

## IMPROVED SHAPE OF THE TOOTH FOR BUCKET WHEEL EXCAVATOR FOR THE CONDITION OF ROMANIAN OPEN PITS

*DAFINOIU, MIHAIL<sup>1</sup>, TOMUȘ, OVIDIU-BOGDAN<sup>2</sup> DINESCU, STELA<sup>3</sup>  
STĂNILĂ, SORINA DANIELA<sup>3</sup> ANDRAȘ, ANDREI<sup>4</sup>*

*<sup>1</sup>Eng.Ph.D., S.N.L. "OLTENIA" Tg-Jiu, Romania, <sup>2</sup>Ph.D. student, <sup>3</sup>Ph.D., Senior lecturer  
<sup>4</sup>Ph.D., Assist. Prof., University of Petroșani, Romania,*

***Abstract:** The paper deals with the aspects related to conceiving and realizing a tooth for bucket wheel excavators devoted to be used in Romanian open pits for excavating the overburden rocks, based on the results of cutting process experimental and theoretical research*

***Keywords:** excavator, teeth, shape, lignite, open pit*

### 1. INTRODUCTION

The research performed, results obtained comparison realized field observation, lead to the conclusion that in the conditions of Romanian open pit lignite mines two type of teeth are recommended for excavating the overburden rocks and lignite in order to increase the effectiveness of bucket wheel excavators and increasing the life of the used teeth.

Establishing the type of teeth is a complex problem, due to the necessity to find compromise solution taking into account the contradictory influence of parameters characterizing the shape and cutting characteristics of teeth. The data regarding the lignite cutting were taken from the literature, and those regarding the overburden rock issued from performed research.

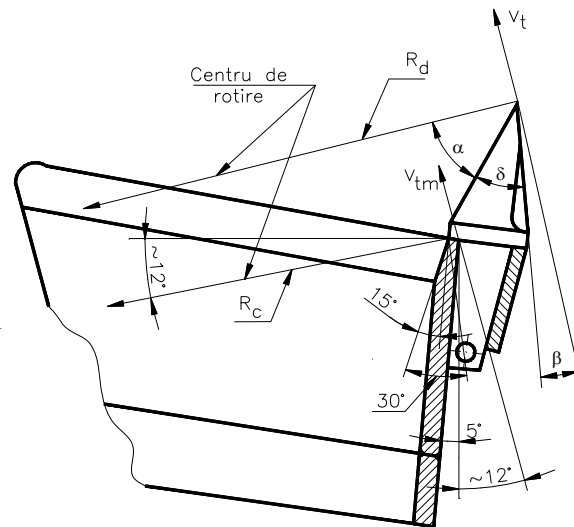
From the comparative study it can be seen that the mechanical solicitation of teeth in case of rock cutting are comparable and in some cases inferior to those relative to lignite. In present analysis we do not taken into account the influence of the wear of teeth which represents a very important factor of influence.

### 2. ANALYSIS OF SHAPE AND GEOMETRIC PARAMETERS OF TEETH

Starting from the above mentioned considerations, from point of view of geometric parameters it results that in Romanian coalfield it is necessary maximum two type of teeth,

one for lignite and other for overburden rocks. In figure 1 it is presented the mounting scheme of the tooth and in table 1 the geometric parameters.

Taking into account the scheme of mounting the teeth on bucket proposed from the fig 1 and table 1 the tooth presented in fig. 2 was conceived.



**Fig. 1.** The scheme of mounting the tooth on the bucket

*Table 1.* Recommended parameters for overburden rock cutting tooth

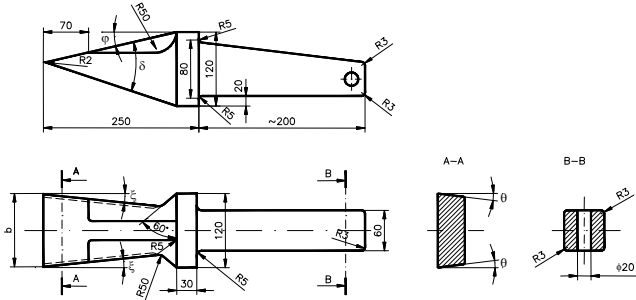
No.	Geometric parameters	Symbol	Type of tooth	
1.	RAke angle	$\alpha$	$55^\circ$	$52^\circ$
2.	Clarence angle	$\beta$	$7^\circ$	$7^\circ$
3.	Edge angle	$\delta$	$28^\circ$	$31^\circ$
4.	Cutting angle	$\gamma$	$35^\circ$	$38^\circ$
5.	Lateral angle (longitudinal)	$\xi$	$5^\circ$	$5^\circ$
6.	Lateral angle (transverse)	$\theta$	$3^\circ$	$3^\circ$
7.	Setting angle	$\varphi$	$13^\circ$	$13^\circ$
8.	Blade width, mm	b	120	120

At both types of teeth the longitudinal lateral angle was considered  $5^\circ$  and transverse lateral angle  $3^\circ$  in order to avoid the friction between the lateral parts of tooth and rock.

The two types of tooth has the same shape, but the are different by the active part's geometric characteristics. The first type, I is a lighter version, with larger rake and smaller

blade angle and is devoted to cut the rocks with low resistance ( $A = 200 \dots 450 \text{ N/cm}$ ) as it is the situation in some pits for the gray shale with fine sand.

The second type, II is a more robust version with smaller rake and larger blade angle, and is recommended for harder rocks as the marly shale and lignite other pits, with resistance between  $A = 450 \dots 800 \text{ N/cm}$ .



**Fig. 2.** Proposed parameters for the tooth

The implementation of proposed teeth supposes the delivery of design documentation of teeth and bucket, because the parameters of location of teeth on bucket are influenced by the geometric parameters of teeth.

Regarding the recommended material for the representative overburden rock, taking into account the abrasiveness producing wear, the following characteristics are recommended:

- tensile strength:  $\sigma_i \geq 1000 \text{ N/mm}^2$
- flow limit :  $\sigma_c \geq 700 \text{ N/mm}^2$
- specific deformation :  $\epsilon > 5 \%$
- Brinell hardness : HB 3000 ... 3600  $\text{N/mm}^2$
- resilience : 80 ... 100 J

The validation of the types of teeth can be done only on basis of real condition experiments (given excavator, given rock, given pit etc.).

**3. DESIGN AND DEVELOPMENT OF THE TEETH**

On the basis of performed research, it was conceived, designed and developed a new tooth presented in figure 3, as a manufacturing drawing.

To conceive of tooth it was taken into account the fact that this one will cut overburden rocks with plastic properties, where a larger blade width has advantages in cutting process.

