1 SCOPE

The work includes the design, manufacturing, supply, transportation, handling, storage, installation (including 1st and 2nd Stage embedded parts and any other necessary element for the proper operation), testing and commissioning of the trash rack cleaning machine with all mechanical, electrical, control and safety equipment and spare parts and special tools.

This scope of supply shall cover, but is not limited to:

- One (1) electric travelling trash rack cleaning machine including hoists, driving motors, cable reel, suspended control and two 1’500 W searchlights complete.
- Runway, with all its anchorages, bolting, clamping, etc., complete
- One (1) set of end stops and buffers to be placed at both ends of the rails and capable of resisting to the impact of the machine at full speed, complete
- One (1) auxiliary hoist complete
- One (1) grappling beam / accessory complete
- Trash skip for the machine
- Supply cables with master switches, control cables
- All equipment required to control / protect the equipment
- Spare parts and special tools as specified

The supply includes all the necessary accessories, frames, fixed or movable pieces, even if not mentioned above, required for warranting a trouble-free and safe operation, inspection and maintenance of the trash rack cleaning machine.

All equipments associated with the travelling rake machine and hoist including power supply equipment, electrical wiring, controls and permanently fixed ladders and platforms for routine maintenance and all required spare parts (list duly approved) shall be supplied and installed along-with the machine.
All required information about blockouts and positioning of parts to be embedded in first stage concrete along-with the data about the forces to be taken by the civil structure shall be supplied well in advance.

The Bidder shall indicate and price in the Price Schedule for Hydro-Mechanical Equipment all tools and equipment required for a proper handling and maintenance of the trash rack cleaning machine. All precision tools shall be of stainless steel.

2 DESIGN
The crane shall be designed, constructed, erected, and commissioned in accordance with IS: 6938, IS: 807, IS: 3177 or international Standards, subject to the approval of the Engineer-in-charge.

3 DESCRIPTION AND FUNCTIONAL REQUIREMENTS
One trash rack cleaning machine shall be supplied and installed to clean the trash rack panels. The machine shall be installed at deck elevation and shall be able to operate and remove all the material carried by the flow, floating debris, wood logs, branches etc. accumulated in front of the screen.

The Bidder shall indicate in the Price Schedule a grab / jib with all associated mechanical, electrical and control equipment as optional mechanism to remove Big trunks, logs, bulky material and large amount of accumulated floating debris

Trash rack cleaning must be possible up to the maximum clogged trash rack (3.0 m head difference) and at maximum turbine discharge.

Care shall be taken to ensure that the rake teeth do not damage the top and bottom members of the screens or the screen tie rods and that when clear of the screen the debris is retained in the rake and not dropped back to the screens or sloping concrete surface. The rake guides shall be designed to avoid running out of the lower part of the guides, being open to prevent accumulation of sediments. The teeth shall protrude about 25 mm between the bars.
The raking machine shall be rail mounted with power supplied via a flexible trailing cable along with the rake as it cleans or parked at one end of the structure.

The trash rake shall be designed to be operated both manually by an operator and automatically without an operator. The rake traverses the trash-rack structure to allow cleaning the entire structure one bay at a time. For fully automatic operation, the machine is guided by the head loss measuring device supplied under the contract. The machine shall start with cleaning when the pressure difference (up-stream & down-stream of trash-rack) ≥ 3kPa. The Bidder shall supply and install sensors etc. complete for measuring the pressure drop and connecting them to the raking machine for automation.

The Contractor shall also include in the Price Schedule as an alternative, a manually operated trash rack cleaning machine (TRCM). The final decision shall lie with the client for the selection of the appropriate TRCM. All operations of the rack-cleaning machine shall be capable of being controlled manually.

The rake shall be arranged to travel up and down the lanes of trash racks and bring trash to the operating level and dump it into a suitable trash skip. Electrically operated hoisting and lowering gear shall be provided in the machinery house. Sufficient steel wire rope shall be provided to enable the trash racks to be raked from the operation level and means of adjustment shall be provided to allow for any unequal stretch of the steel ropes.

