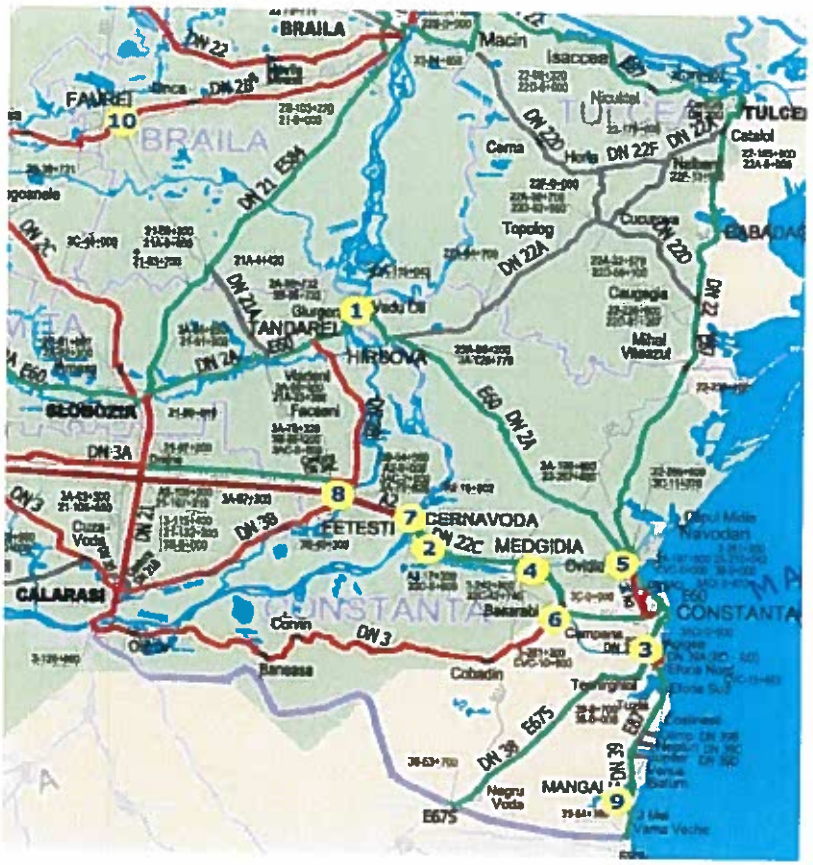
RNCMNR – ROMANIAN NATIONAL COMPANY OF MOTORWAYS AND NATIONAL ROADS

CONSULTING SERVICES FOR DESIGN AND WORKS SUPERVISION OF 10 BRIDGES IN DOBROGEA AREA



TECHNICAL DESIGN

Volumes series 1 - General Documents

Volume 1.1 – General Report – Works Description

August 2008

Louis Berger Group, Inc.

Issue
Status:

Issue	Status	Date
01	For Review	August 2008

DESIGNER/ PROIECTANT
LOUIS BERGER Group Inc.

DESIGN TEAM LEADER
Vittorio Ascoli Marchetti

CONSULTANTS
SOLIDUS srl
Francesco Del Tosto
Romano Tucci

INDEX

1 - SUMMARY.....2
2 - BRIDGE DN2A GIURGENI (B01).....3
3 - BRIDGE DN22C CERNAVODA (B02).....6
4 - BRIDGE DN39 AGIGEA (B03).....9
5 - BRIDGE DN22C PORTA ALBA (B04).....11
6 - BRIDGE DN2A OVIDIU (B05).....13
7 - BRIDGE DN3 BASARABI (B06).....15
8 - BRIDGE A2 CERNAVODA (B07).....17
9 - BRIDGE A2 BORCEA (B08).....19
10 - BRIDGE DN39 MANGALIA (B09).....21
11 - BRIDGE DN2B GAISEAN (B10).....23
12 - DETERIORATIONS.....25
13 - TESTING OPERATIONS.....40
14 - INTERVENTIONS.....50
15 - CONSTRUCTION SCHEMES.....83

IVANESCU T. TOMA
ROMANIA
MLPAT DCLP
NR. 445
A4, B2, D2
INGINER
VERIFICATOR PROIECTE

04-11-2008

1- SUMMARY

The wider objective of this project is to complete maintenance and rehabilitation works on 10 bridges in Dobrogea area, in Romania. Generally speaking, the list of the rehabilitations works refers to:

- Restoring to a former state and/or capacity
- Improving serviceability (structural and/or functional)
- Strengthening

The purpose of this Report is to provide valuable information which can help in better knowing all bridges characteristics, in knowing each type of deterioration, the diagnosis of deterioration executed on the structures by means of non-destructive and dynamics tests and in understanding the designed solutions to rehabilitation.

The bridges and structures included in the projects present various static schemes and configurations. The project includes:

- cable-stayed bridge (bridge 3 in Agigea);
- arch bridges (bridge 4 in Poarta Alba, bridge 5 in Ovidiu and bridge 6 in Basarabi);
- metallic truss bridges (bridge 2 and bridge 7 in Cernavoda, bridge 8 in Borcea);
- precast concrete beam bridge (bridge 9 in Mangalia);
- metallic beam bridge (bridge 1 in Giurgeni).

The rehabilitation and maintenance works included in the Project mainly concern superstructure and bridge deck, with only limited intervention on infrastructure.

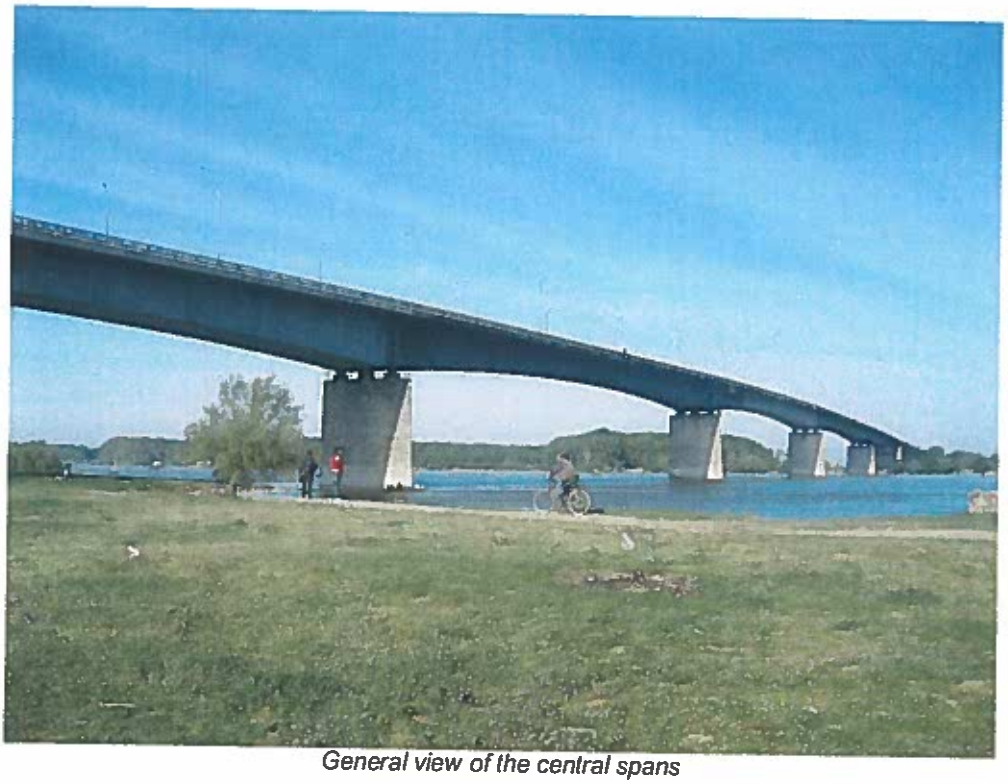
All the designed materials are typological and don't express any kind of preference for any company eventually mentioned.

In the next chapters the main characteristics of all 10 bridges will be described.

IVANESCU T. TOMA
ROMANIA
MLPAT DCLP
NR. 445
A4, B2, D2
INGINER
VERIFICATOR PP

04-11-2008

2 - BRIDGE DN2A GIURGENI (B01)



General view of the central spans

The Bridge is located near Giurgeni, on the DN2A national road which connects Bucharest to Constanta and runs West to East approximately at the km 114. The bridge crosses the Danube River and is a 21 span structure. It is composed by two different parts: the main bridge including 5 spans with a steel box section and the approach ramps together with 16 spans of prestressed concrete beams supported by concrete pier caps.

IVANESCU I. TOMA
ROMANIA MLPAT DGLP
NR. 445
A4, B2, D2
INGINER VERIFICATOR

04-11-2008



General view of prestressed concrete spans

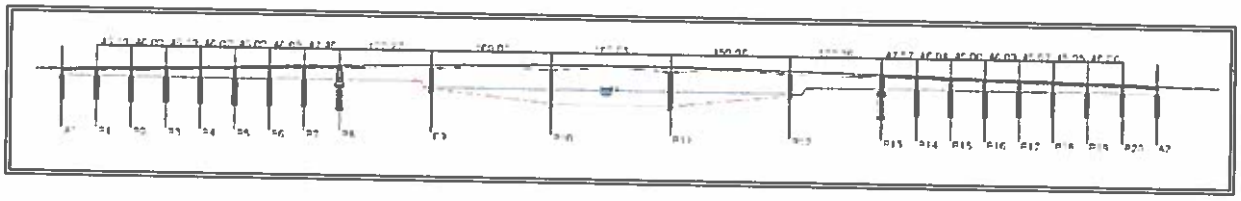
The main characteristics of this bridge are defined as follows:

- Structure typology: prestressed concrete and steel-concrete
- Overhead Length: 1463 m
- Overhead Width: 17.60 m
- Number of spans: 21 (8+5+8)
- Concrete Standard Span Length: 46 m
- Steel Standard Span Length: 122 m and 160 m
- Greater span length: 160 m

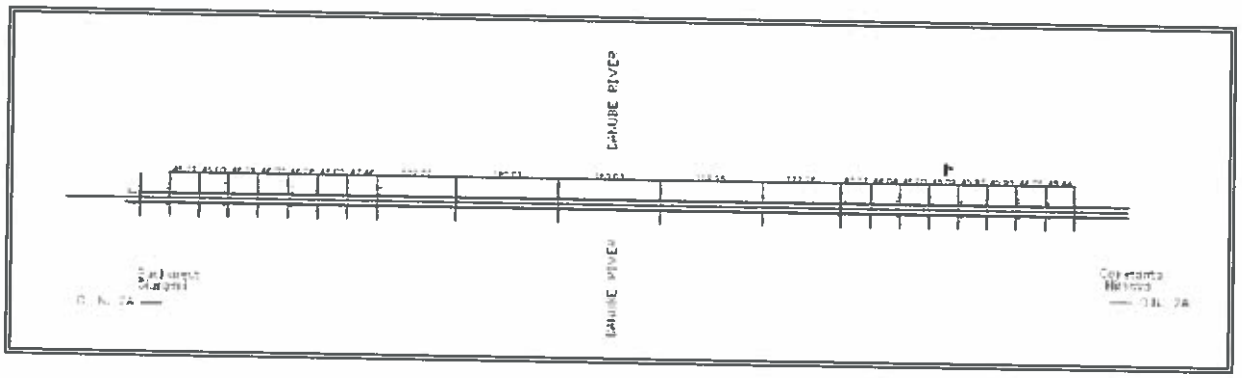
IVANESCU T. TOMA
ROMANIA
MLPAT DCLP
NR. 445
A4, B2, D2
INGINER
VERIFICATOR PROIECTE

04-11-2008

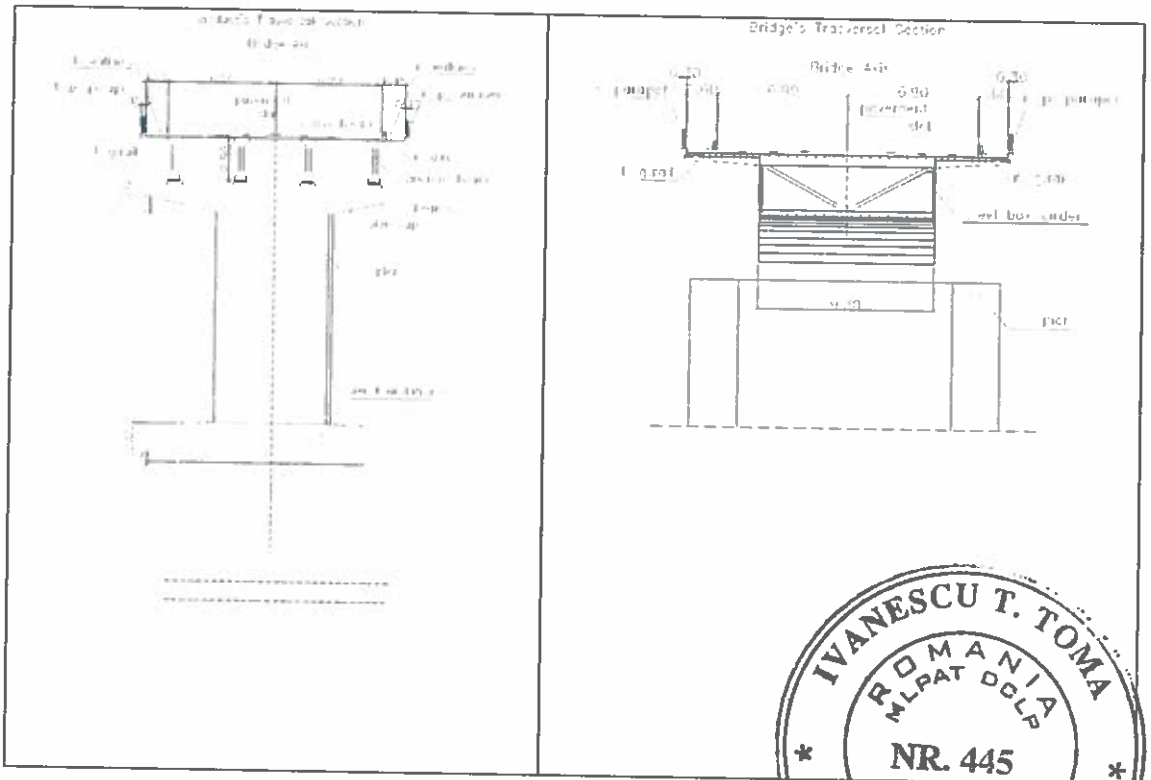
Longitudinal section



Plan



Sections



IVANESCU T. TOMA
ROMANIA
MLPAT DCLP
NR. 445
A4, B2, D2
INGINER
VERIFICATOR PROIECTE
01-11-2008

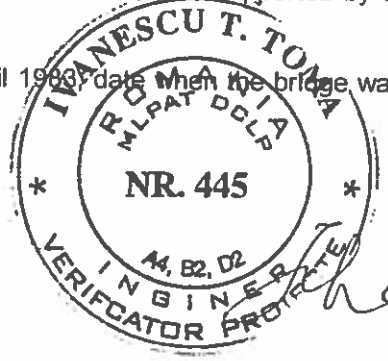
3 - BRIDGE DN22C CERNAVODA (B02)

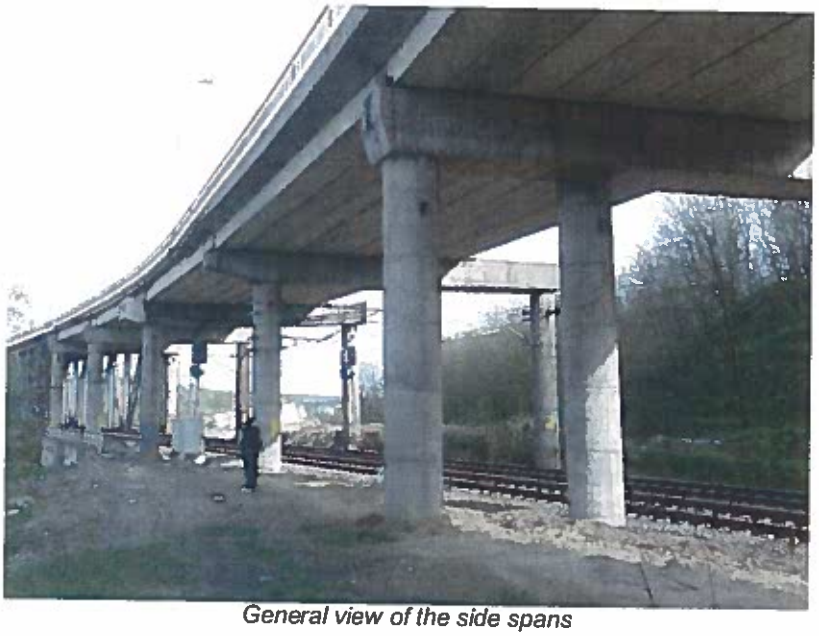


General view of the main bridge

This bridge is located near Cernavoda on the DN22C national road which connects Cernavoda to Constanta approximately at the km 2, over the Danube-Black Sea channel. The bridge runs North-West to South-East, with two lanes per direction and is a 21 span structure composed by two different parts: the main bridge including 4 spans with a metallic truss structure that allows road and rail traffic and the approach ramps together with 17 spans of concrete box beams supported by concrete pier caps.

The works execution period lasted from March 1980 until 1983 date when the bridge was taken over for operation and open for both road and railway traffic.





General view of the side spans

The main characteristics of this bridge are defined as follows:

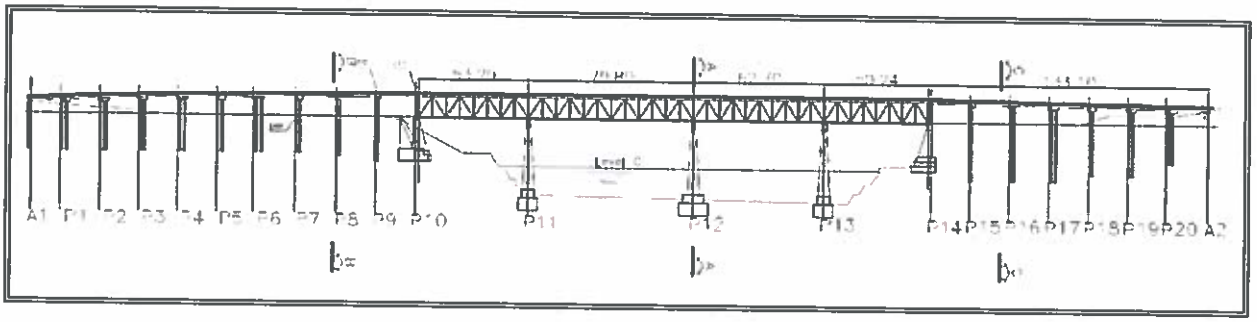
- Structure typology: prestressed concrete and metallic truss
- Overhead Length: 566 m
- Overhead Width: 12.00 m
- Number of spans: 21 (10+4+7)
- Concrete Standard Span Length: 18,00 m
- Greater span length: 79.80 m

For all structures of the access viaducts, the solution adopted consist in indirect (suspended) foundations on D=1,08 m diameter reinforced concrete Benotto piles, placed at the required elevation by drilling.

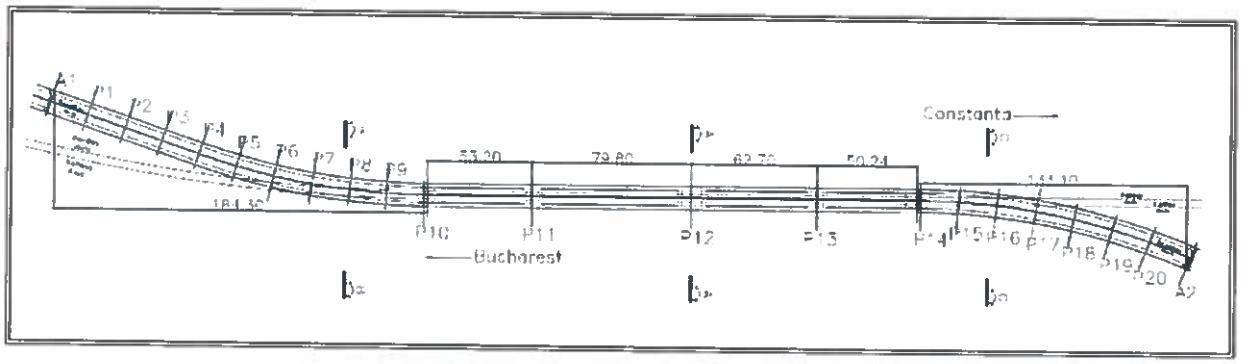
IVANESCU T. TOMA ROMANIA MLPAT DGLP NR. 445 A4, B2, D2 INGINER VERIFICATOR PRO...TE

05-11-2008

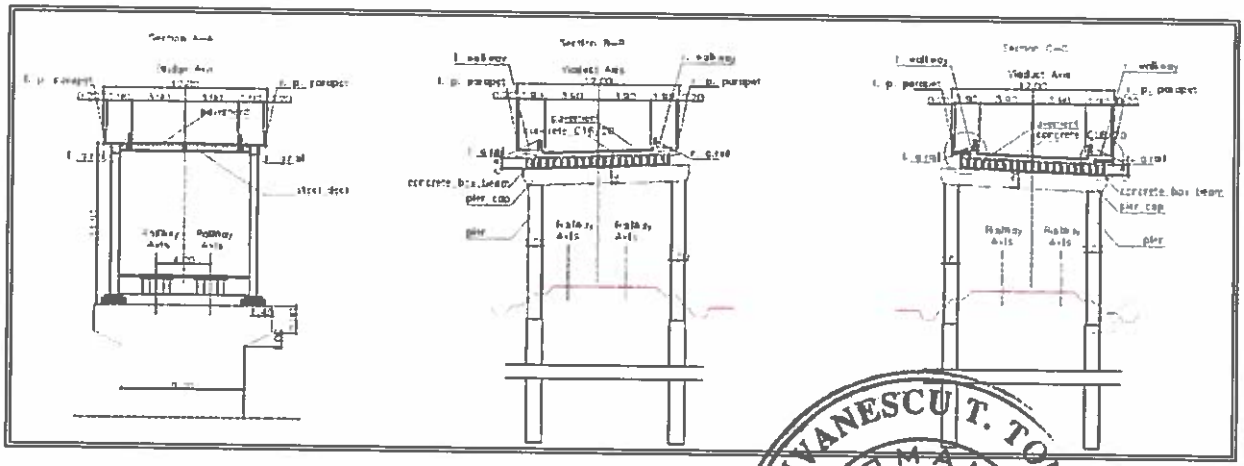
Longitudinal section



Plan



Sections



IVANESCU T. TOMA
ROMANIA
MLPAT DDLP
NR. 445
A1, B2, D2
INGINER
VERIFICATOR
05-11-2008

4 - BRIDGE DN39 AGIGEA (B03)



General view

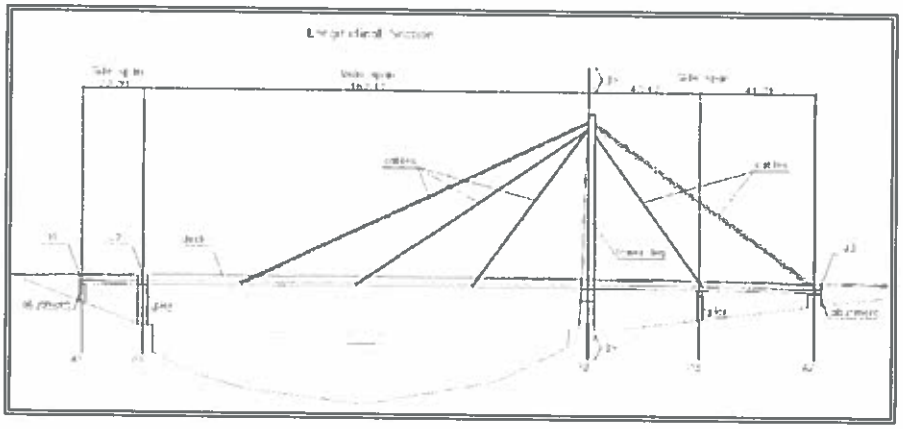
This Bridge is located in *Agigea* on the DN39 national road which connects Constanta to Mangalia and runs North to South approximately at the km 8, over the Danube-Black Sea Channel. This cable-stayed bridge is a 4 span structure with a transversal section composed by steel beams.
The main characteristics of this bridge are defined as follows:

- Structure typology: cable-stayed bridge
- Overhead Length: 266 m
- Overhead Width: 20.90 m
- Number of spans: 4
- Greater span length: 162 m

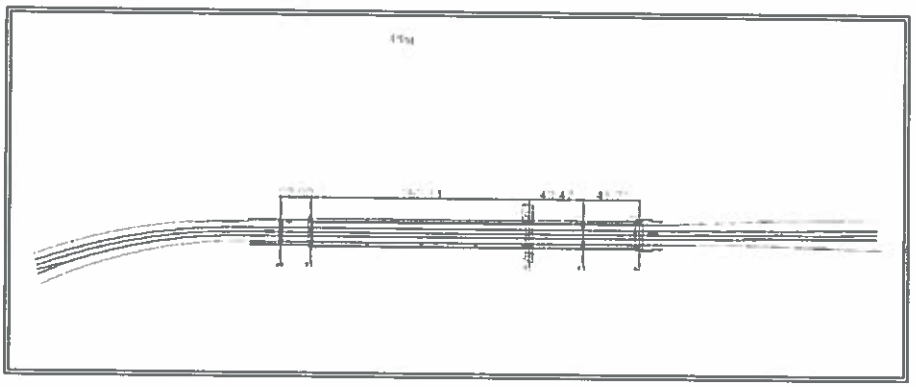
IVANESCU T. TOMA ROMANIA MLPAT DCLP NR. 445 M, B2, D2 INGINER VERIFICATOR PRO...

