

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

Odesa State Academy of Civil Engineering and Architecture

Department Metal, wooden and plastic structures

GUIDELINES

for the educational component

Qualification Work

to the qualification work

for students second (Master's) educational level

Specialty

G19 Building and civil engineering

Educational program

Industrial and civil engineering

RECOMMENDED

by the Scientific and Methodical
commission of the Institute of Civil
Engineering

(Protocol No. 10 of June 3, 2025)

Guidelines for the educational component Qualification work to the qualification work for students second (Master's) educational level by Specialty G19 Construction and Civil Engineering of the Educational program Industrial and Civil Construction / Hilodo O.Yu, Singayevsky P.M., Kupchenko Yu.V., Arsiriy A.M. Odesa state academy of Civil Engineering and Architecture. Odesa: Editorial and Publishing Department 2025. 40 p.

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These methodological guidelines provide essential recommendations for developing a qualification thesis to obtain the Master's degree. These methodological guidelines are intended for Master's level students majoring in G19 Construction and Civil Engineering.

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FOREWORD

A Master's degree is an educational qualification obtained at the second level of higher education, awarded by a higher education institution upon the successful completion of the relevant educational program and the defense of a qualification thesis (MQT) for the Master's degree.

The MQT represents the final stage of study at the second cycle of higher education, contributing to the systematization, consolidation, and expansion of theoretical and practical knowledge within the specialization. It promotes the application of this knowledge to solve specific technical, scientific, economic, and production challenges, and fosters the development of independent work skills.

The form and content of the MQT conform to the «Regulations on the Certification Graduation Work for Obtaining the Master's Degree».

When developing the MQT, the student must utilize current regulatory documents, textbooks, teaching aids, and technical, reference, and scientific literature.

The solutions to the problems presented in the MQT must reflect the latest advancements in construction technology and the current state of architectural and civil engineering science.

The student is responsible for the decisions made in the MQT and for the quality, originality, and timely completion of the work. The MQT is an independent work of the student, and based on its quality and the knowledge demonstrated during its defense, the State Examination Commission decides whether to award the student the "Master" degree.

The appendices to these methodological guidelines provide the rules for formatting drawings and the explanatory note of the MQT.

1. GENERAL INFORMATION

The MQT topics are developed by the Department of Metal, Wooden, and Plastic Structures and communicated to students before the start of their professional internship. After selecting a topic, the student submits an application to the Head of the Department requesting its approval. Specifically, a student may propose an MQT topic related to scientific research or practical design, according to their preference; international students may propose a topic relevant to the conditions of their home country.

The Head of the Department assigns a primary supervisor to each student. Based on information from the Departments, the Dean's office officially assigns each student an MQT topic and a primary supervisor.

When addressing a complex problem, the MQT may be completed by a team of no more than three students (a complex MQT with a unified topic but distinct scientific components), each of whom addresses a specific aspect within the context of the overall problem.

2. REQUIREMENTS FOR THE CONTENTS AND SCOPE OF THE WORK

2.1. Master's Qualification Thesis in the Educational and Scientific Field

The Master's Qualification Thesis for the Award of the Master's Degree comprises a textual component (explanatory note) and a graphical component (posters, drawings, or slides). The recommended length of the explanatory note is 80–120 pages (excluding appendices), and the graphical component should consist of 10–12 A1-sized drawings or posters (larger formats are permissible) or 16–20 presentation slides.

The graphical component of the MQT may be presented with drawings, diagrams, schemes, and the like.

Structural elements of the thesis's explanatory note:

–title page;

- tasks;
- contents;
- main body (sections of the thesis);
- list of references;
- Appendices (if applicable).

Each of these elements, as well as the sections of the main body and the Appendices, must begin on a new page.

Requirements for structural elements.

The title page and Tasks are formatted according to the approved form (see Appendix 1).

The Contents must include the names of all structural elements, headings, and subheadings (if applicable), indicating their numbering and starting page numbers.

The main body of the ARM explanatory note must contain:

- Introduction;
- Sections of the Master's thesis;
- Conclusions.

The Introduction provides a general overview of the work, justifies the selection of the topic, its relevance to current research in the field, the purpose, and the research objectives.

The sections of the MQT must address the tasks assigned by the supervisor.

A consultant is assigned to each section, except for those areas where the supervisor provides consultation.

When using published scientific results, ideas, publications, or materials from other authors within the MQT text, references to those publications must be included. Fragments of published texts by other authors (quotations) may be used in the work, but must include a reference to the source (except for fragments that do not carry independent semantic weight).

Sections of the MQT may be divided into subsections, items, and sub-items. Sections, subsections, items, and sub-items are numbered using Arabic numerals.

Subsections should be numbered sequentially within each section. A subsection number consists of the section number and the subsection's sequential number, separated by a period. A period is not placed after the subsection number (e.g., 1.1, 1.2, etc.). Items should be numbered sequentially within each section or subsection.

The conclusions present the most significant scientific and practical results of the work. If the obtained results have practical significance, information is provided regarding the application of the research findings or recommendations for their utilization. If the research results have been implemented, the information presented includes the item number (comprising the section number and item sequence number, or the section number, subsection sequence number, and item sequence number, separated by periods) and the names of the organizations where the implementation occurred. In this case, the Appendices may include copies of relevant documents.

The author of the work compiles the list of references in one of the following ways:

- in the order references appear in the text;
- in alphabetical order by the last names of the first authors or titles;
- in chronological order.

Each source used must have a reference within the text of the work.

The bibliographic description of the list of references in the MQT is prepared in accordance with the National Standard of Ukraine DSTU 8302:2015, «Information and documentation. References. General statements and rules of composition».

The Appendices may contain supplementary material necessary for a complete understanding of the work:

- A4-sized printed slides (provided the Graphical part is presented as an electronic presentation);
- Intermediate formulas and calculations;
- Tables of auxiliary numerical data;
- Protocols and reports of testing, implementation, calculations of economic impact, and letters of support for the results of the work;

- instructions and methodologies, descriptions of algorithms that are not the primary results of the work, and descriptions and program codes for solving problems using computer tools developed during the execution of the Master's thesis;

- illustrations of an auxiliary nature;

- other data and materials.

The MQT is a scientific study of a theoretical or applied nature, aimed at generating and applying new knowledge. The logical completeness of the MQT implies the integrity and internal unity of the work, and the interrelationship of its Aims, tasks, methodology, structure, completeness, and research results. The independence of the MQT implies its originality and the fundamental novelty of the materials and results presented, or a conceptually new generalization of previously known materials and concepts.

The «Introduction» includes:

- a concise justification for the topic selection, the relevance of the research problem, the object and subject of the research, the defined aim and tasks, and the research methods employed in the project. Furthermore, the theoretical basis of the research must be clearly defined, that is, a list of all the most significant authors who have conducted scientific or applied scientific research on the given problem must be provided. the Master's student's relationship to their research positions is formulated and justified;

- Relevance (Significance, Importance, Priority among other topics). Selecting a Master's thesis topic and justifying its relevance is one of the most important tasks in completing the Master's thesis;

- the extent to which the problem has been developed. This section should demonstrate the insufficient development of the chosen research topic in current scientific literature, highlighting the need to study the problem within new and contemporary contexts;

- Aim of the research. The aim of the research is to predict the anticipated outcome and to determine the optimal approaches for solving problems. This involves selecting appropriate research methods and techniques during the graduate student's

preparation of the Master's thesis and developing an experimental methodology for implementation in the Departments' educational process.

