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FIRE PROTECTION HISTORY-PART 207: 1904 (FIRE-RESISTIVE CONSTRUCTION)

By Richard Schulte

The eighth Annual Meeting of the National Fire Protection Association was held in New York in late May 1904. Among the various topics discussed at this meeting was the subject of the minimum requirements for fire resistive building construction. This discussion is of particular interest since it occurred just a few months after a conflagration destroyed a portion of the City of Baltimore (Maryland). The following is a transcript of the discussion:

"***The Vice President.*** *This is only a preliminary report, and of course the committee will be continued. If there is nothing more to be said on this subject we will proceed with the order of business.*

FIRE-RESISTIVE CONSTRUCTION.

F. E. Cabot, Chairman.

G. E. Bruen,	*W. J. Fredrick,*	*W. C. Robinson,*
E. T. Cairns,	*T. M. Goodloe,*	*F. J. T. Stewart,*
E. U. Crosby,	*W. S. Lemmon,*	*C. A. Trowbridge,*

H. A. Fiske, *H. Wilmerding.*

Mr. Cabot. *In bringing forward the report of the Committee on Fire-Resistive Construction, I want to say one or two words as to why the report is not such as the committee would liked to have made it. In the first place, as you probably realize, the committee spent a great amount of time and did a great deal of work in the investigation of buildings in Baltimore which were of so-called fireproof construction, endeavoring from what we found there to draw some reasonable conclusions for this report. I want to say in regard to the report which we made of that investigation just a word by way of explanation. Some of you who have received it were probably more or less disgusted because your copies were smudged with ink. I wish to say that it was only by the most vigorous efforts on the part of Mr. Robinson that it was possible to get that report into the hands of the members at all, and if he had not transmogrified himself into a printer's devil you wouldn't have had it until this morning; and, therefore, you ought to be thankful for what you did get, and you can have later, if you want it, a better bit of type work.*

I also wish to express for myself the feeling which I have that it was the committee, and not the chairman, and especially one or two members of the committee, who wrote that report. I "also ran." And, gentlemen, no one who did not go through with us the ten days that we spent in Baltimore has any idea, or ever will have any idea, of what we did. We worked from nine o'clock in the morning until twelve o'clock at night, and we worked so that when we got through we were all actually ready to drop. We never shall have a chance to do such work again, we hope. Probably none of us would ever attempt to do it again if we had the chance. But we hope that the work has been done in a way which was worthy of an opportunity such as comes but once in a lifetime.

I also want to take this occasion to say that Mr. Patten of the Philadelphia Board, who was with us throughout the whole week, did not have his name mentioned in print because of a typographical error. Mr. Patten's assistance was of the greatest value, and we are sorry that his name was accidentally omitted.

I will now take up the report, and in doing so I shall have to acknowledge that it has received some criticism from members of the committee since it was put into final form, and I shall try to bring out those criticisms as I read. I will say, for the benefit of those who were not in Chicago last year, that this report is based on a report made at the Chicago meeting last year, and includes the amendments which were then made, and some others which the Baltimore and Rochester fires brought to the attention of the committee as desirable.

***The President.** Mr. Cabot will read the different articles, and will pause at the end of each article to give any member an opportunity to speak upon the article if he desires.*

Requirements as Recommended

– FOR –

Fire Resistive Construction

REQUIREMENTS.

Buildings of fire-resistive construction shall have the walls, floors, columns, girders, beams, partitions, roofs and roof structures of brick, terra cotta, concrete, steel, iron or other such fire-resistive materials as shall be approved for this class of construction by the National Board of Fire Underwriters.

All such structural steel or iron to have standard insulation against heat as described below.

No stone bonds or caps or exposed metal column bases to be used in piers.

Mr. Stone. *It seems to me that the last paragraph could be amended profitably by inserting the word "exposed" before the words "stone bonds or caps." There are times when it seems to me that stone bonds or caps might be used to advantage to spread the weight and bind the wall, but they should not come, of course, to the surface to be exposed to fire. Now, what objection would there be to having a bond with four inches of brickwork in front of it? It might often be very useful indeed to have such a bond and something to distribute the load.*

The President. *The chairman will note the suggestion. I think it is a good one.*

Mr. Cabot. *Yes, sir.*

The President. *There is no objection to using iron bonds, if protected?*

Mr. Cabot. *Oh, no.*

Mr. Longacre. *Is there any objection to the use of stone piers when they are practically underground?*

The President. *Not if they are underground, I should say; but if they are exposed to fire there would be objection to their use.*

Mr. Longacre. *We sometimes find them exposed five or six inches above the ground.*

The President. *There would be danger in that case.*

Mr. Cabot. *I should like to say a word to Mr. Longacre about that. If he had seen what happened in the sub-basement of the Union Trust Company in Baltimore he would never expose anything anywhere. There was nothing burned in that basement except a couple of oil barrels and two little clothes closets about as big as that rack in the corner. The draft from outside the building carried the unburned gases down through the skylight, down into the sub-basement and into the elevator well. and took an inch and a quarter off the brick face around the iron columns.*

> ***1. Brick Bearing Walls*** *–Walls (when carrying floors) to be of good, hard-burned brick laid in best of cement mortar with joints flushed full.*

Mr. Stone. *I would like to inquire what the committee means by "cement mortar." That phrase is rather an indefinite one, as used in specifications. Do you mean wholly cement and sand, without any mixture of lime, or not?*

Mr. Cabot. *I think the committee had in mind a mortar in which cement was used; not a pure cement and sand mixture, but a lime, cement and sand mixture.*

Mr. Stone. *It seems me that some slight modification could be made of that section, by which it could be recognized that such a mixture could be used. I think it is sometimes very difficult to work pure cement mortar without any admixture of lime, and it is unnecessary at times, too.*

Mr. Palm. *I should like to ask Mr. Stone whether he permits a minimum amount of lime to be used in cement mortar . The contention by masons is that it works better.*

Mr. Stone. *It does work better, and I think it produces quite as good a result, if only a minimum amount is used. It seems to me there should be a definition, perhaps, as to the proportion of slaked lime which should be used with the cement.*

Mr. Palm. *About one-half as much lime as cement.*

Mr. Stone. *That is as much as I ever care to use, and it should be lime which has been slaked in a bed, strained, and left to stand at least three days before it is used, and I generally say ten. I require the masons to have two beds of slaked lime, so that they can have one cooling while the other is being used. They use it with sand and cement to make their cement mortar, and generally the proportion after it is slaked is–well, half is not a bad proportion, but sometimes I use less.*

Mr. Palm. *Half as much slaked lime as cement?*

Mr. Stone. *Yes, sir.*

Mr. Cabot. *The committee will take that matter up and try to make a specification, with Mr. Stone's help.*

> *To be not less than 16 inches thick for the two upper stories, increasing in thickness 4 inches each three stories below or fraction thereof (or to be of an equivalent average thickness). If walls are over 100 feet long, they shall be 4 inches thicker than the above or they shall be strengthened by piers or pilasters placed not over 20 feet apart.*
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> *Example: 8-story building would have three 24-inch, three 20-inch, two 16-inch walls.*

Mr. Cabot. *If there is no comment to be made on this I should like to go back to the preceding section and say that it has been called to my attention that a wall carrying the roof wants to be as good as a wall carrying the floor, and if there is no objection we will insert after "floors," under "Brick Bearing Walls," the word "roofs."*

Mr. Stone. *Is that for strength or for fire protection?*

Mr. Cabot. *Both.*

Mr. Stone. *Well, I think it is rarely that a roof needs a 16-inch wall to support it, unless it is for fire protection. If it is on that account I would not criticize it. But really, the load which can come upon a roof is very seldom over 50 pounds to the square foot, over and above the dead load, and it seems to me it would be putting an unnecessary burden upon owners of buildings, unless it was for the purpose of fire protection.*

Mr. Cabot. *It is admittedly necessary for fire protection.*

> ***2. Exterior. Non-Bearing Walls for Skeleton Construction Buildings****–If carried on the steel frame must be of brick, not less than 12 inches thick in any portion. This in addition to ornamental facings or other materials, if any Where such a wall is required to constitute a "fire division," it should be constructed as specified in No. 3 below.*
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> *Self-supporting walls carried up solidly from the foundation to be not less than 12 inches thick for the three upper stories, 16 inches thick for the next three lower stories and 20 inches thick for the stories below and to be well anchored to the steel frame. If walls are over 100 feet long they shall be 4 inches thicker than above, or they shall be strengthened by piers or pilasters located not over 20 feet apart.*

Mr. Cabot. *The chairman has had his attention called to the fact that it seems unnecessary, when a wall is tied to a steel frame, to stiffen it by putting in piers and pilasters.*

Mr. Stone. *I do not think it is necessary.*

Mr. Cabot. *If no objection is made, the chairman will feel authorized to strike out that last sentence.*

