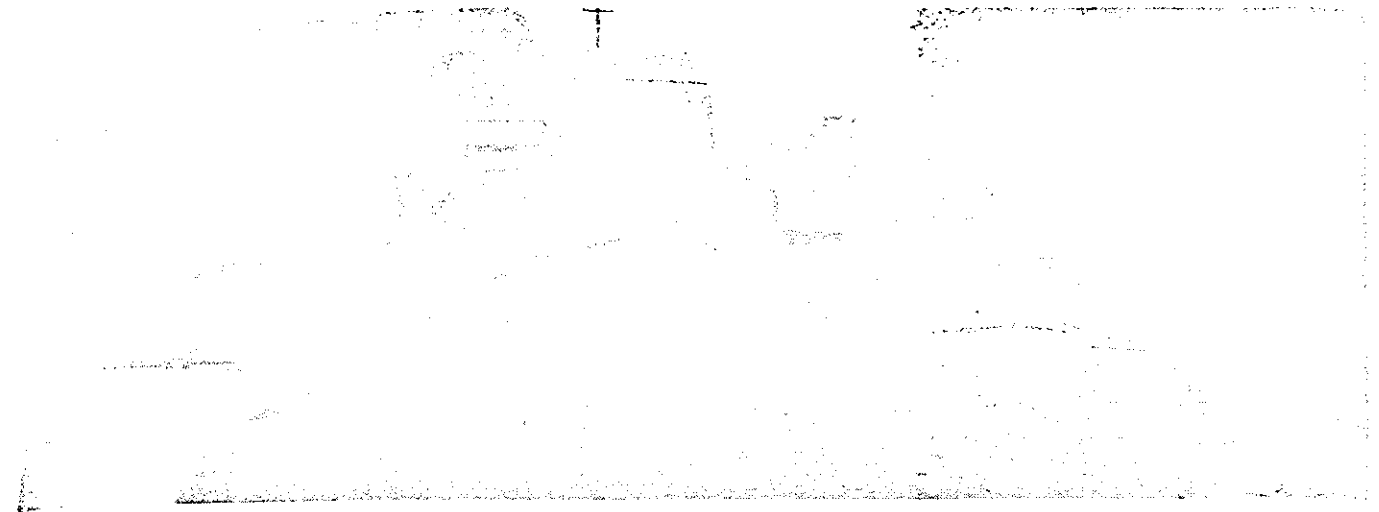


Seal-coating a bituminous-surfaced road, built early in the reconstruction program

Road Rehabilitation

IN THE PHILIPPINE ISLANDS

Progress made on 33 projects in $10,000,000 1947 construction program, in spite of personnel and equipment shortages. Standardization of bridge projects, with concrete favored over steel, has helped reduce delays. Two typical projects are described herein, with photos courtesy Public Road Administration

By F. C. Turner

Division Engineer
U. S. Public Roads Administration
Manila, P. I.

WAR in the Philippines wrought widespread havoc to the highway system. Scarcely any area escaped damage. Even where there was no large-scale fighting, there was guerilla warfare which resulted in wanton destruction of highway facilities.

In 1945 an inventory was made which disclosed that of 1,711 permanent bridges, 621 had been destroyed or badly damaged, and that nearly 3,000 of the 6,352 wooden bridges would have to be replaced. Equally serious was the effect of military traffic on highway surfaces. Roads adequately designed for the slow-moving carabao carreton were called upon to carry army six-by-six trucks, often bumper-to-bumper, in an unending stream. Light asphalt surfacing on city streets was chewed to pieces.

The task that faced the Philippine Bureau of Public Works was a Herculean one. Thirty-five per cent of the highway system was in urgent need of rehabilitation. Engineering and maintenance personnel had become scattered. Offices and records had been destroyed, valuable plans had been lost, and all equipment had been appropriated by the invaders. Major shifts in population also had developed needs for extensive improvements to the highway system.

