PLAINTIFF'S EXHIBIT

GP-1049

Performance of Lath and Plaster

Recommendations



Gypsum Association
201 NORTH WELLS, CHICAGO, ILLINOIS 60606

AIA FILE NUMBER 21-A-2

SGP 0004007

RECOMMENDATIONS FOR PLASTER PERFORMANCE

WITH RESPECT TO CRACK RESISTANCE

The Gypsum Association has prepared certain recommendations to provide the designer with information that will permit him to predict ultimate performance of lathing and plastering systems with a much higher degree of accuracy. They are presented as guideposts and are based upon the data acquired from the Association's recently completed research project, and volumes of the industry's research and recorded field experience, all as related to crack resistance of plaster.

Important though it is, the proper selection of systems and materials must be supported by adequate construction details and definitive specifications. The contractor and mechanic must know precisely what is wanted. Further, competent field inspection is highly important to assure the designer of compliance with his intentions as expressed on plans and specifications.

These guideposts are not intended to be all inclusive. Nevertheless, the basic design principles that influence performance are quite clear. A knowledge of their relative contributions to performance will more accurately reflect the degree of integrity that is expected of the plaster surface. The important design principles and their interrelationship are here enumerated.

THE FINISH COAT OF PLASTER

As used in combination with various lath and plaster systems, the finish coats of plaster exhibit a wide range of performance. Hence, selection of the finish coat becomes very important.

Sand Float Finishes (Keene's cement or gypsum gauging with lime putty and sand) as compared to smooth trowel finishes provide a high factor of safety against cracking. They require a lesser degree of rigidity and strength in the lath and basecoat plaster, and we recommend the use of such finishes for maximum crack resistance. The description of the basic sand float finishes are found in "Recommended Specifications—Gypsum Plastering" published by the Gypsum Association.

Acoustical Plasters and certain texture finishes are known to be highly resistant to cracking and are considered to be equal to sand float finishes in that respect.

When vermiculite basecoat plaster is used over metal lath, or over gypsum lath by the two coat method (double-up), the use of sand float finishes or acoustical plasters should be considered.

Smooth Trowel Finishes such as gypsum gauging-lime putty or Keene's cement-lime putty require a much higher degree of rigidity and strength in the lath and basecoat plaster for good visual performance. When the use of high strength basecoat plasters is impractical, consideration should be given to the elimination of restraint at the perimeter angles or the selection of a more rigid lath, or both, to the degree that is shown in the accompanying table (P. 4). They help to compensate for the lower strength of some basecoat plasters.

The resistance of trowel finishes to cracking, particularly to check cracking, can be increased by the addition of fine aggregate. The use of not less than ½ cubic foot of fine silica sand or perlite to each 100 pounds of gauging plaster or Keene's cement increases the factor of safety in trowel finishes.

The Gypsum Association recommends the fine aggregate proportioning with gauging plaster or Keene's cement when gypsum-lime putty trowel finishes are applied over lightweight aggregate base coats.

THE PLASTER BASE

The rigidity of the base to which the plaster is applied is an important factor in crack prevention. Under comparable circumstances a board type of lath usually provides a higher degree of resistance to cracking than a flexible lath. Under certain conditions the selection of lath is not critical, but when the design calls for a plaster base coat in the moderate to low range of strengths, a smooth trowel finish or restrained perimeters, the selection of the lath often becomes a determining factor in resistance to cracking. The relationship of these variables of design, as they affect visual performance, are shown in the accompanying table (P. 4).

THE PLASTER BASECOAT

Under comparable circumstances crack resistance is closely related to the strength of basecoat plasters, the higher ranking basecoat strengths generally providing a higher degree of resistance. The strongest basecoat plaster is gypsum wood-fiber used neat or a gypsum wood-fiber scratch with sanded brown, followed in order by base coats with sand, perlite and vermiculite aggregate, proportioned as indicated below. If good performance is to be expected of intermediate or low strength plasters, extreme care must be directed to selection of the finish coat and lath, and to the possible need for elimination of restraint at the perimeter angles. Experience and research prove the case for strong base coat plasters where a high degree of surface integrity is to be realized.

