



Građevinski fakultet Sveučilišta u Zagrebu - Tečaj stručnog usavršavanja  
**Izvedba i nadzor čeličnih konstrukcija prema HRN EN 1090-1/-2**

**Voditelj: izv.prof.dr.sc. Davor Skejić**

Zagreb, 13. ožujka 2020.



# Radionička izrada čeličnih konstrukcija

mr.sc. Ivan Bajkovec dipl.ing.građ.

Bajkmont d.o.o.



# Sadržaj

- Specifikacija komponenti
- Projektiranje i izrada radioničke dokumentacije
- Radionička izrada
  - Plan kontrole i ispitivanja
  - Tehnološka priprema
  - Nabava materijala
  - Mehanička izrada i zavarivanje
  - Antikorozivna zaštita
- Pakiranje i transport
- Zaključak i rasprava



Građevinski fakultet Sveučilišta u Zagrebu - Zagreb, 13.03.2020.

Tečaj stručnog usavršavanja: **Izvedba i nadzor čeličnih konstrukcija prema HRN EN 1090-1/-2**

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# Specifikacija komponenti

- Specifikacija komponenti koju daje proizvođač (MPCS)
- Specifikacija komponenti koju daje naručitelj (PPCS)
  - EN1090-2:2018 donosi promjene; u specifikaciji za izvedbu projektant (izrađivač specifikacije) mora definirati traženi razred izvedbe; EXC2 se više ne primjenjuje defaultno (4.1.2.)
  - Isto tako, projektant mora definirati da li komponente koje se izvode zahtijevaju dodatna ispitivanja zavarima metodama bez razaranja (NDT) povrh obujma rutinskog ispitivanja (12.4.2.3; tabela 24)

# Specifikacija komponenti

- Dodatak A – Dodatne informacije, opcije i zahtjevi vezani na razrede izvođenja
  - A.1 Dodatne informacije kako bi se specifikacijom u potpunosti definirali zahtjevi za izvedbu radova

Table A.1 — Additional information

Clause	Additional information required
<b>4.2 - Constructor's documentation</b>	
4.2.1	Hold-points or requirement to witness inspections or tests, and any consequent access requirements
<b>5 - Constituent products</b>	
5.1	Properties of products not covered by listed standards
5.3.1	Grades, qualities and, if appropriate, coating weights and finishes for steel products
5.3.3	Additional requirements related to special restrictions on either surface imperfections or repair of surface defects by grinding in accordance with EN 10163, or with EN 10088-4 or EN 10088-5 for stainless steel Surface finish requirements for other products

# Specifikacija komponenti

- Dodatak A – Dodatne informacije, opcije i zahtjevi vezani na razrede izvođenja
  - A.2 Opcionalne informacije koje se mogu definirati specifikacijom za izvedbu radova

12 – Inspection, testing and corrections	
12.2.1	If there are requirements for specific testing of constituent products
12.3	Other methods for repairing damage resulting in local dents in the surface of hollow sections
12.4.2.1	If parent metal is to be inspected for laminations after welding
12.4.2.3	If other rules are required for definition of the percentage extent of testing
12.4.2.4	<p>If specific joints are identified for inspection together with the extent and method of testing for EXC1, EXC2 and EXC3</p> <p>If weld inspection classes are to be used for defining the scope and percentage extent of supplementary, and, if so, the weld inspection class for each relevant weld</p>

# Specifikacija komponenti

- Dodatak A – Dodatne informacije, opcije i zahtjevi vezani na razrede izvođenja
  - A.3 Specifični zahtjevi za izvedbu radova

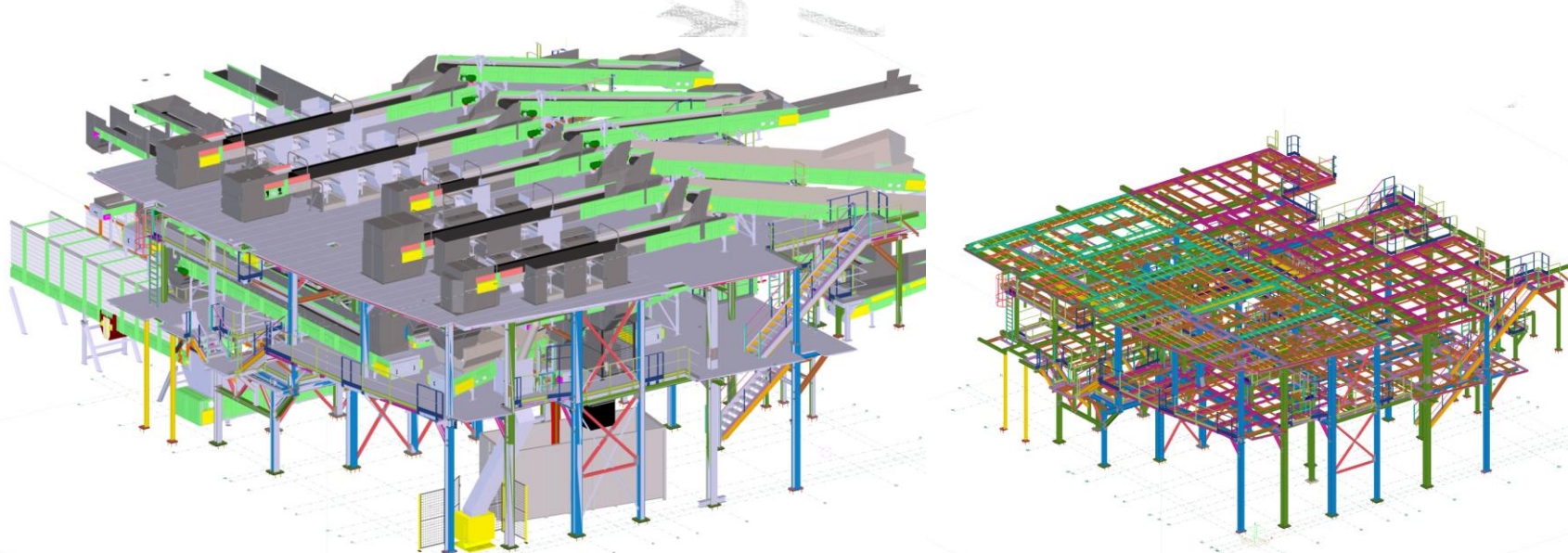
Table A.3 — Requirements to each execution class

Clauses	EXC1	EXC2	EXC3	EXC4
<b>4 – Specifications and documentation</b>				
<b>4.2 Constructor's documentation</b>				
4.2.1 Quality documentation [PC]	Nr	Yes	Yes	Yes
<b>5 – Constituent products</b>				
<b>5.2 Identification, inspection documents and traceability</b>				
Traceability [PC]	Nr	Yes (by marking)	Yes (from receipt to handover)	Yes (from receipt to handover)
Marking [PC]	Nr	Yes	Yes	Yes



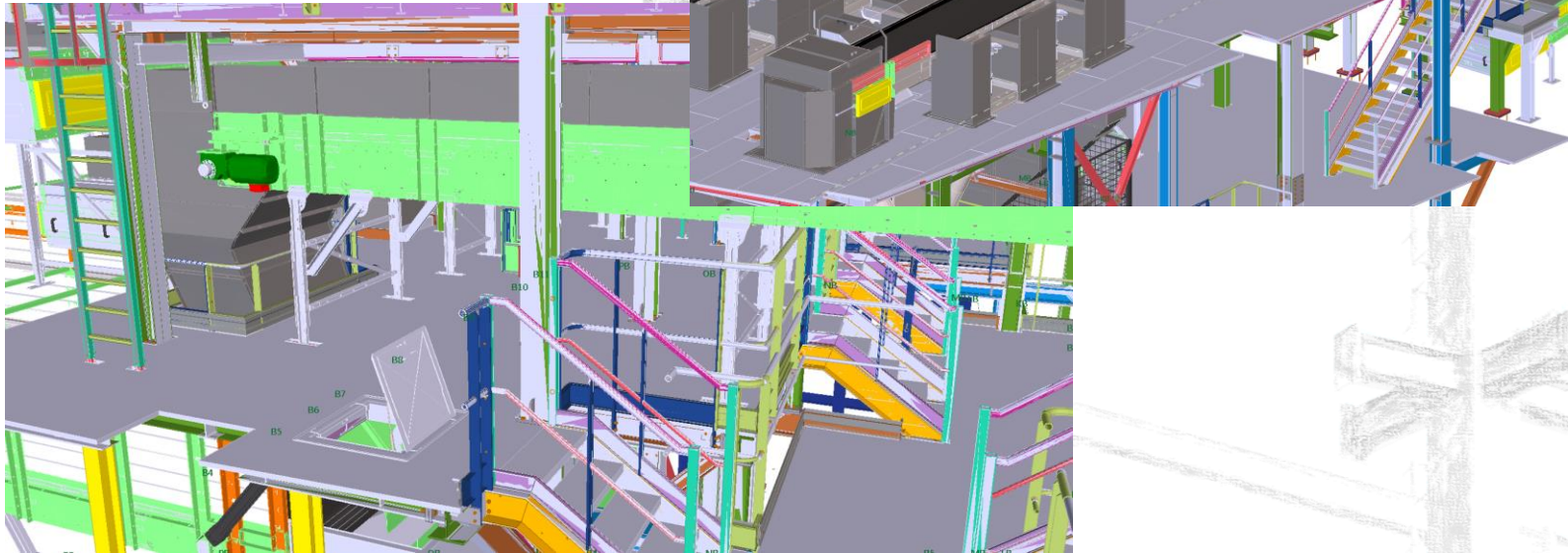
# Projektiranje

- suvremeno i učinkovito izvođenje čelične konstrukcije započinje učinkovitim projektiranjem korištenjem BIM tehnologije



