# STANDARD SPECIFICATIONS

*for*

# Cut INDIANA LIMESTONE Work

*With Supplementary Data relating to the best methods of Specifying and using this stone for all building purposes*

Grading of Stone · Finishes
Detailing · Handling · Setting
Setting Mortars · Cleaning · Etc.

*The Nation's Building Stone*

INDIANA LIMESTONE
The ARISTOCRAT of BUILDING MATERIALS

INDIANA LIMESTONE
SERVICE PUBLICATION
Series A-3 Number 3



INDIANA LIMESTONE QUARRYMEN'S ASSOCIATION
P. O. Box 500 Bedford, Indiana

# *To the Architectural Profession*

IN THE preparation of this publication it has been the effort of this Association to make it of the greatest possible value to all branches of the Architectural Profession. It is also intended to supplement this from time to time by other publications that will further enlarge its usefulness to the profession.

On account of the information and data of interest to Architectural Draughtsmen and Designers, and to Construction Superintendents, as well as to Specification Writers, that is contained in this booklet, especially in the reference notes and appendices; its general use in the draughting room is considered important.

With that in view, additional copies will be cheerfully furnished to Architects, upon request.

The Specification forms included in this booklet, are also available separately, without notes, as follows:

STANDARD SPECIFICATION

This Specification may be had printed in typewriter characters on loose sheets of thin typewriter paper, ready to be filled in and made a part of the Architects Specifications for any building, or for other use in the preparation of cut stone specifications. A copy of this form will be found in the folder accompanying this booklet. See notes regarding its use on inside of folder.

Any number of duplicate copies desired will be cheerfully furnished gratis, without obligation whatsoever, upon receipt of postal request. *Ask for* **Form No. 1 Series A-3.** A blank form for convenience in ordering will be found in back of folder.

This same specification may also be had printed in folder form on heavy paper, punched same as Details and Data Sheets, for desk reference and general office use. *Ask for copy of* **Form No. 5 Series A-3.** *This replaces old form No. 1x of same series.*

*Abbreviated (Standard) Specification*

This may be had in convenient folder form printed in typewriter characters on heavy paper, punched same as Details and Data Sheets for reference and general office use. *Ask for* **Form No. 2 Series A-3.**

*Short Form of Specification*

This form has not been prepared in printed form separate from booklet and for the present is available only in mimeograph form. *Ask for* **Form No. 4m Series A-3.**

*Suggestions for the improvement of current practice are at all times in order.*

---

STANDARD SPECIFICATIONS
Issue of September, 1922

Prepared and Published by
ARCHITECTS SERVICE DEPARTMENT
INDIANA LIMESTONE QUARRYMEN'S ASSOCIATION

# STANDARD FORM *of* CUT STONE SPECIFICATION

*for*

# INDIANA OÖLITIC LIMESTONE

as Adopted and Recommended by

INDIANA LIMESTONE QUARRYMEN'S ASSOCIATION

## INDEX TO CLAUSES

*For itemized reference to the subject matter covered by Appendices and page references to the Specifications, etc., see* General Index *page 56.*

### FURNISHING CUT STONE



NOTE: — For reference to Back Painting, Protective Coatings, Waterproofing, etc., *see Appendix "G."*

### SETTING CUT STONE



*For the convenience of Architects and others using this Specification, it has been further arranged as described on page 2.*

This Specification, together with the accompanying notes, alternate and supplementary clauses, constitutes an outline of the STANDARD PRACTICE, as adopted by the Indiana Limestone Quarrymen's Association for Cut Indiana Limestone; the governing factors and intent or interpretation of which are more fully explained by the notes and reference data in the form of appendices added thereto.

The Technical Division of this Association is constantly conducting research work and investigations bearing on the subject of Specification requirements and it is the intention to revise this STANDARD SPECIFICATION from time to time, in order to keep it up to date with the developments of this research work, or as may be found advisable to improve it and have it conform with the best modern engineering practice as applied to Building Construction.



INDIANA LIMESTONE QUARRYMEN'S ASSOCIATION
P. O. Box 500 Bedford, Indiana

# *Preface to*
# STANDARD SPECIFICATION
# *for*
# INDIANA LIMESTONE

THE Specification proper, complete for all ordinary requirements, is arranged in the most approved manner under sub-headings as indexed on first page. The words or portions of this Specification which are optional and subject to change are printed in *Italics*. Those portions of the Specification which it is desirable to accent are printed in ***bold face type*** or in CAPITALS.

Below the Specification clauses on page 3 and in the margin at right of Specification on all other Specification pages, are printed a series of explanatory notes, also references to the optional or supplementary clauses and descriptive data and to the Specification clauses that should be inserted in the General Specification, for other trades.

The supplementary clauses which are referred to throughout the Specification and which follow the Specification proper should be included only when the work on a particular building requires that these items be specifically covered. These clauses should be inserted where indicated following their proper section heading.

The additional explanatory notes and descriptive data included in the appendices are intended to explain the requirements of the Specification and the reasons therefor more fully than is possible in the marginal notes. Everyone using the Specification should read carefully all of these references.

It is particularly important that the notes in reference to Setting Mortar, sand for setting and pointing mortar, flashing and caulking of projecting members, detailing of stone in connection with Reinforced Concrete and the protection of Cut Stone at time of delivery, during and after erection be carefully studied.

Certain of the more important references are printed in bold face type or capitals to direct the Architect's attention to their importance.

In addition to the Standard Form of Specification, an abbreviated form has been included, page 17, for use in connection with smaller work; also a short form, page 20, for use whenever it is desired to make the Standard Form apply without incorporating this entire form in the General Specifications. Naturally, it is very important in using the short form that the second clause of Section One, making the Standard Form and Standards of the Association apply to the particular work, be made the basis of its use.

It being more or less usual for the Cut Stone to be furnished to the Contractor either f. o. b. cars at destination or delivered alongside curb at the building site by trucks or teams, the Specifications have been so arranged that either the setting only, or the delivery and setting may be readily separated under a separate "Setting Contract."

---

*Prepared and Published by*

ARCHITECTS' SERVICE DEPARTMENT

INDIANA LIMESTONE QUARRYMEN'S ASSOCIATION

BEDFORD, INDIANA

Branch Bureaus *of* Service Department
622 Marbridge Bldg., 47 W. 34th St., New York City

*and at*

Building Material Exhibit,
6th floor Leiter Bldg., 15 East Van Buren St., Chicago

# Specification
## for
# CUT INDIANA LIMESTONE

## 1. WORK INCLUDED.

The work under this contract shall include all labor and material for the furnishing (see notes 1-a, 1-b and 1-c) of Cut Stone work in accordance with the drawings and as hereinafter specified. (See notes 2 to 6.)

## 2. DESCRIPTION OF STONE.

All Limestone specified or shown on drawings shall be *Standard Gray* (see notes 7 and 9) Indiana Oolitic Limestone building stock, free from all defects that would materially impair its strength, durability or appearance, and within the range of variation of color and texture represented by two samples approved by the Architect.

Specially graded stone acceptable as to hardness and color as per samples to be submitted shall be employed where indicated on drawings for *grade courses, steps, platforms* and all other positions exposed to direct wear. (See Appendix "A.")

Wherever the terms "Indiana Limestone" or "Limestone" occur in this specification, they specifically refer to and shall imply "Indiana Oolitic Limestone" quarried in Lawrence or Monroe County, Indiana, by a member of the Indiana Limestone Quarrymen's Association. (See note 8.)

---

**Note 1a.**—If the stone is to be delivered f. o. b. cars, add after the word "furnishing," the following: f. o. b. cars at destination.

**Note 1b.**—If the stone is to be delivered at the building site, add after the word "furnishing," the following: and delivery by truck or team at the building site.

**Note 1c.**—If the setting of the stone is also to be included in this same contract, add after the word "furnishing," the following: delivery and setting.

**Note 2.**—When the work to be executed in stone is not clearly indicated on the drawings, or for any particular reason, it is desirable to enumerate the items of work that are to be included, a further clause should be added to Section 1, see supplementary clause 2-a, page 12.

**Note 3.**—Where any particular items of work are to be excepted or executed in other material, add to Section 1, after the word "specified," excepting the.....
.....which are to be of.....
and will be included under another contract.

**Note 4.**—When it is desired to include with the Cut Limestone work, minor items of work that are not indicated as Limestone, or that are indicated on the drawings as of other materials; except where this is an alternate that is to be figured in two or more materials; add after the word "specified," including also the (enumerating the items of work to be included) that (*are*) (*is*) indicated on drawings as.....

**Note 5.**—When any items that are indicated of other material are *also* to be figured in Indiana Limestone, this should always be covered by a special Sub-heading **"ALTERNATE"** inserted immediately following the clause, **"WORK INCLUDED,"** see supplementary clause 5-a on page 12 for the suggested form of clause for "Alternate Work."

**Note 6.**—When the walls are to be faced with a rough sawed Random Ashlar of Indiana Limestone that will, therefore, be indicated on the sections in similar manner to cut work, trim, etc., it is advisable to make it clear that only the trim is to be covered under the heading of Cut Stone, by a statement to that effect, either inserting the work trim between the words "Stone—Work" or by adding the following clause:
The field of all walls shown faced with stone will be of (*rough sawed*) (*Rock Faced*), Random Ashlar provided for under the General Masonry Contract and is not to be included as Cut Stone work.

Also if quoining is shown on drawings, add to Section 5 **"CUTTING & SETTING DRAWINGS"** the following clause:
The quoining of trim shall be arranged to conform and bond with the scheme of ashlar facing as indicated on detail drawings.

**Note 7.**—This clause should be varied when other class of stone is desired, using the terms "Standard Buff," "Select Variegated," etc.

**Note 8.**—The inclusion of this requirement is important for the reasons given in Appendix "B." See also Supplementary Clause 8-a, page 12.

## 3. SAMPLES.

The contractor shall submit to the Architect, two samples which shall be typical of the extremes which the contractor proposes to furnish. Samples to be about 4 inches wide by 7 inches long by about one inch thick, produced so that the large faces shall show across the grain of the stone, the finish specified to be indicated on the large faces and at least two of the edges to be rock face. Similar samples shall be provided when Select stock or specially graded hard stone is specified for certain positions in the building. **(See Note 9.)**

All samples shall be labeled or otherwise clearly marked with the name of the contractor submitting same, and the grade of the limestone, with the statement: "Samples of Indiana Limestone to be furnished for the.....Building."

## 4. STANDARD PRACTICE.

Insofar as these specifications pertain to the practice set out for the proper use of Indiana Oolitic Limestone, the standards established by the Indiana Limestone Quarrymen's Association of Bedford, Indiana, are to govern. Bidders not familiar with these standards are cautioned to inform themselves regarding them. **(See Note 10.)**

The Architect reserves the right to approve the sub-contractor for Cut Stone before this portion of the work is awarded. **(See Note 11.)**

## 5. CUTTING & SETTING DRAWINGS.

The cut stone contractor shall prepare and submit to the Architect for his approval complete cutting and setting drawings, in triplicate, for all of the Limestone work under this contract. Such drawings shall show in detail sizes, sections and dimensions of stone, the arrangement of joints and bonding, anchoring and other necessary details.

**(See Notes 12 and 13.)**

These drawings shall be based upon and follow the drawings and full size details prepared by the Architect, except where it is agreed in writing that changes be made. Each stone indicated on these drawings shall bear the corresponding number marked on the back or bed with a non-staining paint.

Moulded or projecting courses, unless otherwise shown, shall have not less than four-sevenths *(4/7)*

**Note 9.**—The Indiana Limestone Quarrymen's Association classifies the Industry's product as follows and recommends the use of these terms to indicate the desired grades of stone which its members produce:

| "Regular Grades" | "Special Grades" |
|---|---|
| Select Gray stock. | Rustic Buff. |
| Standard Gray stock. | Special Hard Buff. |
| ~~Select~~ Variegated stock. | Special Hard Gray. |
| ~~Standard Variegated stock.~~ | Indiana Travertine, |
| Select Buff stock. | *sawed either with or* |
| Standard Buff stock. | *across the grain.* |

Other specialties, ranging in color tone from very light *almost a cream white* to distinctly dark are also usually available, samples of which will be submitted upon request.

For a general description of the various grades and recommendation as to their selection and employment, *see Appendix "A."*

**Note 10.**—This applies to the proper handling of stone; preparation and use of setting mortar; selection of sand; method of backing up and detailing generally; cleaning down and protection, etc. The inclusion of this clause is recommended, as when these practices, *which are in a general way covered in the explanatory notes and appendices,* including the Association Standard Classification of Stone, are made a part of the specification, the Architect may have assurance that the Indiana Limestone Quarrymen's Association will take an active interest and co-operate so that the desired results may be obtained.

**Note 11.**—The inclusion of a provision reserving to the Architect the right to approve the cut stone sub-contractor is always recommended whenever the furnishing of cut stone is included in the "General Contract."

**Note 12.**—When the Architect has carefully worked out all of the jointing schemes in his original drawings, the following clause should be inserted after the word details: In no case shall the Contractor, without written permission, deviate from the jointing shown on the Architect's scale drawings.

When reprises are required at internal angles, considerable extra expense is involved and they should generally be confined to 4 or 6-inch return, even when this expense is warranted. *See Appendix "D."*

As it is rather unusual for the Architect to work out all of the jointing of the work and since changes are frequently advisable, the above clause is rather too definite for general usage and the following is suggested as a more reasonable requirement, this clause to be inserted after the words "change be made" in second paragraph of Section 5.

No departure from the Architect's drawings shall be indicated on the drawings submitted for approval, unless the change is specifically called to the Architect's attention by an accompanying letter of explanation.

**Note 13.**—When the Limestone is used as a facing for walls of skeleton frame buildings, a clause should be inserted in the Reinforced Concrete or Fireproofing specifications providing for proper back joint.

See supplementary clause 13a, page 12.

of their cubic contents inside the face of wall and all projecting stones; except where otherwise shown, or specially anchored to the structure and so provided for by details on setting drawings; shall have beds in the wall at least 1″ greater in depth than their maximum projection. There shall be "through" or bond stones wherever indicated on approved stone details.

Provisions for the proper anchoring and doweling or clamping of work in keeping with standard practices; also for the support of stone by shelf angles and loose steel, etc., when required; shall be clearly indicated on the setting drawings. **(See Notes 14, 15 and 16.)**

## 6. DETAILS FOR LINTELS, ETC.

Lintels and Architraves or other members spanning openings, whether supporting a super-imposed load or only their own weight, shall be of the proportions and sectional area that will provide an ample factor of safety based on the average ultimate breaking strength of the stone. **(See Note 17.)**

## 7. CARVING & MODELS. (See Notes 18 to 20.)

All carving *unless otherwise specified* shall be done under this contract *before the stone is shipped* by skilled carvers, in a correct and artistic manner, in strict accordance with the spirit and intent of the Architect's sketches, or from plaster models prepared or approved by the Architect.

## 8. CUTTING. (See Notes 21 to 23.)

All stone shall be cut accurately to shape and dimensions and full to the square, with jointing as shown on approved drawings. All exposed faces shall be cut true and out of wind. Beds and all joints shall be dressed straight and at right angles to the face, unless otherwise shown, and except where otherwise shown or noted on drawings joints shall have a uniform thickness of ¼ inch.

Patching or hiding of defects will not be permitted and Lewis holes shall not be made on exposed surfaces.

Washes shall be as deep as practical and drips of sufficient width and depth to shed water shall be provided on all projecting stones and courses.

Raglets for flashing, etc., shall be cut in the stone where so indicated on the drawings.

Molded work shall be carefully executed from full size details, supplied by Architect and must match perfectly at joints. All arrises to be sharp and true. **(See Appendix "D.")**

**Note 14.**—It is also important that the Architect provide specifically for the furnishing of shelf angles, loose steel, anchor bolts, etc. in the structural steel, reinforced concrete or masonry specifications as the case may be.
*See Supplementary Clauses* **14-a, b, c and d** *on pages* 12 *and* 13, *which are suggested for these purposes.*

**Note 15.**—For further reference to the detailing of stone work applied as a facing to buildings of reinforced concrete floor construction see Supplementary Clause 15-a, page 13, *also see Appendix "C."*

**Note 16.**—With reference to the general subject of detailing cut stone work for cornices, gutters, parapets, flashing, etc., also for Gothic Tracery etc., *see Appendix "D."*

**Note 17.**—Ordinarily a figure of 200 to 250 pounds per square inch is considered a safe working stress based upon the known average modulus of rupture, and may be figured for these members of approximately rectangular section. Where the height is much less than the width or where these members are heavily molded or of irregular cross-section, a lower figure should be used.

**Note 18.**—On important or particular work where models are to be used for all sculptured work the following may be added to Section 7:
Exactly reproducing the models in dimensions, proportion, texture and general character.

**Note 19.**—The Architect should state a provisional sum to be included in the contract for the preparation of such models as he will require, for which the following clause should be inserted; making CARVING the title for Section 7 with MODELS as a separate clause.

### MODELS

This Cut Stone Contractor shall include in his estimate the sum of $ for plaster models of stone carving and sculptural decoration, delivered at the building or at his yard, as may be required. The models shall be made by a modeller selected by the Architect and paid by the Contractor.

It is customary for Architects to approve the modelling in clay from photos of the clay models before the plaster models are cast.

**Note 20.**—For carving that is to be executed after the stone is set, see supplementary clauses 20-a-b-c, on page 13.

**Note 21.**—Where any portion of the stone work is "trim" or detached stone to be built in walls faced with brick, the Architect should show a figured detail of the typical jointing of brick work and add under the heading of "CUTTING" the following clause: All detached stone in walls faced with brick shall be cut to fit the lay of Brick as shown by detail. Otherwise, the stone for trim will be cut to standard dimensions.

All columns shall be accurately cut with the entasis as shown on drawings. All pilasters *unless otherwise indicated* to be cut straight without entasis or taper. (See Appendix "D.")

## 9. CHECKING OUT OF BACKS & FITTING TO STRUCTURAL FRAME.

Stone coming in contact with structural work shall be back checked as indicated on the general drawings. Stones resting on structural work shall have beds shaped to fit the supports. (See Note 24.)

Where stone facing adjoins steel columns and spandrel girders, the depth of stone shall be such that will allow not less than three inches between the extreme edge of metal and the back of stone.

## 10. FINISH. (See Note 25.)

The finish on exposed surfaces generally shall be smooth, machine dressed, showing no tool marks. *Specify also any other finish required on any particular portion of the work.*

## 11. LEWIS HOLES & CUTTING FOR DOWELS, ANCHORS, CLAMPS, ETC.

Lewis holes shall be cut in all stones weighing more than 100 pounds. No Lewis or other holes shall come closer than 2 inches to the exposed face of the stone. (See Note 26.)

Holes and sinkages shall be cut in stones for all anchors, clamps, dowels, etc., called for under this specification and indicated on the cutting and setting drawings.

## 12. LOADING & SHIPMENT. (See Note 27.)

The cut Indiana Limestone shall be carefully packed for rail or wagon transportation with exercise of all customary practical and reasonable precautions against damage in transit. (See Note 28.)

All Cut Stone under this contract shall be delivered promptly as ordered and in the sequence in which it is to be set. (See Note 29.)

## 13. FIELD CUTTING; CORNER STONE.

*Specify in detail any field cutting that will be required.* (See Note 30.)

**Note 30.**—With reference to cutting for pipes, etc., and in regard to Field Cutting generally, *see Appendix "D."* For clause to cover fitting see supplementary clause 30-a, page 14. For clauses to cover Corner Stone see supplementary clause 30-b, page 14, and clause 40-b, on page 15.

**Note 22.**—Where a random ashlar of rough sawed Limestone is used for facing of walls, it is also important that the jointing of this work be studied and the stone trim, quoining, etc. be detailed to fit the scheme of ashlar coursing as it is much cheaper to have the Cut Stone trim cut to fractional dimensions than to require the Stone for wall facing cut to special dimensions. *See Appendix "L."*

Where the ashlar is to be rusticated the method of jointing desired should be clearly indicated on the drawings.

**Note 23.**—For clause to require overhang and drips on all copings, etc., see supplementary clause No. 23, page 13.

**Note 24.**—In requiring back checking for structural work, the Architect should see that the requirement of his drawings are not such that will impair either the lateral strength or bearing capacity of the stone and in no case should stone that has been channeled out for structural steel or reinforced concrete be filled with concrete, or cement mortar, or be detailed in a manner that when erected, expansion of the structural work will tend to split the stone. *See Appendix "D."*

**Note 25.**—By "smooth" is meant the usual smooth planer finish as the work comes from the machines. Where a really smooth or "slick" finish is desired, sand rubbing should be specified.

Where tooled surfaces are desired, they should be noted on drawings, and be also covered by a clause added under Section 10.

For general information and recommendations regarding the finishes most suitable for use on Limestone, *see Appendix "F."*

**Note 26.**—As a matter of course, ashlar four inches thick on the bed, if Lewis holed, will have Lewis holes slightly closer than 2 inches to the exposed face but wherever possible this should be avoided. *See Appendix "J."*

**Note 27.**—The back-painting of stone is not provided for, as this practice is condemned as detrimental to the stone. For further reference to the back-painting of Limestone; the coating of stone with Whitewash before shipment; also in reference to Waterproofing and on the subject of stain-proofing generally, *see Appendix "G."*

**Note 28.**—The boxing or crating of stone is sometimes specified but this is inadvisable on account of the added expense; except for special pieces such as carved panels, fountains, pedestals, balusters, urns and other ornamental carved work and it is generally best to simply require that stone be carefully loaded, leaving it to the judgment of the Contractor furnishing same, as to how this is to be accomplished.

**Note 29.**—This clause applies in all cases, where the Indiana Limestone contract covers "delivery f. o. b. cars"; "delivery at the building site"; or the "furnishing, delivering and setting of the work."

The unloading and delivery at the building site is generally included with the contract for setting. Therefore, when the contract for Indiana Limestone is based on the furnishing of same f. o. b. cars, the specification for that part of the work will end with the "LOADING AND SHIPMENT" clause; as the cartage at destination, the furnishing of setting mortar, anchors and dowels, etc., should be included in the Setting Contract. When delivery to the building site is to be included with furnishing of cut stone, add a "DELIVERY" clause to Section 12, see Supplementary Clause 29-a on page 13, and omit the DELIVERY clause from the Setting Specification which follows.

## SPECIAL NOTE WITH REFERENCE TO CUT STONE CONTRACT TERMS

For specific information regarding the contract terms under which the majority of the leading Cut Stone Contractors of the United States and Canada, both large and small, operate, see the Standard Contract Forms of the International Cut Stone Contractors' & Quarrymen's Association, which may be obtained from any Cut Stone Contractor who is affiliated with that organization, also see their "CODE OF PRACTICE."

The requirements of this specification have been arranged in a form that will not conflict with these well established Trade Practices.

Mention of this is made simply because it is always useless to write a specification that conflicts with these Standard Trade Practices.

Architects should inform themselves on all matters of this kind affecting such an important branch of the work, over which the quarry producer and this Association have no control, as it will assure more satisfactory bids and contract relations generally with the Cut Stone Trade, through whom the Industry's product must reach the building public.

# *Specification for* SETTING INDIANA LIMESTONE

## 14. WORK INCLUDED. (See Notes 31 and 32)

Contractor shall refer to the preceding specification for Cut Indiana Limestone, for more detailed information regarding the Cut Stone that is to be set under this contract; also refer to "General Masonry," *Structural Steel, Reinforced Concrete,* "Sheet Metal Work," "Roofing" and "Carpentry" specifications for references to other work that must be executed in conjunction with this work.

## 15. DELIVERY & STORAGE. (See Note 33.)

All Indiana Limestone delivered f.o.b. cars at destination under *another* contract shall be carefully unloaded and delivered to the building site.

Wagon or truck haul shall be handled throughout by competent workmen and by such methods as will guard against soiling, mutilation or snipping in transit to and upon delivery at the building site. (See Note 34.)

The stone shall be stored at the building site, for whatever period, on planking set so that stone will rest entirely clear of the ground and be protected by proper means from damage to arrises and from contact with anything which would result in the accumulation of dirt, dust, soot, mud, grease or other staining or disfiguring elements. During extended periods of storage at building site, the stone shall be covered with tarpaulin, stout non-staining paper or boards.

**Note 31.**—When the furnishing, delivering and setting of Indiana Limestone is all included in the one contract, the above heading, separating the Cutting and Setting Specifications should be omitted. The first half of Section 14, ending with word "also," may then be omitted and the heading changed to "CO-OPERATION WITH OTHER TRADES."

**Note 32.**—When it is desired to include a clause to cover the furnishing and erection of derricks or hoists, etc., in the specification for setting of Cut Stone, it should be inserted after Section 14, see Supplementary Clause 32-a, page 14.

**Note 33.**—When the delivery of Cut Stone to building site is included with the furnishing of Indiana Limestone, this delivery clause, or first two paragraphs of Section 15, should be omitted and a similar clause, as per **Note 29,** inserted in Section 12, or before the above heading which separates the setting operation from the furnishing of Cut Stone; changing title of Section 15 to STORAGE AT SITE.

**Note 34.**—It is the experience that most damage to stone occurs upon unloading from cars or wagons and while in transit over city streets. It is, therefore, highly important that this part of the operations be conducted with care and by competent men under proper supervision. **A practice resulting in untold damage is the unloading and hauling of stone under contract at a fixed sum per ton, which is usually based on handling rough materials.** This results in such expeditious handling for the sake of profit on the wagon haul as to disregard all precaution against mutilation and snipping.

It is frequently impossible to obliterate damage caused to cut stone while stored at the building site waiting to be set. Rigid observance of the requirements under this clause of the specifications should, therefore, be insisted upon. *See Appendix "J."*

## 16. SETTING MORTAR. (See Notes 35 to 39.)

All Indiana Limestone shall be set in carefully prepared lime mortar tempered with stainless cement of an approved brand. The mixture to consist of one part dry Hydrated Lime or lump lime paste, to not over three parts sharp, **washed clean** sand, with the addition of stainless cement in an amount equal to 15 per cent by volume of the Lime used.

Lump Lime Paste shall be made of best quality freshly burned lump lime slaked with cold water and screened through a three-sixteenths inch mesh screen into a settling box following the practice employed in preparing lime for plastering. The Lime Putty thus prepared to stand in the settling box not less than one week and then be mixed with the sand and be properly stacked to age; the cement to be added and thoroughly worked into the mixture in small batches just prior to its use for the setting of cut stone.

