EMBRACE URBAN GROWTH
AVOID URBAN SPRAWL

YING LI
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P5 Presentation
June 2019
Problem Context: Urban sprawl

Part two: Almere future

Part three: Autonomous vehicle

Part four: Compact analysis

Part five: Design AV parking system
Problem Context: urban sprawl
Urban footprint comparison

Paris, France:
- Urban area: 3,000 km²
- Population: 10 million

Randstad, the Netherlands:
- Urban area: 8,000 km²
- Population: 8 million
Green Heart border changes
Car-dependent city
Impact of urban sprawl

- decrease in biodiversity
- increase in infrastructure investments
- increase in automobile dependency
European Environmental Agency

2013
7th Environment Action Programme

2020
‘Living well, within the limits of our planet’

2050
‘No net land take’

source: https://www.eea.europa.eu/policy-documents/7th-environmental-action-programme
Comparison between urban density and urban form

Which city is more dense?

Paris, France

New York, America
Paris, France

20,200 per sq km downtown

New York, America

25,800 per sq km Manhattan
Contribute to:

- Environmental sustainability
- Non-motorized mobility
- Public space quality
2 Almere future
"Almere has historically been a dormitory town from which residents have been content to travel for both work and leisure"

--- (Woodman, 2004)
Population development in Almere 2000-2040 (forecast from 2018)

Source: ONTWIKKELING BEVOLKING ALMERE 2017 (https://www.osalmere.nl/docs/Ontwikkeling%20bevolking%20Almere%202017.pdf)
Type one: Government proposal - develop new urban land
Type one: Government proposal - develop new urban land

Task: 70,000 new resident
+ 35% population growth

Remain current Almere density: 4,452 per sq km

Possible population growth: 28,000

Possible population growth: 74,000
Type two: Compact proposal - redevelop urbanized land

Task: 70,000 new resident
+ 35% population growth

Future density: 1.35 times denser
6,000 per sq km

Possible population growth:
- 20,000
- 40,000
- 8,000
- 4,000
How to design a **compact Almere** in a future of **automated vehicles**

... ... and contribute to **urban sustainability**?
3

Autonomous Vehicle
The possible impact of AV: sprawl future

Efficient traffic

Valuable travel time
The possible impact of AV: compact future

- Mass transit street space
- Massive parking space
- Land use for conventional vehicles
- Smaller street
- Redevelop opportunity
Scenario building

Government driven

- redevelop opportunity
- protect natural land
  - non-motorized mobility domain
  - less vehicles on road
  - increase accessibility and equality

Private ownership

- street spread further
- decrease natural land space
  - AVs oriented traffic
  - increase vehicles on road
  - increase city budget

Public ownership

- competition between communities
- zoning based on AVs hierarchy

Market driven

- URBAN SPRAWL
- COMPACT CITY
Compact City

Urban Sprawl vs Compact City
Automated Vehicles

Parking revolution

Urban redevelopment

Compact city

AV ownership decrease: 100% → 35%

AV autonomous parking

smaller AV parking stall: 30 m² → 14 m²

urban growth: 100% → 135%
Mobility as a service

The only available option today

Tomorrow's freedom of mobility

Decrease of vehicles ownership
Decrease of vehicles ownership
Future AV ownership = current car ownership * 35%

source: A RethinkX Sector Disruption Report (2017)
Decrease of parking space

- Narrower lanes
  - Conventional vehicles: 3.5 m
  - Autonomous vehicles: 3 m

- Smaller stalls
  - 2.5 m x 5 m

- Stall stacks
  - 21.5 m²
Autonomous parking

with temporary standing lane

without temporary standing lane
- cruise the island

parking stall space 16 m²

parking stall space 12.5 m²
Assembly Row, Somerville, MA

Driverless vehicles storage is packed in hyper-efficient rows on the top level. Garage designed for autonomous for self-parking vehicles can substantially increase their efficiency and use 60% less space.

