

Super low weight measuring trolley

KRAB Slight

for track geometry

The KRAB Slight™ system is the latest step of Krab evolution. It was designed with focus on low weight and easy operation. The measurement speed is limited to approx. 15kph. The trolley weights app. 30kg, only one operator is capable to take it away from the track. On-board computer has enough memory for at least 2000km; its battery works 8 hours without charging. The trolley has versatile adjustable nominal gauge in wide range as an option (for example 760÷1676mm).

Trolley design

The trolley's central body is made of a square profile, which increases stiffness and robustness of the system. The electrically insulated wheels are provided by separated flanges in order to remove different circumferential velocity. Permanent contact of the wheel flanges and running rail edge is provided by springs. A special apparatus having two degrees of the freedom in translation is at the central part of the longitudinal chord. It scans vertical and lateral rail versine.

The trolley can be run by its own electric motor and it can be provided by platform for surveying devices, mirrors and/or GPS antennas as option.



The trolley can be easily fold to extremely compact form that enables easy transport even in tight spaces (stairs in metro).



The wheel surface treatment is executed in hard chromium. The trolley surface finish is yellow powder paint. The arresting mechanism is controlled by ropes in tubes and two levers on pushing rod when the trolley passes through the frog.

Measuring principle

During the measuring run the following so called primary track values (raw data) are scanned in space interval of 0.25m:

- gauge (potentiometer transducer on the left wheel)
- alignment (lateral versine) of the right rail
- top (vertical versine) of the right rail
- cant (new, high reliable and precise inclinometer)
- quasi-twist on the twist base 0.9m (it increases the precision of the final cant measuring)
- track gradient (option)
- track distance (measured by two optical encoders on both rails)
- measuring speed

The accuracy of the reported geometry values, See tab.:

Geometric quantity to be measured	Resolution	Reproducibility 95% [mm] ⁴⁾	Range ²⁾ [mm]
Vertical alignment-Top (waveband 1÷25m)	0.01 mm	±0.5	-15+12
Horizontal alignment (waveband 1÷ 25m)	0.01 mm	±0.8	±25
Gauge	0.01 mm	±0.4 ¹⁾	-20+50
Gauge change per 1m	0.01 mm	±0.6	-
Cant(the relative values)	0.05 mm	±0.7 ³⁾	-
Cant (the absolute value)	0.05 mm	±1.2 ³⁾	±180
Twist (any twist base)	0.05 mm	±1.0/ℓ ³⁾	±13
Speed of trolley moving	0.3km/h	0.3km/h	<15km/h
Track distance	1 mm	1m/km	No limits

¹⁾ excl. temperature effect, ²⁾ range of primary values ³⁾1435mm gauge ⁴⁾EN13848-2,4



On board computer

The real time processing of signals from the sensors is performed by the on-board rugged PDA computer TDS Nomad, whereby the following items are warranted:

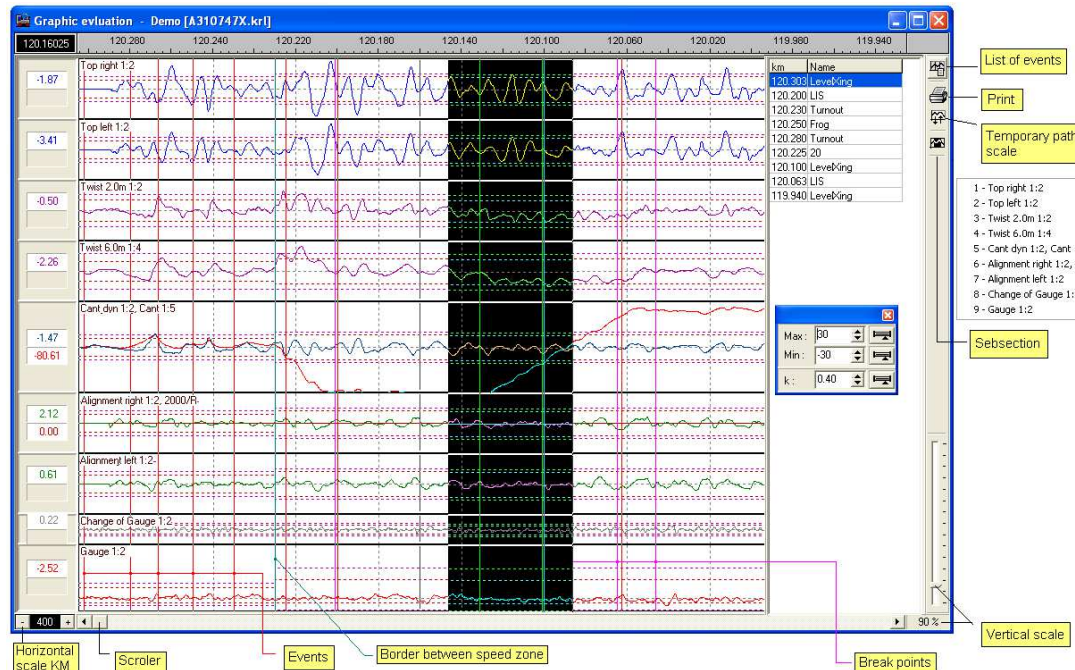
- reading and scanning of signals given above
- on-line processing of the signals:
 - anti-aliasing
 - smoothing of long wave part
 - optical signaling when the geometry data exceed the selectable thresholds
- display of numerical values of the geometry data
- entry of the geometry data into non-erasable storage of on-board computer at the distance 0.25m. The measuring distance is limited by computer memory, typically 2000km.
- entry of the informational description of the track section to be measured
- entry so called events (mud spots in ballast, damaged sleepers etc.) with exact position along the distance
- GPS coordinates collecting, typically each 5m

