

MODULE 19

RURAL ROAD MAINTENANCE QUALITY ASSESSMENT

Objectives

After fulfilling Module 19, you will be able to:

- Understand the parameters used to assess quality of Rural Road Maintenance works
- Know how to define the parameters to assess the maintenance works quality
- Self - assessment.

Requirement

The participants are required to have comprehended following modules:

- Module 2: "*The Concepts of Rural Road Maintenance*"
- Module 4: "*Rural Road Defects and the Causes*"
- Module 12, 13,14 of "*Rural Road Maintenance Techniques*"

Methodology

- The participants are introduced the parameters for road maintenance quality assessment
- The participants are introduced and given guidance on measuring, assessing the road maintenance quality (observation and/or practice)
- Self - Assessment

Training Kit

- Rural Road Maintenance Handbook
- Module 19 "*Rural Road Maintenance Quality Assessment*"

Studying Activities

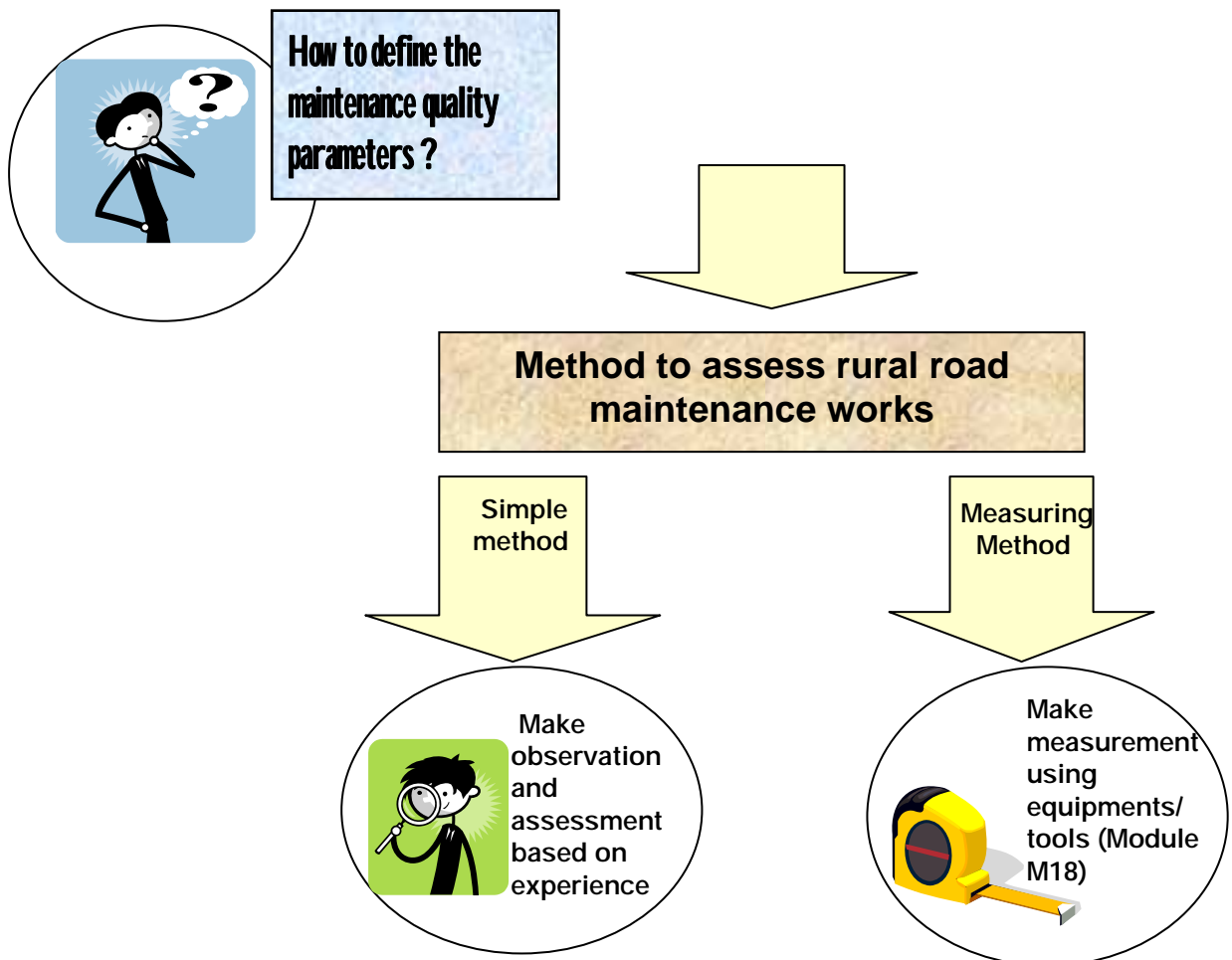
1. Learn about the parameters for road maintenance quality assessment
2. View & find out the measuring method to define the parameters for road maintenance assessment - equipments and/or tools, procedure & calculation.
3. Self - assessment

