

Certified Translation from German

**Report on lateral impact
and roll-over impact with
the mobile guide beam
made by KLEMMFIX GmbH,
Backnang, Germany**

Report No.: BAST/94 5 S 001/LU

Certified Translation from German

Report on lateral impact and roll-over impact with
the mobile guide beam made by
KLEMMFIX GmbH, Backnang, Germany

Report No.: BAST/94 5 S 001/LU

Federal Institute for Highways (BAST)

Dipl.-Ing. G. Lukas
Dr.-Ing. W. Schulte

Bergisch-Gladbach
August 1994

1. Subject of the Study

The study was implemented on the basis of the draft for the "Technical Conditions of Delivery for structural guide elements" ("TL-Leitelemente 94"), draft version dated May 1994.

2. Performing Institute

Federal Institute for Highways (BASt)
Brüderstr. 53
51427 Bergisch Gladbach
Germany

Tel.: +49 022047/430

Test site:

Crash testing facility (AVA) in
Köln-Porz-Lind (near Cologne)

3. Report Number

BAST/94 5 S 001/LU

4. Customer

Klemmfix GmbH
Beim Erlenwäldchen 20
71522 Backnang

Tel.: +49 07191-175-0

5. Test Object

5.1 Date of delivery

April 15, 1994

5.2 Designation of test object

Guide system "LS"

5.3 General description of test object

The system comprises 1120 mm long and 250 mm wide elements made of recycling material with a height of 80 mm, plus attached reflecting parts.

The almost semicircular cross-section of the element has an upper end surface of 60 mm width

Certified Translation from German

and a flat-tapering base [Figs. 2-4]. The weight of a single element is 15.0 kg.

The elements are mutually interlocked at the end face by a hook-shaped flat iron bar with tapped hole attached to the underside. This bar fits into a suitable recess in the adjacent element and thereby creates a non-positive connection of the elements with one another. It is possible - since a bolt and tapped hole are provided - to provide a bolted connection, but this was not done during the impact tests except at the first and last elements. On the underside of each element are 6 rubber discs with a non-slip profile (30 mm diameter) [Figs. 1, 41 and 42]. A recycling symbol and the manufacturing date are stamped in.

On the top of each element, yellow reflector holders - so-called light arches - with 7 lenses on each side are screwed on [Fig. 2 and detailed drawing].

Every second element has a so-called "Leitboy" [Fig. 7 and detailed drawing] held in the guide beam by guide slots. This Leitboy marker element has - on the approach side - an adhesive film (type 2) showing traffic sign No. 605 according to German traffic regulations (StVO), i.e. "guide beacon", reduced in 1:2 scale. The basic element is a red rubber material [Figs. 5 - 7]. The height of the marker is 735 mm and its weight 1.2 kg.

5.4 Drawings of test object

See Appendix
(Annexes 1 - 5)

6. Test implementation

6.1 Pulling equipment

The test vehicle is steered with the aid of an endless cable driven by a hydraulic pressure accumulator motor until just in front of the point of impact. The puller cable connection to the vehicle (made with a chain) is then released, so that the vehicle freely impacts with the test object. The brakes are released by remote control at a point in time suitable for the test operation in question.

6.2 Test vehicle

6.2.1 Model	Golf I
6.2.2 Year built	1981

6.3 Test data: parameter settings

Lateral impact at 1° (test A)

Impact speed requirement	80 kph
Impact angle requirement	1°

Deceleration (test B)

Impact speed requirement	80 kph
Impact angle requirement	0°

6.4 Test apparatus

6.4.1 General sketches	see Annex 6/7
6.4.2 Accompanying photographic documentation	see Annex 8 to 24
6.4.3 Constructed length	21.42 m
20 elements each of 1025 mm (net length) + start and end pieces, bolted, each 440 (net length) + 475 mm (gross length). Numbering of the elements from 1 to 20, plus A and E.	
6.4.4 Surface in test area	Concrete, dry [Fig. 3]
6.4.5 Expected point of impact with approach at 1°	Element No. 5
6.4.6 Expected commencement of deceleration	Element No. 4
6.4.7 Remarks	
Masking tape at the start and end, and behind the system for documenting the transverse and longitudinal displacements.	

