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MUNICIPAL COURT OF THE CITY OF BOSTON

INQUEST REPORT

ON

COLLAPSE OF WALLS AND DEATHS OF FIREMEN

DURING JUNE 17, 1972, FIRE AT HOTEL VENDOME

No. 61146

A. FRANK FOSTER
JUSTICE

November 28, 1973

RE: Collapse of Walls and Deaths of Firemen During June 17, 1972, Fire at Hotel Vendome

This inquest is predicated on a letter dated May 17, 1973, to Chief Justice Jacob Lewiton of the Municipal Court of the City of Boston from Garrett H. Byrne, District Attorney of Suffolk County. Mr. Byrne's letter stated that the fire at the Hotel Vendome on June 17, 1972, and the deaths of nine Boston firefighters during the course of the fire had been investigated by the Office of the District Attorney. He, therefore, requested that under General Laws Chapter 38, Section 8 (as amended) an inquest be held into the deaths in that fire of the following members of the Boston Fire Department:

Thomas J. Carroll, Lt. Engine 32

Richard B. Magee, Engine 33 Fireman

John E. Hanbury, Lt. Ladder 13

Thomas W. Beckwith, Engine 32 Fireman

Joseph P. Saniuk, Fireman Ladder 13

Charles E. Dolan, Fireman Ladder 13

John E. Jameson, Fireman Engine 22

Paul J. Murphy, Fireman Engine 32

Jpseph F. Boucher, Fireman Engine 22

By letter dated May 25, 1973, Chief Justice Lewiton notified District Attorney Byrne that the requested inquest would be conducted commencing Monday, June 4, 1973, at 9:30 AM in Room 379 of the Municipal Court of the City of Boston, and that Justice A. Frank Foster had been assigned to preside over the inquest.

The inquest commenced on June 4, 1973, and a complete transcript of testimony was prepared by Richard D. Ross, 340 Main Street, Melrose, Massachusetts. A copy of such transcript is submitted herewith attached to the inquest report.

The representative of the District Attorney in the presentation of evidence throughout the entire inquest was Lawrence Cameron, First Assistant District Attorney, Suffolk County. At various times throughout the hearing individual witnesses having an interest in the Hotel Vendome in some manner were represented by counsel whose names will appear hereinafter.

The inquest was held on the following dates:

June 4, 5, 6, 7, 8, 11 and 13, 1973.

Set forth herewith is a list of witnesses, their identification and the pages in the transcript wherein their verbatim testimony may be found.

June 4, 1973 — Pages 16 through 113

PASQUALE FRANCHI, 16 Westcliffe Road, Weston, Mass. Engaged in General Construction, Contracting and Development.

Present as counsel for Mr. Franchi was Samuel Hoar, Esq. of Goodwin, Procter & Hoar, 28 State Street, Boston, Mass.

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PASQUALE FRANCHI continued

June 5, 1973 Pages 158 through 183

JAMES CHARLES NEUNDORF, 47 Seaver Street, North Easton, Massachusetts. Superintendent of Construction for Franchi Construction and Eastern Builders.

Mr. Neundorf was represented by Jack Zalkind, Esq., 15 Court Square, Boston, Massachusetts

June 5, 1973 Pages 184 through 218

FREDERICK V. COWEN, 59 Bynner Street, Jamaica Plain, Massachusetts, of LeMessurier Associates, structural engineers.

Mr. Cowen was represented in court by Charles P. Reidy, Esq., 73 Tremont Street, Boston, Massachusetts.

June 6, 1973 Pages 219 through 272

WILLIAM THOEN, 4 Redwood Drive, Ipswich, Massachusetts., of LeMessurier Associates, consultant structural engineer.

Mr. Thoen was represented in court by Charles P. Reidy, Esq., 73 Tremont Street, Boston, Massachusetts

June 6, 1973 Pages 275 through 325

ARTHUR DICKERMAN, 25 Lenox Street, Brookline, Massachusetts. Civil engineer employed by Franchi Construction, and later by Eastern Builders.

Mr. Dickerman was represented in court by Richard W. Renehan, Esq., 225 Franklin Street, Boston, Massachusetts.

June 6, 1973 Pages 328 through 355

FREDERICK STAHL, 57 Hancock Street, Boston, Mass., Professional architect employed by Stahl-Bennett, Inc., Professional Architects.

Mr. Stahl was represented in court by John R. Hally, Esq., 75 Federal Street, Boston, Mass.

June 6, 1973 Pages 358 through 372

WILLIAM McQUEEN, 53 Hancock Street, Boston, Mass., Registered Architect, formerly employed by Stahl-Bennett, Inc., Architects.

Mr. McQueen was represented in court by John R. Hally, Esq., 75 Federal Street, Boston, Mass.

June 6, 1973 Pages 375 through 387

FRANK ADAMS, 125 Derby Street, Salem, Massachusetts. Draftsman-designer, Stahl-Bennett, Inc., Architects, later known as Stahl Associates.

Mr. Adams was represented in court by John R. Hally, Esq., 75 Federal Street, Boston, Mass.

June 6, 1973 Pages 390 through 415

ROGER LANG, 44 Chestnut Street, Boston, Mass., Architect employed as Project Manager for Stahl Associates, Architects.

Mr. Lang was represented in court by John R. Hally, Esq., 75 Federal Street, Boston, Mass.

June 7, 1973 Pages 408 through 422

LOUIS COTTI, JR., 309 Salem Street, Plymouth, Mass. Heating, Ventilation, Air-Conditioning contractor.

June 7, 1973 Pages 425 through 438

WILFRED ZEOLIE, 200 Roosevelt Road, Weymouth, Mass. Sheet metal worker employed by Cotti-Laurence Co., 37 Bridge Street, Weymouth, Mass.

June 7, 1973 Pages 441 through 478

RICHARD THUMA, 2 Allen Road, Winchester, Mass. Commissioner of City of Boston Building Department, represented in Court by Sheldon Drucker, Esq., Corporation Counsel, City of Boston.

June 7, 1973 Pages 481 through 515

JEREMIAH MANFRA, 48 Sunset Hill Road, West Roxbury, Mass.
Building Inspector, City of Boston Building Department.

Represented in Court by Attorney Sheldon Drucker.

June 7, 1973 Pages 518 through 521

SHELDON DRUCKER, ESQ., 25 Roosevelt Road, Newton, Mass.
Assistant Corporation Counsel, City of Boston.
Consultant to Boston Building Department.

