Title

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Section 1: Introduction

The Brisbane City Council is proposing to allow bungie jumping off the story bridge. This report will check the validity of the claims from the bungie jumping company. This will be done by evaluated the claims that a standard jump will consist of 10 bounces over 60 seconds and that the bungie jumper will experience up to 2gs of acceleration. The report will also evaluate the validity of a photo opportunity for the jumper on the bridge deck as well as the possibility of implementing a water touch option for the jumper. This report will also calculate the max speed of the jumper and distance travelled by the jumper

These will all be evaluated using numerical solution find functions to solve for the velocity, distance and acceleration as well as numerical solutions to solve interpolation of those functions to implement the photo opportunity and root finding to solve for the water touch feature.

Section 2 of this report will describe the mathematical model used to describe the path and velocity travelled by the jumper. Section 3 will explore how the model described in section 2 can be solved using numerical methods. Section 4 will aim to solve the question outlined in the introduction with Section 5 summarizing the results from the prior sections.

Section 2: Mathematical Model

The following equation describes the net force experienced by the jumper throughout the jump at a given time ().

The equation is derived from the three forces experienced by the jumper being: earth’s gravity (), where m is the mass of the jumper and g is acceleration due to earth’s gravity, the drag experienced during the jump (), where c is the drag coefficient and v is the velocity of the jumper at a given time, and the tension of the rope (), where k is the spring constant of the rope used, L is the length of the rope and y is the displacement of the jumper from the platform at a given time. This can be simplified and then split into 2 equations.

Where and .

This model assumes that:

* There is no wind affecting the trajectory of the jumper
* The Jumper falls in a straight line from the Platform
* The Jumper does not jump off the Platform rather immediately starts falling
* The force due to Gravity is constant throughout the jump
* The drag coefficient remains the same over the entire jump, that is the shape and surface area of the jumper in the direction of the velocity does not change over the whole jump.
* The water level in the Brisbane River is always the same
* The rope does not stretch (altering its ‘normal’ length) or break throughout the jump

The limitations of this model include:

* The model does not consider