

LINJEN

THE SCANDINAVIAN HIGH-SPEED RAIL

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INDUSTRIAL DESIGN DIPLOMA
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PREFACE

IMAGINE GETTING ON THE TRAIN IN OSLO AT 8 IN THE MORNING. YOU GET SOME WORK DONE, RELAX AND HAVE A SNACK. AT 11 YOU'RE IN COPENHAGEN ARRIVING AT YOUR MEETING.

This is a possibility.

Linjen is an industrial design diploma written at The Oslo School of Architecture and Design in 2012, between August 13th and December 20th.

This report consist of four parts: Departure, Journey, Arrival and Notes.

These parts represents the phases of the project. In Departure you find this preface, the scope of the project and background information. In Journey, the research is presented, while Arrival shows results. The Notes part has a summary of the project, a glossary and the appendix.

The terminology used is generally explained in the text, but should you encounter problems understanding a word or abbreviation, it might be useful to look in the glossary.





SCOPE

The aim is to create a high-speed rail concept on Scandinavian values

I BELIEVE WE NEED A HIGH-SPEED RAIL NETWORK IN SCANDINAVIA.

The distances between the major cities in our region are perfect for choosing high-speed rail (HSR). This would make travel not only quicker and greener, but it would also help create the foundation of a mega-region. This would strengthen Scandinavia's competitive edge and decrease its economic vulnerability, making it more attractive and significant to the rest of the world.

I want to contribute to the HSR vision through industrial design and this diploma project. The aim is to create a HSR concept based on Scandinavian values. This includes a focus on exterior design and building a brand identity foundation. By materializing all the ideas and reports that already exist, I believe people will find the whole vision

of a Scandinavian HSR more tangible and realistic, which hopefully would make them express their support – something that is essential when trying to realize a big project like this.

By exploring Scandinavian values and identity, I want to create a concept with a distinct form and expression where technical aspects and requirements of the design meet Scandinavian culture and identity.

Just to create and/or contribute to the debate of future mobility would be a valuable end result – and for this reason, the concept might benefit from being somewhat provocative rather than a generic high-speed train.

HIGH-SPEED RAIL

HIGH-SPEED RAIL (HSR) IS A TYPE OF PASSENGER RAIL TRANSPORT THAT ALLOWS MUCH GREATER SPEED THAN TRADITIONAL RAIL TRAFFIC.

Because of its high speed, HSR is a serious competitor to air travel up to distances of 700 kilometers. This is because they typically connect to the city center directly, whereas by plane, one will usually have to travel longer to get to the airport. In addition, one will need to check in and go through security routines.

Optimal distance for HSR is 250-900 kilometers¹ and Oslo-Copenhagen

is 600. Over this distance, HSR is also often preferred by customers for allowing them to work or sleep during the whole journey, and for being more environmentally friendly.

The first modern HSR saw the light of day between Tokyo and Osaka in 1964 and had a top speed of 210 km/h. Today, top speeds range from 300 to 431 km/h. Europe's first HSR was Paris-Lyon which opened in 1981, and three years later, Pehr Gustaf Gyllenhammar, launched the idea of "The Scandinavian link" – a Scandinavian HSR network linking us to Europe. While Europe progressed on the subject, Sweden and Norway stood almost at a standstill,



↑
ALSTOM's AGV is one of the most technically advanced trains available.
PHOTO: ALSTOM

focusing on highways. Today, traveling from Oslo to Copenhagen will take at least eight hours. For comparison, Madrid-Barcelona takes two hours and 38 minutes – and that's 21 kilometers longer.

As for energy efficiency, HSR is nine times more efficient than traveling by airplane and four times more efficient than by car². To reach climate goals, the European Union (EU) is investing in HSR, and are co-funding an investigation called The Scandinavian 8 Million City through the "Interreg IV A Öresund - Kattegat - Skagerak" program. The other half is funded by 14 additional partners. The project is based

in and lead from Oslo, and is planned to run until the autumn of 2014.

The fastest train in Scandinavia today is Flytoget – The Airport Express Train between Oslo and Gardemoen – with a top speed of 210 km/h.

PARTNERS

THE SCANDINAVIAN 8 MILLION CITY

THE SCANDINAVIAN 8 MILLION CITY IS AN INVESTIGATION TO BUILD A SCANDINAVIAN HIGH-SPEED RAIL NETWORK.

In 2005, a joint collaboration between the GO-region (Gothenburg – Oslo) and the Øresund Region founded the Corridor of Innovation and Cooperation (COINCO), aimed at creating a shared corridor between Oslo and Berlin, via Gothenburg, Malmö and Copenhagen.

The COINCO North is behind The Scandinavian 8 Million City (TS8MC) with a vision of a high-speed rail (HSR) link between Oslo and Copenhagen by the year 2025.

TS8MC consists of 14 partners made up by local and regional authorities as well as the governments of Denmark, Norway and Sweden. The project is divided in three work packages (WP), where WP1 focuses on short-term milestones regarding the Inter City networks. WP2 is the HSR project with a goal of a travel time from Oslo to Copenhagen at 140 minutes. The WP3 is dedicated to external communication and lobbying activities³.

COINCO North/TS8MC is contributing to this diploma through supervision and funding of print and model costs.



BOMBARDIER

↑
A full size mockup of
Bombardier's latest train,
the Zefiro 380.
PHOTO: BOMBARDIER

BOMBARDIER IS A CANADIAN AEROSPACE AND TRANSPORTATION COMPANY SPECIALIZED IN AIRCRAFTS, TRAINS AND TRAMS. THEY HAVE OVER 70.000 EMPLOYEES AND ARE THE ONLY MANUFACTURER OF BOTH PLANES AND TRAINS.

The company is divided in two: aerospace and transportation. In 2001 when Bombardier acquired Adtranz (that built Flytoget), the company emerged as one of the largest manufacturers of railway rolling stock. Bombardier transportation has 62 production and engineering sites in 25 countries providing jobs for 36,200

employees. They claim to be the global leader in the rail industry⁴.

Bombardier's role in this diploma is technical guidance by inviting me for a two day visit at their site in Hennigsdorf outside Berlin.

RESEARCH

REALITY CHECK: FIELD STUDY

TAKING THE TRAIN FROM OSLO TO COPENHAGEN TODAY IS MORE EXPENSIVE – AND SLOWER – THAN TRAVELING BY PLANE. I TRIED BOTH WITHIN 24 HOURS.

The 8.5 hour train ride (including one transfer in Gothenburg) is not really a common trip – unless they are on an inter rail ticket. People use the route for shorter trips. The people I talked to preferred it for being on time and reliable, and liked it for arriving closer to their final destination. In this segment, the train competes with bus and the car, not the plane. People didn't seem to think that a high speed rail (HSR) was realistic. It sounds like a utopian dream.

From the train ride to Copenhagen, I could see three similarities between the current train ride and the proposed HSR: 1) Walking to Oslo Central Station. 2) Looking out the window at the landscape passing by. 3) Jumping

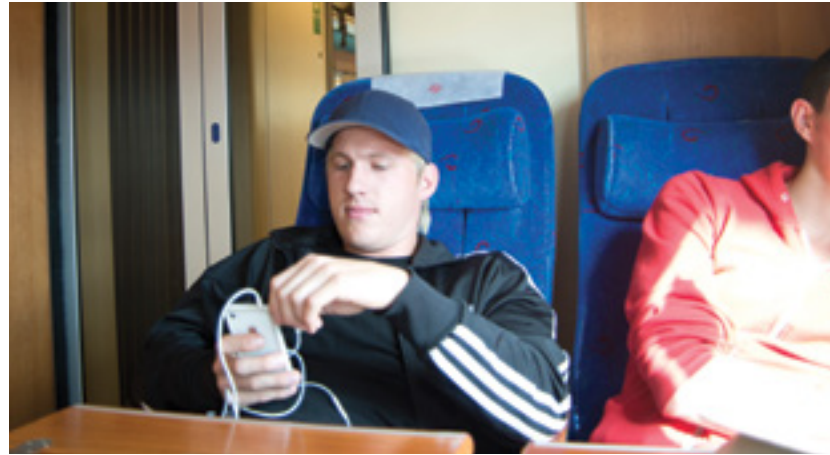
off the train in Copenhagen to be met at the station by a friend. All great feelings. The rest of the ride was not that great. 8,5 hours is a lot. I felt I was being ripped off for paying more than the plane ticket and I had to transfer in Gothenburg.

The flight home was maybe more relevant as this is the real competitor to HSR. Although the plane only takes 1 hour and 10 minutes, I measured the time from Copenhagen Central Station (08.17) to Oslo Central Station (11.58). That's a total of 3 hours and 46 minutes – and actual travel time is only 1 hour and 57 minutes, the rest is made up of walking, checking in, getting through security, more walking, waiting, picking up luggage, even more walking, waiting. It is not a bold statement to say that people generally dislike this part of the travel. If you cut away all of this, cut an hour on the total travel time and still keep prices the same, people will definitely use it – as reports have concluded⁵.

→
The NSB type 73, designed by Terje Meyer, that would take me from Oslo to Gothenburg.



I felt I was being
ripped off



↑
Swedish Jonas (26) uses NSB every week to get home from Oslo to Trollättan.



←
The Bombardier X 31 – in this case known as The Öresund Train – took me from Gothenburg to Copenhagen.

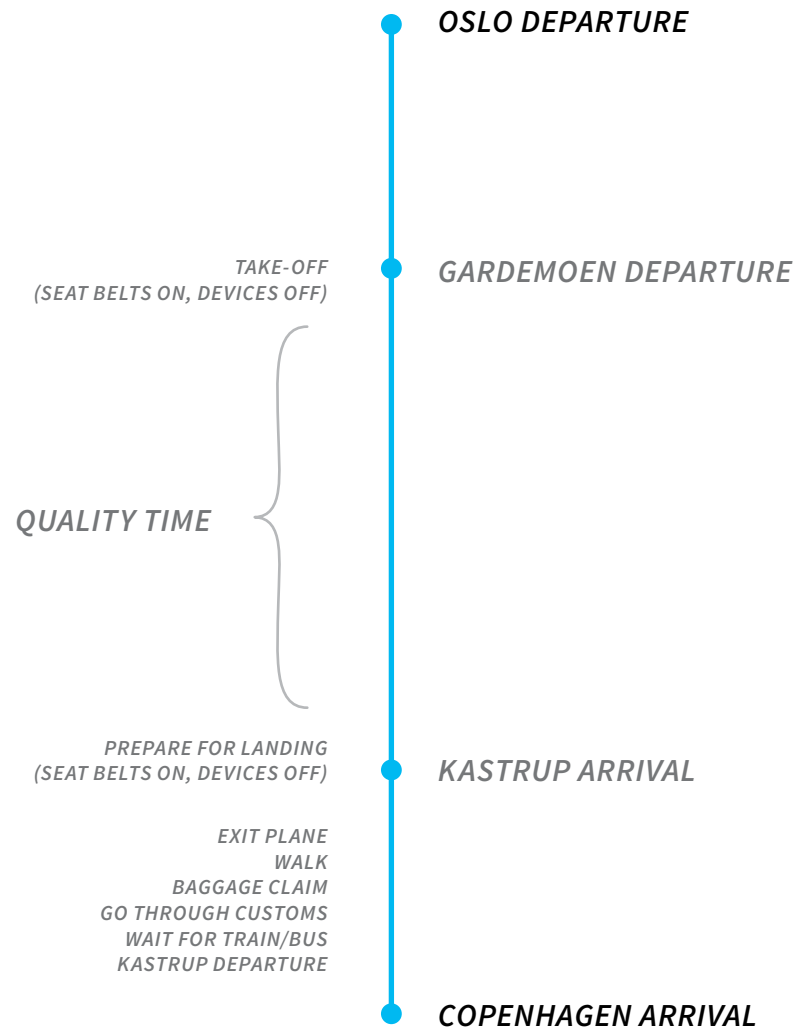


↑
Flytoget has its own platforms (here at Oslo-Gardermoen Airport) with its own design elements like ticket machine and furniture.

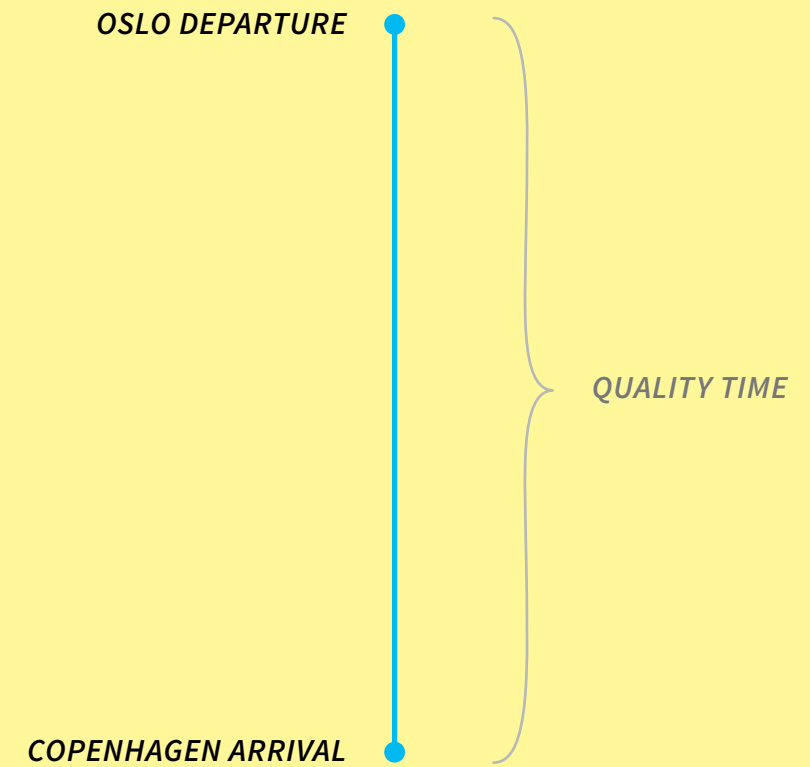
I learnt from the project lead in The Scandinavian 8 Million City in on our first meeting that even though they are trying to realize something that's beneficial for our society, they are in an uphill battle. Powerful people representing the airline industry are lobbying and influencing the decision makers, who, because of the way our democracy works, have a tendency to invest a little bit in roads here and there to keep everyone moderately happy. Deciding to build a HSR is costly and long term, and the reward is in the distant future

– where no politician knows if he or she will be in the same position ...
... But can we afford not to make the investment?

AIR



HSR



↗
The potential 165 minute journey with high-speed rail from Oslo to Copenhagen.

←
Total travel time with air was 225 minutes.

THE GREEN TRAIN

THE GREEN TRAIN IS A SWEDISH RESEARCH AND DEVELOPMENT PROGRAM FOR A NEXT GENERATION HIGH-SPEED TRAIN CONCEPT. IT STARTED IN 2005 AND THE FINAL REPORT WAS PUBLISHED IN JANUARY 2012.

The project is highly relevant to this diploma, as its goals were to adapt the concept to Nordic conditions and to be interoperable in the Scandinavian countries. The final report A⁶ deals with travel market, traffic economy and the basis of The Green Train (TGT) concept. Report B deals with the more technical aspects of the concept and also describes the context and whereabouts of the lines.

→
The TGT concept is intended to work well in the Nordic climate.
ILLUSTRATION:
FRÖIDH /
LUNDBERG

TGT says it will make train travel more attractive through:

- × Shorter traveling times.
- × Lower costs, enabling cheaper fares.
- × An attractive, functional passenger environment with a high level of comfort for all.

The concept also offers operators and infrastructure managers the following advantages:

- × Flexible train length; capacity according to need
- × Many seats in a given train length
- × Reliability and accessibility even in the Nordic climate
- × Low costs give profitability in a market exposed to competition
- × Track-friendliness, which means less wear to track and wheels and enables high speeds on non-perfect track



TGT concludes that wide-bodied trains should be preferred



↑
Sketch of exterior (left)
and design studies of the
front.

←
The author's vision of The
Green Train.

ALL ILLUSTRATIONS:
FRÖIDH /
LUNDBERG



Some of the findings TGT have done are relevant to this diploma, as their research is thorough and made with a similar perspective – but not identical – to The Scandinavian 8 Million City.

- × TGT concludes that wide-bodied trains should be preferred over continental and Scandinavian car-body width. They state it gives 15 percent lower total cost on train traffic and 25 percent more seats in the same car-body⁶ – while maintaining good comfort and punctual traffic (optimized for passenger flow during peak loading when the train is full). 2+2 seat layout in first class, 2+3 in economy.

- × Door layout: Single doors between the bogies are preferred to single doors at car ends and double doors in the center. This will give the most

efficient passenger flow on stops, reducing the total travel time.

- × Electric braking for normal operating, reduces wear on mechanical brake and can be used for regenerating.

The biggest difference between the projects is: TGT will use existing lines (as well as some new ones where needed) and create a big Scandinavian network of HSR. This means the concept is dimensioned up to 250 kph – on the slower end of the scale of HSR, while The Scandinavian 8 Million City wants to build one new line in addition to the existing ones – allowing much higher speeds.

THE SCANDINAVIAN 8 MILLION CITY

THE SCANDINAVIAN 8 MILLION CITY HAS WRITTEN AND COMMISSIONED SEVERAL REPORTS. THESE ARE THE FOUNDATION OF THE REALISM IN THE PROJECT. THESE REPORTS ARE GENERALLY OF POSITIVE NATURE.

Atkins – an engineering and design consultancy – published their report⁷ on market potential for an HSR service on Oslo – Gothenburg – Copenhagen in June 2012. They present a forecast of 9.5 million annual passengers on the route Oslo – Copenhagen in 2024. This forecast increased 30-35 percent by 2043 and 50-60 percent by 2060

compared to 2024. Other conclusions in their report are:

- × HSR share vs air travel city-city journeys would be between 60 to 80 percent.
- × Intermediate stops at sizeable locations are likely to be worthwhile from a demand and revenue perspective
- × It is essential that a new HSR product is tailored and designed to optimize performance in relation to its unique circumstances

Oslo is one of the fastest growing cities in the world⁸. PHOTO: CHELL HILL / WIKIPEDIA

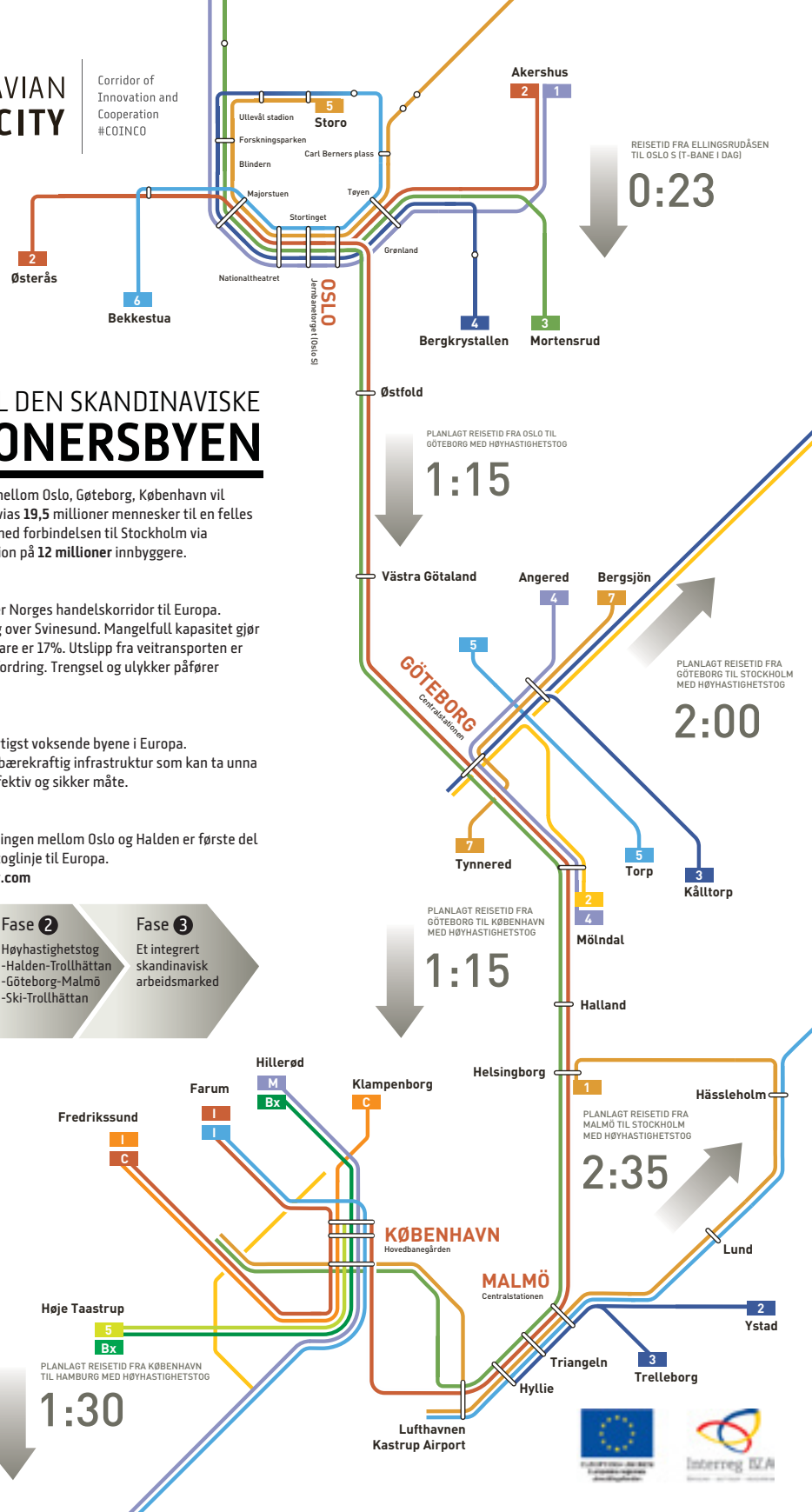


“It is essential that a new HSR product is tailored and designed to optimize performance in relation to its unique circumstances”

- Atkins

THE SCANDINAVIAN 8 MILLION CITY

Corridor of Innovation and Cooperation #COINCO



VELKOMMEN TIL DEN SKANDINAVISKE 8 MILLIONERSBYEN

Et høyhastighetstognettverk mellom Oslo, Göteborg, København vil knytte sammen 8 av Skandinavias 19,5 millioner mennesker til en felles arbeidsmarkedsregion. Tar vi med forbindelsen til Stockholm via Göteborg snakker vi om en region på 12 millioner innbyggere.

Europaforbindelsen
Strekningen Oslo-København er Norges handelskorridor til Europa. 2200 lastebiler kjører hver dag over Svinesund. Mangelfull kapasitet gjør at jernbanens markedsandel bare er 17%. Utslipp fra veitransporten er Osloregionens største miljøutfordring. Trengsel og ulykker påfører samfunnet enorme kostnader.

Lavkarbonsamfunnet
Skandinavia har flere av de hurtigst voksende byene i Europa. Høyhastighetstog vil gi oss en bærekraftig infrastruktur som kan ta unna veksten på en miljøvennlig, effektiv og sikker måte.

InterCity kommer først
Utbygging av InterCity - strekningen mellom Oslo og Halden er første del av en fremtidig høyhastighetstoglinje til Europa. Les mer på: www.8millioncity.com



SI DIN MENING

Delta i debatten på: [Facebook.com/8millioncity](https://www.facebook.com/8millioncity)

It is however stressed that the figures are preliminary forecasts and that the next step would be to secure more consistent and detailed base data. This would result in a higher degree of confidence in the forecasting results.

Still, these are good numbers for The Scandinavian 8 Million City (TS8MC). The current HSR debate in Norway is essentially split in three. One part wants HSR lines in the country before crossing the border, the second doesn't want HSR at all and the third supports building TS8MC first. There are also people who want any HSR, as long as building starts immediately.

The other HSR investigations in the country cannot show as good annual passenger forecast as TS8MC – nor as “cheap” development cost. These figures come from an article in Aftenposten⁹:

- × Oslo – Trondheim: 145 billion NOK, 4,3 million passengers
- × Oslo – Bergen: 159 billion NOK, 4,5 million passengers
- × Oslo – Stavanger: 218 billion NOK, 5 million passengers
- × Bergen – Stavanger: 115 billion NOK, 1,9 million passengers
- × Oslo – Copenhagen: 97 billion NOK, 9,5 million passengers

The article also cites politicians coming from the different fractions:

“A train like this will never exist anywhere in this country. It's too expensive and we are too few. Use the money on something more useful”, says right wing politician Bård Hoksrud (Frp).

“To propose HSR to Copenhagen now is a solid derailment. It can mismanage and postpone the Parliaments decision to build a HSR network to tie the country together”, says Atle Kvamme from Bergen Chamber of Commerce.

← One of the official posters used to promote The Scandinavian 8 Million City. One for each Scandinavian language is published.

PRODUCT ANALYSIS



↑
Lineup of Japanese
Shinkansen trains.
PHOTO: DAMASA /
WIKIPEDIA

FROM REPORTS TO SOMETHING MORE TANGIBLE: LOOKING INTO RELEVANT HISTORY AND EXISTING HIGH-SPEED TRAINS.

To get an understanding of the upcoming task of designing a high-speed rail concept, it was valuable to investigate existing trains. Where do they use what and what are the reasons behind the characteristics?

The first thing I did after writing the diploma program was to plaster the wall next to me with pictures of existing trains that are more or less HSR. They were placed to form a world map to look for “trends”.

Two trains are picked from the map for further study: The Norwegian Flytoget and the Japanese Shinkansen.

Note that maglev trains are not included. This is because they are unsuitable given the scope of this project. Although maglev could potentially reach the highest speed, the speed advantage to conventional HSR is not as big as it used to be. Maglev-technology is still less mature than HSR, and most important – they can not make use of existing rail lines, something necessary when building in Scandinavia.

AMERICA



USA

UK



NORWAY



SWEDEN



RUSSIA



S.KOREA



GERMANY



UZBEKISTAN

ASIA



JAPAN

FRANCE



CHINA



EU



SPAIN



ITALY



TAIWAN



↑
China invited European and Japanese companies when they first started developing HSR. The foreign companies saw potential and built factories producing trains in cooperation with Chinese companies. Here is the CRH1E – originally designed by Bombardier. PHOTO: ALOB3 / WIKIPEDIA



↓
The Zefiro 380 won the IF award for product design 2012, and the first trains was delivered in April the same year¹¹. PHOTO: BJÖRN KÖNIG / WIKIPEDIA



↗
Now, China is producing their very own high-speed trains, somewhat based on the technology they acquired when inviting foreign companies. A Financial Times article title named “Japan Inc shoots itself in foot on bullet train”¹⁰ describes the situation well, and there has been lawsuits. Here is the China Railway CRH380. PHOTO: KHALIDSHOU / WIKIPEDIA



←
The AVE Class 102 developed by Spanish company Talgo is also known as “the duck”. It shows – at least – that there is a wide span in train design. PHOTO: OSIRIS NAREF / WIKIPEDIA

↓
French Alstom is behind the AGV, first put in to service in Italy between Naples and Milan in 2012. It sports a clean design with few materials and colors, large passenger windows and refined surfaces on the front. PHOTO: MIROSLAV BROZ / WIKIPEDIA





SHINKANSEN

→
The current generation
Shinkansen Series E5.
PHOTO: DAJF /
WIKIPEDIA

←
The upcoming Shinkansen
Series E6, with a design
team led by a former
Pininfarina designer.
PHOTO: WIKIPEDIA



THE SHINKANSEN WAS THE FIRST HSR IN THE WORLD, AND IS TODAY A HSR NETWORK THAT IS OPERATED BY FOUR JAPAN RAILWAYS GROUP COMPANIES¹³.

