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भारत सरकार – Government of India
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प्लास्टरिंग

PLASTERING



केमटेक / 2014 / सि / प्लास्टरिंग / 1.0
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Excellence In Maintenance

Indian Railways
Centre for Advanced Maintenance Technology

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प्लास्टरिंग

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प्राक्कथन

भारतीय रेल एक महत्वपूर्ण संस्थान है जिसमें भवनों एवं संरचनाओं का एक वृहद जाल फैला हुआ है इसमें कार्यालयीन भवनों एवं आवासीय भवनों को शामिल किया गया है। इन भवनों में विभिन्न प्रकार की प्लास्टरिंग की जा सकती है।

इस पुस्तिका के माध्यम से केमटेक के अभियॉत्रिकी विभाग ने प्लास्टरिंग के बारे में तकनीकी ज्ञान को विस्तृत रुप से देने का प्रयास किया गया है।

मैं उम्मीद करता हूँ कि यह पुस्तिका इन गतिविधियों में लगे भारतीय रेल के सिविल इंजीनियरिंग कर्मियों के लिए अत्यधिक उपयोगी सिद्ध होगी।

केमटेक, ग्वालियर *(ए. आर. तुपे)*
दिनाँक 28, मार्च 2014 *कार्यकारी निदेशक*

FOREWORD

Indian Railways, a premier organization having vast network of buildings and structures, include office buildings and residential buildings, in which so many types of plastering can be done.

Through this hand book, civil engineering branch of CAMTECH has made an attempt to provide the technical knowledge in detail on the "Plastering".

I hope this hand book will prove to be a valuable source of technical knowledge and will be quite helpful to civil engineering personnel in Railways.

CAMTECH/Gwalior ***(A.R Tupe)***

Date: 28, March 2014 ***Executive Director***

प्रस्तावना

भारतीय रेल एक बड़ा संस्थान है जिसमें काफी संख्या में भवन एवं अभियात्रिकी संरचनायें हैं।

'प्लास्टरिंग' पर इस पुस्तिका को तैयार करने का उद्धेश्य रखरखाव/निर्माण कार्यो में लगे सिविल इंजीनियरिंग कर्मियों को प्लास्टरिंग के सभी तकनीकी जानकारी उपलब्ध कराना है। यह उनके मार्गदर्शन हेतु बनाई गई है।

इस पुस्तिका को उपयोगी बनााने हेतु हर संभव प्रयास किये गये हैं यह पुस्तिका वैधानिक नहीं है तथा इसमें दी गई जानकारी का उद्धेश्य मरम्मत व निर्माण गतिविधियों में शामिल सिविल इंजीनियरिंग कर्मियों के मार्गदर्शन के लिए ही है। इसमें दिये गये अधिकतर ऑकडे, चित्र एवं दी गई जानकारी किसी न किसी रूप में विभिन्न पुस्तकों एवं अन्य छपी हुई सामग्री में उपलब्ध है।

यह पुस्तिका रेल्वे बोर्ड, आर डी एस ओ, भारतीय रेल कार्य संहिता इत्यादि द्वारा जारी निर्देशों का किसी भी प्रकार से विस्थापन नहीं करती। यह पुस्तिका वैधानिक नहीं है, इसमें दी गई जानकारी का उद्देश्य केवल मार्गदर्शन है।

इस पुस्तिका के सुधार हेतु पाठकों के किसी भी सुझाव का हम स्वागत करते हैं।

केमटेक, ग्वालियर *(एस.के.सक्सेना)*
दिनांक 26, मार्च 2014 *उप निदेशक/सिविल*

PREFACE

Indian railways, a big organization has huge number of buildings and civil assets. The construction and maintenance is a continuous process for its development.

The booklet is prepared with the objective to provide informative technical details on “Plastering” for the guidance of civil engineering personnel involved in construction and maintenance work.

Every effort has been made to make this hand book useful to civil engineering personnel. This handbook is not statutory and contents are only for the purpose of guidance. Most of the data, sketches and information mentioned herein are available in some form or the other in various books or printed matter.

This handbook does not supersede any existing instructions from Railway Board, RDSO & Zonal Railways and the provisions of IRWM, Engineering code, specifications and various circulars/reports on the subject.

We welcome any suggestion from our readers for further improvement of this handbook.

