

BUILDING REGULATIONS FOR MANILA;  
DRAWN UP IN CONSEQUENCE OF THE EARTHQUAKES  
OF 18TH AND 20TH JULY, 1880.

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Government-General of the Philippine Islands, Civil Administration, Public Works Branch.

In accordance with the orders of His Majesty's Government, contained in the official telegraphic despatch of the 21st of last month, relating to the plans and technical conditions to which public and private buildings in these provinces are subjected ;

Considering the opinion expressed by the Consulting Committee of Public Works and by the General Meeting of the Administrative Council ;

Considering the law 4, title 23, part 7 of the last official volume of laws which applied the law 7, title 19, part 3, of the same Code to all the dominions of his Majesty ;

Considering that the Administration has the incontestable right and the unavoidable duty of looking after the security of the inhabitants, greatly threatened by the falling of stone-buildings during the earthquakes which so frequently disturb this soil ;

Considering that the serious losses sustained by house owners render it necessary to harmonize as far as possible the interests of the public with those of the respectable class (the house-owners), unfortunately now, so worthy of commiseration, and to which class the greatest guarantees must be given that

all regulations relating to building, dictated by the authorities, are based upon the most strict justice and equity ;

Considering that public buildings, usually employed to lodge or to receive for a certain time a considerable number of persons, must be built in a suitable manner and under such conditions as to prevent their destruction in case of earthquakes ;

Considering that even in the interest of the house-owners it is desirable that private buildings offer due guarantee of security to their inmates ;

In accordance with the reports of the Consulting Committee of Public Works, of the Inspectorate-General of the same branch and of the Administrative Council, and by proposition of the Director General of Civil Administration, I do provisionally decree the following, without prejudice to any final resolution which may be dictated by the Supreme Government :—

1.—Public buildings which may be built in future, without taking into consideration the funds by means of which the building expenses will be defrayed, must be subjected in their construction to the rules proposed by the Inspectorate-General and which are approved to that effect, the same rules being in complete agreement with the opinion expressed by the Consulting Committee.

2.—The provincial chiefs must not permit, under any pretext, that public buildings be constructed or repaired, without their respective projects having been approved by this Government-General, excepting in cases of urgent repairs, which may be authorized by the local authorities.

3.—The projects of public buildings, which are not at the charge of the State or of local funds, must be presented with sufficient details, to clearly explain the proposed system of construction, however, always within the rules previously alluded to.

4.—Every building of a public character must be inspected, before being opened to use, by a competent person, who will be appointed by the Inspectorate-General of Public Works.

5.—Building licences, within the Municipal district of Manila will be issued by the City Mayor, previous information of the project having been given by the Municipal Architect.

Projects must be subjected to the above-mentioned rules.

6.—It will be not necessary to present projects for houses built of wood and covered with “nipa.”

7.—When the construction of a house in the Capital is finished, it must be inspected before being occupied, by the Municipal Architect, the owner having been previously summoned, in order to prove whether the work has been done strictly according to the approved project, whether the buildings are well constructed, and whether the materials employed are of good quality.

The proprietor of any new building, who shall occupy or lease the same without this inspection, will be liable to a fine of \$200, and should the inspectors compel the lessee to leave the house the owner will, in addition, be responsible for the damages and injuries occasioned to him.

8.—In case that in the other communes of the Archipelago there should be no competent persons to whom the inhabitants can address themselves for the compilation of building projects, the presentation of the project for private buildings in these communes will be, for the present, not required; but the houses must be inspected, when finished and before their occupation, by a competent person of the Public Works Office, who resides in the province, or in default of this by the building master appointed by the provincial chief of the Public Works Office.

9.—To every application for repairs in the Capital, a detailed description of the imperfections of the house must be attached. In this description, the works which are applied for

must be clearly described. It is in the power of the Mayor to grant the licence, after considering the report of the Municipal Architect and the statement of the house-owner. In the licence, the works, which have to be done, must be described, in order that the building may offer proper security.

With reference to the effects provided in Article 7 of this decree every repaired house will be considered as a new building.

10.—In the provincial capitals, licences for repairs must be granted by the Governors, who are entitled to delegate to the Sub-Prefects the concession of those, which would be required in their districts. To these works are applied the prescriptions of Article 8 of this decree.

11.—The Mayor of Manila and the chiefs of provinces must see that a competent person examines, without delay, all buildings which have suffered during the last earthquakes, or which in consequence of their peculiar system of construction might be considered as dangerous. These inspections will include buildings covered with ordinary tiles, those having walls or buttresses of stones over the foundations, and all others which might appear damaged.

The owners or their representatives must be summoned and a statement must be prepared of the condition of the house. In this document the visa or the protest of the owner against the fact contained in the protocol must be noted.

12.—After consideration of the inspection mentioned in the preceeding article, the Mayor of Manila or the provincial chiefs will declare the building either in good condition, in good condition after execution of the specified repairs, dangerous or ruinous.

13.—In the declaration of dangerous, the part or the parts of the building which are considered as such, even should they not present signs of ruin, must be specified; it being sufficient to mention errors in construction or bad arrangement

of materials, or any other defect which rationally can be considered as a danger for the inmates, for the neighbouring houses, or for the public road during earthquakes.

14.—The owners of buildings which are declared dangerous, must present, within one month, the project of repairs or of alteration of the same houses. Should their plans not be approved, another equal delay will be granted to them, in order to modify their projects.

After this term the Administration will proceed, at the expense of the party concerned, to the compilation of the projects for repairs, and hand over the same to suitable persons who will execute the works.

