



Economic Commission for Europe**Inland Transport Committee****Working Party on Transport Trends and Economics****Group of Experts on Benchmarking Transport Infrastructure Construction Costs****Tenth session**

Geneva, 30–31 January 2020

Item 3 of the provisional agenda

Transport Infrastructure Construction costs:**Presentation of revised consolidated list of terminologies
on benchmarking road, rail, inland waterways and
intermodal terminals transport infrastructure costs.****Consolidated list of terminologies on benchmarking of road,
rail, inland waterway and intermodal terminals construction
costs*****Note by the Secretariat****I. Background**

1. This document contains:
 - (a) in Annex I: general terminology relevant for benchmarking of all inland transport infrastructure costs, based on ECE/TRANS/WP.5/GE.4/2017/1/Rev.2;
 - (b) in Annex II: revised terminology on benchmarking road transport infrastructure construction costs based on document ECE/TRANS/WP.5/GE.4/2019/1;
 - (c) in Annex III: terminology on benchmarking rail transport infrastructure construction costs based on ECE/TRANS/WP.5/GE.4/2018/5;
 - (d) in Annex IV: terminology used for benchmarking of construction costs of inland waterway infrastructure based on ECE/TRANS/SC.3/2018/15-ECE/TRANS/WP.5/2018/5; and
 - (e) in Annex V: terminology on benchmarking intermodal terminals infrastructure construction costs based on ECE/TRANS/WP.5/GE.4/2018/1.
2. The Group of Experts will be expected to review this document and, on its basis, agree on how it would want to include the terminology chapter in its final report.

* This document contains further up-dates to Working Document No.1 (ECE/TRANS/WP.5/GE.4/2019/1) which was distributed on 22 July 2019.



Annex I

General terminology relevant for benchmarking of all inland transport infrastructure costs

I. Terminology

1. Acquisition: The process of obtaining right of way by negotiation and/or eminent domain proceedings. Negotiation would involve getting the owner to convey, dedicate, or possibly option the property to the public agency. Compensation must be paid in all acquisitions or takings (6).
2. Acquisition cost: All costs included in acquiring an asset by purchase/lease or construction procurement route, excluding costs during the occupation and use or end-of-life phases of the life cycle of the constructed asset (1).
3. Administrative costs: The costs incurred in contract management and administration overhead expenses (4).
4. Annual budget:
 - (a) The total budget for the financial year as approved by the legislative body.
 - (b) The annual budget is a group of appropriations which a department has the authority to disburse or encumber in a fiscal year.
5. Assets: Something that has a potential or actual value to an organization, can be physical or intellectual or financial.
6. Asset management: [definition to be developed].
7. Budget: is a financial plan, actual or estimated, showing the items on which the expenditure of contract funds are authorized (6).
8. Capital Cost: The initial construction costs and costs of initial adaptation where these are treated as capital expenditure. Note 1 to entry: The capital cost may be identical to the acquisition cost if initial adaptation costs are not included (1).
9. Construction contingency: The additional mark-up applied to cover the cost of undefined and yet unknown construction requirements that are expected to be zero at completion of construction. Construction contingency is a risk cost (3).
10. Construction phase: The project development phase that includes advertising the project, awarding the contract, and performing the actual construction (3).
11. Construction Product: The item manufactured or processed for incorporation in construction works. Note 1 to entry: Construction products are items supplied by a single responsible body. Note 2 to entry: Adapted from the definition in ISO 6707-1 according to the recommendation of ISO/TC59/AHG Terminology (2).
12. Construction Service: The activity that supports the construction process or subsequent maintenance (Source: EN 15804:2012+A1:2013) (2).
13. Construction Works: Everything that is constructed or results from construction operations. Note 1 to entry: This covers both building and civil engineering works, and both structural and non-structural elements. Note 2 to entry: Adapted from the definition in ISO 6707-1 (2).
14. Construction Administration Cost: The normal cost of administration, management, reporting, design services in construction, and community outreach required in the construction phase of a project (3).
15. Construction Allowance: The amount of additional resources included in an estimate to cover the cost of known but undefined requirements for a construction activity or work item. A construction allowance is a normal cost (3).

16. Contract:

(a) The procurement document between two or more parties which creates an obligation to provide goods or services or perform tasks and which includes offer, acceptance, exchange of consideration, legal sufficiency, a defined contract period, a maximum amount payable, and terms and conditions as appropriate.

(b) The legally binding document that provides determination of responsibilities and liabilities (6).

17. Contractor: The private entity that provides design, construction, and/or maintenance services to a highway or railway agency. May refer to the design-builder or a concessionaire (4).

18. Cost-based estimating: The method to estimate the bid cost of a work item by estimating the cost of resources (time, equipment, labour, and materials) for each component task necessary to complete the work item, and then adding a reasonable amount for contractor's overhead and profit (4).

19. Cost: The monetary value or price of a project activity or component that includes the monetary value of the resources required to perform and complete the activity or component, or to produce the component. A specific cost can be composed of a combination of cost components, including direct labour hours, other direct costs, indirect labour hours, other indirect costs, and purchased price (However, in the earned value management methodology, in some instances, the term cost can represent only labour hours without conversion to monetary worth) (6).

20. Design life of infrastructure: The length of time for which an infrastructure asset is being designed.

21. Design period of asset:

22. Discounted cost: The Resulting cost when the real cost is discounted by the real discount rate or when the nominal cost is discounted by the nominal discount rate (1).

23. Discount rate: The time value of money used as the means of comparing the alternative uses for funds by reducing the future expected costs or benefits to present-day terms. Discount rates are used to reduce various costs or benefits to their present value or to uniform annual costs so that the economics of the various alternatives can be compared (approximately equal to interest minus inflation) (4).

24. Disposal cost: Costs associated with disposal of the asset at the end of its life cycle, including taking account of any asset transfer obligations. Note 1 to entry: Asset transfer obligations could include bringing the assets up to a predefined condition. Note 2 to entry: Income from selling the asset is part of WLC¹, where the residual value of the road infrastructure components, materials and appliances can be included (1).

25. Drainage: The removal of water from the highway right-of-way area by use of culverts, ditches, outsell channels and other drainage structures (8).

26. Drainage structure: Any device or land form constructed to intercept and/or aid surface water drainage (7).

27. Earthwork: The operations connected with excavating and placing embankments with soil, earth or rock (6). Earthwork for rail: work conducted in order to prepare land for construction work; land grading, soil exchange etc. (9).

28. Edge line: The line used to differentiate the outer edge of the traffic lanes from the shoulder (8).

29. Embankment: The raised structure of soil, soil aggregate, rock or combination of the three. Materials used for fill section (6).

¹ Whole-Life Cost

30. Emulsion: The fluid system in which liquid droplets and/or liquid crystals are dispersed in a liquid. Note 1 to entry: Dispersion is thermodynamically metastable (5).
31. End-of-life cost: The net cost or fee for disposing of an asset at the end of its service life or interest period, including costs resulting from, deconstruction and demolition of the asset infrastructure; recycling, making environmentally safe recovery and disposal of components and materials and transport and regulatory costs (1).
32. Environmental Impact Assessment – the ongoing identification of environmental factors to determine the past, current and potential impact (positive or negative) of an organisation’s activities on the environment. This process includes the identification of the potential regulatory, legal and business exposure, as well as health and safety impacts and environmental risk assessment (10).
33. Estimate The approximate quantity and cost of materials, construction items, and labour required for a specific construction project (6).
34. Excavation: The act of cutting, digging, or scooping to remove material (6).
35. External costs: The costs associated with an asset that are not necessarily reflected in the transaction costs between provider and consumer and that, collectively, are referred to as externalities. Note 1 to entry: These costs may include business staffing, productivity and user costs; these can be taken into account in a LCC² analysis but should be explicitly identified (1).
36. Feasibility study - a structured process that identifies the engineering options and their implications including environmental issues. It culminates in a feasibility report and a design development (and, sometimes, implementation) proposal (10).
37. Foundation: That portion of a structure (usually below the surface of the ground) which distributes the pressure to the soil or to artificial supports. Footing has similar meaning (6).
38. Implementation year: The year that a project is anticipated to be complete and open to traffic (6).
39. Infrastructure: Basic facilities, services, and installations needed for the functioning of a community or society, including water and sewage systems, lighting, drainage, parks, public buildings, roads, railways, waterways and transportation facilities, and utilities (7).
40. Life Cycle: The consecutive and interlinked stages in the life of the object under consideration (2).
41. Life Cycle Cost - LCC: Cost of a civil engineering works or part of works throughout its life cycle, while fulfilling technical requirements and functional requirements (2).
42. Life-cycle cost analysis: An economic assessment of an item, area, system, or facility and competing design alternatives considering all significant costs of ownership over the economic life, expressed in equivalent dollars (4).
43. Net present value: The net value of all present and future costs and benefits converted to a single point in time using a discount rate factor (4).
44. Nominal cost: The expected price that will be paid when a cost is due to be paid, including estimated changes in price due to, for example, forecast change in efficiency, inflation or deflation and technology (1).
45. Normal Cost: The most probable cost for a unit or element of the project. The normal cost represents the cost that can most reasonably be expected if no significant problems occur. The normal cost typically has small uncertainty or variance (3).
46. Operation Cost: The cost incurred in running and managing the facility or built environment, including administration support services. Note 1 to entry: Operation costs

² Life Cycle Cost

could include rent, rates, insurances, energy and other environmental/regulatory inspection costs, local taxes and charges (1).

47. Project: The undertaking to develop, implement, or construct a particular transportation enhancement at a specific location or locations (3).

48. Project classification: The official classification of the type of project provided for in construction (6).

49. Real Cost: Cost expressed as a value at the base date, including estimated changes in price due to forecast changes in efficiency and technology, but excluding general price inflation or deflation (1).

50. Risk: The potential impact of an uncertain condition or action on project objectives and outcomes (4).

51. Risk allocation: The process of allocating contractual obligations and risks between parties (4).

52. Terrain: The physical features of a tract of land (7).

53. Topography: The details of a surface, including natural and man-made structures, on a map or chart (6).

54. Whole-Life Cost: All significant and relevant initial and future costs and benefits of an asset, throughout its life cycle, while fulfilling the performance requirements (1).

55. Whole-Life Costing: The methodology for systematic economic consideration of all whole-life costs and benefits over a period of analysis, as defined in the agreed scope. Note 1 to entry: The projected costs or benefits may include external costs (including, for example, finance, business costs, income from land sale, user costs). Note 2 to entry: Whole-life costing can address a period of analysis that covers the entire life cycle or (a) selected stage(s) or periods of interest thereof. Note 3 to entry: This definition should be contrasted with that for life-cycle costing (1).

