Public transport, walkability and urban development.

Vision Conference: Tartu Public Transport 2030

Andres Sevtsuk
Assistant Professor of Urban Planning
We can not talk about public transportation without talking about walkability and urban development ...
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**Traditional travel demand modeling**

Four step model

1. **Trip generation**
   How many people are going to travel?
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   Where are they going to travel to?
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   What travel mode are they going to use to get there?
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4. **Trip Assignment**
   Given the chosen mode, what route will they take?
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Form of development plays a key role.

Many trips do not need mechanical transportation at all.
All transportation solutions create *externalities* for the spatial and social environment they operate in.
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A key challenge for cities is to prioritize solutions that not only tackle a specific transportation service need, but also address the greatest number of related issues in urban form, housing, and land use distribution in a sustainable and equitable manner.
1. Walkability
A paradigm shift for city governments
"Traditionally, urban economic development has focused on retaining industries and luring new businesses with incentive packages. But in the new century, a different and far more effective model has emerged: focusing first and foremost on creating the conditions that attract people. As cities are increasingly demonstrating, talent attracts capital more effectively than capital attracts talent. People want to live in communities that offer healthy and family-friendly lifestyles: not only good schools and safe streets but also clean air, beautiful parks, and extensive mass transit systems. And where people want to live, businesses want to invest."

M. Bloomberg, 2015
What are the benefits of walkable urban environments?
a. Walkable built environments waste less space on transportation and create more valuable space for living/working/recreation.
b. Residents of walkable cities are healthier.

Body mass index, or BMI, is a measure of a person’s obesity. BMI is your weight (in kilograms) over your height squared (in meters). BMI scores of 30 or greater are considered obese.

San Francisco-Oakland-Fremont, Calif.: 17.5

Topeka, Kans.: 33.3
b. Residents of walkable cities are healthier.

**Sources:** Traffic Fatalities, United States 2016, Fortune/NSC  NHTSA, 2015  
PLOS Medicine, 2005  
WHO, National Safety Council, 2013  
The Lancet, 2008
c. Pedestrians are good for local businesses.

According to Transport for London analysis, pedestrians usually spend 65% more than drivers.

d. Walkable built environments are more sustainable, consume less energy, and emit less CO2?

e. Walkable built environments tend to produce more social interactions
Even Americans increasingly prefer walkable city environments

- Walkable office space commands a 70% premium over auto-oriented office space, on average.

- Since 2009, the walkable 1 percent of Washington DC’s metro area has accounted for 48 percent of new office, hotel, and rental apartment square footage.

- Between 2009 – 2013, 50% of metro Atlanta’s office, retail, hotel, and apartment development occurred in the most walkable 1% of metro area land.

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C. Stimulation of the route. Is it an interesting walk?
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A. Availability of trip origins and destinations within walking distance

B. Safety and comfort of the routes

C. Stimulation of routes. Is it an interesting walk?

D. Public transportation availability.
2. Transportation
20th century visions of the city produced car-centric utopias
La Ville Radieuse by Le Corbusier, 1924.
Which became Car-centric dystopias
Tallinn, Estonia
Tallinn, Estonia
What if we instead thought about the kind of a city we want and then envisioned mobility systems that lead us there?

Source: Dansk Arkitektur Center
Urban mobility beyond the car

a. Destinations to walk to around home and work.
b. Longer trips serviced by mass transit.
The relative cost of travel depend on trip distance.
The relative cost of travel depend on trip distance.
In car-oriented cities, cheaper to move longer distances
→ Incentives longer trips
In pedestrian/transit-oriented cities, cheaper to move shorter distances

→ Incentives shorter trips
Public transit-oriented mobility produces street commerce

Car-oriented mobility produces big-box shopping
Modal capacity
Maximum people per 3m lane per hour per direction (w/o uncomfortable congestion)

Car-based mobility solutions can not service high-density environments.

- Walk: 10,000
- Bikes: 10,000
- Cars: 2,000
- Bus: 6,000
- Light rail and BRT: 11,000
- Heavy rail and metro: +25,000

Car-based mobility solutions can not service high-density environments.
An urban transportation paradox...

Need for mechanical or motorized transportation

Urban Density
An urban transportation paradox...

More trips on foot, because more destinations available nearby.

Need for mechanical or motorized transportation

Urban Density
High built density → high destination density → more trips on foot...

Camden High Street, London
From the perspective of shop-owners, dense and walkable urban design produces a double benefit:

1. More density means more customers nearby, who can access stores on foot.

2. Pedestrians who walk by stores on the way to other destinations or stores, are likelier to drop in than those who undertake a designated trip.
Tartu Tram proposal

Source: Postimees
Modal split in Tartu (all trips)
Source: Tartu 2020 Transportation Plan, Stratum OÜ

A much better picture than Tallinn, where 50% of all trips are now car based!
Does Tartu have the density to support a tram system?

Population densities of neighboring regional cities


Tartu: 24 ppl/hectare
Does Tartu have the density to support a tram system?

But city wide density may be a poor indicator of ridership. More important how many people within walking distance to the system.

