

The logo for Tenbusch Inc. features the word "TENBUSCH" in white, uppercase, sans-serif font, centered within a red rectangular box. This box is flanked by two horizontal blue lines, one above and one below, creating a stylized header element.

TENBUSCH

Pipe Carriers Buyers Guide

Factoring the numerous details to make getting the right pipe carrier easier.

In certain applications, the best means of installing a large diameter pipeline in an existing tunnel or pipe conduit is to carry in and install the new pipeline piece by piece. Tenbusch Inc. designs and fabricates pipe carriers for large diameter pipe installation.

We put this Buyers Guide together to help focus on questions and answers about the pipe, tunnel and other factors in an effort to get the best and most efficient Pipe Carrier for the project.

Introduction

The term "Pipe Carrier" refers to the equipment used to carry mid to large diameter pipe into a tunnel. Pipe Carriers can be configured in multiple variations depending on the specifications and needs of the pipe and the job. This Buyers Guide will look at the varying aspects of the pipe, job and how Tenbusch Pipe Carriers fit best.

Pipe and Existing Tunnel

The first step in evaluating what to look for in a Pipe Carrier is to review the details of the Pipe to be used and the Existing Tunnel –

Pipe

What is the diameter of the pipe being used?

What is the material of the pipe?

What size pipe joints does the job call for?

How much does each pipe joint weight?

Is there any coating on the outside of the pipe? Is there any liner on the inside of the pipe?

Does the coating or liner require any special treatment to preclude damage during the installation process?

Will there be internal braces in the pipe? (stulls)

If so, what kind of special steps will be involved in handling the pipe?

Existing Tunnel

Is the existing tunnel a pipe?

What is the shape and size of the tunnel?

What is the grade of the tunnel? Will the installation process be uphill or downhill?

What is the length of the tunnel?

How many, and where are the access points?

Is the tunnel straight, or are there bends in the tunnel? What are the bend radii?

Will blocking be required under the new pipe? Will the blocking be at each bell? Or will blocking be continuous? If the blocking must be continuous, will a rail be required?

Other Job / Project Considerations

Beyond the pipe and the existing tunnel, contractors have to consider a number of other details that are important when considering the most effective Pipe Carrier. Some of these are listed below –

Labor costs, Equipment Costs, Rail costs

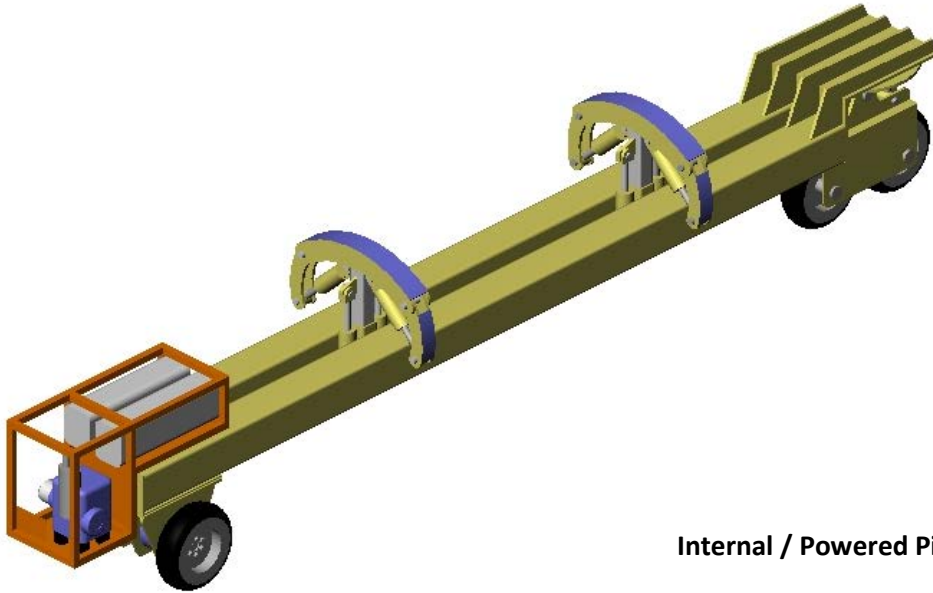
The details of the pipe and tunnel are instrumental in Tenbusch customizing a Pipe Carrier that works safely and as efficiently as possible.