II. References

- (1) Draft international standard ISO/DIS 15686-5.2, (Buildings and constructed assets - Service-life planning Part 5: Life-cycle costing), 2016.
- (2) Sustainability of construction works - Sustainability assessment of buildings and civil engineering works - Part 5: Framework for the assessment of sustainability performance of civil engineering works, European standard prEN 15643-5, 2016.
- (3) NCHRP report 574 (National Cooperative Highway Research Program), Guidance for Cost Estimation and Management for Highway Projects during Planning, Programming, and Preconstruction, 2007.
- (4) NCHRP synthesis 499 (National Cooperative Highway Research Program), Alternate Design/Alternate Bid Process for Pavement-Type Selection, A Synthesis of Highway Practice, 2017.
- (5) Bitumen and bituminous binders - Terminology, EN 12597, May 2014.
- (6) TxDOT Glossary, Texas Department of Transportation, 2013.
- (7) Mass Highway Glossary, 2006.
- (8) State Highway Geometric Design Manual, Glossary of Terms, Transit New Zealand, 2005.
- (9) Definitions compiled by experts of PKP Polish Railway Lines;
- (10) University of Birmingham and Network Rail Railway Lexicon Mk 24, February 2011.

Annex II

Revised terminology on Benchmarking Road Transport Infrastructure Construction Costs

I. Terminology

1. **Abutment:** The part of a bridge consisting of the cap, backwall, and wingwalls at the ends of a bridge which supports the superstructure, contains the earth in the approach fills, and directly receives the impact loads produced by traffic passing from the roadway onto the bridge. An abutment is a wall supporting the end of a bridge or span and sustaining the pressure of the abutting earth (11).
2. **Access:** The driveway by which vehicles and/or pedestrians enter and/or leave property adjacent to a road (14).
3. **Access control:** The condition whereby the road agency either partially or fully controls the right of abutting landowners to direct access to and from a public highway or road (12).
4. **Activity:** The specific action performed by the highway agency or the contractor, such as initial construction or major rehabilitation. An activity is defined by its physical costs, its service life, and its effects on highway users (5).
5. **Highway Agency:** Any government organization responsible for initiating and carrying forward a highway program for the general public. (5).
6. **Aggregate:** The granular material of natural, manufactured or recycled origin used in construction (9).
7. **Alignments:** The geometric design elements that define the horizontal and vertical configuration of the roadways.
8. **Alternative contracting:** The type of contract that is executed in ways other than traditional design-bid-build type (5).
9. **Analysis period:** The time period used for comparing pavement-type alternatives. An analysis period may include several maintenance and rehabilitation activities during the life cycle of the pavement being evaluated. The analysis period should not be confused with the pavement design or service life (5).
10. **Anionic Bituminous Emulsion:** The emulsion in which the emulsifier imparts negative charges to the dispersed bitumen droplets (8).
11. **Arterial:** The highway designed to move relatively large volumes of traffic at high speeds over long distances. Typically, arterials offer little or no access to abutting properties (12).
12. **Asphalt:** The homogenous mixture typically of coarse and fine aggregates, filler aggregate and bituminous binder which is used in the construction of a pavement. Note 1 to entry: Asphalt can include one or more additives to enhance the laying characteristics, performance or appearance of the mixture (10).
13. **Asphalt binder:** Asphalt cement or modified asphalt cement, which acts as a binding agent to glue aggregate particles into a cohesive mass (11).
14. **Asphalt cement:** The asphalt specifically prepared or refined to standards of quality and consistency. It is prepared for direct use in the manufacture of asphalt pavements (11).
15. **Asphalt Concrete (AC):** The asphalt in which the aggregate particles are continuously graded or gap-graded to form an interlocking structure (10).
16. **Asphaltic Concrete Pavement (ACP):** The compacted mixture of mineral aggregate and asphaltic materials. An ACP overlay is a supplemental base-pavement or wearing surface placed on an existing base-pavement or wearing surface where major repairs to a pavement

structure are required to restore a satisfactory riding surface or upgrade the strength of the pavement structure (11).

17. Asphalt Concrete for very thin layers (AC-TL): The asphalt for surface courses with a thickness of 20 mm to 30 mm, in which the aggregate particles are generally gap-graded to form a stone to stone contact and to provide an open surface texture (10).

18. Asphalt for Ultra-Thin Layers (AUTL): The hot mix asphalt road surface course laid on a bonding layer, at a nominal thickness between 10 mm and 20 mm with properties suitable for the intended use. The method of bonding is an essential part of the process and the final product is a combination of the bonding system and the bituminous mixture (10).

19. Asphalt pavement: The structure consisting of one or more layers of asphalt mix resting on a subgrade (16).

20. At-grade: The combination of horizontal alignments and vertical grade lines which intersect (11).

21. Backfill:

- (a) The material used to replace other material removed during construction.
- (b) The material placed adjacent to structures (11).

22. Base: The layer used in a pavement system to reinforce and protect the subgrade or subbase (17).

23. Balanced cantilever bridge: Prestressed concrete balanced cantilever bridges are often built using segmental construction. Balanced cantilever bridges are adopted for comparatively longer spans where simply supported, continuous or rigid frame type superstructures are found unsuitable. (7)

24. Benefit /Cost Ratio (B/C): the method used to compare the benefit versus the cost of proposed alternatives. For highway projects, benefits may include reduced fuel consumption, travel time, and air pollution; costs may include construction, right of way, and maintenance (11).

25. Binder: The material used to adhere to aggregate and ensure cohesion of the mixture. Note 1 to entry: Any solid support may be adhered with the binder (8).

26. Binder Course: The structural part of the pavement between the surface course and the base (10).

27. Bio-Fluxed Bitumen: The bitumen whose viscosity has been reduced by the addition of a flux oil derived from vegetal or animal oils (8).

28. Bitumen: The virtually not volatile, adhesive and waterproofing material derived from crude petroleum, or present in natural asphalt, which is completely or nearly completely soluble in toluene, and very viscous or nearly solid at ambient temperatures (8).

29. Bituminous Base: The main structural element of a pavement. Note 1 to entry: The base can be laid in one or more courses, described as "upper" base, "lower" base. (10)

30. Bituminous Binder: The adhesive material containing bitumen. Note 1 to entry: A bituminous binder may be in any of the following forms: unmodified, modified, oxidized, cut-back, fluxed, emulsified. Note 2 to entry: To avoid uncertainty, whenever possible the term describing the actual binder in question should be used (8).

31. Bituminous Emulsion: The emulsion in which the dispersed phase is bituminous. Note 1 to entry: Unless otherwise stated, continuous phase is assumed to be aqueous solution (8).

32. Borrow: The material used for embankments. Borrow is excavating, removing and properly using materials obtained from approved sources of the right of way. Delivered borrow is borrow obtained by the contractor from sources other than the right of way (11).

33. Box culvert: The culvert with a square or rectangular cross-sectional profile having four sides, including a bottom (13).

34. Bridge:

(a) The structure, including supports, erected over a depression or an obstruction, such as water, a highway, or a railway; having a roadway or track for carrying traffic or other moving loads; and having an opening measured along the centre of the roadway of more than 20 feet between faces of abutments, spring lines of arches, or extreme ends of the openings for multiple box culverts or multiple pipes that are 60 inches or more in diameter and that have a clear distance between openings of less than half of the smallest pipe diameter.

(b) The product that connects a local area network (LAN) to another local area network that uses the same protocol (for example, Ethernet or Token Ring network) (11).

35. Bridge reconstruction: The process whereby an existing bridge is replaced by a new bridge construction (7).

36. Bridge rehabilitation: The process whereby rehabilitation and repairing of an existing bridge with recovering. This definition is not valid for suspension bridges and similar ones bearing special construction techniques (7).

37. Cable stayed bridge: The bridge whose deck is supported at more or less regular distances by cables which are fixed to the top or along a mast protruding from the deck plane. In most cases cable-stayed bridges are self-anchored, i.e. the normal force introduced in the deck by the cables on one side of a mast is compensated by the normal force introduced on the other side (7) [for Turkey to review].

38. Capacity: The ability to accommodate a moving stream of people or vehicles in a given time period (13).

39. Carriageway: The part of a road used by vehicular traffic:

(a) Single carriageway: The road with only one line in each direction.

(b) Dual (double) carriageway: The road on which travelling in opposite direction is separated (see divided highway) (7).

40. Cationic Bituminous Emulsion: The emulsion in which the emulsifier imparts positive charges to the dispersed bitumen droplets (8).

41. Centreline C/L, C.L., CL or C-Line: The line dividing the roadway in two parts, each of which is reserved for traffic moving in one of the opposite directions. It is a survey line with continuous stationing for the length of the project. Construction plans and right of way maps refer to this line. Horizontal alignment is the centre of the roadbed (11).

42. Coarse Aggregate: The designation given to the larger aggregate sizes with D greater than 4 mm and d greater than or equal to 1 mm (9).

43. Concrete: The composite material consisting of a binding medium within which are embedded particles or fragments of aggregate; in hydraulic cement concrete, the binder is formed from a mixture of hydraulic cement and water (11).

44. Controlled access highway: The state highway in accordance with applicable state law on which owners or occupants of abutting lands and other persons are denied access to or from the highway except at such points only and in such manner as may be determined by the department. Maintenance Collection (11).

45. Controlled highways: Those highways officially designated as a part of the Interstate or Primary system of highways (11).

46. Control of Access (COA):

(a) Refers to conditions on certain sections of highways where the right to access the highway by abutting property owners or occupants is fully or partially controlled by a public authority. Control of access is a purchased property interest.

(b) Full control of access means that the authority to control access is exercised to give preference to through traffic by providing access connections with selected public roads only and by prohibiting crossings at-grade or direct private driveway connections.

(c) Partial control of access means that the authority to control access is exercised to give preference to through traffic to a degree that, in addition to access connections with selected public roads, there may be some crossings at grade and some private driveway connections (11).

47. Corrective Maintenance: The activity performed to correct deficiencies that negatively impact the safe, efficient operations of the facility, and future integrity of the pavement section. Corrective maintenance generally is reactive to unforeseen conditions to restore a pavement to an acceptable level of service (5).

48. Correlation Analysis: The statistical technique that is used to study the relationship among variables (5).

49. Corridor: The major area of travel between two points (A corridor may include more than one major route and more than one form of transport) (14).

50. Corridor study: The broad geographical band that follows a general directional flow or connects major sources of trips. It may contain a number of streets, highways and transit lines and routes (11).

51. Cost per lane Km: The average expenditure per lane km (11).

52. Cost per Km: The average expenditure per km for single carriage highways.

53. Course: The element of a pavement constructed with a single asphalt mixture. Note 1 to entry: A course can be laid in one or more layers (10).

54. Crack seal: The application of sealing material directly in the cracks of the pavement surface to prevent moisture damage (11).

