

LIAO RIVER UNDER INTERNATIONAL ORGANIZATION SHWANGTAITZU WEIR AND LOCK.

本文は遼河上流改修工事に關する示法書及契約書にしてその示法書に依れば技師長を以て工
事の遂行の主體とせるものなり

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**CONTRACT FOR THE CONSTRUCTION OF THE SHWANG-
TAITZU WEIR AND LOCK AND WORKS IN
CONNECTION THEREWITH.**

SPECIFICATION.

This Contract comprises the whole of the Earthwork, Masonry, Steelwork, Ironwork, Woodwork, &c. necessary to complete the Engineering Works in connection with the construction of the Liao River Conservancy Boards Weir & Lock for closing the Shwangtaitzu, and works in connection therewith.

It also includes the excavation of the foundations for the above works to the depths and widths shown on the several plans, or to such other depths as may be found necessary, and the removal of the surplus materials excavated to embankment or to spoil, also it includes all pumping, coffer dams, piling, shoring, drciming, fencing, painting, labour, and materials, whether temporary or permanent, which may be necessary; and also the taking down and removal to some place of deposit, to be provided by the Engineer-in-Chief, of all other materials and things now upon the land to be occupied or required by the works. The whole of the work is to be done in accordance with the Plans, Sections, Drawings, Specification, and Indenture

Site of Works

The site of the Weir and the Lock is on the right or west bank of Shwangtaitzu channel (see key plan) where it is dry at ordinary low water stage. At first the structure of the Weir and the Lock will be taken in hand and the Shwangtaitzu channel will afterwards be shifted into the Weir site by opening the new river bed and filling up the old river bed after all works for Weir and lock and also bank protection have been completed. The site of the Lock is to be located on the right or west bank of new Shwangtaitzu channel by the side of the Weir, the approach channel being cut open after the completion of the entire structure, that is both lock and weir.

Lift Gate Weir.

There are to be seven openings of 37.5 ft. clear span each with 6 concrete piers which are to be built across the river bed of the Shwangtaitzu channel at the point of diversion, proper extension of the sectional area being thus provided

to compensate for the contraction of the river bed by these structures.

The gates are of the "Stoney" type seven in all, each workable by two men by means of installed on the iron winches girders to be erected upon the top of the piers which are to also serve as gang ways.

The sill of the Weir is to be flush with the bottom of the river bed that is at 99.7 ft. above datum. The crest of all gates when closed will be at 111.7 ft. above the datum. The gates can be lifted up to such a height as to make their lower edges lie above the highest flood level of August 1921 which is recorded as 117.3 ft. above the datum, that is about 10 ft. higher than the ordinary low water surface at this locality. The top of the piers are to be at 121.0 ft. above the datum.

The concrete foundations for the piers will be 10 ft. deep below the sill level and piles 20 ft. long are to be driven through the bottom by means of a hydraulic jet. The concrete floors of the apron are 2 ft., 4 ft., 3 ft. and 2 ft. thick respectively as in the drawing. Rip-rap stones follow the lower apron for 150 ft. and are covered for 100 ft. with a flexible ferro-concrete making a total thickness of 3 ft.

Reinforced concrete sheet piles of approved design each 20 ft. long are to be driven by means of a hydraulic jet to serve as cut off walls against percolation.

Main structures except the gates are made of concrete having the ingredients in the following respective proportions:

WEIR.					
Class.	Portland Cement	Fine Aggregate.	Coarse Aggregate.	Rubble Stone.	Used For
A	1	2	4		Sheet pile and skin (1 ft. thick) to all exterior surfaces of Piers and Abutments.
B	1	3	6		Apron floor 2 ft. thick and concrete mattress.
C	1	3	6	15%	Main body of all Piers, Abutments and Guide walls.
D	1	3	6	30%	Floor-3 ft.-4 ft. thick.

Lock.

The lock having the sole aim for the passing of junks and rafts up and down the Shwangtaitzu channel through the point of diversion is to be constructed by the site of the Weir, the principal dimension being;

Length 80 ft. clear width 18 ft., with the sill 2.5 ft. lower than that of the weir.

Side walls with their top at 121 ft. above the datum, that is 23.8 ft. high above the sill and 2 gates of iron 22.5 ft. high and 18 ft. wide are to be provided.

The foundation piles and also sheet piles are to be similarly driven as those of the weir described previously.

Main structures except the gates are to be made of concrete the ingredients of which are to be in the following respective proportions :

LOCK.

Class.	Portland Cement	Fine Aggregate.	Coarse Aggregate.	Rubble Stone.	Used For
A	1	2	4		Sheet pile.
C	1	3	6	15%	Body of Wall.
D	1	3	6	30%	Floor and foundation.

SPECIFICATION FOR LOCK AND WEIR AT ERHTAOCHIAO.

GENERAL CONDITIONS.

1. In this Specification, and in the Detailed Qualities, unless there be something in the subject or context inconsistent, therewith, "The Board" shall mean the Liao River Conservancy Board;

"The Works" shall mean the works comprised in this Contract including the Lock, Weir, & diversion of stream at ERHTAOCHIAO (exclusive of lock gates, sluice gates, trestle & girder) They shall include all necessary excavation or dredging; piling driven in place; all cast iron and steel in place; cleaning and washing; all shoring, rigging and false work necessary for the whole of the works completed to the entire satisfaction of the Engineer-in-chief of the Upper Liao River conservancy and shall include extra works; "The Contractor" shall mean the person or persons whose tender for the execution of the works shall be accepted by the Board, and shall include his or their executors and administrations, and if the Contractor be a firm shall also include the partners in such firm for the time being; "The Engineer-in-Chief" shall mean the Engineer-in-Chief holding for the time being the appointment of Engineer-in-Chief of the Upper Liao River Conservancy; "The Assistant" of the Engineer-in-Chief shall mean any person whom the Engineer-in-Chief may from time to time appoint to assist him in superintending the execution of the works or any part

thereof; "In writing" shall mean written or printed, or partly written and partly printed. Words importing the singular number only shall include the plural numbers, and vice versa.

2. The Contractor shall find and provide all labour, services, agency, temporary railways, road, mules, engines, horses, machinery, and power of every kind, scaffolding, staging, trackle, wagons, tools, implements, utensils, apparatus, and plant of every description necessary or convenient for the full, safe expeditions, and proper carrying on and completion of the works including the erection of the Stoney Gates and erection of all Steel Work in connection therewith, and also all materials except the Steel Work of the gates and girders for sluices and lock, and other materials and things specially stated hereinafter to be provided by, and at the expense of, the Board but which are to be placed, fixed, laid down, and otherwise made part of the work by the Contractor, and these materials supplied by the Board are not to be used temporarily by the Contractor in the execution of the works.

**Except certain
Materials to be
provided by the
Board**

3. The Contractor shall be answerable to the Board for the safe custody of all materials provided and delivered to him by the Board for any loss, injury, or damage that may happen or be done thereto after such delivery, and shall remove

**As to Materials
delivered by the
Board to the
Contractor**

the same from the place of delivery to those parts of the works where the same are required to be used, and the Contractor shall be bound by the Manufacturer's Invoices for the said materials unless he shall within one week from the delivery of such materials at the place aforesaid, point out some manifest error therein, and the fact of such error shall be certified by the Engineer-in-Chief, whose decision shall be final, and in case the whole of the materials so provided by the Board shall not be required for the completion of the works the Contractor shall, upon the determination of this contract, deliver up the surplus materials to the Board in good order and condition.

4. The Contractor shall at all times employ and provide on the works as many workmen, horses, mules, engines, wagons, barrows, tools, implements, utensils, temporary rails, sleepers, machinery, apparatus, plant and materials as in the opinion of the Engineer-in-Chief shall be adequate for the due execution and completion of the works, and in case the Engineer-in-Chief shall, at any time be of opinion that a sufficient

**Contractor to
employ sufficient
Workmen &c.**

number or quantity of workmen, horses, mules, engines, wagons, barrows, tools, implements, utensils, temporary rails, sleepers, machinery, apparatus, plant, or materials are not employed or provided by the Contractor (of which the Engineer-in-Chief shall be the sole judge), then, and in every such case the Engineer-in-Chief may, by notice in writing, require the Contractor to provide such additional workmen, horses, mules, engines, wagons, barrows, temporary rails, sleepers, tools, implements, utensils, machinery, apparatus, plant, or materials as he may think necessary, and in case the Contractor shall not, within one week after any such notice shall be given, comply with the requirements thereof, then, and in every such case the Board may employ and provide such additional workmen, horses, engines, wagons, barrows, temporary rails, sleepers, tools, implements, utensils, machinery, apparatus, plant and materials as the Engineer-in-Chief may think necessary, and every such case the wages and other costs and expenses paid and incurred by the Board, with interest thereon at the rate of 6 per cent. per annum, shall be paid to the Board by the Contractor on demand. In addition to the above the Contractor shall provide and operate if necessary the following:—

- 1—At least 2 pumps of more than 15 brake horse power each.
- 2—At least 2 deck pumps with cylinder of more than 6 inches diameter as auxiliary dumping machinery.
- 3—1 water jetting machine of more than 15 brake horse power for jetting down piles complete with all piping and jets.
- 4—1 Concrete mixer of capacity of more than 150 cub. ft. per hour of a type approved by the Engineer-in-Chief.
- 5—1 piling engine of approved pattern with ram of more than 1,000 pounds.
- 6— $\frac{1}{2}$ mile of light rail way with a sufficient number of trucks.
- 7—Interlocking steel sheet piles, each 25 feet long and sufficient for 100 lineal feet of piling when driven interlocked in place.
- 8—Acetyline Flares or Paraffin Arc Lamps for night working and any other articles that may be required for the successful and satisfactory completion of the work.

Contractor to
employ
competent
Foremen &c.

5. The Contractor shall, at all times during the progress of the works, employ and keep on the site of the works competent and proper foremen, agents, and overlookers to superintend and manage the works, and in case the Engineer-in-Chief shall,

at any time, consider that the number of foremen, agents, or overlookers is insufficient, or that any foreman, agent, or overlooker is incompetent, or acting improperly, then the Engineer-in-Chief may give notice, in writing to the Contractor, requiring him to employ permanently, or otherwise, such additional foremen, agents, or overlookers as the Engineer-in-Chief may consider necessary, or as the case may be, to remove any foreman, agent, or overlooker, and put another in his place, and in case the Contractor shall not comply with the requirements of such notices within one week after such notice shall be given as aforesaid, then the Contractor shall forfeit and pay to the Board M. \$. 50 for every day during which he shall neglect to comply with such notice, and the Board may, if they think fit, appoint such additional foremen, agents, or overlookers as the Engineer-in-Chief may consider necessary, and may remove any such incompetent or improper foreman, agent or overseer, and appoint another in his place, at such wages as the Board may think proper, and any wages or other expenses paid or incurred by the Board in consequence of such default as aforesaid, with interest thereon, at the rate of 6 per cent. per annum, shall be paid to the Board by the Contractor on demand, and every foreman, agent, or overlooker so appointed by the Board as aforesaid, shall be considered the servant of the Contractor, and shall have full power to act for, and on behalf of the Contractor, in and about the matters connected with the works in the same manner as if he had been appointed by the Contractor.

