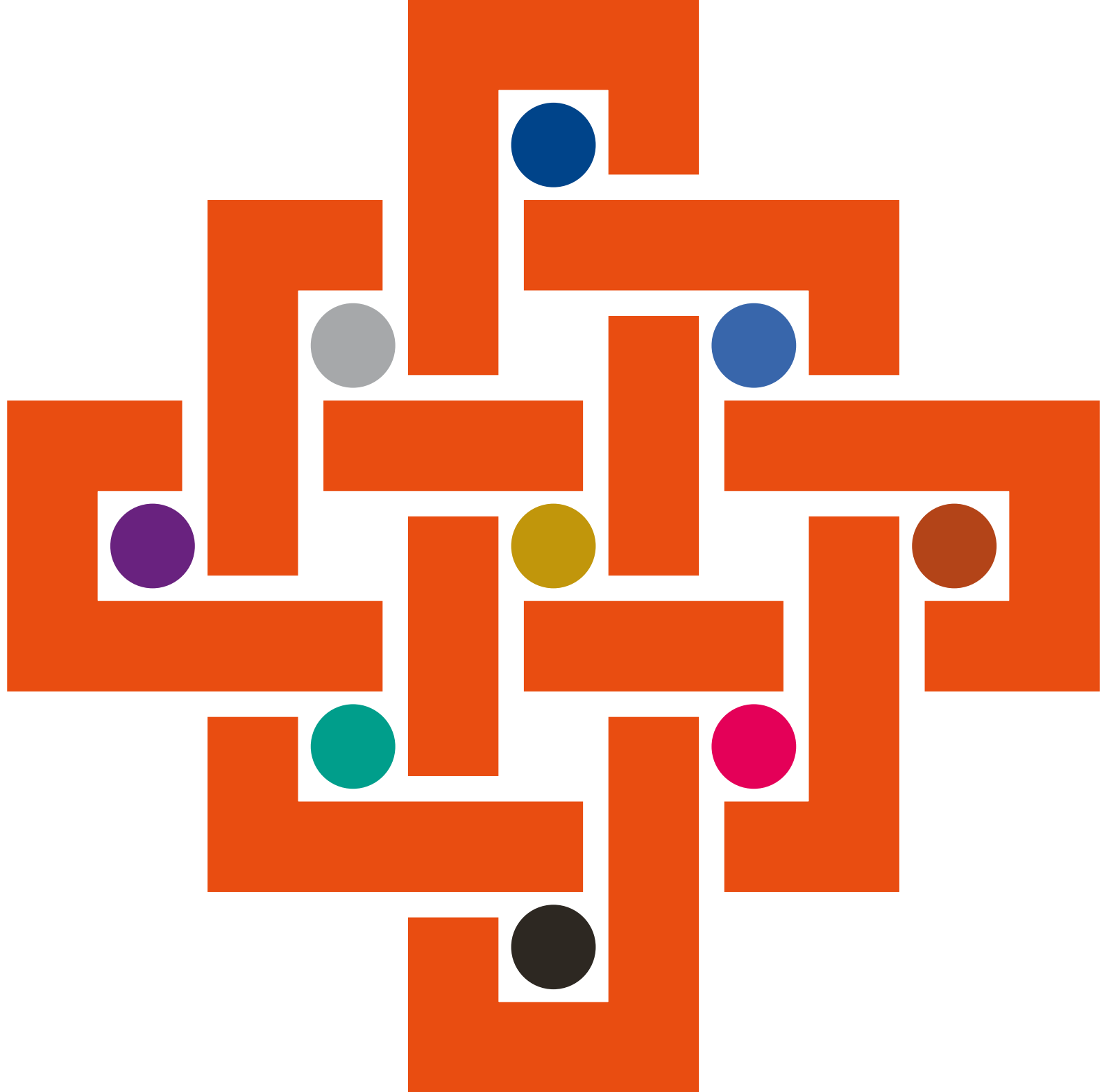




„ЕВРОКОДОВИ-ПОРТА КОН ЕВРОПА“ „EUROCODES-GATE TO EUROPE“

КНИГА НА ТРУДОВИ

PROCEEDINGS



ДГКМ

ДРУШТВО НА
ГРАДЕЖНИ
КОНСТРУКТОРИ НА
МАКЕДОНИЈА

MASE

MACEDONIAN
ASSOCIATION OF
STRUCTURAL
ENGINEERS

19 МЕЃУНАРОДЕН СИМПОЗИУМ
INTERNATIONAL SYMPOSIUM

ОХРИД, С. МАКЕДОНИЈА
OHRID, N. MACEDONIA
27 - 30 април 2022
April, 27th - 30th, 2022

MASE ДГКМ
Macedonian Association of Structural Engineers
Друштво на градежните конструктори на Македонија

Proceedings
Зборник на трудови

19th **International**
Symposium
19^{ти} **Меѓународен**
симпозиум

Ohrid, North Macedonia, 27 – 30 April 2022
Охрид, Северна Македонија, 27 – 30 април 2022

**PROCEEDINGS
OF THE 19th INTERNATIONAL SYMPOSIUM OF MASE
ЗБОРНИК НА ТРУДОВИ
19TH МЕЃУНАРОДЕН СИМПОЗИУМ НА ДГКМ**

Publisher:

**MASE - Macedonian Association of Structural Engineers
Faculty of Civil Engineering, Blvd. Partizanski odredi No. 24 P.Box. 560,
1000 Skopje, Republic of North Macedonia
e-mail: mase@gf.ukim.edu.mk; website: www.mase.gf.ukim.edu.mk**

Издавач:

**ДГКМ - Друштво на Градежни Конструктори на Македонија
Градежен Факултет, бул. Партизански одреди бр. 24 П.Ф. 560,
1000 Скопје, Република Северна Македонија
e-mail: mase@gf.ukim.edu.mk; website: www.mase.gf.ukim.edu.mk**

Editor: **Meri Cvetkovska, President of MASE**

За издавачот: **Мери Цветковска, Претседател на ДГКМ**

Executive Committee of MASE and
Organizing Committee of the 19th International Symposium of MASE:

**Meri Cvetkovska, Andrea Serafimovski, Ana Trombeva Gavriloska, Darko Nakov,
Koce Todorov, Roberta Apostolska, Daniel Cekov, Sonja Cherepnalkovska,
Iva Dzagora, Ilija Markov, Vladimir Vitanov, Nikola Postolov, Riste Volchev**

Претседателство на ДГКМ и

Организационен одбор на 19^{тиот} Меѓународен симпозиум на ДГКМ:

**Мери Цветковска, Андреа Серафимовски, Ана Тромбева Гаврилоска, Дарко
Наков, Коце Тодоров, Роберта Апостолска, Даниел Цеков, Соња Черепналковска,
Ива Цагора, Илија Марков, Владимир Витанов, Никола Постолов, Ристе Волчев**

Technical staff of the Symposium:

**Marija Docevska, Elena Cvetkovska, Evgenija Stojkoska, Aleksandra Cubrinovska,
Dejan Janev, Nikola Nisev, Daniel Nikolovski, Mihail Petrov**

Техничка служба на Симпозиумот:

**Марија Доцевска, Елена Цветковска, Евгенија Стојкоска, Александра
Чубриновска, Дејан Јанев, Никола Нисев, Даниел Николовски, Михаил Петров**

Grafical design of cover page and Symposium poster:

**Mitko Hadzi Pulja, Darko Draganovski
Faculty of Architecture, UKIM, Skopje**

Графички дизајн на корицата и плакатот на Симпозиумот:

**Митко Хаци Пуља, Дарко Драгановски
Архитектонски факултет, УКИМ, Скопје**

e-book:

електронско издание: ISBN 978-608-4510-47-5

19th INTERNATIONAL SYMPOSIUM OF MASE
OHRIID, 27 – 30 APRIL 2022

19^{тм} МЕЃУНАРОДЕН СИМПОЗИУМ НА ДГКМ
ОХРИД, 27 – 30 АПРИЛ 2022

19th International Symposium was supported by:
Организацијата на 19^{тмот} Симпозиум ја помогнаа:
(in alphabetic order)
(по азбучен редослед)

General partners / Генерални партнери:

GRANIT, Skopje
ГРАНИТ, Скопје

Gold partners / Златни партнери:

ACO Building Elements, Bulgaria
АСО Градежни елементи, Бугарија

ADING, Skopje
АДИНГ, Скопје

Chamber of certified architects and certified engineers of Macedonia, Skopje
Комора на Овластени Архитекти и Овластени Инженери на Македонија, Скопје

DOJРАН STEEL, Dojran
ДОЈРАН СТИЛ, Дојран

FACULTY OF CIVIL ENGINEERING, University "Ss. Cyril and Methodius", Skopje
ГРАДЕЖЕН ФАКУЛТЕТ, Универзитет "Св. Кирил и Методиј", Скопје

IZIIS, University "Ss. Cyril and Methodius", Skopje
ИЗИИС, Универзитет "Св. Кирил и Методиј", Скопје

MASON Engineering, Skopje
МАСОН Инженеринг, Скопје

REHAU, Skopje
РЕХАУ, Скопје

SINOHYDRO Corporation Limited Peking, Skopje
СИНОХИДРО Корпорација Лимитед Пекинг, Скопје

TITAN Cementarnica Usje, Skopje
ТИТАН Цементарница Усје, Скопје

Partners / Партнери:

Civil Engineering Institute Makedonija, Skopje
Градежен институт Македонија, Скопје

Institute for Testing Materials and Development of New Technologies "Skopje", Skopje
Завод за испитување на материјали и развој на нови технологии „Скопје“, Скопје

KNAUF, Skopje
КНАУФ, Скопје

19th INTERNATIONAL SYMPOSIUM OF MASE
OHRID, 27 – 30 APRIL 2022

19^м МЕЃУНАРОДЕН СИМПОЗИУМ НА ДГКМ
ОХРИД, 27 – 30 АПРИЛ 2022

SCIENTIFIC COMMITTEE
НАУЧЕН ОДБОР

(in alphabetic order)

(по азбучен редослед)

1. **Grozde ALEKSOVSKI**, Faculty of Civil Engineering,
University "Ss. Cyril and Methodius", Skopje, North Macedonia
Грозде АЛЕКСОВСКИ, Градежен факултет,
Универзитет „Св. Кирил и Методиј“, Скопје, Северна Македонија
2. **Sande ATANASOVSKI**, Faculty of Civil Engineering,
University "Ss. Cyril and Methodius", Skopje, North Macedonia
Санде АТАНАСОВСКИ, Градежен факултет,
Универзитет „Св. Кирил и Методиј“, Скопје, Северна Македонија
3. **Dubravka BJEGOVIC**, Faculty of Civil Engineering,
University of Zagreb, Croatia
Дубравка БЈЕГОВИЌ, Градежен факултет,
Универзитет во Загреб, Хрватска
4. **Golubka N. CVETANOVSKA**, Institute of Earthquake Engineering and Engineering
Seismology-IZIIS, University "Ss. Cyril and Methodius", Skopje, North Macedonia
Голубка Н. ЦВЕТАНОВСКА, Институт за земјотресно инженерство и инженерска
сеизмологија-ИЗИИС, Универзитет „Св. Кирил и Методиј“, Скопје, Северна Македонија
5. **Petar CVETANOVSKI**, Faculty of Civil Engineering,
University "Ss. Cyril and Methodius", Skopje, North Macedonia
Петар ЦВЕТАНОВСКИ, Градежен факултет,
Универзитет „Св. Кирил и Методиј“, Скопје, Северна Македонија
6. **Liljana DENKOVSKA**, Faculty of Civil Engineering,
University "Ss. Cyril and Methodius", Skopje, North Macedonia
Лилјана ДЕНКОВСКА, Градежен факултет,
Универзитет „Св. Кирил и Методиј“, Скопје, Северна Македонија
7. **Igor DJOLEV**, Faculty of Technical Sciences,
University of Novi Sad, Novi Sad, Serbia
Игор Џолев, Факултет за технички науки,
Универзитет во Нови Сад, Србија
8. **Michael FABER**, Department of Civil Engineering, Aalborg University, Denmark
Мајкл ФАБЕР, Оддел за градежништво, Универзитет во Аалборг, Данска
9. **Vladimir GOCEVSKI**, Hydro-Quebec Equipment, Montreal, PQ, Canada
Владимир ГОЦЕВСКИ, Хидро-Квебек, Монтреал, Канада

10. **Rade HAJDIN**, Infrastructure Management Consultants GmbH, Zurich, Switzerland,
Faculty of Civil Engineering, University of Belgrade, Serbia
Раде ХАЈДИН, Инфраструктура Менаџмент Консалтинг GmbH, Цирих, Швајцарија,
Градежен факултет, Универзитет во Белград, Србија
11. **Rüdiger HÖFFER**, Ruhr-University, Bochum, Germany
Рудигер ХОФЕР, Рур Универзитет во Бохум, Германија
12. **Elena DUMOVA JOVANOSKA**, Faculty of Civil Engineering,
University "Ss. Cyril and Methodius", Skopje, North Macedonia
Елена ДУМОВА ЈОВАНОСКА, Градежен факултет,
Универзитет „Св. Кирил и Методиј“, Скопје, Северна Македонија
13. **Mirjana LABAN**, Faculty of Technical Sciences,
University of Novi Sad, Novi Sad, Serbia
Мирјана ЛАБАН, Факултет за технички науки,
Универзитет во Нови Сад, Србија
14. **Djordje LADJINOVIC**, Faculty of Technical Sciences,
University Novi Sad, Novi Sad, Serbia
Ѓорѓе ЛАЃИНОВИЌ, Факултет за технички науки,
Универзитет во Нови Сад, Србија
15. **Ljupco LAZAROV**, Faculty of Civil Engineering,
University "Ss. Cyril and Methodius", Skopje, North Macedonia
Љупчо ЛАЗАРОВ, Градежен факултет,
Универзитет „Св. Кирил и Методиј“, Скопје, Северна Македонија
16. **Dusko LUCIC**, Faculty of Civil Engineering,
University of Montenegro, Podgorica, Montenegro
Душко ЛУЧИЌ, Градежен факултет,
Универзитет во Црна Гора, Подгорица, Црна Гора
17. **Mirjana MALESEV**, Faculty of Technical Sciences, University Novi Sad, Novi Sad, Serbia
Мирјана МАЛЕШЕВ, Факултет за технички науки, University of Novi Sad, Serbia
18. **Peter MARK**, Ruhr-University, Bochum, Germany
Питер МАРК, Рур Универзитет во Бохум, Германија
19. **Viktor MARKELJ**, PONTING d.o.o., Maribor, Slovenia
Виктор МАРКЕЉ, ПОНТИНГ д.о.о., Марибор, Словенија
20. **Zlatko MARKOVIC**, Faculty of Civil Engineering, University of Belgrade, Serbia
Златко МАРКОВИЌ, Градежен факултет, Универзитет во Белград, Србија
21. **Goran MARKOVSKI**, Faculty of Civil Engineering,
University "Ss. Cyril and Methodius", Skopje, North Macedonia
Горан МАРКОВСКИ, Градежен факултет,
Универзитет „Св. Кирил и Методиј“, Скопје, Северна Македонија
22. **Miroslav NASTEV**, Natural Resources Canada – Geological Survey of Canada,
Quebec City, Canada
Мирослав НАСТЕВ, Национални ресурси на Канада - Центар за геолошки
истражувања на Канада, Квебек, Канада