# Projektiranje

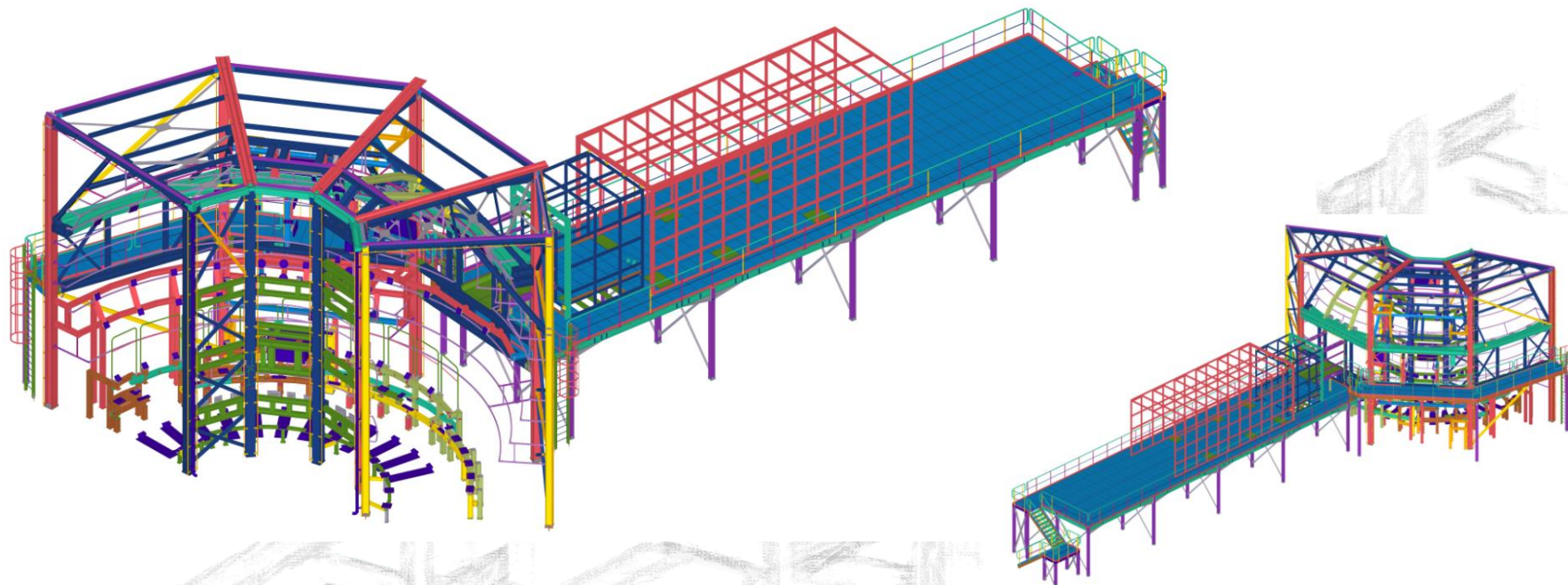
- usklađeni multidisciplinarni modeli





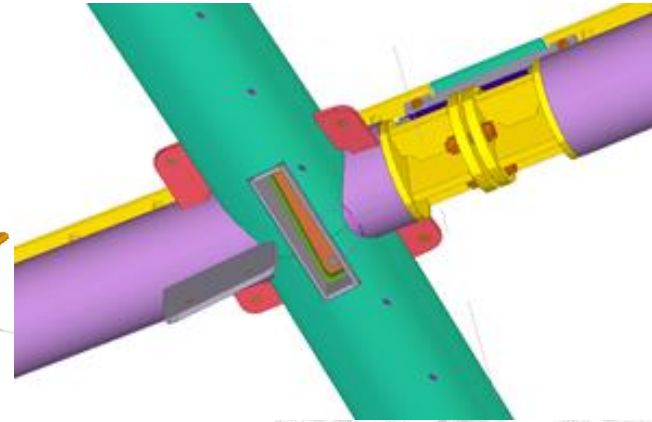
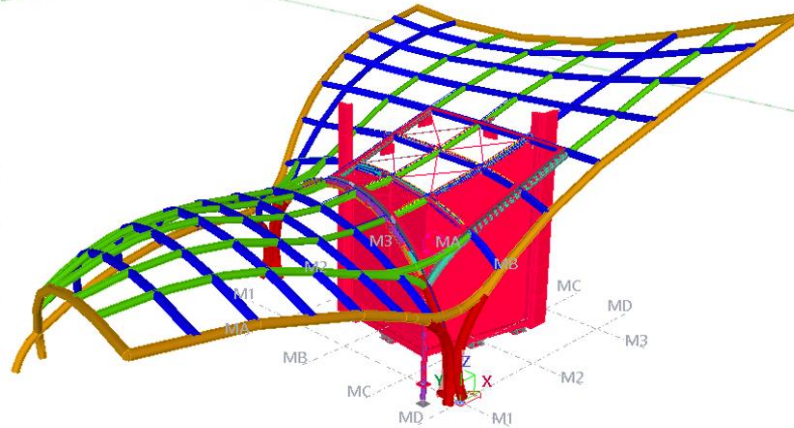
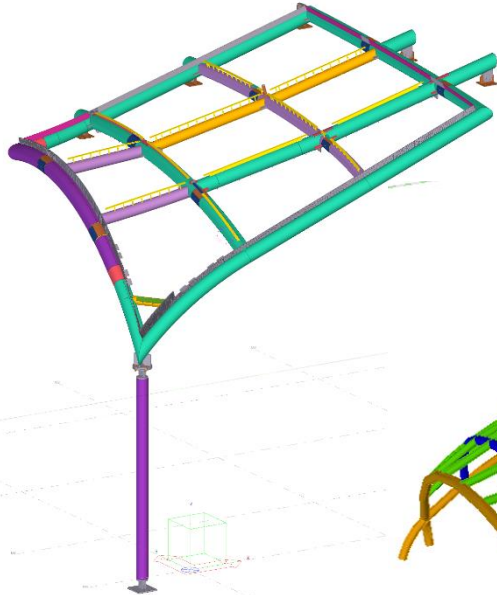
# Projektiranje

- primjena u različitim industrijama



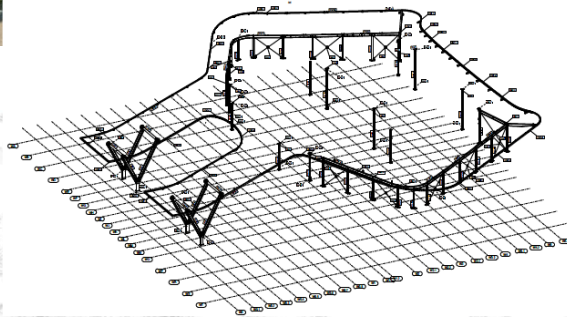
# Projektiranje

- sve kompleksnija geometrija i arhitektonski zahtjevi navode na korištenje jedinstvenih BIM modela



# Projektiranje

## ■ Primjeri zahtjevne arhitekture





# Projektiranje

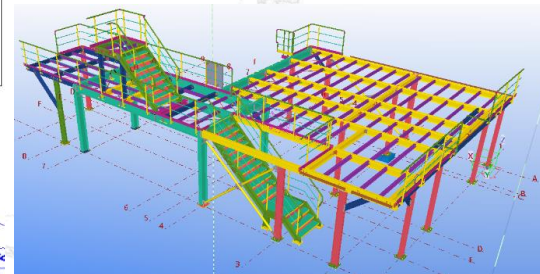
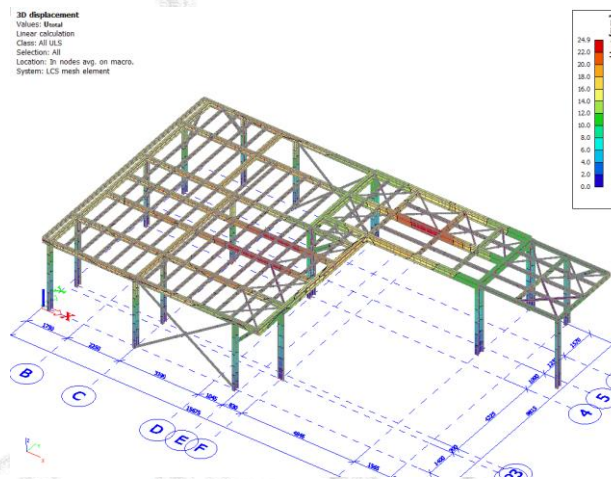
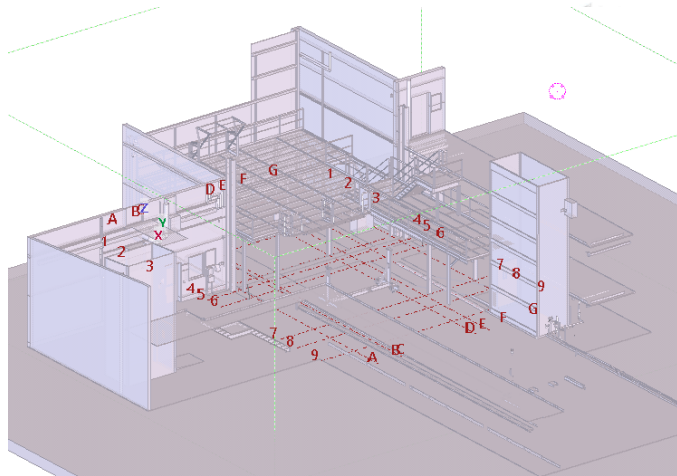
- Primjeri zahtjevne arhitekture





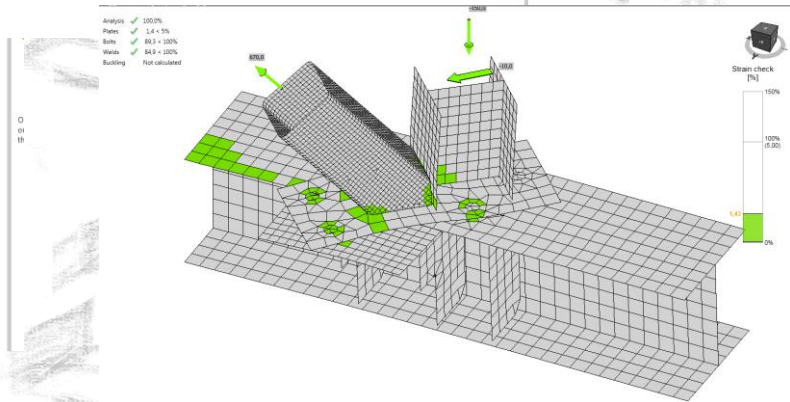
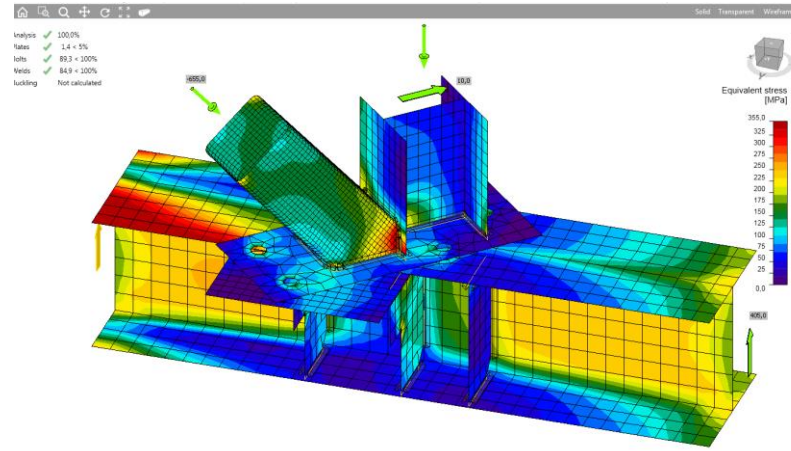
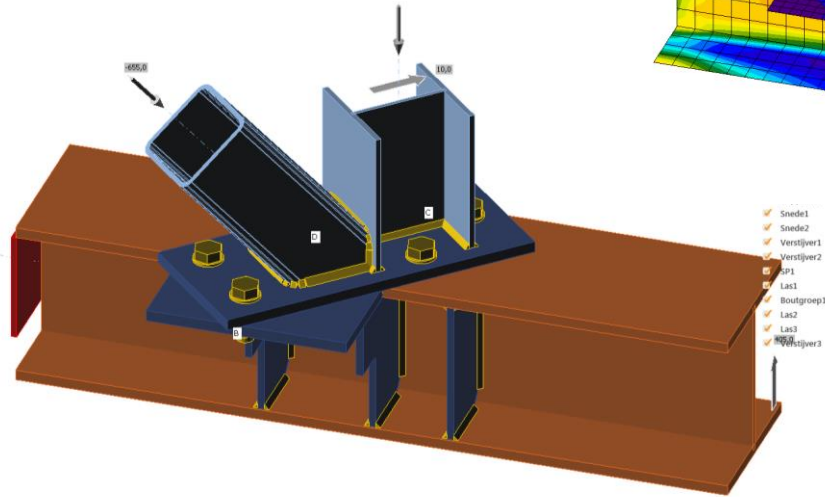
# Projektiranje

- BIM projektiranje počinje sa modelom arhitekture ili industrijskog procesa, nastavlja se statičkim proračunom i rezultira konačnim 3d modelom punim vrijednih informacija koje pomažu svima koji su uključeni u daljnje faze izvođenja projekta



