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# ASPECTS REGARDING BUILDING SITE ORGANIZATION FOR DEMOLITION

BY

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**Abstract.** Each time, organizing a building site for demolition requests solving some problems regarding the condition ensuring the main activity development. In this paper, the author describes the main steps that make up organization of the site for buildings demolition, such as: the building site organizational project, organizing the working site's settlement and lists of activities for the demolition of constructions (activities that take place before demolition, during demolition and after demolition).

**Key words:** demolition; site; organization; activity; project.

## 1. Introduction

According to the number and the type of the constructions which are going to be demolished it is required the realization of some special spaces (social and administrative, which assure life condition or where the equipment and tools are stored), some utilities networks (water, energy) or using the ones which already exist inside the yard. If the demolition is made in a complex which contains more buildings which are close to each other , the fact that some of the smaller, with a lower importance, may be arranged as deposits for tools or housing for the workers it going to occur in the demolition order.

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For total or partial solving of some of these problems, that regards the building site organization, papers, lists of activities and solutions must be proposed from the projection stage on the yard organization project.

## 2. The Building Site Organizational Project

The organization project represents the technical-economical documentation, made by the designer, as organization sketchs. It is formed from a series of drawn and written parts, which include organizational solutions and ensure the required conditions for realizing the demolition. For this purpose the necessary fund are given, according to the general estimation.

The building site organizational project is made in two phases: phase I – it's materialized in a "general organizational plan" made by the designer on the solutions provided in the order note and phase II – elaborated by the general entrepreneur on the "general organizational plan" and on the execution project, which details the solutions provided in the phase I. The second phase is being materialized by a series of drawn pieces, graphics, charts, written pieces and tables regarding the main aspects of the yard organization. The next objectives are aimed:

a) sizing the equipments and machines working area so as to occupy the minimum area, but to not hinder one each other;

b) executing the works in a technically-rational succession;

c) ensuring the conditions for housing and personal hygiene;

d) sizing the activities and the yard organizing objects on the necessary staff number and according to the time;

e) choosing the most economical solutions for the staff transport.

In the same time when the yard organizational project is elaborated, the following aspects must be analysed, in order to solve them: industrialization possibility of the yard organizational objects production; the possibility of the reduction of the setting time on the working site for the organizational objects; the possibility of increasing the re-using number, of the recoverability and functionality level; the possibility of reduction the materials and employment consumption; the possibility of increasing the easiness in installation and decommissioning; the possibility of the costs reduction.

For organizing a demolition working site certain informations are necessary, such as

a) the location of the working site with its surroundings;

b) nearby buildings, their age;

c) the existence of hospitals, museums or other buildings that might be affected by noise, falling of material and vibrations transmitted through the earth;

d) the situation of the communication ways, the existence in the surroundings of rubble stockpiles for the its evacuation from the working site;

e) the possibilities of recruiting the working force from the neighbouring area.

### 3. Organizing the Working Site's Settlement

The completion of the project at the required demands and terms, the growth of work productivity and the reduction of costs are conditioned also by the way of placing the storehouses, the temporary communication ways, as well as of the temporary construction objects of serving the personnel of the working site.

