



## **Impakt Safety Padding Systems for Speed Skating and Short Track Speed Skating Test and Technical Information**

### **Introduction**

The following presentation of products as well as technical informations and tests has the aim to inform the International Skating Union with its bodies about the improvements reached in the sense of protection for athletes participating in Short Track and Speed Skating events. Due to the high speed reached in both of the disciplines the standard of protection has to guarantee a level of safety which can help reducing the risk of injuries to a minimum. The protection mats and systems are a result of years of experience and researches in different Sports conducted by the company Bortolotto. The company, using its know how, consultancies of experts, athletes of high level and in collaboration with the world wide distributor Impakt Sport Equipment S.r.L., was able to create a wide range of protection products for Speed Skating and Short Track Speed Skating.

As a supplier of protection mats for the Short Track Competition and Training Venues and the Speed Skating Oval Lingotto during the Winter Olympic Games Torino 2006 the Company was able to fulfill the high demanding requests of the Sports Department of the Organizing Committee. The innovative systems used at the Olympic Winter Games in Torino confirmed the quality of the products, reaching performances superior to what expected, with no injuries for athletes during the whole training and competition period.

The particular inside structure and solutions of materials and the testing results allow to consider these mats as protection system of new generation.

Herewith we would like to give you some informations about testings and technical specifications.

### **General Technical Specifications**

The protection mats for both Short Track and Speed Skating are having size and shape as per recommendation of the International Skating Union in order to fit the needs of protection. What is differing in our products compared to the presently used protection mats is related to the new inside structure, the cover sheet and the set up of the padding system with poles and belts for the moveable Short Track and Speed Skating systems and the high level results achieved for the traditional Short Track mats used with Ice Hockey rink boards. One of the main challenges was





to guarantee a high safety for athletes, a soft impact and the almost totally reduction of the dangerous bounce back effect. These specifications and details will be explained further on. Four different types of protection paddings are presented and identified with a specific code:

- *Impakt Safety One* - Moveable system for Short Track Speed Skating without ice hockey boards
- *Impakt Safety Two* - Traditional system for Short Track Speed Skating with the use of traditional ice hockey boards
- *Impakt Safety Three* - System for Short Track Speed Skating with a smaller width to be used for young skaters at ice rinks with traditional ice hockey boards
- *Impakt Safety One Speed Skating* - Protection system for Speed Skating Ovals

### 1. Features of the protections

The protection systems are formed of single pieces connectable between each other. Each single mat, is composed of an outside cover sheet and an inside element which is able to absorb the impact speed. The dimension of the different elements are in function of the type of activity and the degree of protection that is requested.

- Short Track moveable system (*Impakt Safety One*)

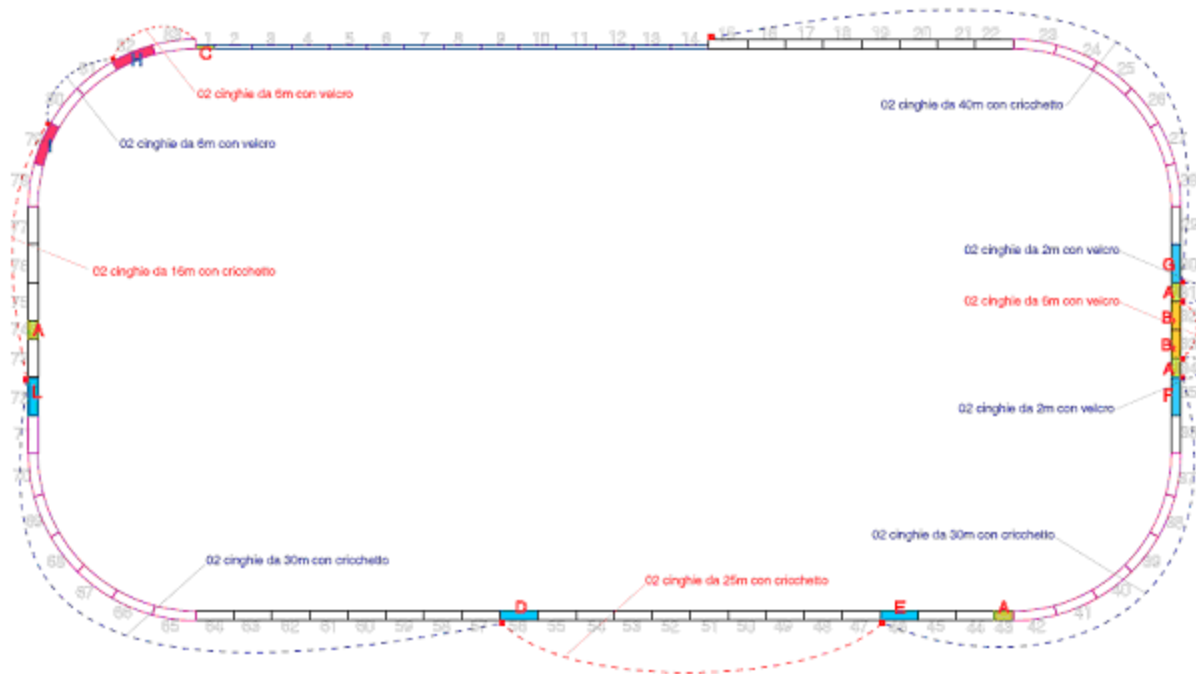
The main purpose of the moveable system is to remove the rigid part behind the mats which are the traditional ice hockey boards present in all the ice rinks. These rigid boards are replaced by single poles and belts which are tightened to keep the padding system in place. As the word moveable explains the mats are able to move to the outside of the ice surface in case of impact by guaranteeing the highest level of protection for the athletes. The layout of the Short Track moveable system without rink boards will be personalized based on the dimension and the area surrounding the ice surface. Based on technical details and exact drawings of the ice rink, a certain number of poles will be fixed on the concrete surface as well as a certain number of poles to allow the entry and exit of the skaters and the ice resurfacing machines.