7. Test Results

Certified Translation from German

7.1 Test number

94 5 S 001 A/B

7.2 Test date

April 15, 1994

7.3 Behaviour of test object

- 7.3.1 Maximum transverse displacement resulting from Fig. 19
Lateral impact at 1° 15 mm
(at element transition 8/9)
- 7.3.2 Maximum longitudinal displacement resulting from
Lateral impact at 1° None
Deceleration - at start (A) 4 mm [Fig. 33]
- at end (E) 33 mm [Fig. 34]
- 7.3.3 Contact distance
Lateral impact at 1° [Photo sequence 9-16]

The tyre contact of the test vehicle with the guide beam started at element 5 and ended at the end of the guide beam. The test vehicle did not cross over the guide beam and impacts with the self-righting flexible Leitboy elements.

Roll-over impact approach at 0° and deceleration [Photo sequence 25-32]

The test vehicle initially drove onto the system centrally. At element 5 the brakes were put full on. Up to the end of the guide beam, the system was not crossed. From element 14, the right-hand front wheel moved back onto the roadway. The Leitboy elements were not detached from their mountings despite the heavy stresses,

- 7.3.4 Actual impact point with at 1° Element No. 5
- 7.3.5 Actual start of deceleration Element No. 5
- 7.3.6 Damage and traces

Certified Translation from German

Neither in the approach at 1° nor in deceleration was damage to the guide beam found. There was also no upward bulging during deceleration.

In both cases, tyre marks can be detected on the guide beam and Leitboy elements [Figs. 20 to 23 and 37 and 38].

Neither in the approach at 1° nor during deceleration were the Leitboy elements or the light arches destroyed or detached. However, minor deformation of the Leitboys was ascertained.

7.4 Test vehicle

No damage

7.4.1 Actual impact speed

Approach at 1°	80.5 kph
Deceleration	80.7 kph

7.4.2 Actual impact angle

Approach at 1°	1°
Deceleration	0°

7.4.3 Behaviour of test vehicle

Approach at 1° (A)

The vehicle contacted the guide beam at an angle of 1° and was guided along the latter over its full length.

From marker No. 3, this and all the following ones were hit by the right-hand front end of the vehicle and pressed down sideways in some cases onto the road surface [photo sequence 9 to 16]. The tyres never parted contact with the road surface during the impact approach.

Roll-over at 0° and deceleration (B)

The guide beam was contacted exactly in the centre by both right-hand wheels [photo sequence 25-32]. The brakes were applied after about 5 m. All 10 markers were hit by the right-hand front end of the vehicle and forced down to

the ground. In the last third of the roll-over operation the right-hand wheel left the guide beam and the decelerating vehicle came to a complete stop after another 10 m with a quarter-turn to the left.

7.4.4 Damage to the test vehicle

No damage was incurred by the test vehicle either during the approach at less than 1° nor during deceleration.

8. Concluding remarks

The test object meets all the requirements of ("TL-Leitelemente 94"), draft version dated May 1994, in particular:

- transverse displacement (15 mm)
- tolerable damage to the guide beam and reflecting parts such as markers and light arches, plus
- lighting requirements of the reflectors used (light arches) as per test report of BAST U5 - cm (PRÜF) dated 27.06.1994.

9. On behalf of the Federal Institute for Highways (BAST)

Manager in charge of testing

Dr.-Ing. Schulte
Regierungsdirektor
Head of Section "Protection and
Guidance Systems"

Dipl.-Ing. G. Lukas

Bergisch Gladbach, 12.08.1994

This test report may only be reproduced in its entirety, unless the BAST has given its express consent to the contrary.