What characterizes many of the trains operating the Shinkansen is the long (in some cases extremely long) noses. Although one might think this is to be able to travel aerodynamically at ultra high speeds, the real reason is somewhat different.

Because of the mountainous terrain in Japan, the Shinkansen has to go through a lot of tunnels. When entering a narrow tunnel at high speed, air pressure is created in front of the train, and this pressure will travel in front of the train, creating a boom at the exit of the tunnel¹⁴. This problem increases with the speed of the train and a smaller diameter of the tunnel, and as Japan was a HSR pioneer, the tunnel diameters are in many cases rather small compared to newer tunnels. To help cope with this problem, long noses are often a feature in Japanese trains¹⁵, here represented

with the Series E6 (left) and E5 (right). The coaches are also air-sealed to ensure comfortable tunnel passes. This, again makes window size limited.

The E5 is built by Hitachi and Kawasaki Heavy Industries and begun its service in 2011. In addition to its 15 meter long nose(!), it has full bogie (wheels and framework) cover to ensure less noise and less aerodynamic drag.

Former Pininfarina designer, Ken Okuyama, supervisor of the Ferrari Enzo design¹⁶, has been brought in by the Japanese manufacturer¹⁷. Now he is supervising the external design and styling of the upcoming two generations – E6 and E7.



←
The Flytoget, here at Asker station, is designed by Norwegian Terje Meyer. PHOTO: TROND STRANDSBERG / WIKIPEDIA

↙
Large tinted side windows and a raw steel finish are some of the main characteristics of the train.

↓
The nose has a rather serious expression.



FLYTOGET, THE AIRPORT EXPRESS TRAIN

THE FLYTOGET IS SCANDINAVIA'S FASTEST TRAIN WITH A TOP SPEED OF 210 KM/H¹⁸. JUST AHEAD OF ITS SWEDISH RIVALS. DENMARK HAS NO HIGH-SPEED TRAINS.

The Flytoget (the Airport Express Train) links the Oslo Airport with the metropolitan areas of Oslo, and also Drammen – but not at high speeds for the latter. The train was designed by Terje Meyer and built by ADtranz (later acquired by Bombardier) with the model name GMB Class 71 in 1997-98¹⁹.

The design was based on the Swedish X2 built in the 1980s, but it is heavily modified. The nose is dominant with a hard shape, almost majestic. Even though not nearly as long most high-speed trains, it has the aerodynamic characteristics of surfaces converging to a point in front on the train before they are cut. The front has great flow and a modern feel when considering Meyer did not have the privilege of working with curved glass. The nose is also said to be designed with moose collisions in mind. Allegedly, the animal is supposed

to be swept to either side during impact²⁰.

In contrast to the classic red trains in Norway, the Flytoget has a raw steel finish, with the exception of the nose that is painted gray. The arguments for opting out of paint were weight, sustainability and that the train would fit into the airport's characteristics of raw materials²⁰. It is holistically designed and the focus on details is seen inside as well as outside, on its own ticket machines, platform furniture and employee clothing to name a few examples.

The Flytoget sports tinted side windows with a continuous glass strip, and is today – 15 years after its introduction – still looking contemporary.

The only HSR line in Norway – although a slow HSR line – is a success, and is evidence that HSR is possible in Scandinavia.

Ironically, its only task is to take passengers to and from an airport.

IDENTITY

IDENTITY RESEARCH

TO BUILD THE FOUNDATION OF A BRAND IDENTITY, SOME PRINCIPLES FROM THE BOOK *DESIGNING BRAND IDENTITY*²¹ IS USED AS GUIDES.

The method claims to be “[...] a rigorous process demanding a combination of investigation, strategic thinking, design excellence, and project management skills.” It presents five phases (seen in the figure on the right). In this project, the focus is set on the first two

phases to build the foundation for the brand identity. This should help form the concept that is made in the product design part of the project. Some design elements (phase 3) will also be created to complete the foundation.

The reason for not doing all five phases is the limitations of this diploma. Also, focusing the efforts on the mentioned phases will strengthen the quality of the final results.



HISTORY: SCANDINAVIAN DESIGN

THERE ARE MANY OF DEFINITIONS FOR SCANDINAVIAN DESIGN, BUT THAT IT IS INSPIRED BY FUNCTIONALISM IS CONSISTENTLY USED THROUGH MOST. EXAMPLES OF DEFINITIONS ARE “SYNONYM TO SIMPLICITY AND ELEGANCE”²² AND “CHARACTERIZED BY SIMPLE DESIGNS, MINIMALISM, FUNCTIONALISM AND LOW-COST MASS PRODUCTION”²³.

Kjetil Fallan takes a critical approach to these and even more shallow characterizations in his book *Scandinavian*

Design. Alternative histories:

“No matter the historical contact, pinning down ‘national characteristics’ is a futile task normally resulting in a list of adjectives that are superficial and stereotypical at best, outright demeaning and petty caricature at worst. Equally reductive are the merely stylistic pigeonholes whereby a whole nation’s or region’s design output is summarized in a few idiosyncrasies.”²⁴



↑
Swedish Volvo PV544.
PHOTO: AVTOINDEX

←
Danish Stelton EM77.
PHOTO: STELTON

→
Norwegian Luxo L-1.
PHOTO: NORSKDESIGN





← Danish furniture designer Hans J. Wegner's "The chair", pictured in Kjetil Fallan's book *Scandinavian Design. Alternative Histories*.

Fallan and his co-authors goes through twelve less known case studies to showcase alternative histories of Scandinavian design. He stresses that there are examples in the Scandinavian design history that has been marginalized, and that the design history in Scandinavia has suffered from a too-narrow subject matter and a modernist bias²⁴.

Another – and less inclusive – view on Scandinavian design is to embrace it as modernism. Its golden era in the 1950s and 1960s was synonymous with the development of modernism, and after its actuality declined in the 1970s and 1980s, it saw a renaissance in the 1990s when the demand for minimalism grew²⁵.

As Widar Halén writes in the book *Scandinavian Design Beyond the Myth*:

“Traditionally, Scandinavian design has been associated with simple, uncomplicated designs, functionality and a democratic approach that has sought

to bring well designed objects to the broadest cross section of the population at the least possible cost per unit. These are the salient characteristics that must be emphasized as significant in the light of recent research on the many kinds of modernism in the twentieth century.”²⁵

The book also points out other rising factors in Scandinavian design, like ergonomics in design and “design for all”.

Shallow characterizations or not, many of the values put into Scandinavian design should be considered in the project of making a Scandinavian high-speed rail concept (identity). Not necessarily because there is a need to show that this is design from Scandinavia, but because the values that continue to survive in within the term are still there because the people of Scandinavia want them there.

“HSR share vs Air for major city-city journeys is between 60-80 percent”

- Atkins

MARKET RESEARCH

The reports on market research for The Scandinavian 8 Million City have been positive. According to Urbanet Analyse, trains have so to speak 0 percent market share in Oslo – Copenhagen, something that could rise to above 90 percent with HSR if price and frequency equals the air travel. On Oslo – Gothenburg train travel today has a market share of 69 percent, something that could rise to 100 with HSR. On Gothenburg – Copenhagen, it could rise from 80 to 98 percent.

Note that these are just some of the figures and variables from the report, which is in total much more complex. But it highlights that the market

potential is great for a HSR. It will also connect Scandinavia to Europe through HSR which could open a new way of going on holiday.

Another report done by Atkins is also positive, as mentioned in chapter “The Scandinavian 8 Million City”. They conclude with a HSR share vs Air for major city-city journeys between 60-80 percent. That is 9.5 million on Oslo – Copenhagen⁷,

UNDERSTANDING THE BUSINESS

Since there is no existing company – only an ongoing funded investigation – there is less business to understand in terms of current values, mission etc. What they do have, however, is the big goal: The Scandinavian 8 Million City. Connecting the three big cities Oslo, Gothenburg and Copenhagen through High-Speed Rail to create a mega-region.

COMPETITIVE AUDIT

There are no existing HSR competitors in Scandinavia to The Scandinavian 8 Million City project. The main competitors will be the airline companies operating on the same potential routes TS8MC will. These are: Scandinavian Airlines (SAS), Norwegian and Widerøe (owned by SAS group).

SAS

SCANDINAVIAN AIRLINES IS THE LARGEST AIRLINE IN SCANDINAVIA.

It was founded in 1946 as a merger between AB Aerotransport (Swedish), Det Danske Luftfartselskab (Danish) and Det Norske Luftfartselskap (Norwegian). The SAS headquarter in Sweden and main hub at Kastrup outside Copenhagen. In 2011 SAS carried 22.9 million passengers, making it the eighth largest airline in Europe. It is partially owned by the governments of Sweden, Denmark and Norway, with a respective ownership of 21.4, 14.3 and 14.3 percent. The remaining 50 percent is held by private owners.²⁶

As part of the SAS group their vision is: “To be Valued for Excellence by all Stakeholders”, while their mission is: “We provide Best Value for Time and Money to Nordic Travelers whatever purpose of their journey”. SAS also has a promise: “Service And Simplicity – We promise to minimize

your travel time and maximize the value of the time you spend with us”. Their priorities are: safety, punctuality and care. Finally, they state their strategy as 4Excellence:²⁷

- × Commercial Excellence – Do the right things that the customer is willing to pay for and make us the natural choice for Nordic travelers.
- × Sales Excellence – Increase cost efficiency and achieve higher levels of loyalty among both companies and travelers. Sales are about relationships, not only transactions.
- × Operational Excellence – Ensure that we deliver the highest quality and cost-efficiency based on customer value.
- × People Excellence – Realize the full potential of employees through strong leadership and cooperation on shared goals.

SAS branded airplane.
PHOTO: SAS



SAS logo, here with both word mark and logotype.



The brand concept²⁸ of SAS is experience based – focusing not on how you will get from A to B, but what you will feel when you do it.

SAS has a strong position in the Europe, but has been struggling the latter years to fight off the pressure from low-cost

airlines. SAS has been cutting costs and fare prices and are positioning themselves right above the low-fare companies. They promote that they are punctual and offer comfort.

The SAS visual identity seems to target a middle aged businessman. Royal blue as their main color, and conservative use of graphic elements. They want to appear grown up and safe – as they also are. They do however go a bit more creative in their campaigns with lots of colored text, as these are likely to aim more towards the leisure travelers – not the businessman. The SAS name is extremely strong and has good pronunciation.



NORWEGIAN

NORWEGIAN AIR SHUTTLE ASA (COMMONLY KNOWN AS NORWEGIAN) IS THE SECOND LARGEST AIRLINE IN SCANDINAVIA WITH 15.7 MILLION PASSENGERS IN 2011.

As SAS' main rival, Norwegian is considered being a low-cost carrier. It is also a fairly young airline company, being founded in 1993. CEO and co-founder, Bjørn Kjos, is the main shareholder and the company's face to the public.

Norwegian's vision is: "Everyone should afford to fly" accompanied by their core values:

- 1) Simplicity
- 2) Directness
- 3) Relevance

They also have operational priorities: safety, service and simplicity. Finally, the business strategy is: "Norwegian intends to become the preferred supplier of air travel in its selected markets and to generate excellent profitability and return to its shareholders." It is also listed how they will achieve this, but the text is too long to fit in this summary.³⁰

The brand concept of Norwegian is functional – to solve a problem: getting

Norwegian branded plane with one of their tail wing campaigns. PHOTO: NORWEGIAN



Norwegian CEO and co-founder Bjørn Kjos is also the company's face in media and to the public. PHOTO: BJOERTVEDT / WIKIPEDIA

The Norwegian logo includes the web-address.

from A to B without spending a lot of money.³⁰

Norwegian's growth since they decided to become a low-cost carrier in 2002 has been enormous, something that culminated in their record order of aircrafts in January 2012 – the largest one in European history. They are low-cost, but offer much better comfort than companies like Ryan Air – who also wants to appear low-cost. Norwegian seems to get their values and priorities through to the customer, something that might be easier for a smaller – more underdog like company to their big brother SAS. They are also clever when it comes to investing in features to get

free marketing, like they were the first airline in the world to offer wifi on European routes³¹ – naturally the people on the plane are impressed and will use social media to talk about it.

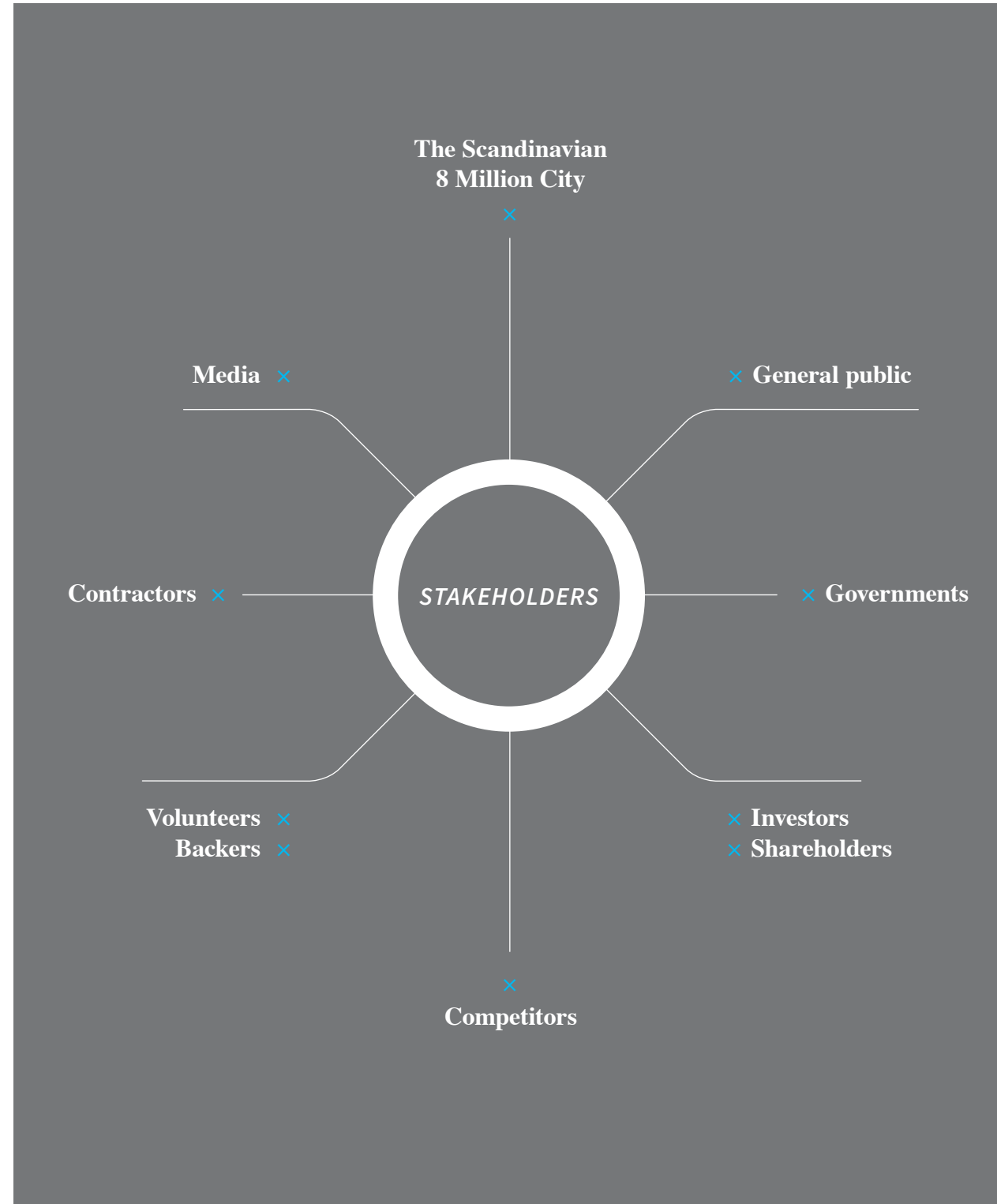
For visual identity, Norwegian is naturally red whereas SAS is blue. The logo includes ".com", likely because the brand name is generic and the brand not strong enough, which is probably why there also is a symbol of a plane in the logo. A natural evolution for the future of the logo would be to simplify or cut out the .com when the brand is strong enough to not need explanation.

STAKEHOLDER AUDIT

THE SCANDINAVIAN HIGH-SPEED RAIL PROJECT IS AT A CRITICAL MOMENT: BUILDING SUPPORT. PEOPLE MUST BE CONVINCED IN ORDER TO GET IT BUILT. IDENTIFYING AND PRIORITIZING THE MOST IMPORTANT STAKEHOLDERS IS CRUCIAL.

Therefore, the list of stakeholders on the right, will need to be expanded if the project should be realized. Now, however, these are the important ones. Potential customers and the general public is important to reach for building an overall positiveness to the project, and these are usually reached through the media. The governments will ultimately make the decisions, and these are influenced by the latter stakeholders mentioned.

Bullding relations with contractors and investors is important for the realism and feasibility of the project, while identifying the competitors will help create a clear strategy.



WORKSHOP





FOLLOWING RESEARCH AND GENERATING IDEAS, AN IDENTITY WORKSHOP WAS USED AS A TOOL TO VERIFY THE IDEAS AND GET NEW ONES.

Creatives were invited because they are used to working on an abstract level and in a workshop setting. After an introduction to my project, we kicked it off with everyone sketching a person they could see as a customer on a future Scandinavian high-speed rail line. Then everybody had to switch paper with some of the others and write a quick bio to that sketch. This created a good mood and put the scenario of rail travel on everybody's mind. The attendees hung

the posters on the wall and gave a quick introduction of their character to the others.

We divided the attendees into groups where they had to brainstorm words and values that could represent a significant number of the characters presented. They would choose the best five words and post them on a value target, where the center would represent the word being 'most Scandinavian', and less the further out you came. Everyone would discuss and reorganize the placing, and also place new ones that were written in advance. The groups then chose three core values, and went back to the drawing board.



Of the nine workshop attendees it was four different nationalities: Norwegian, Danish, German and English.

The final task of the workshop was to pick one character from the wall and one train design concept presented to them. They would match these with their core values to create a brand pitch from their material that they would present to the rest.

The result were informal presentations of a Scandinavian high-speed rail brand. The groups had clear visions and preferences of what to expect when thinking of trains, and this was valuable and relevant to the project's task of finding the core values. The concepts presented seemed still to focus more on practical interior solutions and ideas rather than the brand itself, and that was more

difficult to translate into further use in the project. In retrospect, the attendees might have gotten too much freedom as they steered away from the task at hand into more practical ideas. The reason for this could be that the facilitation was not explicit enough, and a combination with the groups picking an easy route by prioritizing brainstorming of traveling comfort rather than brand names and strategies.

INTERVIEWS

TO VERIFY AND AND GET MORE INPUT ON SCANDINAVIAN IDENTITY, ERLING DOKK HOLM AND THOMAS HYLLAND ERIKSEN WAS INTERVIEWED.

Dokk Holm is a researcher at Markedshøyskolen in Oslo, and holds a PhD from The Oslo School of Architecture and Design where he also teaches. His field is among others are urbanism, form, advertising and consumer sociology. He writes regularly for two Norwegian newspapers and is often active in the public debate.

Hylland Eriksen is professor of social anthropology at the University of Oslo.

Identity politics are included in his field of research, and he is considered a specialist in identity, ethnicity, globalization, creolisation and globalization. He thinks Scandinavians are adapting to the surrounding western world.

Dokk Holm and Hylland Eriksen were glad to discuss the topic, and they both had strong opinions about it. Their input was more or less in agreement with my own findings from research and the workshop, but also complementary.



ERLING DOKK HOLM

ERLING DOKK HOLM IS A STRONG BELIEVER IN THAT THE SCANDINAVIAN SYSTEM WORKS, AND THINKS EGALITARIANISM IS THE MOST IMPORTANT VALUE.

– The difference between us (Sweden, Denmark and Norway) is that we have a common history, and a very similar language. We often mention everything else than language when we talk about our similarities, but I think that is an important point, Dokk Holm says.

– We are small and peripheral in a European context. We have the same political system and a focus on welfare. The class differences are small compared to Great Britain, and we have a strong culture for equality.

– One of the reasons we identify us as Scandinavians can be that we have had very little (internal) conflicts.

– *Do you think that stems from our values?*

– Absolutely.

– *Can you put words on those values?*

– Egalitarian. That is the most important one. Then I think the next one is that we are informal, and also that we practice a high degree of trust. And the values can be translated to politics, so those two terms can be hard to separate. We are a peaceful people... And it works! I see every day that it works. I eat lunch every day in the cantina, and so does the caretaker.

– Here, the income inequality is low, and that is of course a good thing, and people think it's a good thing. In the U.S. the inequality is huge, but even there the poorest think it's a good thing. They want the individual to triumph, while in reality, what matters most to them is the social-political aspects as to their chance of improving their quality of living.

→
Erling Dokk Holm believes the most important Scandinavian value is egalitarianism. PHOTO: MARKEDSHØYSKOLEN

“I eat lunch every day in the cantina... And so does the janitor”

– Erling Dokk Holm





“Foreigners experience Scandinavians as a bit difficult to get into, rich and complacent”

- Thomas Hylland Eriksen

THOMAS HYLLAND ERIKSEN

←
Thomas Hylland Eriksen think Scandinavians are becoming more similar to the western world.
PHOTO: GAD / WIKIPEDIA

THOMAS HYLLAND ERIKSEN STRESSES THE DIFFERENCES BETWEEN IDENTITY AND CULTURE, AND BELIEVES EQUALITY IS AN IMPORTANT SCANDINAVIAN VALUE.

– *What do you think is typical Scandinavian?*

– Equality and an informal style. But also a certain distance and shyness towards strangers.

– *Do you think there is a difference between how we perceive ourselves and how the rest of the world sees us?*

– Most definitely. Foreigners experience Scandinavians as a bit difficult to get into, rich and complacent. We think – like most people think about themselves in the world – that we are normal and act natural.

– *How do you think the Scandinavian identity will evolve? Do you see some trends?*

– Here we must distinguish between

culture and identity. Culture – ie. behavior – is becoming more and more similar to the rest of the western world, thanks to more impulses and increased contact with our surroundings. It means that we are increasingly seeing ourselves as some kind of customers in life’s supermarket, and we find the urban life easier based on shallow friendliness. Identity, on the other hand, changes slower, and can even freeze to a self-image that portrays us a nature loving, simple and modest, even though things are different in practice.

– *What do you consider as Scandinavian values?*

– Equality (Jante’s law), welfare, pushing one’s moralism and modesty (except in Denmark).

THE PRODUCTS ROLE IN A BRAND

“PRODUCTS ARE CREATED IN THE FACTORY. BRANDS ARE CREATED IN THE MIND”, IS QUOTED IN THE BOOK *DESIGNING BRAND IDENTITY*²¹.

The author, Alina Wheeler states that the product is considered as one of the 33 touch points mentioned. It is one of the visuals making up the tangible identity of a brand. I have no doubt on the importance of building a strong brand, and the author, Wheeler, presents a universal brand identity process. A recipe for getting everything right from the get-go, where you work in the following order:

- 1) Conducting research
- 2) Clarifying strategy
- 3) Designing identity
- 4) Creating touch points
- 5) Managing assets

As much as I believe in this process, I believe the train itself in a high-speed rail (HSR) concept can – and should – be more than a touch point created next to letterheads and uniforms. It is an important part of the service and therefore an important brand element. The product in this case is not one being



←
The Zalo bottle from 1952 to 2012. PHOTO: LILLEBORG

updated annually like an iPhone, it's a huge investment and something that will live for many years. My statement is that the shorter the cycle time of a product is, the less important it becomes for influencing the brand identity. It could even benefit from following the brand identity guidelines and be generic – building up under the brand's strategy. On the other hand, when the product is something long lasting it can have a strong impact on the brand identity.

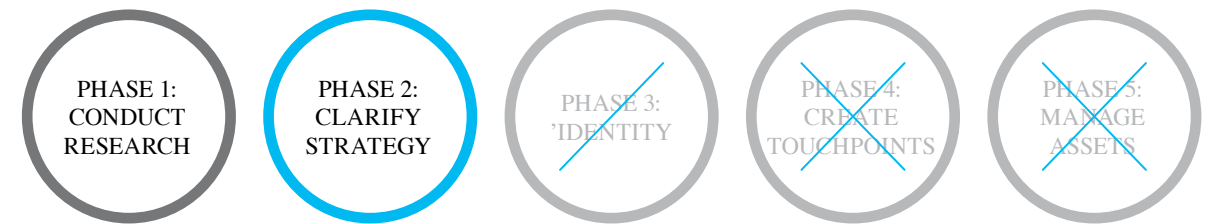
Examples of this are Zalo – which has been awarded the prize for Norway's strongest brand several times³² – and also Flytoget which has been discussed. These are brands where the product

itself is a key component of the complete brand identity. The products might be considered touchpoints, but their individual value in a brand differs from case to case.

Yes, it is built in the factory, but it is created by a designer who is merging technical demand and specification with the same visions and values of the brand. And if it is something as monumental as a train, the product helps the mind create the brand.

BRAND STRATEGY

CLARIFYING STRATEGY



Clarifying brand strategy

Visual identity preview

Core values

Position

The big idea

Naming

Brand brief

CLARIFYING BRAND STRATEGY

The challenge in this phase is to distill the vast amounts of data to something usable

CLARIFYING BRAND STRATEGY MEANS USING THE LEARNINGS FROM THE IDENTITY RESEARCH AND AUDITS TO CREATE A UNIFYING IDEA AND POSITION FOR THE BRAND.

The identity research chapter gave insight to the Scandinavian design history, the business the brand is entering, its market and competitors. It looked at stakeholders and brainstormed around values and Scandinavian identity. Intellectuals from the identity research field were interviewed, and finally, the product's role in a brand where the product is something more than just a touchpoint was discussed.

The challenge in this phase is to distill the vast amounts of data to something usable. To something differentiated. To something that you will feel and understand in a heartbeat.

As mentioned earlier, this brand identity is mostly about creating acceptance and enthusiasm for the idea of a Scandinavian high-speed rail. What created here is not meant to be the soul

answer to a brand identity when (if) the project has been realized – but it is a beginning and also meant to be used to get it realized. It should simply be the foundation on which to build a strong brand that can develop through the phases from investigation to realization of the first high-speed rail network in Scandinavia.

