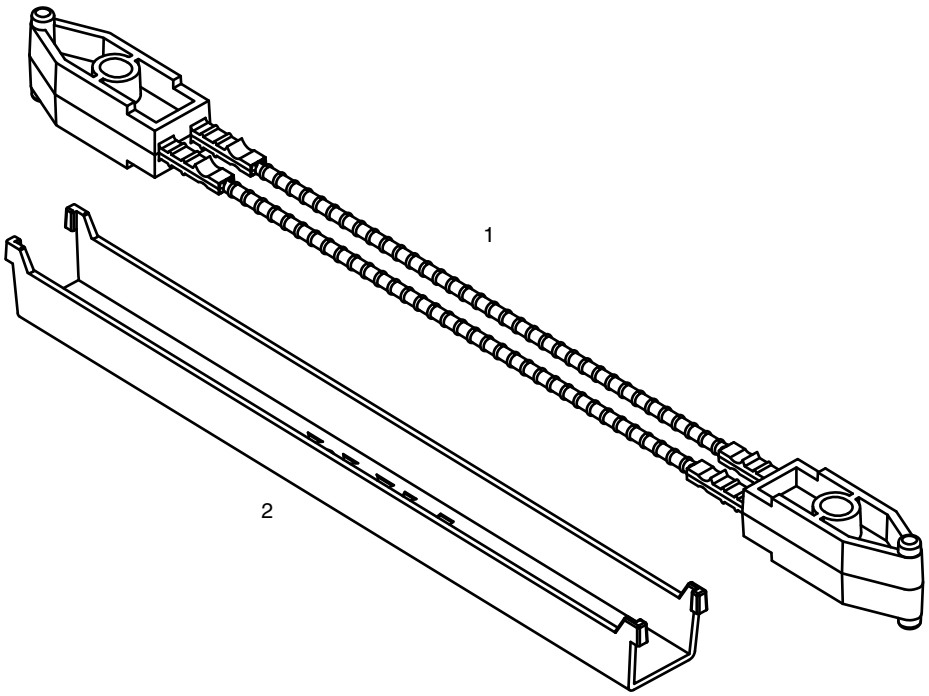
PASCO Structures System

# Cast Beam Spares Set

**ME-6983**




| Included Equipment | Quantity |
|---|---|
| 1. Rebar Member (17 cm) | 30 |
| 2. Mold | 10 |

**Required Materials**

- Sand
- Plaster of Paris

**Related Equipment**

- Load Cell & Amplifier Set (PS-2199)
- 100 N Load Cell (PS-2200)
- Displacement Sensor (PS-2204)
- Dual Load Cell Amplifier (PS-2205)
- Truss Set (ME-6990)
- Bridge Set (ME-6991)
- Advanced Structures Set (ME-6992A)
- Cast Beam Structures Set (ME-7009)

*See www.pasco.com for other PASCO sensors and Structures System sets.*

## Introduction

The Cast Beam Spares Set set consists of a beam that is a model of the reinforcement bars (“rebar”) used in construction, and a mold that is used to produce a model of a beam of reinforced “concrete” or prestressed “concrete”. A mixture of fine sand, plaster, and water is poured into the assembled rebar beam and mold. After the mixture hardens and the mold is removed, the beam can be used as a #4 beam in any PASCO Structure Set.

Sensors and weights can be used to measure the strength of the cast beam when it is a component of a PASCO Structure.

### About Concrete

Concrete is the most widely used construction material in the world. Non-reinforced concrete is strong in compression but weak in tension. Any appreciable tension (for example, due to bending) will cause the concrete to crack and separate.

Non-reinforced concrete must be well supported to prevent bending.

### Reinforced Concrete

*Reinforced concrete* has reinforcement bars ("rebar"), grids, plates or fibers incorporated to increase the tensile strength of the concrete. Since steel is a material that has high strength in tension, it is commonly placed in concrete to add strength and to help the concrete resist tension. Reinforced concrete is sometimes described as *precast* concrete.

Typical reinforced concrete uses reinforcing bars that are round in cross-section and corrugated to improve the bond between the concrete and the steel. The coefficient of thermal expansion for concrete is similar to that of steel, so the concrete conforms to the surface details of the steel, and the concrete's alkaline chemical environment produces a film on the surface of the steel that makes it more corrosion-resistant.

