

## Client:

Metropolitan Water  
Reclamation District of  
Greater Chicago

## Location:

Chicago, IL

## Services Provided:

- Instrumentation of critical components
- Finite element analysis
- Remedial measure development

## Value Provided:

- Strain data supported revised wheel design enabling project completion with limited tire failure
- FEA-based modeling of empirical data at various load scenarios supported rapid retrofit of wheels
- Minimal delay in contractor schedules avoiding contractual penalties

## Background & Project Challenges

The North Branch of the Chicago River of Chicago's Tunnel and Reservoir Plan (TARP) tunnel project consisted of 50,000 feet of machine-bored tunnel, lined with concrete. For concreting, the contractor assembled a set of five cars which carried collapsible forms. Each car rode on four wheels running over a curved concrete invert. Within the first 2,000 feet of concreting, several of the tires experienced catastrophic failure. This problem posed a major threat to the project schedule and cost.

The challenge was to assess the failure and rapidly develop retrofit, working with the contractor, mechanical engineers and component.



## Geocomp Role & Accomplishments

Geocomp's first task was to determine the loads that were being exerted on the wheels. This needed to be accomplished without affecting the 24-hour concreting cycle. Geocomp installed strain gauges on the wheel supports during one cycle and monitored the loads during the following cycle. These measurements indicated that the wheels were overloaded.

Geocomp then assessed the stresses in the polyurethane of the wheels using the measured loads and finite element analysis (FEA). The analysis resulted in the development of a revised wheel geometry and polyurethane molding process. The revised wheels were placed on the cars. The remaining 46,000 feet of tunnel were completed with limited failures

The correction of the problems with the wheels was invaluable to the success of the contractor in lining the tunnel. Geocomp was able to aid the contractor in focusing on the problem by applying a unique set of skills. These skills include:

- instrumentation to determine the loads,
- finite element analysis to determine the stress in the wheels, and
- material behavior to design a better wheel.