CORE VALUES

FOCUSING ON VALUES WHEN WORKING WITH BRAND STRATEGY IS ALWAYS IMPORTANT, AND IN THIS CASE IT IS EXTREMELY IMPORTANT TO CHOOSE THE RIGHT ONES TO BUILD A COMMON IDENTITY THAT ALL THREE NATIONS CAN RELATE TO.

The first pool of values was large. Coming from reading, googling and brainstorming to create the first batch. Then, the workshop contributed with more, and so did the interviews. What was in the pool was values describing Scandinavian people, behavior and culture. But also words that tried to look forward.

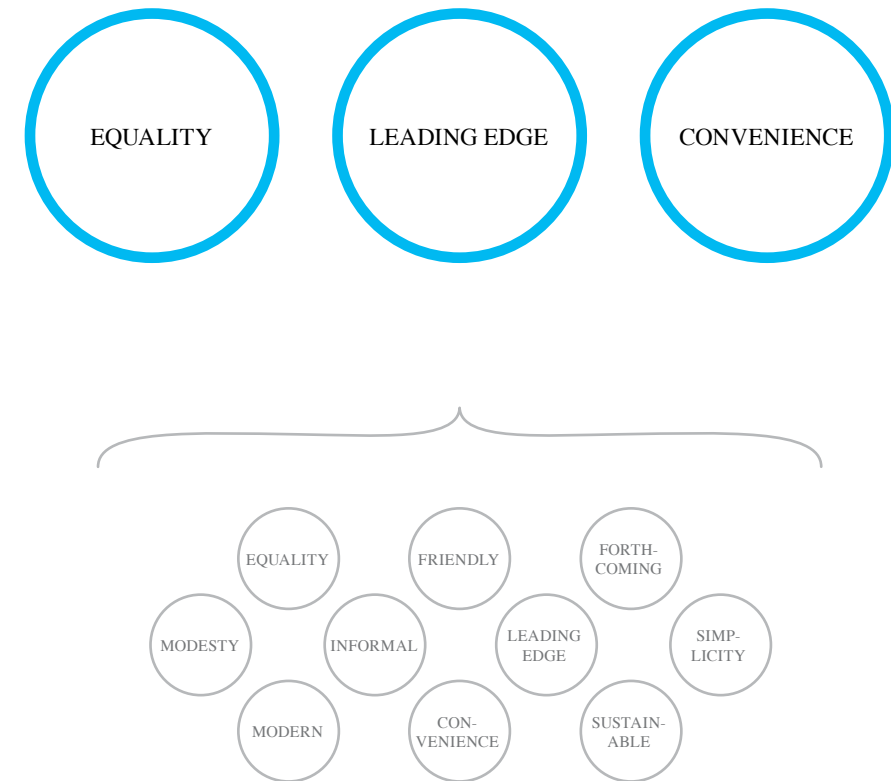
These were cut down to ten values. The ten that represented all fields, but also would be useful in a brand identity. There was no reason to push; i.e., to take moralistic into the next phase as it is hard to argue it would have positive influence in a brand identity. It was also important to take the competitors into consideration. Like safety, a word both Norwegian and SAS use as a value.

Maybe a high-speed train is even a tiny bit safer than the plane, but it is hard to prove and I found it much better to focus on the real competitive advantages of the Scandinavian HSR.

To select the final three, the alternatives were discussed with my supervisors and other with branding experience.

The chosen three core values:

- × **EQUALITY** realates to our common Scandinavian culture. It guarantees that everyone will get the same good service, no matter what country or society you are from.
- × **LEADING EDGE** in sustainability and technology. Providing a premium and reliable experience by pushing the boundaries of travel.
- × **CONVENIENCE** is the extreme competitive advantage over air travel on the distance covered by the Scandinavian high-speed rail.



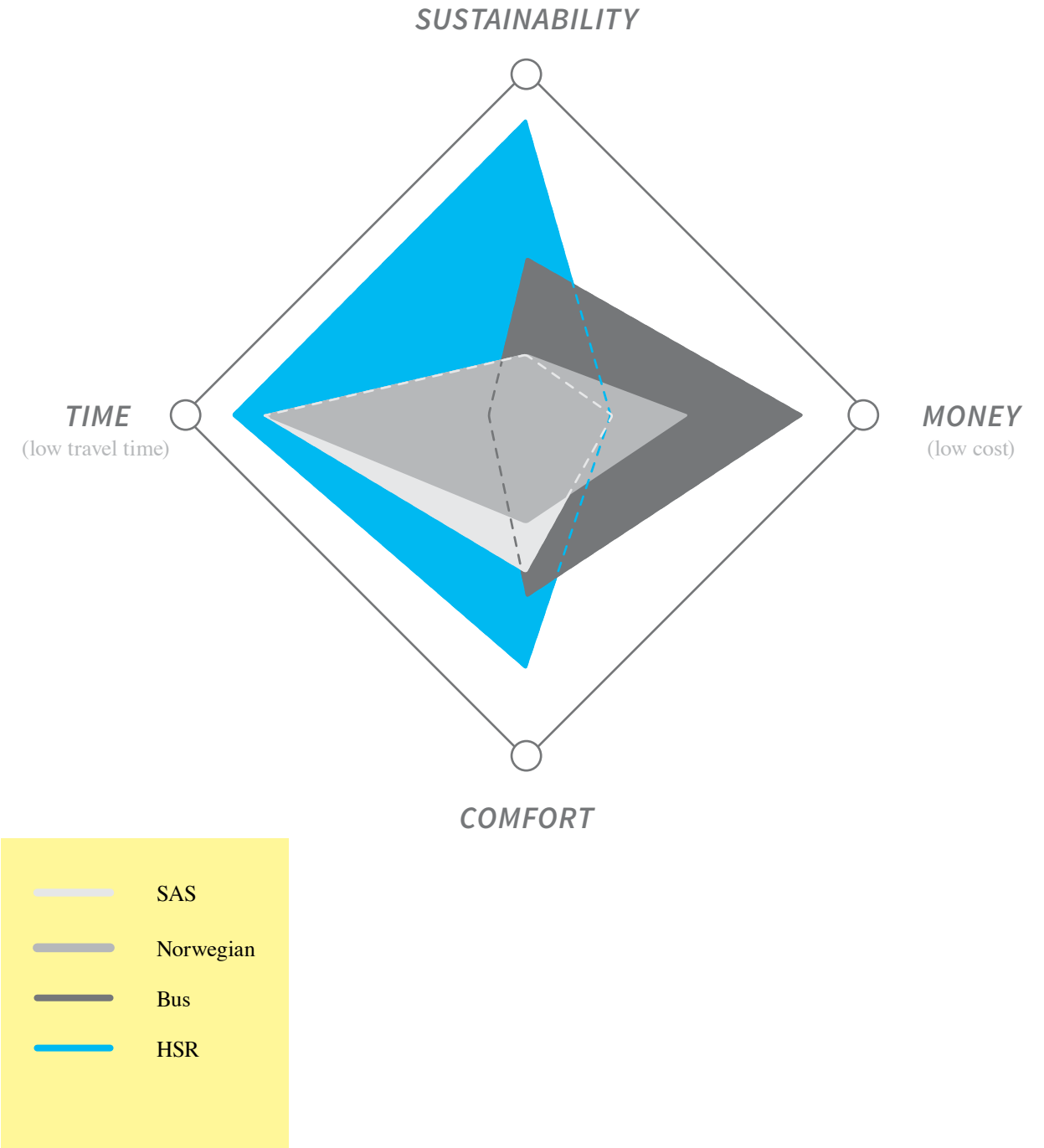
POSITIONING

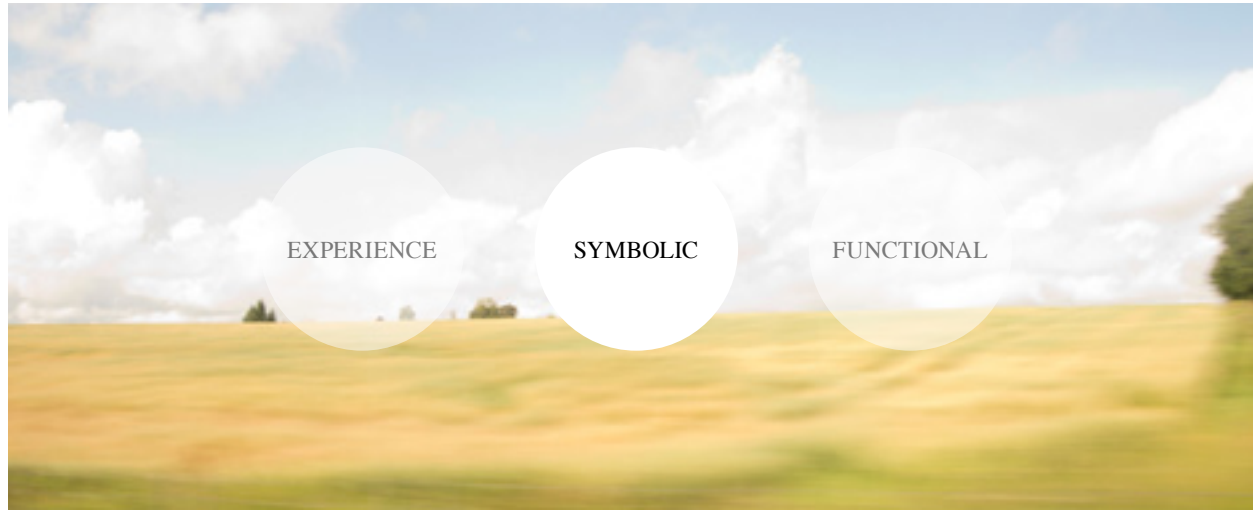
AS THE CORE COMPETITORS TO A SCANDINAVIAN HSR ARE OTHER MODES OF TRANSPORTATION, SOME DIFFERENTIATION IS GIVEN. BUT THAT DOESN'T MEAN THE SUBJECT SHOULDN'T BE ADDRESSED.

High-speed trains are generally considered more environmentally friendly than planes, and this is one of the great benefits of HSR. The other crucial factors are time, money and comfort. If it wasn't, people would use the slow trains today, and they are absolutely not doing that. Something that became painfully clear when doing the field study during the transfer in Gothenburg. No one was transferring. No one was going from Oslo to Copenhagen by train that day (not including the early morning train and the night train).

If you can match time and money, which HSR can, that's when other aspects like sustainability and comfort comes in. For these reasons, this should be the targeted areas for the brand of a Scandinavian HSR.

Comfort can however be many things, and SAS even says they offer a comfortable journey. But how comfortable is it really the complete journey when using air travel (see diagram at p. 26)? Therefore, comfort should be turned into convenience to not be mixed in with what the airlines call comfort (free coffee?). It is a subtle poke to the airlines stating that they can call it comfort, but can never offer a convenient journey from departure to arrival, simply because they only control a certain part of the whole journey.



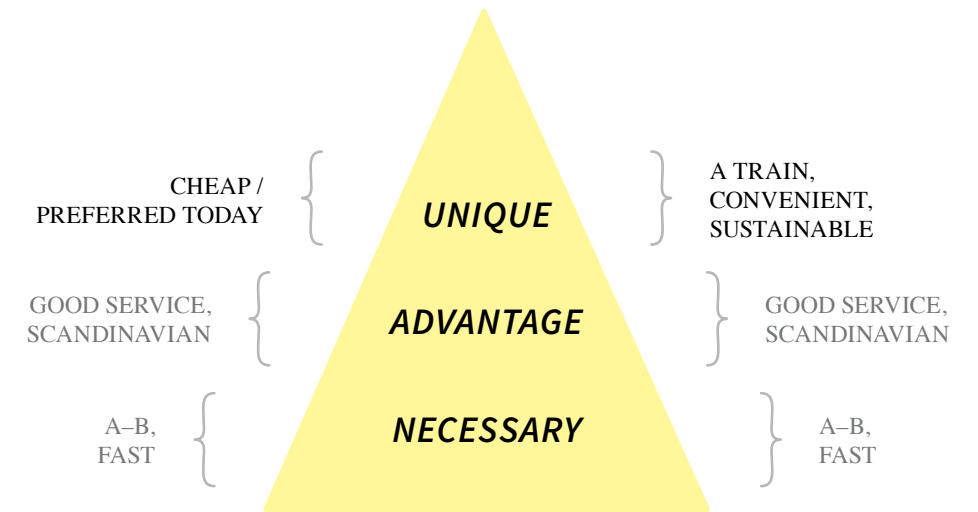


The focus is on the customers that
aren't satisfied with air travel on
shorter distances

The unique selling point of a Scandinavian HSR is that it simply is a train. It is not a plane.

According to Olsen, Peretz & Samuelsen, there are three different brand concepts: Functional, experience and symbolic – and it can be an advantage to differentiate to your main competitors when creating the brand strategy. Norwegian is placed in the functional category for their A to B and “Everyone should afford to fly” strategy, while SAS is a more experience-based brand that focuses on service and excelling on all levels.

The brand concept of the Scandinavian HSR will be symbolic-based, which differentiates from the two main competitors SAS and Norwegian. But maybe even more important: it builds on the unique selling point of simply being a train. The focus is on the customers that aren't satisfied with air travel on shorter distances. It might be because of the sustainability aspect and it might be because they want to remember the good feeling of traveling on rail. They want to make the choice as a statement of distancing themselves from airlines when it's possible.



NORWEGIAN / SAS

SCANDINAVIAN HSR

A NEW SCANDINAVIA

A SUSTAINABLE SCANDINAVIA

A CONVENIENT SCANDINAVIA

A LEADING SCANDINAVIA

***THE
BIG
IDEA***

**THE BIG IDEA SHOULD DISTILL THE ESSENCE OF THE BRAND.
SIMPLICITY IS KEY TO MAKING IT STICK.**

“A new Scandinavia” says something about the visionary nature of high-speed rail. It is ambitious and uniting, positive and expressive.

It is meant to be flexible, where “new” is a replaceable word, allowing variations and use of for instance the values – but not necessarily. It can be a string of words that eventually ends at “new” in a motion setting. It is supposed to be dynamic, yet clear about what it states.

NAMING

LINJEN (SCANDINAVIAN FOR “THE LINE”) IS A UNIFYING BRAND NAME. IT’S A NAME THAT HELPS TO TIE THE THREE SCANDINAVIAN COUNTRIES TOGETHER – WHICH IS WHAT THE BRAND’S SERVICE IS DOING.

Finding a word that had the same meaning in Danish, Norwegian and Swedish was a desirable idea – so when brainstorming resulted in the word “linjen”, it quickly rose as the perfect candidate.

It has a meaning. The new high-speed rail from Oslo to Copenhagen is a line, and that line is what you takes you to your destination.

By using the Scandinavian term, it unifies the three countries. They can all use it as slang in their language: “Vi tager linjen til Oslo” (Danish), “Jeg tar Linjen ned til Danmark” (Norwegian) and “Jag ska resa med Linjen till Malmö” (Swedish). Note that the Danish saying is not as common as the two others, but it is still considered to be

within range of what people will get used to saying.

More features of the name:

- × There are no obvious risks for the name to get outdated as it does not relate to any other features than the rail.
- × It is pronounceable in English, and also gives a location in itself.
- × Domain names (com/no/se/dk) seem reasonable and realistic to acquire as they are not in use by any large companies.



LINJEN

BRAND BRIEF

THE BRAND BRIEF IS AN INTERNAL DOCUMENT SUMMARIZING THE BRAND STRATEGY.

The document is attached in A3 format, and it is meant to be used by Linjen employees in their everyday work. The brand brief is the essence of the brand and provides help and guidelines for decision making and daily tasks.

The intention with a document like this is that it will influence the employees in a positive way to help build the brand from scratch. They can have it on the wall next to them or folded as a document on their desk. The backside

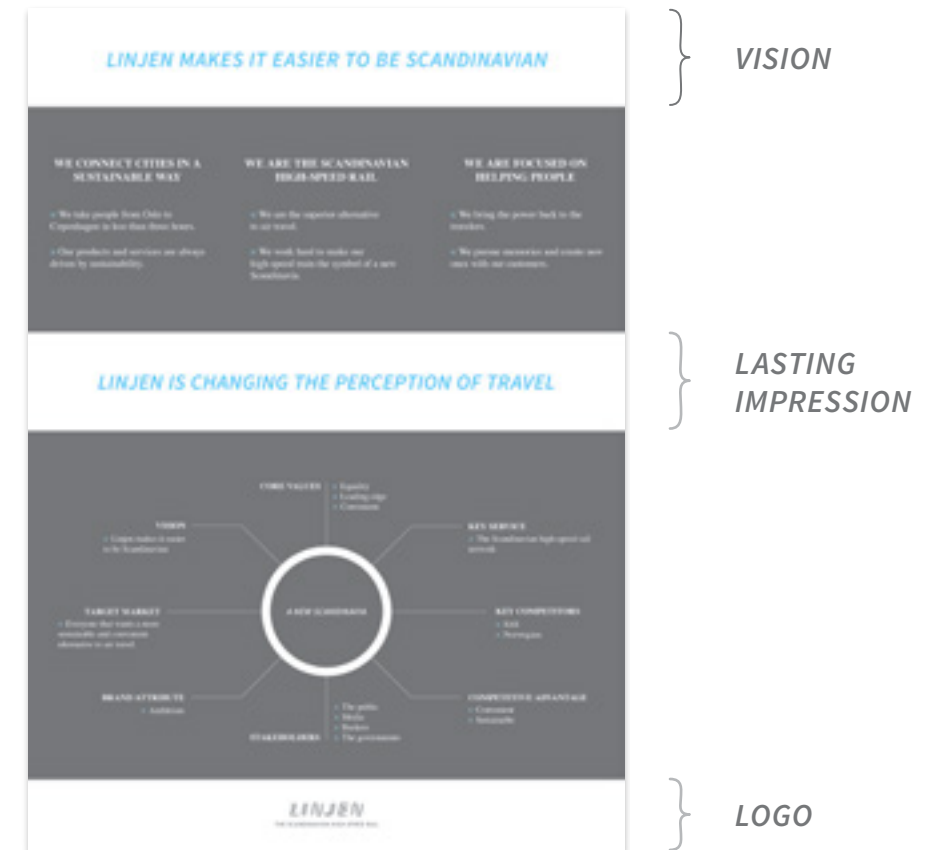
has a visualization printed so it can be used as an inspirational poster as well.

The top half consists of the vision, the brands promises and the lasting impression, while the bottom half has all the brand elements in keyword form with the big idea in the middle, and logo at the end.

The brand brief is the essence of the brand and provides help and guidelines for decision making and daily tasks

CONTEXTUAL, RATIONAL AND EMOTIONAL PROMISES

BRAND BRIEF ELEMENTS





VISUAL IDENTITY PREVIEW

LINJEN

THE SCANDINAVIAN HIGH-SPEED RAIL

THE LINJEN LOGO IS MINIMAL, YET DYNAMIC, AND REFLECTS THE NAME ITSELF.

With italic lettering, divided up in lines to form interesting patterns. Each letter is formed by two lines, which symbolizes the equality core value from the brand strategy. The forward leaning expression is signaling speed and the leading edge that Linjen wants to represent.

Incorporated in the logo is the tagline: “The Scandinavian High-Speed Rail” which should be used when the receiver does not know the brand or will automatically understand what the brand is (like when placed on the train).

This is done because Linjen is a generic word, and it would need some time to be incorporated as a standalone name. However, with the scale that lies within the first Scandinavian high-speed rail, it was considered likely that the name Linjen could be “owned” rather quickly.

The intention is not to create a complete visual identity, but developing the logo was done to give a more complete feel of the brand strategy. It is also allows the product to incorporate the logo and add realism to the concept.

The next step would be to work with graphic designers to create the complete visual identity.



LINJEN



CONCEPT

INITIAL SKETCH PROCESS

WHEN UNDERTAKING THIS DIPLOMA, IT WAS IMPORTANT TO START SKETCHING RIGHT AWAY, EVEN BEFORE RESEARCH AND SPECIFICATIONS.

This for three main reasons:

1) The first was to get into the habit of sketching trains and pushing the quality of them up even before working on the concepts. Without this phase, my experience from other projects is that one can fall into a certain direction of designs, simply because that's all you're able to sketch well. With a good base of training

on a certain product or vehicle, one will feel more confident of pushing the form to new directions while still making believable sketches.

2) The second reason was to create a maturity process. Even though a lot of what is done the first weeks might seem worthless, the findings you've done are far from just that. A design you find appealing the early in the process will mature after several more rounds, and one might realize that the "darling" did not have the qualities needed after all. Skipping this and working in clear cut phases seems risky to me, and I believe a planned



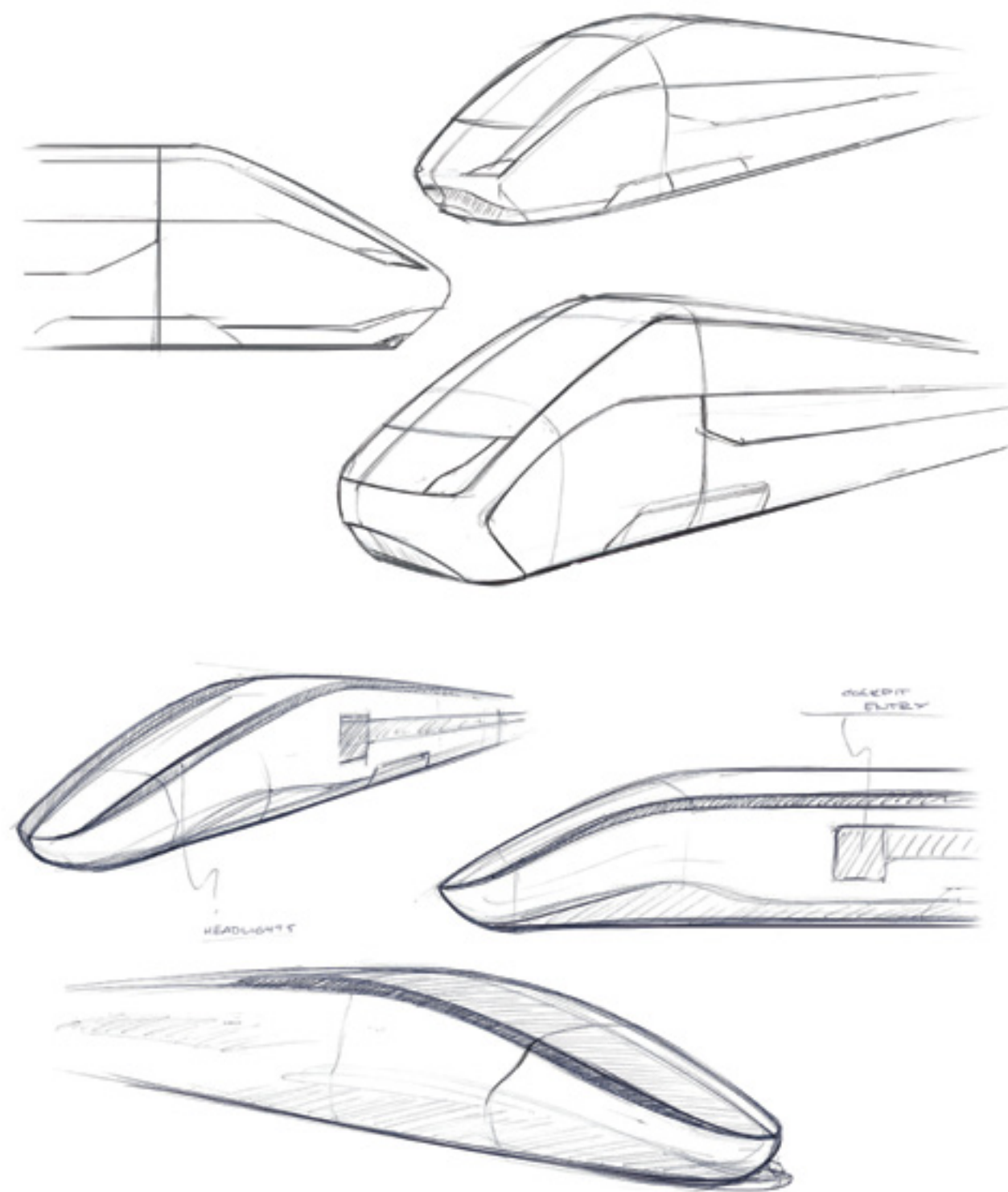
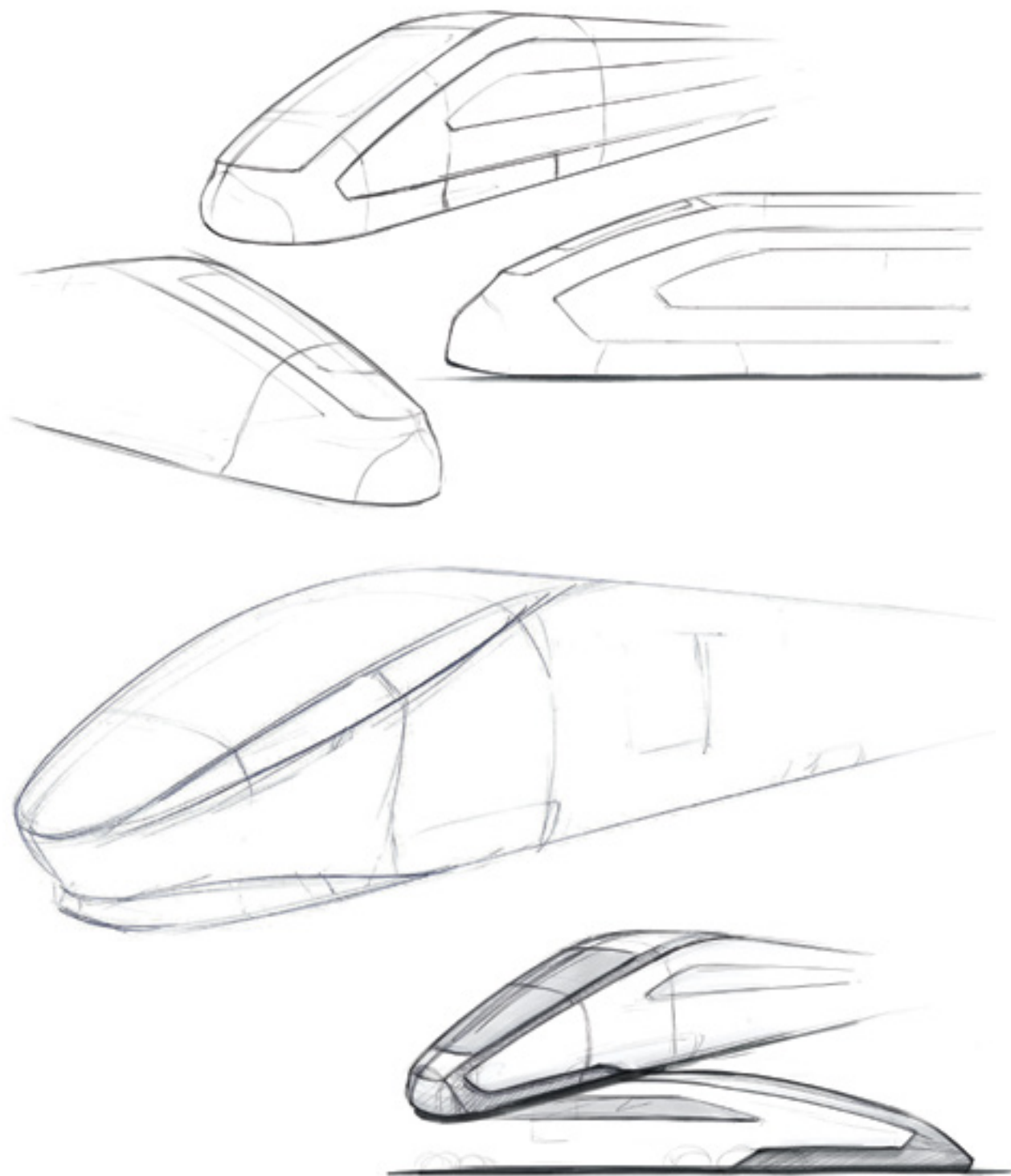
↑
Sketching fast and precise is important to generate many ideas and not waste too much time on that one idea that might later serve little purpose. I prefer black ballpoint pen, with touch-ups of markers or prismacolor. For further development the sketches are scanned and developed in a Wacom table in Adobe Photoshop.

