MODULE 11 RURAL ROAD MAINTENANCE MATERIALS

Objectives

After fulfilling Module 11, you will be able to:

- Know & realize materials for Rural Road Maintenance.
- Understand the quality standards of materials for Rural Road Maintenance.
- Self-Assessment

Requirement

The participants are required to have comprehended following modules:

- Module 1: "*Local Road Network"*
- Module 2: "*The Concepts of Rural Road Maintenance"*
- Module 4: "*Rural Road Defects and Causes"*

Methodology

- The participants are introduced major materials for Rural Road Maintenance (Description and/or using sample of materials)
- The participants are introduced quality standards of road maintenance materials.
- Self-Assessment

Training Kit

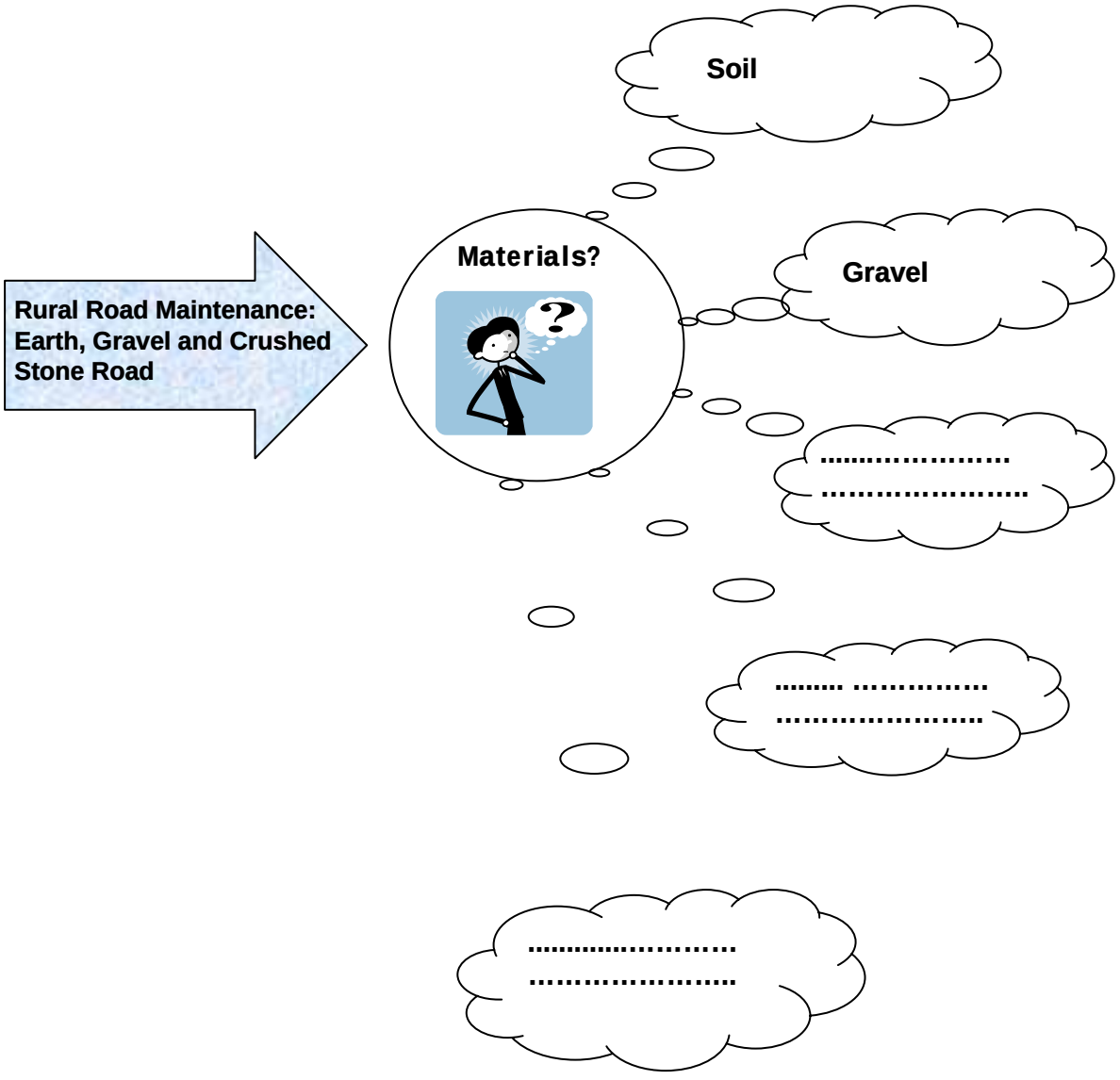
- Rural Road Maintenance Handbook
- Module 11 "*Rural Road Maintenance Materials*"

