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Lecturer, UCLA

David Ross
Lecturer, UCLA

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

Special thanks:
Dirk Ahlbom,
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 Slagges, Transport designer
Gadde Wadde, Director of Advanced Mobility Research, Art Center College of Design, Pasadena
Joe Christianson, Adjunct Assistant Professor, UCLA Institute of the Environment and Sustainability
Martha Welborne, Chief Planning Officer, Los Angeles County Metropolitan Transportation Authority
Ryad Mead, Neofuturistic Concept Artist
John Kaliski, John Kaliski Architects
Michael Metcalfe, MetaLIFE Associates
Jesse Rivera, SpaceX
What is the Hyperloop?

Hyperloop is a unique transportation technology based on pneumatic tubes and transport pods that promise to provide ultra-speed, 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 operating to unprecedented standards of safety, security checks, and distancing 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 involving 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.

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 systems for the future.

SUPRASTUDIO

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 system.

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

SUPRASTUDIO 2014-15 is part of A.U.C.'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, is the dramatic setting for the Hyperloop concept. The Spruce Goose can have massive cost and material impacts when extended throughout the system. This method enables the team to evaluate various hypotheses and ideas to share understanding of the limits and potentials of the concept. They have not yet decided what they do next except to keep on making progress. The winter quarter 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 basis, the students will experiment with various seating and storage layouts to achieve maximum comfort, convenience and efficiency. These layouts will serve 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 lighting. The research will develop a conceptual framework of all of which can be tested within the quarter's expanded station model.

Refined concepts for the station, including operational designs will be developed in this quarter. Advanced ideas for security checks, baggage handling, and "fast mile" transportation will be choreographed to achieve a seamless experience, wherein the environment of the station is seamless, security checks, and distancing 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 involving 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.

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 AHILBORN

Dirk is the CEO and co-founder of JumpStartFund, an online crowdfunding platform for entrepreneurial projects. He is also the CEO of Hyperloop Transportation Technologies, a project incubated using JumpstartFund’s crowdfunding 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 JUMPSFARTFUN

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 crowdfunding 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 existed. Founding members have been part of the Gisvan 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.jumpsfartfund.com.

STUDENTS INCLUDE:

Shuangao Hu, Jiafeng Hong, Xiaoyuan Li, Chashua Chu, Piyang Hou, Christos Kyriakous, Jie Li, Jieliang Chen, Shini Kumar, Hamwong Liu, Dianfeng Chen, Hui Feng, Yifan Zheng, Suhua Wang, Xiaoxiang Zeng, Yafei Zhang, Weizhong Zhang, Shiyuan Zhang, Mingrui Carpio, Guiyue Wang, Yuyan Zhou, Zeyan Ayu Unal, Matt Wilkham, Kai Qian, Shijie Zheng

UCLA ARCHITECTURE AND URBAN DESIGN

UCLA Architecture and Urban Design (A.U.D) 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 scales, the studio overlaps 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.
**Modes of Transportation:**
- **Ancient Road**

**Year:**
- 202 BC – 6 AD

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

**Effects and Results:**
Trade activities along the Silk Road over many centuries facilitated the transmission not just of goods but also ideas and cultures, notably in the area of religions. Daoism, 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:** (in miles)
- **4000**

**Time:** (Minutes/Hours/Day)
- **90**

**Load:** (in Tonnes)
- **Cargo: 0.21**
- **People: 8**

**Cost:** (Dollars/Week)
- **Past: 0.1**
- **Now: 12**
**Route 66**

**Coast to Coast:**

1926-1933: Route 66 is designated.
1933-1945: Route 66 is expanded.
1945-1948: Route 66 is extended.
1956: Route 66 is renumbered to Interstate 40.
1965: Route 66 is abandoned.
1989: Route 66 is restored.

**Causes:**
- Economic growth in the mid-20th century.
- The need for a new highway to connect the east and west coasts.
- The desire to improve travel times and distances.
- The availability of federal funding.

**Effects:**
- The development of new industries along Route 66.
- The growth of small towns along the route.
- The decline of small towns as populations moved to the cities.
- The impact on the environment.

**Analysis of Population Growth 1926-1933**

- Route 66 passed through small towns in the U.S., which were experiencing population growth.
- The route helped to connect these small towns with larger cities.
- The route was instrumental in the development of new industries and economic growth.

**Roadside Attractions**

- Route 66 was known for its roadside attractions, which were a key part of its appeal.
- These attractions included diners, service stations, and gas stations.

**Sections of Route 66**

- Section A: The mountains.
- Section B: The hilly region.
- Section C: The Plains region.
**TRANS-SIBERIAN RAILROAD**

**Time Period:** 1891-1913

**Modes of Transportation:**
- Railroad

**Cause:**
Political and economic. In order to unite the rich and vast lands of Siberia, the Russian Empire worked to build the Trans-Siberian Railroad, which was completed in 1912-1916.

**Effects and Results:**
- Opened Europe to the Pacific, linking the two continents. First transcontinental railroad to span the breadth of Russia.
- Provided safer and faster transportation for people and goods.
- Important for military during the World Wars.
- Stimulated Siberian region by providing economic opportunities and decrease in transportation costs.

**Time Table:**
- Before: 3-6 months
- After: 30 days

**Distance:**
- 5772 miles

**Lead:**
- 100 lbs of freight annually

**Cost:**
- $1,600

**Population Growth of Urban Cities Along Route:**
- Major cities such as Moscow, St. Petersburg, and Vladivostok grew significantly.

