

NLM/SWL/2019/20-01

**CONSTRUCTION OF NEW DIKIDIKINI BRIDGE IN WARD 06
NLM**

CONSTRUCTION METHODOLOGY

CONTENTS

1	Introduction.....	2
1.1	Construction Activities.....	2
1.1.1	Construction	2
1.1.2	Post-Constriction	2
2	Construction Method Statement.....	3
2.1	Earthworks and General Civil Works	3
2.1.1	Establish Survey Control and Setting Out.....	3
2.1.2	Clearing and Grubbing	3
2.1.3	Strip Topsoil and Stockpile.....	3
2.1.4	Foundation Preparation.....	3
2.1.5	Removing Unsuitable Material (Spoil).....	3
2.1.6	Access Roads	4
2.1.7	Protection of the Work.....	4
2.1.8	Blasting.....	4
2.1.9	Batter Stabilization	4
2.1.10	Plant and Equipment.....	4
2.2	River Diversion	4
2.2.1	Initial Planning and Survey.....	4
2.2.2	Construction of Sandbag Dams	4
2.2.3	Dewatering	5
2.2.4	Construction of the Bridge.....	5
2.2.5	Removal of Sandbag Dams	5
2.3	Bridge Structure	5
2.3.1	Piling.....	5
2.3.2	Pile trimming.....	6
2.3.3	Bridge Base/Pile cap construction	6
2.3.4	Bridge Pier Construction	6
2.3.5	Mabey Compact 200 Panel Bridge	7
2.4	Gabions on Baskets	7
2.4.1	Foundation Preparation.....	7
2.4.2	Placement Procedure.....	8
2.4.3	Gabion Stone	8
3	Plant and Equipment.....	8
3.1	Earthworks and Civil Works	8
3.2	Bridge Works.....	8

1 INTRODUCTION

This report outlines the construction methodology for the construction of Dikidikini Bridge, a light vehicle and pedestrian bridge structure. The bridge structure is needed to connect two villages, namely the esiDikidikini village that is in the NLM area, and the Ncembe village which is in the Ingquza Hill LM (Flagstaff) area. These two villages are located on either side of the Mzintlava River.

The two villages are situated in an isolated rural area without any roads to connect them. For socio economic and health reasons there is a need to connect the two villages via a bridge structure. Currently people need to walk through the river to cross between the villages.

The function of the bridge shall be to provide all year-round access to pedestrians and light vehicle traffic to cross the river between the esiDikidikini and Ncembe villages.

The coordinates of the site are as follows:

Latitude:	31°10'07.3" S
Longitude:	29°18'51.3" E

1.1 Construction Activities

Construction and Management activities comprise of:

1.1.1 Construction

- 1.1.1.1. Provide temporary drainage works, temporary pumps and other equipment as may be necessary for the protection, draining and dewatering of the works.
- 1.1.1.2. Temporary water connections, contractor's offices, storage sheds, latrines and barricading shall be in an approved position and subject to the approval of all authorities concerned.
- 1.1.1.3. Construction and maintenance of temporary access road for the duration of the contract.
- ~~1.1.1.4. 51.8m Single Span Bridge across Mzintlava River~~
 - ~~• Prefabricated Modular Bridge type Mabey Compact 200 Bridge~~
 - ~~• 2 No. Bridge Abutments~~
 - ~~• Reno Mattresses and Gabion Baskets~~
- 1.1.1.5. Construction of 1 number Maybe Bridge as detailed in the specification 8547P-STR-SPEC02-TO3.

1.1.2 Post-Constriction

1.1.2.1. De-establishment of site camp;

1.1.2.2. Site rehabilitation;

1.1.2.3. Site clean-up.

2 CONSTRUCTION METHOD STATEMENT

2.1 Earthworks and General Civil Works

2.1.1 Establish Survey Control and Setting Out

Survey control will be setup at the commencement of the project by competent surveyors. Setting out will be conducted using design information received from the design consultants.

2.1.2 Clearing and Grubbing

The site footprint area will be cleared and grubbed as required using a bulldozer and mulching equipment. The mulch will be moved to stockpile sites for later reuse, including for use as erosion and sediment control material during the earthworks phase of the project, as per the Construction Environmental Management Plan (CEMP).

Where necessary, beneath the formation, grubbing will occur up to a depth of 500mm below natural surface to remove all stumps and tree roots.