### Prestressed Concrete

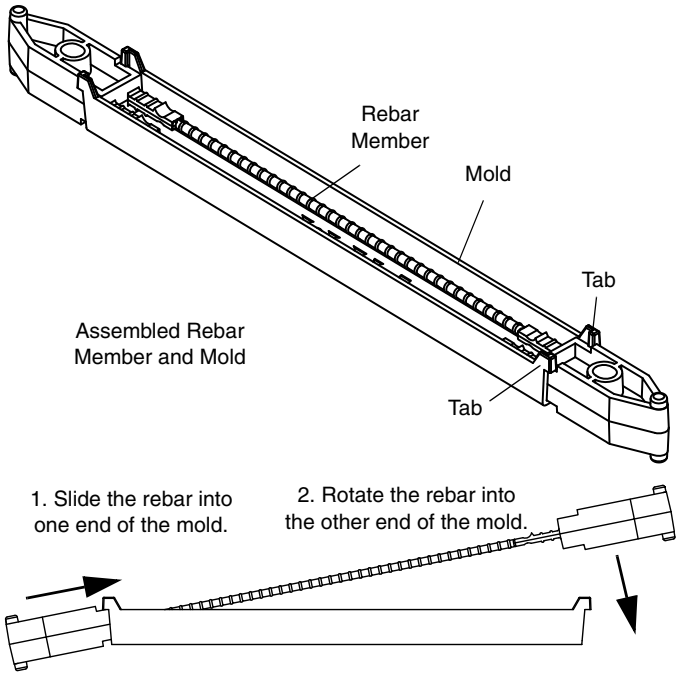
*Prestressed concrete* is an important method for overcoming the concrete's natural weakness in tension. The method can be used to produce beams, floors, or bridges with a longer span than is practical with reinforced concrete. One type of prestressed concrete is *pre-tensioned* or *pre-loaded* concrete.

Pre-tensioned concrete is cast around already tensioned tendons (generally of high tensile steel cable or rod). The bond between the tendon and the concrete protects the tendon and allows for direct transfer of tension. However, pre-tensioned concrete requires stout anchoring points for the tendons so the tendons are usually in a straight line. Most pre-tensioned concrete elements are pre-fabricated and then transported, which limits their size.

# Making a Pre-tensioned Cast Beam

## Assemble the Mold

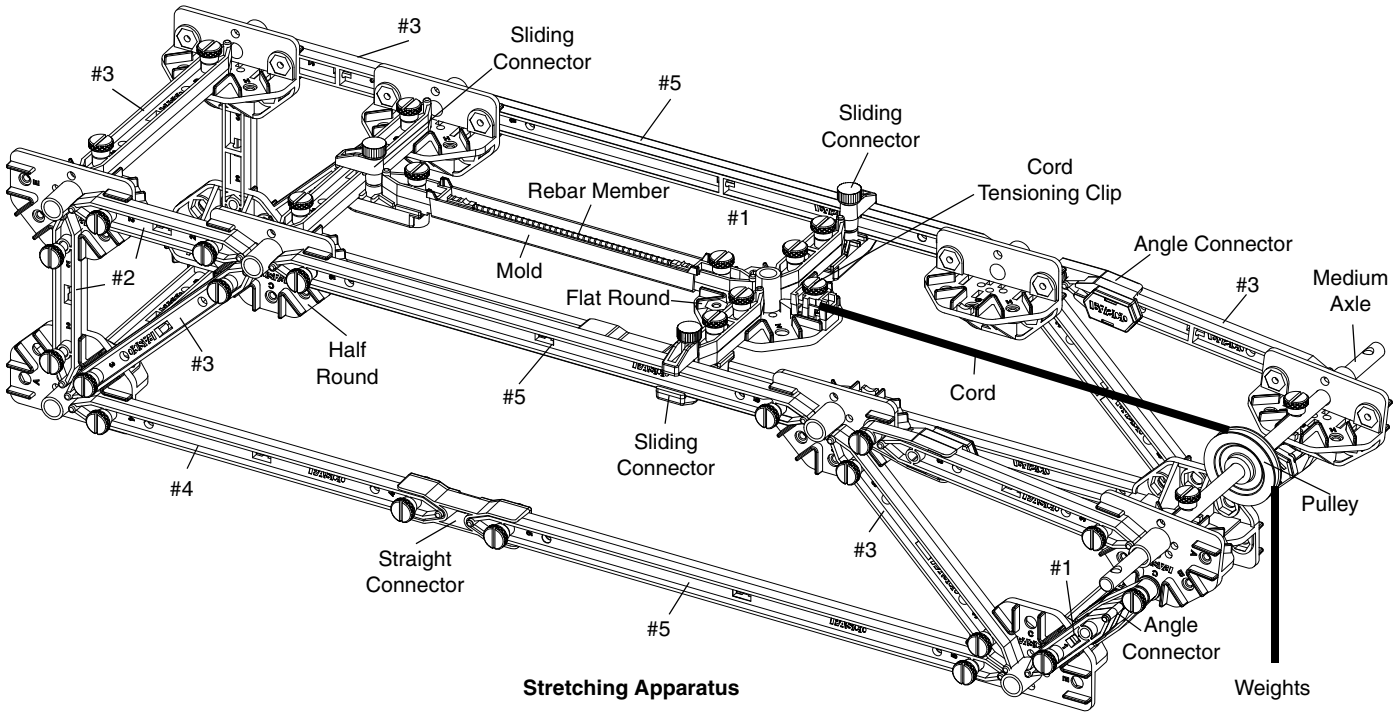
- Assemble the rebar member and the mold. One way to do this is to hold the mold in one hand and the rebar member in the other.
- First, slide one end of the rebar into one end of the mold until the tabs of the mold make contact with the notches on the rebar member.
- Then rotate the rebar member down into the mold so that the tabs on the mold click into place on the rebar member.