The sand must be washed clean, entirely free from silt, vegetable matter, salts and all other injurious substances and must be screened if containing pebbles or very coarse grains that would interfere with the proper bedding and jointing of the work. The water must be clear and devoid of salts and all injurious elements.

### *SPECIAL NOTE REGARDING SETTING MORTARS, ETC.*

*It is not considered practical to specify more definitely, the proportions that should be used as local conditions, particularly as to sand supply, should always govern.*

*See Appendix "H."*

*For full information regarding setting mortars, including formulae for non-staining Cement Mortar and Grout and for Lime Mortar, both by volume and weight, using both Lump Lime and Hydrated Lime, see Appendix "H."*

## 17. SCAFFOLDING. (See Note 40.)

All scaffolding required for the proper execution of this work will be furnished and erected by the Masonry Contractor for the use of all Trades.

**Note 35.**—Where the use of a cement mortar is either necessary or desirable, *see Appendix "H,"* the alternate "SETTING MORTAR" Clauses Nos. 35-a or b, page 14, may be substituted for this Mortar Clause, omitting the first two paragraphs but always retaining under "SETTING MORTAR" the third paragraph relating to "Sand." *See also Note 38.*

**Note 36.**—The experience of many years has shown that there is nothing better than a good lime mortar properly used. The mortar mixture here recommended is an average that should give universal satisfaction where the sand is good, having well graded grains and is free from clay or too high a percentage of fine particles.

When lump lime is used, proper precautions shall be taken by covering, or otherwise, to **absolutely prevent the drying out of paste** and regardless of whether Lump Lime or Hydrated Lime is used, similar precautions should be taken to **prevent the Mortar from drying out** during the period it is stacked to age.

The percentage of cement included is to hasten the setting of the mortar. *See Appendix "H."*

When only Hydrated Lime is specified, the paragraph in reference to slaking of lump lime may be omitted.

**Note 37.**—Frequently the requirements as to Mortar Materials will be thoroughly covered in the General Masonry Specifications and omitted elsewhere throughout the specifications. This procedure is all right and in such cases, the Lime Paste and Sand paragraphs may be omitted providing they are incorporated elsewhere and **sufficient stress laid upon the kind of materials that are to be used in preparation of Mortar for Cut Stone work.** *See Appendix "H."*

**Note 38.**—On account of the Building Code requirements of a great many cities, more particularly in connection with the use of Stone Ashlar Facing for Curtain and Enclosure walls, a cement mortar must frequently be used, in which case only an approved **non-staining cement** may be used. A cement mortar is generally required and should always be used for the setting of Hollow Tile Backing, for which reason enclosure walls built of Limestone Ashlar backed with Hollow Tile should be entirely set in **non-staining cement** mortar. For further information on the use of White Portland and other so-called non-staining Cements, *see Appendix "H."*

**Note 39.**—Where the mortar for all purposes is to be furnished by the General or Masonry Contractor, Architects sometimes omit any specific clause covering mortar in Cut Stone Specification other than to state it will be furnished by another contractor but **this procedure is not recommended** for the reasons given in *Appendix "H."*

**Note 40.**—This is customary practice and the Cut Stone Contractor will invariably exclude the scaffolding in his bid when it is specified in this branch of the work, or when there is any doubt as to who will furnish same. For clause to be inserted in General Masonry Specification, see Supplementary Clause 40-a, page 14.

When the laying of Corner Stone is to be provided for and scaffolding, etc., for Corner Stone ceremony is to be required, insert clause to provide for this following Section 17, see Supplementary Clause 40-b, page 15.

## 18. CENTERING. (See Note 41.)

All wood centering required for the proper setting of Cut Stone work *under this contract* will be furnished and erected by the Carpentry Contractor.

## 19. ANCHORS & DOWELS. (See Note 42.)

All anchors, dowels, clamps, Lewis anchors, etc., required by setting drawings or necessary for the proper erection of the work shall be of thoroughly galvanized iron. Anchors, etc., to be galvanized after they have been bent to shape.

## 20. SETTING CUT STONE. (See Notes 43 and 45.)

The Indiana Limestone shall be set in accordance with the requirements of the drawings. When ready for setting, all stone shall be washed CLEAN ON ALL SIDES by scrubbing with soap powder and water applied with fibre brushes only and be thoroughly rinsed with clean water. Immediately prior to setting, all stone shall again be sponged or drenched on all sides with clean water. (See Note 44.)

The stone shall be set accurately, true to line and level by competent stone setters, with full flushed joints, filling all anchor holes. The face to be set on thoroughly soaked wooden wedges, which shall not be removed until the building is cleaned and pointed.

Heavy projecting courses to be securely propped until mortar has set and the wall above same built.

All beds and vertical joints shall be of a maximum width of ¼ inch, except where otherwise indicated. Mortar shall be raked out ¾ inch from the face of the stone to allow for pointing, and the stone be sponged off along all joints. (See Note 45.)

Splashing exposed faces of cut stone with mortar shall be avoided and any splashing shall be immediately removed with a sponge and clean water. (See Note 46.)

The entire backs of all stone, while wet, (see Note 47) shall be plastered with not less than ½ inch coat of setting mortar before backing up same and where the stone occurs as a facing applied direct to previously erected structural members, both back of stone and face of structural work shall be plastered with setting mortar to insure a thoroughly filled back joint. (See Note 48.)

**Note 41.**—This also is customary practice and the remarks in **Note 40** also apply. For clause to be inserted in Carpentry Specifications, see Supplementary Clause 41-a, page 15.

**Note 42.**—Anchors and dowels should always be galvanized. This is much better than to paint them, though the latter practice is sometimes followed. For further data regarding dowels, anchors and clamps, *see Appendix "I."*

**Note 43.**—The back-painting of stone is omitted from this Specification as **painting the sides and back of stone with Bituminous waterproof compounds is strongly condemned.** For full information on this subject and regarding the Waterproofing of Stone generally, *see Appendix "G."*

**Note 44.**—It is not sufficient to simply dip the stone in water or run a hose stream over it just prior to setting. **It should be washed clean of all dirt and foreign matter of every kind,** using fibre scrub brushes and plenty of clean water, scrubbing the stone with a suitable soap powder, using hot water, and a little white sand, if necessary to remove the dirt. This is very important. Clean stone and properly made setting mortar will go a long way toward assuring a building that will dry out to a beautiful clean light color resulting in a most satisfactory job. The wetting of stone further prevents the absorption of moisture from the setting mortar, which should be permitted to retain its moisture as long as possible.

**Note 45.**—The joints are a very important element in the design of a stone building and the real beauty of Indiana Limestone will be preserved by careful workmanship in setting. Careless or improper setting may spoil the effect of the most perfectly executed stone work and it is, therefore, most important that the entire setting operation be carried on by skilled men under competent supervision. *See Appendix "J."*

**Note 46.**—Splashing exposed faces with mortar should be consistently avoided because it often results in white spots that are very difficult to eradicate.

**Note 47.**—Stone should be sponged again if it dries before back-plastering is done to also prevent the absorption of moisture from the backing mortar.

**Note 48.**—**All concrete surfaces** against which Limestone is applied as a facing material should first be **thoroughly coated with a heavy asphaltic waterproofing** paint or compound and an ample back joint for mortar should always be allowed. *See Appendix C.*

The ends only of sills shall be set in a full bed of mortar, balance of sills to be left free until pointed.

Steps shall be set with a slight pitch to the front.

All cornices, copings and projecting belt courses and all stones forming gutters, etc., shall be set with the vertical joints dry. These joints shall be caulked on exterior profile with picked oakum and shall then be filled solid from above with a mortar grout. Grout shall be composed of one part non-staining cement and one part fine white sand, mixed in small quantities, stirred vigorously until used and of as thick consistency as can be poured into joints. **(See Note 49.)**

Where the Limestone extends down to the grade line of building, the first course above grade shall be set on a layer of *asphalt impregnated felt paper, roofing slate or other* approved non-staining impervious material. **(See Notes 51, 52 and 53.)**

## 21. BACKING UP CUT STONE.

The (*first course of brick next to stone facing*) (*hollow tile backing of stone facing*) shall be laid in the same kind of mortar as used by Masons for setting of stone. **(See Note 54.)**

*NOTE: The amount of mortar required for setting of hollow tile is comparatively small and both facing and entire backing, can, to advantage, be set in the same mortar, for which purpose either a* non-staining cement mortar *or a* lime and non-staining cement mortar *is recommended.* **(See Supplementary clauses 35-a-b.)**

*TEMPORARY COVERING & STAIN PREVENTION.* **(See Note 55, and Note 43.)**

**(Also see Reference at bottom of page 11.)**

## 22. PROTECTION OF FINISHED WORK.

Contractor setting Cut Stone shall co-operate with the Carpentry Contractor who will furnish and erect the necessary protection for sills and projecting stone work. **(See Notes 56 and 57.)**

**Note 49.**—For further information regarding the proper detailing and caulking or flashing of stone at cornices, gutters, coping, etc., *see Appendix "D,"* also Supplementary Clause 49-a, page 15.

**Note 50.**—Large blocks of stone, column drums, etc. cannot be depended upon bedding themselves truly by allowing them to sink into a bed of mortar by their own weight and should be set on lead buttons, as wood wedges are not often entirely satisfactory for this purpose. *See Appendix "J."*

**Note 51.**—This water-proofing course is to guard against absorption by capillary attraction of moisture and impurities from the soil. Ordinary tar paper is not suitable. Sheet lead is sometimes used. *See Appendices "D" and "E."*

**Note 52.**—For buildings erected on an open plot with stone work in contact with soil, a spatter course is often advisable. See Supplementary Clause 52-a, page 15.

**Note 53.**—For special clauses to cover the setting of Gothic Tracery, see Supplementary Clauses 53-a and b, page 15, also *see Appendix "D."* For setting and grouting of Arches generally, Groined Arches and other special work, *see Appendix "J."*

**Note 54.**—It may be considered difficult to lay the first course of brick backing in the same kind of mortar as is used for stone facing but this operation has frequently been employed without any serious difficulty and with thoroughly satisfactory results and it should be followed on all masonry construction where lime mortar is used for the setting of stone. For enclosure walls backed with brick or tile, where cement mortar is required by the Building Code, it is equally, if not more important that backing be set in the **non-staining mortar** used for setting the facing.

**Note 55.**—It is important that all Limestone faced or trimmed walls under construction be properly covered at night and during inclement weather. This covering and protection of all walls, including cut stone, should be specifically covered by the Masonry Specifications. *See Appendix "J."*

**Note 56.**—Particular care should be exercised to protect the stone from contact with oils and grease and paints or other compounds containing oils, both before and after setting.

**Note 57.**—Proper covering or boxing of projecting stone work should be covered under the Carpentry Specification, see Supplementary Clause 57-a, page 15, to be inserted in Carpentry (*or Masonry*) Specifications. For small work the Alternate Clause 57-b may be used. *See also Appendix "J."*

**23. CLEANING.** (See Note 58.)

The face of all stone work under this contract shall be thoroughly cleaned upon completion; this cleaning to be done with soap powder boiled in clean water and applied vigorously with stiff fibre brushes. If necessary, clean, sharp, fine, white sand to be added to the soap and water mixture. After cleaning, all exposed surfaces of stone to be drenched with clear water.

The use of wire brushes or acids of any kind will not be permitted under any circumstances for cleaning the stone work.

**24. POINTING.** (See Notes 59 to 61.)

All face joints shall be brushed out clean ¾ inch in depth, carefully removing all wedges so that pointing will be continuous and after a thorough wetting of the Stone be pointed flush with mortar, consisting of one part stainless cement, two parts clean white sand and sufficient cold lime putty to make as stiff a mixture as can be worked.

*For* Supplementary *and* Alternate Clauses, *see pages* 12 to 16.

*For subject reference and page numbers of* Appendices, *see* General Index *on page* 56.

**Note 58.**—A good household soap powder is best for the cleaning down of Indiana Limestone. Architects should consult the Service Department of the Association for further information on proper cleaning methods and in reference to cleaning preparations. Fibre brushes should always be used because they do not scratch the stone.

Wire brushes or other metal cleaning tools should never be used as they cut away the surface and leave particles of metal in the pores, which may cause rust stains that are difficult to remove.

Acid must not be used because it tends to destroy the protective film which the stone itself deposits on the face. THIS PROTECTIVE FILM MUST NEVER BE DESTROYED. Therefore, acids, wire brushes and sand blasting should never be permitted under any circumstances, or at any time, regardless of the age of building. *See Appendix "K."*

**Note 59.**—If the mixture specified for pointing mortar appears to be a little too rich on account of the character of local sand, add a little more sand making it a 1 to 2¼ or 1 to 2½ mixture with the lime putty added. *See Appendix "H."*

**Note 60.**—For ashlar work the struck or weathered joint is often advisable, or the slightly concave joint may be used throughout but the flush joint is generally more satisfactory for moulded and carved work. The bead joint is not satisfactory and is very seldom used for any purpose in modern work.

**Note 61.**—The remarks in Appendix "H" in reference to setting mortars, sand, etc. also apply to pointing mortar. Formulae both by volume and weight for different mixtures that will also apply to pointing mortars will be found in Appendix "H."

For further information on this important subject consult the Service Department of the Association.

## STAINING AND STAIN PREVENTION

The fact that frequent references to the prevention of staining occur throughout the notes accompanying this specification and that this subject is treated upon so fully in the Appendices, should not be taken either to indicate staining to be a frequent occurrence, or that Indiana Limestone is particularly susceptible to staining.

These references only constitute the sincere and thorough endeavor on the part of this Association and the Industry it represents, to correct existing improper practices, and by making clear the sources of trouble, to prevent the troubles of this nature, which occasionally occur by reason of the misuse of this fine product. Staining is not a fault of Indiana Limestone and is always preventable.

Where staining or discoloration of the stone has occurred, it has invariably, upon investigation, been found to be the direct result of a lack of knowledge or proper care. Any light colored building stone, including both gray and pink granite, will show the effect of stain from Portland Cement mortar, where improper construction details, or methods that do not prevent this, are employed.

## NOTES; SUPPLEMENTARY and ALTERNATE CLAUSES

Which are referred to in the marginal notes accompanying the Standard Form of Specification for Indiana Limestone, on Pages 3 to 11.

These references and clauses are numbered and lettered to correspond with the marginal note references.

**No. 2a., Note 2.,** "WORK INCLUDED."
To this clause the following should be added where the work to be executed in Indiana Limestone is not clearly indicated on the drawings, using **ONLY** the items which apply to the work that is to be included in the particular building, adding any other items that are to be included, which are not herein enumerated:—

"This work shall include all *Ashlar Facings* of *exterior walls, other walls;* all *columns, pilasters, caps; base or grade courses, belt courses, cornices, pediments,* and *copings; sills, steps,* and *platform slabs,* and *the facing and copings of approach work, area walls;* all *lintels, arches, architraves, imposts, key blocks, panels, ballustrades, turrells* and *finals, piers,* and *vault ribs, vaulted ceilings,* and all other work specifically so noted on drawings, including all ornamental and carved decoration occurring in connection with this work."

**No. 5-a., Note 5.,** "WORK INCLUDED."
When alternate figures are desired for executing certain items of work in Limestone that are indicated on drawings as of another material, the following clause should be used, inserting same immediately after the paragraphs under "WORK INCLUDED" with paragraph heading of **"ALTERNATE"** *or*

**ALTERNATE ESTIMATE.**
"Contractor shall also submit with his Bid, an alternate estimate on furnishing the.....
....., in Indiana Limestone in lieu of.....
....."

**No. 8-a., Note 8.,** "DESCRIPTION OF STONE."
For large and important work it is quite permissible and proper for the Architects to add the following clause, inserting same at end of second paragraph after the word "Association":

—"The quarry from which the Limestone is to be obtained shall be one having ample capacity and facilities to insure prompt delivery in such quantities as will permit the rapid execution of the work."
"The Contractor's facilities for cutting and handling as well as character of Limestone Quarry will be considered in the award of contract."

**No. 13-a., Note 13.,** "CUTTING AND SETTING DRAWINGS."
The following clause is suggested to provide for the proper clearance and back joint where the stone is used as facing for walls of skeleton frame buildings: This should be inserted in *"Reinforced Concrete Specification":*

"All reinforced concrete work and concrete fireproof floor construction, including fire-proofing of steel frame, shall be kept one inch free of the back of cut stone and this work shall be detailed to leave at least a full inch between face of concrete members and back of stone as shown on Cut Stone detail drawings."

**No. 14-a., Note 14.,** "CUTTING AND SETTING DRAWINGS," referring to *Reinforced Concrete and Structural Steel Specifications.*
Where Stone is to be applied as a facing to a Reinforced Concrete frame building and requires to be supported over wide openings, or on face of walls, columns, spandrel beams, etc., a paragraph calling for shelf angles should be inserted in the *Reinforced Concrete Specifications* as follows:—

**SHELF ANGLES.**
"Provide and build in any bolts, anchors, sockets, etc., required for the support of shelf angles which are to be furnished and set by (*Mason*) (*Structural Steel*) Contractor for the support of Cut Stone."

Also insert the following clause in either the *"General Masonry" or "Structural Steel" Specification:*

**SHELF ANGLES, ETC.**
"This Contractor shall furnish (*and set*) (*to the mason contractor for setting*) the shelf angles indicated on detail drawings for the support of cut stone *over openings, at floor levels,* etc., and for the anchoring of cornice and projecting members, together with the sockets, anchor bolts, nuts, etc., required for the fastening of same to the structural frame."

**No. 14-b., Note 14.,** "CUTTING AND SETTING DRAWINGS" (*for Reinforced Concrete Structure*).
Where the structural frame or fireproofing is of concrete, it is also generally advisable to include the following clause in the *Specification for Reinforced Concrete work:*

"Provide any concrete brackets, ledges, offsets, etc., required in connection with the concrete structure for the proper support of stone or the backing up of same as indicated by the detail drawings." "Build in all anchors, sockets, bolts, etc., furnished by other Trades for the support or fastening of their work."

**No. 14-c., Note 14.,** "CUTTING AND SETTING DRAWINGS" (*Structural Steel Specification:*)
Specify also under *Structural Steel* that the loose angles and tees which are to be built in the walls for the support of stone work and backing over openings, etc., shall be furnished, for which purposes a clause somewhat like the following is recommended:

"The loose angles and tees indicated on the *general* drawings shall be furnished together with any anchors or bearing plates required, for setting by Mason Contractor."

This clause applies more particularly to masonry structures in lieu of clauses **14-a** and **b** which apply particularly to skeleton frame structures.

**No. 14-d., Note 14.,** *for Fireproofing Specification.*
Whenever Structural Steel Angles or "T" iron cantilevers are employed for the support of Stone Cornices, Balconies and other members where steel is embedded in masonry beyond inspection and is placed in a position where it may be affected by moisture, it should be thoroughly protected from rust by something more than the usual shop and field coats of paint. It is recommended that unpainted steel encased in a covering of concrete be used for this purpose, and to provide for this the following clause should be inserted in the Fireproofing Specifications:

"Structural steel outlook, *angle, tees,* and all cantilever steel construction for the support of overhanding stone cornice *and balcony* members, etc., shall be wrapped with Galvanized No. 28 gauge diamond mesh expanded metal or galvanized wire lath (*Wrights or equal ½" mesh lath*) and be encased with a **non-staining** cement mortar, covering all parts of the steel about ½" thick, or the steel be coated with "Gunite" covering of **non-staining** cement ⅜" in thickness. Structural Steel for this purpose to be left unpainted."

**No. 15-a., Note 15.,** "CUTTING AND SETTING DRAWINGS" (*Reinforced Concrete Specification*).
As an alternate for the clause **13-a,** the following is suggested for inclusion in the *Reinforced Concrete Specification,* as more thoroughly covering this important item.

## ALLOWANCE FOR MORTAR JOINT.

Contractor for the Reinforced Concrete structure shall allow a full inch between the back of the stone as dimensioned and the face of concrete walls, columns, piers, spandrel beams or other members to which the cut stone is to be applied and shall securely build in all anchors, etc., for the anchoring of cut stone, that are furnished by the Mason or Cut Stone Contractors.
Where any bulging or springing of the forms has occurred at any point resulting in less than ½ inch space between face of concrete and back of cut stone, the Reinforced Concrete Contractor shall either carefully trim back the face of concrete or pay the cost of trimming down the stone to permit the proper backing up of cut stone with the non-staining setting mortar.

**No. 20-a-b-c., Note 20.,** "CARVING AND MODELS."
The execution of carving after the stone is set is expensive and should not ordinarily be required, excepting for large figures, figure groups, large Bas Reliefs, and elaborate units of sculptured decoration, covering two or more stones. In such case, the work should be provided for as follows:—

**No. 20-a.,** *for Cut Stone Specification.*
If work is to be done by Cut Stone Contractor, insert the following clause after "CARVING AND MODELS":
The finished carving of (**specify items**) to be done after the stone is set in building shall be included under this contract.

**No. 20-b,** *for Cut Stone Specification:*—
If the work is to be done under another contract, as is often the case where noted Sculptors are employed for figure groups, etc., insert the following clause after "CARVING AND MODELS":

"The carving of (**specify items**) will be executed after the stone is set, under another contract for which sufficient stock projecting beyond normal line of finished work shall be provided."

And where considered advisable the following may be added:

"Cut Stone Contractor shall rough out the work as required by the Architect's details."

**No. 20-c.,** *for Carpentry Specifications:*—
Whenever carving is to be executed after work is set, regardless of by whom executed, the following should be inserted in the "Carpentry Specification":

## SCAFFOLD FOR CARVERS.

This Contractor shall provide, erect and remove, as directed by the Architect, the scaffold and overhead protection required for the carving of (**specify items**) that will be executed after stone is set in building and upon completion of this work provide any boxing or covering that may be necessary to protect same from damage until completion of building.

**No. 23,** *for Cut Stone Specifications:*—
Some Architects provide for overhang and drips where scale details do not clearly indicate same by inserting the following clause in specification under heading of "CUTTING."

Unless otherwise specifically indicated, all copings, caps and sills shall overhang the work below not less than 1½" and shall have ¾" drips.

**No. 29-a., Note 29.,** "LOADING AND SHIPMENT."
When delivery to the building site is to be included with the furnishing of cut stone, add the following clause and omit the similar "DELIVERY" clause from Setting Specification.

## DELIVERY.

"The delivery of Cut Indiana Limestone alongside curb at building site shall be included as a part of this contract.
Wagon or truck to be handled throughout by competent workmen and by such methods as will guard against soiling, mutilation or snipping in transit to and upon delivery at the building site."

**No. 30-a., Note 30.,** "FIELD CUTTING."
With properly detailed work, Field Cutting of Indiana Limestone is seldom necessary, excepting on account of improper clearances and error in the alignment of structural work against which it is to be applied. For this reason, the specifying of Field Cutting requirements will add unnecessarily to the cost of the work in the majority of cases. For use on important or difficult work where a Field Cutting clause is considered necessary, the following is suggested: *See also Appendix "D."*

## FIELD CUTTING.

The contractor for limestone work shall do all cutting and fitting in the field necessary to overcome any inaccuracies in his work or to make the material fit and conform to conditions in the building. A sufficient number of experienced men to do all necessary field cutting shall be kept on the work during the period of setting.

**No. 30-b., Note 30.,** *for Cut Stone Specification.*

When a corner stone is required and a corner stone ceremony to be provided for, the following clause should be inserted in the setting specification following section 18 "CENTERING":

## CORNER STONE.

The Contractor shall set at the point indicated on the drawings, a corner stone which shall form part of the general exterior. A large stone of sufficient size to be used as the corner stone. The face of this stone to be cut with dates and inscriptions as directed. Corner stone shall be drilled out in the center to permit the inserting of copper box approximately —x—x— inches in size which shall be provided at the Contractor's expense. The upper edge of recess in stone to be cut with a rebate below the top of bed to permit the insertion of a two-inch slab of blue stone which is to be built over the copper box in neat cement mortar during the Corner Stone ceremony. At the conclusion of the ceremony, the Contractor shall build at least three courses of the exterior face stone, and the brick backing to the same height, on top of Corner Stone, in a quick setting **non-staining** Cement.

**No. 32-a., Note 32.,** When the furnishing of derrick and hoisting equipment is not covered by the General Masonry Specification and is to be included by the Cut Stone Contractor, the following form of clause is suggested which should be inserted immediately after section "WORK INCLUDED" of the Setting Specifications:—

## DERRICKS, HOISTS, ETC.

"Contractor for setting of Cut Stone shall furnish, erect and remove all derricks, hoists and equipment required for the prompt unloading and setting of stone work; excepting that all scaffolding, centers, protective covering, etc., as elsewhere specified; will be furnished by the Mason or Carpentry Contractors."

**No. 35-a and b., Note 35.,** "SETTING MORTAR."
When the Building Code or other requirements are such that a Cement Mortar must be used, and where the backing is of brick work, the first three paragraphs under heading of "SETTING MORTAR" should be omitted and the clause No. 35-a be substituted therefor:

**No. 35-a.**

"All Indiana Limestone shall be set in a carefully prepared **non-staining** cement mortar, gauged with Hydrated Lime. Mixture to consist of one part approved brand of **non-staining** cement to not over 2½ parts sharp, **washed clean** sand, to which may be added sufficient Hydrated Lime; not to exceed 20 per cent by volume of the cement; in order to render the mortar plastic under the trowel."

For enclosure walls backed with Hollow Tile where both stone facing and backing is to be set in cement mortar, use following clause in lieu of No. 35-a:—

**No. 35-b.**

"All Indiana Limestone facing and the Hollow Tile backing of same in enclosure walls, *and elsewhere*, shall be set in carefully prepared **non-staining** cement mortar gauged with Hydrated Lime. Mixture to consist of one part approved brand of **non-staining** cement to not over 2½ parts sharp, **washed clean** sand, to which may be added sufficient Hydrated Lime not to exceed 20 per cent by volume of the cement used; in order to render the mortar plastic under the trowel."

**No. 40-a and b., Note 40.,** "SCAFFOLDING."

**No. 40-a.,** *for General Masonry Specifications:*—

Clause similar to the following should always be inserted in the "General Masonry" Specifications to cover any Scaffolding required as this is invariably excluded from bids on Cut Stone:—

## SCAFFOLDING.

"This Contractor shall furnish, erect and remove all scaffolding required for the setting of Cut Stone, the brick backing of same and..... .....for the joint use of all trades. All scaffolding to be secure and conform to the local ordinances or other regulations that may govern its erection and use."

