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First Serbian Road Congress, June 5-6 2014.

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САДРЖАЈ

Уводна реч
Милан Вујанић... 15

Поздравна реч
Биљана Вуксановић... 17

ТЕМА 1... Студије и пројектовање / Studies and Design

SOIL TREATMENT WITH LIME FOR FINE CLAYEY SOILS: AN ECONOMICAL SOLUTION FOR SUBGRADE, SUB BASE, BASE & CAPPING LAYERS
Christophe Denayer, Gabriele Tebaldi... 21

MAGISTRALNI PUT M18 (E 762) FOČA (BIH) - ŠĆEPAN POLJE (CG) KAO DIO GLAVNE PUTNE MREŽE REGIONA - PROJEKTOVANJE I MODERNIZACIJA
Predrag Šarkinović, Elvir Alić, Mario Jerčinović... 21

ODABIR OPTIMALNOG SISTEMA NAPLATE PUTARINE ZA MREŽU AUTOPUTEVA REPUBLIKE SRPSKE "CASE STUDY"
Draženko Glavić... 22

PREGLED DIMENZIONIRANJA SAVITLJIVIH KOLNIČKIH KONSTRUKCIJA U EUROPSKOJ I NAŠOJ REGULATIVI
Boris Čutura, Ivan Lovrić, Branko Mazić... 23

EKSPERIMENTALNO ISPITIVANJE STABILNOSTI POTPORNIH ZIDOVA OD PREFABRIKOVANIH BETONBLOK ELEMENATA
Nebojša Davidović, Zoran Bonić, Verka Prolović, Nikola Romić, Nikola Davidović... 24

PROJEKAT AUTOPUTA E-80 NIŠ – DIMITROVGRAD
Milosav Rajković... 24

HIJERARHIJSKA KONTROLA PRISTUPA NA DRŽAVNE PUTEVE - OBAVEZA PLANERA/PROJEKTANTA
Dušan Savković... 26

EVALUATION OF TRAVEL TIME DATA COLLECTION AND TRAFFIC MONITORING TECHNOLOGIES FOR A WIDE-AREA NETWORK
Reza Omrani, Pedram Izadpanah, Goran Nikolic, Alireza Hadayeghi... 26

ИЗВОЂЕЊЕ ТУНЕЛА "БАНЦАРЕВО"
Слободан Савић... 27

SLOVENSKO ZAKONODAVSTVO NA PODRUČJU ODVODNJAVANJA I PROČIŠĆAVANJA PADAVINSKIH VODA IZ JAVNIH CESTA
Uroš Krajnc, Boris Stergar, Metka Pavčič.. 27

SAVREMENI PRINCIPI I METODOLOGIJA GEOTEHNIČKIH ISTRAŽIVANJA I ISPITIVANJA U PUTNOM INŽENJERSTVU
Vladeta Vujanić... 29

NEKI ASPEKTI ZEMLJOTRESNE REGULATIVE VEZANE ZA SAOBRAĆAJNICE
Slobodan Nedeljković, Vladeta Vujanić, Milovan Jotić... 29

UTICAJ PADINSKIH PROCESA NA PUTNO INŽENJERSTVO SRBIJE
Vladeta Vujanić.. 30

ŠTA JE TO GEOTEHNIČKO INŽENJERSTVO, A ŠTA JE TO GEOTEHNIKA U PUTNOM INŽENJERSTVU – TUMAČENJA I ZNAČENJA NJIHOVIH POJMOVA
Vladeta Vujanić... 30

SEIZMIČKI RIZIK LINIJSKIH I TAČKASTIH OBJEKATA STVORENE SREDINE – NEKI ASPEKTI
Slobodan Nedeljković, Vladeta Vujanić, Milovan Jotić... 31

RAZVOJ GEOTEHNIKE U PUTEVIMA SRBIJE (1955 - 2013)
Vladeta Vujanić, Milovan Jotić... 32

GEODINAMIČKI PROCESI NA KOSINAMA AUTOPUTA E-80 OD PROSEKA DO CRVENE REKE
Vladan Vlajković, Željko Žugić, Sandra Milosavljević, Miodrag Pisarević... 33

PROŠIRENJE HOLANDSKOG AUTOPUTA A76 IZNAD POSTOJEĆE KOSINE NASIPA VERTIKALNO NASLAGANIM EPS-BLOKOVIMA
Milan Duškov... 33

TRAMVAJSKI I PUTNI NASIPI (SA VERTIKALNIM BOČNIM STRANAMA) OD EPS-BLOKOVA KOD NADZEMNOG TUNELA AUTOPUTA A4
Milan Duškov, Johan de Jongh... 35

EVALUATION OF ANALYTICAL TOOLS USED FOR THE OPERATIONAL ANALYSIS OF ROUNDABOUTS
Goran Nikolic, Rob Pringle, Kevin Bragg... 36

EXPRESSWAY SINGLE-LANE WORK ZONE CAPACITIES WITH COMMERCIAL VEHICLE IMPACTS
Goran Nikolic, Rob Pringle, Kevin Bragg, Diego Mendoza... 37

PLANNING AND IMPLEMENTING A SUCCESSFUL CLOSURE OF THE HIGHWAY 401 EXPRESS LANES WITH THE HELP OF MICRO-SIMULATION
Goran Nikolic, Rob Pringle... 37

“NOVA“ TEHNOLOGIJA GRADNJE NOSIVIH SPREGNUTIH GRAĐEVINA ČELIČNIM SPIRALNIM CIJEVIMA I KONSTRUKCIJAMA OD VALOVITIH LIMOVA U GRADNJI PROMETNICA
Mario Bogdan, Adam Czerepak, Łukasz Olek... 38

ISPITIVANJE NOSIVOSTI MANEVARSKIH POVRŠINA NA AERODROMU PODGORICA – PRORAČUN PCN-a
Ivan Andrić, SuzanaStefanović, Dragan Stojnić... 39

IZRADA FIZIČKIH MODELA PUTNOG POJASA METODOM 3D ŠTAMPE
Dejan Gavran... 39

GEOTEHNIČKO PROJEKTOVANJE ZEMLJANIH NASIPA I STABILIZACIONIH MERA PROCESA KLIZANJA PRILIKOM IZGRADNJE KORIDORA 10 NA DEONICI: PROSEK - CRVENA REKA
Srđan Spasojević, Dijana Milošević... 40

ULOGA SEKRETARIJATA ZA SAOBRAĆAJ U POSTUPKU PLANIRANJA I PROJEKTOVANJA ULIČNE MREŽE GRADA BEOGRADA
Andrijana Pešić, Daniela Janković, Svetlana Stevanović, Ognjen-Petar Todorović... 41

SISTEM VOZAČ - VOZILO - OKOLINA I SAVREMENO PROJEKTOVANJE PUTEVA
Sanja Fric, Vladan Ilić, Filip Trpčevski.. 42

GEOTEHNIČKI ASPEKTI ISTRAŽIVANJA I PROJEKTOVANJA AUTOPUTA BEOGRAD-JUŽNI JADRAN (E-763), OD OSTRUŽNICE DO OBRENOVCA, DESNOM OBALOM SAVE
Branko Jelisavac, Vladeta Vujanić, Petar Mitrović... 43

PRORAČUN DEBLJINE BETONSKIH KOLOVOZNIH KONSTRUKCIJA ARMIRANIH VLAKNIMA
Nikola Gažo, Milan Bošnjaković... 44

PUTEVI I RIZICI PROUZROKOVANI POPLAVAMA
Mitja Brilly, Maruša Špitalar, Mojca Šraj, Simon Rusjan, Andrej Vidmar... 44

PROJEKTOVANJE PRETHODNE MEŠAVINE ZA POTREBE IZRADE CEMENTOM STABILIZOVANOG DONJEG NOSEĆEG SLOJA NA AUTOPUTU E80 NIŠ – DIMITROVGRAD
Dušan Panić, Ivana Radovanović... 45

SPECIFIKE PROJEKTOVANJA PUTA GRADSKO-PRILEP (R. MAKEDONIJA)
Riste Ristov, Goran Đorđević, Tereza Teodosijevska, Jovan Br. Papić, Slobodan Ognjenović... 46

AUTOPUT BAR – BOLJARE, DIONICA SMOKOVAC – MATEŠEVO, OSNOVNE KARAKTERISTIKE I OPREDJELJENJA
Miloš Knežević, Duško Lučić, Jasmina Ćetković, Željka Beljkaš... 47

PRIKUPLJANJE OTICAJA SA MOSTA “GAZELA”, NJEGOVO PREČIŠĆAVANJE I INFILTRACIJA
J. Despotović, N. Jaćimović, J. Plavšić, D. Pavlović, A. Djukić, A. Todorović, V. Živanović, S. Milić... 48

PODOBNOST PRIMENE OSNOVNIH METODOLOŠKIH POSTUPAKA U ANALIZI USLOVA ODVIJANJA SAOBRAĆAJA NA VANGRADSKIM DEONICAMA PUTEVA
Ljubiša Kuzović, Vuk Bogdanović, Ruškić Nenad... 48

LAND SURVEY OF ROADS FROM UNMANNED AERIAL VEHICLE
Vid Peterman... 49

ТЕМА 2... Стратегија развоја путног транспортног система / Road Transport System: Development Strategy

PRILOG ISTRAŽIVANJU METODOLOGIJE ZA IZRADU STRATEGIJE RAZVOJA, ODRŽAVANJA I REHABILITACIJE CESTA
Mehmed Bublin, Mirza Pozder, Suada Džebo... 53

THE SAFE ROAD TRANSPORT SYSTEM APPROACH
Hans-Joachim Vollpracht... 53

S PROMENOM UZORAKA UREĐENJA PROSTORA DO RAZVOJA ODRŽIVE MOBILNOSTI: SAZNANJA IZ PROJEKTA MORECO
Andrej Gulič... 54

UTICAJ UREDBE O KATEGORIZACIJI PUTEVA DONETE 27.02.2012. GOD. NA PRIVREDNI RAZVOJ TERITORIJE KOJU ODRŽAVA AD"NOVI PAZAR–PUT"
Izet Ljajić, Mirsada Uglić... 55

УЛАГАЊЕ У ВАРИЈАНТУ АУТОПУТА СУРЧИН - ОБРЕНОВАЦ УМЕСТО У ВАРИЈАНТУ ОСТРУЖНИЦА - ОБРЕНОВАЦ ИЗАЗВАЛО БИ НЕСАГЛЕДИВО ВЕЛИКЕ И ДУГОРОЧНЕ ЕКОНОМСКЕ ГУБИТКЕ
Љубиша Кузовић, Бранимир Ујдур, Боривоје Алексић... 56

ТЕМА 3... Финансирање градње и одржавање путне инфраструктуре / Construction Funding and Maintenance of Road Infrastructure

УПРАВЉАЊЕ И ФИНАНСИРАЊЕ ПУТЕВА И ЖЕЛЕЗНИЦА У СРБИЈИ
Александар Цветановић... 59

COST-BENEFIT И COST-EFFECTIVENESS АНАЛИЗА ЗИМСКОГ ОДРЖАВАЊА
Драженко Главић, Марина Миленковић, Александар Трифуновић... 59

PROBLEMI FINANSIRANJA DRŽAVNIH PUTEVA U REPUBLICI SRBIJI PREMA ZAKONU O JAVNIM PUTEVIMA
Vladan Branković, Dejan Kocić, Momir Kočović, Dejan Bulajić... 60

PLANIRANJE I FINANCIRANJE CESTOVNE INFRASTRUKTURE
Ksenija Čulo... 61

ТЕМА 4... Одрживи развој и заштита животне средине / Sustainable Development and Environmental Protection

PRAĆENJE KVALITETA VODE I TLA TOKOM IZGRADNJE AUTOPUTA NA KORIDORU Vc, DEONICA ZVIROVIĆI-BIJAČA
Igor Jokanović, Sanda Zorić, Sandro Zovko... 65

UTICAJ IZGRADNJE INFRASTRUKTURNIH KORIDORA NA ZIVOTNU SREDINU, CASE STUDY E 75
Vukica Popadić Njunjić, Milovan Bekrić... 66

ЗАШТИТА ЖИВОТНЕ СРЕДИНЕ У ЈАВНОМ ПРЕДУЗЕЋУ „ПУТЕВИ СРБИЈЕ”
Биљана Вуксановић, Ђорђе Митровић, Мимоза Јеличић, Душица Милинковић, Ивана Матић... 67

PRIKAZ HEAVEN DSS PROJEKTA EVROPSKE UNIJE ZA UPRAVLJANJE BUKOM OD SAOBRAĆAJA U GRADOVIMA EVROPE
Vesna Zlatanović-Tomašević.. 68

REDUCTION OF POLLUTING SUBSTANCES IN THE ATMOSPHERE EMISSIONS BY APPLICATION OF THE CITY SIMULATION MODELING
Khaertdinov Almaz, Belyaev Eduard, Makarova Irina, Khabibullin Rifat... 69

PHONOBLOC - INNOVATIVE NOISE BARRIERS MADE OF CONCRETE
Gerald Lanz, Alexander Barnas... 69

ZAŠTO PEPEO JOŠ NIJE UPOTREBLJEN U PUTNOM INŽENJERSTVU I KAKO GA UPOTREBITI
Vladeta Vujanić, Simo Tošović, Svetlana Jotić... 70

KAKO I GDE JE MOGUĆA PRIMENA ELEKTROFILTERSKOG PEPELA PRI GRADNJI PUTEVA
Vladeta Vujanić, Simo Tošović, Svetlana Jotić... 70

MONITORING OBORINSKIH VODA U ČVORU ŠKURINJE NA RIJEČKOJ OBILAZNICI
Zdeslav Karlovac, Josip Rukavina, Sergije Babić... 71

CONSTRUCTION OF THE CORRIDOR Xc AND Xd MOTORWAYS – TOWARDS CLOSER COMPLIANCE OF ENVIRONMENTAL PROTECTION MEASURES
Milena Peric, Mick Hall, Aleksandar Bajovic... 72

APSORBIRAJUĆE BETONSKE BARIJERE ZA ZAŠTITU OD BUKE S GUMENIM GRANULAMA
Stjepan Lakušić, Ivica Kušević, Suzana Hozmec... 73

BIOREMEDIJACIJA BILjKAMA KAO METOD ZA ČIŠĆENjE ZAGAĐENIH ZEMLjIŠTA I PODZEMNIH VODA U PUTNOM POJASU
Vladan Tasić... 74

THE SUCCESSFUL USE OF ASPHALT RUBBER IN SLOVENIA AND ITALY
Zvonko Cotič, Mitja Čotar, Ines Antunes... 74

IZAZOVI PRILIKOM OCENE PROSEČNE GODIŠNJE EMISIJE ZAGAĐUJUĆIH MATERIJA U ATMOSFERU OD DRUMSKIH MOTORNIH VOZILA U R. SRBIJI
Vladimir Momčilović, Aleksandar Manojlović... 75

PROTECTION FROM THE ROAD NOISE IN SUBURBAN AND URBAN CITY AREAS IN THE REPUBLIC OF MACEDONIA
Goran I. Mijoski, Risto Manchev... 76

REDUCING TRAFFIC NOISE IN SERBIA; GUIDELINES LOW-NOISE PAVEMENTS AND NOISE BARRIERS
W. van Keulen, B. Vuksanović, I. Andrić, Đ. Mitrović, K. Perić, M. Duškov, R. Westerveld... 77

A-T FRAME PRECAST LINEAR CONSTRUCTIONS
Andrej Cvar... 77

ИСПИТИВАЊЕ И УПРАВЉАЊЕ СТРУГАНИМ АСФАЛТОМ НА ДЕПОНИЈАМА
Марко Орешковић... 78

PLANOVI ODRŽIVE URBANE MOBILNOSTI ZA GRADOVE DUBROVNIK I KOTOR
Tomaž Blaž.. 78

ТЕМА 5... Управљање путевима / Road Management

TEHNIČKA REVIZIJA POSLOVANJA TOKOM IZGRADNJE I REALIZACIJE PROJEKATA U AGENCIJAMA ZA PUTEVE
Igor Jokanović, Dragana Zeljić, Žarko Grujić.. 83

POKAZATELJI STANJA FLEKSIBILNIH KOLOVOZNIH KONSTRUKCIJA U FUNKCIJI UPRAVLJANJA PUTEVIMA
Dragan Mihajlović, Tatjana Grujanić... 84

INTELIGENTNO UPRAVLJANJE KONTROLOM PRISTUPA NA SAOBRAĆAJNICAMA VISoKOG RANGA
Miroslav Božović, Aleksandar Jovanović, Nenad Milutinović... 85

BAZA PODATAKA O KLIZIŠTIMA NA PUTEVIMA SRBIJE
Branko Jelisavac, Svetozar Milenković, Milovan Jotić... 86

KATASTAR KLIZIŠTA NA DRŽAVNIM PUTEVIMA SRBIJE
Milovan Jotić, Mile Zlatković, Boško Ubiparip... 86

GEOTEHNIČKI MONITORING KLIZIŠTA NA PUTEVIMA SRBIJE
Branko Jelisavac, Svetozar Milenković, Dušan Tošić... 87

MANAGING HIGHWAY LANES - DOES IT IMPROVE EFFICIENCY AND EFFECTIVENESS?
Goran Nikolic, Rob Pringle... 88

EVALUATING HOV PLANS AND PRIORITIES – THE CASE OF EXPRESSWAYS IN THE GREATER TORONTO AREA
Goran Nikolic, Rob Pringle... 89

BAZE PODATAKA U PROCESIMA UPRAVLJANJA PUTNOM MREŽOM SRBIJE
Đorđe Uzelac... 89

PLANIRANJE ODRŽAVANJA PUTNIH MOSTOVA
Mašović Snežana, Hajdin Rade... 90

ТЕМА 6... Изградња и одржавање путева и објеката / Construction and Maintenance of Roads and Structures

PREVENCIJA ZALEĐIVANJA MOSTOVA, UVEK DOSTUPAN PUT
Biljana Vuksanović, Miloš Zdravković... 95

ANALIZA STABILNOSTI NASIPA NA TRASI AUTOPUTA KORIDOR Vc, DIONICA SVILAJ – ODŽAK
Neđo Đurić, Petar Mitrović... 95

УПРАВЉАЊЕ ИЗГРАДЊОМ АУТОПУТЕВА У РЕПУБЛИЦИ СРПСКОЈ
Боро Здјелар... 96

STABILIZATION OF A DEEP CUTTING ALONG THE HIGHWAY A63 KEISERSLAUTERN – MAINZ, GERMANY, WITH A FLEXIBLE SLOPE STABILIZATION SYSTEM
Vjekoslav Budimir, Volker Leonhardt, Armin Roduner... 97

KORIŠĆENJE SMART TELEFONA I GOOGLE EARTH KAO SREDSTVA ZA PRAĆENJE RADOVA NA TERENU
Milena Perić... 98

SVOJSTVA PROPUSNIH BETONA I MOGUĆNOST NJIHOVE PRIMENE U SAVREMENOJ PUTOGRADNJI
Milija Stojanović, Miloš Šešlija, Mirjana Malešev, Vlastimir Radonjanin... 99

HIDROIZOLACIJA BETONSKIH MOSTOVA - ISKUSTVA IZ PRAKSE
Tatjana Bošković, Imre Pap, Milorad Smiljanić... 100

REGIONAL BALKAN CASE STUDIES OF GEOSYNTHETIC REINFORCED SOIL STRUCTURES AND ASPHALT REINFORCEMENT USED FOR THE CONSTRUCTION OF NEW OR UPGRADED HIGHWAY ROUTES. DESIGN ASPECTS, PHILOSOPHY AND CONSTRUCTION EXPERIENCES
N. Corney, D. Alexiew, Marija Bakrac... 100

ISKUSTVA U PRIMENI ADITIVA ZA SNIŽENJE TEMPERATURE KOD PROIZVODNJE I UGRADNJE ASFALTA U SRBIJI
Milorad Smiljanić, Imre Pap, Uroš Tatić... 101

OSVRT NA ISTRAŽIVANJA TERENA NA TRASI AUTO PUTA KORIDOR Vc, DIONICA JOHOVAC – DOBOJ JUG, PODRUČJE “USORA“
Neđo Đurić... 102

STABILIZACIJA SEKUNDARNIH I OTPADNIH MATERIJALA SA CEMENTOM UZ DODATAK ADITIVA
Simo Tošović, Vladeta Vujanić, Marijana Nikolić... 103

УСАГЛАШАВАЊЕ ТЕХНИЧКИХ УСЛОВА ИЗ ПРОЈЕКТА СА КВАЛИТЕТОМ ДОСТУПНИХ КАМЕНИХ АГРЕГАТА
Сузана Стефановић, Оливера Ђокић, Братислав Милић... 104

PRIMENA VALJKOM ZBIJENOG BETONA U PUTOGRADNJI
Mirko D. Petković... 105

REHABILITACIJA AUTOPUTA E-75, DEONICA: PROLAZ KROZ BEOGRAD
Ivan Andrić, Dragan Stojnić... 105

ISKUSTVA U UPOTREBI HOBAS CENTRIFUGALNIH CEVI ZA ODVODNJU MOSTA
Jelena Milošević, Eduard Hesky, Stefan Wutte... 106

TEHNIČKO-TEHNOLOŠKE I ORGANIZACIONE PROMENE U PEDESETOGODIŠNJEM PERIODU
Izet Ljajić, Ertan Ljajić, Senad Ibragić, Fatima Ramović... 106

ISKUSTVA U ODRŽAVANJU DRŽAVNIH PUTEVA NA TERTORIJI KOJU POKRIVA AD "NOVI PAZAR-PUT"
Ibrahim Škrijelj, Nermin Ljajić... 107

SPECIAL SOLUTIONS FOR ROAD INFRASTRUCTURE – 10 YEARS OF ROMANIAN EXPERIENCE
Eugen Florescu, Elena Lipan, Cristian Apostol... 108

PRAĆENJE PROJEKATA KORIŠĆENJEM INFORMACIONIH SISTEMA
Ertan Ljajić... 109

SPECIFIČNOSTI IZVOĐENJA RADOVA NA ADMINISTRATIVNOM PRELAZU „JARINJE" I NA MOSTU PREKO POTOKA „BREĐA"
Izet Ljajić, Sead Mujović, Edin Ljajić... 110

INTERNA KONTROLA KVALITETA U LABORATORIJAMA
Vesna Šijaković... 111

ТЕМА 7... Безбедност саобраћаја на путевима / Road Traffic Safety

ПРИМЕНА ТЕХНИЧКИХ СРЕДСТАВА ЗА УСПОРАВАЊЕ САОБРАЋАЈА НА ДРЖАВНИМ ПУТЕВИМА РЕПУБЛИКЕ СРБИЈЕ
Биљана Вуксановић, Слободан Мудреша, Владо Ракочевић, Ивана Суботић... 115

DEVELOPMENT OF INTELLECTUAL TRANSPORT ON-BOARD SYSTEMS FOR THE PURPOSE OF TRAFFIC SAFETY INCREASE
Eduard Belyaev, Irina Makarova, Rifat Khabibullin... 116

INCREASING TRAFFIC SAFETY ON SERBIAN ROADS BY USING STATE OF THE ART CONCRETE SAFETY BARRIERS ACCORDING TO APPLICABLE EUROPEAN STANDARDS
Thomas Edl... 116

ISPITIVANJE ZNANJA VOZAČA O PRAVILIMA BEZBEDNOG PONAŠANJA NA KRUŽNIM RASKRSNICAMA
Svetlana Čičević, Dr Draženko Glavić, Aleksandar Trifunović, Marina Milenković... 117

PASSIVELY SAFE ROAD INFRASTRUCTURE - JUST A FASHION TREND OR A REAL NEED?
Demeter Prislan... 118

VEŠTAČENJE SAOBRAĆAJNIH NEZGODA I PRIMENA NA UNAPREĐENJE BEZBEDNOSTI SAOBRAĆAJ
Milan Vujanić, Nenad Marković... 118

PILOT STUDIJA PROVERE BEZBEDNOSTI SAOBRAĆAJA NA DRŽAVNOM PUTU IIA-100 DEONICA INĐIJA-BATAJNICA
Đorđe Vranješ, Branimir Miletić, Nikola Brborić... 119

ПРИМЈЕНА РСИ – ПРОВЈЕРЕ БЕЗБЈЕДНОСТИ САОБРАЋАЈА НА ДИОНИЦИ МАГИСТРАЛНОГ ПУТА М4, ОД КОЗАРЦА ДО СРЕДЊЕ ЛАМОВИТЕ - СТУДИЈА СЛУЧАЈА У РЕПУБЛИЦИ СРПСКОЈ
Далибор Пешић, Вања Вожни, Александар Трифуновић, Лука Ленхардт... 119

STAVOVI VOZAČA I UPOTREBA ITS TEHNOLOGIJE ZA POVEĆANJE BEZBEDNOSTI SAOBRAĆAJA U USLOVIMA SMANJENE VIDLJIVOSTI
Boris Antić, Aleksandar Trifunović, Luka Lenhardt, Vanja Vožni, Svetlana Čičević... 121

ПРИЛОГ РАЗВОЈУ СТРАТЕГИЈЕ ЗА КОНТРОЛУ СРЕДЊЕ БРЗИНЕ ВОЗИЛА
Крсто Липовац, Гојко Везмар... 122

PROPUSTI ZA NASTANAK SAOBRAĆAJNIH NEZGODA U ZONI OŠTEĆENJA ODNOSNO RADOVA NA PUTEVIMA
Milan Vujanić, Tijana Ivanišević... 123

ANALIZA SAOBRAĆAJNIH NEZGODA NA DELU OBILAZNICE DOBANOVAČKA PETLJA - OSTRUŽNICA, U PERIODU OD 2010-2013. GOD.
Boris Antić, Zlatko Belencan, Dragan Lončarević, Nenad Marković... 124

ANALIZA UTICAJA REHABILITACIJE DRŽAVNOG PUTA NA BRZINE
Dalibor Pešić, Nenad Marković, Marko Trifunović... 125

INDIKATORI BEZBEDNOSTI SAOBRAĆAJA KOJI SE ODNOSE NA PUTEVE
Dalibor Pešić, Krsto Lipovac, Hans-Joachim Vollpracht, Boris Antić... 125

PERCEPCIJA RIZIKA VOZAČA I NJEN UTICAJ NA NASTANAK SAOBRAĆAJNIH NEZGODA
Marjana Čubranić-Dobrodolac, Krsto Lipovac, Svetlana Čičević, Vladan Tubić... 127

PRIMENA VREMENSKIH MODELA U ANALIZI FREKVENCIJE SAOBRAĆAJNIH NEZGODA NA RURALNIM PUTEVIMA
Svetlana Bačaklić, Boško Matović, Dragan Jovanović... 127

ПРЕГЛЕД АЛАТА ЗА ОЦЕНУ БЕЗБЕДНОСТИ ПУТА КОЈИ СУ ПРИМЕЊИВАНИ У РЕПУБЛИЦИ СРБИЈИ
Драгослав Кукић, Дарко Петровић, Крсто Липовац, Далибор Пешић... 128

INFRASTRUKTURA ZA PUNJENJE ELEKTRIČNIH VOZILA
Predrag Vučinić, Nenad Vučinić... 128

SAVREMENE METODE ZA UNAPREĐENJE BEZBEDNOSTI SAOBRAĆAJA POBOLJŠANJEM FAKTORA PUT
Boris Antić, Dalibor Pešić, Jürgen Gerlach, Miladin Nešić... 129

ANALIZA ZAVISNOSTI BROJA SAOBRAĆAJNIH NEZGODA I OBIMA SAOBRAĆAJA NA PUTU
Dejan Anđelković, Boris Antić, Dragan Jovanović... 130

PROTOKOLI SISTEMA UPRAVLJANJA TUNELOM - TUNEL STRAŽEVICA
Nenad Vučinić, Predrag Vučinić... 130

МОГУЋНОСТИ ПРИМЕНЕ ИТС УРЕЂАЈА ЗА УНАПРЕЂЕЊЕ БЕЗБЕДНОСТИ САОБРАЋАЈА НА ДРЖАВНИМ ПУТЕВИМА
Миладин Нешић, Зоран Пешовић, Емир Смаиловић... 131

ANALIZA BEZBEDNOSTI SAOBRAĆAJA U OKRUŽENJU ŠKOLE
Milan Vujanić, Duško Pešić... 131

УПРАВЉАЊЕ ПУТЕВИМА У РЕПУБЛИЦИ СРБИЈИ СА АСПЕКТА БЕЗБЕДНОСТИ САОБРАЋАЈА
Демир Хаџић, Јасмина Јовановић, Оливера Стевић Леденчан, Петар Красић... 133

UPOTREBA COMPUTER VISION REŠENJA U POVEĆANJU BEZBEDNOSTI SAOBRAĆAJA NA PUTEVIMA
Ivana Jovančić, Goran Đajić... 134

UPRAVLJANJE KONTROLOM PRISTUPA - EFIKASNOST I BEZBEDNOST PUTNE MREŽE SRBIJE
Vladan Tubić, Marijo Vidas... 134

DETECTION OF VEHICLE-BORNE HAZARDS WITH ROADSIDE EQUIPMENT
Christoph Seewald, Othmar Lackner... 136

ZAŠTITA OD POŽARA U TUNELIMA
Zorana Sekulović, Dragan Sekulović... 136

THE COMPETENCES OF THE ROAD ADMINISTRATIONS IN GERMANY
Konrad Bauer... 137

ROAD SAFETY DEVELOPMENT IMPACT BONDS INNOVATIVE WAY TO FINANCE ROAD SAFETY IN DEVELOPING COUNTRIES
Alan Ross, Mariya Ivchenko... 137

Уводна реч

Група ентузијаста окупљена око Организационог и Научног одбора покренула је иницијативу организовања *Првог српског конгреса о путевима*. Урадили смо то зато што смо свесни значаја пута и путне инфраструктуре за укупан друштевно-економски развој земље и свесни своје велике одговорности за размену знања и искустава и за унапређење свести о значају путне инфраструктуре.

Посебно желим да нагласим да је ово период у коме је наша мрежа путева додатно озбиљно угрожена. Нема саобраћаја без возила, терминала, али никако га нема без одоварајуће путне мреже. Тешко је и пружати помоћ настрадалима ако путна мрежа не функциониоше.

Развој сваке државе је кореспoдентан развијености њене путне мреже. Најразвијенији у свету имају најразвијенију и најбољу путну мрежу ... и обратно. Развој путне мреже је предуслов и претеча развоја привреде у свим еконоским системима. Пред нама је велики број озбиљних изазова у вези даљег развоја путне мреже.

Србија и земље у региону нису у до сада довољно водили рачуна о мрежи путева, нису поклањали одговарајућу пажњу планирању, изградњи, рехабилитацији, заштити као ни одржавању путева. Резултат је лоше одржавана и нефункционална мрежа слабо увезана у трансевропску мрежу путева. Нису адекватни наши путеви за транзитна кретања на великим растојањима, немамо одговарајуће дистрибутивне и колекторске мреже ни одговарајуће обилазнице.

Није довољно пажње посвећено контроли приступа, па смо сведоци бројних деоница државних путева са недозвољено великим бројем (не)легалних прикључака. Ово доводи до честе дисфункције мреже путева, па се за поједине деонице не зна да ли се ради о путу или о улици у насељу. Нејасно дефинисане функције пута и недоследно спроведени критеријуми, смањују проточност, ниво услуге и ниво безбедности саобраћаја.

Због дуготрајног неадекватног и недопустиво малог улагања у путеве, стање мреже путева није унапређивано. Овако малим улагањима у изградњу и одржавање путева, у наредном периоду би квалитет путева још више слабио. Слаба изграђеност и низак квалитет путне мреже отежава економски и друштвени развој, а посебно одвраћа озбиљна страна и домаћа улагања у нашу привреду. Наиме, изградњом путева се стимулише индустријски, културни и друштвени развој локалних заједница, односно неизградњом путева одређене области губе перспективу за развој. Инвеститори све чешће као услов за улагање истичу изградњу савремених, квалитетних путева којима би се производња повезала са изворима сировина и тржиштем.

Посебно забрињава што Србија и земље у региону нису искористиле велики потенцијал унапређења путева у смањивању страдања у саобраћају. Мада се у развијеним земљама дуже од две деценије истражују, примењују и унапређују врло једноставне савремене процедуре унапређења безбедности путева и мада смо ове процедуре законом прописали као обавезне, још увек није успостављен процес редовне примене ових процедура.

Конгрес има амбицију да скрене и усмери пажњу свих, а посебно стручне, политичке и најшире јавности на чињеницу да се путеви могу озбиљније унапређивати само нашим упорним радом, стабилном финансирању изградње и одржавања путева, стратешким планирањем и успешним, на науци заснованим, интервенцијама.

Председник Научног одбора
проф. др Милан Вујанић, дис

Introductory Speach

A group of enthusiasts which forms the Organizing and Scientific Committee has launched an initiative to organize the First Serbian Road Congress, being aware of great importance of roads and road infrastructure to the entire social and economic development of the country. In addition, this group of experts bears a great responsibility for exchange of knowledge and experience, as well as for raising awareness about the significance of road infrastructure.

Particularly, I would like to emphasize that in this period, our road network is further seriously compromised. The traffic system is made up of vehicles and terminals, but primarily of efficient road network. In this regard, providing help to the victims is difficult if the road network is not functioning properly.

The development of every country corresponds to the development of its road infrastructure. The most developed countries worldwide have the most advanced and efficient road network and vice versa. The development of the road network is a prerequisite and precursor of economic development in all aspects. A number of serious challenges is upon us regarding the further development of the road network.

Serbia and the countries in the region have not been committed enough to the road network planning, construction, rehabilitation, protection and maintenance. The outcome is poorly maintained and dysfunctional network poorly connected to the Trans-European road network. Our roads are not adequate for transport over large distances, we do not have the proper distribution and sewer networks nor the appropriate bypasses.

Not enough attention was paid to controlling access and therefore, we have numerous sections of state roads with a large number of unauthorized (non) legal connections. This leads to frequent dysfunction of the road network making certain sections not being classified as roads or streets. Motorway features are not clearly defined and criteria are inconsistently implemented, which causes reduced traffic flow, decreased level of service and level of safety.

Due to prolonged inadequate and unacceptable low investment in roads, the condition of the road network is not being improved. Such a small investment in the construction and maintenance of roads, could cause in the future a further road quality deterioration. Insufficiently constructed road network and its low quality obstruct the economic and social development and particularly distracts major foreign and domestic investment in our economy. The construction of roads encourages the industrial, cultural and social development of local communities, while the non-development causes certain areas to lose any perspective for development. Clients increasingly emphasize the construction of modern, high-quality roads as a requirement for investment which would link the production to the sources of raw materials and markets.

Of particular concern is that Serbia and the countries in the region did not take advantage of the potential of improving the roads to reduce traffic casualties. Although in developed countries, for more than two decades, very simple modern procedures for improving road safety are being explored, implemented, and improved and even though these procedures are prescribed by law as mandatory in our country, a process of regular application of these procedures has not been established yet.

The Congress aims at drawing the attention of everyone, particularly the professional, political and general public to the fact that roads can be improved only through our hard work, stable financing of road construction and maintenance, strategic planning and successful, science-based interventions.

Scientific Committee Chair
Prof. Dr Milan Vujanic

Поздравна реч

Трагом будућег развоја и са идејом да се дефинишу смернице за даљи развој путева, задовољство је организовати *Први српски конгрес о путевима* на коме ће учествовати велики број стручњака из земље и иностранства, окупљених око седам јединствених тема, а у циљу размене знања и праксе.

