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# Scrapers

# القاشطات

**It is the machine that is used for scraping, transferring and distributing all types of soils, except those with rocks. The scraper is considered as the choice in between loading equipment such as, the power shovel, and the transferring equipment such as, trucks. Therefore, it is not the best in loading or transferring.**

القاشطة آلية تستخدم في قشط ونقل وتوزيع التربة بانواعها عدا الصخرية منها. تعتبر الحل المتوسط بين مكائن التحميل مثل المجرفة الالية والحفارة الناعورية وبين مكائن النقل مثل الشاحنات وعليه فهي ليست الافضل في عملية التحميل او النقل.

**The scraper consists of a big bowel which is carried by a steel structure supported on two wheels. The bowel is movable in the vertical direction and opened in beneath. This opening is supported with a sharp cutter for the soil along with bowel width. The opening can be closed with a movable cover. The scraper capacity can be up to 40 tons.**

تتكون القاشطة من وعاء بشكل طاس كبير (bowel) محمول على هيكل فولاذي مستند على اطارين مطاطيين ويكون هذا الوعاء قابل للحركة العمودية ومفتوح من الاسفل. تسلح الفوهه السفلى الملامسة للتربة بسطح معدني حاد قاطع للتربة وتكون هذه الحافة مثبتة على طول عرض الحوض ويمكن سد الفتحة بغطاء متحرك, سعة القاشطة قد تصل الى 40 متر مكعب.

## ❖ *Scraper Types and Volumes*

**1- Towed by wheeled tractor** قاشطات مسحوبة بواسطة جرار مدولب

**2- Towed by crawler tractor, classified into:** قاشطات مسحوبة بواسطة جرار مجنزر

**a- one engine scrapers** قاشطات ذات محرك واحد

**b- Two engine scrapers** قاشطات ذات محركين

**c- Two bowel scrapers** قاشطات ذات وعائين

**d- Scrapers with mulita engines and bowels operated electrically.**

قاشطات متعددة المحركات و الأحواض تدار كهربائيا

**e- Crane scraper** القاشطات الرافعة

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## ❖ *Scraper Operation*

**The bowel is moved down and then the sharp edge of the bowel goes inside the soil with 15 cm depth, and the soil move inside the bowel with the movement f the scraper until it gets filled, then the bowel moves up and the opening is closed. The scraper transfers the soil to where it is wanted to be filled and distributed. The opening beneath the bowel is opened and the soil comes out with the assistance of a thrower. It is possible to use the scraper in excavation works of roads and airports, because it can excavate, and distribute soil and also do preliminary compaction while it is moving on soil layers.**

**يتم تدوير الوعاء نحو الاسفل بحيث تغرز حافة الوعاء القاطعة بمقدار حوالي 15 سم في التربة وعند سير الالية تغرس التربة داخل الوعاء وتتكدس فيه الى ان تملئ حينذاك يتم رفع الوعاء وتغلق الفوهه بواسطة الغطاء المعدني الخاص وتنقل التربة الى المحل المراد فرشها فيه حيث يرفع الوعاء ويفتح الغطاء مما يؤدي الى تفريغ وفرش التربة ويساعدها في ذلك قاذف خاص مركب داخل الوعاء الى ان يتم تفريغ الوعاء, ممكن استخدام القاشطة في الاعمال الترابية للطرق والمطارات حيث انها تقوم بالاضافة الى حفر ونشر التربة بالرص الاولي عند سيرها فوق طبقات من التربة تم نشرها سابقاً.**

**ملاحظة: حجم التربة الرخو يعادل 96% من حجم التربة المكدسة في وعاء القاشطة، مما يعني:**

**Loose measure of soil volume = 0.96 × volume of the soil excavated and collected in the bowel**

**Ex 1/ what is the maximum speed of a tractor drawing a scraper, by using the performance chart, taking into consideration the following information?**