The area around the moveable system especially in the dangerous corners has to be free from any obstacle and at least 1 meter of space shall be available as shown in an example drawing below



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The mats are connected to each others with velcro straps which also avoids to have blades stucked between the single mats in case of falls which can result in twisted or broken ankles. All the mats are fixed to the ground in order to avoid athletes passing underneath and a continuous control of the tension of the belts as well as the correct placement of the mats is needed. 30 cm of the width of the mats are directly laying on the ice whilst the other 20 cm are off the ice. Each single mat as a net on top of which the inside air of the vertical columns can extrude. Details about it are explained in the specific section.

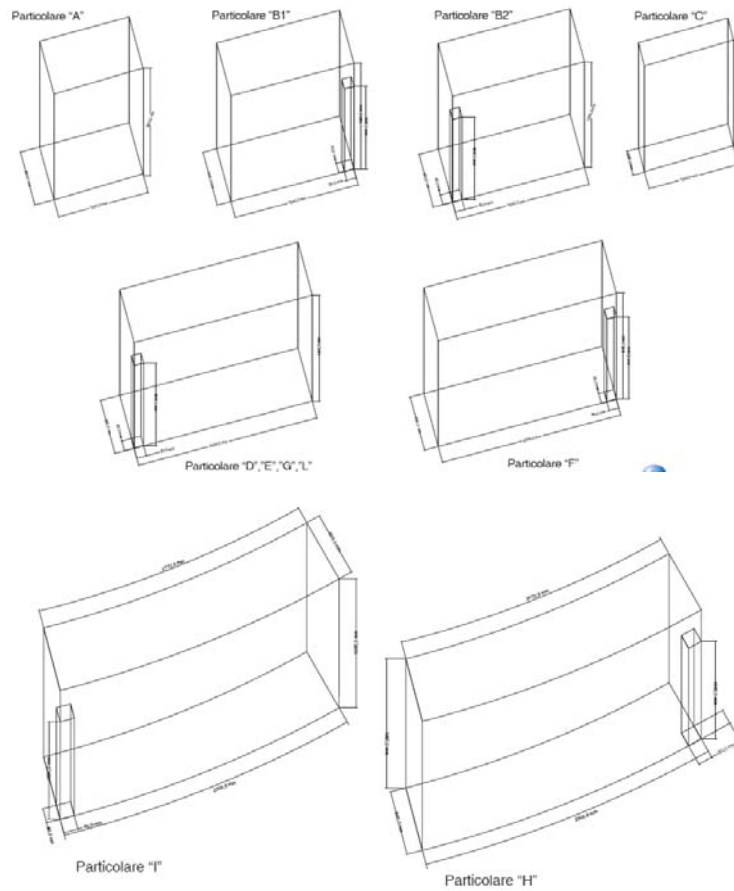
All the corner mats are shaped in order to give the correct size and shape of a traditional ice hockey rink which allows in this case also activities for Figure Skating athletes. To fit perfectly also for this purpose, removeable kick plates are available which can be fixed for high level Figure Skating competitions.

The protection mats of the moveable system are having a width of 50 cm, length of 2 meters and height of 120 cm. For entry and exit doors mats of 1 meter length are used.

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## Images and details



Overall view of a moveable system used during the Olympic Winter Games in Torino. Official Compétition Venue Palavela.

Note: All the protection mats can be personalized with imprinted logos or image and look design

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View of the single poles and the belts . Additional protection for the single poles can be delivered



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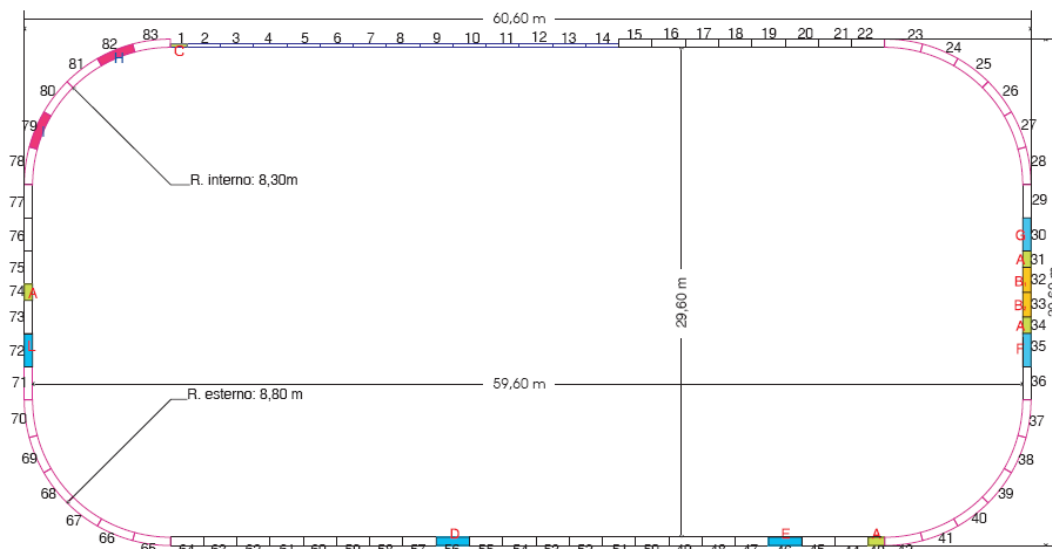
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- Short Track traditional system (*Impakt Safety Two*)