June 8, 1973

GEORGE PAUL
Chief, Boston Fire Dept. Pages 524 through 538

JOHN O'MARA
Deputy Chief, Boston Fire Dept Pages 541 through 559

JAMES McCABE
Lt., Boston Fire Dept Pages 562 through 573

JoHN FEENEY, Firefighter
Boston Fire Department Pages 576 through 582

ROBERT ROSEMOND, Firefighter
Boston Fire Department Pages 585 through 588

CHARLES MAGOON, Deputy Chief
Boston Fire Department Pages 591 through 596

June 11, 1973 Pages 598 through 605

FREDERICK COWEN (recalled), Structural Engineer,
LeMessurier Associates.

Mr. Cowen was represented in Court by Charles P. Reidy, Esq.

June 11, 1973 Pages 608 through 637

WALTER HICKEY, 155 Hickens Avenue, Quincy, Mass.
Registered Professional Engineer. President of
Walter J. Hickey Associates, Inc.

June 11, 1973 Pages 640 through 677

FRANK HEGER, 107 Thornton Road, Needham, Mass.
Consulting structural engineer, a principal in
the firm of Simpson, Gumpertz and Heger, Consulting
Engineers.

Represented in Court by Samuel Hoar, Esq. as above.

June 11, 1973 Pages 680 through 690

PAUL PIERCE of North Kingston, Rhode Island
Structural Engineer employed by Charles T. Main, Inc.,
Prudential Center, Boston, Mass.

June 11, 1973 Pages 691 through 705

EARLE LITTLETON, Professor of Civil Engineering,
Tufts University

June 13, 1973 Pages 708 through 711

CHARLES THEODORE, 105 Bradford Road, Weston, Mass.
Structural Engineer.

There was also in daily attendance throughout the inquest Sergeant Robert Hudson, Boston Police Department, who acted as Special Investigator and Technical Assistant at the inquest.

This Court's primary objective in holding the inquest, taking testimony and reviewing documents is to arrive at a determination, to the extent possible, as to the proximate cause of the collapse of a portion of the Hotel Vendome during the course of the fire on June 17, 1972. Special attention will be directed to the so-called "collapsed section" which was the southeast area of the original hotel structure bordered on the east by Dartmouth Street and on the south by the alley leading from Dartmouth Street in a westerly direction.

As an historical fact based on competent testimony and official records, the Hotel Vendome was constructed between the years 1870 and 1875. The original construction consisted of five floors and basement fronting on Dartmouth Street, with a separate entrance on Commonwealth Avenue. At a later date, circa 1880, an addition to the original structure was built on the western side of the original building, but it will not be necessary to go into further details concerning the western addition inasmuch as it had no material bearing on the event of June 17, 1972.

The Dartmouth Street building was of brick bearing (supporting) wall construction resting on a pile foundation. The exterior walls were faced with stone on the Dartmouth Street and Commonwealth Avenue sides. The floors were of wood construction with wood joists resting in pockets in the bearing walls.

During the site investigation conducted by several professional engineers, a system of wrought iron beams was found which had existed at the second floor level and had been supported by a cast iron column between the first and second floors. It appeared to be the consensus of opinion that the column and beams were installed sometime around 1890. It is extremely significant to note that in making this alteration there was removed from the building the central bearing wall between the first and second floors, thus leaving the upper levels of the building to be supported by the wrought iron beams and the cast iron column. This alteration created a room of nearly 1800 square feet with only a single column near the center of the room. Between the years 1911 and 1968, there were numerous other minor alterations such as the addition of fire escapes, sprinkler improvements, elevator improvements, removal of non-bearing partitions. However, it does not appear to the experts who testified that such alterations contributed to the ultimate collapse of the section alluded to.

On June 30, 1971, an application was submitted to the Building Commissioner to make alterations to the building as follows:

> "Renovate and recombine hotel rooms on floors two to seven to create 124 residential apartment units. Renovate street floor and basement to create shopping mall."
>
> The owner was listed as Pasquale Franchi of 425 Watertown Street, Newton, Massachusetts
>
> After denial, on appeal, the permit was granted on December 6, 1971, and some of the renovation work was still in progress at the time of the fire in a portion of the collapsed area.

It could be found by this court that the above-described alterations of circa 1890, that is, the removal of the bearing wall between the first and second floors, completely changed the structural characteristics of this area of the building. The column which was installed to support the beams extended from the second floor to the first and rested on the central bearing wall which remained between the first floor and the basement floor.

A study of the collapsed section and an analysis of the debris revealed that the new support system introduced under the second floor was not well tied together. There were no bolted connections between the column cap plate and the double-I-beams. There were no anchor bolts tieing the column base plate to the central brick wall and no lugs or recess on the base plate to hold the column in position. A 10-inch-I-beam running North and South which could have provided some lateral support merely rested on the double beams. The double beams were not bolted to supports at East and West ends and were not well tied together where they butted one another over the cast-iron column.

Another factor of considerable significance revolves around the renovations requested by Mr. Franchi in the period from 1971 to 1972. These renovations were extensive and included:

a. Demolition of certain partitions
b. Repair weaknesses found in floor systems
c. Construct new partitions
d. Application of underlayment and finish to floors
e. Installation of new hung ceilings
f. Install new wall surfaces (taped gypsum board)
g. Install new stair towers and elevator
h. Mechanical, including plumbing, HVAC and sprinkler
i. Electrical, including new distribution systems

For the record, it may be noted that the architect for the renovation work was Stahl Associates of 177 Milk Street, Boston, Massachusetts. Structural consultants to the Architect were LeMessurier Associates. The original mechanical design for the renovation was by Vincent J. Piconi. Revised mechanical design was by Irving I. Peltzman. Both of these latter individuals are duly licensed in Massachusetts as Professional Engineers.

Perhaps the most significant alteration conducted in the August-September, 1971 period was the installation of a vent duct 18" x 36" running north and south through the center of the collapsed area under the first floor.

The duct began at a louver opening over a window in the South wall and passed through the North wall beneath a central corridor. Measurements and calculations conducted during the post-collapse survey indicated that a portion of the duct passed beneath the bearing area of the cast-iron column between the first and second floors. The testimony of people engaged in the installation of the duct revealed that an opening approximately 18" by 36" was made through the bearing wall situated in the basement.

One of the questions which will be dealt with in some detail is to what extent, if any, the opening in the basement bearing wall contributed to the ultimate collapse of the southeast section of the building and the deaths of the nine Boston firefighters.

The factual data relating to the fire itself is well supported in official records. The fire started in the Hotel Vendome on Saturday, June 17, 1972, with the first alarm called in at 2:34 PM. According to the Fire Department, the fire started on the fourth floor in a bathroom under construction immediately to the west of the collapsed area. The initial advance of the fire into the collapse area was checked by firemen. However, the fire made rapid progress upward, burned out the high penthouse tower, worked around to the northeast corner of the solarium area and into the roof of the collapse area. Additional alarms were sounded throughout the afternoon.