Размена искустава ће свим учесницима дати могућност и стимулисати их да у својим институцијама учине напоре у унапређењу функционисања путног система. Потреба свих стручњака је да се међусобно повежу, да непрекидно размењују искуства и да заједнички постигну још боље развојне резултате.

Путна инфраструктура има изузетно важну улогу у друштвено-економском развоју наше земље и зато је од великог значаја да сви стручњаци, безрезервно, своје искуство и знање учине доступним широј стручној јавности, чему ће допринети и овај Конгрес.

У име организационог одбора, захваљујем се ауторима, осталим учесницима Конгреса и свима који су допринели да се овај Конкгрес организује.

Председник Организационог одбора
Биљана Вуксановић, дипл. инж. грађ.

Welcome Note

Taking the path of future development with the aim of defining the guidelines for the further road infrastructure development, we have a great pleasure to organize the First Serbian Road Congress, which will assemble prominent global and national experts for exploring seven unique topics, knowledge sharing and experience-based perspectives.

Exchange of experience will motivate the participants to contribute to development of their own institutions, thus providing a general improvement of the road system. Interrelation of experts is of the utmost importance, since the continuous experience exchange provides the highest development results.

The road infrastructure plays a crucial role in the socioeconomic development of our country. Therefore, it is essential that all the experts make their knowledge and experience available to the broader scientific community, which is the purpose of this Congress.

On behalf of the Organizing Committee, I would like to thank the authors, other Congress participants and everyone who have contributed to the successful organization of the Congress.

Organizing Committee Chair
Biljana Vuksanovic, BSc in Civ. Eng.

Студије и пројектовање

Studies and Design

1

SOIL TREATMENT WITH LIME FOR CLAY-CONTAINING SOILS: AN ECONOMICAL SOLUTION FOR SUBGRADE, CAPPING LAYER & SUBBASE

Mr. Christophe Denayer, M.Sc, MBA, Carmeuse Central Europe, Belgium, **Mr. Gabriele Tebaldi, Ph.D., P.E.**, University of Parma, Department of Civil and Environmental Engineering and Architecture, Parma, Italy, **Mr. Saša Božić, M.Sc, ME** Fabrika kreča Carmeuse Integral a.d, Doboj, Bosnia and Herzegovina, **Mr. Radoje Jović**, M.Sc, ME, Jelen Do a.d., Jelen Do, Serbia

Abstract: Clayey soils have a poor rating as subgrade for road construction due to the tendency to swell by absorbing water and to shrink by drying out. However, when lime is mixed into the clayey soil, the soil is not only dried out, but also modified by flocculation. At this stage, the plasticity index of the soil is highly reduced, and the soil becomes friable and granular, making it easier to work and compact. Gradual hardening of the mixture, thanks to bonds formed by pozzolanic reactions between clay and lime will increase the bearing capacity. Compacted clayey soils result in flexible, permanent structural layers for subgrade, capping layers and subbase. Soil treatment with lime is a proven method to build durable basement materials on the base of fine clayey soils, for all type of roads, highways, railways, airports…

Key words: *soil treatment, soil recycling in-situ, lime, fine soils, earthworks*

MAGISTRALNI PUT M18 (E 762) FOČA (BIH) - ŠĆEPAN POLJE (CG) KAO DIO GLAVNE PUTNE MREŽE REGIONA PROJEKTOVANJE I MODERNIZACIJA

Predrag Šarkinović, Elvir Alić, Mario Jerčinović, IPSA Institut, Sarajevo, BiH

Rezime: Magistralni put M18, Foča – Hum (Šćepan Polje) je jedan od rijetkih magistralnih puteva u BIH, čije tehničke karakteristike nisu dovedene do karakteristika shodno nazivu koji nosi i njegovom značaju.
Ovaj put ima izuzetan značaj u mreži puteva BIH, odnosno u entitetu RS, kao i u mreži šireg okruženja. Ističe se značaj ovog puta u povezivanju jugoistoka Balkana sa Evropom.
Uviđajući značaj ovoga puta, SEETO (South-East Europe Transport Observatory), odnosno njegov Upravljački komitet je ovaj put uvrstio u Glavnu putnu mrežu regiona tj. Evrope, označavajući ga kao E762.

Ključne riječi: *magistralni put, Foča – Hum (Šćepan Polje), SEETO, E762*

Abstract: Major road M18, Foca - Hum (Šćepan Polje) is one of the few main roads in Bosnia and Herzegovina, whose technical properties do not comply with those of a major road.
This route has great significance in the network of roads BiH, ie in Entity RS, as well as in the surrounding lands. The importance of this road is connection between Southeastern Balkan and Europe.

Recognizing the importance of this road, SEETO (South-East Europe Transport Observatory) and its Control Committee included this road in the region main roads, marking it as the E762.

Key words: *major road, Foča - Hum (Šćepan Polje), SEETO, E762*

ODABIR OPTIMALNOG SISTEMA NAPLATE PUTARINE ZA MREŽU AUTOPUTEVA REPUBLIKE SRPSKE "CASE STUDY"

dr Draženko Glavić, dipl.inž.saob., Saobraćajni fakultet, Univerzitet u Beogradu, Srbija

Rezime: Rad prikazuje jedinstven primer studije odabira optimalnog sistema naplate putarine za mrežu autoputeva Republike Srpske. Studija je finansirana od strane EBRD za potrebe JP Putevi Srpske. Studija je detaljno obradila sa više aspekata problem i dala odgovore na nedoumice tipa: da li je optimalan otvoreni ili zatvoreni sistem, da li je tehnologija ENP, smartcard, vinjeta, GNSS ili neko drugo rešenje? Cilj ovog rada je upoznavanje stručne javnosti sa primenom procesa multikruterijalne analize. Primena MCDM analize je ilustrovana kroz realan prikaz izbora optimalnog sistema putarine na realnom primeru mreže autoputeva Republike Srpske.

Ključne reči: *MCA, putarina, kriterijumi, težine kriterijuma*

SELECTION OF AN OPTIMUM TOLL COLLECTION SYSTEM FOR THE MOTORWAY NETWORK OF THE REPUBLIC OF SRPSKA - "CASE STUDY"

Abstract: This paper presents a unique case study of selecting the optimal toll collection system for a network of motorways of the Republic of Srpska. The study was funded by the EBRD for the Public Roads of Republic of Srpska. The study deal with the various aspects of the problem and give answers to dilemmas: is the optimal open or closed system, whether it is technology ETC, smartcard, vignettes, GNSS or some other solution? The aim of this paper is to introduce experts with the application process of multicriteria analysis. Application of MCDM analysis is illustrated through a example of election of the optimal toll system on the real example of the motorway network of the Republic of Srpska.

Key words: *MCA, tolls, criteria, criteria weights*

PREGLED DIMENZIONIRANJA SAVITLJIVIH KOLNIČKIH KONSTRUKCIJA U EUROPSKOJ I NAŠOJ REGULATIVI

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Rezime: Dimenzioniranje kolničke konstrukcije ima izrazito veliku važnost u projektiranju prometnica iz jednostavnih razloga što kvaliteta kolničke konstrukcije osigurava trajnost, sigurnost i udobnost vožnje, kao i to što predstavlja značajnu stavku u pogledu troškova izgradnje i održavanja. Postoji veliki broj metoda dimenzioniranja koje su proizišle iz različitih pristupa, teorijskih ili empirijskih, kao i prilagodbi lokalnim uvjetima i strategijama.
U ovom radu je dat pregled metoda dimenzioniranja savitljivih kolničkih konstrukcija u našoj U.C4.012 metodi i u metodama nekih najrazvijenijih europskih država (Njemačka, Austrija, Švicarska i Velika Britanija). Analizirani su principi dimenzioniranja i rezultati koje daju.
Na kraju su data razmišljanja autora o ovoj problematici kao i prijedlozi primjene nekih europskih principa i iskustava na naše prilike.

Ključne reči: *savitljive kolničke konstrukcije, metode dimenzioniranja, prometno opterećenje, standardno osovinsko opterećenje, projektno razdoblje*

Abstract: Pavement design has great importance in the road design from the simple reason that the quality of pavement construction ensures durability, safety and comfort, as well as having a significant item in the cost of construction and maintenance. There are a number of design methods that are arising from different approaches, theoretical or empirical, as well as adapting to local conditions and strategies.
This paper presents a rewiev of design methos for flexible pavement structures in our method U.C4.012 and in methods of few most developed European countries (Germany, Austria, Switzerland and United Kingdom). We analyzed the principles of design and the results they provide.
At the end of article authors gave opinions about this issue, as well as proposals for the application of some European principles and experience to our opportunities.

Key words: *flexible pavement structures, design method, traffic load, standard axle load, design period*

EKSPERIMENTALNO ISPITIVANJE STABILNOSTI POTPORNIH ZIDOVA OD PREFABRIKOVANIH BETONBLOK ELEMENATA

Nebojša Davidović, Zoran Bonić, Verka Prolović, Nikola Romić, Građevinsko-arhitektonski fakultet Univerziteta u Nišu, **Nikola Davidović**, Sika doo Srbija, Zemun - Beograd, Srbija

Rezime: U savremenoj građevinskoj praksi se pored klasičnih krutih potpornih zidova sve češće koriste fleksibilne potporne konstrukcije od mehanički stabilizovane zemlje, gabiona i prefabrikovanih elemenata. Iako su u široj upotrebi tek u novije vreme, njihove prednosti su dokazane i široko prihvaćene. U prvom delu rada dat je prikaz mogućih načina korišćenja prefabrikovanih betonblok elemenata pri izradi potpornih zidova. U drugom delu rada dat je detaljan prikaz sprovedenih eksperimentalnih ispitivanja stabilnosti potpornih zidova od prefabrikovanih betonblok elemenata. Posebno su obrađeni postupci za dejstvo statičkog i dinamičkog opterećenja na zid. Analizirani su dobijeni rezultati i date preporuke za sledeće korake u istraživanju.

Ključne reči: *potporni zid, betonblok element, eksperimentalna ispitivanja, stabilnost, deformacije*

EXPERIMENTAL TESTING OF STABILITY OF RETAINING WALLS CONSTRUCTED OF PREFABRICATED BETONBLOK ELEMENTS

Abstract: In contemporary construction practice in recent years are increasingly used flexible retaining structures of mechanically stabilized earth, gabionms and prefabricated elements. Although these structures widely used only recently, their benefits are proven and widely accepted. The first part of the paper provides an overview of the possible ways of using prefabricated betonblok elements in the construction of retaining walls. The second part of the paper gives a detailed overview of the performed experimental testing of stability of retaining walls constructed of prefabricated betonblok elements. The effect of static loads on the wall was examined in the first stage of the experiment, and the effect of the dynamic loads on the wall in the second phase of the experiment.The results are analyzed and recommendations for future research are given.

Key words: *retaining wall, betonblok element, experimental testing, stability, deformation*

PROJEKAT AUTOPUTA E-80 NIŠ – DIMITROVGRAD

Milosav Rajković, Institut za puteve a.d. Beograd, Srbija

Rezime: Putni pravac E-80, Niš - Dimitrovgrad (Trupale – Granica sa Bugarskom) ima veliki značaj i bitnu saobraćajnu funkciju u smislu najkraće veze zapadne i centralne Evrope sa Bliskim i Srednjim Istokom. Nalazi se u mreži transevropskih

puteva (TEM) na evropskom koridoru Xc. U putnoj mreži Republike Srbije po staroj klasifikaciji, je magistralni put označen kao M-1.12, (po novoj klasifikaciji je državni put IA reda broj 5).
Projektom (Generalnim, Idejnim, Glavnim) sa pratećim studijama je izvršeno utvrđivanje činjenica kojima se definišu potrebe za gradnjom ovog putnog pravca, kao i određivanje niza parametara od ključne važnosti za optimizaciju procesa gradnje, eksploatacije, upravljanja i održavanja budućeg puta.
Cilj ovog rada je prikaz osnovnih elementa projekta kao što su: osnove za projektovanje (saobraćaj, klima, geologija, infrastrukturni objekti, zone zaštite itd), funkcionalne i tehničke karakteristike primenjenih rešenja (granični elementi plana i profila, normalni profil), karakteristična projektna rešenja (putni objekti, kolovozna konstrukcija, odvodnjavanje, zaštita životne sredine, saobraćajna oprema, mostovi i tuneli), raskrsnice, prateći sadržaji (odmorišta, benzinske stanice, baze za održavanje), opšti predračun radova.

Ključne reči: *projekat, Autoput E-80, Niš-Dimitrovgrad, situacija, podužni profili, poprečni profili*

DESIGN OF THE MOTORWAY E-80, NIŠ-DIMITROVGRAD

Abstract: Motorway E-80, Niš – Dimitrovgrad (Trupale - state border with Bulgaria) is a roadway of great significance with essential transport function providing a shortest connection of Western and Central Europe with the Middle and Far East across the territory of the Republic of Serbia. It is a part of the Trans-European road network (TERN) located on the European corridor Xc. According to the former categorization, it was classified as the arterial road M-1.12 in the Serbian road network (according to the current categorization it is labeled a class Ia state road no.5).
The beginning of the motorway E-80 is at the interchange Trupale where the motorway E-80 Niš - Dimitrovgrad separates from the motorway E-75 Beograd - Niš – state border with Macedonia (FYROM). The road passes near the settlements Prosek, Crvena Reka, Bela Palanka, Čiflik, Pirot, Sukovo, Željuša and Dimitrovgrad.
The section of motorway E-80 from Trupale to Prosek, 18.2km in length has been constructed so far, while the section from Prosek to the state border with Bulgaria, 83.4km in length is currently under construction.
The total length of the motorway Niš – Dimitrovgrad, from Trupale to the border crossing Gradina is 101.6km.
The motorway E-80 was designed as a commercial road with a closed toll collection system.
The design with accompanying studies has established the facts, which define the need for construction of this roadway, as well as the series of parameters necessary for optimization of construction, operation, management and maintenance of the future road.
The purpose of this paper (article) is to present and overview the basic elements of the design, such as: design subject matter, design basic data (legislation, traffic, climate, geology, infrastructure facilities, protection zones), functional and technical characteristics of applied solutions (boundary elements of plan and profiles, typical

cross section), distinctive design solutions (earthworks, pavement, drainage works, environmental protection, traffic equipment, bridges and tunnels), intersections, supporting facilities (rest areas, gas stations, maintenance general Bill of Quantities and Cost Estimate.

Key words: *motorway, E-80, Niš, Dimitrovgrad, layout, longitudinal profiles, cross sections*

HIJERARHIJSKA KONTROLA PRISTUPA NA DRŽAVNE PUTEVE - OBAVEZA PLANERA/PROJEKTANTA

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Rezime: Nekontrolisani pristup glavnoj saobraćajnici posredno usporava saobraćajni tok i stvara različite tipove saobraćajnih nesreća, s obzirom da vozila pokušavaju da napuste ili pređu glavne pravce. Ovakvi pokušaji moraju biti ograničeni i treba im obezbediti kontrolisani pristup na primarnu mrežu. Ovaj rad za cilj ima da pokaže neophodnost multidisciplinarnog pristupa u izradi početnih planskih osnova u zavisnosti od ranga puta i stanja na terenu.

Ključne reči: *putna mreža, planska dokumentacija, kontrola pristupa, bezbednost saobraćaja, saobraćajni tok*

Abstract: Uncontrolled access to the main route directly slows down traffic and causes various types of traffic accidents, because drivers are trying to leave or enter the main route. This behaviours have to be limited and should have controlled acces to road network. Goal of this paper is to show neccessity of multi-disciplinary approach in preliminary stages of plans and designs, according to importance of the route and its condition.

Key words: *road network, plans, access control, road safety, traffic*

EVALUATION OF TRAVEL TIME DATA COLLECTION AND TRAFFIC MONITORING TECHNOLOGIES FOR A WIDE-AREA NETWORK

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Abstract: Travel time is the most widely used measure of traffic. Most road authorities have programs to conduct travel time studies to quantify effect of their capital investments in terms of travel time improvements and to identify traffic bottlenecks, which require road improvements in the future. The objective of this paper is to evaluate travel time data obtained from three technologies, namely Bluetooth, in-

vehicle navigation systems, and mobile phone probes; against travel time obtained from the GPS equipped probe vehicles. In this research, data were obtained for the Province of Ontario for freeways, arterials, and ramps from commercial data providers. A multi-criteria statistical methodology was developed to evaluate data from each data provider based on accuracy, coverage, number of observations, and ability to provide data for special facilities such as high occupancy vehicle lanes. The findings of this research suggest that all three technologies were capable of replacing the traditional GPS equipped probe vehicles. This paper offers several recommendations regarding the use of travel time data from different data providers.

Key words: *Travel time, GPS equipped probe vehicles, Bluetooth, in-vehicle navigation systems, mobile phone probes.*

ИЗВОЂЕЊЕ ТУНЕЛА " БАНЦАРЕВО "

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Резиме: У раду су описани проблеми са којима се сусрео извођач радова Subterra a.s. при извођењу радова на изградњи тунела Банцарево. Ови проблеми су резултат другачијег распореда литолошких слојева од оног датог у прогнозом геолошком профилу главног пројекта. Рад се односи на проблематику источног портала тунела Банцарево, који је пројектован да се ради у отвореном ископу (cut & cover). У посебном осврту дати су и неки закључци везани за тунелски ископ.

Кључне речи: *тунел, пешчар, деградиран, инклинометар, конвергенција*

Abstract: This paper provides the description of problems encountered by the Contractor Subterra a.s. during the construction of tunnel Bancarevo. Those problems occurred due to discrepancy between the actual order of lithological layers and the one provided in the forecast geological section from the Final Design.The paper refers to an issue of East Portal of the tunnel Bancarevo, which shall be constructed by cut & cover method. A special reference is made for certain conclusions related to tunnel excavation.

Key words: *tunnel, sandstone, weathered, inclinometer, convergence*

SLOVENSKO ZAKONODAVSTVO NA PODRUČJU ODVODNJAVANJA I PROČIŠĆAVANJA KIŠNIH VODA SA JAVNIH PUTEVA

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Rezime: Ključno zakonodavstvo u Republici Sloveniji na području odvodnjavanja i pročišćavanja kišnih otpadnih voda predstavlja Uredba o emisiji tvari kod odvodnjavanja kišnih voda iz javnih puteva (Službeni glasnik RS 47/2005 od 13. 5. 2005). Sa tom uredbom želeli smo na isti način obuhvatiti sve javne puteve, ne samo autoputeve, sa obzirom na njihovo prometno opterećenje, geološke uslove, zaštitna područja i primaoce kišnih voda sa puteva. Uredba je odredila zagađene vode, koje je potrebno pročistiti. U dobi od osam godina prakse, primetili smo poteškoće kod izvođenja te uredbe i pripremili predloge za dopunu predmetne uredbe.

Naredni dokumenti važnosti odvodnjavanja predstavljaju takozvane tehničke specifikacije TSC 03.380 za javne puteve, koje se odnose na odvodnjavanje puteva. Predlog tehničkih specifikacija iz aprila 2004 bio je od struke označen kao primjeran, a nikada nije bio službeno prihvaćen. Većina projektanata koristila je osnutak kao temelj svog posla. U junu 2010 pripremljena je nova verzija specifikacije TSC 03.380 Odvodnjavanje puteva, koja je bila recenzovana. U 2012 godini takođe su izrađene dopune prema recenziji. Ova verzija Tehničkih specifikacija još do danas nije uzakonjena.

Ključne reči: *odvodnjavanja kišnih voda, pročišćavanja kišnih voda, zakonodavstvo, tehničke specifikacije*

SLOVENIAN LEGISLATION ON WATER DRAINAGE AND TREATMENT FROM PUBLIC ROADS

Key legislation in the Republic of Slovenia in the field of drainage and treatment of rain waste water is the Decree on the emission of substances in the drainage of rain water from public roads (Official Gazette 47/2005 of 13 May 2005). With this regulation, we wanted to cover all public roads (not just highways) the same, with respect to their traffic load, geological conditions , buffer areas and recipients of rain water from the roads. Regulation has determined which contaminated waters are necessary to treat. During the eight years of practice, we have noted the difficulty in performing these ordinances and prepared further proposals for amending the Decree.

The following documents represent the importance of the so-called dewatering TSC 03 380 Technical specifications for public roads, related to the drain passages. The technical specification proposal, dated as April 2004 was marked by the professionals as exemplary, but was never officially accepted. Most designers use it as the basis for their work nevertheless. In June 2010, a new version of the specification TSC 03 380 Drainage of roads was prepared and reviewed. Later, in 2012, the amendments requested by the review were made. This version of Technical specification still has not been legislated to this day.

Key words: *rain water drainage, rain water treatment, legislation, technical specifications*

SAVREMENI PRINCIPI I METODOLOGIJA GEOTEHNIČKIH ISTRAŽIVANjA I ISPITIVANJA U PUTNOM INŽENJERSTVU

Vladeta Vujanić, Beograd, Srbija

Rezime: Geotehnička istraživanja i osmatranja predstavljaju veoma značajan deo planiranja, projektovanja, građenja i održavanja puteva. U mnogim slučajevima geološki i geotehnički uslovi su od presudnog uticaja na izvodljivost, koštanje i sigurnost putne saobraćajnice kao objekta. Zbog toga je nužno stalno praćenje i unapređivanje savremenih principa i metodologije geotehničkih istraživanja. U radu će biti prikazana najvažnija dosadašnja iskustva, iz svetske i naše prakse, kao i pravci daljeg razvoja savremene metodologije istraživanja, pri rešavanju geotehničkih problema, što je od interesa za stručnu javnost na prostoru RS, a i šire.

Ključne reči: *put, savremeni pristupi i metodologija geotehničkih istraživanja*

MODERN PRINCIPLES AND METODOLOGIES OF GEOTECHNICAL INVESTIGATION AND TESTING IN ROAD ENGINEERING

Abstract: Geotechnical investigations and observations are very significant part of planning, design, construction and maintenance of roads. In many cases geological and geotechnical conditions have very important impact on feasibility, costs and safety of road as a structure. Therefore constant following and improvement of the modern principles and metodology of geotechnical investigations is required. Paper will present the most important expiriences from global and domestic practice up to now, and directions of further development of modern metodlogy of investigation, during solving of geotechnical problems, which is in the interest of the professional audience in RS and world wide.

Key words: *road, modern approcahes and metodology of geotechnical investigation*

NEKI ASPEKTI ZEMLJOTRESNE REGULATIVE VEZANE ZA SAOBRAĆAJNICE

Slobodan Nedeljković, Sistem Geo-In, Beograd, **Vladeta Vujanić**, Beograd, **Milovan Jotić**, Institut IMS a.d., Beograd, Srbija

Rezime: Uslovno govoreći, uloga saobraćajnica u prostoru u kome egzistiraju može biti tretirana kao neka vrsta krvotoka tog prostora. Slično krvotoku i saobraćajnice imaju svoju međusobnu hierarhiju zasnovanu na značaju koju obavljaju u saobraćajnom sistemu. Saobraćajnice imaju svoje specifičnosti u funkciji stvorene sredine, i ove specifičnosti traže adekvatnu valorizaciju u zemljotresnoj regulativi. Povećane brzine odvijanja saobraćaja, osim prohodnosti za potrebe fizičkog saobraćaja danas, sve više, traži uvažavanje i bezbedonosne komponente. Valorizaciji ove druge komponente puno treba da pomogne smanjena povredljivost terena, i u zemljotresnim uslovima.

Ključne reči: *putni pravac, inženjersko geološki uslovi, zemljotresni hazard i rizik, zemljotresna regulativa*

UTICAJ PADINSKIH PROCESA NA PUTNO INŽENJERSTVO SRBIJE

Vladeta Vujanić, Beograd, Srbija

Rezime: Poznato je, da najveći problemi izgradnje objekata, nastaju upravo zbog padinskih procesa, koji se manifestuju u vidu: osipanja, odronjavanja, kliženja, lavina i sl., a koji se odvijaju (po pravilu) na relativno kratkim rastojanjima, sa često katastrofalnim posledicama i velikim materijalnim štetama. Zato, izučavanje prirodnih padina na različitim stadijumima nastanka, u različitim geološkim sredinama i fizičko geografskim uslovima, ima veliki značaj kod planiranja, projektovanja i izgradnje, kapitalnih građevinskih (i drugih) objekata, posebno objekata saobraćajne infrastrukture. U radu autori iznose najopštije o značaju izučavanja padina (nastanak, razvoj i tipovi procesa, i dr.), sa posebnim osvrtom na njen najznačajniji proces klizanja, u funkciji graditeljske aktivnosti.

Ključne reči: *padine, padinski procesi, klizišta, izgradnja objekata*

INFLUENCE OF SLOPE PROCESSES ON THE ROAD ENGINEERING IN SERBIA

Abstract: Regarding construction of facilities, it is widely known that major problems, due to slope processes, occur as a rule, at relatively short distance in the form of erosion, rock fall, landslides, avalanche, etc. They often have disastrous effects and cause substantial material damage. For this reason, the study of natural slopes at different stages of occurrence, in various geological milieus, and physical and geographical conditions, has a great significance in planning, design preparation and construction of capital and other building structures, particularly of the road infrastructure facilities. In this paper, the authors present general information on importance of the study of slopes (occurrence, development, process types, etc.), with particular reference to its most significant process of sliding, in the function of construction activity in road engineering.

Key words: *slopes, slope processes, landslides, road construction*

ŠTA JE TO GEOTEHNIČKO INŽENJERSTVO, A ŠTA JE TO GEOTEHNIKA U PUTNOM INŽENJERSTVU – TUMAČENJA I ZNAČENJA NJIHOVIH POJMOVA

Vladeta Vujanić, Beograd, Srbija

Rezime: Geotehničko inženjerstvo, odnosno geotehnika, predstavljaju značajan deo planiranja, projektovanja i izgradnje objekata, uopšte, posebno objekata saobraćajne infrastrukture. Zbog toga je, veoma bitno u primeni ovih inženjersko – tehničkih

disciplina, pravilno razumeti potrebu za njima, zatim njihova značenja i tumačenja. O tome i drugim pitanjima autor u ovom radu iznosi neke svoje stavove i predloge.

Ključne reči: *Geotehničko inženjerstvo, geotehnika, značenje i tumačenje pojmova*

THE QUESTIONS REGARDING GEOTECHNICAL ENGINEERING, GEOTECHNICS WITHIN THE SCOPE OF ROAD ENGINEERING - INTERPRETATION AND SIGNIFICANCE OF THEIR CONCEPTS

Abstract: Geotechnical engineering, i.e. geotechnics, represent a relevant part of planning, design and construction of structures and facilities, particularly in the field of transport infrastructure facilities. In view of that, it is very essential, in the implementation of these engineering – technical branches of knowledge, to understand properly the necessities, followed by their significance and interpretation. In this regard and other issues, the author is revealing in this paper some of his attitudes and proposals.

Key words: *geotechnical engineering, geotechnics, significance and interpretation of concepts*

SEIZMIČKI RIZIK LINIJSKIH I TAČKASTIH OBJEKATA STVORENE SREDINE – NEKI ASPEKTI

Slobodan Nedeljković, Sistem Geo-In, Beograd, **Vladeta Vujanić**, Beograd, **Milovan Jotić**, Institut IMS a.d., Beograd, Srbija

Rezime: Evrokod EC8 zadanim rizikom od 10% traži izradu karata sa povratnim periodom zemljotresa od 100 godina i 500 godina. U radu, ukazuje se na propust informacije o povećanju tog rizika ako se ne raspolaže seizmološkim kartama sa povratnim periodom zemljotresa od 50 godina i 200 godina. Kod saobraćajnica ovaj propust je još izraženiji.
Ukazuje se na potrebu uvažavanja redukcije funkcije objekta (indirektnih štetauzrokovanih zemljotresom) kod savremeno tehničko tehnološko opremljenih objekata. Takođe, ukazuje se da zemljotresni rizik saobraćajnica treba razmatrati i za uslove povećane brzine odvijanja saobraćaja na njima.

Ključne reči: *zemljotresna regulativa, zamljotresni rizik, zemljotresni hazard, nacionalna zemljotresna preventiva*

SEISMIC RISK OF LINE AND POINT STRUCTURES OF CREATED ENVIRONMENTS – SOME ASPECTS

Abstract : Eurocode EC8 with given risk of 10% requires preparation of seismic maps with return period of earthquake of 100 and 500 years. The paper points out the wrong data on the increase of that risk if the seismic maps with return period of earthquake

of 50 and 200 years. This mistake is even more expressed in case of roads.
The paper also emphasizes the necessity of structure function reduction (indirect harms caused by strong earthquake) in case of highly technically-technologically equipped structures. It also indicates that earthquake risk of communications should be considered for the conditions of the increased traffic speed at them.

Key words: *earthquake regulative, earthquake risk, earthquake hazard national earthquake prevention*

RAZVOJ GEOTEHNIKE U PUTEVIMA SRBIJE (1955 – 2013)

Vladeta Vujanić, Beograd, **Milovan Jotić**, Institut IMS a.d., Beograd, Srbija

Rezime: U pogledu praktične primene geotehnike, kod nas u građevinarstvu, glavni podatci i područje njene primene ispoljavaju se, pre svega, sa početkom ubrzane izgradnje savremenih saobraćajnica, još daleke 1935. godine. Od tada, pa do danas, geotehnika je imala buran i dinamičan tok razvoja. Kao savremenici, većeg dela tog perioda, autori ovog rada, kroz analizu rešavanja (nekih) određenih geotehničkih problema, a na osnovu svojih, praktičnih iskustava i iskustava drugih kolega, (pre svega, iz Instituta za puteve), daju prikaz razvoja Metodoloških postupaka i načina geotehničkih istraživanja, pri projektovanju i gradnji puteva u Srbiji, u periodu od 1955. godine, pa do danas.

Ključne reči: *problemi, geotehnika, razvoj, gradnja puteva*

DEVELOPMENT OF GEOTECHNICS IN ROADS IN SERBIA (1955 -2013)

Abstract: The first main data and practical application of geotechnics in civil engineering in our country dated from 1935., with the progress of modern communication construction. The geotechnics has dynamic development from that period up to now. As the contemporaries of this period, the authors of this paper provide review of development of Methodological procedures and modes of geotechnical testing, during design and construction of roads in Serbia in the period of 1955. up to nowadays, through the analysis (solution) based on their own practical experience, as well as the experience of their colleagues (first of from The Highway Institute).

Key words: *problems, geotechnics, development, construction of roads*

GEODINAMIČKI PROCESI NA KOSINAMA AUTOPUTA E-80 OD PROSEKA DO CRVENE REKE

Vladan Vlajković, Željko Žugić, Sandra Milosavljević, Miodrag Pisarević, Institut za puteve ad, Beograd, Srbija

Rezime: Prostorni položaj Autoputa E-80 od Proseka do Crvene Reke i složena morfološka i geološka građa terena su uslovile formiranje visokih zaseka duž cele trase puta. Projektovane su kosine strmog nagiba u kontinuitetu visinski, uz ograničenje u vidu uzanog pojasa ekspropiacije. Tokom izvođenja kosina došlo je do aktiviranja čitavog niza nestabilnosti duž istih. Dinamika procesa je različita u zavisnosti od lokaliteta, ispoljava se na svojstven način u vidu nastanka, veličine i oblika u geološkim različitim sredinama. Generalno nestabilnosti koje se ispoljavaju u vidu školjkanja (klizišta), osipanja i odronjavanja možemo podeliti na kosine izvedene u nekoheretnim glinovito-peskovito-šljunkovitim, koheretnim glinovito-prašinastim i čvrstim stenskim masama.

Ključne reči: *autoput, kosine, izvođenje, klizišta, odroni*

GEODYNAMIC PROCESSES ON SLOPES ON THE MOTORWAY E-80 FROM PROSEK TO CRVENA REKA

Abstract: Location of the motorway E-80 from Prosek to Crvena Reka, as well as a complex morphological and geological composition of terrain, have caused the formation of high cuttings (composite profiles) along the entire motorway route. Slopes with steep gradients were designed continuously at high altitudes, with limitation in the form of a narrow area of land acquisition. During the construction of slopes, there was a series of instability activation along these slopes. The dynamics of the process varies depending on the location and reveals in a specific way in the form of appearance, size and shape in different geological environments. In general, slopes affected by instabilities in the form of spalling (landslides), erosion and rockfalls can be subdivided into slopes constructed in incoherent clayey-sandy-gravely masses, coherent clayey-silty masses and solid rock masses.

Key words: *motorway, slopes, construction, landslides, rockfalls*

PROŠIRENJE HOLANDSKOG AUTOPUTA A76 IZNAD POSTOJEĆE KOSINE NASIPA VERTIKALNO NASLAGANIM EPS-BLOKOVIMA

Milan Duškov, InfraDelft B.V., Holandija

Rezime: Rad govori o proširenju autoputa A76 (na jugu Holandije) sa vertikalno naslaganim EPS-blokovima (EPS=Expanded PolyStyrene foam=stiropor). Proširenje je u dužini od 60 m između dva nadvožnjaka reailzovano u leto 2012 kao inženjerski presedan u Holandiji. Gornja strana EPS-blokova leži 4 m iznad postojeće kosine

nasipa. Kompleksnost situacije povećava da je postojeći nasip autoputa poduprt sa potpornim zidom, a ispod svega leži veliki gasovod. Autoput preseca naime na toj lokaciji hemijsko-industrijsku zonu. Projekat je jedinstven u holandskoj inženjerskoj praksi po geometriji poprečnog preseka. Saobraćajno opterećenje je preko 8.500 teških teretnih vozila dnevno plus putnička vozila. Da bi se osvedočili autoriteti u stabilnost projektnog rešenja uradjena je i parametarska analiza. Najvažnije je bilo dokazati da je trenje između EPS-blokova dovoljno tako da potpora sa strane nije potrebna. U tom smislu su odlučujuće bile sledeće karakteristike EPS-a kao konstruktivnog materijala: a) dovoljan koeficient trenja izmedju blokova, b) mala specifična težina (25 kg/m³) i c) nizak Poasonov koeficient. Zahvaljujući ovim karakteristikama je ovakvo elegantno projektno rešenje bilo izvodljivo u opisanim kompleksnim okolnostima i pored značajnog intenziteta saobraćaja. U Srbiji bi se ovako ekonomično mogli proširivati putevi na kosinama klizišta bez remećenja ravnoteže.

Ključne reči: *lakotežeći nasipi, EPS-blokovi, putno proširenje, klizišta*

WIDENING OF DUTCH MOTORWAY A76 MADE OF VERTICALLY PILED EPS-BLOCKS

Abstract: The paper describes the 60 m long widening of the motorway A76 (located in the south of the Netherlands) between two overpasses made of vertically piled blocks of EPS (Expanded PolyStyrene = geofoam). This sophisticated motorway widening (completed in the summer of 2012) set an engineering precedent in the Netherlands. The upper side of the EPS blocks lies 4m above the existing slope of the embankment. The complexity of original situation was mainly characterized by following aspects. Firstly, the existing motorway embankment is supported by a retaining wall and, secondly, under the slope lays a large pipeline which could not be additionally loaded. The motorway section intersects at the site of a chemical-industrial zone. The project is unique in Dutch engineering practice because of the geometry of the realized cross section. Traffic load is over 8,500 heavy trucks per day plus passenger vehicles. In order to convince road authorities in the stability of our design solution parametric analyses had been carried out. The realized design proves that the friction between the EPS blocks guaranties sufficient embankment stability without horizontal slope support. In this regard, the following characteristics of EPS (as an embankment material) are of overriding importance: a) sufficient friction coefficient between the EPS blocks/layers, b) low own weight (25 kg/m³) and c) low Poisson coefficient. Due to these unique characteristics such an elegant design solution was feasible both under above mentioned complex circumstances and despite the significant traffic intensity. In Serbia this design methodology on a large scale is suitable for economic road widening without disturbing the existing natural balance on slopes resulting from numerous landslides.