Include in this clause also the boarding over sidewalks, when required, if this is not already covered under a special heading of its own in Mason or Carpentry Specifications.

**No. 40-b., Note 40.**

The following clause should be inserted in the *Carpentry Specifications:*

## SCAFFOLD FOR CORNER STONE.

The Carpentry Contractor shall furnish and set for the officials in charge a suitable platform and wooden frame structure for the laying of the Corner Stone and every facility shall be provided by the Contractor in this connection.

**No. 41-a., Note 41.,** "CENTERING."
*For Carpentry Specifications:—*
Whenever Centering is required for the support of Cut Stone Arches, etc., the following clause should be inserted in the Carpentry Specifications:—

## CENTERING.

"All wood centers required for the proper setting of stone work *and*.....in this building shall be furnished and set by Carpentry Contractor. All such centers shall be well and substantially built, of sufficient strength to safely carry the imposed loads, and be thoroughly braced to hold them rigidly in place. Centers shall be removed by Carpentry Contractor when the mortar has set sufficiently to render the work self-supporting."

**No. 49-a., Note 49.,** *for Sheet Metal and Roofing Specifications:*
When Stone Cornices or Copings are to be covered on top or to be flashed with sheet metal and where gutters in stone are to be lined with sheet copper, it is recommended that the following clause be inserted in the Sheet Metal Specifications:

## SHEET METAL FLASHING ON CUT STONE.

"All gutter linings and all Metal on top of Stone Cornices, Belt Courses, Copings, etc., shall be carefully soldered at all joints and be turned down well into the Stone as indicated, and be securely fastened into the raglets provided for the purpose with soft lead wedges spaced about 4″ apart, and the raglets be pointed up flush with non-staining cement."

If copper is specified add:—

"The sheet copper shall be laid over strips of black asphalt coated waterproof paper."

**No. 52-a., Note 52.,** "SETTING."
Where a building is erected on an open lot and the stone work carried down to grade in direct contact with the soil, it is suggested that a spatter course about six inches, or more in width, and three inches in thickness, be laid at right angles to the base course.

This will guard against spattering water and soil against the lower courses of stone and will also shed the water away from the footings, thereby tending to keep the foundations dry. Spatter Course should be shown on plans and may be provided for in Specifications by inserting the following under the heading "WORK INCLUDED":

"Also include Stone Spatter Course shown around base of building at grade, which shall be of special hard stone."

Provide also for the setting of spatter course either under the General Masonry or with the Setting of Cut Stone in approach work.

**No. 53-a-b., Note 53.,** "SETTING."
In Gothic work where the tracery is to be separate' from the jambs and arches of openings; (*See Appendices "D" and "J"*); the Arches should be set first and tracery be set in afterward and the following clause should be inserted under heading of "CUTTING AND SETTING DRAWINGS."

**No. 53-a.**

"Stone tracery of..... openings shall be cut separate from the jambs and arches, so as to be set in afterwards for which purpose the Stone around openings shall have check 1½″ deep, the key stone of tracery to be detailed with inside lip of check cut on the tracery."

And the following clause should be inserted in the setting specifications:—

**No. 53-b.**

## SETTING TRACERY.

"All Tracery that is to be set in after the walls are built, shall be properly dowelled together with dowels 3″ long and be tightly caulked into place on the inside with oakum."

**No. 55-a., Note 55.,** "TEMPORARY COVERING."
It is always advisable to hold the general Masonry Contractor responsible for the covering and protection of all walls during construction since it is just as important that brick walls, or brick backing of Cut Stone, and walls of other masonry materials be covered to prevent damage from rainstorms and during cold weather. **Only** where this covering and protection of walls during construction is **not** specifically provided for by the Masonry Specifications, the following clause should be inserted in the Specifications for Setting of Cut Stone as noted:—

## TEMPORARY COVERING AND STAIN PREVENTION.

"Setting Contractor shall co-operate with the Contractor for General Masonry in seeing that all walls during construction are properly covered at night and during inclement weather and this Contractor will be held jointly responsible with the Masonry Contractor for any damage resulting from neglect in protecting finished work from damage by weather."

**No. 57-a., Note 57.,** "PROTECTION OF FINISHED WORK" *for Carpentry Specifications.*

The following clause is suggested as the form of clause to be included in Carpentry Specifications:—

## PROTECTION AND BOXING OF CUT STONE WORK.

"Whenever necessary or as directed by Architect, all projecting individual stones or courses shall be protected against injury during construction

of building by wooden covering furnished by the Carpentry Contractor, same to be maintained in good and substantial condition until removed by the Carpentry Contractor to permit the cleaning down of Stone Work."

Wood containing an excess of resin, tanin or other substance that might stain the Limestone must not be used for protection of belt courses, etc., and when highly resinous woods are used, they should always be set over DRY felt or resin sized building paper.

**No. 57-b., Note 57.,** *for Cut Stone Setting Specifications.*— For residence and other small moderate cost work where any boxing or wood covering of the finished work is considered unnecessary the following clause may be substituted for the clause under "PROTECTION OF FINISHED WORK," section 22 of Specification:

"The Contractor for setting Cut Stone shall protect all sills and horizontal courses or other stone work projecting from the face of wall with a covering of red resin sized building paper, cut into strips of proper width, lapped 3" at ends and built an even ¾" into joint. This covering to be securely held in place with wood wedges and be weighted down with dabs of mortar, Brick bats or boards and be left and maintained in place until removed for the pointing of Stone.

*Also see Clauses covering* "Protection of unfinished Walls," *and* "Protection of Walls during pouring of Concrete," *on* page 26 *and Clause to provide for* Depth of Ashlar Bond, *on* page 30.

## LIST OF DON'TS

The following list of "Don'ts" embraces the more important items that should be avoided in the detailing, specifying, cutting and setting of Indiana Limestone:—

Don't cut up the design into too small units.

Don't joint columns and pilasters in small drums or sections when fewer units or monolithic shafts can be used.

Don't neglect proper provision for balancing or anchoring down on walls, all of the projecting Stone work.

Don't put too much structural Steel in Spandrel walls.

Don't use shelf angles for support of Stone Lintels when self-supporting Stone Lintels are practicable.

Don't complicate Spandrel Sections with a number of small Steel Members when one simple built-up section will suffice.

Don't check the beds to fit supporting steel; always place the steel lower and check the tops of Stone to fit around same.

Don't allow too little clearance between back of Stone and face of structural members.

Don't check out Stone to fit around steel or other structural Members, to the point of weakening its structural efficiency.

Don't require reprising and other such items involving additional cutting cost, on moderate cost work.

Don't specify too fine tooling.

Don't make rustication on ordinary work too deep.

Don't specify back-painting of Stone with Bituminous water-proofing preparations.

Don't specify Select Stone for all positions in a building.

Don't use ordinary expansion bolts for hanging of Stone.

Don't set Stone in Mortar containing ordinary Portland Cement, or permit the use of ordinary Portland Cement and most Natural Cements in Mortar for the setting of Backing in direct contact with Cut Stone.

Don't slab Stone against Concrete work without having first painted the back of Concrete with heavy coat of asphaltic Water-proofing Compound.

Don't use sand of questionable quality.

Don't neglect requiring the parging of backs of Stone with Lime Mortar where Lime Mortar is used and with non-staining Cement Mortar where that is used, when any different kind of Mortar is used for laying up of Backing.

Don't set dirty Stone or neglect the washing of same before setting.

Don't use Salt in water to lower freezing point of mortar.

Don't use Salt to thaw Ice on face of Cut Stone or to thaw Ice in Lewis and anchor holes.

Don't pile Stone in contact with ground or permit other materials to be piled in contact with stone.

Don't permit wash from Concrete floor construction or scaffolding above to run down onto walls during construction.

Don't permit unfinished walls to be exposed during inclement weather.

Don't permit oil or grease or compounds containing oils to come in contact with the Stone.

ABBREVIATED SPECIFICATION

**This Specification is an abbreviated form of the Association Standard Form of Cut Stone Specification and is recommended as a convenient shorter form for use on less important work, residences and small work generally, and all work for which the more complete Standard Form is considered unnecessary. This form is considered sufficiently comprehensive and complete for all ordinary work, trim jobs, etc.**

# Specification for
# CUT INDIANA LIMESTONE

## 1. WORK INCLUDED; STANDARD PRACTICE.

The work under this contract shall include all labor and material for the furnishing of Cut Stone work in accordance with the drawings and as hereinafter specified.

The standards established by the Indiana Limestone Quarrymen's Association of Bedford, Indiana, pertaining to proper practice in the use of Indiana Limestone, are to govern. Bidders not familiar with these standards are cautioned to inform themselves regarding them.

The Architect reserves the right to approve the sub-contractor for Cut Stone before this portion of the work is awarded.

## 2. DESCRIPTION OF STONE; SAMPLES.

All Limestone shall be *Standard* ($\frac{\text{Gray}}{\text{Buff}}_{\text{Variegated}}$) Indiana Oolitic Limestone building stock, conforming with samples approved by Architect.

Specially graded hard stone shall be used where indicated on drawings, for.....

Wherever the terms "Indiana Limestone" or "Limestone" occur in this specification, they refer to and shall imply "Indiana Oolitic Limestone" quarried in Lawrence or Monroe County, Indiana.

The contractor shall submit two typical extreme samples of each grade of stone which he proposes to furnish, clearly marked with the name of the contractor, grade of limestone and name of building for which submitted.

## 3. CUTTING AND SETTING DRAWINGS, LINTEL DETAILS, ETC.

Contractor shall prepare, and submit to the Architect for approval, complete cutting and setting drawings, in triplicate, for all of the Limestone work under this contract, based upon and following the drawings and details prepared by the Architect, except where it is agreed in writing that changes be made. Such drawings shall show in detail: sizes, sections and dimensions of stone, the arrangement of joints and bonding, anchoring and other necessary details, in keeping with standard practice. Each stone indicated on these drawings shall bear the corresponding number marked on the back or bed with a non-staining paint.

Lintels and Architraves or other members spanning openings shall be of the proportions and sectional area that will provide an ample factor of safety, based on the average strength of the stone.

## 4. CUTTING AND FINISH.

All stone shall be cut accurately to shape and dimensions and full to the square with faces true and jointing as shown on approved drawings. Beds and all joints shall be dressed straight and at right angles to the face unless otherwise shown and all joints shall have a uniform thickness of ¼ inch. Moulded work shall be cut to full size details and must match perfectly at joints. All arrises to be sharp and true.

Patching or hiding of defects will not be permitted and Lewis holes shall not be made on exposed surfaces.

Washes and drips and raglets for flashing, etc., shall be cut where indicated.

The finish on exposed surfaces generally shall be smooth, machine dressed, showing no tool marks.

**5. CARVING.**

All carving shall be done under this contract by skilled carvers, in a correct and artistic manner, from the Architect's sketches, or from plaster models prepared or approved by the Architect.

**6. BACK CHECKING, LEWIS HOLES AND CUTTING FOR ANCHORS, ETC.**

Stone coming in contact with structural work shall be back checked as indicated on the general drawings. Stones resting on structural work shall have beds shaped to fit the supports.

Lewis holes shall be cut in all stones weighing more than 100 pounds.

Holes and sinkages shall be cut for all anchors, clamps, dowels, etc.

(*Also specify in detail any Field Cutting that will be required.*)

**7. LOADING AND SHIPMENT.**

All Limestone shall be carefully packed for transportation with exercise of all reasonable precautions against damage in transit and all stone shall be delivered promptly as ordered and in the sequence in which it is to be set.

## SETTING CUT STONE

**8. DELIVERY AND STORAGE.**

Contractor shall refer to the preceding specification for more detailed information regarding the Cut Stone that is to be set under this contract.

All Indiana Limestone shall be carefully unloaded and delivered to the building site and shall be handled throughout by competent workmen and by such methods as will guard against soiling, mutilation or snipping in transit to and upon delivery at the building site.

The stone shall be stored at the building site, on planking set entirely clear of the ground and be protected by proper means from damage to arrises and from contact with anything which would result in the accumulation of dirt, dust, soot, mud, grease or other staining or disfiguring elements. During extended periods of storage, the stone to be covered with tarpaulin, stout non-staining paper, or boards.

**9. SETTING MORTAR.**

All Indiana Limestone shall be set in carefully prepared lime mortar tempered with stainless cement of an approved brand. The mixture to consist of one part dry Hydrated Lime or properly slaked and prepared lump lime paste, to not over three parts sharp, **washed clean** sand, with the addition of stainless cement in an amount equal to 15 per cent by volume of the lime used, the cement to be added and thoroughly worked into the mixture in small batches just prior to use.

The sand must be washed clean, entirely free from silt, vegetable matter, salts and all other injurious substances and must be screened if containing pebbles or very coarse grains that would interfere with the proper bedding and jointing of the work. The water must be clear and devoid of salts and all injurious elements.

**10. SCAFFOLDING, CENTERING AND PROTECTION OF FINISHED WORK.**

All scaffolding required for the proper execution of this work will be furnished and erected by the Masonry Contractor for the use of all Trades.

All wood centering required for the proper setting of Cut Stone work will be furnished and erected by the Carpentry Contractor.

Contractor setting Cut Stone shall co-operate with the Carpentry Contractor who will also furnish and erect the necessary protection for sills and projecting stone work.

## 11. ANCHORS AND DOWELS.

All anchors, dowels, clamps, Lewis Anchors, etc., required by setting drawings or necessary for the proper erection of the work shall be furnished of thoroughly galvanized iron. Anchors, etc., to be galvanized after they have been bent to shape.

## 12. SETTING CUT STONE.

Indiana Limestone shall be set in accordance with the requirements of drawings. All Limestone when ready for setting shall be washed **clean on ALL sides** by scrubbing with soap powder and water applied with fibre brushes only and then be thoroughly rinsed, and if dry immediately prior to setting, be again drenched on all sides with clean water.

The stone shall be set accurately, true to line and level by competent stone setters, with full flushed joints, filling all anchor holes. The face to be set on thoroughly soaked wooden wedges, which shall not be removed until the building is cleaned and pointed.

All beds and vertical joints shall have a maximum width of ¼ inch, except where otherwise indicated. Mortar shall be raked out ¾ inch from the face of the stone to allow for pointing. Ends only of sills to be bedded.

All cornices, copings and projecting belt courses and all stones forming gutters, etc., shall be set with the vertical joints dry and be caulked on exterior profile with picked oakum; and joints then be filled solid with a mortar grout, composed of one part **non-staining** cement and one part fine white sand.

## 13. BACKING UP AND STAIN PREVENTION.

The entire backs of all stone, while wet, shall be plastered with not less than ½ inch coat of setting mortar before backing up same.

The first course of brick next to stone facing shall be laid in the same kind of mortar as used by Masons for setting of stone.

(*Also specify an effective damp-proofing course at the grade-line, when the limestone is carried down to grade.*)

## 14. CLEANING AND POINTING.

The face of all stone work under this contract shall be thoroughly cleaned upon completion with soap powder boiled in clean water and applied vigorously with stiff fibre brushes, and be drenched with clear water.

The use of wire brushes or acids of any kind will not be permitted under any circumstances for cleaning the stone work.

All face joints shall be brushed out clean ¾ inch in depth, carefully removing all wedges and after a thorough wetting of the stone be pointed flush with mortar consisting of one part stainless cement, two parts clean white sand and sufficient cold lime putty to make as stiff a mixture as can be worked.


*On page 20 will be found a short form of specification, which is intended for use on all classes of work, in lieu of the full standard form, which is thereby made to apply.*

## Short form of Specification for

# CUT INDIANA LIMESTONE

### 1. LIMESTONE; SAMPLES AND STANDARD PRACTICE

All stone (*work*) (*trim*) (*excepting*.....) shall be (*Standard*) (Gray / Buff / Variegated) Indiana Oolitic Limestone building stock quarried in Lawrence or Monroe County, Indiana, and conforming with samples approved by Architect. Contractor shall submit two typical extreme samples of the stone he proposes to furnish, showing the finishes called for and clearly marked for identification.

The standards established by the Indiana Limestone Quarrymen's Association are to govern, and the Standard Form of Cut Stone Specification for Indiana Oolitic Limestone, as adopted by that Association, is hereby made a part of this Specification and shall apply to the work under this contract.

### 2. CUTTING AND SETTING DRAWINGS

Contractor shall prepare and submit to Architect for approval complete cutting and setting drawings in (*triplicate*) based upon the Architect's drawings, details or sketches, showing in detail all of the stone work included in this contract.

### 3. CUTTING AND FINISH

All cutting, tooling and carving shall be accurately executed in accordance with approved drawings. Arrises to be sharp and true and all mouldings be cut to full size details and match perfectly at joints. All joints shall be dressed straight and have a uniform thickness of ¼ inch. Washes, drips, raglets, etc., shall be cut where indicated and the stone be back checked and fitted to the structural work as required by details. Cut all necessary holes and sinkages for anchors, Lewis holes, etc.

The finish of exposed surfaces shall be smooth, machine dressed, showing no tool marks.

## SETTING CUT STONE

### 4. DELIVERY, ANCHORS, SCAFFOLDING, ETC.

Contractor shall carefully unload, deliver and store at building site all cut stone, in a manner that will effectively protect same from damage of every sort.

Furnish all anchors, dowels, clamps, etc., required by setting drawings or necessary for the proper erection of work, all to be thoroughly galvanized iron.

Cooperate with other contractors in the use of scaffolding furnished for all trades and in protection of finished work, etc.

### 5. SETTING MORTAR

All Limestone shall be set in carefully prepared lime mortar, the mixture to consist of one part Hydrated Lime to not over three parts sharp, WASHED CLEAN sand, with the addition of stainless cement, equal to 15% by volume of the lime used.

Sand must be clean and both sand and water be free from all elements that would tend to cause staining of the stone.

### 6. SETTING AND BACKING UP

All Limestone just prior to setting shall be washed clean on all sides, be thoroughly rinsed and be set while wet by competent stone setters; the face to be set on thoroughly soaked wooden wedges with ¼ inch beds and joints, except where otherwise indicated.

Mortar joints shall be raked out ¾ inch from face to allow for pointing. Cornices, copings and protecting belt courses shall be set with vertical joints dry and be properly caulked and grouted solid with equal parts of non-staining cement and fine white sand.

Entire backs of all stone shall be plastered with ½ inch coat of setting mortar and first course of brick or other backing be laid in same mortar.

### 7. CLEANING AND POINTING

The face of all stone shall be thoroughly cleansed upon completion with soap powder and clean water applied with fibre brushes and all joints be brushed and wetted, removing all wedges and be pointed flush with one part stainless cement and two parts clean white sand with a little cold lime putty added.

# *APPENDIX "A"*

## *Association Classification or Grading of Stone*

As given in Note 7 opposite the Specification clause, "DESCRIPTION OF STONE," the Indiana Limestone Quarrymen's Association classifies the Industry's product by color and texture as noted below and recommends the use of these terms to indicate the desired grades of stone which its members produce.

Architects should remember that the Association Classification of the Industry's product is for their direct benefit and the protection of their clients in the specifying of Indiana Limestone and for that reason, it is best to adhere strictly to this form of designation in the writing of Specifications.

REGULAR GRADES

Select Gray stock
Standard Gray stock
~~Select~~ Variegated stock
~~Standard Variegated stock~~
Select Buff stock
Standard Buff stock

SPECIAL GRADES

Rustic Buff
Special Hard Buff
Special Hard Gray
Indiana Travertine

Both the Rustic Buff and the Travertine may be used—*sawed either with or across the grain.*

"Select" stock is much more uniform in color and texture than is required for all ordinary purposes in general building construction. Select stock is recommended for entrance work and those portions of a building within ready range of vision, for carving, sculpture, certain interior work and other special uses. It is considered an unnecessary, if not wasteful, expense to specify Select stock for the entire exterior of the average building, or to use this grade of stone for heavy cornices and other work having fairly large scale detail placed well above the range of close inspection, as the difference in texture between Select and Standard stock in such position cannot be noted.

On the other hand, it is not proper to mix Standard and Select stock or Standard and Rustic stock in any well defined architectural member, such as Grade or Base Course, Belt Course or Cornice, etc. and Architects are justified in insisting that the Cut Stone Contractor use some judgment in selecting the stock of any grade for the several portions of the work.

A building in which no stock finer than "Standard" is used and in which a certain amount of fairly coarse grain stone is properly disposed throughout the work will look better than a building in which 80 per-cent of the stock is "Select" with a few pieces of rather coarse "Standard" awkwardly placed in a belt course or other member between or surrounded by stone of a noticeably finer texture.

For the very finest sculptured work, statuary and low relief carving, or interior work where a particularly fine grain stone is desired, "Select grade—Statuary stock" should be specified. This, of course, should never be used for any ordinary work as it constitutes only a very small percentage of the quarry output, the supply and price of which varies considerably. It is not considered a regular commercial grade for that reason and is only supplied on special order.

"Standard" stock is the standard product of the quarries constituting the bulk of the total output. It is thoroughly sound stone having a range of variation in color shades and texture not found in "Select" but which by reason of the nature of the deposit are confined within limits that make it impossible to determine at a distance of a few feet whether it is "Standard" or "Select" stock.

The capillary attraction and absorption of the Standard stock is somewhat less than of the Select owing to the larger individual pore space. Stone of the Standard Gray, Buff or Variegated classification is generally used for all purposes in the regular run of work. When an Architect decides to use Select stock, it is equally important that the Cut Stone Contractor be *selected* for the known quality of his work, otherwise the additional cost over "Standard" may prove a waste of the client's money, in so far as the appearance of finished building is concerned.

"Rustic" stock, which is only available in Buff color, has more variation in color tone and texture, having a wider range of granular formation than either Standard or Select stock. This grade is particularly suitable for the sawed ashlar facing of walls and for that purpose may, to advantage, be combined with trim of either Standard or Select stock. Rustic stock may also be used for heavy cornices and other boldly detailed simple moulded work.

Rustic is not generally to be recommended to take the place of Standard; or for positions in the building on which there is much cutting and

moulded work, on account of its texture and hardness with resultant increase in cost of cutting. It is, therefore, considered a specialty. On account of its interesting texture Rustic stock has found great favor with some of the leading Architects, particularly for walls, terrace and approach work of country residences, hence the name.

In order to secure this Rustic effect under ordinary working conditions, it is recommended that the specification be made to call for stone ranging in point of texture from Standard to Rustic Buff. This will give a variation and effect about equal to the Rustic for most classes of work for which that particular grade would be especially suited.

Special Hard Gray and Special Hard Buff are grades that are specially adapted for base or grade courses, steps and platforms, buttresses, floor tiling, terrace paving, or any position in building subject to abrasion and constant wear under foot traffic; for which purposes these hard special grades of stone will give most excellent service and are recommended. The price will vary according to the quantity required and nature of work required. These grades of stone constitute only a small portion of the output of the quarries and are not recommended to replace the regular grades for any ordinary purpose.

Frequently it will be found that these special grades are not regularly carried in stock by the local stone trade and must be specially ordered from the quarry producers. To prevent substitution, it is therefore necessary that Architects requiring these grades of stone for special purposes, make their requirements clear to the trade and see that the necessary *Special* stock is ordered well in advance of the time it is to be used at building, as this material, often in the form of grade courses and steps, is one of the first items required.

"Indiana Travertine" is one of the most distinctive products of the Indiana Oolitic Limestone District. It is available in a variety of color tones, carries a generous percentage of honeycomb but is exceedingly hard. It has been very successfully used for both exterior and interior work, on a number of important structures. The peculiar characteristics of this product require that when specified, its adoption and use be based upon a complete advance understanding of just what is wanted and the approximately exact character of stone and workmanship which is to be furnished for that particular work.

Decidedly different effects are obtained by the sawing of stone with the grain *parallel to the bed* or across the grain *perpendicular to the bed*. Stone sawed parallel to the bed will generally give the most interesting and characteristic effect.

While Travertine is nominally a waste product of the quarries, constituting only a very small percentage of the total output, the amount of selection required and extra cost of working up this material will generally make the price somewhat higher than for any of the regular grades. The cost of work executed in this stone will, therefore, vary considerably with the selection required, total quantity and size of block and the relative amount and character of both machine and hand work to be done on it. This stone is recommended chiefly for sawed ashlar and for sawed Facing or Ashlar slabs for interior work. When moulded, the detail should be kept plain and broad in treatment. Indiana Travertine has also been very successfully used for floor tile.

There is no position in a building for which the Indiana Oolitic Limestone quarries cannot furnish the proper material; with the exception that this stone is not particularly recommended for steps, terrace and vestibule pavings and similar work for large public buildings where there is a constant heavy traffic. Although, for all ordinary requirements, the special hard grades particularly will give entirely satisfactory service and in fact are often more satisfactory and slip-proof under foot than either Granite or Marble.

Other specialties ranging in color-tone from very light *almost a cream white* to distinctly dark are also usually available, samples of which, upon request, will be submitted to Architects, Builders and others interested in building.

Architects often word their Specifications to read that stone shall be free from "reeds," "seams" "spawl holes," "sand holes," etc., all reference to which defects are intentionally omitted from the Standard Specification as they do not properly apply to Indiana Limestone but more particularly to certain Sandstones.

The term "reed" applies to the plane of weakness that often occurs parallel to the rift or grain along the bedding planes of laminated stones, particularly in certain sandstones. Indiana Limestone has practically no grain and no weakness along the bedding plane, it is in fact about equally strong, and may with equal facility be cut, or split, at any angle to the bed and for all practical purposes in building construction is treated as a free stone.

Little attention is paid to the setting of this stone on its natural quarry bed. The great majority of ashlar is sawed with the grain parallel to the face of wall and monolithic columns are produced with the grain running vertical. Even the United States Government Architects make these exceptions in applying their specifications to Indiana Limestone, which has been extensively used for important Government Buildings.

It is useless to specify that the stone is to be set on its natural quarry bed, as with Indiana Limestone it is neither necessary nor desirable and the work is seldom executed that way.

The term "seam" applies to a Structural defect that very seldom occurs in Indiana Limestone and would invariably be cut out in the production of the quarry block or slab before the stone reaches the cutting mill.

Sand holes or pebble holes also refer to Sandstone and not to Indiana Limestone.

The term "spawl" refers to damage to the stone after it has been cut and should not be included in the description of stone and is elsewhere covered in the specification, in connection with the cutting, handling and setting of the stone.

