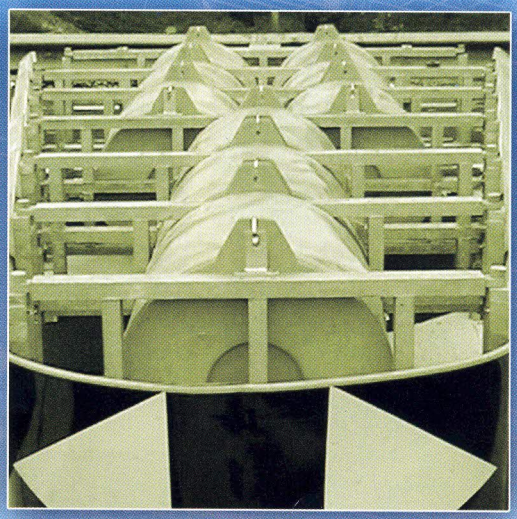
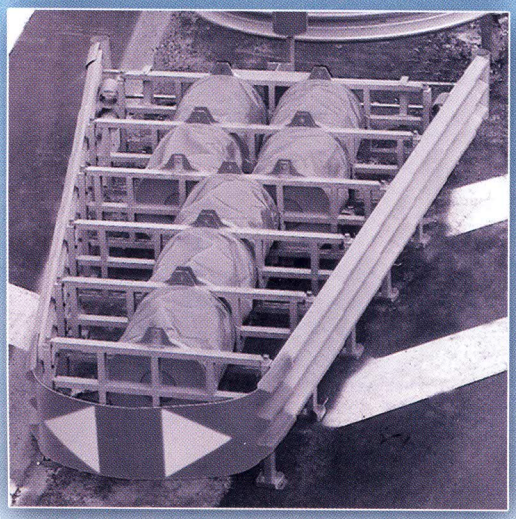
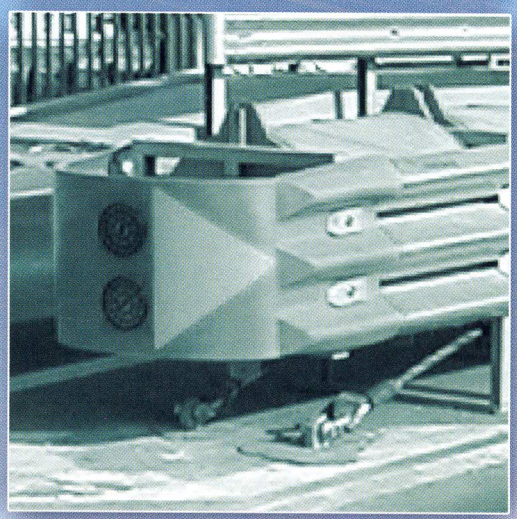
TAU®