Mr. Stone. *I should hope it would be stricken out; I think it is unnecessary.*

Mr. Cabot. *This is not a wall which is to carry the weight of the building.*

Mr. Stewart. *Do I understand it is intended to strike out the requirement that " they shall be four inches thicker than above," as well as the latter part?*

Mr. Cabot. *Only the latter part. I think a wall over 100 feet long should have the additional thickness.*

Mr. Stone. *I don't see why an interior wall, which is not subject to any strain, should have that additional thickness . Why are you building this wall? You are building it, as I understand, to protect one portion of the building from fire in another portion, and you want it to be ample to sustain itself.*

Mr. Cabot. *This is not a fire division wall; it is an exterior wall.*

Mr. Crosby. *We are only requiring four inches of brick on interior columns for fire protection, and we are requiring 12 inches for the exterior wall, the chief reason being, as I understand, that the weather is apt to beat through bricks, and they are more subject to corrosive influences under those conditions. So far as keeping out the heat is concerned, 12 inches must be very ample, because we deem four inches sufficient for interior columns where the heat would be banked up and would be much more severe. So it seems to me quite unnecessary to increase the thickness of that wall by four inches, due to the increased length, and I should like to see the entire last sentence stricken out. I think that is in accord with Mr. Stone's idea.*

The President. *The committee will give that consideration.*

> *Note-Decorations should be as plain as possible and where desired had best be of hard burned terra cotta. Marble, granite and similar stones disintegrate under influence of heat and water and are easily damaged in moderate fires, especially if carved. Use no exposed iron work on outside of building. Care must be taken that the frame work in or at wall is as thoroughly protected as that more conspicuously located.*

Mr. Cabot. *There has been some comment on the words "Use no exposed iron work on outside of building." The committee meant precisely and exactly what it said, because in the Continental Trust Building we saw whole sections of the facing of a wall shoved out of place, because the mullion between two windows wasn't of brick.*

Mr. Stone. *That expression carries a good deal of weight. For instance, when metallic window frames are used, some portions of those are outside, and we can't expect to eliminate that.*

Mr. Cabot. *There can be an iron frame, of course.*

Mr. Stone. *I think the expression should be carefully guarded. It is very seldom you have the very unusual circumstances of that Continental Trust Building fire, and I hardly know what we can use as a substitute for cast iron in some places. Our clients must get some daylight into their buildings, and I think that the very slight extent of the resulting damage, considering the magnitude of the fire in Baltimore, because of the exposure of cast iron, hardly makes it necessary to adopt so drastic a measure as this.*

Mr. Stewart. *I think, as Mr. Stone points out, that that statement is perhaps a little broad, and I would suggest that it be qualified by some statement to the effect that unprotected iron work should not be used on the outside of buildings where it might in any way affect the structure. These mullions that Mr. Cabot refers to were very rigidly tied to the beams both above and below them, and the expansion of the mullions distorted those beams and so threw out the wall which they were carrying. Of course, we must allow a wire glass window in a metal frame.*

Prof. Woolson. *I fully agree with the last speaker. All through the burnt district in Baltimore there were a large number of cast iron fronts which withstood the fire without apparently any serious damage. It seems to me there should be some modification of the statement in this note.*

The President. *The committee will give the matter attention.*

Mr. Palm. *These mullions are not supposed to carry any weight, or but a small amount of weight, and why wouldn't a copper covering approaching the fire-resisting qualities of a good fire door, answer the purpose? It could be made as ornamental as desired.*

The President. *That is a matter of structural detail which we will have to leave to the architect, I think, Mr. Palm. I have been asked to call attention to a matter which was brought up very recently at a meeting of the Franklin Institute, as the result of investigations by Mr. Outerbridge as to the expansion of cast iron. I understand he has communicated with the National Board of Fire Underwriters on the subject, and he asked me, when the proper time came, to call your attention to the fact that cast iron differs from steel and wrought iron in that it expands under heat and does not contract when cooled. In other words, when repeatedly heated and cooled it will expand so much that the tests have produced results which are most extraordinary. I have seen a cast iron bar an inch square and fourteen inches long expanded until the contents of that bar had increased 40 per cent. It became nearly an inch and a half square and sixteen and a half inches long, weighing just the same as it weighed before. Mr. Outerbridge explains that this condition is brought about by a continued expanding without contraction of the molecular iron, and a changing of the carbons in the cast iron to graphite, the intermolecular spaces being filled with graphite. A microscopical examination of the iron subjected to repeated expansion*

and cooling shows a very distinct structural change. It is a matter, I think, of great importance to architects and also to fire insurance engineers, and I bring it before you at this time for your information.

Mr. Stone. *Do you know, Mr. President, whether, after he had done this, he made any test of the comparative strength of an unexpanded bar and an expanded bar, either transverse or compression?*

The President. *I cannot say as to that.*

Mr. Stone. *It would be a matter of great interest if he could carry his investigations one step further.*

The President. *I think that will be done. He called particular attention to the buckling of the mullions in the Continental Building, and that buckling throwing the walls was caused by the fact of the difference in the expansibility of cast iron and steel, the cracks coming when the cast iron expanded, and did not contract.*

Mr. Crosby. *I am glad to see this reference in the note to exposed iron work on the outside of buildings, because indirectly it relates to a subject which the specifications as yet have not attempted to cover. We all know that of late years the practice has been growing to make exterior walls virtually all or very largely window spaces. The practice has grown to a very considerable extent, and as most of these fire-resistive buildings are more or less under exposure, it has resulted that we have an exterior wall which is virtually a plane of glass, offering very slight resistance against the spread of a conflagration. At present there is something of a movement, I think, on the part of architects to reduce these window spaces. It is quite manifest in the new Times Building up town that there is something more of a disposition to build windows as they should be built, allowing more wall space for other purposes, and at the same time affording ample light. Now, a paragraph of this kind indirectly hits the wall which is nothing more than a glass wall with metal mullions; and I think if the committee will consider amending the phraseology by putting in an exception for fire-resistive window frames, properly protected and encased, it will be as much of a modification as is necessary in the standard.*

The President. *The committee will give that matter consideration, Mr. Crosby.*

3. "Fire Division" Walls for Skeleton Construction Buildings–

Each frame and wall to be independent from that of adjoining section or building, irrespective of the type of construction of the adjoining structure. Each of the walls so adjoining to be not less than 12 inches thick.

Self-supporting or bearing walls to be not less than 16 inches thick for the two upper stories, increasing in thickness 4 inches each three stories below or fraction thereof (or to be of an equivalent average thickness).

Each of the walls so adjoining to be not less than 12 inches thick.

Mr. Cabot. *The committee would recommend, or the chairman would recommend, striking out the last paragraph, because it is apparently already covered.*

Mr. Stone. *Mr. President, I do not like to be on my feet so much–*

The President. *Mr. Stone, we are greatly indebted to you for your criticisms, coming as they do from you as a delegate from the American Institute of Architects.*

Mr. Stone. *I would like to ask the committee why they have this first paragraph: "Each frame and wall to be independent from that of adjoining section or building, irrespective of the type of construction of the adjoining structure." I don't know exactly what is meant by that.*

Mr. Cabot: *I do not think the expression is quite as apt as it might be, Mr. President, but what we want to prevent is the pulling down of one building by the thrust of the frame of another building. We understand it is the practice of architects now to tie three, four or five buildings together; and we believe that if we have to pay a fire loss we should pay it on the building in which the fire occurs, and not have to pay for loss on every one of them. That is what we are trying to prevent.*

Mr. Stone. *Now that we are building these large buildings, which are monumental, and which are likely to stand for a great many years, where land is very, very valuable, I do not see why two adjoining owners should not put up a common steel skeleton frame and make a party wall of it, without the necessity of each putting up his own independent wall. Often the lots are not more than 25 or 40 or 50 feet wide, and if the insurance people are going to say to us that we cannot make party walls, it seems to me it will be a very long step backward. I cannot see the necessity of it, any more than I can see the necessity of putting up every fire division wall you put up in two parts. I think this needs most careful consideration, and that we should not require something which is going to take up on narrow lots quite a perceptible proportion of the space by unnecessary walls.*

The President. *I should like to ask Mr. Stone whether, if the wall be a brick wall, a bearing wall, and the structure rests on that–that is, one member of the structure, the girders and the joist rest on that bearing wall–whether that would not answer. There is no objection whatever to a brick party wall; but what we wish to avoid, I take it, is a party wall containing structural iron tied to the adjoining building, which might be damaged by the falling or distortion of the adjoining building due to fire.*

Mr. Stone. *If both buildings are equally protected I can see no reason why this party wall should not be a single unit of itself –a wall by itself – with its skeleton construction properly protected and the framework extended both sides. You certainly do that in large establishments like Wanamaker's and other department stores.*

The President. *For interior division?*

Mr. Stone. *Exactly; and this becomes an interior division wall in a certain sense. The two adjoining owners simply agree to do together that which you as an individual would be allowed to do in your own structure; and the space covered is no more in one case than in the other.*