55. Cross-section: The vertical section, generally at right-angles to the centreline showing the ground. On drawings it commonly shows the road to be constructed, or as constructed (14).

56. Crushed stone: The product excavated from an in-situ deposit of rock, crushed and processed for construction purposes with substantially all faces resulting from the crushing operation (11).

57. Culvert: The structure, usually for conveying water under a roadway but can also be used as a pedestrian or stock crossing, with a clear span of less than six meters (12).

58. Curb: The vertical or sloping element along the edge of a pavement or shoulder forming part of a gutter, strengthening or protecting the edge and clearly defining the edge to vehicle drivers. The surface of the curb facing the general direction of the pavement is called the "face" (11).

59. Curvature: The sharpness of a curve (13).

60. Cut: The section of highway or road below natural ground level. Also referred to as a cutting or excavation (12).

61. Design life of pavement (TR): The length of time for which a pavement structure is being designed based on structural distresses and traffic loadings (5).

62. Design period of pavement: The period considered appropriate to the function of the road. It is used to determine the total traffic for which the pavement is designed (14).

63. Divided highway: The highway with separate carriageways for traffic moving in opposite directions (12).

64. Double layered Porous Asphalt (2L-PA): The asphalt where with a top layer of a grain size 4/8 mm of about 25 mm thick and the second/bottom layer of porous asphalt with a course aggregate (11/16 mm). The total thickness is about 70 mm. It gives a better noise reduction than a single layer porous asphalt due to the finer texture at the top (that gives less tyre vibrations), (10).

65. Expansion (Capacity Improvement): The reconstruction which also involves the construction of additional through travel lanes beyond the work associated with reconstruction (7).

66. Expressway: The divided arterial highway for through traffic. It has a full or partial control of access and generally has grade separations at major intersections (11).
67. Fill: The embankment material placed above natural ground line (11).
68. Flexible pavement: The pavement structure that maintains intimate contact with and distributes loads to the subgrade and depends on aggregate interlock, particle friction, and cohesion for stability (11).
69. Freeway: The highest level of arterial characterized by full control of access and high design speeds (12).
70. Geometric design: A geometric design refers to the dimensions and elements of a highway or road (11).
71. Geometric improvement: The improvements which focus on increasing intersection capacity and enhancing safety; often involves widening to provide auxiliary turn lanes and the installation or modification of traffic signals (13).
72. Girder: The horizontal main structural element of a bridge which supports vertical loads (11).
73. Grade:
- (a) The slope of a roadway, channel, or natural ground.
 - (b) Any surface prepared for the support of construction such as that for paving or laying a conduit (11).
74. Grade controls: The automatic controls on an asphalt pavement which compensate for grade variations. A grade control sensor transmits an electronic signal to either thicken or thin out the depth of the asphalt mat. The signals are based upon the grade control sensor resting on the pavement surface or on a string line (11).
75. Grade line: The slope in the longitudinal direction of the roadbed, usually expressed in percent, which is the number of units of change in elevation per 100 units' horizontal distance (11).
76. Grade separation: The crossing of two roadways, a roadway and railroad, or a roadway and a pedestrian/bicycle facility at different levels (13).
77. Grading for earthworks:
- (a) The preparation of a subgrade, in line and elevation, for application of pavement materials including base and surfacing materials.
 - (b) Any striping, cutting, filling, stockpiling, or combination thereof which modifies the land surface (11).
78. Guardrail: The traffic barrier used to shield potentially hazardous areas (11).
79. Highway: The entire width between the boundary lines of every way publicly maintained when any part thereof is open to the use of the public for purposes of vehicular travel (11).
80. Highway class: The rural/urban description of the lane characteristics (11).
81. Horizontal curve: The bend from a straight line along a roadway (13).
82. Grading: The particle size distribution expressed as the percentages by mass passing a specified set of sieves (9).
83. HCR-Motorways-Expressway: The high Capacity Roads such as Motorways and Expressways. These roads are full access or half access controlled (at least) double carriageway highways. Both physical and geometric capacity of this type of roads are high. The applied design speed on these roads are also higher than on other roads. They may be toll roads.
84. Hot Rolled Asphalt (HRA): The dense, gap graded bituminous mixture in which the mortar of fine aggregate, filler and high viscosity binder are major contributors to the

performance of the laid material". Coated chippings (nominally single size aggregate particles with a high resistance to polishing, which are lightly coated with high viscosity binder) are always rolled into and form part of a Hot Rolled Asphalt surface course. This durable surface layer was often used as a surface layer in the United Kingdom of Great Britain and Northern Ireland (10).

85. Interchange: The grade separation of two or more roads with one or more interconnecting carriageways (14).

86. Intersection: The place at which two or more roads cross at grade or with grade separation (14).

87. Lane line: The broken line separating lanes for traffic moving in the same direction or a solid line for delineating traffic lanes and shoulder edge (11).

88. Lane-Km.: The measure of the total length of travelled pavement surface. Lane-km. is the centreline length (in km.) multiplied by the number of lanes (11).

89. Layer: The element of a pavement laid in a single operation (10).

90. Limited access roadway: The roadway especially designed for through traffic and over, from, or to which owners or occupants of abutting land or other persons have no right or easement of access by reason of the fact that their property abuts such limited access facility or for any other reason. Interstate highways, parkways, and freeways are usually developed as limited-access facilities (11).

91. Line: The baseline of roadway (11).

92. Local road: The road that primarily provides access to adjacent land and provides service to motorists over relatively short distances (11).

93. Longitudinal slope: Either the fore slope, which occurs when the roadway is located on a fill and the clear zone slopes down from the roadway, or the backslope, which occurs when the roadway is located on a cut and the clear zone slopes up from the roadway (13).

94. Low-volume road: The roadway generally subjected to low levels of traffic (11).

95. Medium Capacity Roads (MCR)-Primary Roads: The roads of which the geometric and physical capacity is medium. They are not access controlled. They are usually toll-free roads. They may be double or single carriageway highways. They are also main arterials and principal roads of national highways system of countries. The applied speed limits on these roads are lower than on HCR.

96. Medium Capacity Roads (MCR)-Secondary Roads: The roads whose geometric and physical capacity is medium but relatively lower than MCR-Primary Roads. They are not access controlled. They are toll-free roads. They may be double or single carriageway highways. They are important connectors of the national highways system to towns. The applied speed limits on these roads are lower than on HCR.

97. Maintenance of roadway infrastructure: The preservation through treatment activities of the entire roadway, including surface, shoulders, roadsides, structures, and such traffic control devices which are necessary for the road way to perform its function (5).

98. Maintenance activities: The combination of all technical and associated administrative actions during the service life to retain a civil engineering works or an assembled system (part of works) in a state in which it can perform its required functions. Note 1 to entry: Maintenance includes cleaning, servicing, repainting, repairing, replacing parts of the construction works where needed, or according to approved levels of service. (Construction Products Directive Guidance Paper F). Note 2 to entry: Adapted from the definition in ISO 15686-1, ISO 6707-1 and in Construction Products Directive Guidance Paper F (2).

99. Maintenance cost for road: The total of labour, material and other related costs incurred to retain a road or its parts in a state in which it can perform its required functions. Note 1 to entry: Maintenance includes conducting corrective, responsive and preventative maintenance on constructed assets, or their parts, and includes all associated management, cleaning, servicing, repainting, repairing and replacing of parts where needed to allow the constructed asset to be used for its intended purposes (1).

100. Major arterial: The roadway that services state-wide travel as well as major traffic movements within urbanized areas or between suburban centres (high mobility, limited access) (13).
101. Manufactured Aggregate: The aggregate of mineral origin resulting from an industrial process involving thermal or other modification (9).
102. Mastic Asphalt (MA): The voidless asphalt mixtures with bitumen as a binder in which the volume of filler and binder exceeds the volume of the remaining voids in the mixed". This mixture is very durable and was often used as surface layer in certain countries (10).
103. Median: The portion of a divided highway separating the opposing traffic flows. A median may be traversable or non-traversable.
104. Modified Bitumen: The bituminous binder whose rheological properties have been modified during manufacture by the use of one or more chemical agents. Note 1 to entry: In this context, "chemical agent" includes natural rubber, synthetic polymers, waxes, sulfur and certain organo-metallic compounds, but not oxygen or oxidation "catalysts" such as ferric chloride, phosphoric acid and phosphorus pentoxide. Fibres and inorganic powders ("fillers") are not considered to be bitumen modifiers. Modified bitumens may be employed "directly" or in the form of cut-backs or emulsions or blended with (for example) natural asphalt (8).
105. Motorway: The defined class of road for which certain activities or uses are restricted or prohibited by legislative provision (14) (insert definition from glossary?).
106. Multilane highway: The multilane highway is a highway with three or more lanes (11).
107. Natural Asphalt: The naturally occurring mixture of bitumen and finely divided mineral matter which is found in well-defined surface deposits and which is processed to remove unwanted components such as water and vegetable matter (10).
108. Natural Aggregate: The aggregate from mineral sources that has been subjected to nothing more than mechanical processing (9).
109. New Bridge Construction: The process involving construction of a bridge with approaching roads on an existing road alignment or on new road corridor (7).
110. New road construction: The construction of all parts of a road: structures, subgrade, pavement where no road existed before. (7).
111. New Tunnel Construction: The process involving construction of a tunnel with approaching roads an existing road alignment or on new road corridor (7).
112. Overlay: The layer or layers of paving materials placed on an existing surface where repairs to a pavement structure are required to restore a satisfactory riding surface and/or improve the strength of the pavement structure (11).
113. Overpass for roads: The grade separation where a minor highway passes over the major highway (12).
114. Pavement: That part of a roadway having a constructed surface for the facilitation of vehicular traffic (11).
115. Pavement Condition: The quantitative representation of pavement distress at a given point in time (5).
116. Pavement crack: The fissure or open seam in pavement which does not necessarily extend through the body of the pavement material. Pavement cracking includes alligator, longitudinal, and transverse cracking (11).
117. Pavement design: Design for (1) mixture or materials and (2) structure or thickness. These two designs cannot be clearly separated at the design stage; there must be interaction between them. Specifications are the link between mixtures and thickness design (11).

