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Home »
WBM Road | Construction Procedure of WBM Road | Water Bound Macadam | WBM Road Specification

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Post Contents

What Is WBM Road

The full form of **WBM is Water Bound Macadam Road** which is the most **commonly** used road **construction** procedure for more than **100 years**. The **Water Bound Macadam** is named based on the **Scottish engineer John Loudoun Macadam** who first **introduced** and **construct** the **WBM road**.

WBM Road

Water Bound Macadam is a type of **flexible pavement** in which the **base** and surface layer contains **crushed stone** or broken rock pieces and **materials** are well **interlocked** with the help of a **mechanical roller**.

Then the **voids** are filled with the help of **screening material** and **binding materials (stone dust)** along with **water and compaction**.

The **thickness** and the number of each **compacted layer** in WBM depend upon the **design** consideration and **loading**. However, they **generally** vary from **7.5 cm** to **10 cm** thick.

The **Water Bound Macadam layers** can **easily disintegrate** due to moving **vehicle** loads and surface water, thus the **surface layer** is usually prohibited to **provide** with the **WBM layer**. The road camber of **1 in 36 to 1 in 48** is usually **preferable** on **WBM roads**.

Materials Required For the Construction of WBM Road

There are mainly three types of construction materials are required for the construction of WBM roads:

- **Coarse Aggregate**
- **Screening**
- **Binding Material**

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Coarse Aggregate

Coarse Aggregate consists of a **mixture** of hard and **durable crushed aggregate** and **broken stones**. The **aggregate** used for **every layer** of the **Water Bound Macadam Road** construction should be **well graded**.

Coarse Aggregate

The below tables shows the gradation of the aggregates that can be adopted.

The coarse aggregates used in the construction of the WBM road

should possess the following properties:

- It should be **strong,** hard, and durable.
- It should not have an excessive amount of **elongated and flaky particles.**
- It should be in **acceptable shape and size** as shown in the gradation table.

Grading Number	Size Range in mm	Size of Sieve in mm	Percentage by Weight Passing the sieve
1.	90 to 40	100 80 63 40 20	100 65-85 25-60 0-15 0-5
2.	63 to 40	80 63 50 40 20	100 90-100 35-70 0-15 0-5
3.	50 to 20	63 50 40 20 10	100 95-100 35-70 0-10 0-5

Screening

A **screening** is a **construction material** used in **WBM road construction** work to fill the void or space left between **aggregate** particles after **compaction is done.**

Generally, **construction materials** used for **screening** purposes have **smaller sizes compared** to coarse aggregate.

Screening of Aggregate

The **following table** shows the **standard grading required** for **screening** for the construction of **WBM Road**. To reduce the **overall cost** of WBM roads, **IRC** has **recommended** using non-**plastic materials** such as **kankar, murram, or gravel** instead of screening.

