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# Tapered Roller Bearing Accelerated Life Test Rig Design and Fabrication

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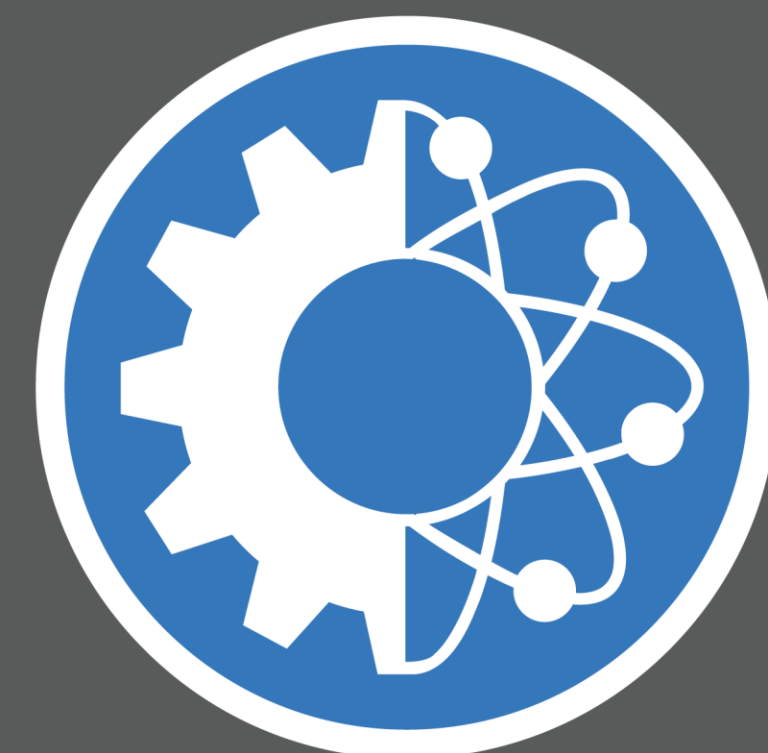
