

**Fachveröffentlichung der  
Bundesanstalt für Straßenwesen**

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**Evaluation of the novice driver training models  
“Accompanied driving from 17” and “Voluntary further  
training seminars for holders of probationary driving  
licences”. Results up to November 2009.**

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**Third report on AP project F1100-4408016 “Evaluation of novice driver training models”**

Federal Highway Research Institute, Section U4 “Driver Training, Driver Improvement”  
Bergisch Gladbach, 31.05.2010 (expanded version)

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Schade, F.-D., Heinzmann, H.-J. (2009). Summative Evaluation of Accompanied Driving from 17. Special evaluation: First evaluation results on the basis of self-reported driving behaviour.

## 1. Introduction

The present report is a compilation of the evaluation results obtained by the end of 2009 in respect of the experimental novice driver training models “Voluntary further training seminars for holders of probationary driving licences” (here: “VFT model”) and “Accompanied driving from 17” (here: “AD17 model”). These models were initially introduced on a trial basis in 2003 and 2005, respectively, and are to be evaluated and tested with regard to their road safety effectiveness before the government makes a decision on permanent integration into the driver licensing system.

Alongside the question of road safety effectiveness (summative evaluation), the studies are also to analyse the experience gained from practical implementation of the individual concepts (process/formative evaluation). Whereas the safety impact is of direct significance for the decision on permanent adoption of the models, the results of the process evaluation are important independently of this decision for considerations of the possibilities for concept optimisation.

The evaluation studies conducted by the Federal Highway Research Institute (BASt) were spread over a total of six sub-projects. These sub-projects are listed in Tab. 1, together with an indication of the precise subject of evaluation and the methodical approach. Complete and conclusive results are available from five of these sub-projects.

In the case of the summative evaluation of the AD17 model, it is currently only possible to present partial results, due to the specific project schedule dictated by the analysis design. These results are available in the form of an intermediate report dated 31.07.2007 (Schade et al., 2007) and a special evaluation dated 30.11.2009 (Schade & Heinzmann, 2009). With its analysis of the safety-related behaviour of novice drivers during their first year of independent driving on the basis of self-reported accident involvement and traffic offences, the latter report covers an important aspect of the overall project objective. Given the conclusive character of the partial results from this special evaluation, it is already possible to make a sound assessment of the road safety effectiveness of the AD17 model at the present juncture. Statements on the road safety effectiveness of the AD17 model are also to be found in an evaluation of the University of Giessen, which investigates the impact of the experimental scheme of accompanied driving as initially implemented at regional level in the federal state of Lower Saxony (Stiensmeier-Pelster, 2008). The corresponding results have been incorporated into the appropriate section of the present report.

The Federal Highway Research Institute (BASt) intends to publish the research results from the individual evaluation projects in the form of scientific reports (M series “People and Safety”), so as to make the findings available in their full scope for the pending traffic policy discussions and for the further professional treatment of issues concerning safety-related novice driver preparation. It is expected that the reports on the evaluation projects which have already been completed will be published in the first months of the coming year. The publication of the final research report on the road safety effectiveness of the AD17 model, on the other hand, will not be possible until the corresponding behaviour-relevant data have been acquired and evaluated in full, presumably in autumn 2010. For this reason, and in the interest of early and comprehensive information, the special evaluation already completed in advance on 30.11.2009 has been appended to the present report in its full version.

Project	Completion	Evaluation topic	Method
FE 82.264/2004 Evaluation of voluntary further training seminars for novice drivers (VFT). Formative evaluation. Project supervision: Dr. Hartmut Kerwien, Bielefeld	End 2009	Practical implementation of the VFT model	Analysis of concept-adequate implementation of the model on the basis of surveys and seminar observations
FE 82.307/2006 Evaluation of voluntary further training seminars for novice drivers (VFT). Analysis of effectiveness. Project supervision: Centre for Evaluation and Methods (ZEM), Bonn	End 2009	Road safety effectiveness of the VFT model	Evaluation of model-related changes in road safety attitudes with the aid of psychological attitude measurements within the framework of a pre-post comparison with a control group
FE 89.226/2009 Evaluation of voluntary further training seminars for novice drivers (VFT), based on VZR data records. Project supervision: Federal Motor Transport Authority, Statistics Dept., Group 31, Flensburg	End 2009	Road safety effectiveness of the VFT model	Determination of the scope of use of the model and comparison of the driving behaviour of VFT participants and non-participants of similar age and experience on the basis of ZFER and VZR data records
FE 82.298/2005 Accompanied driving from 17. Process evaluation. Project supervision: Institute for Empirical Sociology (IfeS), Nürnberg	End 2009	Practical implementation of the AD17 model	Analysis of concept-adequate implementation of the model and general practical experience, based on the questioning of participating novice drivers and accompanists, as well as document analyses
FE 89.221/2009 Designing of accompanied driving practice. Project supervision: Institute for Empirical Sociology (IfeS), Nürnberg	End 2009	Practical implementation of the AD17 model	Deeper analysis of the interaction between novice drivers and their accompanists on the basis of surveys
FE 82.316/2006 Accompanied driving from 17. Summative evaluation. Project supervision: Federal Motor Transport Authority, Statistics Dept., Group 31, Flensburg	30.09.2010  Partial results: 31.07.2007 30.11.2009	Road safety effectiveness of the AD17 model	Evaluation of the model-specific reduction in accident and traffic offence risks on the basis of a comparison of the rates of accident involvement and traffic offences between AD17 participants and conventionally trained novice drivers

**Tab. 1: BASt evaluation projects addressing the novice driver models “Voluntary further training seminars for novice drivers” and “Accompanied driving from 17”**

## **2. Practical implementation of the VFT model: Results of the process evaluation**

### **2.1 Objective**

“Voluntary further training seminars for novice drivers” (VFT model) were introduced on a trial basis by way of the Novice Driver Further Training Ordinance (Fahranfängerfortbildungsverordnung, FreiFortbV) of 16th May 2003. In §6 of this ordinance, it is specified that the Federal Highway Research Institute (BAST) is to evaluate the model to assess the “effectiveness with regard to road safety”. The individual topics and procedures for the evaluation were discussed in advance of the introduction between the BAST and protagonists with practical interests, e.g. the German Road Safety Council (DVR), the driving instructors and the German motorists' association ADAC, and agreed as follows: A first evaluation stage was to address questions concerning the functioning of the model, participation patterns, participant motivation and acceptance (process evaluation). Subsequently, the impact of the model approach on road safety was to be investigated as a second stage (summative evaluation).

The principal objective of the VFT model is to influence youth-specific attitudes and risk-related behaviour by way of educative measures. The intervention is aimed at modification of the young drivers' value systems, attitudes and convictions to the benefit of road safety. The seminar leaders and moderators are expected to realise the affective, i.e. attitude-related learning objectives through forms of interaction which demand active contributions by the participants. This is to be achieved within the framework of group discussions, observed driving practice and practical safety training.

The objective of the formative evaluation is to describe and analyse the practical implementation of the model under the aspect of concept-adequate realisation.

### **2.2 Method**

The empirical analysis of practical implementation was founded on three study approaches:

- Partially structured observations, interviews and written questionnaires to acquire the assessments and experience of the VFT seminar leaders and the moderators of the module “Practical safety training”.
- Questionnaire survey of the VFT participants to acquire their view of the VFT programme modules.
- Structured descriptions of the seminar realisation on the basis of participative observations and interviews conducted by specially trained survey researchers.

### **2.3 Results**

#### **2.3.1 Questioning of seminar leaders and moderators**

The seminar leaders and safety training moderators shared the opinion that the limited response to the model was in part due to the voluntary nature of VFT participation. Its awareness level was seen to be inadequate and the costs deterred potential participants. The shortening of the probationary period was perceived as the predominant motivation for the participation of the novice drivers.

#### **2.3.2 Questioning of participants**

The questionnaires completed by the participants confirmed that the prime motivation for participation was the shortening of the probationary period, followed by an expectation of improved driving

competence. Female participants replied far more often than their male counterparts that they wanted to learn to drive more safely and overcome driving anxieties. Participants under extended probation were even more distinctly attracted by the opportunity to shorten the probationary period, and were significantly less interested in learning to drive safely or improve their driving skills.

The seminar module "Practical safety training" received the best marks in all assessment categories. The participants reported that the practical safety training had brought them the greatest benefits, that it had been more fun than the remaining modules, that it had offered the most valuable contents, that it had best met their expectations, and that it had been most interesting.

In the opinion of the participants, the seminar leaders spoke too much about their own experiences during the group discussions. Otherwise, the seminar leaders and moderators received positive assessments.

### 2.3.3 Seminar observations

The seminar observations served to assess the degree of goal accomplishment of the individual programme modules. The first group discussion achieved the best result with an assessed goal accomplishment of 75 per cent. It was already indicated during these first discussions, however, that the linking of the individual seminar modules was problematical. This applied above all to elaboration of the group's wishes concerning the observed driving practice and the practical safety training. A further problem was identified in time management. At the beginning of the first group discussion, in particular, considerable time was spent on organisational questions.

Compared to the first group discussion, the second and third group discussions displayed a number of realisation deficits. The degree of goal accomplishment for the second module was assessed at 62 per cent by the observers, and the third module was deemed to be only marginally better with a degree of goal accomplishment of 64 per cent.

During the second group discussions, it was recognised that problems arose with regard to communication of the psychological topics "Driving motives" and "Emotions". The aspects of (a) the impact of emotions on attentiveness, (b) the correlation between emotions and competitive behaviour, and (c) the impairment of personal safety by emotions and time pressures, in particular, could not be conveyed adequately in numerous discussions. The interlinking seminar elements were also neglected somewhat during the second group discussion, and there were again certain problems with time management.

The seminar leaders devoted the attention of the third group discussion above all to the topic of "Avoiding driving under the influence of alcohol or drugs", and this was for the most part also treated adequately in the sense of the model concept. Nevertheless, it was conspicuous that the participants were not always able to formulate corresponding strategies to avoid driving under the influence of alcohol or drugs. It was often not possible to convince the participants to maintain behaviour patterns recognised as sensible in the future.

Generally, it was shown that a review of previous group discussions was for the seminar leaders less important than the retrospective contemplation of practical elements.

The objectives of the module "Observed driving practice" were considered achieved to an extent of almost 70 per cent (with the exception of the element "Modern driving", which the observers rated with a degree of goal accomplishment of 58 per cent). The realisation of the exercise component was essentially satisfactory, although only few participants specified actual exercise situations. On the other hand, this aspect was frequently linked with the topic of ecological driving, which involved

above all the provision of tips on a fuel-saving driving style. Primarily safety-relevant driving tips were given less emphasis.

The practical safety training achieved a degree of goal accomplishment of only 64 per cent, the second-lowest value of all modules. The whole thematic element “Braking” was handled in an extremely diverse manner, and in some seminars deviated significantly from the specifications of the handbook. The concept adequacy of the element “Driving through curves” was criticised. The exercises were generally performed very hastily and were seldom clearly differentiated; in many seminars, the speed specifications were not observed.

<b>VFT module</b>	<b>Degree of goal accomplishment</b>
1st group discussion	75%
2nd group discussion	62%
3rd group discussion	64%
Observed driving practice	69%
Practical safety training	64%

**Tab. 2: Degrees of goal accomplishment in the modules of the VFT model**

#### **2.4 Significance of the results**

It can be seen from the results that the novice drivers valued above all those benefits of the seminars which corresponded to their expectations and interests: The shortening of their probationary period and time spent on practical driving exercises.

At the same time, it is evident that the seminar leaders experienced problems with the application of active, attitude-building training forms, and that it was the seminar element dealing with the topic of emotions which caused them the greatest difficulties.

This result also corresponds to international experience. An analysis of Swedish novice driver training courses which followed an explicitly attitude-building concept, for example, revealed that the participants were later of the opinion that the course had above all served to improve their practical driving skills (cf. EU project ADVANCED, 2002).

The evaluation report criticises the overall excessive number of specified goals for the individual seminar modules. This diversity of goals is at the same time a source of time management problems. It is suggested that the broad spectrum of learning objectives be narrowed down significantly and formed into a hierarchy of training goals, as a basis for effective implementation by the seminar leaders and moderators. In addition, thought should be given to a more streamlined timeframe.

The recommendation from an expert point of view is to subject the VFT seminars to a thorough review in the light of the aforementioned points, referring both to the concept of the model and its concept-adequate implementation.

### **3. Road safety effectiveness of the VFT model: Results of the summative evaluation**

#### **3.1 Objective**

The summative evaluation served to analyse the model-related effectiveness of the VFT model with regard to improvements in road safety. The criterion of accident involvement, however, was discounted as a possible measure of road safety effectiveness in the context of a survey study, as it was clearly foreseeable that the necessary sample size would not be attained.

The objective of the VFT model is to reduce the risk of accident for young novice drivers by way of a positive influencing of road safety attitudes. The criterion chosen to verify the effectiveness of the model, therefore, was the change in attitudes achieved through VFT participation.

#### **3.2 Method**

On the basis of the goals formulated in the VFT model handbooks, 11 road-safety-relevant attitudes were identified and subsequently applied within the framework of the evaluation.

The displayed attitudes were measured using reliability-tested attitude scales and a number of individual evaluation items on four occasions: Before VFT participation, shortly afterwards, and on two further occasions during the course of the subsequent year.<sup>1</sup> A reference sample of novice drivers who had not attended VFT seminars – parallelised in respect of gender, driving experience and school education background – was analysed at the same intervals using the same instruments.

It proved particularly difficult to gain the cooperation of an adequate number of study participants; recruitment was only successful thanks to the active support of driving instructors who specifically approached novice drivers, and through the provision of financial incentives for participation. On the basis of an initial sample of over 1,000 persons, it was in the end possible to take the data from approximately 300 persons (experimental group and control group) into account in the final evaluations.

To verify the effectiveness of the model, the following comparative analyses were performed to evaluate the determined attitudes of the VFT participants (experimental group) and non-participants (control group):

- Evaluation of the changes in displayed attitudes over the course of the measurements
- Comparison of the displayed attitudes of VFT participants and non-participants on each measurement occasion
- Combined evaluation of the changes between measurements and the differences between the experimental and control groups.

The combined evaluation is necessary, as it is only on this basis that a statement can be made as to whether changes in the attitudes displayed by the experimental group – either positive or negative – can be attributed to the model intervention. A positive attitude change in the experimental group, for example, can only be interpreted as an intervention effect if no corresponding attitude change is displayed in the control group – given otherwise identical framework conditions.

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<sup>1</sup> The following overall evaluation takes into account only the results of the first three measurements, as no adequate database was obtained to permit analysis of the fourth survey results.

The differences in attitudes were in each case tested with regard to their statistical significance, and the corresponding effect size was determined. The influences of the individual distances driven and further confounding variables were checked during the evaluation.<sup>2</sup>

It can be assumed that the model is effective if, after VFT participation, the attitudes of the participants develop to the benefit of road safety to a significantly greater extent than those of the drivers in the control group. Even in the case of overall negative changes in attitude, a model effect can still be assumed if the VFT participants display a more favourable development than non-participants, i.e. if the deterioration in attitudes in the experimental group is less pronounced than in the control group.

On this basis, the following three questions or hypotheses were considered:

- (1) Pre-post comparison: Do the VFT participants display improved attitudes after participation?
- (2) Absolute comparison of VFT participants and non-participants: Do the VFT participants display more favourable attitudes than the control group after participation?
- (3) Relative comparison between VFT participants and non-participants: Do the VFT participants display more favourable road-safety-relevant attitudes than the control group over the whole course of the measurements (irrespective of generally declining values)?

### **3.3 Results**

The individual safety-relevant attitudes and competence indicators listed in Tab. 3 were evaluated. For the majority of the attitudes and competence indicators considered, no evidence of influence attributable to VFT participation was found.

Partial indications of a positive effect of VFT participation were revealed merely in the attitude domains risk-taking disposition and hazard awareness, but could not be substantiated in the overall evaluation.

Risk-taking disposition: Viewed over the whole course of the measurements, both the experimental group and the control group displayed a perceptible increase in risk-taking disposition. In the isolated evaluation of the third set of measurements, it was to be seen that the risk-taking disposition of the VFT participants was at this time slightly, but nevertheless significantly less distinct than in the control group. This could be interpreted as a (medium-term) effect of the model. The extent by which the increase in risk-taking disposition is lessened due to VFT participation, however, is so small that it is not possible to assume a significant influence on risk-taking disposition.

Hazard awareness was already more pronounced in the experimental group than in the control group before participation in VFT seminars. At the time of the second survey, i.e. immediately after VFT participation, on the other hand, no differences were to be determined between the groups. The results of the third measurement, finally, again showed a significantly greater hazard awareness among the VFT participants than in the control group. This difference, however, could be attributable not only to the VFT participation in the sense of a medium-term effect, but also to the differences which already existed at the time of the first measurements. Nevertheless, as the statistical effect

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<sup>2</sup> The post-hoc tests took the form of either t-tests for independent samples or variance analyses for independent samples (ANOVA) with Bonferroni tests. The measure for the effect size was Cohen's *d* in the case of the t-tests and partial eta-squared ( $\eta^2$ ) in the case of the variance analyses. To evaluate the differences in the development of displayed attitudes between the experimental and control groups, variance analysis with repeated measurements was used.

size at the time of the third survey was found to be significantly greater than at the time of the first survey, model effectiveness can be assumed for this attitude domain.

