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7–9 May 2012, Dubrovnik, Croatia

## Road and Rail Infrastructure II

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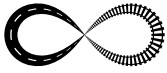
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## PUBLIC BUSES ON EMERGENCY LANES – A VERY SPECIAL USE OF A MOTORWAY IN AUSTRIA

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### Abstract

Linz is the capital of the Austrian region Upper Austria and its political and economic centre; the population of the greater Linz conurbation is over 250,000. It is hardly surprising that the arterial roads leading to Linz were regularly congested at peak hours as early as the 1990s (and they still are). Not only car passengers lost time but many bus passengers also suffered, and the bus time tables became increasingly unreliable.

Given this situation, more than ten years ago the idea was borne to permit public buses the use of the emergency lane of the motorway A7 leading to the city. After years of discussion about this transport policy, many obvious reservations (e.g. those expressed by rescue services) and uncertainties (e.g. how to proceed in wintry conditions) remained. Therefore, the Austrian motorway operator ASFINAG commissioned a feasibility study. It came to the conclusion that it would be both possible and useful to open the emergency lane for public buses in case of congestion on workday mornings. In 2004 the authorities took the plunge and started a 3 km trial operation; nothing like this had ever been tried before. The practical experience gained was so positive that in consequence the measure achieved not only the 'status of regular operations' but was also extended to some additional sections of the motorway.

The paper (i) provides some key findings of the feasibility study and recommendations based on them; (ii) it describes the conditions under which the measure was implemented; and (iii) it highlights the practical experience from different points of view (bus operator, fire and rescue services, police, and road maintenance department).

*Keywords: public bus, emergency lane, motorway, temporary use, congestion*

## 1 Introduction

### 1.1 General comments regarding the special use of emergency lanes

Under normal circumstances the emergency lanes of motorways are used to temporarily park broken-down cars; in case of accidents, emergency vehicles use them; during roadwork they are used for traffic routing on multiple lanes, and they considerably facilitate maintenance work. In general, they are an important factor increasing safety; in comparison to motorway sections without an emergency lane they reduce the accident rate by about one fourth [1].

At the end of the 1990s, after the traffic volume had steadily increased which lead to more frequent congestions, Germany started to open emergency lanes of certain motorway sections temporarily for the moving traffic to increase the road capacity during rush hours [2], [3]. Initially, the emergency lanes were opened by the police with the help of manually operated hinged flap signs but nowadays sophisticated electronic control and information systems are used (traffic-actuated variable message signs, video surveillance systems, etc.). By now, the

temporary opening of an emergency lane ('rush hour lane') is quite common in Germany [4], [5], the Netherlands [6], and in the United Kingdom [7], and it is being tested in a pilot project in Switzerland [8]. Of course, this uncommon use of emergency lanes requires a legal base which means changing the road traffic laws and the introduction of new road signs. The various systems for the temporary opening of emergency lanes are designed in slightly different ways, but in general these lanes are opened for all types of vehicles.

For about one year the Austrian motorway operator ASFINAG has been discussing the possibility of a rush hour lane for a motorway section close to Vienna, but so far there is no timetable for its implementation. But there is a very special way of using the emergency lane in a part of Austria, and to the best knowledge of the author, this is actually a unique way: close to the town of Linz, the emergency lane is opened for public buses in the case of congestions during rush hours.

## 1.2 The concept of a special way of emergency lane use in the Linz area

Linz is the capital of the Austrian region Upper Austria and its political and economic centre; the population of the greater Linz conurbation is over 250,000. It is hardly surprising that the arterial roads leading to Linz were already very busy in the 1990s. Particularly the section of the motorway A7 leading to the town from the east was (and still is) regularly congested at peak hours (Figure 1).

