CE 451: Transp. Engg. II-Pavement Design and Railway Engineering

LOW COST ROAD; EQUIPMENTS; CONSTRUCTION OF EMBANKMENT, SUBGRADE, BASE, FLEXIBLE AND RIGID SURFACE; AND MAINTENANCE OF FLEXIBLE AND RIGID ROAD PAVEMENTS

Moazzem Hossain, PhD

Professor,

Civil Engineering Department, BUET.

LOW COST ROADS

Unsealed rural roads with earth and gravel/brick surfaces comprise the greater proportion of the length of public road in rural areas in developing regions.

Reliable rural road access improves:

• Marketing opportunities for subsistence farmers.

Impassable roads lead to loss of market opportunities, spoiling of crops, reduced or lost income. Agricultural input to the economy is highest during or shortly after the rains and it is essential to move produce at this time.

• Rural community health through better access to health care. Maintaining wet season access is important because it is at this time that instances of malaria, dengue and other water borne diseases are at their peak

• Social welfare. Maintaining inter-community access to family and friends has important social benefits, which help promote a better quality of life for the rural poor.

• Education through better access to schools and shorter travel times.

Natural gravel/brick aggregate surfacing is generally used as a low cost solution to rural access problems in many developing countries.

This material provides an intermediate surface between basic engineered earth and higher cost, usually bituminous, paving.

Ranges from soil-stabilized road to bituminous surfacing

In BD, LGED/Municipality/Zilla Parisad roads

Gravel is appropriate where suitable material is available and laid to surfacing specifications, gravel haul distances are short, road gradients are less than about 6%, rainfall is low or moderate, traffic is relatively low, finance and resources are available for periodic regravelling, and dry season dust generation is not severe.

Disadvantages

Maintenance of gravel is expensive, especially for periodic regravelling, which is typically required at 3 to 5 year intervals. Routine maintenance of a gravel road can be achieved for US$250 - 650/km/year, depending on the method used. However the need to replace the surface losses by periodic maintenance re-gravelling can cost a further US$400 - 2,000/km/year.

health hazard, discomfort and nuisance, air pollution, and reductions in agricultural yields and livestock health. Dust spread over people, villages, in homes and fields has many impacts and costs, many of which have yet to be quantified. Food stores and water resources can be polluted .

Research has shown that typically 30% of ambient particulate matter is attributed to road dust. One vehicle travelling one kilometre once a day every day of the year will typically generate between 0.2 and 0.6 tonnes of fines, this being lost from the road and causing the impacts described above. Put another way, in a dry season, vehicles and wind can remove of the order of 25 tonnes of dust per kilometre of unsealed road every year.

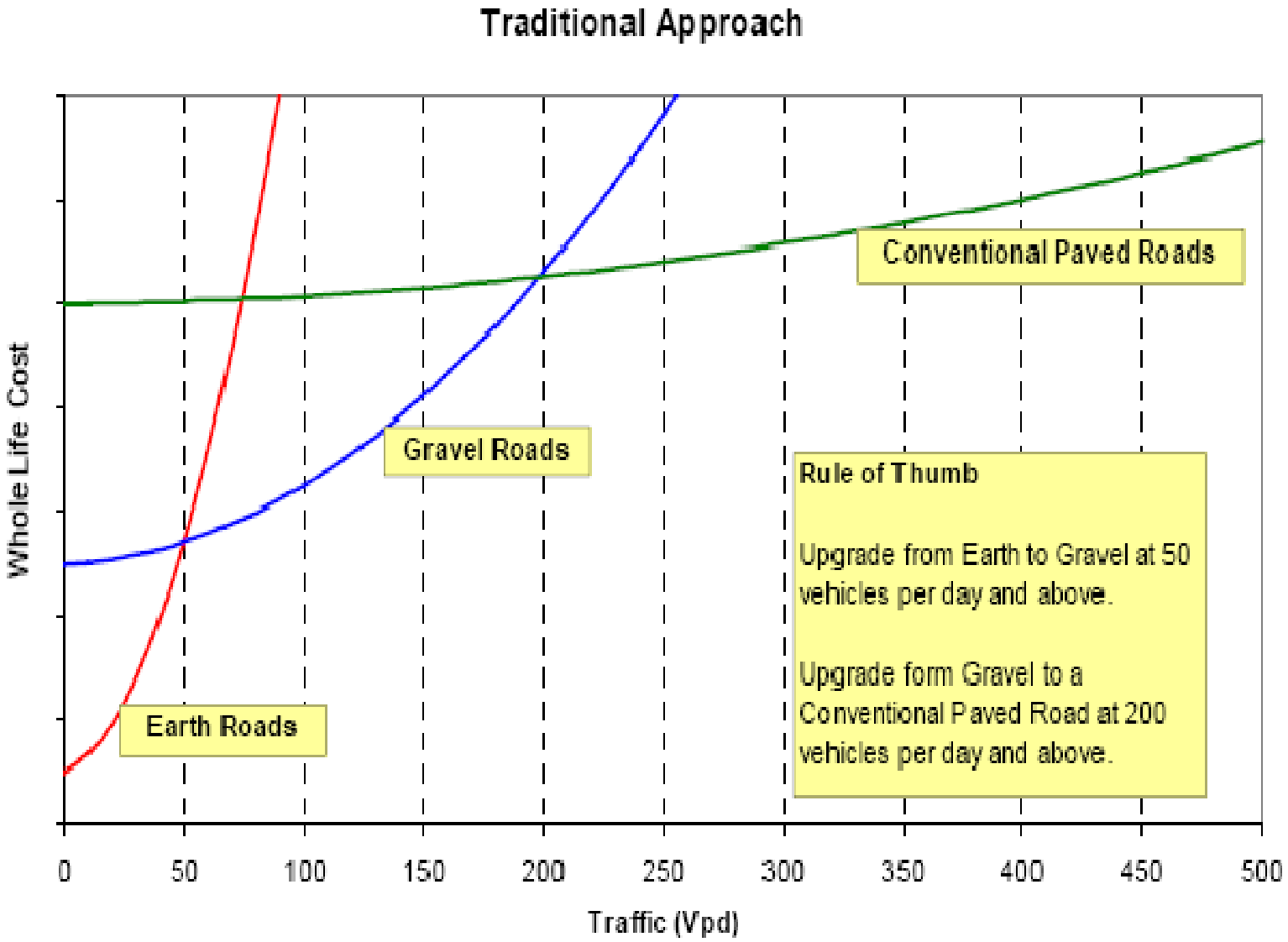
During rain periods, runoff of fines into streams has serious impacts on water quality. Runoff siltation causes a high maintenance requirement in the drainage system. Roads also become slippery leading to increased safety hazards.

