Report – June 2009

Design Research – Graduation MSc4 Architectural Engineering

Infrastructure as Art – Trans Urbanization

Name: ***Sagar Thorat***
St.Nr.: ***1379674***
Mentor: **Dr.*Karel Vollers***

Index

1. Introduction

Cities in the 20th century have been weaved within road networks, the freeway concept has shifted the existence of roadways from 2D to a 3D image which is disliked by its citizen and considered as a ugly and a dangerous place because of its massive structure and pollution facts.
Urban spaces realize that cities still have to be thought out, organized and built around infrastructure.
Infrastructure has as always kept up with the speed in which urban spaces work and has provided mobility to the users by Creating Underground metro systems which are efficiently operating with mega cities of the world.

Relevance

By using the urban infrastructure as a functional space, it sets a new acceptance for future planning regulations where Infrastructure is not a body which should be avoided by setback space. With the Automobile Industry Developing Eco friendly Vehicles there will be a slow transition of complete replacement of polluting vehicles to non polluting ones, which suggests new approaches to designing Infrastructure and the Urban Fabric associated with it.
Like underground metro connections, over ground sky bus systems can be designed integrated with the buildings and provide users with more comfort to move within the city.

Study question

How can modern public transit systems provide new solutions for designing functional spaces within the urban freeways, turning Infrastructure into a workable Public space?

How can we transcend disruption to the landscape to reconcile infrastructure with the city?
How can we get inhabitants to consider it with a favorable eye and change its image back into a positive one, making it appear as the common asset, that it also is and finally become a common place for socializing and sharing in the heart of the city?

2. *Urban design and development Theory*

a. Polycentric Urban regions – Randstad

- The Randstad has a population of seven million; 45% of the total population on 26% of the country's land area. The population of the 25 functional urban regions (FURs) that make up the larger Randstad area, The four most populous FURs are Rotterdam (1.4 million inhabitants in 2002), Amsterdam (991,000), The Hague (810,000) and Utrecht (640,000)(Fig.3).The population of the larger Randstad area since last 20-25 years has grown considerably but the concerns for future development are unequal growth distribution.

Fig 1: Randstad and it major cities..

A number of key figures on the spatial development of the Randstad indicate that a significant demand for housing still needs to be met - 15% at any rate and, if rapid growth should occur, even 30% of the current housing supply. Contributing factors include growth in infrastructure, room for employment (especially for seaports), for nature, water storage and recreation. Estimates are especially high in the container transport sector (between 4x and 6x the scope of 2000). These figures indicate that the general concerns about space shortages and urban sprawl have remained high.
However, these figures also make it clear that the spatial issues are also becoming more complex: developments are increasingly expanding across municipal and provincial borders, while sectoral solutions, such as new roads or new residential areas, are becoming more and more difficult to realise. The slow pace at which projects are being realised in the Netherlands in practice is therefore also a growing problem. That has led to not only the issue of spatial planning being placed high on the agenda, but also the governing of the Randstad becoming a focus of attention.

- In the nineties, a new interest in urban living occurred. This, together with the ongoing flux of foreign migrants helped to stop the population decline that characterized the previous decade. Singles, childless couples, young urban professionals decided to spend a longer period of their lives and careers in the cities. Encouraged by economic growth, the formation of a predominantly urban service economy, an improving housing condition, many of the traditional cities saw their population numbers rising. The direct suburban surroundings and growth centers and new towns like Almere have received rapid growth with many others.

- The population increase of the FURs containing larger cities like Amsterdam, The Hague, and Rotterdam is based primarily on the growth of municipalities that surround these cities.Thus the edges of major cities and their green zones are widely affected by urban sprawl essential for

economic growth of Randstad as a whole. Major cities are growing towards their edges and these edges are nothing but the major national and international Highways.

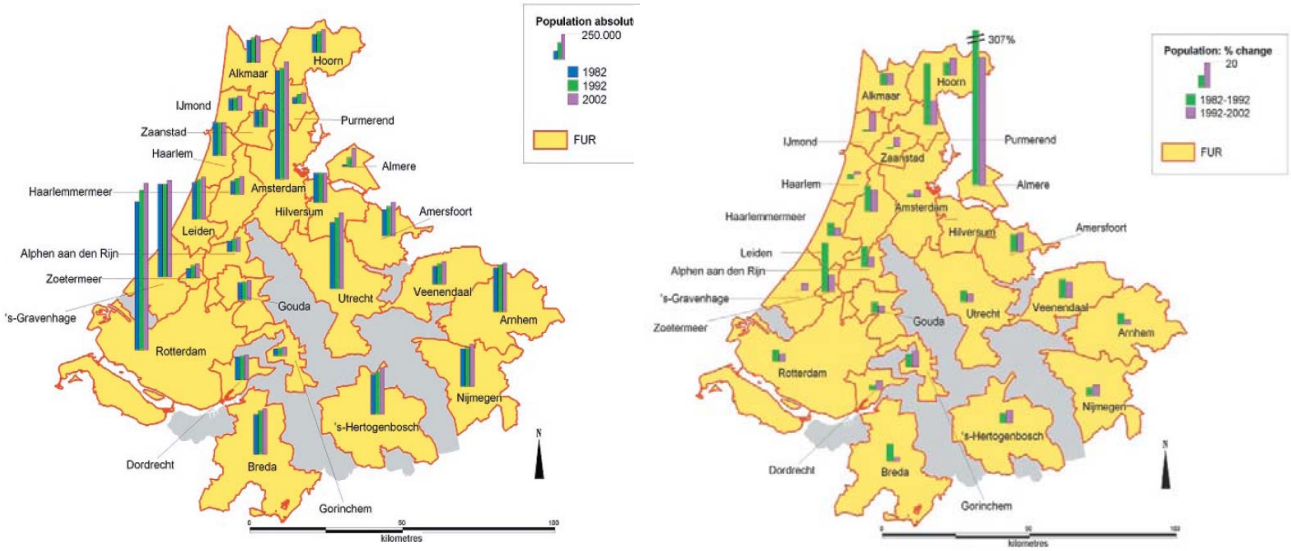


Fig 2: Left, Population obsolete. Right, population change.

Two dominant dense urban metro poles as the North and the South wing are emerging.

- *North Wing*

Amsterdam and area + Almere

- *South Wing*

Rotterdam and area + Den Haag and area

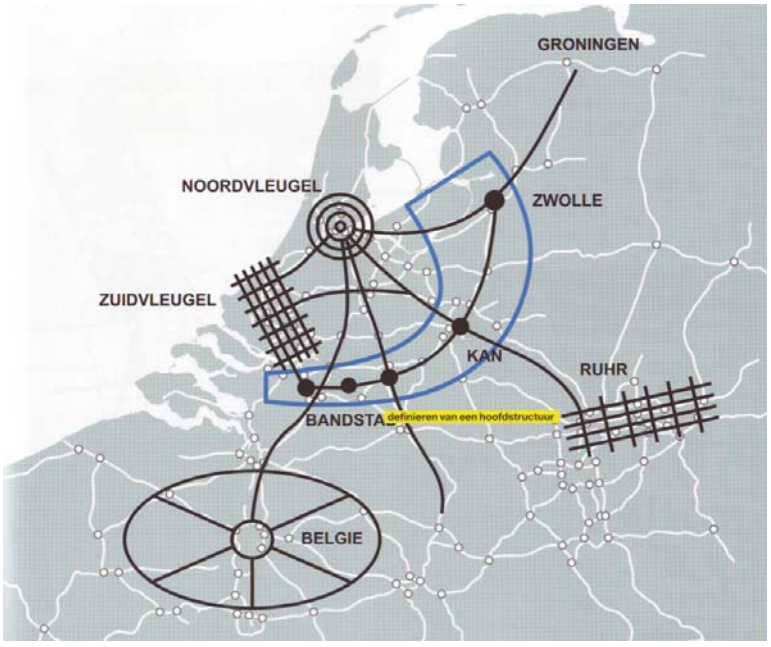


Fig 3: Major Business Links

b. Case Studies – Existing Commercial Developments and Future concerns

Example Development: *Amsterdam Zuid(South) Commercial Hub*

Fig 4: Commercial development near Amsterdam Zuid (South)

- ***Future Development Concerns:***

  Considering the Advantage of polycentric urban regions which is the ratio of land to the developed area, that provides opportunities for sustainable development, open green spaces within efficiently operating business districts.
  These open spaces are Agricultural zones with small green houses and open recreation parks. This character can be exploited and an Agro-Commercial Metropolis can be generated. Opportunities are to combine the best aspects to create an attractive environment.
  But vice-versa this character is under constant urban pressure and the threats are replication of similar developments as seen in metropolises around the world.

- ***Preservation of Historical character***

  Example: Concerned efforts to preserve historical characters of Traditional cities like Amsterdam are seen in proposals from Urban Designers.

Past Present Future

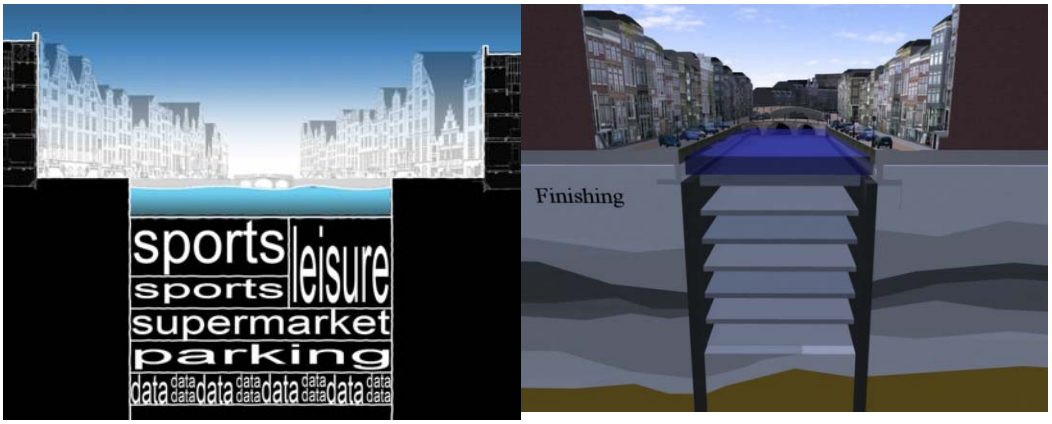


Fig 5: Proposals for the Revitalization of Amsterdam.

3. ***Site Analysis***

- ***Location***

  The Hague, Prins Clausplein

Fig 6: ***View of the Hague Central over the Site at Prins clausplein***

- ***Strategic Importance***

The Dutch city regions since the past were linked by main routes extending across the national borders. The international corridors were formed by two important transport junctions - Rotterdam (seaport) and Amsterdam (airport) - and international places of establishment in the four large cities.

A4 Highway is an International Roadway extending to Germany and Belgium. The development of the space along this highway is of major importance for the Randstad to develop as a sustainable metro pole because it connects the international strengths available to the Dutch.

