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METHODOLOGY OF DESIGNEE OF GEO-TECHNIQUE AND GEO-PROTECTIVE STRUCTURES IN THE LIGHT OF STRUCTURAL FORM-MAKING

Chavdar Kolev

24, Gen. Parensov Str
1000 Sofia
E -mail: ch_kolev@abv.bg

ABSTRACT

Developing and effective application of structures is always an outcome of creation based on accumulated experience and science knowledge. Theoretic elaboration continuously displays and creates new and higher regularity of organization and structure of material, forms and systems.
The system's methodological approach to structural creativity is displaying by deduct transition to the special structural form-making and structural detailing.
Methodology of structural form making is a new area for conventional science approach. In Bulgaria this methodology has elaborated by prof.Milcho Braynov who bring concretely illustration by steel rod structures.
The general principles can be appreciated to other kinds of structures too, including geo-technique and geo-protective. By deductive approach it reach to concretely forms and in the same time is giving an account of interaction between structures of general geo-protective system.
Objective connections between function, form and structure are examined from point of view of geo-protection and geo-technique.
It is proposed a methodology for designing of structures and complex geo-protective systems. There are cited an examples for illustration and confirmation of theoretical treatment.
Developing and effective application of structures is always a outcome of creation based on accumulated experience and science knowledge. Theoretic elaboration continuously display and create new and higher regularly of organization and structure of materials, forms and systems.
Actually methodological approach to the structural creativity is dispelling by deduct transition to the special structural form making and detailing.

INTRUDUCTION

Developing and effective application of structures is always an outcome of creation based on accumulated experience and science knowledge. Theoretic elaboration continuously displays and creates new and higher regularity of organization and structure of material, forms and systems.

The system's methodological approach to structural creativity is displaying by deduct transition to the special structural form-making and structural detailing.

Methodology of structural form making is a new area for conventional science approach. In Bulgaria this methodology has elaborated by prof.Milcho Braynov (1980) who bring concretely illustration by steel rod structures.

The general principles can be appreciated to other kinds of structures too, including geo-technique and geo-protective. By deductive approach it reach to concretely forms and in the same time is giving an account of interaction between structures of general geo-protective system.

OBJECTIVE CONNECTIONS BETWEEN PURPOSE, FORM AND STRUCTURE, FROM POINT OF VIEW OF GEO-PROTECTION AND GEO-TECHNIQUE

The different geo-protective and geo-technique structures are distant to satisfy different functions of concretely protection systems. Structures have different material forms related from his destination. Forms can be defined by functional material organization system, keeping and integrating them in the space. This is their bearing structure. Technology is transmission to real execution of the structures. Hear logic connection between destination-form-structure-technologic.

There is objective connection between function, form and structure.

Destination of the structure is to insure these form in the space that will accept and transmit all forces and actions, borne of function and external conditions. Structure is spine with highest and large.

Unity can be illustrated. Function requires places (roadbed, pavements etc.) for transporting on the time of protection works of roads, railways, bridges etc. These places are organized from point of view of his destination. They define requires of his functional-technological form.

As other structures, forms are conformed by structure requires, aesthetic, ecology and technology considerations.

Form is develops in the space and receives functional forces by the structure. The structure is relevant to the form, but it is primary directive for the form and has to respect to destination.

METHODOLOGICAL DIRECTIONS OF DESIGNING OF GEO-PROTECTIVE STRUCTURES AND SYSTEMS

Designs of structures can development on two directions.

First direction -inductive approach. This standard direction utilization many prepared elements organized to work together.

Second direction -deductive approach. By the way of structural form making to the functional considerations, levels of form making and finally structure. General exit conditions of deductive approach are forming –preliminary and especially on the base of accumulated large experience and information by inductive way.

There is a logic connection between these two approaches. Standard approached is a primary, when receive a concretely information and experience. After that it pass to the general deductive approach. By virtue of second approach elements develop and improve. Elements are preliminary structure material of the standard method. Streamline of the progress is obviously. It is a result of permanent interaction between two approaches.

Development of deductive approach as higher level of effective and resource for creativity of more complicate systems and structures is necessary. It has to display new possibilities and directions for structural creativity.

Standard direction of designee:

This is more dissipate direction in the practice now. The best his characteristic is a line to reduce calculations and detailing of more and more elements of structure and of here general static shim too. Forces are standard too.

Composition elements have four hierarchy levels:

First level-cross sections:

Universal different cross sections are worked out with their geometry and technique characteristics. It is necessary only to be selected and apply in concrete case.

