



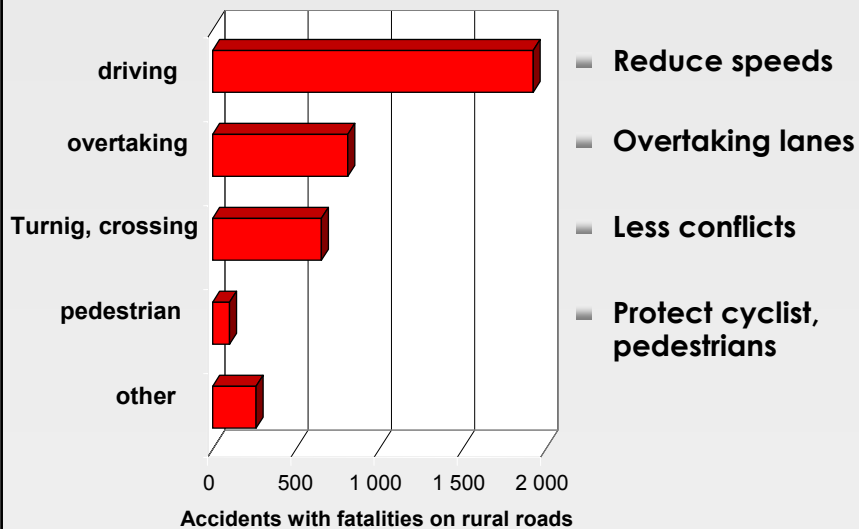
## Standardisierte und wiedererkennbare Strasstypen – Neues Entwurfsprinzip in Deutschland *Road Design - New Typs of Rural Roads in Germany*

Konferenz MAUT 15 Jahre,  
15. und 16. Oktober 2009

Univ.-Prof. Dr.-Ing. Christian Lippold



## Ansätze zur Verbesserung der Verkehrssicherheit





## International: Self-explaining roads

- A self-explaining road is a road designed and built in such a way as to induce adequate behaviour and thereby avoid driving error.
- A perfectly designed self-explaining road would not require speed limit signs or any warning signs (FHWA 2005).



## Gliederung Straßennetz

Kategoriengruppe	Verbindungs-funktionsstufe	Autobahnen	Landstraßen	anbaufreie Hauptverkehrsstraßen	angebaute Hauptverkehrsstraßen	Erschließungsstraßen
		AS	LS	VS	HS	ES
kontinental	0	AS 0		-	-	-
großräumig	I	AS I	LS I		-	-
überregional	II	AS II	LS II	VS II		-
regional	III	-	LS III	VS III	HS III	
nahräumig	IV	-	LS IV	VS IV	HS IV	ES IV
kleinräumig	V	-	LS V	-	-	ES V

RAA

RAL

RASt

## road network - classification

Category group		motorways	rural roads	non built-up main roads	built-up main roads	access roads
connection-function		AS	LS	VS	HS	ES
continental	0	AS 0		-	-	-
long distance	I	AS I	LS I		-	-
overregional	II	AS II	LS II	VS II		-
regional	III	-	LS III	VS III	HS III	
short distance	IV	-	LS IV	VS IV	HS IV	ES IV
local	V	-	LS V	-	-	ES V

RAA

RAL

RASt

5

## Influence of design- and operation-speed

### $V_e$ estimates

- $R_{\min}$  [m] and indirect
- $A_{\min} / A_{\max}$  (f(R))

6



## influence of design- and operation-speed

### $V_e$ estimates

- $R_{\min}$  [m] and indirect
- $A_{\min} / A_{\max}$  (f(R))

### $V_{85}$ estimates

- $H_{\text{crest}}$  [m],
- $q$  [%] (superelevation)
- $R_{\min}$  [m] bei -  $q$
- $\min S_h$  (stopping sight distance)
- $\min S_{\ddot{u}}$  (overtaking sight distance)

Quelle: Hartkopf und Weber, 2003

7



## influence of design- and operation-speed

### $V_e$ estimates

- $R_{\min}$  [m] and indirect
- $A_{\min} / A_{\max}$  (f(R))