Equipment

Here are some model platforms, that we believe, cover most Pipe Carrier conditions. Tenbusch will customize any of the models below to fit the job needs.

Internal / Powered Pipe Carrier

This Pipe Carrier is built to operate inside of the pipe that is being carried into the tunnel. It is powered by a power module at the rear of the unit.



Internal / Powered Pipe Carrier

Typical Scenario when this is used:

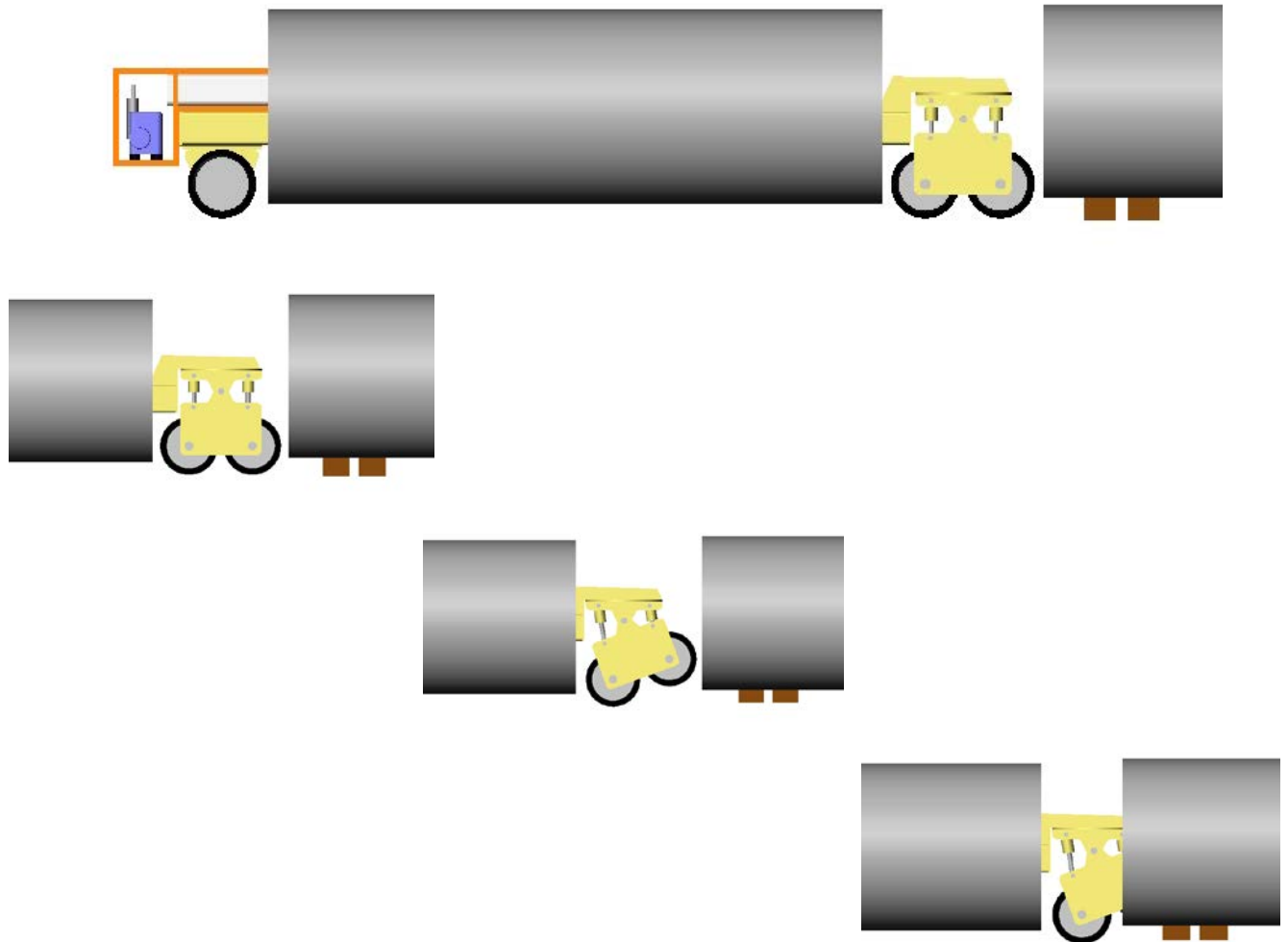
- Lightweight pipe in a long tunnel.
- Steel Liner in a water transmission main.
- When pipe being placed does not have internal stulls.
- Tunnels that do not have a rail.