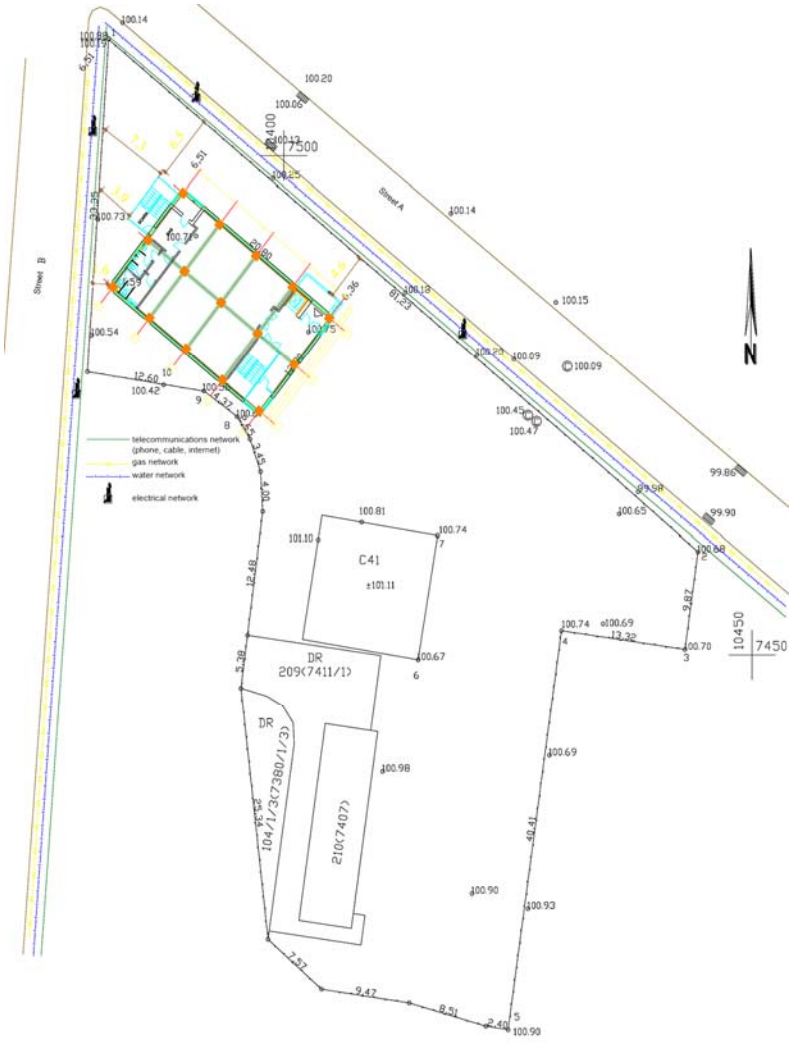


Fig. 1 – Working site's placement plan.

The placing of the working site is done according to the plan of organization of the working site terrain as in Fig. 1, in which it is established the placing on the field of the working site's organization elements and objects. With this opportunity, there must be solved the following problems: the specifying of all the buildings that are to be demolished the temporary facilities necessary for the execution of basic works; the optimal solving of the circulation flows of the machinery without additional confluences or interchanges; building the optimal conditions from the point of view of labour security.

## 4. Lists of Activities for the Demolition of Constructions

There are suggested three lists of activities for a better evolution of the project of demolition in terms of its evolution in space and time namely

a) activities that take place before demolition (Table 1);
b) activities that take place during demolition (Table 2);
c) activities that take place after demolition (Table 3).

**Table 1**

*Activities that Take Place Before Demolition*

| Settlement |
|---|
| – The identification of the settlement, the surroundings, nearby buildings, down-grades and retaining walls.<br>– The identification of the settlement's special restrictions, special restrictions during the operations/activities, the reservation of dust, noise and vibrations.<br>– The identification of the impact over the constructions with a special condition near the settlement that can be affected by the execution of the demolition, such as: hospitals and other locations that are sensible or that can be affected by noise, vibrations and dust. |
| The study of the settlement and of the construction that is to be demolished |
| – The identification of the structure that is to be demolished.<br>– The checkout of the dimensions of the settlement, the construction and the space afferent to the works of demolishing.<br>– The identification of the demands concerning the protection of pavements and surroundings.<br>– The checkout concerning the dimensions of the building: the total height of the structure, the level heights, as well as the indent of the building.<br>– The checkout of the structure's construction method, the types of materials used in building's construction, the methods of construction used, special characteristics of the structure that need a special treatment during demolition, such as elements in console, prestressed and prefabricated elements.<br>– The checkout of the existence of pickups and installations that can affect the progress of the demolition and that need to be moved away before the actual demolition, such as water basins, air-conditioning installations and other utilities.<br>– The study of construction's history: inhabitants, the history of building's employment. |

