

Pursuant to Article 12, paragraph 1, item 1 and Article 24, paragraph 8 of the Electronic Communications Act (Official Gazette No. 73/08), the Council of the Croatian Post and Electronic Communications Agency adopted the following:

ORDINANCE ON TECHNICAL REQUIREMENTS FOR CABLE DUCTS

I. GENERAL PROVISIONS

Contents and scope

Article 1

- (1) This Ordinance prescribes technical requirements that have to be met when developing, planning, designing, building and maintaining cable ducts.
- (2) Cable ducts are a part of the electronic communications infrastructure and their development, building and maintenance are of interest for the Republic of Croatia.
- (3) The provisions of this Ordinance shall apply to the building of new cable ducts, as well as to the reconstruction or upgrading of the existing cable ducts.

Terms and meanings

Article 2

Individual terms in this Ordinance shall have the following meanings:

1. *small diameter pipe*: a pipe made out of high-density polyethylene with 20 to 40mm outside diameter and an internal wall which ensures a very low coefficient of friction;
2. *50mm diameter pipe*: a pipe made out of high-density polyethylene with 50mm outside diameter and an internal wall which ensures a very low coefficient of friction;
3. *large diameter pipe*: a pipe made out of polyvinyl chloride, polyethylene or concrete with 63 to 110 mm outside diameter,
4. *cable gallery*: an underground room shaped like a hallway which is used for housing a large number of cables;
5. *cable ducts*: a part of the electronic communications infrastructure consisting of a network of underground cables made out of appropriate material, manholes and cable galleries, the purpose of which is to install and protect electronic communications cables;
6. *manholes*: multipurpose underground chambers which are placed at locations where cable ducts continue, cross or change directions and in front of access nodes and other facilities housing equipment of electronic communications network;

7. *cable ducts corridor*: a piece of land of a certain width reserved for the building of cable ducts;
8. *microduct*: a cable with outside diameter of 3 mm to 16 mm, with an inside wall ensuring low friction coefficient;
9. *cable duct routing*: designed or already existing routing and a geodetic line of cable ducts within the corridor of the electronic communications infrastructure.

Competence of the Croatian Post and Electronic Communications Agency

Article 3

- (1) The Croatian Post and Electronic Communications Agency (hereinafter. HAKOM) shall promote competition in the provision of electronic communications infrastructure and associated facilities by ensuring to users of services the greatest benefits in terms of choice, prices and quality of services, and encouraging innovation and efficient investments into electronic communications infrastructure and associated facilities.
- (2) As part of the achievement of regulatory principles and objectives from the Electronic Communications Act (hereinafter: the Act); HAKOM shall encourage sharing of electronic communications infrastructure and associated facilities, in particular for the purpose of protecting human health, preserving the environment, protecting space, protecting and preserving cultural goods, sustainable development and national security.
- (3) The objectives referred to in paragraphs 1 and 2 of this Article must serve as criteria when selecting the technology and when planning capacity for the building of cable ducts.

II. DEVELOPMENT AND PLANNING OF CABLE DUCTS

Development of cable ducts

Article 4

- (1) The development of cable ducts shall be based on the concept of development of the electronic communications network and technological development of cables that will use cable ducts, as well as on the technological development of other components of the electronic communications network.
- (2) The development, planning and building of cable ducts must be in compliance with the European standard EN 50174-3:2005, and with the valid Croatian regulations on building and physical planning.
- (3) Underground installation of electronic communications networks shall be allowed only outside urban areas, that is, in areas with low population density.

In all other cases, cables shall be installed by pulling into pipes, that is, by building cable ducts.

- (4) The building of cable ducts in urban areas shall, as a rule, be planned regardless of the number of planned cables of the electronic communications network.
- (5) When preparing physical plans, it shall be necessary to take into account the need to build cable ducts and plan the necessary corridors accordingly.
- (6) Cable duct corridors shall be planned in public roads, wherever possible.