PLASTER AGGREGATE PROPORTIONS

For the above reasons, the Gypsum Association recommends the following proportioning of aggregate per 100 pounds of gypsum neat plaster regardless of whether it is aggregated on the job site or in the factory.

PLASTER BASE	SAND damp-loose		PERLITE OR VERMICULITE
	Volume (cu. ft.)	Weight (lbs.)	Volume (cu. ft.)
GYPSUM LATH			
Two-coat work	2½	250	2
Three-coat work —scratch	2	200	2
brown	3	300	2*

PLASTER BASE	SAND damp-loose		PERLITE OR VERMICULITE
	Volume (cu. ft.)	Weight (lbs.)	Volume (cu. ft.)
METAL LATH			
Three-coat work —scratch	2	200	2
brown	3	300	2*
MASONRY			
Two- or three-coat	3	300	3

* Where the plaster is 1" or more in total thickness, the proportions for the brown coat may be increased to 3 cu. ft.

NOTE: For three-coat work over gypsum or metal lath the proportions of sanded plaster only may be 1:2½ for both scratch and brown coats in lieu of above.

CEILING PERIMETER CONSTRUCTION

Integration of walls and ceilings at the perimeter angles becomes very significant under some circumstances. Differential movement is always a factor, its extent being governed by the building's rigidity and the climatic changes. The performance of lath and plaster depends upon the extent of such movement and the ability of the wall and ceiling surfaces to move independently without transfer of undue stresses from one to the other, and other factors such as the finish coat, the lathing base and the strength of the plaster. It is believed, however, that restraint in the vertical angles of lath and plaster systems is less significant than in the perimeter angles of ceilings, and that performance in partitions is dependent primarily upon the other factors.

We recommend that serious consideration be given to the use of details that will help to eliminate restraint (continuity of lath and plaster) in perimeter ceiling angles where differential movement is anticipated, particularly where trowel finishes are indicated or the rigidity and strength of the lath and base coat are in the moderate to lower range.

LARGE CEILINGS

In addition to perimeter consideration, large unbroken ceiling areas should be divided by relief joints. The maximum recommended distance between such joints is 60 feet with a maximum undivided area of 2400 square feet.

SGP 0004009

RELATIVE PERFORMANCE OF LATH AND PLASTER SYSTEMS

WITH RESPECT TO CRACK RESISTANCE

It must be recognized that performance of lath and plaster systems, like many other building constructions, cannot be predicted with complete accuracy. However, it is believed that a more accurate prediction can now be made, and that a knowledgeable and intelligent selection will more nearly provide the required visual characteristics of the plaster surface.

To assist the designer in this matter the accompanying table shows the anticipated relative performance of numerous lath and plaster constructions. It has been compiled from research data and the industry's long laboratory and field experience. It is based upon full compliance with the provisions of "Recommended Specifications — Gypsum Plastering" published by the Gypsum Association.

Obviously, plaster performance is affected by several factors other than the basic variables considered in these recommendations, such as extreme weather conditions, lack of ventilation, thermal shock, unusual framing, etc. The standard precautions with respect to such factors should always be observed.

In compiling the table of Relative Performance, the absence of such unusual conditions is assumed. The table represents the Gypsum Association's best judgment of the relative resistance to cracking of the principal systems of lathing and plastering.

	RESTRAINED CONSTRUCTION			UNRESTRAINED CEILING CONSTRUCTION		
PERFORMANCE	LATH BASE	PLASTER BASE COAT	FINISH COAT	LATH BASE	PLASTER BASE COAT	FINISH COAT
EXCELLENT	G or M	WF	F	G or M	WF	F
	G or M	S	F	G	S or P	F
				G or M	WF	T
				G	S	T
				M	S	F
GOOD	G or M	WF	T	G2	S or P	F
	G	P	F	G	V	F
	G	S	T	M	P	F
	G2	S	F	G2 or M	S	T
	G	V	F	G	P or V	T
	G2 or M	P	F	M	V	F
	G2 or M	S	T			
	G	P	T			
ACCEPTABLE	G2 or M	V	F	G2	V	F
	G	V	T	G2 or M	P	T
	G2 or M	P	T			

G—Gypsum Lath - 3 Coat Plastering
G2—Gypsum Lath - 2 Coat Plastering
M—Metal Lath - 3 Coat Plastering
WF—Neat Wood-Fiber Scratch and Gypsum Sanded Brown

S—Sanded Plaster
P—Perlited Plaster
V—Vermiculited Plaster
F—Sand Float Finish
T—Smooth Trowel Finish

NOTE: All proportioning of basecoat and finish coat plaster shall be as recommended herein.

