UCLA ARCHITECTURE & URBAN DESIGN

SUPRASTUDIO : HYPERLOOP

M.ARCH.II PROGRAM | RESEARCH FALL 2014-15

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UCLA A.U.D ARCHITECTURE & URBAN DESIGN SUPRA. STUDIO

This publication has been prepared as a part of the Fall 2014 UCLA Architecture and Urban Design Hyperloop SUPERSTUDIO. All research and content in this publication has been produced by the "Hyperloop SUPRASTUDIO" team in collaboration with Hyperloop Transportation Technologies Inc.

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Thank you to our visiting critics for the fall quarter. We appreciate your expertise, time, and effort.

Special thanks:

Dirk Ahlborn,
CEO, Hyperloop Transportation Technology Inc. for his participation, collaboration, discussions, and inspiration.

Guest lecturers include:
Don Sepulveda, Executive Officer, Regional Rail, Los Angeles County Metropolitan Transportation Authority.
Dan Sturges, Transport designer
Geoff Wardle, Director of Advanced Mobility Research, Art Center College of Design, Pasadena
Jon Christianson, Adjunct Assistant Professor, UCLA Institute of the Environment and Sustainability
Martha Welborne, Chief Planning Officer, Los Angeles County Metropolitan Transportation Authority
Syd Mead, Neofuturistic Concept Artist
John Kaliski, John Kaliski Architects
Michael Metcalfe, Metcalfe Associates
Jesse Rivera, SpaceX

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What is the Hyperloop?

Hyperloop is a unique transportation technology based on centuries-old pneumatic tube principles, promising to provide ultra-clean, ultra safe, affordable, intra-urban travel at super-high speed. It will achieve these goals by employing a high-tech mix of physics, material science, and highly efficient engineering principles to minimize its impact on the environment while offering trip times as short as thirty minutes between Los Angeles and San Francisco.

The Hyperloop concept, like most transforming innovations, is not an elaboration on existing technologies, it is a comprehensive new system-wide, highly integrated transportation utility. There is no precedent that exists for this new transportation system including station design, right-of-way, capsule movement along the tracks, or even how to address safety regulations.

The Hyperloop, like the internet and the smart phone ten to fifteen years ago, will represent the coming together of technologies never before employed into mass transportation.

UCLA's Hyperloop SUPRASTUDIO with Hyperloop Transportation Technologies, Inc. Powered by JumpStartFund in conjunction with engineers and expert consultants are having a meaningful critical discussion to begin the process to impact the way we think about high-speed transit tube systems for the future.

SUPRASTUDIO

UCLA's HYPERLOOP SUPRASTUDIO is a platform for critical appraisal, analysis, and research leading to the creation of an innovative, global way to develop a practical and passenger friendly transit tube system.

Under the direction of architecture and urban design professor Craig Hodgetts, students in the 2014–15 SUPRASTUDIO program will contemplate where stations in major cities could be based, what the urban planning around those areas might look like, what design solutions could enhance the experience for travelers (as it relates to station design, vessel design and local transportation options to and from Hyperloop stations) and how such a project could be brought to life.

SUPRASTUDIO 2014–15 is part of A.UD's IDEAS, a platform for cross-disciplinary research and collaborations among students, faculty and industry partners that questions, challenges and expands the current parameters of architectural practice. IDEAS is located at the Hercules Campus in Playa Vista, Calif., the historic site where Howard Hughes built the Spruce Goose aircraft in the 1940s.
butes, such as the diameter of the passenger car have massive cost and material impacts when extended throughout the system. This method enables the team to evaluate various hypotheses in the context of other potential factors in order to optimize the system attributes as a whole.

FALL QUARTER RESEARCH

UCLA's Hyperloop SUPRASTUDIO is looking at all the factors to be considered to make the Hyperloop concept a reality including studies of the hills and valleys along possible routes, and how the right-of-way might affect nearby houses or farms through which it might pass. The studio is studying where people might live who want to take advantage of the speed and convenience the Hyperloop is expected to offer, while considering various locations for stations and the networks of roads, public transportation, and even bicycle routes which might bring people to the terminal.

The Hyperloop terminal itself is the subject of a comparative study of terminals around the world owing to the challenge of providing for up to 120 departures, and an equal number of arrivals every hour, leading the students to speculate on how robots or mechanized turntables might be used.

Understanding and defining the most unique elements of the whole idea – the pneumatic tube through which the passenger compartment will travel, and the passenger compartment itself, has inspired the studio to investigate unprecedented devices for boarding, for entertainment, and for simple human comfort.

The studio conceives the system as a whole, rather than as a collection of parts, in which each piece has a role to play in a harmonious, seamless transportation system. This as a rare opportunity, where i systems, innovation, and design present an opportunity to come together, under one roof.

Students participating in this remarkable effort come from all around the globe including Greece, China, India, and the USA. They share an enthusiasm for the future, for the impact the Hyperloop can have on ordinary people and for the overall nearly utopian impact it will have on energy and global warming.

During the fall quarter students have created maps and diagrams, built models, and even a full-scale mock-up to extend their understanding of the limits and potentials of the concept. They have not yet set about doing what they came together to do – the winter and spring quarters will be devoted to design, down to the smallest detail, to show how the Hyperloop might come to life.

WINTER QUARTER RESEARCH

By utilizing the research from the first quarter the studio will develop specific design scenarios for various parts of the Hyperloop.

Using the full-scale mock-up as a base, the students will experiment with various seating and storage layouts to achieve maximum comfort, convenience and efficiency. These layouts will serve also as important opportunities to introduce potential users to the Hyperloop experience, and to observe how they respond. Various entertainment options will be explored as well, such as video projections, sound effects, and interactive surfaces, all of which can be simulated at actual size within the mock-up of the passenger compartment.

Refined concepts for the station, including operational designs will be developed in this quarter. Advanced ideas for security checks, baggage handling, and "last mile" transportation will be choreographed to achieve a seamless experience, wherein the endless queues, delays, security checks, and distances will be streamlined and consolidated into a single "stream" through the use of advanced software and careful design. By minimizing the time spent from curb to seat, the goal is to reduce the size of the station itself, thereby reducing its impact on the surrounding urban context. Specific ideas regarding last-mile transportation links, such as Hyperloop-financed autonomous vehicles, or high-density auto storage will be investigated as a way to further minimize the footprint of the station complex.

This quarter will also see the development of the right-of-way, including the pneumatic tube structure, the tunnels and supporting columns, and design of accessories to meet special conditions, such as emergency exits, switches to enable cars to by-pass one another, and plans for service and access.

SPRING QUARTER RESEARCH

This quarter will be devoted to individual student team design proposals for the Hyperloop System as a whole. By extracting program data from the previous quarters, student design scenarios will share in the functional requirements, sizes, and relationships to urban infrastructure, giving them a common base, and encouraging them to create architecturally significant designs for the complex as a whole. Final designs and more elaborate installations within the mock-up will incorporate media, materials, color and lighting to give users the ability to envisage the entire experience.

-Craig Hodgetts

PARTICIPANTS AND PARTNERS:

CRAIG HODGETTS

Hodgetts, known for the acoustical design of the all-new Hollywood Bowl and the Wild Beast Pavilion at the California Institute of the Arts, is a cutting-edge architect who specializes in the translation of emerging technologies into practical, future-oriented projects. In 2005, the American Institute of Architecture, Los Angeles awarded Hodgetts its Teacher of the Year award, and in 2006, he was honored with the chapter's Gold Medal.

DIRK AHLBORN

Dirk is the CEO and co-founder of JumpStartFund, an online crowdsourcing platform for entrepreneurial projects. He is also the CEO of Hyperloop Transportation Technologies, a project incubated using JumpstartFund's crowd collaboration process.

MARTA ANNA NOWAK

UCLA Architecture and Urban Design Lecturer with the Hyperloop SUPRASTUDIO, Marta Anna Nowak will organize the studio communication and data analysis with the students.

DAVID ROSS

UCLA Architecture and Urban Design Lecturer with the Hyperloop SUPRASTUDIO, David Ross will lead the development of technology critical to the Hyperloop mission. Ross will also manage the production of models and prototypes with the IDEAS AdvancedTechnology Lab.

HYPERLOOP TRANSPORTATION TECHNOLOGIES, INC POWERED BY JUMPSTARTFUND

El Segundo, CA-based JumpStartFund is a crowd-powered incubator that allows entrepreneurs to build communities of experienced professionals around their projects. Both an equity and rewards-based crowd platform, JumpStartFund helps startup companies and a wide variety of projects. Using the disruptive power of the crowd to vote, comment and contribute on ideas in development, the platform is designed to help create companies that might not have been. Founding members have been part of the Girvan Institute of Technology, a non-profit, public benefit corporation chartered to facilitate the transfer, development and commercialization of technologies, and to foster the growth of early-stage high-tech companies. JumpStartFund's primary mission is to help both entrepreneurs and investors leverage the power of the Internet to make it easier for companies to succeed. For more information, please visit www.jumpstartfund.com.

STUDENTS INCLUDE:

Shuangjiao Hu, Junfeng Hong, Xiaoyuan Li, Chunhua Chiu, Puyang Hou, Christos Kyratsous, Jie Li, Jinliang Chen, Sruthi Kumar, Hanxiong Liu, Danfeng Chen, Hui Feng, Yifan Zhang, Suhua Wang, Xianshuang Zeng, Yafel Zhang, Weizhong Zhang, Shuyan Zhang, Milagro Carpio, Qiaoyue Wang, Yayun Zhou, Zeynep Aysu Unal, Matt Whitham, Kai Qian, Shijie Zhang

UCLA ARCHITECTURE AND URBAN DESIGN

UCLA Architecture and Urban Design (A.UD), part of the UCLA School of the Arts and Architecture, pursues issues confronting contemporary architecture and urbanism through its bachelor's of arts program in architectural studies and its four advanced degree programs: the master of architecture I, master of architecture II, master of arts in architecture, and doctorate of philosophy in architecture. The programs' primary focus on advanced design is complemented by concentrations in technology and critical studies of architectural culture.

ROUTE RESEARCH

CURRENT CONDITIONS

Looking at the route design problem from both the national and regional scale, the studio overlays the Hyperloop network onto the existing modes of transportation. Using the problem-solution model, the studio proposes national and regional strategies of route building, taking social, economical and political conditions into consideration.

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TIMELINE
History of Long-Distance Route

Transportation

Travel

Infrastructure

On foot
3.1mph

The Wagon
2 mph

Horse
15 mph

The Horse Wagon
12 mph

Boat
9 mph

Caravel
30mph

Bicycle
12 mph

Plane 500 mph

Train 55 mph

Hot air
Balloon

Vehicle
50mph

7000-4000 BC | 3000 BC | 2000 BC | From 1000 BC | 10th-15th | 16th-18th | 19th-NOW


Wooden Sledges


Invention of Wheels


Invention of Wheels


Early Navigation


Junks and caravels


Carriage and Post Chaise


Domestication of cattle


6th Century BC
The great canal of Darius I


The Grand Canal:
3rd century BC - 13th century AD


Roman Road


Aquaducts


Flash locks
and pound
locks


Inca Roads


The roads of Telford
and McAdam


The highway/railway/
airline system

TIMELINE
History of Long-Distance Route

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Modes of Transportation:
Ancient Road

Year:
202 BC- 8 AD

Cause:
The Ruler of Han Dynasty in ancient China wants to develop the economy by opening up new markets to different countries. Also they want to use the road to make more alliance with western countries fighting towards Huns.

Effects and Results:
Trading activities along the Silk Road over many centuries facilitated the transmission not just of goods but also ideas and culture, notably in the area of religions. Zoroastrianism, Judaism, Buddhism, Christianity, Manichaeism, and Islam all spread across Eurasia through trade networks that were tied to specific religious communities and their institutions. Notably, established Buddhist monasteries along the Silk Road offered a haven, as well as a new religion for foreigners.

Distance: (miles)	Time: (Minutes/Hours/**days**)	Load: **(*/hour)**	Cost: (Dollar/mile)	
4000	**90**		Cargo: 0.2t People: 8	Past: 0.1 Now: 12

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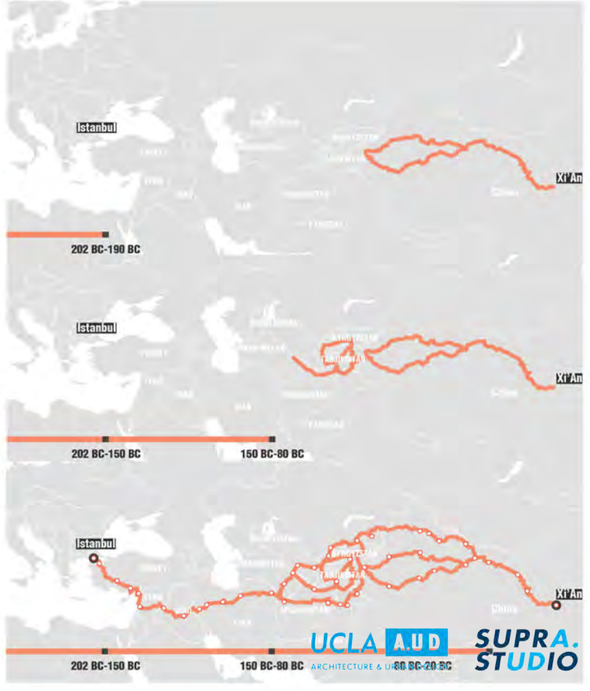
Religion Analysis

Before the Silk Road

After the Silk Road



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Modes of Transportation:
Freeway

Year:
1926

Cause:
Spawned by the rapidly changing demands of America, entrepreneurs, Cyrus Avery of Tulsa, Oklahoma and John Woodruff of Springfield, Missouri conceived of the grand idea of linking Chicago to Los Angeles and began lobbying efforts to promote the new highway. While other East/West highways existed at the time, most followed a linear course, leaving out the rural communities, dependent upon transportation for farm products and other goods. The federal government finally pledged to link small town U.S.A. with metropolitan capitals in the summer of 1926 and designated the road as 66.

Effects and Results:
Its contribution to the nation must be evaluated in the broader context of American social and cultural history. The appearance of U.S. Highway 66 on the American scene coincided with unparalleled economic strife and global instability, yet it hastened the most comprehensive westward movement and economic growth in United States history.Route 66 helped to spirit a second and perhaps more permanent mass relocation of Americans.

1926-1933	1933-1945	1945-1948	1956	1985	1990
Formative Years Increased Job Opportunities Increased Transportation Efficiency Benefiting Trucking Industry	The Great Depression,World War II 210,000 people migrated to California New Military Bases Main road for Supplies delivery	65,000 cars to 3.9 million	New Highway System been built	Out of use	Hisoric Route 66

Distance: (miles)	Time: (Minutes/Hours/**days**)	Load: (People/hour)	Cost: (Dollar/mile)
2448	15	1K	Past: 0.5 Now: 9

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Sections

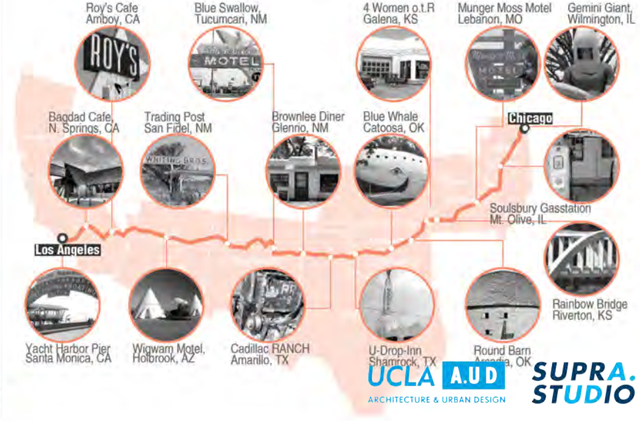
SectionA: The mountainous Region

SectionB: The hilly Region

SectionC: The Plain Region

Analysis of Population Growth 1936-1933

Roadside Attractions



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TRANSCONTINENTAL RAILROAD
Precedent

Modes of Transportation:
Railroad
1862-1869

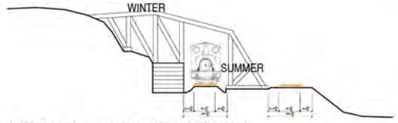
Cause:
-In 1830 the locomotive was invented, having lots of railways built in the East. -In 1849, gold mining is discovered in California, thus introducing a heightened interest of economics and migration to the West.
-Railroad lobbyist from Union Pacific and Central Union pushed for railway to the West
-President Abraham Lincoln signed the Pacific Railroad Act

Effects and Results:
-It opened the US to the Pacific, linking both oceans. First intercontinental continental railroad.
-Immediate effects were and increase of migrants to discover the west. 2.5 million from 1895-1916
-While thousands of Native Americans were displaced.
-Economic, industrial, agricultural growth for the United States
- New growth of towns along route.

1848	1849	1862	1863	1869	1880
California becomes a	California discovers gold. Bringing	President Abraham Lincoln signed the	The Central Union Railroad begins construction in Sacramento. Through manifesdestiny, many Native Americans are displaced.	Both rails meet at	3x miles of railroad track in the US than 1860. Pacific railroad carries $50 million worth of freight each year

Distance: (miles)	Time: (Minutes/Hours/**days**)	Load: (People/hour)	Cost:
1776	**Before: 3 weeks** **After: 7 days**	$50 million worth of freight annually	**Before: $1,000** **After: $100**

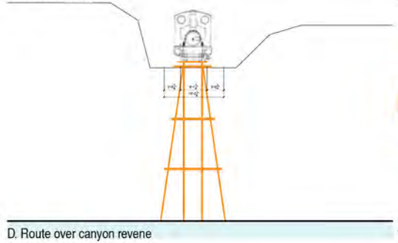
ROUTE SECTIONS



A. Winter and summer routes through high terrain

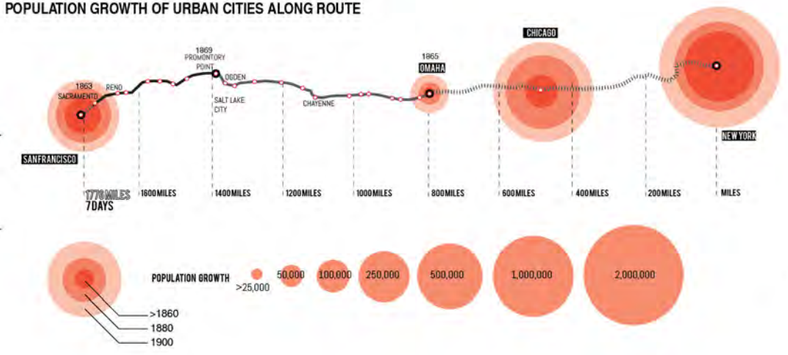
B. Route through plains

C. Route over river



D. Route over canyon revene

POPULATION GROWTH OF URBAN CITIES ALONG ROUTE



POPULATION RAIL GROWTH OF THE US BEFORE AND AFTER RAILROAD

Modes of Transportation:
Railroad
1891-1916

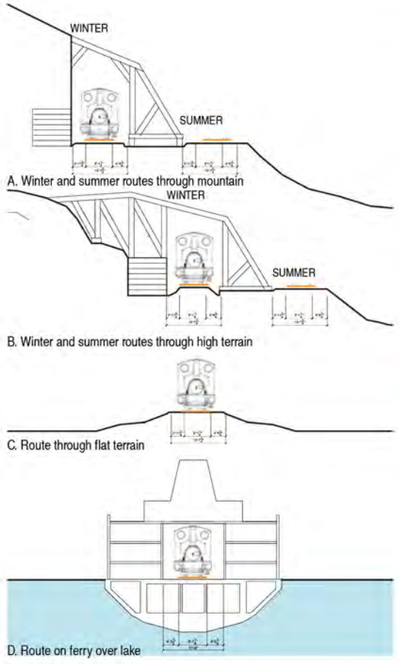
Cause:
Political and economics. In order to unite the rich yields of Siberian nature with the network of Russian railways. Emperor Alexader III was convinced and appointed a plan for construction.

Effects and Results:
-It opened Europe to the Pacific, linking both oceans. First cross continental railroad.
-Immediate effects were Siberian migrants crossing to the east of Russia doubled.
-Economic, industrial, agricultural growth for Russia
- New growth of towns along route.

Distance: (miles)	Time: (Minutes/Hours/days)	Load: (People/hour)	Cost:
5772	**Before: 3-6 months After: 30 days**	**100 lbs of freight annually**	**$160 *1899**

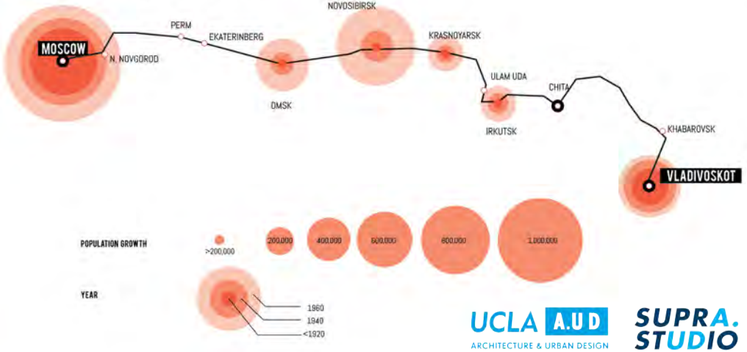
0 1000 2000 miles

ROUTE SECTIONS



DISTANCE DIVISIONS

POPULATION GROWTH OF URBAN CITIES ALONG ROUTE



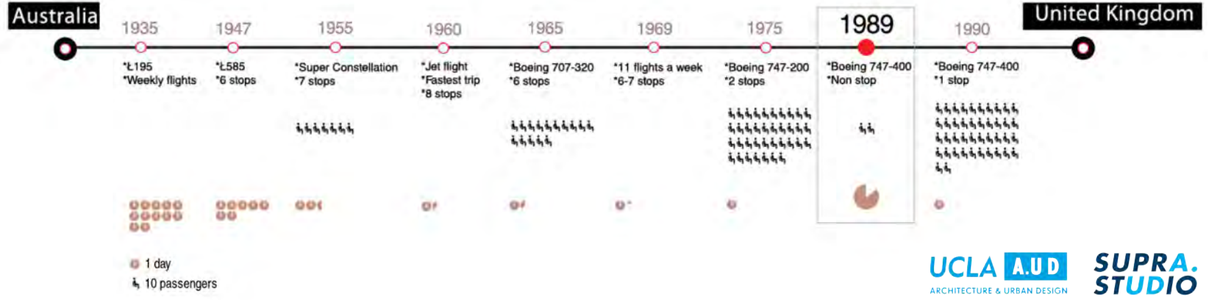
Modes of Transportation:
Flight

Cause:
This flight route connected different continents together, Europe and Australia.

Effects and Results:
Boeing 747–400 flew was the first non stop route from London to Sydney in just over 20 hours and established a new world distance record for a commercial aircraft.

Distance: (miles)	Time: (Minutes/**Hours**/days)	Load: (People/Flight)	Cost:
11185	20	23	Ł195 in 1935 Ł300 in 1947

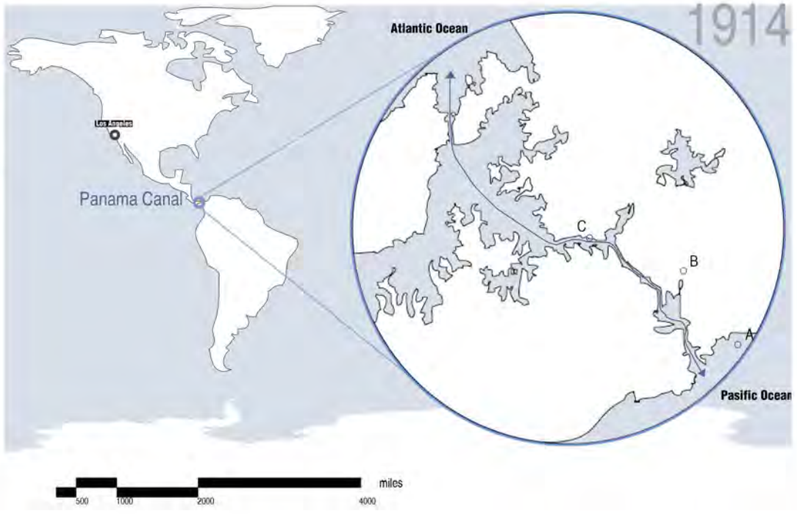
FLIGHT ROUTES
Precedent



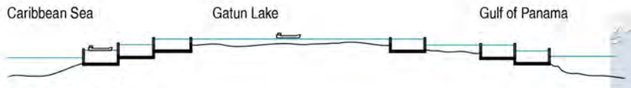
Modes of Transportation:
Canal

Cause:
Connecting the Atlantic Ocean (via the Caribbean Sea) to the Pacific Ocean.

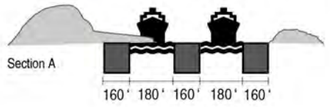
Effects and Results:
Ships traveling between New York and San Francisco save 7,872 miles by using the Panama Canal instead of going around Cape Horn.

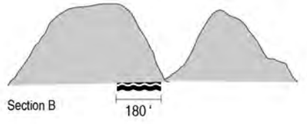


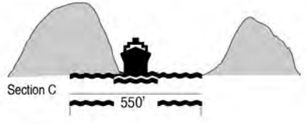
Distance: (miles)	Time: (Minutes/**Hours**/days)	Load: (Ship/Year)	Cost:
48	8-10	1000 ships in 1914 14702 Vessels in 2008	$72.00 per TEU* *2009



Section through the canal







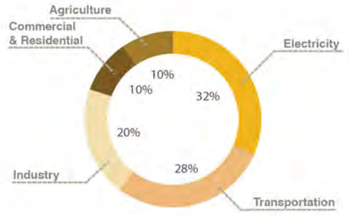


Figure 1: Total U.S. Greenhouse Gas Emissions by Economic Sector, 2012

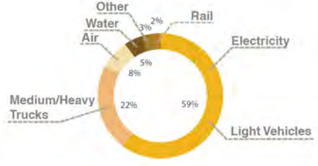
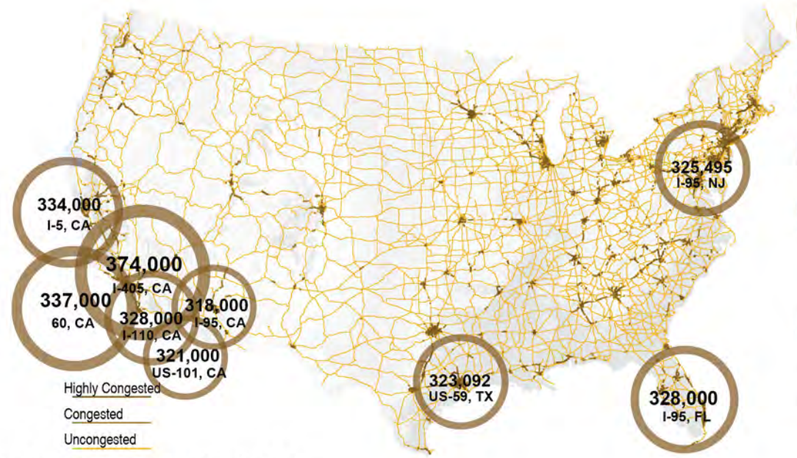


Figure 2: Transportation Energy Use by Mode, 2010

U.S. Highway Network



U.S. Busiest Highway Sections of Annual Daily Traffic

U.S. HIGHWAY TRAFFIC VOLUME

HIGHWAY TRAFFIC VOLUME ON INTERSTATE AND NON-INTERSTATE HIGHWAYS

Figure 3: US Highway 50 westbound, West of Eureka, NV

Figure 4: Arial VIew of a Los Angeles Highway Intersection

U.S. Highway Traffic Volume

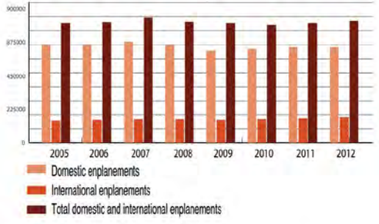
U.S. RAILWAY SYSTEM

RAILWAY SYSTEM & TRAFFIC VOLUME

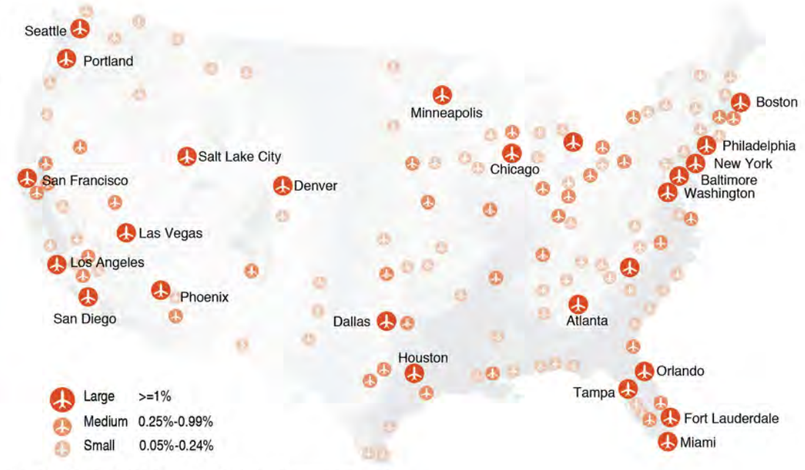
U.S. Railway Traffic Volume

U.S. Railway System

Airline enplanements (domestic and international) peaked in 2007 and bottomed in 2009before starting a steady climb. Between 2009 and 2012, domestic enplanements rose 3.9 percent, and international enplanements rose 12.4 percent. In 2012 total enplanements remained 2.6 percent below the 2007 peak, with domestic enplanements down 5.4 percent, while international enplanements were up 9.5 percent.

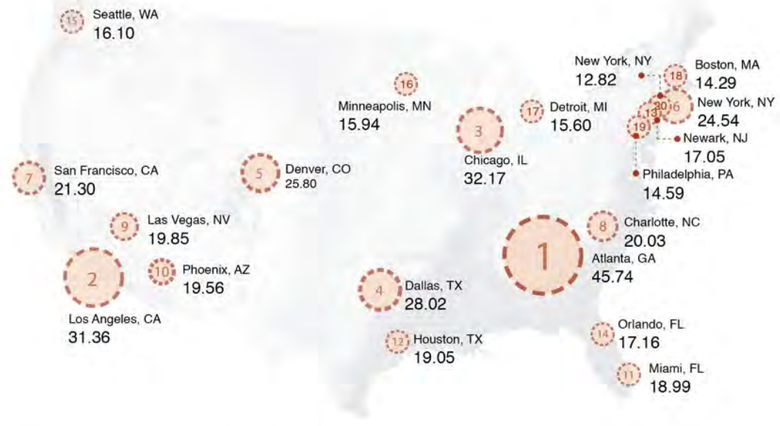


Annual Airline Passenger Enplanements: 2005ñ2012



U.S. Airport Market Size by Number of Domestic Enplanements, 2012

U.S. AIR FLIGHT SYSTEM
AIR HUBS & AIRPORTS RANKING

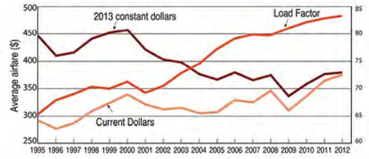


U.S. Passengers Boarded at the Top 25 Airports

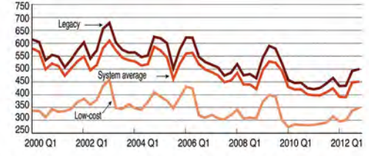
Among large airports, Newark had the highest percentage of flights delayed in 2012, with 34.5 percent of total flights delayed. San Juan, PR, had the most delayed flights for a medium sized airport in 2012, with 30.9 percent of flights delayed. Topping the list for the small airports category, with 38.1 percent of flights being delayed in 2012, was Baton Rouge, LA.

U.S. AIR FLIGHT SYSTEM

BUISIEST ROUTES



Total Domestic Load Factor and Average Airfare, 1995–2012



Average Cost of Airfare for Domestic Flights (2012 dollars)

Rank	City 1	City 2	Passengers(2013)
1	San Francisco, CA	Los Angeles, CA	7,753,200
2	New York City, NY	Miami, FL	5,578,900
3	New York City, NY	Los Angeles, CA	4,693,900
4	Chicago, IL	New York City, NY	3,928,600
5	Orlando, FL	New York City, NY	3,732,500
6	New York City, NY	San Francisco, CA	3,329,600
7	Boston, MA	Washington, DC	3,043,100
8	Seattle, WA	Los Angeles, CA	2,514,300
9	Atlanta, GA	New York City, NY	2,495,100
10	Las Vegas, NV	Los Angeles, CA	2,418,200

U.S. Top 10 Busiest Domestic Air Routes

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U.S. WATERS

INLAND WATERS, FLOW OF COMMODITIES & TOP PORTS

Top 50 & Top 20 Ports in U.S.

Inland Waters U.S.

Annual Flow of Waterborne Commodities, U.S.

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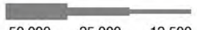
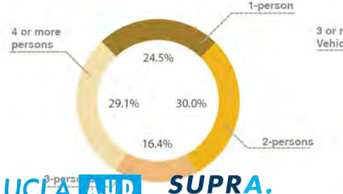
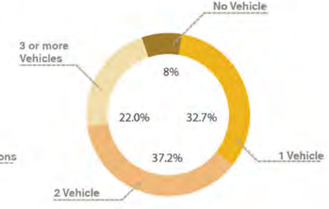
California Highway System



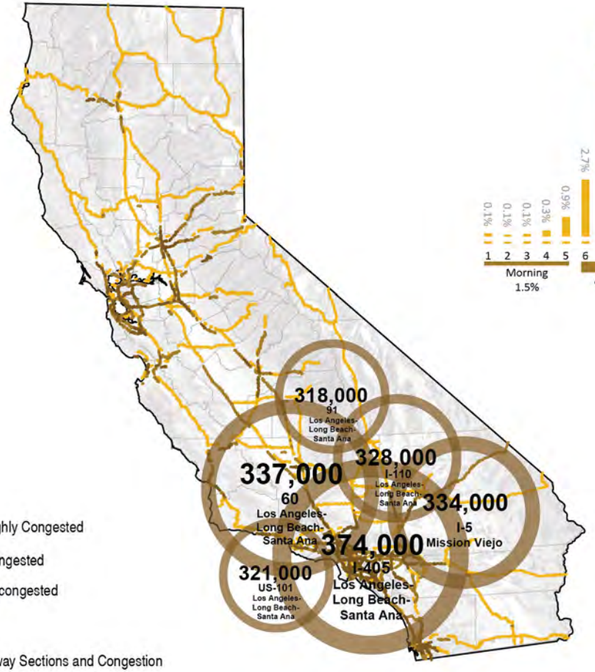
California Highway Traffic Volume



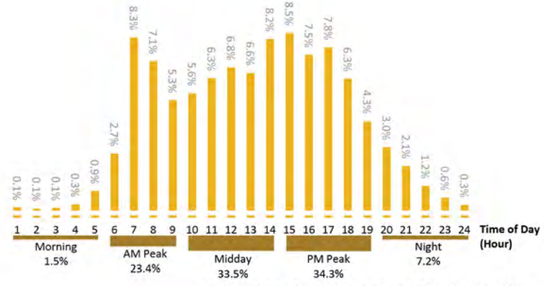
Household Size in California



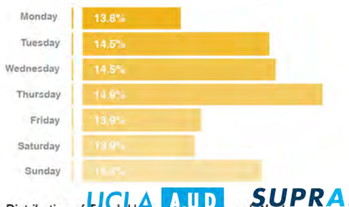
Number of Household Vehicles



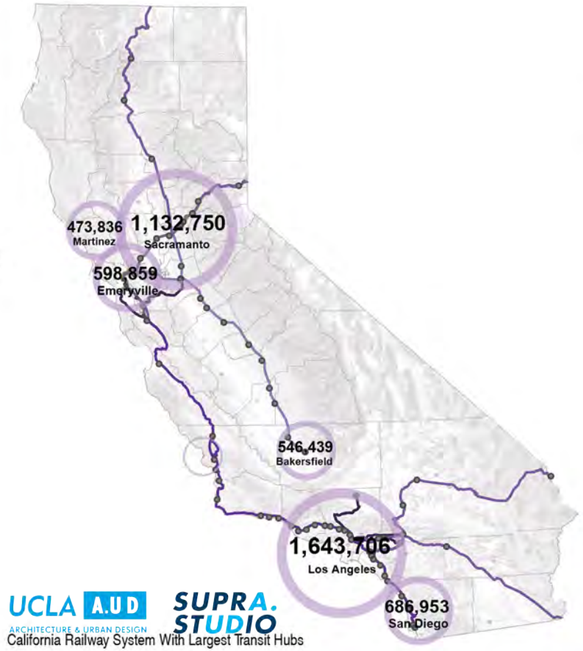
California Busiest Highway Sections and Congestion



Trip Distribution by Departure Hours in One Business Day

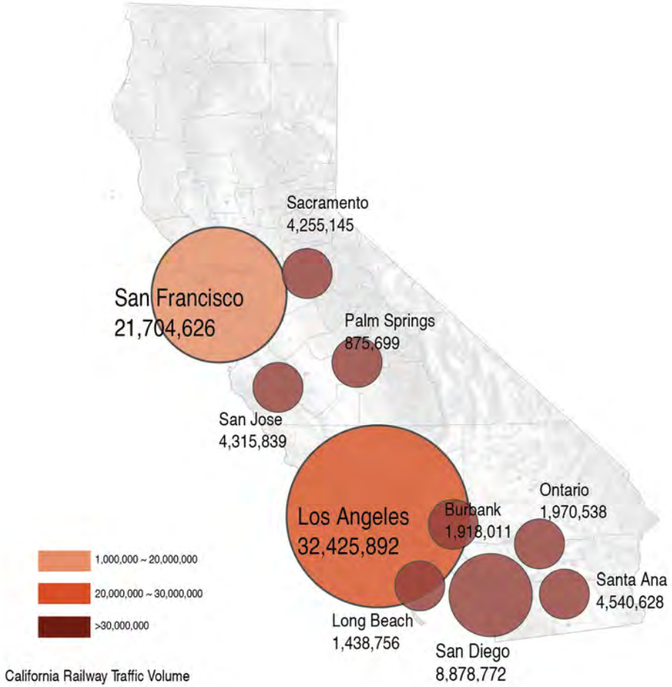


Distribution of Travel, Household by Day of Week

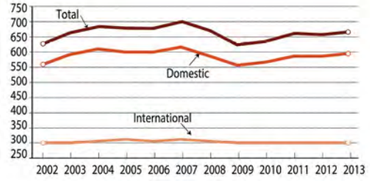


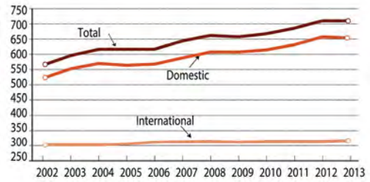
California Railway System With Largest Transit Hubs

California Railway Traffic Volume

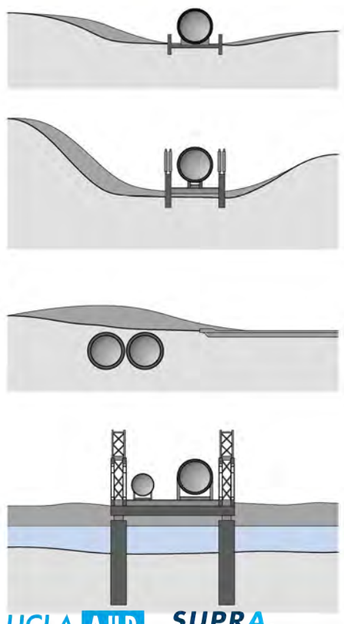


California Railway Traffic Volume

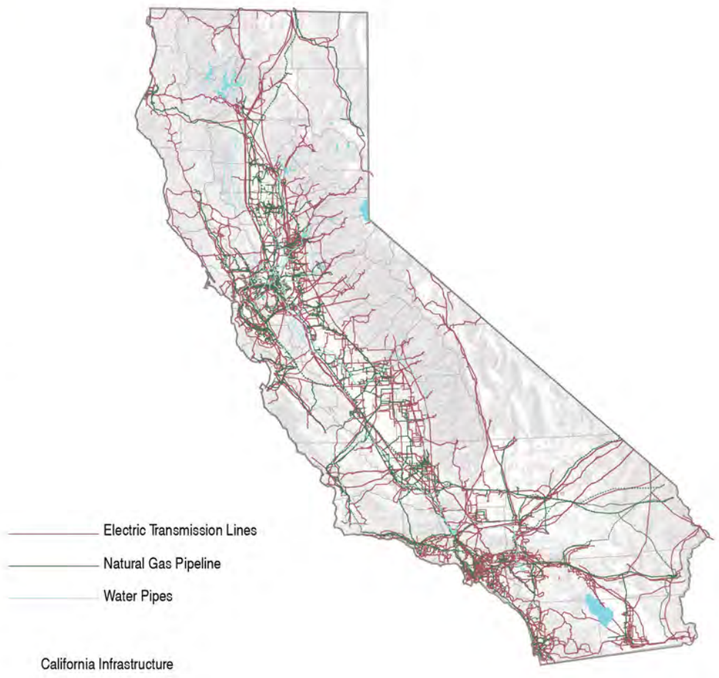




Annual Flight Amount, 2002-2013
1. Los Angeles, CA: Los Angeles International (LAX)
2. San Francisco, CA: San Francisco International (SFO)

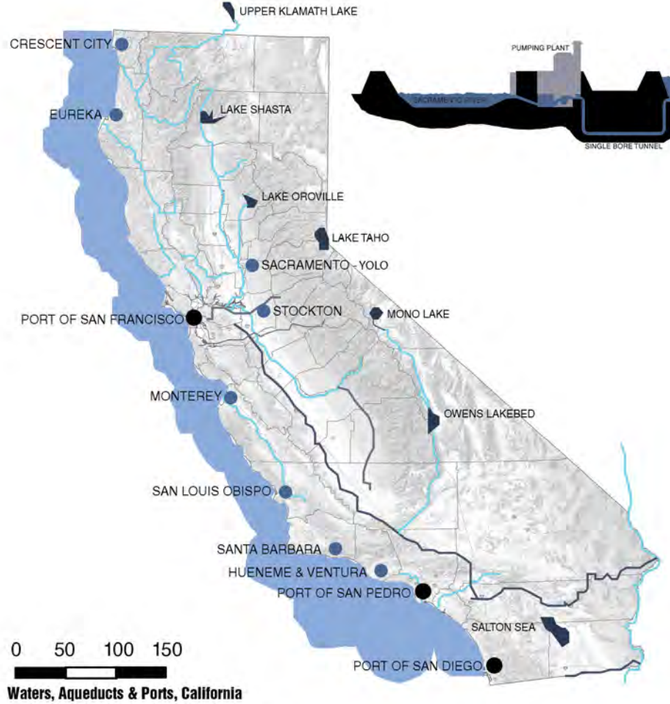


Pipe Line Sections



California Infrastructure

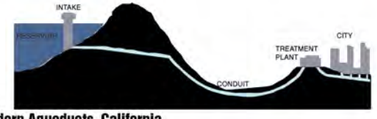
CALIFORNIA PORTS AND WATERS & AQUEDUCT DETAILS



Waters, Aqueducts & Ports, California

Diagram of Proposed Delta Pipelines

Diagram Showing Waterflow from California Aqueduct



Modern Aqueducts, California

PORTS OPERATED BY AGRICULTURE COMMUNITY

PORTS FEDERALLY OPERATED

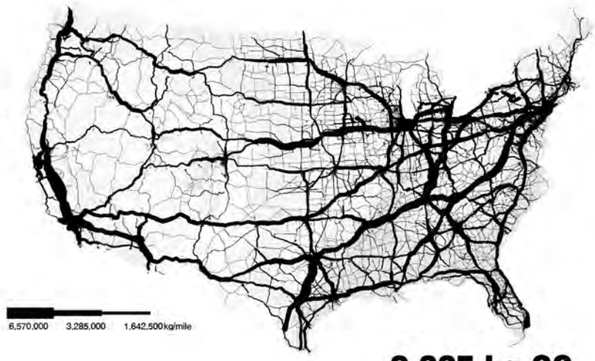
RIVERS

AQUEDUCTS/ CANALS

LAKES/ RESERVOIRS

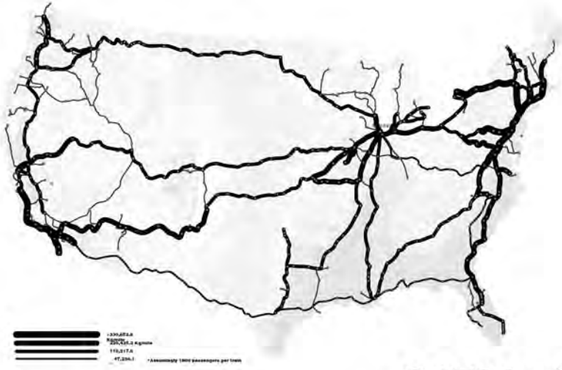
CALIFORNIA'S OCEAN - GOING VESSEL REGULATORY ZONE

Car



0.225 kg CO_2
per passenger mile

Rail



0.172 kg CO_2
per passenger mile

Flight

0.185 kg CO_2
per passenger mile

Ship

0.048 kg CO_2
per passenger mile

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SCOPE OF RESEARCH
Criterias

For the network, 9 criterias have been shortlisted to reveal the potential of the sytem. These criterias are ranked from a scale from 1 to 10 for each city.

Population	Looking for number of people in each city
Population Growth	Understanding the change of population by time
Public Transport System	Seeking for opportunity to use public transportation
Job Number	Research on the number of the employee in each city
Job Growth	Looking for job growth data and their percentage
Ridership	Understanding the frequency and the number of people using public transportation
Tourism	Researching on number of international and national tourists for each city
Proximity to Cities	Calculation of distance and connectivity of cities
Freight	Looking for the frequency and the number of commercial connections among cities

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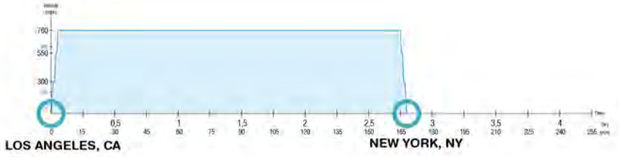
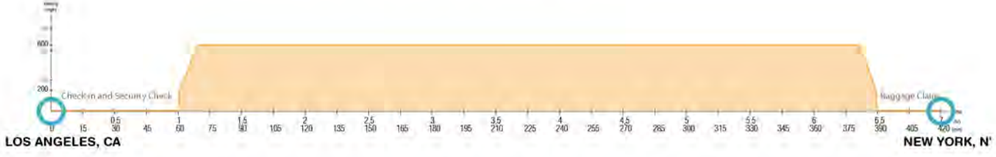
FLIGHT VS HYPERLOOP
Route from Los Angeles to New York

Non Stop



4 stops

Non Stop



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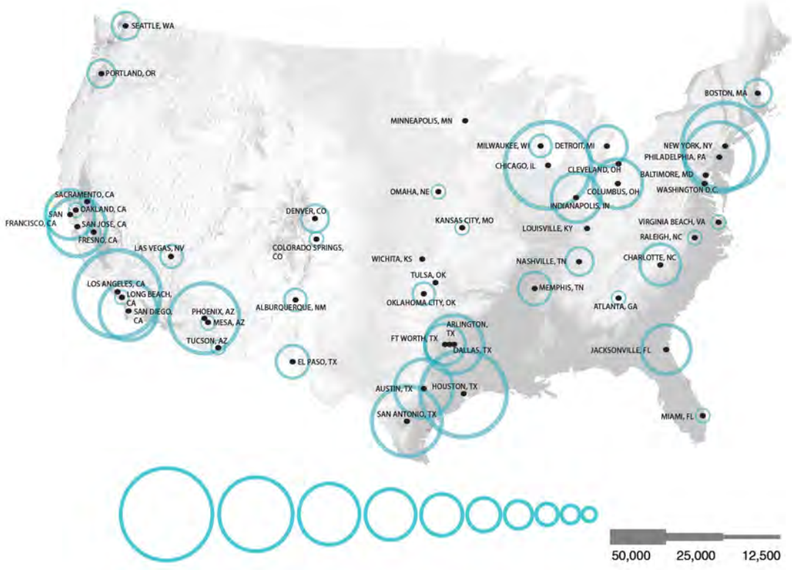
RATING OF TOP 50 POPULATED CITIES

Population

City Name	Population	Score
New York, NY	8.336.697	10
Los Angeles, Ca	3.857.799	10
Chicago, IL	2.714.856	10
Houston, TX	2.160.821	10
Philadelphia, PA	1.547.607	9
Phoenix, AZ	1.488.750	9
San Antonio, TX	1.382.951	9
San Diego, CA	1.338.348	8
Dallas, TX	1.241.162	8
San Jose, CA	982.765	8
Austin, TX	842.592	8
Jacksonville, FL	836.507	7
Indianapolis, IN	834.852	7
San Francisco, CA	825.863	7
Columbus, OH	809.798	7
Fort Worth, TX	777.992	6
Charlotte, NC	775.202	6
Detroit, MI	701.475	6
El Paso, TX	672.538	6
Memphis, TX	655.155	6
Boston, MA	636.479	5
Seattle, WA	634.535	5
Denver, CO	634.265	5
Washington, DC	632.323	5
Nashville, TN	624.496	5
Baltimore, MD	621.342	5
Louisville, KY	605.110	4
Portland, OR	603.106	4
Oklahoma City, OK	599.199	4
Milwaukee, WI	598.916	4
Las Vegas, NV	596.424	4
Albuquerque, NM	555.417	3



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SUPRA. STUDIO

RATING OF TOP 50 POULATED CITIES

Population Growth & Public Transport System

Population Growth

1. Austin, TX
2. Las Vegas, NV
3. Raleigh, NC
4. Houston, TX
5. Phoenix, AZ
6. Charlotte, NC
7. San Antonio, TX.
8. Dallas, TX.
9. Fort Worth, TX.
10. Nashville-Davidson

Public Transport System

1. San Francisco, CA
2. Boston, MA
3. New York, NY
4. Washington, DC
5. Chicago, IL
6. Philadelphia, PA
7. Miami, FL.
8. Minneapolis, MN.
9. Baltimore, MD.
10. Seattle, WA.

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Job Number

1. New York, NY
2. Los Angeles, CA
3. Chicago, IL
4. Washington, DC
5. Dallas, TX
6. Philadelphia, PA
7. Houston, TX
8. San Francisco, CA
9. Miami, FL
10. Atlanta, GA

Job Growth

1. New York, NY
2. Dallas, TX
3. Houston, TX
4. Los Angeles, CA
5. Miami, FL
6. San Francisco, CA
7. Chicago, IL
8. Atlanta, GA
9. Seattle, WA
10. Boston, MA

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Ridership

1. San Francisco, CA
2. Boston, MA
3. New York, NY
4. Washington, DC
5. Chicago, IL
6. Philadelphia, PA
7. Baltimore, MD
8. Sacramento, CA
9. Los Angeles, CA
10. Milwaukee, WI

Most Visited Cities

1. New York, NY
2. Miami, FL
3. Los Angeles, CA
4. San Francisco, CA
5. Las Vegas, NV
6. Boston, MA
7. Washington, DC
8. Chicago, IL
9. Atlanta, GA
10. San Diego, CA

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Proximity to Closest 5 Main Cities

1. San Francisco, CA
2. Baltimore, MD
3. Fort Worth, TX
4. Wichita, KS
5. Phoenix, AZ
6. Los Angeles, CA
7. Portland, OR
8. Nashville-Davidson, TN
9. Houston, TX
10. Detroit, MI

Transport of Freight

1. Memphis, TN
2. Louisville-Jefferson, KY
3. Indianapolis, IN
4. Los Angeles, CA
5. Oakland, CA
6. Fort Worth, TX
7. Chicago, IL
8. Philadelphia, PA
9. Seattle, WA
10. Atlanta, GA

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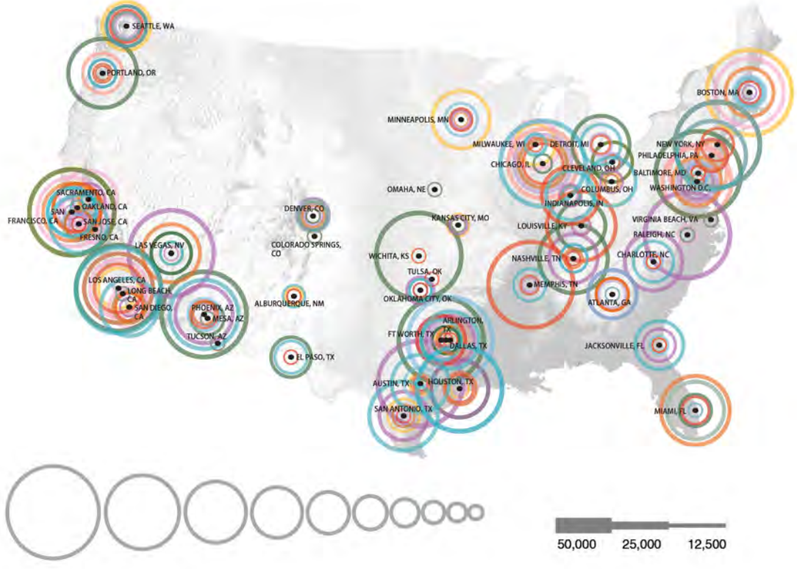

Population Growth
Austin, TX
Las Vegas, NV
Raleigh, NC
Houston, TX
Phoenix, AZ

Public Transport System
San Francisco, CA
Boston, MA
New York, NY
Washington, DC
Chicago, IL

Job Number
New York, NY
Los Angeles, CA
Chicago, IL
Washington, DC
Dallas, TX

Job Growth
New York, NY
Dallas, TX
Houston, TX
Los Angeles, CA
Miami, FL

Ridership
San Francisco, CA
Boston, MA
New York, NY
Washington, DC
Chicago, IL

Most Visited Cities
New York, NY
Miami, FL
Los Angeles, CA
San Francisco, CA
Las Vegas, NV

Proximity to Closest 5 Main Cities
San Francisco, CA
Baltimore, MD
Fort Worth, TX
Wichita, KS
Phoenix, AZ

Memphis, TN
Louisville-Jefferson, KY
Indianapolis, IN
Los Angeles, CA
Oakland, CA

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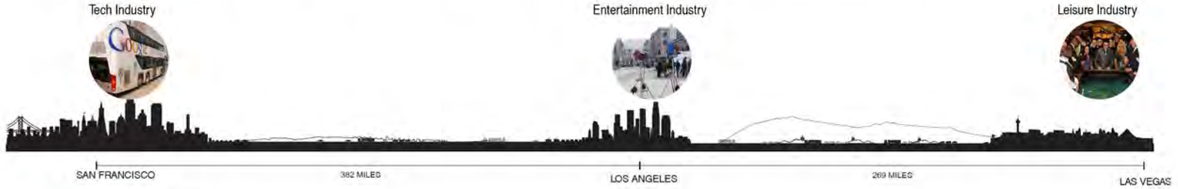
Megaregions are dense and interconnected centers of population and economic activity.

Identified by adjacent metropolitan areas connected by overlapping commuting patterns and business travel.

These regions will continue to grow in population, economy, and interaction. What they lack is an infrastructure that can tie them more seamless.



Major Metropolitan Cities of West Coast

Major Metropolita Cities of East Coast

North and South California Megaregion

North East Megaregion

Cascadia
Major Cities:
Seattle, Portland
Pop: 8 million
Export Industries:
Informational services & manufacturing, farm
GDP: $593

Northern California
Major Cities:
San Francisco, San Jose, Sacramento, Stockton
Pop: 24.3 million
Export Industries: Informational services, farm
GDP: $909

Southern California
Major Cities:
Los Angeles, San Diego, Las Vegas, Riverside
Pop: 15.1 million
Export Industries:
Informational services, tourism
GDP: $1334

Front Range
Major Cities:
Denver, Salt Lake City, Albequerque
Pop: 7.7 million
Export Industries:
Construction and natural resources, informational services.
GDP:$334

Texas Triangle
Major Cities:
Dallas, Houston, San Antonio, Fort Worth
Pop: 20.3 million
Export Industries:Construction and natural resources
GDP:$723

Gulf Coast
Major Cities:
New Orleans, Houston
Pop: 6.6 million
Export Industries:
Construction and natural resources
GDP:$755

Florida
Major Cities:
Miami, Jacksonville, Orlando, Tampa
Pop: 17.5 million
Export Industries: Retail trade and tourism
GDP:$765

Piedmont Atlantic
Major Cities:
Atlanta, Charlotte, Nashville, Memphis,Raleigh,Virginia Beach
Pop: 18.8 million
Export Industries: Transportation, and warehousing
GDP: $1149

North East
Major Cities:
Washington DC, Philadelphia, Baltimore, New York City, Boston
Pop: 52.7 million
Export Industries:
Financial services, education, healthcare, federal govt.
GDP: $3751

Great Lakes
Major Cities:
Chicago, Minneapolis, Detroit, Kansas City, Cleveland, Indianapolis
Pop: 52.9 million
Export Industries: Manufacturing
GDP:$2314

Phase 1: This stadegy answers to the infrastructure the Megaregions need to interact more seemesly between metropolitans.
Phase 2: Coastal regions become more connected making intercontinental and international economies smoother.
Phase 3. Eventually the whole nation is interconnected, makinfg it easier to travel from one coast to the other as easy as it is in Europe.