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Binding Material

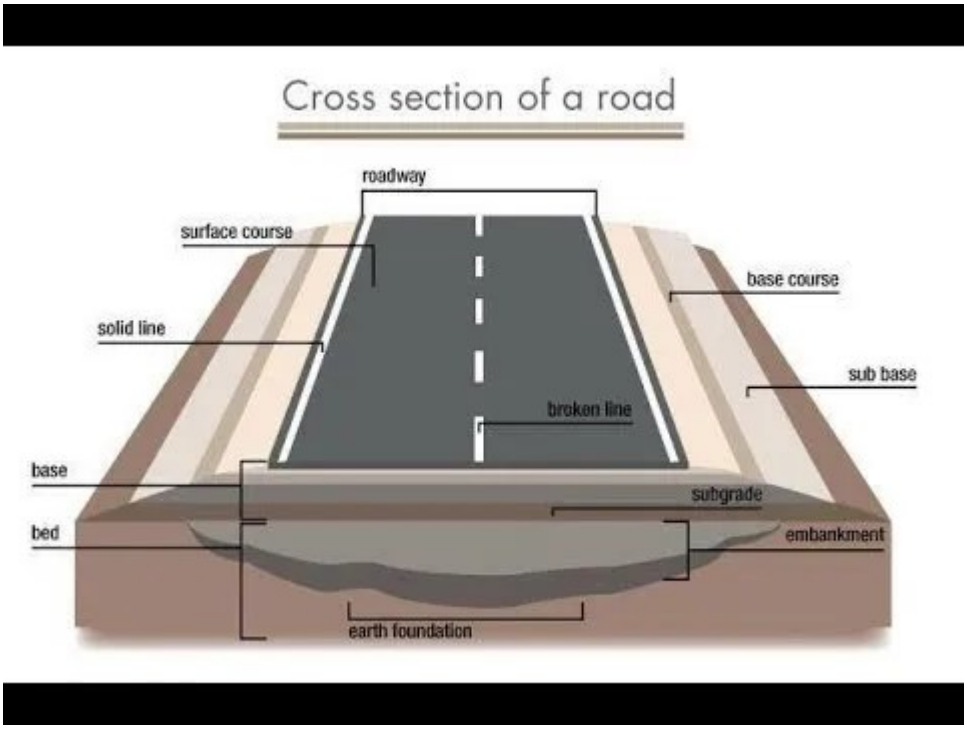
A Binding Material that is going to be utilized for the **WBM road** should be **checked** and authorized by the **working engineer** and it should have **minimum plasticity**. **Generally**, the **Index value** is limited to 6.

Class of Grading	Size of Screening in mm	Size of sieve in mm	Percentage by Weight passing the sieve
A	12.5	12.5 10.0 4.75 0.15	100 90-100 10-30 0-8
B	10.0	10.00 4.75 0.15	100 85-100 10-30

Usually, the **Binding Material** is not required if **screening** is utilized in the construction of **WBM road** or crushed rock as they have **crushable properties**.

Cross Section of WBM Road

Following is the WBM road cross-section drawing,



WBM Road Cross Section

Select the method of execution of the work of WBM road construction in PWD

WBM Road Road Construction Procedure

The execution of **WBM Road** includes a series of **sequential operations** operated with a distinct **interval** of time. The **followings** are the steps to be followed **during construction**.

The construction Procedure of the WBM road is given below,

- Preparation of **subgrade for WBM road** construction
- Laying and fixing steel rebars as **lateral reinforcement.**
- **Coarse Aggregates** Spreading
- Compaction by **heavy roller.**
- **Screening material** spreading on a surface
- **Grouting work** and sprinkling **work**
- Bin**ding materials** applied on the **surface**
- Leveling and **drying process**
- **Side Shoulder** formation
- The Road is open to **traffic**.

WBM Road Construction

1. Subgrade or Foundation Preparation work

- The **subgrade layer** contributes as a **foundation layer** of the road on which **the** base, subbase, and wear course are rested. The required filling and cutting are done to bring the desired R.L. of ground.
- Preparation of this subgrade layer for the grade & camber and, dust & other loose materials are cleaned up.
- If necessary then modified subgrade materials are filled in the holes, depression, and uneven surface and then rolled and compacted.
- The level of the foundation must possess a high degree of uniformity, required cross-section, and elevation along with a **well-drained** condition.