Gravel pit excavations can eventually fill with water and become loci for disease. They are dangerous for children and livestock and inevitably become dumping sites for garbage, building rubble and scrap.

Perhaps the biggest environmental issue associated with gravel roads is that of sustainability of a non-renewable resource. Suitable gravel is becoming a scarce commodity and its injudicious use will eventually lead to there being no such material for any form of road construction.
Env. Concerns for open brick burning in BD!!!

Options?

- Adopting a flexible, realistic and innovative approach to access needs, provision and maintenance,
- Maximising the use of earth (provision of good camber, drainage and traffic control can often extend the serviceability of earth roads) where in-situ soils are suitable,
- Spot improvements where limited available resources are targeted toward appropriate improvement measures at strategic points on the route to ensure an optimal level of access. These would include:
- - Judicious use of gravel (if resources are scarce)
- - Provision of short section of bituminous or non-bituminous surfacings.
- By promoting innovation, using labour-based and light equipment technologies and developing design approaches and maintenance strategies that work with the environment, both the initial construction costs and longer term maintenance demand can be significantly reduced (see Figure below).


Traditional Approach
Whole Life Cost
Conventional Paved Roads
Gravel Roads
Earth Roads
Rule of Thumb
Upgrade from Earth to Gravel at 50 vehicles per day and above.
Upgrade form Gravel to a Conventional Paved Road at 200 vehicles per day and above.
0
50
100
150
200
250
300
350
400
450
500
Traffic (Vpd)