Crash Cushion





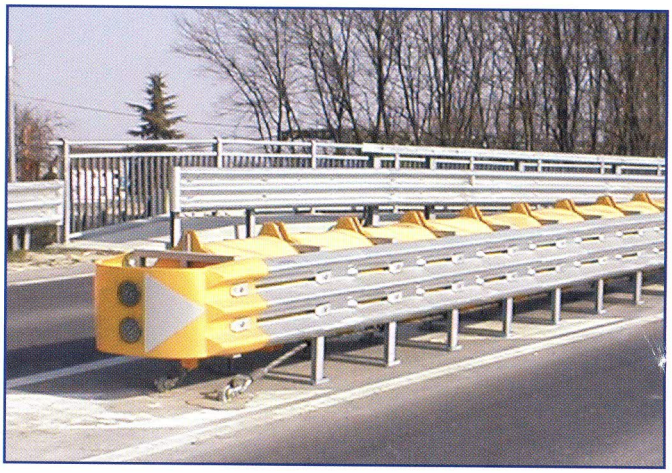


Road Safety

TAU® Crash Cushion

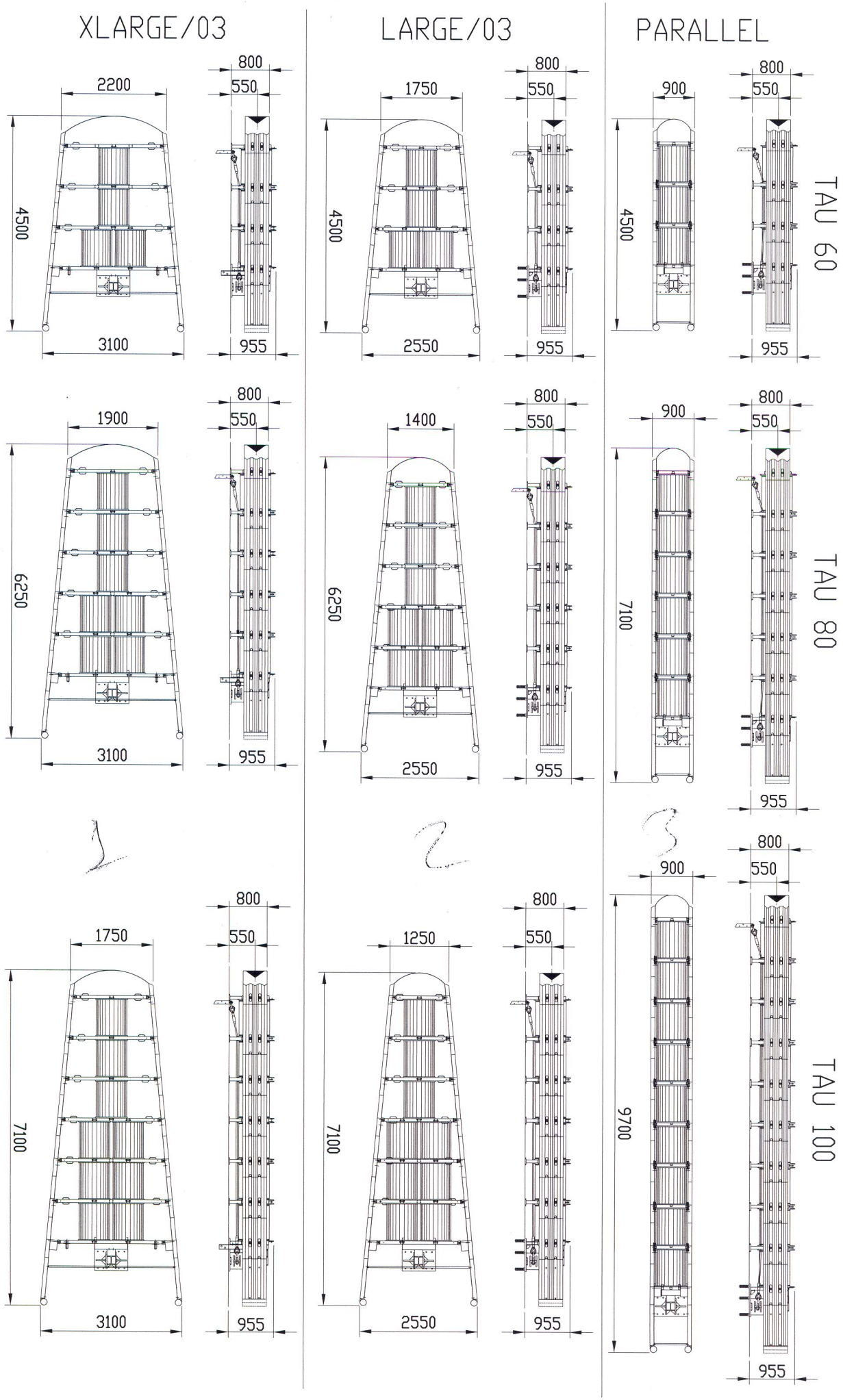
The TAU redirecting crash cushion system fully complies with road safety requirements: it guarantees excellent protection against direct or angular front impact and pushes the vehicles in the right direction in the event of side impact.
TAU consists of modules with airbags that dissipate the energy of impact. These modules can be easily adapted to suit the different levels of impact energy and speeds envisaged. They come in models P, L and XL depending on the speed and width of the obstacle to be protected.
After an impact, the TAU crash cushion system deforms, either at the front or the side depending on the path of the vehicle involved.

In the event of front impact, the TAU telescopes backwards. Since the dissipators are reusable, sometimes the system can be simply restored by repairing the damaged modules.
In the event of side impact, the force is elastically dissipated to the ground by steel frames and cables and the vehicle, running along the side of the 3-wave corrugated panel barrier, is redirected by a slight angle into