## Assemble a Stretching Apparatus

One way to provide tension on the rebar member is to build a stretching apparatus (see next page) with Structure Set members and then pull one end of the rebar member with weights hanging on the end of a cord suspended over a pulley. You can use the ME-6992A Advanced Structures Set or the ME-7009 Cast Beam Structures Set.

**Caution**: Do not stretch the rebar member with more than 100 N of weight (about 10 kg of mass).




**Stretching Apparatus**

- Make sure that the two Sliding Connectors on the #5 beams are slightly loose so that they can slide freely along the beams.
- Fasten the cord to the Cord Tensioning Clip first and then attach the Clip to the Flat Round Connector.
- Mount the assembled mold and rebar member on the stretching apparatus. Attach weights up to 100 N (about 10 kilograms) to the end of the cord in order to stress the rebar member.

## Mix the "Concrete"

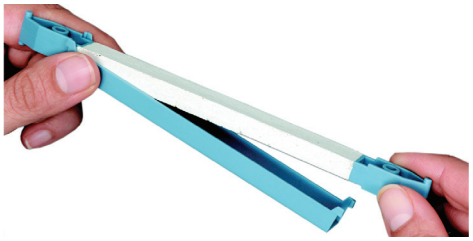
- In a bowl or cup, mix equal quantities of fine sand and plaster of Paris.
- Add a small amount of water to the mixture and stir the ingredients together.
- Continue to add water and stir until the mixure has the consistency of honey.

## Add the Mixture to the Mold

- Carefully pour the sand/plaster mixture into the assembled mold. You may want to use a spoon to ladle the mixtue into the mold.
- Frequently tap the sides of the mold to help the mixture settle and to remove bubbles. Use the spoon to push the mixture down into the spaces around the rebar member.
- Use a tool such as a table knife or wooden tongue depressor to smooth the top surface of the mixture.

**Assemble the Mold**

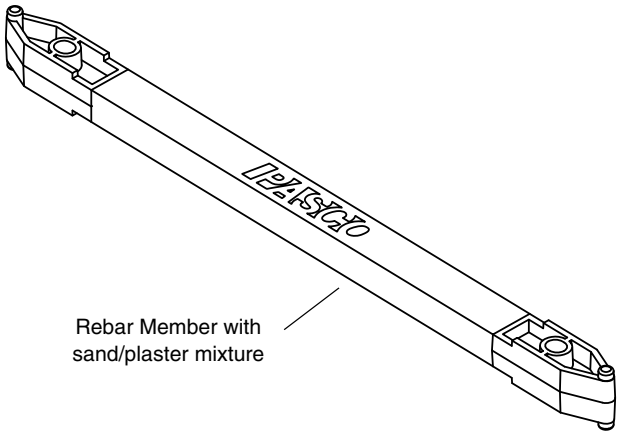
**Pour the Plaster**



**Remove the Mold**

### Remove the Mold

- Let the mixture dry in the mold for 24 hours.
- After the "concrete" dries, remove the rebar member from the stretching apparatus.
- Carefully remove the mold from the cast beam. (The mold can be cleaned and used again.)




# Technical Support

For assistance with any PASCO product, contact PASCO at:

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Email: support@pasco.com

For the latest revision of this Instruction Sheet, visit:

www.pasco.com/go?ME-6983



**Patents Pending** The following PASCO products have patents pending:

| | |
|---|---|
| ME-6987 Flat Structures Members | PS-2198 Load Cell Amplifier |
| ME-6990 Truss Set | PS-2199 Load Cell and Amplifier Set |
| ME-6991 Bridge Set | PS-2200 100 N Load Cell |
| ME-6992A Adv. Structures Set | PS-2201 5 N Load Cell |
| ME-6995 Road Bed Spares | PS-2205 Dual Load Cell Amplifier |