# THE METRO SYSTEM OF FUTURE MEGACITIES

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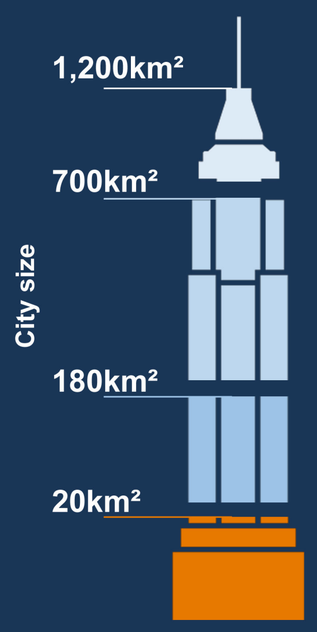
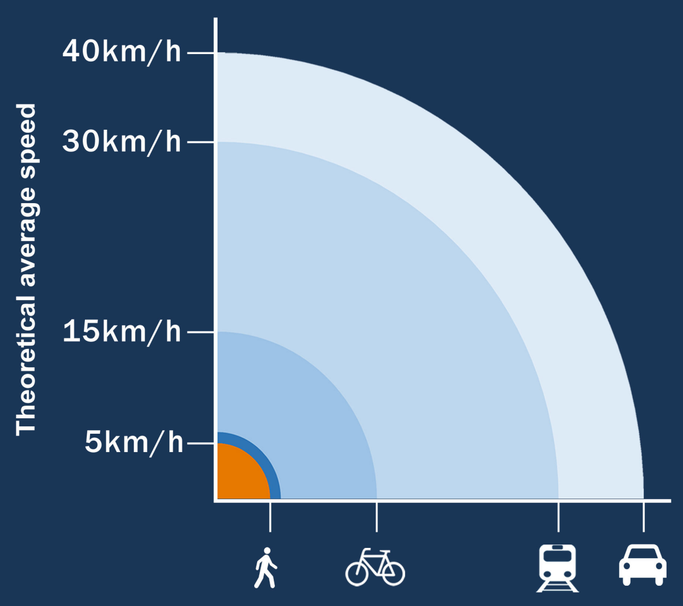
CAPES

## The need for speed

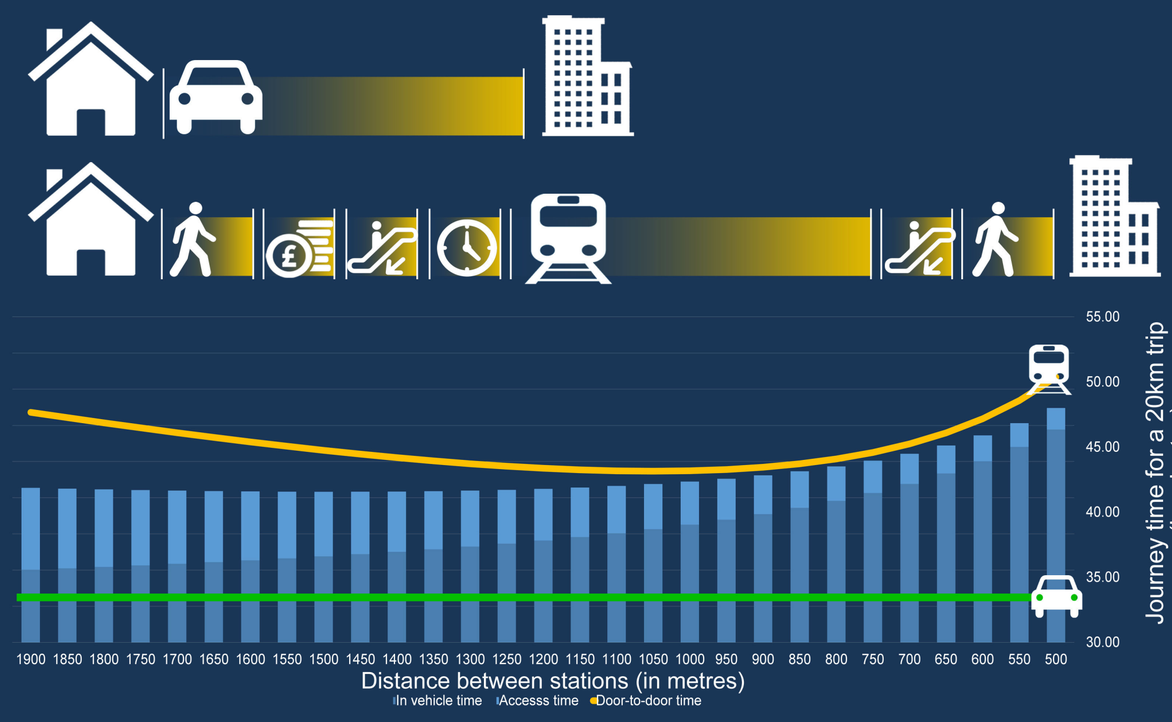
Throughout history, from Greek villages to the modern megacities, cities have been ‘one-hour wide’. Their sizes are determined by the distance one can travel within one hour, so it logically follows that the faster one can afford to travel, the larger the city can be. Once the car became widely available, it also stretched cities beyond the capabilities of public transport to provide competitive speeds due to the coverage paradox. As users tend to always look for the highest speed available, the dominance of the automobile now threatens the economic, social and environmental sustainability of our cities.




