White Paper C

ZIP LINE BRAKE SYSTEMS

By ACCT Standards Development Committee

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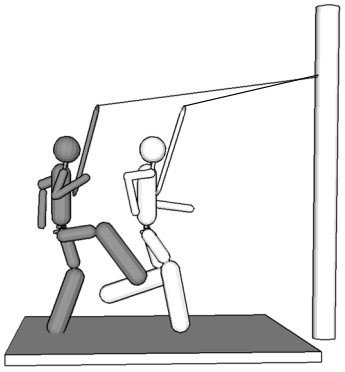
Zip lines vary widely in design and performance. There are many options for line material and construction, and unlimited options for pulleys and associated equipment. Many zip lines are designed with significant sag in the line (also known as belly), therefore gravity will act to decelerate the participant at the landing end. On zip lines that are designed with little sag in the line, the effect of gravity will accelerate the participant in the initial direction of travel and will not significantly decelerate the participant later. Depending on the design of the zip line, entry speeds at the landing area can be significant, and so may pose serious risk to participants and operators alike. Designers of zip lines, brake systems, and landing areas should take special care in accounting for the variations in speed at which participants might arrive.

Brake systems vary widely in character and complexity depending upon the design of the zip line. Some zip lines are designed to capitalize upon gravity or environmental factors such as wind resistance, while others utilize participant interaction such as applied friction with a gloved hand, and still others utilize a device(s).

The following are examples of commonly used brake systems:

1. Active: Gravity + Hand
   On a zip line that utilizes a gloved hand brake, the hand brake is initiated by the participant to control deceleration and stop in the landing area, and so would be referred to as an active brake. The hand brake is often accompanied with the effect of deceleration by gravity, so the two methods together, along with a proper level of instruction, could suffice as the primary brake in the system.

2. Active: Gravity + Feet
   On some zip lines gravity is utilized to slow the participant to a reasonable speed to be able to stride or step to safe arrest. This type of brake is initiated and performed by the participant and so is categorized as an active brake.



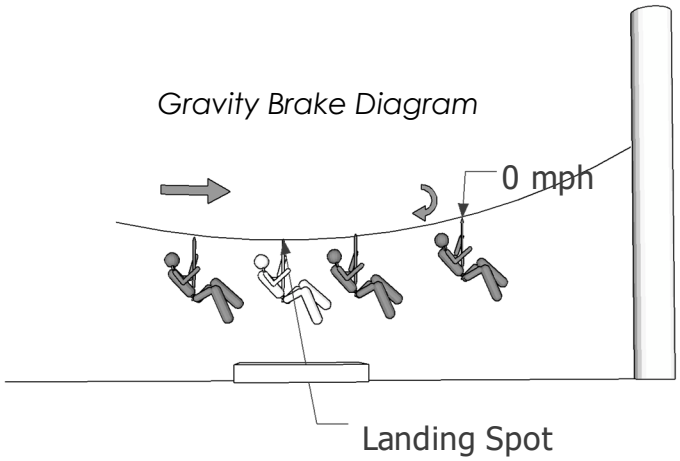
Striding Foot Arrest Diagram

3. Participant Passive
   Some brakes are designed to involve no action by the participant prior to or during arrest. These brakes are passive to the participant and are managed by the operator only. As an example, a brake system may use a traveling brake shuttle to couple with the trolley upon impact in order to arrest the participant away from the landing area, making it possible to then pull the participant into the landing area.

   Another example would be a simple rope and shuttle system where the guide stands adjacent to the zip line to slow the participant before arrival into the landing area. The operator could then simply grab hold of the participant and guide them into the landing area. These brakes can be utilized as primary or emergency brakes.

4. Automatic
   Brakes in this category require no action by either operator or participant to safely arrest the participant. Automatic brakes can be utilized as either primary or emergency brakes.

5. Gravity
   Finally, one of the most common braking systems is gravity alone, or the "gravity brake". This brake system is employed when at the end of the zip line traverse, the participant simply rolls back and forth in the belly of the zip line until coming to a stop. In this case, gravity is the only component of the primary brake, and if no possibility exists of striking anything during normal operations, the zip line will not require an emergency brake.



Further clarifications:

- On zip lines that require an emergency brake, the emergency brake function may be integrated into the primary brake system as long as it acts independently from the primary brake.
- It is generally understood that padding used as a protective element in the landing area does not constitute a brake component.