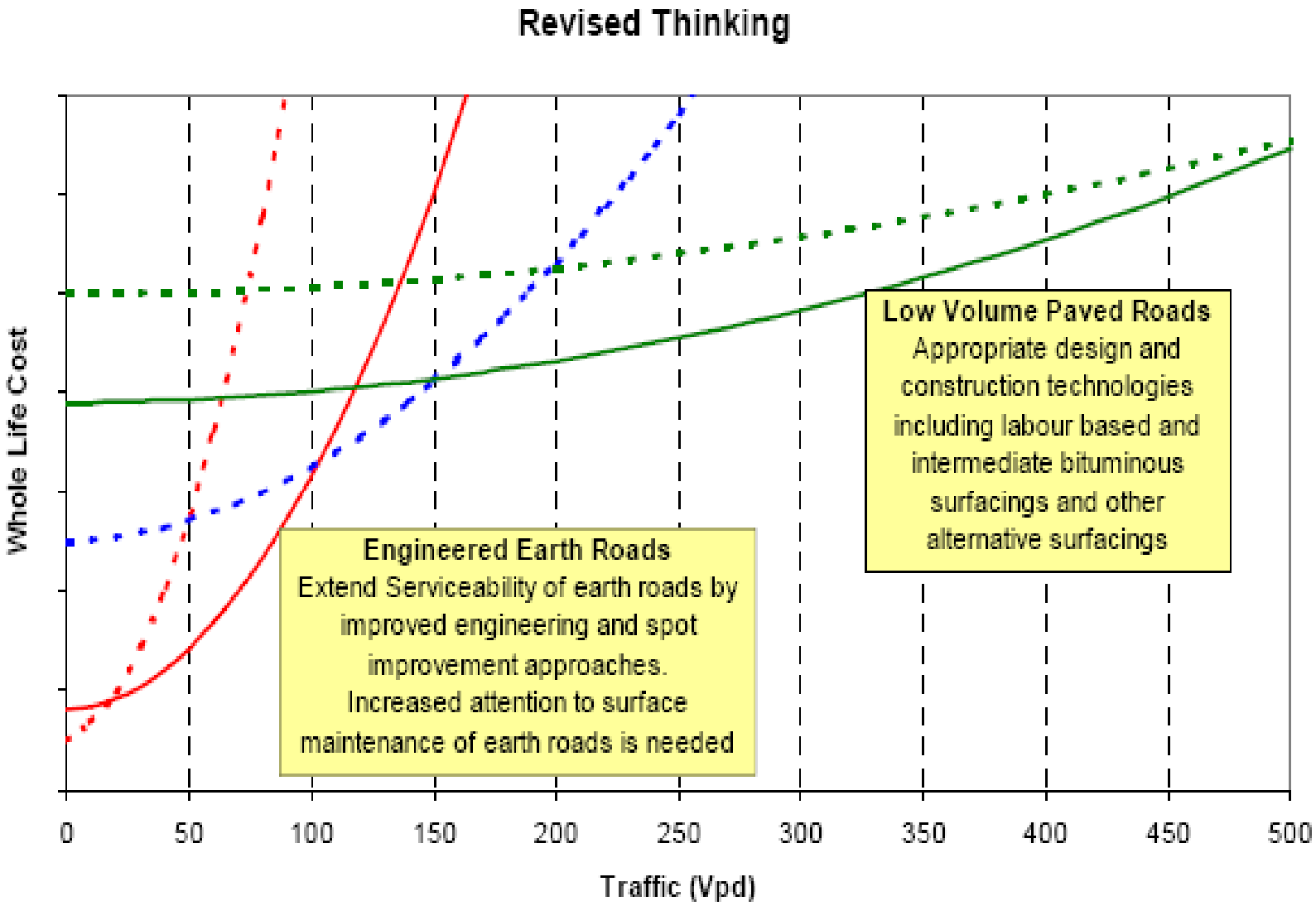

Revised Thinking
Whole Life Cost
Traffic (Vpd)
0
50
100
150
200
250
300
350
400
450
500
Low Volume Paved Roads
Appropriate design and construction technologies including labour based and intermediate bituminous surfacings and other alternative surfacings
Engineered Earth Roads
Extend Serviceability of earth roads by improved engineering and spot improvement approaches.
Increased attention to surface maintenance of earth roads is needed

Image 5 – Pavé (small stone paving) and Concrete Block Paving

mage 1 – Dusty Gravel Road through Community Centre

Image 3 – Bamboo Reinforced Concrete Paving

Image 2 – Dressed Stone Paving under Construction

Table 1 - SCHEDULE OF ALTERNATIVE ROAD SURFACE IMPROVEMENTS

	Road Surface Improvement Options	***Description*** *(A roadbase option may need to be used in combination with the selected surface improvement)*
C1	Dragging Road Surface	Smoothing out minor defects on an earth or gravel road surface and redistributing loose material on the surface, using tyre or blade drag.
C2	Light Grading/Reshaping of Surface	Minor reshaping of an earth or gravel surface to restore correct camber using labour or light/heavy grading equipment.
C3	Natural Gravel Surface	A layer of compacted natural gravel wearing course (typically 15 – 20cm thick)
C4	Lime Stabilization of Existing Surface	Addition of and mixing of quicklime or hydrated lime to a soil or surface material, watering and compaction to increase its strength and reduce its susceptibility to the weakening effect of increasing moisture content. This is achieved by chemical reaction of the lime with the clay particles. Mixing and compaction by light or heavy equipment.
C5	Stone Chippings Surface	A layer of single sized (typically 20mm) crushed stone chippings.
C6	Hand Packed Stone Surface	A layer (typically 20 – 30cm thick) of large broken stone pieces, tightly packed and wedged in place with stone chips rammed by hand into joints, with remaining voids filled with sand. The I land Packed Stone is normally bedded on a thin layer of sand/gravel
C7	Dressed Stone Surface	A layer (typically 15 – 20cm thick) of stone blocks cut (dressed) to a cubic shape by hand, laid by hand. Joints mortared/sealed or tightly packed and wedged with stone chips rammed into place with remaining voids filled with sand. The Dressed Stone is normally bedded on a thin layer of sand/gravel.
C8	Stone Sett Surface (Pavé)	As dressed stone, however stone blocks are smaller; typically about 10cm x 10cm x 10cm with mortared joints.
C9	Concrete Block Surface	A layer of concrete blocks (typically each 10cm x 20cm and 7 – 10cm thick) laid by hand on a thin (3 – 5cm) sand bed with joints also filled with sand and lightly compacted.
C10	Clay Brick Surface	A layer of high quality clay bricks (typically each 10cm x 20cm and 7 – 10cm thick) laid by hand on a thin sand bed with joints also filled with sand and lightly compacted, or bedded & jointed with cement mortar.
C11	Bamboo Reinforced Concrete Surface	Jointed slabs of structural quality concrete reinforced with a split bamboo rod grid. Joints with steel weight transfer dowels and bitumen seal.
C12	Steel Reinforced Concrete Surface	Jointed slabs of structural quality concrete reinforced with a mild steel rod grid. Joints with steel weight transfer dowels and bitumen seal.
C13	Bituminous/Tar Sand Seal Surface	A seal consisting of a hand or machine applied film of bitumen (straight run, cutback or emulsion) or road tar followed by the application of excess angular sand or fine crushed stone, lightly rolled into the bitumen/tar.
C14	Ottaseal Surface	A layer consisting of a hand or machine applied film of relatively soft bitumen (usually straight run or cutback) followed by the application of graded natural gravel or crushed stone aggregate (typically 16mm downwards), rolled into the bitumen using heavy pneumatic tyred rollers.