All trowel finishes to be aggregated as recommended herein.

GYPSUM ASSOCIATION • 201 N. Wells Street • Chicago, Illinois 60606

Form LP 8-63 Printed in U.S.A.

SGP 0004010

HOW TO SELECT GYPSUM LATH AND PLASTER SYSTEMS



Gypsum Association

201 N. Wells St., Chicago, Illinois 60606
1350 N. Highland Ave., Hollywood, California 90028

This new method for selecting gypsum lath and plaster assemblies is a simple 1, 2, 3 step procedure. For directions on how to use this method see the back of this cover.

SGP 0004011

Selecting Gypsum Lath-Plaster Systems Is Easy As 1, 2, 3

Keeping posted on the many different lath and plaster systems available today is not an easy job for architects and designers. Knowing the performance characteristics of the wide variety of components is a tough, behind-the-scenes responsibility—and it's time consuming. A new procedure for evaluating and specifying lath and plaster assemblies has been designed by the Gypsum Association to help architects and designers select the right lath and plaster for every job—quickly and accurately.

The procedure clearly defines the relative performance of lath and plaster components for the vital areas of fire resistance, sound control and appearance or crack resistance. Here's how it works:

STEP 1: After determining the building code requirements for fire resistance, and the client's sound isolation needs, the architect or designer refers to the Gypsum Association's *Fire Resistance Design Data* manual to select the lath and plaster systems which offer the indicated fire protection and sound control.

STEP 2: Now, the architect or designer determines the lath and plaster assembly which offers the required resistance to cracking by referring to the Gypsum Association's *Performance of Lath and Plaster Systems* manual.

STEP 3: Having determined the components which meet the design criteria for the job, the final step, preparing the specifications, is simplified by following the *Recommended Specifications—Gypsum Plastering* manual.

Copies of these three manuals are enclosed.



Gypsum Association

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SGP 0004012

Machine Applied Gypsum Plaster

SCOPE

This recommendation covers the application of gypsum basecoat plasters over gypsum, metal or wire fabric lath, and masonry by means of mechanical and pneumatic equipment.

PLASTER MIXERS

Plaster mixers shall be capable of producing a uniform and homogeneous plaster mix in the required quantities.

Plasters mixers shall be kept clean and in good mechanical condition.

PLASTER APPLICATION MACHINES

No more length of pipe and/or hose from the mixer to the spray nozzle should be used than the conveying equipment will handle without the use of extra retarder or more mixing water than is required to meet the slump test as provided in the section on "Gypsum Plaster Mix Proportions."

Plastering machines shall be capable of transporting the specified plaster mix and properly distributing this mix on the plaster base.

Plastering machines and accessory equipment shall be kept clean and in good repair at all times.

Plastering machines shall be cleaned and hoses washed out at least twice a day.

PROTECTION AND CLEANUP

All surfaces adjoining plaster areas which may be damaged by plaster shall be thoroughly protected during the application of plaster.

The debris caused by the application of machine applied plaster shall be cleaned up immediately after each operation is completed.

GYPSUM PLASTER MIX PROPORTIONS

Gypsum plaster mixes shall be identical, for each type of plastering, to those specified for gypsum plastering as published by the Gypsum Association.

Gypsum plaster mixes not covered above shall meet the requirements of applicable building codes.

All gypsum plaster and aggregate job batches shall be based on one (100 lb.) bag of plaster or a multiple thereof. Split sack mixes shall not be permitted.

All aggregates shall be accurately and uniformly proportioned to the bag or bags of plaster by weight or volumetric measurement.

The amount of water added to each batch of plaster shall be that quantity which results in a plaster slump of not more than 4 in., when tested in a 2 x 4 x 6 in. cone, or 9 in., when tested in a 4 x 8 x 12 in. cone.

Additives which increase the water demand of gypsum mixes shall not be used.