**- The total weight (tractor and scraper) is 45000 kg**
**- Road grade is 6%**
**- rolling resistance is 40 kg/ton**

**Solution:**

**Percentage of R.R = 40 × 1/1000 (to convert ton into kg) = 4%**

**So the total resistance percentage (R.R and g) = 10%**

**From the performance chart with (W = 45000, T.R = 10%) we find the following:**

**The tractor moves at $2^{nd}$ gear with a speed of 9.6 km/hr and rim pull power of 4500 kg**

**Ex 2/ the volume of wheel scraper weighs 40000 kg when it is empty is 30 $m^3$ and 80000 kg when it is loaded. The scraper is towed by a tractor weighs 30000 kg and the loading is going down with a grade 10%. If the total engine power of the scraper and tractor is 65000 kg during loading, what is the gain on engine power during loading in downward direction?**

**Solution:**

**When the empty scraper is going down**

**Total Weight = (40000 + 30000)/1000 = 70 ton**

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**Power to counter grade = 10 × 70 × -10 = -7000 Kg**

**So, 7000 kg is the saving on engine power for tractor and scraper**

**The power gain percentage = 7000/65000 = 11% (approx.)**

**When the loaded scraper is going down**

**Total Weight = (80000 + 30000)/1000 = 110 ton**

**Power to counter grade = 10 × 110 × -10 = -11000 Kg**

**So, 11000 kg is the saving on engine power for tractor and scraper**

**The power gain percentage = 11000/65000 = 17% (approx.)**

**The means that the power gain percentage on engine power is about 11% when the scraper is empty and about 17% when it is loaded.**

**Ex 2/ with the following information:**

- **Net weight of scraper is 41906 kg**
- **The soil is muddy sandy soil weighted 32166 kg**
- **Stack size of the scraper is 24.5 m3**
- **Swelling percentage is 33%**
- **Rolling Resistance is 40 kg/ton**
- **Fixed time is 3 min.**
- **Operating factor is 50 min/hr**

**The distance of transferring is 1200 m as the following:**

| | Distance (m) | Grade % | Speed (km/hr) | Movement direction |
|---|---|---|---|---|
| 1 | 360 | +4 | 15 | Going when the equipment is loaded |
| 2 | 420 | +2 | 17.38 | |
| 3 | 420 | -2 | 42 | |
| 4 | 420 | +2 | 33.6 | returning when the equipment is empty on the same road |
| 5 | 420 | -2 | 42 | |
| 6 | 360 | -4 | 36 | |

**Find the following:**

1. **The required power for R.R and grade while going and return.**
2. **The transferred soil for one day (productivity per one day) if work is 8 hours per day.**
3. **If it is required to transfer 16500 m3 within 5 days, how many scrapers are required to finish the work?**

**Net weight for scraper = 41906 kg / 1000 = 41.91 ton**

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**Loaded weight for scraper = (41906 + 32166) kg / 1000 = 74.07 ton**