CAMTECH/Gwalior ***(S.K. Saxena)***
Date: 26, March 2014 ***Dy. Director/Civil***

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इस हस्तपुस्तिका के लिये भविष्य में प्रकाशित होने वाली संशोधन पर्चियों को निम्नानुसार संख्यांकित किया जायेगाः

The correction slips to be issued in future for this handbook will be numbered as follows:

केमटेक / 2014 / सि / प्लास्टरिंग / 1.0 / सीएस # XX दिनांक _____

CAMTECH/2014/C/PLASTERING/1.0/CS # XX date _____

जहॉ XX सम्बन्धित संशोधन पर्ची की क्रम संख्या है (01 से प्रारम्भ होकर आगे की ओर)

Where "XX" is the serial number of the concerned correction slip (starting from 01 onwards).

प्रकाशित संशोधन पर्चियॉ
CORRECTION SLIPS ISSUED

क्र.सं. / Sr. No.	प्रकाशन की तारीख / Date of issue	संशोधित पृष्ठ संख्या तथा मद संख्या / Page no. and Item No. modified	टिप्पणी / Remarks

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1. परिचय / Introduction

Plastering is a process of applying one or more coats of mortar to a concrete surface, brick works, and stone masonry. It must be durable such that it resists the penetration of moisture and should be able to resist weather conditions uniformly. It should also be pleasing in appearance. These properties depend upon materials used, composition of mix, and degree of mechanical bond between the plaster and the backing surface and workmanship. Lack of bond with the backing, cracking, crazing of surface and discoloration are principal defects in plastering. Sufficient care has to be taken to overcome these defects.

Plaster protects the wall against wind, rain, abrasion, and improves the thermal performance and appearance. Plaster should be easy to apply without the use of expensive and elaborate tools. All type of plasters, especially those on external surfaces, need to offer erosion resistant, impermeability to moisture, impact resistance and well bonded to the wall. A proper plastering will give a good look and require less maintenance.

There are number of ways in which plastering can be done. The choice of the type of plastering to be provided depends upon the architectural features, local availability of materials and also the budget.

2. प्लास्टरिंग की शब्दावली / Terminology of plastering:

2.1 **Background:** The surface to which the first coat of plaster is applied.
2.2 **Blistering:** The development of defect in the form of one or more loose swellings on the finished plastered surface.
2.3 **Cracking:** The development of one or more fissures in the plaster surface. This can happen due to several reasons.
2.4 **Crazing:** The development of a series of minute hair cracks in an irregular closely spaced pattern over the finished surface.
2.5 **Dado:** This is the lower part of the plastered wall (upto 1.5 meter above floor) which is made more resistance than the upper part in order to protect it from the effect of water used in floor washing, dust, dirt, damage to walls due to furniture movement etc.
2.6 **Dubbing Out:** This is the process of filling the voids, cracks or hollow spaces present in the solid wall before applying the plaster.
2.7 **Finishing coat:** The final layer in which the plaster is laid to cover the total area is called a finishing coat. In plastering, two or three coats are usually applied. The outermost top coat of the plaster is known as finishing coat.
2.8 **Flaking:** The patches of plaster when scaled off either due to lack of adhesion or failure of bond with the under coat is called flaking.
2.9 **Gauging:** The mixing of various constituents of plaster in proper proportions is called gauging.
2.10 **Hacking:** This is the process of roughening of solid backgrounds to provide suitable mechanical bond or key or plastering.

2.11 **Keys:** These are the indentations or corrugations on the surface of under coat or background on which the plaster is applied to form a mechanical bond with the surface and/or with the previous layer.

2.12 **Laitance:** The thin layer of cement which forms sheen over the freshly laid concrete when subjected to excessive trowelling.

2.14 **Peeling:** This results from separation of the plaster from the background.

2.15 **Under coats:** These are base coats applied under the finishing coat. These under coats are applied to provide a smooth, uniform and sound finishing surface for receiving the final coat. The first coat is usually applied by dashing against the wall and is termed as rough under coat of plastering. The next coat is applied later with mason's trowels and is made fairly smooth.

2.16 **Scratch coat:** The thickness of this coat should be approximately 10 mm to 12.5 mm and must be laid over the full length of the wall or to natural breaking points like doors and windows.

Before the scratch coat hardens, it should be deeply scratched to provide a good mechanical key for base coat. This coat should be kept damp for atleast three days immediately following its application.