These sections are worked out for the anchor's cable and fittings, for the reinforcement of pilots and other concrete structure, sections of tubes 9sleel, plastic, concrete), artificial blocks for board- protection, geo-synthetic materials, etc.

Second level - structure elements and zones.

The question is about three-dimensional elements, with all their limits of bearing capacity. For examples: breakwater blocks, a large past of steel passive anchors, support for tunnels, etc.

Third level - kinds of structure shims. Type designs of structures are developing for consideration diapason of measures, forces and destinations. It can develop structural composition on this base.

For examples: dowel piles or groove wall, forced by sliding. Complex anchor structure (passive or reinforcement is a brightly example. There is a high level of type –structure in area of board-protection systems.

Fourth level – structural compositions.

Talking about catalog of complexly structural compositions. When there is a catalogue, designing convert to creative process of composition and construction convert to complex montage activity.

Generally fourth level is not attain in construction, including geo-protection and geo-technique.

Matura is natural process for the designer. When he has accumulated experience enough, information and theoretical knowledge from the work on standard shim, coming a moment of become aware of many general relations, result of general view to the structural problems. This is the way to higher quality level, where become deductive approaches of structural form making and form detailing.

Design is suitable for automation on the four levels and it has attained yet with high quality. Naturally, automation is the faster developed in high-industrialized countries, where decisions of structure problems have very large practice.

Level of automation follows above hierarchy order but in reverse direction. The higher automation is activity on fist and second level, on a smaller scale on thirty, but with many picks yet. The poorly developed is the higher forth level.

Level of automated and unification design and construction of geo-technique and geo-protection projects is on a low level in comparison with superior structures (building, brigs, towers, etc.). The reason is the great diversity of terrain and geological conditions and of streamline to correspond with ecological principia of minimum actions in to natural process. Underground construction cycle as the protection keeps his character of small and labor-consuming stage. Way of automation and unification design and construction by inductive approach give home intellects a time and possibilities to decision of high level questions.

Wrote above doesn't neglect many unique structures, borne by catalog-standard approach. The great number standard cross-sections and structure elements don't limit creative process of unique decisions.

Direction of activity and thinking way of the deductive approach is exactly opposed to above approach. It is following a logic line of structural form making. It is starting from general ideas and considerations and step by step it is walking to detailing.

STRUCTURAL FORMS MAKING -BASIC DIRECTION OF ELABORATE A METHOD FOR DESIGNING OF GEO-PROTECTION AND SUPPORT STRUCTURES

Methodic structure can be show on three levels:

I level – to basic structure forms:

- Initial function -technological forms.

These can be different type structures: anchors, dowels, contra-forces, brigs.

- Initial cross sections, type of material, loading capacity, general static schemas:

The cross can be box, circle, ellipse, rectangular, double-T.

Construction materials are concrete, reinforced concrete, steel, stones, geo-synthetics, wood etc.

II level - to final structure forms-flat and space structures.

III level - to entire volume –space structure systems.

Structural form making represents deductive way, starting from preliminary structure forms, conforming with purpose to finally decision for all system.

Finally form of structures will be definite by multiple cycle: function-technological form - initial structural forms - structural cross section - basic structural form - finally structure form.

The process is multiple because it is interactive, multi-factorial. Discover of the decision is a creative process, first of all. Accumulation of great personal experience, as information enough and theoretic knowledge out cycle and make easier the work for definition of finally form.

Structural cross sections with defined kinds material and form receive, stand forces M, Q, N by their reinforcing and deforming condition.

All ordered characteristics of structural cross sections have dynamic connections between them, because all of them are developing continuously. For example, section's, forces change himself continuously in reaccept with increasing of external forces. The development of people lead to increasing of functional forces, those structures have to stand. Weight of vehicles over transport structures is increasing, floors-number of buildings increasing too etc. By this way it is boring a necessary of higher loading capacity of sections, improving of materials etc. Such a way from initial circle section to double-T, box etc.

Other approach for increase of loading capacity is increase of section's high.

Direction of structural forms is developing to these, which work by N only, without M, from solid-walled to lattice structures. Tendency is objective and if reflect way of technical progress to more simple but more effectively static schemas, covered in improving structure forms.

World experience of landslide protection shows the same indications. Flexible one-dimensional anchor protection structures (working by N-forces only) dominant in the best-industrialized countries. Reinforced concrete structures go on from circle full pilots dowel to large-dimensional, that are obviously higher effectively under bigger loads.