Key words: *light-weight embankments, EPS blocks, road widening, landslides solution*

TRAMVAJSKI I PUTNI NASIPI (SA VERTIKALNIM BOČNIM STRANAMA) OD EPS-BLOKOVA KOD NADZEMNOG TUNELA AUTOPUTA A4

Milan Duškov, InfraDelft B.V., **Johan de Jongh**, Heijmans N.V., Holandija

Rezime: Rad govori o do 6 m visokim i ukupno 360 m dugim pristupnim nasipima (sa vertikalnim bočnim stranama) od EPS-blokova preko novog dela autoputa A4. Između Delfta i Schiedam-a (kod Roterdama).Tamo deonica autoputa A4 u gradnji preseca postojeću tramvajsku prugu. Zbog okolnih naselja se taj deo budućeg autoputa gradi u nadrzemnom tunelu. Na mestu ukrštanja morala se postojeća tramvajska linija podići 6 m, a tlo je vrlo stišljivo. Zbog vrlo strogih zahteva za buduća sleganja je primenjeno projektno rešenje sa lakotežećim EPS-blokovima. Time je dodatni pritisak na tlo praktično izbegnut jer je težina konstrukcije jednaka masi iskopanog sloja zemlje. Plus je zbog ekonomičnosti i uštede prostora poprečan preseka nasipa izveden bez kosina, sa praktično vetikalnim stranama. Dodatne prednosti su a) izvođenje u dve faze, prvo podužni deo sa kolovoznom konstrukcijom pa tek onda deo sa tramvajskom prugom, i b) kratko vreme izvođenja. Postojeća tramvajska linija je smela biti zatvorena samo 12 nedelja. Primenjena projektna metodologija je omogućila završetak radova tačno po planu (2. decembra 2013.). Prethodno je bilo reči o konvencionalnoj gradnji sa izvođenjem za godinu dana. Sve u svemu je ovim projektom metodologija projektovanje putnih i tramvajskih nasipa značajno modernizovana i Holandija je dobila jedinstveno inženjersko rešenje.

Ključne reči: *lakotežeći nasipi, EPS-blokovi, putno proširenje, klizišta*

COMBINED TRAMWAY AND ROAD EMBANKMENTS MADE OF VERTICALLY PILED EPS-BLOCKS NEXT TO DUTCH MOTORWAY A4

Abstract: The paper deals with the up to 6 m high and in total 360 m long embankments (without slopes) of EPS-blocks constructed on the both sides of a new section of the A4 motorway between Delft and Schiedam (near Rotterdam). This new section of the A4 motorway crosses the existing tram tracks. Because of the surrounding residential area the considered part of the future motorway goes through a surface tunnel structure. The existing tram line had to be raised 6 m high at the crossing point and the soil is highly compressible. Due to very strict requirements for future settlements the design solution with light weight EPS blocks is applied. Consequently an additional pressure on the ground is practically avoided because the own weight of the structure is equal to the mass of excavated soil layers. In addition the implemented cross sections without slopes are cost effective and space saving. Extra advantages are a) building in two phases: firstly the longitudinal embankment part with a road structure has been completed before starting the embankment part for the tramways, b) a short construction time: the existing tram line has been closed for only 12 weeks and the applied design methodology enabled the completion exactly as planned. Previously considered conventional construction methodology would endure a year. All in all, this project contributed to improving the

methodology for designing road and tramway embankments and the Netherlands gained a unique engineering solution.

Key words: *light-weight embankments, EPS blocks, road widening, landslides solution*

EVALUATION OF ANALYTICAL TOOLS USED FOR THE OPERATIONAL ANALYSIS OF ROUNDABOUTS

Goran Nikolic P.Eng., Ontario Ministry of Transportation, **Rob Pringle P.Eng.**, MMM Group Ltd., **Kevin Bragg**, INRO, Canada

Abstract: Roundabouts have long been a staple as an intersection configuration in the United Kingdom and elsewhere in Europe. Although they have been present in limited numbers in North America, they have only recently been a subject of interest in Ontario. Roundabouts can provide increased safety and reduced delay to road users under suitable circumstances. The Ontario Ministry of Transportation has initiated a variety of activities aimed at the investigation of roundabouts as an alternative to signalized intersections in appropriate locations. One such activity is the selection of a suitable method or methods for evaluating the operational performance of roundabouts. A variety of methods are available, ranging from analytical/empirical to simulation.

This paper reports on initial investigations to compare the efficacy of six methods, based on their performance with respect to level-of-service evaluation at several case-study roundabouts. It was apparent that all methods reasonably estimated delay at lower volume levels. Unfortunately, the available data did not cover situations close to or at capacity levels sufficiently well to arrive at a definitive conclusion under those conditions. However, it was apparent that the results from the various methods demonstrated increasing variability with increasing traffic levels. Based on the evaluation reported here, a provisional strategy has been proposed for the operational evaluation of roundabouts in Ontario. However, further evaluation is required in conjunction with additional data collection under congested conditions to confirm the proposed strategy.

Keywords: *roundabouts, capacity, operational analysis methods*

EXPRESSWAY SINGLE-LANE WORK ZONE CAPACITIES WITH COMMERCIAL VEHICLE IMPACTS

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Abstract: Like other government transportation agencies, the Ontario Ministry of Transportation performs regular maintenance and reconstruction of freeways across the province. If lane closures are required for this maintenance, they have to occur during a window of time in which travel demand is below the capacity of the remaining open lanes. To date, the estimates of capacity for single-lane work zones have been based on relatively simplistic planning assumptions. The impact of heavy vehicles has not generally been considered and it has been observed that overnight construction windows defined on the basis of these assumptions are often subject to significant queuing and delays.

In an attempt to understand work zone capacity, data was collected at seven work zones in the Greater Toronto Area during the fall of 2008. Analysis of this data indicated a wide and unexplained variation in the capacities achieved at the surveyed locations. It was hypothesized that the orderliness of the merging behaviour may be an important factor in the explanation of this variation, particularly the distance upstream from the lane drop location at which the vehicles in the dropping lane merge into the through lane. Using micro-simulation, the effects of different merging processes were evaluated and simulation outputs corresponding to the observed data were achieved.

It was observed that there appear to be two operational regimes, one with higher throughputs corresponding to early merging and relatively smooth operation in the remaining open lane. The second, with lower throughputs, involved late merging and interrupted flow in the open lane. These results are preliminary and would benefit from additional data collection and analysis oriented to the evaluation of this particular phenomenon.

Key words: *work zone, freeway capacity, heavy vehicles*

PLANNING AND IMPLEMENTING A FULL CLOSURE OF THE HIGHWAY 401 EXPRESS LANES WITH THE HELP OF MICRO-SIMULATION

Goran Nikolic P.Eng., Ontario Ministry of Transportation, Canada, **Rob Pringle P.Eng.**, MMM Group Ltd., Canada,

Abstract: Highway 401, through the Greater Toronto Area, is one of the busiest stretches of expressway in North America, with more than 400,000 vehicles per day. In addition to serving commuting flows across the Greater Toronto Area, Highway 401

serves as the primary corridor for passenger and commercial traffic between Quebec and Windsor and points beyond.

In 2003, the Ministry of Transportation of Ontario (MTO) investigated the possibility of closing the eastbound Highway 401 express lanes, between Kipling Avenue and Jane Street, for two weekends in 2004 to rehabilitate the road base. Such a closure would have previously been considered too risky in terms of the impact on traffic flow. However, the alternative construction schedule would involve approximately 70 overnight closures and an additional cost of $1.5 million. A micro-simulation model (VISSIM) was used to assist in the assessment of traffic impacts and the development of a traffic management strategy to keep traffic moving on the collector lanes through the work-zone area.

Through micro-simulation, it was demonstrated that the proposed closure was feasible, assuming a combination of a comprehensive public communications plan, selected on and off-ramp closures, an incident management plan, and reduction in traffic levels of 20 to 25% through diversion. Simulated conditions, during peak weekend traffic periods with the closure in place, were projected to be equivalent to or better than typical weekday morning peak-period conditions.

The closure was implemented on the third and fourth weekends of August, 2004. Observed traffic conditions were essentially as predicted, with operation falling in between typical weekend and weekday peak conditions. The projected level of diversion was achieved, traffic was kept moving, and only minor incidents, quickly cleared, were recorded. The construction work was completed on time and met all standards and specifications.

Key words: *highway construction impacts, micro-simulation, traffic operations*

"NOVA" TEHNOLOGIJA GRADNJE NOSIVIH SPREGNUTIH GRAĐEVINA ČELIČNIM SPIRALNIM CIJEVIMA I KONSTRUKCIJAMA OD VALOVITIH LIMOVA U GRADNJI PROMETNICA

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Rezime: Primjena čeličnog valovitog lima u gradnji prometnica poznata je više od 100 godina. Prve takve ploče proizvedene su 1784. godine, dok je njihova masovna proizvodnja započela tek 1890. godine. Kako bi se svladali sve veći rasponi i omogućili veći protoci, 1931. godine prvi se puta koriste konstrukcije od valovitog lima koje su spajane na mjestu ugradnje. Čelični propusti se često izrađuju u zemljama s razvijenom čeličnom industrijom i skupom radnom snagom.
Usporedbom čeličnih spiralnih cijevi HelCor®, promjera do 3,6 m, čeličnih konstrukcija tipa MultiPlate MP200, raspona do 12,00m i SuperCor®, raspona do 25,50 m, sa konvencionalnim betonskim za jednaku statičku nosivost, čelični pokazuju brojne

prednosti. Sve gore navedene prednosti će rezultirati njihovom intenzivnijom primjenom u projektiranju i izgradnji infrastrukture i u našem okruženju, to jest na području jugoistočne Europe (SEE).

ISPITIVANJE NOSIVOSTI MANEVARSKIH POVRŠINA NA AERODROMU PODGORICA – PRORAČUN PCN-a

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Rezime: Aerodrom u Podgorici je deo primarne saobraćajne infrastrukture Crne Gore i predstavlja objekat od izuzetnog privrednog značaja, posebno u domenu turističke ponude. U cilju dobijanja jasnije slike o funkcionalnom i strukturnom kapacitetu u odnosu na očekivano saobraćajno opterećenje izvršeno je ispitivanje da bi se utvrdilo stanje kolovozne konstrukcije manevarskih površina aerodroma. Ovaj rad je napisan sa ciljem da se stručna javnost na konkretnom primeru upozna sa metodom determinisanja relativne nosivosti kolovozne konstrukcije aerodromskih manevarskih površina - proračun PCN broja.

Ključne reči: *PCN broj, relativna nosivost, kolovozna konstrukcija, manevarske površine*

IZRADA FIZIČKIH MODELA PUTNOG POJASA METODOM 3D ŠTAMPE

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Rezime: Iako su polovinom prošlog veka makete puteva predstavljale osnovni medijum ne samo za vizuelne, etsetske, pa i bezbednosne analize trasa puteva, pojavom računarskih 3D modela one, makete, iščezavaju iz projektantske prakse. Računarski triangulisani 3D modeli putnog pojasa predstavljaju dobru osnovu za izradu triangulisanih STL (stereolitografskih) modela. Ovi se modeli lako “štampaju” na 3D printerima, čak i u koloru. Međutim, u odnosu na uobičajene triangulisane modele, STL model počiva na strogim pravilima u pogledu orijentacije trouglova, zatvorenosti modela i eventualnih grešaka. Takođe, zbog veoma visokih cena ne samo 3D printera, već i materijala za 3D štampu, neophodno je i uvođenje metoda optimizacije modela kojima se utrošak materijala smanjuje za 5, 6 ili 7 puta. I sam proces 3D štampe nameće neke zanatske normative kako bi maketa uopšte bila izvodljiva, stabilna i trajna. Rad prikazuje metode STL koverzije i optimizacije modela putnog pojasa sa ciljem 3D štampe.

Ključne reči: *CAD, 3D, STL, maketa*

PRODUCING ROADWAY MAQUETTES ON 3D PRINTERS

Abstract: By mid twentieth century, physical 3D models (maquettes) provided the only means for the optical, aesthetic and safety analyses of the road. With the computer revolution, taking place by the end of the eighties, maquettes became completely outdated. But, in recent times, triangulated 3D computer models present the sound base for the production of triangulated STL (stereolitographic) models. These 3D models are easily printed on 3D printers, even in color. But, unlike ordinary CAD models, STL models must obey strict rules, primarily concerning the triangles' orientation and the "water-tightness". Also, bearing in mind the extremely high costs of both the 3D printers and the printing materials, optimization methods, reducing the material consumption 5, 6, or even 7 times, have to be introduced. In order to produce the printable, stable and durable macquette, even the sole printing process imposes some "secrets of the craft". The paper explains how to convert the ordinary triangulated roadway model into the STL model and how to optimize the model.

Key words: *CAD, 3D, STL, maquette*

GEOTEHNIČKO PROJEKTOVANJE ZEMLJANIH NASIPA I STABILIZACIONIH MERA PROCESA KLIZANJA PRILIKOM IZGRADNJE KORIDORA 10 NA DEONICI: PROSEK - CRVENA REKA

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Rezime: Putevi su izrazito dugački infrastrukturni objekti, pa su osnovni preduslovi za izradu dobrog projekta precizni geodetski snimci, i kvalitetna geološka i geotehnička istraženost terena. Nažalost kada se putevi projektu u nepristupačnim terenima i u teškim geološko - geotehničkim uslovima, navedeni preduslovi se ne mogu u potpunosti i u potrebnom kvalitetu ispuniti. Za stvarnu težinu geotehničkih uslova se saznaje tek pri izvođenju, a posledice su izraženi procesi nestabilnosti, uticaj podzemne vode i naravno potreba za dopunskim projektovanjem.
U radu je opisano projektovanje armiranih nasipa u cilju njihove optimizacije, i stabilizacionih mera nastalih procesa klizanja useka tokom izgradnje, sa ciljem da se skrene pažnja na princip pratećeg projektovanja (monitoring projektovanje) za kvalitetno i sigurno izvođenje i prilogođavanje stvarnim uslovima u tlu.

Ključne reči: *putevi, geotehnička istraženost, armirani nasipi, useci, stabilizacione mere, prateće projektovanje*

GEOTECHNICAL DESIGN OF REINFORCED EMBANKMENTS AND STABILIZATION MEASURES FOR LANDSLIDING PROCESS DURING THE CONSTRUCTION OF CORRIDOR X AT SECTION: PROSEK – CRVENA REKA

Abstract: Given that motorways are particularly long infrastructural objects, accurate geodetic surveys and quality geological and geotechnical site investigations are required for development of good road design. Unfortunately, in rough terrain and in difficult geological - geotechnical circumstances, these preconditions are hard to achieve. The actual geotechnical conditions can be identified during construction stage, which results in emphasized instabilities, impact of water, and the need for additional design.
This paper describes the design of reinforced (soils) embankments in order to ensure their optimization. Furhter on, the design of stabilization measures of the unstable cuts occurred during the construction are described. All described measures hihglight the importance of the accompanying design concept (monitoring design) for quality and safe construction, and for adaptation to the actual soil conditions.

Key words: *roads, geotechnical investigations, reinfor.embankment, cuts, stabilization measures, accompanying design*

ULOGA SEKRETARIJATA ZA SAOBRAĆAJ U POSTUPKU PLANIRANJA I PROJEKTOVANJA ULIČNE MREŽE GRADA BEOGRADA

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Rezime: Ubrzan, nedovoljno planski, razvoj Beograda, u prostornom i funkcionalnom smislu, doveo je do nesklada između saobraćajnih kapaciteta i potreba gradskih funkcija. U skladu sa tim neophodan je adekvatan planski razvoj grada. U ovom radu prikazana je uloga i iskustvo Sekretarijata za saobraćaj, u procesu planiranja i projektovanja ulične mreže grada. Sistematizacijom više normativnih dokumenata, odnosno odgovarajućih zakona i pravilnika iz oblasti planiranja, projektovanja, izgradnje, bezbednosti saobraćaja, ali i stručnim znanjem i iskustvom stečenim u praksi, Sekretarijat za saobraćaj učestvuje u planiranju grada kao celine, kao i definisanju konkretnih saobraćajno – tehničkih rešenja. Adekvatno definisana i dosledna primena tehničke regulative, na svim nivoima planiranja, projektovanja i izgradnje ulične mreže, dovela bi do poboljšanja stanja saobraćajnog sistema grada, odnosno sprečilo bi dalju izgradnju saobraćajnica koje svojim eksploatacionim mogućnostima nezadovoljavaju osnovne saobraćajno-tehničke uslove.

Ključne reči: *planska dokumentacija, tehnička regulativa, saobraćajno – tehnički uslovi, iskustva, Gradska uprava grada Beograda - Sekretarijat za saobraćaj*

THE ROLE OF THE SECRETARIAT FOR TRANSPORT IN THE PLANNING AND DESIGNING OF THE STREET NETWORK IN THE CITY OF BELGRADE

Abstract: The rapid, insufficient planning, development of Belgrade, both in the spatial and functional terms, led to a mismatch between traffic capacity and needs of urban functions. Accordingly, it is necessary to adequately planning the development of the city. This paper describes the role and experience of the Secretariat of Transport in the planning and designing of the street network of the city. Secretariat for Transport participate in the planning of the city by systematization of normative documents, and relevant laws and regulations in the field of planning, designing, construction, conducting traffic safety researches, but also with the expertise and experience gained in practice and by defining specific traffic - technical solutions. Adequately defined and consistent application of technical regulations, at all levels of planning, both equally design and construction of the street network, would lead to the improvement of the transport system of the city, and to prevent further construction of streets that do not meet basic traffic and technical requirements.

Key words: *plans, technical regulations, traffic and technical requirements, experience, Belgrade City Administration - Secretariat for Transport*

SISTEM VOZAČ - VOZILO - OKOLINA I SAVREMENO PROJEKTOVANJE PUTEVA

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Rezime: Velike materijalne štete i veliki broj ljudskih žrtava, učinili su da bezbednost saobraćaja postane jedan od najaktuelnijih problema društva u kojem živimo. Od svih činilaca koji mogu uticati i koji, u krajnjoj liniji, utiču na bezbednost u celini, izdvajaju se tri činioca: vozač, vozilo i okolina. Dejstvo ova tri činioca (V-V-O) je uzajamno povezano, tako da vozač, vozilo i okolina čine kibernetički sistem u kojem svaki činilac ima svoju jasno definisanu ulogu. Većina informacija koja dopire do vozača iz sistema V-V-O stiže prvo vizuelnim putem, pri čemu najveći uticaj na vozačevo ponašanje pri upravljanju vozilom ima upravo put. Kao jedan od glavnih problema u savremenom projektovanju puteva izdvaja se zahtev kako projektovati put koji će u potpunosti biti podređen načinu vožnje na tom putu. U ovom radu će se razmatrati moguće izmene u procesu projektovanja koje bi obezbedile projektovanje puteva po meri vozača.

Ključne reči: *bezbednost, vozač, vozilo, okolina, put, projektovanje*

THE DRIVER - VEHICLE - ENVIRONMENT SYSTEM AND MODERN ROAD DESIGN

Abstract: Considerable material damage and large number of casualties have made the road safety to become one of the most current problems of our society. From all the factors that can influence and that, in the end, affect the road safety in general,

three factors stand out: driver, vehicle and environment. The effect of these three factors (D-V-E) is related to each other, so that the driver, the vehicle and the environment form cybernetic system in which each factor has a clearly defined role. Majority of information of the D-V-E system are firstly visually reached by drivers, wherein the driver's behaviour during vehicle driving is the most affected just by road. As one of the major problems in the modern road designs stands a request to design the future road which will be fully subordinated to the driving style, meaning how to design a road in accordance with the driver. This paper will present the possible changes in road design process that could provide the road design according with the driver.

Key words: *safety, driver, vehicle, environment, road, design*

GEOTEHNIČKI ASPEKTI ISTRAŽIVANJA I PROJEKTOVANJA AUTOPUTA BEOGRAD-JUŽNI JADRAN (E-763), OD OSTRUŽNICE DO OBRENOVCA, DESNOM OBALOM SAVE

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Rezime: Na izlazu iz Beograda, od Ostružnice do Obrenovca, Generalnim i Idejnim projektom (Institut za puteve 1998 - 2008 god.), autoput Beograd – Južni Jadran (E-763), nožice klizišta Umka – Duboko, dužine 3 km. Nakon vrlo detaljnih geološko-geotehničkih i drugih istraživanja i je lociran desnom obalom reke Save, u temenu rečnog meandra, monitoringa, utvrđena su svojstva klizišta i vodotoka a na osnovu čega su nađena sanaciona rešenja koja obezbeđuju u zoni stabilnost autoputa i okolnog ugroženog terena, na kome su infrastrukturni, stambeni i drugi objekti.

Ključne reči: *autoput, klizište, istraživanja, monitoring, reka, sanacija*

GEOTECHNICAL ASPECTS OF INVESTIGATIONS AND DESIGN OF MOTORWAY ASPEKTI BELGRADE - SOUTH ADRAITIC (E-763) FROM OSTRUŽNICA TO OBRENOVAC , ALONG THE RIGHT BANK OF THE RIVER SAVA

Abstract: In the Final and Preliminary design (prepared by The Highway in the period 1998-2008) Institute motorway Belgrade-South Adriatic (E 76) , from Ostruznica to Obrenovac , is situated at the exit from Belgrade ,along the right bank of the river Sava at the vertex of river meander in the toe zone of the landslide Umka –Duboko, 3 km long. After very detailed geological-geotechnical and other investigations and monitoring , characteristics of landslide and water course were determined and based on them repair solutions which provide stability of motorway and surrounding jeopardized terrain with residential and other structures, were found out.

Key words: *motorway, landslide, investigations, monitoring, river, repair*

PRORAČUN DEBLJINE BETONSKIH KOLOVOZNIH KONSTRUKCIJA ARMIRANIH VLAKNIMA

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Rezime: Primena betonskih kolovoznih konstrukcija armiranih vlaknima je sve rasprostranjenija. Primenom odgovarajućih vlakana može se značajno povećati izdržljivost betona, a postoji doprinos i u povećanju trajnosti kao i otpornosti na habanje, udare i zamor. Povećanjem žilavosti moguće je redukovati debljinu betonskog preseka i povećati rastojanje između dilatacija. U radu je prikazan savremeni način proračuna i dimenzinisanja betonskih kolovoznih konstrukcija armiranih vlaknima zasnovan na ostvarenoj izdržljivosti kompozitnog materijala. Poseban akcenat je dat na izbor vrste i tipa vlakana prema njihovoj funkciji u finalnom betonskom konglomeratu, uz objašnjenje relavantanih parametara kojima se definiše mehaničko svojstvo betonskog kompozita. Dat je i osvrt na druge vrste betonskih kolovoznih konstrukcija. Prezentovani model proračuna je opšte prihvaćen u svetskoj praksi i može biti od koristi u praktičnoj primeni u domaćoj praksi, kako projektantima tako i izvođačima specijalizovanim za ovakve tipove konstrukcija.

Ključne reči: *kolovozne konstrukcije, armiranje kolovoza, vlakna, izdržljivost, zamor*

Abstract: The application of fiber reinforced concrete pavement is constantly expanding. Applying appropriate fiber type could result with concrete higher strength, also with increased lifetime and resistance to abrasion, impact and fatigue. Higher toughness may reduce concrete pavement thickness and increase joint spacing. The paper describes modern design of fiber reinforced concrete pavements based on achieved toughness of composite material. Special reference is made on chose of type and class of fibers according their function in final concrete conglomerate with description of relevant mechanical parameters of concrete composite. Reference is made on other types of concrete pavements. Presented design model is generally accepted in world practice and it could be helpful for domestic projects, as for designers as well for contractors specialized for pavement constructions.

Key words: *concrete pavements, pavement reinforcement, fiber, toughness, fatigue*

PUTEVI I RIZICI PROUZROKOVANI POPLAVAMA

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Rezime: Analiza žrtava zbog poplava u Sloveniji je pokazala izuzetnu važnost zaštite učesnika u saobraćaju. Sve više je smrtnih slučajeva među vozačima zbog vožnje po putu zahvaćenim poplavom. Vrlo brzo, vozilo na poplavljenom putu počinje da pluta i

voda ga nosi sa sobom. Vozilo polako tone sa katastrofalnim posljedicama za vozača i putnike u vozilu. Tako učesnici u saobraćaju predstavljaju 62 % žrtava prilikom poplava u SAD-u. Analiza uticaja klimatskih promjena na poplave, urađena za sliv reke Save, je pokazala da će poplave sa stogodišnjim povratnim periodom postati ubuduće poplave sa desetogodišnjim povratnim periodom. Poplavljena područja retkih poplava postaće područja sa čestim poplavama. Ova pojava predstavlja izazov i zahtijeva promjenu postojećih rešenja zaštite pri gradnji puteva i mostova. Naime pri pojavi katastrofalnih poplava, ruši se ili oštećuje veliki broj mostova. Mostovi su takođe jedan od uzroka plavljenja područja uzvodno od mosta. U radu su prikazani rezultati više studija izvedenih u okviru projekata Evropske unije i drugih istraživanja.

Ključne reči: *žrtve poplava, putevi, klimatske promene, mostovi, štete od poplava na putevima*

Abstract: The research into the fatalities during floods in Slovenia has pointed out to the utmost importance of traffic. Indeed, there is a growing number of fatalities among the drivers who are willing to drive their vehicles across a flooded road surface. However, the vehicle quickly turns into a vessel that slowly sinks, with catastrophic consequences for the driver. For example, in the USA 62% of fatalities, i.e. drivers and passengers, are caught in flooded roads. When assessing climate change impacts in relation to the floods in the Sava River basin, we found that in the future the 100-year return period events will become 10-year events. What is today considered as low flood risk areas will in the future become high flood risk areas. This phenomenon presents a challenge and calls for a change in the existing practice. Furthermore, contemporary water management calls for more room for water and higher flood safety for roads and bridges. In fact, during catastrophic floods bridges are often torn down or damaged. Bridges are also the cause of floods in the areas upstream the bridge. The paper will also present the results of several studies carried out within EU projects and other research.

PROJEKTOVANJE PRETHODNE MEŠAVINE ZA POTREBE IZRADE CEMENTOM STABILIZOVANOG DONJEG NOSEĆEG SLOJA NA AUTOPUTU E80 NIŠ – DIMITROVGRAD

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Rezime: U radu su data iskustva sa upotrebom cementa klase 32,5 i hidrauličnog veziva za puteve HRB 12,5 pri projektovanju prethodnog sastava cementom stabilizovane mešavine za ugradnju u noseći sloj kolovozne konstrukcije na autoputu E80 Niš - Dimitrovgrad. Urađena su ispitivanja koja su pokazala da se zahtevi za čvrstoćom propisani u Tehničkim uslovima, uz obezbedjenje homogenosti mešavine, mogu postići samo upotrebom veziva HRB 12.5. Ovo vezivo čini stabilizovani sloj manje osetljivim na pojavu pukotina tokom njegove hidratacije i očvršćavanja i samim tim sprečava njihovu pojavu u gornjim slojevima kolovozne konstrukcije.

Ključne reči: *cementna stabilizacija, stabilizovana mešavina, HRB 12,5, vezivo za stabilizaciju nosećeg sloja kolovoza*

Abstract: In this paper we presented experiences based on using cement class 32.5 and hydraulic road binder HRB 12.5 in designing preliminary mix design of cement/binder stabilized mixture for the placement in sub-base layer of pavement in the highway E80 Niš - Dimitrovgrad. Performed testing has shown that the strength requirements set out in the Technical Specifications, with provided homogeneous mixture, can only be achieved by using binder HRB 12.5. This binder makes stabilized layer less sensitive to cracking during its hydration and hardening and thus prevents cracking in the upper layers of the pavement.

SPECIFIKE PROJEKTOVANJA PUTA GRADSKO-PRILEP (R. MAKEDONIJA)

Riste Ristov, Prostor AD, Kumanovo, R. Makedonija, **Goran Đorđević**, Prostor AD, Kumanovo, **Tereza Teodosijevska**, Prostor AD, Kumanovo, **Jovan Br. Papić**, Univerzitet „Sv.Kiril i Metodij“, Građevinski fakultet, **Slobodan Ognjenović**, Univerzitet „Sv.Kiril i Metodij“, Građevinski fakultet, Skoplje, R. Makedonija

Rezime: Jedan od najfrekventnijih putnih pravaca po osi istok-zapad u R. Makedoniji je put Gradsko-Prilep. Duž njega postoji nekoliko težih sektora koji veoma otežavaju saobraćaj, zbog čega je pristupljeno izradi projektne dokumentacije za njegovu rekonstrukciju, ali za dve faze. Naime, planirano je da se u prvoj fazi put projektuje i koristi kao ekspresni, dok bi dalje prerastao u autoput. Deonica započinje sa denivelisanim povezivanjem sa postojećim putem, nastavlja se duž reke Raec kroz Farišku i Drenovsku klisuru, i završava sa petljom Gradsko. Teren kroz koji je vođena trasa odlikuje se izrazitom neravnomernošću, pa se može klasifikovati od izrazito planinskog do ravničarskog, a dodatni ograničavajući faktor je blizina postojećeg puta i uslov da isti bude u upotrebu. Diktirana projektna brzina od 100 km/h navodi na ispruženiju osovinu puta u horizontalnom i vertikalnom smislu što iznuđuje zamašan broj pridružnih građevinskih objekata na trupu puta. Pristup i način projektovanja objekata i petlji po celoj dužini trase biće prikazani u radu.

Ključne reči: *put, projekat, rekonstrukcija, objekti, petlje*

Abstract: Gradsko-Prilep is one of the most frequent roads in R. Macedonia. Along the road there are several sections that pose serious obstacles for regular traffic flow in this central state road along east-west axis. Thus, it was necessary to prepare project documentation for its improvement, but in two phases. Namely, it is planned to design and build the road as an express one in the first phase, while in the second it will be expanded into highway. The planned section starts with deleveled connection with existing road and continues along the River Raec through canyons of Farishka and Drenovska rivers, ending with deleveled Gradsko interchange. The route ground is generally variable and extremely irregular. It can be classified as lowland to explicitly mountain terrain. Additional limitation is the proximity of the existing road and the

condition that it should be in service. The projected speed of 100 km/h requires a wider horizontal and vertical centre line, demanding numerous supporting structures on the body of the road. This paper presents the approach and method of designing along the entire route."

AUTOPUT BAR – BOLJARE, DIONICA SMOKOVAC – MATEŠEVO, OSNOVNE KARAKTERISTIKE I OPREDJELJENJA

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Rezime: Projekat autoputa Bar – Boljare predstavlja najvažniji prioritet Vlade Crne Gore i jedan je od elemenata naše integracione strategije prema Evropskoj Uniji, koji će omogućiti veću i sigurniju mobilnost ljudi, roba i usluga. Autoput treba da poveže Crnu Goru, od jadranske obale preko glavnog grada Podgorice sa granicom Srbije, a preko Požega-Beograd puta sa TEN-T koridorom X sa Rumunijom i Centralnom Evropom. Istovremeno će bolje povezati glavne regionalne centre Sarajevo (Bosna i Hercegovina), Tirana (Albanija) i Skoplje (Makedonija). Navedene činjenice predstavljaju neke od razloga zbog kojih ovaj projekat ima važnu stratešku ulogu za cijeli Region.

Ključne reči: *autoput, trasa, Smokovac, Mateševo*

HIGHWAY BAR – BOLJARE, SECTION SMOKOVAC – MATESEVO, MAIN CHARACTERISTICS AND ORIENTATIONS

Abstract: The project highway Bar - Boljare is the most important priority of the Government of Montenegro and one of the elements of our integration strategy towards the European Union, which will enable greater and safer mobility of people, goods and services. The highway should connect Montenegro from the Adriatic coast across the capital Podgorica to the border of Serbia and over Pozega- Belgrade roud with TEN-T Corridor X with Romania and Central Europe. At the same time, it will make better connection between major regional centers in Sarajevo (Bosnia and Herzegovina), Tirana (Albania) and Skopje (Macedonia). These facts represent some of the reasons why this project has an important strategic role for the whole region.

Key words: h*ighway, route, Smokovac, Matesevo*

PRIKUPLJANJE OTICAJA SA MOSTA "GAZELA", NJEGOVO PREČIŠĆAVANJE I INFILTRACIJA

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Rezime: U radu se prikazuje odvođenje kišnih voda sa kolovoza na mostu Gazela preko reke Save u Beogradu, kao i sa prilaznih rampi. Most je sagrađen 1970. godine bez sistema za kanalisanje kišnih voda osim slivnika koji su vodu direktno ispuštali sa mosta u vodotok. Tokom 2010-2012. godine most je rekonstruisan uz dogradnju sistema za kanalisanje i prečišćavanje kišnih voda. Ograničenja i uslovi postavljeni za količine i kvalitet oticaja su strogi jer se most nalazi u zoni sanitarne zaštite Beogradskog vodovoda. Oticaj kišnih voda sa mosta se prikuplja i delimično ispušta pre nego što se koristi za infiltraciju i prihranjivanje akvifera pri obali reke Save.

Ključne reči: *kišne vode, oticaj, odvodnjavanje, most, prečišćavanje, infiltracija*

COLLECTION, TREATMENT AND INFILTRATION OF STORM RUNOFF FROM THE GAZELA BRIDGE

Abstract: The paper presents the storm water drainage from the pavement and the on- and off-ramps of the Gazela bridge over the Sava River in Belgrade. The bridge was constructed in 1970 without a storm drainage system, except for the inlets from which the storm water was discharged from the bridge directly to the river. During 2010-2012, the bridge was reconstructed including the construction of the storm drainage and treatment system. Limitations and requirements that were imposed for the storm water quantity and quality were severe because the bridge crosses the sanitary protection zone of the Belgrade water supply system. The storm runoff from the bridge is collected and partially discharged before it is used for infiltration and aquifer recharge in the Sava River bank.

Key words: *storm water, runoff, drainage, bridge, treatment, infiltration*

PODOBNOST PRIMENE OSNOVNIH METODOLOŠKIH POSTUPAKA U ANALIZI USLOVA ODVIJANJA SAOBRAĆAJA NA VANGRADSKIM DEONICAMA PUTEVA

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Rezime: Utvrđivanje sposobnosti deonica vangradskih puteva da udovolje zahtevima saobraćaja podrazumeva analizu kapaciteta i nivoa usluge. To je neophodan korak u postupcima planske i operativne analize prilikom izgradnje ili rekonstrukcije puteva. Tokom istorije razvijani su različiti modeli za proračun kapaciteta puteva, koji su modifikovani i prilagođavani promena karakteristika saobraćajnog toka. U skladu sa promenama postupaka za proračun kapaciteta, menjani su kriterijumi i parametri na

osnovu kojih se određuje nivo usluge. U svetu se za određivanje kapaciteta i nivoa usluge najčešće koristi metod HCM, koji je od 65 god. do danas doživeo velike promene i transformacije. U našoj zemlji i regionu je od 80-tih godina prošlog veka u postupcima analize korišćen model koji se bazirao na preporukama HCM, ali koji je bio modifikovan i prilagođen lokalnim uslovima. U ovom radu analizirana je podobnost primene ovih metodoloških postupka u različitim uslovima odvijanja saobraćaja.