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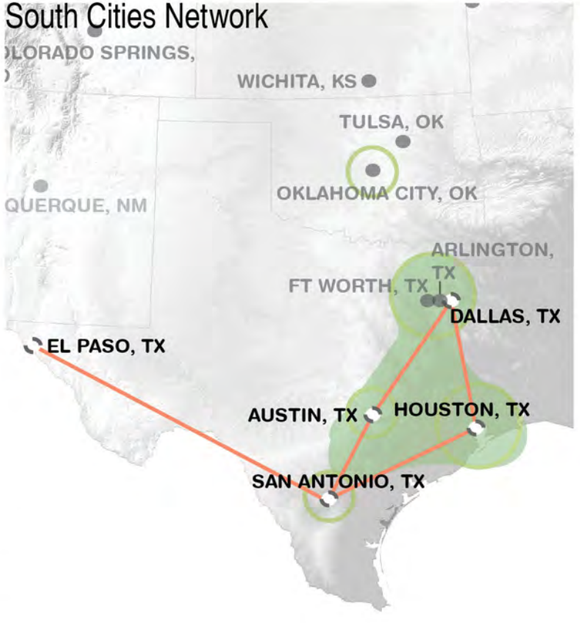

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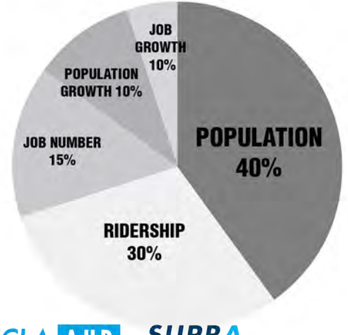
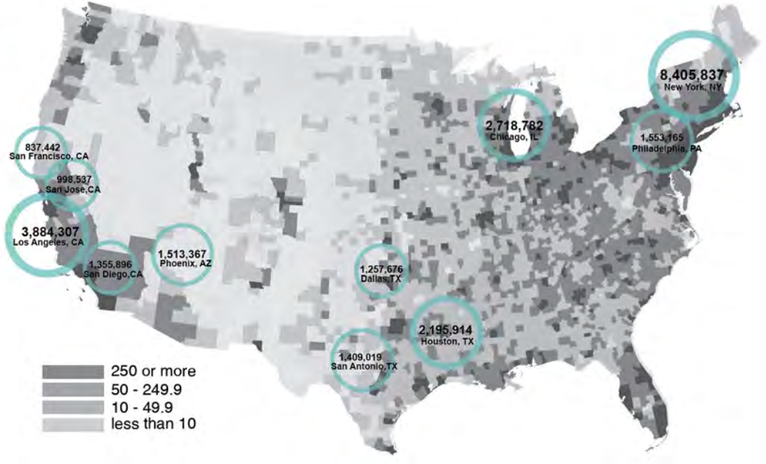
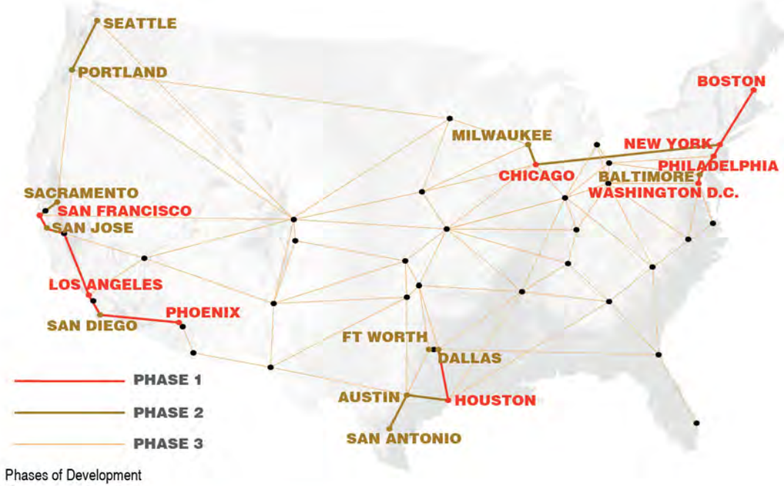
Largest cities in ridership



City Selection Criteria



Population density and Largest cities



Phases of Development

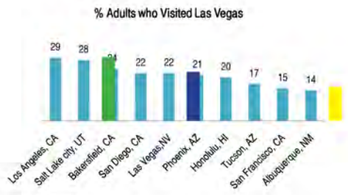
City Rankings

City	final
New York, N.Y.	9
Chicago, Ill.	8.55
Los Angeles, Calif.	8.5
Phoenix, Ariz.	7
Philadelphia, Pa.	6.6
Houston, Tex.	6.35
Washington, DC	5.7
San Francisco, Calif.	5.65
Boston, Mass.	5
San Diego, Calif.	4.95
Dallas, Tex.	4.8
Baltimore, Md.	4.75
Sacramento, Calif.	4.5
Portland, Ore.	3.9
San Antonio, Tex.	3.85
Seattle, Wash.	3.85
Fort Worth, Tex.	3.6
Austin, Tex.	3.3
Milwaukee, Wis.	3.15
San Jose, Calif.	3.15
Charlotte, N.C.	2.85
Atlanta, Ga.	2.75
Jacksonville, Fla.	2.7
Raleigh, N.C.	2.65
Oakland, Calif.	2.65
Nashville-Davidson, Tenn.1	2.55
Denver, Colo.	2.55
Minneapolis, Minn.	2.5
Indianapolis, Ind.	2.45
Columbus, Ohio	2.4
Las Vegas, Nev.	2.4
Miami, Fla.	2.4
Fresno, Calif.	2.2
Detroit, Mich.	2.1
Kansas City, Mo.	2
Memphis, Tenn.	1.9

LAS VEGAS
Number of Convention Delegates : 39,668,221
Average Daily Auto Traffic - All Major Highways to Vegas - 97,423
Average Daily Auto Traffic - 1-15 at NV/CA Border - 39,317 (~43%)

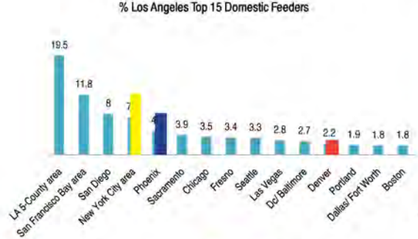
SAN FRANCISCO
Top 10 Feeder Markets Include-
New York
San Diego
Los Angeles
Portland
Washington
Sacramento
Boston
San Francisco Bay Area (outside of SF)

LAS VEGAS
NUMBER OF VISITORS - 39,668,221



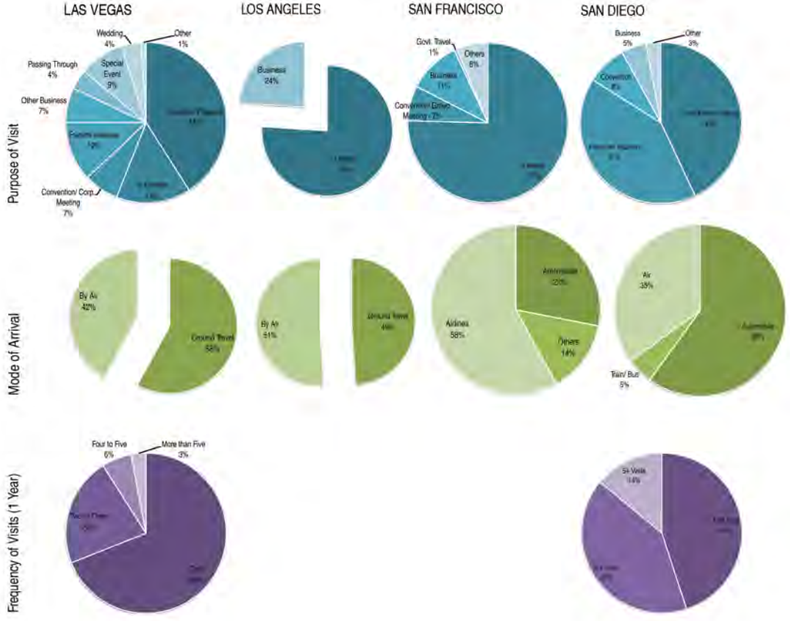
SAN FRANCISCO
NUMBER OF VISITORS – 16,900,000

LOS ANGELES
NUMBER OF VISITORS - 28,500,000



SAN DIEGO
NUMBER OF VISITORS – 16,200,000

Las Vegas
Los Anegels
San Francisco
San Diego



1. Maximum percentage of visitors to Vegas is from L.A.
2. Most pecentage of people travel to these cities for leisure purposes as opposed to official visits.
3. Cars and air travel take predominant roleover any other ground or public transport.
4. Cars and air travel play an equal role in modes of arrival to Vegas.

Freight Railroad

Passenger Railroad

Highway

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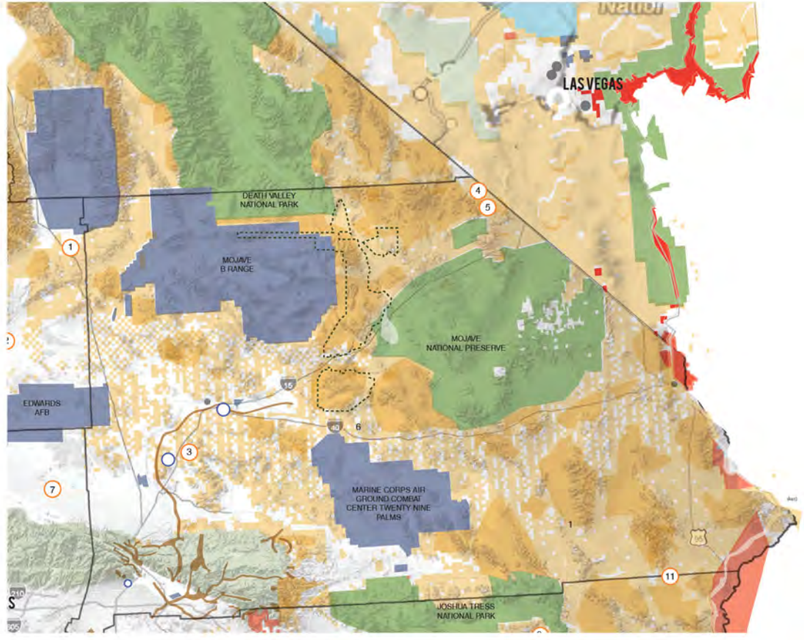

Looking into solar farm and wind turbine infrastructure in the desert because they relate to the land use and how they were permitted (by the Bureau of Land Management) . Since there is a push for more renewable energy and more solar farms in the desert, this may be useful when it comes to the Hyperloop because it can also be considered as an energy infrastructure. The desert has always been a good resource of energy.

The land use of the Mojave Desert is always changing, most of it belonging to the government (the Bureau of Land Management and only about 14% is Native American Land which you can see on the map. There are also areas being looked at for conservation of biological habitats. There have also been lawsuits over ecological disturbances.

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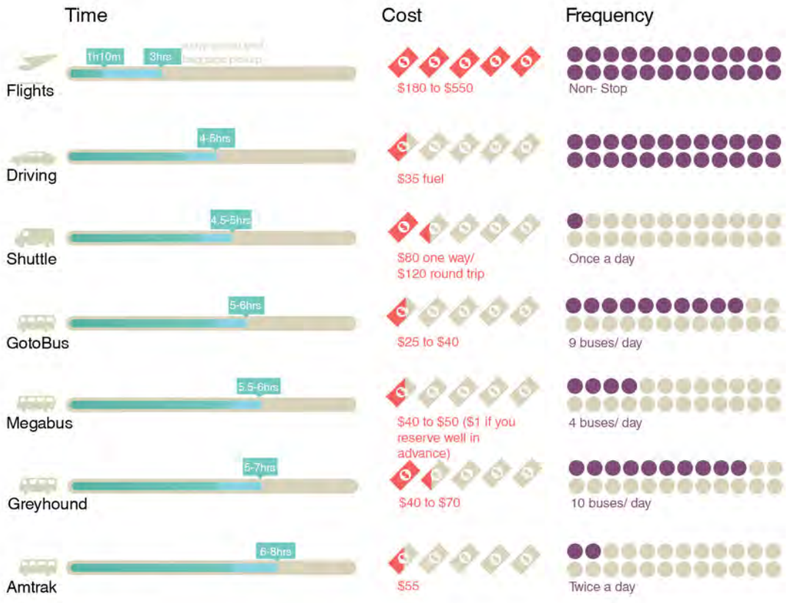
COMPARISON OF TRANSPORT

Comparing Different Modes of Transport to Los Angeles

LAS VEGAS
Average Daily Auto Traffic - All Major Highways to Vegas - 97,423
Average Daily Auto Traffic - 1-15 at NV/CA Border - 39,317 (~43%)



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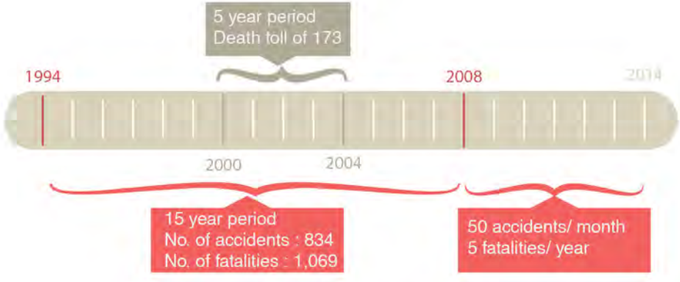
COMPARISON OF TRANSPORT

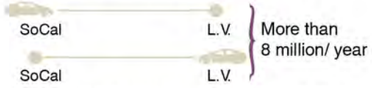
Data on Accidents and Problems of Driving on i-15

Reasons for Fatal Accidents

Data on Accidents & Fatalities on I-15 California-Nevada Corridor



"I-15 First in Most Dangerous Highway in America"



More than 8 million people drive back and forth annually from southern Nevada to southern California.

Costs of Speeding Tickets

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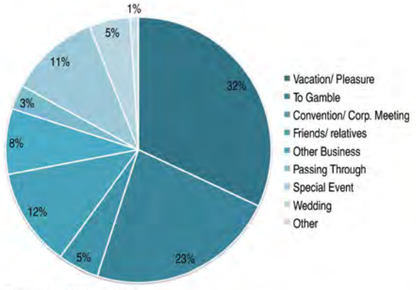
TOURISM IN VEGAS FROM SoCal

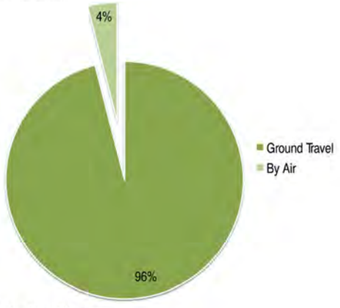
Data on Domestic Tourism from SoCal to Vegas

1. Maximum (96) percentage of people prefer ground travel while travelling from Southern California to Vegas. Only 4% use air travel.
2. 60% of visitors use their own cars to travel withing vegas and 32% walked.

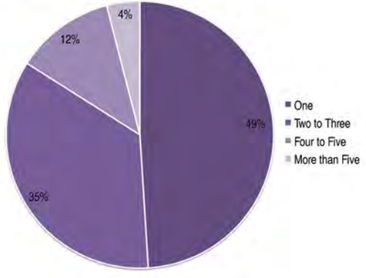
Purpose of Visit



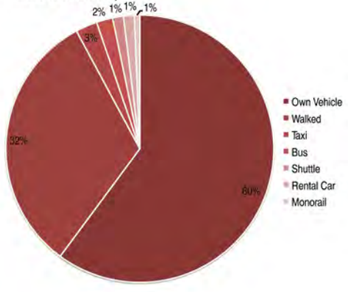
Mode of Arrival



Frequency of Visits (1 Year)



Mode of Local Transport



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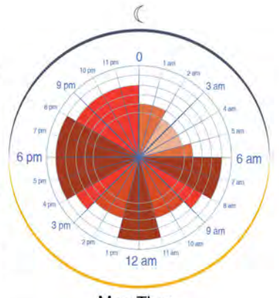
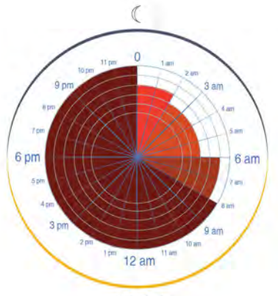
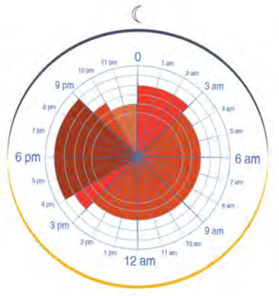
FREQUENCY OF DEPARTURES

Weekday vs weekend

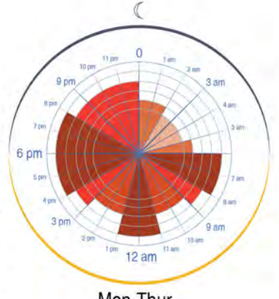
from **Los Angeles** to **Las Vegas**

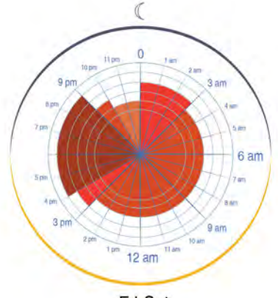


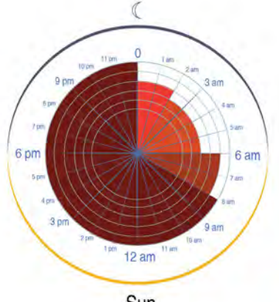




from **Las Vegas** to **Los Angeles**







Weekends

Friday morning - late Friday night

Sunday 12pm - 8 pm

Holiday weekends

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	AIRPLANE	RAILWAY	ROAD	SHIP	HYPERLOOP
SPEED	500-600mph	200mph	80mph	22-33mph	500-550mph
FREQUENCY	50 per day	2-3 per day	N/A	N/A	Every 30s- 20min
FLEXIBILITY	Fixed routine Non - stop	Fixed routine Frequent stop	Flexible routine Random stop	Restricted routine Frequent stop	Fixed routine Frequent stop
CAPACITY	100-300 Passengers per flight (66-100 per hour) Restricted Luggage	1200 Passengers per train Luggage	1-7 Passengers per car Luggage	For freight	840 Passengers per hour Vehicles Luggage
DISRUPTION OF NEIGHBORHOOD	Point	Linear	Linear	Point	Linear
TERMINAL SIZE	Large	Medium	N/A	Various	Medium
CO_2 EMISSION	0.185kg/ passenger mile	0.172kg/ passenger mile	0.225kg/ passenger mile	0.048kg/mile	0.170kg/ passenger mile

HYPERLOOP

PROS
- -Fast
- -Energy saving
- -Frequent departure
- -Flexible schedule
- -Large capacity

CONS
- -Additional stations within a route effects the speed and time of travel
  Solution: planning by phases
- -Requires new infrastructure
  Solution: follow existing routes
- -Affected by e[illegible]
  Solution: de[illegible]

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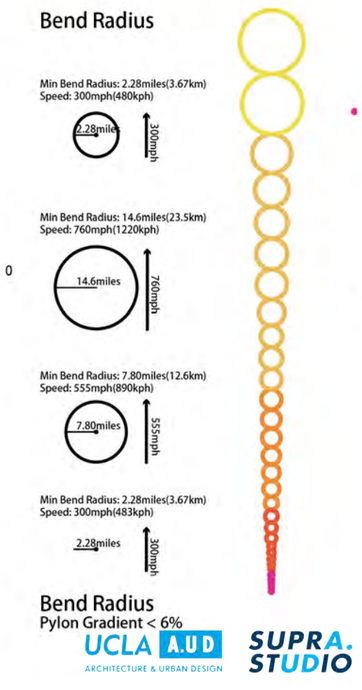
Proposal 1:
Los Angeles--San Bernadino--Las Vegas

Proposal 2:
Los Angeles--Anaheim--San Bernadino--Las Vegas

Proposal 3:
Los Angeles--Santa Clarity--Las Vegas



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Distance: 228mi

Percentage of Land Type:
Urban: 43.4mi 19.0%
Mountain: 23.6mi 10.35%
Desert: 161mi 70.65%

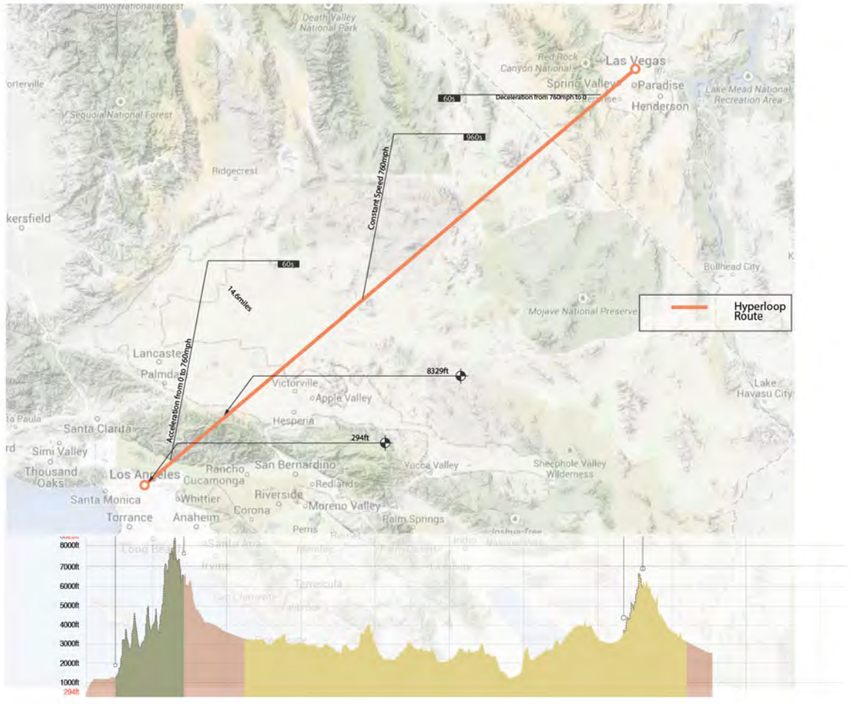
Slope:
Max: 36,6%, -29.9%
Avg: 4.7%, -3.4%

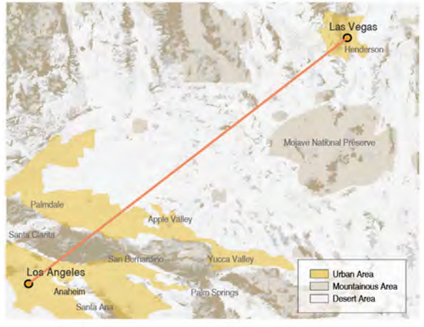
Number of Small Curves: 0

Speed
Urban/Mountain: 760mph
Desert: 760mph

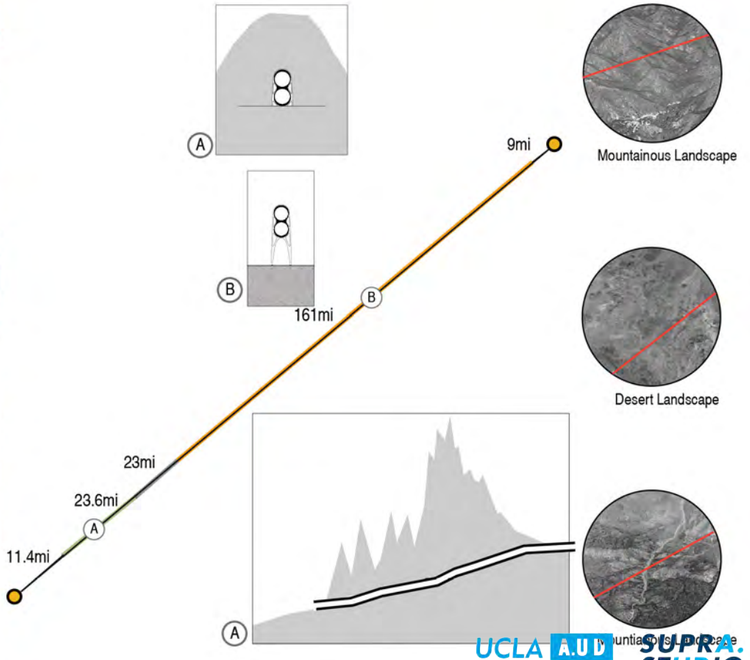
Travel Time: 18'00"

Avg Speed: 760mph





STRAIGHT ROUTE
Ideal Straight Route from Los Angeles to Las Vegas



Distance: 261miles

Percentage of Land Type:
Urban: 50.6mi 29.3%
Mountain: 141.2mi 54.1%
Desert: 69.2mi 26.5%

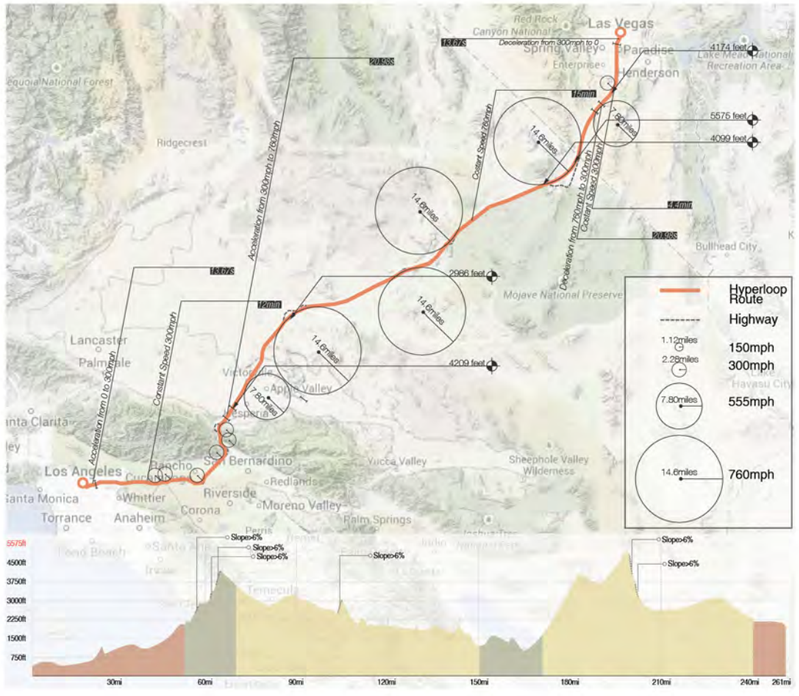
Slope:
Max: 9.7%
Avg: 2.2%, -1.9%

Number of Small Curves: 3

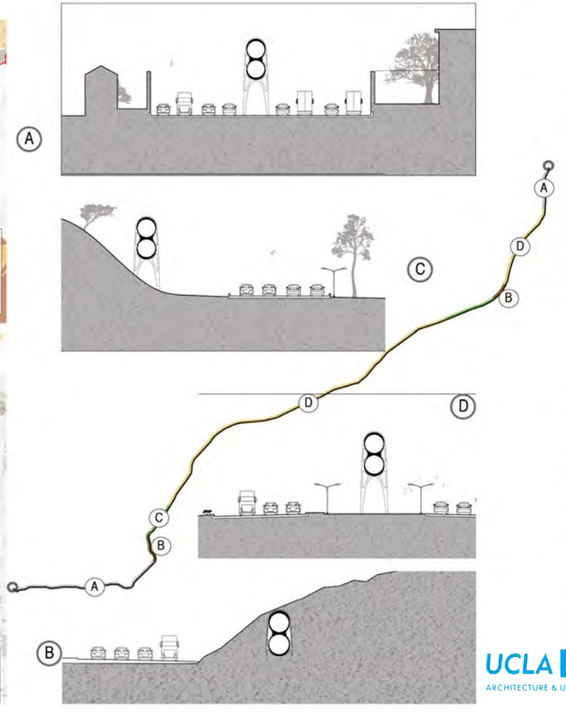
Speed
Urban/Mountain: 300mph 483km/h
Desert: 760mph 1223km/h

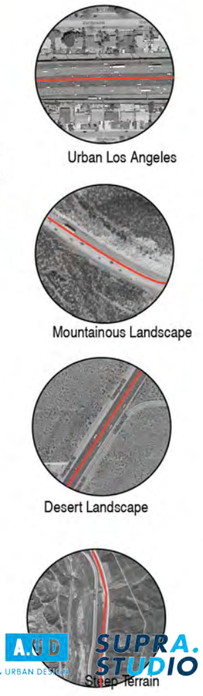
Travel Time: 32'33"

Avg Speed: 481.1mph



ROUTE STRATEGY 1
Highway System from Los Angeles to Las Vegas





ROUTE STRATEGY 2
Freight Railroad From Los Angeles to Las Vegas

Distance: 320mi

Percentage of Land Type:
Urban: 54.7mi 17.1%
Mountain: 98.8mi 30.9%
Desert: 166.5mi 52.0%

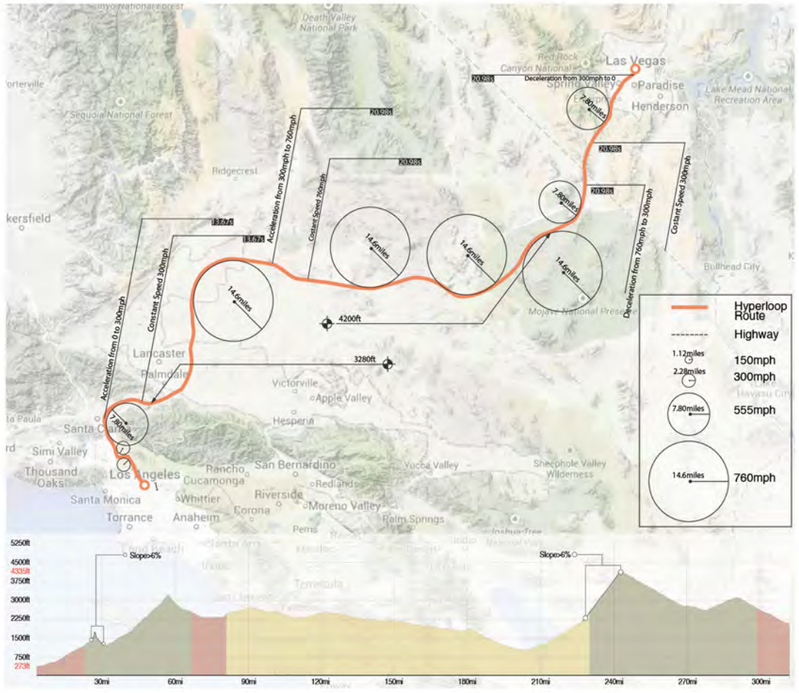
Slope:
Max: 8.5%, -8.5%
Avg: 1.3%, -0.9%

Number of Small Curves: 2

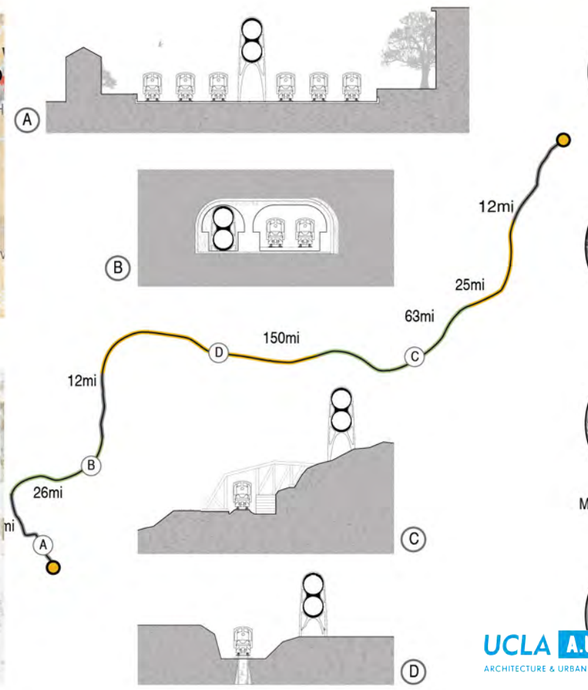
Speed
Urban/Mountain: 300mph 483km/h
Desert: 760mph 1223km/h

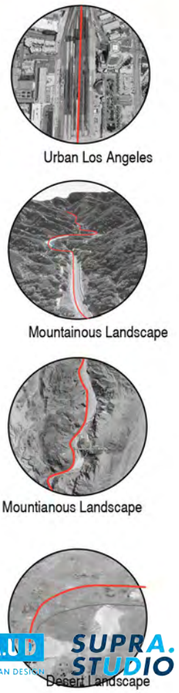
Travel Time: 43'50"

Avg Speed: 438.4mph



ROUTE STRATEGY 2
Landuse and Urban Condition





ROUTE STRATEGY 3
Flattest Route From Los Angeles to Las Vegas

Distance: 292mi

Percentage of Land Type:
Urban: 64.0mi 21.9%
Mountain: 61.5mi 21.1%
Desert: 166.5mi 54.9%

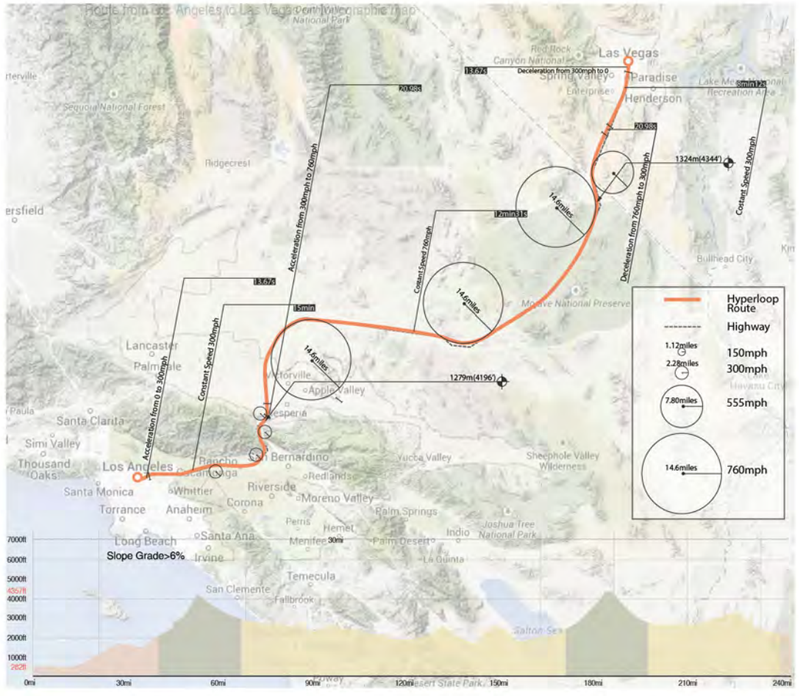
Slope:
Max: 7.2%, -5.2%
Avg: 1.5%, -1.1%

Number of Small Curves: 4

Speed
Urban/Mountain: 300mph 483km/h
Desert: 760mph 1223km/h

Travel Time: 37'52"

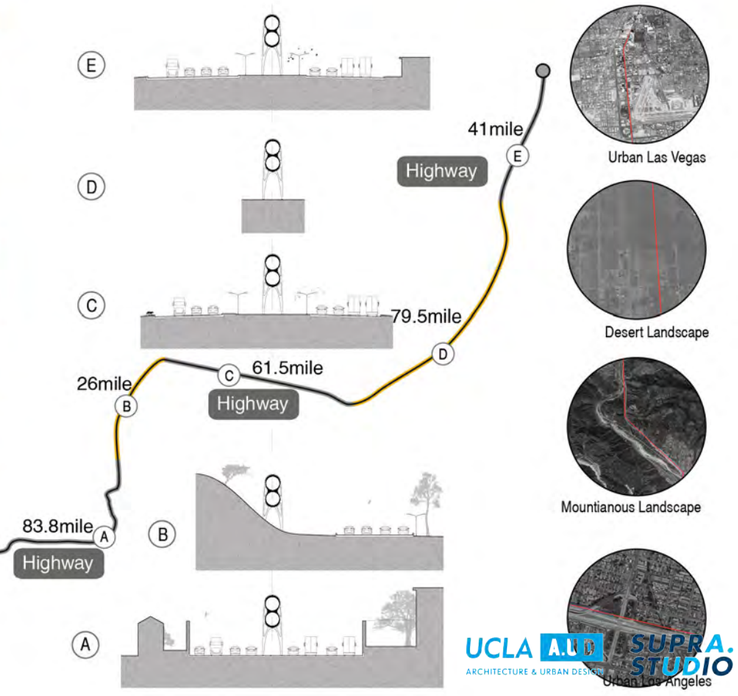
Avg Speed: 463.5mph



Route from Los Angeles to Las Vegas political land use map

Route from Los Angeles to Las Vegas urban condition map

ROUTE STRATEGY 3
Land Use and Urban Condition



ROUTE STRATEGY COMPARISON

Comparison of Four Strategies

Travel Time

- Highway Route
- Freight Rail Route
- Most Flat Route
- Most Straight Route

Travel Distance

- Highway Route
- Freight Rail Route
- Most Flat Route
- Most Straight Route

Small Curve

- Highway Route
- Freight Rail Route
- Most Flat Route
- Most Straight Route

Construction Difficulty

- Highway Route
- Freight Rail Route
- Most Flat Route
- Most Straight Route

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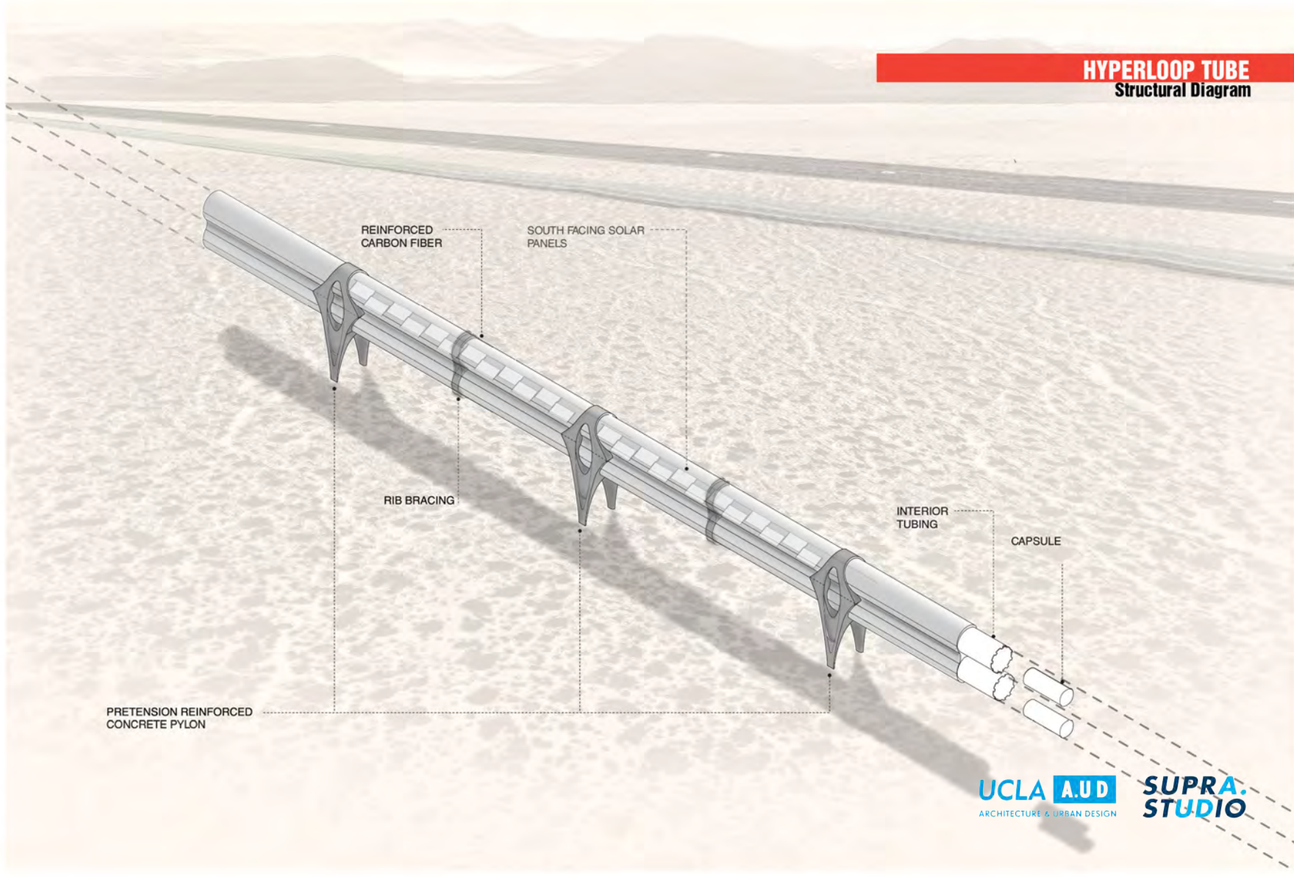
HYPERLOOP TUBE

Structural Diagram



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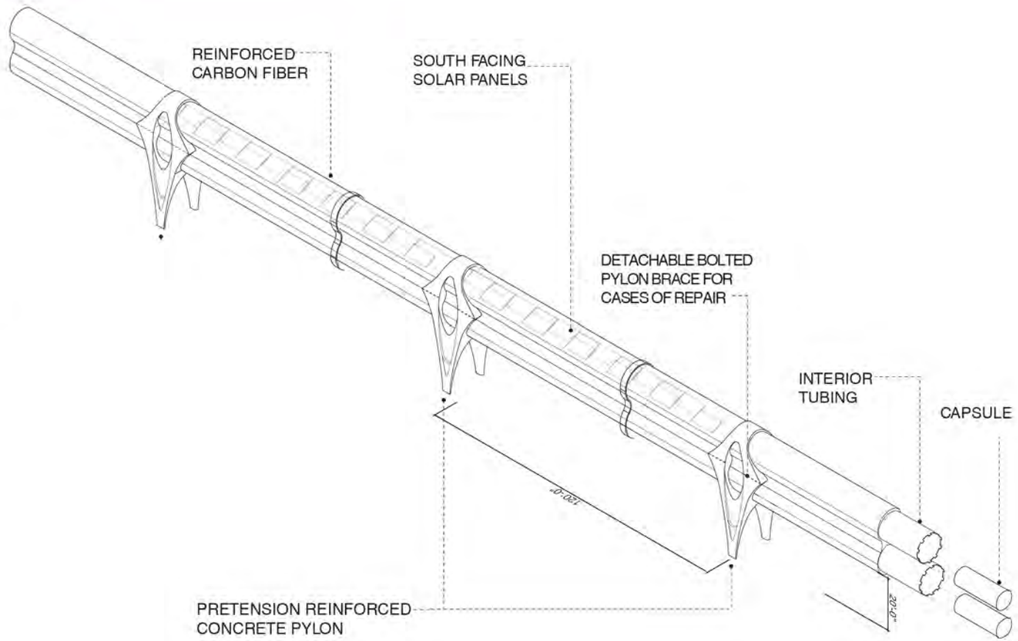
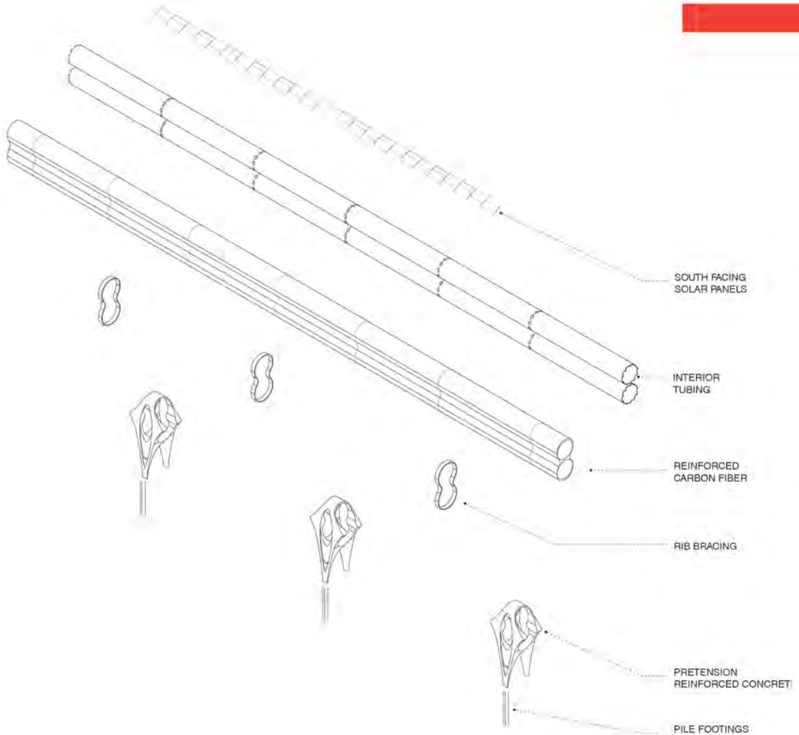
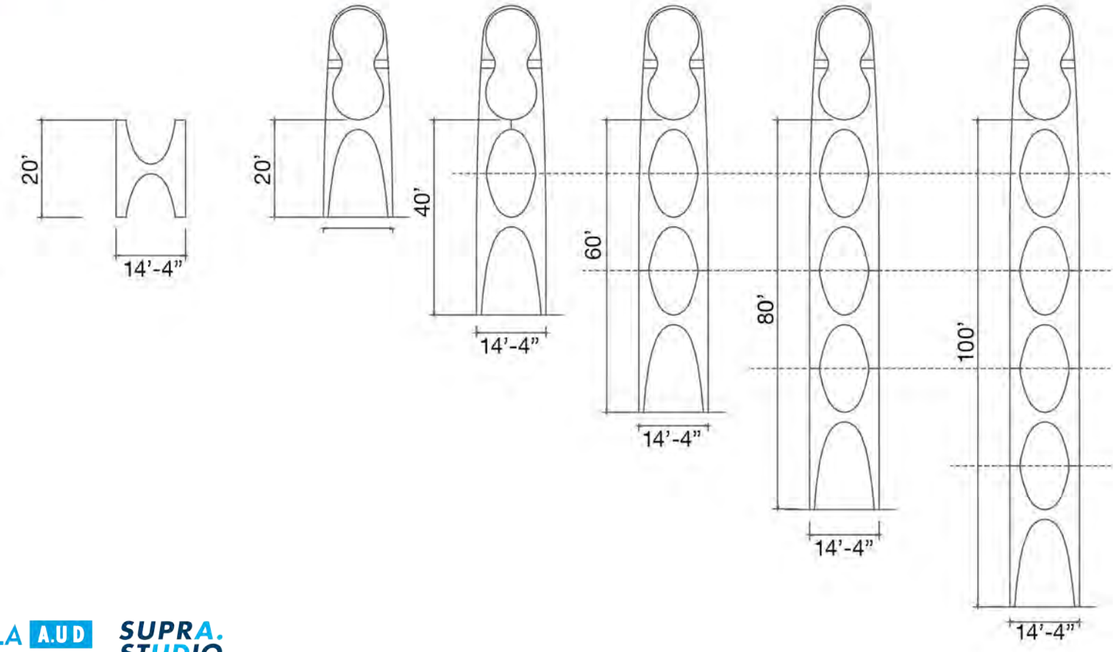
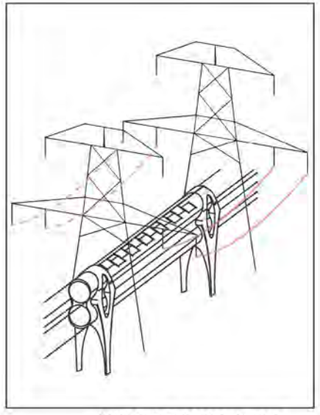
SUPRA. STUDIO

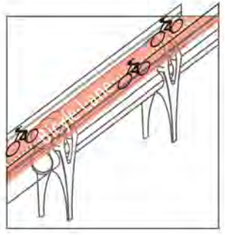

REINFORCED
CARBON FIBER
SOUTH FACING
SOLAR PANELS
DETACHABLE BOLTED
PYLON BRACE FOR
CASES OF REPAIR
INTERIOR
TUBING
CAPSULE
PRETENSION REINFORCED
CONCRETE PYLON


SOUTH FACING
SOLAR PANELS
INTERIOR
TUBING
REINFORCED
CARBON FIBER
RIB BRACING
PRETENSION
REINFORCED CONCRETE
PILE FOOTINGS

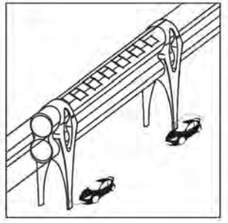




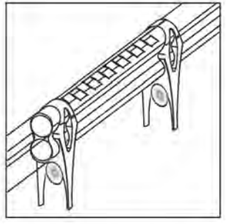
CAN BE TIED TO ELECTRIC GRID



COULD CARRY RIGHT OF WAY
BIKE PATH



CAN CHARGE YOUR CAR



CAN GENERATE WIND POWER


AND PEACE ENTERS OUR HOMES
YOU LICK YOUR LIPS
OUR HOMES FILL
NERVOUSLY
VEERING TOWARD
ARROGANCE
AND MY HEAD ACHES ALL OVER AGAIN
EXPIRING FOR LOVE IS
BEAUTIFUL BUT STUPID
THIS WAITING,
I AM LOSING
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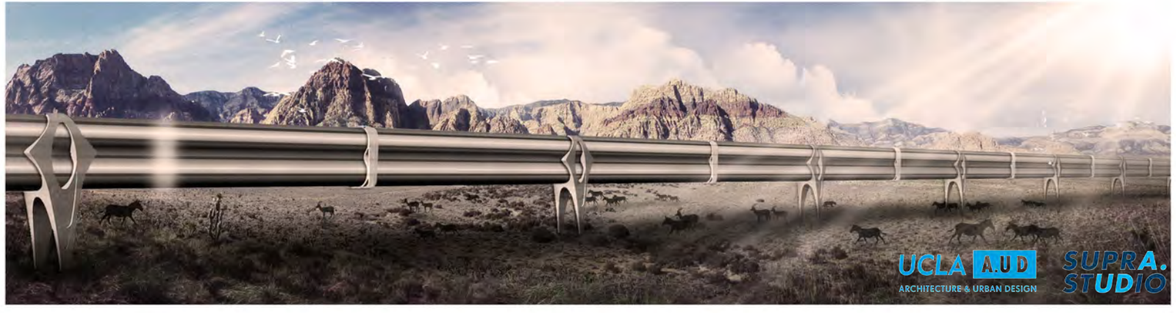
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URBAN RESEARCH

Mapping|Strategy|Site Selection

A new transportation system and a city will have a delicate and intimate relationship influencing each other from inception through public use. The last mile of the Hyperloop and how it maneuvers in and out of a city is the studios primary concern.. Mapping multiple criteria of the city, evaluating these criteria and overlapping them are the main concerns to locate the stations in an urban area. The studio generated two strategies for the new system plugging in the city through aiming at the existing problems of the city and the characteristics of the Hyperloop. A central station or multiple decentralized stations has both advantages.

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TIMELINE 1780•1990
Infrastrcture History of Los Angeles

4 Periods

Transportation Network

El Camino Real Road
Southern Pacific Rail Road
Newhall railroad tunnel(from LA to SF)
Los Angeles & San Pedro Railroad
Pasadena and Los Angeles Railway
Los Angeles Railway
Pacific Electric Railway
Highway network
Freeway network

Population Growth

Technology

1781: Felipe de Neve, Governor of Spanish California, names the settlement.

1821: Mexico achieves independence from Spain.

1842: California's first discovery of gold is made at Placerita Canyon

1848: Mexico formally cedes California to the United States,

1850: Los Angeles is incorporated as a municipality, and California becomes the 30th state in the union.

1887: Industry Expanding

1913: Los Angeles Aqueduct built

1920: Boom of Hollywood

1941-1945: Workers and Miltary Factory

1955: First Disneyland Theme Park

Second World War

Baby Boomers

Village of Los Angeles

Industry Age of Los Angeles

Boom of City of Los Angeles

Industrial and Financial Gaint

1780 1790 1800 1810 1820 1830 1840 1850 1860 1870 1880 1890 1900 1910 1920 1930 1940 1950 1960 1970 1980 1990

1865 1996

1875

1869 1883

1886

1901

1910

1961

1920

The royal road

Rise of the railroad

Golden Age of the railroad

Decline of the railroad

Age of Freeway & Highway

Labour Work

Steam & Coal

Electricity

Oil

179 315 365 650 2,240 5,730 11,200 50,100 102,500 319,200 1,576,700 2,966,850 3,485,398

1800:Horse wagon

1805: The first American trading ship arrives at San Pedro Bay

1812:First steam lomotive

1871: First Rail Link Between Los Angeles and San Francisco

1886: The price of a train ticke between Kansas City and Los Angeles falls to one dollar.

1888: First electric lomotive in U.S.

1892: Oil Discovery

1897: First Automobile on Los Angeles Street

1901: Angels Flight Rail Car Opens

1915: 55,000 Cars on L.A Streets

1930: Los Angeles International Airport Opens

1926: Route 66 Completed

1940: Arroyo Seco Parkway Opens

1939: Union Station Opens

1940: Arroyo Seco Parkway Opens

1944: Peak Ridership of Pacific Electric Railway

1953: Completion of Four Level Freeway Interchange

1962: Last Red Car Trolly Passes Operation and Red Car Tracks Demolished

1990: Metro Blue Long Beach Line Is the First Light Rail Line To Return to Los Angeles

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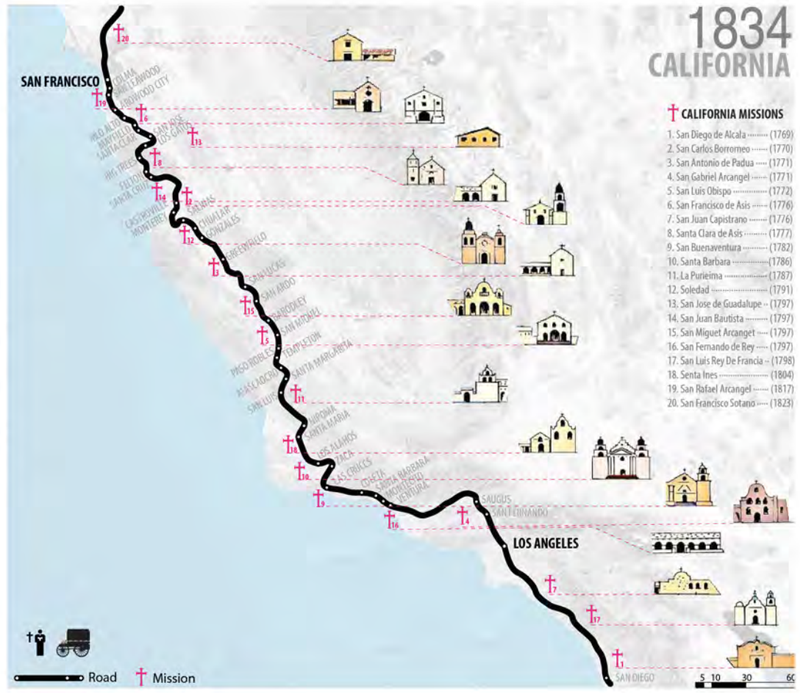
Also translated as "the royal road," or, "the king's highway," El Camino Real was indeed among the state's first long-distance, paved highways. Dating back to 18th centry, The Caminal Real was
the spanish military road which went through military bases, missions, and pueblos(civilian towns) throughout northern and southern California. The roads' actual path(across present Los Angeles) was not fixed and changed over time as weather, mode of
travel and even the tides dictated.

By the late nineteenth century, although local segments of El Camino Real were still heavily used, the primitive highway was
eclipsed in importance by a water route between Southern and
Northern California. Boats rather than the so-called royal road usually transported goods and passengers over long distances.

In early twentyth century, due to the rise of the automobile and
people's passion for tourism, the old Camino Real revived. By the mid-1920s, the highway construction was complete, and in 1925 the state legislature designated much of it as U.S. Highway 101. Today, mission bells continue to guide motorists along the route.



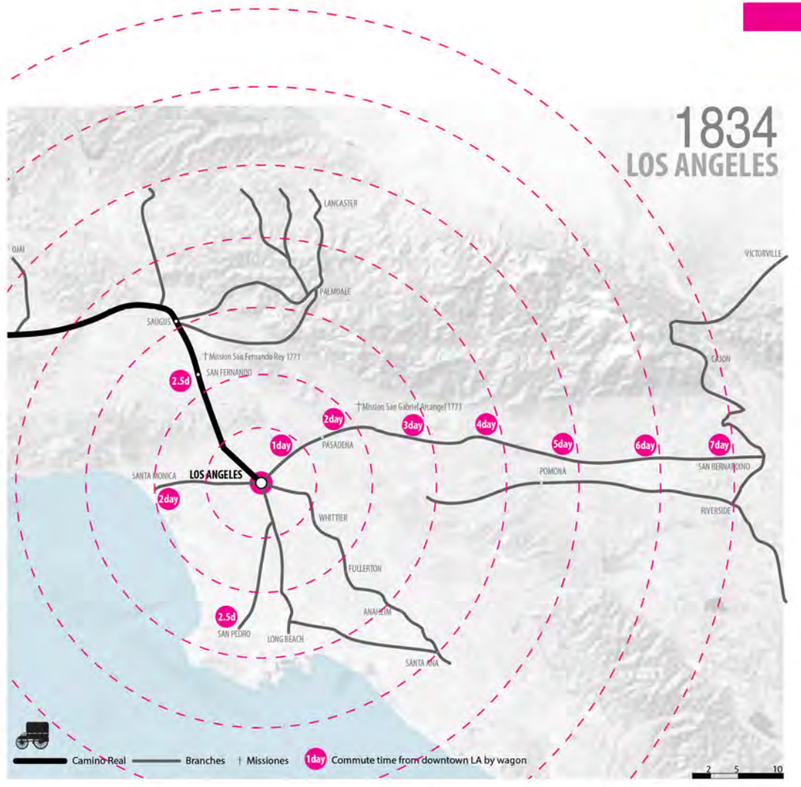


Fig1: 1925 postcard depicting an automobile on El Camino Real in front of Mission San Fernando

Fig2: A view of El Camino Real in Tustin

Fig3: Bell erected by the Auto Club in 1928

Fig4: Roadside marker in1937

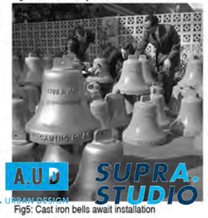


Fig5: Cast iron bells await installation

By the mid-19th century, Americans realized that arrayed before them was a land so rich in natural resources and so promising to a restless populace that "California or Bust" meant a trip to the promised land.
The world's first transcontinental railroad built between 1863 and 1869 to join the eastern and western halves of America arouse a great wave of immigration and brought economic booming for area it passed. In 1885, a competition between Southern Pacific Railroads and Central Pacific produce the one-dollar trip from Kansas to Los Angeles and cause a great wave of immigration.
However, some town would not grant privileges to the Southern Pacific Railroad, they simply built another town or evicted the
farmers.
Five lines radiating from present Los Angeles towards San Fernando(1871), San Bernardino(1874), Anaheim(1874), Wilmington(1869), and Santa Monica(1875) constitute the framework for the Greater Los Angeles. The railway system made life convenient wherever living in Santa Monica or Spadra.
Following the habit of living evenly across the land, the immigrants created town-sites along the tracks rather than the usual outward sprawl from a central nucleus.