Planning the capacity of cable ducts

Article 5

- (1) The coverage and capacity of cable ducts shall be planned by the investor, who can be any infrastructure operator, in accordance with the valid physical plans.
- (2) The basis for planning the capacity of cable ducts in a certain area shall be a physical planning document of this area. The area where cable ducts are planned and the physical planning document do not need to overlap. The planning of cable ducts shall be carried out for a certain logical whole which may be only a part of an area covered by a physical planning document or by several physical plans.
- (3) Regional physical plans and physical plans for towns and municipalities shall contain the planning of ducts in such a manner that corridors are determined for future building of cable ducts. Urban plans and detailed design plans, as well as implementation plans as part of the planning of electronic communications infrastructure along the corridors, shall define the capacity of cable ducts as well.
- (4) The planning of capacity cable ducts shall be carried out in accordance with planned capacities of electronic communications networks. The planned capacity of access electronic communications networks in a certain area must satisfy needs of all constructed and planned facilities in the area in question for a period of a minimum of 5 years. In addition to capacity of access electronic communications networks, the planned capacity of cable ducts must also satisfy the needs for pulling connector cables.
- (5) The data referred to in paragraph 3 of this Article which are not available shall be based on an educated guess or on comparison with similar areas in which planned capacity is known.
- (6) If the building of cable ducts is planned by an infrastructure operator who is at the same time the fixed electronic communications network operator, and the urban plan does not define the capacity of cable ducts, the planned ducts

must have 30% more capacity than needed by that electronic communications network operator.

- (7) The planning of the type of pipes, their dimensions and the number thereof, as well as of the type and dimensions of manholes, shall be based on the assumption that fibre cables will be used as a standard solution.
- (8) The planning of cable ducts for the pulling of copper cables with capacity up to 300 pairs, shall be allowed only in the access segment of the electronic communications network in the final part up to the user or where technically justified (e.g. the need to pull intermediary cables for collocations).
- (9) As a rule, only one cable ducts system shall be planned and built in a certain area for connector and access cables, that is, for all planned cables regardless of their purpose.
- (10) The planning of cable ducts capacity shall take into account needs for a minimum of 5 years.
- (11) The planning of capacity of cable ducts must take into account the necessary reserve needed for efficient maintenance of all electronic communications networks using the ducts and the appropriate level of reliability and availability of the access network. The necessary maintenance reserve (service space) is space that needs to remain free and which is sufficient for pulling the largest diameter cable used at a certain part of cable ducts.
- (12) Following the definition of technology and capacity of cable ducts, the planning process should define the planned route. The planning of the route shall require the gathering of information about planned construction or reconstruction of roads from the government body responsible for physical planning, as well as about all other planned infrastructure works in the area in question.
- (13) The planned route of cable ducts shall necessitate the gathering of information about plans of other utilities companies so that the location and dynamics of building could be coordinated. If technically feasible, the building of joint integrated infrastructure should be encouraged, wherever possible, already in the planning stage. Competent bodies for collecting these data are, as a rule, units of local government and self-government. Planners of cable ducts may gather the above-mentioned data themselves and ask for harmonisation and coordination of joint activities from the local government and self-government.
- (14) The definition of the location of manholes, the determination of distance between manholes and the selection of typical profiles of used cable duct pipes shall take into account characteristics and features of fibre cables and optical fibres such as small dimensions, demanding and more complex ends and wearing at joints.

III. SELECTION OF MATERIALS FOR THE BUILDING OF CABLE DUCTS

Cable duct manholes

Article 6

- (1) Manholes make possible the making of cable ends, and, where necessary pipe ends, the housing of spare cable lengths and the change of pulling direction for cables or pipes.
- (2) The following types of manholes shall be used in the process of building of cable ducts:
 - a) Concrete monolithic manholes
 - b) Precast concrete manholes
 - c) Plastic monolithic manholes
 - d) Precast plastic manholes
- (3) Concrete monolithic manholes shall be built on a location envisaged by the project. These manholes shall be planned only in exceptional circumstances when manholes of special dimensions are necessary or the envisaged manhole location is inaccessible which makes it difficult or impossible to deliver and install a precast manhole.
- (4) Precast concrete manholes shall be installed at a planned location from prefabricated elements. The selection of dimensions of a manhole depends on the number of pipes ending in the manhole, the number and type of cables planned to be laid through the manhole, and number and dimensions of connectors which are planned to be placed in such manholes. If data on planned cables and connectors are unknown, the dimensions of the manhole shall be planned according to the number of pipes in cable ducts, that is, on the basis of an educated guess about the number of cables that will be installed through planned pipes. Precast concrete manholes of the following dimensions should be used as a rule:
 - a) Width – 60-110cm
 - b) Height (depth) – 80 -100cm
 - c) Length –60-170cm
- (5) Plastic manholes have the same function as concrete manholes. They may be used in all cases, particularly when a manhole of special dimensions is required or when the envisaged manhole is located at an inaccessible location where it is difficult to deliver and install a concrete manhole.
- (6) The selection of the type of a manhole shall be left by this Ordinance to the investor, provided that its technical purpose has been met.
- (7) Cable duct manholes and their covers must be able to sustain the following weight as an integral whole:
 - a) 125kN in a sidewalk or on a free field