# Projektiranje

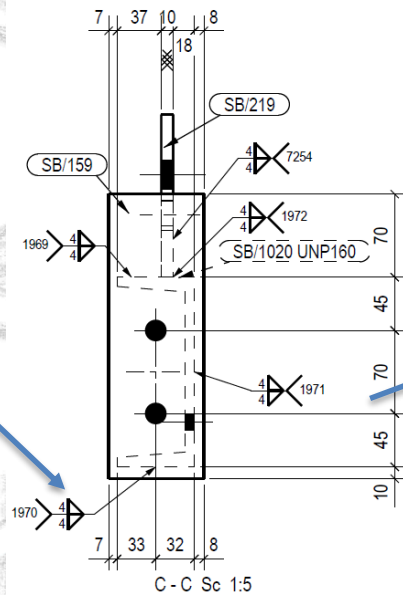
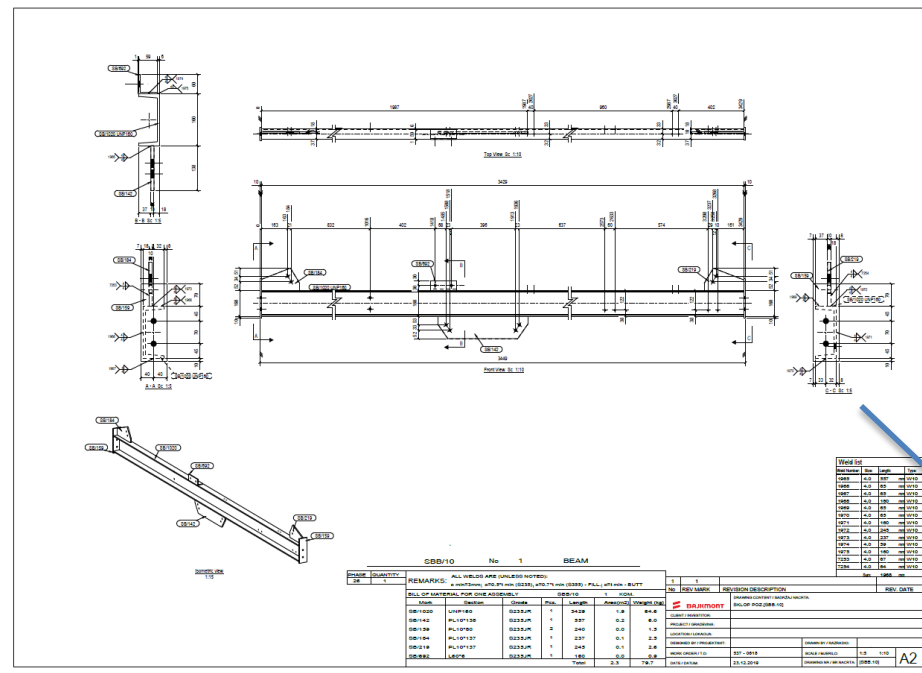
## ■ Proračun spojeva



-

# Projektiranje

- iz 3D modela se generiraju 2D radionički nacrti za proizvodnju




## Weld list

Weld Number:	Size:	Length:	Type:
1965	4.0	557 mm	W10
1966	4.0	65 mm	W10
1967	4.0	65 mm	W10
1968	4.0	160 mm	W10
1969	4.0	65 mm	W10
1970	4.0	65 mm	W10
1971	4.0	160 mm	W10
1972	4.0	245 mm	W10
1973	4.0	237 mm	W10
1974	4.0	59 mm	W10
1975	4.0	160 mm	W10
7253	4.0	67 mm	W10
7254	4.0	64 mm	W10
Sum:		1968 mm	



# Projektiranje

## Planovi zavarivanja (7.2.1)

		QRE_537-0818_12060101_R0_WELDING AND CONTROL PLAN										Datum / Date:						
PLAN ZAVARIVANJA I KONTROLE																		
Projekt / Project:			Naziv dijela / Building:				Naručitelj / Customer:				Ugovor br. / Contract no.:		Proizvodni broj / Works no.:					
Konstrukcijski podaci Design Data					Podaci o zavarivanju i toplinskoj obradi Welding and Post Weld Heat Treatment Data							NDT Metode i % ispitivanja NDT Methods & % of Testing				Napomena Remark		
Nacr. br. Assembly no.	Zavar. br. Weld no.	Tip zavara Weld Type	Oсно. mat. 1 Base mat. 1	Oсно. mat. 2 Base mat. 2	Žig zavarivača Welder stamp	WPQR br. WPQR no.	T <sub>p</sub> (°C) min.	Postupak zavarivanja Welding process	Korjenski sloj - Dodatni materijal Root Layer - Filler Material			TO PWHT Da / Ne Yes / No		VT	MT		RT	UT
		SW / MW	Kvaliteta Quality	Kvaliteta Quality	Datum zavarivanja Date of welding	WPS br. WPS no.	T <sub>m</sub> (°C) max.	Postupak zavarivanja Welding process	Popuna i završni sloj - Dodatni materijal Fill and Final Layer - Filler Material			Uputa za TO br. PWHT proced. no.						
			Dimenzije Dimensi. (mm)	Dimenzije Dimensi. (mm)					Vrsta	Type	Ø (mm)	Šarža	Charge					
SBB.10	1970	W10	≤S355J2+N	≤S355J2+N	BM01	CP-860-18 020/2014	120°C	135	SIAT Pittarc G9			Ø1,0	12941/2019	/	X	/	/	/
		SW	t=10mm	t=10,5mm	15.01.20.	KT1-3	/	/	/			/	/	/	100%	/	/	/

**Legenda / Legend:**  
 SW - Radionički zavar / Shop Weld, MW - Montažni zavar / Site Weld, WPS - Uputa za zavarivanje / Welding Procedure Specification, Ø - Promjer dodatnog materijala za zavarivanje / Filler Material Diameter,  
 TO / PWHT - Toplinska obrada nakon zavarivanja / Post Weld Heat Treatment, Tp - Temperatura predgrijavanja / Preheat Temperature, Tm - Međuprolazna temperatura / Interpass Temperature,  
 OM / BM - Osnovni materijal / Base Material, BW - Sučeljeni zavar / Butt Weld, NW - Zavar priključka / Nozzle Weld, W10 - Kutni zavar / Fillet Weld,

Izradio / Made by:

Odobrio / Approved by:

Nadzor / Author. inspector:

Obrazac / Form:

Strana



Građevinski fakultet Sveučilišta u Zagrebu - Zagreb, 13.03.2020.

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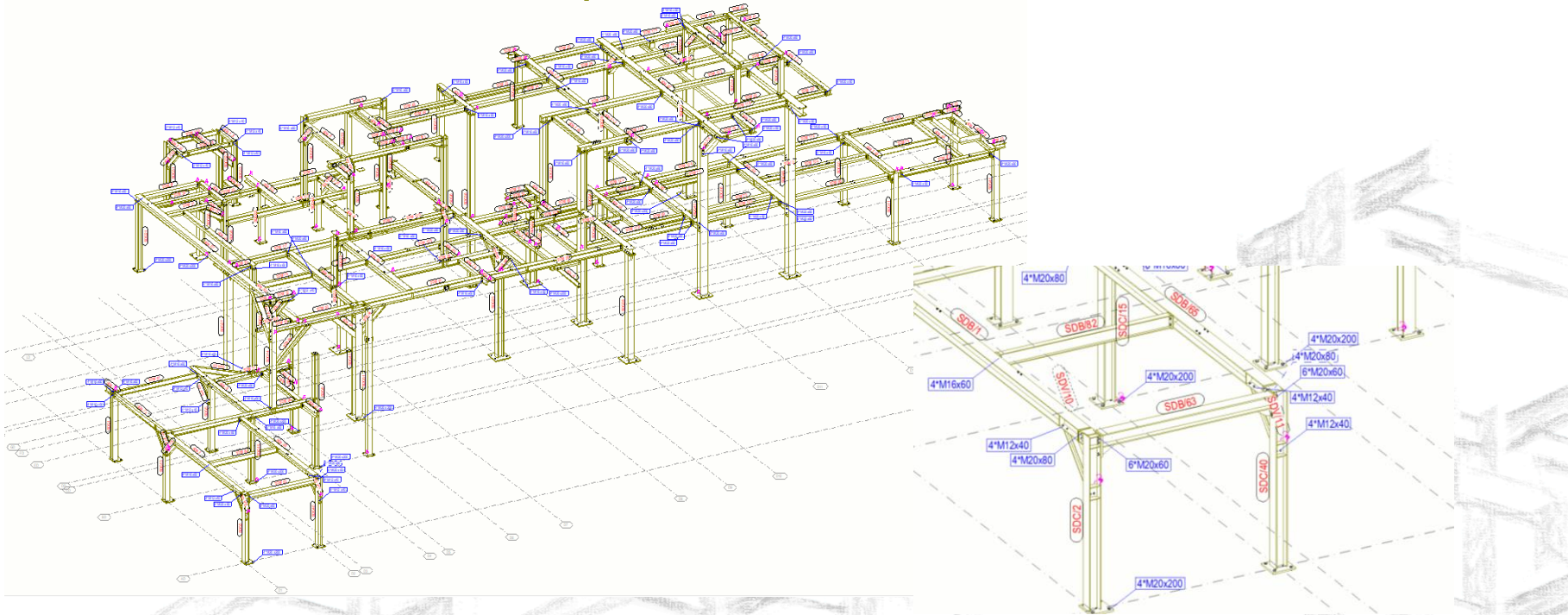
# Projektiranje

- Sve potrebne liste i specifikacije

Standard	Site/Shop	Dimenzije	Kom.	Naziv
	Site	BOLT 30.0 X 110.0	210	BOLT30*110
	Site	BOLT 20.0 X 100.0	58	BOLT20*100
	Site	BOLT 20.0 X 70.0	210	BOLT20*70
	Site	BOLT 20.0 X 65.0	252	BOLT20*65
	Site	BOLT 20.0 X 60.0	84	BOLT20*60
	Site	BOLT 20.0 X 55.0	42	BOLT20*55
	Site	BOLT 20.0 X 50.0	454	BOLT20*50
	Site	BOLT 20.0 X 45.0	32	BOLT20*45
	Site	BOLT 16.0 X 60.0	378	BOLT16*60
	Site	BOLT 16.0 X 50.0	272	BOLT16*50
	Site	BOLT 16.0 X 45.0	40	BOLT16*45
	Site	BOLT 16.0 X 40.0	292	BOLT16*40
	Site	BOLT 12.0 X 100.0	3	BOLT12*100
	Site	BOLT 12.0 X 55.0	8	BOLT12*55
	Site	BOLT 12.0 X 50.0	126	BOLT12*50
	Site	BOLT 12.0 X 45.0	484	BOLT12*45
	Site	BOLT 12.0 X 40.0	1766	BOLT12*40
	Site	BOLT 12.0 X 35.0	216	BOLT12*35
	Site	BOLT 12.0 X 30.0	1732	BOLT12*30
		NUT 30.0	210	NUT30-555
		NUT 22.0	1132	NUT20-555
		NUT 16.0	982	NUT16-555
		NUT 12.0	4335	NUT12-555
		WASHER 32.0	420	WASHER30-7989
		WASHER 21.5	1132	WASHER20-7989
		WASHER 17.5	982	WASHER16-7989
		WASHER 13.5	4335	WASHER12-7989

# Projektiranje

## Montažni nacrti



# Projektiranje

- Numerički podaci (NC) potrebni za automatiziranu proizvodnju

Contracts 436-1116 / B / PBG/16													
9	Drawing	Description	Drawer	Coating	Revision	Delivery	Project Manager	Reference	Classification	Family	Typology	Creation	Accessory weight
F		A.05.01.08 Duplex apartmani u etazi 02 i 03	I. Vukorepa	C3								25.9.2017. 11:41	613,22
B		A.05.01.03 Dilatacija 2 - Zatvoreni prostor unutarnjeg bazena	A. Rođić	C4								2.11.2017.	83.101,47
C		A.05.01.04 Dilatacija 3 - Zatvoreni prostor	A. Rođić	C3								2.11.2017. 20:15	495.573,31

55	Mark	Quantity	Total Weight	Total Surface	Description	Category	Manager	Coating	Comment 1	Comment 2	Comment
	PBG/10	1	1.598,83	26,159							
	PBG/11	1	1.859,77	30,336							
	PBG/12	1	1.469,83	24,977							
	PBG/13	1	2.152,12	35,657							
	PBG/14	2	2.293,12	37,273							
	PBG/15	1	2.088,40	34,011							
	PBG/16	1	2.088,40	34,011							
	PBG/17	4	2.293,76	37,285							
	PBG/18	4	1.162,14	19,043							
	PBG/19	2	1.162,78	19,055							
	PBG/2	1	2.277,59	39,780							