For the more particular work, where price is not an object of consideration and where precision in every detail is considered an essential, the following clause may be added under the section "CUTTING," after the sentence reading "Patching and Hiding of Defects will not be permitted." Ordinarily such a clause is non-essential and will only unnecessarily increase the cost to the client without appreciable advantage.

*For paragraph under heading of "CUTTING"*

"Any stone showing flaws or imperfections in cutting, bruises, or defects of any kind, when delivered upon the site, shall not be set, but shall be referred to the Architect for his decision as to whether the stone shall be entirely rejected or be recut for another position in the wall. All rejected stone must be immediately removed from the premises."

## *APPENDIX "B"*

### *Association Service Work and Product of Members*

The recommendations and standard practice of this Association are solely an effort to improve and standardize current usage and to assure the proper and economical use of its members' product in modern building construction. The standard practice of this Association is rapidly becoming universally recognized.

The inclusion of a requirement, that the stone be furnished by a Quarry producer who is a member of the Indiana Limestone Quarrymen's Association is important for the following reasons:—

***First:***—The famous Oolitic Limestone of Indiana *formerly called Bedford Stone* is commercially available only in Lawrence and Monroe Counties and the Architect should protect both his client and himself against substitutes.

***Second:***—Practically all of the long established and proven quarries from which this dependable stone has been produced for generations are controlled by the EIGHTEEN separate and distinct companies who are members of the Indiana Limestone Quarrymen's Association, supporting the research, technical and service work of this organization and promoting the standardization of the Industry's Product and service to the Building Profession.

***Third:***—The Indiana Limestone Quarrymen's Association has, in the past, been called in to reconcile unsatisfactory results that were only the result of using unfit stone from small isolated quarry operations and it cannot recognize such service as equivalent in any way to the service of its members;—therefore, will not assume any responsibility for its recommendations or standards as applying to other than its members' product.

***Fourth:***—The Indiana Limestone Quarrymen's Association is spending substantial sums for Service work to Architects and the Building Trades and for Research and Development of the Industry to best serve the building needs of the country. This work is being paid for by its members exclusively.

***Fifth:***—Architects specifying the product of Association members are assured of Association co-operation from the inception of the work until *and after* its completion and will be free to enjoy the full advantage of any service that it may be within the power and ability of the Technical or other Division of the Association to render.

Indiana Limestone constitutes one of the great natural resources of the country. The industry has grown to such an extent that it is in no sense local or sectional but national in character, and forms a very vital and necessary part of the country's vast building activity from coast to coast.

It may safely be stated, that much stone which the American Quarrier is now forced to discard by the frequently too exacting requirements of Architects, would have been welcomed by the Gothic or Renaissance Builders, constituting a national waste that we must learn to curtail and retrieve.

One branch of the activities of this Association is to convert, for the use of the Building Public, much of this wasted product, by the development of new methods, etc. The conversion of this product to use will lessen the production cost and make possible the more economical use of this fine natural stone for all building purposes.

The constructive work of this Association is of direct interest and benefit to the Building Professions and public generally and fully merits their earnest support.

Indiana Limestone *is a universally used building stone and being the most important building stone quarried in America has justly been termed* "The Nation's Building Stone."

## *APPENDIX "C"*

### *The Detailing of Indiana Limestone when used in connection with Reinforced Concrete Construction*

When using Limestone as a facing for walls of reinforced concrete structures, or steel frame structures fire-proofed with concrete, or in connection with Concrete work generally, there are several important factors that must receive consideration and should govern the detailing of the design, as follows:—

1. Ordinary Portland Cement and Mortar or Concrete made therefrom, will cause staining and discoloration of Indiana Limestone, most Marbles and other light colored building stones. For this reason, the stone must never be set with a mortar containing ordinary Portland Cement and must not come in contact with Concrete work.

2. Moisture either contained within or passing through Cement Mortar or Concrete and drawn into the stone facing in the drying out of walls, is sufficient to cause staining that will destroy temporarily and sometimes permanently, the natural light color tones and effect of a Limestone structure. This requires that an effective means be provided to prevent moisture from the Concrete or water passing through Concrete from being drawn into the stone. Waterproofing the surfaces of Concrete is the best way to accomplish this. The application of damp-proof coatings to the backs of Cut Stone is not a satisfactory method, and is both uncertain in effect and often decidedly detrimental to the stone. Back-painting of the stone applied as a facing for Concrete work is therefore condemned, just as strongly as when used as facing for regular masonry walls of brick or stone.

3. An ample allowance for back joint should always be provided to permit parging the backs of all stone with the non-staining setting mortar, as a further means of protection. On account of the known irregularities of concrete construction, regardless of how carefully executed, due to swelling and warping of forms, etc., it is impractical to detail the work without ample clearances at all points of bedding or contact between the stone facing and the structural work.

4. Concrete must never be poured against cut stone or against ordinary common brick work in contact with same. Whenever possible, the concrete structural work should be completed before the stone facing is erected. Where the work must be carried up jointly, as in the case of Limestone faced load-bearing walls, carrying long-span concrete floor construction, it is always important to require the floor construction be poured in advance of setting the stone facing at these points, or to provide a damp-proof coated Brick or Hollow Tile backing of the Stone, against which the concrete may be poured.

5. There is also great danger of staining from the water washing over Reinforced Concrete fire-proofing and floor construction during rain-storms, while the walls are being carried up and this wash should not be permitted to fall on and be absorbed into the brick work or backing of stone. Complete protection of the walls from all drippings or wash from the structural floors and scaffolding above same, by tarpaulin or canvas supported by properly constructed outriggers should always be provided. Protection against the splashing of stone work during the pouring of concrete should also be provided.

6. It is important that anchors, sockets or some means of anchorage be built into the concrete, wherever required for the support or fastening of stone facing of enclosure walls generally, as it is not good practice and seldom permissible to do much, if any, cutting into completed structural concrete members.

---

The allowance of a proper back joint between the face of concrete work and the back of Cut Stone is covered in a general way by Notes 13 and 15 and supplementary clause 13-a. It is equally important that ample clearance be allowed in connection with the bedding or support of stone work on concrete members, and this should be carefully studied in detailing the work.

Where the stone is to be supported on shelf angles fastened by bolts or sockets built into the concrete, it is generally advisable to do the drilling of these steel angles in the field, to avoid misfit and assure the proper alignment of these supporting members and avoid checking beds. Steel outlookers supporting stone should always be detailed so as to permit of adjustment.

Where Cut Stone is to be slabbed up against any concrete work; whether this be the structural members of a reinforced concrete frame, concrete wall work, or concrete fireproofing and floor construction; such concrete surfaces must be given a heavy coat of some standard brand Damp-proof Paint or Asphaltic Water-proofing Compound thoroughly covering the entire surfaces, in advance of the setting of Cut Stone. This damp-proofing of Concrete surfaces is less costly than the customary back-painting of stone, which practice is condemned.

An asphaltic damp-proofing compound somewhat heavier than the so called Cut Stone backing compounds should be used. Compounds such as are used for the damp-proofing of foundation walls or for the coating of brick work to which plastering is to be applied direct, are considered more suitable and better for this purpose. Based upon present information, the use of only moderately heavy asphaltic or mineral Bitumen damp-proofing compounds of well established brands are recommended. *See Appendix "G."*

All surfaces of the Concrete to which both the Limestone and the immediate backing up of same are to come in contact should be thoroughly coated. If too thin a preparation is used, or if the Concrete is porous and the first application sinks in deeply and does not cover the surface with a proper impervious coating, a second application is advisable. Most of these preparations, particularly the more satisfactory, will leave a somewhat "tacky" surface to which the setting mortar will readily adhere when applied in the setting of Cut Stone.

A full inch joint or bedding clearing is recommended as the minimum that should be allowed, frequently 1¼ inch to 1½ inch is better, particularly at Columns. With an inch allowance, the actual joint will seldom average over ¾ inch in thickness.

The allowance of this rather wide joint is for several reasons:—to allow for the irregularities in concrete work, to assure a reasonably thick back joint for the proper protection of the stone and to avoid any necessity for costly and improper field cutting and fitting of the stone facing, which in most cases for reasons of economy, should be detailed about as thin as the requirements of good construction will permit.

The proper filling of this back joint, particularly when it is found to average around an inch or more, can very easily be accomplished by plastering a coat of setting mortar against the damp-proof coated structural member, as well as against the back of stone, bedding these two surfaces together in the operation of setting and working in any additional mortar required to fill up the joint. Improper filling or the simple slushing up of joint along top of stone is not permissible.

There is always a certain amount of movement in skeleton frame structures and the secure bedding of any facing material is desirable. No other masonry material has as high an elastic value as Indiana Limestone and is so well adapted to internally absorb the stresses from wind and temperature changes that occur in modern building construction and proper bedding is of the greatest importance, if the full value of this physical factor possessed by Indiana Limestone, is to be utilized.

The above applies to stone slabbed up against or applied to a backing formed by concrete structural members. Where the stone is checked out hollow to fit around reinforced concrete columns or steel columns fire-proofed with concrete, as in the case of solid stone piers or columns, then the back joint should **not** be filled, or the stone be bedded solid against concrete, as the expansion of concrete due to temperature changes is very liable to cause splitting of the stone.

In such instances at least a full 1 inch clearance should be allowed between the finished face of concrete fireproofing and the back of all stone that is checked out to fit around same.

The elastic characteristic mentioned is one of the reasons why Indiana Limestone has proven so successful and in every way superior to other material for the facing of the modern skeleton frame structure. A comparison of the condition of such structures faced with different materials, after a few years, will at once make this apparent to the observing Architect.

To provide for the protection of walls during the pouring of concrete work the following clause is suggested for inclusion in the REINFORCED CONCRETE or GENERAL MASONRY Specifications:—

*PROTECTION OF WALLS:*—"Walls shall at all times be protected from drippings during the pouring of concrete and where the setting of cut stone work, or the backing of same, is being carried on below, a tarpaulin or canvas supported on suitable outrigging shall be provided just below the work of concreting."

The necessity of pouring concrete against Cut Stone should be studiously avoided in the detailing of the work. This may sometimes occur in bearing wall construction and where concrete ceiling slabs or mezzanine floors are to be poured and supported on stone-faced wall work already in place.

In the few instances where this is necessary, the work should be done by lining the cut stone with hard burned clay tile or brick set in lime mortar with all joints filled and pointed flush and the tile or brick then be given coating of a standard brand of heavy asphaltic water-proofing such as is used for damp-proofing of foundation walls.

*See Association Service Publications Series "D," for proper methods of detailing work.*

It is well to remember that the unsightly staining or discoloration of the best Cut Stone work resulting from Portland Cement Mortar or Concrete, often cannot be eradicated and the slight additional expense of the tile or brick and water-proofing will prevent endless trouble.

Where the concrete floor construction is supported by wall and will be poured and rest directly on the backing of stone but where the cut stone facing has been left off for erection after the floor construction has been completed, it is also important that the top of brick or other backing and the outer wood form which is necessary for the retention of concrete, be lined with waterproof felt paper, and the stone work below protected with heavy canvas or tarpaulin during the pouring of concrete.

To properly provide for the pouring of Concrete against stone work, the following clause is suggested, which work should be included in the General Masonry Contract.

*POURING CONCRETE AGAINST STONE-FACED WALLS:*—Where Concrete must be poured against Cut Stone, at.....or elsewhere throughout the work, the backs and all other surfaces of the stone indicated as in contact with Concrete, shall be lined with "2 Hollow Tile Blocks, or 1 inch thick Tile Slabs (*or a 4-inch course of brick*) set and thoroughly bedded against the stone in Lime Mortar with all joints carefully filled. The surfaces of Tile shall then be given a coating of hot Asphalt, or standard brand of heavy Asphaltic Damp-proofing Paint."

## *APPENDIX "D"*

### *The Proper Detailing of Indiana Limestone*

The proper detailing of Cut Stone work from the structural standpoint and entirely apart from the consideration of design, frequently does not receive the study and careful development in the drawings prepared by Architectural Draftsmen, that it deserves.

The projection and contour of mouldings, the jointing scheme and other elements of the design, will receive careful consideration but the structural support and bonding or anchorage and the relationships to the work of other trades is often left to be worked out by the Cut Stone Contractor's draftsman. Naturally, these men, while thoroughly familiar with the proper detailing and jointing of stone, may not be as well qualified as the Architect's Office to give the proper joint study to the requirement of all materials entering into the completed structure.

This often results in certain unfortunate relationships being fixed beyond all change before the stone draftsman starts work on the project and he is obliged to make the best of certain fixed conditions, which might have been changed in the earlier stages of development of the final drawings, without involving additional cost and with decided advantage to the building.

It would, therefore, appear that this condition might well be reversed and the Architectural Draftsman devote the most thorough study to working out all structural details, including approximately exact relationships of the various parts, clearances, supports, bonding and anchorage, leaving the jointing of the work, apart from the major jointing scheme that is considered a part of or essential to the design, largely to the stone draftsman.

Another argument in favor of this system is that comparatively few draftsmen, even including designers, have had any very thorough experience in the detailing of Stone and from their experience in the detailing of Brick and Terra Cotta, etc., are generally inclined to cut up the work into too small units, resulting in a loss in scale and often preventing the more effective execution of the architectural idea, on which the particular design is based; unless the Architect can himself spend considerable time over the drawing board, correcting these tendencies. This thought is, therefore, commended to the consideration of all Architects.

As elsewhere stated, Indiana Limestone need not be detailed, for the so-called "grain," which frequently is hardly detectable, to be set as in the natural quarry bed. This rule, in fact, does not apply to Indiana Limestone, which for all practical purposes is treated as a freestone.

INDIANA LIMESTONE is NOT usually set on the natural quarry bed and for the best effect should not be specified to be set in that manner, as this may often result in increasing the cost, with less satisfactory appearance and no added value insofar as structural stability and permanence are concerned.

Monolithic Columns and very large Column Sections always have the grain running vertical and the majority of Ashlar facing will be sawed with grain parallel to face of wall.

This gives the designer greater freedom in the laying out and jointing of work and in detailing generally, as it makes both possible and entirely practical, the use of certain large size units without increasing the cost and in various ways, gives this material a decided advantage over most other natural stones.

One of the first or cardinal principles in the detailing of cut Indiana Limestone work, whether it be the Ashlar of a heavy masonry structure or the facing for enclosure wall of skeleton frame building, is that this stone facing is a solid masonry material capable not only of supporting its own weight for considerable height but also of supporting super-imposed loads. Therefore, except in rare instances, it should not be treated as a veneer added to the thickness of wall but as a part of the wall itself, whether this be a load-bearing masonry wall, curtain wall, or enclosure wall supported at every story on the structural frame.

Naturally, it is neither necessary nor advisable to "bond" or anchor the Limestone facing of an enclosure wall, in exactly the same manner as in a heavy masonry wall, but the facing and backing should be combined in the proper manner as a structural wall for the particular purpose that it has to serve and the facing not simply be hung to the backing.

Second, the stone projecting courses or members, should whenever possible, be balanced on the wall. When this is not practicable, as is often the case with projecting belt courses and cornices occurring opposite to spandrel beams, etc., the stone should be anchored down onto the wall and rarely be hung up to steel above, as in the case of Terra Cotta. The one general exception to this rule is that certain members of heavy stone cornices on light enclosure walls may have to be supported partly by hanging.

On following pages will be found a series of classified reference notes in regard to various details and the customary or recommended practice in the detailing of the average run of work.

Many of these recommendations contemplate methods of improving the current practice, and others, methods of reducing the cost. It is not, however, the intention or desire of this Association to recommend methods of cheapening the execution of the finer and more monumental type of Cut Stone work. The worthy tradition of this noble trade should be strictly adhered to, whenever the practical requirements and the limits as to cost make this possible.

It is, therefore, more to encourage the thoroughly practical handling of this fine natural stone in the detailing and execution of everyday work, appropriate to the type and general character of buildings of varying importance and cost, that many of these recommendations are made. Indiana Limestone, it should be understood, is a universally adaptable material, equally suitable for the small store front or residence and the finest monumental structure.

This fact is, to an ever increasing extent, becoming recognized by the Architectural Profession as a whole, as present day examples of its employment for both the finest and the very simplest type of commercial structures will demonstrate. Its more general use as a facing material or skeleton frame structures, is accounted for only by demonstrated merit and ultimate economy and requires no further comment.

In the past, however, young Architects have frequently made the mistake of following the stone work requirements of a State Capital Building for a small rural Bank, etc. This has improperly restricted the more general use of natural Stone and fostered the use of substitutes, in buildings for which Indiana Limestone was specially suited, from both Architectural and economic standpoints.

The DETAILS AND DATA SHEETS, Series "D" of the Associated Service Publications, illustrating construction details, should be consulted for further suggestions.

These sheets are constantly in course of preparation for periodical issue and will be sent serially, as issued, to all Architects and Architectural Draftsmen desiring them.

Another principle that should govern in the design of Stone work, is the prevention of disfiguring washes over the face of Stone. In the past this was seldom given the study that it deserves but many of the most progressive Architects of the present are giving this special attention, in the design of their work. The results invariably are most gratifying and fully repay the designer for any additional labor involved.

See Arrises, on page 30, in reference to the Specification requirement that all arrises be sharp.

***Stain Prevention:***—The principal factors in the prevention of stain, in detailing of Cut Stone, are to prevent direct contact with Portland Cement Mortar and Concrete and to prevent moisture from passing through the walls both during construction and after completion.

***Waterproof Course at Grade Level:***—The top of foundation wall at grade, just under the first course of stone at grade line, should be thoroughly waterproofed to prevent moisture in the foundation walls from being drawn up and out through the stone work just above grade, which often results in the staining of stone by elements contained in the soil.

The top of foundation walls should generally be thoroughly waterproofed. Where this is not done, either a layer of asphalt impregnated felt paper as specified (*not ordinary tar paper*), or sheet lead, should be used so as to interpose a moisture stop between the foundation and Cut Stone. Sheet lead is not only impervious but will equalize uneven pressure and is better than felt paper but more expensive and for that reason should not be specified on moderate cost work.

The seat for stone on foundation, if of concrete, should in any event, be given a heavy coat of hot asphalt or approved damp-proof paint.

***Steps:***—Steps of Indiana Limestone should be shown sawed square with a lap of two inches or in other words, the step be made two inches wider than the width of tread. Special hard stone should be specified for this purpose and the nose should always be shown slightly rounded, just enough to prevent the liability of snipping a sharp corner.

In very wide steps, it is generally best to limit the length of a single piece to around 8 feet, although considerably longer lengths may be used, where there are proper facilities for unloading, handling and setting of same and the proper support for such long lengths provided for in the details.

***Platforms:***—Platform slabs of any reasonable dimension may be obtained in a single piece but when very large, ample allowance for the necessary increase in the thickness should be provided for. The difficulty of transporting and handling such large slabs is an item of expense that should be avoided whenever possible. The special hard stone should always be used for steps, platforms and terrace paving, etc.. And usually for vestibule floors.

***Column and Pilaster Bases:***—Column Bases should invariably be turned from a single block of stone, only in comparatively rare instances, in connection with very large column bases, is it either necessary or advisable to have the Plinth separate from the moulded portion of base.

With pilaster bases, it is different and is not always advisable to require that double pilasters or combined pier and pilaster bases, or even large single pilaster-pier bases be cut from the solid with full heads and returns, particularly for the ordinary run of work, as this often adds materially to the cost.

Such bases can generally be jointed without detriment to the design. While it is a general rule to avoid all mitre joints in Stone work, here is one of the exceptions to this rule, as a fine mitre joint at the intersection of Pilaster Base and Pier Base to which it is engaged, is generally the most acceptable method of jointing same.

The Scotia and Fillet at base of both columns and pilasters should be cut on the column and pilaster shafts for all but the very cheapest grade of work; excepting that in connection with stone trimmed Brick faced buildings, where the Pilaster Bases and Capitals are of Stone and the Shafts of Brick, the Scotia and Fillet at both ends should be cut on the Stone Base and Capital, on account of the better effect obtained.

***Columns:***—In the majority of cases, it is inadvisable to joint the columns in a series of small drums to conform to the height of ashlar courses even when the columns are engaged. There is nothing finer than Monolithic Columns, whether plain or fluted, but such columns, particularly when of large size, on account of the difficulty of handling and setting, will cost more than if built of several sections.

For the average column, even up to 24 feet or more in height of shaft, three sections will generally be found to work out best, although five and in rarer instances four, may sometimes be advisable, when that number will work out better with the ashlar jointing scheme. With engaged Columns built of three sections, the center section of shaft, cap and base section should be cut either 4 or 8 inches thicker on back, *generally 4 inches*, to bond in with the wall masonry.

Sometimes the sections or drums of large or very heavily loaded columns are set with sheet lead beads but for all ordinary purposes a mortar bed with lead buttons to facilitate the proper setting, is quite sufficient. When sheet lead beds are considered necessary the following form of clause may be used in the setting specification to cover this work:—

"The joints between base, shaft and capital sections of..... Columns shall be made with 5 pound (*6 pound*) sheet lead cut back two inches from the face and with the center cut out to allow space for squeezing."

The center line in front of a fluted column should always occur in the center of a flute. The proper number of flutes may vary somewhat dependent upon the size of the column and relative scale of the design, just the same as the dimension and spacing of columns may properly vary from classical precedent, to conform with the design and scale and their purpose, or position, in a particular structure.

The common rule is to detail Greek Doric Columns with 20 flutes, unless very large in scale, when, up to 24 flutes may be used, and to detail Ionic and Corinthian Columns with 24 flutes. This is often varied when the columns are engaged.

The scotia and fillet at base and the scotia, fillet and bead at cap should be cut on the shaft of columns; this refers to Tuscan, Roman Doric and Corinthian Orders; as with Ionic Orders, the bead is generally included on the capital. In the Greek Doric Order the joint between shaft and cap should be placed in the groove which occurs near top of shaft.

Columns up to 12 feet or 14 feet in height will generally cost no more if made monolithic than when jointed into sections.

***Pilasters:***—The above remarks in reference to the jointing of columns into small drums, apply with equal, if not greater, force to Pilasters. Small Pilasters, if not too thin, generally up to 10 feet or 12 feet in length may, to advantage, be made monolithic. All moderate size pilasters, particularly those having rather slight projection should be jointed in sections, and in the majority of cases three, in a few instances four, or at the most five sections will work out best.

Pier and Pilaster bases should be indicated with full heads where it is desired that they be cut from the solid.

It is not considered good practice to require entasis on Pilasters and it appears to be the general consensus among Architects; that, except in rare instances when very carefully designed for some special requirement, the pilaster with entasis, does not look so well as the straight pilaster. It is very much more costly to produce, making it a wasteful expense. There is no parallel between the entasis on columns and pilasters, as the entasis on columns is easily produced and always advisable. The scotia and fillet and scotia, fillet and bead, should be cut on the shaft of Pilasters the same as with Columns.

***Ashlar:***—Heads on external angles where the ashlar is 4 inches thick with 8-inch bond courses should for economy, on all ordinary work be made 8 inches. If the Ashlar facing is made 5 inches or 6 inches thick, the head may correspondingly be made 4 inches thicker and 9 inches or 10 inches in thickness, so that it will course in with the Brick or Hollow Tile backing and so that the facing material generally will be confined to two thicknesses.

Heads produced in this way may to advantage be shown solid. Where heads of greater thickness are called for they will generally be checked in the form of an "L" piece around the corner.

Reprises, when required at internal angles should generally be shown as a 4-inch or 6-inch return but as this method of detailing involves considerable extra expense, it should not be used for the ordinary run of work; except in special instances where this expense may be warranted.

Vertical joints in reveals are not desirable unless there is a break or panel in which joint can suitably be made. For this reason, jambs and beads should in most instances, be at least the full depth of reveal and it is generally best to work out this depth in brick units making the jambs and heads either 4 inches or 8 inches thicker than normal thickness of Ashlar facing.

Jambs and heads of casement window and door openings should be carried in about 2 inches beyond the outer face of frames. Again the rule in reference to brick units of thickness will apply. It may save a little on the cube and cost of cut stone work to cut an inch or two off the backs of certain stone members, but cutting and waste and extra cost of laying of that extra inch or two of brick backing, will more than offset this saving.

Ashlar Facing may in rare instances, to advantage be made 4 and 6 inches, or 6 and 8 inches thick, that is, where facing generally is either 4 inches or 6 inches thick, the bond course may be made only 6 inches or 8 inches thick respectively, but 2 inches is **not** a very satisfactory bond and considerably increases both the material and labor cost of backing up. Ashlar should, therefore, be detailed either 4 and 8 inches thick, or 6 and 10 inches thick and ordinarily for masonry walls, making every third course a bond course.

Making every alternate course a bond course, as required by some Building Codes, is considered unnecessary; except for quite heavy masonry structures.

For enclosure walls carried on the structural frame at each story level, one bond course to a story height is often sufficient and two or three the most that should be required. Many Building Codes will permit the use of Ashlar facing for enclosure walls without any bond courses but that is not recommended as good practice for the reasons stated in the forepart of this Appendix.

Where the Architect has not carefully worked out the details of bonding, it is often advisable to explain what is required in the Specifications by a clause to cover this item, inserted after the paragraph, "CUTTING AND SETTING DRAWINGS" for which the following form is recommended:—

> "Where the depth of bond of the stone facing with backing is not shown on scale details, it shall be understood that bond stones generally are to have a depth of one-half brick or about 4 inches more than the general depth of facing or adjacent stone work, otherwise the bonding shall conform to that shown on the approved Setting Drawings."

***Arrises:***—The usual Specification provision requiring that "Arrises shall be sharp" should not be interpreted to mean a really sharp or knife edge but a fine, slightly rounded, clean, straight edge, as it is customary to run a rasp over the sharp edges left by machine work, slightly rounding them, to avoid chipping and this improves the appearance of the work.

***Placing Ashlar Anchors:***—While it is customary to place Ashlar Anchors in the top bed, it is often advisable when certain forms of Hollow Tile Backing are used, to place them in the vertical joints. It is always advisable to give a little more careful study to detailing the general scheme for placing of these anchors in connection with Hollow Tile Backing than for Brick; both to insure proper anchorage and to avoid unnecessary cutting of the tile. Occasionally in connection with brick backing, instances will occur where placing anchors in the vertical joints is also preferable.

***Random Ashlar:***—For information concerning Random Ashlar Facing and all uses of Indiana Limestone that may generally be classed as Masonry, rather than as Cut Stone work, see the Association Masonry Specification referred to in Appendix "L." It is not considered advisable to include the Specification for Indiana Limestone Masonry with the data on Cut Stone on account of the probable confusion and for that reason all data in reference to this class of work will be issued in separate publications.