23. **Tihomir NIKOLOVSKI**, Faculty of Civil Engineering,
University "Ss. Cyril and Methodius", Skopje, North Macedonia
Тихомир НИКОЛОВСКИ, Градежен факултет,
Универзитет „Св. Кирил и Методиј“, Скопје, Северна Македонија
24. **Svetlana PETKOVSKA ONCEVSKA**, Faculty of Civil Engineering,
University "Ss. Cyril and Methodius", Skopje, North Macedonia
Светлана ПЕТКОВСКА ОНЧЕВСКА, Градежен факултет,
Универзитет „Св. Кирил и Методиј“, Скопје, Северна Македонија
25. **Doncho PARTOV**, University of Structural Engineering and Architecture,
VSU "L. Karavelov", Sofia, Bulgaria
Дончо ПАРТОВ, Универзитет за градежништво и архитектура,
ВСУ "Љубен Каравелов", Софија, Бугарија
26. **Ivana BANJAD PEČUR**, Faculty of Civil Engineering, University of Zagreb, Croatia
Ивана БАЊАД ПЕЧУР, Градежен факултет, Универзитет во Загреб, Хрватска
27. **Predrag POPOVIC**, Vice President & Senior Principal,
Wiss Janney, Elstner Associates, Chicago, USA
Предраг ПОПОВИЌ, Потпретседател и Директор,
Елстнер соработници, Чикаго, САД
28. **Vlastimir RADONJANIN**, Faculty of Technical Sciences,
Универзитет во Нови Сад, Србија
Властомир РАДОЊАНИН, Факултет за технички науки,
Универзитет во Нови Сад, Србија
29. **Bosko STEVANOVIC**, Faculty of Civil Engineering,
University of Belgrade, Serbia
Бошко СТЕВАНОВИЌ, Градежен факултет,
Универзитет во Белград, Србија
30. **Veronika SHENDOVA**, Institute of Earthquake Engineering and Engineering Seismology-
IZIIS, University "Ss. Cyril and Methodius", Skopje, North Macedonia
Вероника ШЕНДОВА, Институт за земјотресно инженерство и инженерска
сеизмологија-ИЗИИС, Универзитет „Св. Кирил и Методиј“, Скопје, Северна Македонија
31. **Vlatko SHESHOV**, Institute of Earthquake Engineering and Engineering Seismology-IZIIS,
University "Ss. Cyril and Methodius", Skopje, North Macedonia
Влатко ШЕШОВ, Институт за земјотресно инженерство и инженерска сеизмологија-
ИЗИИС, Универзитет „Св. Кирил и Методиј“, Скопје, Северна Македонија
32. **Prof. Mladen ULICEVIC**, Faculty of Civil Engineering,
University of Montenegro, Podgorica, Montenegro
Проф. Младен УЛИЧЕВИЌ, Градежен факултет,
Универзитет во Црна Гора, Подгорица, Црна Гора
33. **Ales ZNIDARIC**, Slovenian National Building and Civil Engineering Institute,
Ljubljana, Slovenia
Алеш ЗНИДАРИЌ, Институт за градежништво на Словенија,
Љубљана, Словенија

PROCEEDINGS
19th INTERNATIONAL SYMPOSIUM OF MASE
ЗБОРНИК НА ТРУДОВИ
19th МЕЃУНАРОДЕН СИМПОЗИУМ НА ДГКМ

C O N T E N T
СОДРЖИНА

МА

MASE AWARDS
ПРИЗНАНИЈА НА ДГКМ

МА-1

Goran MARKOVSKI, Marija DOCEVSKA, Atanas STRASHESKI, Irina PETRESKA **1**
INTEGRAL BRIDGE “MIHAJLO APOSTOLSKI” OVER THE RIVER VARDAR IN SKOPJE
(MASE AWARD IN THE FIELD OF STRUCTURAL DESIGN FOR 2019)
Горан МАРКОВСКИ, Марија ДОЦЕВСКА, Атанас СТРАШЕСКИ, Ирина ПЕТРЕСКА
ИНТЕГРАЛЕН МОСТ “МИХАЈЛО АПОСТОЛСКИ” ПРЕКУ РЕКАТА ВАРДАР ВО СКОПЈЕ
(ПРИЗНАНИЕ НА ДГКМ ЗА ПРОЕКТИРАЊЕ НА КОНСТРУКЦИЈА ЗА 2019)

МА-2

Goran MARKOVSKI, Marija DOCEVSKA, Atanas STRASHESKI, Viktor MARKELJ **17**
EXTRADOSED BRIDGE OVER THE RIVER VARDAR IN SKOPJE
(MASE AWARD IN THE FIELD OF STRUCTURAL DESIGN FOR 2020)
Горан МАРКОВСКИ, Марија ДОЦЕВСКА, Атанас СТРАШЕСКИ, Виктор МАРКЕЉ
“EXTRADOSED” МОСТ ПРЕКУ РЕКАТА ВАРДАР ВО СКОПЈЕ
(ПРИЗНАНИЕ НА ДГКМ ЗА ПРОЕКТИРАЊЕ НА КОНСТРУКЦИЈА ЗА 2020)

МА-3

Tome TROMBEV, Ljubisha CAUSEVSKI, Zlatko SAMARDZIOSKI, Robert KONESKI, Aleksandar TROMBEV, Toni JOVANOVSki **31**
PRODUCTION, TRANSPORT AND INSTALLATION OF THE ROOF STEEL STRUCTURE AT THE CITY STADIUM IN CETINJE, MONTENEGRO
(MASE AWARD IN THE FIELD OF CONSTRUCTION FOR 2020)
Томе ТРОМБЕВ, Љубиша ЧАУШЕВСКИ, Златко САМАРЦИОСКИ, Роберт КОНЕСКИ, Александар ТРОМБЕВ, Тони ЈОВАНОВСКИ
ИЗРАБОТКА, ТРАНСПОРТ И МОНТАЖА НА ПОКРИВНАТА ЧЕЛИЧНА КОНСТРУКЦИЈА НА ГРАДСКИОТ СТАДИОН ВО ЦЕТИЊЕ, ЦРНА ГОРА
(ПРИЗНАНИЕ НА ДГКМ ЗА ИЗВЕДБА НА ОБЈЕКТ ЗА 2020)

<u>МА-4</u>	Simona BOGOEVSKA A HOLISTIC FRAMEWORK FOR DATA-DRIVEN DIAGNOSTICS OF OPERATIONAL WIND TURBINES <i>(MASE AWARD IN THE FIELD OF SCIENTIFIC RESEARCH FOR 2019)</i> Симона БОГОЕВСКА ХОЛИСТИЧКИ ПРИСТАП ЗА ДИЈАГНОСТИКА НА ВЕТЕРНИЦИ ПРЕКУ ИЗМЕРЕНИ ПОДАТОЦИ <i>(ПРИЗНАНИЕ НА ДГКМ ЗА НАУЧНО ИСТРАЖУВАЊЕ ЗА 2019)</i>	43
<u>МА-5</u>	Jordan BOJADJIEV INNOVATIVE METHOD FOR IMPROVEMENT OF THE SEISMIC RESISTANCE OF THE MASONRY INFILL WALLS IN RC FRAME STRUCTURES <i>(MASE AWARD IN THE FIELD OF SCIENTIFIC RESEARCH FOR 2019)</i> Јордан БОЈАЦИЈЕВ ИНОВАТИВЕН МЕТОД ЗА ЗГОЛЕМУВАЊЕ НА СЕИЗМИЧКАТА ОТПОРНОСТ НА СИДОВИТЕ ОД ИСПОЛНАТА ВО АРМИРАНО БЕТОНСКИ РАМОВСКИ КОНСТРУКЦИИ <i>(ПРИЗНАНИЕ НА ДГКМ ЗА НАУЧНО ИСТРАЖУВАЊЕ ЗА 2019)</i>	55
<u>МА-6</u>	Mile PARTIKOV ANALYTICAL AND THEORETICAL RESEARCH OF HOLLOW SECTIONS JOINT RIGIDITY EFFECTS ON BEHAVIOUR OF VIERENDEEL TRUSSES <i>(MASE AWARD IN THE FIELD OF SCIENTIFIC RESEARCH FOR 2020)</i> Миле ПАРТИКОВ ЕКСПЕРИМЕНТАЛНО И ТЕОРИСКО ИСТРАЖУВАЊЕ НА ВЛИЈАНИЕТО ОД КРУСТОСТА НА ЈАЗЛИТЕ КАЈ ВИРЕНДЕЛ НОСАЧИ ОД ЗАТВОРЕНИ ПРОФИЛИ <i>(ПРИЗНАНИЕ НА ДГКМ ЗА НАУЧНО ИСТРАЖУВАЊЕ ЗА 2020)</i>	69
<u>IP*</u>	INVITED PAPERS ПОВИКАНИ ПРЕДАВАЊА	
<u>IP-1</u>	Roberta APOSTOLSKA NATIONAL IMPLEMENTATION OF MKS EN1998-1:2004 – STATUS AND CHALLENGES Роберта АПОСТОЛСКА НАЦИОНАЛНА ИМПЛЕМЕНТАЦИЈА НА МКС EN1998-1:2004 – СТАТУС И ПРЕДИЗВИЦИ	83
<u>IP-2</u>	Toni ARANGJELOVSKI DESIGN OF PRESTRESSED CONCRETE STRUCTURES ACCORDING TO EUROCODE 2 Тони АРАНЃЕЛОВСКИ ПРОЕКТИРАЊЕ НА ПРЕТХОДНО НАПРЕГНАТИ КОНСТРУКЦИИ СПОРЕД ЕВРОКОД 2	99

* in alphabetic order of the first author's surname

<u>IP-3</u>	Josif JOSIFOVSKI TOWARDS THE ERA OF THE EUROCODES - FUTURE DEVELOPMENT AND SECOND GENERATION OF EUROCODE 7 Јосиф ЈОСИФОВСКИ КОИ ЕРАТА НА ЕВРОКОДОВИТЕ – ИДЕН РАЗВОЈ И ВТОРА ГЕНЕРАЦИЈА НА ЕВРОКОД 7	113
<u>IP-4</u>	Andreas KAPPOS A CRITICAL OVERVIEW OF THE NEW EUROCODE 8 – PART 3	129
<u>IP-5</u>	Hartmut PASTERNAK THE NEW EUROCODE 3 - DESIGN OF STEEL STRUCTURES - PART 1-1: GENERAL RULES AND RULES FOR BUILDINGS	142
<u>IP-6</u>	Nenad PEČIĆ DESIGN OF CONCRETE STRUCTURES ACCORDING TO EUROCODE 2 AND BAB 87: COMPARISON OF BASIC CALCULATIONS	147
<u>IP-7</u>	Davor SKEJIC EUROCODE 1 - CLIMATIC LOADS ON BUILDING STRUCTURES	163
<u>IP-8</u>	Milan SPREMIĆ, Zlatko MARKOVIĆ ADVANCE DESIGN METHODS OF STEEL STRUCTURES BASED ON EUROCODE 3	177
<u>MT</u> *	MAIN TOPIC ГЛАВНА ТЕМА	
<u>MT-1</u>	Sead ABAZI, Natasha NEDELKOVSKA, Bojan SUSINOV, Spasen GjORGJEVSKI VERIFICATION OF RETAINING WALLS BEARING CAPACITY ACCORDING TO MKS AND EUROCODE 7 BY THE THEORY OF RELIABILITY Сеад АБАЗИ, Наташа НЕДЕЛКОВСКА, Бојан СУСИНОВ, Спасен ЃОРЃЕВСКИ ВЕРИФИКАЦИЈА НА НОСИВОСТ КАЈ ПОТПОРНИ СИДОВИ СПОРЕД МКС И ЕВРОКОД 7 СО ПРИМЕНА НА ТЕОРИЈА НА ДОВЕРЛИВОСТ	193
<u>MT-2</u>	Zoran BRUJIĆ, Radomir FOLIĆ, Miloš ČOKIĆ PUNCHING SHEAR DESIGN ACCORDING TO SECOND GENERATION EUROCODE 2 (prEN 1992-1-1:2021)	201
<u>MT-3</u>	Meri CVETKOVSKA STRUCTURAL FIRE DESIGN ACCORDING TO EUROCODE 1 Мери ЦВЕТКОВСКА ПРОЕКТИРАЊЕ ЗА ПОЖАРНА СОСТОЈБА ВО СОГЛАСНОСТ СО ЕВРОКОД 1	211