14	Part	Quantity	Profile	Length	Width	Grade	Weight	Coating
	PB_67	3	LHM25	671,50	220,00	S355J2	27,88	
	PB_66	4	LHM25	620,00	200,00	S355J2	23,23	
	PB_65	4	LHM25	615,00	220,00	S355J2	25,44	
	PB_61	1	IPE600	894,00		S355J2	109,41	
	PB_59	1	IPE600	249,00		S355J2	30,43	
	PB_54	1	IPE600	10483,01		S355J2	1.282,87	
	PB_50	2	IPE600	892,00		S355J2	109,00	
	PB_49	2	IPE600	247,00		S355J2	30,07	
	PB_38	1	LHM12	220,02	160,12	S355J2	2,02	
	PB_31	3	LHM12	220,02	156,55	S355J2	1,98	
	PB_3	2	IPEA450	319,00		S355J2	21,42	
	PB_23	4	LHM12	150,00	132,00	S355J2	1,67	
	PB_2	2	IPEA450	249,00		S355J2	16,72	
	PB_11	6	LHM15	249,00	104,00	S355J2	3,05	



# Projektiranje

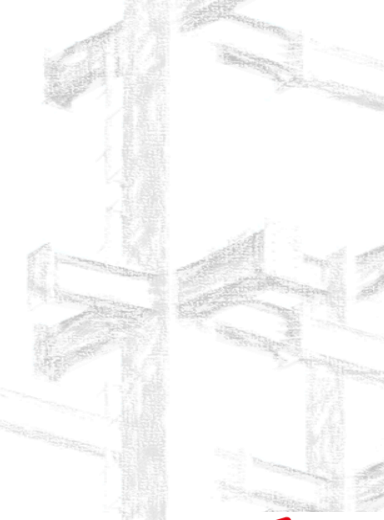
- Jednostavno praćenje izdanih nacрта i izmjena u projektu

Document manager

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	Changes	Created ▼	Document type				Locked by		✓	Ready for issuing by	✉	Issued	Mark	Modified	Name	Output date	Size
All documents		28.10.2019	GaDrawingDocument								✉	12.03.2020	[2]	28.10.2019	PLAN POZICIJA		572x416
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Single-part drawings		28.10.2019	GaDrawingDocument								✉	12.03.2020	[5]	28.10.2019	PLAN POZICIJA		819x590
Assembly drawings		28.10.2019	GaDrawingDocument								✉	12.03.2020	[6]	28.10.2019	PLAN POZICIJA		819x590
Cast unit drawings		28.10.2019	GaDrawingDocument								✉	12.03.2020		28.10.2019	PLAN POZICIJA		819x590

- Plan kontrole i ispitivanja – ITP (4.2.1)



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**BAJRMONT**

**FABEMA METAL**


**IGH**

**PETICA**  
- Cluj -

**ArcelorMittal Construction**

# Radionička izrada

## Plan kontrole i ispitivanja – ITP - osnove

 <b>PLAN KONTROLE I ISPITIVANJA ČELIČNE KONSTRUKCIJE U RADIONICI</b> <b>INSPECTION &amp; TEST PLAN - STEEL STRUCTURE IN WORKSHOP</b>							Brz. No.:
							QPW_446-0738_00000003_R0_Plan kontrole
Brz. No.	Tip kontrole i ispitivanja Type of test and inspections	Kriterij prihvaćanja Acceptance criteria	Količina kontrole Quantity of check	Procedura Procedure	Oblik zapis Format of record	Inspektor / Aktivnost Inspector / Activity	Napomena Remarks
1	Osnove Fundamentals						
1.0	<ul style="list-style-type: none"> <li>Provjera sposobnosti za izvođenje radova</li> <li>Testing the ability to perform the work</li> </ul>	<ul style="list-style-type: none"> <li>FPC</li> <li>EN 1090</li> </ul>		BA-MT-MP4-4-03 BA-MT-MP4-4-04 BA-MT-MP4-4-05	Z H R R	<ul style="list-style-type: none"> <li>tehnički pregled svih vrsta kopca</li> <li>analiza svih vrsta naručenja</li> <li>analiza projekta kada ga daje naručitelj</li> <li>analiza projekta kada ga daje Bajkmont</li> <li>imenuje odgovornih osoba</li> <li>technical review of the customer's request</li> <li>analysis of order requests</li> <li>project analysis when it is provided by the customer</li> <li>project analysis when it is provided by Bajkmont</li> <li>appointing of responsible persons</li> </ul>	
1.1	<ul style="list-style-type: none"> <li>Sustav upravljanja kvalitetom</li> <li>Zapisi o ispitivanjima i kvalifikacijama</li> <li>Quality Management System</li> <li>Approvals and qualification records</li> </ul>	<ul style="list-style-type: none"> <li>EN ISO 9001</li> <li>EN 1090</li> <li>EN ISO 3834-2 for ENCS=4</li> <li>EN ISO 3834-3 for ENCS=2</li> </ul>			Z H R R		
1.2	POTVRBA ATESTA ZAVARIVAČA I OPERATERA • Valjanost i kvalifikacije VERIFICATION OF WELDER'S AND OPERATOR'S CERTIFICATES • Validity and qualification	<ul style="list-style-type: none"> <li>EN ISO 9606-1</li> <li>EN ISO 14732</li> </ul>			Z/H H R R R	<ul style="list-style-type: none"> <li>lista atestiranih zavarivača i operatera predviđenih za ovaj projekt mora biti dio dokumentacije</li> <li>list of assigned welders and operators in the project to be attached to the documentation</li> </ul>	
1.3	ODOBRENJE POSTUPAKA ZAVARIVANJA • norme i instrukcije za zavarivanje • odobrenje zavarivačkih postupaka • kontrola zavarivačkih postupaka • upute za zavarivanje (WPS) APPROVAL OF WELDING TECHNIQUES • regulations and instructions for fusion welding • requirements for and approvals of welding techniques • inspection of welding techniques • welding procedure specifications (WPS)	<ul style="list-style-type: none"> <li>EN ISO 15607</li> <li>EN ISO 15614-2</li> <li>EN ISO 15609-1</li> </ul>			Z/H H R R R	<ul style="list-style-type: none"> <li>lista atestiranih postupaka zavarivanja i lista uputa za zavarivanje predviđenih za ovaj projekt mora biti dio dokumentacije</li> <li>list of assigned WPS's / WPS in the project to be attached to the documentation</li> </ul>	
1.4	POTVRBA OSOBNA DA NOT • sadržaj i odobrenje • valjanost • prethodnost	<ul style="list-style-type: none"> <li>EN ISO 10171</li> </ul>			Z/H H R R R	<ul style="list-style-type: none"> <li>lista certifikiranog osoblja za NOT predviđenog za ovaj projekt mora biti dio dokumentacije</li> <li>list of assigned personnel for NOT in the project to be attached to the documentation</li> </ul>	

<b>CERTIFIKAT O KVALIFIKACIJI POSTUPKA ZAVARIVANJA (WPQR)</b> <b>QUALIFICATION OF A WELDING PROCEDURE (WPQR)</b>	
<b>CERTIFIKAT TO-1108 C 0325/15</b>	
1. Proizvođač upućuje na zavarivanje:	Inspektor, ispitivač:
2. Materijal za zavarivanje:	Inspektor, ispitivač:
3. WPS No.:	WPS No.:
4. Proizvođač:	Proizvođač:
5. Adresa:	Adresa:
6. Norme za ispitivanje:	Norme za ispitivanje:
7. Područje odobrenja:	Područje odobrenja:
8. Postupak zavarivanja:	Postupak zavarivanja:
9. Vrsta zavarivanja:	Vrsta zavarivanja:
10. Osim toga:	Osim toga:
11. Osim toga:	Osim toga:
12. Osim toga:	Osim toga:
13. Osim toga:	Osim toga:
14. Osim toga:	Osim toga:
15. Osim toga:	Osim toga:
16. Osim toga:	Osim toga:
17. Osim toga:	Osim toga:
18. Osim toga:	Osim toga:
19. Osim toga:	Osim toga:
20. Osim toga:	Osim toga:
21. Osim toga:	Osim toga:
22. Osim toga:	Osim toga:
23. Osim toga:	Osim toga:
24. Osim toga:	Osim toga:
25. Osim toga:	Osim toga:
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100. Osim toga:	Osim toga:


Građevinski fakultet Sveučilišta u Zagrebu - Zagreb, 13.03.2020.

Tečaj stručnog usavršavanja: **Izvedba i nadzor čeličnih konstrukcija prema HRN EN 1090-1/-2**

**Voditelj:** izv.prof.dr.sc. Davor Skejčić

# Radionička izrada

## Plan kontrole i ispitivanja – ITP – procedure za izvođenje



PLAN KONTROLE I ISPITIVANJA ČELIČNE KONSTRUKCIJE U RADIONICI

INSPECTION & TEST PLAN - STEEL STRUCTURE IN WORKSHOP

Br.:

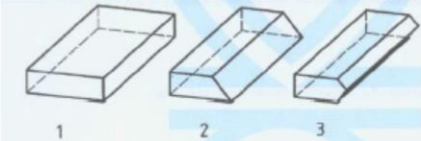
QPW\_446-0718\_00000003\_R0\_Plan kontrole

Br.	Tip kontrole i ispitivanja Type of test and inspections	Kriterij prihvaćanja Acceptance criteria	Olim kontrole Quantity of check	Procedura Procedure	Oblik zapisa Format of record	Inspektor / Aktivnost Inspector / Activity			Napomene Remarks
						M Potpis Signature	CUS Potpis Signature	SUP Potpis Signature	
1.4	VERIFICATION OF CERTIFICATES OF PERSONNEL FOR NONDESTRUCTIVE TESTING <ul style="list-style-type: none"> <li>duties and responsibilities</li> <li>validity</li> <li>applicability</li> </ul>	• EN ISO 9001:2015, 8.6.2							• List of the applied examiners to be added.
1.5	Nadzor zavarivanja Welding supervisor	• EN ISO 14731		BM-RUP-Q-01-01 BM-RUP-Q-02	Z	H	R	R	• EN ISO 3834-2, Chapter 7.3. Nadzor zavarivanja mora posjedovati odgovarajuće tehničko znanje prema EN 1090-2, section 7.4.3.  • EN ISO 3834-2, Chapter 7.3. Welding supervisor has to have sufficient technical knowledge acc. to EN 1090-2, section 7.4.3.
1.6	Toplinsko rezanje Thermal Cutting	• EN 1090-2, chapter 6.4.3 • EN ISO 9013 • Radna procedura / TWP		BM-RUP-QS-TS-01 BM-RUP-MTV-01	TWP	H	R	R	• U području predloženom lokalnom otvrdnjavanju ispitati da se četiri uzorka rubne površine prema EN ISO 6507, sa četiri testa tvrdoća po uzorku Testiranje će se provoditi periodički. Maksimalna dopuštena tvrdoća rubne mase (HV10): materijal prema EN 10025-2 do -5 max. 380  • Four samples of free edge surfaces acc. to EN ISO 6507, with four hardness tests per each sample, shall be taken at areas which are susceptible to local hardening. Testing will be done periodically. Allowed max. hardness of free edge surfaces (HV10): materials acc. to EN 10025-2 to -5 max. 380
1.7	Izravnavanje • Procjena kvalificiranog postupka za izravnavanje plamenom (Zahtjevi prema EN ISO 9013 & EN ISO 9014)  Straightening • Procedure qualification tests for flame straightening (Only required for EN ISO 9013 & EN ISO 9014)	• EN 1090-2, section 6.5.3 • Radna procedura / TWP		BM-RUP-Q-01-01	TWP	H	R	R	• Ako se traži, inače nije primjenjivo  • If required, otherwise chapter not applicable
1.8	Izrada rapa Holing	• EN 1090-2, section 6.6 • Radna procedura / TWP		BM-RUP-QS-01-01	TWP	H	R	R	• Ako se traži, inače nije primjenjivo  • If required, otherwise chapter not applicable

BAJKMONT d.o.o.  
Severna, Croatia

Opće upute za toplinsko rezanje  
Thermal cutting general procedures  
rev. 1 14.04.2017. BM-RUP-QS-TB-01