Ključne reči: *put, kapacitet, nivo usluge*

ELIGIBILITY OF APPLICATION OF THE BASIC METHODOLOGICAL PROCEDURES FOR THE ANALYSIS OF TRAFFIC CONDITIONS AT RURAL ROAD SECTIONS

Abstract: Determining the abilities of rural roads to fulfill the traffic demands involves the analysis of the capacity and level of service. This is a necessary step in the procedures of planning and operational analyses during the construction or reconstruction of roads. Throughout history, different models have been developed for the calculation of the road capacity, which have been modified to the changes of the traffic flow characteristics. In accordance with changes in the procedures for capacity calculation, criteria and parameters for determination of the level of service was changed. Most common method for determination of the capacity and level of service is HCM method, which has experienced very big changes and transformations since his first edition in 1965. Since 80's years of the last century model for capacity analysis of the roads in our country and the region was based on the recommendations of HCM, but it was adjusted to the local conditions. This paper analyzes the suitability of the application of these methodological procedures in various traffic conditions.

Keywords: *road, capacity, level of service*

LAND SURVEY OF ROADS FROM UNMANNED AERIAL VEHICLE

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Summary: In this paper we present, how we use a quadrocopter unmanned aerial vehicle with a camera attached to it, to do low altitude photogrammetric land survey of roads. We use the quadrocopter to take highly overlapping photos of the area of interest. Ground control points are used to georeference the data. Further processing is applied to generate digital orthophoto map, digital surface model, digital terrain models and point cloud. Practical example of land survey of road from a UAV is presented in the paper. Further examples show the usefulness of low altitude photogrammetry for documentation of archaeological excavations and assessment of volumes of material. In the final analysis we conclude that low altitude photogrammetry can help bridge the gap between laser scanning and classic tachymetric survey, since it offers advantages of both techniques.

Key words: *unmanned aerial vehicles, three-dimensional, pointcloud, orthophoto, digital terrain model*

Стратегија развоја путног транспортног система

Road Transport System: Development Strategy

2

PRILOG ISTRAŽIVANJU METODOLOGIJE ZA IZRADU STRATEGIJE RAZVOJA, ODRŽAVANJA I REHABILITACIJE CESTA

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Rezime: Oblikovanje strategije rezvoja, održavanja i rehabilitacije cesta zahtjeva sposobnost prepoznavanja dinamike saobraćajnog i društvenog sistema. U okviru rada analizirane su bitne konponente metodlogije izrade strategije kao što su baze podataka, finansiranje, prekategorizacija i društveno - ekonomski pokazatelji. U radu su tretirana i pitanja SWOT analize, ciljeva razvoja saobraćaja, izbor kriterija za višekriterijalno vrednovanje i izbor prioriteta intervencija. Istraženi su kriteriji za održavanje cesta i načela održavanja kao i kriteriji za realizaciju strategije, te akcioni planovi i elementi monitoringa. U zaključcima se daju ključna načela i elementi strategije razvoja, održavanja i rehabilitacije cesta.

Ključne reči: *strategija, razvoj, ceste, održavanje, rehabilitacija*

ANNEX TO THE RESEARCH OF METHODOLOGY FOR DRAFTING STRATEGY OF DEVELOPMENT, MAINTENANCE AND REHABILITATION OF ROADS

Abstract: Drafting strategy of development, maintenance and rehabilitation of roads requires ability to identify dynamics of traffic and social system. The research includes analysis of major components of the methodology for drafting strategy such as databases, financing, pre-categorization and social and economic indicators. It also includes SWOT analysis, objectives of traffic development, selection of criteria for multi-criteria valuation and selection of intervention priorities.The criteria for road maintenance and principles of maintenance as well as the criteria for strategy implementation, action plans and monitoring elements have been analysed as well. Key principles as well as elements of the strategy of development, maintenance and rehabilitation of roads are given in conclusions of the paper.

Key words: *strategy, development, roads, maintenance, rehabilitation*

THE SAFE ROAD TRANSPORT SYSTEM APPROACH

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Abstract: More than 1,24 million people die each year on the worlds roads and between 20 to 50 million suffer from nonfatal injuries. The UN Road Safety Collaboration Meetings under the leadership of WHO developed the Programme for the Decade of Actions for road safety taking nations into the responsibility of improving their accident figures by the five pillars of a national Road Safety Policy, safer Roads,

safer Vehicles, safer Road Users and Post Crash Care. It is this Safe System Approach that takes into consideration the land use, infrastructure and transport planning, road user's abilities and limitations and the close cooperation of all governmental and none governmental stakeholders involved. The contribution will present the main activities of the fife pillars with a focus on PIARC´s Road Infrastructure Management tools to improve safety and function of the road infrastructure based on the experiences with the land use problems in Asian, African and European countries. The report will show how actions of short and long term measures on all five pillars have reduced the number of traffic victims remarkable in Eastern Germany after reunification and in addition how the hierarchy of motorways, 2+1 express roads, the rural roads and traffic calming in built up areas, have improved the economic development of cities and villages in a safe way

Key words: *UN Global Plan for Road Safety, PIARC tools for Road Infrastructure Safety Management, Legal regulations on safer roads, the positive effects of the 2+1 cross section within the road Hierarch*y

S PROMENOM UZORAKA UREĐENJA PROSTORA DO RAZVOJA ODRŽIVE MOBILNOSTI: SAZNANJA IZ PROJEKTA MORECO

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Rezime: Rad predstavlja rezultate međunarodnog projekta MORECO - mobilnost i troškovi stanovanja - u kojem kao partner učestvuje Urbanistički institut Republike Slovenije i koji se sprovodi u okviru evropskog programa Alpine Space. Projekat se bavi objašnjavanjem veza između mogućih budućih mesta stanovanja, mobilnostnog ponašanja i pristupačnosti. Pri tome daje poseban naglasak posledicama koje nekontrolisano širenje naselja uzrokuje uslugama javnog prevoza. Zagovara održivi, resursima i životnoj sredini adekvatan razvoj naselja koji prati objekte usluga od opšteg interesa i smerove linija javnog prevoza. Suštinski cilj projekta je promovisanje održive mobilnosti kroz razvoj policentričnog sistema naselja, glavni operativni cilj je promovisanje implementacije lokacijskih odluka privatnih i javnih aktera na lokacijama koje se nalaze u blizini stanica javnog prevoza. U cilju podizanja svesti različitih skupina, zainteresovanih strana i opšte javnosti, projekat MORECO razvio je tri "oruđa", jedno opisno za kreatore politika i donosioce odluka i dva računarska: oruđe za prostorne planere i oruđe za domaćinstva.

Ključne reči: *stanovanje, pristupačnost, održiva mobilnost, MORECO projekat*

ACHIEVING SUSTAINABLE MOBILITY AND REDUCED TRANSPORT COSTS BY CHANGING THE PATTERNS OF SPATIAL ORGANIZATION: FINDINGS OF THE MORECO PROJECT

Abstract: The paper presents the results of a project entitled MORECO – Mobility and Residential Costs – in which Urban Planning Institute of the Republic of Slovenia

participates as a partner. The project is cofinanced by the EU transnational territorial cooperation programme for the Alpine Space. It is dealing with the correlation between future housing locations, mobility behaviour and accessibility, especially the consequences for public transport. MORECO's main objective is to support a sustainable, resource-friendly settlement development which follows supply facilities and public transport axes. MORECO wants to steer future housing markets towards smart locations that offer a good quality of supply to minimise future mobility costs. In order to raise awareness of different groups, stakeholders and the general public, three "tools" were developed. One is descriptive and aimed at political decision-makers and those in administration who execute the decisions, particularly on the municipal level, the other two are computer-based: tool for urban planners and traffic planners and tool for households.

Key words: *housing, accessibility, sustainable mobility, MORECO project*

UTICAJ UREDBE O KATEGORIZACIJI PUTEVA DONETE 27.02.2012.god. NA PRIVREDNI RAZVOJ TERITORIJE KOJU ODRŽAVA AD“NOVI PAZAR–PUT“

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Rezime: Najbolje ogledalo stepena razvoja neke države su njeni putevi. Razvoj putne infrastrukture prati privredni razvoj kraja kome putna mreža pripada. Prostor na kom AD „Novi Pazar – put“ održava putnu mrežu ima svoje specifičnosti koje se odnose kako na konfiguraciju terena tako i na klimatske uslove. Pored toga, za najveći deo ovog prostora, putevi su jedina veza sa okruženjem. U vreme donete Uredbe o kategorizaciji državnih puteva od 27.02.2012.god. na putnoj mreži koju održava ovo preduzeće asfalt je bio zastupljen na svega 73% dužine puteva od čega je „dobrog“ asfalta bilo samo na 42% dužine mreže. Da bi se izbegle nesagledive posledice koje je Uredba o smanjenju dužine putne mreže za 51% mogla da izazove po ove i onako nerazvijene krajeve, u periodu od skoro dve godine preduzimane su brojne aktivnosti koje su imale nekad manjeg a nekad većeg efekta ali koje su konačno urodile plodom – novom Uredbom od 31.12.2013.god. kojom su nam svi izuzeti putevi ponovo vraćeni, odnosno vraćena im je kategorija državnog puta.

Ključne reči: *loše stanje putne mreže, Uredba o kategorizaciji puteva, nedovoljan privredni razvoj*

Abstract: Country level of development is best seen on its roads. Development of road infrastructure is followed by the economic development of the region where the road network belongs. The area in which JSC "Novi Pazar - put" maintaine road network has its own specifics which are related to the terrain and climate conditions. In addition, for the most of this area the roads are the only connection with the outside world. At the time of issue regulations on the classification of state roads by 27.02.2012. in road network maintained by this company asphalt was present only

on 73% of the total roads length, of which the "good" asphalt was only on 42% of total network. In order to avoid devastating consequences which Regulation on the reduction of the length of the road network by 51% could cause, to this already underdeveloped regions, over a period of almost two years a number of activities were undertaken, that had once small and sometimes large effect, but which are ultimately come to fruition - the new Regulation of 31.12.2013. returned all roads that were taken from our maintanance network, respectively these roads are again declared as a state roads.

Key words: *bad road network condition, the Regulation on the classification of roads, insufficient economic development*

УЛАГАЊЕ У ВАРИЈАНТУ АУТОПУТА СУРЧИН - ОБРЕНОВАЦ УМЕСТО У ВАРИЈАНТУ ОСТРУЖНИЦА - ОБРЕНОВАЦ ИЗАЗВАЛО БИ НЕСАГЛЕДИВО ВЕЛИКЕ И ДУГОРОЧНЕ ЕКОНОМСКЕ ГУБИТКЕ

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Резиме: Од обилазнице Београда до Обреновца пројектоване су две варијанте аутопута, које се међусобно битно и очигледно разликују по свим најзначајнијим карактеристикама. У раду су изложени основни техно-експлоатациони и економски подаци о пројектованим варијантама, приказано поређење пројектованих варијанти на основу изложених најзначајнијих техно-експлоатационих и економских показатеља и указано на НЕСАГЛЕДИВО ВЕЛИКЕ И ДУГОРОЧНЕ ЕКОНОМСКЕ ГУБИТКЕ које ће претрпети економија Република Србија уколико се избор варијанте аутопута изврши применом вишекритеријумске анализе, која је подложна утицају субјективног фактора, уместо COST-BENEFIT методом.

Финансирање градње и одржавање путне инфраструктуре

Construction Funding and Maintenance of Road Infrastructure

3

УПРАВЉАЊЕ И ФИНАНСИРАЊЕ ПУТЕВА И ЖЕЛЕЗНИЦА У СРБИЈИ

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Резиме: Стање у путној привреди и железници је изузетно лоше. Проблем је више година пажљиво гајен тако да би морале хитно да се предузму адекватне мере да би се избегао распад саобраћајне инфраструктуре без које нема ни напретка Србије. У овом чланку је дат приказ управљања и одржавања путева и пруга у свету и код нас, са жељом да се укаже на апсурде наше локалне праксе. У закључцима су набројане мере које би требало предузети да би се актуелно стање поправило и кренуло путем где сав остали свет иде.

Кључне речи: *путеви, железнице, управљање и финансирање*

ROAD AND RAILWAY MANAGEMENT AND FINANCING IN SERBIA

Abstract: Present situation in Serbian road and railway sector is extremely serious. Problems were accumulating during recent years and they impose urgent actions and measures in order to avoid the collapse of road ana railway infrastructure, without which there is no possibility for growth and prosperity in Serbia. The topic of this paper is an analysis of road ana railway management and maintenance in the world and in Serbia with the aim to point out the absurd solutions in our actual practice. Necessary measures for the improvement of the actual practice are presented in conclusions.

Key words: *roads, railways, management and financing*

COST-BENEFIT И COST-EFFECTIVENESS АНАЛИЗА ЗИМСКОГ ОДРЖАВАЊА

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Резиме: Зимско одржавање има важну улогу у обезбеђивању нормалног функционисања привредних и друштвених активности, за шта је основни предуслов нормално функционисање саобраћајног система, пре свега друмског саобраћаја кроз осигурање мобилности, нивоа услуге и безбедности корисника пута. Предузећа задужена за одржавање су стално пред изазовом да обезбеде висок ниво услуге (НУ) и побољшају мобилност и безбедност у зимским условима. Постоји потреба да се боље разумеју и квантитативно утврде трошкови, користи и ефекти зимског одржавања путева. Стога ће овај рад представљати покушај идентификовања и квантификовања трошкова и користи зимског одржавање, као и дефинисање методолошког оквира за COST-BENEFIT и COST-EFFECTIVENESS анализу. Дефинисана COST-BENEFIT и COST-EFFECTIVENESS АНАЛИЗА ЗИМСКОГ ОДРЖАВАЊА могу наћи примену код доношења одлука о улагању повећаних средстава, као и одлука о стандардима-

нивоима зимског одржавања, који проузрокују различите параметре у CBA анализи (IRR, B/C, ENSV) и CEA анализи. На крају рада као резултат биће рада биће дате методолошке смернице за CBA И CEA зимског одржавања.

Кључне речи: *CBA, CEA, Зимско одржавање, трошкови одржавања пута, директне користи, индиректне користи*

COST-BENEFIT AND COST-EFFECTIVENESS ANALYSIS OF WINTER MAINTENANCE

Abstract: Winter maintenance plays an important role in ensuring normal functioning of economic and social activities, what is the basic prerequisite for the normal functioning of the transport system, particularly road transport through the provision of mobility, level of service and safety of road users. Companies responsible for maintaining are on the constant pressure to provide a high level of service (LOS) and improve mobility and safety in winter conditions. There is a need to better understand and quantitatively determine the costs, benefits and effects of winter road maintenance. Therefore, this paper represent an attempt to identify and quantify the costs and benefits of winter maintenance, as well as an attempt to define a methodological framework for cost-benefit and cost-effectiveness analysis of winter maintenance. Defined cost-benefit and cost-effectiveness analysis of winter maintenance may be applied in cases of making decisions about investing increased resources in winter maintenance, as well as making decisions on standards for winter maintenance, which can cause a variety of parameters in CBA analysis (IRR, B/C, ENPV) and CEA analysis. At the end the result will be the methodological guidelines for CBA and CEA of winter maintenance

Key words: *CBA, CEA, winter maintenance, road maintenance costs, direct benefits, indirect benefits*

PROBLEMI FINANSIRANJA DRŽAVNIH PUTEVA U REPUBLICI SRBIJI PREMA ZAKONU O JAVNIM PUTEVIMA

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Rezime: Višegodišnji problem nedostatka novca za održavanje državnih puteva u Republici Srbiji, dovelo je do toga da je čak 75 odsto državnih puteva u nezadovoljavajućem stanju. Ukidanjem naknada za održavanje državnih puteva od akcize na derivate nafte i tečnog naftnog gasa i naknada koje pripadaju upravljaču tog puta i nerešavanjem pitanja adekvatnih izvora za finansiranje mreže državnih puteva koji bi zamenili ukinute izvore, dovelo je tu putnu mrežu u katastrofalno stanje. U ovom radu dat je pregled finansiranja državnih puteva prema Zakonu o javnim putevima sa predlogom mera u pogledu izvora finansiranja te mreže puteva.

Ključne reči: *bezbednost saobraćaja, finansiranje državnih puteva, zakonski propisi, preventiva, upravljač*

PROBLEM OF FINANCING OF STATE ROADS IN REPUBLIC OF SERBIA BY LAW ON PUBLIC ROADS

Abstract: The perennial problem of lack of money for maintenance of state roads in the Republic of Serbia, led to the fact that as many as 75 percent of state roads in an unsatisfactory condition. Abolition of fees for maintenance of state roads from excise taxes on petroleum products and liquefied petroleum gas and fees belonging to the control of the road and not solving issues of adequate resources to finance state road network that would replace the abolished sources, has led to the road network in a disastrous state. This paper gives an overview of the financing of state roads under the public roads with proposed measures in terms of funding sources and the road network.

Keywords: *road safety, financing of state roads, legislation, prevention, control*

PLANIRANJE I FINANCIRANJE CESTOVNE INFRASTRUKTURE

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Rezime: Javni sektor nosi puno više tereta izdataka infrastrukture nego što bi se realno očekivalo da bi mogao podnijeti. U posljednjih nekoliko desetljeća, javljaju se inovativne i raznovrsne tehnike financiranja koje omogućuju sve brži prijelaz rizika stvaranja i održavanja prometne infrastrukture s javnoga na privatni sektor. Korištenje neregresnog i ograničenog regresnog financiranja projekta (također poznat kao project finance) dopušta sponzorima podizanje kredita osiguranih prihodima, a ne imovinom projekta a to se sve više koristi u industrijaliziranim zemljama i zemljama u razvoju. Financiranje u ovom obliku može biti složen i dugotrajan proces, budući da se interesi različitih partnera moraju osigurati kroz pregovore i ugovorne uvjete. Kao posebni oblici project finance tehnika za razvoj prometne infrastrukture, novi pristupi poznati kao build – operate - transfer (BOT) razvijeni su i sada igraju važnu ulogu u provedbi infrastrukturnih projekata. Ovaj pristup zahtijeva puno bolje planiranje i jasnije definiranje rizika nego što je to slučaj s tradicionalnim projektima. Komercijalne, tehničke, financijske, gospodarske procjene i procjena utjecaja na okoliš trebaju osigurati donošenje odgovarajućih odluka i dobivanje «vrijednost za novac». Članak objašnjava prednosti i izazove planiranja i financiranja projekata cestovne infrastrukture.

Ključne reči: *cestovna infrastruktura, projektno financiranje, BOT*

PLANNING AND FINANCING ROAD INFRASTRUCTURE

Abstract: Public sector carries more infrastructure spending than one can reasonably expect it to handle. In recent decades, innovative and diverse financing techniques have emerged that allow more rapid transfer of risk of creation and maintenance of transport infrastructure from the public to the private sector. The use of project financing without or with limited recourse (also known as project finance) allows sponsors to raise loans secured by income and not by assets of the project and such approach has been increasingly used both in industrialized and developing countries. This form of funding can be a complex and lengthy process, because the interests of the various partners must be ensured through negotiations and contractual terms. Special form of project finance techniques used for the development of transport infrastructure, a new approach known as Build - Operate - Transfer (BOT) has been developed and are now plays an important role in the implementation of infrastructure projects. This approach requires much more planning and a clearer definition of risk than is the case with traditional projects. Commercial, technical, financial, economic assessment and environmental impact assessment should ensure appropriate decisions and getting "value for money". The paper discusses the benefits and challenges of planning and financing of road infrastructure projects.

Key words: *road infrastructure, project finance, BOT*

Одрживи развој и заштита животне средине

Sustainable Development and Environmental Protection

PRAĆENJE KVALITETA VODE I TLA TOKOM IZGRADNJE AUTOPUTA NA KORIDORU Vc, DEONICA ZVIROVIĆI- BIJAČA

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Rezime: Izbegavanje negativnih uticaja prilikom bilo koje vrste radova na putnoj mreži (izgradnja, održavanje, rekonstrukcija/rehabilitacija) bi trebalo da bude prioritet investitora, a stvaran rezultat zavisi od lokacije i veličine projekta i sa njim povezanih aktivnosti. Praćenje stanja pojedinih parametara kvaliteta životne sredine predstavlja ekvivalent kontroli kvaliteta radova (nulto stanje=prethodna ispitivanja, periodična merenja=tekuća kontrola kvaliteta). Definicija specifičnih aktivnosti radi praćenja uticaja i stanja životne sredine je predmet razrade u okviru plana monitoringa ili plana praćenja stanja. Poznato je da u današnje vreme izvođači ugovaraju radove po veoma niskim cenama, te na sve moguće načine pokušavaju da izbegnu praćenje stanja životne sredine. Takođe, u želji da što pre počnu sa realizacijom radova, „zaborave" na potrebu utvrđivanja nultog stanja koje je veoma bitno za kasnije praćenje realizacije usklađenosti sa zahtevima, odnosno definisanje da li je izvođač prouzrokovao eventualnu štetu ili je zagađenje već postojalo pre izvođenja radova. U ovom radu akcenat će biti stavljen na iskustva u pripremi i realizaciji plana upravljanja zaštitom životne sredine, odnosno jednog od njegovih elemenata, plana praćenja stanja, i to u delu koji se odnosi na kvalitet vode i tla, za projekat izgradnje autoputa na koridoru Vc u južnom delu Bosne i Hercegovine.

Ključne reči: *izgradnja, plan upravljanja zaštitom, praćenje stanja, kvalitet vode, kvalitet tla*

WATER AND SOIL QUALITY MONITORING DURING CONSTRUCTION OF MOTORWAY AT CORRIDOR Vc, SECTION ZVIROVIĆI - BIJAČA

Abstract: Avoiding negative impacts in any kind of work on the road network (construction, maintenance, reconstruction/rehabilitation) should be a priority for investors, and actual result depends on the location and size of the project and related activities. Monitoring the status of certain parameters of environmental quality is equivalent to controlling the quality of work (zero status=preliminary tests, periodic measurements=current quality control). The definition of specific activities in order to monitor the impact and the environmental conditions is the subject of development within the monitoring plan. It is known that nowadays contractors contract works at very low prices, and by all means try to avoid environmental monitoring. Also, in order to commence works as soon as possible, they "forget" the need to determine the baseline condition, which is very important for later monitoring the implementation of the compliance with the requirements, and the definition of whether the contractor has caused any damage or pollution already existed prior to the construction. In this paper, emphasis will be placed on experience in the preparation and implementation

of the environmental management plan, exactly one of its elements, the monitoring plan, in part related to the quality of water and soil for the construction of the motorway on Corridor Vc in the southern part of Bosnia and Herzegovina.

Key words: *construction, environmental management plan, condition monitoring, water quality, soil quality*

UTICAJ IZGRADNJE INFRASTRUKTURNIH KORIDORA NA ZIVOTNU SREDINU, CASE STUDY E 75

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Rezime: U Republici Srbiji postoji niz Zakona, Pravilnika i Uredbi koji uređuju oblast izgradnje Infrastrukturnih Koridora, ali specifična problematika izgradnje puta i uticaja na životnu sredinu nije posebno definisana. Izrada Studije o proceni uticaja (Environmental Impact Assessment – EIA) projekta autoputa na životnu sredinu, u najopštijem smislu je proces u kome se identifikuju, analiziraju i procenjuju neželjeni uticaji na životnu sredinu pre donošenja odluke o izgradnji.
Procena uticaja je deo svih faza procesa realizacije Projekata i alat za održivi razvoj. To uključuje proces odlučivanja, proces utvrđivanja značajnih uticaja i utvrđivanja prioriteta (sa posebnom pažnjom na pitanja uticaja na životnu sredinu kada postoje ograničeni resursi i kapaciteti) i proces planiranja (planovi, programi i strategije razvoja za rešavanje ili sprečavanje raznih ekoloških problema). Najbolja zaštita životne sredine u toku izgradnje Infrastruktornih koridora je još u fazi projektovanja, a od suštinske važnosti je usklađivanje trase sa prostorno-planskom dokumentacijom. Ova praksa je u Republici Srbiji u rutinskoj zakonskoj primeni.
U radu će biti prikazana procena uticaja na životnu sredinu i uloga javnosti i loklane zajednice na primeru izgradnje Autoputa E 75 od Niša do granice Makedonije. Generalno, deo trase prolazi kroz obradivo poljoprivredno zemljište i ima značajan uticaj koji se manifestuje kroz stalnu ili privremenu promenu namene korišćenja zemljišta i zagađenja istog u okolini autoputa.

Ključne reči: *Infrastrukturni Koridor, procena uticaja, javnost*

Abstract: In the Republic of Serbia, there are a number of the Act, the Rules and Regulations governing the field of building infrastructure corridors, but the specific issue of road construction and the environmental impact is not specifically defined. The Study on Environmental Impact Assessment (Environmental Impact Assessment - EIA) motorway project on the environment, in the most general sense, is a process in which to identify, analyze and assess adverse effects on the environment before deciding on the construction.
Impact assessment is part of all phases of the process of project and tool for sustainable development. This includes the decision-making process, the process of determining significant impacts and identify priorities (with particular attention to issues

of environmental impact when there are limited resources and capacities) and process planning (plans, programs and development strategies for solving or preventing a variety of environmental problems). The best protection of the environment during the construction of infrastructure corridor is still in the design phase, and the essential harmonization alignment with spatial planning documents. This practice is in the Republic of Serbia, in routine legal application.
The paper will be presented to estimate the environmental impact and the role of Local Government and public communities on the example of the construction of Highway 75 E from Nis to the Macedonian border. Generally, the portion of the route passes through arable land and has significant influence, which manifests itself in a temporary or permanent change of land use purpose and pollution in the vicinity of the same highway.

Key words: *Infrastructure Corridor, impact assessment, public*

ЗАШТИТА ЖИВОТНЕ СРЕДИНЕ У ЈАВНОМ ПРЕДУЗЕЋУ „ПУТЕВИ СРБИЈЕ"

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Резиме: У раду је дат приказ активности које су предузимане у циљу разрешењу односа пута и животне средине у Републици Србији од доношења закона 1991. године до данас, а кроз рад Јавног предузећа „Путеви Србије". Од оснивања посебног Одељења за заштиту животне средине у саставу Сектора за стратегију, пројектовање и развој у Јавном предузећу „Путеви Србије" 2006. године до 2011. године доминантна активност је била праћење израде студија о процени утицаја путева на животну средину. Од 2011. године, тежиште се пребацује на израду упутстава и приручника за различите аспекте заштите животне средине у путној привреди. План је да се, до 2015. године, везано за умањење утицаја друмског саобраћаја на ниво буке, за ванградске деонице на мрежи државних путева Србије са ПГДС-ом преко 6 милиона возила, израде стратешке карте буке. На иницијативу Европске агенције за заштиту животне средине, прате се годишње емисије гасова из друмског саобраћаја који утичу на глобалне климатске промене, коришћењем модела COPERT IV. Праћење стања животне средине (мониторинг) у путном појасу је приоритет у раду Одељења за заштиту животне средине у наредном периоду.

Кључне речи: *заштита животне средине, студије, ЈП „Путеви Србије", стратешке карте буке, праћење стања животне средине*

ENVIRONMENTAL ISSUES IN PUBLIC ENTERPRISE "ROADS OF SERBIA"

Abstract: This paper presents the activities that have been taken in aim to resolve the relations between the road and the environment in the Republic of Serbia since the first Law of Environmental Protection was issued (at 1991.) until today and through

the work of the Public Enterprise "Roads of Serbia". Since the establishment of a separate Department of Environmental Protection within the Sector for the strategy, design and development of the Public Enterprise "Roads of Serbia" from 2006th until the 2011th the main activity was tracking the EIA studies for the transport sector. From 2011th the focus is put on the development of guidelines and manuals for the various aspects of environmental protection in the transport sector. The plan is to complete strategic noise maps, related to mitigation of road traffic noise level, with the rural sections of the state road network in Serbia which have Annual average daily transport over 6 million vehicles till 2015th. At the initiative of the European Environmental Agency, using the COPERT IV model, the annual emissions from road transport, which affect to global climate changes are supervising. Environmental monitoring in the road area is a priority for the Department of Environmental Protection in the future.

Key words: *Environmental protection, studies, PE "Roads of Serbia" strategic noise maps, monitoring*

PRIKAZ HEAVEN DSS PROJEKTA EVROPSKE UNIJE ZA UPRAVLJANJE BUKOM OD SAOBRAĆAJA U GRADOVIMA EVROPE

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Rezime: Za urbanu celinu u skladu sa održivim razvojem, neophodno je uspostaviti upravljanje sistemom zaštite životne sredine, saglasno zakonima, propisima i standardima. Sistem zaštite životne sredine i zaštite od buke čine mere, uslovi i instrumenti, koje obezbeđuju subjekti zaštite čije se obaveze i odgovornosti sagledavaju u primeni postojećih zakona i propisa. U radu je dat prikaz projekta HEAVEN DSS, Saobraćaj i organizacione mere zaštite, koji primenjuje Direktivu 2002/49/EU za borbu protiv buke u gradovima za perod do 2016 godine.

Ključne reči: *buka, saobraćaj, upravljanje bukom*

REVIEW OF HEAVEN DSS EU PROJECT NOISE MANAGEMENT FROM TRANSPORT IN EUROPEAN CITIES

Abstract: The urban unit in accordance with sustainable development, it is necessary to establish a management system for environmental protection, in accordance with the laws, regulations and standards. The system of environmental protection and noise protection measures are conditions and instruments that provide protection subjects whose duties and responsibilities perceived in the application of existing laws and regulations. This paper presents the project HEAVEN DSS, Transport and organizational protection measures, which applies Directive 2002/49/EC to combat noise in cities for the Period up to 2016.

Key words: *noise, traffic, noise management*

REDUCTION OF POLLUTING SUBSTANCES IN THE ATMOSPHERE EMISSIONS BY APPLICATION OF THE CITY SIMULATION MODELING

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Abstract: One of the purposes of the millennium development, the accepted UN defined ensuring ecological stability. Key strategy for achievement of this purpose is transition strategy to "green economy", assuming primary development of those branches which create and increase the natural capital of the earth or reduce ecological threats and risks. The maximum pollutants of environment are the industrial enterprises and motor transport. In particular sharply the problem is shown in megalopolises therefore the techniques, allowing to increase the accuracy of forecasts on change of an ecological situation for acceptance of adequate measures for its improvement are necessary. One of such methods is the control method of transport streams on megalopolis roads. Basis for decision-making is optimizing experiment on the imitating model, allowing to establish the optimum density and average speed of a stream at which norms of emissions won't be exceeded. By drawing up model the real condition of atmospheric air in the considered city, and also environmental risks is considered. The task was solved for Naberezhnye Chelny.

Key words: *ecology, population health, transport, simulation modeling*

PHONOBLOC – INNOVATIVE NOISE BARRIERS MADE OF CONCRETE

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Abstract: The Phonobloc system for producing noise barriers made of concrete, which uses local resources (raw materials and production lines), has been developed by the Kirchdorfer Group within a two-year research project. It takes into account the requirement of Serbia that the construction of the road infrastructure include as many local and national contractors, producers and suppliers as possible. This thesis shows that the innovative method to produce noise barriers, that fully meet all European standards and provide the highest level of acoustic properties, is consistent with the relevant Serbian standard EN 1793-1. Furthermore, it demonstrates that it is possible by the particular characteristics of the innovative Phonobloc material to use it for a variety of products.

Key words: *noise barriers, lightweight aggregate concrete, sound absorption*

ZAŠTO PEPEO JOŠ NIJE UPOTREBLJEN U PUTNOM INŽENJERSTVU I KAKO GA UPOTREBITI

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Rezime: U radu se prikazuju tehnički uslovi i mogućnost primene pepela.

Ključne reči: *pepeo, stabilizacija, optimatizacija*

WHY ASH STILL HASN'T USED IN ROAD ENGINEERING AND HOW TO USE IT

Abstract: This paper presents technical requirements and the possibility of using fly ash.

Key words: *ash, stabilization, optimization*

KAKO I GDE JE MOGUĆA PRIMENA ELEKTROFILTERSKOG PEPELA PRI GRADNJI PUTEVA

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Rezime: U radu su prikazani mogući načini ugradnje elektrofilterskog pepela iz TENT - Obrenovac, odnosno TEKO - Kostolac u konstrukciju puta. S obzirom na povoljna mehanička svojstva elektrofilterskog pepela koja su detaljno ispitana u okviru istraživačko razvojnog projekta kao i potrebe da smanjimo gomilanje pepela na deponijama, pokazaćemo na primerima moguće načine ugradnje u nasipe, rovove i klinove iza objekata. Analiziraće se cene izgradnje naspa sa i bez dodataka kreča u odnosu na klasično izvedene nasipe od prirodnih kamenih i zemljanih materijala.

Ključne reči: *elektrofilterski pepeo, nasipi, izgradnja*

HOW AND WHERE IS POSSIBLE APPLICATION OF FLY ASH IN ROAD CONSTRUCTION

Abstract The paper is revealing potential modes of incorporating fly-ash in the road structure. In view of suitable mechanical properties of fly-ash which have been thoroughly examined within the framework of research-developmental project along with the needs of reducing the accumulation of fly-ash on waste dumps, we shall present the examples of its potential utilization in embankments, ditches, and wedges behind the structures The costs pertaining the construction of embankments with and without the addition of lime in relation to standard emabnkments made of stone and earhen materials will be sumbitted to the analysis.

Key words: *embankment, fly-ash, incorporation*

MONITORING OBORINSKIH VODA U ČVORU ŠKURINJE NA RIJEČKOJ OBILAZNICI

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Rezime: Jedan od osnovnih ciljeva poslovanja tvrtke HAC-ONC d.o.o. je preventivnim mjerama spriječiti, odnosno ublažiti negativne utjecaje svoje djelatnosti na okoliš i svesti ih na prihvatljivu razinu. Radi poboljšanja mjera zaštite okoliša, u suradnji s Građevinskim fakultetom iz Rijeke i komunalnim društvom Vodovod i kanalizacija iz Rijeke pokrenut je program monitoringa količine i kakvoće oborinskih voda u čvoru Škurinje na riječkoj obilaznici. Ovaj program omogućit će kvalitetnu procjenu onečišćenosti oborinskih voda sa autoceste koja će se analogijom, uz neznatne izmjene, moći primijeniti na čitavo koncesijsko područje. Transfer znanja i tehnologija, te razmjena iskustava sa svjetskim liderima iz ovog područja stvorit će kvalitetnu osnovu za unapređenje upravljanja oborinskim vodama i održavanja sustava odvodnje. Stečena znanja i usvojene tehnologije iskoristit će se kao osnova za izradu elektronske baze podataka o sustavu odvodnje. Pored toga rukovodstvo tvrtke dobit će kvalitetnu osnovu za donošenje strateških odluka vezanih za održavanje sustava odvodnje i upravljanje oborinskim vodama.

Ključne reči: *cesta, onečišćenje, oborinske vode, monitoring, upravljanje*

STROMWATER RUNOFF MONITORING ON ŠKURINJE JUNCTION OF RIJEKA BYPASS

Abstract : One of the main goals of Croatia Motorways – Maintenance and Tolling Ltd. is to prevent or diminish negative effects of it's activities on environment, reduce them on acceptable level and to contribute to environment betterment. Monitoring program of stormwater quantity and quality on Rijeka bypass, Škurinje junction was established in cooperation with Faculty of Civil Engineering form Rijeka and communal company Vodovod i kanalizacija form Rijeka to improve environment protection measures. This program will enable a high quality approximation of pollution from stormwater runoff which could, with minor corrections, be applied on whole concession area. Transfer of knowledge and technology and experience exchange with world's leaders in this area will create a base for upgrade of stormwater management and drainage maintenance. Acquired knowledge and acquired technologies will be used as a base in creating of electronic data base for drainage system. This will also create a good base for top management's strategic decisions on drainage system maintenance and stormwater management.