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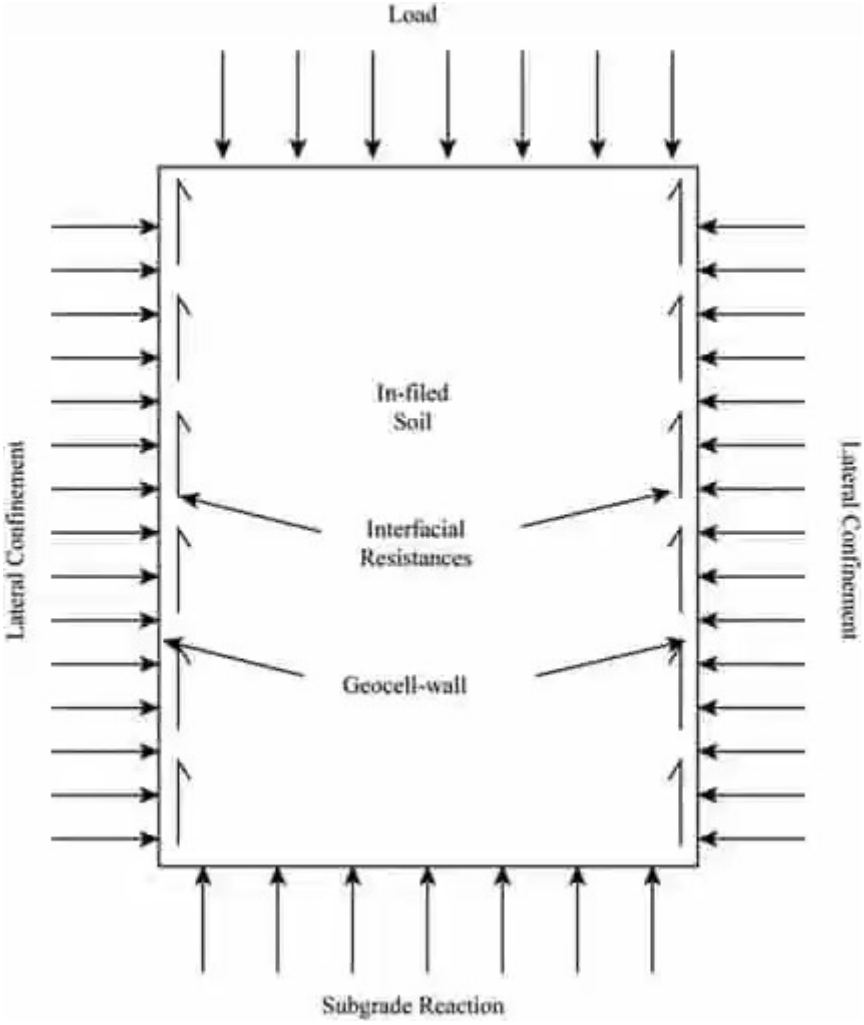
2. Providing Lateral Confinement



Providing Lateral Confinement

- The **lateral reinforcement or confinement** is constructed before the laying of **different layers** of **Water Bound Macadam** materials.
- Before laying of **aggregates** the shoulders have a **thickness** similar to the **WBM road properly** compacted layers. It should be **constructed** with proper quality of **murram** or **earth.**
- But if the **soil** is unstable and the road is at a **higher elevation** or **required** to be filled, then the **retaining wall** can be constructed as **lateral confinement**.
- The **main purpose** of providing lateral **confinement** is that the road surface to be **constructed is retained** in between them and it **becomes easy for the lay** of **coarse aggregates.**

3. Spreading the Coarse Aggregates

Spreading the Coarse Aggregates

- To spreading the **coarse aggregates** over the surface of the subgrade, the **lumped mass** of coarse aggregates is stacked at the definite interval of the road through the required length of the road to be **constructed**.
- Then the coarse aggregates are evenly spread on a subgrade base with the help of different types of **machinery** like **backhoe** or **dozer**.
- The total number of layers and thickness of aggregates depends on the details of **pavement design**. The thickness of every **layer** should be such that after compaction it gives a **7.5 cm** thick layer.
- In general, for **minor** or **ordinary roads**, the thickness of a single compacted layer should be **75 mm** and is sufficient. For major or special roads, two layers of **150 mm** each compacted thickness may be provided.
- Then, the road profile is checked by placing **templates** across the road every **6 m**. the surface is checked from time to time to ensure the proper **camber** and **grade** of the road.

4. Rolling Process

Rolling Process

- The process of **rolling** is carried out along the **edges first** and then **moved** to the center for the straight section of the **road**. For super **elevated curves**, **rolling** is finished from the **lower end** of **superelevation** and then moved to the **high edge**.
- To carry out rolling in **Water Bound Macadam Roads**, the vibratory rollers or **three-footed** power rollers weighing **6 tons to 11 tons** are used.
- **Skilled operators** must be used for driving the **roller** as the fault rolling **operations** lead to the formation of **corrugations**, the unequal **finish** of road surface, or **wearing** of the road in a few months of **construction**.
- The main **objective** of this **rolling** is to fix the **coarse aggregate** thoroughly over one another.