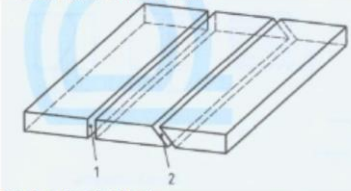
### 3.2.3. Tipovi rezanja/Cutting types



Slika 3- Izrazi na završenom radnom komadu / Figure 3- Terms on the finished work piece

#### Značenje/Key

1. Okomiti rez/Vertical cut
2. Kosi rez/Bevel cut
3. Kosi rez (dvostruki)/Bevel cut(double)



Slika 3- ravni rez/Straight cut

1. Okomiti rez/Vertical cut
2. Kosi rez/Bevel cut

Ispisani protokoli su u elektroničkoj kopiji. Dokument dostupni su na serveru BAJKMONT\ITP\_dokumenti\jezika\hrv (ili po potrebi) i u obliku ispisane i primopisane od nadležnog osoblja

Stranica: 46 / 58



# Radionička izrada

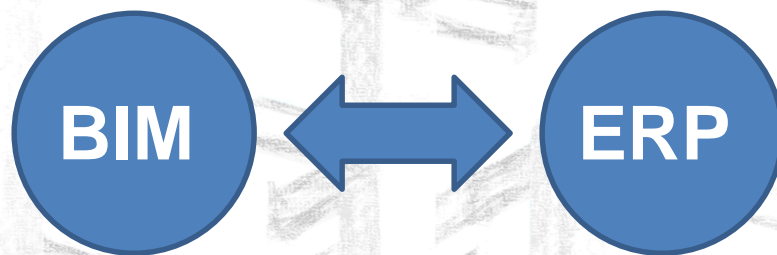
## Plan kontrole i ispitivanja – ITP – obrasci

BAJKMONT										PLAN KONTROLE I ISPITIVANJA ČELIČNE KONSTRUKCIJE U RADIONICI				Br.: QPW_446-0718_00000003_R0_Plan kontrole	
INSPECTION & TEST PLAN - STEEL STRUCTURE IN WORKSHOP															
Br.	Tip kontrole i ispitivanja	Kriterij prihvaćanja	Obim kontrole	Procedura	Oblik zapisa	Inspektor / Aktivnost			Napomene						
No.	Type of test and inspection	Acceptance criteria	Quantity of check	Procedure	Form of record	MI Potpis	CUS Potpis	SUP Potpis	Remarks						
	Dimensional check of the product	• Detail drawing and main dimensions							• Internal						
12.7	VIZUALNA KONTROLA PRIPREME ZA ZAVARIVANJE • Oblik šljaha • Mismatchanje lica materijala • Razmak u korjenju • Čistoća pripremljenih lica  VISUAL INSPECTION OF WELD PREPARATION • Edge form • Mismatch of edges • Root gap • Cleanliness of prepared edges	• Plan zavarivanja / Welding plan • WPS • Crteži / Drawings • EN ISO 14731	100%	BM-RUP-2-OU-01	-	X	SC	SC	• Interno Izvršava nadzor zavarivanja  • Internal Execution by welding supervisor						
12.8	Dimenzijska kontrola sklopova prije zavarivanja (pripreme postaje)  Dimensional check of assembly in tackwelded condition	• Crteži • Tolerancije prema EN 1090-2, Annex D • Drawings • Tolerances according to EN 1090-2, Annex D	100 %	BM-OSR-OPS-10	-	X	SC	SC	• Interno  • Internal						
12.9	Izvođenje zavarivanja  Execution of welding	• EN 1090-2; section 7.5.17 • WPS	100%	BM-RUP-2-OU-01	Q	X	W/SC	W/SC							
12.10	Kontinuirana kontrola od strane nadzora zavarivanja • Kontrola završetka • Kontrola WPS • Kontrola korištenja dodatnog materijala • Nadzor parametara zavarivanja, temperature pregrijavanja i međutemp. (ITO ako se izradi)  Permanent check by the welding supervisor: • Check of welders • Check of WPS • Check of applied filler metals • Supervision of welding parameters, preheating and interpass temperature (PWHT if applicable)	• WPS • Crteži / Drawings	100%	BM-RUP-2-OU-01	-	X	-	-	• Interno Izvršava nadzor zavarivanja  • Internal Execution by welding supervisor						

BAJKMONT										QRE_446-0718_13030008_R0_DIMENSIONAL CHECK		Datum / Date: 31.03.20.	
VIZUALNA I DIMENZIONALNA KONTROLA SKLOPOVA													
Projekt Project: ŽIGARA SLJEME					Ugovor br. Order No.								
Naziv dijela Building: ČELIČNA KONSTRUKCIJA GORNJE POSTAJE - glavni stupovi					Proizvodni broj Works No.: 446-0718								
Naručitelj Customer					Propisana norma Main standard: EN 1090-2, Annex B, class 2								
Kontrola u proizvodnji Production control			Kontrola na montaži Assembly control			Kontrola prije rekonstrukcije Control before reconstruction			Kontrola nakon rekonstrukcije Control after reconstruction				
X													
Br / Nr:	Crtež broj / Drawing no.:		Kontrolne aktivnosti / Control Activities							Nalaz / Result			
	Naziv sklopa / Assembly mark.:		Predmet kontrole / Control Subject							OK WCR No.: OK			
1	ZLO2	1 kom	DULJINE, RAZMAH I GEOMETRIJA PROVRTA .....							OK			
2	ZLO6	1 kom	DULJINE, RAZMAH I GEOMETRIJA PROVRTA .....							OK			
3	ZLO5	1 kom	DULJINE, RAZMAH I GEOMETRIJA PROVRTA .....							OK			
4	ZLO7	1 kom	DULJINE, RAZMAH I GEOMETRIJA PROVRTA .....							OK			
5	ZLO8	1 kom	DULJINE, RAZMAH I GEOMETRIJA PROVRTA .....							OK			

# Radionička izrada

- BIM model se povezuje sa proizvodnjom putem ERP (Enterprise Resource Planning) softvera koji svojim MMRP (Manufacturing and Material Resource Planning) modulima integrira različite aktivnosti kao što je tehnološka priprema proizvodnje, upravljanje zalihama materijala, nabava, te samom proizvodnja i montažom komponenata čelične konstrukcije



# Radionička izrada

- Prijenos podataka iz BIM modela u ERP sustav

The screenshot displays a software interface for managing parts and production. The top menu bar includes various modules like Nomenclature, List of Parts, Assembly List, Phases, Pre-provisioning, Bars, Nesting, Stock, Production, Delivery, Documents, Properties, Delete, Print, Forecast Time, Entry, Shipping Schedule, Diary, Process, Detail, Deliveries, Contract, Drawing, Filter, and View. Below the menu, a table lists parts with columns for Drawing, Mark, Part, Description, Quantity, Project Manager, Reference, Drawer, Coating, Delivery, Total Weight, Total Surface, Responsible, Description, Comment, and Part prepar... The table contains multiple rows of data, including parts like LHM 32553R 391 54, 4BR\_10, 4BR\_14, 4BR\_23, 4BR\_3, 4BR\_4, 4BR\_5, 4BR\_6, 4BR\_7, 4BR\_8, 9PL\_14, 9PL\_18, 9PL\_19, 9PL\_20, 9PL\_32, 9PL\_43, 9PL\_46, 9PL\_5, 1\_29, 1\_30, 1\_31, and 1\_42. A 3D model of a steel structure is visible in the bottom right corner.

Drawing	Mark	Part	Description	Quantity	Project Manager	Reference	Drawer	Coating	Delivery	Total Weight	Total Surface	Responsible	Description	Comment	Part prepar...
	L_72	LHM 32553R 391 54		1	PLATES					1	0,04				
	4BR_10	LHM 32553R 3.452 1.196		1	PLATES					97	6,29				
	4BR_14	LHM 32553R 3.452 1.020		1	PLATES					83	7,87				
	4BR_23	LHM 32553R 1168 1.700		4	PLATES					27	2,33				
	4BR_3	LHM 32553R 3.452 1.020		1	PLATES					83	7,87				
	4BR_4	LHM 32553R 3.452 1.196		1	PLATES					96	8,17				
	4BR_5	LHM 32553R 3.452 1.196		5	PLATES					486	41,43				
	4BR_6	LHM 32553R 3.452 985		1	PLATES					79	6,72				
	4BR_7	LHM 32553R 3.452 986		1	PLATES					79	6,72				
	4BR_8	LHM 32553R 3.452 1.196		1	PLATES					96	8,18				
	9PL_14	LHM 32553R 3.189 1.100		1	PLATES					83	7,04				
	9PL_18	LHM 32553R 3.189 1.011		1	PLATES					61	5,64				
	Quantity (1)	Part preparation		3	PLATES					228	19,42				
	Weight (83)	0.0% (0)		1	PLATES					76	6,47				
	9PL_20	LHM 32553R 3.189 1.461		1	PLATES					110	9,35				
	9PL_32	LHM 32553R 1.038 1.013		1	PLATES					8	0,65				
	9PL_43	LHM 32553R 2.987 60		2	FLOSNATO					8	0,75				
	9PL_46	LHM 32553R 3.017 60		2	FLOSNATO					9	0,76				
	9PL_5	LHM 32553R 3.189 1.461		2	PLATES					219	18,69				
	1_29	LHM 32553R 3.379 390		1	PLATES					48	2,51				
	1_30	LHM 32553R 2.941 390		2	PLATES					87	4,50				
	1_31	LHM 32553R 3.379 390		20	PLATES					977	50,56				
	1_42	LHM 32553R 7.641 940		2	PLATES					87	4,50				

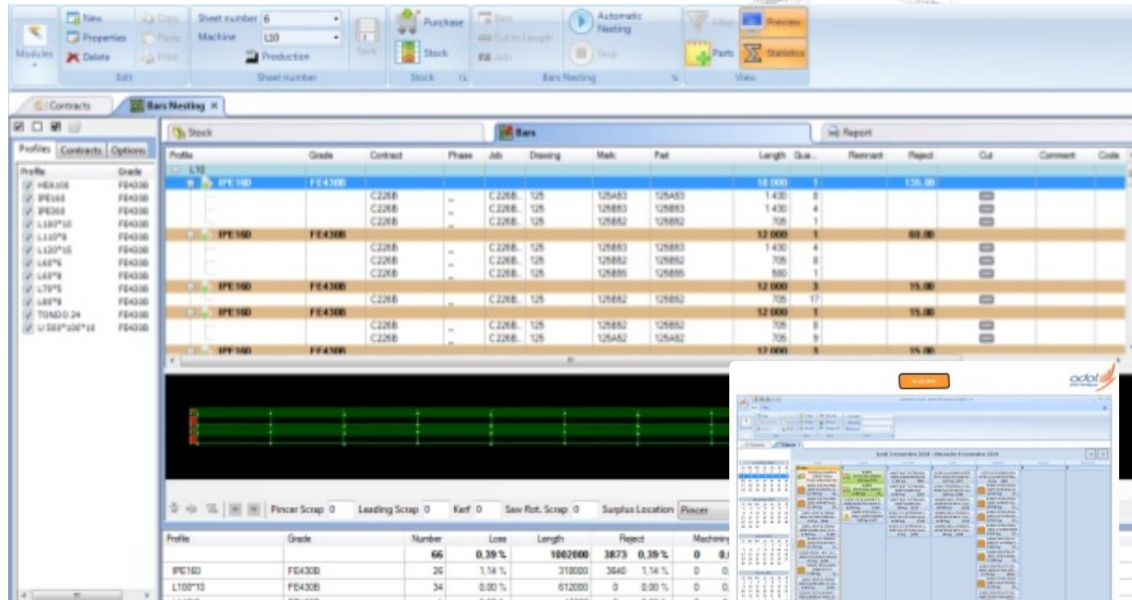
Građevinski fakultet Sveučilišta u Zagrebu - Zagreb, 13.03.2020.