The *Impakt Safety Two* mats are used with traditional ice hockey boards by placing the mats directly on the ice. The padding is of new generation after lots of studies and prototypes by taking in consideration the basic materials and inside structure of the “*Impakt Safety One*” moveable mats. The main challenge was to achieve high protection results by reducing the width taking also in consideration that a rigid surface would remain behind the mats. Although the result of protection is reduced compared to the moveable system these mats have reached an enhancement of 38% compared to the present standard mats recommended in the ISU communication. This therefore guarantees a high improvement of safety for the athletes. In order to fit the usual needs and width to which all the athletes are used, the size was reduced to 40 cm whilst the height (120cm) and length (200cm) remain the same as well as the inside structure and the air extrusion through a net on top of the mats.

Each single mat is connected through velcro straps and the placement is extremely simple. All the mats can remain for very long periods in direct contact with the cold ice surface without altering the specific protection features. Customized mats for entry and exit doors are available and the specific layout and the exact number of mats is established on a drawings of the single ice rinks.

Example of layout



The mats in the corners are not shaped but will be as all the other mats of rectangular shape as they lean against ice hockey boards.

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- Short Track traditional system for young skaters (*Impakt Safety Three*)

These protection mat system has a reduced width of 30 cm and is studied to fit the needs of ice rinks which are not having high level Short Track activities and are considered to be sufficient for young skaters. The inside structure differs from the other two systems mentioned above although the level of protection is still at a very good level.

- Speed Skating moveable protection system (*Impakt Safety One Speed Skating*)

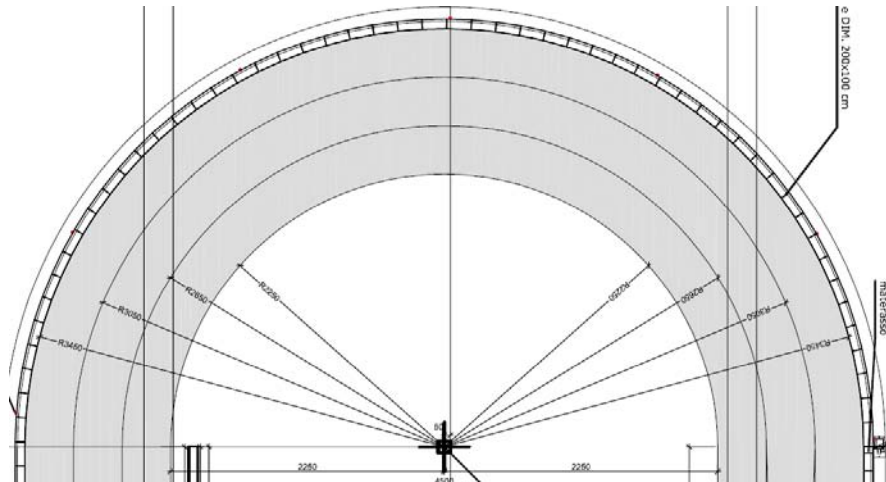
In Long Track Speed Skating, the athletes are achieving speeds up to 60 kilometres per hour and therefore demands an high quality protection system in order to guarantee a safe impact and reduce to a minimum the bounce back effect. Also taking in consideration that athletes are not wearing any kind of body protection, for this reason the padding has to be of high quality and avoid any kind of friction or dangerous hard edges.

Based on the Short Track moveable system and experience, a similar inside structure was adopted as well as the connection with velcro straps and the layout of the track and system with poles and belts which allow the mats to move slightly to the outside of the ice surface at the moment of the impact. 40 cm of the mats are laying on the ice while other 40 cm of the mats are off ice. The mats are fixed on the ground to avoid athletes passing underneath which can result in dangerous injuries. At the moment the athlete hits the mat air will extrude through a net placed at the higher part of the mat. For outdoor rinks the net is placed at the backside of the mat covered with a light vinyl layer in order to avoid foam absorbing snow and rain.