- Research objectives. The research objectives of the master's thesis are determined by the stated aim and represent specific, sequential stages (paths) for solving the research problem and achieving the primary aim.

- Research methods. A research method is a means of obtaining reliable scientific knowledge, skills, practical abilities, and data across various spheres of activity. For example, the following methods can be used in the research: studying and analyzing scientific literature; studying and generalizing domestic and international practice; full-scale experiment, modelling, comparison, analysis, synthesis, etc.;

- Scientific novelty. Scientific novelty is a new scientific result or a novel solution to a posed problem, expected upon completion of the research. Novelty can be expressed in a new object or subject of research (considered for the first time), the introduction of new material into scientific circulation, a different formulation of known problems and tasks, a new method of solution, a novel application of a known solution or method, new experimental results, the development of original models, etc.

- Practical Significance. Practical Significance lies in the potential application of the research results in practical activities, irrespective of whether the qualification work is theoretical or practical.

The presentation of material in the Master's thesis must be consistent and logical. All chapters must be interconnected. Particular attention should be paid to the logical transitions between chapters.

The main body of the Master's thesis.

The main body of the Master's Thesis comprises several logically complete sections (chapters), which may be subdivided into paragraphs and items. Each chapter is dedicated to solving one of the tasks formulated in the Introduction and concludes with the author's findings resulting from the research conducted. Each chapter provides the foundation for the next. The qualification thesis must contain at least two chapters. Chapter titles should be concise and accurately reflect their main content. The chapter title cannot replicate the MQT title. Each section begins with a general outline of the

subsequent presentation, including a concise summary of each paragraph within the chapter. The order of theoretical and experimental sections in the main body of the Master's thesis is not prescribed but is determined by the nature and logic of the research.

The first section should present a detailed overview of the current state of the art (the problem statement) and the Relevance of the research, based on a review of regulatory documents and both domestic and international literature.

The concluding section analyzes the main scientific results obtained by the author during the research process (in comparison with the results of other authors), presenting the author's recommendations and proposals, and the experience and prospects for their practical application.

The Conclusions of the MQT should formulate:

- specific conclusions based on the research results, corresponding to the stated objectives, and representing solutions to these objectives;
- the main scientific result obtained by the author in accordance with the aims of the research (solution of the posed scientific problem, obtaining or applying new knowledge about the subject and object of study), confirmation or refutation of the working hypothesis;
- possible avenues and prospects for further work.

All MQT materials of a reference and auxiliary nature (that are not included in the main text – text documents, tables, charts, illustrations, experimental design schemes, samples of questionnaires and tests developed by the author) are included in the Appendices.

The master's thesis, particularly its theoretical component, should incorporate current scientific literature, addressing each problem in light of the latest domestic and international scientific advancements.

2.2 Master's Qualification Thesis in the Professionally-Oriented Program

The work comprises two parts. The first part involves calculations and the design of standard sections within a construction project: architectural, structural, selection of foundations and substructures, organizational-technological, and economic aspects. Part two is devoted to engineering research (scientific research). This part comprises 15-30 sheets of explanatory notes and 1-2 sheets of the graphical part. In this section, students are expected to demonstrate their ability to achieve a specific outcome in the area of scientific research.

The structure of the Master's thesis explanatory notes includes:

- Title page;
- Contents;
- Introduction;
- Chapters and subchapters of the main body;
- Conclusions;
- List of used information sources;
- Appendices.

The content of each of the listed parts of the Master's thesis is determined by the topic. The choice of topic depends on the chosen direction and form of the scientific component. It also depends on the student's field of activity and the results of the analysis of information sources. In the process of preparing the thesis, the student should apply the studied calculation methods, design principles, and architectural design techniques, as well as established methodological approaches and theories for preparing the scientific component.

In addition to the explanatory note, the final Master's thesis must include a graphical component, particularly for the scientific component.

Introduction The introduction should be 2-5 pages in length. Regardless of the Master's thesis topic, the introduction must contain the following key elements:

Formulation of the primary objective. The initial sentence of the professional program work should begin by stating the solution to the problem (primary objective),

for example: «This work is dedicated to developing a construction project for a competitive [object name, e.g., shopping center], considering the results of...» (the main result of the scientific component).

Justification of the topic's relevance. It should generally include the following components:

- the number of buildings under construction in Ukraine (or the region) that are being designed, the large volume and/or cost of the work, Structures, calculations, etc., considered in the scientific component. Moreover, the text of the explanatory note must specify this information for the city, region, and country, and the corresponding work, Structures, calculation methods, etc. This is important because with large volumes of work, even a slight saving will lead to a significant overall economic effect.

- the effectiveness of the proposed solution to the primary research Tasks. This effectiveness may be economic, technical, social, environmental, or otherwise. An example of technical effectiveness is the improvement of the technical characteristics of the object of study.

- the absence of typical solutions and information in current regulatory literature and official recommendations (for the methodological type of Master's thesis, in textbooks and teaching aids) and effective solutions to the primary design and scientific component Tasks (specify what is lacking).

The justification of the topic's relevance should be approximately 0.5-1 page in length.

Aim of the Master's thesis. Typically, it is a more complete (paraphrased) version of the title, with further clarification and specification. It reflects the intended outcome that the author aims to achieve. The aim should be formulated concisely, in one or two sentences.

Research objectives specify and elaborate on the aim. For the design component: design a building ... (specify the building name and project sections). For the scientific component: analyze information sources related to the topic of the works, and identify the most effective solution ... (specify which ones), develop (or improve) the technology ... etc. There may be several tasks, each designed to reflect aspects of the

chosen topic and to help solve the main problem formulated in the aims. Tasks are the elements that, when performed sequentially, will enable the attainment of the planned result, i.e., achievement of the stated aim. Alternatively, they may lead to the conclusion that the application of certain tools is not relevant or effective. The tasks outlined in the Introduction are addressed systematically in the sections of the work.

The object of research is the planned building or structure.

The subject of scientific research lies within the scope of the research object. To define the subject of research, a specific aspect of the object is identified as the focus of scientific research. This aspect is the primary focus of the Master's student.

The object and subject of research, as categories in the scientific process, relate to each other as the general and the specific.

The methodological basis of the research encompasses the techniques employed in completing the work (calculation or modelling program, calculation methods, patent search, experimental research methods used, etc.).

Scientific novelty, or scientific results, includes new dependencies, regularities, methods, methodologies, results of multi-criteria analysis for selecting an Effective solution, and the development (or improvement) of technology, etc.

The anticipated practical Significance of the work may lie in the development of a design solution, the calculation and design of structural drawings, a technological plan, and recommendations for implementing the research results (attention should be paid to the nature of the research results' effectiveness). Practical Significance depends on the stage of implementation of the results obtained. These may include the following:

- A construction project of a building or structure (specify the name);
- Validation of results at conferences and/or through publications in specialized scientific journals;
- Validation in production settings;
- Implementation of results on actual construction or reconstruction sites;
- Use of results in the development of regulatory documents.