**1- Going loaded**

**P1 = 40 × 74.07 + 10 × 74.07 × (+4) = 5925.6 kg**

**P2 = 40 × 74.07 + 10 × 74.07 × (+2) = 4444.2 kg**

**P3 = 40 × 74.07 + 10 × 74.07 × (-2) = 1481.4 kg**

**Returning empty**

**P4 = 40 × 41.91 + 10 × 41.91 × (+2) = 2514.6 kg**

**P5 = 40 × 41.91 + 10 × 41.91 × (-2) = 838.2 kg**

**P6 = 40 × 41.91 + 10 × 41.91 × (-4) = 0 kg**

**2- Going Time = [(360 × 60) / (15 × 1000)] + [(420 × 60) / (17.38 × 1000)] + [(420 × 60) / (42 × 1000)] = 3.49 min**

**Returning Time = [(420 × 60) / (33.6 × 1000)] + [(420 × 60) / (42 × 1000)] + [(360 × 60) / (36 × 1000)] = 1.95 min**

**Cycle Time = 3.49 + 1.95 + 3 = 8.44 min**

**No. of Cycles = 50/8.44 = 5.92 = 6 cycles**

**Productivity of Scraper per one hour = 0.96 × 24.5 × [1/(1+0.33)] × 6 = 106.1**

**Productivity of Scraper per one day = 106.1 × 8 = 848.8 m3**

**3- Productivity of Scraper for 5 days = 848.8 × 5 = 4244 m3**

**No. of required Scrapers = 16500/4244 = 3.888 = 4**

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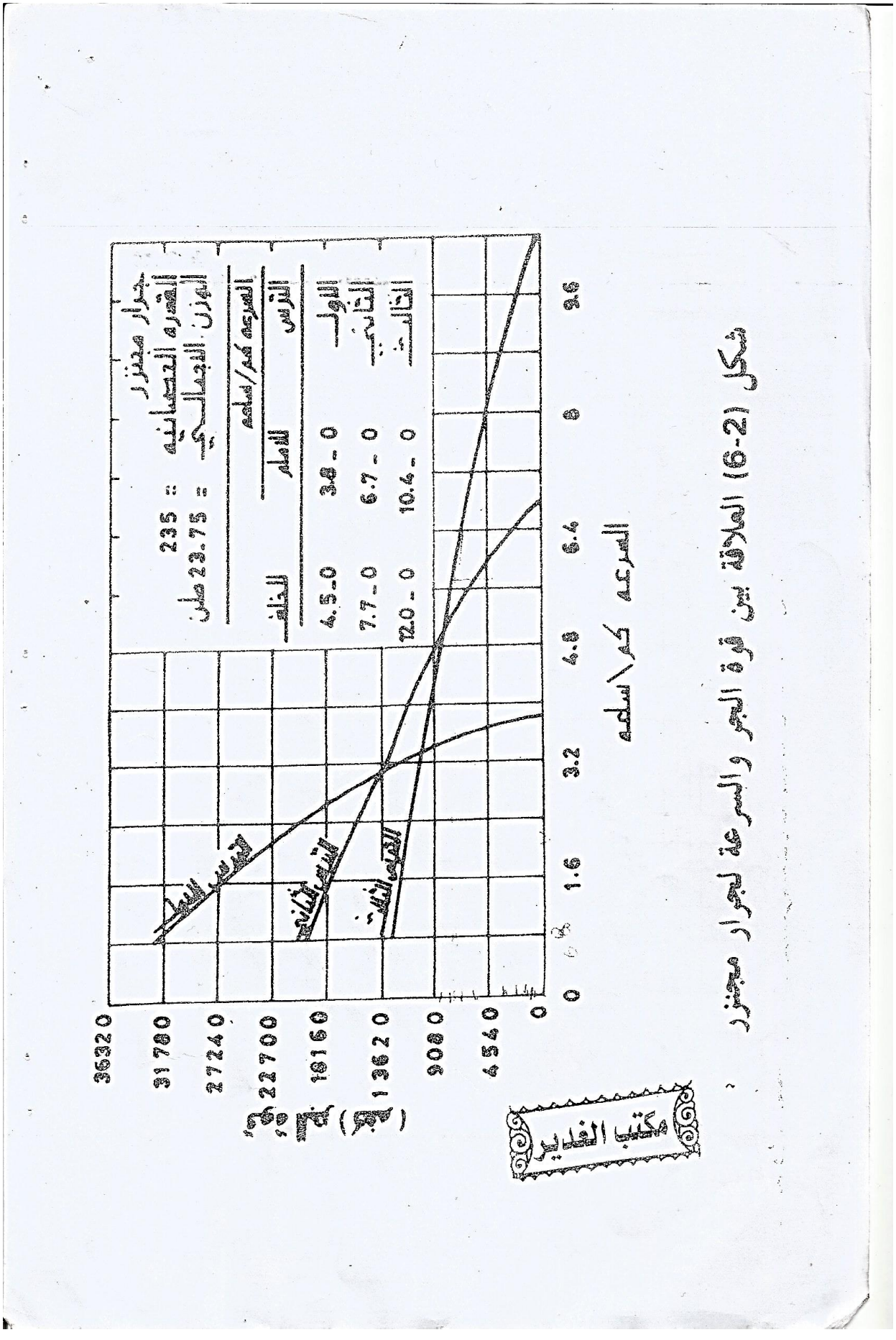


