



Republic of Serbia  
Directorate for Inland Waterways

# **Danube Commission Recommendations and AGN on Serbian Stretch of the Danube River**

**Budapest, September 29, 2010.**

The goal of this presentation is to:

- Analyze the applicability of AGN rules and Danube Commission recommendations on Serbian part of the Danube River, and
- Raise questions regarding some parameters important for safe navigation

# Danube Commission Recommendations

- Published in 1988
- **Defines the dimensions of the fairway**
- For Serbian part of the Danube River characteristic dimensions are:
  - o Min depth – 2.50m at Low Navigation Level (LNL)
  - o Min width – 180m (100m on rocky bottom)
  - o Curvature Radius – 1000 m (750m in special geomorphic cases)

(All is applicable for free flowing sections of the river)

РЕКОМЕНДАЦИИ  
ПО УСТАНОВЛЕНИЮ ГАБАРИТОВ ФАРВАТЕРА,  
ГИДРОТЕХНИЧЕСКИХ И ДРУГИХ СООРУЖЕНИЙ  
НА ДУНАЕ

RECOMMANDATIONS  
RELATIVES A L'ETABLISSEMENT DES GABARITS DU CHENAL, DES OUVRAGES  
HYDROTECHNIQUES ET AUTRES  
SUR LE DANUBE



ДУНАЙСКАЯ КОМИССИЯ  
БУДАПЕШТ

1988

COMMISSION DU DANUBE  
BUDAPEST

- Published in 1996
- **Defines the dimensions of characteristic vessels and convoys**
- Free-flowing sector through Serbia belongs to class VIc
- Main requirement is to provide navigation of vessels with min. 2.50m draught for min 240 days
- Serbia and Germany are only Danubian countries that did not sign the Agreement



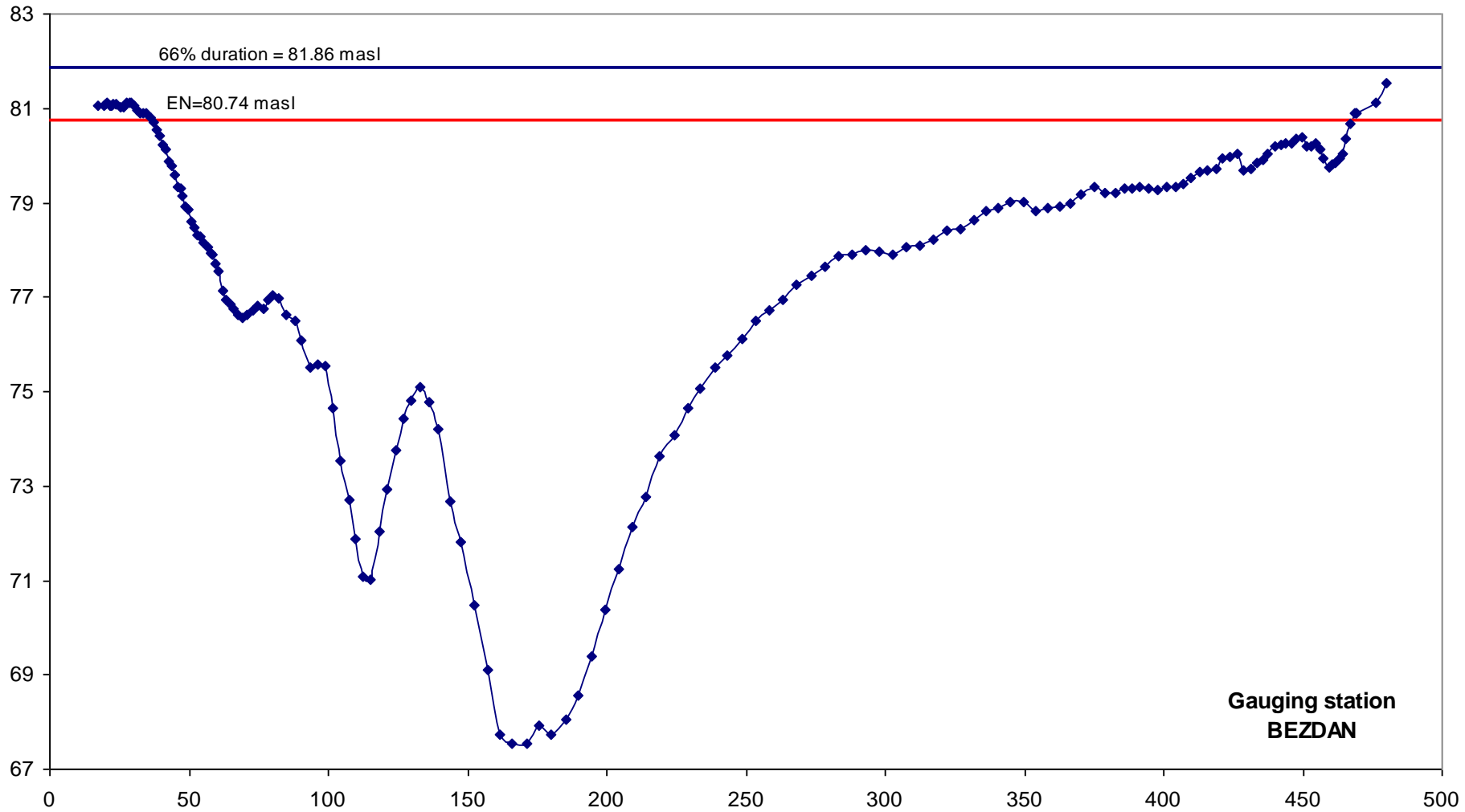
- **DK Recommendations:**
  - 2.5m of water to be available during the 94% of the year (343 days per year)
- **AGN:**
  - to provide navigation of vessels and convoys with 2.5m draught for min 240 days per year (66% of days)