**Table 1** (Continuation)

| Unities localization |
|---|
| – The checkout of all the utilitarian installations, underground and overground, that are in the surroundings.<br>– The cut-off of every utility of the building that is to be demolished, in conformity with the demands of utilities' companies.<br>– The set-up of the alimentation with some types of utilities during the demolition project, such as bringing up of water for the suppression of dust. |
| Organizing and programming the demolition |
| – The identification of the factors that can affect the demolition's programming: operational restrictions required by certain rules or by certain anticipated climatic factors.<br>– The making of a realistic demolition plan that will reflect the estimated time used for the approval and the willingness of the demolition process, the necessary time for the installation of precaution measures, the testing and the disposal of dangerous materials in case they exist, the cleaning and restoration of the settlement. |
| The testing and the disposal of dangerous materials |
| – The investigation – made by a specialist – for the determination of materials that contain asbestos.<br>– If there is necessary the destruction of the materials that contain asbestos, there is also necessary the effectuation of a rapport and a plan of reducing the quantity of asbestos, as well as a notification of starting the work with asbestos at work department. |
| Labour protection measures |
| – Demands of completing the protection of pavements and adjacent constructions for the protection of pedestrians.<br>– Demands of completing work panes and work platforms in order to retain the dust and rubble.<br>– Temporary suspensions and props for any weakened structure.<br>– The protection of the road service and the pedestrian traffic near the settlement.<br>– Suspensions for surrounding retaining walls.<br>– Safety procedures for the operations with machinery. An adequate carrier for the support of the machinery and the installation of some temporary suspension. |
| The rubble manoeuvring |
| – The selection and the disposal of unstructural materials such as the woodwork and their recycling or depositing.<br>– An adequate number of slides for removing the rubble depending on their rate of generation and evacuation.<br>– The planning of the traffic line for manoeuvring the rubble as well as reserving several parking places for lorries. |
| Stability checkouts |
| – The stability of the building that is to be demolished and of the mechanical equipments used.<br>– The effects upon nearby buildings or neighbouring properties. |
| Approvals |
| – The presentation of the supervision plan.<br>– The presentation of the details of the people capable of handling the machinery used in the demolition.<br>– The presentation of the details concerning the removal of the rubble, the organisation system. |

**Table 2**
*Activities that Take Place During Demolition*

| |
|---|
| – Precaution measures and temporary suspensions for nearby constructions in conformity with the proposed project.<br>– The disposal of dangerous materials is done after the demolition; chemical wastes like oils, asbestos or toxic chemical substances can be handled in conformity with the rules of chemical waste's disposal.<br>– All workers on the working site will be informed regarding the character of the project and they will be instructed regarding the labour protection.<br>– It will be established the access way in case of emergency.<br>– It will be established a clear and functional communication line with the person in charge of the working site.<br>– The demolition will be done according to the established project.<br>– The rubble will be disposed in order to avoid the agglomeration of the working site.<br>– The dust emission will be monitored according to the rules imposed by the Ministry of Environment.<br>– There is necessary a permanent supervision of the working site by the competent responsible of the working site, as well as the supervision made by a specialist in special structures.<br>– There will be taken measures for assuring the labour protection for all the employees on the working site, as well as the well-functioning of all the machinery on the working site.<br>– There will be assured the security of the working site.<br>– There will be programmed regular checkouts and inspections of the scaffolds, as well as special inspections before and after accidental fires. |

**Table 3**
*Activities that Take Place After Demolition*

| |
|---|
| – For sloping settlements or for those that have retaining walls, the following measures will be applied: the surface of the terrain will be calked in order to prevent water infiltrations; there will be assured the surface draining off; the demolition plan will be in the control of the foundation's building contractor in order to keep the temporary suspensions built during demolition.<br>– The limits of the settlement will be delimited and assured in order to prevent fraudulent entry.<br>– The settlement will be cleaned from rubble and will be levelled.<br>– If any building pits, these will be protected. |

## 5. Organising and Dimensioning the Spaces for Serving the Working Site's Personnel

Within the spaces for serving the working site's personnel are included the following groups of constructions: housing constructions and their extensive constructions (bedrooms, cafeterias, bathrooms, laundries, etc.); administrative constructions (offices, guard and control compartments, dumps and stations for guard installation against fires).

In the case of demolition projects there can be invoked housing objects with mobile or demountable character, necessary until the end of the project or it can be invoked the solving of houses on a local plan. Also, if the project of demolition contains more spaces that are to be demolished, these can be used provisory for the development of certain activities.

### 5.1. The Determinig of Water Consumption

In demolition working sites, water is consumed for technological, domestic, sanitary purposes and for controlling fires. Because the unity's water necessities are unknown, and the consumption is subdued to some big nonuniformities, its establishing is quite difficult and can't be done with accuracy. On the working sites with a normal consumption of water, the water quantities for the production process is determined in function of some average consumptions established for the main works on the site.

In technological purposes, water will be used for cooling the cutting-concrete blade, for washing the machinery that leaves the working site for the transportation of rubble, for continuous aspersion of the wall and the concrete structures that will be cracked by hammer drills and by fluid clipper, as well as after their fall, when they are transformed into rubble to make sure that large quantities of dust won't get scattered. Also, in some cases water can be used even for the demolition of some construction elements or portions, through the demolition technology that uses high pressure water jets and for soaking the buildings that are to be demolished through the method of controlled explosion.