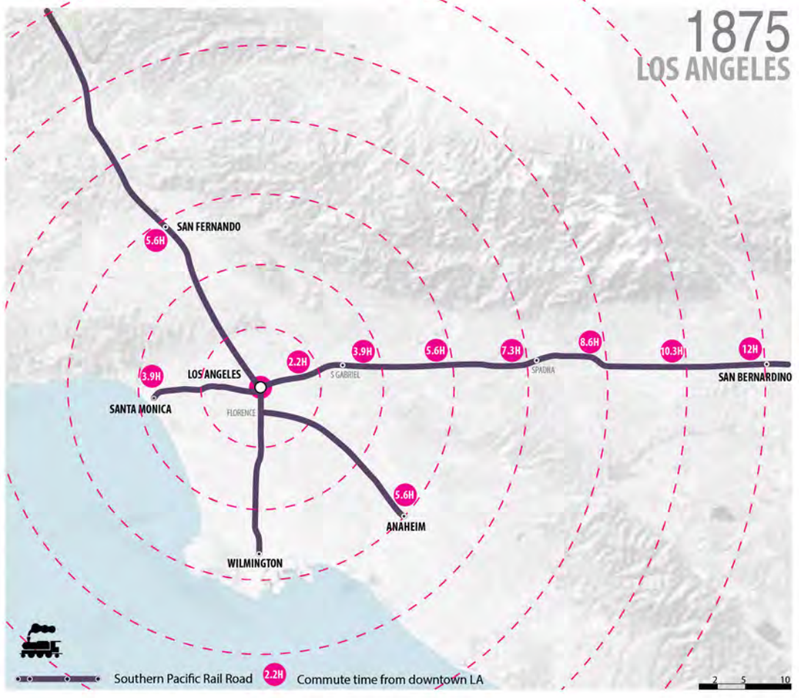
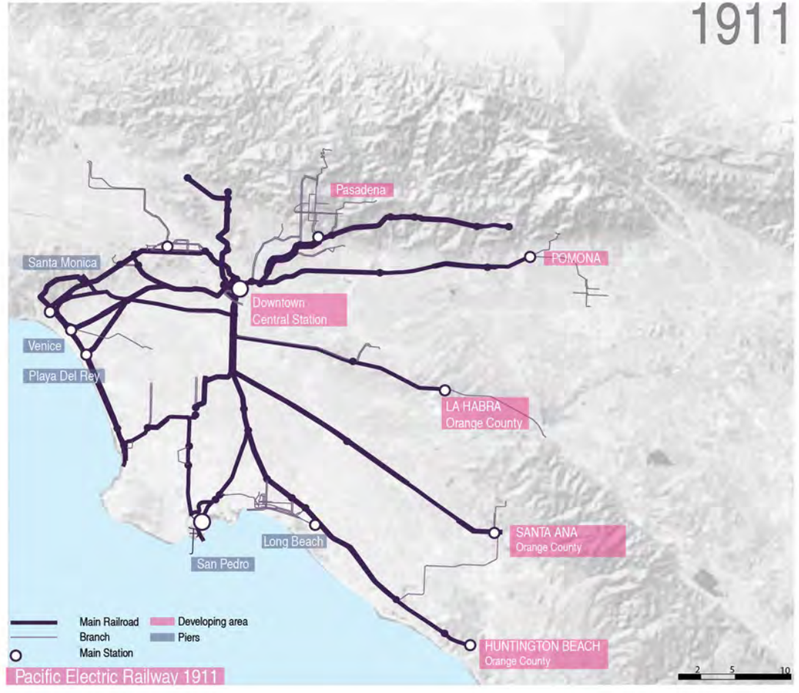



Fig6: A saddle was dug out between Dairy Hill and Communications Hills for train going through


Fig7: Los Angeles and Independence Railroad (Expo Line predecessor) in Santa Monica in1880

UCLA A.U.D ARCHITECTURE & URBAN DESIGN SUPRA. STUDIO

The first railway was build between Los Angeles and San Pedro for shipping. Then it expanded to other piers along the coast, as well as the main residential neighborhood in Pasadena. It formed the basic skeleton of Pacific Electric Railway network.



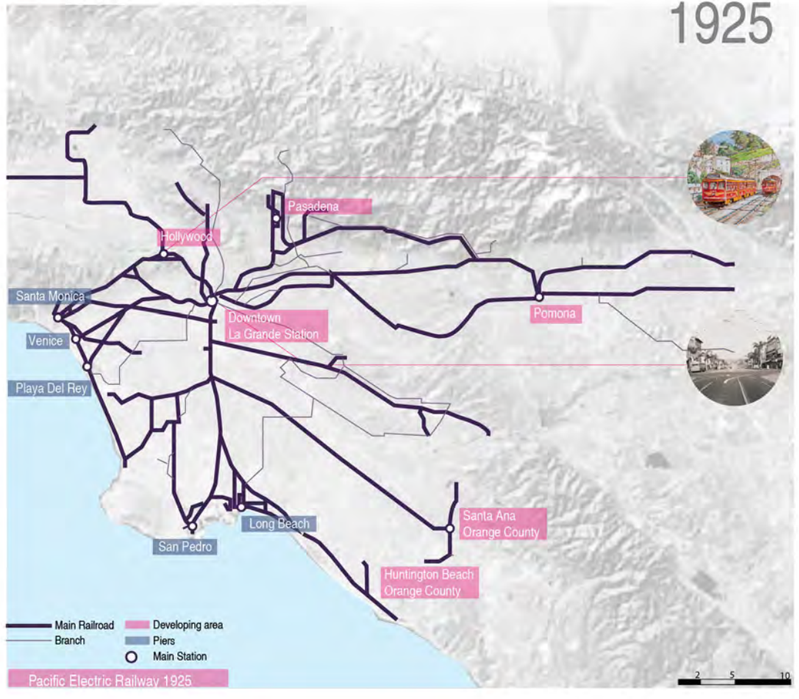
It soon expanded its range since the booming growth of city Los Angeles. It started to sprawl to cities outside County of Los Angeles. More networks were built by the previous skeleton,especially in the coast area,where all the shipping and labour work located.

Fig9 Poster of Pacific Electric Railway

The golden age of electric railway came with the time of Great Los Angeles. In its peak time, Red Car street car were all over the street. It could be called stopped on the street. Then as the discovery of oil, individual automobiles started to occupy the market. As the 'red car' caused serious traffic congestion on the street, they were finally abandoned. Then came the age of Freeways.

Fig 10:Poster of Red Car Street Car

Fig9 Poster of Pacific Electric Railway



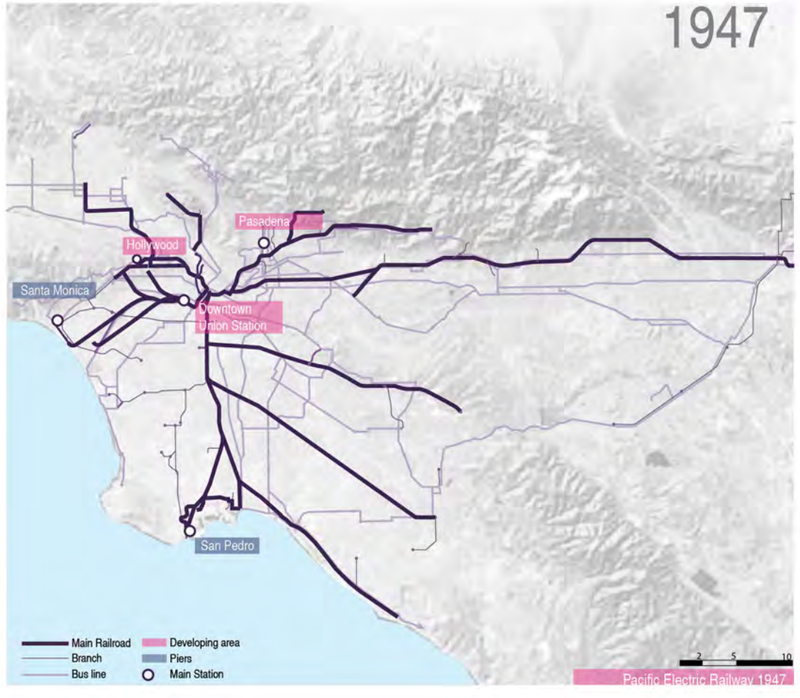


Fig 12:Traffic Congestion of Red Car and Automobile

Fig 13:Red Car Stacked in Junk Yard,1956

Arroyo Seco Parkway 1935 - 1939
1937 Freeway Plan Proposal
While the Arroyo Seco Parkway was under construction, proposals for a vast system of non-stop stretches of new freeways was underway. Connections between existing cities were drawn and a future high speed connective pathways were born.
The very first stretch of freeway to be constructed in Los Angeles is the Arroyo Seco Parkway connection between downtown and Pasadena. Two lanes on either side were concieved - each with one "slow" lane and one "fast" lane for passing vehicles. These two sides were originally different colors.
Although rendered in a utopian vision, new highway projects laid waste to historic neighborhoods and cut communities into seperate pieces. Ideas of going underneath existing structures were never realized, and the repurcussions of new freeway projects were never fully thought through.
Art Deco bridges connected existing roades over the parkway. These bridges allowed many workers to have a job during the great depression - one main reason why this freeway project was built at this time early in Los Angeles freeway history.

Fig 14: Cahuenga Freeway


Fig 15: Rendering of proposed route through buildings


Fig 16: Clreared residential area for a new parkway

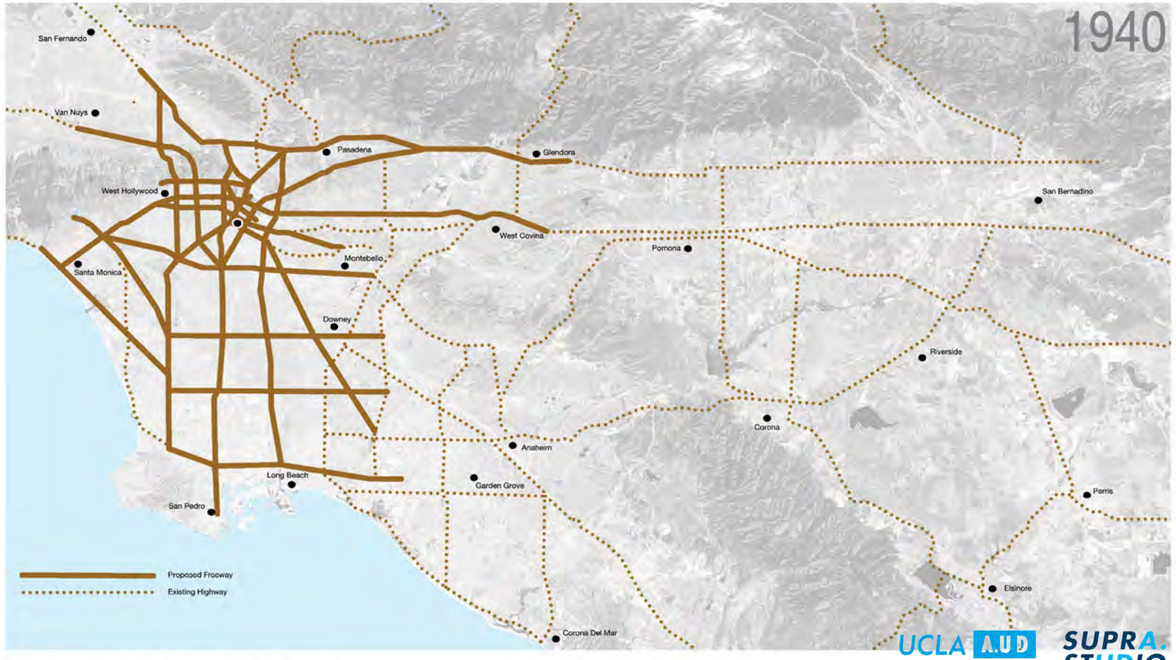

Fig 17: Original concept of highway "on-ramp"


Fig 18: Arroyo Parkway grand opening


Fig 19: View of the Arroyo Parkway


Fig 20: Arroyo Parkay with overhead bridge

THE FIRST FREEWAYS
History Research | Freeways



Map of proposed Los Angeles freeways and existing highways 1940

Downtown Los Angeles spread in a "Y" formation radially to three major destinations for the people of the city. The foothill valley suburbs, beach suburbs, and the San Pedro shipping town were the major areas of interest in the early days of the city. Santa Monica pier, as we know it today was completed in 1916.

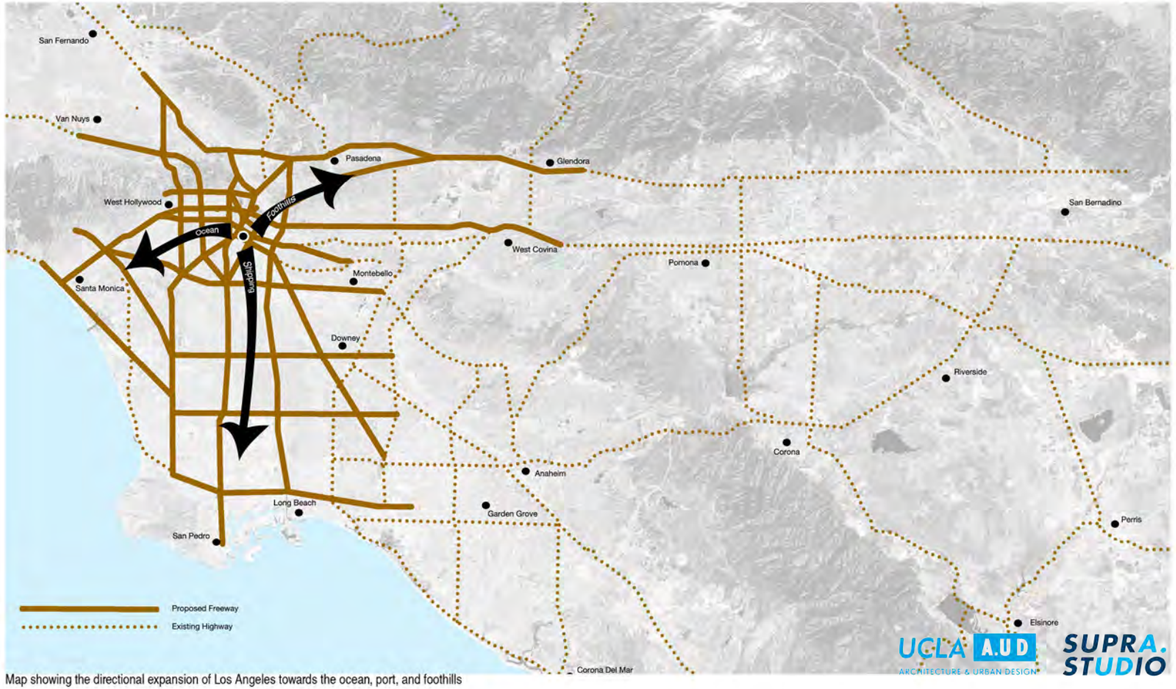
Fig 21: View of the Santa Monica Pier soon after completion 1916

Fig 23: Orginal "Guide to Pasadena"

Fig 22: Downtown Los angeles 1920

Fig 24: San Pedro shipping yard

Fig 25: Santa Monica beach 1920



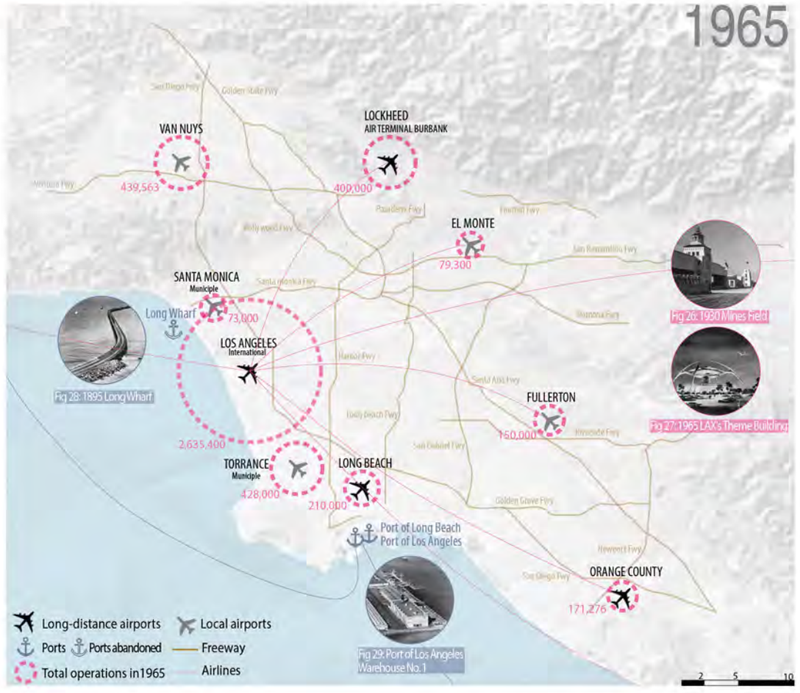
Map showing the directional expansion of Los Angeles towards the ocean, port, and foothills

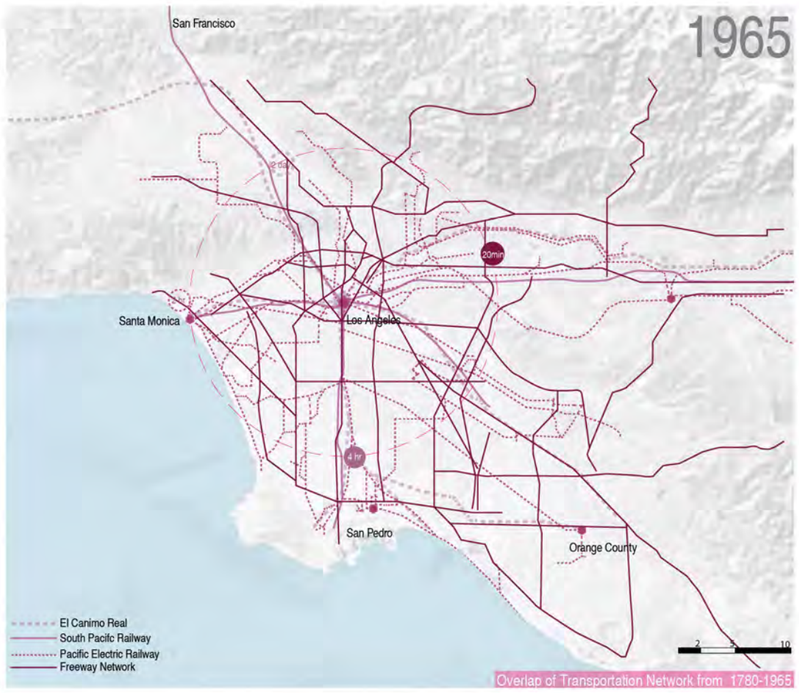
On September 26, 1927, the city signed a ten-year lease for 640 acres in Mines Field (known as today's Los Angeles International Airport), and L.A.'s first municipal airport was born. Before long,other airports rose in Los Angeles in 1920s and 1930s.

With an improved runway and dedicated facilities, a city airport would encourage airmail and passenger traffic between Los Angeles and other aviation-friendly cities, while a permanent presence would allow airlines, maintenance companies, and other private enterprises to cluster around the site.

The Long Wharf in Santa Monica opened in 1894 called the Port Los Angeles. The wharf was the longest in the world at the time at 4,600 feet served by Southern Pacific's trains and ended in 1913.

Before 1907 the Port of Los Angeles opened, San Pedro Bay has been a port to receive visting ships. In 1911, adjoined with the Port of Los Angeles, the Port of Long Beach opened. Both of them have helped transform the City of Angels into the largest business investment in America. The opening of the Panama Canal in 1914 was integral to the growth of the harbors. Los Angeles' strategic position on America's West Coast meant that its harbor would quickly become the main ports o' call for Pacific and Atlantic trade.





On September 26, 1927, the city signed a ten-year lease for 640 acres in Mines Field (known as today's Los Angeles International Airport), and L.A.'s first municipal airport (but not the first airfield to serve the Los Angeles area.) was born.

With an improved runway and dedicated facilities, a city airport would encourage airmail and passenger traffic between Los Angeles and other aviation-friendly cities, while a permanent presence would allow airlines, maintenance companies, and other private enterprises to cluster around the site.

Atlanta
Outside the city
92.3 million passengers/year

Tokyo
Outside the city
62.3 million passengers/year

London
Outside the city
69.4 million passengers/year

Chicago
Outside the city
66.5 million passengers/year

HongKong
Outside the city
53.3 million passengers/year

Frankfurt
Outside the city
56.4 million passengers/year

21min 30min
14 miles

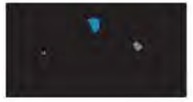
37min 78min
15.5 miles

36min 66min
16.4 miles

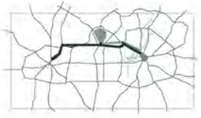
43min 97min
19.2 miles

32min 04min
20 miles

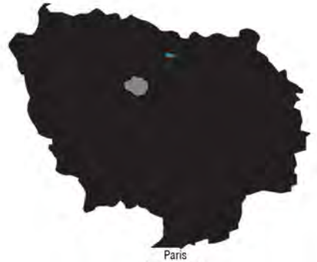
19min 35min
7 miles



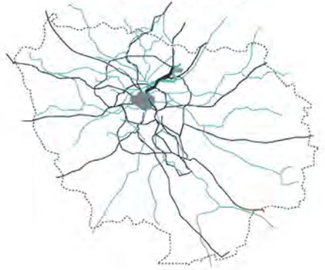
Dallas/Fort Worth
Inside the city
57.8 million passengers/year



26min 64min
20 miles



Paris
Inside the city
60.9 million passengers/year

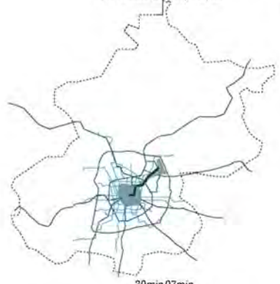


49min 63min
20 miles

Los Angeles
Inside the city
61.8 million passengers/year

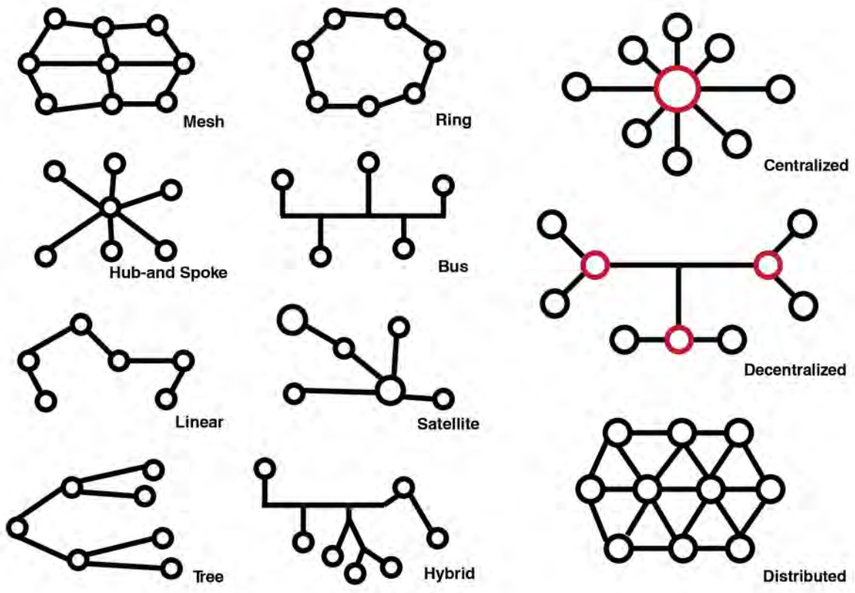
26min 48min
20 miles

Beijing
Inside the city
77.4 million passengers/year



30min 97min
20 miles

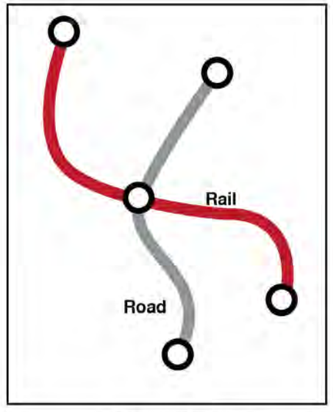
AIRPORTS & STATIONS | 10 CITIES
Navigating Stations



One center has privileged accessibility and thus represents the dominant element of the network and the spatial structure it supports.

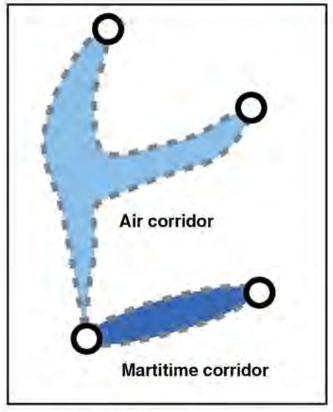
Although the center is still the point of highest accessibility, the network is structured so that sub-centers have also significant levels of accessibility.

No center has a level of accessibility significantly different from the others.



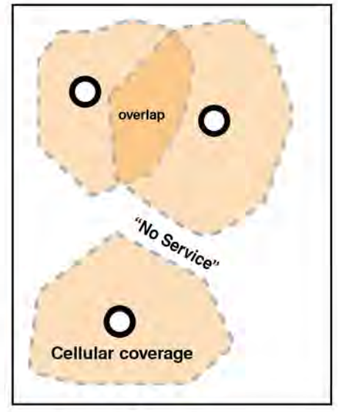
Clearly defined

- Strictly reserved space for transport infrastructure.
- Ownership can also be clearly established.



Vaguely defined

- Space may be shared with other modes.
- Not the object of any particular ownership, only rights of passage.



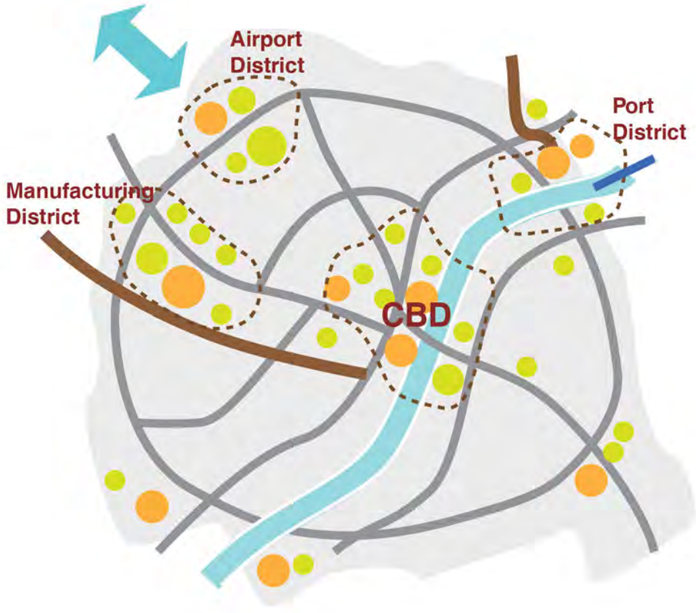
Without definition

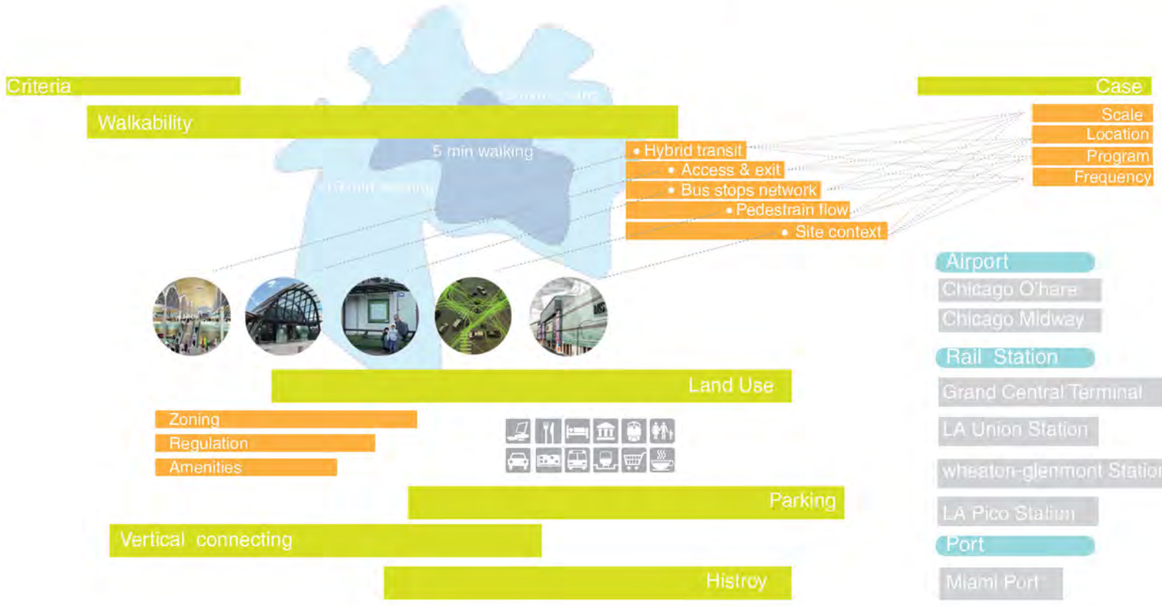
- Space has no tangible meaning, except for the distance it imposes.
- Little control and ownership are possible.
- Agreements must be reached for common usage.

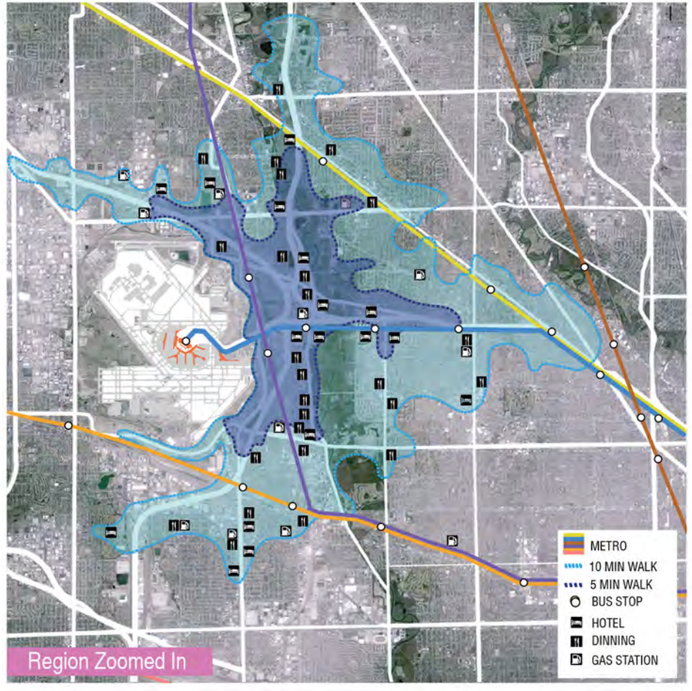
Accessibility nodes:
Relate to locations that transfer passengers and freight, thus offering accessibility to resources and markets within and/or outside the urban area.

Economic nodes:
Refer to locations that perform a secondary (manufacturing), tertiary (services) or quaternary (research, education) function of economic significance.

Built area
Accessibility node
Economic node
Tansit link
Rail link
Air link
Maritime link



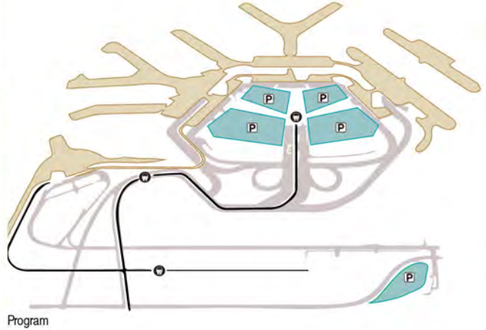




Land Use

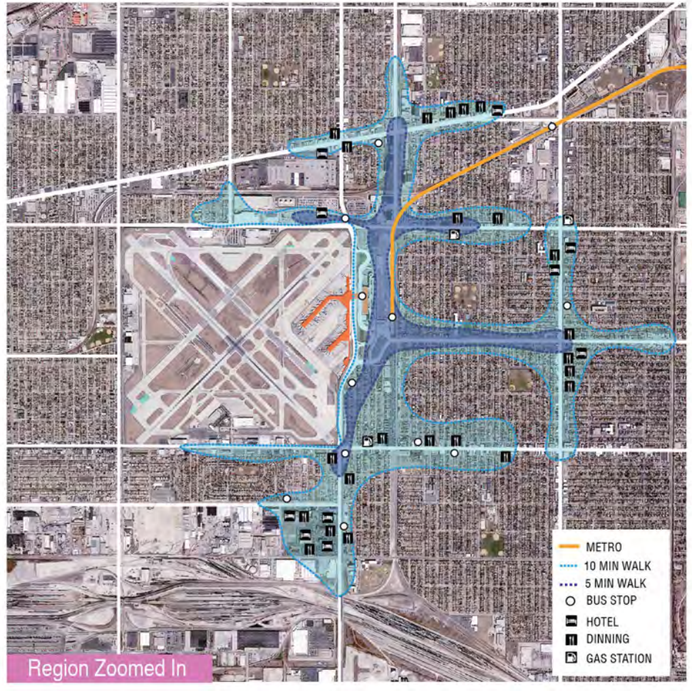
Fig. 26 : O'hare Airport

Parking



Program

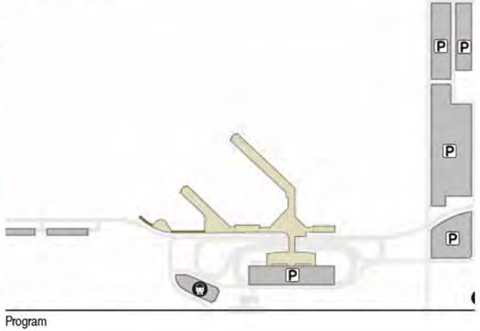
O'Hare is an airport 21 miles away from the downtown Chicago. It was an aircraft assembly plant before the land turned into the main airport not only serves the whole United States but also worldwide. A Blue Line Metro and Kennedy Expy are built to connect the airport and the downtown area. Each takes you about 55 min and 35 min to the heart of the city. The airport is surrounded by Logistics centers, green parks and family houses. There are also two rails connect the Chicago Union Station and the airport, the NCS and MD-W. Main commercial stores area gathered around in the east outside the airport, where the expressway and metro enter the airport and rails pass through.



Land Use

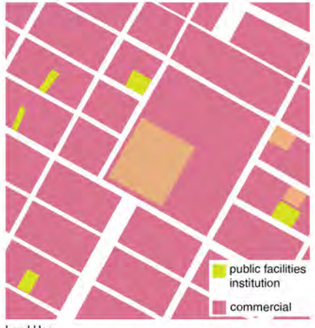
Fig. 27 : Midway Airport

Parking



Program

Midway is the only airport for Chicago before WWII. By 1931 the airport claimed to be the "World's Busiest". The airport is located in a residential area where few commercial gathered around the airport. They gathered along the Stevenson Expy in the north and S Cicero Ave passing the airport from the east side. A Orange Line, which has linked the airport to the downtown Chicago for 30 min has a terminal here. The biggest logistics center lays in the south two blocks away from the airport and there is a cargo line link the two. The other two Logistics centers are each 5 miles in the north and 3 miles in the east. These centers are functioned and communicate by complex rails systems.



Land Use

Fig. 28 : Grand Central, 1880

Grand Central Terminal (GCT) is a commuter (and former intercity) railroad terminal at 42nd Street and Park Avenue in Midtown Manhattan in New York City, United States. It is one of the largest transit center in the world. Built by and named for the New York Central Railroad in the heyday of American long-distance passenger rail travel, it is the largest such facility in the world by number of platforms with 44 serving 67 tracks along them.

Infilled in the high density Manhattan district, the surrounding of GCT is mostly commercial use high-rise buildings and he gird in this area is relative small. Within 10 minutes walking distance, there are plenty of restaurant, store, offices and other public commercial use spaces.

Parking

Fig. 29 : Grand Central, 1913

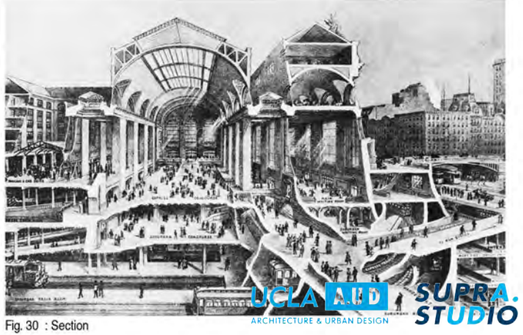
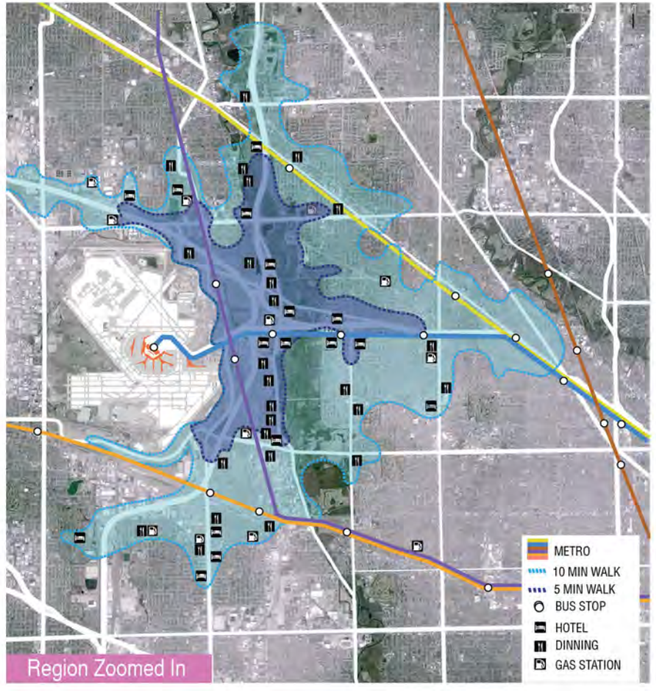


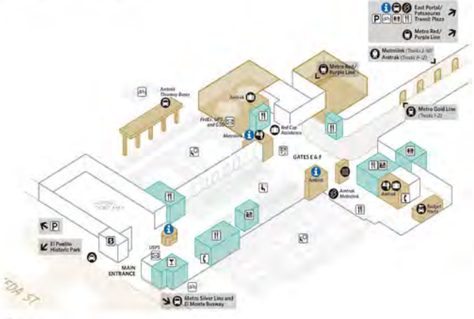
Fig. 30 : Section



Land Use

Parking


Fig. 31 : Union Station, 1923


Program

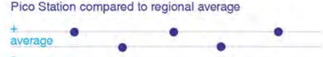
Los Angeles Union Station (LAUS) is the main railway station in Los Angeles, California and the largest railroad passenger terminal in theWestern United States.The site of LAUS used to be a part of old Chinatown. It opened in May 1939 as the Los Angeles Union Passenger Terminal, replacing La Grande Station and Central Station.

Today, the station is a major transportation hub for Southern California, providing 60,000 passengers a day access to Amtrak (the National Railroad Passenger Corporation) long distance trains, Amtrak California regional trains, Metrolink commuter trains, and several Metro Rail subway and light rail lines.

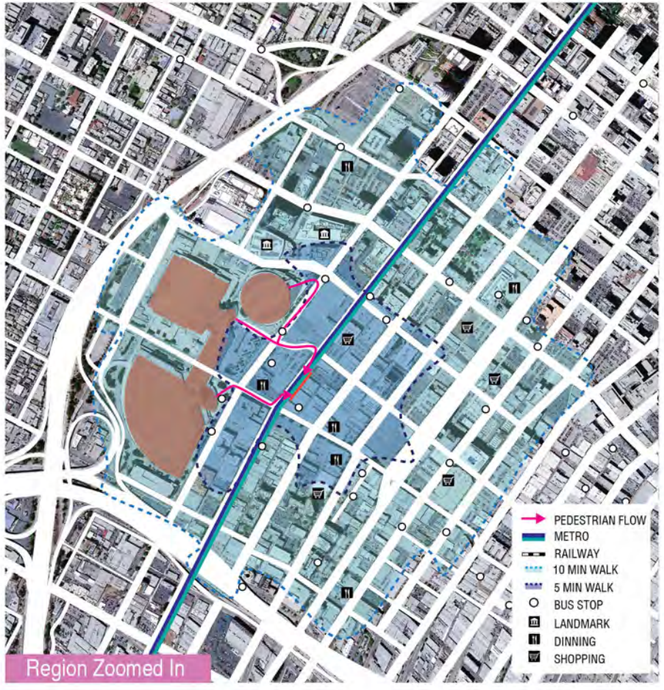
LAUS locates in a historical downtown neighborhood. Within 10 minunte walking distance, passengers may reach various of restaurant, school, shopping center and a cluster of landmark and civic buildings. The land use of the surrounding is mixed by commercial, public facility and residential use. There are three metro lines connected in this station.

Station Fact:
Neighborhood Type CBD/Special District
Station Type Surface, Moderate corridor ridership
Neighborhood Change Stable Low Income
Development Opportunity High

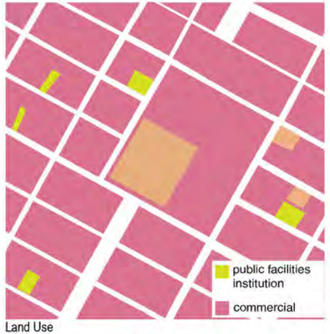
Pico Station compared to regional average



Region Zoomed Out



Region Zoomed In



Land Use

Fig. 32 : Los Angeles Convention Center

Parking

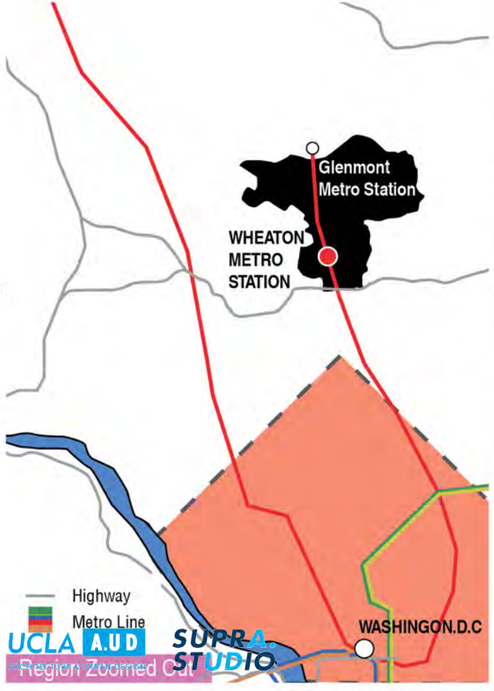
Fig. 33 : Los Angeles Staples Center

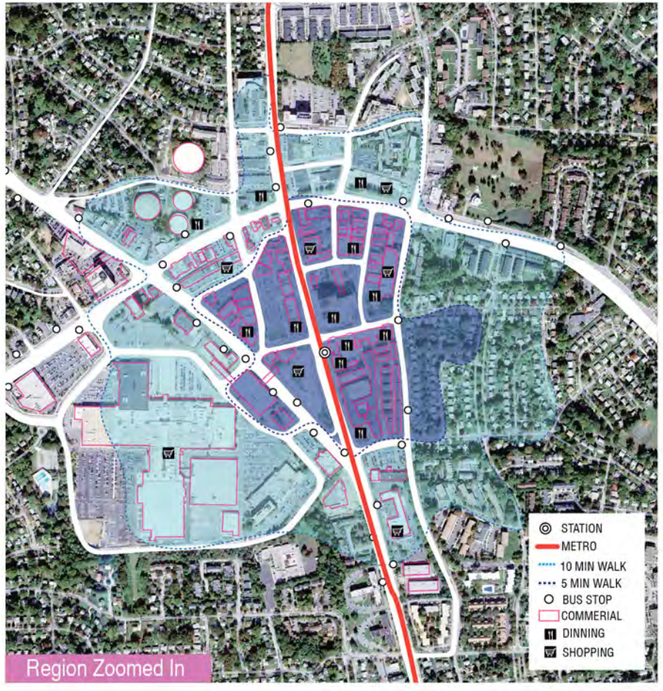
Pico Station, located in the Boyle Heights neighborhood of Downtown Los Angeles serves two of Los Angeles County's Metro Rail Lines with connections to a third line one block away.

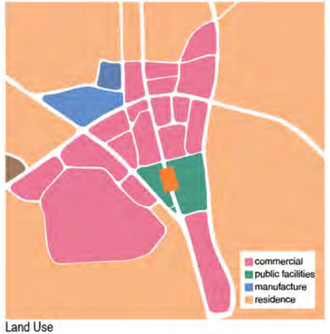
The station serves a number of entertainment and special events venues including the Staples Center (home to the L.A. Lakers), the Los Angeles Convention Center, the Fashion Institute, California Hospital Medical Center, and the L.A. Live Entertainment Complex.

- Serves special events, sporting and cultural events
- High density residential, including the new Met Lofts building which offers one and two bedroom rental apartments in close proximity to the station
- Resturants and shopping are within a short walk
- Two large surface parking lots serve the entertainment venues surrounding the transit station

Program







Land Use

Fig. 34 : Wheaton Metro Station/Birdview

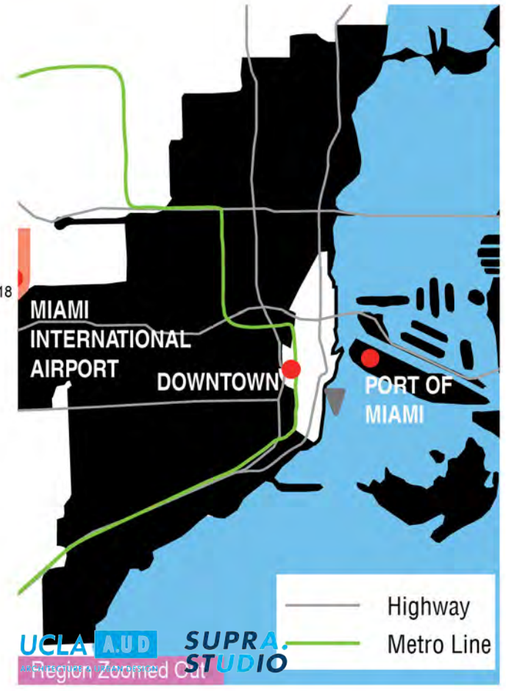
Parking

Fig. 35 : Program

The Wheaton Metro Station site locates at Georgia Avenue, Sliver Spring, Maryland. It is at the Intersection of Reedie Drive, Veirs Mill Road, and Georgia Avenue, in the Wheaton Central Business District.

The station serves the suburb of Wheaton. The trip to this station takes approximately 24 minutes from the Metro Center, the Metro terminal in downtown. Also, it is quite close to the Metro Bus Bays which own 11 parcels comprising approximately 132,083 square feet.

Located at the end of both city's light rail and metro bus system, the station quickly became an important joint for suburb residents. Growing demand on shopping and other commercial properties are spawn by the accumulation of commuting and transfering. The Metro property on the west side of Georgia Avenue is approximately 215,492 square feet. Hence, a Metro Parking Garage that takes up approximately 83, 409 square feet was build recently.



Region Zoomed Out

Region Zoomed In

Fig.36 : Land Use

Fig. 37 : Port of Miami, 2005

Parking

Program

PortMiami is a seaport located in Biscayne Bay in Miami, Florida, United States. It is connected to Downtown Miami by Port Boulevard—a causeway over the Intracoastal Waterway—and to the neighboring Watson Island via the Port of Miami Tunnel. The port is located on Dodge Island, which is the combination of three historic islands (Dodge, Lummus and Sam's Islands) that have since been combined into one. It is named in honor of 19 term Florida Congressman Dante Fascell.

PortMiami is recognized, and has been for many years, as the "Cruise Capital of the World" and "Cargo Gateway of the Americas". It has retained its status as the number one cruise/passenger port in the world for well over two decades accommodating the largest cruise ships in the world and the operations of such major cruise lines as Carnival, Royal Caribbean and Norwegian Cruise Line, until the late 2000s.

Miami Port is also the largest recreational port in the Eastern US. The tourists as well as cargo can get access to the port by railroad, the freeway Tunnel and water. Besides, the port develops quite a large number of recreation cruise ships that serve the increasing sightseeing population.

30 Minutes Journey Before Hyperloop

Hyperloop as the 5th transportation

Los Angeles is spreading out through history.

Fig 38: Gore's birdeye map of Los Angeles as it appeared in 1871.

Fig 39: Greater Los Angeles, 1931.

Fig 40: Sunny Southern California, 1970.

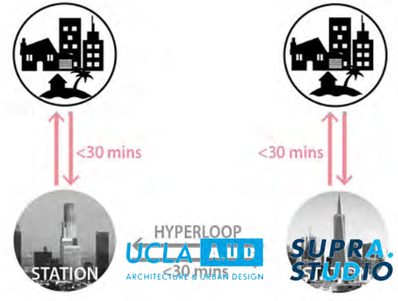
30 mins' capture area from downtown LA wothout traffic

30 mins' capture area from downtown LA woth traffic

30 Minutes Journey with Hyperloop

Hyperloop as the 5th transportation

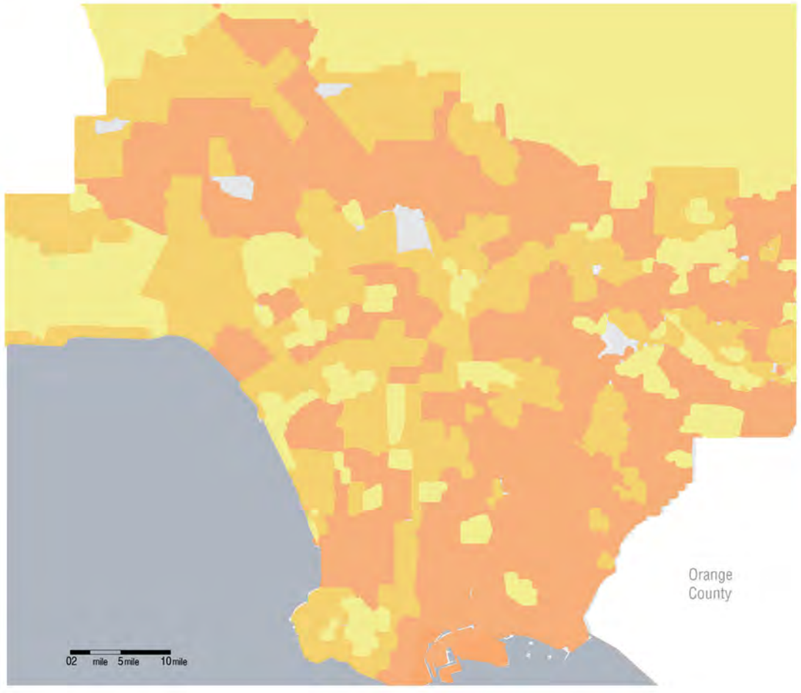
Vision of Hyperloop:
With supersonic Hyperloop, the 30mins journey can expand to San Francisco, Las Vegas and Phoenixes from Los Angeles. So the challenge is how could we get people to their destination (home or office) consuming less time once they get off Hyperloop. Once the long-distance travel and in-city travel are connected together and the city's transportation is much more efficient.



Los Angeles | Total Population

Mapping the Criteria

	Community	Population Total
01	Long Beach	462,731
02	Glendale	195,047
03	Santa Clarita	157,447
04	Pomona	150,269
05	Torrance	137,933
06	Pasadena	134,941
07	East Los Angeles	125,897
08	Lancaster	120,783
09	Palmdale	117,432
10	El Monte	116,249



Population measures the number of people who live in the area.

Index

41,803 and above

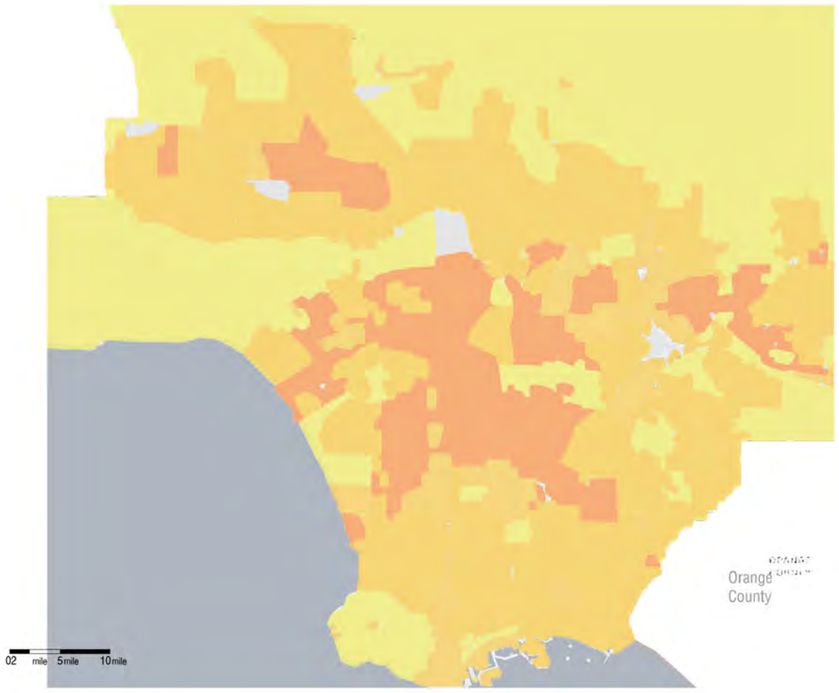
12,514 and above

less than 12,514

Los Angeles | Population Density

Mapping the Criteria

	Community	Population per Sqm
01	Koreatown	42,611
02	Westlake	38,214
03	East Hollywood	31,095
04	Pico-Union	25,352
05	Maywood	23,638
06	Harvard Heights	23,473
07	Hollywood	22,193
08	Walnut Park	22,028
09	Palms	21,870
10	Adams-Normandie	21,848



Population density measures the numbers of people per sqmi

Index

10,446 and above

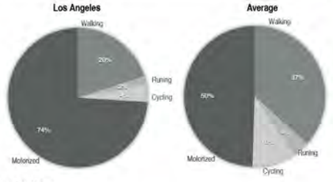
3,754 and above

less than 3,754

Los Angeles | Freeways & Major Street

Mapping the Criteria

	Community	Freeway/highway Number
01	Central City	12
02	Burbank	11
03	Southeast Los Angeles	10
04	Pasadena	9
05	Hollywood	9
06	Pomona	9
07	Redondo Beach	9
08	Long beach	9
09	Glendale	8
10	Santa Monica	8



Motion Pattern

MAJOR HIGHWAY
SECONDARY HIGHWAY 80 feet standard right of way width

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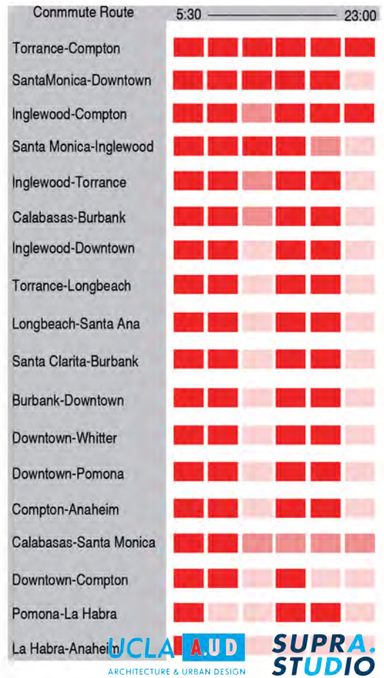
Los Angeles | Traffic Conjestion

Mapping the Criteria



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Los Angeles | Enterprise Zone

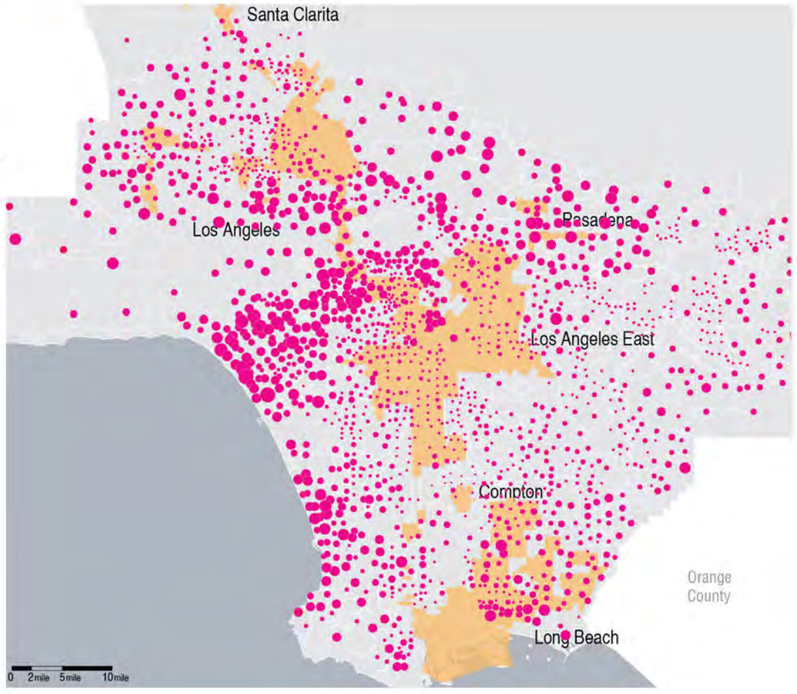
Mapping the Criteria

	Community	Type of development
01	Compton	Enterprise zones*
02	Long Beach	Enterprise zones*
03	Los Angeles	Enterprise zones*

Ranking in Enterprise Zones

	Community	Number of professional workforce
01	Santa Monica	102,300
02	Downtown LA	100,000
03	Westwood	90,000

Ranking in workforce



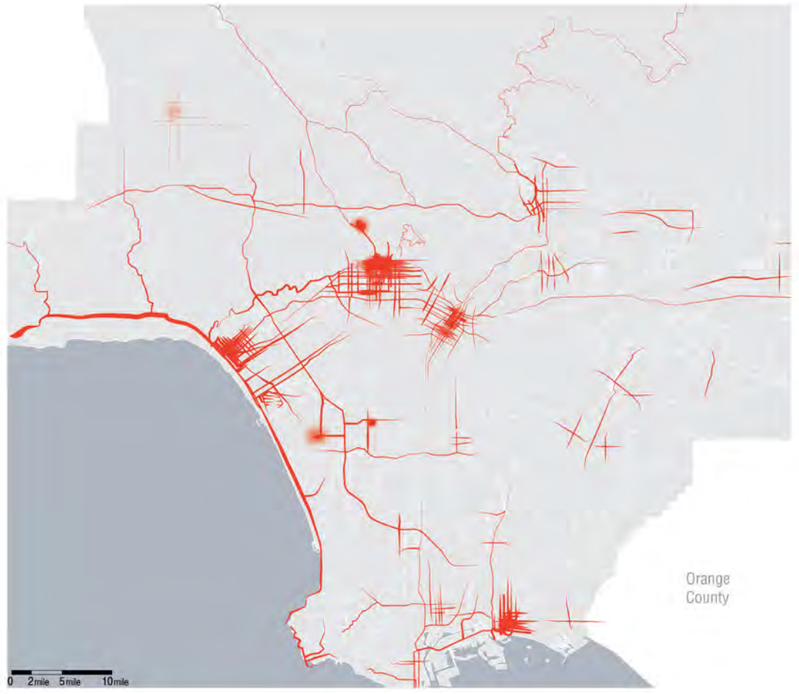
Bubble size represents count of professional, scientific and technical industry workers

Enterprise Zones ● Professional Jobs

Enterprise zones are areas provided by the government designed to encourage business investment. The creation and purpose of the program was to stimulate economic development by providing tax incentives to businesses enabling private sector market forces to revive the local economy.