* in alphabetic order of the first author's surname

<u>MT-4</u>	Sofija DUSHANOVSKA, Darko NAKOV, Goran MARKOVSKI, Toni ARANGJELOVSKI, Denis POPOVSKI ANALYSIS OF SECOND-ORDER EFFECTS ACCORDING TO EUROCODE 2 Софија ДУШАНОВСКА, Дарко НАКОВ, Горан МАРКОВСКИ, Тони АРАНЃЕЛОВСКИ, Денис ПОПОВСКИ АНАЛИЗА НА ВЛИЈАНИЈА ОД ВТОР РЕД СПОРЕД ЕВРОКОД 2	223
<u>MT-5</u>	Kemal EDIP, Vlatko SHESHOV, Julijana BOJADJIEVA, Dejan IVANOVSKI, Toni KITANOVSKI BASIC DESIGN PRINCIPLES TO EUROCODE 8-5	233
<u>MT-6</u>	Igor GJORGJIEV, Angela POPOSKA WIND ACTION ON STRUCTURES ACCORDING TO EUROCODE Игор ЃОРЃИЕВ, Ангела ПОПОСКА ДЕЈСТВО ОД ВЕТЕР НА КОНСТРУКЦИИ СПОРЕД ЕВРОКОД	247
<u>MT-7</u>	Ivan GLIŠOVIĆ, Marija TODOROVIĆ, Nađa SIMOVIĆ VIBRATIONAL SERVICEABILITY DESIGN METHOD FOR TIMBER FLOORS ACCORDING TO EUROCODE 5	257
<u>MT-8</u>	Dejan IVANOVSKI, Kemal EDIP, Julijana BOJADJIEVA, Vlatko SHESHOV, Toni KITANOVSKI COMPARATIVE ANALYSIS OF STABILITY OF RETAINING WALLS ACCORDING TO THE CURRENT PRACTICE AND EUROCODES Дејан ИВАНОВСКИ, Кемал ЕДИП, Јулијана БОЈАЏИЕВА, Влатко ШЕШОВ, Тони КИТАНОВСКИ КОМПАРАТИВНА АНАЛИЗА НА СТАБИЛНОСТ НА ПОТПОРНИ СИДОВИ СПОРЕД ДОСЕГАШНА ПРАКСА И ЕВРОКОДОВИ	267
<u>MT-9</u>	Josif JOSIFOVSKI, Merita ISMAILI, Aleksandra N. ATANASOVSKA CALCULATION OF PILE BEARING CAPACITY ACCORDING TO EUROCODE 7 USING THE RESULTS FROM CPT AND SPT SITE INVESTIGATIONS Јосиф ЈОСИФОВСКИ, Мерита ИСМАИЛИ, Александра Н. АТАНАСОВСКА ПРЕСМЕТКА НА НОСИВОСТ НА КОЛ СО РЕЗУЛТАТИ ОД ЛАБОРАТОРИСКИ ИСПИТУВАЊА СПОРЕД ЕВРОКОД 7	277
<u>MT-10</u>	Josif JOSIFOVSKI, Merita ISMAILI, Aleksandra N. ATANASOVSKA CALCULATION OF PILE BEARING CAPACITY ACCORDING TO EUROCODE 7 USING THE RESULTS FROM LABORATORY TESTING Јосиф ЈОСИФОВСКИ, Мерита ИСМАИЛИ, Александра Н. АТАНАСОВСКА ПРЕСМЕТКА НА НОСИВИОТ КАПАЦИТЕТ НА КОЛ СПОРЕД ЕВРОКОДОТ 7 ОД РЕЗУЛТАТИТЕ ДОБИЕНИ СО CPT И SPT ИСПИТУВАЊА	286

<u>MT-11</u>	Milorad JOVANOVSКИ, Jovan Br. PAPIĆ, Igor PEŠEVSKI EDUCATION AND QUALIFICATION REQUIREMENTS – VALUABLE ANNEX TO THE SECOND GENERATION OF EUROCODE 7 Милорад ЈОВАНОВСКИ, Јован Бр. ПАПИЌ, Игор ПЕШЕВСКИ ОБРАЗОВАНИЕ И КОМПЕТЕНЦИИ – ЗНАЧАЕН АНЕКС НА ВТОРАТА ГЕНЕРАЦИЈА НА ЕВРОКОД 7	296
<u>MT-12</u>	Milorad JOVANOVSКИ, Igor PEŠEVSKI, Jovan Br. PAPIĆ EUROCODE 7 AND ROCK MECHANICS: A PROBLEM OR A CHALLENGE? Милорад ЈОВАНОВСКИ, Игор ПЕШЕВСКИ, Јован Бр. ПАПИЌ ЕВРОКОД 7 И МЕХАНИКА НА КАРПИ: ПРОБЛЕМ ИЛИ ПРЕДИЗВИК?	304
<u>MT-13</u>	Semso KALAC, Naja ZEJNELAGIC, Dusko LUCIC THE ALGORITHM OF ANALYSIS AND DIMENSIONING OF STEEL WATER TANK ACCORDING TO EUROCODES	314
<u>MT-14</u>	Tatjana KOČETOV MIŠULIĆ, Aleksandra RADUJKOVIĆ EVALUATION OF BENDING MODULUS OF ELASTICITY IN TIMBER ACCORDING TO EN 384 AND EN 14358	320
<u>MT-15</u>	Despina KRSTEVSKA, Elena DUMOVA-JOVANOSKA, Grozde Aleksovski TREATMENT OF THE HORIZONTAL IRREGULARITY FOR UNREINFORCED MASONRY BUILDINGS IN NATIONAL PROVISIONS OF 1981 AND EUROCODE 8 Деспина КРСТЕВСКА, Елена ДУМОВА-ЈОВАНОСКА, Грозде АЛЕКСОВСКИ ТРЕТМАН НА НЕРЕГУЛАРНОСТА ВО ОСНОВА КАЈ ОБЈЕКТИ ОД НЕАРМИРАНА СИДАРИЈА ВО НАЦИОНАЛНИТЕ ПРОПИСИ ОД 1981 Г. И ЕВРОКОД 8	328
<u>MT-16</u>	Zlatko MARKOVIĆ, Jelena DOBRIĆ, Milan SPREMIĆ NEW GENERATION OF EUROCODE 3 – THE MOST IMPORTANT CHANGES	342
<u>MT-17</u>	Darko NAKOV DESIGN PRINCIPLES OF EUROCODE 2 Дарко НАКОВ ПРИНЦИПИ НА ПРОЕКТИРАЊЕ СПОРЕД ЕВРОКОД 2	352
<u>MT-18</u>	Mladen NASTESKI, Denis POPOVSKI, Mile PARTIKOV ANALYSIS AND DESIGN OF A STEEL JOIST, COMPARISON OF MACEDONIAN STANDARD WITH EUROCODE Младен НАСТЕСКИ, Денис ПОПОВСКИ, Миле ПАРТИКОВ АНАЛИЗА И ПРЕСМЕТКА НА R-НОСАЧ, СПОРЕДБА НА МАКЕДОНСКИОТ СТАНДАРД СО ЕВРОКОД	366

<u>MT-19</u>	Ivana NIKOLOVSKA, Natasha NAJDOVSKA, Jovana MIRCHEVSKI, Andrea VELKOVA, Aleksandar BOGOEVSKI COMPARISON OF SEISMIC ACTIONS FOR ABUTMENTS ACCORDING TO EUROCODE AND OUR REGULATIONS Ивана НИКОЛОВСКА, Наташа НАЈДОВСКА, Јована МИРЧЕВСКИ, Андреа ВЕЛКОВА, Александар БОГОЕВСКИ СПОРЕДБА НА ВЛИЈАНИЈА ОД СЕИЗМИКА КАЈ КРАЈНИ СТОЛБОВИ ОД МОСТОВИ ПО ЕВРОКОД И НАШИ ПРОПИСИ	376
<u>MT-20</u>	Nikola NISEV, Denis POPOVSKI, Mile PARTIKOV CONTEMPORARY PRINCIPLES OF INDUSTRIAL BUILDING PROJECT IN ACCORDANCE WITH EUROCODE Никола НИСЕВ, Денис ПОПОВСКИ, Миле ПАРТИКОВ СОВРЕМЕНИ МЕТОДИ НА ПРОЕКТИРАЊЕ НА ИНДУСТРИСКИ ОБЈЕКТ ВО СОГЛАСНОСТ СО ЕВРОКОД	385
<u>MT-21</u>	Jovan Br. PAPIĆ, Ljupčo DIMITRIEVSKI, Milorad JOVANOVSКИ, Igor PEŠEVSKI, Leon GUCULj (DIS)CONTINUITY IN THE DESIGN OF RETAINING WALLS: GREETINGS FROM EUROCODE 7! Јован Бр. ПАПИЌ, Љупчо ДИМИТРИЕВСКИ, Милорад ЈОВАНОВСКИ, Игор ПЕШЕВСКИ, Леон ГУЦУЉ (ДИС)КОНТИНУИТЕТ ВО ПРОЕКТИРАЊЕТО НА ПОТПОРНИ СИДОВИ: ПОЗДРАВ ОД ЕВРОКОД 7!	396
<u>MT-22</u>	Dragan STAMEV, Siljan MIHAJLOVSKI, Liljana GRKOVA, Bojan GOLABOSKI COMPARATIVE ANALYSIS OF MAIN RC PRESTRESSED BOX STRUCTURE ACCORDING TO DIN AND EUROCODES Драган СТАМЕВ, Силјан МИХАЈЛОВСКИ, Лилјана ГРКОВА, Бојан ГОЛАБОСКИ КОМПАРАТИВНА АНАЛИЗА СПОРЕД DIN И ЕС НА РАСПОНСКА АБ ПРЕДНАПРЕГНАТА САНДАЧЕСТА КОНСТРУКЦИЈА	404
<u>MT-23</u>	Naum STEFANOVSKI, Philip WILLEMS, Elena POPOVSKA WIND CALCULATION: TOO MUCH WORK FOR SMALL STRUCTURES???	414
<u>MT-24</u>	Angelko STOJANOVSKI, Denis POPOVSKI, Mile PARTIKOV ANALYSIS OF COMPOSITE COLUMNS LOADED BY BIAXIAL ACTION USING DIAGRAMS OF INTERACTIONS ACCORDING TO EUROCODE 4 Ангелко СТОЈАНОВСКИ, Денис ПОПОВСКИ, Миле ПАРТИКОВ АНАЛИЗА НА БИАКСИЈАЛНО ТОВАРЕНИ СПРЕГНАТИ СТОЛБОВИ ПРЕКУ ДИЈАГРАМИ НА ИНТЕРАКЦИЈА СПОРЕД ЕВРОКОД 4	420
<u>MT-25</u>	Angelko STOJANOVSKI, Denis POPOVSKI, Mile PARTIKOV DEFINITION OF DEFORMATION EQUATION OF COMPOSITE CROSS-SECTION ACCORDING TO EC4 Ангелко СТОЈАНОВСКИ, Денис ПОПОВСКИ, Миле ПАРТИКОВ ДЕФИНИРАЊЕ НА ДЕФОРМАЦИОНА РАВЕНКА НА СПРЕГНАТ ПРЕСЕК СПОРЕД ЕВРОКОД 4	430

<u>MT-26</u>	Bojan SUSINOV, Spasen GjORGjEVSKI, Sead ABAZI DESIGN OF EMBEDDED RETAINING STRUCTURES ACCORDING TO EUROCODE 7 USING FINITE ELEMENT METHOD Бојан СУСИНОВ, Спасен ЃОРЃЕВСКИ, Сеад АБАЗИ ПРОЕКТИРАЊЕ НА ПОДГРАДА ОД ВКОПАНИ СИДОВИ СПОРЕД ЕВРОКОД 7 СО МЕТОДОТ НА КОНЕЧНИ ЕЛЕМЕНТИ	440
<u>SE</u> *	<i>SEISMIC ENGINEERING</i> <i>СЕЙЗМИЧКО ИНЖЕНЕРСТВО</i>	
<u>SE-1</u>	Timur CURIĆ, Demir VATIĆ ANALYSIS OF THE INFLUENCE OF PASSIVE SEISMIC PROTECTION IN RC STRUCTURES WITH SOFT GROUND FLOOR	446
<u>SE-2</u>	Kefajet EDIP, Roberta APOSTOLSKA SEISMIC RISK ASSESSMENT AT URBAN SCALE - PILOT STUDY, KARPOSH, SKOPJE Кефајет ЕДИП, Роберта АПОСТОЛСКА ПРОЦЕНА НА СЕЙЗМИЧКИ РИЗИК ВО УРБАН РАЗМЕР – ПИЛОТ СТУДИЈА, ОПШТИНА КАРПОШ, СКОПЈЕ	456
<u>SE-3</u>	Mihail GAREVSKI, Valentina LUCKOVA, Tanja ILIEVSKA, Marina KORDOSKA POSSIBILITY TO ANALYZE THE WIND TURBINES BY APPLYING THE ROLLING REGULATIONS AND EUROPEAN STANDARDS	464
<u>SE-4</u>	Mihail GAREVSKI, Valentina LUCKOVA, Tanja ILIEVSKA, Marina KORDOSKA “DO YOU REMEMBER IT?” – A NEW APPROACH TO CITIZEN SEISMOLOGY Михаил ГАРЕВСКИ, Валентина ЛУЧКОВА, Тања ИЛИЕВСКА, Марина КОРДОСКА “ДАЛИ СЕ СЕЌАВАТЕ?” – НОВ ПРИСТАП ВО ГРАЃАНСКАТА СЕЙЗМОЛОГИЈА	473
<u>SE-5</u>	Goran JEKIC, Veronika SHENDOVA, Roberta APOSTOLSKA, Aleksandar ZLATESKI, Aleksandar ZHUROVSKI, Elena DELOVA, Julijana BOJADJIEVA IZIIS’ PROTOCOL FOR EVALUATION OF SEISMIC RESISTANCE OF EXISTING BUILDINGS - SEISMIC CERTIFICATE	484
<u>SE-6</u>	Admir KAJRIMANOSKI, Koce TODOROV NONLINEAR SEISMIC ASSESMENT OF SOFT STOREY STRUCTURES Адмир КАЈРИМАНОСКИ, Коце ТОДОРОВ НЕЛИНЕАРНА ПРОЦЕНА НА СЕЙЗМИЧКИОТ ОДГОВОР НА КОНСТРУКЦИИ СО ФЛЕКСИБИЛЕН КАТ	492