The introduction to a Master's thesis may not include all of the listed items. However, any introduction should include the following: relevance of the topic, aims and tasks for its achievement, and the novelty and significance of the research results. Other items are included in the introduction depending on the results obtained. The absence of any items must be agreed upon with the Master's thesis supervisor.

Architectural Design Section

In the thesis, this section always appears first, following the introduction. It begins by describing the initial design parameters of the structure, specifying the climatic region, construction site location, average air temperatures during warm and cold periods, the climatic and seismic zones for construction, the structure's consequence class, and its fire resistance rating.

Following this, a description of the building's spatial planning solution is provided. The designed premises should be specified (for industrial buildings, this includes descriptions of the main technological and auxiliary premises located within the workshop; for residential and public buildings, both occupied and unoccupied spaces), along with their dimensions, and the building's total and usable floor area.

The architectural and structural design must specify the building's structural system, detailing the materials used for internal and external walls, staircases, floors and roofing, roof, flooring, doors, and windows.

The following section describes the exterior and interior finishes of the building. The type of finish for the ceiling, walls, and other structures is specified, based on the building's structural and spatial planning solution.

The building's engineering systems are then briefly described, specifying the sources of heat, water, gas, and electricity supply. Subsequently, a thermal performance calculation of the external walls is performed, considering the construction area, material, and structure of the external walls.

The graphic component must include the following: master and site plans, wind rose, building schedule, technical and economic indicators of the master plan, floor

plans, longitudinal and transverse sections, room schedule if necessary, roof plan, nodes, elevations, and technical and economic indicators of the buildings.

Structural Design and Calculation Section

In this section of the work, the calculation of elements or structures is performed according to the assigned tasks. Accordingly, calculations are performed using a designated software program. The calculation typically begins with load determination. Subsequently, a static analysis is performed. The design properties of the materials are assigned. The material class and design properties are specified. Elements and structures are calculated using the limit state method.

The graphic component includes working drawings of selected structural elements or structures, an element specification, and a bill of materials.

Innovation section

In addition to the design part (calculations and drawings), the final master's thesis in the educational and professional direction must contain an engineering research (innovation) part. In the process of performing the engineering research part of such work, the master's student must demonstrate the ability to independently conduct scientific and patent searches, set and solve tasks, analyze special information, scientifically argue and defend his point of view, relying on the formed competencies.

The main forms of innovative research are:

- experimental - experiments in full-scale, laboratory conditions or the so-called numerical experiment;
- scientific and methodological - consists in the development of methodological literature on the scientific and methodological directions of the department (MV, sections of textbooks, textbooks) taking into account the topic and design results;
- engineering research - selection of effective construction solutions (organizational, technological, constructive) to perform specific tasks on the designed construction site. Such studies usually involve analysis of traditional solutions and innovations on the topic of work, selection of efficiency criteria and determination of

the most effective solution. On its basis, a new design solution can be developed instead of the basic design.

Bases and foundations

Foundations are calculated and designed in accordance with the task specifications. Temporary and permanent loads for the entire building are compiled to facilitate foundation selection. Soil conditions are specified according to the selected construction site and the consultant's Tasks. An assessment of the geotechnical conditions of the construction site is performed. The physical and mechanical properties of soils are presented in tabular form. The selection of the bearing layer type and several types of foundations is justified. After calculation and comparison of the options, the chosen one is indicated.

To determine the soil conditions, physical-mechanical properties, and strength characteristics, a geological cross-section at a scale of 1:100 must be presented, illustrating the soil stratification. Based on relevant calculations, a stress diagram is constructed, accounting for the geotechnical conditions of each layer separately, considering both self-weight and external loads.

Stresses due to the self-weight of the soil and external loads are determined. Settlement is determined for each layer, physical-mechanical and strength characteristics are calculated, and the foundation is designed. The foundation is calculated for bearing capacity, considering the deformation of the supporting soil. To this end, the soil resistance beneath the foundation's base is calculated. The final foundation dimensions are refined through a process of trial and error, and a graphical representation is produced. Following a technical and economic analysis and a comparison of the cost indicators for each foundation option, the most cost-effective option is selected.

The graphic component includes: a foundation plan, a section indicating geotechnical elements and stress diagrams, a detailed elaboration of the foundation design, and a bill of materials for the construction of the foundations.

Construction Production Technology

Technological charts are typically developed in this section.

This may be: variant 1 – an improved or novel technology based on a patent search and a prepared patent application; or variant 2 – a technology selected through a multi-criteria analysis of traditional and innovative solutions. Variant 3 – as per the supervisor's tasks.

The explanatory note must define the scope of the technology application chart, calculate the volume of work for the entire building, develop instructions on the technology and organization of construction processes, occupational safety and health, environmental and fire safety measures, calculate labor costs, and specify requirements for quality control and work acceptance, as well as technical and economic performance indicators.

The graphic component specifies the scope of application, quality control procedures, safety precautions, a feasibility study (FES), machinery and equipment requirements, material requirements, a work production organization scheme, photographic fragments illustrating the work sequence, and a work execution schedule.

Construction Production Organization

This section comprises an explanatory note and drawings.

The explanatory note must include the following:

- Characteristics of construction conditions;
- Establishment of nomenclature and calculation of work volumes;
- Determination of labor intensity of works;
- Justification and development of a schedule;
- Determination of requirements for labor resources and construction equipment;
- Development of a construction site layout plan;
- Organization of material and technical supply;
- Calculation of technical and economic indicators.

The graphical component of the section comprises 2 sheets. The first A1 format sheet includes a construction schedule generated using current software, resource

charts, and technical and economic indicators. The second A1 format sheet includes a construction site layout plan, a representative section through the construction site layout plan (longitudinal or transverse), an explication of the construction site layout plan, and a legend.

Labor protection and civil protection

This section should include an analysis of forecasting and prevention of natural and man-made security emergencies, protection of the population and territory from man-made and natural emergencies, guaranteed protection of life and health of people, land, water and air space, industrial and social facilities within the permissible limits of risk factors.

Economical Section

Cost estimate documentation is compiled for labor and material resources, considering the effective solutions selected in the research section. Calculations are performed for indicators and accruals related to general production costs, along with the average limit of funds allocated for the erection and development of temporary title buildings and Structures. the average limit of funds allocated for additional expenses incurred during construction and installation works; costs to cover the risks of all construction participants; funds to cover administrative costs; annual forecast index of inflation in construction (funds to cover expenses related to inflationary processes are determined considering the construction completion date); average rate of estimated profit; municipal tax rate.

A summary cost estimate, an object estimate, or a local estimate for general construction works is prepared. Sometimes, in consultation with the supervisor, local cost estimates are calculated for the purchase and installation of technological equipment, internal and external electrical installation works, plumbing, air conditioning, heating, fire and security alarm systems, and other low-voltage systems.

3. REQUIREMENTS FOR THE CONTENTS AND SCOPE OF THE WORK

The explanatory note for the MQT is printed in the official language and bound in a hardcover. It is also submitted electronically (in .doc, .docx, or .pdf format) on a CD, which is placed in an envelope attached to the explanatory note and submitted to the archive. The electronic version of the MQT is submitted to the issuing department.

At the student's request, the work may be translated into English or another language, with the translation submitted to the SEC.

The text of the work is printed on one side of A4 white paper (210x297 mm), with the following margins: left - 20 mm; right, top, and bottom - 10 mm. Use Times New Roman 14-point font with a line spacing of 1.5.