The VFT participants also displayed a significant change in their self-assessment of safety-relevant driving competence over the course of the measurements. There was a significant increase between the first and third surveys. As this same phenomenon was observed in the control group, however, it is not justified to conclude that the model is effective in this respect.

In all other attitude and competence constructs taken as criteria to verify the effectiveness of the VFT seminars, no hypothesis-relevant results were recorded.

Attitude scales/items	Hypothesis		
	(1)	(2)	(3)
1. Personal importance of driving (Scale B)	n.s.	n.s.	n.s.
2. Realistic assessment of traffic demands (Scale C)	n.s.	n.s.	n.s.
3. Readiness to observe traffic rules (Scale D)	n.s.	n.s.	n.s.
4. Risk-taking disposition/risky behaviour (Scale E)	n.s.	$\leq .05^1$	n.s.
5. Adequate self-assessment with regard to driving ability in different complex driving situations (Scale F)	n.s.	n.s.	n.s.
6. Reflection of own driving behaviour (Scale G)	n.s.	n.s.	n.s.
6.1. Reflection of driving behaviour with regard to vehicle control (Scale G1)	n.s.	n.s.	n.s.
6.2. Reflection of driving behaviour with regard to incorrectly observed traffic situations (Scale G2)	n.s.	n.s.	n.s.
6.3. Reflection of driving behaviour with regard to influences arising from accompanying circumstances (Scale G3)	n.s.	n.s.	n.s.
6.4. Reflection of driving behaviour with regard to influences arising from moods and emotions (Scale G4)	n.s.	n.s.	n.s.
7. Hazard awareness (Scale H)	n.s.	$\leq .05^1$	n.s.
8. Risk avoidance (Scale I)	n.s.	n.s.	(-)
9. Locus of control (Scale J)	n.s.	n.s.	(-)
10. Assessment of own safe driving behaviour (Scale K)	n.s.	n.s.	n.s.
11. 1. Critical assessment of general driving ability (Item L1)	n.s.	n.s.	n.s.
2. General admission of driving competence deficits (Item L2)	n.s.	n.s.	n.s.
3. General assessment of driving competence with reference to safe driving (Item L3)	$\leq .001$	n.s.	n.s.

Hypotheses:

(1) = VFT participants display improved attitudes after participation.

(2) = VFT participants display more favourable attitudes than the control group after participation.

(3) = VFT participants display more favourable attitudes than the control group over the whole course of the measurements

n.s = Result not significant, hypothesis must be rejected;  $\leq .05$  = Hypothesis confirmed with  $p \leq .05$ ;  $\leq .001$  Hypothesis confirmed with  $p \leq .001$ ; (-) = Hypothesis was not tested

<sup>1</sup> Referring to significant differences between participants and non-participants at the time of the third measurement.

**Tab. 3: Results of hypothesis testing in the summative evaluation of the VFT model**

### **3.4 Significance of the results**

Viewed on the basis of the results of the present evaluation, the VFT model has failed to develop relevant effectiveness with regard to the whole spectrum of attitudes addressed by the programme.

An attitude effectiveness is only revealed partially and to a minor extent at certain points: The results point to effects for particular individual aspects in only two of eleven attitude domains.

Given the present results, it is not possible to attribute a sustained preventive effectiveness to the VFT model in the sense of an improvement in road-safety-relevant attitudes. Against this background, it is rather inconceivable that the VFT model will be able to achieve more than just marginal changes in the driving behaviour of novice drivers.

The evaluation results are not essentially different to those obtained in conjunction with the comparable preventive programme “Jugend fährt sicher” (“Young people driving safely”) and already presented in the past (cf. Schulz et al., 1995).

The repeated failure to supply proof for the effectiveness of attitude-related supplementary training offers for novice drivers in the form of VFT seminars or the earlier “Jugend fährt sicher” courses should give cause for a fundamental reappraisal of the existing concepts for attitude-related intervention addressing novice drivers. At the same time, it should be kept in mind that, alongside driving experience deficits, age- and novice-typical attitudes are decisive factors contributing to the above-average accident risk of young and novice drivers, and that the development of effective prevention concepts in this field is of major importance for road safety.

## **4. Participation figures and road safety effectiveness of the VFT model: Evaluation of VZR and ZFER data records**

### **4.1 Objective**

The objective of this study was to determine the scope of utilisation of the model and to assess the road safety effectiveness of the VFT model through a comparison of the safety-relevant driving behaviour of VFT participants and non-participants of the same age and with similar driving experience<sup>3</sup> on the basis of corresponding data records retrieved from the Central Register of Traffic Offenders (VZR) at the Federal Motor Transport Authority (KBA) in Flensburg.

### **4.2 Method**

The number of drivers participating in the VFT model was determined on the basis of data retrieved from the Central Register of Driving Licences (ZFER), which is similarly maintained by the Federal Motor Transport Authority in Flensburg. The attributes gender, age, federal state of the responsible licensing authority, and probation status before participation were recorded in each case.

Data on relevant traffic behaviour were retrieved from VZR data records for both VFT participants and non-participants – parallelised according to gender, age, federal state and duration of the probationary period before the start of the present observation.

The VFT participants formed the experimental group (E), further sub-divided into persons with a two-year probationary period (E2) and those with an extended probationary period (E4). The survey cov-

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<sup>3</sup> Measured by the duration of driving licence possession

ered all VFT participants who could be contacted (full sample). Under the given basic scheduling, it was possible to include practically the whole population of participants from the year 2007.

Novice drivers for whom no VFT participation had been recorded since the granting of a class B or BE driving licence were assigned to the control group (C), with a corresponding sub-division into C2 and C4 in accordance with their probation status. The persons actually forming the control groups were selected by way of stratified random sampling.

On the basis of personal identification data, the individual records held in the Central Register of Traffic Offenders were retrieved for all persons assigned to the experimental (E) and control (C) groups (N = 11,780) on two dates, namely on 18.01.2009 (to forestall the possible deletion of older offences from the register) and on 02.08.2009. The register numbers of unambiguous query results were listed and the automated VZR statistics database was searched for entries between 2007 and the survey date in 2009 on the basis of these register numbers. All data records retrieved in this way were listed and subsequently processed to ensure unambiguous assignment to the sample. From this data pool, which comprised all VZR records pertaining to E and C group members, a subset was formed containing the entries which referred to traffic offences which had been committed during the observation period, but at the same time also entered in the register at the latest 18 months after the start of the probationary period. These VZR records were subjected to thorough plausibility checks and categorised dichotomously according to their references to the catalogue of traffic offences and/or accident indicators.

### 4.3 Results

#### 4.3.1 Scope of participation in the VFT model

Ever since introduction of the VFT model in 2004, participation has remained at a distinctly low level of significantly less than one per cent of the persons granted a class B/BE driving licence. Tab. 4 provides an overview of the participation in the years 2004 to 2008, compiled on the basis of an analysis of amendment notices submitted to the Central Register of Driving Licences at the Federal Motor Transport Authority by the local licensing authorities. Due to the limited participation, however, no mentionable road safety effect can be assumed for the model as a whole, irrespective of whether a significant safety effectiveness is determined in connection with VFT participation.

Year	VFT participants, total, N	VFT participants with normal probationary period, N (%)	VFT participants with extended probationary period, N (%)
2004	498	426 (86 %)	72 (14 %)
2005	1461	1094 (75 %)	367 (25 %)
2006	2310	1647 (71 %)	663 (29 %)
2007	2433	1690 (69 %)	743 (31 %)
2008	1826	1052 (58 %)	774 (42 %)

**Tab. 4: VFT participants in the years 2004 to 2008, categorised according to their probation status before participation**

#### 4.3.2 Safety-relevant driving behaviour

The safety-relevant driving behaviour of VFT participants (E) and non-participants (C) is compared in Tab. 5 on the basis of the assignment to different traffic offence categories in the central register.

For the VFT participants, the records pertaining to relevant traffic behaviour were analysed for an observation period of one year, starting at the end of the shortened probationary period subsequent to VFT participation. In the case of non-participants, the equivalent period of time was considered.

Column E shows the ratio of VFT participants with records of the specified conspicuous behaviour to their non-participating counterparts. Contrary to expectations, the novice drivers were not found to drive more safely and with greater respect for traffic rules after VFT participation. Instead, the group of VFT participants displayed conspicuous behaviour consistently – and in some cases considerably – more frequently than the group of non-participants.

Column F indicates the tested statistical significance of the differences between VFT participants and non-participants.

A Comparison	B Indicator	C E group			D C group			E Ratio E to C	F Significance
		Freq.	Records		Freq.	Records			
			Abs.	%		Abs.	%		
E2-1 vs. C2-1	Accident	1,239	35	2.82	1,239	19	1.53	1.84	*
	Endangering	1,239	66	5.33	1,239	19	1.53	3.47	***
	Alcohol/drugs	1,239	7	0.56	1,239	4	0.32	1.75	n.s.
	Speeding	1,239	68	5.49	1,239	18	1.45	3.78	***
	Total	1,239	119	9.60	1,239	49	3.95	2.43	***
E2-2 vs. C2-2	Accident	355	12	3.38	355	6	1.69	2.00	n.s.
	Endangering	355	24	6.76	355	5	1.41	4.80	***
	Alcohol/drugs	355	2	0.56	355	1	0.28	2.00	n.s.
	Speeding	355	33	9.30	355	7	1.97	4.71	***
	Total	355	46	12.96	355	16	4.51	2.88	***
E4-1 vs. C4-1	Accident	525	29	5.52	525	21	4.00	1.38	n.s.
	Endangering	525	51	9.71	525	34	6.48	1.50	*
	Alcohol/drugs	525	7	1.33	525	5	0.95	1.40	n.s.
	Speeding	525	66	12.57	525	36	6.86	1.83	**
	Total	525	105	20.00	525	72	13.71	1.46	**
E4-2 vs. C4-2	Accident	123	6	4.88	123	5	4.07	1.20	n.s.
	Endangering	123	6	4.88	123	3	2.44	2.00	n.s.
	Alcohol/drugs	123	0	0.00	123	2	1.63	0.00	n.s.
	Speeding	123	11	8.94	123	8	6.50	1.38	n.s.
	Total	123	19	15.45	123	16	13.01	1.19	n.s.

Compared groups:

E2-1: VFT participants with two-year probationary period, VFT participation in first year of probation; Start of observation: Earlier end of probationary period after 12 months (end of probation)

C2-1: Non-participants with two-year probationary period; Start of observation: Beginning of second year of probation

E2-2: VFT participants with two-year probationary period, VFT participation in second year of probation; Start of observation: Earlier end of probationary period after VFT participation (end of probation)

C2-2: Non-participants with two-year probationary period; Start of observation: Timing analogous to E2-2

E4-1: VFT participants with four-year probationary period, VFT participation in first to third year of probation; Start of observation: Earlier end of probationary period after 36 months (end of probation)

C4-1: Non-participants with four-year probationary period; Start of observation: Beginning of fourth year of probation

E4-2: VFT participants with four-year probationary period, VFT participation in fourth year of probation; Start of observation: Earlier end of probationary period after VFT participation (end of probation)

C4-2: Non-participants with extended probationary period; Start of observation: Timing analogous to E4-2

Indicators:

A "Accident": Culpable accident

B "Endangering": Record of an endangering of road traffic

C "Alcohol/drugs": Record of an alcohol- or drugs-related offence

D "Speeding": Record of a speeding offence

E "Total": Record of any traffic offence

Significance:

Difference between E and C groups, Fisher's exact test, unidirectional hypothesis: n.s. = not significant, \* =  $p \leq .05$ , \*\*  $p \leq .01$ , \*\*\*  $p \leq .001$

**Tab. 5: VZR records pertaining to members of all compared E and C groups**

The novice drivers who attended a voluntary further training seminar before the final year of an extended probationary period (E4-1) are most frequently represented in the records of the Central Register of Traffic Offences across all indicators. The sub-groups with the fewest VZR records were those of non-participants who were driving under a two-year probationary period at the time of sampling (C2-1 and C2-2).

Particularly remarkable here is the greater frequency of VZR records of the VFT participants compared to the non-participants. This applies to all sub-groups and with one exception (alcohol/other drugs) also for all indicators. The frequency of conspicuous behaviour among VFT participants is between 1.35 times (two-year probationary period, culpable accidents) and 4.04 times (two-year probationary period, speeding offences) higher than in the case of non-participants.

Tab. 6 summarises the indicators of conspicuous behaviour for the groups of drivers during a regular (two-year) or extended (four-year) probationary period.

A	B	C			D			E	F
		E group Freq.	Records		C group Freq.	Records			
			Abs.	%		Abs.	%		
E2 vs. C2	Accident	1,594	47	2.95	1,594	25	1.57	1.88	**
	Endangering	1,594	90	5.65	1,594	24	1.51	3.75	***
	Alcohol/drugs	1,594	9	0.56	1,594	5	0.31	1.80	n.s.
	Speeding	1,594	101	6.34	1,594	25	1.57	4.04	***
	Total	1,594	165	10.35	1,594	65	4.08	2.54	***
E4 vs. C4	Accident	648	35	5.40	648	26	4.01	1.35	n.s.
	Endangering	648	57	8.80	648	37	5.71	1.54	*
	Alcohol/drugs	648	7	1.08	648	7	1.08	1.00	n.s.
	Speeding	648	77	11.88	648	44	6.79	1.75	**
	Total	648	124	19.14	648	88	13.58	1.41	**

Compared groups:

E2: VFT participants with two-year probationary period (E2-1 plus E2-2)

C2: Non-participants with two-year probationary period (C2-1 plus C2-2)

E4: VFT participants with four-year probationary period (E4-1 plus E4-2)

C4: Non-participants with four-year probationary period (C4-1 plus C4-2)

Indicators:

A "Accident": Culpable accident

B "Endangering": Record of an endangering of road traffic

C "Alcohol/drugs": Record of an alcohol- or drugs-related offence

D "Speeding": Record of a speeding offence

E "Total": Record of any traffic offence

Significance:

Difference between E and C groups, Fisher's exact test, unidirectional hypothesis: n.s. = not significant, \* =  $p \leq .05$ , \*\*  $p \leq .01$ , \*\*\*  $p \leq .001$

**Tab. 6: VZR records of E and C groups, summarised according to probation status**

#### 4.4 Significance of the results

The results of the analysis of data records retrieved from the Central Register of Driving Licences (ZFER) and the Central Register of Traffic Offenders (VZR) at the Federal Motor Transport Authority (KBA) reveal, firstly, the limited reach of the VFT model, which attracts the participation of less than one per cent of all novice drivers, and secondly, the unexpectedly poorer safety-relevant driving behaviour of VFT participants after attendance at a voluntary seminar, compared to other novice drivers of the same age and with similar driving experience who have not attended a VFT seminar.

The present data evaluation does not permit VFT participation to be viewed as causal for the poor driving behaviour of the VFT participants, and it is thus unjustified to attribute directly counter-productive road safety effects to the VFT model. It is possible that other factors are responsible for the difference in driving behaviour. Thought is here to be given first to the probation rules, which were (for the most part) still applicable for the non-participants during the parallelised observation period, whereas the group of VFT participants was no longer subject to such rules, having benefited from a shortening of the probationary period on account of the seminar participation. Insofar as the probation factor is indeed causal for the different driving behaviour, the VFT model could be attributed at least an indirect counter-productive road safety effect, as the shortening of the probationary period is after all a consequence of the VFT model. Further causal factors which could be assumed to explain the differences in driving behaviour may be found in the deviating characteristics of the sample groups due to self-selection effects, e.g. the conceivable circumstance that the VFT seminars are attended especially by those novice drivers with a tendency to conspicuous driving behaviour, as a means to achieve a shortening of the probationary period. Before asserting such an assumption, however, it must be clarified why no differences in (poor) driving behaviour are to be seen between the VFT participants driving under a regular two-year probationary period and those whose probationary period has already been extended to four years due to convictions for traffic offences. The latter, after all, would normally be expected to display at least a more distinct tendency to conspicuous behaviour than the novice drivers subject to a regular probationary period.

The questions referring to possible causes for the poorer driving behaviour of the VFT participants cannot be answered on the basis of the present data. To this end, more detailed studies with a broader database are necessary.

The results seem to indicate that it is not justified to continue promoting VFT participation through the incentive of a shortened probationary period. The removal of this incentive would have a preventive effect in respect of both aforementioned assumed causes for the poorer driving behaviour, namely the curtailing of the generally protective influence of the probationary period and the attractiveness of VFT participation for drivers with a tendency to conspicuous driving behaviour.

It is true that the results supply no proof of a causal correlation between VFT participation and poorer driving behaviour, but there is similarly no evidence that any positive road safety effects are generated by VFT participation, and thus no basis for a recommendation to maintain the model, for example with removal of the incentive of a shorter probationary period.

## **5. Practical implementation of the AD17 model: Results of the process evaluation**

### **5.1 Objective**

The purpose of the process evaluation was to analyse the pilot scheme realised to test the model approach of “Accompanied driving from 17” at national level, in order to clarify the conditions for a broader and reliable routine implementation of the model, and at the same time to provide sound empirical data for an assessment and possible further development of the model concept. The issues placed in the foreground concerned the ready accessibility of the model, its practicability and the safety-relevant aspects of its implementation.