Topping the list are the cities, owing to their international functions, each with its own specialization: Rotterdam in freight logistics, **The Hague in international law**, Utrecht in education and research, while Amsterdam stands out with a broad profile, but especially in terms of professional and creative services and tourism. The Dutch Government has opted to make use of the existing governing structures and it has become unlikely that the provinces will merge (into a single Randstad province, for example), or the collaboration between municipalities will be strengthened, the question remains how urban fragmentation can be prevented.

Fig 7: ***Sketch A4 Highway interconnections***

The Hague traditionally stands out as the most densely populated FUR (2,500 Inhabitants per km2), followed by Amsterdam, Rotterdam and Utrecht respectively. The Hague has enough potential within itself to emerge as an attractive region to be touring spree. The Hague is the second tourist region to be. The combination of coastal and historical city with all its provisions, the royal image, conference facilities, attached to the historic city of Delft, is unique. The Hague land must be wiser in terms of turnover and employment. In terms of employment, it is relatively few structured.

- ***The Hague Vision 2020***

  The Dutch Government has set out plans for revitalization of Denhaag and its surrounding communities. The development targets critical Proposals for future commercial and transport growth in The Hague, making it a place for international attractions.

  In this scheme The A4 Highway and Prin sclausplein is a critical zone to be developed by the year 2020.

Fig 8: ***Development Plans for Denhaag 2020 Vision***

- ***Case Study –Transit Influential Developments***

  La Defense Business District, Paris - La defense resembles a condensed version of the urban policies and ideologies of the entire period of French planning.The EPAD which is the Governing authority for the La Defense, has since its creation in 1958 operated profitably by investing in land improvements, most Importantly paying to bring regional rail and metro links to the district, Those buildings never could have been built had EPAD not created a market for them through the expansion of the mass transit network it paid for, and of course by building The Slab.

Fig 9: ***From Top Left to Bottom Right Urban development of La Defense from 1958 - 2005***

4. ***New Mobility concepts for the complex urban environment***

a. Relevance

Computer, 1973

Computer, 2007

Mobile Phone, 1973

Mobile Phone, 2007

PRT, 1973

PRT, 2007

Fig 10: ***Mobility Developments***

- Mobility demands cause an ever increasing pressure on the urban arena setting a very influential parameter for Building Development.

Fig 11: ***Example of Highway interface development in Osaka, Japan***

- There is a need for innovative solutions to facilitate mobility.
- Automated road transport may contribute to sustainability by a more efficient use of resources and space and increased transport safety.

b. Case Study – Personal Rapid Transit at Heathrow Airport

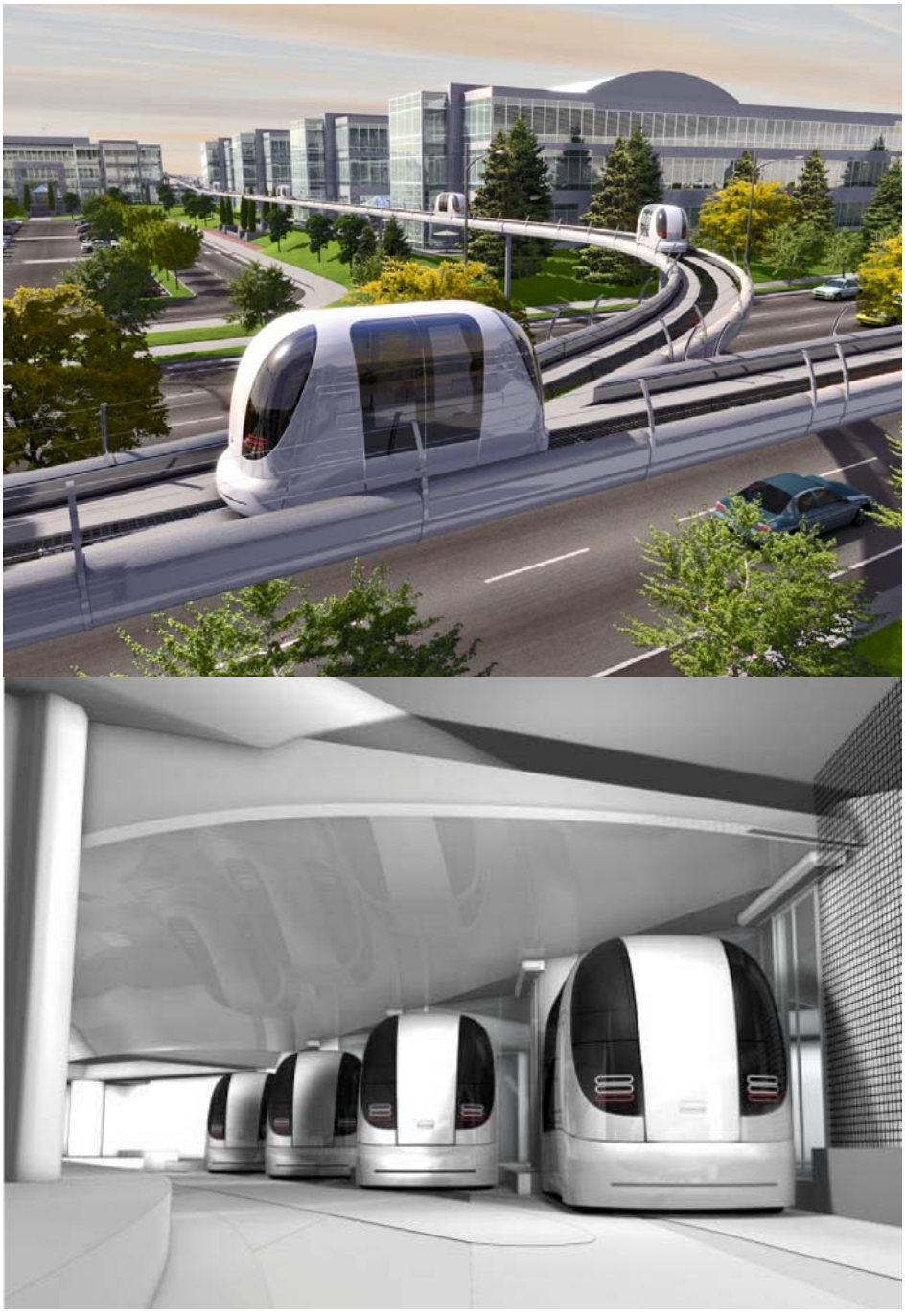


Fig 12: Design Development Images, Top, PRT Guideway through the city, Bottom, Vehical parking at stations

- **Vehicle performance**

Max speed 25 mph
Emergency deceleration rate 3 m/s^2
Maximum range on a battery charge
25 miles
Maximum payload 500 kg
Materials - Aluminum frame structure and Acrylic body panels with Acrylic glazing.

- **Control System**

The vehicles are controlled by a central control system which determines availability of the route a vehicle will take on the guide way network, determines the start time of each vehicle on its chosen journey, monitors the positions of all operating vehicles in transit and manages empty vehicles. The nature of the control system is “synchronous” which means it ensures the vehicle does not start its journey until a clear path is available to the destination. This is similar to an air traffic control system booking ‘slots’ along a track. The management of empty vehicles is a key function of the control system and governor of overall system performance as it ensures that empty vehicles are most efficiently positioned within the guide way network to cater for anticipated or emerging demand, with minimal passenger waiting times (ordinarily the vehicles wait for passengers at the berths and the target time from a passenger selecting a destination at the station to commencing the journey, is less than 30 seconds). As part of the overall control system there is an independent Automatic Vehicle Protection system (AVP) which ensures vehicles on the guideway are separated by a safe distance at all times.

- **Guide way**

The guide way is a two-meter-wide trough, comprising a flat floor with a central cable tray and 18”
high “kerbs.” The guide way is unpowered. It can be constructed of different materials to suit the
particular application, examples include steel with pre-cast concrete plank, fiberglass grid floor or
simple concrete base with either concrete or plastic kerbs at ground or floor level. The guideway is of lightweight construction due to the low overall loading (British Standard for a footpath is 5kN/m2,
ULTra loading is 2.2kN/m2) This low overall loading also allows the vehicles to run on existing
building floors without significant strengthening or modification.

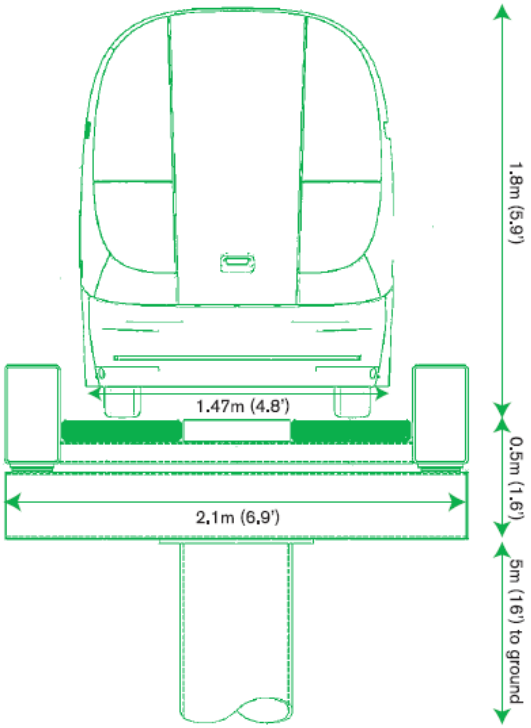


Fig 13: Section

- **Application - Infrastructure and Development at Heathrow Airport**

At present the Automated Personal Rapid Transit is operational between distantly located Parking Lots and Airport Terminals.

Fig 14: Infrastructure and development at Heathrow Airport

c. Future Perspectives

- The Ultra light weight character of these systems provide varying possibilities for them to be installed within cities and its communities.

Fig 15: Left, Impressions for PRT within communities. Right: Intercity connections with PRT.

- **Volkswagen Concepts 2028 – Key Characteristics.**

Vehicles that communicate with traffic lights and other vehicles.

Intelligence to find a free parking space and park in it automatically without a driver.

Hybrid concepts, combustion engine and electrical engine.