6. The Engineer-in-Chief shall have power to require the Contractor to remove from the Board's premises all materials which the Engineer-in-Chief shall consider to be unfit, unsound, ill-seasoned, defective, of inferior quantity, or otherwise improper, and also to require the Contractor to take down and remove all works which the Engineer-in-Chief shall consider to be not done according to the Specification, Plan, Sections, and Drawings, or otherwise improperly executed on which he may consider unfit or improper for the purpose (and that notwithstanding the same may have been previously passed, certified for, or approved of), and in either case to require proper and satisfactory materials and work to be substituted, such rejected workmanship and materials to be at once taken away by the Contractor who shall employ and supply good and proper workmanship and materials instead at his own cost and expense and in case the Contractor shall neglect or refuse

**Improper
Material or
Work to be
removed**

Penalty if bad Work or Material are not removed by the Contractor.

to replace such rejected workmanship and materials to the satisfaction of the Engineer-in-Chief after expiration of forty-eight hours the Engineer-in-Chief shall have the power and be at liberty to have such rejected workmanship and materials taken away and good and proper workmanship and materials put instead at the whole cost and expense of the Contractor or the Engineer-in-Chief shall assess and value the difference in cost and the loss damage sustained by the Board consequence of such defective workmanship or materials being supplied and executed by the Contractor instead of good and proper workmanship and materials in the performance and completion of the said works and the value costs and damage shall deducted from any moneys which may be due from the Board to the Contractor failing to have such rejected materials removed from the works or near the site of the works within the period specified in any notice given by the Engineer-in-Chief to the Contractor requiring such removal the Contractor shall pay to the Board such sum or sums as the Engineer-in-Chief may decide not exceeding *MEXICAN DOLLARS ONE HUNDRED ONLY* (MEX. \$. 100) for each day or part of a day during which the said materials remain on the works or near the site of the works after the expiry of the said period, and the Board shall be entitled to retain such sum or sums out of any moneys then or thereafter due from them to the Contractor.

Quantities.

7. The Board shall not be answerable for the correctness of the estimated Quantities of any of the works, and no question or dispute shall be raised with reference thereto. All payments will be made in the manner hereinafter provided, on measurements of the work as actually carried out. It shall not be incumbent upon the Board, or the Engineer-in-Chief, or his Assistant, to set out any of the works, but the Contractor must, at his own expense, make copies of the original Plans, Sections, and Drawings, for his own use, and he shall be held responsible for the perfect setting out of all the works.

Setting out works.

Power to issue Further Plans, &c.

8. The Engineer-in-Chief shall have full power and from time to time, to make and issue such further Plans, Sections, and Drawings, and to give such further instructions and directions as may appear to him necessary or proper for the guidance of the Contractor, and the good and sufficient execution of the works according to the terms of this Specification, and the Contractor shall execute, obey, and be bound

by the same as fully and effectually as if they had accompanied, or been mentioned, or been referred to in this Specification.

9. The Contractor must satisfy himself as to the nature of the soil; the general form of the surface of the ground; quantity and nature of the materials to be excavated; the nature of the foundation for the Piers, Lock Walls, etc. the quantity or work and materials necessary for the entire completion of the Contract; the means of access to the works or other accommodation he may require; all probable contingencies; and, generally all matters which can in any way influence his Tender for this Contract; and neither the lines shown on the Drawings, nor any information shown on the Drawings shall be taken as indicating that the earth or rock is of any particular nature, or as indicating the condition of the ground, the amount of water to be met with, or means of access, or any other matter; and the Contractor shall take upon himself all the risk and responsibility of the due and careful execution of the several works included in this Contract, or which may become contingent thereupon; and no information any such matter derived from the Drawings or Specifications (excepting such as can be obtained only by reference to the Drawings or Specifications and not by inspection or examination of the circumstances themselves), and no information obtained from the Engineer-in-Chief or any agent of the Engineer-in-Chief or of the Board will relieve the Contractor from any risk or from the entire fulfilment of his Contract, including all details and incidental works not particularly mentioned in the Specification, but which, whether in the temporary or in the permanent works, must evidently be required by the nature of the work included in the Contract.

Contractor to satisfy himself on all points, and take upon himself all responsibilities for the careful execution of the works.

10. The Board shall make the necessary arrangements for enabling the Contractor to take possession of the Lands required for the site of the works, but they do not guarantee possession of the whole of such lands at any one time, and they shall not be under any liability to the Contractor for any delay in putting him in possession of any such lands.

Possession of Lands.

11. The Contractor shall not, in the execution of the works, enter upon or otherwise make use of any lands adjoining the site of the works, without the consent, in writing, of the Board, testified under the hand of the Engineer-in-Chief or his

Works to be executed within area thereof.

assistant, or of their Secretary and Vice President, or of the owners and occupiers of such adjoining lands having been previously obtained.

Delivery & conveyance of Contractor's Materials, &c. 12. The Contractor shall be at liberty to take delivery of all materials, horses, mules, engines, machinery, wagons, tools, implements, and plant of any description required for the purposes of the Contract, and received by the Board for delivery to the Contractor, and of all materials provided by the Board at Newchwang. The Contractor shall at his own cost make such arrangements for the delivery of the materials, plant, and other things hereinbefore referred to on the site of the works as shall be satisfactory to the Board and shall pay all railway and other charges for the carriage thereof, and for demurrage on wagons etc.

Contractor to make all compensation except for purchase of actual site of works. 13. The Contractor shall make such full compensation and satisfaction as shall be claimable to all owners, lessors, or occupiers of lands or roads adjoining, or near to the site of the works, or any part thereof, which shall be entered upon, used, injured, or temporarily occupied for any of the purposes of the Works, or for leading materials thereof, or otherwise howsoever, and all other persons whomsoever entitled in that behalf for, or in respect of the use and occupation of such lands, or roads, or for, or in respect of all loss, damage, or injury to be occasioned to, or sustained by such owners, lessors, or occupiers, or other persons, or any of them, by, or by reason of the execution of the Works, (save, and except, for the land which shall be required and bought by the Board as, and for, the actual site of the works), or by reason of the neglect or omission of the Contractor to comply with all, or of any of the provisions or conditions in the Specification or Contract, and such compensation and satisfaction shall extend to, and include, all royalties, rents, and other payments for getting stone, sand, gravel, rubble, clay, or other materials for the works, or any of them, or which shall be procured elsewhere than from any part of the site of the works.

Contractor to include everything Necessary. 14. The Contractor shall do, and provide not only the works, materials, and things, expressly mentioned and specified in the Specifications, Plans, Sections, and Drawings; but also all such other works, materials, and things, as are necessary or proper for the due execution, completion, and stability of the works, and all such other works, materials, and things, shall be considered as included in the amount of the Contractor's tender.

15. The Contractor shall also be responsible for all injuries and accident that may occur by reason of defective insufficient or absence of lighting fencing or barriers or by reason of any act or default, of any of the workmen or other persons employed in or about the said works or by reason of any other cause connected with the execution of the said works and the

The Contractor responsible for injuries and accident to persons.

Contractor shall indemnify and hold harmless the Board from all consequences of any such injuries or accidents, provided always that if any claim shall be made against the Board for any such injury or accident as aforesaid and the Board shall be of the opinion that the Contractor should pay and satisfy such claim the Board shall be entitled to call upon the Contractor to make and he shall make such payment or satisfaction and in the event of his failing to do so the Board shall be entitled himself to make such payment or satisfaction, and to deduct the amount cost or equivalent thereof from any moneys due from the Contractor hereunder or otherwise to recover the same from the Contractor.

16. The Contractor shall upon the direction of the Engineer-in-Chief suspend the whole or any part of the works during unsuitable weather. Such periods of suspension of works shall be added to the time for the completion of the works.

Suspension of Work.

17. In case of frost of inclemency of weather the Contractor shall effectually cover protect and secure the several works as occasion may require and prevent admission of wet through the apertures and the Contractor shall also effectually case with boarding all angles liable to damage.

Works to be protected from weather.

18. If the Board shall at any time think proper to make additions to or reductions in the thickness of the walls or the piers shown on the Contract Drawings, or to make any alterations, or reductions in, or additions to any other parts of the

Power to order Extra Works, to abandon or reduce Works.

works, or to omit, or abandon any part of the works, they shall be at liberty so to do, upon giving the Contractor written instructions for such alterations, additions, omissions, or abandonment, signed by the Engineer-in-Chief, and the Contractor shall, from time to time, upon such written instructions being given, comply with the same, and execute and complete, or vary, or omit, or abandon, as the case may be, the works therein mentioned or referred to in accordance with such written instructions; and any such alterations, additions, reductions, omissions, or

abandonment, shall not vitiate the Contract, nor shall they affect the same, beyond what may be the necessary consequence of such alterations, additions, reductions, omissions, or abandonment; and the Contractor shall not be entitled to any payment in respect of loss or profit by reason of the omission or abandonment or reduction of any portion of the works.

19. The value of all such alterations, additions, reductions, or omitted, or abandoned works, as aforeside, shall be ascertained according to the Schedule of Prices hereunto annexed, and the amounts to be paid to, or allowed by, the Contractor, in respect of any such additional or altered works, or in respect of any such omitted or abandoned works, or in respect of any of the works, the value and price whereof shall be affected by any such alterations, additions, reductions, or omissions, shall be fixed and certified by the Engineer-in-Chief and shall (as the case may be) be paid to or allowed by the Contractor accordingly.

20. The Contractor shall not in any case, or under any circumstances, be considered as having authority for any alterations or additions in, or to the works, or for the omissions, or abandonment of any part of such works, unless written instructions for the same, signed by the Engineer-in-Chief shall, in each case, have been given; nor shall the Contractor be paid for, or be entitled to make any claim for, or in respect of any such alterations or additions, unless such written instructions shall have been given; and this, notwithstanding that such alterations or additions may have been actually made and executed, and may be adopted, and used by the Board; and no course of conduct shall be taken to be a waiver of the obligation on the part of the Contractor to obtain such written instructions, as aforesaid, in each and every case.

21. In the event of any extra works being so ordered as aforesaid, then an account showing the measurement thereof, as regards that part which is to be paid for by measurement according to the Schedule of Prices hereunto annexed, and an account for day's work of that portion which cannot be paid for by measurement shall be forwarded by the Contractor to the Office or other place of business of the Engineer-in-Chief weekly, or at such other periods as the Engineer-in-Chief shall by writing under

Value of extra
or Abandoned
Works.

Written
orders for
Extra Works
to be obtained.

Accounts of
Extra Works
to be forwarded
to the
Engineer-in-
Chief.
Day Works.

his hand require; and in default of such accounts being forwarded as aforesaid, the Contractor shall not be entitled to be paid for, or make any claim in respect of such extra work.

22. In the event of no price being provided in the Schedule of Quantities and Prices for any work or articles which may be ordered, then, and before the work is commenced, the price, mode of measurement, and time of completion shall be fixed by agreement in writing between the Engineer-in-Chief and the Contractor, and signed by both parties, or if no agreement be come to, the Engineer-in-Chief shall have power to fix such price as he may think fair, and the Contractor shall execute the works at such price.

**Work for
which no
price is
provided.**

23. The materials and workmanship are to be subject to such tests as the Engineer-in-Chief may consider necessary, and all labour, apparatus, moulds, or other things required therefor, are to be provided at the expense of the Contractor.