15.—According to the importance of the work of repairs or of alteration in the buildings declared dangerous, a period will be established, within which the work must be finished, the Administration being authorized, in case of delay on the part of the house owner, to pull down, at his own expense, the dangerous part of the house.

16.—Should a building be declared ruined, the part which has to be pulled down, and the period within which this work has to be carried out, must be specified.

17.—The concerned party can appeal against the decisions of the Mayor of Manila and of the provincial Chiefs in building matters to this Government, which will definitely and without further appeal decide, on the proposition of the Direction-General of Civil Administration, and after having heard the opinion of the Consulting Committee of Public Works.

18.—The authorities charged with the execution of this decree must forward every month to the Direction-General of the Civil Administration a report of the buildings which have been visited, giving the description of each building and enclosing a copy of the respective technical certificates made by the surveyor.

They must, at the same time, report the work of repairs or

of alteration, which have been deemed necessary, and have been finished, transmitting copy of the certificates proving the accomplishment of such works.

Let this decree be communicated to all whom it may concern and published for general information, with the approved rules and with the technical opinion of the Consulting Committee of Public Works, which opinion has served as a base to the same rules, and let a copy of this decree be presented to H.E. Minister for Colonies.

(Signed)

PRIMO DE RIVEIRA.

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PRINCIPAL RULES, IN ACCORDANCE WITH WHICH PUBLIC AND PRIVATE BUILDINGS MUST BE CONSTRUCTED OR REPAIRED IN THE PHILIPPINE ISLANDS.

1.—In every project for building, the class and character of the soil is to be reported, giving the depth at which water is met or filtrations appear.

2.—To determine the dimensions of the foundations it must be supposed that they have to bear a weight double the actual weight, in order to guard against the effects which the movement of earthquake vibrations may produce upon that part of the building.

3.—In case of building upon mud or other soils of little consistency, the project must show the proposed method of consolidation as well as the dimensions of piles, platforms, and sheet piling.

4.—The material for foundations upon wet soil must be of hydraulic composition, and proper proportions are to be used in the composition of the mortar to render the walls impermeable and proof against disintegration from the constant action of water.

5.—The construction of continuous foundations is specially recommended; separate foundations for piers or buttresses are, however, authorized, if of adequate dimensions, but only

when it can be shown that considerable economy results from such an arrangement.

6.—The excellent character of hydraulic concrete, the homogeneity of its mass, and the perfect consistency of all its parts recommend it above all other materials for the foundation of every class of buildings.

It is, however, permitted to build stone foundations of volcanic tuff, employing squared stones and placing them in horizontal layers with their extremities touching; but in such cases the angles of diagonal courses which project beyond the general line of the foundation must not be included in the width of the foundations.

7.—The height of stone walls of public buildings must be in accordance with their use and disposition, but in private buildings they must be limited to a height corresponding to the ground-floor of such buildings; but they can also have a basement store in addition.

8.—The length of stone walls cannot be more than double their height without their being supported by cross walls or strengthened by exterior or interior buttresses.

9.—The thickness of stone walls must be at least one-fifth of their height. In this thickness is not included the stone facings or brick linings of walls, which are not of the same construction throughout.

The thickness of transverse walls can be reduced a little according to the span of the floors which they support, but it must never be less than one eighth of the height.

10.—The angles of the building must be strengthened by means of exterior and interior buttresses, whichever is most suited to the character of the building.

11.—The exterior walls must be perfectly united with the transverse walls and with the buttresses, and the whole construction must be executed carefully and uniformly.

In works of alteration or extension, the new constructions

must be united to the old ones with the greatest care, both buildings being tied together, or what is preferable, keying the new into the old work.

12.—Stone walls which present the greatest number of joints and the greatest homogenousness are these which best resist earthquakes; however, the different classes of construction to be preferred are the following: hydraulic or common concrete; construction of bricks; construction of free-stone with brick linings; construction of free-stone alone; or construction of rough stone.

Single piers or buttresses must be constructed of hydraulic concrete, bricks or free-stone with brick facing. This kind of support can be only constructed on the ground floor.

13.—Stone lintels, besides being constructed with care, may rest upon a support of iron or of timber. In monumental buildings monolithic lintels must be used of a resistance adequate to their purpose, and of dimensions regulated by the class of the material used.

14.—The erection of triumphal arches, or any other form of construction in which the materials are in a position of equilibrium and do not offer by themselves perfect stability over the supports on which they rest, must be avoided as much as possible.

15.—With the exception of cases of absolute necessity the intersection of vaults, either by means of concave or of convex angles, is not allowed, and it is not permitted to cut lamettes into vaulted galleries; pendentives, gurned vaulting and sloping vaults, such as “capialzado” and similar complicated constructions, must be also avoided.

16.—However, vaults with hollow key-stones of iron covered with baked clay can be employed.

17.—In order to avoid inconvenience to citizens, it is recommended to the proprietors to look especially after the good execution of stone walls and to correct the vicious practices



of workmen. Of these bad practices the following will be quoted :—

Placing in the basements stones badly worked, covering the joints with mortar and grouting with liquid lime.

Constructing common stone walls by putting between the squared stones, forming the outlines of the wall, pieces of rubble and liquid lime in a disorderly way.

Failing to wet the stone walls before they have taken a dry form, and to wet the materials when they are put in their place.

Employing salt water in the mixing of mortar.

Using lime badly burned or mixed with coal. In order to ascertain the good quality of lime it is sufficient to pour over it a few drops of a strong acid, which setting free the carbonic acid produces effervescence ; in such case the lime being improperly burnt must be rejected.

Improperly making mortar, by not previously passing the materials of which it is composed through a sieve.