* in alphabetic order of the first author’s surname

<u>SE-7</u>	Marko MARINKOVIĆ, Svetlana BRZEV, Nikola BLAGOJEVIĆ, Ivan MILIĆEVIĆ, Željko ŽUGIĆ, Petar BURSAC PERFORMANCE OF MASONRY BUILDINGS DURING THE NOVEMBER 26, 2019 ALBANIA EARTHQUAKE (MW 6.4) AND DECEMBER 29, 2020 PETRINJA EARTHQUAKE (MW 6.4)	502
<u>SE-8</u>	Ana NANEVSKA, Toni KITANOVSKI, Aleksandar ZUROVSKI, Daniel TOMIC, Goran JEKIC, Roberta APOSTOLSKA COMPARISON OF DIFFERENT STANDARDS FOR SEISMIC DESIGN OF REINFORCED CONCRETE FRAME STRUCTURE Ана НАНЕВСКА, Тони КИТАНОВСКИ, Александар ЖУРОВСКИ, Даниел ТОМИЌ, Горан ЈЕКИЌ, Роберта АПОСТОЛСКА СПОРЕДБА НА СТАНДАРДИ ЗА СЕИЗМИЧКО ПРОЕКТИРАЊЕ ПРЕКУ ПРИМЕР НА АБ РАМОВСКА КОНСТРУКЦИЈА	512
<u>SE-9</u>	Zabedin NEZIRI, Radmila SALIC REVIEW AND COMPARATIVE ANALYSIS OF AVAILABLE FAULT DATABASES FOR THE TERRITORY OF N. MACEDONIA Забедин НЕЗИРИ, Радмила ШАЛИЌ ПРЕГЛЕД И КОМПАРАТИВНА АНАЛИЗА НА ПОСТОЈНИ БАЗИ НА ПОДАТОЦИ ЗА РАСЕДНИ СТРУКТУРИ НА ТЕРИТОРИЈАТА НА С. МАКЕДОНИЈА	522
<u>SE-10</u>	Zoran RAKICEVIC, Aleksandra BOGDANOVIC, Dimitar JURUKOVSKI, Predrag GAVRILOVIC DESIGN PROCEDURE FOR COMPLEX STRUCTURES UNDER DYNAMIC LOADS	532
<u>SE-11</u>	Zoran RAKICEVIC, Aleksandra BOGDANOVIC, Dimitar JURUKOVSKI, Predrag GAVRILOVIC STRUCTURAL DESIGN FOR SEISMIC AND WIND ACTION OF A TELECOMMUNICATION TOWER-CASE STUDY	540
<u>SE-12</u>	Learnt TARAVARI, Daniel VELINOV, Koce TODOROV APPLICATION OF PROBABILITY MODELS IN ESTIMATION OF SEISMIC ACTIVITY OF THE BALKAN PENINSULA AND ITS NEARBY REGIONS Леарт ТАРАВАРИ, Даниел ВЕЛИНОВ, Коце ТОДОРОВ ПРИМЕНА НА ВЕРОЈАТНОСНИ МОДЕЛИ ЗА ПРОЦЕНА НА СЕИЗМИЧКАТА АКТИВНОСТ НА БАЛКАНСКИОТ ПОЛУОСТРОВ И НЕГОВАТА БЛИСКА ОКОЛИНА	548
<u>SE-13</u>	Vladimir VUKOBRATOVIĆ THE INFLUENCE OF JERK ON THE SEISMIC RESPONSES OF RIGID LINEAR ELASTIC AND NONLINEAR SDOF SYSTEMS	558
<u>SE-14</u>	Aleksandar ZLATESKI, Veronika SHENDOVA, Elena DELOVA, Goran JEKIC, Aleksandar ZHUROVSKI HARMONIZATION OF SEISMIC VULNERABILITY ASSESSMENT OF URBAN HISTORIC CENTERS	568

FE*

FIRE ENGINEERING ПОЖАРНО ИНЖЕЊЕРСТВО

<u>FE-1</u>	Mirjana LABAN, Snežana ILIĆ, Igor DŽOLEV, Suzana DRAGANIĆ EUROPEAN AND NATIONAL ASSESSMENT PROCEDURE FOR THE FIRE PERFORMANCE OF FACADES	577
<u>FE-2</u>	Milica MIRKOVIĆ MARJANOVIĆ, Aleksandar KIJANOVIĆ, Snežana ILIĆ, Goran TODOROVIĆ, Radovan GOSPAVIĆ EXPERIMENTAL AND NUMERICAL ANALYSIS OF A WALLS MADE FROM AERATED CONCRETE BLOCKS EXPOSED TO FIRE	583
<u>FE-3</u>	Milica MIRKOVIĆ MARJANOVIĆ, Aleksandar KIJANOVIĆ, Snežana ILIĆ, Goran TODOROVIĆ, Radovan GOSPAVIĆ THE COMPARATIVE ANALYSIS OF THERMAL BEHAVIOUR OF A DIFFERENT THICKNESSES WALLS MADE FROM AUTOCLAVED AERATED CONCRETE BLOCKS EXPOSED TO FIRE	591
<u>FE-4</u>	Nikola RAJIĆ, Andrija RAŠETA INITIAL BOW IMPERFECTION SENSITIVITY IN THE BUCKLING RESISTANCE OF AUSTENITIC I-SECTION COLUMNS IN FIRE	598
<u>FE-5</u>	Nikola RAJIĆ, Andrija RAŠETA, Igor DŽOLEV, Vladimir ŽIVALJEVIĆ BUCKLING RESISTANCE ASSESSMENT OF STAINLESS STEEL WELDED I-SECTION COLUMNS IN FIRE USING ABAQUS	608
<u>FE-6</u>	Nikola RAJIĆ, Andrija RAŠETA INFLUENCE OF RESIDUAL STRESSES ON THE MINOR AXIS BUCKLING OF AUSTENITIC STAINLESS STEEL COLUMNS IN FIRE	618
<u>FE-7</u>	Almir RUSHITI, Meri CVETKOVSKA FIRE RISK ASSESSMENT IN PUBLIC BUILDINGS Алмир РУШИТИ, Мери ЦВЕТКОВСКА ПРОЦЕНА НА РИЗИК ОД ПОЖАР ВО ЈАВНИ ОБЈЕКТИ	628
<u>FE-8</u>	Ashkan SHOUSHARIAN MOFRAD, Hartmut PASTERNAK NUMERICAL STUDY OF SANDWICH PANEL CONNECTION SUBJECTED TO SHEAR FORCES AT ELEVATED TEMPERATURES	638

* in alphabetic order of the first author's surname

GE*

GEOTECHNICAL ENGINEERING ГЕОТЕХНИЧКО ИНЖЕНЕРСТВО

GE-1

Sead ABAZI, Bojan SUSINOV, Bulent SULOODJA, Pavle PETROVSKI **647**
SLOPE STABILIZATION MEASURES ON A LOCAL ROAD IN V. ZIROVNICA, MUNICIPALITY OF MAVROVO AND ROSTUSE

Сеад АБАЗИ, Бојан СУСИНОВ, Булент СУЛООЏА, Павле ПЕТРОВСКИ
МЕРКИ ЗА СТАБИЛИЗАЦИЈА НА КОСИНА НА ЛОКАЛЕН ПАТ ВО С. ЖИРОВНИЦА, ОПШТИНА МАВРОВО И РОТУШЕ

GE-2

Ana BOJADZIEVA, Sead ABAZI, Mila SMILJANOVSKA **655**
ANALYSIS OF SHELF EXCAVATION RETAINING SYSTEM IN URBAN AREAS

Ана БОЈАЏИЕВА, Сеад АБАЗИ, Мила СМИЉАНОВСКА
АНАЛИЗА НА СИСТЕМ ЗА ЗАШТИТА НА ПЛИТОК ИСКОП ВО УРБАНИ ГРАДСКИ СРЕДИНИ

GE-3

Konstantin KAZAKOV, Lena MIHOVA, Doncho PARTOV **661**
BURIED ROAD BRIDGE – GEOTECHNICAL CONSIDERATIONS AND ALTERNATIVES FOR FINITE ELEMENT MODELING

GE-4

Toni KITANOVSKI, Vlatko SHESHOV, Julijana BOJADZIEVA, Kemal EDIP, Dejan IVANOVSKI **671**
DEFINITION OF SOIL PARAMETERS USING DRAINED MONOTONIC TESTS WITH HIGH RANGE OF INITIAL DENSITIES

GE-5

Tijana MAJKIĆ, Igor DŽOLEV, Andrija RAŠETA, Vladimir ŽIVALJEVIĆ **679**
MATERIAL POINT METHOD: A NUMERICAL SOLUTION FOR THE SOIL-STRUCTURE INTERACTION PROBLEMS

GE-6

Adis SKEJIĆ, Amra TURALIĆ **685**
ANALYSIS AND NUMERICAL MODELING OF FULL-SCALE STUDY RELATED TO SETTLEMENTS OF MULTILAYER REINFORCED EARTH PLATFORM OVER A SOFT SUBGRADE

* in alphabetic order of the first author's surname

CS*

CONCRETE STRUCTURES БЕТОНСКИ КОНСТРУКЦИИ

- CS-1** Dubravka BJEGOVIĆ, Ivana BANJAD PEČUR, Marijana SERDAR **694**
PAST AND FUTURE DEVELOPMENT OF CEMENT INDUSTRY IN CROATIA
- CS-2** Dejan GEGOVSKI, Toni ARANGJELOVSKI, Darko NAKOV, Goran MARKOVSKI **704**
RELIABILITY ASSESSMENT OF THE SUPERSTRUCTURE OF PRECAST PRESTRESSED BRIDGES
Дејан ГЕГОВСКИ, Тони АРАНЃЕЛОВСКИ, Дарко НАКОВ, Горан МАРКОВСКИ
ОЦЕНА НА ДОВЕРЛИВОСТ НА ГОРНИОТ СТРОЈ НА МОНТАЖНИ ПРЕТХОДНО НАПРЕГНАТИ МОСТОВИ
- CS-3** Dejan JANEV, Toni ARANGJELOVSKI, Darko NAKOV, Goran MARKOVSKI **714**
OVERVIEW OF STANDARDS FOR STATIC AND DYNAMIC PROOF LOAD TESTING OF RC BRIDGES
Дејан ЈАНЕВ, Тони АРАНЃЕЛОВСКИ, Дарко НАКОВ, Горан МАРКОВСКИ
ПРЕГЛЕД НА СТАНДАРДИ ЗА СТАТИЧКО И ДИНАМИЧКО ИСПИТУВАЊЕ НА АБ. МОСТОВИ СО ПРОБНО ТОВАРЕЊЕ
- CS-4** Stefan KOSTOVSKI, Goce PRANGOVSKI, Tanja SERAFIMOVA **724**
EXPERIMENTAL STUDY OF MECHANICAL BEHAVIOR OF CONCRETE WITH METAL FIBERS
Стефан КОСТОВСКИ, Гоце ПРАНГОВСКИ, Тања СЕРАФИМОВА
ЕКСПЕРИМЕНТАЛНА СТУДИЈА НА МЕХАНИЧКО ОДНЕСУВАЊЕ НА БЕТОН СО ДОДАТОК НА МЕТАЛНИ ВЛАКНА
- CS-5** Jens LÖSCHMANN, David SANIO, Peter MARK **733**
TEMPERATURE INDUCTION INTO RC STRUCTURES
- CS-6** Goran MARKOVSKI, Marija DOCEVSKA, Filip TRAJKOVSKI **741**
ADAPTATION OF THE PRESTRESSING METHODOLOGY TO THE BRIDGE CONSTRUCTION METHOD
Горан МАРКОВСКИ, Марија ДОЦЕВСКА, Филип ТРАЈКОВСКИ
УСОГЛАСУВАЊЕ НА МЕТОДОЛОГИЈАТА НА ПРЕТХОДНОТО НАПРЕГАЊЕ СО ТЕХНОЛОГИЈАТА НА ГРАДБА НА МОСТ

