URBAN MOBILITY IN THE "DIGITAL AGE TRANSPORTATION".
THE TRANSFORMATION OF URBAN MOBILITY: MAJOR MILESTONES

1661. Blaise Pascal Letter to the Duke d'Roanne. The emergence of the idea of regular public transport

- “…Les carrosses devaient toujours suivre le même itinéraire et devaient respecter les horaires fixés, les départs ayant lieu tous les demi-quarts d'heures de leur terminus même si ceux-ci étaient vide. Les passagers devaient payer leur place cinq sols…”

1908. The appearance of the first car for mass consumption – Ford T

- “…greatest need today is a light, low-priced car with an up-to-date engine with ample horsepower, and built of the very best material. . . . It must be powerful enough for American roads and capable of carrying its passengers anywhere that a horse-drawn vehicle will go without the driver being afraid of ruining his car.”

2010th. Digital age transportation

- “…The arrival of the ‘information everywhere’ world has opened up new opportunities to make the existing transportation network far more efficient and user friendly.”

- IT-tools provided an opportunity for individualization "Pascal mobility" and at the same time "socialization" of "Ford mobility."
TYPOLOGY OF CITIES AND OBJECTIVE SPACE LIMITATIONS
TRANSPORT POLICY VS SPATIAL CONSTRAINTS

Above the "blue line" in large cities of the American type there might be «auto-oriented» transport policy "predict and provide". Idea of abandoning automobile dependency dictated largely humanitarian and environmental imperatives. Automotive mobility is quite possible, but not very good for the livability of the city.

In between the "blue" and "green line" there is a dominating (or should dominate) balanced transport policy «sufficient supply and demand management» in the spirit of the German "White Paper" (J.W.Hollatz, F.Tamms (Hg): Die Kommunalen Verkehrsprobleme in der BRD. Ein Sachverständigerenbericht und die Stellungnahme der Bundesregierung. Essen 1965.) The level of car ownership and daily use of the vehicle is limited by restrictions resulting from the principles of the "livable city,""sustainable mobility..."

Below the "green line" the cities have no choice: the need of a strict policy "Promote / Opposition". Automotive mobility is possible only within radical restrictions in the spirit of Singapore practice. Rejection of such a policy leads to chronic congestion and degradation of the urban environment...
DOES EVERY CITY CAN BE ADAPTED TO MASS MOTORIZATION? KEY FORMULA...

\[ S_v = 10^7 \times \frac{\epsilon}{d \times m} \]

- \( S_v \) — square meters of streets & roads per 1 vehicle
- \( \epsilon \) — the ratio of area occupied by streets & roads to the total area of the city
- \( d \) — population density, people per 1 ha
- \( m \) — motorisation level, vehicles per 1000 inhabitants

In USA (Canada, Australia...) cities \( \epsilon = 0.3-0.35 \), i.e. average 30%-35% of urban area in streets & roads.

In European cities \( \epsilon = 0.2-0.25 \),
in Asian cities \( \epsilon = 0.1-0.12 \),
in Russian cities \( \epsilon < 0.1 \).
AREA LIMITATIONS (RATIO BETWEEN «LAND AREA IN STREETS AND ROADS» AND «VEHICLES FLEET IN THE CITY»: RESULTS OF CALCULATIONS)

![Bar chart showing the ratio between land area in streets and roads and vehicles fleet in the city for different cities.](chart.png)

- New York: 203
- San Francisco/Oakland: 176
- Los Angeles: 153
- Paris: 141
- London: 98
- Madrid: 96
- Singapore: 72
- Tokyo/Yokohama: 63
- Moscow 1988: 110
- Moscow 2014: 28

**Sq m of Streets & Roads per vehicle**
Within the international comparisons Modal Split in Moscow does not correspond to our level of motorization
City is able to adapt to motorization level of 800 and more units per 1000 residents

<table>
<thead>
<tr>
<th>Dominant development type (especially in suburbia) - Car Oriented Development</th>
<th>Limitations on automobile usage in city center</th>
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<tbody>
<tr>
<td>Imperative condition of adaptation - dense multi-linked street network</td>
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<tr>
<td>Network takes to 35% of city territory; all sorts of parking takes to 30%</td>
<td>Network configuration - dual circuit: first circuit - streets; second circuit - freeways</td>
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<td>City, adapted to automobile (by Robert Moses) can be functional, but has no chances to become livable one (by Jane Jacobs)</td>
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</tr>
<tr>
<td>Non-eliminated shortage of public areas, lack of convenient pedestrian zones</td>
<td>Non-eliminated shortage of territorial and investment resources for acceptable mobility conditions saving</td>
</tr>
</tbody>
</table>
TYPICAL TRACK OF AUTOMOBILE AND CITY COEXISTENCE (IN DEVELOPED COUNTRIES)

- City adapts to mass motorization of residents
- Transportation behavior is adapted to city abilities
To achieve the minimum conditions for a comfortable car mobility requires «phase transition» from the current level of $\epsilon = 0.08-0.1$ to $\epsilon > 0.25$ (or from $sv \approx 30$ to $sv \approx 100$). Can we make this transition? Alas ...
AREA LIMITATIONS