Fuel cell, Hydrogen + Oxygen = Electricity/H2O

Fig 16: Automated vehicle designs

5. ***Concept Development***

a. Concept theory

- Since the citizens Adaptation to the automobile, it has been the most influential factor to effect the development and organization of cities.
- Automobiles have created undesired effects within the city and environmental challenges effecting globally.
- Building developments in Highway Zones are characterized by Buffer screens/zones and Setback spaces which are apart from the Constructed buildings, and are consuming the usable city space.
- *Since last 5-8 years the Automobile industry has seen positive developments towards cleaner and energy efficient vehicles.*
- *This fact gives urbanism new directions to create systems which can better integrate the modern light transit systems with existing Transit infrastructure.*

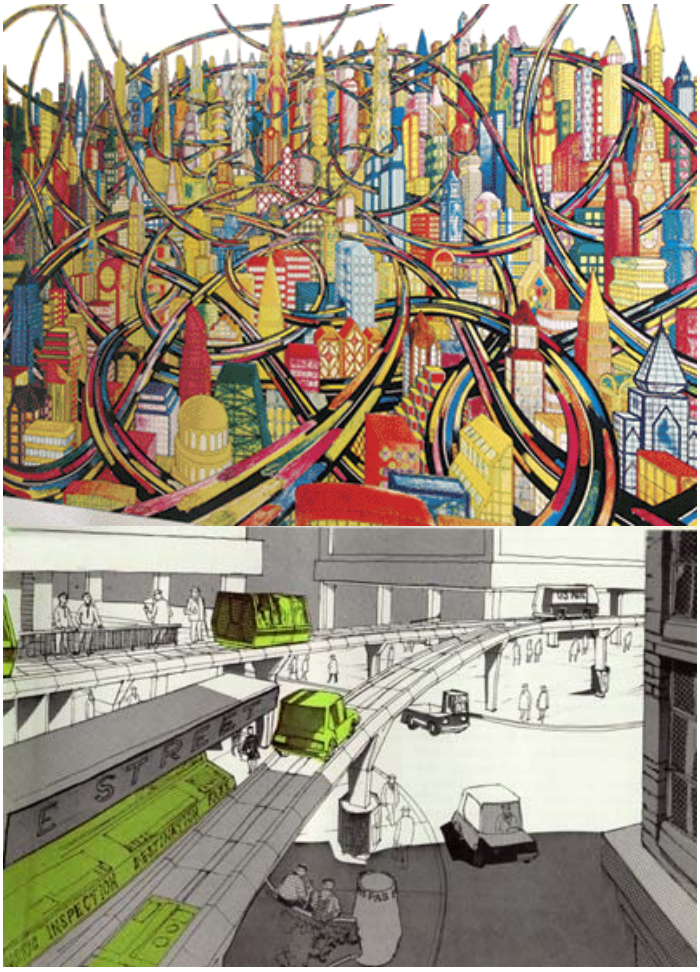


Fig 17: Sketches

b. *Towards urban readymade – Highway Parameters shaping new environments*

- *The design is developed within the Highway network*
- *The shape of the highway structure and the speed intensities are the Parameters to generate Interactive spaces.*

Fig 18: Highway parameters

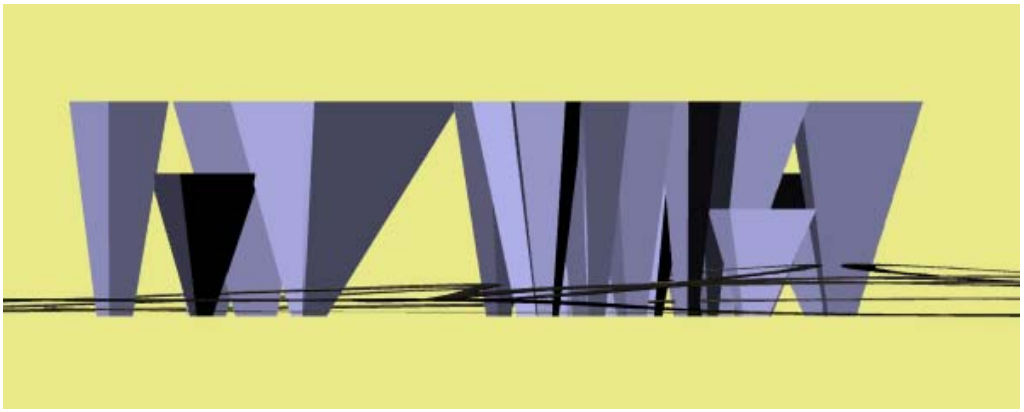
c. Site Parameters

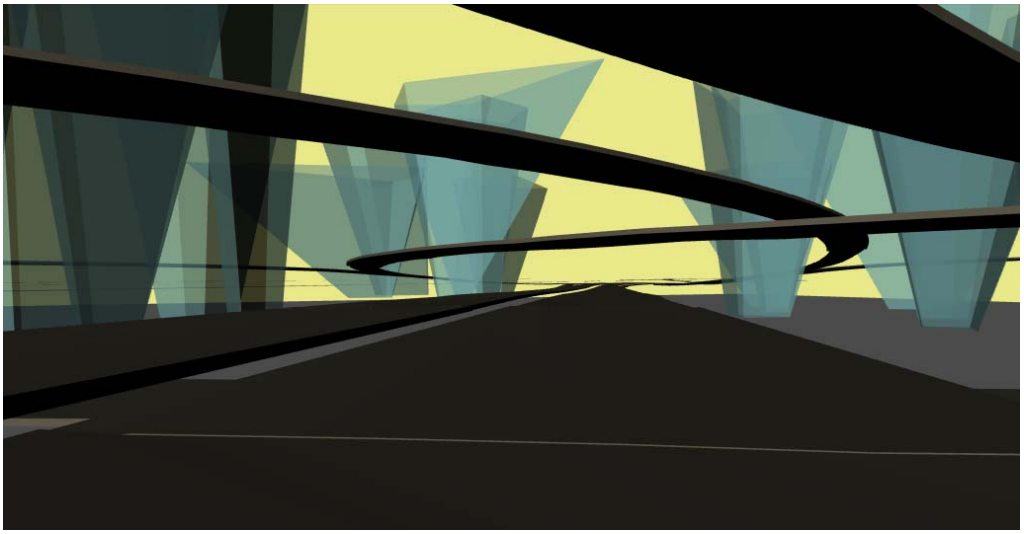
- *Utilizing Volumes within Highway Interface*
- *These volumes are characterized by road heights varying from 4 to 21 meters.*

Fig 19: A4 Highway Junction Prinsclausplein,

d. Study of Building Typology along the Highway.

- *A minimized building foot print*
- *Densification of Building mass has to be controlled to avoid loss of Day light*





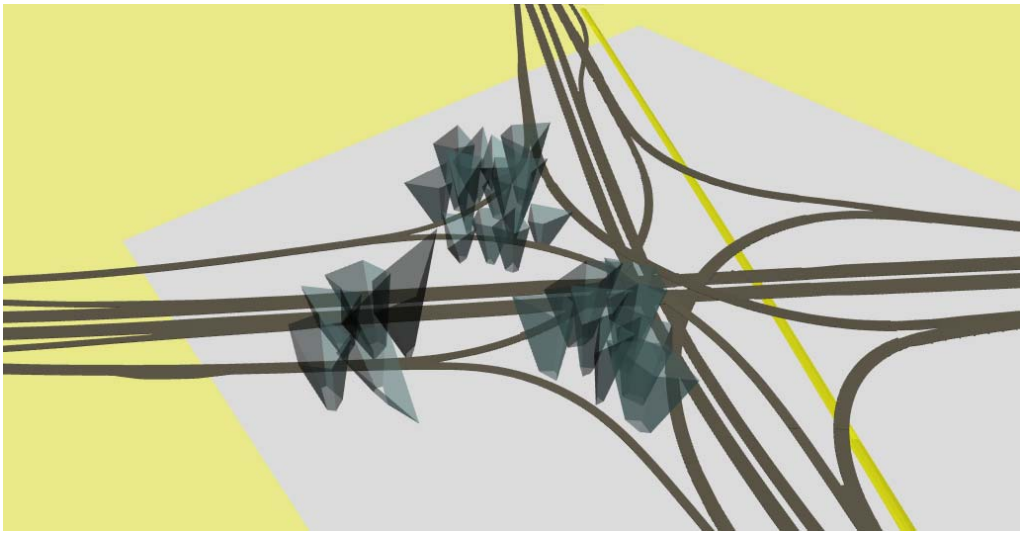


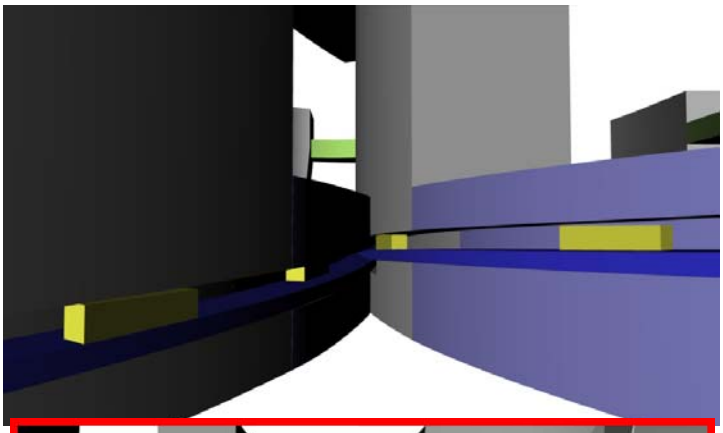
Fig 20: Concept Perspectives

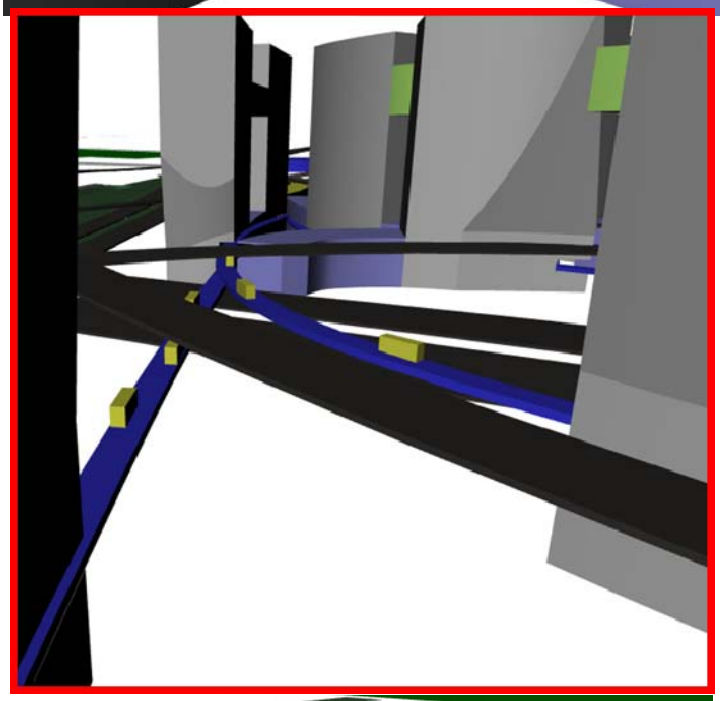
e. Introduction of Light Public Transit System – Sky Bus Parameter

- *Why sky bus? Accessibility to the buildings is a major issue as citizens would be reluctant to enter the Highway zone by bike or walking and this would make the development, less efficient to utilized*

- *To attract citizens by a much needed glamour image.*

- *Providing an automated transit system which is electrically operated like the Underground metro systems operating in mega cities.*
- *The driverless pods/buses carrying passengers automatically along special elevated roadways at speeds of up to 25-40 kmph, these are designed to take 6-8 passengers and arrive at every five minutes at the transit nodes.*
- *The sky bus will be continuously aligned and connected to the building.*