- b) 400kN in on roads and other surfaces envisaged for vehicle traffic.

Pipes of cable ducts

Article 7

- (1) The pipes of cable ducts make the basic construction element of cable ducts, and this Ordinance envisages the use of the following types of pipes:
- a) Microducts
 - b) Small diameter pipes
 - c) 50mm diameter pipes
 - d) Large diameter pipes

Use of microducts

- (1) Microducts shall be used for direct installation under the ground or for pulling into already installed small diameter pipes. Walls of microducts must be 0.45 - 2mm thick. If microducts are individually placed directly under the ground, the walls must be 1.5 -2mm thick. It is suggested placing under the ground such groups of microducts which are protected by additional protective coatings during manufacture, which keeps them together and provides additional firmness and protection at the same time. This type of mechanical protection needs to be nonconductive. In that case, walls of microducts may be less than 1.5mm thick. The above-mentioned combination of microducts is called microduct structure. Dimensions for two characteristic types of microduct structures are given in Table 1.

Table 1

Number of pipes	Outside diameter, microducts 5/3.5 (mm)	Outside diameter, microducts 10/8 (mm)
2	13.5x8.5	13.7x23x7
4	15.7	27.9
7	18.6	33.8
12	23.9	-
19	28.6	-
24	33.6	-

In addition to microduct structures proposed in Table 1, other microduct structures may also be used where necessary.

- (2) A microduct structure may be in the shape of a tape or “cable structure”. It is recommended that the space between microducts in case of “cable” infrastructure be filled by suitable filling compound that prevents longitudinal and vertical diffusion of moisture into the core of such a structure.
- (3) In case of microducts that are pulled into already installed small diameter pipes, dimensions of standardized microducts, the nominal value of outside and inside diameter, the minimum outside and inside diameter and minimum thickness of walls are prescribed in Table 2:

Table 2

Outside/inside diameter (mm)	Outside diameter (mm)	Minimum inside diameter (mm)	Minimum wall thickness (mm)
3/2.1	3 _{+0,1/-0,05}	2.0	0.45
5/3.5	5 _{+0,1/-0,05}	3.4	0.75
7/4	7 _{+0,1/-0,05}	3.9	1.5
7/5.5	7 _{+0,1/-0,05}	5.4	0.75
8/6	8 _{+0,1/-0,05}	5.9	1.0
10/6	10 _{+0,1/-0,05}	5.9	2.0
10/8	10 _{+0,1/-0,05}	7.9	1.0
12/8	12 _{+0,1/-0,05}	7.9	1.0
12/10	12 _{+0,1/-0,05}	9.9	1.0
14/12	14 _{+0,1/-0,05}	11.9	1.0
14/10	14 _{+0,1/-0,05}	9.9	2.0
16/12	16 _{+0,1/-0,05}	11.9	2.0

The microducts from Table 2 have walls of different thickness depending on the manner of use. Microducts with thicker walls (1.5 -2.0mm) may be individually pulled into pipes of cable ducts and laid directly under the ground after they exit cable ducts. Microducts with thinner walls must always be in small diameter pipes or protected (in manholes) by some other type of protection (high-density polyethylene coverings).

- (4) Microducts 7/5,5, 10/8 and 12/13 need to be used in case of multiple use of space in small diameter pipes, while microducts 12/8, 14/10 and 16/12 need to be used in combination with pipes PE20 and PE25 for more efficient use of space in large diameter pipes.
- (5) In special cases (routes with a large number of sharp turns), flexible microducts may be used. As a rule, flexible pipes are used only on the last segment (few hundreds of meters) to the user. Outside diameter of these pipes is 4 to 10mm, and interior diameter is 2.5 to 6.4mm.