2.17 **Base coat (In case of thick plaster):** The surface of scratch coat should be dampened evenly before base coat is applied. This coat is about 10 mm thick depending upon the overall thickness and then roughened with a wooden float to provide bond for the finishing coat. The second coat must be damp-cured for at least seven days and then allowed to become dry.

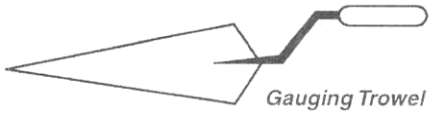
2.18 **Finishing coat:** Before this coat is applied, the base coat is dampened evenly. Joints should be avoided and the finishing coat should be applied in one operation with thickness not exceeding 6 mm.

2.19 **External plaster:** The external plaster is made in richer cement mortar proportion than the internal plaster. It is usually done in two layers, first layer is of 10 mm to 12.5 mm thickness and final layer is of 6 mm thickness or in three layers if thickness requirement is higher. Waterproofing compound may be added in case the plaster is exposed to severe wet conditions. The finish can be of the type specified.

2.20 **Internal plaster:** The internal plaster is usually done in a single layer of 12.5 mm with good quality finish on top.

3.0 प्लास्टरिंग हेतु औजार एवं उपकरण/Tools and equipments for plastering:

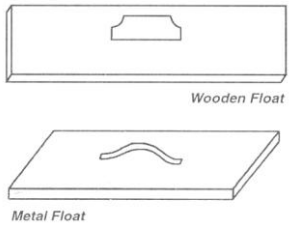
3.1 **Gauging Trowel:** This trowel is used for gauging small quantities of materials and for applying plaster on moldings, corners etc. This is available in sizes varying from 15 to 45 cm in length. The tip of the steel blade of this trowel is either pointed or bull nosed.


Gauging Trowel

3.2 **Floats:** A float is a tool used for spreading the mortar on the surface. A wooden float, similar to a laying trowel, is used for final or finishing coat of plaster. This wooden float is also known as the skimming float. The size of float is about 30 cm x 10 cm and thickness is about 10 mm.

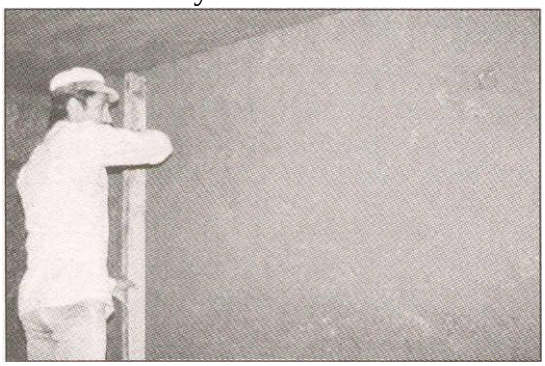
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The ordinary metal float is also known as laying trowel. This trowel is used for laying the material and trowelling so as to get the desired finish. The blade of this metal float is made of tempered steel and is of about 30 cm x 10 cm in size. The float which has got nails projecting by about 3 mm from the surface is known as "Devil float". This float is used for scratching the plastering surfaces to make indentations so as to give a good mechanized bond with the subsequent coat.

3.3 **Float Rule:** This tool has a rule which is used to check the level of the plastered surface between the successive layers.



3.4 **Plumb Bob:** This tool is used in forming the layer of plaster perfectly in a vertical plane. This also helps in controlling the thickness of the plaster.



3.5 **Other tools:** In addition to the above mentioned tools, other tools such as straight edged, bushes, set squares, spirit levels, scratchers, plumb rules are used during different stages of plastering.

4.0 प्लास्टरिंग के प्रकार/Types of plastering: On the basis of mortar material used, plastering can be divided in following categories:

4.1 **मड. प्लास्टरिंग/Mud plastering:** Provision of mud plaster is an age old method for plastering the walls and the practice is found in almost all part of world. Mud plaster can be used for any surface including mud or burnt bricks, stones etc.

Mud plaster is usually adopted in village towns as they are made out with local material employing local mason. It is economical. Mud plaster is more comfortable than other type of plastering in thermal condition.

Scaffolding: Single scaffolding should be done.

Preparation of surface: The joints should be raked out and surface washed of all dust and allowed to dry before plaster is applied.

Mortar: Mud Mortar should be prepared from good brick earth. This should be free from grass roots, gravel kankar etc. The earth should contain no efflorescent salts nor should it be collected from a locality where there are white ants. The earth should be reduced to a fine powdered state and mixed with plenty of water in a pit, adding chopped straw at about 33 kg per cum of earth.