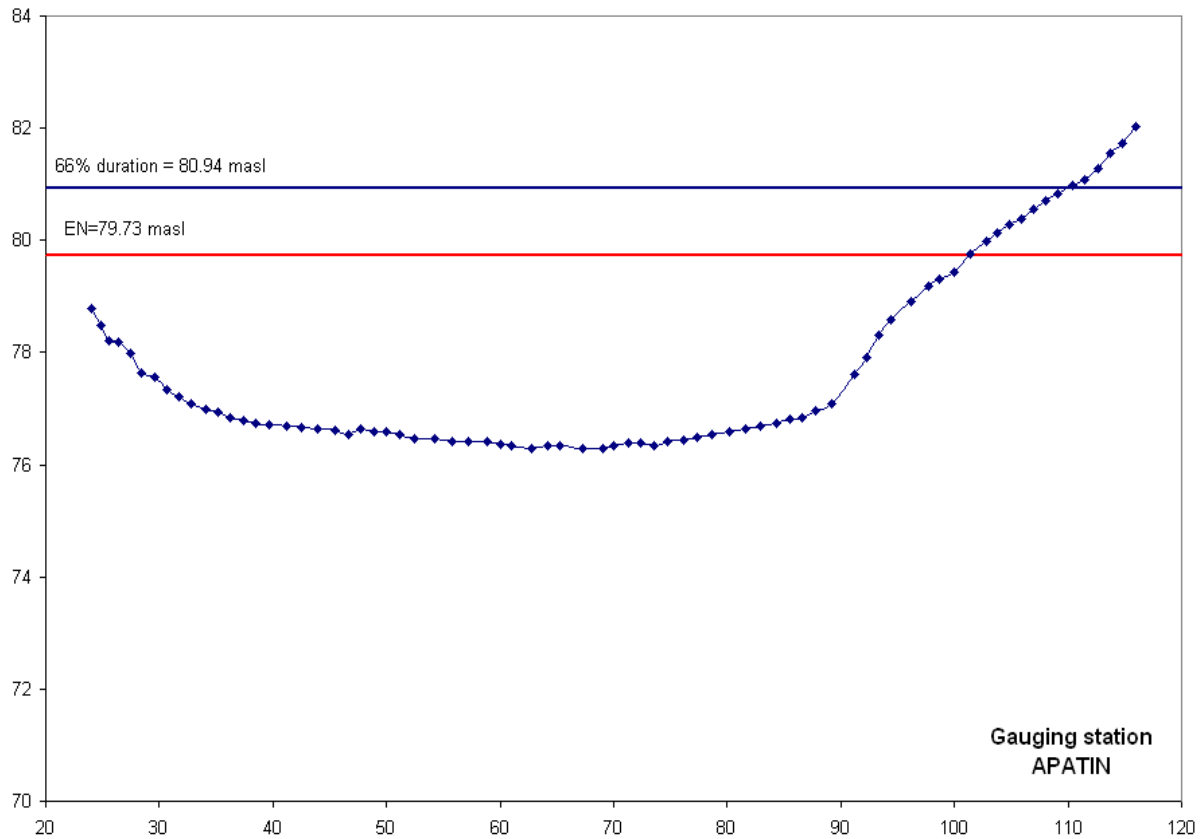
# Analysis on selected gauging stations



# Gauging station Bezdán

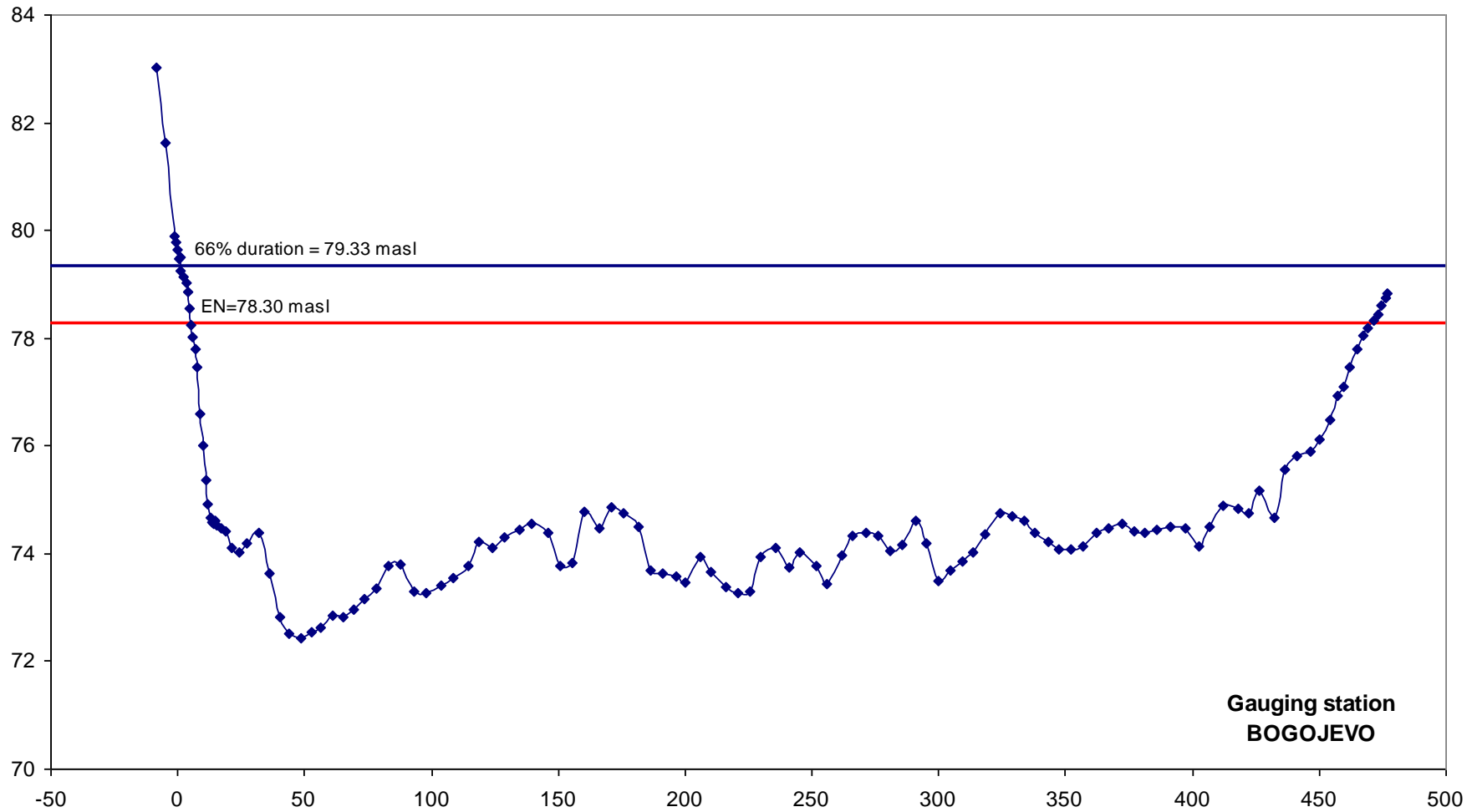


# Gauging station Apatin



WWW.MOJAPATIN.COM

# Gauging station Bogojevo



Gauging station	E.N. (m.a.s.l.)	66% duration (240 days) (m.a.s.l.)	Difference
Bezdan	80.74	81.86	1.12 m
Apatin	79.73	80.94	1.21 m
Bogojevo	78.30	79.33	1.03 m

- **Underkeel clearance** presents the distance between the bottom of the vessel and the river bottom
- Calculation of these parameters performed by different authors, and for different types of inland waterways (free flowing sections of the river, canals, ...)
- As example, some of approaches will be presented at following slides

- PIANC (International Navigation Association) published in 1999 report under title:  
**Factors Involved in Standardising the Dimensions of Class Vb Inland Waterways (Canals)**



**Factors Involved  
in Standardising the Dimensions  
of Class V<sup>b</sup> Inland Waterways (Canals)**



PTCI  
Report of Working Group No. 20  
Supplement to Bulletin n° 101  
(1999)

