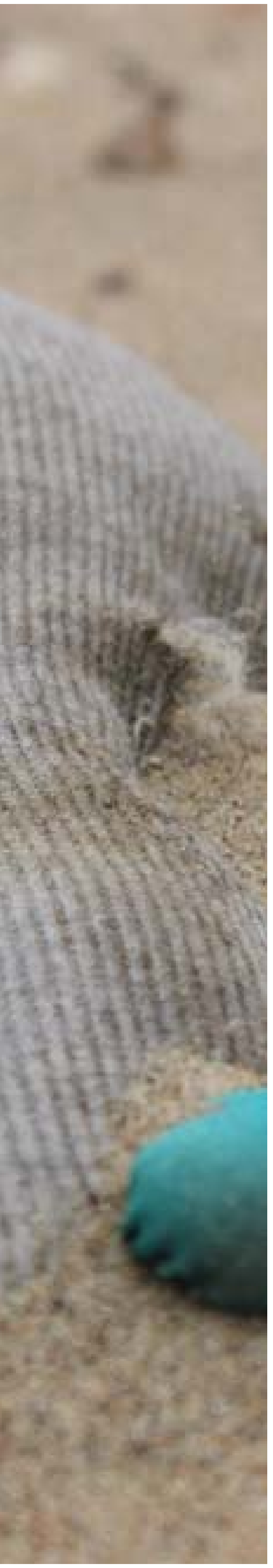
When the air is already in movement a couple of other forces start working on the air stream. First of al there is the rotation of the earth. This rotation causes a shearforce on the wind. This shearforce we call the "Coriolisforce", wich can be calculaed with the latitude and the traveling velocity of the air;

$$C = 2\,U\,\omega \sin\phi \ \text{ms}^{-2}$$

This shearforce works (seen from the earthservice) on the northern hemisphere in the direction of the clock. On the southern hemisphere we see the shearforce working in the counter direction. Moving to the equator, we see the effects of the rotation fade and nearby the equator we don't see the horizental displacement any more.

One other forces working on the wind is the friction force, wich works on the wind when it is moving over the service. How much friction the service has, is determend by the roughness (Cw) of the service. How much the roughness slows done the wind, can be calculated with;

$$W = C_w\,U \ \text{ms}^{-2}$$



Windspeed and winddirection

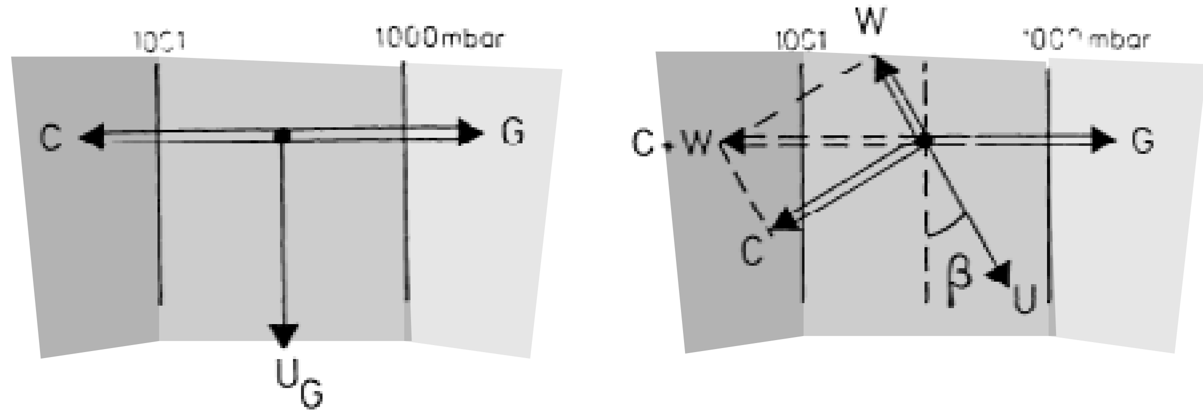
On moving air, or wind, the gradientforce, the coriolisforce and the friction force are always working. The extent to wich they are working, determences the wind we percieve. If we state that the windspeeds constant, and therefore the sum of the forces zero, we can theoratacally calculate the windspeed and the winddirection.

In the upperlayers of the admosfeer the friction force can be neglected, because these layers of air ar not moving over the service. This means that the gradientforce and the coriolis force must be in balance. The winddirection (U) is hereby perpendicular on the two other forces. Wind will flow parallel with the isobares (lines that connect points with the same pressure, air wil thereby not be flowing from highpressure to lowpressure. This winddirection is also called the geostrofic wind(direction).

Closer to the ground we see friction force. This friction force, togheter with the coriolis force will balance with the gradiant force. The winddirection (U) will still be perpendicular to the coriolis forces, wich means that the direction will thilt towarts the low pressure area. When the friction force is bigger, the tilthing of the winddirection will be bigger. This means that the presure differences between the high presure feeld and the low presure feeld will reduce. This reducing of presure difference will hereby go faster if the friction on the service is bigger.

As a result of the friction forces of the service of the earth the presure differences will be slowly resolving, and air is flowing from high presure feelds to low presure feelds. Hereby an other force works on the airstreams, because they flow in circular paths there is an centrifugal force. Wind nearby low presure feelds, are hereby more likely to be strong winds. The coriolis force and the centifugal forces are then working in the same direction. Windsnearby high presure feelds are by the contradictonal of the to forces more likely to more moderate.

The friction force from the air with the service of the earth will slow the wind down, make it tilths its direction, and make pressure feelds desolve slowly.



Figuur 3.2 Ontstaan van de geostrofische wind U uit gradiëntkracht G, Corioliskracht C en wrijvingskracht W (wet van Buys Ballot) op het Noordelijk Halfrond.

(bewerking van) Wieringa.J. and Rijkoort.P.J. (1983)

Windprofiles

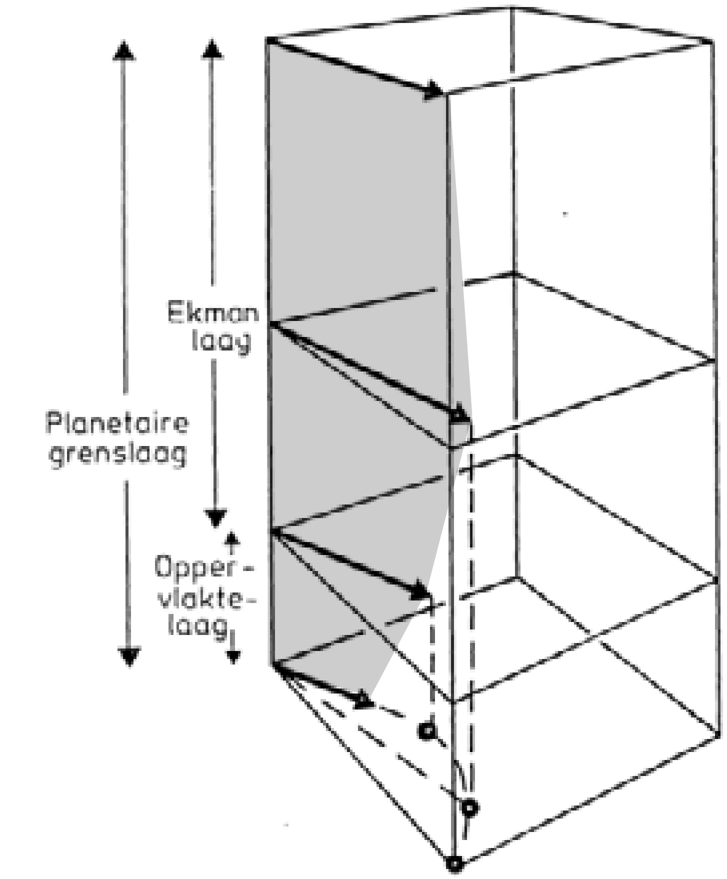
Most commenly used to discribe the difference in wind in te upperlayers of the admosfere and the more lower layers are windprofiles. These profiles show the windspeeds at different hights.

The admosferic layer of the earth consist of serveral layers. The most differences are seen in the planetary boundery layer, that is the lowest first kilometer. The planetary boundery layer can be divided in the service layer (the first 60 meters) and the ekman layer (from 1km - 60 meters from the earth service).

Looking at windprofiles we first see the influence of the friction force become bigger, with the reduction of hight. On the upper layers of the admosfere the fiction force can be neglected, and as discribed before the windspeed and direction will be almost equal to the geostrofic wind. When we enter the planetary boundery layer downwarts we first see the wind tilth its position, and loose a little bit of the speed. In the service layer we mostly see the loosing of speeds, and just a little bit of tilthing.

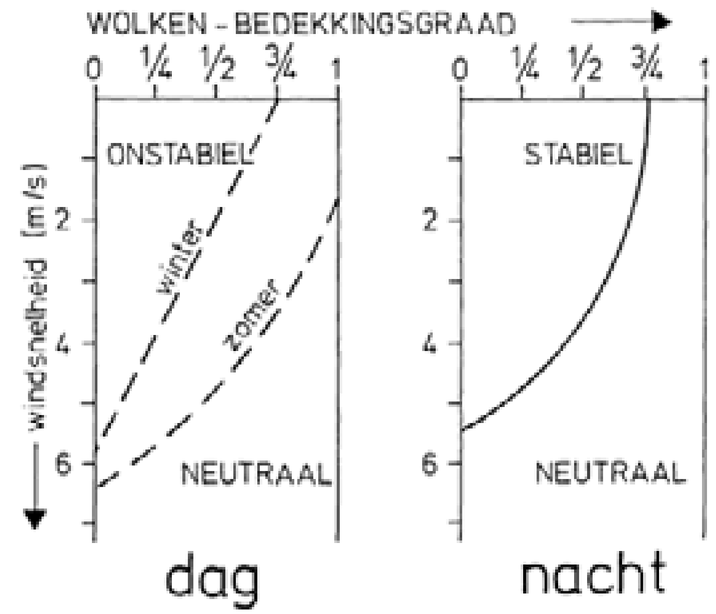
Windprofiles are mostly looked at from the service of the eart till 60 meters above it. In these feel the winddirection is mostly a fixed factor. The sorth of terrain wich the airstream come from, and thereby the fricton forces, in combination with the heat distrubution over the hight will dertimen the windprofile in the service layer.

When we view the temprature distrubution over the hight in the service layer we can see tree states; it can be stable, unstable and neutral. The service layer is stable when earth service is cool, and the air above it warmer. The cold air on the ground, is very dense and almoste won't mixe with air from higher layers. Hereby it's hard for the windspeeds to transfer from the higer layers to the cold lower layers.
The service layer is unstable when the earth service is warmer than the air above it. The warm air nearby the service has an low density, and will rise in the form of bubbles. This convection will also allow cold air from higher layers to sink and transfer the windspeed from these layers.
The servic layer is neutral when temprature differences are not really determing. This can be when the windspeeds are very high and will transfer anyway. When windspeeds are very high, and the terrain is rough, wind gusts will mixed the air (turbulance) and thereby transfer the windspeed to lower layers. An other sytuation in wich the neutral state will occure is when the sky is very cloudy, and the radiation of the sun has no change to heat op the service of the earth, and there will almost no temprature difference in the service layer. When the service state is neutral the windprofile is determinded by the fraction of the terrain.



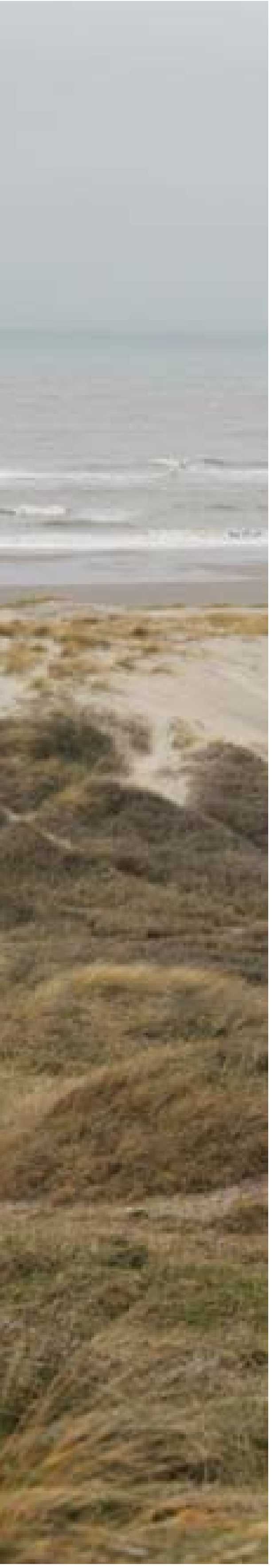
Figuur 3.3
Verandering van de windvector met de hoogte in de planetaire grenslaag.

(bewerking van) Wieringa.J. and Rijkoort.P.J. (1983)



Figuur 3.4
Schematische samenvatting van de stabiliteitsklassificatie volgens Pasquill.

Wieringa.J. and Rijkoort.P.J. (1983)



3. Windclimate - Netherlands

Windclimate in the Netherlands

Looking at global windpatterns we see low pressure feelds in the planetary boundery layer at places with a high service temprature. This means that around the equator we see a low presure beld. Next to that we see a highpresure beld in the subtropes, with next to that a low presure beld. The Netherlands are systuated in the lowpresure beld next to the subtropical high presure beld. Because the air of the high presure feelds at the subtropes and the pole is essentially flowing from to the low presure feelds where the netherlands are sytuated. The place where the to pressure feelds meet we call a frond, and this perticullar front we call the polarfrond. This frond moves over Europa en can be placed at different latitudes. This frontline is determing for or weather because it can cause depressions (feelds of low pressure) and determine the positions of highpressure feelds. Wich both bring a different weatherclimate with them.

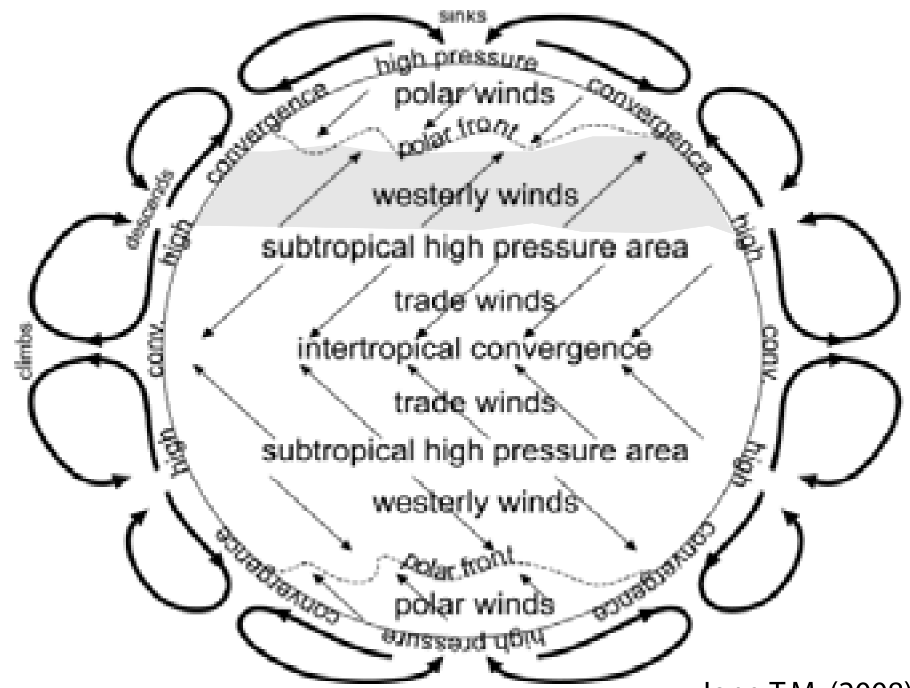
J.Wieringa shows in his book that an analyses from winddata from measering point over the country, shows that in the Netherlands the location with respect to the North sea is determented for the windspeeds above the service layer. For the windclimate closer to the ground the roughness is playing a part too.

A yearly average is however not very representive to discribe a windclimate from. In the Netherlands we can divide the year in 6 seasons of two months , difinded by the location of the highpresure feelds;

- January - February ; Winds out of the North East
- March - April ; stormy weather above land
- May - June ; seawinds at the coast
- Juli - August ; West circulation
- September - October ; Winds out of the North East
- November - December ; West circulation

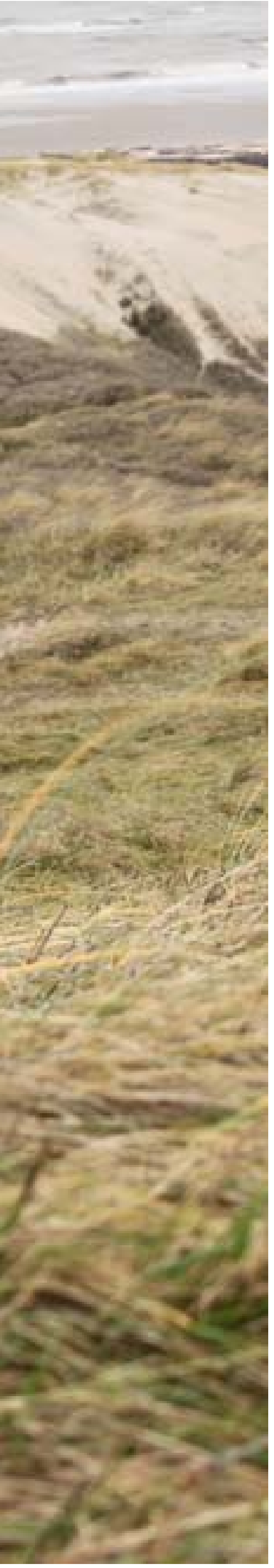
westcirculation is the sytuation in wich the polarfront is above Netherland, and depressions are moving above the north of the country. Because of the fact that depressions usually have the strongest winds at the south side, the westcirculations cause a lot of wind and storms in the Netherlands. The west circulations determine the weather in the Netherlands 30% of the time.

Over the year, with the seasons the windspeeds are chancing, we call this the annual going.



