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Terms and definitions related to inland water transport

Economic Commission for Europe

Inland Transport Committee

Working Party on Transport Trends and Economics

Thirty-first session

Geneva, 3–5 September 2018

Item 8 of the provisional agenda

Group of Experts on Benchmarking Transport Infrastructure Construction Costs

Terminology used for benchmarking of construction costs of inland waterway infrastructure

Note by the Secretariat

I. Mandate

1. This document is submitted in line with cluster 5: Inland Waterway Transport, paragraph 5.1 of the programme of work 2018–2019 (ECE/TRANS/2018/21/Add.1) adopted by the Inland Transport Committee at its eightieth session (26 February 2018).

2. At its fifty-third session, the Working Party on the Standardization of Technical and Safety Requirements in Inland Navigation considered the documents on terminology related to inland waterways, prepared by the Group of Experts on Benchmarking Transport Infrastructure Construction Costs (ECE/TRANS/WP.5/GE.4/2018/3 and ECE/TRANS/WP.5/GE.4/2018/4), and proposals submitted by Belarus and Ukraine, as well as the notes by the Secretariat, and requested the Secretariat to finalize the document, taking account of the discussions at the sixty-second session of the Working Party on Inland Water Transport (SC.3) (ECE/TRANS/SC.3/WP.3/106, para. 62).

3. SC.3 and the Working Party on Transport Trends and Economics may wish to consider this document and decide as appropriate.

* Reissued for technical reasons on 28 August 2018.



II. Terminology

A. Hydrological and hydrotechnical terms

4. Alluvial: something made of gravel/mud/silt/sand deposited and formed by rivers or floods (3).
5. Alluvium: a fine- grained deposit, composed mainly of mud and silt, deposited by a river (3).
6. Apron: layer of stone, concrete or other material to protect a structure's toe against scouring (3).
7. Aquatic dredged material placement: dredged material placement options under which the dredged material is submerged and remains under water (3).
8. Bar: an elevated region of sediment (sand or gravel) that has been deposited by the flow (3).
9. Barrage: hydraulic structure designed to retain head water on secondary branches of a river in order to regulate the delivery rate in the main channel (4).
10. Bathymetry: the study of underwater depth of water bodies, topography of a water body (3).
11. Bed profile: a curve indicating the elevation and shape of a river bed; may be a longitudinal curve or a transverse curve at a cross-section (3).
12. Bottom water outlet: hydraulic structure for draining reservoir or channel (4).
13. Canal: artificially created watercourse in an earthen cutting or embankment (4).
14. Canalization of rivers: means of increasing depth of waterways by creating pools using dams and connecting them with locks (4).
15. Chevron: U-shaped river engineering structure with blunt nose and open end facing downstream; the current is diverted along both sides of the structure (3).
16. Cross-section, profile: a plane, generally perpendicular to the centreline of the river or the fairway (3).
17. Dam: water retaining structure partitioning off the waterway and its valley to raise the water level (4).
18. Design level: water level at the stream flow measuring station established with multi-year probability (4).
19. Differentiated parameters: planned dimensions of inland waterways depending on water levels (4).
20. Discharge (Q): the volume rate of water flow, including any suspended solids (e.g. sediment), dissolved chemicals and/or biological material which is transported through a given cross-sectional area ($Q=A \times V$, where A is cross sectional area (m^2) and V is the mean velocity of water (m/s)) (3).
21. Drawdown: the difference between the working and the design water level (4).
22. Dredged material: material excavated from the river bed (3).
23. Dyke (or dike): hydraulic structure in the form of an embankment designed to protect against flooding, to restrict artificial water bodies and watercourses or to guide diverted water flows (4).
24. Fairway: area on an inland waterway for the movement of craft and marked locally and (or) on a map. It also allows for safe passage on the water, indicated by aids to navigation (4).
25. Fairway axis: centreline of the fairway (3).

