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Chairman Collins: Neither are ours in New York. If the condition does develop and not as a result of a leak, where there is an abnormal heat condition created, it is presumed that the condition results from proximity over which we have no control. So the electric company takes the full burden of repairing their cable.

J. E. Hillemeyer: There is an old telephone cable that was in the same position forty years or more. Our street main was parallel or adjacent to it for about the last twenty-three years. The telephone cable functioned all right, but the paper insulation on the wires was so brittle and crisp they gave out at one spot which was some nine feet away from the crossing.

Chairman Collins: You apparently paid for that.

J. E. Hillemeyer: No, but they thought we should do something.

Chairman Collins: Mr. McQuitty, please convey our thanks to Mr. Suche for his valuable contribution.

Chairman Collins: The paper you are about to hear is, to my mind, a very interesting presentation. I have not seen the material, but personally I am deeply inquisitive regarding the contents and the scheme behind the author's planning. There will be many people in the industry who will feel that maybe one of our dreams of tomorrow, if not for today, is being realized.

Mr. J. J. Schenk has been in close contact with the design, construction and operation of the new 650 pound line in Rochester, N. Y. He, therefore, is well qualified to present this picture, so I now call upon him to do so.

. . . Mr. Schenk then presented his prepared paper . . .

THE NEW, MILE LONG, TEN INCH, HIGH PRESSURE STEAM TRANSMISSION MAIN AT ROCHESTER, NEW YORK

J. J. Schenk

The Rochester Gas and Electric Corporation, like many other utilities in the district heating business, was and still is faced with the problem of adding steam generating capacity to supply the increased demands for district steam service in its commercial or downtown area. This district now is supplied by a steam plant containing three Bigelow

Hornsby boilers of 1122 hp each, and for the past few years it has been necessary to operate all three boilers during peak load periods, leaving no reserve capacity.

Three plans for providing additional capacity were considered:

(1) The addition of another boiler at the present plant.

(2) The building of a new plant at some other location on the system.

(3) The construction of a high pressure steam transmission main from the principal steam electric generating plant located in the factory district about one mile away to the commercial district.

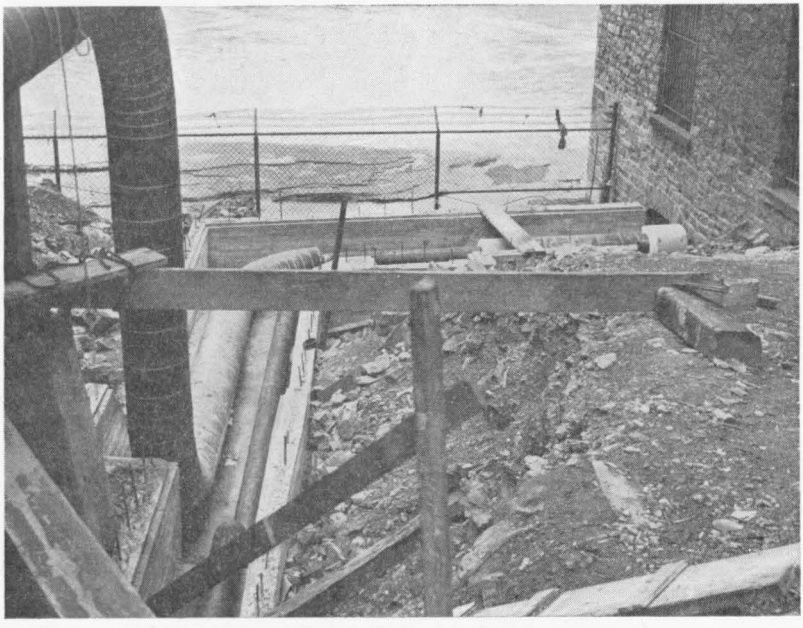

FIG. 1.—Insulated 10-Inch High-Pressure Steam Transmission Line Emerges from Station No. 3, of Rochester Gas and Electric Corporation, which is located on the Genesee River.

After careful study of all three plans, it was decided to build the transmission line.

