Treasure Hill Comments

Nicole Deforge [ndeforge@fabianvancott.com]
Sent: Thursday, August 03, 2017 4:43 PM
To: Francisco Astorga; Treasure Comments
Attachments: THINC July planning commis~1.pdf (1001 KB)

Dear Francisco,

Please include the attached letter with the public comments for the Treasure Hill conditional use permit application. Please note that included with the letter are sources for the swell figures mentioned by THINC at the July planning commission meeting, as requested by Adam Strachan.

Thank you.

Nikki

NICOLE M. DEFORGE
Attorney
FabianVanCott
215 South State Street, Suite 1200
Salt Lake City, UT 84111-2323
Phone: 801.574.2620
ndeforge@fabianvancott.com
www.fabianvancott.com

NICOLE M. DEFORGE
DIRECT 801.531-8900
ndeforge@fabianvancott.com

August 3, 2017

VIA E-MAIL (treasure.comments@parkcity.org)

Park City Planning Commission
P.O. Box 1480
Park City UT 84060

Re: Treasure Hill Conditional Use Permit Application – July 12, 2017 Planning Commission Meeting

Dear Members of the Park City Planning Commission:

I am writing on behalf of THINC, Inc., a non-profit organization comprised of hundreds of Park City residents, business owners, and home owners. This letter is intended to supplement the public comments made on behalf of THINC at the July 12, 2017 meeting of the Planning Commission with respect to Project Number PL-08-00370, Treasure Hill Conditional Use Permit Application, Creole Gulch and Town Lift Mid-Station Sites. It is also intended to provide a written version of the comments provided to the Planning Commission by Brian Van Hecke at the July 12, 2017 meeting, as requested by Chair Strachan.

First, as a general observation, the Applicant is continuing its practice of withholding the requisite detail on the Treasure Hill project and promising it at some unknown time in the future. It obtained its Master Plan approval based on one set of plans and promises—and was expressly directed by the City at that time that it would need to provide detailed information on those plans at the conditional-use review stage. Then it substantially revised those plans and promises during this years-long conditional review process, claiming that it was not bound by the plans it provided at the Master Plan stage.

Now the Applicant hopes that the City will let them off the hook again and simply grant a conditional use permit without having provided much of the detail needed for the project and required of a conditional use application. The Applicant promises to provide that detail later still—and simply expects the City to trust that the details will actually resemble what was approved as part of the Master Plan. But the devil is always in the details. As part of the Master Plan approval, the Applicant was required to provide that detail now—it cannot be allowed to punt that ball even further down the road and hope that no one will notice any inconsistences between what was actually approved in 1985 and what is actually going to be built.

<u>Construction Plans/Traffic</u>

As for its construction plans. Paragraph 9 of the Master Plan approval specifies that "at the time of conditional use review/approval, individual projects or phases shall provide detailed ... construction staging plans." Instead of providing "detailed construction staging plans" for the CUP review, Applicant's Constructability Report provides 9 sentences. As for construction phasing, the report includes only 5 sentences. As the Planning Staff noted, there is no timeframe at all for the various construction phases, such as excavation, footing & foundation, vertical construction, and so on. Such an incomplete application does not comport with the Master Plan approval, and should therefore not be approved. *See Keith v. Mountain Resorts Development, LLC*, 2014 UT 32, ¶ 31, 337 P.3d 213 ("[a] development approval does not create independent free-floating vested property rights – the rights obtained by the submission and later approval of a development plan ***are necessarily conditioned upon compliance with the approved plan***.") (emphasis added).

Although the Applicant previously submitted a few more details in the 2006 presentations made by Big-D to the Planning Commission, it is unclear from Big-D's May 30, 2017 Construction Feasibility Report, which Applicant just submitted, whether that report incorporates anything form the 2006 presentations. In the 2017 version, Big-D predicts 3-5 years of construction, but merely provides 13 bullet point statements, each one sentence or less, to describe the entire construction process. Those bullet points consist almost entirely of vague suggestions and recommendations like: have a "controlled construction entrance"; provide "safety-certified flaggers"; provide a "project website to communicate schedules to neighbors." These are merely feel-good statements devoid of any real substance. They certainly do not qualify as detailed construction staging plans as required by the Master Plan approval.

To the extent that the 2017 Big-D letter incorporates any of its prior presentations to the Planning Commission, there is a great deal of inconsistency and much to be concerned about. For example, in its presentations, Big-D claimed on the one-hand that construction traffic would travel one-way to the project from Lowell and back from Empire. But in the 2017 letter, they state that "heavy construction traffic" will be limited to Lowell. This means that the largest construction vehicles would be occupying both of the very narrow lanes of Lowell at the same time. And keep in mind that all other traffic will be going in both directions during construction, regardless of what the construction routes may be. There is no explanation of how construction traffic will be mitigated.