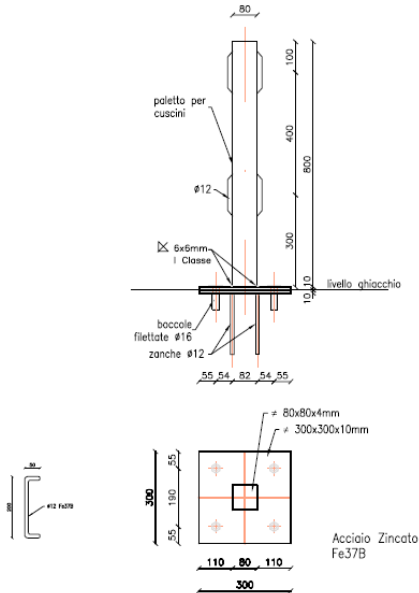
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Details of the poles:



Based on technical details and exact drawings of the ice rink a certain number of poles will be fixed on the concrete surface as well as a certain number of poles to allow the entry and exit of the skaters and the ice resurfacing machines. The area around the track should be free of obstacles in a range of 1 meter to allow the padding to move to the outside of the ice surface.

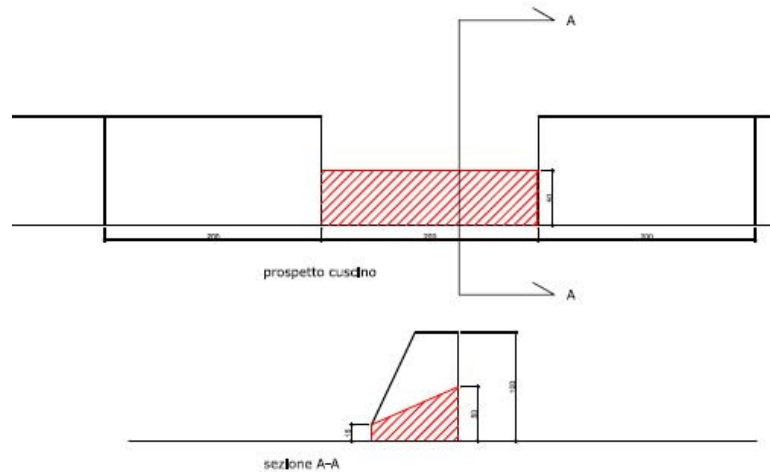
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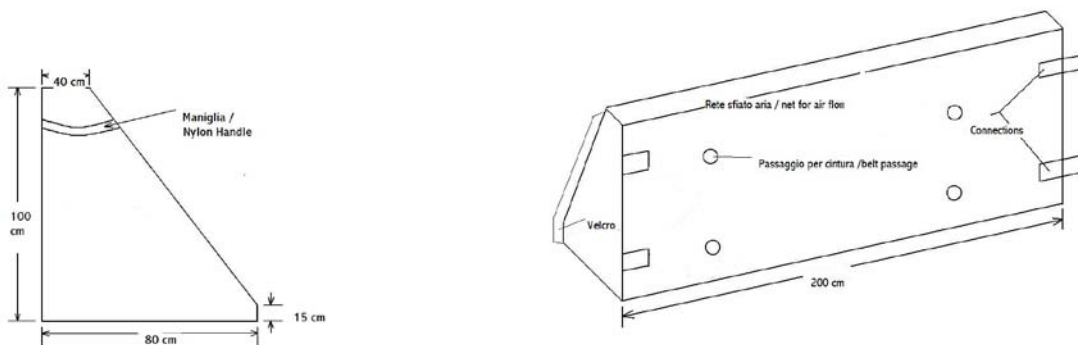
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Additional poles will allow entry and exit from the outside. Special low mats at the finishing lines are placed for correct photofinish and timing equipment data collection.



The Speed Skating mats are not having a rectangular shape. The bottom width is 80 cm, the height is 100cm (can be increased to 120cm if needed) and the top width is 40 cm. This solution allows to have a perfect viewing angle for the spectators all around the track.



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Images and details:



Details of the belts.  
The light blue net on top of the mats is visible through which the air can extrude.

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The cover sheet can be personalized with image and look design as well as logos.

Velcro straps at the bottom and top edge allow easy placement of banners

## 2. Cover sheet material (for all the *Impakt Safety* protection mats and systems)

The cover sheet is made in woven Btex®, yield of deep researches and experimentations. Btex® beyond being a recorded brand, is a material that is used exclusively by the Bortolotto company.

The woven has a special superficial engraving, specially studied to confer the covering an excellent antiabrasiv result. Btex® has an excellent mechanical resistance, supports high thermal jerks and guarantees therefore the softness to up to -20 degree celcius and a considerable duration in time. Therefore the mats can be placed and left for long periods on the ice without getting stiff and hard, as it happens normally with traditional nylon an pvc covers. Besides these features, Btex® is fireproof, antiallergical, sanitized, waterproof and easy cleanable, has a good resistance to the UVA rays and can be personalized by digital printings.



This material comes in two different thickness which can be chosen to fit specific needs

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Characteristics:

	U/M	Value
<b>Btex® 1</b>		
Weight	g/mq	600=10%
Thickness	mm	1,1=0,2
Lengthwise breaking load	N	>400
Transversal breaking load	N	>200
Stretching to transversal disruption	%	40:100
Stretching to lengthwise disruption	%	130:200
Fireproof	-	Class 2

### 3. Particularity of the covering

The protection systems are realized with special openings by using a synthetic net. The surfaces of the net are dimensioned to exude the restrained air at the inside of the protections with a precise relation between speed and time of evacuation.

To make the use of the protections also feasible for open air Venues, the net can be covered with a special membrane that allows the exit of the air and hinders water to enter.