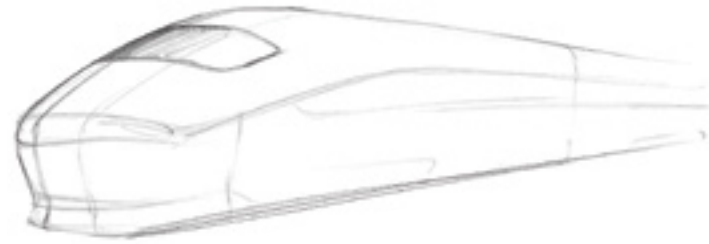
and compressed sketch phase is a dangerous path when doing a product with focus on form. Maybe you will still end up with a concept based on one of the early ideas, but then you really know it has qualities for surviving the selection process since the beginning.

3) The third and final reason was to have a bank of sketches. With 50-100 A3 sheets filled with design ideas, you can at any stage in the design process dig through those looking to rediscover something. With only 5-10 sheets of that one darling, you miss out on this very helpful way of

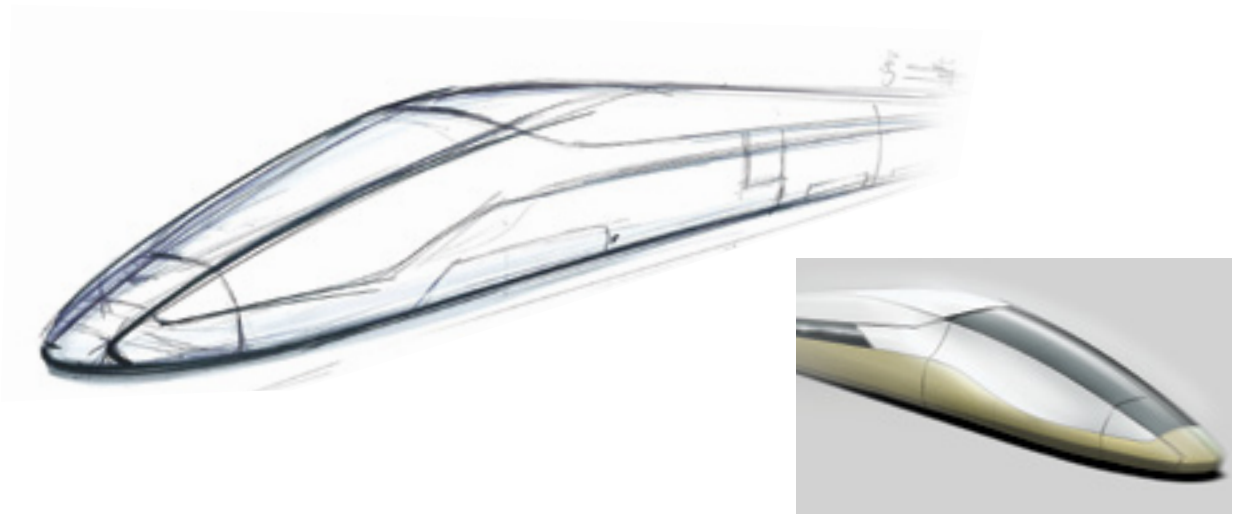
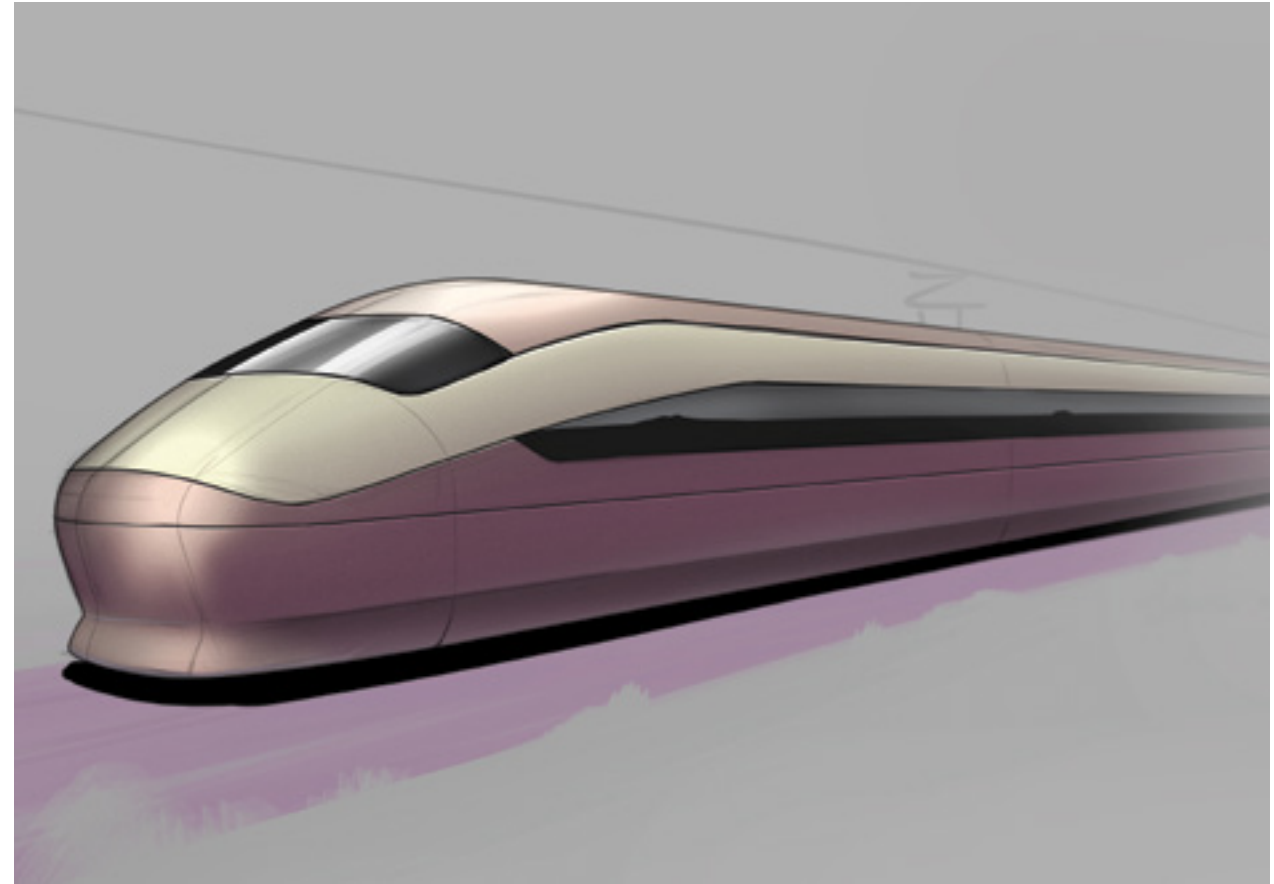
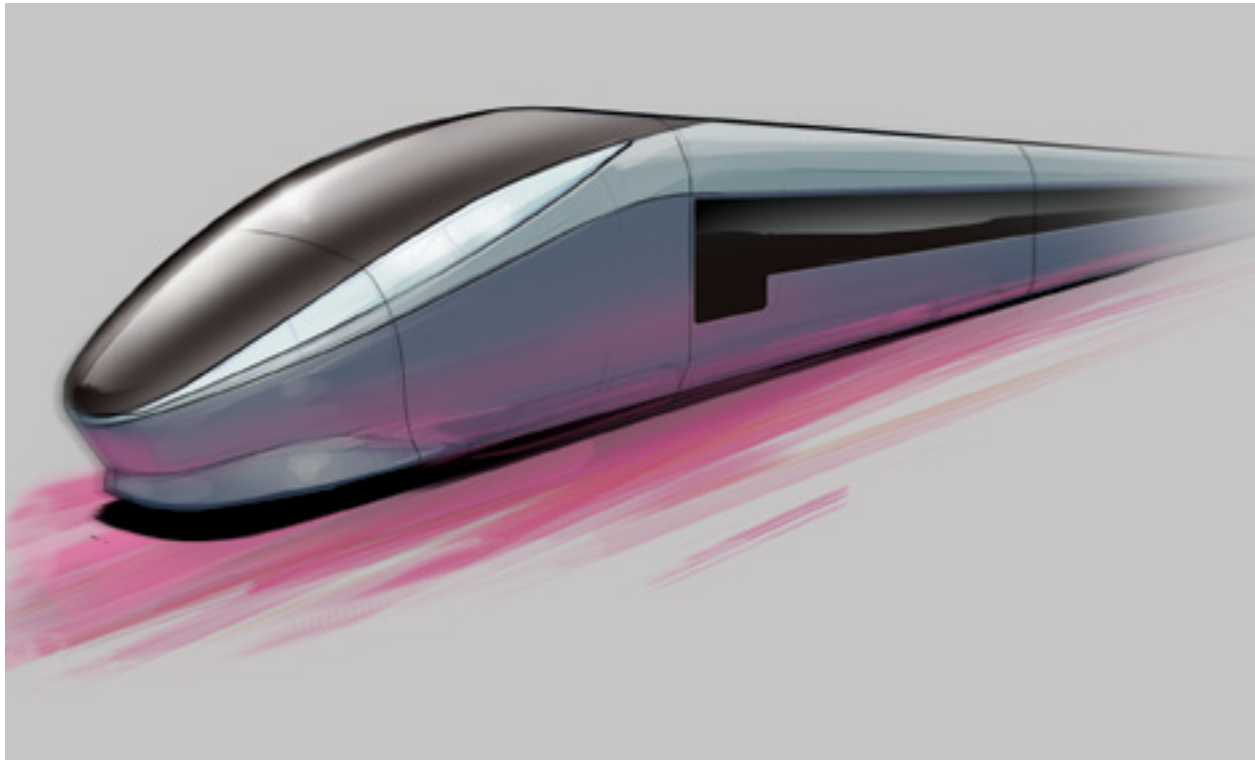
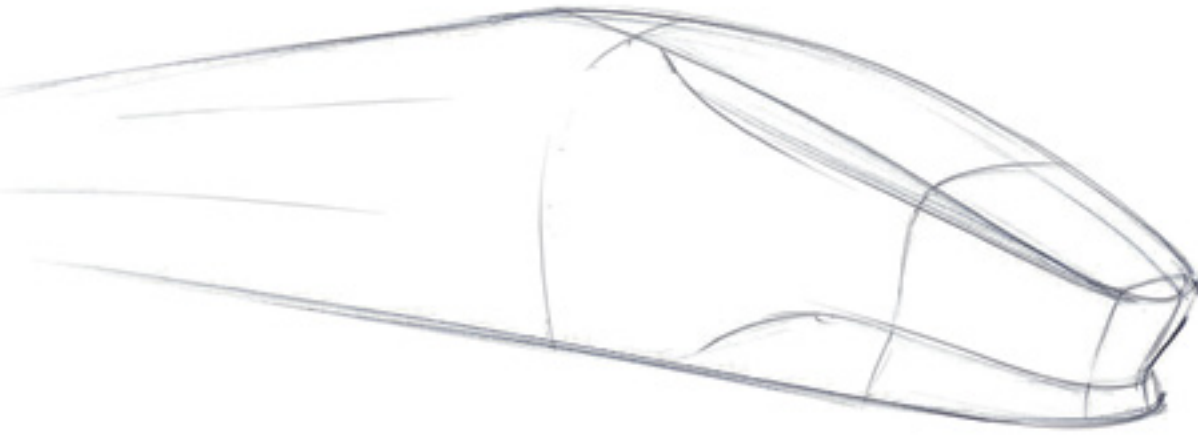
working. Also, when developing the chosen concept, you can also look in the sketch bank for detailing ideas that you can mix in with the concept.

The following pages show a few examples from these. Some has been brought into the concept stage and some are hidden way back in the bunch.





Evolution exercise of the Norwegian high-speed train Flytoget.



SPECIFICATIONS

THIS LIST OF SPECIFICATIONS IS A RESULT OF THE RESEARCH AND SHOULD SERVE AS GUIDELINES TO WHAT THE CONCEPTS SHOULD ACHIEVE ON A TECHNICAL LEVEL. THEY ALSO TAKE COINCO NORTH RECOMMENDATIONS INTO ACCOUNT.

× **SPEED: ABOVE 250 KPH**

To enable the desired travel time from Oslo to Copenhagen, it must be a proper HSR. This sets some requirements to train design in terms of aerodynamics, and a tracks built for very high speeds.

× **HEIGHT: SINGLE-DECK**

In this concept, single-deck is opted over a double-deck solution. There are three main reasons for this: 1) The passenger demand is not seen as high enough to take full advantage of the double-decker, like seen in Central Europe where the cities are much bigger. 2) The travel time is quite low (sub three hours) which means the train sets can manage the route several times a day, enabling frequent departures with a relatively low

number of train sets. 3) A double-decker requires the introduction of stairs that makes the carriages less accessible, and the lower ceilings gives challenges to the perceived comfort.

× **WIDTH: 3,5 METERS**

Following The Green Train's (TGT) advice of a width of 3,5m, which is compatible with rails and stations in Denmark, Sweden and Norway. It makes room for a 2+3 layout of the seat, which is considered necessary when opting for a single-deck unit to lower the total cost and fit enough passengers. According to TGT, the fundamental idea of a wide carriage gives a 15 percent lower total cost for the train traffic⁶.

× **LIGHTWEIGHT**

An emerging positive trend within rail transport is focusing on the weight of the rolling stock. Focusing on lightweight materials and using concepts that cut weight (Jacobs bogies), total weight is lowered and so is the energy consumption.

× **CARBODIES: LONG WITH BOGIES AT THE ENDS. SINGLE DOORS BETWEEN THE BOGIES (QUARTER MODEL)**

The use of long carriages – like seen in Bombardiers Zefiro 380 – is chosen for this concept. It is tried and tested. The use of two single doors per carriage allows for punctual traffic even at peak loading⁶.

× **SEATING: 2+3 SLIM SEATS**

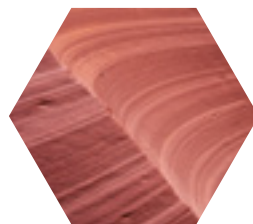
The seating layout research in TGT is thorough and relevant to this concept, and is adopted. With the wide-bodied train with 2+3 it accommodates 25 percent more seats compared to normal width⁶. The use of slim seats help make this possible while retaining leg room.

× **TRACKS: USE OF VIADUCTS**

The train will use existing or future InterCity rail networks in and around the main cities where it stops (Oslo-Ski in Norway). As these are not build for very high speed because of factors like dense population and the geography, the remaining lines between these areas should be as

straight as possible to enable very high speeds so the total travel time is as low as intended. The concept therefore suggests that a substantial amount of elevated tracks – built on viaducts – is used. This technology is one of the breakthroughs of modern HSR. A fast construction period means easier access to loans and Public Private Partnership (PPP) finance models. It reduces the financial risk for the involved stakeholders, since the project will not generate revenue before trains are in operation and tickets are sold. 86 percent of the 1302 km long high-speed railway between Beijing and Shanghai is elevated, and it was built in only 2,5 years (Beijing–Shanghai High-Speed Railway). Although the visual footprint is larger than regular built railway, the footprint on the soil is minimal, something that should be strived after as the proposed line would cross cultivated land. It also removes the problem with crossing roads, other railways and animals.

DIRECTIONS



THE RESULTS FROM THE INITIAL SKETCH PHASE WAS SOON DIRECTED INTO SEVERAL DIRECTIONS. THREE OF THESE WERE THEN DIFFERENTIATED AND FURTHER DEVELOPED.

This phase of the project has influenced – and been influenced by – the identity process and brand strategy. The outcome aims to be a result of a merge between:

- 1) Research and identity
- 2) Specifications and demands
- 3) The designer's intuition and aesthetic vision

The concept itself wants its Scandinavian recipients to feel and mean something. It – as also discussed in the brand identity chapter – aim to have a relation to the Scandinavian identity. Stating this is walking on a knife-edge between clichés and an angry mob, but setting these boundaries are important to the development of the concept – and to create an interesting design.

To do this, I have tried to sum up my research into some keywords of what Scandinavian form can be:

- × Geometric inspiration
- × Minimal styling
- × Functional
- × If organic: with contrast
- × If hard: with a human touch

It seems valuable to also state what I don't think Scandinavian form is:

- × Very organic
- × Decorative
- × Stretched

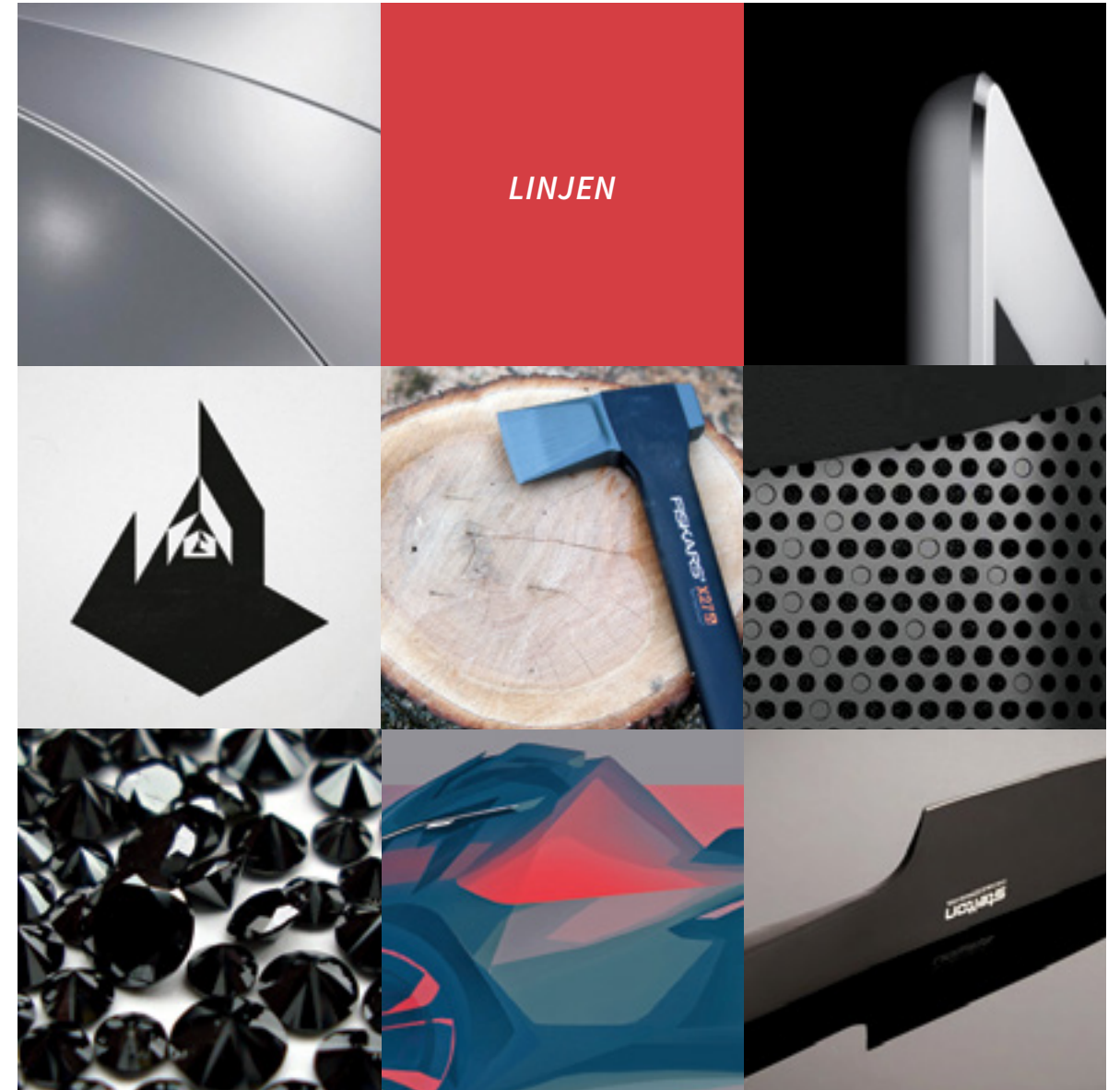


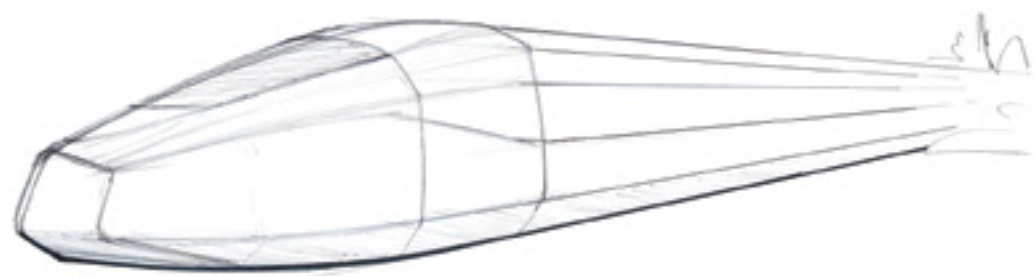
ORGANIC FACET

DIFFERENTIATES FROM THE EXISTING DIRECTION OF HIGH-SPEED TRAIN DESIGNS.

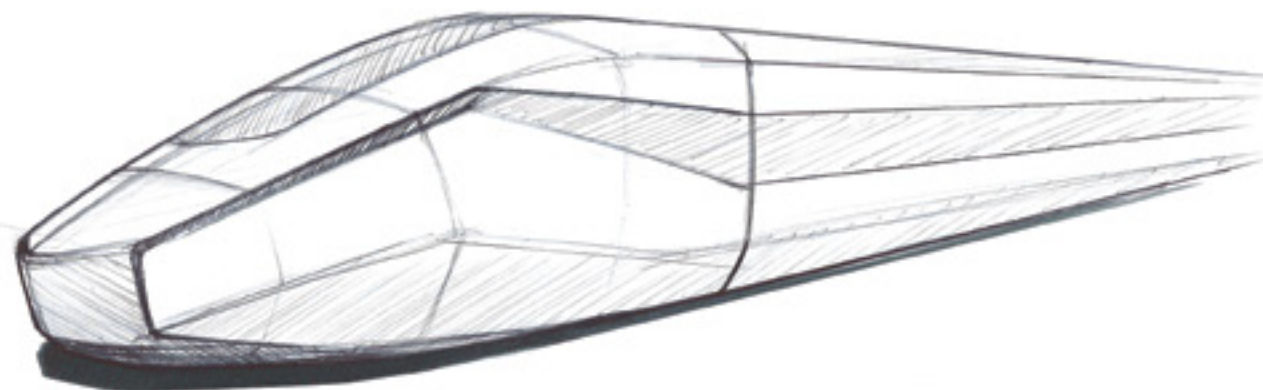
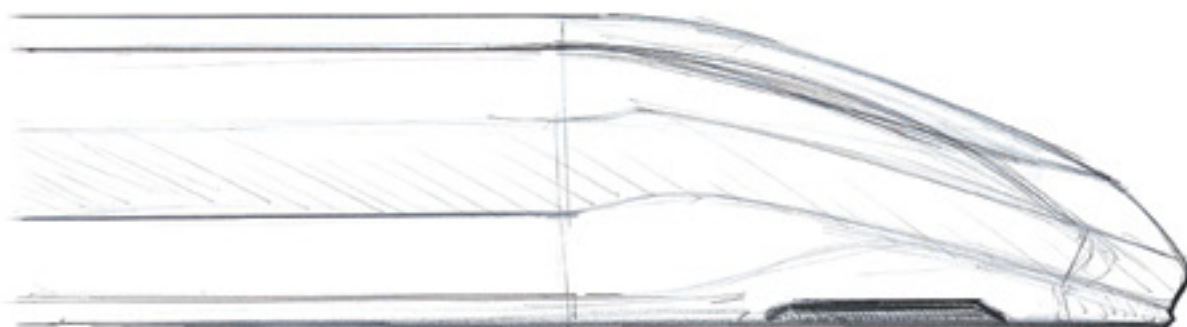
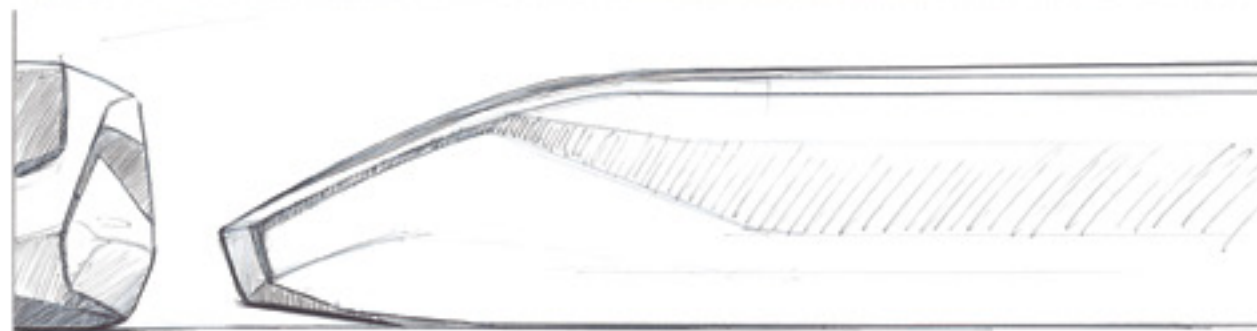
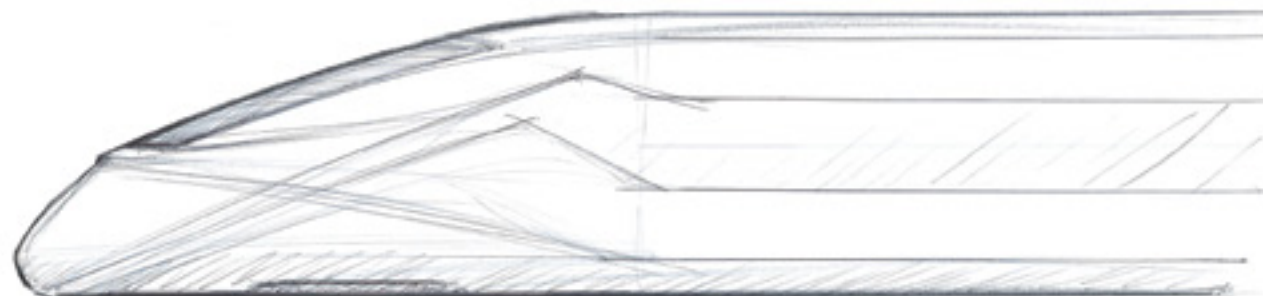
It explores the aerodynamics of hard surfaces and takes inspiration from other modes of transportation and products.