Also, in those 2006 presentations, Big-D predicted up to 10 construction/delivery/employee shuttles/trucks per hour along Lowell/Empire. That number appears to include only trucks going to the site and not any vehicles coming back the other direction on Lowell. Based on the stated construction hours of 7am-9pm for every day but Sunday, that could mean up to 280 construction-related vehicle trips per day on Lowell, 6 days a week, for 3-5 years.

All of those vehicles are expected to arrive via the Empire/Silver King intersection, which is already at failure rate according to Applicant even without the inclusion of any construction traffic. And the Big-D diagrams show the trucks being forced to cross into the oncoming traffic lanes at that intersection and others in order to navigate the turns at all. This will be gridlock. Yet none of this was figured into the recent traffic studies that the Applicant presented last month. There is simply no possible way for the narrow, historic streets and neighborhoods of Old Town to possibly handle this type of construction traffic for years and years and years.

Landscaping/Erosion Control

The Master Plan approval also required on page 15 that the Applicant provide the "detailed landscaping plans and erosion control/revegetation methodologies for minimizing site impacts ... at the time of conditional use review." Instead of detailed methodologies, the 2017 Big-D Report merely states that it could implement "aggressive revegetation and landscaping of areas closest to neighbors" and install "temporary erosion and sedimentation control facilities in accordance with best management practices."

The Planning Staff notes that even Applicant's own geotechnical experts have concluded that the "hillside is creeping" but that there is only a "short inadequate section on slope stability" in the geotech reports. AGEC has stated merely that it will provide its professional opinions and recommendations on this and related geotechnical issues—we still have no idea what those might be, despite the requirement for detailed methodologies at the time of conditional use review. Applicant has not provided anything remotely resembling detailed erosion control methodologies, as was required at the time of conditional use review.

These concerns are on top of the violations of express limits found in the Master Plan approval with respect to excavation. Mr. Stormont highlighted these limits in his September 2, 2016 letter to the Planning Commission at pages 5 and 6 of that letter. But by way of a reminder, one example of an express limit found in the Master Plan approval is on page 11 with respect to "Visibility: ...the tallest buildings have been tucked into Creole Gulch where topography combines with densely vegetated mountainside to effectively reduce the buildings' visibility."

That tuck into Creole Gulch is a clear and express requirement of the Master Plan approval. Yet the current plans eliminate any possibility of a tuck that follows the slope of the existing mountainside and instead replace it with blasted cliffscapes.

And to make matters even worse, those cliffscapes sit outside of the building area boundary, again in violation of the express requirements of the Master Plan approval. Mr. Stafsholt highlighted this problem in his September 14, 2016 public comments, and Mr. Stormont outlined the legal problems associated with this problem in his October 4, 2016 letter to the Planning Commission at pages 3-5, and in his November 7, 2016 letter at pages 2 to 4, which we would ask you to review and carefully consider.

Now, we have a revised excavation plan that adds yet another violation of the Master Plan approval. We've already talked about paragraph 9 of the approval requiring detailed construction plans, which we do not have, but that same paragraph also states: "[C]ut and fill shall be balanced and distributed on site whenever practicable, with any waste material to be hauled over City specified routes." Yet revision 17.1 shows approximately 100,000 cubic yards of material being relocated off-site in the "Pay Day Placement Zone." This is most apparent on page 222 of the July 12, 2017 Planning Commission packet—and is yet another clear violation of the requirements of the Master Plan approval. That Master Plan approval in 1986 did not anticipate or approve affecting neighboring property with 100,000 cubic yards of material, period. Of course, as staff has noted, we also have no explanation as to how areas that could previously only hold 125,000 cubic yards of material can now hold more than 1 million cubic yards of material.