The mixture of earth, straw and water should be allowed to mature for not less than 4 days. During this period it should be worked up at intervals with foot and/or phawaras so that it is plugged into a homogeneous mixture.

The mortar when ready should be of such consistency that it will readily slide off the face of trowel but should not be so wet that the mortar parts into large drops while falling.

Application: Plastering should be started from the top and worked towards the grounds.

The plaster should be applied in two coats of 12mm and 6mm thickness. The prepared mixture should be applied to the surface in a uniform coat of average thickness of 12mm and then smoothened and made even with a straight edge and with floats. This should be allowed to set but not to become dry before the second coat is applied. The latter should be 6mm thick uniform throughout. It should be finally polished with a trowel after it has been smoothened with wooden floats.

All corners, arises, angles and junctions should be truly vertical or horizontal as the case may be, and should be carefully and neatly finished. Rounding and chamfering corners, arises, grooves at junctions etc. where required, should be done without any extra payments. Such rounding, chamfering and grooving should be carried out with proper templates or battens to the sizes as required.

Finish: The plaster should be finished to a true and plumb surface and to the proper degree of smoothness as required. The work should be tested frequently as the work precedes with a true straight edge not less than 2.5 m long and with plumb bobs. All horizontal lines and surfaces should be tested with a level and all jambs and corners with a plumb bob as the work proceeds.

Precautions: No curing should be done. The surface should be protected from damage till it dries out. Any cracks that open out during drying should be opened out and thoroughly repaired with mixture of clay and cow dung. Any portions which sound hollow when tapped should also be re done after cutting out the hollow portions.

Thickness: The average thickness of the finished plaster excluding the key of the joints should not be less than 18 mm. The minimum thickness of the plaster over any portion of the wall of brick work should not be less than 15 mm at any point while in the case of stone walls; this should not be less than 12 mm over the bushings.

4.2 **लाइम प्लास्टरिंग/Lime plastering:** As good quality fat lime is not available in the market and also the sand contains lot of organic impurities, lime mortar is no longer popular. Plastering of wall surface with lime as a binder has been vogue historically. The lime to be used can be either Fat lime or Hydraulic lime.

Fat lime is said to make a good plaster as it makes good putty after slaking. Hydraulic lime on the other hand makes a stronger and hard plaster although, if it contains some unslaked particles, they may slake over a period of time, displaying blistering on the plastered surface.

Following are the main advantages of lime plastering,

i. It has light reflecting qualities creating unique aesthetics.
ii. It has the quality of absorbing moisture and can regulate temperature and humidity levels.
iii. It has good weathering properties.
iv. Use of hydraulic and non hydraulic lime creates good water resistant properties.

Thickness of the lime plaster may be 12 mm, 15 mm or 18 mm and as specified. Thickness on smooth side of wall is 12 mm and at rough side it is 15 or 18 mm thick. 18 mm thick lime plaster can be applied in two layers, the first being of 12 mm and second being 06 mm thick.

Curing of plastered surface commence after 24 hours of its application and for 7 days depending upon the climatic conditions.

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4.3 सीमेंट प्लास्टरिंग/**Cement plastering:** Cement plastering is an excellent plaster for all locations. It is strong and durable, and can be furnished in a wide range of colour and textures.

The cement plaster should be 12 mm, 15 mm or 20 mm thick as specified in the item.

Scaffolding : For all exposed brick work or tile work in important works, double scaffolding independent of the work having two sets of vertical supports should be provided. The supports should be sound and strong, tied together with horizontal pieces over which scaffolding planks should be fixed.

For all other brick work in buildings, single scaffolding should be permitted. In such cases the inner end of the horizontal scaffolding pole should rest in a hole provided only in the header course for the purpose. Only one header for each pole should be left out. Such holes for scaffolding should, however, are not allowed in pillars/columns less than one metre in width or immediately near the skew backs of arches. The holes left in masonry works for scaffolding purposes should be filled and made good before plastering.

In case of special type of brick work, scaffolding should be got approved from the Engineer in advance.

Preparation of Surface: The joints should be raked out properly. Dust and loose mortar should be brushed out. Efflorescence if any should be removed by brushing and scrapping. The surface should then be thoroughly washed with water, cleaned and kept wet before plastering is commenced.