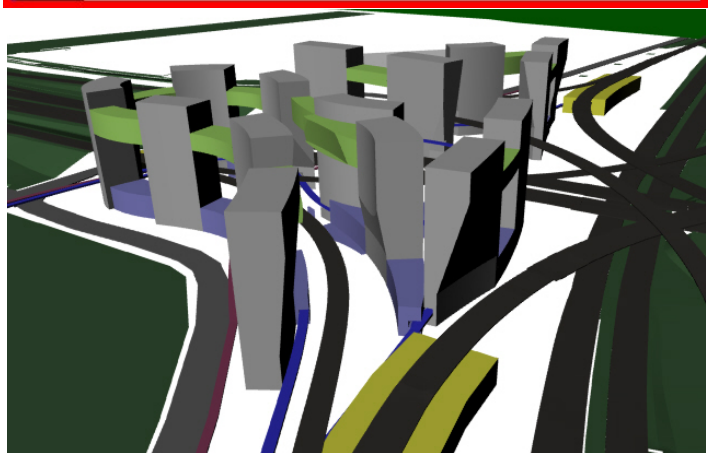


Fig 21: Concept Perspectives

6. ***Urban Planning***

a. Strategic Implementation of Concepts

- *Connections with upcoming transit routes for the Vliet zone along A4 Highway*
- *The Proposed sky bus system is connected to the city Rail networks*

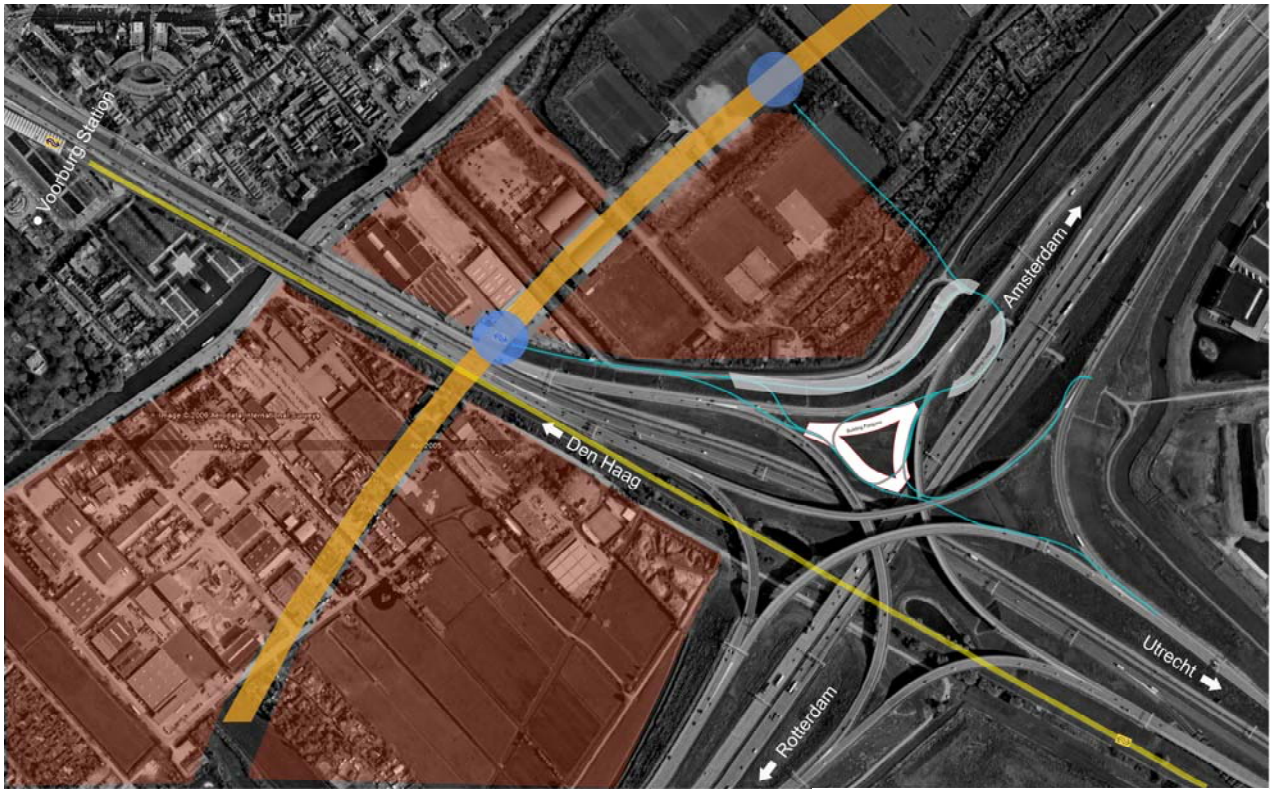
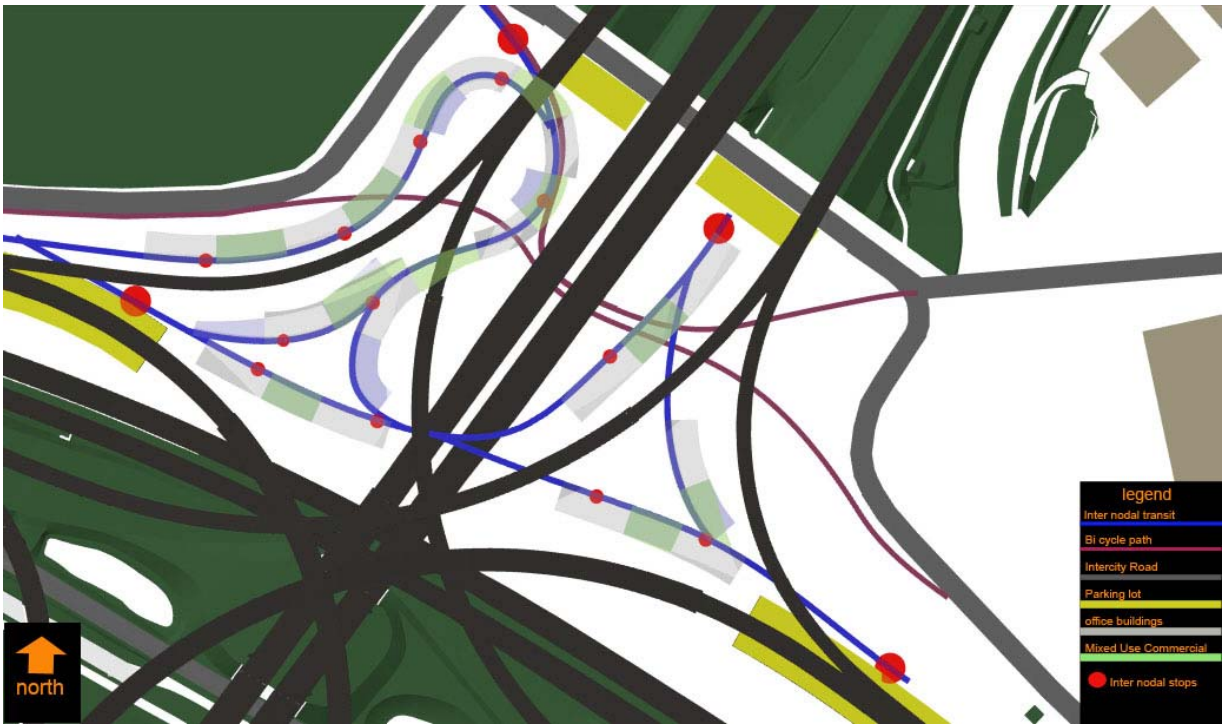


Fig 22: Site Plan and future developments

- *Defining site boundaries and providing parking spaces at the periphery of the site.*
- *The sky bus carrying passengers to the desired location makes stops at Car Parking lots located on the edges of the development scheme.*
- *Passengers travelling by car can easily connect within buildings and nearby parking lots.*
- *The transit nodes will be located at every 80-100 meters where passengers can hop on hop off.*
- *The transit nodes will be large courts with commercial lobbies and recreation spaces, providing indoor pedestrian links to the shops within the complex, and elevators to elevated commercial spaces.*



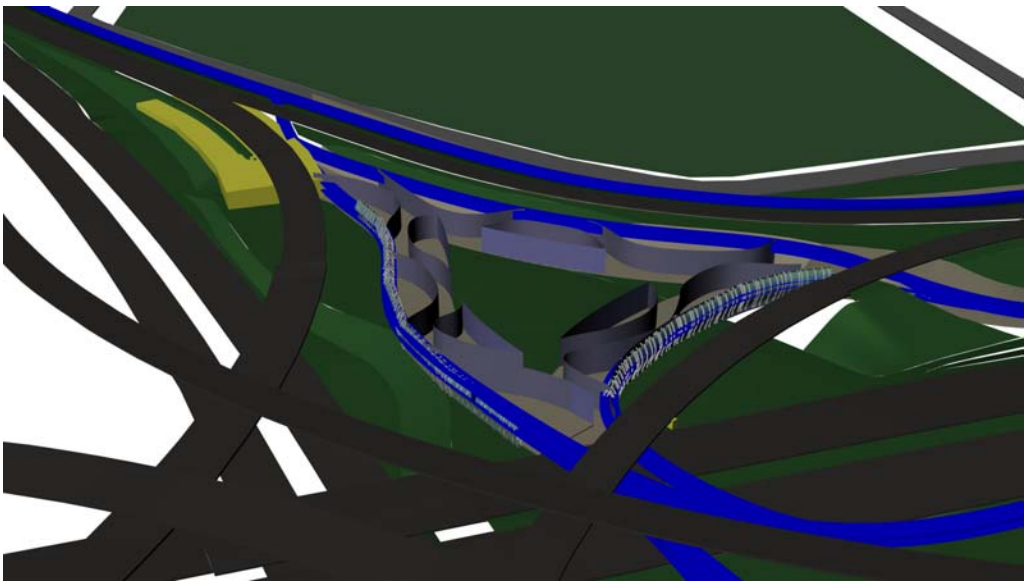


Fig 23: Top, Plan. Bottom, Perspective

- ***Strategic Planning/Zoning of Buildings***

- *Proposed Mixed use planning for efficient use of the Proposed Sky Bus Transit.*
- *The end commuters of the Sky bus Transit will vary from shoppers to officers and resident, This will encourage mixed use growth and development.*
- *Dedicated Zones at different levels are proposed according to the comfort requirements of users, like buffering from sound and pollution.*

