

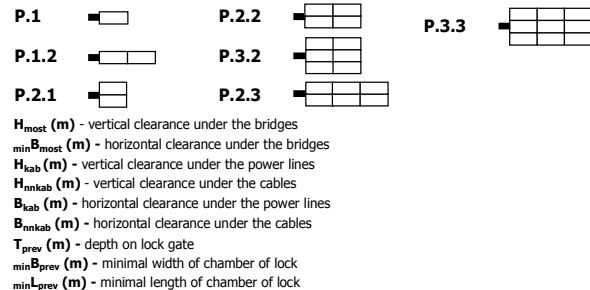
**DETAILED PARAMETERS
FOR WATERWAY CLASSIFICATION
ON THE SAVA RIVER**

Consolidated text (Decision 13/09)

DETAILED PARAMETERS FOR INLAND WATERWAY CLASSIFICATION - "SAVA INITIATIVE"
according to (UN/ECE, GENEVA 1996.)

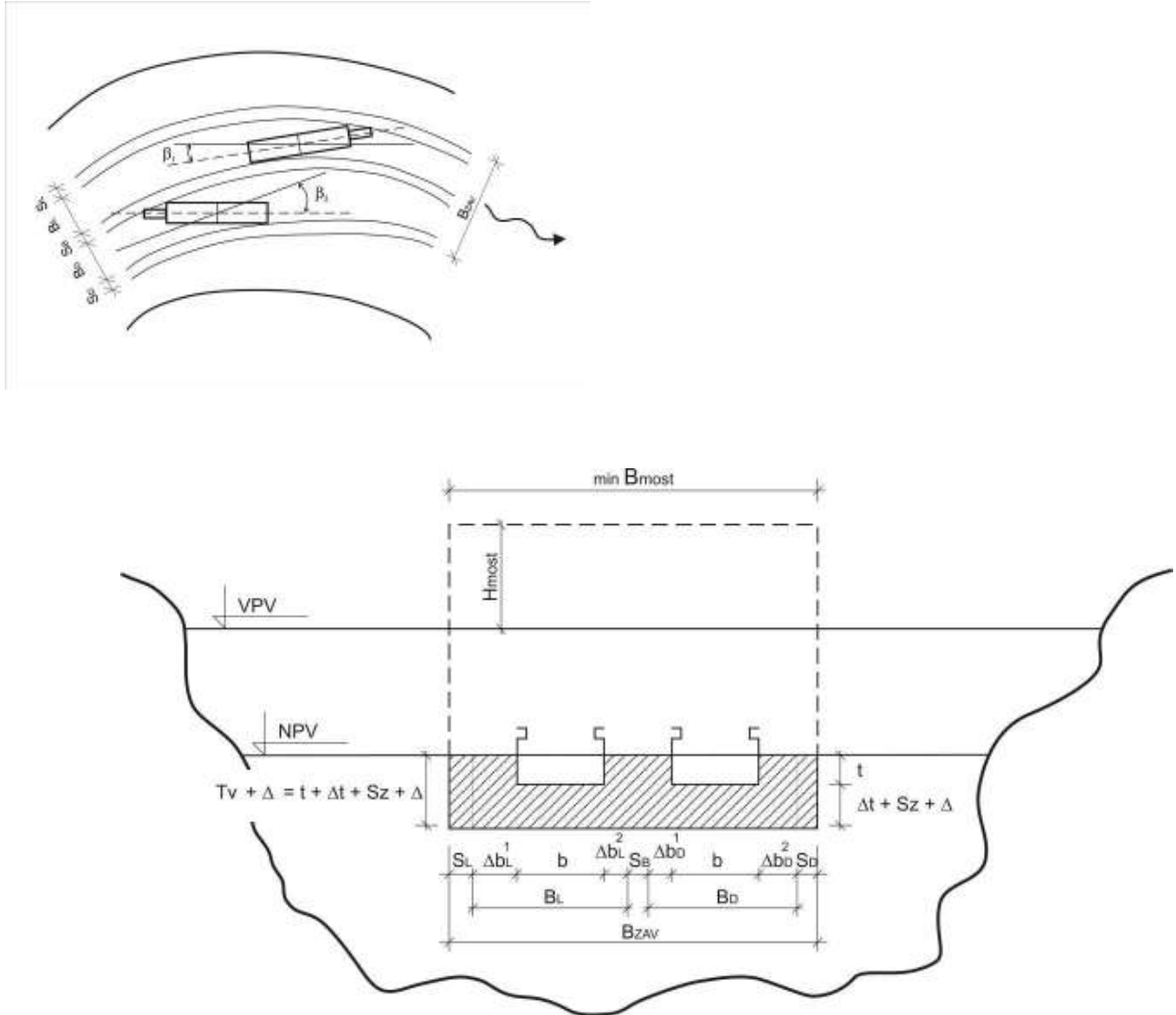
WATERWAY	IMPORTANCE		REGIONAL					INTERNATIONAL																									
	CLASS		I	II	III	IV	Va	Vb	VIa	VIb	VIc	VII																					
	CLASS MARK		—	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====																		
MOTOR VESSELS AND BARGES	SKETCH	t & s p																															
	l (m)	t & s p	41	57	67 - 70	80-85 70	95-110 76.5-85	95-110 76.5-85	95-110 76.5-85	120-140 76.5-85	120-140 76.5-85	120-150 76.5-85																					
	b (m)	t & s p	4.7-5.05	8.2 - 9.0 - 10.1	8.2 - 9.0 - 10.1	9.5 9.5	11.4 11.4	11.4 11.4	11.4 11.4	13-15 11.4	13-15 11.4	13-15 11-11.4																					
	t (m)	t & s p	1,4	1.6 - 2.0	1.6 - 2.0	2.5 2.5 - 2.8	2.5-2.8 2.5-4.5	2.5-2.8 2.5-4.5	2.5-2.8 2.5-4.5	2.8-3.9 2.5-4.5	2.8-3.9 2.5-4.5	2.80-3.90 2.50-4.50	3.90 - 4.5 2.50-4.50																				
	W (t)	t & s p	180	500 - 630	470 -700	1 000 - 1 500	1 500-3 000 1 600-3 000	1 500-3 000 1 600-3 000	1 500-3 000 1 600-3 000	3 000-6 000 1 600-3 000	3 000-6 000 1 600-3 000	3 000-6 000 1 600-3 000	3 000-6 000 1 600-3 000																				
PUSHED CONVOYS	CONVOYS					P.1			P.1			P.1.2			P.2.1		P.2.2		P.3.2		P.2.3		P.3.3										
	l (m)					118 - 132			85			95 - 110			172 - 185			95 - 110		185 - 195		195 270 - 280		285									
	b (m)					8.2 - 9.0			9.5			11.4			11.4			22.8		22.8		33 22.8		33-34.2									
	t (m)					1.6 - 2.0			2.5 - 2.8			2.5 - 4.5			2.5 - 4.5			2.5 - 4.5		2.5 - 4.5		2.5 - 4.5											
W (t)					1000 - 1200			1250 - 1450			1600 - 3000			3200 - 6000			1600 - 3000		6400 - 12000		9600 - 18000		14500 - 27000										