## 5.2 Method

Within the framework of the process evaluation, 3,780 participants in the model selected at random from the Central Register of Driving Licences (ZFER) at the Federal Motor Transport Authority (KBA) were contacted on up to 4 occasions and asked to complete an online or paper-based questionnaire on their everyday practical experience of the model. In one instance, similar questionnaires were also sent to 1,735 of their accompanists.

Certain sections of the differentiated questionnaires were repeated on each occasion. In this way, in addition to the cross-sectional evaluations referring to particular moments in time or durations of participation, it was possible to identify developments over the whole accompaniment phase at both the aggregate level of the AD17 population as a group (trend studies) and at the individual level of single participants (panel studies).

The key data on the scope and quality of driving practice within the framework of the accompanied driving model were acquired on the basis of weekly reports. The subjects were asked to provide information pertaining the relevant evaluation parameters retrospectively for the last seven days before the date of the questionnaire ("report week"). This procedure guarantees minimal memory losses, valid data and – given the repeated questioning of the novice drivers at different points of their individual accompaniment phase – a true representation of the practical implementation of the model over the whole possible duration of 12 months.

## 5.3 Results

The results of the process evaluation presented in the following are to be viewed against the background of rapid acceptance of the AD17 model in Germany and a response far exceeding the original expectations. By January 2008, all the federal states had adopted the experimental model. During the course of 2007, the model became the dominant form of driver training among 18-year-old novice drivers, who can be estimated to represent approx. 40 per cent of the learner drivers obtaining a class B/BE driving licence (cf. Fig. 1). The proportion of AD17 participants, referred to all those obtaining a class B/BE driving licence, was already 25 per cent in 2007, and a further significant increase in this figure to 35 per cent was then recorded in 2008. The rapid and comprehensive propagation of the AD17 model is not only an indicator of the high degree of acceptance of the model among novice drivers and their parents, but also evidence of the practicability of the underlying approach, as is also supported by numerous results of the process evaluation.

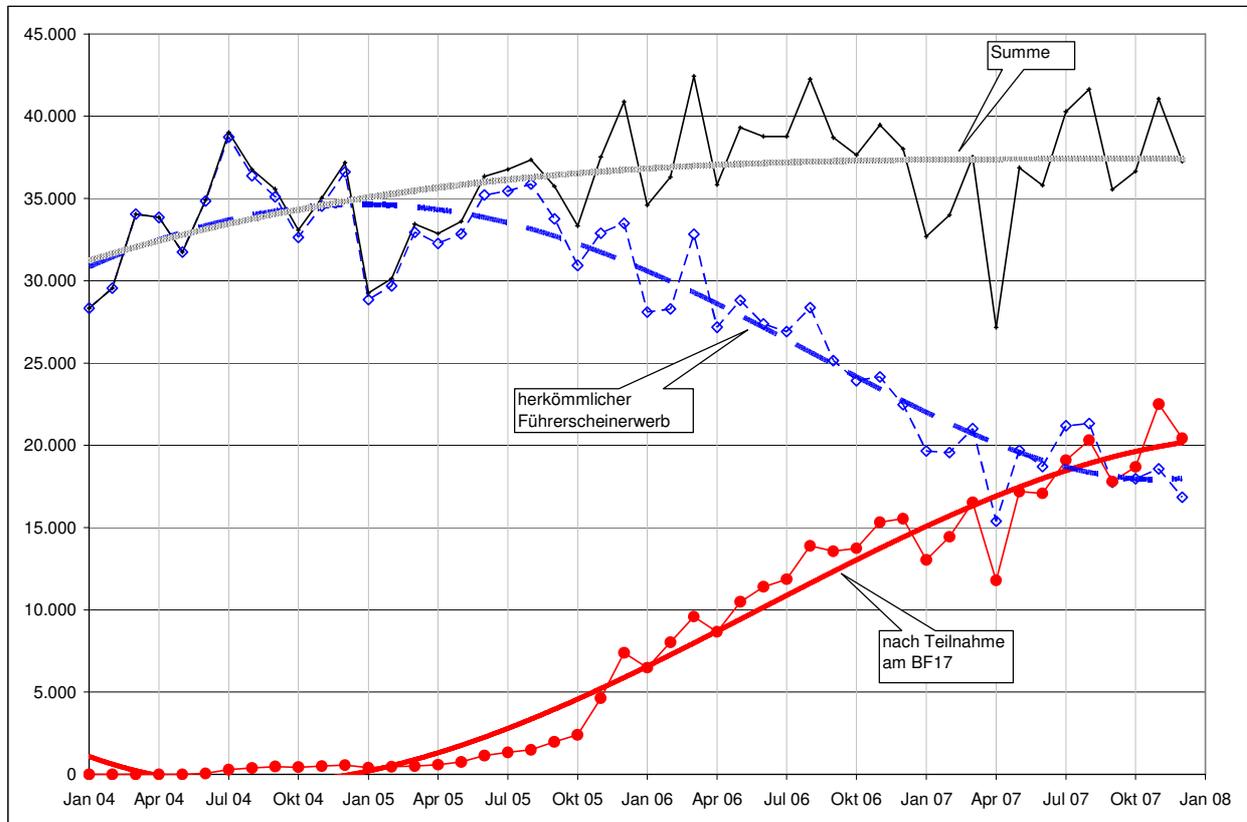
### *Socio-structural characteristics*

The AD17 model participants were found to display certain socio-structural differences compared to a representative sample of all 17-year-old youths in Germany – like 18-year-old novice drivers in general, but here now somewhat more distinctively. At the time of the sampling in 2007, more participants were from families with a better educational or economic background.

### *Motivation to participate in the model*

Participation in the accompanied driving model was overwhelmingly a decision of the young drivers themselves. Over and above that, parents and – to a slightly lesser extent – age cohorts were important sources of encouragement. The motivation for participation was determined above all by personal interest in the ability to drive. Safety considerations were similarly *one* strong motive. Assistance and support for their children and everyday practical concerns, for example lower vehicle in-

surance premiums, were the most widespread motives in the parent population, closely followed by safety aspects. The reasons stated by participants and their parents are thus complementary and bear witness to the relevance and good practicability of accompanied driving in this age-specific phase of the life cycle.



Legend:

Unfilled markers on dashed line: Persons obtaining a conventional driving licence; trend line: 4th order polynomial

Filled markers on solid line: AD17 participants; trend line: 4th order polynomial

Solid line without markers: Total; trend line: 3rd order polynomial

**Fig. 1:** Development of the monthly numbers of persons between the ages of 18 years and 18 years and 3 months receiving a card driving licence for vehicle class B/BE in Germany, divided into those who participated in the AD17 model and those who obtained their driving licence in the conventional manner (Source: Schade et al. 2008)

### Accompanists

The novice drivers generally had no difficulty finding a suitable accompanist. In most cases, two accompanists were specified on the driving test certificate. Over the whole duration of the accompaniment phase, parents dominated as the most frequent accompanists. In almost two-thirds of cases, the accompanist was the driver's own mother, belonged to the 40- to 49-year age group and lived in the same household as the novice driver. The person first mentioned as the most frequent accompanist generally remained the same over the whole course of the accompaniment phase. Any further accompanists were predominately also members of the novice driver's own family.

### *Preparation for participation in the model*

Only 2.5% of the participants and 3.8% of their most frequent accompanists visited an optional preparatory course in advance of the participation in the AD17 model. The new model was instead rather a topic for informal discussion and exchange.

### *Actual duration of the accompaniment phase*

The majority of the young drivers was not able to utilise the maximum accompaniment duration of 12 months. An average of five months passed between the candidate's 17th birthday and their receiving a driving test certificate. The late granting of a driving licence was due either to delayed commencement of driver training or to a longer duration of training. The average duration of actual accompanied driving was between seven and eight months, with the quarter of participants with the shortest accompaniment phase specifying a duration of accompanied driving practice up to five months, and the quarter of participants with the longest accompaniment phase a duration of accompanied driving practice of eleven or twelve months.

### *Days of driving mobility*

The participants drove a vehicle with their accompanist on an average of 3.1 days during their first report week. The average number of days of driving mobility decreased slightly with increasing duration of the accompaniment phase.

### *Distances driven*

The novice drivers reported an average daily distance driven (median) of 9.3 km (arithmetic mean: 13.2 km). These figures also take into account those days on which no driving was done. The median of daily driving from Monday to Friday was 7.8 km (arithmetic mean: 11.7 km). Longer distances were driven on Saturdays and Sundays (median: 8.5 km, arithmetic mean: 17.0 km) than during the week.

The median of the average daily distance driven by mobile participants was 24.0 km (arithmetic mean: 32.4 km). Mobile novice drivers recorded a daily median of 20.8 km driving from Monday to Friday (arithmetic mean: 28.5 km), and a daily median of 25.0 km driving on the two days at weekends (arithmetic mean: 41.0 km).

Accumulating the figures, an average weekly distance driven (median) of 65.0 km (arithmetic mean: 92.2 km) was documented for the whole group of model participants. Mobile participants drove on average 71.7 km per week (median; arithmetic mean: 102.3 km).

Accordingly, AD17 participants drove on average 318.5 km per month (median: 260.4 km). This extrapolated monthly distance driven remained essentially constant over the course of the accompaniment phase. Participants with an average accompaniment duration of eight months recorded approx. 2,400 km of driving practice over this period. Driving practice of the order of 3,800 km could thus be extrapolated for an accompaniment duration of twelve months.

The comparison of driving mobility patterns between the 17-year-old model participants and "normal" 18-year-old novice drivers reveals significant differences: Whereas accompanied driving is devoted to practice, the development of individual driving mobility is shifted to the focus of independent driving from the age of 18 onwards, reflected, for example, in a higher proportion of night-time leisure mobility at weekends.

### *Driving time*

On all weekdays, most accompanied journeys lasted merely up to 15 minutes, though on several days there was only little margin to those cases which reported a driving time of up to 30 minutes. Longer periods of driving were to be noted above all on Saturdays and Sundays. Due to the many days without any accompanied driving at all, half of all model participants – including the immobile participants – recorded an overall average daily driving time of no more than 9.6 minutes (median). Counting only the days on which they actually drove, half of the mobile participants reported a driving time of up to 25.0 minutes, while the other half was on the road for even longer.

### *Journey purpose*

The four dominant journey purposes or destinations for accompanied driving were private journeys (family, visits), household errands, leisure purposes and journeys to either school or the place of training/employment. This shows how participation in the accompanied driving model was embedded in the everyday activities of the novice drivers and their families.

### *Passengers*

For each day from Monday to Thursday, more than two-thirds of the mobile model participants reported that they had driven with no other passengers beside the accompanist, whereas this applied to only around half of the drivers on Sundays. The more frequent “private” journeys at the weekend were reflected in a higher proportion of further adult or also younger passengers on those days.

### *Roads used*

Throughout the model period, journeys within built-up areas dominated. Cross-country roads and motorways were used most frequently on Sundays.

### *Interaction between novice driver and accompanist*

An analysis of the results regarding the interaction between novice driver and accompanist provided evidence of an appropriate interpretation and exercising of the assigned roles, on the part of both the novice drivers and the accompanists, in the sense of a constructive partnership to promote the acquisition of practical driving competence.

During their journeys, the novice drivers perceived their accompanists as attentive passengers and reliable partners for verbal exchanges. The aspect of enhanced safety was not placed in the foreground by the novice drivers. In most cases, there was no explicit preparatory or evaluative discussion of the accompanied driving session. Approx. three in ten participants reported calming verbal intervention on the part of the accompanist (e.g. the advice to take a break or drive more slowly). Nevertheless, the participants were fully aware of their own responsibility as drivers. The support of the accompanist with regard to hazard perception did not intervene in the drivers' independent decision-making responsibility. Situation-specific intervention by the accompanist, e.g. remarks concerning excessive speed, point to the generally protective character of accompanist behaviour.

With increasing duration of the accompaniment phase, the approval for the presence of the accompanist declined. The young drivers no longer acknowledged the attentiveness of the accompanist to the same extent as at the beginning, and the latter's support in terms of alertness to hazards, critical feedback and cautionary explanation was similarly only perceived to a lesser degree. Conversely, the participants' emphasis of their own responsibility as drivers increased. These developments all corre-

spond to the accordingly increased driving experience of the model participants as the accompaniment phase progresses.

The majority of participants and accompanists detected no influence on family relationships through the joint efforts embodied in the accompanied driving model. Positive effects, where at all significant, were seen by accompanying fathers.

The role played by the accompanists apparently exerted influence also on their own safety-related driving behaviour. A considerable proportion of the accompanists stated that their participation in the accompanied driving model had led to them refreshing their own knowledge of traffic rules, paying more attention to road safety issues, and themselves driving with a greater safety awareness. In this respect, the accompanied driving model assumes the character of a multi-generational road safety instrument.

#### *Subjective indicators of experience-building*

Already during the second wave of questioning, the model participants indicated a feeling of increased driving experience. Those with the most actual driving practice were praised significantly more often by their accompanists for their improved vehicle control and more foresighted, composed and confident driving.

The impact of greater driving experience was also revealed in the fact that those participants with more driving practice described a feeling of uncertainty in difficult traffic situations less often than their counterparts with little driving practice. A comparison between former and active model participants on the basis of the latter's initial questionnaires supplied indication that a period of up to three months of accompanied driving does not yet lead to a perception of growing driving experience. In the trend results, an increase in driving experience was expressed in the significant decline in the proportion of novice drivers who felt unsafe in certain traffic situations over the course of time.

#### *Vehicles used*

The vehicles used within the framework of accompanied driving were on average 6.7 years old, had clocked a mileage of slightly more than 90,000 km and were most frequently rated with an engine power between 51 and 80 kW (69 to 109 hp).

Compared to the vehicles of other 18-year-old novice drivers, the vehicles driven by model participants were newer and powered by larger engines. This fact indicates the use of vehicles already present in the family of the participant, and thus vehicles which are more modern and equipped with more safety features than those typically driven by novice drivers.

#### *Traffic offences and accident involvement*

The few self-reported traffic offences leading to a fine being imposed on the model participant are a good indicator for the general law abidance of the AD17 driver population.

According to their own information, the model participants were only very seldom involved in accidents. The limited scope of the process evaluation sample, however, does not permit generalisation of these results.

The data received from the federal states on conspicuous driving behaviour within the framework of the accompanied driving model, which were similarly incorporated into the process evaluation, also provided a clear indication of faithful abidance by the law and a low accident prevalence.

#### *Recommendation of the AD17 model to others*

Almost all the young drivers questioned replied that they would recommend participation in the accompanied driving model to others, the decisive reason mentioned being the possibility to build up more extensive practical experience before commencing independent driving.

#### *Conclusions for practical implementation*

The process evaluation of the nationwide experimental introduction of the model “Accompanied driving from 17” identifies the structures which have developed through this new approach to novice driver preparation in the context of the life realities of the young participants and their families. Against the background of the empirical results, the following conclusions and recommendations can be formulated:

- Suitability of the model approach

The AD17 model has demonstrated its suitability in respect of the central criteria of accessibility, practicability and safe implementation. Scope for optimisation is revealed in various individual aspects.

- Better utilisation of the additional opportunities for preparation

Those young persons who wish to drive independently from the age of 18 years should be encouraged to make the fullest possible use of the additional opportunities for preparation offered within the framework of the AD17 model. This means above all early commencement of their driver training and correspondingly early completion of the driving test, preferably already before their 17th birthday. Furthermore, it calls for resolute exploitation of the opportunity for driving practice within the given private framework, for which – as the results of the evaluation show – the prerequisites are usually good, particularly with regard to the motivation of those involved.

The conditions for better utilisation of the opportunities for preparation offered by the AD17 model can generally be improved by all measures serving to raise the level of information and further promote motivation. In this connection, it is recommended that the instrument of accompanied driving be made a central topic of the active safety-relevant communication geared to the target group of prospective drivers and their parents. Further thought should be given, in particular, to closer cooperation with schools. The use of foreign-language information media is similarly to be considered as a means to address corresponding target groups.

- Optimisation of time management with regard to driver training

Professional public relations work could bring further positive influence to bear on opinion formation with regard to both participation and support in the role of accompanist. Better knowledge of the possibilities for early granting of a driving licence could also serve to improve the young person's time management well in advance of his or her 17th birthday by encouraging an earlier commencement of the accompaniment phase.

- Number of accompanists entered in the driving test certificate

As the potential availability of an accompanist is improved with an increasing number of accompanists entered in the driving test certificate, novice drivers should be recommended to nominate a sufficient number of persons for this role.

- Preparation and accompanying support for participants: School road safety programmes, preparatory events, handbook and Internet

School workshops and integration of the model into school road safety programmes are suitable means to provide corresponding information at an early stage and to enable young people to fit the extended period for development of driving experience into the schedules of their youth-specific life cycle.

A mandatory introductory event for novice drivers and accompanists, e.g. in the form of an information evening, could prove a barrier to AD17 participation. The recommendation is consequently a voluntary offer of an introductory event and the parallel development of informative and creative accompanying media for novice drivers and accompanists, which could be conveyed to the target groups via various channels, such as driving schools, insurance companies, road safety campaigns and the Internet.

The concept for a standard information package, serving as a handbook for the potential participants and their parents, should also be discussed. Given the particular affinity of the youth target group for the medium Internet, it appears expedient to design and maintain an Internet platform for the AD17 model. Information presented in a visually appealing form (layout, integration of videos, etc.) could explain the scientific background and methodical purpose of the extended period of novice driver preparation – i.e. the correlations between driving practice, competence-building and accident risk – in a readily understandable fashion. At the same time, it could provide tips on the openings for early entry into the scheme of accompanied driving, advice on optimum realisation of diverse driving situations, and a forum for discussion and exchanges of the experience gained with the model, to mention just a few of the possibilities.