26. Fairway parameters: depth, width, vertical clearance and bend radius of the fairway (4).
27. Flood control: regulation of flood waters to prevent or minimize inundation of valuable property or land (3).
28. Floodplain (flood plain): an area of land adjacent to a stream or river that stretches from the banks of its channel to the base of the enclosing valley walls and experiences flooding during periods of high discharge events (3).
29. Ford: a shallow sector of the river that stretches across the whole width of the river (3).
30. Free flowing river: sections of natural rivers which are not impounded due to barrages such as hydropower plants or lock facilities and where water levels can be subject to considerable fluctuations (3).
31. Gauge zero: elevation of the gauging station with respect to the mean sea level (3).
32. Gauging station: equipment for measuring the water level of surface water bodies (3).
33. Geodetic survey: a survey that takes the configuration and size of the earth's surface into account and is used to precisely define horizontal and vertical positions suitable for conducting other surveys (3).
34. Granulometric river bed improvement: the use of coarse gravel to cover lower zones of the river bed in order to halt river bed degradation (3).
35. Granulometry (of the sediment): size of particles of sediment forming the river bed (3).
36. Gravel: unconsolidated rock fragments that have a general particle size range and include size classes from granule- to boulder-sized fragments (3).
37. Guaranteed parameters: dimensions of inland waterways as set in the technical specifications for the design levels (4).
38. Guide bund: a transverse river training structure aiming to narrow the river bed and to divert flow into the fairway in order to maintain sufficient depth by increasing the natural sediment transport capacity (3).
39. Head water: raised water level caused by the obstruction or hindrance of the watercourse or a change in the flow of groundwaters.
40. High navigable water level (HNWL) corresponds to a level existing for not less than 1% of the navigation period, established on the basis of observations over a substantial number of years (30 to 40 years), excluding periods when there was ice (5).
41. Hydraulic complex: a set of hydraulic structures all at the same location and used for the same purpose (4).
42. Hydraulic structure: engineering structure designed to make use of water resources and to control the harmful effects of the water (4).
43. Hydroelectric power plant: a set of hydraulic structures and equipment used to convert the energy potential of a watercourse into electrical power (4).
44. Hydromorphology: physical characteristics of a river, including the river bed, banks, connections with the landscape, including longitudinal continuity and habitat continuity (3).
45. Inland waterway network: all inland waterways open for public navigation in a given area (1).
46. Inland waterways: natural or artificially created water bodies and watercourses indicated by navigation signs or other means and used for navigation (4).

Note: inland waterways include rivers, lakes, reservoirs, canals and other water bodies. The length of rivers and canals is measured in mid-channel. The length of lakes and

lagoons is measured along the shortest navigable route between the most distant points to and from which transport operations are performed. A waterway forming a common frontier between two countries is reported by both.

47. Lock (navigation lock): hydraulic system to overcome differences in height along a waterway, in which vessels may be raised or lowered by filling up or emptying out one or more lock chambers (3).

48. Lock chamber: an enclosure consisting of a section of canal that can be closed to control the water level. It is used to raise or lower vessels that pass through it (4).

49. Longitudinal dike (training wall): a rock structure parallel to the river centre line to confine the flow in the fairway (3).

50. Low navigable water level (LNWL) corresponds to a long-term mean water level reached or exceeded on all but 20 ice-free days per year (approximately between 5% and 6% of the ice-free period) (5).

51. Maintenance of navigable hydraulic structures: operation and repair of hydraulic structures designed to allow navigation.

52. Mean discharge: average quantity of water that flows through a certain cross-section of the river per unit of time over a certain period of time (m^3/s) (3).

53. Mean high water (MHW): mean of multi-year maximum water levels; the average water level is measured at a water gauge over a specific period of time (3).

54. Mean low water (MLW): mean of multi-year minimum water levels (3).

55. Mean water level (MWL): mean water level over a multi-year period (3).

56. Morphological modelling: application of specialized software packages in order to determine and predict morphological changes of the river bed (3).