06-11-2008

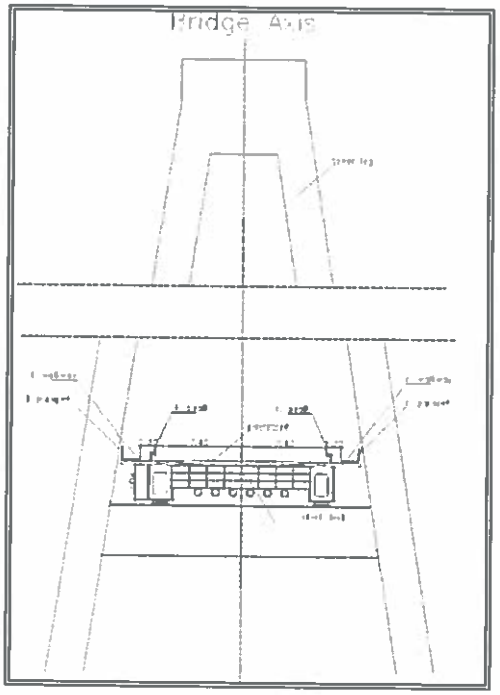
Longitudinal section



Plan



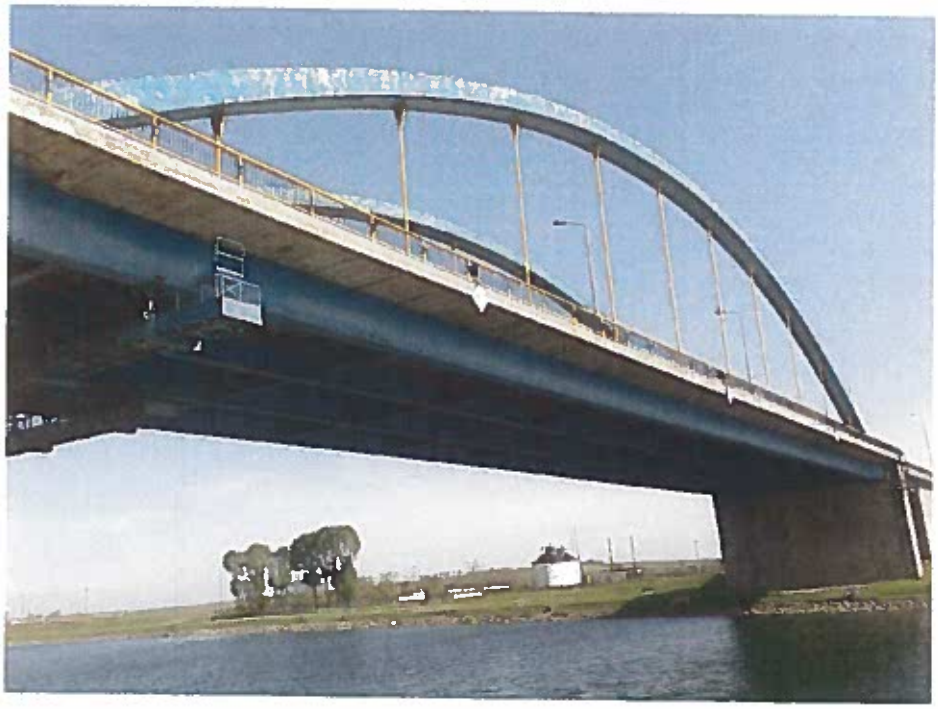
Section



IVANESCU T. TOMA
ROMANIA
MLPAT DCLP
NR. 445
INGINER
VERIFICATOR PROIECTE

06-11-2002

5 - BRIDGE DN22C PORTA ALBA (B04)



General view

This bridge is located near Porta Alba on the DN22C national road which connects Cernavoda to Constanta approximately at the km 38, over the Danube-Black Sea Channel. This bridge runs North to South and is a 3 span structure, which the main span is an arch bridge composed by a steel beams transversal section and the approach ramps are a simple pre-stressed concrete beams bridge.

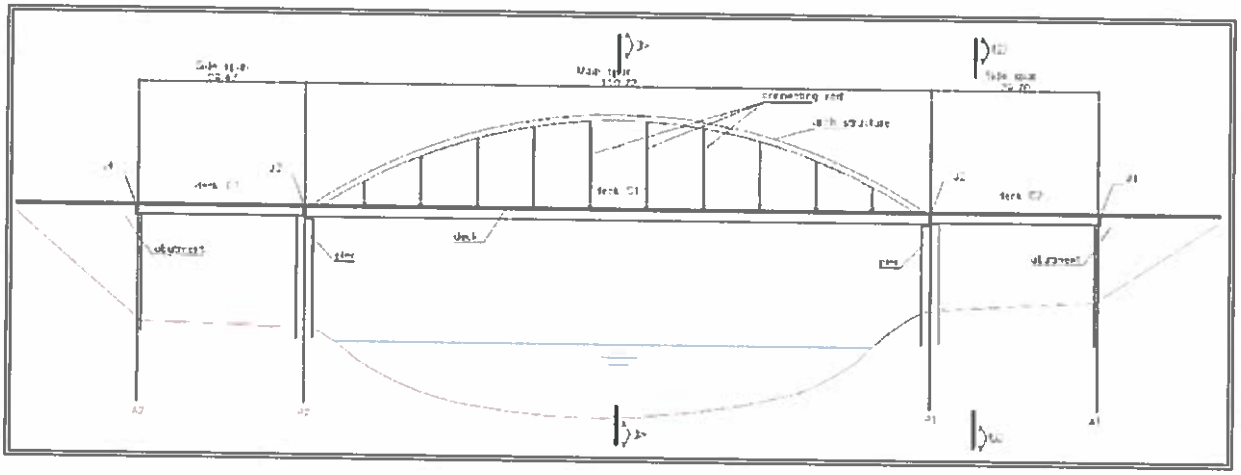
The main characteristics of this bridge are defined as follows:

- Structure typology: Arch bridge, steel - concrete
- Overhead Length: 170 m
- Overhead Width: 22.40 m
- Number of spans: 3
- Greater span length: 111 m

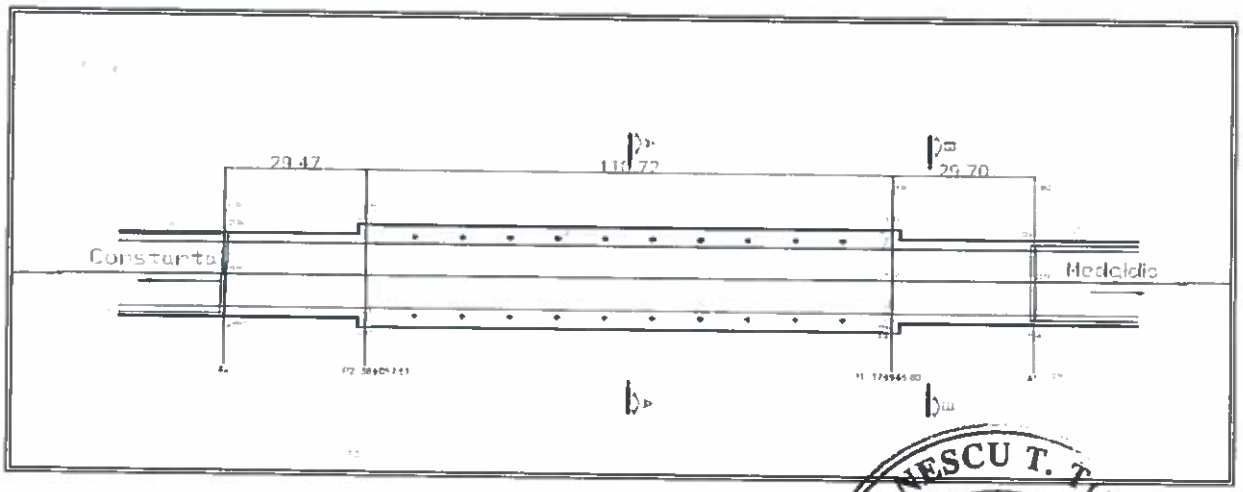
IVANESCU T. TOMA ROMANIA MLPAT DCLP NR. 445 A4, B2, D2 INGINER VERIFICATOR

07-11-2008

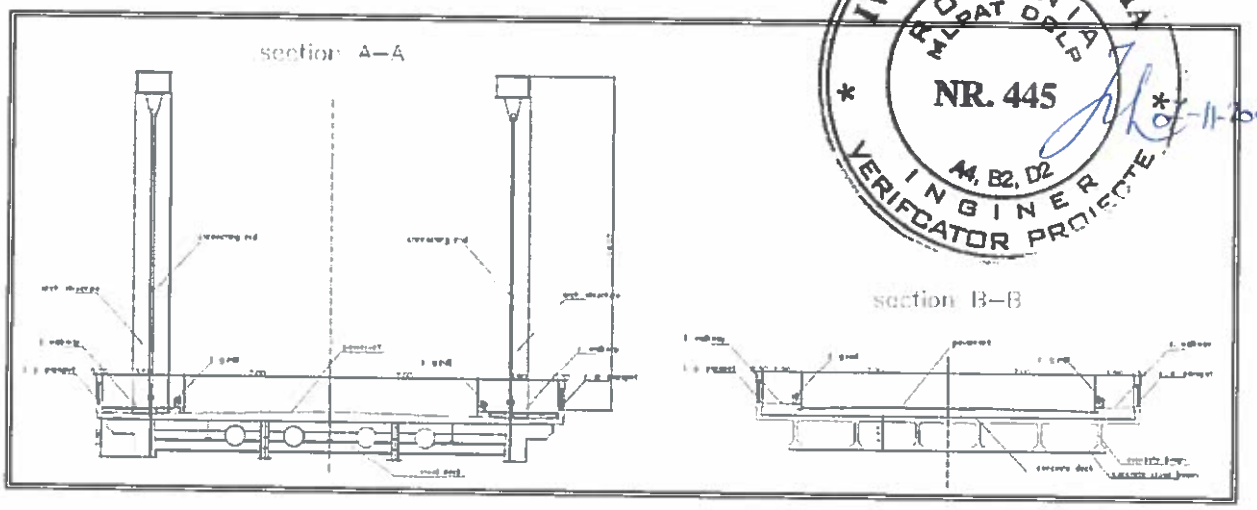
Longitudinal section



Plan

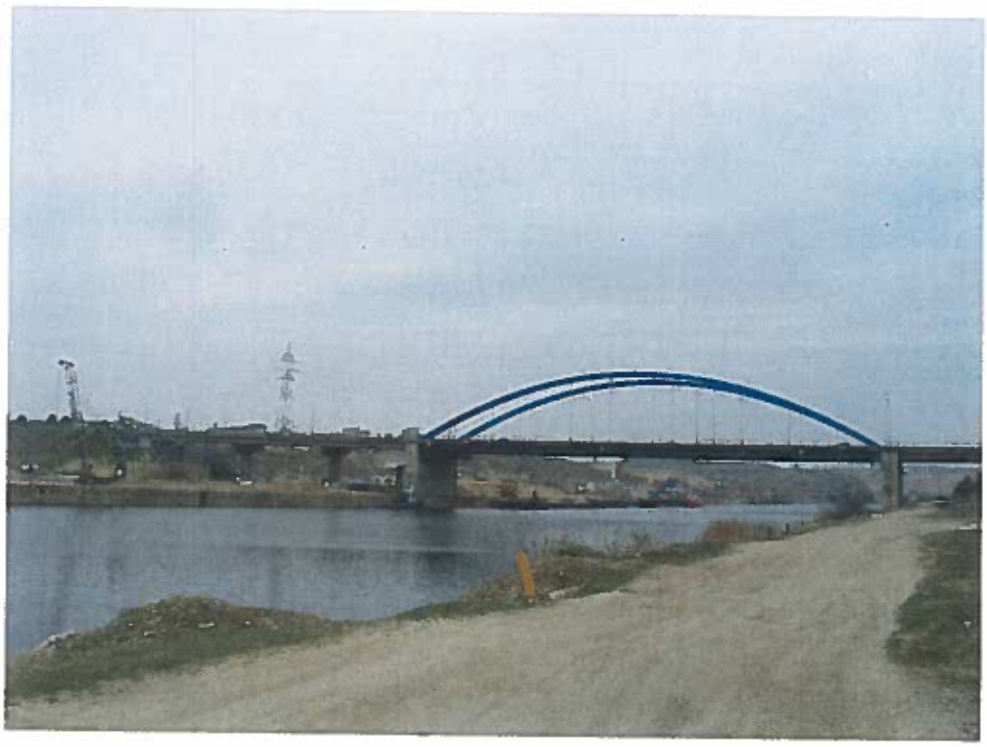


Section



IVANESCU T. TOMA
ROMANIA
NR. 445
A1, B2, D2
INGINER VERIFICATOR PROIECTE
07-11-2008

6 - BRIDGE DN2A OVIDIU (B05)



General view

This bridge is located near Ovidiu on the DN2A national road which connects Harsova to Constanta approximately at the km 196, over the Danube-Black Sea Channel. This bridge runs North to South and is a 6 span structure, which the main span is an arch bridge composed by a steel beams transversal section and the approach ramps are a small continuous span bridge composed by pre-stressed concrete beams.

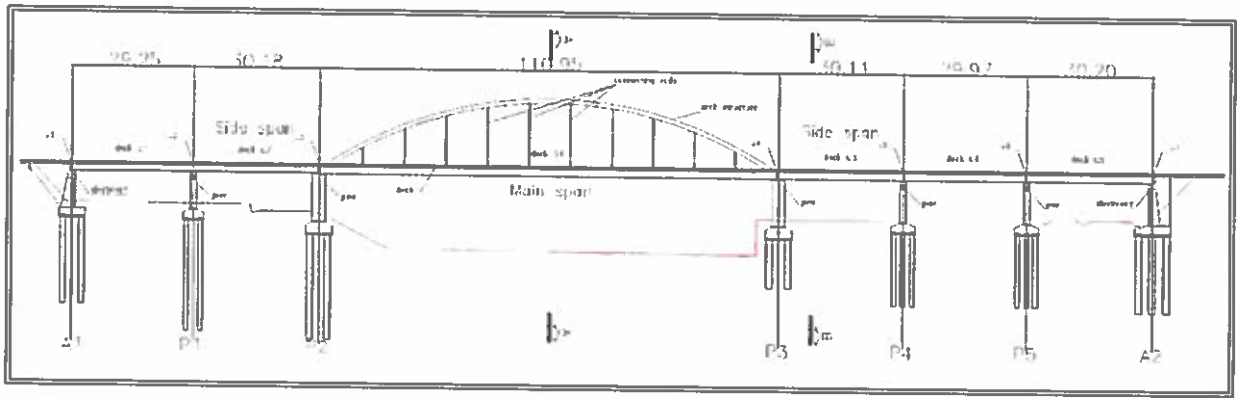
The main characteristics of this bridge are defined as follows:

- Structure typology: Arch bridge, steel - concrete
- Overhead Length: 261 m
- Overhead Width: 22.30 m
- Number of spans: 6(2+1+3)
- Standard Concrete Span Length: 30 m
- Greater span length: 111 m

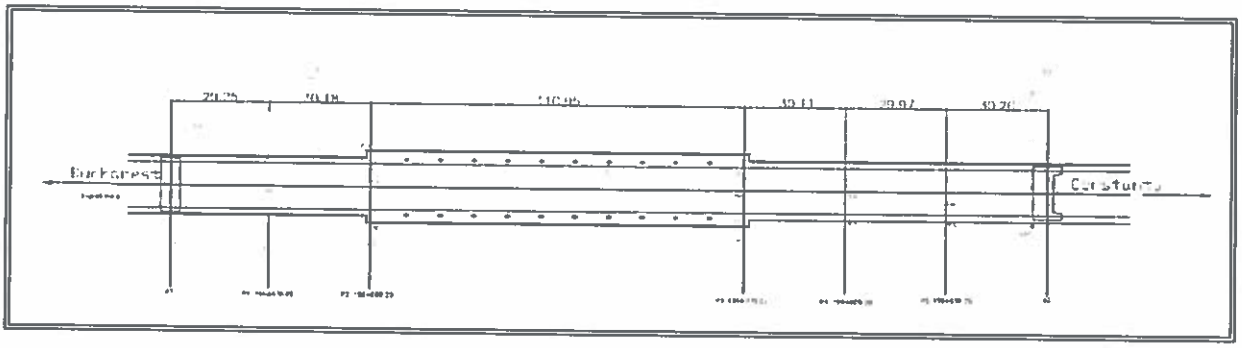
IVANESCU T. TOMA ROMANIA MLPAT DCLP NR. 445 A4, B2, D2 INGINER VERIFICATOR PROIECTE

08-11-2008

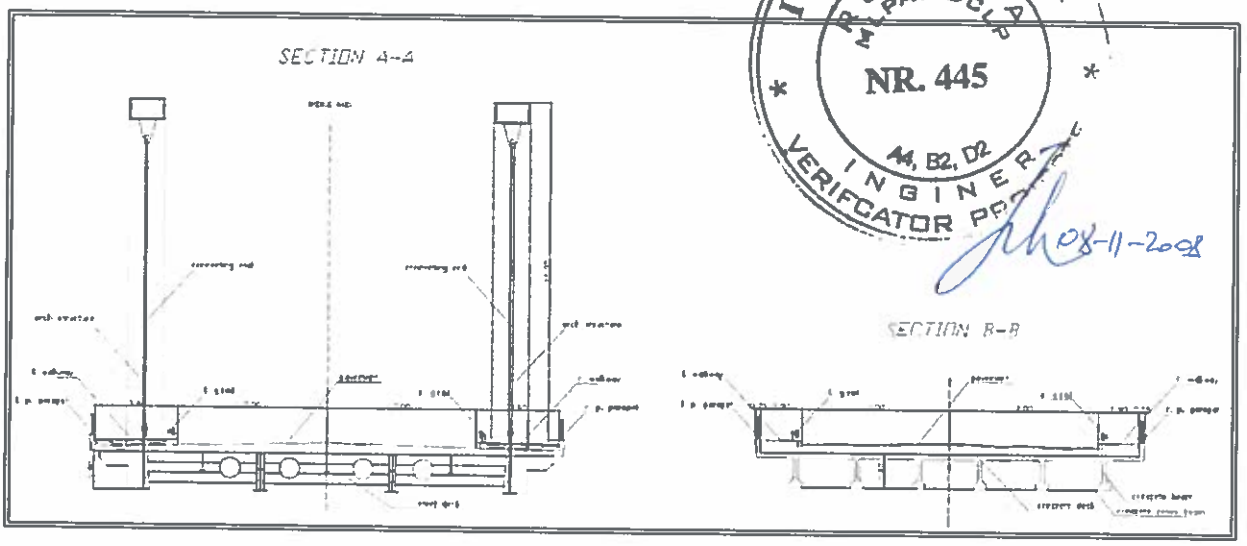
Longitudinal section



Plan

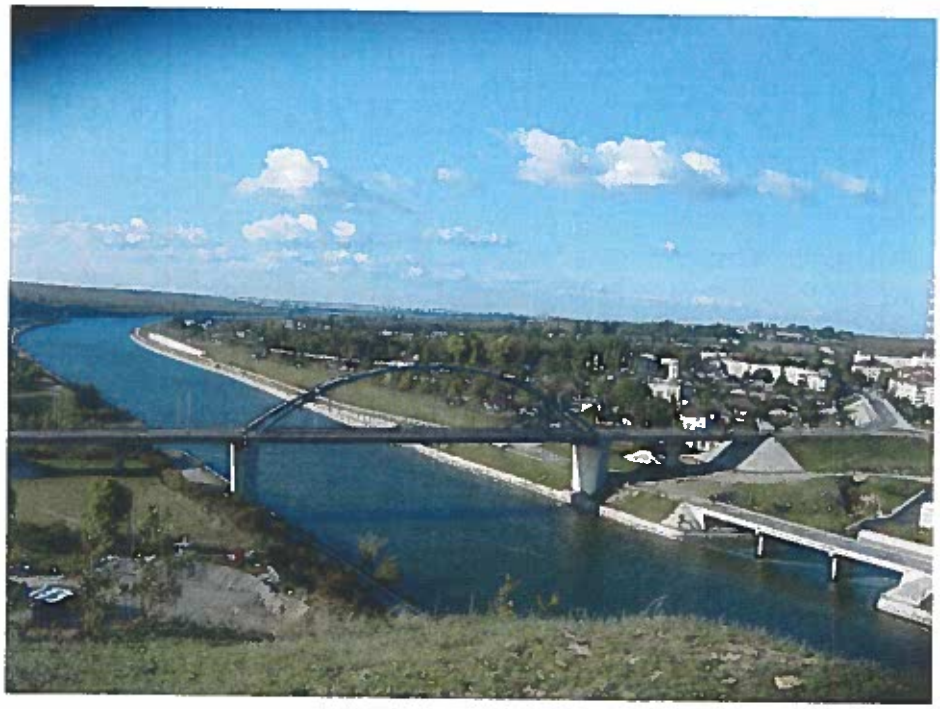


Section



IVANESCU T. TOMA
ROMANIA
MEMBRU ACAT DE CLUJ
NR. 445
44, B2, D2
INGINER
VERIFICATOR PROIECTE
08-11-2008

7 - BRIDGE DN3 BASARABI (B06)



General view

This bridge is located near Basarabi on the DN3 national road which connects Bucharest to Constanta approximately at the km 242, over the Danube-Black Sea Channel.. This bridge runs North-East to South-West and is a 5 span structure, which the main span is an arch bridge composed by a steel beams transversal section and the approach ramps are a small continuous span bridge composed by pre-stressed concrete beams.