**Construction Dates:**
- 1891-1913

**Significant Events:**
- 1891: Construction begins.
- 1912-1916: Completion of the Trans-Siberian Railroad.
**Flight Routes**

**Past Event:**

**Modes of Transportation:**
Flight

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

**Effects and Results:**
Boeing 747-400 flew 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:**
- **Australia**: 11185 miles
- **United Kingdom**: 5400 miles

**Time:**
- **Australia**: 20 hours
- **United Kingdom**: 23 hours

**Load:**
- **Australia**: 315 passengers

**Cost:**
- **First Class**: $1195
- **Business Class**: $1055
- **Economy Class**: $800

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**Future Event:**

**Flying Deck No. 40**
- 24 passengers
- 5600 miles
- 14 hours 46 minutes
- The longest flight by first-class passengers in the world
- Served by Qantas in 1987

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**Timeline:**
- **1989**
  - Boeing 747-400 route
- **1914**
  - Flying Deck No. 40
- **1957**
  - S. Al Shabbah
**PANAMA CANAL**

**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.

<table>
<thead>
<tr>
<th>Distance: (miles)</th>
<th>Time: 8-10</th>
<th>Load: 1000 ships in 1914, 14702 vessels in 2008</th>
<th>Cost: $72.30 per 'TEU'</th>
</tr>
</thead>
</table>

1913
5200 miles
30 days

1954
13000 miles
99 days 8 hours
Airline enplanements (domestic and international) peaked in 2007 and rebounded in 2008 before declining a steady drip. Between 2009 and 2013, domestic enplanements rose 3.4 percent, and international enplanements rose 12.4 percent. In 2012 total enplanements remained 1.4 percent below the 2007 peak, with domestic enplanements down 5.4 percent, while international enplanements were up 9.5 percent.

Annual Airline Passenger Enplanements: 2000-2012

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

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 86.1 percent of flights delayed. Topping the list for the small airports category, with 96.1 percent of flights being delayed in 2012, was Galveston, TX.
SOP OF RESEARCH
Criteria

- Population
- Population Growth
- Public Transport System
- Job Number
- Job Growth
- Ridership
- Tourism
- Proximity to Cities
- Freight

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

- Looking for number of people in each city
- Understanding the change of population by time
- Seeking for opportunity to use public transportation
- Research on the number of the employee in each city
- Looking for job growth data and their percentage
- Understanding the frequency and the number of people using public transportation
- Reseaching on number of international and national tourists for each city
- Calculation of distance and connectivity of cities
- Looking for the frequency and the number of commercial connections among cities

FLIGHT VS HYPERLOOP
Route from Los Angeles to New York
### Rating of Top 50 Populated Cities

<table>
<thead>
<tr>
<th>City Name</th>
<th>Population</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>New York, NY</td>
<td>8.335,997</td>
<td>10</td>
</tr>
<tr>
<td>Los Angeles, CA</td>
<td>3.981,799</td>
<td>10</td>
</tr>
<tr>
<td>Chicago, IL</td>
<td>2.714,890</td>
<td>10</td>
</tr>
<tr>
<td>Houston, TX</td>
<td>2.193,621</td>
<td>10</td>
</tr>
<tr>
<td>Philadelphia, PA</td>
<td>1.547,057</td>
<td>9</td>
</tr>
<tr>
<td>Phoenix, AZ</td>
<td>1.489,750</td>
<td>9</td>
</tr>
<tr>
<td>San Antonio, TX</td>
<td>1.382,931</td>
<td>9</td>
</tr>
<tr>
<td>San Diego, CA</td>
<td>1.339,546</td>
<td>8</td>
</tr>
<tr>
<td>Dallas, TX</td>
<td>1.341,507</td>
<td>8</td>
</tr>
<tr>
<td>San Jose, CA</td>
<td>1,002,765</td>
<td>8</td>
</tr>
<tr>
<td>Austin, TX</td>
<td>942,920</td>
<td>8</td>
</tr>
<tr>
<td>Jacksonville, FL</td>
<td>836,507</td>
<td>7</td>
</tr>
<tr>
<td>Indianapolis, IN</td>
<td>834,582</td>
<td>7</td>
</tr>
<tr>
<td>San Francisco, CA</td>
<td>825,867</td>
<td>7</td>
</tr>
<tr>
<td>Columbus, OH</td>
<td>809,786</td>
<td>7</td>
</tr>
<tr>
<td>Fort Worth, TX</td>
<td>777,992</td>
<td>6</td>
</tr>
<tr>
<td>Charlotte, NC</td>
<td>775,930</td>
<td>6</td>
</tr>
<tr>
<td>Detroit, MI</td>
<td>701,475</td>
<td>6</td>
</tr>
<tr>
<td>El Paso, TX</td>
<td>672,306</td>
<td>6</td>
</tr>
<tr>
<td>Memphis, TN</td>
<td>655,150</td>
<td>6</td>
</tr>
<tr>
<td>Boston, MA</td>
<td>636,479</td>
<td>5</td>
</tr>
<tr>
<td>Seattle, WA</td>
<td>624,355</td>
<td>5</td>
</tr>
<tr>
<td>Denver, CO</td>
<td>624,355</td>
<td>5</td>
</tr>
<tr>
<td>Washington, DC</td>
<td>602,023</td>
<td>5</td>
</tr>
<tr>
<td>Nashville, TN</td>
<td>434,695</td>
<td>4</td>
</tr>
<tr>
<td>Baltimore, MD</td>
<td>621,342</td>
<td>5</td>
</tr>
<tr>
<td>Louisville, KY</td>
<td>600,110</td>
<td>4</td>
</tr>
<tr>
<td>Portland, OR</td>
<td>500,106</td>
<td>4</td>
</tr>
<tr>
<td>Oklahoma City, OK</td>
<td>500,199</td>
<td>4</td>
</tr>
<tr>
<td>Milwaukee, WI</td>
<td>566,916</td>
<td>4</td>
</tr>
<tr>
<td>Las Vegas, NV</td>
<td>596,244</td>
<td>4</td>
</tr>
<tr>
<td>Detroit, MI</td>
<td>589,172</td>
<td>3</td>
</tr>
</tbody>
</table>