Tečaj stručnog usavršavanja: **Izvedba i nadzor čeličnih konstrukcija prema HRN EN 1090-1/-2**

**Voditelj:** izv.prof.dr.sc. Davor Skejić

# Radionička izrada

- Kreiranje optimiziranih reznih lista za štapne materijale kako bi se smanjio nekorisni otpad i ukupan utrošak materijala



BAJOMONT Bars Nesting Results										5.4.2018
Machine	FICEP SAW	Sheet number	886	Time						
Profile	Grade	Mark	Length	Part	Reamant	Quantity	Length	Report	Grade	
<b>(B65_16) HEA120</b>										
S355J2	2	147015	1470	1	172	2 050	0:03:21	0		
<b>(B65_16) HEA120</b>										
S355J2	2	147015	1470	1	172	2 050	0:03:22	2		
<b>(B65_16) HEA120</b>										
S355J2	2	147015	1470	1	172	1 630	0:05:06	0		
<b>(B65_14) HEA120</b>										
S355J2	2	147015	1470	1	172	3 500	086.4	156	4	
<b>(B64_150) HEA120</b>										
S355J2	2	147015	1470	1	172	3 500	086.3	126	3	
<b>(B64_160) HEA120</b>										
S355J2	2	147015	1470	1	172	3 500	086.2	158	2	
<b>(B65_15) HEA120</b>										
S355J2	2	147015	1470	1	172	1 630	0:05:44	1		



# Radionička izrada

- Kreiranje optimiziranih reznih lista za pločaste materijale kako bi se smanjio nekorisni otpad i ukupan utrošak materijala

Grade	Thickness	Profile	Machine	Contract	Drawing	Standard Gap	Comment	Quantity
S235JR	10.0	LPM10	PLASMA	622-0917	S.B1	5.0	2.0 PLASMA	20.220
S235JR	8.0	LPM8	PLASMA	622-0917	S.B1	5.0	2.0 PLASMA	20.220
S235JR	10.0	LPM10	PLASMA	622-0917	S.B1	5.0	2.0 PLASMA	20.220
S235JR	8.0	LPM8	PLASMA	622-0917	S.B1	5.0	2.0 PLASMA	20.220
S235JR	10.0	LPM10	PLASMA	622-0917	S.B1	5.0	2.0 PLASMA	20.220
S235JR	8.0	LPM8	PLASMA	622-0917	S.B1	5.0	2.0 PLASMA	20.220
S235JR	10.0	LPM10	PLASMA	622-0917	S.B1	5.0	2.0 PLASMA	20.220
S235JR	8.0	LPM8	PLASMA	622-0917	S.B1	5.0	2.0 PLASMA	20.220
S235JR	10.0	LPM10	PLASMA	622-0917	S.B1	5.0	2.0 PLASMA	20.220
S235JR	8.0	LPM8	PLASMA	622-0917	S.B1	5.0	2.0 PLASMA	20.220

No. Part	Qty	Tool	Project	Drawing	Dimensions	Weight
1	2	436-1116	X		604 X 360	19.0

# Radionička izrada

## Upravljanje zalihama i nabavom



Bajkmont d.o.o.  
Sevete, Svetomatejska 12

Zahtjevnica 2002000115

Projekt: 766-1117

Objekt:

Kupac:

Sevete, 26.2.2020.

Modules									
Nomenclature	List of Parts	Assembly List	Phases	Pre-provisioning	Bars	Nesting	Stock	Production	Delivery
Documents	New	Copy	Price request	Manual Entry	Properties	Paste	Enter Quote	Order	Delivery
Delete	Print	Order	Input						

Article	Grade	Length	Width	Qty in Stock	Qty Reserved	Qty Available	Minimum Qty	Qty Ordered	Qty Requested
HEA120	S355J2+N	1,950		1		1			
HEA120	S355J2								
864_160		580		1		1			
864_163		580		1		1			
240_29		610		1		1			
261_21		690		1		1			
240_26		770		1		1			
240_30		810		2		2			
886_2		1,020		1		1			
886_3		1,040		1		1			
240_31		1,150		1		1			
886_4		1,720		1		1			
261_24		1,820		2		2			
865_19		2,130		1		1			
865_16		2,140		1		1			
865_17		2,140		1		1			
865_18		2,150		1		1			
HEA120	S235JR	6,000		5		5			
847_29		510		1		1			
843_3		750		1		1			
		780		1		1			
		830		1		1			
		880		1		1			
		960		1		1			
343_23		970		1		1			
843_7		1,790		2		2			
622_9		2,000		1		1			
		2,230		2		2			
622_10		2,260		1		1			
843_4		2,830		1		1			
		3,030		1		1			
		6,000							
		15,000							

Warehouse	Storage Area	Quantity	Weight	Surface	Sheet number	Contract	Cast Number
HEA120 - S355J2 - 2140		1	42,56	1,45			

Rb	Šifra	Naziv artikla	Kvaliteta	Dimenzije	Količina	Težina	Ukupna težina
1		LIM3	S235JR	6.000x1.500 mm	6	211,95 kg	1.271,70 kg
1		LIM10	S235JR	6.000x2.000 mm	1	942,00 kg	942,00 kg
2		LIM15	S235JR	6.000x2.000 mm	1	1.413,00 kg	1.413,00 kg
1		LIM25	S235JR	3.000x2.000 mm	1	1.177,50 kg	1.177,50 kg
1		FI30	S235JR	6.000 mm	10	33,29 kg	332,93 kg
2		FL50*10	S235JR	6.000 mm	1	23,58 kg	23,58 kg
3		FL60*5	S235JR	6.000 mm	4	14,16 kg	56,64 kg
4		FL90*10	S235JR	6.000 mm	1	42,42 kg	42,42 kg
5		HEA180	S235JR	12.000 mm	3	426,24 kg	1.278,72 kg
6		HEA180	S235JR	12.800 mm	3	454,66 kg	1.363,97 kg
7		HEA300	S235JR	12.000 mm	10	1.059,96 kg	10.599,60 kg
8		IPE160	S235JR	12.000 mm	15	189,26 kg	2.838,90 kg
9		IPE160	S235JR	13.500 mm	5	212,92 kg	1.064,59 kg
10		IPE450	S235JR	9.280 mm	6	719,89 kg	4.319,34 kg
11		L50*50*5	S235JR	6.000 mm	16	22,62 kg	361,92 kg
12		L60*60*5	S235JR	6.000 mm	6	27,42 kg	164,52 kg
13		L70*70*7	S235JR	12.000 mm	16	88,56 kg	1.416,96 kg
14		RHS50*30*3	S235JR	6.000 mm	6	20,91 kg	125,47 kg
15		SHS100*4	S235JR	12.000 mm	21	144,72 kg	3.039,12 kg
16		SHS30*3	S235JR	6.000 mm	6	15,26 kg	91,56 kg

31.924,44 kg



Građevinski fakultet Sveučilišta u Zagrebu - Zagreb, 13.03.2020.

Tečaj stručnog usavršavanja: **Izvedba i nadzor čeličnih konstrukcija prema HRN EN 1090-1/-2**



**Voditelj:** izv.prof.dr.sc. Davor Skejčić

30



# Radionička izrada

- Barkodiranje, skeniranje i direktni feedback umreženih strojeva

		S																																	
		Z																																	
		A																																	
Contract : <b>436-1116</b>																																			
Description : <b>HOTEL PARK</b>																																			
Phase :		Job :																																	
Drawing : <b>B</b>	Grade : <b>S355J2</b>																																		
Description : <b>A.05.01.03 Dilatacija 2 - Zatvoreni prostor un</b>																																			
Mark :	<b>PBG/16 IPE600 / 10483 mm</b>																																		
Master Part : <b>PB_54</b>																																			
Description :	<table border="1"> <tr><td>PB_11</td><td>LM15</td><td>6</td></tr> <tr><td>PB_2</td><td>IPEA450</td><td>2</td></tr> <tr><td>PB_23</td><td>LM12</td><td>4</td></tr> <tr><td>PB_3</td><td>IPEA450</td><td>2</td></tr> <tr><td>PB_31</td><td>LM12</td><td>3</td></tr> <tr><td>PB_38</td><td>LM12</td><td>1</td></tr> <tr><td>PB_49</td><td>IPE600</td><td>2</td></tr> <tr><td>PB_50</td><td>IPE600</td><td>2</td></tr> <tr><td>PB_59</td><td>IPE600</td><td>1</td></tr> <tr><td>PB_61</td><td>IPE600</td><td>1</td></tr> <tr><td>PB_65</td><td>LM25</td><td>4</td></tr> </table>		PB_11	LM15	6	PB_2	IPEA450	2	PB_23	LM12	4	PB_3	IPEA450	2	PB_31	LM12	3	PB_38	LM12	1	PB_49	IPE600	2	PB_50	IPE600	2	PB_59	IPE600	1	PB_61	IPE600	1	PB_65	LM25	4
PB_11	LM15	6																																	
PB_2	IPEA450	2																																	
PB_23	LM12	4																																	
PB_3	IPEA450	2																																	
PB_31	LM12	3																																	
PB_38	LM12	1																																	
PB_49	IPE600	2																																	
PB_50	IPE600	2																																	
PB_59	IPE600	1																																	
PB_61	IPE600	1																																	
PB_65	LM25	4																																	
Comment 1 :																																			
Quantity : <b>1</b>																																			
Weight : <b>2.088,40 kg</b>																																			
Coating :																																			
																																			
<b>436-1116/B/PBG/16/IPE600 / 10483 mm</b> <b>A.05.01.03 Dilatacija 2 - Zatvoreni prostor unutarnjeg bazena</b>																																			




Građevinski fakultet Sveučilišta u Zagrebu - Zagreb, 13.03.2020.

Tečaj stručnog usavršavanja: **Izvedba i nadzor čeličnih konstrukcija prema HRN EN 1090-1/-2**

**Voditelj:** izv.prof.dr.sc. Davor Skejić

# Radionička izrada

- Sustav automatski ispunjuje zahtjeve za sljedivost (5.2)

		QRE_635-0918_12030001_R0_MARKING TRANSFER					Datum / Date:	
		LISTA PRIJENOSA OZNAKA					03.01.19.	
Projekt / Project :		Naziv dijela / Building:		Naručitelj / Customer:		Ugovor br. / Contract no. :		Radni nalog / Works no.:
TTTF		STEEL STRUCTURE - ITEM 3						635-0918
Part	Quantity	Nesting No.	Length	Width	Thickness	Grade	Heat Number	Certificate No.
TTF_M3-D_215A	1	4697_1	941	220	LIM20	S355J2	77492	0082740818
TTF_M3-D247	4	4657_3	83	40	LIM6	S500MC	613609	1002060502
TTF-M3-D-1	2	1278-1	3,541		HEA100	S355J2+AR	101892C	8338 2018
TTF-M3-D-1	1	1278-2	3,541		HEA100	S275JR	101930A	8213 2018
TTF-M3-D-10	1	1278-10	141		HEA100	S355J2	101892C	8338-2018
TTF-M3-D-100	1	1278-31	2,288		HEA300	S355J2	30483A	3131 2018
TTF-M3-D-102	1	1278-31	343		HEA300	S355J2	30483A	3131 2018
TTF-M3-D-103	1	1278-30	342		HEA300	S355J2	30483A	3131 2018
TTF-M3-D-103	1	1278-35	342		HEA300	S355J2	30483A	3131 2018
TTF-M3-D-104	1	1278-22	11,429		HEA240	S275JR	60575	3846991



