INTERNATIONAL STANDARD

ISO 16039

First edition
2004-04-15

Road construction and maintenance equipment — Slipform pavers — Definitions and commercial specifications

Matériels pour la construction et l'entretien des routes — Machines pour le pavage — Définitions et specifications commerciales

Reference number
ISO 16039:2004(E)

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Published in Switzerland

Contents

Page

Foreword

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ISO 16039 was prepared by Technical Committee ISO/TC 195, *Building construction machinery and equipment*.

Introduction

This International Standard deals with slipform pavers for placing, compaction, forming and finishing cement concrete in roadway, street, airport construction and other structures of related design. This International Standard provides definition of equipment and technical characteristics of machinery as well. Enclosed figures explain performance of slipform pavers and their components.

Road construction and maintenance equipment — Slipform pavers — Definitions and commercial specifications

1 Scope

This International Standard establishes definitions, terminology and the content of commercial literature specifications for mobile, self-operating machines used for placing and finishing cement concrete, commonly called “slipform pavers”, which mould concrete in a plastic condition. It specifies the general machine configuration and the special equipment depending on the types of work to be executed. This work can be concrete roadways, road safety structures (barriers, walls, etc.), road drainage structures (edgings, gulleys, gutters, etc.) and airport paving (runways, taxiways, aprons, etc.).

The document does not apply to machines with non-travelling formwork fixed to the ground and to those construction works which require only a vertical progression.

2 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

2.1
slipform paver
mobile machine used for the purpose of applying layers of construction material such as cement concrete on surfaces, or for constructing profiled structures

2.2
mould
element which gives to the concrete the shape desired for the construction work, in particular its transverse cross-section

NOTE The following moulds are typically used by slipform pavers:

— barrier mould;

— curb and gutter mould;

— parapet mould;

— glare-screen mould;

— variable-height median-barrier mould;

— pavement mould;

— canal-ditch mould.

2.3
mounted mould
element which gives to the concrete the shape, entirely supported by the machine frame

NOTE The following mounted mould types can be identified:

— center mounted: the mounting of the slipform mould between the tracks of the machine, also known as straddle;

— side mounted: the mounting of the slipform mould on the outside of the machine frame.

2.4
floating mould
mould which is only drawn along by the machine and supported by the already finished part of the construction work

2.5
concrete-mix distributor
device which makes it possible to distribute the concrete mix at the front of the paving process (Figure A.7)

NOTE 1 The following examples of concrete mix distributor types can be identified:

— auger: screw-type device used to transfer material (Figure A.7);

— charging conveyor: an endless belt or auger used to elevate concrete mix into a mould or to place it near the center of a pavement;

— diverter plough: a pusher-blade type device used to transfer material from side to side.

NOTE 2 In some designs, the concrete mix may be delivered to a hopper without transverse distribution.

2.6
reinforcement guide
set of supports whose role is to position the longitudinal reinforcements within the zone where the concrete mix is plastic

NOTE The reinforcement guide is commonly referred to as rebar flute or flutes.

2.7
front metering strike-off
device comprising generally a vertically sliding plate, intended for regulating the concrete mix height within the grout box to a specific depth

2.8
vibration zone
zone located perpendicular to the vibration device and within which the concrete mix is in the plastic state, i.e., suitable for slipforming

2.9
distance of vibration
maximum distance in a given direction where the action of the vibration is effective

NOTE For internal vibration devices in general, action distance within the concrete mix is referred to (commonly referred to as the “radius of vibration”).

2.10
final finisher
plate placed at the rear of the machine, independent of the mould, which rests on the existing construction work with a view to providing secondary finishing of the concrete surface

NOTE The device may be used as an attachment for execution of concrete surfaces. It may be static or dynamic.

2.11
slope controller
cross-slope sensor, which makes it possible to give a specific slope to the machine performing the construction work to be executed, irrespective of the slope of the support over which the machine moves

NOTE This device can be considered an accessory or attachment item on pavers to measure cross slope and mechanically control the slope attitude of a machine.

2.12
trimmer
attachment for a slipform paver for small paving works, with a rotating cutting wheel which can be fitted to produce a level surface for either sub-grades or bases (Figure A.1, item 4)

NOTE A trimmer for large works is typically a separate machine.

2.13
dowel-bar inserter
DBI
device located at the rear of the mould or on the lateral formwork, or in the mould structure itself, the role of which is to place multiple load-transfer dowel bars (transverse contraction joint) in the freshly paved concrete structure (Figure A.5)

2.14
tie-bar inserter
device, the role of which is to drive the tie bars into the concrete mix during the paving process (Figure A.6)

NOTE There are several locations for tie-bar inserters: centreline, edge of pavement and shoulder line.