Studying Activities

1. Learn about materials for unpaved pavement maintenance (realize the materials & their quality)
2. Learn about materials for bituminous pavement maintenance (realize the materials & their quality)
3. Learn about the main materials for on-road structures maintenance (realize the materials & their quality)
4. Self - assessment

1. Learn about materials for maintaining earth, gravel and crushed stone road – definitions and requirements

☞ *Think of materials* that are necessary for maintaining the above road?
Look at and complete the following diagram:



Learn about soil for Rural Road Maintenance

1. Read "*Rural Road Maintenance Handbook*", Page 128, 129 and then add more information in the following table:

- Mark (**++**) for *the commonly used soil* for Rural Road Maintenance
- Mark (**+**) for *the usable soil* for Rural Road Maintenance
- Mark (**-**) for *soils that are not allowed to use* for Rural Road Maintenance
-

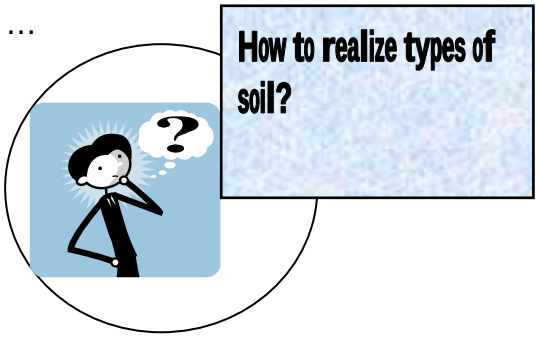
No.	Types of soil	For refilling earth road bed and road surface		
		The commonly used soil (++)	The usable soil (+)	Soils that are not allowed to use (-)
1	Sandy clay (more clay, less sand)	++		
2	Clayey sand (more sand, less clay)			
3	Sandy clay mixed with laterit			
4	Clayey sand mixed with laterit			
5	Clay		+	
6	Sand			
7	Soil dust, sand dust			
8	Borrow damp soil			
9	Rubble mixed with soil			
10	Salty soil			-
11	Soil with high percentage of salt and crystal			
12	Muddy soil			
13	Humus (with many grass roots and wastes)			

For Rural Road Maintenance, it is the best to use.....
.....
.....
.....

notes

Soil is an indispensable material in constructing and maintaining Rural Road. It is used to refill earth road bed and earth pavement. There are many types of soil, *however, not all of them can be used for road maintenance.*