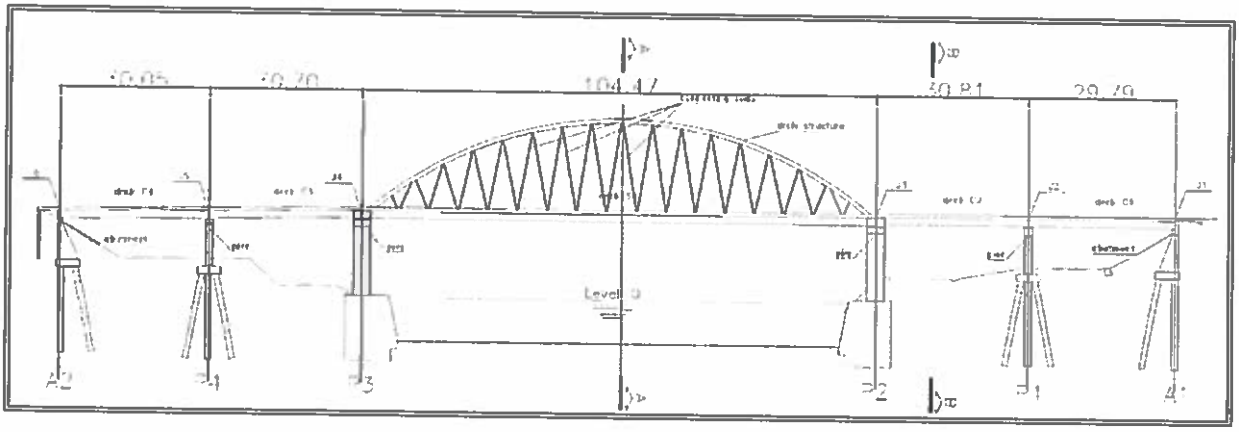
The main characteristics of this bridge are defined as follows:

- Structure typology: Arch bridge, steel - concrete and pre-stressed concrete for side spans
- Overhead Length: 226 m
- Overhead Width: 14.20 m
- Number of spans: 5 (2+1+2)
- Standard Concrete Span Length: 30 m
- Greater span length: 104.5 m

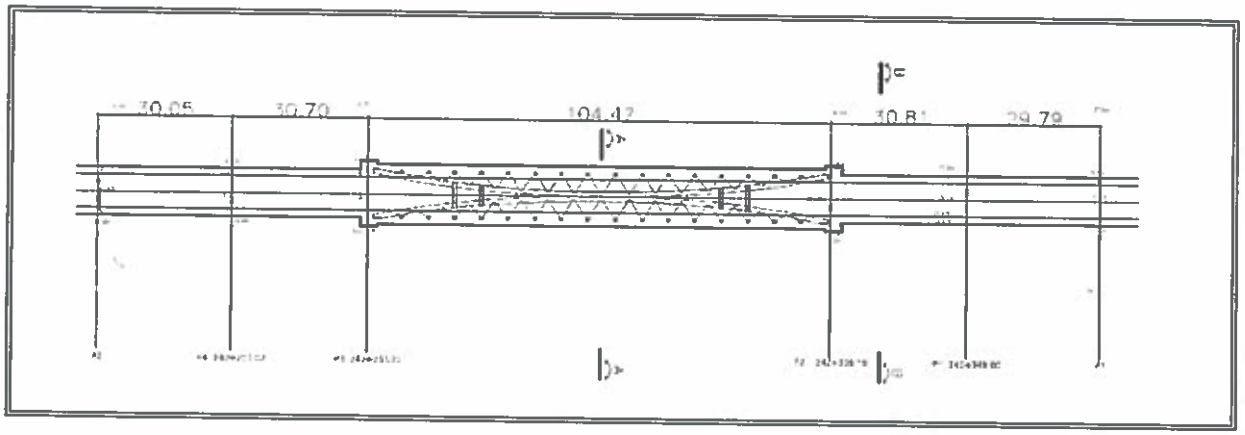
IVANESCU T. TOMA ROMANIA MLPAT DCLP NR. 445 A4, B2, D2 INGINER VERIFICATOR PROIECTE

12-11-2008

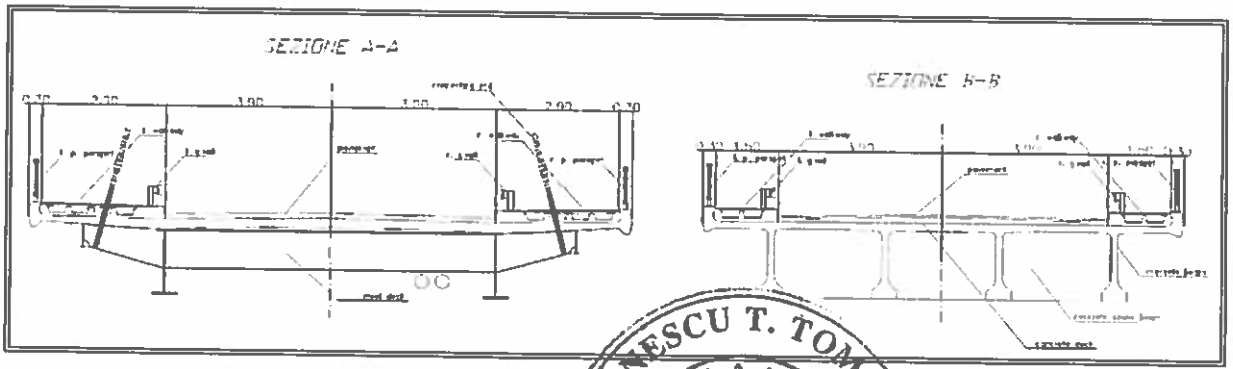
Longitudinal section



Plan



Section



IVANESCU T. TOMA
ROMANIA
MLPAT DCLP
NR. 445
A1, B2, D2
INGINER
VERIFICATOR PROIECTE

12-11-2008

8 - BRIDGE A2 CERNAVODA (B07)



General view

This Bridge is located near *Cernavoda* on the A2 motorway (approximately at the km 149) inserted in the European Transport Corridor IV section Fetesti-Cernavoda which connects the Black Sea with Central Europe, over the Danube River. This bridge runs North-West to South-East and is a 21 span structure, composed by two different parts: 3 main spans which are a metallic truss bridge with a steel transversal section allowing the road and rail traffic and the approach ramps composed by 18 spans of a double road carriageway also supported by a metallic structure.

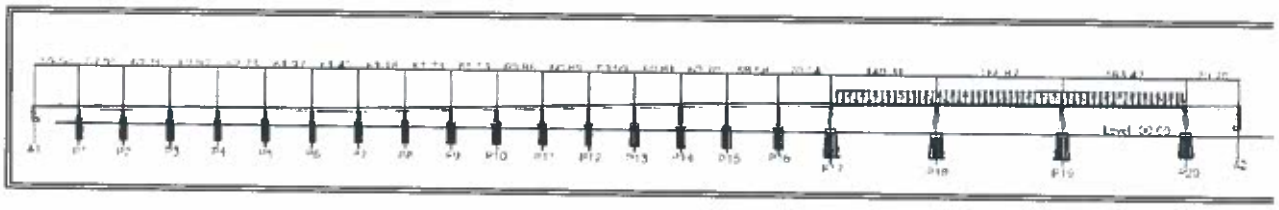
The main characteristics of this bridge are defined as follows:

- Structure typology: metallic truss bridge
- Overhead Length: 1596 m
- Overhead Width: 34.40 m
- Number of spans: 21(17+3+1)
- Greater span length: 166.90 m

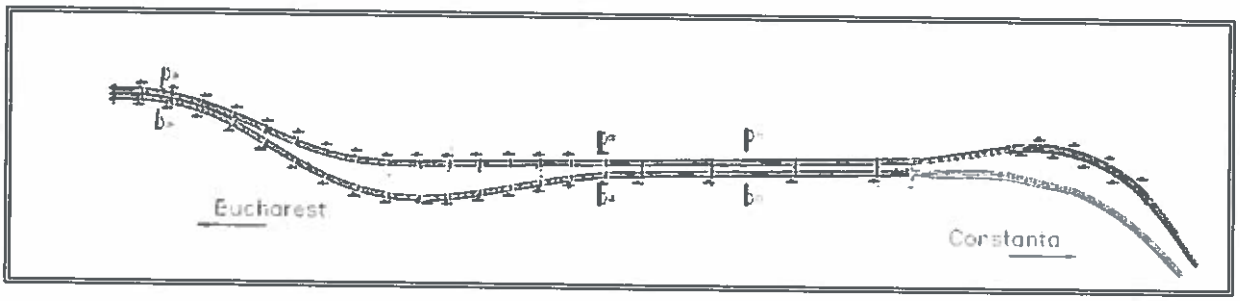
IVANESCU T. TOMA ROMANIA MLPAT DGLP NR. 445 A4, B2, D2 INGINER VERIFICATOR PRO

14-11-2008

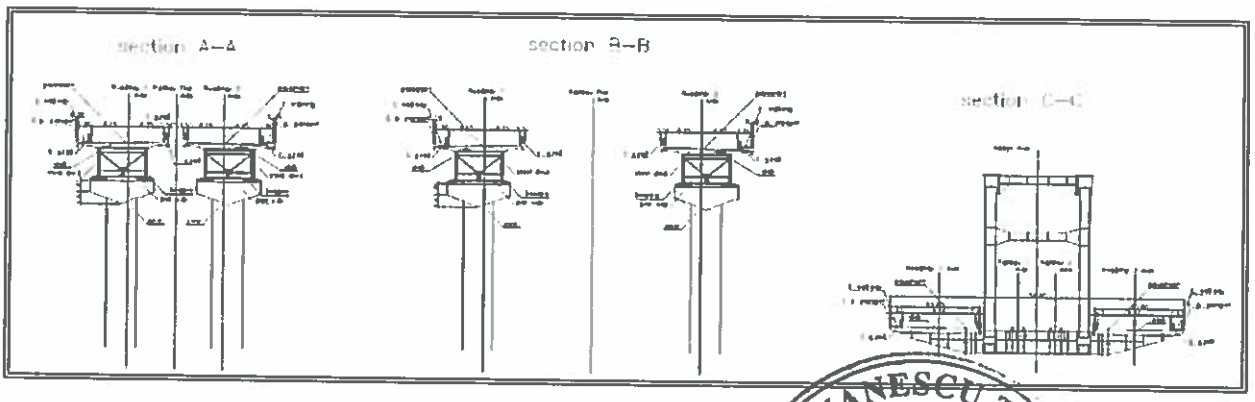
Longitudinal section



Plan



Section



IVANESCU T. TOMA
ROMANIA
MLPAT DCLP
NR. 445
A4, B2, D2
INGINER
VERIFICATOR PROIECTE

14-11-2008

9 - BRIDGE A2 BORCEA (B08)



General view

This Bridge is located near *Fetesti e Borcea* on the A2 motorway (approximately at the km 136) inserted in the European Transport Corridor IV section Fetesti-Cernavoda which connects the Black Sea with Central Europe, over the Danube River. This bridge runs North-West to South-East and is a 14 span structure, composed by two different parts: 3 main spans which are a metallic truss bridge with a steel transversal section allowing the road and rail traffic and the approach ramps composed by 11 spans of a double road carriageway supported by pre-stressed concrete beams.

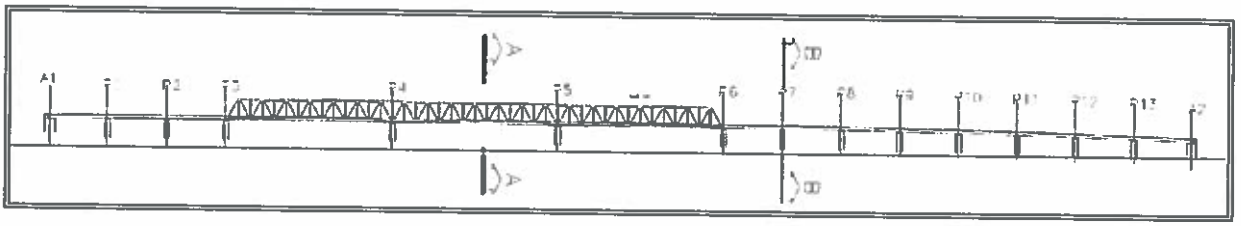
The main characteristics of this bridge are defined as follows:

- Structure typology: metallic truss bridge and pre-stressed concrete.
- Overhead Length: 968 m
- Overhead Width: 34.40 m
- Number of spans: 14 (3+3+8)
- Standard Concrete Span Length: 50 m
- Greater span length: 140.90 m

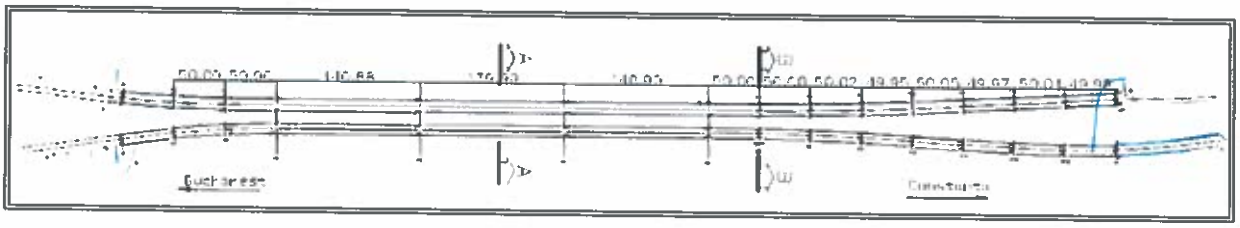
IVANESCU T. TOMA ROMANIA MLPAT DGLP NR. 445 A4, S2, D2 VERIFICAT

18-11-2008

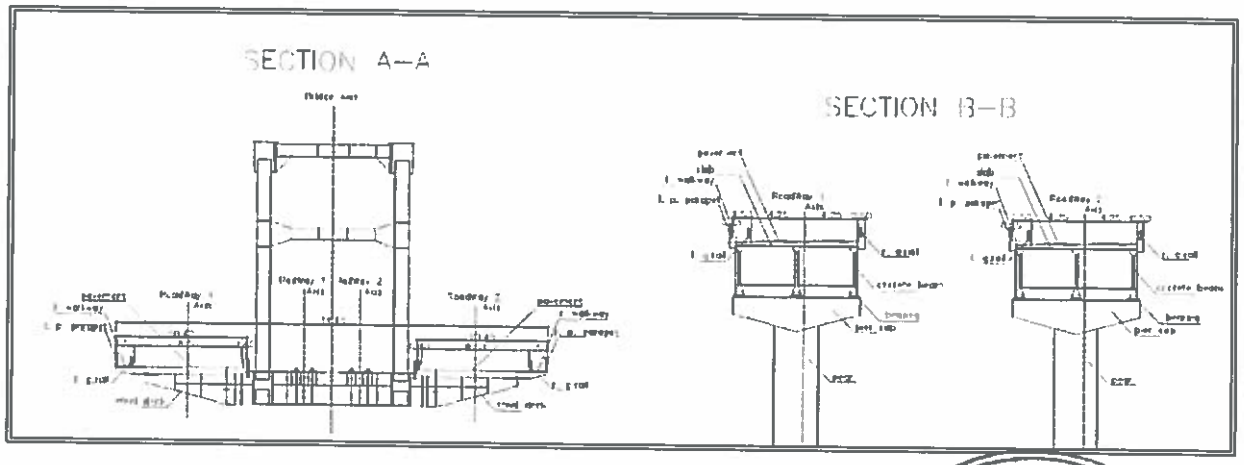
Longitudinal section



Plan

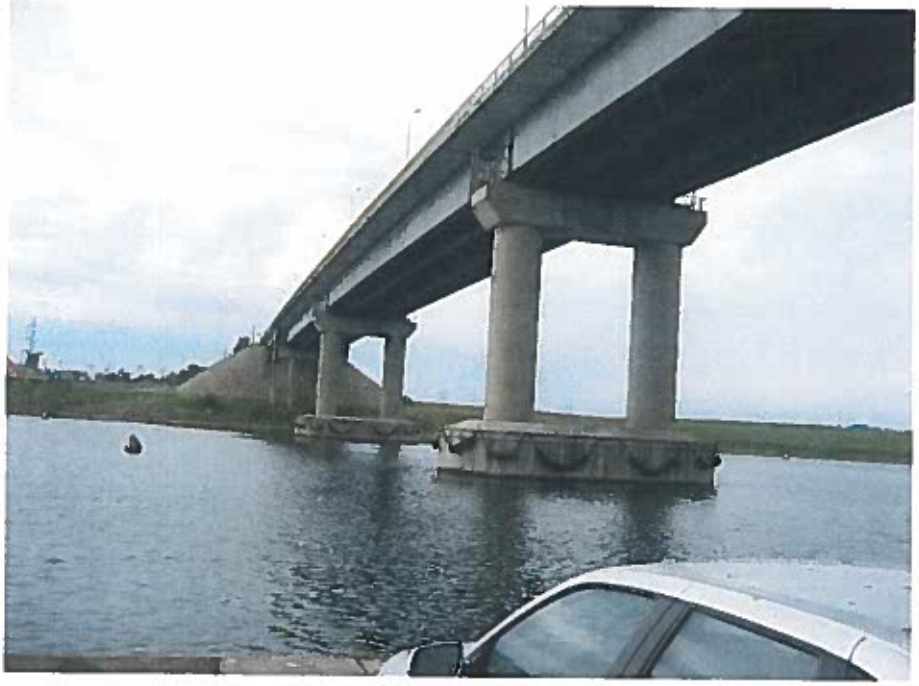


Section



IVANESCU T. TOMA
ROMANIA
MLPAT DGLP
NR. 445
INGINER VERIFICATOR
18-11-2008

10 - BRIDGE DN39 MANGALIA (B09)



General view

This Bridge is located in *Mangalia* on the DN39 national road which connects Constanta to Mangalia and runs North-West to South-East approximately at the km 49. This bridge is a 8 span structure divided as follows: 3 steel spans and 5 pre-stressed concrete spans.

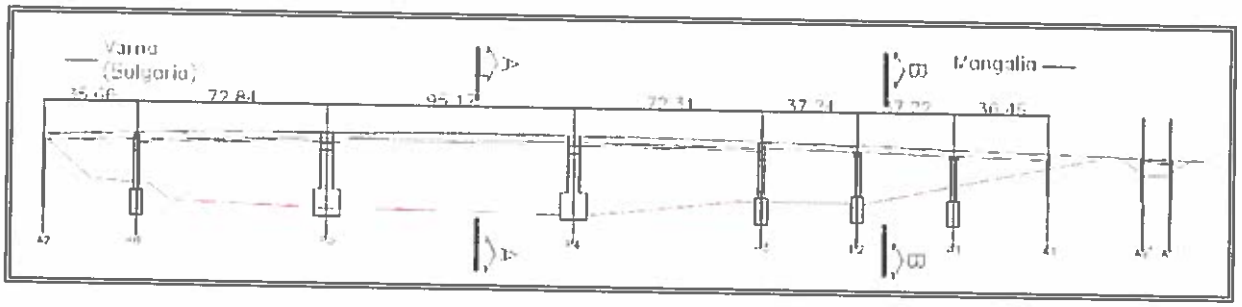
The main characteristics of this bridge are defined as follows:

- Structure typology: steel - concrete and pre-stressed concrete beam bridge
- Overhead Length: 434 m
- Overhead Width: 19.30 m
- Number of spans: 8
- Greater span length: 95.20 m

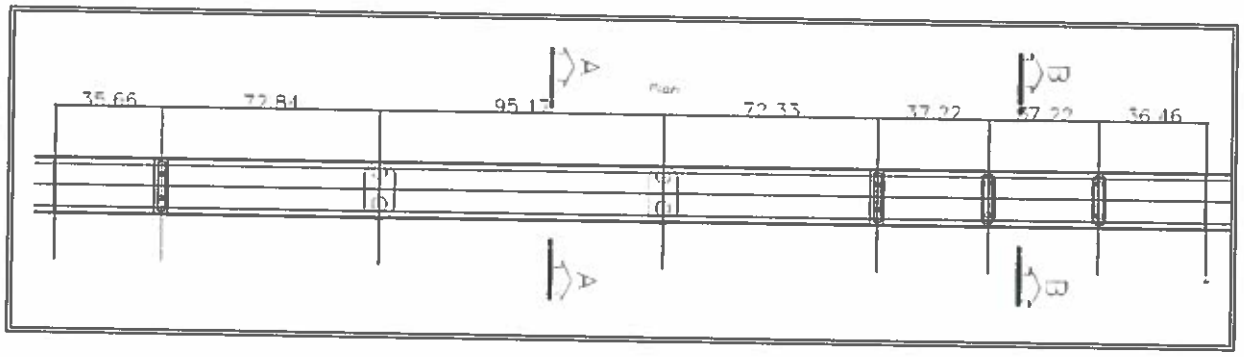
IVANESCU T. TOMA ROMANIA MLPAT DCLP NR. 445 A4, B2, D2 INGINER VERIFICATOR

18-11-2008

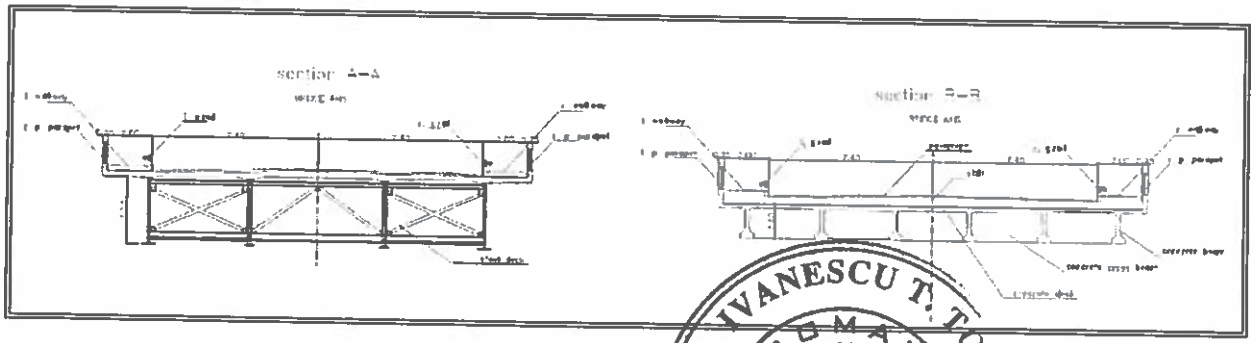
Longitudinal section



Plan



Section



IVANESCU T. TOMA
ROMANIA
MLPAT DCLP
NR. 445
A4, B2, D2
INGINER
VERIFICATOR PROIECT

18-11-20-8

11 - BRIDGE DN2B GAISEAN (B10)



General view

This bridge is located near Gaisean on the DN2B national road which connects Braila to Buzau approximately at the km 47, over a railway. This bridge runs North-East to South-West and is a 3 span structure composed by pre-stressed concrete beams.

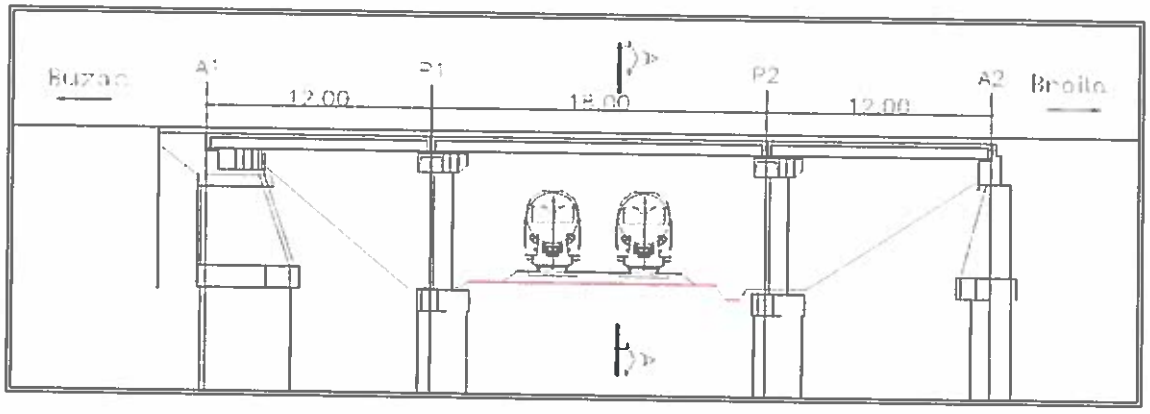
The main characteristics of this bridge are defined as follows:

- Structure typology: pre-stressed concrete.
- Overhead Length: 42 m
- Overhead Width: 10.70 m
- Number of spans: 3
- Greater span length: 18 m

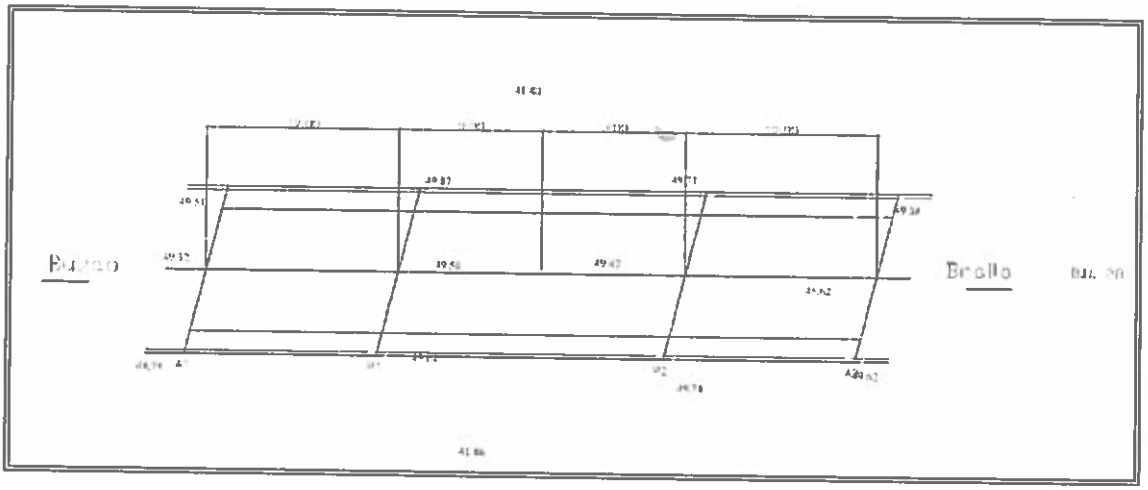
IVANESCU T. TOMA ROMANIA MLPAT DGLP NR. 445 A4, B2, D2 INGINER VERIFICATOR

24-11-2008

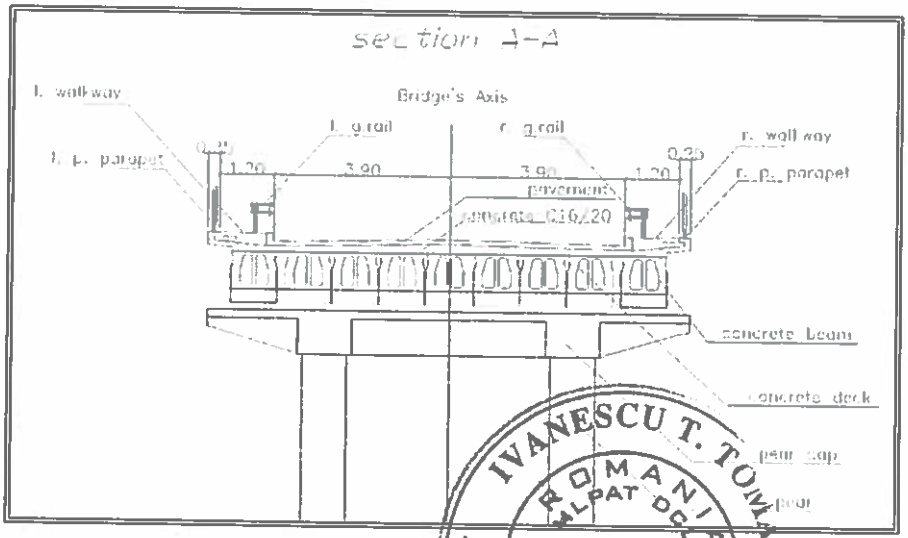
Longitudinal section



Plan



Section

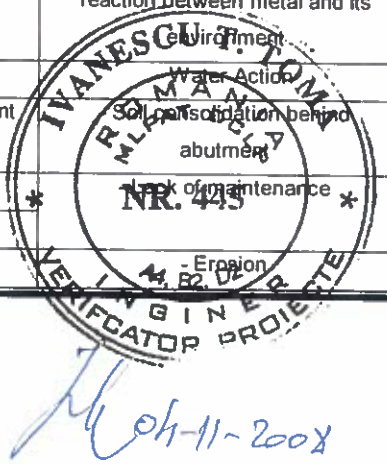


IVANESCU T. TOMA
ROMANIA
NR. 445
A4, B2, D2
INGINER VERIFICATOR PROIECTE

12 - DETERIORATIONS

All different types of deterioration were organized by groups, according to the related location:

Work Type	Defects	Possible causes
Road finishes and equipment	-Coating degradation or corroded parapet	- Chemical or electrochemical reaction between metal and its environment
	-Heavy local corrosion or damaged parapet	
	- Inadequate or damaged guard rail	- Steel corrosion or vehicle impact
	- Inadequate or damaged electrical equipment	- Lack of maintenance
	- Lack of steel plates in walkway	
Pavements	- Holes or damaged pavements	- Heavy traffic and/or lack of maintenance
	- Damaged or degradation drainpipes	- Lack of maintenance
	- Deteriorated walkway pavement	
	- Damaged expansion joints	- Lack of maintenance and fatigue
	- Damaged bearings	
Concrete Repair	- Efflorescence and spalling on deck slab and honeycomb in transverses	- Percolation of water and inadequate aggregate grading and/or poor compaction
	- Cracking and spalling of concrete beam	- Carbonation and/or Chlorides
	- Corrosion and spalling of pier caps	
	- Spalling of cover over shear reinforcement	
	- Lack of strengthening or damaged concrete elements	- Inadequate design, poor concrete or damaged prestressed bars
	- Inadequate Superstructure	- Frequent longitudinal cracks on pre-stressed concrete beams due to insufficient load resistance
Steel Works	-Coating degradation or corroded steel structures	- Chemical or electrochemical reaction between metal and its environment
	- Lack of stay cables maintenance	- Lack of maintenance
	-Missing bolts	
	- Damaged and corrosion of inspection gantry and rails	Chemical or electrochemical reaction between metal and its environment
Earthworks	- Cracking and disconnection of stoneworks	Water Action
	- Subsidence of embankment behind abutment	Soil consolidation behind abutment
	-Landslip of cone quarters	Lack of maintenance
	- Damaged storm water collecting system	
	- Deteriorated river embankment	- Erosion



04-11-2008



Bridge 6 - Coating degradation and diffused corrosion on steel parapet



Bridge 2 - Heavy local corrosion and damaged parapet



IVANESCU T. TOMA ROMANIA MLPAT DGLP NR. 445 A4, B2, D2 INGINER VERIFICATOR PROIECTE 06-11-2008

Bridge 1 - Damaged expansion joint and inadequate guard rail height



IVANESCU T. TOMA ROMANIA MLPAT DGLP NR. 445 A4, B2, D2 INGINER VERIFICATOR PROIECTE 06-11-2008

Bridge 3 - Damaged electrical equipment



Bridge 7 - Lack of metallic slabs

IVANESCU T. TOMA ROMANIA MLPAT OCLP NR. 445 M, B2, D2 INGINER VERIFICATOR PROIECTE

14-11-2008



Bridge 2 - Pit holes on the road pavement

IVANESCU T. TOMA ROMANIA MLPAT OCLP NR. 445 M, B2, D2 INGINER VERIFICATOR PROIECTE

05-11-2008



Bridge 8 - Damaged drainpipe, inadequate guard rail height, walkway slab breakdown and damaged pavement

IVANESCU T. TOMA ROMANIA MLPAT DCLP NR. 445 M4, B2, D2 INGINER VERIFICATOR PROIECTE

18-11-2008



Bridge 2 - Unsuitable and damaged expansion joint at the connection between concrete and steel structure

IVANESCU T. TOMA ROMANIA MLPAT DCLP NR. 445 M4, B2, D2 INGINER VERIFICATOR PROIECTE

05-11-2008



Bridge 1 – Damaged and corroded bearings

IVANESCU T. TOMA ROMANIA MLPAT DCLP NR. 445 A4, B2, D2 INGINER VERIFICATOR PROIECTE

08-11-2008



Bridge 1 – Efflorescence and degradation of concrete around drainpipe on deck slab underside

IVANESCU T. TOMA ROMANIA MLPAT DCLP NR. 445 A4, B2, D2 INGINER VERIFICATOR PROIECTE

08-11-2008



Bridge 4 - Underside view of approach span – note honeycomb in transverse beam

IVANESCU T. TOMA ROMANIA MLPAT DGLP NR. 445 A4, B2, D2 INGINER VERIFICATOR PROIECTE

07-11-2008



Bridge 10 - Lack of cover on prestressed beams

IVANESCU T. TOMA ROMANIA MLPAT DGLP NR. 445 A4, B2, D2 INGINER VERIFICATOR

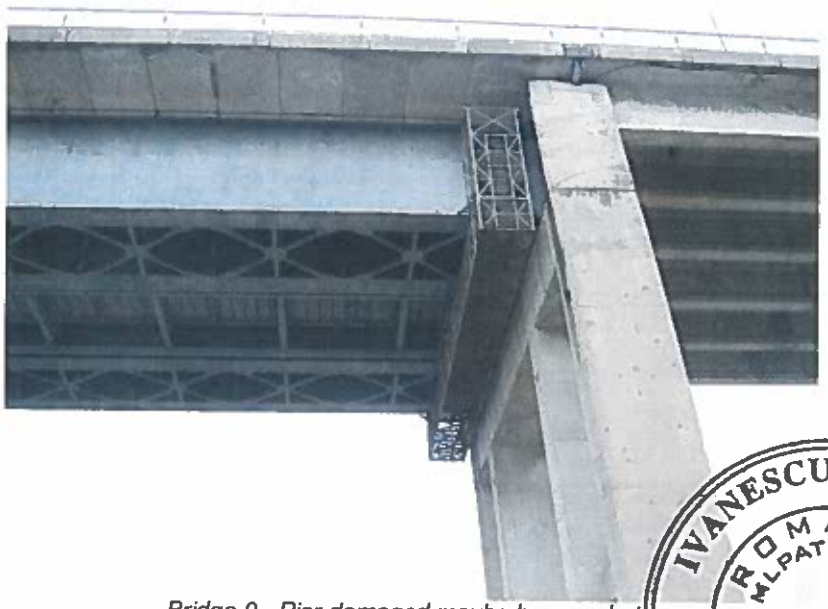
21-11-2008



Bridge 1 - Corrosion and spalling of pier caps

IVANESCU T. TOMA ROMANIA MLPAT DGLP NR. 445 A4, B2, D2 INGINER VERIFICATOR PROIECTE

1-11-2008



Bridge 9 - Pier damaged maybe by gun shots

IVANESCU T. TOMA ROMANIA MLPAT DGLP NR. 445 A4 B2, D2 INGINER VERIFICATOR PROIECTE

18-11-2008



Bridge 3 - Honeycomb in concrete tower leg



Bridge 2 - Deteriorated cap beam and maybe improperly retrofitted



IVANESCU T. TOMA ROMANIA MLPAT DGLP NR. 445 A4, B2, D2 INGINER VERIFICATOR PROIECTE

18-11-2008

Bridge 8 - Cracking on prestressed concrete beam due to water percolation inside socket



IVANESCU T. TOMA ROMANIA MLPAT DGLP NR. 445 A4, B2, D2 INGINER VERIFICATOR PROIECTE

05-11-2008

Bridge 2 - Cracking and spalling of concrete prestressed beam due to water percolation



Bridge 7 - Corrosion on steel deck girders



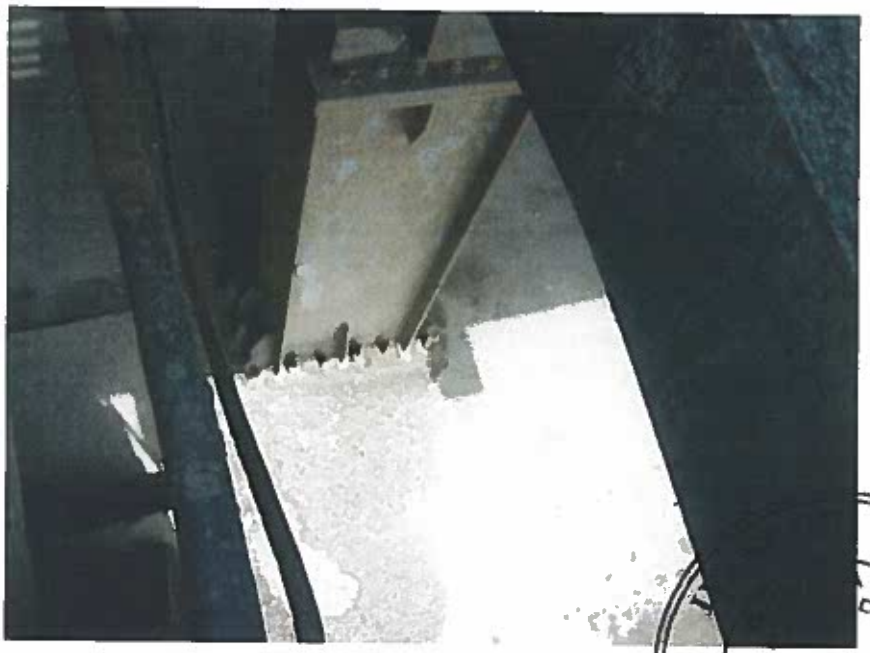
Bridge 5 - Corrosion and deterioration on coating of tension steel struts



Bridge 6 - Coating degradation on main arcs steel



Bridge 3 - Stay cables transition box



Bridge 8 – Missing and no strengthening anchor bolts



Bridge 9 - Detail of gantry – note coating breakdown



Bridge 1 - Cracking and disconnections of stoneworks

IVANESCU T. TOMA ROMANIA MLPAT DCLP NR. 445 A4, B2, D2 INGINER VERIFICATOR PROIECTE

04-11-2008



Bridge 3 - Subsidence of embankment behind abutment

IVANESCU T. TOMA ROMANIA MLPAT DCLP NR. 445 A4, B2, D2 INGINER VERIFICATOR PROIECTE

06-11-2008



Bridge 9 - Landslip of cone quarters

IVANESCU T. TOMA ROMANIA MLPAT DCLP NR. 445 44, 82, 02 INGINER VERIFICATOR PROIECTE

18-11-2008



Bridge 1 - Right *river side erosion*

IVANESCU T. TOMA ROMANIA MLPAT DCLP NR. 445 44, 82, 02 INGINER VERIFICATOR PROIECTE

07-11-2008

13 - TESTING OPERATIONS

The aim of the investigation and testing program was to obtain enough information on the condition of the bridges to enable appropriate remedial steps to be taken. Occasionally, the material obtained, and appropriate analysis, did not give sufficient information on the behaviour of the structure.
In order to assess the structural integrity of 10 bridges in Dobrogea Area the following operations have been carried out:

- Completely non-destructive tests:
  - rebound hammer test: used to evaluate the surface hardness of concrete;
  - ultrasonic pulse velocity testing: used to measure the sound velocity of the concrete and its compressive strength;
  - covermeter testing: used to locate steel reinforcing bars and measure the distance of bars beneath the surface of concrete;
- Partially destructive tests:
  - core tests: used to extract the samples of concrete and road paving to be subjected to tests;
- Laboratory tests:
  - On concrete:
    - compression strength determination test: used to determine the strength of concrete under standard conditions;
    - carbonation depth measurement test: used to determine whether moisture has reached the depth of reinforcing bars and hence the corrosion may be occurring;
    - chloride penetration resistance of concrete testing: used to assess the ability of chloride ions to penetrate the concrete and hence to corrode the steel reinforcing bars;
  - On road paving:
    - quantitative extraction of bitumen from bituminous paving mixtures test: used to determine the quantity of bitumen in pavement samples;
    - index of aggregate particle shape and texture test: used to determine the particle index of aggregate as an overall measure of particle shape and texture characteristics;
- Dynamic tests: used to determine the dynamic properties of bridges.

Tests have been performed in two phases, the second one depending on the result of the first one. Here are presented the available results of the first phase, and in the following design phase _ Detailed Design _ all tests will be summarized and presented.



04-11-2008

The different kind of tests carried out to assess the structural integrity of the bridges in Dobrogea area, are summarized in the following table:

BRIDGE	Ultrasonic pulse velocity	Rebound hammer	Son.Reb.	Covermeter	Dynamic tests	Stay-cables measurements	Core - compression strenght (concrete)	Carbonation depth	Chloride penetration	Core (road paving)	Extraction of bitumen - index particle of aggregate
1	16	16	16	4	5			1	1	4	4
2	13	13	13		3		12			4	4
3					2	10				4	4
4	4	4	4		1	6	2	2	2	3	3
5	5	5	5		1	6	2	2	2	4	4
6	6	6	6		1	6	2	2	2	4	4
7	1	1	1		8			1		4	4
8	8	8	8		4		2			4	4
9	7	7	7				2			4	4
10	6	6	6				3			4	4
Total	66	66	66	4	25	28	25	23	23	39	39

IVANESCU T. TOMA ROMANIA MLPAT D.C.P. NR. 445 A4, B2, D2 INGINER VERIFICATOR PROIECTE

21-11-2008

The main results of non-destructive tests (pulse velocity, rebound hammer Rck, Son.Reb. Rck) are summarized in the following table, where Rck is a test compression resistance and not a characteristic resistance:

BRIDGE	POINT OF MEASURE	DIRECTION	STRUCTURAL ELEMENT	Velocity (m/s)	Rck (kg/cm²) Rebound Hammer	Rck (kg/cm²) Son.Reb.
1	d1		span	4341	500	646
1	d2		span	3503	560	405
1	d3		span	3510	570	409
1	d4		span	3293	405	266
1	d5		span	3243	360	239
1	d6		span	3664	460	374
1	d7		span	3575	530	383

IVANESCU T. TOMA ROMANIA MLPAT D.C.P. NR. 445 A4, B2, D2 INGINER VERIFICATOR PROIECTE

21-11-2008

BRIDGE	POINT OF MEASURE	DIRECTION	STRUCTURAL ELEMENT	Velocity (m/s)	Rck (kg/cm²) Rebound Hammer	Rck (kg/cm²) Son.Reb.
1	d8		span	4217	515	508
1	d14		span	3087	125	152
1	d15		span	3987	620	588
1	p15		pier	3352	505	316
1	p16		pier	3216	325	222
1	p17		pier	2752	315	148
1	p18		pier	3035	425	225
1	p19		pier	2799	265	141
1	p20		pier	3048	420	224
2	d1		span	3860	570	523
2	d2		span	3858	580	521
2	d3		span	3843	615	535
2	d4		span	3754	475	440
2	d21		span	3457	510	347
2	p4		pier	3635	490	380
2	p5		pier	2301	150	66
2	p6		pier	2592	350	135
2	p7		pier	3094	315	197
2	p8		pier	3213	455	269
2	p9		pier	2383	425	124
2	p10		pier	2784	495	199
2	p19		pulvino	2768	215	122
4	p1		pier	2716	285	136
4	p2		pier	3254	550	313
4	sp1		abutment	2578	200	99
4	sp2		abutment	3097	535	271
5	p1		pier	2810	305	153
5	p2		pier	2573	240	109
5	p3		pier	2531	220	99
5	p4		pier	3228	455	272
5	p5		pier	2664	265	125
6	p1		pier	2612	175	95
6	p2 - left side		pier	2880	550	232
6	p2 - right side		pier	2385	585	152
6	p3 - left side		pier	3366	345	260
6	p3 - right side		pier	2967	370	194
6	p4		pier	3463	400	299
7	d10		span	3366	520	367

IVANESCU T. TOMA
ROMANIA
NR. 445
A4, B2, D2
INGINER
VERIFICATOR PROIECTE

14-11-2008

BRIDGE	POINT OF MEASURE	DIRECTION	STRUCTURAL ELEMENT	Velocity (m/s)	Rck (kg/cm²) Rebound Hammer	Rck (kg/cm²) Son.Reb.
5	d103	Bucharest-Constanta	beam	3705	515	442
5	d203	Bucharest-Constanta	beam	4205	600	658
5	d303	Bucharest-Constanta	beam	3504	550	465
5	d101	Constanta-Bucharest	beam	3817	555	465
5	d201	Constanta-Bucharest	beam	3941	540	496
5	d301	Constanta-Bucharest	beam	3191	520	286
5	p2_1	Constanta-Bucharest	pier	2514	410	139
5	p2_2	Bucharest-Constanta	pier	3987	490	477
9	p1 - left side		pier	3114	360	216
9	p1 - right side		pier	3575	530	383
9	p2		pier	3344	310	237
9	p3 - left side		pier	3461	490	342
9	p3 - right side		pier	3409	290	241
9	p6 - left side		pier	2723	445	177
9	p6 - right side		pier	3485	300	258
10	sp1		abutment	2449	265	105
10	p1		pier	3167	260	189
10	p2		pier	1825	160	40
10	sp2		abutment	2935	390	195
10	d301		beam	3011	470	233
10	d101		beam	3006	285	174

Ambient vibration tests were performed in this experimental work. The following table shows the identified eigenfrequencies of each bridge:

BRIDGE	SPAN	LENGHT (m)	DIRECTION	FREQUENCY / MODAL SHAPE (Hz)
1	7	46.06		2.62
1	8	47.46		2.62
1	12	47.57		2.62
1	15	46.04		2.62
1	16	46.00		2.62
2	12	79.50		3.27
3	3	162.11		0.57
3	4	22.00		5.98
4	2	110.72		1.59
5	3	110.95		1.66
6	3	104.47		2.14
7	3	62.10	Bucharest-Constanta	1.71
7	10	61.13	Bucharest-Constanta	1.71
7	14	60.61	Bucharest-Constanta	1.71
7	21	70.70	Bucharest-Constanta	1.65
7	3	62.10	Costanta-Bucharest	1.59
7	10	61.13	Costanta-Bucharest	1.77
7	14	60,61	Costanta-Bucharest	1.83
7	21	70.70	Costanta-Bucharest	1.65
8	3	50.00	Bucharest-Constanta	2.44
8	7	50.00	Bucharest-Constanta	2.38
8	3	50.00	Costanta-Bucharest	2.50
8	7	50.00	Costanta-Bucharest	2.56

IVANESCU T. TOMA ROMANIA MLPAT DCLP NR. 445 44, B2, D2 INGINER VERIFICATOR PROIECTE

21-11-2004

IVANESCU T. TOMA ROMANIA MLPAT DCLP NR. 445 44, B2, D2 INGINER VERIFICATOR PROIECTE

18-11-2004

The measurements of stay cables tension on Bridge 3 are exposed in the following table:

Bridge	Direction	Stay-Cable	f (Hz)	n	L (m)	T / m (kN/(kg/m))	T (kg/cm2)
3	Constanta - Mangalia	1	4,73	4	100,8	14,21	1136,8
3	Constanta - Mangalia	2	4,50	3	67,74	10,32	825,6
3	Constanta - Mangalia	3	4,17	3	71,3	9,82	785,6
3	Constanta - Mangalia	4	5,05	5	102,05	10,62	849,6
3	Constanta - Mangalia	5	2,15	3	139,47	9,99	799,2
3	Mangalia - Constanta	1	1,24	1	100,8	15,62	1249,6
3	Mangalia - Constanta	2	1,56	1	67,74	11,17	893,6
3	Mangalia - Constanta	3	2,72	2	71,3	9,4	752
3	Mangalia - Constanta	4	3,04	3	102,05	10,69	855,2
3	Mangalia - Constanta	5	2,90	4	139,47	10,22	817,6

The above exposed results do not confirm the necessity of replacing tendons in the cable-stayed bridge (bridge n. 3 in Agigea).

The core tests were extracted by drilling, using a diamond coring tool cooled with water. The extracted cores were subjected to a series of tests:

- Compressive strength determination test;
- Carbonation depth measurement test;
- Chloride penetration resistance of concrete testing.

Please find below available results of the compressive strength determination test:

IVANESCU T. ROMA NR. 445 INGINER VERIFICATOR PP A4, B2, D2

06-11-2008

Bridge	Span	Beam	Pier	Abutment	Compressive Strength
1			P17r		265
2			P1r		340
2			P1l		330
2			P2l		360
2			P3l		320
2			P4l		280
2			P5r		130
2			P5l		160
2			P6l		310
2			P7l		290
2			P8l		300
2			P9l		320

	2				A1	380
	4			P1l		260
	4			P2l		280
	5			P1l		240
	5			P4l		290
	6			P1s		150
	6			P4r		290
	7			10		320
*	7			10		330
	8	1	3			350
	8	2	3			380
	8	3	3			330
	8	1	1			390
	8	2	1			380
	8	3	1			350
	9			P2lr		300
	9			P6l		320
	10			P1r	A1	230

IVANESCU T. TOMA ROMANIA MLPAT DCLP NR. 445 A4, B2, D2 INGINER VERIFICATOR PROIECTE

21-11-2008

Please find below a comparison between the results obtained from the ultrasonic pulse velocity test and the rebound hammer test for all bridges, except for bridge 3:

Bridge	Element		Ultrasonic Velocity Results		Rebound Hammer Results					Design	Comparison Rck from	
	Type	Number	V	Rc	R av	Rc	interval	Rc max	Rc min	Rck=Rd	Ultrasonic Velocity R_v / Rd	Rebound Hammer R_{RH} / R d
			m / s	kg/cmq		kg/cmq	kg/cmq	kg/cmq	kg/cmq	kg/cmq		
	span	d1	4341	361,6	47,5	500	75	575	425	400	0,904	1,063
		d2	3503	291,8	50,3	560	75	635	485	400	0,729	1,213
		d3	3510	292,4	50,5	570	75	645	495	400	0,731	1,238
		d4	3293	274,3	39,0	405	70	475	335	400	0,686	0,838
		d5	3243	270,1	36,5	360	65	425	295	400	0,675	0,738
		d6	3664	305,2	42,0	460	70	530	390	400	0,763	0,975
		d7	3575	297,8	45,5	530	75	605	455	400	0,744	1,138
		d8	4217	351,3	48,0	515	75	590	440	400	0,878	1,100
		d14	3087	257,1	26,8	125	45	170	80	400	0,643	0,200
		d15	3987	332,1	53,0	620	80	700	540	400	0,830	1,350
		average		**303,4**	**43,9**	**465**	**71**	**535,0**	**394,0**	400	**0,758**	**0,985**
		p 15	3352	279,2	44,3	505	75	580	430	300	0,931	1,433
*		p 16	3216	267,9	34,8	325	65	390	260	300	0,893	0,867
		p 17	2752	229,2	34,0	315	65	380	250	300	0,764	0,833
		p 18	3036	252,9	40,3	425	70	495	355	300	0,843	1,183
		p 19	2799	233,2	31,3	265	60	325	205	300	0,777	0,683
		p 20	3048	253,9	39,8	420	70	490	350	300	0,846	1,167
		average		**252,7**	**37,4**	**375,8**	**67,5**	**443,3**	**308,3**	300	**0,842**	**1,028**

IVANESCU T. TOMA ROMANIA MLPAT DCLP NR. 445 A4, B2, D2 INGINER VERIFICATOR PROIECTE

04-11-2008

Bridge	Element		Ultrasonic Velocity Results		Rebound Hammer Results					Design	Comparison Rck from	
											Ultrasonic Velocity	Rebound Hammer
	Type	Number	V	Rc	R av	Rc	interval	Rc max	Rc min	Rck=Rd	R_v / Rd	R_{RH} / R d
			m / s	kg/cmq		kg/cmq	kg/cmq	kg/cmq	kg/cmq	kg/cmq		
2	beam	d1	3880	323,2	50,5	570	75	645	495	500	0,646	0,990
		d2	3858	321,4	51,0	580	75	655	505	500	0,643	1,010
		d3	3843	320,1	52,8	615	80	695	535	500	0,640	1,070
		d4	3754	312,7	46,3	475	70	545	405	500	0,625	0,810
		d21	3457	288,0	44,8	510	75	585	435	500	0,576	0,870
		average		**313,1**	**49,1**	**550**	**75**	**625,0**	**475,0**	500	**0,626**	**0,950**
	pier	p 4	3635	302,8	43,5	490	70	560	420	300	1,009	1,400
		p 5	2301	191,7	24,0	150	45	195	105	300	0,639	0,350
		p 6	2592	215,9	36,0	350	65	415	285	300	0,720	0,950
		p 7	3094	257,7	34,0	315	65	380	250	300	0,859	0,833
		p 8	3213	267,6	41,8	455	70	525	385	300	0,892	1,283
		p 9	2383	198,5	40,3	425	70	495	355	300	0,662	1,183
		p 10	2784	231,9	43,8	495	70	565	425	300	0,773	1,417
		average		**238,0**	**37,6**	**382,9**	**65,0**	**447,9**	**317,9**	300	**0,793**	**1,060**
	pier cap	p 19	2768	**230,6**	**28,0**	**215**	**60**	**275**	**155**	350	**0,659**	**0,443**