***Sills:***—All Sills, excepting Slip Sills, should be cut with lugs and seating for jambs. The lugs on door and window sills or on sills that form a water table or base course between pilaster or column bases should generally be only 2 inches wider than space between jambs or plinths.

Architects will sometimes specify in detail that "sills are to be cut with lugs, scotia, wash and drips" but that is not considered necessary for any all Cut Stone job, as these details, together with jointing should be indicated on detail drawings. For that reason such a clause is not included in the specifications. Only for small or comparatively moderate cost work, where stone sills are used in connection with Brick walls and for which details are not specially prepared, is it considered at all necessary to describe in detail the several items of Cut Stone trim.

Stone window sills should always extend at least one inch under the wood sill and 2 inches is better. Drawings should indicate whether slip or lug sills are desired and when water bars are to be furnished with window frames, this should either be marked on drawings, indicating that raggle for water bars is to be cut in stone sills, or be specifically provided for by inserting the following clause in Specification under "CUTTING":—

> "All window sills shall be cut with raggles for water bars."

While a reasonable pitch to wash on sills may be desirable, it should not be made over ¾-inch on lug sills for average work, on account of the increase in cost of cutting deep washes.

There seems to be some well justified differences of opinion among leading Architects as to the value of projection and drips for sills in all-stone-faced buildings. The general rule is to project the sill 1½ inch from face of Ashlar and cut a deep drip on under side of same and when so projected the sill should always have a drip cut on underside, but very satisfactory results have been obtained in buildings having the face of sills without drip kept flush with the face of Ashlar.

Door sills should generally be carried in to center line of wood or metal threshold, or when the vestibule flooring is of tile or marble may be carried entirely through wall and have the threshold cut on the stone sill. The cutting of wash is frequently omitted on door sills particularly in moderate cost work as when cut square, they can be set with a very slight pitch to front. About ⅛-inch is sufficient pitch for this purpose.

Door sills when cut with wash, should be cut with bevel and not a scotia at lugs. Lugs on sills should only extend 2 inches beyond opening in stone faced walls but may often extend 4 inches into brick faced walls. This also applies to window sills.

***Jack-Arches:***—Jack Arches, particularly when they occur in the facing of enclosure walls and except when of very wide span and depth, should generally be cut in a single piece and be false jointed. The question arises, as to why cut false joints into a perfectly sound piece of stone capable of acting as a beam and supporting the load over opening. This, of course is a question of design. It is assumed that jointing would not be resorted to if it were not a necessary or desirable feature of the design.

***Lintels:***—The depth of bearing for support of lintels at jambs is important and should preferably be as little as both structural and design considerations will permit. An ordinary lintel with from 3-inch to 5-inch bearing is preferable in most instances to one with greater extension beyond face of jambs and 4-inch bearing is a good average. Where structural steel is used to support either stone facing or entire wall, over long self-supporting stone lintels, the placing of such steel should be arranged with ample clearance over top of stone lintel, both on account of the inherent minor irregularities in structural steel work and to avoid placing of load on stone lintel when steel is deflected under its full loading after the wall work above has been built.

***Mullions:***—Thin Mullions or moulded piers should also be shown as a single length, with false jointing to conform with the coursing of wall ashlar or trim around openings when this is considered desirable. They often look much better, particularly if slender and when carved with sculptured detail, if left solid and without joints. Such mullions should be dowelled into sill and head with non-corrosive metal dowels; brass, bronze or thoroughly galvanized iron. *See Appendix "I."*

Narrow piers are also frequently cut in a single section and false joints. Even when rusticated narrow piers may often to advantage be cut in a single piece. When it does not affect the design such items of detailing should be made optional.

***Transom Bars:***—Transom bars should, except in the cheapest grade of work, be cut with seats for mullions and this should be clearly indicated on details and where jointing is necessary they should be jointed over center of mullions.

***Colonnade Lintels:***—For Entablatures, Cornices or Belt courses spanning either an open Colonnade, or an engaged Column or Pilaster-Pier treatment of a Facade, it is advisable whenever practical to make the Architrave or Lintel member of the entablature or belt course of a single length, spanning the space between supports.

Where the Pilaster treatment is very flat, there is not the same objection to jointing as with piers, engaged columns or free standing columns and the Architrave may be jointed, preferably making same in three sections.

Where the Lintel is of one piece, particularly with a free standing Order it should be detailed so that the weight will not rest on the outer edge of column caps; this can be accomplished by setting the lintel stone on lead buttons or sheet lead pads that are placed back within line of column shaft, pointing up around edges only with mortar after the entire work is completed.

Whenever it is necessary to hang the lintel *or to support same in center, a questionable practice,* only Lewis anchors should be used and the top of stone be kept clear of the steel, except at points of bearing, where lead pads should be used. *See Appendix "I."*

Where a self-supporting colonnade lintel forms the lower member of an entablature or pediment, the weight of all work above lintel for all usual column spacings should be separately supported on steel beams spanning the opening over top of lintel member. This steel should never rest directly on the lintels but should be raised clear of lintel and be supported from a pad stone, not exceeding in width the narrow diameter of column drum, carefully bedded on top of capital. Lintel stones may abut this pad stone at sides with a facing stone to fill the space between same and carry the architrave mouldings across the top of column cap.

***Arches:***—The Voussoirs of ordinary arches not extending entirely through wall are generally made of an even depth; this depth may, to some extent, be regulated by the depth of reveal of the openings which they span but should almost invariably be either 4 inches or 8 inches deeper than the normal thickness of ashlar facing in all stone faced buildings and generally at least 8 inches deep in Limestone trimmed Brick walls.

The Arch Stones should always be at least the full depth of reveal. Working to Brick units of depth will facilitate the backing up, avoiding a lot of cutting, fitting and waste of the backing and permit the building of backing or relieving arches of Brick work in standard units of thickness, to which the Stone Arch should be anchored.

The Voussoirs of large or heavily loaded arches should generally be both bonded and anchored to the brick arch in back of same for which purpose the alternate Voussoirs, starting with Key Stone should be made 4 inches thicker.

It is never advisable to detail arches for a bed joint between Voussoirs of less than a full quarter inch, even when $\frac{3}{16}$-inch joints may be required elsewhere throughout the work, as the proper thorough bedding of Arch Stones is important. *See Appendix "J" regarding Setting.*

***Gothic Arches:***—Typical Gothic or Pointed Arches including the jambs and sills usually extend all the way through wall proper, even when the building is other than a church and is finished on the interior with plastering or wood panelling.

Tudor Gothic or "Collegiate" *Gothic* Arches, having elliptical, segment or pointed crowns are frequently treated as lintels and cut from a single piece; in mullioned windows jointing same over the center of mullions and when used in this manner, may, together with the jambs, or quoining at jambs *and the sills* be treated as a facing, even though the mullions are slender and for that or other reasons are detailed to show as stone mullions on the interior.

It is quite customary to run the plastering into jambs and head, to finish up against frame but in such cases the sill and lintel or arch stone should be of sufficient depth to be cut with seats to receive full thickness of mullions. The previous remarks with reference to thickness of backing units, as a governing factor in determining the depth of arches generally, will also apply.

***Tracery:***—In Gothic work, particularly in Church work where there is a heavy Triforium or Clerestory wall over arched openings containing Stone tracery, or where the tracery is slender and elaborate in detail, it is advisable to set the arches over openings first and to detail the tracery entirely separate, to be set in afterward. For this purpose, a check or rabbet about 1½ inches deep should be provided in jambs and Arch, the key piece of tracery to be cut with the inside lip of check solid on the Key piece.

Tracery is often detailed in this manner where one kind of stone is to be used for the trim, or for walls including jambs and arches and another kind of Stone for tracery.

This method of detailing tracery is not customarily followed, however, in the general run of buildings erected of Indiana Limestone, the tracery at sides of openings being cut on the solid with jambs. When the work is laid out in this manner, great care should be exercised in setting of arches to have the Arch Voussoirs properly bedded, assuring arch action and preventing the improper transfer of load to interior tracery.

The best type of dowel for ordinary tracery is made from heavy weight ½ inch size brass pipe cut about 3 inches long. The Holes cut for these dowels should be a full ¾ inch in diameter and about 2 inches deep. Supplementary clause *53-a* provides for tracery that is to be set separately. *See also Appendix "J."*

Where stained glass windows or leaded glass is to be set in a check in the stone mullions or other tracery, the usual depth of check is ⅜ inch to ½ inch. The check on one side should be cut double this depth to facilitate slipping the stained glass into place.

***Balconies:***—Where balconies are placed on modern skeleton frame buildings, some special means of support and anchorage is usually necessary. One method of securely supporting same when slab is of moderate projection, but where it is not possible to bolt the back of stone slab down onto wall, is to wedge same down onto wall by driving steel wedges under flange of steel angles bolted to face of spandrel beams along the back of Balcony slabs. In other instances they may be supported by outlook angles placed over brackets.

Whenever outlook angles are used for any purpose in connection with the support of Cut Stone, they should rest on shims and the method of attachment to structure be adjustable.

Where the Balcony slab is to be formed of two or more pieces of Stone, a slightly pitched saw cut should be made in the edge of each slab at joints between same and the joint be made tight by the insertion of a strip of brass. The ordinary brass floor rail for sliding doors is the best material for this purpose. A similar detail is good for any stone slabs that are to be used to roof over a Bay Window or any portion of a building.

***Balustrades:***—Balustrades on Cornices are frequently not set on a high enough plinth and when they are placed on a building at considerable elevation above the line of sight they should be studied in perspective. As it is generally advisable to pitch cornice inward, this may often require a gutter in front of Balustrade, in which case Balustrade may be set upon a double plinth. In other cases, the wash on top of Cornice may be drained back under Balustrade to a gutter in rear of same and the plinth or lower rail of Balustrade be blocked up, or perforated with drains at intervals for this purpose.

When sections of Balustrade are set as panels filling openings in parapet walls with parapet coping and Balustrade rail forming a continuous horizontal member, the parapet should break back to thickness of Balustrade a sufficient distance each side of opening to take the return of coping and permit rail of normal section to run full width of opening, thus reducing the cost.

One of the best methods for keying of Balustrade rails, etc., is to set a square piece of stone in diagonally, into "V" shape cuts in the ends of rail.

Balustrades used for decorative purposes will naturally vary considerably in height and general proportion, to be in keeping with the scale of the design and no general rule can be given. Balustrade for Terraces, Balconies, etc., should generally be from 30 inch to 38 inch in height, in order to be in proper scale with the human body and to also best serve their purpose as a railing.

***Cornices:***—The design and proper detailing of cornices is very important on account of its effect on the cost of the work. A very simple treatment has been found to be decidedly appropriate and effective for small residences and moderate cost commercial structures. Modillion cornices should always be avoided in this class of work and the elaboration of all cornice detail restricted, often to the extent of restricting the cornice to a simple moulded coping course, that will form a suitable cap to the wall.

A study of the more recent work of leading Architects will show some very excellent results, that have been obtained from designs which were evidently prepared with this idea in mind.

It is a great mistake to detail a fine stone cornice and then hang an ugly metal gutter in front of it, as the gutter and cornice can usually be combined with pleasing effect.

In average work where there is a break or internal angle in cornices, a mitre joint is frequently permissible. This is at variance with the general rule that mitre joints be avoided in stone work but will often effect considerable saving in cost, as it enables the return or head mouldings to be cut by machine. The requirement that all cornice members be cut with full heads and returns involves considerable hand labor and consequent increase in cost, without a corresponding advantage in the ordinary run of commercial work, although for the more monumental work this might not be considered permissible.

Cornice Stones that do not have sufficient bearing on the wall to balance overhang and must be anchored to steel work or other structural member in back of same, should have these anchors placed about 2 feet apart with two of these anchors to each stone 2 feet or more in width.

The vertical joints in main cornices should never be made less than ¼ inch otherwise they cannot be grouted properly.

To facilitate the grouting of large cornice members, a "V" shape groove, in the form of an inverted "V" is often cut in face of vertical joints, which also serves as a key. These grooves should be cut to template, to insure them coming exactly opposite on the two sides of joint.

Whenever possible, it is advisable to pitch the wash on Cornices, etc., back to a gutter rather than out over the face of same and the joints in the tops of cornices should always be made watertight to prevent seepage and staining of the face, which is a common fault, owing to improper attention having been paid this important feature.

It is frequently advisable to flash with sheet metal the tops of main cornices; also to flash the tops of minor cornices that form the crowning feature of the order embellishing lower portion of building and by forming gutters in same carry water to drainage system inside of building, thus preventing any wash over face of cornice.

***Copings:***—The watertight caulking or flashing of wall copings is equally important. Some Architects specify weathered joints, with cut wash and lugs for copings, cornices, etc., and on projecting members but this is usually very unsightly and always adds considerably to the cost and is not to be recommended as either necessary or desirable. Proper caulking or flashing and careful setting is considered the most satisfactory method of avoiding any trouble from staining on account of leakage through vertical joints.

Another scheme for making the joints in top members of wide cornices and in copings watertight, which under certain conditions, may be specially suitable for this purpose and preferable to caulking, is to make a horizontal saw cut in the joints about an inch or so below and parallel to line of wash and to insert in this cut a strip of brass sliding door track. The vertical joint is first grouted about up to the line of saw cut and is grouted full to the underside of brass track as the latter is pushed into place. The remainder of joints above brass strips are then pointed up later in the usual manner.

*See Appendix "J" for important notes in reference to the setting, grouting and caulking of cornice members, copings, etc.*

***Protecting Structural Steel Work Supporting Cornices:***—Structural Steel Outlook Angles or Tees and all cantilever steel construction for the support of stone Cornice or Belt Course members, Balconies, etc., should be protected from rust by something more than the usual shop and field coats of paint. Such members should be wrapped with Galvanized 28 gauge diamond mesh expanded metal, or galvanized wire lath (*Wrights or equal ½ inch mesh lath*), encased in non-staining cement, covering all parts of the steel about ½ inch thick, or the steel be coated with "Gunite" ⅜ inch thick using non-staining cement. To provide for this see Supplementary Clause 14-d.

***Flashing Cornices, Coping and Belt Courses:*** In the detailing of stone work, it is also important to see that the stone will not be subject to the wash from a copper roof or cornice or wash from copper, bronze or brass railings, lamp standards, statuary or other ornamental features. Where such metal work occurs, the details should prevent this, as the wash from copper soon becomes a metallic oxide staining solution. Proper drips should be provided in all cases.

Where deck or other roofs of copper occur in back of a Belt Course or cornice, a gutter to carry off the wash from same should be provided.

Where there is a copper flashing on top of stone cornice or other projection the work should be detailed so as to prevent wash from same over the face of stone.

Copper gutters and flashing sometimes stain the stone by condensation or sweating on the underside of the copper and such metal should not be applied direct to the stone but over a layer of black waterproof paper (*not tar felt*).

***Raglets for Flashing:***—The exact position of Raglets for sheet metal work, flashing, etc. should always be indicated on the Cut Stone details before these drawings are approved, unless the cutting of these raglets is to be done in the field, at extra cost.

***Beds and Joints:***—Joints ¼ inch thick are called for in this Standard Specification because this thickness of joint is considered to be the most satisfactory and practical for the average run of work. Finer joints do not add appreciably to the cost of cutting the stone and $\frac{3}{16}$ inch joints may be specified in very high class work but do not permit as thorough bedding and jointing of stone and require very careful setting.

Unless the setting is next to perfect, joints thinner than ¼ inch have no advantage and, therefore, are not recommended for the regular run of work and ⅛ inch joints are only permissible on finely cut interior work. Joints somewhat wider than ¼ inch are often advisable for certain types of exterior work, rough sawed ashlar, etc.

***Field Cutting:***—All Field Cutting, other than the occasional necessary fitting should be avoided because it costs money and must invariably be paid for by clients as an extra under the terms of the International Cut Stone Contractors and Quarrymen's Assn. contracts. Field cutting ordinarily is unnecessary. Raglets for sheet metal water bars, etc. can be accurately shown on details and be cut at the mill. The coring out of columns and holes that are to be cut or drilled for pipes or electric conduits should always be marked clearly on the drawings, as this work can be executed much more cheaply and with less chance of damage in the mill, than in the field.

This work including cutting for pipes, etc. when not indicated on the details will not be included by Cut Stone Contractors under any general clause of the Specification, and must be shown by a lettered reference on drawings, or be specifically covered by a clause in the Specification describing in detail the field work that will be required.

Field Cutting, except where it constitutes the correction of error or inaccuracies in the stone cutting is invariably done at the expense of Owners.

***Large Blocks for Special Purposes:***—Large slabs or blocks of Stone are always practical insofar as the Quarry and the Mill production is concerned but very often should not be used on account of the extra cost that is involved by requiring special equipment on a residence or other small job, for the handling of a few, or probably only a single piece of Stone.

Therefore, in out-of-the-way localities, the Cut Stone Contractor's equipment must often be given consideration in the detailing of the work, or in other words, certain methods of detailing that would be regular practice in New York or Chicago and other large cities, might not be advisable in the country home away from any large center, or where the Cut Stone work is let to a Local Cut Stone Contractor.

***Stone Applied as Facing to Steel Frame Structure:***—This subject has already been covered in the specification proper and the supplementary clauses. The importance of ample allowance for clearances as referred to in the forepart of this Appendix, should be kept in mind. The structural steel members of a frame are often a little out of line and there is a further chance for variation in the irregularity of the fire-proofing which encases the structural steel.

The stone should never be back-checked to the point of weakening its structural efficiency but if ample clearances are not allowed, this is generally the result.

Where the Building Code requires that all wall columns be encased with a course of Brick, at least 6 inches should be allowed between the extreme edge of steel and the back of stone; 4 inches for Brick, 1 inch between Brick and Steel for rivet heads and to encase the steel with mortar and 1 inch between brick and stone. Where a minimum 2 inch thickness of concrete fireproofing is required, at least 4 inches should be allowed as the concrete must average around 3 inches in order to properly encase cover plates, etc. and there should be at least a full inch between this concrete fireproofing and back of stone. See Appendix "C" for reference to stone that is checked out hollow to fit around reinforced concrete or concrete encased columns.

In providing beds on steel plates or angles for cut stone the usual ¼ inch allowance is seldom sufficient and about ¾ inch should be allowed and the stone below be checked out to fit this allowance. It is an easy matter to bed up the extra ½ inch, and this often saves considerable expensive field cutting for checking out the beds to fit where the steel is a little out of line. Never check the beds, always the heads of stone.

Lintels and other long stone resting on structural steel should generally be supported at ends only by lead pads.

# NOTES ON THE DESIGN OF STRUCTURAL STEEL

It is really very important that more careful consideration be given to the requirements of the facing material in the preliminary layout of structural steel work than is often the case.

The facing material along with the details of support for enclosure walls are very often studied only after the size and position of columns, girders and main beams, including even the spandrel members, have been fixed. This is not the best method of procedure, as a careful study of the Spandrel sections during the preliminary stages of design and layout of the structural frame will often result in considerable economy in the steel work.

Details for Spandrel sections should be carefully worked up in pencil during the early stages of preparing the small scale drawings, enabling them to be studied along with the Architectural features of the design and before the column centers and other lines have been definitely fixed; not afterwards; as these are the first items of information needed by the Structural Engineer in the detailing of the steel. This is also the case when the frame is of reinforced concrete.

The Spandrel sections should be kept as simple as possible, using self-supporting stone lintels whenever practicable and all unnecessary steel be eliminated, when an Indiana Limestone facing is to be used; as a lot of small steel in the wall sections, angles, channels and loose lintel steel can frequently be omitted by a properly designed spandrel girder placed in the right position for the support of both facing and backing of enclosure walls.

It must also be remembered that masonry, particularly Stone work, is decidedly more rigid than steel and the steel work for the support of same should be designed with that in view. This may often mean that a single deep built-up plate and angle section is preferable to a plain rolled section or combination of shapes, for spandrel members.

This does not necessarily involve a greater weight of metal for spandrel girders or lintel members supporting masonry of walls but a different disposition of the material.

Any attempt to support the lintels or walls over wide openings with steel sections that will deflect appreciably under load, will usually occasion arch action in the masonry, preventing the steel from carrying the loads in the manner for which it was designed, which may cause excessive stresses in some portions of the masonry that may result in the crushing of mortar, opening of joints and sometimes even the spalling or chipping off of corners or cracking of the stone.

On the other hand too much steel in spandrel walls should be avoided; it is only necessary to have the supporting members stiff so that the steel frame will actually carry the load it is intended to carry without putting stress in the enclosure wall masonry. And another important point is to so detail the work that the Stone facing will not be pinched between supporting members of the structural frame, when slight movements due to temperature changes occur.

There is also a tendency to place wall Columns too close to the face of wall and it is usually advisable to fix the center line of these columns in a position that will permit the thickness of Stone Facing and one course of Brick work plus the proper allowance for joints between the outer face of steel and the normal face of wall in the shaft or main portion of building.

Placed in this position, the eccentric loading from walls can generally be balanced by the eccentric loading from floor girders and this will usually permit the flanges for the regular plate and angle columns to be turned out towards face of wall, where they best serve for resisting wind stresses and for wind bracing connections, permitting the floor girder connections to be placed on the opposite flange of these columns.

And it is very important in the erection to assure that the frame is carrying all of the enclosure wall load which it is intended to carry and that this load is not being supported largely by the Facing through the deflection and settling to bearing of the steel work in back of same. This may often mean in tall buildings that the erection of Stone Facing and Backing of enclosure walls should be started simultaneously at several different floor levels and the entire enclosure walls of the shaft and upper portions of the building be completed, before the Stone work of Base or lower stories is set.

It may not always be found practical to do this but the one point is to assure that frame is carrying the full load of upper walls, particularly when there is an Arcade or Colonnade treatment of Stone work forming the base portion of a tall building, as Stone work of this character in lower portion can usually be made self-supporting for several stories in height and for that reason steel should be kept out of it as far as practicable.

Stone Lintels should be made self-supporting whenever practicable. This is usually possible even in paired or grouped windows by the use of Stone Mullions which give a better appearance and greater structural stability to any Stone design. This often simplifies the Spandrel Sections, making it necessary to support only the Spandrel Panels and sills on the structural frame.

Where Shelf Angles for Lintels must be used, it is often better to use loose Lintels than to have them rigidly connected to the structural frame, and where such connections are considered advisable, it is generally best to bracket or hang them from the Spandrel Girder with a slotted bolt connection that will permit of some adjustment, which is nearly always necessary to bring Steel Members of this character into the exact position for the support of Stone.

This also applies to outlook angles which should never be rigidly connected but always fastened to the frame with a hooked or bolted connection over shim plates that will permit of adjustment into the exact position required for the support of projecting Stone work.

A little careful study given to details of this kind during the early stages of the Steel Design will usually result in the simplification of both the structural steel and the stone work and facilitate the erection of both.

# *APPENDIX "E"*

## *Flashing, Sheet Metal Work and Roofing in Contact with Limestone; Caulking Compounds, etc.*

One of the most important details of construction for buildings faced with a light colored Stone like Indiana Limestone, is the proper flashing of Gutters, parapet walls and copings, etc., in connection with cornices and wherever there is any danger of water finding its way into the walls.

The wash from roofs or water passing through Brick work in any appreciable quantity or seeping through improperly filled joints in Cut Stone cornice members, will often contain elements that may cause either efflorescence or unsightly discoloration of the Stone. Even where this is not the result, the darker and moist appearance of frequently moistened stone and the streaking of same by wash of this kind is most undesirable and will mar the beauty of any building.

Frequently, too little attention is paid to this important item. The proper methods of caulking vertical joints in cornices and copings are outlined in Appendix "J." Caulking and grouting is satisfactory for projecting Belt courses and ordinary cornices but where gutters are to be provided at main cornices, this is not sufficient and the top of Cornice should be flashed with Sheet Metal.

In the majority of cases to permanently assure the best appearance of a Stone building it is advisable to carry the water back to a gutter and to avoid any wash over the face of building. Even when the Cornice occurs at the base of a parapet or attic wall, it is often better to provide a metal lined gutter at foot of wall, than to pitch the top of cornice outward to drain over the face. This may appear an unusual procedure at first but it is not and is one of the secrets of the most excellent and clean appearance of certain buildings.

Sheet copper is the popular flashing and gutter lining material but when applied to Indiana Limestone or other light colored stone must be carefully detailed to avoid the possibility of staining from the copper. There should be no possibility of wash from the copper over face of Stone. Sheet Lead, Zinc and Block Tin, especially the latter, are preferable to Copper for such purposes.

Furthermore, as briefly mentioned in Appendix "D," when copper gutter lining or flashing is applied direct to Indiana Limestone, there is the possibility of some staining by sweating or condensation on the under side of the copper and the under surface of copper should, therefore, be kept from direct contact with the Stone by a layer of Waterproof paper.

Ordinarily felt paper is not suitable for this purpose and where felt paper is used only an asphalt impregnated felt is permissible.

The comparatively thin smooth black waterproof paper such as is used for special purposes is considered the most satisfactory for the purpose.

Where these products are not available a rosin sized building paper is better than ordinary tar paper.

The fact that Copper must come in contact with Stone where the edge of flashing is let into raglet for fastening is not considered important, so long as the major portion of the undersurface area is kept from contact with the Stone.

Parapet walls and parapet copings are often the source of trouble where there is any dampness or staining of the upper portions of building walls. The conditions acting upon a parapet wall are more severe than upon the main walls of a building below roof line, as the parapet is exposed on both sides and the metal counter flashing at back of same very often leaky, especially when improperly secured into joints of Brick work.

It is, therefore, recommended that the entire back of all reasonably low parapet walls which are not faced with Cut Stone or other finished material, be counter flashed up to coping and that this flashing be carried under the stone coping to within 2 inches of the front face of wall. This need not be of sheet metal, which might add considerably to the expense. The Johns-Manville Company and the Barrett Manufacturing Company and doubtless other reliable Roofing Manufacturers, have recently developed new products and details for the application of these roofings on back of parapet walls, in connection with which specially prepared sheets of composition roofing are carried high up on the back of parapet and may also be continued to top and through wall under the coping. This form of flashing takes the place of the ordinary sheet metal flashing and cap flashing and can be highly recommended.

Details showing the application of this form of flashing to Indiana Limestone faced buildings will be incorporated in the details in the Series "D" Publications of this Association, showing Cornice, Coping and parapet wall sections.