Mr. S. H. Lockett. *Ordinarily we would be glad to take the entire risk which Mr. Stone speaks of under separate ownerships as one, without any difference in the rate at all. I think Mr. Stone is right.*

Mr. Goddard. *Doesn't it resolve itself into a question of underwriting and a question of risk in the particular locality? If you have a building of that size under one ownership, with a division wall, a single division wall, you take a certain line at a certain rate. Now, if it appears that damage in one building is liable, on account of the form of construction, to produce damage in the other building, it becomes rather a question of underwriting, it seems to me, than a question of engineering; and the companies would have to look out for lines and rates on buildings which were constructed with single party walls under joint ownership.*

Mr. Stewart. *I do not think that this is a matter entirely of underwriting. Our purpose is to make a standard, and while I feel personally that perhaps this is quite a high standard, yet I do not feel that we could afford to name as a standard for a perfect building one which allows a single steel frame having a fire wall carried from story to story of that steel frame. If a severe fire occurs on one side of that wall and breaks down the frame, the wall is going with it, and the fire is going through, or the falling wall is going to pull down the other building. In other words, you have simply got one frame subjected to a fire, and if that comes down, your wall comes with it.*

We have had some fires already in fireproof buildings, or fire-resistive buildings, where the frame, or a part of it, has collapsed and more or less distorted the walls, and it seems to me that we should hardly be justified in naming a standard to name one that consisted of a fire wall carried on a steel frame, which is liable under severe conditions to distortion which is likely to affect the wall. What we have in mind here is something that we want to consider as a positive fire stop. However severe the fire may be on one side of that wall, we want to have it so that if the entire building collapses, the building on the other side of the wall will remain intact and uninjured.

Mr. Goddard. *Possibly Mr. Stewart may misunderstand what I meant. I was not speaking as to the desirability of the different forms of construction, but as to whether this was an engineering or an underwriting question; and I cannot see how, when the question of ownership settles the whole question, it can be called a question of engineering. It must be underwriting. And if Mr. Stewart takes two buildings and fears that this wall will fall on account of fire in one, if that was all under one ownership and was one building divided into two fire sections, you would have exactly the same engineering difficulty that you would have if there were two buildings under two ownerships with a party wall of that construction. Therefore it is not a question of engineering, but of underwriting. Now, if we feel that the only way we can make a proper fire division wall between sections of a building is by having two independent walls, then we are justified in asking for them between two buildings under separate ownership. But if we can take a building of 20,000 square feet area, and properly divide it into two fire sections of 10,000 square feet each by a certain construction of fire wall between those two sections, we can do the same thing if those two sections are under two ownerships, without having any different form of construction between the two buildings.*

Prof. Woolson. *I think that in this case we have no protection against two owners, providing we pass this rule in this form, who wish to build adjoining buildings, pooling their issues and putting up one building. A man can make an arrangement with his neighbor by which he can put the building up and avoid the rule in that way, and you cannot control it after the building is built. Then there is another thing, I think we are setting up a bug-a-boo here which really does not exist. If the rest of these conditions are adopted, I do not believe the danger which is feared will exist, for a steel frame, if built according to these rules, will not fall down. It is going to stay up, in my opinion. With the protection which the committee has put around these steel frames, and judging by the results which were shown in the Baltimore fire, where steel frames were properly protected, I believe that a steel structure put up under these conditions is going to stand, even though the contents of the building are burned out.*

Mr. Cabot. *There seems to he a very curious misunderstanding here. I didn't know that we were talking about owners; we are talking about fire division walls, and the situation is just the same practically whether a building is owned by one person or by two persons or by 400. We are talking about division walls and sections, and, as Mr. Stewart says, we are adopting a standard. We are not attempting to legislate, as Mr. Goddard's electric committee legislates, as to what shall be done and what shall not be done, but we are building up a standard; and I don't believe any man in this room, if he had a large dry goods store, for instance, if Siegel-Cooper's and Wannamaker's backed up against each other, would want to tie those two frames together. That is what we are legislating about, gentlemen.*

Mr. Crosby. *This matter received a good deal of discussion in the committee, and the point raised by Prof. Woolson is the one on which the whole discussion hinged, or upon which it partly hinged, I should say, and that is, when the next section, was of fire-resistive construction, should we consider that the frame, and hence the entire structure, is likely to come down in case of fire, or should we assume that it should stand up; and we felt that the only safe course was to assume that the adjoining or abutting section might fall, and therefore we must make our fire division wall safe against that fall. Of course in the majority of cases, or at least in many cases, we have no control over the adjoining section. It may be of ordinary construction, or of semi-fire resistive construction of one of the older types, or it may be one of the fire-resistive buildings, many of which exist to-day, so crowded with inflammable material and of such types of construction that when the test does come some day the whole thing will go down into the basement. Even after the Baltimore and Rochester fires we have had no test of many buildings of that type which will exist, which many people think will not stand up under a very heavy fire in their contents.*

Prof. Woolson. *Excuse me; I supposed this applied to new buildings and not to old ones.*

Mr. Crosby. *The section next to it is not built when you are building your original section; so it was felt the only safe course to pursue was to make the specification in the standard such that we could confidently expect the wall would stand and hold out the fire from the exposed section.*

Mr. Stone. *Assume that two parties owning adjoining estates want to put up a party wall; I see no other place in these rules where this matter of party walls comes in except here, and so we may as well discuss it in this connection. In the first place, you want such a wall to have its foundation spread equally on both sides. You want to avoid putting caissons in and levering and all that sort of thing which is necessary if one party builds on his estate and the next man wants to build on his estate. Those are questions which, perhaps, do not belong to this body to consider, but they are questions of great importance. Now, assume a man wants to put up a 12 or 14-story building and he agrees with his neighbor to put up a party wall, and that wall is of steel construction arranged to accom*[m]*date the building which he is going to put up; he may or may not agree with his neighbor as to the location of the supports which he may want in his wall, and we will assume that he does not arrange for it, but he puts up this wall on a foundation which is spread both ways, and carries it up to the height he wants and protects his frame. By and by his neighbor wants to put up a building which is not fireproof; he has got to support his floors otherwise, which he can do, and then the building is consumed. We assume that this wall is a sufficient fire protection from the next estate. We also should, in such a case as that, see that he does not expose the skeleton frame by any cutting into it, because we insist that the skeleton frame shall be kept protected. Now, I think*

it is doing a great injustice to owners of real estate to compel such a thing as this, and I think it is entirely unnecessary in different portions of the same building owned by the same man. I think we are creating a bug-a-boo. I do not think that there is any danger from it, with the kind of construction which is contemplated here. What we want to do is to get construction of a kind which will allow the real estate owners to use as much of their property as they possibly can with safety to life and limb and property; and I think it would be a very bad thing to put this provision in as it stands now.

Mr. Palm. *I take it there would be no objection to a large building under single ownership covering two or three 25 or 30-foot lots; and I would suggest that where the area does not exceed a certain given amount the question could be met by limiting the area, and by requiring an independent wall where the area was beyond that certain amount. I should like to have the question considered further.*

Mr. Goddard. *With the chairman's explanation that it is the expectation of the committee that they will obtain the same class of division walls between sections of the same building as has been discussed for use as party walls between buildings of different ownerships, the question does immediately become one of engineering; there is no doubt about that. But I did not so understand the section when I spoke, and I think that most of the speakers have taken the position that while, as this section reads, it sets up the same standard for a division wall between sections of a building as it does for party walls between buildings of different ownership, yet they could hardly credit the committee with expecting to get that class of division walls. With that statement on the part of the chairman, however, that he is asking for the same wall between sections as he is between buildings, every inconsistency disappears and it is a question of engineering, not as to whether we need it between separate buildings, but whether we need it for fire sections, and the question of ownership does not come in, and the question of buildings does not come in at all, but it is simply a question whether these independent walls are needed for fire stops; and that, I think; anybody would acknowledge is purely a question of engineering.*

Mr. Stewart. *Mr. President, I think the points that Mr. Stone made in his remarks are really matters of expediency, from the standpoint of the owner and matters of underwriting from the standpoint of the underwriters. The committee feel that this standard which, as I say, is perhaps high, is necessary as a standard. Now, if it is not feasible to get this, perhaps Mr. Stone will be able in some particular case to get something that is 99 per cent as good as this. To illustrate: If a building standard in every respect, including this requirement for walls, would rate at 20 cents per 100, perhaps he could approach it with a building which would be sufficiently superior so that it could be rated at 20*[-]*½ cents. In other words, we can under special conditions get something that is practical, which will approach this very nearly, and be considered on its merits; but for purposes of a standard the committee felt that we*

could scarcely go lower than this. If we go below this, then we have got to take into consideration a great many points, especially details of construction and methods of fireproofing of the steel work, the number of floor openings, the chances of fire spreading, the occupancy, and almost every detail, and hence the probability of each particular building collapsing and bringing down the wall. All those points, I think, are matters of underwriting, and in specific cases we may not be able to get this double wall on independent frames, but we may be able to get so near that for practical purposes the requirements of the owner can be met and the underwriting interests will not be seriously prejudiced.