Key words: *road, pollution, stormwater runoff, monitoring, management*

IZGRADNJA AUTOPUTEVA KORIDOR Xc I Xd – KA BOLJOJ PRIMENI ZAHTEVA U POGLEDU ZAŠITE ŽIVOTNE SREDINE

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Rezime: Da bi se ispunile obaveze u pogledu odobrenja i finansiranja projekta, svaka deonica na autoputevima Koridorima Xc i Xd treba da usvoji i da ispuni uslove Plana upravljanja životnom sredinom (Environmental Management Plan (EMP)). EMP prikazuje uticaj deonice autoputa na životnu sredinu i na podložne subjekte koji bi mogli da budu ugroženi i detaljno opisuje mere za sprečavanje tog uticaja, koje Izvođač radova treba da preduzme u cilju zaštite životne sredine.
Konzorcijum Ove Arup & Partners International Ltd i Institut Kirilo Savić naimenovan je kao Konsultant za nadzor plana upravljanja životnom sredinom (Environmental Management Plan Supervision Consultant (EMPSC)) i vrši praćenje implementacije EMP-a. Ovaj rad je zasnovan na iskustvima stečenim tokom vršenja dužnosti EMPSC-a, koja uključuje i opis prepreka u ispunjenju zahteva EMP-a tokom izgradnje autoputa, kao što su, na primer, kompleksna arheološka zaštita, različite interpretacije prečišćavanju otpadnih voda nastale pranjem mešalica za beton i skladištenje ulja na radnom prostoru. U ovom radu su opisani neki od najvažnijih razloga za zaštitu životne sredine i predložene su mere najbolje prakse u oblasti zaštite životne sredine sa ciljem da budući projekti lakše i bolje primene zahteve o zaštiti životne sredine po EMP-u.

Ključne reči: *autoput, pitanja zaštite životne sredine, EMP, mere zaštite životne sredine, najbolja praksa*

CONSTRUCTION OF THE CORRIDOR Xc AND Xd MOTORWAYS – TOWARDS CLOSER COMPLIANCE OF ENVIRONMENTAL PROTECTION MEASURES

Abstract: To fulfill consent and finance obligations of the project, every works section on the Corridor Xc and Xd motorways is required to implement and comply with an Environmental Management Plan (EMP). The EMP describes the environmental impacts of the motorway section, the sensitive receptors that could be affected and details the mitigation measures to be undertaken by the Contractor during the constructions works to protect the environment.
Arup in JV with IKS have been appointed as Environmental Management Plan Supervision Consultant (EMPSC), to supervise the implementation of the EMPs. This paper draws on the experience gained through the EMPSC's role to describe the challenges to delivering EMP requirements during the construction of a motorway, for example the complexity of delivering archaeological protection, the different interpretations of treatment of washout water from concrete mixers and the storage of hydrocarbons on site. The paper provides a description of some key reasons for environmental protection and proposes the environmental best practice measures that will strengthen compliance with EMPs in future projects.

Key words: *motorway, key environmental issues, EMP, mitigation measures, environmental best practice*

APSORBIRAJUĆE BETONSKE BARIJERE ZA ZAŠTITU OD BUKE S GUMENIM GRANULAMA

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Rezime: Razvojem prometne infrastrukture, posebice cestovne, te porast broja vozila znatno utječe na povećanje razine buke. Zaštita od prometne buke danas je prioritet u zemljama EU. Uobičajeni načini zaštite od buke uz prometnice je primjena barijera za zaštitu od buke. U radu se prikazuje zaštita od buke primjenom apsorbirajućih betonskih barijera. Apsorbirajući sloj betonskih barijere se uobičajeno izrađuje od laganog betona s ekspandiranom glinom ili s drvenim vlaknima. S ciljem pronalaženja alternativnog materijala za izradu apsorpcijskog sloja betonskih barijera, ali pri tome vodeći računa o održivom razvoju Građevinski fakultet Sveučilišta u Zagrebu razvio je betonske barijere za zaštitu od buke tipa RUCONBAR (Rubberized Concrete Noise Barriers) čiji je apsorpcijski sloj izveden laganim betonom s dodatkom gumenih granula dobivenih reciklažom otpadnih guma. Barijere RUCONBAR u strukturi svojeg apsorbirajućeg sloja sadrže 40 % gumenog granulata dobivenog recikliranjem otpadnih guma i kao takav predstavlja inovativno i ekološko rješenje u proizvodnji barijera za zaštitu od buke.

Ključne reči: *zaštita od buke, apsorbirajuće betonske barijere, gospodarenje otpadom, otpadne gume*

NOISE ABSORBING CONCRETE BARRIERS WITH RUBBER GRANULES

Abstract: The development of transport infrastructure, especially in road sector, and a constantly increasing number of vehicles, are greatly responsible for a considerable increase in noise levels. Traffic noise protection is currently a priority in all EU countries. Noise protection barriers are generally used to reduce noise generated by road traffic. Noise protection by means of noise absorbing concrete barriers is presented in the paper. The absorbing layer of concrete barriers is normally made of lightweight concrete with expanded clay or wooden fibres. In order to find an alternative material for the absorbing layer of concrete barriers, and taking into account sustainable development objectives, the Faculty of Civil Engineering of the University of Zagreb developed concrete noise barriers named RUCONBAR (Rubberised Concrete Noise Barriers) whose absorbing layer is made of lightweight concrete to which rubber granules obtained by waste-tyre recycling are added. In the structure of their absorbing layer, RUCONBAR barriers contain 40 percent of rubber granules obtained by waste-tyre recycling and, as such, they constitute an innovative and environmentally-friendly solution for fabrication of noise barriers.

Key words: *noise protection, noise-absorbing concrete barriers, waste management, waste tyres*

BIOREMEDIJACIJA BILjKAMA KAO METOD ZA ČIŠĆENJE ZAGAĐENIH ZEMLJIŠTA I PODZEMNIH VODA U PUTNOM POJASU

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Rezime: Mere preduzete na zaštiti zemljišta i podzemnih vode mogu biti mere prevencije i mere sanacije, sa ciljem da se spreči dalje širenje kontaminanata u slučaju da je do akcidenta već došlo, kao i da se preduzmu odgovarajuće remedijacione tehnike. Bioremedijacija biljkama tj. fitoremedijacija je korišćenje prirodne sposobnosti biljke da zadrži, degradira ili otkloni toksične hemikalije i polutante iz zemljišta i vode. U okviru uobičajenog rasta i razvoja, pojedine biljke klasifikovane kao hiperakumulatori, apsorbuju više metala od ostalih biljaka.

Ključne reči: *kontaminanti, zemljište, podzemne vode, remedijacija, biljke, hiperakumulatori*

BIOREMEDIATION PLANTS AS A METHOD FOR CLEANING POLLUTED SOIL AND GROUNDWATER IN THE ROAD AREA

Abstract: Precautionary measures to protect soil and water sources can either be preventive to hinder the occurrence of an accident, or for damage control, implemented to keep pollutants from spreading in the event of one. Bioremediation plants videlicet phytoremediation is the use of a plants natural ability to contain, degrade or remove toxic chemicals and pollutants from soil or water. Some plants, classified as hyperaccumulators, absorb more metal than other plants, including metals that do not appear necessary for plant function.

Key words: *contaminants, soil, groundwater sources, remediation, plants, hyperaccumulators*

THE SUCCESSFUL USE OF ASPHALT RUBBER IN SLOVENIA AND ITALY

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Abstract: Today great efforts shall be done to plan effective techniques and frameworks for waste disposal and above all waste recycling, in order to keep down or even reduce, where it is possible, environmental pollution due to the storage of unproductive resources. The development of such these green technologies brings to the possibility of computing, case by case, the reduction in CO2 emissions together with the increasing safe of money and of raw materials. Regarding the shortening of weaving factor for road pavement laying, for example, a possible solution is to employ recovery materials which are directly related to the road final use, such as tires, with the aim to enclose as much as possible the whole productive cycle and at the same time to enlarge environmental benefits. Asphalt rubber technology arises from all this concepts; moreover, it has shown

to provide very good mechanical performances even at very low temperatures, which is suitable for a continental climate, with a longer duration and less maintenance required. In addition, its specific mix design has been studied both to reduce noise emissions and to optimize acoustical absorption. In this paper, after a brief summary of the state of AR technology all over the world, results of a quantitative analysis of environmental benefits arising from the use tire recycling in road pavements are shown also in terms of energy balance and CO2 safe.

Key words: *asphalt pubber, wet process, reduction CO2 emmissions, reduce noise emmisions*

IZAZOVI PRILIKOM OCENE PROSEČNE GODIŠNJE EMISIJE ZAGAĐUJUĆIH MATERIJA U ATMOSFERU OD DRUMSKIH MOTORNIH VOZILA U REPUBLICI SRBIJI

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Rezime: Ocena emisije zagađujućih materija drumskih transportnih vozila korišćenjem softvera COPERT 4, verzija 10 zahteva brojne ulazne podatke visokog kvaliteta. Ocena se zasniva na određivanju prosečnog godišnjeg pređenog puta na nacionalnoj teritoriji po kategorijama vozila i različitim eksploatacionim uslovima, pri poznatim klimatskim uslovima i podacima o količinama utrošenih pogonskih goriva i njihovom sastavu i kvalitetu. Ako se kao merodavni usvoji nacionalni vozni park, izazov je odrediti kompletnost i tačnost nacionalne baze podataka o motornim vozilima, koja ne sadrži sve neophodne podatke od značaja za kvalitetnu ocenu emisije. Budući da su putnički automobili dominantni, jedan od izazova je odrediti prosečan godišnji pređeni put službenih i privatnih vozila, njihov ukupni pređeni put, ali i njihovo učešće u voznom parku po zahtevanim kategorijama. Sledeći izazov je metodologija i realizacija prostorne raspodele emisije zagađujućih materija u atmosferu po deonicama puteva I i II reda, koja će biti prikazana u radu.

Ključne reči: *ocena emisije, COPERT 4, prostorna raspodela, putevi I i II reda*

CHALLENGES IN ASSESSING AVERAGE ANNUAL POLLUTANTS EMISSIONS INTO THE ATMOSPHERE FROM ROAD MOTOR VEHICLES IN THE REPUBLIC OF SERBIA

Abstract: Assessment of pollutants' emissions from road vehicles using COPERT 4, version 10 requires numerous high-quality input data. The assessment is based on the determination of average annual distance traveled at the national territory per vehicle category for different operating environments, in defined climatic conditions and consistent with consumed fuel quantities, their sulphur and lead content and their quality. As national vehicle fleet is determined as relevant, the challenge is to assess the

completeness and acuracy of the national motor vehicle database, which does not contain all necessary information for high-quality emission assessment. Since passenger cars are dominant in the fleet, one of the challenges is to determine the average annual distance traveled of both company and private vehicles, their total distance traveled, and their shares in the fleet per requested categories. Another challenge was the methodology for spatial distribution of pollutants' emissions into the atmosphere for each primary and secondary road section, which will be presented in the paper.

Key words: *emission assessment, COPERT 4, spatial distribution, primary and secondary roads*

UTICAJ I ZAŠTITA OD SAOBRAĆAJNE BUKE NA PUTEVIMA U REPUBLICI MAKEDONIJI

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Rezime: Buka ima veliki uticaj na životnu sredinu i predstavlja ozbiljan problem jer doprinosi do značajnog smanjenja kvaliteta života ljudi. U redosledu uticaja na životnu sredinu, buka je u samom vrhu, zajedno sa zagađenjem vazduha i vode. Posebno je važno naglasiti da buka ima štetan uticaj ne samo na okolinu, već i na vozača i putnika u vozilu. Poseban akcenat u radu se stavlja na buku izazvanu iz motornog saobraćaja – pod nazivom „saobraćajna buka", koja zavisi od površinskih karakteristika voznih površina.

Ključne reči: *buka, vozna površina, pneumatic, merenja buke, zvučne barijere*

PROTECTION FROM THE ROAD NOISE IN SUBURBAN AND URBAN CITY AREAS IN THE REPUBLIC OF MACEDONIA

The noise has great influence on the environment and represents a serious problem, because it contributes for significant reduction of the life quality of the people. In the order of the influences on the environment the noise is on the very top, together with the pollution of the air and the water. It's very important to point out that the noise has bad influence not only on the environment, but also on the driver and the passengers in the car. Special accent in the paper is put on the noise caused from the motor traffic – so called „traffic noise", which is dependent from the surface characteristics of the pavement surfaces.

Key words: *noise, pavement surface, tires, measures for noise protection, acoustic barrie*

REDUCING TRAFFIC NOISE IN SERBIA; GUIDELINES LOW-NOISE PAVEMENTS AND NOISE BARRIERS

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Abstract: Due to the developing economy in Serbia traffic intensities will increase significantly. This has led to unacceptable noise levels especially near highways. Traffic noise is, therefore, the most prominent source of environmental noise. In Serbia knowledge on the development and application of low-noise roads and noise barriers is developing. Existing experiences form the Netherlands are transformed with respect to local circumstances.
This will lead to a wide application of low-noise roads and noise barriers in Serbia for acceptable costs and with local people and equipment. Thus the negative environmental aspects of developing infrastructure will be reduced significantly and the noise will remain below acceptable levels The result of a G2G project to achieve the project goal is a final document with guidelines for techniques, methods, standard, cost optimization and planning to reduce traffic.

Key words: *low-noise pavements, noise barriers*

A-T FRAME PRECAST LINEAR CONSTRUCTIONS

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Abstract: A-frame and T-frame precast linear constructions were developed with a view to enable simple, quick and inexpensive placement of linear engineer constructions. These constructions are innovative because they do not require deep foundations and so they have only a minimal pressure on the underlying basis. Primarily they are used as noise protection barriers to reduce noise from motorways and railroads. Due to the simplicity of their constructions they can be also used on other building and engineering projects.

Key words: *large-scale linear constructions without foundations; simple precast engineering constructions, noise protection barriers*

ИСПИТИВАЊЕ И УПРАВЉАЊЕ СТРУГАНИМ АСФАЛТОМ НА ДЕПОНИЈАМА

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Резиме: Производња асфалтних мешавина на асфалтној бази обухвата низ поступака, почевши од депоновања, преко пројектовања мешавина, начина производње, па све до контроле квалитета. Уколико се додаје стругани асфалт у мешавину, посебно треба обратити пажњу на поједине поступке везане за производњу, од којих је један начин руковања струганим асфалтом. Један од циљева његове употребе је свакако уштеда материјала – како агрегата, тако и битумена, и са еколошког и са економског аспекта. У овом раду су приказане поједине смернице за испитивање и управљање струганим асфалтом на депонијама којима би требале да се воде произвођачи, како би производили мешавине скоро идентичних, па чак и бољих карактеристика од мешавина са новим агрегатом.

Кључне речи: *асфалтна мешавина, стругани асфалт, депонија*

RAP STOCKPILES MANAGEMENT AND TESTING

Abstract: Production of asphalt mixture on asphalt plants includes a series of procedures, ranging from stockpiling, through a mix design, methods of production, to quality control. If RAP is added to the mixture, it should pay more attention to certain procedures related to production, one of which is way of the handling RAP. One of the goals of its use is certainly saving materials - both aggregate and bitumen, from the ecological and economic aspects. This paper presents some guidelines for RAP stockpiles management and testing which should be kept by manufacturers in order to produce a mixture of almost identical, or even better performance than a mixture with a virgin aggregate.

Key words: *asphalt mixture, RAP, stockpile*

PLANOVI ODRŽIVE URBANE MOBILNOSTI ZA GRADOVE DUBROVNIK I KOTOR

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Rezime: U okviru evropskog projekta Adria.MOVE IT!, izradili smo saobraćajne studije i planove održive urbane mobilnosti za gradove Dubrovnik i Kotor. Naša namera je izložiti metodu pripreme Planova održive mobilnosti i naše iskustvo na konkretnim projektima. Hteli bi i predstaviti tehnička rešenja infrastrukture i organizaciju saobraćaja, koji se u spomenutim gradovima nastoji uspostaviti na osnovi Planova održive urbane mobilnosti. Specifičnost saobraćajnih problema u spomenutim gradovima jeste veliki pritisak turista sa kruzera na staru gradsku jezgru i zbog toga zagušenje ostalog saobraćaja. Rešenje tih problema predlaže se izgradnjom

pešačkog tunela sa pokretnom trakom, promenom organizacije javnog autobuskog prevoza, razvojem javnog gradskog prevoza morem, promenom saobraćajnog režima na nekim ulicama, izvođenjem tački parkiranja i prelaženje na druge oblike saobraćaja, rekonstrukcijom dela infrastrukture kako bi se dalo više mesta pešacima, biciklistima i javnom saobraćaju. Uz to predviđaju se i drugi, meki pristupi, kao što su različite organizacione mere i promocija upotrebe održivih oblika saobraćaja.

Ključne reči: s*aobraćajna studija, plan održive urbane mobilnosti, Dubrovnik, Kotor, zagušenje saobraćaja, pešački tunel s pokretnom trakom, održive oblike saobraćaja*

PLANS OF SUSTAINABLE URBAN MOBILITY FOR THE CITIES OF DUBROVNIK AND KOTOR

Abstract: In the framework of the European project Adria.MOVE IT! , we have developed a traffic studies and plans of sustainable urban mobility in cities of Dubrovnik and Kotor. Our intention is to present the method of preparation of sustainable mobility plans and our experience on specific projects. We'd like to present technical solutions of infrastructure and organization of traffic which will be established in these cities on basis of local sustainable mobility plans. The specificity of the traffic problems in these cities is a very high pressure of cruising tourist to the old town and because of that traffic congestion. The solution of these problems is construction of a pedestrian tunnel with a conveyor belt, changes in public bus system, development of urban public transport by sea, changes of driving direction on some streets, development of park+ride system, reconstruction of infrastructure in order to enable more space for pedestrians, cyclists and public transport. Beside that, other, soft approaches are proposed, such as different organizational measures and promotion of sustainable forms of transport.

Key words: *traffic study, plan of sustainable urban mobility, Dubrovnik, Kotor, traffic congestion, pedestrian tunnel with a conveyor belt, sustainable forms of transport*

Управљање путевима

Road Management

5

TEHNIČKA REVIZIJA POSLOVANJA I REALIZACIJE PROJEKATA U AGENCIJAMA ZA PUTEVE

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Rezime: Tehnička revizija se u okviru projekata koje finansiraju međunarodne finansijske institucije pojavila tek u poslednjih deset do petnaest godina kao specifičan vid kontrole tokom realizacije infrastrukturnih projekata. Pri tome je značajan deo ovih aktivnosti usmeren na super-kontrolu kvaliteta izvedenih radova. Međutim, kao poseban vid tehničke kontrole se pojavljuje ocena efektivnosti, integriteta i transparentnosti aktivnosti koje obavljaju agencije za puteve. Cilj ovog posla je da omogući agencijama za puteve, odgovarajućim ministarstvima i vladi, kao i međunarodnim finansijskim institucijama koje podržavaju sektor puteva da provere ispravnost ulaganja, upravljačkih aktivnosti i podrške organizaciji upravljanja, kao i uspostavljanje sistema za otkrivanje koruptivnih aktivnosti. U radu se prikazuju osnovne postavke tehničke revizije kompletnog poslovanja agencija za puteve i same realizacije projekata, odnosno izvršenja radova u skladu sa tehničkim uslovima.

Ključne reči: *agencije za puteve, tehnička revizija, poslovanje, kontrola kvaliteta*

TECHNICAL AUDIT OF ACTIVITIES AND PROJECT IMPLEMENTATION IN ROAD AGENCIES

Abstract: Technical audit of projects financed by international financing institutions emerged only in the last ten to fifteen years, as a specific form of control over the implementation of infrastructure projects. An important part of these activities is focused on super-control quality of work. However, a special form of technical control assesses effectiveness, integrity and transparency of activities carried out by road agencies. The aim of this work is to enable road agencies, the relevant ministries and government, and international financing institutions that support the road sector, to check correctness of investment, management activities and support to management organization, as well as establishing a system for detection of corrupt activities. The paper presents basic assumptions of technical audit for complete business of road agencies and implementation of projects themself, or execution of works in accordance with technical specifications.

Key words: *road agencies, technical audit, business, quality control*

POKAZATELJI STANJA FLEKSIBILNIH KOLOVOZNIH KONSTRUKCIJA U FUNKCIJI UPRAVLJANJA PUTEVIMA

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Rezime: Sistemi upravljanja putevima pružaju najbolje mogućnosti ocjenjivanja dobiti, gubitaka i opšte efikasnosti uloženih finansijskih sredstava. Oni direktno odražavaju uspješnost ulaganja u izgrađenu putnu infrastrukturu, a pri tom ostaju funkcionalni, relativno lako razumljivi i korisni, kao pomoćno sredstvo donosiocima odluka na svim nivoima.
Pokazatelji ključnih parametara stanja, kao što su podužna i poprečna ravnost, pukotine, makrotekstura, površinska oštećenja i nosivost kolovozne konstrukcije uz kombinovanje drugih vanjskih uticaja kao što su saobraćajno opterećenje, klima i sl. daju mogućnost sveobuhvatnog vrednovanja i ocjene stanja puta. Ovakvim vrednovanjem se može razviti model, odnosno metode, za ocjenu stanja fleksibilnih kolovoznih konstrukcija u zavisnosti od strukturnih i površinskih karakteristika. Upravljači putevima u Bosni i Hercegovini nemaju pravu sliku stanja puteva, jer nije razvijena metodologija kojom bi se postojeći podaci mogli vrednovati, uporediti i predstaviti.
U radu će biti prikazane aktivnosti koje treba sprovesti za razvoj modela, odnosno sistema, kojim bi se vrednovalo stanje fleksibilnih kolovoznih konstrukcija, kako bi upravljači, ali i korisnici puteva imali globalnu sliku stanja putne mreže i kako bi se uradilo vrednovanje dionica po kategorijama puteva i veličini saobraćaja kao i uvid u homogenost kvaliteta dionica po putnim pravcima.

Ključne reči: *putevi, upravljanje putevima, ocjena stanja, pokazatelji stanja, fleksibilne kolovozne konstrukcije*

PERFORMANCE INDICATORS OF FLEXIBLE PAVEMENT STRUCTURES USED IN ROAD MANAGEMENT

Abstract: Road Management systems provide ways to get the best options appraisal, losses and overall effectiveness of invested funds. They directly reflect the investment performance of the constructed road infrastructure, while remaining functional, relatively easy to understand and useful as an aid to decision-making at all levels.
Indicators of key condition parameters, such as longitudinal and transverse evenness, cracks, macro-texture, surface damage and bearing capacity of pavement with a combination of other conditions such as traffic volume, climate etc. give the possibility of a comprehensive evaluation and assessment of road conditions. Such evaluation can be used for developing model and methods for assessment of flexible pavements, depending on structural and surface characteristics. Road managers in Bosnia and Herzegovina do not have a true picture of the road conditions, because there is no developed methodology for the evaluation, comparison and presentation of existing data. This paper will presented the activities to be undertaken for the development of the model, ie. the system, which would be used to evaluate the condition of flexible

pavements and provide the managers, as well as road users with a global overview of the road network conditions and to make an evaluation based on by category of roads and traffic volume as well as insight into the homogeneity of roads quality.

Key words: *roads, road management, evaluation, performance indicators, flexible pavement*

INTELIGENTNO UPRAVLJANJE KONTROLOM PRISTUPA NA SAOBRAĆAJNICAMA VISOKOG RANGA

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Rezime: U ovom radu dati su predlozi modela za upravljanje ramp meteringom. “Ramp meter” je uređaj koji pomoću svetlosnih signala (samo crveno i zeleno svetlo) reguliše ulivni tok na glavnu saobraćajnicu u odosu na trenutnu saobraćajnu situaciju. Ovakvim upravljanjem treba smanjiti zagušenja u glavnom toku, povećati brzinu saobraćajnog toka i kapacitet glavne saobraćajnice. U radu su predložena tri modela koja bliske rampe stavljaju u jedan funkcionalan sistem. Prvi model se bazira na formulisanju zadatka linearnog programiranja, gde se kao ulazni podaci uzimaju kombinacije podataka dobijenih sa detektora i unapred definisanih veličina (maksimalni dozvoljeni red vozila na rampi). Drugi model bazira se na podacima sa detektora koji se iskazuju kao odnos saobraćajnih zahteva i kapaciteta. Ovi podaci predstavljaju ulaz u neuronsku mrežu. Treći model se bazira na fazi logici. Izlazi iz predloženih modela predstavljaju broj vozila na čas koja se ulivaju u glavni tok sa svake od rampi. Modeli su testirani na primeru i rezultati su prikazani u radu.

Ključne reči: *saobraćajnica, saobraćajni tok, ramp metering, linearno programiranje, neuronska mreža, fazi logika*

INTELLIGENT CONTROL ACCESS TO HIGHWAYS

Abstract: This paper offers suggestions for managing models ramp metering. " Ramp Meter" is a device by means of light signals (only red and green light) regulates the flow of pouring the major pathway relative to a current traffic situation. Such management should reduce congestion in the main flow, increase the speed of traffic flow and the capacity of the main road. The paper proposed three models that close ramps placed in one functional system. The first model is based on the formulation of linear programming tasks, where such inputs are taking a combination of data obtained from the detector and predefined size (the maximum allowed queue of vehicles on the ramp). The second model is based on data from detectors that are expressed as the ratio of traffic demand and capacity. These data are input to a neural network. The third model is based on fuzzy logic. Get out of the proposed models represent the number of vehicles per hour that flow into the main stream with each of the ramps. The models were tested on the example and the results are presented in this paper.

Key words: *roads, traffic flow, ramp metering, linear programming, neural networks, fuzzy logic*

BAZA PODATAKA O KLIZIŠTIMA NA PUTEVIMA SRBIJE

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Rezime: Brojna aktivna klizišta, registrovana u zoni puteva, ugrožavaju bezbedno odvijanje saobraćaja a njihova sanacija iziskuje značajna finansijska sredstva. Baza podataka o klizištima na putevima Srbije, na čijem formiranju se radi više od deset godina, ima za cilj evidentiranje i redovno ažuriranje informacija o kilizištima i drugiim pojavama nestabilnosti. Ovo dalje omogućava blagovremeno, potpuno i tačno informisanje nadležnih institucija o broju pojava, stanju aktivnosti, stepenu ugroženosti saobraćajnica (hazard i rizik). Baza daje rejting pojava na osnovu čega se planiraju aktivnost i sredstva za održavanje, detaljnija istraživanja i preduzimanja sanacionih mera kao i informisanje učesnika u saobraćaju.

Ključne reči: *klizišta, putevi, baza podataka, održavanje, sanacija*

DATABASE ON LANDSLIDES ON SERBIAN ROADS

Abstract: Numerous active landslides, registered in zones of roads, jeopardizes traffic safety and their repair requires significant financial funds. Database on landslides at roads of Serbia, which has been prepared for ten years, aims at recording and regular updating of data on landslides and other appearances of instability. It further enables timely, fully and accurate informing of authorized institutions on the number of appearances, state of activity, degree of endangerment of roads (risk and hazard) Database provides rating of appearances and base for planning of activities and funds for maintenance, detailed investigations and taking of repair measures as well as informing of traffic participants.

Key words: *landslides, roads, database, maintenance, repair*

KATASTAR KLIZIŠTA NA DRŽAVNIM PUTEVIMA SRBIJE

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Rezime: Na državnim putevima I i II reda, u periodu od 2005. do marta 2014.god. registrovano je približno 340 nestabilnih pojava (klizišta, tecišta, odrona, sipara) različitih dimenzija i stepena aktivnosti. Sve ove pojave imale su za posledicu deformacije na putevima sa otežanim odvijanjem saobraćaja, a na nekim deonicama

i do njegovog potpunog prekida i ugrožavanja života ljudi, bezbednosti saobraćaja, sigurnosti putnih, stambenih, privrednih i drugih objekata. Samo tokom 2005. i 2006.god. došlo je do formiranja oko 80 klizišta za čiju sanaciju je bilo potrebno izdvojiti dodatna finansijska sredstva koja nisu bila predviđena budžetom. Ovakvo stanje stabilnosti na putevima nametnulo je potrebu za hitnom izradom katastra klizišta koji bi omogućio Investitoru donošenje pravovremene odluke o prioritetima za sanaciju, kao i kontinuiranom praćenju i upravljanju rizikom od klizišta. Osim toga, katastar klizišta je i argumentovana dokumentaciona osnova za izradu baze podataka o klizištima na državnoj putnoj mreži Srbije. U ovom radu daje se prikaz metodološkog pristupa pri izradi katastra klizišta i drugih nestabilnih pojava na državnim putevima Srbije.

Ključne reči: *katastar, klizišta, sanacije, baza podataka*

CADASTRE OF LANDSLIDES ON STATE ROADS OF THE REPUBLIC OF SERBIA

Abstract: Approximately 340 appearances of instability (landslides, soil fluctions, rockfalls, screes) with different dimensions and states of activity were recorded at state roads of II and III category in the period from 2005 to March 2014. All appearances resulted in deformation at roads with deteriorated traffic conditions and at some section even in its complete interruption and threat to human lives, traffic safety and safety of road, residential, industrial and other structures. Only in 2005 and 2006, 80 landslides were formed, which repair required additional financial funds, which were not envisaged by the state budget. This stability condition at roads induced the urgent preparation of landslide registry which would enable the Investor to make timely decision on repair priorities as well as continuous monitoring and management of landslide risk. Additionally, landslide registry is argumentational and documentational base for preparation of landslide database at state road network of Serbia. This paper presents review of methodological approach to preparation of registry of landslides and other unstable appearances at the state roads of Serbia

Key words: *registry, landslide, repair, database*

GEOTEHNIČKI MONITORING KLIZIŠTA NA PUTEVIMA SRBIJE

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Rezime: Geotehnički monitoring nestabilnih terena predstavlja vizuelno i instrumentalno osmatranje i evidentiranje promena u zoni klizišta i na postojećim objektima. Monitoringom se izučava proces klizanja i utvrđuju: uzroci, mehanizam i dinamika pomeranja tela klizišta, a na osnovu ukupnih rezultata, vrši se procena stepena hazarda, ugroženosti i rizika od klizanja. U radu je opisana metodolologija geotehničkog monitoringa, pojmovi, oprema, obim i učestalost osmatranja. Zatim su,

hronološkim redom, dati primeri monitoringa klizišta u zoni puteva, mostova i naselja u Srbiji koji su vršeni u periodu 1991-2013. god. sa opisom ugrađene opreme i osnovnim rezultatima.

Ključne reči: *monitoring, klizišta, oprema, putevi, primeri*

GEOTECHNICAL MONITORING OF LANDSLIDES ON SERBIAN ROADS

Abstract: Geotechnical monitoring of landslide includes visual and instrumental observation and recording of alterations in the landslide zone and at the existing structures. Monitoring enables studding of sliding process and determining of the following facts: causes, mechanism and dynamics of landslide body movement and the estimation of hazard degree, endangerment and risk from sliding is performed based on the general results. Methodology, terms, equipment, volume and frequency of observations are described in this paper. Then the examples of monitoring at roads of Serbia, which were performed in the period from 1991 – 2013 are chronologically stated with description of installed equipment and the most important results.

Key words: *monitoring, land slide, equipment, roads, examples*

MANAGING HIGHWAY LANES – DOES IT IMPROVE EFFICIENCY AND EFFECTIVENESS?

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Abstract: Highway lanes can be managed to achieve various objectives. In the case of high-occupancy vehicles (HOV's), an exclusive HOV lane has been shown to increase the proportion of multiple-occupant vehicles and therefore the person-capacity of the highway. Managing lanes for specific classes of vehicles, such as high-occupancy autos, transit vehicles, or commercial vehicles, can yield operational or safety benefits or achieve more strategic objectives.
This paper contains a case-study evaluation, undertaken for the Ontario Ministry of Transportation, of managed lanes for specific classes of vehicles, including high-occupancy vehicles and commercial vehicles. Highway 427, from Highway 401 north to Highway 7, was used as a case study. Micro-simulation, using the VISSIM package, was the evaluation tool of choice. Simulation of 2011 traffic conditions was undertaken under various lane-management scenarios, including general-purpose use at all times (existing situation) and various levels of restricted use with respect to specific vehicle classes. Findings are discussed in the context of how the Ministry of Transportation can best utilize additional lanes that may be constructed in the future.

Key words: *HOV lanes, managed lanes, CV lanes*

EVALUATING HOV PLANS AND PRIORITIES – THE CASE OF EXPRESSWAYS IN THE GREATER TORONTO AREA

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Abstract: The proportion of High-Occupancy Vehicle (HOV) commuting trips in the Greater Toronto Area (GTA – includes the City of Toronto and the Regions of Halton, Peel, York, and Durham) has been declining over recent years. In an effort to reverse this decline and make more efficient use of the available infrastructure, the Ministry of Transportation of Ontario has begun to implement HOV lanes on the 400-series highway system. The implementation of HOV lanes on portions of Highway 403 and 404 in late 2005 met with substantial success, being well-used in peak periods. In support of the planning and prioritization of future HOV lane implementation, the Ministry conducted several studies, one focused on the Greater Toronto Area west of Highway 427 and one focused on the area to the east, to forecast HOV use of potential future HOV network components. The current paper addresses the GTA East study.
The paper begins by providing some background with respect to auto occupancy and HOV use trends in the Greater Toronto Area. The success of the Highway 403 and 404 HOV lanes is reviewed briefly as context to the development and testing of a broader network. The modeling process used to forecast future HOV use in response to potential HOV lane network configurations is presented as an integrated approach, incorporating both the EMME macroscopic travel demand model and the VISSIM and PARAMICS micro-simulation models. The development and validation of a model to estimate incremental increases in HOV use as a function of travel time savings is presented and the validation of this model, using before-and-after data from the Highway 403 and 404 projects is discussed.
HOV forecasting is not a standardized tool in the transportation planning toolbox. Different approaches have been attempted with varying levels of success. This paper is a useful addition to the literature on the subject in that it discusses some of the key issues encountered and describes the development and adaptation of models and methods to address these issues. Issues discussed include making maximum use of available data, model validation with before-and-after data, and the integration of macroscopic travel demand modeling with micro-simulation to combine the strengths of both approaches.

Key words: *HOV lanes, forecasting*

BAZE PODATAKA U PROCESIMA UPRAVLJANJA PUTNOM MREŽOM SRBIJE

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Rezime: Procesi upravljanja putevima zahtevaju dobru informacionu osnovu, pa formiranje i permanentno usavršavanje informacionog sistema, uz održavanje ažurnosti podataka, takođe čini nerazdvojni deo procesa upravljanja. U radu se daje kratak prikaz i analiza aktuelne informatičke podrške koja se u JP ''Putevi Srbije'' koristi u pojedinim aktivnostima sistema upravljanja putnom mrežom. Posle toga se ukazuje na moguće korake u daljem razvoju metodoloških i informatičkih rešenja.