IVANESCU T. TOMA ROMANIA MLPAT DCLP NR. 445 A4, B2, D2 INGINER VERIFICATOR PROIECTE

05-11-2008

Bridge	Element		Ultrasonic Velocity Results		Rebound Hammer Results					Design	Comparison Rck from	
											Ultrasonic Velocity	Rebound Hammer
	Type	Number	V	Rc	R av	Rc	interval	Rc max	Rc min	Rck=Rd	R_v / Rd	R_{RH} / R d
			m / s	kg/cmq		kg/cmq	kg/cmq	kg/cmq	kg/cmq	kg/cmq		
4	pier	p1	2716	226,2	32,3	285	60	345	225	200	1,131	1,125
		p2	3254	271,1	46,8	550	75	625	475	200	1,355	2,375
		average		**248,7**	**39,6**	**418**	**68**	**485,0**	**350,0**	200	**1,243**	**1,750**
	abutment	sp 1	2578	214,7	27,0	200	60	260	140	200	1,074	0,700
		sp 2	3097	258,0	45,8	535	75	610	460	200	1,290	2,300
		average		**236,4**	**36,4**	**367,5**	**67,5**	**435,0**	**300,0**	200	**1,182**	**1,500**

IVANESCU T. TOMA ROMANIA MLPAT DCLP NR. 445 A4, B2, D2 INGINER VERIFICATOR PROIECTE

05-11-2008

IVANESCU T. TOMA ROMANIA MLPAT DCLP NR. 445 A4, B2, D2 INGINER VERIFICATOR PROIECTE

08-11-2008

Bridge	Element		Ultrasonic Velocity Results		Rebound Hammer Results					Design	Comparison Rck from	
	Type	Number	V	Rc	R av	Rc	interval	Rc max	Rc min	Rck=Rd	Ultrasonic Velocity R_c / Rd	Rebound Hammer R_{RH} / R d
			m / s	kg/cmq		kg/cmq	kg/cmq	kg/cmq	kg/cmq	kg/cmq		
5	pier	p1	2810	234,1	33,5	305	65	370	240	200	1,170	1,200
		p2	2573	214,3	29,8	240	60	300	180	200	1,072	0,900
		p3	2531	210,8	28,3	220	60	280	160	200	1,054	0,800
		p4	3228	268,9	41,8	455	70	525	385	200	1,344	1,925
		p5	2664	221,9	31,3	265	60	325	205	200	1,110	1,025
		average		**230,0**	**32,9**	**297**	**63**	**360,0**	**234,0**	200	**1,150**	**1,170**

Bridge	Element		Ultrasonic Velocity Results		Rebound Hammer Results					Design	Comparison Rck from	
	Type	Number	V	Rc	R av	Rc	interval	Rc max	Rc min	Rck=Rd	Ultrasonic Velocity R_c / Rd	Rebound Hammer R_{RH} / R d
			m / s	kg/cmq		kg/cmq	kg/cmq	kg/cmq	kg/cmq	kg/cmq		
	pier	p1	2612	217,6	25,3	175	45	220	130	200	1,088	0.650
		p2l	2880	239,9	46,8	550	75	625	475	200	1,200	2,375
		p2r	2385	198,7	48,8	585	75	660	510	200	0.993	2,550
		p3l	3386	282,1	35,8	345	65	410	280	200	1,410	1,400
		p3r	2967	247,2	37,0	370	65	435	305	200	1,236	1,525
		p4	3463	288,5	38,8	400	70	470	330	200	1,442	1,650
		average		**245,6**	**38,8**	**404**	**66**	**470,0**	**338,3**	200	**1,228**	**1,692**

IVANESCU T. TOMA ROMANIA MLPAT DCLP NR. 445 A4, B2, D2 INGINER VERIFICATOR PROIECTE

12-11-2008

Bridge	Element		Ultrasonic Velocity Results		Rebound Hammer Results					Design	Comparison Rck from	
	Type	Number	V	Rc	R av	Rc	interval	Rc max	Rc min	Rck=Rd	Ultrasonic Velocity R_c / Rd	Rebound Hammer R_{RH} / R d
			m / s	kg/cmq		kg/cmq	kg/cmq	kg/cmq	kg/cmq	kg/cmq		
7	span	d10	3386	282,1	48,3	520	75	595	445	500	0.564	0,890

IVANESCU T. TOMA ROMANIA MLPAT DCLP NR. 445 A4, B2, D2 INGINER VERIFICATOR PROIECTE

11-11-2008

Bridge	Element		Ultrasonic Velocity Results		Rebound Hammer Results					Design	Comparison Rck from	
											Ultrasonic Velocity	Rebound Hammer
	Type	Number	V	Rc	R av	Rc	interval	Rc max	Rc min	Rck=Rd	R_v / Rd	R_{RH} / R d
			m / s	kg/cmq		kg/cmq	kg/cmq	kg/cmq	kg/cmq	kg/cmq		
8	beam	d103	3705	308,6	48,0	515	75	590	440	500	0,617	0,880
		d203	4206	350,4	52,0	600	80	680	520	500	0,701	1,040
		d303	3504	291,9	50,3	560	75	635	485	500	0,584	0,970
		d101	3817	318,0	47,0	555	75	630	480	500	0,636	0,960
		d201	3941	328,3	46,3	540	70	610	470	500	0,657	0,940
		d301	3191	265,8	45,0	520	75	595	445	500	0,532	0,890
		average		**310,5**	**48,1**	**548**	**75**	**623,3**	**473,3**	500	**0,621**	**0,947**
	pier	p2_1	2514	209,4	39,5	410	70	480	340	300	0,698	1,133
		p2_2	3987	332,1	43,5	490	70	560	420	300	1,107	1,400
		average		**270,8**	**41,5**	**450,0**	**70,0**	**520,0**	**380,0**	300	**0,903**	**1,267**

IVANESCU TOMA ROMANIA NR. 445 A4, B2, D2 INGINER VERIFICATOR PROIECTE

18-11-2008

Bridge	Element		Ultrasonic Velocity Results		Rebound Hammer Results					Design	Comparison Rck from	
											Ultrasonic Velocity	Rebound Hammer
	Type	Number	V	Rc	R av	Rc	interval	Rc max	Rc min	Rck=Rd	R_v / Rd	R_{RH} / R d
			m / s	kg/cmq		kg/cmq	kg/cmq	kg/cmq	kg/cmq	kg/cmq		
9	pier	p1l	3114	259,4	36,5	360	65	425	295	300	0,865	0,983
		p1r	3575	297,8	45,5	530	75	605	455	300	0,993	1,517
		p2	3344	278,6	33,8	310	65	375	245	300	0,929	0,817
		p3l	3481	290,0	43,5	490	70	560	420	300	0,967	1,400
		p3r	3409	284,0	32,8	290	60	350	230	300	0,947	0,767
		p6l	2723	226,8	41,3	445	70	515	375	300	0,756	1,250
		p6r	3485	290,3	33,3	300	65	365	235	300	0,968	0,783
		average		**275,3**	**38,1**	**389**	**67**	**456,4**	**322,1**	300	**0,918**	**1,074**

Bridge	Element		Ultrasonic Velocity Results		Rebound Hammer Results					Design	Comparison Rck from	
											Ultrasonic Velocity	Rebound Hammer
	Type	Number	V	Rc	R av	Rc	interval	Rc max	Rc min	Rck=Rd	R_v / Rd	R_{RH} / R 8
			m / s	kg/cmq		kg/cmq	kg/cmq	kg/cmq	kg/cmq	kg/cmq		
10	abument	sp1	2449	204,0	32,3	285	60	345	225	300	0,680	0,750
		sp2	2935	244,5	38,0	390	65	455	325	300	0,815	1,083
		average		**224,2**	**35,2**	**338**	**63**	**400,0**	**275,0**	300	**0,747**	**0,917**
	pier	p 1	3167	263,8	31,0	260	60	320	200	300	0,879	0,667
		p 2	1825	152,0	25,8	180	45	225	135	300	0,507	0,450
		average		**207,9**	**28,4**	**220,0**	**52,5**	**272,5**	**167,5**	300	**0,693**	**0,558**
	beam	d301	3011	250,8	42,5	470	70	540	400	500	0,502	0,800
		d101	3006	250,4	32,3	285	60	345	225	500		
		average		**250,6**	**37,4**	**377,5**	**65,0**	**442,5**	**312,5**	500	**0,501**	**0,625**

In comparison between ND test and Rck Design, worst results are for bridge 2 where usually the relationship Rc/Rck is 0,6-0,7 for beams and pier 5. This reason leads to the substitution of deck structure and to the reinforcement of some of the piers.

IVANESCU T. TOMA ROMANIA MLPAT DCLP NR. 445 A4, B2, D2 INGINER VERIFICATOR PROIECTE

21-11-2008

14 - INTERVENTIONS

All interventions were organized by groups, in accordance with the related location and type of deterioration, as it is exposed in the following table, where designed interventions executed on each bridge can be seen:

CODE	MAINTENANCE AND REHABILITATION WORKS	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10
	ROAD FINISHES AND EQUIPMENT										
A1	Painting of pedestrian parapet										
A2	Replacement of pedestrian parapet										
A3	Guard rail replacement										
A4	Electrical equipment replacement										
A5	Walkway slab substitution										
	PAVEMENTS										
B1	Roadway pavement and waterproofing replacement										
B2	Roadway superficial drainage rehabilitation										
B3	Walkway pavement replacement										
B4	Expansion joints replacement										
B5	Bearings replacement										
	CONCRETE REPAIR										
C1	Deck slab repair										
C2	Prestressed concrete beams repair										
C3	Pier caps concrete repair										
C4	Piers concrete repair										
C5	Tower leg concrete repair										
C6	Structural strengthening										
C7	Superstructure replacement										
	STEEL WORKS										
D1	Painting of steel structures										
D2	Stay cables maintenance										
D3	Strengthen of anchor bolts										
D4	Rehabilitation of inspection gantry and rails										
	EARTHWORKS										
E1	Ashlar stoneworks repair										
E2	Repair of strutture connection with embankment										
E3	Cone quarters rehabilitation										
E4	Rehabilitation of storm water collecting system										
E5	River bank improvement										

IVANESCU T. TOMA
ROMANIA
MLPAT DCLP
NR. 445
A4, B2, D2
INGINER VERIFICATOR PROIECTE

04-11-2008

ROAD FINISHES AND EQUIPMENT

A1 – Painting of pedestrian parapet

This item requires the painting of steel pedestrian parapet, and so the following operations became important factors in achieving satisfactory protection:

- surface preparation,
- coating materials,
- application techniques,
- impact of regulations.

This intervention will be applied on all bridges except for bridge 10 in accordance with design drawings.

Surface Preparation

Pedestrian parapet painting surface preparation involves power tool cleaning (SSPC SP 3) in areas showing visible deterioration, followed by application of an epoxy zinc primer and a polyurethane finish coat.

Hand and Power Tool Cleaning. About half of the bridges painted on an annual basis are overcoated. This method of maintenance painting requires washing the steel with water and using power tools to clean loose paint and rust from the surface. The predominant specification calls for SSPC SP 3, power tool cleaning, in areas where deteriorated paint or rust are visible.

Removes loose rust, loose mill scale and loose paint. Intact materials may remain. Power tools use electrical and pneumatic equipment to provide faster cleaning. They include sanders, wire brushes or wheels, chipping hammers, scalers, rotating flaps (rotopeen), needle guns and right angle or disk grinders.

Cleaning metal surfaces is less expensive using power tools than using hand tools. In addition, power tool cleaning generally requires much less stringent containment and produces less waste than abrasive blast cleaning.

Thus, power tools are used frequently for spot cleaning of damaged coatings, where contamination of adjacent areas by abrasive is unacceptable.

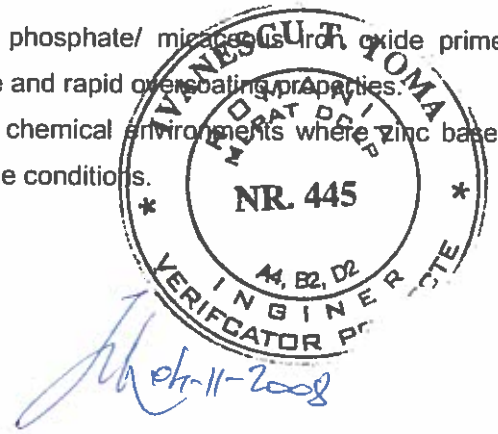
Coating Materials

Primer - Intercure 200 HS:

A two component, high solids, low VOC, epoxy zinc phosphate/ micaceous iron oxide primer offering excellent barrier protection, low temperature cure and rapid overcoating properties.

Intercure 200 HS is preferred for use with systems for chemical environments where zinc based materials can be subject to attack in both acid and alkaline conditions.

Recommended Thickness: 80 microns



Finish Coat - Interthane 990:

A two component acrylic polyurethane finish giving durability and long term recoatability.

Level of sheen and surface finish is dependent on application method. Avoid using a mixture of application methods whenever possible. Best results in terms of gloss and appearance will always be obtained with conventional airless spray application.

Recommended Thickness: 60 microns

Both products have been approved by International Protective Coatings.

Application Techniques

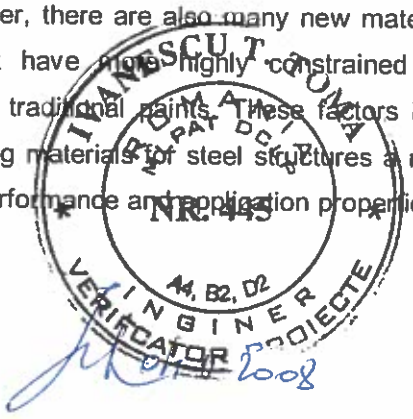
Bridge coatings can be sprayed, brushed, or rolled onto the steel, depending upon the requirements of the particular job. The majority of coatings are applied using airless spray. However, in many cases where nearby traffic or facilities may be impacted by overspray, the agency may restrict the use of spray equipment, and brushing or rolling will be required. With the use of containment on all cleaning jobs, often the specification will call for the containment to remain in place for spraying the primer. The containment can then be moved and the final coats brushed or rolled.

There has been a renewed emphasis on stripe painting techniques for complex bridge surfaces. Most striping is specified as hand striping using only a brush. Stripe painting is considered good painting practice for slower drying coatings. These coatings tend to "thin" at edges and acute angles due to the surface tension of the wet-applied paint film. Often, this phenomenon has caused paints to fail prematurely on edges of flanges and fasteners. Stripe coating these areas will ensure proper paint film build and should alleviate this potential problem.

Impact of Regulations

A lot of countries regulations have effectively eliminated the use of traditional lead-based alkyd and high-solvent paints. Specific environmental and worker health and safety regulations have been established to limit generating, handling, and disposing of waste containing toxic heavy metals (e.g., lead and chromium). Likewise, air pollution regulations continue to reduce the allowable solvents in coatings.

Industry has responded to these regulatory drivers by providing a broader spectrum of coating materials that are compliant with new regulations. Many of these materials actually offer significant performance improvements over older formulations; however, there are also many new materials that provide disappointing performance, and many that have more highly constrained use parameters (e.g., mixing, application technique, etc.) than traditional paints. These factors have combined to make the selection and specification of coating materials for steel structures a more complex practice requiring a significant knowledge of the performance and application properties of a wide range of coating materials.



Specifications and regulations requiring containment of surface preparation activities vary, and continue to evolve, but the time, labor, skill, oversight, and equipment needs for steel surface preparation have all increased dramatically over the past 15 years. Although these cost increases caused a significant reduction in the number of bridges being painted during the 1990s, this trend is reversing. The costs are coming down somewhat, and the new protocols (and their associated costs) have placed a higher premium on work quality in maintenance painting operations.

A2 – Replacement of pedestrian parapet

This intervention will be applied on bridges 2 and 10 in accordance with design drawings, where parapet corrosion is considered irreversible or is highly damaged, as it is dangerous to pedestrian traffic.

In these cases, it is necessary to dismantle the existing parapet and assemble the new one with the following operations:

- removal of the parapet connection screws;
- cutting with oxyacetylene flame of the posts;
- loading and transport of the material resulting from the demolition to an approved dump area;
- procurement, transport, storage and handling of the pedestrian parapet elements and other related materials and equipment;
- local transport and handling of the parapet panels;
- assembling and installation of the parapet panels;
- rust protective coat painting;
- parapet painting in two layers using airless spray;
- verifications after execution in accordance to the design;
- sampling and laboratory testing;

Steel plates embedded in the reinforced concrete support beams are included.

A3 – Guard rail replacement

It needs to dismantle existing guard rail and assembling the new one with the following operations:

- removal of the guard rail connection screws;
- cutting with oxyacetylene flame of the posts;
- loading and transport of the material resulting from the demolition to an approved dump area;
- procurement, transport, storage and handling of the guard rail elements and other related materials and equipment;
- local transport and handling of the guard rail elements;
- assembling of the guard rail elements;
- supply and installation of the reflective elements;
- rust protective paint;

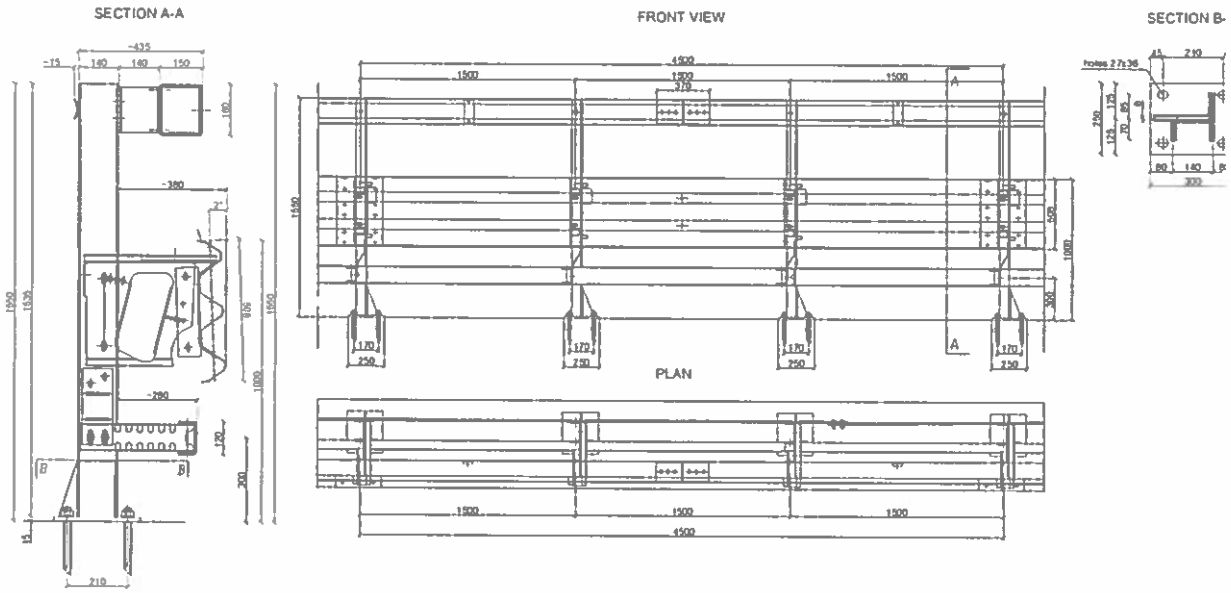
IVANESCU T. TOMA ROMANIA MLPAT DCLP NR. 445 A4, B2, D2 INGINER VERIFICATOR PROIECTE

04-11-2008

- final paint in two layers;
- verifications after execution in accordance to the design;
- sampling and laboratory testing;

Steel plates embedded in the reinforced concrete support beams are included.

This intervention will be applied on all bridges in accordance with design drawings, taking into consideration that bridge 6 lacks of the guard rail in correspondence to concrete spans, so the new guard rail must be installed as well as all other bridges:



Guard-rail Type H3-Bridge with 1,5 m height to be placed on all bridges

A4 – Electrical equipment replacement

It needs to dismantle existing electrical equipment and assembling the new one according to the following activities:

- dismantling of the existing electrical equipment;
- loading and transport of the material resulting from the demolition to an approved dump area;
- procurement, transport, storage and handling of the new electrical elements and other related materials and equipment;
- assembling and installation of the new electrical elements;
- verifications after execution in accordance to the design;
- sampling and laboratory testing.

This intervention will be applied on all bridges except for bridge 10 in accordance with design drawings.

IVANESCU T. TOMA ROMANIA MLPAT DCLP NR. 445 A4, B2, D2 INGINER VERIFICATOR PROIECTE
04-11-2008

The new road illumination main elements will be composed by the following elements:

POLESTAR POLE:

Cylindrical-conical pole model POLESTAR which has the cylindrical section at the base with a length of not less than 2300 mm. The poles are derived from an ERW normalized pipe suitable for hot-rolling which is made of killed steel of the S275JR type according to the EN 10025 (previously FE 430) standard.

On the pole are forecast all the following workings:

_ Cable input slot 186 x 46 mm;

_ Junction box slot 186 x 46 mm suitable for a steel door of "flush pole" type, complete with antivandalism closing;

_ Earthing supports device and the electrical equipment located inside the slot;

_ Junction box model Conchiglia MVE 416/1 or similar;

_ An aluminium sphere Ø 76 mm is installed on the pole top (on request).

The above mentioned lighting pole has 14 mt above ground level for what concerns bridge 1 whereas it has 12 mt above ground level for what concerns all other bridges.

BRACKET MILETUS 200:

MILETUS decorative system according is characterized by a special bracket supporting the lighting body:

_ Central node made of steel S235 JR;

_ Multiple arms options (up to six arms);

_ Implemented with circular section pipes made of steel S235 JR, calendered and welded;

_Extending lighting body mount tang Ø 60;

_ Hanging lighting body mount option with sleeve PG 34 female;

_The pole-bracket coupling is assured through an appropriate system of threaded seats and special security dowels made of stainless steel;

_ Main bearing pipe Ø 76 made of steel S235 JR;

_ Bolts and nuts made of stainless steel;

_ Coupling to poles whose top shell terminates in Ø 76 after undergoing the necessary presetting workings.

IVANUSCHI T. TOMA ROMANIA MLPAT DCLP NR. 445 A4, B2, D2 INGINER VERIFICATOR PROIECTE

04-11-2008

LUMINAIRE ORIGIA 800 250W:

Luminaire with a simple and versatile line, suitable for all kind of streets and urban scenaries:

_ joint and frame in aluminium cast;

_ turned aluminium cap, 20/10 thick;

_ reflector in high grade aluminium bright finished 1 mm thick;

_ ampholder fixed to the cap made of self-extinguishing insulating material with high thermomechanical qualities;

_access to the optic group by means of three set screw at 120° operating on a quarter of turn;

_ closing temperd flat glass 5 mm thick;

_ transparent methacrylate bowl (only for pendant fixture);

_ lampholder E27 / E40;

_ PG 34 male adapter for pendant fixture;

_side mounting joint Φ 65 mm with four set screw 8 MA;

_ pole-top mounting plate;

_laying mounting.

This luminaire will be placed on bridges 2, 3, 6 and 9.

LUMINAIRE LUMADA VP 250W:

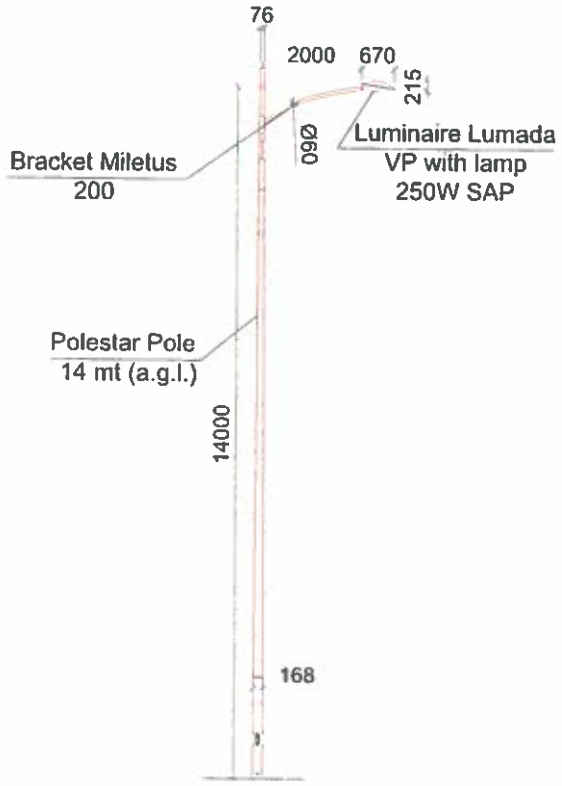
Streetlighting with a futuristic and extremely winning design that together with its functionality, soundness and reliability makes it the safe and ideal choice for the lighting of main motorways, city area and outskirts roads, crossings, parkings, squares and large road areas, both motorways.

The standard colour is light grey RAL 7035.The lampholder is mounted by adjustable square support in cast aluminium. It can be quickly removed by hand without the need of tools. Attachment suitable for straight or curved poles up to a maximum diameter of 80 mm. The adjustable system allows continuous 0°÷120° adjustments from the outside without opening the set thanks to a graduated scale the required inclination can be set.