Los Angeles | Tourist Moving Pattern

Mapping the Criteria



	Community	Number of tourists per year
01	Hollywood	36,976,320
02	Santa Monica	7,500,000
03	Malibu	6,200,000
04	Long Beach	6,200,000
05	Downtown LA	4,000,000
06	Manhattan Beach	3,800,000
07	Inglewood	2,600,000
08	Pasadena	1,500,500
09	Westwood	1,369,500
10	Redondo Beach	800,000

The red line shows the moving track of tourists and the highlighted area shows its popularity.

987,074 ridership — daily in weekday

170 routes

94 stops — average on each route

6.2% population — commuted to work in public transit

Daily Boardings & Alightings by Street Intersection

- Under 1k
- 1k - 3k
- 3k - 5k
- 5k - 15k
- 15k +

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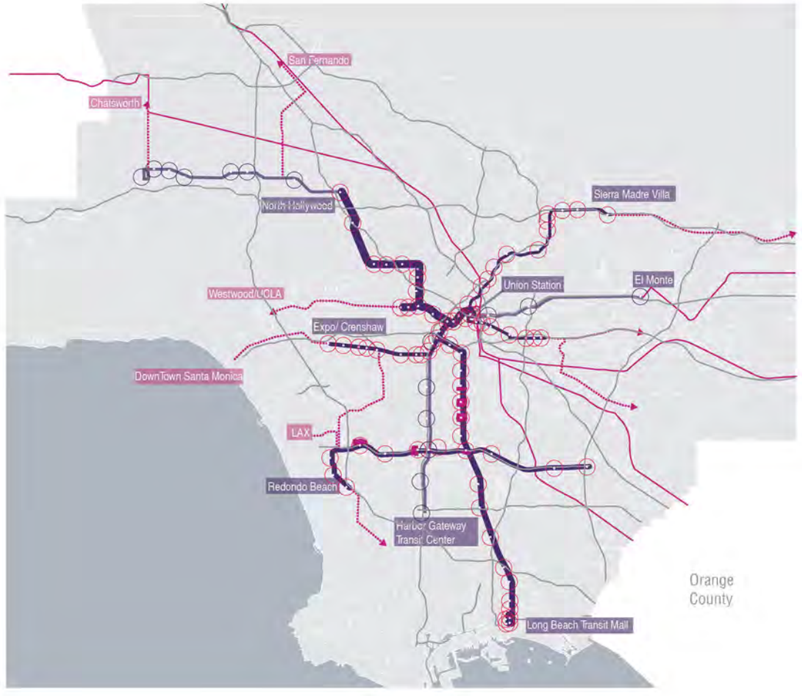

6 lines — Metro Rail

over **80** stations — in total

362,904 ridership — daily in weekday

serve **16%** — of total population

25 miles/h — average speed

- Red/Purple Line 3,858,820
- Blue line 2,188,058
- Green line 1,066,744
- Gold Line 1,062,4
- Expo line 641,899
- Rapid bus line silver/orange

Fixed terminals
Amtrak/Metrolink
Bus connections
Parking lot

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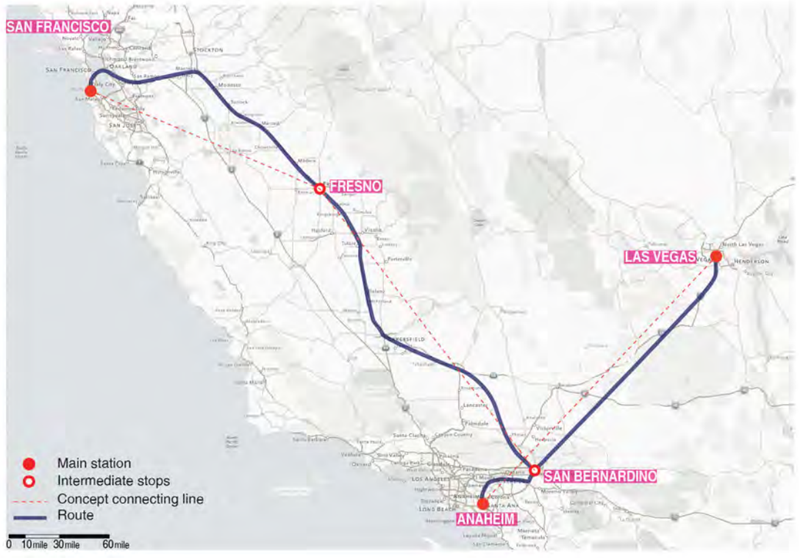
Potential consumers:
business travelers, weekend tourists;

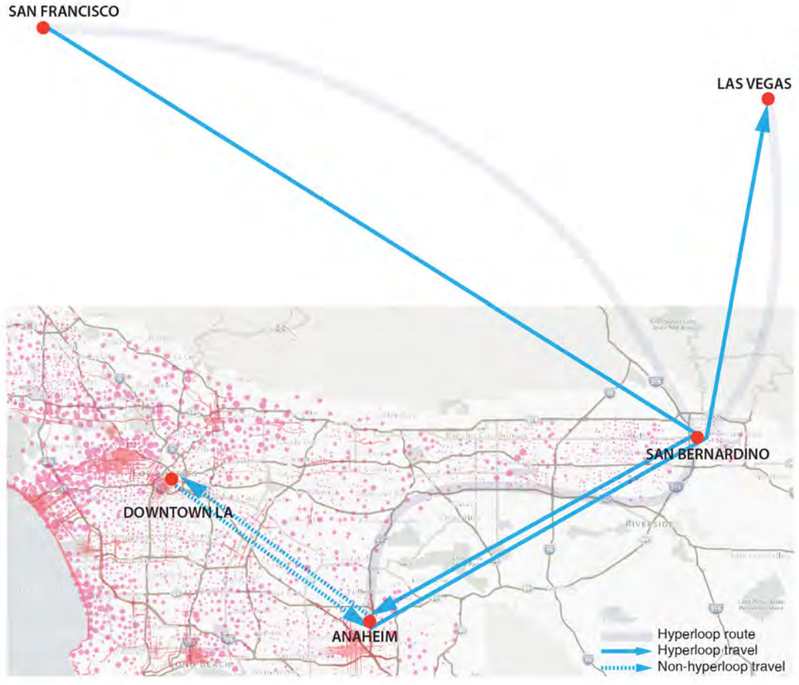
Ideal destination:
well populated by capable consumers(like Las Vegas, San Francisco, Los Angeles);

Obstacles:
legal issues about planning infrustructure (Whether the project would bump up against numerous environmental and regulatory roadblocks is questioned);

Route:
i) Principle: attaching to highway, bypassing natural conservation parks;
ii) Network: main station: San Francisco, Los Angeles, Las Vegas; intermediate stops: Fresno, San Bernardino.

	feasibility	distance	travel time
SF -- FRENSNO	10	194 miles	19.5 mins
FRENSNO -- SB	10	276 miles	18.6 mins
ANAHEIM -- SB	10	54.1 mies	10.8 mins
SB -- LAS VEGAS	10	267 miles	15.3 mins





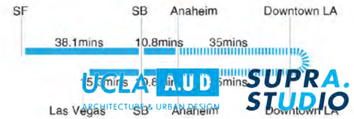
There's a comparison of criteria between los angeles and Anaheim.

-Number of tourists annully

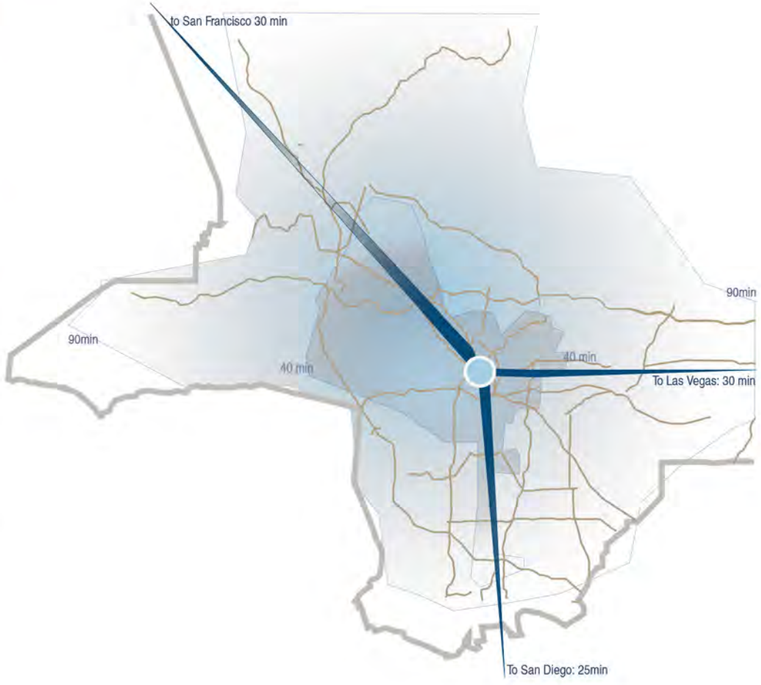
-Professional, scientific, technical industry workforce

-Total population

Los angeles has much more potential customers that couldn't be ignored. Travellers to and from Los Angeles have a travelling route of San Francisco-San Bernardino-Anaheim-Los Angeles, Los Angeles-Anaheim-San Bernardino-Las Vegas. It will take 30-40mins by car from downtown LA to Anaheim.



Smooth Transit focuses to use main station as hyperloop transit hub. Passengers from all 3 directions will transit in the main station. However, Hyperloop has to work as a network to integrate into the city. The strategy is to set station in a dense area, combined with existing transit hotpot so as to relieve the first and last mile problem. In a more deeper sense, mini hyperloop system will be adopted in the urban environment. It still uses the same technology as hyperloop, but it will be slower. Riding with existing infrastructure, the network will be implanted into the city transit hotspot, so as to shrink the city by time.



Public transportation system
Private vehicles
Inter-urban hyperloop

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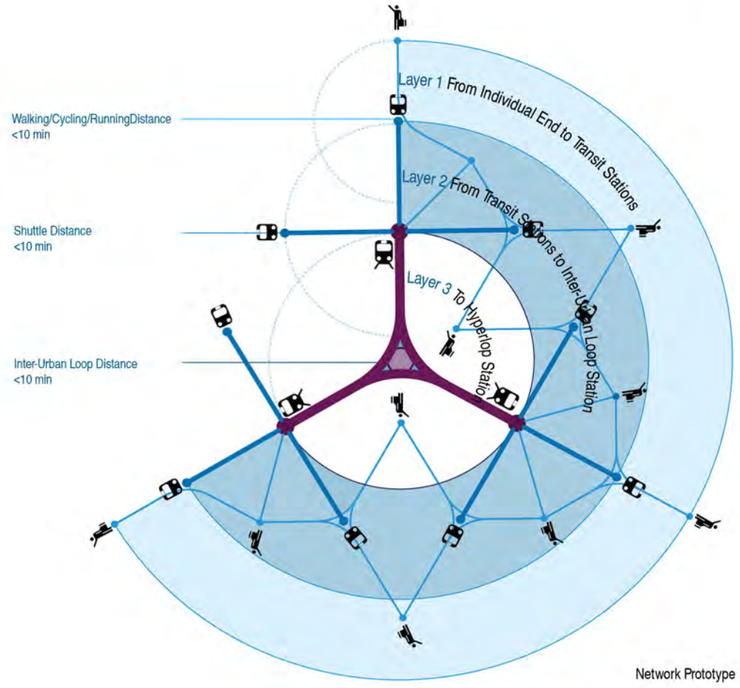
Locate a MAIN Station: Smooth Transit
Strategy 01| Smooth Transit



Network Prototype

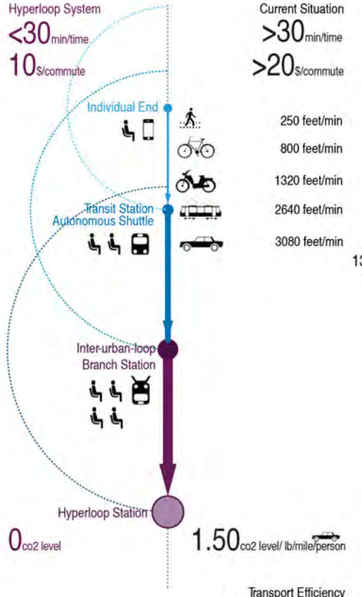


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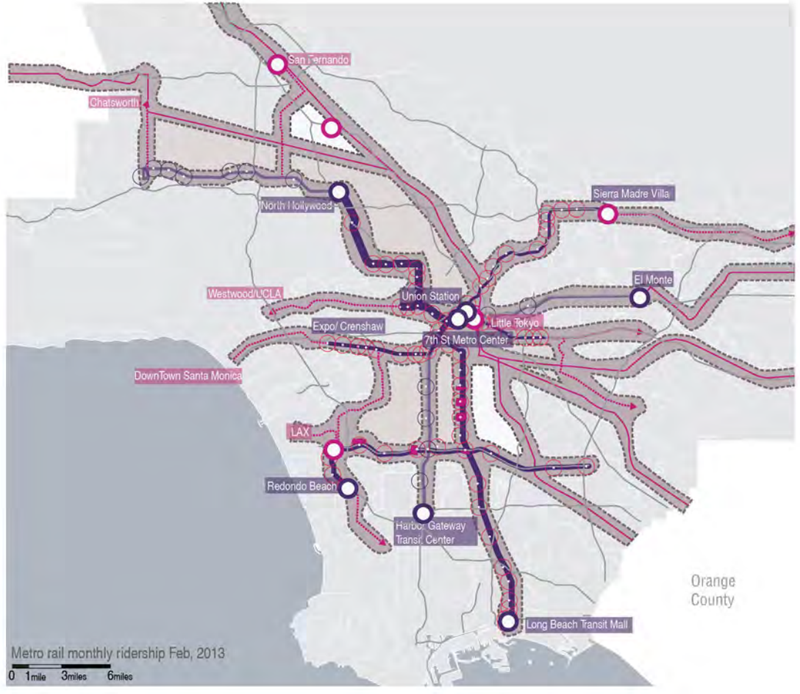
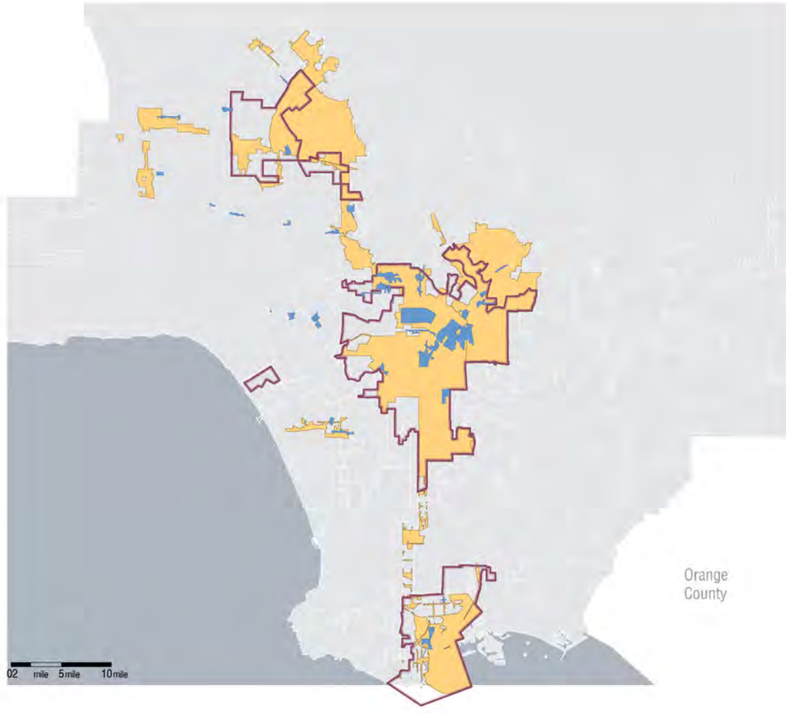
Fig41:Metro Rail's development trend



Red/Purple Line 3,858,820
Blue line 2,188,058
Green line 1,066,744
Orange line 1,041,619
Expo line 641,899
Rapid bus line silver/orange

Fixed terminals
Amtrak/Metrolink
Fixed Extensions
Existing TOD
Freeway
Service Coverage



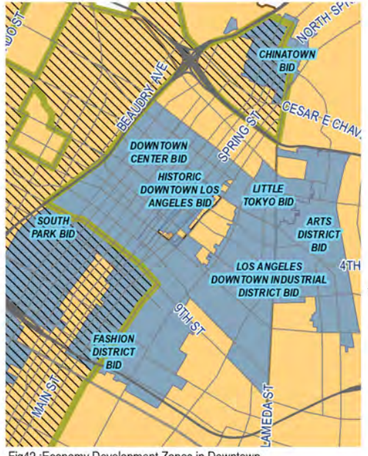


Fig42 :Economy Development Zones in Downtown

LA Revitalization Zone(LARZ)
Business Improvement [illegible](BID)
State Enterprise Zone(SEZ)

Hyperloop main station helps efficient transit from 3 destinations

Urban Hyerloop
Urban Hyperloop Branches
45 miles/h
6 miles = 10 minutes drive (local)
9 miles = 10 minutes drive (freeway)

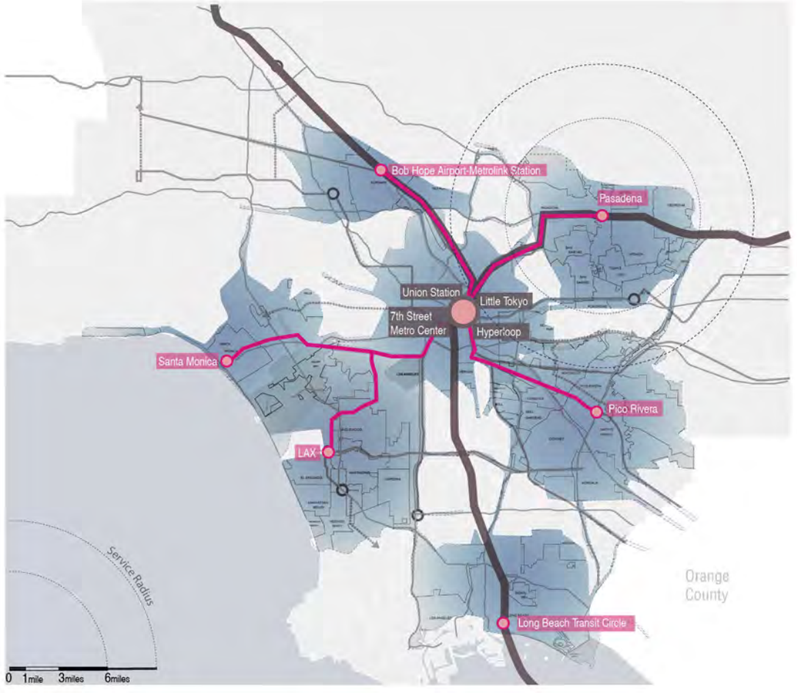
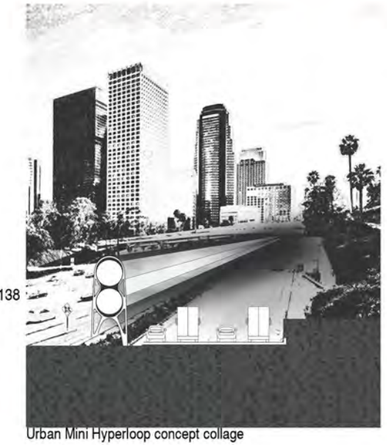
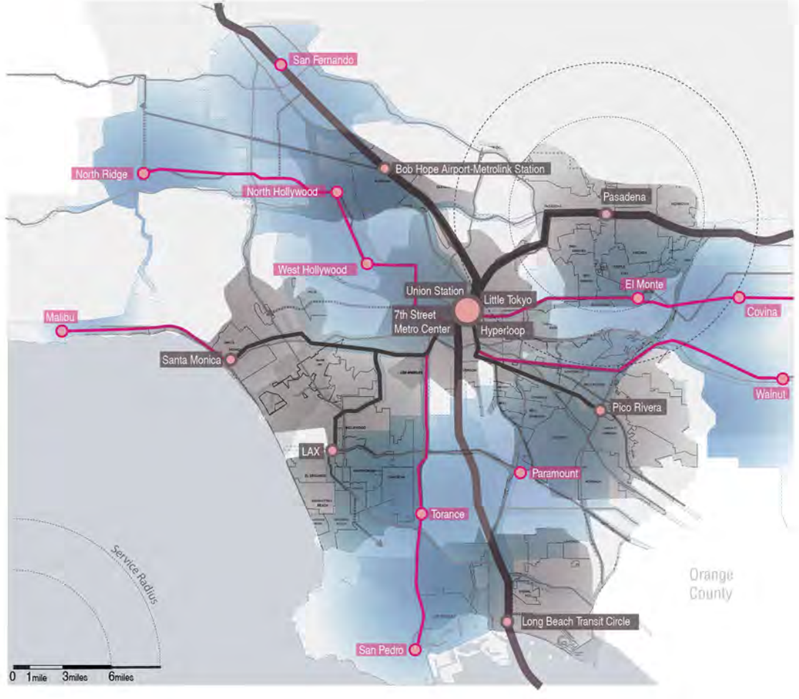


Fig 43: Airtrain propoal

Urban Hyerloop
Urban Hyperloop Branches
45 miles/h
6 miles = 10 minutes drive (local)
9 miles = 10 minutes drive (freeway)



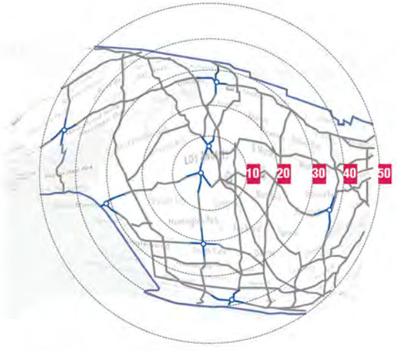
Urban Mini Hyperloop concept collage



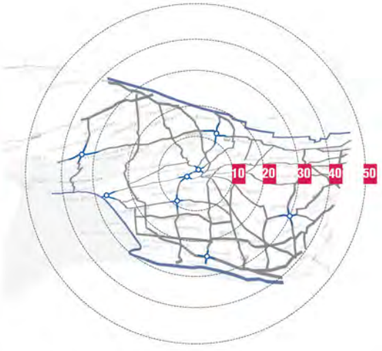
Urban Hyerloop
Urban Hyperloop Branches

6 miles = 10 minutes Hyperloop
9 miles = 10 minutes drive (freeway)

How long it takes from home to Union Station?



Driving on Freeway
Fish-ball Pattern



Phase 01 Hyperloop
Shrink Central City

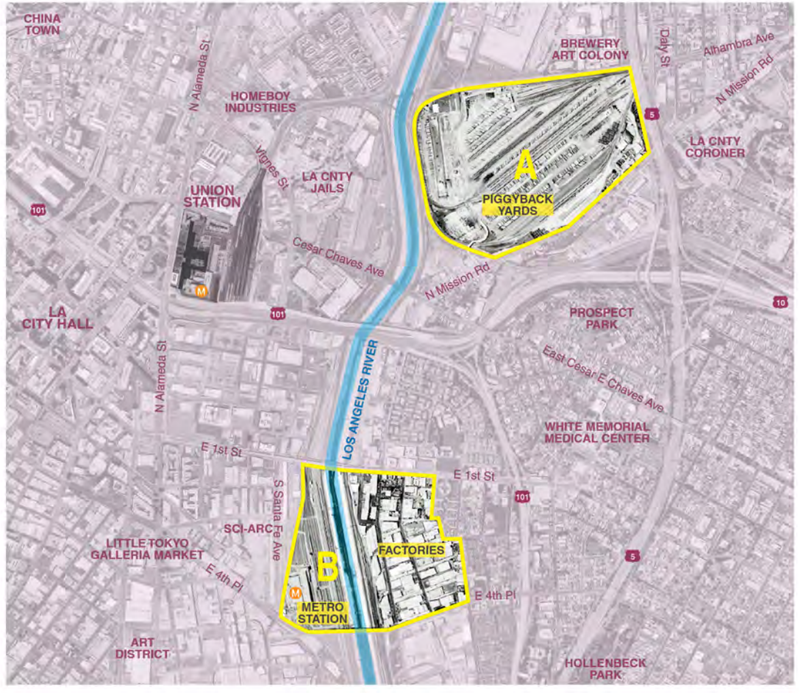
Phase 02 Hyperloop
5 minutes to main station

Phase 03
Shrink the city

Potential Sites: Location

Strategy 01| Smooth Transit

Two potential sites are selected near Union station in downtown los angeles. Connected with the big transit hub of rail and metro in Union station, both of the two sites have high accessibility. They are discarded land close to LA River in down town Los Angeles and facing a challengee to revital. Hyperloop station are coming and give them a second life.



Union Station

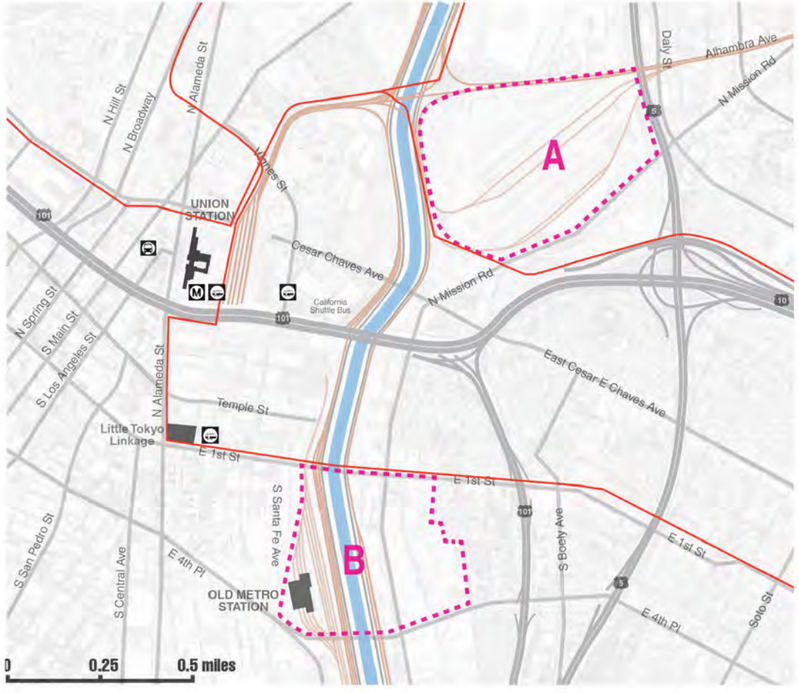
LAX Terminals

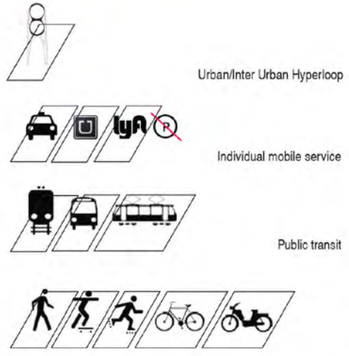
Site A

Site B

Potential Sites: Accessibility

Strategy 01| Smooth Transit





High Accessibility with multiple transit method

Freeway
Road
Rail
Metro Line
Abandoned Rail
Los Angeles River

Subway
Bus
Rail

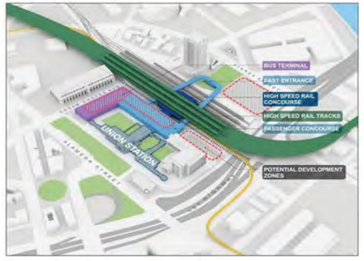
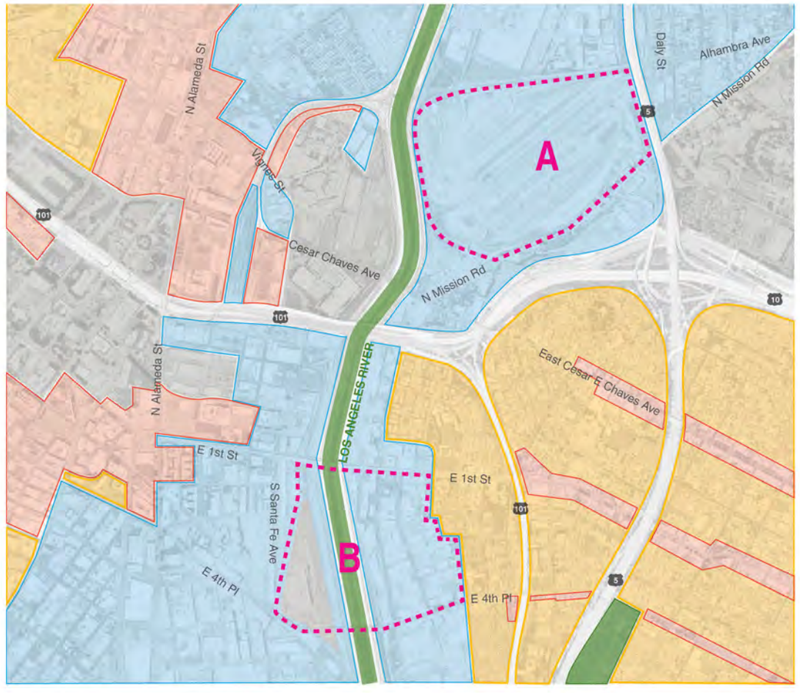


FIg 44:Union Station New MasterPlan

Both potential stations locate in the abandoned manufacture zone, which interrupts urban context. Union Station is planned to expanded into a more hybrid transit station, and together with hyperloop, the area will become a highly efficient union transit district.



Multi Family Residential
Commercial
Manufacturing
Open Space
Public Facilities

SITE A: Union Pacific Piggyback Yards

Fig 45:Birdview of site A- Piggyback Yards filled with used containers.

Fig 46:It was a place to load truck trailers "piggyback" onto railroad flat cars.

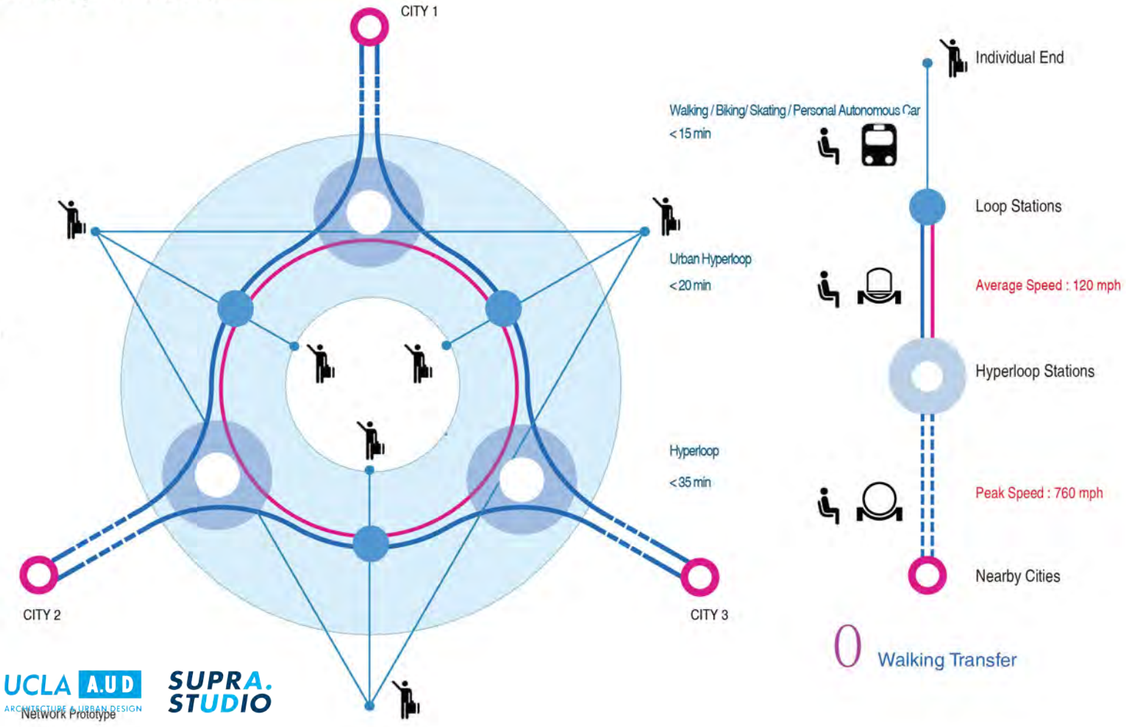
Fig 47:View across the L.A. river.

SITE B: Old Metro Station+LA River+Old Factories

Fig 48:Birdview of site B.

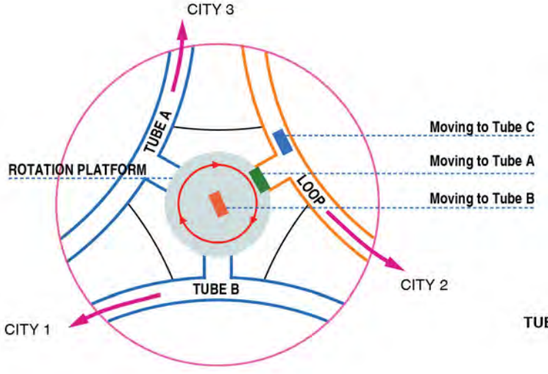
Fig 49: The old metro station is abandoned now.

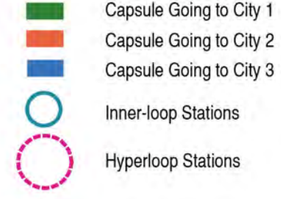
Fig 50:View of the L.A. river.



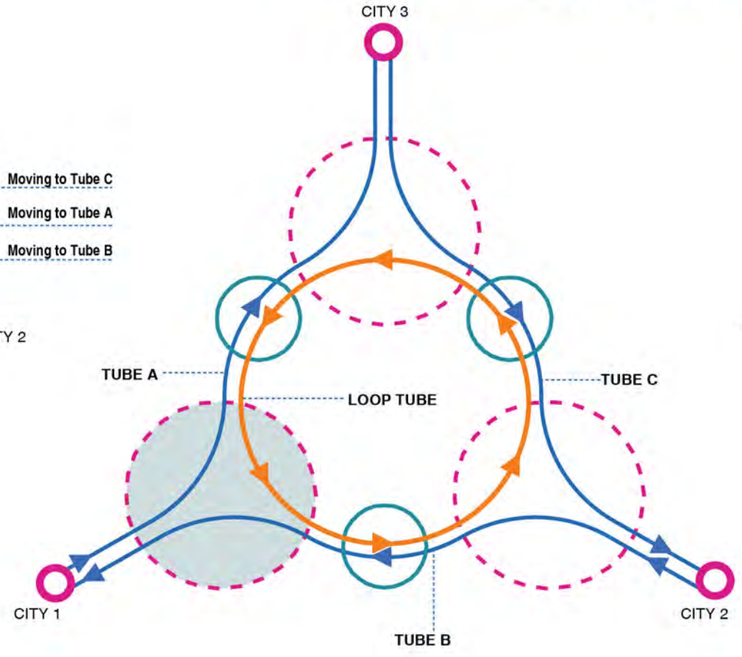
0 Walking Transfer

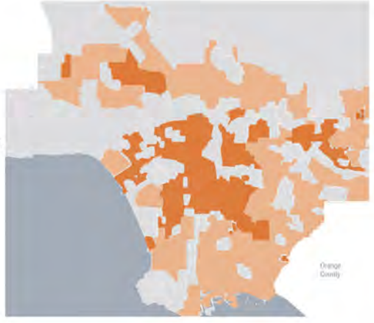
Network Prototype





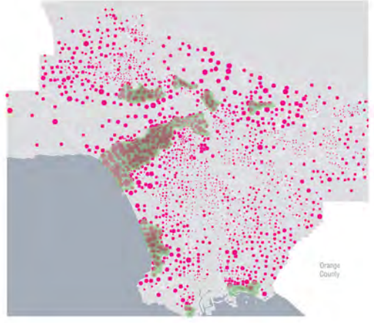
Multiple Capsules For Different Destinations



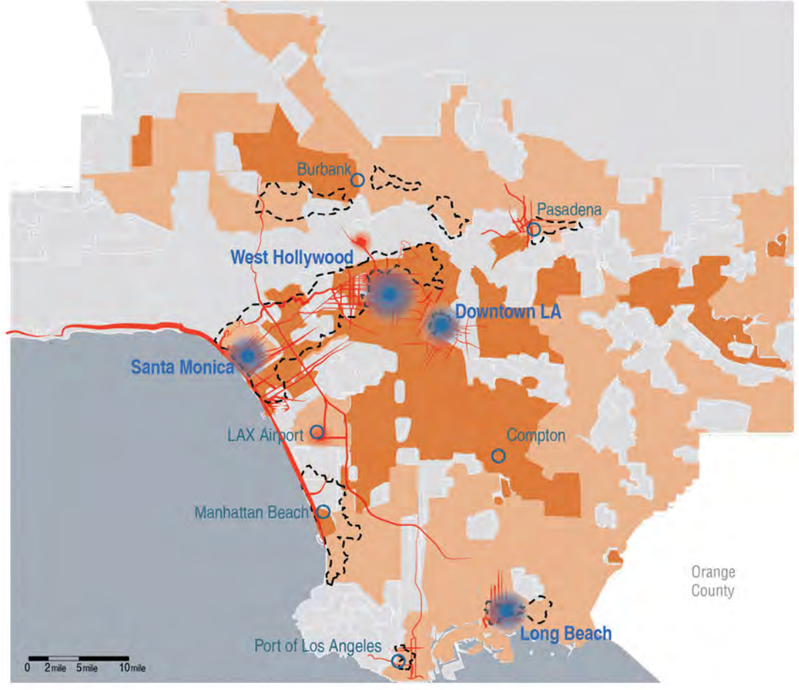


Residents
Communities with highest population density & quantity

Tourists
Most Popular Tourism Routes



Business
Communites with most professional workers



Water Road
Freeway
Railroad

Existing Infrastructure

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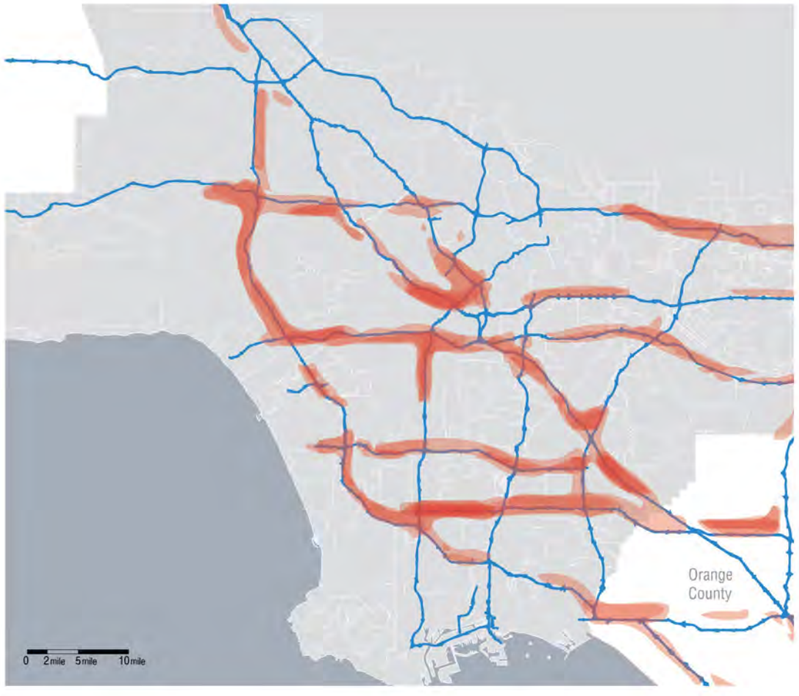

Slow Traffic

Smooth Traffic

Major Highways

Traffic Conggestion of Major Highways

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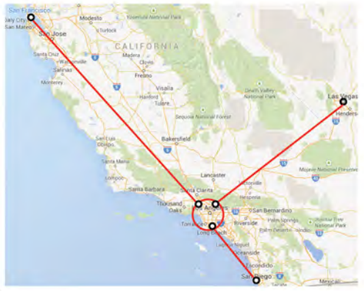

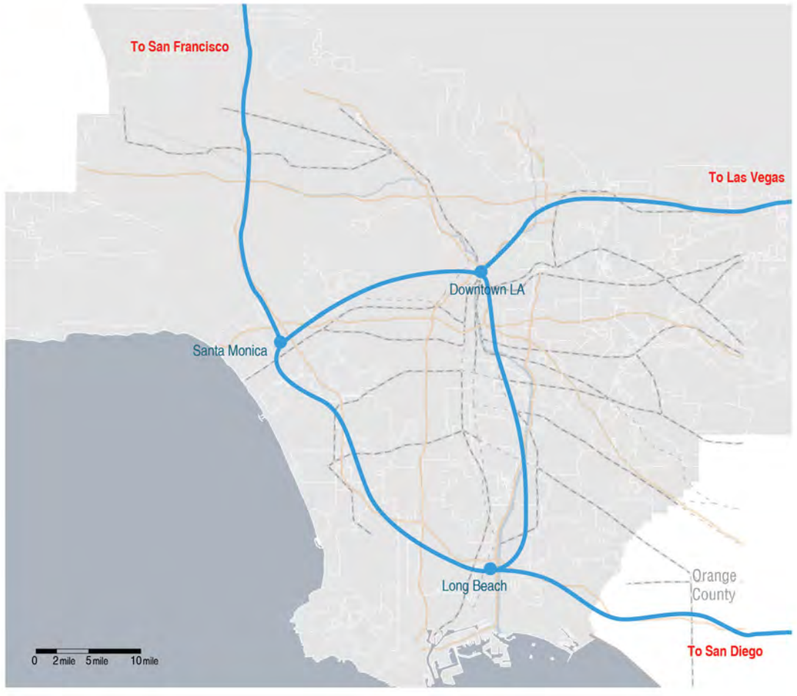

Hyperloop Stations
Possible Route
Basic Form of Hyperloop LA

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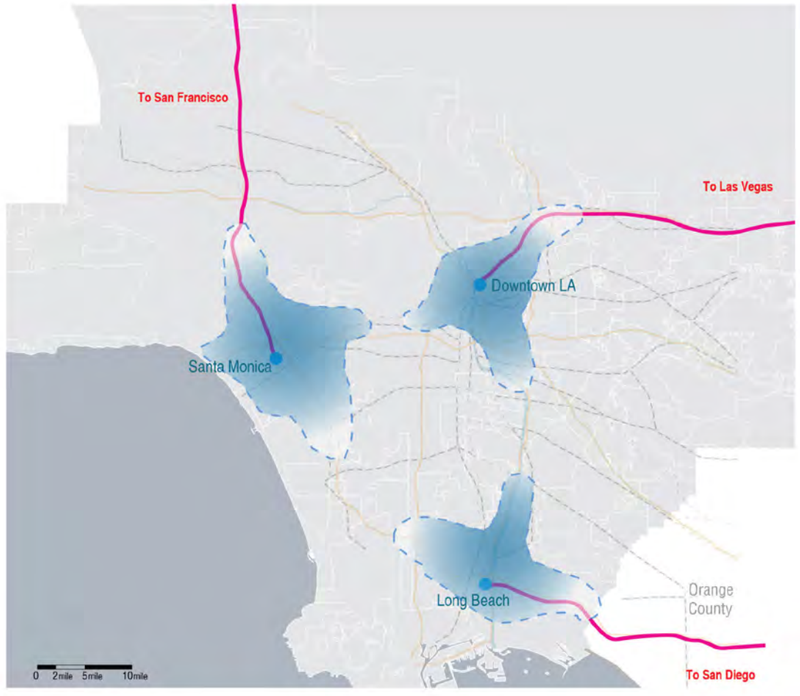

Hyperloop Stations
Possible Route
10 min Driving Rang
Possible Network

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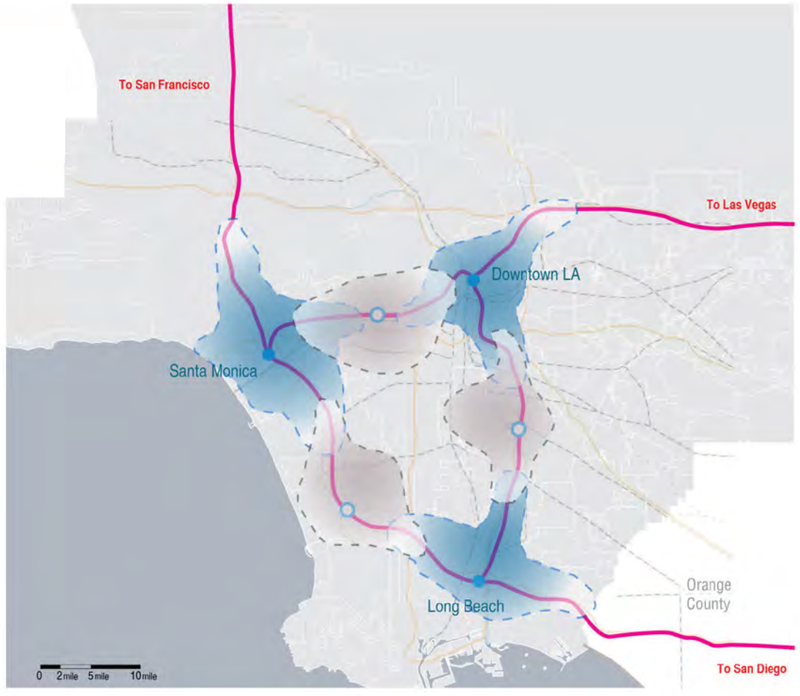
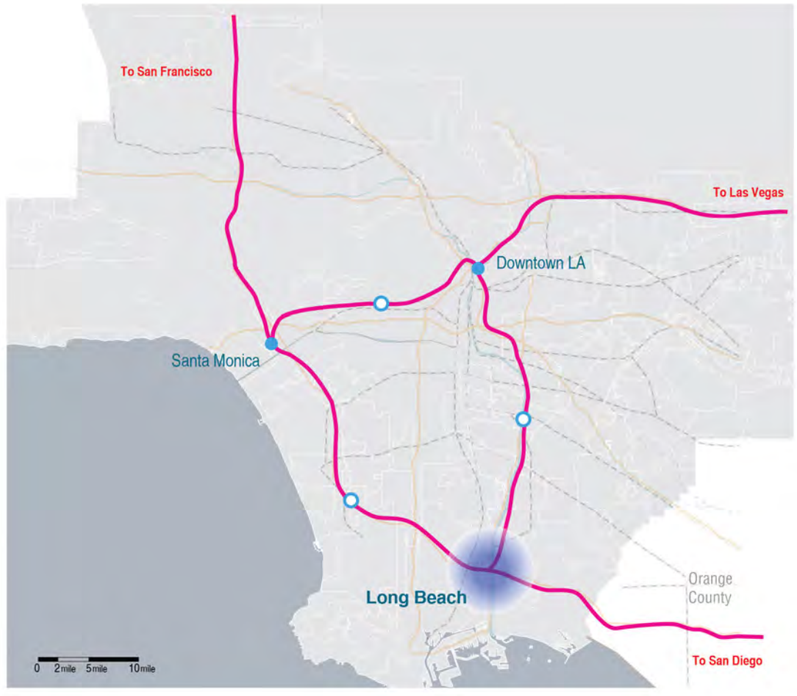
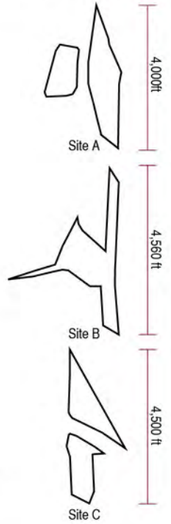


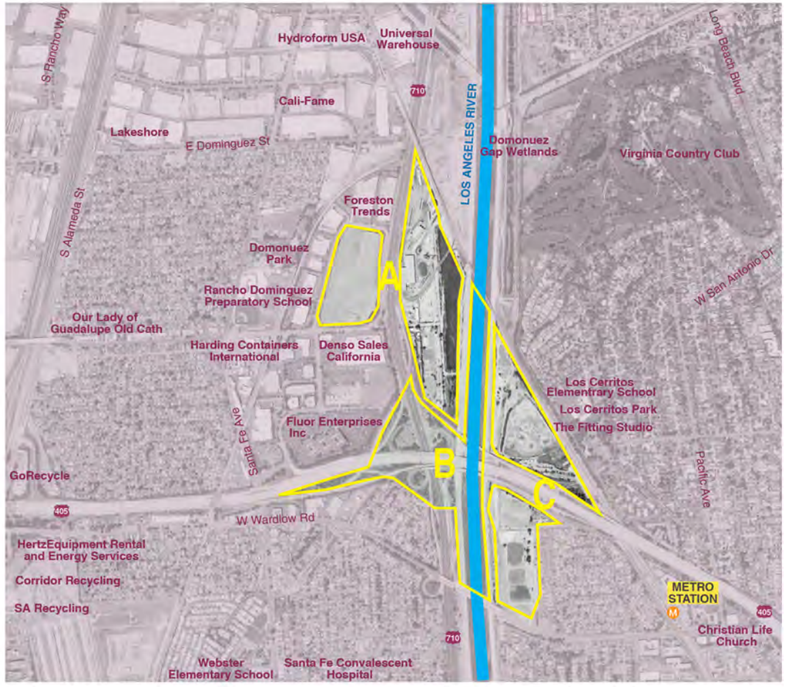
- Hyperloop Stations
- Possible Route
- 10 min Driving Range
- 10 min Walking Range
- Possible Network



- Potential Area
- Inner Loop Tube
- Hyperloop Tube

Two potential sites are selected near Union station in downtown Los Angeles. Connected with the big transit hub of rail and metro in Union station, both of the two sites have high accessibility. They are discarded land close to L.A. River in down town Los Angeles and facing a challengee to revital. Hyperloop station are coming and give them a second life.





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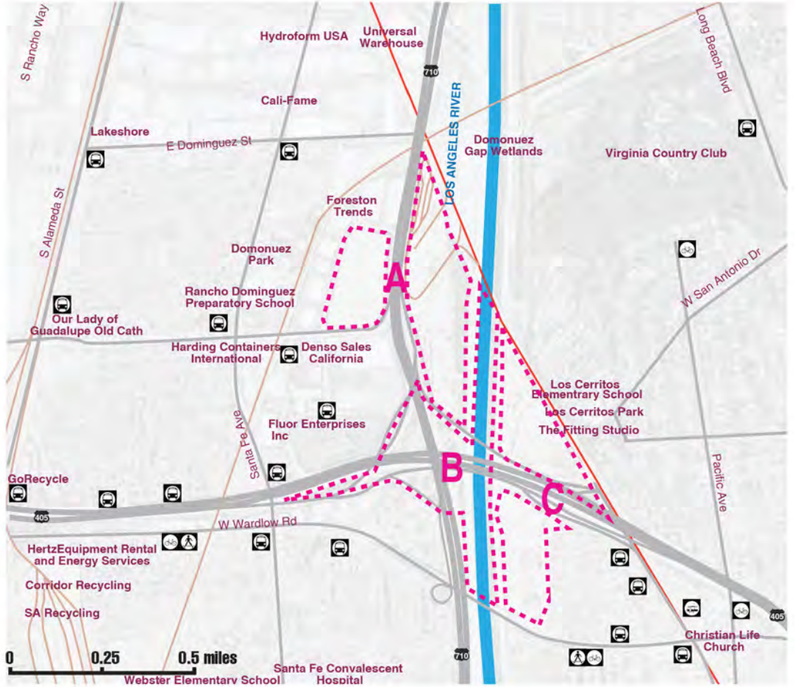

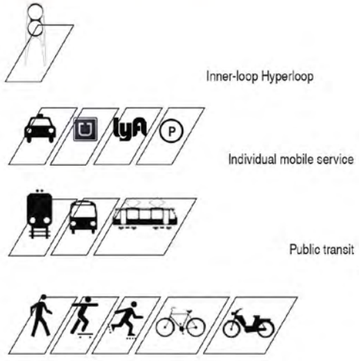

High Accessibility with multiple transit method

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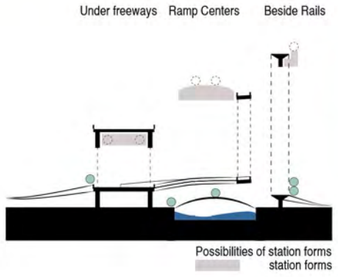

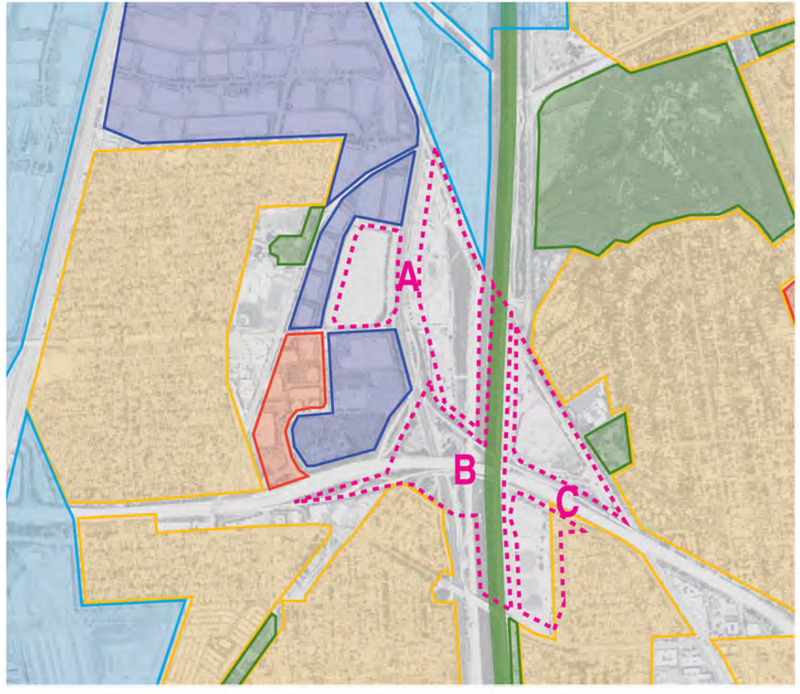

2,000 Parking Lots

- Multi Family Residential
- Office
- Commercial
- Manufacturing
- Open Space
- Public Facilities

SITE A: Piggyback Yards & Vacance land

Fig 51: Birdview of site A - Piggyback Yards filled with rails and vacance lands.

SITE B: Ramps & River

Fig 52: The ramps and river can be used as a way to load the passengers.

SITE C: Vacance between Fwy 405

Fig 53: Vast empty lands on both sides of the Fwy 405 create possibilities.

Fig 54: Views of rails gatherred on the site under the bridge..

Fig 55: The river and ramps create a void between current infrustructures.

Fig 56: Lands beside the freeway potentially link the Los Angeles River

UCLA A.U.D ARCHITECTURE & URBAN DESIGN SUPRA STUDIO

STATION RESEARCH

BUS | PORT | RAILWAY | AIRPORT

Station research focuses on two parts: existing stations and possible hyperloop station.
The studio analyzed bus stations, railway stations, ports and airports. From these studies we discovered main problems with station designs, that is the time, the capacity, the circulation and the amenities. The platform is the most important part of the Hyperloop station. Issues of concern include the need for high frequency use during rush hours, capsules turning capacity inside station and airlock.

UCLA A.U.D ARCHITECTURE & URBAN DESIGN SUPRA STUDIO

TIMELINE OF BUS STATION DEVELOPMENT

Transportation Technology

Station

Function

Service

Animal

Carriage

Animal power bus

1830s:
Steam motor-drive bus

Trolleybus

1881:
Motor bus

1920s:
First bus services in USA

1920s:
Yellow Coach

1970s~2000s:
Bus rapid transit system(BRT)

Beacon Tower

Inns

Modern bus station

BRT bus stop

"Ruins of a beacon tower of the Han Dynasty in Lop Nur,
Xinjiang Uygur Autonomous Region
Shang Dynasty (1600 BC - 1046 BC)
Zhou Dynasty (1046 BC - 256 BC)

Foundation of Roman mansio at Eining, Germany.

Roma Roads System (500 BC)

Tabernae in Herculaneum

1890s:
First ever recorded bus station

1900s:

1920s:

2000s:

Military use

Transport official documents and personal letters

Civil transportation

Tabernae: Food, accommodation...for normal people
Cauponae: Food, accommodation...for aristocratic people
Mutationes: For livestock and vehicles, etc.veterinary...

