

RAIN AND ROAD DAMAGES

Is rain the real culprit for road damages?

The newspapers on Saturday, 04 December 2021 reported an interesting news. Famous Malayalam movie actor criticized the state government of Kerala for the miserable condition of roads in the state in the presence of PWD minister on the occasion during the state-level inauguration of publishing the road maintenance period (DLP-Defects Liability Period) of PWD roads at a celebrated function in Thiruvananthapuram. Thiruvananthapuram Mayor and Vattiyoorkavu MLA were also shared the stage on the occasion.

Presiding over the function, Vattiyoorkavu MLA said it was difficult to repair the road during monsoons. In response to this, the actor said that if the roads could not be repaired during the monsoon season, then the roads would not be there in Cherrapunji*. He added, 'so that's not the case'.

Then what's the real issue with our roads?

Also, the actor said during the same occasion "People who pay road tax deserve good roads".

A valid statement which all common people desperately wishes to say / says since years.

Apparently, what is important, frequent maintenance or constructing good quality roads to minimise maintenance?

How long the systems can accuse the rain and escape from their responsibilities? How to construct a proper road pavement? Is the current construction method used for road works by Local Bodies* and by Public Works Department (PWD) are sufficient? Do we people will be fortunate to travel through good roads in near future?

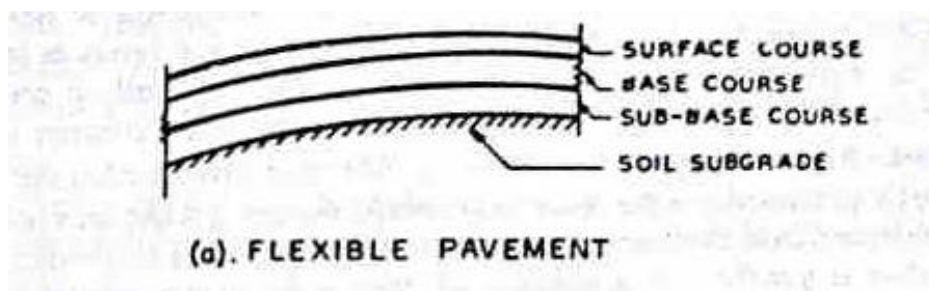
Many a cases people might be wondering how could a road be paved similar to a wall poster by sticking a thin asphalt layer using a spread of bituminous prime coat on top of the wet mix macadam which is not compacted or prepared as per the standards. Sometimes this happens on top of the existing damaged road without milling the top layer instead merely brushing it using broom.

The public might also be interested in knowing what is the real issue with our roads. How a standard road to be constructed in order to attain its ideal life?

Types of Pavement

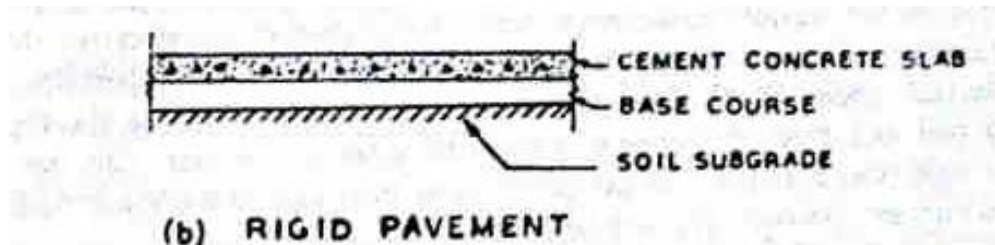
Based on the structural behaviour, pavements are generally classified into two categories;

- a) Flexible Pavement: Flexible pavements are those, which on the whole have low or negligible flexural strength and are rather flexible in their structural action under the loads. A typical flexible pavement consists of four components: i) soil subgrade ii) sub-base course iii) base course iv) surface course.



- b) **Rigid Pavement:** Rigid pavements are those which possess not worthy flexural strength or flexural rigidity. The stresses are not transferred from the grain to grain to the lower layers as in the case of flexible pavement layers. The rigid pavements are made of Portland cement concrete – either plain, reinforced or prestressed concrete. The rigid pavement has the slab action and is capable of transmitting the wheel load stresses through a wider area below.