The hoisting gear shall incorporate a fluid coupling to protect the motor if the rake becomes jammed by an obstruction on rising. A "slack rope" device shall be provided to operate a cutout to stop the motor should the rake jam when lowering. Lowering the rake shall be accomplished by running the hoist motor in reverse, and limit switches shall be provided to limit the upward and downward travel and positioning of the travelling gantry in the different bays. An electromechanical brake shall be incorporated in the hoist gear to prevent movement of the rake immediately should the hoist motor stop or the electricity supply fails.
The Bidder shall give special consideration to the arrangement of the rake when in its highest position so that the load can be easily dumped into the trash-skip etc. with a minimum of handling.

The cleaner frame shall be rigid and dimensioned to carry the load of the hoist machinery, the maximum rake load (with maximum lever arm). If the cleaner frame is subdivided during transportation, major joints shall be doweled and bolted.

The wheels shall have double flanged and wheel carriages shall have buffers at the outer side as well as sturdy retainers to prevent the cleaner from tilting at adverse conditions, i.e., maximum rake load. Sufficient counterweights for the maximum rake load shall be provided.

The Bidder shall include a description of the working action of the rake mechanism and its hoisting machinery. Collected trash shall be firmly held by the rake bucket when the rake is running upwards. The buckets shall close automatically when the rake reaches the lowest point of each run, either initiated by the upward movement of the rake itself, or by separate wires or other means.

At the upper position, the rake shall be above a horizontal /inclined plate welded to the plate forming an elongation of the concrete face. The plate shall protect the rail and the power supply, and the length shall be sufficient so that the trash can easily be raked into the trolley.

All hinged joints, wheel spindles, gears, etc. on the rake shall be equipped with self-lubricating bushing, well protected against the Silt-Laden water. All spindles shall be made from stainless steel. The rake teeth shall be replaceable, made of hardened or abrasion resistant steel.

The main hoist of the cleaner shall be, protected by a well-ventilated steel sheet cabinet. The cabinet shall contain all parts of the operating machinery, electrical components and ample room for inspection and maintenance. Electrical light shall be included, as well as door locks.
The trash rack cleaner shall be operated from a platform with rails and a light roof at one side, giving a good view for the operator. The control cabinet, protection class IP 44, shall have easy operated controllers and an accurate and reliable indicator of the rake position. The tripping of the overload protection for the rake as well as at slack rate hoisting wire shall be clearly indicated. The cabinet shall have a switch for automatic rake stopping at the bottom of the intake trash racks.

Electric power for the trash-rack cleaner shall be supplied through an insulated conductor rail along the front concrete, and with a lockable main switch at the cleaner frame.

The supply includes a trolley, designed for running between the cleaner frame legs, below the trash rack cleaner raking board. The trolley shall have rubber tires with ball bearings, and shall have standard connections for pulling or pushing by a tractor. The flooring shall be designed to allow easy, manual emptying to both sides and one rear side. The trolley shall be pin connected to the cleaner frame so that both travel simultaneously along the intake length. Disconnecting the pin or pins frees the trolleys to be pulled by a tractor.

The supply shall as far as possible be shop primed and given 2 finishing coats before transportation from works. The paint system selected shall be according to the Specifications approved by Engineer-in-Charge. Touching up and a final finishing coat shall be, done by the Contractor after erection.

4 SPARE PARTS

Spare parts shall be supplied as listed below:

- Two sets of detachable stainless steel combing rake teeth strip with fasteners.
- Two sets of wheel assembly.
- One set of control relays
- One set of motor protector.
- One set of terminal switch.
- Three sets of limit switches of each type.
- One set of push button.
- One set of brake linings for each type of brakes.
- One set of motor carbon brushes.
- Ten sets of fuse elements, lamps, indicators etc.,
- Two sets of 10% of all nuts, bolts and washers.
- Two sets of bearing / bushes of all motors.
- One set of all types of grease nipples.
- One set of electronic print cards of each type.
- For hydraulic system of TRCM & Grappler.
- One set of gaskets, packing seals etc.,
- One set of overload switch.
- One set of solenoid, valves, pressure gauge, and pressure switch of each type.
- One set of terminal switch
- One set of relays.
- One set of self-lubricating bearing / bushes of each type.
- Two sets of fuse elements.
- Two sets of oil filter.