Waiting and resting
Trackers
Transfer

Advertisement

Information: map, tourism information...

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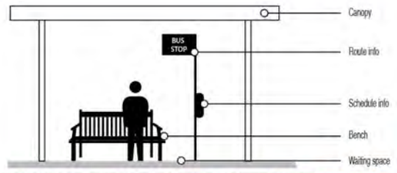
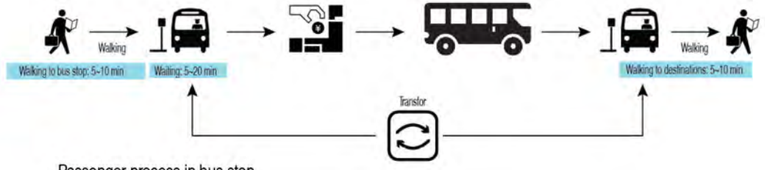
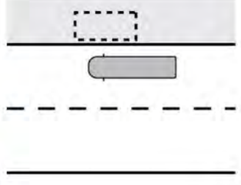


Fig 02

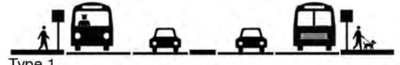
Fig 03



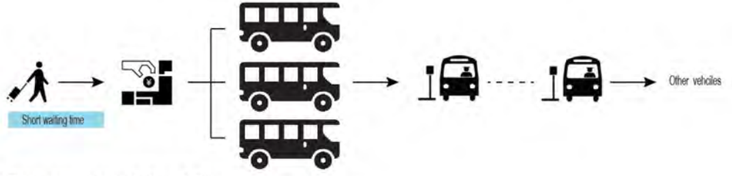
Passenger process in bus stop



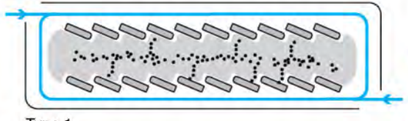
Bus stop typology

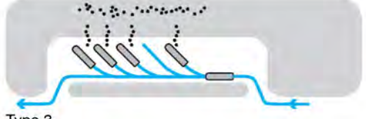


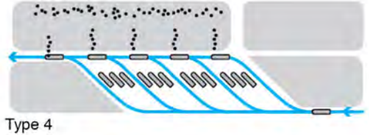
Bus stop typology



Passenger process in bus station







Terminal station typology

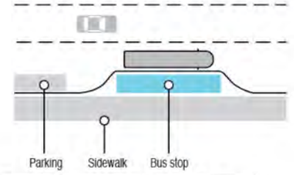


Fig 04

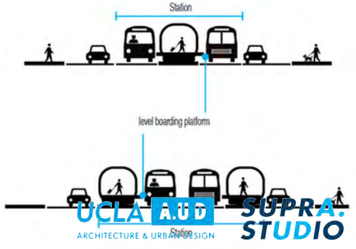
Fig 05

Bus rapid transit (BRT, BRTS) is a bus-based mass transit system. A true BRT system generally has specialized design, services and infrastructure to improve system quality and remove the typical causes of delay. Sometimes described as a "surface subway", BRT aims to combine the capacity and speed of light rail or metro with the flexibility, lower cost and simplicity of a bus system.[2]

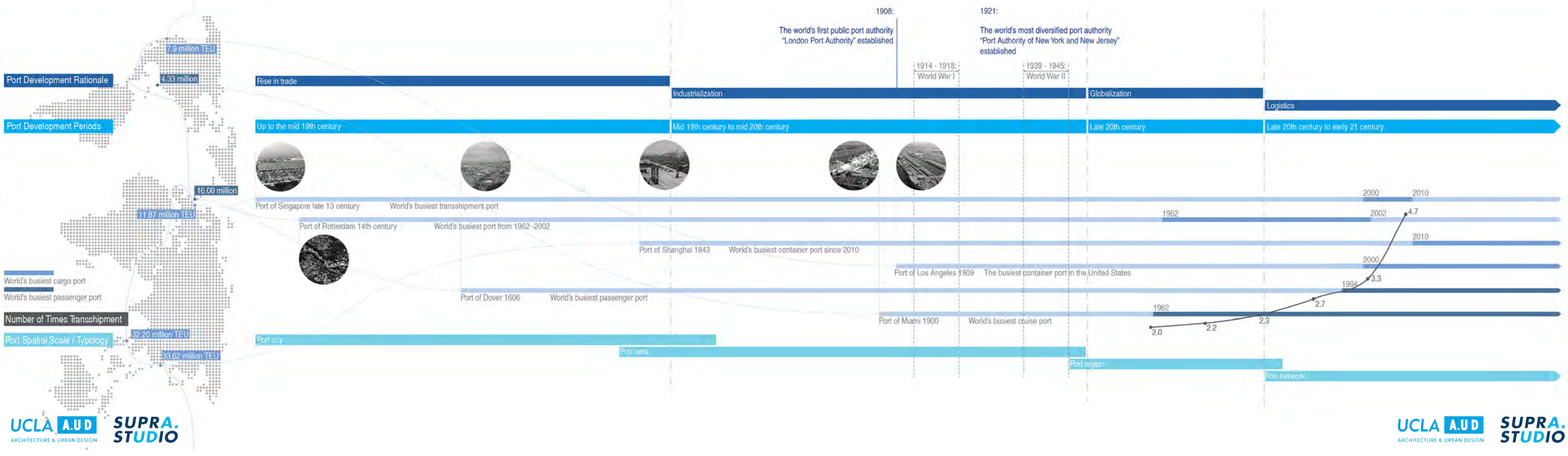
Fig 06

Fig 07

BRT systems typically feature significant investment in enclosed stations which may incorporate attractive sliding glass doors, staffed ticket booths, information booths, and other more standard features listed above. They will often include level boarding, using either low-floor buses or higher boarding platforms level, and multiple doors to speed passenger boardings and enhance accessibility to disabled passengers. Validation of ticket upon entry to the 'station' rather than boarding the bus in a similar manner to that used on entry to a subway system is also common, particularly at busy stations.[3]



TIMELINE OF PORT DEVELOPMENT



There is a vast array of port sites linked to varied nautical profiles:
Mainland Ports
These ports are linked to a major river, which is often serving a vast hinterland. There are ports in a delta (New Orleans, Bangkok), at the margin of a delta (Calcutta, Rangoon, and Rotterdam), in an estuary (Le Havre, New York, Buenos Aires), near an estuary (Liverpool, Lisbon, Quebec) or along a river (Montreal, Antwerp, Portland). For instance, one of the oldest ports in the world, Ostia, was at the mouth of the Tiber river and acted as Rome's port.
Seaports
These ports have direct access to the sea and try to take advantage of a local geographical feature. This can involve bays (Tokyo), natural harbors (San Francisco, Durban), or protected locations (Gdansk: sand dunes, Dakar: islands, Honolulu: reefs).

Port location is constrained by two physical characteristics of the site. The first involves land access and the second concerns maritime access. Both must be jointly satisfied as they are crucial for port operations, which rely on a maritime / land interface. This interface takes the form of a buffer along the coastline (or a river depending on the port site) that experiences, due to an appropriate site, the accumulation of port infrastructures. The interface can also be subject to environmental and social conflicts. Thus, both land and maritime access can impair port operations and port development since a port benefiting from good land access but from a poor maritime access will be facing constraints as well as a port that has a good maritime access but a poor land access. However, maritime access is the attribute that can be mitigated the least. Activities such as dredging and the construction of port facilities are very expensive, underlining the enduring importance of a good port site. Such a site conveys the best marginal utility to port infrastructure investments.

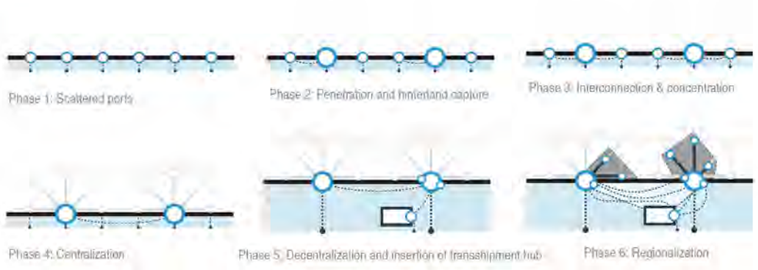


Fig 29 Port sites and functions

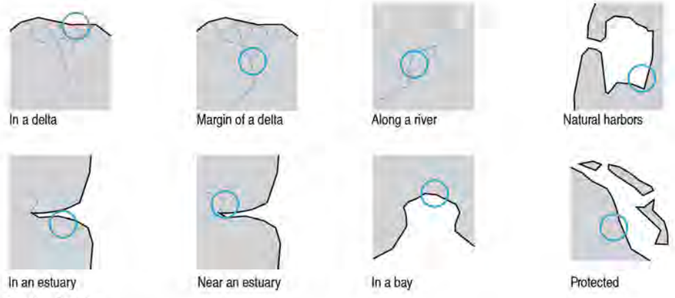


Fig 30 Port sites

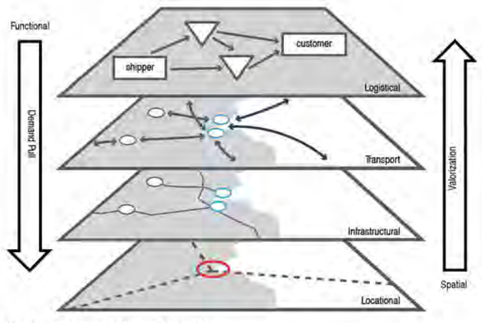
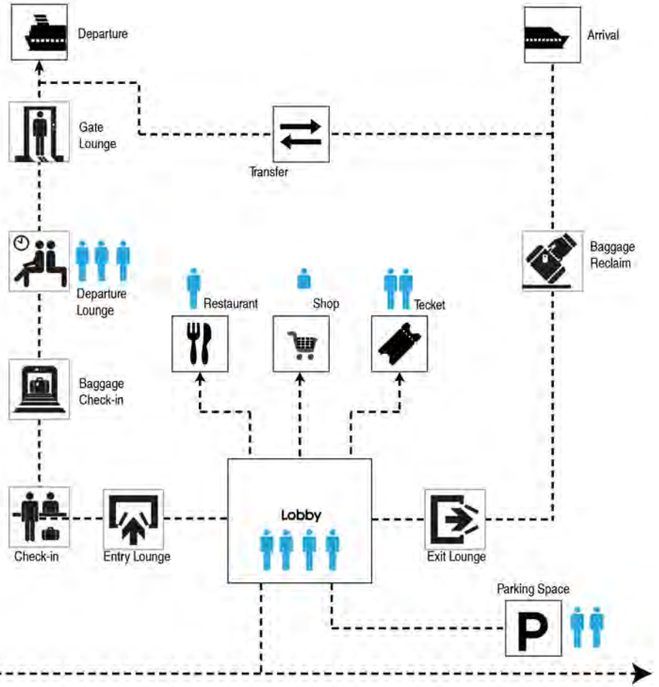


Fig 31 A multi-layer approach to port dynamics

Since ports are the nexus of maritime and inland transport systems, port hinterlands are strongly shaped by port dynamics, particularly over four inter-related layers ranging from a spatial to a functional perspective:
1. The locational layer relates to the geographical location of a port in relation to the central places in the economic space and forms a basic element for the intrinsic accessibility of a seaport, which can be a central place or an intermediate location within transport chains. A good intermediate location can imply a location near the main maritime routes such as offshore hubs (e.g. Singapore, Mediterranean load center ports such as Marsaxlokk and Gioia Tauro) and/or near production and consumption centers such as gateway ports (e.g. Rotterdam, New York, Santos). For gateway ports, a good location is a necessary condition for attaining a high intrinsic accessibility to a vast hinterland, which often builds upon the centrality of the port region. It becomes a sufficient condition when the favorable geographical location is valorized by means of the provision of efficient infrastructures and transport services.
2. The infrastructural layer involves the provision and exploitation of basic infrastructure for both links and nodes in the transport system. Containerization and intermodal transportation, particularly the transshipment infrastructures they rely on, have contributed to a significant accumulation of infrastructures in a number of ports. This is where the intrinsic accessibility is valorized since a port site has little meaning unless capital investment is provided.
3. The transport layer involves the operation of transport services on links and corridors between the port and other nodes within the multimodal transport system and the transshipment operations in the nodes of the system. It is a matter of volume and capacity.
4. The logistical layer involves the organization of transport chains and their integration in logistical chains, namely port-centric logistics. This layer is mostly managerial with a decision making process in terms of the allocation of flows and the location of transshipment facilities.

PORT TERMINAL CIRCULATION

Passengers coming from different place access to ports with different kind of transportation. Most of them are using public transportation. Others are coming from the parking please. First, they get into the lobby, where they can purchase tickets, and also have food. Then after getting through the check-in process, they will be arrived at the departure lounge and waiting for their ship. When the ship comes, people get on board.



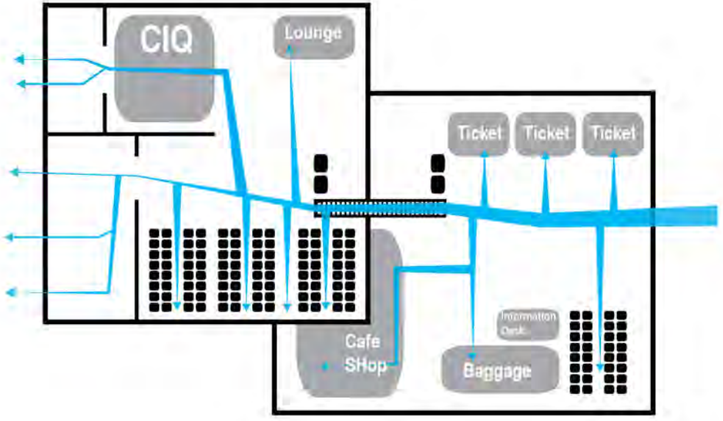
PORT TERMINAL LAYOUT

The information desk and check-in counters are located in the lobby along with cafés and shops. The check-in counters on either side of the Lobby handle the boarding procedures and luggage delivery services.

There are conveyor belts behind the counters to send passengers' baggage down to the delivery trucks on the first floor.

CIQ (Customs, Immigration and Quarantine) facilities are for those passengers arriving on foreign cruise ships who are required to go through the customs, immigration and quarantine procedures.

The conveyor belts provided on both sides of the Plaza can send the passengers' baggage, which has been unloaded from ships onto the apron on the 1st floor, up to the CIQ facilities for inspection.

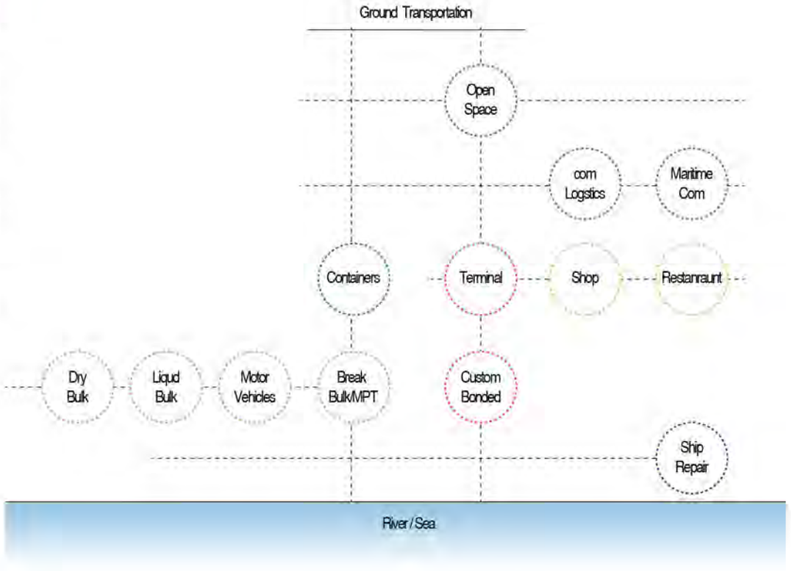


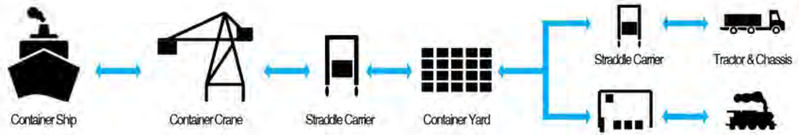
When developing a complete port it is essential to consider how the progressive expansion can be planned to ensure that the selected site is a successful port in the longer term.

Further development of trade often results in ports being modified to accommodate different vessels and commodities. Ultimately trade can move away to deeper water sites and the old layouts can be redefined for other uses, such as commercial or residential.

Optimising the positioning of marine structures requires detailed consideration of the hydrodynamic conditions at that location. Even small changes can have a significant effect on the local wave climate or siltation pattern.

The shore-side layout has to be planned to enable delivery and evacuation of cargo (and passengers) commensurate with the capacity to service vessels at the berths.





Handing Process Diagram

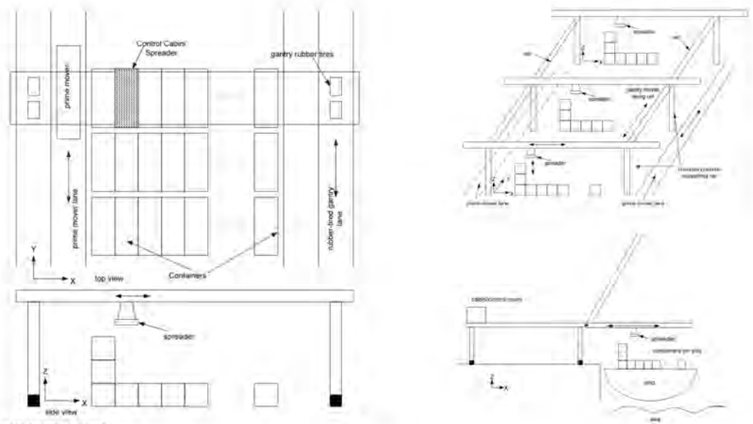


Fig 32: Giantry Cranes

Yard cranes load and unload containers between the prime movers and container slots in the yard.

The yard crane is an inverted U-shaped structure with rubber tires. An operator sits on a small control room mounted on top of the inverted U. The spreader is used to "grasp" the containers during loading an unloading. The spreader is hung from the crane at about the position of the control room. The operator drives the crane and operates the spreader, which picks up and releases the container during loading and unloading operations respectively. Figure 2 shows a schematic diagram of the workspace of the yard crane. The crane moves along the Y-axis and the control room, together with the spreader, move on the crane along the X-axis.

The spreader can be lifted or lowered to pick up or unload containers. The spreader moves with the control room along the X-axis to position itself on top of the appropriate container slot. The movements of the spreader and the crane are controlled via "joysticks" by the operator in the control room. The operator moves the crane and spreader so that the spreader is on top of the prime mover or container slot.

The containers are standard in size and have a pick up slot at each of the four corners on top of the container. To pick up a container, the four "fingers" of the spreader must engage the pick up slots of the container through a twist-lock mechanism to lift the container. The operator skillfully moves the crane and spreader to pick up the container. He uses his eyes and experience to do the job.[4]

The only structure of its kind in the world, the Falkirk Wheel will be 115 feet (35 meters) high -the equivalent height of eight double-decker buses. It will be 115 feet (35 meters) wide and 100 feet (30 meters)long. TheWheel will lift loads of 600 tonnes (300 tons at each end)- the approximate weight of 100 adult African elephants. The Wheel will be able to carry eight or more boats at a time and a single trip will take about 15 minutes. The Wheel will stand in a 330 feet (100 meters) wide, circular basin with moorings for over 20 boats. The total project cost is approximately 17million and work will take 22 months from beginning to end. The project will involve over 500 construction staff. The Wheel site takes up 110 acres (45 hectares) -the bulk of which includes an abandoned open-cast mine. The project will involve major landscaping, and the removal of 300,000 tons of soil. Construction materials include 7,000 cubic meters of concrete,1,000 tons of reinforced steel, 1,200 tons of prefabricated steel and 35,000 square meters of canal lining. The Wheel is designed to last for at least the next 120 years. The first wheel-based boat lift was proposed by a German engineer at the beginning of this century-though it was never built. The Falkirk Wheel will be the world's first rotating boat lift and the first boat lift to be built in Britain since the Anderton Boat Lift in Cheshire (1875).

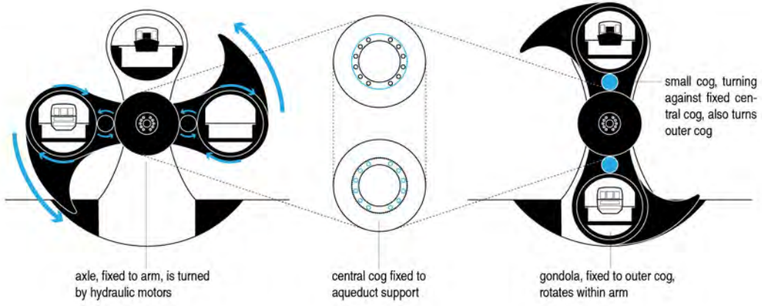


Fig 34: Timelapse Fig 34: Central Cog

The wheel uses only 1.5 kWh of energy to complete one half-turn - the equivalent of boiling only 8 electric kettles. Boats displace their own weight in water, so each gondola always weights the same.

Fig 35: Osanbashi Yokohama

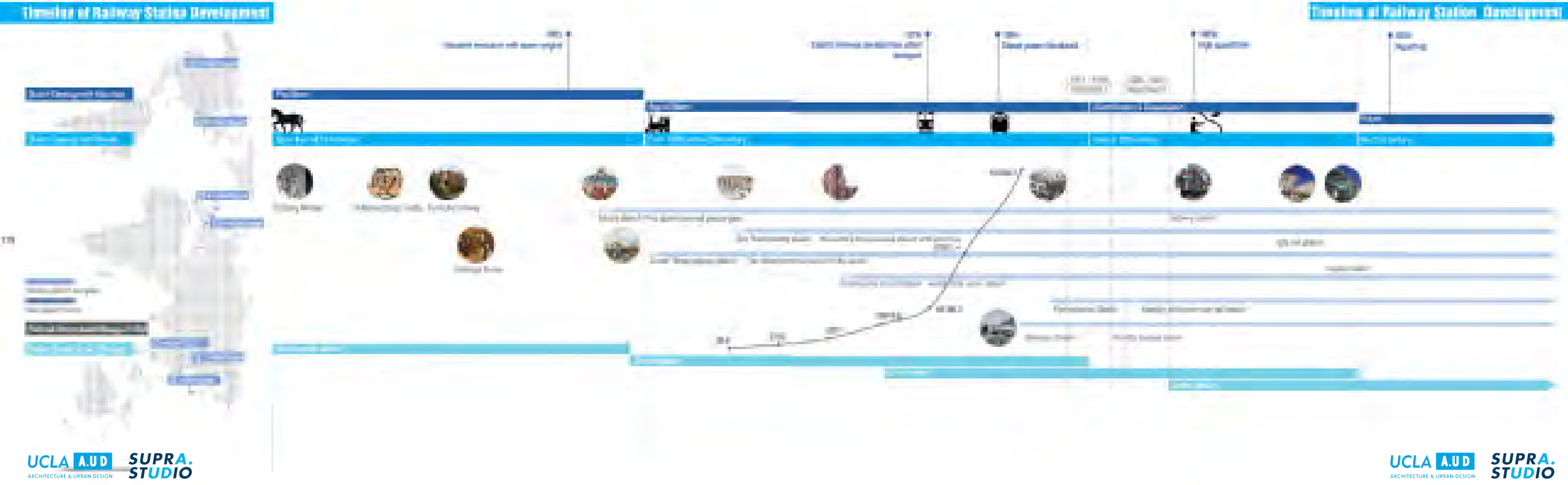
Fig 36: Tel Aviv Port Public Space

A lot of ports offer a variety of open spaces - parks, plazas, walkways, and a waterfront promenade - where visitors can enjoy outdoor activities and stunning views of the City and the Bay.

The rooftop level of Osanbashi Yokohama is open 24 hours. It is an open-air plaza furnished with wooden decks and natural grass lawns.
The building's height was kept at the lowest possible level (15m max.) to enhance the spectacular appearance of ships. Cruise ships calling at the Terminal can be seen from the mainland, and passengers on-board can enjoy the unobstructed views of the Port and the city.
The Rooftop Plaza is one of the best locations to enjoy the scenery of the Yokohama waterfront district. On a clear day, you can also see Mt. Fuji in the distance. The night views here are definitely the best - you can have the beautiful views of the Red Brick Warehouse, skyscrapers in Minato Mirai 21, Marine Tower, Hikawa-maru and the Bay Bridge.

Situated on one of Israel's most breathtaking waterfronts, the Tel Aviv Port was plagued with neglect since 1965, when its primary use as an operational docking port was abandoned. The recently completed public space development project managed to restore this unique part of the city, and turn it into a prominent, vivacious urban landmark.

Timeline of Railway Station Development



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Timeline of Railway Station Development

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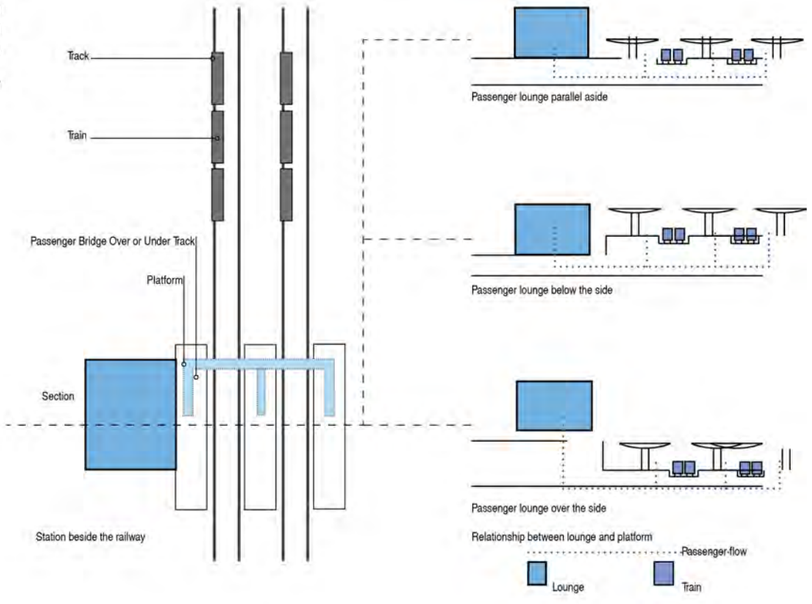
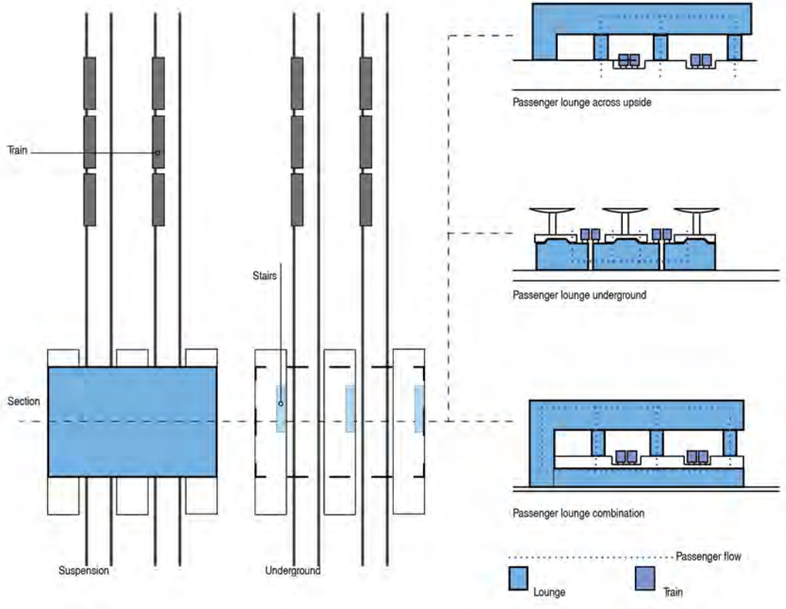
The railway stations using a variety of layout patterns. Due to the different relationships of the yard and station house in horizontal and vertical directions, the style can be divided into side type, liner type or composite type. There are also stations on the ground, suspension or underground. Specific design can use different layout models according to the scale of station, environmental and site conditions.
Passengers using platform bridge, underground aisle or other accesses to get to the platform while boarding.





Turntable

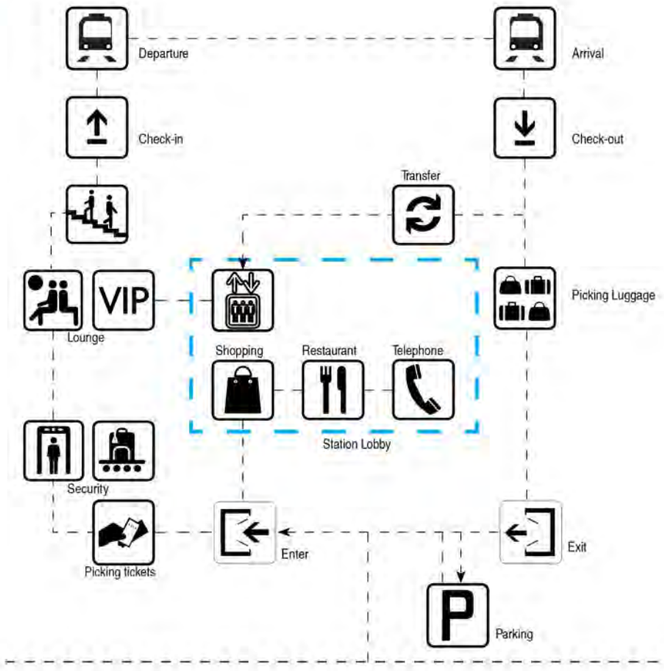
A railway turntable is a device for turning railroad rolling stock, usually locomotives, so that they can be moved back in the direction from which they came. This is especially true in areas where economic considerations and/or a lack of sufficient space have served to weigh against the construction of a turnaround wye.

Fig 09: Railway turn table

RAILWAY STATION CIRCULATION

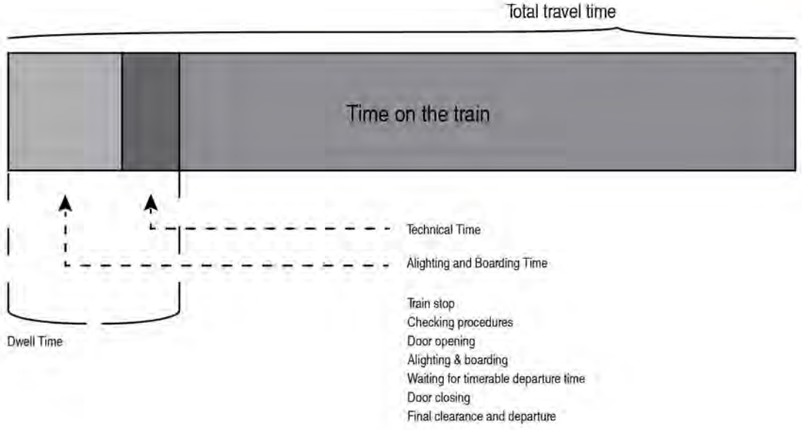
Different procedures when taking a train

As seen above, travelling by train can be much more than just riding the train. Besides riding the actual train, the journey is a composition of one or several shorter local trips to and from the stations. The traveller has to make a number of actions, choices and movements during the journey, especially inside the station. Besides reliability, frequency, comfort and total travel time of the train itself and other local transports to and from the station building it is important for the traveller to get good information throughout the whole trip.



TRAVEL TIME ANALYSIS

Passengers' behavior during waiting



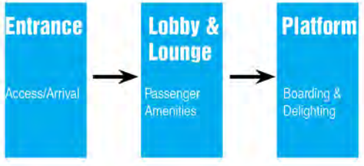
The total dwell time and the total running time are together the main parts of the total travel time of a train. The dwell time and the running time are opposite to each other. The running time is the time when the train is moving while the dwell time is the time when the train is standing still.

The number of boarding and alighting passengers is mentioned as an important part of the boarding and alighting process but it is also mentioned that it is really important to remember how the passengers are distributed in the coach and on the platform.

Different behaviors
1. Knowledge basis; Passengers who know where they should stand, place themselves accordingly.
2. Clustering close to entrances, stairways, rain shelters and other platform infrastructure and facilities. Often done by passengers who does not know their way
3. Standing where others stand. Often done by passengers who do not know their way.

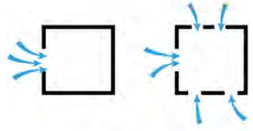
A station is a dynamic environment, involving movement and potential conflicts between a range of station users.
1. Spatial capacity meet with predicted future demand
2. legible spaces, with direct, convenient routes
3. multiple access points to increase permeability and catchment area
4. high quality lighting supporting passenger movement and activities.

Making places easy to use for all passengers and station users.
1. Provide obstacle and step free spaces to accommodate the needs of all users
2. Optimise lift and escalator locations and capacities
3. Provide for mobility assistance where appropriate



Three zones of typical activities and facilities in a railway station

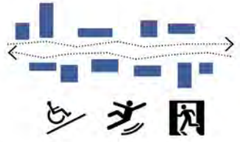
The station can be extended to meet with a higher capacity in the future



Multiple entry points provide permeable access and movement to the passenger

Clear, unobstructed passenger movement and balanced artificial illumination

Accessible design ensures stations are easy to use for all passengers and station users.



Lift entrance located on main pedestrian flow with good sightlines and uncluttered spaces to and from key destinations.

Lift, escalator, stair located on desire lines with good natural surveillance and use of transparent structure.

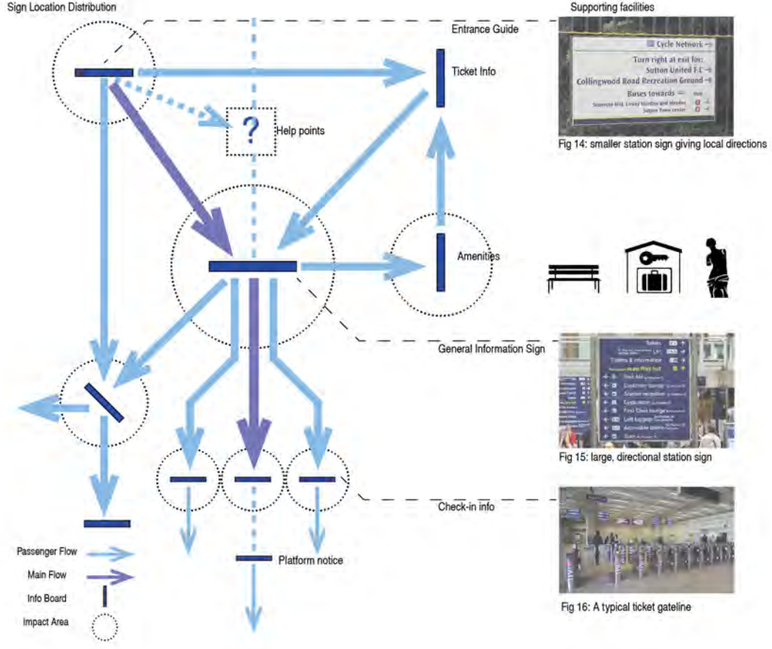


Fig 14: smaller station sign giving local directions

Fig 15: large, directional station sign

Fig 16: A typical ticket gateline

Adopting principles of accessible and legible design for passenger information and wayfinding from the outset will result in places that are easy to use, require minimal signage and are well integrated with their surroundings.
Comfortable, clean, well maintained stations provide an attractive environment that protects users from uncomfortable climatic conditions and unpleasant sensory experiences such polluted air, dirt or noise and provides users with a sense of security and safety. Amenities should be included, where appropriate, to fulfil basic needs and add value to the passenger experience.

Fig 17: features that enhance passenger comfort, convenience and pleasure

TIMELINE OF AIRPORT DEVELOPMENT

TIMELINE OF AIRPORT DEVELOPMENT

1908:
The world's first airport College Park Airport in Maryland was built

initial airport was lawn

1930's:
Approaching lighting began to use

1939 - 1945:
World War II

1914 - 1918:
World War I

1960's:
Aero bridge appeared

1975:
Airport on the sea appeared

1990's:
Security Check-in maturity

2000's:
Number of Airport in the world reached 44,000

Second Industrial Revolution

Third Industrial Revolution

Globalization

Logistics

Up to the beginning of 20th century

1950's to late 20th century

Late 20th century

Late 20th century to early 21st century

College Park Airport in Maryland

World's first airport in 1909

Bisbee Douglas municipal Airport

World first for motorplane in 1909

Kaliningrad Devau Airport 1922

World's first civil aviation airport

Hartsfield-Jackson Atlanta International Airport

Where world's first took off in 1949

World's Largest Airport

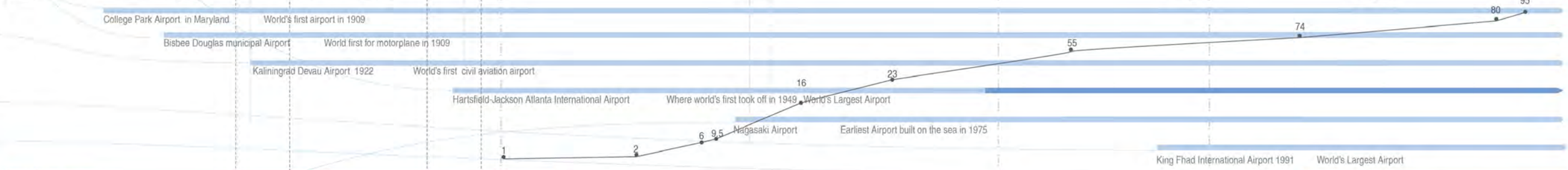
Nagasaki Airport

Earliest Airport built on the sea in 1975

King Fhad International Airport 1991

World's Largest Airport

Qamdo Bangda Airport 2009 World's highest Airport



Airport single conection

Airport series

Airport interaction

Airport network

UCLA A.U.D ARCHITECTURE & URBAN DESIGN

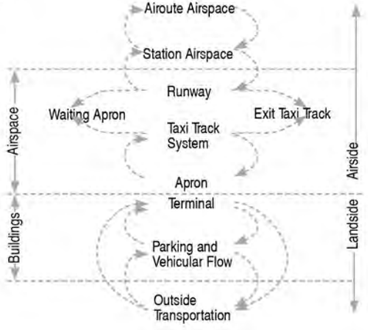
SUPRA. STUDIO

Terminal Topology

An airport has two major components; an airfield and terminals.

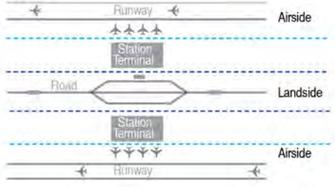
A typical airfield is composed of a runway for takeoffs and landings as well as two (or one) parallel taxiing lanes (taxiway). Connecting lanes between the runway and the taxiing lanes usually have an angle permitting the quick exit from the runway for planes that have just landed.

Modern airfield designs provide two of three exiting options per landing direction depending of the plane's size. A small aircraft will take less distance to brake than a large aircraft and has thus the opportunity to exitthe runway, freeing valuable takeoff or landing slots., freeing valuable takeoff or landing slots.

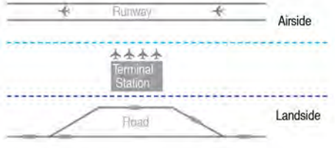


UCLA A.U.D ARCHITECTURE & URBAN DESIGN SUPRA. STUDIO

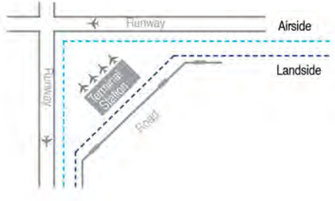
Type 1



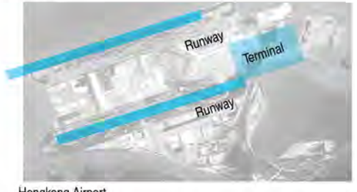
Type 2



Type 3



Case :



Hongkong Airport

Riyadh International Airport

Detroit Airort

AIRPORT TYPOLOGY

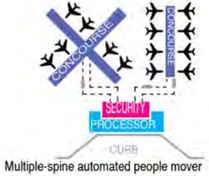
Simple linear terminal

Satellite concourse configuration

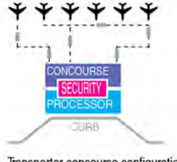
Expanded linear terminal and concourse

Single-level terminal with dual curbs

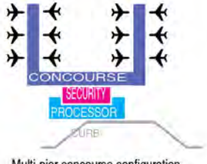
Pier concourse configuration



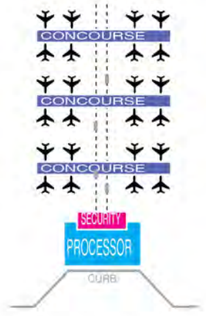
Multiple-spine automated people mover



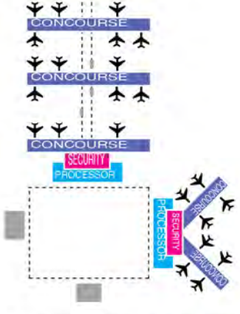
Transporter concourse configuration



Multi-pier concourse configuration

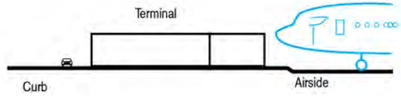


Spine automated people mover

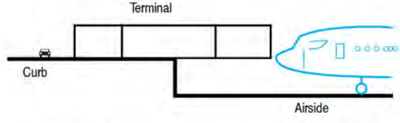


One-way or two-way loop automated people movers

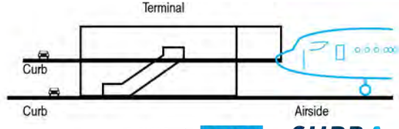
Different Section Type of Airport



Single-layer Terminal



Staggered-layer Terminal



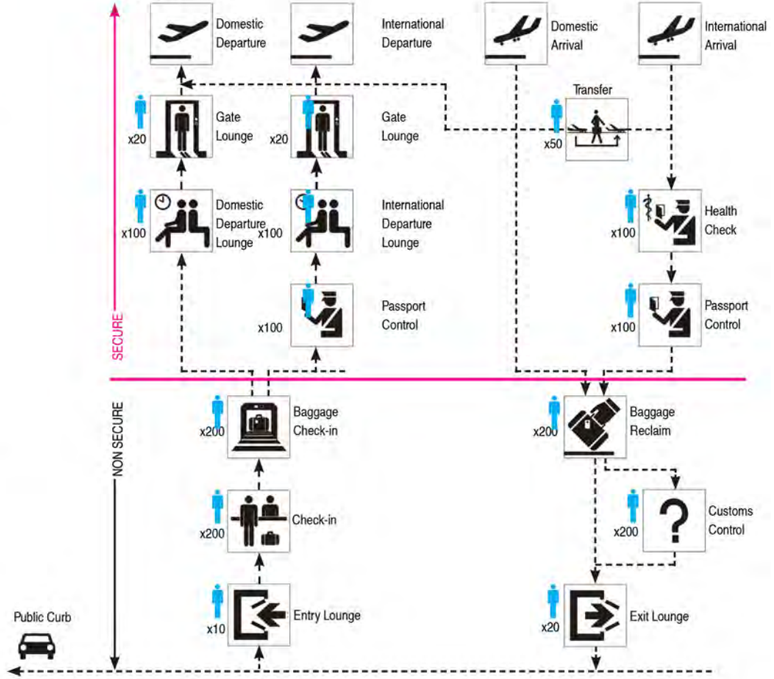
Multi-layer Terminal

UCLA A.U.D ARCHITECTURE & URBAN DESIGN SUPRA. STUDIO

Princple & Passenger Circulation

Princple of Circulation Design

Passenger Circulation



Baggage Beltway
the systems can zip more than 6,000 bags an hour along 20 to 30 miles of belts traveling up to 20 miles per hour.

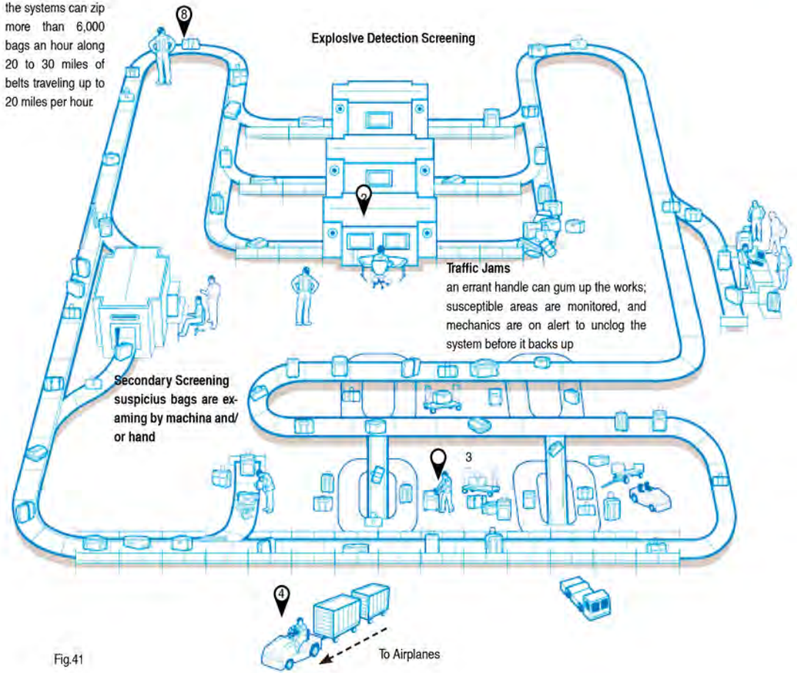
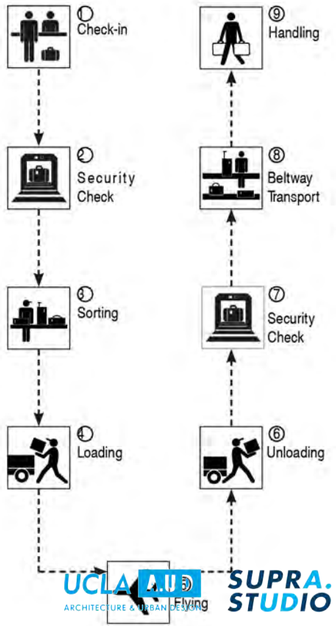


Fig.41

Baggage Circulation



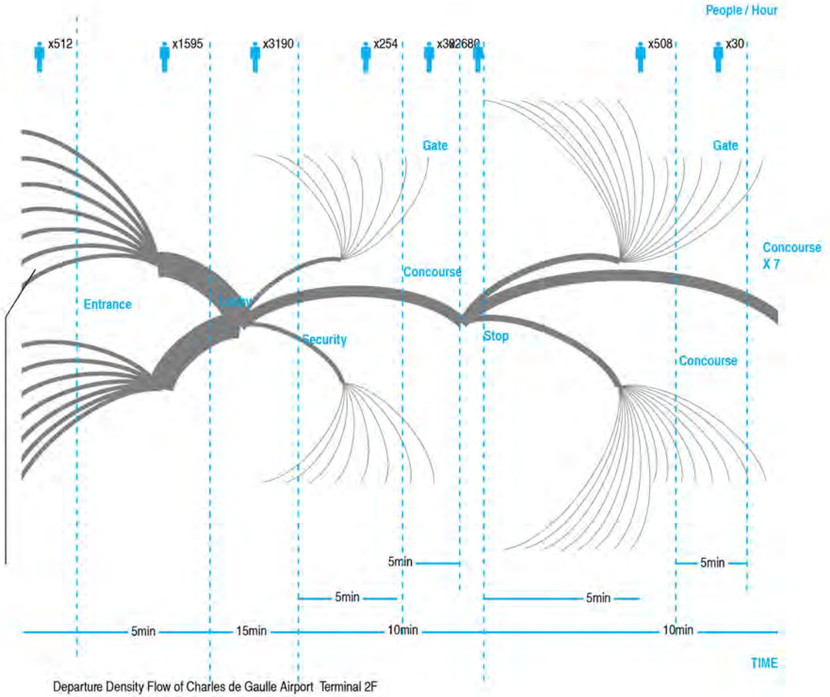
In the airport, passengers keep moving form one point to another so the whole passengers can be seen as a flow with different density.The terminal like some complicated pipes is a huge moving system. How to guide the people inside it and to let them move as fluentas water is the key issue to design a airport.

Global Efficient Airport Rank:

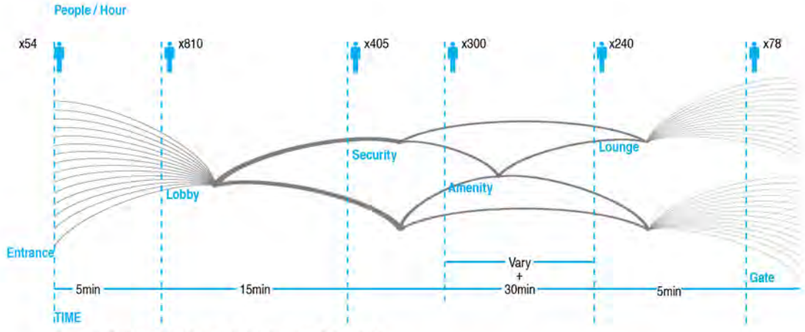
North America:
1. Hartsfield–Jackson Atlanta International Airport (USA)
2. Minneapolis -St. Paul International Airport (USA)
3. Charlotte Douglas International Airport (USA)
Europe:
1. Copenhagen Kastrup International Airport (Denmark)
2. Athens International Airport (Greece)
3. Zurich Airport (Switzerland)
7. Charles de Gaulle(France)

Hartsfield–Jackson Atlanta International Airport
(1st Efficient in North America)
55,884,352 people per year
153107 people per day
6380 people per hours

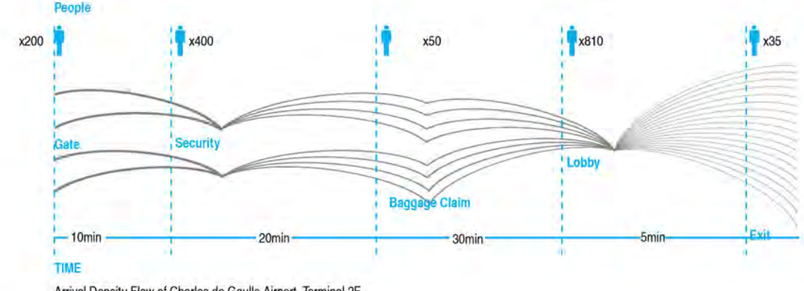
Departure Plan of Terminal Hartsfield–Jackson Atlanta International Airport



Departure Density Flow of Charles de Gaulle Airport Terminal 2F



Departure Density Flow of Charles de Gaulle Airport Terminal 2F



Arrival Density Flow of Charles de Gaulle Airport Terminal 2F

Charles de Gaulle Airport :
2nd Large Airport in Europe
7th Efficient Airport in Europe

Terminal 2F of Charles de Gaulle Airport:
14,2 million people per year
39000 people per day
1620 people per hour

Fg.42: Departure Plan of Ternminal 2F

Fg.43: Arrival Plan of Terminal 2F

INNER DESIGN OF TERMINAL

The inner design of airport has four main element: space, sturcture, light and objects.

Space:
Different sizes or volumes of inner spaces helps the travellers to know whether a particular corridor or consourse is a major or a minor one.The orchestration of space into several recognizable hierarchies allows passengers to find their way around with minimum of fuss.The angle of flights, going and width of stairsand escaltors should indicate the degree of publicness or privateness of that particular route .

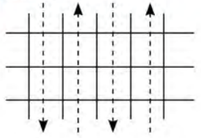
Sturcture:
The role of the primary elements of structure-columns, walls, and beams-is both to support the terminal physically and to support the perception of major routes psychologically. Structure is a means by which direction can be indicated and the rhythms of movement can be articulated. Passengers can follow the beautiful structure of the building and find their destination.

Daylight:
Used in the correct fashion, light can be a solid, expressive material to guide trvellers through the complex changes of direction and level encountered in a modern airline terminal.The orientation of the terminal building should allow sunlight into the core of the building. The degree of light intensity helps to distinguish the hierarchy of routes.

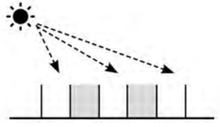
Object:
Designers need to see objects as orentating elements solid points of reference that interrupt vistas or limit the edges of space. These solid element contain functional space(staff offices, toilets, immigration control etc). Certain key objects, for instance, An artwork as sculpture punctuating the free flow of space in the concourse. [7]

Space: Size

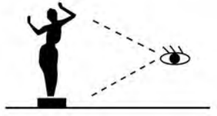
Structure: Direction



Daylight: Brightness



Object: Attraction



TWA Terminal

Charles De Gaulle Airport

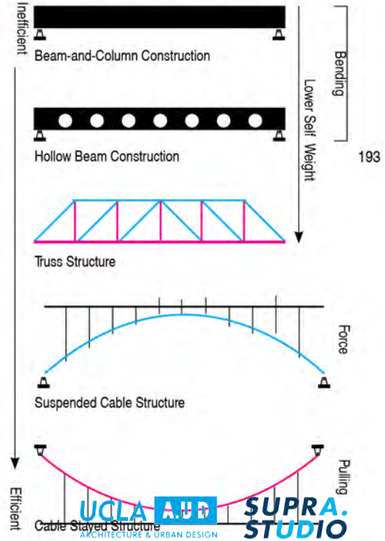
Bangkok Airport

Heathrow Airport

STRUCTURE TYPE OF TERMINAL

Princple of Large Span Structure:
Bending is the least efficient form of structure, cable stayed structure and cable suspended structure are much more reasonable

Blue: Force Red: Pulling



Cable Suspended Structure

Arch Structure

Tent Structure

Vault Structures

Trusses Structure

Shell Structure

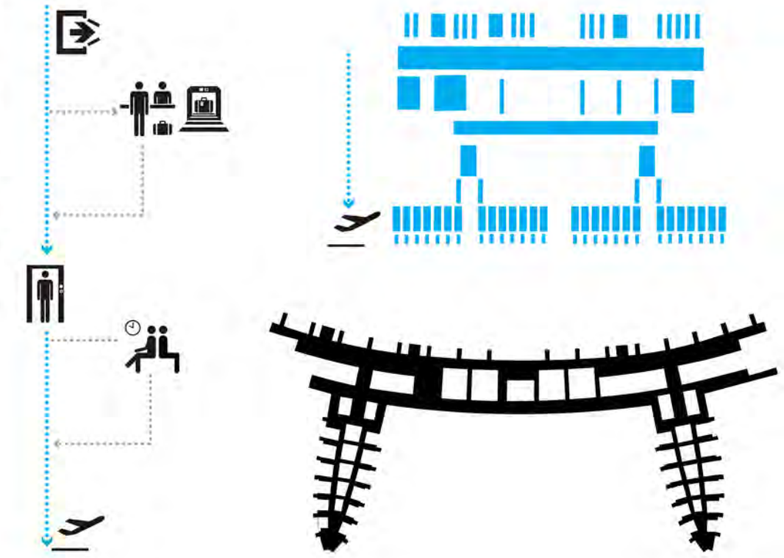
Tree Structure

Cable Stayed Structure

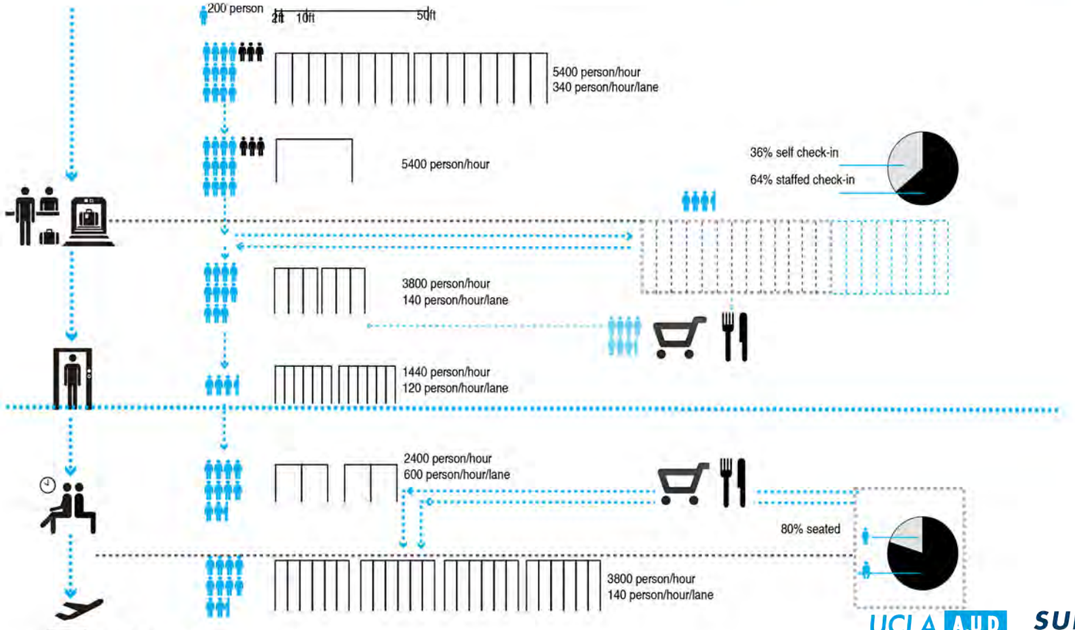
Determining terminal facility requirements begins with examining the adequacy of each existing component to serve current activity. From that basis, forecast changes in activity are applied to develop recommendations for the future planning horizon. The size of the space and the width of the hallway are related to the density of people and decide the capacity of airport. [12]

All the datas in this diagram are pick up from the peak time in Airport Paris-Charles-de-Gaulle. 3800 people will get on board in a hour.

As the diagram shows, not all the capacity palce and hallway on the depature layer are the same, in some places, the hallway is a little narrow, like the security check-in, and only get through about 40% people of the passage before the security check-in, which means, people have to wait. Yet it does not mean it is not reasonable, not all peole will go to check-in immediately, some may go shopping or having meals, and considering about it is not all at peak time, the capacity should be limited in an approriate degree.



