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## THE CONSTRUCTION ADAPTATION FOR CONSIDERABLE ROAD SAFETY I/48 IN OSTRAVA REGION IN CZECH REPUBLIC

**Summary.** Traffic safety is one of the most important factors determining the efficiency of road transportation. I/48 highway, playing an important role of a transit communication link between Austria and Poland requires taking all means to improve the current level of safety. The short-term, instant and long term plans have been commissioned in the Civil Engineering Faculty, Road Engineering Section of the Technical University of Ostrava. The paper outlines the approach to all investigated solutions.

## USPRAWNIENIA KONSTRUKCYJNE ZWIĘKSZAJĄCE BEZPIECZEŃSTWO RUCHU NA DRODZE I/48 W REGIONIE OSTRAWSKIM W REPUBLICE CZESKIEJ

**Streszczenie.** Na drodze I/48 od kilku lat obserwuje się wzrost liczby wypadków spowodowanych zmianą natężenia i struktury ruchu. Artykuł przedstawia propozycje zastosowania środków inżynierii ruchu i ulepszeń konstrukcyjnych, które powinny poprawić bezpieczeństwo ruchu na najbardziej krytycznych odcinkach drogi.

### 1. INTRODUCTION

Among the most important factor safety road operation belongs at first velocity and intensity of road operations, further then element of lane communication, its cross adjustment, surface of road and verge, view of conditions, solving crossings, facilities of communications, organisation and steerage of operations, reliability and conformability of operation participants, quality and reliability of vehicles scenic of environment or development around communications and certainly much further. Each of these factors either individually or frequent together, can directly or indirectly work fluency movement vehicles by the road and endanger safety of operations.

Safety of road operations becomes one of qualitative criteria of functional qualification road communications. Near the proposal given disposals on escalation safety roads operations and thereby also decrease accident frequency with must to go out from knowledge real causes, which with on enhancement accident frequency share.

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According to the data of computer system accounting accidents in road operations were in year 2002 to Police Czech Republic reported 190 718 accidents, near which were 1314 men dispatched, 5492 heavily wounded and 29013 men wounded slightly. The estimation of incurred material damages were approx. 8,9 bil. Kc.

Majority of accidents (almost 92 %) did by drivers of motor vehicles the ground of wrong way ride (approx. 65 %) and the ground of non-performance velocity of ride (approx. 15 %), in sequence of percent occurrence is no giving advantages of driving (near 18 %) and 2,5 % of accidents for wrong overtaking.

The 9 552 of accidents, caused by alcohol meant 136 men forfeit life and next were wounded.

Today's state of technical makes possible take advantage of fully automatic of video about operations on terrestrial communications, especially on dangerous segments. Direct detect systems, based on imagery of video, overlaying whole section motorways or roads. Indirect video systems could be used in especial go-if about mobile installation near road works and which they can in real-time inform the drivers about situation, which is expectation and warn against is before on-coming traffic blocks.

## 2. ROAD I/48

Road I/48 is long-term replaces motorway D-47, which will connect Ostrava and motorway net of CR and carry out to comfortable traffic bindings among Austria (Vienna) resp. Germany and Poland (Katowice region).

On the road with high traffic stress - as far as approx. 22 000 units/24 h., with high share heavy to the right is absent sufficient equipment (latitude make-up, overpass crossings, road surface, etc.), which with display in number of arithmetic and consequence traffic accidents, which with on thirty km section in year 2002 from-play approx. 230, therefrom 13 have vital ones. Regarding to international function of road is already at present quality to the right unsatisfactory.

In the plant of traffic-container bindings, beneficial road net and supposed changes in political-economic areas (EU), demand instantaneous solving these situation.

Pursuant very alarm state traffic safety on road I/48 especially in section between Nový Jičín and Přibor, was by Ministry of Transport in Prague to the right and connection booked up by means of elaboration of complex appreciation of road I/48 in given section, including proposal for instantaneous, short-time and also perspective organisation, traffic and also building disposals. Processing by Study was charged at VSB-Technical University of Ostrava, Faculty of Civil Engineering, Department of Transport Engineering (see [1]).