After the liberation of the Philippines, the American Army expended much effort in opening highways for traffic, and most of the important roads were passable by the end of 1945. Much of this work, however, was of a temporary nature.

U. S. Aid Given

The United States, recognizing the inability of the Philippines to reconstruct their highway system without outside assistance, and realizing the desirability of establishing a stable economy as quickly as possible, proffered financial aid under an act of Congress in 1946. The U. S. Public Roads Administration was designated as the agency to handle the highway features of the rehabilitation program.

An allocation of some $16,000,000 in the fiscal year 1947 was sufficient to allow the programming of 33 construction projects consisting of the repair or replacement of 27 bridges, the construction of approximately 31 kilometers of concrete pavement, 48 kilometers of intermediate type bituminous surfacing, and 47 kilometers of low-type bituminous surfacing intended as a temporary dust palliative on roads subjected to heavy military traffic.

$12,375,000 has been allotted for 1948. Some 116 projects have been programmed and approved, accounting for about 75% of that allocation. The projects total 315 kilometers and include 93 bridges.

The Philippine Bureau of Public Works is responsible for actual engineering location, design and construction control. Work is to be done under

...tracts awarded after competitive ...dding. Public Roads Administration ...epresentatives exercise only general ...supervision and serve as consultants ... local authorities. This procedure ...ll develop a strong local highway ...partment and assist in the rehabili...ation of the contracting industry.

Lack Modern Equipment

There is a serious lack of modern ...nstruction equipment in the Islands. The necessity for immediate rehabilitation of 35% of the highway system makes hand-labor methods totally inadequate.

In order to expedite the work, a pool of war surplus and other essential equipment has been established. Contractors are allowed to draw upon this equipment pool, on a rental basis, to supplement their supply of road-building machinery. Operators have to be trained and the progress and quality of the work suffers during this training period.

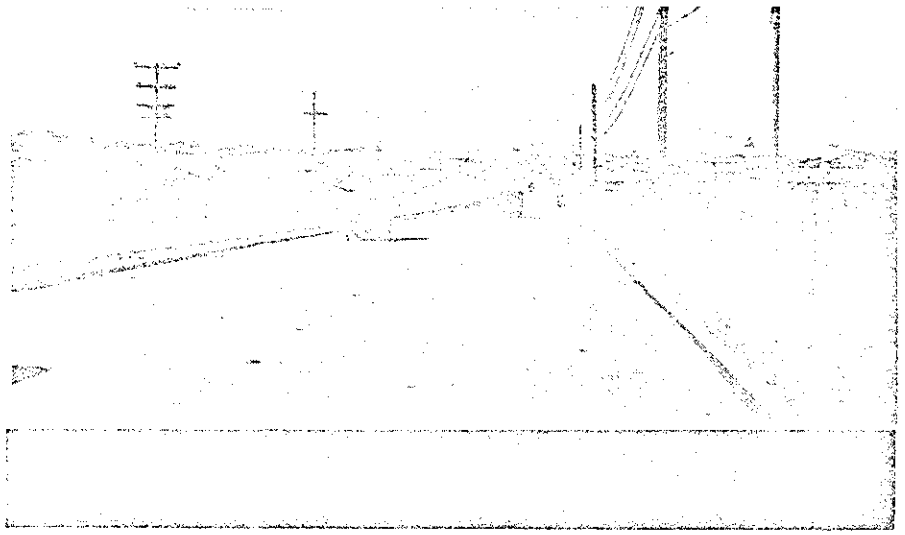
Bridge Projects Standardized

The scarcity of materials, particularly steel, has delayed the bridge construction program.

Three methods have been adopted to improve the situation: (1) Wherever possible, reinforced concrete design has been favored over structural steel, even though it may be more costly. (2) In order to simplify fabrication, a few standard span lengths and designs have been adopted. Every effort is made to use standard unit lengths wherever possible. (3) A supply of reinforcing steel has been obtained and stocked. This is distributed to contractors as needed.