Mr. Crosby. *I think this discussion has led to a clear understanding of the committee's intent, that we have endeavored to make this positive fire stop between buildings or sections, irrespective of ownership, purely as a physical matter; and we recommend it as the best thing which it is feasible to propose. Now, the committee, as I recollect the discussion when they made their report a year ago, made a suggestion for a 16-inch wall as a fire division under certain conditions; and personally, I am much in favor of a note, or a second clause under this rule, which will allow a fire division wall between sections of fire-resistive construction, as coming under these specifications, to be a 16-inch wall total. I think that is perfectly proper. But when it comes to cutting off a section which is not built up to these specifications, then the rule as it now stands would seem to be necessary to afford a positive cut-off.*

Mr. Stone. *I think what Mr. Crosby says is in the right direction. What I think we want to do is to emphasize the point of making the construction so good that we can do that which all owners of real estate want, and that is, get a good wall, thoroughly substantial in every respect, within the smallest possible compass. And it seems to me that our effort should be, not toward multiplying walls, but so constructing those walls that they shall accomplish the purpose we are after. If the committee will extend investigation in that direction, I believe that could be brought about, rather than to do it in this way. If you think a 12-inch wall is too little between two buildings for tire* [fire] *protection, make it 16 but don't require two 12-inch walls.*

Mr. Cabot. *I want to emphasize what I said before, that we are not talking about the separation of estates; we are not considering whether a building belongs to one man or to 400 men. We are talking about a fire cut-off, and I should like to put the concrete question to Mr. Stone whether, if he were asked to construct a building for Siegel-Cooper, having a floor area of 50,000 square feet, which was to butt up against one for Mr. Wanamaker, with 50,000 square feet, he would not consider it necessary to put in two 12-inch walls.*

Mr. Stone. *I would specifically say that I would not consider it necessary to put in two walls. I would consider, with such an area as that, that particular wall should have especial construction, because of the vast areas and the amount of inflammable material within them but I would not advise my client to put up two walls.*

Mr. Cabot. *Or two frames?*

Mr. Stone. *Or two frames. No sir, I would not. I would advise him to put up the single frame on its single foundation, spreading out equally on both sides, and I would protect that frame with extra precautions; and after the Baltimore fire, which most of us here have seen, I say we have ample proof that that can be done and the building remain in its integrity after a heavy fire on one side of that wall, and I believe it will protect it from destruction by a fire on the other side of the wall, provided it doesn't go around into the windows–that is, I mean this wall would form a complete curtain and protection.*

Mr. Steeb. *It seems to me that there are three different points or discussion brought up here. In the first place, this wall, as I take it, is a wall in a single separate building standing by itself, for fire division purposes in that building; in other words, it is to cut off the area subject to one fire in that one building. In the next place, it is in the construction of a large building, or a building of any size, by two separate ownerships as a division between the ownerships of those buildings, and also a cut-off for fire. In the third place, it is in constructing two separate and distinct buildings specifying what the fire division between those distinct buildings shall be. Now, it seems to me if you have a single building of large area belonging to one party and it is being cut up, simply divided into fire sections, the necessity for two walls there is not as great as between two buildings of large area adjoining each other, being constructed separately or on the same frame-work. I would say under the first proposition, that of a single building being divided up into fire sections, it seems to me that if we had one single wall to divide it, that is sufficient. If it is a large framework in two distinct sections, then it becomes a question of the thickness of the wall. But if there are two entirely distinct buildings put up, either at the same time or at different times, then it seems to me that there should be two distinct walls.*

Mr. Goddard. *To bring the matter to a head, Mr. President, I would move that the committee be requested to consider the advisability of introducing, perhaps, a note under that section, that where the sections or buildings are of standard construction –standard under this, I mean fire-resisting, of course–are of standard fire-resisting construction, with frames which are not independent, a single 16-inch wall would be considered as acceptable.*

Mr. Cabot. *I am quite ready to accept that suggestion for the committee.*

The President. *Mr. Goddard makes a motion, but the chairman of the committee is willing to accept the suggestion for the committee, so if there is no objection it will take that course without putting it to a vote. There seems to be no objection.*

Mr. Cabot. *That will make it necessary to modify the next section.*

Mr. Stewart. *I would like to ask if that would permit the use of open well holes; or, in other words, do you contemplate a building which is strictly standard as to floor construction and all other recommendations which go along with the specifications?*

Mr. Goddard. *I think that is a question I had rather leave to the more careful consideration of the committee; because we have had suggested here two buildings of 50,000 square feet floor area, filled with combustible material, which are to a certain extent exceptional buildings; and it is possible that the committee may want to modify that a little further in the way of the class of building which is being considered. And then we have had mentioned a little building, 50 feet by 100, two of them together, where anybody would accept a 16-inch wall with a single frame. I had rather leave the whole question as to detail and particulars to the more careful and mature consideration of the committee.*

The President. *If there is no objection, it will take that course.*

> *A wall forming a fire division from an adjoining building of other than fire-resistive construction shall be independent of the adjoining wall and structure, and not less than 12 inches in thickness, irrespective of thickness of adjoining wall.*
>
> *Note–Only well laid bricks are to be used for exterior walls or fire divisions. The use of tile for such purpose is opposed as a less satisfactory material and more liable to disturbance by falling weights and fire department streams.*
>
> *Note– See No. 11 for partitions.*

Mr. Cabot. *The chairman's attention has been called to the fact that we have entirely omitted concrete in that fire division wall, and that it is possible, with the growing use of concrete and the improvements in the methods of its use, something of that sort might be perfectly feasible and advantageous; and unless objection is made the committee will feel authorized to consider concrete in that connection.*

Mr. Stone. *Before we pass to the next section, I should like simply to ask that the committee, when they reframe this, consider what seem to me to be a few inconsistencies here with regard to 12 inches and 16 inches. I do not care to go over them, but I think perhaps it would be well to reconsider that matter. If we believe that a 16-inch wall is the necessary thickness for fire protection, let us have it understood so.*

Mr. Fiske. *I don't quite see why this last paragraph is in here anyway, for it seems to me the first paragraph covers it.*

Mr. Cabot. *I have already said that this will have to be modified on account of the changes in the preceding section. Let us not discuss it now, for we have too much to do. We have got to reword this whole section.*

Mr. Fiske. *All right.*

> ***4. Post or Column Covering****–All vertical metal supports shall be insulated by not less than 4 inches of brick, or of concrete, or of terra cotta, or of other such insulating material as may be approved by the National Board of Fire Underwriters, independent of any air space next* [to] *the metal. Well laid brick is strongly preferred for column covering. No portion of the covering within the limits of thickness to be scored or impaired as for the running of wires, pipes or tubes.*
>
> *Note–"Independent of any air space" here means in addition to such a space if any. It is a most desirable practice to fill any space about the steel skeleton and the fire-proofing material with Portland Cement mortar applied directly against the steel, this being an excellent protection against rust.*

Mr. Stone. *There is one thing here. I notice in section 5 it allows the lower flanges of the beams to be protected by two inches, and they are certainly subjected to as much heat as the vertical divisions, for which four inches are required. I am not quite sure, but it seems to me that the Baltimore fire shows that two inches well done is sufficient protection, and it seems to me that four and two conflict.*

Mr. Cabot. *The reason the committee make that distinction is that the beam does not carry the load that the post does, and a very small amount of softening might result, as it did in one case, in four squares on four floors having to be taken out.*

> *Too much importance can not be attached to the method of applying fire-resistive coverings to the columns. When tile blocks are used they should be firmly secured in position by copper wire. And whatever system is used it should be arranged so that it will stand the impact of hose streams as well as the heat of fire.*

No piping or conduits to be located within the covering above required, or between same and the column.

Note.– No plaster, whether or not on metal lathing, shall be considered a part of the covering required.

Mr. Crosby. *I should like to suggest as a substitute for copper wire a new method of attaching which seems to be secure, which came to my notice last night. It seemed to me quite an equivalent.*

The President. *The chairman will note an equivalent, of course.*

It is essential that the fire-resistive covering extend from the fire resistive floor all the way to the ceiling, and that it be entirely independent of any combustible material for support or strength. An exceedingly bad practice is the use of plaster of Paris or ornamental metal capitals or cornices in lieu of a proper and complete application of the fire-resistive material. Plaster or plaster of Paris should not be considered as in any degree affording all or a portion of the insulation required in fire protective coverings used in buildings of this type.