Further, THINC would encourage staff and the Planning Commission to carefully consider whether a 25% swell figure is appropriate, as various treatises and professional publications indicate that 40% is a very conservative swell figure, and 50% (or greater) is far more realistic. *See* excerpts enclosed herewith from *Surface Mining*, AIME volume, Seeley W. Mudd series, 1968, and from the Bulking Factor table found at www.engineeringtoolbox.com/soil-rock-bulking-factor-d_1557.html. The Alta Engineering Inc. Treasure Project Constructability Assessment submitted by the Applicant and included in the July 12, 2017 Planning Commission packet on pages 209-10 that the "majority of the excavation materials from the site are expected to be weathered quartzite and white limestone and dolomite." As the *Surface Mining* text and Engineering ToolBox table indicate, such materials have swell factors ranging from 50% to 80%, far above the 25% figure used by the Applicant. Using such commonly accepted figures from learned treatises demonstrates that even assuming that the volume of materials estimated by the Applicant to be excavated is correct, when appropriate swell factors are used, there is inadequate space at the sites identified by the Applicant for the deposit of these materials. Greater impacts to these areas will necessarily result, or the Applicant will be forced to truck excess materials off-site on already failing roadways. No mitigation for such profound impacts to Park City's roads or dedicated open space has been our could be proposed.

Taking all of these problems together, you have multiple violations of the Master Plan approval and a complete failure to satisfy CUP criteria 15. That criteria requires consideration of "slope retention and appropriateness of the proposed Structure to the topography of the Site." The current plans do not retain any of the existing slope, highlighting that the proposed structures are far from appropriate to the topography of the site. The Master Plan approval contemplated smooth terrain and buildings tucked into the hillside, but the current plan has retaining walls, cliffscapes with huge drop offs, and fully exposed buildings. Those profound impacts to Park City – removing the mountainside - cannot be mitigated.

Exhibit 17 Refinements

As for the latest refinements found in Exhibit 17, they are yet another example of Applicant purporting to give with one hand while actually taking more with the other. Applicant's so-called efforts to mitigate project impacts are in reality simply a shifting of impact from one criteria to another. For example, the Applicant proposes to eliminate a story or reduce a footprint from one building here or there, but then adds stories to other buildings, which may result in the Applicant exceeding the height limitations of the Master Plan. We would ask that this be clarified.

It also claims to be mitigating impact by reducing excavation, grading, and square footage—but the reduction is from the 2009 plans—not from what was approved in the Master Plan. When compared to the Master Plan approval, the Applicant's claimed reductions are illusory. It now claims an 11,500-square foot reduction from its 2009 plans, yet this is in reality still hundreds of thousands of square feet more than its Master Plan approval. It now claims a reduction of roughly 100,000 cubic yards in excavated material from its 2009 plans, but the excavation required is far greater than what was proposed at the Master Plan stage because they are going much deeper and further back into the mountain than they originally indicated. Instead of having the buildings partly underground and partly above ground, the current plan is to blast the entire mountain away – and to do much of that blasting outside of the building area boundary and to move much of the blasted materials offsite – all in violation of the Master Plan approval. We would refer to THINC's numerous prior public comments on these topics, as they remain just as applicable now as they were when they were submitted.

At the end of the day, the Applicant still far exceeds their approval, and they do not comply with the CUP criteria that must be considered at this stage. For those reasons, Applicant's CUP application must be denied.

Thank you again for your consideration of THINC's concerns. We appreciate the opportunity to be heard.

Sincerely,

Nicole M. Deforge, Esq.

Surface Mining

Editor

EUGENE P. PFLEIDER

Associate Editors

George B. Clark
Howard L. Hartman
Adolph Soderberg

Sponsored by the Seeley W. Mudd Memorial Fund

FIRST EDITION

A Volume in the Seeley W. Mudd Series
published by

The American Institute of Mining, Metallurgical, and
Petroleum Engineers, Inc.
NEW YORK · 1968

TABLE 8.3-1
MATERIAL WEIGHTS

Material	Lb/cu yd (Bank)	Lb/cu yd (Loose)	% Swell
Caliche	2430		
Cement, Portland	2700	2250	20
Cinders, blast furnace	1540		
Coal, ashes and clinkers	1080		
Clay, compact natural bed	2940	2210	33
Dry excavated	1850		
Clay and gravel, Dry	2700	1930	40
Wet	3090	2200	40
Coal, Anthracite	2300	1700	35
Bituminous	1900	1410	35
Coke		650–850	
Concrete	3240–4100	2330–2950	40
Concrete, Wet		3500–3750	
Copper ore	3800	2800	35
Earth, Dry Loam	2100	1550–1830	15–35
Moist	2700	2080–2250	20–30
Wet	3370	2700–2800	20–25
Earth, sand, gravel	3100	2640	18
Earth and rock	2500–3200	1920–2460	30
Granite	4500	2520–3000	50–80
Gravel, Dry, loose		2570	
Wet, loose		3200	
Dry, ¼″–2″		2840	
Wet, ¼″–2″		3380	
Pit run (graveled sand)		3240	
Gypsum	4500	2700	65
Limestone	4400	2660	65
Rock, well blasted	4000	2680	50
Sandstone	3900	2600	50
Sand, Dry	3250	2900	12
Moist	3400	2980	14
Wet	3600	3200	14
Sand and Gravel, Dry	3320	2920	14
Wet	3900	3380	16
Shale, riprap	2800	2100	33
Slag	3670	2970	24
Stone, crushed	3240–3920	2400–2900	35
Taconite	4050–5400	2900–3860	40
Trap rock	5000	3340	50

Some of the above material weights vary in accordance with moisture content.