Two Typical Projects

Typical of the work accomplished are two projects which involved the reconstruction of portions of two main thoroughfares entering Manila from the northeast. These are Quezon Boulevard and Santa Mesa Boulevard. Both had been partially completed before the war. The proposed reconstruction followed practically the the original construction, a bituminous



penetration macadam on a native stone base.

Plans were started early in 1947 by the city engineer's office, working in cooperation with a representative.

Contracts were awarded to two local contractors. The Quezon Boulevard improvement is 1.4 miles in length and the Santa Mesa project is 0.5 mile long. In order to preserve the existing base and gravel surfacing as a foundation for the new concrete pavement, grades were laid to conform to the old surface.

The design called for a 6-lane divided concrete highway with curb and gutter and bituminous sidewalks on each side of the roadway. The concrete surface in each lane is 39 ft. wide between curbs, and the roadway is divided by an earth-filled median strip 8 ft. wide. The concrete surface is 7 in. thick and reinforced.

These thoroughfares are the main traffic arteries from the northeast into the city of Manila and short term counts have indicated that up to 1,500 vehicles per hour make use of these streets. Due to the high traffic volumes and to the fact that adequate detours for heavy vehicles using these routes would entail the use of roads adding approximately 10 miles to each individual trip it was decided to construct only one side of the divided highway at a time. This method added 28 days to the contract time for each project.

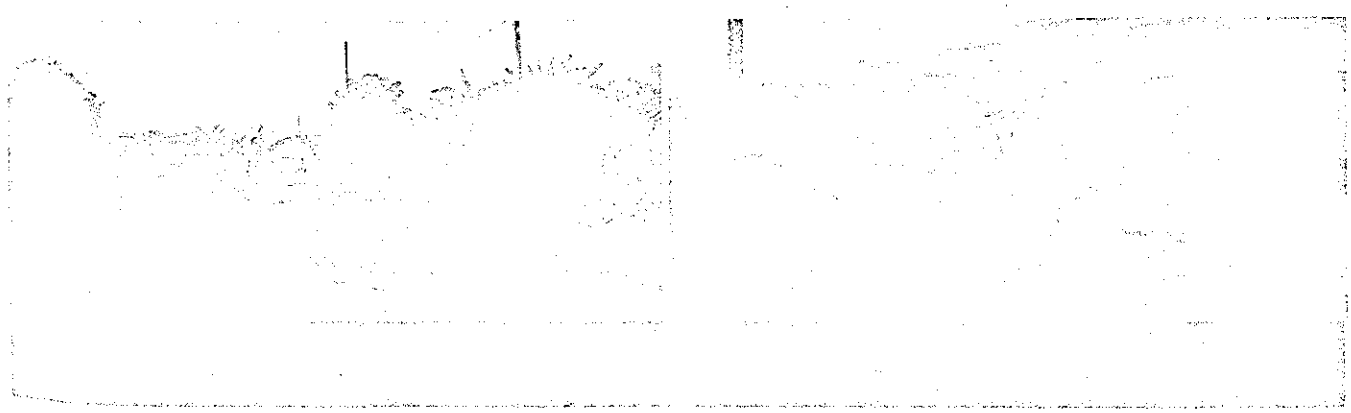
The Santa Mesa project was the first let to contract. The low bid was $370,098. This was considered reasonable and was accepted. Unit quantities and bid prices of major items were as above:

Item	Quantities	Estimated Unit Price	Contract Bid Price
Preparation of base	77,030 sq. yds.	$0.40	$0.213
Curb and gutter	29,207 lin. ft.	3.25	3.08
Asphalt paving	20,690 sq. yds.	1.55	1.75
Concrete pavement	55,064 sq. yds.	4.00	5.49

At the time work was started, paving forms, curb and gutter forms, and similar items for the specified design were not available, and had to be made on the project from local materials. Modern batching plants, pavers and finishing machines were lacking. Consequently, a large portion of the work had to be done by hand labor. A few motor graders, rollers and scrapers were used in the grading and preparation of the base. Aggregate production, batching, mixing and finishing was practically all done without the benefit of modern equipment.