1. Learn about the parameters for road maintenance quality assessment

Quality assessment should be carried out not only when maintenance works is finished but also during implementation.

Each maintenance work can be assessed using particular parameters. Some popular parameters are given below.

- Material quality parameters (as presented in Module M11)
- Geometric dimension parameters
- Density of compacted soil and pavement materials.
- Evenness of bitumen spraying and crushed stone spreading.
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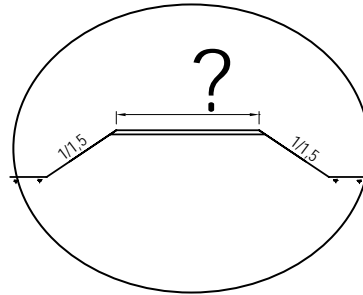
Read the following presentation *to know about* parameters for geometric dimension assessment

These parameter used to assess geometric dimensions of road maintenance works if they conform to requirements.

geometric dimension assessment parameters

Length/width:

1. Formation
2. Pavement
3. Drain
4. Retaining wall
5. Foundation
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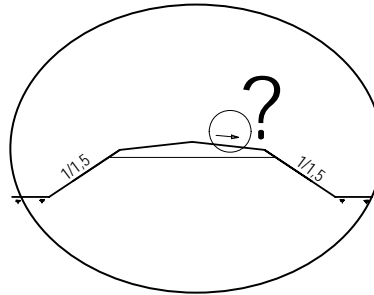


Length/width permitted tolerance:

1. It does not exceed tolerance of 10cm.
2. It does not exceed 5% respective dimensions of drains/ culverts...

Cross fall

1. Pavement camber
2. Formation



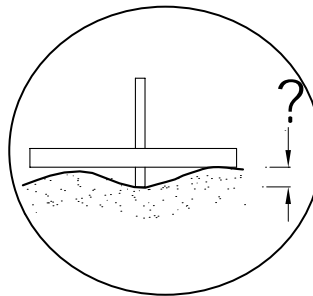
Cross fall permitted tolerance

It does not exceed:

1. $\pm 0.5\%$ for pavement
2. $\pm 0.5\%$ for shoulder

For example, the finished cross fall should be from $(4 - 0.5) = 3.5\%$ to $(4 + 0.5) = 4.5\%$ for required cross fall of 4%

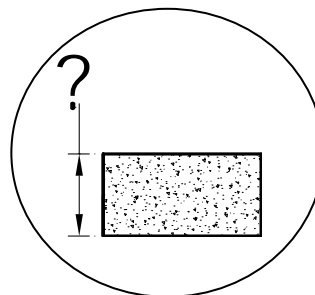
Roughness of pavement assessed by 3m straight edge



Roughness permitted tolerance:

Interstice between the straight edge and pavement does not exceed mm depended on type of pavement

Pavement thickness



Pavement thickness permitted tolerance

Maximum tolerance of pavement thickness is 10%

For example, the finished pavement thickness should be from $(20 - 20 \cdot 10/100) = 18\text{cm}$ to $(20 + 20 \cdot 10/100) = 22\text{cm}$ for required pavement thickness of 20cm

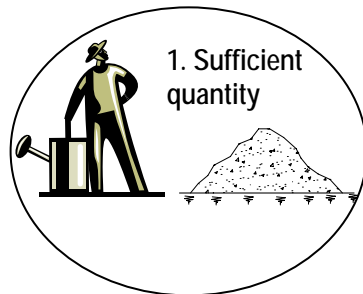


Read the following paragraph *to understand* parameter to assess evenness of bitumen spraying and chippings spreading

Manual bitumen spraying and chippings spreading usually are required during bituminous pavement construction and/or maintenance of rural road.