2.15
vibrator for slipform paver
vibration device mounted in front of the mould to facilitate uniform compaction of the extrusion process

3 Operating principle

Slipform pavers use the properties specific to concrete and in particular its ability

— to become fluid when submitted to vibration;

— to regain its consistency when forced through the extrusion process and no longer submitted to vibration.

The principle of the slipform paver is to use the time the concrete mix is in a plastic condition in order to mould it to the desired shape, by appropriate extrusion-type mould and applied energy.

4 Description of a slipform paver

4.1 Basic unit

A slipform comprises a self-propelled frame on which are installed the following:

— a device to distribute the concrete mix within the confines of the mould;

— a vibration system used for compaction of the concrete mix when in the plastic state as it is being moulded;

— a mould, which defines the shaping of the concrete;

— a sensor control system for control of steering (alignment), and elevation (grade) from known references;

— a control console and operator's station;

— a power unit.

Depending on the type of work to be executed (drainage structures, road safety structures and pavements), the base machine is equipped with additional devices.

4.2 Device for execution of drainage structures

For execution of drainage structures (edgings, gutters and so on), the slipform paver is supplemented by a device which regulates the delivery of the material within the vibration zone and mould (screw feeder, belt conveyor).

4.3 Devices for execution of road-safety structures

For these construction works (barriers, walls etc.), the slipform paver may include the following equipment:

— a device which regulates the delivery of the material (screw feeder, belt conveyor);

— a mould supply hopper (via its upper part);

— at least two internal vibrators;

— a slipform mould;

— a slope controller which enables the maintenance of the machine's slope attitude while advancing.

The mould, depending on the machine design, may be mounted on the left-hand or right-hand side of the machine frame or underneath this frame.

NOTE Some machines can be operated without a slope controller in certain applications.

4.4 Equipment of slipform pavers for execution of roadways, airfields, and other large pavement structures

4.4.1 Basic equipment

For these construction works, the slipform paver includes the following equipment:

— a spreading device or transverse distributor, either auger screw or diverter plough, to spread the material laterally in front of the paving mould;

— a vibrating device. The vibrating device is a set of internal vibrators spread out regularly over the whole width of the construction work. The position of the internal vibrators in the vertical plane is adjustable and is determined as a function of the material to be placed and the layer thickness to be produced;

— a mould with side forms in order to produce the appropriate width pavement;

— a sensor control system for control of steering (alignment) and for control of elevation (grade) from known references.

4.4.2 Other equipment

Depending on the specific cases, the following equipment allows execution of the various paving operations: dowel-bar inserter, tie-bar inserter, internal vibrator and final finisher.

5 Adjustable parameters on a slipform paver

Certain machine parameters can be adjusted in order to take into account the special characteristics of the concrete and of the shape of the construction work. These are as follows:

— the position of the vibration device in relation to the mould, in order to prevent the air which escapes from the concrete mix becoming "trapped" beneath the mould;

— the vibration force (frequency setting), so that the concrete mix is subjected to vibration at the front part of the mould with the underneath rear part of this mould being vibration-free;

— the rate of supply of the concrete mix to take into account, for example, the machine-advancement speed;

— the guiding system sensitivity, in particular to meet the requirements for smoothness specified for the construction work.

6 Commercial specifications

6.1 General

The following characteristics shall be specified.

6.2 Main assemblies

Main assemblies should be specified according to the type of the slipform paver. Examples of the main components of slipform pavers for minor, medium-sized and big road-paving works are presented in the following figures:

— Figure A.1 — Basic components of a small slipform paver;

— Figure A.2 — Basic components of a medium or large slipform paver.

6.3 General characteristics of a slipform paver

6.3.1 Applications

These specifications apply to the following operations:

— single layer paving with small, medium and large paving widths;

— road-drainage structure paving edgings, shoulders, curbs, curb and gutters and so on;

— road safety structures barriers, walls, and so on;

— special purpose paving dual layer paving, canal paving, and so on.

6.3.2 Specifications

The general specifications are listed below, together with the units of measure, where appropriate:

— maximum working width underneath the machine millimetres;

— minimum working width underneath the machine millimetres;

— maximum working width of lateral formwork millimetres;

— maximum working thickness millimetres;

— maximum working height of lateral formwork millimetres;

— working speed metres per minute;

— travelling speed metres per minute;

— number of crawlers (units);

— width of crawler plates millimetres;

— stroke of levelling cylinder millimetres;

— vibrating equipment:

  — number of vibrators (units),

  — type of vibrators: hydraulic or high-frequency electric;

— guiding equipment system:

  — sensor for controlling height and working directions from known reference (e.g. stringline),

  — type of sensor: electronic or hydraulic,

  — three-dimensional machine control system;

— overall dimensions (paving mode):

  — length l millimetres,

  — width b millimetres,

  — height h millimetres;

— overall dimensions (transport mode):

  — length l millimetres,

  — width b millimetres,

  — height h millimetres;

— operating mass:

  — the operating mass and the actual maximum axle loads of wheeled machines shall be indicated; in the case of crawler-type machines, the maximum operating mass (including all additional devices) shall be indicated,

  — if it is possible to ballast the machine, the operating mass of the machine, including the maximum ballast, shall be additionally indicated;

  — transport mass.

