## IV. CONCLUSIONS

The advantages of this modification of blasting geometry without subdrilling are : reducing explosive usage, faster cycle time to drill a blast hole, increase drilling efficiency, longer drill bit lifetime and reduce drilling cost.

Blasting design for jointed limestone do not need subdrilling with geometry [burden x spacing x (hole depth– sub drilling)] = [4m x 5m x (15m – 0m)] with rectangular zigzag drilling pattern and deck loading system. Blasting fragmentation is suitable for bucket capacity maximum 5.4 $m^3$. Deck loading system is more suitable for jointed limestone compared to coloumn loading system, because the blasting energy on the deck loading is distributed more evenly so that boulders percentage relatively decrease to 50% and excavator productivity increase up to 36.10% and blasting cost decrease 17.18%.

Blasting design jointed limestone for excavator with bucket capacity more than 5.4 $m^3$, for example for excavator Hitachi EX 2000 with bucket capacity 10,5 $m^3$can be applied blasting geometry [burden x spacing x (hole depth – subdrilling)] = [5m x 5m x (15m – 0m)] with deck loading system and square-zigzag drilling pattern.

Basically in blasting geometry design, the size of resulted fragmentation should be suitable to the bucket capacity of excavator.

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