Photos, drawings, diagrams, charts, maps, and tables (illustrations) should be placed directly after the text where they are first mentioned, or on the following page. Illustrations and tables placed on separate pages are included in the general page numbering. Illustrations are designated as "Fig." and numbered sequentially within each section, except for those presented in the Appendices.

The illustration number should consist of the section number and the sequential number of the illustration, separated by a period. For example, "Fig. 3.2" (the second figure in the third section). The illustration number, title, and explanatory captions are placed sequentially below the illustration. If only one illustration is presented in the work, it is numbered according to the general rules.

Numerical data are generally presented in tabular form. Tables should be placed immediately after the text where they are first mentioned, or on the following page. All tables must be referenced in the text of the explanatory note. Tables are numbered using Arabic numerals within each section, except for those included in the Appendices.

The table number consists of the section number and the table's sequential number, separated by a period; for example, Table 2.1 (the first table in Section 2). A table may have a title, which is printed in lowercase letters (except for the initial capital letter) and placed above the table. The title should be concise and reflect the table's contents.

If a table cannot fit on one page, it should be continued on the next page, indicating the table number, for example, 'Continuation of Table 1'. On the subsequent page, only the column numbering is indicated, omitting the table header elements. For example, in the upper right corner, write 'Continuation of Table 4'.

Formulas and equations should be placed directly after the text where they are referenced, centered on the page. Formulas and equations in the explanatory note (excluding those presented in the Appendices) are numbered sequentially within each section.

The number of a formula or equation consists of the section number and its sequential number, separated by a period; for example, formula (1.3) is the third formula in Section 1. The formula or equation number should be indicated at the formula or equation level in parentheses, aligned to the extreme right of the line.

Explanations of the symbols and numerical coefficients used in formulas or equations should be provided directly below the respective formula, in the same order as they appear within the formula or equation. Explanations of symbols and numerical coefficients should begin on a new line. The initial explanatory sentence should begin a new paragraph with the word 'where,' omitting the colon.

In writing the thesis, the student must provide references to the Sources, materials, specific findings, ideas, and Conclusions upon which the research problems and objectives are based. These references enable the reader to locate the documents and verify all necessary information pertaining to them. References should cite the latest editions of publications. Earlier editions should only be referenced if the material they contain is not included in the latest edition.

When using information and materials from monographs, review articles, and other extensive sources, the reference must accurately indicate the page numbers, illustrations, tables, and formulas from the source referenced in the work.

References to sources within the text should be indicated by their sequential number in the reference list, enclosed in double square brackets, for example, «... in the works [1 – 7]...».

If a reference to a specific part or page of a source is required in the text, it should be provided in a footnote, with the reference number corresponding to its bibliographic entry in the list of references. References to illustrations should indicate the figure number, for example, "Fig. 1.2." References to formulas should indicate the formula number in parentheses, for example, "... in formula (2.1).

To substantiate arguments with credible sources or to critically analyze a published work, quotations should be included. Academic integrity demands accurate reproduction of quoted text, as even slight alterations to the cited passage can distort the author's intended meaning.

The general requirements for quotations are:

a) Quotations begin and end with quotation marks and must replicate the original source's grammar and author's stylistic choices. Scientific terms introduced by other authors are not enclosed in quotation marks unless they have been the subject of widespread debate. In such instances, the term 'so-called' is used;

b) Quotations must be complete, without arbitrary shortening of the author's text or distortion of the author's ideas. Omission of words, sentences, or paragraphs during quotation is permissible without distorting the author's original meaning and should be indicated by three ellipsis points. These ellipsis points may be placed anywhere within the quotation (at the beginning, in the middle, or at the end). If a punctuation mark preceded or followed the omitted text, it should not be retained.

c) each quotation must include a reference to the source;

d) in the case of indirect quotation (paraphrasing or presenting the ideas of other authors in one's own words), which significantly economizes the text, one should be extremely accurate in presenting the author's ideas and correct in evaluating their results, providing appropriate references to the source.

Layout of graphic material. Drawings in CAD are prepared in accordance with the requirements of current standards: DSTU, DBN, etc. The Graphical part of the thesis may be presented as slides in an electronic presentation (ideally 16–20 slides), with mandatory duplication on A4 paper. The paper version of the slides is included as an appendix to the explanatory note.

The explanatory note, along with the electronic version of the thesis on CD, Drawings, and the paper version of the slides, must be submitted to the OSACEA archive.

4. PROCEDURE FOR DEFENSE AND EVALUATION OF QUALIFICATION THESIS WORKS

Final student certification is conducted through a thesis defense before the State Examination Commission (SEC). The organization and execution of student MQT defenses are carried out in accordance with the «Regulations on the procedure for the establishment and operation of the State Examination Commission at OSACEA. The MQT defense is evaluated according to the requirements of the «Regulations on the Criteria for Assessing Students' Knowledge at OSACEA.

Structure of the Presentation During the MQT Defense

Presentation time: up to 5-7 minutes.

Presentation Contents: the topic of the MQT, its Relevance, construction site location, key indicators, capacity, productivity, etc., and the master plan and adopted solutions. Construction site data and technical-economic indicators related to the master plan.

Variants of considered solutions in the MQT. Characteristics of the variants. Technical and economic indicators of the variants. Justification for selecting the optimal variant.

Architectural and structural design section.

Brief description of plans, sections, elevations, and details. Building materials used.

Structural analysis and design section.

Adopted solutions, designed load-bearing structures, and their calculation methods. Characteristics of joints, nodes, and connections. Contents of the research component of the project.

Organization and economics; construction production technology.

Characteristics of the developed technological processes. Contents of the construction site layout plan, network and calendar Charts.

Safety and fire prevention measures.

Key technical and economic performance indicators.

Clear and concise answers must be provided to questions from members of the State Examination Commission and attendees.

The student must provide the necessary explanations or address the reviewer's comments. During the State Examination Commission's evaluation of the student's MQT defense, feedback from the reviewer and primary supervisor is considered.

*Tasks for the MQT***ODESA STATE ACADEMY OF CIVIL
ENGINEERING AND ARCHITECTURE**

Institute: _____

Department: _____

Educational Level: «Master»

Specialty: _____

Educational program: _____

APPROVED

Director of the Institute

« ____ » 20 _____

**TASK
TO CARRY OUT THE QUALIFICATION WORK
OF THE MASTER'S DEGREE**_____

(Student's last name, first name, and patronymic)

1. Topic of the WORK _____

Approved by Order of the Rector of OSACEA No. _____ from «____» 20_____

2. Work Supervisor

(Last name, first name, and patronymic, academic degree, academic rank)

3. Submission deadline for student's thesis defense _____

4. Table of Contents of the explanatory note by section:

Section 1. _____

Section 2. _____

Section 3. _____

Section 4. _____

Section 5. _____

Section 6. _____

Section 7. _____

Section 8. _____

5. Graphical materials by section

Section 1. _____

Section 2. _____

Section 3. _____

Section 4. _____

Section 5. _____

Section 6. _____

Section 7. _____

Section 8. _____

7. Calendar plan for thesis execution:

Types of work and their contents	Date of completion
Section 1.	
Section 2.	
Section 3.	
Section 4.	
Section 5.	
Section 6.	
Section 7.	
Section 8.	
Final Formatting of the Work	
Submission of the Work for Review and Plagiarism Check	
Preliminary Defense of the Work at the Department	

8. Advisors for Sections of the Qualification Work

Section	Advisor's Surname, Initials, and Position	Checked	
		Date	Signature
Section 1.			
Section 2.			
Section 3.			
Section 4.			
Section 5.			
Section 6.			
Section 7.			
Section 8.			