Improper bonding of squared stones ; there being very often visible in stone walls broken by earthquakes a series of joints in several layers or planes continuous throughout the thickness of the walls.

18.—It is also necessary to inform the public that cement arrives here damaged, and that it deteriorates rapidly in the warehouses. Before using this expensive material one ought to ascertain its good quality by having it inspected by a competent person.

19.—The vertical frame-work of public buildings, and especially of those which serve to contain a great number of persons, even only temporarily, such as churches, markets, theatres, etc., must be constructed of iron, but it is allowed to employ timber when this material is more economical.

The vertical frame-work of private buildings can be executed of iron or timber, giving to the wall-pillars the neces-

sary dimensions and fastening the same together by means of diagonal braces, especially at the corners.

20.—The frame-work of the upper stories must rest upon the walls of the lower stories. Such frame-work, however, must not be in direct contact with the walls, but must lie upon one or two plates which receive the vertical pillars of the frame-work or upon a capping of stone in order to prevent the destructive action of moisture in the timber. It is, however, permitted to employ posts of a frame-work which continue through both stories, protecting the parts which are under the ground with damp-proof walls, by heating and tarring the same and sheathing with lead plates or with small boards of “molave,” should not the pillars themselves be of this kind of timber. It is to be noted, that “molave” and “ipil” are the only two kinds of timber which can be in direct contact with the walls.

21.—Posts must be neither built into nor touch the walls, the necessary space being left in order that they may not injure the stone walls during earthquakes.

The separation between the two constructions (stone or masonry and timber) will depend upon the connections of woodwork and bracing of the timbers, but in any case it must not be less than ten centimètres. The most convenient connection for the posts is by means of longitudinal and transversal timber pieces.

22.—Wooden partitions must not be exposed to the weather, and must be protected by verandahs or by sheathing of galvanized iron plates or other adequate material.

Partitions of “molave,” which can be tarred or oil-painted, are excepted from this rule.

23.—The exterior covering of framed walls must only be made with bricks, enclosing the wall spaces in open frame-work with posts and diagonal ties. In fault of hollow bricks common bricks can be used.

Brick walls in conjunction with wooden frame-work must

have a thickness in the highest part of the buildings of  $\frac{1}{2}$  brick and in the lower part of 1 to 2 bricks, it being allowed to replace the open frame-work of the brickwork by strong laths fastened to the inner framing with screws on both sides.

24.—Notwithstanding the instruction contained in the preceding article, the use of mixed constructions must be, as far as possible, avoided, as the different elasticity of the materials of which they are composed produces great derangement of their different parts, and the partial sinking of the rigid portions of the building.

25.—For the covering of the iron or wooden frame-work, well strengthened together, the use of large blocks of cement, or of the artificial stone known in England under the name of "Victoria Stone," which permits of leaving between both sides of the walls, which are covered inside with wooden planks, a space to protect the houses from the heat, is recommended.

26.—The internal partitions of rooms must be of metallic plates or sheathing, brick partitions or those called in the country "pampangos" being absolutely prohibited. The junctions of the frame-work of all these partitions must be strong, well connected with the posts to which they correspond, and perfectly triangular.

27.—The beams of the floor must not be built in the walls, but must lie on a wall plate of "molave," which is to rest on the walls. Care must be taken to strengthen the posts by means of diagonal ties, attaching the same to the posts by means of bolts, and to the wall plates of "molave" by means of nails.

28.—When the space between the corridors makes it convenient to put an intermediate support for receiving the sills, the walls on which it rests must be strengthened by a buttress.

In no case is it permitted, whatsoever may be the requirements of the place, to have the supports of the upper story

resting over a void, as is seen in many private buildings, although these voids be strengthened by lintels of timber.

29.—Trusses, which offer the greatest guarantees against the action of earthquakes are those of central support, this arrangement permitting the employment of rough beams of “yacal of Angat,” the timber which best resists deflection.

When the corridors are of different span, or when it is the question of covering only one part, it is necessary to use rigid trusses of timber pieces acting upon one another in preference to the hanging system, to that “à la Polonceau,” or to any other complicated system.

30.—Trusses consisting of a series of parts resting on “queen” posts are also admitted, giving to these the necessary dimensions, in order that they may resist the load supported on their middle point and connecting rafters with the lower beams.

31.—Rigid trusses of iron are to be preferred in all public buildings, excepting when the span between the walls does not exceed seven mètres, or in cases where wooden trusses would be cheaper.

32.—Both in public and private buildings, points of convenient and easy access must be arranged, in order frequently to inspect the truss and thus prevent the damage which moisture and insects occasion in the timber.

33.—In order to avoid the disturbance of trusses so frequent in earthquakes special care must be taken that the horizontal pressure of the “roof beams” or of the floor beams does not act on the vertical partitions, and still less on the balconies of the building, internal wood-work of window and door lintels over posts must also be avoided, excepting in case that the dimensions of the work done be very small in proportion to the size of the posts, and even then, the internal woodwork has to be strengthened by means of a bolt.

34.—Flat roof trusses with transversal beams at the top, very much used in the country, must be strengthened by adding a roof supported by vertical posts, and rafters which rest on the "tie-beams," but in this case the number and the size of the tie-beams must be sufficient to resist the bending which they have to bear.

35.—In public buildings the covering of the roof must be made of flat tiles of rhomboidal plates of galvanized iron, with borders, nailing hidden, and free room for expansion. Should this material not be found in the market, corrugated iron can be employed, screwed together and without provision for expansion.

36.—In private buildings, tiles, galvanized iron, zinc, tin-plates, or any other metal which is not combustible and of equal weight, may be used as a roof covering.