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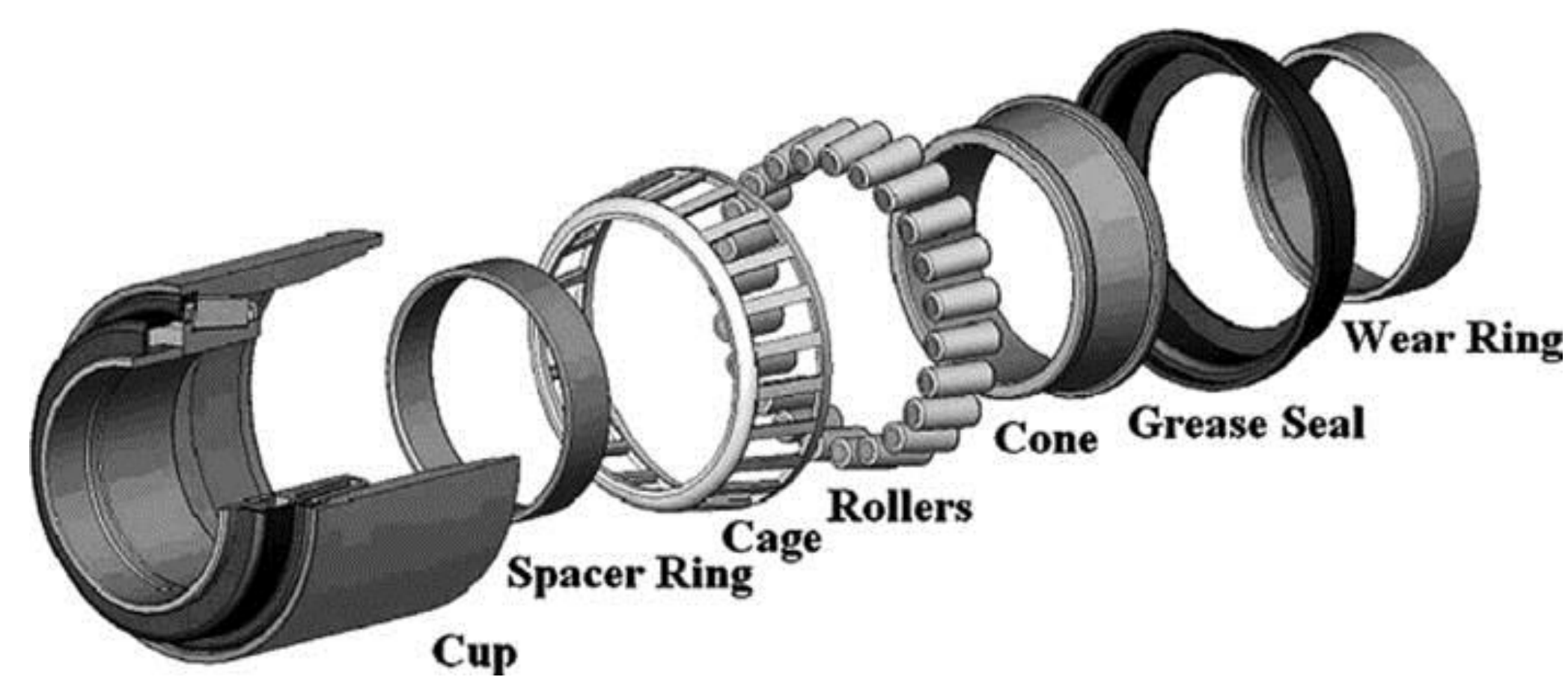
# Tapered Roller Bearing Accelerated Life Test Rig Design and Fabrication