**Materials of
Workmanship
to be subject
to tests.**

24. The Contractor shall, when required, furnish the Engineer-in-Chief with a statement, either verbally or in writing, as the Engineer-in-Chief may require, of his general arrangements, and as to any temporary works he proposes to adopt for the execution of the works, and any other statements as to any part of the works, or as to anything connected therewith which the Engineer-in-Chief may require, and in case the Engineer-in-Chief shall require any alteration to be made in the Contractor's plans, methods or arrangements, the Contractor shall make such alterations accordingly.

**Contractor to
furnish state-
ment of his
General
arrangements
&c.**

25. Whenever any work, materials, labours, agency, tools, machinery, plant, or thing whatever, is, in the Specification, or in the detailed Quantities named, or implied to be done, executed, or provided, it shall in all cases, unless expressly stated to be done or provided at the expense of the Board, be deemed and taken that the same shall be entirely done and provided at the cost and expense of the Contractor.

**Everything
not otherwise
provided for
to be at
Contractor's
expense.**

26. The Plans, Sections, and Drawings, represent generally the forms and dimensions of the several works. If there should be any discrepancy between the dimensions as indicated by the scale and those marked in figures, the figures are to be considered as correct;

**Discrepancies
in Plans, &c.**

and if there should be any discrepancy between the figures and Specifications, or between the form of construction, or the materials indicated in the Drawings, and those given in the Specification, the directions of the Specification shall be adopted, and in all cases of defective description or of ambiguity, the explanation given by the Engineer-in-Chief shall be Considered Correct, and shall be binding on the contractor.

**Contractor
to make
fortnightly
returns of men,
&c. employed.**

27. The Contractor shall make correct fortnightly returns to the Engineer-in-Chief of the number and description of men, employed on the works, and the work done by any pumping, excavating, or other machinery, in such form, and with such other information as may be required by the Engineer-in-Chief.

Night Work.

28. In cases of Emergency, the Contractor shall carry on by night-work any part of the works which the Engineer-in-Chief may direct, without being entitled to make any additional change for such night work.

Police.

29. The Contractor shall pay all the costs and expenses attendant upon the employment of any Police, which the Local Magistrates may appoint for the preservation of the peace, or the prevention of trespass and theft, or for any other purpose, in or near the site of the works, and shall indemnify the Board from all costs and expenses in respect thereof ever and above the amount entered thereof by the Contractor in his tender.

**Plant, &c.
provided by
Contractor, to
be Board's
Property.**

30. The plant, tools, and materials provided by the Contractor, shall, in all cases, from the time at which they, or any of them, may be brought upon the works and lands taken by or on behalf of, or used permanently or temporarily by, or on behalf of the Board, and during the construction and until the completion of the said works, become, and continue the property of the Board; and the Contractor is hereby prohibited from removing the same, or any part thereof, during the progress of the works, without the consent, in writing, of the Engineer-in-Chief.

**Contractor to
bear all risks.**

31. The Contractor shall be responsible for the sufficiency of the centering, scaffolding, ropes, shoring, timbering of trenches, tools, plant, and machinery of all kinds, and generally of all the means used for the fulfilment of this Contract, whether such means may or may not be approved of or recommended by the Engineer-in-Chief or his

assistant, and shall renew, modify, or alter the same, and generally make better arrangements whenever the Engineer-in-Chief or his Assistant may require him so to do.

32. The works shall be commenced not later than the 1st. September, 1924, and the Contractor shall complete the works on or before the 30th. June, 1926. The Board, however, do not bind themselves to accept the lowest or any tender, either as to time or cost. At the expiration of the time mentioned in the tender, should the Contractor have failed to complete the works to the entire satisfaction of the Engineer-in-Chief, and deliver the same up to the Board in compliance with all the terms of this Specification, he shall pay a penalty per day of M. \$. 50 for every day during which the works shall remain incomplete after that date.

Time of completion.

Liquidated Damages for delay by Contractor.

33. If by reason of any additions to or alterations in the works, or from delay in giving to the Contractor, after request by him in writing, possession of any of the lands required for the site of the works, or from any other cause, the Contractor shall, in the opinion of the Engineer-in-Chief, have been unduly delayed in the completion of the works, it shall be lawful for the Engineer-in-Chief to grant, and he shall if so requested in writing by the Contractor grant from time to time by writing under his hand, such extension of time as he may deem reasonable, and no such extension shall prejudice or in any way affect the validity of the Contract or any Bond or other security given for the due performance thereof, and every such extension of time shall be deemed to be in full satisfaction for any actual or probable loss or injury sustained or sustainable by the Contractor in the premises.

Extension of time.

34. The Works shall not be considered as completed, within the meaning of the Contract, until a certificate shall have been signed by the Engineer-in-Chief, and delivered to the Contractor, stating that the same are so completed, and have been accepted as such by the Board, and that, notwithstanding any previous entry thereon, or taking possession, working, or using thereof, or of any part thereof, by the Board.

Certificate of Completion to be obtained.

35. The Contractor shall afford all facilities for the execution of the works comprised in the exceptions to this Contract, or of any other works which may be undertaken by the Board, or by such parties as may be employed by the Board, so that such works may be properly and conveniently

Contractor to afford facilities for execution of excepted and other works.

completed by such time as the Engineer-in-Chief may require; and he shall proceed in such manner with and complete in such order portions of the work as the Engineer-in-Chief may require. The Engineer-in-Chief shall be the sole judge as to what facilities are due and proper, and can be afforded without any undue interference with execution of this Contract.

Contract not to be assigned, &c. without Licence, in writing. 36. The Contractor shall not, without the previous consent in writing of the Board, under the hand of The Secretary and Vice President thereof, assign or under-let the Contract, or any part thereof, or without the previous consent in writing of the Engineer-in-Chief, make any Sub-Contract for the execution of the works, or any part thereof, except as to labour.

All Penalties to be paid as Liquidated Damages. 37. In every case where any penalty is hereby imposed upon the Contractor, such penalty shall be taken to be in the nature of liquidated damages payable by the Contractor to the Board, and the same shall be recoverable by the Board accordingly.

Penalties, &c. may be retained by Board. 38. In every case where, under, or by virtue of the provisions herein contained, the Contractor shall become liable to the payment of any sum of money to the Board, whether by way of penalty or indemnification, or otherwise, the Board may deduct such sum from any balance or moneys which may be, or become due to the Contractor under the Contract, or may recover the same from the Contractor by action, or otherwise.

Where Board primarily liable to Penalties, &c. they may pay or compound, &c. 39. In every case where the Board are primarily liable to any penalty, or payment, hereby agreed to be borne, or paid by the Contractor, or from the payment whereof the Contractor is to indemnify the Board, it shall be lawful for the Board of their own authority, and without any previous notice to, or consent of the Contractor, to pay, and adjust, compound, or resist the same as they may think fit, and the Contractor shall repay to the Board the amount which they shall pay in respect thereof, together with all costs, charges, and expenses incurred or paid by the Board in relation thereto.

Provisions in case of death of Contractor. 40. If, owing to the death of the Contractor, or from any other cause as hereinafter provided, the Board should take the works into their own hands whether or not they relet the

whole or any of the undertaking, they shall retain all the horses, mules, plant, boilers, and machinery and materials which the Contractor may have brought upon the works until such time as the whole of the works shall have been satisfactorily completed; nevertheless, in such case the Board may sell or otherwise dispose of any horses or other portions of the plant which it may be inexpedient to retain.

41. If the Contractor shall become bankrupt, or in any way compound with his creditors, or shall fail in the due performance of any part of his undertaking, or shall declare in writing his inability to proceed with the works, or if the Engineer-in-Chief shall certify by writing, under his hand, that the Contractor is not proceeding with the works with due diligence and to his satisfaction, the Board may determine the Contract by a notice, in writing, under the hand of their Secretary and Vice President, and may enter upon and take possession of the works, and of the plant, tools, and materials of the Contractor, and use, or sell the same, as the absolute property of the Board.

Provisions in
case of Bank-
ruptcy of Con-
tractor, &c.

42. If the Contract shall be determined, as aforesaid, the Board may relet the undertaking of the Contract, or any part thereof, and upon such conditions as they think fit, from time to time, may engage workmen, and provide all such materials, implements, and apparatus, and employ the same in such manner as the Engineer-in-chief may think necessary and proper for completing the works, or any of them, or for repairing and remedying, or endeavouring to repair or remedy any defects which may appear therein, and when the Contract shall have been so determined, or so soon thereafter as the Engineer-in-Chief may think convenient, the Engineer-in-Chief shall fix, and determine, what amount (if any) is then reasonably earned by the Contractor in respect of work actually done, and in respect of the value of any plant, tools, and materials provided by the Contractor and taken to by the Board, and the amount thereof, after allowing for all sums then already paid to the Contractor on account, shall remain in the hands of the Board without interest, until twelve calendar months after the completion of the works, the date of such completion being fixed by Certificate of the Engineer-in-Chief; and the Engineer-in-Chief shall be at liberty, by a certificate to be granted by him at any time before the expiration of such period of twelve months from the completion of the works, to authorise the Board to deduct the

Board may
relet the Con-
tract, or com-
plete the
Works.

damages, losses (including loss on realisation of the plant, tools, and materials taken to by the Board as aforesaid), costs, charges, and expenses, in his opinion, incurred by them in consequence of the premises, or to which they may be put, or be liable, together with the forfeitures (if any) incurred by the Contractor, and all which amounts the Engineer-in-Chief may fix and determine by the same Certificate, or by one or more separate Certificates, from sum or sums of money which would so become due and owing to the Contractor; and in case such sum or sums of money shall not be sufficient to delay such damages, losses, costs, charges, expenses, and forfeitures, then the Contractor will forthwith pay the deficiency to the Board, and the Board may recover the same from the Contractor by action, or otherwise.

<p>Contractor Maintain Works until expiration of 6 months after Completion.</p>	<p>43. The Contractor shall, during the progress of the works and, with the exception of the Stoney gates and appurtenances and lock gates and appurtenances for the period of six calendar months after the same shall have been completed and open for use and until the Engineer-in-Chief shall have certified that the responsibility of the Contractor, under the Contract, shall have ceased and determined and been entirely fulfilled, maintain and keep the works in good and perfect order, repair and condition including all amendments, re-erections and repair, rendered necessary by accidental causes or by flood, storm, tempest, fire, trespass, or other means and shall leave and deliver up the said works in good and perfect order, repair and condition, at the expiration of the Contract.</p>
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<p>44. In case the Engineer-in-Chief shall, at any time before the expiration of the period during which the works are to be maintained by the Contractor, as aforesaid, consider that the works, or any part thereof, are not being maintained and kept by the Contractor in such good and perfect order, repair, and condition, as aforesaid, it shall be lawful for the Board to execute, or to cause to be executed, by some other person or persons, any amendments or repair, which the Engineer-in-Chief may consider necessary, and the costs, charges, and expenses of the same, or otherwise, incurred in relation thereto, and all damages whatsoever, with interest thereon, at the rate of 6 per cent. per annum, shall be paid to the Board by the Contractor on demand.</p>	<p>Engineer-in- Chief may, if necessary, repair during this period at Cost of Contractor.</p>
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45. The Contractor shall not use any explosive compound in connection with the works, excepting with the written consent of the Engineer-in-Chief, and only at such times as he shall direct; and when such compound is used, the Contractor shall provide and use sufficient means by sheathed timber covering or other modes approved of by the Engineer-in-Chief, for preventing stones or other materials from doing damage, but no approval by the Engineer-in-Chief of such means or consent to the use thereof shall relieve the Contractor from liability in respect of any damage caused by the blasting. All additional expense such as payment of flagmen, signalmen &c., contingent upon the blasting is to be borne by the Contractor.