### $V_{85}$ estimates

- $H_{\text{crest}}$  [m],
- $q$  [%] (superelevation)
- $R_{\min}$  [m] bei -  $q$
- $\min S_h$  (stopping sight distance)
- $\min S_{\ddot{u}}$  (overtaking sight distance)

### $V_e + V_{85}$ does not estimate

- $H_{\text{sag curve}}$  [m]
- $L_{\text{straight}}$  [m]
- $S_{\max}$  [%] (gradient)
- Cross section
- Type of intersection
- Road operation

Quelle: Hartkopf und Weber, 2003

8



## Speed in the guidelines

- No design speed
- Calculation based on driving dynamics with a moderate design speed
- Supplementary safety calculation of accident investigation (e.g. minimum radius) or driving psychologic studies (e.g. orientation sight distance)
- No 85th percentile speed



### **Standardisierte Straßen:**

**wenige, möglichst einheitliche und untereinander deutlich unterscheidbare Straßentypen**

### **Wieder erkennbare Straßentypen:**

**Autofahrer sollen die Straßentypen erkennen und danach handeln**



## Design classes

- Cross section
- Type of intersection
- Road operation
- Design elements, for example:
  - $H_{\text{crest}}$  [m],  $H_{\text{sag curve}}$  [m]
  - $L_{\text{straight}}$  [m]
  - $s_{\text{max}}$  [%] (gradient)
  - Relation between two curve radii

Quelle: Hartkopf und Weber, 2003



## road network - classification

Category group		motorways	rural roads	non built-up main roads	built-up main roads	access roads
connection-function		AS	LS	VS	HS	ES
continental	0	AS 0		-	-	-
long distance	I	AS I	LS I		-	-
overregional	II	AS II	LS II	VS II		-
regional	III	-	LS III	VS III	HS III	
short distance	IV	-	LS IV	VS IV	HS IV	ES IV
local	V	-	LS V	-	-	ES V

RAL



## Road Category and Design Class

Road Category	Connection-Function	Design-Class
LS I	long distance	EKL 1
LS II	overregional	EKL 2
LS III	regional	EKL 3
LS IV	short distance	EKL 4

13



## Road Category and Design Class

Road Category	Normalfall	Low traffic volume
LS I	EKL 1	EKL 2
LS II	EKL 2	EKL 3
LS III	EKL 3	EKL 4
LS IV	EKL 4	EKL 4

14



## Road Category and Design Class

Road Category	Normalfall	High traffic volume
LS I	EKL 1	EKL 1
LS II	EKL 2	EKL 1
LS III	EKL 3	EKL 2
LS IV	EKL 4	EKL 3

15



## Straßenkategorien und Verkehrsstärke







Straßen- kategorie	gesenkte EKL bei [Kfz/24h]	erhöhte EKL bei [Kfz/24h]
LS I	< 10.000	
LS II	< 7.000	> 17.000
LS III	< 2.000	> 15.000
LS IV		> 3.000

16





## Betriebsform / Operating Type

Entwurfsklasse Design-Class	Verkehrsarten auf der Fahrbahn Traffic Mode on Road
EKL 1	
EKL 2	
EKL 3	
EKL 4	  

( ) prüfen / check

17



## Überholprinzip / passing on rural roads

Entwurfsklasse	Überholprinzip	Passing Type
EKL 1	durchgängig alternierende Überholfahrstreifen	continuous alternating passing lanes
EKL 2	einzelne Überholfahrstreifen	single passing lanes
EKL 3	keine planmäßigen Überholsichtweiten	no regular passing sight distances
EKL 4	Überholen unerwünscht	passing undesirable