Hallway for depature

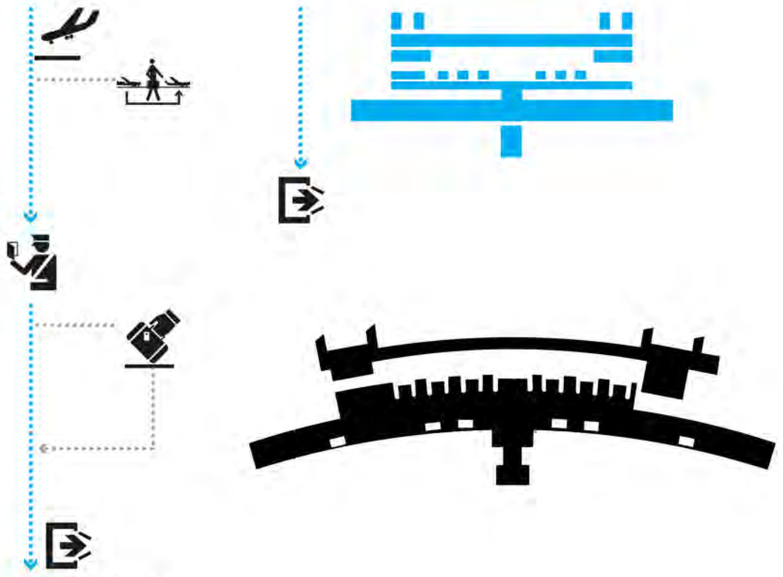


capacity analysis for depature

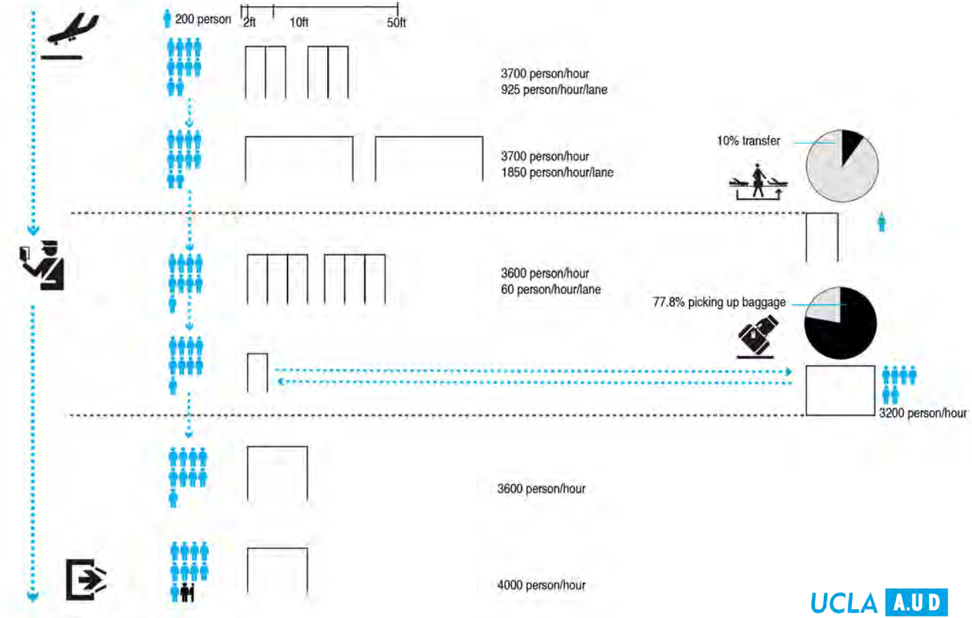
All the datas in this diagram are also pick up from the peak time in Airport Paris-Charles-de-Gaulle.

As the diagram shows, not all the capacity palce and hallway on the arrival layer are the same, in some places, the hallway is a little narrow, the pressure for the arrivals is alittle less than the space for depature. But it till have some place like baggage claim to wait.

Baggage claim requirements are based primarily on peak hour deplaned passengers, the concentration of these arriving passengers within a 20 minute time period, and - to a lesser extent - checked bag per passenger ratios. Observations at most U.S. airports indicate that themajority of domestic passengers arrive at the baggage claim area before their bags areunloaded onto the claim units. At an airport such as MSO, virtually 100 percent of the passengers are waiting prior to first bag delivery. The result is that the claim unit should be sized for the estimated number of passengers waiting for baggage, because most bags are claimed on the first revolution of the claim unit. [13]



Hallway for arrivals



capacity analysis for arrivals

An Airport will consume a great deal of energy and water, and produce large amount of carbon dioxide, which tend to take the ecology into consideration when designed. The majority of the energy consumption comes from air condition, and also illumination consume a lot if energy.
There are two kind of approaches to reduce energy consumption, the passive conservation and active conservation.

Most standard claims by the LEED can be achieved by passive energy conservation measurements, which is cheaper, easy to deal with than active conservation measurement. For example , retionalise the shape of the structure to save materials, and makes it easy to keep warm so as to reduce the consumption of air conditioner,or maxmizing the use of natural light and ventilation to reduce te consumption of air conditioner and illumination.

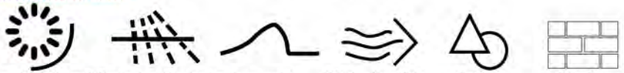
The active conservation measurement which are using new technology also play a important role to save energy,like using Ev cars, LED and GPUS,and solar enenrgy, which can definetely reduce the electricity consumption and output of carbon dioxide.

253 Gwh
electricity generated
12 Gwh
ventilation
348 Gwh
heating energy
92 Gwh
lighting
105 Gwh
cooling energy

Electricity consumption
The amount of electricity consumed by a grand- scale airport is equivalentto that of a city with a population of 50,000
2,5 million m3 of drinking water supplied
Annual carbon footprint (predicted) 19 lbs. CO2/ft2

Sustainable Site
Water Efficiency
Energy and Atmosphere
Materials and Resources
Indoor Environmental Quality
Innovation and Design Process
LEED evaluation basis

Reducing Carbon dioxide



Passive Energy Conservation

Active Energy Conservation

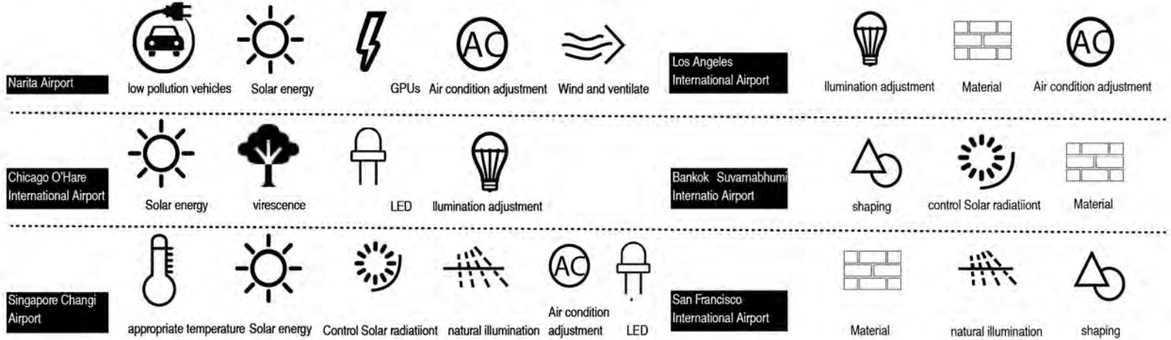


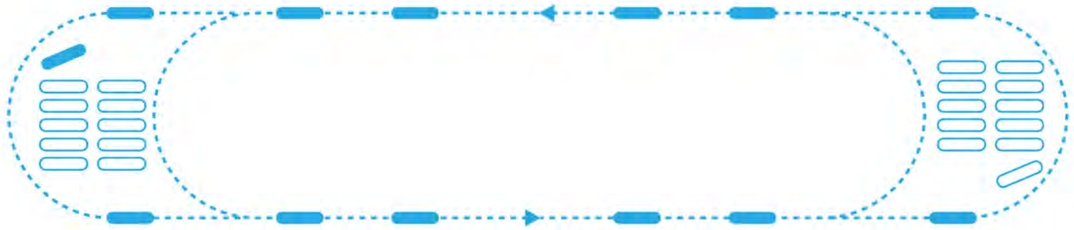

Fig.48:jet diffuser


Fig.49:Solar panel roof


Fig.50:"sunlight " roof in singapore airport


Fig.51:natural illumination

The shortest time: ≈6 min from entrances to departure platform
: ≈4 min to leave the station



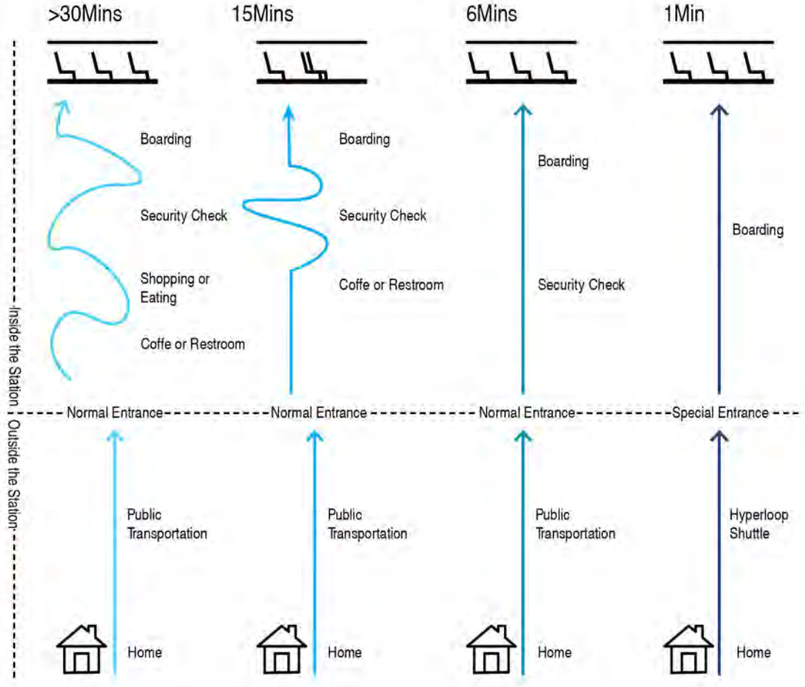
1 hour departure	1 Peak hour departure	1 hour in the station	1 Peak hour in the station	Passengers in the system
X 30	X 120	X 60	X 240	X 3360
X 840	X 3360	X 1680	X 6720	X 13440
X 240~420	X 960~1680	X 480~840	X 1920~3360	

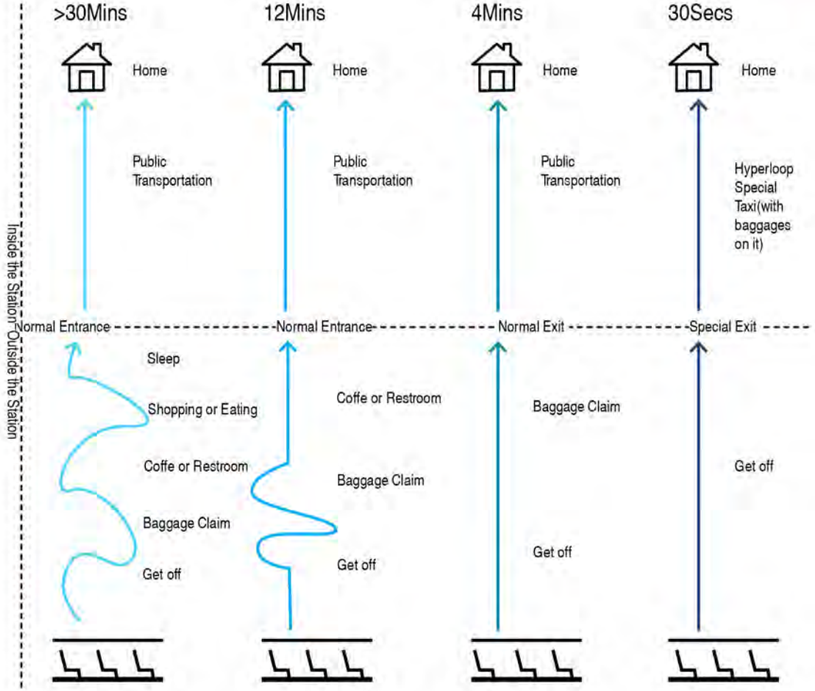
The time passengers will spend inside the station affect the design a lot. Time can decide the size of station, the amenties in the station and the number of passengers inside the sitation.

So, first of all we need to deside how long we want the passengers to stay inside the station. If we want them pass the station as soon as possible, we can design it like a subway station. So our station will be very efficient. To further improve the efficiency we could provide some special services such as Hyperloop Shuttle to take passengers from their own home then directly to the gate.

Special Service: Hyper Shuttle

With Security Check on it and carry people from their own home to the station. Better Choice for family and those who in a hurry. Let your time consume in the station no longer than 1 minute





Arrvial part of the station is always more simple compared with departure part, people usually not in a hurry to catch up their seats. There is no security check and usually no need to stay.

Special Service: Hyper Taxi

When you get off the capsule your baggage would already be in the taxi. It will take you home or anywhere you want.

With the growth of time people stay in station, there will be more passengers stay in the staion, so the size of station is expanding and more functions are needed to add into the space.

The behavior of passengers become more free and the design of whole station will face more troubles.

1 Minute Station:

Number of passengers in station in rush hour: **112**
Amenties : **none**

6 Minutes Station:

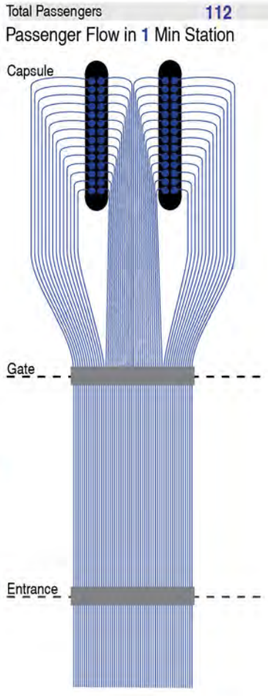
Number of passengers in station in rush hour: **672**
Amenties : **restroom, automat**

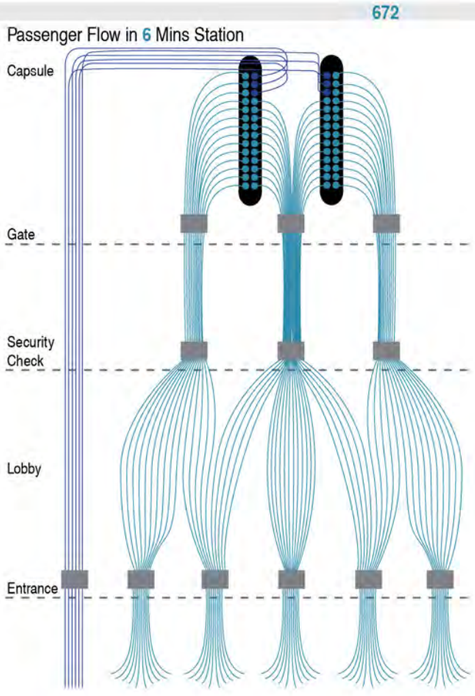
15 Minutes Station:

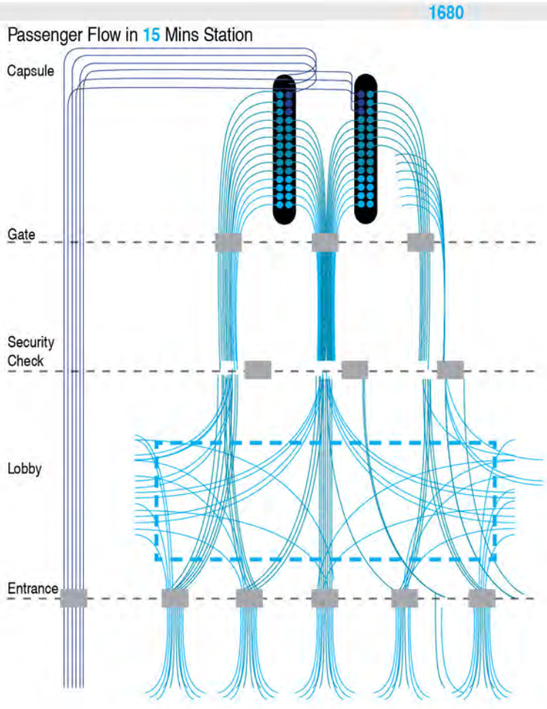
Number of passengers in station in rush hour: **1680**
Amenties : **restroom, automat, cafe, supermarket**

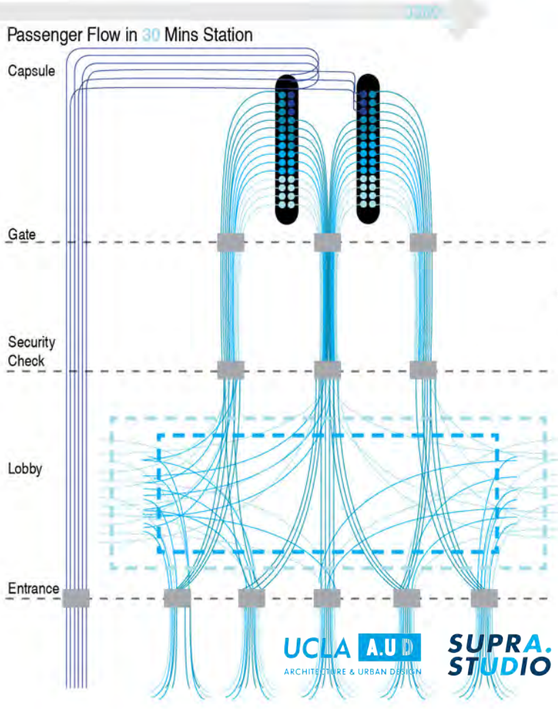
> 30 Minutes Station:

Number of passengers in station in rush hour: **> 3360**
Amenties : **restroom, automat, cafe, supermarket restaurant, mall.....**









PASSENGER CIRCULATION
Time Based Non-stop Station

PASSENGER EXPERIENCE
Time Based Non-stop Station

Los Angeles Departure

San Francisco Arrvial

Daylight
Green Space
Soft Space
Hard Space
Share Space

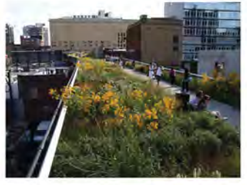
Shuttle Entrance
Normal Entrance
Restaurant
Coffee
Restroom
Arrival Lobby
Short Term Rent Shop
Magazine
Mall
Museum
Security Check
Lounge
Gate
Baggage Claim
Hotel
Departure Lobby
Advice Wall
Entrance

300Mins
7 Mins
3 Mins
10 Mins
60Mins
30Mins
> 3 Hours
6 Mins

1 Min
>30 Mins
6 Mins
15 Mins

4 Mins
12 Mins
>30 Mins
30 Secs

Platform: Green & City View



Inside CapsuleInside Capsule

Short Term Rent Shop

Hyperloop Museum

Suggestion Wall

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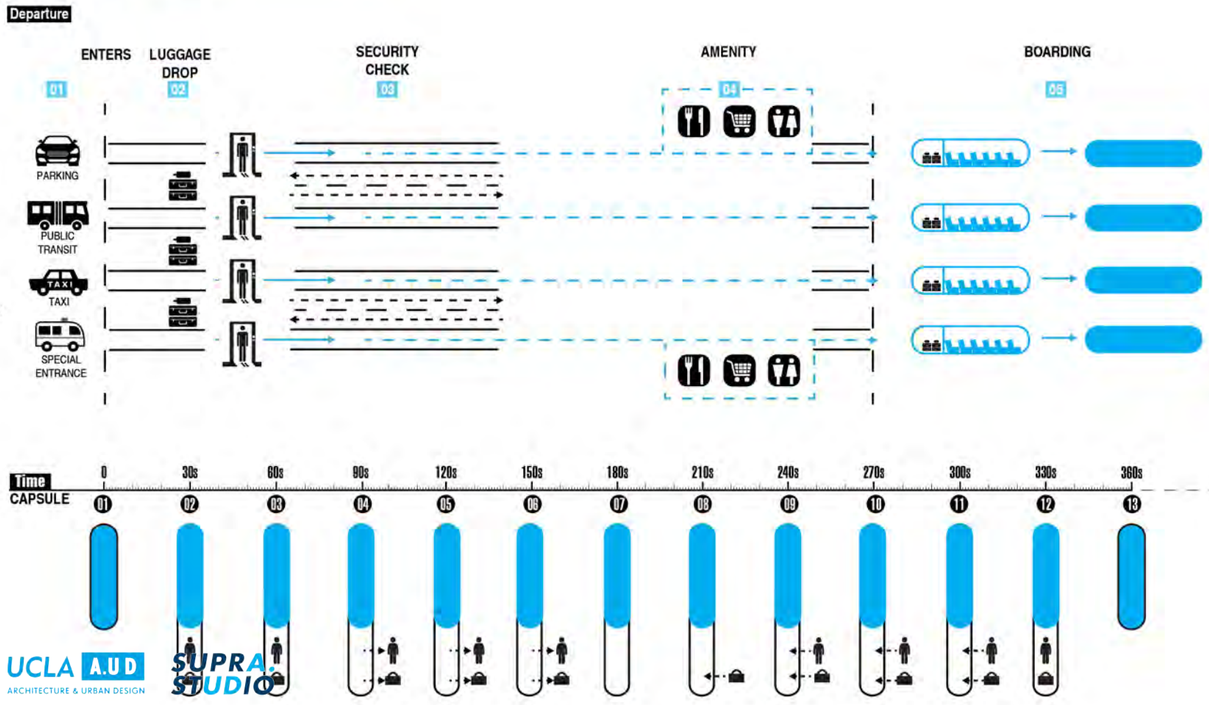
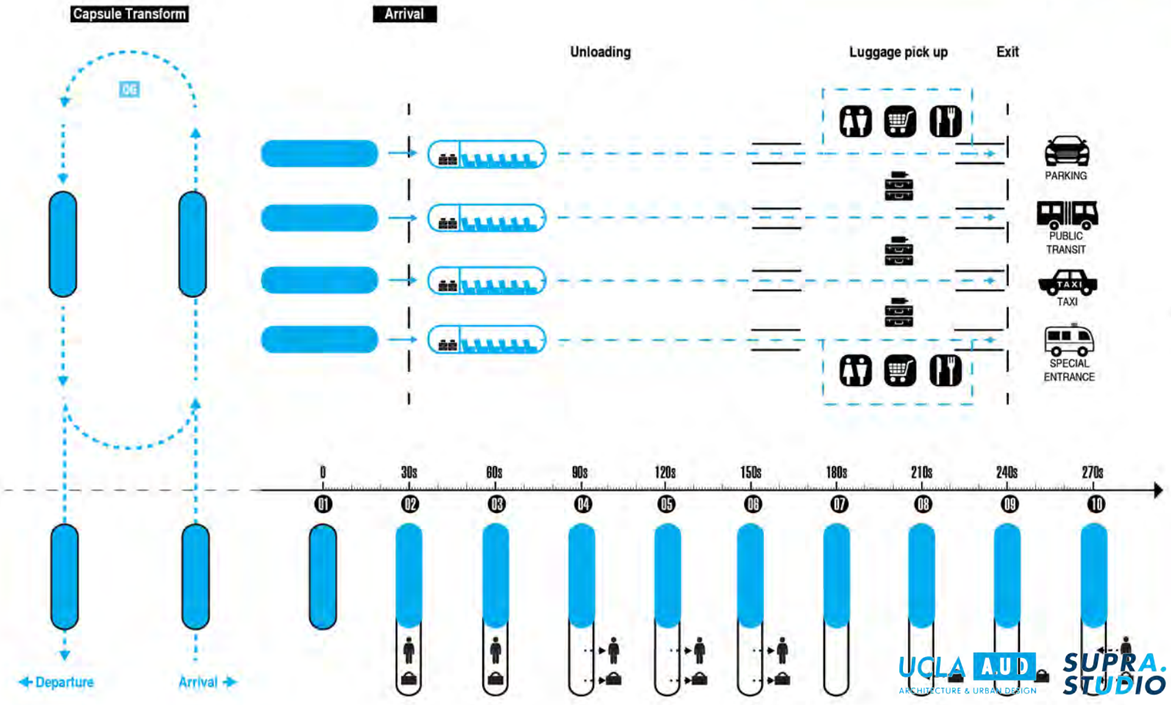
UCLA A.U.D ARCHITECTURE & URBAN DESIGN SUPRA STUDIO


Departure
ENTERS
01
LUGGAGE DROP
02
SECURITY CHECK
03
AMENITY
04
BOARDING
05
PARKING
PUBLIC TRANSIT
TAXI
SPECIAL ENTRANCE
Time
CAPSULE
0
30s
60s
90s
120s
150s
180s
210s
240s
270s
300s
330s
360s
01
02
03
04
05
06
07
08
09
10
11
12
13


Capsule Transform
06
Arrival
Unloading
Luggage pick up
Exit
PARKING
PUBLIC TRANSIT
TAXI
SPECIAL ENTRANCE
0
30s
60s
90s
120s
150s
180s
210s
240s
270s
01
02
03
04
05
06
07
08
09
10
Departure
Arrival

FAST BOARDING STRATEGY
Check-in Part

Possible Reasons for Delay in Progress

1 Buy tickets at the cash counter in station.

2 Too certain time that make people go to station much eariler to avoid accident.

3 Carry too much baggage when walking in the station

4 Too many people wait in the station

Strategy 1

Save the time on part 1, 3, 4

1 Buy tickets of a certain period of time such as 8:00am-9:00am from internet

4

2 Drop the baggage at the entrance to the robot

3

3 Use the phone, printed email or other methods to pass the security check.

1

Efficiency: ●●●
Controllability: ●●●●●
Comfort: ●●●
Flexibility: ●●
Economic: ●●●●

Overall: 18

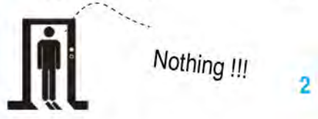
Strategy 2

Save the time on part 1, 2, 3

1 Drop the baggage at the entrance to the robot

3

2 Directly go to the security check and board the capsule



2

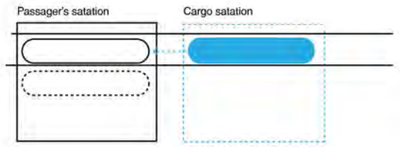
3 Pay the tickets on the back of seats

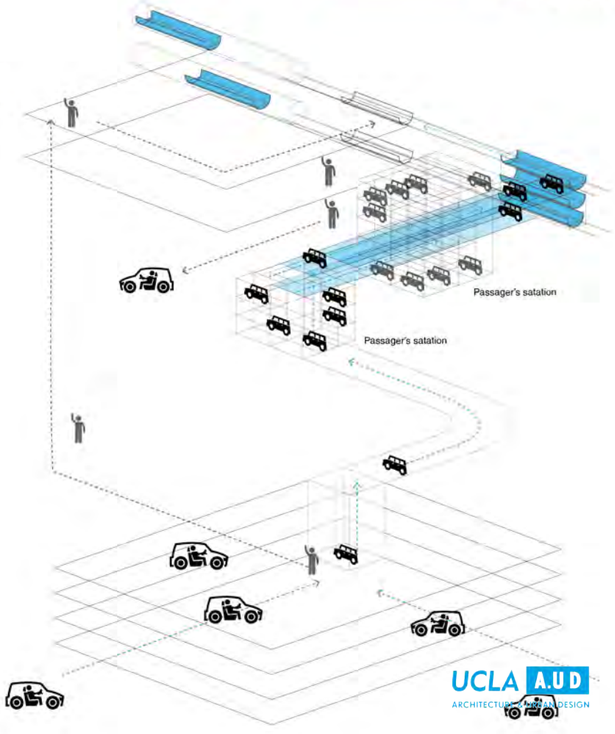
1

Efficiency: ●●●●
Controllability: ●●
Comfort: ●●●●
Flexibility: ●●●●
Economic: ●●●

Overall: 17

FAST BOARDING STRATEGY
Time Based Non-stop Station





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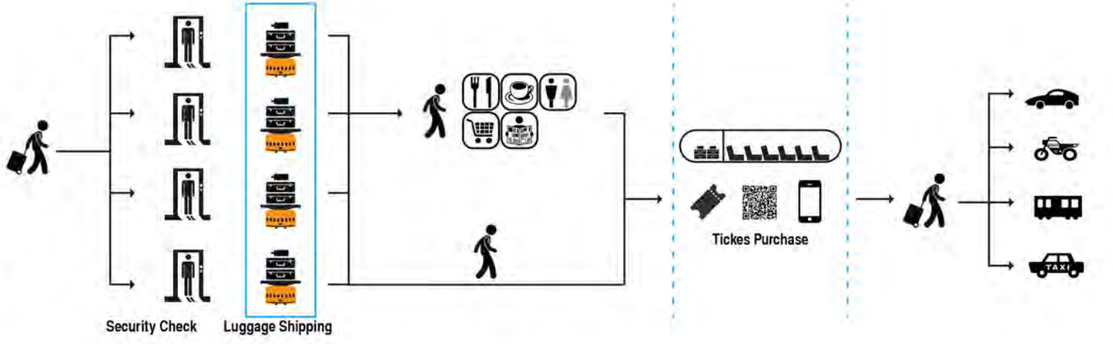
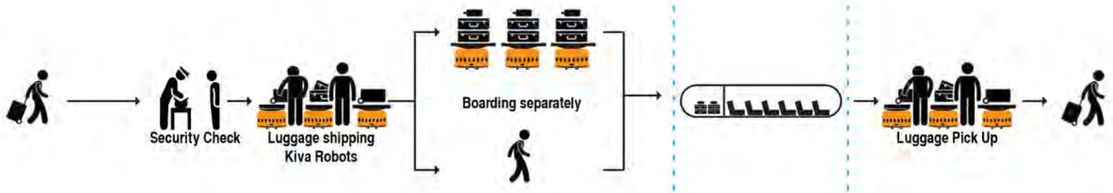
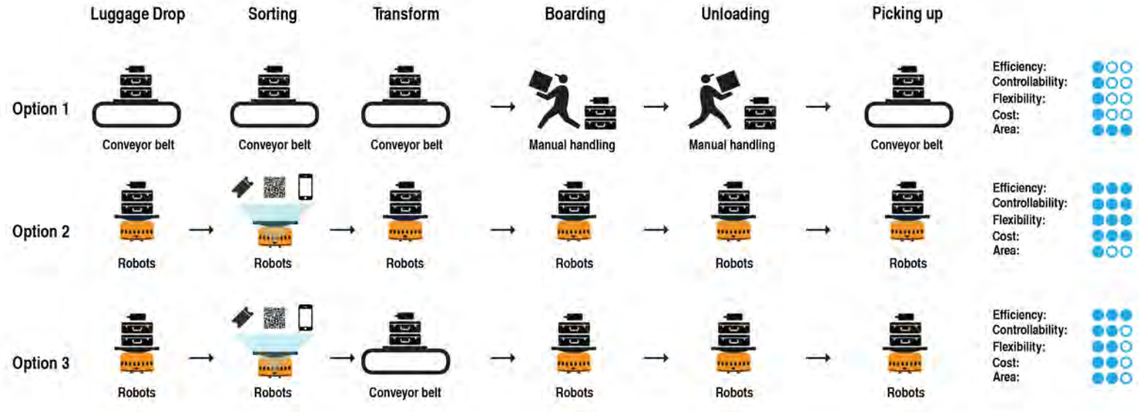




FAST BOARDING STRATEGY
Time Based Non-stop Station



Kiva Robot

16 inches tall
25 inche wide
330 Pounds (150 Kilograms)
3-5 baggage
lift 3 times (330 lbs)

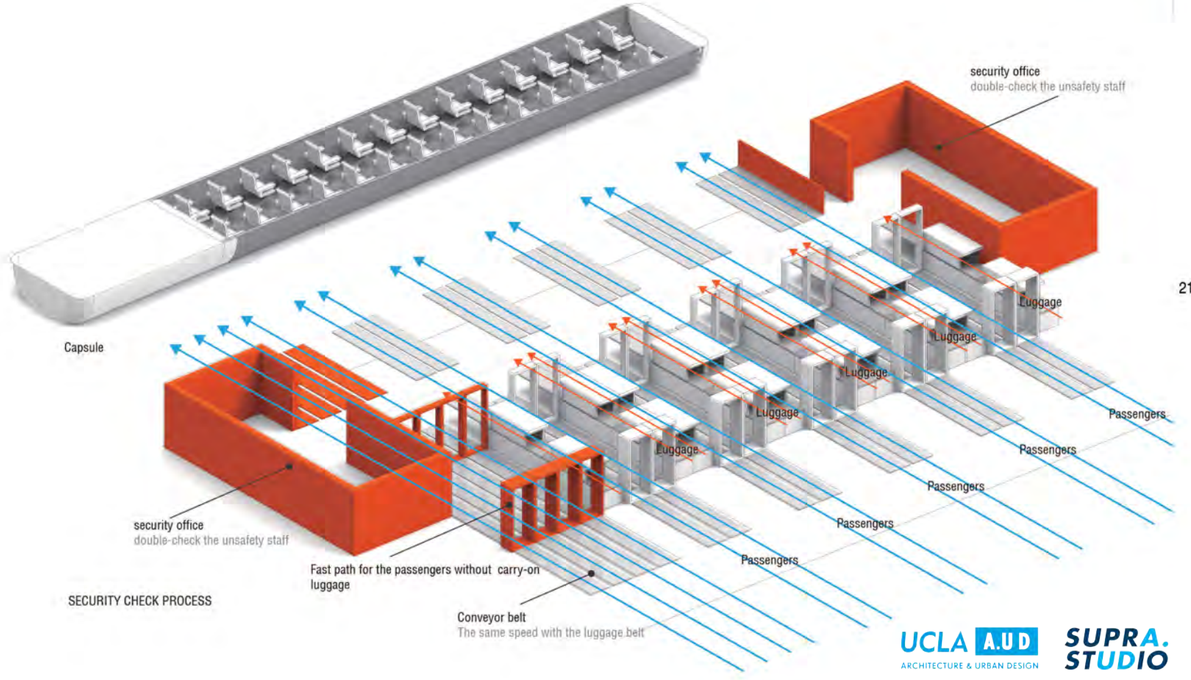
Robots caculate

Dropping&sorting	X 20~28
Transform	X 20~28
Boarding	X 20~28
Unloading	X 20~28
Total:	X 80~112

Dropping&sorting	X 20~28
Transform	Conveyor belt
Boarding	X 20~28
Unloading	X 20~28
Total:	X 60~84

Possible Reason of Delay	Strategy 1	Strategy 2
1. Quantity of the security check is not enough for people	1. Add more security check	1. Open a fast path for the passengers without carry on luggage
2. The separate luggage check slows down the whole speed		
Man security check (quick)		
Luggage check(slow)		
3. People without carry-on luggage should wait in the same line	2. The separate luggage check slows down the whole speed	Passengers without carry-on luggages
Efficiency: ●	Efficiency: ●●●●●	Efficiency: ●●●●
Controllabillity: ●●●●	Controllability: ●●●●	Controllability: ●●●●
Comfort: ●	Comfort: ●●●	Comfort: ●●●
Flexibility: ●	Flexibility: ●●●	Flexibility: ●
Economic: ●	Economic: ●●	Economic: ●●●
Overall: ●	Overall: ●●●●	Overall: ●●●●●

FAST BOARDING STRATEGY
Security Design



SECURITY CHECK PROCESS

FAST BOARDING STRATEGY
Restroom Design

Possible Reasons for bathroom delay

1 No enough toilets (especially for women)

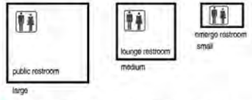
2 Narrow space at single entrance and exit with doors

3 Waiting line at the sinks

4 Broken or lack of sanitary

Strategies

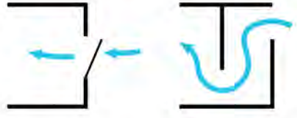
1 Distribute and layout different kinds of restrooms in diffrerent places



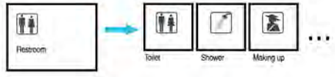
2 Single restrooms for both men and women to balance the heavy use desity.

3 Design multi-entrance & exit for restroom to flow the traffic and meet for different

4 Using labyrinth style of entrance and exit creating no "doorway" to avoid blocking



5 Create seprate stations for different usages or sequences to relieve blocking



6 Different sink design to enhance efficienicy and prevent lingering

7 Fit new reliable, durable fixtures and lighter and more engaging environment

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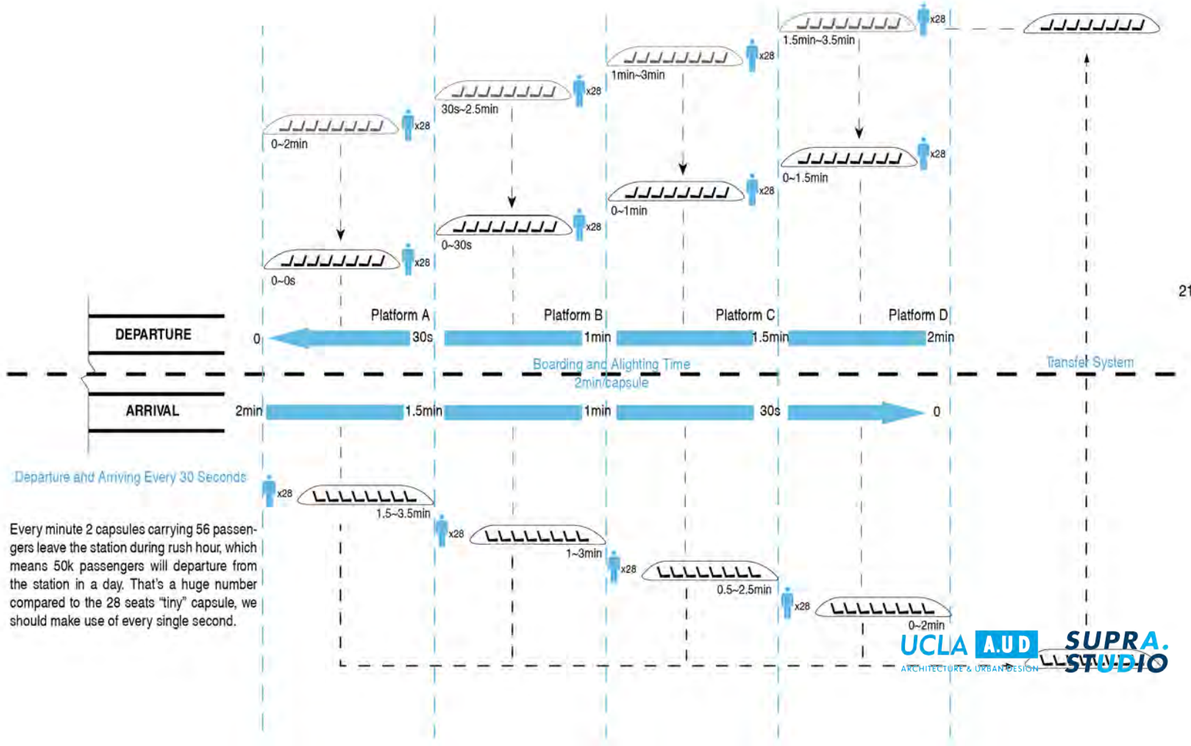
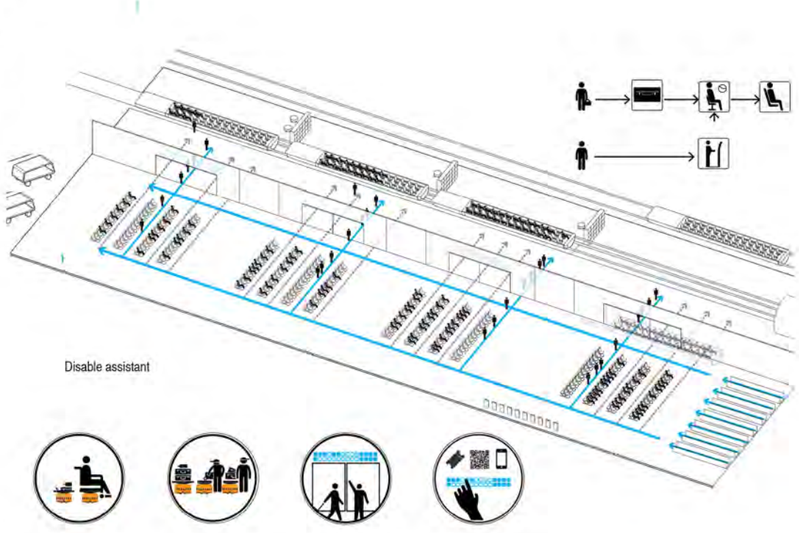
CAPSULE DISPATCHING
Platform design



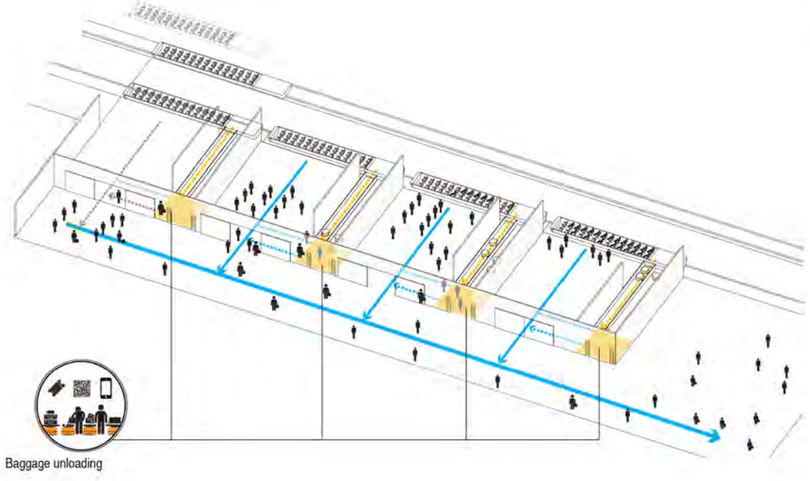
Every minute 2 capsules carrying 56 passengers leave the station during rush hour, which means 50k passengers will departure from the station in a day. That's a huge number compared to the 28 seats "tiny" capsule, we should make use of every single second.

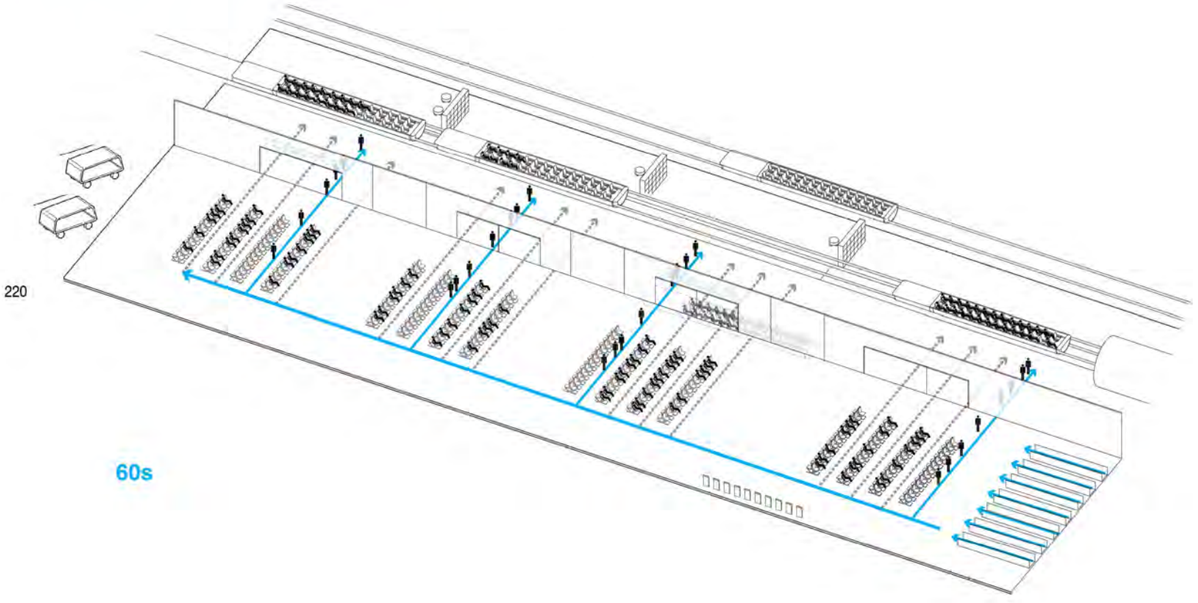
UCLA A.U.D ARCHITECTURE & URBAN DESIGN SUPRA. STUDIO

In order to make the boarding experience more delightfully and orderly, avoid the waiting time, some measurements have been taken. There are two kinds of passengers, the ones with baggage and the ones without baggage. Passengers with baggage have already chosen their seats when they drop the baggage to robots. Passengers without baggage will choose the seats after the security check, by using a touch screens which show the vacant seats and capsules.
In front of the lounge, lays the LED ,showing the capsules which are about to set out. Two minutes are needed for one capsule finishing boarding,but at rush every 30 seconds a capsule will set out.



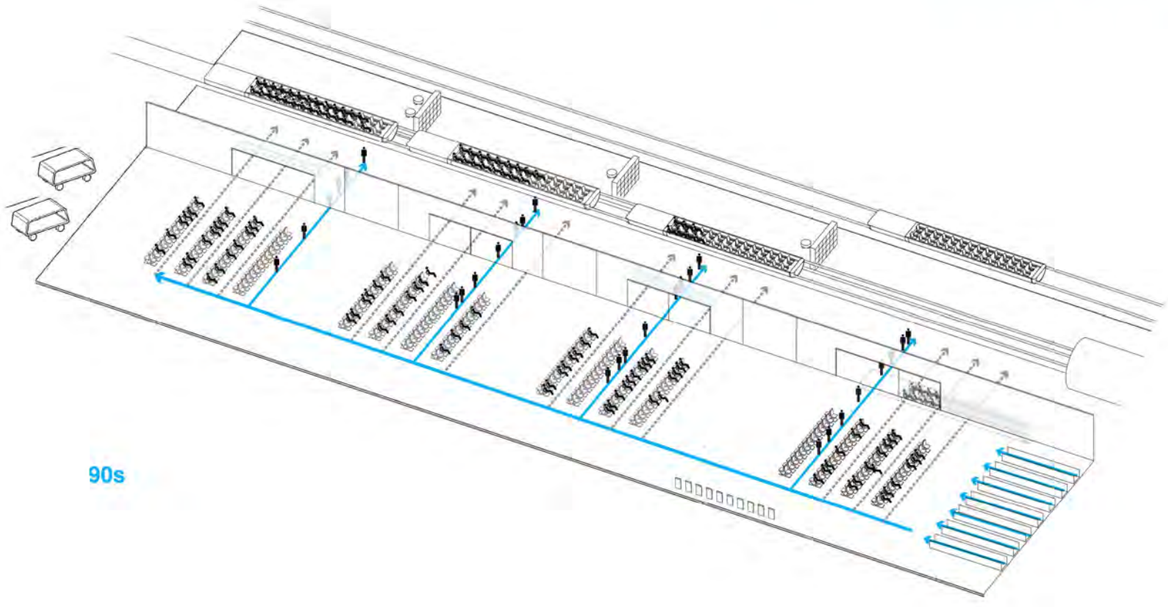
Compared to the boarding procedure, the process of unloading is much easier. When a capsule arrives at the platform, the luggage in the other side of the capsule will be transport to a conveyer belt which goes parallel with the leaving passengers. With the help of these belt and other robots, passengers are able to pick up their baggages as soon as they exit the station in a specific place corresponding to the position where they dropped their luggages.





60s

DEPARTURE CIRCULATION
Platform Design



90s

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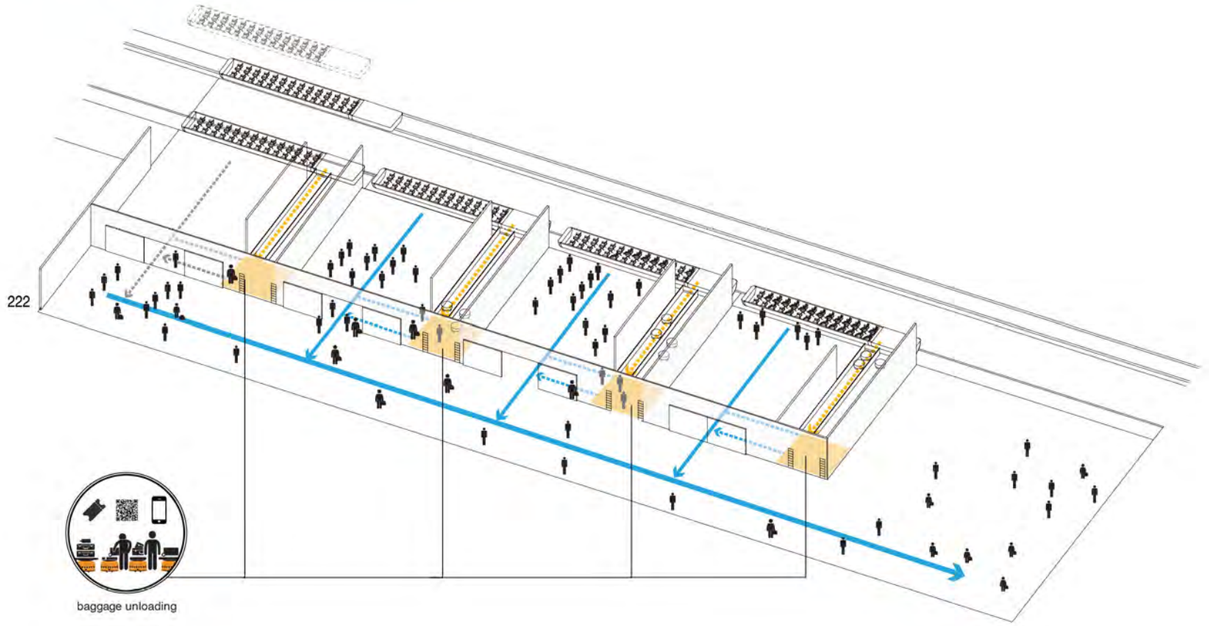
SUPRA. STUDIO

ARRVIAL CIRCULATION

Platform Design



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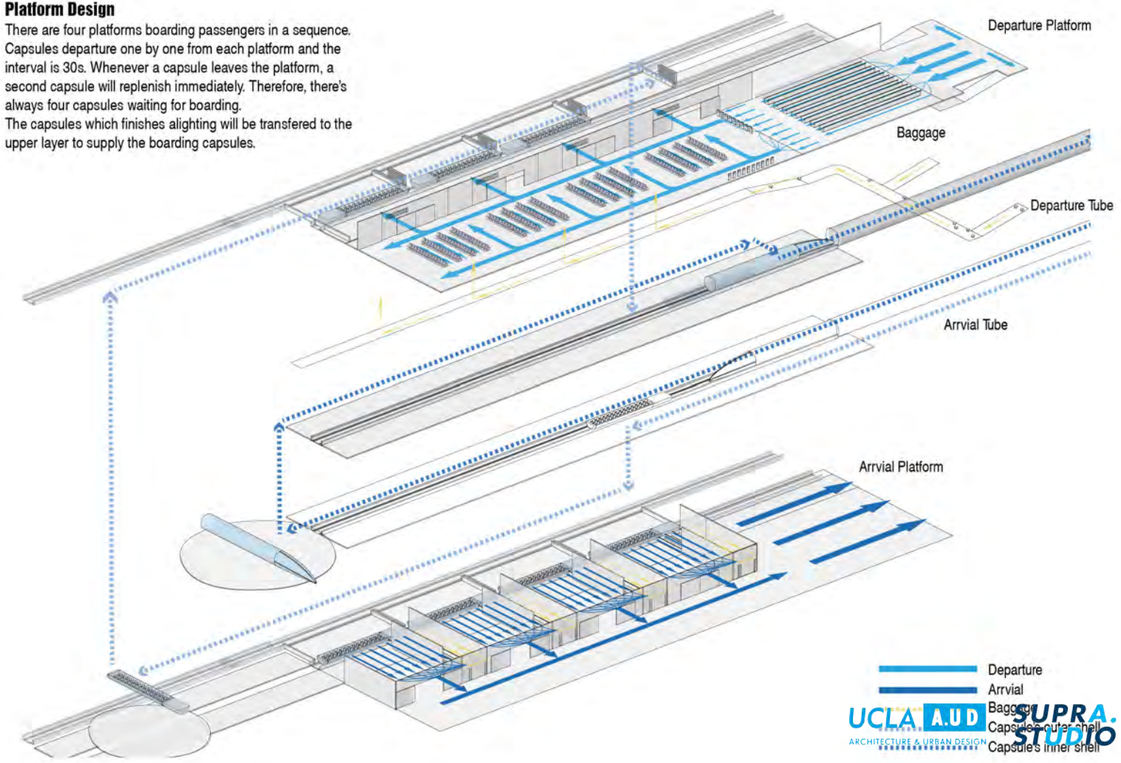
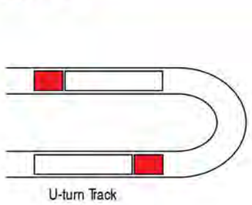
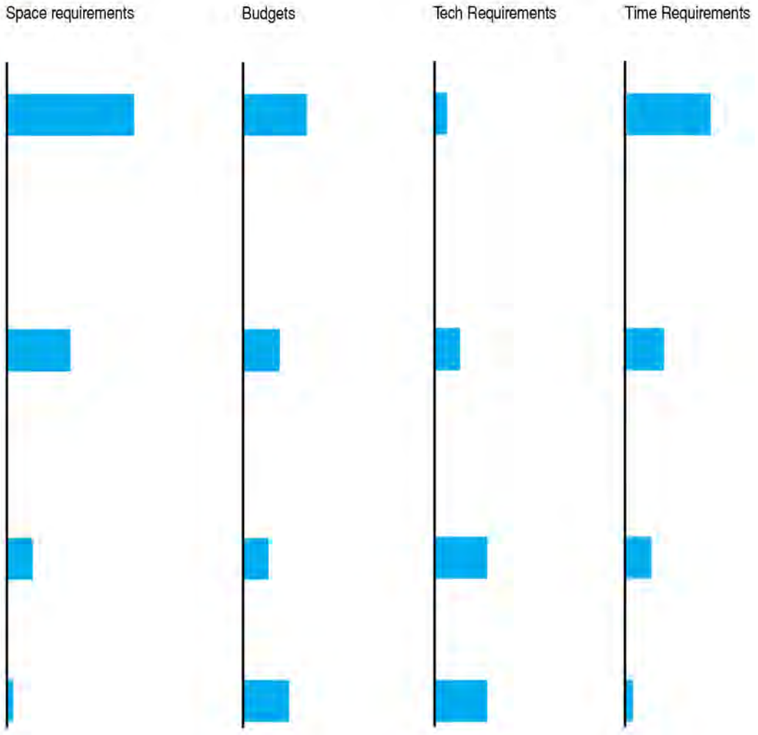
Platform Design

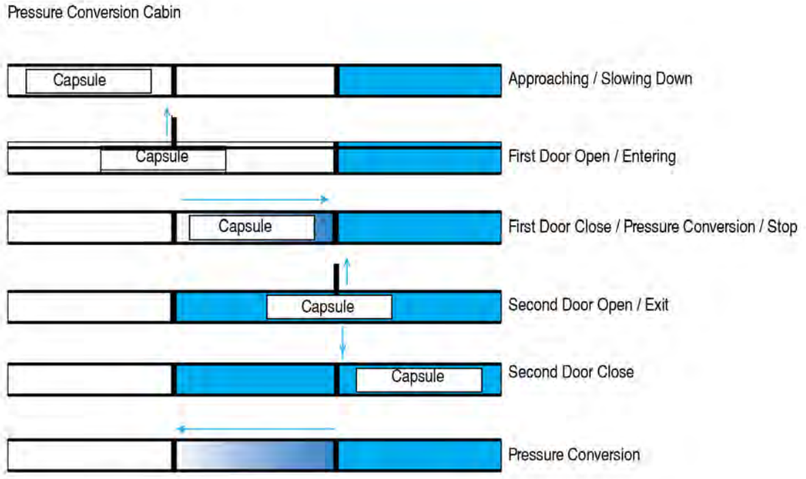
There are four platforms boarding passengers in a sequence. Capsules departure one by one from each platform and the interval is 30s. Whenever a capsule leaves the platform, a second capsule will replenish immediately. Therefore, there's always four capsules waiting for boarding.
The capsules which finishes alighting will be transfered to the upper layer to supply the boarding capsules.



UCLA A.U.D ARCHITECTURE & URBAN DESIGN SUPRA. STUDIO







CAPSULE RESEARCH

HISTORY | PRECEDENTS | TECHNOLOGY

In this section, the studio based their capsule research on consequential factors that would affect one's use of Hyperloop. Starting with fundamental dimensions of precedents, such as aircrafts and trains, the studio focused on how to visualize abstract traveling experience. We are interested to combine emotion and activities with speed, time, scale, and distance, during one's Hyperloop travel experience. This research aims is to propose a potentially reasonable arrangement within a constrained space, which would enhance both comfort and traveling experience.