Key Aspects of the Tenbusch Internal / Powered Pipe Carrier

- Separately Controlled Arms - Left and Right arm are separately controlled allowing for easier alignment to the previously set pipe.
- Versatility - Arms can be changed out when dealing with a larger or smaller diameter pipe in the future.
- Removable engine module can be removed to be in the future to power other Tenbusch Pipe Carriers

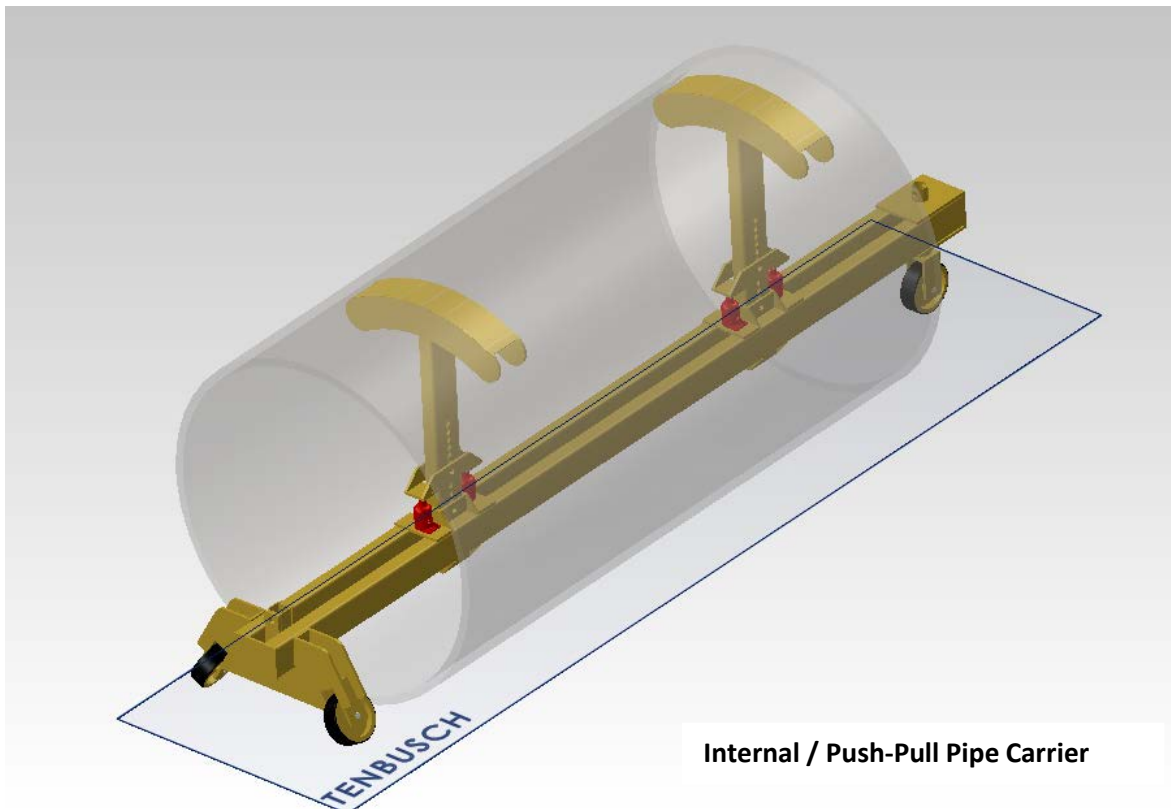
This sequence of pictures will help in understanding the importance of

- Controlling the pipe at all times - up & down, left & right
- When placing the pipe, the front axles must allow the front of the pipe carrier to drive into the previously set pipe, even if it is blocked.
- When working with some pipe materials, the front wheels must not be allowed to roll over the bell or spigot, it must instead *walk over* the joint.



