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# CONSIDERATIONS REGARDING PARAMETERS DEPENDENCIES OF REINFORCED CONCRETE SHARE EQUIPMENT TYPES FOR BUILDINGS DEMOLITION

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## ABSTRACT

*The models of demolishing jaws and pulverizers that are already on the market give us the necessary information for the development of a research program regarding the optimum choice of the necessary machinery in demolishing projects, the evaluation of expenses and the dimensioning of the communication ways used for the chosen machinery. The result of this analysis, using the technical documentation supplied by the machinery producers, can be used as a guide in designing this kind of machinery and as a verifying tool in predimensioning the equipment.*

**KEYWORDS:** equipment, pliers for demolition, sizing

## 1. INTRODUCTION

The concrete demolition equipment available on the market allows us to see the big picture in the developement of a research. This gives us information on the optimal way of choosing the needed machines in a demolishing project, in estimating costs (rent, maintenance, fuel, etc.)., in choosing the main machine and the necessary hydraulic systems needed to operate the concrete processors. It also allows us to recognise the possibility of dimensioning the machines, access ways depending on their weight and jig dimensions (access ramps, cranes for positioning them on top of the buildings, complementary support systems between the building's levels, etc).

According to the experience acumulated through time, the companies that produce this type of equipment have eliminated the non advantageous operating types. On account of this, by using the available data from the technical documentation, the result of this analysis can be used as a guide in designing these types of machines, because it offers a way of verifying the predimensioning of the equipment.

## 2. THE ANALYSIS OF THE DEPENDENCIES OF CONCRETE SHEARS FOR DEMOLISHING REINFORCED CONCRETE STRUCTURES

For designing or choosing these types of machines, it is necessary to have defined a set of initial parameters which can be adopted according to the necessities of usage of the demolishing machines.

Among these functional parameters, applicable to the categories of machines, we mention :

1.The necessary jaws opening the machine – parameter dictated by the dimensions of the reinforced structure element to be demolished;

2.The squeezing force (at the first tooth) - parameter dictated by the concrete type of the reinforced structure elements to be demolished ; The second force at the cutting blade level in case this one exists – parameter given by the reinforcement type. In the case of these two parameters there is a direct link, given by the fact that the clamp’s teeth and the blade are situated on the same mechanical element (the jaw);

3.The main equipment type is a dictated parameter mainly by the weight and the way of operating the working element (clamp), including the compatibility between the clamp and the main machine.

The first important parameter of the concrete cutters is the jaws opening, as shown below. To have a good productivity, the working element (the clamp) must also allow for a specific squeezeing force at the exterior tooth and also a short tehnologic time to ensure the fast breakage of the concrete.

After the graph analysis of the data, we observed a certain accordance opening – squeezeing force at the first tooth, which can be seen in figure 1.

Starting from concrete share data on the concrete, we made a graphcal representation of the squeezeing force at the point of the jaw’s exterior tooth depending on the maximum opening, too. We observed a particular distribution of the points, in 3 main directions. The points displacement suggests the possibility of a liniar regression for the 3 directions and we gain the equations of these directions : r1 (the maximum slope), r2 (the intermediate slope), r3 (the minimum slope), also the correlation coefficients for characterizing the link between the two parameters.

We can observe the fact that the r3 straight-line is generated by most of the points and for the other two, r1 and r2, we have 7 to 8 times less points. This suggests an affinity for the manufacturers of this type of machine to the r3 straight-line and implicitly the current market. The statistical processing of the data and graphs was done using MATHCAD software.

Calculating the results in the straight-line equation which models the first direction r1 is a correlation coefficient of 0,98, where x represents the opening of the jaw measured at the exteriot tooth.

The results were calculated as a corelation coefficient of 0,99.

Calculating results in the straight-line equation which models the first direction r3 with a corelation coefficient of 0,91.