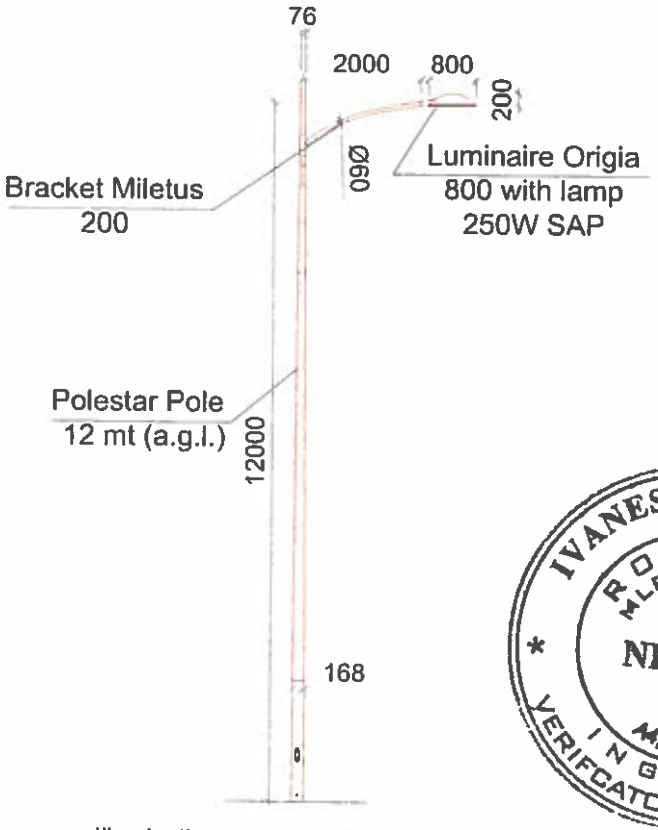
This luminaire will be placed on bridges 1, 4, 5, 7 and 8.

IVANESCU T. TOMA
ROMANIA
MLPAT DCLP
NR. 445
A4, B2, D2
INGINER
VERIFICATOR PROIECTE

04-11-2008



Illumination system on Bridge 1



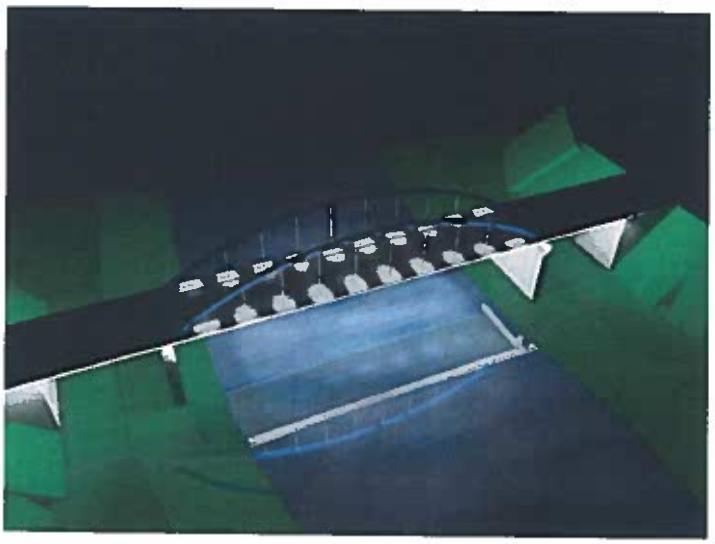
Illumination system on Bridge 2, 3, 6 and 9

IVANESCU T. TOMA
ROMANIA
MLPAT DGLP
NR. 445
M, B2, D2
INGINER
VERIFICATOR PE

04-11-2008

An exterior architectural lighting system has been designed for bridges 3, 4, 5 and 6:

- PROJECTORS WITH ROTOSYMMETRIC LIGHT WITH METAL HALIDE 70W LAMPS
- MICRO PROJECTORS LED 6W WITH ROTOSYMMETRIC LIGHT



Exterior architectural lighting on bridge 4

A5 – Walkway slab substitution

This item needs to restore the missing lids and to provide for lack of steel plates on the walkways. Particularly it is sometimes required to dismantle existing walkway slab around damaged zone, and assembling the new steel slab.

The item covers the following activities:

- dismantling of the existing walkway slab;
- loading and transport of the material resulting from the demolition to an approved dump area;
- procurement, transport, storage and handling of all related materials and equipment;
- laying the walkway slabs;
- verifications after execution in accordance to the design;

This intervention will be applied on bridges 7 and 8 in accordance with design drawings.

IVANESCU I. TOMA ROMANIA MLPAT DCLP NR. 445 A4, B2, D2 INGINER VERIFICATOR PROIECTE

07-11-2008

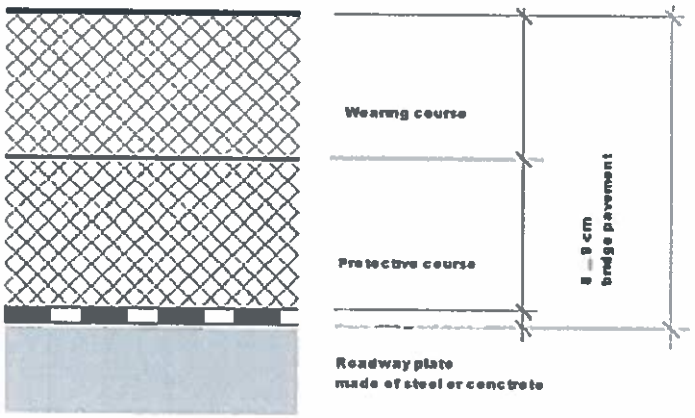
PAVEMENTS

B1 – Roadway pavement and waterproofing replacement

This intervention will be applied on all bridges except for bridge 9 in accordance with design drawings and is due to the very bad conditions of present bituminous conglomerate pavements.

Roadway pavements on bridges must absorb traffic loads, transfer them to the supporting structures and remain even and resistant to deformation and provide good anti-skid conditions for vehicles. At the same time they must protect the bridge structure from surface water which in winter contains de-icing salt which promotes corrosion.

The new bridge pavement, which is 9 cm thick, consists of a wearing course, a protective course or binder and a sealing course. The protective and wearing course are made of asphalt. The sealing course can be made from various materials but these must be tested construction materials.

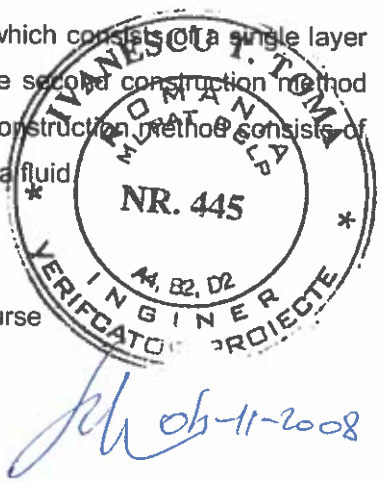


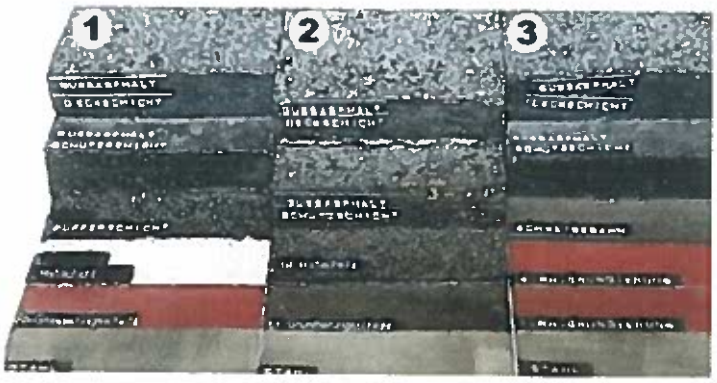
New pavement section

There are three permitted methods of constructing the sealing course on concrete bridges. All three construction methods are bound surface-to-surface with the concrete of the bridge superstructure without a dividing course. Firstly cement deposits and any loose materials are removed from the concrete surface through blasting. The concrete is then primed with epoxide resin. If the concrete surface is too rough an epoxide resin mortar can be used to fill scratches.

The most commonly used construction method is a sealing course which consists of a single layer bitumen sheet. It can be torched on with a special gas burner. The second construction method uses a two-layered bitumen sheet. The sealing course in the third construction method consists of two-element reaction resin, usually polyurethane, which is applied as a fluid.

- Construction method 1 is a reaction resin sealing course
- Construction method 2 is a bitumen sealing course
- Construction method 3 is a reaction resin/bitumen sealing course





Pavements on steel bridges with different sealing courses

In contrast to roadway pavements on concrete bridges, pavements on steel bridges are subjected to large deformations through the elastic behavior of the steel road plates.

Non-porous mastic asphalt is usually used for the protective course of the bridge pavement. Polymers are mixed with the mastic asphalt especially for steel bridges - due to the higher dynamic loads. Rolled asphalt is used for the protective course in the two-layer sealing course on concrete.

The bridge pavement execution covers the following activities:

- scarifying and removing the existing bituminous surface;
- loading and transport of the material resulting from the demolition to an approved dump area;
- cleaning and removal of any loose material from the concrete surface by sand blasting;
- procurement, transport, storage and handling of all related materials and equipment;
- execution of the leveling and slope concrete;
- waterproofing execution in accordance with the specific instructions in use;
- performance of the in situ adherence tests of the membrane, at the required frequency;
- execution of the asphalt mortar waterproofing protection;
- assuring water tightness in correspondence of the waterproofing edges using specific elastic materials;
- laying 40 mm thick protective course including surface preparation applying primer coat with bitumen emulsion
- laying 40 mm thick wearing course including surface preparation applying primer coat with bitumen emulsion
- verifications after execution in accordance to the design;

IVANESCU T. TOMA ROMANIA MLPAT DCLP NR. 445 A1, B2, D2 INGINER VERIFICATOR PROIECTE

04-11-2008

B2 – Roadway superficial drainage rehabilitation

The item covers the substitution of the existent drain pipes and grids:

- removal of the existing damaged drain pipes and/or related grids;
- loading and transport of the removal material to an approved dump area;
- procurement, transport, storage and handling of necessary materials and equipment;
- installation of the new drain pipes and/or related grids;
- finishing works to ensure waterproofing;
- verifications after execution in accordance to the design.

This intervention will be applied on all bridges except for bridges 1 and 9 in accordance with design drawings.

B3 – Walkway pavement replacement

This intervention will be applied on all bridges in accordance with design drawings.

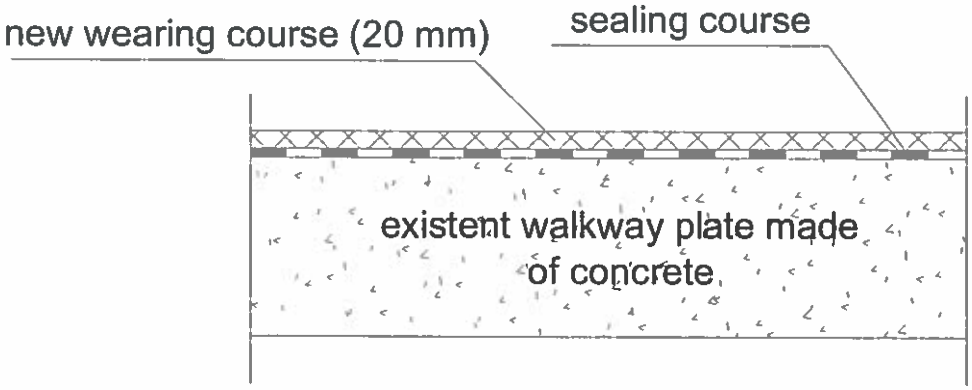
Scarifying and removing the existing pavement and replacement it. The item covers the following activities:

- scarifying and removing the existing surface;
- loading and transport of the material resulting from the demolition to an approved dump area;
- cleaning and removal of any loose material from the concrete surface by sand blasting;
- procurement, transport, storage and handling of all related materials and equipment;
- execution of the leveling and slope concrete;
- waterproofing execution in accordance with the specific instructions in use;
- performance of the in situ adherence tests of the membrane, at the required frequency;
- execution of the asphalt mortar waterproofing protection;
- assuring water tightness in correspondence of the waterproofing edges using specific elastic materials;
- laying 20 mm thick wearing course including surface preparation applying primer coat with bitumen emulsion
- verifications after execution in accordance to the design;

NOTE: the surface will be calculated for the width of two kerbs and bridge total length.

IVANESCU T. TOMA
ROMANIA
NR. 445
A4, B2, D2
INGINER
VERIFICATOR PROIECTE

04-11-2008

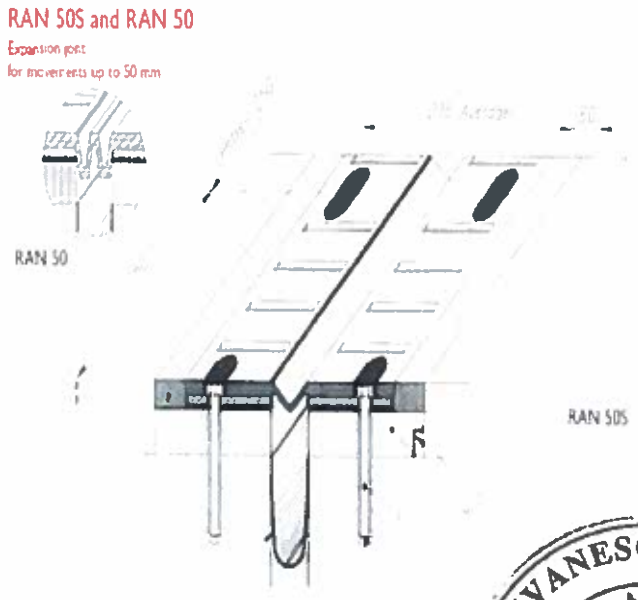


New walkway section

B4 – Expansion joints replacement

This intervention will be applied on all bridges except for bridges 3, 9 and 10 in accordance with design drawings.

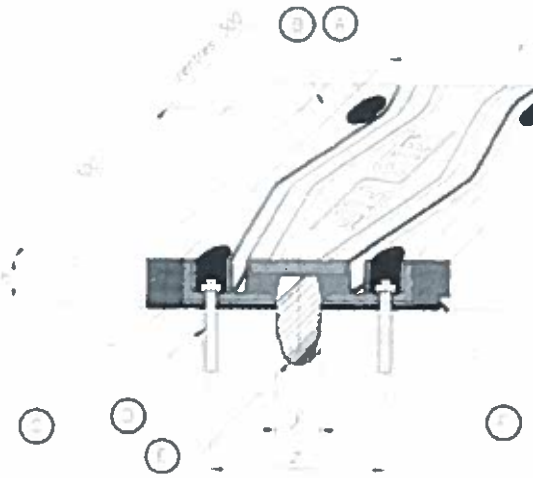
All joints designed are supplied by FIP Industrial with the following details:



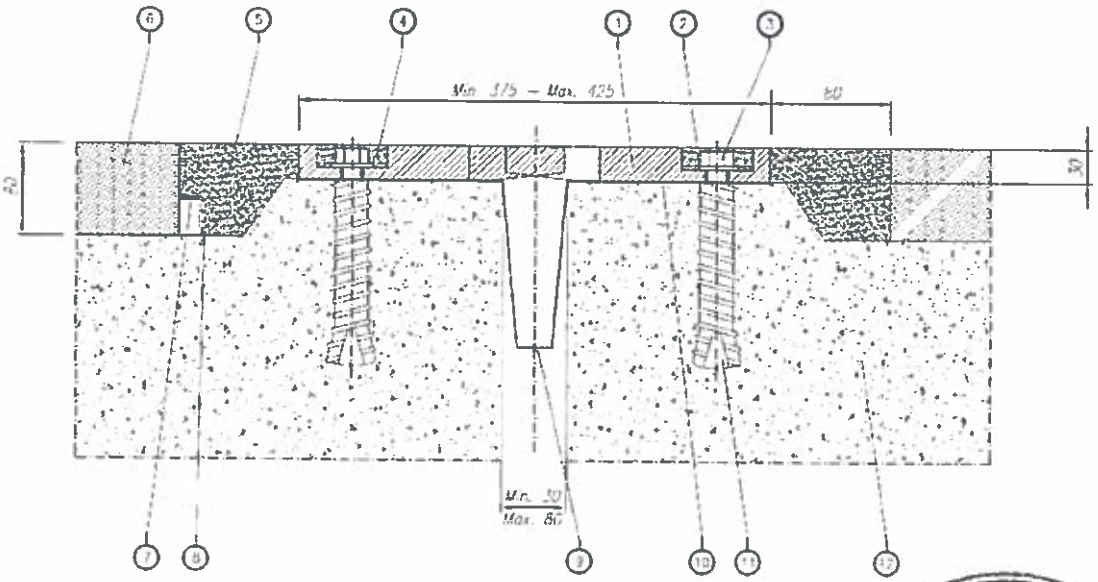
50 type Expansion Joint

IVANESCU T. TOMA
ROMANIA
MLPAT DCLP
NR. 445
M, B2, D2
INGINER
VERIFICATOR PROIECTE

04-11-2008



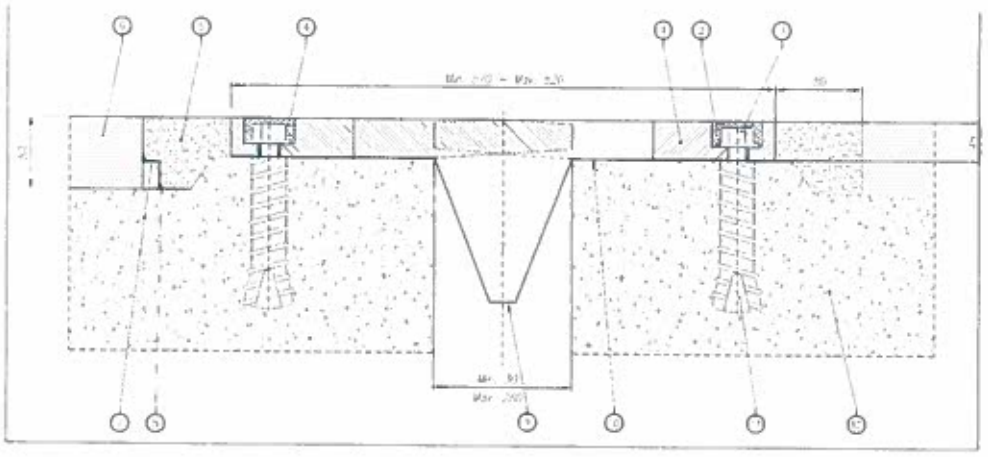
GPE 120 type Expansion Joint



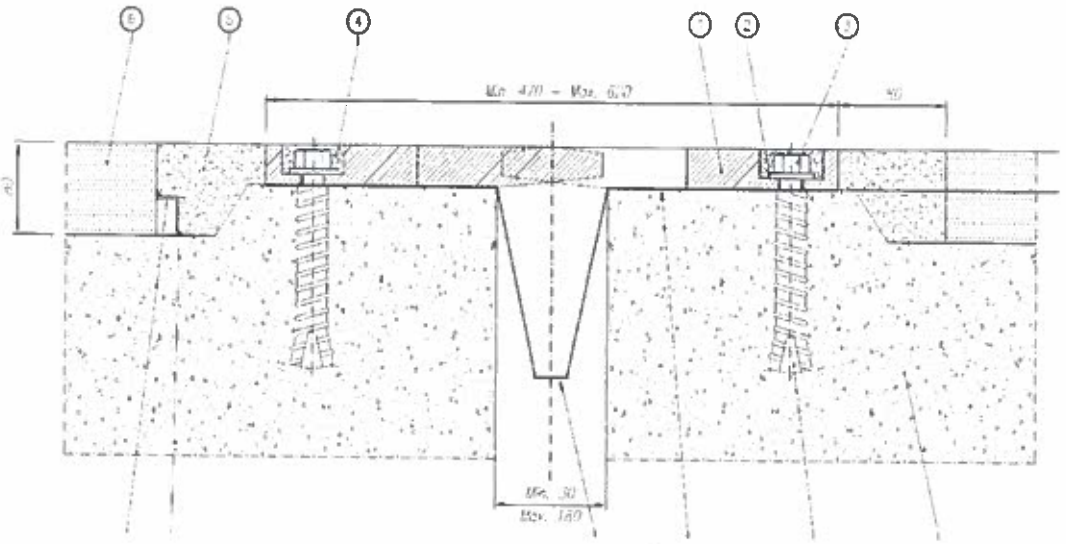
GP 50 type Expansion Joint

IVANESCU T. TOMA
ROMANIA
MLPAT DGLP
NR. 445
A4, B2, D2
INGINER
VERIFICAT PROIECTE

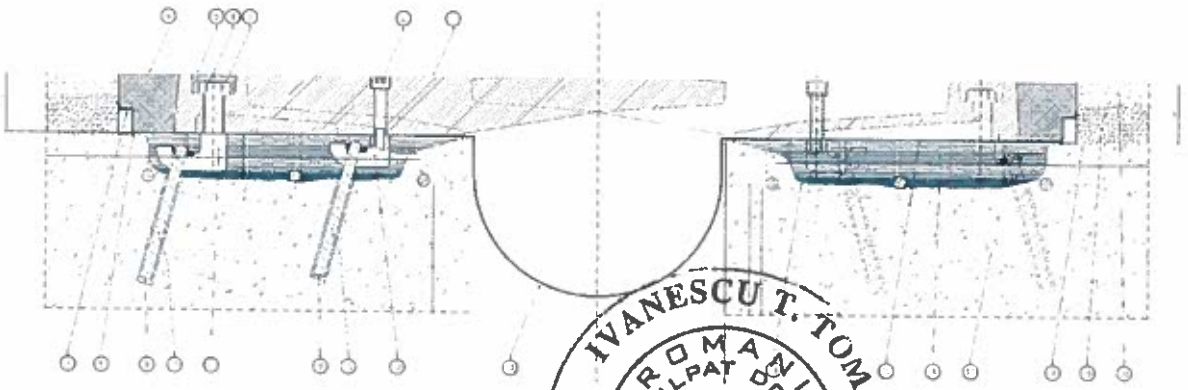
06-11-2008



GP 250 type Expansion Joint



GP 150 type Expansion Joint



FE C 500 type Expansion Joint

IVANESCU T. TOMA
ROMANIA
MLPAT DCLP
NR. 445
A4, B2, D2
INGINER
VERIFICATOR PROIECTE
04-11-2008

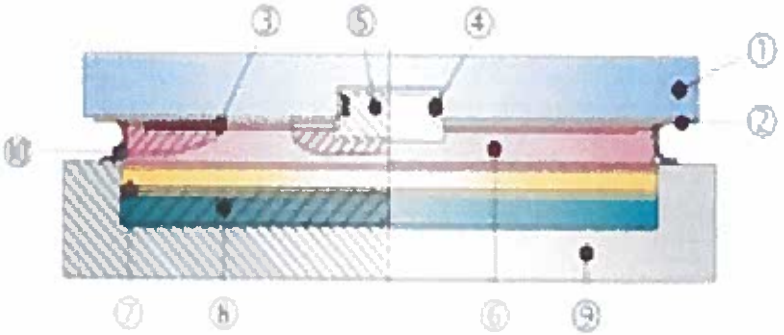
Particular note for bridge 2 expansion joints where the designed GP 50 type and GP 250 type joints may not be the better choice in order to the transversal displacements founded by the testing operations.

Energy source	DISPLACEMENTS (mm)			
	Motorway span		Railway span	
	Vertical	Horizontal	Vertical	Horizontal
Traffic	23.01	35.16	30.43	20.24
Train	21.68	12.19	45.63	22.28

B5 – Bearings replacement

This intervention will be applied on bridge 1 in accordance with design drawings.
The item covers the following activities:
- procurement, transport, handling and installation of the necessary materials;
- procurement of scaffoldings and platforms for works;
- installation and dismantling of the scaffoldings;
- disassembling of the existing bearings;
- installation of the new steel-PTFE bearings;
- verifications after execution in accordance to the design.

NOTE: This item includes the use of hydraulic rams for deck uplift of 4 spans simultaneously.