Formula SAE J-732B (2) stipulates tipping load to be the minimum "W" which will raise the rear axle. Operating load must not exceed 50% of minimum tip load.

The following examples will illustrate the importance of using proper bucket sizes:

1. Assume a machine is being used for stock-pile coal handling and has a bucket providing operating-capacity loads based on the specific density of loose bituminous coal, 1410 lbs/cu yd (Table 8.3-1). An alternate job could

be rehandling loose limestone at 2660 lbs/cu yd. The machine would ously overloaded, and a smaller bucket should be installed so as not t recommended operating load.

2. Conversely, if the original intent was for handling loose limestone a bucket was sized for that job but later moved to a loose bitumin operation, the production output in cubic yards could be nearly by changing to the right size coal bucket.

Operating cycles for calculating production output take into acco following factors:

1. Digging time
2. Transport time
3. Dump time
4. Return time

In addition, if trucks are being loaded it may be necessary to a time factor for spotting the truck.

Machines are operated in a wide variety of job conditions wh cause large differences in ownership and operating costs, part costs related to tires or crawler-tractor tracks and shoes. Manuf can supply tires suited to provide maximum efficiency and optim for many varying conditions, so it is important to equip the machi proper types. For instance, tires for rock work are poorly sui work in sand, and conversely so. Also there is a sizeable diffor tire costs depending on their specifications.

In addition to first cost, there is a variation in tire life expectanc varying working conditions:

Type of Soil	Operating Hours Before Recap
Rock and shale	1250 to 2750
Clay	3000 to 5000
Sand	5000 to 8500

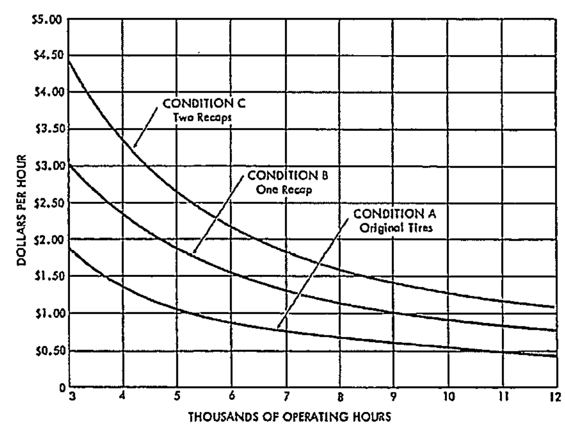


Fig. 8.3-3. Hourly tire cost, 57,700-lb wheel tractor. Tire size—2 16PR.

TABLE 8.3-1
MATERIAL WEIGHTS

Material	Lb/cu yd (Bank)	Lb/cu yd (Loose)	% Swell
Caliche	2430		
Cement, Portland	2700	2250	20
Cinders, blast furnace	1540		
Coal, ashes and clinkers	1080		
Clay, compact natural bed	2940	2210	33
Dry excavated	1850		
Clay and gravel, Dry	2700	1930	40
Wet	3090	2200	40
Coal, Anthracite	2300	1700	35
Bituminous	1900	1410	35
Coke		650– 850	
Concrete	3240–4100	2330–2950	40
Concrete, Wet		3500–3750	
Copper ore	3800	2800	35
Earth, Dry Loam	2100	1550–1830	15–35
Moist	2700	2080–2250	20–30
Wet	3370	2700–2800	20–25
Earth, sand, gravel	3100	2640	18
Earth and rock	2500–3200	1920–2460	30
Granite	4500	2520–3000	50–80
Gravel, Dry, loose		2570	
Wet, loose		3200	
Dry, ¼″–2″		2840	
Wet, ¼″–2″		3380	
Pit run (graveled sand)		3240	
Gypsum	4500	2700	65
Limestone	4400	2660	65
Rock, well blasted	4000	2680	50
Sandstone	3900	2600	50
Sand, Dry	3250	2900	12
Moist	3400	2980	14
Wet	3600	3200	14
Sand and Gravel, Dry	3320	2920	14
Wet	3900	3380	16
Shale, riprap	2800	2100	33
Slag	3670	2970	24
Stone, crushed	3240–3920	2400–2900	35
Taconite	4050–5400	2900–3860	40
Trap rock	5000	3340	50

Some of the above material weights vary in accordance with moisture content.