5. Girder Covering*–All metal girders shall be insulated throughout by not less than 4 inches of brick, or of concrete, or of terra cotta, or of other such insulating material as may be approved by the National Board of Fire Underwriters, except that the upper face of upper flanges and the lower face of lower flanges may have not less than 2 inches of brick, or of concrete, or of terra cotta, or of other such insulating material as may be approved by the National Board of Fire Underwriters.*

Mr. Cabot. *It has been suggested that in view of the fact that a great many of the skew-backs in Baltimore showed defects, we add after the word "face" in the seventh line the words "and edges," so it will read "the upper face of upper flanges and the lower face and edges of lower flanges may have not less than two inches," etc. That will require the terra cotta men to work their brains; they will have a problem.*

Prof. Woolson. *I intended to say a word on the question of post or column covering, but I was called out of the room and just missed the reading of that. It seems to me here would be a good place for the Association to insist upon some kind of a locked joint for blocks that are put around posts, so that they will be self-sustaining, aside from copper wire to hold them together. It could be very easily done with terra cotta blocks. They could be made with some kind of a lock joint which would hold them together. They could be shoved down from the top, and they could all be protected except the top one, and some scheme could be arranged to fasten them together at the top, I think; but all of them except the very top joint could certainly be fastened*

together with some kind of a lock joint which would slip down so that they would not depend upon the flimsy construction of a piece of copper wire, which will easily melt off when the plaster comes off and let the blocks fall down. I think even in other blocks than terra cotta we might arrange to have something which make the blocks self-sustaining when the plaster falls off and the copper wire melts.

Mr. Cabot. *In respect to what Prof. Woolson has said, I have only to say this: I am not an engineer, but I have had some experience with the trowel and with the man who lays these blocks, and if you put a lock in there he will knock it off. I do not believe anybody has ever seen a column which was properly wound with copper wire, where the copper wire was affected by the heat. They certainly were not in Baltimore, for we found a lot of them, and the copper wire stood right up to the last gasp. I do not believe that locking these things together is what you want. You want to build them up in such a way that they will stay. You can't lock brick together, and I don't believe the professor would suggest such a thing.*

Prof. Woolson. *No.*

Mr. Cabot. *We believe that terra cotta blocks properly designed to fit around a column will stay without a lock; and I think that every man who has had to do with fireproof construction from the underwriters' end– and a good many of them on the engineering end–will allow that if the lock gets in the way the trowel will hit it, accidentally or otherwise.*

Mr. Walsh. *May I inquire whether there would be any objection to using something in the form of a staple locking over the joint?*

Mr. Cabot. *I think that would be admirable–something of that sort–in the hollow places; but I should not consider it would be specially satisfactory here. I think this whole question of column covering is something which the terra cotta men should give us a little thought on. I think we can fairly say to them, "Gentlemen, it is up to you."*

Prof. Woolson. *There is one other point. Has the question been brought up in regard to any other kind of brick than ordinary hard fire brick? There is a strong tendency at the present time to introduces in the market, by three or four different companies, so-called sand lime brick. That is not mentioned, and I was wondering whether the committee had considered it, and whether it would make any difference in regard to what the brick is. I don't know whether its fire resistance has been determined or not. I have made a number of tests myself, but I am not yet satisfied. So far as strength is concerned, they fulfill conditions. The committee say "well laid brick is strongly preferred for column covering," but say nothing about bricks which are manufactured without being burned.*

Mr. Cabot. *As I understand, the committee mean by "brick" baked clay in a solid piece; or, possibly, for a lining, brick with a hole in it; but they would not consider a brick made up of unbaked material, or which was not baked after being formed, as a brick. It would be considered as "such other material as may be approved," and such a thing is not at present approved.*

Prof. Woolson. *They sell it as brick.*

Mr. Cabot. *I understand they sell it as brick; but that doesn't make it so. A lot of stuff is sold as rubber-covered wire, which isn't what it is sold for.*

Prof. Woolson. *I am not at all prepared to defend this brick, but I have made some severe tests of it within the last few weeks, so far as fire-resistance is concerned, in comparison with ordinary hand-burned brick, and it stood up remarkably well. It didn't always do it, by any means, but I think it is something which we may have to deal with in the future.*

Mr. Cabot. *We don't say we won't approve it; only it isn't a brick.*

> ***6. Floor Beam Covering***–*All the metal floor beams shall be insulated by not less than 2 inches of terra cotta, or concrete or other such insulating material as may be approved by the National Board of Fire Underwriters.*
>
> Note–No plaster, etc. See note, Sec. 4.
>
> ***7. Spacing of Floor Beams***–*This is a matter entirely dependent upon the type of construction, the weight and size of materials, and in many cases the restrictions of the municipal building laws. It is not felt that it is feasible for the Underwriters to pass upon this subject except in general terms.*

Mr. Cabot. *We have a letter from Mr. Field, in which he says that in his opinion it would be very difficult to lay down in any code of this sort any standard of definite spacing for floor beams.*

Prof. Woolson. *I should like, referring back to No. 5, to ask if that thickness of four inches is the minimum thickness which would be allowed?*

Mr. Cabot. *Certainly, not less.*

Prof. Woolson. *Would there not be times when it would be feasible to get as good protection with less thickness? I made tests this past winter upon cast iron coverings, or coverings for anything of this kind, of some varieties of material which was two inches thick. I exposed a cast iron plate one inch thick to a heat of 1,700 degrees for one hour, having it protected on the other side by various kinds of protected cov-*

erings two inches thick, and I failed to get a transfer of heat through that two inches–I ought not to say the plate was exposed to the fire, but the material was exposed to the fire–of over 400 degrees. It seems to me if we had three inches it would be ample and it would be much easier to put on and hold in position than four inches.

Mr. Stone. *I endorse what Prof. Woolson says on that subject.*

The President. *Four inches is just the thickness of one brick.*

Mr. Cabot. *I should like to tell you what was called to my attention last night by Mr. Robinson. In the roof of one of the buildings in Baltimore, which was constructed of about five inches of concrete, there were laid some sleepers to which the roofing covering was fastened. It was evident on examination that the heat was not applied to the upper surface, because the tarred paper was there; yet in a number of cases those sleepers were burned out for a length of eight or ten, and in some cases as much as eighteen feet. I do not think any laboratory experiments on matters of this sort are worth the time they take. You cannot concentrate your heat; you do not have the heat all around. In actual test in a great fire you have radiating surfaces; you have currents of air and masses of incompletely burned material, which we have got to deal with in these, buildings, I don't think any member of the committee has any doubt about that four inches.*

Mr. Cairns. *I think another point of importance is that four inches is about as thin a piece of material as can be built stably–that is, to stand up–without regard to the amount of heat it is subjected to. You can't build up a wall ten or twelve of* [or] *fifteen feet high of 2-inch pieces of tile on edge, and have it stand.*

Mr. Steeb. *In municipal building laws do they have different lengths, and if they do, wouldn't it be well to have a note to say that we believe that the minimum length, instead of the maximum length, should be used?*

The President. *The committee thought it advisable not to pass on that at all, leaving it open to the municipal laws.*

Mr. Crosby. *Will you allow me one moment, Mr. President, to speak of the Baltimore fire and its lessons, as I draw deductions somewhat different from those drawn by Mr. Stone? We have for a great many years been waiting for a severe test of this type of construction, and in the Baltimore fire we found it to a certain extent, but it was nothing like a complete test, particularly in view of the small amount of combustibles in most of the buildings. There are a good many of us to-day who are firmly of the belief–and it is merely an opinion, I will admit; because we have not had the actual test–that should such a wide-spreading fire occur in many city districts where these so-called fire-proof buildings of large area now exist, filled with tons of combustible material, the results would be far different from those shown down in Bal-*

timore, and that, while they were bad enough there, they would be infinitely worse elsewhere. So we think we can afford to ask for these four inches of protection. In fact, the best tile people come to us to-day and say, "Why don't you insist on it? We can furnish them, we have the designs, and we recommend them; but we can't get the architects and owners to spend the money for them."

Mr. Cabot. *Mr. President, I wish to read from a letter from Mr. Crosby a quotation which he encloses from a letter from Capt. Sewell, an engineer of the United States Army, who was detailed to investigate this subject in Baltimore. Capt. Sewell writes as follows:*

"Referring to the confidential extracts from the report of the Committee on Fire-Resisting Construction, I would say that I have very few criticisms to offer. I think the standard of design and construction set in this report will result in excellent buildings; but wherever you refer to the thickness of covering on structural metal–that is, column coverings, beam coverings and girder coverings–I would suggest that you require that the covering material shall be solid. For instance, if you say that a column covering may be four inches thick, the average contractor would interpret it as meaning he could use 4-inch hollow tile, which would really not give you more than 1½ inches of solid material, and that 1½ inches would be disposed in two thin webs, so that it would merely be an invitation to the fire to strip it off. I would recommend that you require 4 inches of solid brickwork or concrete or porous terra cotta for column coverings; that where you require two or more inches of covering for girders or beams, that it should be that thickness of solid material, either concrete, porous terra cotta or brickwork. I would recommend that, in case hollow tiles are used, the thickness of the individual webs be not less than 1½ inches, and that the material itself be always of porous terra cotta. With these additions, I should say little was left to be added to the report of the committee.