Ključne reči: u*pravljanje putevima, Informacioni sistem o putevima, procesi upravljanja putevima, podaci o putevima, baze podataka o putevima*

ROAD DATA BASSES IN PROCESSES OF ROAD NETWORK MANAGEMENT SYSTEM

Abstract: Processes within the road management system requires good information base, including establishment and continuous improvement of information system, while maintaining the efficiency of data also makes it an inseparable part of the management process. This paper provides a brief overview and analysis of current IT support, which in PE " Roads of Serbia" is used in some activities of the management road network. After that, report indicates suggestions for possible steps in the further development of methodologies and information system solutions.

Key words: *road management, information system of roads, road management processes, data on roads, road database*

PLANIRANJE ODRŽAVANJA PUTNIH MOSTOVA

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Rezime: Mostovi su vitalni deo putne mreže i zahtevaju kapitalne investicije za izgradnju i održavanje. Cilj upravljanja mostovima je održavanje mostova u prihtaljivom stanju za predviđenu namenu pri minimalnim troškovima. Svi savremeni sistemi upravljanja mostovima, koji se mogu razlikovati u detaljima, sadrže model predviđanja propadanja i model za utvrđivanje optimalne politike održavanja. Za razvoj sistema upravljanja mostova od nesumljivog je značaja dobro utemeljena i održavana baza podataka o mostovima, koja predstavlja osnov za formiranje modela propadanja. U radu je prikazan model propadanja mostovskih elemenata zasnovan na Markovljevim lancima koji je zatim primenjen na mrežu mostova u Srbiji. U tu svrhu su korišćeni podatci iz baze podataka o mostovima koja je u nadležnosti JP Putevi Srbije. Za utvrđivanje optimalne politike održavanja konsekventno se primenjuje Markovljev process odlučivanja. Ilustrativni primer prikazan u radu, a zasnovan na stvarnim podacima iz baze podataka o

mostovima,ukazuje na potrebu za većim finansiskim sredstvima za održavanje mostova, naročito u početnom periodu, imajući u vidu trenutno stanje mostova u Srbiji.

Ključne reči: *baza podataka o mostovima, sistem upravljanja mostovima, održavanje, optimalna politika*

MAINTENANCE PLANNING OF ROAD BRIDGES

Abstract: Bridges are a vital part of the road network and require capital investment for construction and maintenance. The objective of bridge management is to maintain bridges in acceptable condition for its intended purpose at minimum cost. All modern Bridge Management Systems vary in detail, but generally they comprise a deterioration model to predict condition development and a preservation optimization model to determine the optimum preservation policy. Well established and maintained a database is crucial for the development of the bridge management, since it is the basis for the formulation of deterioration models. This paper presents a model of bridge element deterioration based on Markov chains, which is then applied to a network of bridges in Serbia. For this purpose, data from a Bridge Information database, which is under the jurisdiction of Public Roads of Serbia, were used. Consistently, Markov decision process is applied to determine the optimal maintenance policies. An illustrative example is shown in the paper, and, based on actual data from the database, points to the need for greater financial means for the maintenance of bridges, especially in the initial period, given the current state of bridges in Serbia.

Key words: *bridge information database, bridge management system, maintenance, optimal policy*

Изградња и одржавање путева и објеката

Construction and Maintenance of Roads and Structures

6

PREVENCIJA ZALEĐIVANJA MOSTOVA, UVEK DOSTUPAN PUT

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Rezime: Prevencija zaleđivanja mostova predstavlja iskorak u odžavanju putne infrastrukture (kako redovne tako i investicione), te podiže efikasnost zimske službe, čime se postižu merljivi i vidljivi rezultati koji kao krajnji ishod daju veću efikasnost i bezbednost saobraćaja (imajući u vidu da se mostovske konstrukcije prve lede), te produžavaju vreme eksploatacije saobraćajnica. Smanjenom upotrebom hemikalija umanjuju se štetne posledice po okolinu, pa možemo govoriti o ekološkom iskoraku. U ovom radu je stavljen akcenat upravo na rešavanje saobraćajnih i investicionih problema primenom novih, modernih tehnologija.
Cilj ovog rada je da pokaže kako se mogu napraviti moderne saobraćajnice(efikasne i bezbedne), te je zbog nezavršenog investicionog procesa u Srbiji ovo plodno tle za uvođenje inovacija, pa smatramo da će rezultati(ušteda na redovnom i investicionom održavanju, povećana bezbednost saobraćaja) ostvareni na ovaj način biti lako poredivi sa izgrađenim deonicama u našoj zemlji.

Abstract: Preventing of icing bridges is a step in the maintenance of road infrastructure (both, regular and investment), and increase the efficiency of the winter service, which leads to measurable and tangible results that the ultimate outcome provide greater efficiency and traffic safety (keeping in mind that the bridge structure are first freezing) and prolong the exploitation of traffic. Reduc using of chemicals are reduced adverse effects to the environment and in that case we can talk about environmental perspective.
In this paper, emphasis is on solving the problems in public transport, traffic and investments problems by using new and modern technologies.
The aim of this paper is to show how we can make a modern road (efficient and safe), and because of the unfinished investment process in Serbia, this is attractive for innovation. We believe that the results (saving on regular and investment maintenance, increased traffic safety) generated in this manner will be easily comparable with a section of our country.

ANALIZA STABILNOSTI NASIPA NA TRASI AUTOPUTA KORIDOR Vc, DIONICA SVILAJ – ODŽAK

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Rezime: Izgradnja autoputa koridor Vc koji prolazi kroz Bosnu i Hercegovinu, zahtijevala je značajna geološka i inženjerskogeološka istraživanja, obzirom da prolazi kroz terena složene geološke građe. Na dionici Svilaj – Vukosavlje koja polazi od rijeke Save i ide dolinom rijeke Bosne, teren pripada akumulacionom reljefu južne Posavine.

Na predmetnoj dionici u cilju postizanja projektovane nivelete puta, gradiće se nasipi, različite moćnosti, koji su u pojedinim dijelovima terena preko 12,0 m. Nagib kosine nasipa je postavljen tako da bude jednobrazan od vrha pa do kontakta sa tlom, bez bermi, ma koliko iznosila visina nasipa. U radu su prikazana tri karakteristična profila na određenim stacionažama. Urađena je analiza stabilnosti nasipa u prirodnim uslovima i uslovima primjene određenih sanacionih mjera, radi povećanja faktora sigurnosti.

Ključne riječi: *teren, autoput, nasip, analiza stabilnosti*

STABILITY ANALYSIS EMBANKMENT ON THE ROUTE OF THE HIGHWAY CORRIDOR VC, SVILAJ - ODŽAK

Abstract: Construction of Corridor Vc of the highway which passes through Bosnia and Herzegovina, demanded significant geological and engineering geological investigations, as passes through the field of complex geological structure. From Svilaj - Vukosavlje which starts from Sava River and goes through the valley of the Bosna River, the terrain belongs accumulation relief southern Posavina.

At this section in order to achieve the projected roadway, will be built levees, different thicknesses, which in some parts of the field to 12.0 m. The slope of the embankment slope is set to be uniform from the top to the contact with the ground, no berms, no matter how much was the height of the embankment. The paper presents three typical profiles on a certain chainages. Analysis has been carried of stability of the embankment under natural conditions and the conditions of application of certain remedial measures in order to increase safety factor.

Key words: *terrain, highway embankment stability analysis*

УПРАВЉАЊЕ ИЗГРАДЊОМ АУТОПУТЕВА У РЕПУБЛИЦИ СРПСКОЈ

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Резиме: Градња аутопутева у Републици Српској везује се за политичку одлуку Владе из 2002. године.
До данас је пуштено у саобраћај 34,5 км, а траје градња 72,00 км. Учесници у градњи на првој дионици су учили на властитим грешкама. Први аутопут Градишка – Бањалука грађен по принципу „Изгради по пројекту“, други од Бањалуке до Добоја гради се према „Испројектуј и Изгради“.
Различити приступи захтијевају различиту организацију свих учесника у градњи. Можемо ли искористити прилику да неке наше компаније израсту у равноправне судионике на међународним тендерима. Шта требамо учинити на појединим нивоима па да уз такве компаније престанемо бити само корисници кредитних средстава.

Кључне ријечи: *управљање, градња, знање, конкурентност, развој*

MANAGEMENT MOTORWAY CONSTRUCTION IN REPUBLIC OF SRPSKA

Abstract The construction of motorways in the Republic of Srpska linked to the policy decision of the Government of the 2002 nd year. It was built 35 km of motorway, now in traffic, and during the construction of 72km. The participants in the construction of the first section are taught from their own mistakes. First motorway, Gradiška - Banja Luka, built on the principle of "To build in according with design “(Red FIDIC), second Banja Luka to Doboj is being built by “Design and build” (Yellow FIDIC). Different approaches require different organization of all participants in the construction.
Can we take a chance that some of our companies grow in equal participants in international market.
What we need to do at certain levels so that such companies to stop being customers only credit funds.

Key words: *management, construction, knowledge, competitiveness, development*

STABILIZATION OF A DEEP CUTTING ALONG THE HIGHWAY A63 KEISERSLAUTERN – MAINZ, GERMANY, WITH A FLEXIBLE SLOPE STABILIZATION SYSTEM

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Abstract: Flexible slope stabilization systems made from wire meshes in combination with nailing are widely used in practice to stabilize soil and rock slopes. They are economical solutions and a good alternative to measures based on rigid concrete liner walls or massive supporting structures. Apart from designs using conventional steel wire, meshes from high-tensile steel wire are now also available on the market. The latter can absorb substantially higher forces and transfer them onto the nailing. Special concepts have been developed for the dimensioning of flexible surface stabilization systems for use on steep slopes in more or less homogeneous soil or heavily weathered loosened rock, but also on fissured and layered rock in which the bodies liable to break out are determined by fissure and layer surfaces. Stabilizations implemented in soil and rock, with and without vegetated face, confirm that these measures are suitable for practical application.

Along the highway A63 from Kaiserslautern to Mainz, Germany, a cutting was made in mottled sandstone prone to weathering. This cutting is up to 35 m deep on the northern and 15 m on the southern side. The inclination of the slope is generally 45° and flattens off slightly towards the top edge of the slope. Transverse to the slope surface there are several fissures going right across, of a width of up to several cm. Relaxation processes in the form of removal of rock masses at the front led to a tremendous loosening of the rock compound with the result that the tectonic-based

fissure systems were visibly activated. Approx. 2 years after the excavation the slopes revealed to be unstable and required subsequent protection measures.

As a protective measure the slope stabilization system TECCO® was selected. It was dimensioned on the one hand against superficial instabilities. On the other hand, the global stability was investigated according to the sliding-block method. Individual wedge-shaped bodies susceptible to break out were analysed varying distances between fissures and fissure gradients, in order to dimension the nailing and to determine the minimum required nail lengths. Besides information regarding design as well as practical application, the geotechnical situation is going to be analysed with the aim to sensitize engineers accordingly.

Key words: *slope, stabilization, flexible, cutting, high tensile mesh, surface stabilisation*

KORIŠĆENJE SMART TELEFONA I GOOGLE EARTH KAO SREDSTVA ZA PRAĆENJE RADOVA NA TERENU

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Rezime: Dostupnost smartphone uređaja u 21. veku inženjerima je pružila mogućnost da u rukama drže močnu tehnologije. Ovaj rad opisuje inovativnu upotrebu smart tehnologije, koja uz korišćenje programa Google Earth, može da eliminiše nekoliko teškoća sa kojima se inženjeri susreću na terenu. Kao prvi problem koji se obrađuje u ovom radu je fizička orijentacija na terenu a kao primer uzet je projekat izvođenja autoputa. U radu se opisuje kako se AutoCAD crteži trase prenose u fajlove za Google Earth i koji se kao takvi mogu koristiti kao podloga za GPS lokacijskih mogućnosti smart tehnologije. Sledeći problem na linijskom projektu, kao što je autoput, je velika dužina trase i dugačak rok izvođenja. Ovaj rad prikazuje kako Google Earth i korišćenje smart telefona na terenu omogućava brz i sažet pregled velike količine informacija i praćenje kako se te informacije menjaju u prostoru i vremenu.

Ključne reči: *smart tehnologija, Google Earth, teren, GPS, praćenje u vremenu i prostoru*

THE USE OF SMART PHONES AND GOOGLE EARTH AS A MEANS OF TRACKING ISSUES ON SITE

Abstract: The availability of the smartphone in the 21st century has given engineers the ability to hold an impressive amount of technology in the palm of their hand. This work describes an innovative application of this smart technology, predominantly through the use of Google Earth, to eliminate some of the difficulties that engineers face on site. The first problem that this work addresses is that of physical orientation on site, taking the example of a motorway construction project. It is shown how AutoCAD alignment drawings may be transferred into Google Earth files, which can

then be used as a reference for the GPS location abilities of smart technology. Another difficulty on a linear project, such as a motorway, is its large scale and the extensive time needed for its construction. This work describes how Google Earth and the use of a smartphone on site enable the clear and concise illustration of a large amount of data and the tracking of how this information varies in both space and time.

Key words: *smart technology, Google Earth, site, GPS, tracking in both space and time*

SVOJSTVA PROPUSNIH BETONA I MOGUĆNOST NJIHOVE PRIMENE U SAVREMENOJ PUTOGRADNJI

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Abstrakt: U radu je prikazana mogućnost primene propusnog betona u savremenoj putogradnji. Opisane su osnovne karakteristike ove specifične vrste betona, sa posebnim osvrtom na njegov uticaj na životnu sredinu. Posebno su analizirani komponentni materijali i preporuke za optimalan sastav propusnih betona. Na osnovu eksperimentalnih rezultata drugih autora izvedeni su zaključci o uticaju fizičkih svojstava poroznog betona na njegove mehaničke karakterisitke. Zbog specifične kombinacije svojstava (vodo-propusnost, zadovoljavajuće mehaničke karakteristike) propusni betoni se mogu koristiti kao završni sloj kolovozne konstrukcije za parkirališta, puteve koji imaju manja saobraćajna opterećenja, puteve sa jakim bujičnim kišama, podove staklenika, pešačke i biciklističke staze i dr. Osnovni cilj rada je popularizacija ove vrste betona zbog mogućnosti supstitucije dela veziva primenom industrijskih otpadnih materijala (leteći pepeo i zgura) i potpunom ili delimičnom zamenom prirodnog agregata građevinskim otpadom (stari izdrobljeni beton u obliku krupnog agregata). Na taj način bi se u okviru domaće putogradnje otvorile šire mogućnosti za zaštitu životne sredine i održivo građevinarstvo.

PERMEABLE CONCRETE PROPERTIES AND POSSIBILITY OF ITS APLLICATION IN ROAD CONSTRUCTION

Abstract: This paper presents the possibility of application of permeable concrete in contemporary road construction. The main characteristics of this specific type of concrete are described, with special emphasis on its environmental impact. Component materials and recommendations for the optimal composition of permeable concrete are specially analyzed. Based on the experimental results of other authors, conclusions about the influence of the physical properties of porous concrete to its mechanical characteristics are made. Due to the specific combination of properties (water-permeability, satisfying mechanical properties) permeable concrete can be used as the final pavement layer for parking lots, roads with lower traffic loads, roads with heavy torrential rains, greenhouse floors, pedestrian and bicycle paths, etc.. The

main goal of the paper is to popularize these types of concrete due to the possibility of replacing part of binder by applying industrial wastes (fly ash and slag) and complete or partial replacement of natural aggregate with construction waste (old crushed concrete as coarse aggregate). This would opened up wider opportunities for environmental protection and sustainable construction within the domestic road construction.

HIDROIZOLACIJA BETONSKIH MOSTOVA – ISKUSTVA IZ PRAKSE

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Rezime: Hidroizolacija kolovozne ploče na betonskim mostovima ima važnu ulogu u zaštiti betona i produženju trajnosti i veka eksploatacije mostova. Da bi hidroizolacija u potpunosti ostvarila svrhu neophodna je primena kvalitetnih tehničkih rešenja i materijala, kao i stručno ugrađivanje. U radu su izneta iskustva stečena pri praćenju ugrađivanja hidroizolacionih sistema sa polimer-bitumenskim trakama na betonskim mostovima, ispitivanju i kontroli kvaliteta izvedenih radova, sa osvrtom na probleme i propuste koji se sreću u praksi.

Ključne reči: *hidroizolacija, betonski mostovi, polimer-bitumenske trake, prionljivost*

WATERPROOFING OF CONCRETE BRIDGES – PRACTICAL EXPERIENCES

Abstract: Waterproofing of concrete bridge decks has an important role in the protection of concrete and extending the durability and service life of bridges. In order to waterproofing fully achieve the purpose essential is usage of quality technical solutions and materials, as well as professional performing of waterproofing works.This paper reviews the experiences gained in monitoring the installation of waterproofing systems with polymer-bitumen membranes on concrete bridges, testing and quality control of the executed works, with emphasis on the problems and failures that are encountered in practice.

Key words: *waterproofing, concrete bridges, polymer-bitumen membrane, adhesion*

REGIONAL BALKAN CASE STUDIES OF GEOSYNTHETIC REINFORCED SOIL STRUCTURES AND ASPHALT REINFORCEMENT USED FOR THE CONSTRUCTION OF NEW OR UPGRADED HIGHWAY ROUTES. DESIGN ASPECTS, PHILOSOPHY AND CONSTRUCTION EXPERIENCES.

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Abstract: This paper describes a number of reinforced soil structures built as key elements within the construction of a number of highway projects within the last 5

years. The projects are located within the Republic of Serbia, Montenegro and Bulgaria and include reinforced soil structures with a variety of facings.
Serbian projects include the 9.5m high green faced bridge approach embankments on the 2008 Belgrade Bypass, Surcin - Orlovaca Section, and the 2010 construction of the Pancevo-Vrsac Bridge Abutment. Whilst an example from neighbouring Montenegro looks at the use of reinforced green faced slopes on the Bijelo Polje Ring Road project. With respect to asphalt reinforcement the recent (2011 and 2012) example of the rehabilitation of a section of the route Airport-Bubanj potok through central Belgrade will be detailed.
Within Bulgaria this paper will highlight two hard faced reinforced soil wall options; namely the Muralex® system which provides a 'gabion' type facing solution used on the Road III-868 Devin–Mihalkovo project in the southern Rodopi Mountains, with 28 separate reinforced soil structures built the tallest being in excess of 20m high. This project was constructed between 2008 to 2011.
Additionally a segmental concrete block faced vertical wall system used for the approach embankments on an elevated interchange on the Sofia Ring Road project from 2011-12 will be described.
The project environments, problems and typical solutions are described, as well as design and calculation insights, with typical cross-sections and photographs illustrating the specific points of interest.
Some important construction related issues and first hand experiences are also reported with respect to the these individual projects.

Key words: *geosynthetic, reinforcement, highway, embankment, asphalt, seismic*

ИСКУСТВА У ПРИМЕНИ АДИТИВА ЗА СНИЖЕЊЕ ТЕМПЕРАТУРА КОД ПРОИЗВОДЊЕ И УГРАДЊЕ АСФАЛТА У СРБИЈИ

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Резиме: Производња и уградња асфалтних мешавина одвија се на еквивискозним температурама везива (0,2 Pa x s и 2,0 Pa x s) и оне се крећу за класичне асфалтне мешавине са битуменом BIT 60 од 160 ± 100C код производње и 150 ± 100C код уграђивања. Уколико се користе полимер-модификована везива те температуре су за 10-150C више у односу на битумен BIT 60. У циљу уштеде енергије и смањење емисије зрачења угљен-диоксида у свету се све више примењују адитиви који снижавају вискозност везива и тиме снижавају температуре код производње и уградње асфалта и до 300C.
У раду су приказани наша искуства у примени вишенаменског адитива REDISET WMX код производње и уградње асфалтних мешавина типа асфалтног-бетона, битуменизираног агрегата и мастис асфалта. Урађене су три деонице пута у околини Ивањице, Сурчина и Београда и приказани су резултати испитивања.

Кључне речи: *адитив за снижење температуре, битумен, асфалт*

EXPERIENCE IN APPLYING ADDITIVES TO LOWER THE TEMPERATURE IN THE MANUFACTURE AND INSTALLATION OF ASPHALT IN SERBIA

Abstract: The production and installation of asphalt mixture is carried out at equi-viscous temperatures of binder (0.2 Pa.s and 2.0 Pa.s) which are for usual asphalt mixtures with bitumen BIT 60 between 160±100C in production and 150±100C in paving. If used the polymer-modified binder these temperatures are of 10-150C higher than with the bitumen BIT 60. For the purpose of saving energy and reducing the emission of carbon dioxide it is increasingly used additives which lower the viscosity of binder and thereby lowering the temperature in the production and paving of asphalt mixtures up to 300C.
This paper presents our experiences in the application of multi-purpose additives REDISET WMX in the production and installation of different types of asphalt mixture, i.e. asphalt-concrete, base course mixtures and mastic asphalt. There were made three road sections around town Ivanjica, Surcin and Belgrade and presents the results of tests.

Key words: *additive for lowering the temperature, bitumen, asphalt*

OSVRT NA ISTRAŽIVANJA TERENA NA TRASI AUTO PUTA KORIDOR Vc, DIONICA JOHOVAC – DOBOJ JUG, PODRUČJE “USORA“

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Rezime: Područje Usore koje se nalazi na dijelu koridora Vc, veoma je složeno, kako po geološkim i geomorfološkim karakteritikama terena, tako i prostornom rasporedu naseljenih objekata. Utvrđivanje trase prošlo je kroz više faza, uvažavajući različite faktore i probleme koji su prisutni na terenu. Na kraju odabrana je trasa koja nije najpovoljnija ali je za sve prihvatljiva, iako je skoro sva u nasipima i ima jednu petlju i pet (5) mostova na dužini 5,065 km.
Terenski radovi za trasu i objekte na trasi urađeni su prema programu istraživanja i Smjernicama za geološka i geomehanička istraživanja, koje su važeći dokument za istraživanje i projektovanje puteva u Bosni i Hercegovini. Kvalitet izvedenih istraživanja je zadovoljavajući. Dobiveni podaci terenskih istraživanja, zajedno sa laboratorijskim ispitivanjima su osnova za izradu elaborata o geološkim, inženjerskogeološkim, hidrogeološkim i geotehničkim karakteristikama izgradnje ove dionice autoputa.

Ključne riječi: *auto put, istraživanje terena, trasa, mostovi*

REVIEW ON OF RESEARCH FIELD FOR ROADS CORRIDOR Vc SHARES JOHOVAC - DOBOJ JUG, SECTION "USORA"

Abstract: Area Usora located on a part of the Corridor Vc is very complex, both in terms of geological and geomechanical characteristics of the terrain, and the spatial distribution of residential buildings. Determining the route passed through several

phases, taking into account various factors and problems that are present in the field. At the end of the route is selected, which is not the cheapest but it is acceptable for all, although almost all of the bank and has a loop of five bridges on the length of 5.065 km
Field works for the route and the objects along the route were done according to the research program and the Guidelines for geological and geomechanical studies, which are valid document for the research and designing roads in Bosnia and Herzegovina. Quality of research is satisfactory. The data obtained of field research, together with laboratory tests are needed to establish the study of geological, engineering geological, hydrogeological and geotechnical characteristics of the construction these shares highway.

Key words: *highway, research the terrain, route, bridges*

STABILIZACIJA SEKUNDARNIH I OTPADNIH MATERIJALA SA CEMENTOM UZ DODATAK ADITIVA

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Rezime: Reciklaža po dubokom hladnom postupku prisutna je već niz godina kod nas. Pretežno se radi reciklaža po sledećem postupku:
- Na asfaltni sloj se naspe drobljeni agregat 0/31 mm.
- Reciklerima se izvrši defragmentacija materijala uz kompjutersko doziranje penastog bitumena i cementa.

Ovaj rad ima za cilj pokaže osobine stabilizacije u kojoj bi se umesto penastog bitumena sa cementom upotreljavao LATEX- BDMV4RTR. Reciklirani sloj za razliku od čiste stabilizacije ima znatno povećanu otpornost na mraz i smanjeno upijanje vode. LATEX-BDMV4RTR je ekološki čist proizvod, vremenski nerazgradljiv i neškodljiv za životnu sredinu. LATEX-BDMV4RTR se dodaje u količini od max. 10%, što ga čini isplativijim od penastog bitumena, koji se dodaje u odnosu na agregat. Sve prednosti hladne reciklaže su i dalje prisutne, stabilizacija se izvodi na licu mesta, nema deponovanja materijala iz konstrukcije puta i naknadna ugradnja novog.

Ključne reči: *latex, stabilizacija, put, optimatizacija*

STABILIZATION OF SECONDARY AND WASTE MATERIALS WITH CEMENT AND ADDITION OF ADDITIVES

Abstract: Deep cold recycling procedure is commonly applied in our country for quite some time. Recycling is carried out in accordance with the following procedure:
– crushed aggregate 0/31 mm is filled over the asphalt course,
– recycling devices carry out the defragmentation of materials along with computer aided feeding of foamed bitumen and cement.

The purpose of this paper is demonstrate the properties of stabilization carried out

with LATEX-BMDV4RTR instead of utilizing foamed bitumen with cement. Recycled course in contrast to pure stabilization has a considerably higher resistance to frost and decreased water absorption. The product thereof is oecologically pure product, not-prone to degradation in the course of time, and unharfmful to the environment. This product is added in the quantity of maximum 10% thus making it more cost-effective than the foamed bitumen, which is added in relation to the aggregate. All advantages of cold recycling are still present, the stabilization is carried out right on the spot, there is no stockpiling of materials from the road structure with subsequent placing of new one.

Key words: *latex, stabilization, road, environment, optimization*

УСАГЛАШАВАЊЕ ТЕХНИЧКИХ УСЛОВА ИЗ ПРОЈЕКТА СА КВАЛИТЕТОМ ДОСТУПНИХ КАМЕНИХ АГРЕГАТА

Сузана Стефановић, Оливера Ђокић, Братислав Милић, Институт за путеве, Београд, Србија

Резиме:Технички услови који се односе на квалитет агрегата за доњи носећи слој из Главног пројекта Аутопута Е-75 на деоници Владичин Хан – Доњи Нерадовац базирани су на методама лабораторијских испитивања из SRPS EN стандарда. Квалитет мермера са сепарација “Стрезовце” и “Будућност” код Прешева није усаглашен са техничким условима за еквивалент песка (SE) и делимично за гранулометријски састав, док су им остали параметри задовољавајући. Због тога се квалитет ситних честица додатно испитивао преко опита метилен-плаво (MB). Резултати испитивања показали су да агрегати имају дозвољен садржај минерала глина. Да би се избегло одбијање добрих агрегата за израду носећих слојева коловозне конструкције, оцену употребљивости вршили смо према MB, док смо SE више везали за гранулометријски састав агрегата. Због напред наведенихог, закључено је да је неопходна континуирана контрола квалитета производње у погледу гранулометријског састава, садржаја ситних честица, еквивалента песка и метилен-плаво за оба агрегата. За потврду добијених закључака коришћена је анализа носивости доњих носећих слојева на аутопуту Е-75, БЕОГРАД – НИШ – СКОПЉЕ, деоница: Букуревац – Граница Македоније, km 966+000 – km 976+250, лева страна коловоза, где је камени агрегат са сепарације “Стрезовце” уграђен 2011. године.

Кључне речи: т*ехнички услови, агрегат мермера, еквивалент песка, метилен-плаво*

HARMONIZATION OF TECHNICAL SPECIFICATIONS FROM DESIGN AND QUALITY OF AVAILABLE STONE MATERIAL

Abstract: Technical Specifications for the quality of aggregate used for construction of base course, from the Final Design of Motorway E-75 on the section Vladicin Han

– Donji Neradovac, are based on laboratory test methods according to standards SRPS EN. Marble taken from separations Strezovce and Buducnost near Presevo, meet all criteria from Technical Specifications, except the criteria for Sand equivalent (SE) and partially for grain size composition. Therefore, the quality of fine particles was tested additionally by Methylene blue experiment (MB). Testing results have shown that the aggregates contain the allowed amount of clay. In order to avoid elimination of generally good aggregates for construction of pavement base courses, usability assessment was performed according to MB, while SE was used for grain size composition of aggregate. Consequently, it was concluded that the continuous quality control of production is necessary regarding grain size composition, content of fine particles, sand equivalent and methylene blue for both aggregates. For confirmation of findings obtained, the bearing capacity analysis was conducted for base course layers on Motorway for E-75, BELGRADE – NIS – SKOPLJE, section: Bukurevac – State Border with Macedonia (FYROM), km 966+000 – km 976+250, the left carriageway, with stone aggregate taken from the separation Strezovce and 2011. године.

Key words: *technical specifications, marble aggregate, sand equivalent, methylene blue*

PRIMENA VALJKOM ZBIJENOG BETONA U PUTOGRADNJI

Mirko D. Petković, Keco Invest Engineering GmbH i Int. Experts Group

Rezime: Otkrićem valjkom zbijenog betona (RCC) i njegove mogućnosti da tehnički vrlo efikasno i ekonomično eliminiše uobičajeni metod rada i zameni klasični masivni beton, asfalt, kamen, zemlju i sličan građevinski materijal, praktično je započet još jedan alternativni pristup načinu izgradnje masivnih građevinskih konstrukcija, prvo u putogradnji i uopše niskogradnji, a zatim i u hidrogradnji.U radu su prezentirane osnovne informacije o ovom materijalu, njegovoj istoriji, sastavu, tehnologiji, primeni, ekonomskim pokazateljima, prednostima i sl.

Ključne reči: *valjkom zbijeni beton, istorija, kolovozne konstrukcije, produktivnost, ekonomija, ekologija*

REHABILITACIJA AUTOPUTA E-75, DEONICA: PROLAZ KROZ BEOGRAD

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Rezime: Autoput E-75, koji delom prolazi kroz Srbiju, spada u značajnije Evropske putne pravce. Svrstava se u trans Evropski magistralni pravac koji povezuje krajnji sever sa jugom Evropskog kontinenta.U Srbiji autoput E-75 povezuje najveće gradske centre i ima značajnu ulogu u privrednom razvoju Srbije. Na delu prolaska kroz Beograd, saobraćajno optrećenje dostiže svoj maksimum, što je rezultiralo pojavom oštećenja površine kolovoznog zastora viskog intenziteta. U cilju dobijanja jasnije slike

o funkcionalnom i strukturnom kapacitetu u odnosu na očekivano saobraćajno opterećenje, izvršeno je ispitivanje da bi se utvrdilo stanje i predložilo rešenje rehabilitacije kolovozne konstrukcije na delu autoputa E-75, prolaz kroz Beograd. Ovaj rad je napisan sa ciljem da se stručna javnost upozna sa primenjenim tehničkim merama rehabilitacije u cilju podizanja kvaliteta usluga korisnika.

Ključne reči: *autoput E-75, rehabilitacija, kolovozna konstrukcija, oštećenost zastora*

ISKUSTVA U UPOTREBI HOBAS CENTRIFUGALNIH POLIESTERSKIH CEVI ZA ODVODNJU MOSTA

Jelena Milošević ing. građ., Eduard Hesky dipl. ing. građ., Stefan Wutte ing., Hobas Rohre GmbH Austrija / Hobas Rohre GmbH-Predstavništvo u Republici Srbiji

Rezime: U članku se navode glavne karakteristike HOBAS centrifugalnih poliesterskih cevi, koje su posebno značajne za upotrebu u projektima odvodnje mostova. Takođe se navode primeri ugradnje u različitim uslovima, kao i detalji na koje je potrebno obratiti pažnju prilikom projektovanja i izvođenja, u cilju funkcionalnosti odvodnje, dugotranosti i ekonomske isplativosti.

Ključne reči: *poliesterske cevi, odvodnja, mostovi, funkcionalnost, trajnost, ekonomičnost, brza ugradnja*

TEHNIČKO-TEHNOLOŠKE I ORGANIZACIONE PROMENE U PEDESETOGODIŠNJEM PERIODU

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Rezime: U radu je obrađeno zimsko održavanje puteva na teritoriji koju pokriva AD “Novi Pazar – put”. Prikazano je održavanje puteva u vremenskom razdoblju od 50 godina, od osnivanja firme do današnjih dana. Pedeset godina je period u kojem su se tehnologije i sredstva za održavanje puteva značajno menjali, pa je ovo i svojevrstan istorijski prikaz razvoja održavanja puteva u zimskim uslovima ne samo za našu firmu, već i sire, jer sui ostale firme imale sličan razvojni put. Značajnu ulogu u zimskom održavanju puteva u našem krajuimale sui slaba razvijenost putne mreže, oštre zime, teški tereni. Putevi su jedina sredstva za promet ljudi i robe u našem kraju, pa smo i zbog toga morali da uložimo dodatne napore da putevi budu prohodni i bezbedni, čak i u najsurovijim uslovima. Nakon 50 godina iskustva možemo da se pohvalimo savremenim sredstvima i tehnologijama za zimsko održavanje puteva, al ii detaljnim praćenjem svih parametara bitnih za kvalitetno održavanje puteva u zimskim uslovima.

Ključne reči: *zimsko održavanje puteva, istorijat zimskog održavanja, nerazvijeni putevi, vremenski uslovi*

Abstract: In this paper is writen about winter maintenance of roads in the territory covered by the JSC "Novi Pazar - Put". Winter road maintenance, over a period of 50 years, from the founding of the company to this day, is shown. Fifty years is a period in which the technology and resources for road maintenance significantly changed, so this is sort of a historical overview of the development of road maintenance in winter, not only for our company, but also beyond, as other companies had a similar development path. Poorly developed road network, harsh winters and difficult terrain had important role in winter maintenance of roads in our area. Roads are the only means of transport for people and goods in this area, so we were forced to make additional efforts in order to make roads passable and safe, even in the harshest conditions. After 50 years of experience we are proud for using modern mechanization and technologies for winter road maintenance, but also for detailed monitoring of all parameters essential for proper maintenance of roads in winter conditions.

Key words: *winter road maintenance, winter maintenance history, undeveloped roads, weather conditions*

ISKUSTVA U ODRŽAVANJU DRŽAVNIH PUTEVA NA TERTORIJI KOJU POKRIVA AD“NOVI PAZAR-PUT“

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Rezime: Priča o aktivnostima preduzeća AD „Novi Pazar – put“ na održavanju puteva počinje davne 1962.godine kada se formiraju preduzeća za puteve i kada je ovom preduzeću povereno na održavanje 455 km puteva I ,II i III reda od kojih je samo 7km sa asfaltnim zastorom.
U proteklim periodima menjale su se nadležnosti upravljanja i načini finansiranja, kategorije, dužine i izgrađenost putne mreže, ali se nije promenio značaj puta za život i egzistenciju područja kroz koja prolaze.
Da bi putevi bili u funkciji moraju se održavati, kako u zimskom tako i u letnjem periodu.
Zbog specifičnih različitosti klimatskih uslova, terena i izgrađenosti putne mreže u zimskom periodu ne mogu se nači dve deonice sa istim potrebama i načinom organizovanja aktivnosti - područje Pešetri sa ekstremno niskim temperaturama, olujnim vetrovima i dužinom trajanja zimskih uslova, pristupni putevi zimskim turističkim centrima (Kopaonik, Golija i Goč).
U letnjem periodu uticaj klisura i neuređenih visokih kosina nameće obim i vrstu radova na uklanjanju osulinskih materijala kao i problem velikog uništavanja opreme i signalizacije na putevima.
Veliki broj objekata, tunela i zidova kao i aktivnih klizišta znatno otežavaju održavanje puteva u letnjem i u zimskom periodu i utiču na povećanu cenu rada.
Ovakvi uslovi i zahtevi korisnika obavezuju nas da nabavljamo adekvatnu mehanizaciju, i unapređujemo tehnologiju i iznalazimo najoptimalnija rešenja.