SLUMP CONE CONTROL OF PLASTER CONSISTENCY

Note: This method of controlling the plaster to water ratio is dependent upon strict adherence to recommended aggregate to plaster proportions.

The plastering contractor shall furnish at least one slump cone with accessory equipment for each operating plastering machine on the job.

Slump cone equipment shall be present on the job site when basecoat plastering begins and shall remain on the site until it is completed.

Slump cone equipment shall be available for the use of the building official, inspector, architect or engineer.

Slump tests shall be made in either the small or the large cones described above.

Slump tests shall be made in the manner described in the section titled "Method of Making Slump Tests."

APPARATUS FOR SLUMP TESTS

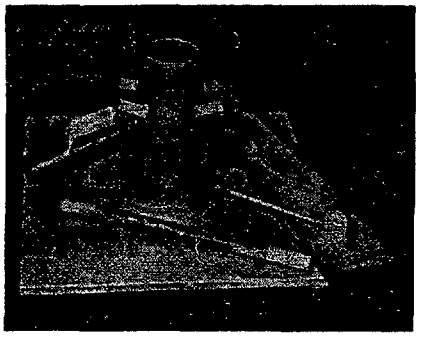
Small slump cone and equipment.

a. Material—22 gage galvanized sheet metal.
b. Size—6 in. high, 4 in. in diameter at the base, and 2 in. in diameter at the top.
c. Base Plate—12 x 12 in. nonabsorbent plane surface.
d. Tamping Rod—12 in. length of ⅜ in. steel rod rounded at each end.
e. Small scoop or margin trowel.
f. Rule or tape measure.

Large slump cone and equipment.

Note: The large slump cone is described more particularly in American Society for Testing and Materials' Designation C143. This is the cone normally used for control of concrete mixes.

a. Material—16 gage galvanized sheet metal.
b. Size—12 in. high, 8 in. in diameter at the base, and 4 in. in diameter at the top.
c. Base Plate—24 x 24 in. nonabsorbent plane surface.
d. Tamping Rod—24 in. length of ⅝ in. steel rod rounded at each end.
e. One pint scoop or cut-off brick laying trowel.
f. Rule or tape measure.





METHOD OF MAKING SLUMP TESTS

Place cone on center of dry base plate located on a level, firm surface. Hold cone tightly against plate.

Fill the cone with mortar obtained from the plaster mixer. Puddle mortar while filling to eliminate voids.

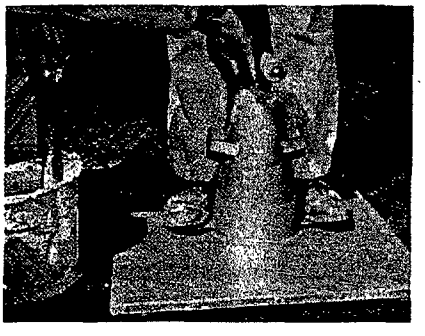
Screed mortar level with top of cone.

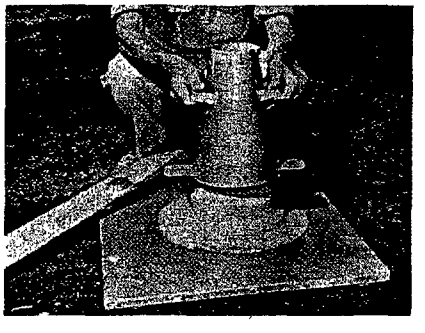
Clean off any material spilled onto base plate during filling operation.

Slowly and uniformly lift cone straight up from the base plate and carefully place it on the base plate next to the mortar sample. Lift in the same way from test to test.

Lay a straight edge or the tamping rod across top of cone, being careful not to disturb or jostle the plate.

Measure the slump as the distance in inches between the top of the cone (bottom of straight edge) and the top of the mortar sample.

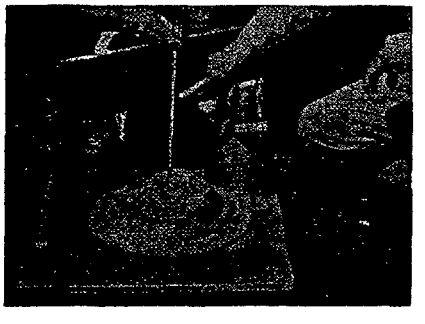




APPLICATION OF GYPSUM PLASTER

Plaster shall be applied in the same number of coats and to the same thicknesses as specified for hand plastering.