		the bitumen/tar.
C14	Ottaseal Surface	A layer consisting of a hand or machine applied film of relatively soft bitumen (usually straight run o cutback) followed by the application of graded natural gravel or crushed stone aggregate (typically 16mm downwards), rolled into the bitumen using heavy pneumatic tyred rollers.
C15	Bitumen/Tar Surface Dressing Surface	A seal consisting of a hand or machine applied film of bitumen (straight run, cutback or emulsion) o road tar followed by the application of a single layer of single sized (6 20mm) stone chippings, lightly rolled into the bitumen/tar
C16	Bitumen Slurry Seal Surface (and "Cape" Seals)	A seal consisting of fine graded aggregates (typically 10mm downwards), water, bitumen emulsion, cement, and sometimes an additive, mixed in a concrete mixer or other machine and spread on the road surface by hand or machine. Cape seals are combinations of Surface Dressing and Slurry Sea
C17	Bituminous Premix Macadam Surface	Graded crushed stone material (typically 28mm downwards) usually derived from fresh sound quarried rock, boulders or granular material and mixed with a bituminous binder (straight run, cutback or emulsion) and laid and compacted. Material may be hand or machine mixed and laid. Compaction by light or heavy equipment.
C18	Penetration Macadam Surface	Two or three layers of single size crushed stone (of decreasing nominal aggregate size, e.g. 63 mm downwards) each compacted and with bitumen (straight run, cutback or emulsion) or road tar sprayed between each stone application.
C19	Water Bound Macadam Roadbase	A layer of nominal single sized (typically up to 50mm) crushed stone compacted and fully blinded with well graded fine aggregate which is watered into the voids and compacted to produce a dense stable material. Layer thickness up to twice the nominal stone size. Material may be hand or machine crushed and laid.
C20	Dry Bound Macadam Roadbase	A layer of nominal single sized (typically up to 50mm) crushed stone compacted and fully blinded with angular sand or fine crushed stone material which is then vibro-compacted to produce a dense stable material. Layer thickness up to twice the nominal stone size. Material may be hand or machine crushed and laid. Suitable in areas short of water.
C21	Slurry Bound Macadam Roadbase	A layer (about 7cm thick) of single size aggregate (typically 50mm) blinded with smaller aggregate (typically 25mm), plate compacted and grouted with bitumen emulsion slurry before final compactio
C22	Crushed Stone Roadbase	A layer (usually up to 20cm thick) of graded crushed stone material (typically 50mm downwards) usually derived from fresh sound quarried rock, boulders or granular material. The angular material derives its strength primarily from mechanical interlock. Material may be hand or machine crushed.
C23	Mechanically Stabilised Roadbase	Addition and mixing of granular material such as crushed stone or sand to a material to increase its strength and achieve the properties required of a roadbase.
C24	Chemical or Emulsion Stabilized Roadbase	Addition and mixing of a stabilizer such as lime, cement, or ion exchange chemicals, to a material t increase its strength and achieve the properties required of a roadbase. Mixing and compaction by light or heavy equipment.
C25	Improvement using Recycled Materials	Use of recycled road pavement materials, brick kiln waste, broken brick, demolition materials, industrial slags, etc.

Engineered Earth Roads

Bituminous Soil Stabilization

Material

- Well graded soil, sand, clays : very fine ones are avoided
- Rapid/medium/low curing liquid asphalt or
- Medium/slow setting emulsion
- Water

Field Control

- By monitoring compaction and relevant CBR value

Road mix/ Travelling/ Central Plant Construction

Compaction By: Sheep-foot or Pneumatic tyred roller

Oiled earth Surfaces

Material

- Silt and clays
- low curing liquid asphalt or
- Medium curing cutback asphalt or
- Slow setting emulsion
- Water

Compaction By: Under traffic or Pneumatic tyred roller

Cement Stabilization

Material

- Soil suitable for subgrade
- Portland cement (7 – 14% BY VOLUME)
- Water

Cement and Water content fixed by lab testing

- M-D relationship
- CBR vs Density relationship

Field Control

- By monitoring MC, compaction and relevant CBR value

Road mix/ Travelling/ Central Plant Construction

Construction method detail in Wright's book

Needs curing

Compaction By: Based on soil type

Compaction Equipments:

Clay/Silty soil: Sheep-foot or Pneumatic tired roller

Sandy Soil: Pneumatic tired roller, Vibratory compactor

Granular Soil: Steel – wheel roller

LIME STABILIZATION

Material

- **Plastic Clay soil**
- **Lime (3 – 6% BY VOLUME)**
- **Water**

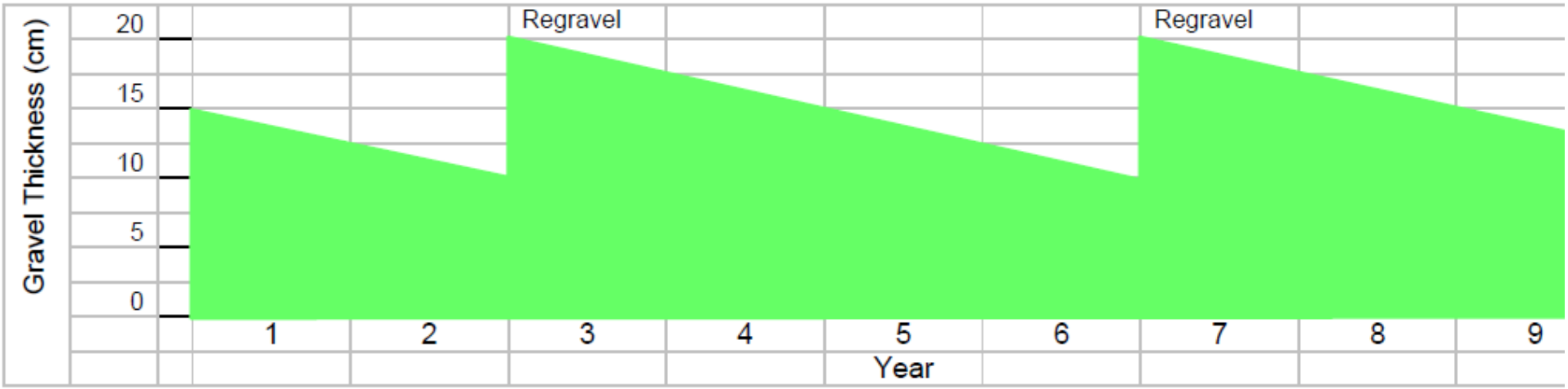
Cement and Water content fixed by lab testing