MAIN CLASS PARAMETERS			Regulated rivers	Regulated rivers	Canalized rivers	Regulated rivers	Canalized rivers	Regulated rivers	Canalized rivers	Canals	Regulated rivers	Canalized rivers	Canals	Regulated rivers	Canalized rivers	Canals	Regulated rivers	Canalized rivers	Regulated rivers	Canalized rivers	Regulated rivers	Canalized rivers	Regulated rivers	Canalized rivers									
	R _{min} (m)		250	250	250 - 450	300	300 - 550	360	360	700	360	360	750	450	450	800	450	450	600	600	750	1000	1000	1200									
	T _{NPVpg} (%); T _{NPVrg} (%)		60; -	60; -	85; 90	60; -	85; 90	60; 94	85; 94	-	60; 94	85; 94	-	60; 94	85; 94	-	60; 94	94; 94	60; 94	94; 94	60; 94	94; 94	94; 94	94; 94									
DIMENSION OF FAIRWAY	T (m)					2,3			2,2			2,4			2,4																		
	T _v (m) + Δ		1,3	1,3	1,6	1,6	2	3,3	3,3	3,4	3,4	3,4	3,4	3,4	3,4	3,4	3,7	3,7	3,6	3,6	3,8	3,8	3,8	3,8									
	B (m)		35	45	45	55	30	55	35	65	40	75	100	140	120	150																	
	B _{zav} (m)		25 35	35 45	40 45	75 75	40 40	85 90	40 45	95 100	50 55	100 120	150 150	150 180	125 125	170 200	160 160																
SAFETY CLEARENS BETWEEN VESSEL AND BRIDGE/POWER LINES	H _{most} (m)		3	3	4	7			7			7			9,5	10	9,5	10	9,5	10	9,5	10											
	min B _{most} (m)		35	45	45	45			30			55			35			65			40			75		100		140		120		150	
	H _{kab} (m)		15 15,75 17	15 15,75 17	15 15,75 17	15 15,75 17	15 15,75 17	15 15,75 17	15 15,75 17	15 15,75 17	15 15,75 17	15 15,75 17	15 15,75 17	15 15,75 17	15 15,75 17	15 15,75 17	19 20,40 21,9	19 20,40 21,9	19 20,40 21,9	19 20,40 21,9	19 20,40 21,9	19 20,40 21,9	19 20,40 21,9	19 20,40 21,9									
	H _{nkkab} (m)		12	12	12	12	12	12	12	12	12	12	12	12	12	12	16,5	16,5	16,5	16,5	16,5	16,5	16,5	16,5									
	B _{kab} (m); B _{nkkab} (m)		B _{kab} ; B _{nkkab} = širina rubova pokosa kanala ili udaljenost vanskih stopa obrambenih nasipa kod rječka iznad VPV + 12.0m																														
DIMENSION OF LOCKS	T _{prev} (m)		1,6	2	2,25	2,5	2,5	3,0			4,0			4,5			4,5		4,5		4,75	4,75	4,75										
	min B _{prev} (m)		10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10									
	min l _{prev} (m)		60	60	70 - 75	90 - 190	115 - 190	190 - 210	230	260 - 310	310	310																					