# Radionička izrada

- Sustav omogućuje stalni uvid u status izvođenja projekta

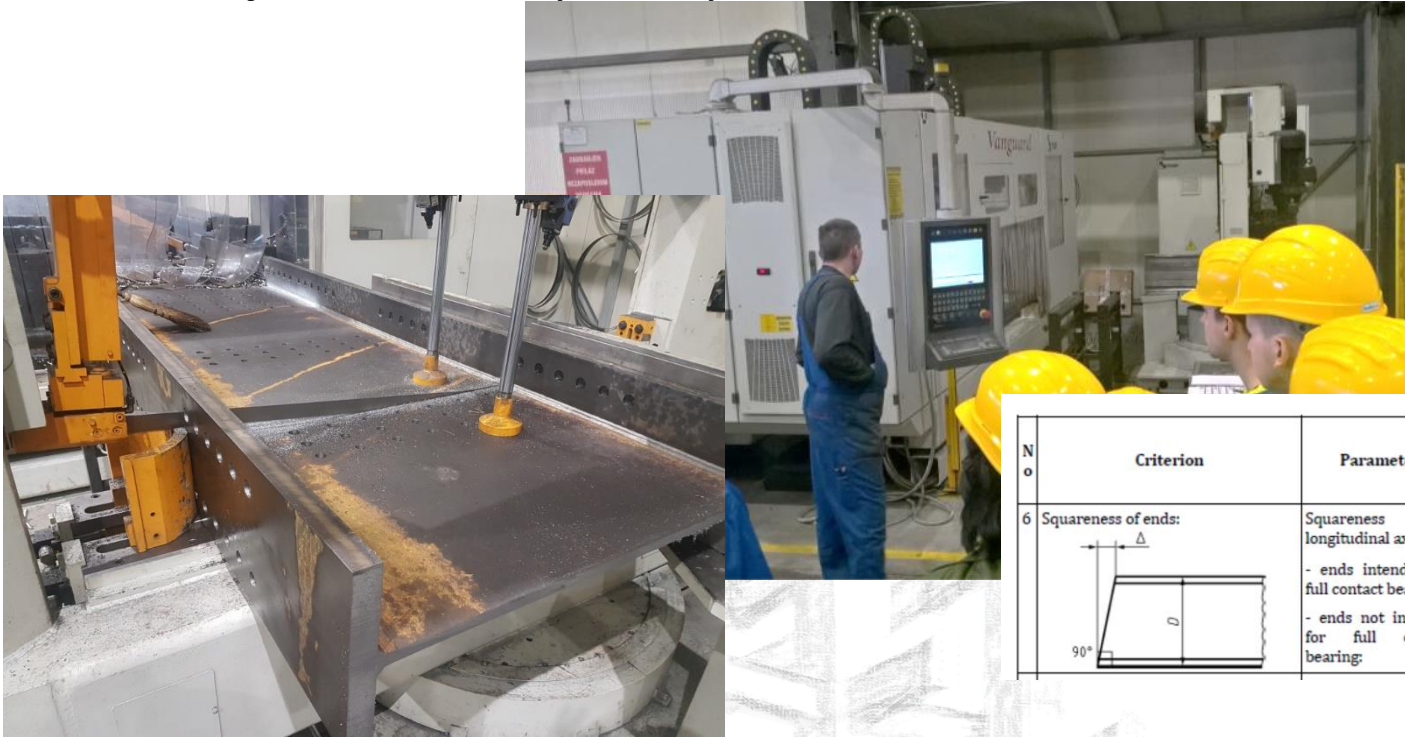
Drawing	Mark	Part	Description	Quantity	Project
1			ISPORUKA 3.10.2017		
2			ISPORUKA 22.1.2018		
3			ISPORUKA 19.4.2018		
4		3			

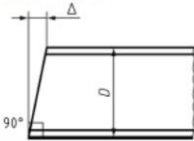
  

	Part preparation	Assembly	Welding	Internal	Coating	Shipment
Quantity (181)	100.0% (1177)	100.0% (92)	100.0% (97)	100.0% (181)	10.0% (189)	25.0% (52)
Weight (2.181)	100.0% (2.181)	100.0% (2.079)	100.0% (2.039)	100.0% (2.181)	6.5% (142)	2.2% (49)
Forecast Time (9:00)	0:00	0:00	0:00	0:00	0:00	0:00
Real Time (0:00)	0:00	0:00	0:00	0:00	0:00	0:00

# Radionička izrada

## ■ Izrezivanje i izrada rupa na profilima



No	Criterion	Parameter	Functional tolerances <sup>a</sup> Permitted deviation $\Delta$	
			Class 1	Class 2
6	Squareness of ends: 	Squareness to longitudinal axis: - ends intended for full contact bearing: - ends not intended for full contact bearing:	$\Delta = \pm D/1000$ $\Delta = \pm D/100$	$\Delta = \pm D/1000$ $\Delta = \pm D/300$ but $ \Delta  \leq 10 \text{ mm}$

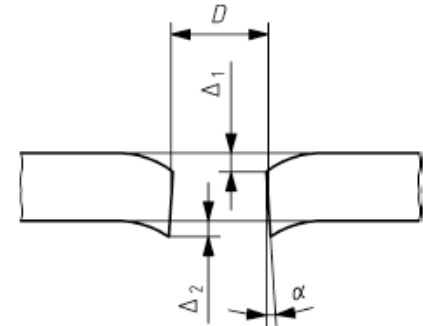
# Radionička izrada

- Izrezivanje limova
- Novi zahtjevi za CPS / CPQR (Dodatak D)



# Radionička izrada

- Izrada rupa na profilima i limovima
- Probijanje vs. bušenje



$$D = \frac{(d_{\max} + d_{\min})}{2}$$

$$\max(\Delta_1 \text{ or } \Delta_2) \leq \max(D/10 ; 2 \text{ mm})$$

$$\alpha \leq 4^\circ \text{ (i.e. 7 \%)}$$



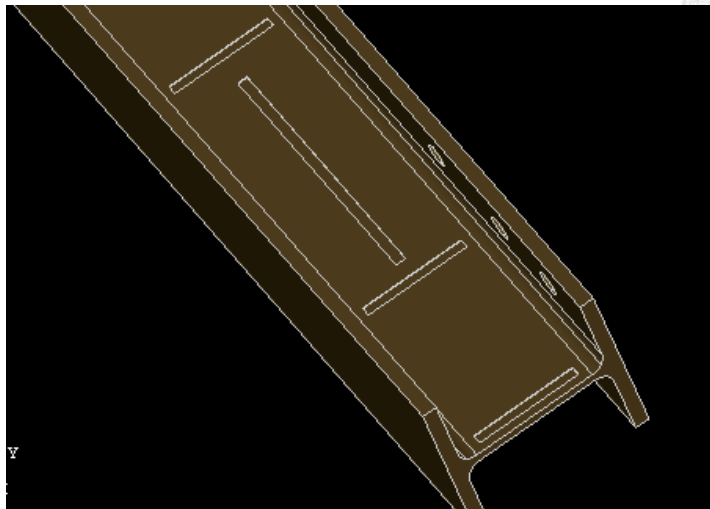
# Radionička izrada

- Sklapanje pozicija u sklopove i dimenzionalna kontrola (12.3)



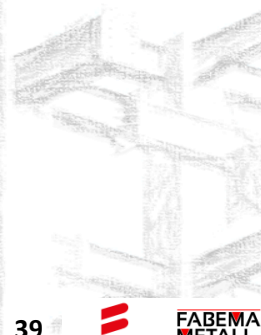
# Radionička izrada

- Automatsko markiranje omogućava da se podatak o položaju ugradnje pozicije u sklopu direktno iz BIM 3d modela prenese na CNC stroj – te stroj taj položaj markira što znatno ubrzava potrebno vrijeme izrade, te gotovo eliminira mogućnost ljudske pogreške



# Radionička izrada

- Sklapanje sklopova kompleksne geometrije





# Radionička izrada

- Sklapanje sklopova kompleksne geometrije je isto tako znatno olakšano uslijed dostupnosti BIM modela na shop flooru





# Radionička izrada

## ■ Predmontaža (6.10)



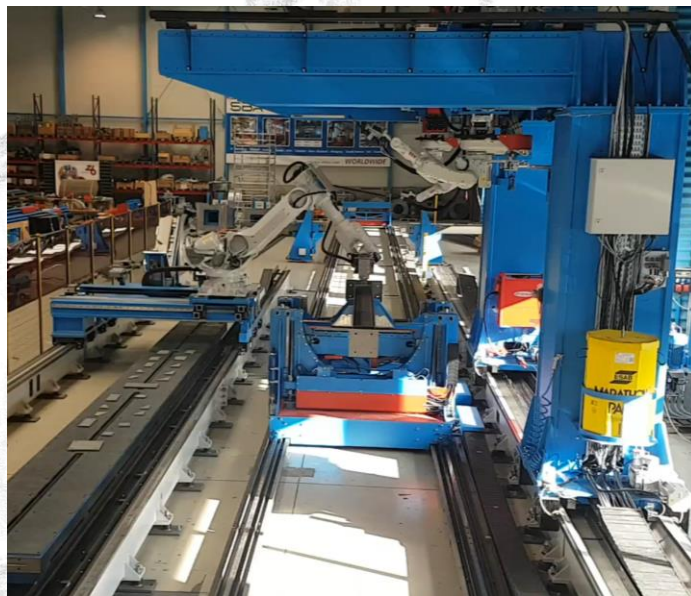
# Radionička izrada

- Specijalni proces zavarivanje predstavlja najsloženiji dio izrade komponenti čelične konstrukcije
- U najvećem dijelu se i dalje izvodi ručno, a kod većih serija robotima



# Radionička izrada

- u narednom periodu očekuju se veliki iskoraci u robotizaciji procesa izrade koja se trenutno koristi pretežito isključivo u proizvodnji većih serija elemenata zbog složenosti programiranja





# Radionička izrada

## ■ Kontrola zavarivanja – odabir razreda ispitivanja zavara (Dodatak L )

Table L.1 — Guidance on a method for selection of weld inspection class

Level of fatigue utilization <sup>a</sup>	Consequences from failure of joint or component <sup>c</sup>	Stress in weld <sup>b</sup>	Weld Inspection Class (WIC)
<b>High</b> fatigue utilization	Substantial <sup>b</sup>	Welds with the direction of dynamic principal stress transverse to the weld (between 45° and 135°)	WIC5
		Welds with the direction of dynamic principal stress in the direction of the weld (between -45° and +45°)	WIC4
	Not substantial <sup>c</sup>	Welds with the direction of dynamic principal stress transverse to the weld (between 45° and 135°)	WIC3
		Welds with the direction of dynamic principal stress in the direction of the weld (between -45° and +45°)	WIC2
No fatigue (i.e. quasi-static) or <b>Low</b> fatigue utilization	Substantial <sup>b</sup>	Welds with high <sup>d</sup> tensile stresses transverse to weld	WIC5
		Welds with low tensile stresses transverse to weld and/or high <sup>d</sup> shear stresses	WIC4
	Not substantial <sup>c</sup>	For welds in EXC3 or EXC4 with high <sup>d</sup> tensile stresses transverse to weld	WIC3
		All other load-bearing welds except welds in EXC1	WIC2
		Welds in EXC1 and non-load-bearing welds	WIC1

Table L.2 — Percent extent of supplementary testing according to WIC

Weld Inspection Class (WIC)	Type of joint	RT	UT	MT/PT
WIC2	Full penetration in-line butt weld	0	10	10
	Full penetration T-butt weld	0	10	10
	Partial penetration welds with penetration depth greater than 12 mm	0	5	5
	Other partial penetration welds and all fillet welds	0	0	5



# Radionička izrada

- Antikorozivna zaštita elemenata čelične konstrukcije se može izvesti vrućim pocinčavanjem ili premazivanjem zaštitnim premazima
- EN 12944-5:2018 izmjene u definicijama trajnosti (VH > 25 g.)