1. Sliding element - 2. Stainless steel - 3. PTFE - 4. Low friction strip - 5. Guide element - 6. Intermediate element - 7. Sealing ring - 8. Elastomeric pad - 9. Pot - 10. Dust protection

New Bearing Components

IVANESCU T. TOMA ROMANIA MLPAT DGLP NR. 445 44, B2, D2 INGINER VERIFICATOR PROIECTE

11-2008

Bearing Type	Nominal Vertical Load (KN)	Max Horizontal Load (KN)	A (mm)	B (mm)	C (mm)	D (mm)	H (mm)	Max. Movement (mm)
Unidirectional sliding	3000	335	440		440	430	118	50
Unidirectional sliding	3000	335	440		440	430	118	50
Multidirectional sliding	3000		440		440	430	118	50
Fixed	3000	503	440	400			95	

New Bearings Characteristics

IVANESCU T. TOMA
ROMANIA MLPAT DCLP
NR. 445
A4, B2, D2
INGINER
VERIFICATOR AP... CTE

04-11-2021

CONCRETE REPAIR

C1- Deck Slab Repair

C2 – Prestressed Concrete Beams Repair

C3 - Concrete Pier Caps Repair

C4 - Concrete Piers Repair

C5 – Tower Leg Repair

For each of the following chapters about concrete repair (C1- C5), the following activities will be covered:

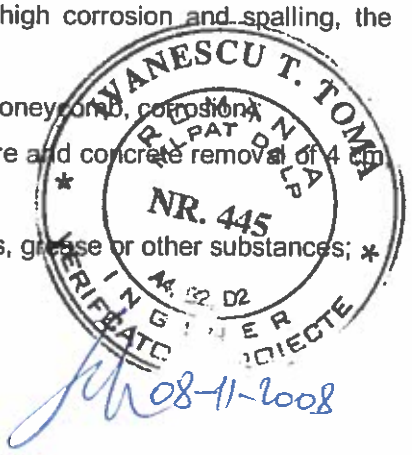
- Sounding of concrete to locate areas of delamination;
- preparation and cleaning of surface by means of sand blasting and water washing and/or concrete removal by means of hydrodemolition;
- loading and transport of the material resulting from the demolition to an approved dump area;
- procurement, transport, storage and handling of all related materials and equipment;
- epoxy and polyurethane compounds application;
- application of a corrosion inhibitor and a cementitious mortar where concrete is removed;
- verifications after execution in accordance to the design;

These interventions can be divided in 2 different work sequences in accordance with the type and location of the deterioration. Therefore, when efflorescence, low corrosion and spalling are founded, the following work steps may be implemented:

1 - Sounding of concrete to locate areas of deterioration (spalling, honeycomb, corrosion);
2 - Concrete sand blast cleaning to prepare the surface for receiving protective materials;
3 - Concrete water washing with 1500 psi of pressure to remove oils, grease or other substances;
4 - Application of an epoxy resin primer coat like MASTERSEAL PRIMER PU from BASF or similar;
5 - Application of a polyurethane resin protective coat like MASTERSEAL FORMULA PU from BASF or similar.

Differently, when the concrete surface present honeycomb and high corrosion and spalling, the following work steps may be implemented:

1 - Sounding of concrete to locate areas of deterioration (spalling, honeycomb, corrosion);
2 - Hydrodemolition of damaged concrete with 30000 psi of pressure and concrete removal of 4 cm being attention with reinforcing steel;
3 - Concrete water washing with 1500 psi of pressure to remove oils, grease or other substances;



4 - Application of a modified polymer cementitious monocompound corrosion inhibitor like EMACO NANOCONCRETE AP from BASF or similar;

5 - Application of a thixotropic cementitious mortar with restrained expansion, fiber-reinforced with flexible inorganic fibres, like EMACO FORMULA TIXOFIBER from BASF or similar;

6 - Application of an epoxy resin primer coat like MASTERSEAL PRIMER PU from BASF or similar;

7 - Application of a polyurethane resin protective coat like MASTERSEAL FORMULA PU from BASF or similar;

Note: For C2 intervention, only the first work sequence is applicable because, hydrodemolition can't be done on the prestressed concrete beams

The applied products are described as follows:

MASTERSEAL PRIMER PU

Is a solvent-borne two-pack epoxy resin with low viscosity acting as primer for the elastomeric polyurethane coating MASTERSEAL FORMULA PU and as curing agent for the mortars of the EMACO FORMULA range.

Stir the 2 parts separately, then pour part B (hardener) into part A (base) and use a low-speed mechanical mixer to obtain a smooth mix. The product must not be diluted; it may be applied by spraying or by roller (for limited areas).

MASTERSEAL FORMULA PU

Is a two-pack elastic solvent-borne polyurethane resin with high solids content by volume, forms a film coating with satin finish having a crack bridging ability and high protective capacity against agents that cause damage to reinforced concrete.

Stir part A well in its can using a low-speed mechanical mixer; ensure that all of part B is emptied into part A and blend together for a couple of minutes, using the mechanical mixer, before application.

The product may be applied by short pile roller or by spray. When using a hand roller, it is advisable to apply 2 successive coats at least 12-18 hours apart in excellent environmental conditions (20°C and 65% r.h.).

In airless spraying, the recommended dry thickness of 200-300 µm (micron) may be applied in a single coat.

EMACO NANOCONCRETE AP

Is a single-pack light grey, polymer-modified cementitious primer containing corrosion inhibitors. Must be applied by brush immediately after having removed the rust. The first coat is applied over the whole length of the bar, using a stiff brush for a thickness of approx. 1mm and the second coat is

IVANESCU T. TOMA
ALPAP OLA
NR. 445
A1, B2, D2
INGINER
PROIECTE
VERIFICAT
04-11-2008

applied as soon as the first is dry. Then wait for the inhibitor to have set sufficiently before carrying out the repair work with the EMACO FORMULA TIXOFIBER.

EMACO FORMULA TIXOFIBER

Is a ready-mixed air-cured thixotropic cementitious mortar with restrained expansion that is resistant to environmental agents, contains polyacrylonitrile fibres and is reinforced with flexible and durable inorganic fibres. The reinforcement fibres have length 12mm, diameter 14 μm, tensile strength 1700 MPa and modulus of elasticity 72000MPa.

Must be applied onto macroscopically roughened but cohesive surfaces that have been cleaned and satured with water. In the case of extensive surfaces, the product may applied for a thickness from 1 to 5 cm in a single layer using screw or piston sprayers.

During the interruptions in spraying, it is necessary to thoroughly clean the tubes and the pump itself using water under pressure and a soft tube-cleaning rubber ball.

C6 – Structural Strengthening

This intervention can be divided in :

- interventions with CFRP laminates and transverse straps on bridge 2 pier caps and on bridge 8 prestressed concrete beams;
- reinforcing of pier P5 (and maybe other piers) on bridge 2 by means of wrapping with reinforced concrete and execution of a new piers foundation with pressure grouted micropiles.

Concerning the interventions with carbon reinforced fibers polymers,the item covers the following activities:

- procurement, transport, storage and handling of all related materials and equipment;
- application of a bicompound epoxy primer
- application of coats of epoxy adhesive for bonding new concrete with CFRP laminates and transverse straps;
- application of CFRP laminates;
- application of CFRP straps;
- verifications after execution in accordance to the design

IVANESCU T. TOMA ROMANIA MLPAT DGLP NR. 445 A4, B2, D2 INGINER VERIFICATOR PROIECTE

04-11-2008

	MBT-MBrace Laminate LM 10/1,4	MBrace Fiber High Modulus
Fiber Type	Carbon	Carbon
Nominal Thickness (mm)	1,4	0,165
Tensile Modulus (GPa)	165	390
Tensile Strength (MPa)	2300	2500
Ultimate Strain (%)	1,8	0,8

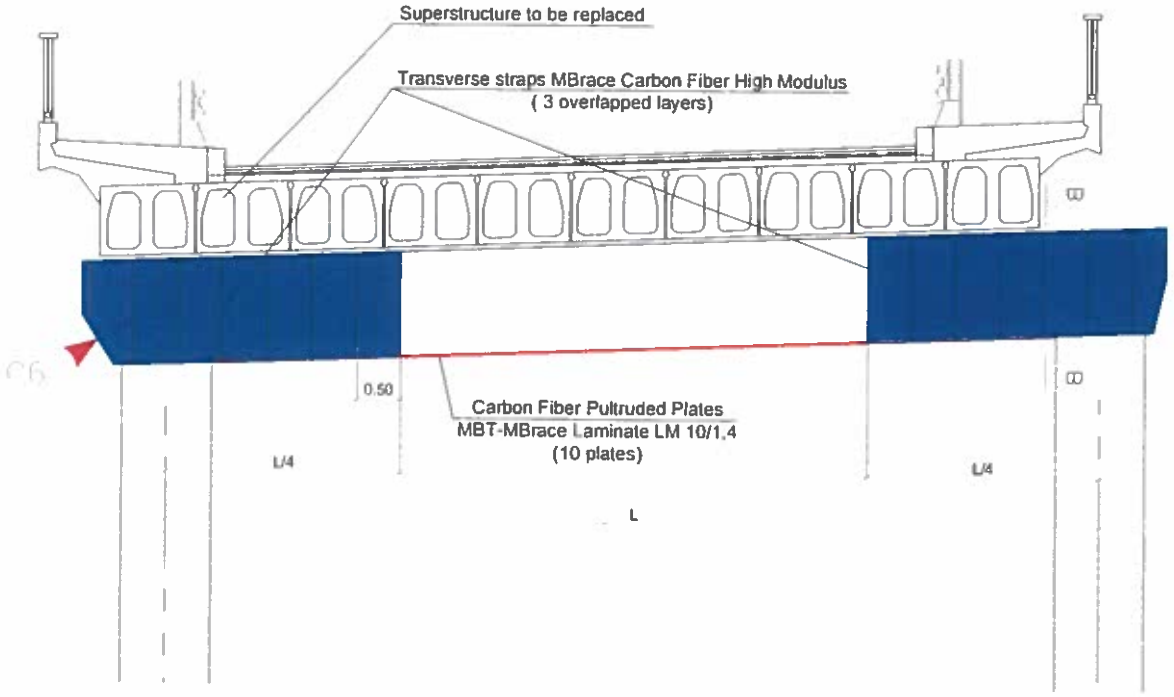
Characteristics of CFRP Composite System

Composite fabrics are an effective method for providing shear, confinement, or flexural strength to concrete and masonry. The most commonly used FRPs in the construction industry are carbon, E-glass and aramid fibers. In all cases, they are used in conjunction with an adhesive, typically epoxy resins. FRP fabrics have high strength and high modulus, yet arte very light and very flexible.
As such, they can conform to most sizes and geometry found in the field. The fabric can be applied in many different methods, including wet lay-up, dry lay-up, and vacuum bagging. The size and complexity of the project usually dictate the installation method. Surface preparation is very critical for FRP applications. All surfaces to receive FRP must clean and dry and free of contaminants. The surface concrete must be in good condition and all corrosion-related problems must be adequately addressed prior to FRP application.

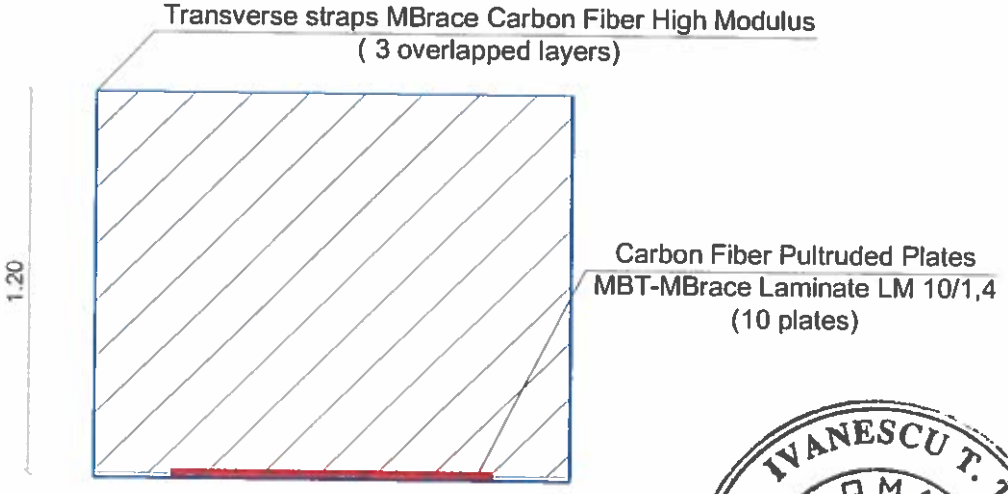
Composite strips or plates, commonly carbon fiber, have been used for strengthening concrete and masonry since the early 1990s. The plates are manufactured using the pultrusion process and can be made to varying widths, thickness, shapes, and strengths depending upon the equipment and raw materials used. Because the pultruded plates are thicker and more rigid than FRP fabrics, they are generally limited to strengthening flat members such as beams or slabs for flexural applications as well as narrow elements as joists. The members can be strengthened for positive moment (typically on the bottom) or negative moment (typically on the top).
The pultruded plates are manufactured under controlled conditions so the physical properties are generally more predictable. An epoxy paste adhesive is generally used for bonding the FRP plates onto the substrate; and because the FRP is so light, temporary supports are not necessary, even in overhead installations.

IVANESCU I. TOMA ROMANIA MLPAT DCLP NR. 445 M, B2, D2 INGINER VERIFICATOR PRO

04-11-2008



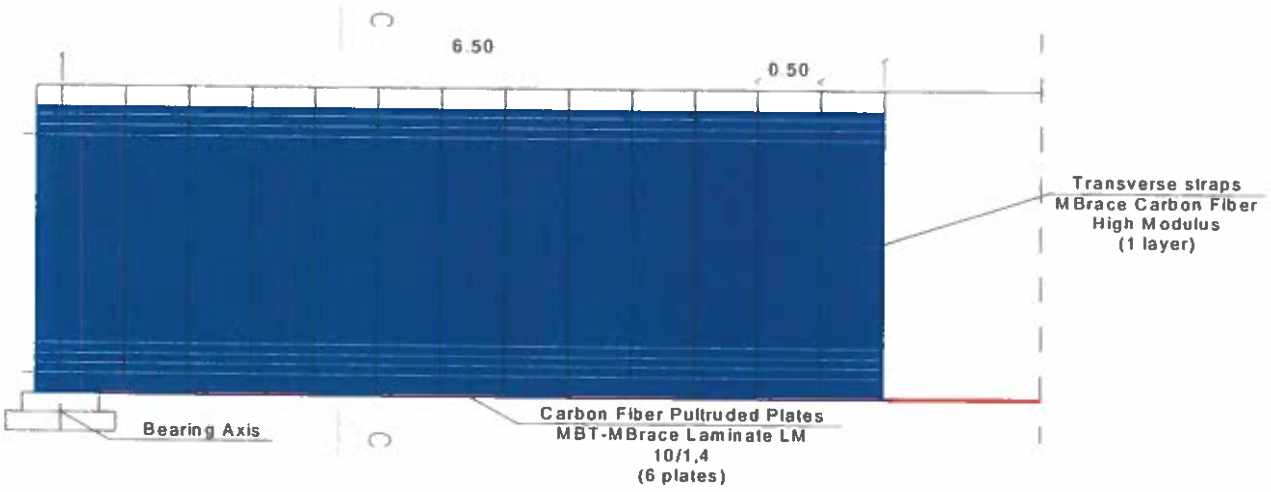
Intervention on Bridge 2 Pier Caps



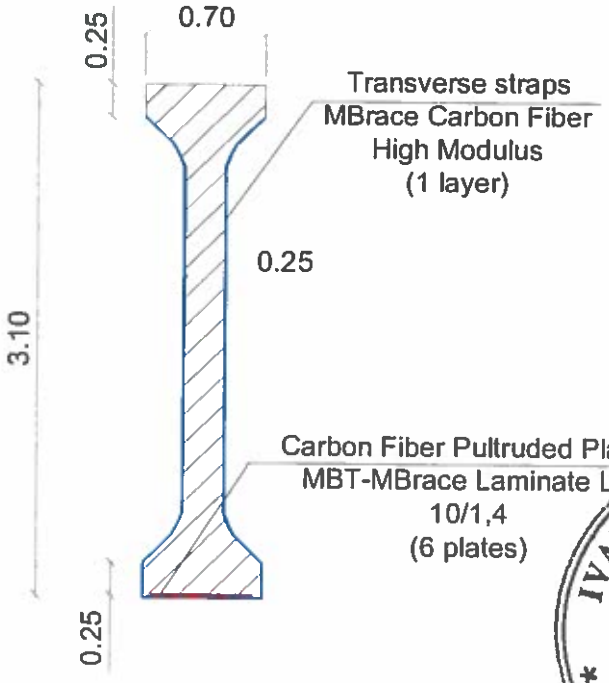
Intervention on Bridge 2 Pier Caps – Section B-B

IVANESCU T. TOMA
ROMANIA
MLPAT DGLP
NR. 445
A4, B2, D2
INGINER
VERIFICATOR PF

05-11-2008



Intervention on Bridge 8 external prestressed concrete beams



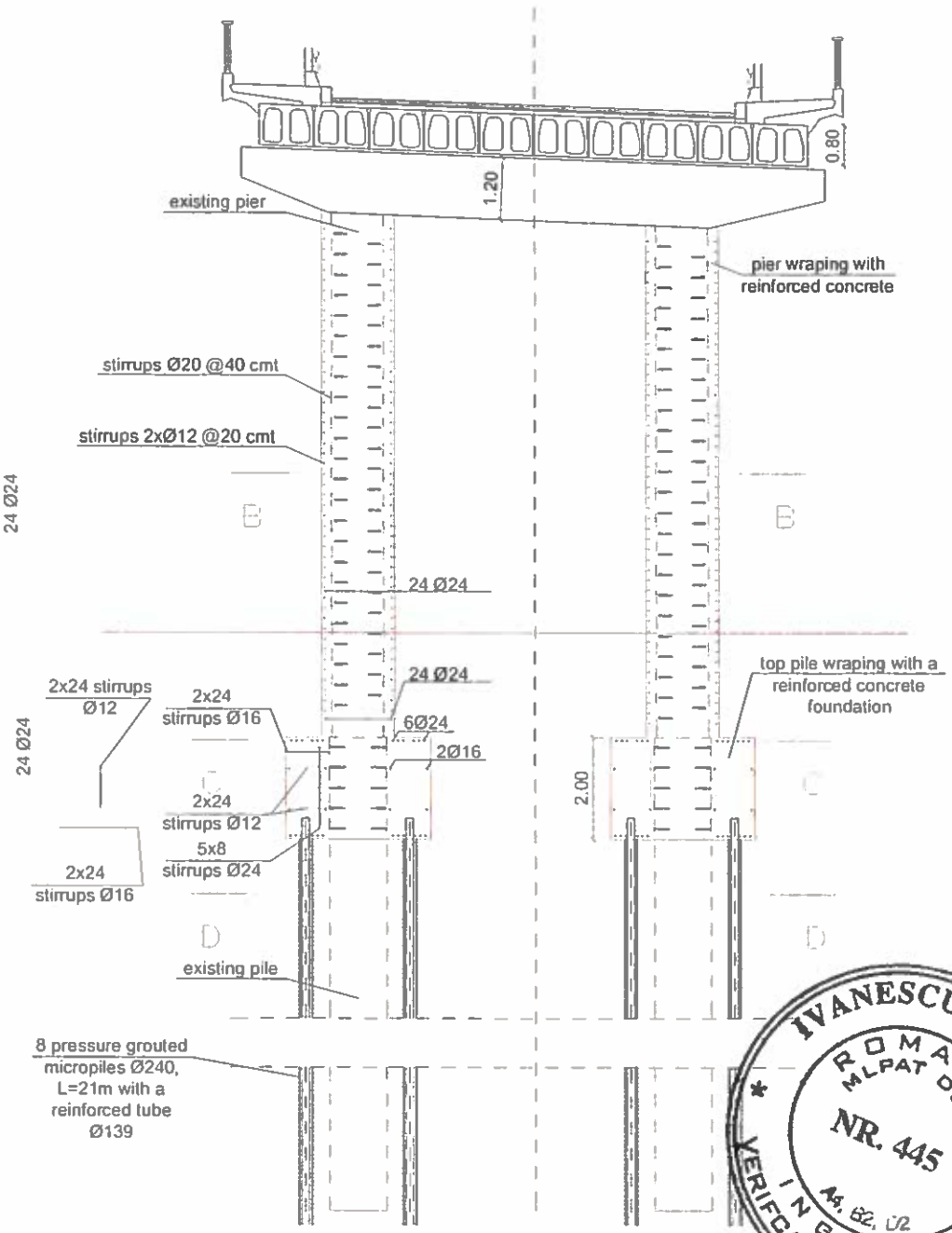
Intervention on Bridge 8 external prestressed concrete beams – Section C1, C2, D2

IVANESCU T. TOMA
ROMANIA
MLPAT DCLP
NR. 445
INGINER PROIECTE
VERIFICATOR

18-11-2008

In other way, the intervention on pier P5 on bridge 2 covers the following activities:

- procurement, transport, storage and handling of all necessary materials and equipment;
- placement of new steel reinforcement around the piers and piers foundation;
- placement of formworks to concrete placement;
- concrete placement;
- execution of pressure grouted micropiles.



Bridge 2 Pier P5 Reinforcing

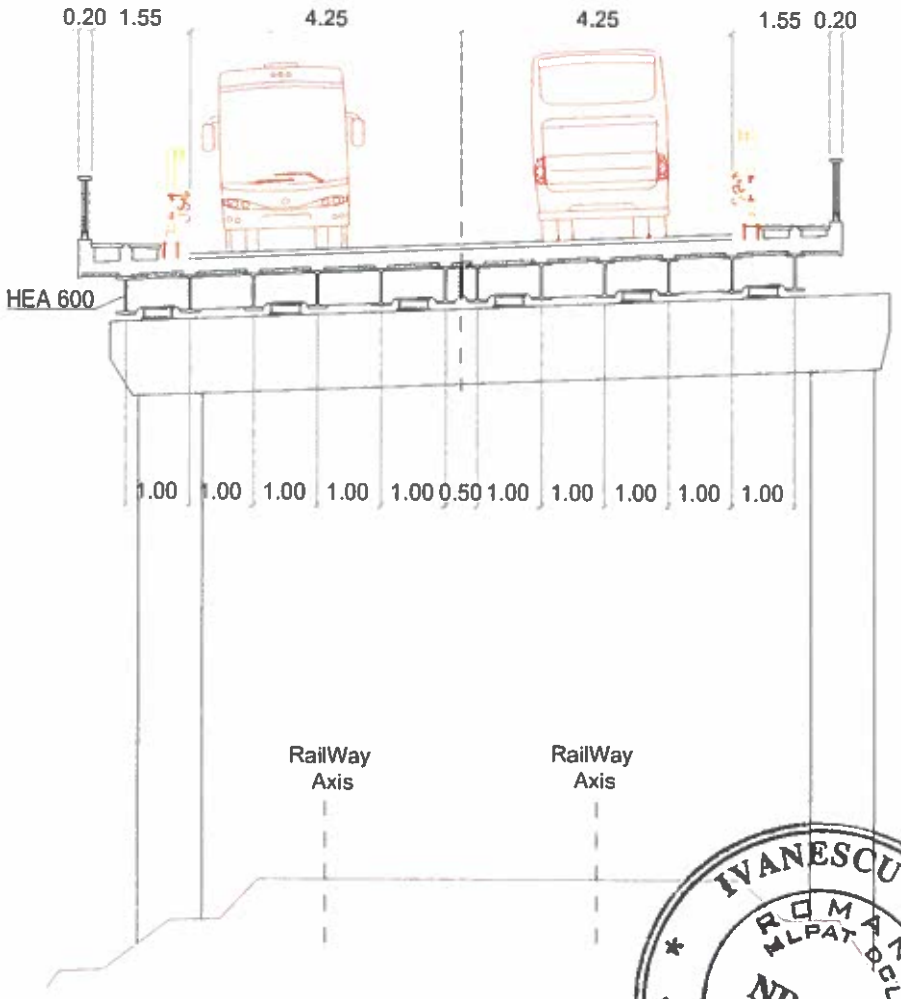
IVANESCU T. TOMA
ROMANIA MLPAT DCLP
NR. 445
A4, B2, C2
INGINER
VERIFICATOR

05-11-2008

C7 – Superstructure replacement

This item may be applied on bridge 2 viaduct and covers the following activities:

- procurement, transport, storage and handling of all necessary materials and equipment;
- demolition of existing deck anyway (longitudinal and transversal beams, deck slab, kerbs, etc..);
- disassembling of the existing bearings;
- loading and transport of the material resulting from the demolition to an approved dump area;
- installation of new steel-PTFE bearings;
- building of the new superstructure consisting of continuous steel concrete composite girders including scaffoldings and/or precast elements for cast facility;
- verifications after execution in accordance to the design;



New Transversal Section on Bridge 2 Viadu

IVANESCU T. TOMA ROMANIA MLPAT DGLP NR. 445 M, B2, D2 INGINER VERIFICATOR PRO

05-11-2008

STEEL WORKS

D1 – Painting of steel structures

This item requires the painting of steel structures, and so the following operations became important factors in achieving satisfactory protection:

- surface preparation,
- coating materials,
- application techniques,
- impact of regulations.

This intervention will be applied on all bridges except for bridges 2, 8 and 10 in accordance with design drawings.

Surface Preparation

Power Tool Cleaning to Bare Metal SSPC-SP11:

It produces a greater degree of cleaning than SSPC-SP3 and may be considered for coatings requiring a bare metal substrate. This method produces surfaces that "look" like near white or commercial blast.

Examples of circumstances where this specification may be applied are:

_ Touch-up of welded or damaged areas of erection assemblies;

_ Reducing volume of hazardous waste produced by abrasive blasting;

_ Cleaning around sensitive equipment or machinery.

High Pressure (30000 psi) Waterjetting SSPC-SP12 :

Generally used in maintenance cleaning of previosly painted surfaces. Waterjetting opens the profile under the existing paint or rust and removes the detritus.