The cement concrete pavement slab can very well serve as a wearing course surface as well as an effective base course. Therefore, usually the rigid pavement structure consists of a cement concrete slab below which a granular base or sub-base course may be provided.



Factors to be Considered in Pavement Design

Pavement design consists of two parts

- a) Mix design of materials to be used in each pavement component layer.
- b) Thickness design of the pavement and component layers.

The various factors to be considered for the design of pavements are;

- i) Design wheel load
- ii) Subgrade soil
- iii) Climatic factors
- iv) Pavement component material
- v) Environmental factors
- vi) Special factors in the design of different types of pavements

Road Pavement Components

Subgrade: If the existing subgrade is suitable for construction, then it should be compacted to not less than 95% of the maximum dry density (MDD). If the embankment to be filled with suitable excavated material or imported material, then it should be spread in the layers not exceeding 25cm each layer and compacted to achieve required MDD. Each compacted layer shall not be less than 95% of MDD. Minimum CBR (California Bearing Ratio) for Subgrade is 15%.

Granular Subbase: Granular Subbase material / road sub base material shall consist of hard, durable natural/screened gravel or crushed stone and shall be free from clay balls or other deleterious substances. Granular sub base shall be well graded and it should achieve CBR 30%.

Aggregate Base Course / Wet mix Macadam: This work shall consist of furnishing and placing one or more courses of high quality crushed aggregate, including binder soil if required bound by means of carefully controlled moisture content. CBR greater than or equal to 80% required for this work.

Asphalt Base Course / Binder Course/ Wearing Course: Bituminous paving courses shall consist of coarse aggregates, fine aggregates, filler material and bitumen binder. Aggregate gradation differs for different courses. Mix design to be prepared for each layers. Each layers to be compacted to its required density.

Bituminous Prime Coat: it shall consist of applying liquid asphalt to a previously prepared and approved sub base, aggregate base course, wet mix macadam.

Bituminous Tack Coat: It shall consist of applying emulsified asphalt diluted with an equal quantity of water (1:1) to a previously prepared bituminous base course or bituminous binder course or to an existing bituminous course.

All the works to satisfy with the complete project specification and comply with all required tests in addition to the few abstract specified above.

Difference Between Bitumen and Tar

Bituminous binders used in pavement construction works may be broadly divided into bitumen and tar.

Bitumen: Bitumen is a petroleum product obtained by the distillation of petroleum crude.

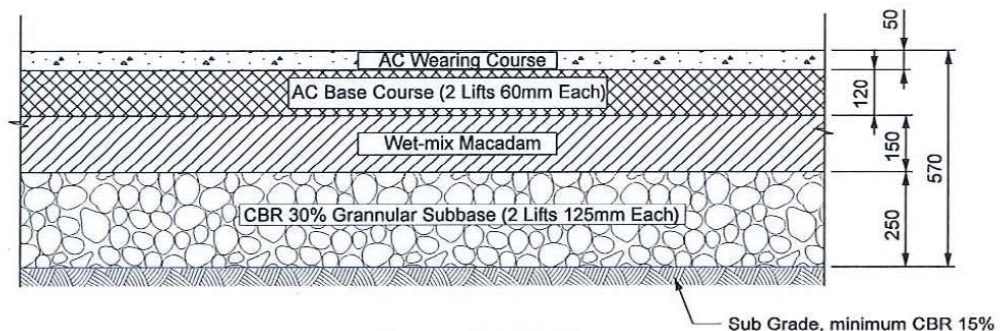
Tar: Tar is obtained when the natural organic material such as wood and coal, carbonized or destructively distilled in the absence of air. The coal tar is widely used in construction among wood tar and coal tar.