In case of concrete surface, if a chemical retarder has been applied to the form work, the surface should be roughened by wire brushing and all the resulting dust and loose particles cleaned off and care should be taken that none of the retarders is left on the surface.

Mortar: The mortar of the specified mix using the type of sand described in the item should be used. It should be as specified in schedule. For external work and under coat work, the fine aggregate should conform to grading zone IV or as specified in the item and for finishing coat work the fine aggregate should conform to grading finer than of Grading Zone IV. Water Proofing of the Plaster, where so specified, should be done by the addition of an appropriate brand of cement water proofing compound to the cement used for making the mortar.

Application: Ceiling plaster should be completed before commencement of wall plaster.

Plastering should be started from the top and worked down towards the floor. All put-log holes should be properly filled in advance of the plastering as the scaffolding is being taken down. To ensure even thickness and a true surface, plaster about 15 x15 cm should be first applied, horizontally and vertically, at not more than 2 metres

intervals over the entire surface to serve as gauges with the help of aluminium /steel straight edges. The surfaces of these gauged areas should be truly in the plane of the finished plaster surface. The mortar should then be laid on the wall, between the gauges with trowel. The mortar should be applied in a uniform surface slightly more than the specified thickness. This should be beaten with thin strips of bamboo about one metre long to ensure thorough filling of the joints, and then brought to a true surface, by working a wooden straight edge reaching across the gauges, with small upward and sideways movements at a time. Finally the surface should be finished off true with trowel or wooden float accordingly as a smooth or a sandy granular texture is required. Excessive troweling or over working the float should be avoided. During this process, a solution of lime putty should be applied on the surface to make the later workable.

All corners, arises, angles and junctions should be truly vertical or horizontal as the case may be and should be carefully finished. Rounding or chamfering corners, arises, provision of grooves at junctions etc. where required should be done without any extra payment. Such rounding, chamfering or grooving should be carried out with proper templates or battens to the sizes required.

When suspending work at the end of the day, the plaster should be left, cut clean to line both horizontally and vertically. When recommencing the plastering, the edge of the old work should be scrapped, cleaned and wetted with lime putty before plaster is applied to the adjacent areas, to enable the two to properly join together. Plastering work should be closed at the end of the day on the body of wall and not nearer than 15 cm to any corners or arises. It should not be closed on the body of the features such as plasters, bands and cornices, nor at the corners or arises. Horizontal joints in plaster work should not occur on parapet tops and copings as these invariably lead to leakages. No portion of the surface should be left out initially to be patched up later on except in the following respects:

- Beating with thin bamboo strips should not be done on the cement plaster, and
- No lime putty solution should be applied on the face when finishing.

Further the plastering and finishing should be completed within half an hour of adding water to the dry mortar.

Thickness : Where the thickness required as per description of the item is 20 mm the average thickness of the plaster should not be less than 20 mm whether the wall treated is of brick or stone. In the case of brick work, the minimum thickness over any portion of the surface should be not less than 15 mm while in case of stone work the minimum thickness over the bushings should be not less than 12 mm.

Curing: Curing should be started as soon as the plaster has hardened sufficiently and not to be damaged when watered.

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The plaster should be kept wet for a period of at least 7 days. During this period, it should be suitably protected from all damages at the contractor's expense by such

means as the Engineer may approve. The dates on which the plastering is done should be legibly marked on the various sections plastered so that curing for the specified period thereafter can be watched.

Few decade ago, cement complying to IS 269 (33 grade) was used for plastering. At present, high grade cement such as 43 grade (IS 8112) and 53 grade (IS 12269) are being used.

All three grades of cement mentioned above are essentially recommended for use in concrete. Masonry cement is not available and hence, the user has no option but to use these cements for masonry and plaster work.

OPC is multipurpose cement and can be used in all applications from concreting to finishing works in a satisfactory manner.

4.4 रफ कास्ट प्लास्टर / **Rough cast plaster:** Rough cast finish comprises of a mixture of sand and gravel in specified proportions dashed over a freshly plastered surface.



Scaffolding: Scaffolding should be requiring as similar as cement plaster.

Preparation of Surface: The joints should be raked out; dust and loose mortar should be brushed out. The surface should be thoroughly washed with water, cleaned and kept wet before plastering is commenced.
Mortar: Mortar of specified mix using the type of sand described in the item should be used; where coarse sand is to be used, the fineness modulus of the sand should not be less than 2.5.

Applications: The plaster base over which rough cast finish is to be applied should consist of two coats, under layer 12 mm thick and top layer 10 mm.