By 4:45 pm the fire was burning furiously under the roof of the collapse area. Photographs taken during the progress of the fire indicate that portions of the roof had either collapsed or burned completely prior to the general collapse.

At 5:28 pm, while firemen were controlling fires in the exterior mansard and cornice, the entire 1800 square foot area at the southeast corner of the building collapsed and nine firemen decended to their deaths, crushed under tons of building rubble.

The collapse itself has been described by various witnesses as being very rapid; that only a few seconds of time could have elapsed from the initial failure of the structure to the complete collapse. Once the initial failure took place there was no way,

given the nature of the structure as it existed, to prevent the complete collapse of the 1800 square foot area. The roof of the structure had been extensively damaged by fire and had partially collapsed approximately twenty minutes before the collapse of the structure itself. In the opinion of at least one expert witness, Charles T. Main, who made a painstaking study of the debris and related matters, the collapse was initiated by a bearing wall and/or shear failure of the bearing wall under a single central column between the second floor and the first floor. That failure allowed the cast-iron column to drop to the basement level resulting in a complete collapse of the upper floors.

The cast-iron column had been supporting two sets of double 15" wrought-iron-I beams which, in turn, supported a 12" brick central bearing wall extending all the way to the roof and supporting the second, third, fourth and fifth floors and the roof.

When the column fell into the basement the double-I-beams started downward at the center. At the east side the double-I-beams were buried in the exterior Dartmouth Street wall. As the beams angled downward in the center, large rotational forces were set up which actually broke this section of wall, causing the upper section to slide down. Some of that material was observed to have buried an automobile which was parked on the Dartmouth Street sidewalk.

At the west side of the collapse area the double-I-beams were supported by another set of double beams running north and south. A large rotational force was also set up at this point; a flange of the supporting beam was bent and cracked, and a section of the brickwork was torn out of the west side

Thus with all support lost, the central bearing wall started to fall straight downward bringing the connecting floor systems with it.

The Court noted at that time an intelligent determination of the legal issues presented must necessarily rely on the opinions of the expert witnesses who analyzed all the pertinent circumstances of the case. Testimony was taken from professional engineers and architects with impressive academic and professional credentials. Such experts were asked admissible hypothetical questions incorporating all of the known physical factors relating to the building, such as:

1. The proximate cause of the collapse
2. The identity of any other factors which may have contributed to the collapse
3. To what extent, if any, did the drilling of the holes in the basement bearing wall contribute toward the demise of the structure?

There are set forth herewith certain pertinent excerpts from the testimony of Dr. Frank Heger, a principal in one of the engineering firms which made a lengthy and intensive study of the problem.

I am going to recall your attention back to the change in the structural changes in that C wall, back around 1890. And having in mind what happened at that time, can you tell us what effect the replacing of the wrought-iron columns and this one cast iron column resting upon the top of the wall there in the basement had upon that wall?

Well, in the original arrangement of the building with a completely masonry wall with a hole high in the building, the loads from the upper floor were spread out for the entire width, which was about 40 feet in that particular area.

Q And this is running east to west?

A. Running east to west, yes. So that you had the loads from the upper floors brought down to the foundation in more or less uniform, spread out fashion. Now, because somebody must have wanted to open up the first floor, they replaced the structural bearing strength of the masonry wall, the original masonry wall to the first and second floors, with double wrought-iron beams which were intended to support the upper part of the masonry wall, and which itself was supported by the center column and by an end column.

THE COURT. That is between the first and second floor.

THE WITNESS. Between the first and second floor. So that the wrought-iron beam carries the entire load that was formerly carried by the brick bearing wall the wrought-iron beams now carried, and those beams were supported at three points, center point and each end point. Now, the effect of that is to concentrate the load from the upper floors on those three points and to create this point of high bearing below. Now, that was a particularly serious problem here, because they did not provide a means in that alteration of spreading that

load out again, so that you had a concentration of the load at below the center bearing column, for example, which was not spread out any more than by what a 12 by 12 inch steel plate would spread it out.

Q And can you give us some idea as to what degree of angle a 12 by 12 plate, which you found there, would spread that load out? Can you give us some idea?

A Well, of course the load, the stress force on the masonry immediately below the plate would be the load, the total load here divided by the area of the plate. It then would spread down into the masonry at an angle that would be somewhere between 45 and 60 degrees with a horizontal --

THE COURT. And that would be consistent with the two diagrams, would you say?

THE WITNESS. In other words, if you wanted to determine the stress of the masonry four feet down from the bottom of the column, that might be spread out over a width that was anywhere from six to eight feet, say, so that the stress would be very, substantially low, providing there were no openings or anything in the wall by the time you got four feet down. But you have a very high stress here, right below the bearing, and it spreads out as you go down the wall. Now, the wall always had a column in it, so that the wall always had a door opening in it -- I am sorry. Not on the column.

THE COURT. When you speak of the wall, you are talking now of the basement?

THE WITNESS. Basement wall apparently always had a door opening, the door opening that I show in figure 4-7 is shown on the original drawings that were in the Boston Public Library. And so that there was some limitation as to how far the load from that column would be spread out by the brick wall.

Now, the fact that the load which was originally evenly distributed was not concentrated could also have affected the loads on the foundation pile which were down below, and they would tend to be increased under the column.

Q Do you have an opinion, Dr. Heger, as to those changes that were made back in 1890, whether they were proper changes as you would expect to find in a situation such as that?

A Yes , I have an opinion.

Q What is your opinion?

A My opinion is that they were very much improper changes, that they caused -- that they were carried out in such a way that several of the parts of this structure were highly overstressed, not just one. The worst overstress occurred in the masonry right below the center column which was stressed too, under the dead load, and is the weight of the building. And this recently designed load was stress to about five times a reasonable value for a safe stress, and that condition must have existed for

more than some 90 years, if that may be true. There was also a very high point of overstress at the easterly end of the 15-inch double I beam, which was also stressed probably up to about four times their reasonable value.

Q That is close to the Dartmouth Street side?

A Close to the Dartmouth Street side. There was a less overstressed but, nevertheless, highly overstressed condition at the westerly column, at the bottom of the westerly column. Double I beams themselves had only about half -- No, they had a little more than half, but they did not have nearly the strength that they should have had to carry the weight of this wall, so they were significantly overstressed. Another beam in the second floor, the ten-inch I beam was very highly overstressed. If it had ever got --

THE COURT. Which beam are we referring to?

