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THE PANAMA AND NICARAGUA CANALS—A COMPARISON.

Elsewhere in this issue we give a comprehensive description of the Nicaragua Canal project. In our issue of February 4th will be found a similar account of the Panama Canal. In both articles it has been our aim to give an impartial statement of facts. To assist the reader in forming his own estimate of the relative merit of these two colossal undertakings we present the following comparison of the salient features of both.

HARBORS.—Panama.—At each end of the canal is a good natural harbor. Both have been in use for about half a century as the terminals of the Panama Railroad. The Bay of Limon is a magnificent landlocked harbor with deep anchorage; the Panama harbor is shallower, and the maritime canal will have to be kept open by dredging.

Nicaragua.—Artificial harbors will have to be built at each end. At Brito the construction would involve building a 3,500 foot jetty and dredging out a 140 acre harbor to a depth of 30 feet. At Greytown a fine harbor once existed, but has since been destroyed by natural forces. An artificial harbor, protected by jetties, would have to be built in the face of the determined efforts of Nature to prevent it. It would no doubt be practicable to create the harbor; but it would be at a cost which was estimated at \$2,500,000 by the Ludlow board. To this must be added the cost of continuous dredging and of the periodical construction of protective works to prevent the shoaling of the harbor. In 1893, Major McFarland, who was sent by the Secretary of War to investigate the canal, reported to the Senate that the construction of a suitable harbor at Greytown alone would cost \$9,500,000, while according to the same authority that at Brito would cost \$5,000,000.

TRANSPORTATION FACILITIES.—The Panama Canal has a double track railroad extending parallel with the whole route, and terminating on each ocean at deep water piers.

Nicaragua has 9 miles of single track at its Greytown end. The other 161 miles of the route are destitute of transportation facilities. General Hains, of the Walker Board, considers that a double track standard road parallel to the route of the canal, and costing \$100,000 per mile, is an indispensable prerequisite to its economical construction.

PLANT.—Panama has a plant that cost originally \$30,000,000 scattered along the route, and has good accommodations provided for 15,000 men.

At Nicaragua there are five dredges, a machine shop and some storehouses at Greytown.

PROGRESS OF THE WORK.—At Panama two-fifths of the work is completed. Fifteen out of the total forty-six miles are dredged to the original width and to a depth of from 16 to 29½ feet. Work has been opened up for the full length of the canal.

At Nicaragua some 4,000 feet of the canal has been dredged to a depth of 17 feet and 30 miles of right of way has been cleared of timber.

DIFFICULT ENGINEERING PROBLEMS.—At Panama the character of the Culebra cut has been determined by tunnels and cuttings and no further trouble will take place as the work proceeds. The Chagres will be controlled by two dams, one to supply the summit level, the other to form a basin for navigation. The amount of flood, possibilities of water supply, and all necessary data have been accurately determined.

At Nicaragua, if the company's route is adopted, there will be nearly 100 dams, big and little, with a total length of 8 miles, most of which will be of earth and clay, upon a clay foundation. If the compromise route is adopted, the number of dams and their height will be reduced, but they will still be numerous. If the low level route be adopted, the earth embankments will be thrown out at the cost of extensive protective works in the lower levels where the canal passes through the delta to Greytown.

RAINFALL.—Maximum at Panama, 93 inches per year. Maximum at Nicaragua, 256 inches per year.

CLIMATE.—At Panama, deadly when the surface ground was first opened up; but not abnormally unhealthy, now that the subsurface excavation has been

reached. At Nicaragua the climate, on account of the prevailing trade winds, is at present healthy. The opening of the work may induce some fever. Save as regards the rainfall of 22 feet per year, it is probably preferable to Panama.

PROBABLE COST OF CONSTRUCTION.—Panama Canal.—Estimated cost, based on four years' survey by 150 engineers, and endorsed by an international commission, including the chief engineers of the Manchester and Kiel Canals, is \$102,000,000

Nicaragua Canal.—Various and widely different schemes proposed, with a variation of 110 per cent between the highest and lowest estimates. The ranking engineer of the latest board places the ultimate cost at about \$150,000,000.