It was determined that a 10 in. main was necessary. With an initial pressure of 650 psi at the source of supply and 250 psi at the end of the line (a 400 lb drop), it would be possible to deliver 200,000 lb of steam per hour to the system. The addition of desuperheating water

increased the available steam by about 10 per cent or a total of 220,000 lb per hour. This amount of steam was equivalent to that to be obtained by installing another boiler at the downtown plant and the line would be considerably less expensive.

Another distinct advantage is the flexibility of such an installation. It permits shutting down the downtown plant in the summer months, during which time repairs can be made to the boilers. It also permits sectionalizing the system in the event of leaks. Repairs can be made on the system, greatly reducing the number of customer interruptions.

FIG. 2.—For 812 Feet the Line Suspended from Steel Supports Passes Through Part of the River Gorge.

Inasmuch as the steam supplied to this transmission line is taken directly from the boiler header at the main generating plant, the pressure is 650 psi and the temperature 750 F. The downtown system was designed for 400 lb maximum pressure and 500 F temperature; therefore it is necessary to reduce pressure and temperature of this steam before it enters the system. A pressure reducing and desuperheating plant was designed to be installed at the end of the main just before it feeds into the old system.

The next step was the selection of a suitable route. About 40 per cent of the main could be constructed on company property, the other 60 per cent would be on public and private right-of-way. Test holes were made in the streets to locate underground obstructions after which design work was started.

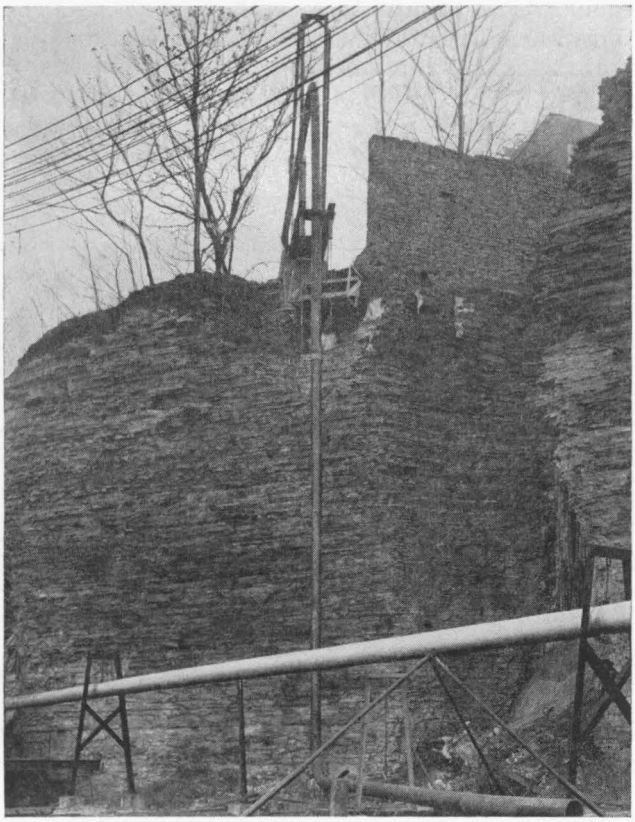

FIG. 3.—Construction of 65-foot rise of Steam Transmission Line from River Gorge to Street Level. The Pipe is Anchored at Base of Vertical Rise.

The line was designed and constructed by the Power Piping Division of the Blaw-Knox Company, in cooperation with our own engineers. The pipe hangers, functional supports and steel "A" frames, pipe bends, etc., were fabricated by Blaw-Knox Company at their Pittsburgh plant and shipped into Rochester. All excavating, concrete work, manhole construction, etc., was done by C. P. Ward, Inc., a local contractor.

Actual construction of the line was started November 1, 1945, and was completed by November 1, 1946, thereby giving us plenty of time to get the line operating satisfactorily before the heavy load period.

Our operating experience with this line has been very satisfactory. The line has carried a load up to 75 per cent of its capacity and all control reducing and desuperheating equipment has functioned properly. In the beginning some difficulty was experienced with water carry-over, but by making some changes in the size of the steam line supplying the desuperheater this fault was corrected.