Jong T.M. (2008)

Jong T.M. (2008)



seawindclimate and landwindclimate

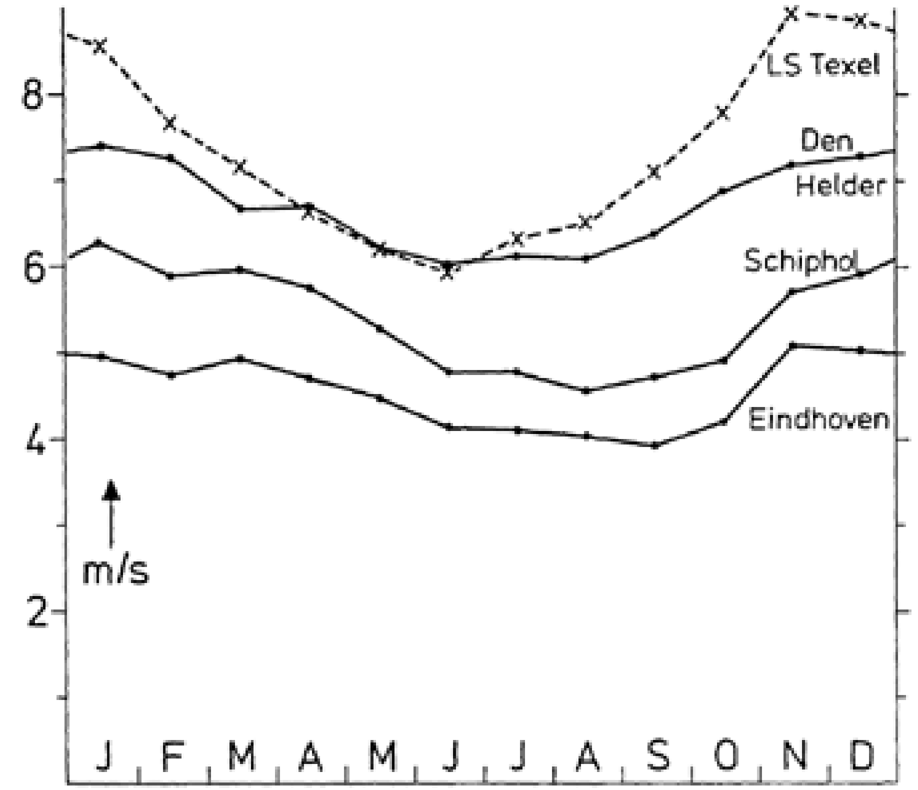
Over the year, with the seasons the windspeeds are chancing, we call this the annual going. This annual going is based on the stability of the service layer as earlier mentions, because these stability is based on temprature and radiation on the service this stability is affected by the seasons.
On sea the service takes more time to head up, and thereby the stability of the service layer above sea is more slowly effected. This means that, while the friction force is less and we would thereby expect that windspeeds would be higher, that is not true for the hole year. When in the spring the temprature difference between the air and the sea is very small the windspeeds on land are not much less than the winds at sea. Thereby the annual going is much bigger at sea than at land.

This annual going of the sea is also causing an other phonomonen; seawinds. Seawinds occure very locally by the cost, at sunny springdays, when the tempreture difference between the air in the service layer. Above the seawater the air is cool (just like the water), while above land the air is warmer, because of the radiation of the sun that headed up the service. The air above land rises leaving an low presure feeld near the ground. Cold air from the sea, flow towards the low presure feeld at land. At higher level the exect opposite phenomonon occures.

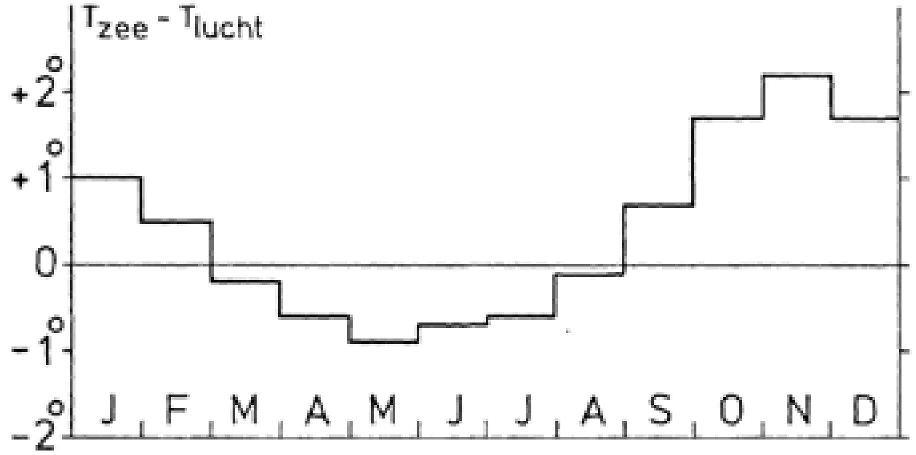
Next to the annual going, we have the daily going, the changing of windspeeds over the day. This daily going occures, because of the changing stability of the service layer over the day. Mainly in the summer, during the day the service of the earth heats up, by the radiation of the sun. Hereby the service layer becomes unstable and windspeeds will transfer easier to the the lower layers. In the winter this daily going is thereby less noticable. This also counts for the winds at sea.

When we look at the windclimate in the Netherlands, we can divide it into tree several subclimates. the seeclimate, the costalclimate, the landclimate. Looking at the design location, it is located in the costalclimate areas.dat This means that it is a mixe of the seeclimate and the landclimate.

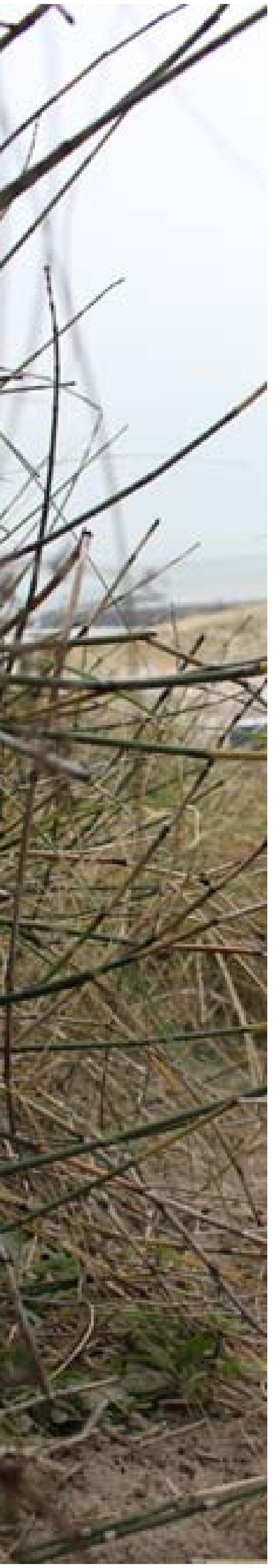
Figuur 4.9
Jaarlijkse gang van de maandgemiddelde wind op vier stations.



Figuur 4.10
Jaarlijkse gang van het temperatuurverschil tussen lucht en zee op het lichtschip Haaks, nabij Den Helder, in het tijdvak 1910-1940 (Verploegh, 1959).



Wieringa.J. and Rijkoort.P.J. (1983)



Windclimate scheveningen

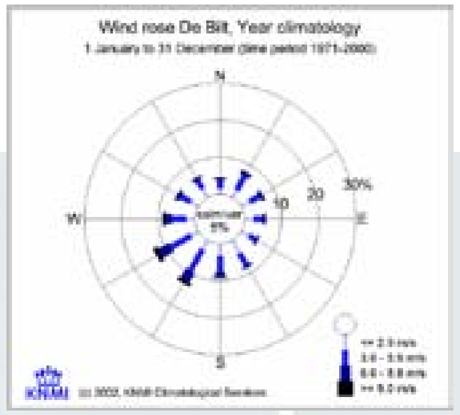
Describing, researching and designing on the location in scheveningen harbor, we base ourselfs on the winddata from measuring station Hoek van Holland. This measuring station is geograficly not the closed station, but has the most comparable sytuation, by being located on the line of the demarcation between sea and land.

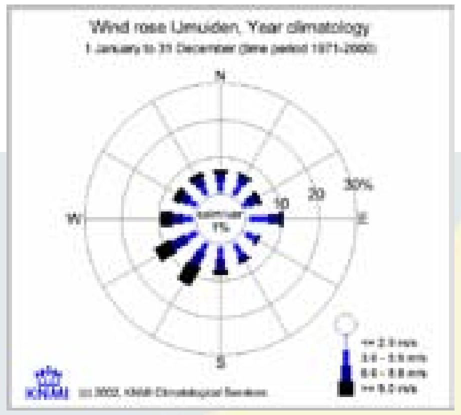
The yearly windrose showes that a real dominant winddirection is absent, and there are much strong winds (>9 m/s). If we compare it with measuring station the Bild, we see that the winds are less dominant than further away from the sea. Thereby the windsspeeds are cleary higher, than further on land, like aspected and discribed before. When we compare the results with the measing station Ijmuilden, wich is on a pier in the sea, we sea much also a lot similarities. Hoek van Holland shows a truely mixed picture from the two.

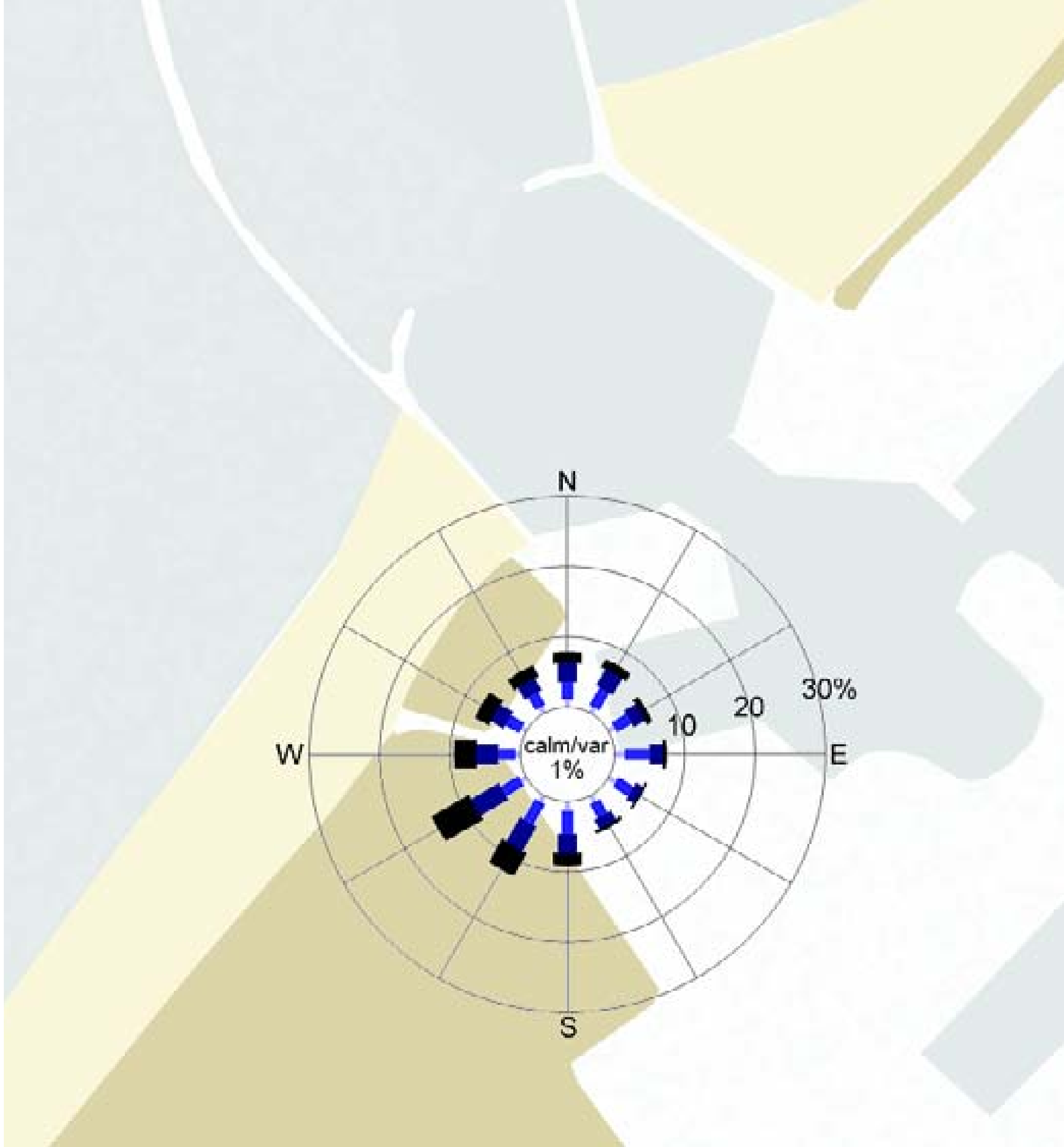
When we look at the montly windroses we see that several months do have there dominant wind direction. Looking at the winter months we see strong winddirections between west and southwest. When we look at the spring and early summer months we see this shifting towarts north west and north east. The late summer and autum months show a fragmented picture, without a clear dominant wind direction.

Looking at the windspeeds we see that the most high windspeeds come from the sea and the relative open feelds of the dunes. Lower windspeeds are measured from where the city is located (east). This phenomonon can be explaned as an combination of different terrain roughnesses and thereby friction forces and the natural differences from wind from sea and wind from land.

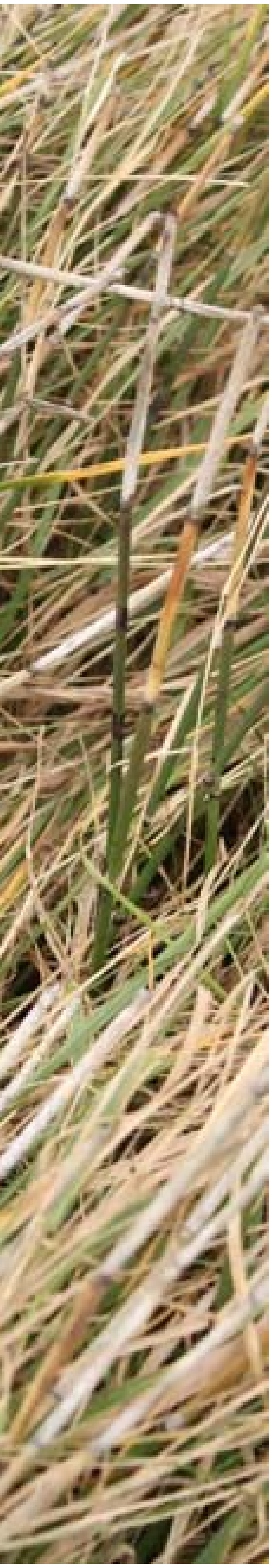
The windclimate of scheveningen is thus a typical costal climate, wich is very close to the cost, and thereby pics up a lot of influences from the seewindclimate. Combined with the locational typologically sytuation between the city and the see, wich are two very different windprofiles.







Year - Windrose on location



Januari

Februari

March

April

May

June

July

August

September

October

November

December

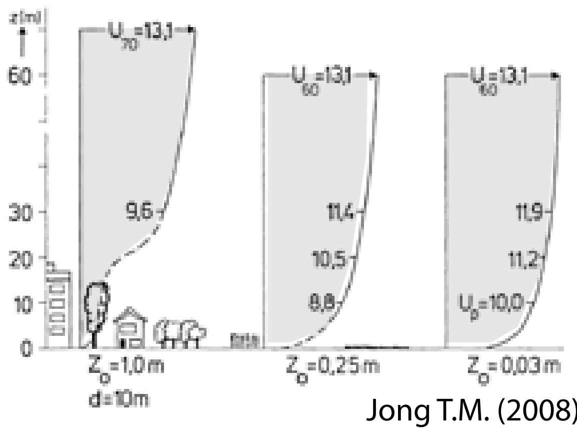
4. Routing - Wind and landscapes

Integrated in the design there is the public routes from the harbor area trough the dunes to the beach en if that is preferable to the pier. in order to design this route, not only the actual walkway is designed but also the landscape around it. In order to find out how the windexprience of the user will we will look at the interaction between the wind and the landscape.

roughness classes

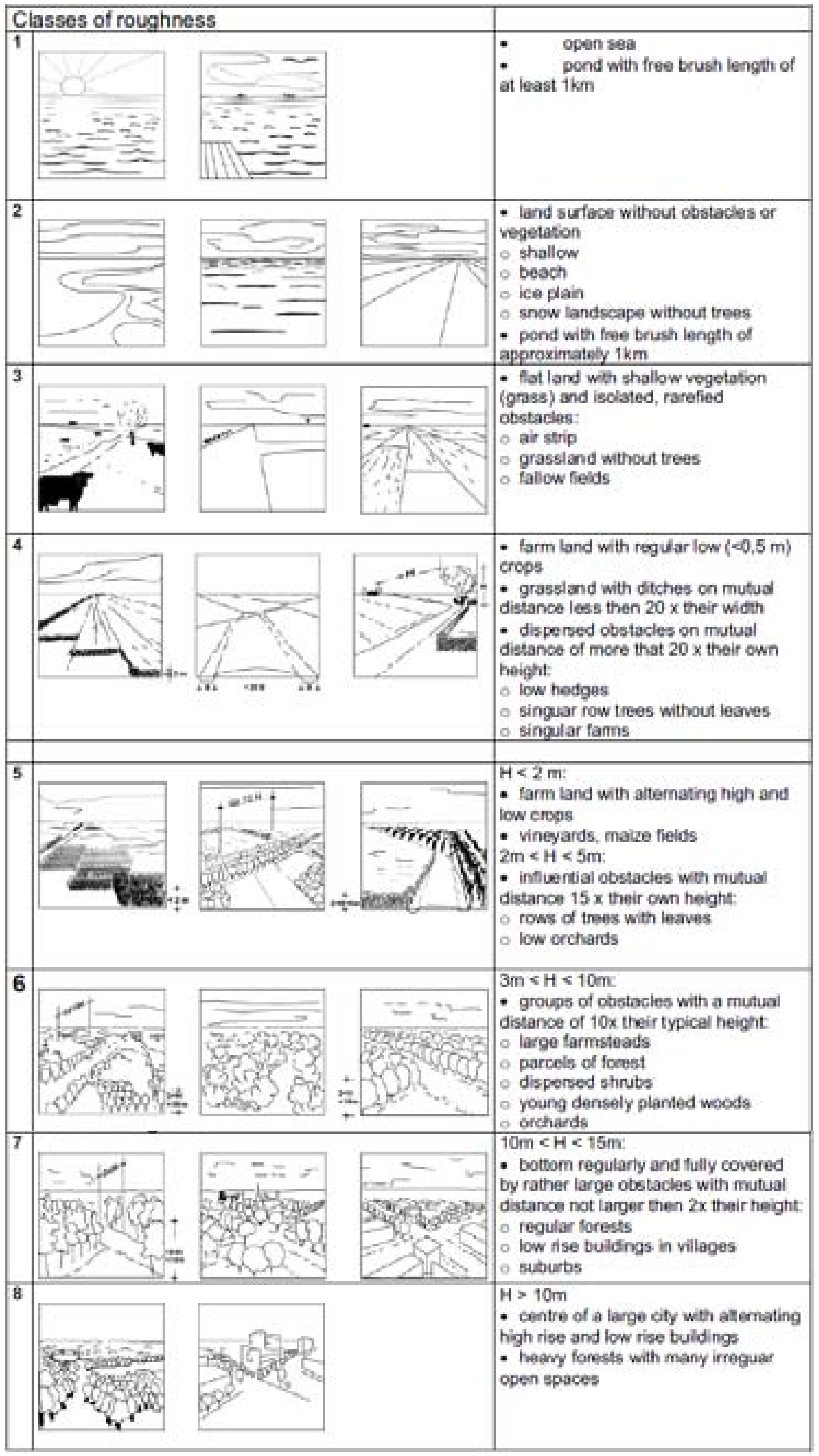
If we want to know how much fraction force the service is giving on the airflow, we have to nog how rough the service is. A rough service means a lot of fraction force, where a smooth service can cause almost none fraction force. If we look at every location on itself, it is hard to determine how rough the service is at that location. Therefore roughness classes are used to classificate several types of terrain and make comparation possible. The roughness are as shown at the next page. To every roughness class there is a z-value assigned. When the service is smooth, the z-value is low and the friction force will be low. That the roughness of the service won't slow down the wind so much, and the windprofile will show high windspeeds on low levels.