Metal cap flashing that is turned into Stone faced walls should preferably be set into raglets specially provided for it rather than be set into the joints which usually do not occur at the right points. These raglets can be cut into the stone horizontally, vertically, or at an angle and can generally be provided at low cost if they run straight and are not stopped or stepped up in a manner that complicates the cutting of same.

Running them straight will also reduce the cost of metal flashing.

Such raglets may be from ⅜ inch to ⅝ inch in width and are usually about 1 inch to 1¼ inch in depth. The Metal Cap flashing should be securely fastened into same with soft lead wedges spaced 3 inches or 4 inches apart and the raglet be pointed flush with pointing mortar. This is much preferable to setting the cap flashing with an elastic cement. See Supplementary Clause 49-a for clause to be inserted in Specification for Sheet Metal work. For information regarding the caulking of copings, cornices and Belt courses, etc., with elastic cement, refer to Appendix "J."

***Elastic Caulking Compounds:***—For the present it is only possible to state authoritatively that the use of all caulking compounds containing grease and oils should be consistently avoided at any point where they come in contact with and may discolor the Limestone. Architects are requested to communicate with the Technical Division of the Association for further information or advice on this subject.

"Mineral Rubber" Asphalt Compounds have also been used to a limited extent for the caulking of copings and parapet walls but cannot be used on exposed work on account of their color and tendency to run in warm weather and their value in connection with Stone work is very questionable, for which reason they are not recommended.

***Metal Flashing of Stone Joints:***—In connection with fine monumental buildings and for all important work, where it is desired that every known precaution be taken to prevent any water from seeping through the vertical joints of horizontal members, Cornices and Belt Courses, projecting from the Ashlar face of building; and where it is not practicable or desirable to pitch the top of these members back to a suitable gutter along face of building, enabling the entire top of such projecting members to be covered with sheet metal:—the joints only of such projecting members may be flashed with narrow strip of Block Tin without detriment to the appearance of buildings. This takes the place of caulking with lead wool or elastic caulking compound, *as referred to in appendix "J,"* and although more costly is probably superior to any other method for the highest grade work.

The vertical joints between stones that are to be flashed with tin should be carefully grouted full with setting mortar grout same as when these joints are to be caulked.

Only pure block tin should be used for this purpose, using tin about $\frac{1}{32}$ inch in thickness, cut in strips about 4 or 5 inches wide. These strips are turned down ½ inch into raglets cut in the stone on each side of the joint and at ends so that these strips when finished will show a width of only 3 or 4 inches.

Whenever practicable, this flashing should be carried to within about 1 inch of the outer edge of projecting course and be carried up about 2 inches on vertical face at back of same. Tin strips should be securely fastened into joints with a suitable number of soft lead wedges and raglet be pointed flush with pointing mortar. A cut in the Stone not over ⅜ inch wide and ½ inch deep is all that is required to form these raglets.

Properly executed, this makes a very neat job; the tin will not become black and dirty like other metals but is of a color and nature, that on weathering a little, tends to blend with the Stone making it scarcely noticeable, even when not above the line of sight.

## *APPENDIX "F"*

### *Surface Finishes for Indiana Limestone*

Almost any surface finish desired can be applied to Indiana Limestone and either machine or hand tool finishes may be used, excepting that certain so-called "hard-stone" finishes are not to be recommended and should not be used for other than special purposes.

***Sawed Finish:***—The cheapest finish and for certain purposes the best, is the rough sawed finish, which consists of leaving the surface of stone as it comes from the saws. A surface of this character has considerable texture and is recommended specially for Random Ashlar, also for Coursed Ashlar, when the "Rustic" Buff variety of Stone is used for the wall facing of buildings of somewhat informal design, or for any building where the greatest amount of texture possible with a sawed stone surface is desired.

***Smooth Finishes:***—The "smooth" finish referred to in Specification, is the generally recognized Standard finish of both plain and molded surfaces for all purposes and is the finish produced by the planers, without hand work, other than the removal of objectionable tool marks where they occur. While referred to as smooth, it is a machine finish and the surface always has a certain amount of texture. This is the finish always furnished for all parts of the work when other finish is not specifically designated.

Where a really smooth finish is desired, wet process sand rubbing or wet rubbing with carborundum should be specified, as grinding smooth with dry carborundum is not to be recommended as a proper method of finishing. Many contend that sand and water rubbing is the best finish for Indiana Limestone in smoky city atmospheres, because the surface so treated offers no lodgment for soot and facilitates the self washing down property, which is an unusual feature of this stone, not possessed by any other building material. This accounts for the comparatively clean and light appearance of most Indiana Limestone buildings after years of exposure, compared with adjacent buildings of other material.

It is good practice to require the washes to be rubbed where the ordinary smooth or other finishes are used throughout balance of the work, particularly when the pitch is slight as a rubbed surface offers the minimum lodgment for dirt and facilitates the natural washing of rains.

The next step in the line of plain finish is the honed finish which is only used for fine interior work and the final step is the polished finish which ordinarily is not considered practicable and is seldom used on Limestone. Some of the harder grades of Indiana Limestone will take a very satisfactory polish and such a finish is in every way practicable for special purposes in connection with Interior work. Cut Stone Contractors, however, seldom have facilities for furnishing honed and polished finishes. Interior work of this class is almost invariably handled by Interior Marble Work Contractors, who have the necessary equipment.

A good rule to follow is to require the lower story to be sand and water rubbed and leave the balance of the work as it comes from the planers; or better still, where a textured surface is desirable, have this balance left with sawed finish rubbed down slightly to remove objectionable irregularities and bring out the natural texture of the rock.

***Machine Tooled Finishes:***—The more customarily used machine tooled finishes are the four, six and eight bat to the inch tooling. Two bat to the inch tooling is also used on large scale work and ten bat to the inch tooling is sometimes used where a specially fine tooling is desired. This class of tooling in common practice is understood to imply what is properly termed fluting, that is, concave depressions. Convex tooling is less usual but is sometimes desired for special purposes and can be furnished.

The two bat tooling has been used with excellent result on large Ashlar facets for large buildings, *always running vertically*, but is not recommended for the ordinary run of work where a tooled surface may be desired, or for other than special purposes. It is expensive because it must be super-imposed or matched. That is, wide tooling cannot be applied promiscuously same as other tooling, the lines must be continuous from course to course.

All molded work should generally be finished smooth and if it is tooled at all, the tooling should run in the direction of the mold and not across it, unless largely increased cost is of no consequence.

With reference to the tooling of Ashlar Surfaces, some Architects contend vertical tooling is preferable, others horizontal but it is generally acknowledged that this depends largely on the type of building and general character of the design. Horizontal tooling is often objected to as it catches a lot of dirt and prevents the normal washing down of building by rain.

Some Architects who use tooled surfaces rather extensively, require the tooling to be vertical on plain surfaces, perpendicular on all large fillets and longitudinal on moulded courses.

While machine finishes are more generally used than hand tool finishes, because of the greater cost of the latter, particularly when applied on large areas of surface, the beauty of certain hand tooled finishes is undeniable and they are preferable to machine finishes for certain purposes where the added cost is warranted.

***Hand Tooled Finishes:***—The judicious use of a small amount of hand tooled finishing to accent certain architectural members of an otherwise smooth planer finished building, will set off the design and often add much in the way of character and distinction to the building. For instance, the quoin or arch stone may be hand tooled, or certain quoining of rusticated work be tooled to make it stand out from the balance of rustication, or in a perfectly plain wall the lintels may sometimes be tooled to advantage.

A small amount of hand tooling in contrast to plain surfaces, or machine tooled work, will generally give a richer effect than where there is an abundance of hand tooled work. Hand tooling can be treated exactly like the application of Sculptured detail and like such detail, it needs a contrasting back-ground to attain its full value.

Notable as examples of hand tooling which look particularly well on Indiana Limestone are crandalling, drove and tooth chiseling. Various widths of cut may be used and special effects for particular purposes be arrived at by experimentation.

Bush-hammering and other similar Granite or "hard-stone" finishes are not practical, except on the hard varieties of Indiana Limestone and are not recommended. Rock faced work is in every way practical but is not much used except for Random Ashlar. Where a rough effect is desired, the "rough picked" or "hand pointed" finishes are often used.

It is not customary to tool the treads of steps and where this is desired, it should be indicated on details and be noted in specification.

## *APPENDIX "G"*

### *Damp-Proof Coatings, Back Painting, Etc.*

Back painting or coating of the back and sides of Indiana Limestone before it is set with Bituminous waterproofing compounds, as a preventive for staining and discoloration, has been brought into prominence and the practice established in offices of many Architects chiefly through the promotional activities of the representatives of the many brands of Damp-proof coatings and paints.

This practice at best was never more than a make-shift and an attempt to overcome a condition that never should be allowed to exist. It is the wrong kind of "cure" and is strongly condemned. If an Architect wants to have the back of the stone painted, no particular harm will result, providing just the right kind of a damp-proof coating is applied and providing all other recommendation as to cleaning and setting of the stone, setting and pointing mortars are followed. When these recommendations are followed, there is no need for back painting and in the majority of cases it entails a useless expenditure that constitutes a waste of the client's money.

The application of damp-proof coatings, that is certain kinds of these coatings, is approved and in fact recommended in connection with concrete construction, **BUT** the coating should always be applied to the face of concrete and not to the stone, as referred briefly in the notes and supplementary clauses.

This Association, as the official representative of the Indiana Limestone Quarry operators, and speaking also for Cut Stone Contractors generally, recommends that back painting of stone be eliminated from all specifications for Indiana Limestone, for which reason, a requirement for back painting has not been included in the Standard Form of Cut Stone Specification.

From present knowledge based upon the experience of leading Cut Stone Contractors and extensive investigation, the following conclusions have been taken to warrant condemning the back painting of Indiana Limestone.

***First:***—The somewhat common practice of specifying Back Painting is looked upon as a bad habit, which became prevalent in the Specifications of Architects due to a number of reasons, the chief of which may be enumerated as follows:

1—Lack of knowledge on the part of both Architect and Contractor, including Cut Stone Contractor, of the importance of selecting sand for setting mortar and of mortars and their effect generally.

2—Carelessness of both General and Cut Stone Contractor in the handling and setting of stone.

3—The growing use of concrete construction.

4—The "cure all" claims and energetic sales promotion activities of Waterproofing Paint and Compound Manufacturers.

5—Lack of action on part of stone industry in both finding out true cause of trouble and combating the growth of a bad practice.

and ***Second:***—The **Facts.** The stone as quarried contains considerable moisture in the form of quarry sap, also in the working of cut stone considerable water is used, and the moisture absorbed into the body of stone is retained for a long time. It is therefore not possible to have recently worked stone perfectly dry. It may appear bone dry on the surface but there is an element of contained moisture that must dry out in process of seasoning long after the stone is set in the building.

To specify seasoned stone, as some Architects do, is simply to specify an unknown quantity, the only seasoning recognized by the industry is the preliminary drying of the quarry blocks which takes place immediately after they have been separated from the ledge and exposed to the air for a short period of time. Quarry blocks stacked for a year or more will, when split apart, be moist on the interior. The element of contained moisture therefore, cannot be eliminated. What is the answer? Wet stone cannot be painted with a heavy impervious coating because it will peel off. The coating must be thin to sink deeply into the pores of the stone and such a coating is not wholly impervious and often tends to aggravate conditions which it is supposed to counteract.

In the handling of cut stone, loading and unloading on cars, hauling and setting, more or less of this coating is sure to be rubbed, scraped or chipped off and its effectiveness destroyed. Unless another coat is applied at the building, moisture from the backing can seep through into stone.

Painted stone cannot be washed clean and the fact that such surfaces are dark gray or black, is a good excuse for neglecting any cleaning of same and the setting dirty stone. The fact that stone is apparently protected by a "so-called" protective coating is also an excuse for using cement mortar in the backing and in direct contact with, or adjacent to, the back of stone.

Furthermore, painting stone on five sides to within an inch or less of the exposed face, if effective, compels any soluble matter or impurities contained in the backing and mortar to proceed along the joints, towards the face of the stone in the drying out of wall and it finally finds egress within an inch or less of the face, then spreads fanwise and promptly shows its discoloring effects.

Bituminous waterproofing preparations are frequently thinned with gasoline and other light volatile oils, which carries some of the heavy substances of the compound into the

stone and the extrusion of this, of itself tends to create undesirable discolorations.

Therefore, if the result for which back painting is applied to cut stone, is to be obtained, *i.e. the entire separation of cut stone from the backing and the prevention of moisture from backing from passing through the stone,* the back painting must be done over the whole back surface of stone and joints, after it has been erected in the wall and before the brick, tile or other backing up masonry is built. This is seldom, if ever, a feasable operation in modern building construction; except possibly for large monumental structures, the stone facing of which could be built up self standing, in separate stages of reasonable height and be allowed to stand for the setting of mortar and the application of damp-proof coating over both stone and joints, before backing up of same was started.

Some Architects have used the application of damp-proof coatings on cut stone only as a means of protection during long distance shipment. Proper loading and careful packing of the stone and a thorough washing of same at building, just before setting, is the better way to provide for this.

For this same purpose of protecting the cut stone during long distance shipment, a coating of white wash is also sometimes specified to be applied to stone before shipment. This white wash is composed of Limestone planer dust and water with a very small amount of lime added to make it hang to surface of stone. The value of this is very questionable and when used it should all be thoroughly washed off before the stone is set, using stiff fibre scrubbing brushes and clean water, continually rinsing the stone with plenty of fresh water.

Only a very small amount of lime should be used, as otherwise the white wash is difficult to remove. At best it is looked upon as a somewhat dangerous procedure and is not recommended, although when in the hands of an experienced Cut Stone Contractor all the way through, it is considered an effective method of keeping the stone clean while in transit and during storage at the building.

If too much lime is used causing it to set hard, or if allowed to remain on stone after it is set in building, it prevents the normal and proper evaporation of quarry sap and will combine with the moisture in stone and any soot or dirt that is deposited on same and by hardening form an insoluble discoloring filling in the pores on the face of stone.

***Colorless Water-Proof Coating:***—Colorless Damp-proof Coatings have not in the past generally been considered either necessary or advisable on Indiana Limestone, as Water-proofing the Stone, under any ordinary conditions of exposure on the exterior of a building, is not necessary to assure the permanence of the Stone or to prevent staining and the accumulation of grime from the atmosphere.

Indiana Limestone has the remarkable characteristic of remaining clean longer than any other building material and where subjected to the wash of clean rainwater and the action of wind and sunlight it will remain clean and retain its pleasing light color for an indefinitely long period, even under very severe conditions of exposure.

The growing use of concrete construction, however, and the extensive use of Portland Cement Mortar in buildings faced with Limestone complicates conditions and such a coating, as a temporary means of protection, may often be warranted.

The grade course or stone in contact with the earth may to advantage, be coated with a colorless water-proof preparation, to render easy the washing off of splashings during rainstorms and to prevent any discoloration, staining, or efflorescence from elements in the soil, and this material may often to advantage, also be used to coat tops of wide copings or cornice members and for other special purposes.

Such Coatings, however, should be of a composition that will not darken, discolor or otherwise affect the Limestone and should possess some real water-proofing value.

Some Architects specify that all surfaces of the stone be coated with colorless water-proofing before shipment and while this may have some merit, it also has the disadvantage of closing the pores of stone to the drying out of any contained moisture and the coating of face only appears to be a better method.

Generally, when used on an all stone building, it is also recommended that it be applied to the face of the stone only, after the pointing and cleaning down has been done. This will not interfere with the normal bond between the stone and the setting mortar.

Colorless Water-proof Coatings are probably more particularly useful on trim jobs than for buildings entirely faced with stone and for trim jobs all six sides of stone are usually coated.

When Indiana Limestone is used as trim in Brick faced walls, where the brick facing and other brick work in contact with the stone is not laid in either a lime or non-staining cement mortar, or where a lime-cement mortar or any other mortar containing a quantity of Portland Cement will be used, there is hardly any other way of effectively protecting the stone and the application of such coating to all sides of this stone is recommended.

In addition to such waterproof coating, all sides of the stone that are built into the walls should be parged with lime *or non-staining cement* mortar and this same mortar be used for setting all the stone. In fact, it is on trim jobs that the greatest care is necessary in connection with set-

ting of Indiana Limestone, or any other light colored stone, on account of the several elements used, and the numerous joints. The often high absorption of the brick may continually permit considerable moisture to get around the back of stone through absorption by the brickwork and through unfilled mortar joints. The discoloration and efflorescence which occasionally occurs on the stone work of brick, stone trimmed walls, is usually attributable to this cause.

Colorless Waterproofing has also been used simply to protect the stone from dirt during shipment and until set in the building, in which case the effective permanence of such coating is of little concern, but again the question arises as to whether only face or all six sides be treated.

It must be kept in mind, however, that all so-called Colorless Waterproofing preparations are not colorless, and not waterproof and may prove decidedly detrimental to the stone, or at least to the appearance of the structure. The Technical Division of the Association should be consulted when further information on this important subject is desired.

## *APPENDIX "H"*

### *Setting and Pointing Mortars*

The subject of setting and pointing mortars after careful investigation, is thought to be the most important one connected with the setting of Cut Stone and to embrace all of the problems of stain prevention. These investigations invariably lead to the conclusion that nearly all of the trouble of this nature that has occurred in the past was in part, if not entirely, due to a misunderstanding of this one subject.

The known staining effects of Portland Cement Mortar and Concrete and the trouble caused thereby has been a continual bug-bear to the Cut Stone Contractor, resulting in the very general adoption of the principle that only Lime Mortar should be used for the setting of Indiana Limestone and other light colored Stones, with no alternate to cover conditions where it was impossible, or not desirable from other viewpoints, to use a Lime Mortar.

For instance, the Architect and the Contractor was confronted with Building Code requirements which greatly hampered the use of Lime Mortar and sometimes made it impossible, and where this was not the case, a premium was placed on its use by the requiring of thicker walls or the fixing of unreasonably low working stress.

The result was that the Contractors and Architects promptly disregarded the Stone Contractors' recommendations as impracticable and used Cement Mortars for all purposes and relied on the back-painting of Cut Stone with Bituminous Water-proof preparations as a means of protecting the Stone.

This often resulted in a finished building with unsightly discoloration or staining of the Stone, which could not be eradicated, except by the slow and untiring hand of nature, some of it disappearing after a period of years and in other instances submitting but little to the bleaching effect of its exposure to sun and rain. In some few cases, the trouble did not stop at staining and a disintegrating action of the Cement Mortar has actually been noted.

These conditions led to the instituting of research work embracing both the investigation of existing structures and tests of various kinds and this work is now well in hand but has not yet been completed or carried to definite conclusion in all respects.

One result, however, is to confirm the opinion based upon the experience of many years, that a Lime Mortar, however impracticable its use may sometimes appear to be, is the best for the setting of Limestone. For this reason a Lime Mortar is recommended for every purpose for which it can consistently be used and for all other purposes only a non-staining Cement Mortar, using Cement of an established brand, the non-staining qualities and merit of which, can be attested by suitable examples of work on which it has been used with satisfactory results.

The Alternate Mortar clauses which accompany the Specifications provide for non-staining Cement Mortar. *See Notes 35 to 39 and the Supplementary Clauses which they refer to.*

The unfair load-bearing advantage that is often given to Portland Cement Mortar, however, does not appear to be justified by the facts. It is, of course, acknowledged that Cement Mortar has a considerable greater crushing strength than Lime Mortar but this difference does not justify the frequent allowance of only 80 pounds or 100 pounds per square inch on masonry laid in a good Lime Mortar, as against 400 pounds to 600 pounds and in some cases, 800 pounds to 1000 pounds per square inch, for exactly the same masonry laid in Cement Mortar. There has been a general tendency to place undue weight upon the compressive strength of Mortars. There is seldom a requirement where anything like the full safe compressive value of the stone is needed or can be utilized.

It is true that the strength of the wall depends largely on the Mortar, and the theory that "*A chain is only as strong as its weakest link*" may with certain modifying factors, be properly applied to a wall but the difference in the crushing strength of the Mortars is not the only factor to be considered in a comparison of the bearing values of masonry.

Straight Cement Mortars are short and it is difficult for the mason to spread them to an even bed over the entire surface and to bed the stone or brick so that all joints and crevices are filled. Cement Mortar does not adhere readily to a vertical surface and will slide or fall off.

Straight Lime Mortars or Mortars in which a large percentage of Lime is used, on the other hand, are plastic and the ease of working makes it possible for the ordinary moderately skilled workman without special effort to thoroughly bed the work and fill the joints.

In fact, it is customary to add a certain percentage of Lime to all Cement Mortars used for setting masonry for this very reason, to make the mortar plastic and workable under the trowel. This addition also results in masonry of greater strength, density and water-tight value.

Almost any ordinary Lime Mortar made of a good Lime when tested in the wall will give results that seem to warrant compressive values very much higher than the loading for which it is ordinarily permitted to be figured and used.

***Lime:***—Either good Lump Lime or dry Hydrated Lime may be used with equally satisfactory results for the setting of Indiana Limestone. The disadvantage of Lump Lime is the time and often also the space required for the making of Mortar, in connection with the usual hurried modern building operation.

Lime Paste, to be satisfactory, should be slaked at least two weeks in advance of its use for Mortar. Some consider three weeks the minimum and the longer it is aged the better the Mortar will be.

The one thing to avoid in Lime is a Lime containing Calcium Sulphate, *Gypsum*, in any appreciable percentage. Both Calcium Sulphate and Calcium Sulphide are very bad for Lime Mortars that are to be used for the setting of Cut Stone. The proportion of sulphur as sulphate should not exceed 25–100 per cent and the sulphate as sulphide should be low. This is a technical question which the Architect will seldom have opportunity to go into, or the Contractor bother about, for which reason it is an advantage to specify a Hydrated Lime of any well known brand, as the manufacturers can then be relied upon to look after this in the production of the Hydrate; or to require that Lime conforms with the SPECIFICATIONS of the AMERICAN SOCIETY for TESTING MATERIALS, for MASONS HYDRATED LIME.

For various reasons, the use of Hydrated Lime is generally preferable in modern building work. It is so much more convenient to handle and there is always the assurance that the Lime has been properly slaked. Hydrated Lime, when stored at the building, will keep better than Lump Lime and can be stored with absolutely no danger of fire.

The statement sometimes made that the Masons prefer the Lump Lime because it gives a fatter Mortar and will carry more sand is based on a misunderstanding and improper comparison.

It is not to be expected that 100 pounds of Hydrate will carry as much sand and produce as much Mortar as 100 pounds of Lump Lime slaked to a paste as the cementing elements contained in the two are not equal, by reason of the weight of water that has already been added and chemically combined with the Hydrate.

100 pounds of high Calcium Lump Lime will give about 132 pounds of dry Hydrate, from which it will be noted that 100 pounds of Lump Lime is equivalent to ⅓ greater weight of Hydrated Lime and for an equal comparison of the relative value of the Mortars, ⅓ greater quantity of sand must be mixed with the paste produced from 100 pounds of Lump Lime.

***Hydrated Lime:***—Hydrated Lime weighs from 36 to 45 pounds per cubic foot averaging about 40 pounds, which is the figure generally used in proportioning Mortar by weight.

A 100 pound Burlap or canvas sack, therefore, contains 2½ cubic feet. Hydrated Lime is more usually put up in paper bags containing 50 pounds and in some few instances is sold in 40 pound paper bags.

The Mortar formulae given are based on the Hydrated Lime being furnished in 50 pound bags and the proportion must be varied when the Lime is furnished in either 40 pound bags or 100 pound sacks.

Hydrated Lime requires about equal its weight of water to produce a paste or putty of ordinary consistency, the volume of which will equal about 90 per cent of the volume of dry Hydrate. Thus to every 50 pound bag of Hydrated Lime about $\frac{8}{10}$ cubic feet or 6 gallons of water are required, giving about 1.1 cubic feet paste.

***Lump Lime:***—Lump Lime weighs 50 to 60 pounds per cubic foot. The weight per bushel is taken at 75 or 80 pounds according to the law of the State in which Lime is purchased by bushel, the contents of which will average about 1.25 cubic feet.

The contents of a barrel of Lump Lime will vary. A 200 pound barrel should contain 180 pounds net or about 3.1 cubic feet. A 300 pound barrel should contain 280 pounds net or about 4.7 cubic feet.

Lump Lime is now in most localities, purchased by the ton, for which reason the Mortar for-

mulae give the quantity by weight, as well as by cubic foot measure.

Lump Lime swells considerably in volume in the production of paste. A barrel weighing 180 pounds net and containing a little over 3 cubic feet will produce from around 6 to over 8 cubic feet Lime paste. It is customary to assume that a barrel will produce 7½ or 8 cubic feet paste but 6 to 6½ cubic feet paste is probably a better average.

A good rule is to slake about 33 pounds of Lime for every cubic foot of Lime Paste required, this will generally result in some little excess of the volume needed. The paste or Lime putty as it is often called, will weigh all the way from about 80 up to 110 pounds per cubic foot, according to original weight of Lime and the quantity of water absorbed.

It is this great variation that makes it impossible to definitely recommend any one Mortar mixture to govern all cases and it is well to remember that the Lime absorbing the greatest quantity of water, while producing a larger quantity of paste will not produce the strongest Mortar. Such Lime is also subject to greater shrinkage in setting and consequently needs to be more heavily sanded to avoid undue shrinkage. This makes the use of a rich mortar mixture with very fat limes undesirable.

The variation in sands will further increase this variable mortar-making quality of different limes. The Architect may not be particularly interested in the detail facts but they are of vital interest and are given to indicate the possibility of error, if rigid adherence to a given specification is insisted upon under the varying condition of different localities. Lime paste after slaking should be properly covered during storage, to prevent drying out of moisture.

***Cement:***—Ordinary Portland Cement, ***which should never be used,*** is always assumed to average 100 pounds per cubic foot in weight but for convenience in figuring one sack containing 95 pounds net is usually taken to equal one cubic foot in proportioning mortars and the so-called non-staining White Portland Cements may be figured on this same basis.

In proportioning Lime-Cement or Cement-Lime Mortars, only 30 pounds of good quality Lump Lime should be taken to produce a volume of paste equivalent to one sack of white Portland Cement.

***Sand:***—The weight of dry sand will average a little over 80 pounds per cubic foot or around 2250 pounds per cubic yard.