Its sharp character can be used to emphasize the Linjen brand, and its use of form and materials can be provoking, but also forward-leaning and a forecast of what will come.

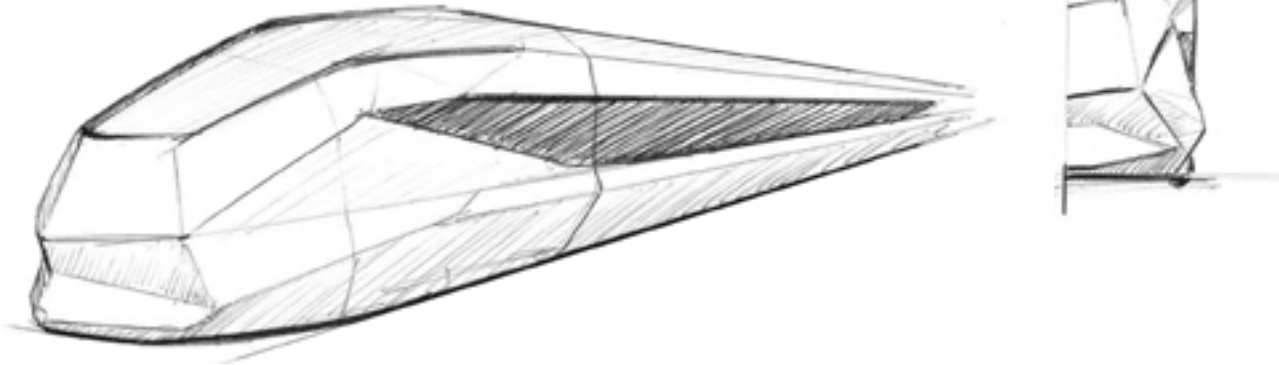




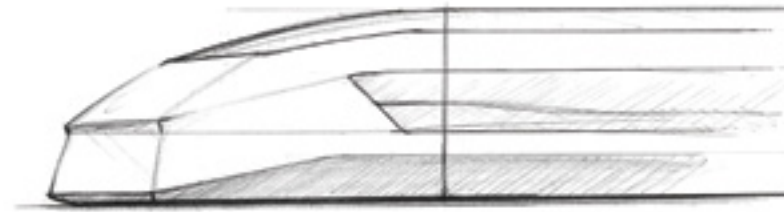
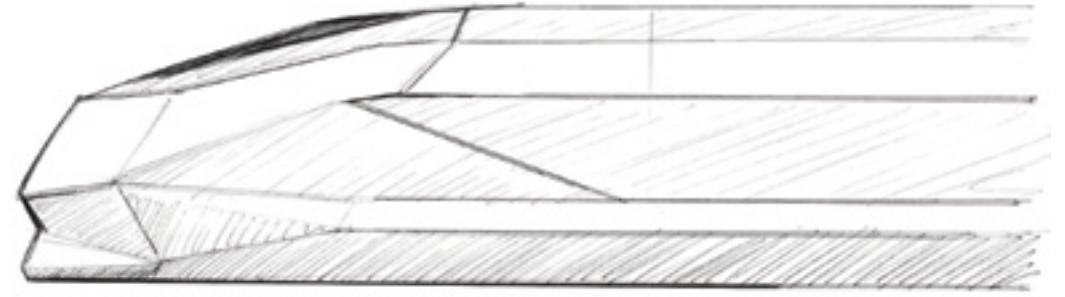
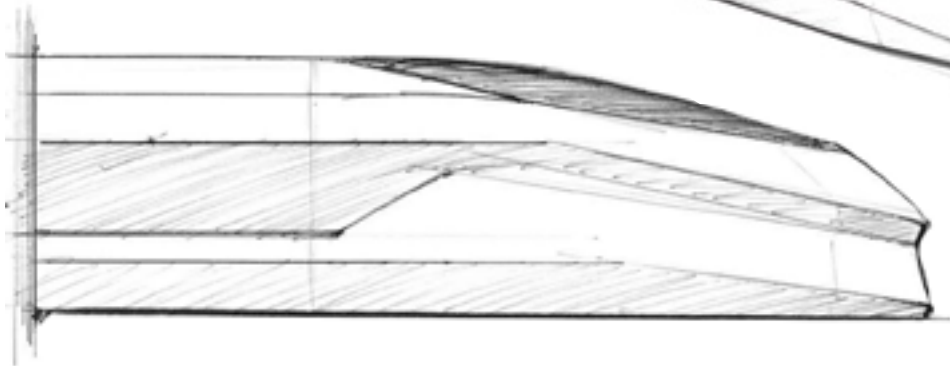
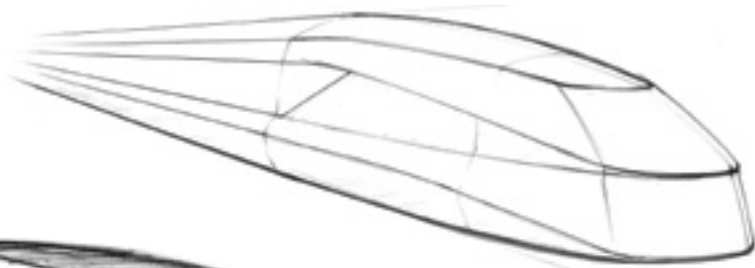
IDEATION



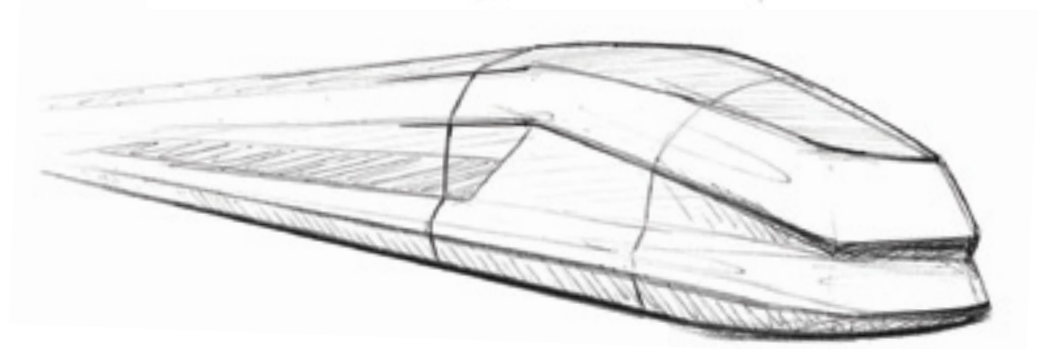
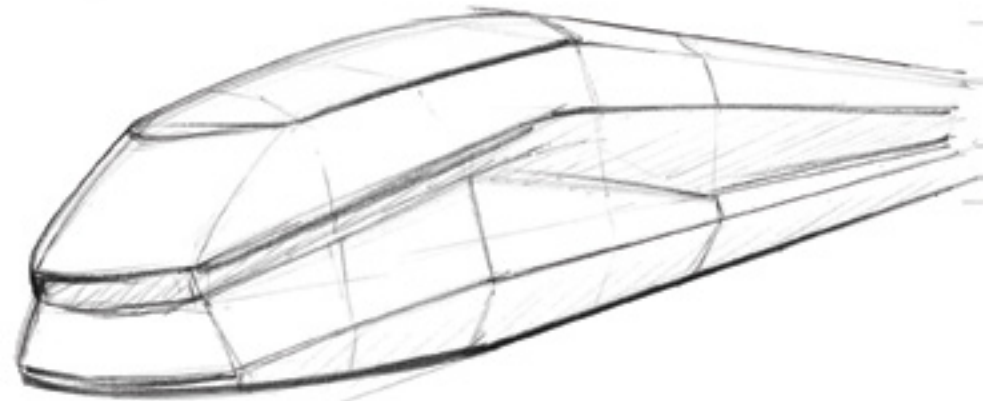
Very sharp facets. Needs to be more organic.



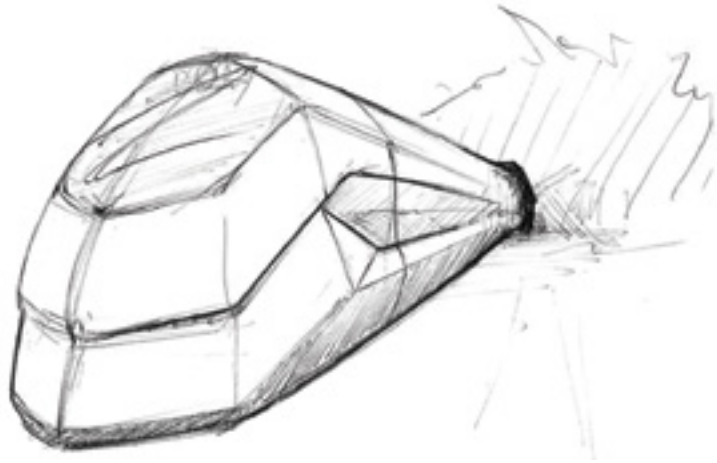
IDEATION



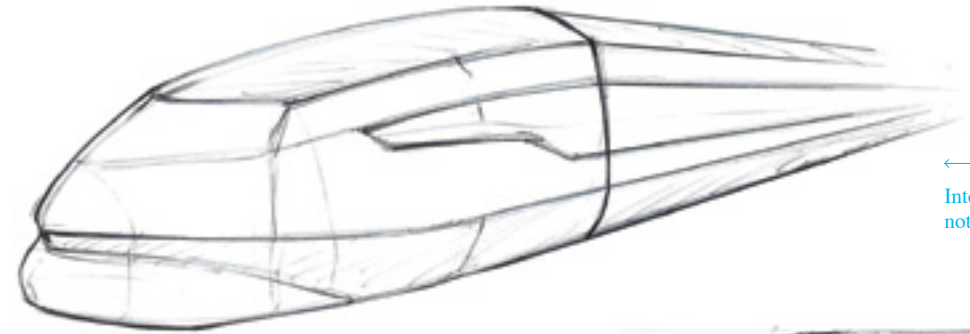
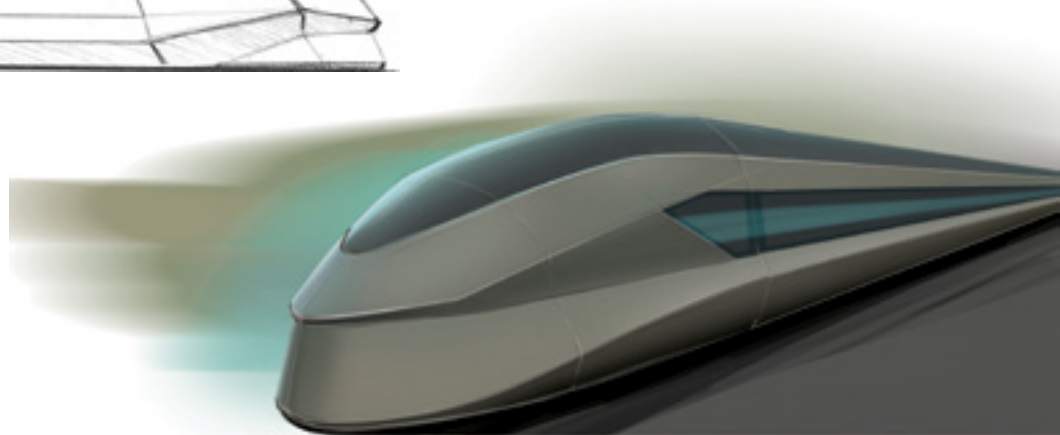
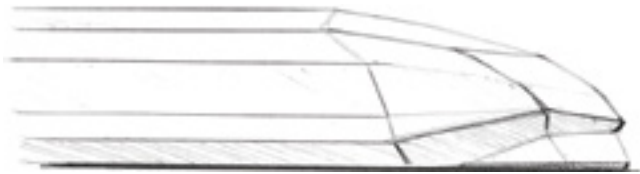
Better mix between organic and faceted.



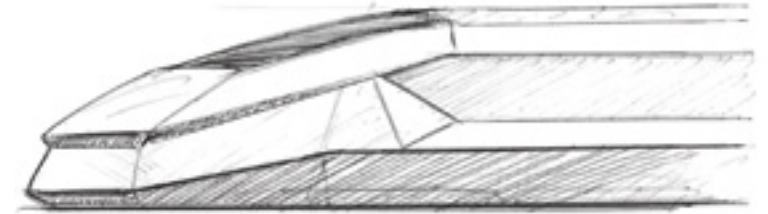
Very muscular looking.
Probably too mean.



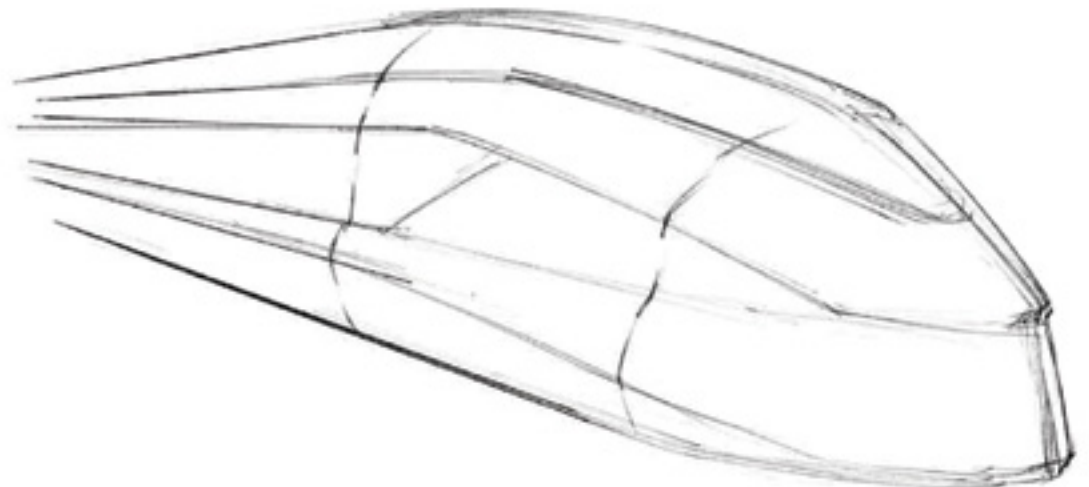
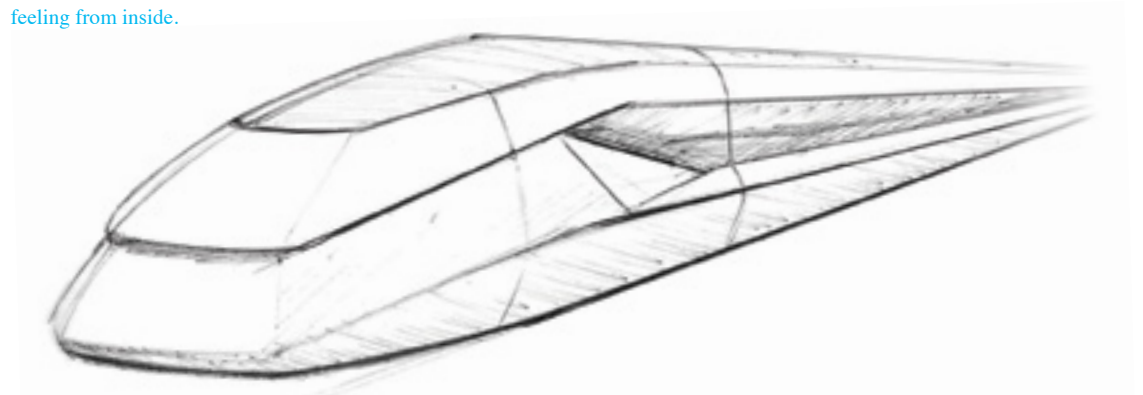
REFINEMENT



Integrated snow plow. But
not that much needed?



Interesting upward facing
surface below the side
windows. Can create a safe
feeling from inside.





*CLAY
SKETCH
MODEL*





ORGANIC FACET SUMMARY

THIS CONCEPT HAS A LOT OF POTENTIAL. THE COMBINATION OF THE ORGANIC AND THE FACETED IS INTERESTING AND SOMETHING I THINK WE WILL SEE MORE OF IN THE YEARS TO COME.

It might have its skeptics when speaking of aerodynamics, but looking at jet fighter aircrafts, it is reasonable to think that one can overcome these challenges.

The facets should be used functionally, like in the front for enhancing the snow plow, and they give good opportunities to incorporate other functions into the design.



It has its strength in differentiating from other high-speed trains (HST), but the link to a Scandinavian identity is harder to argue for, even though it fulfills some of the keywords like organic with contrast and functional.

Although I see a lot of potential in the sketches, I do think some of its character is being lost through the Photoshop render (above). This concept definitely needs to be further refined and tuned to get the essential qualities of it visible – and not just looking like a science fiction concept.

↑
Some clear cut facets mixed with organic surfaces. Thin light strips integrated in the small front facet.

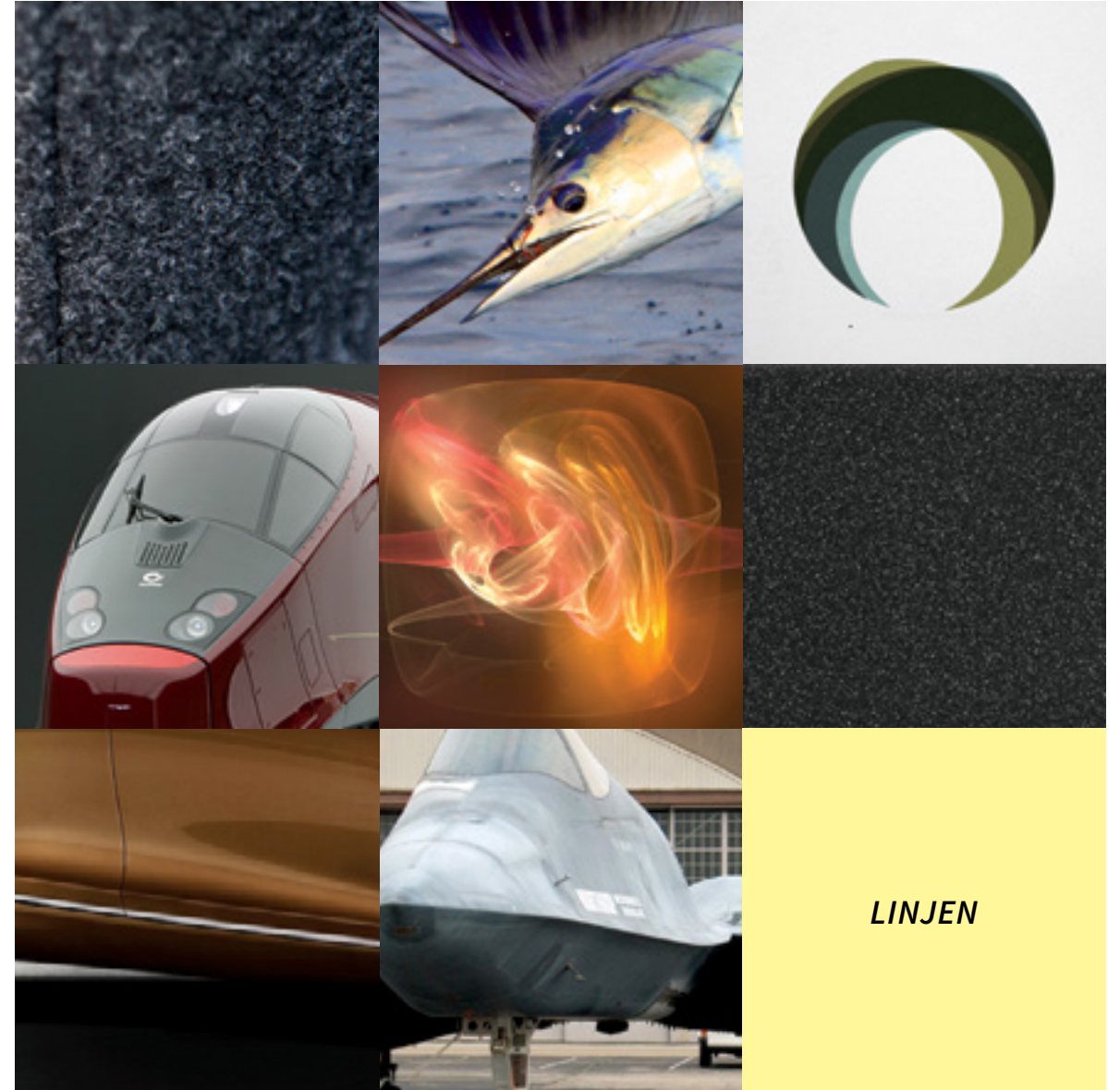


FLUID

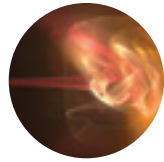
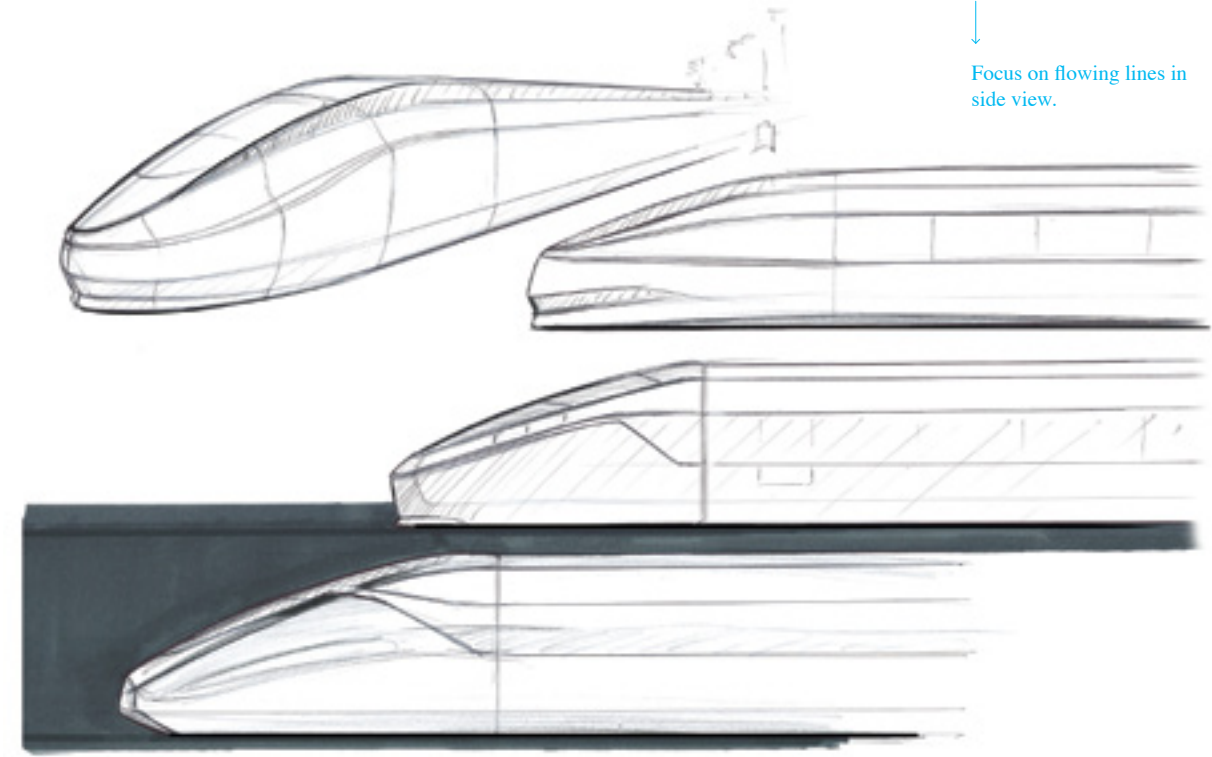
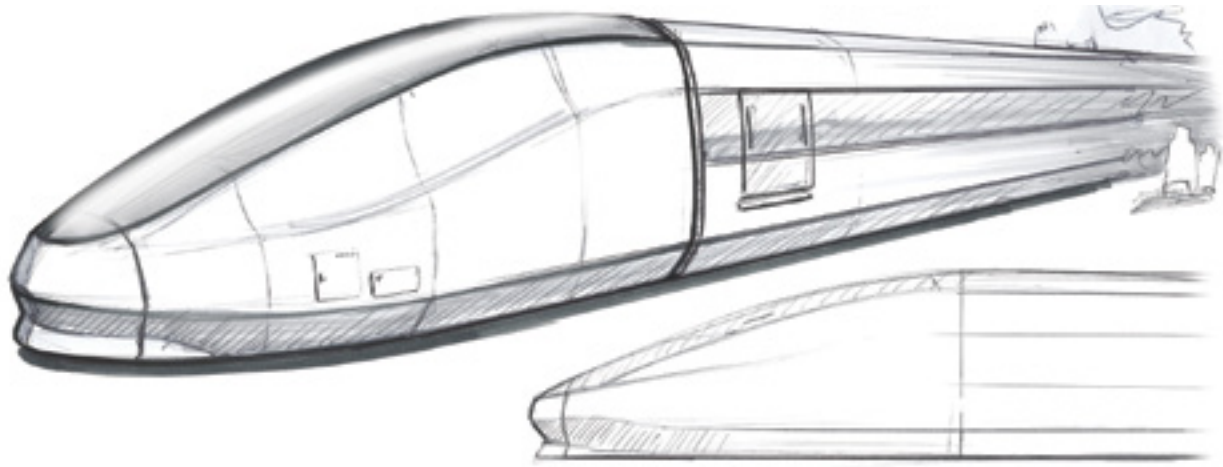
THE MORE TRADITIONAL HIGH-SPEED TRAIN DIRECTION IN TERMS OF SURFACES AND SHAPES, BUT AT THE SAME TIME LOOKING FOR THAT SCANDINAVIAN EDGE.

Lines should be flowing, but in a rigid matter to create a holistic appearance. The expression is aerodynamic and it gives the impression of flowing through the landscape with ease.