In the design location in Scheveningen harbor, there are a two different roughness classes. On the seasite we haven roughness clas 1, wich is linked to a windprofile with high windspeeds at low levels. On the other site we have the city of The Hague, wich false into roughness class 8. This roughness class with building higher the 10 meter, wich are usually in the core of a big city, with high and lowrise buildings. This roughness class is linked to a profile in wich the windspeeds are much more slow down and wind a lower level show low windspeeds.



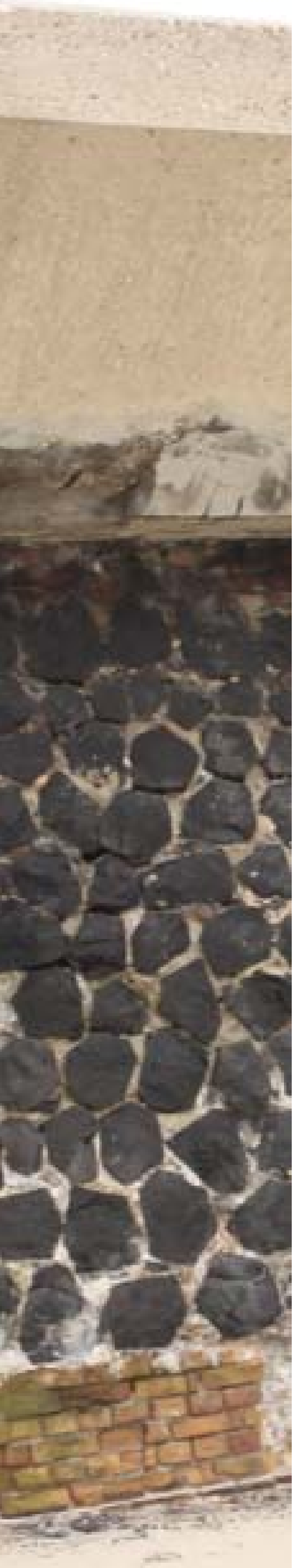
Jong T.M. (2008)

windprofiles - Scheveningen harbor



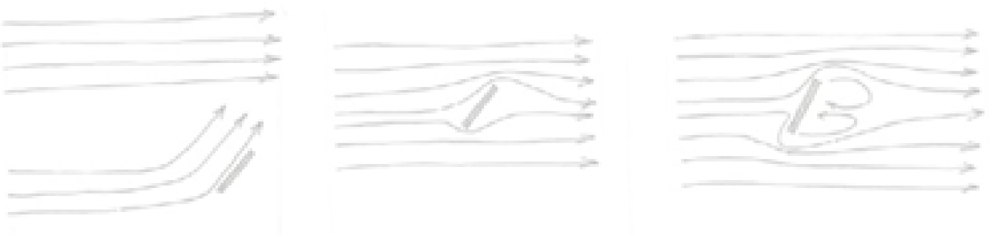
Classes of roughness	
1	• open sea • pond with free brush length of at least 1km
2	• land surface without obstacles or vegetation ○ shallow ○ beach ○ ice plain ○ snow landscape without trees • pond with free brush length of approximately 1km
3	• flat land with shallow vegetation (grass) and isolated, rarefied obstacles: ○ air strip ○ grassland without trees ○ fallow fields
4	• farm land with regular low (<0,5 m) crops • grassland with ditches on mutual distance less then 20 x their width • dispersed obstacles on mutual distance of more that 20 x their own height: ○ low hedges ○ singuar row trees without leaves ○ singular farms
5	H < 2 m: • farm land with alternating high and low crops • vineyards, maize fields 2m < H < 5m: • influential obstacles with mutual distance 15 x their own height: ○ rows of trees with leaves ○ low orchards
6	3m < H < 10m: • groups of obstacles with a mutual distance of 10x their typical height: ○ large farmsteads ○ parcels of forest ○ dispersed shrubs ○ young densely planted woods ○ orchards
7	10m < H < 15m: • bottom regularly and fully covered by rather large obstacles with mutual distance not larger then 2x their height: ○ regular forests ○ low rise buildings in villages ○ suburbs
8	H > 10m • centre of a large city with alternating high rise and low rise buildings • heavy forests with many irreguar open spaces

Jong T.M. (2008)



Turbulentie

In normal sytuation airflows flow in smooth laminar paths, wich means that layers or air ar orderly stacked. In other words if an airstream is smooth and the adjunt airstreams are moving in the same direction, we call it an laminar airflow.



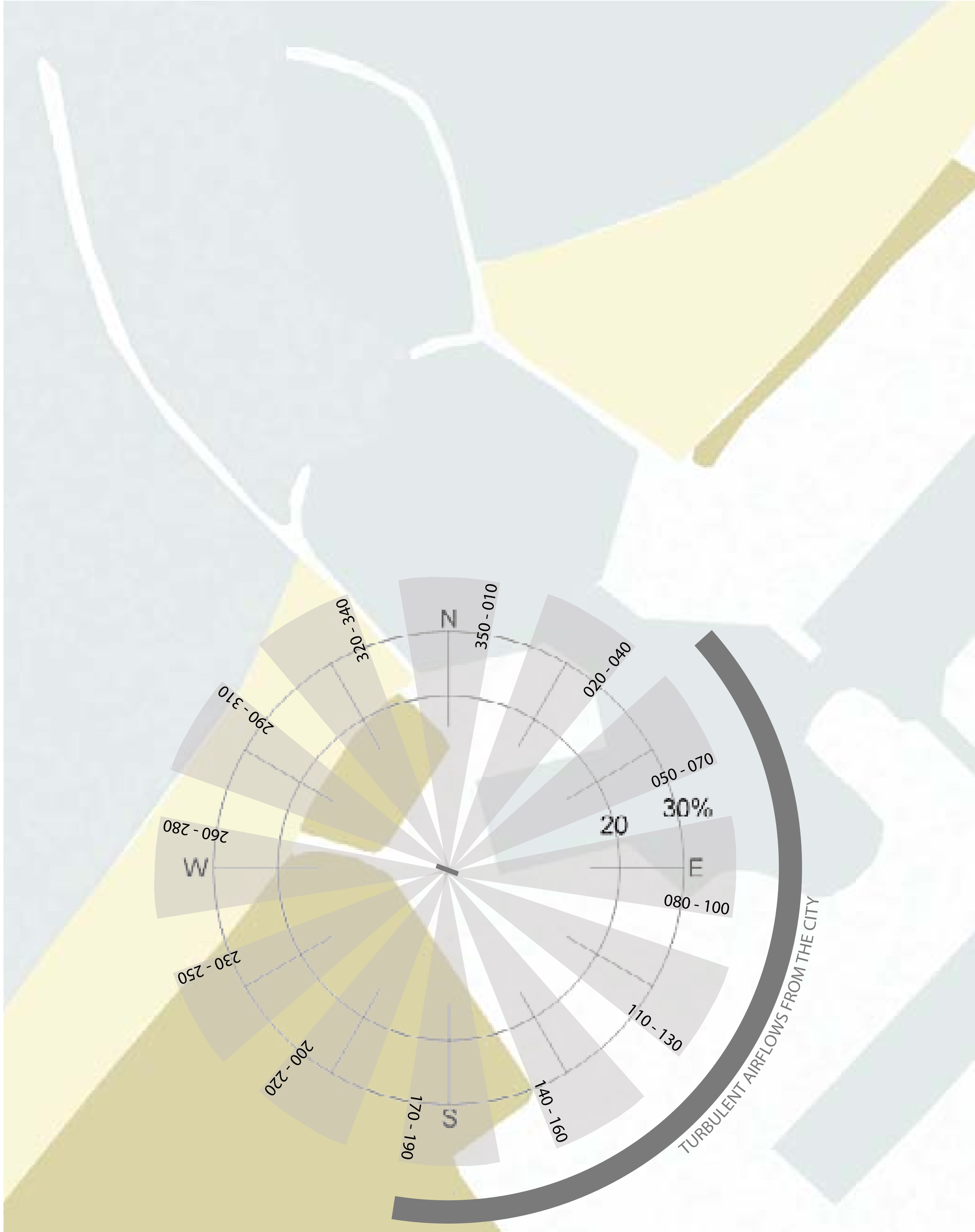
When an obstical or service is in the way of an airstream the orderly stacked smooth laminar airflow will be desturbed. If an obstical causes slow, gentle alternations, the laminar flow will stay in takt. The airflow will be able to compress a little and thereby contains is form. When an obstical or service causes more abrubt and less subtile alternations, the laminar windflow will become turbulent. Turbulent airstreams seperate suddely from adjacent airstreams and move in circular, less predictable directions. The circular motion is caused by the low pressure feeld, behind the obsticals.

Obsticals can have all kinds of dimensions, and there for the turbulent airflows have them too. The circular motions, also called turbulent eddies, are there in al kinds of measurments too. If we look at landscapes we the roughness of the service determince how big the eddies will be and there by how turbulent the air wil be. As a result of the eddies an turbulent airflows will be experienced as gusty winds, while laminar windstreams will be experienced as smooth air flows.

Dunes

In Scheveningen harbor we are between two very different windclimate. The windclimate of the sea and that of the city. Wind from different sites of the location have a different history and therefore there own charastaristics. Between these two different windclimates we see the dunes.

Dunes are formed by the wind. sandparticals from the beach are moved till the face un obstical (mostly plants or an already excisting dune). There the wind is slown down, and no longer able to move the sand particals. Sandparticals can be move in different ways, determine on there size and mass. First of all very small parts (almost dust) get picked up by the wind and are moved without touching the ground, over lond distences. Slightly bigger sandparticals will be picked up, but will bounche back to the ground.



over lond distences. Slightly bigger sandparticals will be picked up, but will bounche back to the ground. This createds a movement of bounches. The biggest sandparticals are not leaving the ground but are dragged over the service, somethimes by the direct force of the wind, but mostly by other smaller particals touching it.

The way windflows occure at a certain location is thereby a controlling force in the creation and shaping of dunes. Because of the almost constantedly presence of the wind and the changing of winddirections and velocity, dunes are always changing and moving.

In order to prevent dunes from moving we make obsticals. In most dune sytuation we pland marram, as showed on the side page. The sand gets stucks between the struckture of the marram and is secured against the wind.

Besides the influence from the wind on the shaping of the dunes, the shape of the dunes has also a big influence on the wind. On the follow pages we see pictures from an artical that describes the research of wind can´t be done in 2D only, because it is to complex for that. Looking at the pictures we see that the dunes create a windclimate that is very instable. Wind becomes a little bit turbulent and thereby creates different windfeelds. Next to that we see that the changing winddirection can create very different windflow too.

For the location of scheveningen count that a part of the existing dune is compleetly covert greening, wich means that won't be moving very fast. An other part is newer and not compleetly coverd, this part is more likely to move. When we want to design and create a extra dune landscape with a route and several objects, we should take into accound that we will create un instable systuation wich will further develope in time. This developement will be difficult to predict, because of the dubble influence from the dunes and windflows.

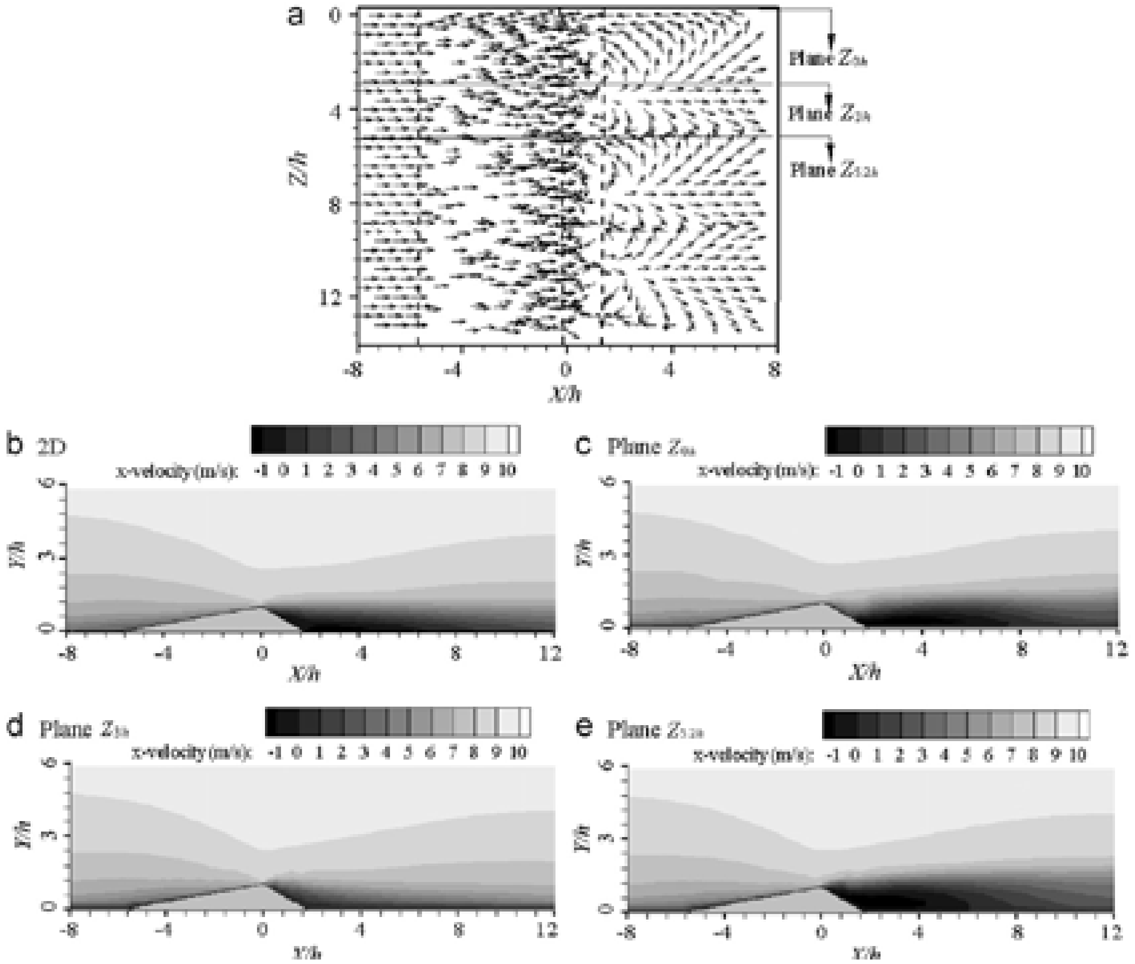


Fig. 8. Vector plot of simulated wind flow direction near the 3D transverse dune model (a), and velocity contour plots of the 2D model (b), and at different planes of the 3D model (c–e). The dashed line in (a) indicates the outline of the dune model. Vectors are taken at the midpoint of grids with a skip of 20.

Liu.B. e.a.(2011)

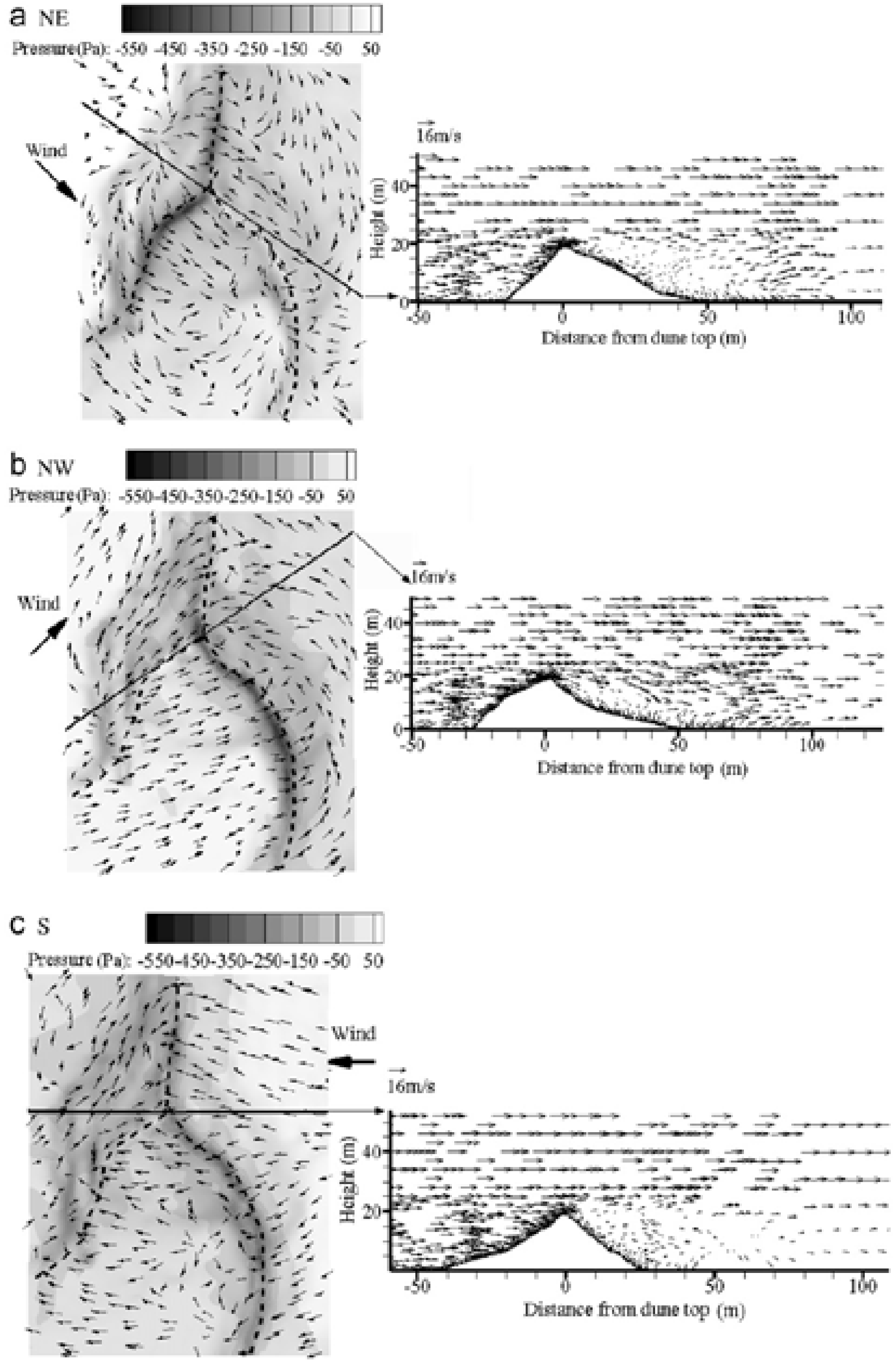
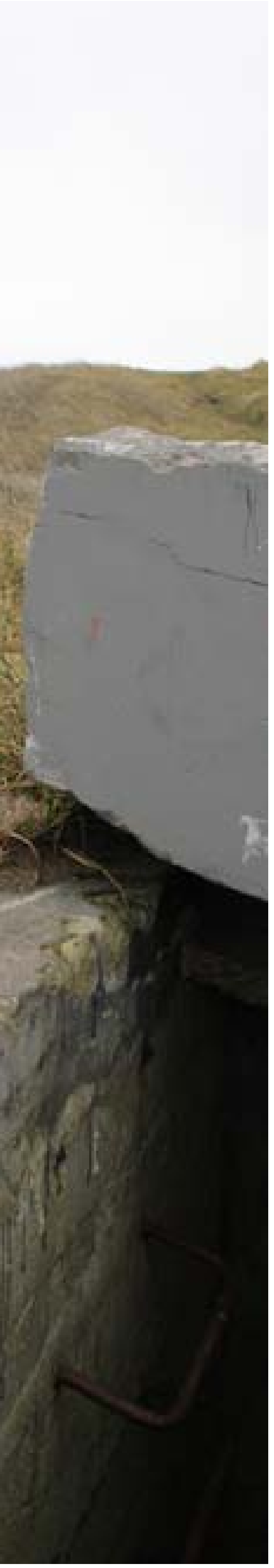
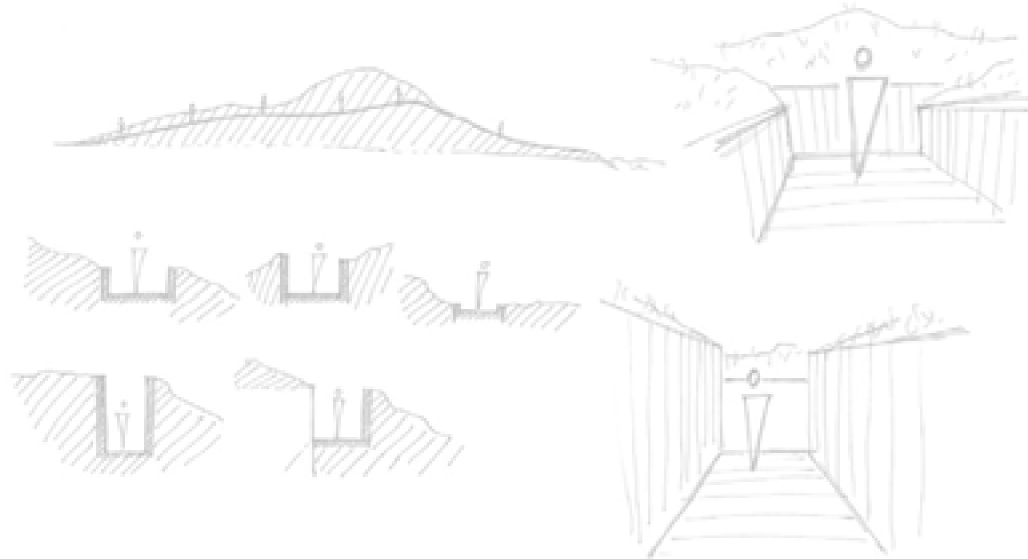