THE WITNESS. That beam which says 10-inch I. It's coming in and goes perpendicular out to the second floor. That beam reached what would be a reasonable maximum design stress just under the weight of the floor itself. When you allowed for the people, loads and the other live loads that should be allowed on there, that beam would reach just about its ultimate strength. So it really was only half as strong as it really needs to be. There was same other 12-inch beam on that floor. But framed into a 10-inch beam, which was only a fraction of the strength they were, was overstressed. So, my conclusion is whoever did that alteration didn't use very much engineering -- didn't really use very much quantitative engineering.

The Court notes that all of the above excerpts from the testimony of Dr. Heger related to the alterations which took place circa 1890, namely, the removal of the central bearing wall between the first and second floors. The Court will now proceed to a consideration of Dr. Heger's testimony insofar as it relates to the hole which was drilled in the bearing wall in the basement in order to accommodate the duct extending from the north restaurant area to the south wall and into the alley. Following are quoted pertinent excerpts from Dr. Heger's testimony on this facet of the investigation:

Q Now, as you view this today, and if you view it as a result of your study, what effect if any do you say that a hole punched through the wall, broken through the wall, of the size that you estimated, had upon the stress of that wall?

A Well, before the duct opening was cut there, the wall had a stress that was substantially overstressed before the duct opening, but not as overstressed as right below the column, because the stress had been spread out by the wall by the fact that it would be spread out say on a 45 to 60 degree angle. By cutting the duct opening in the position that it was cut, it very likely increased the stress that existed up to a level about the same as what it was below the column itself. I think it is virtually impossible to make an accurate theoretical

calculation of that stress at that point, because there would be too many assumptions involved. But I think you can see from the geometrical layout that the hole just about reaches the edge of the base plate above. It may go just a hair, maybe an inch inside the base plate.

Q Doctor, notwithstanding the fact that this area was overstressed since 1890, the building stood up until 1972. Is that correct?

A Yes.

Q There were no signs of any weakening or anything said about signs of weakening by any of the people with whom you spoke there with reference to your investigation of the case?

A That is correct. Nothing. The type of overstress that we had in this masonry would not be reflected in anything that you might look at. I think that is true. The overstress in the wrought-iron beams that existed did not apparently produce any permanent bending, or you might say, bowing of these beams, because I looked at they very carefully after they were uncovered from the wreckage. And they were straight, and they were not permanently bent. So, while they were overstressed, again, they were not overstressed to the point where they reached yield or permanent bending stage.

Q And notwithstanding the fact that the cutting of that wall took place in August, that wall stood up, and

the building, for another eight, eight and a half months, until the fire of 1972. Is that correct?

A Yes.

Q Now, did you, as a result of your investigation, learn that the door closest to the center of that bearing wall in the basement was actually placed in a different position on the field or working plans there at the site than the actual location of the door opening itself?

A Well, yes, I did. The door shown on the drawings which were prepared by the architects and by the engineers was not dimensioned. There were no dimensions on that drawing, so any information that you might infer about its location had to be scaled from the drawings. But when that door location was scaled, it would come out where I have shown it in figure 4-7 in the report. That would be the position of it, based on scaling of the architects or the engin eers.

Q And did you place this dotted line or did somebody under your direction place it in the position where the door appeared on the working plans of the architect?

A Yes.

Q And can you tell us what the distance was from the location of the door as it actually was there on the wall and its location on the working plans?

A I don't have the exact figure, but I think it's about six feet, five or six feet.

Q Five to six feet?

A It was shown on the architects' and engineers' drawing about five or six feet to the East of its true location.

Q All right. Now, this is a shot, looking from this elevation of the central bearing wall, this is actually looking from the North, from the north side looking south. Is that correct?

A That is right. It is looking South.

Q Now, assume that the builder, contractor, who is putting through the hole in the vent looked at the plans and observed that the door in the plans appears to be in the location as you have found them to have been in the plan, and observed that the Lally column is to the right of the door, the second floor, on the plans, at least. And assume further that he ordered a cut in the wall here to the left of the door, somewhat in the fashion as it actually was. Would you tell us whether or not, in your opinion, the opening put in that position had any effect upon the stress area of the Lally column, or the wall; excuse me.

A If the door had been in the dotted position, the principal effect of the column would have to be on the right side of the door, because there is not really enough masonry between the top of the door and the bottom of the column to spread out very much of the column load if any of the column load were over to the left side or the easterly

side of the door. So, it would be entirely logical to think that by cutting an opening, if an opening had to be made, by putting it to the left, to the east, it would be keeping it away from the stress or the bearing zone. It also would not be illogical to think that the column might go down inside the brick wall in the basement, also, close enough to the door, if someone was aware of the relative position of the dotted door and the column.

Q Now, did you do a study as to what the amount or the estimated amount of water that was actually inducted into that building during the fire of June 17th or '72 was?

A We did.

Q And would you tell us how you were able to conclude the approximate number of gallons or pounds or weight of water that was inducted into the building?

A Yes, I would be glad to. As a part of our study on the loads on that column, of course, we first estimated the weight of all of the materials that were above that column that was in the building, and we were able to get the characteristics of those materials from observations made during debris removal. And that was one element of the load on that column. And the second element of possible load on that column is water that was introduced in the fire fighting efforts and remained in the building. It was a little more difficult to evaluate. In order to try to do this, we, first of all, tried to find as many photographs of the fire fighting operations as we could.

And I was able to get several sets of photographs which showed a sequence taken over a period of, I think in one case, over a period of two hours. I assembled all of the photographs into several books so that they all could be examined. The next thing -- And many of these photographs showed the fire fighting apparatus. The next thing I tried to do was get the fire department's records that would tell what apparatus was at the fire, what its capacity was, and so on. And, first of all, I didn't know what records to get, but I didn't get too far with the fire department in getting those records, so I called someone I knew at the National Fire Protection Association and asked them if they knew of a consultant who could assist me in finding what records to get and finding what records to get and finding what the characteristics of the fire fighting equipment might be. And they suggested that I talk with Mr. Warren Kimball who had been in charge of a division of the National Fire Protection Association that dealt with fire fighting, was very familiar with various fire equipment. He had recently retired, and he lived in Rhode Island, so that I did get in touch with Mr. Kimball. Mr. Kimball suggested that I get the company run records from the fire department. However, I was not able to get the company run records.

So, I went down to see Mr. Kimball, accompanied by Mr. Terenzio of Edwards & Kelcey. I brought all of the photographs I had, and Mr. Terenzio brought all of

the ones that he had, and we went over these photographs. We looked at the equipment. Mr. Kimball identified the equipment. He was very familiar with the Boston Fire Department's equipment. He knew the pumping capacity of the equipment. On the basis of this, we made an estimate of the total pumping capacity at the fire. We made an estimate of the probable pumping capacity that was being used. In this sense, he was drawing on his experience in many, many similar types of investigations. We then made an estimate of the amount of that pumping capacity that was pumping water into the collapsed section. On the basis of those estimates, we estimated a total amount of water that went into the collapsed section of one thousand -- 126,000 gallons, that came out.