6.4 Engine data

The following shall be specified:

— manufacturer;

— type;

— power kilowatts;

— displacement cubic centimetres;

— revolutions hertz (revolutions per minute);

— number of cylinders;

— cooling;

— fuel consumption litres per hour.

6.5 Fluid-tank capacities

Fluid-tank capacities are as follows:

— fuel tank litres;

— hydraulic fluid tank litres.

6.6 Electrical system

Information on the electrical systems is as follows:

— supply voltage volts;

— charging system amperes.

6.7 Dimensional characteristics (small paver)

Dimensional characteristics for a small paver are as follows (see also Figure A.3):

— width between crawlers b_2 millimetres;

— width of lateral formwork b_3 millimetres;

— width of crawler plate b_4 millimetres;

— height of lateral formwork h_1 millimetres;

— height of charging of concrete mix to the delivery conveyor or screw feeder h_2 millimetres;

— distance between the crawler axes l_2 millimetres;

— distance between rear crawler axes and the rear of the paver l_3 millimetres;

— overall length l millimetres;

— overall width: with lateral formwork b millimetres;

— overall width: without lateral formwork b_1 millimetres;

— overall height h millimetres.

6.8 Additional features of a slipform paver

The following items are included where appropriate.

— telescoping machine frame;

— hydraulically telescoping rear crawlers;

— front steering control with sensor;

— level control with sensors;

— slope control;

— microprocessor control system with display of operating data;

— hydraulically telescoping suspension for lateral paving kit offset mould;

— rear steering control;

— rubber track pads for crawler.

6.9 Additional equipment

The following items are included where appropriate.

— belt or type concrete mix feeding system;

— trimmer for processing the surface to be paved;

— transverse concrete delivery screw;

— spreading auger;

— dowel bar inserter for automatic dowel bar insertion;

— tie bar inserter;

— paving kit for concrete slabs;

— mould for slipforming profiles;

— grade line kit;

— final finisher attachments;

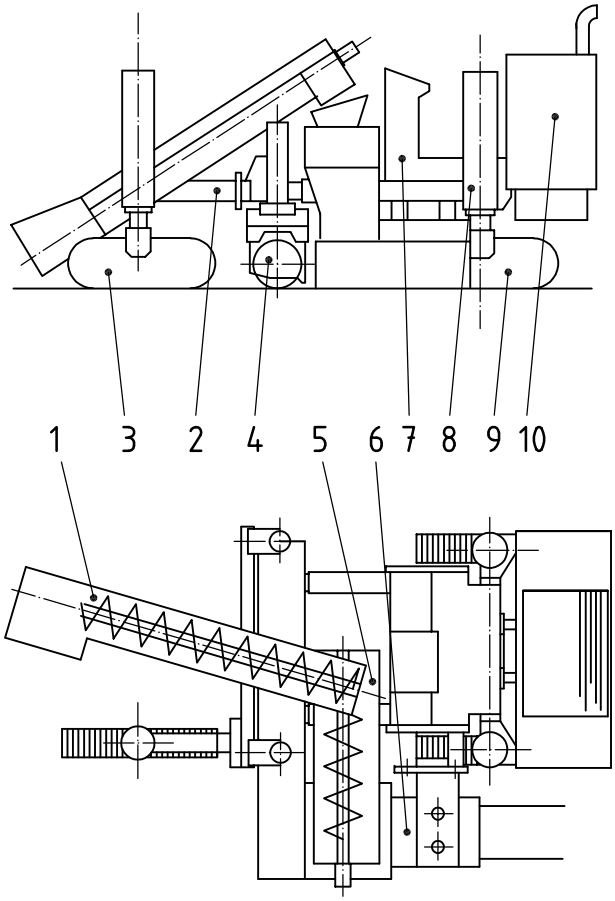
— water tank and accessories for cleaning;

— equipment for paving double layer.