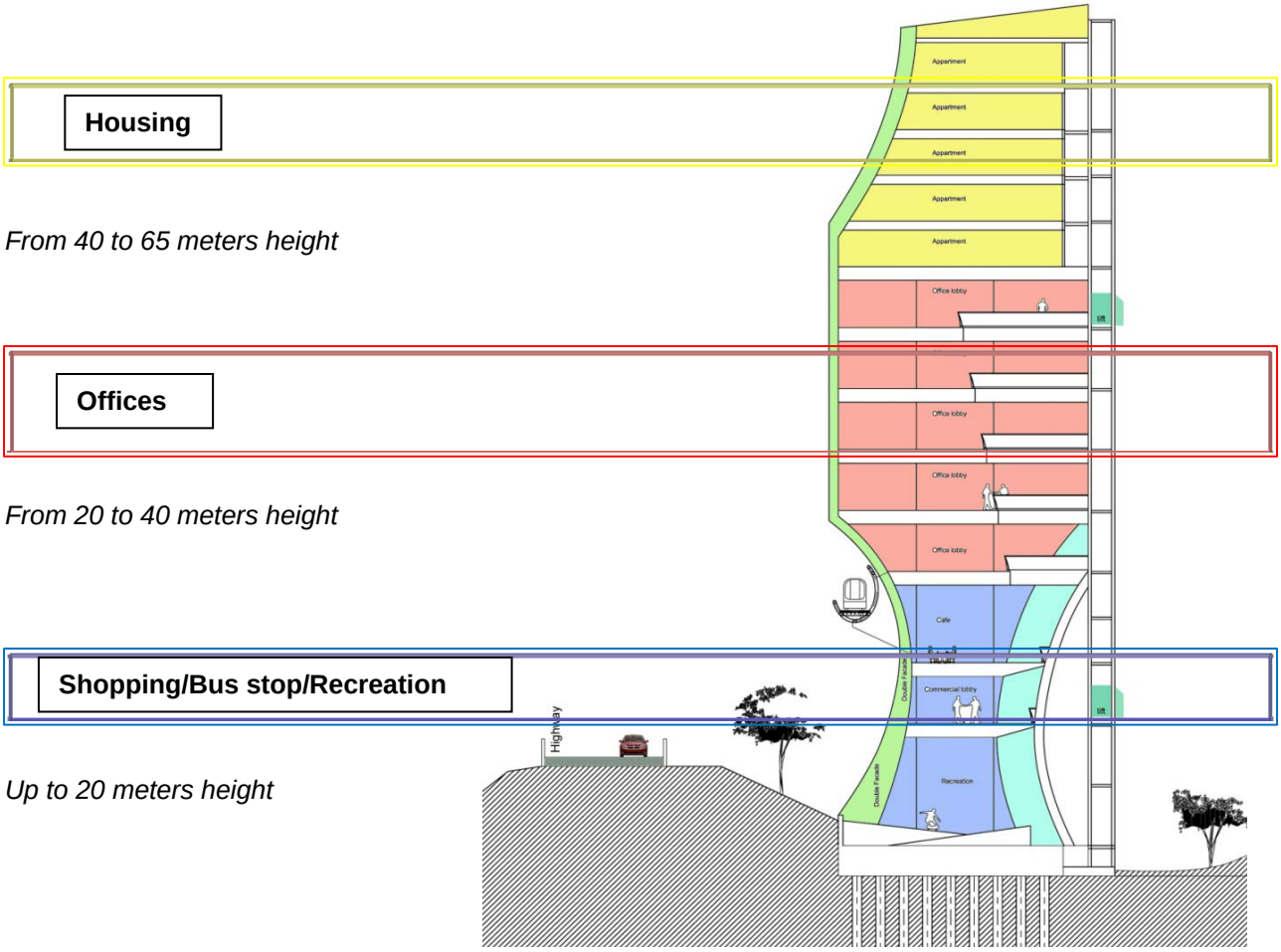


Fig 24: Section

7. ***Application of parameters to Design***

a. *Key Factors- Buffer Line*

- *Plot/Site limited for Horizontal Plan*
- *Future Road Developments*
- *Physical Constraints – Safety/Pollution*

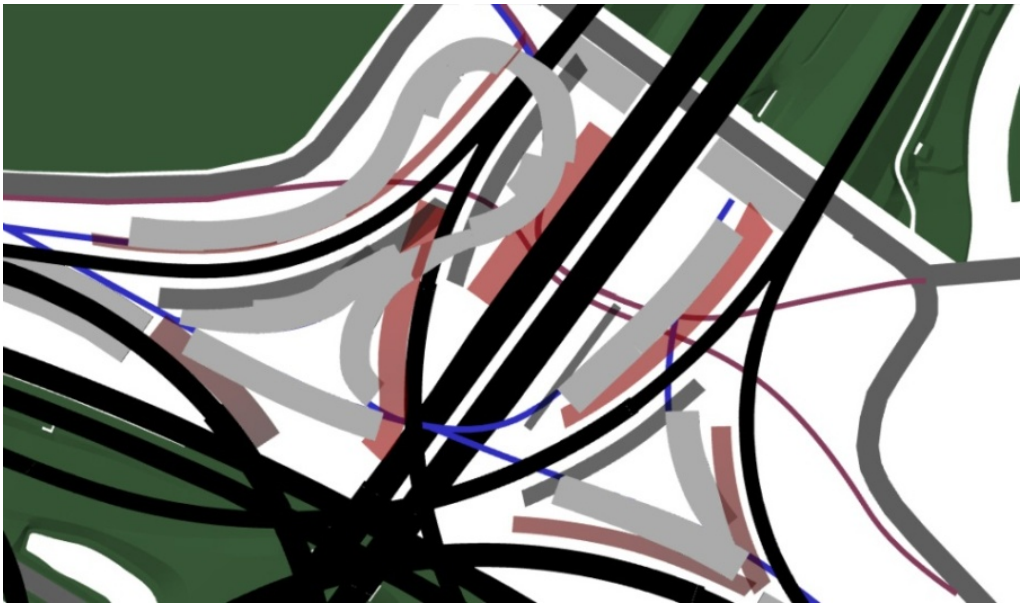


Fig 25: Plan

b. *Installation of Automated Sky Bus*

- *Step 1 – Dual guide way with separate structure.*

  Due to limited horizontal space a separate Structural system will prove inefficient.
  Dual Track will consume wider space for structure

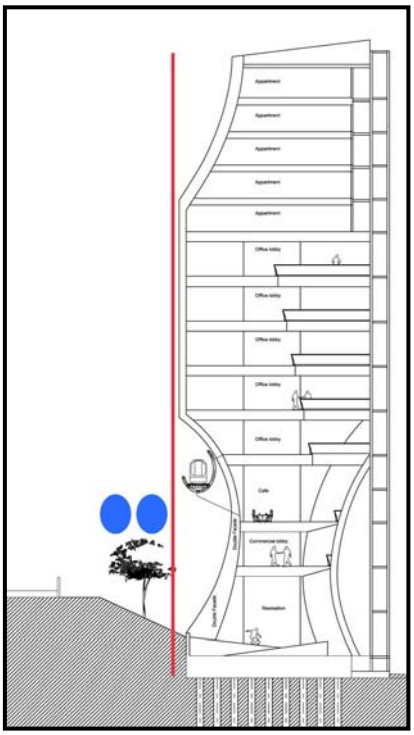


Fig 26: Schematic Section

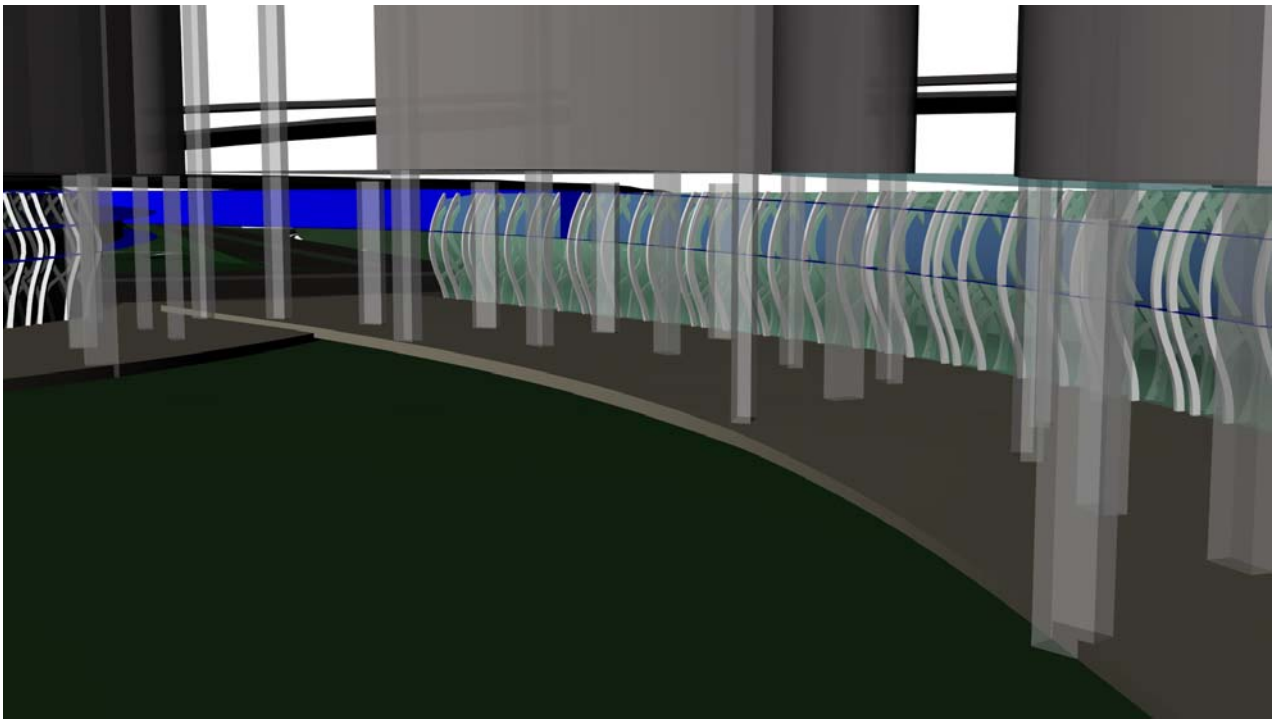


Fig 27: Perspective, Guide way aligned to the buildings.

- *Single Track better Integration along critical Building Line*
- *A much needed barrier from the Major highway*

- *The sky bus system acts as a visual and a physical buffer from the highway.*

- A transition zone with reduced speeds gives users the opportunity to better adapt with the Highway Zone.