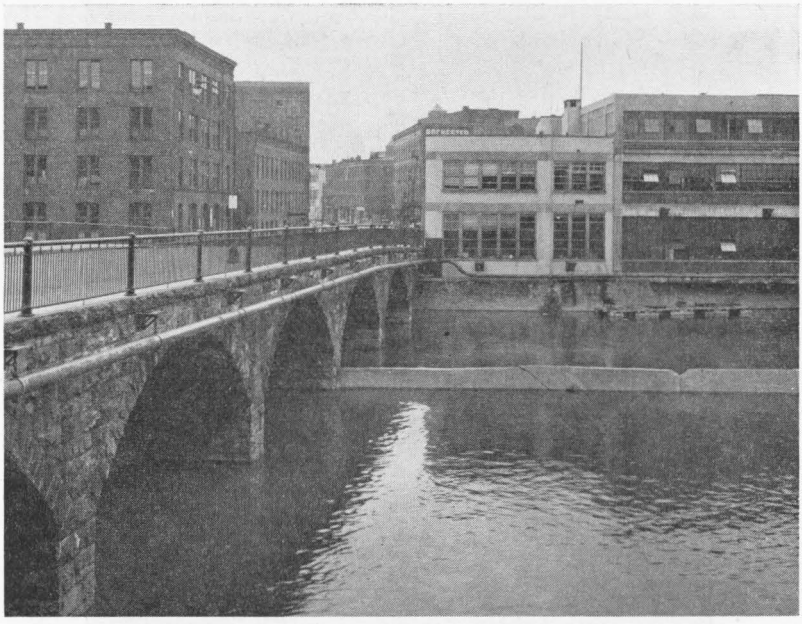

FIG. 4.—Steam Main Crosses Genesee River Suspended from Side of Bridge and Continues Alongside of Buildings.

Our experience has indicated that if the facilities are available, high pressure transmission lines have a definite place in a district heating plan and offer distinct operating advantages, over added boilers in an overloaded plant.

The materials and equipment used in the construction of this main are as follows:

Pipe—10 in. Schedule 80—Grade B Steel—Specification A 106
Insulation—One thickness Unibestos "Super"—inner 1½ in.—1200 F limit, outer 2 in.—750 F limit

Conduit—Ric-wil insulated pipe units—21 ft lengths
Manholes—Reinforced concrete
Welding—Electric arc by certified welders
Traps—Armstrong bucket
Valves—Lunkenheimer
Expansion—Loops and offsets
Desuperheater—Blaw-Knox Company
Water Softener—Permutit Company
Feed Pumps—McGowan Reciprocating 7 ÷ ½ × 4 × 10 Duplex
Controls—Bailey Meter Company

A. F. Metzger: How did you get the right of way to run the loop around the vacant lot? (see Fig. 7).

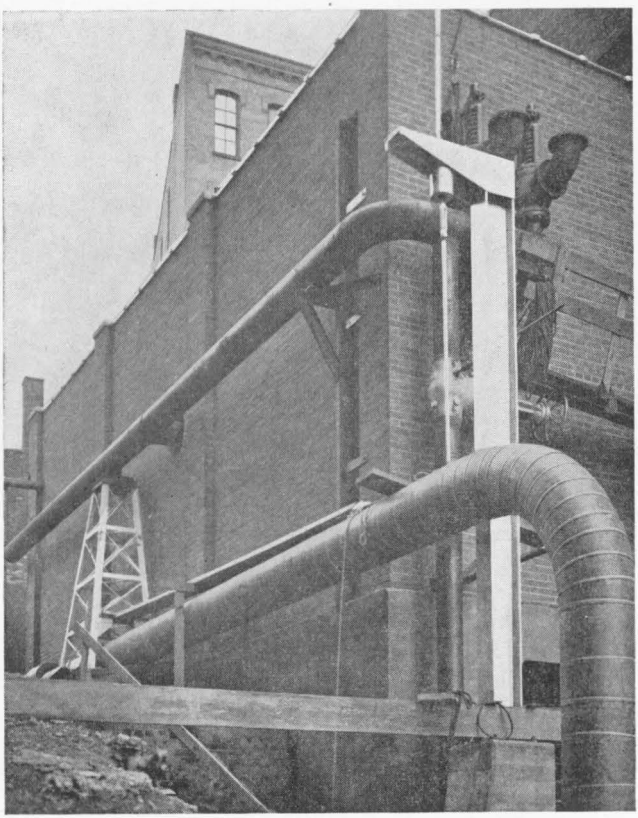

FIG. 5.—Steam Line (lower) Entering Desuperheater House, with Line Above Leading to Safety Pressure-Relief Valve Located at Upper Right.