57. Morphology (of the river bed): describes the shapes of river channels and how they change over time (3).

58. Multibeam: specialized equipment for hydrographic surveys used for precise 3D imaging of the river bed (3).

59. Navigable canal: waterway built primarily for navigation (1).

60. Navigable hydraulic structure: hydraulic structure on a waterway allowing navigation (including bank protection structures, breakwaters, dykes, moles, dams, approach channels, underwater structures created by dredging, pumping stations, navigable locks, boat lifts, hydroelectric power plant buildings, spillways, bottom water outlets and outlet works, tunnels and other facilities) designed to comply with set fairway parameters and allow the passage of vessels.

61. Navigable pass: navigable hydraulic structure allowing passage of vessels through a hydraulic complex (4).

62. Navigable river: natural waterway open for navigation, irrespective of whether it has been improved for that purpose (1).

63. Radius of curvature of the fairway: measured on a plan or a map, the radius of an arc on the axis of the fairway (4).

64. Reservoir: an artificial water body formed of a water retaining structure on a watercourse for water storage and flow regulation (4).

65. Riprap: rock armour, rubble or other material used to armour shorelines, streambeds, bridge abutments, etc. against scour and water or ice erosion (3).

66. River basin: the land area that is drained by a river and its tributaries (3).

67. River bed (riverbed): bed formed by the flow of the river, along which run-off is carried without flooding the flood plain (4).

68. Shoal: shallow section of river bed difficult for navigation (4).
69. Spillway: hydraulic structure for passage of water discharged from upstream pool to avoid overfilling (4).
70. Stream flow measuring station: hydrological station for monitoring water levels and flows (4).
71. Towpath: bank that the fairway runs along (4)
72. Water conduit: hydraulic structure for water supply and drainage in the appropriate direction (4).
73. Water outlet: hydraulic structure for release from the upstream pool of the channel or waterway (4).
74. Water retaining structure: hydraulic structure designed to retain head water (4).
75. Waterways: stretches of water bodies and watercourses used for navigation and logging (4).
76. Weir: device in hydraulic structure in which water is discharged through an opening from a free surface of the flow (4).

B. Inland waterway infrastructure and inland water transport

77. Aids to navigation (AtoN): devices, systems or services, external to a vessel, designed and operated to enhance safe and efficient navigation of all vessels and/or vessel traffic (6).

78. Beach area: part of the coastal protection belt on the water line, along the sea, around marine bays and estuaries subject to restrictions on economic activity (4).

79. Categories of navigable inland waterways in line with the UNECE/ECMT Classification of European Inland Waterways; canals, navigable rivers and lakes are shown in the annex (7).

NB.: In some cases the “carrying capacity of vessels” may be used to classify navigable inland waterways.

80. Coastal protection belt: part of a water protection zone of a given width along a river, the sea or around reservoirs which is subject to stricter controls on economic activity than the rest of the water protection zone (4).

81. Combined transport: waterway suitability for combined transport is classified as follows:

(a) Waterways suitable for combined transport: inland navigation vessels with a width of 11.40 or 11.45 m and a length of approximately 110.0 m are able to operate on such waterways carrying three or more layers of containers, 50% of the containers being empty. Otherwise a permissible length of pushed convoys of 185.0 m should be possible, in which case they could operate with two layers of containers, 50% of containers being empty.

(b) Waterways suitable for combined transport with restrictions: this is mainly interpreted by Governments as inland waterways allowing the transport of at least two layers of containers, 50% or less of them being empty, sometimes with the use of ballasting.

(c) Waterways not suitable for combined transport: waterways where the transport of even two layers of containers is impossible (5).

82. Connections to other modes of transport: availability and distance from ports to connections to other modes of transport in km:

- (a) Maritime shipping;
- (b) Passenger rail connection;

- (c) Freight rail connection;
- (d) Motorway access;
- (e) Airport (1).

83. Deepening dredging: dredging to maintain specified parameters in approach channels (in a port) (4).

84. Draught: vertical distance from the lower part of the hull to the water level mark corresponding to the current load of the vessel.

