Response by Prof. Joop Evers

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The remarks by professor Weidmann concern: (1) Trip booking (discussed in III); The unmanageable number of O/D-relations (discussed in I); (2) Relations with other PT-modalities (discussed in II); (3) Capacity (see I and Profile paper: 'State of art of fast transport by buses'); (4) Political feasibility (discussed in V and VI); (5) Speed (discussed in II) and (6) Infrastructure (discussed in II, VI and VII).
The remarks of professor Bookhuis concern: (1) FTR as an alternative for car travelling (discussed in IV) and (2) Opportunities (discussed in VII).
The author thanks professor Brookhuis and professor Weidmann for their interesting and stimulating remarks.

1. How to select the O-D relations to be served?

As professor Weidmann rightly states, in any significant network, the number of O/D-relations will be too large to be served on the basis of FTS, simultaneously. For example, Figure 2 in the Profile-paper shows a hypothetical PRT-network; the distances between the main stations vary from 15 to 30 km; local roundtrips with local stops are indicated by triangles. In Amsterdam FTR is integrated with two metro stations. Direct connections with frequent local transport also may apply to Den Haag. For most of the local trips, free bus lanes are supposed to be available. In principle, no FTR-services are offered between local trips in the same city.
Thus in this example there are over 250 combinations of local trips. To find selections, the logistical '80/20-law' is followed, reflecting the observation that in production normally 80% of the turnover is realized with only 20% of the assortment. In this case the assortment is the set of trips differentiated in time. The selection may vary in relation to the calendar and the time of the day.
During peak-hours, FTR-service can be offered to a full extent on a wide selection. During pit-hours, FTR-service may be replaced by scheduled, conventional bus-services. In the context of the example, a general transfer point may be introduced at Schiphol (i.e.

Amsterdam Airport), which will reduce the complexity of service providing drastically. Of course, the same infrastructure, the same buses and even the same (but slightly adapted) intelligent fleet deployment can be used.
To serve the demand in a rush hour on the trajectory Schiphol-Almere, 160 trips are needed in each direction. With this volume it is possible to maintain attractive assortments. In addition, calculations show that, accepting an occupation rate of 2/3rds, at least 2/3rds of the services may be delivered on the basis of fixed schedules. For the other segment, FTR will work with 'time guarantees', which will follow a stable pattern, to be announced at least one month in advance.

2. How does FTR relate to other PT-forms; can FTR be integrated?

FTR is focused on fast intercity PT on rather small distance scales. Indeed, as professor Weidmann states, FTR is not an alternative for high speed long distance travel services, but rather FTR will be complementary. In the example, FTR and the TGV are connected at Schiphol station; the timing of FTR services can be adjusted.
FTR is also complementary with respect to local PT. For instance, when there is high performance local PT (such as a metro), one may connect FTR via one or a few integrated stations. Another possibility is to start and/or to terminate FTR-trips with a local trip, transfers may be avoided completely.
FTR might be an interesting alternative for light rail. The capacities of sprint lanes and railroads are comparable: 20,000 passengers per hour. For most travellers FTR is 'all-in' faster. For many passengers there will no need to transfer. The service is much more differentiated than light rail can offer.

3. Does FTR's booking system limit travel flexibility?

Professor Weidmann mentions the 'Deutsch Bahn PEP ticket scheme' as a case of failure (see H. Link, 2004: 'PEP: a yield-management scheme for rail passenger fares in Germany', Japan Railway & Transport Review, No. 38). The system was designed as a yield-management scheme, introducing complex pricing schemes for early booking, reductions and penalties on cancellations and rebooking. The system was experienced as rigid and blocking; it was withdrawn shortly after introduction.
In contrast with this, the FTR-booking interface is designed to facilitate access. There is a uniform distance-related basic fare and a small booking fee. In case of cancellation the basic fare is returned; modifying the timing costs an additional fee. Last-minute booking requires no booking fee.
One may book 'on-time' in three variants: (i) specifying the 'latest arrival time' at the destination; (ii) specifying the 'earliest departure time'; (iii) reserving a seat in a pre-scheduled trip. Booking takes place until, say, one hour in advance; after that the last-minute regime starts. The traveller information system will be connected with the information systems of other modalities (airplanes, TGV), in such a way that travellers may tune their bookings and get guidance whilst travelling.
Participation in FTR requires a personal ID-card, which also supports the financial settlements. Communication goes via 'SMS', or, using a 'smart phone' via Internet. On the

request of the client, the system may introduce a personal 'virtual guide', who will monitor the journey 'door-to-door'. Using a 'smart phone', this 'guide' may use GPS for real-time travelling support.