Ključne reči: *zimsko održavanje puteva, letnje održavanje, klimatski uslovi, terenski uslovi, izgrađenost putne mreže*

Abstract: The story about activities of the JSC " Novi Pazar - put" on maintenance of roads begins in 1962. when the road companies in Serbia are formed. To this company maintenance of 455 km of roads I, II and III importance, of which only 7km was with the asphalt surfacing, has been entrusted.
In the previous period competence of management and financing, categories, length and development of the road network has been changed, but the significance of the roads for life and existence in these area didn't.
Roads must be maintained, both in winter and in summer, in order to be in function.
In the winter, due to the specific diversity of climatic conditions, terrain and the development of road networks, two sections of the same needs and ways of organizing activities can not be found - Pester area with extremely low temperatures, stormy winds and duration of winter conditions, roads to the winter tourist centers (Kopaonik, Golija and Goc).
In the summer, the impact of the gorges and high slopes determine the volume and type of work on removing debris material, as the problem of a large destruction of equipment and signage on the roads.
A large number of road objects, tunnels and walls, as well as active landslides significantly hinder the maintenance of roads in the summer and in the winter time and affect the increased cost of maintenance.
These conditions and investor requirements oblige us to procure adequate machinery, improve the technology and find optimal solutions.

Key words: *winter road maintenance, summer road maintenance, weather conditions, terrain conditions, development of road network*

SPECIAL SOLUTIONS FOR ROAD INFRASTRUCTURE – 10 YEARS OF ROMANIAN EXPERIENCE

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Abstract: Technical solutions for stabilizing both cohesive and non-cohesive soils using special hydraulic binders were first developed in Europe in the 1990’s. The industry requirement for hydraulic binders that are both more efficient and more suited to the need of infrastructure works can be explained by two factors:
- In the case of cohesive soils, the need for a binder that annihilates the clay fraction while also improving the short term bearing capacity
- In the case of non-cohesive soils, the need for a binder that limits the effects of thermal cracking, an effect which is inherent in all hydraulic binders but preponderant in cement.
Road hydraulic binders were first introduced in Romania in 2003, when Holcim

proposed the use of Dorosol-Doroport products for the execution of various construction projects. This paper aims to describe a range of site studies (along with their correspondent laboratory studies) covering various projects: access roads and platforms for a wind farm (with emphasis on reducing the clay behavior of a cohesive soil), constructing the earthworks and capping layer for a highway project (a project in which the construction schedule was followed without delays due to the use of special hydraulic binders that improved the short-term bearing capacity) or cold recycling a severely damaged flexible pavement, using road hydraulic binders (with the main purposes of improving and homogenizing the bearing capacity characteristics). During their first 10 years of availability on the Romanian market, special solutions for stabilizing soils with the help of road hydraulic binders have been employed on more than 800 construction sites of various sizes. The resulting experience has allowed everyone in the industry (designers, constructors, clients and suppliers) to confirm the effectiveness of this technology, while also constantly improving it.

Key words: *soil stabilization, hydraulic binder, bearing capacity, pavement recycling, road infrastructure*

PRAĆENJE PROJEKATA KORIŠĆENJEM INFORMACIONIH SISTEMA

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Rezime: U uslovima sve veće konkurencije i težih uslova poslovanja više nije dovoljno samo dobiti posao i uraditi ga, već se i za svaki projekat moraju pratiti dinamika izvođenja radova, svi troškovi i prihodi. Ažurno, tačno i detaljno. To nije moguće bez nekog od savremenih Informacionih Sistema. U ovom radu je opisana praktična primena Informacionog Sistem namenjenog za putarske firme. Kako planirati na projektima? Kako pratiti prihode i troškove na projektima? Kako vršiti detaljnu analizu angažovanja mehanizacije, materijala i radne snage na gradilištima? Koliko je projekat trebao da košta, a koliko je zaista koštao? Cilj ovog rada je davanje odgovora na ova pitanja, koja su od ključne važnosti za uspešno vođenje projekata. Kao posebno poglavlje je izdvojeno praćenje mehanizacije, jer je kompleksnost i važnost ove Radne Jedinice u putarskim firmama velika.

Ključne reči: Informacioni Sistem za putarske firme, praćenje projekata, dinamika izvođenja radova, praćenje prihoda i troškova projekata, praćenje mehanizacije

Abstract: With growing competition and more difficult business conditions, it is not enough to get and finish the job, but project dynamics, all costs and income must be tracked for each project. Promptly, accurate and in detail. This is not possible without modern Information Systems. This paper describes the use of the Information System for road companies. How to plan a projects? How to track income and costs on projects? How to carry out a detailed analysis of machinery, materials and labor engaged at the construction sites? How much the project should cost, and how much it really cost? The aim of this paper is to provide answers to these questions, which

are crucial for successful project management. As a special section monitoring machinery has been set aside, because the complexity and importance of machinery in road companies are great.

Key words: *Information Systems for road companies, tracking projects, projects dynammics, monitoring income and project cost, monitoring machinery*

SPECIFIČNOSTI IZVOĐENJA RADOVA NA ADMINISTRATIVNOM PRELAZU „JARINJE“ I NA MOSTU PREKO POTOKA „BREĐA“

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Rezime: Rad obrađuje dva objekt a: administratvni prelaz „Jarinje“ i sanaciju mosta „Bređa“, koja su specifična po načinu i uslovima izvođenja radova na njima.
Hitni nalog da se administrativni prelaz „Jarinje“ na državnom putu IB-31 uradi za 12 dana je uslovio da su radovi otpočeti na osnovu dve skice koje su predstavljale situaciono rešenje administrativnog prelaza.Uz saglasnost Investitora angažovali smo projektante koji su radili projekat paralelno sa izvođenjem radova.
Radovi su izvođeni na niskim temeperaturama koje su se spuštale i do -20^{0}C. U takvim uslovima urađeni su kameni zidovi visine do 7m, sve potrebne instalacije, a nakon toga, uz konsultacije sa Institutom za puteve, Beograd urađen je asfaltni kolovoz, nakon čega je prelaz zvanično pušten u rad u predviđenom roku.
Objekat koji je takođe bio specifičan za izvođenje je most preko potoka „Bređa“ koji se nalazi na državnom putu IB-22. Most dužine L=117m je izgrađen 1971. god. a prva sanacija je rađena 1985. god. Visina stubova na sredini mosta iznosi do 30m. Zbog izuzetno lošeg stanja most je bio zatvoren od 2009. godine a saobraćaj se odvijao devijacijom urađenom kao privremenim rešenjem. Velika visina stubova i nepristupačni teren onemogućavali su izradu klasične cevaste skele, zbog čega se došlo na ideju da uradimo viseće skele pomoću kojih smo izvršili sve neophodne radove na sanaciji i most pustili u saobraćaj krajem oktobra 2013. godine.

Ključne reči: *hitan nalog, niske temperature, velika visina srednjih stubova, nepristupačan teren*

Abstract: The paper is about two construction objects: the administrative crossing "Jarinje" and the rehabilitation of the bridge "Bredja", which are specific for the method and conditions of the works carried out on them.
Urgent order to complete administrative crossing "Jarinje " on a state road IB-31 for 12 days caused the works to begin based on the two layout sketches of the administrative crossings. With the consent of the investors we hired designers who worked on the project in parallel with the execution of the works.
The works were carried out at low temperatures that descended down to -20^{0}C. In such conditions, stone walls up to 7m high and all necessary installation are made. Subsequently, in consultation with the Highway Institute Belgrade the asphalt driveway

is finished. After that crossing was officially put into the use on schedule.
Road construction, which was also specific to carried out it the bridge over the creek "Bredja", located on the national road IB-22. Bridge L = 117m in lenght was built in 1971. and first rehabilitation was done in 1985. Height of the pillars in the middle of the bridge is up to 30m. Due to the extremely poor condition bridge has been closed since 2009 and the traffic was carried on alternative road made as a temporary solution. Great pillars height and rough terrain prevented the use of the classical tubular scaffold. Consequently we came on an idea to make a hanging scaffold with which we perform all necessary work to repair the bridge and put into the use at the end of October 2013.

Key words: *urgent order, low temperatures, high middle pillars, inaccessible terrain*

INTERNA KONTROLA KVALITETA U LABORATORIJAMA

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Rezime: Kvalitet, kao trajno opredeljenje laboratorije, a u cilju dobijanja pouzdanih i verodostojnih rezultata ostvaruje se kroz dosledno sprovođenje referentnih standarda, usvojene politike kvaliteta, uputstava i dokumenata QMS...
Interna kontrola kvaliteta predstavlja kontinuirano i kritičko praćenje sopstvenih analitičkih procesa i redovnih radnih aktivnosti laboratorije. Kontrola obuhvata analitički proces od ulaska uzorka u laboratoriju do izdavanja izveštaja o ispitivanju ili kontrolu samo kritičnih delova analitičkog procesa.
Kontrola kvaliteta je postupak kojim se proverava prihvatljivost dobijenih rezultata ispitivanja pri čemu je najvažnije sredstvo u kontroli kvaliteta upotreba kontrolnih karti.

Ključne reči: *politika kvaliteta, kontrola kvaliteta, kontrolne karte*

THE INTERNAL QUALITY CONTROL IN LABORATORIES

Abstract: The quality as permanent commitment of the laboratory, aimed at reaching reliable data, is effectuated through consistent implementation of adopted quality policy, instructions, QMS documents and referential standards, aimed at achieving reliable and credible results.
Internal control of quality represents continuous and critical observation of one's own analytical processes and regular operating activities of the laboratory. The control encompasses the analytical process from the entry of specimens into the laboratory till the issuance of testing report or control of only critical parts within the analytical process. The quality control is a procedure through which the reliability of the gathered data is evaluated, and the most important instrument for quality control is the utilization of control cards.

Key words: *quality policy, quality control, control cards*

Безбедност саобраћаја на путевима

Road Traffic Safety

7

ПРИМЕНА ТЕХНИЧКИХ СРЕДСТАВА ЗА УСПОРАВАЊЕ САОБРАЋАЈА НА ДРЖАВНИМ ПУТЕВИМА РЕПУБЛИКЕ СРБИЈЕ

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Резиме: Техничким средствима за успоравање саобраћаја учесницима у саобраћају се физички ограничава брзина кретања возила, односно додатно се упозоравају да брзина којом се крећу није безбедна.

Циљ овог рада је да дефинише примену техничких средстава за успоравање саобраћаја на државним путевима, у контексту постојеће законске регулативе која обрађује ову тематику, са циљем да се техничка регулатива осавремени и побољша, како би се ова област значајно унапредила са становишта безбедности саобраћаја на државним путевима.

Примењена техничка решења на путној мрежи треба да испуњавају савремене захтеве у погледу активне и пасивне безбедности и такође, морају бити ефикасна и препознатљива за све учеснике у саобраћају.

Кључне речи: *успоравање саобраћаја, безбедност саобраћаја, државни пут*

USE OF TRAFFIC CALMING DEVICES ON STATE ROADS IN THE REPUBLIC OF SERBIA

Abstract: Traffic calming devices are used to physically limit the vehicle speed, i.e. to warn the traffic participants that their speed is unsafe.

The purpose of this paper is to define the use of traffic calming measures on state roads in light of the existing legislation dealing with this subject matter, in order to modernize and upgrade the technical regulations, so that this area would become significantly improved from the standpoint of traffic safety on state roads.

Traffic devices used on the road network should fulfill the current requirements concerning active and passive safety, and they should be efficient and acknowledged by all traffic participants as well.

Key words: *traffic calming, traffic safety, state road*

DEVELOPMENT OF INTELLECTUAL TRANSPORT ON-BOARD SYSTEMS FOR THE PURPOSE OF TRAFFIC SAFETY INCREASE

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Abstract: One of the most serious problems connected with development of a transport and road complex and the advancing growth of automobilization in many countries is the safety problem. The analysis of road accident reasons shows that their main part both in Russia, and in Europe, occurs because of the driver. This group of reasons unites the term "rash actions" (injudicious action) at which the driver incorrectly estimates either a road situation, or possibilities of the car. Seeking to create "the perfect car", producers don't reflect that complication of a design and increase of technical characteristics repeatedly increase probability of problems emergence at its operation and service. The intellectual on-board system which has to provide realization of feedback not only in system driver - car - road, for the analysis of system current state at regular operation of the car and between the driver and services of fast reaction - at emergence of emergency situations, and also in system car - service station - plant - manufacturer for implementation of its technical condition monitoring and control can reduce risk of emergence.

Key words: *intellectual on-board systems, operation of cars, safety, reliability*

INCREASING TRAFFIC SAFETY ON SERBIAN ROADS BY USING STATE OF THE ART CONCRETE SAFETY BARRIERS ACCORDING TO APPLICABLE EUROPEAN STANDARDS

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Abstract: On European roads it is obligatory to use vehicle restraint systems according to European standard EN 1317. Highway projects funded by the European Development and Investment Bank must fulfill the traffic safety requirements as stated in these European regulations. Using premium precast concrete barriers allows the coverage of all aspects of passive road safety in modern highway design.
The latest achievements in the development of concrete barriers show clearly that breakthrough prevention for heavy trucks and soft impact behavior for small passenger cars are not in contradiction anymore. Even rigid concrete barriers can provide acceptable impact severity for vulnerable road users by using optimized profiles and high performance coupling methods.
Furthermore it is of utmost importance to secure highway bridges by using dedicated bridge safety barriers. These barrier-types must redirect and hold back heavy vehicles safely and reduce the stress and load for the bridge structure to prevent structural damage. Modern barriers are equipped with energy absorbing devices to reduce impact loads significantly.

Keywords: *concrete safety barriers, EN 1317, containment level, working width, ASI, crash test, bridge barriers, work zone protection*

ISPITIVANJE ZNANJA VOZAČA O PRAVILIMA BEZBEDNOG PONAŠANJA NA KRUŽNIM RASKRSNICAMA

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Rezime: Uloga raskrsnica je da na bezbedan, brz i ekonomski opravdan način regulišu raspodelu korisnika na željene smerove kretanja u saobraćajnom toku, uz minimalne negativne uticaje na životnu sredinu. Posmatrano sa aspekta bezbednosti saobraćaja, glavna prednost kružnih raskrsnica, u odnosu na klasične trokrake ili četvorokrake raskrsnice, je redukovanje konfliktnih tačaka. Rezultati mnogobrojnih istraživanja pokazuju da se izgradnjom kružnih raskrsnica drastično smanjuje broj saobraćajnih nezgoda, a naročito nezgode sa povređenim i nastradalim licima. Pored podizanja nivoa bezbednosti saobraćaja kružne raskrsnice doprinose redukciji saobraćajne buke i smanjenju emisije štetnih gasova. Savremene raskrsnice sa kružnim tokom imaju osobine koje ih nesumnjivo čine atraktivnim za primenu, a na našim prostorima su nepravedno zapostavljene. U radu su prikazane osnovne karakteristike kružnih raskrsnica, primeri kružnih raskrsnica u Republici Srbiji, kao i rezultati ankete koja se odnosi na ispitivanje nivoa znanja vozača o pravilima koja važe na kružnim raskrsnicama.

Ključne reči: *bezbednost saobraćaja, kružne raskrsnice, ponašanje vozača*

ASSESSMENT OF DRIVERS KNOWLEDGE ABOUT SAFE BEHAVIORS ON ROUNDABOUTS

Abstract: The function of the intersections is to safely, quickly and in economically viable manner, with minimal negative effects on the environment, regulates the distribution of users into the desired directional movement within the traffic flow. From the point of view of traffic safety, roundabouts have better safety performance over three- or four-way conventional types of intersections, providing fewer conflict points. The huge amount of studies indicates that the construction of roundabouts drastically reduces the number of traffic accidents, particularly with fatalities and injured persons. Along with significant safety improvements they contribute to the reduction of traffic noise, as well as, pollution and fuel usage. Despite the characteristics of modern roundabouts that make them undoubtedly attractive and efficient, in our region they have been unfairly neglected. This paper presents the main features of roundabouts, examples of various types of roundabouts in the Republic of Serbia, as well as the survey results, of testing the knowledge of the rules for driving roundabouts.

Key words: *traffic safety, roundabouts, driver behavior*

PASSIVELY SAFE ROAD INFRASTRUCTURE – JUST A FASHION TREND OR A REAL NEED?

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Abstract: The fact that road traffic is a serious problem of society in respect of people being killed and hurt in the accidents is gaining every day more and more attention. The estimations of monetary value of one fatality are reaching 1,7million euros and even more. The economic damage, only in Europe, is immense, not to mention the psychic traumas of people closely related to the victims. Roads are meant to bring you to the desired destination but they just cannot be only a stabilised driving surface. According to the high volume of traffic, roads need to be designed in a way to ensure the maximum safety possible. It means that beside the road geometry, quality of a surface, vertical and horizontal signalisation they must be suitably equipped with passively safe road infrastructure or as used in some countries, road furniture. European norms for passively safe infrastructure already exist but there is no common approach to the implementation of passive safety in respect to the infrastructure. Unfortunately the sphere of road furniture is often considered as a trendy fashion in road design being likely a money making issue. The article explains, on example of poles for public lighting, that the implementation of passively safe road furniture is a real need.

Key words: *passively safe infrastructure, road furniture, European norms, poles for public lighting*

VEŠTAČENJE SAOBRAĆAJNIH NEZGODA I PRIMENA NA UNAPREĐENJE BEZBEDNOSTI SAOBRAĆAJA

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Rezime: Veštačenje saobraćajnih nezgoda je jedna od najstarijih i najpouzdanijih metoda za utvrđivanje direktnih uzroka nastanka saobraćajnih nezgoda. Na ovaj način se detaljnom analizom raspoloživih materijalnih elemenata vezanih za nastalu saobraćajnu nezgodu, stručnom analizom od strane veštaka, analiziraju uzroci i okolnosti pod kojima je nastala konkretna saobraćajna nezgoda. Utvrđivanjem uzroka i okolnosti veštačenjem se mogu utvrditi ili isključiti eventualni doprinosi puta vezani za nastanak nezgode. Naime, stručnom analizom može se utvrditi da li je put prouzrokovao nastanak saobraćajne nezgode odnosno doprineo nastanku nezgode odnosno materijalne štete. Na taj način mogu se prepoznati nedostaci puta koje je neophodno otkloniti, kako bi put bio bezbedan za saobraćaj. Nedostatak ove metode je što se vrši nakon nastanka nezgode i za njeno kvalitetno sprovođenje potrebno je duže vreme, pa nije pogodna za preventivno delovanje, niti se njome brzo i proaktivno deluje na podizanje nivoa bezbednosti saobraćaja na putu. S druge strane ova metoda daje najpouzdanije i najpreciznije podatke, tako da je u kombinaciji sa drugim

proaktivnim pristupima najcelishodnija za kvalitetno unapređenje nivoa bezbednosti saobraćaja na putu.

Ključne reči: *bezbednost saobraćaja, put, saobraćajne nezgode, veštačenje, analize*

PILOT STUDIJA PROVERE BEZBEDNOSTI SAOBRAĆAJA NA DRŽAVNOM PUTU IIA-100 DEONICA INĐIJA-BATAJNICA

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Rezime: U radu je prikazan sumirani izveštaj o sprovedenoj proveri bezbednosti saobraćaja (Road safety inspection-RSI) na deonici državnog puta IIA-100 Inđija – Batajnica na ukupnoj dužini od 16 kilometara. Prilikom sprovođenja pilot studije i kroz sve faze sprovođenja RSI u radu smo dali ključne smernice koje je neophodno uzeti u obzir prilikom spovođenja ove metode za unapređenje bezbednosti puteva. Na kraju rada, dati su predlozi za izradu podzakonskog akta kojim će detaljnije biti uređen način sprovođenja RSI u Republici Srbiji.

Ključne reči: *bezbednost saobraćaja, put, provera, saobraćajne nezgode*

Abstract: In this work we give some important informations from Report of road safety inspection on public road No. IIa-100, destination Inđija-Batajnica, in 16 km of total length. In this pilot study from all phases of RSI, we give some key recommendations for implementation of road safety inspection to promote road safety. At the end, this work is giving proposals for amendments to the law for better implementation of RSI procedures in Republic of Serbia.

Key words: *road safety, road, inspection, traffic accidents*

ПРИМЈЕНА РСИ – ПРОВЈЕРЕ БЕЗБЈЕДНОСТИ САОБРАЋАЈА НА ДИОНИЦИ МАГИСТРАЛНОГ ПУТА М4, ОД КОЗАРЦА ДО СРЕДЊЕ ЛАМОВИТЕ - СТУДИЈА СЛУЧАЈА У РЕПУБЛИЦИ СРПСКОЈ

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Резиме: Због великог броја саобраћајних незгода, које за посљедицу имају погинула и повријеђена лица и велике материјалне штете, експерти из цијелог свијета свакодневно осмишљавају системе који ће повећати безбједност свих учесника у саобраћају. Донедавно се сматрало да су саобраћајне незгоде неминовне, а једини одговорни за настанак саобраћајних незгода били су возачи моторних возила. Заштитне мјере су, у овом случају, предузимане тек када ситуација постане неприхватљива, са аспекта саобраћајних незгода. Циљ

модерног приступа безбједности саобраћаја је предузимање свих мјера које могу спријечити настанак саобраћајних незгода. Ове мјере се дефинишу на основу анализа саобраћајних незгода које су се већ догодиле, али и на основу континуираниог праћења стања безбједности саобраћаја на одређеном подручју. Овакав присуп безбједности саобраћаја подразумијева да узрок саобраћајне незгоде не мора искључиво да буде лоше понашање возача, већ то може да буде и лоше стање пута, неадекватно регулисање саобраћаја, небезбједна околина пута и слично. Идентификација опасних мјеста на путевима, поред дефинисања постојећег стања и примјене управљачких мјера, представља основ у управљању стањем безбједности саобраћаја. Најбољи начин за утврђивање опасних мјеста на дионици пута коју треба унаприједити по питању безбједности саобраћаја, јесте идентификација и анализа опасних мјеста на дионици пута. При избору метода којим ће се вршити идентификација опасних мјеста на путевима морају се пратити искуства развијених земаља, са најбољом праксом у овој области. Рад садржи опис савремених алата за унапређење безбједности саобраћаја, а посебна пажња је посвећена провјери безбједности саобраћаја, као једној од најефикаснијих метода за спрјечавање настанка саобраћајних незгода. У раду је детаљно приказана и провјера безбједности саобраћаја која је спроведена на дионици магистралног пута М.4, од Козарца до Средње Ламовите, која је у 2012. години проглашена „дионицом смрти“ у Републици Српској, због броја, а нарочито тежине незгода које су се ту догодиле.

Кључне речи: *безбједност саобраћаја, алати за унапређење безбједности саобраћаја, провјера безбједности саобраћаја*

IMPLEMENTATION RSI - ROAD SAFETY INSPECTION ON SECTION OF THE MAIN ROAD M4, FROM KOZARAC TO SREDNJE LAMOVITE - A CASE STUDY IN THE REPUBLIC OF SERBIAN

Abstract: Due to a large number of traffic accidents resulting in death, injury and financial damage, many experts around the world are inventing the systems which will increase the safety of all traffic participants. Until recently the traffic accidents were considered unavoidable and the only responsible for causing traffic accidents were drivers of motor vehicles. The safety measures weren't taken until the situation got unacceptable from the aspect of traffic accidents. The aim of modern approach to traffic safety is to take all the measures which can prevent traffic accidents. These measures are created based on analysis of traffic accidents which already happened and based on reports from constant following of situation in traffic safety in specific area as well. This approach to traffic safety means that the cause of a traffic accident does not only have to be bad behavior of a driver, but also it can be bad condition of a road, inapproprate traffic regulation, road environment unsafety and similar. The work includes the description of contemporary methods for improvement of the traffic safety and special attention has been paid to Road Safety Inspection being one of the most efficient methods to prevent traffic accidents. The best way to determine dangerous places on the road section, that have to be improved regarding of traffic safety, is the identification and analysis of dangerous places on the road section.

Selecting a method that will perform the identification of black spots on roads, must follow the experiences of developed countries that had the best practice in this area. The work also fully describes the Road Safety Inspection that was carried out on the section of the main road M.4 from the place of Kozarac to Srednja Lamovita, which was declared „ the section of death“ in The Republic of Srpska in the year of 2012, due to the number and particulary because of the severity of accidents which had happened there.

Key words: *traffic safety, methods for improvement of the traffic safety, Road Safety Inspection*

STAVOVI VOZAČA I UPOTREBA ITS TEHNOLOGIJE ZA POVEĆANJE BEZBEDNOSTI SAOBRAĆAJA U USLOVIMA SMANJENE VIDLJIVOSTI

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Rezime: Bezbednost saobraćaja na putevima, pored brojnih faktora, nesumnjivo zavisi i od meteoroloških uslova i pojava. Bilo koji meteorološki element ili pojava, koji menja odnose između elemenata saobraćajnog sistema (čovek (vozač), vozilo, put, okolina) ili promeni karakteristike nekog (ili svih) od navedenih elemenata, direktno utiče na operativne i bezbednosne performanse celokupnog sistema. Vozači reaguju na slabu vidljivost na različite načine: neki smanjuju brzinu vozila, dok neki precenjuju svoje sposobnosti i ne smanjuju brzinu vozila. Kako bi olakšali vožnju u uslovima smanjene vidljivosti, vozači najčešće slede zadnji deo vozila ispred sebe, ne vodeći računa o rastojanju sleđenja, stanju kolovoza i mnogim drugim okolnostima koje mogu doprineti nastanku saobraćajne nezgode. Shodno tome, stvaraju se opasni uslovi (na deonicama puta na kojima je smanjena vidljivost) koji su veći ukoliko postoji velika disperzija brzina, a najugroženija su vozila koja se kreću velikim, kao i vozila koja se kreću malim brzinama. Uočavajući veliki značaj meteoroloških uslova i pojava za nadzor saobraćaja u realnom vremenu, države koje prednjače u bezbednosti saobraćaja, potencijalne probleme smanjene vidljivosti rešavaju upotrebom ITS tehnologije. ITS sistemi upozoravaju vozače i sadrže senzore na određenim delovima puta, koji automatski aktiviraju izmenjive saobraćajne znakove na kojima se ispisuju savetodavne poruke u pogledu ograničenja brzine vozila, preporučeno rastojanje sleđenja vozila, trenutna vidljivost, udaljenost kolone vozila usled zastoja i sl. Primarni cilj ovog rada je da se predstavi značaj razumevanja uticaja nepovoljnih vremenskih uslova na operativne aktivnosti i bezbednost saobraćaja, promovišu strana iskustva i strategije za rešavanja ovih problema, prikažu stavovi vozača o doprinosu ITS portala povećanju nivoa bezbednosti saobraćaja i funkcionisanju saobraćajnog toka, kao i mogućnosti implementacije predstavljenih rešenja u Republici Srbiji.

Ključne reči: *bezbednost saobraćaja, ITS tehnologija, smanjena vidljivost, rastojanje sleđenja, stavovi*

ATTITUDES OF DRIVERS AND IMPLEMENTATIONITS TECHNOLOGIES TO INCREASE ROAD SAFETY IN REDUCED VISIBILITY CONDITIONS

Abstract: Road traffic safety, in addition to a number of factors, undoubtedly depends on the weather conditions and phenomena. Any of meteorological element or occurrence, which changes relationship between the elements of the transportation system (human (driver), vehicle, road, environment) or changes the characteristics of some (or all) of these elements has a direct impact on the operational and safety performance in entire system. Drivers react on poor visibility in different ways: some reduce vehicle speed, while others overestimate their abilities and do not reduce the speed. In order to facilitate driving in low visibility conditions, drivers usually follow the vehicle in front of them, not caring about distance of following vehicle, pavement conditions and many other circumstances that may affect the occurrence of accidents. Consequently, there are hazardous conditions (on road sections where visibility is poor), which are more severe if there is a large speed dispersion, and the most vulnerable are the vehicles that move at high and the ones that move at low speeds. According to the great importance of meteorological conditions and the necessity for monitoring traffic in real time, countries that are leaders in traffic safety, potential solution for reduced visibility problems discovered in application of ITS technologies. ITS systems warn drivers by using sensors in certain parts of the route, which have a role to automatically activate changeable traffic signs that are showing advisory messages such as: the speed limit, the recommended distance of vehicles, the current visibility, distance to the columns of vehicles due to delays and other. The primary objective of this paper is to present the importance of understanding the impact of poor weather conditions on the operational activities and road safety. It is also important to promote foreign experiences and strategies for solving these problems, to check driver's opinions about the ITS portals and its impact in increase of traffic safety level and operation of the traffic flow, as well as implementation opportunities of the presented solutions in the Republic of Serbia.

Key words: *traffic Safety, ITS technologies, reduced visibility, the distance followed, attitude*

ПРИЛОГ РАЗВОЈУ СТРАТЕГИЈЕ ЗА КОНТРОЛУ СРЕДЊЕ БРЗИНЕ ВОЗИЛА

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Резиме: Контрола средње брзине возила је релативно нов и технолошки иновативан приступ контроли и санкционисању саобраћајних прекршаја који је све популарнији у великом броју земаља. Закон о безбедности саобраћаја на путевима Републике Србије, усвојен крајем 2009. године, поставио је законску основу за мерење средње брзине возила на путу. Међутим, због непостојања

одговарајућих техничких система у Србији још увек није успостављен овај начин контроле. У последњих годину дана ово питање актуелизовано је од стране управљача путева. У раду је објашњен техничко-технолошки принцип функционисња система за контролу и санкционисање прекршаја прекорачења средње брзине, као и искуства из праксе земаља у којима су инсталирани такви системи.

Кључне речи: *стратегија, контрола средње брзине, брзина од тачке до тачке, системи камера за снимање саобраћајних прекршаја*

ENCLOSURE TO THE STRATEGY FOR AVERAGE SPEED ENFORCEMENT

Abstract: Average speed enforcement is a relatively new approach for traffic enforcement with rising popularity throughout a large number of countries. The Low on road traffic safety in Serbia published at the end of 2009, defined legal base for average speed enforcement. However, this kind of speed enforcement still hasn't been applied in Serbia because specific technical systems are necessary. During last year, this topic was actualized by road agencies. This paper explains how average speed enforcement systems work and gives a brief view on experiences from various countries from the world.

Keywords: *strategy, average speed enforcement, point-to-point speed, traffic enforcement camera systems*

PROPUSTI ZA NASTANAK SAOBRAĆAJNIH NEZGODA U ZONI OŠTEĆENJA ODNOSNO RADOVA NA PUTEVIMA

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Rezime: Povećanje intenziteta saobraćaja na putevima, na teritoriji Republike Srbije, kao i potreba za izgradnjom, održavanjem i rehabilitacijom puteva, problemi su sa kojima se svakodnevno suočavamo. Broj mesta na kojima se „izvode“ radovi na putevima, na kojima su nastale prepreke, odnosno oštećenja na kolovozu kontinuirano se povećava, pa se povećava i broj rizičnih situacija u kojima se mogu naći vozači. Pored opisa problema, u radu su dati i primeri saobraćajno-tehničkog veštačenja saobraćajnih nezgoda, koje su nastale u zoni radova na putevima. Analize saobraćajnih nezgoda nastalih u zoni radova na putevima podrazumevaju definisanje propusta učesnika saobraćajnih nezgoda, što pomaže pri definisanju odgovornosti i mera za unapređenje bezbednosti saobraćaja.

Ključne reči: *bezbednost saobraćaja, saobraćajne nezgode, zone radova na putu, oštećenja na kolovozu, posledice saobraćajnih nezgoda*

RESPONSIBILITY FOR TRAFFIC ACCIDETS OCCURANCE IN ROAD WORK ZONES

Abstract: Increased road traffic flow intensity, at the territory of the Republic of Serbia, as well as need for construction, maintenance and rehabilitation of roads, are the problems with which we are facing every day. Number of places where road works are being "performed", because of formed physical obstacles or road pavement defects, is continuously increasing, and number of risk situations in which drivers can be found is increasing as well. In addition for problem description, the paper presents examples of traffic and technical expertise of traffic accidents that occurred in the road work zones. Analysis of traffic accidents which occurred in the road works zones includes definition of the omissions of the traffic accidents participants, which helps in defining the responsibilities and measures to improve road safety.

Key words: *traffic safety, traffic accidents, road work zones, roadway defects, traffic accidents consequences*

АНАЛИЗА САОБРАЋАЈНИХ НЕЗГОДА НА ДЕЛУ ОБИЛАЗНИЦЕ ДОБАНОВАЧКА ПЕТЉА – ОСТРУЖНИЦА, У ПЕРИОДУ ОД 2010-2013. ГОД., СА ПРЕДЛОГОМ МЕРА

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Резиме: Дубинска анализа саобраћајних незгода је најпоузданији начин за утврђивање евентуалног доприноса пута настанку саобраћајне незгоде. Имајући у виду могућности ове анализе Законодавац је и предвидео обавезу управљача пута да за саобраћајне незгоде са погинулим лицима, обавезно мора извршити дубинску анализу те саобраћајне незгоде. На овај начин управљач пута а и све заинтересоване стране обезбеђују најквалитетнији материјал којим је могуће утврдити или искључити утицај пута на настанак конкретне саобраћајне незгоде. Спровођење оваквих анализа омогућава свеобухватно и стручно сагледавање свих услова и околности настанка незгоде, а тиме и препознавање сличности између узрока насталих незгода на неком подручју и дефинисање тих узрока. На овај начин могуће је препознати постојање одређених недостатака пута који на неком подручју доприносе настанку незгода.

Кључне речи: *безбедност саобраћаја, пут, саобраћајне незгоде, дубинска анализа, анализе*

Abstract: In-depth analysis of traffic accidents is the most reliable way for determining the potential contribution of road to traffic accident occurrence. Bearing in mind the

usefulness of this analysis, legislator enacted obligations of the road administrator, that for the accidents with fatalities, performing in-depth analysis is mandatory. In this way, road administrator and all interested subjects provide the highest quality material, by which is possible to determine or exclude the impact of road on the occurrence of specific accidents. Conducting such analysis provides comprehensive and professional consideration of all the causes and circumstances of the accident, and thus the recognition of similarities between the causes of accidents occurred in observed area and defining of these causes. In this way it is possible to recognize the existence of certain road deficiencies, which contribute to the accident occurence in observed area.

Key words: *road safety, road, traffic accidents, in-depth analysis, analysis*

ANALIZA UTICAJA REHABILITACIJE DRŽAVNOG PUTA NA BRZINE

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Rezime: Najčešća okolnost nastanka saobraćajne nezgode, a neretko i uzrok, predstavlja nepoštovanje ograničenja brzine kretanja. Odluka vozača o poštovanju ograničenja brzine kretanja često se odnosi na njegovu subjektivnu procenu bezbednosti, a između ostalog utiču faktor puta i putne okoline kao što su izgled puta, stanje kolovoza, širina saobraćajnih traka, izgled okoline i slično. U ovom radu biće prikazan uticaj rehabilitacije kolovoznog zastora državnog puta na ponašanje učesnika u saobraćaju u pogledu brzine kretanja. Efekti uticaja rehabilitacije kolovoza ispitivani su na osnovu podataka dobijenih sa brojača saobraćaja na putu van naselja i na putu u naselju. Rezultati istraživanja pokazali su da se posle rehabilitacije kolovoza prosečna brzina kretanja vozila povećala i to na putu van naselja za 13 km/h, a na putu u naselju prosečna brzina se povećala za 3,5 km/h, dok se standardno odstupanje prosečnih brzina smanjilo i to na putu van naselja za 3,1 km/h, a na putu u naselju standardno odstupanje prosečnih brzina se smanjilo za 3,5 km/h. Istraživanje sprovedeno u ovom radu ukazuje da rehabilitacija državnog puta utiče na promenu ponašanja učesnika u saobraćaju u pogledu brzine kretanja i to povećanju prosečne brzine kretanja, povećanju procenta vozača koji prekoračuju ograničenu brzinu kretanja i smanjenju standardnog odstupanja prosečnih brzina.