18



## design class and cross section type

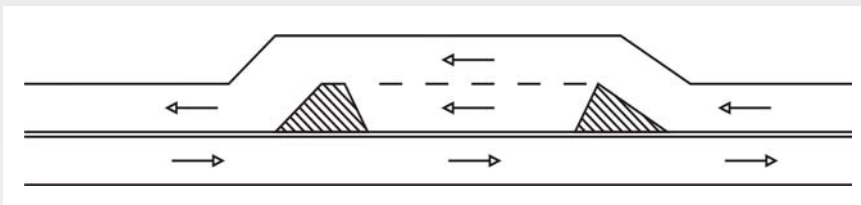
Entwurfsklasse Design Class	Querschnittstyp Cross Section Type
EKL 1	
EKL 2	
EKL 3	
EKL 4	

19



## Cross Section with single Overtaking lane

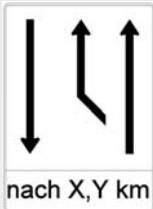
RQ mit ÜFS



20



## Examples for Overtaking lanes







## design classes and alignment

Entwurfsklasse Design class	Linienführung Alignment
EKL 1	
EKL 2	
EKL 3	
EKL 4	

25

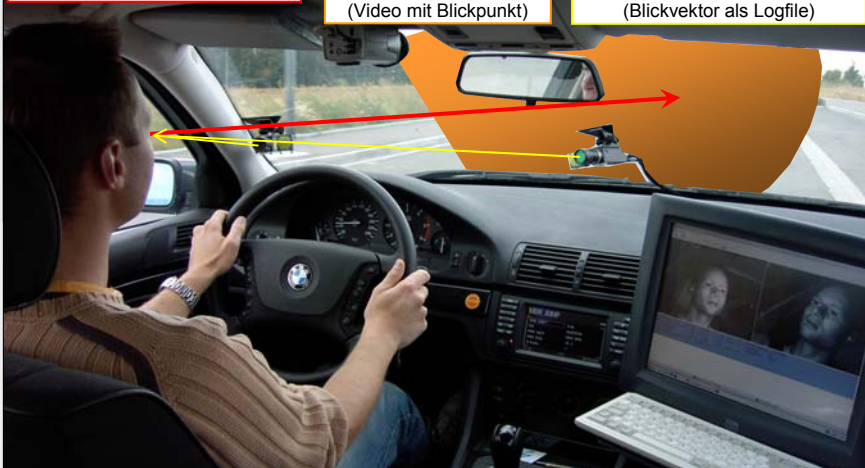


## Eye tracking

Blickrichtung des Fahrers

Szenerieerfassung  
(Video mit Blickpunkt)

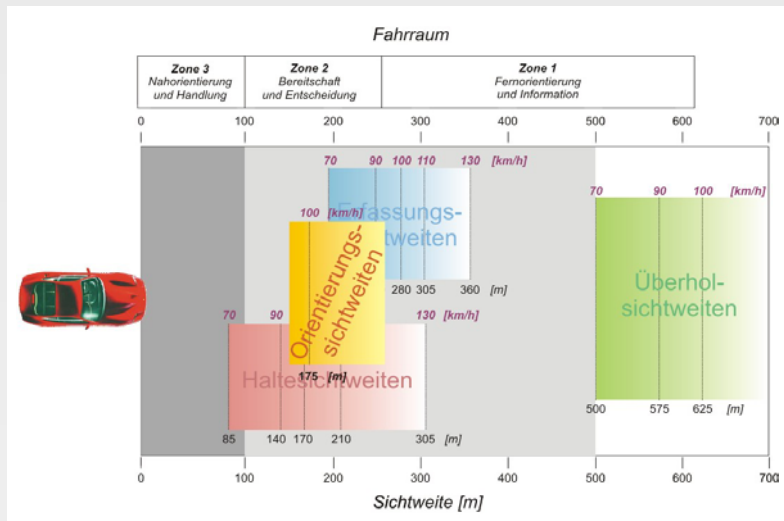
Blickrichtungserfassung  
(Blickvektor als Logfile)