Considerable functional is the free system of protections (without rigid boards) realized with poles. Straps of high resistance and controlled tension, placed at different heights at the back side of the protections guarantee an even higher absorption of the impact speed and avoids the bounce back effect.

The protection systems foresee special elements to couple the single mats and appropriate systems to fix the protection mats to the rink boards.

Special cut resistant textures are under evaluation and testings for a future application, with the main goal to keep the softness of the cover sheet.

### 4. Inside structure of the single mats (for all protection mats and systems)

The excellent results of the protections are reached with a special inside structure made of different layers of foam.

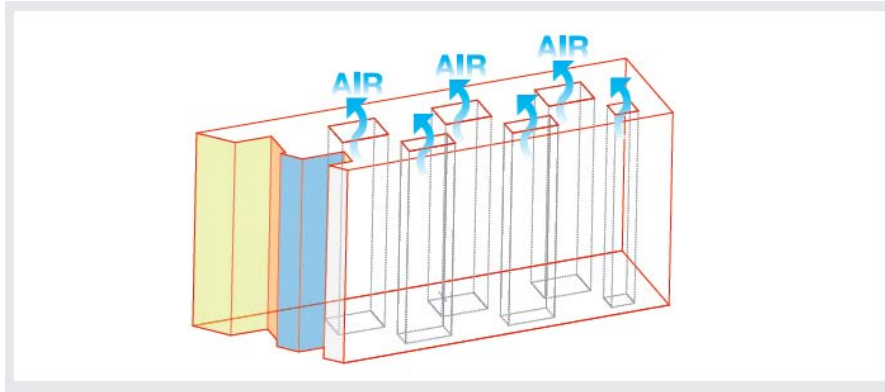
The front part is made of a special shock-absorber with slow memory, able to absorb the first phase and speed of the impact, avoiding a severe impact for the athlete. The other components of the protections are realized with different layers of foam with different density and an open cell structure. This open cell structure is studied to guarantee the right proportion between air volume and foam mass, mandatory for the correct cushioning and reduction of speed of the colliding athlete.

The foams are specially chosen based on their compression factors and deformation, which at the moment of the impact have to compress to a limited extent, evacuating the air across the appropriate open air channels. Each single system has different inside structures which were

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especially studied and tested to reach the highest possible impact force and bounce back reduction.



The internal part of the mat is made up of several kinds of foam, which have different thicknesses and shapes. Viscoelastic foam and rebounded foam have a real efficacy. The viscoelastic low resilience foam has been engineered and performed for the aerospace industry for the positioning of astronauts. With the aim of obtaining the maximum distribution of the compression load in static and dynamic conditions. The viscoelastic low resilience material is self-shaping: this property allows distributing the body weight uniformly on the whole surface, avoiding some parts being overweighted. The viscoelastic foam comes back to the original shape even after heavy and long term pressure and assures a good shock absorption. The foam, with its completely open cells, assures an excellent speed of air escaping. An agglomeration is by definition a compacted material, obtained from hot-pressed particles (granules) mixed with substances that will in turn glue the elements. An agglomeration offers an optimum resistance to compression over time, which is different from a normal foam. It has a compressed cellular structure instead of a free structure. Therefore, not like a normal foam, the cells, being already compressed, suffer a minimally negligible deformation with time. A greater compression of the mix corresponds to an increased agglomeration density and therefore the greater density corresponds to a better resistance to compression.

## Tests

In the months of June and July 2007 the company Impakt Sport Equipment s.r.l. and Bortolotto s.r.l. presented the prototypes of the protection mats for Short Track and Speed Skating to the University of Engineering, Mechanical Engineering Department of Torino for the evaluation of the impact force reduction to be compared with the ISU standard.

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The tests were conducted by using a drop test system with the parameter, weight and procedures similar to the one indicated in the ISU rules. Although in several cases pendulum tests are performed the drop test is a very simple test that can be done in many testing centres and allows easy comparison of data. It takes in consideration also the worst case of collision as a normal body impact would have a distribution of the speed and impact zone over the whole body and not a very small part as the drop mass.

As a first step the protection mats with the present ISU specifications were tested. The internal foam material was exactly the same as per ISU specifications. The outside cover was much softer, therefore the results of the ISU mats was better than the real situation based on ISU specifications. This first test evaluation was mandatory to set the testing machine and to be able to compare all the subsequent data of the new protection mats tested afterwards.

The second scientific test was conducted on the prototype with a width of 50 cm with the code "Impakt Safety One" studied to be used as moveable system without rigid boards. During this test a special frame was placed underneath the mat in order to create the same flexibility, the same movements as the vertical system without boards. This helped to guarantee the real application of the mats and the correct impact force reduction and distribution.

The same mats were placed also directly on the concrete floor to determine the impact force reduction without the use of poles and belts.

Afterwards several mats were tested until finally the 2 best were identified with the requested width of 40 cm studied to be used as normal at the inside of the ice rink boards. These mats have the code "Impakt Safety Two". The results were excellent, reaching almost the same values as the 50 cm mats having a reduced width, which can comply with the ISU specifications.

As final solution also a protection mat with a width of 30cm was tested which can be used for Junior level skaters which has the code "Impakt Safety Three".

By analyzing the data, also the test on the speed skating prototype with code "Impakt Safety Speed Skating" were excellent reaching almost the results of the Short Track moveable system.