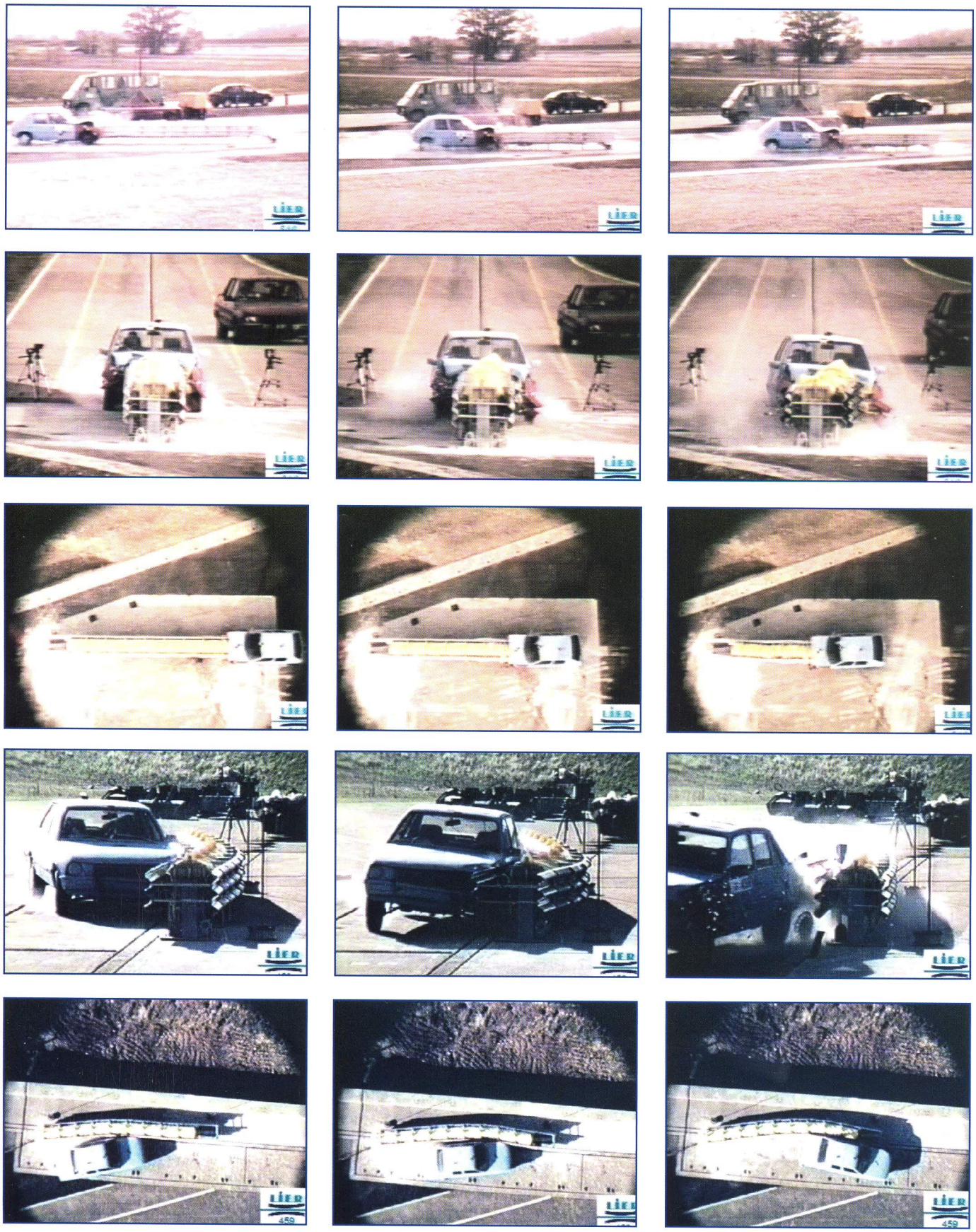
the correct path to return to the lane. Here too, simple maintenance is often enough by replacing a few parts. TAU has been studied with computer models and fully tested with real crash tests. TAU has been tested under the requirements of the European Norm EN 1317-3 by the French Laboratory LIER and by the American Agency Safe Technologies Inc.

Technical Drawnings



Crash Tests

Real crash tests according to European Specifications EN 1317-3.



Pictures of some crash tests by the French Laboratory LIER in Lyon.

FAQ about Crash Cushion

1. What is a "Crash Cushion"?
A crash cushion is a device placed in front of an obstacle so as to lessen the impact in the event of a collision. It is part of the family of safety fences.

2. What are the dangers involved in colliding with an obstacle?
When a collision occurs any unrestrained body in the vehicle continues to follow the trajectory of the vehicle and so smashes into the sides of the vehicle itself, causing fractures and in many cases irreparable damage to internal organs.
If the passenger is wearing a seatbelt, the body is restrained but the internal organs can suffer the effects of strong acceleration and be ruptured. Moreover, the head is not restrained and may suffer trauma to the cervical vertebrae (whiplash) or injury from banging against the inside of the vehicle.

During the design stages, car manufacturers run crash impact tests at speeds of up to 50 km/h, even for top of the range models, so the injuries are probably very serious in traffic accidents occurring at speeds greater than 50 km/h.

3. How does a Crash Cushion work?
It is a case of physically dissipating - at least to some extent - some of the kinetic energy of the vehicle before it gets to the point of actually hitting the solid object, rather like putting a cushion in front of a wall before hitting it.
In the older type of system containers of water or sand were used and these acted in such a way as to transfer momentum, transforming the speed of the vehicle into millions of particles sprayed in all directions.
The more recently developed methods are not subject to weather conditions, as is the case with water, and they don't scatter debris everywhere, but work by using elements which absorb energy through deformation.
With the TAU, the energy is absorbed by compressing air inside bags that can then be reused simply by changing the small safety diaphragm.