Mr. Stewart. *Before leaving this subject, I should like to inquire of Prof. Woolson, through you, Mr. President, if any test was made of the mechanical strength of that 2-inch fireproofing which was tested for heat conduction.*

Prof. Woolson. *Before or after the test?*

Mr. Stewart. *At any time.*

Prof. Woolson. *Some tests were made for mechanical strength.*

Mr. Stewart. *Did you regard it as perfectly stable and rigid to resist mechanical shock?*

Mr. Woolson. *It seemed to be in very good condition, what I saw. Of course, they were selected blocks–what were considered as first-class blocks–in all cases.*

***8. Material of Arches**–Roofs and floors shall be of an approved system of brick, concrete or terra cotta, or other material which may be approved by the National Board of Fire Underwriters for such purpose, with satisfactory insulation of special supports or tie rods.*

Note– For "concrete steel" or "steel concrete" construction aside from using the best materials, proper tension members and employing only those experienced in concrete engineering, the greatest care must be exercised during construction, in the preparation, application and setting of the concrete. This is all important, yet errors in this respect have already been conspicuous. These are needless errors not inherent in this type of construction but in its application.

***Mr. Walsh.** I should like to inquire in connection with this form of construction whether, in the minds of the committee, it is considered advisable to limit in any way the amount of concrete covering over the reinforcing members. There was one building in Baltimore which was of that construction, in which the concrete fell away and exposed the reinforcing members, the concrete covering in that case being only about an inch thick. Referring to the report of Capt. Sewell, whose letter has just been read, in that report, which I saw in the Engineering News, reference was made to the square corners of the girders having a tendency to break off, and Capt. Sewell suggested that all corners should be rounded. It seems to me, with only about an inch covering, the same thing which happened in that one building might happen again.*

***Mr. Cabot.** The committee has not thought it advisable to undertake at the present time to go into the engineering of concrete work. I will take this occasion to say that a number of the members of the committee–we have not voted upon it as a whole committee–think it might be advisable another year, if this committee is continued, to undertake to draft some detailed specifications for concrete work; and I should be glad at the end of the reading of this report, to hear suggestions as to whether or not the Association desires us so to do.*

***Mr. Crosby.** In that connection I have heard it suggested that the committee may also take up the study of the design of concrete blocks, the question of thickness of the webs, and all the other features of tile blocks–not only the question of concrete construction and special construction, but also all the features of tile construction.*

***Prof. Woolson.** I will make the suggestion that we provide that all concrete applied to a building of this character should be mixed in a mechanical mixer. Too much concrete work is done by careless workmen and under careless inspection. You can overcome, it seems to me, a good deal of that by insisting on the use of a mechanical mixer.*

The President. *The note calls attention to that.*

Mr. Stone. *I should like to call the attention of the committee to one form of construction which they do not recognize in the eighth paragraph–it seems to me it is not recognized at all, unless it is under "other material"–and that is the Gustavino construction, which I think is particularly good for fire purposes.*

Mr. Cabot. *We consider that brick– that is, a solid piece of clay baked after it is formed. The committee has that very much in mind, and has been very much pleased with what it has seen of it in certain places.*

Mr. Stone. *They use the word "tile" in connection with it altogether– Gustavino calls it tile– and it seems to me you should give some indication that it is considered suitable.*

> *A suspended ceiling is frequently employed with this type of construction, and, as commonly built of plaster, can not be relied upon as furnishing any considerable degree of protection.*
>
> *A very serious defect often incorporated into buildings otherwise well constructed is the use of a suspended ceiling beneath the roof, the roof members themselves not being properly fireproofed.*
>
> *Where metal clips are used for holding the tiles used in facing girders and beams, the clips should be protected from heat by the tile itself as the outside coating of plaster can not be relied upon.*

The President. *The chairman will make a note of that.*

Mr. Walsh. *With reference to the use of clips to hold protecting coverings on girders and beams, it seems to me there is a form of clip which might be used which, while exposed to heat, might be expected to fulfill the purpose for which it was placed there. It is a form of clip which entirely encloses the block and laps up against the web of the beam, and is put in position before the floor is set.*

Mr. Cabot. *Our attention has been called to the practice, which is now beginning to prevail in some parts of the country, of holding the block by a piece of wire, wrapping the block and going up over the flange of the beam. The committee think it advisable to consider that also in this connection.*

Mr. Cairns. *That is a wire net, and not simply a single wire?*

Mr. Cabot. *A wire net.*

Careful workmanship and use of only the best materials are essential.

***9. Wearing Floors**–Floor surfaces shall be of non-flammable material.*

In sub-standard buildings, if wooden top floors are used, concrete of good quality should be used to fill all the space between flooring and arch and the nailing strips for floors should be imbedded in the concrete so that there will be no unfilled space between floor boards and arch.

***Mr. Walsh.** May I ask, referring to the first paragraph of Article 9–"Floor surfaces shall be of non-inflammable material"–what position would so-called fire-proof wood have?*

***Mr. Cabot.** I have yet to learn of any wood which is not flammable.*

***Mr. Stone.** I suppose this is meant to cover such things as asbestolene.*

***Mr. Cabot.** Yes, sir.*

***10. Floor Openings**– Stair, elevator and dumb waiter shafts shall be entirely enclosed by walls of brick, concrete or terra cotta, or such other material as may be approved by the National Board of Fire Underwriters for this purpose. Minimum wall thickness to be 6 inches. Walls of well laid brick are strongly preferred.*

***Mr. Cabot.** I should like to stop right there, if there is any comment to be made on that part of the section.*

***A Member.** I should like to suggest that six inches be changed to four inches, to conform to the rest. It is just the thickness of a brick.*

***Mr. Cabot.** Would the gentleman be willing to take a four-inch terra cotta tile, running from one story to another of a building, where the floors were of the height of this one? I don't think he would.*

***Mr. Stone.** Is this supposed to include the elevators in such a building as this, for instance–an all-office building?*

***Mr. Cabot.** No. I will explain for Mr. Stone's benefit that we do not intend to cover a building of this type. A building used entirely for office purposes is not supposed to come quite up to the standard here laid down. This is intended for a mercantile building.*

***Mr. Stone.** How about department stores?*

Mr. Cabot. *Those are exactly what we want to hit.*

Mr. Walsh. *May I inquire what was in the mind of the committee in fixing the minimum thickness of the wall at six inches?*

Mr. Cabot. *We didn't think it necessary to make it eight, and we didn't think four was enough.*

Mr. Walsh. *Don't you think common brick would be enough?*

Mr. Cabot. *A single brick? No; we wouldn't talk about a single brick, any way.*

Mr. Walsh. *It would be eight inches laid the other way, and that would furnish a satisfactory foundation for fire doors.*

Mr. Barbour. *I would like to ask if it is contemplated that there shall be no natural light in an elevator shaft. For instance, if it was against the outside wall, and it was desired to have windows to light the shaft itself, other than the ventilating light at the top, would that be permitted under this specification?*

Mr. Cabot. *That comes in under the latter part of the section, which I have not read yet. I should not on the moment suppose that there was the slightest objection to so doing where you can.*

Mr. Barbour. *The latter part of the section deals only with the skylight at the top.*

Mr. Cabot. *That is right. This says "shall be entirely enclosed."*

The President. *The committee will make a note of Mr. Barbour's suggestion.*

Mr. S. H. Lockett. *We have shown great deference to the thickness of brick heretofore in making a standard for the thickness of these partitions, and why shouldn't we be consistent here? You couldn't make a partition of six inches of brick, and I think six inches is too thin, anyway.*

Mr. Cabot. *You wouldn't hesitate to take six inches of concrete?*

Mr. S. H. Lockett. *No.*

Mr. Cabot. *The difficulty comes, Mr. President, in attempting to go into detail. If you are prepared to say not less than 12 inches of terra cotta and not less than 8 inches of brick, and not less than 6 inches or concrete, all right; but then the terra cotta man will come along and bang you on the head because you haven't treated him as well as you have the concrete man. It didn't take us much more than two weeks to draw that part of the section.*

> *The shafts should extend above the roof and have a skylight with thin glass in metal sash and frame protected by a standard wire screen, both above and below the glass. Wired glass is not acceptable. There should also be a ventilator in the top of the shaft. Standard fire doors shall be placed at openings to each story. Shafts not extending through the upper floor may be enclosed at top in a manner similar to the sides, but provision should always be made to ventilate shafts of any considerable height at the top to carry off smoke.*

Mr. Kenney. *I should like to ask why you do not fix the minimum height for the shaft to extend above the roof. It says "The shafts should extend above the roof"–how much?*

Mr. Cabot. *The minimum height, Mr. President; we don't care. This is a fire-proof building, and the minute the shaft breaks through the roof it is all right.*

Mr. Kenney. *An inch or more?*

Mr. Cabot. *Yes, a quarter of an inch. This is an elevator well, and you don't care about a parapet wall on this; it is simply to carry the fire through the roof, and when you get it a quarter of an inch above the roof it is just as well as if it were a mile.*

Mr. Kenney. *The committee do not approve of wired glass for skylights, and I would like to ask the reason for that. Would there be any objection if proper area is provided for, to having a wired glass top; and if so, why?*

Mr. Cabot. *No, I don't think, there would be any objection if you had plenty of other ventilation space. I don't think that any man who had had any experience with wired glass laid flat would use it.*

> *All other vertical openings, such as pipe or wire ducts or channels, except ventilating shafts, unless enclosed as above, shall be stopped with masonry or concrete at each floor.*

Ventilating shafts shall be enclosed as required for other shafts, except that the necessary ventilating openings shall be protected by an automatic closing fire door, or by metal louvres riveted into metal frames solidly set in the masonry of the shaft, louvres being set at an angle to prevent draft from shaft into room.