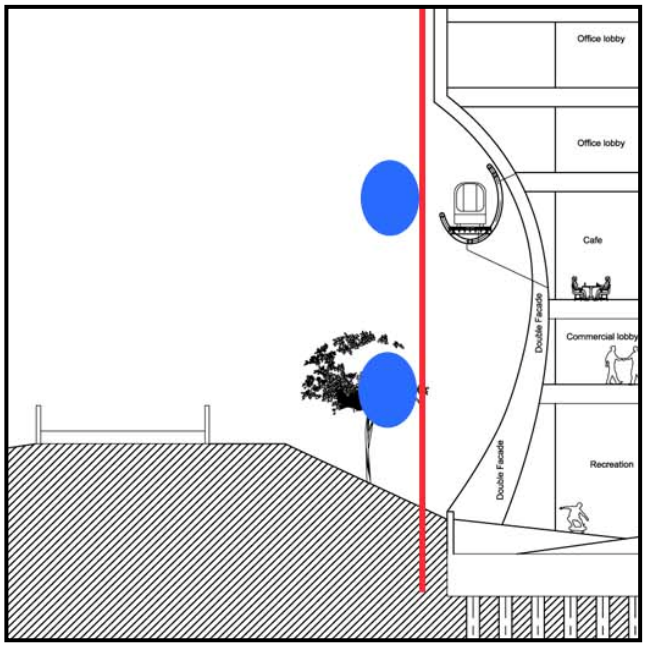


Fig 28: Schematic Section

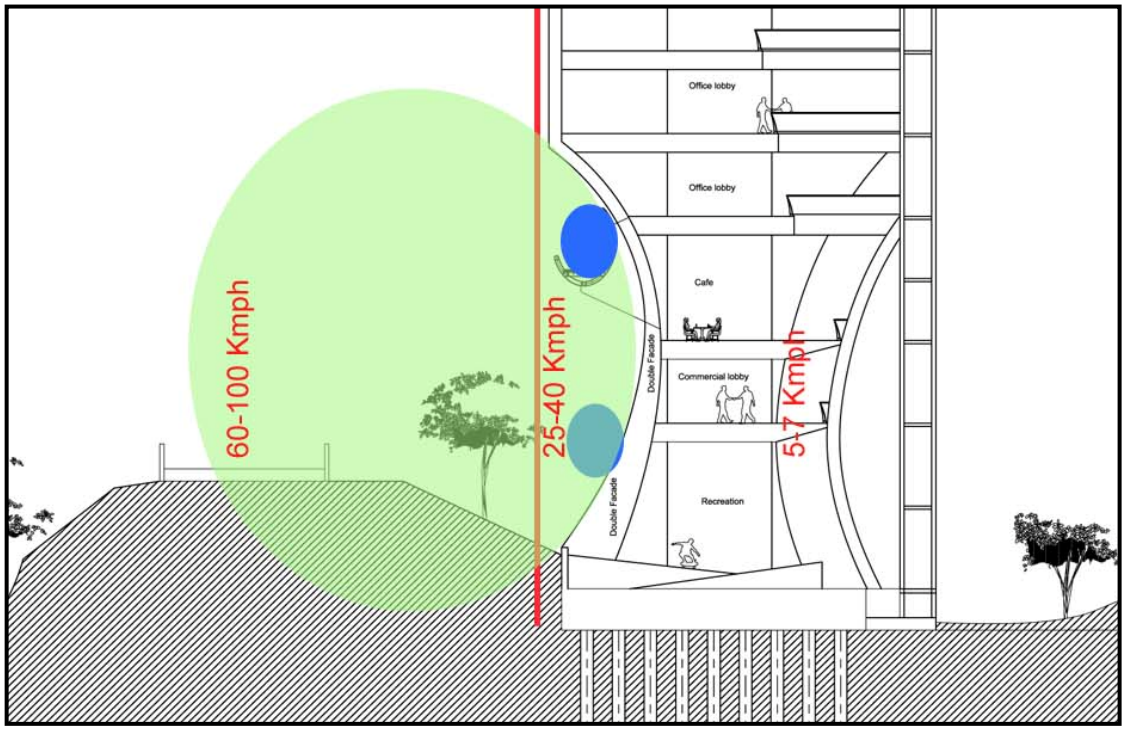


Fig 29: Schematic Section

c. Overall Shaping

- The Parameters further extend to effect the overall shaping of the Building.
- As the height of the building increases the Parameter is used to improve the Quality of Light and Creating Interactive volumes between two adjacent buildings.

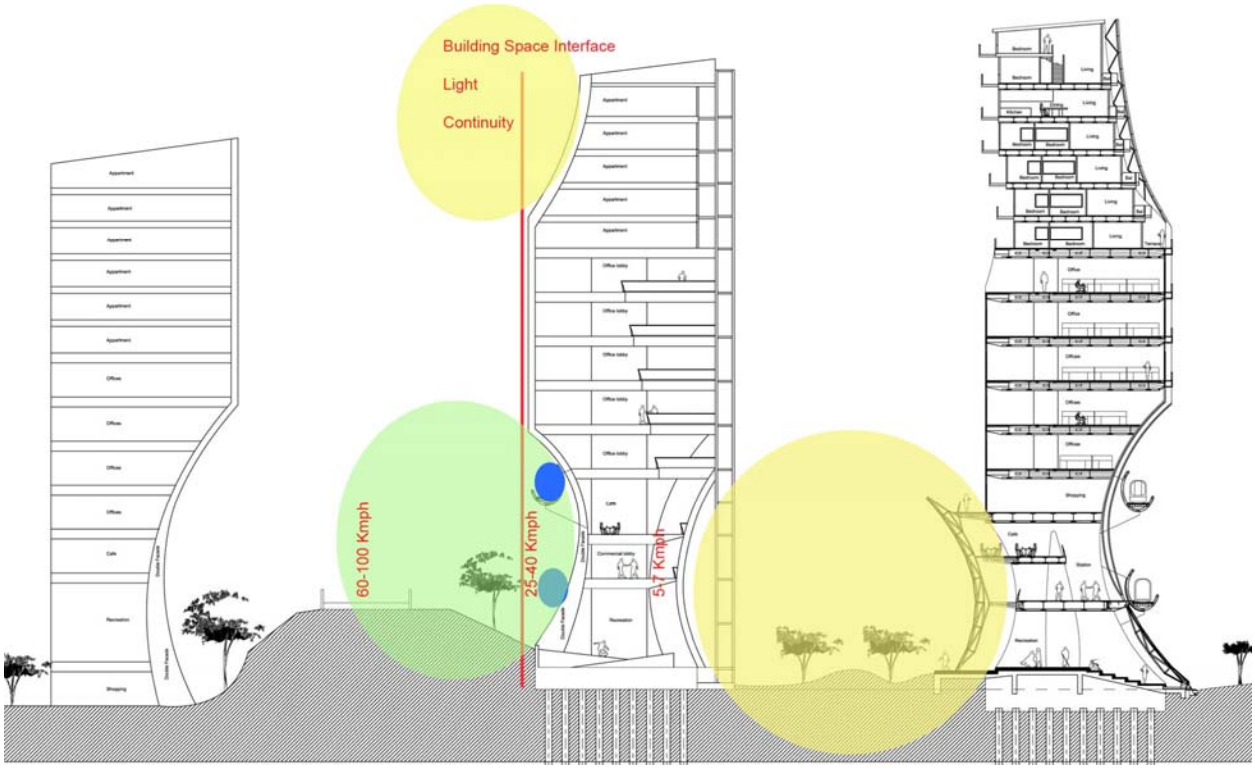


Fig 30: Schematic Section

d. 3D Simulation of Parameters

- *Defining Building Volume on the Site*

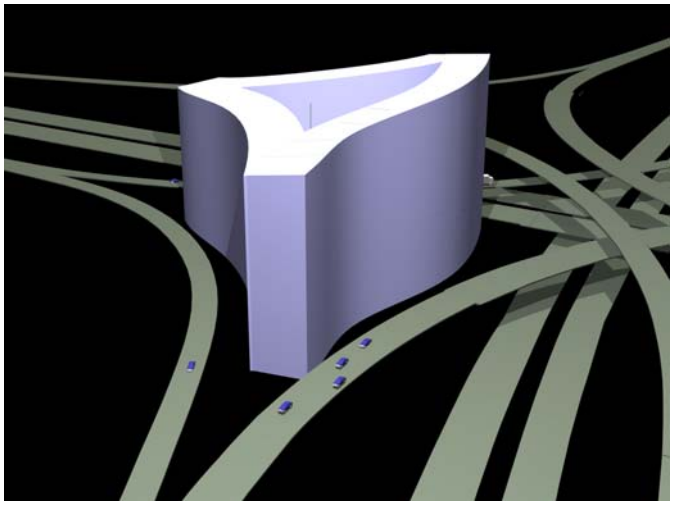


Fig 30: Perspective

- *Highway Interface Patterns*
- *Shape extracted from different speed intensities*
- *Over lapping of Bridges*
- *Tubes ranging from 8 to 16 meters in Radius which is the width of the Highway roads*
- *These shaping Tubes is an interactive parameter resembling the physical relation of the Building from the Highway.*