2. …

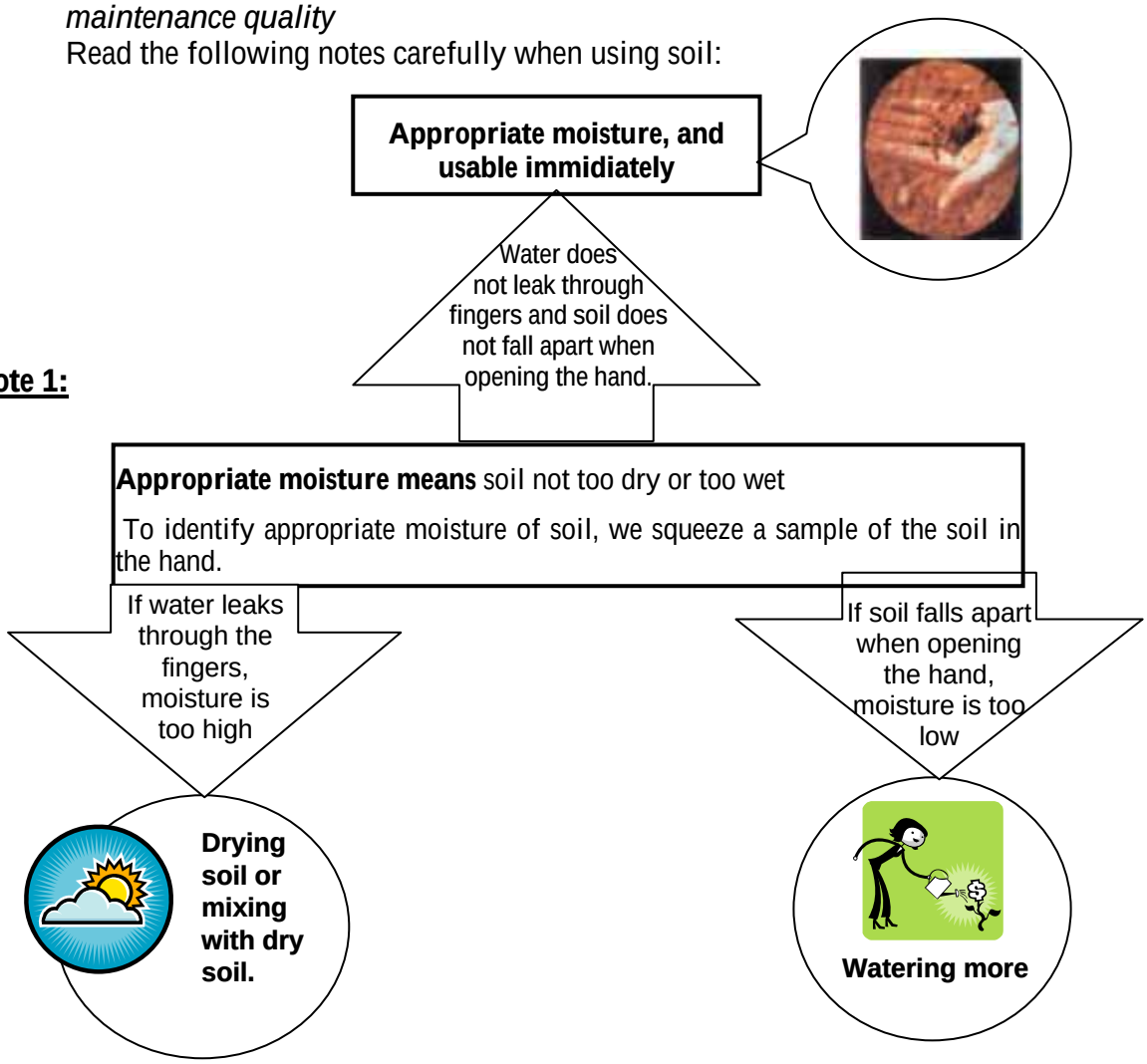


Read "*Rural Road Maintenance Handbook*", table 12- page 130 to know how to realized major soil
Then add more in the following table:

Soil class	Feeling when rolled in hand	Appearance of soil piece after rolling in hand?	Squeeze when dry?	Condition when wet?	Can it be rolled into stick shape?	Other features
……	Fine particles of same shape	Only fine and smooth particles are seen	…… …… ……	Plastic and sticky	Easy to roll into sticky shape with diameter (<3mm)	…… …… ……
……	…… …… ……	Particle size over 0.25mm are seen	Easy to crush	Plastic but not so sticky	…… …… ……	…… …… ……
……	…… …… ……	Majority of particles are over 0.25mm	Very easy to crush	Less sticky Less plastic	Difficult to roll into stick	Rough section

3. How to use the soil?
   It is necessary for chosen soil to be used effectively and appropriately to ensure road maintenance quality
   Read the following notes carefully when using soil:

Note 1:



Note 2:

If sand is used for filling then sand must be laid in …… and watered.

Note 3:

If rubble mixed with soil is used then it must be added with……

Note 4:

In low land areas where only damp clay is available for filling sub-grade then:

- Spades or shovels should be used to cut the clay into ……..
- Size of soil cuttings……..
- Clay cuttings should be dropped from high distance for them ……..each other.
- While placing, we should trample on clay cuttings to increase their density.