J. J. Schenk: We have arranged to lease the lot from the city for $50 a year on a three year basis, renewable at the end of three years.

The city has been holding title to this lot for the reason that some day they may build a bridge across the river at this point. We have purposely kept our line low because the bridge, if it is built, will be considerably higher than our steam line, and I believe the line can stay where it is even though a new bridge is built.

FIG. 6.—Main Emerging from Building at Left Runs Along Outer Wall of Substation Through Expansion Loop Before Entering Desuperheater House.

R. B. Donworth: Are you willing to tell us how much it cost?

J. J. Schenk: The total cost of the line is $320,000.

R. B. Donworth: How long is it?

J. J. Schenk: There is 4800 feet of the ten inch, and 250 feet of the twelve inch line. We call it a mile overall.

R. B. Donworth: That is a cost of about $63 a foot.

I also want to ask what the velocity and pressure are through the main at maximum rated flow.

J. J. Schenk: We have had the line operating only up to around 75 per cent of its theoretical capacity. We had hoped to get the full bene-

fit of this line this past winter, but we found that the electric load going up at the same time required some of the steam we were to have, so we have not been able to use the line to its full capacity.

The pressure drop for that load was only fifty pounds. The theoretical drop for full load should be about 400 pounds. We expect to get quite a rapid drop in pressure from 150,000 lb per hour up to 200,000 lb per hour. However, I do not believe we are going to get the pressure drop we thought we would get.

FIG. 7.—The Expansion Loop Takes Care of 5 to 6 Foot Changes in 1000-foot Straight Run of Pipe Located in Raceway.

R. B. Donworth: What is the velocity at 220,000 lb per hour flow?

J. J. Schenk: I think it is 20,000 to 30,000 ft per minute.

R. B. Donworth: I notice you used water softeners of some sort in connection with the desuperheater.

J. J. Schenk: Yes, we have to use raw water as there is no condensate, or treated water available at this point.

J. T. Davis: How long have you had it in operation?

J. J. Schenk: Since last November.

J. T. Davis: Have you had to clean the desuperheater?

J. J. Schenk: Yes, last week, and they did find some sludge in the bottom. They also found a couple of spots where the baffle supports had dropped off. It looked as if these lugs had been poorly welded.

J. T. Davis: Where the line is above the surface of the ground, how is it protected from the weather? Do you have any copper on it?

J. J. Schenk: We used just ordinary conventional overhead construction, with roofing paper banded over the insulation, no copper.

Chairman Collins: Since price has come into the picture, would you care to comment on the relationship between the cost of this method, and the estimated cost of the alternative method?

J. J. Schenk: The new line cost about 50 per cent of the cost of the installation of another boiler in the present plant. Of course, the installation of a new plant at some other location on the system would cost four times as much.

W. W. Stevenson: You mentioned that the line underground is surrounded by concrete. Do we understand that was done throughout all the underground portion?

J. J. Schenk: That is right. I might as well tell you why. A short time previous to the installation of the new line we experienced some conduit corrosion in underground construction that had been in for eight or ten years. When it was installed we were a little green. We should have known better, but we installed it through some old backfill that contained some cinders. So we just played safe with this new installation. There was no reason to expect that we were going to have cinders around the conduit, but we felt it was worth spending a little extra money to insure ourselves that the line would stay there for a long time.

W. W. Stevenson: Have you made any provision for the expansion of the concrete envelope?

J. J. Schenk: No, we did not. It is just one solid run of concrete.

J. E. Hillemeyer: You spoke about two six-inch safety valves.

J. J. Schenk: They are on the 250 pound line.

R. B. Donworth: Is there any protection against excessive temperature?

J. J. Schenk: Just alarms so the operator's attention is called to it. The two buildings are closely connected; it is just a matter of stepping through a door from one section of the plant to desuperheating building.

