

System Availability in Scalable Elevator Systems

MULTI is first elevator system driven without rope in the world, in which cars can travel in both vertical and horizontal directions in the shaft. This system provides many advantages, for example, higher handling capacity and lower energy consumption in comparison with conventional elevator systems. However, relevant studies about the availability of MULTI system is still missing, which stops MULTI from being widely implemented worldwide. This thesis investigates availability of MULTI system in three different models.



Foto: Donghe Yan

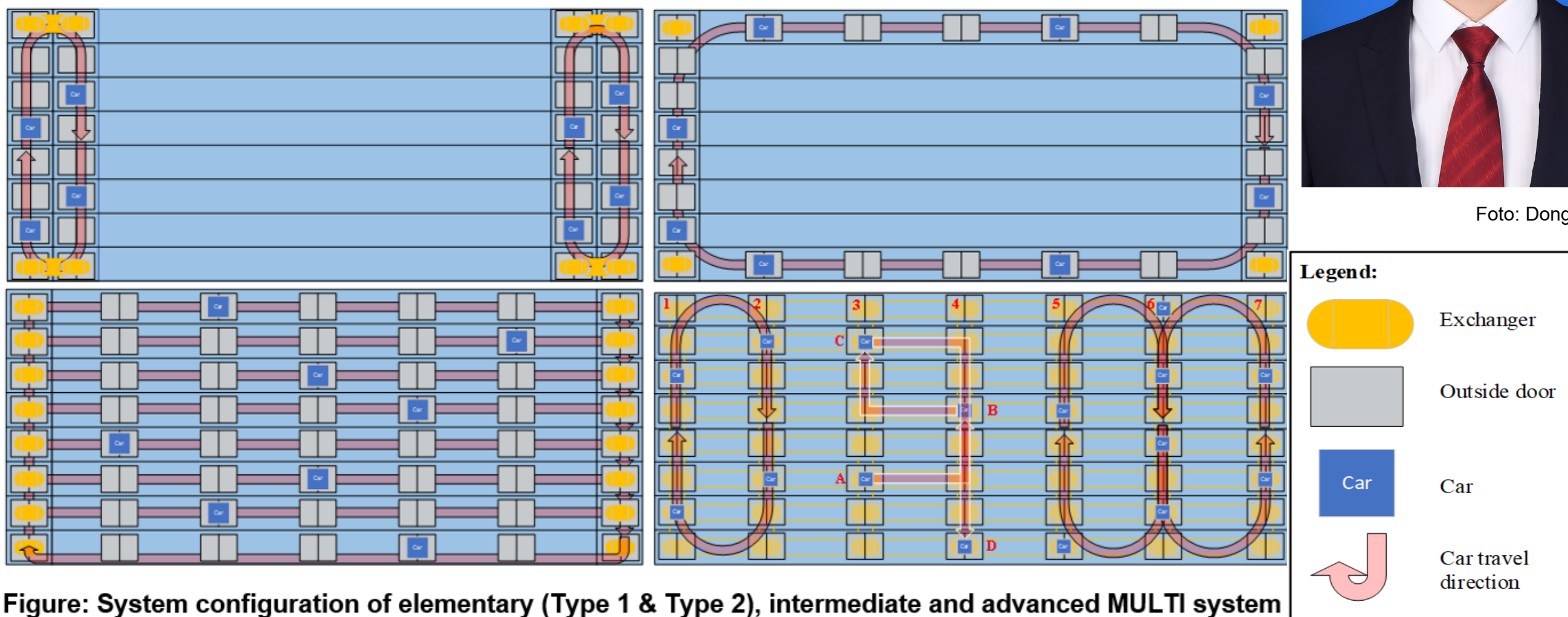


Figure: System configuration of elementary (Type 1 & Type 2), intermediate and advanced MULTI system

First Model: System model without considering system configuration

The first model focuses on attributes of components (failure rate and MTTRpl) and their ways of connection. In order to improve system availability, several components are designed redundantly, and thus the calculation of failure rate and MTTRpl of redundant component group (m oo n) is inevitable.