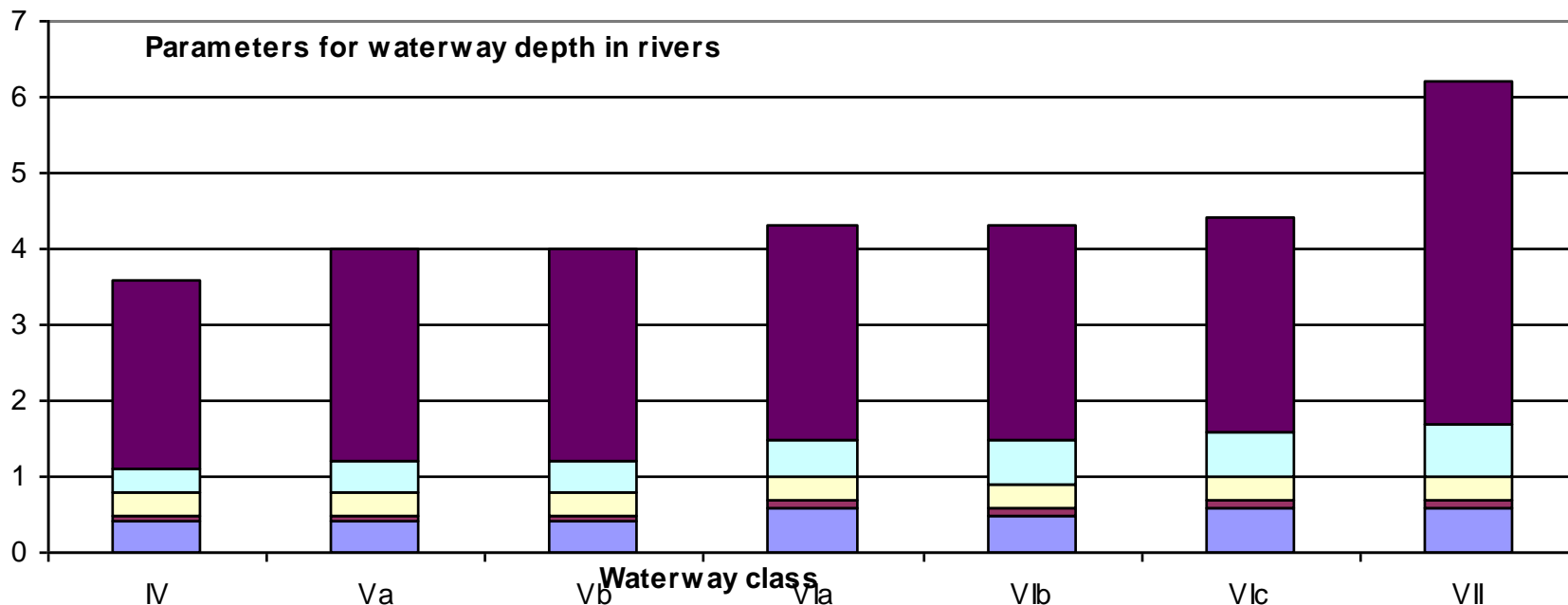
INTERNATIONAL NAVIGATION ASSOCIATION

**Table 2**  
**National recommendations for Class Vb waterways**

Characteristics	FRANCE (Class VI in circular N° 76.38 of 1 March 1976)	GERMANY (Decree BW 24/BW 23/BW 28/ 52.05.00/16VA of 1 August 1994 and others)	NETHERLANDS (Richtlijnen Vaarwegen CVB, without wind effects, 1996)	EMCT and UN/ECE recommendations (1992)
Push tows type L x l	180 x 11.40	185 x 11.40	186.50 x 11.40	172/185 x 11.40
Lock Le x le (useable dimensions)	185 x 12	190 x 12/12.5	210 x 12.50	
Depth of water on sill	4.50 m	4 m	4.7 m	
Minimum navigation rectangle	38 x 4	33 x 4	34 x 5.20	
Normal wetted section	200 m <sup>2</sup>	172 m <sup>2</sup>	258 m <sup>2</sup>	
Ratio "n"	Normal section : 6 Reduced section : 5	Normal section : 5.4 Reduced section : 4.7->5.3	Normal section : 5.65 Reduced section : 3.88	
Depth of channel	4.50 m	4 m	5.60 m	
Permissible draught	3.00 m	2.50 m	4 m	
Ratio between draught and depth of water	1.5	1.4	1.4	
Underkeel clearance	1.5 m	1.2 m	1.60 m	
Normal section vertical banks	38 x 4.50 m <sup>2</sup>	42 x 4 m <sup>2</sup>	46 x 5.60 m <sup>2</sup>	
Normal trapezoidal section	34 x 4.50 m <sup>2</sup> (banks 1:3)	31 x 4 m <sup>2</sup> (banks 1:3)		
Minimum radius of curvature	Normal : 1000 m Reduced : 750 m	-	Normal : 6L = 1110 m Reduced : 4L = 746 m	
Extra width on bends	16000/R		According to Graewe's formula	
Maximum permissible speed	Loaded : 8.5 km/h Empty : 12 km/h	Loaded : 10 km/h Empty : 12 km/h	Determined by waterway authority	
Height between water level and service road	Normal : 1.50 m Minimum : 1.00 m	0.70 m	-	
Width of service road	3.50 m	3 m	-	

- Faculty of Civil Engineering in Zagreb prepared document **“Detailed Parameters of Inland Waterway Classes for program “Sava Initiative”**, in 2003.
- Document used for preparation of SRBC document **“Detailed Parameters for Waterway Classification on the Sava River”**