Formula SAE J-732B (2) stipulates tipping load to be the minimum "W" which will raise the rear axle. Operating load must not exceed 50% of minimum tip load.

The following examples will illustrate the importance of using proper bucket sizes:

1. Assume a machine is being used for stock-pile coal handling and has a bucket providing operating-capacity loads based on the specific density of loose bituminous coal, 1410 lbs/cu yd (Table 8.3-1). An alternate job could

2. Location and radius of curves in haul road sections. (Would have bearing on vehicle road speeds.)
3. Road widths.
4. Road surface as it relates to rolling resistance.
5. Location of possible stops other than at the point of material discharge. (Stops for crossroads, rail tracks, etc.)
6. Dust control as it relates to driver visibility.

Material Discharge

1. Restriction points that could affect maneuverability and spot time.
2. Point of discharge—into crusher, hopper, feeders, or on wastepile.
3. Crusher size and type.
4. Size of crushed material (has bearing on possible selection of other type of equipment if material has to be rehandled).
5. Whether crushed material passes directly to processing plant or is discharged onto a surge pile (has bearing on possible haulage unit delay due to plant shutdown).
6. Crusher capacity per hour (should not be less than required production).
7. Plant capacity behind crusher (same comment as above).

Weather Conditions

1. Ambient air temperature range. This could have a bearing on vehicle cooling ability and could establish requirements for special options such as shutters, thermatic fans, air conditioning, etc.
2. Arid or rain conditions. This has a bearing on dust, traction, or other conditions.
3. Frost and spring thaws. This reflects on seasonal road and general operating conditions.

Altitude

What is the maximum, mean, and lowest elevation in the pit or other locations in the operation where the use of haulage units is under consideration? The effect of altitude over 2000 ft has a decided bearing on engine performance.

Haulage Unit Speed Limits

At times, for safety or other reasons, it is necessary or desirable to hold the vehicle speeds to less than their designed values. This is pertinent to steep grades, on sharp curves, narrow roads, congested plant areas, etc.

Loading Facility

1. Type—Power shovel, dragline, front-end loader, overhead hopper, etc.
2. Make, model, and size—cubic yard capacity (shovel-dragline-loader).
3. Bucket factor (shovel-dragline-loader)—this value varies with the type and nature of material and relates to the effective loading capacity of bucket.
4. Cycle time (shovel-dragline-loader)—this is the time required by loading unit for picking up bucket load, swinging or turning, discharging the material in haulage unit, and returning to reload position.
5. Hopper capacity and rate of discharge (cubic yards or tons, as the case may be).
6. Shovel-dragline-loader capacity per hour (should not be less than required production per hour).

Required Production

Usually given as a specified quantity of cubic yards or tons per period of time. This should be resolved into a quantity per hour. When value is given in tons, define whether short (2000 lb), long (2240 lb) or metric (2204.6 lb).

Time Elements

1. Number operating days per year.
2. Number of shifts and resulting operating hours per day. The product of above results in scheduled number of operating hours per year.

   NOTE: On a three shift basis, it is common to consider approximately twenty-one operating hours per day.

9.2-4. Explanatory Information. Having established all of the required operational data, it is now necessary to expand this information for use in the haul study. Accordingly, this section contains back-up data on certain of these items which not only defines the item but provides a reference for specific values, etc.

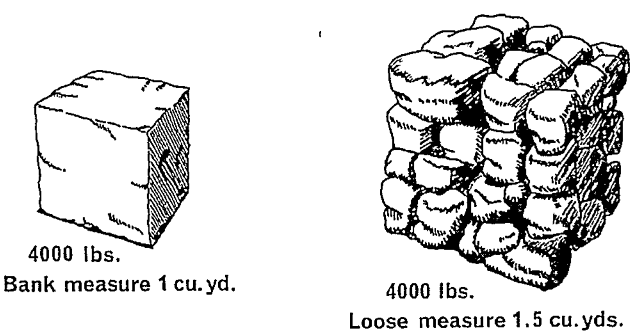


Fig. 9.2-8. Pictorial definition of meaning of *material swell.*

MATERIALS. On nearly all earthmoving and mining operations, the material requirement is given in terms of bank or in-place cubic yards. The in-place weight of the material is given in terms of specific gravity—pounds per cubic foot or pounds per cubic yard. When the in-place material is dug or blasted from its original position, it breaks up into particles or chunks that lie loosely on each other. This rearrangement creates spaces or voids and adds to its bulk. This change from bank to loose yards is commonly known as *swell*, and is given in *percent of swell*. This is best illustrated in Fig. 9.2-8.