In the latest estimates (it should be mentioned) the unit prices adopted are much lower for Nicaragua than they are for Panama, where dredging, for instance, is estimated to cost 50 cents a yard, as against a few cents at Nicaragua. With this disparity in prices, it is likely the relative proportion of 1 to 1½ in a comparison of the cost of the two schemes is approximately correct.

To determine the comparative advantages of the two routes, were they both completed and open to traffic, the following considerations must be noted:

LENGTH OF CANAL.—Panama, 46 miles; Nicaragua, 170 miles.

TIME OF TRANSIT.—Panama, 15 hours; Nicaragua, 45 hours.

EXTENT OF DANGER ZONE.—From the time a vessel is lifted above tidewater to the time she reaches tidewater at the last lock she is liable to be wrecked through the failure of the dams, lock gates, etc. At Panama the "danger zone" is 23 miles in extent; at Nicaragua it extends for 157 miles.

SUMMIT LEVEL.—Panama, 98 feet, reached by three locks; Nicaragua, 110 feet, reached by four locks, according to latest surveys.

ACCESSIBILITY.—Panama and Nicaragua are about equally accessible for the world at large; but for a voyage from our Eastern to our Western seaboard Nicaragua is about 375 miles shorter. This is compensated, however, by the 30 hours extra time taken in the transit at Nicaragua as compared with Panama.

STRATEGIC VALUE.—If both canals should be declared neutral (we are committed by treaty to maintain the neutrality of Panama and ought therefore to declare the neutrality of Nicaragua), all warships, including our own, would seek the shorter canal, because of the limited time they would be within the danger zone, as explained above. A charge of dynamite at a lock gate could shut a whole fleet up in the isthmus for an indefinite period.

In summing up our somewhat lengthy consideration of the broad question of a canal across the isthmus we are free to confess that all considerations of a purely practical nature indicate that it is for the best interests of this country and the world at large that only one canal should be built and that it should be secured by the completion of the canal upon which two-fifths of the work has already been done. The problems of construction are simpler, the cost will be 50 per cent lower, and the time and risks of transit less in the case of the Panama route.

The only possible recommendation in favor of the Nicaragua scheme is the sentimental one. It will be "Our own canal, built with our own money, controlled by ourselves." Without dwelling upon the fact that such sentiments are diametrically opposed to the prevailing international conviction that such great waterways should be open to all and at all times absolutely neutral, we ask, Are we ready to spend \$150,000,000 for a toy? For if we do not gain some solid advantages from Nicaragua (not in the way of pecuniary profits, since the government may not enter commercial enterprise for gain) which cannot be offered to us by Panama, Nicaragua will be nothing more in the eyes of the world than an expression of national vanity.

But we shall gain nothing from Nicaragua. Certainly not in a strategic sense. If we build Nicaragua to let our warships through and keep other warships out, the rest of the world will see to it that Panama is built to let its warships through and keep ours out.

Furthermore, we have already guaranteed the neutrality of Panama. Hence we should be placed in the supremely ridiculous position of having spent \$150,000,000 to open an exclusive canal for our navy, while we are pledged to use the very ships of that navy to keep open a rival canal for the enemy.

THE HORSELESS CARRIAGE AND PUBLIC HEALTH.

One year ago a company put thirteen horseless electric cabs for hire on the streets of New York. To-day the same company operates one hundred cabs and they are so popular that they have to be taken from the public cab stands and kept in the cab house to fill telephone and messenger orders of regular customers. Three hundred cabs are needed to fill the demand, and it is doubtful if the demand would be supplied. In addition to the cabs there are at least thirty delivery wagons, pleasure vehicles, etc., in Manhattan proper. It is probable that many hundreds will be in use another

year, but the number will be limited, as horseless carriages are complicated pieces of machinery and have to be built carefully, and the factories are now crowded to their utmost.