l (m) - length
b (m) - beam
t (m) - maximum draught
W (t) - tonnage
t & s - barges and motor vessels
p - pushed unit
R_{min} (m) - minimal radius of curvature
TNPVpg (%) - duration of low navigation level (NPV) for navigation including maximum draught (% of navigable days with NPV or higher levels)
TNPVrg (%) - duration of low navigation level (NPV) for navigation including reduced draught (% of navigable days with NPV or higher levels)
T (m) - depth of fairway for navigation with reduced draught (94% duration)
T_v (m) - depth on a level of draught below NPV (with velocity submersion and skew)
Δ (m) - absolute reserve
B (m) - width of waterway in a stream
B_{zav} (m) - width of waterway in a curve
lsast (m) - length of proper vessel or pushed convoy



Annex 1: Classification enclosures

Figure 1. Cross-section and plan view of river bed and fairway in a curve for the appropriate case of passing by



VPV – high navigable water level

NPV – low navigable water level

B_{zav} – fairway width in a curve

B_L, B_D – lane width

S_L, S_B, S_D – additional width

Δb_L¹, Δb_L², Δb_D¹, Δb_D² – vessel side-slip

b – vessel width

T_v+Δ – fairway depth

t – maximum draught

Δt – vessel skew

S_z – velocity submersion

Δ - absolute reserve

H_{most} – vertical clearance under the bridge

min B_{most} – horizontal clearance under the bridge

β₁, β₂ – horizontal angle of vessel side-slip

Definitions:

Low navigable water level:

Low navigable water level of freeflow river at some water gauge corresponds to the discharge $Q_{94\%}$. $NPV = V_{94\%}$ [cm or m.a.s.l.] and in any point of freeflow river it corresponds to level of water surface with discharge of 94% duration in a year. It is defined from statistical analysis of water level duration taking into account 30 years of observation. Traditionally it is used to define flow profile with low water level when navigation at small rivers is performed with reduced draught of proper vessel.

High navigable water level:

High navigable water level of freeflow river at some water gauge corresponds to the discharge $Q_{1\%}$. $VPV = V_{1\%}$ [cm or m.a.s.l.] and in any point of freeflow river it corresponds to level of water surface with discharge of 1% duration in a year. It is defined from statistical analysis of water level duration taking into account 30 years of observation. Traditionally it is used to define vertical clearance under the bridges or power line/cables.

Water level with 60% duration: $V_{60\%}$

According to AGN [Annex IIIb] for every waterway class safety navigation should be guaranteed 240 days during the year for proper cargo vessel with maximum draught. This corresponds to the discharge $Q_{60\%}$. $V_{60\%}$ [cm or m.a.s.l.] and in any point of freeflow river it corresponds to level of water surface with discharge of 60% duration in a year.

Reduced draught

It is common to navigate when water level is lower than NPV. According to AGN [Annex IIIb] navigation at international E waterways (IV. to VII. class) principally should be provided during whole year except ice period. This means it should be provided during the water levels lower than NPV but reduced draught of 1.2m is permitted.

Δt – vessel skew is statical submersion of bow or rudder (it is disregarded at longway axis of vessel) and adopted value is 0.1m.

S_z – velocity submersion is consequence of wave system of bow or rudder, vessel streaming velocity, size and form of vessel or convoy, wet area of vessel or convoy, or restricted of waterway and adopted value is 0.2m.

Δ - absolute reserve is always free water between hulk and river bed where navigation has never been performed or never been used in some other way and adopted values are: for classes I-IV = 0.3m, for class V = 0.4m, for classes VIa and VIb = 0.5m and for classes VIc and VII = 0.6m.

Small radius categories:

R_{\min} [m] - minimal radius of river bed axis in curve and

R_{izn} [m] – special radius of river bed axis in curve.

Minimal radius of river bed curve is the smallest radius of river bed axis that allows undisturbed two-way navigation on low navigable water level.

Special radius of river bed curve is 25-30% smaller than minimal. It is not defined generally but in practice it is still used at river sectors when it is not possible to apply

minimal due to some terrain and urban problems. In that case it is applied bigger width of river bed than minimal one calculated for minimal radius.

Navigation lane

It is part of fairway at which navigation of vessel or convoy is performed permanently i.e. a part of water surface that vessel or convoy can achieve during the navigation concerning its width, side-slip in curve or wriggle at stream.

Fairway

Fairway is imagined rectangle in a river cross-section in which navigation is permanently performed i.e. a part of a river cross-section that vessels or convoys could achieved during the navigation concerning width and depth. Horizontally it is defined with fairway lane and security widths. At one direction fairway consists of one fairway lane and security widths. Vertically it is defined with vessel draught, vessel skew and velocity submersion of vessel or convoy that occur during navigation.

Clearance under the bridge is free space between fairway and bridge (Figure 1.). Vertically it is space between water surface and bottom edge of bridge construction and horizontally it is space between inner side of river pier fundament. Here will be defined clearance under the bridge as imagined rectangle defined with width B_{most} [m] and height H_{most} [m] as minimal clearance under the bridge for every class of waterway. It contains extra space that vessel can not achieve neither concerning the width nor height. During two-way navigation under the bridge it is reduced at one direction due to security of bridge construction but river bed width is not reduced.