118. Pavement distress: The cracking, rutting, distortion or other types of surface deterioration which indicates a decline in the pavement's surface condition or structural load-carrying capacity (11).
119. Pavement management: The method of finding cost-effective strategies for providing, evaluating and maintaining pavements in a serviceable condition (11).
120. Pavement Management System (PMS): The set of tools or methods that can assist decision makers in finding cost-effective strategies for providing, evaluating and maintaining pavements in a serviceable condition (11).
121. Pavement preservation: The program employing a network level, long-term strategy that enhances pavement performance by using an integrated, cost-effective set of practices that extend pavement life, improve safety and meet motorist expectations (6).
122. Pavement structure: The combination of sub-base, base, paving geotextiles, and surface courses placed on a subgrade to support and distribute the traffic load to the roadbed (3).
123. Pavement reconstruction: The replacement of the entire existing pavement structure by the placement of the equivalent or increased pavement structure. Reconstruction usually requires the complete removal and replacement of the existing pavement structure. Reconstruction may utilize either new or recycled materials incorporated into the materials used for the reconstruction of the complete pavement section. Reconstruction is required when a pavement has either failed or has become functionally obsolete (6).
124. Pavement rehabilitation: The act of restoring a pavement to a former condition. It consists of structural enhancements that extend the service life of an existing pavement and/or improve its load carrying capacity. Rehabilitation techniques include restoration treatments and structural overlays:
- Major rehabilitation consists of structural enhancements that both extend the service life of an existing pavement and/or improve its load-carrying capability.
 - Minor rehabilitation is non-structural enhancement made to the existing pavement sections to eliminate age-related, top-down surface cracking that develops in flexible pavements as a result of environmental exposure (5, 6).
125. Pavement replacement: The renewal of the pavement by providing a new paved surface without changing capacity or geometry of the road, i.e. without changing the subgrade or by removing the total thickness of all layers of pavement, existing asphalt layers from an existing pavement and providing a new paved surface without changing the subgrade (7).
126. Paving Bitumen: The bitumen used to coat aggregate and/or reclaimed asphalt, mainly used in the construction and maintenance of paved surfaces and hydraulic works. Note 1 to entry: In Europe, the most-used grades of paving bitumen are defined by their needle penetration at 25°C, up to a maximum value of 900 x 0,1 mm (8).
127. Pedestrian bridge: The bridge designed for, and intended to carry, primarily pedestrians, bicyclists, equestrian riders and light maintenance vehicles, but not designed and intended to carry typical highway traffic (18).
128. Percent of grade: The grade of centreline or profile grade road between vertical points of intersection +0.10% = Increase in elevation by 0.10 feet for each 100 feet station (11).
129. Percent slope (% Slope): The change in elevation divided by the horizontal distance over which the change occurs for a vertical line. (11).
130. Periodic Maintenance: The periodic activities on a section of road at regular and relatively long intervals aiming to preserve the structural integrity of the road. These operations tend to be large scale, requiring specialized equipment and skilled personnel. They cost more than routine maintenance works and require specific identification and planning for implementation and often even design. Activities can be classified as preventive, resurfacing, overlay and pavement reconstruction (19).
131. Portland cement: The finely powdered substance, usually grey or brownish grey, composed largely of artificial crystalline minerals, the most important of which are calcium

and aluminium silicates. The calcium silicate compounds, upon reaction with water, produce the new compounds capable of imparting the stone like quality to the mixture (11).

132. Portland cement concrete pavement: the hardened mixture of Portland cement, aggregate, and water used to pave streets or highways. This mixture may or may not contain steel reinforcing (11).

133. Pre-cast: The concrete that is formed, placed, and cured before being placed in its final position. An example is a pre-cast concrete beam for a bridge (11).

134. Prestressed concrete: The precast concrete subject to pretensioning, post-tensioning, or a combination of both (11).

135. Preventive Maintenance: The planned strategy of cost-effective treatments to an existing roadway system and its appurtenances that preserves the system, retards future deterioration, and maintains or improves the functional condition of the system (without significantly increasing the structural capacity) (5).

136. Pre-stressed simple beam bridge: The type of bridge, simply supported prestressed concrete beams (7).

137. Porous Asphalt (PA): The bituminous material with bitumen as a binder prepared so as to have a very high content of interconnected voids which allow passage of water and air in order to provide the compacted mixture with drain and noise reducing characteristics (10).

138. Radius: The line segment extending from the centre of a circle to the curve (11).

139. Reconditioning: The process including improvement of grades, curves, intersections or sight distances in order to improve traffic safety or changing the subgrade to widen shoulders or to correct structural problems in addition to resurfacing or pavement replacement. (7).

140. Recycled Aggregate: The aggregate resulting from the processing of inorganic or mineral material previously used in construction. Note 1 to Entry: Recycled aggregates can also be obtained from production residues or nonconforming products, e.g. crushed unused concrete (9).

141. Regulating Course: The course of variable thickness applied to an existing course or surface to provide the necessary profile for a further course of consistent thickness (10).

142. Remaining Service Life: The structural life remaining in the pavement at the end of analysis period (5).

143. Reinforced concrete pavement: The Portland concrete pavement in which steel is used to control the width of shrinkage and thermal cracking of the concrete. The steel adds strength to the concrete in tension (11).

144. Residual Value of pavement: Value of the in-place pavement materials less the cost to remove and process the materials for reuse (5).

145. Restoration:

(a) The act or process of accurately recovering the form and details of a property and its setting as it appeared at a particular period of time by means of the removal of later work or by the replacement of missing earlier work (4).

(b) The repair and/or replacement of specific lost functions within a natural system, such as habitat, water buffers, and soil function (13).

146. Resurfacing: Placing a new surface on an existing road to increase skid resistance, to seal by aiming to preserve road from negative atmospheric conditions, to increase driver comfort, to extend pavement life, to reduce noise etc, etc. The aim is not to increase the bearing capacity of pavement. (7).

147. Renewing of road surface with reinstalling bituminous layer by removing determined depth of pavement by milling in order to increase bearing capacity of road and to eliminate road defects. (7).

148. Right of Way (ROW):

(a) The general term denoting land, property or interest therein, usually in a strip, acquired for or devoted to transportation purposes.

(b) The general term denoting land, property or interest therein, usually in a strip, acquired for or devoted to a highway for the construction of the roadway. Right of way is the entire width of land between the public boundaries or property lines of a highway. This may include purchase for drainage (14).

149. Rigid pavement: the pavement structure which distributes loads to the subgrade, having as one course a Portland cement concrete slab of relatively high-bending resistance (11).

150. Road: A route trafficable by motor vehicles. In law, the public right-of-way between boundaries of adjoining property and is owned or administrated by a road authority (14). Or Definition from 1968 Convention on Road Traffic: The entire surface of any way or street open to public traffic.

151. Roadbed: The graded portion of a highway prepared as a foundation for the pavement structure and shoulders (3).

152. Roadside: The general term denoting the area beyond the shoulder breakpoints (12).

153. Road infrastructure: The infrastructure which forms part of a roadway, pathway or shoulder, including:

- structures forming part of the roadway, pathway or shoulder,
- materials from which a roadway, pathway or shoulder is made (7).

154. Road tunnel: The tunnel constructed for the purpose of building an underground road (7).

155. Roadway:

(a) The portion of the highway within the limits of construction.

(b) That portion of a highway improved, designed, or ordinarily used for vehicular travel, exclusive of the berm or shoulder. In the event a highway includes two or more separate roadways, the term "roadway" as used in the Equipment Manual shall refer to such roadway separately, but not to all such roadway collectively (11).

156. Roadway alignment: The vertical and horizontal location of a road (13).

157. Roadway improvement: The construction or reconstruction made to the roadway cross-section (11).

158. Rolling terrain: The natural slopes consistently rise above and fall below the highway grade with, occasionally, steep slopes presenting some restrictions on highway alignment. In general, rolling terrain generates steeper gradients, causing truck speeds to be lower than those of passenger cars (12).

159. Routine Maintenance for highway systems: The work that is planned and performed on a routine basis to maintain and preserve the condition of the highway system or to respond to specific conditions and events that restore the highway system to an adequate level of service (6).

160. Rural: The areas with large expanses of undeveloped or agricultural land, dotted by small towns, villages, or any other small activity clusters (13).

161. Rural road: The road, street, way, highway, thoroughfare, or bridge that is located in an unincorporated area and that is not privately owned or controlled, any part of which is open to the public for vehicular traffic, and over which the state or any of its political subdivisions have jurisdiction (11). It is characterized by low volume high-speed flows over extended distances. Usually without significant daily peaking but could display heavy seasonal peak flows (12).

162. Salvage Value: The value (positive if a residual economic value is realized and negative if demolition costs are accrued) of competing alternatives at the end of the life cycle or analysis period. [It] typically consists of remaining service life and residual value (5).
163. Seal coat: The asphaltic coating, with aggregate, applied to the surface of a pavement structure for the purpose of waterproofing and preserving the surface, reconditioning a previous asphaltic surface treatment, improving the surface texture of the wearing surface, changing the surface colour or providing resistance to traffic abrasion (11).
164. Service life: The period of time from completion of construction until the structural integrity of the pavement is determined to be unacceptable and rehabilitation/replacement is required (Hallin et al. 2011) (5).
165. Shoulder: The portion of the roadway adjacent to the travelled way (on either side) for accommodation of stopped vehicles, for emergency use, and for lateral support of base and surface (11).
166. Shoulder breakpoint: The hypothetical point at which the slope of the shoulder intersects the line of the fill slope. Sometimes referred to as the hinge point (12).
167. Soft Asphalt (SA): The mixture of aggregate and soft bitumen grades". This flexible mixture is used in the Nordic countries for secondary roads (10).
168. Shoulder drains: the drains usually used to drain runoff from bridge embankment areas (11).
169. Shoulder hinge point: The point in the cross-section of a road, at which the side slope would intersect with the unsealed shoulder, or in the absence of an unsealed shoulder, the sealed shoulder (14).
170. Sidewalk: The portion of the cross-section reserved for the use of pedestrians (12).
171. Sight distance: The distance measured along the carriageway over which objects of defined height are visible to a driver (14).
172. Single tube road tunnel: The tunnel through which the traffic normally flows in two directions (bi-directional flow) (7).
173. Skid resistance of a road surface: The capacity to convey friction in the contact area between tyre and road surface. Skid resistance is necessary to offset the horizontal forces that occur in the contact area between tyre and road surface during vehicle movements (accelerating, braking and steering). In order to be able to drive safely on a road it is important for a road surface to have adequate skid resistance in both wet and dry conditions (15).
174. Stone Mastic Asphalt (SMA): The gap-graded asphalt mixture with bitumen as a binder, composed of a coarse crushed aggregate skeleton bound with a mastic mortar". This mixture is often used as a surface layer in case high stability is needed. The surface structure also has good noise reducing properties (10).
175. Subbase: The layer or layers of specified or selected material of designed thickness placed on a subgrade to support a base course (or in the case of rigid pavements, the Portland cement concrete slab). The layer used in the pavement system between the subgrade and the base course (11).
176. Subgrade: The top surface of a roadbed upon which the pavement structure, shoulders, and curbs are constructed and extending to such depth as will affect the structural design (3, 17).
177. Substructure: That part of a bridge structure covered on bent details, or below the bridge seats including back walls and wing walls at abutments (11).
178. Sunk costs: Costs of goods and services already incurred and/or irrevocably committed. Note 1 to entry: These are ignored in an appraisal. The opportunity costs of obtaining or continuing to tie up capital are, however, included in WLC analysis and the opportunity costs of using assets can be dealt with as costs in LCC analysis (1).
179. Superelevation: The method of banking the roadway by attaining a vertical difference between the inner and outer edges of pavement (11).