The quality of machine applied plaster shall be equivalent to that of hand applied work.



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COLD WEATHER PLASTERING

Past experience shows that plastering during winter months can be troublesome if certain job precautions are overlooked by the builder and plastering contractor. To prevent oversights this winter, it is advisable to heed the following recommended job practices.

It is known that the condition of basecoat plaster, the preparation of lime putty and the gauging of lime putty is vital to the success of the plastering application. But so are the elements of *temperature and ventilation.*

As stated in the American Standards Specifications ASA A42.1, 1955, Gypsum Association's *Recommended Specifications — Gypsum Plastering* and A42.4, the following job preparations must be adhered to — in connection with temperature and ventilation — to insure good results. "When the prevailing outdoor temperature at the building site is less than 55°F., a uniform temperature of not less than 55°F., and not more than 80°F., shall be continuously maintained in the building for a period[1] of not less than:

1. One week prior to the application of plaster.
2. While the plastering is being done.
3. And after the plaster is dry.

The heat shall be well distributed in all areas, and deflection or protective screens shall be used to prevent concentrated or uneven heat on plaster areas near the heat source. Where required, heat shall be furnished by _____.[2]

Ventilation shall be provided to properly dry the[3] plaster during and subsequent to its application. In glazed buildings this shall be accomplished by keeping windows open approximately 2 in. at top and bottom (or side-pivoted windows approximately 4 in.) to provide air circulation;[4] and by use of temporary circulators or the air conditioning system (in enclosed areas or buildings lacking openings for natural ventilation).

It must be remembered that any cementitious mixtures, like plaster or concrete, start life with very low strengths, and that their ultimate strengths depend on such factors as time or water content. The early strength of wet plaster is generally insufficient to withstand thermal shocks of even minor intensity. Greater precautions must be taken when the materials are wet than when they are dry.

[1]To minimize the possibility of plaster cracking due to structural movements caused by thermal changes, the building should be permitted to become adjusted to the uniform temporary heating conditions for at least one week prior to the start of plastering.

[2]The name of the party who shall furnish heat shall be inserted here _____.

[3]A portion of the water used in mixing gypsum plaster is necessary for the chemical reaction which sets and hardens the plaster. The excess amount required for mixing and application must be dried out after set has taken place.

[4]In addition to drying the plaster, free circulation of air is necessary to avoid "sweat-outs," particularly in enclosed areas lacking natural ventilation.