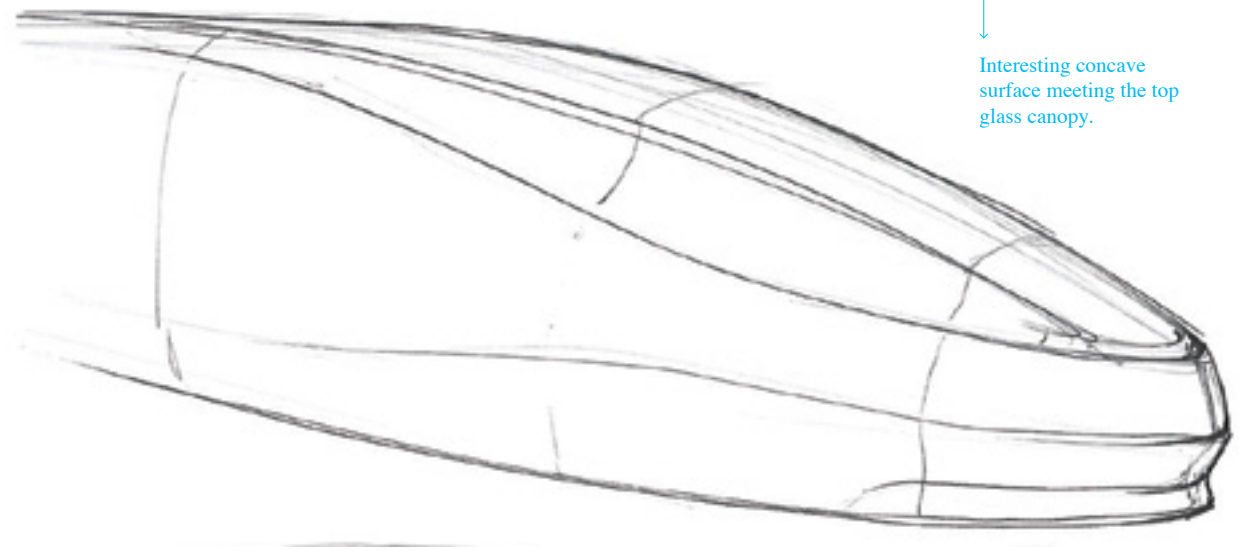
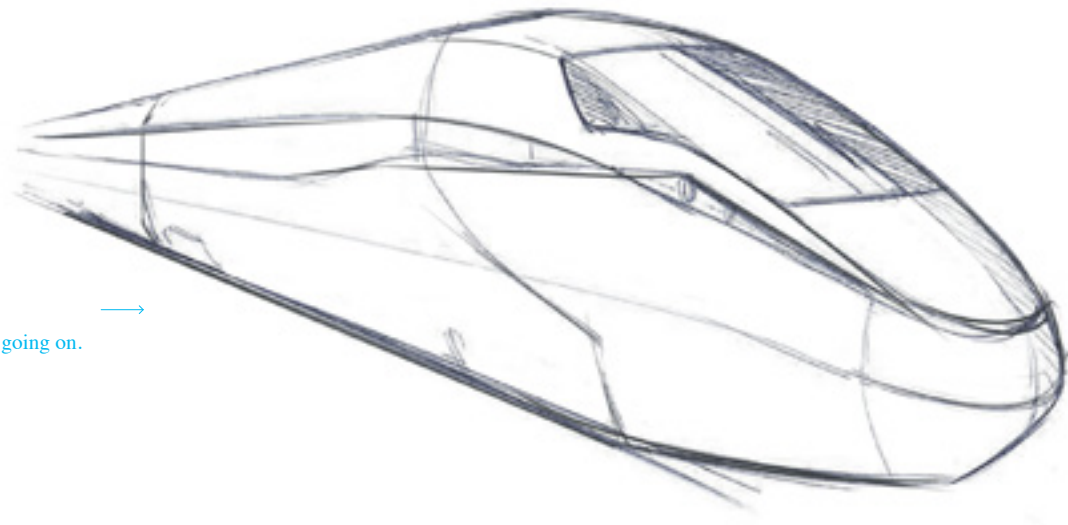
Form inspiration from nature, but maybe even more from existing planes and trains.



LINJEN



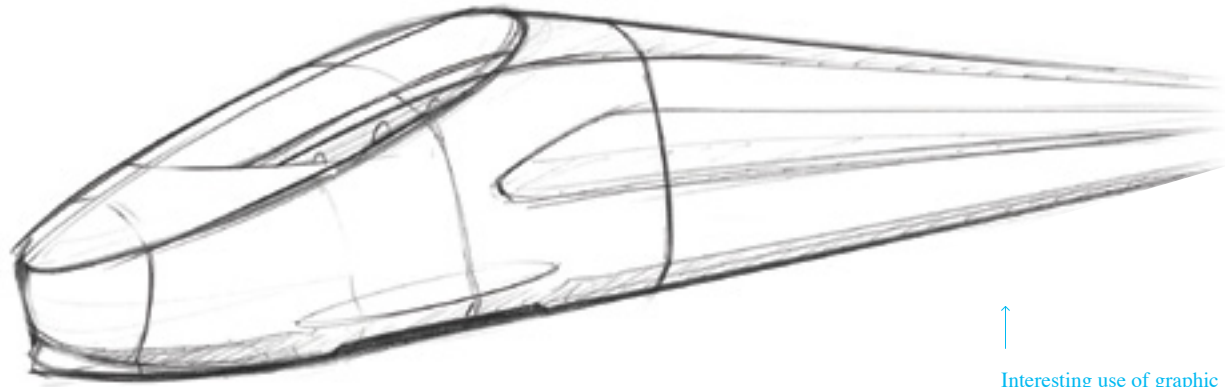
IDEATION



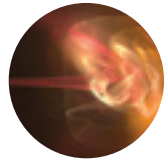
Too much going on.

Focus on flowing lines in side view.

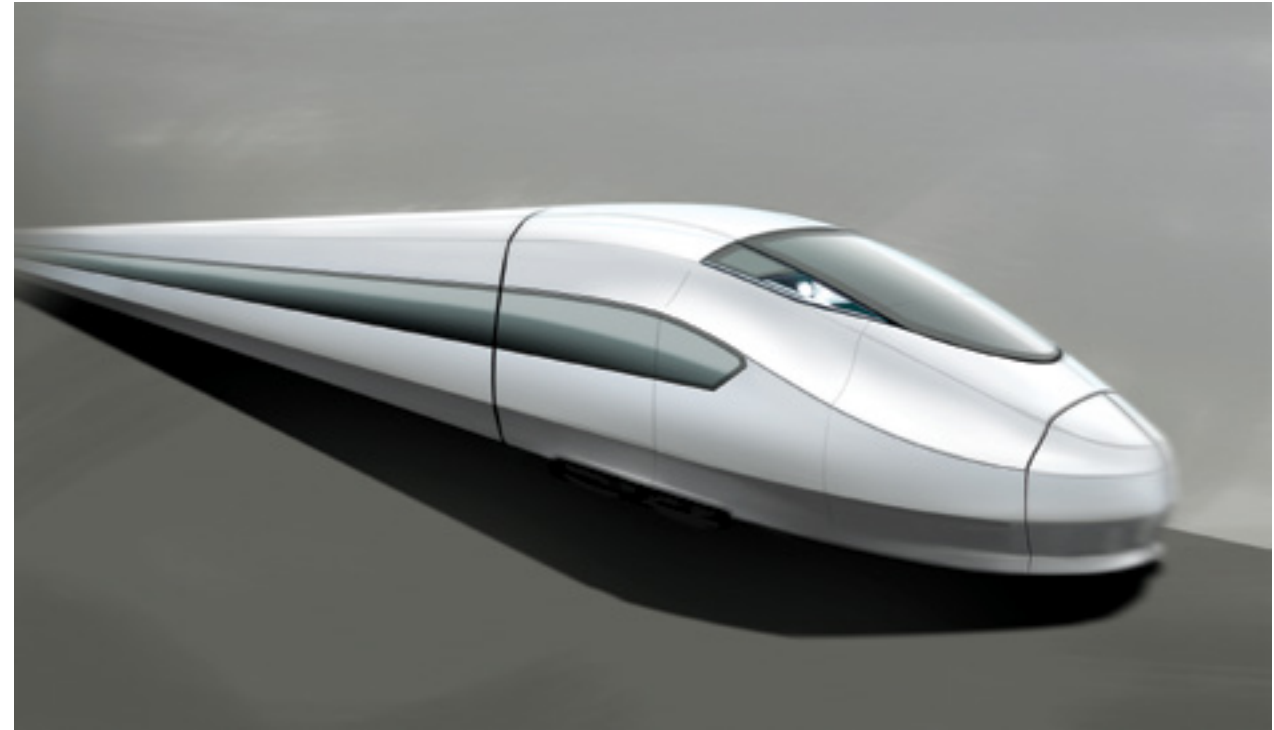
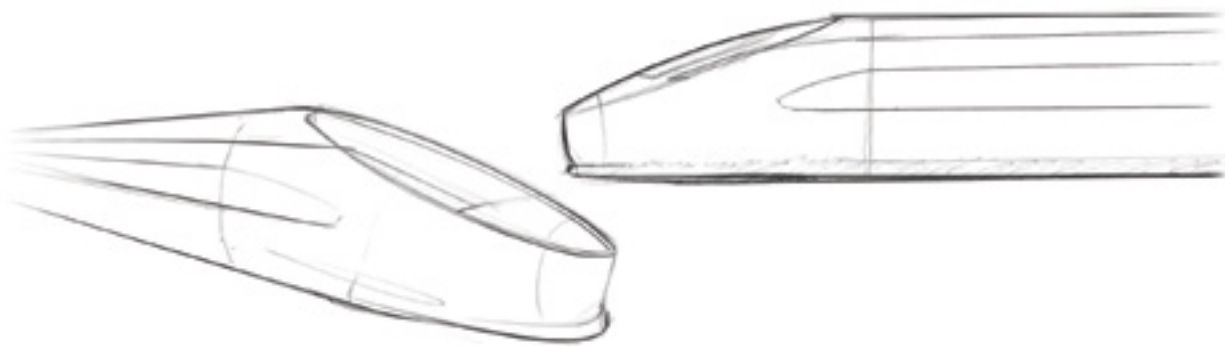
Interesting concave surface meeting the top glass canopy.



↑
Interesting use of graphic element to close in an area with canopy and lighting.



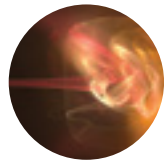
REFINEMENT



↑
One interesting element (concave surface) is not enough to create an interesting overall shape.



→
Panel for integrated lighting along with glass canopy.



*CLAY
SKETCH
MODEL*

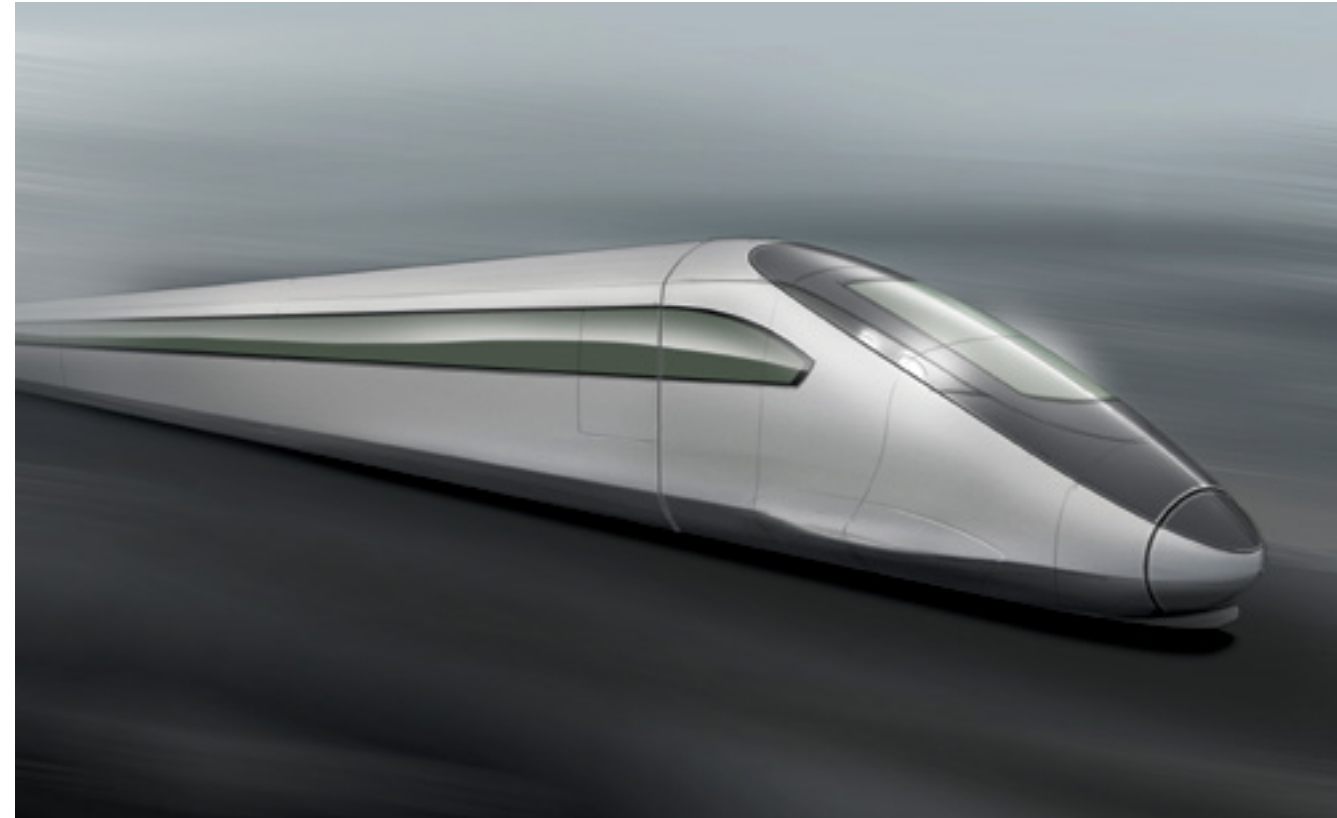




FLUID SUMMARY

AS OPPOSED TO THE ORGANIC FACET CONCEPT, THIS HAS A MUCH MORE CONVENTIONAL LOOK AND STYLE.

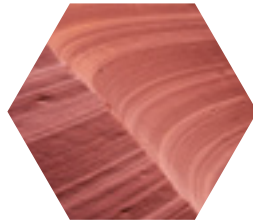
Fluid is a clean and minimal concept where a lot of its overall quality will rely on the details. The big contrasted front glass surface is not new in HST designs, but here it is taken to the extreme and really integrated into the design. Its use of flowing lines is important to the harmonic qualities, and so are the tweaking of surface details, like the concave surface above the first bogey.



As with the organic facet concept, its Scandinavian link does not really shine through, even though it's a subtle and minimal design. This needs to be addressed if the concept is developed further.

One of its strengths is the aspect of realism. It could end up as a very believable concept, but care must be shown to not end up looking like other HST's like the Alstom AGV or the Bombardier Zefiro 380.

↑
A form that expresses ease more than speed. It gives a feeling that it doesn't need much effort to flow through the landscape.

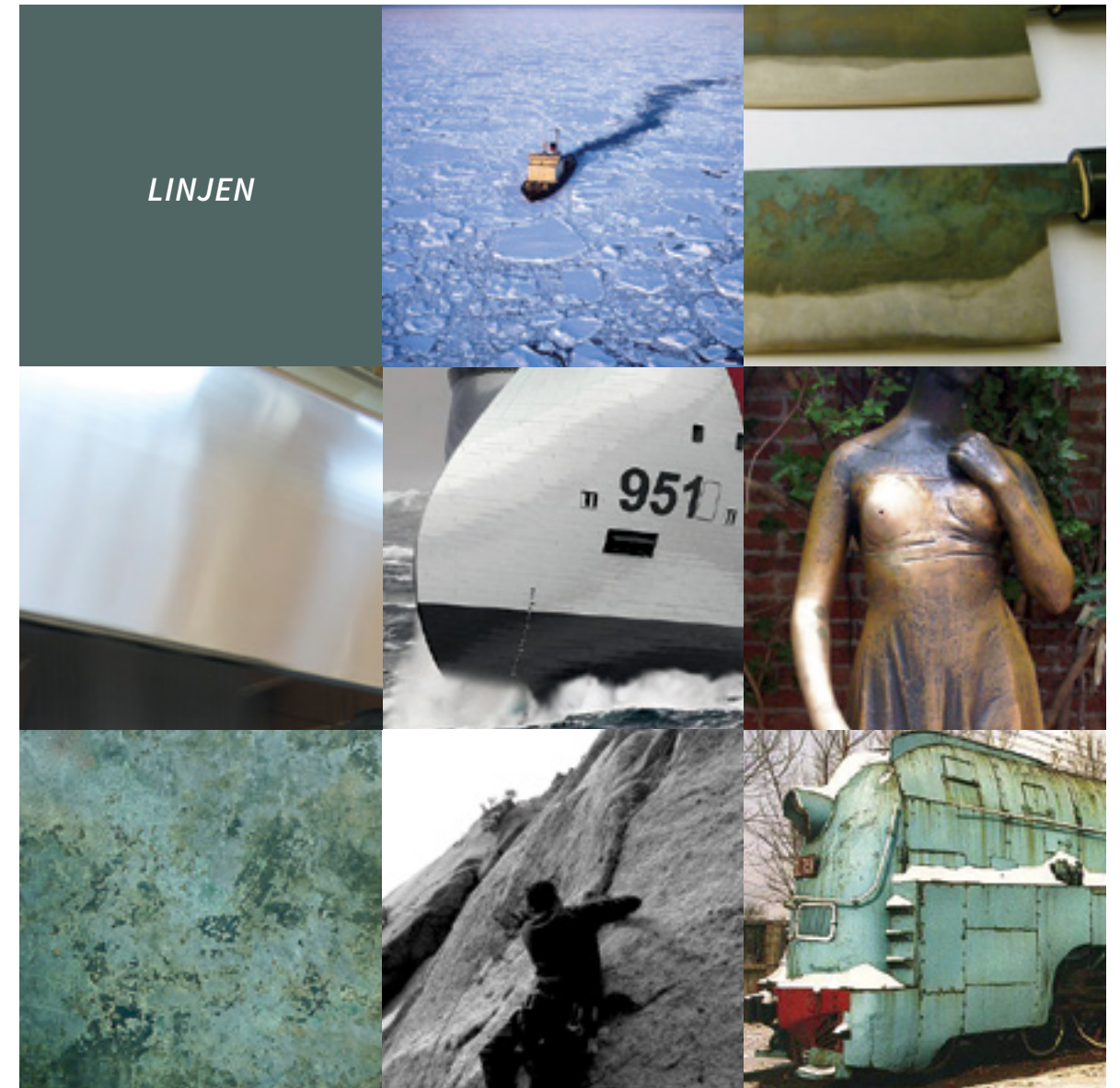


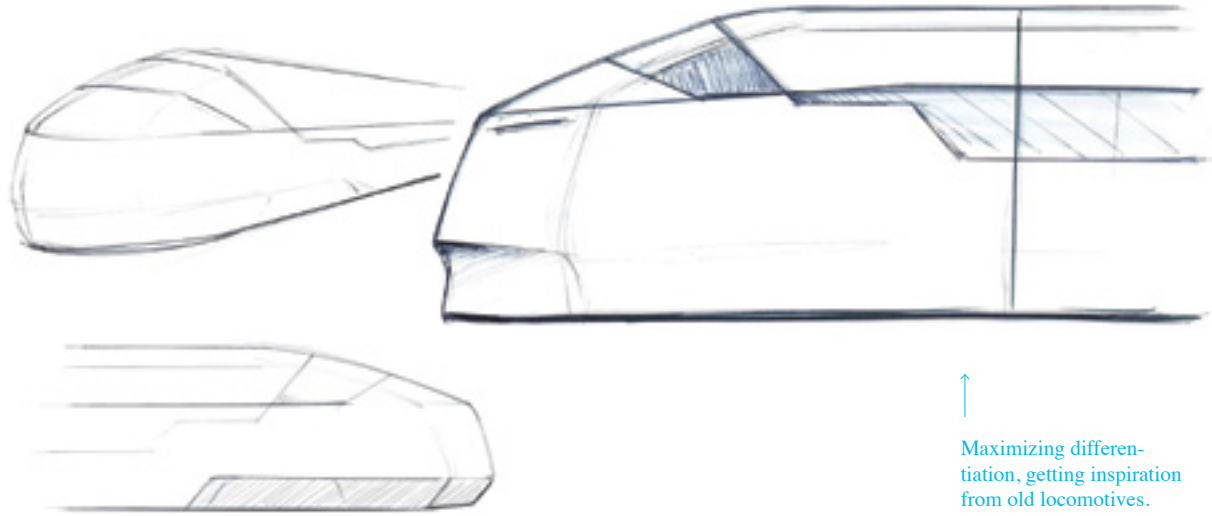
SHAPED BY TIME

THIS CONCEPT PORTRAYS SOMETHING RUGGED THAT HAS STOOD THE TEST OF TIME. IT IS STRONG ENOUGH TO HANDLE THE WEATHER AND CHALLENGES THAT COMES.

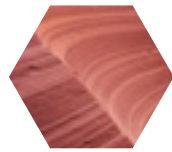
Details and shapes that can be contrasted through form and material, emphasizing where the wear and tear is taking place – but of course in a convincing way that shrugs of the forces of nature.

It should have a characteristic appearance that emphasizes a safe feeling. Something that will take you where you want by plowing its way.

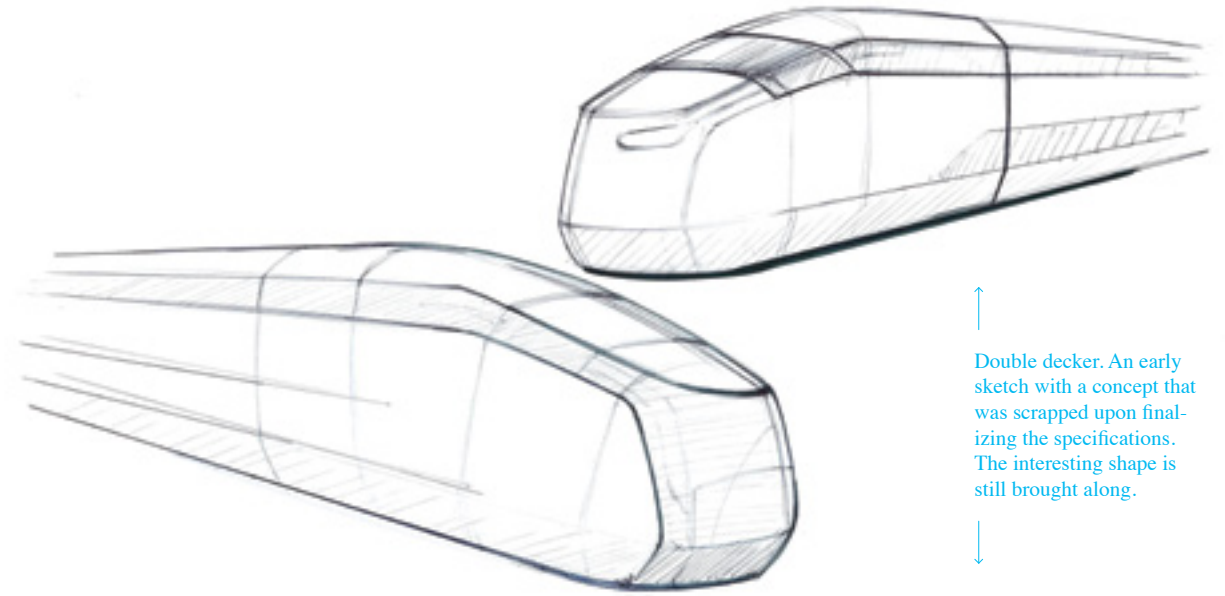
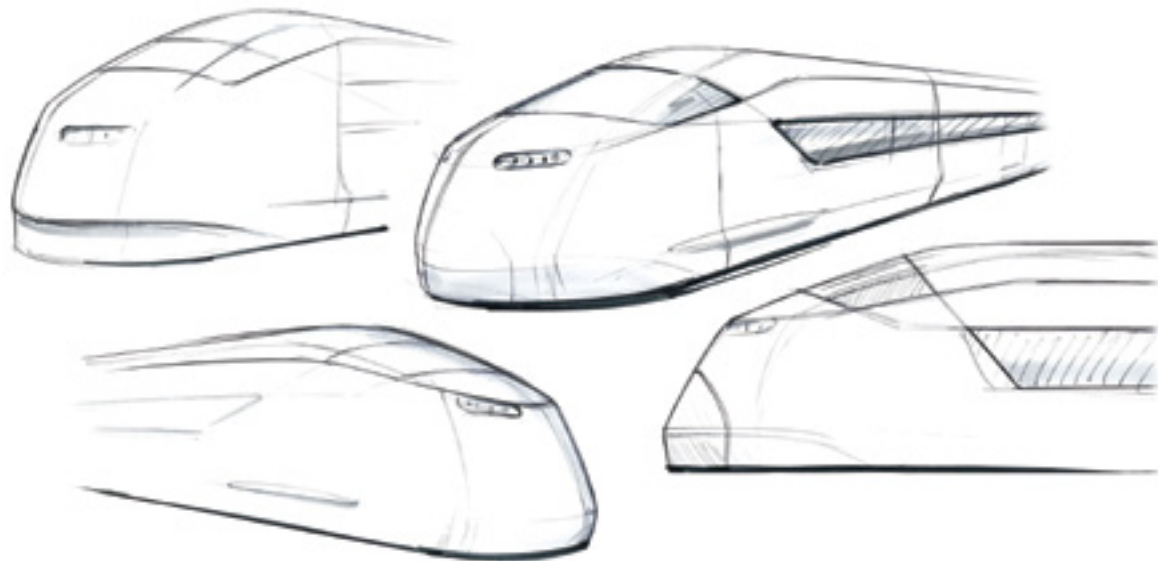




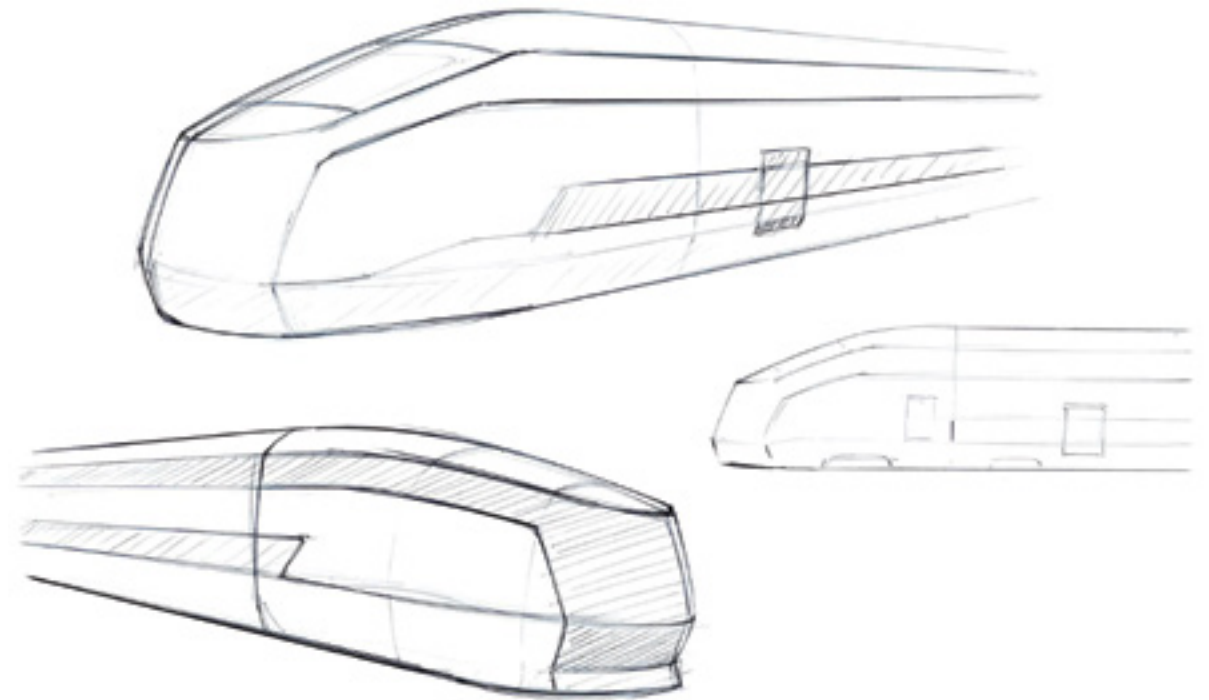
↑
Maximizing differentiation, getting inspiration from old locomotives.