Physique-mechanic characteristics of geo-synthetic have unsteady evolution, categorically, the new raw material PEHD is dominating.

When structure's element forms are determining, there is a contradiction between considerations for minimum expense of material on side and expense of labor and energy on other side. This thesis has a good illustration by more complicated structures (anchors, piles and shafts). Their expense of labor is principally more and changes reflect brittle on the time and the price of execution.

Minimum expense of labor and energy consider maximum typical elements, which lead to over dimensioning and over expenditure of material insertion level.

In this case optimization has a high level of indetermination, but it is normal for geo-protect structures, to prefer economy of labor and energy, respectively time, to answer the consideration of emergency and all spectra of undetermined external loads. In the spirit of snowed method it has be display the principia of effectively geo-technique and geo-protective structures, of their economic and reliability. So will create completed initial impression about methodological direction.

PRINCIPIA OF EFFECTIVENESS OF STRUCTURE

The principle for effectiveness of structure is following:

- Concentration of materials
- Parallel execution of more destinations.
- Translating of loads on the shortest way to the basic.
- Maximum exploitation of material load capacity

By concentration of material bigger loads are standing by smaller number elements. So load capacity of presstreced anchors attained 1500kN, shafts and groove wall change the pilots under the biggest loads, support-walls and other flat elements, generally, rice to thin-walled but ribbed etc.

Execution of more of one destination is a characteristic of geo-technique and geo protection structures. Their infrastructure character is a primer condition. Their destination for protection is other premise, to be loaded by horizontal, forces, generally. Their grad load capacity on vertical direction stay without exploitation. There are brightly examples for rational multifunctional and celebrate decisions. That is Monte Carlo's Casino, constructed on protected structure of great landslide on see board. There are similar ideas in Bulgaria to utilize flat on the piles that support Kabacum.

According to the standard has a possibility well based buildings to receive and horizontal load from landslides-reverse process.

All coast-protection shown dam on the See have concrete pavements over the crown. That has transport function. There is a send behind for artificial beach. Buildings and installations have constructed on other places of dams. Many ruble groins are ports in the same time. There are many cases of rood and railway protection, where great rectangle wool based by piles stand horizontal forces from sliding and load of vehicles and superstructure.

Geo-technique and geo-protect structures in quality of infrastructure principally transfer load to the art basic directly, on the shortest way.

The problem of maximum exploitation load capacity is permanent for engineers. Higher levels of indefinite of soil characteristics, included in calculations create some complications. Tanks of intensive development of Soil Mechanic, of accumulation of long order hydrologic meteorology information, of rapid technological development in the world, methods for static calculations and dimensioning are carried out to correspondence with these, about superior structures.

There is not exclude in Bulgaria in this direction.

Executable economy of decisions for building transport and hydraulic structures is creating by the Methods of limit conditions and Method of admissible tensions.

ECONOMY AND RELIABILITY OF DESIGNED OF GEO-TECHNICAL AND GEO-PROTECTIVE STRUCTURES

Optimal economy, raise security and reliability are two general considerations of structural designing.

Optimal designing is subordinate to logic, as to the structural form making, as to investment process, including planning-investigation-design-construction-exploitation. This logic calls interaction parts of the project (analyses about destination, calculation, technology and exploitation).

Criteria about optimal structure are different as following - *qualitative* (functional, durability, maintainability and reliability, aesthetic) and *quantitative* (expense of materials, labor and energy, time). It has to look for maximum about quality and minimum about quantitative.

Approaches and principia of optimum economy and rice security and reliability of geo-technical and geo-protective structures and systems are subordinated of approach to structural form making.

Analyze can be settled by adducing of these principia to concrete task.

Showed methodological approach is one of first steps to general analyzing of structural creative in area of geo-protective and geo-technical activity. First his task is to reduce principia to specific aims. Obviously, there are shades, borne of connection between geo-protection and nature, of natural sensitive to humane intervention in processes, as of unique relief and geological morphology.

Conclusions from methodical analyze are adducing to followed:

- Design and construction of geo-protective and geo-technical structures and systems are quite writing in the principia of structural form making.
- There is experience, information and theoretic knowledge enough, to go on from inductive to deductive approach in this area and to look for more new general system's relations, new strictures, their elements and cross sections.
- The process of increasing of exploitation loads and derivative of them section forces, of section height and strengthening of materials is valid.
- The new materials, structures and technologies, borne of technical progress provoke need of developing of great level of creative- the structural composition.
- Principia of structure effective, of economy and reliability can be serve for create and improve of methods related comparison, valuations and analyses of projects and structures.

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