Since up to 15 public buses use the above mentioned section of the A7 every workday morning during rush hours, not only car passengers lose time but numerous bus passengers also suffer, and the bus timetables became increasingly unreliable. For that reason, more than ten years ago the bus service operator had the idea that it would help if buses were permitted to use the emergency lane. So he suggested a project which he considered suitable to an ideas competition on how to promote mobility services. Although his project wasn't awarded he did not abandon the idea but started to present it to various traffic and political decision makers. As it often happens when somebody tries to introduce any new traffic-related measure, a long-drawn discussion about transport policy began. It revealed rather different opinions, attitudes, and arguments, which basically either supported or rejected the bus service operator's suggestion. Even years later, many obvious reservations (expressed by rescue services and others) and uncertainties (e.g. how to proceed in wintry conditions) remained.

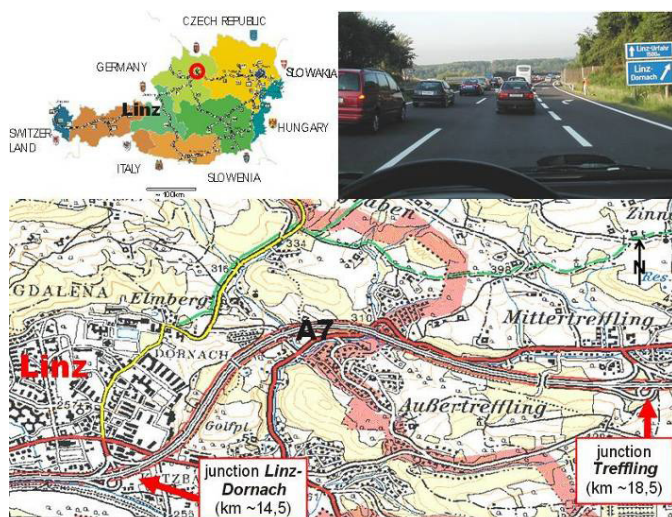


Figure 1 Congestion on the A7 close to the exit Linz-Dornach

## 2 The Feasibility Study

The discussions about possible kinds of use of the emergency lane did not lead to any specific result. Those who supported the special use of the emergency lane were unable to achieve its implementation while those against the measure lacked arguments to kill the idea. Therefore, the Austrian motorway operator ASFINAG commissioned a feasibility study [9] to obtain objective and well-founded information (i) whether anything could be done to improve the situation, and (ii) if yes, what kind of action would lead to the most favourable result, and (iii) how to implement the respective measure.

### 2.1 The Object of Investigation

The study focused on a 5 km section of the westbound carriageway of the A7 leading to Linz. The section started at the motorway access at Treffling junction, included the Linz–Dornach junction and ended at the exit at Linz–Urfahr junction (Figure 2). From its beginning to the access Linz–Dornach the carriageway has two lanes of 3.75 m each (plus a hard strip of 1.0 m on the left) and three lanes from that access onward. On the right there is a continuous emergency lane, 3.0 metres wide. Some of the regular service buses use the motorway even before they get to Treffling junction, others access the motorway there; all of them leave the motorway at the exit Linz–Dornach; from there they access the urban road network. Several scenarios for the use of the emergency lane were investigated: (1) opening the emergency lane for regular service buses in case of congestions at peak hours; (2) opening the emergency lane for HOVs (high occupancy vehicles, i.e., with three or more occupants) at peak hours; (3) marking a particularly long deceleration lane (max. 2.6 km) ahead of the exit Linz–Dornach.

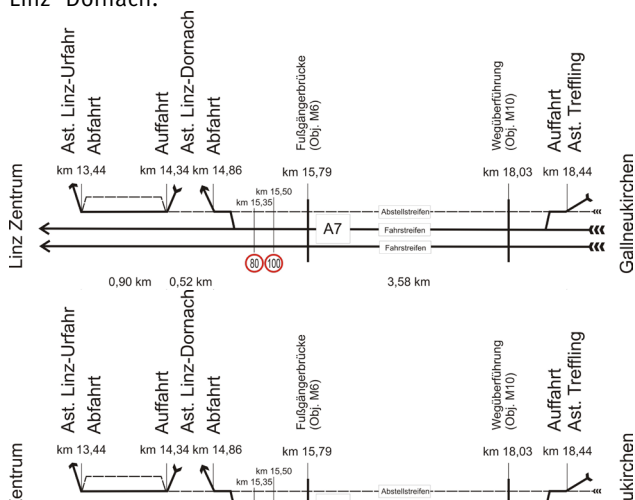


Figure 2 System diagram of the section in question

### 2.2 Methods used

Various methods were used as part of the survey:

- Traffic counts: manual counts during morning peak hours were used to complement already available data about the traffic volume.
- Accident analysis: the accident rate (personal injury accidents only) during the previous five years was analyzed in detail for both carriageways of the A7.

- Survey of bus drivers: bus drivers were asked to record their arrival time at the first bus stop after leaving the motorway at the exit Linz–Dornach for two weeks. These arrival times were compared to the scheduled time according to the time tables.
- Survey of the degree of occupancy: during morning peak hours the number of occupants per car on the A7 was counted, the number of occupants per bus was estimated.
- Calculation of the travel time: At two points at the A7 (down from the bridge above the motorway at km 18.0 and at a short distance ahead of the exit Linz–Dornach at km 15.1) video recordings were made; the number plates of vehicles were recorded manually and the travel time during morning peak hours was calculated.
- Support by a group of experts: the experience of a group of experts – members were representatives of the local transport authority, the motorway operator, the bus operator, the police force, rescue services, and the fire brigade – was taken into account. Throughout the project, intermediate results were discussed and the next steps planned.

### 2.3 Results (Examples)

The following detailed results of the study are only part of the overall findings.

The average daily traffic volume on the motorway section included in the survey was below 30,000 veh/24h and hardly surpassed 3,000 veh/h even during peak hours. This means that the traffic volume is significantly below the capacity of the cross section. The frequent congestions during morning rush hours are therefore due to bottlenecks further downstream in the urban area (there the ADT increases to above 100,000 veh/24h).

The accident rate on working days was quite typical for a motorway section with regular tailbacks during morning rush hours. The number of accidents was above average (0.71 accidents/km per year) but they were comparatively harmless (22 of the 23 injured people suffered only slight injuries). Three quarters of the accidents occurred in the time from 6:00 a.m. to 9:00 a.m., and 10 of 11 were rear end accidents.

The survey of the bus drivers showed delays particularly on Mondays and Thursdays with buses being 20 or more minutes late compared to their timetables (Fig. 3).

The car occupancy during morning rush hours is shown in Figure 4. On average, the car occupancy rate was 1.32 people per car; 75% of the cars had only one occupant, i.e. the driver, 20.5% had two and 4.5% had three or more occupants. In the case of buses, 10 were considered fully occupied (70 passengers each) and 3 half occupied (25 passengers each). This means an average number of 60 passengers per bus.

Measuring the travel time on a Monday morning showed that due to congestions between about 6:45 a.m. to shortly before 8:00 a.m. more time was needed for the same distance (Figure 5). It was a mere coincidence that the tailback on this particular day reached the first cross section used for measurements. Compared to a trip during an inter-peak period and when observing the speed limits on the 2.8 km long measuring section, the loss of time amounts to a maximum of 8 minutes (the one obvious exception, the 'fast' car at 7:17 a.m., was a police car on the emergency lane). The average time loss per vehicle per congestion was 3.59 minutes. Ten regular service buses were affected; one of them (the one at 7:00 a.m.) illegally used the emergency lane for about 1 km and thus managed to avoid the congestion. For bus passengers, a total time loss of about 36 person hours per congestion was calculated; on the assumption of 75 of these events per year this would amount to a total of 2700 person hours.