37.—In buildings with only ground-floor, the covering can consist of a terrace, the "gaditana" system, for those of a greater inclination the Roman "terazzo" being recommended.

38.—Covering of common tiles can be only employed in isolated buildings of one story, which are not used for dwellings, as for instance for warehouses, shops, etc. etc.

39.—Such common tile coverings as actually exist, can only be allowed after a proper inspection has demonstrated that the trusses offer a resistance or that they can be strengthened; that the inclination of the roof-tiles does not threaten the sliding down of the tiles in event of earthquakes, and that solidity of the building corresponds to the weight of the roof.

40.—Coverings of common tiles will be allowed to remain only upon the condition that the rooms are protected by plank ceilings or by laths placed on the tie-beams of the truss.

The planks which have to serve for this protection can be (unworked) rough roof-spars, which must be put at the maximum distance of 5 centimètres from each other. The laths can be of "palma brava" or of other cheap but strong and

durable material; the nails between the laths must be at least 5 centimètres long.

41.—In metallic coverings the necessary openings for ventilation must be made, in order to avoid as far as possible the effects of heat in the dwellings, but at the same time care must be taken that these openings, which admit the air, do not permit rain-water to enter into the house.

42.—Galleries or balconies, being flying parts of the buildings require special care. They have to be strong, light, and well bound to the whole building.

They must rest on the floor beams of the upper stories, which must be accordingly long enough. Should, this however, be impossible, isolated beams may be used which must be strongly bound with the floor beams. The isolated beams have besides to be supported by a projecting plate which will be, in its turn, supported by decorative struts or consoles.

The frame-work of wooden walls must be constructed with care, employing exclusively for them, as well as for the filling in, timber of "molave," the upper connection of the same with the interior posts must be solidly strengthened, and the covering must be so disposed that it does not press upon the frame-work. Flying roofs must be made to rest on the beams of the trusses, because it is quite possible to give to these roofs the necessary extension to cover the balconies.

Roofs of galleries or balconies and the lower covering of the eaves can be utilized to admit air into the trusses.

The movements of sliding and opening panels and those of blinds must be so arranged that such panels can never fall on the public road.

In repairing the many balconies shaken and deranged by the action of earthquakes, in addition to the above mentioned matters, the necessity of solidly strengthening the wood-work by means of iron ties or other iron-work must be remembered.

43.—The competent officials entrusted with the inspection and supervision of all classes of buildings, must be especially careful that good principles of construction be observed as well in the projects as in the execution of the works, making use of the preceding rules, although short and incomplete, in order to become acquainted with the opinion formed by the Administration in the important matter to which these rules refer.

Manila, 17th August, 1880.

MANUEL RAMIREZ, Inspector-General.

Opinion of the Consulting Committee of Public Works which has served as foundation for the determination of the preceding rules.

RAMIREZ, President.

PALACIOS.

L. NAVARRO.

CENTENO.

CÈSPEDES.

BATLE.

LOPEZ BAYO.

CÁMARA.

GARCIA, Secretary.

Consulting Committee of Public Works of the  
Philippine Islands.

The Consulting Committee of Public Works assembled in extraordinary meeting, which took place on the 27th, 28th, and 29th instant, in order to further the instructions issued by the higher authorities relating to the system or systems of construction to be adopted in these Islands, for public and private buildings, taking into account the results produced by the last earthquakes and after having amply discussed the report presented by the Reporter Señor Don Lopez Navarro, which report has been compiled in consequence of the discussion and decision of the Engineers and Architects of the State, who constitute the General Inspectorate of Public Works, and

which took place in the preparatory Meeting of the 20th last, expresses the following opinion :—

The Committee must first of all recognize the truth of the fact that the power and the resources of human industry are unable to arrest the destructive power of earthquakes, it being unnecessary to call to mind the effects of some of the great motions of the earth which have broken masses of the most compact rocks and thrown to a considerable height objects and persons. On this account the Committee will suppose that it is a question of preventing the effects of earthquakes, the intensity of which may be equal or a little superior to that which reached those we experienced in Manila on the 18th and 20th instant. The Metereological Observatory of this Capital has published data referring to the duration, amplitude, nature, and direction of the motions. The newspapers have circulated a lithographic copy of the (curves) diagram of the seismometer. From the observations made in the Municipal Athenæum by the Jesuit Fathers and from the communications received from the several provinces of the Island of Luzon, it appears that the earthquake of the 18th has been, with respect to its intensity, duration, variety of motions, and extension of area which it has embraced, the greatest known in this Capital, or at least the greatest of which there is a record, as scientific observations of such phenomena date only a few years, but not including even the earthquake of 1863. That this assertion is not exaggerated is proved by the fact that it has destroyed several old buildings, the church tower and parsonage of the suburb of Sampaloc, as well as the church and convent of Guadalupe in the vicinity of the city, which constructions were amongst the most ancient of the archipelago, and have resisted, until now, without suffering any damage, all earthquakes which have occurred since the Spanish rule, and which have been cited as models of indestructible solidity. If we consider besides, that after the earthquake of the 18th, have followed two