Mr. Fiske. *Going back a moment to the sentence which reads, "Standard fire doors shall be placed at openings to each story," there is no mention made of window openings, which are frequently found, and I think it would be well to insert a provision that wire glass windows shall be placed at all openings.*

The President. *That matter has already been called to the attention of the chairman.*

Mr. Cabot. *Windows opening outside of the building?*

Mr. Fiske. *I am speaking of outside.*

Mr. Cabot. *I don't think the committee is prepared to accept a window inside such as that.*

Mr. Stewart. *That matter received consideration, but in view of the fact that the ability of wired glass to stand fire was limited by the melting point of the glass, and in view of the possible intense heat inside of buildings where this would be used, we were not satisfied to recommend it for elevator doors, or windows in elevator shafts inside buildings; in other words, it is not for anything except exterior openings.*

Mr. Grier. *I should like to ask the chairman of the committee what the angle of those louvres would have to be to prevent draft into the room?*

The President. *The chairman holds up his hands.*

Mr. Cabot. *I am no engineer, as I have said before. Such a device is used in this city, and, I believe, has been found to work very satisfactorily. Of course, the louvres are bent upward. The detail of the thing has got to be worked out.*

Mr. Longacre. *I should like to ask if it is intended in the section beginning "All other vertical openings"–the paragraph before the last one which has been read–to legislate against material chutes designed to carry off waste paper and other rubbish?*

Mr. Cabot. *Unless built in accordance with these specifications, yes.*

Mr. Longacre. *That would prevent, then, such a chute being made to, say, the third or fourth floor of a building, and not extending through the roof?*

Mr. Cabot. *Unless properly ventilated; that is especially provided for there–"Provision should always be made to ventilate shafts of any considerable height at the top to carry off smoke."*

Mr. Longacre. *Does that necessitate your shaft being carried up to the roof?*

Mr. Cabot. *Not if a proper ventilator is carried up. In other words, Mr. President, as I understand what the gentleman is talking about, it is the device which is used in a great many stores to carry the waste paper down from floor to floor. Now, that is the most beautiful place for a fire there is in the whole store. You can have a first-class fire there, and the chances are that at least one opening may be open and the whole heat will pour into that story, unless you have, say, a cast iron boiler flue properly carried up and vented outside or through the top of the building.*

Mr. Longacre. *It can be vented at any floor?*

Mr. Cabot. *Certainly, where it goes outside and will not hurt anybody else.*

Mr. Goddard. *To make Section 10 clear, I think it would be well for the committee, when they consider the subject of window openings and doors, to state distinctly that no window openings into the building will be considered as standard.*

The President. *The committee will note that, I think.*

Mr. Cabot. *Hold on a minute. Window openings, however protected? Would you object to them if protected with standard fire doors?*

Mr. Goddard. *I had a great deal rather have a good, tested, double-wired glass window than a standard fire door, which undoubtedly would be left open. If you are going to shut out a properly constructed wired-glass protection to that little opening, which would always be in position, I would rather shut out the fire door, which may be in position and may not be, and which under the laboratory test has not shown any great advantage over a wired-glass window, except in the point of the glazing of the window.*

Mr. Cabot. *And the radiation.*

Mr. Goddard. *A double window, you might provide for.*

Mr. Cabot. *Well, I haven't heard anything about any test any where of such a window.*

Mr. Goddard. *Very true; but the committee might provide for it. Now, you take a little opening into an elevator shaft, which would be glazed with a moderately small pane–a single pane– of wired glass, and you overcome to a very great extent, if not entirely–it certainly could be overcome–the trouble which arises from the poor or ineffective glazing; and if you are going to allow a window with a fire door– and I suppose by that you mean a fire shutter–I think you had better take the other into consideration. I think it should be made plain here how that window should be protected, or else no such windows will be considered as standard.*

The President. *The committee will make note of that suggestion.*

Mr. Steeb. *With regard to the point brought up by Mr. Fiske, it is almost impossible in the large department stores to get them to use standard fire doors on the elevator openings, because they are too bulky; and I think it would be advisable to put some suggestion in here whereby that can be provided for, for they are bound to have something, and they won't use a standard fire door, and of course a wire net door is preferable to anything but that for that class of openings.*

Mr. Cabot. *I think they will, if you require them to.*

Mr. Steeb. *I understand that there is a new building at the corner of 14th street and 5th avenue which has this wire netted protection on the openings.*

Mr. Robinson. *May I ask what is meant by wire netted?*

Mr. Steeb. *I mean wired glass.*

Mr. Robinson. *I sincerely hope you will not put any provision in for material of that character, for you are going to have it roll right out of your frames, no matter what they are made of, as soon as the softening point has been reached. It would be establishing a bad precedent, and I had rather hold to the standard which the chairman suggests.*

There shall be no light wells within a standard building.

No stone treads shall be used on stairs unless backed by satisfactory metal plate, grill or mesh work.

11. Partitions*–All partitions shall be of nonflammable material and not to rest on wooden floors. Use no wood studs or framing nor plaster of Paris.*

Partitions here referred to are those minor subdivisions moved about frequently to suit the requirements of tenants or landlords. This paragraph does not relate to the walls forming stair and elevator enclosures, nor the fire division walls elsewhere specified. The above rule legislates against many common errors, as for instance, the use of wood studs in partitions covered with metal lath and plaster, and the building of such partitions on wood flooring or wood strips which, in a fire burn and allow partitions to settle and collapse.

Mr. Stone. *I rise to ask whether, in the Baltimore fire or elsewhere, the value or otherwise of expanded metal or wire lath partition, etc., has been learned; and that also brings up the question of whether it is possible to enclose an elevator shaft with such a partition of less thickness than six inches.*

Mr. Cabot. *We have learned it otherwise. I do not think the wire lath partition had a fair test in Baltimore, so far as I could find out, because every one of them was on wooden studs, and where they were on wooden studs they laid down in large quantities. In one or two cases, where they rested on top of the floor, they would have come down even if the studs had not been of wood. I do not think we found in Baltimore a metal lath and plaster partition with a metal stud fastened to the fireproofing top and bottom, and that is what I understand Mr. Stone wanted to ask about.*

Mr. Stone. *Yes. I mean fastened at the top and bottom.*

Mr. Cabot. *I do not think there was a single partition of that sort in Baltimore in the buildings into which we went. I didn't see one, and if any member of the committee saw one, I wish be would so state.*

Mr. Robinson. *I do not think such a partition existed there, but a number of suspended ceilings of that construction seemed to stand pretty well. It was hardly consistent with what you might claim to be the results that the partitions gave; it seemed to indicate that some thing was wrong with the partitions, although we could not always find the evidence. The ornamental plaster work forming the pilasters and panels sometimes stood in place with remarkably little damage, and that seemed to indicate that there might be something in the expanded or wire lath and plaster partition which we could approve of, if we only knew what it was.*

Mr. Patten. *I believe in the Alexander Brown building there were wire lath and plaster partitions on angle iron, and they resisted the fire pretty well, although at that point it was not very hot. In one of the corner rooms in the rear of the building the fire entered from the falling of the walls of the hotel in the rear, broke out the wire glass windows, and was apparently held by the wire lath and plaster partition.*

The President. *There was practically no combustible material in that room, however, Mr. Patten.*

Mr. Robinson. *There was considerable combustible material in the room. The fire burned in that room for twelve hours in quite a considerable stock of stationery. The cashier told me that it burned the wooden doors and burned a desk and destroyed a marble column in the room. The damage in the bank was a little over $20,000. I could not ascertain how the partitions were held, but it was evident that they did stand well. That is one case I had forgotten.*

Mr. Wilmerding. *I should like to call attention to the fact, however, that there was very little water thrown in Baltimore, and that must be taken into consideration in connection with these partitions.*

Mr. Fiske. *I should like to see something in this rule to cover the question of the mechanical strength of partitions. I think we ought to insert a rule here requiring all partitions to have some metal reinforcing members to give the proper mechanical strength. That certainly has been shown by the Baltimore fire to be a very important matter. We want these partitions to stand up against the severe shock from hose streams or anything of that kind, so as to form barriers in the floors. I think perhaps it can be left with the committee, but I should like to see something of that sort provided for.*