The question of Sand for both setting and backing up Mortars, being an item of minor expense, is one that is often overlooked but is of such importance in connection with the setting of Cut Stone work, that it is not infrequent for discriminating Architects to incorporate in their specifications, a clause requiring the Contractor to submit for approval a sample of the sand he proposes to use, accompanied by full information and a signed statement as to its source of supply, and, if the condition seems to warrant it, to also require that the sand be tested for the presence of salts and clay, loam or organic matter. It is recommended that this course be followed, particularly in those districts where any of the sand supply may be questionable.

There have been cases where poor sand and where water with a high chemical content were the direct cause of staining and discoloration of the stone work, creating results that were alike damaging to the reputation of the Architects, Cut Stone Contractor and General Contractor, although Stone that was acknowledged to be perfect and in every way satisfactory was, in each instance used.

Sea beach sand and sands from rivers and bays influenced by tidal action and all sands containing salts which of themselves retard the setting of mortar, cause efflorescence, staining, discoloration and sometimes disintegration, should be carefully avoided by testing. It is equally important that the water be free from salts, iron, sulphur and other staining elements. In any locality where there is doubt as to purity of source of the water supply, the water should be analyzed.

Full directions for the simple field testing of sands both for the presence of clay or organic matter and for salts will be furnished upon application to the Technical Division of the Association.

Too much emphasis cannot be laid on the need of having ***washed clean*** sharp sand and pure water. It is only on account of the importance of sand in connection with the setting of Cut Indiana Limestone that so much stress has been laid upon specifying requirements for same, in notes 37 and 39 accompanying specification.

The best sand is a well graded coarse, hard and sharp or gritty silicate, making preferable a sand that is white or reasonably light in color, containing no mica, coal, etc. Where the sand is fine or of uniform size grain, a richer mixture than 1 to 3 should be used Very fine sand, or sand containing loam or an excess of clay, however pure, should never be used. Where the sand contains very coarse grains or pebbles that would interfere with the proper bedding of the stone, it should be screened.

A good specification requirement for sand is as follows:

> "Sand must not show over 35% passing 50 mesh sieve nor over 10% passing 100 mesh sieve and shall contain over 90% Silica and be entirely free from all organic matter, salts, coal dust or other foreign substances."

***Lime Mortar:***—A 1 to 2½ mixture with small percentage of cement ADDED is recommended as an average good mortar mixture

under all ordinary conditions, but the quality of the sand is very important in determining the exact mixture to be used.

Therefore, Setting Mortar composed by Volume of one part Lime to ***not over*** 3 parts sand has been specified as a standard, because this is considered a safe limit.

The mortar should never be made too rich as an over rich Lime Mortar will shrink so much in setting that it will crack and lose its strength. Two parts sand to one of Lime is the advisable minimum amount of sand and 1½ parts sand to one of Lime about the limit of richness beyond which shrinkage will usually more than offset any theoretical gain in strength.

A 1 to 3 mortar made of clean sand having well graded fine to coarse grains may often be much stronger and preferable to a 1 to 2 mortar made of sand that is too fine or having grains nearly uniform in size. With good sharp well graded sand, even a leaner mixture than 1 to 3 is sometimes permissible.

The percentage of cement specified is included to hasten the setting of the mortar as Lime Mortar has the tendency to set more slowly than Cement Mortar and this is often objectionable on modern work. Only non-staining cement is permissible for this purpose and ordinary Portland Cement and most natural cements must never be used to hasten the hardening of mortar that is to be used for the setting and backing of Indiana Limestone.

The volume of cement incorporated in a lime mortar may be treated either as an addition, or as replacing an equal volume of lime, but in order to keep the proper relative proportion of sand and cementing materials the proportions of mixture should be varied accordingly. For instance, a 1 to 3 mixture with 15% of cement added is really equivalent to a 1 to 2.6 mixture and to specify a 1 to 2½ mixture with 20% of the lime replaced by an equal volume of cement would give a mortar having a little larger proportion of cement but of about equivalent richness.

Up to 20, or even 25% of the lime specified in a straight lime mortar may, in that way, be replaced by an equal volume of cement without disturbing the proportions of sand to cementing material.

***Lime-Cement Mortar:***—Frequently a straight Lime Mortar cannot be used to advantage and the use of a Lime-Cement Mortar is advisable for all purposes including the setting and parging of Stone and laying up of backing. Where this is the case, the so-called 50-50 Mortar, that is so highly recommended by the National Lime Association, based upon the tests of Professor MacGregor at Columbia University, is recommended, and the following mixture by volume suggested: "One-half part Hydrated Lime or Lime Paste, one-half part white Cement of approved brand and *from two to three* parts sand."

A Mortar of this kind using two parts sand was decided upon after considerable experimentation for a very large operation and was used throughout for the setting of Cut Stone, Face Brick and Common Brick Backing masonry with highly satisfactory results. With good sand, this is a little richer than ordinarily need be used.

In light wall work, such as 12 inches thick enclosure walls, where the greatest thickness of backing is only 8 inches, it is generally advisable to use a mortar of this kind throughout for both facing and backing.

***Cement or Cement-Lime Mortar:***—Building Codes often permit only the use of Cement Mortar for all forms of Hollow Tile construction, in which case a straight non-staining Cement Mortar must be used for the backing. In most other instances a Lime-Cement Mortar is better and even when a cement mortar is required, it is always best and in most instances permissible to use at least a small percentage of lime, to make the mortar more plastic and workable for both stone setting and backing up purposes. As previously stated only an approved non-staining cement is permissible.

The usual mixture for a Cement Mortar for stone setting purposes is, one part non-staining cement to from 1½ to 2½ parts sand; and for a cement-lime mortar a similar mixture replacing 10, 15, 20 or 25 per cent of the Cement, with an equal volume, ***not weight***, of Hydrated Lime.

Cement or Cement-Lime mortars should be used within 30 minutes after mixing and for that reason must be prepared in reasonably small batches just prior to use. The same applies to Lime-Cement Mortar, for which the Cement should be added to the PREVIOUSLY MADE AND AGED Lime Mortar just before it is used. Lime Mortar, whether to be used alone or to be mixed with Cement, should be made and stacked as long before use as conditions on the job will permit, always being properly covered to prevent drying out.

***Special Limestone Mortar:***—Whenever Indiana Limestone planer chips and dust are available, the sand problem is at once solved by using this by-product instead of sand, resulting in a very excellent mortar for the setting of Cut Stone. This mortar can be proportioned with a little less cement than with sand; owing to the fact that the Limestone dust has great cementing qualities of its own and the usual addition of Hydrated Lime to cement mortars is not necessary when the planer dust is used in lieu of sand.

For setting purposes, the Limestone planer chips are screened through a ⅛-inch mesh screen and for pointing purposes through a 3-32-inch mesh screen. At present, there is no regular source of supply for this by-product, which for lack of special equipment is wasted, but if there was a sufficiently great and regular demand for this material, the mills would, without doubt,

install the screening and sacking equipment and undertake the furnishing of same at moderate cost along with the Cut Stone.

***Grout:***—A Mortar Grout is nothing more than a good rich mortar that has, by the addition of a greater quantity of water, been mixed to the consistency of thick cream, so that it can be poured into thin vertical joints and be worked into all crevises between and in back of stone. A reasonably fine sand is preferable for grout and it must be kept constantly stirred until used to avoid the separation and settling of the sand, and should be mixed as thickly as can be poured to avoid undue shrinkage. Either Lime or non-staining Cement Mortar grout may be used, the cement grout being more often used.

The usual proportions by volume for Cement Mortar Grout are 1 part non-staining Cement to from 1 to 1½ parts of fine White Sand.

***Pointing Mortar:***—For pointing mortar, an over rich mixture is often used, but this is a mistake as its tendency is to shrink away from stone, become loose and eventually fall out of joints. There is no reason why it should differ much from the setting mortar, excepting that it should be somewhat stiff though plastic and only a fine white sand or planer screenings be used. Lime Mortar is seldom used for pointing.

The customary mixture is, one part non-staining Cement to from 1½ to 2, or even 2½ parts of fine white sand, with about 15 per cent of Lime added, using more Lime if necessary to obtain the desired plasticity and working quality. Probably the best pointing mortar obtainable is that made by using the Indiana Limestone planer screenings in lieu of sand.

It is important that the joints be brushed out and be wetted so as to prevent the absorption of moisture from the pointing mortar before it has set, as this will result in a weak mortar that may crumble away. The very fact that pointing mortar must be of a stiff mixture, and comparatively less water than for other mortar mixtures being used, makes it of the greatest importance that the Stone be thoroughly wetted, especially in warm dry weather. The nickle-plating of pointing tools is sometimes advisable.

***Mixing Mortar:***—It is customary to mix the mortar for Cut Stone work by hand in the usual mortar box, but with the improved forms of portable machine mortar mixers that are now on the market, there is apparently no reason why a properly machine mixed mortar would not be equally satisfactory where a Cement or Cement-Lime Mortar is to be used, but it is very doubtful if machine mixing will prove as satisfactory as hand mixing for Lime Mortar.

Mortar batches for Cut Stone work must be reasonably small, however, and the usual Concrete Mixer is not even suitable for mixing Cement Mortars.

The approved method for mixing Lime Mortar made of Lump Lime is to work the sand into the Lime Paste, adding water as required and to work the mortar about up to the proper degree of plasticity before any Cement, when used, is added.

With Hydrated Lime, the Lime is turned over dry with the Sand until the mixture is of an even color before the water is added, and with Lime-Cement Mortar a similar procedure is followed, the Cement being worked in dry with the Lime. In this case, however, the batches must be of a size that can be used within 30 minutes after mixing, as the retempering of mortar containing Cement that has started to set is not permissible.

Cement or Cement-Lime Mortars are mixed in a similar manner, the non-staining Cement and Hydrated Lime being mixed together dry to a uniform color before water is added. The use of Lime Paste with a Cement Mortar is somewhat more difficult, as the Cement and Sand must first be worked to a paste and the Lime Paste then be worked in with same.

Salt should never be used to lower the freezing temperature of water used in the mixing of Mortar for Cut Stone work as it will invariably cause efflorescence and often discoloration of the finished Stone Work.

***Lime Mortar:***—The usual batch for a good average Lime Mortar of the recommended proportions would be composed by volume and weight as follows:

NOTE.—These quantities will equal by volume approximately 1 to 2½ for Hydrated Lime and 1 to 2¾ for Lump Lime Paste.

***When Made of Hydrated Lime***

| By Volume | Material | By Weight |
|---|---|---|
| 2—50-lb. bags | Hydrated Lime | 100 lbs. |
| 5½ cu. ft. | Sand | 460 lbs. |
| ⅓ sack | Stainless Cement | 32 lbs. |

***When Made of Lump Lime***

| By Volume | Material | By Weight |
|---|---|---|
| 2 cu. ft. | Lump Lime | (Dry Lump) 66 lbs. or about 180 lbs. Paste |
| 5½ cu. ft. | Sand | 460 lbs. |
| ¼ Sack | Stainless Cement | 24 lbs. |

Keeping the quantity of Lime and Cement the same and either decreasing the quantity of sand by from ½ to 1 cu. ft., or increasing same from ½ to 1½ will give all of the variation in mixture that will ever be required.

***Cement-Lime Mortar:***—The usual batch for the recommended average good Cement Mortar mixture, for setting Stone, *approximately 1 to 2 with 25 per cent of the Cement replaced by Lime* would be composed by volume and weight as follows:

| By Volume | Material | By Weight |
|---|---|---|
| 2 Sack | Stainless Cement (White Portland) | 190 lbs. |
| 5¼ cu. ft. | Sand | 440 lbs. |
| ½ Sack | Hydrated Lime | 25 lbs. |

*Or ½ cu. ft. Lime Paste requiring 15 lbs. dry lump.*

***Lime-Cement Mortar:***—The usual batch of 50-50 Lime-Cement Mortar of average good or 1 to 2½ mixture as recommended for general use in setting facing, parging and backing up, where it is not possible to use a Lime Mortar to advantage, would be composed by volume and weight as follows:

| By Volume | Material | By Weight |
|---|---|---|
| 8/10 Bag | Hydrated Lime | 40 lbs. |
| 1 Sack | Stainless Cement | 95 lbs. |
| 5 cu. ft. | Sand | 420 lbs. |

Mixing Mortars on the ground or in other than clean, tight mortar boxes should not be permitted.

Water should preferably be added to all Mortars by spray from a hose or sprinkling can, though unfortunately this is not the customary practice.

Water used for mixing mortar should be free of injurious chemical elements. Water containing any appreciable Alkali content should always be avoided, as water with a high Alkali content will often tend to cause some discoloration of the stone, which time alone will eradicate.

***Cement Pointing Mortar:***—The average pointing mortar would be mixed a little richer than the foregoing setting mortars and would be composed as follows:

| By Volume | Material | By Weight |
|---|---|---|
| 2 Sacks | Stainless Cement (White Portland) | 190 lbs. |
| 4½ cu. ft. | Sand | 375 lbs. |
| ⅛ Sack | Hydrated Lime | 17 lbs. |

For any work, for which a Lime Mortar is not considered suitable and in any locality where a Lime Mortar cannot be used ONLY a **Non-Staining** Cement, or a **Non-Staining** Cement-Lime, or Lime-Cement Mortar should be used.

*The Technical Division of Association will be pleased to serve the Architectural Profession of any particular Setting Mortar problems.*

## *APPENDIX "I"*

### *Anchors, Dowels, Clamps, Etc.*

This subject is one that can be more satisfactorily explained by detail drawings than by text and, therefore, is only covered in a general way by the following descriptive text but will be fully covered by the Series "D" Detail Sheets of the Association.

The first principle which applies to all anchors, clamps, Lewis hangers, dowels, etc., in fact, to all metal work that is built into stone work and with particular reference to dowels and clamps, which must often be built into exposed vertical joints fairly close to the surface, is that such work must be of a non-corrosive nature or be effectively protected against rust or corrosion of any kind that will cause staining of the Stone. Rust, particularly on small work, will almost invariably cause swelling that will split the stone. For this reason iron or steel must never be used, unless thoroughly galvanized, tin coated or otherwise effectively protected against any deterioration from the action of moisture. Asphalt coating of metal work is sometimes resorted to but is not to be recommended, as the cost of properly galvanizing the few items of metal work ordinarily required constitutes such a small item of expense compared with the cost of Stone work, that it is well worth while in all but the cheapest grade of work.

Galvanizing should always be done after the metal has been bent to shape and made ready for use, with the possible exception of tie anchors for fastening Stone Facing to reinforced concrete columns, the length and shape of which cannot very well be previously determined and for which purpose light weight round or square galvanized iron rods, which can be cut to length on the job, are recommended.

Even Galvanized iron is not considered entirely satisfactory for small Dowels; cornice, coping or balustrade rail clamps and the use of Brass or Bronze is recommended for these particular purposes.

Every block of stone that does not have at least one bed bonded to the backing by contact with a Bond stone or course that extends back into the wall, should be anchored to the backing. This means that only where every second, or every third course of an ashlar facing is a bond course, is it permissible to altogether omit anchors from the stone of an ashlar facing, and frequently it is

advisable to also anchor certain stones in addition to the bonding of facing to the backing.

No set rule can be laid down to cover this, as the requirements of Building Codes will generally govern, although these regulations are often either unduly stringent and wasteful, or improperly lax on this point; more particularly in the way that these requirements are often literally interpreted alike for all classes of work, without regard for the character of Building under consideration.

The question of proper anchorage should be left largely to the practical man who actually details the Stone, assuming the Architect has assured himself that the work has been placed in the hands of a thoroughly reliable Cut Stone Contractor. The chief problem is not so much to oversee the provisions for anchorage, as to see that the setting contractor **provides and puts in** all the anchorage and fastening provided for by the approved detail drawings.

***Ashlar or Facing Anchors:***—The standard anchor for ashlar and other ordinary facing stone is made of $\frac{3}{16}$ inch thick by 1 inch or 1¼ inch wide flat iron or soft steel having one end bent down a scant inch into the Stone and other end bent up a full 2 inches into the backing and of a length that will extend from the anchor hole a distance of one full brick, *about* 8½ inches, into the brickwork where brick is used for backing, or to hook over the center web of Hollow Tile where tile is used for backing. Such anchors when 1 inch wide have an area of .188 square inch and a safe tensile strength of around 850 pounds each which is more than required for all ordinary purposes. If the $\frac{3}{16}$ inch flat iron is not available ¼ inch should be used. This heavier weight is often preferred and specified by Architects.

Anchors made of ⅛ inch thick by 1 inch wide band iron are often used but are rather light, and while they serve the purpose are only to be recommended for the cheaper class of work.

For very high courses or heavy work ¼ inch thick by 1¼ inches or 1½ inches wide anchors may be used or even ⅜ inch by 2 inches for special purposes, but such heavy anchors are seldom necessary. It is generally better to use a greater number of lighter weight anchors for long or heavy stone than to increase the size of anchors and it is a nuisance to have more than one size ashlar anchor on any job.

One anchor to each stone that is to be anchored is the customary rule for ordinary ashlar facets, with two or more anchors to a stone only when the stones are either particularly large or about 3 feet or more in length.

Stone Facing that is to be backed up with any form of Hollow Tile should always be detailed with the anchor holes placed in a position that will normally place the anchor into a position where it can be properly hooked onto the tile without unnecessary cutting of the tile. With certain forms of tile, this frequently makes it advisable to place the anchors in the vertical joint near top of stone in preference to placing same as usual along the top bed.

Anchors should not be placed in the mortar joint; a sinkage of ample width and of a depth slightly thicker than anchor should always be provided in back of anchor holes.

***Cornice Anchors:***—Special anchors for cornice and belt course stones that do not have sufficient bearing to balance same on the wall, should be hooked into the stone a full 2 inches or more in depth and should be spaced about 2 feet apart, with at least two such anchors to each Stone.

***Column and Other Facing Anchors:***—It is often desirable to anchor the stone facing at either reinforced concrete columns or steel columns encased in concrete, by hooking around same without cutting into the concrete, as cutting into concrete fire-proofing is not permitted by most Building Codes and is also costly in labor, particularly if patching and repair of the concrete is involved. For this particular purpose anchors of ⅜ inch or $\frac{7}{16}$ inch round, ⅜ inch or $\frac{5}{16}$ inch square galvanized soft steel rods may be used. These should be hooked down 2 inches into a hole drilled into the Stone at one side and may be bent right around column and be hooked into a similar hole at the other side, or may be hooked into a hole drilled into concrete on both sides of Columns and can readily be cut to length with a suitable shear and be bent to shape on the job, as the work progresses. Such anchors are most suitable and convenient for various purposes in securely fastening the stone to structural members of modern skeleton frame buildings.

***Lewis Anchors:***—Wide Lintels and all horizontal members that must be supported to steel work above, *a detail that should be avoided in stone construction whenever possible,* should never be supported by expansion bolts but always by Lewis anchors of the number and size required for the proper and safe support of the particular piece of work, for which no general rule can be given.

The Lewis anchors generally used are ¾ inch, ⅞ inch or 1 inch and should always be galvanized. Two large size well placed Lewis anchors are often preferable to four smaller ones and only in rare instances should more than four be used for a single piece of stone. The holes for Lewis anchors should be cut reasonably deep but should never extend closer than 2 inches to the soffit of stone and 2½ inches or 3 inches is better.

The anchor, however, should have a minimum depth in the stone of 3 inches and preferably from 3½ inches to 4 inches, which means that it is not practical to hang stone much less than 6 inches in depth with Lewis anchors.

When Colonnade Architraves or other soffit members are hung by Lewis anchors to steel angles or beams of shallow depth which also sup-

port the masonry above same, the soffit member should not be hoisted tight against the underside of steel but should be bolted up against lead pads or steel plate washers with lead pads between same and the stone, to provide ample clearance between the top of stone and underside of steel and allow for deflection of the steel from weight of masonry above, without throwing any load onto the center or any portion of the stone soffit hung below same. Sometimes conditions will require that the stone be checked out in center to provide ample clearance.

To insure an even distribution of the bearing of Lewis anchors particularly for either rather light stone or large heavy members, it is often advisable to provide for carefully leading the Lewis anchor into stone after the wedge piece has been driven but this is not customary practice. A thin pad of lead wool between the anchor and stone would also accomplish this.

***Clamps:***—Clamps for parapet copings, Baluster rails, when used, are generally of ¼ inch by 1¼ inches flat iron galvanized and for copings of fountain basins, etc., and other heavier work may be of ⅜ inch or ½ inch by 1½ inches flat iron galvanized, all being turned up 1½ inches or 2 inches at ends and are 6 inches, 8 inches or 12 inches in length. These are sometimes dropped into a sinkage on top of stone but are more generally set underneath with the ends turned up into cuts in the underside of stone. Clamps of this character should always be very heavily and thoroughly coated by galvanizing and such clamps are not recommended for Baluster rails and light copings or other very light stonework.

The top members of Cornice are sometimes clamped together, but in the great majority of cases this is not necessary and is generally decidedly objectionable, on account of the very serious danger from rusting. Crown members of cornices when not extending the full depth may be dowelled onto the supporting stone member underneath same and also be anchored back, if not securely balanced on the bed against any possibility of overturning and where considered necessary may be jointed with a keyed check.

***Column Drums:***—The dowelling of large column drums is not considered essential but on the other hand decidedly unnecessary. Picking the beds will provide ample key in the mortar joint.

***Dowels:***—The very best dowels for balusters, baluster rails, mullions and all ordinary light work are made of ½-inch size heavy brass pipe cut about 3 inches long. Such dowels are preferable to solid brass or bronze pins and may also be used for Gothic mullions and tracery, when this is not too slender in scale requiring that ⅜ inch solid dowel pin be used. ¾-inch diameter holes should be drilled for these pipe dowels to provide equal penetration into both stones and these dowels whenever practical be set in the upper piece first, which enables a more secure grouting of both ends of dowel.

Iron pipe dowels may be substituted for brass pipe dowels in the cheaper grade of work only, **not galvanized iron pipe** but ordinary black pipe thoroughly galvanized after it has been cut to length for dowels.

Baluster rails, etc., should have dowels in vertical joints only when jointed in a long run between Balustrade piers and may be dowelled onto piers with vertical dowels in the bed joint, always using bronze or brass pins where the brass pipe dowels are too large. It is frequently better for the stones forming Baluster rails to be keyed together, with lead or with a stone key let into a check.

Coping stones on gables or hips may be dowelled at lower end into kneelers and at joints between coping stones but should only be keyed into kneelers at upper ends of same and at key stone.

## *APPENDIX "J"*

### *Handling, Setting and Protection of Cut Stone*

***Delivery, Handling and Storage:***—By far the greatest quantity of Cut Stone, particularly Indiana Limestone, that is used in modern building construction, is cut and entirely finished ready for setting in the wall before it is delivered to the building site. This applies both to the stone that is cut by the large mills in the Indiana Limestone district and to the still greater volume that is cut in the local or city stone yards and mills throughout the country.

Therefore, the great majority of Cut Stone, whether it is plain sawed ashlar, steps, sills, etc.; either simple or elaborate trim; or highly enriched cut and carved work; when delivered to the building is a finished product and should be treated as such and be afforded the same care in handling and storage which is generally, as a matter of course, accorded to every other material of value that is used in building construction.

No one would think of throwing fine interior millwork, interior marble or other finished interior items around in the mud, but the very fact that Stone is stone, seems often to be taken as an excuse for handling it with no more care than if it

were a carload of rough rubble stone for foundations or other rough structural purposes.

The finish of the exterior is certainly just as important as the interior, in fact, more people will see the exterior and know the building only by its outer appearance, and cut stone is the most important item used for that purpose in buildings large and small.

An Architect cannot expect stonework of distinctive appearance if the unloading, storage and setting of the Cut Stone is not placed in the hands of someone experienced and capable, so that proper and sympathetic handling is assured.

For this reason it is considered advisable for Architects to control the subletting of this work under the terms of specifications and contract.

Cut Stone stacked at the building must not be made a resting place for workmen or a depository for dinner pails and their contents, or a convenient place on which to unload and pile other materials and items of equipment, which are by no means infrequent occurrences.

Cut Stone should not be stacked in such a manner that entire weight is resting on the arrises. Excelsior and soft wood strips should be used to properly separate the finished faces when cut stone is stacked in piles and, in addition to being placed on a platform or planking raised free of contact with the ground, it should be barricaded or fenced in, when stored for extended periods at building site. The joints are an important element in the design and snipped arrises will impair the effect of the finished work.

The question of skilled workmanship in setting is also important. It is common experience that stone of a lower grade carefully cut and properly set in skilled manner can be made to appear equal in every way to the finest product of the quarry. The very best workmanship in cutting can and often is negatived by improper handling in the setting operation.

Some Architects specify that all stone weighing over 80 pounds shall be set with a derrick. This is a rather low limit and it is considered entirely safe and proper to leave the exact method of handling to the Setting Contractor, once the work has been placed in charge of an experienced setter.

Full information regarding setting mortars including Mortar materials and formulae for various mortar compositions will be found in Appendix "H" and references to Anchorage, Anchors, Dowels, etc., in Appendix "I." Additional information pertaining in a general way to the setting of Cut Stone will also be found in Appendices "C" and "D."

***Erection of Stone Facing for Tall Buildings:***—In the erection of a Stone Facing for modern skeleton frame structures, it is important that the work be executed in a manner which will insure that the steel frame actually supports the wall loads it is intended to carry.

This may mean that the building of enclosure walls, including the setting of facing, should be started on one of the upper stories, working down instead of up, or starting the work at two or three stages in the upper stories. It is generally advisable to leave the setting of the more or less monumental work in lower stories until last, so as to be assured that the structural frame is carrying the full load of upper walls, before the lower work is set. This will avoid unintended and excessive loading on the Stone work of lower stories.

***Lewis Holes:***—There is some difference of opinion as to just what stone should be Lewis holed and it is difficult to give a rule that should apply in all cases, on account of the varying local conditions and methods of handling.

The Building Codes of some cities require that all stone weighing around 100 pounds or more be lifted with Lewises. In other places grab hooks are generally used for setting of ashlar and most other stone weighing up to 300 or 400 pounds.

On the other hand some Cut Stone Contractors make it a rule to Lewis practically all stone on account of the greater convenience and safety in handling. Therefore it is advisable to consult the local Building Code and in some cities it will be found necessary to change the specification clause to require that all stone weighing over 75 or 80 pounds be Lewis holed.

Where use of grab hooks is the general custom the requirement may be changed to make Lewis holes necessary only for stones weighing over 300 pounds.