Internal / Push-Pull Pipe Carrier

This Pipe Carrier uses the job site's prime mover to move the pipe and carrier into place. This pipe carrier has no power module. The forward wheels are steered manually. It uses simple automotive style jacks to lift the pipe. It is used primarily for light weight pipe in short tunnels.



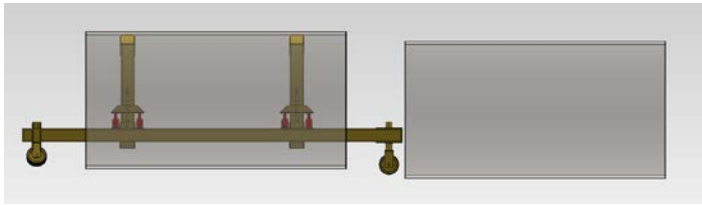
Typical scenario when this configuration is used:

When using light weight pipe that is easily manipulated.
Short length tunnels.

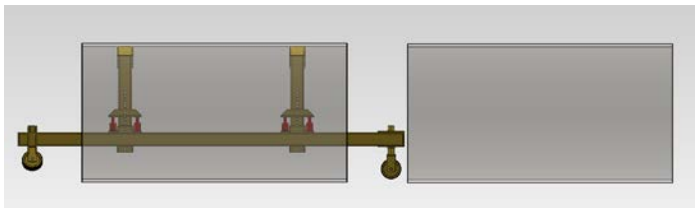
Key Aspects of the Tenbusch Internal / Push-Pull Pipe Carrier

Simple Design - Can be pushed or pulled by a prime mover, does not need to have its own power source.
Lifting can be accomplished by the use of automotive hydraulic jacks.
Steerable at the front axle

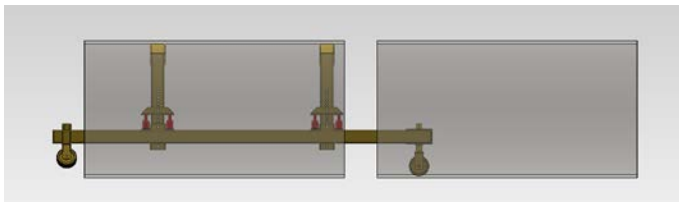
This sequence of pictures shows the how the pipe carrier is used to efficiently set the pipe without the use of hydraulic power and with very limited stroke of the bottle jacks.



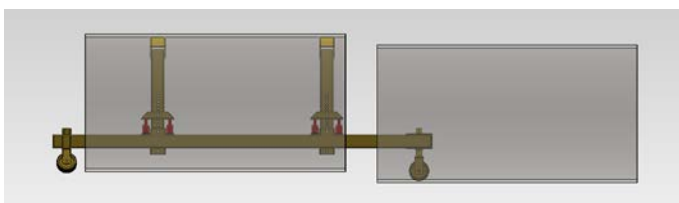
The pipe is picked up in the pit area and transported to the previously set pipe. Notice the pipe is carried forward of center on the pipe carrier.



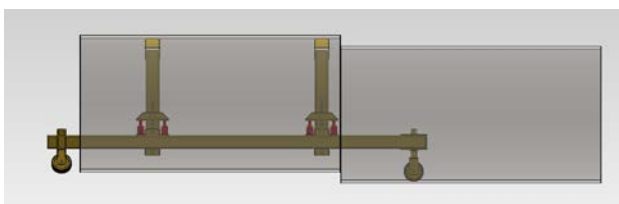
The new pipe is lowered, taking the weight off of the pipe carrier.



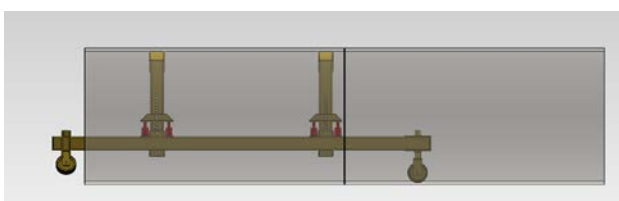
With the weight off of the pipe carrier, it is advanced into the previously set pipe.