9. Date of Task Assignment _____

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
ODESSA STATE ACADEMY OF CIVIL ENGINEERING AND
ARCHITECTURE

(Institute)

(Department)

APPROVED
Head of the Department

„____” 20____

EXPLANATORY NOTE
TO THE QUALIFICATION WORK OF THE MASTER'S DEGREE

(Title)

Prepared by student of group _____

(Speciality)

(Educational Program)

(Full last name, first name, and patronymic)

Supervisor _____
(Last name and initials)

(Academic title, academic degree)

Odesa 20__

REVIEW
on the Qualification Work

of a student of the Institute of _____

specialty of the educational program _____

Topic of the work _____

Scope of the work _____

Conclusion regarding compliance with the assignment _____

Relevance of the selected topic _____

Application of modern achievements in science and technology in the work _____

Application of computer technologies in the work _____

Practical significance of the work _____

Quality of the work's presentation _____

Comments and suggestions _____

Overall conclusion regarding the work and recommendation for awarding the educational qualification of "Master" _____

Recommended grade _____

Reviewer

_____/_____
(Surname, Initials)(Signature)

Position, Place of Work _____

"_____" 20_____

1. DRAWING PRESENTATION: GENERAL REQUIREMENTS

When preparing design, working, and other technical documentation intended for the erection of buildings and structures, it is necessary to follow the requirements of SPDB standards (System of Project Documentation for Construction), as well as the requirements of the standards of the Unified System for Design Documentation (ESKD). A list of ESKD standards, the requirements of which must be considered when preparing graphic and textual documentation for construction, is provided in Annex B of DSTU B A.2.4-4:2009.

Drawings should be executed at optimal scales, considering their complexity and information density.

Scales are not indicated on drawings, except for product drawings and other cases stipulated in the relevant SPDB standards.

1.1 Formats

All documents included in the building or structure project shall be prepared on drawing paper sheets of standard formats. The dimensions of the outlines are provided in Table 1.

Table 1

Format Designations	Format Side Dimensions
A4	297x210
A3	297x420
A2	594x420
A1	594x841
A0	1189x841

The lines of the main border are indented from the edge of the sheet by 20 mm on the left and 5 mm on the right, top, and bottom.

1.2 Drawing Lines

The following lines are recommended for creating drawings of building details, products, and Structures:

- Solid thick - 0.35 mm;
- Solid thin - 0.15 mm;
- Dashed - 0.15 mm;
- Dash-dotted thin - 0.15 mm;
- Dash-dotted thick - 0.2 mm;
- Open - 0.7 mm.

1.3 Scales

Table 2 shows the reduction scales used in construction Drawings.

Table 2

Image Scales	Scope of Application
1:200; 1:400; 1:500; 1:800; 1:1000	Plans and sections of buildings and structures; layouts of prefabricated structural elements
1:10; 1:15; 1:20; 1:25; 1:50	Working drawings of components and details from the main set of working drawings
1:20; 1:25; 1:50; 1:75; 1:100	Views, sections, cross-sections, and reinforcement schemes of reinforced concrete elements; Fragments of plans and sections of buildings

1.4 Fonts

Inscriptions and dimensions in the drawings are rendered using drafting font. The letter height in Drawings must be at least 2.5 mm.

When producing Drawings using computer software, it is recommended to use the Simplex font with a line weight of 0.15 mm.

1.5 Lettering on Drawings

Working Drawings intended for construction and installation are grouped into sets (main sets of working Drawings) according to the designations provided in Table 3.

Table 3

№ No.	Name of Main Set Working Drawings	Mark Set
1	General Layout	GP
2	Architectural Solutions	AR
3	Architectural and Structural Solutions (when combined into a single set of architectural and structural drawings, excluding marks CM and CMD)	AB
4	Reinforced Concrete Structures	RC
5	Metal Structures	CM
6	Metal Structures: Shop Drawings	KMD
7	Transportation Structures	TS
8	Power Supply	EP
9	Gas Supply	GP
10	External Gas Supply Networks and Structures	ZG
11	Heating Networks	TM

1.6 Coordinate Axes

Coordinate axes are indicated on the representation of each building or structure, and assigned an independent labeling system.

Coordinate axes are depicted on building or structure representations using thin dashed-dotted lines with long dashes, and are designated with Arabic numerals and uppercase letters of the Russian (Ukrainian) alphabet (excluding the letters: З, Ё, О, Х, Ц, Ч, Ш, Ъ) within circles of 6-12 mm diameter.

Gaps are not permitted in the numerical and alphabetical designations of coordinate axes (except as specified).

Numbers are used to designate coordinate axes along the side of the Buildings and Structures with a large number of axes. If there are insufficient letters in the alphabet

to designate Coordinate axes, the subsequent axes are designated with two letters, for example: AA; BB; VV.

The sequence of numerical and alphabetical designations of Coordinate axes follows the plan from left to right and bottom to top (Figure 1a) or as shown in Figures 1b and 1c.

Coordinate axes designations are typically placed along the left and bottom sides of building and structure plans.

For individual elements positioned between the coordinate axes of the main load-bearing structures, additional axes are added and denoted as a fraction: the numerator indicates the designation of the preceding coordinate axis, and the denominator represents an additional ordinal number within the section between adjacent coordinate axes, as illustrated in Fig. 1g.

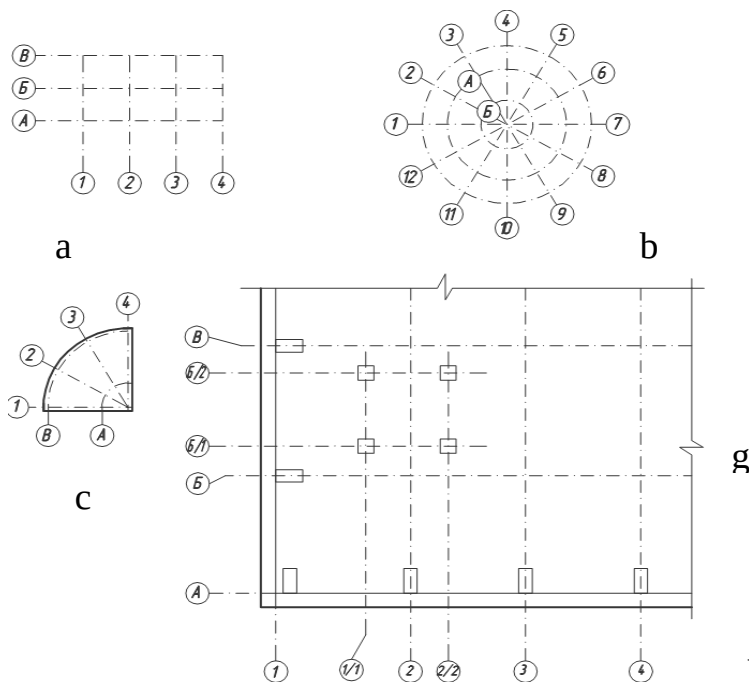


Figure 1

In illustrations of repeating elements tied to multiple coordinate axes, the axes are labeled according to Figure 2a (for no more than three coordinate axes), Figure 2b (for more than three coordinate axes), and Figure 2c (for all alphabetical and numerical coordinate axes).