**Blasting
operations.**

46. The Contractor shall provide in his tender the sum or sums given in the Detailed List of Quantities and Prices under the heading or "Provision Money", to be used wholly or in part, or not to be used at all, as the Engineer-in-Chief may decide. The sums of money shall be provided to cover the cost of any additional works or part thereof which the Engineer-in-Chief may consider necessary to be done by the Contractor. The Engineer-in-Chief shall also have power to carry out the works for which such provision moneys are provided by means of other Contractors, and intends to do so should consider it desirable, and the Contractor shall not on this account be entitled to claim any profit or commission with respect to the same. If no part or only parts of the various sums of money provided for additional or special works be used, then the whole or the parts not used shall be deducted from the amount of the Contract, and the Contractor shall not be entitled to claim any profit in respect of the same.

**Provision of
Money for
additional
Works.**

47. All measurements relative to the removal of earthwork, shall be taken from the dimension of the materials before excavation, and, whereevr practicable, from the actual contents of the cuttings or excavation. All measurements of quantities shall be the net contents or measurements of the work as executed according to the Drawings, no allowance being made for slips of earthwork, or for waste of stone from dressing, such as occurs in hollow quoins, or for the waste of timber in pile head or scarfs or tenons, or at the end joints of runners, or in similar cases, and no allowance shall be made for circular work, face-work or any incidental circumstances, notwithstanding any customs which may exist to the contrary; and in no case shall any dimensions be included in the measurement, or any quantities be included in the accounts or be

Measurements,

paid for which shall exceed the dimensions required by the Contract, or ordered as herein provided for as extra works; and if the dimensions or executed works excess those marked upon the Drawings the exceed will not be allowed in measuring up the work unless a written order, signed by the Engineer-in-Chief, authorising payment for the same, is produced by the Contractor.

Terms of Payment.

48. The Contractor shall be entitled to payment for the works in manner following, that is to say:—At the end of every month (unless other periods be agreed upon) the Contractor, or his qualified Agents, shall go over the works with the Engineer-in-Chief, or his Assistant, to ascertain the quantity which has been executed, and payments will be made, upon the Certificate of the Engineer-in-Chief, to the amount of 90 per cent, of the value of the work so executed at the first payment, and subsequently to the amount of 90 per cent. of the value of work executed since the previous payment to the Satisfaction of the Engineer-in-Chief. So soon as the Engineer-in-Chief shall have certified that the whole of the works have been completed to his satisfaction, the Board shall pay to the Contractor one moiety of the balance then due to him, after making such deductions therefrom as the Board may be authorised to make, and the ultimate balance, whatever the same may be found to amount to, after making such deductions therefrom as the Board may be authorised to make, with interest on such last mentioned balance at the rate of 6 per cent. per annum from the time of the completion of the works until payment shall be made by the Board to the Contractor so soon as the Engineer-in-Chief shall have certified that the responsibility of the Contractor under the Contract shall have ceased and determined, and been entirely fulfilled. Provided always, and it is hereby expressly declared, that no money shall be considered to be due or owing to the Contractor, and that the Contractor shall not make any claim against or demand upon the Board for, or on account of any work executed by the Contractor, unless the Engineer-in-Chief shall certify the amount thereof and that the Contractor is reasonably entitled to such instalment or balance respectively, nor unless such Certificate shall have been presented to the Secretary & Vice President of the Board, nor shall any such sum or sums of money be considered payable to the Contractor until the expiration of seven days after such Certificate shall have been so presented, nor shall any omission to pay the amount of such Certificate at the time the same shall be payable, be held, or deemed, to vitiate the Contract, but in such case the Contractor shall be entitled

to interest thereon at the rate of 6 per cent. per annum for such time as such omission shall continue. It is to be distinctly understood that all the periodical Certificates of the Engineer-in-Chief are for payment on account only, and shall not be held to signify the approval of the whole of the works or materials referred to in such Certificates, and the Contractor will not be relieved from any risk or liabilities to which he may be subject under the Contract until the final acquittance shall have been given him under the last Certificate.

49. The following form of Certificate will be adopted, and the Contractor will be required to sign the same on every occasion of a payment being made:—

Form of Certificate.

Certificate No.....

Date.

LIAO RIVER CONSERVANCY BOARD.

I hereby certify that the sum of may be paid to on account of the above Contract

Amount previously certified	\$
Amount above certified	\$

To the Secretary & Vice President,
Liao River Conservancy Board,
NEWCHWANG.

Engineer-in-Chief, \$
Upper Liao River Conservancy.

Received from the Liao River Conservancy this Receipt day of
192 , the sum of
in respect of the above Certificate.
\$: :

50. Nothing herein contained shall prevent the Board, if they think fit so to do, from making advance, from time to time, to the Contractor upon account of the works in progress, although the same may not have been completed and certified, but in every such case the money so advanced shall be carried to a separate account with the Contractor, distinct from the Statement of Account shown on

Power for Board to make advances.

the said Certificates and not intermixed therewith.

**Repetitions
and variations
to be construed
most favoura-
bly to Board.**

51. In the case of terms repeated wholly or partially in the Specification and Detailed Quantities, or either of them, or in the case of any variance between the terms of the Specification and Detailed Quantities, or any of them, the Board may adopt all, or any of the provisions, so as to secure in all cases the most ample protection.

**Service of
Notices on
Contractor.**

52. Where any Notice or other Document is to be given to, or served on the Contractor, the same may be so given or served, either by delivering the same to him personally or to his agent, or by leaving the same or sending the same through the Post, addressed to him at his usual or last known place of abode or business; and in case there shall be more than one Contractor, a Notice or other Document, which shall be given to or served on any one of the Contractors or their representative on the works, shall be deemed to have been given to or, served on all of them.

**Disputes &c.
to be referred
to Engineer-
in-Chief.**

53. If, and whenever, any doubt, dispute, or difference shall arise or happen, touching or concerning the works, or any of them, or relating to the questions, qualities, description, or manner of work done or executed, or to be done and executed by the Contractor, or to the quantities or quality of the materials to be employed therein, or in respect of any additions, omissions, alterations or deviations, made to, in, or from the works, or any part of them, or touching or concerning the meaning or intention of this Specification, or of the Detailed Quantities, or any part thereof, or of any Plans, Sections, Drawings, instructions, or directions referred to in the said Specification, or which may be furnished or given during the progress of the works or touching or concerning any certificate, Order, or Award, which may have been made by the Engineer-in-Chief, or in any-wise whatsoever relating to the interest of the Board or of the Contractor in the premises, then, and in every such case, such doubt, dispute, or difference, shall, from time to time be referred to, and be settled and decided by the Engineer-in-Chief, who shall be competent to enter upon the subject matter of such doubt, dispute, or difference, with or without formal reference or notice to the Contractor and who shall judge, decide, order, and determine thereon, and that whether the Contract be then existing or completed, or determined, and who shall have full power and authority to correct and amend any errors or inaccuracies in this

Specification, or in the Detailed Quantities, or in any Certificate, Order, or Award, made in pursuance hereof, and to the Engineer-in-Chief shall also be referred the determination of any sum, or sums, or balance of money to be paid to, or received from the Contractor by the Board, in respect of the works, or any part thereof, or of any matter arising under or in connection with the Contract.

54. The directions, decisions, admeasurements, valuations, certificates, orders, and awards, of the Engineer-in-Chief (which said directions, decisions, admeasurements, valuations, certificates, orders, and awards, respectively, may be made, from time to time), shall be final and binding upon the Board and Contractor respectively, and shall not be set asids, or be attempted to be set asids, or objected to on account of the Engineer-in-Chief being a salaried official of the Board, or on account of any technical or legal defects therein, or in the Specification or Detailed Quantities, or in the Contract founded thereon, or on account of any informality, omission, delay or error of proceeding, in or about the same, or any of them, or in relation thereto, or on any other ground, or for any other reason, or for any pretence, suggestion, charge, or insinuation of fraud, collusion or confederacy, or otherwise howsoever; and it shall not be competent for the Contractor, or the Board, to except to any hearing or determination before, or of the Engineer-in-Chief, or to any Certificate, Order, or Award proposed, made, or executed by the Engineer-in-Chief, on the ground of any want of jurisdiction, or excess of authority or irregularity of proceeding, or otherwise; but any and all matters made the subject of any such hearing or determination or included in any Certificate, Order, or Award, and whether or retrospective or respective operation or effect, shall be deemed to have been property submitted to the Engineer-in-Chief, and be taken to have been properly adjudicated upon. But nothing herein contained shall prevent the Engineer-in-Chief from requiring the removal of any improper work, although the same may have been certified for, or from correcting or amending any errors, or inaccuracies, in any Certificates, Order, or Award.

**Directions, &c.
of Engineer-
in-Chief to
be final.**

55. The Contractor shall, enter into a formal Deed of Contract with the Board for the due fulfilment of the undertaking in the form hereto annexed.

**Deed of
Contract.**

56. The Contractor upon signature of this Agreement shall deposit with the Board 10 per cent. of the total amount payable to him under the Contract as security for the due performance

**Contractor to
deposit 10 per
cent of Value**

of Contract and fulfilment by him of all his liabilities and obligations as security. under the terms of the Contract to be repaid at the date of payment of the final instalment under the Contract. Provided that the Board shall have the power and be at liberty to deduct from such deposit any sum or sums which may become due from the Contractor to him under the Contract and that nothing in this clause contained shall discharge the liabilities of the Contractor for the payment of liquidated damages or penalties.

This deposit shall earn interest at rate of five per cent. per annum.

Sureties. 57. Should the Contractor become bankrupt or fail or neglect to proceed with or complete the works to the satisfaction of the Engineer-in-Chief the undersigned Sureties hereby severally and jointly undertake bind and oblige themselves to carry out and complete or be responsible for the cost of the carrying and completing by another of the works in accordance with the terms of the Specification and of this Contract Document and to entire satisfaction of the Engineer-in-Chief and the total cost to the Board of the whole work however or by whom carried out shall not exceed the original contract sum of.....

Witnesses to Signature of

Surety for Contractor

Witnesses to Signature of

Surety for Contractor

The Board do not bind themselves

58. The Board do not bind themselves to accept the lowest or any tender.

GENERAL STIPULATIONS AS TO WORK.

Extent of application of General Stipulations 1. General Stipulations which are to apply to the whole of the works, wherein the workmanship and materials described may be used, and which stipulations are intended to apply to the extra or unspecified works, as well as to the Contract or specified works, excepting in cases where it is otherwise stated.

Increase of Quantities.

2. The increase in the quantity of excavation of any kind, masonry, brickwork, concrete, steelwork or other matter and material which may arise, will be paid for according to the rate

specified in the Detailed List of Quantities and Prices, and if any diminution shall arise in any of the quantities of excavation of any kind, masonry, brickwork, concrete, steelwork, or other materials and matter, the difference will be charged to the Contractor at the rate specified in the Detailed List of Quantities and Prices, and no claim by him for loss of profit will be allowed or paid.

Diminution of
Quantities.

3. The Contractor shall provide and fix, at his own cost, all temporary works and materials, and he must submit drawings of any proposed temporary constructions for the Engineer-in-Chief's approval before they are erected and brought into use upon the works, but such approval shall not exempt the Contractor from any responsibility as to the sufficiency of such works or materials, and he must bear all risk in connection therewith.

