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Urban Mass Transit Goes Driverless

Dr Gerard Yelloz

Siemens Tansportation Systems

Urban Mass Transit Goes Driverless - Definitions

MASS Transit = Light and Heavy metros greater than 25 000 pphd

Driverless – Unattended Train Operation (UTO)
Is there an attendant PERMANENTLY in the train cab?

If no, this is a driverless system:

The operation can be qualified as Unattended Train Operation since there is nobody in the cab

There could be either:

✓ **no attendant** on-board the train,

✓ **or an attendant** walking along the cars to assist passengers but in no way attending in the cab or pushing buttons for doors opening.

NB: Only in case of fall-back mode, the presence of an attendant in one of the cars could help recover train operation faster.

Urban Mass Transit Goes Driverless – The trend is definitive

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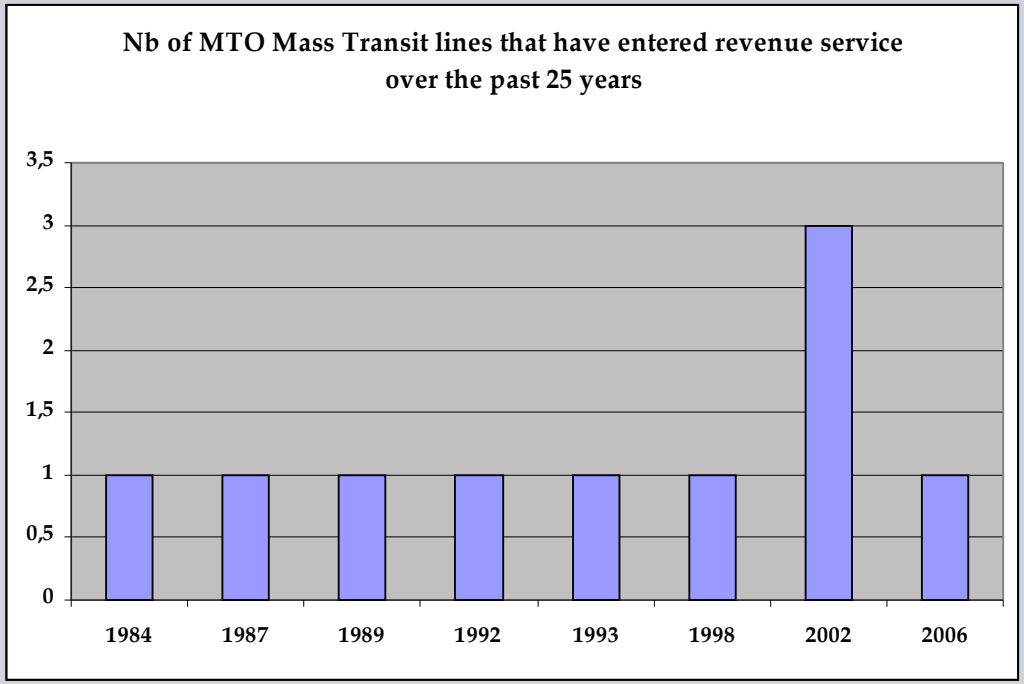
Trend Definitive

For new line as for line revamping/upgrade.

Europe Community is leading:

- ✓ Many on-going upgrades,
- ✓ New lines since 10 years are all driverless



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Driverless Lines in Operation (326.3 km)

Length	References in Service
163 km	**EUROPE** **France:** Paris L14, Lyon LD, Lille, Rennes, Toulouse, **Italy:** Torino, **UK:** London (Docklands), **Denmark:** Copenhagen
49.6 km	**NORTH AMERICA** **Canada:** Vancouver (Millenium and Expo lines)
113.7 km	**ASIA** **Malaysia:** Kuala Lupur (LRT2), **Hong Kong:** Penny's Bay Link, **Singapore:** NEL, **Taiwan:** Taipei (Mucha line), **Japan:** Osaka, Tokyo

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Driverless Lines in Construction (393 km)

Length	Ongoing References
198 km	**EUROPE** **France:** Paris L1, L14 ext, Toulouse, **Switzerland**: Lausanne **Italy:** Torino, Brescia, Milano (M5), Roma (LC) **UK:** London (DLR), **Spain:** Barcelona (L9), **Hungary:** Budapest (M4), **Denmark:** Copenhagen (M2) **Greece:** Thessaloniki,, **Germany:** Nuremberg,
19 km	**NORTH AMERICA** **Canada:** Vancouver (Canada line)
69 km	**MIDDLE EAST** **United Arab Emirates:** Dubai
107 km	**ASIA** **China:** Beijing (Airport line) **Singapore:** Circle line, **Taiwan:** Taipei (Neihu line), **South Korea:** Yongin (Everline)

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Driverless Lines in the Future (313 km)

Length	Future References
At least 216 km	**EUROPE** **France:** Paris L14 ext, Toulouse ext , Rennes ext **Italy:** Torino (L2), Milano (M4&5), Roma (LC&D) **UK:** London (Docklands), **Czech Republic:** Prague (LD), **Denmark:** Copenhagen (M2), **Finland:** Helsinki **Greece:** Thessaloniki,, **Belgium:** Brussels, **Spain:** Madrid
	NORTH AMERICA **Canada:** Vancouver ext(Canada line)
13 km	**SOUTH AMERICA** **Brazil:** Saõ Paulo (L4) *(1st driverless in South America)*
At least 84 km	**ASIA** **China:** Shanghai (L10), Tianjin,