2.1.3 Strip Topsoil and Stockpile

Stripping of topsoil will be in accordance with requirements on the drawings; topsoil will be stripped and transported to nominated stockpile sites within the works. Topsoil to be maintained and preserved for later use onsite during rehabilitation and de-establishment stage. All necessary erosion controls will be installed around the topsoil stockpiles in accordance with the CEMP.

2.1.4 Foundation Preparation

Foundations will be jointly inspected by the Contractor and Client's Environmental Representative following the removal of topsoil, to determine the suitability thereof. Any unsuitable material will be removed at this time.

2.1.5 Removing Unsuitable Material (Spoil)

All unsuitable material will be removed by excavator and will be carted using tipper trucks to an approved spoil area as agreed by Client's Environmental Representative. Unsuitable material will be removed as directed by the Client's Environmental Representative.

2.1.6 Access Roads

Access to the site will be along the existing gravel road corridor. Graders and water carts will be utilised to minimize generation of dust and maintain drainage to minimize erosion and sediment transport.

2.1.7 Protection of the Work

There are no known services within the villages which will require precautionary measures, however a steering committee will assist to avoid disturbance of any important communal sites. The proposed bridge which will be constructed within a watercourse thus precautionary measures will be taken throughout the project to avoid pollution of the water.

2.1.8 Blasting

Blasting will be prohibited in this project.

2.1.9 Batter Stabilization

All constructed batters adjacent to the concrete approach roads will be stabilised by placing reno mattresses packed with gabion stone.

2.1.10 Plant and Equipment

Topsoil will be removed by loaders, with assistance from graders as required. Excavators will be used to de-silt existing water courses and areas of deeper spoil.

The bulk earthworks will be moved by tipper trucks and excavators. Compaction will be carried out predominantly using compactors and drum rollers. The rolling pattern will be trialled after commencing on site to determine the most effective compaction method. All layerworks construction will be achieved using graders, water carts and rollers.

2.2 River Diversion

Temporary river diversion will be required during construction to allow a workable construction area and prevent unnecessary environmental damage to the surrounding area.

All work will be done during the dry season to facilitate water management.

Temporary river diversion will entail:

2.2.1 Initial Planning and Survey

A survey will be conducted of the construction site and the surrounding area to determine the best location for the river diversion. Factors such as the size and flow rate of the river, the location of the bridge construction site, and the local topography will be taken into account. A detailed construction plan will then be developed based on the survey results.

2.2.2 Construction of Sandbag Dams

To divert the river flow, sandbag dams will be constructed upstream of the construction site. These dams will be made of sandbags, which are an effective way to block the flow of water. The sandbags will be stacked in a pyramid shape and tied together using ropes to create a

solid barrier. The height and length of the sandbag dam will depend on the size and flow rate of the river.

2.2.3 Dewatering

Once the sandbag dams are in place, the next step is to dewater the construction site. This involves using pumps to remove the water from the area where the bridge will be built. The water will be redirected to the downstream side of the sandbag dams using temporary pipes or channels.

2.2.4 Construction of the Bridge

With the construction site dewatered, the actual bridge construction can begin. Workers will have access to the dry riverbed, allowing them to build the embankment protection and bridge abutments. The bridge deck will then be placed on top of the abutments.

2.2.5 Removal of Sandbag Dams

Once the bridge construction is complete, the sandbag dams will be removed. This will be done gradually to avoid causing any sudden changes in the water flow, which could be dangerous. The sandbags will be opened and the sand will be returned to the riverbed, while the bags will be disposed of properly.

Ultimately, it will be the responsibility of the Principal Contractor to propose a specific method for flow diversion, accounting for construction-specific constraints (including Health and Safety considerations).

2.3 Bridge Structure

2.3.1 Piling

It is intended that Odex (Overburden Drilling Excentric) piling system will be employed.

Odex piling is a piling mechanism suitable for drilling through rough and sub-terrain formed objects such as boulder, shale, and rock. It can be used to simultaneously drill through overburden/ soil and rock, flush out unwanted material and bring a steel casing down the hole with the drill.

The piling design engineer will provide a layout of the piles and the piling rig will set out over each proposed pile position.

- Once drilling starts, the Odex reamer swings out creating a hole with a diameter greater than that of the steel casing. This allows the steel casing to traverse down behind the drill bit without having to first remove the drill bit to insert the casing.
- If the pile is required to be planted into the bedrock, the drill bit has the capability to drill and remove the rock.
- Once desired depth has been reached, the reamer swings back in allowing the drill to be removed back up through the casing.