Current road I/48 in section km 0,000 – 34,000, it is in section Bělotín – Rychaltice, with handgrip of towns Starý Jičín, Nový Jičín, was constructed in years 1966 as far as 1989. In time of initiation of these laps construction by standard CSN 73 6101, from 30.8.1962.

According to the this standard and then forecast of traffic intensity was road I/48, designed and carried out in space make-up in category width S 15/100.

The carriage way however be in the frames of reserve horizontal traffic notation changed on two not divided four lanes carriage way therewith, that parameter of road from views of directive and width make-up stay for designed velocity up to 100 km/h.

Absence of lay by strips and decrease of lanes width has then near duration of proposal velocity 100 km/h, consequence expressive enhancement of accident frequency.

Traffic notation was carried out into halve of year 2001 in standard for this road. Essentially concerns absolutely simple vertical and horizontal traffic notations, which

throughout judge section mark conditions ride for 4 lanes entire carriage way with overpass crossing with the other communication, barring ground splicing crossing road I/48 with road II/482 direction Rybí and Kopřivnice. Limitation of mounted velocity is in virtue of law – the most velocity limit 90 km/h. This most velocity limit is systematically overpass and traffic flow with move familiarly at speeds of 100 - 120 km/h and also higher.

In half of year 2001 was for enhancement safety marked, lawful velocity limit 90 km/h, fulfilment horizontal figure traffic sing B 20a (the most velocity limit 90 km/h) on carriage way in every lane among Nový Jičín and Příbor. Further plumb traffic informative mark on yellow signal basis, denotation section with traffic accident with exceedingly heavy aftermath, namely among Nový Jičín and Příbor.

Further was reduced velocity limit in section Dub - Starý Jičín on 70 km/h, owing to the the ground of bad building state-surface of road I/48. Detailed analysis and comparison of traffic accidents, possible connection and cause in places, other occurrence of formal causes of traffic accident frequency, point of view:

- in correct transverse arrangements, like entire two-way four lanes without lay by strip with lane in width only 3,25 m, near directive and altitude arrangements road for the rate 100 km/h. It makes possible relatively comfortable driving up to velocity 140 - 180 km/h, which is on judge section road familiarly reached. Pass permission velocity 90 km/h by the all running vehicles,
- high share of heavy freight vehicle in traffic flow, which is approx. 20 % and in one time segment with escalate up to 35 - 40 % (near definite chance short-term coalition vehicle in traffic flow) enhancement of arithmetic traffic accidents which,
- for increasing of traffic accidents happened around everybody's interface of road communication to I/48,
- on right-handed facing the drive Bělotín - Rychaltice (up direction station) is occurrence of traffic accidents under two observed years 2000 and 2001 more distinctive greater than in retrace namely 64,8 : 35,2 %.

*Traffic notation* was effected into halves of year 2001, concerning simple perpendicular also horizontal traffic notation, which throughout judge section mark only conditions ride for 4 striped entire carriage way with overpass crossing with other communications (roads) barring grade splicing crossing road I/48 with road II/482 direction Rybí and Kopřivnice. Limitation of mounted rate is in virtue of law - upper-most permission rate 90 km/h. This upper-most permission rate is running exceeded and traffic flow with move up-mostly velocity of 100 - 120 km/h and also higher.

Middle of year 2001 for enhancement safety was overstrike lawful of velocity limit 90 km/h fulfilment horizontal figure traffic sing B 20a upper-most velocity-limit 90 km/h on carriage way in every lane among Příbor and Nový Jičín. Further plumb traffic sing informative on yellow signal base denotation section with traffic accident, exceedingly weighty (heavy) aftermath among Příbor and Nový Jičín. Further was reduced velocity-limit in section Dub – Starý Jičín on velocity 70 km/h from bad road surface, point of view.

Over this disposal uses preponderance driver road throughout section at velocities this limit, as well as before. It is possible then state, that traffic notation not overstrike, but not provision law about upper-most velocity-limit on road (overstrike additional notation) hasn't no influence over mounted rate vehicle. The unwind in principle only therefrom, what kind is building state carriage way and what kind making have vehicle by the road driving through, foreground. whether road is checking by police.