180. **Superelevation rate:** The rate of rise in cross section of the finished surface or a roadway on a curve, measured from the lowest edge to the highest edge (11).
181. **Superstructure:** That part of a bridge structure covered on the span details, or above the bridge seats (11).
182. **Surface Course:** The top layer or layers of a pavement structure designed to accommodate the traffic load and resist skidding, traffic abrasion, and weathering (3).
183. **Surface treatment:** The application of bituminous material followed by a layer of mineral aggregate. Multiple applications of bituminous material and mineral aggregate may be used (16).
184. **Suspension bridge:** The type of bridge in which the deck (the load-bearing portion) is hung below suspension cables on vertical suspenders (7).
185. **Technical Performance:** The performance related to the capability of construction works or an assembled system (part of works), which are required or are a consequence of the requirements made either by the client, users and/or by regulations (2).
186. **Technical Requirement:** The type and level of technical characteristics of a construction works or an assembled system (part of works), which are required or are a consequence of the requirements made by the client, users and/or by regulations (2).
187. **Toll road:** The highway open to traffic only upon payment of a direct fee (11).
188. **Traffic lane:** The strip of roadway intended to accommodate the forward movement of a single line of vehicles (11).
189. **Travel lane:** The portion of a roadway for the movement of vehicles, exclusive of shoulders and auxiliary lanes (13).
190. **Two-tube tunnel (twin tube tunnel):** The tunnel through which traffic flows in one direction through each tube that is uni-directional flow (7).
191. **Underpass:** The grade separation where the subject highway passes under an intersecting highway (12).
192. **Underwater tunnel:** A tunnel which is partly or wholly constructed under a body of water. They are often used where building a bridge or operating a ferry link is impossible, or to provide competition or relief for existing bridges or ferry links (7).
193. **Urban:** The central business districts, residential districts and open space parks typical of larger cities (13).
194. **Vertical curve:** The parabolic curve drawn tangent to two intersecting grade lines to provide a smooth transition from one grade to another (11).
195. **Viaduct:** The elevated roadway span over a valley, floodplain, wetland, or gorge which provides unrestricted wildlife movements or passage of other activity (13).

II. References

- (1) Draft international standard ISO/DIS 15686-5.2, (Buildings and constructed assets - Service-life planning Part 5: Life-cycle costing), 2016.
- (2) Sustainability of construction works - Sustainability assessment of buildings and civil engineering works - Part 5: Framework for the assessment of sustainability performance of civil engineering works, European standard prEN 15643-5, 2016.
- (3) Standard specifications for construction of roads and bridges on federal highway projects FP - 14, United States Department of Transportation, Federal Highway Administration (Section 101), 2014.
- (4) NCHRP report 574 (National Cooperative Highway Research Program), Guidance for Cost Estimation and Management for Highway Projects during Planning, Programming, and Preconstruction, 2007.

- (5) NCHRP synthesis 499 (National Cooperative Highway Research Program), Alternate Design/Alternate Bid Process for Pavement-Type Selection, A Synthesis of Highway Practice, 2017.
- (6) Memo: Pavement Preservation Definitions - Pavement Preservation - Design & Analysis - Pavements - Federal Highway Administration.
- (7) General directorate of Turkish highways definition.
- (8) Bitumen and bituminous binders - Terminology, EN 12597, May 2014.
- (9) Aggregates for bituminous mixtures and surface treatments for roads, airfields and other trafficked areas, EN 13043, 2016.
- (10) Bituminous mixtures - Material specifications - Part 1-9, EN 13108 series (1-9), 2016.
- (11) TxDOT Glossary, Texas Department of Transportation, 2013.
- (12) Geometric Design Guidelines, South African National Roads Agency Limited.
- (13) Mass Highway Glossary, 2006.
- (14) State Highway Geometric Design Manual, Glossary of Terms, Transit New Zealand, 2005.
- (15) Skid Resistance on National Roads, Ministry of Infrastructure and the Environment, Rijkswaterstaat Major Projects and Maintenance, June 2017.
- (16) ASTM D8, Standard Terminology Relating to Materials for Roads and Pavements.
- (17) AASHTO M 146, Standard Specification for Terms Relating to Subgrade, Soil-Aggregate, and Fill Materials.
- (18) NCHRP 20-07, TASK 244 LRFD Guide Specifications for The Design of Pedestrian Bridges.
- (19) Word Bank, Transport Note No. TRN-4, June 2005, Washington, D.C.

Annex III

Terminology on Benchmarking Rail Transport Infrastructure Construction Costs

I. Terminology

1. Active level crossing - automatic with user-side protection: The level crossing where user-side protection is activated by the approaching train. This shall include a level crossing with both user-side protection and warning (1).
2. Active level crossing - automatic with user-side warning: The level crossing where user-side warning is activated by the approaching train (1).
3. Active level crossing – manual: The level crossing where user-side protection or warning is manually activated by a railway employee (1).
4. Active level crossing - rail-side protected: The level crossing where a signal or other train protection system permits a train to proceed once the level crossing is fully user-side protected and is free from incursion (1).
5. Ballast: The selected material placed on the subgrade to support and hold the track with respect to its alignment within the bounds of specified top (vertical) and line (horizontal). Ballast preferably consists of accurately graded hard particles, normally stone, easily handled in tamping, which distribute the load, provide elasticity, drain well and resist plant growth. Generally, ballast must consist of broken stones. Granite is a very suitable material thanks to its toughness (2).
6. Branch line: The line carrying trains from the mainline to destinations on lower priority routes than the mainline (2).
7. Bridge: The structure that is built over a river, road, or other railway line to allow trains to cross from one side to the other (3).
8. Broad-gauge: The track wider than the standard gauge of 1435 mm (2).
9. Catenary system: The generalised term used to describe the whole overhead line equipment (2).
10. Connected facility: The facility connected to the main railway network, such as a terminal or port. Such facilities are connected to rail transport but lie outside the main railway network (4).
11. Construction of the railway infrastructure: The civil engineering, signalling, electrification, telecommunications, plant and electrical distribution and related computer systems (2).
12. Contact wire: The overhead wire touched by an electric train's pantograph in order to draw power (2).
13. Conventional lines: All railway lines that are not classified as 'dedicated high speed lines' or 'upgraded high speed lines' (4).
14. Corridor (railway): - The major railway line along a geographical route (4).
15. Culvert: The small bridge or pipe carrying a stream under a railway (3).
16. Dedicated high speed line: The line specially built to allow traffic at speeds generally equal to or greater than 250 km/h for the main segments. High speed line may include connecting lines, in particular connecting segments into town centre stations located on them, on which speeds may take account of local conditions (4).
17. Dedicated line: The rail link used exclusively by one type of traffic (freight or passengers) (4).

18. Development of the railway infrastructure: The network planning, financial and investment planning as well as the constructing and upgrading of the infrastructure (5).
19. Diamond crossing turnout: The turnout where two tracks cross (3).
20. Double-track line: The line in which one track is provided for each direction of travel (4).
21. Ecopassage for railway: The structure which allows animals to cross the railway line safely (3).
22. Electrified line: The line equipped with a power cable providing electric traction power to the trains (6).
23. Elevator: The installation which transports people or goods vertically between specific levels of a railway station (3).
24. Escalator: The installation in the form of moving stairs which transports people or goods vertically between specific levels of a railway station (3).
25. European Railway Traffic Management System (ERTMS): The major industrial project being implemented by the European Union, which will serve to make rail transport safer and more competitive. It is made up of all the train-borne, trackside and lineside equipment necessary for supervising and controlling, in real-time, train operation (4).
26. European Train Control System (ETCS): The component of ERTMS to guarantee a common standard that enables trains to cross national borders and enhances safety. It is a signalling and control system designed to replace the several incompatible safety systems currently used by European railways. As a subset of ERTMS, it provides a level of protection against over speed and overrun depending upon the capability of the line side infrastructure (4).
27. Fastenings: The elements such as bolts and springs that fasten rails to a sleeper (3).
28. Footbridge for railways: The engineering structure designed for pedestrians, constructed over the railway line (3).
29. High speed line: The specially built high-speed line equipped for speeds generally equal to or greater than 250 km/h or specially upgraded high-speed lines equipped for speeds of at least 200 km/h (7).
30. Infrastructure manager for railway (railway infrastructure manager): The body or firm responsible for the operation, maintenance and renewal of railway infrastructure on a network, as well as responsible for participating in its development within the framework of its general policy on development and financing of infrastructure (5).
31. Interoperability: The ability of a rail system to allow the safe and uninterrupted movement of trains which accomplish the required levels of performance (5).
32. Land grading: The work conducted in order to ensure a level base for further construction work (3).
33. Level crossing: Any level intersection between a road or passage and a railway, as recognised by the infrastructure manager and open to public or private users. Passages between platforms within stations are excluded, as well as passages over tracks for the sole use of employees (1).
34. Lighting installation: The non-traction installation including lighting of passenger passages, platforms, level crossings, marshalling yards, signal boxes etc. (3).
35. Main line: The main inter-city and other main passenger or freight route available for rail services. Main railway lines comprise the high-speed railway lines and important major conventional railway lines (4).
36. Maintenance of the railway infrastructure: The works intended to maintain the condition and capability of existing infrastructure (5).