Hypothesis: 50% of all vehicles at the same time moved out of their parking lots and parking

\[ \rho_{\text{nom}} = w_l \times 10^{-4} \times \frac{d \times m}{\varepsilon} \]

\[ \rho_{\text{real}} = \alpha \times w_l \times 10^{-4} \times \frac{d \times m}{\varepsilon} \]

\[ \alpha \text{ – share of vehicle fleet moved out of} \]
\[ d \text{ – population density, people per 1 ha} \]
\[ m \text{ – motorisation level, vehicles per 1,000 inhabitants} \]
\[ \varepsilon \text{ – share of land area in streets & roads} \]
\[ w_l \text{ – the width of the lane, m (= 3,35 m = 11 feet)} \]

In USA (Canada, Australia…) cities \( \varepsilon = 0,3-0,35 \), i.e. average 0,3-0,35 of urban area in streets & roads. In European cities \( \varepsilon = 0,2-0,25 \), in Asian cities \( \varepsilon = 0,1-0,12 \), in Russian cities \( \varepsilon < 0,1 \).
Area Limitations: Continuing the Theme...

Hypothesis: 50% of all vehicles at the same time moved out of their parking lots and parking

Average density, vehicles per 1 km of one 11-foot lane

LOS, Level of Service (A, B, C, D, E, F)
LET US RETURN TO OUR FORMULA...

\[ \rho_{real} = \alpha \ast w_l \ast 10^{-4} \ast \frac{d \ast m}{\varepsilon} \]

- Can we reduce the population density (d)? Alas...
- Can we radically increase the density of the road network (\(\varepsilon\))? We will never have any money, not urban space...
- Can we reduce the intensity of the daily use of cars?
- Can we reduce the level of car ownership?

The modern experience shows that, yes, we can.

Western Europe experience: car sharing...
Tokyo experience: "no own parking lot, do not own a car..."
Singapore experience: most radical measures, including "vehicle quota system..."

Issue of city transformation from “non-automobile cluster to automobile one” has no solutions through road construction. There will not be enough both, money and area. Achilles of road construction will never pass the turtle of motorization.
SINGAPORE’S EXPERIENCE IS THE MOST RADICAL ONE FROM KING SENNACHERIB EPOH

Private Transport Policy Measures = Ownership + Usage Measure

Ownership Control

1. Limit ownership
   → Vehicle Quota System (VQS)
1. Increase ownership cost:
   ▪ Additional Registration Fee
   ▪ Excise duty
   ▪ Road tax

Usage Restraint

1. Electronic Road Pricing (ERP)
2. Petrol duty
3. Parking Control
FIRST WRITTEN RULE OF PRIVATE CARRIAGES

"That anyone parking a chariot so as to obstruct the royal road should be put to death with his head impaled on a pole in front of his house«

Quotation from King Sinahherib's law

*Ancient Assyrian conception «Royal road» had almost the same sense as modern term «Public arterial highway».

Amount of household's carriages is comparable to population. Popularity of such carriages and conditions of their usage impact with unavoidable area limits.
PUBLIC TRANSPORT "INVENTION FORMULA" OR PATHWAY TO "SUSTAINABLE MOBILITY"
RECIPE IS COMMON: HIGH QUALITY PUBLIC TRANSPORT WITH HIGH GRADE OF "RIGHT-OF-WAY"
WHERE THE PRIVATE AUTOMOBILE AND AUTOMOBILE ORIENTED MOBILITY WILL BE SAVED?

Suburban development (car-oriented development) – the last bastion and reservation zone for mass private cars and automobile dependency

Predominant type of travel – "P & R"

Trips to rest, shopping and entertainment

Luxury & Old Fashioned segments

S'ils n'ont pas de pain (TRANSIT), qu'ils mangent de la brioche (PRIVATE CAR)!

It's a pity that someone will continue eat the brioche!
FOR INDIVIDUAL CARRIAGES: 3RD DIMENSION. ONE-MAN HELICOPTER

We shouldn’t laugh about awkwardness of these devices. Carriage manufacturers had a good laugh on Henry Ford’s “oil stoves” 110 years ago...
FOR INDIVIDUAL CARRIAGES:
3RD DIMENSION. "FLYING CAR"

Terrafugia Transition "flying car"

 Turbo-fan unmanned flying device "X-HAWK flying car"
FOR INDIVIDUAL CARRIAGES: COLLABORATIVE CONSUMPTION + SELF DRIVING
ONE MORE RECIPE: TRANSPORT MOBILITY IS REPLACED BY RESIDENTIAL MOBILITY
ONE MORE RECIPE: REPLACING THE BUSINESS TRAVEL WITH HOME WORK
A BRIEF STATEMENT OF THE MAJOR ADVANCES IN THE DEVELOPMENT OF PUBLIC TRANSPORT IN MOSCOW

- Record rates of subway construction
- Revitalization of ground public transport
  - Modern buses and trams
  - Revitalization of tram lines
  - Right-of-Way
  - Online information at bus/tram stops
  - Ticket-tariff European-style menu
- The integration of rail transport in the system of urban public transport
  - High-speed trains “city – airport” (AEROEXPRESS)
  - Modernization of commuter rail service
  - The “Moscow Little Ring Railway” project
- Transport interchange nodes
IMPLEMENTATION OF INTERNATIONAL EXPERIENCE:
IN RUSSIA THERE WAS A "PARKING REVOLUTION";
REGIME OF FREE PARKING WAS CANCELED

Russian edition of this book was issued this month.