Durability		Low (l)			Medium (m)			High (h)			Very high (vh)		
Type of primer		Zn (R)	Misc.		Zn (R)	Misc.		Zn (R)	Misc.		Zn (R)	Misc.	
Binder base of primer		ESI, EP, PUR	EP, PUR, ESI	AK, AY	ESI, EP, PUR	EP, PUR, ESI	AK, AY	ESI, EP, PUR	EP, PUR, ESI	AK, AY	ESI, EP, PUR	EP, PUR, ESI	AK, AY
Binder base of subsequent coats		EP, PUR, AY	EP, PUR, AY	AK, AY	EP, PUR, AY	EP, PUR, AY	AK, AY	EP, PUR, AY	EP, PUR, AY	AK, AY	EP, PUR, AY	EP, PUR, AY	AK, AY
C2	MNOC	a			—	—	1	1	1	1	2	2	2
	NDFT				—	—	100	60	120	160	160	180	200
C3	MNOC	—	—	1	1	1	1	2	2	2	2	2	2
	NDFT	—	—	100	60	120	160	160	180	200	200	240	260
C4	MNOC	1	1	1	2	2	2	2	2	2	3	2	—
	NDFT	60	120	160	160	180	200	200	240	260	260	300	—
C5	MNOC	2	2	—	2	2	—	3	2	—	3	3	—
	NDFT	160	180	—	200	240	—	260	300	—	320	360	—

# Radionička izrada

- Priprema površina prije izvođenja antikorozivne zaštite premazima (10.2)

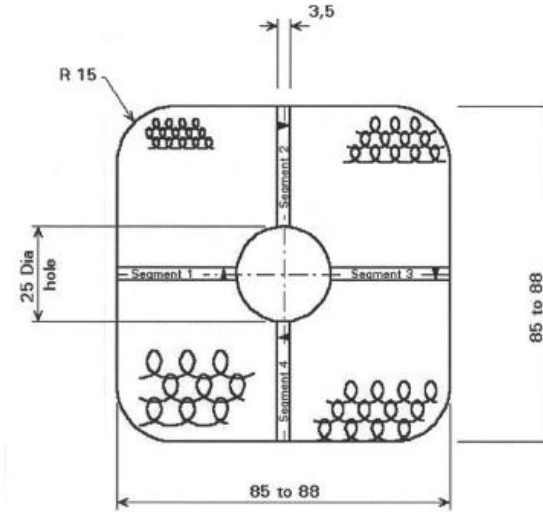


Type of imperfection		Preparation grades		
Description	Illustration	P1	P2	P3
<b>1 Welds</b>				
1.1 Welding spatter	<p>a) b) c)</p>	Surface shall be free of all loose welding spatter [see a)]	Surface shall be free of all loose and tightly adhering welding spatter (see a) and b)] Welding spatter shown in c) may remain	Surface shall be free of all welding spatter
1.2 Weld ripple/profile		No preparation	Surface shall be dressed (e.g. by grinding) to remove irregular and sharp-edged profiles	Surface shall be fully dressed, i.e. smooth

ISO 8501-1  
ISO 8501-3

# Radionička izrada

- Kontrola hrapavosti substrata  
ISO 8503



ISO comparators for steel, blast-cleaned with shot abrasives ISO comparator za čelik, čišćen mlazom sa sačma abrazivom	
Fine (S) Fini	Profiles equal to segment 1 and up to but excluding segment 2 Profilji jednaki segmentu 1 i do segmenta 2, ali isključujući segment 2
Medium (S) Srednji	Profiles equal to segment 2 and up to but excluding segment 3 Profilji jednaki segmentu 2 i do segmenta 3, ali isključujući segment 3
Coarse (S) Grubi	Profiles equal to segment 3 and up to but excluding segment 4 Profilji jednaki segmentu 3 i do segmenta 4, ali isključujući segment 4

# Radionička izrada

- Nanošenje zaštitnih premaza





# Radionička izrada

- Proizvodnja komponenti čelične konstrukcije se izvodi u pogonu sa uspostavljenim sustavom tvorničke kontrole proizvodnje (FPC) sukladno HRN EN 1090-1 za izradu sukladno HRN EN 1090-2
- Tijekom inicijalne kontrole tvornice i FPC-a, prijavljeno tijelo (NB) razmatra početno ispitivanje tipa (ITT) i/ili početno ispitivanje proračuna (ITC) (6.2 EN 1090-1)

Komponente čeličnih konstrukcija prema specifikaciji kupca i broju narudžbe povezane ugovornim dokumentima

*Structural steel components according to customer specification and order number associated contract documents*

Komponente se mogu koristiti izravno ugrađene u konstrukcije ili u spregnute konstrukcije koje se sastoje od čelika i betona. Komponente mogu biti izrađene od vruće ili hladno valjanih materijala ili od građevinskih materijala izrađenih drugim proizvodnim procesima. Mogu biti izrađene od čelika kvadratnog / pravokutnog presjeka, profila različitih oblika, od plosnatih, cjevastih, lijevanih ili kovanih komada. Komponente mogu biti nezaštićene ili zaštićene od korozije premazivanjem ili drugim površinskim tretmanom.

The components can be used either directly built into structures or in composite structures comprised of steel and concrete. The components can be manufactured from hot-rolled or cold-formed or by other technologies produced construction materials. They can be made of steel of cross sections / profiles of different shapes, from flat stock, tubular, cast or forged pieces. They can be unprotected or protected against corrosion by coating or other means of surface treatment.

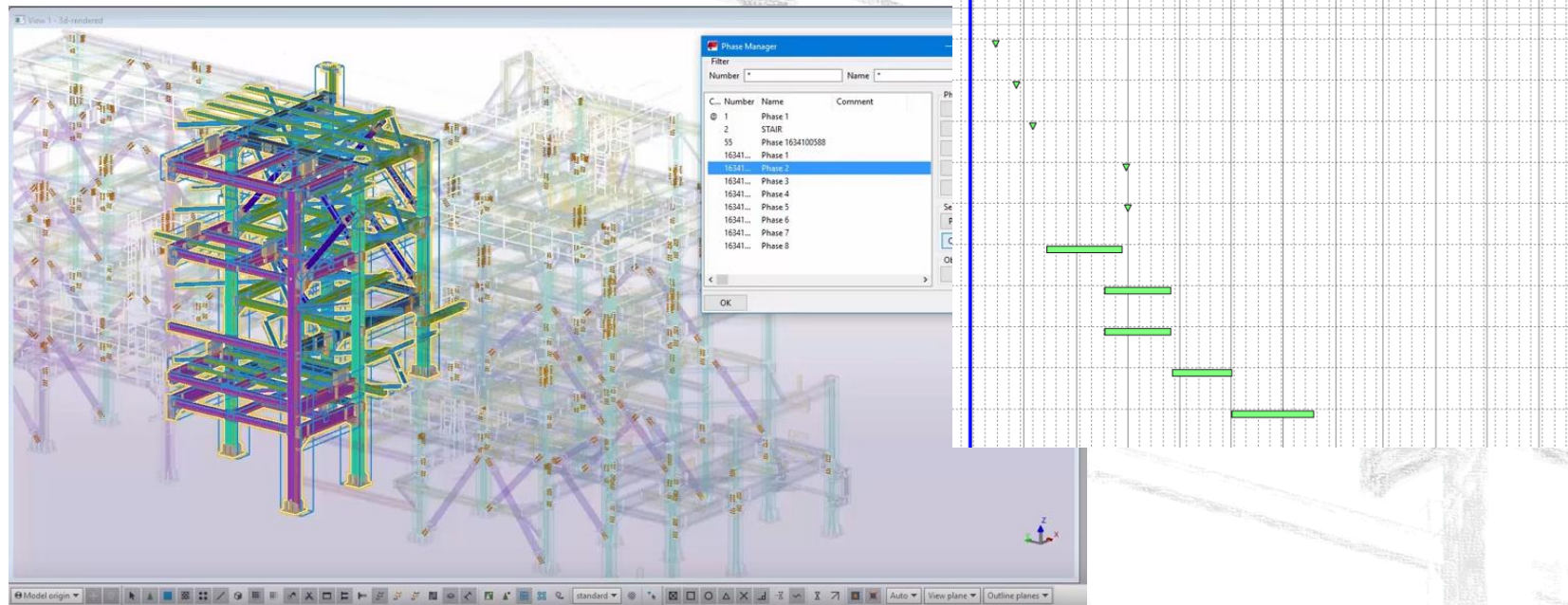
- Proizvedene komponente čelične konstrukcije se na tržište isporučuju sa CE oznakom i Izjavom o svojstvima (DoP)

	
<b>EN1090-1</b> <b>0045-CPR-1090-1.00249.TÜVNORD.2013.003</b>	
<b>"BAJKMONT d.o.o."</b> Svetomatejska 12 , 10360 Sesvete , Croatia	
<b>13</b>	
<b>Auftragsnummer / Job number: 044-0117</b>	
<b>EN 1090-1:2009+A1:2011</b>	
<p>Die Komponenten können entweder direkt in Strukturen oder in Verbundstrukturen aus Stahl und Beton eingebaut werden. Die Komponenten können aus warmgewalztem oder kaltgeformtem oder aus anderen hergestellten Werkstoffen hergestellt werden. Sie können aus Stahl von Querschnitten / Profilen unterschiedlicher Formen hergestellt werden, aus Flach-, Rohr-, Guss- oder Schmiedeteilen. Sie können ungeschützt oder durch Korrosion durch Beschichtung oder durch eine Oberflächenbehandlung geschützt werden.</p> <p>The components can be used either directly built into structures or in composite structures comprised of steel and concrete. The components can be manufactured from hot-rolled or cold-formed or by other technologies produced construction materials. They can be made of steel of cross sections / profiles of different shapes, from flat stock, tubular, cast or forged pieces. They can be unprotected or protected against corrosion by coating or by a surface treatment.</p>	
<b>Verwandte Leistungen siehe Leistungserklärung Nr. :</b> Related performances see declaration of performance No. :	<b>1713-BM-KRKNOSE</b>

[illegible]

# Radionička izrada

- Planiranje isporuka u BIM modelu – u skladu sa planom izvođenja radova na gradilištu





# Radionička izrada

## Planiranje isporuka u ERP sustavu

Nomenclature

List of Parts

Assembly List

Phases

Pre-provisioning

Bars

Nesting

Stock

Production

Delivery

Documents

New

Properties

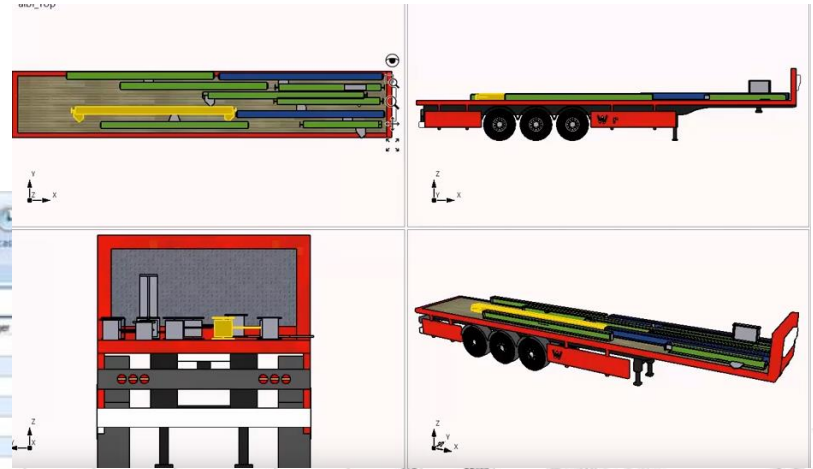
Forecast

Delete

Print

Edit

Contracts		436-1116 x			
Drawing	Mark	Part	Description	Quantity	Project Manager
	PCG/367			1	
	PCG/368			1	
	PCG/369			1	
	PCG/370			1	
	PCG/371			1	
	PCG/372			1	
	PCG/373			3	
	PCG/374			2	
	PCG/375			1	
	PCG/376			1	
	PCG/377			1	
	PCG/378			1	
		PC_448	HEAA1000 S35532 L-468		
		PC_493	HEAA1000 S35532 311		
		PC_525	HEAA1000 S35532 L-468		
		PC_1032	Part preparation Drilling	6,198	
		Quantity (1)	0.0% (0)	0.0% (0)	6,198
		Weight (2,040)	0.0% (0)	0.0% (0)	
		PC_1183	LPM10 S35532 404 260		
		PC_1184	LPM10 S35532 590 404		
		PC_1178	LPM10 S35532 225 203		
		PC_1179	LPM10 S35532 343 225		
		PC_1180	LPM10 S35532 225 170		





# Radionička izrada

- Pravilno pakiranje i transport (F.1.4)



# Zaključak i rasprava

- Pitanja, komentari?