Read Module M14 again to remember method of manual bitumen spraying and chippings spreading.

There are 2 main requirements of bitumen spraying and chippings spreading



Bitumen spraying:
The difference of bitumen spraying rate per sq.m does not exceed 5% in comparison with requirement

Chippings spreading:
The difference of chippings spreading rate per sq.m does not exceed 8% in comparison with requirement

Practice

Commune X Maintenance Group carried single bitumen sealing with bitumen rate of 1,2 kg/m²; and chippings spreading rate (0,5x1cm sized) of 10 litre/m²

Calculate the bitumen and chipping rate (per sq.m) that conform to requirement?

Solution

Calculate the chipping rate per sq.m:

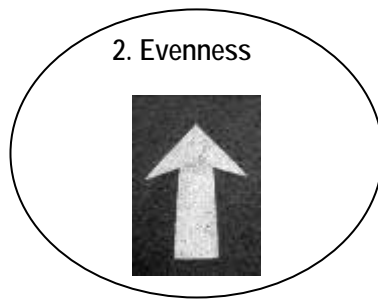
The minimum chipping rate is : 10litre - 10 litre *8/100 = 10 litre - 0,8 litre = 9,2 litre/m²

The maximum chipping rate is:

Calculate the bitumen rate per sq.m:

The minimum bitumen rate is:

The maximum bitumen rate is:



Bitumen spraying:

The difference of bitumen in different locations on pavement does not exceed 10%

Chippings spreading:

The difference of chippings in different locations on pavement does not exceed 10%

Practice

Commune X Maintenance Group carried single bitumen sealing with bitumen rate of 1.2 kg/m²; and chippings spreading rate (0.5x1cm sized) of 10 litre/m²

Sprayed bitumen and spread chipping follow checking results at three locations on pavement are given below:

At checking location 1: bitumen : 1.15kg/m²; chippings : 9.3 litre/m²

At checking location 2: bitumen: 1.25kg/m²; chippings: 10.7 litre /m²

1. Check for sufficiency of bitumen & chippings at both of the checking locations
2. Check for evenness of bitumen spraying and chippings spreading?

Solutions

1. Check for sufficiency of bitumen and chippings

Items	Unit	Required Rate	Actual		Quantity differences in comparison with requirement		Permitted tolerance (%)	Conclusion	
			At location1	At location2	At location1	At location2		At location1	At location2
Bitumen	kg/m ²	1.2	9.3	10.7	$\frac{(1.2-1.15)}{1.2} \times 100 = 4.16$	5	Good
Chipping	litre/m ²	10	1.15	1.25	$\frac{(10.7-10)}{10} \times 100 = 7$	8	Good

2. Check for evenness of bitumen spraying and chipping spreading

Items	Unit	Actual rate at	
		Location 1	Location 2
Chippings	litre/m ²	10.7	9.3
Bitumen	kg/m ²	1.15	1.25
Difference between rate at the locations	%	$\frac{(1.25-1.15)}{1.15} \times 100 = 8.7$
Permitted tolerance	%	10	10
Conclusion		Good

Final conclusion:

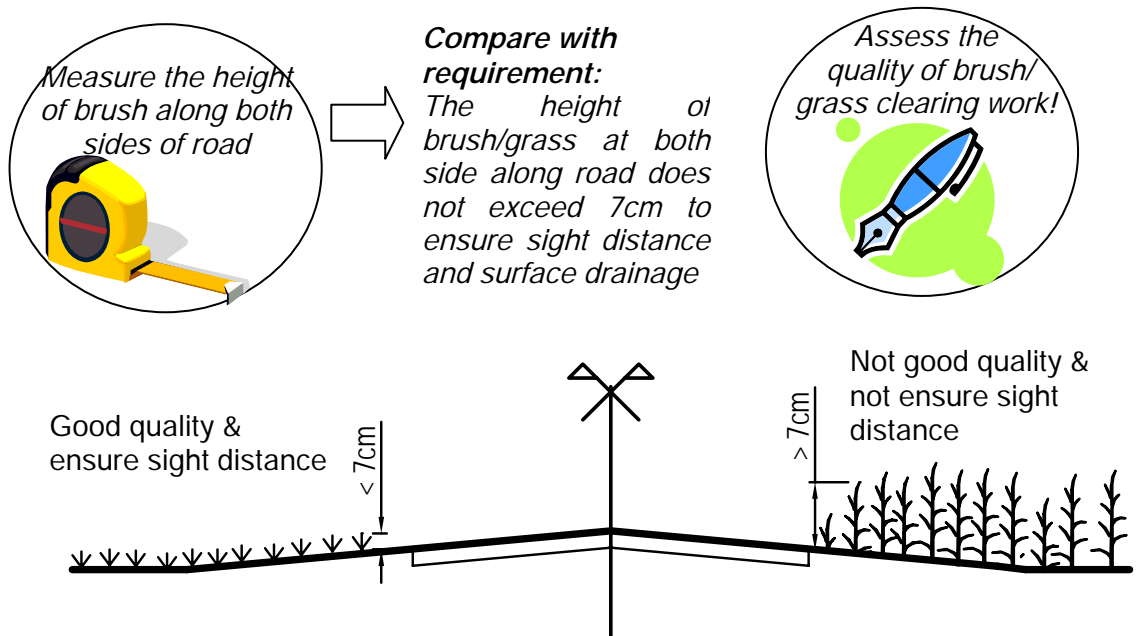
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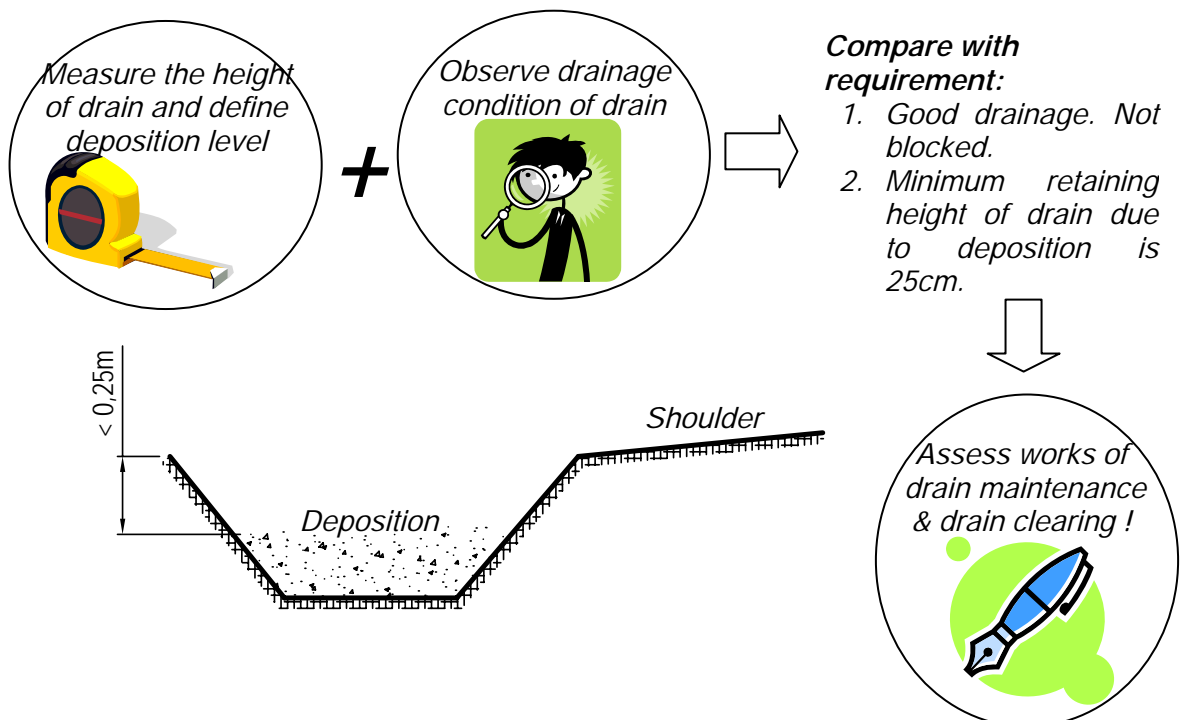
2. Learn about measuring method to define quality control parameters of maintenance works - tools, procedure and calculation.