12 mm under layer: This should be applied in the same manner as cement plastering. The surface should be further roughened by furrowing about 2 mm deep with a scratching tool diagonally both ways to form a key for the finishing coat. The scratched lines should be at not more than 15 cm apart. The surface should be kept wet till the finishing coat is applied.

Top Layer: The top layer should be applied a day or two after the under layer has taken initial set. The latter should not be allowed to dry out, before the top layer is laid on. The mortar used for applying top layer should be sufficiently plastic and of rich mix 1: 3 (1 cement: 3 fine sand) or as otherwise specified so that the mix of sand and gravel gets well pitched with the plaster surface. In order to make the base plastic, about 10% of finely ground hydrated lime by volume of cement, should be added when preparing mortar for the top layer.

Finish: It should be ensured that the base surface which is to receive rough cast mixture is in plastic state. The rough cast mixture should consist of sand or gravel or crushed stone of uniform colour from 2.36 mm to 12.55 mm or as specified and in the proportions as specified accurately to the effect required. The mixture should be wetted and should be dashed on the plaster base in plastic state by hand scoop so that the mix gets well pitched into the plaster base. The mix should again be dashed over the vacant spaces if any so that the surface represents a homogeneous surface of sand mixed with gravel. A sample of rough cast plaster should be got approved by the Engineer.

Coloured Finish: For a coloured rough cast finish, a high grade mineral pigment will be mixed with Portland cement or white cement (as the case may be) to obtain the required shade and tint. Organic dyes should not be used, as they are likely to fade.
This finish is suitable for rural or coastal areas and for severe conditions of exposure. This is a finish which is splashed on to the surface as a wet mix and left rough.

4.5 **पैबल डैश प्लास्टर/Pebble dash plaster:** Application of pebble dash finish is as similar as rough cast plaster, except that the washed pebble or crushed stone graded from 6.3 mm 12.5 mm or as specified should be dashed over the plaster base and the vacant spaces if any should be filled in by pressing pebbles or crushed stone as specified by hand, so that the finished surface represents a homogeneous surface.



Preparation of scaffolding, preparation of surface, and Mortar will be same as rough cost plaster.

This is the durable of all finishes and is generally free from defects. This gives a rough texture and is obtained by means of small pebbles or crushed stone. The pebbles of stones are sometimes lightly pressed or tapped into the mortar.

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If the wall is exposed to severe weather conditions, cement and sand mix with an addition of small quantity of lime is preferred. When this finish is to be applied on strong and dense backgrounds such as dense concrete blocks or structural concrete having a very smooth surface or uneven suction characteristics, a suction splatter-dish of rich mortar mix is applied and no subsequent smoothening is necessary.

4.6 **सैंड फेसड़ सीमेंट प्लास्टर/Sand Faced Cement Plaster**

Base Coat: The first coat or the base coat should be approximately 12mm and should be continuously carried out without break to the full length of wall or natural breaking points such as doors, windows etc. The base coat should be splashed on to the prepared surface with heavy pressure, brought to true and even surface and then lightly roughened by cross scratch lines, to provide bond for the finishing coat. The mortar proportion for this base coat should be as specified in the respective item of work. The base coat should be cured for at least seven days.

Top Coat: The second coat should be 6mm thick. Before application of the second coat, the base coat should be evenly damped. This coat should be applied from top to bottom in one operation and without joints; finish should be straight, true and even. The mortar proportion of this coat should be as specified under the respective item of work. Sand to be used for the second coat and for finishing work should be as specified in the item description. The second coat should be finished with sponge. Grooves should be made as per the drawings.

Curing: The surface should be kept wet for at least a week.

4.7 **स्मूथ फिनिश प्लास्टर/Smooth finish plaster :** When a smooth finish is desired, the minimum amount of working should be applied to the wetted surface and a wooden float, rather than a steel trowel is to be used. Rendering should not be permitted to dry too quickly. When no neeroo finish is desired, the mix should contain lime. The recommended proportions of cement, lime and sand in the mortar vary from 1:1:6 for exposed surfaces and 1:2:9: for protected ones.



4.8 **टैक्सचर्ड फिनिश प्लास्टर/Textured finish plaster:** Textured finishes are now becoming very popular and may be obtained in a variety of ways in many different designs. Special effects can be obtained by scraping the surface of the rendering with a straight edge hacksaw blade or with the edge of a steel trowel. The time to scrape must be chosen correctly. Some judgment is needed in this respect. Inadequate and excessive drying and hardening of the mortar surface have to be avoided. The period

may vary from an hour to a day, depending both on the type of mix and climatic conditions.