37. Marshalling yard: The railway facility equipped with tracks with special layout and technical facilities, where sorting, formation and splitting-up of trains takes place; wagons are sorted for a variety of destinations, using a number of rail tracks (8).
38. Narrow gauge: The gauge track narrower than the standard gauge of 1435 mm (2).
39. Network: The lines, stations, terminals, and all kinds of fixed equipment needed to ensure safe and continuous operation of the rail system (6).
40. Non-electrified line: The line not equipped with a power cable providing electric traction power to the trains; usually trains on such line are driven by diesel engine (3).
41. One-sided turnout: The turnout where from one main track (of a main line), one or two diverted tracks (of a branch line) diverge (3).
42. Overhead power line: The electric power transmission line suspended to towers or poles. Overhead line equipment includes the wires and associated equipment, suspended over or adjacent to the railway line, for supplying electricity to trains (4).
43. Passenger information system: The system presenting all key elements of a railway timetable for passengers at stations (3).
44. Passive level crossing: The level crossing without any form of warning system or protection activated when it is unsafe for the user to traverse the crossing (1).
45. Pedestrian passage: The structure that allows pedestrians to pass the railway without any threat of collision with a train; there are different types of pedestrian passages e.g. footbridges or tunnels (3).
46. Platform: The structure constructed alongside the tracks at a passenger station that allows passengers wait, board and disembark from a train (3).
47. Preparatory work: The work conducted in order to prepare land for earthwork; removal of trees and bushes, demolition, etc. (3).
48. Rail: The rolled steel shape designed to be laid end-to-end in two parallel lines on sleepers, to form a track for railway rolling stock (2).
49. Railway infrastructure: The railway lines and engineering structures, buildings, and equipment, including grounds on which they are situated, dedicated to management passenger and freight services as well as maintenance of the property of the railway manager (3).
50. Railway infrastructure in ports and terminals: The line infrastructure in the administrative area of ports and terminals (3).
51. Railway line: One or more adjacent running tracks forming a route between two points (4).
52. Railway station: A building or a building complex designed to provide services for passengers and accompanying persons, i.e. ticket offices, waiting rooms, shops, bars; facilities for train operations are excluded from this definition (3).
53. Ramp: The structure constructed alongside the tracks at a freight station which allows goods to be loaded and unloaded from a train (3).
54. Removal of wired infrastructure collision: The removal of any type of cables or wires which were originally installed at the place of construction, upgrade or renewal work, in order to avoid collision with new wired infrastructure to be installed at this place (3).
55. Renewal of the railway infrastructure: The major substitution works on the existing infrastructure which do not change its overall performance (5).
56. Retaining structure: The engineering structure used for soil stabilisation, especially at slopes (3).
57. Secondary line (or branch line): The line of less importance than a main line (or trunk line) (4).
58. Section: The railway track between two locations (e.g. between two stations) (6).

59. Siding: The section which is directly or indirectly connected with a railway line, used to perform loading, maintenance, or parking operations of railway vehicles or movement and entering of railway vehicles into operation on a railway network (3).
60. Signal box: The small building near a railway, which contains the switches used to control the signals (9).
61. Signalling system: The system used to control railway traffic safely, essentially to prevent trains from colliding. The main purpose of signalling is to maintain a safe distance at all times between all trains on the running lines (4).
62. Single-track line: The line where traffic in both directions shares the same track (4).
63. Slab track: The form of railway track comprising a concrete base to which the base plates carrying the rails are secured. It eliminates the need for individual sleepers (2).
64. Sleeper: The wood, concrete or steel object that holds the rails apart and supports the track on the ballast (2).
65. Soil exchange: The excavation work conducted in order to remove the original soil and refilling this area with the soil meeting the requirements of the construction work (3).
66. Standard-gauge: The track at the width of 1435 mm (3).
67. Subgrade: The prepared surface of the natural ground or upper surface of fill material (2).
68. Superstructure - The group of track elements that are found above the formation layer, i.e. rails, sleepers, fastenings, ballast (3).
69. Switches and crossings: The specially designed rail components allowing trains to change tracks; any track elements which are not plain line (2).
70. Tamping: The compacting ballast under the sleepers to maintain the correct geometry of the track (2).
71. Technical specification for interoperability (TSI): The specification by which each subsystem or part of a subsystem is covered in order to meet the essential requirements and ensure the interoperability of the European Union rail system (1).
72. Telecommunications and IT: The installation for wireless communications in railway traffic management (3).
73. Terminal: The station where handling of goods takes place (goods are loaded on, or unloaded from, transport vehicles). May also include shunting of wagons between trains, without any loading or unloading (4).
74. Track: The assembly of rail, fastenings and sleepers over which railway carriages, wagons, locomotives and trains are moved (2).
75. Track bed: The foundation of the track, adjusted for laying the superstructure (3).
76. Traction current: The electric current supplied for the purpose of electric traction, collected by pantograph from the overhead supply (4).
77. Traction electric power engineering: The construction of overhead power lines, cable lines, substations, lightning protection, earthing systems etc. (3).
78. Trunk line: The line that is the main route on a railway (4).
79. Tunnel: The structure provided to allow a railway line to pass under higher ground, and which has excavated without disturbing the surface of that ground (2).
80. Turnout: The trackwork element where a track divides into two (2).
81. Turnout sleeper: The special kind of a sleeper laid under a turnout; it is longer than a regular sleeper (3).
82. Upgrade of the railway infrastructure: The major modification works to the infrastructure which improve its overall performance (5).

83. Upgraded high speed line: The conventional line specially upgraded to allow traffic at speeds of at least 200 km/h for the main segments (4).
84. Viaduct: The multi-span bridge structure for non-collision traffic across the railway line (3).

II. References

- (1) Directive (EU) 2016/798 of the European Parliament and of the Council of 11 May 2016 on railway safety;
- (2) University of Birmingham and Network Rail Railway Lexicon Mk 24, February 2011;
- (3) Definitions compiled by experts of PKP Polish Railway Lines;
- (4) RailNetEurope (RNE);
- (5) Directive (EU) 2016/2370 of the European Parliament and of the Council of 14 December 2016 amending Directive 2012/34/EU as regards the opening of the market for domestic passenger transport services by rail and the governance of the railway infrastructure;
- (6) Infrabel, www.infrabel.be/en;
- (7) Directive (EU) 2016/797 of the European Parliament and of the Council of 11 May 2016 on the interoperability of the rail system within the European Union;
- (8) Eurostat/ITF/UNECE, RNE;
- (9) Collins Dictionary.

Annex IV

Terminology used for benchmarking of construction costs of inland waterway infrastructure

I. Terminology

A. Hydrological and hydrotechnical terms

1. Alluvial: something made of gravel/mud/silt/sand deposited and formed by rivers or floods (3).
2. Alluvium: a fine-grained deposit, composed mainly of mud and silt, deposited by a river (3).
3. Apron: layer of stone, concrete or other material to protect a structure's toe against scouring (3).
4. Aquatic dredged material placement: dredged material placement options under which the dredged material is submerged and remains under water (3).
5. Bar: an elevated region of sediment (sand or gravel) that has been deposited by the flow (3).
6. 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).
7. Bathymetry: the study of underwater depth of water bodies, topography of a water body (3).
8. 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).
9. Bottom water outlet: hydraulic structure for draining reservoir or channel (4).
10. Canal: artificially created watercourse in an earthen cutting or embankment (4).
11. Canalization of rivers: means of increasing depth of waterways by creating pools using dams and connecting them with locks (4).
12. 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).
13. Cross-section, profile: a plane, generally perpendicular to the centreline of the river or the fairway (3).
14. Dam: water retaining structure partitioning off the waterway and its valley to raise the water level (4).
15. Design level: water level at the stream flow measuring station established with multi-year probability (4).
16. Differentiated parameters: planned dimensions of inland waterways depending on water levels (4).
17. 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 (m²) and V is the mean velocity of water (m/s)) (3).
18. Drawdown: the difference between the working and the design water level (4).
19. Dredged material: material excavated from the river bed (3).

20. 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).
21. 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).
22. Fairway axis: centreline of the fairway (3).
23. Fairway parameters: depth, width, vertical clearance and bend radius of the fairway (4).
24. Flood control: regulation of flood waters to prevent or minimize inundation of valuable property or land (3).
25. 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).
26. Ford: a shallow sector of the river that stretches across the whole width of the river (3).
27. 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).
28. Gauge zero: elevation of the gauging station with respect to the mean sea level (3).
29. Gauging station: equipment for measuring the water level of surface water bodies (3).
30. 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).
31. 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).
32. Granulometry (of the sediment): size of particles of sediment forming the river bed (3).
33. Gravel: unconsolidated rock fragments that have a general particle size range and include size classes from granule- to boulder-sized fragments (3).
34. Guaranteed parameters: dimensions of inland waterways as set in the technical specifications for the design levels (4).
35. 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).
36. Head water: raised water level caused by the obstruction or hindrance of the watercourse or a change in the flow of groundwaters.
37. 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).
38. Hydraulic complex: a set of hydraulic structures all at the same location and used for the same purpose (4).
39. Hydraulic structure: engineering structure designed to make use of water resources and to control the harmful effects of the water (4).
40. Hydroelectric power plant: a set of hydraulic structures and equipment used to convert the energy potential of a watercourse into electrical power (4).
41. Hydromorphology: physical characteristics of a river, including the river bed, banks, connections with the landscape, including longitudinal continuity and habitat continuity (3).

42. Inland waterway network: all inland waterways open for public navigation in a given area (1).
43. 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.
44. 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).
45. 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).
46. Longitudinal dike (training wall): a rock structure parallel to the river centre line to confine the flow in the fairway (3).
47. 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).
48. Maintenance of navigable hydraulic structures: operation and repair of hydraulic structures designed to allow navigation.
49. 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).
50. 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).
51. Mean low water (MLW): mean of multi-year minimum water levels (3).
52. Mean water level (MWL): mean water level over a multi-year period (3).
53. Morphological modelling: application of specialized software packages in order to determine and predict morphological changes of the river bed (3).
54. Morphology (of the river bed): describes the shapes of river channels and how they change over time (3).
55. Multibeam: specialized equipment for hydrographic surveys used for precise 3D imaging of the river bed (3).
56. Navigable canal: waterway built primarily for navigation (1).
57. 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.
58. Navigable pass: navigable hydraulic structure allowing passage of vessels through a hydraulic complex (4).
59. Navigable river: natural waterway open for navigation, irrespective of whether it has been improved for that purpose (1).
60. 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).
61. Reservoir: an artificial water body formed of a water retaining structure on a watercourse for water storage and flow regulation (4).

62. Riprap: rock armour, rubble or other material used to armour shorelines, streambeds, bridge abutments, etc. against scour and water or ice erosion (3).
63. River basin: the land area that is drained by a river and its tributaries (3).
64. River bed (riverbed): bed formed by the flow of the river, along which run-off is carried without flooding the flood plain (4).
65. Shoal: shallow section of river bed difficult for navigation (4).
66. Spillway: hydraulic structure for passage of water discharged from upstream pool to avoid overfilling (4).
67. Stream flow measuring station: hydrological station for monitoring water levels and flows (4).
68. Towpath: bank that the fairway runs along (4)
69. Water conduit: hydraulic structure for water supply and drainage in the appropriate direction (4).
70. Water outlet: hydraulic structure for release from the upstream pool of the channel or waterway (4).
71. Water retaining structure: hydraulic structure designed to retain head water (4).
72. Waterways: stretches of water bodies and watercourses used for navigation and logging (4).
73. 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

74. 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).
75. 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).
76. 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.

77. 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).
78. 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).