CRITERION: Passenger Service Quality Improvement

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SAFETY

- ✓ **No human errors, fail-safe systems**, highest level because of built-in technology,
- ✓ Fire detection, safe braking, auto driving

Higher service quality of operation by higher:

FLEXIBILITY

- ✓ **Meet evolution demand** even in case of unexpected events no matter what the time is,
- ✓ **Automatic injection/withdrawal** of trains *(meaning faster execution and trains available on request),*
- ✓ **Automatic setting of temporary service,**
- ✓**Train evacuation** through **dedicated train doors**

CRITERION: Passenger Service Quality Improvement

Higher service quality of operation by higher:

FREQUENCY

Regular and smaller headway handled by computer,
✓ **Shorter travel time**,
✓ **Shorter passenger waiting time**

SERVICE TIME

✓ Can be operated **24/24, 7/7 ,**
✓ **Mixed operation** *(trains with driver can be injected),*

AVAILABILITY/RELIABILITY

✓ Built-in **redundancy,**
✓ Built-in **diagnostic,**
✓ Intrinsic **MTBF** very high,
✓ **If the system uses PSD:**
then no suicide, no tunnel intrusion providing confident journey time

Customers feel safe, do not wait, have no surprise thanks to continuous service. They just have to step in and let go.

CRITERION: City Image Enhancement

A Driverless line means:

- ✓ **Showcase of a modern city due to**:
  Service quality,
  Technology
- ✓ **Impact on the station architectural design:**
  Modern,
  Clean,
  Attractive,
- ✓ **A communicating transport system:**
  Voice communication from passengers to OCC,
  Announcements, information from OCC or stations to passengers on-board or in stations

CRITERION: Human Factors Evolution

CHANGE THE OPERATING COMPANY STAFF PROFILES

- ✓ **Multi-discipline,**
- ✓ **More Intelligent Technology and Telecoms** oriented rather than electro-mechanical,
- ✓ **Staff focuses on passengers' service** in stations and on-board,
- ✓ **Staff** can ensure, when and where necessary, passenger **security,**
- ✓ **Drivers' jobs** are to **disappear**…

PASSENGER BEHAVIOUR CHANGE BY HIGHER RESPECT OF THE TRANSPORT SYSTEM BECAUSE OF…

- ✓ **Better assistance** when they need information,
- ✓ **Higher sense of safety** with CCTV, presence of staff,
- ✓ **The feeling of being more respected** given trains on-time, frequent and well fit service,

CRITERION: Economical Benefits

LOWER INVESTMENT COST FOR A NEW LINE

- ✓ **Shorter trains** with frequent service,
- ✓ **Smaller platforms** and **smaller depots**

LOWER OPERATING COST

- ✓ **Lighter drivers training** -only for fall-back modes-,
- ✓ **Disappearance of strikes –** continuity of service and income…-,
- ✓ **Built-in real time diagnostics** for better LCC,
- ✓ **Built-in detailed preventive maintenance** information,
- ✓ **Always the needed number of trains** are running, during off peak especially,
- ✓ **Energy consumption reduction** by smooth and regular automatic driving,
- ✓ **Fleet management** resulting in **better train/km ratio**

CRITERION: Economical Benefits

HIGHER REVENUES, ATTRACTIVITY FOR INVESTORS

- ✓ **Higher revenue** by **passenger attraction**,
- ✓ **Higher transport capacity** /train ratio,
- ✓ **PPP interest** for operation and maintenance and driver issue,
- ✓ Follow **technological evolution,**

UITP report in 1997:
Driverless is cheaper both in investment and O&M

CRITERION: Communicating Transport System

COMMUNICATING SYSTEM

- ✓ **Real time information** on **platforms,**
- ✓ **On-board real time information,**
- ✓ On-board and in station **CCTV and voice communication:** help fighting against crimes, enhanced feeling of safety among passengers

The Transport System Listens to Customers

Criteria for Choices

All criteria are contributing to the election of driverless operation for a mass transit but their importance differs from a city to another.

EXAMPLES of criterion for the choice:

- ✓ **Economic:** Copenhagen, Nuremberg,
- ✓ **Service Quality**: Paris, Lyon, Lille,
- ✓ **Strike issues**: Seoul, London,
- ✓ **PPP**: Saõ Paulo

Each city has its own specificity, passenger behavior, profiles, political issues (private, public) making the choice for a driverless system more local than national…

And Europe, WHY?

European Motivations for choosing Driverless

- ✓ The driver job, the Transport Company Human Resources Policy,
- ✓ The Quality of Service to Public,
- ✓ The Passengers profiles: low, middle and high level classes,
- ✓ The fight against car in congested urban cities,
- ✓ The Operation and Maintenance Cost,
- ✓ The Capital (Investment) Cost,
- ✓ The Ecological Trend and City environment changes,
- ✓ The Petrol Price,
- ✓ The Security Improvement