Comparison of Tar & Bitumen

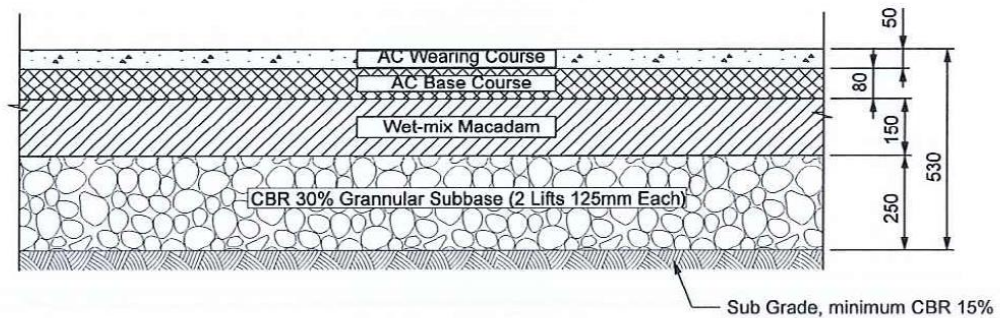
Both bitumen and tar have similar appearance, black in colour though they have different characteristics. Both these materials can be used for pavement works. The tar is considered to have much inferior weather resisting property. Tar is more temperature susceptible and bitumen are less temperature susceptible. The free carbon content is more in tar, which in most of the cases considered as an impurity.

Typical Road Cross Sections

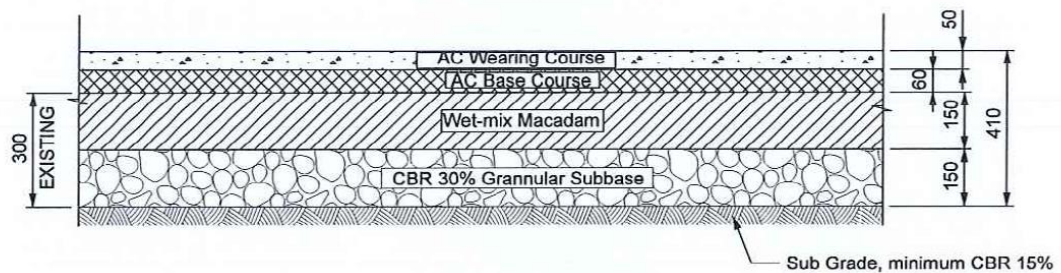
Typical road cross sections of flexible pavements designed for different design speeds, wheel loads and considering the other applicable parameters are as follows (for reference); Generally, flexible pavements are used for road construction by Local Bodies and PWD.



TYPE 1 PAVEMENT



TYPE 2 PAVEMENT



TYPE 3 PAVEMENT

Is the current construction method used for road works by Local Bodies and by Public Works Department is Sufficient

The world has been travelled a long way ahead in construction methods with new technologies. The machineries like Grader, Asphalt Paver, Vibratory Roller, Pneumatic Tyre Roller, Asphalt Coring Machine, Asphalt Milling Machine, Hot Mix Plant* etc. have been widely used in construction.

Same time still we can see around us, the public roads been constructed using manual spreading of asphalt, bituminous prime coat and it's been somehow compacted with the basic Road Roller, the similar one which our legendary actor Pappu Chettan drove through Thamarassery Churam (Pass) decades back.

Finally, Is Rain the Real Culprit for Road Damages

Do you think the roads in our state / under Local Bodies / by PWD are constructed fulfilling the Engineering standards and requirements?

Some of the standards are mentioned above for a quick check. At least to the road cross sections or the road layers, construction materials in general and machineries used which are visible even for a pedestrian passing through.

If your answer is a big "NO", then, obviously, please don't blame the innocent rain, you know where the problem lies with. Let the rain showers when nature wishes. We need rain too for a sustainable environment.

If your answer is "YES" then also, please do not blame rain, dear professionals please go back to your designs and standards, research and develop a better design for roads to withstand rain.

References:

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- CESMM4 (Civil Engineering Standard Method of Measurement); by Institution of Civil Engineers (ICE), 40Marsh Wall, London E14 9TP
- The New Indian Express news dated 04 December 2021;

<https://www.newindianexpress.com/states/kerala/2021/dec/04/actor-jayasurya-takes-a-dig-at-poor-quality-kerala-roads-in-the-presence-of-pwd-minister-2391787.html>

Notes:

* Cherrapunji, a place in Indian state of Meghalaya which is often considered as the wettest place on earth with most rainfall; But for now nearby Mawsynram currently holds that peculiarity.

* Local Bodies – Local bodies are Local Self Governing Departments, means Grama Panchayats, Block Panchayats, District Panchayats, Municipalities Corporations etc.

* Hot Mix Plant – These are asphalt hot mixing plants used for mixing the asphaltic surface courses of the road.