شكل (6-2) العلاقة بين قوة السحب والسرعة لجرار مجنزر

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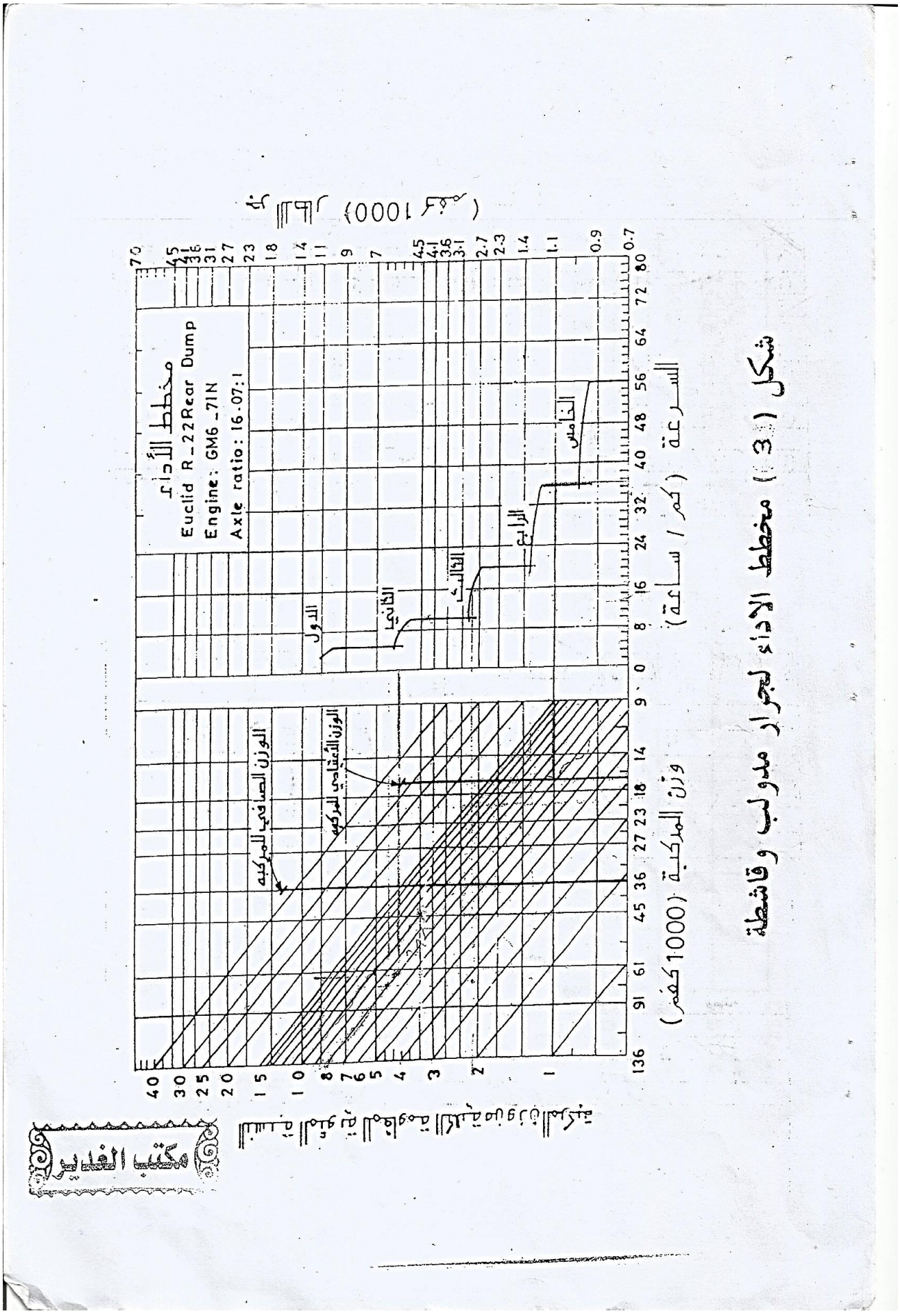


شكل ( 3 ) مخطط الاداء لجرار مدولب وقاشطة

مكتب الغدير