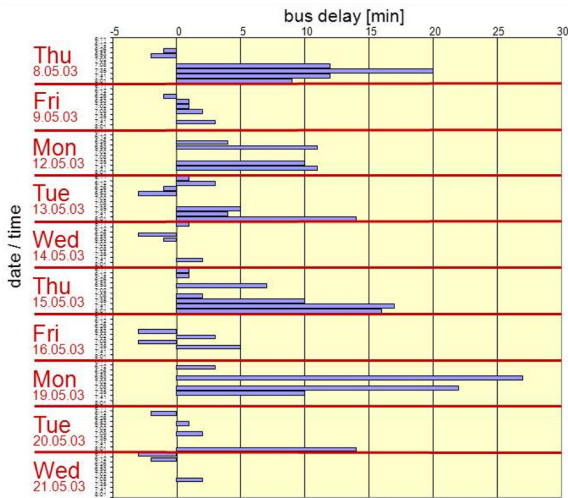


Figure 3 Late running of the public buses after leaving the A7 at Linz–Dornach, based on the recordings of the bus drivers

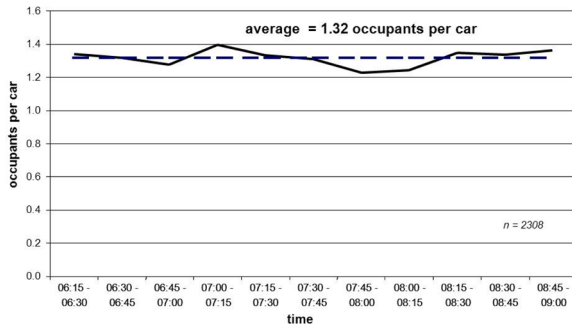


Figure 4 Car occupancy on the A7 (Monday, 6:15 to 9:00 a.m.)

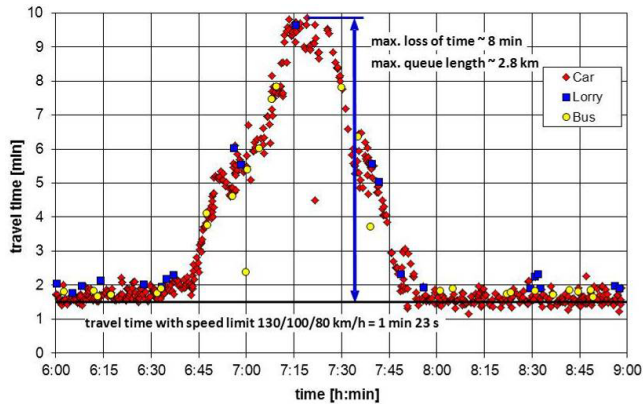


Figure 5 Travel times on the A7, from km 17.9 to 15.1 (Monday, 6:00 to 9:00 a.m.)

## 2.4 Recommendations

Taking the experience of the group of experts into account, the feasibility study resulted in the following conclusions and recommendations.

Opening the emergency lane for HOVs does not seem recommendable. Important arguments against this approach include the difficulty of signalling (no suitable traffic signs are available), the expected problems in the weaving sections of the Linz–Dornach junction, the concern that emergency vehicles might be obstructed in emergencies, and last but not least worries that the system might be abused since the police force has not the capacity for efficient enforcement. Particularly long deceleration lanes did not seem recommendable either. Similar arguments as those already mentioned speak against this approach. Moreover, the secondary road network would probably have to cope with more traffic caused by those car drivers who first pass congestion on the motorway and then leave it sooner than really necessary. This would be an undesirable effect.

But on certain conditions e.g. creating an emergency lane of 3.5 m by narrowing the traffic lanes and the hard strip on the left beside the lanes, it was possible to recommend the temporary opening of the emergency lane for buses. In addition to this, new signs were created to alert drivers to the fact that buses are permitted to use the emergency lane.