The President. *The Chair has a memorandum here to call the committee's attention to that very same point. If I am correct, the new building law of Pennsylvania requires metal studding for all door openings from the fire-proof floor to the fire-proof ceiling above. Am I right, Mr. Wilmerding?*

Mr. Wilmerding. *I think that is right.*

The President. *I think the point is worth considering.*

Mr. Stone. *I hope if the committee go as far as that they will go further and say that all partitions shall extend from fire-proof floor to ceiling–not simply the door openings, but all of them.*

Mr. Cabot. *All the studs, you mean?*

Mr. Stone. *Yes.*

Mr. Robinson. *I rather question the advisability of tying a partition to the ceiling and to the floor with a solid metal member of any kind.*

The President. *At openings?*

Mr. Robinson. *At any position. It occurred to me and to a number of our committee in Chicago–Mr. Cairns and I talked it over, and Mr. Stewart and I talked it over–and we felt that a metal member might be a detriment to the partition, because if it expanded it would throw it out of line and might throw it down. We rather felt that the partition should be constructed of such material as would be self-sustaining, and held in position rather by something else at the ceiling or at the floor, particularly at the ceiling.*

Mr. Stone. *At the floor concrete will do just as well. I think perhaps a bed of concrete on both sides, or something of that kind, would hold it and that a steel member would not be necessary.*

Mr. Robinson. *The point raised by Mr. Fiske, or by the President, as I understood it, was to support a partition from the floor to the ceiling by a continuous metal member.*

The President. *At openings?*

Mr. Robinson. *At openings and at other points.*

Mr. Stone. *Yes, at all points.*

Mr. Robinson. *We found a number of partitions which were wedged to the ceiling, and of course the minute the wedge broke the partition was absolutely loose, standing on its own foundation, and anything would throw it down. But we did not feel sure enough of our ground–I think I can speak for the committee on this point– to specify any particular method of holding these partitions upright.*

Mr. Stewart. *I should like to say that the committee rather felt in discussing this subject that perhaps the solution of it would be in the line of a more stable and better construction of the partition rather than attempting to take these small tile and standing them up on edge and trying to hold them in position with a lot of metal studding. The metal studding is likely to bulge or to warp, and that is going to throw the thin tile out of line; so I think the solution of the matter will lie rather in a more stable construction of the partition, using smaller members similar to brick construction.*

> ***12. Finish****–The quantity of combustible finish shall be reduced to a minimum and none shall be placed in vertical shafts.*
>
> *Combustible lath or furring is to be avoided.*
>
> *It is recommended that outside walls be lined with hollow brick that plaster may be applied directly on the bricks.*

Mr. Stone. *Is there any objection to the use of the words "or terra cotta" in there?*

Mr. Cabot. *Not if you do not count it as a part of the thickness of the wall.*

Mr. Stewart. *Perhaps that would not be specially objectionable, but it might be well to remark here that we found in a number of cases in Baltimore, where furring made of light tile was used, that the furring was practically a total loss; after the plaster went off the furring all split and fell down.*

Mr. Robinson. *That was very generally true–I might say almost universally true. The furring walls were very poorly laid and very unstable as soon as the mortar was disintegrated a little by the heat. They are a total loss to-day; the companies are paying a total loss on them.*

> ***13. Roof Covering****–Roof to be covered with non-flammable material. Slate not to be used unless laid approximately flat.*

Mr. Stone. *It is a very common practice to use tar and gravel over fire-proof construction. Do you bar that?*

Mr. Cabot. *No, I don't think it was intended.*

The President. *I am glad that point has been brought up; it is one I had in my own mind, the question of barring slate or tar-and-gravel roof on terra cotta construction. The chairman has answered it to my mind.*

> ***14. Superstructures*** *–All roof houses to be of brick, concrete or terra cotta. Unprotected iron superstructures not acceptable.*
>
> ***15. Skylights****–Skylights to have metal frames and sash and, except over fireproof shafts (see No. 10), to be not less than 1/4-wired glass or ½-in. glass protected above and below by approved wire screens.*

Mr. Robinson. *Do I understand that you are going to reinsert tar-and-gravel roof?*

Mr. Cabot. *I should like to have any member of the committee correct me if I am wrong, but I had assumed that where a roof was properly finished, the putting of a coating of tar and gravel over the top would not be considered as making it a flammable roof.*

Mr. Robinson. *I should think you had better take care to have your ventilating shafts, which may carry fire up through your roof, more than a quarter of an inch high, if you are going to have a roof which will burn.*

Mr. Cabot. *I should like to refer the gentleman to what he himself told me yesterday about those sleepers that burned out under this roof and didn't carry the fire a quarter of an inch beyond where the fire existed in the sleepers.*

Mr. Robinson. *That is true, but I am not prepared to say it would not in the next fire. I will say, however, that roofs of that character in Baltimore were practically always a total loss; they were buckled up, some of them four or five inches, and the concrete underneath them.*

The President. *I should like to ask the question whether they carried fire.*

Mr. Robinson. *I didn't notice in any case that such a roof had carried fire, although a number of them were badly roasted underneath–that is, so you could pick them up; there was no strength to them.*

Mr. May. *I should like to inquire what an improved fire screen is.*

Mr. Cabot. *Our specification calls for a half-inch mesh, not less than No. 14 gauge, iron or metal frame–it may be 12, but I think it is 14.*

Mr. Crosby. *It is the National Board's specification now.*

Mr. Goddard. *It is one-inch mesh and No. 12 wire.*

Mr. Stone. *What becomes of the chairman's remark about flat glass?*

Mr. Cabot. *If a man wants to use it, we can't prevent him; but I don't believe anybody will use it who has ever had any experience with it.*

Mr. Fiske. *Is that matter of tar-and-gravel roofing left entirely clear? As a member of the committee, I supposed this rule was absolutely prohibitive without any question, and I cannot see any other interpretation of it.*

Mr. Cabot. *I think the matter had better go back to the committee, if no objection is made.*

The President. *I think it had better go back as the committee suggests, and if there is no objection it will take that course.*

Mr. Grier. *I should like to suggest that slate be left out of this entirely, if the matter is to go back to the committee.*

Mr. Cabot. *No, not at all. We found in Baltimore a slate roof laid approximately flat, in pieces perhaps about that square (indicating), and about so thick, laid in cement, and it was the finest roof I ever saw.*

Mr. Grier. *I had no conception of a slate roof except where the slate were nailed to the wood.*

> ***16. Waterproofing of Floors****–Every floor to be made water tight by a special surfacing or stratum impervious to water, with special precautions taken at columns, walls and at stair, pipe, wire, lighting fixture or other openings.*
>
> *Note–This waterproofing to be completed after plumbers, electricians, etc., have done their work. Water-tight curbs at least 12 inches high are recommended as additional precautions at each floor about pipes, etc., which pass through the floor.*

Mr. Stone. *You don't make any provision for scuppers, but leave people to do as they are a-mind to, I suppose.*

Mr. Cabot. *We didn't feel as though we could.*

> ***17. Tanks , Etc.****–Tanks or other concentrated weights, especially on roofs or in attics, should be mounted on supports that are thoroughly protected against the effect of heat.*

Mr. Cabot. *Just one word in conclusion. The committee desire to say that if you build a first-class building it does not justify you in omitting to protect it against outside exposure, just as well as you would a very much less perfectly built building.*

The President. *Gentlemen, we have now considered the committee's report in detail; there have been some amendments accepted by the committee, but none put to vote. What is it your pleasure to do with the report?*

Mr. Goddard. *I move it be approved as amended.*

Adopted."

The discussion of the requirements for fire resistive construction above is quite interesting for a number of reasons. Perhaps of most interest is the fact that this discussion took place only a few months after the "Great Baltimore Fire" had occurred. It is obvious that the members of the Committee had spent a great deal of time studying the Baltimore conflagration and that their investigation of the Baltimore fire greatly influenced their opinions regarding what constitutes fire resistive building construction.

From the discussion, it becomes obvious that no standardized fire test of the structural elements existed in 1904 and that the concept of a standardized fire test had yet to be conceived. Professor Woolson's comments clearly indicate that the testing of the fire resistance of structural building elements was only in its infancy.

In the absence of a standardized structural fire resistance test and hourly fire resistance ratings for structural components of buildings, fire resistance was measured in terms of the thickness of walls and of coverings provided for steel structural members. In other words, fire resistance was specified in a materials-oriented manner, rather than in a performance manner.

From the discussion, it also becomes very evident that engineers in the first decade of the twentieth century took a highly conservative approach to building fire protection. This conservative approach certainly seemed justified by their experience with conflagrations, as well as the limited capabilities of both municipal water systems and municipal fire departments.

Also of note in this discussion are the references to reinforced concrete construction. It is apparent from the references to concrete construction that the concept of reinforced concrete construction was relatively new in 1904.

One last point of note regarding the discussion above is the degree of participation in the discussion by the representative of the American Institute of Architects, Mr. Stone. Mr. Stone's comments clearly influenced the thinking of the members of the NFPA in attendance at the meeting in 1904.

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