To calculate:

1. *Swell factor* of a material = 100 ÷ (100 + % of swell).
2. *Loose cubic yard weight* of a material = swell factor × bank cubic yard weight.

Required Production

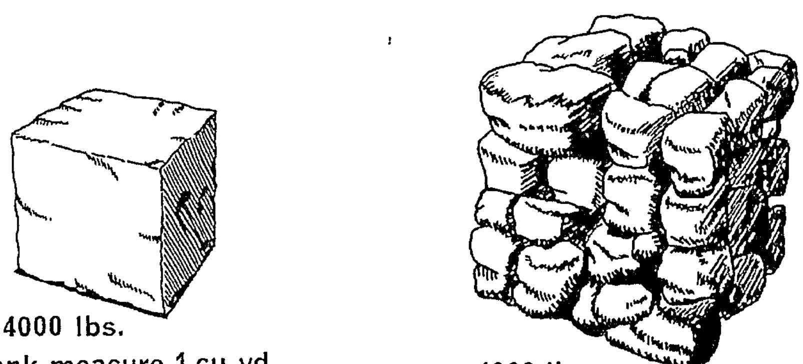
Usually given as a specified quantity of cubic yards or tons per period of time. This should be resolved into a quantity per hour. When value is given in tons, define whether short (2000 lb), long (2240 lb) or metric (2204.6 lb).

Time Elements

1. Number operating days per year.
2. Number of shifts and resulting operating hours per day. The product of above results in scheduled number of operating hours per year.

   NOTE: On a three shift basis, it is common to consider approximately twenty-one operating hours per day.

9.2-4. Explanatory Information. Having established all of the required operational data, it is now necessary to expand this information for use in the haul study. Accordingly, this section contains back-up data on certain of these items which not only defines the item but provides a reference for specific values, etc.



4000 lbs.
Bank measure 1 cu. yd.

4000 lbs.
Loose measure 1.5 cu. yds.

Fig. 9.2-8. Pictorial definition of meaning of *material swell.*

MATERIALS. On nearly all earthmoving and mining operations, the material requirement is given in terms of bank or in-place cubic yards. The in-place weight of the material is given in terms of specific gravity—pounds per cubic foot or pounds per cubic yard. When the in-place material is dug or blasted from its original position, it breaks up into particles or chunks that lie loosely on each other. This rearrangement creates spaces or voids and adds to its bulk. This change from bank to loose yards is commonly known as *swell,* and is given in *percent of swell.* This is best illustrated in Fig. 9.2-8.

To calculate:

1. *Swell factor* of a material = 100 ÷ (100 + % of swell).
2. *Loose cubic yard weight* of a material = swell factor × bank cubic yard weight.

3. *Bank cubic yard weight* of a material = loose weight per cubic yard ÷ swell factor.

Normally, the project or mining engineer can furnish accurate data as to weight of the materials to be hauled and their percent of swell or swell factor. This information should be determined at the operation site. In the event this information is not available, the figures in Table 8.3-1 could be used for estimates.

Grade Resistance. This is defined as the drawbar pull or tractive effort required to overcome gravity in propelling a vehicle up an incline. It amounts to 20 lb per ton or 1% of unit weight for each percent of grade. For example, a 5% grade would offer a resistance of 100 lb for each ton of vehicle weight.

Rolling Resistance. Rolling resistance is the amount of drawbar pull or tractive effort required to overcome the retarding effect between the tires and the ground. It includes the resistance caused by the tire penetration into the ground, by the flexing of the tires under the load, and (to a degree) by the friction in the wheel bearings (Fig. 9.2-9). It is normally

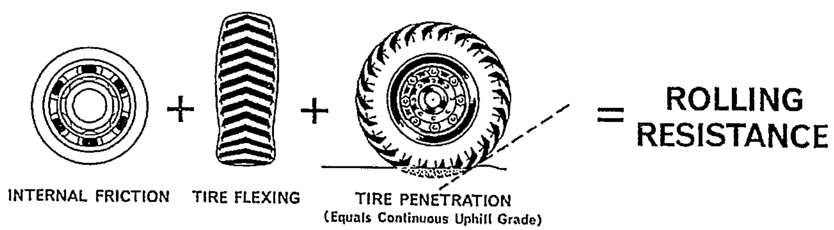


Fig. 9.2-9. Rolling resistance created by tire penetration, tire flexing, and internal resistance in final drive set. Indicated as pounds pull per ton of vehicle weight or as a percent of vehicle weight.

expressed as pounds pull per ton of vehicle weight, or as a percent of vehicle weight. For example, a common value used to cover a well-maintained, smooth, hard, dry dirt and gravel road is 40 lb per ton or 2%.