Second Model: System model by considering system configuration

The second model takes system configurations into account, as MULTI system is scalable and can be applied in different buildings. System availability of MULTI system in this model depends on the availability of independent travel, which is defined as transportation of passengers from one point with boarding possibility to another.

Third Model: System model by considering traffic demands

In the third model, a new kind of availability is defined, namely availability of transport, which describes how many percent of the passenger travel demands can be satisfied by MULTI system within a given time interval. Furthermore, availability of transport of MULTI system within one day is calculated by considering failure possibilities and reliabilities of subsystems.

To enhance system availability, components with lower failure rates and shorter MTTR are always preferred. Components with higher failure rates can be designed redundantly and proficient maintenance

workers are needed. Preventative maintenance is a feasible method to increase availability. However, the pre-requisition is certain period of down time of MULTI system.

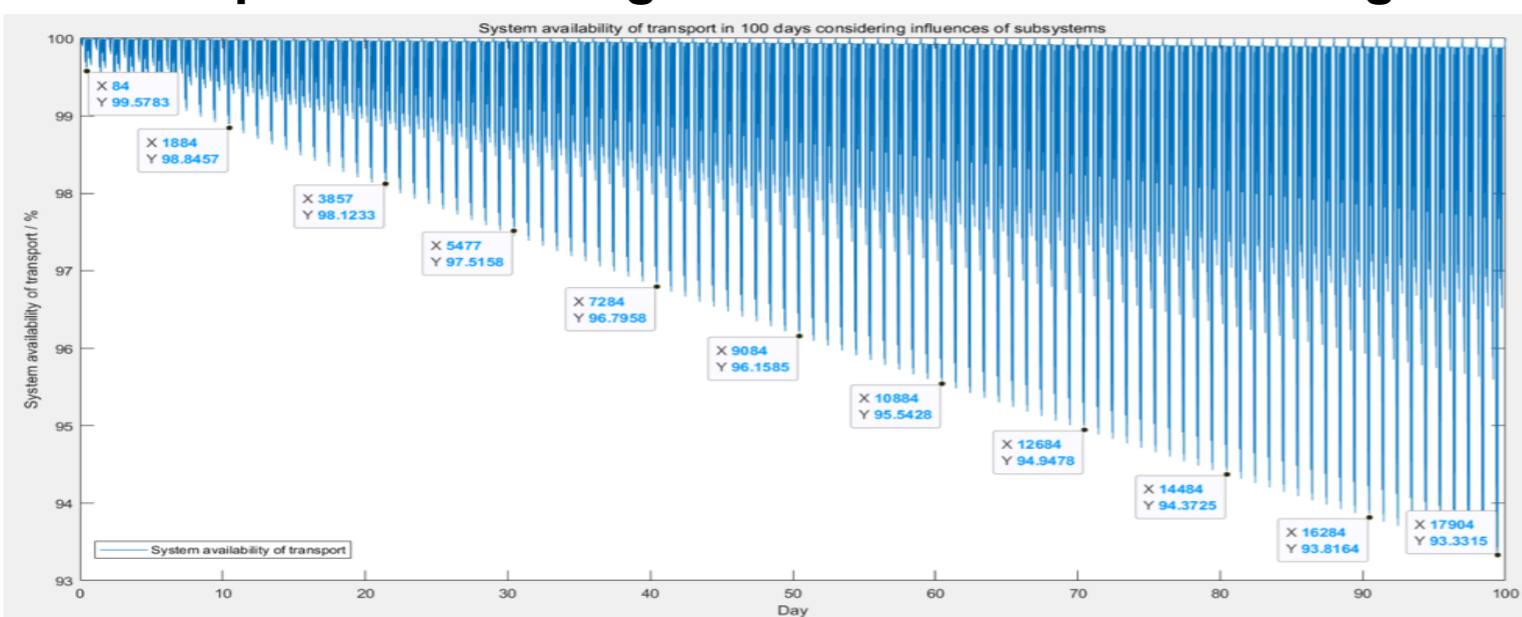
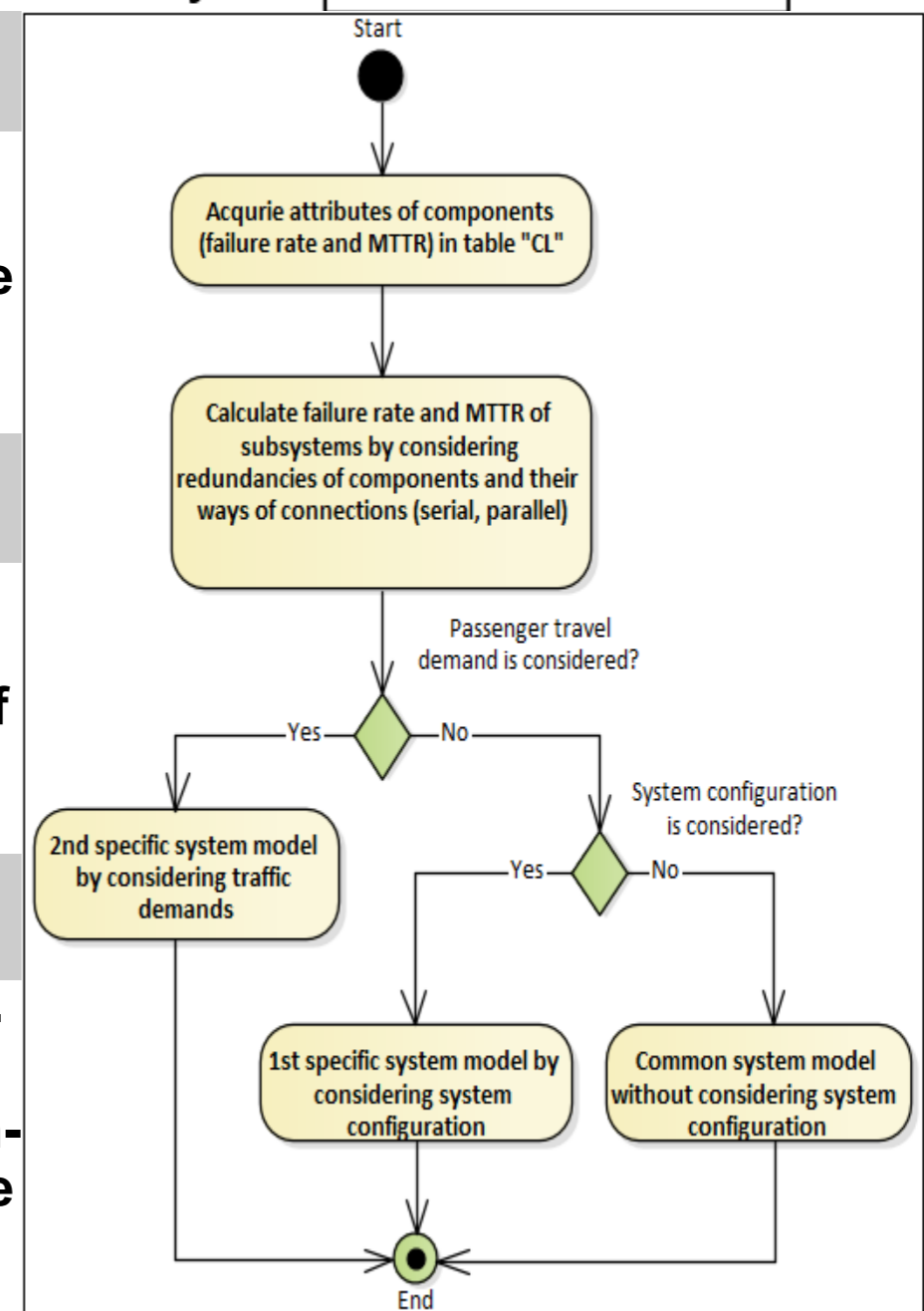


Figure 47: System availability of transport in 100 days considering influences of subsystems



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