### Population Growth

1. Austin, TX
2. Las Vegas, NV
3. Raleigh, NC
4. Houston, TX
5. Phoenix, AZ

### 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
DATA ON DOMESTIC TOURISM

Comparison of Data on Domestic Tourism of Vegas/L.A. S.F. & San Diego

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

LAS VEGAS
Number of Conventional Delegates: 35,000.21
Average Daily Auto Traffic: All Major Highways to Las Vegas: 87,433
Average Daily Auto Traffic: I-15 at NV/CA Border: 35,317 (~40%)

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

LOS ANGELES
Number of Visitors: 25,000.000

SAN DIEGO
Number of Visitors: 20,000.000

% Los Angeles Top 10 Domestic Visitors:
- Las Vegas
- Los Angeles
- San Francisco
- San Diego

% Overweight People in San Diego:
- Las Vegas
- Los Angeles
- San Francisco
- San Diego
Looking into solar farms 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% to 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.
### Comparison of Transport

#### Las Vegas
- **Average Daily Auto Traffic** - 97,423
- **Average Daily Auto Traffic - 1-15 at NVCA Border** - 85,317

#### Time
- **Fights**
  - $160 to $950
- **Driving**
  - $20 fare
- **Shuttle**
  - $80 one way / $120 round trip
- **GoToBus**
  - $20 to $40
- **Megabus**
  - $40 to $225 ($12 if you reserve seat in advance)
- **Greyhound**
  - $45 to $70
- **Amtrak**
  - $60

#### Frequency
- **Non-Stop**
- **Once a day**
- **Every 10 buses/day**
- **Every 10 buses/day**

### Reasons for Fatal Accidents
- **33%** Speeding
- **50%** No Seatbelts
- **25%** Drinking & Driving

### Data on Accidents & Fatalities on 1-15 California-Nevada Corridor
- **1994**: 2000
- **2004**: 2004
- **2014**: 2014

### Costs of Speeding Tickets
- **$400**: >21 mph over speed limit
- **$210**: 1 mph to 20 mph over speed limit
- **$90**: <11 mph over speed limit

### "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.
1. Maximum (90%) percentage of people prefer ground travel while traveling from Southern California to Vegas. Only 4% use air travel.
2. 68% of visitors use their own cars to travel within Vegas and 32% walked.

### Purpose of Visit

- **Vacation/Leisure** 45%
- **Cruise** 20%
- **Group/Charter Trip** 10%
- **Honeymoon** 10%
- **Other** 15%

### Mode of Arrival

- **Ground Travel** 35%
- **Air** 45%

### Frequency of Visits (1 Year)

- **One** 40%
- **Two to Three** 20%
- **Four or More** 40%

### Mode of Local Transportation

- **Car** 30%
- **Taxi** 20%
- **Bus** 10%
- **Walk** 10%
- **Ride-Sharing App** 10%
- **Motorcycle** 5%
- **Other** 5%

---

### Frequency of Departure

- **Weekends**
  - Friday morning - No Friday night
  - Sunday 1:30pm - 4pm

- **Holiday Weekends**
  - L.A. to L.V.
  - L.V. to L.A.

- **Once in 30 sec**
- **Once in 5 min**
- **Once in 10 min**
- **Once in 2 min**

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**Visual Data Comparison**

- **From Los Angeles to Las Vegas**
  - Mon-Thur
  - Fri-Sat
  - Sun

- **From Las Vegas to Los Angeles**
  - Mon-Thur
  - Fri-Sat
  - Sun
STRAIGHT ROUTE
Ideal Straight Route from Los Angeles to Las Vegas

- Distance: 232.4 mi
- Percentage of Land Type:
  - Urban: 43.4\% (10.0\%)
  - Mountain: 29.8\% (10.8\%)
  - Desert: 26.8\% (70.4\%)
- Slope:
  - Max: 10.6\% - 19.9\%
  - Avg: 4.7\% - 5.4\%
- Number of Small Curves: 0
- Speed:
  - Urban/Mountain: 760 mph
  - Desert: 790 mph
- Travel Time: 10 hours
  - Avg Speed: 750 mph

Mountainous Landscape
Desert Landscape
ROUTE STRATEGY 1
Highway System from Los Angeles to Las Vegas

Distance: 201 miles
Percentage of Land Type:
- Urban: 26.8%
- Green: 25.8%
- Desert: 38.9%

Slope:
- Max: 9.2%
- Avg: -2.9%

Number of Small Curves: 3

Speed:
- Urban/Mountain: 50-60 mph
- Desert: 50-70 mph

Travel Time: 3h 30m
- Avg Speed: 65 mph

Urban Los Angeles
Mountainous Landscape
Desert Landscape
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 studio’s primary concern. Mapping multiple criteria of the city, analyzing these criteria and overlapping them are the main concerns to locate the stations in an urban area. This 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.
Also translated as "the royal road" or "the king’s highway" El Camino Real was linked among the stable’s for long distance, paved highways. Dating back to 16th century. The Camino Real was the Spanish military road which went through military bases, missions, and pueblo civilian towns throughout northern and southern California. The road’s actual path (original Los Angeles) was not fixed and changed over time as weather, maps of travel and even the times dictated.

By the late 18th 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. Brevity rather than the so-called royal road usually transport goods and passengers over long distances.

In early 20th century due to the rise of the automobile and people’s passion for tourism, the old Camino Real revived. By the mid-1930s, the highway construction was completed, and in 1932 the state legislature designated much of it as U.S. Highway 101. Today, mission bells continue to guide motorists along the route.
ELECTRIC RAILWAYS: EARLY AGE

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

ELECTRIC RAILWAYS: SPRAWLING

It soon expanded its range since the booming growth of the city Los Angeles. It started to spread to other residential areas of Los Angeles. More railways were built by the previous shawon, especially in the coast area, where all the shipping and labor work located.