The pipe carrier lifts the new pipe.



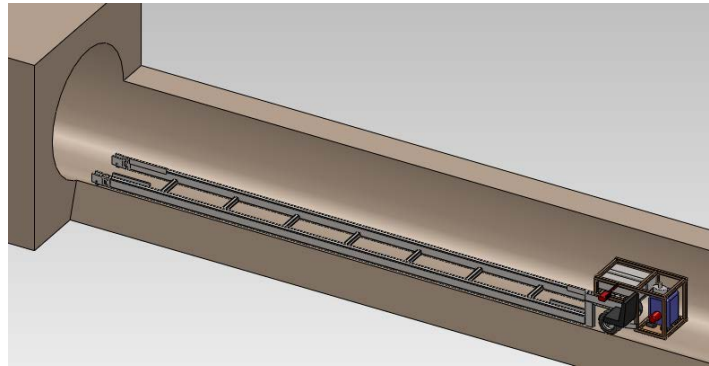
With the new pipe lifted, the pipe carrier is advanced.



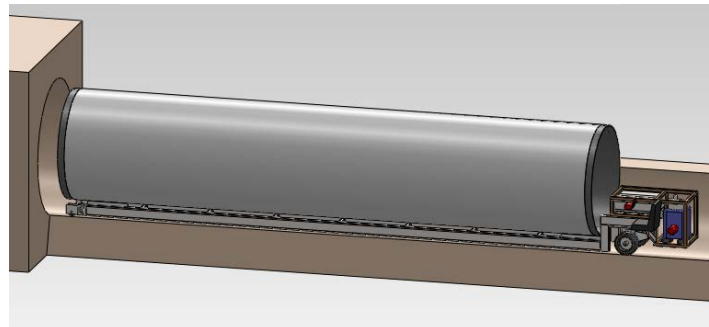
The new pipe is lowered into alignment with the previously set pipe.

External / Self Propelled Pipe Carrier

This Pipe Carrier lifts the pipe from the outside and carries it into place. Once into place, the carrier lifts the pipe into position and pushes it into place mating with the previous set pipe.



External / Self Propelled Pipe Carrier



Typical Scenario when this is used:

An External / Self Propelled Pipe Carrier is required when placing a pipe with internal stulls.

Key Aspects of the Tenbusch External / Self Propelled Pipe Carrier

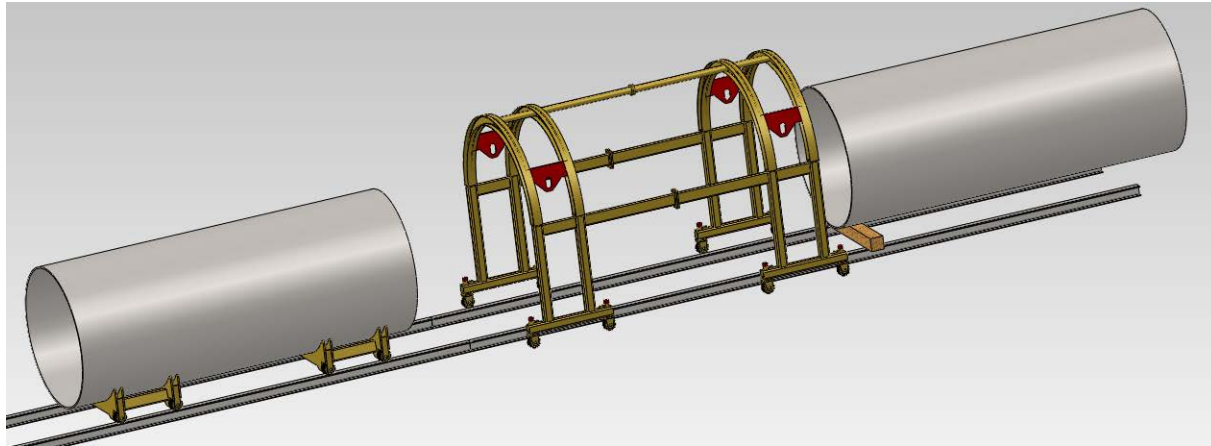
Steerable – Built with steerable front wheels and controls in the back and front, allowing the men to manipulate the pipe from the inside of the previously set pipe when necessary.