Temporary
Work and
Materials.

4. The Contractor will have full permission to erect any temporary houses, offices, &c., necessary during the execution of the works, or any machinery for excavating or embanking, provided that the sites for such erections are obtained by the Contractor with the consent of the parties concerned.

Temporary
Houses,
Office, &c.

5. *Contract Plan No. 1* is a general site plan showing site of proposed Shwangtaitzu Weir and Lock.

Contract Plan No. 2 is a site Plan of the Shwangtaitzu Weir & Lock, with Cross & Longitudinal Section along the site of excavation together with an earth-work list of a total estimated quantity of 88,714 fangs, not including the excavation in the present Shwangtaitzu channel which must be allowed for by Contractor in the Schedule of prices. (see clause E below).

Contract Plan No. 3 is a detail plan of the Weir & Lock to be constructed. The Steelwork of lift gates to the weir and lock gates to the lock also all steel girders, lifting gear and tackle in connection with these gates will be supplied by the Board, the Contractor to allow a price per gate for erecting and fitting including all fittings.

Contract Plan No. 4 embodies details of a concrete block making machine, details of Reinforced Concrete Sheet Piles and Moulds, Reinforced Concrete Block Bank Protection Mattress, Pile driving Caps etc. etc.

The Board whilst believing all details of these surveys etc. as shown on these plans to be accurate yet accepts no responsibility in this connection as

stated in clause 26 of the Specification.

order of Works 6. The order in which the works are to be executed is as follows :—

(A) The Excavation for the piers of Weir and for the Lock are to be taken out as required either one by one or all together as desired by the Contractor.

(B) The whole of the Weir & Lock to be completed in accordancy with the Plans, Specifications and Contract and after having been certified in writing by the Engineer-in-Chief as having been constructed and completed to his satisfaction.

(C) The embankment A. B. & C. D. shown on Contract Plan No. 2 are to be constructed.

(D) The Excavation along the South East Bank of the diversion to be executed and the bank protection shown on Contract Plan No. 2 to be carried out and in accordance with Details to be supplied later by the Engineer-in-Chief. For the bank protection embodied in this clause allow M. \$. 10,000 in Schedule of prices.

(E) The approaches to the Lock & Weir to be excavated to the depths and widths as shown on Contract Plan No. 2 and the excavated materials piled on the island on the South side of the diversion so as to be afterwards used in filling up the old arm of the River, Dams are to be left in at either end and are to be afterwards removed by dredger or by explosive as required by the Engineer-in-Chief.

If it is decided to remove these by dredger this will be done by the Board and the amount allowed by the Contractor for the removal of these dams will be deducted from the total amount of the Contract.

(F) After the Engineer-in-Chief has certified in writing that the Weir & Lock are in satisfactory working order, the closure of the old branch of the Shwangtaitzu river shall be taken in hand, the embankment D. E. composed of mattresses of fascines 40 feet square at the bottom and reducing to a width of 10 feet by 40 feet long at the top, each row breaking joint shall be sunk weighted with stone and earth and super-imposed one above the other making a fascine barrier the top height of which is to be at 117'.0 ft. above datum.

The excavation taken from the diversion and stored on the island South of the Weir shall then be filled into the old arm of the river to a level of 115'.0 ft. above datum.

Slopes 7. The slopes are to be dressed to the inclinations shown on the Cross Sections, or as may be decided upon by the Engineer-in-Chief; they are to be neatly and uniformly trimmed to the face of the cutting or embankment.

8. The Contractor is to deposit all surplus material in the embankments, spoil bank or old river arm and the cost thereof is to be included in the prices for "Earth-work" in the Detailed List of Quantities and Prices.

**Contractor to
deposit all
Surplus
Materials**

9. The Contractor will have to be at the risk of any subsidence of the material from ground slips or otherwise, as he will only be paid for the amount of measurement given for the embankments or cuttings, as the case may be. All slips distorted by slips will have to be re-dressed and if previously covered with bank protection they must be again protected to the slope specified. If required by the Engineer-in-Chief the Contractor will have to drain the seat of the embankments.

**Subsidences &
Slips to be
made good.**

10. The whole of the excavation in this contract is to be taken out to the form and dimensions shown on the Cross Sections and herein described, and is to be deposited in the embankments, fillings, closures and accommodation works, as directed by the Engineer-in-Chief.

Cutting.

11. The Contractor shall make the necessary side water channels for draining the bottom of the excavation and to adopt such other means as will allow all water to find free and uninterrupted course from the cuttings into a main drain, or sump from which it must be pumped. The Contractor is responsible for maintaining the excavations for the Lock & Weir free of water to the satisfaction of the Engineer in-Chief.

**Surface
Drainage.**

12. The Contractor shall make all drains, alteration, or diversions in existing drains or watercourses, which may be found necessary for the exclusion of water from the excavations. Whenever or wherever springs, soaks, or streams appear and issue from the face of the slopes, the Contractor will be bound to make and maintain during the progress of, the works, dry rubble drains, in such positions and in such a manner as the Engineer-in-Chief may direct from time to time, in order to prevent the said springs, soaks, or streams of water from injuring the slopes; the whole of such water is to be conveyed into the side water channels a little below the cutting level. The Contractor is also to make the necessary side water channels for draining the bottom of the excavations or to adopt such other means as will allow all water to find a free and uninterrupted course from the cuttings. Where beds of sand and other loose materials occur, the face of the slopes is to be protected from the injurious affects of any springs or streams of water by such other means

Drainage.

as may be deemed advisable or necessary by the Engineer-in-Chief. Should any slips take place in the cutting during the excavation of the material after the slopes are completed or during the 1/2 year of maintenance, the Contractor is to take such steps to cure them as the Engineer-in-Chief may direct, notwithstanding that it should be found necessary by him to carry the drainage beyond the board boundary.

Prices to Cover Cost of Requirement specified. 13. The above-mentioned requirements are not to be considered as extra work, and no extra charge will be allowed for them, as it is to be distinctly understood that the Contractor in his prices for "Earth-work" is to include the cost of all contingent works, such as blasting, shoring, timbering, pumping, filling in, levelling, punning selected material behind the walls, disposing of surplus materials, or carrying to spoil, and any others elsewhere specified.

Embankments Slopes. 14. The side slopes of the embankments in this Contract are to be made with a slope of 1 in 2 that is to say, 2 feet 0 inches horizontal to 1 foot of vertical height, or other slope as directed by the Engineer-in-Chief.

Allowance for Settlement. The embankments are to be carried forward uniformly as nearly at the finished height and width as the due allowance for subsidence of materials will admit of, and this allowance is not to exceed or fall short of the quantity deemed necessary, from time to time, by the Engineer-in-Chief. In all cases this must be strictly and carefully attended to, in order to avoid the necessity of making any subsequent addition, either to the height or width of the embankment, to bring it to the proper level and dimensions,

Temporary Drainage. The surface of the embankments is to be kept in such form, or to be intersected by such drains or channel, as will always effectually prevent the formation of pools of water upon it, and ensure the embankments being kept as dry as possible during the progress of its formation.

Excavation Foundation and Trenches. 15. The Contractor is to excavate the foundations and trenches for all piers, walls, tunnels, culverts and all works specified or unspecified, to keep out the water, construct dams and stagings, and provide all necessary struts, shoring, planks, and tools of every description, whether left in the work or not, necessary to perfect the execution of his work, at his own expense, and the cost thereof is to be included in the amount of his Tender under the head of "Earth-work".

The excavations in trenches for retaining walls and piers etc., are included in the quantities given in the Detailed List of Quantities and prices as "Earth-work" and the width of such excavation in trenches are, in each case, to be taken as being the horizontal width of the concrete at the foundation level.

**Measurement
of Excava-
tion of Foun-
dations and
Trenches.**

In all cases the excavation in foundations is to be taken as being below the slopes of the cuttings and of a horizontal width equal to the maximum widths of the concrete foundations.

16. The cost of any additional excavation caused by the mode of construction is to be included in the Contractor's price in the Detailed List of Quantities and Prices for "Earth-work" and no extra payment will be made for any excavations outside the above-mentioned limits. And in case any of the foundations of any of the works shall, in the opinion of the Engineer-in-Chief, be required to be carried lower than is shown upon the Drawings, the Contractor is to make such extra excavations, and to do all extra pumping or other contingent works incident thereto, at the rate specified in the Detailed List of Quantities and prices for "Earth-work" as the case may be.

**Foundations
to be car-
ried deeper
than shown
if necessary**

17. The earth which may be necessary to fill in the concrete foundations is to be well selected, filled in 12 inches layers, each layer being well punned, and the expense of so doing is to be borne by the Contractor and not to be charged as extra. The value of such filling is to be included in the price for the "Earth-work" in the Detailed List of Quantities and Prices. The earth filling which may be necessary to fill in at the back and between the Lock walls, shall be filled in 12 inches layers of selected materials and each layer shall be well punned. Should the Contractor require any additional price or prices for carrying out the above requirements over and above the price given for earth work in cutting in the Detailed List of Quantities and Prices, he shall enter the extra price or prices in the Schedule of prices for "Earth-work".

**Filling
Round
Founda-
tions.

Filling for
Platform and
Dock &c.**

18. If the Contractor, by inadvertence, or without the instructions of the Engineer-in-Chief, shall take out any material below the level of the foundations, either as shown on the

**Unauthorised
Excavation.**

Drawing or as authorised by the Engineer-in-Chief, he shall not without the express sanction of the Engineer-in-Chief, refill the excavated material, but shall, if so required by the Engineer-in-Chief, make up the trench to the correct level with concrete without any extra charge.

Timbering and Supporting Foundations and Trenches. 19. In connection with the excavation for all works, the sides and ends of trenches, &c., shall be thoroughly supported by timbering, sheeting, wallings, struts, polling boards, bars, interlocking steel piles and or other suitable materials, including, where necessary, sheet piling, and the prices in the Detailed List of Quantities and Prices for "Earth-work" shall include the use of all material and for all labour in placing and withdrawing the material.

Payments for timber left in Foundation, &c. When required, in the opinion of the Engineer-in-Chief, for the security of the works and adjacent structures, timber shall not be withdrawn, but shall be left and built in as the Engineer-in-Chief may direct and order, and for all timber so left in by order of the Engineer-in-Chief but not otherwise, the Contractor shall receive payment at the rate of Mexican dollar cents seventy only per English cubic foot, with the exception hereafter mentioned, but for timber left in without specific orders of the Engineer-in Chief, or where left in under the Engineer-in-Chief's orders, such orders being necessary in consequence of the negligence of the Contractor, there will be no extra payment beyond the prices in the Detailed List of Quantities and Prices for "Earth-work".

payment for all piling left in Foundations. No polling board or timber of one and a half inches in thickness and under will be paid for in any case. In the case of all temporary piling left in to order, the above-mentioned price of Mexican Dollar cents seventy per English cubic foot shall include the cost of all labour and pile shoes.

— CONCRETE, —

MATERIALS.

A. Cement and Cement Mortar.

Quality. 20. The whole of the cement for these works herein referred to shall fulfill the condition of the latest specification

defining Portland cement drawn up by the Engineering Standards Committee of Great Britain or shall conform to the Standard Specification & Tests for Portland cement of the American Society for Testing Materials or shall comply with the Government Specification for Cement Testing of the Japanese Government.