Spare parts not mentioned, but deemed necessary by the Bidder for a minimum of 5 years of operation, shall be included.

All spare parts shall be clearly marked and properly packed for long time storage.

5 TYPES OF TRASHRACK CLEANING MECHANISM

The following types of trashrack cleaning mechanism are envisaged with the functional requirements listed above;

a. Backhoe Style Rake on Deck Rails
b. Cable Style Rake on Deck Rails
c. Manual Cleaning Arrangement from the Platform over the Piers
5.1 BACKHOE STYLE RAKE ON DECK RAILS

This trash rake can be designed to be operated both manually by an operator and automatically without an operator. The rake looks like a rail mounted backhoe. The rake traverses the trashrack structure to allow cleaning the entire structure one bay at a time. The unit can pivot around a vertical axis to allow the rake to dump debris directly in a trash rail car, truck, or trailer either traveling along with the rake as it cleans or parked at one end of the structure.

Trash rake operation in Automatic Mode

At the startup signal, the trash rake travels to the first trashrack cleaning point and stops. The rake arm pivots out over the water and the arm is extended to the programmed cleaning level using hydraulics. The rake head gripper is then brought toward the structure until it contacts the rack. An adjustable pressure force is maintained between the gripper scraping bar and the racks as the rake head is raised along the rack face, cleaning the rack with an upward scraping motion. At the programmed high position, the gripper closes around the collected debris, securing it for removal. The rake then raises the debris, pivots to position the rake head over the deck, and dumps the debris into a designated dumping container. This dumping procedure may require traveling to a dumping area at the end of the structure if a trash rail car, trailer or truck does not travel with the rake as it cleans. The cleaning cycle is then repeated until each trashrack section has been cleaned. Once all the trashracks have been cleaned, the rake will return to the designated parking position.

5.2 CABLE STYLE RAKE ON DECK RAILS

This trash rake can be designed to be operated both manually by an operator and automatically without an operator. The trash raking machine rides on deck mounted rails to traverse the structure to allow cleaning all of the trashracks, one section at a time. Cleaning is accomplished by lowering and controlling the debris gripper with cables. Debris can be raked up into a trash rail car or bin that moves with the rake. Optional features can be provided as part of the trash rake (such as a jib crane hoist with grab rake, or stoplog lifter) to increase the functionality of the system. Because
the trashracks end below the piers and the existing guides extend above the piers, a trashrack extension may be required above the existing trashracks to allow the debris to be raked high enough to mate with the trash rake body so it can be dumped into the car or bin.

**Trash Rake Operation in Automatic Mode**

At the startup signal, the trash rake travels to the first trashrack cleaning point and stops. The hoist then lowers the gripper (with gripper jaws in the opened position), engaging the trashracks near the top section of the trashracks and descends to the bottom of the trashrack. As the gripper is lowered, debris is collected within its jaws. Upon reaching the bottom limit, hydraulic cylinders close the gripper jaws, securing the debris for removal. The hoist then raises the gripper and debris up to the trolley. The trolley motor is started and the trolley is moved to the designated dump area where it stops and dumps the debris. The cleaning cycle is then repeated until each trashrack section has been cleaned. Once all the trashracks have been cleaned, the rake will return to the designated park position.

### 5.3 MANUAL CLEANING ARRANGEMENT FROM THE PLATFORM OVER THE PIERS

Lightweight hand rakes are used to clean the floating debris, wood logs, branches etc. accumulated in front of the trashrack screen from a platform built over the piers in front of the trashracks. Suitable access from the higher platform /bridge with provision to transfer trash (in the cage) safely for disposal has to be made. The Bidder shall have to plan and design the proposal for approval from the Engineer-in-Charge.

**Operation**

Cleaning is accomplished by lowering the handheld rakes and the debris are collected within jaws. The hand rake is taken up and debris are dumped in the cage kept on the platform. The cage shall be designed in such a way that after filling, the trash is encased/locked properly and does not fall back while it being shifted to the trailer,
trolley etc. for suitable disposal. The cleaning cycle is then repeated until each trashrack section has been cleaned.

The Bidder shall indicate in the Price Schedule of all the three types of cleaning arrangements described above including all associated mechanical, electrical and control equipments separately for evaluation by Engineer-in-Charge.