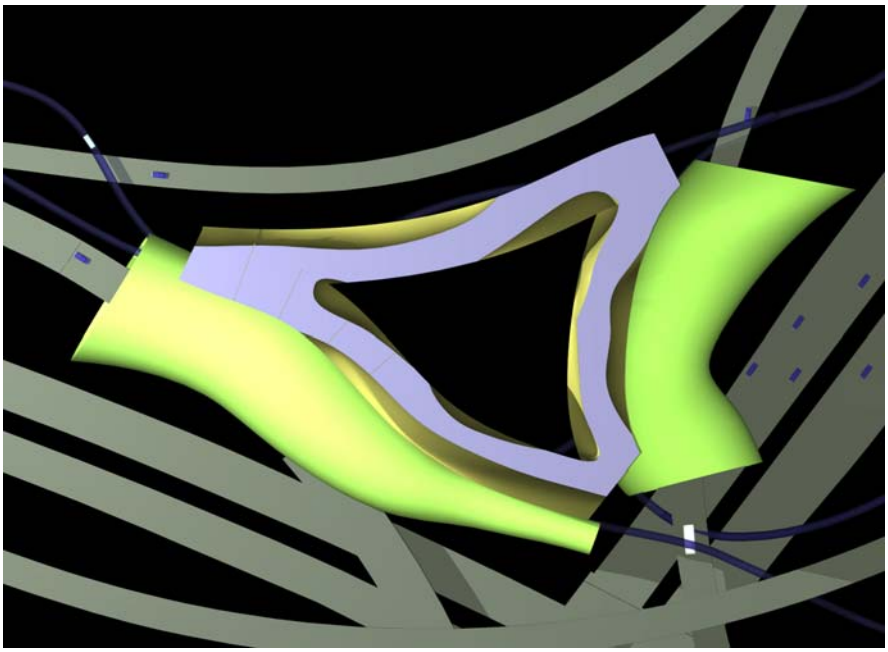


Fig 31: Top View

- *Generating Interactive Building volumes*

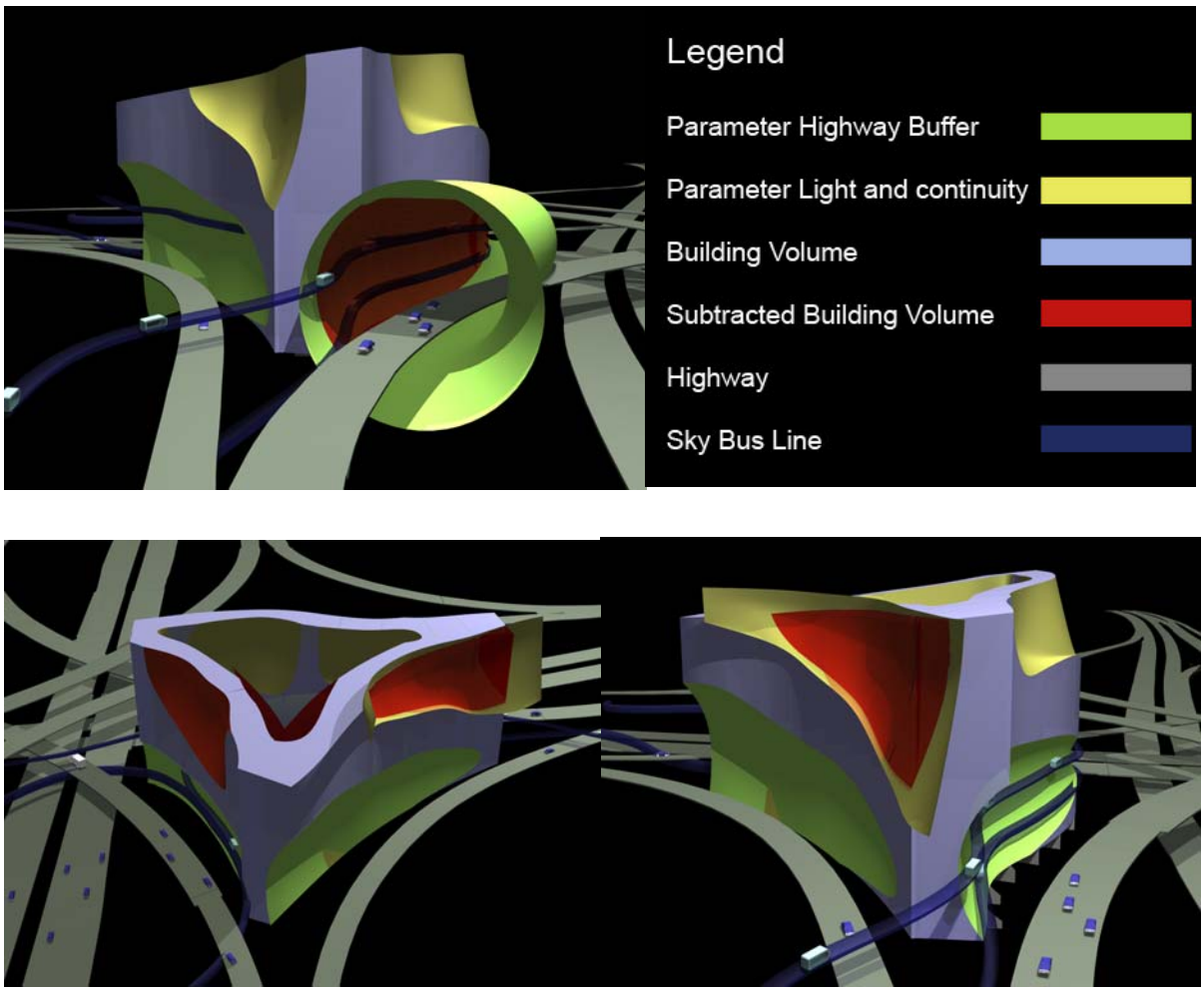


Fig 32: Parametric design Perspectives

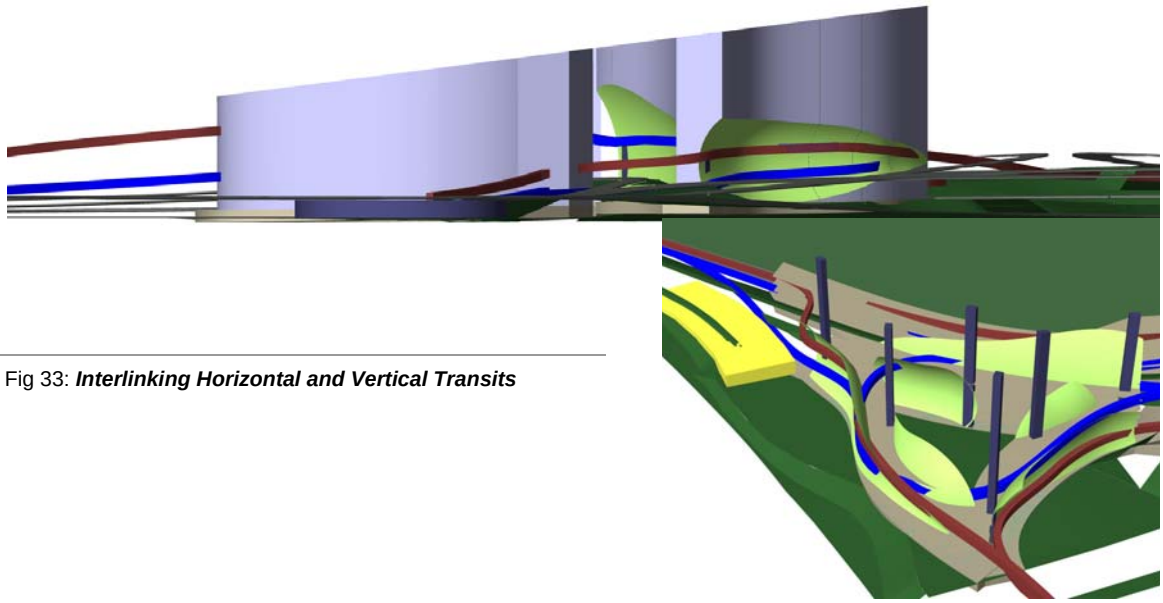


Fig 33: ***Interlinking Horizontal and Vertical Transits***

8. ***Study for Various Functions***

a. Housing Plans

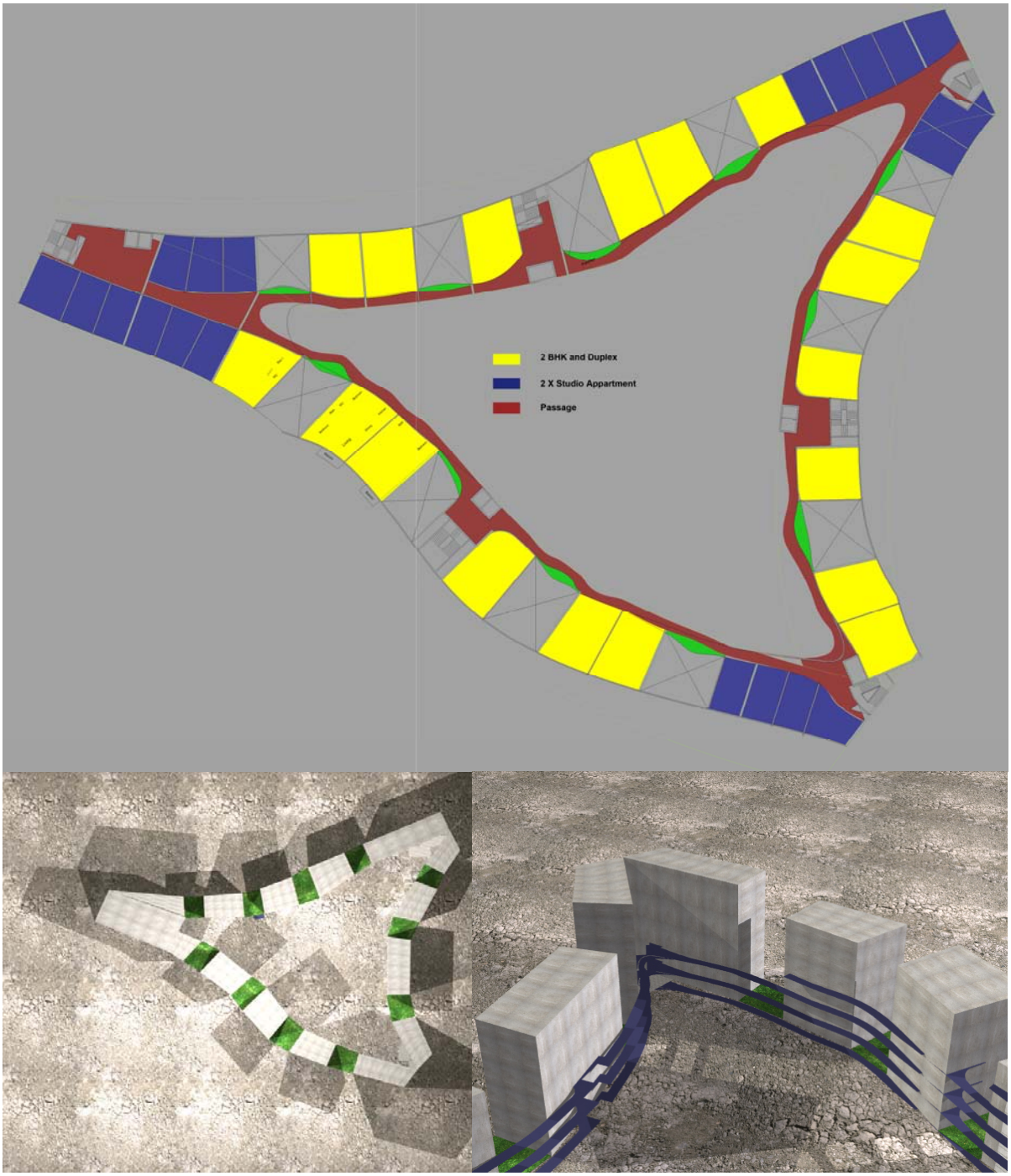


Fig 33: ***Volumetric studies of Corridors and Open courts***

- ***Design Improvisations***

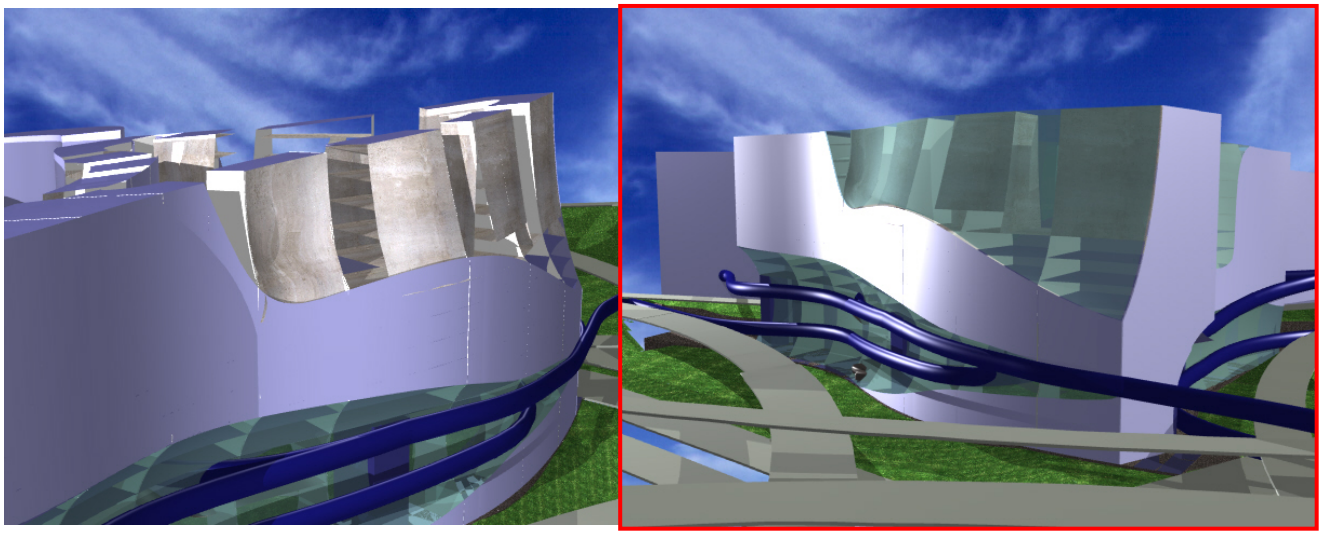


Fig 34: ***Left, housing volumes with****out scree. Right, Housing voulumes with screen*

A Wind and Sound Buffer Screen is provided

The Monotonous corridors were optimized to the minimum.