/high-res of Pacific Electric Railway
The golden age of electric railway came with the rise of Great Los Angeles. In its peak time, Red Car street car were all over the street. It could be called slapped on the street. Then as the discovery of oil, individual automobiles started to annoy the market. As the 'red car' caused serious traffic congestion on the street, they were finally abandoned. Then came the age of Freeways.
Amour Seco Parkway 1900-1950
1927 Freeway Plan Proposal
While the Amour Seco Parkway was under construction, proposals for a vast system of non-stop arteries of new freeways was underway. Connections between existing cities were drawn and future high-speed connecting pathways were born.

The very first stretch of freeway to be constructed in Los Angeles is the Amour Seco Parkway connection between downtown and Pasadena. Two lanes on either side were conceived – each with one "fast" lane and one "slow" lane for passing vehicles. These two sides were originally different colors.

Although rendered in a utopian vision, new highway projects laid waste to historic neighborhood and cut communities into separate pieces. Ideas of going underground existing structures were never realized, and the repurposings of new freeway projects were never fully thought through. Art Deco bridges connected existing nodes over the park. 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.
Downtown Los Angeles spread in a ‘Y’ formation radially to three major destinations for the people of the city: The coastal 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 20: View of the Santa Monica Pier soon after completion 1916
Fig 21: Organs ‘Guide to Paradise’
Fig 22: Downtown Los Angeles 1926
Fig 23: San Pedro shipping yard
Fig 24: Santa Monica Beach 1926

Map showing the directional expansion of Los Angeles towards the ocean, port, and foothills.
On September 30, 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 1930s and 1940s.

With an improved runway and dedicated facilities, a city airport would encourage air 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 gather around the site.

The Long Beach project in Santa Monica opened in 1934, followed by the Port of Los Angeles. The latter was the largest in the world at the time of 4,000 feet served by Southern Pacific’s tracks and ended in 1913. Before 1937 the Port of Los Angeles opened, San Pedro Bay has been a port for receiving ships. In 1911, adjacent with the Port of Los Angeles, the Port of Long Beach opened. Both of these have helped transform the City of Angelenos into the largest business investment in America. The opening of the Panama Canal in 1914 was integral to the growth of the port. Los Angeles’ strategic position on America’s West Coast meant that its harbor would quickly become the major port of call for Pacific and Atlantic trade.

On September 24, 1927, the city signed a ten-year lease for 460 acres in Mines Field (now known as today’s Los Angeles International Airport), and L.A.’s first municipal airport was born.

With an improved runway and dedicated facilities, a city airport would encourage air 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 gather around the site.
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 studies.
- Not the object of any particular ownership, only rights of passage.

Without definition
- Space has no tangible meaning, except for the distance it improves.
- Little control and ownership are possible.
- Agreements must be reached for common usage.
O'Hare Airport 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 Expry are built to connected the airport and the downtown area. Each takes you about 50 min and 30 min to the heart of the city. The airport is surrounded by logistics centers, green parks and family houses. There are also two railroads connected the Chicago Union Station and the airport, the NSCS and MDAU using commercial services area gathered around the east outside the airport, where the expressway and marks enter the airport and rail passes through.
Grand Central Terminal (GCT) is a commuter and former intercity rail station located at 42nd Street and Park Avenue in Midtown Manhattan in New York City, United States. It is one of the largest transit centers 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.

Located in the high-density Manhattan district, the surrounding area of GCT is mostly commercial and high-rise buildings and the lot in this area is relatively small. Within 10 minutes walking distance, there are plenty of restaurant, store, offices and other public commercial use spaces.
Los Angeles Union Station (LAUS) is the main railway station in Los Angeles, California, and the largest rail passenger terminal in the Western United States. The site of LAUS used to be 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 lies in a transitional downtown neighborhood. Within a 10-minute walking distance, passengers may 113 reach various of restaurants, school, shopping center and a cluster of office and civic buildings. The land use of the surrounding is mixed by commerical, public facility and residential use. There are three metro lines connect-ed in this station.

Station Fact:
Neighborhood Type: CBD/Special District
Income Level: Moderate-Low
Neighborhood Character: Transit Centric
Low Income Development Opportunity: High

Per Station compared to regional average
The Wheaton Metro Station site is located at Georgia Avenue, Silver Spring, Maryland. It is at the intersection of N. Main Street, Vermont Avenue, and Georgia Avenue, in the Wheaton Central Business District.

The station serves the suburb of Wheaton. The trip to this station takes approximately 26 minutes from the Metro Center to the Wheaton terminal in downtown. Also, it is quite close to the Metro Bus Bases which cover 11 panels comprising approximately 132,089 square feet.

Located at the end of both city's light rail and metro bus system, the station quickly became an important part for suburban residents. Growing demand on shopping and other commercial properties are seen by the accumulation of commuter and traveling. The Metro property, on the 117 west side of Georgia Avenue is approximately 2,010,892 square feet. Homes, a Metro Parking Garage that takes up approximately 83,408 square feet was built recently.
PortMiami is a seaport located in Biscayne Bay in Miami, Florida, United States. It is connected to Downtown Miami by Port Boulevard—a causeway near 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 four historic islands (Boller, Lummus and Sands Islands) that have since been combined into one. It is named in honor of 19th term Florida Congressman Dante Fascell.

PortMiami is recognized, and has been for many years, as the “Cruise Capital of the World” and “Cruise 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 operation 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 rail, highway, Port Miami Tunnel and road. Baysides, the port develops quite a large number of recreational cruise ships that serve the increasing sightseeing population.
Los Angeles is spreading out through history.

Fig. 28: Great britay map of Los Angeles as it appeared in 1871.

Fig. 29: Greater Los Angeles, 1901.

Fig. 30: Beverly-Southern California, 1910.