# Sava River Basin Commission (SRBC)



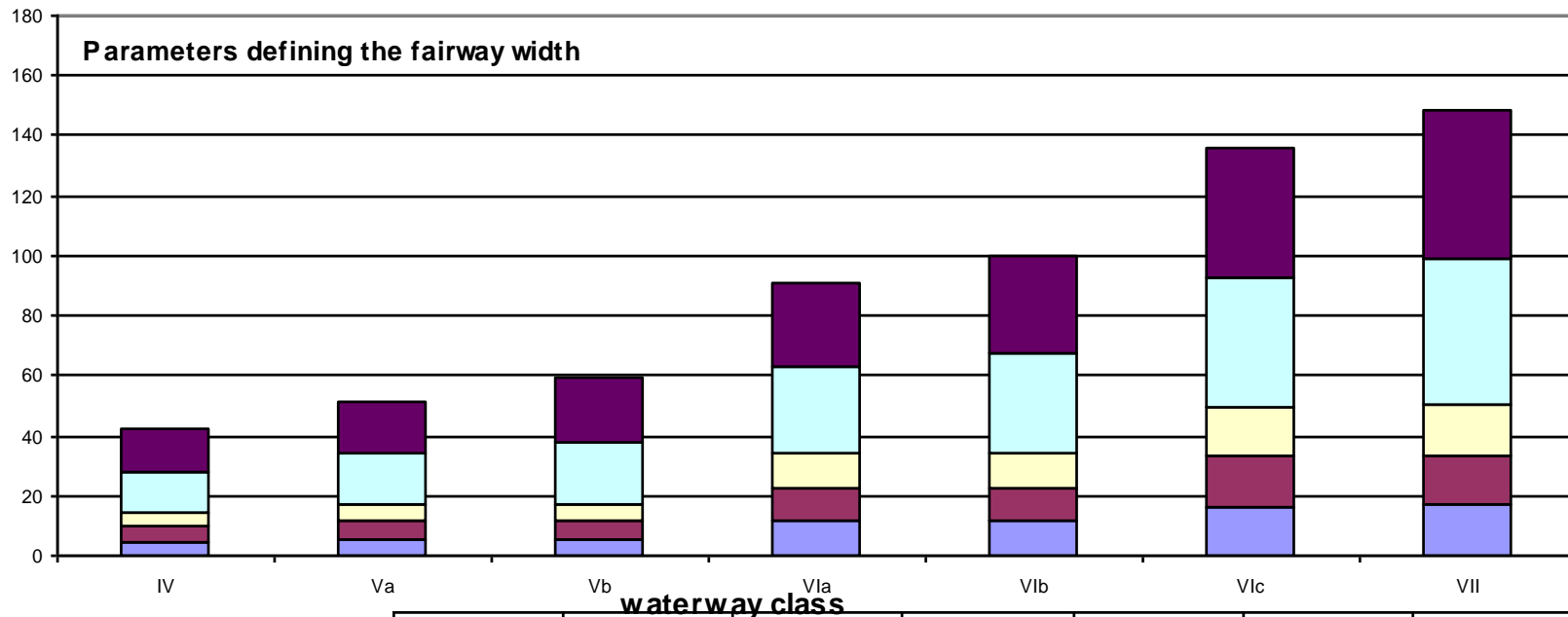
	IV	Va	Vb	VIa	VIb	VIc	VII
Velocity submersion (m)	0.4	0.4	0.4	0.6	0.5	0.6	0.6
Vessel skew (m)	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Impreciseness (m)	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Absolute reserve (m)	0.3	0.4	0.4	0.5	0.6	0.6	0.7
Draught (m)	2.5	2.8	2.8	2.8	2.8	2.8	4.5
Overall (m)	3.6	4	4	4.3	4.3	4.4	6.2

- **DK Recommendations:**
  - 180 m for straight sections, and 100m for rocky bottom
- **AGN:**
  - No recommendations – only width of representative vessel or convoy given

Available literature gives the analysis of width necessary for safe navigation (e.g. Sava River Basin Commission)



# Fairway width per SRBC



	IV	Va	Vb	Vla	Vlb	Vlc	VII
Distance between lanes (m)	4.75	5.7	5.7	11.4	11.4	16.5	17.1
Additional width (m)	4.75	5.7	5.7	11.4	11.4	16.5	16.5
Additional width (m)	4.75	5.7	5.7	11.4	11.4	16.5	16.5
Upstream lane (m)	14.0	17.2	21.1	28.6	33.0	43.2	49.1
Downstream lane (m)	14.0	17.2	21.1	28.6	33.0	43.2	49.1
Overall (m)	45.0	55.0	65.0	80.0	105.0	140.0	155.0

All mentioned above leads to following conclusion:

Due to the certain limitations of AGN (lack of definition of parameters necessary for safe navigation) it would be of great interest for Danubian countries to adopt AGN as its own recommendation, but, to define as well:

- Low and high navigation level
- Fairway width, and width of bridge opening
- Fairway depth
- Curvature radius
- Clearance under the power cables
- Dimensions of the navigation locks

Dragutin Žakula, 1996  
Former Director of Plovput



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Thank you for your attention

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