Read the following paragraphs to know about quantity control of brush/grass clearing for sight distance.



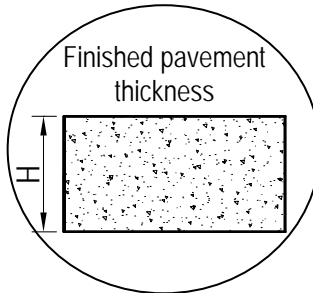
Read & learn about method to assess quality of drain clearing work





Read carefully the method below of pavement thickness estimate and *make followed calculations*

Dig a pit and measure pavement thickness using straight edge or locked steel tape



Permitted tolerance of pavement material thickness does not exceed 10%.

The required finishing pavement thickness is 15 cm. What is the permitted range values of pavement thickness ? Present calculation in following line.

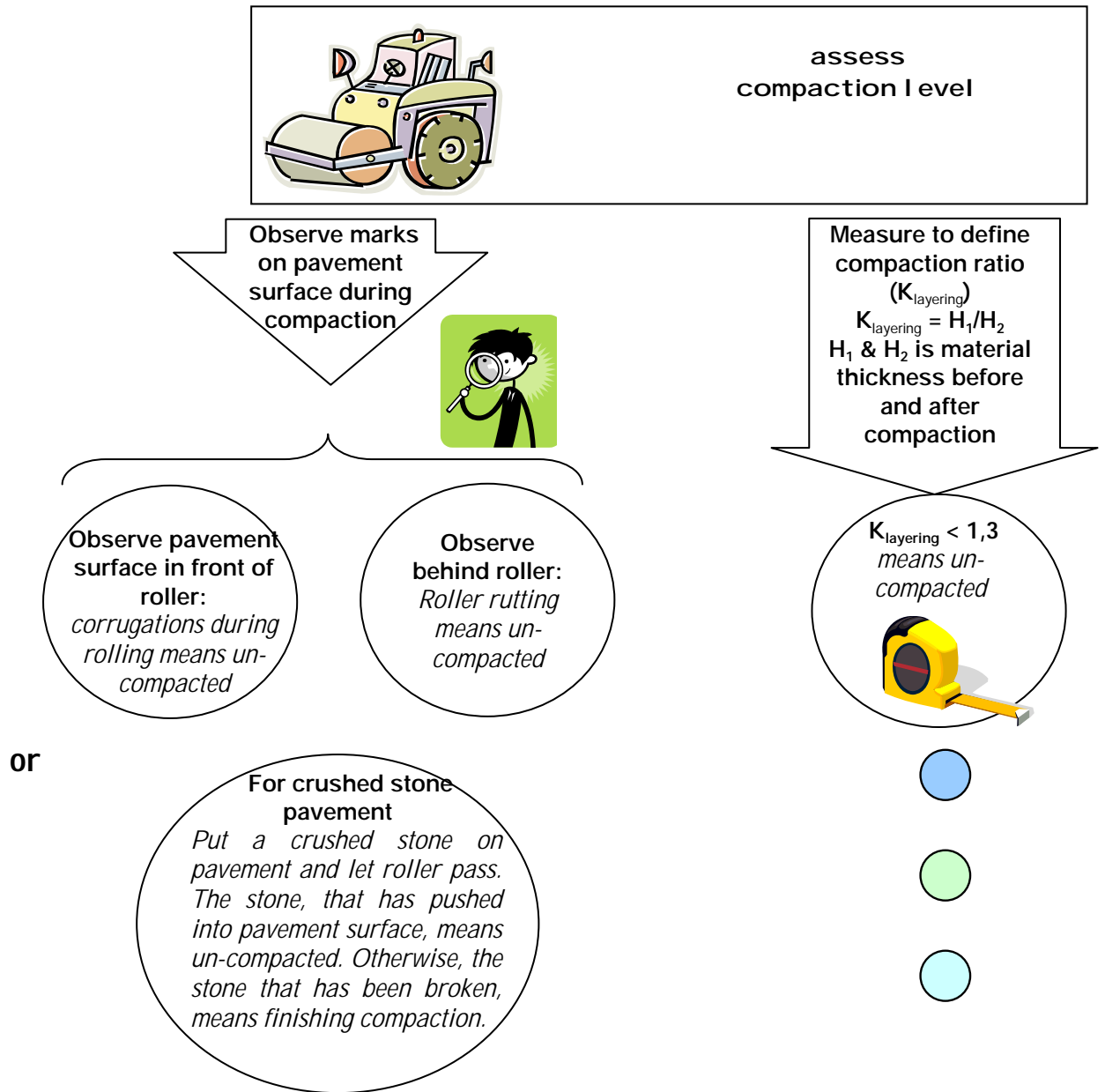
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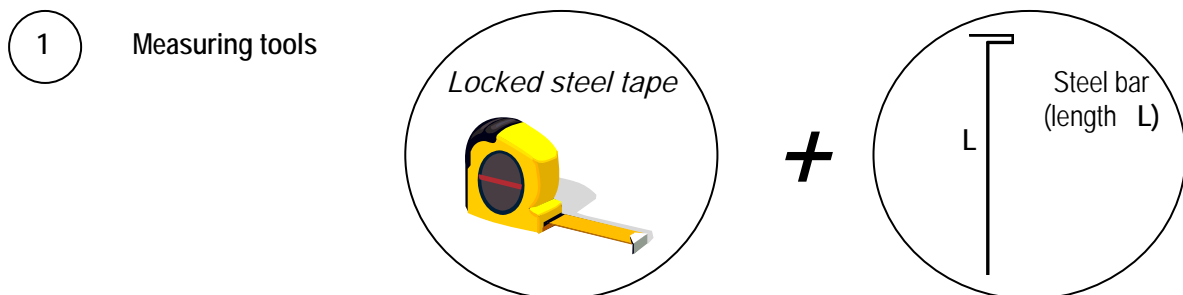
Look at methods to assess density of compacted sub-grade and pavement material