Vision of Hyperloop:
With supersonic Hyperloop, the 30min journey can expand to San Francisco, Las Vegas and Phoenix 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 daily travel are connected together and the city’s transportation is much more efficient.
Smooth Transit focuses on a hub-and-spoke network. Passengers from all 3 areas will travel to the main station. The strategy is to create a network of existing transit hubs, so as to relieve the first and last mile problem. A more advanced concept, Hypertrip, will be adopted in the urban environment. It will use the same technology as Hyperloop, but it will be designed with existing infrastructure. The network will be implemented into the city transit hotspots, so as to shrink the city by time.
Two potential sites are selected near Union station in downtown Los Angeles. Connected with the big transit hubs of rail and metro in Union station, both of the two sites have high accessibility. They are distant land close to LA River in downtown Los Angeles and facing a challenge to revitalize. Hyperloop station are opening and give them a second life.

Union Station

LAX Terminals

High Accessibility with multiple transit method
SITE A: Union Pacific Piggyback Yards

SITE B: Old Metro Station+LA River+Old Factories
Grasping the Sprawled City
Strategy G1: Inner Urban Loop

Circulation System
Strategy G1: Inner Urban Loop

Walking Transfer

Loop Station
Average Speed: 120 mph

Hyperloop Stations
Peak Speed: 700 mph

Nearby Cities

Walking Transfer
Potential Sites | Zoning

Strategy EQ: Year Drive Loop

SITE A: Piggyback Yards & Vacancy land

SITE B: Ramps & River

SITE C: Vacancy between Fwy 405

Fig 51: Sections of site A - Piggyback Yards filled with rails and vacancy lands.

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

Fig 53: Ramps on both sides of the Fwy 405 create possibilities.

Fig 54: Views of site gathered in this site under the bridge.

Fig 55: The rail and ramps create a link between current railhead locations.

Fig 56: Lands under the Fwy 405 is another potential site.
STATION RESEARCH

BUS | PORT | RAILWAY | AIRPORT

Station research focuses on two parts: existing stations and possible Hyperloop stations.

The studies analyzed bus stations, railway stations, ports, and airports. From these studies, we discovered main problems with station designs, that is the times, the capacity, the circulation, and the accessibility. 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 access.
Bus rapid transit (BRT, BRTD) is a bus-based mass transit system. A true BRT system generally has dedicated 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]

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 platform levels, 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]
There is a vast array of port sites linked to varied natural profiles:

- **Hampton Ponds**: These ports are linked to a major river, which is often serving a vast hinterland. There are ports in delta (New Orleans, Singapore), at the mouth of a gulf (Guayaquil, Pusan, and Rotterdam), in an estuary (Le Havre, New York, Buenos Aires), near an estuary (Liverpool, Lisbon, Quebec) or along a river (Montreal, Arveyrte, Portland). For instance, one of the oldest ports in the world, Ostia, was at the mouth of the Tiber river and settled on Rome's port.

- **Seaports**: These ports have direct access to the sea and try to take the advantages of local geopgraphical features. They may be on lakes or lagoons, or they may be on the river banks, or they may be on the beach. In this case, the transport of goods is easier.

Port locations are constrained by two physical characteristics of the site: the topography and the climate. The topography can be flat or hilly, and the climate can be dry or humid. The climate can also be subject to environmental and social conflicts. Thus, both land and maritime access can impact port operations and port development since a port benefiting from good land access but from a poor maritime access will be having constraints as well as a port with a good maritime access but a poor land access. Moreover, maritime access in the altitudes that can be mitigated the least. Artificiales such as dredging and the construction of port facilities are very expensive, so defining the ending importance of a good port site. Such a site conveys the load marginal utility to port infrastructure investments.

Since ports are the nexus of marine and inland transport systems, port hinterlands are strongly shaped by port dynamics, particularly over four interrelated layers ranging from a spatial to a functional perspective:

1. **The location layer** relates to the geographical location of a port in relation to the central places in the economic space and forms a basis element for the intrinsic accessibility of a port, 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 oil flow hubs (e.g., Singapore, Macau), or cargo ports (e.g., Rotterdam, New York, Santos). For gateway ports, a good location is a necessary condition for obtaining a high intrinsic accessibility to a vast hinterland, which often builds upon the centrality of the port. It becomes a sufficient condition when the favorable geographical location is not further improved by means of the provision of efficient infrastructure and transport services.

2. **The infrastructural layer** involves the provision and exploitation of basic infrastructure for both links and nodes in the transport system. Containment and intermodality transportation, particularly the transport infrastructure they rely on, have contributed to a significant aggravation of infrastructures in a number of ports. This is where the intrinsic accessibility by a valorized sense to a port has a fine meaning unless a capital investment is provided.

3. **The transport layer** involves the operation of transport services on links and connections between the port and other nodes within the multimodal transport system and the transport operations in the nodes of the system. It is a matter of volume and capacity.

4. **The logistics layer** involves the organization of transport chains and their integration in logistical chains, notably port-terminals logistics. This layer is overly impacted with a growing importance of the process in terms of supply chain management and the development of transshipment facilities.
PORT TERMINAL CIRCULATION

Passengers arriving from different places access ports with different kinds of transportation. Most of them are using public transportation. Others are arriving from the parking places.

First, they get into the lobby, where they can purchase tickets, and also have food. Then after getting through the security process, they will be directed to the departure lounge and waiting for their ship. When the ship comes, people get on board.

PORT TERMINAL LAYOUT

The information desks and check-in counters are located in the lobby along with safety 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 passenger baggage to the delivery trucks on the 1st floor.

CIQ (Customs, Immigration and Quarantine) facilities are for those passengers arriving on foreign vessels 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 passenger baggage, which has been unloaded from ships onto the upper 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 part in the longer term. Further development of trade often results in ports being modified to accommodate different vessels and commodities. Ultimately, ports are more 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 on-site layout has to be planned to enable delivery and evacuation of cargo (and passengers) to accommodate the capacity to service vessels at the berth.

Port Gas

Dry Bulk
Liquid Bulk
Motor Vehicles
Roll-on Roll-off

Container
Terminal
Stop
Restaurant

Yard crane load and unload containers between the prime mover and container slots in the yard.