## Results

Maximum vertical acceleration measured (m/s<sup>2</sup>)

Model	Notes	H=1m	H=2m	H=3m	H=4m
<b>ISU Standard</b>		<b>119,1</b>	<b>192,7</b>	<b>261,7</b>	<b>324,9</b>
Impakt Safety One	Moveable system	30,3	40,8	55,7	68,4
Impakt Safety Two		63,2	105,6	149,2	199,8
Impakt Safety Three		82,6	157,3	163,6	-
Impakt Safety One Speed Skating	Moveable system	41,3	60,3	81,7	100,7

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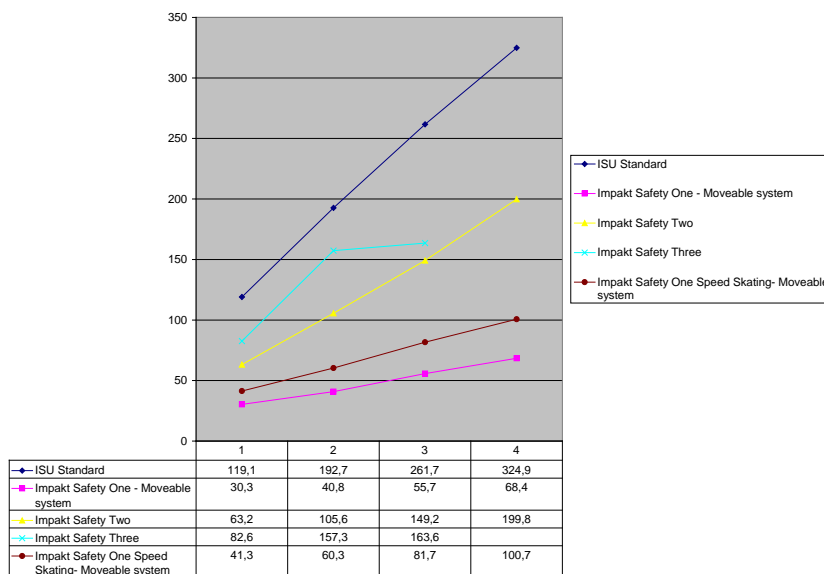
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The new mats performed extremely well in comparison to the present ISU standard. Impact forces in drop test were reduced significantly.

Taking in consideration the max speed the different systems performed as follows:

- *Impakt safety One* the moveable system (OWG Torino) an enhancement of 78,9 % compared to the present ISU standard
- *Impakt Safety Two* an enhancement of 38,5 % compared to the present ISU standard
- *Impakt Safety Three* an enhancement of 37,6 % at a reduced speed and drop height of 3 meters



Note: lower values are considered as best values for the safety of the athletes.

As mentioned in the short explanations above the main goal of the new paddings systems studied and manufactured by Bortolotto and Impakt Sport Equipment S.r.l. was to achieve an excellent protection for the athletes which would allow them to have a soft impact and avoid the dangerous bounce back effect which could result in other severe injuries by being pushed back to the racing lane.

A couple of sequences of images will clearly show how the mats are working and how the athlete will remain close to the protection mats.

It is not the intention to show images of low standard safety products and the severe injuries that might be a consequence of not being able to absorb the impact force nor is it the intention to give comments on other products available on the market.

