

transportation service. With the proper correlation of all the units of transportation and their proper control and regulation will come a greater usefulness and a greater opportunity for service by the company to the community. Such co-operation will be heartily welcomed by the transportation companies and will bring wonderful results in providing improved street traffic conditions. The street railways of today recognize their relationship to the traffic problem and welcome every opportunity to co-operate in the solution.

In the preparation of this paper, reference has been had to much that has been written and said on this and kindred subjects. Quotations have been taken liberally from many sources and acknowledgment is given to the last four monthly issues of the "Aera" magazine, the "Electric Railway Journal News," "The Report and Recommendations of the Metropolitan Street Traffic Survey" by Miller McLintock, the Proceedings of the 1930 Meeting of the American Electric Railway Association and to the 1930 Proceedings of the American Society of Municipal Engineers.

CIVIL ENGINEERING AND THE PUBLIC HEALTH

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High above a lovely Italian lake stands one of the largest statues in the world—112 feet from ground to top, the colossal figure of Carlo Borromeo, archbishop of Milan, hero of the great plague which visited the city in 1572. When other wealthy men fled to their country estates to escape the approaching scourge, the archbishop remained to comfort his afflicted flock in their distress. After his death the people raised this great memorial to him because he stayed to bring them the consolation of religion, though he could do nothing to alleviate their bodily ills nor to stay the hand of death.

If, as some believe, the plague of 1572 in Milan was typhoid fever, then one of the first sanitarians to conquer this ancient pestilence was the German, Pettenkofer, who in Munich in 1867 caused the death rate from this disease to drop suddenly from 203 per 100,000 to almost nothing. How did he do this? By persuading the city to install sewers, to abandon their polluted wells, and to build a new pure water supply. But where is the memorial to this man? I can find no record of one.

Quoting from "Riders of the Plagues" by Tobey: "In spite of these tremendous benefactions, Pettenkofer was practically unknown by the people. The late Dr. Victor C. Vaughn relates in his memoirs that one day en route to Pettenkofer's laboratory he found flags flying and bands playing and upon

inquiry was informed that it was the birthday of the insane king of Bavaria. When, however, he asked numerous persons how to reach Pettenkofer's office, none had ever heard of the eminent scientist." Pettenkofer's melancholy death might be thus recorded: "He died by his own hand of despair born of neglect." Human nature is generous to a fault toward noble men who have the happy faculty of saying the right word of kindness and of cheer. But how often it forgets its real benefactors who bring about a permanent improvement of living conditions and advance the genuine progress of civilization. More often than not people are waving flags to honor an insane king of Bavaria.

I should like to draw a modern parallel to compare the brave and good archbishop who comforted his people with the kindly physician of the present day who does as much and sometimes more for our own afflicted ones. The value of his service is recognized. Who would not wish to erect a statue a thousand feet high to the memory of the good doctor in whose care our dear ones recovered their health and strength? The very modern doctor's prices seem a bit high, perhaps; but even so, we know that his services are worth the cost and we would pay twice as much, if need be, for the same help when the emergency comes.

But we call on the doctor *after* we are sick. He does not often prevent sickness—his business is to cure it if he can and he cannot be expected to be especially interested in keeping us well so long as he is paid only for curing us after we have become sick. The prevention of sickness is still in the hands of the public health authorities—the modern Pettenkofers—the engineers, and laboratory workers, and other agents of such great organizations as our own State Department of Health, and also in the hands of other officials and particularly the engineers who, co-operating with the State Department of Health, are making and keeping our state clean and free from disease. But this most important phase of the public health movement is all but lost sight of.

Now as formerly the proper collection and disposal of sewage, the securing of pure drinking water, and the elimination of flies and mosquitoes by proper disposal of garbage and refuse and the draining of swamps, all recognized civil engineering activities, are important phases of the public health movement. I think we can hardly overemphasize the importance of engineering to the cause of sanitation. I want to remind you that as engineers you are a part, and a very important part, of this mighty movement.

As we look back over the past, we see the great improvement in the condition of mankind that has been brought about by a revival of sanitary engineering. I say a revival because the ancient Romans understood this art and practiced it on a large scale. They built sewers and excellent water supplies

and they drained swamps. Plagues there were because they did not understand the cause of disease, but they had certain correct, common sense notions and they delighted in cleanliness; so the plagues of Rome were nothing to those of the middle ages which followed.