Table 8.3-2 lists the approximate rolling resistance values for a number of different road surfaces.

Gradeability. This can be defined as the ability of a vehicle to negotiate a given grade taking into account both grade and rolling resistance. The sum of these two values is expressed as "total resistance in percent of vehicle weight." The use of this alone, however, will not measure the performance or gradeability of the vehicle. To achieve this, one must have engine performance, gear ratios, tire data, weights, etc. This information is not normally available, so the engineer, in order to determine the speed a

vehicle will negotiate a particular grade having a certain rolling resistance (total resistance), will have to refer to the vehicle manufacturer's performance chart. Figure 9.2-10, showing a representative performance chart has been marked to show the possible speed of the loaded vehicle operating on an adverse 8% grade having a 2% rolling resistance (10% total resistance). It will be noted when following a path of the dotted (- - -) lines tha the loaded unit can climb the 8% grade at a speed of 8 mph in 2nd gea lock-up. To illustrate possible empty vehicle performance, the chart ha been marked to show operation on a 6% grade with a 2% rolling resistanc (8% total resistance). It will be noted that the empty unit can negotiat this grade at a speed of 23.5 mph in 6th gear converter.

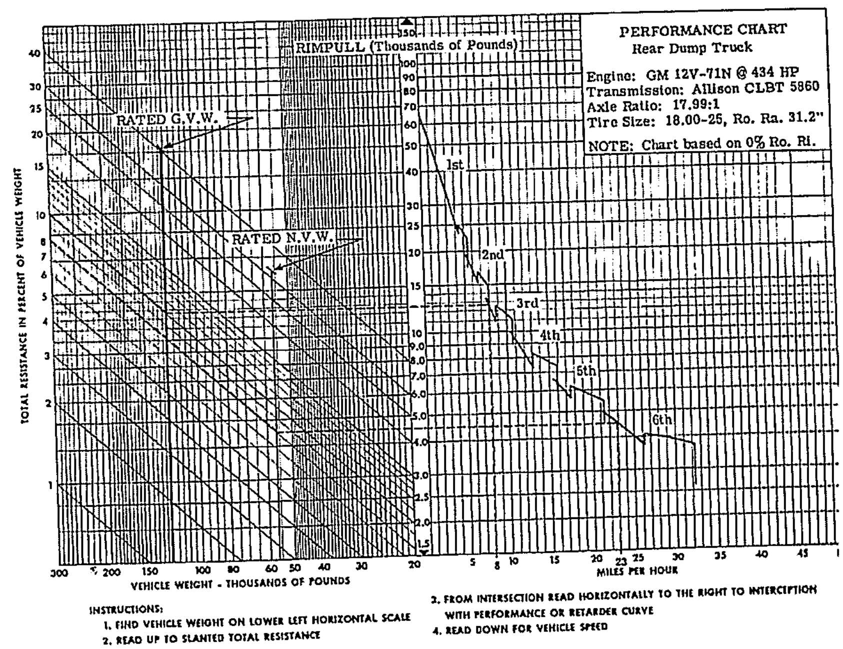


Fig. 9.2-10. Typical performance chart covering a 35-ton capacity ro dump truck equipped with 434 hp engine, 6-speed powershift transmission, a 18.00-25 (32) tires.

Incidentally, if the contemplated net or gross vehicle weights sho change for some reason or other, the solid vertical lines so marked the chart can be moved right or left accordingly and the same procedu would be followed to determine speeds.

Most haulage units today are fitted with an auxiliary braking arran ment usually referred to as a "retarder." This is a device designed serve as a brake working through the drive line to hold back the veh on downgrade haul roads. The use of the retarder saves the regular ser

3. *Bank cubic yard weight* of a material = loose weight per cubic yard ÷ swell factor.

Normally, the project or mining engineer can furnish accurate data as to weight of the materials to be hauled and their percent of swell or swell factor. This information should be determined at the operation site. In the event this information is not available, the figures in Table 8.3-1 could be used for estimates.