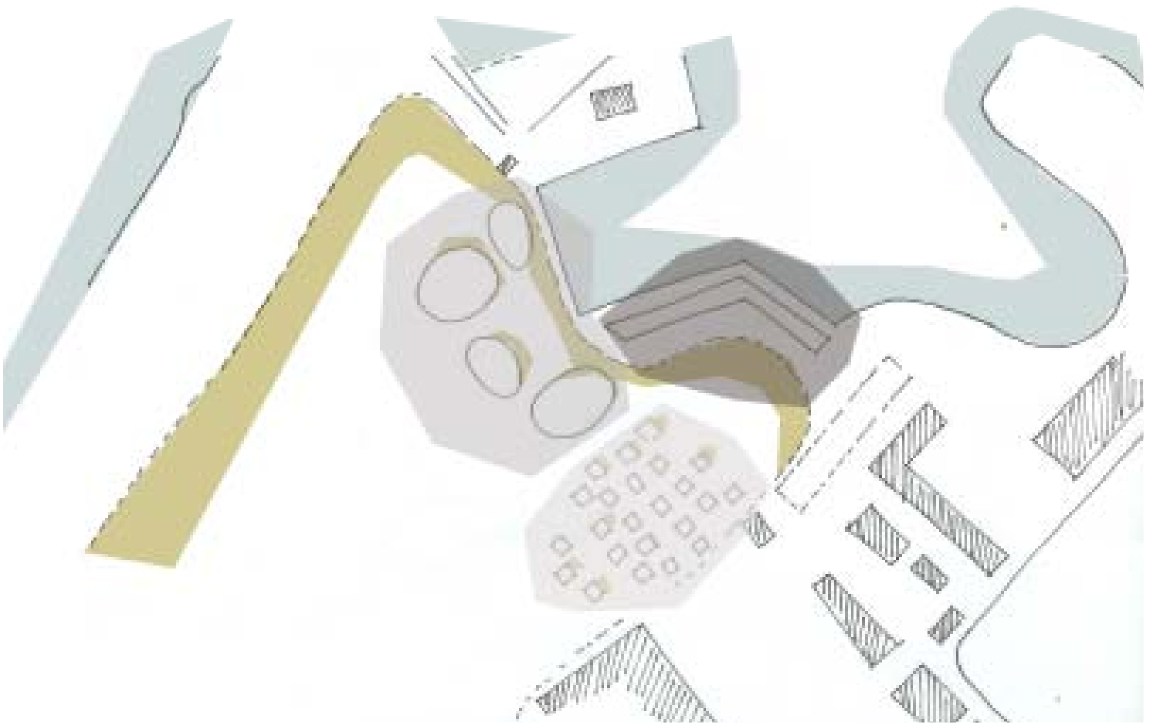
Fig. 10. Simulated pressure (Pa) fields of the pyramid dune under three wind directions with unified arrows superimposed to show the near surface flow direction (left), and the velocity fields in the central vertical planes (right). Dashed lines represent the dune crests and solid lines indicate the locations of vertical planes. The length of referential velocity vectors in the middle correspond to 16 m s^{-1}. Velocity vectors are taken at the midpoint of grids with a skip of 50.

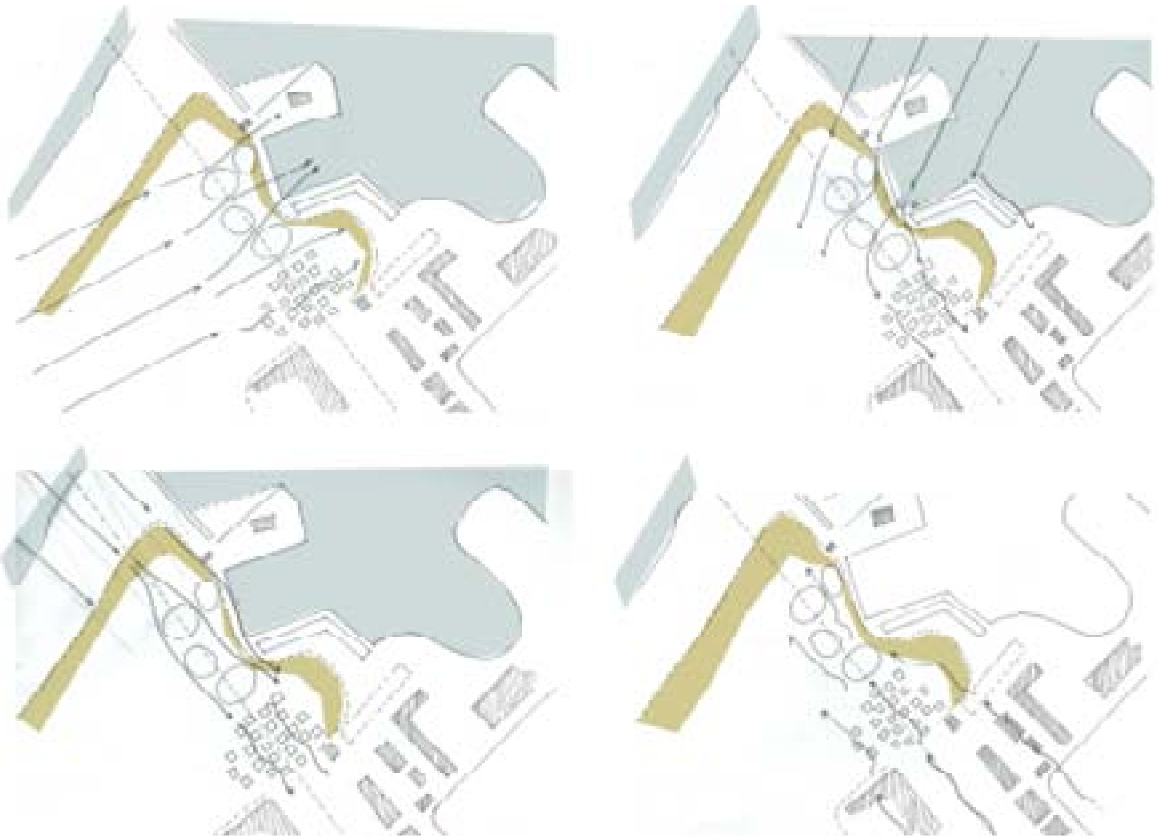
Liu.B. e.a.(2011)



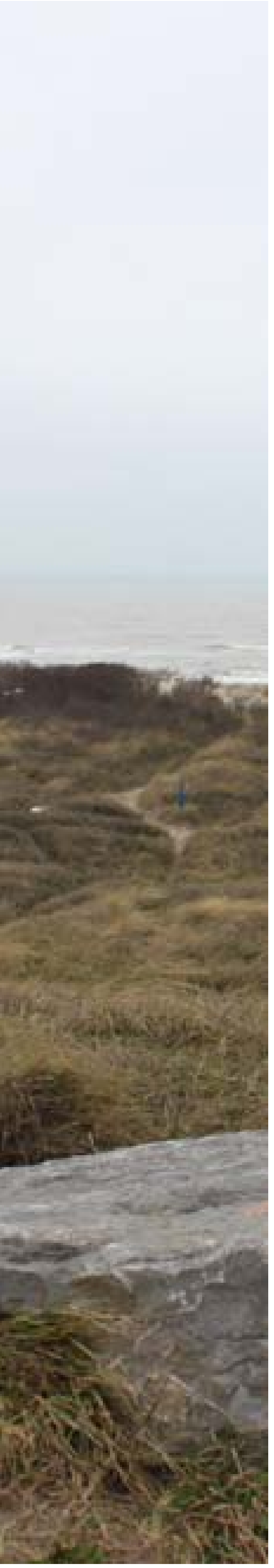
routing on location.





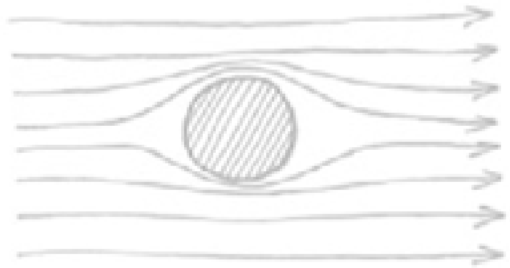


First layout of the routing - With the shape of the dune and the compositions of the buildings, the airstreams will be influenced into several different windclimates. A laminar, a turbulent and an windlow windclimate.

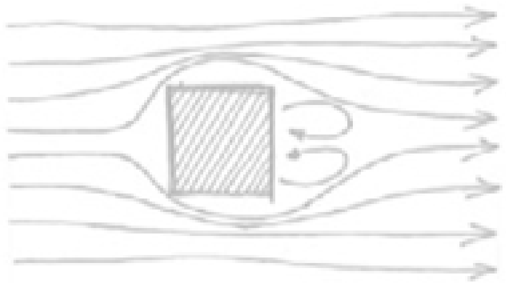


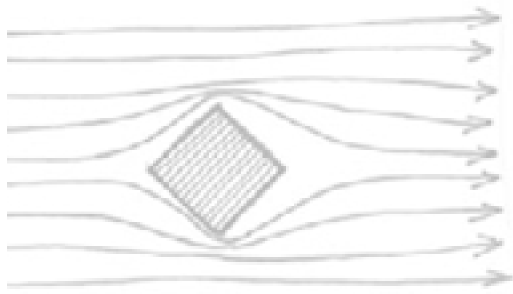
5. Composition - Wind and buildings

Designing a hotel that uses wind and natural ventilation, not only to make the building more sustainable and serve users better, but also to connect the building with the contect, a different hotel typology is introduced. Any building would require a research to the effect of obsticals (or buildings) on airflows, and how different building forms would change these effects. Designing a hotel that consist out of several buildings does also require a research to the effects on the wind of a compositions of obsticals.



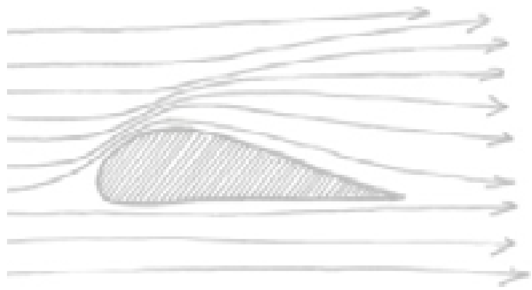
Obstical form

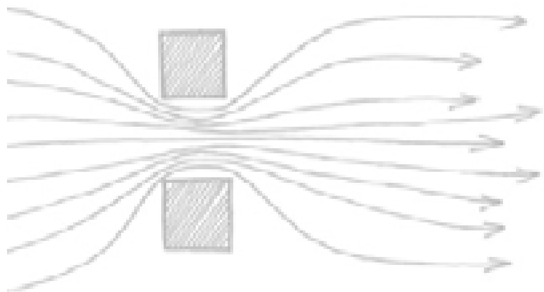




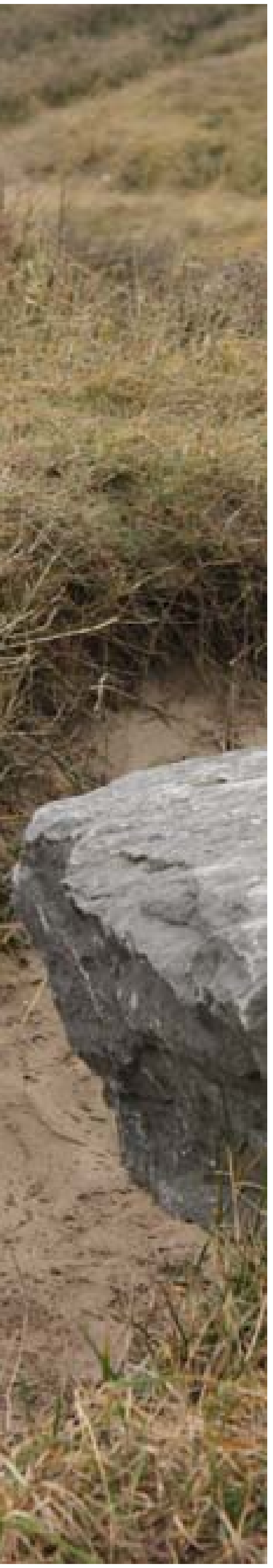
As a result of the laminar and turbulent airflows, the form of the obsticals determine the reactoin of the wind flow. Round, or rounded obsticals will cause slow and gentle alterations, the laminar flow will stay in takt. This is possible because of the fact that the windflows are able to stick very close to the obstical, and sudden low pressure feelds are avoided. Square obsticals will cause abrubt alterations and thereby make laminar airflows turbulent. This is a result of the fact that the wind isn't able to make such abrubt alternations and won't stick to the service of the obstical. This makes the apparence of sudden high and low pressure feelds possible. In ordere to fill up these lowpressure feelds, the wind will flow in circular motion to wards these presure feelds, and will thereby become turbulent. This not only meas that squar obsticals make airflows less predictiable but also that they cause more pressure differences than round obsticals. This phenomonon is descripted for horizontal airflows, but in vertical direction the same phenomonon can be described.

Bernuli vs. Venturi.



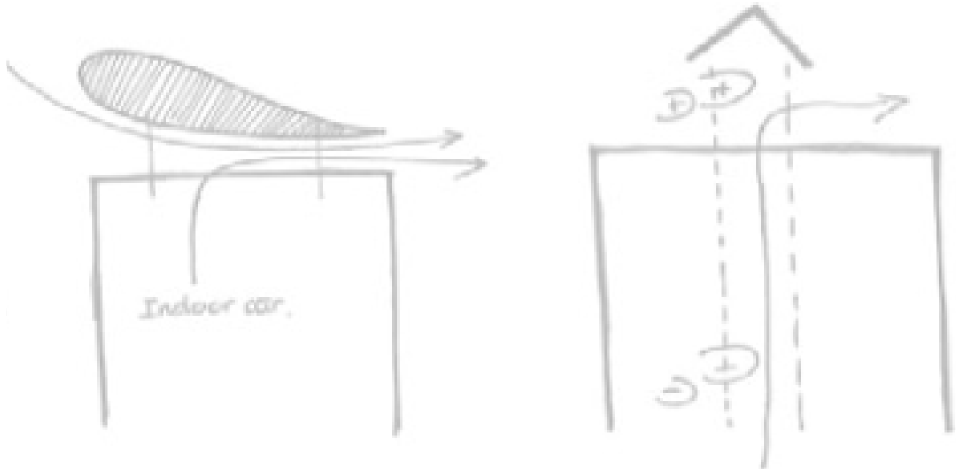


The buildingform will not only make the wind stay laminar or become turbulent, but can also speed up or slow down the windspeed. The bernulli and venturi discribe the way buildings can contribute to that. The bernulli effect is the decrease in pressure when an airflow is speeded up in order to cover a greater distance that adjuncted aiflows. When an object is asymatric, airflows will flow faster on one site than on the other. This bernulli effect enables airplane wings to create lift. The venturi effect is mostly known form childeren playing with stones in rivers. When we make the area for water to flow trough smaller, the water will flow faster. This same phenomonon is seen for wind trough a small opening, and causes an accelaration if an airflow is flowing trough an opening. This phenomon is caused becaus more wind or water has to pass in the same time trough a smaller area.



Building additions

As a result of the fact that when an obstical stands in the way of an airstream the airstream will change its direction and move around it. With this phenomonon we can navigate airstreams around the building. Often we in order to so, we not only use the building form but also building additions. This can be either to speed op wind to gain energy out of buildings, to protect users from windbother or to regulate the indoor climate. The other pages shows an couple of examples. Research done at TNO shows that even the conection between facade plates can determine the reaction from airstreams on the faceade. Every obstical will influence the wind, and make it alternated. Herefore every detail of on buildings schould be designed with the wind in mind. With highrise buildings, that catch much wind, facade plates sometimes let lose and cause demage on buildings and people.