Screen of the PDA computer

Assessment of the collected data by Krab8.2 software

After the measuring, the collected raw geometry data are transferred from the on-board PDA computer into PC computer. The Top and Alignment of track can be expressed in terms of so called real geometry (with unit transfer function) or chord geometry. The chord length is selectable, for example 6/4m. Thus the following items are available:

- actual track alignment and top in waveband $\lambda=1\div 25m$
- separation of all geometric signal into long wave ($\lambda>25m$) and short wave ($\lambda<25m$) parts.



The example of track geometry graph printed by assessment software Krab8.2

- so called section assessment - statistic evaluation of the track geometry based on standard deviation and quality index
- table of local defects, print out of geometrical lay and tables
- introduction of the track design values (Cant, Curve radius and Gauge widening)

The basic technical data:

Mass: 30 kg basic form
3 kg turnout groove option

8 hours without battery charge
working temperature: $-5\div 55$ °C.

Address: Komerční železniční výzkum, spol. s r.o.
U Kaplicky 1199, PRAGUE 6, CZ-16500
tel./fax: +420 233 920 185, cell.: +420 604 830 199
e-mail: iturek@kzv.cz
web: www.kzv.cz

Switch point inspection by **KRAB Slight**

KRAB-Slight can be used for switch point inspection as an option. The extra auxiliary rollers for flange groove width measuring have to be mounted on the basic trolley. Measuring program is provided by special part of switch point measuring. Extra analysis software SWITCH™ is available for off-line data manipulation, analysis and the Inspection Report print out. The switch point is understood as an integral part of the track. So, the regular scanning of the track geometry values runs at background and important discrete location of the switch points are measured in detail when trolley stops.

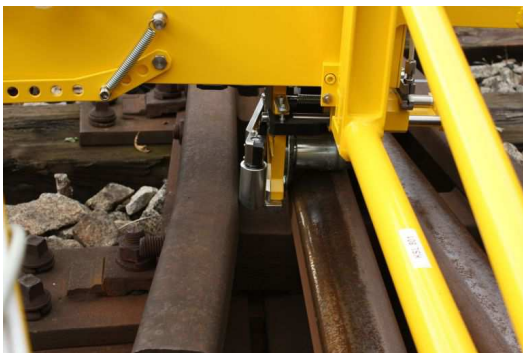
Auxiliary rollers

The trolley has to be provided by two special shoulders bearing isolated rollers. These shoulders are applicable to existing trolley as an additional part. The rollers can be lift up to transporting position and activate to measuring position very easily:



The rollers measure:

- width of open tongues
- groove of the guard rail
- groove of the wing rail and frog
- backgauge



The basic technical data:

Mass of shoulders: +3 kg
Accuracy: better then 1mm for all switch values

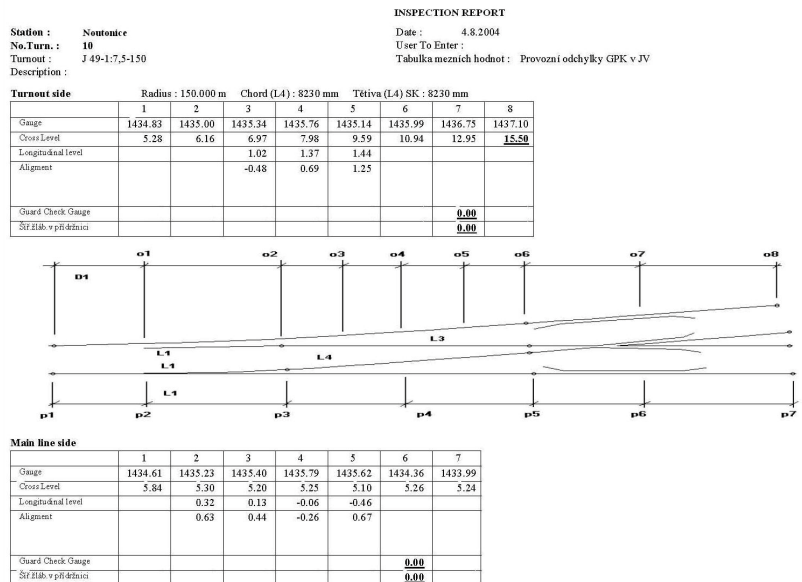
Measuring software

Extra part of measuring program Krab8vNET supports the data collecting at discrete switch location in the form of special events. Each such event contains the name of the

station, switch nr. measured values and values coming from visual inspection.

Analysis software SWITCH™

This advanced software tool automatically couples the main and diverted branches of the switches, parses the events and builds Switch Inspection Report:



Address: Komerční železniční výzkum, spol. s r.o.
U kaplicky 1199, PRAGUE 6, CZ-16500
tel./fax: +420 233 920 185, cell.:+420 604 830 199
e-mail: jturek@kzv.cz, **web:** www.kzv.cz