The desolation, misery, ignorance, and general despair which settled down upon the world at the close of the Roman Empire was attended by, perhaps even caused by, the pestilences which raged throughout the whole world at that time. The organized life of the cities was broken up; the excellent water supplies, built by the Romans wherever they went, were destroyed or abandoned. Consequently, people lost the art of bathing; drains fell into disuse, drinking water was taken from polluted streams and wells. Is it any wonder that pestilences came with all this filth to invite them?

The greatest plague of all started in 1348. It was known as the Black Death. It was probably the bubonic plague, which is attributable to general insanitary conditions. This dreadful scourge reduced the population of England by 50 per cent, of Italy by 50 per cent, and of France by 75 per cent. It is said that the islands of Cyprus and Iceland—one at one extremity of Europe and the other at the other—were entirely depopulated by this plague. By comparison, war was of little consequence as a cause of death, except as it helped to spread disease.

Of course, the great obstacle to the discovery of the cause of disease was the attitude of the church, which discouraged inquiry of all kinds for many years by the effective means of the stake and the rack and other ingenuities of the Holy Inquisition. In 1522, Dr. Weitt of Hamburg attended and studied the case of a woman in labor. He was burned to death for his impiety. "Woman shall suffer, it is the will of God. Let man offer spiritual consolation."

Nor were the services of the physician of even a later time an unmixed blessing. Quoting from Harper's "The Conquest of Death at Birth" by Haggard: "In 1773 a great epidemic of puerperal fever more than decimated the lying-in hospitals of Europe, and after raging for three years culminated in Lombardy, where it is said that for a year not one woman lived after bearing a child. Semmelweiss labored through a lifetime of persecution [by his jealous colleagues] in the vile wards of the great charity lying-in hospitals of Europe." He found the cause of puerperal fever, the contaminated hands of the attending physicians, and the remedy—"Doctor, clean your hands!" Today such admonitions are, of course, unnecessary; and puerperal fever has been overcome.

Slowly from the sad experiences of the almost hopeless, disease-ridden world of the middle ages was organized a body of knowledge which served to check the pestilences. Vaccination against smallpox was developed by Jenner in 1796. Paul

Revere, of Revolutionary fame, as President of the Board of Health of the City of Boston, placed his seal of approval upon it, and so smallpox was dealt a timely blow in this country, although the nature of vaccination was not then understood.

But chief among the useful early sanitary ideas was the notion that filth and disease somehow go hand in hand. Prisons were cleaned out. The insanitary living conditions in the vicinity of factories were legislated against and systematic studies were made of certain epidemics, which pinned the cause upon a polluted water supply as in the cholera epidemic in London, which was traced to the famous Broad Street pump. The improvement of the city's water supply was seen to result in improvement of health conditions as shown by Pettenkofer, already mentioned.

The great discoverer who solved the mystery of epidemics was Pasteur, who showed that germs are the cause of certain diseases. That chemist, in revealing the nature of the worst enemy of mankind, has done more for the race than any other who ever lived, and it is difficult to imagine how any future discovery can equal his in its far-reaching, beneficial effects. Let doctors and engineers alike acknowledge their debt to this man. Under the leadership of a great physician, Lister, the medical profession slowly made a right-about-face and utilized the germ theory of disease. Before Lister and Pasteur it is doubtful whether the surgeon cured or killed a greater number. The work of Pasteur showed the sanitary engineers that they were on the right track, and they pushed ahead confidently to the development of satisfactory methods for the purification of water and the treatment of sewage at the Lawrence Experiment Station in this country and later in many university and state laboratories the world over.

I regard the civil engineer (known sometimes in the public health field as the sanitary engineer) as directly responsible for the control of typhoid fever and other water-borne diseases such as dysentery and Asiatic cholera. Water supply and sewage disposal are directly in his charge. Indirectly but surely, he is responsible for the control of filth diseases, such as the bubonic plague, which is carried by rats and fleas, and typhus, which is carried by body lice. The modern methods for disposal of garbage and refuse spell the doom of thousands of rats. Abundant water popularizes bathing and bathing discourages the louse.