Q Gallons or pounds, do you remember?

A Pounds. I am sorry. Pounds.

Now, that is part of the estimate. It's still very much an estimate. It's probably based -- has a considerable and substantial basis. From there on we had to estimate -- I had to estimate how much of that water might have remained in the building and how much of it was in the tributary area as the area of the building that is carried by the center column. The tributary area, I believe, if I remember correctly, was about 25% of the whole area of that section.

At this point I spoke further with the fire department and with Mr. Hickey, and I was able to get them

to allow me to look at estimates that had been made. I think there were 22 statements, if I remember correctly, made by firemen. I went to Mr. Hickey's office, and I carefully summarized, made my own notes of what each of these firemen had said. I was particularly interested in what they said about the amount of water in the building. There was quite a bit of discrepancy, but I think being able to look at those statements was very, very helpful. There was no doubt that there were parts of the building that had substantial water in them. There were some parts that apparently had no visible water, very little visible water because they cut holes with axes through the floors. There were parts that they had not really observed that I could tell.

It was at least one room that -- one of the statements -- I don't recall the name of the man, but I have it in my notes -- indicated had water discovered some weeks later, and he was on his way to get his axe to cut a hole to get rid of that water there when the building collapsed. So I said, all right, I'll go about this, you might say, by taking my estimate of the total water put into the building, pro-rating that to the amount of water that would have been in a tributary of the column, and seeing what several reasonable percentages of that -- I took 15% and 30% -- would mean in terms of depth of water within the structure. Now, 15% of my estimate of the total water in the building reduced to an average depth of water of about four inches. Thirty percent produced about eight inches. I also looked at

the type of construction that we have here, the fact that we have a one-inch, I think, if I remember -- Right, it's one-inch thick homosote material. We have gypsum board ceilings, wire taped, and we have some degree of water retention, and in some cases we have double ceilings. We have an old gypsum ceiling that was not taken out. We have a layer of gypsum, some water between the two layers of wood sheeting on each floor, so that you could have, maybe, one to two inches of water just absorbed in these materials. You could have quite a bit of water held in these gypsum ceilings that wouldn't even be visible. We could have, of course, water just standing on the floors in certain rooms and not in other rooms.

So that the estimate of how much of the water put in is actually retained, of course, is strictly an estimate. Now, the figures I came up with ranged, as I say between 15 and 30 per cent of the total water I estimated went into that section, and they represented the load -- The low of that range represented 42,000 pounds of water on that column; the high of that range represented 84,000 pounds.

Now, the weight of the structure that was on that column into any water was 175,000 pounds.

The Court regards the testimony of Dr. Heger commencing on line 6 of Page 667 of the transcript, and quoted below, to be of particular significance in the resolution of the problems presented in this case:

Q And do you have an opinion as to whether or not the low estimate that you arrived at, together with the dead load of the weight of that structure, had an effect upon the collapse?

A Yes

Q And what is your opinion, sir?

A Well, my opinion is that the collapse resulted from the combined effect of the dead load and the water load on a structure which had this latent defect in it from the beginning.

THE COURT. And when you speak of "from the beginning,"from 1890?

THE WITNESS. In other words, even without the water load, the overstress on this masonry was so high that you would have to say it was grossly unsafe, structurally, all that period. It so happens that it didn't fail. But it certainly was loaded to five times what any reasonable engineer would allow on that structure. Now, we put onto that a water load which produced -- the combined effect of the water load and the dead weight load did produce a stress that was right within the range of the estimated ultimate strength we found from the rests, also. That is another thing. So that everything added up as far as that was concerned, the information that we had. I think it should be noted that the design that the live load column was supposed to carry was 175,000 pounds. It is supposed to carry

38,000 pounds, live load. Whether it ever had that much load on it is purely conjecture. It probably had a little bit of that live load on it in addition to the water. So, the load on the column, according to my estimates, was somewhat over its safe design load if it had been properly designed. But if it had that low estimate of water on it, it wasn't a great deal over what its safe design load should have been.

The Court must necessarily accord considerable weight to the opinion of Dr. Heger with reference to his opinion as to the primary cause for the collapse of the building. On page 668, commencing with line 17, the question and answer examination of Dr. Heger is continued:

Q Doctor, was that your primary cause for the collapse of this building in 1972, the load that was put on this building during the fire, together with the latent condition that you observed as a result of your investigation, back in 1890? Is that your primary cause?

A Well, I think you have to say that you had here things that happened in this building that -- which caused defects that can't be known. You had a collapse of a roof, which was a rather substantial weight that came down -- concrete weight on a roof. You had other things that went on in the fire. Things burned down up there which caused shocks, and so on. And from all the information I could find, the most probable cause, I would say, was the combined effect of the latent high stress that

existed there for all those years plus the water load, plus, possibly, some small weakening from the wetting of this masonry. I think the effect of the moisture on the masonry at the beginning of our investigation, we thought this could have been one of the more probable weakening effects. It turns out that it probably wasn't a big effect, but it could have had some additional effect.

On the question of the effect of the opening in the basement bearing wall, there is further quoted from Dr. Hickey's testimony the following excerpts:

Q Well, what effect did the opening in the wall there have with reference to the collapse?

A The opening was another factor that probably reduced somewhat the strength of the assembly. I think that the opening was not cut under the column, and it was cut close enough to be in a highly stressed bearing zone. Now, workmanship varies somewhat in masonry, so you can't be sure which point is the weakest point and at which point the failure was. So, theoretically, if you had exactly the same masonry throughout the whole wall, if the wall is slightly weaker below where the duct column is and it is just below the column, but it is the same order of magnitude in both those two places.

Q Doctor, can you give us an opinion in this question. Do you have an opinion as to whether or not, as a result of studies of the condition of the wall, the estimate of the added weight of the water and the fire of June 17, 1972, together with the information you have arrived at with

reference to the change that was made in the structural bearing of that wall back in 1890, now, do you have an opinion as to whether or not that building would have collapsed on June the 17th as a result of the added load, water and so forth, had not the hole been put in the wall? Can you answer that or can you give us an opinion on that?

A Yes.

Q You can. And what is your opinion?

A Well, I would have to say that the building would probably have collapsed based on what we know about these overstresses under the base plate, that the overstress is so high that no one could assume it would not collapse

Q Without that hole having been put there?

A Whether the hole was there or not.