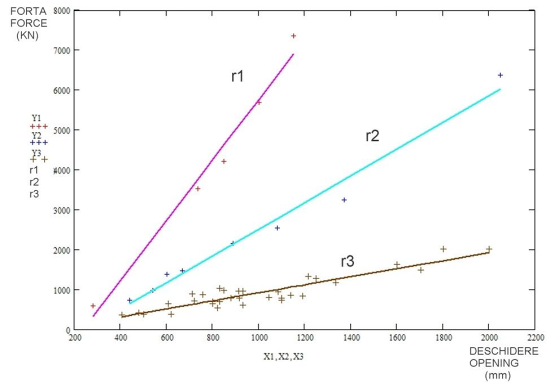


Figure 1. Opening – squeezing force at the first tooth dependency representation

In conclusion, you can write down a set of 3 liniar equations which model this dependency resembling to talk about three lines (wais) designing this type of equipmnet.

$$\begin{aligned} r1(x) &= 7{,}559 * x - 1795 \\ r2(x) &= 3{,}345 * x - 835{,}7 \\ r3(x) &= 1{,}009 * x - 94{,}6 \end{aligned} \quad (1)$$

We present the dependency graphs along only with the regresion equation, the corelation coefficient and the number of dependencies used for each of the cases.

We analized graphically the equipment weight – squeezeing force at the first tooth dependency and observed certain concordances between the different parameters. The dependency is represented in figure2.

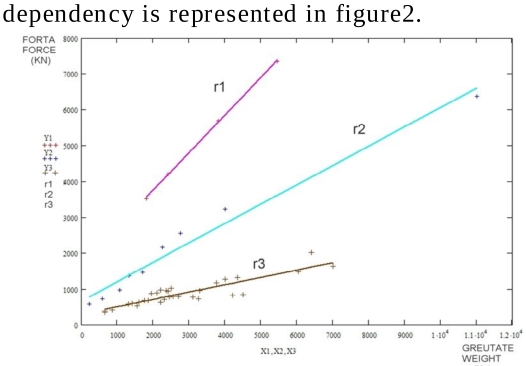


Figure 2. Equipment weight – squeezeing force at the first tooth dependency representation

In figure 2 you can observe the same 3 distinctive types of design approaching method of the concrete crushing shears, the most utilised version being r3 (minimum slope) with 31 cases out of 58, fact also determined for the opening – squeezing force at the exterior tooth dependency.

Following the same principle for regression, from the data we obtained the following set of equations:

$$\begin{aligned} r1(x) &= 1{,}044 * x - 1686 \\ r2(x) &= 0{,}541 * x - 668{,}9 \\ r3(x) &= 0{,}204 * x - 307{,}5 \end{aligned} \quad (2)$$

The correlation coefficients are for r1(x) – 0,99 , r2(x) – 0,99 , r3(x) – 0,80. According to these coefficients you can evaluate that the liniar modelling for the 3 cases is correct.

Another dependency finding is given by the opening scissors jaw at the first tooth and the equipment weight, parameters and it is ilustrated in figure 3.

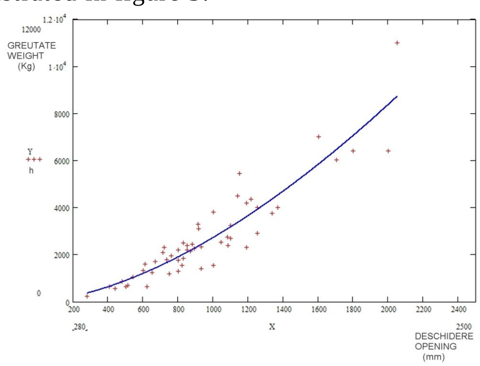


Figure 3. Opening jaw at the first tooth – equipment weight dependency

Opening cutters jaw at the first tooth – equipment weight dependency allows us to obtain general images of the working element dimensions depending on the jaws opening measured at the exterior teeth. This can be used for the assessment of the machine’s weight before beginning the designing process itself or purchasing the machine. This weight is necesary for the main machine determination on which the equipment will be fit.

The independent parameter in this case is the compulsory jaw opening according to the maximum dimensions of the reinforced concrete elements to be crushed.

Analysing the obtained point distribution from the values in the graphical representation of the opening scissors jaw at the first tooth – equipment weight, it can be observed that there is a slight tendency of upward curveing. Because of this a power function is proposed. Following the obtained results after calculus, we find the following equation that models the distribution:

$$H(x) = 0{,}035 * x^{1{,}63} + 29{,}5 \quad (3)$$

where x represents the jaws opening at the first tooth in mm. The corelation coefficient for this dependency is 0,92.