26



## Orientation Sight Distance



27



## Spatial Alignment



28



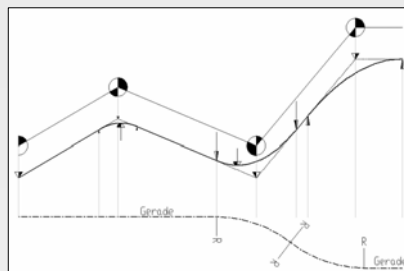
## Spatial Alignment



29



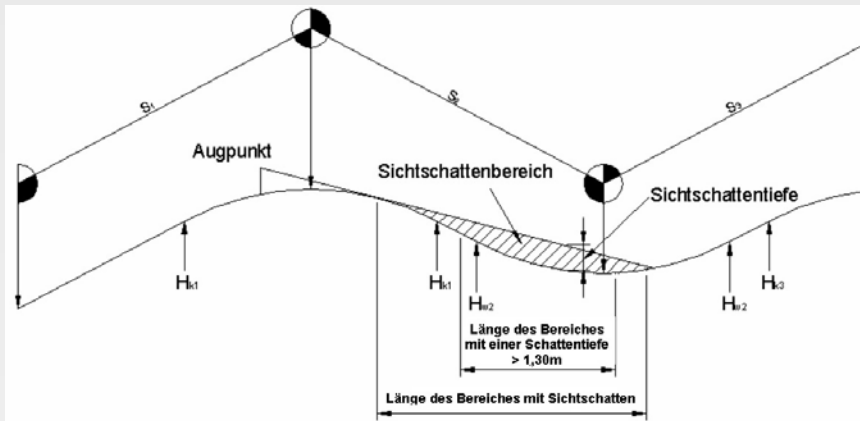
## Spatial Alignment



30



## Spatial Alignment



31



## Design Class and Speed Limit

Entwurfsklasse	V <sub>zul</sub>
EKL 1	110
EKL 2	100
EKL 3	90
EKL 4	70

32





## Entwurfsklasse und Knotenpunkte

Entwurfsklasse	Verkehrsführung in Knoten
<b>EKL 1</b>	
<b>EKL 2</b>	
<b>EKL 3</b>	
<b>EKL 4</b>	

33



## design classes and junctions

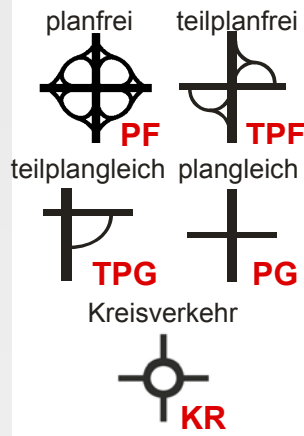
Design Class	Traffic guidance in the junction
<b>EKL 1</b>	
<b>EKL 2</b>	
<b>EKL 3</b>	
<b>EKL 4</b>	