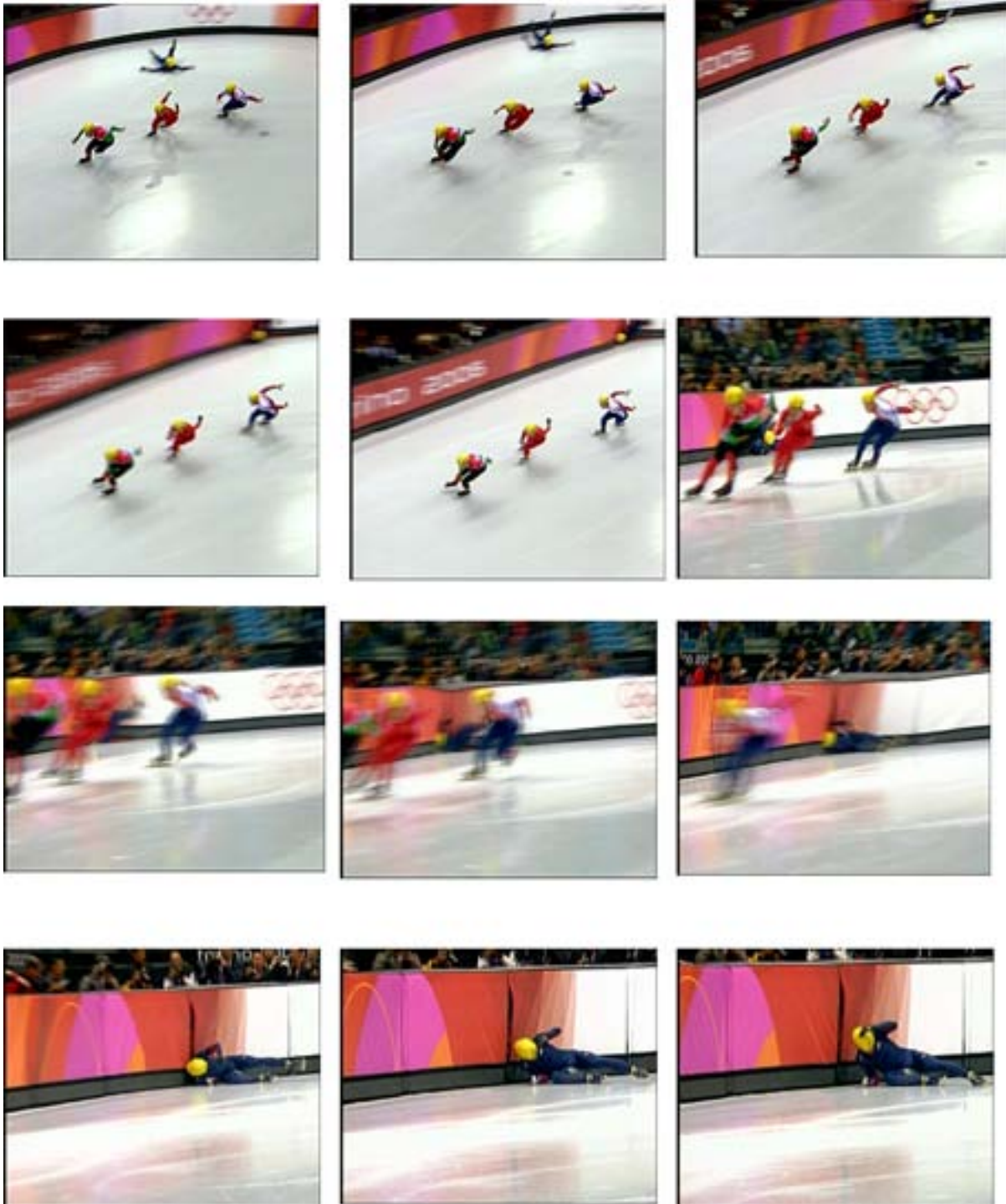
**It shall also be understood that no system although being at high level, may cancel completely the risk of injuries, but it should be the intention to reduce this risk to a very low percentage**

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Sequence of short track images



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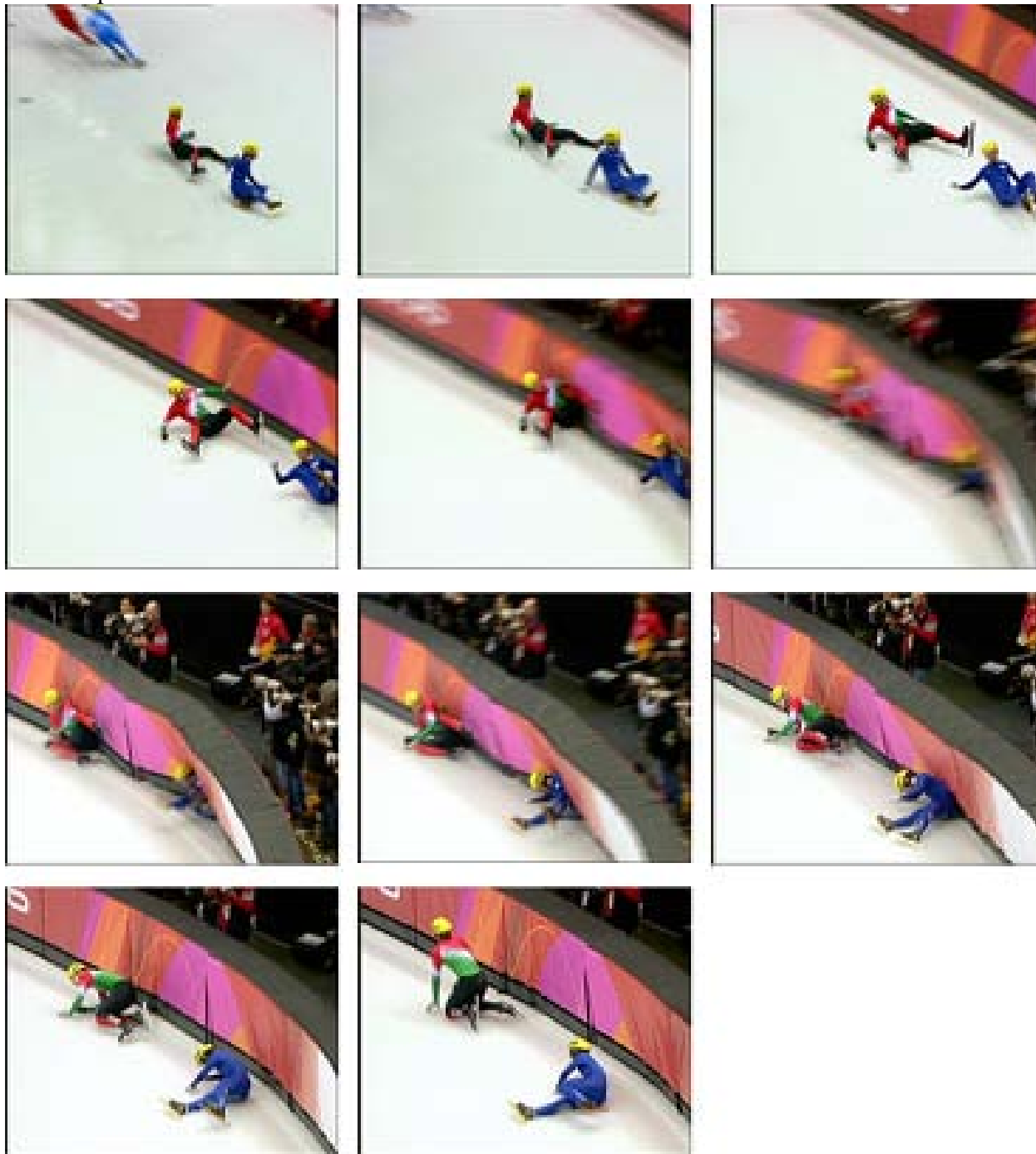
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other sequence