The key to cleaning by water is to get the energy of pressurized water transferred to the substrate efficiently.

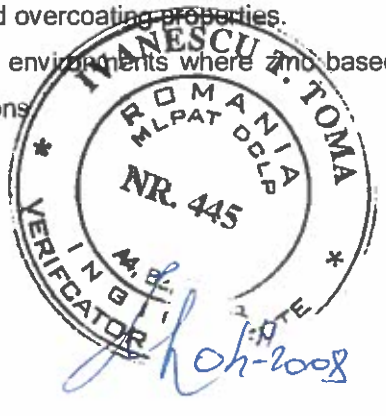
Coating Materials

Primer - Intercure 200 HS:

A two component, high solids, low VOC, epoxy zinc phosphate/ micaceous iron oxide primer offering excellent barrier protection, low temperature cure and rapid overcoating properties.

Intercure 200 HS is preferred for use with systems for chemical environments where zinc based materials can be subject to attack in both acid and alkaline conditions.

Recommended Thickness: 80 microns



Intermediate Coat - Intercure 420 HS:

A two component, high solids, low VOC, epoxy micaceous iron oxide intermediate coating offering excellent barrier protection, low temperature cure and rapid overcoating properties.

The incorporation of plate-like micaceous iron oxide pigment, both increases the barrier effect and improves long term overcoating properties of the system.

Recommended Thickness: 100 microns

Finish Coat - Interthane 990:

A two component acrylic polyurethane finish giving durability and long term recoatability.

Level of sheen and surface finish is dependent on application method. Avoid using a mixture of application methods whenever possible. Best results in terms of gloss and appearance will always be obtained with conventional airless spray application.

Recommended Thickness: 60 microns

Both products have been approved by International Protective Coatings.

Application Techniques

Bridge coatings can be sprayed, brushed, or rolled onto the steel, depending upon the requirements of the particular job. The majority of coatings are applied using airless spray. However, in many cases where nearby traffic or facilities may be impacted by overspray, the agency may restrict the use of spray equipment, and brushing or rolling will be required. With the use of containment on all cleaning jobs, often the specification will call for the containment to remain in place for spraying the primer. The containment can then be moved and the final coats brushed or rolled.

There has been a renewed emphasis on stripe painting techniques for complex bridge surfaces. Most striping is specified as hand striping using only a brush. Stripe painting is considered good painting practice for slower drying coatings. These coatings tend to "thin" at edges and acute angles due to the surface tension of the wet-applied paint film. Often, this phenomenon has caused paints to fail prematurely on edges of flanges and fasteners. Stripe coating these areas will ensure proper paint film build and should alleviate this potential problem.

Impact of Regulations

A lot of countries regulations have effectively eliminated the use of traditional lead-based alkyd and high-solvent paints. Specific environmental and worker health and safety regulations have been established to limit generating, handling, and disposing of waste containing toxic heavy metals (e.g., lead and chromium). Likewise, air pollution regulations continue to reduce the allowable solvents in coatings.

Industry has responded to these regulatory drivers by providing a broader spectrum of coating materials that are compliant with new regulations. Many of these materials actually offer significant

IVANESCU TOMA ROMANIA MLPAT DCD MR 445 44, 82, D2 INGINER VERIFICATOR PRO

01-11-2008

performance improvements over older formulations; however, there are also many new materials that provide disappointing performance, and many that have more highly constrained use parameters (e.g., mixing, application technique, etc.) than traditional paints. These factors have combined to make the selection and specification of coating materials for steel structures a more complex practice requiring a significant knowledge of the performance and application properties of a wide range of coating materials.

Specifications and regulations requiring containment of surface preparation activities vary, and continue to evolve, but the time, labor, skill, oversight, and equipment needs for steel surface preparation have all increased dramatically over the past 15 years. Although these cost increases caused a significant reduction in the number of bridges being painted during the 1990s, this trend is reversing. The costs are coming down somewhat, and the new protocols (and their associated costs) have placed a higher premium on work quality in maintenance painting operations.

D2 – Stay cables maintenance

The item covers the inspection and eventually the cleaning of coated strands of anchorages and will be applied on bridge 3.

D3 – Strengthen of anchor bolts

On bridge 8, for the connections wich have missing anchor bolts, is required to restore them and a total check of the same connections.

The item covers the following activities:

- procurement, transport,storage and handling of related materials and equipment;
- restore missing anchor bolts in the connections;
- Check anchor bolts for adequate attachment.

D4 – Rehabilitation of inspection gantry and rails

On bridges 1, 7 and 8 it is proposed an anti-corrosion treatment and painting as designed to intervention A1 – Painting of pedestrian parapet.

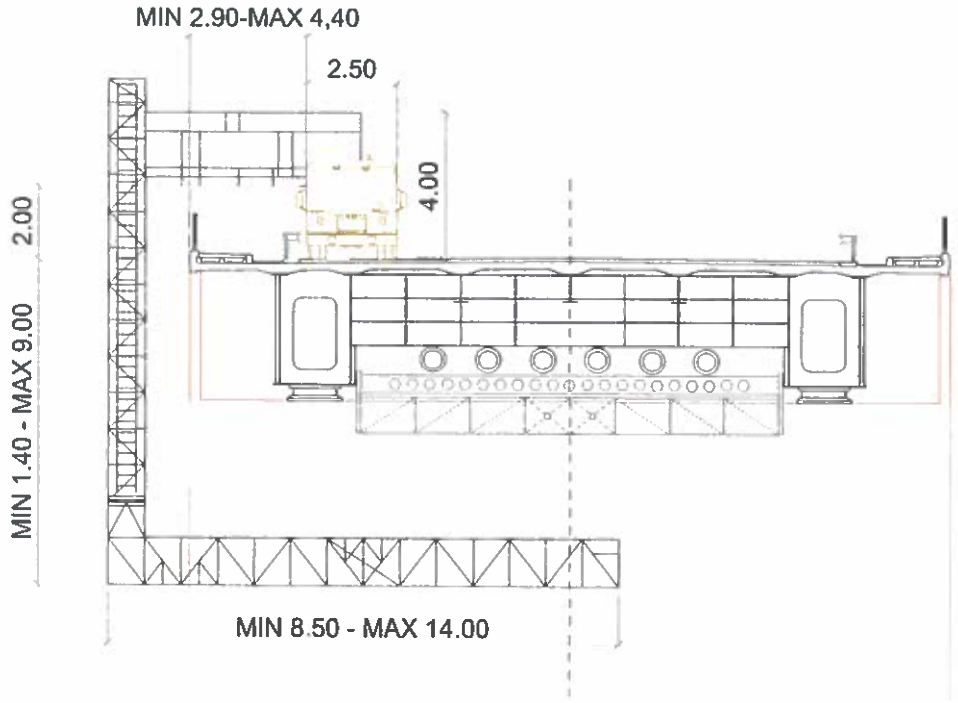
For bridges 3, 4, 5 and 9, this item covers the following activities:

- removal of the existing inspection gantry or/and rails;
- loading and transport of the material resulting from the demolition to an approved dump area.

In this cases, to future bridge maintenance work is proposed a purchase of a by-bridge with a maxim payload of platform of 600Kg.

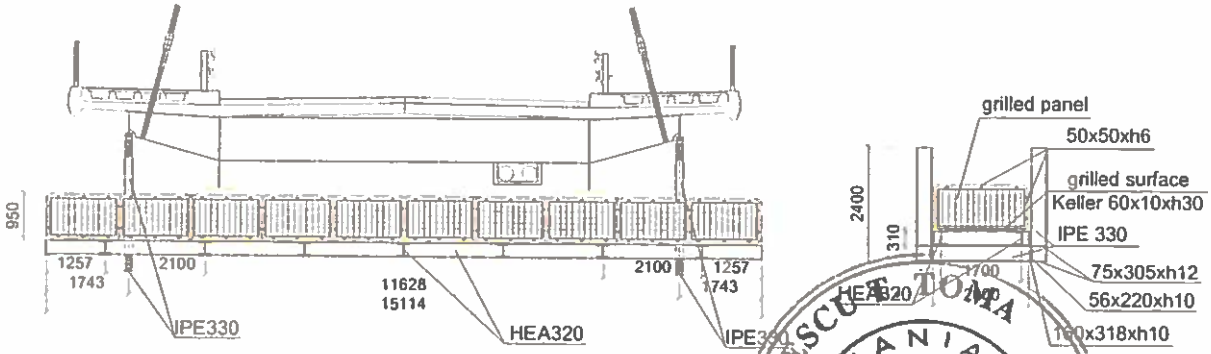
IVANESCU T. TOMA
ROMANIA
NR. 445
M, B2, D2
INGINER
VERIFICATOR

04-11-2008

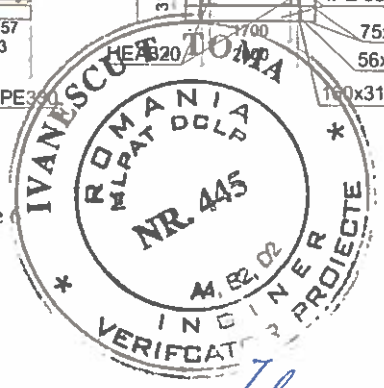


BY-BRIDGE BARIN ABC 140/LS WITH SCANIA 8*2 380 HP TRUCK CHASSIS

On bridge 6, the location and direction of connecting rods makes impossible the use of a by-bridge like the one showed above. Consequently, it had been designed a new inspection gantry:



New Inspection Gantry on Bridge 6



12-11-200x

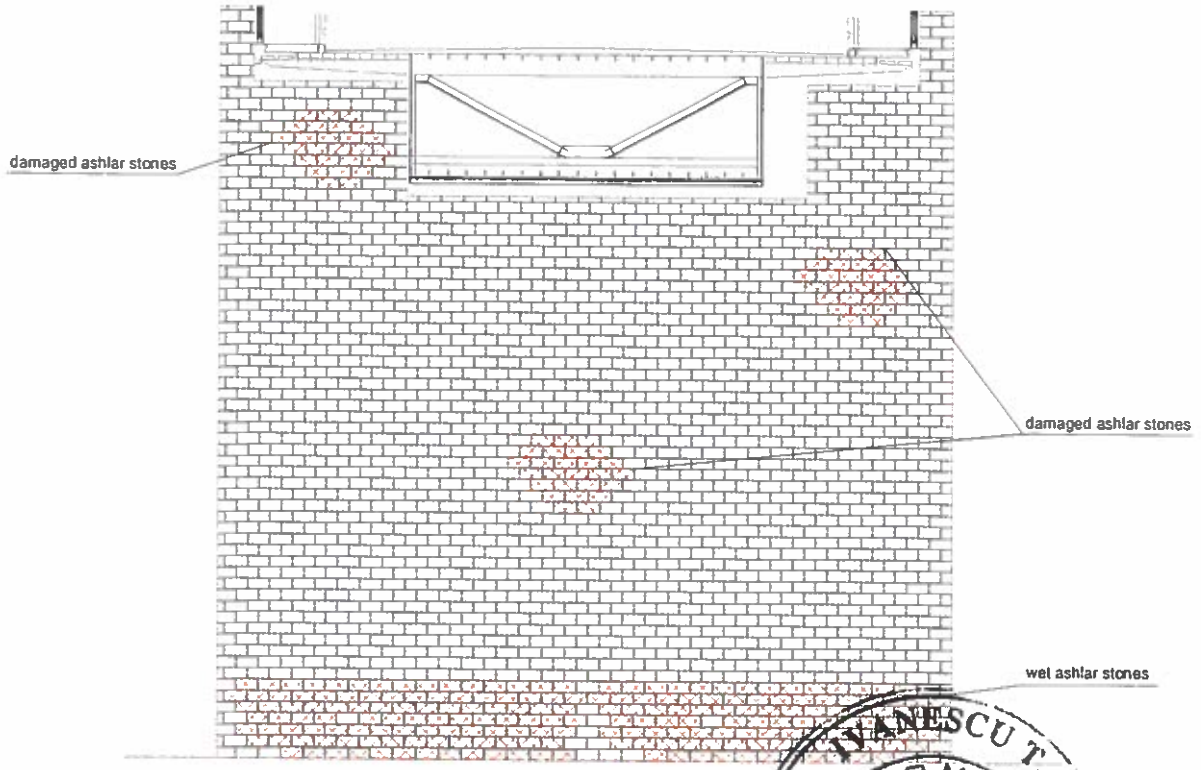
EARTHWORKS

E1 – Ashlar stoneworks repair

Is required the dismantling of the existing damaged ashlar stoneworks and laying and restoring, into the limited damaged zone, of new stoneworks.

The item covers the following activities and will be applied only on bridge 1:

- procurement, transport, storage and handling of necessary materials and equipment;
- removal of the damaged ashlar blocks;
- loading and transport of the removal materials to an approved dump area.
- laying new ashlar stoneworks;
- verifications after execution in accordance to the design.



Damaged Ashlar Stoneworks on Bridge 1 Piers

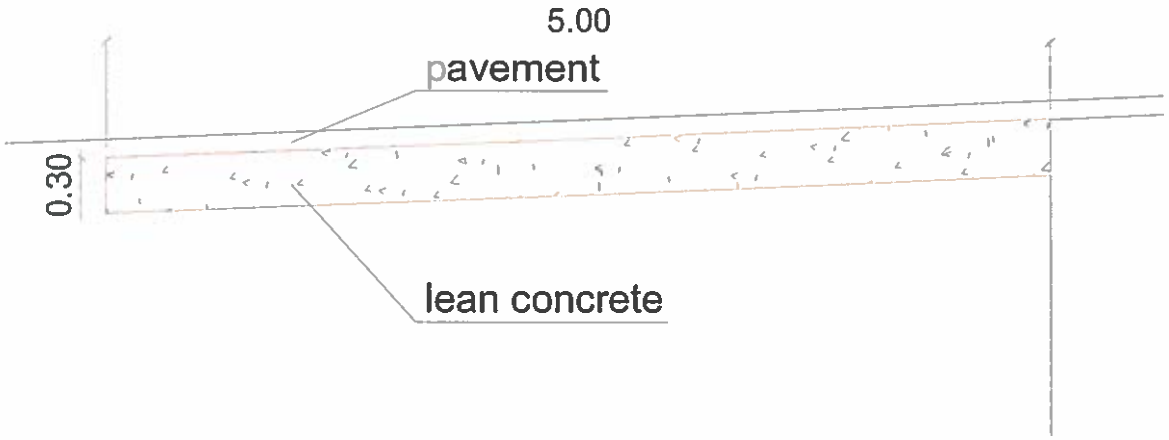
ROMANIA
NR. 445
INGINER VERIFICATOR PROIECTE
A, B2, D2
06-11-2008

E2 – Repair of structure connection with embankment

Is required to fill embankment behind abutment up, with lean concrete.

The item covers the following activities:

- procurement, transport, storage and handling of necessary materials and equipment;
- excavation of soil in borrow pit or in an intermediary storage;
- loading and transport of the soil resulted from excavations to the approved storage yards;
- filling with lean concrete;
- checking of the filling quality after compaction.
- verifications after execution in accordance to the design.



Intervention E2 scheme

This intervention will be applied on bridges 2, 3 and 10 in accordance with design drawings.

IVANESCU T. TOMA ROMANIA MLPAT DCLP NR. 445 A4, B2, D2 INGINER VERIFICATOR PROIECTE

04-11-2008

E3 – Cone quarters rehabilitation

This intervention will be applied on bridges 9 and 10 in accordance with design drawings.
Cone quarters rehabilitation by the same original materials, including land cleaning of bushes and shrubs, excavation, filling with suitable fill material or natural aggregates stabilized with cement.

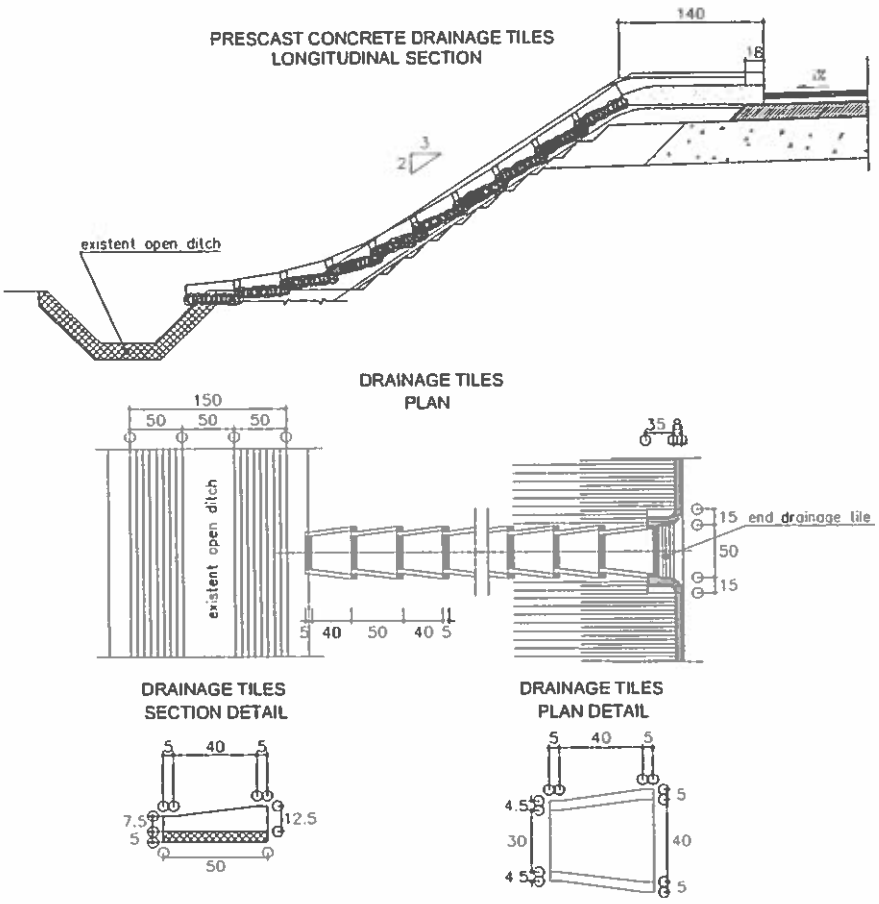
The item covers the following activities:
- land cleaning of bushes and shrubs;
- procurement, transport, storage and handling of necessary materials and equipment;
- excavation of soil in borrow pit or in an intermediary storage;
- loading and transport of the soil resulted from excavations to the approved storage yards;
- spreading of soil in 10 cm layers and compaction;
- finishing works, check of the achieved surfaces in respect to the design;
- checking of the filling quality after compaction.

E4 – Rehabilitation of storm water collecting system

This intervention will be applied on bridges 3, 4, 5 and 6 in accordance with design drawings.
The item covers the following activities:
- procurement, transport and handling of the necessary materials;
- soil excavation;
- ballast layer, including material, transport spreading and compaction;
- concrete preparation, transport and casting;
- execution of the storm water collecting system foundation;
- precast elements assembling;
- mortar preparation, transport and handling;
- filling the prefabricates joints;
- verifications after execution in accordance to the design.

IVANESCU T. TOMA ROMANIA MLPAT OCLP NR. 445 A4, B2, D2 INGINER VERIFICATOR PROIECTE

01-11-2008



Drainage Tiles Details

E5 – River bank improvement

This intervention will be applied on bridges 1, 4, 6 and 8 in accordance with design drawings.

Is necessary to avoid further increase of this erosive phenomenon.

This item covers the following activities:

- procurement, transport, storage and handling of necessary materials and equipment;
- land cleaning of bushes and shrubs;
- soil leveling;
- loading and transport of the discard materials to the approved storage yards;
- placement of rocks as protection of basement in artificial cuts made to profile the river banks;
- laying of river gabion mattresses made of hexagonal double twisted wire mesh filled with stones. The woven steel wire used to manufacture the mattress is heavily zinc-coated soft tempered steel;
- casting of lean concrete layer;
- finishing works, check after execution in accordance to the design.



15 - CONSTRUCTION SCHEMES

Please find below a table relating to the different interventions type and location and also the temporary work structure applied:

INTERVENTION TYPE	INTERVENTION LOCATION		TEMPORARY WORK STRUCTURE	INTERVENTION CODE
WITH TRAFFIC DEVIATION	UNDER DECK LEVEL	CONCRETE SPANS	SCAFFOLDINGS	B5, C6, C7
		STEEL SPANS	BY-BRIDGE	D1, D3, D4
	ABOVE DECK LEVEL (ROADWAY LEVEL)			A1,A2,A3,A4, A5, B1, B2, B3, B4, C1, C7, E2
WITHOUT TRAFFIC DEVIATION	UNDER DECK LEVEL	EMBANKMENT		E3, E4, E5
		CONCRETE SPANS	SCAFFOLDINGS	E1
		CONCRETE SPANS	PLATFORM LIFTS	C1, C2, C3, C4
	ABOVE DECK LEVEL	TOWER LEGS AND STAY CABLES	SLIDING PLATFORM	C5



)R/INVESTITOR

ROMANIAN NATIONAL COMPANY OF MOTORWAYS AND NATIONAL ROADS

COMPANIA NATIONALA DE AUTOSTRAZI SI DRUMURI NATIONALE DIN ROMANIA

R/PROIECTANT

LOUIS BERGER GROUP inc.

ONSULTING SERVICES FOR DESIGN AND WORKS SUPERVISION OF 10 BRIDGES IN DOBROGEA AREA

TECHNICAL DESIGN

GENERAL DOCUMENTS

TD - GD - 02

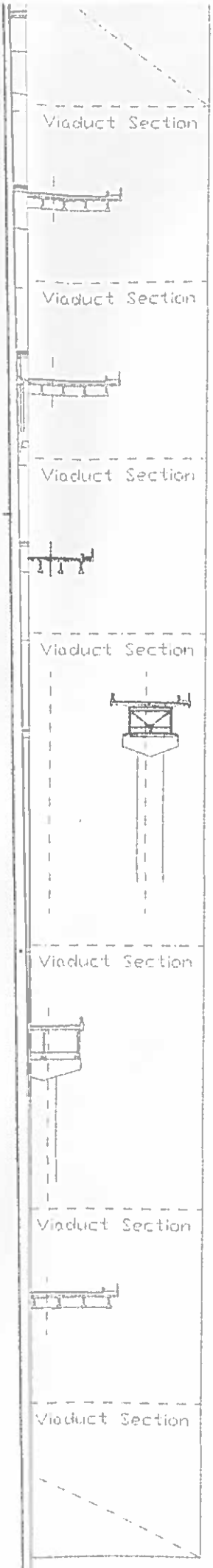
M LEADER
scoli Marcheti

DOTT. Ing. VITTORIO ASCOLI MARCHETTI ORDINE INGEGNERI ROMA N° 12645

CHOROGRAPHY - ROUTE MAP

ITS
r.l. - Roma Italia
el Tosto
cl

various	file name TD - GD - 02				
rev.	revision title	des	ver/chk	CP / PC	APPR. AUTHORITY
0	Issue	SOLIDUS	ASCOLI		



IVANESCU T. TOMA
ROMANIA
MLPAT
NR. 445
M.&D.
INGINER
VERIFICATOR PROIECTE

06-11-2008

INVESTOR/INVESTITOR

ROMANIAN NATIONAL COMPANY OF MOTORWAYS AND NATIONAL ROADS

COMPANIA NATIONALA DE AUTOSTRAZI SI DRUMURI NATIONALE DIN ROMANIA

DESIGNER/PROIECTANT

LOUIS BERGER GROUP inc.

CONSULTING SERVICES FOR DESIGN AND WORKS SUPERVISION OF 10 BRIDGES IN DOBROGEA AREA

TECHNICAL DESIGN

GENERAL DOCUMENTS

TD - GD - 03

DESIGN TEAM LEADER
Vittorio Ascoli Marchetti

ORDINE DEGLI INGEGNERI DELLA PROVINCIA DI ROMA
VITTORIO ASCOLI MARCHETTI
N° 12645

GENERAL BRIDGES SCHEME

CONSULTANTS
SOLIDUS s.r.l. - Roma Italia
Francesco Del Tosto
Romano Tucci

scale	various	file name TD - GD - 03				
data / date	rev.	revision title	des	ver/chk	CP / PC	APPR. AUTHORITY
08 aug 2008	0	issue	SOLIDUS	ASCOLI		

UR/INVESTITOR

ROMANIAN NATIONAL COMPANY OF MOTORWAYS AND NATIONAL ROADS

COMPANIA NATIONALA DE AUTOSTRAZI SI DRUMURI NATIONALE DIN ROMANIA

ER/PROIECTANT

LOUIS BERGER GROUP inc.

ONSULTING SERVICES FOR DESIGN AND WORKS SUPERVISION OF 10 BRIDGES IN DOBROGEA AREA

TECHNICAL DESIGN

GENERAL DOCUMENTS

TD - GD - 08

AM LEADER
Ascoli Marche

Dott. Ing. VITTORIO ASCOLI MARCHETTI
ORDINE INGEGNERI ROMA N° 12645

CONSTRUCTION SCHEMES

NTS
r.l. - Roma Italia
Del Tosto
cci

various	file name	TD - GD - 08				
rev.	revision title		des	ver/chk	CP / PC	APPR. AUTHORITY
0	issue		SOLIDUS	ASCOLI		