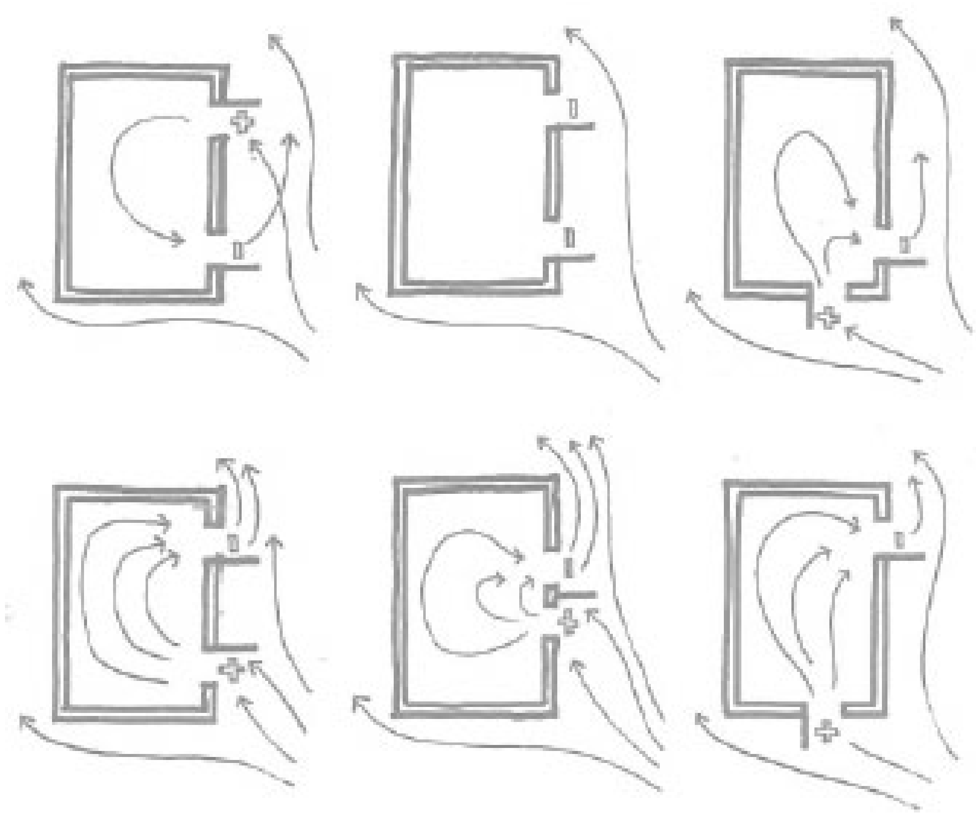


Influence feelds

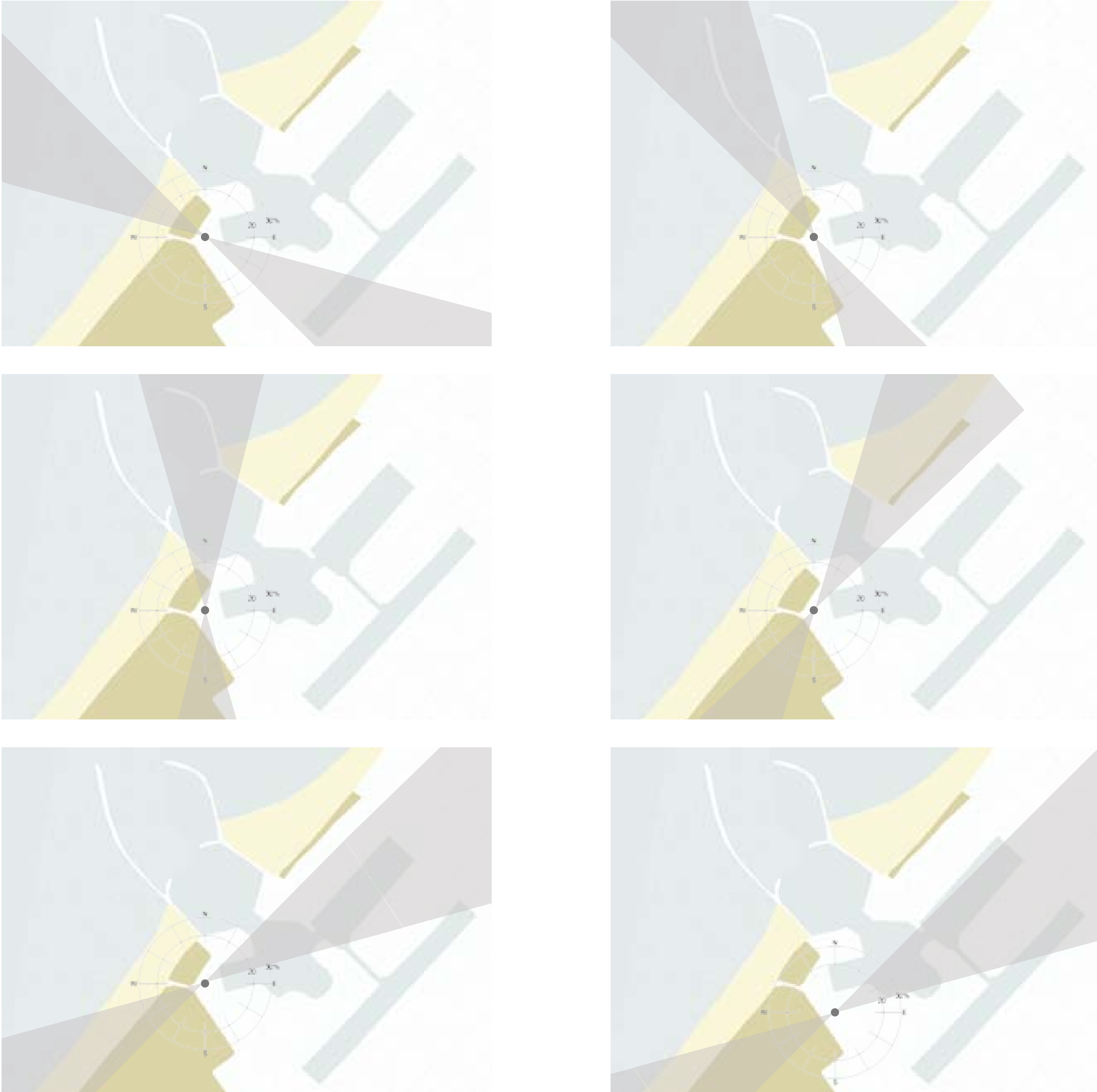
When an obstical stands in the way of an airstream, as said above, the airstream will change its direction and move around it. After the obstical is past the movement of the side airstreams are normative and the airstream will go back to the direction and speed of the site winds. This returning to the origonal state will take a lengh of 15 times the building hight, in the direction of the wind. Firstly this shows that the building hight is influencing the windflows. The higer the building is, the harder it is fore the wind to pass it. This has to do with the low pressure feeld that is bigger when the building is higher.

Secondly this means that by different winddirections the area that is influenced by the obsitcal is different. For a location like our design location in Scheveneningen Harbor this, where a clear winddirection is missing, the influence of the building on windflows must be analyst for more than one winddirections. In Scheveneningen Harbor, we see that some of the influence feelds contain parts of the harbor and the design location. The wind in the harbor, must be analyst in this area to avoid problems for boats that come in and out of the harbor.

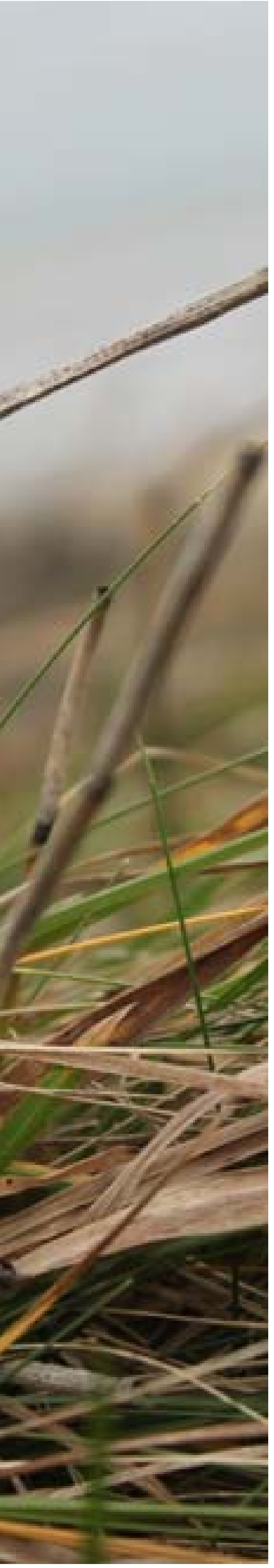
The next pages show the influence feelds and the building hight analyses done fore the design location.

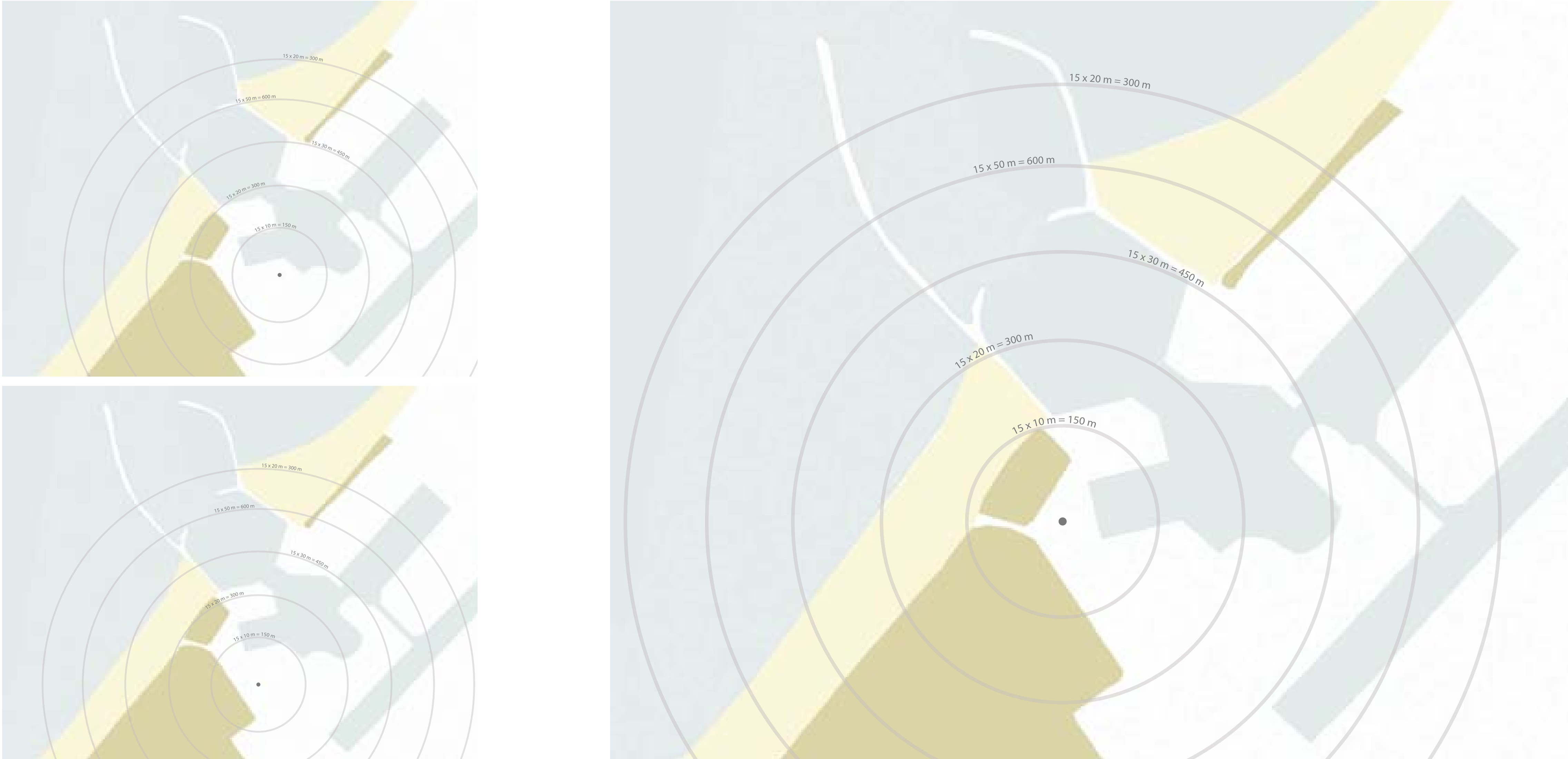


Moore F. (1993)

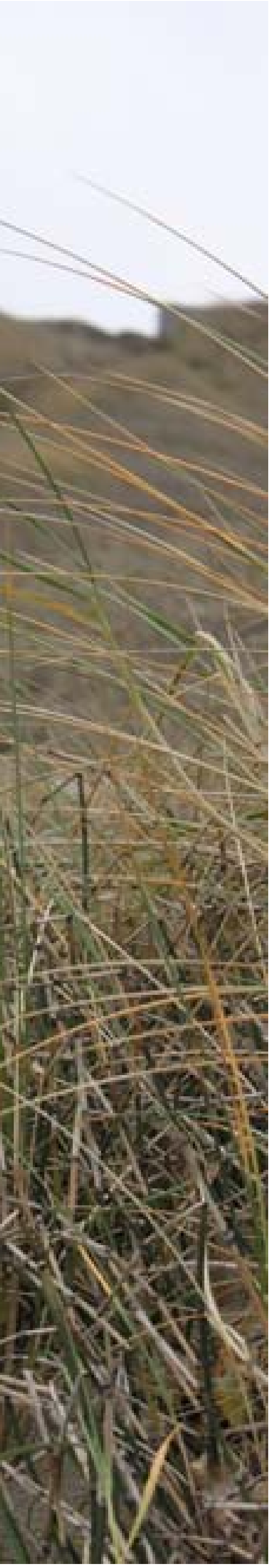


Influence feelds on the locations for all the winddirections.





Influence area - 15 x building hight.



composition of buildings.

Clear is that when we analyse the wind on a building, knowing where the wind has been before (the history), can tell us a lot about the wind that is working on the building. Is it laminar or turbulent? How is the distrubution of windspeeds over the hight of the building (windprofile)?

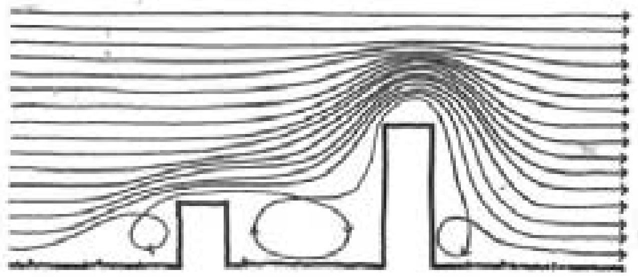
Looking to the influence one building can have on windflows and the influence feelds analyses that are done. We can conclude that the when we want to design a composition of buildings, the other buildings will influence the wind that will work around the analysed building.

First of al there is the component form. Earlier we stated that when a windflow passes a round or rounded object, that is will stay laminar because it is able to stick to the building. As a result of the fact that there will be some change in the windflow, there will be some influence at the building stream on wards, but it will be not so dramatic and the windflow will still be laminar. When we look at a components that have a sqaure form we will see that they will force to wind to deviade a lot more. This means that the buildings around it will encounter a lot more influence from it. There by the airflow will change to a turbulent airflow, wich will change it´s characteristics drasticly.

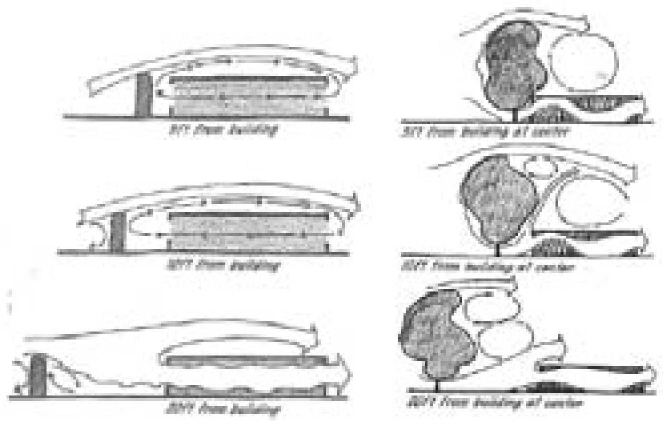
Second of al the arrangement of the components plays a big role. If we look at the influence feelds we see that a building has a sertain influence feeld, determine from the winddirection. As a result of this we can firstly conclude that that the arrangement of the components and the influence from this arrangement is influenced by the winddirection at a sertain moment. Analysain this, will thus include several winddirection at the location of Scheveningen Harbor. Secondly we can conclude that influence the building has is also determined by the way the two are arranged.

Next to the influence feelds, we should take the influence circels for the building hight into accound, if we want to determine if a building is in a influence feeld.

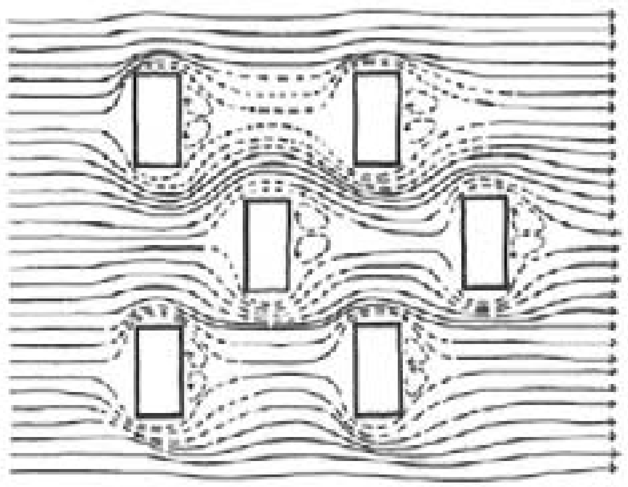
Designing an composition in the Harbor of Scheveningen we will have to work with different senerioos, for different windspeeds and direction. This a a result of the absence of a clear dominant wind direction, and the very different windclimates the location is sytuated between.