more of great intensity on the 20th, a quantity of small tremors and a constant motion of the soil for eleven days, it seems not hazardous to take as a basis for the determination of the resistance of future buildings, the results deduced from the observation of those which have resisted the catastrophe so destructive to this city. As all members of the committee were engaged since the 18th in attending to the imperative duties of the service under those critical circumstances, they could not study with all the necessary attention the effects occasioned by the last earthquakes upon different kinds of buildings sufficiently to compare and judge the different and sometimes contradictory results which are to be deduced from the inspection of each building ; but in general terms one can ascertain *that when the construction has been performed properly with all classes of materials the buildings remain intact with slight imperfections.* The damages of recently made government buildings are insignificant when compared with those sustained by private construction, in spite of what occurred during the earthquake of 1863. The most of the government buildings which were ruined or suffered injury had notorious vices of construction or considerable defects of execution, or they had been actually condemned. The use of old constructions, in complete repairs, the necessity of reducing the expenses of the works, the hurry to declare in urgent cases the buildings fit for their use, and in many cases the want of competent supervision, have been the causes, which, added to the extraordinary force of the commotion, have produced the losses which the State has suffered, really considerable, but fortunately not so great as might be expected, considering the magnitude of the catastrophe. It has been already said that constructions with all classes of materials can be accepted, provided that these are rationally employed. In order to prove it, the committee will mention the effect produced by the last earthquakes in different buildings. The Bridge of Spain has only suffered a slight imperfection in the arch, depressed to  $\frac{1}{11}$ , the other five stone arches where the maximum elevation is

a fifth of the span ( $\frac{1}{5}$ ), having remained in a good state. The Cathedral, recently built, does not show any damage, notwithstanding that the stone-walls have a height of 14 metres. The wings raised on the corners of the "San Juan de Dios" Hospital and those of the old Custom-house, the former wings being of two stories and the latter of three, have suffered only some slight cracks (imperfections) visible in the front walls of the wings of the Custom-house. The chapel of the "Hospicio de San Jose," whose walls have a height of 13 metres, is unharmed. Finally, many other stone buildings that we could mention have escaped unhurt from the last earthquakes, as for instance, the tower of Santa Cruz and the belvedere ("mirador") of the University, which is composed of three stories of stone walls, over which are two other walls of timber framing crowned by a rotunda. Considering such results, is it possible to proscribe the use of stone-walls? Is it to be forgotten that timber work, when in contact with the soil, is exposed to deterioration in the pillars produced by moisture and most subjected to insects? The Committee does not hesitate to guarantee *that stone-walls when they are of little elevation, when they have a thickness adequate to their height, and principally when they are well constructed*, not only can be used without danger, but they serve to preserve the timber-framing which rest upon them. Two-storied buildings are eminently suited to requirements, besides being economical, as they diminish the cube of the foundations and the surface of the ground covered, and although it does not seem prudent to have them totally built of stone walls, nevertheless the above mentioned examples of very high storied walls which have resisted the last earthquakes make it incontestable that there is an advantage and complete security in constructing of stone the walls of the ground-floors of public and private buildings. In order that stone walls may offer the greatest guarantees of stability the committee advises the following prescriptions:—

- 1.—Care must be taken that the walls be transversely joined

with others at a maximum distance of double their height or strengthened by buttresses.

2.—Stone lintels, besides being prepared with care must rest in private buildings on supports of “molave,” the same disposition is also recommended for public buildings, reserving for monumental buildings monolithic lintels of the dimensions corresponding to the class of materials employed in these constructions.

3.—Constructions which present the greatest number of joints, are preferred, on account of the elasticity which they possess, and consequently the committee give here the order for the different constructions of stone walls, provided that their execution be carefully carried out: hydraulic concrete, ordinary concrete, brick linings, and common stones. The preference given to the concrete is not only based upon the good qualities of this composition and upon its cost, but upon the security of its construction even when executed by the bad local workmen, provided however that its mixing be performed by machinery and under the supervision of a competent person.

4.—The vicious practice of filling up stone-walls with loose stones, often consisting of *débris* mixed with liquid lime, also that of placing the stones on dry beds, jointing the extremities with mortar and filling up with liquid lime, must be absolutely prohibited.

Volcanic tuffs absorb rapidly the water of the mortar and of liquid lime, and thus the mixture has no binding properties, the result being dry walls which are shaken by the slightest commotion of the soil.

5.—It is of the greatest importance to constantly wet stone-walls until the complete setting of the mortar, as well as to carefully watch the construction of the wall and the selection of the materials of which it is composed, as the resistance of the walls against the action of earthquakes depends chiefly upon

the perfect union of the squared or quarry stones with each other. Unfortunately the lime sold in the market used to be defective, and the people admit it in their constructions without testing. Such lime produces a bad mixture, and does not permit the tuff to show one of its best qualities, namely its good cohesion with the mortar.

6.—The thickness of the principal walls (those which have to bear a load) must be at least one-fifth of their height; approximately the same for transversal walls, which bind the former walls, and not including in this thickness the squared stones or bricks of the facings when the construction is not homogenous.

7.—Pillars of wooden walls must not be built into the stone walls, but they must rest on these either by means of beams (supports or chains) bound with the beams of the pavement or by the beams of the frame-work.

8.—As the effects of vibrations of earthquakes are chiefly observed in the angles of buildings, they must be internally or externally strengthened according to the circumstances of the building.

9.—Considering the conditions of the soil in Manila, composed chiefly of mud and covered in many points by stagnant water, it is necessary to state that the solidity of buildings depends upon their foundations, in order that private buildings may not be constructed with very imperfect foundations without ever being consolidated by piles or by employing hydraulic mixture. Briefly, following the practices of good construction and observing extraordinary care, there is no inconvenience in admitting masonry walls for the ground-floor of buildings, provided that the whole be well prepared—not constructing large walls without supports, limiting the openings as far as possible, strengthening these and the angles as they form the weak parts of buildings, and taking care to elevate the walls over continuous foundations of a resistance

adequate to the load that they have to bear, and composed of materials corresponding to the quality of the soil. Timber frame-work, horizontal as well as vertical, offers the greatest security against the action of earthquakes. Timber-work, however, presents great inconveniences, as for instance :—

1.—The risk of fire.