In which:

(a) Declared draught: maximum draught of vessels arriving in a port within one year or season;

(b) Navigable draught: maximum draught with which a vessel can move through an approach channel (in a port) in actual hydrometeorological conditions at the time of the vessel's passage (4).

85. Dredging: work to deepen, expand or align existing and create new navigation channels (4).

86. Dry dock: structure for the inspection, repair and construction of vessels in a dry basin in which the vessel stands below the level of the water in the port (4).

87. Engineering works: dredging, remedial work, sweeping, maintenance dredging, hydrographic surveys and maintenance of inland navigation equipment (4).

88. Hydrographic conditions of navigation: a range of measures to ensure conditions for inland navigation, including equipping inland waterways with navigation and communications systems, aids to navigation, visible and audible alarms, and providing information to vessels on navigation and hydrometeorological conditions (4).

89. Hydrographic survey: geodetic and hydrological work performed for the purposes of engineering works and maintenance of hydraulic structures with the necessary technical documentation (4).

90. Inland waterway infrastructure: all facilities for inland navigation, including hydraulic structures on the waterway, beacons, roadstead, winter harbours, places of refuge, aids to navigation, power generation facilities, communications networks and facilities, alarm systems, information systems and vessel traffic management systems, and other facilities for the operation of inland waterways (4).

91. Internavigational period: the period during which inland waterways are closed to navigation (4).

92. Maintenance dredging: work to remove obstacles to navigation (4).

93. Maintenance of navigation equipment: preparation, installation, rearrangement and cleaning of navigation signs, work to ensure their visibility, soundings, provision of informing to skippers about current and changing conditions (4).

94. Navigational equipment: a system of special alarms for safe navigation (4).

95. Navigational period: the period during which the inland waterways are open for navigation (4).

96. Pilot chart: schematic map of inland waterways with navigation equipment indicated (4).

97. Remedial work: installation in river bed of structures to create and support differentiated guaranteed depths or to protect bank from scouring (4).

98. Roadstead: part of inland waterways intended for berthing, formation and uncoupling of vessel convoys, integrated fleet service operations and for trans-shipment operations (4).

99. Slipway: structure for the construction or repair and launch of a vessel (4).
100. Sweeping: work to locate underwater obstructions to navigation (4).
101. Turnaround time: total of operating time of vessel or survey team, time required for servicing and time towing vessel (4).
102. Vertical clearance: height in the middle of the bridge with due regard of the fairway and the shape of the bridge; it takes into account the security clearance of about 30 cm between the uppermost point of the vessel's structure or its load and the bridge (5).
103. Waterline: boundary of water on shore of water body (shoreline) (4).
104. Winter harbour: part of a surface water body and (or) set of structures set up and equipped for the repair, berthing or technical inspection of vessels and floating objects (4).
105. Winter shelter: natural or artificial basin designed for winter mooring and repair of vessels (4)

C. Ports and port infrastructure

106. Bollard: mooring post for the purpose of berthing of ships and other vessels to a port structure (8).
107. Breakwater: hydraulic structure providing protection to port or coastal waters from waves, deposits and ice. Depending on the facilities protected, breakwaters can be subdivided into:
 - (a) Port (external), separating port basin from the water body;
 - (b) Internal (groyne), dividing a basin into smaller areas (8).
108. Fender: shock absorption system for dissipating the force of impact of vessels, reducing load on the wharf structure and the side of the vessel, and protecting them from mechanical damage (4).
109. Groyne: breakwater with neither end connected to the shore (4).
110. Harbour aquatorium: defined section of the water body, except the fairway, designed for the safe approach, manoeuvring, berthing and departure of vessels (4).
111. Infrastructure providing access to ports: fairways and facilities, devices and installations associated with their functioning, leading to each seaport and located within the area of a seaport. These include port entrance channels, fairways, anchorages, turning basins and vessel traffic services (VTS) and vessel traffic management systems (VMTS) (8).
112. Inner approach channel: hydraulic structure, a natural or artificial waterway located within a port, designed to allow vessels to approach or depart from quays and to manoeuvre within seaport waters. Some ports have loading/unloading and parking quays along channels (4).
113. Landing stage: a place solely for vessels to embark or disembark passengers, not part of an inland port (1).
114. Mole: breakwater with one end adjacent to the shore (4).
115. Outer harbour: area of water within the port adjacent to roadstead and the entrance to the port, separated from the port by breakwaters. Used for performing manoeuvres by entering and exiting vessels, it is also the area where waves act differently and their height and influence becomes much less severe (8).
116. Port basin: area of water adjacent to the shoreline surrounded by quays or other port structures, maintained at the required depth level, by which ships are berthed and their cargo is exchanged (8).