Population densities of neighboring regional cities


But city wide density may be a poor indicator of ridership. More important how many people within walking distance to the system.
Two cities with similar size and density that have a light rail system:

Bergen
Freiburg
Bergen Norway
Population: 275,000
Density: 5.9 ppl/ha
Opened: 2010
• First phase opened in 2010 with 9.8km of track, connecting city center transit hub, football stadium and 2 university campuses.
• Additional extension to Rådal and to the airport added in 2012 and 2015.
• Now 20 stations (14.3km of track).
• Daily ridership over 31,000 ppl.
• Excellent connection with bus services.
• Headways: 5min peak hour, 10min non-peak, 1h night.
• Passenger capacity is 212 (84 seats) per tram.
• All stations and all tram doors are step-free, providing access for mobility-impaired passengers.
• All trains have wireless internet access.
• Tracks in city streets stand on rubber jackets to reduce noise.
• Tram has priority at traffic lights to improve speed.
• City implemented denser development incentives around the stations, prioritizing most new residential and commercial development close to tram.
Freiburg
Population: 218,043
Density: 15 ppl/ha
Opened (new): 1983
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• 36.4km of track.
• 68 stops, 5 lines.
• 65% residents and 70 per cent of all jobs located within 300 m from a stop.
• Since 1976, increase in car trips in Freiburg was only 1.3%. Public transport passengers have increased 53% and bicycle trips 96%.
• Occupancy permits for new housing not granted until tram has begun operations in the block → disincentive for driving.
Neither Bergen or Freiburg just built tram lines to move people... they also adjusted their development regulations, traffic policies and bus systems to make sure that tram ridership grows over time and that the city evolves into a transit and pedestrian oriented environment.
A public transit authority must cover the entire metro area. Municipal reform helps Tartu...

Zurich example

- 1990 ZVV authority created to oversee transit in the whole metro area around ZRH.
- ZVV sets the service standard (timetable, frequency, quality) and a maximum budget that satisfies this minimum service level. ZVV collects revenues.
- ZVV bids out the operations of the lines, where it owns the vehicles and tracks. Bid contracts are usually 2 years.

Source: Postimees
The more connection, the higher utility of a network...

It is critical to integrate tram lines seamlessly with buses.
Details matter...
Stations near street intersections, bus stops right next to them.
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A minute is not necessarily a minute...

In vehicle time: 1x

In vehicle time standing: 1.5x

Penalty Transfer time: 1.1x

Waiting time: 1.75x

Access/Egress: 2.5x

Source: Alex Erath, ETH Future Cities Laboratory
**Tram alignment**

If access time to and from transit is perceived the most, what does this suggest for alignment and stop placement?

A split line appears to cover more, but it actually covers less since passengers consider mode choice based on roundtrips, and access times is most costly.
Vehicle “bunching”
Melbourne, AU
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Melbourne, AU

Why is it so common?

• Assume a regular departure interval, e.g. 5 min headway.

• Passengers arrive at stops at a steady rate.

• If one vehicle is delayed by a minute (for any reason), then it has to pick up more passengers in the next stop.

• The vehicle behind it picks up less passengers and eventually catches up with the one ahead of it.

• Vehicles end up travelling in “clumps”
Tram "bunching"
Melbourne, AU

Solutions?

• Enforce real-time scheduling by providing drivers with GPS-based ITS technology.

• Make shorter routes... with loop connections.

• Increases reliability by ~ 35 per cent, as each service is required to make fewer stops. This reduces the probability of bus bunching.
Looped tram route?
Tartu
3. Urban development
Plan new transit oriented developments around the tram Tartu
Transport Oriented Development (TOD)

- Less parking
- More density
- Mixed uses
- Walkable urban design

Curitiba, Brazil.

Geneva, Switzerland.
Higher density will produce more ridership.

Tartu
Example TOD policies in other cities

**Freiburg**
New housing projects can not be occupied until a tram is available within 300m.

**Singapore**
Buildings within 400m from MRT can provide 20% less parking.

**Zurich**
Buildings near tram require 30-40% less parking.  
Building height and FAR allowances are 2X higher near stops.  
Gradual density decay with distance from stops, phasing out at around 600m.

**California**
Office building developers have to offer their employees a choice to either have off-street parking or cash out an equivalent sum.

**Stockholm / Ottowa**
Incentivize mixed use sub-centers along transit to generate efficient bidirectional flows. Have a balance of jobs/housing/retail/services within communities and between communities.
New development scale and granularity should match Tartu’s DNA.
Willingness to walk to transit
400m does not feel the same everywhere...
Access to transit must be analyzed along street networks...

600m circle VS actual walkshed.

Sparse street network

Highly connected street network
Ridership depends on...
Connectivity of the network, density around stations, **walkability to stations**.
By coordinating transportation and urban development, we get to not only solve transportation, but to also shape transportation demand...
What should be accessible on foot and when do we need transit?

66% of all trips are convenience or recreational

A lot of carbon is saved if most of them can be done on foot...

\[ \text{Density Urban Design} \]

Source: 2009 US National Household Travel Survey
Forget about the monorail...
Forget about the monorail...

- On-ground tram more adaptable to unforeseen changes in the city.
- On-ground tram not only moves people, but street level stations also help calm traffic and make better urban spaces.
- Step-free access is important in 21st c. transit.
- Overhead infrastructure becomes a nuisance over time.
Thank you!

asevtsuk@gsd.harvard.edu