21. To secure due progress, the Contractor shall, immediately after the order to commence the works has been given, procure and deliver on to the site of the works such a stock of cement as will enable him to use cement at least six weeks old, and shall at all times during the progress of the works until their approaching completion keep stored on the works such a quantity of cement as the Engineer-in-Chief shall deem sufficient. Each consignment of cement to the site of the works shall be accompanied by the Manufacturer's advice note and guarantee, which shall afterwards be forwarded to the Engineer-in-Chief.

Stock of
Cement.

22. Although the Engineer-in-Chief may have passed any consignment of cement, still he shall have the power to further reject such consignments if he finds any deterioration in the quality of the cement.

Rejection of
Consignment.

23. The Contractor shall provide, without charge, all labour, apparatus, and assistance the Engineer-in-Chief or his Assistant may require for examining or testing the cement and he shall provide at the works, and keep in good repair, suitable cement testing machines, approved by the Engineer-in-Chief for testing the cement in a convenient shed, which shall be devoted to this purpose alone.

Testing
Machines.

24. The Contractor shall provide, without charge, perfectly dry, water-tight sheds near the site of the works for storing the cement to be used in the work. When delivered on the works, the cement shall be shot from the bags on to the perfectly dry floor of the shed to a depth not exceeding four feet, and be permitted to remain at least six weeks before it is used in the permanent work. The cement shall be turned over from time to time in the sheds as may be directed by the Engineer-in-Chief. The cement mortar used in these works shall be as directed by the Engineer-in-Chief and it shall not be re-used or re-mixed after it has become set.

Cement Sheds.

Aeration.

Cement
Mortar.

B. Fine Aggregate.

General Requirements. 25. Fine aggregate shall consist of sand, having clean, hard, strong, durable, uncoated grains and free from injurious amounts of dust, lumps, soft or flaky particles, shale, alkali, organic matter, loam, or other deleterious substances.

Grading.—Fine aggregate shall range in size from fine to coarse, within the following limits:

Passing through No. 4 sieve.....not less than 95 per cent.

Passing through No. 5 sieve.....not more than 30 per cent.

Weight removed by decantation.....not more than 3 per cent.

Sieve Analysis.—The sieves and method of making sieve analysis shall be as follows:

TABLE 1.

Sieve Number 1 or Size in inches.	Sieve Opening.		Wire Diameter.		Tolerance, per cent		
	in.	mm.	in.	mm.	Average Opening	Wire Diameter	Maximum Opening
No. 100	0.0059	0.149	0.0040	0.102	6	20	40
No. 50	0.0117	0.297	0.0074	0.188	6	20	40
No. 30	0.0232	0.59	0.0130	0.33	4	10	25
No. 16	0.469	1.19	0.0213	0.54	3	10	10
No. 8	0.0937	2.38	0.0331	0.84	3	10	10
No. 4.....	0.187	4.76	0.050	1.27	3	10	10
$\frac{3}{8}$ -in	0.375	9.5	0.092	2.33	3	10	10
$\frac{1}{4}$ -in	0.75	19.0	0.135	3.42	3	10	10
1-in	1.00	25.4	0.162	4.12	3	10	10
1½-in	1.50	38.0	0.177	4.50	3	10	10
2-in	2.00	50.8	0.192	4.88	3	10	10
3-in	3.00	76.0	0.25	6.3	3	10	10

(1) Sieve No. 100 to No. 4 are based on "Table of fundamental Data on Standard Specification for Sieves" issued by the U. S. Bureau of Standards, 1920. The liberal tolerances will permit the used of certain sieves which do not *exactly* correspond to the numbers given in the table.

C. Coarse Aggregate.

26. Coarse aggregate shall consist of crushed stone, gravel, or other approved inert materials with similar characteristics, or combinations thereof, having clean, hard, strong, durable, uncoated particles free from injurious amount of soft, friable, thin, elongated or laminated pieces, alkali, organic, or other deleterious matter.

General
Requirements.

Coarse aggregate shall range in size from fine to coarse within the following limit:

Grading.

Passing in. sieve (maximum size).....	100 per cent.
Passing 1/2 in. „ (intermediate size).....	50 per cent.
Passing No. 8. „	0 per cent.

D. Rubble Aggregate.

27. Rubble aggregate shall consist of clean, hard, durable stone larger than coarse aggregate and not larger than one-man stone.

Rubble
Aggregate.

E. Storage of Aggregate.

28. Aggregate shall be so stored on platforms or otherwise as to avoid the inclusion of foreign materials. Before using, frost, ice, and lumps of frozen materials shall be removed.

Aggregate
Storage.

F. Water.

29. Water for concrete shall be clean and free from oil, acid, alkali, organic matter, or other deleterious substance.

General
Requirements.

PROPORTIONING AND MIXING CONCRETE.

A. Proportioning

30. The unit of measure shall be the cubic foot. Ninety-four (94) pounds (one gab or $\frac{1}{4}$ lbs.) or Portland cement shall be considered as one cubic foot.

Unit of
Measure.

31. Each of the constituent materials shall be measured separately by volume. The method of measurement shall be such as to secure the specified proportions in each batch. In volume measurement,

Method of
Measurement.

the fine aggregate and the coarse aggregate shall be measured loose as thrown into the measuring device. The water shall be measured by an automatic device that will insure the same quantity in successive batches.

Proportions. 32. The proportions of cement, fine and coarse aggregate shall be classified as specified in the Specification.

B. Consistency.

33. The Engineer-in-Chief shall determine and specify the consistency of the concrete for various portions of the work based on the tests of the materials to be used. The consistency of the concrete shall be measured by the slump test in the manner described in the "Tentative Specifications for Workability of Concrete for Concrete Pavements" (Serial Designation : D62—20T), of the American Society for Testing Materials. The slump for different types of concrete shall not be greater than as indicated in the Table below. The consistency shall be checked from time to time during the progress of the work.

WORKABILITY OF CONCRETE.

Type of Concrete.

	Maximum slump in inches.
1—Mass concrete	2.
2—Sheet piles	6.
3—Blocks	1.

In determining workability, the newly mixed concrete shall be placed in a truncated cone-shaped metal mold 12 in. high, 8 in. in diameter at the base, and 4 in. in diameter at the top, and provided with handles at the sides. The concrete shall be lightly tamped with a rod as it is placed in the mold which, when filled, shall be immediately removed and the slump or settlement of the concrete noted.

C. Mixing.

Machine Mixing. 34. Mixing, unless otherwise authorised by the Engineer-in-Chief, shall be done in a batch mixer of approved type, which will insure an uniform distribution of the materials throughout the mass, so that

**Determination
of Workability.**

the mixture is uniform in color and homogeneous. The Mixer shall be equipped with suitable charging hopper, water storage, and a water, measuring device controlled from a case which can be kept locked and so constructed that the water can be discharged only while the mixer is being charged. It shall also be equipped with an attachment for automatically locking the discharge lever until the batch has been mixed the required time after all materials are in the mixer. The entire contents of the drum shall be discharged before recharging. The mixer shall be cleaned at frequent intervals while in use.

35. The mixing of each batch shall continue not less than 1½ min. after all the materials are in the mixer, during which time the mixer shall rotate at a peripheral speed of about 200 ft. per min. The volume of the mixed materials per batch shall not exceed the manufacturer's rated capacity of the Mixer.

Time of
Mixing.

36. When hand-mixing is authorized by the Engineer-in-Chief it shall be done on a water-tight platform. The materials shall be turned at least six times after the water is added from the hose of a watering can and until the batch is homogeneous in appearance and color.

Hand-Mixing.

37. During windy weather protection is to be provided at the platforms by screens or otherwise, as may be directed by the Engineer-in-Chief, to prevent the cement being blown away.

Protection in
windy
weather.

38. Retempering of concrete or mortar which has partly hardened, that is, remixing with or without additional cement, aggregate, or water, shall not be permitted.

Retempering.

DEPOSITING CONCRETE.

A. Depositing in Air.

39. Before beginning a run of concrete, hardened concrete and foreign materials shall be removed from the inner surfaces of mixing and conveying equipment.

General.

40. Before depositing concrete, debris shall be removed from the space to be occupied by the concrete; forms shall be thoroughly wetted (except in freezing weather), or oiled. Reinforcement shall be thoroughly secured in position and approved by the Engineer-in-Chief.

Approval.

Handling. 41. Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by method which shall prevent the separation or loss of the ingredients. It shall be deposited in the forms as nearly as practicable in its final position to avoid rehandling. It shall be deposited in approximately uniform horizontal layers; the piling up of the concrete in the form in such manner as to permit the escape of the mortar from the coarse aggregate will not be permitted. Forms for walls or other thin section of considerable height, shall be provided with openings, or other devices which will permit the concrete to be placed in a manner that will avoid accumulations of hardened concrete on forms or metal reinforcement. Under no circumstances shall concrete that has partly hardened be deposited in the work.

Spouting. 42. Where concrete is conveyed by spouting, the plant shall be of such size and design as to ensure a practically continuous flow in the spout. The angle of the spout with the horizontal shall be such as to allow the concrete to flow without separation of ingredients. The spout shall be thoroughly flushed with water before and after each run. The delivery from the spout shall be as close as possible to the point of deposit. When operation must be intermittent, the spout shall discharge into a hopper.

Compacting. 43. Concrete, during and immediately after depositing, must be beaten, trodden and worked into position an iron punner, and a rod or fork being used. but not in such a manner as to force the water and cement from their combination with the rest of the concrete but in such a manner as to ensure that the liquid cement permeates and occupies the whole space between the other materials. For inaccessible portions of the forms where rodding or forking is impracticable, the concrete shall be assisted into place by tapping or hammering the forms. The concrete shall be thoroughly worked around the reinforcements, and around embedded fixtures, into the corners of the forms. The concrete when finished shall be solid compact mass, absolutely free from honeycomb or small interstices of any kind. Any concrete falling short of these requirements must be cut out and remedied to the satisfaction of the Engineer-in-Chief at the expense of the Contractor. All facing shall be thoroughly smooth by thoroughly probing and working with long trowels or thin iron rammers to form an uniform and smooth face without after treading.

44. Water shall be removed from excavations before concrete is deposited unless otherwise directed by the Engineer-in-Chief. A continuous flow of water into the excavation shall be diverted through proper side-drains to a sump, or by other approved methods which will avoid washing the freshly deposited concrete.

**Removal of
Water.**

45. Exposed surfaces of concrete subjected to premature drying shall be kept thoroughly wetted for a period of at least 7 days.

Protection

46. No concrete shall be either mixed or deposited during freezing weather.

Cold weather.

47. Concrete shall be deposited continuously and as rapidly as practicable and until the unit of operation, as approved by the Engineer-in-Chief, is completed.

**Depositing
Continuously.**

48. The surface of the hardened concrete shall be roughened and thoroughly cleaned of foreign matter and laitance, and saturated with water and forms retightened before depositing concrete. If the concrete be left exposed and becomes hard, dry, unsound or dirty, it shall be cleaned off, picked and grouted with a thin course of cement mortar before another layer is added without any extra charge. An excess of mortar on vertical or inclined surfaces shall be secured by thoroughly rodding or forking the freshly deposited concrete to remove the coarse aggregate from contact with the hardened concrete.

Bonding.