Two following methods can be combined to check density of compacted sub-grade and pavement of rural road



To define compaction ratio K_{layering}



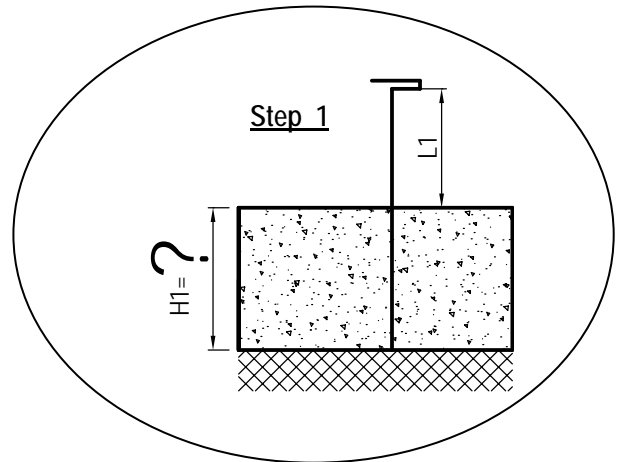
2 Measure material layer thickness

Step 1

After layering and grading:

1. Put steel bar to full depth of layered material thickness.
2. Measure the distance, L_1 , from top of steel bar to material layer surface using locked steel tape

$$\rightarrow H_1 = L - L_1$$

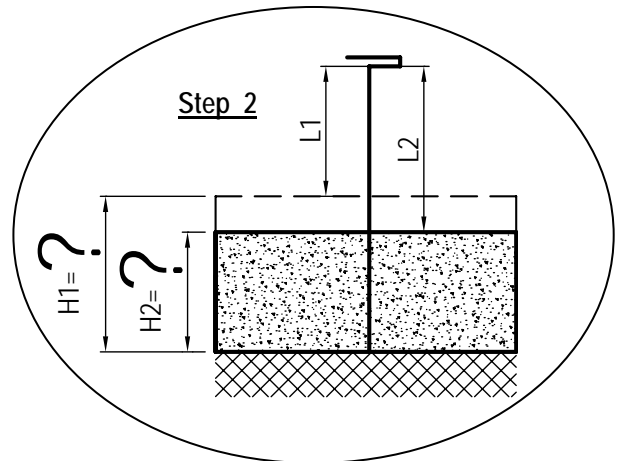


Step 2

After compaction:

1. Grade material around steel bar to compacted surface
2. Measure the distance, L_2 , from top of steel bar to material layer surface using locked steel tape

$$\rightarrow H_2 = \dots\dots\dots$$



3 Calculate compaction ratio: $K_{\text{layering}} = \frac{H_1}{H_2}$



note

Density is key factor of sub-grade and pavement quality. It should be controlled during construction and checked after completion



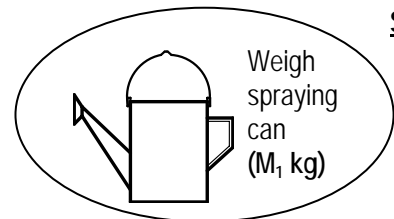
Read the paragraph of bitumen spraying assessment below : *bitumen rate & spraying evenness.*

Bitumen should be sprayed evenly and fully covered pavement surface. Hand-spraying should make by strips that overlaps 2-5 cm into each others. Walking speed of spraying worker need be controlled to ensure evenness.

1 Implementing Procedure

Step 1

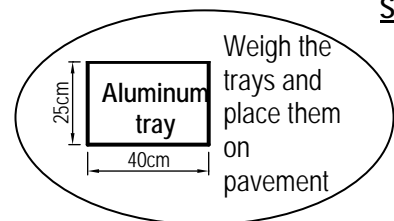
Weigh spraying can
 The mass of spraying can is M_1 kg.



Step 1

Step 2

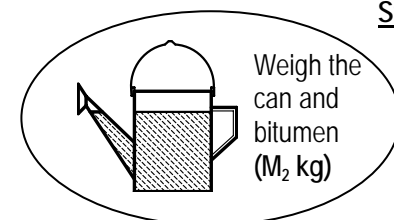
Weigh two aluminum 25cmx40cm trays. Tray 1 weighs Q_1 kg, ans tray 2 is Q_2 kg
 Place the trays on pavement that is going to be sprayed bitumen



Step 2

Step 3

Take hot bitumen into spraying can..
 Weigh the spraying can that includes bitumen .
 The mass of can included bitumen is M_2 kg

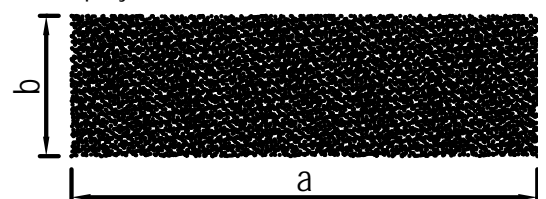


Step 3

Step 4

Spray all bitumen evenly on pavement surface (by rectangle strip).
 Define the area of sprayed bitumen. $S = a . b$, (m^2)

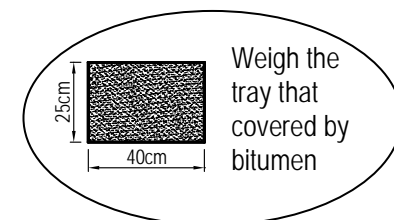
Spraying bitumen evenly, then measure sprayed area



Step 4

Step 5

Take the aluminum trays that are covered by bitumen out of pavement and weigh.:
 Tray 1(covered by bitumen) weight is P_1 kg
 Tray 2 1(covered by bitumen) weight is P_2 kg



Step 5

2 Results and Assessments

Bitumen that has been sprayed on pavement

$$\text{Bitumen content} = \frac{M_2 - M_1}{S}, \text{ kg/m}^2$$

Compare the calculated bitumen rate with required rate to define if the difference exceed 5% ?

Bitumen that has been sprayed in tray 1 = $P_1 - Q_1$ (kg)

Bitumen that has been sprayed in tray 2 = $P_2 - Q_2$ (kg)

Make comparison to define if the deference between bitumen in the two trays exceed 10% ?

 Assess chippings spreading: chipping rate and evenness.

Chippings is spread immediatly after hot bitumen spraying. The two trays that has been covered by bitumen, is replace on pavement to define the evenness of chipping spread.