- Offers of pedagogical support

There is currently still little discussion of promotion for the accompanied driving model in the form of professional pedagogical support through the driving schools and driver safety training schemes. The AD17 model has introduced a completely new field into the existing system of novice driver preparation, characterised by new participants, the consumption of considerable human and time resources, and new forms of activity. This new field of activity is closely associated with the established forms of professional driver training and is geared to the same objective, namely improvement of the initial practical competence of novice drivers. The participants in the accompanied driving model – accompanists and novice drivers – should thus be consulted to determine the level of fundamental interest in offers of constructive professional support, as a basis for further consideration on the part of the relevant providers.

- Further research

It is suggested that a research project be installed to investigate the potential differences between AD17 participants and non-participants. The data collected through a survey addressing these two groups would permit a differentiated study of the motivation determining the learner driver's decision for or against participation in the AD17 model.

The process evaluation of the pilot scheme considers a large sample of novice drivers and an extensive pool of corresponding background data on everyday practical implementation of the model. At the beginning of the evaluation, each novice driver consented to the retrieval of personal data records from the Central Register of Traffic Offenders (VZR). Combination of these two data sources could permit deeper insights in the sustained effects of participation in the model even after the novice driver reaches adulthood.

#### **5.4 Significance of the results**

The considerable expansion of practical novice driver preparation in the context of the “Accompanied driving from 17” model has led to structural changes in the system of driver training in Germany. Nevertheless, it would appear that the possibilities are yet to be exploited to the full with regard to the duration of the accompaniment phase and the scope of actual driving practice. These aspects are recommended as topics for future optimisation efforts, for which purpose a basis may be found in the diverse results of the process evaluation.

Alongside more effective utilisation of the inherent potential of the model, namely longer-term development of practical driving experience, it would also be expedient to promote meaningful interactions between the AD17 model approach and other similarly targeted measures within the framework of an integrated system of novice driver preparation in Germany.

## **6. Road safety effectiveness of the AD17 model: Results of the summative evaluation**

### **6.1 Objective**

The principal objective for the summative evaluation of the AD17 model is to verify the effectiveness of the underlying approach of a greater scope of driving practice within the framework of novice driver preparation as a means to achieve improved driving and traffic competence, subsequently reflected in a reduced risk of accident involvement and a reduced likelihood of committing traffic offences at the start of an independent driving career. To determine the directly causal impact of the model, a comparison of participating and non-participating novice drivers must also consider and take into account the possibly distorting influences of model-independent factors. Furthermore, secondary effects of the model may become significant in other areas beyond the development of driving competence, above all in connection with altered mobility structures and the correspondingly changed accident situation – for example increased practice mobility during the accompaniment phase or greater demand for an early start to independent driving mobility already at the age of 18 years.

### **6.2 Studies presented to date**

Results referring to the road safety effectiveness of the AD17 model have been presented in three studies to date. Two of these studies are sub-project reports with intermediate results from the BAST evaluation of the AD17 model, processed by the Department for Statistics at the Federal Motor Transport Authority (KBA). The third study refers to the experimental scheme implemented at regional level in the federal state of Lower Saxony before introduction of the national model.

The fundamental approach common to all three studies is a comparison of safe driving behaviour between novice drivers who have taken advantage of the option of accompanied driving and those trained in the conventional manner (driver training exclusively in a driving school) during the initial phase of independent driving. The studies differ, nevertheless, in respect of several relevant parameters, for example the period under observation, the data used to depict driving behaviour, and their consideration of confounding influences which could distort the measured impact of the model. The following table provides an overview of the aforementioned studies.

### 6.3 Results

In all three studies, a two-figure percentage reduction in the rates of accident involvement and traffic offences was determined as attributable to accompanied driving.

The study conducted in Lower Saxony (Stiensmeier-Pelster, 2007) compared 4,454 AD17 participants and 2,421 conventionally trained novice drivers over their first 18 months of independent driving on the basis of data records referring to traffic offences or accidents in the Central Register of Traffic Offenders (VZR). This revealed that the AD17 participants committed 22.5% fewer traffic offences and were involved in 28.5% fewer accidents. A second objective of the study was to analyse the effect of a longer or shorter period of actual practice during the maximum one-year accompaniment phase. The AD17 participants with an accompaniment phase of more than 6 months were found to have committed 23.1% fewer traffic offences and were involved in 57.0% fewer accidents than those whose accompaniment phase had been less than 6 months. All the aforementioned differences were determined to be statistically significant.

<b>Study</b>	<b>Objectives</b>	<b>Data evaluated</b>	<b>Observed period after commencement of independent driving</b>
Stiensmeier-Pelster, 2007 (evaluation study commissioned by the State Minister of Transport of Lower Saxony)	Comparison of frequency of traffic offences and accident involvement between AD17 participants and conventionally trained novice drivers  Comparison of AD17 participants with longer and shorter accompaniment phases	Participants in an experimental scheme in the federal state of Lower Saxony before national implementation of the AD17 model  Data records from the Central Register of Traffic Offenders (VZR)	Months 1 to 18
Schade et al., 2007 (study contributing to BAST project 82.0316/2006 "Summative evaluation of accompanied driving")	Comparison of frequency of traffic offences and accident involvement between AD17 participants and conventionally trained novice drivers	Participants in the nationally implemented AD17 model from several federal states  Data records from the Central Register of Traffic Offenders (VZR)	Months 1 to 3
Schade & Heinzmann, 2009 (study contributing to BAST project 82.0316/2006 "Summative evaluation of accompanied driving")	Comparison of frequency of traffic offences and accident involvement between AD17 participants and conventionally trained novice drivers	Participants in the nationally implemented AD17 model from several federal states  Self-reported accidents and traffic offences	Months 1 to 12

	Comparison of AD17 participants with greater and lesser actual driving practice during the accompaniment phase	above a defined relevance threshold	
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**Tab. 7: Studies presented up to the end of 2009 with results pertaining to the road safety effectiveness of the AD17 model**

For the first intermediate report within the framework of the BAST evaluation project (Schade et al., 2007), two groups of 7,500 persons each were selected at random to compare the safe driving behaviour of AD17 participants and conventionally trained novice drivers, again taking data records referring to traffic offences or accidents in the Central Register of Traffic Offenders (VZR) as indicators. External scheduling requirements limited the observed period to the first three months of independent driving. The results pointed to an approx. 20% higher risk of traffic offences and a 30% higher risk of accident for the conventionally trained novice drivers compared to the AD17 participants. As the period of observation was still deemed too short, however, these results could not yet be validated statistically and were thus initially interpreted by the authors merely as a trend in favour of the safety effectiveness of the AD17 model.

The third study (Schade & Heinzmann, 2009) analysed the driving behaviour of a total of over 18,000 eighteen-year-old drivers in the first year of their independent driving of a motor vehicle. Two samples of drivers of the same age were selected at random from the Central Register of Driving Licences (ZFER): Firstly, AD17 novice drivers who had completed at least a 3-month phase of accompanied driving, and secondly, “normal” novice drivers who had obtained a conventional driving licence.

The evaluation takes into account all self-reported accident involvement and traffic offences above a defined relevance threshold (accidents: police called to record the accident, estimated damage of at least €1,200, injury to persons; traffic offences: all offences punished with a fine of more than €25). On the basis of these data, the rates of significant accident involvement and significant traffic offences were determined both on a time-related basis, i.e. per 1,000 drivers and year, and according to the scope of actual driving practice, i.e. per million kilometres driven.

Compared to the group of conventionally trained novice drivers, the AD17 participants were seen to be involved in 19 per cent fewer significant accidents and committed 18 per cent fewer significant traffic offences per 1,000 novice drivers and year. On the basis of actual driving practice (kilometres driven), the figure for significant accident involvement was even 23 per cent lower in the AD17 group, while significant traffic offences were reduced by 22 per cent.

In the course of a more detailed evaluation, the possible influence of various model-independent factors was analysed, in order to identify spurious correlations or effects which could mask those of accompanied driving – e.g. an uneven distribution of male and female drivers in the analysis groups. The confounding variables considered were the factors gender, school education background, place of residence, positive parental role model and vehicle availability, alongside the combinations negative parental role model/lower education background and higher education background/limited vehicle availability. After taking into account the influences of these factors, adjusted values were derived for the difference between the AD17 group and the group of conventionally trained novice drivers. In all cases, these remaining differences were shown to be statistically either very or highly significant (cf. Tab. 8).

Besides the verification of significantly lower rates of accident involvement and traffic offences among novice drivers who had taken part in the accompanied driving scheme, the study also revealed indications that the extent of actual driving practice during the accompaniment phase correlates positively with later driving behaviour in the sense of a “dose-response relationship”.

#### 6.4 Significance of the results

The evidence for a two-figure percentage reduction in the rates of accident risk and traffic offences among novice drivers during the initial phase of independent driving, as to be found in the various (partial) evaluations presented to date, documents a considerable road safety effectiveness of the accompanied driving model, and indeed a scope of safety relevance far beyond that anticipated in the context of novice driver measures to date.

Statistical variable	AD17 group	Conventional driver training	Difference between AD17 and conventional driver training	Difference between AD17 and conventional driver training taking into account confounding variables
Rate of accident involvement per 1,000 drivers and year	89.4	110.5	-19%	-17%***
Rate of traffic offences per 1,000 drivers and year	66.6	81.6	-18%	-15%**
Rate of accident involvement per million kilometres driven	10.87	14.07	-23%	-22%***
Rate of traffic offences per million kilometres driven	8.10	10.38	-22%	-20%***

Legend: n.s. = Difference to parity (1.0) not significant; \* = statistically significant ( $p \leq 0.05$ ); \*\* = statistically very significant ( $p \leq 0.01$ ); \*\*\* = statistically highly significant ( $p \leq 0.001$ );

**Tab. 8 : Rates of significant accident involvement and traffic offences in the analysis groups per 1,000 drivers and year and per million kilometres driven**

In Germany, empirical proof of model-specific road safety effectiveness has so far only been furnished with regard to the probationary driving licence introduced in 1986. Compared to the accompanied driving model, however, the extent of the attested safety gain attributable to the instrument of a probationary driving licence is considerably narrower: On the basis of the evaluation results, a model-specific reduction in road safety risks of 5 per cent is assumed, but that applicable exclusively to male novice drivers in urban contexts (cf. Meewes & Weißbrodt, 1990).

The present findings on the road safety effectiveness of the accompanied driving model stem from different, in many respects independent studies on the basis of extensive samples. The validity of the result tendencies which have emerged in all the (partial) evaluations to date, namely the indication of a significant road safety effectiveness of the accompanied driving model, is supported in particular by the careful consideration given to the influences of confounding variables in the special evaluation

presented recently by Schade and Heinzmann (2009), and by the critical methodical appraisal of the results obtained (cf. the original report contained in the annex to this evaluation).

This notwithstanding, the scientific findings presented to date have still not been able to clarify all questions relating to the effectiveness of the accompanied driving model. It remains essentially open, for example, whether and to what extent the risk-reducing effects of the accompanied driving model are preserved beyond the first year of independent driving, and likewise whether secondary effects lead to a parallel increase in risk within the framework of changed mobility structures.

## **7. Conclusion**

The overall evaluation of the VFT model was unable to confirm the road safety effectiveness of this approach. No improvements were achieved in the vast majority of the road safety attitude domains addressed by the VFT model. Given the lack of attitude effectiveness, it is also not possible to assume that the VFT model exerts an effective influence on behaviour.

It is especially disturbing to learn that participants in the VFT model display a significantly greater risk of accident involvement and traffic offences compared to novice drivers of the same age and with similar driving experience who have not attended a VFT seminar. Empirical clarification of the origin of this negative result will require more detailed studies on the basis of a more extensive set of data. Possible explanations, insofar as a directly causal effect of the VFT participation is excluded, can most reasonably be assumed to lie in the curtailed effectiveness of the probationary licence rules in the case of VFT participants (participation is honoured with a shortening of the probationary period by up to one year) and self-selection effects in conjunction with VFT participation (model may attract above all those novice drivers with a tendency to conspicuous driving behaviour, as a means to achieve a shortening of the probationary period). In view of the significantly poorer driving behaviour of the VFT participants, and against the background of the aforementioned plausibility considerations regarding the underlying causes, however, it seems expedient to already now remove the incentive of a shorter probationary period in case of VFT participation.

The evaluation of practical implementation of the VFT model revealed need for further development at several points. This refers to the quality of the active, attitude-building training forms to be applied by the seminar leaders and moderators, as well as questions concerning optimised seminar organisation in the interest of training quality. It is here recommended that the seminar concept be subjected to a thorough review, and that the conditions for concept-adequate implementation be improved.

The evaluation results published to date with regard to the road safety effectiveness of the AD17 model show evidence of a model-related two-figure percentage reduction in the rates of accident risk and traffic offences during the initial phase of independent driving from the age of 18 years. A special intermediate report presented on 30.11.2009 within the framework of the ongoing BAST evaluation revealed a 22 per cent lower accident risk and 20 per cent fewer traffic offences for AD17 participants in their first year of independent driving, in each case referred to the scope of kilometres driven. Further relevant factors influencing driving behaviour, e.g. gender, were also taken in account, so as to permit a statement on the solely model-related effectiveness. The figures document a considerable enhancement of novice driving competence as a result of the period of accompanied driving. Even so, the findings have still not been able to provide a conclusive answer to all questions

relating to the effectiveness of the AD17 model. It remains to be clarified, whether and to what extent the model of accompanied driving leads to changes in mobility patterns (mobility during the accompaniment phase, increased demand for driving licences at an earlier age), and which additional risk loads this may entail. Results addressing these questions and likewise the road safety gains from accompanied driving during the second year of independent driving practice can only be presented with the final results of the BAST evaluation in autumn 2010.

The AD17 model has already attracted a rapid and widespread response throughout Germany during its trial phase. This testifies to the high level of acceptance among novice drivers and their parents, and is at the same time indication of the practicability of the underlying approach. This is supported comprehensively by the diverse results of the process evaluation.

The considerable expansion of practical novice driver preparation in the context of the accompanied driving model has led to structural changes in the system of driver training in Germany. Nevertheless, it would appear that the possibilities are yet to be exploited to the full with regard to the duration of the accompaniment phase and the scope of actual driving practice, and these aspects can be recommended as topics for future optimisation efforts.

The results of the evaluation projects addressing the experimental novice driver training models “Voluntary further training seminars for holders of probationary driving licences” and “Accompanied driving from 17” are thus now available as a basis for assessment of these models and for the pending discussions on further development of the system of novice driver improvement in Germany. They are to be integrated directly into a BAST project which is aimed at elaboration of a framework concept, and thus the technical and professional foundations for the further development of novice driver preparation, in cooperation with experts representing scientific research, traffic politics and all those concerned with practical implementation.

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**Annex**

# **Summative Evaluation of “Accompanied Driving from 17”**

**Special evaluation:**

**First evaluation results  
on the basis of self-reported driving behaviour**

**Research Project FE 82.0316/2006  
of the Federal Highway Research Institute**

Franz-Dieter Schade  
Hans-Jürgen Heinzmann

Federal Motor Transport Authority,  
Dept. for Statistics

Flensburg, 30.11.2009



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**Abbreviations:**

AD17	Accompanied driving from the age of 17
AD17 group	Analysed sample of persons who obtained their driving licence under the AD17 model
cDL group	Analysed sample of persons who obtained their driving licence in the conventional manner ("cDL")
VZR	Verkehrszentralregister – Central Register of Traffic Offenders
ZFER	Zentrales Fahrerlaubnisregister – Central Register of Driving Licences

## Foreword

The following exposition, which builds upon the method-oriented intermediate report on the present project “Summative Evaluation of Accompanied Driving from 17” of 31.07.2008, similarly possesses the status of merely an intermediate report. It is planned to present a final report in autumn 2010, as soon as all envisaged sources of data have been utilised and evaluated.

The results presented here can nevertheless be considered final and conclusive in the sense that they cover the whole aspect of self-reported behaviour on the part of the survey participants. In other words, the data source “Participant survey”, with all responses with regard to traffic accidents and traffic offences during the first year of independent driving, was available in its entirety as a basis for the present evaluation. The final report will thus also contain no fundamentally different findings.

This notwithstanding, the results presented here may still be supplemented or relativised by those of two outstanding study tasks: Firstly an analysis of the data records pertaining to the survey participants which are held in the Central Register of Traffic Offenders (VZR), and secondly an analysis of VZR data records pertaining to selected driver groups which were retrieved independently of the survey – and without the knowledge of the persons concerned – and subsequently processed anonymously<sup>1</sup>. These analyses require a longer period of time, because the corresponding VZR entries only become available for consideration with a delay of up to twelve months after the traffic offence or accident.

An analysis of the VZR data records is an important and indispensable element of the evaluation. The first of the two analyses serves to safeguard the findings against the influences of subjective memory effects or even falsification tendencies, the second to take into account possible distortions arising from the participants’ knowledge of the study objectives. The overall evaluation can only be viewed as verified after presentation of these two additional analyses. The statements of the present report<sup>2</sup> are thus to be read under this important proviso.