FORM L-P-6-64

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SGP 0004015

GYPSUM LATH

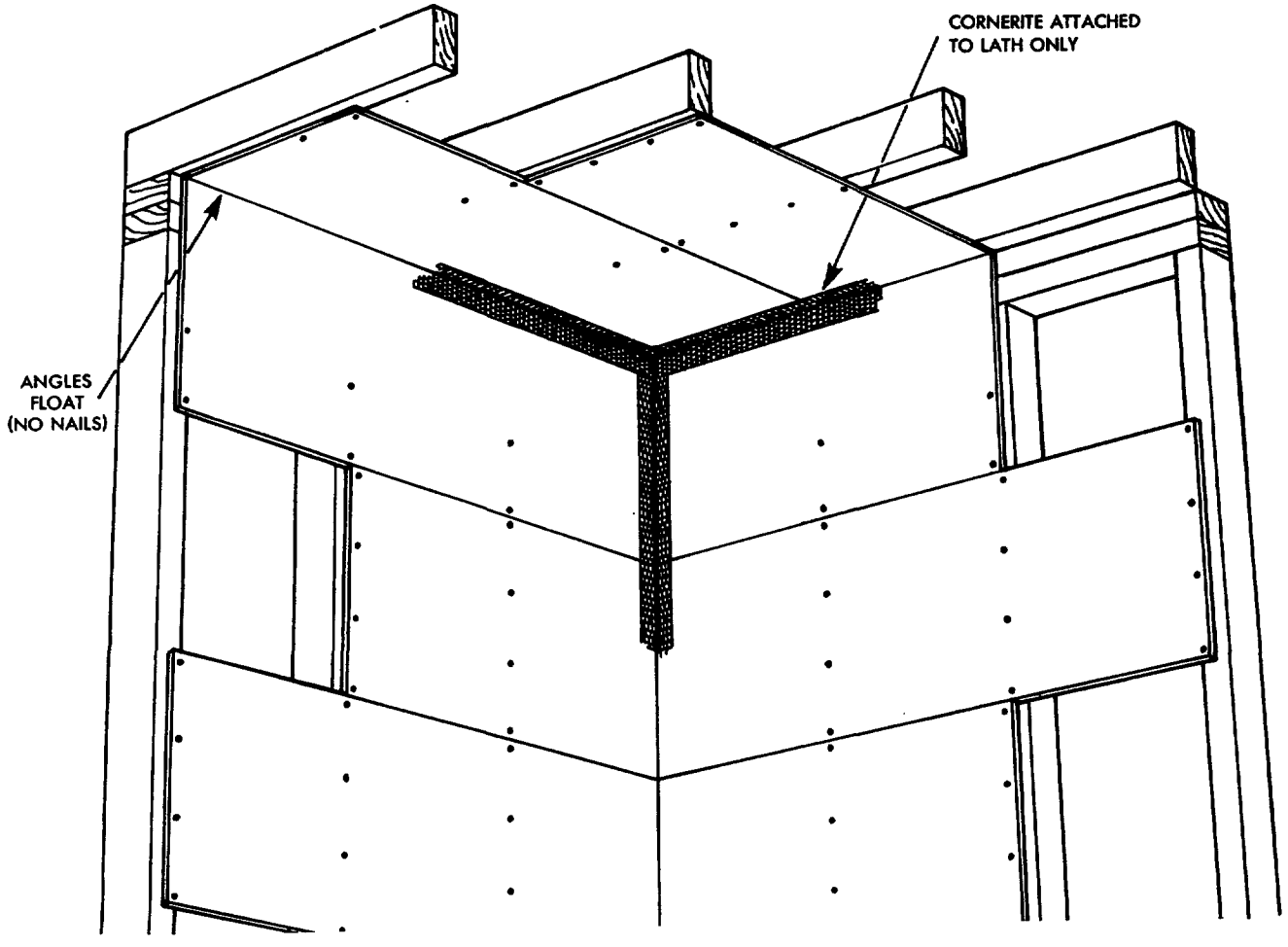
FLOATING ANGLE CONSTRUCTION AND NAILING AND STAPLING RECOMMENDATIONS

The "Floating Angle" method of application of gypsum lath was developed to reduce plaster cracking caused by stress at intersections of framed walls and ceilings.

It consists of eliminating the last two nails or staples in all interior angles, (both horizontal and vertical).

Conventional nailing or stapling (see other side) of four fasteners per 16" wide piece of lath on each joist or stud should be used on remainder of the ceiling and wall areas, with the ceiling lath applied first.

Cornerite with flanges of 2 inches or more shall be attached to the lath only (not to the framing members) in all "floating" angles.



See other side for nailing and stapling recommendations.

AIA FILE NUMBER 20-B-2

NAILING AND STAPLING RECOMMENDATIONS

THICKNESS OF LATH AND DESCRIPTION OF FASTENER	SPACING
–NAILS–	
3/8" thick lath 13 gage, 1-1/8" long, 19/64" flat head, blued	16" wide lath, 4 nails per lath per framing support, spaced 5", and placed not closer than 3/8" from ends or edges. (Note: Some fire resistive constructions require 5 nails per lath per support.) For 24" wide lath, use 5 nails per lath per framing support.
1/2" thick lath Same as above except 1-1/4" long.	Same as above except that where placed on supports 24" on center, 5 nails, spaced at 4" on center per lath per support, shall be used. For 24" wide lath, use 6 nails per lath per support.
–STAPLES–	
3/8" thick lath Minimum recommended staple: 16 U.S. Standard gage flattened galvanized wire, 7/16" wide crown (outside measure), 7/8" long legs with divergent points.	Staples shall be driven with the crown parallel to the long dimension of the framing member, using not less than 4 staples per 16" width of lath per framing member and not more than 5" o.c., in such a manner that the crown bears tightly against the lath but does not cut into the face paper. The legs of the staples shall be no less than 3/8" from the ends and edges of the lath.
1/2" thick lath Same as above but staples 1" long.	Same as above except that where placed on supports 24" on center, 5 staples, spaced at 4" on center per lath per support, shall be used. For 24" wide lath, use 6 staples per lath per support.