B. Rubble Concrete.

49. Rubble aggregate shall be thoroughly embedded in the concrete. The individual stones shall not be closer to any surface or adjacent stone than 1 ft. all spaces and interstices being closely filled with fine concrete.

**Rubble
Concrete.**

C. Depositing Under Water.

50. Depositing concrete under water will not be allowed except when instructed to do so by the Engineer-in-Chief and the methods, equipment, and materials to be used shall be submitted to and approved by the Engineer-in-Chief before the work is started. Concrete shall be deposited by a method that will prevent the washing of cement from the mixer, minimize the formation of laitance, and avoid flow of water until the concrete has fully hardened. Concrete shall be placed so as to minimize segregation of

General.

materials. Hand-mixing will (see clause 36) not be permitted. Concrete shall not be placed in water at temperature below 35° Fahr.

Proportion. 51. Concrete deposited under water shall consist of not less than 1 part of Portland cement to 2 parts of fine and 4 parts of coarse aggregate.

Coffer-dam. 52. Coffer-dams shall be sufficiently tight to prevent flow of water through the space in which concrete is to be deposited. Pumping will not be permitted while concrete is being deposited, nor until it has fully hardened.

Depositing continuously. 53. Concrete shall be deposited continuously, keeping the top surface as nearly level as possible, until it is brought above water, or to the required height. The work shall be carried on with sufficient rapidity to insure bonding of the successive layers.

Method. 54. The following method shall be used for depositing concrete under water.

(a) Tremie.—The tremie shall be water-tight and sufficiently large to permit a free flow of concrete. It shall be kept filled at all times during depositing. The concrete shall be discharged and spread by raising the tremie in such manner as to maintain as nearly as practicable an uniform flow and avoid dropping the concrete through water. If the charge is lost during depositing the tremie shall be withdrawn and refilled.

(b) Drop-Bottom Bucket.—The bucket shall be of a type that cannot be dumped until it rests on the surface upon which the concrete is to be deposited. The bottom doors when tripped shall open freely downward and outward. The top of the bucket shall be opened. The bucket shall be completely filled, and slowly lowered to avoid back-wash. When discharged the bucket shall be withdrawn slowly until clear of the concrete.

Laitance. 55. The concrete shall be disturbed as little as possible while it is being deposited, in order to avoid the formation of laitance. Laitance shall be removed.

FORMS.

General. 56. Forms shall conform to the shape, lines, and dimensions of the concrete as called for on the plans. Lumber used in forms for exposed surfaces shall be dressed to an uniform thickness and shall

be free from loose knots or other defects. Joints in forms shall be horizontal or vertical. For unexposed surfaces and rough work, undressed lumber may be used. Lumber once used in forms shall have nails withdrawn, and surface to be in contact with concrete thoroughly cleaned, before being used again.

57. Forms shall be substantial and sufficiently tight to prevent leakage of mortar; they shall be made of strong timber flaming and longitudinal tongued and grooved planed boarding or shuttering, and the timbering shall be properly supported by runners, uprights, struts and tie bolts, proper precaution being taken to prevent the possibility of bulging or movement of any kind, and where exposed to the action of water the boarding shall be made water tight. If adequate foundation for shores cannot be secured, trussed supports shall be provided. Moulds for sheet piles and mattress blocks are to be as shown in Contract Plan No. 4.

Design.

58. Bolts and rods shall preferably be used for internal ties; they shall be so arranged that when the forms are removed no metal shall be within 1 in. of any surface. Wier ties will be permitted only on light and unimportant work; they shall not be used through surfaces where discoloration would be objectionable. Shores supporting successive stories shall be placed directly over those below, or so designed that the load will be transmitted directly to them. Forms shall be set to line and grade and so constructed and fastened as to produce true line. Special care shall be used to prevent bulging. Exposed concrete face work shall be solid and smooth, true to line and level, and otherwise perfect and in the erection of the framing and boarding special precaution shall be taken to ensure absolute accuracy, and under no circumstances will any rough, irregular, uneven, distorted, or otherwise unsatisfactory work be accepted.

Workmanship.

59. Unless otherwise specified, all square corners shall have a 3 in splay.

Moulding.

60. The boarding of forms shall be thoroughly cleaned and scraped each time after being used, and redressed when required, and on the inside if shall, every time after erection immediately before again being used, be smeared with soft soap or non staining mineral oil to ensure the face of the concrete being perfectly smooth. Where oil is used, it shall be applied before the reinforcement is placed.

Oiling.

Inspection of Forms. 61. Temporary openings shall be provided at the base of wall and pier forms, and other places where necessary, to facilitate inspection and cleaning immediately before depositing concrete.

Removal of Forms. 62. Forms shall not be disturbed until the concrete has adequately hardened, nor shall the permanent shores be removed until the structure has attained its full design, strength and all excess construction load has been removed. Wall and Pier forms shall be left in place until the concrete has hardened sufficiently to sustain its own weight and the construction loads likely to come upon it.

SURFACE FINISH.

Surface Wash. 63. The framing and boarding shall not be slackened until the whole of the concrete to the top is two weeks old, and after the boarding is removed should any part of the face be of rough or uneven surface it shall be picked out in squares to the depth of six inches and be refilled against boarding as directed by the Engineer-in-Chief without extra charge beyond the Contract Price.

Immediately on the removal of the boarding for exposed concrete facework it shall be washed over with cement and sand in the proportion of two parts of sand to one of cement. It shall be applied with a white wash Brush.

If required by the Engineer-in-Chief, the surface of any concrete work is to be truly levelled or formed to any slope as may be desired or formed so as to facilitate the drainage of all water in any manner he may determine.

CURING.

Protection of Concrete after depositing. 64. Concrete shall be protected from injurious action from the sun, heavy rains, currents, of water, frost, or mechanical injury and in dry weather it shall be wetted down frequently as long as the Engineer-in-Chief instructs.

— METAL REINFORCEMENT. —

Quality of reinforcing metal. 65. All steel used should have a tensile strength of not less than 60,000 lbs. per square inch of section, and elastic limit of not less than 50 per cent, nor more than 60 per cent of the

ultimate tensile strength, with an elongation of not less than 20 per cent in a length of 8 ins. Any bar must stand bending cold round a bar of its own diameter, through an angle of 180°, and should close down upon itself without fracture on the outside of the bent portion. All welding will be prohibited, unless where absolutely necessary, and must be done only with the sanction of the Engineer-in-Chief.

66. Metal reinforcement before being positioned, shall be thoroughly cleaned of mill and rust scale, and of coatings of any character that will destroy or reduce the bond. Reinforcement appreciably reduced in section shall be rejected, Reinforcement shall be re-inspected and when necessary cleaned where there is delay in depositing concrete.

Cleaning.

67. Reinforcement shall be carefully formed to the dimensions indicated on the plans or called for in the Specifications. The radius of bends shall be four or more times the least diameter of the reinforcement bar.

Bending.

68. Where concrete bedstones are ordered by the Engineer-in-Chief, they are to be composed of concrete made in the proportion of three parts of granite, crushed to pass through a 3/8 inch diameter mesh, and one part of portland cement, with sufficient fine-ground granite to fill up all the interstices. The bed-stones are to be made. They are to be made and exposed to the weather at least four months before they are used. Should the Engineer-in-Chief desire, steel bars, of whatever section he requires, are to be laid in layers as will be directed in the concrete during the process of making the blocks. The cost of laying the metal shall be covered by the price in the Schedule and Detailed List of Quantities and Prices for Steel in Bars, &c. in concrete.

Bed stones
and Rein-
forcements.

Where directed by the Engineer-in-Chief sheets of expanded metal, steel bars, or rails are to be inserted in the concrete. They shall be of several sizes as specified or directed. The expanded metal shall be laid down in as large sheets as possible, and the lap at the joints shall be at least two meshes measured on the maximum dimensions. The bars, sheets or rails shall be placed in the concrete at the heights and levels directed by the Engineer-in-Chief. The cost of laying the metal bars or expanded metal in concrete of any description shall be covered by the price in the Schedule and

Expanded
Metals, &c.

Detailed List of Quantities and Prices for Steel bars in Bars, &c., in concrete.

— **CONCRETE SHEET PILING.** —

Sheet piling 69. Concrets sheet piles are to be used as shown in the drawings (Plans No. 3 and 4).

Reinforced Concrete sheet pile consists in enclosing rows of steel rods, bound at intervals by iron ties, in a casing of concrete of 1, 2, 4 proportion, as shown in the Drawings, 20 ft. long, or 14 ft. long and all 20 in. wide $5\frac{1}{2}$ in thick. There are 3 rows of pairs of vertical rods of $\frac{5}{8}$ in. diameter connected at 10 in. intervals by horizontal bands made of No. 4 galvanized wires. The pile is moulded with cylindrical grooves in each side, in which the spur, made of 22 in. long 6 in. wide and $\frac{3}{16}$ in. thick-steel plates inserted between the first and the second band, of an adjoining pile engages, for guidance in driving. When the consecutive piles have been driven, their combined grooves shall form a cylinder which shall be cleaned out with water and filled with cement grout under pressure.

Guide for Sheet piles. 70. Piles 15 ft. long and 8 in. diameter shall be driven on one side of the line of sheet piling at intervals not less than 6 ft. and two pairs of two horizontal walling pieces made of half round timber shall be fixed to one side of the piles by menas of $\frac{3}{4}$ in. diameter wrought iron bolts. The above is to serve as the guide to the sheet piles while being driven. The space between the two walling pieces forming each pair shall be equal to the thickness of the sheet piles. This guide arrangement may be removed and repeatedly used for the same purposed according to the progress of sheet piling.

Driving of Sheet piles. 71. Sheet piles shall be driven principally by means of water jetting and when the power of the said jetting is insufficient as to require heavy hammering in addition to jets the lower ends of the concrete sheet piles shall be protected by steel shoes, and the heads of the piles must be protected by a steel helmet bedded on saw dust or sand bags with the further interposition of a wooden dolly between the hammer and the helmet as shown in the Drawings.

In all cases sheet piles shall be driven to the full depths specified and close enough to secure water tightness.

72. All foundation piles shall be of a length such that they may be driven to the depths shown on the Drawings by means of hydraulic jetting if driving by a monkey alone is not sufficient. After being cut off at the proper elevation, they must show solid heads, free from cracks or brooming. The plane of cut off for piles shall in every case be one foot above the bottom of concrete foundation. All piles shall be driven, using suitable iron rings on heads and with ends pointed as required. Spaces between the piles driven shall be well rammed and made level to receive foundation concrete.

Foundation
Piles.

— TIMBER AND METAL. —

73. All timber must be of a quality equal to or superior to "Yalu" pine and must be sound, straight-grained, and free from sap, loose or rotten knots, wind-shakes or any other defect that would impair its strength or durability; it must be sawed (or hewed) perfectly straight and to exact dimensions, with full corners and square edges.

Timber.

Timber used in foundation piling shall be sound and perfectly straight and have the bark stripped off before being driven. The specified diameter refers to the smaller end.

74. All metals shall be free from any defect and should comply with standard Specification and of best quality manufactured by a reputable firm. Maker's name should be stated in tender.

Metal.

— FLEXIBLE FERRO-CONCRETE MATTRESS — (BANK PROTECTION).