<sup>1</sup> By replacing names and reference numbers with a random project number

<sup>2</sup> The authors would like to thank Mr. Willmes-Lenz (BAST) and Ms. Bremer (KBA) for their reviewing of the initial draft of 30.09.09 and for their valuable comments and amendments.

## 1 Objectives

There are three possible effects which could conceivably be observed following implementation of the model of “Accompanied driving from 17” (AD17). These effects are to be taken into account in an evaluation. For the sake of maximum clarity, they are here to be described separately, although the individual effects will to a certain extent be superimposed in practice:

*Hypothetical effect 1: Model expands the at-risk population*

The introduction of new possibilities generally leads to an increased demand, because new target groups are addressed. Persons who would otherwise have obtained a driving licence later, or possibly not at all, may be especially receptive for the new AD17 model. Consequently, the number of 18-year-old drivers increases, and with it the number of traffic accidents involving this age group (Fig. 1, right-hand block compared to left-hand block).

*Hypothetical effect 2: Model leads to internal differentiation into “good” and “poor” risks<sup>3</sup>*

The introduction of new possibilities, and thus of additional selection options, generally leads to differentiation within the target group. Persons representing so-called protective factors – e.g. female and higher-level school education – and a correspondingly lower accident risk may be concentrated in the group of “AD17 drivers”. Those with a higher accident risk, accordingly, then form the bulk of the group which obtains a driving licence in the conventional manner (“cDL drivers”). The total number of accidents remains unaffected by the internal differentiation (Fig. 2).

In the chosen example, the number of accidents involving AD17 drivers is 10,000 less than to be expected after division into two equal groups, that for the cDL drivers correspondingly 10,000 more.

*Hypothetical effect 3: Model itself serves as a protective factor*

Certain components of the AD17 model exert positive (causal) influences on the participating drivers and thus lower their accident risk (Fig. 3). The accident situation of the cDL drivers remains unchanged and corresponds to their proportion of the overall pool of drivers (in the chosen example: 50,000 accidents).

<sup>3</sup> Terminology of the insurance branch

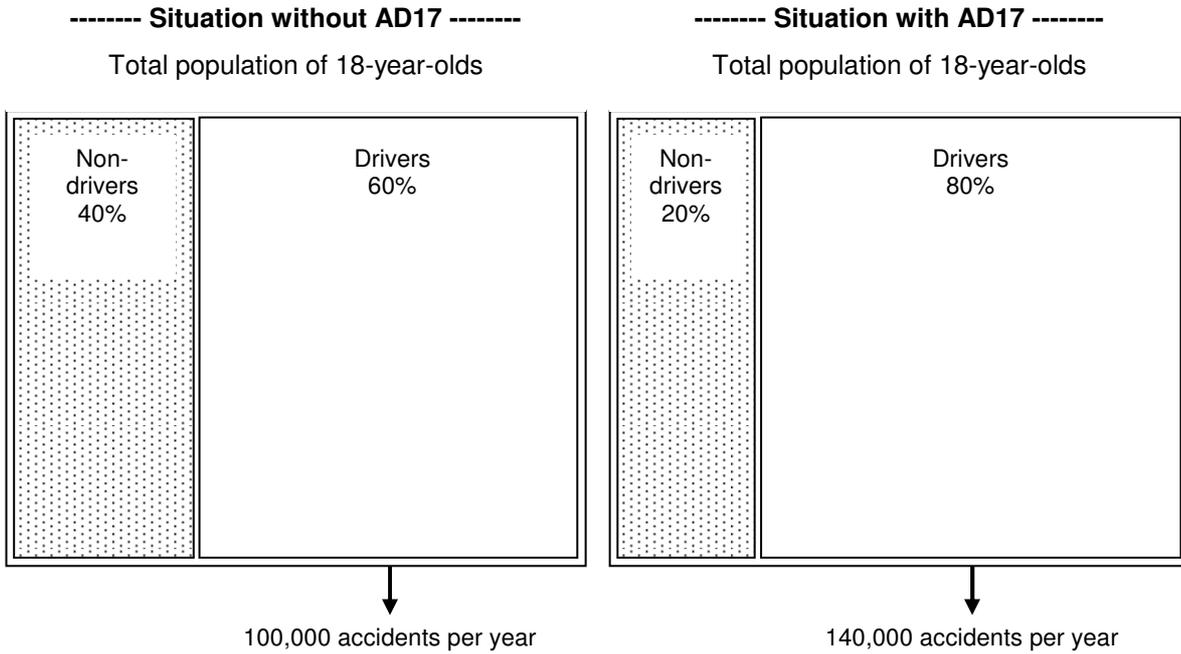


Fig. 1: Models expands the at-risk population (figures for illustration only)

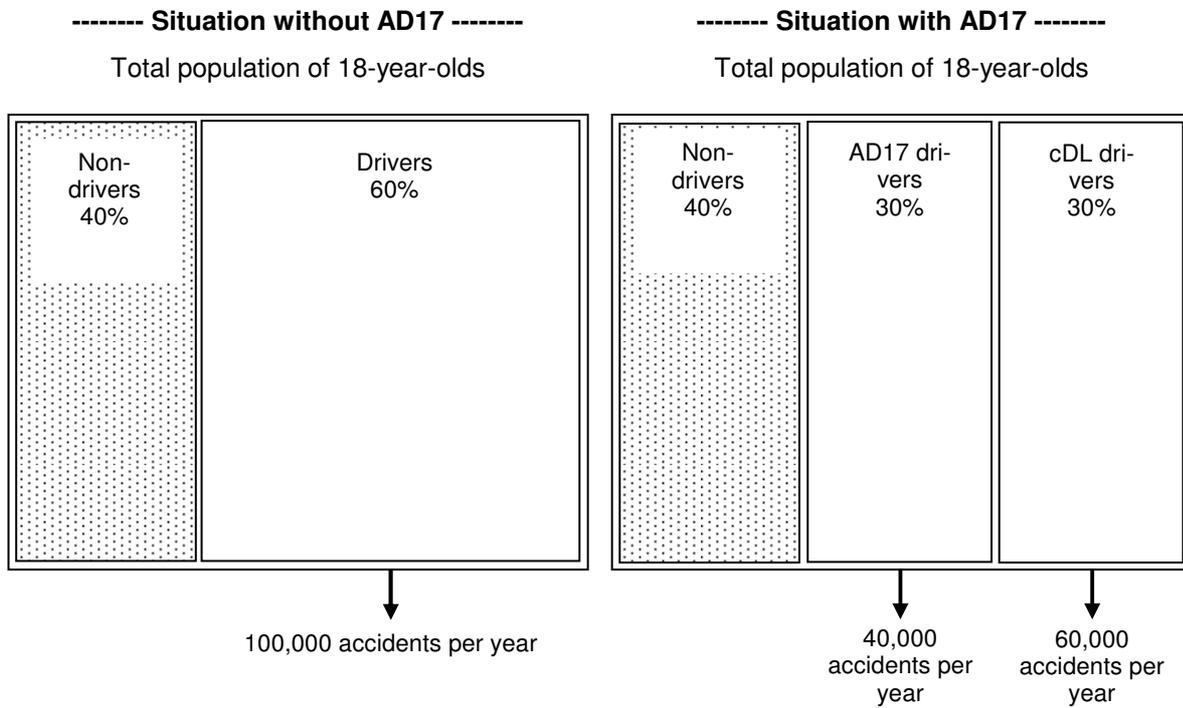
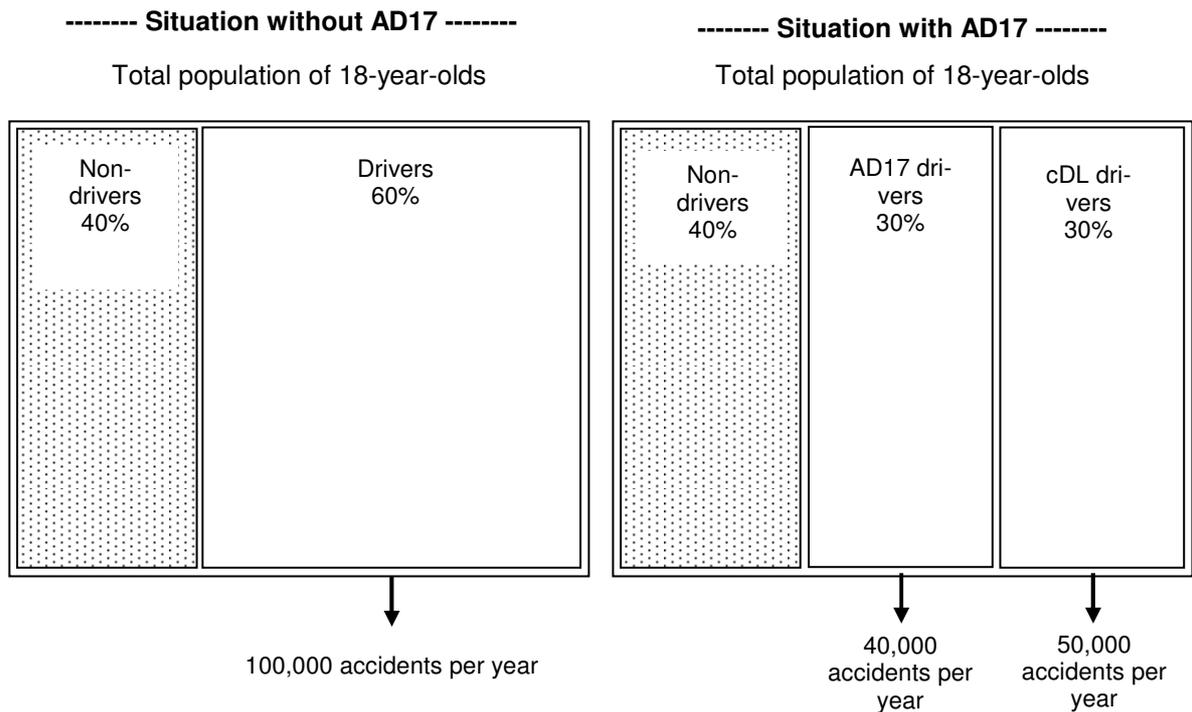


Fig. 2: Model leads to internal differentiation into good and poor risks (figures for illustration only)



**Fig. 3: Model serves (causally) as a protective, i.e. risk-reducing factor (figures for illustration only)**

In practice, all three effects may be found superimposed. One of the challenges for an evaluation is thus to distinguish the aforementioned effects. The mere fact of a reduction in the per capita risk of AD17 drivers compared to cDL drivers cannot be taken as evidence for Effect 2 or 3. The objectives for the present evaluation refer exclusively to the Effects 2 and 3<sup>4</sup>. Effect 3, and the underlying question as to the risk-reducing potential of accompanied driving, is here placed in the foreground.

<sup>4</sup> An evaluation of Effect 1 is not subject of the present report. A first statement on this effect was already to be found in the intermediate report of 31.07.2008 (Schade, Heinzmann & Feddersen, 2008, p. 33). It was there noted that the demand for driving licences among 17 to 18-year-olds increased by only a few percentage points in 2006 and 2007. More recent statistics on the numbers of probationary driving licences, however, indicate moderate growth in the age group under 20 years for driving licence classes B and BE (and those classes which include these classes), namely by 4.6% in 2005, a further 6.3% in 2006, and again by 5.1% in 2007. In 2008, by which time all the German states had finally adopted the AD17 model as a pilot scheme, the growth then stagnated (-0.5%). It can be derived from these figures that the demand for driving licences in this age group has increased by the order of around 20% in total since 2004. This conclusion, however, remains provisional and must be verified in detail, underpinned with further data and referred to demographic developments in the context of the final report.

## 2 Method<sup>5</sup>

The persons asked to participate in the survey underlying the present evaluation were selected at random from the Central Register of Driving Licences (ZFER) at the Federal Motor Transport Authority (KBA) in Flensburg. This random sample included both persons who had just obtained a driving licence on the basis of the AD17 model (AD17 group: approx. 20,000 persons) and persons of the same age who had obtained a driving licence in the conventional manner (cDL group: approx. 40,000 persons). Participation in the online survey was voluntary; in the end, properly completed questionnaires were received from almost 9,000 participants in the AD17 group and almost 10,000 participants in the cDL group.

The participants completed an initial questionnaire on average 6 to 7 months after commencement of independent driving after their 18th birthday, and then a final questionnaire after on average a further 7 months. In individual cases in which the period between these two survey dates was particularly long, an additional intermediate questionnaire was sent to the participant. Except where explicitly mentioned otherwise, the study considers also those persons who terminated their participation prematurely after completing an initial or intermediate questionnaire. In these cases, the applicable period of observation is the period up to receipt of the last properly completed questionnaire.

The purpose of the questionnaire was to acquire details of all evaluation-relevant driving behaviour during the applicable period, namely all forms of accident involvement, irrespective of the attributable portion of blame<sup>6</sup>, and all forms of punished traffic offences.

For the evaluation of this self-reported behaviour, “significance thresholds” were defined to exclude trivial cases and to establish a common set of criteria for all groups. The significance threshold for accidents is damage of “significant value” (assumed to mean €1,200 or more, in line with legal practice

<sup>5</sup> For details, see intermediate report of 31.07.2008

<sup>6</sup> The aspect of blame for accidents was not addressed, as this could firstly detract from the willingness to give honest replies, or even to participate in general, and secondly the validity of such information remains questionable even when given by the most honest survey participants. Furthermore, the 18-year-old driver is the person chiefly to blame in the vast majority of cases, as can be seen from the accident statistics of the Federal Statistical Office (2009, p. 143): 73% of the 18 to 20-year-old male drivers and 67% of the female drivers bore the main blame for accidents with injured persons in 2008. As the proportions quoted in the aforementioned statistics drop rapidly with increasing age, it can be extrapolated that the proportion of cases in which the main blame is attributable to the 18-year-old drivers under review here (i.e. without consideration of the 19 and 20-year-olds) will be much higher still.

to date with regard to § 315c of the German Criminal Code, StGB) or injury to persons. It remains irrelevant whether the damage or injury is incurred by the survey participant or another involved person. A further indicator for the exceeding of a certain relevance threshold is deemed to be the recording of an accident by the police, as is recommended and practised in case of a suspicion of driving under the influence of alcohol, for example.

Following inspection of the standard federal catalogue of traffic offences and punishments, the relevance threshold for traffic offences was set at a fine of €25, as offences punishable by fines above this amount are only rarely to be considered minor infringements (meaning parking offences or the like).

Which is the decisive criterion for the evaluation: The frequency of relevant incidents referred to time and the applicable population – here per 1,000 drivers and year – or the frequency referred to the extent of driving practice – here per million kilometres driven?

Schade & Heinzmann (2008, p. 17) discuss the conditions under which a time-based criterion (per 1,000 drivers and year) is more appropriate than a distance-based criterion (per million kilometres). In administrative contexts, especially where the private driving licence holder is the subject of traffic policy or other individual decisions, they plead against the use of kilometre-based assessment. After all, it is for good reason that the law grants no “mileage bonus” with regard to traffic offences and accidents, for example (cf. also Holte, 2006).

On the other hand, one of the objectives of accompanied driving from the age of 17 is to promote the development of driving competence. As such competence is to be operationalised as the frequency of errors relative to the scope of driving practice, however, the frequency of accidents and traffic offences per million kilometres driven should be considered as a second criterion alongside the time-based assessment.

The statistical calculations of this evaluation employ the so-called Poisson regression method. This form of analysis permits the simultaneous influences of different events on a count variable – here the number of traffic offences and accidents within a given period of time – to be determined separately and assessed individually in respect of their statistical significance. In doing so, this method also takes into account the varying numbers of persons in the different groups and any differences in the lengths of periods under observation.

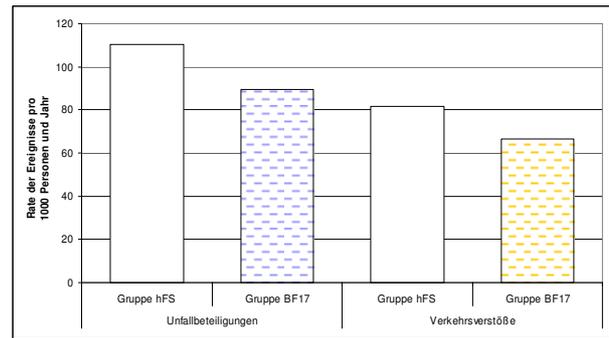
### 3 Results obtained with regard to self-reported driving behaviour

The survey served to analyse self-reported accidents and traffic offences which were deemed to lie above a specified significance threshold. Tab. 1 summarises the cases covered by this analysis.

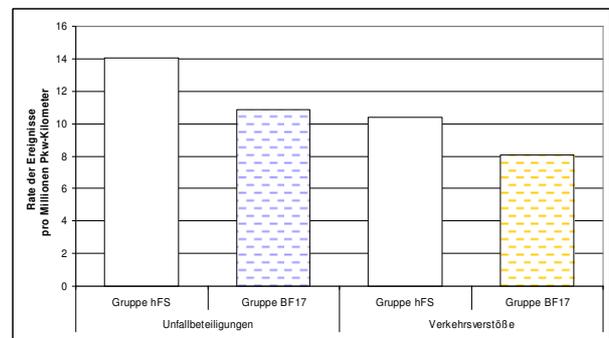
Scope of sample	N = 18,762
Reply medium	Online questionnaire
Analysis groups	AD17 group (8,785) and cDL group (9,977)
Analysis period	Evaluation of the data of all returned questionnaires

**Tab. 1: Analysis conditions and number of cases**

More than 18,000 persons took part in the survey and together reported on more than 18,000 years of driving experience and almost 150 million kilometres driven. Together, they reported 1,372 significant traffic offences and 1,852 cases of involvement in significant traffic accidents (Tab. 2).