* in alphabetic order of the first author's surname

<u>CS-7</u>	Goran MARKOVSKI, Toni ARANGJELOVSKI, Darko NAKOV, Marija DOCEVSKA, Dejan JANEV, Evgenija STOJKOSKA CRACKS IN REINFORCED CONCRETE STRUCTURES DUE TO RESTRAINED IMPOSED DEFORMATIONS – CASE STUDIES Горан МАРКОВСКИ, Тони АРАНЃЕЛОВСКИ, Дарко НАКОВ, Марија ДОЦЕВСКА, Дејан ЈАНЕВ, Евгенија СТОЈКОСКА ПУКНАТИНИ КАЈ АРМИРАНОБЕТОНСКИ КОНСТРУКЦИИ ОД СПРЕЧЕНИ ПРИНУДНИ ДЕФОРМАЦИИ – ПРИМЕРИ ОД ПРАКСА	751
<u>CS-8</u>	Stevcho MITOVSKI, Ljupcho PETKOVSKI, Frosina PANOVSKA NUMERICAL ANALYSIS OF CONCRETE ARCH DAM AT STATIC LOADING – A CASE STUDY	761
<u>CS-9</u>	Dragan STAMEV, Martin RADOESHKI, Ivan NAUMOVSKI, Bojan GOLABOSKI SKOPJE EAST GATE - EXHIBITION AND SHOPPING CENTER – SKOPJE Драган СТАМЕВ, Мартин РАДОЕШКИ, Иван НАУМОВСКИ, Бојан ГОЛАБОСКИ SKOPJE EAST GATE – ОБЈЕКТ ЗА ИЗЛОЖБИ И ТРГОВСКИ ЦЕНТАР – СКОПЈЕ	769
<u>CS-10</u>	Ivica STOILOVSKI, Toni ARANGJELOVSKI, Blazhe DUKOVSKI PROPERTIES OF SELF-COMPACTING CONCRETE CONTAINING FLY ASH Ивица СТОИЛОВСКИ, Тони АРАНЃЕЛОВСКИ, Блаже ДУКОВСКИ СВОЈСТВА НА САМОВГРАДЛИВИОТ БЕТОН СО ЛЕТАЧКА ПЕПЕЛ	777
<u>CS-11</u>	Evgenija STOJKOSKA, Marija DOCEVSKA, Darko NAKOV, Toni ARANGJELOVSKI, Goran MARKOVSKI CRACK WIDTH CONTROL IN RC BEAMS: EXPERIMENTAL AND ANALYTICAL RESULTS Евгенија СТОЈКОСКА, Марија ДОЦЕВСКА, Дарко НАКОВ, Тони АРАНЃЕЛОВСКИ, Горан МАРКОВСКИ КОНТРОЛ НА ОТВОР НА ПУКНАТИНИ КАЈ АБ ГРЕДИ: ЕКСПЕРИМЕНТАЛНИ И АНАЛИТИЧКИ РЕЗУЛТАТИ	787
<u>CS-12</u>	Marijan STRKOV, Stefan BOCEV, Marjan KOCEV OPTIMIZATION DURING CONSTRUCTION – BRIDGE OVER R. BALTALISKA, EXPRESSWAY A4 STIP-RADOVIS Маријан ШТРКОВ, Стефан БОЦЕВ, Марјан КОЦЕВ ОПТИМИЗАЦИЈА ПРИ ИЗВЕДБА – МОСТ ПРЕКУ Р. БАЛТАЛИСКА, ЕКСПРЕСЕН ПАТ А4 ШТИП-РАДОВИШ	797
<u>CS-13</u>	Milica VIDOVIĆ, Jelena DRAGAŠ, Veljko KOKOVIĆ, Dimitrije ZAKIĆ, Miroslav TERAVCEVIĆ PHYSICAL AND MECHANICAL PROPERTIES OF ULTRA-HIGH- PERFORMANCE CONCRETE WITH LIMESTONE	807

SS*

STEEL STRUCTURES ЧЕЛИЧНИ КОНСТРУКЦИИ

<u>SS-1</u>	Aleksandra CHUBRINOVSKA, Denis POPOVSKI, Mile PARTIKOV ANALYSIS OF SHEAR FORCE IN COMPOSITE BOX GIRDER BRIDGES INCLUDING THE DISTORTION Александра ЧУБРИНОВСКА, Денис ПОПОВСКИ, Миле Партиков АНАЛИЗА НА ТРАНСФЕРЗАЛНА НОСИВОСТ НА СПРЕГНАТ САНДАЧЕСТ НОСАЧ КАЈ МОСТОВИ СО ЕФЕКТИ НА ДИСТОРЗИЈА	817
<u>SS-2</u>	Damjan DENKOVSKI, Denis POPOVSKI, Ivan MICEVSKI COMPARISON OF MECHANICAL AND CHEMICAL ANCHORS ACCORDING TO RESULTS OBTAINED FROM EXPERIMENTAL RESEARCH Дамјан ДЕНКОВСКИ, Денис ПОПОВСКИ, Иван МИЦЕВСКИ КОМПАРАЦИЈА НА РЕЗУЛТАТИ ДОБИЕНИ ОД ЕКСПЕРИМЕНТАЛНО ИСПИТУВАЊЕ НА МЕХАНИЧКИ И ХЕМИСКИ АНКЕРИ	827
<u>SS-3</u>	Anita GJUKAJ, Petar CVETANOVSKI, Ana TROMBEVA-GAVRILOSKA DESIGN OF BEAM-TO-COLUMN CONNECTIONS FOR MOMENT RESISTANT FRAMES, END-PLATE BOLTED CONNECTIONS	834
<u>SS-4</u>	Vladimir GOCEVSKI LAUNCHING OF LA1 BRIDGE AND CAPACITY INCREASE OF POLARIS BRIDGE IN REMOTE AREAS OF QUEBEC	852
<u>SS-5</u>	Milica KOPRIVICA, Aleksandar ĆERANIĆ, Saša KOVAČEVIĆ, Ratko SALATIĆ, Nenad MARKOVIĆ INFLUENCE OF STIFFENER AND FLANGE ON ELASTIC CRITICAL LOAD OF I-GIRDERS SUBJECTED TO PATCH LOADING	858
<u>SS-6</u>	Ditar MEMEDI, Denis POPOVSKI, Mile PARTIKOV REDUCTION OF BENDING MOMENT AND MIDSPAN DEFLECTION OF THE COMPOSITE FRAME WITH SEMI-RIGID CONNECTIONS Дитар МЕМЕДИ, Денис ПОПОВСКИ, Миле ПАРТИКОВ РЕДУКЦИЈА НА МОМЕНТИТЕ И УКЛОНИТЕ НА СПРЕГНАТА РАМКА СО ПОЛУ-КРУТИ ВРСКИ	866
<u>SS-7</u>	Ivan MICEVSKI, Denis POPOVSKI, Mile PARTIKOV EXPERIMENTAL INVESTIGATION OF BEHAVIOR OF CHEMICAL ANCHOR Иван МИЦЕВСКИ, Денис ПОПОВСКИ, Миле ПАРТИКОВ ЕКСПЕРИМЕНТАЛНО ИСПИТУВАЊЕ НА ОДНЕСУВАЊЕ НА ХЕМИСКИ ВГРАДЕНИ АНКЕРИ	876
<u>SS-8</u>	Nikola NISEV, Denis POPOVSKI, Mile PARTIKOV TESTING THE BEHAVIOUR OF SHEAR CONNECTORS WITH DIFFERENT TRANSVERSE STEEL DECKS	882

* in alphabetic order of the first author's surname

<u>SS-9</u>	Doncho PARTOV, Jiří STUDNIČKA, Hartmut PASTERNAK, Yvona KOLEKOVA, Lazar GEORGIEV ABOUT THE HISTORY OF THE MERRISON RULES, GIVING THE ANSWER OF THE DISASTROUS FAILURE OF STEEL BOX GIRDER BRIDGES	891
<u>SS-10</u>	Elena POPOVSKA, Philip WILLEMS, Naum STEFANOVSKI SEMI RIGID SUPPORTS LEAD TO BETTER SOLUTIONS	901
<u>SS-11</u>	Elena POPOVSKA, Mile PARTIKOV, Denis POPOVSKI STIFENESS COMPARISON OF UNSTIFFENED AND STIFFENED T- JOINTS OF HOLLOW SECTIONS	909
<u>SS-12</u>	Nemanja RANČIĆ, Marko MILOŠEVIĆ, Milica MARKOVIĆ, Jelena MARKOVIĆ BRANKOVIĆ ANALYSIS OF APPLICATION THE HOT DIP GALVANIZING IN MODERN STEEL STRUCTURES	915
<u>SS-13</u>	Anka STARČEV-ĆURČIN, Andrija RAŠETA, Danijel KUKARAS, Miloš ŠEŠLIJA, Igor DŽOLEV INFLUENCE OF A STEEL FRAME ON CERTAIN RESULTS OF EXPERIMENTALLY TESTED RC WALL MEMBERS	922
<u>SS-14</u>	Angelko STOJANOVSKI, Denis POPOVSKI, Mile PARTIKOV COMPOSITE COLUMNS - BIGGER INVESTMENT PROFIT Ангелко СТОЈАНОВСКИ, Денис ПОПОВСКИ, Миле ПАРТИКОВ СПРЕГНАТИ СТОЛБОВИ – ПОГОЛЕМА ИНВЕСТИЦИОНА ДОБИВКА	932
<u>SS-15</u>	Milos STOKUCA, Golubka NECHEVSKA CVETANOVSKA THE ROLE OF CLADDING AND ROOFING PANELS IN THE LOAD BEARING CAPABILITIES AND DEFORMATIBILITY OF CONSTRUCTIONS Милош СТОКУЌА, Голубка НЕЧЕВСКА-ЦВЕТАНОВСКА ЈАКОСТ И ДЕФОРМАБИЛНОСТ НА ЧЕЛИЧНИ КОНСТРУКЦИИ КОНСТРУИРАНИ СО ФАСАДНИ И КРОВНИ ПАНЕЛИ	942
<u>SS-16</u>	Trajche ZAFIROV, Antonio JAEVSKI, Viktor HRISTOVSKI COMPARATIVE NUMERICAL RESEARCH OF STEEL UPGRADES ON EXISTING RC STRUCTURES Трајче ЗАФИРОВ, Антонио ЈАНЕВСКИ, Виктор ХРИСТОВСКИ КОМПАРАТИВНО НУМЕРИЧКО ИСТРАЖУВАЊЕ НА НАДГРАДБИ ОД ЧЕЛИК НА ПОСТОЕЧКИ АБ КОНСТРУКЦИИ	950

AMS*

ASSESSMENT, MONITORING AND STRENGTHENING OF STRUCTURES ПРОЦЕНКА, СЛЕДЕЊЕ И ЗАКАЈНУВАЊЕ НА КОНСТРУКЦИИ

AMS-1

Aleksandra BOGDANOVIC, Zoran RAKICEVIC, Julijana BOJADJIEVA, Lidija KRSTEVSKA, Angela POPOVSKA, Filip MANOJLOVSKI, Igor MARKOVSKI, Antonio SHOKLAROVSKI, Nikola NAUMOVSKI, Dejan FILIPOVSKI

960

3D SEISMIC NETWORK IN URBAN ENVIRONMENT- CASE STUDY, OHRID, NORTH MACEDONIA

Александра БОГДАНОВИЌ, Зоран РАЌИЌЕВИЌ, Јулијана БОЈАЏИЈЕВА, Лидија КРСТЕВСКА, Ангела ПОПОСКА, Филип МАНОЈЛОВСКИ, Антонио ШОКЛАРОВСКИ, Никола НАУМОВСКИ, Игор МАРКОВСКИ, Дејан ФИЛИПОВСКИ

ЗД СЕИЗМИЧКА МРЕЖА ВО УРБАНА СРЕДИНА – ПРИМЕР СТУДИЈА, ОХРИД, СЕВЕРНА МАКЕДОНИЈА

AMS-2

Zlatko BOGDANOVSKI, Zlatko SRBINOSKI, Filip KASAPOVSKI, Tome GEGOVSKI, Filip PETROVSKI

966

GEODETIC MEASUREMENTS FOR DETERMINING NON- VERTICALITY OF PILLARS FROM “SKOPJE AQUEDUCT”

AMS-3

Julijana BOJADJIEVA, Vlatko SHESHOV, Kemal EDIP, Aleksandra BOGDANOVIC, Irena GJORGJESKA, Toni KITANOVSKI, Dejan IVANOVSKI

973

IN SITU GEO-LABORATORY FOR EARTHQUAKE GEOTECHNICAL HAZARDS RESEARCH

AMS-4

Goran CHAPRAGOSKI, Golubka NECHEVSKA CVETANOVSKA
**FINITE ELEMENT ANALYSIS OF CFRP STRENGTHENED RC
COLUMN**

979

Горан ЧАПРАГОСКИ, Голубка НЕЧЕВСКА ЦВЕТАНОВСКА
**АНАЛИЗА СО МЕТОД НА КОНЕЧНИ ЕЛЕМЕНТИ НА АБ СТОЛБ
ЗАЈАКНАТ СО КАРБОНСКИ ЛЕНТИ**

AMS-5

Kenneth C. CRAWFORD
**INVESTIGATION OF CFRP-CONCRETE BOND ON 12 M2
RETROFITTED BRIDGES**

986

AMS-6

Elena DELOVA, Aleksandar ZLATESKI, Veronika SHENDOVA, Zhivko BOZHINOVSKI, Liljana MIJALKOVA