- **M-D relationship**
- **CBR vs Density relationship**

Field Control

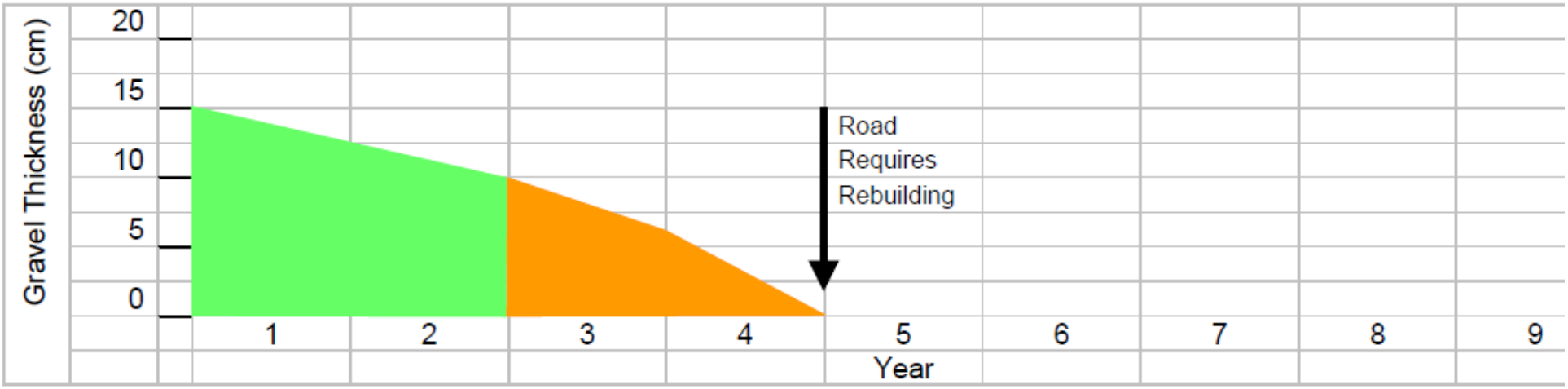
- **By monitoring MC, compaction and relevant CBR value**

Figure 1 - GRAVEL THICKNESS **WITH** PREVENTATIVE MAINTENANCE (Including timely re-gravelling)



Sustainability of gravel surfacing is particularly dependent on timely availability of considerable financial & physical resources at frequent inter regravelling. Many road authorities/communities have difficulty in achieving this.

Figure 2 - GRAVEL THICKNESS **WITHOUT** PREVENTATIVE MAINTENANCE (**No** timely re-gravelling - investment is lost!)



NOTE: Based on deterioration rates predicted for lateritic gravel roads, hilly, high rainfall (2,000 mm/year) with traffi TRRL Laboratory Report 1111 and incorporated in RTIM. Use of poor quality material will cause even faster rates of gra

APPROPRIATE SEALS

Sand/grit seals

These seals consist of a tack coat of appropriate bituminous binder that is covered with a thin layer of relatively clean sand. Typically this material is obtained from rivers in granitic terrain but may be available in other areas depending on the geomeorphology and geology, eg residual quartzitic soils. The material should preferably have a maximum size of 6.7 mm and less than 2 or 3 per cent finer than 0.075 mm. Recent experience, however, has shown that sands with up to 20 per cent of material finer than 0.075 mm can be constructed using labour based techniques and perform well under light traffic.

Slurry seal

Slurry seals have, probably deservedly, earned a reputation as performing poorly if the recommended gradings [9] are not strictly adhered to on conventional road rehabilitation projects. Experience has, however, shown that slurry seals constructed from a reasonably clean crusher dust, or even selected river sands, can prove successful as a first seal on roads carrying low traffic volumes (less than 75 vpd) particularly when the heavy vehicle count is low (less than 3 or 4 vpd).

Chip seals

Chip seals, however, make use of an essentially single sized, strong, crushed material, increasing the stone costs considerably. Recent work [6] has shown that it may be possible to use much weaker aggregates and possibly even screened natural gravels successfully for chip seals on low volume roads.

Graded aggregate seals

These seals are characterised by using aggregate that is relatively widely graded with low viscosity binders, They consist of the generic type of seal (eg, Otta seal [3,12]) as well as various proprietary seals. Otta seals constructed with natural gravels (often just scalped at 19 mm) have performed particularly well in many countries. The proprietary seals usually make use of crushed aggregate.
Like sand seals, graded aggregate seals do not follow rational designs, with regular sweeping of the aggregate onto binder rich areas until a natural balance between the binder and aggregate is achieved.