The civil engineer is also responsible for the control of malaria and yellow fever, for since the brilliant work of Ross in India and our own Walter Reed, young physicians both of them, we know that these diseases are transmitted by a mosquito. Gorgas at Panama proved that the draining of swamps and the removal of all other adjacent water pools eliminates the mosquito—hence the need for the engineer. Panama was once a pest hole of yellow fever. Now it is a health resort.

The construction of the canal was as much a problem of removing mosquitoes as it was of the removal of earth. Both were civil engineering achievements of the first magnitude.

Lest you might suppose that the public health movement has completed its task, I will remind you that last year there were in the United States 50,000 cases of typhoid fever, the disease which Pettenkofer showed us how to eliminate; there were 350,000 cases of diphtheria, a disease which can be prevented by a simple vaccination.

And we must not forget the economic misery occasioned by disease. Quoting from the *North American Review*, October, 1931, "To ninety per cent of the population illness may not only bring pain and sorrow. One run of sickness may wipe out the savings of a lifetime, permanently reduce the family's standard of living, and spoil the prospects of growing boys and girls.

"We are not adequately protected against either illness or the costs of illness."

I think it behooves all of us to keep the public health problem in mind as it affects our own work—the health of the workers on construction and elsewhere. Are they drinking good water? Is that relic of barbarism, the common drinking cup, still in use?

When a good road or sewer, or even ditch, is built on suitable ground along a well-chosen route of durable materials and of sufficient capacity, one may take a pardonable pride in the excellence of the work itself. But when the construction of a ditch or sewer or properly protected water supply is going to conserve human lives and health, then the structure is an even finer thing.

May I close my remarks by referring to my original analogy? I said I wanted to compare the fine old bishop Borromeo to the modern physician who gives comfort, and it must be admitted, also very material help in time of sickness but who does little to prevent disease. The State Department of Health and its many helpers, including the engineers of the State, who are actually preventing the occurrence of disease) I call the modern Pettenkofers. Now I should like to search the modern scene for some one to liken to the insane king of Bavaria for whom so many flags were flying. The advertising man comes first to mind. Stuart Chase says that modern advertising had its birth in the patent medicine industry. "Come with me to any hospital," says Dr. Goldwater, "and I will show you bed after bed where it stands proved that the patient advanced from the first stage of tuberculosis to third stage by placing faith in patent medicines which did not contain a single helpful ingredient." There is a good deal of evidence in the literature to support the contention that the advertising of health frauds and quackeries has a confounding and injurious effect upon the public health movement of today. I wish the strong

arm of the law could be used against these charlatans and I should be willing to entrust to the State Department of Health all the power that it might need for correcting this abuse.

But doubtless it would not like to take this police duty upon itself. Its important function is one of co-operation, instruction, and organization. And in this work it should be given the utmost of our support. It can look to no other professional group more interested in the prevention of disease than are we engineers. This is our job as well as the Departments. To it we look for guidance. The State Departments of Health are the directors of the modern public health movement which in the words of Winslow "is based upon democratic education of a free and intelligent people by the force of intelligent leadership."

CITY SANITATION PROBLEMS

By L. S. Finch, Sanitary Engineer, Indiana State Board of Health, Indianapolis

The first problem when sewage treatment becomes necessary is to collect all the sewage, or as much of it as may be possible under local conditions, in one place for treatment. If a master plan for the sewerage system has not been prepared and all sewers and interceptors have not been constructed as a part of that plan, the cost of intercepting and connecting sewers may be enormously increased, and in some cases works which have been constructed may become entirely useless.

Our cities and towns in Indiana are not "boom towns" of the mining or oil field class. They are permanent, and it is obvious that it is almost criminally shortsighted to fail to plan a sewerage system to meet the needs of the future. No project which involves such large expenditures or is so closely related to the public health, welfare, and comfort as is a sewerage system or sewage treatment plant, should be constructed without competent engineering advice. Many Indiana cities and towns have wasted money on sewers and sewage treatment works which were not properly designed. Money so spent is twice wasted, since the works will have to be reconstructed sooner or later.

NECESSARY SEWERAGE FACILITIES

As was said, the first problem in providing sewage treatment is to get all of the sewage in one place. For this purpose, it is usually necessary to construct collecting or intercepting sewers which receive the discharge of various sewers and convey it to the site of the treatment plant. The construction of such intercepting sewers should be carried out as