Assembly Row, Somerville, MA

The garage is expected to reduce parking square footage by 26%, with a mix of conventional and driverless cars. When the garage is used exclusively for driverless cars, parking square footage can be reduced by up to 60%.
Decrease of parking space

parking stall space (with sharing space)

30 m²

16 m² parking stall with temporary standing lane

14 m² Possible AV parking stall space

12 m² empirical AV parking garage design

current

2040

14 m² per parking stall
Transform parking space

Conventional city section

Future city section with AV on road
AVs would make parking no longer a nightmare
Compact Analysis
Design area

Almere center area

100% - urban growth - 135%

40,000 population
Redevelop opportunity
Calculation for population growth
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<thead>
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<th>Design base</th>
<th>Redevelop type</th>
<th>Current space</th>
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## Calculation for population growth

<table>
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<tr>
<th>Main Category</th>
<th>Current space (sq m)</th>
<th>Redevelop percentage</th>
<th>Numbers of floor</th>
<th>Redevelop space in surface</th>
<th>Redevelop density (per sq m)</th>
<th>Possible population growth</th>
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AVs would contribute to redevelop parking space and urban blocks
5 Design AV Parking System
Calculation for future AV parking space

Population in Almere center area

Current (2018) 110,000
Future (2040) 148,500

increase to 135%

car ownership

0.37 conventional car per person
0.16 AV per person

decrease to 35%

Space for parking unit

30 m² for conventional car
14 m² for AV

Future AV parking space

333,000 m²
AV parking system

Total AV parking space
333,000 m²

AV garage in periphery
166,500 m²

AV floor parking in community
133,000 m²

AV private parking (personal preference)
33,000 m²
Potential spots for AV parking garage
Scheme for AV garage in periphery

To place 166,500 m² AV parking garage

6 AV parking garage + 7 floor

4000 m² floor area in average

- potential AV garage position
- current industrial area
- design area
- main transit street
- traffic dispersion flow
Automotive industry transformation

- Automobile researcher and designer
- AV production industry
- AV repair and maintenance industry
- Mobility service provider
Automotive industry transformation

- Function related with automotive industry
- Office function related with vehicle design
- Commercial function related with vehicle dealer
Scheme for AV industry park

- AV parking garage
- AV industry Park
- Industries/companies
- Mobility service provider
- New housing
- Street system

- Replacement of current parking function and automobile production
- Appearance of the new industrial chain for automated vehicles
- Involvement of mobility service provider
- Compact development for housing project
AV floor parking in community

Total AV floor parking in Almere center communities
133,000 m²

Population percentage 9.5%

To place 12,600 m² AV floor parking in design area

potential AV floor parking position

Stedenwijk neighborhood

mixed-use building
Function analysis of redevelop blocks

Traffic condition analysis
Possible position for AV floor parking

- No. 24 mix border
- No. 20 mix border
- No. 21 community parking
- No. 19 mix border
- No. 17 community parking

---

<table>
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<tr>
<th>Service range</th>
<th>Current function</th>
<th>Redevelop space for building surface (m²)</th>
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<td>No. 24 mix border</td>
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<td>20000 * 35% = 7,000</td>
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<td>No. 20 mix border</td>
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<td>26000 * 35% = 9,100</td>
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<td>5000 * 50% = 2,500</td>
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<td>No. 19 mix border</td>
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<td>83000 * 35% = 29,050</td>
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<td>No. 17 community parking</td>
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<td>12000 * 35% = 4,200</td>
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Legend:
- main street - neighborhood access
- internal street - local access
- basic street system bridge
- canal system
- value to place mixed-use building with AV flow parking
- transform parking function
- design area
Function transformation

- function related with automotive industry
- office building
- shops

AV industry park
Mixed land use

- residential function
  - elderly housing
  - house for disabled people
  - normal family housing

- mixed-use residential building with commercial function
  - shops
  - restaurant
  - office
  - start-ups

- mixed-use residential building with public function
  - health care
  - education
  - cultural center
  - entertainment
Mixed land use

Legend:
- Mixed-use residential building with commercial function
- Mixed-use residential building with public function
- Residential building
- Community pavements
- Community open space
Traffic flow analysis
Diverse indoor and outdoor activities.
Actors and activity programs

- residents
- neighbors
- businessman
- visitors

Commercial activities
- cafe
- street store
- fast food
- shopping

Business activities
- start-ups
- business exchange
- local business

Night activities
- night lectures
- community movie night
- community quiz night

Community activities
- childcare and day care
- community library
- community celebration
- healthcare service
- local exhibition
- artistic performance
- give and take market

Outdoor activities
- garden visit
- children recreational activities
- family party
- barbecue / picnic
- outdoor workouts
- jogging
- cycling
- walking
Dynamic activity programs all day long
Activity design
THANKS FOR LISTENING