Single surface dressing & Double surface dressing

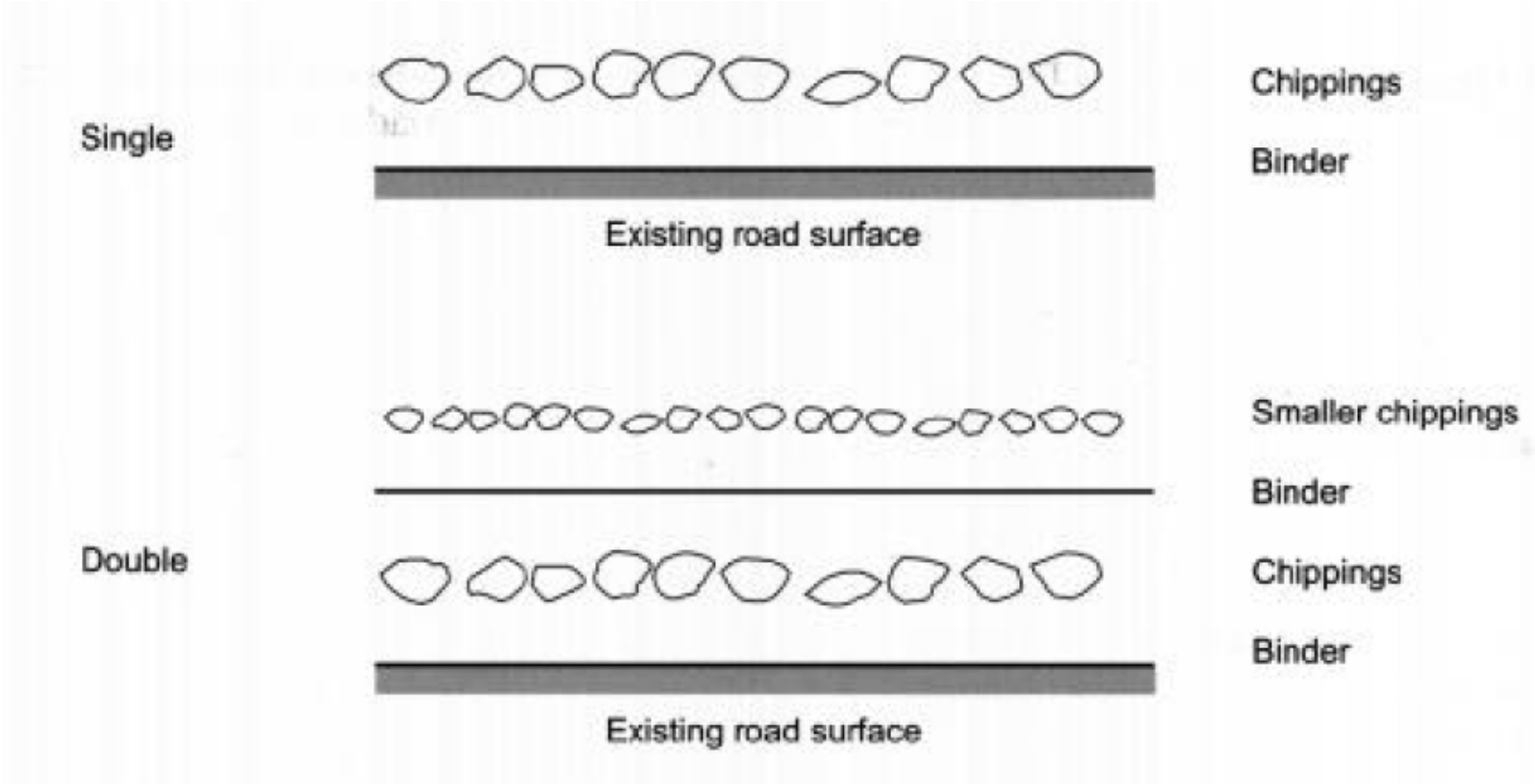


Table 3 Recommended nominal size of chippings (mm)

	Approximate number of commercial vehicles with an unladen weight greater than 1.5 tonnes currently carried per day in the design lane				
Type of surface	*2000-4000*	*1000-2000*	*200-1000*	*20-200*	*Less than 20*
Veryhard	10	10	6	6	6
Hard	14	14	10	6	6
Normal	20Ø	14	10	10	6
Soft	*	20Ø	14	14	10
Very soft	*	*	20Ø	14	10

SEAL OPTIONS

A wide range of seal options is available for consideration on low volume sealed roads. Each of these has particular advantages and disadvantages and will vary in cost. However, the final selection of an appropriate seal for any project must be based on the consideration of a number of factors, not necessarily related directly to the prevailing technical issues. These include:

- **Pavement structure**
- **Natural environment**
- **Social environment**
- **Political environment**
- **Construction techniques and plant availability**
- **Maintenance capacity**

Table 1 Bituminous surfacings for low volume roads

Surface type	Suitable for labour	If no maintenance capacity exists	Steep gradient	Wet road or poor drainage	Junction or turning trucks	Specifications	Design method	Cost (SABITA, 1992) Rand/m^2	Lifespan (years) (Wolff & Viser, 1991)
Fog seal	Yes								
Priming									Only weeks
Dust palliative	Good	No	No	No	No			2.22	Temporary
Primer seal						Loose		As sand	1-3
Sand seal	Good	No	No	No	No	Loose	Empirical	1.90	4-5 (van der Walt, 1979) Temporary
Single dressing	Fair	No	No	Yes	No	Precise	Rational	1.92	10
Double dressing	Fair	Yes	No/ Yes <12 per cent	Yes	Yes	Precise	Rational	4.17	12
Slurry seal	Very good	Yes, if thick	No	Yes	Yes, if thick	Precise		2.02 – 3.42	4 (fine) 6 (coarse)
Cape seal	Very good	Yes	Yes up to 10/12 per cent	Yes	Yes	Precise		5.15	10
Single Otta	Yes	Yes	No	Yes	No	Loose	Empirical		10
Double Otta	Yes	Yes	Yes	Yes	Yes	Loose	Empirical	Generally cheaper than a double surface dressing (BOTSWANA, 1999)	10
Single Otta with sand seal								Cheaper than a double Otta seal (BOTSWANA, 1999)	
Penetration macadam	Very good		Probable					Expensive	

Road treatments in Bangladesh

General

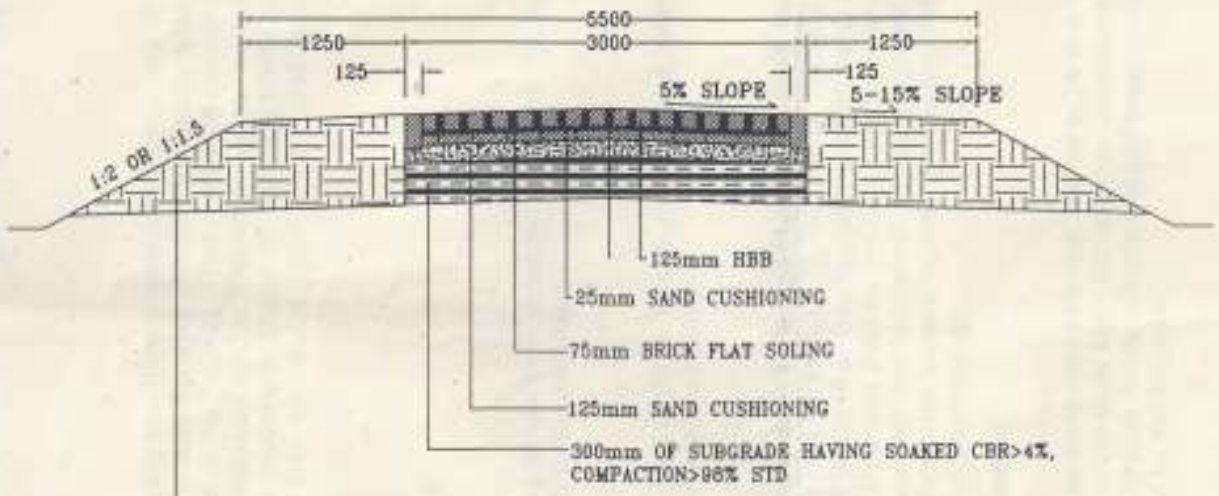
The dominant seal for low-volume roads in Bangladesh is the premixed carpet. Two forms are used:

- **a 3 per cent bitumen carpet which is normally constructed with a seal coat, and**
- **a 5-6 per cent bitumen carpet, which needs no seal coat.**
- **Surface dressing can also be widely found.**
- **Herringbone Bond Brick (HBB) on flat soling**

In practice, HBB is a rapid, cheap improvement on an earth road, and is seen as one step in a staged construction. The HBB is laid on in-situ soil and the passage of traffic over several years serves to compact this soil. When appropriate (higher traffic, available funds and compacted material), the bricks are lifted, cracked, laid as a Water Bound Macadam (WBM) or Aggregate Sand Soil (ASS) base, and sealed. This appears to be an accepted process, although the base and seal must not be unduly delayed as a failed HBB surface is exceptionally rough to rickshaws and other vehicles.

❖**Herringbone Bond Brick (HBB) on flat soling**

RURAL ROAD SECTION WITH HBB PAVEMENT



DRAWING PLATE UNR-HBB-1A

LOCAL GOVERNMENT ENGINEERING DEPARTMENT	
APPROVED BY	UNION/ RR ROAD SECTION THROUGH HILLS (ROAD TYPE B)
	PROJECT: DESIGN UNIT
MD. SHAHIDUL HASSAN CHIEF ENGINEER	01
	SHEET

Herringbone Bond Brick Pavement

a. Description

This work shall consist of a base composed of bricks, laid on edge in a herringbone pattern, placed on a prepared single layer brick flat soling in accordance with these Specifications and to the lines, grades levels, dimensions and cross sections shown in the Drawings and as required by the Engineer.

b. Materials

The materials shall consist of First Class or Picked Jhama Bricks that meet the requirements of Article 3.0b of these Specifications.

Construction Methods

a. Laying the Bricks

A sand cushion of 25mm thickness (minimum) with sand of F.M. not less than 0.5 would be placed over the brick flat soling. The brick then shall be laid on edge with 125mm across the surface in a single layer in a herringbone pattern to the lines, grades, levels, dimensions and cross section shown on the Drawings and as required by the Engineer. The edge of the layer shall be made with cut bricks to produce a line that is compatible with brick edging. The joints shall be filled with sand of FM 0.5 brushed in and the completed layer shall be sprinkled liberally with water.

UNION ROAD HBB PAVEMENT

Plate UNR-HBB -1A For Road Type 8

This is a standard single lane option of Union Road with Herring Bone Bond (HBB) Pavement. This HBB pavement is proposed where quality control is hard to ensure or traffic volume does not justify bituminous pavement. It is aimed at all weather traffic flow at the initial stage.

Road geometry of this HBB Pavement Road is comprised of 3.00m HBB pavement with 1.25m earthen shoulder on each side totaling 5.50m in crest.

It has sub-grade having 4% Soaked CBR and 125 mm sand cushioning compacted to 100 percent STD. Another 25mm sand cushioning has been provided in between flat soling and HBB. This is an option of HBB pavement for Union Road in plane lands and also in hilly areas.

Single and double surface dressing

A single surface dressing is not common in Bangladesh. Trials carried out revealed it gave a rougher surface than a double surface dressing and was felt to be too thin for inexperienced contractors.

The double surface dressing is generally a popular seal. If, as is usual, a viscous binder is used, the base has to be primed. Since a single sized aggregate is expensive, in practice some aggregate grading is used in a surface dressing, the result therefore being close to an Otta seal.

Seal coat

This term refers to a grade aggregate premix around 7 mm thick. It is too thin for use on an aggregate, but is normally used over a normal premix carpet and appears to serve its function well. It uses locally found pea gravel.

Single and double sand seal

Sand seal normally refers to a spray and spread seal using a fine graded aggregate. It is sometimes used as an overlay, but is not in common use.

Normal carpet, and normal carpet with seal coat

This premix carpet is probably the most common, low-volume road seal in Bangladesh. It is constructed using a 20 mm downgraded aggregate (a coarse and fine blend). It uses 3 per cent bitumen and is not waterproof. As a result it requires a seal coat on top, although this will only provide waterproofing from above, and not from rising moisture, which can be common in Bangladesh. it is laid to 25 or 40 mm thickness, the former being more common.

Dense carpet

This premix carpet is similar to the normal carpet, except that it uses 5-6 per cent bitumen and is made from a more carefully specified mix of 12.5 mm stone (typically 45 per cent), 6.5 mm stone (25 per cent), 2.5 mm pea gravel (15 per cent) and fines (15 per cent). As a result, it is fully waterproof and does not require a seal coat. This makes the seal easier to check after construction, and makes it cheaper than the normal carpet with its seal coat. Again, it is laid to 25 or 40 mm thickness.