Annex A
(informative)

Examples of slipform-paver designs and their assemblies

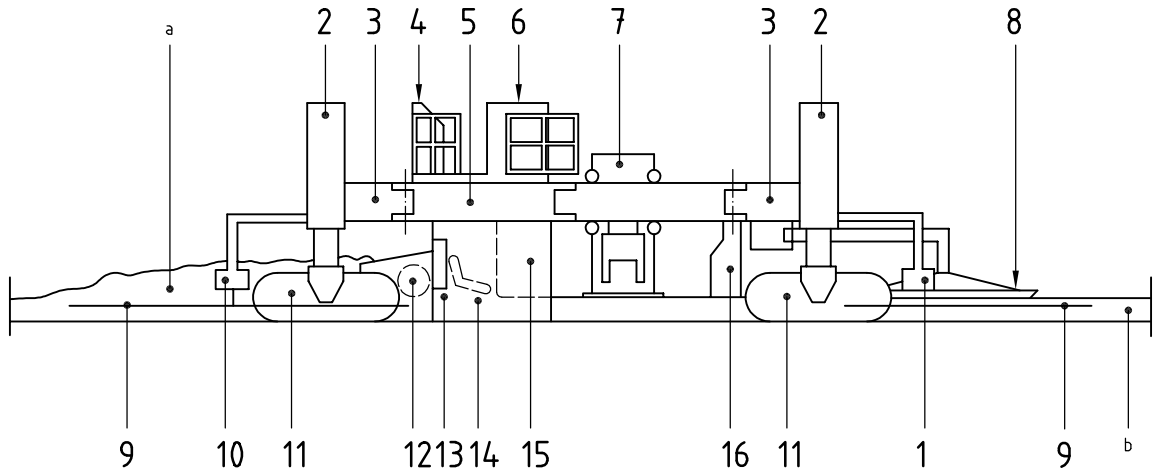
Figures A.1 to A.10 show examples of slipform-paver designs and their assemblies.



Key

1 main concrete mix delivery screw feeder with facility for adjustment in all directions
2 telescopic frame accommodating the trimmer and the optional transverse concrete mix delivery screw feeder
3 crawler track with facility for sideways displacement and steering to negotiate tight bends
4 laterally and vertically adjustable trimmer for lateral formwork and slab paving kits
5 optional transverse concrete mix delivery screw/feeder for telescoping offset mould
6 hydraulically displaced offset mould
7 control console
8 levelling cylinders with adjustable guides
9 hydraulically outwards displaced rear crawlers
10 power unit

Figure A.1 — Basic components of a small slipform paver



Key

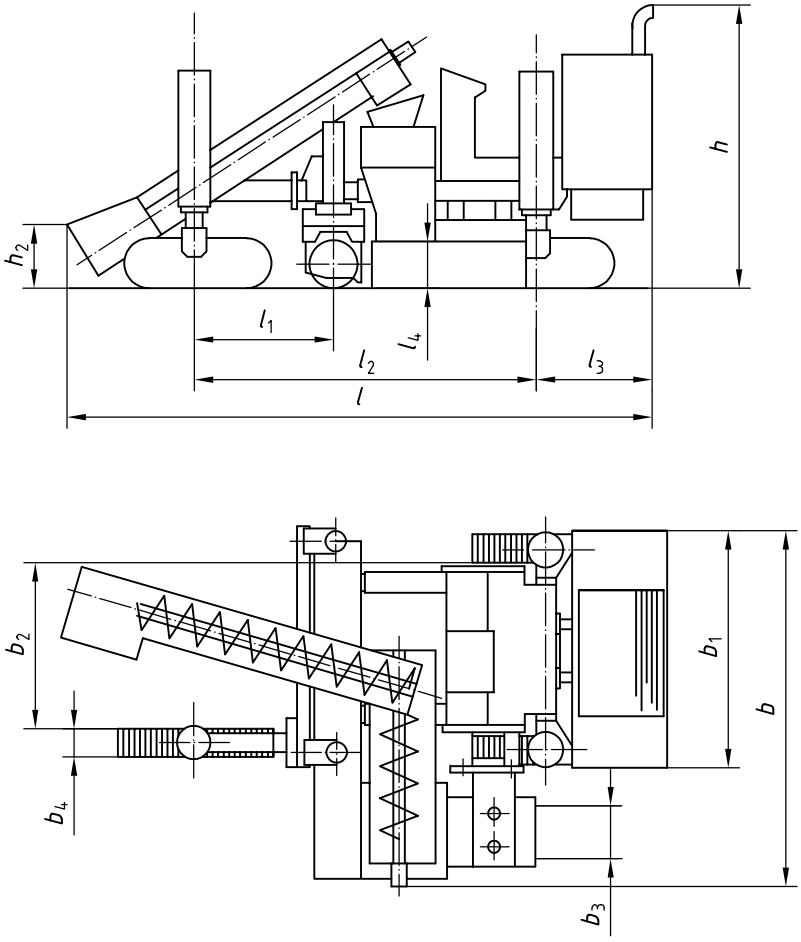
1 sensors for levelling and steering, rear
2 levelling cylinder
3 swing leg
4 operator's platform
5 main frame
6 power unit
7 dowel bar inserter DBI
8 final finisher
9 stringline
10 sensors for levelling and steering, front
11 crawler track assembly
12 spreading auger
13 screed metering front
14 HF vibrators
15 extrusion pan
16 oscillating transversal finishing beam

a Discharged concrete mix.

b Finished concrete slab.