2.—Liability to attacks of insects and especially to the “anay” (white ant, a kind of *Termes*), which is found in great quantities all over the archipelago and against which there exists no effectual preservative, nor does it seem easy to find one.

3.—The difficulty of covering walls of timber, as the brick linings and facings become loose during earthquakes, and the necessity of giving a great thickness to the timber pieces of which such frame-work is composed. If it is required to have the wall sufficiently thick to protect the house from heat, a lining of  $\frac{1}{2}$  brick is not sufficient for this purpose.

4.—The facility with which timber lying under the soil and that exposed to the weather becomes rotten.

5.—The difficulty, or rather, the impossibility to find in the market seasoned lumber, and especially in the present circumstances, the demand for timber being enormous and recently cut wood being generally sold.

According to the opinion of the committee, without prescribing timber for any class of frames, the preference must be generally given to iron, as well for supports as for ties and frame-works, especially taking care to make these rigid. The vertical frames must be of T iron or of lattice trusses, united as is customary, as these permit of double or single filling in, whichever may be most convenient; either of plates of the artificial stone known in England as “Victoria Stone” or of “bèton,” or of cement, as in this case the interior lining can be made with small blocks, which leaves an air-room to guard against heat. Iron beams, besides binding the walls

better than those of timber, can be arranged so that they do not bear on the cantilevers. Finally, rigid frame-works of such material not only offer an absolute guarantee against disturbance during earthquakes, but they serve to strongly bind together the whole construction, giving to it unity, and procuring for the whole mass the necessary resistance against the motion of vibration, which the succession of motion make a very essential condition, as it seems proved that in earthquakes there occur peculiar lines in which vertical vibrations reach an enormous power of projection. It is also of importance, in order to show the preference for iron over timber, to mention the consideration that the wooden frame-works are internally covered by flat ceiling rendering it difficult to inspect any sinking of the building, even when partial, this being a sign of the existence of the "anay" (white ant). Considering that timber has to be employed on a great scale in private and even in Government buildings, not only in provinces, where this material abounds, but in the Capital, notwithstanding its high price, the committee think it necessary to state the general rules which are to be following in timber-work:—

1.—Pieces which are under the soil or in contact with stone walls, must be made of "molave," and in case it be not possible to have them made of this timber, the part buried in the wall must be carbonized, tarred, and lined with plates of "molave."

2.—The practice of bedding frame posts in walls must be avoided, it being preferable to have them tenoned into a supporting plate; but when the former arrangement is unavoidable the ends must be protected by hydraulic cement or other impermeable material.

3.—The commonly used arrangement of bedding wall posts in the walls or of letting the same into the walls, is *vicious*, as during earthquakes they strike and destroy the walls.

4.—Moulding or cap-pieces placed over posts, so much

employed in this country, are only admitted when the cap-pieces have great bearing ; as the tops of the pillars do not present resistance to horizontal shocks, tenoning is generally preferred.

5.—Trusses which offer the greatest security against earthquakes are those of central support. This arrangement also permits the employment of unwrought beams of “yacal of Angat” this timber presenting the best conditions against bending. When corridors have unequal spans or when only one span has to be covered, rigid trusses are to be preferred to trusses “à la Polonceau,” or to any other complicated system, as the latter being arranged for vertical pressure, they may be easily deranged by the irregular motion of earthquakes. The necessity of binding the upper-frame of buildings, and the absolute importance of protecting dwellings from the sinking of roofs, make it almost always necessary to increase the tie-beams, in which case this excess of strength can and should be utilized to lay over the same the ceiling joists, making a convenient covering for the galleries. It is to be noted that there is perhaps no building in Manila in which the tie-beams have not more than sufficient resistance to stand the bending which can be produced by the above mentioned system.

6.—If there is no gallery, the vertical frames must be protected by an impermeable (water-proof) sheathing. The material which must be employed as a roof covering is a very important question, which the Committee will treat with special care. It is customary in this country to employ coverings of ordinary tiles and of galvanized iron, the use of flat tiles of native manufacture having been commenced only recently. The tiles are ordinarily put on a double lath-work (baraquilas and baratejas) with the object of avoiding their falling in, and in consequence of the great slope necessary to prevent the tiles sliding down. The bad quality of tiles, notwithstanding that the clay with which they are made is good, necessitates put-

ting a double gutter and a double covering, besides the already existing bed in the lathing. From such a vicious construction and bad material it results that the tile covering in consequence of its great slope, considerably elevates the centre of gravity of the covering, so that much timber is required in the highest part of the building, and the weight of the tile-covering is enormous; that it does not prevent the use of gutters, very inconvenient and dangerous to the preservation of trusses; and, finally, that in earthquakes tiles easily fall down, occasioning danger to passing people and to the interior of the dwellings. Coverings of common tiles put on boards, have the advantage over the before-mentioned of protecting the interior of the building, but besides the inconveniencies that have been enumerated for tiles resting on laths, they offer more facility for sliding. The terrace as a covering, which is anyhow better than tile-covering, from the standpoint of stability, offers the inconvenience of requiring large pieces of timber and many gutters. This last inconvenience is partly obviated by constructing terraces in gaditan (Cadiz) fashion instead of the Italian terraces used in the country; but the former is very heavy on account of the numerous layers of different materials which are necessary in its composition. In the side chapels of the cathedral a covering of Roman "terrazzo" has been used with good result, putting together the joints with cement. The chapels measure about 9 square metres and the side vestibule towards Cabildo-street  $9 \times 12$  mètres. These spans are larger than those which can be covered by terraces in gaditan fashion, and notwithstanding this the strong storms which have followed the earthquakes have hardly left a trace. This system has been tried, but the committee would not recommend it, the use of flat tiles being superior. This kind of covering of flat tiles, not requiring mortar, is light and does not either unnecessarily overload buildings or require strong trusses. Unfortunately flat tiles manufactured in this place are crooked and badly baked, although they have given a good result in the block of houses