79. 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).
80. Deepening dredging: dredging to maintain specified parameters in approach channels (in a port) (4).
81. 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).
82. Dredging: work to deepen, expand or align existing and create new navigation channels (4).
83. 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).
84. Engineering works: dredging, remedial work, sweeping, maintenance dredging, hydrographic surveys and maintenance of inland navigation equipment (4).
85. 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).
86. Hydrographic survey: geodetic and hydrological work performed for the purposes of engineering works and maintenance of hydraulic structures with the necessary technical documentation (4).
87. 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).
88. Internavigational period: the period during which inland waterways are closed to navigation (4).
89. Maintenance dredging: work to remove obstacles to navigation (4).
90. 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).
91. Navigational equipment: a system of special alarms for safe navigation (4).
92. Navigational period: the period during which the inland waterways are open for navigation (4).
93. Pilot chart: schematic map of inland waterways with navigation equipment indicated (4).
94. Remedial work: installation in river bed of structures to create and support differentiated guaranteed depths or to protect bank from scouring (4).

95. Roadstead: part of inland waterways intended for berthing, formation and uncoupling of vessel convoys, integrated fleet service operations and for trans-shipment operations (4).
96. Slipway: structure for the construction or repair and launch of a vessel (4).
97. Sweeping: work to locate underwater obstructions to navigation (4).
98. Turnaround time: total of operating time of vessel or survey team, time required for servicing and time towing vessel (4).
99. 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).
100. Waterline: boundary of water on shore of water body (shoreline) (4).
101. Winter harbour/ shelter: part of a surface water body and (or) set of structures set up and equipped for the repair, winter mooring, berthing or technical inspection of vessels and floating objects (4).

C. Ports and port infrastructure

102. Bollard: mooring post for the purpose of berthing of ships and other vessels to a port structure (8).
103. 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 (groynes), dividing a basin into smaller areas (8).
104. 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).
105. Groyne: breakwater with neither end connected to the shore (4).
106. Harbour aquatorium: defined section of the water body, except the fairway, designed for the safe approach, manoeuvring, berthing and departure of vessels (4).
107. 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).
108. 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).
109. Landing stage: a place solely for vessels to embark or disembark passengers, not part of an inland port (1).
110. Mole: breakwater with one end adjacent to the shore (4).
111. 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).
112. 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).

113. 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.

114. 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).

115. 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).

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

117. 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).

118. 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).

119. 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).

120. 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).

121. 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).

122. 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).

123. 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).

124. 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).








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

II. References

- (1) UNECE, Eurostat, ITF, Illustrated Glossary for Transport Statistics. ec.europa.eu/eurostat/documents/3859598/5911341/KS-RA-10-028-EN.PDF/6ddd731e-0936-455a-be6b-eac624a83db4.
- (2) American Society of Civil Engineers (ASCE) www.infrastructurereportcard.org/making-the-grade/glossary/.
- (3) via donau, Good Practice Manual on Inland Waterway Maintenance, www.viadonau.org/fileadmin/content/viadonau/01Newsroom/Bilder/2016/167_PL2_Manual_Waterway_Maintenance.pdf.
- (4) National standards of member countries of the Working Party on Inland Water Transport (SC.3).
- (5) Inventory of Main Standards and Parameters of the E Waterway Network ("Blue Book"), third revised edition (ECE/TRANS/SC.3/144/Rev.3), www.unece.org/trans/main/sc3/sc3res.html.
- (6) International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA), International Dictionary of Marine Aids to Navigation, 2016 revised edition, www.iala-aism.org/wiki/dictionary.
- (7) UNECE resolution No. 30 on Classification of European Inland Waterways (TRANS/SC.3/131), www.unece.org/trans/main/sc3/sc3res.html.
- (8) ECE/TRANS/WP.5/GE.4/2018/4, www.unece.org/trans/main/wp5/wp5_ge_benchmarking_transport_infrastructure_construction_costs_05.html.

Appendix

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 convey: 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 |
| | | III Gustav Koenigs | 67–80 | 8.20 | 2.50 | 650–1 000 | | | | | | | 4.00–5.00 |
| | East of Elbe | I Gross Finow | 41 | 4.70 | 1.40 | 180 | | | | | | | 3.00 |
| | | II Type BM-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 | | |
| | | | | | |  | 195–200 ¹ | 33.0–34.2 ¹ | 2.50–4.50 | 9 600–18 000 | | 9.10 ⁴ | |

| Waterway type | Waterway class | Motor vessels and barges | | | | | Pushed convoys | | | | | Minimum height under bridges H (m) |
|---------------|----------------|---|-------------------|-----------------|----------------------------|---------------|---|----------------------|----------------------------|---------------|---------------|------------------------------------|
| | | Type of vessel: general characteristics | | | | | Type of convey: general characteristics | | | | | |
| | | 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 | | | | | | | 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.

Annex V

Terminology on Benchmarking Intermodal Terminals Infrastructure Construction Costs

1. Slope: The incline angle of a roof surface, given as a ratio of the rise to the run. Should be above 2 per cent.
2. Internal Road: Roads that are completely inside the Logistic / Intermodal Platform. Should support mega trucks operations (two lines in each direction, wide enough) and mega trucks weight (about 5 Tn/sq m).
3. Plot: any measured piece or parcel of land, prepared for the installation of logistic activities. The entrance should be free of obstacles, to allow truck operations.
4. Installations: any construction needed to guarantee the supplying to the plot.
5. Telecommunication installation: a kind of telecom technology to guarantee the voice and wide band connection to any plot. Should be done by optical fibre. In addition, it should include an installation to guarantee the supply to all the designed area by connecting to an external network.
6. Energy installation: electrical installation to guarantee the energy consumption of the plot. Should be designed at least with 50 W/sq m. In addition, it should include an installation to guarantee the supply to all the designed area. It can be done by a new electrical substation or by connecting to an external network.
7. Water Installation: installation to guarantee the water consumption of the plot. In addition, it should include an installation to guarantee the supply to all the designed area. It can be done by a depot or by connecting to an external network.
8. Water treatment installation: installation to guarantee the evacuation of sewage water of the plot. In addition, it should include an installation to guarantee the treatment to all the designed area. It can be done by a own treatment plant or by connecting to an external network.
9. Green areas: free areas inside the logistic/intermodal platform dedicate to gardens. It is mandatory in most of designing regulations.
10. Traffic signalization system: all the installation needed to regulate and control the circulation of vehicles into the designed area.
11. Security system: all the installation needed to guarantee the security into the logistic/intermodal platform. It includes gate control, monitoring, and perimeter security. It should select the best technology in any case.
12. Railway connections: connections between railways and logistic platforms, airports, ports or inland waterways.
13. Renewable energy: any kind of energy generation that has zero carbon emissions: solar, wind, etc. At least a 30 per cent of the power consumption of a logistic / intermodal platform should be generated by own systems of renewable energy.
14. Acquisition costs: All costs needed to obtain the terrain needed to develop the logistic platform. Can be obtained by expropriation, buying or leasing.
15. Logistic Platform: Centre in a defined area within which all activities relating to the transport, logistics and distribution of goods, both for national and international transit, are carried out by various operators on a commercial basis.
16. Intermodal terminal: Area prepared for the interchange of goods between two different transport means, mainly trucks and train.
17. Administrative Costs: Costs incurred in contract management administration overhead expenses.

18. Project: Document that reflect the construction plan and costs of developing o modifying a logistic area.
19. Line: Each part of a road wide enough for one vehicle, often marked off by painted lines.
20. Earthmoving: The needed movement to obtain a terrain with less of 2 per cent of scope.
21. Conduits: A pipe, tube or similar prepared to be used in water circulation or by electrical or telecommunications installations.
22. Carrying capacity: The capacity of the land to support weight without deformation.
23. Pavements: The upper part of a road.
24. Electricity supply: The installation needed to guarantee the power to be used by any area of the logistic platform.
25. Dark water treatment plant: The installation needed to treat residual water to be adapted for the waste.
26. IT: Installation of telecommunications.
27. Potable water: Water prepared for human consumption.
28. Fire Prevention: Installation needed to combat or avoid the fire risk.
29. Access Control: All installation needed to check the access of people or vehicles to an area. Usually informed by control cams, barriers, plate readers, etc.
30. CCTV: System of control by images used to security. Usually is formed by fixed cams, domos, recorders and control room).
31. Tasks preceding project development: all tasks to be implemented before the start of the project for a logistic platform (costs by unit)
 - (a) Demand study (\$/Unit): Analysis of demand to determine if the logistic platform is needed.
 - (b) Modification of urban planning (\$/Unit): tasks related to modification of the local town planning to allow the development of the logistic platform.
 - (c) Environmental impact assessment (\$/Unit): Assessment needed to receive the administrative environmental approval.
 - (d) Archaeological requirements (\$/Unit): Tasks related to receiving the administrative approval related to archaeological requirements.
 - (e) Other administrative approvals (\$/Unit): Tasks related to receiving other administrative approvals.
32. Land acquisition: Expropriation, purchase or renting the land needed to develop the logistic platform:
 - (a) Land Purchase (\$/m2): Cost (by m2) of land acquisition by purchasing the land. It includes the needed document management.
 - (b) Expropriation (\$/m2): Cost (by m2) of land acquisition by expropriating the land. It includes the needed document management.
 - (c) Renting (\$/m2/year): Cost (by m2 and by year) of land acquisition by renting the land. Include the needed documents management.
33. Engineering tasks: Tasks related to preparation for construction:
 - (a) Project (\$/Unit): Elaboration of the engineering project.
 - (b) Construction Permit (\$/Unit): Cost of licences (all taxes paid to start the construction jobs).

(c) Works Management (\$/Unit): Cost of engineering works during the construction.

34. Land adaptation: Tasks needed to adapt the available land to the technical requirements of a logistic platform:

(a) Land clearing (\$/m²): Tasks required to take out the topsoil. Price by m².

(b) Earth movement (\$/m³): Soil movements needed to adapt the land to the requirements. Price by m³ of soil moved.

(c) Gravel Column (\$/m³): Technique to increase the carrying capacity of the land. This technique consists of inserting gravel columns into the underground. Price of m³ of gravel inserted.

(d) Concrete Column (\$/m³): Technique to increase the carrying capacity of the land. This technique consists of inserting into the underground concrete columns. Price of m³ of concrete inserted.

(e) Drain wick (\$/m²): Technique to increase the carrying capacity of the land. This technique consists of inserting into the underground drain geotextile. Price of m² of geotextile inserted.

(f) Preload (\$/m³): Technique to increase the carrying capacity of the land. This technique consists of inserting additional soil into the underground to produce the desired effect. Price of m³ of soil placed.

(g) Perimeter fence (\$/m): Perimeter fence used to guarantee that the logistic area is a closed area. Price of lineal meter of fence.

35. Internal roads: Internal roads in the logistic area:

(a) Asphalt Road (\$/m²): m² of asphalt road, including all the sub-layers needed.

(b) Concrete Road (\$/m²): m² of concrete road, including all the sub-layers needed.