Figure A.2 — Basic components of a medium or large slipform paver

Dimensions in millimetres



Key

b overall width: with lateral formwork
b_1 overall width: without lateral formwork
b_2 width between crawlers
b_3 width of lateral formwork
b_4 width of crawler plate
h overall height
h_1 height of lateral formwork
h_2 height of charging of concrete mix to the delivery screw feeder
l overall length
l_1 distance between the axes of the front crawler and trimmer
l_2 distance between the crawler axes
l_3 distance between rear crawler axis and the rear of the paver

Figure A.3 — Dimensional characteristics of a small slipform paver

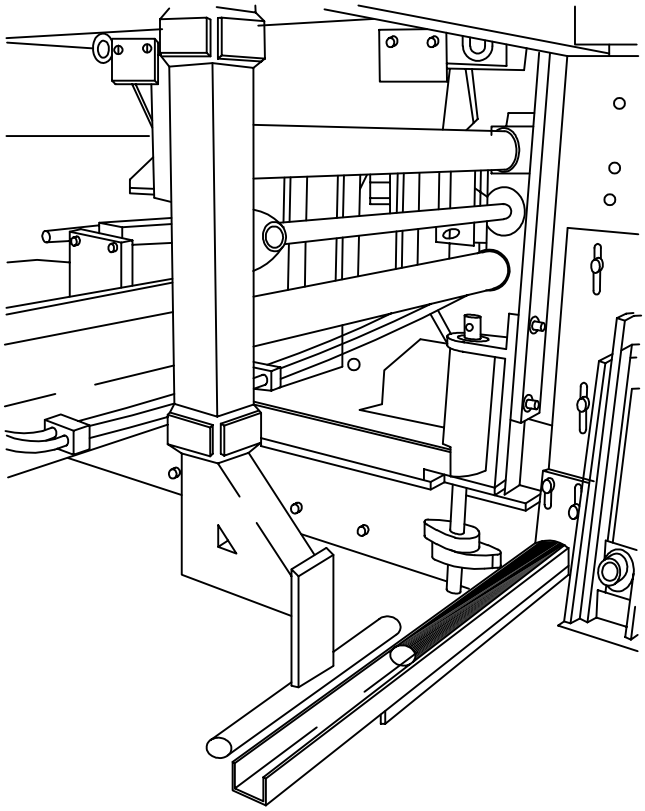
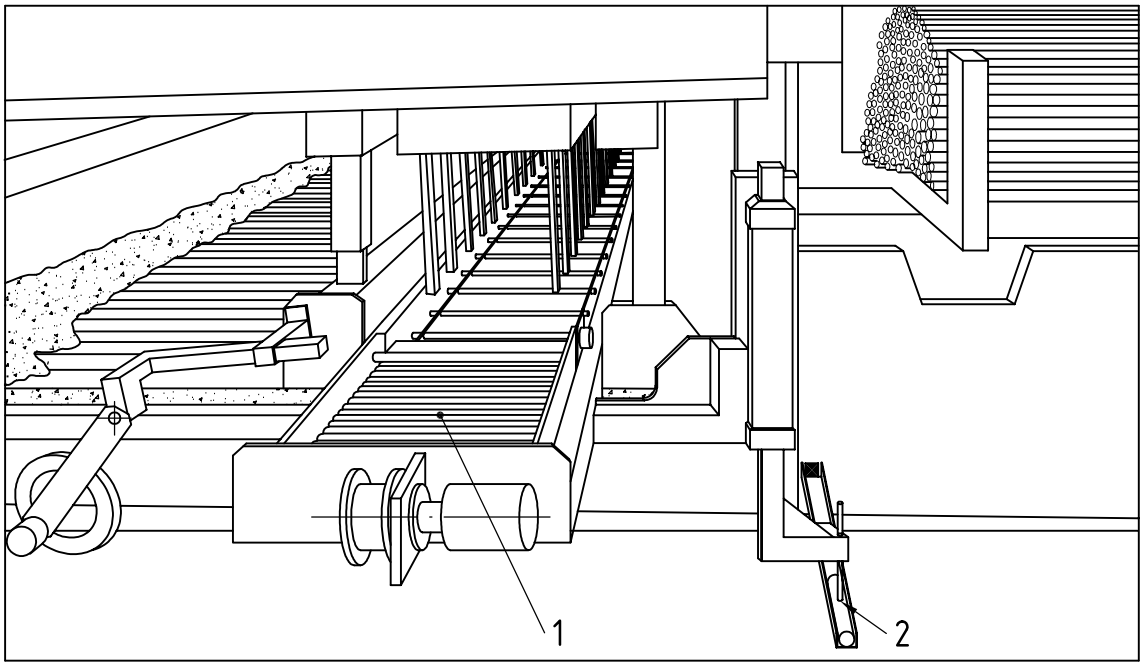