Power Options – Can be used with a power module or used with a loci and rails.

Lifting Options – Can be configured to allow the operator to control front, back, and side to side lifting independently.

External / Manual Pipe Carrier

With this machine configuration, the new pipe is loaded onto carts at the access shaft, the carts utilize a rail and carry the pipe into place with the project's prime mover. Once in place, the pipe is lifted with the gantry frame. The carts are removed and returned to the access shaft to receive another pipe. While the next pipe is being brought into the tunnel, the crew inside can easily set the newest pipe and block as necessary under it.



External / Manual Pipe Carrier

Typical Scenario when this is used:

Used when the pipe uses internal stulls.

Key Aspects of the Tenbusch External / Manual Pipe Carrier.

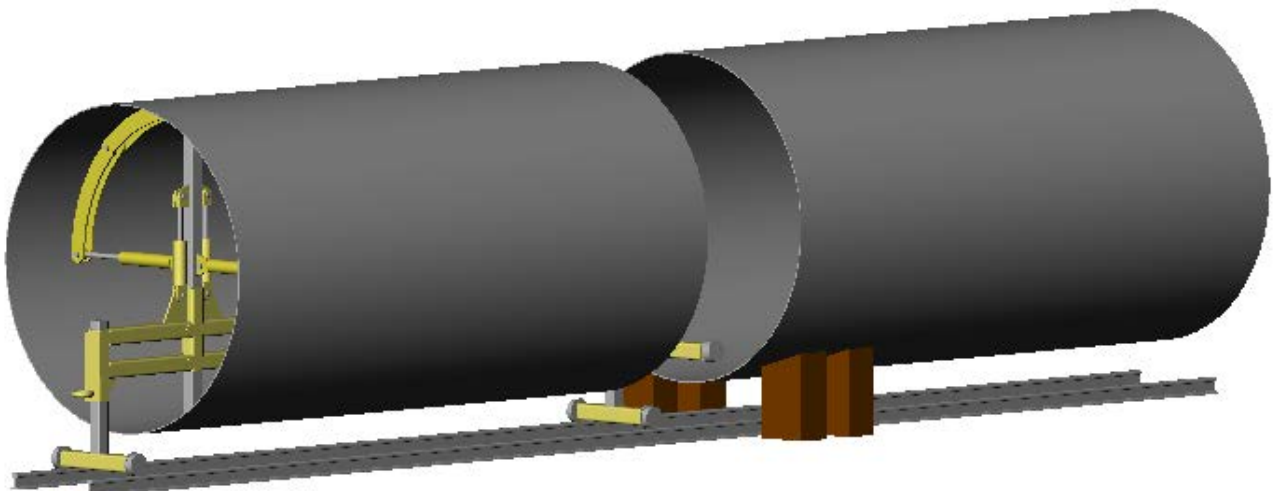
Simple and Cost effective design - This Pipe Carrier is built to use the jobs prime mover and can use hand rigging to lift and lower the pipe under the gantry.

Steerable - Gantry wheels swivel to allow the workers to position the gantry where they need it as they lift and place the new pipe.

Robust – engineered to handle the weight of long sections of heavy pipe with internal stulls.

Internal / Rail Wheel / Push- Pull Pipe Carrier

The following machine was designed to place a large diameter steel pipe in a tunnel. The new pipe was blocked, to allow the removal of short sections of rail as each new pipe was installed in place. The rail was existing from the spoil removal operations during the excavation of the tunnel. The contractor-owned locomotive was available to use with the pipe carrier. The pipe carrier was designed to be operated by the hydraulic system of the locomotive.



Typical Scenario when this is used:

When placing large diameter steel pipe.