36. Pavements: Internal pavements in the logistic area:

(a) Pedestrian pavement (\$/m²): m² of pavement adapted to pedestrian. Such pavement cannot support truck circulation. Price by m² of pavement.

(b) Plot access pavement (\$/m²): m² of pavement constructed to access the plot. This pavement should support truck circulation. Price by m² of pavement.

37. Conduits: A pipe, tube or similar prepared to be used in water circulation or for electrical or telecommunications installations:

(a) Rain water drainage conduit (\$/m): Conduits to guarantee the drainage of rain water. Price by lineal m of conduit.

(b) Dark water conduit (\$/m): Conduits for dark water. Price by lineal m of conduit.

(c) Potable water conduit (\$/m): Conduits for potable water. Price by lineal m of conduit.

(d) Low-tension line conduit (480 v) (\$/m): Conduits for low-tension electrical line. It does not include the cables. Price by lineal m of conduit.

(e) Medium-voltage line conduit (480 v - 20 kv) (\$/m): Conduits for medium-tension electrical line. It does not include the cables. Price by lineal m of conduit.

(f) High-tension line conduit (>20 kv) (\$/m): Conduits for high-tension electrical line. It does not include the cables. Price by lineal m of conduit.

(g) Telecommunication conduit (\$/m): Conduits for telecommunication lines. It does not include the cables. Price by lineal m of conduit.

(h) Telephony conduit (\$/m): Conduits for telephone lines. It does not include the cables. Price by lineal m of conduit.

(i) CCTV conduit (\$/m): Conduits for CCTV installation. It does not include the cables. Price by lineal m of conduit.

(j) Optical fibre conduit (\$/m): Conduits for Optical Fibre installation. It does not include the cables. Price by lineal m of conduit.

(k) Fire prevention conduit (\$/m): Conduits for Fire Prevention installation. It typically uses water from tanks. Price by lineal m of conduit.

38. Cables: Cables installed in the logistic area urbanization:

(a) Low-tension electrical cable (\$/m): Low-tension electrical cable installed in the logistic area. Usually a line requires more than 1 cable. Price by lineal m of cable.

(b) Medium-voltage electrical cable (\$/m): Medium-tension electrical cable installed in the logistic area. Usually a line requires more than 1 cable. Price by lineal m of cable.

(c) High-tension electrical cable (\$/m): High-tension electrical cable installed in the logistic area. Usually a line requires more than 1 cable. Price by lineal m of cable.

(d) Multimode optical fibre (\$/m): Multimode fibre optics cable installed in the logistic area. Usually each cable has more than 1 fibre (typically, 16 or 32). Price by lineal m of cable.

(e) Monomodal optical fibre (\$/m): Monomodal fibre optics cable installed in the logistic area. Usually each cable has more than 1 fibre (typically, 16 or 32). Price by lineal m of cable.

(f) Telephone cable of pairs (\$/m): Telephone cable of pairs installed in the logistic area. Usually each cable has more than 1 pair (typically, 32). Price by lineal m of cable.

39. Roads installation: Internal roads additional installation:

(a) Road Paint (\$/m²): All signalling painting on the roads. Price by m² of paint.

(b) Pedestrian cross-roads (\$/m²): Pedestrian cross-roads. Usually are elevated from roads, in order to help the accessibility and the speed control of trucks. Price by m² of pedestrian cross-road.

(c) Sign Posts (\$/unit): All the sign-posts needed in the logistic area to control the internal circulation. Price by sign posts installed.

(d) Streetlights (\$/unit): All the streetlights installed in the logistic area. Price by streetlights.

40. Potable water supply: Entire installation needed to guarantee the supply of potable water:

(a) Deposit (\$/m³): If needed, deposit of potable water to supply to the area. Price of m³ of deposit.

(b) External conduit (\$/m): Connection from the logistic area to external point of connection (given by local water company supplier). Price by lineal m of conduit.

(c) Connection valve (\$/Unit): Connection valves installed in the logistic area. Price by valve installed.

(d) Check valve (\$/Unit): Check valves installed in the logistic platform. Price by valve installed.

(e) Pumping (\$/Unit): If needed, pump system of potable water. Price by system installed.

41. Power supply: Entire installation needed to guarantee the supply of electricity:

(a) Power station transformer (\$/Unit): Power station transformer installed in the logistic area. Price by unit installed.

(b) Low-tension electrical panel (\$/Unit): Electrical panel installed in the logistic area. Price by unit installed.

(c) Power sub-station (\$/MW needed): Construction (or payment) of sub-station needed to guarantee the power supply. Prize by MW needed in the logistic area and used in the sub-station.

42. Rain drainage: Entire installation needed to guarantee the rain drainage, excluding conduits:

(a) Pumping (\$/Unit): If needed, pumping system to guarantee the rain drainage. Price by unity installed.

(b) Oil separators (\$/Unit): Installation of fat separators to avoid that engine oils enter the rainwater drainage system. Price by unity.

(c) Storm tank (\$/Unit): Storm tank is a tank that can collect rainwater to avoid flooding. Price by unity installed.

(d) Canalization of existing courses (\$/m2): Canalising existing courses in the land selected for developing the logistic platforms. Price by m2 of canalization.

43. Dark water treatment: All the installation needed to guarantee the circulation and treatment of dark water:

(a) Treatment system (\$/eq people): Installation of treatment system to adapt the dark water to the applicable regulations. Price by equivalent people served by the treatment system.

(b) Pumping (\$/Unit): If needed, a pumping system to guarantee the circulation of dark water should be installed. Price by unity installed.

44. Technical and social facilities complex:

(a) Hotels and Restaurants and other Social facilities (\$/Unit): including hotels, restaurants, resting area, training centre, hairdresser, sewer etc.

(b) Technical support and trade area (\$/m2): including facilities to provide technical support, incl. changing of the wheels/ tires, wires, mechanics, painting, maintenance, etc.

(c) Administration and commercial offices (\$/Unit): Customs, standards and permission issues; freight forwarding, transportation offices; insurance, banks and other commercial offices etc.

(d) Other facilities (\$/m2): support services for the companies at the logistic platform.

45. Garbage treatment plant:

Garbage Treatment Plant (\$/m3): solid and liquid waste management facility

46. Telecom supply: Entire installation needed to guarantee telecom services:

(a) Outdoor telephone panel (\$/Unit): Outdoor telephone panel installed (where any customer is connected to the telecom company). Price by unit installed.

(b) Monomodal optical fibre interconnection panel (\$/Unit): Interconnection panel for monomodal optical fibre. Price by unit installed.

(c) Optical fibre repeater (\$/Unit): Signal repeater of monomodal optical fibre. Price by unit installed.

(d) Multimodal optical fibre interconnection panel (\$/Unit): Interconnection panel for multimodal optical fibre. Price by unit installed.

(e) Multimodal optical fibre interconnection panel (\$/Unit): Signal repeater for multimodal optical fibre. Price by unit installed.

47. Fire prevention: The entire range of installations required by fire protection systems

(a) Fire tank (\$/m3): Water tank used to supply water to fire protection systems. Price by m3 of tank.

(b) Check valve (\$/Unit): Valves installed to prevent contamination and flooding from water sources used in fire protection systems. network. Price by valve installed.

(c) Fire prevention pumping (\$/Unit): Pump system to guarantee the pressure of water in the fire protection system. Price by pump system installed.

(d) Fire truck (\$/Unit): response time shall be less than 5 minutes.

48. Green areas: All tasks required for design and maintenance of the internal green areas:

(a) Transplantation (\$/Unit): Any transplantation that may be required from the original land into the logistic area. Price by transplant done.

(b) Topsoil movement (\$/m3): Topsoil moved to the green areas. Price by m3 of topsoil moved.

(c) Gardening (\$/m2): Gardening tasks required to finalize the green areas. Price by m2 of green area adapted.

(d) Irrigation network (\$/m): Network of pipes needed to guarantee the irrigation in the green areas. Price by lineal meter of pipe installed.

(e) Irrigation tank (\$/m3): Tanks designed to collect rainwater and other kinds of water for irrigation purposes. Price by m2 of tank installed.

(f) Irrigation pumping (\$/Unit): Pump system to guarantee the pressure needed in the irrigation water network.

49. CCTV: Close Control TV system:

(a) Fixed digital cams (\$/Unit): Fixed digital cameras installed in the logistic area. Price by unit.

(b) Domo cam (\$/Unit): Standalone camera which captures 360-degree panoramic videos and images installed in the logistic area. Price by unit.

(c) Digital recorders (\$/Unit): Digital recorders with more than 14 days of autonomy. Price by digital recorder installed.

(d) Control room (\$/Unit): Control room equipped with monitors, and other technical equipment, tables, chairs, etc. Price by control room installed.

50. Access control: Access Control system:

(a) Access control barrier (\$/Unit): Automated barrier for the access control system. Price by Access control barrier installed.

(b) Plate recognition (\$/Unit): Plate reader system in order to control the access of vehicles in the logistic area. Price by plate reader installed.

(c) Logical access control (\$/Unit): Tools and protocols used for identification, authentication, authorization, and accountability in computer information systems Price by system installed.

51. Intermodal terminal: An intermodal terminal is a big area, usually constructed in reinforced concrete to allow the interchange between trucks and train. (construction requirements may include: see items 34, a-g)

52. Truck park: A truck park is a big area, usually done in reinforce concrete to allow the trucks to park (construction requirements may include: see items 34, a-g)

53. Container freight station (CFS): Area prepared for handling of incoming/outgoing the containers (consolidation and deconsolidation of cargo):

(a) General CFS area (\$/m3): Goods are prepared for another transport mode or destination.

(b) CFS area for Dangerous Goods (\$/m³): special segregation, separation and handling in accordance with a specific stowage plan.

54. Warehouse: a building for the storage of goods:

(a) General cargo Goods (\$/m²): Long, middle and short-term storage area.

(b) Heat Controlled Goods (\$/m²): Long, middle and short-term storage area for special products requiring temperature-controlled storage.

(c) Separated Goods (\$/m²): Long, middle and short-term storage area for products requiring specific treatment.

(d) Dangerous Goods (\$/m²): Long, middle and short-term storage area for dangerous goods in accordance with ADN or other relevant agreements.

(e) Goods in Pressurized Equipment (\$/m²): Long, middle and short-term products requiring pressurized storage.

(f) Explosive Goods (\$/m²): Long, middle and short-term for explosives.

(g) Cold Chain storage(\$/m²): Long, middle and short-term storage area for products requiring a temperature-controlled environment.

(h) Handling area (\$/m²): area designed for loading and unloading of cargo.

(i) Loading and Unloading area (\$/m²): the services of loading or unloading cargo between any place or point of rest on a wharf or terminal, and railcars, trucks, or any other means of land transportation and barges.