34



## Knotenpunktarten

**bauliche Grundform +**



**Betriebsform**

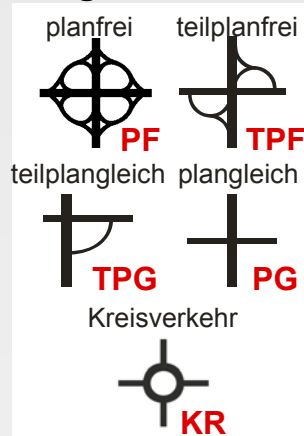


35

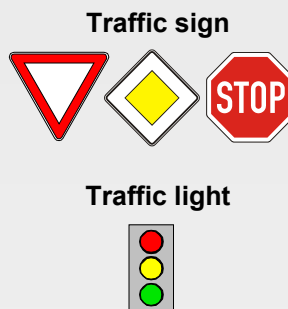


## Types of junctions

**design**



**+ operation**

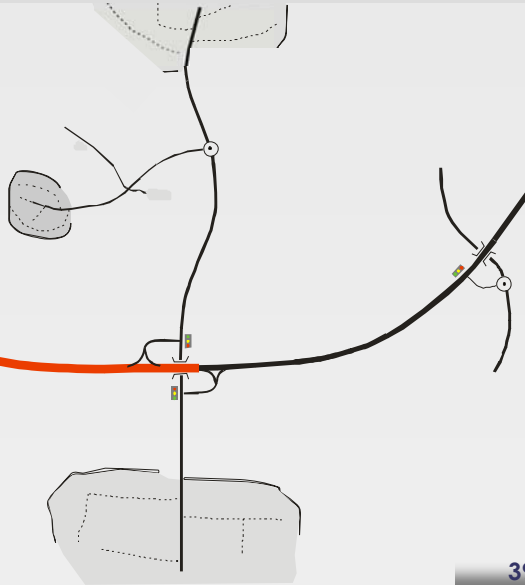


36





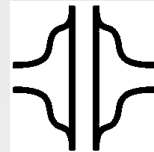
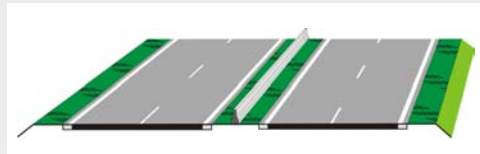
## Design Class EKL 1



39



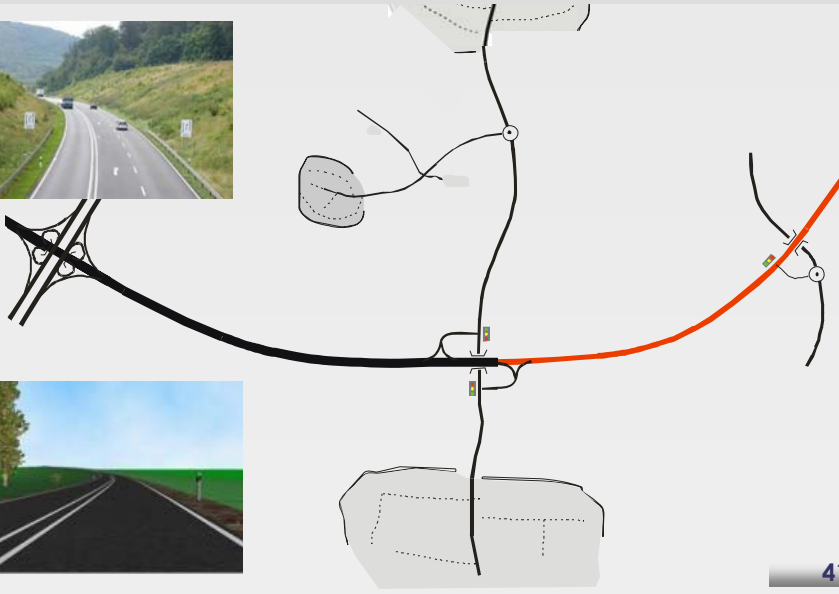
## Design Class EKL 1



40



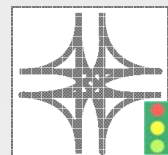
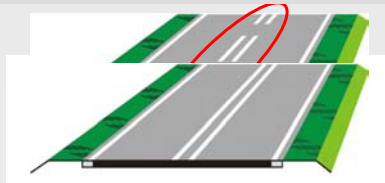
## Design Class EKL 2