Then itself edits traffic notation, or validity law, it is impossible traffic flow limit in a hurry or in way drive.



*Behaviour of drivers* is on video recorded which was acquisition in frames study [1] in the most critic section between km 26 - 28. Here it can be find out devil-may-care behaviour of drivers, e.g. :

- ride in strip (overtaking) of lorries and buses near in extenso traffic use to capacity of cross transverse profile of road with counter interference,
- double overtaking (cyclist regarding absence verge must play lane),
- divagation left from genuine interface ramp overcross in km 28,00 near Příbor and next ones.

Because the road in the all 4 lanes has in both directions practically the same parameters and concentration and flow velocity is as well in both directions comparable make oneself felt here quite doubtless fatigue complex.



Rys. 1. Lokalizace badaného odcinka cesty I/48

Fig. 1. The location of examined stretch of I/48 road

It is conditioned by quite in principle for majority participants of road operations (regardless of their common condition and health) especially go off distance and area without end of drive before places manifestation fatigue. This is common conditions for rise fatigue with aftermath decrease attention, decrease orientation, micro-sleep, etc.

Near judge of such conditions from views to the right in both travel directions, it is possible to say that conditions for rise of fatigue are the most major facing the engine from Bělotín to Rychaltice, than from Rychaltice to Bělotín.

For both directions reads together, that with judge section on international road E-462, where in traffic flow in round 50 % transit traffic. Near analysis find out these chief matter:

*The direction Ostrava (Poland)*

The source places of transit traffic they are Austria, Prague and Czech country, Brno and southern Moravia, Olomouc. The previous travelling time is the shortest approx. 1 an hour (from Olomouc), further from Brna approx. 2 - 2,5 hours, from Prague approx. 4 - 5 hours and from Austria as well 4 - 5 hours. The conditions of previous monotonous drive, they are given by relatively very good building state altogether divided by 4 lanes high-speed roads or (motorways)

*Direction Olomouc (Austria, Germany)*

The source places of transit traffic, they are especially from Ostrava agglomeration (comprehensive also district Frýdek-Místek and district Karvina), acc. the base count of traffic from year 2000 concerned approx. 65 % of vehicles in traffic flow. Further source is Poland in surplus approx. 35%. Previous travelling time is 65 % approx. 0,5 - 1,0 h. in last % then more than 2 hours. The conditions of previous monotonous drive from these sources there're not, because drive from these sources is pursuance up largely two lanes, two-ways roads, where the driver must has enhancement attention and driving activity.

The above-mentioned terms among sources of transport and places of enhancement accident frequency in given section road I/48, the right-handed facing of drive Bělotín - Rychaltice (in direction station) is occurrence traffic accidents under two observed years 2000 and 2001, espressivo greater than in opposite namely 64,8 : 35,2 %.

*Appreciation of road safety in year 2001.*

As far as we would appreciate from views of road safety accident frequency judge given in section of road I/48, it is possible hereto use calculation from CSN 73 6101 (from year 1962 base appendixes č.3 to article 11 of these specification).

Near using of these philosophy reached to the record, that step accident frequency near current width and building make-up - with 15 (N = 2,284 about<sup>0/oo</sup>) espressivo surpass admissible step of accident frequency for category width 21/100 (N = 1,450 about<sup>0/oo</sup>).

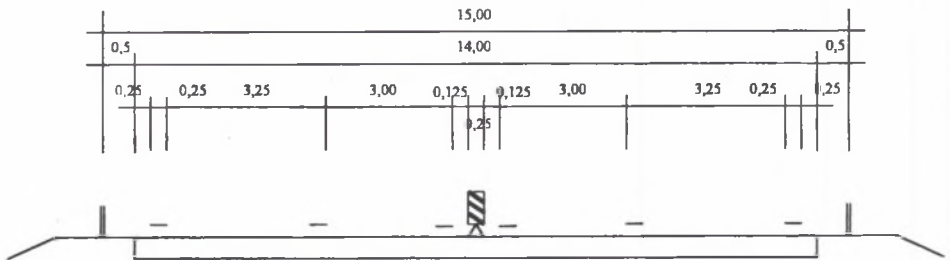
According to the the same philosophy as far as it is impossible road rebuild is only possible of disposal reduction of velocity (step safety with width lower at velocity of espressivo escalates).