**Fig. 4: Rates of significant accident involvement and traffic offences in the analysis groups per 1,000 drivers and year**



**Fig. 5: Rates of significant accident involvement and traffic offences in the analysis groups per million kilometres driven**

	AD17 group	cDL group
Number of survey participants	8,785	9,977
Total number of years under observation	8,855	9,589
Total kilometres driven (in millions)	72.84	75.33
Reported cases of significant accident involvement	792	1,060
Reported cases of significant traffic offences	590	782

**Tab. 2: Numbers of survey participants, significant accidents and traffic offences by analysis group**

Compared to the group of cDL drivers, the rate of significant accident involvement among AD17 drivers is seen to be 19% lower per 1,000 drivers and year, and even 23% lower per million kilometres driven (Tab. 3; see also Fig. 4 and Fig. 5).

The differences in the rates of significant traffic offences are only marginally reduced: Among AD17

drivers, the figure per 1,000 drivers and year is 18% lower, and that per million kilometres driven 22% lower than for the cDL drivers. In other words, the expected effect of the AD17 model is reflected clearly in all indicators.

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Statistical variable	AD17 group	cDL group	Difference between AD17 and cDL
Rate of accident involvement per 1,000 drivers and year	89.4	110.5	-19%
Rate of traffic offences per 1,000 drivers and year	66.6	81.6	-18%
Rate of accident involvement per million kilometres driven	10.87	14.07	-23%
Rate of traffic offences per million kilometres driven	8.10	10.38	-22%

**Tab. 3: Rates of significant accident involvement and traffic offences in the analysis groups per 1,000 drivers and year and per million kilometres driven**

## 4 Critical methodical evaluation

In general, as is also the case here, a diversity of objections can be expressed to question purely descriptive results. A critical and scientific methodical evaluation is thus imperative. Such evaluation is the objective of the discussion in this section.

### 4.1 Are the analysis results statistically significant?

The aforementioned values were determined on the basis of a limited sample and are by nature subject to a sampling error. Are the established differences nevertheless statistically significant, or could they be interpreted by critics as a consequence of a sampling error?

An analysis of statistical significance within the framework of the so-called Poisson regression produces values of less than one per cent<sup>7</sup> as the probability of a sampling error for each of the four results<sup>8</sup>. The “null hypothesis”, namely that there are no differences between the groups (or that the AD17 group even performs less well than the group of novice drivers holding conventional driving licences), can be rejected with a probability of error of less than one per cent. The alternative hypothesis that the AD17 group performs better, on the other hand, can be assumed to be true.

### 4.2 Are the AD17 and cDL analysis groups strictly comparable and can the results be generalised?

The question addresses the uncertainty as to whether the compared analysis groups are really comparable, such that the established differences can be attributed clearly to participation in the AD17 model and are not a result of “side effects”. At the same time, it is to be asked whether the results obtained are suitable for generalisation.

In the course of preliminary analyses (Schade, Heinzmann & Feddersen, 2008), it was determined that the distortions in the two samples, insofar as they exist at all, are only minor, meaning that the samples can be considered representative for the federal states participating in the AD17 model<sup>9</sup>.

Even so, there are small differences which are to be taken into account in the further evaluation.

Otherwise, the groups were of the same age during the period under observation. The period of observation for both groups began immediately with their commencement of independent driving, and furthermore during the same calendar period, meaning that they were subject to the same traffic conditions and even the same seasonal influences. All seasons of the year are covered.

The fact that the number of participants and the mean duration of observation differ slightly between the two groups is taken into full account in the methodology, as it applies a doubly relativised measure for comparison: The number of relevant occurrences (accidents, traffic offences) per 1,000 persons and year.

### 4.3 Do any “external” variables exert distorting influences?

Another possible objection is that the AD17 and cDL groups may differ in further factors besides the model by which they obtained a driving licence, and that these factors could have a protective effect, i.e. they could already reduce the risks of accident involvement or traffic offences. Such factors which are known from traffic research include female gender and a higher level of school education. The objection refers to the differentiation into “good” and “poor” risks described in Section 1 as Effect 2. Could it be the case that the AD17 model attracts more female drivers and persons with a higher level of school education, and that this group already displays a lower risk merely on the basis of these and possibly further protective factors, rather than any positive influences for the young drivers being attributable to the particular experience of the AD17 model?

It is scarcely possible to conclusively invalidate objections of this kind unless all potential protective factors are known. On the other hand, the objection can only refer to those factors which are firstly proven to be protective, and secondly occur more frequently in the AD17 group than in the cDL group. It is to be considered in the following, whether or not these conditions are met.

The preliminary analyses for the intermediate report revealed a tendency in the direction of more female drivers in the AD17 group than in the cDL group, and likewise more residents of rural areas and more persons who had obtained or were preparing for at least an advanced school-leaving certificate (in the following summarised as persons with a higher school education background). In addition, a difference was determined between the groups with regard to the driving behaviour of a parental role model: AD17 drivers replied slightly

<sup>7</sup> In all cases  $p < 0.001$  for the unidirectional hypothesis that the rates of accident involvement and traffic offences in the AD17 group are lower than those of the cDL group

<sup>8</sup> Differences in accident involvement and traffic offences referred to both the number of drivers and the kilometres driven

<sup>9</sup> At the time of sampling in mid-2007: Bavaria, Berlin, Brandenburg, Bremen, Hamburg, Lower Saxony, North Rhine-Westphalia, Rhineland-Palatinate, Saarland, Saxony, Schleswig-Holstein

more frequently that their parents were correct in their abiding by road traffic rules<sup>10</sup>. This could be a further protective factor.

In this context, it is expedient not only to investigate objections that protective factors could possibly establish a spurious correlation between the AD17 model and a reduced frequency of accident involvement or traffic offences. Attention should also be paid to the opposite case: An external variable with an “anti-protective” effect, namely the somewhat greater vehicle availability in the AD17 group<sup>11</sup>, leads to underestimation of the causal influence of the AD17 model on road safety. After all, only those licence holders with actual opportunities to drive are able to commit traffic offences or be involved in accidents. Where AD17 drivers have more frequent opportunities for accident involvement, however, this overlays the possible accident-reducing influence of the AD17 model.

To adequately estimate the degree of causal correlation between the AD17 model and traffic behaviour, it is thus necessary to take into account “external variables” which could overlay and neutralise any causal effects.

Proof of whether or not the specified factors display the expected protective and anti-protective correlations with accidents and traffic offences is obtained by way of regression calculations. The results are shown in Tab. 4.

Whereas the factors education background, place of residence<sup>12</sup> and parental role model – contrary to expectations – are shown to have no or only minor influence on the rate of novice driver accident involvement and traffic offences, the factor gender is highly significant: Female novice drivers display a 22% lower accident rate than male novice drivers, and even a 50% lower frequency of traffic offences. As was expected, a higher vehicle availability increases the rates of accident involvement and traf-

fic offences. Alongside vehicle availability per se, the combinations with education background are also relevant in respect of driving behaviour: Where a higher education background coincides with limited vehicle availability, the rates of both accident involvement and traffic offences are reduced significantly, and that beyond the extent which is already to be expected from the simple combination of factors (such multiplication effects are known in statistical analysis as interaction effects).

The analysis shows, therefore, that at least the slightly higher proportion of female drivers in the AD17 group could have contributed to the positive result of the AD17 model. In this respect, the objection of result distortion under review here must be taken seriously. The highly significant interaction between vehicle availability and education background, on the other hand, is not to be assigned critical importance, as there is no difference between the AD17 and cDL analysis groups in terms of this specific combination of factors – limited vehicle availability and higher education background – irrespective of the slight difference in vehicle availability which is revealed when this factor is viewed in isolation.

At the same time, the analysis points to the considerable influence of the factor vehicle availability, which could well mask any strong causal effects if it is not taken into account explicitly.

#### *Time-based comparison*

In the following, regression analysis is used to verify whether the differences in accident involvement and traffic offences between the two analysis groups remain valid when the influences determined in Tab. 4 are taken into account. Questions of particular interest are: Could the differences between the analysis groups presented in Tab. 3 possibly be explained merely by the slightly different gender composition? Does the slight difference in vehicle availability between the groups mask any strong causal effect?

<sup>10</sup> A positive parental role model is assumed for the purposes of the following analyses if the survey participant confirmed conscientious driving behaviour on the part of both parents, insofar as data were given (survey question: “My father/mother is very correct in abiding by road traffic rules”; this statement is “true” or “absolutely true”). Approx. 45% of novice drivers gave such a positive assessment of their parents.

<sup>11</sup> Unlimited vehicle availability over the period of observation is assumed where the participant replies unanimously in all questionnaires completed that he or she is the owner of the vehicle used or at least its sole user (applicable in 37% of cases).

<sup>12</sup> An evaluation on the basis of place of residence (as opposed to the usual reference to the place of accidents) was recently presented by Holz-Rau & Scheiner (2009). According to their results, town-dwellers face a slightly greater risk of accidents involving minor injury than the residents of rural areas, but a considerably reduced risk of a traffic accident resulting in serious or fatal injuries.

Factor	Ratios of accident involvement and traffic offences compared to the relevant reference group	
	Accident involvement per 1,000 drivers and year	Traffic offences per 1,000 drivers and year
Gender: Female (versus male)	0.78 ***	0.50 ***
Education background: Advanced school certificate (versus lower)	0.91 n.s.	1.00 n.s.
Place of residence: Rural areas (versus others)	1.02 n.s.	0.88 *
Parental role model: Positive (versus negative)	1.00 n.s.	0.98 n.s.
Vehicle availability: Unlimited (versus limited)	1.95 ***	2.38 ***
Combination negative parental role model / lower education background (versus others)	1.18 n.s.	1.31 *
Combination higher education background / limited vehicle availability (versus others)	0.68 ***	0.59 ***

Legend: n.s. = Difference to parity (1.0) not significant; \* = statistically significant ( $p \leq 0.05$ ); \*\* = statistically very significant ( $p \leq 0.01$ ); \*\*\* = statistically highly significant ( $p \leq 0.001$ )

Interpretation example: The ratio of the accident involvement of female novice drivers compared to their male counterparts is 0.78. This means that the accident risk for female drivers is lower by 22%.

**Tab. 4: Rates of accident involvement and traffic offences as dependent on selected external factors (time-based comparison)**

Factor	Ratios of accident involvement and traffic offences compared to the relevant reference group	
	Accident involvement per 1,000 drivers and year	Traffic offences per 1,000 drivers and year
Gender: Female (versus male)	0.78 ***	0.50 ***
Education background: Advanced school certificate (versus lower)	0.92 n.s.	1.02 n.s.
Place of residence: Rural areas (versus others)	1.03 n.s.	0.88 n.s.
Parental role model: Positive (versus negative)	1.01 n.s.	0.99 n.s.
Vehicle availability: Unlimited (versus limited)	1.97 ***	2.40 ***
Combination negative parental role model / lower education background (versus others)	1.18 n.s.	1.32 *
Combination high education background / limited vehicle availability (versus others)	0.68 ***	0.59 ***
Driving licence model: AD17 (versus conventional model)	0.83 ***	0.85 **

Legend: n.s. = Difference to parity (1.0) not significant; \* = statistically significant ( $p \leq 0.05$ ); \*\* = statistically very significant ( $p \leq 0.01$ ); \*\*\* = statistically highly significant ( $p \leq 0.001$ )

Interpretation example: The ratio of the accident involvement of AD17 drivers compared to those obtaining a driving licence in the conventional manner is 0.83. This means that the accident risk for AD17 drivers is lower by 17%.

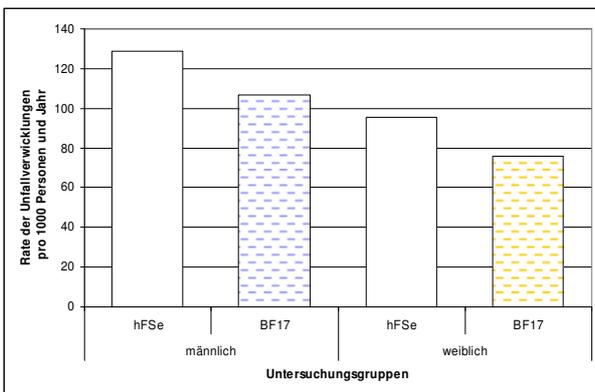
**Tab. 5: Influence of the driving licence model on the rates of accident involvement and traffic offences, taking into account further factors (time-based comparison)**

These questions are addressed by Tab. 5. The sole objective here is to ascertain whether and to what extent the originally established impact of the AD17 model remains valid when the objection of distorting “external variables” is taken into account. The bottom row of the table shows a significant reduction in accident involvement by 17% (originally 19%; see Tab. 3) for the AD17 group compared to the cDL group, and a reduction of 15% (originally 18%) in respect of traffic offences.

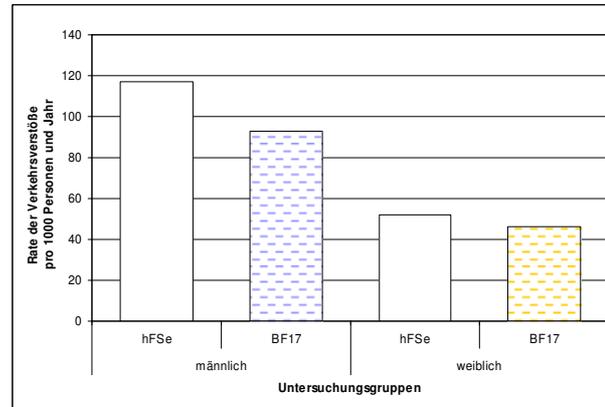
This shows that the AD17 model has indeed resulted in a slight internal risk differentiation in the sense of the effect described in Section 1, namely both in favour of the AD17 group (more female novice drivers) and to its detriment (more novice drivers with unlimited vehicle availability). The two opposing effects do not neutralise each other completely, however, with the result that the originally established differences between the groups are reduced by two to three percentage points.

The remaining road safety gain of 15 to 17% from the AD17 model can now be attributed to the specific influence of “AD17 experience” (assuming that there are no further, unknown external variables to be considered).

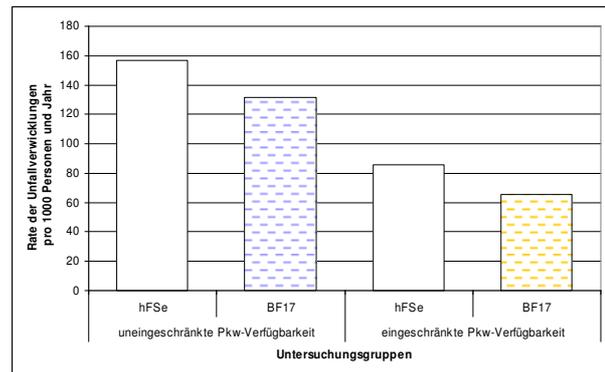
The following graphs (Fig. 6 and Fig. 7) illustrate the differences between the analysis groups if only the protective factor gender is taken into account. Subsequently, a further pair of graphs demonstrates the considerable “anti-protective” influence of vehicle availability on accident involvement and traffic offences (Fig. 8 and Fig. 9).



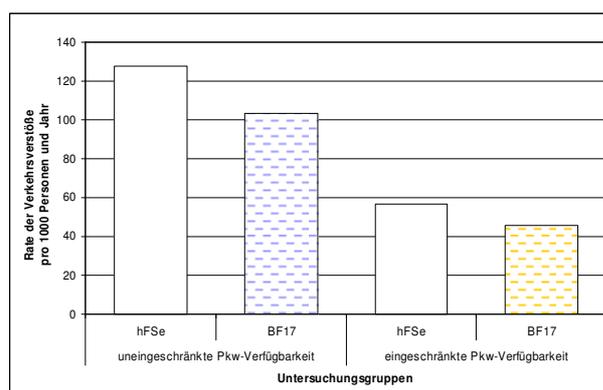
**Fig. 6: Rate of accident involvement per 1,000 novice drivers and year in the first year of independent driving, differentiated by driving licence model (conventional/AD17) and gender**



**Fig. 7: Rate of traffic offences per 1,000 novice drivers and year in the first year of independent driving, differentiated by driving licence model (conventional/AD17) and gender**



**Fig. 8: Rate of accident involvement per 1,000 novice drivers and year in the first year of independent driving, differentiated by driving licence model (conventional/AD17) and vehicle availability**



**Fig. 9: Rate of traffic offences per 1,000 novice drivers and year in the first year of independent driving, differentiated by driving licence model (conventional/AD17) and vehicle availability**

How great is the influence which can be attributed to the further differences between the AD17 and cDL groups which were determined in the course of the preliminary analyses?

A series of further minor differences is by nature such that the effects on accident involvement and traffic offences, insofar as they are manifested at all, would rather tend to diminish the positive impact of the AD17 model. Consequently, they are irrelevant for the objection of a falsely positive AD17 effect: AD17 drivers tend to report less prior practice with other vehicles, emphasise more frequently the importance of a high level of mobility, mention more frequently the availability of several vehicles in their household and the availability of a vehicle with an engine power of more than 50 kW, and report more frequently a weekly distance driven of more than 200 km and a driving time of more than four hours. All these differences imply an increased risk of accident involvement or traffic offences for the AD17 group and thus cannot be taken as a basis for the expressed criticism of a spurious correlation. It is rather the case that they promote underestimation of any AD17 effect<sup>13</sup>.