Lift lobbies were shaped to be more interactive, like stepped terrace.

Fig 35: ***Perspective with interactive corridors and stepped terraces***

b. Office Plans

- *Options 1 - Offices were provided with a continuous connecting corridor with interactive green courts.*

Fig 36: ***Plan***

- *Options 2 – Corridors were removed, and lobbies were improved, providing large open space and stepped courts.*

Fig 36: ***Plan***

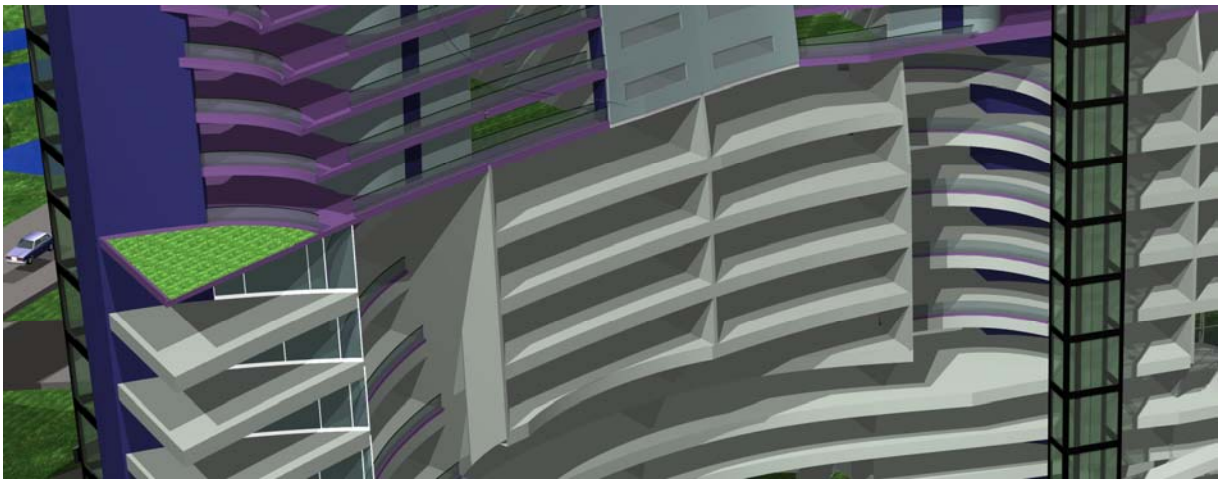
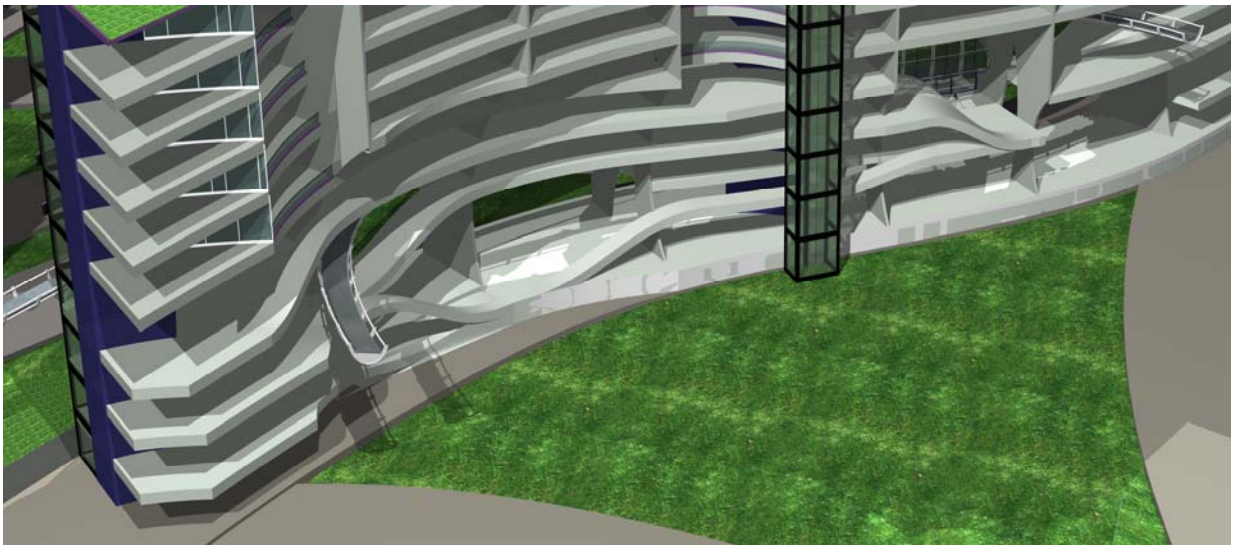


Fig 36: *Perspective with office floors and step courts.*

c. Shopping and recreation

Large open courts are provided for recreation, exhibition and cafes, flanked with automated walkways creating a continuous horizontal link.
The sky buses run way blends with the space to provide an energetic atmosphere.



9. Evaluation

a. Remarks and recommendations

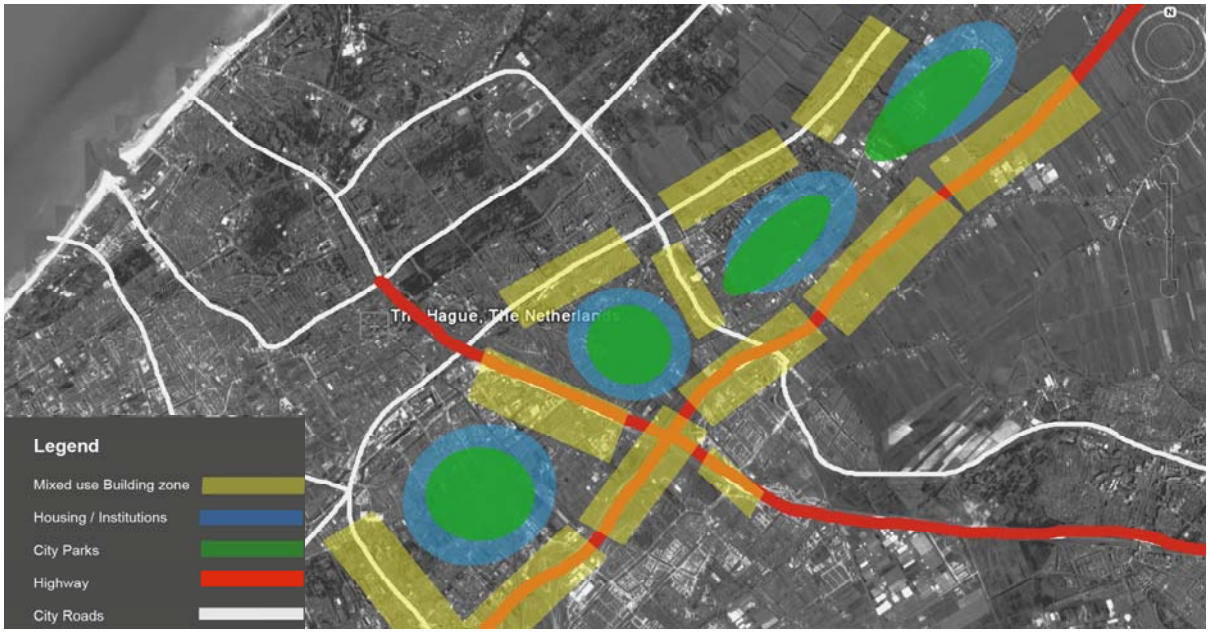
- Integration of light and clean transit systems like tramways, buses within buildings gives an opportunity to avoid construction of tram stops and bus stops. Mixed use design of buildings is promoted, as a result of the diversity within the end users of the transit facilities.

Jane Jacobs ***in her book "The Death and Life of Great American Cities"***, argued that modernist urban planning rejects the city, because it rejects human beings living in a community characterized by layered complexity and seeming chaos. These policies, she claimed, destroy communities and innovative economies by creating isolated, unnatural urban spaces. In their place Jacobs advocated a dense and mixed-use urban aesthetic that would preserve the uniqueness inherent in individual neighborhoods. Her aesthetic can be considered opposite to that of the modernists, upholding redundancy and vibrancy, against order and efficiency.

- A level of horizontal transparency is achieved since bus stops and tram stops are open visible entities of a city, which will encourage interactive atmosphere within the city communities.

- **A Conceptual Proposal** in the Figure Below shows development of a new growing urban plan. It is characterized by Hierarchical Mixed use developments along the Highway Zone. The plan provides the possibility to create larger open spaces (city parks) right within cities. Streets can be boulevards and biking tracks for free movement and better community interaction.

However the scheme needs careful zoning and categorization of business communities, to avoid mass user concentration and also inefficient working of selected zones.



Conclusions

Over Decades of Technological Development, citizens have preferred mobility as the prime factor for organization.

The positives of and Polycentric urban regions have to preserved and carried forward to a new direction of sustainable urban development.

Urban designers should consider new transport systems as a plus point and an opportunity to formulate efficient urban design strategies.

If new transport systems are moving ahead with cleaner operation, there is a need for new design strategies. Future cities can be developed in a controlled and adaptive way which integrates Transit within building systems offering possibilities such as:

- Saving city space
- Minimizing commuting and transit exchange timings
- Enhancing comfort levels for commuters.
- *Providing better connections with futuristic roads and automated transport developments, like automated/dedicated rails for goods and transport vehicles*

b. References

- Monographs

Institute of Community studies/The Young Foundation & Polynet Partners, Hall.P, Pain, K 2005, POLYNET Action 1.1 Commuting & definition of functional urban regions. The Randstad.

Gemeente Den Haag, March 2006. Structuurvisie Den Haag 2020, *Wéreldstad aan Zee,* Vliet/A4-zone.

- Websites

http://library.tudelft.nl (Technical University Delft Library)

http://www.atsltd.co.uk/prt/infra/

http://books.google.com

http://www.google.com

http://en.wikipedia.org

http://www.tubularrail.com/PhotoGallery.htm

http://faculty.washington.edu/jbs/itrans/

http://faculty.washington.edu/jbs/itrans/techtable.htm

http://www.earthtools.org/

http://www.denhaag.com/default.asp?id=8944