41



## Design Class EKL 2



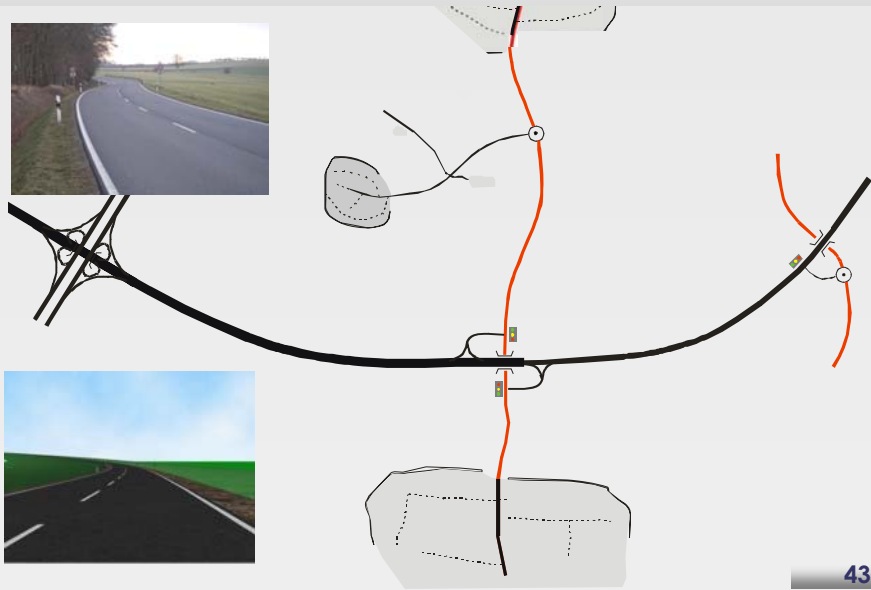
Ausnahme



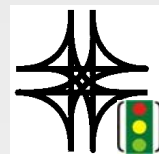
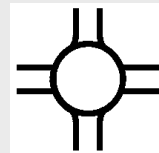
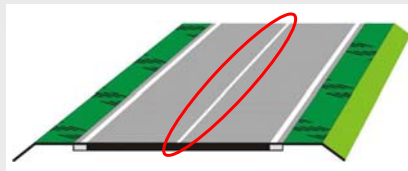
42



# Design Class EKL 3



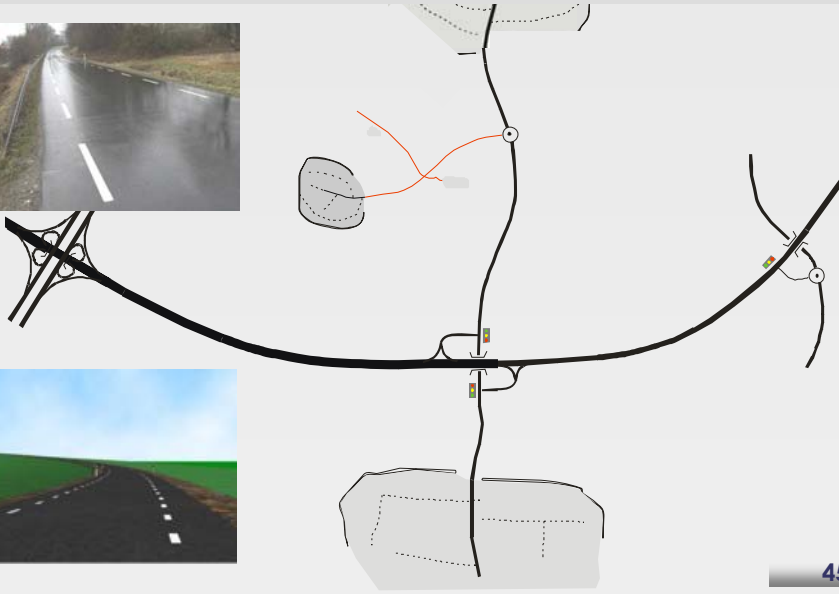
# Design Class EKL 3



( ) prüfen



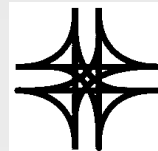
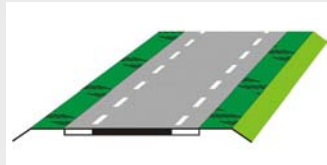
## Design Class EKL 4



45



## Design Class EKL 4



46



## Literatur

- FGSV / AA 2.2 „Landstraßen“ – Richtlinien für die Anlage von Landstraßen RAL (Entwurf 2009)
- Lippold / Weise / Jählig / Kuczora – Überführung der sektoralen Richtlinien RAS-Q / -L / -K in ganzheitliche Entwurfsrichtlinien RAL (Schlußbericht Dresden 2006)
- Hartkopf; Hartkopf / Weber; BAST – Vorträge zur RAL (Kassel 2008, Köln 2009)
- Stefan Matena - Best Practice on Road Design and Road Environment (Ripcord-Iserest - Final Conference 27.9.-28.9.2007 in Bergisch Gladbach)