### 3. PROPOSAL

*a - instantaneous disposal*

- traffic sing define the genuine (outer) strip for the all vehicle, left (inner) only for personal (into 3,5 t). Latitude of genuine (outer) strip 3,25 m, latitude left (inner) strip 3,00 m, near given latitude reach the enlargement verge (fortification 0,25 and unconsolidated 0,50 m), into the center of way occupy guiding system (guiding door-ster and guiding portfolio) – offered ( see Fig. 2).
- cause-notation on two lanes road with crash barrier in axes of road, from views of capacities by decreasing of velocity down on 50 km/h. Not suitable solving for international road.

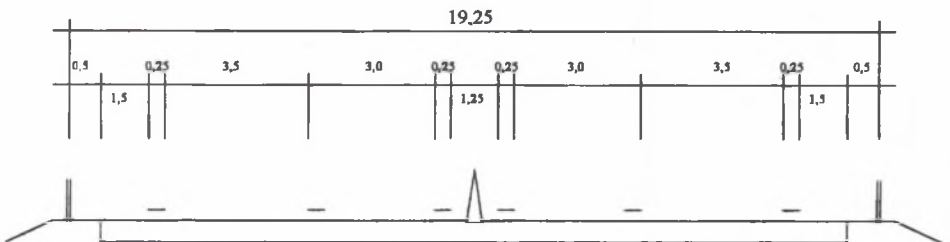
- dividing of current two lanes road with dividing central crash barrier, contrast bath placing two lanes and counter one's mounted and one's lay by strip. In one lane segment would happen to creation column and substantial reduction of velocity. The section fusion lane is potential accident here and there. The not suitable solve for international road.



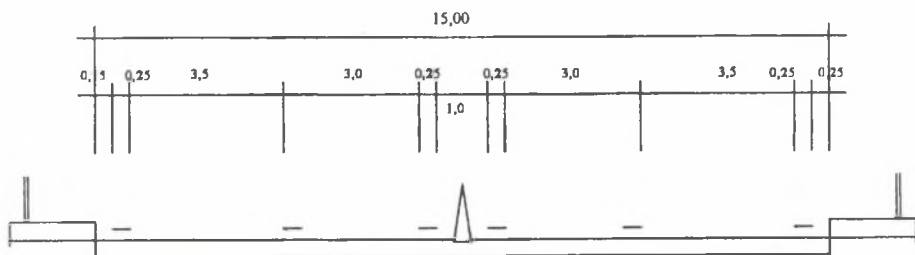
Rys. 2. Przekrój poprzeczny czteropasowej drogi z systemem znaków prowadzących  
 Fig. 2. The cross section of four climb lanes with the central guiding system

b - perm disposal

- the building enlargement of road on free latitude 19,25 m. This latitude go out from minimalization of occupation soil along road body. In mound would with enlargement of fulfilment by means of reinforced poured body and in notch recess steel-concrete side shaped L. Reduction of road latitude is necessary on current toll object - advised - see Fig. 3.
- reconstruction road in category R 22,5, whence follow also need enlargement bridge and carry out overpass crossing, parallel subsidiary to communication and next.



Rys. 3. Przekrój poprzeczny czteropasowej drogi I/48 z zastosowaną betonową barierą ochronną  
 Fig. 3. The cross section of road I/48 with four climb lanes, divided by central concrete crash barrier



Rys. 4. Przekrój poprzeczny czteropasowej drogi na moście z zastosowaną betonową barierą ochronną

Fig. 4. The cross section of road I/48 with four climb lanes, divided by central concrete crash barrier on bridges

Ministry of Transport CR with near-incline to solving of divide current road, especially in section of Nový Jičín - Pířbor funicular crash barrier however without needed enlargement transverse profile road. Outer lane in latitude 3,25 m and inner lane in latitude 3,00 m. Admissible velocity will restricted on 80 km/h, perpendicular traffic sing will prohibited overtaking lorries and heavy duty trucks and prohibited will gateway for cyclists.