992

ANALYSIS AND TECHNICAL SOLUTION FOR STRENGTHENING FOR THE EXISTING BUILDING “SOKOLANA” IN KUMANOVO

* in alphabetic order of the first author's surname

<u>AMS-7</u>	Viktor GEORGIEV, Simona BOGOJEVSKA DATA-DRIVEN MONITORING AND PROGNOSIS OF THE BEHAVIOUR OF ENGINEERING STRUCTURES Виктор ГЕОРГИЈЕВ, Симона БОГОЈЕВСКА ПОДАТОЧЕН ПРИСТАП ЗА СЛЕДЕЊЕ И ПРОГНОЗА НА ОДНЕСУВАЊЕ НА ИНЖЕНЕРСКИ ОБЈЕКТИ	1000
<u>AMS-8</u>	Jasna GRUJOSKA-KUNESKA, Goran JEKIC, Veronika SHENDOVA COMPARATIVE ANALYSIS OF DYNAMIC CHARACTERISTICS OF THE St. NIKITA CHURCH Јасна ГРУЈОСКА-КУНЕСКА, Горан ЈЕКИЌ, Вероника ШЕНДОВА КОМПАРАТИВНА АНАЛИЗА НА ДИНАМИЧКИТЕ КАРАКТЕРИСТИКИ НА ЦРКВАТА СВ. НИКИТА	1008
<u>AMS-9</u>	Hristijan GRUJOSKI, Sergej CHURILOV CONDITION ASSESMENT, ANALYSIS AND DESIGN OF AN EXISTING REINFORCED CONCRETE AQUADUCT IN COMPLIANCE WITH EUROCODES AND REHABILITATION MEASURES Христијан ГРУЈОСКИ, Сергеј ЧУРИЛОВ ПРОЦЕНКА НА СОСТОЈБА, АНАЛИЗА, ДИМЕНЗИОНИРАЊЕ И МЕРКИ ЗА САНАЦИЈА НА ПОСТОЕН АРМИРАНОБЕТОНСКИ АКВАДУКТ СОГЛАСНО ЕВРОКОДОВИ	1016
<u>AMS-10</u>	Shpresim IBRAIMI, Boris TANESKI, Cvetanka HADZI PECOVA, Grozde ALEKSOVSKI, Stanislav MILOVANOVIC CONSOLIDATION AND STRENGTHENING OF THE CHURCH OF ST. BOGORODICA IN DRENOVO AND THE OLD MOSQUE IN RAVEN Шпресим ИБРАИМ, Борис ТАНЕСКИ, Цветанка ХАЏИ ПЕЦОВА, Грозде АЛЕКСОВСКИ, Станислав МИЛОВАНОВИЌ КОНСОЛИДАЦИЈА И ЗАЈАКНУВАЊЕ НА ЦРКВАТА СВ. БОГОРОДИЦА ВО ДРЕНОВО И СТАРАТА ЦАМИЈА ВО РАВЕН	1027
<u>AMS-11</u>	Shpresim IBRAIMI, Boris TANESKI, Jovan PEJOSKI, Kiril PERUNKOVSKI, Viktor GEORGIEV, Tane VASILEVSKI, Boris TASEVSKI, Stanislav MILOVANOVIC LOAD TESTING OF SUSPENSION PEDESTRIAN BRIDGE - PANORAMIC WHEEL ON VARDAR RIVER Шпресим ИБРАИМИ, Борис ТАНЕСКИ, Јован ПЕЈОСКИ, Кирил ПЕРУНКОВСКИ, Виктор ГЕОРГИЈЕВ, Тане ВАСИЛЕВСКИ, Борис ТАСЕВСКИ, Станислав МИЛОВАНОВИЌ ИСПИТУВАЊЕ СО ПРОБНО ТОВАРЕЊЕ НА ВИСЕЧКИ ПЕШАЧКИ МОСТ – ПАНОРАМСКО ТРКАЛО НА РЕКА ВАРДАР	1041
<u>AMS-12</u>	Lulzim IDRIZI, Bujar JASHARI, Rrahim SEJDIU WOOD STRUCTURES REPAIR	1051
<u>AMS-13</u>	Miloš KNEŽEVIĆ, Ivana TEŠOVIĆ, Radenko PEJOVIĆ, Duško LUČIĆ, Kemal ABDIĆ, Miloš VUČINIĆ, Teodora BULATOVIĆ, Kostantin DRAGOVIĆ, Jelena PEROVIĆ, Sara KONATAR EXPERIENCES FROM REHABILITATION WORKS ON CONCRETE BRIDGES ON THE RAILWAY LINE “VRBNICA-BAR”	1059

<u>AMS-14</u>	Mirjana MALEŠEV, Vlastimir RADONJANIN, Slobodan ŠUPIĆ, Ivan LUKIĆ, Olivera BUKVIĆ THE REPAIR OF THE LOAD-BEARING STRUCTURE OF OPEN UNIVERSITY BUILDING IN NOVI SAD	1070
<u>AMS-15</u>	Filip MANOJLOVSKI, Angela POPOSKA, Antonio SHOKLAROVSKI, Aleksandra BOGDANOVIC, Nikola NAUMOVSKI DYNAMIC CHARACTERISTICS OF REINFORCED CONCRETE STRUCTURE OBTAINED FROM AMBIENT VIBRATIONS MEASUREMENTS	1080
<u>AMS-16</u>	Senad MEDIĆ, Hanka HADŽIĆ, Enver SELIMOVIĆ, Sergey CHURILOV, Goran SIMONOVIC, Mustafa HRASNICA EXPERIMENTAL TESTING OF A BRIDGE IN KRALJEVA SUTJESKA	1086
<u>AMS-17</u>	Vlado MICOV, Igor GJORGJIEV, Aleksandar ZHUROVSKI, Trajche ZAFIROV TESTING OF OVERPASS ALONG „DEMIR KAPIJA- SMOKVICA“ SECTION UNDER TRIAL LOAD	1092
<u>AMS-18</u>	Canko PANEV, Tatjana MANAILOVA STOJANOVSKA, Elena STANKOVA ADAM, Irina PETRESKA, Boban HRISTOV, Sashe ALEKSOVSKI RECONSTRUCTION WORKS OF THE BRIDGE ON R1204 OVER RIVER PCHINJA Цанко ПАНЕВ, Татјана МАНАИЛОВА СТОЈАНОВСКА, Елена СТАНКОВА АДAM, Ирина ПЕТРЕСКА, Бобан ХРИСТОВ, Саше АЛЕКСОВСКИ ИЗВЕДБА НА ГРАДЕЖНО САНАЦИОНИ РАБОТИ НА МОСТ НА R1204 НАД РЕКА ПЧИЊА, ДОБРОШАНЕ	1102
<u>AMS-19</u>	Predrag POPOVIC PRACTICAL APPLICATIONS OF NON-DESTRUCTIVE TESTING IN ASSESSMENT AND REPAIRS OF STRUCTURES	1111
<u>AMS-20</u>	Predrag POPOVIC, Terrence PARET, Howard HILL RETROFITS OF EARTHQUAKE DAMAGED STRUCTURES IN THE USA	1122
<u>AMS-21</u>	Vlatko SESOV, Roberta APOSTOLSKA, Radmila SALIC, Marta STOJMANOVSKA, Marija VITANOVA, Julijana BOJADJIEVA, Aleksandra BOGDANOVIC, Kemal EDIP CRISIS PROJECT: COMPREHENSIVE RISK ASSESSMENT OF BASIC SERVICES AND TRANSPORT INFRASTRUCTURE	1136
<u>AMS-22</u>	Merima SHAHINAGICH-ISOVICH, Marko CHECHEZ, Emir CHOSICH, Toni ARANGJELOVSKI, Darko NAKOV, Aleksandra CHUBRINOVSKA ASSESSMENT OF CONCRETE STRUCTURE STADIUM “RODJENI” IN MOSTAR	1146

<u>AMS-23</u>	Antonio SHOKLAROVSKI, Angela POPOSKA, Filip MANOJLOVSKI, Aleksandra BOGDANOVIC, Lidija KRSTEVSKA, Nikola NAUMOVSKI EXPERIMENTAL INVESTIGATION OF THE CHURCH OF ST. ATHANASIOS IN VAROSH, PRILEP BY AMBIENT VIBRATION METHOD Антонио ШОКЛАРОВСКИ, Ангела ПОПОСКА, Филип МАНОЈЛОВСКИ, Александра БОГДАНОВИЌ, Лидија КРСТЕВСКА, Никола НАУМОВСКИ ЕКСПЕРИМЕНТАЛНО ИСПИТУВАЊЕ НА ЦРКВАТА СВ. АТАНАСИЈ, ПРИЛЕП СО МЕТОДАТА НА АМБИЕНТ ВИБРАЦИИ	1147
<u>AMS-24</u>	Bratislav STIPANIĆ BASICS OF MAINTENANCE FOR STRUCTURES ON ROADS	1153
<u>AMS-25</u>	Slobodan ŠUPIC, Mirjana MALEŠEV, Vlastimir RADONJANIN, Vesna BULATOVIĆ, Vladan PANTIĆ THE ASSESSMENT OF THE LOAD-BEARING STRUCTURE OF OPEN UNIVERSITY BUILDING IN NOVI SAD	1159
<u>AMS-26</u>	Marija VITANOVA, Borjan PETRESKI, Viktor HRISTOVSKI PARAMETRIC FRAGILITY ASSESSMENT OF BRIDGE STRUCTURES	1169
<u>ST*</u>	<i>SELECTED TOPICS</i> <i>СЛОБОДНИ ТЕМИ</i>	
<u>ST-1</u>	Željka BELJKAŠ, Miloš KNEŽEVIĆ RESEARCH STUDY ON TECHNOLOGICAL-TECHNICAL AND ORGANIZATIONAL ELEMENTS OF A BUSINESS FACILITY “GREEN MARKET” IN PODGORICA	1177
<u>ST-2</u>	Liljana DIMEVSKA, Meri CVETKOVSKA, Ana Trombeva GAVRILOSKA, Bojan KARANAKOV ENERGY PERFORMANCE ANALYSIS OF BRUTALIST ARCHITECTURE USING BIM TECHNOLOGIES Лилјана ДИМЕВСКА, Мери ЦВЕТКОВСКА, Ана Тромбева ГАВРИЛОСКА, Бојан КАРАНАКОВ ПРИМЕНА НА БИМ ТЕХНОЛОГИИ ЗА АНАЛИЗА НА ЕНЕРГЕТСКИ ПЕРФОРМАНСИ НА БРУТАЛИСТИЧКА АРХИТЕКТУРА	1185
<u>ST-3</u>	Vasko GACEVSKI, Zlatko ZAFIROVSKI, Marijana LAZAREVSKA, Ivona NEDEVSKA, Riste RISTOV, Slobodan OGNJENOVIC APPROACH TO RISK ANALYSIS IN RAILWAY TUNNELS Васко ГАЦЕВСКИ, Златко ЗАФИРОВСКИ, Маријана ЛАЗАРЕВСКА, Ивона НЕДЕВСКА, Ристе РИСТОВ, Слободан ОГЊЕНОВИЌ ПРИСТАП ЗА АНАЛИЗА НА РИЗИЦИ КАЈ ЖЕЛЕЗНИЧКИ ТУНЕЛИ	1196

* in alphabetic order of the first author's surname

<u>ST-4</u>	Violeta GJEŠOVSKA, Vasko STOJOV CLIMATE-METEOROLOGICAL AND ANTHROPOGENIC INFLUENCE ON THE FALL OF THE WATER LEVEL IN LAKE PRESPA	1202
<u>ST-5</u>	Violeta GJEŠOVSKA, Bojan ILIOSKI, Aleksandra STEVKOV VARIATION AND TREND OF ANNUAL MAXIMUM DAILY RAIN IN MACEDONIA	1212
<u>ST-6</u>	Bojan ILIOSKI, Violeta GJEŠOVSKA, Drenushe FIDANI APPLICATION OF HEC-RAS AND ArcGIS FOR FLOOD MAPPING SURFACES IN URBAN AREAS - CASE OF THE CITY OF GOSTIVAR	1222
<u>ST-7</u>	Bujar JASHARI, Lulzim IDRIZI, Adifete AVDYLI DURABILITY OF ACCESSORIES IN JOINTS OF FURNITURE CONSTRUCTIONS	1230
<u>ST-8</u>	Marijana LAZAREVSKA, Vasko GACEVSKI FUZZY ENGINEERING Маријана ЛАЗАРЕВСКА, Васко ГАЏЕВСКИ ФАЗИ ИНЖЕНЕРСТВО	1240
<u>ST-9</u>	Marijana LAZAREVSKA, Vasko GACEVSKI FUZZY NETWORK PLANNING Маријана ЛАЗАРЕВСКА, Васко ГАЏЕВСКИ ФАЗИ МРЕЖНО ПЛАНИРАЊЕ	1248
<u>ST-10</u>	Teodora MIHAJLOVSKA, Vladimir VITANOV, Ana TROMBEVA – GAVRILOSKA FORM-FINDING OF AN ENVELOPE OF A DOUBLE-LAYER SHELL SUBJECTED TO SEISMIC LOADING Теодора МИХАЈЛОВСКА, Владимир ВИТАНОВ, Ана ТРОМБЕВА – ГАВРИЛОСКА ДЕФИНИРАЊЕ НА ЕНВЕЛОПА НА ДВОСЛОЈНА ЛУШПА ПРИ ДЕЈСТВО НА СЕИЗМИЧКА СИЛА	1258
<u>ST-11</u>	Tomislav ŠČAPEC, Ivan GABRIJEL, Marija JELČIĆ RUKAVINA, Ivana BANJAD PEČUR NUMERICAL MODELING OF INNOVATIVE CAVITY INSULATED LSF PANELS WITH DIFFERENT WALLBOARDS	1266
<u>ST-12</u>	Kaltrina SPAHIU APPLICATION OF INNOVATIVE MATERIALS ON THE FACADE OF SOCIAL OBJECTS	1276
<u>ST-13</u>	Dragana STANOJEVIĆ, Milan TRIVUNIĆ, Mirjana TERZIĆ, Milena SENJAK PEJIĆ IMPROVING CONSTRUCTION WASTE MANAGEMENT WITH THE SUPPORT OF THE BENCHMARKING METHOD	1282

ST-14

Kire STAVROV

1288

**DESIGN OF THE WOOD JOINTS IN TIMBER STRUCTURES
FOLLOWING BY THE EXAMPLE OF THE THREE LEG JOINT**

Кире СТАВРОВ

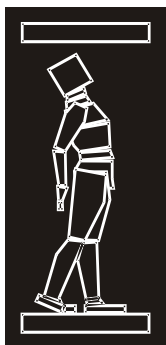
**ПРОЕКТИРАЊЕ НА ВРСКИТЕ НА ЗАСЕК КАЈ ДРВЕНИТЕ
КОНСТРУКЦИИ ПРЕКУ ПРИМЕРОТ НА ТРОНОЖНА ВРСКА**

ST-15

Arta SYLEJMANI, Ivana BANJAD PEČUR, Bojan MILOVANOVIĆ

1296

**A COMPARATIVE OVERVIEW OF THE ENERGY PERFORMANCE
CERTIFICATE (EPCs) APPLICATION IN SOME EU COUNTRIES**



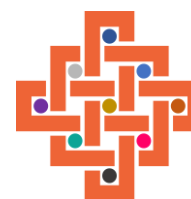
ДГКМ
ДРУШТВО НА
ГРАДЕЖНИТЕ
КОНСТРУКТОРИ НА
МАКЕДОНИЈА

Партизански одреди 24,
П.Фах 560, 1001 Скопје
Северна Македонија

MASE
MACEDONIAN
ASSOCIATION OF
STRUCTURAL
ENGINEERS

Partizanski odredi 24,
P. Box 560, 1001 Skopje
North Macedonia

SS - 8



mase@gf.ukim.edu.mk
<http://mase.gf.ukim.edu.mk>

TESTING THE BEHAVIOUR OF SHEAR CONNECTORS WITH DIFFERENT TRANSVERSE STEEL DECKS

Nikola NISEV ¹, Denis POPOVSKI ², Mile PARTIKOV ³

ABSTRACT

The topic of this paper is the analysis of the behavior of shear connectors with transversal sheeting. To determine the behavior of the shear studs, i.e. to determine the maximum carrying capacity of the connector and its ductility, test specimens were made with a variation of the sheeting as well as the number of connectors in the cross-section. The research methodology and the test procedure is conducted according to the rules and guidelines in Eurocode 4. Before testing the specimens, quality control of the composite materials is conducted and the results are used to determine the design shear resistance for headed studs automatically welded. The testing procedure is carried out according to rules and recommendations in Eurocode 4, EN 1994-1-1, Annex B. All of the samples are tested with the same equipment and the same testing conditions. First, the load is applied until it reaches 5% of the expected failure load without a partial safety coefficient. Then the load is cycled 25 times between 5% and 40% of the expected failure load. After the 25th cycle, from 5%, the load is increased until failure is achieved in one or more of the elements of the test sample. The results from the testing are processed and presented as a P- δ diagram.