If necessary, the orientation of a coordinate axis to which an element is tied, relative to an adjacent axis, is determined according to Figure 2g.

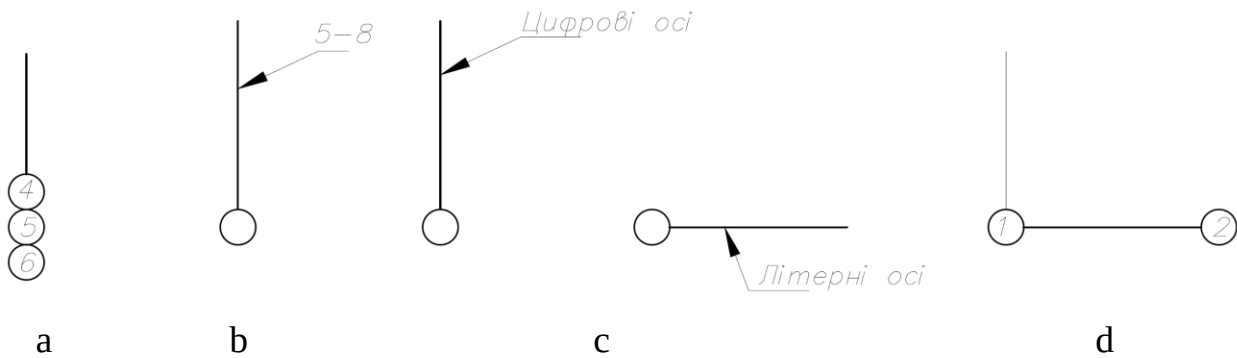


Figure 2

1.7 Applying Dimensions, Slopes, Elevations, and Inscriptions

The dimension line, where it intersects extension lines, contour lines, or center lines, is terminated by serifs in the form of thin, solid lines 2-4 mm long, drawn sloping right at a 45° angle to the dimension line. Dimension lines should extend beyond the outermost extension lines by 1-3 mm (Fig. 3a).

When dimensioning a diameter or radius inside a circle, as well as angular dimensions, the dimension line is terminated with arrows. Arrows are also used when dimensioning radii and internal fillets (Fig. 3b).

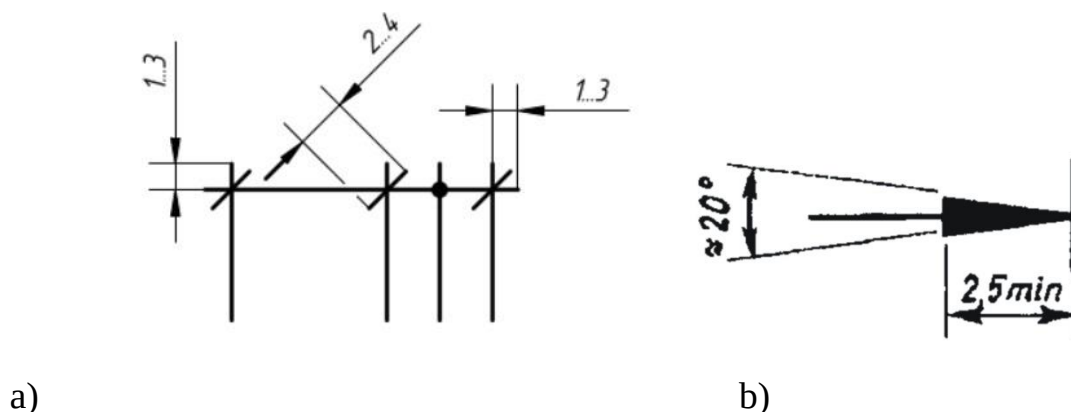


Figure 3

Elevation marks (height, depth) of structural elements, equipment, pipelines, air ducts, etc., relative to the reference level (conditional "zero" mark), are indicated by a

symbol according to Figure 4 and are specified in meters with three decimal places, with a comma separating the decimal fraction from the integer.

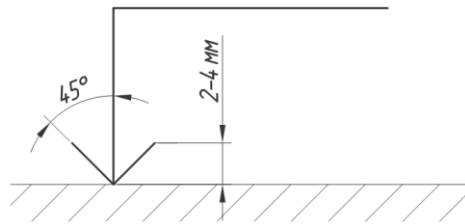


Figure 4

The "zero" mark, typically assigned to the surface of a structural element in a building or structure located near the ground's surface, is indicated without a sign. Elevations above zero are indicated with a "+" sign, and elevations below zero with a "-" sign.

On elevations (facades), sections, and cross-sections, elevations are indicated on leader lines or contour lines as shown in Figure 5a; on plans, they are shown in a rectangle as shown in Figure 5b, except in cases stipulated in the relevant SPDB standards.

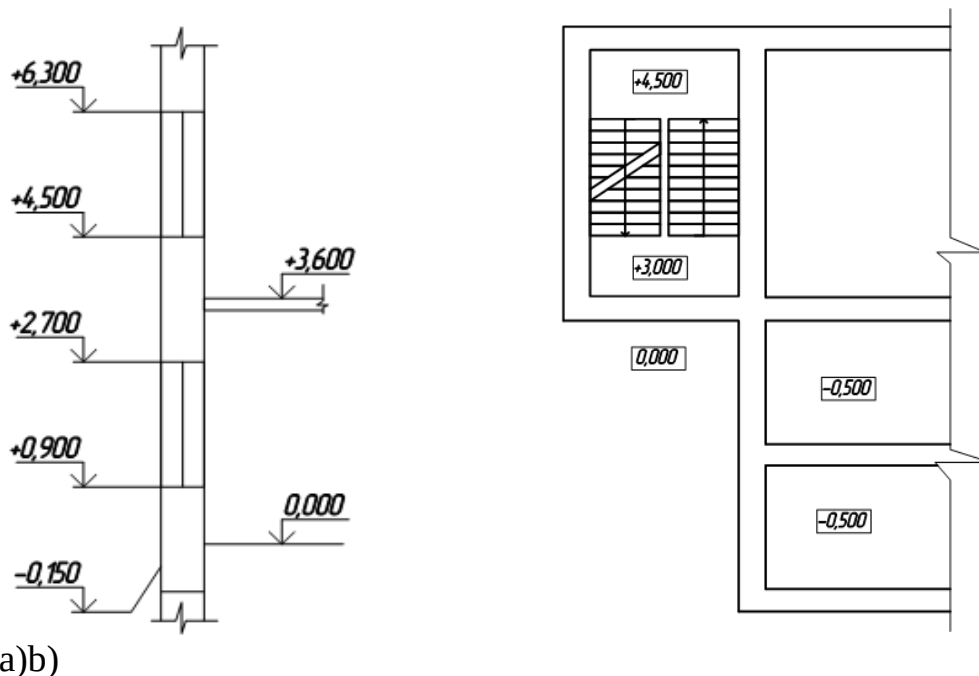


Figure 5

On plans, the direction of a plane's slope is indicated by an arrow. If necessary, the slope's value is shown above the arrow as a percentage (according to Figure 6) or as a ratio of height to length (e.g., 1:7).