5.0 प्लास्टरिंग मे उपयोग होने वाली सामग्री/Material used in plastering:

All the material used in plastering is confirming to the relevant standard.

Lime, Cement and sand and water are essentially used for plastering. In addition to these sometime gravels, water proofing compounds and chemical admixtures are used. Scaffolding is required for plastering operation.

Water: Water used in plaster work should be of a quality suitable for drinking purpose. It should be free from chlorides and organic impurities.

Grading of sand: Most suitable particle size grading of sand for plaster work for internal and external walls and ceilings is given below:

IS Sieve Designation	Percentage Passing
10 mm	100
4.75 mm	95-100
2.36 mm	95-100
1.18 mm	90-100
600 micron	80-100
300 micron	20-65
150 micron	0-50

Where the grading falls outside the limits of grading zones of sieves larger than 600 micron by total amount not exceeding 5% it should be regarded as falling within the grading. This tolerance should not apply to percentage passing 600 micron IS sieve or to percentage passing any other sieve size on the finer limit.

The required grading adjustment is often done by screening and / or by blending together either natural or crushed sands which may be by themselves of unsuitable grading.

For most work, two types of sands are generally recommended – one for the backing coat or base coat and another for the final (finishing). The sand for the final and base coat should be 100% passing 2.36 mm sieve and not more than 5% should pass 150 micron sieve. For finishing coat, the maximum size should be restricted to that passing 1.18 mm sieve.

Water proofing compound and chemical admixtures: Water proofing compounds: Generally, they are not required specially if corrected type and quality of other materials of mortar are available. These compounds are generally very fine, hydrophobic in nature and therefore they easily penetrate the fine bonds and pores and prevent entry of dampness from outside in to the plaster.

Whenever they are used they should be uniformly dispersed and properly mixed in mortar to give the desired performance. They impart cohesiveness to the mortar mix.

Workability of admixtures: Plasticizers can be used in warm or hot weather specially because they help in reducing water content of the mix and thereby help in reducing shrinkage cracks. However, reduction of water must be supported by proper curing. Use of admixture does not mean that cracks will not appear even if curing is neglected.

Air Entraining admixtures: Air entraining admixtures serve three fold purposes and can be appropriate for use in plastering work. The tiny air bubbles give a cushioning effect to the plaster when expansion or contraction takes place due to temperature and moisture variations.

The tiny air bubbles being spherical in shape give good workability and cohesiveness to the mortar mix and thereby give ease of working or applying. Air entrained mortar gives good water retention properties and thereby reduces the shrinkages and crazing problem of the plaster considerably.

However, air entrainment being significant (10% to 15%), will reduce the strength of the plaster considerably. Since strength in plaster is not that significant the advantages this admixture gives to improve the other properties more than offsets the above disadvantages.

Scaffolding: It is always advisable to provide double scaffolding for plastering work. It is easier to fix and remove at various heights without damaging the masonry or plaster. If single scaffolding is used, the masonry is often punctured or broken to fix the scaffold and give it stability. These punctured holes are filled up in an incorrect manner and the holes plastered in one go as the scaffold is removed. This results in weakness in masonry and also results in leakages.



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6.0 प्लास्टरिंग की आम खराबियाँ/Common defects of plastering:

Most frequently noticed defect in plastering are comes under following categories;

6.1 **Non structural cracks:** Crazing is non structural cracks occurred in plastering. It is a net work of fine cracks usually in hexagonal pattern. It is result of over trowelling a rich mix and due to moisture loss after the plaster has hardened. Plaster will always shrink and crack so it is desirable that it should develop a large number of fine, un noticeable crack at close spacing.

6.2 **Structural cracks:** some cracks visible in the plaster may result from cracking of the wall. This can be caused by differential movement of the foundation, moisture expansion or drying shrinkage of masonry unit or thermal movement of the roof.

6.3 **Deboning:** Deboning of plaster is noticed as a hollow sound when the surface is tapped. It is important to make sure that the bond between plaster and wall is as good as possible. It can be done by cleaning dusty or oily wall surface thoroughly. Allow the wall to reach the correct moisture content. Using cement slurry and bonding liquids as needed.