Key Aspects of the Tenbusch Internal / Rail Wheel / Push- Pull Pipe Carrier

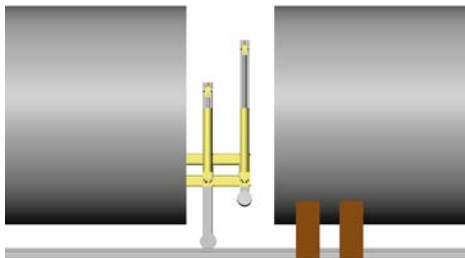
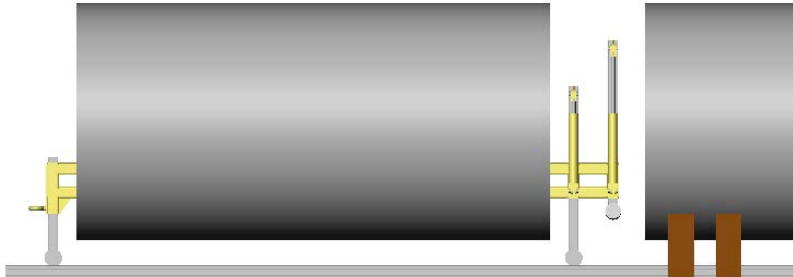
Two Front Axles – allows the pipe to be set directly up against the previously set pipe.

Compatibility – effective in using the previously laid rail and locomotive.

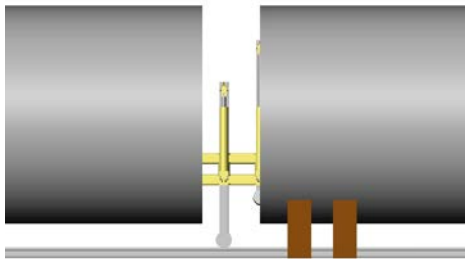
Versatility – Arms can be changed for different diameter pipes for future jobs.

This machine has a feature that is commonly used – two front axles.

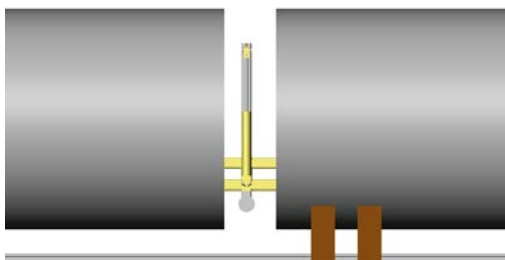
With the use of two front axles, as the sequence below shows, the pipe can be placed end to end with the previously set pipe. This is equally effective whether the new pipe is plain end or bell and spigot.



1) The carrier is advanced with the front axle elevated.



2) When the elevated axle is in the previously set pipe, it is extended,



and 3) the trailing axle is elevated.

4) The pipe can then be placed in its final location

In addition to the different features that have been mentioned in the previous pages, the following features are commonly part of the machine:

- Diesel engines are always fitted with a catalytic converter for operation in a tunnel or pipe. The exhaust gas can be directed to the underside of the machine in either direction.
- The engine and hydraulic components can be built as a module for use in other Tenbusch Pipe Carriers.
- Lifting arms are mounted in a socket in the frame. This allows the machine to be fitted with different lifting arms for different pipe diameters in the future. Lifting arms normally include a rubber surface to preclude damage to the interior surface of the new pipe.
- The pipe carrier is usually fitted with 12 volt sealed beam lights.
- A telescoping arm can be fitted to the front of the frame to pull the pipe carrier forward when it is necessary to pull a pipe home into the bell of the previously set pipe.
- Pipe carriers can be configured to handle different length pipe products. If necessary the frame of the pipe carrier can be *telescoping*, to accommodate different pipe lengths on the same job. (i.e. changing from full length joints to shorter mitered joints and back to full length joints). Alternatively, the frame can be configured in *modules* to allow the frame to accommodate 40 foot joints now and shorter joints in the future.
- Pipe carriers that are pushed or pulled can be fitted with a small, limited, self contained hydraulic system to operate the lifting cylinders.
- Pipe carriers can be fitted with steering capability in both the front and the rear wheel assemblies. Steering can be hydraulically or manually operated.

This presentation is meant to aid tunneling professionals when choosing the appropriate pipe carrier to use on a particular job. Every job is different. We have done our best to offer a few sample configurations along with a discussion of what is appropriate and possible. At TENBUSCH, we recognize that every job is different. We build *custom* equipment for underground contractors like yourselves.

Thank you for your time. Please don't hesitate to call us with any questions that you may have.

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