C. D. Zimmerman: What per cent of the line is on top of the ground?

J. J. Schenk: It is about half underground and half overhead.

R. M. McQuitty: Did you consider the use of slip expansion joints in any places instead of bends?

J. J. Schenk: Yes, it was considered. We wrote to all the people who made expansion devices and none of them could provide expansion

joints for that pressure and temperature. We knew pretty well beforehand we were not going to use them, but we inquired. Our tendency is to get away from expansion joints altogether regardless of pressure or temperature.

Wherever possible, any lines that we built within the last few years have been constructed without expansion joints. We have been fortunate enough to get locations where we could install loops. I do not believe we always will be able to do so; we may have to use some joints. But we will not use joints where it is possible to do anything else.

In fact, we are taking out expansion joints in some locations and replacing them with bends, even going so far as to do it all in the manhole space. A few weeks ago we removed an 8 in. joint that has been out of line for three or four years and we could do absolutely nothing about it due to the fact that a shutdown of the main would interrupt service to half of our downtown customers.

An expansion loop was installed in its place. This could be done because ground temperatures are up, and the amount of expansion to be provided for with the loop was not nearly as much as one would expect, as if it were a new installation.

H. C. Goellner: What type of desuperheater are you using?

J. J. Schenk: A Blaw-Knox desuperheater which carries the water in the bottom section and has a series of baffles up through it. There are two steam supplies, one to the water section and the direct steam supply to the upper section controlled by a butterfly valve. Most of the steam, of course, goes into the bottom section through the water, then as you wish to increase the temperature the butterfly valve automatically opens and supplies more live steam to bring up the temperature.

H. C. Goellner: Do you have automatic control on the water?

J. J. Schenk: It is fully automatic.

H. C. Goellner: What is the minimum flow you handle?

J. J. Schenk: About ten thousand.

H. C. Goellner: Do you get good control at ten thousand?

J. J. Schenk: Yes, we do now, we had difficulties at the beginning.

W. W. Stevenson: Where the line is only two feet under the street, did anything happen to the street?

J. J. Schenk: Nothing, except that this past winter at that point it was dry and the rest of the pavement was wet. It is only for a very short distance. The grade drops very rapidly.

I might say something about the insulation at this point. We specified tubular insulation. Unfortunately, the insulation people did not make the tube as large as it should have been. It was a fairly snug fit on the pipe. This tight insulation set up a tremendous friction when

we attempted to cold pull the line before making the final welds. It required 150 tons of jacks to force that line. If the insulation had not been structurally strong it might have caused serious trouble. However, we were able to pull the welds through the insulation. As I say, it took two 75 ton jacks to pull about 600 feet of straight run of pipe through the conduit.

Insulation of that type should be loose fitting so it can be pushed along the pipe very easily with enough room for a weld to pass through it. Where you have three to five feet of movement at some points in the line you want it to be so the pipe could move easily and not be restricted through friction of pipe covering or supports.

J. E. Hillemeyer: Did you install any thermocouples?

J. J. Schenk: We did about two feet from the manhole wall. We have taken only one set of readings and they have been very satisfactory. We intend to take some more this summer and learn the conditions this time of year. I have not brought those figures with me.

R. M. McQuitty: What temperature do you attempt to maintain?

J. J. Schenk: We admit approximately 100 degrees superheat into the old system. Before we came here to the meeting, we shut down the old plant so the whole downtown system is now being supplied from this new tie line. The peak is now about 50,000 pounds per hour.

J. E. Hillemeyer: Do you expect to get full capacity through the line from the electric plant?

J. J. Schenk: We do not expect to get it this coming winter. Instead of getting 200,000 lb we can get about 150,000 lb. The electric load is growing rapidly, so there is no available excess steam. They are building a new plant down at the lake side. At the rate that it is going ahead it will not be ready until next winter.

C. D. Zimmerman: How far from the old plant does this line tie in? Have you changed the pressure of the distribution system?

J. J. Schenk: This main ties into the old system approximately three-quarters of a mile from the plant so that we back-feed into the system. It has not changed the average system pressure; however, some parts of the system now have higher pressure due to feeding in the steam at a different location.

Chairman Collins: Thank you, Mr. Schenk.

Chairman Collins: I am going to ask Paul Chenzoff to present his paper on packing for slip type expansion joints.

. . . Mr. Chenzoff then presented his prepared paper . . .