Ključne reči: *rehabilitacija, bezbednost saobraćaja, državni put, ograničenje brzine, ponašanje učesnika u saobraćaju*

INDIKATORI BEZBEDNOSTI SAOBRAĆAJA KOJI SE ODNOSE NA PUTEVE

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Rezime: Indikatori bezbednosti saobraćaja (eng. Safety performance indicators – SPI) predstavljaju bilo koju meru koja je uzročno vezana za saobraćajne nezgode i posledice saobraćajnih nezgoda i predstavljaju vezu između posledica saobraćajnih nezgoda i mera za smanjenje posledica tih nezgoda. Indikatori se mogu definisati kao kvantitativno i kvalitativno merilo koje je dobijeno iz niza posmatranih činjenica i zbog toga mogu sadržati velike količine informacija prikazane na prost način, koje ako se prepoznaju mogu biti iskorišćene na adekvatan način u cilju poboljšanja bezbednosti saobraćaja. Poseban značaj indikatora u bezbednosti saobraćaja ogleda se u praćenju učinka, definisanju i uspostavljanju trendova, predviđanju problema, proceni političkog uticaja, poređenju itd. Putevi su takođe prepoznati kao jedan od ključnih elemenata od izuzetnog značaja za bezbednost saobraćaja, pa su u tom smislu u definisani i indikatori bezbednosti saobraćaja koji se odnose na puteve, a u ovom radu su detaljno i opisani. Putna infrastruktura mora biti prilagođena potrebama svih učesnika u saobraćaju i mora ispuniti sve bezbedonosne uslove, kako bi se saobraćaj mogao odvijati na prvom mestu bezbedno, pa su u tom smislu definisane dve kategorije indikatora bezbednosti saobraćaja, a to su indikatori koji se odnose na putnu mrežu i indikatori koji se odnose na projektno bezbedonosne karakteristike puta.

Ključne reči: *indikatori bezbednosti saobraćaja; bezbednost saobraćaja; put; putna mreža; projektno-bezbedonosne karakteristike puta*

ROAD SAFETY PEREFORMANCE INDICATORS RELATING TO ROADS

Summary: Road Safety Performance Indicators - SPI are any measure that is causally related to traffic accidents and the consequences of accidents and provide a link between road traffic accidents and measures for reducing the consequences of such accidents. SPI can be defined as a qualitative and quantitative measure that is derived from a series of observed facts and can therefore contain a large amount of information presented in a simple manner, which, if recognized can be used in an appropriate manner in order to improve traffic safety. The special significance of indicators in road safety is reflected in the monitoring of performance, defining and establishing trends, detecting problems in trtaffic safety, assess the political impact, comparing with others etc. Roads have also been recognized as one of the key elements of great importance for road safety, and in this sense SPI related to the roads are defined and in this paper those SPI and described in detail. Road infrastructure must be adapted to the needs of all road users and must meet all safety requirements, in order to fulfill safe trafic and safe transport in the first place, and in this sense two categories of road safety indicators were defined, SPIs related to the road network and SPIs related to the safety design characteristics of the road.

Key words: *SPI; traffic safety; road; road network; safety design characteristics of the road*

PERCEPCIJA RIZIKA VOZAČA I NJEN UTICAJ NA NASTANAK SAOBRAĆAJNIH NEZGODA

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Rezime: Fenomen rizika je prisutan u svakoj čovekovoj aktivnosti. Na ponašanje u saobraćaju utiču rizici zaustavljanja, kontrole, otkrivanja prekršaja i kažnjavanja za prekršaj, kao i rizici drugih posledica: rizik učešća u saobraćajnoj nezgodi, rizik povređivanja, rizik smrtnog stradanja itd. U literaturi se razmatraju opšti i specifični, te objektivni i subjektivni rizik. Percepcija rizika je složena funkcija uzrasta i iskustva vozača. To se podjednako odnosi na prihvatanje rizika, ali i na njegovo pogrešno opažanje. Koncept rizika je posebno značajan u situacijama gde se pred vozača postavljaju izuzetno složeni zahtevi u smislu prilagođavanja ponašanja U okviru saobraćajne psihologije razvile su se brojne teorije u kojima koncept rizika ima ključnu ulogu. U radu će biti prezentovan prikaz najrelevantnijih teorija i istraživanja u oblasti percepcije rizika vozača.

Ključne reči: *percepcija rizika, ponašanje vozača, teorije rizika, saobraćajne nezgode*

RISK PERCEPTION AND ITS INFLUENCE ON TRAFFIC ACCIDENTS

Abstract: The phenomenon of risk is present at each human activity. Human behavior in traffic is affected by the risks of stopping, control, detection of traffic offense and penalty, as well as the risk with other consequences: the risk of involvement in a car accident, risk of injury, risk of fatality, etc. The literature discusses both general and specific, and objective and subjective risk. The risk perception is a complex function of age and driver experience. Both of which are associated with acceptance and misperception of risk. The concept of risk is particularly important in the situations where extremely complex tasks are imposed to the driver. In the traffic psychology there have been developed many theories in which the concept of risk has a key role. In this paper the most relevant theories and research in the field of drivers' risk perception will be presented.

Key words: *risk perception, driver behavior, teories of risk perception, traffic accidents*

PRIMENA VREMENSKIH MODELA U ANALIZI FREKVENCIJE SAOBRAĆAJNIH NEZGODA NA RURALNIM PUTEVIMA

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Rezime: Frekvencija saobraćajnih nezgoda tradicionalno predstavlja predmet velikog broja istraživanja. Prethodnih decenija javilo se mnoštvo različitih metodoloških pristupa modelovanja nastanka saobraćajnih nezgoda. Sa aspekta vremenske analize nastanka saobraćajnih nezgoda u dosadašnjoj praksi izdvojila su se dva pristupa:

kolektivni (analizira saobraćajne nezgode u dužem vremenskom periodu) i pojedinačni (analizira saobraćajne nezgode u realnom vremenu). U radu je dat prikaz najznačajnijih vremenskih modela u analizi frekvencije saobraćajnih nezgoda.

Ključne reči: *analize bezbednosti saobraćaja, vremenski modeli, saobraćajne nezgode*

ПРЕГЛЕД АЛАТА ЗА ОЦЕНУ БЕЗБЕДНОСТИ ПУТА КОЈИ СУ ПРИМЕЊИВАНИ У РЕПУБЛИЦИ СРБИЈИ

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Резиме: Оцена безбедности пута представља значајан сегмент успостављања система управљања путном инфраструктуром. У складу са дефинисаним оценама безбедности на путу пројектују се и реализују мере и активности у циљу унапређења безбедности саобраћаја. Кроз оцењивање безбедности пута пружа се могућност сагледавања ефикасности реализованих мера. У стручној јавности постоји низ методологија – алата за оцену безбедности пута, који су научно доказивани и примењивани у пракси. Одабир алата зависи од приступа проблему безбедности пута, и може да обухвати паралелну примену више алата за коначну оцену. У раду су представњени алати за оцену безбедности пута који су претходних година примењивани у Србији, попут: методологије идентификације опасних места – црних тачака, европског и међународног програма за оцену безбедности пута (EuroRAP/iRAP) и модела избора релевантног ризика страдања за оцену безбедности пута. Овај рад приказује основне појединости и карактеристике алата за оцену безбедности пута који су примењивани у Србији. Практична примена алата разматрана је на примеру деонице државног пута IA-2 „Ибарска магистрала“ од Београда до Чачка. Упоредним сагледавањем алата истакнуте су њихове предности и недостаци (за и против), као и могућност адаптације на постојеће услове одређене стручним и друштвено политичким окружењем у Србији.

Кључне речи: безбедност пута, алати, оцена, ризик, опасна места

INFRASTRUKTURA ZA PUNJENJE ELEKTRIČNIH VOZILA

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Rezime: Električna vozila su postala u poslednjih nekoliko godina naša realnost. Skeptici su sumnjali da će uopšte doći do ovakvog razvoja događaja usled visoke

početne cene samih vozila i ostalih delova sistema. Razvojem tehnologija u ovoj oblasti, koja se još naziva i "e-mobilnost", došlo se do saznanja iz kojih proizilazi potreba uvođenja novih standarda, opreme, sredstava i specijalističkih znanja koja će praktično uticati na studije, projekte, strategije, finansiranje, izgradnju i održavanje puteva, bezbednost saobraćaja i zaštitu životne sredine. Planiranje i projektovanje celog sistema je važno zbog upotrebne efikasnosti samih vozila i ostalih elemenata sistema tokom eksploatacije kao i početnih troškova za ulaganje u sistem.

Ključne reči: *e-mobilnost, električna vozila, planiranje, troškovi ulaganja*

SAVREMENE METODE ZA UNAPREĐENJE BEZBEDNOSTI SAOBRAĆAJA POBOLJŠANJEM FAKTORA PUT

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Rezime: Iako je u sistemu faktora čovek – vozilo – put – okolina, faktor čovek (u sadejstvu sa ostalim faktorima) u 93% slučajeva odgovoran za nastanak saobraćajnih nezgoda, put i okolina (u sadejstvu sa faktorom čovek i vozilo) uzrokuju više od trećine saobraćajnih nezgoda (34%). Uzimajući to u obzir i shvatajući značajne rezerve za unapređenje bezbednosti saobraćaja, poboljšanjem elemenata faktora put, osmišljen je niz proaktivnih i korektivnih metoda čijom sistematičnom primenom se, kako pre izgradnje tj. u fazi projektovanja puta, tako i za već postojeće puteve, mogu uočiti nedostaci koji umanjuju nivo bezbednosti saobraćaja. Najrazvijenije zemlje, a među njima i Srbija, su zakonski regulisale primenu takvih metoda i obavezale upravljača puta da ih periodično sprovodi. U ovom radu biće izložene i detaljno opisane metode – tehnike koje se odnose na poboljšanje puteva, definisane u članu 156. Zakona o bezbednosti saobraćaja na putevima Republike Srbije.

Ključne reči: *bezbednost saobraćaja, faktor put, zakonska regulativa, proaktivne mere, korektivne mere*

MODERN METHODS FOR HIGHER TRAFFIC SAFETY BY IMPROVEMENT OF THE FACTOR “ROAD”

Abstract: Although human factor (in conjunction with other factors) is in 93% of cases responsible for the occurrence of traffic accidents, road and environment (in conjunction with the human factor and vehicle) cause more than one-third of traffic accidents (34%). Taking this into account and considering significant reserves of the factor “road” for improving the level of the road traffic safety, the defects that reduce the level of road safety could be successfully spotted by applying a series of proactive and corrective methods, especially when systematic approach is applied either in the design phase of the road, or for already existing roads. Most developed countries, including Serbia, legislated the application of such methods and obligated road

managers to conduct these measures periodically. In this paper are presented methods and techniques for improvement of the roads, as it is defined in Section 156 of the Road Traffic Safety law of the Republic of Serbia.

Key words: *traffic safety, factor "road", legislative, proactive measures, corrective measures*

ANALIZA ZAVISNOSTI BROJA SAOBRAĆAJNIH NEZGODA I OBIMA SAOBRAĆAJA NA PUTU

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Rezime: Bezbednost saobraćaja na putevima zavisi od mnoštva parametara, pa je pri projektovanju, a posebno pri rehabilitaciji važno poznavati međuzavisnosti između tih parametara i frekvencije saobraćajnih nezgoda. Brojna istraživanja pokazuju da se broj saobraćajnih nezgoda na konkretnom putu može dovesti u vezu sa obimom saobraćaja, a najčešći su rezultati koji pokazuju da se ne radi o tipičnoj linearnoj vezi, s obzirom na to da frekvencija nezgoda ima težnju brzog rasta do određenog nivoa PGDS-a, a nakon toga težnju blagog pada do određenog nivoa PGDS-a. Imajući u vidu ovaj odnos, a vodeći se odnosom broja nezgoda i PGDS-a na putevima, u radu su prikazani praktični rezultati povezanosti frekvencije nezgoda i ukupnog broja PGDS-a. Reč je o rezultatima na kilometarskim deonicama koje su prethodno identifikovane kao opasna mesta na osnovu metode zasnovane na ukupnom broju saobraćajnih nezgoda. Ispitivanje je sprovedeno na putnoj deonici od Kneževca do Ribarića, ukupne dužine 284 kilometara, za period od 2005. do 2011. godine.

Ključne reči: *bezbednost saobraćaja, međuzavisnost, frekvencija nezgoda, PGDS, opasna mesta*

PROTOKOLI SISTEMA UPRAVLJANJA TUNELOM - TUNEL STRAŽEVICA

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Rezime: Važnost tunela u drumskom saobraćaju, kao nezaobilazne karike u infrastrukturi putne mreže, u sadašnjem vremenu ne ogleda se samo kroz njegovu fizičku pojavu na mreži nego i kao nezobilazan objekat koji se nadzire i kojim se upravlja, kako u eksploatacijskom smislu tako i u energetskom smislu, zavisno od kategorije tunela. Upravljački sistemi tunela moraju imati mogućnost

reakcije na predviđene i definisane situacije tj. događaje koji predstavljaju netipične situacije u odnosu na redovno odvijanje sapobraćaja. Od izuzetnog značaja jeste bezbednost saobraćaja u zoni objekta tunela, a direktan uticaj na to ima sistem upravljanja tunelom. Sastavni delovi takvog sistema jesu protokoli upravljanja.

Ključne reči: *sistem upravljanja, nadzor, protokol, scenario, bezbednost saobraćaja, SCADA*

МОГУЋНОСТИ ПРИМЕНЕ ИТС УРЕЂАЈА ЗА УНАПРЕЂЕЊЕ БЕЗБЕДНОСТИ САОБРАЋАЈА НА ДРЖАВНИМ ПУТЕВИМА

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Резиме: Услови ограничених финансијских ресурса са једне стране и потреба унапређивања безбедности саобраћаја са друге стране намећу нове, ефикасне и економичне моделе управљања саобраћајем. У том смислу примена ИТС-а се показала као оптимално решење. Појам интелигентни транспортни системи (ИТС) представља систем мера и технологија примењених у транспортном систему који обједињује информатичку и телекомуникациону технологију са циљем унапређења безбедности саобраћаја и ефикаснијег функционисања саобраћаја. Правовремене и квалитетне информације прослеђене учесницима саобраћаја, управљачу пута и осталим институцијама значајно утичу на хомогеност саобраћајног тока, а самим и на смањење броја саобраћајних незгода, краћег времена путовања, већег нивоа услуге на путевима и др. Коришћење система ИТС-а, као што су: системи за откривање незгода, системи упозорења (знакови са изменљивим садржајем), откривање прекршаја, црне кутије у возилима, променљива ограничења брзине, интелигентно вођење саобраћајног тока, тренутни утицај на видовну расподелу транспорта или системи који предност дају јавном превозу значајно унапређују механизам управљања саобраћајем. У овом раду су приказани примери најбоље праксе коришћења ИТС-а у земљама света. Анализиране су постојеће и могуће области примене ИТС-а на државним путевима у Републици Србији.

Кључне речи: *безбедност саобраћаја, интелигентни транспортни систем, управљач пута, пут, модел управљања саобраћајем*

ANALIZA BEZBEDNOSTI SAOBRAĆAJA U OKRUŽENJU ŠKOLE

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Rezime: Vodeći uzrok smrtnosti i povreda za decu školskog uzrasta su saobraćajne nezgode. Istraživanja saobraćajnih nezgoda sa učešćem dece pešaka pokazuju da su deca pešaci najviše ugroženi u okruženju škole, odnosno u gravitacionom području

школе које представља простор на коме се деца крећу на путу од куће до школе. Имајући то виду, на теритоији града Новог Сада је спроведено макроистраживање о безбедности деце, а део истраживања се односио на безбедност деце у окруженју школа. Један од циљева истраживања је био да се испитају уticаји елемента пута на безбедност деце у окруженју школе. У раду је представљен модел анализе безбедности саобраћаја у гравитационом подручју школе, заснован на три различите методе, којим је могуће утврдити места повећане угрожености деце. Први метод је статистички и служи за утврђивање објективног ризика на основу анализе саобраћајних незгода са учешћем деце, тј. локација на којима се јавља накупљање незгода. Други метод је анкета којом се утврђује субјективни ризик на основу ставова ученика, родитеља и наставника о опасним местима у гравитационом подручју школе. Могуће је да учесници сматраји одређену локацију небезбедном, иако та локација, са статističkog аспекта није угрожена, па је потребно локацију истражити осталим методама. Трећи метод је посматрање и засновано је на обиласку гравитационог подручја школе, са посебним освртом на локације које су издвојене кроз анализу субјективног и објективног ризика. Излазни резултат истраживања су проблеми уочени у окруженјима школа, као и предлог мера за унапређење безбедности деце у саобраћају на локацијама повећане угрожености.

Кључне речи: *безбедност саобраћаја, деца, окруженје школе, модел анализе безбедности деце*

TRAFFIC SAFETY ANALYSIS IN SCHOOL AREA

Abstract: Traffic accidents are leading cause of death and injuries regarding school-age children. Analysis of traffic accidents with child-age pedestrian participants show that child-age pedestrians are most endangered in locations near school, concerning school area, which stands for area that encompasses children routes from home to school. Having that in mind, macro research on children safety has been conducted at City of Novi Sad area, whereby segment of research was related to children traffic safety in school areas. One of research goals was inquiry of road elements influence on children traffic safety in school areas. In this paper, model of traffic safety analysis in school areas has been presented, which (model) is based on three different methods, that enable determination of increased endangerment of children. Frist method is statistical method and it is used for determination of objective risks, on the basis of analysis of traffic accidents with children participants, concerning locations with traffic accidents accumulation. Second method implies conducting interviews, so subjective risk about dangerous spots in school areas can be determined, on the basis of pupils, parents and teachers attitudes. It is possible that pupils consider specific location not to be safe, although that same location, based on traffic accidents staticstics, is not dangerous, so other methods need to be applied on that location for final conclusions. Third method is observation and it is based on school area go-by, with special emphasis on locations which were singled out through subjective and objective risk analysis. Research outcomes can be classified as identified problems in school areas, and proposed measures for improvement of children traffic safety on increased risk locations.

Key words: *traffic safety, children, school area, traffic safety analysis model*

УПРАВЉАЊЕ ПУТЕВИМА У РЕПУБЛИЦИ СРБИЈИ СА АСПЕКТА БЕЗБЕДНОСТИ САОБРАЋАЈА

др Демир Хаџић, дипл.инж., Јасмина Јовановић, Оливера Стевић Леденчан, Петар Красић

Резиме: Безбедност, односно безбедност у саобраћају, представља једно од основних начела које једно друштво треба да омогући својим грађанима.Људске навике се тешко мењају и потребан је велики временски период (десет, двадесет па и више година) да би се направила генерацијска разлика у захтевима за безбедним саобраћајем. Примера ради, сигурносни појас у аутомобилу. Појас је за једну генерацију први пут виђен у неким зрелим годинама, следеће генерација га користи из страха од полицијске казне, док генерација после има прилику да разуме и сврху сигурносног појаса, а не само страх од полицијске казне. Дакле, сам процес учења и разумевања је веома дуг јер поред саме едукације потребно је и васпитање, односно да то радите из убеђења, а не из страха или зато што то сви раде.
Са друге стране прилагођавање инфраструктуре – путева, много је бржи и лакши процес. Наиме, увођењем одређених стандарда у планирању, пројектовању и изградњи, односно одржавању путева може се постићи да пут буде безбедан. Наравно, треба бити и реалан јер све ово представља процес, стога се опет враћамо на део навика, у овом случају инжењерских навика које се уз добро испланиране мере (стратегију) могу мењати.

Кључне речи: *пут, безбедност саобраћаја, управљање*

MANAGEMENT OF ROADS FROM ROAD SAFETY ASPECT IN THE REPUBLIC OF SERBIA

Abstract: Safety, and traffic safety represent one of the basic principles that a society should allow to its citizens. Human habits are difficult to change and large amount of time is necessary (ten, twenty or more years) to make a generational difference in the requirements for safe transport. For example, the seat belt in the car. For one generation seat belt is for the first time seen in some mature age, the next generation use it for the fear of police fines, while later generation have opportunity to understand purpose of seat belt, not just the fear of police fines. Thus, the process of learning and understanding is very long, because apart from the education the upbringing is necessary, and to do it out of conviction, not out of fear or because everyone else does it.
On the other hand adaptation of the infrastructure – roads, is much faster and easier process. Namely, by introduction of specific standards in the planning, design and construction, and with road maintenance can be achieved that road is safe. Of course, to be realistic all of these represents the process, thus we are back to the part of the habits, in this case engineering habits that with well-planned measures (strategy) can be changed.

Key words: *road, traffic safety, management*

UPOTREBA COMPUTER VISION REŠENJA U POVEĆANJU BEZBEDNOSTI SAOBRAĆAJA NA PUTEVIMA

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Rezime: Ovaj rad se bavi primenom computer vision sistema u povećanju bezbednosti učesnika u saobraćaju na putevima. Computer vision predstavlja skup tehnika za prikupljanje, obradu, analizu i interpretaciju slika i video materijala iz spoljašnjeg sveta u cilju dobijanja numeričkih ili simboličkih rezultata. U radu su predstavljeni do sada razvijeni "computer vision" sistemi, sa posebnim osvrtom na moduli computer vision sistema vezane za detekciju i praćenje kretanja učesnika u saobraćaju – kako automobila, tako i pešaka. Predstavlja se primena computer vision sistema u detekciji nedozvoljenog prelaska automobila preko pešačkog prelaza na kome je prisutno kretanje pešaka.

Ključne reči: *computer vision, bezbednost puteva, pešački prelazi, detekcija učesnika u saobraćaju, primena softvera*

APPLICATION OF COMPUTER VISION SYSTEMS IN IMPROVING THE ROAD SAFETY

Abstract: This paper covers computer vision systems and their application in improving the road safety. Computer vision is a set of methods for acquiring, processing, analysis and interpreting images and video data from the real world in order to produce numerical or symbolic results. The already developed and implemented computer vision systems are introduced, with a special focus on modules related to computer vision system for the detection and tracking of traffic participants - both cars and pedestrians. This paper presents application of the computer vision system in monitoring pedestrian crossings with a goal to detect traffic offences made by drivers.

Key words: *computer vision, road safety, pedestrian crossings, detection and tracking of traffic participants, application of software*

UPRAVLJANJE KONTROLOM PRISTUPA – EFIKASNOST I BEZBEDNOST PUTNE MREŽE SRBIJE

Prof. dr. Vladan Tubić dis, **Marijo Vidas dis**, Saobraćajni fakultet, Univerzitet u Beogradu

Rezime: Putevi predstavljaju značajne resurse i najvažnije javne investicije jedne zemlje. Svaki put ima dvostruki zadatak, da obezbedi efikasno saobraćajno povezivanje i u isto vreme omogući pristupačnost do lokacija u neposrednom okruženju puta. Ovi zadaci su kontradiktorni, pa je bitno racionalno uravnoteženje. Dostizanje zahtevane efikasnosti i očuvanje bezbednosti u saobraćajnom toku inicira

већу контролу приступа и обратно, повећан број приступа негативно утиче на безбедност учесника и смањење капацитета пута. Уticaj kotrole pristupa ima različit karakter na saobraćajne uslove na vangradskoj i gradskoj mreži, zbog bitno drugačijih osobenosti saobraćajnog procesa, ali i atraktivnosti zemljišta kome (ne)treba omogućiti pristup. Haotična urbanizacija u neposrednom putnom okruženju u našoj zemlji, posebno je izražena na državnim putevima i njihovim prolascima kroz naseljena mesta. U radu će biti prikazani rezultati istraživanja uticaja velikog broja priključaka na kapacitet i Nivo Usluge izabranih deonica državne putne mreže. Iako je prvi pravilnik kontrole pristupa nastao još davne 1902.g., (New Jersey, USA) broj priključaka, odnosno pristupa koji je istraživanjima detektovan na našim putevima nije zabeležen u savremenoj literaturi i jasno ukazuje na činjenicu da se ovim problemom niko nije bavio. Zbog bezbednosnih razloga se rešenje traži u ograničenjima brzine koji ne odgovaraju rangu puta, a visoko kapacitivni vangradski putevi postaju deonice gradske ulične mreže. U radu će biti prikazane tehnike i smernice koje bi napokon trebale naći primenu i u našim uslovima, kao i modeli za kvantifikaciju uticaja na bezbednost i efikasnost saobraćaja.

Ključne reči: *kontrola pristupa, bezbednost saobraćaja, nivo usluge*

ACCESS MANAGEMENT – EFFICIENCY AND TRAFFIC SAFETY OF ROAD NETWORK IN SERBIA

Abstract: Roads constitute a valuable resource and a major public investment. Every road has two tasks to achieve, to provide efficient traffic connection and at the same time to provide accessibility to locations in the immediate environment of the road. Reaching wanted efficiency and maintaining safety, needs more access control, since increased number of connections, will have negative impact on traffic safety and road capacity. Influence of access management has a different character to the traffic conditions on rural and urban road network, due to divergence in traffic processes, as well as in the attractiveness of the land. The chaotic urbanization in the immediate road environment in our country is particularly evident on state roads and their passages through urban areas. The paper presents results of research on the effect of a large number of connections to the capacity and level of service, for selected sections of the national road network. Although the first access control rule book is from 1902, (New Jersey, USA) number of connections, detected on our roads, is not recorded in the current literature. For safety reasons, speed limits do not match to rank of the road and highly capacitive interurban roads are becoming sections of the city street network. Here will be displayed techniques and guidelines that should find implementation in our conditions, as well as models for quantifying the impact on traffic efficiency and safety.

Key words: *access control, traffic safety, level of service*

DETECTION OF VEHICLE-BORNE HAZARDS WITH ROADSIDE EQUIPMENT

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Abstract: Various hazards can be caused by vehicles passing by or driving through tunnels or bridges or other civil structures along or on roads. While in the last decades major achievements were reached regarding driver's safety and behavior – mostly by new technologies and solutions inside vehicles – there has not been too much progress when looking at roadside equipment to make roads saver. However, some hazards like too hot axles or too wide dimensions can't be detected or prevented with in-vehicle equipment or at least not with today's in-vehicle equipment. This paper gives an insight of some of the possibilities to detect such hazards with roadside equipment. It focusses on optical detection methods. Most of these methods have been in use for a few years so that also some brief facts from evaluation about these systems are given.

Keywords: *dangerous vehicles, optical detection, free flow, roadside equipment, over heated vehicles, over sized vehicles*

ZAŠTITA OD POŽARA U TUNELIMA

Zorana Sekulović, dipl.inž.maš., Mr Dragan Sekulović, dipl.inž.maš.,Cepting d.o.o., Beograd, Srbija

Rezime: Na osnovu požara koji su se dešavali u tunelima širom sveta može se zaključiti da posledice u ovakvim situacijama nisu nimalo bezazlene, pogotovo kada se uzme u obzir broj ljudskih žrtava koje je vatrena stihija do sada odnela. Posebnu opasnost u tunelima predstavlja činjenica da iz dana u dan raste broj opasnih materija koje se transportuju širom sveta. Na osnovu toga je 30. decembra 2002. god. evropska komisija predložila osnivanje "Trans Evropske mreže Tunela" (skr. TEN-T) i usvajanje određenih normativa na osnovu kojih bi se obezbedio visok stepen zaštite ljudi i materijalnih dobara u tunelima širom evropske zajednice. Primenom odgovarajućeg metoda zaštite od dima, kao i pravilnim dimenzionisanjem puteva evakuacije, u toku faze projektovanja, može se u značajnoj meri samanjiti broj nastradalih.

Ključne reči: *tunel, kontrola dima, vatrogasno vozilo*

FIRE SAFETY IN TUNNELS

Abstract: Fire incidences in tunnels around the world that occurred in the past clearly show that consequences of such disasters are far from harmless, especially when numbers of casualties are taken into account. The number of dangerous materials being transported worldwide increases daily, which in turn increases the risk of fire,

particularly in tunnels. Therefore, on December 30th, 2002, The European Commission proposed the formation of "Trans European Network of Tunnels" (TEN-T) and the adoption of specific standards that would provide guidelines for high level of people and property protection in tunnels, throughout the European Union. The number of causalities can significantly decrease by applying appropriate smoke protection systems, as well as proper dimensioning of escape routes during the design phase.

Key words: *tunnel, smoke control, fire truck*

THE COMPETENCES OF THE ROAD ADMINISTRATIONS IN GERMANY

Konrad Bauer, Bundesanstalt für Strassenwesen, Bergisch Gladbach, Germany

Abstract: Competence is used in the sense of “being responsible”. According to the German constitution (the Federal Basic Law), and the traditional administrative structure in Germany you have to differ between four types of territorial entities responsible for road construction and maintenance having road authorities the Federation (Bundesrepublik Deutschland), the 16 Federal States (Bundesländer, the 300 districts (Kreise/ Landkreise) and 110 autonomous cities (kreisfreie Städte) and the 10.100 district-affiliated municipalities (kreisangehörige Gemeinden).The Federation has road acts concerning the 13.000 km Federal motorways and 40.000 km Federal highways. For all other road categories with about 950.000 km there exist the road acts of the 16 Federal Länder. In these acts the competences of the different authorities are laid down.

Key words: *German road owners, German road administration, competent authorities, responsibility, territorial entities*

ROAD SAFETY DEVELOPMENT IMPACT BONDS - INNOVATIVE WAY TO FINANCE ROAD SAFETY IN DEVELOPING COUNTRIES

Dr Alan Ross, Currently Road safety adviser European Investment bank and team leader on an EU funded TRACECA regional project covering 10 countries in Caucasus and Central Asia**, Mariya Ivchenko,** Economist and project coordinator on 10 country TRACECA regional road safety project

Abstract: Globally there are over 3.500 deaths per day on roads, equivalent to a 911 Twin towers tragedy every single day, 365 days a year but road crashes remain a “silent plague” that has not had the international attention or investment that other global diseases and illnesses have received. Many countries now lose 3-4 % of their annual GDP as a result of road crashes which in many cases are preventable and for which effective solutions are known and proven. Most developing countries do not yet have the institutional capacity to address their road safety problems effectively to

reduce deaths and injuries and the resulting recurring annual losses to their economies. These losses are now frequently greater than the total development assistance that such countries receive from all sources so the effectiveness and socio – economic impact of such aid support is often undermined and negated by this recurring drain upon the finances of such countries.

Due to failure to recognize the scale of such losses, many countries do not invest sufficiently in safety improvement and are often reluctant to borrow from development banks to improve safety on their roads as they still tend to see expenditure on road safety as a “cost” rather than as an “investment”. This systemic underfunding of road safety remains a continuing impediment to safety improvement and efforts to reduce the resultant losses so more innovative solutions need to be explored to get adequate funding applied in this area.

This offers a unique opportunity for the private sector (especially ethical) investors and development aid agencies to use innovative financial instruments such as “road safety development impact bonds (DIBs)” to raise the funding for investment in such countries to improve road safety in return for a share of the “savings” delivered. This can offer unusually high financial returns on investment and in the case of development agencies could have a significantly greater impact on the poverty and the social, health and economic development of the countries to which they provide aid. For investors such investments can be not only very lucrative but can be done with minimal risk. This paper outlines a proposal for establishing new type of financing mechanism called “ Road safety Development impact bonds” and creating a conducive market in the developing world for investment via such financial instruments to generate hundreds of US$ millions in new investment for road safety in order to make a dramatic impact on the Global road safety problem.

Јубилеј - шездесет година часописа
Пут и саобраћај

Уредништво научно стручног часописа *Пут и саобраћај* има задовољство да обавести и упозна научну и стручну јавност да ове године часопис *Пут и саобраћај* обележава 60 година излажења. Научно стручни часопис *Пут и саобраћај* је покренут 1955. године с циљем да окупи најшири круг стручњака који се баве путним и саобраћајним инжењерством.
Часопис *Пут и саобраћај* ISSN 0478-9733 (варијанта наслова "Journal of Road and Traffic Engineering") се публикује тромесечно и редовно доставља репозиторијуму Народне Библиотеке Србије, Центру за научне информације, Universitaebibliothek Hanover Germany, Staatsbibliothek zu Berlin Germany, Библиотеци Светозар Марковић, Библиографском институту, Библиотеци Матице Српске, Библиотеци Грађевинског, Саобраћајног и Рударско-геолошког факултет Универзитета у Београду, Библиотеци ФТН из Новог Сада, као и библиотекама факултета у Бања Луци, Скопју, Подгорици, Сарајеву и Битоли. Часопис *Пут и саобраћај* добијају такође и предузећа за путеве, институти, пројектантске фирме, факултети, министарства саобраћаја и грађевина, секретаријати, дирекције, као и институције од локалног до републичког нивоа у региону (Србија, БиХ, Р. Српска, Црна Гора, Словенија, Хрватска и Македонија). Часопис је присутан и у *on-line* индексираној бази СЦИндекс-српски национални цитатни индекс, а индексира се у следећим светским базама података: Index Copernicus, Trid, Doaj, док је у процедури индексирања у: Kobson, ProQuest, CrossRef., Index Copernicus, Google Scholar, CrossRef, J-Gate, Scholarly Journals Index. Чланци су доступни и на сајту СДП VIA-VITA www.via-vita.org.rs.

Радови у часопису су рецензирани и садрже оцену научног, стручног и практичног значаја. Часопис *Пут и саобраћај* је у категорији научних часописа М51, односно у категорији водећи национални часопис. Циљ уредништва је да кроз перманентно повећање квалитета, часопис буде место размене нових научних и стручних идеја које ће кроз радове у часопису доспети до шире научне и стручне јавности. Часопис *Пут и саобраћај*, је на корак до преласка у категорију М24-национални часопис међународног значаја. Остварењем овог циља путна и саобраћајна струка би добила први пут прилику да објављује радове у часопису који је на SCI листи и има IF. За квалитет и континуитет излажења часописа *Пут и саобраћај* заслуге имају главни и одговорни уредници, уредништво часописа, као и сви стручњаци који објављују радове у часопису.

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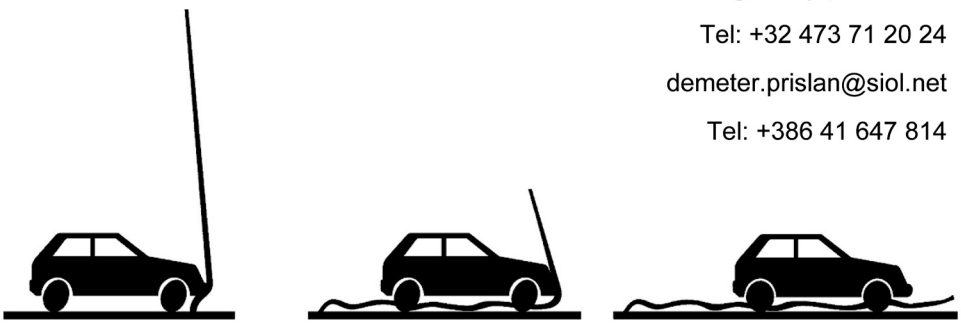

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