recently built near the market of the "Quinta" and in some buildings in Cavite. It is to be hoped that this industry will improve, and in the meanwhile the manufacture of cement-blocks could be tried, as although the raw material would be more expensive, the backing and the considerable number of tiles lost in the manufacture of clay would be saved, which perhaps will make these blocks (plates) cheaper than tiles. Coverings of galvanized iron have the advantage of being light, and can be used on light trusses; but they do not last as long as those of earthenware,—they render absolutely necessary the employment of flat roofs and of ventilators in order to protect the houses or warehouses which they cover, from heat, and they are easily thrown down during hurricanes. The market of the Philippines has only corrugated iron, which is fixed on the beams by means of screws, and by binding together the sides of the plates with rivets. In order to render the screws more secure nuts are put below. In this way some inconveniences of this system are avoided but there still exists the defect of expansion and the great waste of material in covering, in order that the wind should not drive water through the horizontal joints. It seems unnecessary to say that with the exception of the inconvenience, which metallic covering presents on account of the heat, the other imperfections are avoided by using rhomboidal plates with borders, and putting the same on boards. The screw-heads remain invisible, thus avoiding their oxidation and the holes in the plates permitting their expansion, which renders it more durable. From the above stated considerations regarding covering, it results that, in the opinion of the committee, preference must be given, according to the use of the building, to flat tiles or to galvanized iron, both these methods of covering being approved, and "terazzo" laid in Roman fashion, and for small spans the terrace being permitted. Coverings of common tiles must be only tolerated in isolated buildings of only one floor, as factories, shops, etc., etc., and not used for dwellings. Regarding the accessory parts of buildings, thin stone-walls, even

those having timber-frame work, and those with decorations of great projection, like those called in the country "pampan-gos" must be prohibited; wide arches, usually very flat, with the exception of those cases in which the distribution of the building make them really necessary, and also the vicious practice of loading floor-beams with beams in order to prolong the truss over the flying-galleries, are not permitted; and finally great care must be observed in constructing very heavy windows, which so frequently fall down in the public roads during earthquakes and hurricanes.

Taking together what has been pointed out, the committee is of opinion that the building of solid materials in the whole archipelago ought to be subjected in the future to the following rules:—

1.—The foundation must be adequate in its dimensions and manner of construction to the load which it has to bear, and to the nature of the soil, keeping in mind that foundations have to give unity to the building and have to resist the action of earth movement over the whole mass of the building.

2.—Stone-walls can be used with advantage in the basement and walls of the ground floor, giving them the minimum thickness of the fifth of their height, taking special care of their good execution, seeing that the walls are homogeneous, and not building walls the length of which exceeds twice their height, without their being bound with other walls or strengthened by buttresses.

3.—Generally speaking mixed constructions are not convenient, and especially those of timber and stone-walls, on account of dislocations which the different elasticity of the materials produce.

4.—For frameworks and trusses, iron should be preferred in all public buildings of a certain importance, timber being permitted for provisional constructions, for beams and even for all classes of frame-work and trusses, provided that its cost is cheaper as compared with iron.

5.—The obligation is imposed on private builders of improving the actual system of construction, especially in the trusses, strengthening the existing ones, which need it, in order to avoid the falling of roof-coverings, very frequent during earthquakes. To this end, an approved and necessary precaution, is to put over the tie-beams a plank-floor to protect the dwellings.

6.—For roof-coverings, flat tiles, or galvanized iron should be preferred, according to the arrangement and use of the building, covering of "terrazzo," laid in Roman fashion, or terraces for galleries, the span of which does not exceed 6 mètres, being permitted in certain cases. Common tile covering can be only used in isolated buildings of one floor and not employed for dwellings.

7.—For accessory works, as for instance, the construction of arches and lintels, the above given instructions must be kept in mind.

Finally, the Committee proposes that the greatest supervision be exercised in buildings, which are used to contain a great number of persons, as, for instance, prisons, markets, churches, and schools, it not being sufficient only to study their projects and carefully construct them, but in addition to attend to their preservation, frequently visiting the same and correcting immediately any defects which may be noticed.

The urgency demanded from the Committee for this report, prevents the same from entering into a more detailed examination of the different objects which it embraces, and it reserves the right upon consultation, to express further its complete opinion with regard to any special question, which it has now only casually mentioned.

Manila, 29th July, 1880.

(Signed) M. RAMIREZ, President.

FRANCISCO GARCIA, Secretary.

(True copy.)

M. RAMIREZ, Inspector-General.

## CIRCULAR.

To the Mayor of the city of Manila and the chiefs of provinces and districts of this Archipelago.

SIRS,—The rules, to which in future constructions and repairs of public and private buildings in this Archipelago are subjected, having been dictated by this Government General and published in the *Gazette* of to-day, it is indispensable that you provide, at once, with the greatest diligence and attention, for the most strict and punctual observance of the rules mentioned.

In consequence of this and in consideration of my decree of the 18th instant, to be put in force from the date of its publication in the *Official Gazette*, all permits of a provisional character which have been granted by your honour or by your delegates, for the execution of work of any kind in buildings, which have suffered from the last earthquake, must immediately cease, and all new works must be subjected to the prescriptions which I hereby declare valid.