Grade Resistance. This is defined as the drawbar pull or tractive effort required to overcome gravity in propelling a vehicle up an incline. It amounts to 20 lb per ton or 1% of unit weight for each percent of grade. For example, a 5% grade would offer a resistance of 100 lb for each ton of vehicle weight.

Rolling Resistance. Rolling resistance is the amount of drawbar pull or tractive effort required to overcome the retarding effect between the tires and the ground. It includes the resistance caused by the tire penetration into the ground, by the flexing of the tires under the load, and (to a degree) by the friction in the wheel bearings (Fig. 9.2-9). It is normally

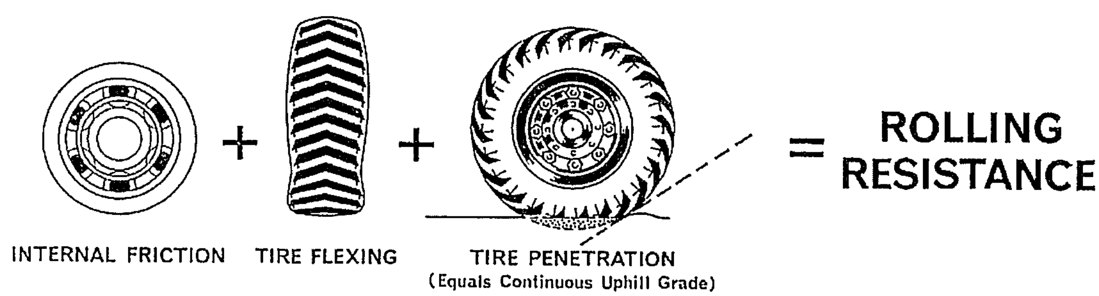


Fig. 9.2-9. Rolling resistance created by tire penetration, tire flexing, and internal resistance in final drive set. Indicated as pounds pull per ton of vehicle weight or as a percent of vehicle weight.

expressed as pounds pull per ton of vehicle weight, or as a percent of vehicle weight. For example, a common value used to cover a well-maintained, smooth, hard, dry dirt and gravel road is 40 lb per ton or 2%.

Table 8.3-2 lists the approximate rolling resistance values for a number of different road surfaces.

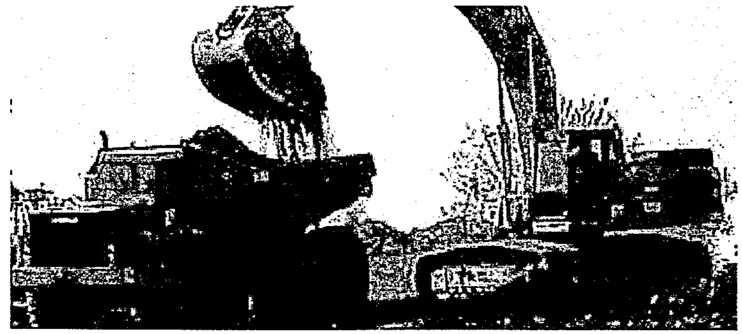
Gradeability. This can be defined as the ability of a vehicle to negotiate a given grade taking into account both grade and rolling resistance. The sum of these two values is expressed as "total resistance in percent of vehicle weight." The use of this alone, however, will not measure the performance or gradeability of the vehicle. To achieve this, one must have engine performance, gear ratios, tire data, weights, etc. This information is not normally available, so the engineer, in order to determine the speed a

Unit Converter
Temperature 0.0 °C °F Convert!
Length 1.0 m km in

Soil and Rock - Bulk Factors

Soil and rock expansion - or swell - after mining

Soil or rock from the borrow expands when dropped on the lorry or the landfill - or stockpiled. One cubic from the borrow does not translate to one cubic dump.



Bulking or swell factors for some materials:

Material	Density at the Borrow 10^3 (kg/m^3)	Bulking (Swell) Factor (%)
Basalt	2.4 - 3.1	75 - 80
Clay	1.8 - 2.6	20 - 40
Dolomite	2.8	50 - 60
Earth		20 - 30
Gneiss	2.69	75 - 80
Granite	2.6 - 2.8	75 - 80
Gravel, dry	1.80	20 - 30
Gravel, wet	2.00	20 - 30
Gravel, wet w/clay		50 - 60
Limestone	2.7 -2.8	75 - 80
Loam		15 - 25
Quartz	2.65	75 - 80
Rock		40 - 80
Sand, dry	1.60	20 - 30
Sand, wet	1.95	20 - 30
Sandstone	2.1 - 2.4	75 - 80
Slate	2.6 - 3.3	85 - 90