The yard crane is an inverted U-shaped structure with rubber tires. An operator sits in a small control room mounted on top of the inverted U. The operator is called to "go" from the container to the roll-on roll-off loading area. The operator moves from the crane at the position of the control room. The operator drives the crane and operates the spreader which lifts up and releases the container during loading and unloading operations respectively. Figure 2 shows a schematic diagram of the work space of the yard crane. The crane moves along the Y-axis and the control room, together with the spreader, moves on the crane along the X-axis.

The spreader can be tilted or lowered to pick up or unload containers. The operator moves the control room along the X-axis to position it on top of the appropriate container slot. The movements of the crane and the crane are controlled by a "remote" 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 "spring" of the spreader must engage the pick up slots of the container through a rectangular mechanism to lift the container. The operator then moves the crane and spreader to pick up the container. He uses his eyes and experience to do the job.

Dry Bulk
 Liquid Bulk
 Motor Vehicles
 Roll-on Roll-off

Terminal
 Stop
 Restaurant

Shade Center
 Container Crane
 Container Yard

Conveyor Crane

Fig 3. Container Crane
The only structure of its kind in the world, the Falkirk Wheel will be 115 feet (35 meters) high - the equivalent of eight double-decker buses. It will be 115 feet (35 meters) wide and 190 feet (60 meters) long. The total project cost is approximately £17 million and will take 28 months from beginning to end. The project will involve over 500 construction staff. The whole site takes up 110 acres (44 hectares). The tunnel, which includes an abandoned sewage canal, will involve major landscaping and the removal of 900,000 tons of soil. Construction material include 7,000 cubic metres of concrete 1,200 tons of reinforced steel, 1,200 tons of precasted steel and 300,000 square metres of canal lining. The Wheel is designed to last for at least the next 120 years. The first wheel-based boatlift was proposed by a German engineer at the beginning of this century but 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).

The wheel uses only 1.5 kWh of energy to complete one turn - the equivalent of boiling only 1 kettles of water. Each paddle weighs 500 pounds, so each paddle always weighs the same.

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 roof level of Oshibashi Yokohama is open 24 hours. It is an open-air plaza furnished with wooden decks and natural gravel areas.

The building’s height was kept to the lowest possible level (10m max) to enhance the operability and appearance of ships. Cruise ships sailing 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 see the Mt. Fuji. We hope you will enjoy the beautiful views of the Red Brick Warehouse, the Yokohama Station, the Yokohama Port, the shipyard, and the Mt. Fuji.
RAILWAY STATION TYPOLOGY

The railway stations using a variety of layout patterns. Due to the different relationships of the pole and station house in horizontal and vertical directions, the style can be divided into side type, linear 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 avenues to get to the platform while boarding.

Train turning around

Tumble
eA tumble table is a device for turning railroad rolling stock, usually locomotives, so 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 in the yard necessitate a way to weigh against the construction of a turn around yard.
Railway Station Circulation

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, such as ticket purchase and movement 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

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: basic passengers who know where they should stand, place themselves accordingly
2. Cluttering: close to entrances, stairways, rain shelters and other platforms infrastructure and facilities, often done by passengers who do not know their way
3. Standing: passengers who stand, get off and 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 must meet predicted future demand.  
2. Legible spaces, with direct, convenient routes.  
3. Multiple access points to increase permeability and establishment.  
4. High quality lighting supporting passenger movement and activities.  
Making places easy to use for all passengers and station users.  
1. Provide obstacles and step free spaces to accommodate the needs of all users.  
2. Optimize lift and escalator locations and capacities.  
3. Provide for mobility assistance where appropriate.
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 (runways). Connecting lanes between the runway and the taxiing lanes usually have an angle permitting the path and from the runway for planes that have just landed.

Modern airfield designs provide two of these exiting options per landing direction depending on the plane's size. A small aircraft will take less distance to take off than a large aircraft and has thus the opportunity to exit the runway having valuable takeoff or landing data, having valuable takeoff or landing data.

Case:

Hongkong Airport

Type 1

Single line terminal

Satellite concourse configuration

Expanded linear terminal and corresponding berths service with dual notches

Per concourse configuration

Multiple spur automated people mover

Transporter concourse configuration

Multi-plaza concourse configuration

One-way or two-way loop automated people mover

UCLA AUD SUPRA STUDIO
In the airport, passengers keep moving from one point to another so the whole passengers can be seen as a flow with different density. The terminal line cone complicated pipes is a huge mixing system. How to guide the people inside it and to let them move as faster as possible 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)
4. Charles de Gaulle (France)

Hartsfield-Jackson Atlanta International Airport (1st Efficient in North America)
- 95,894,352 people per year
- 153,137 people per day
- 50,000 people per hour

Charles de Gaulle Airport:
- 2nd largest airport in Europe
- 7th efficient airport in Europe

Terminal 2F of Charles de Gaulle Airport:
- 14.2 Mln people per year
- 39,000 people per day
- 1,000 people per hour

Fig.42: Departure Plan of Terminal 2F
Fig.43: Arrival Plan of Terminal 2F
INNER DESIGN OF TERMINAL

The inner design of airport has four main elements: space, structure, light and objects.

Space:
Different sizes or volumes of inner spaces helps the travelers to know whether a particular corridor or concourse is a major or a minor one. The combination of spaces into several recognizable hierarchies allows passengers to find their way around with minimum of loss. The angle of flights, going and width of stair and escalator should indicate the degree of puleliness or prominence of that particular route.

Structure:
The role of the primary elements of structure-columns, walls, and beams-to both support the terminal physically and to 180° support the perception of major nodes psychically. Structure is a means by which direction can be indicated and the rhythm of movement can be established. 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 travelers through the complex changes of direction and level encountered in a modern airport 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 enrolling elements solid points of reference that interrupt vistas or limit the edges of space. Those solid elements contain functional space(spatial) objects. Solid objects are not so important through they objects, for they are times objects that, for the viewer, are an entry to the free flow of space in the environment.