☞ Learn about **natural gravel** for Rural Road Maintenance

Gravel material is *a mix of different particle sizes following particular grading principles.* Air voids between coarse particles are filled by finer and air void will be decreased during compaction.
The better gradation (particle size contents are conformed to standard gradation), the higher density will be reached after compaction.
Read carefully contents in following table *to know* characteristics of three types of natural gravel commonly used for road construction:

Types of gravel	Place where gravel is available	Features	Construction Requirements
Alluvial gravel	**Rivers or streams in mountainous areas**	- **Mix of pebble and sand** - **Without plastic clays.**	- **Remove over sized pebble.** - **Add more clays to increase plasticity and make it easy to compact**
Laterite	**Hills in midland region**	- **Red - brown color.** - **Formed by dark brown laterites in different sizes.** - **Include a lot of clays.**	- **Reduce clays.** - **Used at appropriate moisture**
Colluvial gravel	**Rolling terrain in mountainous and midland areas**	- **Yellow or bright brown color** - **Include a lot of pebbles and clays.**	- **Reduce clays (if clay content is high).** - **Used at appropriate moisture**

Referring to your local circumstances and present in summary types of available soil and gravel materials in your locality:
……..
……..
……..
……..
……..
……..
……..
……..
……..
……..
……..

Learn about **crushed stone as a material** for Rural Road Maintenance

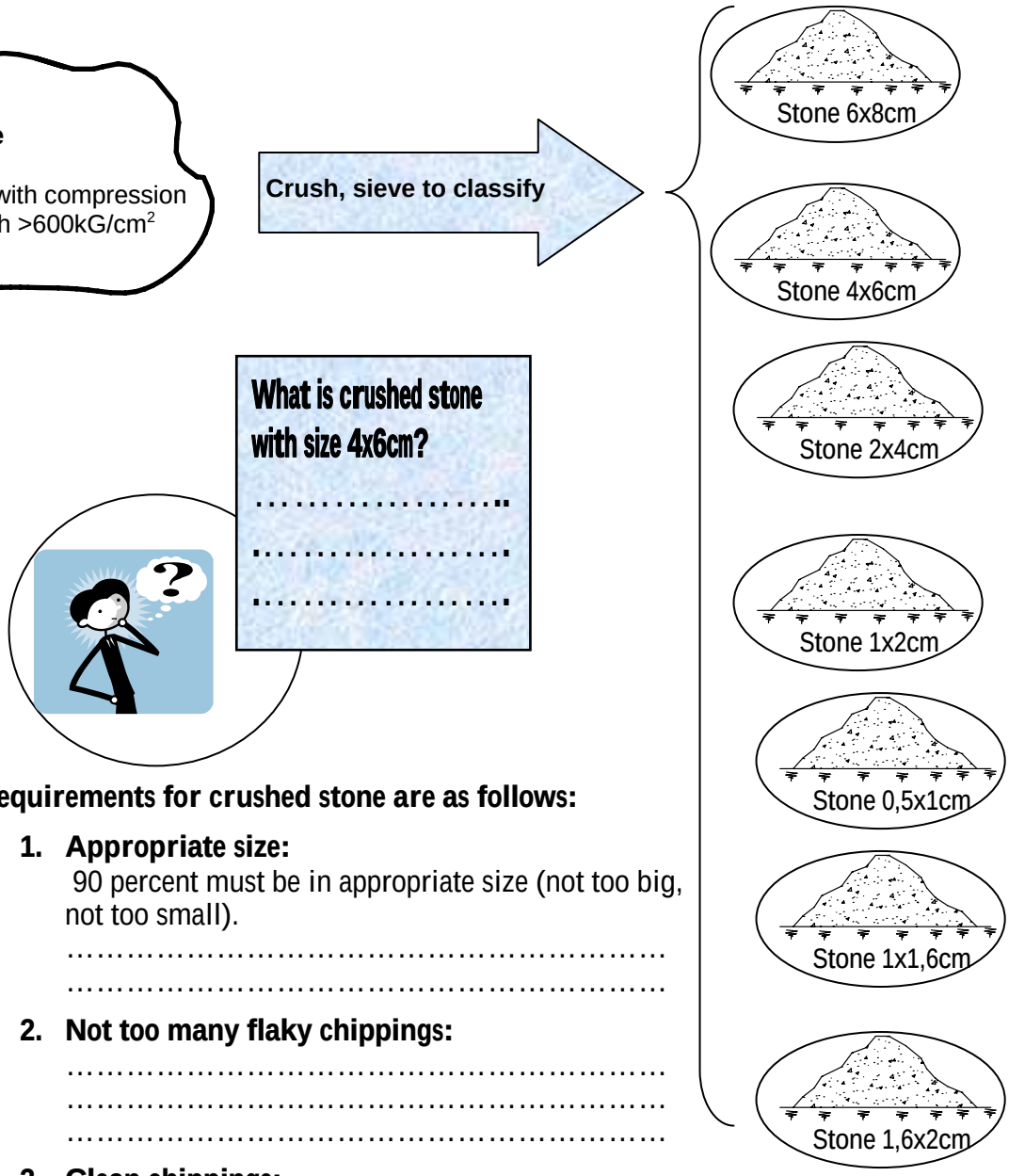
Stone with different sizes is mostly used in road construction and maintenance. Read "Rural Road Maintenance Handbook", page 131, 132 to know the features of and requirements for crushed stone. Then add more information in the following figure:

Stone

Stone with compression strength >600kG/cm^2

Crush, sieve to classify

Types of stone



What is crushed stone with size 4x6cm?

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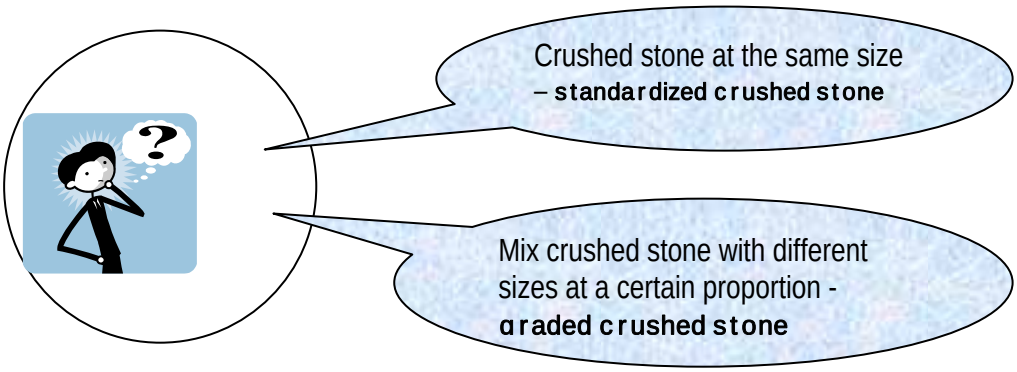
.....