May, 1959

Application of

GYPSUM PLASTER ON EXTERIOR LOCATIONS

APPLICATION OF GYPSUM PLASTER ON EXTERIOR LOCATIONS

Gypsum plaster may be used on ceilings of open porches, carports, or walkways, on soffits of eaves, or other exterior areas that are protected from direct exposure to water.

MATERIALS AND APPLICATION

Materials and application shall be in strict conformance with the applicable requirements of "Recommended Specifications – Gypsum Plastering," published by the Gypsum Association, and American Standards Association A42.4.

Adequate ventilation shall be provided for the space immediately above such installations. The ratio of the total net free ventilating areas to the area of the ceiling shall be not less than 1/150. Screening shall be not less than 8 mesh per in.

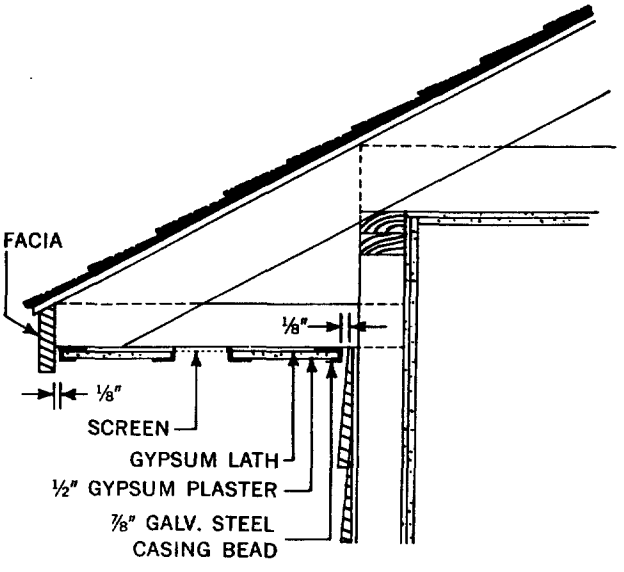
Expansion joints shall be provided at a minimum of 20 lineal ft. or 200 sq. ft. of area.

Where framing is spaced 24 in. o.c., use 1/2 in. gypsum lath and 1 in. No. 66 galvanized casing bead. Where framing is spaced 16 in. o.c., use 3/8 in. gypsum lath and 7/8 in. No. 66 galvanized casing bead. Insulating gypsum lath may be used.

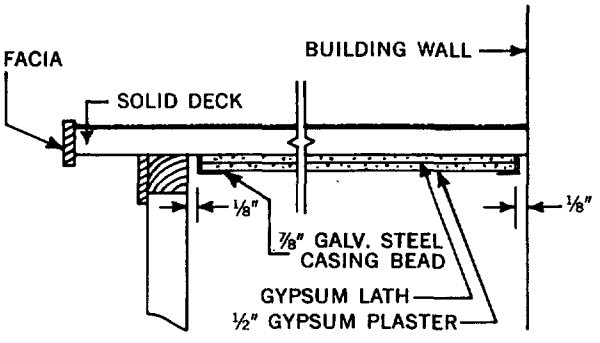
Gypsum basecoat plaster shall be used with sand aggregate only. Application of basecoat and finish coat plaster shall be done only when the temperature during application and set of the plaster is above freezing.

DECORATION

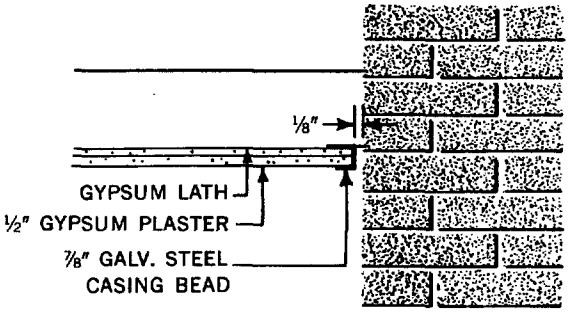
After the plaster is dry, paint with two coats of a good quality exterior paint, such as an acrylic paint.