STRUCTURE TYPE OF TERMINAL

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

- Basic Form
- Red Pulling

- Beam-and-Column Construction
- Hollow Beam Construction
- Tensile Structure
- Suspended Cable Structure
Determining terminal facility requirements begins with assessing the adequacy of each existing component to serve current or anticipated activity levels. In this case, the emphasis is on the need for additional capacity for the future planning horizon, as the size of the space and the width of the hallway are related to the density of people and the capacity of the airport. [1][2]

All the data in this diagram is pulled up from the peak time in Airport Pierre Charles de Gaulle. 3595 people will get on board a flight. As the diagram shows, not all the capacity is taken up or used. In some places, the hall in the baggage claim is wider than it needs to be. There is no queuing in this area, so it is not necessary for people to wait in line. If it does not mean that it is not necessary, not all people will go to check in immediately, some may go shopping or having meals, and consider all this not to wait at peak time, the capacity should be limited in an appropriate degree.
All the data in this diagram are also picked up from the peak flow in Airport Paris Charles de Gaulle.

As the diagram shows, not all the capacity pane and hallway on the arrival area are the same. In some places, the hallway is a little narrow, the pressure for the arrivals is still less than the space for either side. But if there's some place like baggage claim to wait.

Baggage claim requirements are based primarily on peak hour deployed passengers, the concentration of these arriving pass-
190engers within a 20 minute time period, and - to a lesser ex-
191tent - checked bag per passenger ratios. Observations at most U.S. airports indicate that majority of domestic passengers arrive at the baggage claim area before their bags are loaded onto the claim units. At an airport such as MIA, virtually 100 percent of the passengers are waiting on to first bag delivery. The result is that the claim units should be sized for the estimat-
ed number of passengers waiting for baggage, because most bags are claimed on the first revolution of the claim unit. [13]
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 consumes a lot of energy.

There are two kinds of approaches to reduce energy consumption, the passive conservation and active conservation.

Most standard climbs by the LEED can be achieved by passive energy conservation measures, which is cheaper, easier to deal with than active conservation measure. For example, rotate the shape of the structure to save materials, and makes it easy to keep warm so as to reduce the consumption of air conditioner, making the use of natural light and ventilation to reduce to consumption of air conditioner and IL and

The active conservation measures which are using new technology also play a important role to save energy using EV car, LED and GPHUs and solar energy, which can definitely reduce the electricity consumption and output of carbon dioxide.

SOLAR ENERGY

Electricity consumption

The amount of electricity consumed by a grand-scale airport is equivalent to the city with a population of 1,000.

Annual carbon footprint (poloemies) 186,000 GPHUs

The active conservation measures which are using new technology also play an important role to save energy using EV car, LED and GPHUs and solar energy, which can definitely reduce the electricity consumption and output of carbon dioxide.

SOLAR ENERGY
The time passengers will spend inside the station will differ based on the design of the station. Time can be saved by optimizing the design of the station and the number of passengers inside the station.

The station will have a very efficient service. To further improve the efficiency, we provide some special services such as Hyper Shuttle to take passengers from their own homes directly to the gate.

Special Service: Hyper Shuttle
With security check on it and carry people from their own homes to the station’s hotel or taxi for families or those who are in a hurry. Let your time consume at the station no longer than 1 minute.

Special Service: Hyper Taxi
When you get off the capsule you carry 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 station, 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
Amenities: none

6 Minutes Station:
Number of passengers in station in rush hour: 672
Amenities: restroom, automat

10 Minutes Station:
Number of passengers in station in rush hour: 1600
Amenities: restroom, automat, cafe, supermarket

> 30 Minutes Station:
Number of passengers in station in rush hour: > 3380
Amenities: restroom, automat, cafe, supermarket, restaurant, mall
**FAST BOARDING STRATEGY**

**Security Design**

1. Security Check Efficiency
   - Add more security check
   - Reduce the security check time
   - Increase the security check capacity

2. Security Check Costs
   - Reduce the security check costs
   - Increase the security check revenue
   - Improve the security check design

3. Security Check Flexibility
   - Increase the security check flexibility
   - Reduce the security check time
   - Improve the security check user experience

**Possible Reasons for Delay**

1. Quantity of the security check is not enough for the passengers
2. The security check moves slower than the vehicle speed
3. People without carry-on luggage should wait in the same line

**Efficiency**

- **Security Check Efficiency**
  - Improve the security check efficiency
  - Reduce the security check time
  - Increase the security check capacity

- **Security Check Costs**
  - Reduce the security check costs
  - Increase the security check revenue
  - Improve the security check design

- **Security Check Flexibility**
  - Increase the security check flexibility
  - Reduce the security check time
  - Improve the security check user experience
In order to make the boarding experience more delightfully and orderly, avoid the waiting line, 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 known that they will take them the baggage in robots. Passengers without baggage will choose the seats after the security checks, by using a touch screen which show the vacant seats and capacities.

In front of the lounge, lays the LED showing the capsules which are about to set out. Ten minutes are needed for one capsule finishing boarding but at each 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 on the other side of the capsule will be transport to a conveyor belt which pass parallel with the loading passengers. With the help of these belt and other robots, passengers are able to pick up their luggages as soon as they exit the station in a specific place corresponding to the position where they dropped their luggages.
Platform Design

There are four platforms boarding passengers in sequence. Capsules depart 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 boarding will be transferred to the upper layer to supply the boarding capsules.
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.
In 1960, London Pneumatic Dispatch Company design 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 carry a person. The system was used between 1960 and 1974.