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5. Application of Screening (Fine) Material

- The **next step** is the spreading of the **screening material**. After the process of **rolling** is completed, **screening material** is applied to fill

all the voids that **remained** between the **aggregates** after the **compaction**.

- The quantity of **screening** is generally used to fill about **50%** of the **total voids** and the remaining **50% of voids** are filled with **filler materials**.
- The process of **spreading**, **booming**, and **rolling** is carried out **simultaneously** for each layer till the surface of **coarse aggregate** seems **firm** and well **compacted** without any **voids**.
- The **screening** is applied in **3 layers** or even more than that as per the sire **conditions**.
- After **compaction**, **booming** of the **each layer** must be done to remove the **un-compacted screening** material.

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6. Sprinkling of Water and Grouting

A sprinkling of Water and Grouting

- After completion of **wet rolling** with **screening materials**, the layer is **water sprinkled** and then again **rolled** so that the **water erodes** the surface finer and **seeps** and **deposits** it to the **inner voids**.
- The **water sprinkling** and process of **rolling continued** until all the voids are **filled** and a wave of **grout flushed** ahead of the **roller**.
- The quantity of **water** to be sprinkled is **commonly dependent**

upon many factors such as **size** and **nature** of aggregate, type of **surface desired,** etc.

- If the **voids** are still **viewable** then an additional layer of **screenings** can also be **applied** and properly **compacted**.

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7. Application of Binding Materials

Application of Binding Materials

- The same **procedure** is used for the application of **binding materials** as that of **screenings**. Hereafter each layer of water is **sprinkled** and a **rolling operation** is carried out.
- At the time of **rolling operation**, the wheel of the **roller** should be **continuously** watered to **wash out** binding material that gets **stuck** to the rollers' wheels.
- The **binding material** is generally stone dust or lime dust **depending upon** the **suitability** and requirements of **WBM road**, which are applied in 2 or more **consecutive thin layers**.

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8. Leveling and Drying of Surface

- After the **final rolling operation**, the **WBM** is left to cure for a **single day**, and a day after if any **depressions** or **undulations** are

visible then again the adequate amount of **screenings** and **binding materials** can be spread and **compacted**.

- The **WBM road** can be changed by using the upper courses as a **bituminous mix** as well so that the easy **rotting** and **disintegration** of the **surface are prevented**.

9. Preparation of Shoulders

Preparation of Shoulders

- While **curing** the road, shoulders are **constructed** alongside by **keeping** proper slope with earth **filling work.** They are properly **compacted**.

10. Open for Traffic

Opening For Traffic

- After proper **drying** and without any **depressions**, the road is then made up for the **traffic**.
- For a **few days,** the traffic should be **well disturbed** over the **full width** of the road by **placing obstacles longitudinally** in the form of **drums**, **barricades**, etc.

Maintenance of WBM Road

Within a **short period**, if any type of **potholes** or rugs is shown on the **newly constructed Water Bound Macadam Road**, the concerned **authority** should repair it by **filling** it with the **required material**, and **placing** the material on **potholes** should be done properly.

To prohibit **aggregate** from getting **loose from** the surface course of the **road**, a thin layer of **moist soil** should be **spread over** the surface **periodically**, particularly after the **rainy season**.

The **unevenness** that occurred must be **removed** from the **constructed** road through **dragging**. It may cause the **circumstance** more badly for the constructed roads.

Fresh materials should be **used** in place of any **broken materials** on the **constructed road**.

Every **2 to 5 years** after the constriction, the **surface** of the constructed road is **required** to be **renewed**, keeping in view the **volume of traffic.**

After the **road opens** for traffic, the **loose mixture** must be **removed** that comes on the top of the road **surface**. Along with the **fresh binding material**, the **leveled** road surface should be **added** and it should be properly **compacted** and **watered**.

The **dust problem** can be **effectively** removed by providing a **surface dressing** of **bituminous materials**.