A screening plant had been procured from the U. S. Army and was

(*Continued on page 22*)



...ricants; shops for heavy electrical ...ipment and small electrical sup...s: carpenter shop with layout ...r; machine shop with forge and ...dering equipment; and a central air ...mpressor station (360 hp.). Each ...lding fronts onto a corresponding ...rage yard; wood, steel, etc. Traffic ...ween shops is by road, or narrow-...uge railway. Offices, infirmary, ..., are at the yard entrance.

A field laboratory on the site is ...ipped to test cement, aggregates ...d concrete, including compression ...ts on 0.20-meter cubes or on cored ...mples.

Electrical power for operating ...ipment and for lighting is supplied ...y a 36-kv. line and by a 20-kv. emer...ency line. Distribution is made at ...0 kv. Seven step down transformers ...,000/380 v., varying from 300 to ...60 kva, supply the project. The ...wer needed for the project is about ...90 kva. Several static condensers ...prove the power factor, which is ...ways bad on construction projects.

Housing the Workers

Today there are some 1,000 work...s on the project, and the maximum ...pected is about 1,400. The camps ...e in a town about 2 kilometers ...wnstream. There is a separate ...amp for men without families, in...luding barracks for 30 to 40 men, ...mplete with lavatories and toilets.

The camp for workers with families ...ludes 34 prefabricated houses ...Phenix) divided into 250 apart...ents.

Permanent houses are being built ...r the dam-operating personnel ...about 22 people).

Now in Full Swing

The years 1948-49 will be devoted ...placing the 350,000 cu. met. of con...te in the dam and power house. ...tallation of the first turbine and penstock will begin in autumn 1948, as soon as the 40-ton traveling crane is erected. In 1949, the schedule calls for completing the first turbo-generator unit, and the 460-ton permanent traveling crane, which will enable setting the rotor. The year 1950 will be devoted to completing and adjusting the plant. Apart from the construction of the dam itself, a major task is the restoration of roads.

Assembling forms for elbow of first turbine lining

Acknowledgments: From 1942 to 1946, the preparatory works were executed by the firm Andre Borie. The equipment installation and the construction are performed by the Societe Generale d'Entreprises and Entreprise Andre Borie; the penstocks are manufactured by Schneider et Cie; the generators by Alsthom, the turbines by Neyret-Beylier and the Atliers de Charmilles.

The dam and the power house were designed by the Ex. Union d'Electricite, with Mr. Coyne as consultant and were further developed by the Electricite de France in collaboration with the Societe Generale d'Entreprises.

Philippine Roads

(*Continued from page 15*)

utilized to the limit of its capacity in the production of concrete aggregate. This supply had to be supplemented by material obtained from river deposits, which were shoveled, screened, washed and loaded by hand. Several 14-S concrete mixers were used for mixing the concrete.

Because of the lack of modern plants and experience in this type of construction, problems of control were always arising. It was difficult to obtain uniform aggregate gradation, the operators and finishers consistently urged wetter mixes to facilitate placing, and the finishing had to be checked continually to avoid irregularities in the surface.

Since these projects were completed, a central batching plant, concrete paver, and finishing machines have been obtained by the Public Roads Administration and placed in the equipment pool to be available for use on other projects. At least two complete plants have been ordered by local contractors, and difficulties encountered on these first projects will be avoided on subsequent work.

These projects were the first major postwar highway construction in the Philippines, and were undertaken under difficult conditions. They demonstrate the transition that is occurring in highway construction methods in this part of the world. They have shown that modern equipment and efficient processing plants are essential in speeding up the program of reconstruction and thereby hastening the economic recovery of the Philippines.

By bringing their skill and their experience in modern construction methods to aid in the rehabilitation program, American contractors could be of great service to a grateful and friendly nation. Their participation is needed and would be welcomed by both the Philippine Bureau of Public Works and the Public Roads Administration.