CARE seal

The CARE seal is a thin, graded aggregate premix carpet, very similar to a normal or dense carpet, as above. CARE originally used a 7 mm premix seal in 1997, but it proved too thin on a variable base. The thickness was increased to 12 mm. It is used on rural roads where traffic is generally low and light. Aggregate is a 10 mm downgrade, a blend of coarse stone

LOW COST WRAP-UP

- A NUMBER OF LOW COST ROAD SURFACE OPTIONS

- SOMETIMES CONSTRUCTED WITHOUT A FORMAL DESIGN PRACTICE

- PHASED CONSTRUCTION SOMETIMES OFFER LOW COST ROAD AFTER 1ST PHASE

- BANGLADESH LOW COST ROAD PRACTICE

- STABILISED ROAD SURFACE AS LOW COST OPTION

EQUIPMENTS

Find the different highway construction equipment names below and in more sources in literature and website

Make a list of equipment manufacturers from below and more sources in literature and website

YOUTUBE road construction equipment video

BUCKETS AND ATTACHMENTS

ROGERS

GORMAN-RUPP PUMPS

FINN

JRB

HENSLEY

WIX FILTERS

HENDRIX

ALLIED Construction Products, LLC

ESCO Engineered Products

MANUFACTURERS

NEW HOLLAND CONSTRUCTION

KOBELCO

Kawasaki Loaders

GRADALL

SAKAI Masters of Compaction

MOXY

Manufacturers:

Caterpillar Equipment
Deere Equipment
Case Equipment
Komatsu Equipment
Bobcat Equipment
Hitachi Equipment
Volvo Equipment
JCB Equipment
New Holland Equipment
Grove Equipment
Terex Equipment
AEI
ABCO
ELF India

Changlin Stock Co., Ltd.

Shenyang North Traffic Co.

Hunan Sanyi Heavy Industry

Modern (Int'l) P & M Holdings Ltd.

Shanghai Longyang Machinery Co.

Liaoning Hainuo Construction Machinery

Lanting Gaoke Asphalt Company Ltd.

Zhenjiang Huatong Aran Machinery

Xianxi Construction Machinery Group

Zhenjiang Huachen Huatong Road Surface Machinery

Aggregate Equipment
High Frequency Screening Plant. Plant can be used to screen: Aggregate materials - manufactured sand, mortar sand, agriculture lime, coal, clay; Damp or wet sticky materials; Processed or recycled materials - trash, slag, ash, shingles, shredded tires, compost, wood waste, just to name a few materials.

Ag / Farm Equipment (inc. Tractors)
Tractors - 175 HP Or Greater
(Listings From TractorHouse.com)
Air Compressor
Asphalt / Paving / Concrete Equipment
Compaction Equipment
Crane
Crawler Loader
Dozer
Drill
Dumper
Excavator
Forestry Equipment
Forklift
Generator Set
Lift
Light Tower
Loader Backhoe
Motor Grader
Pipelayer
Pump
Scrap Processing / Demolition
Scraper
Skid Steer
Skip Loader
Sweeper / Broom

Trailer

(Listings From TruckPaper.com)

Trencher / Boring Machine / Cable Plow

Truck:

Construction / Over-The-Road

(Listings From TruckPaper.com)

Off-Highway Truck

Water Equipment

Wheel Loader

Other Equipment

Light Tower

- *lighting is required in order to illuminate construction area*
- *operation in construction, commercial, industrial jobs and applications where reliable lighting is required.*

Light Tower

High Frequency Screening Plant

- Produces aggregate at high rate.
- It is required to,
  - maintain or increase daily production efficiently and cost effectively eliminating extra labor cost
- 2 types (manufacturers point of view)
  - Stationary
  - Portable

Stationary

Portable

Street Sweeper

A pulse machine that runs up to eight coils, providing large coverage (up to eight feet) with localized target indication.

USES

- *makes the streets cleaner*
- *important part of storm water pollution prevention*
- *prevents unwanted materials from flowing into the storm drains and polluting our bays and causing backups and flooding*
- *keeps job sites clean and safe and helps to minimize tire damage*

Street Sweeper

Water Equipments

Tools and machineries, used in construction purposes

- *to mix up water with other materials,*
- *to supply water continuously*
- *to spread and pumping in highway construction.*

Water Equipments

Compaction Equipment

Purpose:

- Increase the load-carrying capacity of the roadbed.
- Reduce the volume of surfacing material required to maintain the road bed

Types:

- Vibratory smooth drum roller
- Pneumatic tired drum roller
- Vibratory pad foot roller
- Grid roller

Drum Roller

Grid roller

Bulldozer

- large and powerful engineering vehicles.
- used on large and small scale construction sites
- To dig canals, raise earth dams, and do other earthmoving jobs

Bulldozer

Scraper

Scraper

- *The scraper is a self-propelled open bowl, pneumatic-tired, two-axle, single diesel-engine driven, articulated frame steer vehicle.*

USES:

Used for loading, hauling, and spreading earth materials. for improving, maintaining, and constructing combat trails, main supply routes, airfields, excavating protective positions and antitank ditches.

Dumper

- *Designed for carrying bulk material*
- *Types*
- *First Generation Dumper*
- *Modern Dumpers*

Dumper

DEALER OF TEREX

DEALER	CONTACT
RDO Equipment Co.	(701)355-4198 - Bismarck, North Dakota
Honnen Equipment	(303)287-7506 - Commerce City, Colorado
G & H Service Inc	(800)545-1278 - Newton, New Jersey
Flint Equipment Co.	(229)888-1212 - Albany, Georgia
Ontrac Equipment	(866)411-3311 - Thunder Bay, Canada

E3-500 HMA Drum Mixer

For further information of dealer just visit

www.terex.com

Photo 5. Asphalt Paver.

Photo 6. Truck Containing Asphalt backing up to Paver.

Photo 7. Asphalt Compacted immediately by Steel Wheeled Roller, with Multi Tyre Roller in distance.

Photo 8. Gauging Box to ensure delivery of correct volume of Aggregate for each batch.