The merit as regards convenience and economy of the new means of transportation is patent to all, but there is another point which should not be overlooked. In a few years, the horseless vehicle will change the aspect of many of our great cities, and the new industry which has had such a struggle for existence will, in time, transform our cities. In ten years New York has witnessed remarkable changes in transportation. It has seen the old horse cars discarded for the cable, and now the cable is to make room for the underground electric system. With even the partial exit of the horse will disappear to a great extent the dust and mud and noise and the cobblestone pavements, and it will benefit the public health to an almost incalculable degree. The first point to be considered is that of street paving. Each year miles and miles of asphalt have been laid in place of the wretched cobblestone and block pavements. Of course, there are certain conditions under which asphalt pavements are not available, as on streets where the trucking is the greatest, for the trucks, which are heavy in themselves, are loaded with tons of goods, and the metallic tires cut into the asphalt. The cost of keeping a pavement in repair under such conditions is something enormous. A good example of this may be seen on a block of Chambers Street, between Broadway and Centre Street, New York; the ruts in the asphalt pavement are very deep and repairs are constantly being made. With the introduction of the horseless wagons and "auto-trucks," steel or iron tires will undoubtedly give way to heavy rubber cushion or possibly pneumatic tires, and, at any rate, solid rubber tires would be used, in order to obtain the necessary bite upon the pavement. No matter how heavy the traffic, asphalt pavements would then be available and afford the best possible street pavement for automobile vehicles of all kinds. Cobblestones and Belgian block pavement will be renewed as fast as they wear out with asphalt, and the result will be that in time cab riding will be a positive pleasure and a bicycle can go anywhere.

The noise and clatter which makes conversation almost impossible on many streets of New York at the present time will be done away with, for horseless vehicles of all kinds are always noiseless or nearly so. This question of noise has much to do with the general health of the community. Specialists have many times expressed an opinion that the nervous diseases which exist in the city are aggravated, if not caused, in many cases, by noises incident to a great city's traffic. The bells of the new vehicles will of course be somewhat annoying at first.

A point, most important of all, connected with the displacement of the horse is undoubtedly that of the cleanliness of our streets. When we stop to analyze the dust and mud, we find that two-thirds of all of the dirt which we find in the street is caused by the horses themselves, as the dust from other sources and the attrition of the pavement is slight. Therefore, if all of the horses could be done away with, two-thirds of the dirt would disappear in its turn. While this may virtually be regarded as impossible even a great many years hence, at the same time there is no question that the greater use of the horseless carriage, wagon, and truck will produce a marked effect upon our streets. The number in use is so comparatively small at present that it cannot be reckoned with. But by the time we have two thousand horseless vehicles in the streets, we will begin to see a marked difference. The most obvious and important part of the work of street cleaning in a great city like New York is the removing of accumulations from the surface of the streets. In the late Colonel Waring's book, entitled "Street Cleaning," we find that forty per cent of the entire disbursement of the department is for sweeping and sixty per cent of the laboring force is employed in this part of the work, which is now done by hand. Machine sweeping was formerly much used, specially by contractors, but the work done by it was unsatisfactory and the dust raised even after preliminary sprinkling was very great. It is now considered by sanitary experts that there is little, if any, economy of sweeping with machines, and in the summer of 1895 the use of it in what is now known as Manhattan and the Bronx Boroughs of the city of New York was abandoned. At the present time there are 1,600 men engaged in sweeping the streets of New York. The wages of the men vary from \$50 to \$60 per month, depending on whether they have worked one, two, or three years for the Department. The average amount they receive is, consequently, \$55 a month, or \$660 per year; this, multiplied by 1,600, gives us \$1,056,000. This is the actual amount spent in sweeping alone, but in addition to this must be considered the cost of brooms and scrapers, and also carting and dumping. The 1,600 men collect 690 loads of sweepings per day, each load containing 1.5 cubic yards, so that each day 1,035 cubic yards of street sweepings are carted away to the dumps. In the New York Street Cleaning Department, 32 per cent of the appropriation goes for carting and 25 per cent of the