Keywords: shear connectors, composite structures, headed stud.

¹ PhD Student, MSc, Faculty Civil Engineering, University "Ss. Cyril and Methodius", Skopje, Republic of North Macedonia, nikolanisev@yahoo.com

² Associate. Prof., Faculty of Civil Engineering, University "Ss. Cyril and Methodius", Skopje, Republic of North Macedonia, popovski@gf.ukim.edu.mk

³ Assistant Prof, Faculty Civil Engineering, University "Ss. Cyril and Methodius", Skopje, Republic of North Macedonia, partikov@gf.ukim.edu.mk

1. INTRODUCTION

The general idea for the use of composite structures arises from the need for maximum utilization of the mechanical characteristics of the concrete slab and the steel profile. This approach for designing the composite structures is based on using the compressive strength of the concrete slab, also its horizontal rigidity within the composite structure, combined with the bending resistance of the steel profile to achieve maximum load capacity.

The cross-section of this structure is a composition of steel profile that carries a concrete slab laid on a metal sheet. The connection of the steel and the concrete slab can be achieved with :

- design of a mechanical connection between the metal sheet and the concrete slab with ribbing or protruding the sheets.
- using a mechanical shear connector that can be welded directly on the steel profile or with the method of trough deck welding.

The use of composite structures shortens the construction time of the building because it eliminates the need for scaffolding and cladding, which drastically reduces the time required for construction and the cost of labor. These structures compared to the reinforced concrete structures, have between 20 and 40 % less self-weight which is positive for constructions that are in seismically active areas.

If we take into consideration the entire process of construction of the composite structures, it can be concluded with certainty that its economically far more cost-effective than the classic reinforced concrete structure.



Fig. 1. Constructed composite structure



Fig. 2. Shear studs welding process



Fig. 3. Through-deck welded stud

2. HEADED SHEAR STUD CONNECTORS IN SOLID SLAB

2.1 Design resistance

The headed shear stud connector resistance in accordance with EN 14555 for automatically welded studs in composite cross-section is determined with :

$$P_{Rd} = \frac{0.8 \cdot f_u \cdot \pi \cdot d^2 / 4}{\gamma_V} \quad (1.1.)$$

или

$$P_{Rd} = \frac{0.29 \cdot \alpha \cdot d^2 \cdot \sqrt{f_{ck} \cdot E_{cm}}}{\gamma_V} \quad (1.2.)$$

Whichever is smaller, with:

$$\alpha = 0.2 \cdot \left(\frac{h_{sc}}{d} + 1 \right) \quad \text{for } 3 \leq \frac{h_{sc}}{d} \leq 4 \quad (1.3.)$$

$$\alpha = 1 \quad \text{for } \frac{h_{sc}}{d} > 4 \quad (1.4.)$$

γ_V is the partial safety factor witch value is recommended to 1.25.

d is the diameter of the shank of the stud, a variable value between 16 and 25mm

f_u is the specified ultimate tensile strength of the material of the stud but not greater than 500 N/mm².

f_{ck} is the characteristic cylinder compressive strength of the concrete at the age considered, of density not less than 1750 kg/m³.

h_{sc} is the overall nominal height of the stud.

2.2 Metal sheeting with ribs transverse to the supporting beams

When the sheeting in the composite cross-section is transversely placed relative to the steel profile the shear resistance of the headed studs is reduced by correction factor k_t . Design shear resistance of the solid slab should be taken into consideration and it should not be greater than 450 N/mm². Reduction factor k_t :

$$k_t = \frac{0.7}{\sqrt{n_r}} \cdot \frac{b_0}{h_p} \cdot \left(\frac{h_{sc}}{h_p} - 1 \right) \quad (1.5.)$$

h_p the total height of the metal sheeting ribs

h_{sc} the height of shear stud, maximum $h_p + 75$ mm

n_r , the number of shear studs in cross-section is not greater than 2.

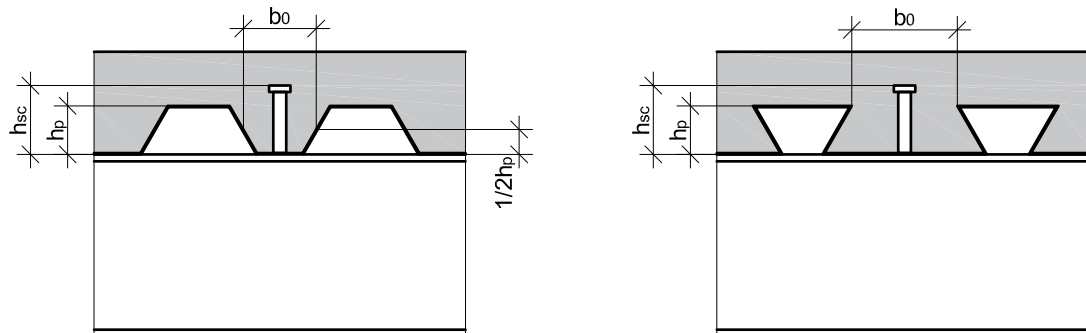


Fig. 4. Composite cross-section with transversally set sheeting

The factor k_t should not be greater than $k_{t,max}$ given in Table 1.

Table 1. Upper limits $k_{t,max}$ for the reduction factor k_t

Number of stud connectors per rib	Thickness of sheet (mm)	Studs not exceeding 20 mm in diameter and welded through profiled steel sheeting	Profiled sheeting with holes and studs from 19 to 20mm
$n_r=1$	≤ 1	0.85	0.75
	>1	1.00	0.75
$n_r=1$	≤ 1	0.70	0.60
	>1	0.80	0.60

The values for k_t are applicable in case when the following conditions are satisfied:

- The steel sheeting profile should not exceed a height greater than 85mm and the distance between ribs of the sheeting should not be smaller than the height.
- Shear studs that are used in the composite cross-section should be with a diameter smaller than 20mm if they are welded with the method of through-deck-welding.
- Shear studs welded directly to the steel profile should not exceed a diameter greater than 22mm.

3. TESTING THE SHEAR CONNECTORS

3.1 Modified test on shear connectors

To prove the load capacity of the shear studs in the composite cross-section with the quality of the material in Macedonia, modification of the standard test method should be performed. The modification is by the regulation and rules from Eurocode 4. The modified test was performed on test specimens whose cross-section is composed of metal sheets that are placed transversely relative to the steel profile from both sides of steel profile flanges, shear studs welded in two ways either directly to the steel profile or with a procedure called through deck welding, at the end the cross-section package is formed by casting a concrete slab over the metal sheets.

The materials used for this modified test are by the regulations and rules of Eurocode 4. For the steel profile in the composite cross-section, IPE270 with a length of 600mm was used because it is the smallest profile with enough width of the flange so two shear studs can be welded. On the top of the steel profile, a metal plate with a thickness of 15mm is welded with an additional UPN profile just below the plate to provide better force transmission and to improve the rigidness of the joint. Metal sheets used in the test specimens were with a thickness of the sheet of 1.0mm and indented or open profile, or more specifically BONDECK 600 with a distance between ribs of 200mm and HIDECK 75 with a distance between ribs of 180mm.

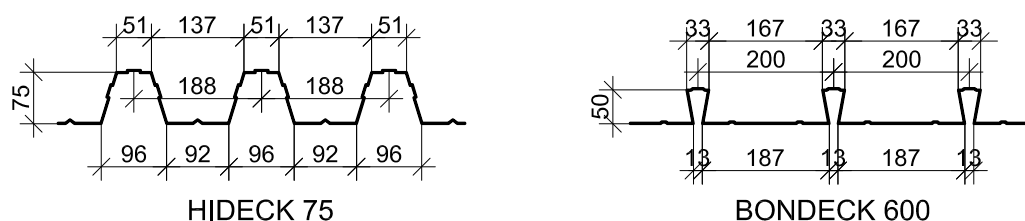


Fig. 5. Steel sheeting for composite structures

The shear studs used in this test were from the manufacturer NELSON with a height of the stud, $h = 100\text{mm}$, and the diameter of the body of the shear stud, $d=19\text{mm}$. Shear studs were arranged in different variations in the composite cross-section either in a single-row or double-row depending on the metal sheet and test model combinations. The reinforced concrete slab was with a total height of 120mm with concrete class C25/30 and reinforcement steel Q166, $\text{Ø}6/15\text{cm}$. This experiment covers the testing and analysis of four different test models with different shear stud distribution along the cross-section and the method of studs welding.

Table 2. Test specimens combinations

Model	Metal sheet		Shear studs		Through-deck welding
	Bondeck 600	Hideck 75	One-row	Two-row	
1		✓		✓	✓
2		✓	✓		✓
3	✓		✓		✓
4	Solid slab			✓	

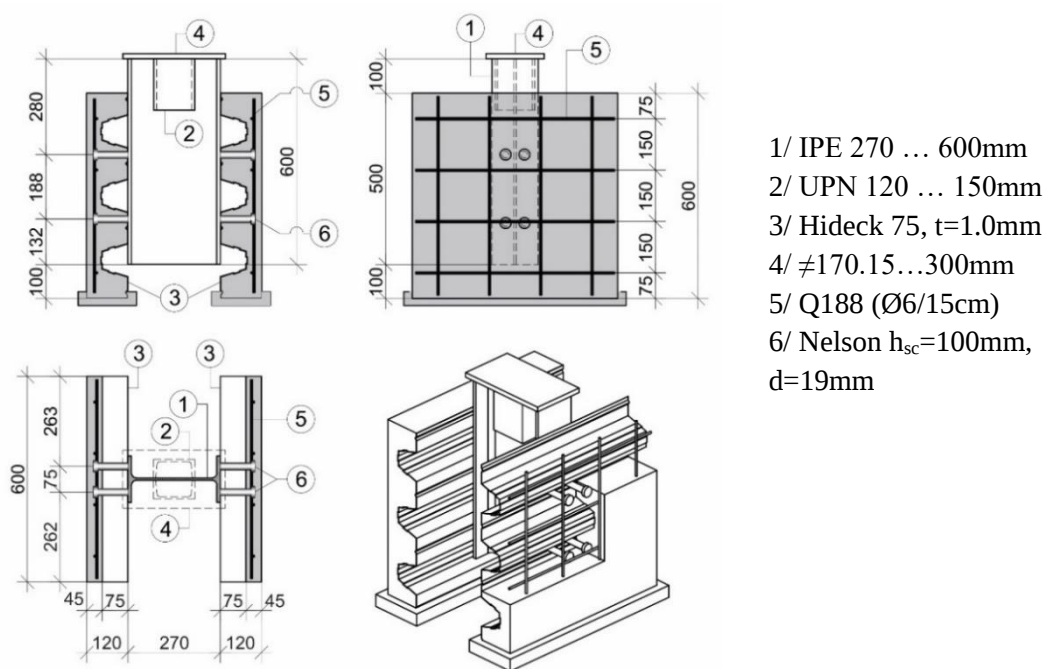


Fig. 6. Test specimen for a modified experiment on shear connectors

3.2 Testing process

The full test procedure of the modified test on shear connection was made in correspondence with the recommendations of Eurocode 4 and related to the rules of the standard test. Before the start of the testing, all the test specimens need to be in a nearly ideal vertical position so that we can have a true distribution of the applied force. For the application of the vertical compression force, 100T press was used connected with an electronic dynamometer that will show the applied force values in real-time.

Controlling of the horizontal detachment of the concrete slab in relation to the steel profile was made with four inductive displacements measurement sensors with a measuring range of 10_{mm}. On the bottom of the steel profile on both sides, vertical displacements were measured with three sensors with a measurement range from 200_{mm}. The loading scheme is given below in figure 4.18.

To cancel out the parasitic influences in the cross-section and to ensure that the results obtained for the slip are correct, the test body is loaded with a force of 40% of the failure load. The next stage in the loading of the test specimen is cycled 25 times with a force between 5% to 40% of the predicted failure load. The expected failure load must not be reached in time less than 15 min. After achieving the failure load, the examination of the test specimen is completed and the results are saved, which will be displayed later in the form of force/displacement or (P / δ) diagrams.