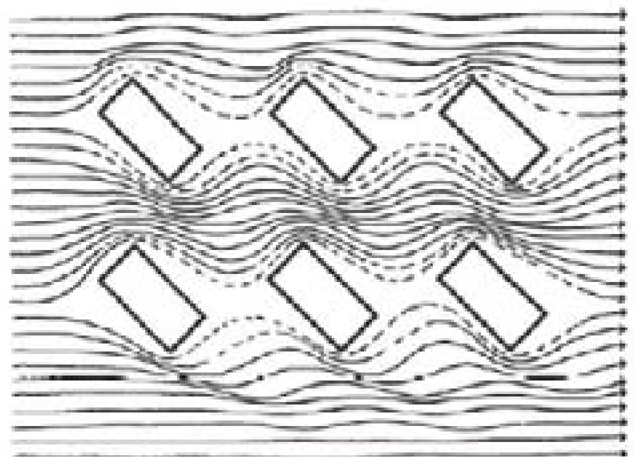


Moore F. (1993)



Moore F. (1993)





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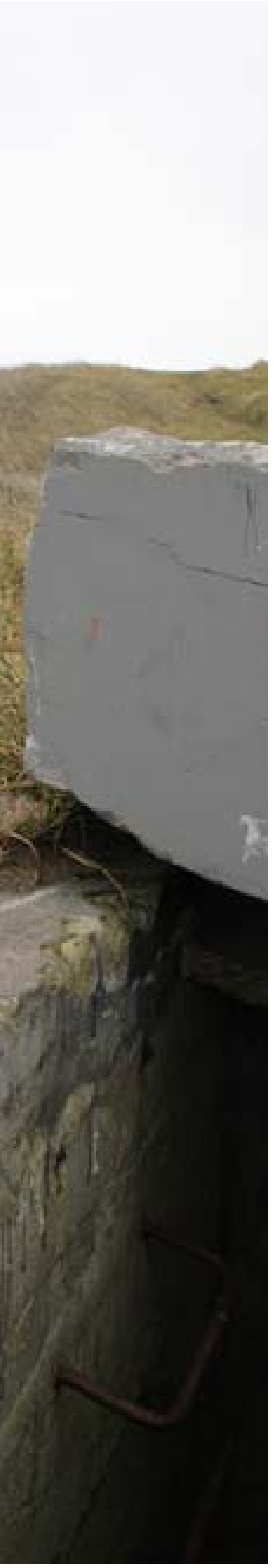
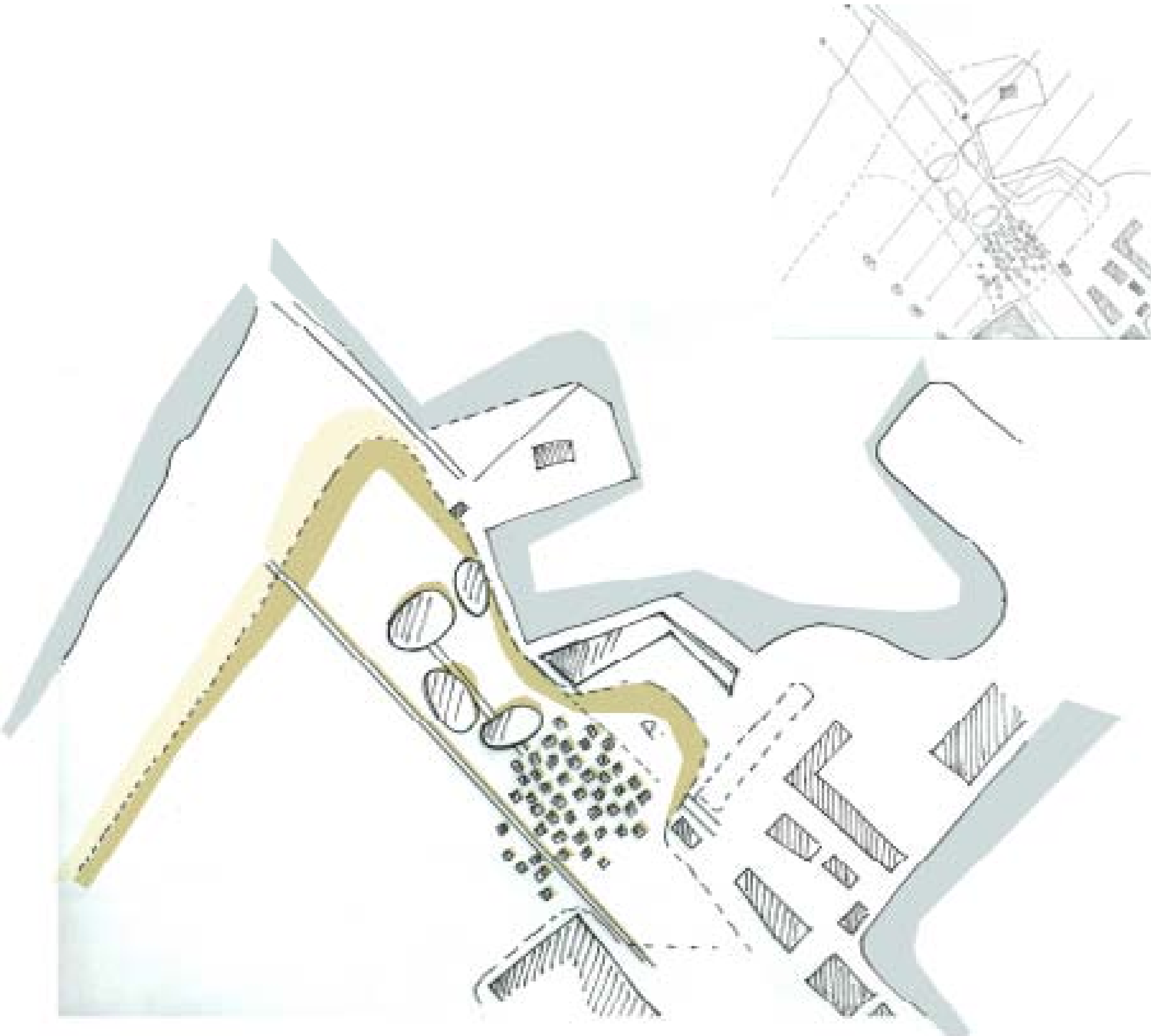
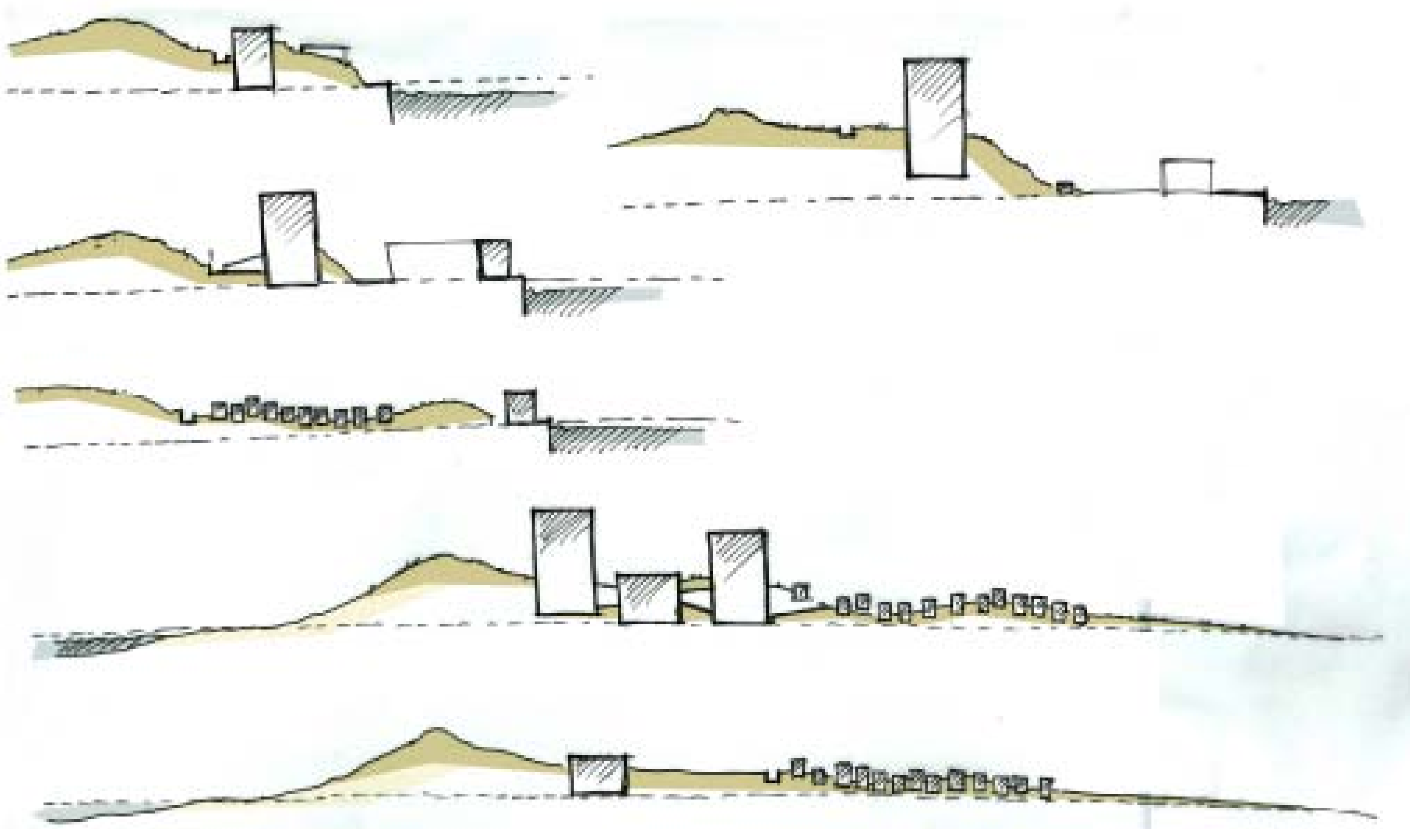
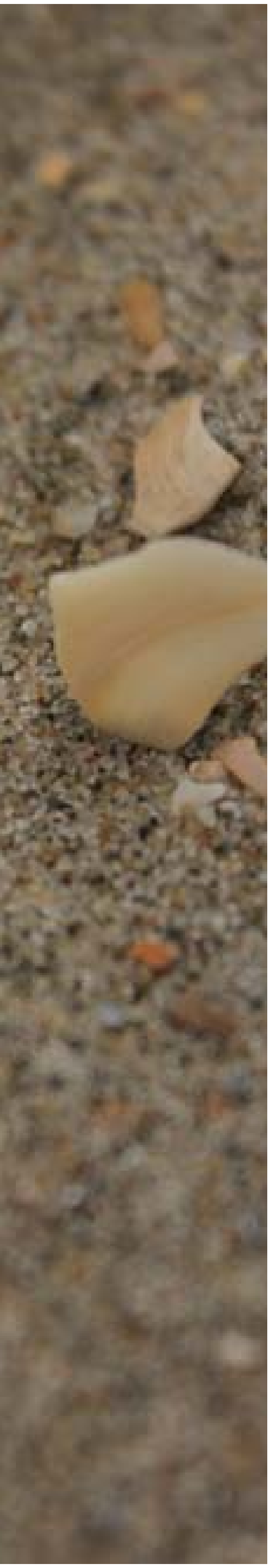


Composition on location.



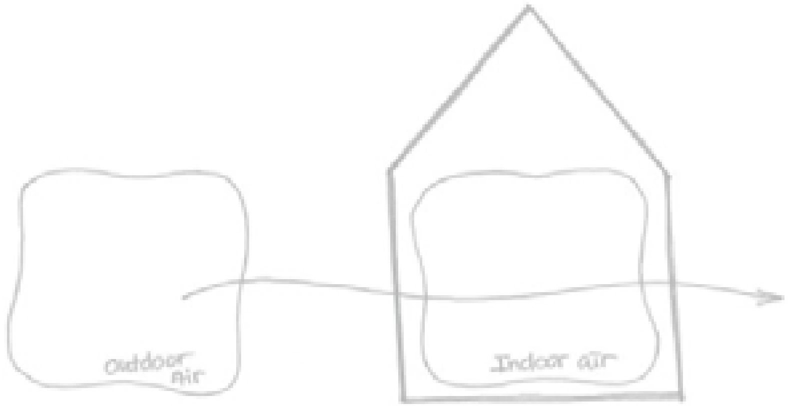


First design sketshes - building composition



6. Interieur - Wind in buildings

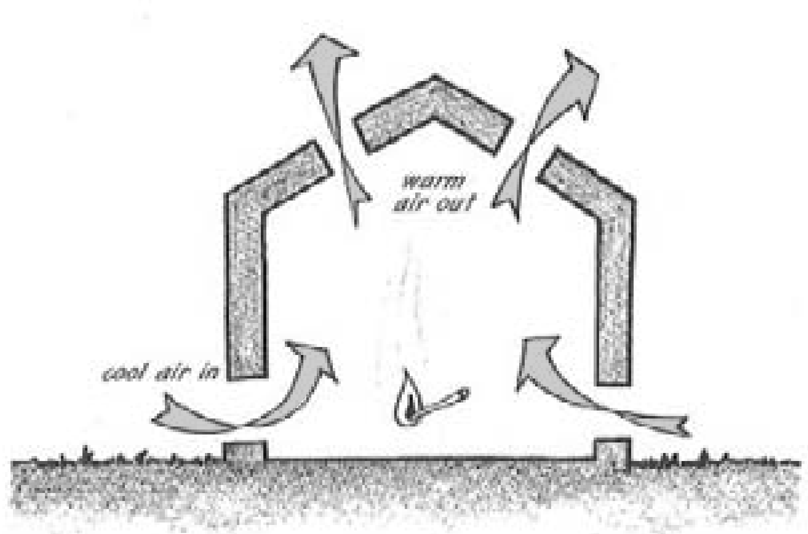
Well we could say that a building is primarily a shelter against wind and rain, we need air in our building. If we thereby define wind as the movement, we could say that most of our buildings do have wind in them. Because the airspeeds are very low, we don't usually talk about wind, but air movement or ventilation and heatflows.



Natural Ventilation

Ventilation is the changing of the air in a room, and is done in order to control airquality and airtempratures in the building. Ventilation in order to control airquality is called basicventilation, and is state in regulations. Ventilation in order to control airtemprature is called summerventilation and is not regulated. We can devide to mechanical driven ventilation, and natural driven ventilation. This research will focus on the posibillities from natural ventilation because it past the best in the design approach.

With natural ventilation the airflowing to the rooms, in order to change it, is driven by natural forces. This are the same forces that drive airstreams outsite the building, pressure differences, by obsticals of temprature differences. Although this resources are free and sustainable, thy are difficult to control. The design challenge for designing natural ventilated buildings is thereby mostly about controlling air movement.

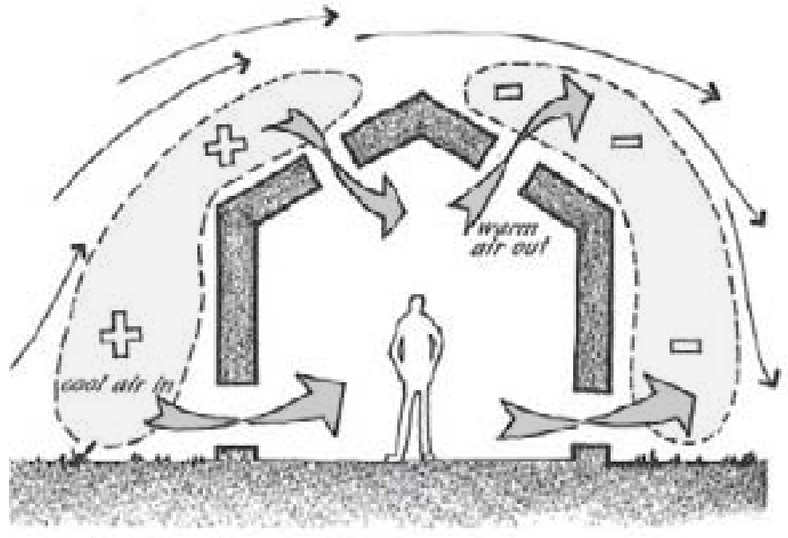


Moore F. (1993)

We can divide natural ventilation in two different kinds. The kind that is defined by the pressure differences that occure as a result of wind. Wich we call winddriven natural ventilation. The second kind is defined by the pressure differences that occure as a result of temprature differences, and is called stock ventilation.

Winddriven natural ventilation

The way wind interacts with the building is determined by the shape of the building and it seroundings. This shapes difine low and high pressure feelds around buildings. On the windward site of a building, wind gets stuck and the pressure will rise. On the leenward site of a building, there will be a lowpressure feeld. This enables an airflow trough the building from the windware site to the the leeward site of the building. Ventilation is by wind can therefore be controlled by the form and position of the the building.



Moore F. (1993)

To create the speed of changing the air, we can create bigger pressure differences. By the use of the venturi and bernulli effects we can shape the building or building additions in a way in wich they speed up windflows and

create bigger pressure differences. This principle is often used by placing wings on the roof of a buildings. The wind has to speed up in order to pass a bigger distance than the adjunctend airflows, and hereby lowers his density and pressure.

An important issue we have to take into accound when designing a building that wind is not controlble because of its natural resources. We can influence is flowing paths, but we can't controlle it's original direction and windspeed. This means that the sability of the system can be a problem if we use natural ventilation driven by wind. Thereby buildings can create turbulent eddies, wich enables the creation of guts. This guts can make the windspeeds very instable. This means that we have to look for sertain points in the design that are constaintly high and low presure feelds, and may use ventilation openings that are designed to controll airspeeds.

Stack ventilation

Buoyance forces are the driving forces behing stack ventilations and arise when there are tempreture differences between inside and outside or between different spaces. In the admosferic boundry layer we see this forces be driving behind stable or instable service layers. In buildings we see the same temprature distributions over spaces, that determine airflows.

Using this stratifaction we can distuigish to different kinds of stackventilation, mixed ventilation and dispacement ventilation. Mixed ventilation can be compared with an instable serves layer. When a opening is made in at the top of a space, and cool air is comming in, the incomming air will decent in a circular movement. This turbulent movement will make the air mix and creates an uniform interior temprature distribution. The same effect we see when warm air enterns the room at a low level. The warm air will rise in circular movement and mix the air. In the artical:"the fluid mechanics of natural ventilation" by P.F. Linden, calculations ar discribed that can be used to calculade the speed, temprature, and volume of the flux. Linden.P.F.(1999)

Displacement ventilation more comparable with a stable service layer, and is characterisited by high temprature differences over the hight of the space.   By displacement ventilation we use two different openings. The first one enables cool air to come in, at a low level in the room. The second one enables hot air to escape at a high level of the space. This means that high pressure differences occure in the space.

The level where the pressure level is excactly as high as the pressure level outsite the room we call the neutral level. In side pressure at lower levels is lower, and creates a sucksing wich is used to suck cool air in the space. The inside pressure at higer level is higher and creates a pushing wich is used to

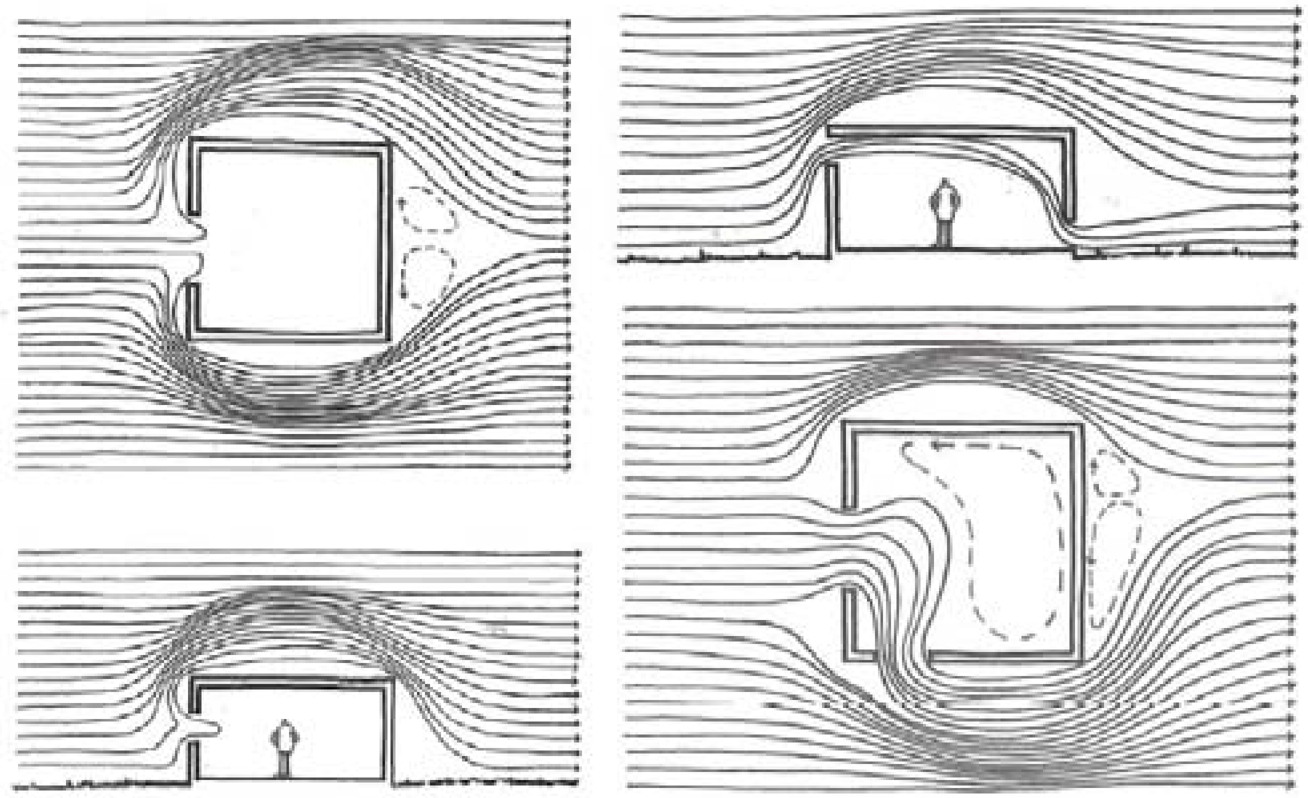


Figure 15.18: An opening on windward side only results in poor ventilation; an additional leeward opening — completing the connection between high and low pressure regions — is essential to promote airflow through the structure. (After Bowen, 1981.)