If necessary, the slope value may be indicated in parts per thousand (‰) or as a decimal fraction accurate to three decimal places. On Drawings and diagrams, the symbol «», the acute angle of which should point in the direction of the slope, is placed before the dimension indicating the slope's magnitude. The slope indication is placed directly above the contour line or on the leader line's landing (shelf). ∠

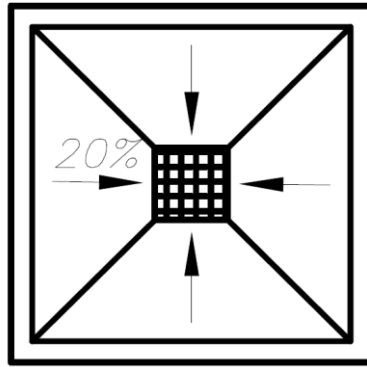


Figure 6

Leader lines and annotations for multilayer structures are to be prepared in accordance with Figure 7.

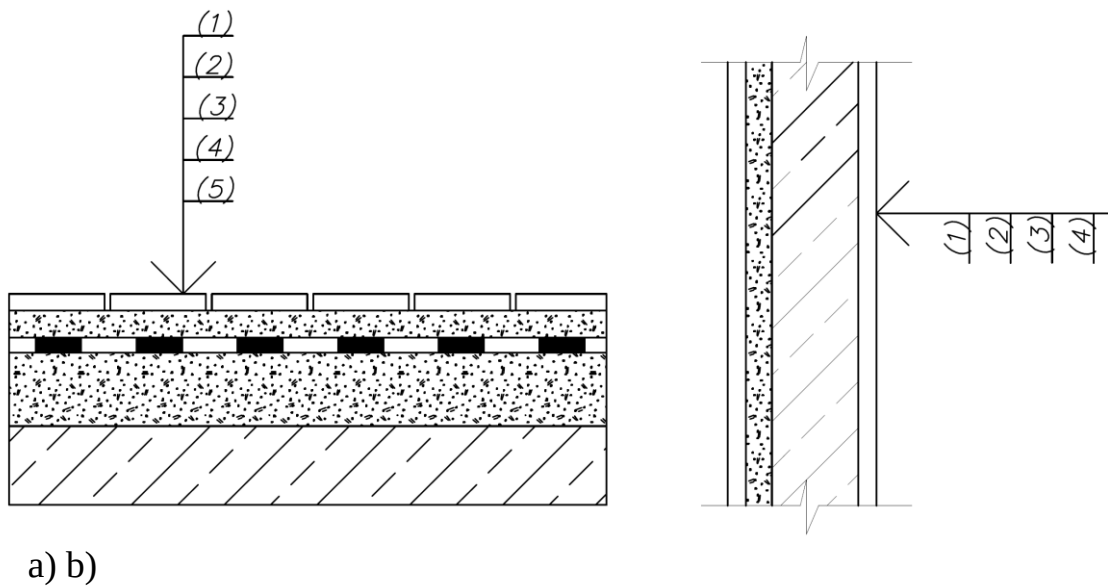


Figure 7

1.8 Images (sections, cross-sections, elevations, fragments)

Sections of a building or structure are designated with Arabic numerals sequentially within the main set of working drawings.

Independent numbering is permitted only for sections of individual areas of a building or structure, where all drawings are located on a single sheet or a group of sheets.

Sections may also be designated with capital letters of the Russian or Ukrainian alphabet.

The viewing direction for a section on a building and structure plan is generally from bottom to top and from right to left.

If individual parts of the view (facade), plan, or section require a more detailed representation, then enlarged details – nodes and fragments – are additionally produced.

When depicting a node, the corresponding location is marked on the view (facade), plan, or section with a closed, thin, solid line, typically a circle or oval, and the node's sequential number is indicated in Arabic numerals on the leader line, as shown in Figure 8.

If the detail is located on another sheet, the sheet number is indicated below the horizontal line of the extension line (Figure 8a) or on the horizontal line of the leader line next to it in parentheses, as shown in Figure 8b.

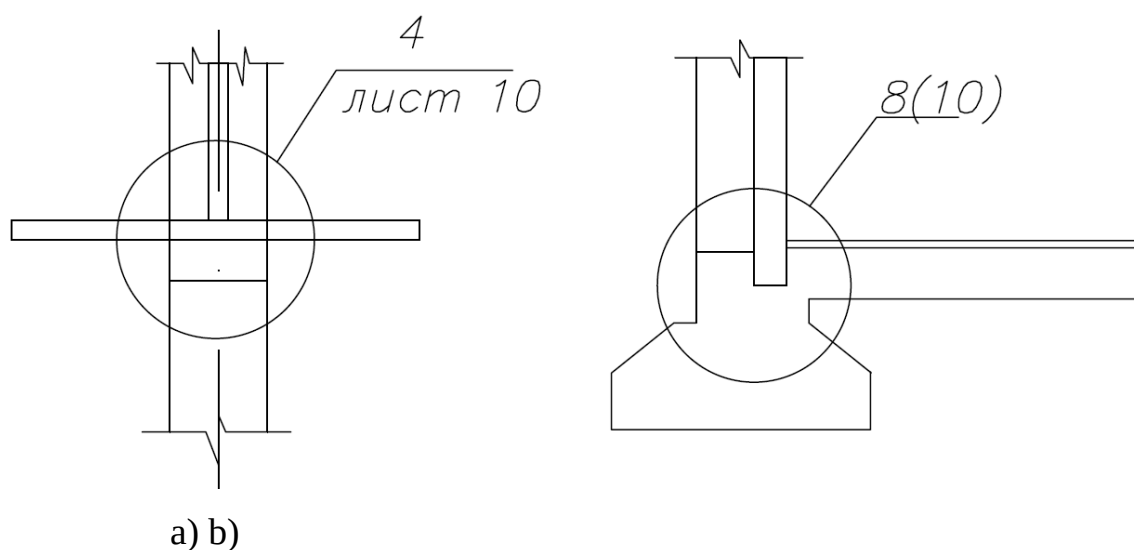


Figure 8

Above the detail drawing, its ordinal number, as per Figure 9, is indicated within a circle. A detail that is a complete mirror image of another (original) detail is assigned the same ordinal number as the original, with the addition of the index "n".