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UCLA A.U.D ARCHITECTURE & URBAN DESIGN SUPRA. STUDIO

TRANSPORTATION TIMELINE

Aircrafts, Trains, Cars, Ships

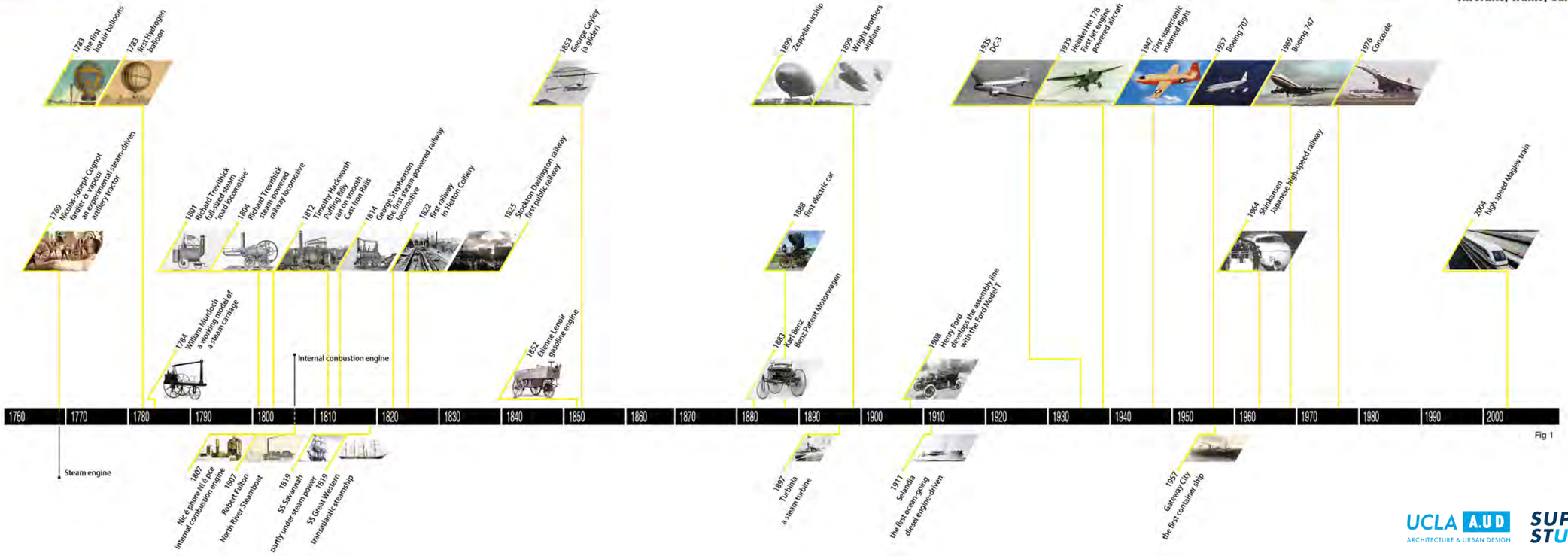


Fig 1

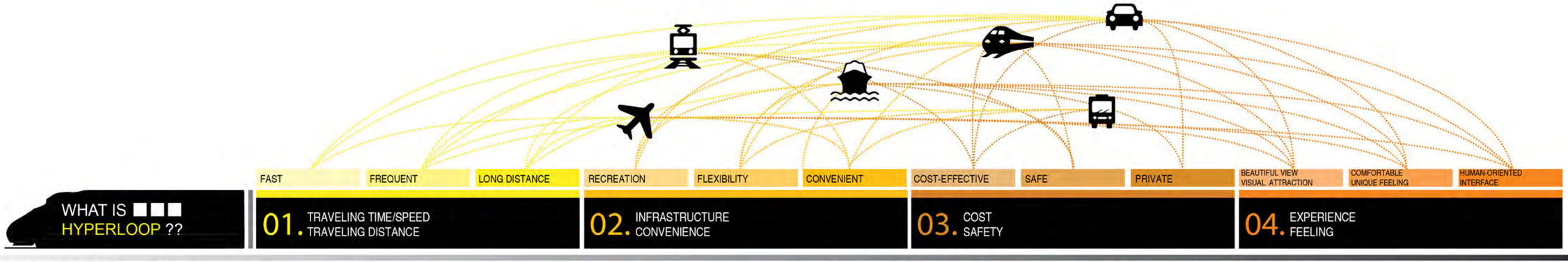
UCLA A.U.D ARCHITECTURE & URBAN DESIGN

SUPRA. STUDIO

TRANSPORTATION TIMELINE
Aircrafts, Trains, Cars, Ships

UCLA A.U.D ARCHITECTURE & URBAN DESIGN

SUPRA. STUDIO



THE CONCEPT OF HYPERLOOP CAPSULE

WHAT MAKES YOU CHOOSE HYPERLOOP?

UCLA A.U.D ARCHITECTURE & URBAN DESIGN SUPRA. STUDIO

CONCEPT OF HYPERLOOP CAPSULE
To Realize A Human - Oriented Hyperloop Capsule

UCLA A.U.D ARCHITECTURE & URBAN DESIGN SUPRA. STUDIO

HISTORY OF THE HYPERLOOP CAPSULE
Constructed Projects In The Past

In 1863, London Pneumatic Dispatch Company design build and operate an underground railway system for the carrying of mail, parcels and light freight between locations in London. the dimension of the system is large enough to carrier a person. The system was used between 1863 and 1874.

In 1870, a 300-foot subway ran beneath Broadway in New York City. It was the creation of inventor Alfred Ely Beach. Cars were propelled by a vacuum blower that pushed the car through the tunnel -- similar to the system used at bank drive-up windows. The demonstration subway ran for three years.

Nowadays, travel through a high speed tube has already been a Symbol of future in people's mind. Dreamers and inventors always come up with diverse ideas to make it come true. After Elon Musk announce the hyperloop alpha document, many people start to build a full scale mock-up to test the feasibility.

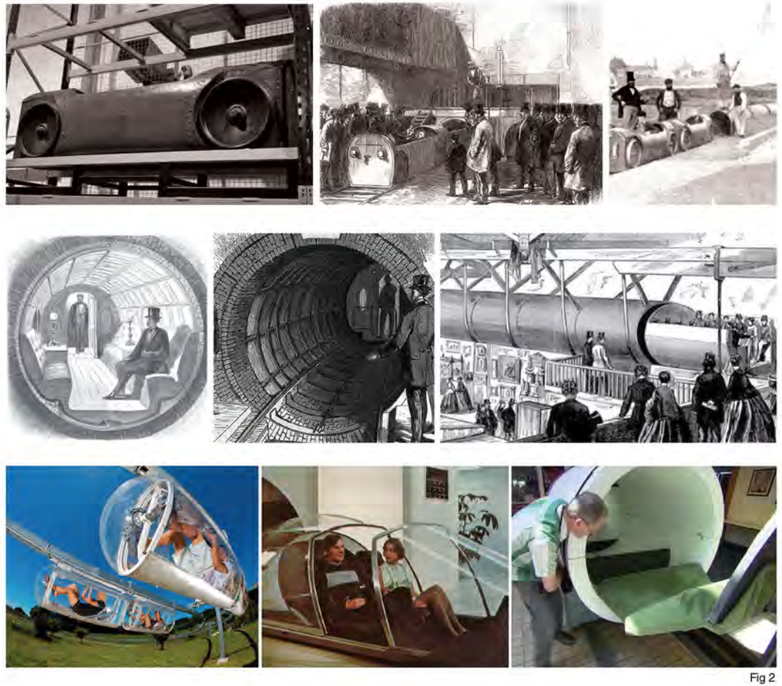


Fig 2

Things to do in 10 min

Make a phone call
Read an advertisement
Update a status
Write a postcard
Check email
A quick make up
Enjoy a coffee

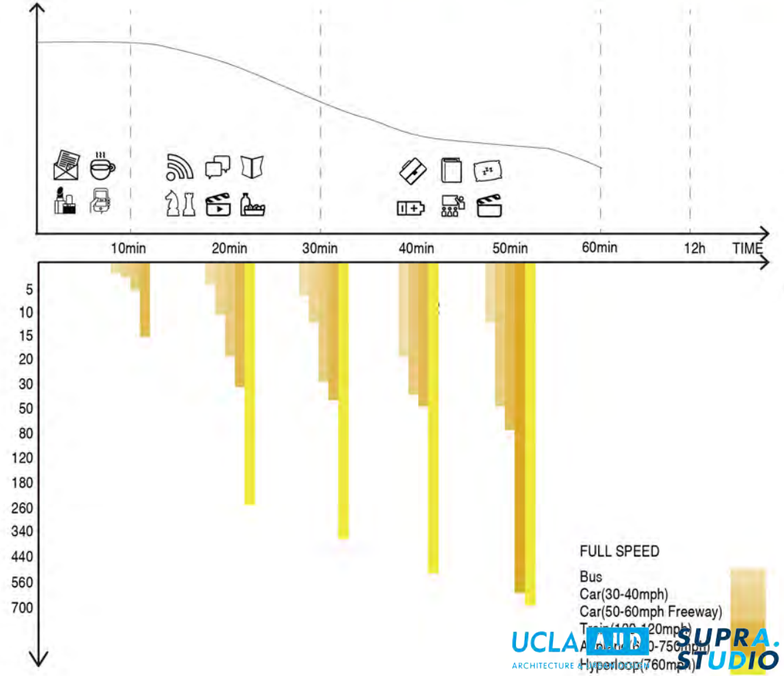
Things to do in 10-20 min

Play a chess game
Have a conversation
Write a blog
Have a meal
Read a newspaper
Watch a cartoon

Things to do in 30-60 min

Charge your phone
Have a lecture
Take a nap
Watch a TV series
Do office work
Enjoy a book

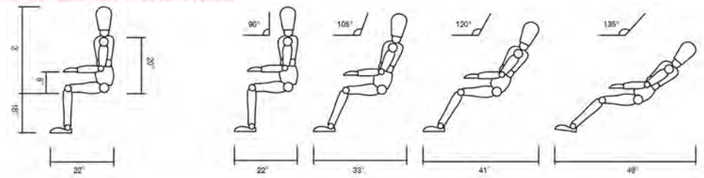
COMMERCIAL AIRCRAFT
Boeing 747-400 Cargo Freighter (2008), Concorde (1978)



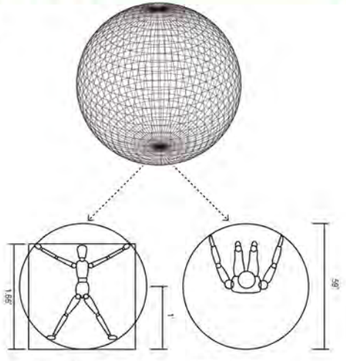
RELATIONSHIP BETWEEN HUMAN AND SPACE

In order to find out the most appropriate space for Hyperloop, it is necessary to study the relationship between human and space which includes aspects of space dimension and human emotion. We try to find out it by analyzing the space in vertical and horizontal directions.

DIMENSION OF VERTICAL DIRECTION

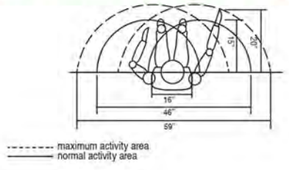


DECOMPOSE A SPACE

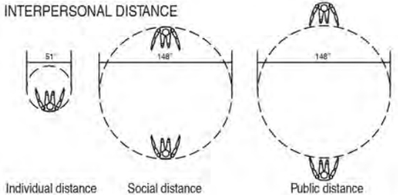


Horizontal Plane

ANALYSIS OF HORIZONTAL PLANE

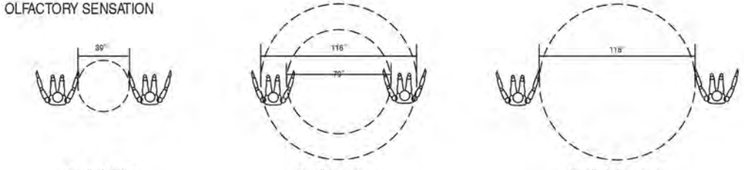


INTERPERSONAL DISTANCE



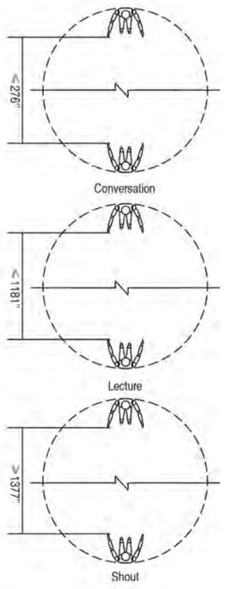
Individual distance Social distance Public distance

OLFACTORY SENSATION



Smell of clothes Smell of perfume Smell of sharp taste

AUDITORY DISTANCE

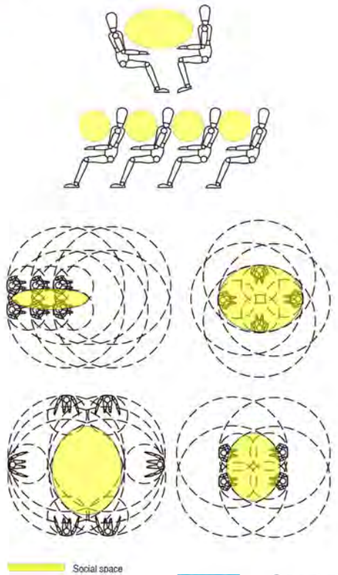


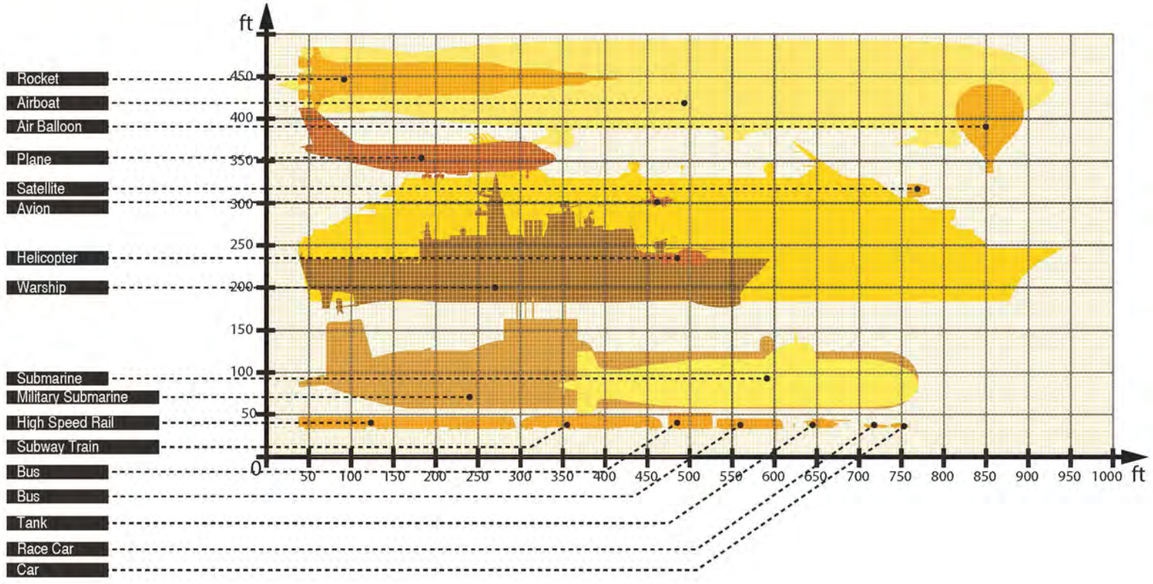
SPACE EXPERIENCE

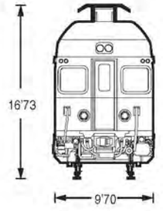
Human emotion is always important while making a design, it could be influenced by so many factors like dimension, environment, user experience, etc. It is widely accepted that different spaces could generate specific feelings. Here we are going to research the influence of space and distance to human emotion. As we have already studied the relationship between human and space in dimension aspect, it would be possible for us to view a single person as a bubble and combine several bubbles in different patterns to find out the most appropriate function for different area.

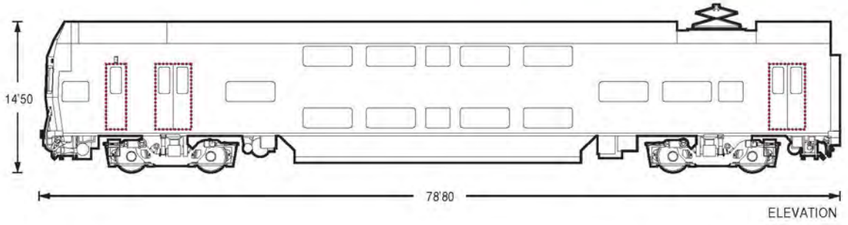
DESIGN FACTORS

SOCIAL SPACE IN VEHICLES





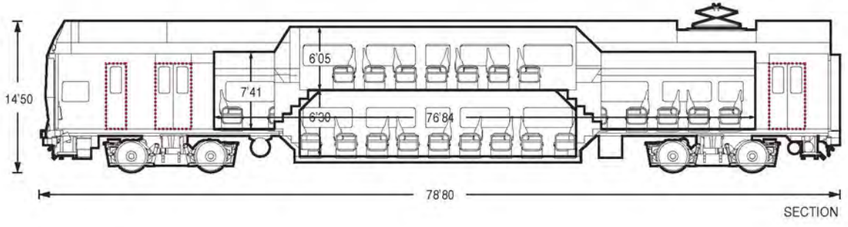


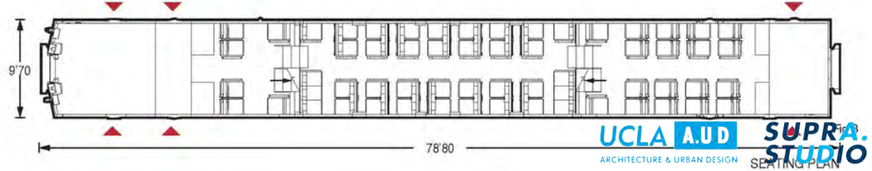


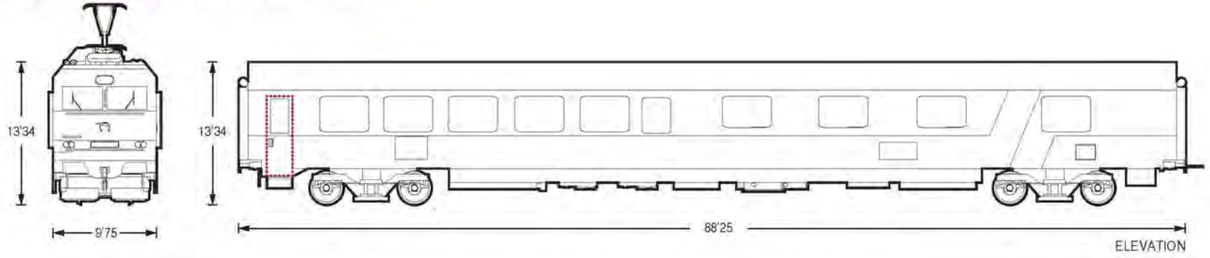
Transport Sydney Trains-Intercity V set train

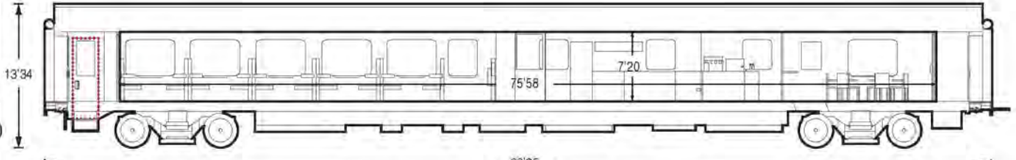
General Information

Type: inter-city high speed rail
Capacity: 96 seats (driving cars)
112 seats (trailer)
Speed: 81 mph (130 km/h)
Size(ft): L: 78'80, W: 9'70, H: 14'50
Weight: 61 t (60 long tons; 67 short tons)
In service: 1970-present









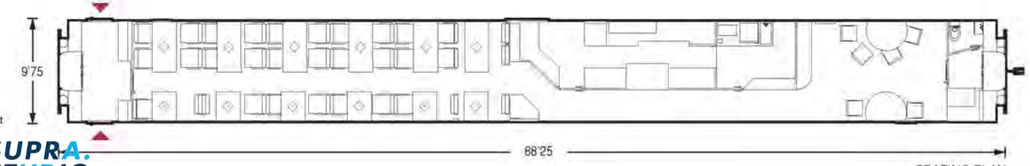


Fig 4

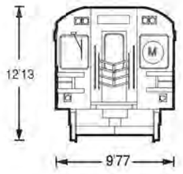
EuroCity express train

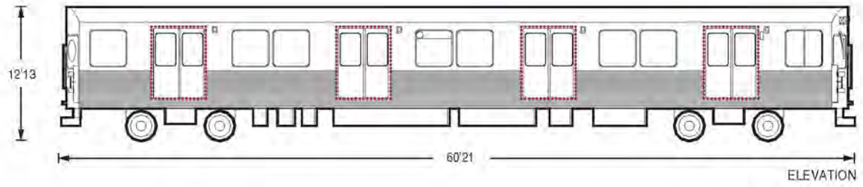
General Information

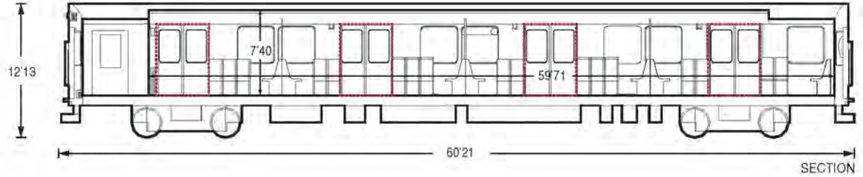
Type: cross-border train
Capacity: 39 seats/car (dining)
64 seats/car (normal)
Speed: 31- 62 mph
(50-100 km/h)
Size(ft): L: 88'25, W: 9'75
H: 13'34 (dining)
In service: 1987-present

0 1 2 4 8 16 ft

UCLA A.U.D ARCHITECTURE & URBAN DESIGN SUPRA STUDIO







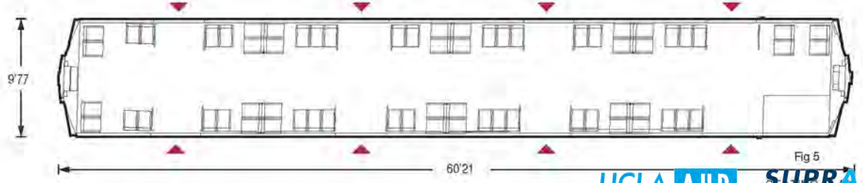


Fig 5

New York City Subway-M Sixth Avenue Local

General Information

Type: local public rapid transit
Capacity: 66 seats/car
Speed: 55 mph (89 km/h)
Size(ft): L: 60'21, W: 9'77 H: 12'13
Weight: 39 t
In service: 2006-present

0 1 2 4 8 16 ft

UCLA A.U.D ARCHITECTURE & URBAN DESIGN SUPRA STUDIO

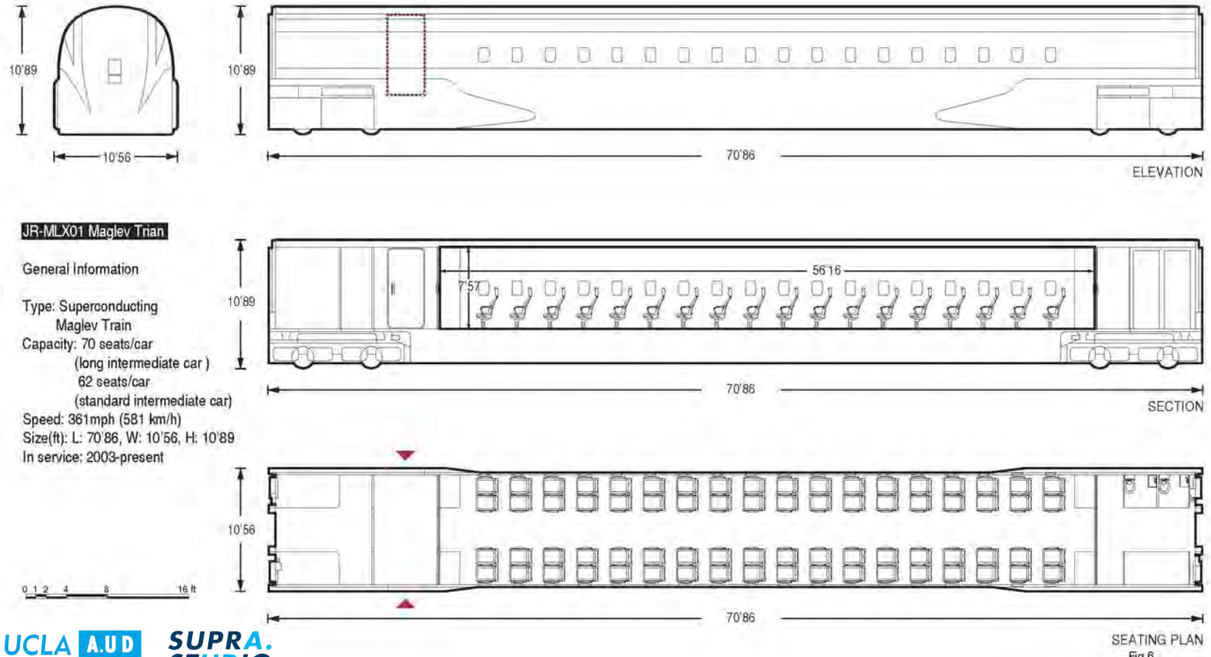


Fig 6

JR-MLX01 Maglev Trian

General Information

Type: Superconducting Maglev Train
Capacity: 70 seats/car (long intermediate car)
62 seats/car (standard intermediate car)
Speed: 361mph (581 km/h)
Size(ft): L: 70'86, W: 10'56, H: 10'89
In service: 2003-present

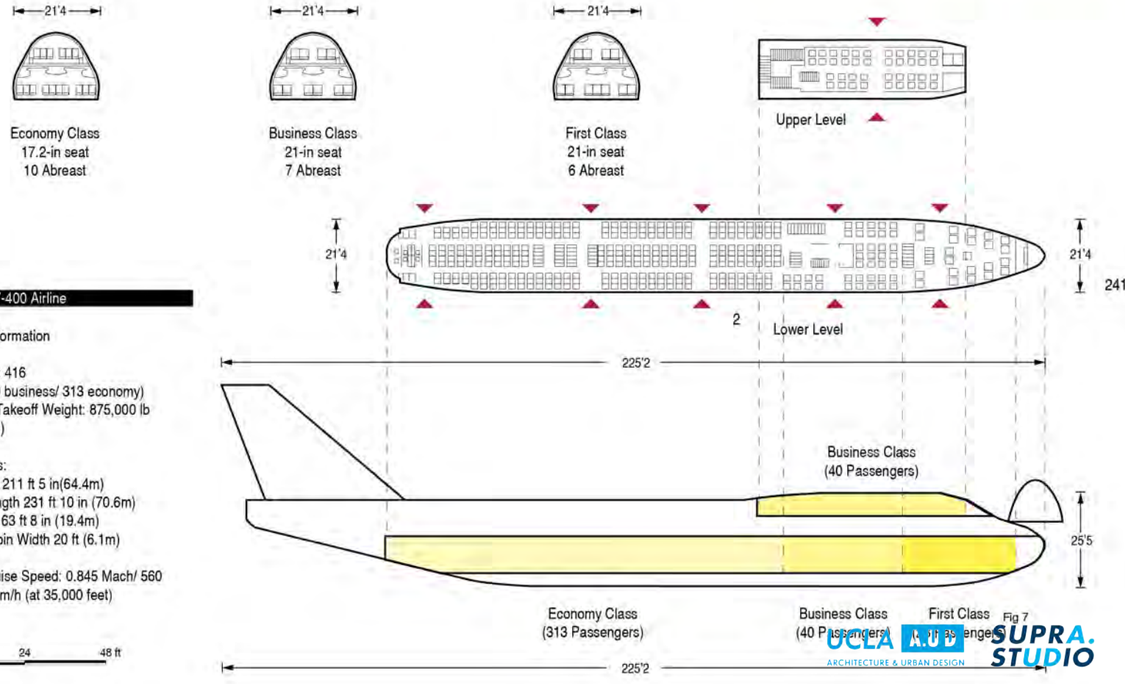


Fig 7

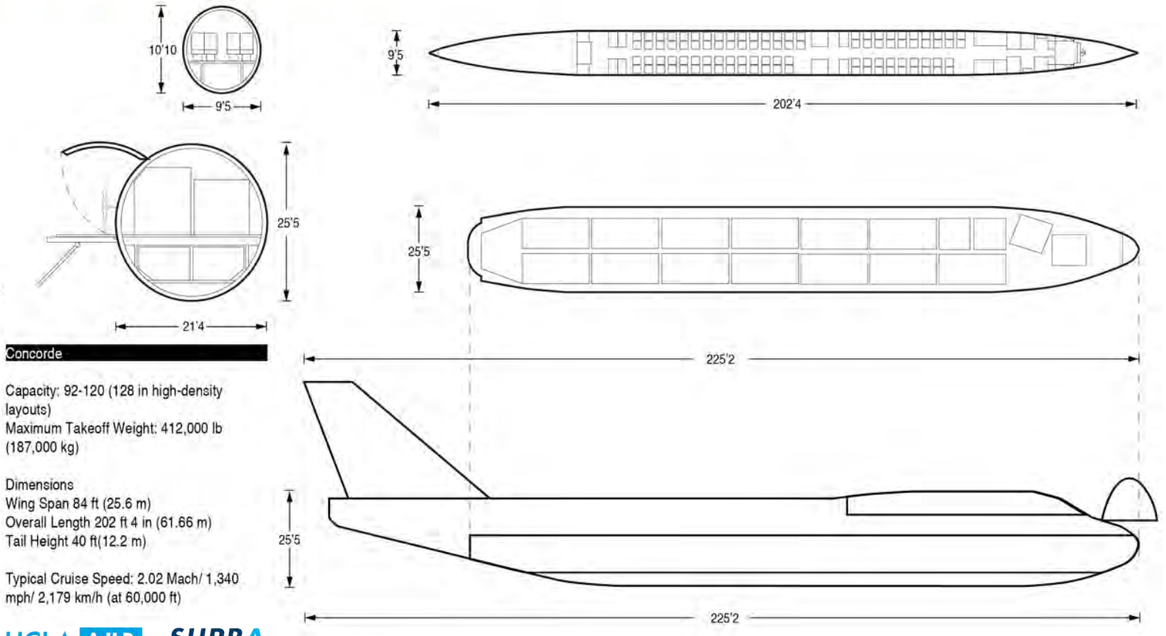
Boeing 747-400 Airline

General Information

Passenger: 416
(23 first/ 80 business/ 313 economy)
Maximum Takeoff Weight: 875,000 lb (396,900kg)

Dimensions:
Wing Span 211 ft 5 in(64.4m)
Overall Length 231 ft 10 in (70.6m)
Tail Height 63 ft 8 in (19.4m)
Interior Cabin Width 20 ft (6.1m)

Typical Cruise Speed: 0.845 Mach/ 560 mph/ 901 km/h (at 35,000 feet)



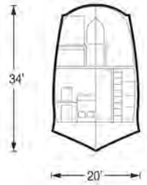
Concorde

Capacity: 92-120 (128 in high-density layouts)
Maximum Takeoff Weight: 412,000 lb (187,000 kg)

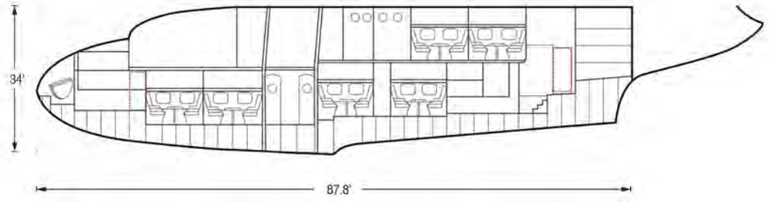
Dimensions
Wing Span 84 ft (25.6 m)
Overall Length 202 ft 4 in (61.66 m)
Tail Height 40 ft(12.2 m)

Typical Cruise Speed: 2.02 Mach/ 1,340 mph/ 2,179 km/h (at 60,000 ft)

Fig 8



Section A

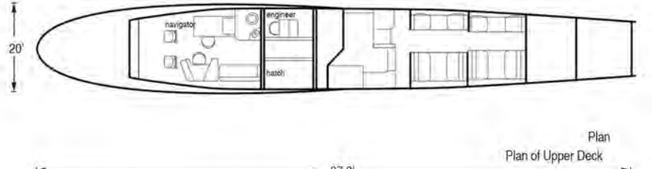


Section B

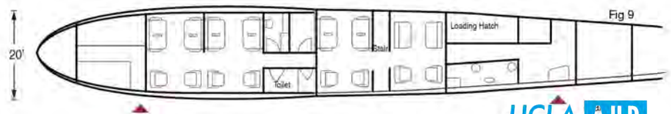
Short Solent

General Information

Type: passenger flying boat
Capacity: 34 passengers
Speed: 273 mph (439 km/h)
Size(ft):L: 87' 8, W:113', H: 34'3
Weight: 47,760 lb (21,664 kg)



Plan
Plan of Upper Deck



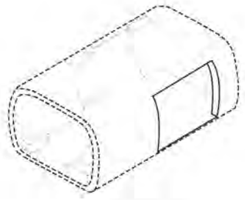
Plan of Lower Deck

Fig 9

Military AircraftUH-60 (BLACK HAWK)

Type: twin turboshaft engine helicopter
Capacity: 2,640 lb (1,200 kg) of cargo internally, including 11 troops or 6 stretchers, or 8,000 lb (3,600 kg) (UH-60A) or 9,000 lb (4,100 kg) (UH-60L) of cargo externally

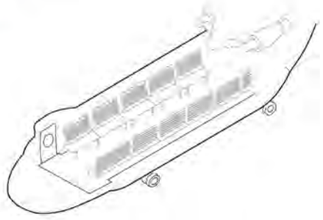
Speed: 183 mph (295 km/h)
Size(ft): L: 64'10, W:7'9 H:16'10
Weight: 10,624 lb (4,819 kg)
In service: 1981-present



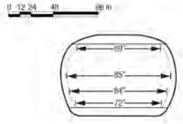
SECTION A

Heavy-lift Helicopter-CH-47

Type: tandem rotor heavy-lift helicopter
Capacity:33–55 troops or 24 litters and 3 attendants or 28,000 lb (12,700 kg) cargo
Speed: 196 mph, (315 km/h)
Size(ft): L:52' fuselage, 98'10, W:12.42'
H: 18'11
Weight: 23,400 lb (10,185 kg)
In service: 1960s-present



SEAT INSTALLATION



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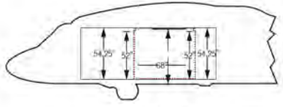
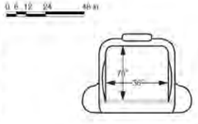
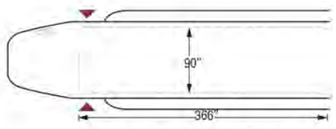


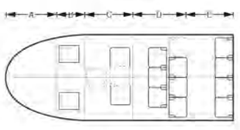
CABIN DOOR DIMENSIONS

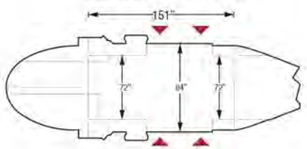


CROSS SECTION A



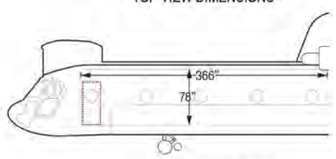
TOP VIEW DIMENSIONS



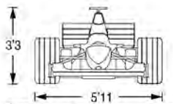


CAPSULE DIMENSIONS

CROSS SECTION B

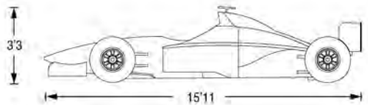


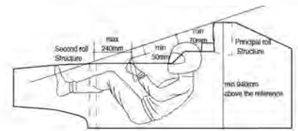
SIDE VIEW DIMENSIONS



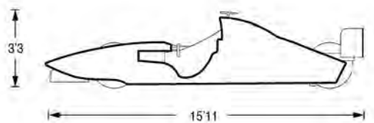
F1 Racing Car

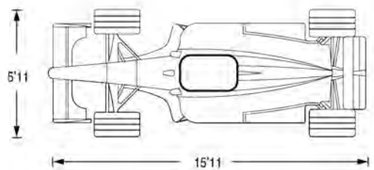
Type: Racing Car
Capacity: 1 seat/car
Speed: 233 mph (372.8 km/h)
Size(ft): L: 15'11, W: 5'11, H: 3'3





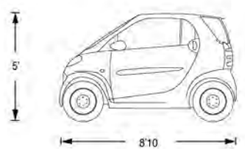
STRUCTURE





Smart Fortwo

Type: Coupe
Capacity: 2 seats/car
Speed: 96 mph (153.6 km/h)
Size(ft): L: 8'10 W: 5'9, H: 5'



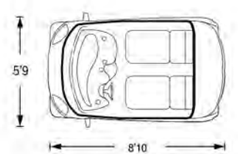
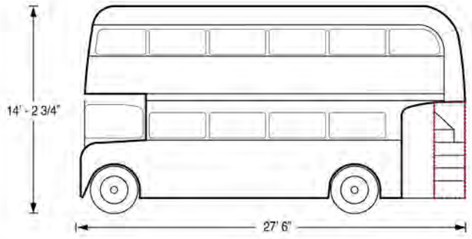
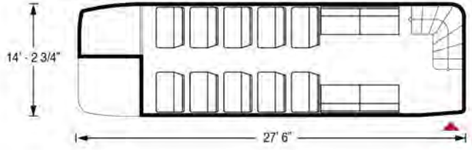


Fig 11



ELEVATION



UPPER DECK PLAN

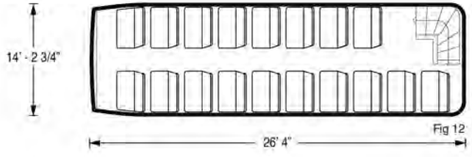


Fig 12

LOWER DECK PLAN

Routemaster bus
Manufactured by London Transport

Type:	Double-decker, rigid
Capacity:	57-72 seated passengers
Speed:	50 mph (80 km/h)
Size (ft.):	L: 27' 6"
	W: 8'
	H: 14' - 2 3/4"

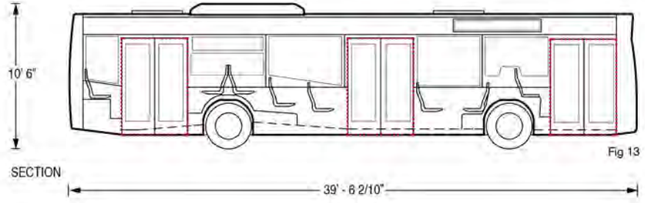
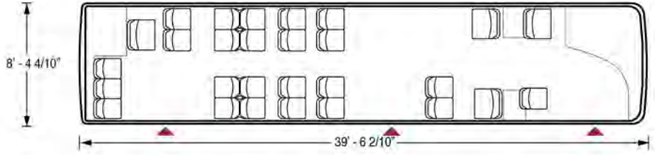
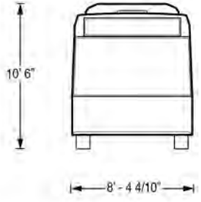


Fig 13

SECTION

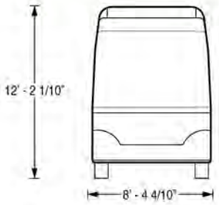


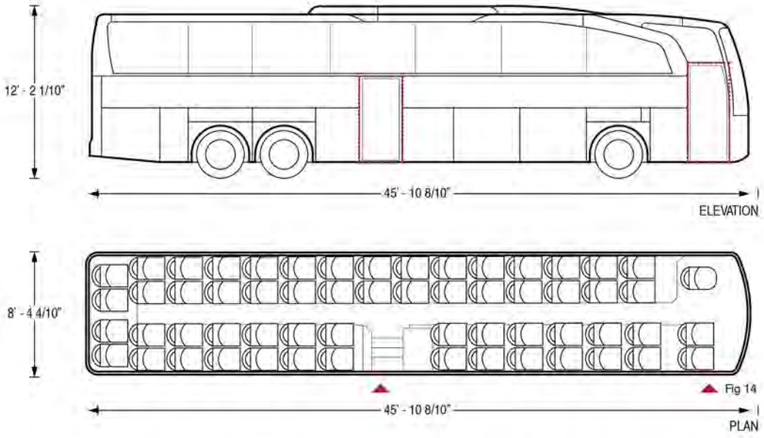
PLAN



Volvo 7700
Manufactured by Volvo

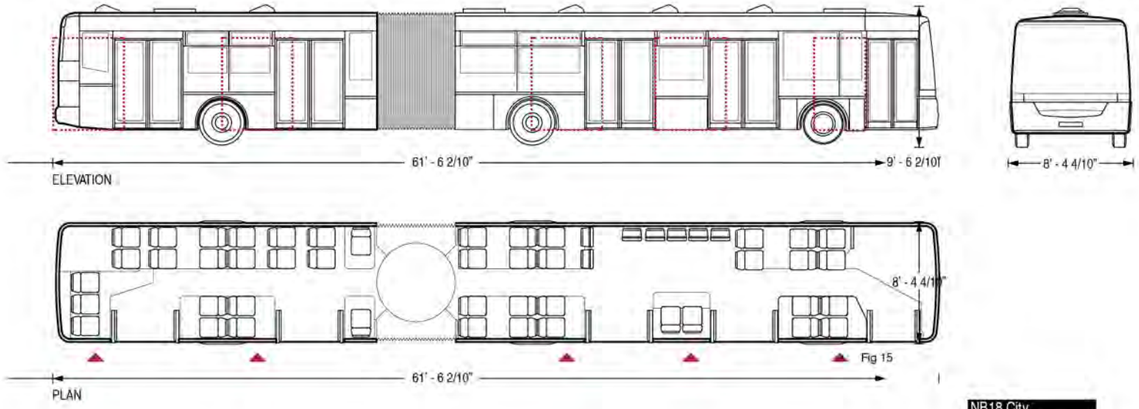
Type:	Single-decker, rigid
Capacity:	32 seated passengers
	90 passengers in total
Speed:	68 mph (110 km/h)
Size (ft.):	L: 39' - 6 2/10"
	W: 8' - 4 4/10"
	H: 10' 6"





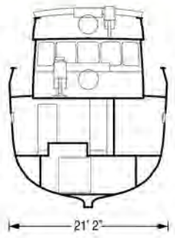
Travego L
Manufactured by Mercedes - Benz

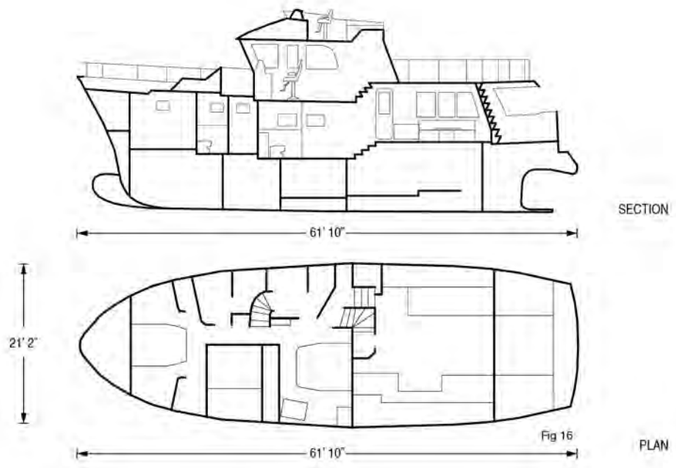
Type:	Single-decker, rigid
Capacity:	58 seated passengers
Speed:	65 mph (100 km/h)
Size (ft.):	L: 45' - 10 8/10"
	W: 8' - 4 4/10"
	H: 12' - 2 1/10"



NB18 City
Manufactured by SOR

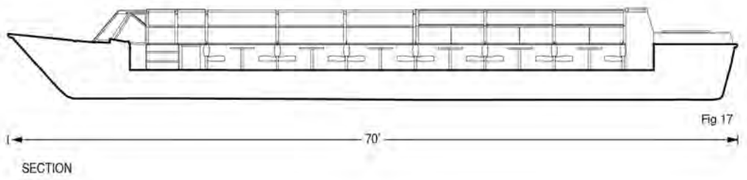
Type:	Single-decker, articulated
Capacity:	44 seated passengers
	161 passengers in total
Speed:	50 mph (80 km/h)
Size (ft.):	L: 61' - 6 2/10"
	W: 8' - 4 4/10"
	H: 9' - 6 2/10"

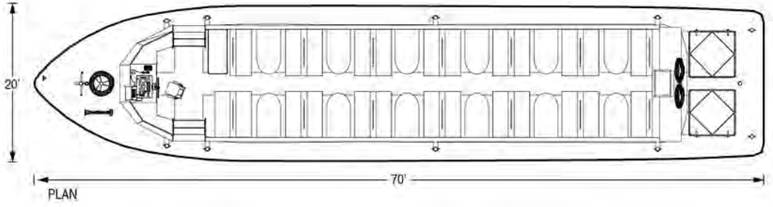




Seaton Expedition Sixty

Type:	Cruiser
Capacity:	5 passengers
Speed:	11.5 mph (18.5 km/h)
Size (ft.):	L: 61' 10"
	W: 21' 2"



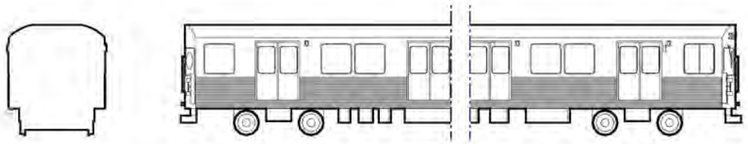


Amsterdam Canal Cruiser

Type:	Tourist Transportation/Attraction
Capacity:	50 seated passengers
Speed:	18.6 mph (30 km/h)
Size (ft.):	L: 70'
	W: 20'

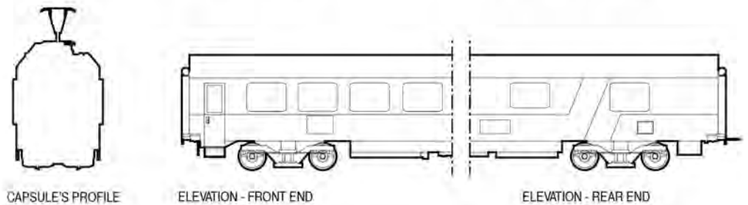
New York City Subway - M Sixth Avenue Local

Maximum Velocity: 18 mph (29 km/h)



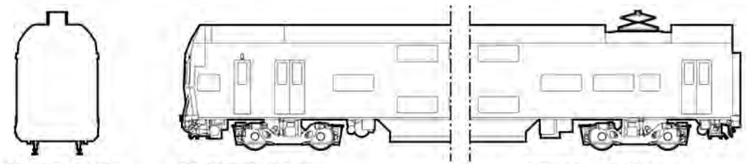
EuroCity Express Train

Maximum Velocity: 31 - 62 mph (50 - 100 km/h)



Transport Sydney Trains - Intercity V Set Train

Maximum Velocity: 81 mph (130 km/h)



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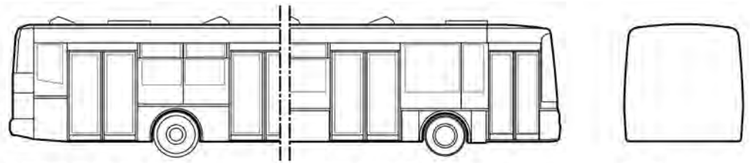
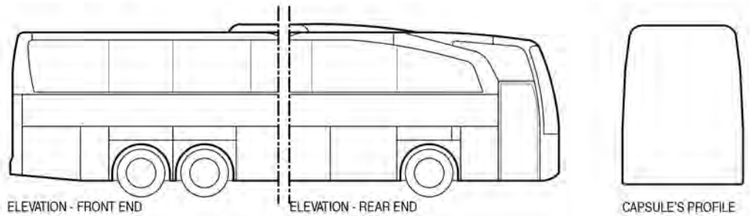
SOR NB 18 City

Maximum Velocity: 50 mph (80 km/h)



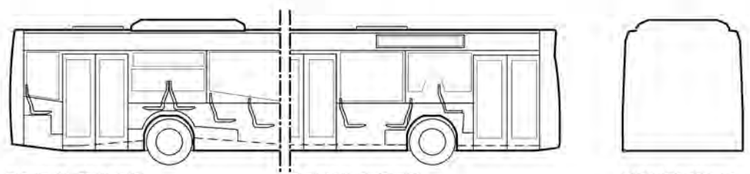
Mercedes - Benz Travego L

Maximum Velocity: 65 mph (100 km/h)



Volvo 7700

Maximum Velocity: 68 mph (110 km/h)



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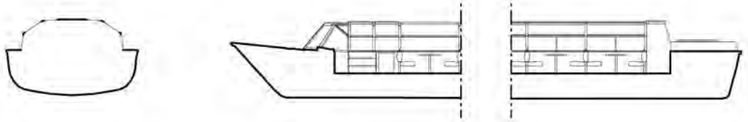
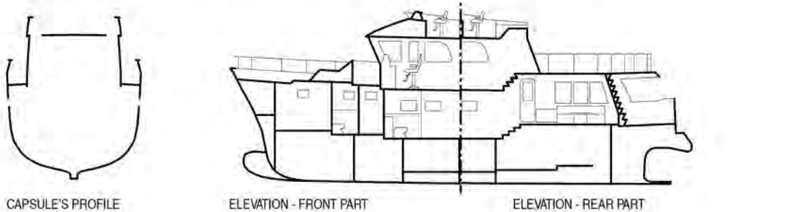
Amsterdam Canal Cruiser

Maximum Velocity: 18.6 mph (30 km/h)



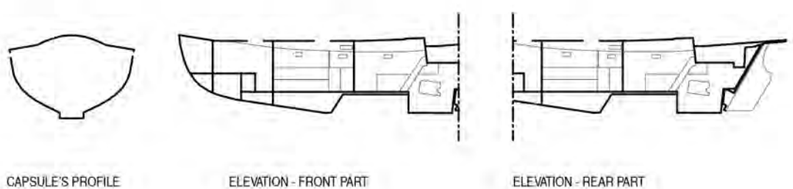
Seaton Expedition Sixty

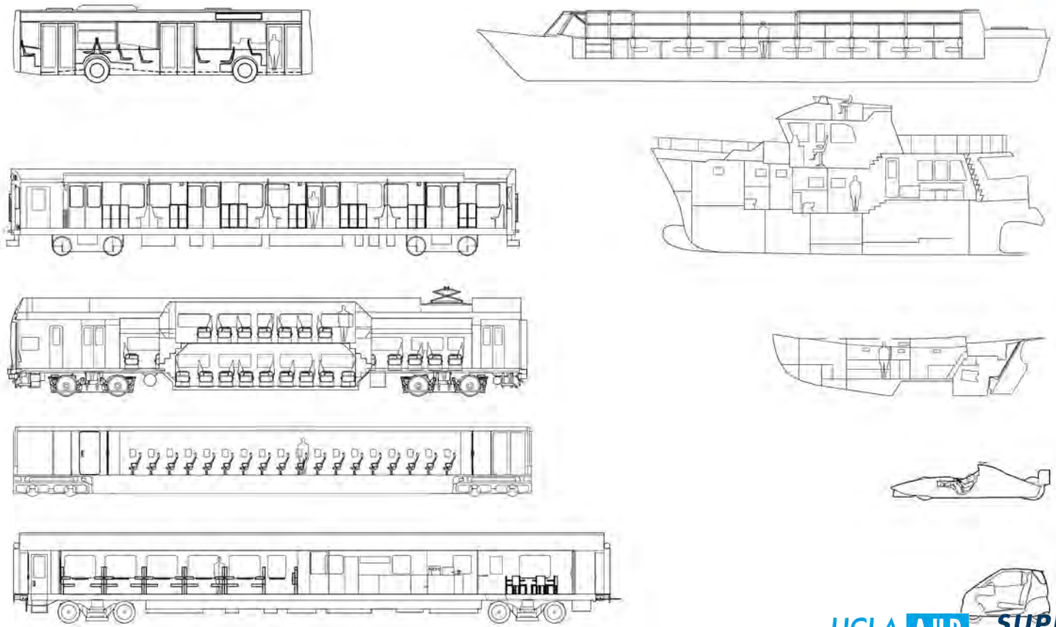
Maximum Velocity: 11.5 mph (18.5 km/h)



Freedom 33

Maximum Velocity: 7 mph (11 km/h)





SUMMARY
Layout of the Capsule and Seating Arrangement

Categorized by personal vehicles, city metro system, long range transportation system and tourist transportation/attraction. The captions show how seats are arranged in the capsule and the density during rush hour. Compared with minimum living space, the layout of capsule need to find balance between comfort and efficacy.

Minimum dining room

Minimum restroom

Minimum bedroom

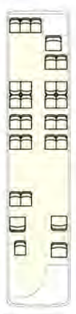
25
sq ft/ person
0.04
person/ sq ft

Smart For Two
Capacity : 2

8
sq ft/ person
0.125
person/ sq ft

Formula One
Capacity : 1

5.2
sq ft/ person
0.191
person/ sq ft



Volvo 7700
Capacity :
Seated : 32
Stand : 58

7
sq ft/ person
0.138
person/ sq ft

London Roadmaster
Capacity :
Seated : 57
Stand : 15

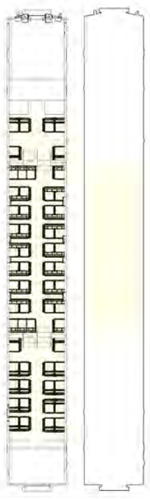
3.6
sq ft/ person
0.270
person/ sq ft

SOR NB18 City
Capacity :
Seated : 44
Stand : 117

3.6
sq ft/ person
0.280
person/ sq ft

New York City Subway
Capacity :
Seats : 240

7.5
sq ft/ person
0.133
person/ sq ft



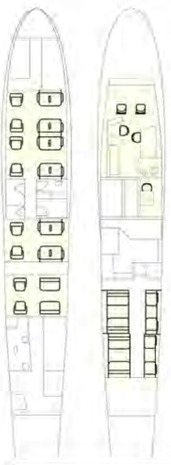
Sydney Intercity Train
Capacity :
Seates : 112

9.8
sq ft/ person
0.1
person/ sq ft

Mercedes Benz Travego
Capacity :
Seates : 58

SUMMARY
Layout of the Capsule and Seating Arrangement

18
sq ft/ person
0.05
person/ sq ft



Seaplane-Short Solent
Capacity :
Seates : 34

8
sq ft/ person
0.125
person/ sq ft

Amsterdam Canal Cruise
Capacity :
Seates : 50

17
sq ft/ person
0.05
person/ sq ft

EuroCity Experess Train
Capacity :
Seates : 69

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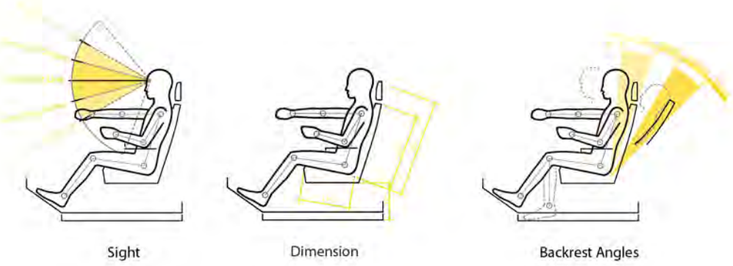
Criticial factors in human scale



The whole journey

Fig 18

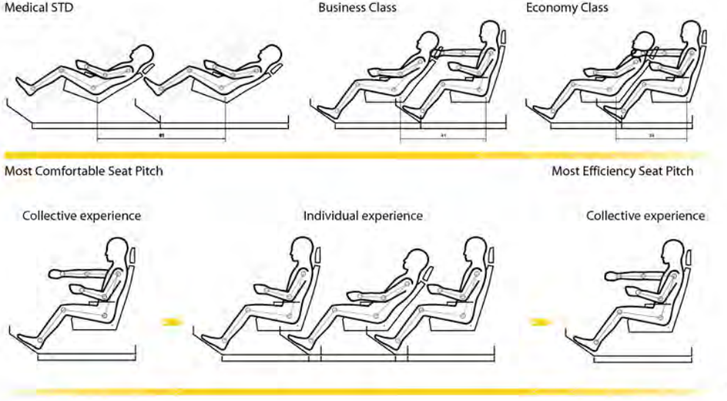
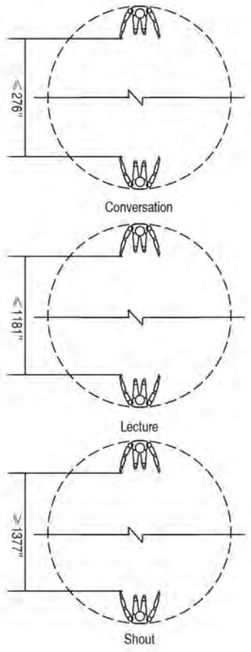
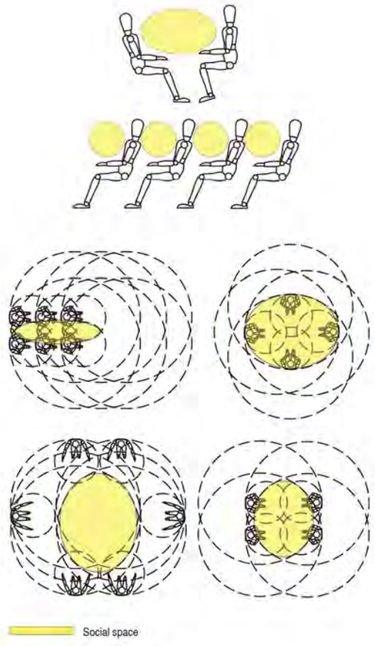


Fig 19

AUDITORY DISTANCE



SOCIAL SPACE IN VEHICLES



SPACE EXPERIENCE

Human emotion is always important while making a design, it could be influented by so many factors like dimension, environment, user experience, etc. It is widely accepted that different spaces could generate specific feelings. Here we are going to research the influence of space and distance to human emotion. As we have already studied the relationship between human and space in dimension aspect, it would be possible for us to view a single person as a bubble and combine several bubbles in different patterns to find out the most appropriate function for different area.