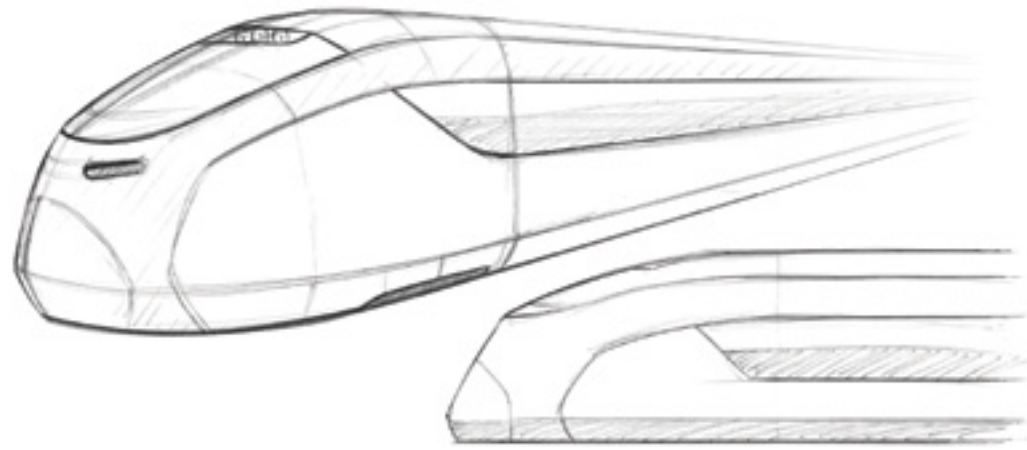


IDEATION

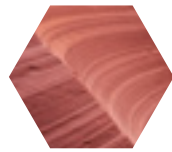


↑
Double decker. An early sketch with a concept that was scrapped upon finalizing the specifications. The interesting shape is still brought along.
↓

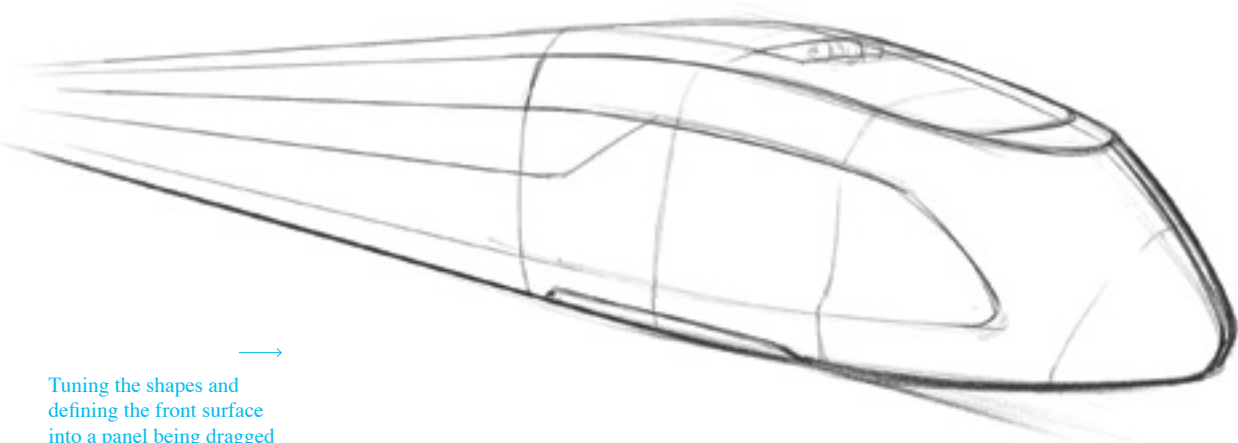




↙
Not looking very fast.

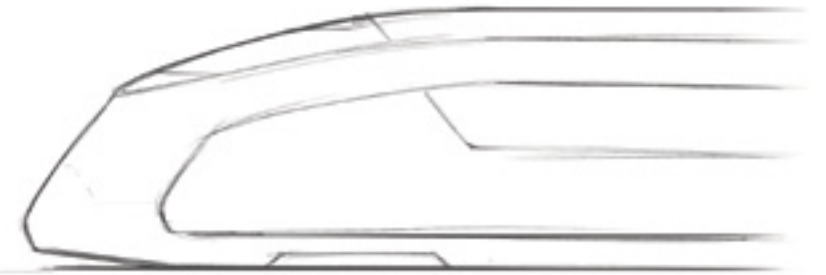


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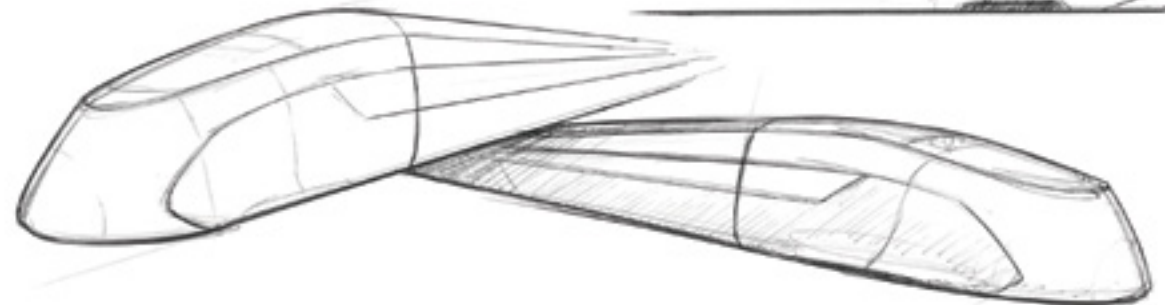
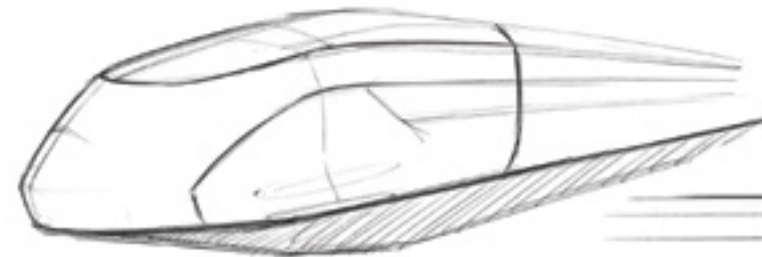


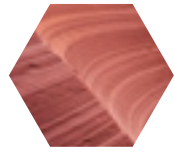
→
Tuning the shapes and defining the front surface into a panel being dragged backwards.

→
Two tone idea from the upper glass to the front surface.



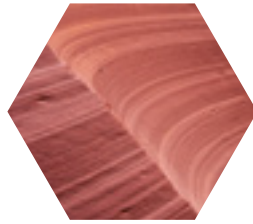
↙
Proportions starting to look good.





*CLAY
SKETCH
MODEL*



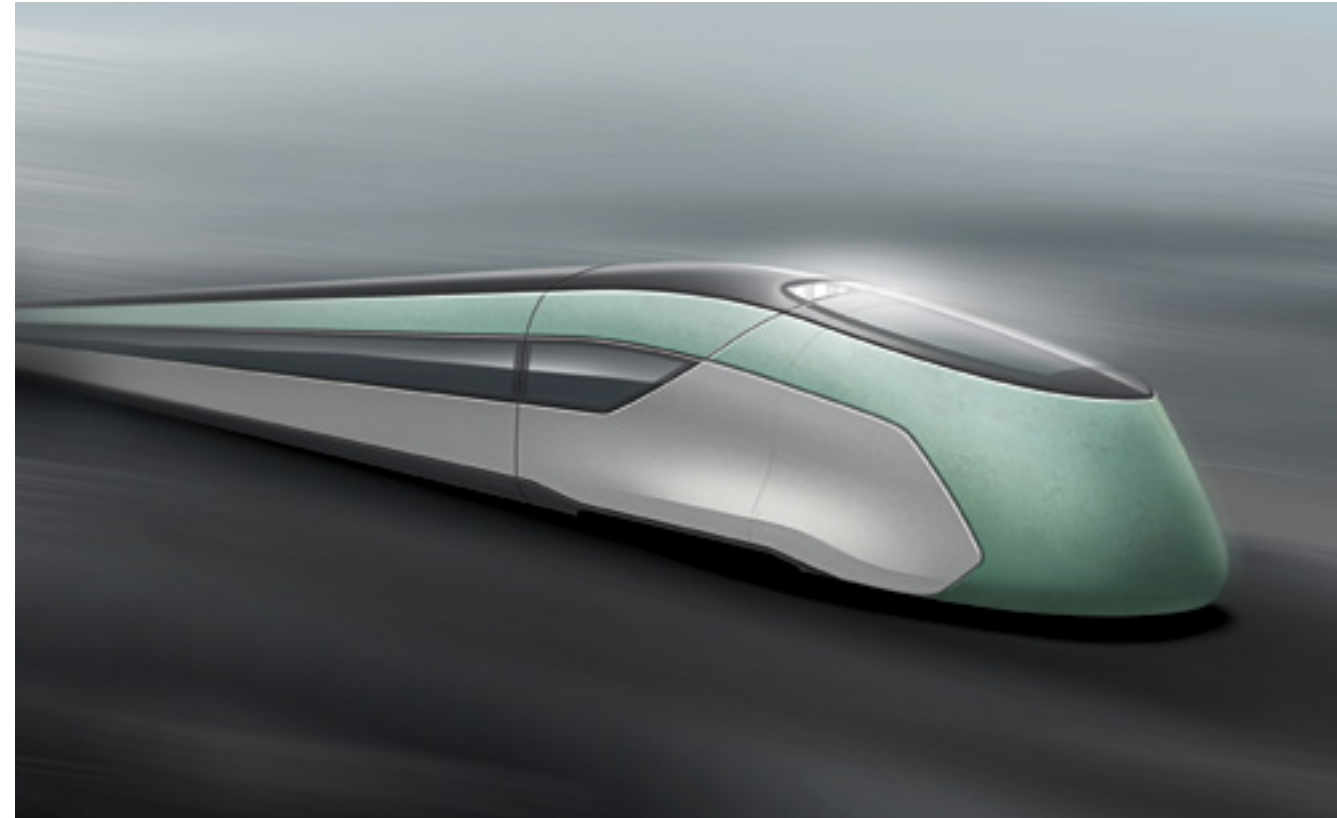


SHAPED BY TIME SUMMARY

THIS CONCEPT HAS THE BIGGEST STORYTELLING ASPECT, AND THAT MIGHT ALSO BE ITS BIGGEST STRENGTH.

With a front surface looking like it has been grinded back by the forces of nature, this is also intended to be a copper surface.

This surface will start off with a bright and shiny penny shade, but gradually get patina and eventually starting to look green. This process actually preserves the material and protects it from the elements, something that can create some really interesting effects as



the most exposed areas will go through this process quicker than the less exposed areas, creating a play of color and patina.

The form in itself is somewhat distancing it from other HST on the market, but its high-standing character does give somewhat of a link to the Norwegian Flytoget. This strong characteristic can be seen as a quality and give a feeling of safety. A train that doesn't get stopped by the weather.

Compared to the other two concepts, it might relate more to a Scandinavian identity, but this also needs to be addressed if taken further.

↑
Copper introduced as material for the front surface being stretched backwards.

CHOICE OF CONCEPT

WHEN CHOOSING THE FINAL CONCEPT, IT WAS VALUABLE TO GO BACK AND LOOK AT THE OVERALL SCOPE OF THE PROJECT.

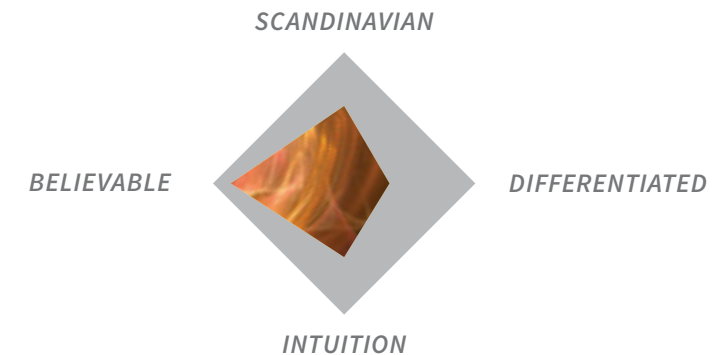
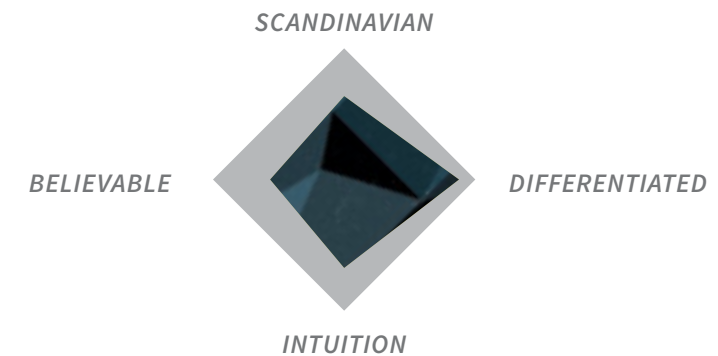
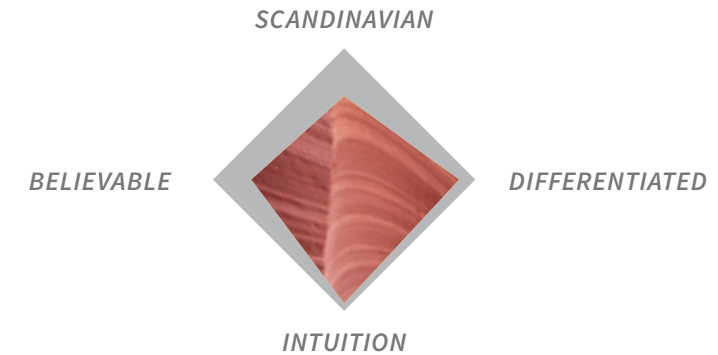
To weigh the three concepts, I created a diagram with four parameters to help clarify the wanted qualities.

- 1) It is important that the final result sticks out and hopefully creates a stir in the debate, and is not just something that passes quietly. I translated this into the term differentiated.
- 2) Believable within the concept setting has been important through the whole process, and is where the technical requirements meet the concept proposals.
- 3) The Scandinavian identity that has been so important in the brand strategy foundation should also be reflected in the design concept. If successful, this will help create a total brand experience that is united, more than if it feels like a train that has been “branded”.

- 4) Finally, the intuition. In some ways a sum of the previous three, but also adding other factors that cannot easily be described. It says something about the potential within the concepts.

The diagrams on the right is a summary of how the concepts score, and they also reflect the discussions with my external supervisor, Svein Gunnar Kjøde, concluding with the shaped by time concept as the one to take further.

It has character and potential, and adds the storytelling aspect that is interesting. We saw a lot of potential in the organic facet concept, but came to the conclusion that it has too many uncertainties along with its lack of Scandinavian link. The fluid concept came in short as “just another nice looking train” – especially compared to the other two.





CONCEPT DEVELOPMENT

REALITY CHECK 2: FLYTOGET OPERATORS



AFTER CHOOSING THE SHAPED BY TIME CONCEPT, I MET WITH OSLO AIRPORT EXPRESS – FLYTOGET – OPERATORS TO GET THEIR INPUT ON A HIGH-SPEED TRAIN CONCEPT.

Jon E. Johansen is an experienced train operator from both regional NSB routes and Flytoget. He invited me to their headquarters at Posthuset by the Oslo central station. I presented the project and we discussed pros and cons. Some of his colleagues also dropped in to watch, and I was almost surprised by their acceptance of the concept. They enjoyed that it pushed some boundaries of conventions in train designs, but had

also valuable feedback and criticism.

Even though the windshield is of a bit to narrow angle to be feasible in production, they said the field of view should not pose a problem for them. They actually prefer a narrow view, and side windows are only used as emergency exits. – To see too much is disturbing, we need to be focused on what's up ahead, Johansen said.

I learnt that the headlamps of a train have to form an isosceles triangle so they are not to be confused with cars. Having one above the cockpit is not a problem, but it should not be the high beam headlamp, as it would decrease

↑
Experienced train operator
Jon E. Johansen.



↑
Our view from
Flytoget when passing the
Lillestrøm station.

the vision of the operator in low light, foggy, rainy and snowy conditions. When used on the back of the train, there should be two red lights on a horizontal axis clearly visible.

Concerns about snow on the tracks and the train's ability to plow was – according to the operators I talked to – not a problem. When trains run frequently on a line, the snow that has

fallen between departures is blown away by the air pressure. However, a small plow should still be considered.

After the meeting, I was invited to join them on a trip with Flytoget. Johansen showed the cockpit while his colleague was operating the train, and after stopping at The Oslo Airport, he showed the exterior functions and features.

“To see too much is
actually disturbing”

- Jon E. Johansen

CLAY MODELING

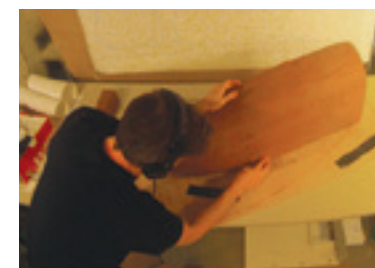
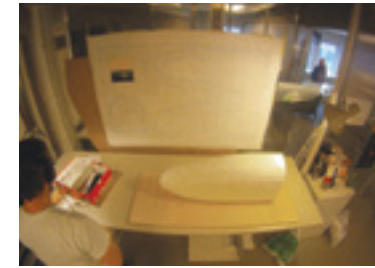
TO DEFINE AND REFINE THE CHOSEN CONCEPT, I STARTED CLAY MODELING IN 1:10 SCALE.

The reason for choosing clay and a scale that big was that I have really good experience with working with this medium in transportation design. The large size (900x380x175mm) lets you work fast and precise, even with details.

After modeling up the first iteration from the package (blueprints) based on the sketches, it was easy to evaluate what was working and what was not. The medium lets you redesign on the fly and get immediate results. Also going back to the drawing board while looking at the current clay version was valuable.

An example of strength in the clay modeling technique was when completing modeling the original package in clay. A lot of the characteristics from the

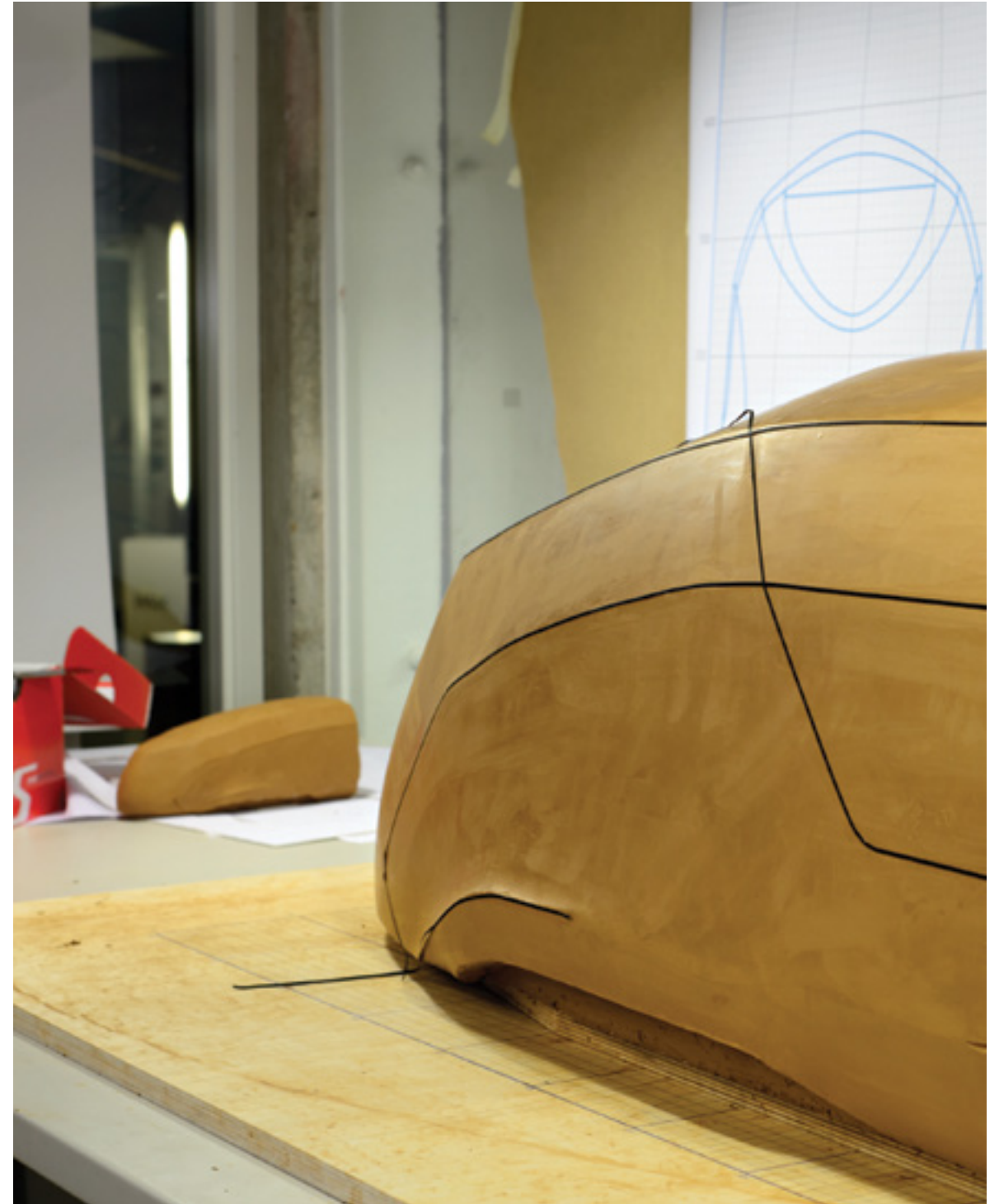
sketches were lost in the package-phase. The top of the nose was too low and the bottom too high. It looked good in the 2D views, but in reality it had lost a lot of character. Within an hour of tweaking and adding clay, the characteristics were restored. I will argue that this translation phase between sketches and CAD is extremely important. Going straight to CAD will lead to a lot of design information getting lost – or never to be found – resulting in a more dull end result.



Early stage of refining surfaces and lines. Notice the silhouette lacks snap and is too dull. The nose top is too low and the design looks more generic that intended in the sketches.



The final clay version. The silhouette is not just a dull curve, but has a lot more tension. Top of the nose is a little higher and much more defined. Overall surface tuning and detailing of the bogey cover is complete.





Final clay model in side view. Rear is stretched in photoshop to represent more of the design.



REALITY CHECK 3: BOMBARDIER VISIT

FOR TWO DAYS AT BOMBARDIER OUTSIDE BERLIN, I WAS ABLE TO TEST MY CONCEPT AND LEARN FROM PROFESSIONALS.

← Bombardier transportation site in Hennigsdorf outside Berlin has 2500 employees.

✓ Michael Sohn, head of industrial design for Germany and Scandinavia in Bombardier transportation.

↓ The full scale mockup of the Bombardier Zefiro 380.



I was lucky enough to be invited to Bombardier in November. The agenda for the two days started with me presenting my project for designers, aerodynamic and crash specialists. At that stage the concept was chosen, the clay model was finished and CAD modeling was underway, so some early renderings were shown in addition to the concept sketches and clay photos.

The discussion that followed was highly valuable. Of course, these people are experts and used to work with this every day, but they accepted that it was on a conceptual level and that my experience with train was limited, and gave feedback thereafter.

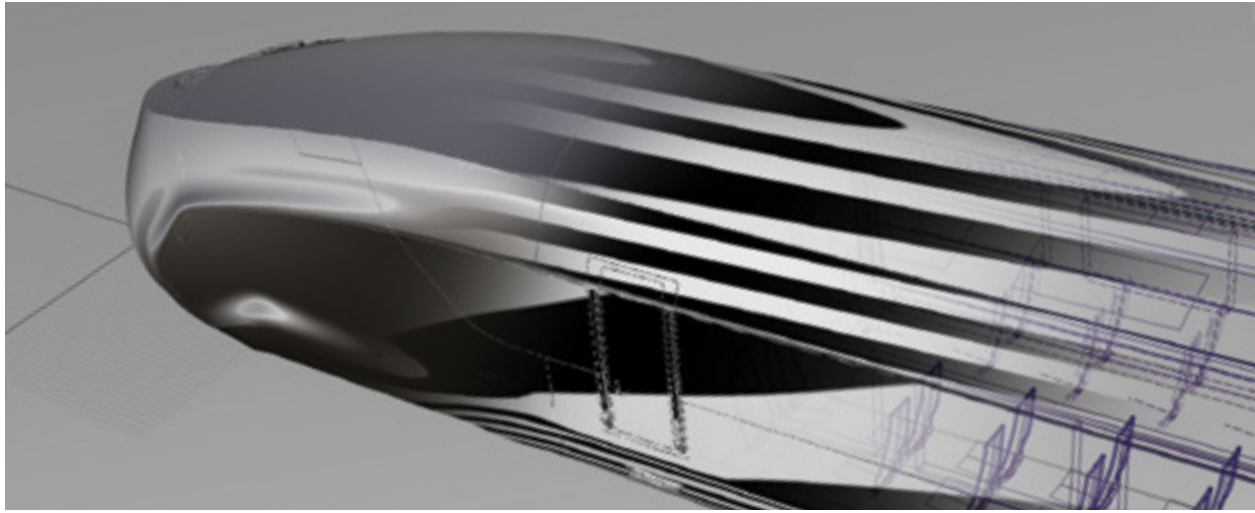
Their main concern was the shallow angle of the windshield. They had experienced their own problems with the glass on the Zefiro 380, as it is hard to create glass of good enough quality when you are seeing through such a large amount of material (because of the angle). They were also skeptical about the visual dead zone for the train operator. This was expected, as the angle and silhouette is a conceptual freedom I allowed myself

to take in order to emphasize the design expression.