There are set forth herewith what the Court regards as pertinent excerpts from the testimony of Mr. Charles William Terenzio, Chief Structural Engineer in the Boston Office in the firm of Edwards & Kelcey. Mr. Terenzio conducted a study of the collapse of the Hotel Vendome and made certain conclusions which are quoted herewith:

Q And did you at sometime come to a conclusion as to the primary cause of the collapse of June 17, 1972?

A Yes, we did, in the form of a report.

Q And can you tell us now what the primary cause of the collapse was, in your opinion.

A In our opinion, the primary cause of the collapse was the excessive water load that was introduced into the building during the fire fighting operations.

Q Did you have the history of the change in the structural bearing of this southeast section, back around 1890, by the replacing of a bearing wall on the first floor with wrought-iron columns and a cast iron -- wrought iron --

A Wrought-iron beam.

Q Wrought iron beams and a cast iron column. Is that correct?

A Yes, we did.

Q And what if any effect did that have upon the bearing capacity of that wall? This is back in 1880 or 1890.

A When the renovations were done back in the 1890's. it introduced a condition in the masonry bearing wall in the basement of the building which was very touchy from the time it was introduced into the building, back in 1890, up until the collapse occurred.

THE COURT. What was touchy? I don't quite follow you. The masonry wall?

THE WITNESS. By the removal of the masonry bearing wall, the first floor level, and making all of the loads from the flooring above into the beams and bringing them down through the column created quite a high stress condition in the basement wall underneath the column.

Q That is down in this area. (Referring to figure 4-7)

A That is correct.

Q And did you do a study as to what additional stress was put upon that wall?

A We did a study on it in three parts. The conditions,

which we called dead load condition, which is what is in the building. We did a study under live load condition, of what loads would be introduced into the building, and an estimate of the loads that were introduced into the building during the fire fighting operation.

Q Now, did you learn, also, that at sometime around August, 1971, that somebody from the Franchi company or Eastern Builders had put a hole in the bearing wall somewhere in the vicinity of the base of the column which was supporting those upper floors?

A Yes, we were aware of this fact.

Q All right. And what if any effect do you say that that cutting through of the wall in that area had upon the bearing capacity of that wall?

A The introduction of the hole caused a redistribution of the loads in the wall, but the ultimate effect was not to change the picture of the stress levels to any marked degree at the elevations that the hole was introduced at.

Q Well, is it your testimony, sir, that in your opinion the hole did not affect the stress area of that bearing wall to any appreciable degree?

A Not to any appreciable degree.

Q You say that it distributed the stress area to other parts of that wall. Was that your testimony?

A There is a redistribution of the stress level at the elevation that the conduit was placed through at.

Q I see. Now, having in mind the fire of June 17, 1972, which is some eight and a half months after this hole was put in

the wall, and some 80 years after the major change in the structure of that bearing wall, do you have an opinion, as a result of your investigation, of the primary cause of the collapse of the building?

A The primary cause of the collapse of the building was the introduction of the water load into the building during the fire fighting operation. It increased the load on that central column on that first floor, and that, in turn, triggered what we believe to be the cause of the collapse, excessive water load in the building.

Another expert who offered testimony was Mr. Paul F. Pierce of North Kingston, Rhode Island, a structural engineer in the employ of Charles T. Main, Inc., which firm conducted a study of the collapse of the Hotel Vendome. This study was conducted primarily by Mr. Pierce at the request of the City of Boston Building Commissioner Richard Thuma. Following are relevant portions of Mr. Pierce's testimony:

Q And can you tell us, briefly, what your investigation consisted of, what you did in order to arrive at certain conclusions?

A Well, we started excavating the debris in an attempt to find out what part of the structure failed and caused the collapse. And we studied the old drawings of the Vendome. We studied the past history as best we could, building records. And as we dug down through the debris, we took careful observations of everything we encountered.

Q And at sometime you submitted a report to the City of Boston, to the Building Commissioner. Is that right?

A Yes, sir.

Q Now, in your investigation and your study of the history of this building, and in particular with the southeast section -- You are familiar with that section? -- did you learn that there had been structural changes in the first floor of that building sometime around the turn of the century, 1890 or so?

A Yes. sir.

Q Can you tell us what was done at that time?

A That portion of the building was formerly two separate houses with a wall between them, and at sometime this dividing wall, which was also a bearing wall, was taken out, between the first and second floors, and some girders put in to hold the rest of the structure up above. And these girders rested on one single column which, in turn, rested on a wall in the basement.

Q All right. Now, the girders that you refer to supported the structure above the second floor. Is that correct?

A Yes, supported the second floor and then the wall, the bearing wall supported the third floor, the fourth floor, the fifth floor, and the roof.

Q And the roof.

A All resting on that one set of girders and the column.

Q Now, in your experience and your background, and your knowledge about what was done at this time back in 1890,

or thereabouts, can you tell us whether the changes in that structure that you have just described were properly done, in your opinion, at that time?

A They were not properly done. There was not enough follow-through in the calculations, I would say. The beams above were adequate. The column was substantially adequate, but the bearing value under the column was excessive. There wasn't enough area of base plate resting on the masonry wall.

Q Now, but what did you mean by base plate? What kind of a base plate did you find there?

A We found a steel base plate, 12 inches square and two inches thick. And the bearing value of that plate on the masonry was greatly excessive.

Q What do you mean by greatly excessive? Can you give us some idea of the --

A Well, the Boston Building Code for that type of model allowed, at most, about 250 pounds per square inch of bearing. Our calculations indicated a bearing value of around 1,400 pounds per square inch. And the test that we made on the mortar -- We had made by a testing lab -- gave a value of, I think, about 600 pounds per square inch.

THE COURT. Tests of what?

THE WITNESS. Of the sample of the mortar taken out of this wall. The best test we got was 980 pounds per square inch. Now, this is an ultimate strength. In other words, the mortar just fractured at that point.

Q Well, again, you said that -- What was the bearing point

that you said that this, the maximum bearing point that this wall would carry or should carry?

A If you were designing it, you should only allow 250 pounds per square inch.

Q And you say how much weight was actually being borne by that wall?

A At the time of the collapse, I would say about, it was 200,000 pounds of load in that one column.

Q And what was the ratio of the excess that was actually -- Was it six or seven times, or what in your opinion?

A I would say about three times.

Q About three times.

A About three times.

Q Three times the stress that actually should have been on that wall.

A Yes, now, I would say six times if you base it on that 250 was the allowable of the Boston Building Code. It would be about 1,400 actually, under it.

Q That would be somewhere around six times?

A Yes.

Q Now, at sometime in August of 1971, did you learn that a hole had been put in that basement wall, somewhere near the door, for some duct work to be installed? Did you learn that, sir?

A When we made our investigation, we found a duct running across the basement area of the building.

Q Yes.