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Sequence of speed skating images



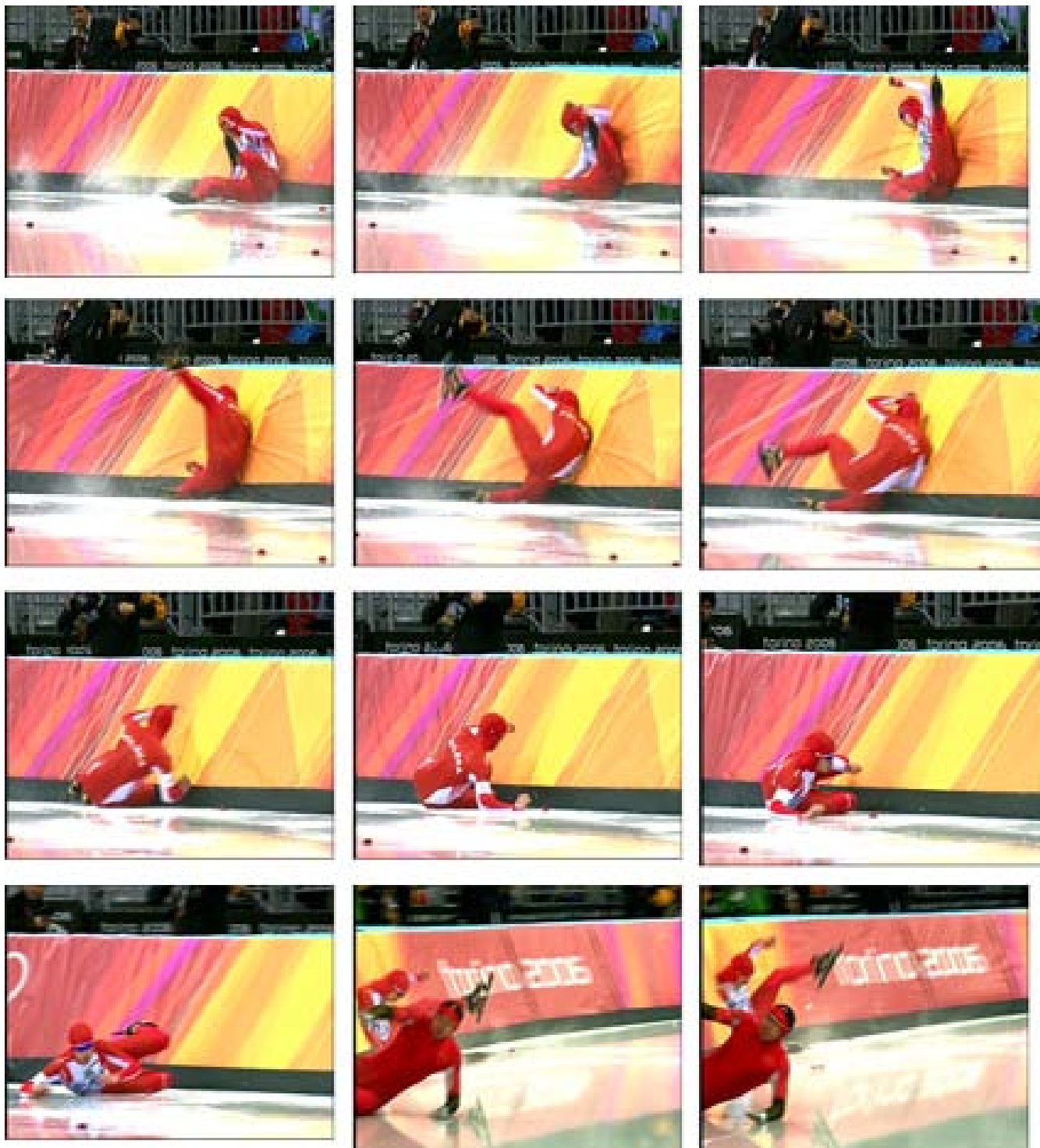
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## Conclusion

The main objective was to gain a more insight view of the impact conditions and to achieve a high standard protection for the speed skating and short track speed skating athletes. Several tests, and the Olympic Winter Games in Torino as well as other competitions with these mats in place have proved that this goal was achieved. For this reason it was the intention of the company to present some technical specifications and make the informations available to the International Skating Union and to the respective Members .

It is also the intention to provide assistance as well as detailed offers in case of interest which will certainly fit all the different needs and wishes.

Kind regards  
Impakt sport Equipment s.r.l.  
General Manager  
Diego Cattani

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