Use of small diameter pipes

Article 9

- (1) During building of cable ducts, small diameter pipes are envisaged for direct laying in the ground or for pulling into large diameter pipes. If small diameter pipes are placed directly into the ground, pipes with outside diameter of 32 and 40 mm are used with working pressure of at least 1000kPas (10 bars).
- (2) If small diameter pipes are envisaged for pulling into large diameter pipes, standard high-density polyethylene pipes with small diameter should be used, with working pressure of at least 1000kPas (10 bars), of types PE20, PE25, PE25 AND PE40, the dimensions of which are laid down in Table 3:

Outside diameter D (mm)	Standard deviation (mm)	▲ D	Wall thickness ▲ s (mm)	Standard deviation ▲ s (mm)
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20	+0.3	2.0	+/-0.4
25	+0.3	2.0	+/-0.4
32	+0.3	2.0	+/-0.4
40	+0.4	2.4	+/-0.5

Use of 50mm pipes

Article 10

- (1) 50mm pipes are laid directly into the ground during building of cable ducts, and microducts, and, in exceptional circumstances, copper cables, are pulled into them when cable ducts are being used.
- (2) In special circumstances, the pulling of high capacity optical cable may be planned (capacity exceeding 96 optical fibres) directly into a 50mm pipe if the pulling of other cables on the same route is not planned or in case of the existing cable ducts with sufficient free space because of which pulling of micropipes is not required.

Use of large diameter pipes

Article 11

- (1) Large diameter pipes are pipes with 64 to 110mm outside diameter, which may be made out of polyvinyl chloride or polyethylene. Large diameter pipes shall be laid into the ground at the moment of building cable ducts, and when cable ducts are used, small diameter pipes, micropipes, high capacity optical cables (number of fibres ≥ 288) are pulled into them, as well as copper cables in exceptional circumstances.
- (2) Large diameter pipes made out of other materials, such as concrete and various metals, may be used only in exceptional circumstances in order to overcome certain obstacles on the route or if they have been built in as such into prefabricated elements when bridges, tunnels, viaducts and similar road facilities were built.

TECHNICAL REQUIREMENTS FOR BUILDING CABLE DUCTS

Building of cable ducts

Article 12

- (1) The majority of costs for building electronic communications networks are incurred by construction works which include trenching for installing electronic communications cables into the ground or building a system of cable ducts, or covering and repairs of damaged surfaces. The aim is to reduce these costs by applying smaller dimensions of trenches for placing cable ducts. On the other hand, the planning and building of cable ducts must technologically satisfy the minimum requirements for safety of electronic communications infrastructure and networks using that

infrastructure. For that reason, the following minimum requirements have to be taken into account when building cable ducts:

- a) in urban areas (public surfaces intended for pedestrian traffic: sidewalks), the minimum trench depth is 60 cm or more – depending on cross cut of cable ducts – so that there is 50cm of sub-layer between the pipe and the surface
- b) for cables and system of cable ducts on private property and along unconstructed areas the minimum depth is 80cm or more – depending on the cross cut of cable ducts – so that there is 70cm of sub-layer between the pipe and the surface. In A category of land, the sub-layer may be reduced to 50cm. Any reduction of sub-layer below 70 cm must be explained in the design, and, where necessary, it must envisage safety measures necessary as a result of the reduction of the sub-layer.
- c) For roads, crossroads and other surfaces intended for vehicle traffic, the minimum trench depth is 80 cm or more – depending on the cross-cut of cable ducts – so that there is 70cm of sub-layer between the pipe and the surface, that is, in accordance with special requirements of managers of public or unclassified roads or road construction project
- d) For trenches up to the houses (on private property), the minimum depth of a trench is 40 cm or more depending on the cross-cut of cable ducts – so that there is 35 cm of sub-layer between the pipe and the surface
- e) In gravel- surfaced areas (land categories A and B), sand must be placed 5 cm below and 5 cm above the pipes
- f) The sand bed will increase the depth of the trench by +5cm so that minimum coverage (50/70/35 cm) is achieved
- g) for 60cm deep trenches, the minimum width is 30cm and for trenches deeper than 60 cm the minimum width is 40 cm. For trenches built by a chain dredge the minimum width is 15 cm
- h) if the minimum sub-layer may not be achieved, pipes are protected by 10cm of concrete.