Feedback I found highly valuable was their take on further expressing the Scandinavian features. Although the renders I showed were simple without detail, they had black strips of tinted side windows. I was advised to think different. They argued that Scandinavians love big windows to get in as much sun as possible – since we have so little of it. They also argued that the sides needed to be passenger focused and more inviting, and that doors should be in contrasted colour to meet regulations.

As for the use of copper, they seemed to find it intriguing. Some really liked the storytelling idea while some were more quiet. Even though it might not end up as being feasible for production, they could not say that it wouldn't work – which must be considered as good enough for using it in this concept. Especially when I see the interest it is generating both with professionals and non-professionals.

The rest of the first day was spent at their design studio going through train images and discussing them with one of the industrial designers. Day two was spent with different specialists in crash concepts, gauging and aerodynamics.



CAD DEVELOPMENT

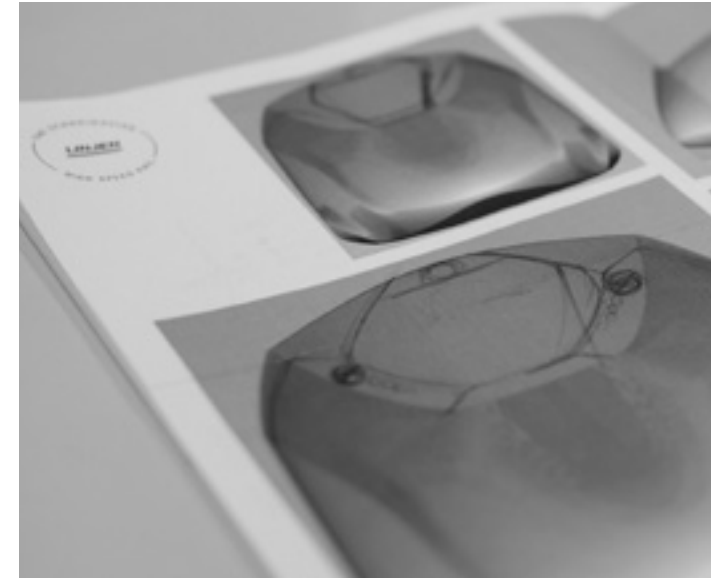
EVEN THOUGH THE DESIGN FREEZE IS MORE OR LESS PASSED WHEN MOVING FROM CLAY TO CAD, A LOT OF DESIGNING IS YET TO BE DONE.

When the main concept is thoroughly worked out, the next steps are easier. The big surfaces are working nicely together, but the devil is still in the details. And on a train it is a lot of details – many of them a design project in themselves. To cope with all of this, a lot of design is done in CAD or on quick thumbnail sketches. It is the fastest way at this point, because the level of detail is hard to get by freehand drawing.

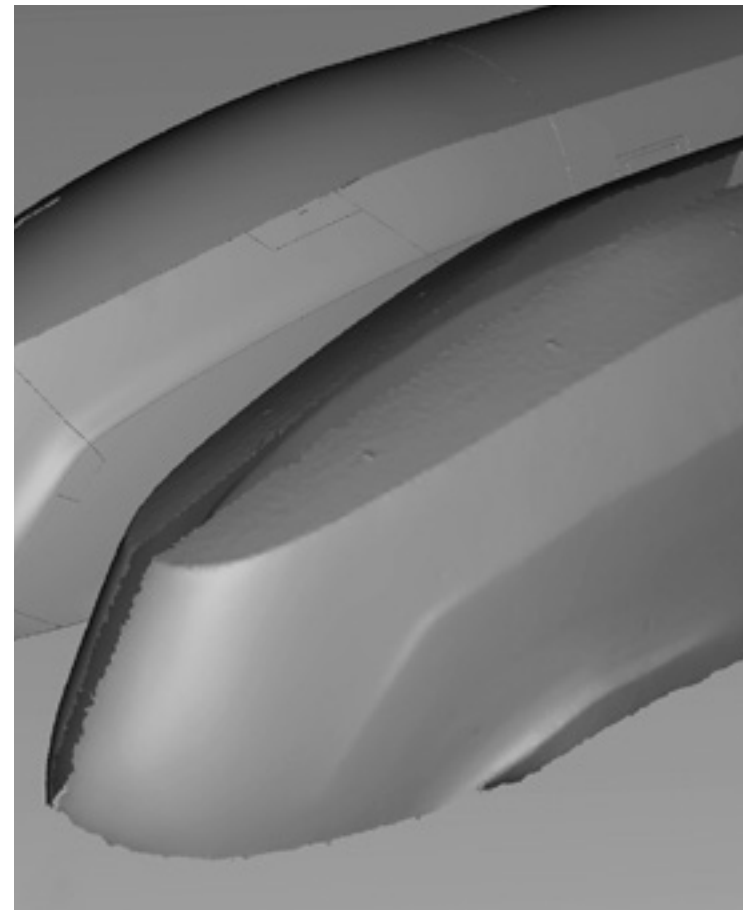
The clay model was 3D scanned to get all proportions right. This mesh was then used as a base to create the accurate CAD model. This is a big task when working with automotive design, because the surfaces are complex and they must be of high quality. Surface continuity and reflective quality is important as the object is large and any imperfections will show in reflections in renderings.

↑
Alias Automotive 2013 was used to create the CAD model.

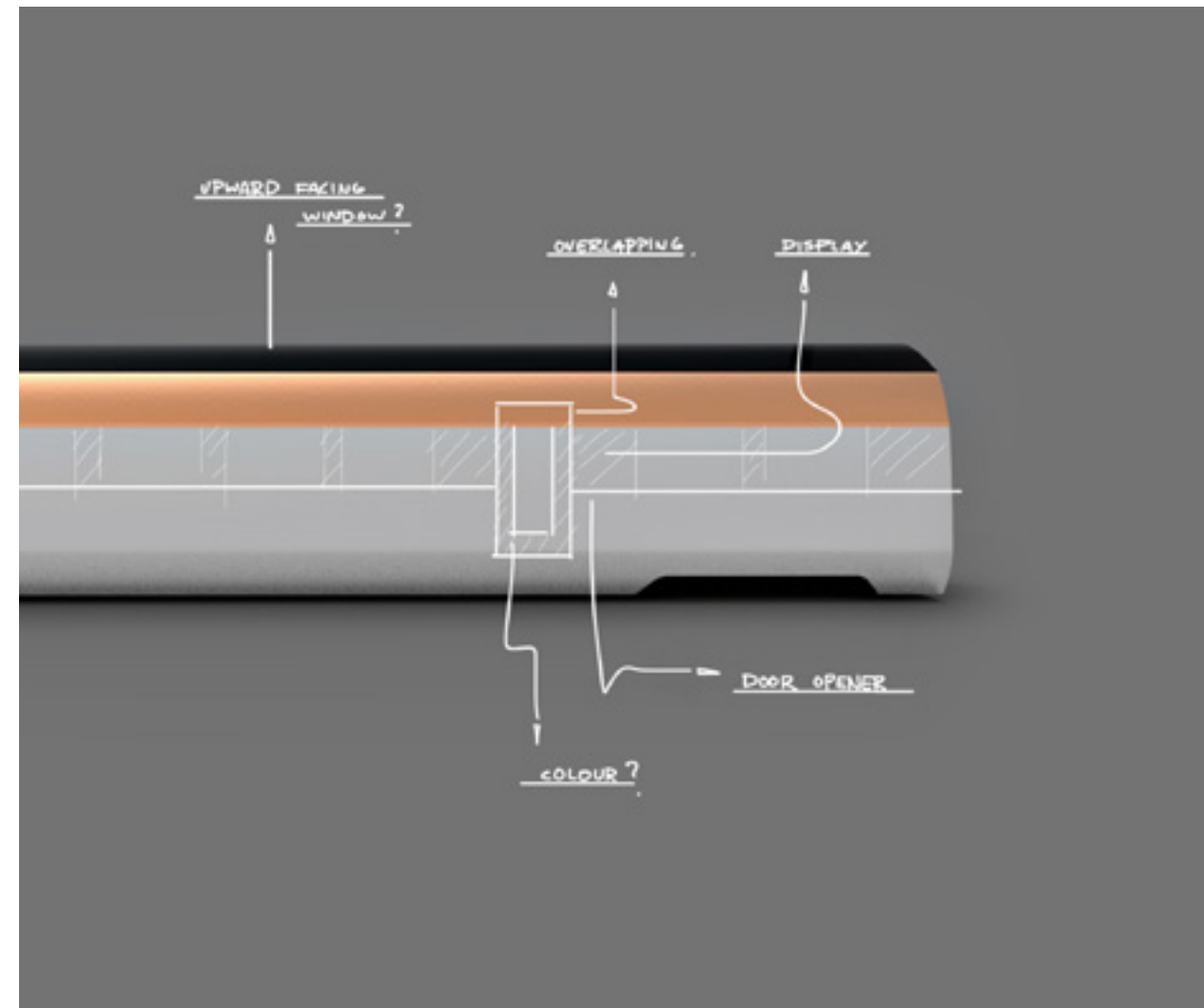
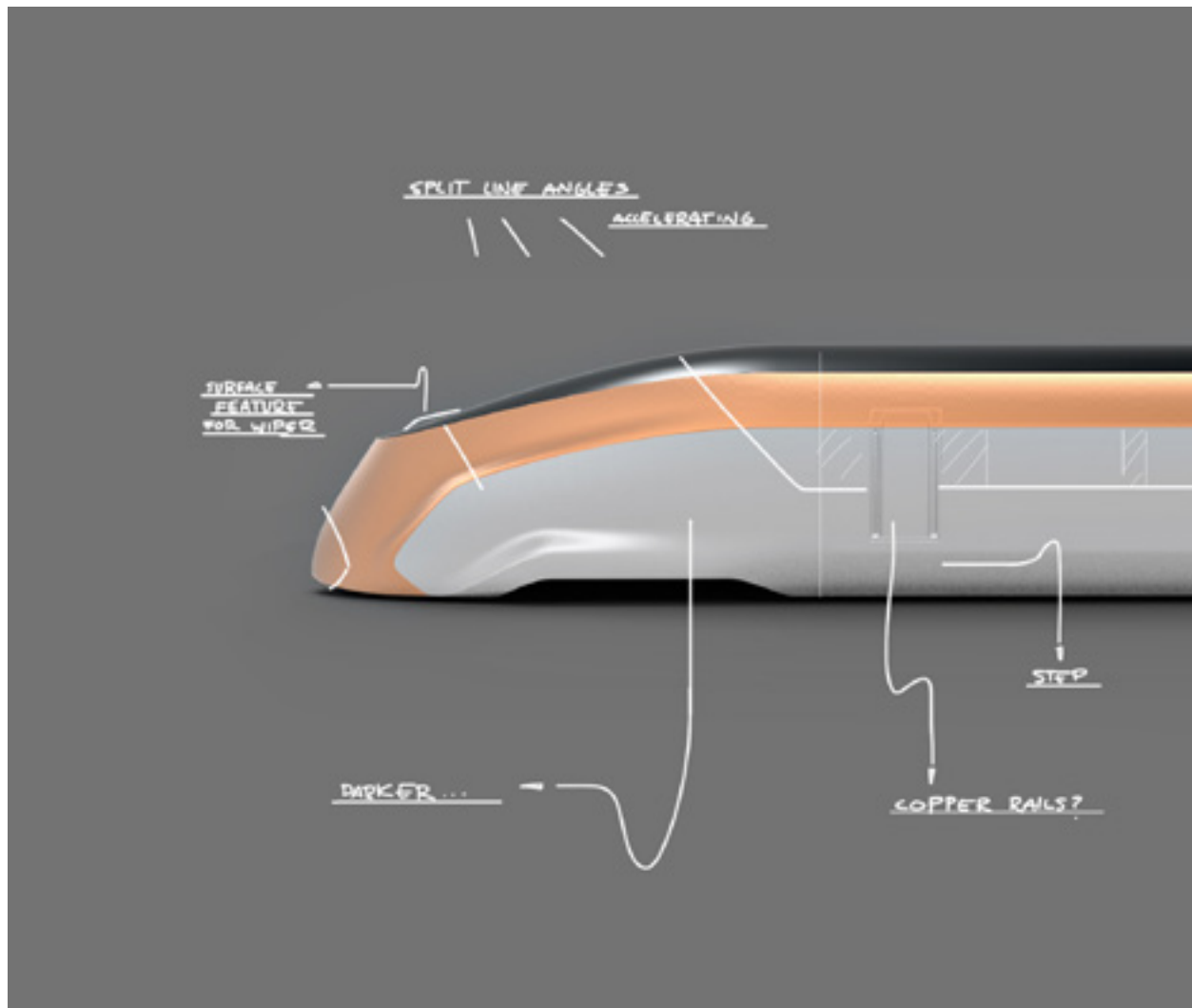
→
3D scanned mesh in front and the final CAD model in the back.



←
Sketching on screenshot prints is quick and effective when detailing.



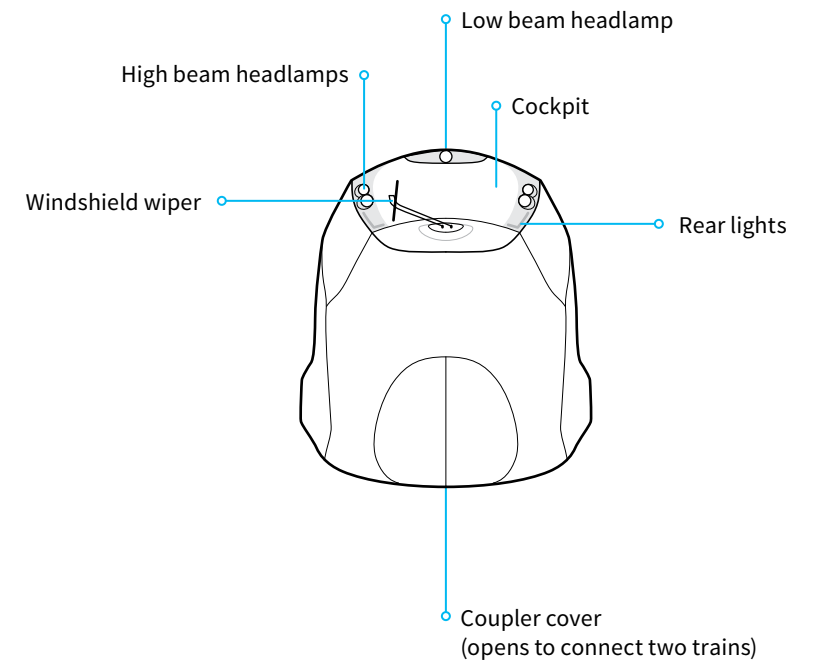
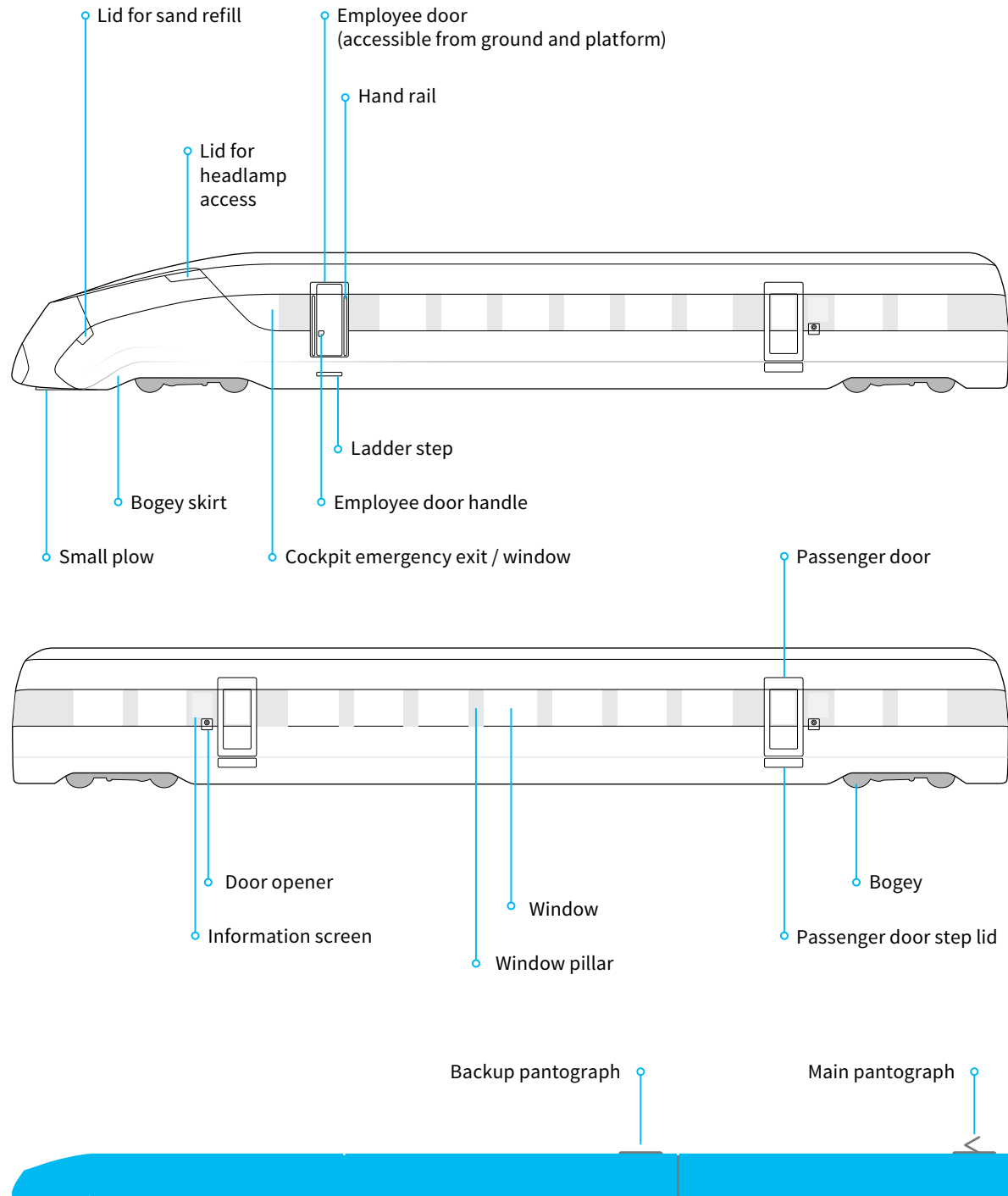
↑
Quick thumbnail sketching is a good tool when working in CAD on complex models.



Interim renders are good to take a step back from the CAD software and get a good second look at what's been done and how the decisions look. With previews of the materials in mind,

it's easier to see opportunities. In the screenshot above, the split lines in the front were sketched in to make sense as an overall design feature as well as functional features.

RESULTS



LINJEN HSR CONCEPT

- × Carbody length: 2700 cm
- × Width: 350 cm
- × Height: 380 cm
- × Long carbodies with bogies at the end
- × Double single doors (quarter model)
- × Main exterior materials: Copper, anodized aluminum & glass.





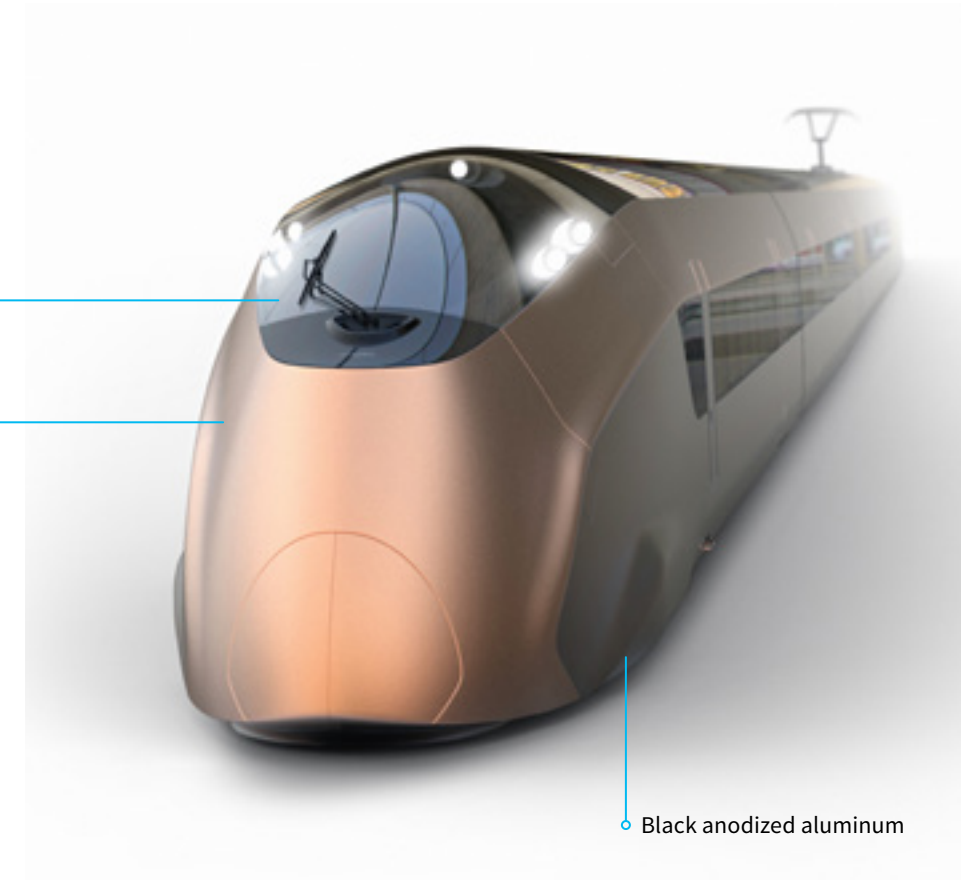
Front lighting layout and main exterior materials.

Rear view details.

Glass

Copper

Black anodized aluminum



THE FINAL RESULT IS A HIGH-SPEED TRAIN DESIGN WITH STRONG IDENTITY.

In the ends of the train, the design expresses the high-standing character with subtle, muscular shapes. It has kept and refined the essence from the concept sketches with forms looking grinded back by time.

The head and rear lamps are placed on the inside of the glass. Head lamps

use brushed aluminum detailing, while the red rear lamps use LED strips that complements the surrounding shapes. A windshield wiper is integrated through surface detailing in front of the glass that reflects the muscular shapes on the side and above the front bogey. These features ends up in the Linjen logo that sets the period of the top surface.

The main materials are copper, anodized aluminum and glass. All 100 percent recyclable materials.



WHILE THE FRONT DESIGN EXPRESSES CONFIDENCE AND RELIABILITY IN A MUSCULAR WAY, THE SIDES ARE MUCH MORE INVITING.

When experienced from a distance or the platform, Linjen is designed to be open and inviting to passengers and potential passengers. The windows are not tinted black, but clear to show the warm spacious interior and the people inside. This contributes to the feeling of going on the train rather than boarding a sealed up plane. Which has been a goal through differentiating from the airline companies.

The passenger doors (detailed on the next page) use the copper material to clarify their position and, again, underlining the openness of the train. It also breaks up the long extruded shapes into something more interesting.







Year 1



Year 5



Year 10



→
Imagined patina process
through ten years of
service (windows are
rendered in black to focus
on the exterior material).

←
Passenger door, door
opener and information
screen.





SUMMARY

This project has been
ambitious and rewarding

**THROUGH THIS DIPLOMA,
LINJEN HAS BEEN CREATED AS
A SCANDINAVIAN HIGH-SPEED
RAIL CONCEPT.**

It has been built on knowledge gathered from The Scandinavian 8 Million City and The Green Train. The result is a visual concept with a strong identity. It will serve as promotional material in the effort to create the first real high-speed rail network in Denmark, Norway and Sweden.

As a diploma, this project has been ambitious and rewarding. The strength of the process has been the hard work and continuous production of material at every stage. The belief in, and selection of methods, has been key to create a successful concept.

Things that could have been done differently include the timing of the

Bombardier visit – that should have been earlier for optimal effect of the feedback, and the facilitation of the workshop. Still, both produced results that were brought along in the project.

The next step for Linjen is to be put in use by The Scandinavian 8 Million City. Throughout the project they have shown enthusiasm for the results and expressed that they are looking forward to showcase the Linjen material as part of their investigation.

In a best-case scenario, the effort to initiate the creation of a Scandinavian high-speed rail is successful, and Linjen will continue to serve as inspiration and a vision of the Scandinavian high-speed rail.

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GLOSSARY

- × **AGV:** Automotrice à grande vitesse. High-speed EMU developed by Alstom. The successor of the TGV.
- × **ALSTOM:** French/international power generator and transportation company. Made the TGV and AGV.
- × **BOGEY:** Framework for/and the wheels of a train.
- × **BOMBARDIER:** Canadian manufacturer of planes and trains.
- × **CAD:** Computer-aided design. In this case used for three dimensional objects.
- × **COINCO:** Corridor of Innovation and Cooperation.
- × **COUPLER:** Mechanism for connecting two rolling stocks.
- × **CRH:** Chinese HSR system.
- × **DSB:** Danske Statsbaner (Danish State Railways). The largest Danish and Scandinavian train operating company.
- × **EMU:** Electric multiple unit. A multiple unit train consisting of self-propelled carriages, using electricity as the motive power.
- × **FLYTOGET:** Norwegian high-speed airport rail link connecting Oslo Airport to Oslo Central Station. Scandinavia's fastest at 210km/h.
- × **HSR:** High-speed rail.
- × **HST:** High-speed train
- × **IC:** InterCity. Trains that can run up to 250 kph.
- × **ICE:** InterCityExpress. System of high-speed trains.
- × **ICE 3:** Family of high-speed EMUs developed by Siemens.
- × **NSB:** Norges Statsbaner (Norwegian State Railways).
- × **PACKAGE:** Automotive industry term for defining the basic architecture of the vehicle.
- × **PANTOGRAPH:** An apparatus mounted on the roof of an electric train to collect power through contact with an overhead wire.
- × **RENDERING:** CAD model converted to a 2D image.
- × **ROLLING STOCK:** All the vehicles that move on a railway.
- × **SHINKANSEN:** Network of HSR lines in Japan.
- × **SCANDINAVIA:** Denmark, Norway and Sweden.
- × **SJ:** Statens Järnvägar (Swedish State Railways).
- × **TGV:** Train à Grande Vitesse. France's HSR service. First in Europe.

APPENDIX

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