In 1970, 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 tank 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. Dreams and inventions always come up with diverse ideas to make it come true. After Elon Musk publicizes the Hyperloop alpha document, it is the time to make mock-up models. Supra Studio is responsible for making a 3D mock-up model. The project is built in the UCLA studio. Supra Studio is a design studio with a special feature on 3D printing. The 3D printing technology makes the production of the model more economical and efficient. The Hyperloop is designed to be a high-speed transportation system. It can travel at full speed of 700 mph, which is much faster than the Concorde (2.04 Mach). On average, the travel time can be reduced by 80% compared to current travel time. In addition, it can travel 2000 km in 50 minutes, which is more than twice the distance of Concorde's maximum range. At the same time, the price of a ticket is about 1/3 of a train ticket. The project has great potential to promote the development of the transportation industry.
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 by analyzing the space in vertical and horizontal directions.

**DIMENSION OF VERTICAL DIRECTION**

**ANALYSIS OF HORIZONTAL PLANE**

**INTERPERSONAL DISTANCE**

**OUTER FORWARD SENSE**

**SINGLE EXPERIENCE**

Human emotion always important while making a design. It could be influenced by air main factors like the dimension, environment, color, 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. We have already studied the relationship between human and space in dimension aspect. It would be possible for us to see a single person as a bubble and combine several bubbles in different patterns to find out the most appropriate function for different areas.

**DESIGN FACTORS**

- Space Analysis
- Basic Microsystem
- User Experience
- Interaction Design
- Human Engineering

**SOCIAL SPACE IN VEHICLES**

- Construction
- User Experience
- Design
CAPSULE TYPES
Scale Comparisons of Different Capsule Types

CAPSULE TYPES
Trains - InterCity High Speed Rail - Transport Sydney InterCity X30 Train (1970)
CAPSULE TYPES
Air Transportation - Boeing 747-400 Cargo Freighter (2006), Concorde (1976)

AIRCRAFT CAPSULE
Seaplane - Short Solent (1944)

General Information
Type: passenger flying boat
Passengers: 34 passengers
Speed: 270 mph (435 kph)
Height: 47 ft 10 in (14.6 m)
Weight: 47,340 lb (21,484 kg)
CAPSULE TYPES
Buses - Streamliner (1994)

- Manufactured by Mercedes-Benz
- Type: Single-deck, rigid
- Capacity: 50 seated passengers
- Speed: 65 mph (105 km/h)
- Size (ft): L: 45 - 10 8/16; W: 8 - 2 1/16; H: 12 - 2 1/16

CAPSULE TYPES
Buses - New Flyer City (2000)

- Manufactured by New Flyer
- Type: Single-deck, articulated
- Capacity: 44 seated passengers
- Speed: 50 mph (80 km/h)
- Size (ft): L: 41 - 6 3/16; W: 8 - 4 15/16; H: 9 - 6 3/16
Categorized by personal vehicles, city metro system, long-range transportation system and local transportation systems. The charts show how seats are arranged in the capsule and the density during rush hour. Compared with existing flying spaces, the layout of capsule needs to find a balance between comfort and efficiency.
SEATING ARRANGEMENT
Social Space in Seating Design

Critical factors in human scale

SEATING ARRANGEMENT
Social Space in Seating Design

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 different aspects, 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 areas.

DESIGN FACTORS

- Spatial Design
- Interaction Design
- Human Engineering
- Behavior
- Usability
- Experience
80% of passengers aged between 18-24 use social media.

31% of passengers find security the most stressful part of their 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.

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 fulfilling time and a wonderful experience.

1. Wide variety of entertainment and information choices:
   - DVD, CD, MPG, TV and radio
   - Full digital audio and video distribution
   - Virtual office features
   - Flexible configuration
   - Interactive mapping
   - Touchscreen control of all system capabilities

Light and Illumination

A palette of three light moods:

- Daytime
- Nighttime
- Emergency
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 lifted, 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 36

Projectors mounted on the capsule
VISUALIZATION
To Realize a Virtual Visual Environment—Windows vs. Windowless

**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 the 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, its lower costs.

Hyper wide camera visual angle range

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

Hyper wide angle cameras mounted on the tube

**Windowless capsule design strategy**

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

When these devices 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 that track the fingers or the projected images. The tracking is very accurate, with similar performance to a desktop computer.
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 signage models 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 Supastudio building, this model was both designed and constructed in less than three weeks. Fiber 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 what is now Playa Vista, California.
HYPERLOOP FULL SCALE MOCK UP

1-3. The GND mill process:
1. Piling the module base first in the frame.
2. Placing the cross pieces that connect the three rings.
3. Placing the cross pieces with the middle frame.
4. Placing the top parts on the middle frame with the cross pieces.
5. The top part on the middle frame was completed.
6. The long parts were placed vertically in the frame.
7. Fitting the rib pieces onto the first module's base.
8. Placing the cross pieces that connect the three rings.

08. Completion of the first module on December 18th, 2014.
10. The top part for the next two modules was pre-assembly.
11-13. The three modules were completed on December 15th, 2014.
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 space travel 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

Syd Mead presented the "HYPERLOOP SUPRASTUDIO" with an impressive lecture in the robotics 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-loop would work as a transmission device that established around studio as study model for Hyperloop, while 8 teams of capsules started from skeleton study which
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're excited to see further progress from the mock-up team.

LA AUTO SHOW

After the field trip in the morning, the Hyperloop studio visited the LA Auto Show held in the Convention Center in downtown LA. The aim of the field trip was to learn more about industrial design from companies and vehicles that might inspire us in our future projects.

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
Model courtesy of Hyperloop Capsule Strategy 2, Xiayuan Lu, UCLA.

Image courtesy of Website: http://www.splashlight.com/products/UCLA


Image Courtesy of Website: http://www.brucefrankel.com/remoteinterface-398179

Image courtesy of Website: http://www.slashlight.com/products/UCLA.

Image Courtesy of Website: http://www.innovatewatch.com/

Image Courtesy of Website: http://www.splashtube.com/remoteinterface-980554.

Image courtesy of Website: http://www.splashlight.com/products/UCLA.

Image courtesy of Website: http://www.innovatewatch.com/