1 Procedure

Step 1

Measure out chippings by wooden box with dimension of $a \times b \times h$ (dm)

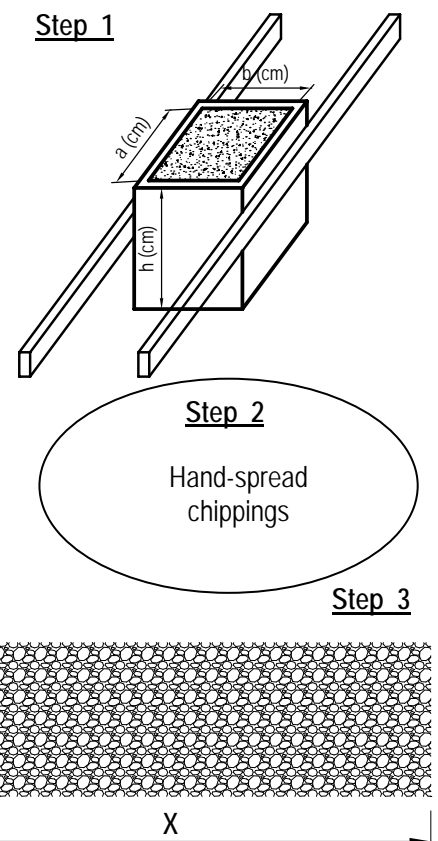
→ Chipping volume in the box is : $V = a.b.h$, litre

Step 2

Hand-spread all chippings in the wooden box on pavement in rectangular area

Step 3

Measure the chipping rectangular area, $S = x . y$ (m²)



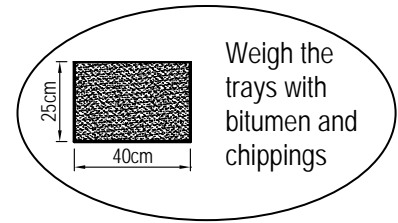
Step 4

Step 4

Take the two trays of sprayed bitumen and spread chippings, then weigh them:

Mass of tray 1 (with bitumen and chippings) is K_1 kg

Mass of tray 2 (with bitumen and chippings) is K_2 kg



2 Calculate and Assess

Spread chipping quantity

$$\text{Chipping rate} = \frac{V}{S} = \frac{a.b.h}{x.y} \text{ (litre per sq.m)}$$

Compare calculated chipping rate with requirement to find if the difference exceeds 8%.

Chipping spread on tray 1 = $K_1 - P_1$ (kg)

Chipping spread on tray 2 = $K_2 - P_2$ (kg)

Compare the chippings spread on the tray 1 and tray 2 to find if the difference exceeds 10%.

Kiểm tra - Danh gia **Assessment**

1 Hamlet A Road Maintenance Group carried out reconstruction of gravel pavement.

During construction, they used 50cm long steel bar to measure depth of layered material. The results were $L_1 = 22\text{cm}$, $L_2 = 30\text{cm}$. Define the layering ratio (K_{layering}) and give conclusion on density of compacted material.

Solution

Due to $L_1 = 22\text{cm}$, the layered materials thickness (before compacting) is:

$$H_1 = L - L_1 = \dots\dots\dots, \text{ cm}$$

Due to $L_2 = 30\text{cm}$, the material thickness after compaction is :

$$H_2 = L - L_1 = \dots\dots\dots, \text{ cm}$$

Then, layering ratio is :

$$K_{\text{layering}} = \frac{H_1}{H_2} = \dots\dots\dots$$

Conclusion:

Good	Not good
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2 A commune A transport staff took the results during inspection of bitumen spraying as followed.

Mass of bitumen spraying can : 0.8 kg

Mass of bitumen spraying can with hot bitumen: 7.1 kg. It was used to spray on pavement area of 5 m²

Mass of tray 1 (without bitumen) is 0.5 kg

Mass of tray 2 (without bitumen) is : 0.55 kg

Mass of tray 1 with hot bitumen is 0.65 kg

Mass of tray 2 with hot bitumen is 0.72 kg

Required bitumen rate is 1.5 kg/ cu.m. Make calculation to find out if the sprayed bitumen rate is sufficient and even.

Solution:

Sprayed bitumen on pavement:

....., kg

Sprayed bitumen rate:

....., %

The difference between sprayed bitumen rate % requirement:

....., %

Bitumen sprayed on tray 1:

.....*kg*

Bitumen sprayed on tray 2:

.....*kg*

The difference between sprayed bitumen on tray 1 and tray 2

....., %

Conclusion:

.....

Good

Not good