## 3 Implementation

The concept was implemented in September 2004, initially as a pilot project. With the exception of the widening of the emergency lane, the suggestions specified in the study were taken into account, and new information signs were erected (Figure 6). The bus operator was granted a special permit (administrative decision) to use the emergency lane of the A7 between Treffling and Linz–Dornach in case of congestion from Monday to Friday from 6:00 a.m. to 9:00 a.m. on the following conditions:

- a maximum speed of 50 km/h for buses on the emergency lane;
- driving at walking speed when moving from the emergency lane to the deceleration lane;
- no merging back into the normal traffic lane (in case the congestion is easing);
- mobile phone connection between the bus driver and the operator's control centre;
- no driving on the emergency lane in case of accident, road work, or a broken down vehicle there.

This approach proved such a success that in 2006 the concept was also implemented for the opposite carriageway of the A7. This section of the motorway ends about 10 km northeast of Treffling junction; at times when commuters drive home, the last few kilometres were frequently congested. To ease the congestion, buses were permitted to pass congestions from Monday to Thursday from 4:00 p.m. to 7:00 p.m. and on Fridays from 12:00 noon to 7:00 p.m. Since 2010 buses driving in the direction of Linz have been permitted to move onto the emergency lane even before they reach Treffling junction – i.e. prior to the respective exit or access – if the tail of the morning congestion reaches that far back.



**Figure 6** Road signs to indicate that regular service buses are permitted to use the emergency lane (text on the left: emergency lane ... Mon.-Fri. 6:00-9:00 a.m. ... only for public buses to exit Dornach (text at the bottom in Czech) text on the right: Watch for buses!)

## 4 Experiences

In numerous personal discussions with representatives of the various organisations involved, in autumn 2011 the author gathered information about the practical experience with the scheme.

**The bus operator:** buses use the emergency lane virtually every day. Of course, bus drivers have to adjust their speed to road, traffic, and weather conditions, respectively, so there have never been any problems. Even if there is some obstacle on the emergency lane – which happens only rarely – merging back into the normal, congested traffic lane is no trouble. Buses run far more reliably and the number of passengers has increased considerably on the lines in question. Obviously a number of commuters have decided to abandon their cars for a bus. The overall verdict: 'We can't imagine operating without this option!'

**The police:** so far, no accidents have been reported in connection with the use of the emergency lane by buses. Occasionally it happened that (foreign) coaches used the emergency lane which is not permitted. The misuse of the emergency lane by car drivers seems to be limited or at least not worse than before the opening of the emergency lane for buses. Policemen in unmarked cars are mainly responsible for the supervision.

**Rescue services and fire brigades:** None of the emergency services operations were ever hindered by or encountered problems due to buses using the emergency lane.

**The highway maintenance unit:** over the phone we keep in contact with the bus operator. For example, in case of heavy snowfall the buses may only use the emergency lane after we have cleared away the snow. We use slightly more road salt now because clearing the emergency lane has a higher priority than it had in the past. We only cut the green at times when buses are not permitted to use the emergency lane, but that is no problem.

## 5 Conclusions

The permission for regular service buses to use the emergency lane to avoid congestions on the motorway proved such a successful promotion of bus traffic that this scheme has achieved 'status of regular operations' on the A7. Once more it was proved that a good idea combined with a thorough preparation can lead to cheap but nevertheless highly practical traffic solutions. A certain degree of persistence, tenacity, and persuasiveness of those people who have a good idea are necessary. As in this particular case, a certain degree of courage of the competent authorities to give such an idea the chance to prove its practicability is also required.

## 6 Most recent development

Since 1st January 2012 a new Austrian law requires drivers to clear a path for emergency vehicles. In case of congestion all vehicles on the left lane are required to move to the far left and may use the hard strip on the outer left. Vehicles on the right lane are requested to move to the far right and use the emergency lane as far as necessary. Some representatives of public authorities held the opinion that because of the new law buses should be forbidden to use the emergency lane regularly, because there would no longer be sufficient space for them and it would be too dangerous. In December 2011, the whole successful project seemed suddenly endangered. At the last minute an agreement was reached: buses are still permitted to use the emergency lane but they have to reduce their maximum speed from 50 to 30 km/h. The experience of the first six weeks clearly supports the promoters of the scheme: it still works.

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