Certified Translation from German

10. Annexes

Annex 1 - 5	Detailed drawings of test object	p. 8 - 12
Annex 6 and 7	General sketches of test array	p. 13, 14
Annex 8 to 24	Photographic documentation	p. 15 - 31

Certified Translation from German

Annex 1

Scale 1 : 5

Guide beam

Article No.: L60

Certified Translation from German

Annex 2

Scale 1 : 5

Guide beam, end piece

Article No.: L62

Certified Translation from German

Annex 3

Scale 1 : 5

Guide beam, end piece A

Article No. L61

Certified Translation from German

Annex 4

Leitboy marker element

Mini-beacon

Scale 1:5

Tolerance ± 3 mm

Certified Translation from German

Annex 5

Scale 1 : 2

Light arch

Article No. L65

Certified Translation from German

Annex 6

General sketch of test ground and arrangement for 1° approach

lateral displacement in mm
shown greatly out-of-scale

CONTACT

Camera 1

Marker on every 2nd element

Light arch on every element

Camera 2

Certified Translation from German

Annex 7

General sketch of test ground and arrangement for 0° roll-over and deceleration starting at element 5

Camera 1

DECELERATION INITIATED

Marker on every 2nd element

Light arch on every element

Camera 2

Certified Translation from German

Annex 8

Photo documentation

(A) Approach at 1°

Photo 1: Guide beam underside with non-slip elements

Photo 2: Light arch

Certified Translation from German

Annex 9

Photo 3: Approach situation (1°) before

Certified Translation from German

Annex 10

Photos 5 and 6: Approach geometry before with test vehicle,
pulling device and high-speed camera

Certified Translation from German

Annex 11

Photo 7: Approach geometry at element 10

Photo 8: Approach situation before, with test vehicle

Certified Translation from German

Annex 12

Photos 9 - 12: 1° approach, photo sequence $\Delta t = 0.2$ s (part 1)

Certified Translation from German

Annex 13

Photos 13 - 16: 1° approach, photo sequence $\Delta t = 0.2$ s (part 2)

Certified Translation from German

Annex 14

Photo 17: Overall situation after 1° impact approach

Photo 18: Maximum displacement in element 8

Certified Translation from German

Annex 15

Photo 19: Maximum displacement in element 8

Photo 20: Marks on element transition 7/8

Certified Translation from German

Annex 16

Photo 21: Leitboy element marks, No. 7

Photo 22: Leitboy element marks (film-covered side), Nos. 7 - 10

Certified Translation from German

Annex 17

Photo 23: Leitboy element marks (rear), with fitting equipment

Photo 24: Initial situation for 0° roll-over with deceleration

Certified Translation from German

Annex 18

Photos 25 - 28: Photo sequence of roll-over with deceleration
 $\Delta t = 0.2 \text{ s}$ (part 1)

Certified Translation from German

Annex 19

Photos 29 - 32: Photo sequence of roll-over with deceleration
 $\Delta t = 0.2 \text{ s}$ (part 2)

Certified Translation from German

Annex 20

Photos 33 and 34: Start and end pieces after roll-over with
deceleration

Certified Translation from German

Annex 21

Photo 35: End position after completed roll-over with deceleration

Photo 36: Marks on guide beam after completed roll-over with
deceleration

Certified Translation from German

Annex 22

Photo 37: Leitboy element No. 8 and braking marks on elements 15 and 16

Photo 38: Marks on guide beam after roll-over with deceleration

Certified Translation from German

Annex 23

Photo 39: Marker No. 9 on element No, 18 after roll-over

Photo 40: Flexible deformation of Leitboy elements Nos. 5 and 6 during roll-over with deceleration

Certified Translation from German

Annex 24

Photo 41: Guide beam element underside and Leitboy element after both test operations

Photo 42: Underside of a guide beam element after both test operations

This is to certify that the above is a true and conscientious translation prepared by me of the original written in the German language, which was submitted to me for translation.
Stuttgart, 6.9.1994
Sworn translator in and for the Courts of Baden-Württemberg duly commissioned for the English and German languages.
Reg. No. J.B.235
Total fee DM