- Casing tubes that are to be permanently fitted are then usually sealed with a cement grout.
- Borehole will then be filled with concrete/grout and reinforcement in place.

The above process will be repeated for each of the pile positions.

2.3.2 Pile trimming

The area for the pile cap will be carefully excavated around each pile. In the immediate vicinity of each pile the excavation will be done by hand.

Once the entire embankment pile cap area has been exposed each pile will be cut around the perimeter using grinders. The piles will then be trimmed to the correct level using handheld breakers.

All broken/demolished concrete will be removed from site to an approved dump site, leaving no concrete waste on the site.

2.3.3 Bridge Base/Pile cap construction

Formwork will be designed by competent person and erected around the perimeter of where the base is to be constructed. Reinforcement will then be placed as per the design.

Concrete will preferably be delivered using ready mix.

If ready mix is not possible, concrete will need to be batched on site, the on-site batching will be situated on a concrete slab with rollover-bunding to contain wash down and water runoff. The position of the on-site concrete batching will be as per the requirements of the Client's Environmental Representative.

Regular inspections will be undertaken by the Contractor and the Client's Environmental Representative to ensure:

- Materials will be stored carefully;
- No waste shall be allowed to enter waterways;
- All waste from concrete mixing will be disposed of at offsite locations.

2.3.4 Bridge Pier Construction

The formwork for the pier body will be made of large steel moulds. Concrete pours for the concrete pier will be limited to 5m height per day's production.

Two formwork sides to the pier will be erected (i.e. 90 degrees to each other) whereafter the reinforcing will be placed in the mould.

All reinforcement will be fixed into position then the final two sides formwork to the pier will be placed.

Reinforcement will as far as possible be assembled on the ground and craned into position, limiting the requirement for erecting reinforcing at heights.

2.3.5 Mabey Compact 200 Panel Bridge

It will remain the responsibility of the bridge supplier to propose the bridge construction method. Below includes items that may be considered/incorporated in the contractors methodology.

The proposed bridge system will be a rapid-build, pre-engineered, modular bridge.

Due to accessibility to the site, it is expected that modular sections will be delivered in portions through the use of articulated trucks. A mobile crane will access the site. The mobile crane will be of sufficient off-road capacity to be able to access the site, considering the difficult access conditions.

An erection specialist from the bridge manufacturer will need to be present on site for the duration of the erection of the bridge. The bridge components will be assembled on the eastern edge of the river.

The bridge will be supported off of rollers positioned on the eastern abutment of the river.

The bridge will then be incrementally launched from the Eastern abutment to the Western abutment.

2.4 Gabions on Baskets

The following procedure defines the requirements for gabion wall basket or mattress installation works to maintain the soil stability for any kind of installations, including riverbank protection.

The following tools and materials will be arranged before starting the wire basket installation works:

- Gabion baskets as required by specification;
- Lacing wire;
- Geotextile fabric (A4 Biddim or similar);
- Gabion stones;
- Safety Equipment (Gloves. Goggles, Helmets etc).

2.4.1 Foundation Preparation

The foundation on which gabions will be placed shall be cut or filled and graded to the position and levels as shown on drawings. Surface irregularities, loose material, mud, vegetation, and foreign matter shall be removed from foundation surface area. Where fill is required, it will consist of materials conforming to specified requirements.

Gabion basket and bedding or specified geotextiles will not be placed until foundation preparation is completed, and the subgrade surfaces have been inspected and approved by the Engineer or the Engineer's representative.

Upon approval of the surface, geotextile will be placed in accordance with requirements of the drawings and specifications.

2.4.2 Placement Procedure

Empty gabions will then be placed on the foundation, interconnected to the adjacent gabions along the top, bottom and vertical edges using lacing wire.

2.4.3 Gabion Stone

The gabions will be carefully filled with rock by hand methods, ensuring alignment, avoiding bulges, and providing a compact mass that minimises voids.

3 PLANT AND EQUIPMENT

3.1 Earthworks and Civil Works

Typical plant and equipment used shall include:

- Tipper Trucks;
- D11 or D6 bulldozers;
- Water Carts;
- Vibrating Rollers;
- Compactors; and
- Graders.

Other equipment, such as excavators, articulated dump trucks, backhoes and loaders will also be required.

3.2 Bridge Works

Specialised bridge equipment will be required for the bridge trusses. Plant required for these operations include cranes.