Moore F. (1993)

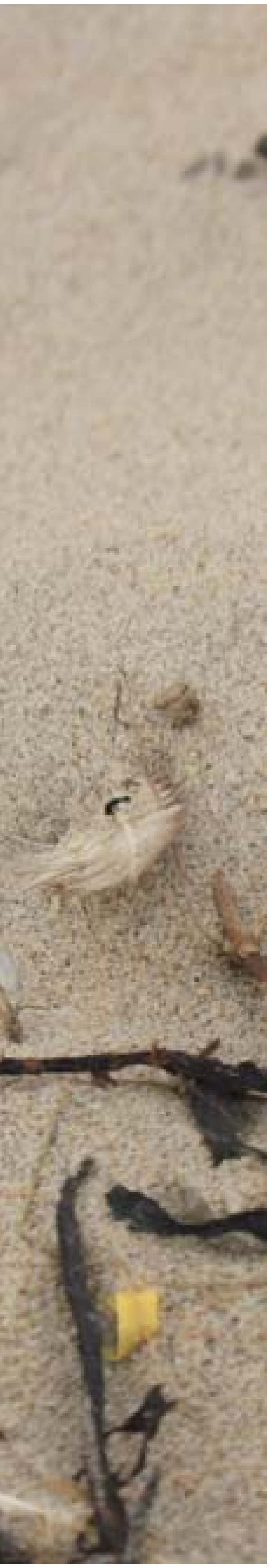
puch hot air out of the space. For designing this means that the uper openings should be above neutral level and the lower openings should be beneath neutral level. In the artical:"the fluid mechanics of natural ventilation" by P.F. Linden, calculations ar discribed that can be used to calculade the speed, temprature, and volume of the flux.

Displacement ventilation is as said characterised by big temprature differences of the space. This temprature differences can taka on a lot of different patterns and are determince, among other things, mostly by the souces of buoyancy, or heating or cooling sources. In practise they very in number and kind. We can have a single heat or cooling sorce, and a very clean interface, of a coulple of heating and cooling sorces, wich complicates the interface and the temprature distribution.

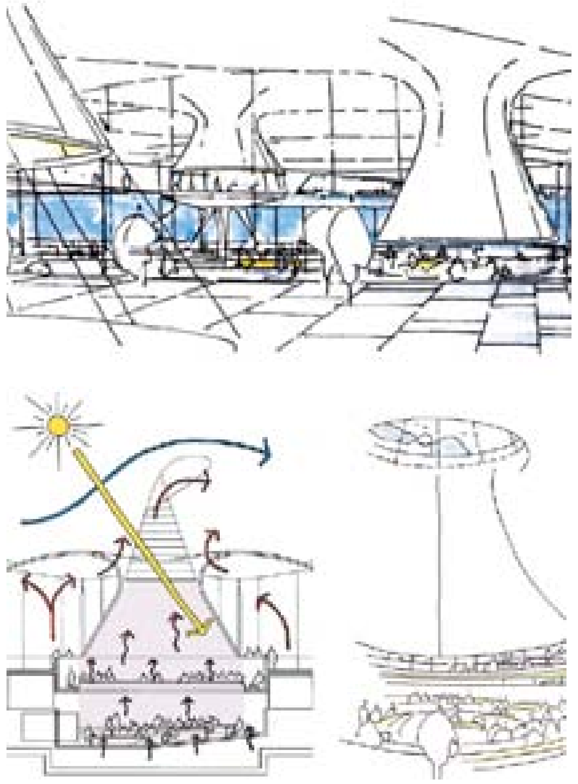
Wind and stack ventilation

If we combine the sytems of wind and stack ventilation, it can became reinforcing or opposing, determined by the placing of the openings and the windspeed and direction. If we look at displacement ventilation, we have warm air in the space, being replaced by cooled air from outsite. If the lower (cool) openings are on the windward site, and the upper openings are on the leeward site the wind will be reinforcing. The artical:"the fluid mechanics of natural ventilation" by P.F. Linden says the following: "The effect of the wind on the stack-driven flow is threefold: The interface is raised, there is an reduction in the temprature stap across the interface and an increased airflow rate through the space. " This means that the interface between the high and low temprature is higer in the space, the temprature differences is smaller and the airstreem faster.

When the low opening is on the leeward site and the high opening on the windward site of the building, the wind will oppose the stack ventilation. The opposite effects will occure. The interface will sink, to a point where the ventilation starts being mixed ventilation. Were the cold outsite air and the hot air mix in the space. This will also decrease the airflow rate, or slow down the airstream. The temprature difference over the space will be mixed and become more uniform.



Buildings that use Natural Ventilation



National Essamble for Whales - Rigard Stirk Harbour + Partners

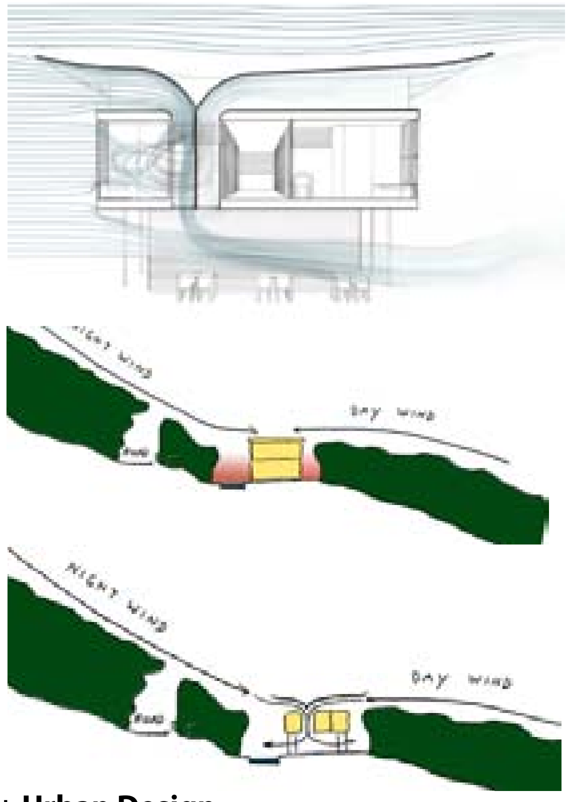
Design: Rigard Stirk Harbour + Partners
Year: 2005
Location: Cardiff, Whales

Architectural Expression -The architectural expression of the building is deterimend by the ventilation opening from that not only shows where the debatinghall is. On the outsite of the building twe mostly see the windcatcher on the roof. The rest of the architectural experience is focused on the connecton with the river and the waterfrond.

Wind - The windcather on the roof of the building is made so that the the opening always points to the lowpressure feeld of the windcather. Thereby air gets drawn from insite to the outsite of the building. The glass roof warms up the air from the big hall, hereby the hot air gets trough the glass and thereby ventilateds the bigg hall.

Integration AE - The integration of architecture and enginaring is basted on the right form to ventilate the building. The rest of the building has an more office like outline and is less integraded. The public spaces show the sustainable goals of the people inside the building, and therefore the measurments taken are very easy to recocnigze.

www.rsh-p.com



Breeze engine - Zoka Zola Architecture + Urban Design

Design: Zoka Zola Architecture
Year: 2011
Location: Southern China

Architectural Expression - The architectural expression is clearly linked to the technical wind research. The building is composted out of tree layers. The outdoor layer, at the underground where the community activities take place. The "closed" room layer, that is shown as a box. And the roof layer, that captures the wind. The use of bamboo shows the ecological concept of the building.

Wind - In the forests where the building is located in the hot air get stuck between the trees. By bringing the wind in from above the trees the roof brings in the cool air in and around the building. Hereby the building is naturally cooled and ventilated. The roof is two sided and every room can be reached from each side. This is because at the day time, the wind is landward, and at night time the wind is turned seawards.

The building is CO_2 neutral, with the help op PVcells that are placed on the large roofspace. This is with help of the subtropical climate.

Integration AE - The integration between architecture and enginering is very high. In the building you can see that the wind has been leading in the design proces. Every building part is design at airstreams and how they flow.

www.zokazola.com

7. Windexperience -

Designing a hotel that uses the wind not only to make it more sustainable, but also to connect it to the context, windexperience is a important part of the design. This part of the research focuses on the the way we experience wind.

Windcomford and danger

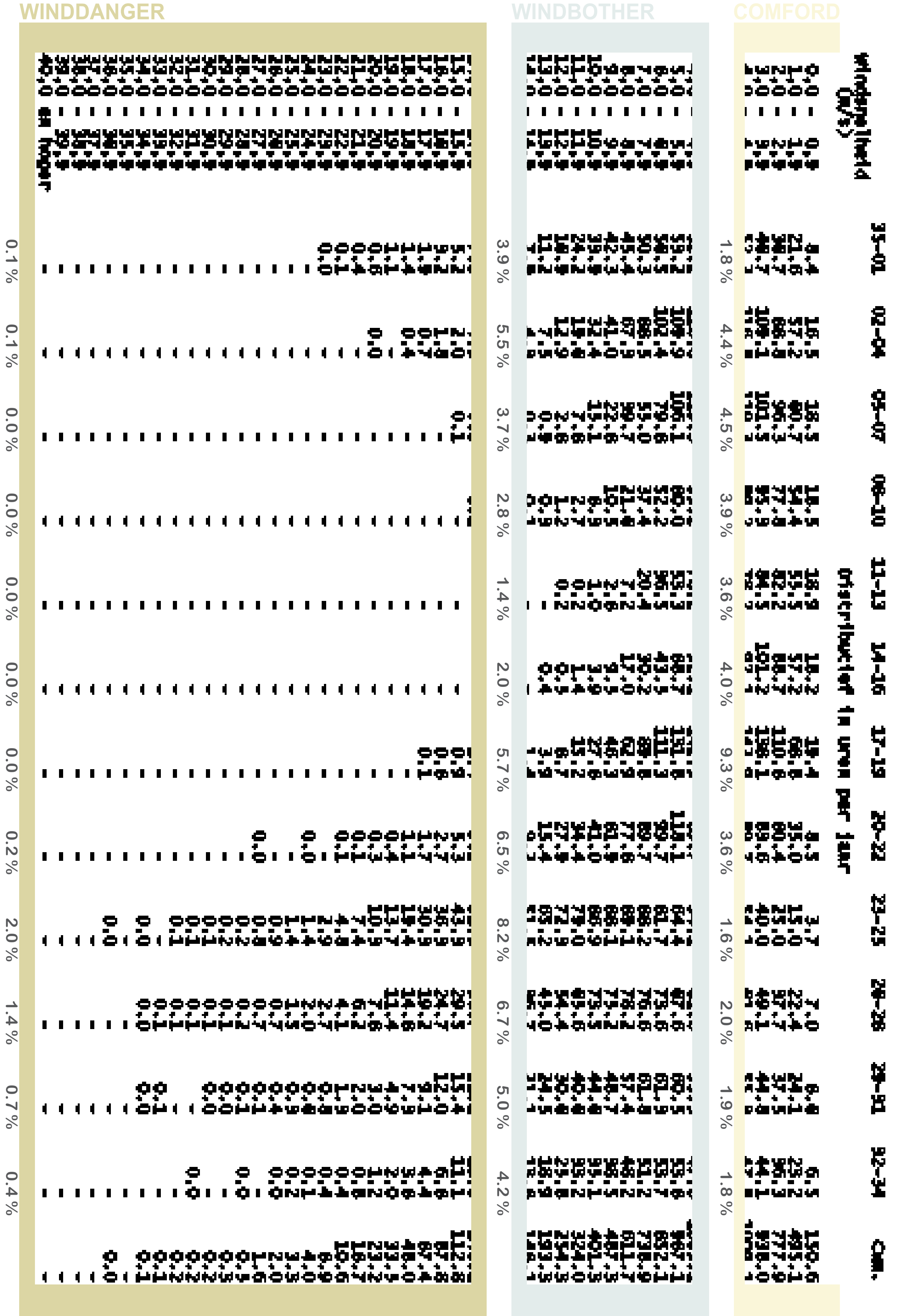
In the netherlands normes are determened for how people experience wind, by sertain windspeeds and activities. Windspeeds up to 5 m/s are considerd save. For the percentage in time the windspeed exceed curtain windspeeds determine the review of the windclimate for certain activities. A windclimate is considerd good as the majority of people doesn't experience any windbother. A moderate windclimate is described as a sytuation in wich now and than people experience wind bother. A windclimate is considered bad is fht majoriyt of people does experience windbother.

For sitting the windclimate is good when the wind doesn't exceed 5,0 m/s more then 2,5% of the time, moderate 2,5% - 5,0 % and bad for an exceeding of more than 5 % of the time.

For slow walking the windclimate is good when the wind doesn't exceed 5,0 m/s more then 5,0% of the time, moderate 5,0% -10,0 % and bad for an exceeding of more than 10 % of the time.

For walking windclimate is good when the wind doesn't exceed 5,0 m/s more then 10% of the time, moderate 10% - 20 % and bad for an exceeding of more than 20 % of the time.

For the review of a windclimate in order to determing of there is a risk for winddanger we look at the percentage of time the wind exceeds a windspeed of 15,0 m/s, not more than 0,05 % of the time. The risk is conciderd limited if it exceeds 15,0 m/s 0,05 - 0,3 % of the time, and high when it exceeds this number for more than 0,3% of the time.



NEN 8100:2006
NORMTEKST

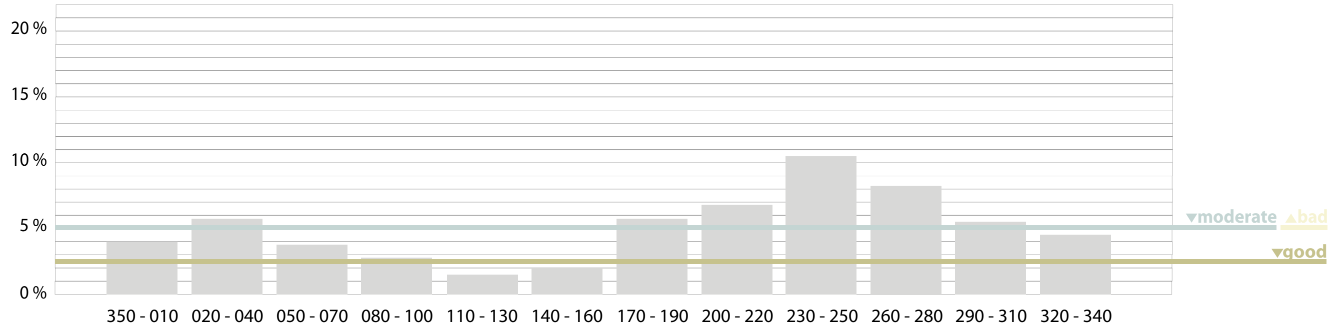
Tabel 1 — Eisen voor de beoordeling van het lokale windklimaat voor windhinder

Overschrijdingskans $p(v_{LOK} > v_{DR;H})$ in procenten van het aantal uren per jaar	Kwaliteitsklasse	Activiteiten		
		I. Doorlopen	II. Slenteren	III. Langdurig zitten
< 2,5	A	Goed	Goed	Goed
2,5 – 5	B	Goed	Goed	Matig
5 – 10	C	Goed	Matig	Slecht
10 – 20	D	Matig	Slecht	Slecht
> 20	E	Slecht	Slecht	Slecht

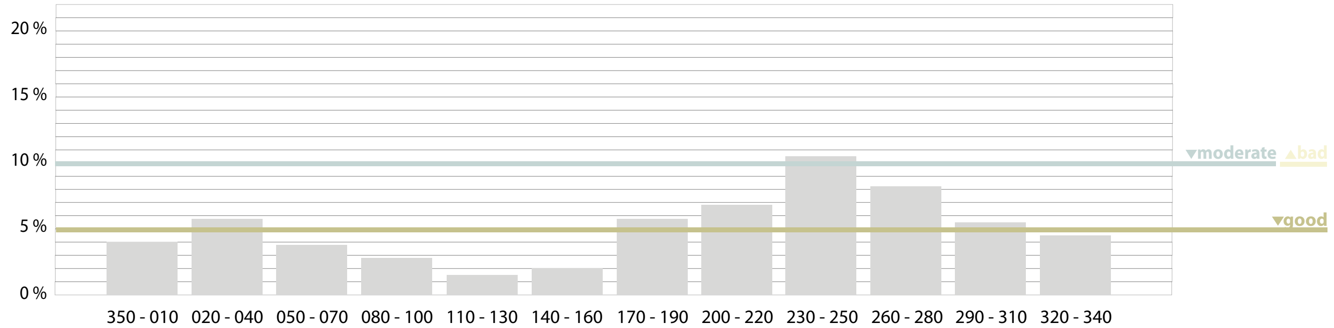
Tabel 2 — Eisen voor de beoordeling van het lokale windklimaat voor windgevaar

Overschrijdingskans $p(v_{LOK} > v_{DR;G})$ in procenten van het aantal uren per jaar	Kwalificatie
$0{,}05 < p < 0{,}30$	Beperkt risico
$p \geq 0{,}30$	Gevaarlijk

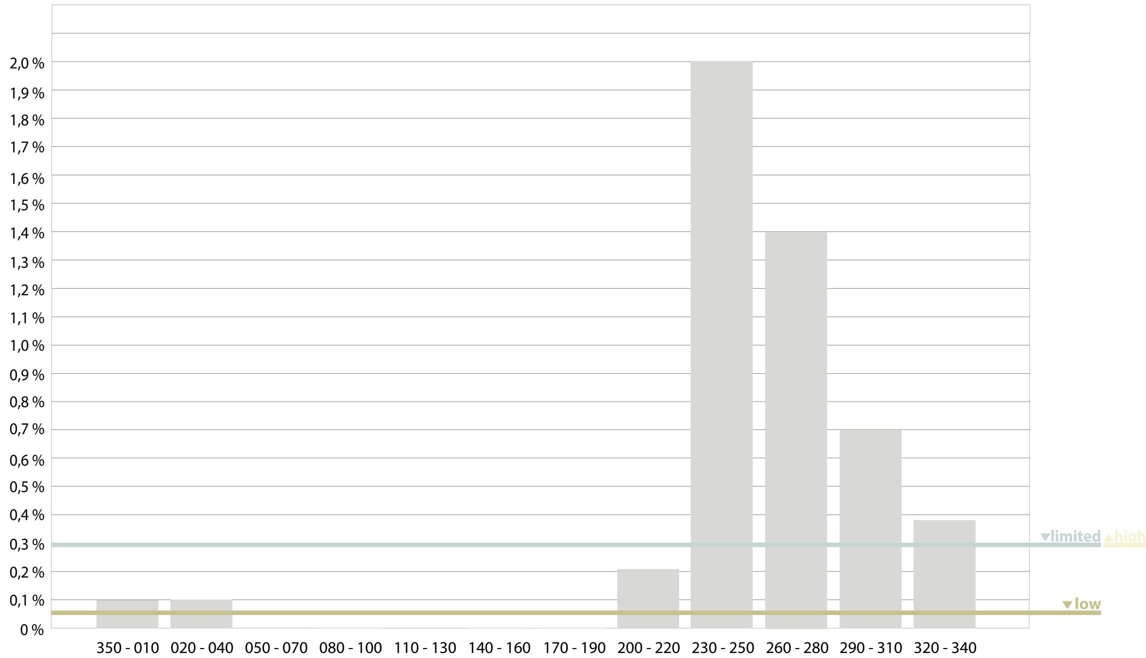
NEN 8100:



