

Figure 2: Dwell and stop time (including standard deviation) of tram and RandstadRail before and after the introduction of RandstadRail on the same route

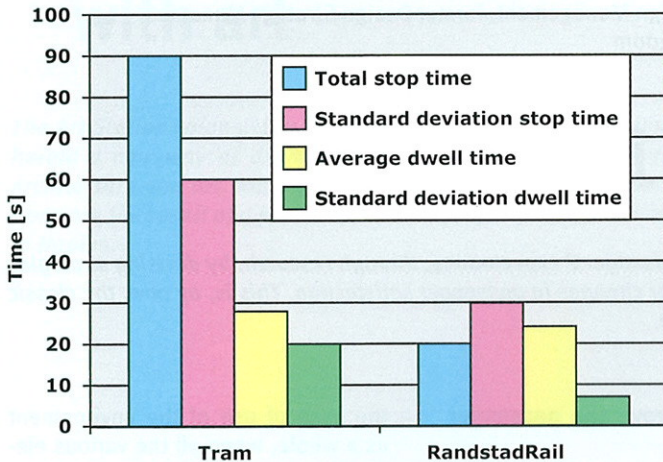
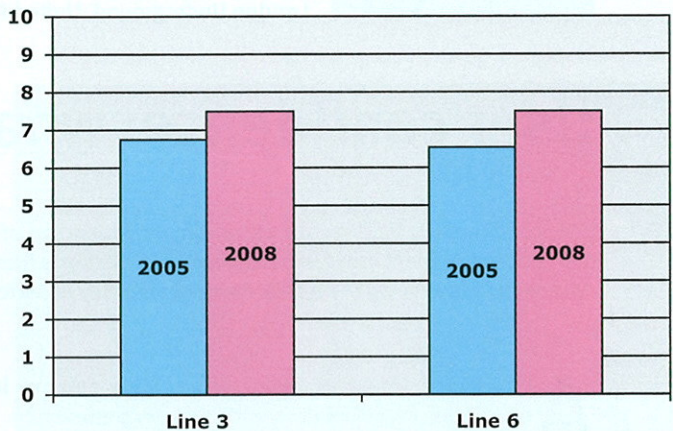


Figure 3: Customer satisfaction rating for reliability of two lines before (2005) and after (2008) the introduction of RandstadRail



HTM has designed a new, three-step control philosophy^{2,3} to mitigate variability in driving times and deviations from the timetable.

The first step is preventing timetable slippage: infrastructure provides exclusive right of way as far as possible and RandstadRail has traffic priority at intersections. RandstadRail stops at every stop and never leaves ahead of schedule. Vehicles enable level boarding via wide doors. A display screen in the cabin shows the driver the punctuality of his vehicle in real-time (figure 4).

The second step involves coping with timetable deviation by building slack time into schedules at stops, trajectories and terminals, ensuring that minor timetable slippage is resolved with little impact on passengers.

The final step to get vehicles on schedule again is performed by the traffic control centre: a comprehensive overview of all vehicles enables them to respond to disturbances with measures such as slowing down vehicles in the vicinity of a delayed vehicle. Re-routing and shortening lines are also possible in the event of major disturbances.

Impact of operational control

The various measures outlined above were applied from the outset and continued during the first year of operations. Both increased experience and more developed research were used to continuously improve the system. The effects measured in 2008 included:

- Percentage of trips departing with a deviation between -1 and +1 minute increased from 70% to 93%;

- Number of trips departing ahead of schedule decreased from 50% to 6.5%;
- The average value of stop time has decreased and the standard deviation is also smaller, resulting in higher levels of reliability;
- Standard deviation in dwell time has fallen from 20s to 7s. Average dwell time improved from 28s. to 24s. per stop;
- Customer satisfaction with regard to reliability clearly increased after the introduction of RandstadRail. Since the outset, RandstadRail has experienced an increase in ridership (see figure 3) and passenger numbers are steadily rising.

More information is available at:
<http://www.htm.net/Pages/DEF/533.htm>

References

- ¹ Vosser, D.J and L. Haring, "The future belongs to light rail", in: *PTI* September/October 2008, p. 10-12.
- ² Oort, N. van and R. van Nes, "RandstadRail: Increase in public transport quality by controlling operations", in: *Proceedings Second International Seminar on Railway Operations Research*, Hannover, 2007.
- ³ Oort N. van, R. van Nes, "Controlling operations of public transport to improve reliability: Theory and practice", in: *88th Annual Meeting of the Transportation Research Board*, Washington, D.C., 2009.

Figure 4: Display showing punctuality to the driver



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