Figure A.4 — Tie bar inserter — for bars located in the edge of a pavement

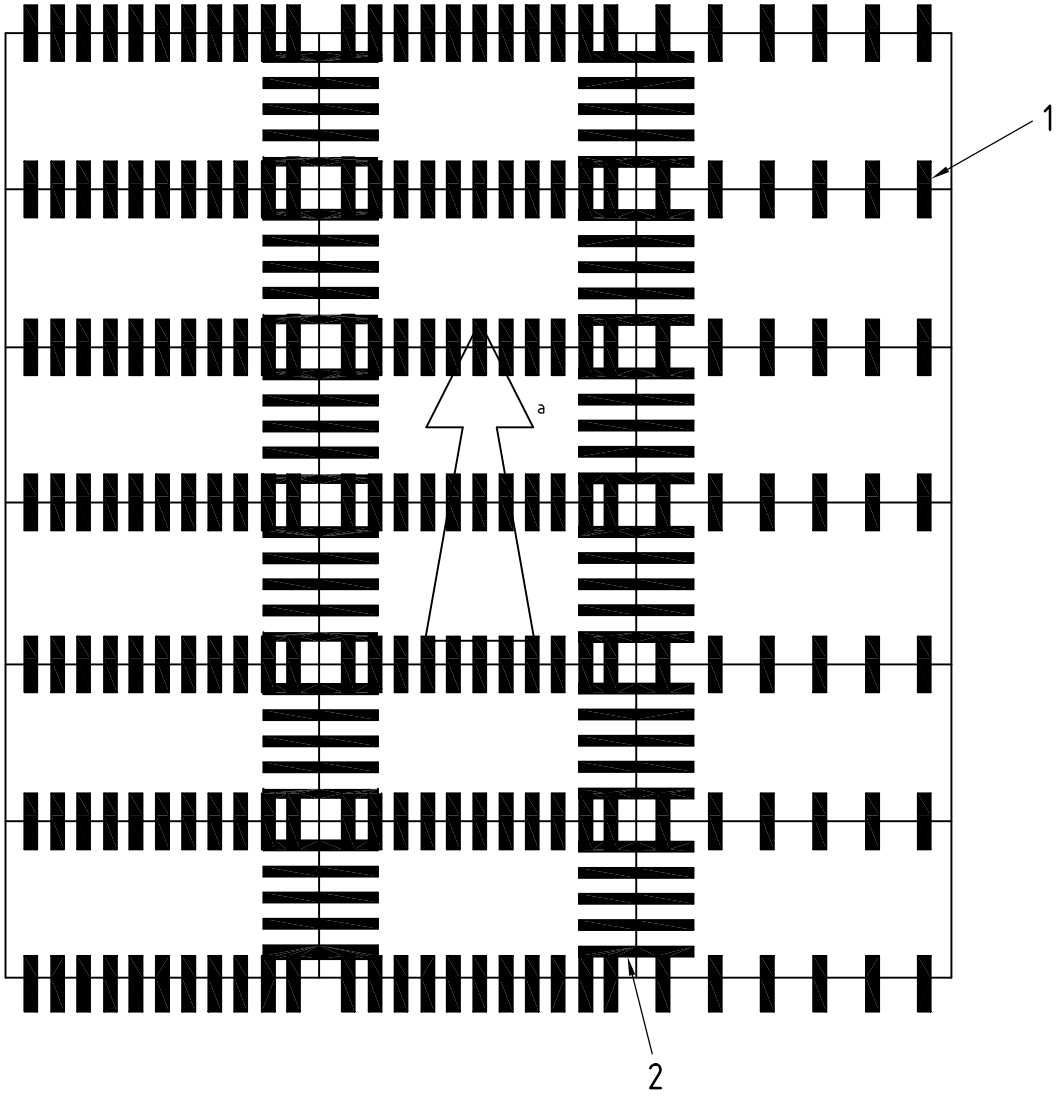


Key

1 dowel bar inserter with dispenser car

2 tie bar inserter for bars located in the edge of a pavement

Figure A.5 — Dowel-bar inserter and tie-bar inserter



Key

1 dowel bar

2 tie bar

[a] The arrow indicates the direction of advance of the slipform paver.