FRAME WALL



CAR PORT or PORCH



MASONRY WALL

AIA FILE NO. 21-A-2

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SGP 0004018

FORM GPEL 3/64

Recommended Practices for Construction of Ceilings With Gypsum Lath, Metal Lath and Plaster

GENERAL

For normal job conditions the Gypsum Association recommends that lath and plaster be applied in strict accordance with the following specifications:

A42.4 Standard Specifications for Interior Lathing and Furring

Gypsum Association's "Recommended Specifications—Gypsum Plastering."

These specifications reflect *minimum* requirements for normal job conditions and are inadequate for abnormal or unusual job conditions, such as:

1. Unventilated attic or plenum space.
2. Insulation supported by the lath prior to plastering.
3. Lath supported by edge clips only under high humidity conditions.
4. The wetting of gypsum lath before plastering or wetting the scratch coat over metal lath.
5. The use of excessive water in the plaster mix.
6. Excessive aggregate proportioning in the plaster mix.
7. Thin basecoat plasters.
8. The use of water in darbying plaster.
9. Slow setting plaster.
10. Application of acoustical plaster to wet basecoat plaster.

For these unusual conditions the Gypsum Association recommends that the minimum requirements of these specifications be supplemented by the following procedures:

VENTILATION

The space above the ceiling shall be ventilated so that the ratio of total net free ventilating area to the area of the ceiling shall not be less than 1 to 150. Location of vents shall provide positive ventilating action. If ventilation does not meet this requirement, plaster shall be applied by the three-coat method.

INSULATION

Where insulating batts, blankets, blown wool, or fill insulation is installed over the gypsum lath prior to the application of the basecoat plaster, the moisture evaporating from the plaster may condense within the insulation or on the underside of the vapor barrier. Therefore, wherever possible, insulation should be installed after the plaster has set and dried.

When insulation is installed before plastering, three-coat work is recommended and the scratch coat should be allowed to partially dry before applying the brown coat.

CLIPS

When the lath is attached to ceilings by clips providing edge support only, three-coat work is required; and, under conditions of high humidity, the scratch coat should be allowed to partially dry before applying the brown coat. Under high humidity conditions, the use of butt clips and center board clips to further reinforce the lath attachment is preferred.

WET LATH

Wetting of lath prior to plastering reduces suction of the lath and reduces plaster strength. The lath (or the scratch coat) shall never be wetted before plastering.

PLASTER—WATER RATIO

Basecoat plaster slump should not exceed 4 inches when tested in a 2" x 4" x 6" cone at the mixer. This slump standard is based on plaster mixes which should never exceed proportions recommended by the Gypsum Association.

AGGREGATE PROPORTIONING

The use of high aggregate ratios reduces plaster strength. Aggregate proportions shall meet the requirements of those recommended by the Gypsum Association.

Recommended Practices for Construction of Ceilings With Gypsum Lath, Metal Lath and Plaster

BASECOAT THICKNESS

Application of a thin basecoat plaster seriously reduces the strength of the ceiling. The basecoat plaster shall be applied to full thickness as required by "Recommended Specifications—Gypsum Plastering" especially where an acoustical plaster finish is used.

WATER DARBYING

Use of water in darbying plaster increases the water-plaster ratio and reduces plaster strengths. Water should never be used for darbying and only sparingly for floating.

SLOW SET PLASTER

The setting time of plaster shall not exceed 4 hours. Faster set can be obtained by adding small amounts of ground raw gypsum to the plaster mix. Or, a controlled fine spray of 5% aluminum sulfate solution can be applied to the plaster after application on the ceiling to obtain a faster set.

ACOUSTICAL PLASTER

Acoustical plaster should never be applied to a wet basecoat. The basecoat plaster shall be dry prior to application of acoustical plaster. If suction of the basecoat plaster must be adjusted to properly receive the acoustical plaster, care shall be exercised to avoid the use of excessive water.