I have the honour, etc.,

(Signed)

PRIMO DE RIVERA.

FINANCE BRANCH.

In conformity with the proposal of the Intendencia General of Finance, in accord with the Direction General of Civil Administration, complying with the § 3 of the decree of 29th July last, this Government General disposes, that the goods mentioned in the following extract will enjoy the privilege mentioned in the § 2 of the decree and for the term contained in the same.

Manila, 20th August, 1888.

(Signed)

PRIMO DE RIVERA.

EXTRACT.

Item 39.—Columns, capitals, socles, corbels, basement plates, posts, tubes, gutters, and other pieces for iron construction.

Item 41.—Angle-iron C, T, & Y, beams, trusses and lattice

trusses, frames or parts of the same, thick and hollow transversal beams, round, square and lattice-columns and supports, hooks, pillars, bolts, buttresses, channels, bands, and other accessory pieces for iron construction.

Manila, 20th August, 1888.

(Signed)

PRIMO DE RIVERA.

Are duty free, up to that date, the goods above mentioned and metallic powders, iron and zinc plates to serve for roofs of buildings and the necessary nails and screws :—

#### IMPORTANT DOCUMENTS.

The Municipality of the city publishes to-day in the *Gazette* the following order, the reading of which as well as of the other document we recommended to the house-owners.

“I hereby give notice, that H.E. the Governor-General of these Islands having, on the 18th instant, ordered by decree the rules to which constructions of buildings in this Capital and its suburbs have to be subjected (in addition to those already existing on transfer of properties and architecture), and having ordered to this municipality the exact fulfilment of the same, I direct the following :—

“Art. 1.—No construction or repairs of any class of buildings which exist in this Capital and its suburbs can be made without a previous licence of this Municipality, which will grant the same in strict accordance with the orders dictated by the Superior Authority in the decree of 18th instant.

“Art. 2.—Legally authorized works, which are now in course of construction, when finished, will be subjected to official technical inspection, in order to comply with the decree of H.E. the Governor-General of these Islands of the 18th instant.

“Art. 3.—Any work done in buildings without the licence of this Municipal Office, whatever may be its importance, will be immediately suspended by my agents, the owners of the

house, in which such works are done being liable to a fine of \$25, which must be paid at once."

"Art. 4.—The Veteran Civil Gard, the Municipal Guard of the suburbs, and the other instruments of my authority are intrusted with the exact fulfilment of these orders."

In consequence of the above, the Secretary of the Municipal Council publishes the orders of H.E. the Mayor, which are as follows:—

"In order to comply with the orders of the Superior Decree of the Government General of these Island dated 18th instant, relating to the general rules to which in future town buildings of solid materials are subjected and to the conditions required for repairs or for alteration of existing buildings in order that they may have the due solidity to resist the destructive action of earthquakes, and considering the great number of buildings of solid materials which exists in this Capital, which constructions must be inspected according to the above decree, as well as the dilapidation and destruction caused in these by the earthquakes of the 18th and 20th of July last, this Municipal Office, acting in accord with the Municipal Council, and in order to organize an extraordinary service connected with the municipal surveying service for city constructions, with the least possible delay, which, however, will be limited in view of the successive circumstances which might render it advisable, decrees the following:—

1.—The service of the municipal works remains divided into:—

- (a) Public and private town constructions,
- (b) Maintenance of buildings, bridges, promenades, roads, and municipal dams.
- (c) Construction of buildings supported by municipal funds.

2.—The Engineer Don Genaro Palacios, technical Director

of the City Water Works, is appointed chief Inspector of the extraordinary service of public municipal and private constructions. He will have under his immediate orders the whole technical *personnel* of the Municipality, and the auxilliary *personnel*, which for special office works may be absolutely necessary and be proposed by the said Engineer, who will divide the work amongst his subordinates as he may think convenient.

3.—The duty of buildings, bridges, promenades, dams, and roads, within the limits of the municipal district, as well as the construction of buildings which are at the charge of the Municipal Exchequer, will be discharged as formerly by the Municipal Architect.

4.—The technical *personnel* under the order of the Chief Engineer of the extraordinary service consists of the Engineers Don Juan Bernard, Don Eduardo Cañixares, and Don Geronimo de Ibarburu, of the Masters of Works for the Fine Art Academy of San Fernando, Don Antonio Ulloa and Don Manuel Santiago Torrejon, of the Master Engineer Don Crispinians Cabrera, and of the Municipal Architect, who also is put under the immediate orders of the Chief Engineer for services in the above mentioned extraordinary branch.

5.—The Chief Engineer of the extraordinary service must communicate directly with the Municipal Office on all business referring to this office, proposing the solution of all the questions submitted for his opinion and in conformity with the above mentioned superior decree.

6.—The documents, communications, and certificates delivered by the technical *personnel* of the extraordinary service must be prepared on paper stamped with the following inscription "Municipality of Manila," "City Constructions," Extraordinary Service."

7.—Certificates must be delivered by the technical official entrusted with the service in the district referred to in the

certificate, authorized by the "sanction" of the chief and the visa of this Municipality.

8.—The distribution of the extraordinary service must be directed by the Chief Engineer to this Municipality. He must communicate to his subordinates the instructions, orders, and dispositions which he may deem necessary, those subordinates having to address to the Chief Engineer the reports, certificates, and all necessary documents in relation to their service.

9.—The Chief of this extraordinary service must submit to the consideration of this Municipality, everything he deems convenient to the best of his service.

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