(2) The minimum requirements laid down in paragraph 1 of this Article do not have to be met in case of micro-trenching. In that case, microducts have to be installed in accordance with ITU Recommendation ITU-T L.49. Since routes cannot be held during reconstruction of roads in which microducts have been laid, the microtrenching technique should be chosen only for connecting users to the existing network, in case of temporary capacity or in case of reserve routes which may be temporarily suspended if necessary.

(3) The selection of a combination pipes to be used for building a certain route of cable ducts should be based on the most cost-effective solution that will satisfy the planned needs. The selection of the combination of pipes should rely on the following guidelines:

- a) Large diameter pipes are planned for purposes of installing large dimension cables which cannot be pulled into small diameter pipes. Large diameter pipes are also planned in cases of reconstruction, shifting and upgrading of the existing ducts, if this is a more economical solution than installing other types of pipes. Large diameter pipes may also be planned at road crossings, crossings under railways and

waterways, and for laying on bridges, tunnels, viaducts and similar facilities.

- b) Small diameter and 50mm diameter pipes are a standard solution for building cable ducts. When determining the necessary number of small pipes, it has to be borne in mind that one copper cable is pulled into every pipe or a number of microducts, depending on the dimensions of installed small diameter pipes.
- c) When building cable ducts, microducts are installed as a microduct structure in a trench next to small diameter pipes, or instead of them, as a standard solution for building of cable ducts. If it is planned that microducts will be pulled into small diameter pipes, then they are not pulled at the moment of building of cable ducts, but later during its use.

(4) The minimum capacity of cable ducts is:

- a) Four pipes in a residential area on main routes of cable ducts, if only access cables are planned for the route in question
- b) Two pipes in a residential area on separated or branching cable ducts, if only access cables are planned for the route in question
- c) Six pipes within business and residential business areas if only access cables are planned for the route in question
- d) If the laying of connector cables is planned for the route in question, the number of pipes referred to in items a,b and c of this paragraph needs to be increased by two
- e) Two pipes along local or county roads
- f) Four pipes along national and main roads and along motorways

The above-mentioned pipes shall be, as a rule polyethylene pipes with 50mm diameter or a corresponding microduct structure. In the case referred to in item b), small diameter pipes (32 and 40mm) may be laid instead of 50mm diameter pipes, provided that they satisfy the need.

- (5) The selection of the type and dimensions of a manhole that will be used for the building of a certain route of cable ducts will be based on the most economical solution, that is, the smallest manhole that will satisfy the need for space will be installed.
- (6) The selection of a type of s manhole (dimensions) should be based on the necessary space for the housing of cables, the housing of spare lengths of cables and all planned joints on cables. In addition to the planned joints, account should be taken of future needs for a certain percentage of non-planned joints, due to unplanned needs and faults on cables. On trenches where only connector cables are planned, space for 30% additional unplanned joints should be envisaged, and on routes of cable ducts in the access part up to 50% of additional unplanned joints. The number of planned joints shall be increased for the above-mentioned percentage.
- (7) Manholes do not need to be planned at places where microducts are branching and separating in case of a microduct structure which is installed directly into a trench. The separation and branching of pipes may be conducted on the appropriate joint which does not have to be located in the manhole.

- (8) The distance between manholes of cable ducts in residential areas shall, as a rule, not exceed 250m.
- (9) All built cable ducts should be subject to the testing by calibration and appropriate protocol about testing should be prepared and annexed in case of technical inspection.
- (10) All ends of free (unused) pipes must be closed by appropriate closures in order to prevent the penetration of sludge and mud into pipes.

Building of cable ducts within integrated infrastructure

Article 13

- (1) Since building of cable ducts is expensive due to the need for digging and repairing of surfaces, the joint building of different infrastructure facilities is encouraged, that is, the building of integrated infrastructure. Besides being economical, this way of construction preserves the environment, space and contributes to the protection of cultural goods.
- (2) When new residential and business zones are built, when building new or reconstructing old roads, and when interventions at different infrastructures are planned at the same time and in the same place, integrated infrastructure should be encouraged.
- (3) In case of reconstruction or complete replacement of certain infrastructural facilities, such as gas pipes, water supply system and drains, it is recommended that, instead of being dismantled, they are used for the building of cable ducts by installing small diameter pipes, microducts and microduct structures into abandoned installations.
- (4) The building of integrated infrastructure should be recommended in urban plans and in conditions defined for the issuing of location permits.

