Smart Bollard Project

Sponsor: City of Chico

Joseph Duval – Steven Israel – Mike Krasovic – Justin Sielsch

Faculty Advisor: Dr. Greg Watkins

PROJECT OVERVIEW

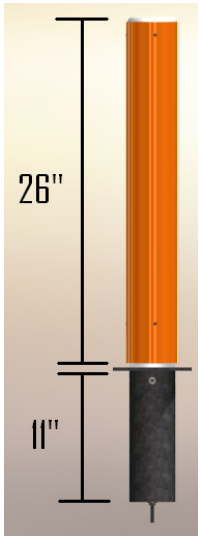
The purpose of this project was to replace existing bollards with a flexible design to reduce the risk of injury to cyclists while maintaining the appearance of a rigid bollard.

The constraints of the project included:

- Design must interface with existing Cal Trans standard concrete footing, steel pipe sleeve and eye bolt
- Bollard height matches current standard at 26 inches above the ground
- Looks like a rigid bollard

The objectives of the project included:

- Bollard absorbs minimal amount of a cyclist's energy upon impact
- Maintains upright position
- Minimal deflection due to high speed winds
- Easy to install
- Inexpensive

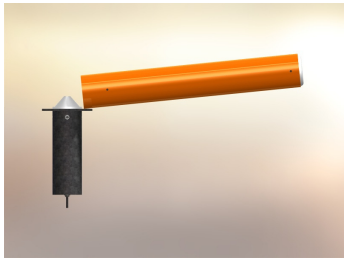


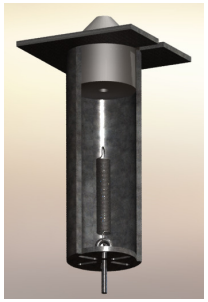
HOW IT WORKS

This bollard design implements a spring and cable system creating the ability to flex when impacted by a cyclist, reducing the chance of injury. It also serves as a vehicle deterrence by maintaining the appearance of a rigid bollard.

Benefits of the flexible bollard:

•Reduces risk of injury to cyclists
•Fits in the current standard footing
•Appears to be rigid
•Low maintenance & durable
•Comparable to cost of Cal Trans standard rigid bollard





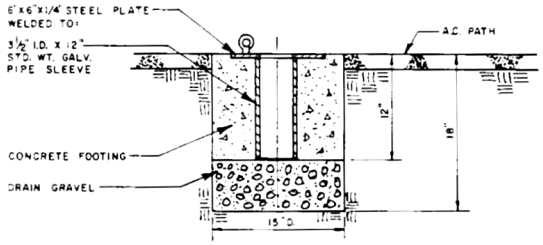
SPRING SELECTION

A collision analysis taking into account the worst case scenario, head on impact, was conducted using The Work-Energy Theorem to determine an appropriate spring rate. These results were combined with wind analysis results and yielded an acceptable spring rate range of 11-168 lbs/in.

The ideal spring will not allow the bollard to deflect due to high speed winds and will only absorb a minimal amount of a cyclist's energy. An extension spring with a spring rate of 15 lbs/in was selected for this design.

CALTRANS STANDARD

The current Cal Trans standard bollard is a rigid galvanized pipe anchored to a concrete footing, shown below. The Smart Bollard will interface with this footing in the same manner as the current standard rigid bollard found on all paved bike paths throughout Chico.



PROJECT OUTLOOK

The Smart Bollard will reduce the risk of injury to cyclists while maintaining the appearance of a rigid bollard. The durable design will allow it to serve it's purpose for prolonged periods of time with little to no maintenance.