

# Technology

Vulcan has developed (HDT) High damping technology, capable of (**dispersing, absorbing/transforming and damping**) impacts (2m/s 3/m/s low frequency/medium impact and **4m/s** high frequency/very strong impact).

VTECH is the first soft helmet specially developed to protect people with special needs, including very young children, people with osteogenesis, loss of balance, epilepsy, autism, and in general people who require specialized protection etc ...

### Patents

- International # PCT/IB2019/058536
- United States (US 17/211,615)
- Mexico (MX/a/2021/004178)
- Spain (ES P202190021)

Vulcan has an international patent on invention that protects intellectual property, design, technology and production process.

### **ASTM Standards**

- ASTM F1446-2015b
- ASTM F2397-2009

Impact tests carried out by **ICS**; one of the 3 most recognized impact laboratories in the USA, guarantees that VTECH approves ASTM standards, and improves the standards by a wide margin.

## Materials

The matrix with special patented formula for impacts, Vinyl free, Phthalate free, Latex free, hypoallergenic materials, prevent the formation of fungus, is easily washed and disinfected, the materials are approved by the (FDA).



## **Measurement parameters**

- A1- A2.- Peak acceleration Maximum acceleration to which the head is subjected. Measured in gravitational forces (g).
- **B1- B2**.- Head Injury Criterion (**HIC**) Relationship between maximum acceleration and duration of impact.



#### A1.- ACCELERATION GRAPHICS (G) 3m / s

The test applies three impacts in a row to the same area of the hull.

According to the standard, in an impact at **3m/s** the result must not exceed an acceleration of **100g**, VTECH obtained min **58g**, max **79g**, being the only one that remains below 25% probability of concussion.

All other hulls were hit only once and obtained more than **100g** above the limit established by the ASTM standard and exceeded the 75% probability of concussion.



#### A2.- ACCELERATION GRAPHICS (G) 4M/S



#### This test applies a single impact to the helmet.

According to the standard, in an impact at **4m/s** the result must not exceed an acceleration of **300g**. VTECH obtained min **82g**, max **121g**, being the only one that remains below 75% probability of concussion.

The other helmets obtain more than **300g**, above the limit established by the ASTM standard, and exceeded the 75% probability of concussion.

Below, the following graphs are presented that detail how in the case of the **HIC the** percentage of risk is studied more.



#### B1.- GRAPHICS (HIC) 3m/s



**B2.- GRAPHICS (HIC) 4M/S** 





In the case of **HIC**, the percentage of risk is studied more.

According to the impact we can observe how VTECH maintains low level of risk of suffering minor, major, critical or fatal injuries.

The more the impact velocity increases, the greater the difference between VTECH and regular helmets.

VTECH remains below **330 HIC** which corresponds to **AIS code 1** (headache and dizziness) as indicated in Table #1.

The other helmets exceed **1,980 HIC** to **2,107 HIC** which corresponds to the **AIS code 5 and 6** (risk of fracture s, large bruises, unconsciousness + 25 hours, serious injuries or not surviving) as indicated in Table #1.

#### TABLE #1

Head Injury Criteria	AIS Code	Level Of Brain Concussion And Head Injury
135 – 519	1	Headache or dizziness
520 – 899	2	Unconscious less than 1 hour – linear fracture
900 - 1254	3	Unconscious 1 – 6 hours – depressed fracture
1255 - 1574	4	Unconscious 6 – 24 hours – open fracture
1575 – 1859	5	Unconscious greater than 25 hours – large haematoma
<mark>&gt;1860</mark>	6	Non survivable

Table 1. Levels of Consciousness In Relation To Head Injury Criteria [46]

## ACCELERATION GRAPHICS AGAINST TIME

Graph **C1.** - In **3 m/s** VTECH is the only one that remains below 25% probability of concussion and also below what is established by the norm of an acceleration of 100g., in the case of MACHO we can observe a damped behavior, but above an acceleration of **100g**, limit established by the standard. The remaining helmets have a behavior without damping.

Graph C2.- In 4 m/s, VTECH is the only one that remains below what is established by the norm of an acceleration of **300g** and maintains the damped behavior while the other two do not.

It is worth mentioning that an unmuffled behavior generates an increased risk of brain damage due to the oscillation of accelerations in the brain due to aftershocks or small waves after impact, these waves mean that after the impact the brain continues to bounce against the cranial cavity causing severe brain injuries and death.







V= VTECH M=MACHO G= GAME BREAKER W= WINNING



Graphic C2 V= VTECH M=MACHO W= WINNING







V= VTECH M=MACHO G= GAME BREAKER







## **GENERAL CONCLUSIONS**

The soft helmets existing in the world market only cushion impacts of **2m/s**, being inefficient since most of the blows or falls are in a range of: **3m/s**, **4m/s** and **5m/s**, so the user's brain will have irreparable or fatal damage using these helmets.

As for rigid helmets are unsuitable for medical use since a rigid material without an adequate internal cushioning system is totally inefficient, in addition to being heavy, foggy, they can cause damage in some cases such as autism when self-lacerating the user would hurt his hands when hitting a rigid helmet.

VTECH has developed state-of-the-art technology, first generation materials that ensure excellent performance in shock absorption, protection, vision, ergonomics, comfort, lightness, durability, resistance and versatility undoubtedly the best soft helmet worldwide that covers a wide variety of uses, recommended in the medical market that requires reliable protection against impacts up to **4m/s**.

VTECH is the only soft helmet recommended for medical use that reduces the probability of suffering a concussion to only 7.5% in an impact of 4m/s, against other helmets that have more than 75% chance of suffering a major concussion, skull fractures or fatal damage.

## **Custom helmets**

Helmets, which can have unlimited presentations of color, prints, figures etc., have the versatility of being able to add reinforced bras, face protective micas and internal comfort pads, according to the needs of use, inside and outside the helmet. Attached photo file helmets boy and girl and others.