Two of the important differences revealed by the preliminary analyses, however, could still be relevant: It is less often the case that AD17 drivers use either older vehicles or vehicles in a poor technical condition. This circumstance could have helped the AD17 group to a lower rate of accident involvement. To investigate this hypothesis, the replies of the two analysis groups with regard to the nature of any accident involvement were scrutinised more

<sup>13</sup> Given the limited sample sizes, it is not possible to incorporate all these factors into a regression analysis, and in this way to separate their particular influence so as to retain an unfalsified AD17 effect: The frequency matrix contains zero assignments, which are impermissible for the calculation.

closely. Of the 1,335 cases of accident involvement reported by the cDL group, 10 instances were attributed to “technical defects or maintenance deficits” (0.7%); among the 1,036 cases of accident involvement reported by the AD17 group, this cause was mentioned 9 times (0.9%). Technical causes thus played only a very minor role in the accidents, and there was furthermore practically no difference between the two groups. The better condition of the vehicles used by the AD17 group is thus unsuitable as an explanation for their lower accident rate.

#### *Kilometre-based comparison*

Would the results perhaps be better if the rates of accident involvement and traffic offences were to be compared on the basis of kilometres driven?

The general survey data show that the annual distances driven by participants in the AD17 group were on average 4.7% higher than in the cDL group (8,226 km compared to 7,856 km; derived from Tab. 2). Increased exposure to traffic can hardly serve to explain a reduced risk of accident involvement and traffic offences, and a kilometre-based evaluation of driving behaviour is thus unlikely to call the effectiveness of the AD17 model into question. Nevertheless, this objection is still to be investigated.

Tab. 6 shows the results of Poisson regression analyses of *kilometre-based* accident involvement and traffic offences. From these figures, it can be determined firstly (see the bottom row of the table), that a kilometre-based comparison, taking into account the same control variables, actually places greater emphasis on the AD17 effect, now showing a reduction in the accident rate by 22% (previously 17%) and a reduction in traffic offences by 20% (previously 15%).

Secondly, as expected, it becomes clear that a consideration of accident involvement and traffic offences relative to the kilometres driven dilutes the influence of vehicle availability, and furthermore the influence of gender. The (greater) vehicle availability and the (male) gender of the drivers thus play no significant role for the numbers of *accidents* per million kilometres. For the numbers of *traffic offences* per million kilometres, however, they are still of considerable, albeit slightly reduced importance<sup>14</sup> (see Fig. 10 and Fig. 11).

<sup>14</sup> The factor of vehicle availability, as defined here (see footnote 11), comprises two essential elements, both of which are related to the absence of a social corrective: On the one hand, a high degree of availability means that the driver feels less restricted in his/her impulses to use the vehicle and probably drives more kilometres as a result. Secondly, as the driver is usually also the owner of the vehicle, and as such less obliged to account to others for driving behaviour (e.g. notices of fines are received directly), he/she may be

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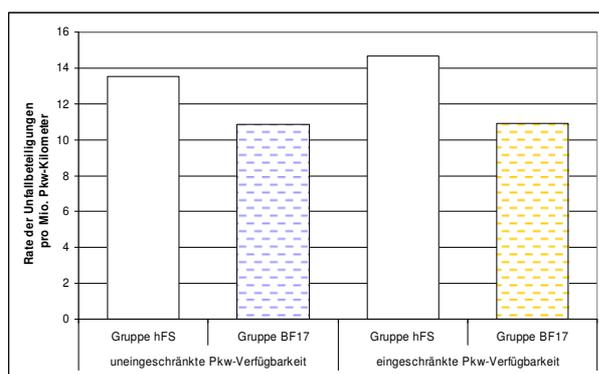
less hesitant to risk traffic offences.

The kilometre-based comparison neutralises the first contributory element of vehicle availability, namely the amount of driving done. The accepted risk of convictions for traffic offences, on the other hand, remains unaffected by the new perspective. The remaining effect of vehicle availability shown in Tab. 6 presumably reflects this second component.

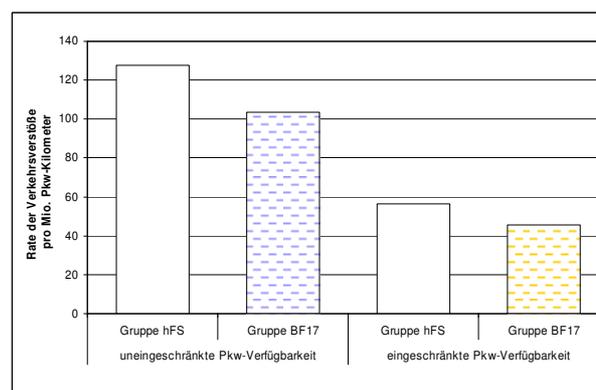
Factor	Ratios of accident involvement and traffic offences compared to the relevant reference group			
	Accident involvement		Traffic offences	
	per million kilometres	per year (cf. Tab. 5)	per million kilometres	per year (cf. Tab. 5)
Gender: Female (versus male)	0.98 n.s.	0.78 ***	0.63 ***	0.50 ***
Education background: Advanced school certificate (versus lower)	1.17 n.s.	0.92 n.s.	1.30 **	1.02 n.s.
Place of residence: Rural areas (versus others)	0.95 n.s.	1.03 n.s.	0.81 **	0.88 n.s.
Parental role model: Positive (versus negative)	1.00 n.s.	1.01 n.s.	0.97 n.s.	0.99 n.s.
Vehicle availability: Unlimited (versus limited)	1.01 n.s.	1.97 ***	1.24 **	2.40 ***
Combination negative parental role model / lower education background (versus others)	1.17 n.s.	1.18 n.s.	1.31 *	1.32 *
Combination high education background / limited vehicle availability (versus others)	0.92 n.s.	0.68 ***	0.79 *	0.59 ***
Driving licence model: AD17 (versus conventional model)	0.78 ***	0.83 ***	0.80 ***	0.85 **

Legend: n.s. = Difference to parity (1.0) not significant; \* = statistically significant ( $p \leq 0.05$ ); \*\* = statistically very significant ( $p \leq 0.01$ ); \*\*\* = statistically highly significant ( $p \leq 0.001$ )

**Tab. 6: Influence of the driving licence model on the kilometre-based rate of accident involvement and traffic offences, taking into account further factors and compared to the time-based calculation in Tab. 5**



**Fig. 10: Rate of accident involvement per million kilometres driven in the first year of independent driving, differentiated by driving licence model (conventional/AD17) and vehicle availability**



**Fig. 11: Rate of traffic offences per million kilometres driven in the first year of independent driving, differentiated by driving licence model (conventional/AD17) and vehicle availability**

#### 4.4 Are the results distorted by non-cooperating participants?

The above analyses were based on the replies of all survey participants, i.e. also those who terminated their cooperation prematurely after returning an initial or intermediate questionnaire. Would the results have been more valid without consideration of these non-cooperating survey participants, despite the correspondingly diminished sample size?

To answer this possible objection, the analysis for Tab. 5 was repeated without the data of those persons who terminated their survey participation prematurely. The analysis conditions and adjusted numbers of cases are to be seen in Tab. 7.

Scope of sample	N = 12,532
Reply medium	Online questionnaire
Analysis groups	AD17 group (6,021) and cDL group (6,511); limited to participants who completed a final questionnaire
Analysis period	Evaluation of the data of all returned questionnaires

Tab. 7: Analysis conditions and number of cases

Factor	Ratios of accident involvement and traffic offences compared to the relevant reference group			
	Accident involvement per year		Traffic offences per year	
	Adjusted sample	Values in Tab. 5	Adjusted sample	Values in Tab. 5
Gender: Female (versus male)	0.79 ***	0.78 ***	0.51 ***	0.50 ***
Education background: Advanced school certificate (versus lower)	0.93 n.s.	0.92 n.s.	0.92 n.s.	1.02 n.s.
Place of residence: Rural areas (versus others)	1.06 n.s.	1.03 n.s.	0.92 n.s.	0.88 n.s.
Parental role model: Positive (versus negative)	0.98 n.s.	1.01 n.s.	0.98 n.s.	0.99 n.s.
Vehicle availability: Unlimited (versus limited)	2.01 ***	1.97 ***	2.30 ***	2.40 ***
Combination negative parental role model / lower education background (versus others)	1.09 n.s.	1.18 n.s.	1.32 *	1.32 *
Combination higher education background / limited vehicle availability (versus others)	0.71 **	0.68 ***	0.66 **	0.59 ***
Driving licence model: AD17 (versus conventional model)	0.83 ***	0.83 ***	0.83 **	0.85 **

Legend: n.s. = Difference to parity (1.0) not significant; \* = statistically significant ( $p \leq 0.05$ ); \*\* = statistically very significant ( $p \leq 0.01$ ); \*\*\* = statistically highly significant ( $p \leq 0.001$ )

Interpretation example (row "Gender"): The ratio of the accident involvement of female novice drivers compared to their male counterparts is 0.79. This means that the accident risk for female drivers is lower by 21%.

Tab. 8: Influence of the driving licence model on the rates of accident involvement and traffic offences, taking into account further factors and excluding those persons who terminated their survey participation before completing a final questionnaire (compared to the corresponding values of the unadjusted sample from Tab. 5)

The results in Tab. 8 (grey columns) display only marginal changes compared to the values of Tab. 5, and furthermore changes with no effect for the previously drawn conclusions. It can be seen, in particular, that the inclusion of those persons who terminated their survey participation prematurely in the analyses of Section 4.3 does not lead to an overestimation of the AD17 effects – rather the opposite is the case (see last row of table).

#### 4.5 Does the model possibly achieve merely a temporary effect?

Another objection addresses the possibility that, on account of the much longer period of parental accompaniment in the AD17 group, the positive effects also last somewhat longer<sup>15</sup> than the otherwise equally positive effects of conventional driver training, even though this difference may become less and less distinct after a few weeks or months. Is the proven AD17 effect thus real exclusively or predominantly at the beginning of independent driving and does it then fade rapidly?

To be able to investigate this question, the self-reported accidents and traffic offences of all participants who took full part in the survey and also completed a final questionnaire were assigned to an early and a later analysis period: Firstly the period up to completion of the initial questionnaire (on average six to seven months after the commencement of independent driving), and secondly the period between the initial and final questionnaires (on average approx. seven months). In the following – for the sake of simplicity – these periods are described as the first half and second half of the observation period. Tab. 7 indicates the cases which were deemed relevant here.

First of all, it was determined by way of Poisson regression<sup>16</sup>, whether the rates of accident involvement and traffic offences actually differ significantly between the two periods. This produced a highly interesting result (see last row of Tab. 9): While the rate of traffic accidents fell significantly by on average 19% between the first and second half of the observation period, the rate of traffic offences rose significantly by on average 29% between the two periods. Although very important for road safety research, this result is not a subject for the discussion within the framework of this report and thus cannot be followed up at this juncture.

The relevant question for the present analysis refers solely to whether or not the protective influence of the AD17 model decreases in the second half of the observation period. From a statistical point of view, this should be reflected in the Poisson regression in the form of a significant interaction effect between driving licence model and section of the observation period. Interaction effects, however, are revealed neither for accident involvement nor for traffic offences. In both cases, a regression model comprising solely main effects, in other words a model which assumes exclusively zero interactions, is shown to be fully compatible with the data (Pearson chi-square for the model “Traffic accidents” with 55 degrees of freedom: 63.3,  $p = 0.207$ ; Pearson chi-square for the model “Traffic offences” with 55 degrees of freedom: 47.8,  $p = 0.744$ ).

Viewing the rates of accident involvement and traffic offences (see Fig. 12 and Fig. 13), it is even possible to identify an – admittedly not significant – opposing tendency: The decrease in the rates of accident involvement and traffic offences in connection with the AD17 licence model actually appears to be even more distinctive in the second half of the observation period than in the first half.

The aforementioned objection of a possibly temporary effect is thus not supported by the data. It can be assumed that the effect of the AD17 model is preserved over the whole observation period covering the first approx. 14 months of independent driving. Nevertheless, it is planned to return to this question once more at a later date and to perform a further more detailed analysis on the basis of data from the Central Register of Traffic Offenders.

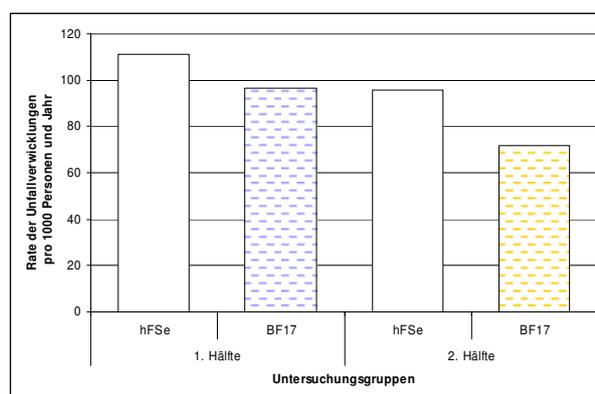
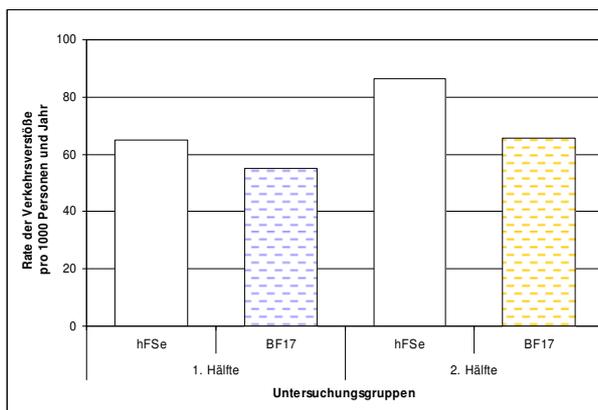


Fig. 12: Rate of accident involvement, differentiated by driving licence model (conventional/AD17) and section of observation period

<sup>15</sup> The previous accompanists (parents) continue to travel in the passenger seat for several weeks in the mind of the young driver.

<sup>16</sup> The factor “Place of residence”, which had not displayed particular significance in any of the previous regression analyses, was no longer included for the subsequent analyses, so as not to burden the sample size unnecessarily.



**Fig. 13: Rate of traffic offences, differentiated by driving licence model (conventional/AD17) and section of observation period**

Factor	Ratios of accident involvement and traffic offences compared to the relevant reference group	
	Accident involvement per 1,000 drivers and year	Traffic offences per 1,000 drivers and year
Gender: Female (versus male)	0.79 ***	0.51 ***
Education background: Advanced school certificate (versus lower)	0.93 n.s.	0.92 n.s.
Parental role model: Positive (versus negative)	0.98 n.s.	0.98 n.s.
Vehicle availability: Unlimited (versus limited)	2.01 ***	2.30 ***
Combination negative parental role model / lower education background (versus others)	1.09 n.s.	1.32 *
Combination higher education background / limited vehicle availability (versus others)	0.71 **	0.66 **
Driving licence model: AD17 (versus conventional model)	0.83 ***	0.83 **
Section of observation period: Second half (versus first half)	0.81 ***	1.29 ***

Legend: n.s. = Difference to parity (1.0) not significant; \* = statistically significant ( $p \leq 0.05$ ); \*\* = statistically very significant ( $p \leq 0.01$ ); \*\*\* = statistically highly significant ( $p \leq 0.001$ )

Interpretation example: The ratio of accident involvement during the second half of the observation period compared to the first half is 0.79. This means that the accident risk is reduced by 19%.

**Tab. 9: Rates of accident involvement and traffic offences as dependent on the section of the observation period, taking into account further factors**

#### 4.6 What evidence supports a (causal) effect of the AD17 model?

Particularly sound evidence for the (causal) effect of a measure is often only to be obtained through verification of a so-called “dose-response relationship” and proof of the “specificity” of the effect. To this end, a cause of the effect is postulated, i.e. an “agent”, the intensity of which is to determine the

degree of effect. In the case of the AD17 model, the “agent” is driving practice while accompanied by an adult driver. If this practice tends to zero, then it is no longer possible to expect a positive effect from the model. The driving practice can be measured by the duration of the accompaniment phase as a number of months, though the more direct approach would be to determine the distance driven with accompaniment in kilometres.

The specificity of an effect describes how the positive response to the underlying measure is witnessed predominantly in precisely the aspect of behaviour for which the measure was developed. In the case of the AD17 model, the principal effect should be achieved in terms of overall driving safety and not merely in a sphere of behaviour which is only loosely associated with safety (e.g. confident navigation in an unknown town or particular skill when parking). A non-specific effect would give rise to doubt as to the underlying effect mechanism.

#### *Dose-response relationship:*

To permit statements on the dose-response relationship, the AD17 group was analysed more closely. The corresponding analysis conditions and the number of cases are given in Tab. 10.

Scope of sample	N = 6,021
Reply medium	Online questionnaire
Analysis group	All participants of the AD17 group who completed a final questionnaire
Analysis time	Evaluation of the data of all returned questionnaires

**Tab. 10: Analysis conditions and number of cases**

The sample of AD17 drivers was divided firstly on the basis of the duration of the accompaniment phase (up to 6 months<sup>17</sup>, over 6 up to 10 months, over 10 up to 12 months), and secondly according to actual driving practice during this period (up to 500 km accompaniment, 501 to 1,000 km accompaniment, more than 1,000 km accompaniment).