DESIGN FACTORS

SEATING ARRANGEMENT
Flexible Seating Arrangement

Flexible arrangement

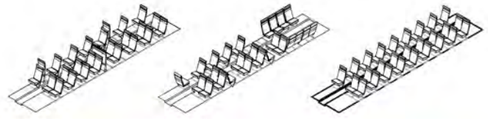
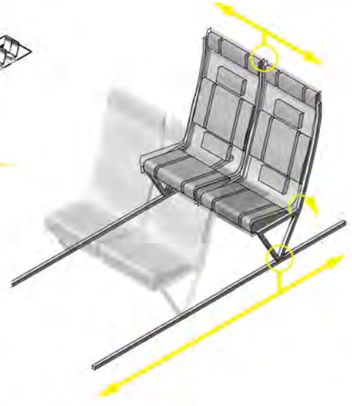


Fig 20

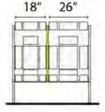


Ergonomic Sensor

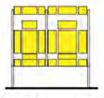
Personal Control

Speed Report

Ticket System



Adjustable seat wide



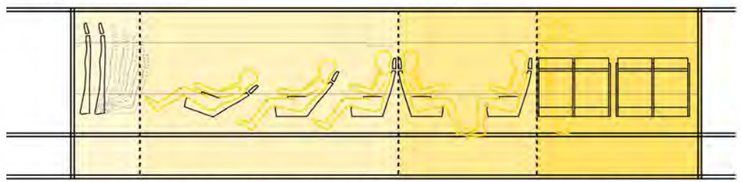
Adjustable seat support

Adjustable pitch and stacker

Flexible material

Stack while not passenger

Boarding with friends



Different seat pitch with different seating position

Boarding as large group

CAPSULE DIMENSION
Capsule Dimension Based On Seating Arrangement

Crowded — Spacious

5 sq.ft/person
Airplane average

6.8 sq.ft/person
Amtrak Coach

6.5 sq.ft/person
Coach average

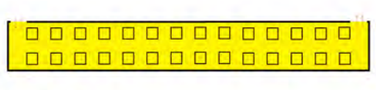
12.5 sq.ft/person
Airplane first class average

Avaliable Space	5.8 sq.ft/person	5.6	5.1	6.8	7.6	11	6
Passanger Numbers	28	27	28	27	28	28	28
Seat Arrangement	2 rows	3	4	3	3	3	4
Interior Material	779 sq. ft.	518	508	653	726	1089	508
Exterior Material	215 cu. ft.	249	283	363	400	606	283
Length	42 ft	27	21	27	30	45	21
Diameter	6.3 ft	7	8	8	8	8	9

DOORS

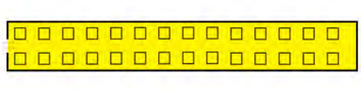
STRATEGY 1

BOARDING TIME: max 20s
LOADING PLACE: head and bottom LOADING TIME: 10~70s
TOTAL TIME: max 90s



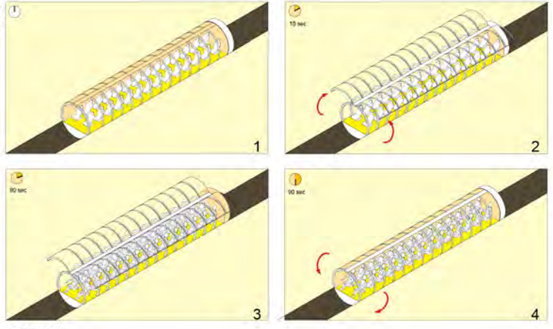
STRATEGY 2

BOARDING TIME: max 40s
LOADING PLACE: head and bottom LOADING TIME: 10~70s
TOTAL TIME: max 120s

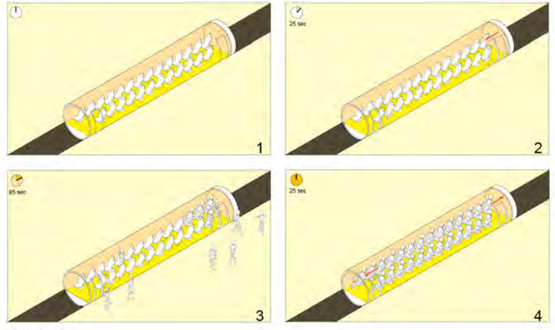


STRATEGY 3

BOARDING TIME: max 80s
LOADING PLACE: head and bottom LOADING TIME: 10~70s
TOTAL TIME: max 160s



STRATEGY 1



STRATEGY 2

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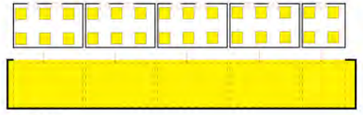
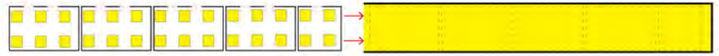
BUBBLES



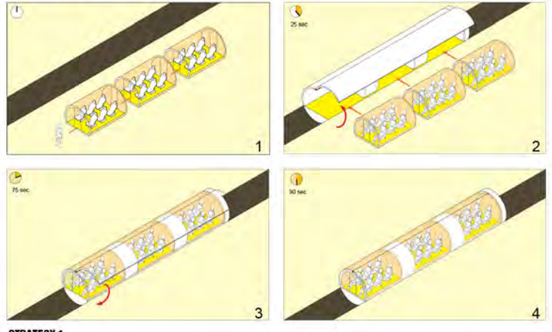
STRATEGY 1

BOARDING TIME: max 25s
LOADING PLACE: carrier
SLIDE-IN TIME: 65s
TOTAL TIME: 90s

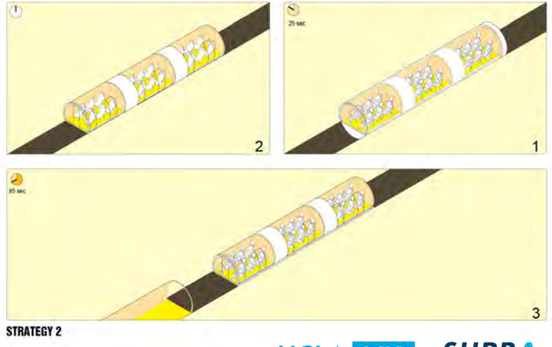


STRATEGY 2

BOARDING TIME: max 25s
LOADING PLACE: carrier
SLIDE-IN TIME: +60s
TOTAL TIME: 85s



STRATEGY 1



STRATEGY 2

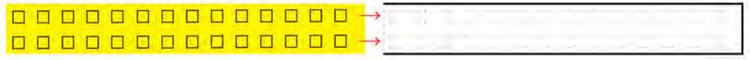
UCLA A.U.D ARCHITECTURE & URBAN DESIGN SUPRA. STUDIO

BOARDING STRATEGY
Doors, Slide-in Seats and Bubbles

SLIDE-IN SEATS

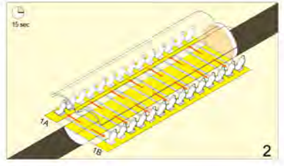
STRATEGY 1

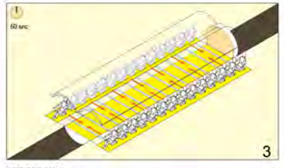
BOARDING TIME: 75s
LOADING PLACE: carrier
TOTAL TIME: 75s



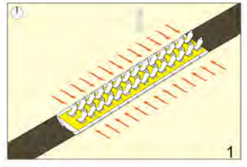
STRATEGY 2

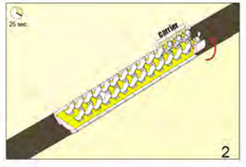
BOARDING TIME: 25s
LOADING PLACE: carrier
SLIDE-IN TIME: +60s
TOTAL TIME: 85s

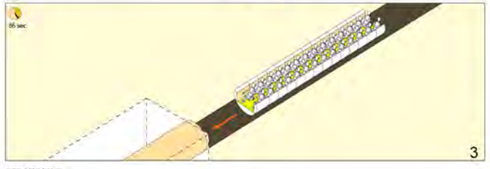




STRATEGY 1







STRATEGY 2

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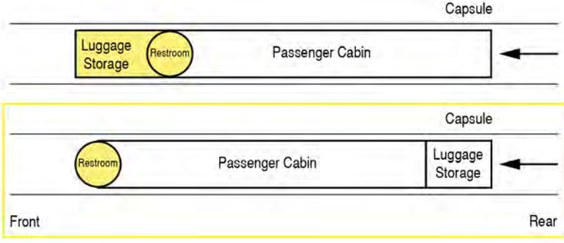
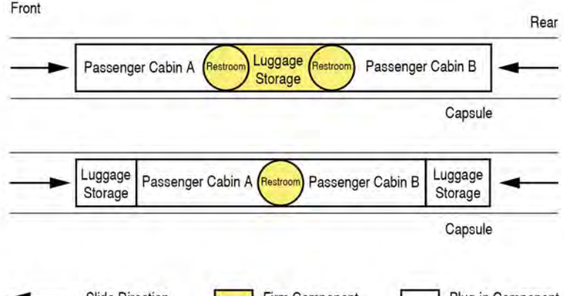
COMPARTMENT ARRANGEMENT
Loading Sequence

UNIDIRECTION ENTRY

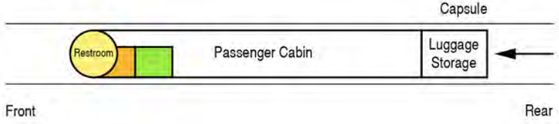


BIDIRECTION ENTRY

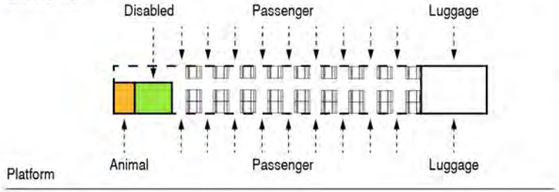


Slide Direction | Firm Component | Plug-in Component

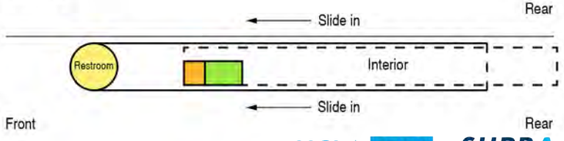
INFRASTRUCTURE



BOARDING



LOADING



Disabled | Pet Compartment | Boarding Direction

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PASSENGER INTERFACE
To Realize A Human-oriented Passenger Interface

DUE TO THE SITA PASSENGER SELF-SERVICE SURVEY 2012

80%
of passengers aged between 18-24 use social media.

31%
of passengers find security the most stressful part of the passenger journey.

44%
of passengers are stressed due to concerns over loss of time.

WHAT DO PASSENGERS WANT ?

In today's mobile connected world, passengers demand the same comforts in the Hyperloop as they do at home or the office.

Fig 21

FEATURES OF INTERFACE

Virtual Office

Entertainment

Security

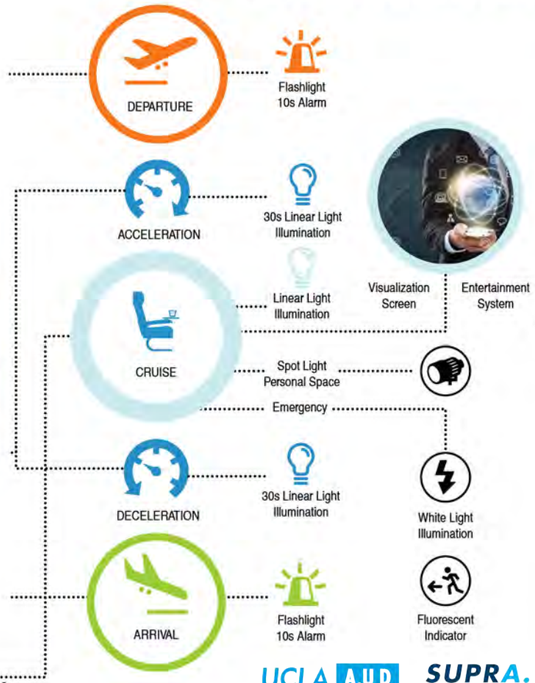
FEATURES OF INTERFACE

Passengers are presented with a variety of choices in Hyperloop Capsule. From controlling lighting and temperature to experiencing advanced information, entertainment and management functionalities, you will decide what happens in your journey and have a fulfilled time and a wonderful experience.

1. Wide variety of entertainment and information choices:
   DVD, CD MP3, TV and Radio
2. Full digital Audio and Video distribution
3. Vertual office features
4. Flexible configuration
5. Interactive moving map
6. Touchscreen control of all system capabilities

LIGHT AND ILLUMINATION
Color Emotion And Illumination System

Fig 22



SOUND
Sound Design Strategy

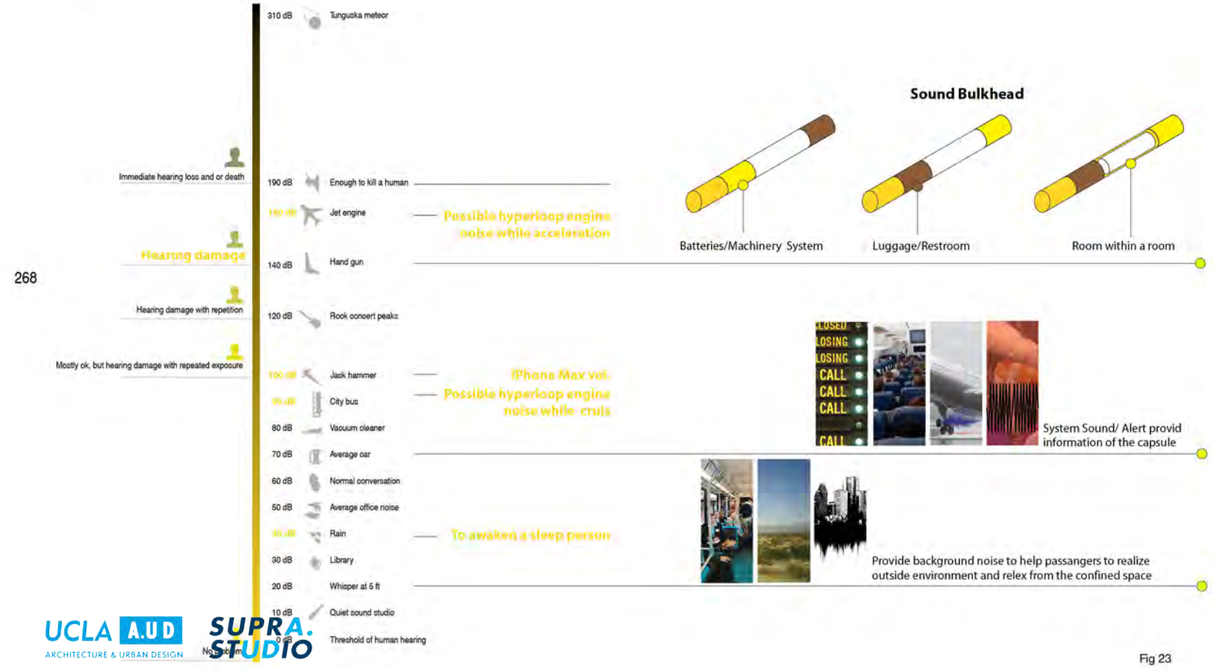


Fig 23

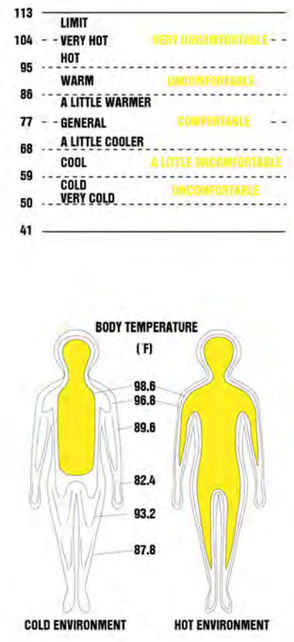
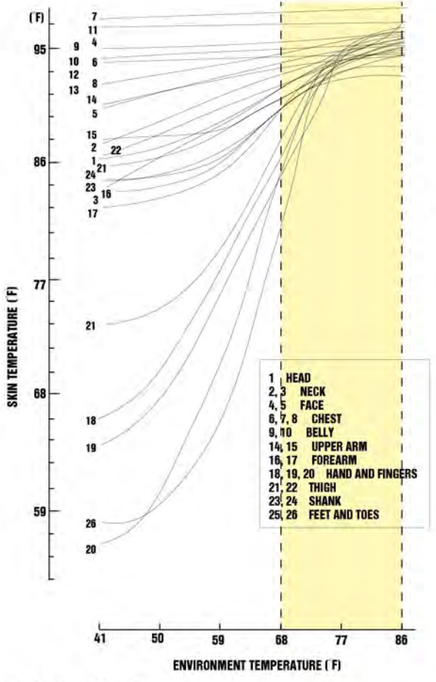
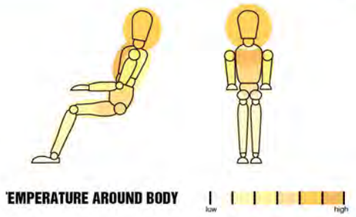


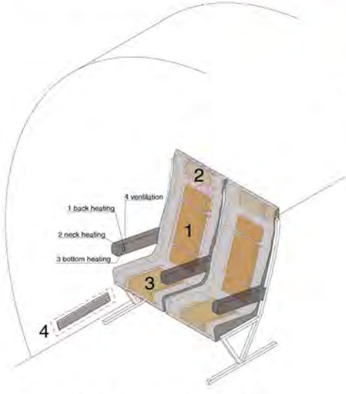
Fig 24

TEMPERATURE
Basic Statistics of Temperature



SKIN TEMPERATURE



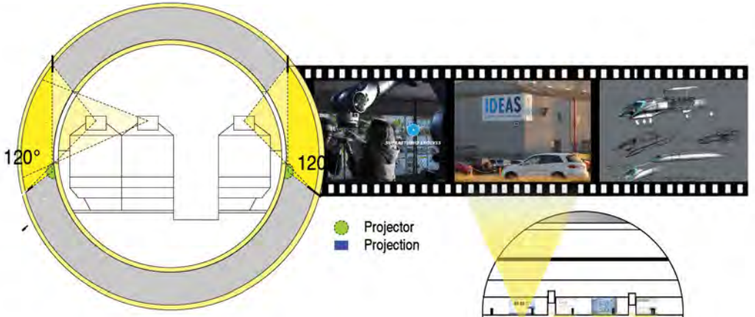


TEMPERATURE ADJUSTMENT ON SEAT

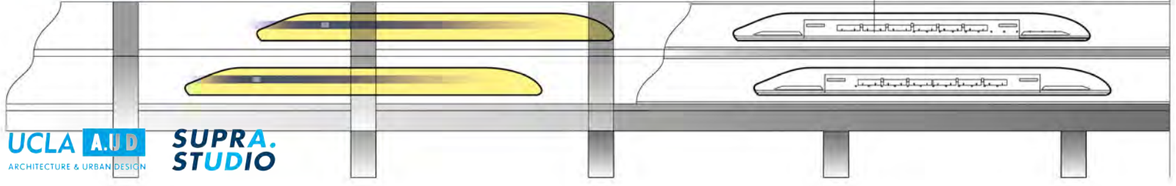
Moving Projector

The moving screen proposal has projectors mounted outside each window. Several linear projection screens would be installed on the tube correspondingly. With the moving projector, visual image would keep pace with passengers. This proposal reduces huge cost on installing screens along the tube.

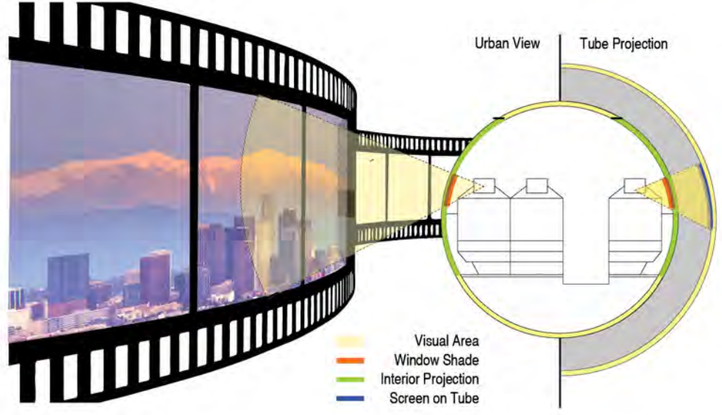
Fig 25



Projectors mounted on the capsule



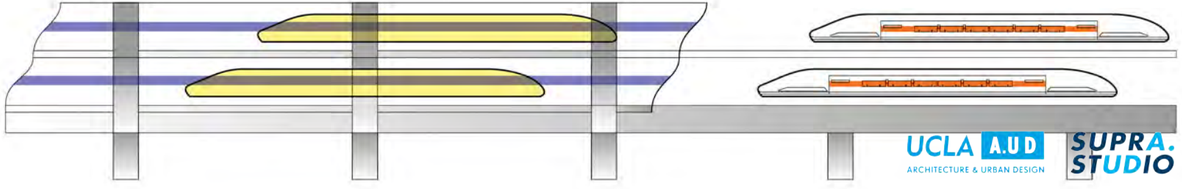
A Transparent Capsule Without Camera



With the no camera proposal, two layers of screen are installed in the system. Interior screen on both wall would display notification, travel information and public service advertisement. Screen mounted on the tube follows the speed of the capsule. It could be seen only when the window shelter is lift up, which would protect individual privacy. Passengers could watch their own video, or attach their personal device to the screen.

When the capsule is operating in urban area, window shelter would allow passengers to admire cityscape and experience speed change.

Fig 26



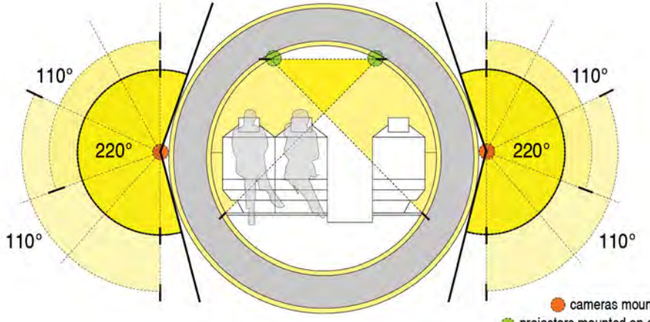
A Transparent Capsule Without Windows

The Hyperloop has cameras mounted on the tube to capture a full 360 degree view, and then project that on the inside of the capsule walls and ceilings covered by flexible screens.

The Hyperloop could also enable passengers to display any panoramic views on the screen. Themes are also adjustable, which would allow different scenes to be changed: a 360-degree view of city, a lush forest or even a trip in space etc.

Removing windows has its engineering advantages. It would reduce the weight of the Capsule, thus lower costs.

Fig 27

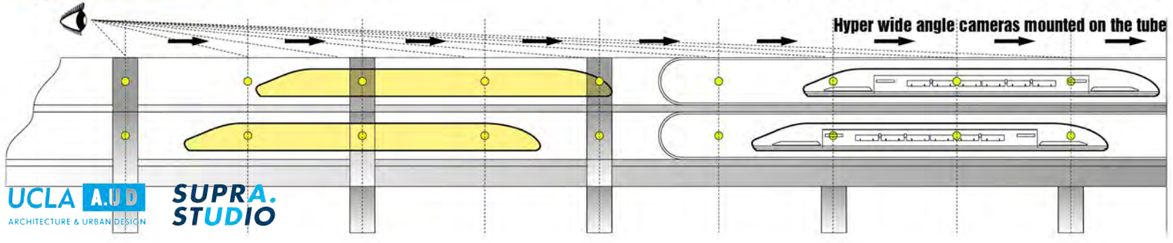


cameras mounted on tube
projectors mounted on capsule wall

Hyper wide camera visual angle range

With camera rotation, passengers can capture a 220° one side view and a 360° whole view of city.

Hyper wide angle cameras mounted on the tube



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A Transparent Capsule Without Windows-Individual projection

Fig 28

projectors mounted on capsule wall

Windowless capsule design strategy

Passengers can interact with the capsule, using their iPad, phone, laptop, etc.

Fig 13

When these device connect with the capsule via wireless, just simply drag the image, game, movie, music onto the wall, then they will be projected.

Passengers can actually interact with these projected images. There are a set of cameras track the fingers on the projected image. The tracking will be quite accurate, with similar performance to an iPad touch interface.

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VISUALIZATION
To Realize A Virtual Visual Environment-Windows vs. Windowless

A Transparent Capsule Without Windows-Collective Projection

fg 1. Capsule without illumination and visual Environment

fg 3. Real Moving Scene

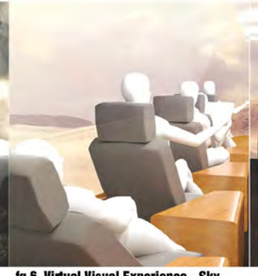
fg 5. Virtual Visual Experience - Ocean

fg 7. Virtual Visual Experience - Universe

fg 9. Virtual Visual Experience - Snow Mountain

fg 2. Capsule with illumination

fg 4. Virtual Visual Experience - Forest



fg 6. Virtual Visual Experience - Sky

fg 6. Virtual Visual Experience - Desert

fg 10. Virtual Visual Experience - Movie

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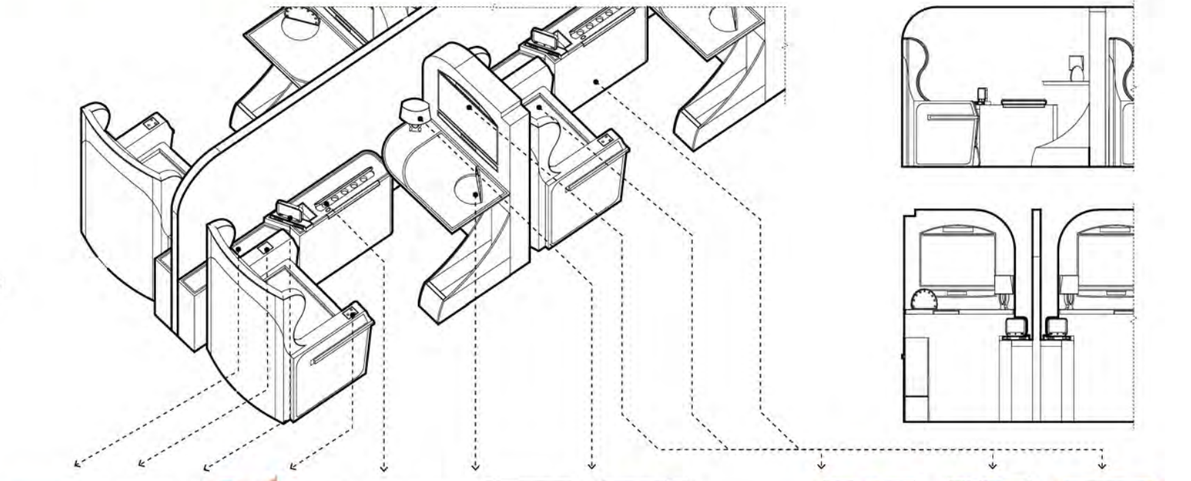
PASSENGER INTERFACE
To Realize A Human-oriented Passenger Interface



Book, Magazine, bag, trash space

Calling, Seat control panel

Moving Map Tablet Mount Dock

Membrane Switch Panels, reading/table light, thermal control,

headsets, HDMI and USB devices, Ethernet sources and bluetooth devices.

HD Galley Control Panel, easy access to all cabin functions

table light and overhead light

Scroll Wheel and table light

HD Widescreen LCD

Blu-ray and DVD Player

Folding board for meal

Space for working

Fig 30

THE FUTURE PASSENGER INTERFACE
Proposals For The Hyperloop Capsule Interface

Fig 31

SELF-ADJUSTING SEAT
-Universal Comfort

The Hyperloop seat:
A combination of material, function and styling.

- Adaptation to body sizes
- Adjustment feature reclines according to body weight and locks into the appropriate position.
- Form illustrates the function and stays honest to each materials purpose.

SMART ENERGY

The body heat will be collected by seat or pod as passengers relax or sleep, and combined with other energy sources, to fuel capsule appliances.

ECOLOGICAL & SELF-RELIANT MATERIALS

Materials will be self-cleaning. Coatings are used on the surfaces of bathrooms and will be found on the fabric of seats and the carpets.

These intelligent materials could also be self-repairing, which is already used today in surface protection. Certain paints can seal a scratch by themselves, just as the human skin does.

INTERACTIVE

Scenes showing the destination, a city skyline or a tropical forest, will be projected onto the walls viewed from 360 degrees by introducing the holographic technology.

The operation will be enhanced by the interactive touch-screen panel. Passengers operation is quick, simple and intuitive.

MORPHING

Materials that change shape and return to their initial form, growing like the leaves of a plant, are a very real possibility. Morphing materials might be metals or polymers that have a 'memory', or are covered with a 'skin' that will instigate a shape change. A memory is created using sensor and activator systems that give materials a certain level of artificial intelligence, allowing them to adapt to the passengers' needs.

PANAROMATIC VIEW

The Hyperloop Capsule will provide passengers a panaromatic view of the moving world.
- Passengers can see the outside view from the one side vision glass when the capsule is moving in a lower speed during the acceleration or deceleration.
- And the max digital media will project a high quality full 360 degree navigable virtual tour images which allows the user to experience the journey as if

ENTERTAINMENT FOR A

In the future, technology and virtual reality will be seamlessly integrated with our normal lives, services will be individually tailored and environmental needs will be addressed in everything that we do. All of which will be just as true in the air as it is on the ground.

Intuitive technology will allow passengers to access all flight, destination and environmental information at the wave of a hand. Pop-up pods will offer more private spaces that can be used for anything from virtual business meetings or lectures to a romantic meal or reading a bedtime story to the kids back home, with global connectivity and holographic projection [illegible] A virtual shopping mall will provide [illegible] on to passengers and the virtual gaming wall will let tennis, baseball and even golf fans get in a bit

Evacuration Programing

EMERGENCY SITUATION

Accident Happen/Hyperloop Stopped
0 mile

briefing of passengers

Most emergencies can be managed without taking passengers off of the capsule, but sometimes an evacuation is necessary. In the following situation, a full capsule evacuation might be necessary.

Mechanism Factors
- Engine/Power/Pressure Failure
- Tube/Capsule Structural Damage
- Collision/Explosion

Huamn Factors
- Fire

Natural Factors
- Hurricane/Wind
- Seismic Power
- Ice
- Tsunamis/Flood
- Lighning

Attacking
Medical
Control Error

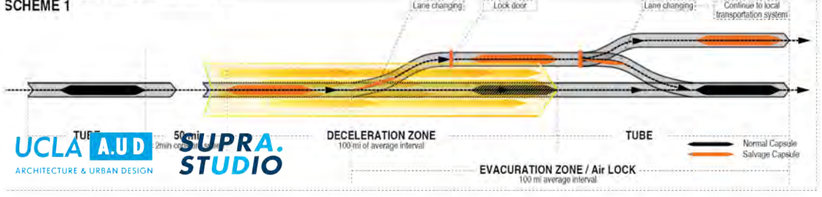
Accident Happen

Deceleration Starts
0-100 miles

landing of deployed wheels

Three Types Of Tube Evacuation

SCHEME 1



EVACUATION PROCESS

STEP 1 Follow the instruction

Listen for announcements and follow the instructions from authorized personnel.

Remain on the seat if possible

IF NOT,

STEP 2 Remain inside the car Or Go to an unaffected car

Remain inside the car if possible. If not,

Go to the next car through end or front doors.

STEP 3 Stay firm and wait for capsule stop.

Deployable wheels start landing while capsule slow down to a speed under 100 mph.

Do not release the seatbelts if possible. If not, Stay firm while holding the arm rails. Wait for capsule stop.

Decelerated
0-100 miles

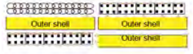
powerd by small onboard electric motors

Arriving at emergency station
100 miles

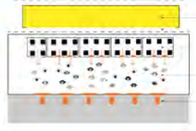
passengers evacuration prepared

STEP 4 Arriving at emergency station

Capsule goes into the emergency tube and stops at one of the emergency stations. Capsule disassembly work starts.



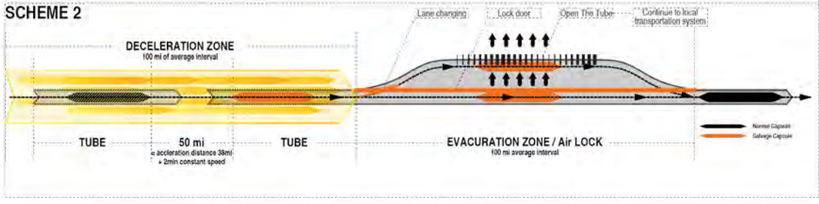
STEP 5 Passengers unloading



When arriving at the station, crew members will provide specific instructions.

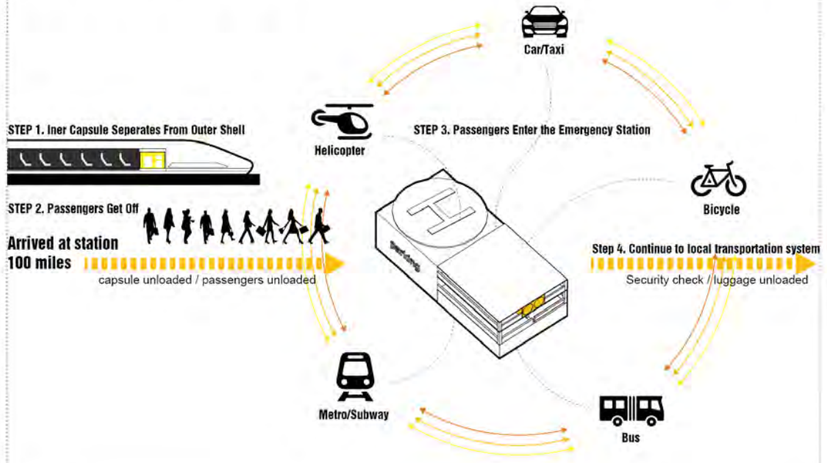
Follow the instruction and get off the capsule.

SCHEME 2

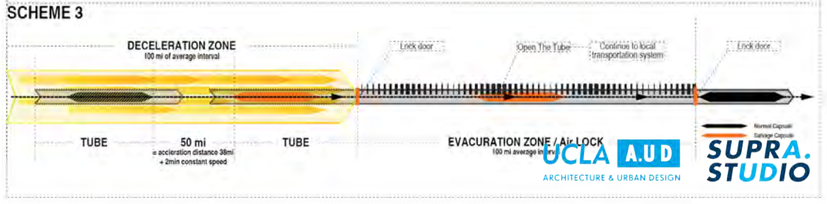


PASSENGER EVACUATION
To Realize An Efficient Evacuation System

CONECTION WITH EMERGENCY STATION



SCHEME 3



DESIGN STRATEGIES BASED ON TIME
Passenger Experience During The Journey

ACTIVITY SEATING

LIGHTING SOUND TEMPRATURE ENTERTAINMENT

Station

Boarding 00:00

Environment

Entertainment

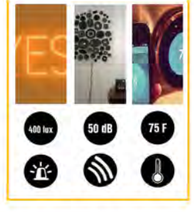
While boarding, there will be orange colored illumination in the capsule to make people relaxed and focused, which makes the boarding process more efficient as well as avoid being nervous. Instruction broadcast will be released by station. Seats will lower to help passengers boarding into capsule.

Loading 01:00

Environment

Entertainment

When passengers loading into capsule, there will be orange colored illumination to make people relaxed and focused. The capsule's broadcast system will remind passengers to be careful with relax music.



Urban Route

200 mph 02:00

Environment

Entertainment

During the low speed cruise in the Urban, there will be natural light introduced into the capsule. Passengers can decide what they want to listen through the individual entertainment system. Passengers are allow to change their seating angle to find the most comfortable seating position.

Intercity Route

Acceleration 12:30

Environment

Entertainment

When acceleration begins, Capsule enter the tube, at the same time, there will be flash light flashes several times and instruction follows. The system light turns blue. The sound-proof system starts working. Individual entertainments will be paused.

760 mph 13:04

Environment

Entertainment

The capsule during the high speed intercity cruise will have systematic artificial day-light as well as individually preferred light effect, all kinds of activities will be activated at this period. Passengers can decide what they want to listen through the individual entertainment system.

The capsule could let passengers to pick any panoramic view to be displayed. Passengers can adjust the theme and change to any scene through the interactive interface (touchscreens, laptop, phone, pad, etc.): a 360-degree view of city, a lush forest or even a trip in space etc.

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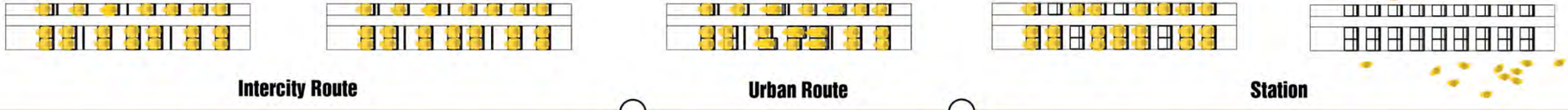
DESIGN STRATEGIES BASED ON TIME
Passenger Experience During The Journey



Intercity Route

Urban Route

Station

ACTIVITY

SEATING

Emergency

Environment

Entertainment

When emergency issues happen, the light turns light blue, people would keep calm and follow the instruction. The emergency broadcast system starts working. Passengers will hear the instructions and system sound. Individual entertainments will be stopped

760 mph 13:04

Environment

Entertainment

When acceleration begins, Capsule enter the tube, at the same time, there will be flash light flashes several times and instruction follows. The system light turns blue. The sound-proof system starts working. Individual entertainments will be paused.

Deceleration 22:38

Environment

Entertainment

During the low speed cruise in the Urban, there will be natural light introduced into the capsule. Passengers can decide what they want to listen through the individual entertainment system. Passengers are allow to change their seating angle to find the most comfortable seating position.

200 mph 28:38

Environment

Entertainment

When unloading, there will be orange colored illumination to make people relaxed and focused. The capsule's broadcast system will remind passengers to be careful with relax music.

Unloading 29:38

Environment

Entertainment

While arrival, there will be orange colored illumination in the capsule to make people relaxed and focused, which makes the process more efficient as well as avoid being nervous. Instruction broadcast will be released by station. Seats will lower to help passengers take out off capsule.

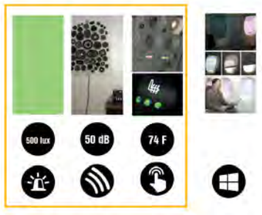
Arrival 30:38

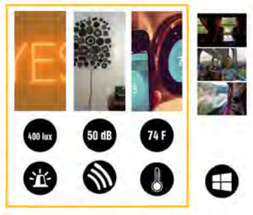
LIGHTING

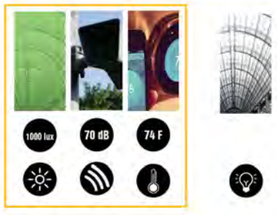
SOUND

TEMPRATURE

ENTERTAINMENT







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FULL SCALE MOCK UP

The full scale mockup will operate as a tool to study interior and exterior spaces immediately within and around the hyperloop capsule. Advanced composite materials along with varying metals will be implemented when constructing the final capsule design, however, this test mockup tool was built with wood for cost effectiveness and speed of fabrication. Using CNC milling within the UCLA Suprastudio building, this model was both designed and constructed in less than three weeks. Birch plywood was the chosen material – the same building material Howard Hughes used to build his “Spruce Goose” aircraft between 1942 and 1947 within the confines of our studio in Playa Vista, California.

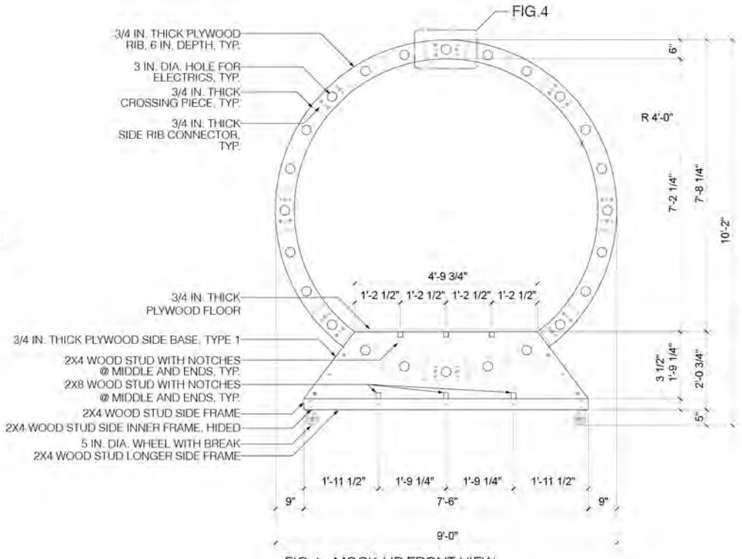


FIG.1 MOCK-UP FRONT VIEW

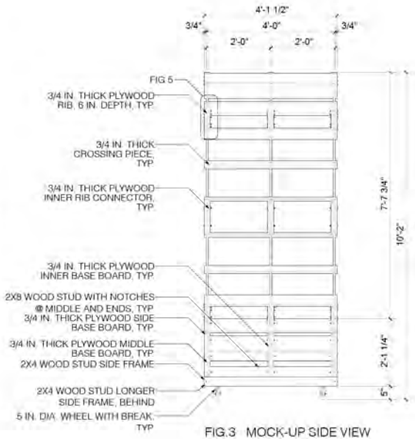


FIG.3 MOCK-UP SIDE VIEW

DIMENSIONS

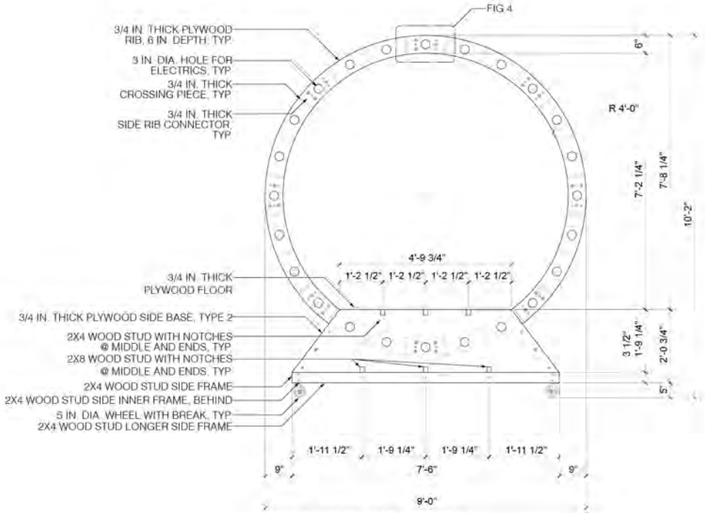


FIG.2 MOCK-UP BACK VIEW

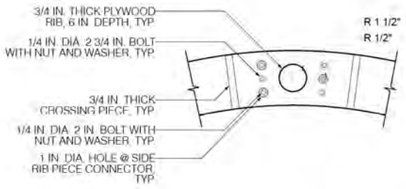


FIG.4 SIDE RIB CONNECTOR DETAIL, TYP.

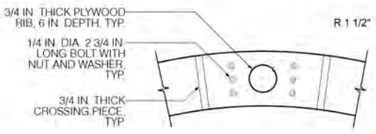
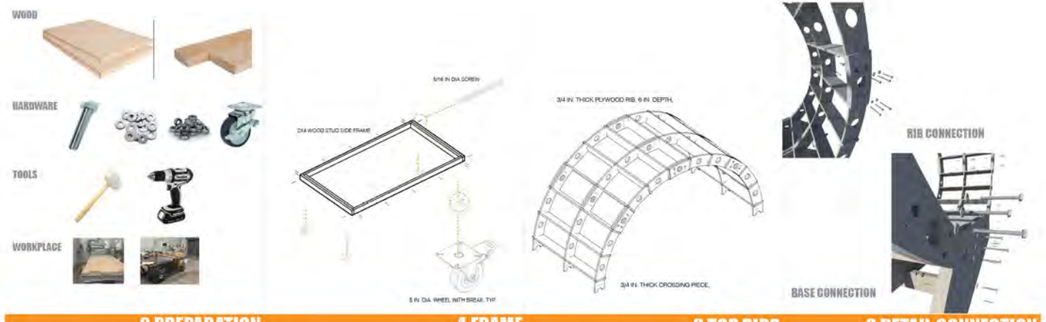
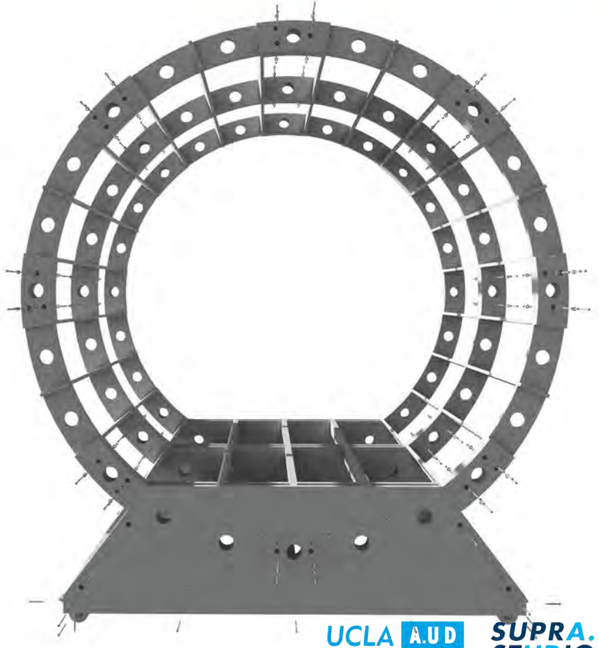
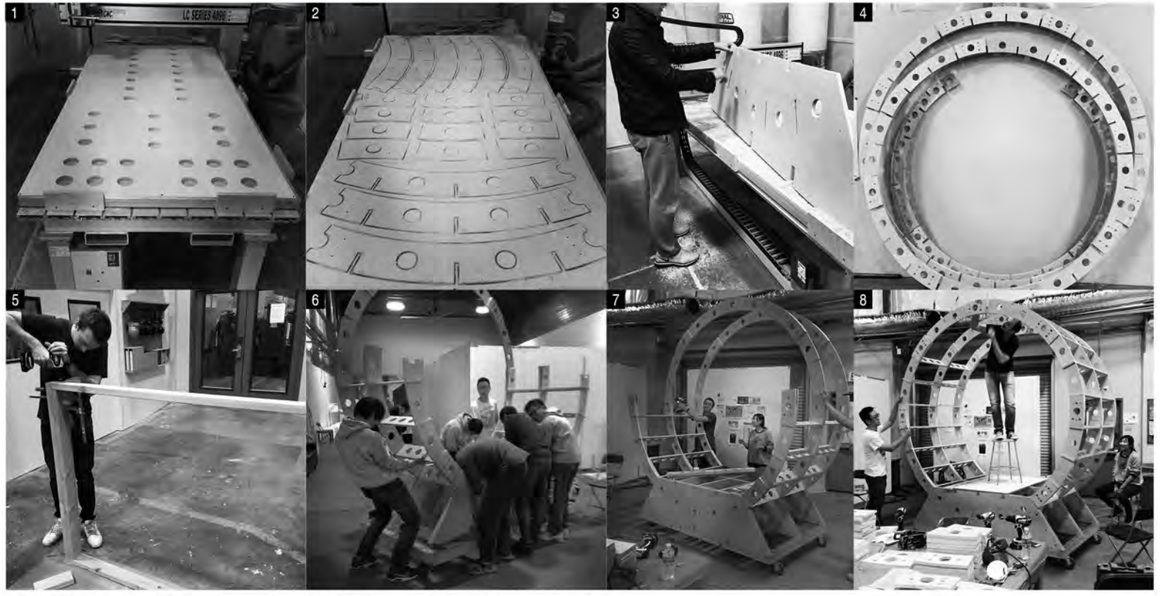


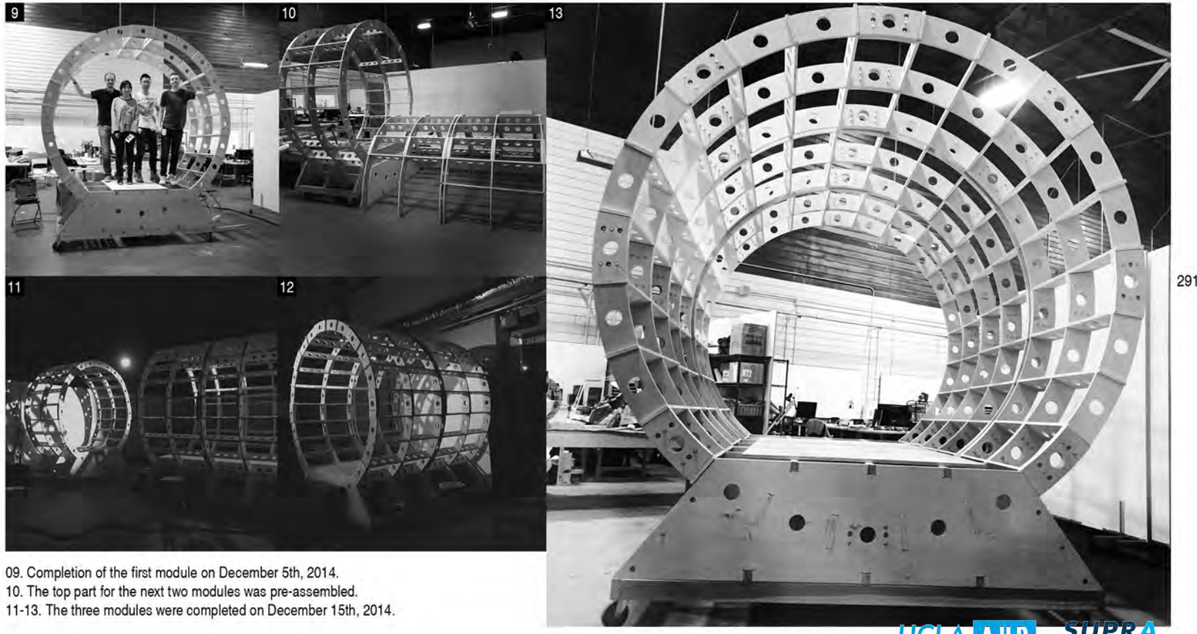
FIG.5 INNER RIB CONNECTOR DETAIL, TYP.


WOOD
HARDWARE
TOOLS
WORKPLACE
2.PREPARATION
1/4 IN DIA SCREW
2X4 WOOD STUD SIDE FRAME
5 IN. DIA. WHEEL WITH BRAK. TYP
4.FRAME
3/4 IN. THICK PLYWOOD RIB, 6 IN. DEPTH.
3/4 IN. THICK CROSSING PIECE.
6.TOP RIBS
RIB CONNECTION
BASE CONNECTION
8.DETAIL CONNECTION
PLYWOOD
X 24
X 48
X 24
X 3
X 6
LUMBER
X 3
X 3
3/4 IN. THICK PLYWOOD SIDE BASE
5.BASE
TOP RIBS
BUTTOM RIBS
FLOOR BEAMS
BASE
FRAME BEAMS
FRAME
7.COMBINE
9.FINISH





1-3. The CNC mill process
4. Variations of the size of the 9 sheet.
5. Assembling the frame for the module base.
6. Fitting the module's base onto the frame.
7. Bolting the rib pieces onto the first module's base.
8. Placing the cross pieces that connect the three rings.



09. Completion of the first module on December 5th, 2014.
10. The top part for the next two modules was pre-assembled.
11-13. The three modules were completed on December 15th, 2014.

LECTURES & ACTIVITIES

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HYPERLOOP SUPRASTUDIO KICK OFF

HYPERLOOP SUPRASTUDIO is excited and welcomed Jon Christianson from UCLA Institute of the Environment and Sustainability, to give a lecture on spacial history and his view on high speed transportation as a historian. We had a discussion on what the Hyperloop idea might do to our history and future, and the viability of land along the route.

LECTURE BY SYD MEAD

Sy Mead presented the HYPERLOOP SUPASTUDIO with an impressive lecture in the robotic laboratory through showing examples of his drawings, sketches, and renderings from the early 70's until the present. His elaborate drawing style of machinery provided an opportunity to explore a wonderland of fantasy and imagination. Through Mead sharing his design experience with the studio he also expressed his anticipation and interest in the work the studio was conducting on the Hyperloop.

FIRST MOCK-UP

First mock-up was launched and ideas on tubes and capsule were proposed as draft models. Hyper-tubes would work as a transmission device that establish around studio as study model for Hyperloop, while 8 teams of capsules started from skeleton study which could lead to full scale studio model.

FIRST TUBE TEST

The studio built the first test vacuum tube on Wednesday! The experiment was really exciting. Together with instructors Marta Nowak and David Ross, we picked up used-materials and applied them directly to the tube. Samples were 'shot' from by air-pressure, which ranged from foam to cans.

LECTURE BY DAN STURGES

Dan Sturges, an ambitious creative entrepreneur, gave the Hyperloop SUPRASTUDIO an inspiring lecture on Halloween.He focused on 'last mile' and explained his concentration on how small, individual vehicles could change people's life. We had a heated discussion on the infinite possibilities of shared transportation system, especially its impact on changing people's behavior.

MID-REVIEW WITH DIRK AHLBORN

Dirk Ahlborn, CEO at JumpStarter Inc and Hyperloop Transportation Technologies Inc. (HTT), attended our fall quarter midterm review on Monday. During the presentation, each team reported productive results through previous research on capsule, station, urban, and route. A preliminary publication demonstrating our efforts last month was published.

ART CENTER OF DESIGN

The Hyperloop SUPRASTUDIO went on an inspiring field trip to Art Center College of Design in Pasadena on Wednesday. Geoff Wardle, associate chair of Art Center College of Design, showed us the studio around the transportation department.

CAPSULE MOCK UP PRODUCTION

The mock-up group completed their first piece of work, a 10 ft diameter capsule skeleton, which is designed for intensive study. Two more similar structures would be produced and assembled together in the following three weeks. We The studio expects to see further progress from the mock-up team.

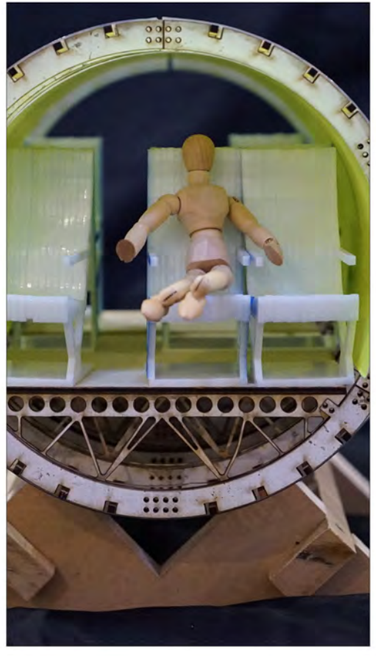
LA AUTO SHOW

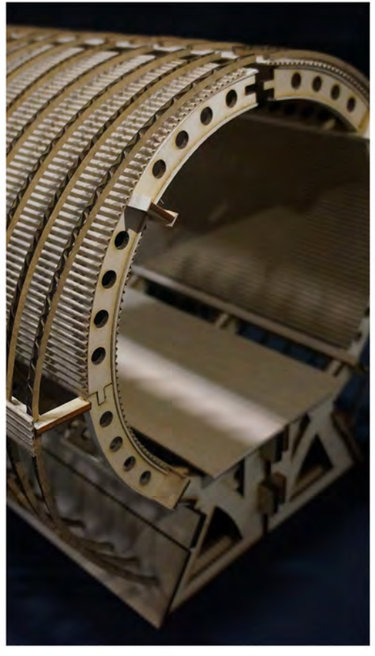
After Tech Seminar review in the morning, the Hyperloop studio visited the L.A. Auto Show held in at the Convention Center in downtown L.A. The aim of this field trip is was to learn more about industrial design from examining precedences that might inspire the capsule design process.

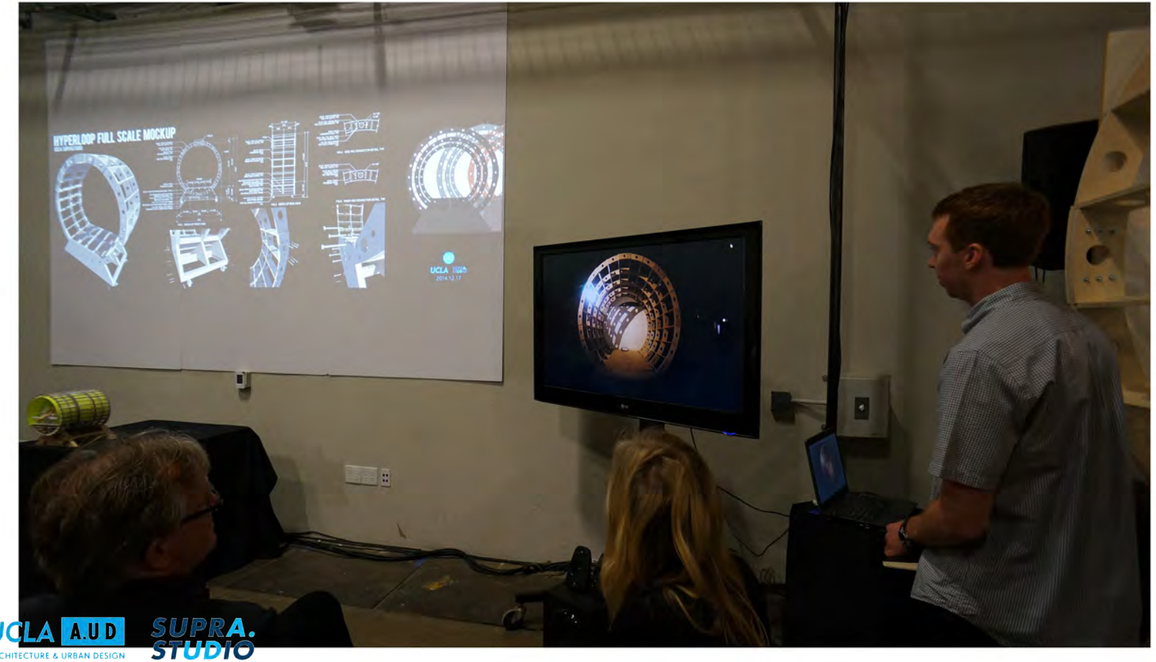
MOCK UP PRODUCTION

The first module of full-scale capsule is built up today! The 8-feet-diameter unit only took team mock-up 4 hours to assemble. Pieces of plywood were pre-fabricated by CNC machine, which led to highly accurate manufacture. The complete of first module proves the success of structure,material, as well as the way pieces were connected.

MOCK UP COMPLETE






HYPERLOOP FULL SCALE MOCKUP

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Photomechanical Print from " Prune Country Railroading: Steel Trails to San José" by Norman W. Holmes.
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1961 artist's rendering of LAX's Theme Building, designed by architect William Pereira. Courtesy of the California Historical Society Collection, USC Libraries.
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Fig 12&13
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