A And we made measurements, brought down one of our surveyors, and we made accurate measurements to determine just where that duct had run. And we even salvaged pieces of the duct that would determine the transitions in the duct, the bends, where it came out of the exterior wall, where it went through the north bearing wall. And we determined that a portion of that duct passed under this column, under the bearing plate of the column.

Q Under the bearing plate of the column. All right. Now, what effect, if any, do you feel that that had on that, breaking through the wall and placing the duct in that position, had on the collapse of the building on June 17, 1972?

A I think it had quite an effect on it. It was remarkable to me that the building didn't collapse right then and there when the cut-out was made.

Q Having in mind the stressed area that you say actually came into being back in 1890, you are aware, of course, that the building stood up for another 90 years or so. And having in mind the cutting through of the wall for the duct, in approximately August of 1971, and that the building did not collapse until June the 17th of 1972, approximately eight and a half months later, did you learn any factors on that date, on June the 17th, as to what happened with reference to any added stress on the wall in the basement?

A Well, we think that the fire and the resultant water that was thrown into the building added enough extra load to finally trigger the collapse, not from water standing on the floors, but from water being absorbed into the materials.

Q For example, what do you mean by that?

A In between each of the -- There was a sub-floor and the finished floor. Between those two layers was about an inch thick layer of plaster, and of course that would be very dry over a very long, long period of time. When water was thrown in the building, that would absorb a lot of water and thereby a lot of weight. And I think that just that weight, plus the water draining down on the bearing wall at the bottom, may have softened this mortar somewhat. We have a lower value of a mortar in a wet condition than we do when it's dry. And this combination triggered the collapse.

Q Well, let me ask you this question. Do you have an opinion as to the primary cause of the collapse of the building as a result of your studies and your background and experience, sir?

A Well, I would have to say that it was as a result of the fire, but I am convinced that the building was doomed to collapse in a very short time. I don't know why it didn't go down before.

Q Well, do you say that from the time of 1890 --

A Even back that far, there was danger of a collapse of the building.

Q There was.

A Yes, sir.

Q I see. And you say the primary cause of the collapse on the 17th was the fire, or what was done at the time of the fire.

A Water that was pumped in, I think, triggered the final collapse.

Q I see.

A Just enough extra load plus a weakening of the mortar.

Q Now, do you have an opinion, Mr. Pierce, as to whether or not the building would have collapsed had this hole in the wall not been cut in August of 1971, and just the factor in the change of the construction of the supporting structure in 1890, together with whatever elements and water, and the weight and so forth, whatever happened on June 17, '72?

A I think the building would have collapsed had the duct never been cut, especially since this building was being remodeled. This floor was going to be an area of shops, stores, and as such would have, maybe on an opening day or something, would have a large live load there, many people on the floor, and this could have triggered the collapse.

Q Now, let me see if I understand. That even if that hole in the wall had not been made, you testify that you believe that the plan for the first floor here was for several shops along the first floor.

A Yes, that is what they call a concourse.

Q The concourse. All right.

A And it was going to have rows of shops down this big central aisle.

Q And it was your opinion that some added live weight, or load, as you call it, such as an opening day or something --

A Yes.

Q -- could have triggered the collapse of that entire portion of the building. Is that your testimony?

A And the building up above had no live load on the floors at all. But if the people moved in the apartments, they would bring in furniture, so there would have been live loads added to all of these other floors. The Boston Building Code calls for 40 pounds per foot of live load on a structure like that. There was no reserve in that structure for any live load. The cast iron column was loaded right up to the limit, to the working limit, on just the basis of the dead load alone.

THE COURT. And your opinion is that this collapse could have resulted at some future date even if the duct work were not cut through.

THE WITNESS. Yes, I would say so. The bearing value under that 12 by 12 plate was greatly in excess of the allowable, and the wall below, ageing, a hundred years old, would be always getting weaker.

In order to round out this inquest report, it is necessary to incorporate the pertinent information and professional opinions rendered by Mr. Walter J. Hickey, President of Hickey Associates, a registered professional engineer. Mr. Hickey and his firm entered into a contract with the City of Boston, specifically the Boston Fire Department, to investigate the collapse of the Hotel Vendome. Thereafter, Mr. Hickey filed a report with the Fire Commissioner and other city officials outlining his investigation and his conclusions. During the course of his testimony (Page 609 of the transcript), Mr. Hickey stated he and his employees were never able to determine specifically the exact cause of the collapse; that many factors could have entered into the final collapse--any combination of factors or any individual factor--but they did find out what part of the structure failed, namely, the basement wall where it was supporting the cast iron column. He testified the collapse of the wall brought down the supporting steel above that which, in turn, brought down the other floors of the building.

Mr. Hickey, in his investigation, ascertained that some time around 1890, a portion of the bearing wall between the first and second floors was removed and a series of wrought iron beams and a column system were installed to replace the wall. In his opinion the 1890 renovation was not adequate, reasonable nor proper. He stated the renovation caused too severe a stress to be imposed on the underlying structure, namely, the twelve inch brick wall in the basement.

Mr. Hickey further testified that the building was in a dangerous condition and that the installation of the duct in the opening in the basement bearing wall would increase the stress, but to what extent he could not hazard an opinion. He conceded it was possible that even without the drilling of the hole in the basement wall the collapse could have resulted from the fire and the live weight. The "live weight" is a term used to describe the introduction of additional weight over and above the weight of the structure. It will be recalled that Dr. Heger testified that in his estimation the fire fighting operation resulted in the introduction of some one hundred twenty-six thousand pounds of water.

Mr. Hickey concluded the ultimate collapse of the building could have been the result of a combination of factors and there was no concise one he could pinpoint.

Another witness who offered significant testimony was Mr. Richard Thuma, a professional engineer who had been Building Commissioner of the City of Boston at that time for over six years. In his testimony Commissioner Thuma stated he would not expect an inspector in his department to observe that a hole was cut through a bearing wall approximately the dimension of three feet by eighteen inches because it is quite common to cut holes in walls and a hole that size really had little effect on the bearing capacity of a wall unless it happened to be in a very critical place. The Commissioner stated he has since learned a hole was cut in a wall at the Vendome, but prior to his experience at the Vendome he would not have thought about it at all. In his further testimony he stated if it were necessary to make changes in the

building, such as breaking through the wall in the basement above the door for duct work, he would not be concerned as to whether or not the stress of the building might be changed as a result of it. As a reason, Commissioner Thuma stated that an opening of the size indicated was not really a major undertaking; that he did not wish to minimize it but it was a reasonable thing to do at the time. When asked if he had an opinion as to whether or not the primary cause of the collapse was the result of cutting through the wall, he responded that he did not think so. In support of his answer, he stated the hole was cut in the building and the building stood for eight months after that. He stated in his judgment the building collapsed because when it was modified sometime just before the turn of the century, it was improperly modified by that bearing plate on a masonry wall and the fact that the wide-flanged beam on top of the column was not properly connected.