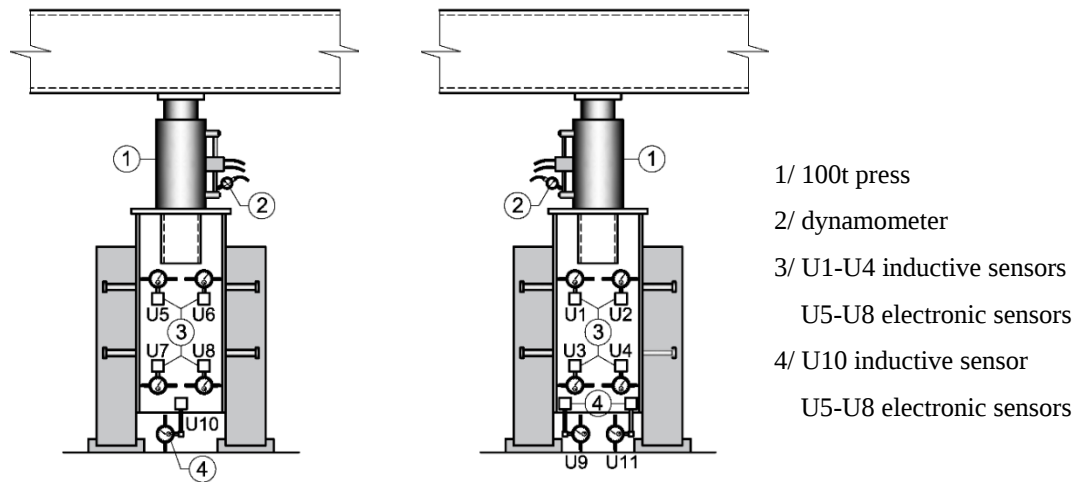


Fig. 7. Loading scheme of the test specimen (both sides)

3.3 Testing results

After the completion of the test and after the processing of the readings obtained from the instruments was performed, the following results were obtained for the values that show a realistic picture of the load capacity and ductility of the shear stud connectors:

- The characteristic resistance P_{rk} for a single shear connector
- 2) Slip capacity of the specimen δ_u , measured as a maximum slip for characteristic load level,
- 3) The characteristic slip capacity δ_{uk} , which should be taken as the minimum test value of δ_u reduced by 10%.

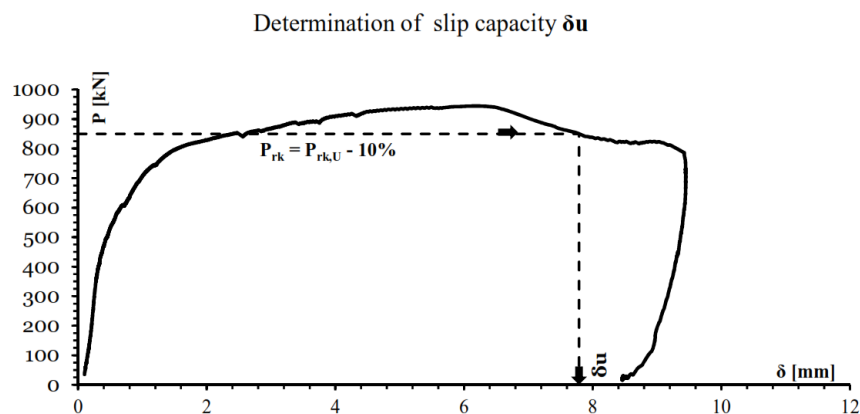


Fig. 8. The procedure of calculating the slip capacity of a single shear connector

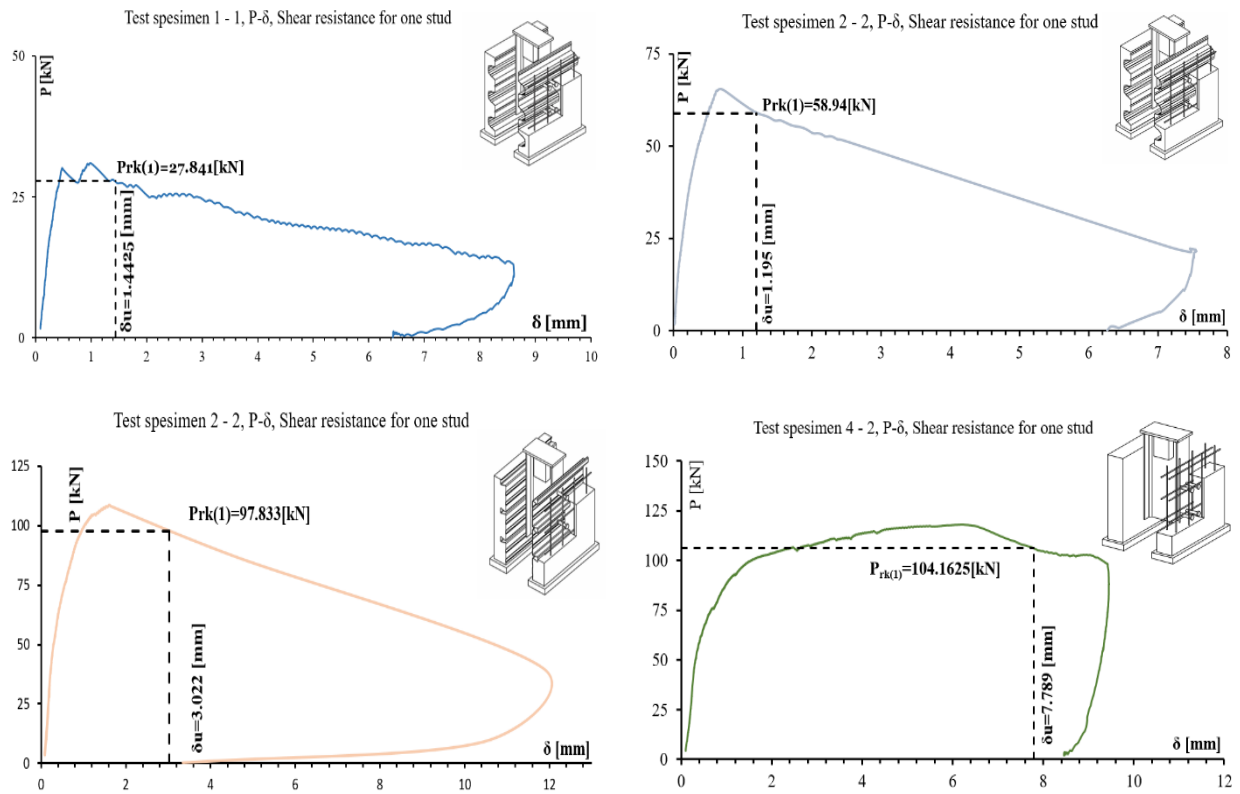


Fig. 9. Single P-δ diagrams for characteristic resistance P_{Rk} of single shear connector

For every test specimen the maximum characteristic resistance of single shear connector $P_{Rk,U}$ is shown in the individual and summary diagrams, also the maximum slip capacity is presented of the connectors corresponding to force reduced by 10% from the maximum failure load.

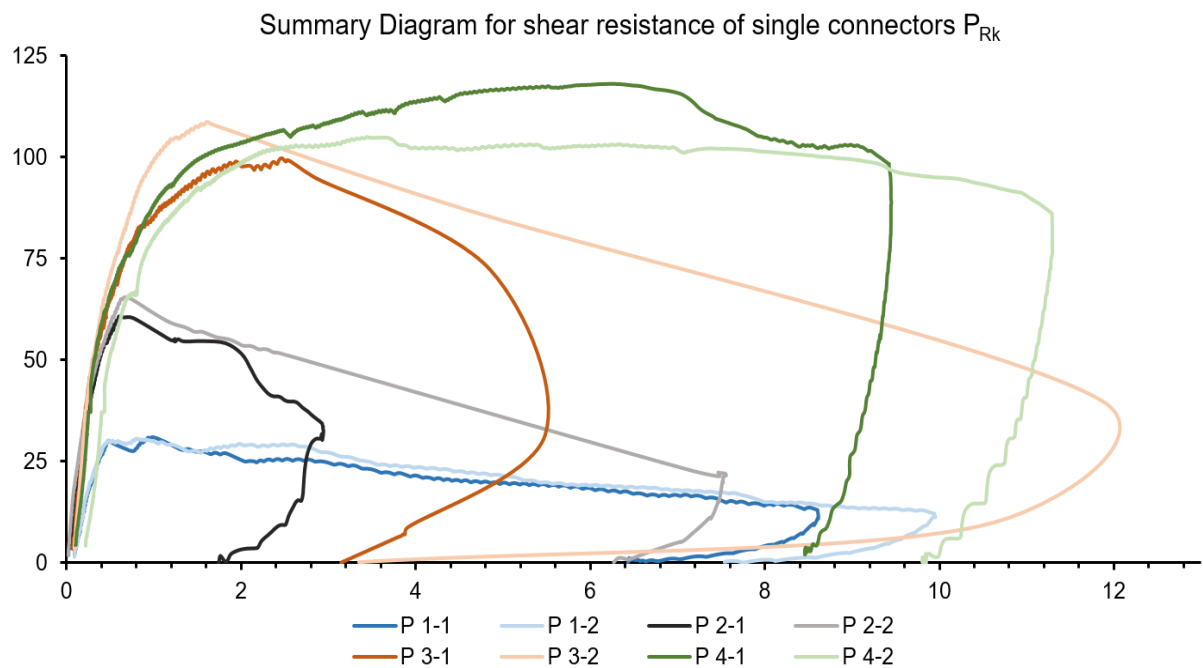


Fig. 10. Summary P-δ diagrams for characteristic resistance P_{Rk} of single shear connector

Table 3. shows all the results of the test specimens for the full shear resistance of the model considering all the shear connectors in the cross-section, also the results obtained from the testing and designed values of characteristic shear resistance of a single connector. Additionally in the following table, the results are compared with a coefficient that shows the difference between the tested value of the shear resistance and the designed value calculated by the rules of Eurocode 4.

Table 3. Results from modified testing on shear connectors

Test spec.	$P_{Rk,U}$		P_{Rk}		$P_{Rk,U(1)}$		$P_{Rk(1)}$		P_{max} (EC4)	$P_{max,(1)}$ (EC4)	Results difference coef.
	[kN]		[kN]		[kN]		[kN]		[kN]	[kN]	
1.1	247.5	246.2	222.75	221.6	30.94	30.78	27.85	27.7	210.74	26.3425	1.14
1.2	244.9		220.41		30.61		27.55		210.74	26.3425	
2.1	242.9	252.5	218.61	227.2	60.73	63.12	54.66	56.81	149	37.25	1.41
2.2	262		235.8		65.5		58.95		149	37.25	
3.1	399	416.9	359.1	375.2	99.75	104.2	89.78	93.81	354.15	88.5375	1.15
3.2	434.8		391.32		108.7		97.83		354.15	88.5375	
4.1	944.5	892.1	850.05	802.9	118.06	111.5	106.25	100.4	833.3	104.163	1.07
4.2	839.7		755.73		104.96		94.46		833.3	104.163	

Table 4. shows the maximum slip capacity of the shears studs that are calculated for force reduced by 10% from the maximum failure load. Also, the characteristic slip capacity values are presented that are used to determine the ductility of the shear studs.

Table 4. Slip capacity of single shear connector

Test spec.	δ_u		δ_{uk}	
	[mm]		[mm]	
1.1	1.443	2.158	1.2983	1.942
1.2	2.874		2.586	
2.1	1.296	1.245	1.166	1.121
2.2	1.195		1.076	
3.1	3.398	3.21	3.058	2.889
3.2	3.022		2.719	
4.1	7.789	8.994	6.808	8.095
4.2	10.199		7.004	

4. CONCLUSION

The design resistance in dependence of the concrete slab, with all dimensions and concrete strength class, determine the main resistance of the headed stud shear connectors. If the design resistance is needed to be determined not from the concrete slab but from the headed stud, then a lower quality steel for the stud or greater concrete strength class is required.

The analysis recommendations from Eurocode 4, for the bearing capacity of the shear stud with transverse steel sheeting, is underestimating the real capacity of the shear connectors. According to the testing the real bearing capacity is greater from 14 to 41 % from the analysis recommended in Eurocode 4. The results for solid concrete slab are in accordance to the recommendations given in Eurocode 4.

The value of the slip capacity is $\delta_{sk} < 6\text{mm}$ which means that the shear connectors for this testing case are not ductile, and that they can be applied for achievement of full plastic capacity of the designed cross section. More ductile behaviour is obtained with the solid slab model. If a more ductile behavior for the structure is needed, for the models with transverse steel deck, a smaller diameter or lesser strength quality for the headed stud shear connector is recommended.

REFERENCES

- [1] Цветановски П., Печатени предавања по спрегнати конструкции, 2011, Скопје, Р. Македонија.
- [2] Popovski D., Experimental and theoretical research of the effects of composite steel and concrete structures from continuous beams, doctoral dissertation, 06.2015, Faculty of civil engineering in Skopje, UKIM, Skopje, R. Macedonia.
- [3] D. Popovski, P. Cvetanovski, M. Partikov, "Testing the behavior of shear connectors", MASE 16th symposium, Ohrid, Macedonia, 2015.
- [4] V. Damjanovski, P. Cvetanovski, D. Popovski, "Analysis of the behavior of shear connectors with longitudinal sheeting and solid", MASE 17th symposium, Ohrid, Macedonia, 2017
- [5] P. Cvetanovski. D. Popovski, M. Partikov, V. Dmjanovski, "Experimental investigation of load and slip capacity of headed stud connectors in composite slabs for buildings", Annual of the University of architecture, civil engineering, and geodesy, Sofia, Volume 46, 2018.
- [6] P. Cvetanovski. D. Popovski, M. Partikov, V. Dmjanovski, "Experimental investigation of load and slip capacity of headed stud connectors in composite slabs for buildings", Annual of the University of architecture, civil engineering, and geodesy, Sofia, Volume 46, 2018.
- [7] P. Cvetanovski. D. Popovski, M. Partikov, V. Dmjanovski, "Experimental investigation of load and slip capacity of headed stud connectors in composite slabs for buildings", Annual of the University of architecture, civil engineering, and geodesy, Sofia, Volume 46, 2018.