The “dose-response relationship” here refers to the hypothesis that AD17 drivers reporting a longer accompaniment phase, and in particular those with more driving practice in terms of kilometres, will display lower rates of accident involvement and traffic offences<sup>18</sup>, because the protective effect of the model should be greater under these conditions. Correspondingly, drivers with a less intensive accompaniment phase should display higher rates of accident involvement and traffic offences.

To test this hypothesis, the intensity of the accompaniment phase is taken into account in the re-

<sup>17</sup> Due to the selection criteria applied, there are unfortunately very few cases of an accompaniment phase of less than 4 months in the sample, meaning that no analysis of this group is possible, despite the fact that it could be particularly interesting for the questions addressed by the present study.

<sup>18</sup> This is a so-called unidirectional hypothesis, meaning that the statistical testing is likewise unidirectional.

gression analyses as a predictor, based on the data provided by the survey participants on the length of their accompaniment phase in months and their driving practice during this accompaniment phase in kilometres. Due to the significantly reduced sample size – after all, the analysis views only the AD17 group, and there, in turn, only those persons who also completed a final questionnaire – it is only possible to consider the most important control variable, namely gender, in the regression analysis. Otherwise, certain frequency cells would remain empty.

One particular methodical difficulty stands in the way of the direct approach. Driving practice during the accompaniment phase correlates positively with driving practice during the first year of independent driving: Evidence shows that those participants who record the most kilometres during the accompaniment phase will also drive more later. This still applies if vehicle availability is taken into account. As more driving means a higher level of risk, a spurious correlation is manifested: Paradoxically, a more intensive accompaniment phase is linked with a later increased risk of accident involvement and traffic offences. It could thus be concluded that accompaniment is counterproductive. There is no simple remedy for this methodical difficulty (which results from the presence of a so-called “confounder”). The solution is to refer the numbers of accidents and traffic offences not to the period of a year, as in Section 4.3, but instead to the kilometres driven, so that differences in individual driving practice no longer influence the results directly.

The results of the regression analyses are shown in Tab. 11 and Tab. 12. While less *driving practice* during the accompaniment phase (see Tab. 11) leads to an increase in accident involvement and traffic offences, the *duration* of the accompaniment phase – at least for a minimum duration of 4 months – displays no clear correlation (see Tab. 12). Applying the defined significance threshold of 1.0 per cent for the present analyses – which, given the importance of the study, represents the just still acceptable probability of error – only one effect remains for the evaluation of the results<sup>19</sup>: Driving practice of less than 500 kilometres during the accompaniment phase can be linked to an in-

<sup>19</sup> The analysis suffers in that the sample size is too small to support rare occurrences and weak effects. If all reported accidents and traffic offences were to be considered, instead of only those exceeding the defined relevance threshold (see Section 2), the data set would be much larger (1,373 traffic offences instead of 425, and 784 traffic accidents instead of 590). This would raise the power of the statistical test. In fact, the influence of driving practice would also achieve the demanded minimum significance of 1 per cent with regard to accidents under these more favourable conditions.

creased rate of traffic offences per million kilometres. A dose-response relationship can thus be determined with regard to the rate of traffic offences,

but not with regard to the rate of accident involvement.

Factor	Ratios of accident involvement and traffic offences compared to the relevant reference group	
	Accident involvement per million kilometres	Traffic offences per million kilometres
Driving practice: up to 500 km (versus over 1,000 km)	1.21 *	1.47 ***
Driving practice: 500 to 1,000 km (versus over 1,000 km)	1.25 *	1.14 n.s.
Gender: Female (versus male)	0.93 n.s.	0.62 ***

Legend: n.s. = Difference to parity (1.0) not significant; \* = statistically significant ( $p \leq 0.05$ ); \*\* = statistically very significant ( $p \leq 0.01$ ); \*\*\* = statistically highly significant ( $p \leq 0.001$ ); n.a. = significance test not applicable, as unidirectional hypothesis to be rejected

**Tab. 11: Influence of driving practice on the kilometre-based rates of accident involvement and traffic offences, taking into account gender**

Factor	Ratios of accident involvement and traffic offences compared to the relevant reference group	
	Accident involvement per million kilometres	Traffic offences per million kilometres
Duration of accompaniment phase: 4 to 6 months (versus 10 to 12 months)	0.95 n.a.	1.03 n.s.
Duration of accompaniment phase: 6 to 10 months (versus 10 to 12 months)	1.13 n.s.	0.86 n.a.
Gender: Female (versus male)	0.93 n.s.	0.64 ***

Legend: n.s. = Difference to parity (1.0) not significant; \* = statistically significant ( $p \leq 0.05$ ); \*\* = statistically very significant ( $p \leq 0.01$ ); \*\*\* = statistically highly significant ( $p \leq 0.001$ ); n.a. = significance test not applicable, as unidirectional hypothesis to be rejected

**Tab. 12: Influence of the duration of the accompaniment phase on the kilometre-based rates of accident involvement and traffic offences, taking into account gender**

#### *Specificity:*

In the aforementioned analyses, trivial accidents and traffic offences were explicitly excluded. This approach was chosen for methodical reasons, so as not to leave decisions on which events and circumstances were to be considered worthy of reporting to the subjective discretion of the survey participant, and instead to ensure the application of common criteria for all replies received.

An analysis of trivial accidents and traffic offences (Tab. 13) shows no particular differences between the AD17 and cDL groups. This supports – alongside a diminished validity of data on trivial circumstances – the assumption of a specific effect of the AD17 model, as there is little influence on trivialities.

	AD17 group	cDL group	Difference between AD17 and cDL
Rate of trivial accident involvement per 1,000 drivers and year	27.6	28.7	- 4%
Rate of trivial traffic offences per 1,000 drivers and year	134.2	133.6	± 0%

**Tab. 13: Rate of insignificant (trivial) accident involvement and traffic offences in the analysis groups**

In the following, it is to be determined whether the AD17 effect becomes more distinct with increasing severity of the accident involvement or traffic offence. To this end, separate calculations<sup>20</sup> are performed with modified significance thresholds.

Tab. 14 indeed shows that the risk-reducing effect of the AD17 model is especially evident with regard to serious accidents and traffic offences.

Indicator and significance threshold applied	Difference between AD17 and cDL
Accidents:	
All reported accidents	-16%
Only accidents with injury to persons, damage exceeding € 1,200 or recording by the police	-19%
Traffic offences:	
All reported traffic offences	- 6%
Those punishable by a fine over €15	-12%
Those punishable by a fine over €25	-18%
Those punishable by a fine from €40	-30%

**Tab. 14: Dependence of the rates of accident involvement and traffic offences per 1,000 drivers and year on the significance threshold applied (the thresholds applied elsewhere in the present study are highlighted grey)**

The model is apparently effective above all in respect of accidents and traffic offences above a higher relevance threshold, and less so or not at all in respect of minor incidents such as parking infringements or “car park bumps” when manoeuvring. This specificity is a further point which supports a direct causal correlation between model and effect.

#### 4.7 Are factors known which could further enhance the AD17 effect?

It is possible that the AD17 model, as it is currently implemented, is still not optimal, meaning that the effect assessments presented here actually underestimate the true potential of accompanied driving. Are further factors known, alongside the duration and distance of accompanied practice treated in Section 4.6, which could enhance the success of the AD17 model?

One possibility which comes to mind is the gender of the accompanying passenger, especially as studies document the positive influence of female passengers on young drivers (Williams, 2003, presents corresponding findings). The hypothesis that a female accompanist could enhance the effect of the AD17 model, and that this effect could also be dependent on the gender of the driver, was tested for the AD17 group on the basis of the present data. The analysis conditions and the number of cases corresponded to those of Section 4.6 (there see Tab. 10).

The results of the Poisson regression analyses for accident involvement and traffic offences, each on the basis of both time and kilometres driven, are to be found in Tab. 15 (row highlighted grey): There is no evidence that the gender of the accompanying passenger during the accompaniment phase influences the relevant driving behaviour of the participant during the observation period – the main effects referring to the accompanist are not significant in any of the four analyses. No mentionable interactions of the genders of the driver and accompanying passenger occur (all four regression models display a good fit under the assumption of no interaction;  $p$  between 0.98 and 0.34). There is thus no combination of genders which is significantly more favourable than all others in the context of the AD17 model.

<sup>20</sup> These calculations are not regression analyses taking into account control variables, but direct determination of the rate of accident involvement and traffic offences per 1,000 drivers and year by the same method as was applied in Section 3.

Factor	Ratios of accident involvement and traffic offences compared to the relevant reference group			
	Accident involvement		Traffic offences	
	per million kilometres	per 1,000 drivers and year	per million kilometres	per 1,000 drivers and year
Gender of driver: Female (versus male)	0.95 n.s.	0.71 ***	0.65 ***	0.49 ***
Gender of most frequent accompanist: Female (versus male)	1.00 n.s.	1.01 n.s.	0.97 n.s.	0.97 n.s.

Legend: n.s. = Difference to parity (1.0) not significant; \* = statistically significant ( $p \leq 0.05$ ); \*\* = statistically very significant ( $p \leq 0.01$ ); \*\*\* = statistically highly significant ( $p \leq 0.001$ )

**Tab. 15: Influence of the gender of the most frequent accompanying passenger during the accompaniment phase on the rates of accident involvement and traffic offences in the period under observation**

#### 4.8 Is self-reported behaviour a sufficiently valid basis for evaluation?

Objections are occasionally expressed with regard to the method of self-reported behaviour, especially where the subject – as here – refers to “negative behaviour” or even failure<sup>21</sup>. It is claimed that the method is insufficiently valid for an evaluation with far-reaching (legal) consequences.

To be able to investigate this objection, the results presented here are to be complemented by an evaluation of the data records pertaining to the survey participants in the Central Register of Traffic Offenders (VZR). In accordance with the project schedule, however, these data will not be available in full until spring 2010.

#### 4.9 Does the knowledge of participation in a road safety study exert a systematic positive influence on driving behaviour?

The objection that participants could be influenced by their knowledge of the study objective is justified in principle. However, there is initially no reason to assume that this objection does not apply equally to both analysis groups. Distortion of an equal extent is unproblematic from the methodical point of view, because the present study is based solely on comparisons and not on absolute figures.

Mentionable pretence on the part of the survey participants, as is indeed to be documented in studies with a short duration, seems to be reasonably ex-

cluded given the observation period of more than a year.

Moreover, the design of the evaluation study provides for similar analyses and calculations to those presented here to be performed also for groups of drivers who have not been contacted and are consequently unaware of the study purpose: Two large samples of young drivers of both present groups have been drawn from the Central Register of Driving Licences (ZFER) and corresponding data records, if any, are to be retrieved from the register of traffic offenders. In accordance with the project schedule, however, these data will not be available until 2010.

<sup>21</sup> Relevant studies (e.g. recently Staubach & Lüken, 2009), however, fail to support the assumption that the accident reports of involved persons are generally less useful.

## 5 Summary and conclusion

Three questions are to be investigated, of which only the third is a core subject for the present evaluation:

1. Does the AD17 model expand the at-risk population of 18-year-old drivers (with the probable consequence of increased accident figures; Effect 1)?
2. Does the AD17 model lead merely to internal differentiation into “good” and “poor” risks (Effect 2)?
3. Does the AD17 model itself have a directly protective effect (Effect 3)?

### Method

The present evaluation refers to self-reported instances of relevant driving behaviour – traffic offences and traffic accident involvement – from over 18,000 eighteen-year-old drivers in the first year of their independent driving of a motor vehicle, representing in total more than 18,000 years of “probation” and almost 150 million kilometres of driving practice.

Two samples comprising persons of the same age are compared: Drivers who had completed at least a 3-month phase of accompanied driving before the approximately one-year project observation phase (“AD17 drivers”), and “normal” novice drivers who had obtained a conventional driving licence shortly after their 18th birthday (“cDL drivers”). The members of both analysis groups were drawn at random from the records of the Central Register of Driving Licences (ZFER) and asked to participate in the study on a voluntary basis. Around 44% of the AD17 drivers and 25% of the cDL drivers actually completed the initial questionnaire on the Internet (the final questionnaire, on average seven months later, was completed by slightly fewer participants).

All forms of accident involvement are evaluated, irrespective of the portion of blame attributable to the participant, insofar as the police was called to record the accident, damage of at least €1,200 was estimated or injury to persons was reported (“significant accidents”). In addition, all traffic offences punished with a fine of more than €25 were taken into account (“significant traffic offences”). The rates of significant accident involvement and significant traffic offences were determined both on a time-related basis, i.e. per 1,000 drivers and year, and according to the scope of actual driving practice, i.e. per million kilometres driven.

### Result

The rate of significant accident involvement in the group of AD17 drivers is seen to be 19 per cent lower than that in the group of cDL drivers, while the rate of significant traffic offences is 18 per cent lower, both figures calculated per 1,000 novice drivers and year.

When seeking to evaluate specifically the influence on driving competence, it is expedient to consider the results in relation to actual driving practice (per million kilometres driven): On this basis, the rate of significant accident involvement in the group of AD17 drivers is even 23 per cent lower than in the group of cDL drivers, and the rate of significant traffic offences 22 per cent lower.

### Critical methodical evaluation

These results stand up to all critical methodical objections – with minor limitations – and can thus be deemed to provide first proof, within the framework of the overall project, for the effectiveness of the AD17 model in the sense of causal effect 3:

- The specified differences in accident involvement and traffic offences are statistically significant.
- The random samples of young drivers, and likewise the observation conditions, are comparable, and the results obtained in the eleven federal states which were participating in the model at the time of sampling are suitable for generalisation.
- The objection that the model leads to internal risk differentiation between the two analysis groups (Effect 2), and that this is in part responsible for the determined differences (spurious correlation), cannot be invalidated conclusively: The slightly greater proportion of female drivers in the AD17 group does indeed improve the good result of the AD17 drivers by a further few percentage points (implies a greater AD17 effect than is actually the case).
- At the same time, however, the greater vehicle availability in the AD17 group is an “external” variable which masks the actual causal effect of the AD17 model by a few percentage points (implies a lesser AD17 effect than is actually the case).
- If both distorting influences are taken into account, this leaves a reduction of 17 per cent in significant accident involvement<sup>22</sup> and 15 per cent with regard to significant traffic offences as the causal effect (Effect 3) in the time-based

<sup>22</sup> As, for methodical reasons, the survey considers only accident *involvement* and does not seek to clarify any attributable portion of blame, it can be expected that the reduction in *culpable* accidents would prove even more distinct.

analysis (per 1,000 novice drivers and year). In the kilometre-based comparison (per million kilometres driven), the reduction is correspondingly to 22 per cent for accident involvement and to 20 per cent for significant traffic offences.

- The inclusion of data from those persons who terminated their survey participation prematurely, before completing a final questionnaire, does not distort the results in favour of a greater AD17 effect (rather the opposite is the case).
- The possible objection that the AD17 effect is merely a temporary consequence of the long and intensive accompaniment phase can be refuted: The effect during the second six months of independent driving is at least as great as during the first six months (if at all different, then actually greater).
- Initial evidence of a “dose-response relationship” for the AD17 model could be found: Those participants who gather little driving practice during the accompaniment phase later display an increased risk with regard to traffic offences. There is similarly a tendency towards a corresponding correlation in respect of accident involvement. The length of the accompaniment phase, on the other hand, appears to play no role from a minimum duration of three months upwards.
- It is possible to verify a certain specificity for the AD17 model: It has little or no effect on trivialities (e.g. “car park bumps” when manoeuvring or minor parking infringements). By contrast, the effectiveness of the AD17 model increases with the severity of accidents or traffic offences.
- The latter findings are to be deemed aspects which further underpin the (causal) effectiveness of the AD17 model (in the sense of Effect 3).
- No evidence was found to indicate that the effectiveness of the AD17 model is enhanced when a female passenger assumes the role of accompanist.
- Objections regarding the validity of self-reported behaviour and the possible influence of a participant's knowledge of the study objective are to be treated in further analysis steps on the basis of data retrieved from the Central Register of Traffic Offenders during 2010.

#### *Conclusion and outlook*

Following critical methodical appraisal of the data and valuations presented here, it is reasonable to speak of an overall positive effect of the AD17 model with regard to road safety and compliance with traffic regulations. Even after taking into account a number of influencing factors, it is possible to ascertain a reduction in the rate of accident involvement by 22 per cent and a reduction in traffic

offences by 20 per cent per million kilometres driven.

Nevertheless, an evaluation incorporating Effect 1 (model expands the at-risk population) could still relativise this result: If it is shown, for example, that the introduction of the AD17 model leads to 20 per cent more 18-year-olds holding a driving licence, and consequently 20 per cent more 18-year-old drivers subject to an accident risk (Effect 1), then a 20 per cent reduction in the accident rate in the first year (Effect 3) is just sufficient “compensation”. In this case, the net effect for road safety in the first year of independent driving would be zero. The AD17 model, consequently, must seek its justification in a road safety gain in subsequent years, assuming that such gains exist. It is thus intended to extend the period of observation for the data records to be retrieved from the Central Register of Traffic Offenders to cover a second year, and in this way to determine whether the AD17 model achieves a longer-term effect.

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