117. Port infrastructure: harbour and freely accessible facilities, devices and structures within the land area or waters of the port, associated with the functioning of the port and intended for performing tasks assigned to the port by the port management body.

118. Port or quay operator: transport organization operating the port or quay, goods operations (including trans-shipment), servicing of vessels or other vehicles and (or) services for passengers and their luggage (4).

119. Public port infrastructure: harbour aquatorium, rail and road access routes (up to the first intersection outside the port area), telecommunications, heating, gas, water and electricity installations, utilities systems, other objects for the use of two or more economic actors at the seaport (4).

120. Quay wall: constructed vertical or almost vertical wall to hold waterside cranes (3).

121. River port: all the facilities located on the land and in the waters of inland waterways, set up and equipped to provide services for passengers and vessels, loading, unloading, receiving, storage and dispatching of goods, in combination with other modes of transport (4).

122. Ro-Ro berth: a location at which a Ro-Ro ship can berth and load and unload motor vehicles and other mobile Ro-Ro units via ramps from ship to shore and vice versa (1).

123. Seaport hydraulic structures: engineering structures (harbour aquatorium, quays, jetties, other types of wharf facilities, moles, dams, groynes, other shore protection structures, artificial or natural underwater structures, including channels, operational aquatorium of a wharf, anchorages) located within the land area or waters of a seaport and designed to ensure the safety of vessels during navigation, manoeuvring and when moored (4).

124. Seaport infrastructure: mobile and fixed objects that allow the seaport to function, including harbour aquatorium, hydraulic structures, docks, tugs, icebreakers and other ships of the port fleet, aids to navigation and other navigation and hydrographic equipment for maritime routes, vessel traffic management systems, information systems, trans-shipment equipment, rail and road access ways, telecommunications, heating, gas, water and electricity installations, other installations, equipment and utilities systems located within the land area or waters of a seaport and designed to ensure the safety of maritime navigation, the provision of services and State monitoring in the seaport (4).

125. Statistical port: a statistical port consists of one or more ports, normally controlled by a single port authority, able to record ship and cargo movements (1).

126. Turning basin: a basin located between docks and port channels or fairways, with special provisions for the safe performance of rotating manoeuvres of ships to allow them to enter port channels, change course, or align in port with the use of their own thrusters or with the help of tugboats. The diameter of a turning basin should correspond to 150% of the length of the largest vessel to use its area (8).

127. Wave absorber: a structure preventing from forming rebound waves in a dock; may be a separate unit or a part of a quay or a breakwater (8).

128. Wharf (wharf structure): hydraulic structure with devices for the safe approach of vessels and used for the safe berthing, loading, unloading and servicing of vessels and the embarkation and disembarkation of passengers (4).

Note: types of quay according to design feature:

- (i) massive reinforced concrete box caisson;
- (ii) massive caisson foundation;
- (iii) on a cellular cofferdam;
- (iv) L-shaped wall;
- (v) with capping beams and anchor slab;

- (vi) with capping beams and raking trestle;
- (vii) with capping beams;
- (viii) slab quays (8).

Types of wharf:

- (a) Quay: wharf structure adjacent to the shore and located along the water's edge (4).
- (b) Pier: wharf structure set on the slope of the shore such that there is practically no side pressure on the construction (4).
- (c) Jetty: wharf structure standing proud from the shore in the port waters and allowing ships to berth on at least two sides (4).
- (d) Dolphin: wharf structure consisting of a separate standing structure for positioning of the vessel during docking or for guiding vessels and other craft along the wharf (8).
- (e) Floating jetty: berthed vessel fixed to the shore or in the roadway of an inland waterway, designed for mooring and berthing of vessels and manufacturing operations (4).