On the working sites that have a large consumption of water, the water demand must be calculated in different stages of the works' execution, making calendar graphs in order to establish the height of consumption.

In the case of ordinary works, the water discharge for the development of demolition activities is calculated as following:

$$\mathrm{DW}_d = \frac{1.2 K_n \sum W_{c_i}}{8\ \mathrm{h} \times 3{,}600\ \mathrm{s/h}}, \tag{1}$$

in which: 1.2 is the factor that takes into account unexpected consumptions; $\mathrm{DW}_d$ – the water discharge for execution needs, expressed in litres per second; $W_{c_i}$ – water consumption for each consumer, in litres on a shift with the duration of 8 h; $K_n$ – the factor of ununiformity of the water consumption on a shift.

The obtainment and the distribution of water on the working site imply a consumption of electric energy, as well as other expenses (creating the source, water purification installations, their maintenance, etc.), which makes necessary the intensification of water saving actions, by applying the following measures:

the opening of water alimentation points only in places that are strictly necessary; the use of hydraulic soil and rock dislocation only in well-justified cases; the use of some device that shall adjust the water consumption machinery and vehicles-cleaning stations, etc.; water recirculation, whenever it is possible; the well-ballanced organisation of powering with water the showers, the laundries.

### 5.2. The Determination of Electric Energy Consumption

The working sites are great electric energy consumers, because of the mechanization of works. The cost of electric energy represents, at major works, about 1.5...2.5% of the entire cost. Therefore, electric energy has several uses (in powering vehicles and machinery, blowpipes for cutting the fixtures, oxyacetylene flame, different devices of cutting and cracking connected to the electric network, the lighting of productive auxiliary stations, of dumps, of social and administrative buildings).

The total necessary electrical power is obtained by totalling the power necessary on each consumer, as following:

$$P_T = \frac{K_{np}}{\cos\varphi}\left(K_{s1}\sum P_n + K_{s2}\sum P_{ii} + K_{s3}\sum P_{ie}\right), \tag{2}$$

where: $P_T$ represents the total necessary power, [kW]; $K_{np}$ = 1.10 – the factor through which are taking into account network power loses; cos $\varphi$ – network power factor, which depends on the number and the kind of the capacities (in average, is 0.75); $P_n$ – the nominal power of machinery and installations, [kW]; $P_{ii}$ – the illuminators' power, for interior illumination; $P_{ie}$ – the illuminators' power, for exterior illumination; $K_{s1}$, $K_{s2}$, $K_{s3}$ – homologous factors of simultaneity.

### 5.3. The Determination of Blast Air Consumption

Blast air is used, at demolition works, for energizing the air tools (perforators, air hammers, air scissors, etc.) for energizing different devices and machinery.

Usually on demolition working sites there are used stations of mobile compressors, that are commonly placed on the works' execution site.

The blast air quantity is determined using the following rule:

$$\mathrm{QA} = K_a K_{sa} E q_{\mathrm{t}}\,, \tag{3}$$

where: QA represents the flow of the compressors' installation, [$m^3$/min], induced air; $K_a$ – the factor of blast air loses in the network (1.3...1.5); $K_{sa}$ – the

factor of simultaneity (for a connected tool = 1; for 2...4 tools = 0.90; for 4...6 tools = 0.80...0.83, etc.); $q_t$ – the consumption of blast air for every air tool, [$m^3$/min], served by the respective installation.

## 6. The Assurance of the Necessary Logistics for the Demolition – Decommission of the Constructions

During the development of the processes of the demolition works' production complex and numerous problems come out, that can generate a lot of possible versions, in what concerns manual-powered execution of the works.

For obtaining the best technical-economical results, in function of the actual work conditions, it is necessary that from the multitude of possible versions to be chosen a version that is as close as possible to the optimal solution. Therefore, from simple manual processes of cracking and perforation, there can be got up to complex versions of demolition through powered means.

In Fig. 2 there is presented the variation curve of the economical efficiency in function of the technological versions of mechanizations, where: $N_A$ is the number of allowable versions; $N_P$ – the number of possible versions; $E_A$ – the efficiency of the applied solution.