75. The main body of the flexible ferro-concrete mattress to protect the slope of river bank up and down stream of the weir consists of the ferro-concrete blocks 1 ft. 11½ in. long, ½ ft. wide and 5 in. thick each knitted together by passing No. 4 galvanized steel wire through two holes previously made in the middle plane of each block so as to form a flexible stone mattress, each block being so set as to break joints.

Main Body.

76. Each block of specified size shall be made 1 : 3 : 6 proportion concrete well rammed into the mould and shall be

Blocks.

reinforced with four bars of No. 12 galvanized steel wire a little shorter than the length of the block with their ends bent at right angles and inserted lengthwise and separately near the corner of the block as in the drawings. (Plan No. 4).

Underlining. 77. An underlining mat of willow fascine about 4 in. thick made continuous by knitting the fascines by No. 16 galvanized steel wire at one and half ft. intervals (assigning 0.8 bundle of tightly bound willow fascine of two or three years growth under the assumption that the bundle shall be at least 6 ft. long and 1 ft. in diameter per sq. yard) shall be set on the bank graded to the slope of 1 : 2 previous to the laying of the concrete mattress.

— RIP RAP COVERED WITH CONCRETE MATTRESS. —

Rip Rap. 78. Rubble stone larger than 1 cub. ft. and containing not more than 30 per cent of smaller stones of not less than 1 in. diameter are to be hand laid evenly and as close as possible by filling in the unavoidable interstices between larger stones with the smaller stones to the uniform thickness of 2 ft. 7 in. to cover the new river bed for 150 ft. downstream of the floor concrete. The rip rap shall be covered evenly with the flexible concrete mattress the same as above specified, for the length of 100 ft. from the lower end of the floor concrete as shown in the drawings.

ERECTION AND PAINTING OF GATES, TRESTLES, GIRDERS &c.

Preparation of Material before Assembling. 79. The various members forming parts of a completed frame or structure after being assembled shall be accurately aligned and adjusted before riveting is begun. Surface in contact after assembling and parts difficult of access after erection shall have two coats of red lead paint before assembling.

Riveting. 80. Riveted members shall have all parts well pinned up, and firmly drawn together with bolts before riveting is commenced. Completed rivets shall look neat and finished; shall have heads of approved shape, full and of equal size; heads shall be central on shank and grip the assembled pieces firmly. Recupping and caulking of rivets will not be permitted. Loose, burned, or otherwise defective rivets shall be cut out and

replaced ; great care shall be taken in cutting out rivets not to injure the adjacent metal, and if so requested by the Engineer-in-Chief they shall be drilled out.

81. Steel for reinforcing concrete shall not be painted. Painting Steel
All surfaces shall have two coats of painting and must be Work after
carefully cleaned of all moisture, scale, rust, grease, dirt chips Erection.
and other foreign matter before being painted, and the first coat shall be dry
before the second coat is applied. No painting shall be done in wet or windy
weather except under cover, and never in freezing weather. Paint shall be
composed of red lead, white zinc, raw linseed oil, and turpentine Japan dryer
mixed in proportions of 100 pounds of lead, 20 pounds of zinc, 5 gallons of
oil, and 3 3/4 pints of dryer. Succeeding coats of paint shall be mixed so as to
vary somewhat in colour in order that there may be no confusion as to the
surfaces which have been painted.

Form of proposal of

do hereby propose to make and complete the whole
of the works in connection with the construction of the Shwangtaitsu Weir &
Lock and works referred to in the Specification etc. including the Excavations,
Embankments, Bank Protection, Road Diversions, Drains, Fencing, &c. Removal
of the materials excavated to Spoils and Embankments, and to find and provide
all requisite materials according to the Specification, Plans, Sections, and Drawings
on or before and on the terms
and conditions mentioned and contained in the Draft of Contract exhibited to
for the sum of Mexican Dollors.....
.....(M. \$.) and

have hereinafter set forth the price of the different descriptions of
Works at which the Aggregate Amount of this Tender is computed, and
further propose that any alterations, reductions, or
omissions in, or additions to, the Works hereby contracted for shall be paid for
to or deducted for by as the
case may require, according to the List of Prices also hereinafter set opposits
to each description of Works. And in case this tender shall be
accepted, hereby undertake to excute a Contract to be

prepared by the said Board according to the Draft before referred to, within a month from this date and propose

as Securities for the due performance of such Contract

and do hereby forward enclosed with this tender certified cheque dated this day made payable to the said Board for a sum equal

in amount to 10 per cent on the said sum of Mexican Dollars.....

.....(M. \$). Which amount shall

become the property of the said Board should fail to

take up and fulfill this Contract should it be allotted to

Should be allotted this Contract then this amount shall

remain the property of the said Board until such time as this Contract has been

fulfilled and completed by in the terms of the Specification,

Contract, Plans, and Drawings.

Witness our hands this

day of 192 .

FORM OF CONTRACT.

THIS INDENTURE made this day of 192

between carrying on the business of Contractor, for Public Works, under the firm of

(hereinafter called the Contractor) of the one

WHEREAS part, and the Liao River Conservancy Board (hereinafter called **THE BOARD** the Board) of the other part. Whereas the Board advertised for

Tenders for the execution of the Works mentioned and referred to in the Specification and Detailed Quantities hereto annexed, and according to such Specification and

Detailed Quantities, and to the Plans, Sections, and Drawings referred to therein respectively, and to the provisions of this Agreement, and the Contractors sent in to the

Board their Tender (a copy of which is hereto annexed) for the construction of the said Works according to the said Specification, Detailed Quantities, Plans, Sections,

and Drawings and this Agreement, at the respective prices mentioned or referred to in such Tender, amounting altogether to Mexican Dollars

..... (M. \$

and the Board, accepted the said Tender. **AND WHEREAS** the said Plans, Sections, and Drawings have been signed by the Contractors, and deposited with

the Engineer-in-Chief having the superintendence and control of the Works on behalf

of the Board hereinafter referred to as the "Engineer-in-Chief" NOW THESE PRESENTS WITNESS that it is hereby agreed between the parties hereto, and Contractor and every two of them do, and each one of them doth (so far as the stipulations and provisions herein mentioned or referred to, are to be performed and observed by them) hereby covenant with the Board, and the Board do (so far as the said stipulation and provisions are to be performed or observed by them) hereby covenant with the contractors in manner following, that is to say:—

1. The Contractors shall, at their own expense, and with all due diligence and despatch, well, substantially, and in a workmanlike manner, with the best materials of their respective kinds, and to the satisfaction of the Engineer-in-Chief, make, execute, and complete in every respect, and deliver up to the Board the several works mentioned or referred to in the said Specification and Detailed Quantities, according to the said Specification, Detailed Quantities, Plans, Sections, and Drawings, and subject to the provisions, stipulations and conditions contained in the said Specification and Detailed Quantities, and with such alterations and additions to, and omissions from, the said works (if any) as the Engineer-in-Chief may, from time to time, during the progress of the works direct in writing, and shall truly and satisfactorily complete the said works, and deliver up the same to the Board within the time in the said Specifications in that behalf mentioned.

2. The Board shall pay to the Contractor at the times, in the manner, and subject to the stipulations in the said Specification in that behalf mentioned, the several sums of money specified or referred to as the prices of the said work respectively in the said Tender sent in to and accepted by the Board as aforesaid.

3. The Contractors shall abide by, perform, and observe all the provisions, stipulations, and conditions contained or referred to in the said Specification and Detailed Quantities, and all such provisions, stipulations, and conditions shall be deemed to be incorporated with, and to form part of, these presents, and for the purpose of any reference of and matter submitted to the decision and determination of the Engineer-in-Chief under the provisions of the said Specification, this Contract may be taken before a Board of Arbitration consisting of two members of the Consular Body, the Commissioner of Customs, H.E. the Tao-Yin and another Chinese Member mutually agreeable to both parties. The decision

of this body to be absolutely final and binding upon both the Contractors and the Board.

IN WITNESS

our hands this day of

192 .

Contractors.

Quarantor.

**DETAILED LIST OF QUANTITIES
AND
PRICE OF ENGINEERING WORKS**

Engineer-in-Chief's Office,
Newchwang.

February 1924.

The following are the Prices at which the sum of
are computed and at which agree to
execute all Extra and Additional Works, or have deductions made from or
additions made to Estimate

**THE UNDERMENTIONED PRICES MUST BE HELD TO INCLUDE
ALL REQUIREMENTS MENTIONED IN THE SPECIFICAION.**

	Quantities about.	Price per unit.	Mex. \$.
EARTH WORK.			
Excavation for diversion chahnel.	fang. 88,714.		
" " foundation including timbering &c. (earth for side slopes not included).	2,940.		
Filling behind Lock wall (extra unit price if required by Contractor), clause 17 page 35			
Dredging (in the river channel and under the dams left at extremities of the diversion channel to be fixed later), clause E page 32	Not known.		
Fascine Mattress, Clause F page 32	c. yd. 2,632.		
Provsion money. Clause D page 32			10,000.
CONCRETE.			
To be deposited in place (including from).			
Class A. (1 : 2 : 4)	c. ft. 12,442.		
" B. (1 : 3 : 6)	35,000.		
" C. (1 : 3 : 6 with 15% rubble)	145,724.		
" D. (1 : 3 : 6 with 30% rubble)	72,222.		

	Quantities about.	Price per unit.	Mex. \$.
CONCRETE SHEET PILES.			
Concrete sheet piles 20 ft. long (including reinforcement)	lin. ft. 1,453.		
Driving above.	"		
Concrete sheet piles 14 ft. long, (including reinforcement)	72.		
Driving above.	"		
WOODEN PILES.			
Foundation piles, 20 ft. × 0.75 ft. dia.	450.		
Driving above.	"		
Foundation piles, 15 ft. × 0.6 ft. dia.	1,254.		
Driving above.	"		
CONCRETE BLOCK MATTRESS.			
Concrete mattress.	sq. yd. 7,308.		
Fascine mat for above.	3,883.		
RIP RAP.			
Rubble stone including laying (large than 1 cub. ft. size), Clause 78 page 50	cub. yd. 4,561.		
MOULDS.			
(exclusive of from for concrete in place)			
Iron moulds for casting concrete block, (with 3,000 wooden sole plates 1.95' × 1/2' × 0.1')	sets. 5.		
Wooden mould for casting concrete sheet piles.	" 50.		
Extra bottom planks for above.	150.		

	Quantities about.	Price per unit.	Mex. \$.
ERECTION OF GATES.			
Erecting, fitting complete with all fitting, girders, supports, winches, etc., as supplied by Makers and delivered to the Contractor at Yingkou, (7 " Stoney " sluice gates and two lock gates) and painting.	tons. 230.		
CONCRETE COUNTERBALANCE.			
(Subject to change)			
Concrete (Class A) (including forms).	cub. ft. 2,889.		
Reinforcement Steel Bars.	pounds. 5,103.		
CONCRETE BED STONE.			
Clause 68-page 47.	Not known.		
EQUIPMENTS ON HIRE OR PURCHASE.			
(State hire or purchase)			
Pumps above 15 brake horse power. (as in general conditions clause 4)	at least 2.		
Dock pumps with cylinder of more than 6" diar	" " 1.		
Water jetting machine with pipes &c.	" " 1.		
Concrete mixer above 150 cub. ft. per hour capacity.	" " 1.		
Piling engine.	" " 1.		
Light rails with trucks.	at least $\frac{1}{2}$ miles.		
Interlocking steel sheet piles 25 ft. long.	lin. ft. 100.		
Acetylin Flares.			