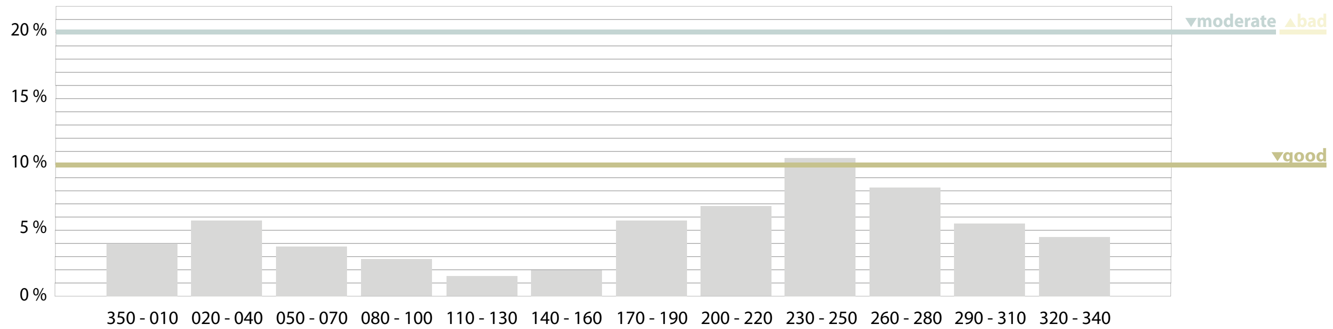
sitting



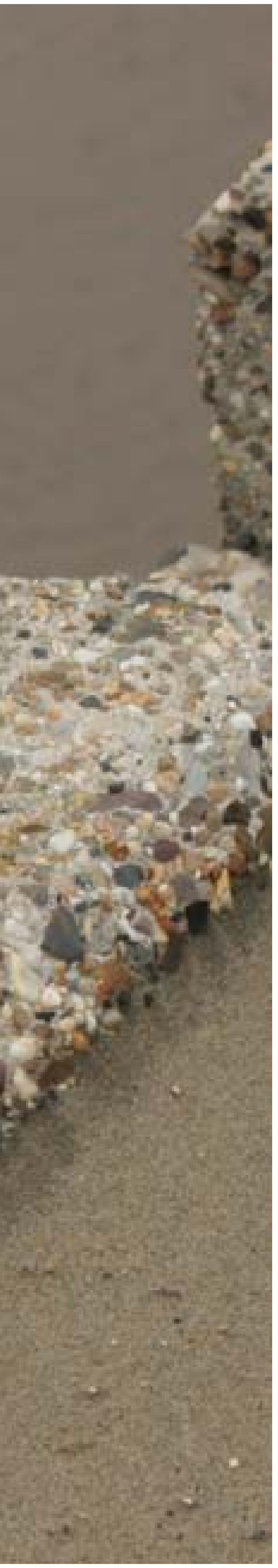
Slow walking



Winddanger



Walking



Wind visualistion

Wind is not visual from it self, because air isn't. Only clouds are visual, but they are in higher layers of the admosfere and say noting about the wind in the service layer.

To be able to understand how we experience wind, we can look at the way we review it and order it. If we look at the international beaufort scale on land, we see a veriaty of sense used to review wind. We see visual aspect, where a medium shows the movement of the wind, like smoke or the movement of dust and papers. Feeling, were the temprature of the wind, and the movement of air are sensable with the face. Hearing, where the winds makes noise by vibrating kabels. And the forces of the wind, wich formes an obstical to move against.

Clear is that when we want to visualise the wind, we need a medium to do so. This can be done in a very direct way, with the movement of object or parts of objects. On the location, this is one of the ways we currently experience the wind. The movement of the sand particals, the movement of the marram, and the waves. An other way to visualize the marking of the air, by puting particals in the air, and creating clouds. A thirth way is a less direct way, and uses the sensors to measure the movement of the winds, and after that visualise. This can for example done with lightning facades.

The same can be said for the hearing of the wind. If we experience the wind, this is because the winds brings a medium (object) in virbration. This virbration can be taken over by the air and create a sound. This way of experiencing wind is also allready a part of the windexperience on the location. For example is we stand near to the windmail, the kabels of the boats in the harbor of just the way the winds flows pass your ear. We can also produce this sounds in a less direct way, the same way we can visualise wind.

Feeling and temprature

When we talking about feeling the wind, we are talking about several things; windspeed, airtemprature and windforces. Talking about airforces, we can notices aspecially by strong winds. Strong winds can blow us from our bycicle, give speed to sailing boats, or be an obstical to walk.

Looking at temprature we must distinghuis outsite situations and inside situations. With outside situations the windspeed can play an important role in the way we experience temprature. By storng winds the temprature we experience can be several degrees lower than the actual air temprature. This is because the wind, let our body give more heat to the air, by contacting it to new cold air sooner than normal.

INTERNATIONALE BEAUFORT-SCHAAL TE LAND

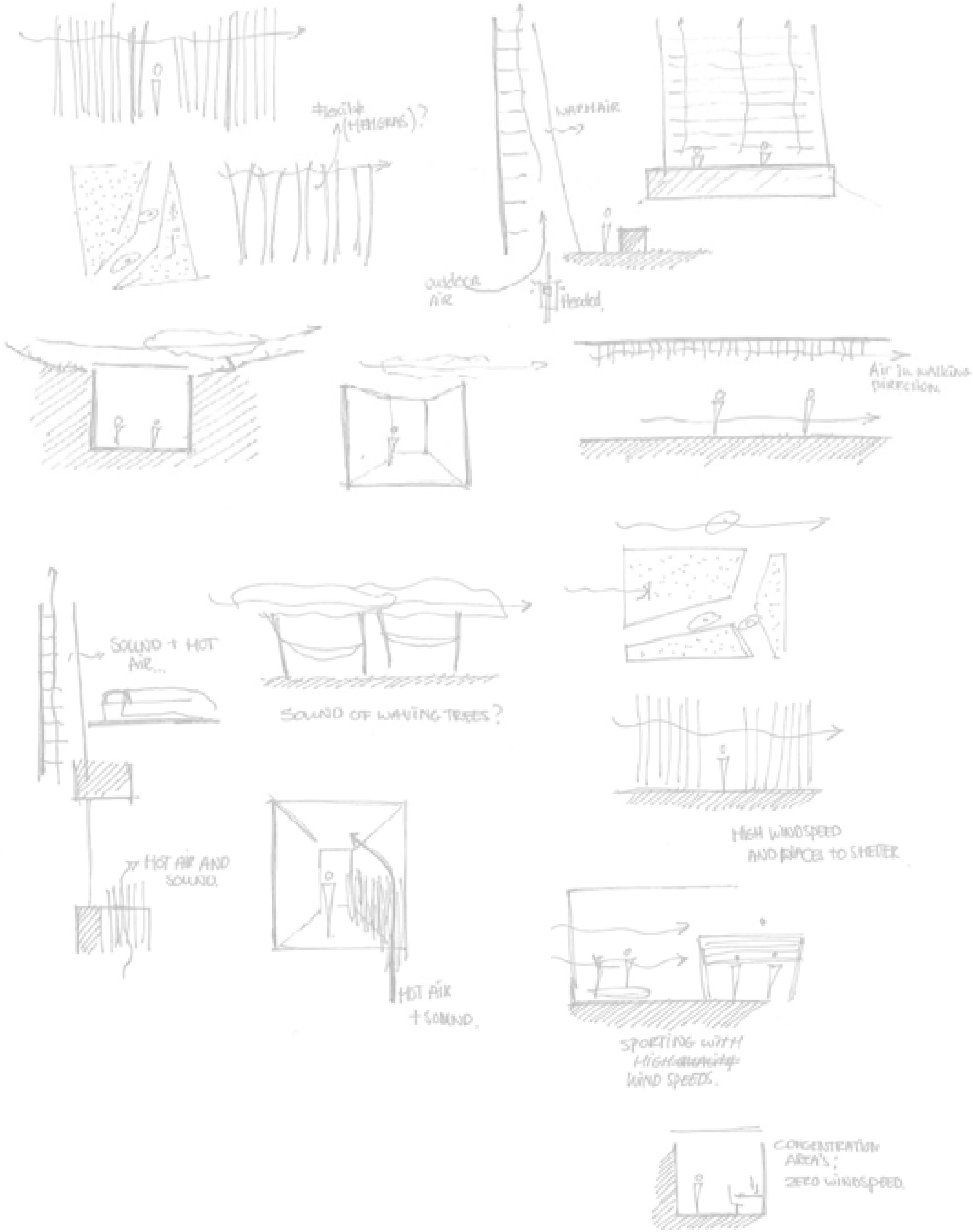
Klassenummer en benaming	Omschrijving zichtbare uitwerking te land (verkort)	Windsnelheid (m/s)
0 Stil	Rook stijgt bijna recht omhoog	0-0,2
1 Zwakke wind	Windrichting herkenbaar aan rookpluimen	0,3-1,5
2 Zwakke wind	Wind merkbaar in het gezicht, bladeren ritselen	1,6-3,3
3 Matige wind	Bladeren en takken bewegen, lichte vlag wappert	3,4-5,4
4 Matige wind	Stof en papier dwarrelen op (boven open terrein?)	5,5-7,9
5 Vrij krachtige wind	Bebladerde takken zwaaien	8,0-10,7
6 Krachtige wind	Wind fluit in draden papaplu's moeilijk hanteerbaar	10,8-13,8
7 Harde wind	Gehele bomen bewegen, wind is hinderlijk om tegen in te lopen	13,9-17,1
8 Stormachtig	Takjes breken af, lopen is lastig ook bij wind opzij	17,2-20,7
9 Storm	Schoorsteenkappen en dakpannen worden afgerukt, lichte schade in bossen	20,8-24,4
10 Zware storm	Flinke schade aan gebouwen, bomen worden ontworteld	24,5-28,4
11 Zeer zware storm	Zware schade in steden en bossen	28,5-32,6
12 Orkaan	(komt te land vrijwel nooit voor)	≥ 32,7

Wieringa.J. and Rijkoort.P.J. (1983)

With indoor tempratures, we see this happening with draft situations, at very specific point from or bodies.

Diverse studies, like franger, to how we review tempratures, and if we find a climate comfortable show that a couple of things are determing for the way we judge tempratures. First of al there is our own energy balance determing on what we are doing, we want the space to be hot or cold in order to make keep our body at the right temprature. When we are sporting we want to be able to give of heat to the air, is we are resting we don't want to lose heat to the air. Hereby closes are a factor, because they can slow down the transition from heat to the air, determine on how well your closing is isolating.

Next to that there is an acceptation difference for different places, a phycological factor. Outsite we expecting not optimal and changing tempratures, Indoor that is something we do not expect and thereby don't want. If we are able to influence the sytuation ourself, by opening a window, we are willing to except a lot more temprature fluxtuatoins.

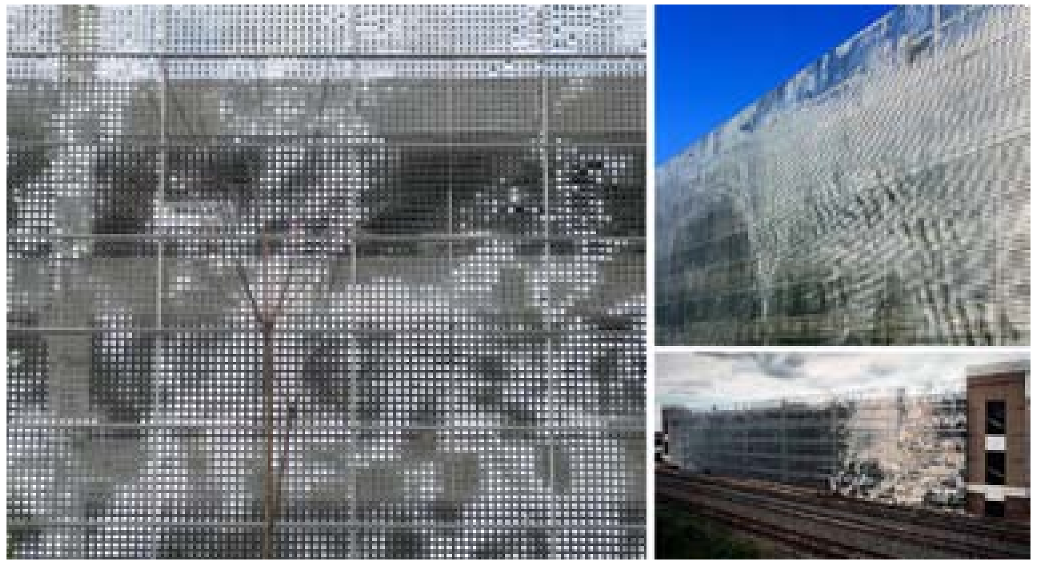


Buildings that make wind visual

Design: One Design Inc
Year: 2011
Location: Beijing, China

"The Cloud Room designed by Shanghai-based architect Bing Bu sits on the roof terrace of the National Art Museum of China, a historical landmark from the 1960's in Beijing"... "The outside white polycarbonate panels follow a computer generated cloud-like profile. Each piece revolves according to the wind, casting moving shadows and reflections onto a second layer of translucent polycarbonate. Standing inside, people can think of this cloud room as an apparatus of urban observation or meditation – the translucent interior screen gives a mix of vague pixel urban image intertwined with wind and sun."

www.archdaily.com



Design: Ned Kahn
Year: 2000
Location: Gateway village, Charlotte, North Carolina

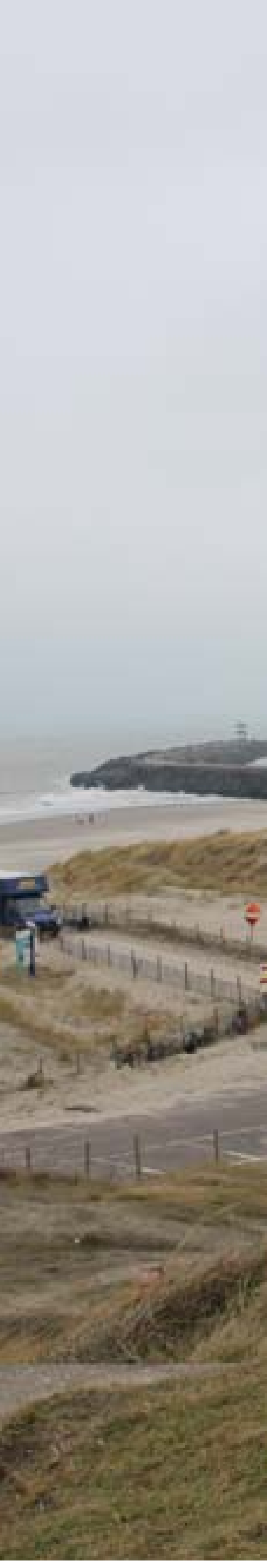
"Kahn, who has developed an international following for his artworks that incorporate the use of natural elements such as wind and light will collaborate with UAP and BAC's design team to create a 5000 Sq m kinetic façade for the new Domestic Terminal short-term car park"... "Viewed from the exterior, Kahn's proven concept for one side of the car park will appear to ripple and move due to the wind passing behind 250,000 aluminium panels. Inside the car park, intricate patterns of light and shadow will be projected onto the walls and floor as sunlight passes through the kinetic façade. In addition to revealing the ever-changing patterns of the wind, the artwork has many environmental benefits by being designed to also provide ventilation and shade for the interior of the car park."

www.archdaily.com

Design: nArchitects
Year: 2006
Location: Lacoste, France

"Windshape was conceived as two eight-meter-high pavilions that dynamically changed with the Provençale wind. A vine-like structural network of white plastic pipes, joined together and stretched apart by aluminum collars, emerged from the limestone walls and terraces of Lacoste's hillside." ... "By varying the degree of tension in the string, nARCHITECTS built Windshape to respond to the wind in several ways, from rhythmic oscillations to fast ripples across its surfaces. During heavy winds, Windshape moved dramatically, and made a hissing sound akin to dozens of jumpropes. The pavilions took on a multitude of temporary forms over the course of the summer, as they billowed in and out, and momentarily came to rest. In this way, the local winds and the Mistral gave shape to constantly mutating structures"....

www.archdaily.com



Conclusions

Desiging a hotel that uses the wind not only to make it more sustainable, but alos to connect it to the context, researching the genare charasteristics of wind, the local wind climate, wind experience and influencing the wind is important. In this research we haven tipt on that research and tried to put design concequences next to it.

Wind is an natural phenomenon and can be discribed as the movement of air. This movement of air is primarly caused by pressure differences in the admosfere, wich thereby creates wind. These presure differences aris mainly from temprature differences. When the air is in movement the rotation of the earth and the friction forces of the service start having influence on the wind, and the tree deterime the winddirection and speed. The distrubution of the windspeed over the service layer is determined by the temprature distrubution trough this layer, and is shown in windprofiles.

The windclimate in the Netherlands is determined by the location by the see. The anual and the daily going are determined by this location and show differences trough out the land. For the design location of scheveningen we see a big influence of the see windclimate and thereby we have an flattend anual and daily going, and the winddirection is not so dominate.

Windflows are influenced by the roughness of the terrain and landscape, wich can make a wind slow down and make it turbulent. The design location of scheveningen has winds from to very differenct inflow terrains, the sea and the city. The flow from the see is laminar, from the city we see a turbulent windflow. The dunes on the location it self, determine the wind, but are also influenced by the wind. This makes it difficult to simplify the sytuation.

Buildings, Obsticals and compositions can influence airflows by the forcing it to go around it. Airflows can hereby speed up or become more turbulent, determining on the hight, form or compostion. The influence feelds are determined by the winddirection and are stretchted over an area from 15 times the builging hight.

Natural ventilation is the movement of air in order to cool, and remove unwanted particals from the air. Winddriven natural ventilation is depending of the winddirection and the form of the building, to form high and low pressure feelds around the building. Stackventilation is depenting on temprature differences in the space to form pressure feelds. A combination of the to can be positive or negative depending on the wind direction.

Wind experience is mostely viewed by how much the wind bothers us. Normes are stated in order to review a wind climate this way. But is we want design with the more positive experiences of the wind, we can use al our sensise. In order to use or view or hearing sens we must use a medium, because the wind it self is invisable and doesn't make much sounds.

Desiging a winddriven archiventure in the harbor is Scheveningen we can use the general knowlegdes about windflows, landscapes and buildings to take the first stapes in desiging an desired windclimate. Using the knowlegde about the different types of ventilation we can design first shemes for ventilation, and airstreams trough the building. Designing with how we can experience wind in mind makes it possible to design a hotel that connects people more to the contect and gives a special user experience.

Literature

Books

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