Figure A.6 — Lay-out of the dowel and tie bars in concrete pavement construction

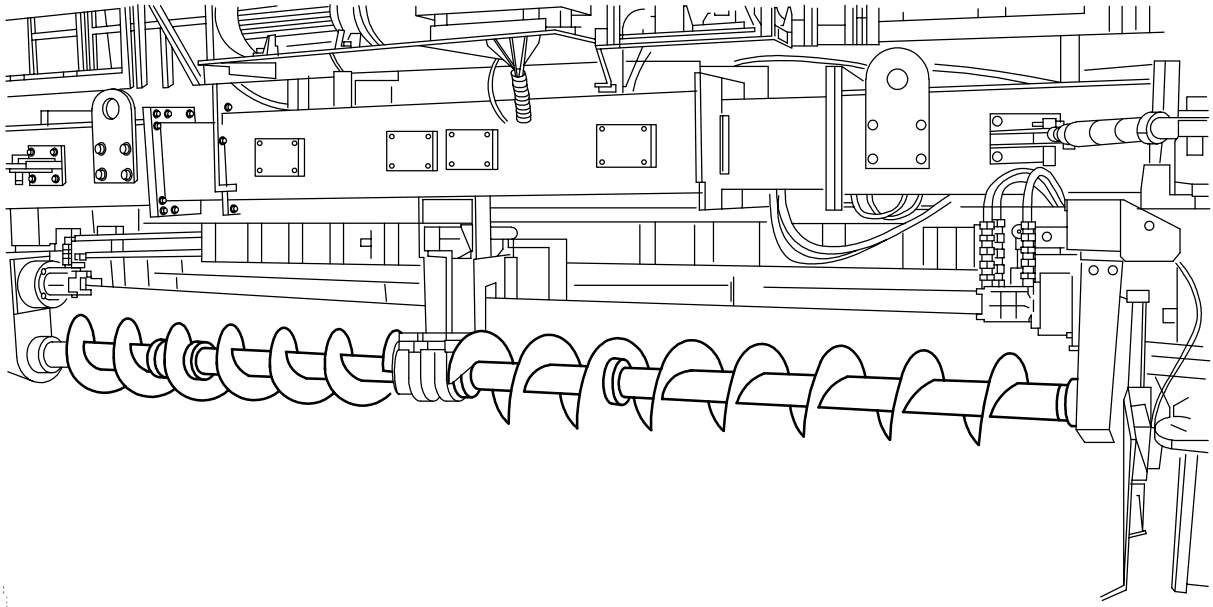


Figure A.7 — Concrete mix distributor spreading auger type

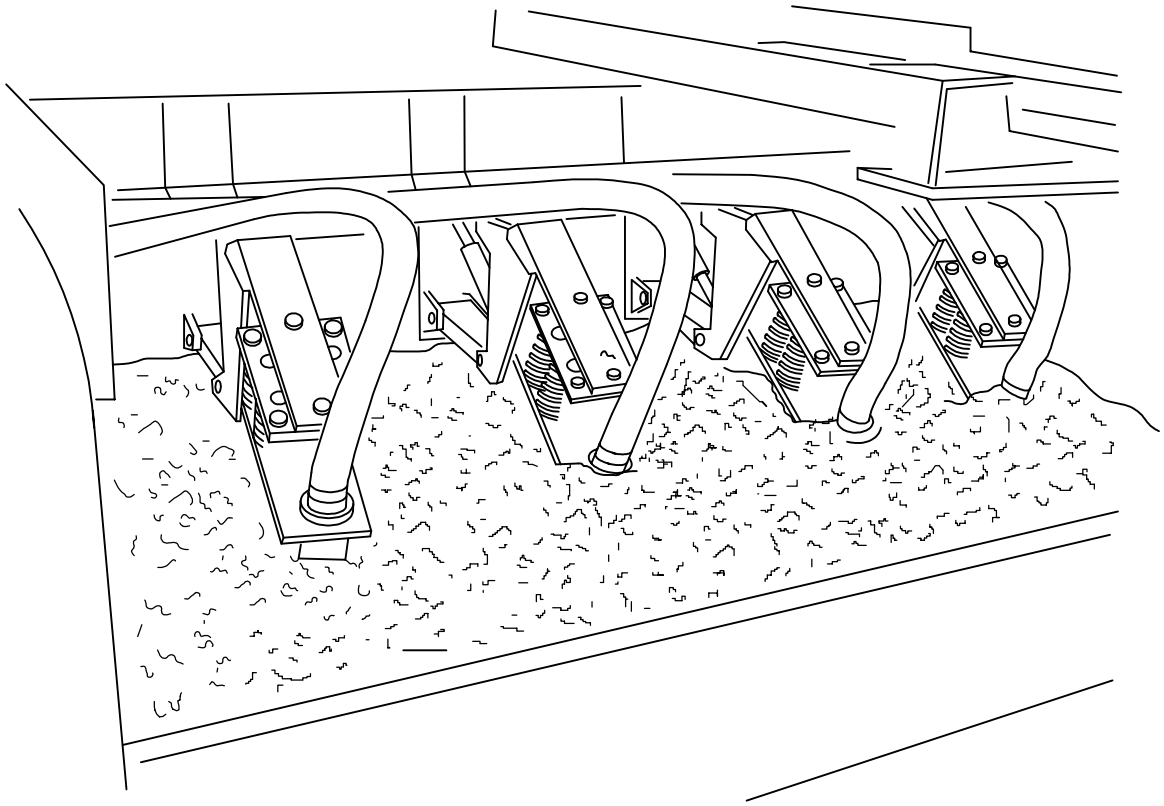


Figure A.8 — Vibrators on slipform paver

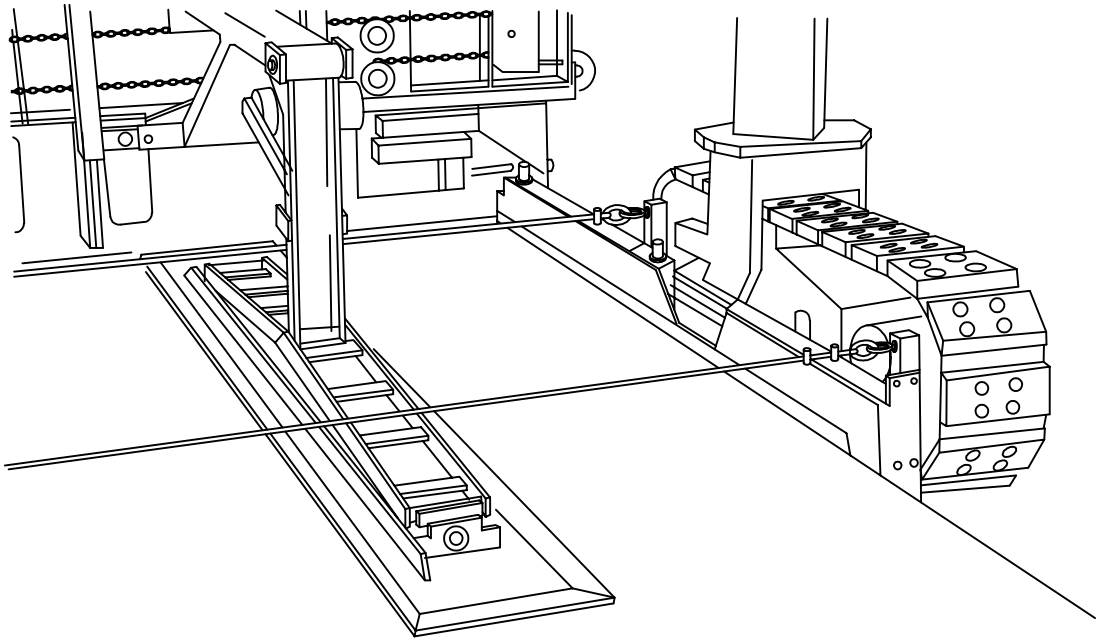


