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Productivity of Construction Equipment

إنتاجية الآليات الأنشائية

❖ *Productivity of Equipment*

In general, productivity means the percentage of outputs to inputs. It is also possible to define the productivity in construction works as explained below.

بشكل عام، الإنتاجية تعني نسبة المخرجات إلى المدخلات. أما الإنتاجية في الأعمال الإنشائية، فتعني الأتي

Productivity in Construction: - ***the number of completed units of work by skilled worker or efficient machine within a specific time. E.g. the productivity of skilled worker is 5 m3/hr and the productivity of excavator is 25 m3/hr.***

الإنتاجية في الأعمال الإنشائية: عدد الوحدات المنجزة من العمل بواسطة أيدي عاملة ماهرة و آليات مختصة و كفوءة خلال فترة محددة من الزمن. كمثال، إنتاجية عامل ماهر 5 م^3 و إنتاجية حفارة 25 م^3

Performance: - ***the percentage of the planned standard time required performing a specific activity to the actual observed time at the work site. E.g. the bulldozer performance is 80% and the worker performance is 70%.***

النسبة المئوية للوقت القياسي المخطط له في أداء فعالية معينة إلى الوقت الفعلي المسجل في موقع العمل. مثلا أداء المقلعة هو 80٪ وأداء العمال هو 70٪.

$$Performance = (Standard\ Time\ (hr) / Actual\ Time\ (man - hr)) \times 100\%$$

$$Standard\ Time = Basic\ Time + Allowances\%$$

Ex/ the basic estimated time by a contractor to excavate 1 m^3 is 4 minutes by using an excavator 0.5 m^3 and the allowances is (50%). 100 m^3 have been completed (excavated) within 2 days. What is the performance of the excavator and its operator if the working time is 8 hours per day?

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Solution:

Standard Time **(S.T.) = B.T. + Allow.**

= 4 + (50/100) × 4

= 6 min/m^3 = 6/60 × 100 m^3 = 10 hr (to completely excavate the 100 m^3)

Actual Time **(A.T.) = 2×8×1 = 16 man – hr**

So, Performance = (10/16) × 100 = 62.5%

❖ *Equipment Productivity Rules*

- **Cycle Time = Going Time + Returning Time + Fixed Time**
- **No. of Cycles per one hour = Operating Factor / Cycle Time**
- **Productivity of Equipment = No. of Cycles × Capacity of (blade, bowel, etc.) in bank measure**
- **Capacity of (blade, bowel, etc.) in bank measure = Capacity in Loose Measure × S.F.**

❖ *Bulldozer*

It is one of the equipment used in the construction projects for the soil works to clean the site, open the roads, pushing the soil and loading it, etc. It is possible to classify bulldozer types according to the following:-

- **Wheels**
  1. **Wheeled**
  2. **Crawler**
- **Moving the blade with**
  1. **Cable**
  2. **Hydraulic**

❖ *Bulldozer Use in Construction Works*

1- Cleaning the site from cut wood and trees.	**تنظيف الموقع من الأشجار**
2- Opening the roads in the mountains and rocks.	**فتح الطرق الوعرة في الجبال**
3- Pushing the soil for about 100 meters.	**دفع التربة لمسافة 100 م**
4- Assisting the scrapers in loading process.	**مساعدة القاشطة في التحميل**
5- Distributing the filled soil at the site.	**نشر التربة أثناء عملية الدفن**
6- Refilling the trenches and pits.	**اعادة مليء الخنادق**
7- Cleaning the site from the rubbles.	**تنظيف الموقع من الأنقاض**
8- Working on road maintenance.	**العمل في صيانة الطرق**
9- Cleaning the stores of bring in soil and rocks.	**تنظيف مواقع تكديس التربة و الأحجار**

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Bulldozer cleaning the site of trees



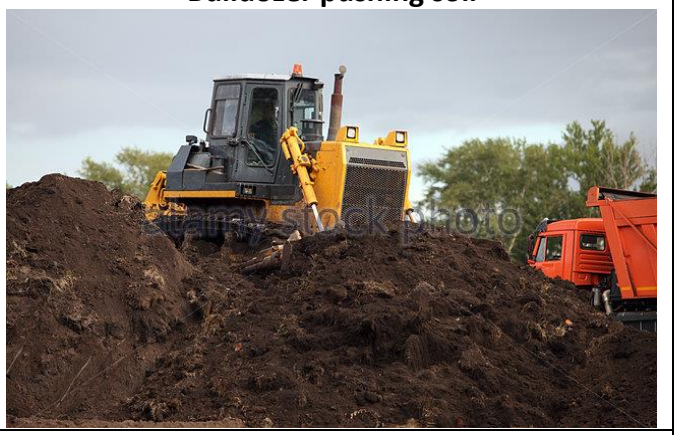
Bulldozer cleaning the site of rocks & boulders



Bulldozer opening the road



Bulldozer pushing soil



Bulldozer working on road maintenance



Ex/ find the productivity of a bulldozer that has the following specifications:

- **Blade length 2.9 m and height 0.9 m**
- **Soil grade in front of the blade 1:2**
- **swelling percentage (Sw) 25%**
- **Operation factor 50 min/hr**
- **Speed during pushing the soil is 2.4 km/hr**
- **Speed in return is 5.6 km/hr**
- **Fixed time 0.32 minute**
- **Distance of soil transfer is 30 m**

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Solution:

Going Time = (30 × 60) / (2.4 × 1000) = 0.75 min

Returning Time = (30 × 60) / (5.6 × 1000) = 0.32 min

Fixed time = 0.32 min

Cycle time = 1.39 min

No. of Cycles = 50 / 1.39 = 35.97 cycles

Blade volume in loose measure = (2.9 × 0.9 × 1.8) / 2 = 2.35 m^3

Loose = (1 + Sw) × Bank

Blade volume in bank measure = $\frac{1}{(1+0.25)}$ × 2.35 = 1.88 m^3

Bulldozer productivity per hour = 1.88 × 35.97 = 67.62 m^3