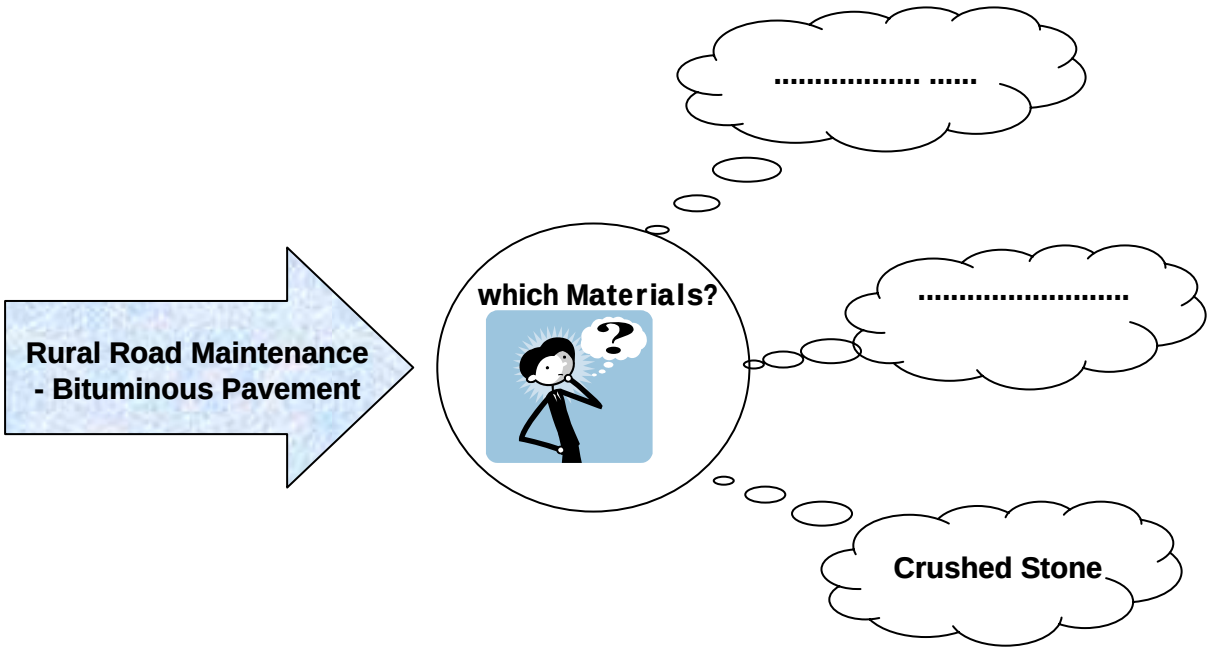
Requirements for crushed stone are as follows:

1. **Appropriate size:**
   90 percent must be in appropriate size (not too big, not too small).
   .....
   .....
2. **Not too many flaky chippings:**
   .....
   .....
   .....
3. **Clean chippings:**
   .....
   .....
4. **Abrasion value should not be too high:**
   .....
   .....
   .....



Learn about materials for bituminous pavement maintenance - definition and requirements

☞ Which materials do you think necessary for bituminous pavement maintenance? Fill in the blanks to complete the following figure:



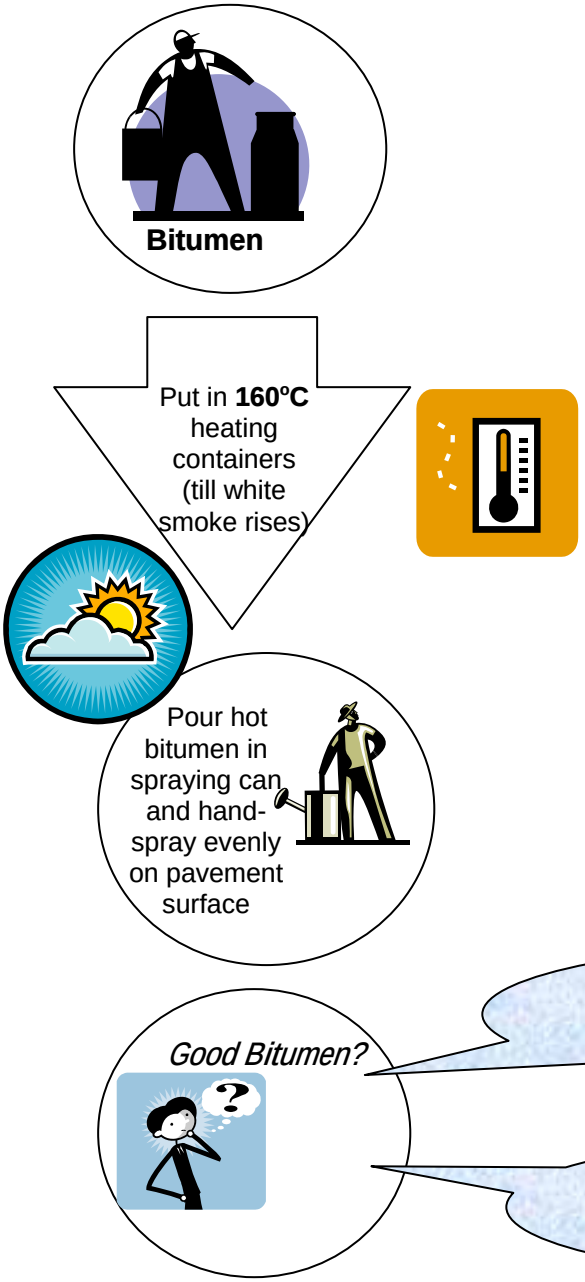
Where:

- Characteristics
- Definition
- Classification
- Using Requirements

of all types of materials in Rural Road Maintenance Handbook for Commune Staff. Binder (bitumen) is presented in following paragraph.