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Advantages of WBM Road

Followings are the advantages of WBM road,

- It is **cost-effective** as the cost of **construction** of **Water Bound Macadam road** is **comparatively low.**
- In the **construction** of the **WBM road**, **no skilled laborers are required**.
- Water Bound Macadam roads are **constructed** with the help of **locally** and **easily available materials**.
- If WBM roads are **maintained perfectly** from time to time then they could **resist heavy traffic** and **approximately** about **900 tons** per day.

Disadvantages of WBM Road

Followings are some disadvantages of WBM road,

- The maintenance **cost** of **Water Bound Macadam** road is high as compared to the **bitumen base course**.
- The **overall life span** of Water Bound Macadam road is **less than the bitumen road.**
- A **high probability of danger** to traffic and **inconvenience** is there if these **roads** do not receive **proper** maintenance **periodically**.
- These roads lead to **yielding and softening** of the **subsoil** as these roads are **absorbent** to **rainwater**.
- When a **fast-moving vehicle passes** over a **WBM road**, the **stone piece gets disturbed** and finally, the road surface **disintegrates**.

FAQs

What is WBM road?

WBM in the term '**WBM Road'** stands for **Water Bound Macadam.** It is a type of **flexible pavement** in which the base and surface layer contains crushed stone or broken rock pieces and materials are well interlocked with the help of a **mechanical roller**.

What maintenance is required for WBM roads?

MAINTAINANCE FOR WBM ROADS

1. The concerned authority should repair it by **filling** it with the required material, and placing the material on **potholes** should be done properly.
2. **Fresh materials** should be used in place of any **broken materials** on the constructed road.
3. Every **2 to 5 years** after the constriction, the surface of the constructed road is required to be **renewed**.
4. The **dust problem** can be effectively removed by providing a surface dressing of **bituminous materials**.

What is WBM Road Specification?

WBM ROAD SPECIFICATION

In WBM Road the binding material consists of fine-grained material passing through a 0.425 mm sieve is used, in order to prevent raveling of the stones. Locally available kankar nodules or limestone dust may also be utilized. The binding material having a plasticity index value of 4 to 8 is used in construction.

State the Advantages of Macadam Roads?

Advantages of Macadam Roads

1. It is **cost-effective** as the cost of construction of Water Bound Macadam road is comparatively low.
2. In the construction of the WBM road, **no skilled laborers are required**.
3. Water Bound Macadam roads are constructed with the help of **locally** and **easily available materials**.
4. If WBM roads are **maintained perfectly** from time to time then they could resist heavy traffic and approximately about **900 tons** per day.

What are the Disadvantages of Macadam Roads?

Disadvantages of Macadam Roads

1. The maintenance **cost** of **Water Bound Macadam** road is high as compared to the bitumen base course.
2. The **overall life span** of Water Bound Macadam road is less than the bitumen road.
3. A **high probability of danger** to traffic and inconvenience is there if these roads do not receive proper maintenance periodically.
4. These roads lead to **yielding and softening** of the subsoil as these roads are absorbent to rainwater.

WBM Meaning

The full form of WBM is **Water Bound Macadam**. It is the layer of road constructed from **broken stone aggregates** bound together by **stone dust** or screening material and **water applied** during construction and compacted by a **heavy smoothed wheel roller.**

What Does WBM Mean?

WBM means "**Wanna-Be Moderator".**

WBM Road Specification

The thickness and number of layers in WBM road depend upon the details of the design pavement. In general, for ordinary roads, 75 mm thickness of layers is sufficient for a single layer. For special roads, 150 mm thickness for 2 layers of pavement can be selected.

WBM Road Construction Procedure

The construction Procedure of WBM Road is as follows,

1. Construction of the Foundation for Receiving the WBM Course.

2. **Providing the Lateral Confinement**
3. **Coarse Aggregates Spreading**
4. **Rolling**
5. **Application of the Screenings.**
6. **Sprinkling and Grouting.**

7. Application of the Binding Material.

8. **Setting and Drying.**
9. **Preparation of Shoulder.**
10. **Opening to Traffic.**

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