## Overview

$L_{10}$  bearing fatigue life testing is a costly and prolonged process, as the bearing is characteristically designed for durability and reliability. The purpose of this project is to optimize and construct a  $L_{10}$  life test rig for accelerated fatigue testing.

The rig will test the Association of American Railroad Class K, 6 1/2 x 9-inch double-row tapered roller bearing to their maximum fatigue life as quickly as possible.

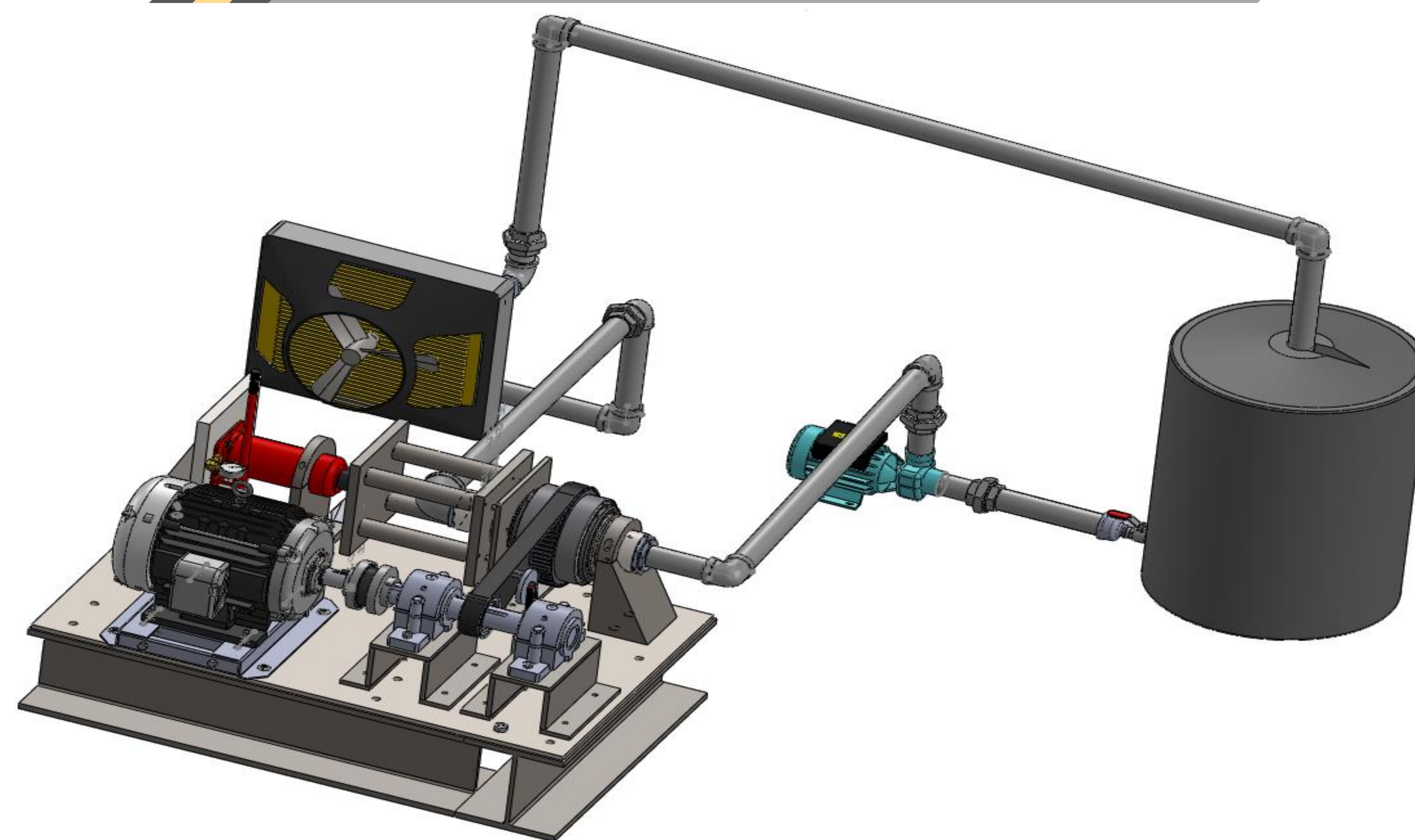
Brenco's rail car roller bearings are designed to run for 1.1 million miles before they fail. However, if a bearing is designed with faulty materials and put into use, fatigue failure can occur as soon as 250,000 miles or earlier.



## Purpose of Test Rig

1. To provide input to the material selection and manufacturing process to aid in evaluating materials and manufacturers.
2. To decrease the amount of test time from nineteen months.
3. To estimate the long-term behavior of a bearing under the appropriate load. The design imitates the stresses and forces similar to real application by loading every roller simultaneously.
4. Using the belts to spin the bearings on the outer raceway allows for a much safer and efficient testing analysis. This prevents premature failure of the support bearing during testing.
5. Provide a higher level of assurance that the bearing will perform under aggressive loading conditions