Learn about **bitumen material** for Road Construction and Maintenance

Bitumen is a product extracted from the oil refinery process. It is black, stone-binding and waterproof.
Bitumen is commonly used in surface layer of pavement construction. Types of bituminous pavement called asphalt concrete, bitumen sealing, bitumen penetration depending on using materials, material manufacturing methods and construction procedures.
Bitumen sealing and bitumen penetration are most popular in Rural Road Network.
Hard bitumen with penetration 60/70 is commonly used in constructing *bitumen sealing and bitumen penetration*



Bitumen requirements:

1. Good adhesion to stone
2. Penetration at 25°C is 60 – 70° (0.1mm)
3. Elongation at 25°C is 100cm (minimum)
4. Soften point is 46 - 55°C
5. Flash point is 230°C (minimum)

3. Learn about materials for road structures maintenance - definition and requirements

Learn about **cement** for road structures maintenance.

Some types of cement concrete are commonly used:

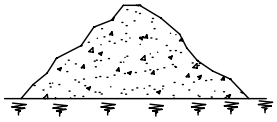
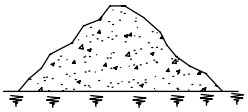
- Hoang Thach Cement
- Bim Son Cement
- Nghi Son Cement
- Chinphon Cement
- ……
- ……

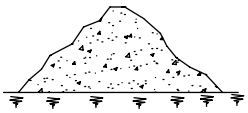
Types of cement for road & road structures repair and maintenance

- Cement-grade 200 (PC20)
- Cement-grade 300 (PC30)
- Cement-grade 400 (PC40)

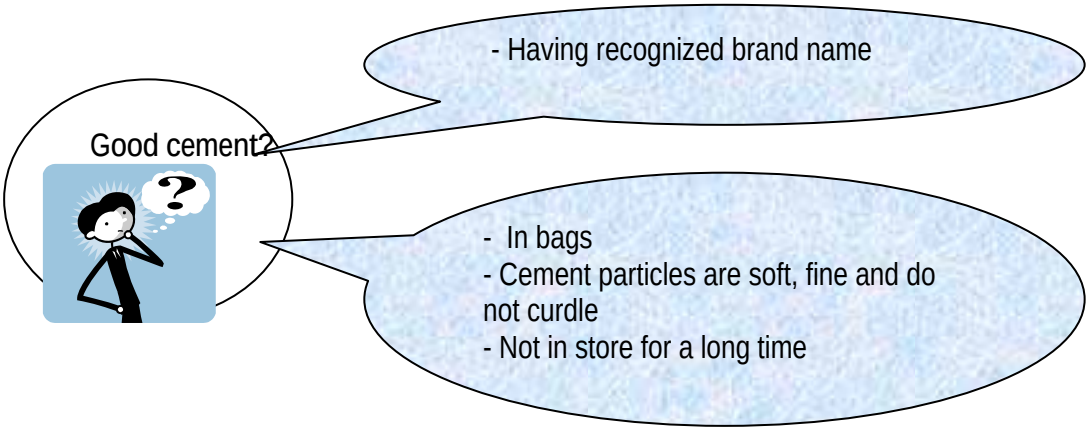
Cement Usage

Write down names of products containing cement in the suitable blanks:


Cement + 
Crushed stone + 
Coarse sand + Water = ...


Cement + 
Coarse sand + Water = ...