## The coverage paradox

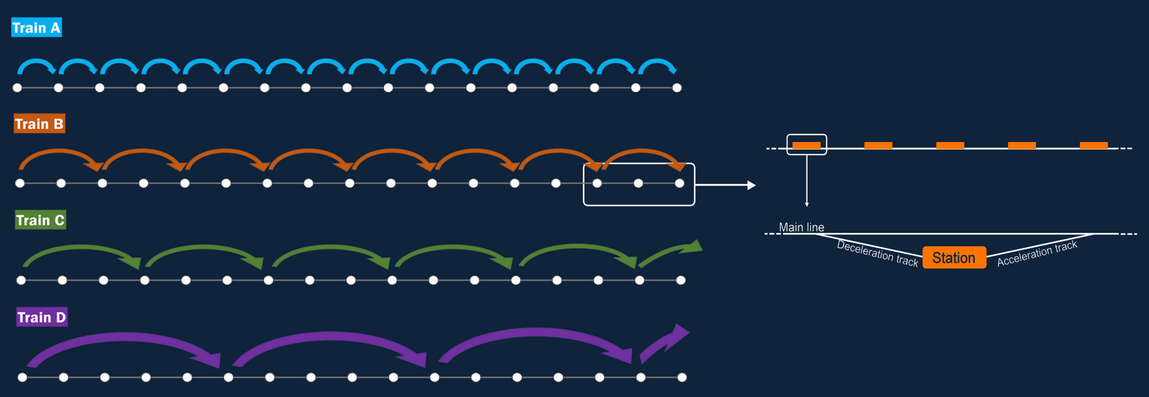
The journey by car involves mainly a motorised component while the same journey by metro involves at least two components, one of access to stations where distance is the critical factor, and in-vehicle time where speed is the critical factor. Hence, if stations are far apart, a metro will have a higher average in-vehicle speed, but access time increases as well. Conversely, when stations are close together, access is fast but the average in-vehicle speed on the metro is reduced. In both cases, their door-to-door journey times are significantly higher than those of private modes.




# THE SOLUTION

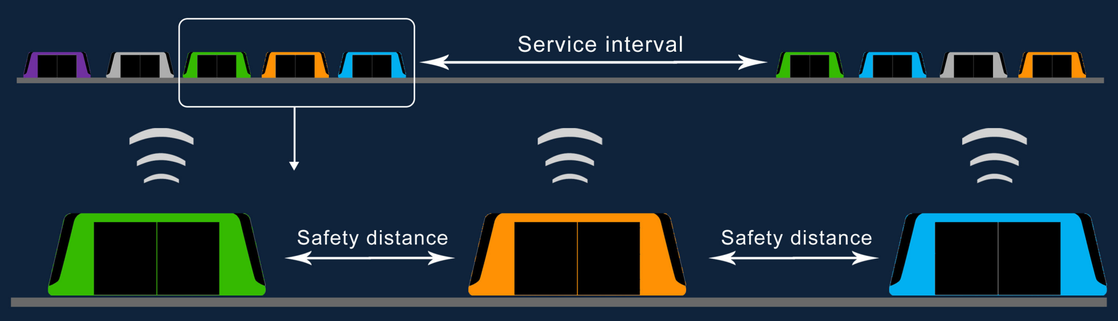
## Optimised operations

In order to overcome the coverage paradox, this solution firstly proposes an operational strategy where different trains stop at different intervals along the line for higher average speeds. For example, a service that stops every 3 stations (type C) can offer twice the speed of a train that stops in every station. Secondly, when stations are located off the main line, the distance between them can be reduced to a minimum. The closer station spacing reduces access time while the pattern strategy increases the average in-vehicle speeds.




## Reinventing the train

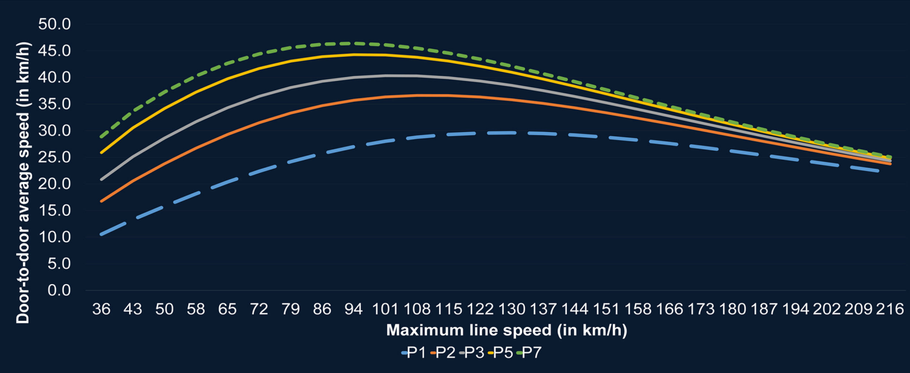
To make such operations possible, the system comprises autonomous vehicles using vehicle-to-vehicle communication to travel together as a platoon/convoy. A particular pattern is assigned to each vehicle (the equivalent of a car in a metro train), or a set of vehicles where demand is high, and vehicles or sets of vehicles following different patterns run closely to form a platoon/convoy. This strategy guarantees that every station will be serviced by a vehicle of every pattern at the minimum service interval, which significantly increases the capacity of the system.




# RESULTS

## AVERAGE DOOR-TO-DOOR SPEEDS


## DOOR-TO-DOOR JOURNEY TIME (20KM TRIP)


## SYSTEM CAPACITY (PASSENGERS PER HOUR)