## Test Rig Design

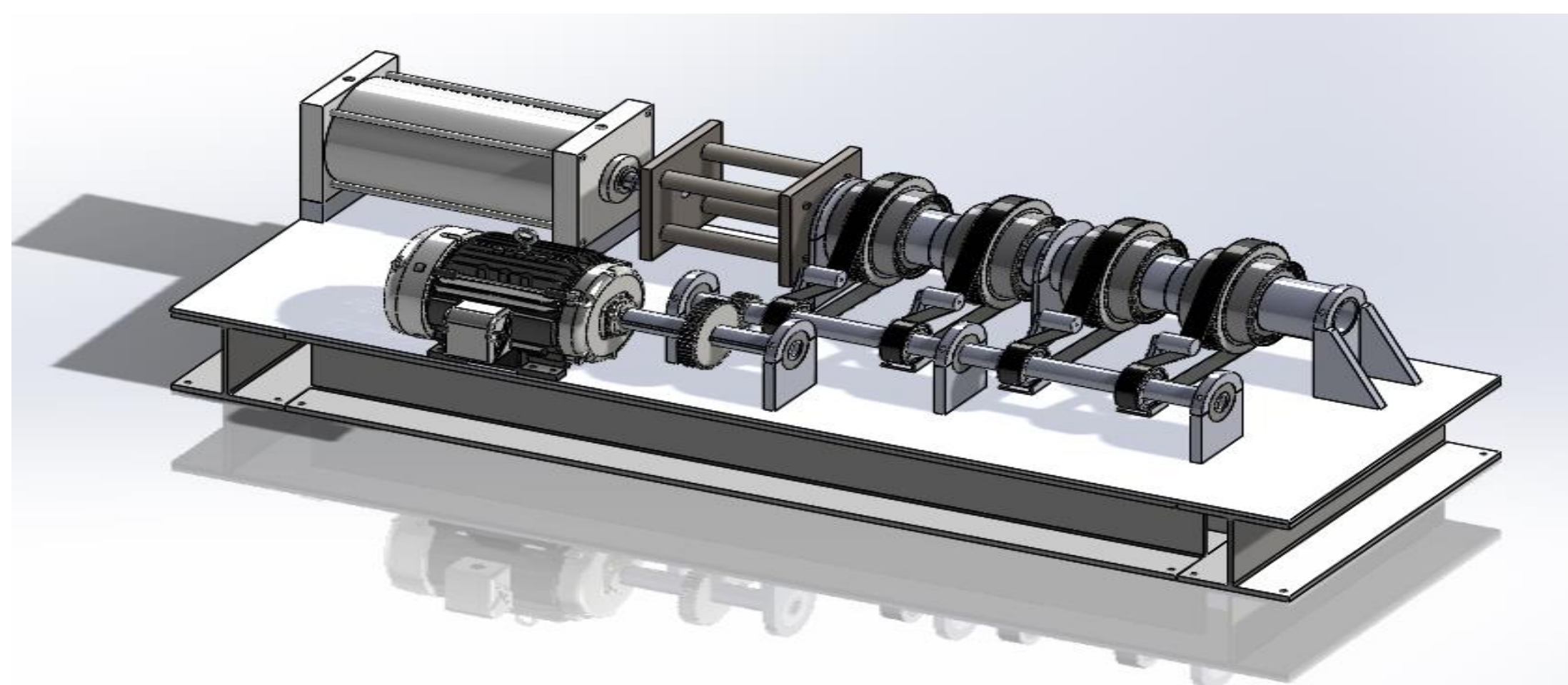


This design axially loads the roller bearing, allowing a more suitable design to test the material's cleanliness. With this approach, predicting the failure rate of the bearing assembly will be easier, quicker, and will allow for more accurate results.

This design does not replicate how the bearing will be loaded in their actual application. This design is only meant to accelerate their life and test them to failure.

In the actual application, only one bearing at the peak of its rotation will be fully loaded. However, with this design, all 23 rollers will be fully loaded for the entirety of the test.