***Base Course:***—The bedding of base course on foundation walls should always receive special attention, because it is at this point that any slight settlement of foundation will be either taken up or be transmitted to stone work above. No general rule can be given as nothing will prevent cracking of the walls above if the foundation settles unevenly. A thick mortar bed and back joint at base course, by reason of the lesser strength of mortar, will often provide a cushion that will take up very slight irregularities in settlement.

***Wood Wedges:***—The wedges for use in setting of Limestone are best made of soft pine, white wood or spruce and should be 2½ inches to 2¾ inches long, ⅞ inch wide and ½ inch thick at butt, tapered to an edge $\frac{1}{16}$ inch to ⅛ inch thick. It is important that all wood wedges in setting be thoroughly soaked before use, so that they will swell all they are going to before being built in the wall, and will shrink again as they dry out with the drying out of setting mortar.

If dry wedges are used, the swelling of same by absorption of moisture from mortar is often sufficient to lift the stone and destroy the mortar bond in joints or to spall off the face of the stone, or they may cause spalling of the stone later on, by the

difficulty of removal when the building is being cleaned down and pointed. Thoroughly soaked wedges of fairly soft wood will shrink sufficient to make their removal easy and without danger of damage to stone.

Wood wedges should always be removed to a depth of at least ¾ inch and the entire wedge be removed whenever possible, before pointing up is done. It is not good practice to simply break off the wedges just within face line of wall, but that is what often happens where they are not properly soaked and swell after they are set in the wall, making their removal a very difficult matter.

***Setting Column Sections, Etc:*** — Wood wedges are not satisfactory for the setting of large column sections, bases for statuary and other large stone and all items of this character should be set on lead buttons or pads. Three lead buttons are generally used for Columns, as three buttons are preferable to a greater number for nearly all purposes, on account of the tripod effect of a three-point bearing.

Lead buttons are nothing more than little square or circular pieces of sheet lead which are cut from $\frac{3}{16}$ inch or ¼ inch thick sheet lead according to thickness of joint desired, and for columns are usually about 1½ inches square set 3 inches back from the face of column. Beds are then filled with mortar all around these buttons, but keeping mortar off top of buttons.

These buttons serve to arrest the uneven descent of block and assure the proper and even bedding of same without possibility of snipping the edges and to prevent the improper squeezing out or crushing of mortar during process of hardening. Wood wedges are not satisfactory for setting of heavy column sections, etc., for the reason that if the stone strikes one wedge before it settles on the bed it may snip the edge and cause damage that often cannot be repaired without leaving an unsightly blemish.

Heavy Column sections are sometimes set with sheet lead beds, without Mortar, except for pointing, but this is not the usual practice. For this purpose sheet lead should be kept about 2 inches in from face of column and have a fair size hole cut out of the center to allow for squeezing to a solid bearing over entire area of joint.

All large blocks whether set on lead buttons or pads, or on wood wedges should have the joints thoroughly filled with stiff mortar by working same in with a mortar sabre, or saw blade or other suitable tool, until the stone appears to float on the mortar bed. The mortar sabre is a tool extensively used abroad, but in this country is usually replaced by an old carpenter's saw, where something longer than a trowel must be used.

***Setting Cornices, Belt Courses and Copings:*** —It is very important that the vertical joints in all cornices or belt courses projecting from the face of building wall, the top members of all main cornices and copings and Balustrade rails, be thoroughly filled with setting mortar. Where this is not done the passage of water is sure to show in some manner on the face of stone work and probably disfigure an otherwise fine piece of work.

Vertical joints in such members cannot be properly filled simply by slushing up at time of setting and should always be grouted solid. It is a mistake to make these joints less than a full ¼ inch, regardless of the thickness of joints elsewhere throughout the work. The stone should be set with the vertical joints dry and the exterior profile of the members be carefully caulked with picked oakum *or newspapers soaked in water* and the joint be poured full with as thick a mortar grout as can be properly worked into same, allowing the usual ¾ inch of depth at top of joint for pointing up later. With very large stone, it is advisable to cut an inverted "V" shape key channel on vertical joints to facilitate this grouting.

The caulking is later removed and thus provides the necessary space for pointing up of joints. If the grout is too thin, it will tend to shrink away from the stone in setting and the joint may not be tight. To avoid this shrinkage a proper portion of sand should always be used and the grout be continually stirred until used to prevent the separation and settling of the sand.

Large cornice members are sometimes caulked with lead wool as an extra precaution. Where this is to be done, the grouting should only fill joint to within about 2 inches of top and a full inch of this depth be caulked with lead wool driven in tightly leaving the upper ¾ inch for pointing mortar.

Sometimes the grouting is dispensed with, the stone being bedded with vertical joints buttered with mortar and caulking with lead wool or oakum relied upon to make them tight, but this is not considered as good practice as the proper grouting of these joints. Lead wool, when used, should supplement and not replace the thorough filling of vertical joints in cornices and other exposed horizontal members.

Objection is sometimes raised to the grouting of Cornices and Belt Courses because it usually involves the use of an outside scaffold but this hardly seems a logical objection. (See Notes under heading of "Scaffolding," page 52.)

Still another scheme is to substitute an elastic caulking cement for the ¾ inch of pointing mortar on all top surfaces, washes, gutters, etc. Only caulking compounds that are light in color and free from oils and grease that would discolor the stone, are suitable for this purpose.

The greatest advantage of an elastic caulking compound is for caulking the coping and parapet walls built on top of modern steel frame structures, rather than for work in connection with buildings having solid masonry walls, as these skeleton frame structures are more subject to movement

from wind stress and due to expansion and contraction of the structural frame. For reference to Elastic Caulking Cements or compounds, see Appendix "E."

By way of comment it may be stated that many old-time masons consider that newspaper soaked in water to be an excellent caulking material for interior of stonework and protected or unexposed caulking purposes, such as back of window frames, etc. Newspaper caulking used for such purposes in old buildings, upon demolition of these buildings has been found to be in perfect condition after a round 100 years of service.

***Setting Arches:***—Before arches are set the center should be established and the position of all joints be accurately laid out on centers. Setting the springers and lower quarters of an arch is more nearly like bedding other stone and usually presents no particular difficulty, but the upper half of arches require particular care in bedding of joints. First of all, arches should never be detailed with too fine a joint. ¼ inch is the minimum that should be allowed.

Small arches may always be set with a full bed of mortar on all voussoirs, including keystone. Large arches are sometimes set with only a ring of mortar around the edge of voussoir joints which are then grouted full. Except for very large arches this is not considered to be the best practice, or as satisfactory as setting the Arch Stone in a full bed of mortar. Even with very large arches only the upper half would need to have grouted joints and where grouting is required, the cutting of a key channel on both sides of joint is generally advisable.

Very large arch stones are sometimes set with lead pads or buttons same as used for column drums and with these it is possible to set the arch dry, drop the center, then caulk the profile of joints and grout them full, but the nearly level joints adjacent to spring line cannot be readily grouted and these should be bedded in the usual manner.

The mortar for bedding arches should be a little thinner and more plastic than the average good setting mortar mixture and the stone should be set in a very full bed of mortar and be rammed tight to the point of squeezing out of mortar, in order to insure a thorough bedding of all Arch Stones.

Wood wedges may be used to facilitate the even bedding of Arch Stones one-quarter way up from springer, beyond which they should not be used. In setting stones in the upper half of arch the weight should be suspended with a taut derrick line until the block has been rammed to a solid bed on the block below, before weight is finally dropped onto centers.

Sometimes Arch Voussoirs are cut with a sinkage in center of beds for a mortar key, but this is very unusual and is not recommended except for special work, where it is necessary to provide specially for resistance to vibration or other action that might tend to break the bond and cause lateral movement; as in the stone facing of a steel railway viaduct. Ordinarily an inverted "V" shape grouting channel would amply provide for this requirement.

***Ribbed Vaults:***—For ribbed vault arches the springers will usually form a part of and be set with the piers. The main ribs should always be set first, then secondary ribs and finally the filling in of field or ceiling arches. The first operation in setting work of this character is to accurately locate and set the bosses, starting with main boss. The ribs are then set and keyed up to bosses. Unless it is assured that the weight of this work will defect the centering sufficient to assure proper arch action in the ribs before the field is set, arrangements should be made to lower slightly the centering under ribs, by the partial withdrawal of wedges supporting this centering, before proceeding with the setting of field.

Since the arched filling of groined and ribbed vaults must be set on centering and be keyed up with the soffit practically out of sight, this usually requires that the soffit be gone over and dressed up after the centers have been removed, in order to correct the minor irregularities of setting, that cannot be avoided where the stone is set with the face on a form. This refers both to the truing up the joint lines and to the perfecting of soffit curves.

***Gothic Tracery:***—*See also Appendix "D."*

Where the tracery is cut solid on the jambs requiring that the setting of tracery proceed along with the balance of wall, it is very important that great care be exercised in the setting of jamb stones and the arches over openings, to thoroughly bed the work, so as to avoid settlement of the arch after the wall above has been built, which would throw the load from same onto the tracery. Where the wall is thick and the arch Stones deep, it is sometimes advisable to set the upper third of arch on lead pads, caulk and grout same, as previously referred to under setting of arches.

Where the tracery is detailed separate from jambs and arch, it is customary to provide a check for tracery about 1½ inches deep and the tracery should then be set after the wall is entirely completed. Tracery should be bedded in this check with a tight mortar joint at back and on outside, and on the inside of check be caulked solid and watertight with oakum, the caulking being driven down into check about ½ inch to allow for pointing.

Where the intricate detail of tracery does not permit the usual length of dowel to be used, in the setting of same into opening, a short dowel, or a key of stone, slate or lead should be used.

***Sills:***—The proper and usual method of setting door and window sills by bedding only the ends of same is so well understood that it requires no

further comment. There is one exception to this rule, which is in connection with sills for mullioned windows that are not jointed under all mullions, requiring that such sills be carefully bedded at all points forming bearing under mullions.

***Raked Joints:***—When raked joints are specified for the ashlar facing, the stone should be set in a slightly stiffer mortar than usual, the use of wedges omitted wherever possible and the joint be filled fairly close to face of stone so that it can be raked out to an even depth and with the assurance that joint is filled weathertight at back of groove thus formed. Raked joints should usually have a depth of ½ inch or ⅝ inch, but never more than that and ⅜ inch is frequently sufficient.

***Temporary Covering and Stain Prevention:***—As elsewhere stated, there always exists the greatest danger of staining the finished work from the passage of moisture into the stone from the backing or other masonry with which it is placed in contact. The wash from floors and scaffolding above must not be permitted to fall upon the stone work, or be absorbed into masonry backing of same. The setter should always cooperate to see that the walls are properly protected at all times during construction and until they have been capped off and the tops of same properly caulked or flashed. This will avoid trouble for everyone concerned, the setter included but is seldom given the attention it deserves.

Dirt, soot, brick dust, scum from top of concrete floor construction and other matter is frequently washed down from scaffolding and floors above onto unfinished walls during rains and is often the source of discoloration trouble in the finished stone work. This will usually bleach out in time but is certainly an unsightly disfiguration while it lasts, and with proper care is always preventable.

It is equally important to protect the walls from all water to prevent damage during cold weather, as the action of frost and snow may destroy the bond between the stone facing and backing, or cause serious damage to the appearance of stone work later on, by efflorescence from the mortar and a darkening of the stone. *See Note 55 and Supplementary Clause 55-a.*

***Freezing Weather:***—The use of Salt for the removal of Ice from Lewis or Anchor Holes should never be permitted. Care should be exercised to prevent moisture or snow accumulating in the Lewis holes, etc., and when this does occur, the best way to remove it is to cut it out clean with a chisel, recutting the size of hole a sixteenth inch or so larger all around in the operation.

Salt should never be used, even on the outer surfaces of Cut Stone, to facilitate the removal of ice as unsightly efflorescence that may continue for a long time, is almost certain to result. Stone coated with ice should be taken into a warm place and be allowed to thaw out and dry.

If only a comparatively few small pieces are affected, they may be dipped into a barrel of clean warm water for the removal of frost and then be allowed to dry in a warm room, the water in barrel being kept warm by the insertion of a coil of pipe through which exhaust steam may be run.

***Protection of Finished Work:***—This is separate and distinct from the temporary covering of unfinished work at night and during inclement weather and should be separately provided for in the Specifications. *See Note 57 and Supplementary Clause 57-a.*

This work is more properly included with the rough carpentry work, although on large operations it is sometimes included in the General Masonry contract but it should not be included, or only covered in a general way under the setting of Cut Stone, as it usually involves carpentry work that cannot be done by masons and is invariably specifically excepted by all Cut Stone Contractors, in their bids.

What little money is required to properly carry out this provision is amply repaid in the appearance of the finished structure. In work of minor importance, red resin sized building paper is frequently used for protection and while this is satisfactory for small buildings, paper alone will not prevent injury from falling tools, or brick, etc. When used, paper should be carefully built in the joints to a depth of only ¾ inch and be held in place with wedges until the building is finished and cleaned down for pointing. This may be included in the Setting Contract. *See Alternate Clause 57-b.*

***Scaffolding:***—Since an outside Scaffold is required for the cleaning down and pointing and is generally advisable for other operations in connection with the setting of Stone work on any fair size job; as it is difficult, especially when the units are large, to turn out a really first class and satisfactory job of setting where the work is handled entirely from an inside scaffold, the use of an outside scaffold is recommended whenever this is practicable, as it facilitates erection and enables the Stone Setter and Bricklayer to work simultaneously without constantly interfering with each other.

Modern types of outside hanging scaffold are coming into more general use by Contractors, especially for skeleton frame buildings and usually result in a considerable saving in the time and cost of erection, over the old methods.

***Flashing Cut Stone:***—See Appendix "E" for reference to Flashing and Sheet Metal work in connection with Cut Stone.

***Stain Prevention:***—The occasional staining or discoloration of Indiana Limestone, it must be remembered, is invariably occasioned by some external agency either acting in a chemical

way upon the stone, or depositing some insoluble matter in the pore space adjacent to face. Every precaution should be taken in connection with the setting of stone to prevent this, particularly to prevent water from leaching through stone, or moisture passing from cement mortar or concrete into the stone. Back-painting of stone with Bituminous preparations, however, is specifically condemned. For further information bearing on this subject, see Appendices "C," "D" and "G."

## *APPENDIX "K"*

### *The Cleaning of Indiana Limestone*

The subject of cleaning may be divided into three general classes as follows:

1. The cleaning down of Stone work upon completion. This is usually done at time of pointing and after all other exterior work is finished.

2. The removal of staining or discoloration, caused by the setting of dirty stone; the use of bad sand, or Portland Cement; or by other causes external to the stone, the results of which may appear prior to or sometime after completion of the work.

3. The cleaning or renovation of old buildings and old stone work generally.

***Cleaning Down New Stonework:***—The first presents no particular problem, if the work has been properly detailed, handled and set. It consists of the simple scrubbing down of building with soap powder and water, and the occasional use of a little fine white sand where some abrasive action is necessary to cut the dirt. Chemical cleaning powder compounds should not be used in lieu of standard Household soap powder, and only stiff fibre scrubbing brushes should be used. It is on trim jobs that trouble from improper cleaning down methods is most likely to occur, as it is customary to clean down the brickwork with acid solutions.

The Limestone should always be copiously drenched with clean water from a hose during the process of cleaning. The use of metal scraping tool should be permitted only for the removal of mortar dropped or splashed onto stone and not previously removed. Stone work of fine appearance that will weather beautifully will be the result.

***Removal of Stain:***—The second division embraces all major problems connected with cleaning, all of which can be avoided and therefore should be overcome by "prevention" rather than by "cure."

It is difficult to formulate any general recommendations, as each instance should receive the special attention that the contributing causes appear to make necessary. This subject will be treated on by a special Bulletin in Series "A" of the Indiana Limestone Service Publications. Architects and Builders, or others who are professionally interested, are requested to consult the Service Department for further information and advice on these cleaning problems, accompanying inquiries with as full a recital of the facts as possible.

Recommendations for the prevention of staining will be found in the other Appendices and throughout the notes accompanying the Specification. To reiterate: the stone, before setting should be cleaned by exactly similar method to that recommended for the final cleaning down of stone work. It is not sufficient to simply dip the stone in water or run a hose stream over it prior to setting, it should be washed clean of all dirt and foreign matter of every kind, by scrubbing with fibre brushes, using an approved soap-powder, plenty of clean water, and white sand, if an abrasive is necessary to remove the dirt.

Clean stone and properly made Setting Mortar will go a long way toward assuring a building that will dry out to a beautiful clean light color tone, resulting in a most satisfactory job, creditable alike to Architect and Contractors.

Ordinary discoloration of the Stone work, occasioned only by the use of dirty stone may often be eradicated by a simple process. This consists of repeated alternate 30 minute continuous drenchings by a hose and hourly drying periods, which must be continued for several days. This process has proven effective for removing dark spots of considerable size.

***Renovating Old Stonework:***—The third division has nothing to do with the original construction of stone buildings and unfortunately, except in connection with alterations and additions, does not often come to the Architect's, or even the Builder's attention.

Therefore, it embraces problems that are not usually considered of direct interest to Architects.

This should not be the case. Architects should not stand by and see the appearance of their fine work seriously, if not irreparably damaged, by improper cleaning or renovation methods. In the interest of the permanent good appearance of their work, every Architect should make it a

practice to caution the owners of Stone Buildings designed by them, not to employ any cleaning processes without first consulting someone qualified to advise and pass judgment on same. This applies with equal force to all Natural Building Stones.

Architects can with propriety suggest that owners either take the matter up with them or consult the Technical Division of the industry, whose facing material has been used.

Whenever cleaning of old stone work is considered advisable, or necessary, as in the case of altered buildings, where it is desired to have the old and new work match up as nearly as possible in color tone, only the approved cleaning by scrubbing with soap powder and water should be resorted to. Sand Blast, acid or chemical preparation cleaning and cleaning by wire brushes or metal tools should never be employed. The Technical Division of the Association will be pleased to furnish gratis all information available on this subject and to advise on all problems involving the cleaning of Indiana Limestone.

The growing improper use of Sand Blast for the cleaning of Natural Stone is of vital interest to Architects and its combatal should be made a subject for personal attention, whenever such matters come to their attention. The roughening of surface and opening of pores, occasioned by sand blast, will only facilitate the more rapid accumulation of grime from the atmosphere.

Acid cleaning is often even more dangerous to the general appearance of building, as it will affect the permanence of the surface of the Stone.

Architects can be assured of the cooperation of this Association on all matters pertaining to the proper preservation of natural stone buildings and it will be esteemed a favor, if they will notify the Service Department when matters of this kind come to their attention.

***Permanent Beauty and Weathering Qualities:***—Indiana Limestone possesses a remarkable self-cleaning quality and will resist the accumulation of a coating of grime to a greater extent and retain its fine light natural color tone for a longer time than any other Building Material, White Glazed Terra Cotta included.

This is not theory but well established fact, that will be clearly demonstrated by a comparison of the condition of buildings faced with different materials in most large cities. The few instances where Indiana Limestone uncleaned after years of exposure to severe atmospheric conditions, does not present a better, cleaner and more pleasing appearance than the frequently cleaned glazed surface materials, may be directly attributed to some improper condition connected with the construction of the work.

Upon no other building material does the often destructive hand of time, touch more gently than upon properly constructed Indiana Limestone. This is demonstrated by the numerous fine buildings of considerable age that preserve their handsome original appearance but slightly mellowed by time and exposure to the elements.

This may be explained as follows:

There apparently exists an affinity between oils and glassy or glazed surfaces on to which the oily soot contained in the atmosphere of our manufacturing cities adheres tenaciously and rapidly forms a heavy coating. Such surfaces will often in a short period of time, become more dead and blacker in appearance than the surface of roughly finished granite, the very nature of which surface would be expected to offer the maximum lodgment for a coating of dirt.

Indiana Limestone, on the other hand, possesses a so-called self cleaning quality, due to an apparent neutralizing and repelling action, which prevents the soot from adhering to the surface and causes it to be continually washed off by heavy rains. This combined with the bleaching action of the sun accounts for the fine appearances of Indiana Limestone buildings after many years of exposure and except under the very worst conditions of exposure, makes cleaning unnecessary.

Any claims that other materials can more easily be cleaned are thus more than offset to advantage, by the fact that Indiana Limestone does not require frequent, if any, cleaning.

Certain prominent Architects have voiced the opinion that the cleaning of a fine natural stone building which has aged gracefully is a sacrilege, and a constantly growing number of leading Architects are at least coming to look upon such cleaning as undesirable.

These Architects, further, are taking every precaution in designing their Buildings, to detail the work so as to prevent disfiguring washes over the face of the stonework. This thought appears to be worthy of far greater consideration than it has received in the past. In cases where the stone work of buildings was originally badly stained on account of improper mortar or setting methods, this staining has often in time bleached out or gradually disappeared, resulting in a contsant improvement in the appearance of these structures; the errors of man being corrected by the somewhat slow but untiring process of nature; but where the disfiguring stain is the result of a wash, due to improper detailing the natural cleaning process is under a continuous handicap and cannot accomplish much improvement.

# *APPENDIX "L"*

## *Random Ashlar Wall Facing*

*of*

## Random Indiana Limestone Ashlar

"Random Ashlar" as customarily applied is a broad term, in that it covers such a wide range of work, embracing nearly everything between Random Rubble stone wall construction and the regularly coursed Cut Stone Ashlar. Random Ashlar may have sawed, smooth, tooled or rock face finish and involve only a few, or many sizes of units; and in fact, be widely varied in character of treatment.

The Random Ashlar particularly referred to here is that form of facing which can be produced from sawed-four-side material, or for rock face work from either sawed-four-side split in two, or from slabs of sawed two side material split to the thickness of bed required.

Short length quarry blocks, quarry-run as to color and texture, are used for this purpose and the product known as "RANDOM INDIANA LIMESTONE ASHLAR" makes this stone available in a form that affects considerable economy in the use of a stone facing for buildings of informal or semi-formal design.

This makes the employment of a stone facing entirely practical for buildings that must be confined within certain restricted limits of cost, notwithstanding the fact that a stone facing is desired and in every way preferable to the use of other facing materials.

RANDOM INDIANA LIMESTONE ASHLAR is of itself capable of a wide range of treatment. The Architect is not confined to units of a given size or shape. The scale can be varied to suit the design of any particular building and the units be made proportionately long or square according to the general character of the design. Innumerable jointing schemes may be worked out employing comparatively few course heights.

This form of wall facing may, with equally satisfactory results, be combined with severely plain, or elaborately moulded and carved trim, and in the simpler moderate cost buildings, may be used alone, or with the cut trim limited to an entrance or other single feature.

Architects will find its possibilities worthy of the most careful study. Furthermore, it will in many instances be found that the cost of this product in the finished wall will actually be less than cheap local stone, on account of the saving in labor.

Random Ashlar wall facing is essentially Mason work and should be treated as such and always be kept separate from the Cut Stone work in Specifications.

Other Publications of the Association will treat more fully on this product, its possibilities and use. The specification prepared and recommended to provide for this form of wall facing is issued separately, as a Masonry Specification, as this is not intended to cover any work that should be classed as Cut Stone, or ordinarily included as such. But in those sections of the country where regular Mason Contractors do not exist, this work can best be handled by the Cut Stone Trade.

In those localities where established and responsible Mason Contractors, who can furnish estimates on important work, are not to be found, Architects will often find that it is an advantage to secure estimates from the regular Cut Stone Contractors, having them handle this work, even though it is to be sublet to local Masons.

Where this work must be handled by the Cut Stone Contractors, it is important that they be made to understand that it is Mason work, jointed on the job, and not Cut Stone work, and is not to be accurately cut to previously prepared detail drawings, as this will materially affect the cost of this form of wall facing.

Another important factor in the cost, is the careful working out of a general scheme for layout and jointing, requiring the employment of as few a number of course heights as will give the desired result. And the Cut Stone trim should be made to fit and bond with the adopted scheme of Random Ashlar wall facing. It is much easier and less costly, to use a few standard heights of unit for facing, cutting the trim to fractional heights where necessary, than to require all the facing; constituting the bulk of the work; to be cut to special heights of courses to conform with the previously arranged quoining of trim.

Most schemes of Random Ashlar Facing ordinarily desired, can be worked out with from four to six units of height, many with but three or four and even the more elaborate schemes with comparatively few height units.

It is also desirable to use units of height that are multiples of and will conform with the course heights of standard size Brick or Hollow Tile Backing units, whenever this is practical, in order to facilitate the proper bonding of facing and backing, without unnecessary and wasteful cutting and fitting of the backing material.

# GENERAL INDEX



# INDEX TO APPENDICES

*List of Members of the*

INDIANA LIMESTONE QUARRYMEN'S ASSOCIATION
supporting the technical, research and service work of this Organization for the benefit of Architects, the Cut Stone Trade and all users of Indiana Limestone.

Bloomington-Bedford Stone Co. Bloomington, Ind.
Chicago & Bloomington Stone Co., Bloomington, Ind.
Consolidated Stone Co. - - - Bedford, Ind.
Crescent Stone Co. - - - Bloomington, Ind.
Empire Stone Co. - - - Bloomington, Ind.
Furst-Kerber Cut Stone Co. - - Bedford, Ind.
Hunter Bros. Stone Co. - - Bloomington, Ind.
Imperial Stone Co. - - - - Bedford, Ind.
Indiana Quarries Co. - - - Bedford, Ind.
J. Hoadley & Sons Co. - - Bloomington, Ind.
Mathers Stone Co. - - - Bloomington, Ind.
Monroe County Oolitic Stone Co., Bloomington, Ind.
National Stone Co. - - - Bloomington, Ind.
Perry Stone Co. - - - Ellettsville, Ind.
Shea & Donnelly Co. - - - Bedford, Ind.
Star Stone Co. - - - - Bloomington, Ind.
W. McMillan & Son - - - Bedford, Ind.

---

## *ASSOCIATION SERVICE*

Architects and Builders are cordially requested to make free use of the Service Department and Bureaus of the Association as a source of reliable and impartial information regarding the products of the industry and their proper and economical use and for assistance on any of their problems pertaining to INDIANA LIMESTONE and its employment in building construction.

---

*Address: SERVICE DEPARTMENT, P. O. Box 500, Bedford, Indiana*

# INDIANA LIMESTONE

The ARISTOCRAT of BUILDING MATERIALS

STANDARD SPECIFICATIONS
Issue of September, 1922