Figure A.9 — Final finisher

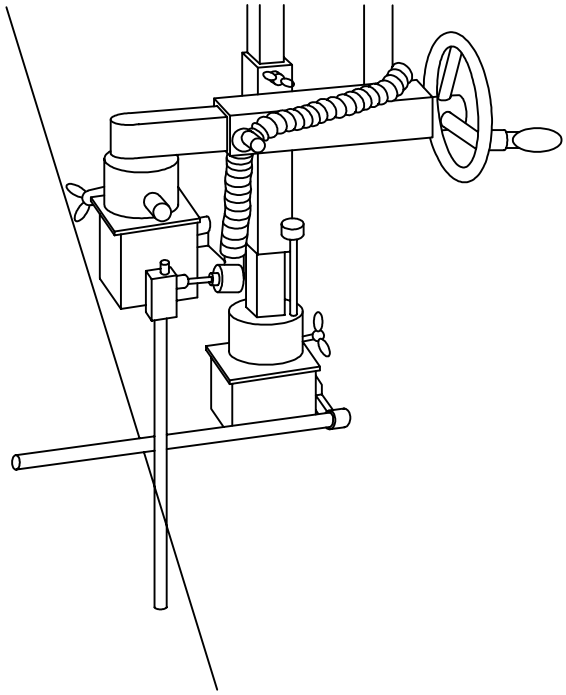


Figure A.10 — Sensors for control of steering (alignment) and elevation (grade) from stringline

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ICS 01.040.91; 91.220

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