129. Wharf length: total length of wharf structures in metres (1).

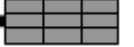
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Annex

Classification of European Inland Waterways

Waterway type	Waterway class	Designation	Motor vessels and barges					Pushed convoys					Minimum height under bridges H (m)	
			Type of vessel: general characteristics					Type of convoy: general characteristics						
			Max. length L (m)	Max. beam B (m)	Draught ² d (m)	Tonnage T (m)		Length L (m)	Beam B (m)	Draught ⁶ d (m)	Tonnage T (m)			
1	2	3	4	5	6	7	8	9	10	11	12	13		
Of regional importance	West of Elbe	I Barge	38.50	5.05	1.80–2.20	250–400							4.00	
		II Kampine	50–55	6.60	2.50	400–650							4.00–5.00	
		Gustav Koenigs	67–80	8.20	2.50	650–1 000							4.00–5.00	
	East of Elbe	I Finow	41	4.70	1.40	180							3.00	
		Type BM-II 500	57	7.50–9.00	1.60	500–630							3.00	
		III ⁶	67–70	8.20–9.00	1.60–2.00	470–700	118–132	8.20–9.00	1.60–2.00	1 000–1 200			4.00	
Of international importance	IV	Johann Welker	80–85	9.5	2.50	1 000–1 500		85	9.5 ⁵	2.50–2.80	1 250–1 450		5.25/7.00 ⁴	
	Va	Large Rhine vessel	95–110	11.4	2.50–2.80	1 500–3 000		95–110 ¹	11.4	2.50–4.50	1 600–3 000		5.25/7.00/ 9.10 ⁴	
	Vb							172–185 ¹	11.4	2.50–4.50	3 200–6 000			
	VIa							95–110 ¹	22.8	2.50–4.50	3 200–6 000		7.00/9.10 ⁴	
	VIb	³	140	15.0	3.90			185–195 ¹	22.8	2.50–4.50	6 400–12 000		7.00/9.10 ⁴	
	VIc							270–280 ¹	22.8	2.50–4.50	9 600–18 000		9.10 ⁴	

Motor vessels and barges							Pushed convoys					Minimum height under bridges H (m)
		Type of vessel: general characteristics					Type of convoy: general characteristics					
Waterway type	Waterway class	Designation	Max. length L (m)	Max. beam B (m)	Draught ² d (m)	Tonnage T (m)	Length L (m)	Beam B (m)	Draught ⁶ d (m)	Tonnage T (m)		
1	2	3	4	5	6	7	8	9	10	11	12	13
VII								195–200 ¹	33.0–34.2 ¹	2.50–4.50	9 600–18 000	
								275–285 ⁷	33.0–34.2 ¹	2.50–4.50	14 500–27 000	9.10 ⁴

¹ The first figure takes into account the existing situations, whereas the second one represents both future developments and, in some cases, existing situations.

² Takes into account a security clearance of about 30 cm between the uppermost point of the vessel's structure or its load and a bridge.

³ Allows for expected future developments in ro-ro, container and river-sea navigation.

⁴ Checked for container transport:

5.25 m for vessels transporting two layers of containers;

7.00 m for vessels transporting three layers of containers;

9.10 m for vessels transporting four layers of containers;

50% of the containers may be empty or ballast should be used.

⁵ Some existing waterways can be considered as Class IV by virtue of the maximum permissible length for vessels and convoys, even though the maximum beam is 11.40 m and the maximum draught 4.00 m.

⁶ The draught value for a particular inland waterway is to be designated according to the local conditions.

⁷ Convoys consisting of a higher number of barges can also be used on some sections of waterways of Class VII. In this case the horizontal dimensions may exceed the values shown in the table.