4. Can FTR compete with the private car?

Professor Brookhuis wonders whether FTR can really grow to become an alternative for the use of private cars. His remarks on the '65 minutes law' for commuter travelling are extremely relevant. Indeed this typically represents FTR's 'A-segment'. Referring to the example Schiphol-Almere-Groningen, spanning 190 km, Brookhuis recommends a speed of 180 km/hour. Indeed for this distance, he is right. However, the example of Figure 2 covers a densely populated area with daily congestions, spanning a distance of 120 km. Here, driving at 120km/h for a substantial part of the market, FTR will beat the 70 minutes barrier.
Other factors are the availability to FTR-services and the 'emotional image'. In the example, the volume is such that FTR may deliver high frequency, differentiated transport. This opens many opportunities. For instance, it is easy to offer combined tickets for public events and dedicated FTR-travelling. The idea is to associate FTR with a metropolitan, communicative way of living, where travelling feels like well organized, reliable carpooling with members of the same community.
Professor Brookhuis rightly states that, concerning comfort, buses are usually seen as inferior. It is clear that, taking into account functionality and 'emotional image', buses need re-designing. Combined with the novelty of the concept, it is clear that the start of FTR will be difficult.
Conclusion: one may expect that FTR: (i) will offer an alternative for the use of private cars, especially during peak-hours, (ii) will fit into an 'urban way of living', capable of attracting other markets, and (iii) will, indeed, have a difficult start.

5. Do sprint lanes have huge visual impacts on the landscape?

Sprint lanes are equipped with automated intensive traffic/vehicle guiding based on real-time communication. Thus we have 'traffic lights on dashboard' and 'intelligent cruise control'. The objective is to maintain a safe, uniform speed (say 130 km/h) and, eventually, to trigger 'safety stops'. In addition, the idea is to equip sprint lanes with a system for lateral guiding. Therefore there will be no need for hard shoulders; distributed parking strips will do. Thus sprint lanes will occupy a similar width as a railroad.
Studies on the connection Schiphol-Groningen (i.e. the Zuiderzeelijn) project sprint lanes on an earlier projection of a trace for a TGV connection. It appears that (for 180 km/h driving speeds) the radii curves and the length of entries and exits are compatible with this starting point; see Consortium FTR, 2006. Professor Weidmann's view on this aspect seems to be too pessimistic (remark 4).

6. Is FTR economically exploitable?

In our example only the trajectory between Almere and Schiphol must be constructed; for the other trajectories free bus lanes are already in operation. Therefore, using the figures of earlier studies, we focus on the trajectory Almere-Schiphol. Referring to the construction costs of the free bus lane Schiphol-Haarlem, it seems reasonable to estimate the investment at € 580 million. From feasibility studies on a PT-connection between Schiphol and Groningen (i.e. the Zuiderzeelijn), one may expect a volume of 72,000 per workday and 36,000 on an average 'non-work day'. Because of imbalances, the average degree of occupation is set at 60%.
Using buses with 25 seats, the service will utilise 150 busses during an average peak hour. During a workday the buses drive 164,000 km in total during 1,700 operation hours in total. For the average 'non-work day' this will be 76,800 km and 800 hours, respectively. Using the figures of the report *Cost Indicators of Public Transport* (CVOV, 2005), this leads to the figures presented in table 1.

Table 1. Estimated exploitation costs FTR on the trajectory Schiphol-Almere

	€ / year	**€ / bus-km**	**€ / trav-km**
Sprint lanes: 18% of invest.	104.4 mln	2.20	0.123
Fixed fleet costs: 50.000 €/bus	7.5 mln	0.16	0.009
Operating costs: 80 €/uur	39.1 mln	0.83	0.047
Bus costs per km: € 0,60 €/km	28.3 mln	0.60	0.034
Total	179.3 mln	3.79	0.213

Note: the figures in the columns refer to the same costs, but converted to different rubrics. From the report mentioned above, one may deduce that light rail is more expensive, both in investment and exploitation. Conclusion: (i) FTR seems economically exploitable, and (ii) light rail is more expensive.

7. Does FTR fit in with governmental transport policies?

Professor Brookhuis rightly states that FTR will only have a chance to succeed if some flanking measures are taken. Intelligent BRT (i.e. Bus Rapid Transport) as a starting point for FTR needs free bus lanes. Constructing free bus lanes and upgrading existing lanes to facilitate a speed of 130 km/h is an obvious step.
At the moment the policy is focused on adding lanes to auto highways and constructing railways. For the densely populated western part of the Netherlands that is not rational. The capacity of one free bus lane exceeds the capacity of eight highway lanes. Comparing light rail and FTR, we see that the capacities of sprint lanes and railroads are comparable. For most travellers FTR will be 'all-in' faster, and the FTR-service is much more differentiated than light rail can offer. The objective should be to offer a time saving alternative for the use of private cars, especially during peak-hours.