In this representation was used a number of 53 numerical dependencies.

The equipment weight – main machine type (its weight) dependency is ilustrated in figure 4.

Starting from the graph in figure 3 which ilustrates the opening scissors jaw at the exterior tooth – equipment weight dependency, the main machine type can be determined, which is to be used with a particular model of working equipment. The case here is represented by the reinforced concrete crushing clamps, using figure 4 or equation 3 obtained by regresion model with MATHCAD software.

This way we can make a preliminary estimation of the necessary parameters for the working equipment and the main machine depending on the jaws opening.

Analysing the distribution of the points obtained from the graphical representation of equipment weight – main machine type values (its weight), we can observe that this has a slight downward curveing tendency. Due to this a power function is proposed. Following the obtained results after calculus, it came down to the following equation that models the distribution:

$$G(x) = 0{,}053 * x^{0{,}806} + 0{,}283 \quad (4)$$

where x represents the equipment’s weight expressed in kg.

The correlation coefficient for this dependency is 0,91.

For this representattion we have used a number of 45 numerical dependencies.

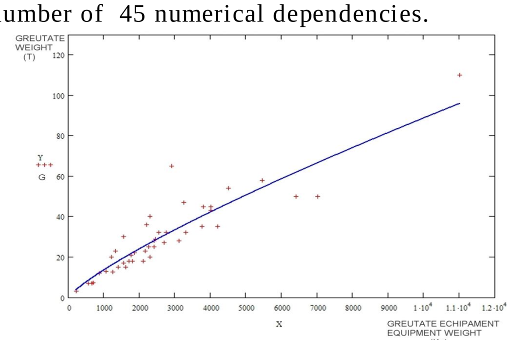


Figure 4. Equipment weight – main machine type (its weight) dependency

## 3. CONCLUSIONS

In this study the following set of dependecies were analysed:
opening – squeezing force at the exterior tooth ; equipment weight – squeezing force at the first tooth ; opening shares jaws at the first tooth – equipment weight ; equipment weight – main machine type (its weight).

The study can be extended to other sets of parameters, too, needed for choosing or designing concrete or reinforced concrete share structure type and also for analysing the shares type equipment for detaching concrete off the reinforce bars, equipment that presents some particularities compared to the concrete scissors.

Figure 5 presents the way of choosing the equipment type and main machine using the graphic representations from this study.

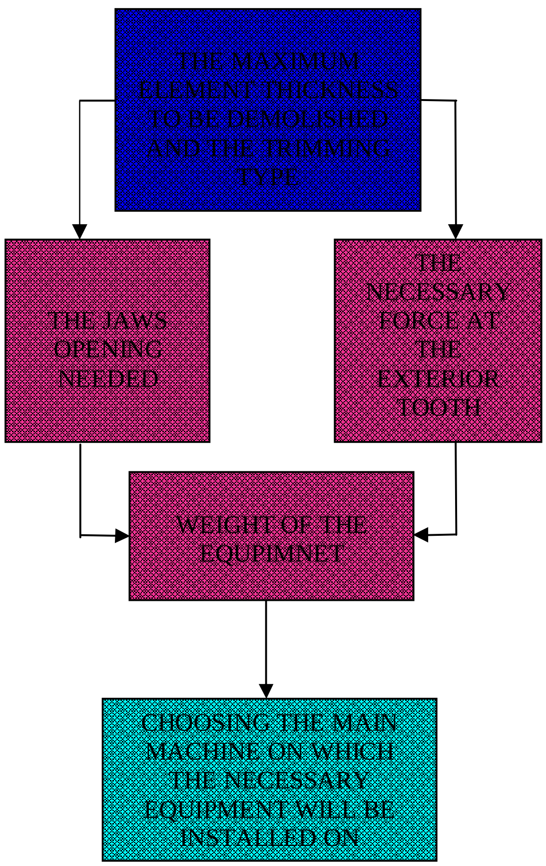


Figure 5. Choosing the equipment type and the main machine using graphical representations

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