6.4 **Lack of hardness:** Following are the reason of lack of hardness.

i) Insufficient cement.
ii) The use of sand containing more dust.
iii) Use of poor mix.
iv) Due to addition of extra water in the mix.

6.5 **Grinning:** Greening is the term given to the appearance of a plastered surface when the positions of the mortar joints are clearly visible through the plaster. It is caused by the difference in suction between the masonry unit and the mortar.

6.6 **Expansion:** These include swelling, softening, layer cracking and spalling of the plaster.

6.7 **Popping:** Pop outs are the conical fragment that breaks out of the surface of the plaster leaving holes which vary in size. They are caused by the presence of contaminant particle in the mix which, reacting with the moisture in the mix, expand and cause cavities in the plaster.

7.0 प्लास्टरिंग के अवयवों का अनुपात/Proportioning of ingredients of plaster:

The proportion of cement and sand in plaster will depend on several factors as given below:

- The environmental conditions existing around the masonry.
- The type and grade of cement
- The type and grade of sand
- Location i.e. internal or external
- The purpose of application

The material must be batched volumetrically using correct size boxes (Ferma). If natural moist sand is used then bulkage correction should be made.

8.0 अवयवों का मिलान/Mixing of ingredients :

It is preferable to mix the ingredients in a mixer. Dry mortar is mixed initially and thereafter water is added to the dry mix to get the required consistency. The quantity of the mortar made at a time should be such that it can be consumed within 30 to 45 minutes. If excess mortar is prepared it dries up either due to evaporation of water or due to water absorption by sand and/or due to water consumed by cement hydration. Addition of water should be carefully monitored and should be added in such a quantity that it gives the required workability. Excess water will cause shrinkage problems as well as lower strength.

It is observed that excess mortar is often prepared and not utilized in time. The workers even break of lunch leaving the wet mixed mortar to dry out. Water is again added resulting in lower strength and more shrinkage problem.

9.0 सावधानियाँ एवं जाँच बिंदू/Precautions and checking points:

Defect free plaster is desirable. Generally plaster is done for domestic purpose on a structure and therefore it should be uniform, leveled properly with proper edges and well formed corners. The surface should be free from cracks and other defects. Site engineer/supervisor must supervise the work at every stage with proper care. In hot weather early and continuous curing is must. Cracks in the plaster can be considerably reduced if this is taken care of. It can be checked with making following check points,

Sr. No.	Particulars	Remarks
1.	Type of plaster	-
2.	Surface of plaster	External/ Internal
3.	Joints of masonry	Sealed proper or not
4.	Dampness of surface before plastering	Satisfactory or not
5.	Numbers of coat and thickness	-
6.	Preparation of surface for plastering	Satisfactory or not
7.	Proportion of mix	-
8.	Quality of water	Satisfactory or not
9.	Quality of cement	Satisfactory or not
10.	Quality of sand	Satisfactory or not
11.	Quality of lime	Satisfactory or not
12.	Quality of water proofing/ Admixture if used	Satisfactory or not
13.	Curing	Done or not done
14.	Scaffolding (Single or Double)	Safe or unsafe

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संदर्भ/REFERANCE

1	Unified specification
2	IRWM
3	BMTPC literature
4	Gujrat Ambuja literature
5	http://www.hoshenlee.com/plastering_machine.html
6.	Other printed literature from various textbooks and internet.

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टिप्पणी/NOTES

गुणवत्ता नीति

रेलों में यात्री और माल यातायात की बढती माँग को पूरा करने के लिए गुणवत्ता प्रबंध प्रणाली में अनुसंधान, डिजाइनों और मानकों में उत्कृष्टता तथा सतत् सुधारों के माध्यम से सांविधिक और नियामक अपेक्षाओं को पूरा करते हुए सुरक्षित, आधुनिक और किफायती रेल प्रौद्योगिकी का विकास करना।

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हमारा उद्देश्य

अनुरक्षण प्रौद्यौगिकी और कार्यप्रणाली को उन्नयन करना तथा उत्पादकता और रेल्वे की परिसम्पत्ति एवं जनशक्ति के निष्पादन में सुधार करना जिससे अन्तर्विषयों में विश्वसनीयता, उपयोगिता और दक्षता प्राप्त की जा सके।

यदि आप इस सन्दर्भ में कोई विचार और सुझाव देना चाहते हों तो कृपया हमें इस पते पर लिखें:

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