DATE: 21 August 2017

SUBJECT: zipSTOP Over-speed Events

This notice supersedes any previous notices regarding zipSTOP over-speed events.

After a limited number of reports of sudden webbing wear with the zipSTOP device, the Head Rush engineering team initiated a six week investigation into conditions that could lead to this type of event. The engineering team reviewed manufacturing tolerances and procedures, site specific conditions, and performed a large number of devices tests. At the conclusion of this investigation, Head Rush found that the only condition where this sudden webbing wear occurs is when a device experiences a significant over-speed event. An over-speed event is defined as any arrival speed above the speed outlined in the product manual for a given configuration.

The zipSTOP manual states the maximum rider arrival speeds as outlined below:

- zipSTOP
  - 1:1 Configuration – 36km/h (22 mph)
  - 1:1 with Pivot Mount – 36 km/h (22 mph)
  - 2:1 Configuration – 60km/h (37 mph)
  - 3:1 Configuration (not recommended) – 72 km/h (45 mph)
- zipSTOP IR
  - 1:1 Configuration – 60 km/h (37 mph)
  - 1:1 with Pivot Mount – 60 km/h (37 mph)

The zipSTOP manual also stipulates that the maximum rider weight must not exceed 150 kg (330 lbs). All participants should be weighed with equipment to assure they do not exceed the device specifications.

The zipSTOP should not be used if weights and/or speeds above these operational requirements are experienced. Other conditions, such as not allowing the webbing to fully retract, can exacerbate the sudden webbing wear concern (a webbing extended as little as 2 meters can cause a 16% increase in the maximum braking force).

The zipSTOP Zip Line Brake is robustly built and is designed to include a factor of safety. However, we found that significant over-speed events can cause damage to the internal components and lead to sudden webbing wear or increased likelihood of sudden webbing wear. The serious nature of this damage reinforces the importance of not allowing over-speed events. The damage caused by over-speed events is not apparent on the

exterior of the device, but there is readily apparent indications of over-speed on internal components. The only external indication would be instances of rapid or sudden webbing wear, indicating the device would need to be sent for service.

If your zip line is designed to the maximum speeds allowed by the zipSTOP, it is critical to routinely measure rider arrival speed and cease operations when conditions exist where over-speed events may occur. To reduce the possibility of inaccurate judgement calls by staff, it is recommended to measure the

speed of all riders using a radar gun to assure that over-speed events do not occur. Conditions that may result in over-speed events include, but are not limited to, weather conditions such as tail winds, temperature and humidity, rider weight, rider orientation and any combination of these items. It is also important to guide customer behavior to prevent over-speed situations. This includes instructing riders to not "cannonball" or ride in a position that minimizes wind resistance (i.e. prone or seated "pencil" positions).

Please note that Head Rush cannot endorse or approve any zipSTOP or zipSTOP IR device installation outside the operational range outlined in the installation manual. Zip lines that routinely experience conditions leading to over-speed events should modify their zip line or operation parameters to stay within the speed limits on the zipSTOP. When using the zipSTOP or zipSTOP IR as a primary brake, the installer MUST utilize an independent emergency arrest device that has been independently tested at operational speeds to protect against unforeseen issues. Design, installation, inspection and maintenance of the zip line, including the complete braking system, is the responsibility of the installer and operator.

Measuring Arrival Speed

Determining maximum participant arrival speed on a zip line is imperative. Luckily, measuring maximum arrival speed is not difficult with the proper tools.

It must be noted that environmental conditions such as temperature, wind, precipitation, and rider position can have an enormous effect on participant arrival speeds. For example, rider arrival speeds can vary by 30 mph (48 kph) due to changing wind patterns. Therefore it's imperative to measure arrival speeds when the weather creates the fastest riding conditions for each zip line. For example, if a zip line experiences changing wind patterns, measure the arrival speed when there is a tail wind.

A rider will travel the fastest in cold weather, on a wet line, with a tail wind, on a worn in trolley and in a prone position. It is vital to perform arrival speed measurement when the environmental conditions create fast riding conditions.

Necessary Tools

- Radar Gun or other speed measuring device: Some options for radar guns are, Bushnell Velocity Speed Gun or an All Purpose Pocket Radar Gun. Other speed measuring devices are acceptable as long as the speed measured and recorded occurs immediately before braking is initiated.

Steps to Measure Arrival Speed

Important: Always perform unmanned testing to determine arrival speeds upon commissioning of the line and to test any new or modified braking installations prior to sending individuals down the line.

1. An operator at the terminal end of the zip line will take and record arrival speeds using the radar gun.
2. As soon as the rider trolley and weight are visible to the operator, they should point the radar gun at the rider trolley and begin measuring the speed.

a. If the Bushnell Velocity Speed Gun is used, it will begin to measure speeds when the rider trolley and weight are ~300 ft (91 meters) or closer from the operator.

3. Immediately before the rider engages the primary brake, the operator should evaluate and record the speed of the rider trolley.
    a. Please note: The maximum speed shown by the radar gun is most likely not the arrival speed. It is likely that the zip line levels out near the terminal pole and riders speed decreases as they approach the primary brake. Be sure to record the speed immediately before the participant engages the primary brake. Always follow the manufacturer's directions of any speed measurement device. When using a radar gun, measurement should be taken in line with the direction of travel without moving the gun. Measurements taken from the side or at a high angle may be inaccurate.
4. It is recommended to record the wind speed and direction during testing using an anemometer at the launch or arrival platform (do not depend on phone based weather apps). This will help determine how wind affects rider speed. A pivoting anemometer is recommended to accurately determine speed and direction.