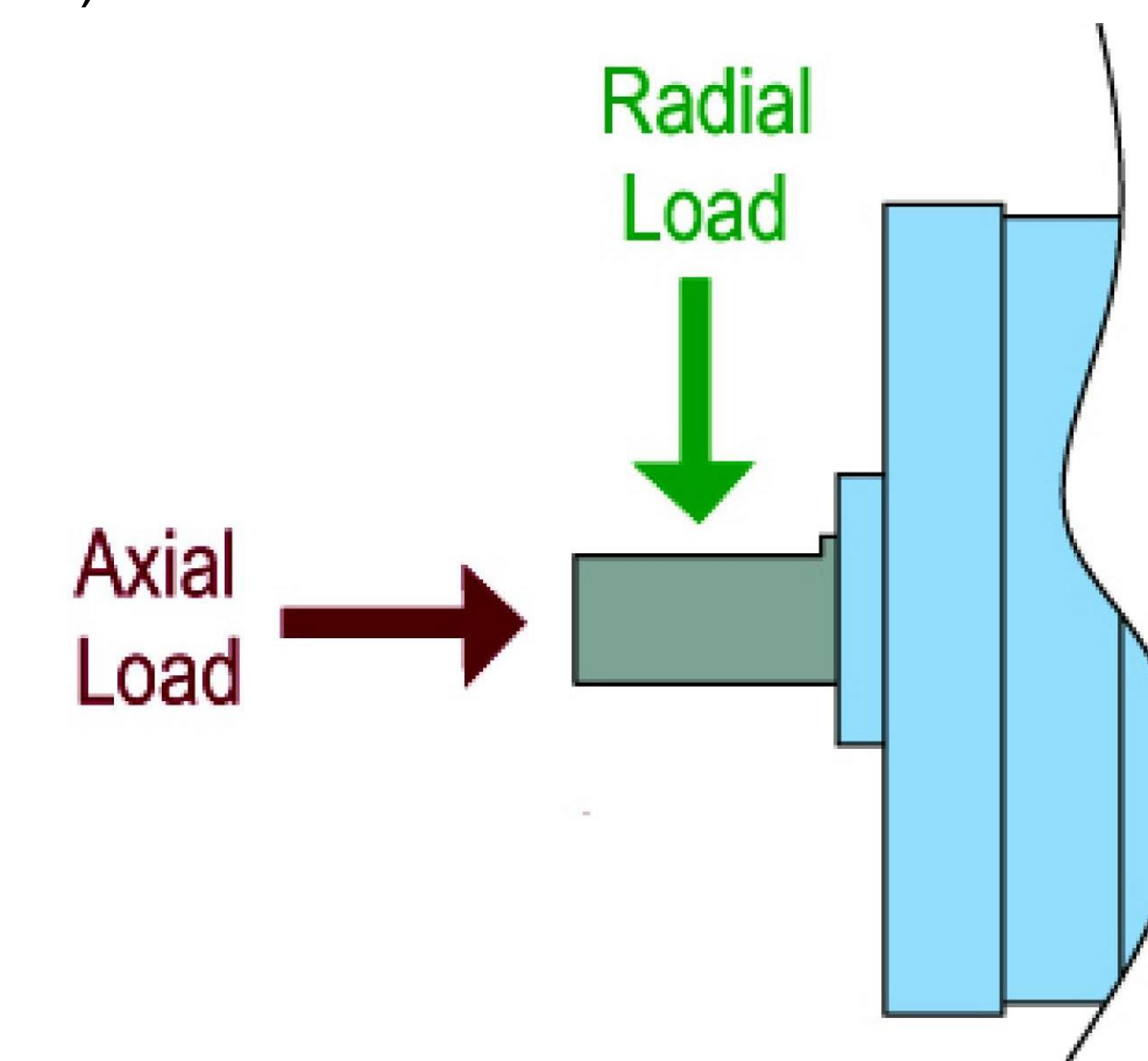
The past test rig design was meant to test four bearings simultaneously. This idea was modified due to the cost of materials, power requirements, and time restrictions.



## L10 Analysis

The American Bearing Manufacturers Association (ABMA) defines the Basic Rating Life,  $L_{10}$ , as the bearing life associated with a 90% reliability when operating under conventional conditions, i.e. after a stated amount of time 90% of a group of identical bearings will not have yet developed metal fatigue.  $L_{10}$  life is also referred to by manufacturers as the 'minimum expected life'.

$L_{10}$  life of a Class K bearing under a 286,000 lb<sub>r</sub> railcar is 1,105,000 miles 100% loaded continuously (as in standard life test), 2,201,000 miles 50% loaded (as in application in service).



**$L_{10}$  Calculations of a Class K Tapper Roller Bearing**

Method of Testing	Current Way of Testing	Proposed Way of Testing
Loading Orientation	Radial	Axial
Load [ $l_b$ ]	34,400	14,378
Basic Rating Life [miles]	1,102,000	140,110
Basic Rating Life Test Time	1.57 [Years]	72.98 [Days]

**Amsted Rail**

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