Here's however necessity call attention, that funicular crash barrier have essentially major deformation space, which with in case stroke getting into counter (1,7 m) than crash barrier of other type - cast down. steel-concrete (New Jersey) with latitude 0,5 m. These funds they are apart substantial near width narrow road. In case, when will not building dissemination road body they can unyielding fastening disposal accident frequency heighten.

#### 4. ENCLOSURE

The carry out funicular crash barrier without enlargement road in the most dangerous section from safety views has substantial contribution from views enhancement of safety operation. Under first quarter of year 2003 on road reach the mere eight traffic accident with minimum aftermath, which is in with stocking with original approx. 14 %. The main cause beheld in psychological incidence crash barrier near decrease latitude of "speedy" lane. Is here instead question, when is this prevention lasting character or when drivers, who thereby section goes frequent, throw off mental barrier.

Long-term shilly-shally with carry out of motorway D/47 with hardscrabble from a lot of reasons:

- unsatisfactory of connection of space dilative to EU,
- therewith joint of economical development region, which way is route motorway led
- sorely route of current roads (security audit) - losses lives, health, possession
- progressive life environment along current route road, carryout for lower traffic stress, etc.



## Literature

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2. Řezáč M. –Krajčovič M.: Vybavenost pozemních komunikací a bezpečnost silničního provozu (Sborník konference dopravy, STU Bratislava, 2002).

## Streszczenie

Znaczny wzrost natężenia ruchu na drodze krajowej I/48 (obecnie ok. 20000 poj./dobę) oraz zmiana charakteru ruchu (zwiększenie udziału ciężkich pojazdów i ruchu tranzytowego) spowodowały wyraźne pogorszenie się stanu bezpieczeństwa ruchu. Z tego powodu Katedra Budownictwa Transportowego Wydziału Budownictwa VŠB-TU Ostrava otrzymała zadanie przeprowadzenia szczegółowych analiz bezpieczeństwa ruchu, których efektem powinny być propozycje natychmiastowych oraz zalecanych do wdrożenia w terminie późniejszym rozwiązań w zakresie organizacji ruchu i przebudowy elementów drogi.

Fragmentem drogi, na którym zidentyfikowano najwięcej miejsc niebezpiecznych, był odcinek Nový Jičín - Přebor. Wśród czynników ograniczających bezpieczeństwo ruchu na tym odcinku należy wymienić przede wszystkim nie odpowiadające wymogom wynikającym z obecnych funkcji (droga tranzytowa międzynarodowego znaczenia, droga zbiorczo-rozprowadzająca) parametry techniczno-eksploatacyjne. W rezultacie prędkość rzeczywista rzadko osiąga wartość 70 km/h, ale ze względów bezpieczeństwa jest ograniczana nawet do 50 km/h.

W celu poprawienia bezpieczeństwa ruchu na drodze zaproponowano między innymi:

- przekształcenie przekroju poprzecznego (rys.3),
- rozdzielenie ruchu pojazdów osobowych (pas wewnętrzny) i ciężarowych (pas zewnętrzny),
- weryfikację i uzupełnienie oznakowania poziomego i pionowego (rys.2),
- zastosowanie barier ochronnych (rys.3 i 4).

Przedstawione w artykule zabiegi organizacyjno-budowlane są zgodne z powszechnie uznanymi metodami. Są niezbyt kosztowne (z wyjątkiem poszerzenia jezdni) i można je wdrożyć stosunkowo szybko, lecz nie stanowią nowych jakościowo rozwiązań technicznych. Przyczynią się jednak, dzięki fizycznemu odseparowaniu obydwu kierunków ruchu za pomocą betonowych barier i polepszeniu warunków prowadzenia pojazdu za pomocą czytelnych i widocznych różnych elementów oznakowania, do zwiększenia bezpieczeństwa ruchu na drodze zaprojektowanej i wybudowanej zgodnie ze standardami obowiązującymi w latach 60. minionego wieku.