IV. MARKING OF CABLE DUCTS AND KEEPING RECORDS OF BUILT CABLE DUCTS

Marking of manholes and pipes in cable ducts

Article 14

- (1) Manholes of cable ducts and large diameter pipes on the field must be marked.
- (2) Small diameter pipes which are laid directly into the ground shall not have to be marked if separators or other equipment preventing them from shifting their position is used during installation. In case of danger that small diameter pipes

could be interwoven, they must be marked in every manhole of cable ducts. In such cases microducts in different colours might be used instead of small diameter pipes.

- (3) Small diameter pipes pulled into large diameter pipes must be marked in every manhole of cable ducts. Small diameter pipes in different colours or with a different number of longitudinal lines made during manufacture may be used instead of markings, if deemed by the investor to be cost-effective
- (4) Markings referred to in paragraphs 2 and 3 of this Article must be permanent and protected against accidental removal.
- (5) When a larger number of microducts are laid down, they are laid down in groups. Each microduct within the same group must be of different colour so that they would differ between each other. It is not necessary to additionally mark each individual microduct..

Keeping records about built cable ducts

Article 15

- (1) Technical documentation shall be prepared for built cable ducts. The documentation must be prepared in electronic form.
- (2) Geodetic images from the study for the cadastre of lines shall be used as a basis for the preparation of technical documentation for cable ducts. Geodetic images of cable ducts and the preparation of a cadastre study shall be carried out in accordance with valid regulations on geodetic surveys and real estate cadastre.
- (3) The purpose of creating an image of cable ducts is to present the route of cable ducts, to document the type and number of manholes, the length and type of pipes between two manholes or between a manhole and a certain facility, and monitoring the available space in cable ducts.
- (4) The following information must be contained in the presentation of cable ducts:
 - a) Location of manholes
 - b) Cable duct route, number and type of pipes and their dimensions (paths of route between manholes)
 - c) Profiles and available space of manholes (manhole frames – data on spatial distribution of pipes must be added to every manhole).

VI. MAINTENANCE OF CABLE DUCTS

Article 16

- (1) The owner or manager of cable ducts must have a maintenance plan for cable ducts. The maintenance plan should envisage at least:
 - a) Preventive maintenance, and

b) Corrective maintenance.

(2) Preventive maintenance shall include a group of activities, which are carried out periodically and aimed at timely discovering and correcting irregularities that might lead to problems in use of cable ducts and safety of use and integrity of electronic communications networks that are using them.

(3) Preventive maintenance of cable ducts shall include tours, checks, controls and repairs on cable ducts to ensure its safe use. Activities that must be planned for cable ducts as part of preventive maintenance include the following:

- a) Controlling for presence of harmful and explosive gases
- b) Airing the manhole
- c) Cleaning the manhole and rat control
- d) Removing (pumping-out) water
- e) Keeping records of unauthorised entry into manholes resulting in use of pipes
- f) Checking the levelling of the manhole in relation to the surroundings

The owner or manager of cable ducts must keep up to date documentation about the above-mentioned activities (date, list of carried out activities and signature of a responsible person).

(4) Preventive maintenance shall be carried out at least once a year, and for parts of cable ducts which are shared by several operators, preventive maintenance in intervals shorter than one year may be defined. If the owner or manager of cable ducts deems it necessary or in case of danger that cable ducts might be damaged or electronic communications traffic could be interrupted, individual preventive activities shall be carried out even before it was envisaged.

(5) Corrective maintenance shall mean that the maintenance plan defines the procedure and measures in case of damage to cable ducts and ensures the repairs to be done as soon as possible. If safety of electronic communications networks in cable ducts is at risk, the plan may envisage temporary measures to preserve the safety of electronic communications networks.

VII. FINAL PROVISIONS

Article 17

(1) This Ordinance shall enter into force within 8 days from its publication in the Official Gazette.

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Zagreb, 29 September 2010

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