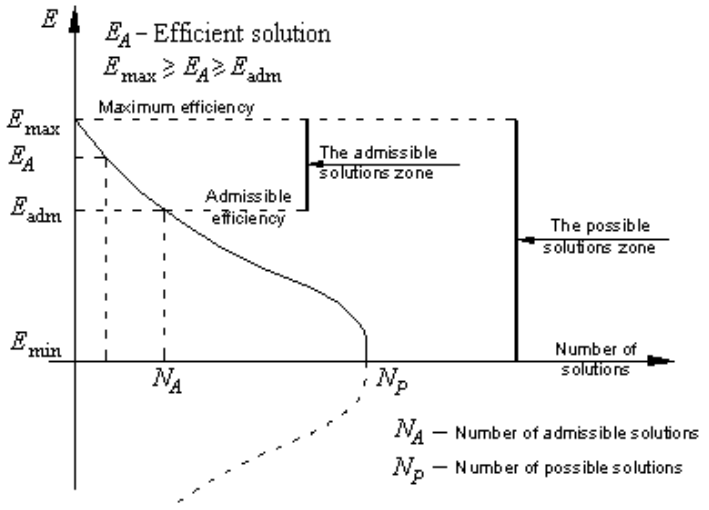


Fig. 2 – The variation curve of the economical efficiency.

The automation and robotization of the decommission – demolition works can be seen as an advanced, present-day stage of the technical progress in the field of mechanization. Thus, after a chronological analysis of the technical

progress in the field of construction works' mechanization, there can be identified the following development stages: partial or simple mechanization, complex mechanization, automation and robotization (Fig. 3).

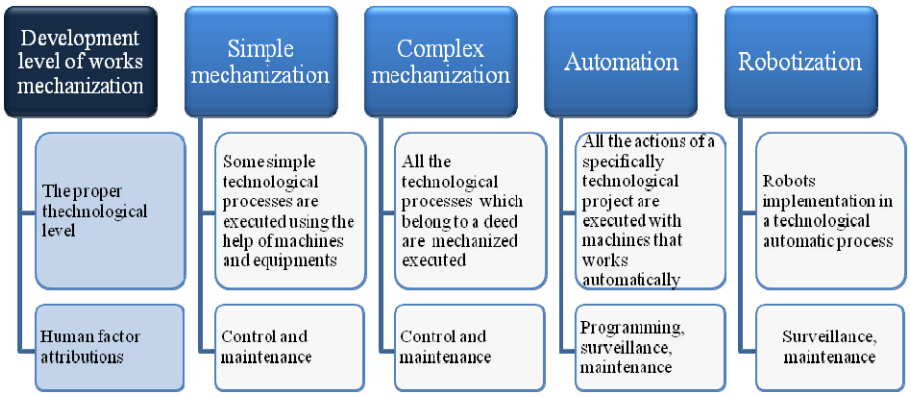


Fig. 3 – The development stages of the works' mechanization.

To be made a fairly roundly analysis of the technical-economical conditions of powered execution of a demolition work, there is necessary the stocktaking and the study of every possible mechanization version, corresponding to the technical endowment or the posibilities of endowment and leasing that it disposes.

In that view, based on the known or designed execution technologies, it is recommended:

a) the establishing of the board of the possible mechanized technological versions, for each activity, individually;

b) the forming of machinery systems on versions of technological solutions of the development of the processes.

## 7. Conclusions

The completion of the demolition's execution in the initially established terms and conditions is conditioned by the knowing of the project, its phasing, the knowing of the objective that is to be demolished and of its structure. The placing of the equipment's powering sources, of the temporary communication ways, of the water and electric networks, as well as of the objects of temporary constructions of serving the working site's personnel is another factor that plays a major role in respecting the terms of execution of the demolition project. As concerns the plan of organisation of the working site to be conceived judiciously, to answer to all the specifies demands, it must be done in several versions, being selected afterwards the optimal version.

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## ASPECTE PRIVIND ORGANIZAREA DE ŞANTIER PENTRU DEMOLAREA CONSTRUCŢIILOR

(Rezumat)

Organizarea unui şantier pentru demolarea unei/unor construcţii solicită, de fiecare dată, rezolvarea unor probleme care se referă la asigurarea unor condiţii optime pentru desfăşurarea activităţii de bază.

Sunt descrise principalele etape care trbuie parcurse la organizarea unui şantier de demolare. Astfel, se aduce în discuţie probleme ce se leagă de proiectul de organizare al unui şantier de demolare, organizarea teritoriului unui şantier, liste de activităţi ce au loc înainte, în timpul şi după activitatea de demolare. Se prezintă modul de organizare şi dimensionare a spaţiilor de servire ale personalului şantierului şi se enumeră aspecte privind asigurarea logisticii necesare pentru dezafectarea – demolarea construcţiilor.