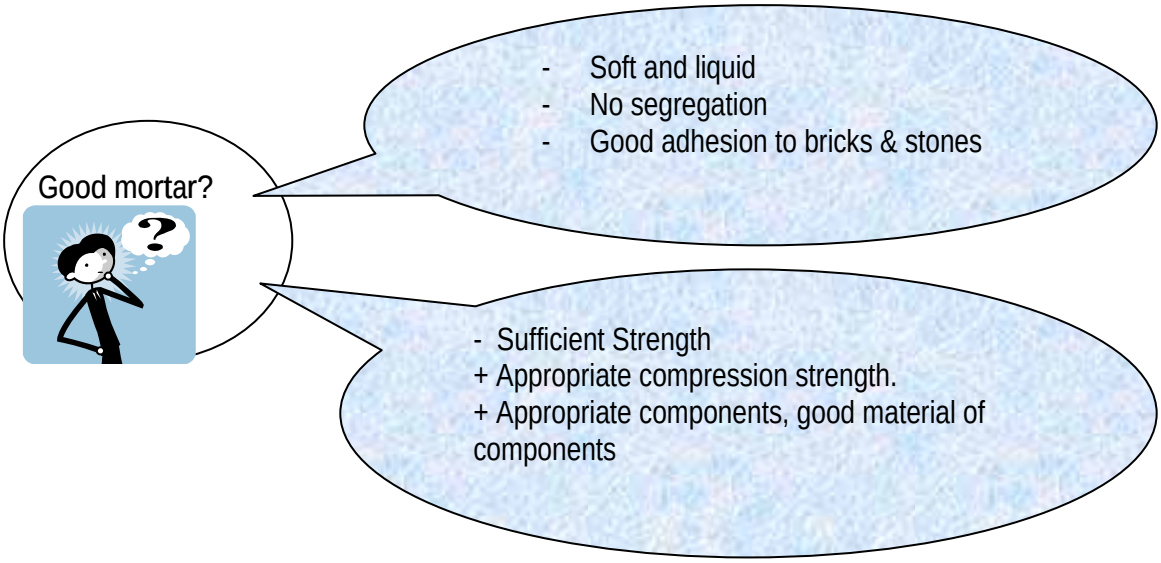

Cement + 
Fine sand + 
Lime + Water = ...



☞ Learn about **mortar as a material** for road structures maintenance.

Cement mortar is commonly used for Rural Road Maintenance, specifically as follows:
- To repair drain system such as building and lining.
- To repair culverts such as building and plastering apron, head wall, wing wall or crack sealing.
- Repair bridges such as building, jointing, lining and plastering the quarter cone…
- Repair/reinforce retaining wall
- …

Read "*Rural Road Maintenance Handbook*" page 138 and 142 to understand types of mortar.



Practical exercise

Find out mixing rates of lime mortar -grade 50 using cement-grade 300 (PC30)?

Task:

Refer to table 16, page 140 in *"Rural Road Maintenance Handbook" for component materials used for 1m^3 of mixed mortar with strength of 50 after mixing fine sand and cement with a strength of 300 as follows:*

- Cement: ……....
- Powdered lime:…….
  (Hydrated lime:…….)
- Fine sand:……..

Learn about **cement concrete** for road structures maintenance.

Look at Appendix 4 - Part III - section 3 (page 133, 134, 135) in "Rural Road Maintenance Handbook" (for Commune Staff) and fill in the following table requirements for component materials of cement concrete

Component Materials	Technical requirements
Crushed stone	*- Sufficient strength* *- Appropriate size.* *-The flakiness ratio should not exceed 25%* *- The friable and clay particle ratio should not exceed 10%* *- Clean*
Sand	…… …… …… …… ……
Cement	…… …… …… …… ……
Water	…… …… …… …… ……

Kiem tra - Danh gia **Assessment**

1. Fill in the blank in following paragraph requirements of materials for rural road maintenance.

1. Crushed stone using for double bitumen sealing treatment should be .....

.....

2 Cement using for mortar building head wall of culvert should be .....

.....

3 Hard bitumen using for pothole filling should be .....

.....

4. Colluvial gravel for reconstructed gravel pavement should be .....

.....

Good	Not Good

2. Write in following blank table name of necessary materials to carry out rural road maintenance activities :

Double bitumen sealing on crocodile cracking pavement

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.....

.....

Replace broken concrete slabs

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Good	Not good