The Commissioner further stated the column was very strong in compression but that when such a column gets out of vertical alignment it has no strength at all; that the load imposed on that column by the water put in during the extinguishing of the fire so grossly overloaded the column and its bearing capacity on that wall that it failed. He expressed the opinion the column would have failed whether there had been a hole in the wall or not.

Testimony was also taken from Mr. William Thoen of Ipswich, Mass., a consulting structural engineer of LeMessurier Associates. As such, he was engaged by Stahl Associates, the architectural firm which was drawing plans for the renovation work at the Hotel Vendome in 1971.

Mr. Thoen's primary function as a structural engineer was to advise the architects and the contractors what could be done in the way of alterations without jeopardizing the structural stress of the building.

In 1971, Mr. Thoen spent considerable time at the Hotel Vendome in keeping with his contract. He became acquainted with the southeast portion of the Vendome and was familiar with the bearing wall in the basement.

On examination, Mr. Thoen was asked to what extent, if any, the making of the opening in the basement bearing wall would have in connection with the collapse of the southeast section. There is quoted herewith directly the pertinent portion of Mr. Thoen's opinion:

"The next event was the placing of the duct work, which was -- I am not even sure when that was done -- but a duct was put through, and as described in this drawing. Nothing collapsed. And it was in that condition for roughly eight months or so, and the next event that took place was the fire, and all of its related events, which include heat and vibration and water, weight and damage and so forth. And it was at that time that the collapse occurred. So, my answer to your question was that if the opening itself had caused the collapse, we might well have expected the collapse at

the time that the opening was placed through. It is conjecture as to whether the wall might have stood during the fire if the the opening was not there. That I don't think anybody can know, because the wall could have easily have failed right at the level of the basement or in that vicinity which was already overstressed by the added weight of the water, whatever happened during the fire. So, I agree that the stress pattern changed because of the opening, and there might have been some local high intensity stresses, which may have contributed. I don't know. But it is also true that the base plate, the area underneath the base plate, was highly stressed. And I am not sure one could ever prove conclusively that the failure was only due to the opening being put through. Now, that is my opinion, of course."

Frederick V. Cowen gave testimony concerning his experience with the Hotel Vendome. He was then employed as a structural engineer for the LeMessurier Associates. In September, 1971, he was assigned by his company to visit the Hotel Vendome and familiarize himself with the renovation project then underway. In so doing, he had occasion to visit the basement of the southeast section of the building. He observed the hole in the bearing wall in the basement where the duct went through.

Mr. Cowen stated if he were supervising the work at the time he would not have bored the hole at the point where it was, but that he would study the matter and place it at some point in the wall where there was less stress.

When asked for an opinion, Mr. Cowen stated he did not believe that the duct hole in the wall was the cause of the collapse.

Frederick A. Stahl of 57 Hancock Street, Boston, identified himself as a professional architect who was engaged by Pasquale Franchi to plan the renovation of the Hotel Vendome in 1971. He is a principal in the architectural firm of Stahl-Bennett, Incorporated. He and other members of his firm spent time in 1971 in the Hotel Vendome and became acquainted with the entire structure. The pertinent excerpt from his testimony concerning the cause of the collapse is quoted herewith:

"Let me ask you this question, this direct question, Mr. Stahl. Having in mind your background, your education, your experience, which has been considerable in the renovation of buildings of this nature or similar buildings, and having particularly discussed this entire collapse with many of the experts and being the actual architect on the job, do you have an opinion as to whether or not cutting through of that wall was the cause -- I mean the cutting through of the wall with reference to the duct --

True, true.

-- was the cause of the collapse of that building, the southeast section of the building on June the 17th, 1972?

It seems reasonably clear to me that the event of the fire itself and the loads and impacts that were brought into play in the fire were the cause of the collapse.

THE COURT. Would you say that that may have contributed?

THE WITNESS. I think it may have, yes."

In addition, Roger Lang, a professional architect associated with Mr. Stahl, performed architectural duties on the site at the Hotel Vendome at various times during 1971. In that capacity he became acquainted with the basement area of the southeast section and was familiar with the duct opening through the bearing wall in the basement. In connection with his opinion as to the influence of the opening on the ultimate collapse of the section, there is quoted herewith the verbatim testimony of Mr. Lang:

"Now, I am going to ask you this question, sir: Do you have an opinion as to whether or not the cutting through of the bearing wall in the location that it was made, keeping in mind, now, the position of the Lally column, the base of the Lally column, and the purpose and its function, and also the position of the door which we call the center door in the bearing wall, do you have an opinion as to whether or not the cutting through of the wall at that position was a cause of the collapse of the building on June 17, 1972?

A Yes, sir, I do.

Q What is your opinion?

A It is my opinion that the duct opening was not the cause of the collapse. And I base that primarily on my knowledge that the duct opening was made six or seven months prior to the collapse itself, and that there was no evidence during that entire period that additional distress became evident or that cracking or bulging or any of the tell-tale signs of weakening were evident in that area and, therefore, I have to conclude that the

additional stock and stress caused by the fire and the burning roof debris collapsing and the amount of water that went into the structure, and so on, that occurred on June 17th was more likely the cause of the collapse.

THE COURT. May I ask you, would you in your opinion believe that the duct work may have contributed to the collapse of the wall?

THE WITNESS. Possibly so."

CONCLUSIONS OF THE COURT

This Court finds that no single factor or circumstance could be assigned as the proximate cause of the collapse and resulting deaths of the Boston firefighters. In reviewing the opinions of the experts it would appear to the Court there were numerous factors involved and it was a combination of these factors which caused the collapse.

First and foremost, the removal of the bearing wall in 1890 between the first and second floors weakened the entire structure, and in the opinion of the experts made it possible for a collapse to occur at any time. The stress placed on the basement bearing wall of seven or eight times the amount allowed by good professional structural engineering was a very important contributing factor.

In addition, the introduction of the estimated sixty-three tons of water into the building on June 17, 1972, may well have been a strong factor in triggering the collapse. In the opinion of some of the experts, not only the weight of the water was important but the wetting of the masonry may also have been a factor which caused the collapse.

The fire itself constituted an important contributing force as it could have resulted in a sudden shock to the structure. Whether the drilling of the hole in the basement bearing wall contributed substantially to the collapse is a matter of conjecture, and in the opinion of some experts the

break-through in the basement wall may have been a contributing factor.

It is the conclusion of this Court that no individual or individuals now alive were solely responsible for the tragic events of June 17, 1972.

A. Frank Foster