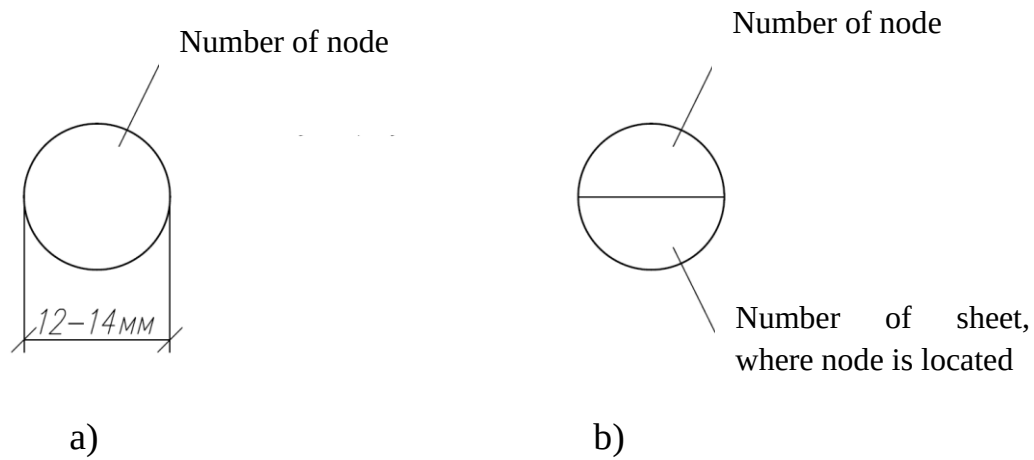


Figure 9

If an image (for example, a plan) does not fit on a sheet of the accepted format, it should be divided into several sections and placed on separate sheets.

In this case, each sheet displaying a section of the image should include a diagram of the entire image, showing the necessary coordinate axes and a legend (hatching) indicating the portion of the image displayed on that sheet, as illustrated in Figure 10.

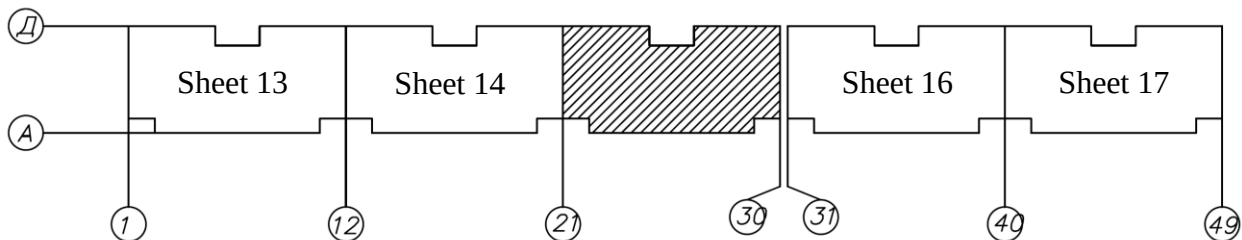


Figure 10

In the titles of floor plans for buildings or structures, indicate the finished floor elevation or the floor number. For example: Plan at elevation 0.000; Plan of floors 2-9.

In the titles of building (structure) sections, indicate the designation of the corresponding section plane. For example: Section 1-1.

In the titles of building and structure facades, indicate the extreme axes between which the facade is located. For example: Facade 1-12.

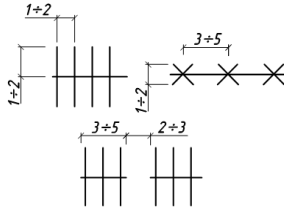
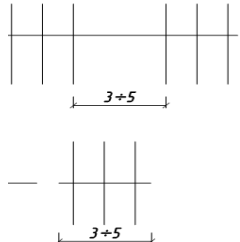
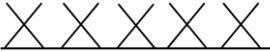
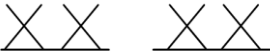
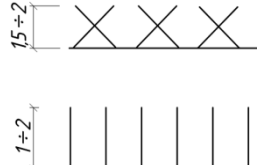
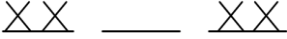
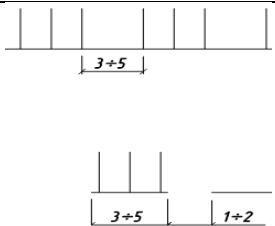
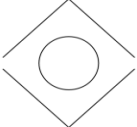
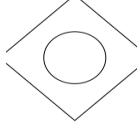
1.9 Legend

Element symbols are regulated by relevant standards.

The following are presented below:

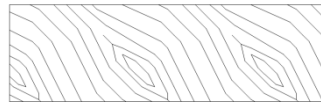
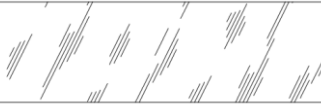
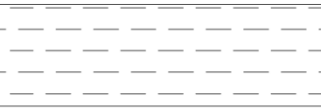
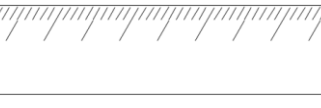
- Conventional representations of welded joints (Table 4);

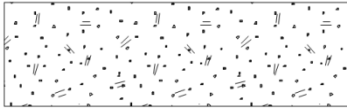
Table 4

Designation	Weld Representation		Image dimensions, mm
	Plant weld	Field weld	
Butt weld (continuous): - From the visible side; - From the hidden side	 	 	
Intermittent version: - from the visible side; - From the hidden side	 	 	
Continuous weld seam of a fillet, T, or lap joint: - from the visible side; - From the hidden side	 	 	
Intermittent version: - from the visible side; - From the hidden side	 	 	
Spot contact weld seam of a lap joint			

- graphic symbols for materials in cross-section (Table 5);

Table 5

Material	Cross-section designation
General material designations	
Metals and hard alloys	
Reinforced concrete	
Concrete	
Construction mortar	
Non-metallic materials (insulation), including fibrous monolithic and slab (pressed) materials, except as noted below	
Wood	
Natural stone	
Ceramics and silicate materials for masonry, including brickwork, artificial stone, blocks, and similar	
Glass and other translucent materials	
Liquids	
Natural soil	

Backfill	
Waterproofing	
Vapor barrier	

1.10 Main Inscriptions

The main inscriptions for drawings and sheets of the explanatory note are provided on Fig. 11.

				<i>Qualification master's work</i>			
				<i>Topic of qualification master's work</i>			
<i>Developed</i>	<i>Name</i>	<i>Signature</i>	<i>Date</i>				
				<i>Type of building. Type of manufacture</i>	<i>Stage</i>	<i>Sheet</i>	<i>Sheets</i>
<i>Head of dep.</i>					<i>S</i>	<i>1</i>	
<i>Adviser</i>				<i>Content of the sheet</i>	<i>OSACEA, Dep. of MW&PS</i>		
<i>Cons.</i>							
<i>Student</i>							

					<i>Explanatory note</i>		<i>Sheet</i>
<i>Зм.</i>	<i>Sheet</i>	<i>Doc. No.</i>	<i>Signature</i>	<i>Date</i>			

Figure 11. Main title blocks of drawings and sheets of the explanatory note

REFERENCES:

1. DSTU 9243.4:2023 System of design documentation for construction. Basic requirements for design documentation.
2. DBN V.2.6-198:2014 Steel Structures. Design Standards.
3. DBN V.1.2-14-2009 General principles for ensuring the reliability and structural safety of buildings, structures, structural members, and foundations. Kyiv: Minregion of Ukraine, 2009.
4. DBN V.2.6-161:2017 Timber Structures. Basic Provisions.
5. DBN A.3.1-5-2016 “Organization of construction production”. Kyiv, Ministry of Regional Development, Construction and Housing and Communal Services of Ukraine. 2016.
6. DBN V.2.2-15:2019 Buildings and structures. Residential buildings. Basic provisions.
7. DBN V.1.1-7:2016 Fire safety of construction sites. General requirements.
8. Kramar G.M., Meshcheryakova O.M. Methodological manual for performing the master's qualification work in specialty 192 “Construction and civil engineering”. Ternopil, 2020. 56 p.