4. Where should a Crash Cushion be placed?
Wherever there is a fixed obstacle which is not protected by a safety barrier, at a distance of between 5 to 10 m from the side of the road, taking into consideration the speed at which vehicles are travelling, (planning rules AASHTO-USA and Swiss Standard SN640566), in such a position that any cars going off the road will hit this.
So for example, in front of:
- Rigid signposts (portals) and lampposts
- Bridge supports, footbridges, columns, etc.
- Corners created where two stretches of barrier join
- The ends of concrete or metal guard rails or unprotected sound-proofing barriers
- At the beginning of sections of roadwork
- At tollbooths

5. How does one choose the right Crash Cushion?
According to certain specific features of the site to be protected:
- Geometric: there are those with parallel sides (width = 900 mm), which are best used as the front part of a barrier or in front of a single post, or wide ones with a triangular shape, (the rear width can be up to 3100 mm), suitable for corner protection or for very large obstacles
- Speed of the traffic: the choice should be based on the speed range (50 - 80 - 100 km/h) which determines the energy likely and consequently the size of the equipment
- Direction of the collision which is considered most probable: except for the very rare occasions where a collision from the side is thought to be impossible, the barrier chosen should be one of the redirecting kind

6. What do we mean by "redirecting"?
When sideways collisions occur (something which happens with safety barriers) crash cushions function in two distinctly different ways:
- Non redirecting, those which give way and allow the vehicle to fall downhill. This is often a dangerous situation because, not only could there be other obstacles down below, but also because, if the vehicle is near the main obstacle when it collides at an angle with the cushion, it could also hit the obstacle itself. Therefore this kind should only be used with confidence when the possibility of a side collision is totally out of the question,
- Redirecting, those which act like a safety barrier and absorb the force in such a way as to set the vehicle back into its original path without causing any great danger.

7. What criteria should the Crash Cushion meet?
Like safety barriers, a crash cushion shall comply with standards that require a detailed design. It must also undergo full scale crash tests to establish how it will perform and to ascertain the levels of danger likely to be experienced by the passengers in the vehicles which need protecting.
The standard applying in Italy is the Ministerial Decree 223 and subsequent amendments. This foresees the following tests for the highest class of redirecting crash barriers:
- Direct head-on collision (0°), car mass = 1300 kg, speed = 100 km/h
- Head-on, offset (0°, 1/4 L vehicle), car mass = 900 kg, speed = 100 km/h
- Side (15°, 1/3 length), car mass = 1300 kg, speed = 100 km/h.

The European standard EN1317-3 – published and currently in the process of being accepted by all EU countries - provides for further tests which guarantee even more stringent safety measures.

8. Why are tests carried out on two different kinds of car?
The test on the heavy car (1300 kg) indicates the maximum load possible for the crash barrier and so is suitable for testing the structural adequacy and the maximum capacity for absorption at a level that is theoretically considered to be the highest to which the crash barrier is likely to be subjected.
The light car (900 kg) has 30% less energy and so this test checks whether or not the crash barrier is too "hard" for the passengers and whether it would cause levels of acceleration greater than the specified maximum acceptable (criteria ASI = 1.4).

9. What is ASI?
This is a conventional index which measures impact severity and possible injury to passengers and is obtained from the quadratic mean of acceleration levels (in actual fact, deceleration) in three perpendicular directions (forwards, sideways and upwards) compared with levels which are considered to be safe.

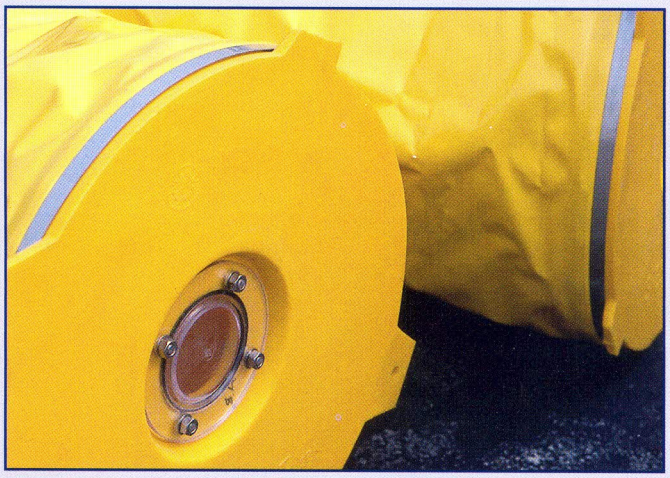
ASI level 1 = very safe, level 1.4 = still acceptable, but at any level higher than that there will probably be serious consequences. It is more difficult to obtain a low score with crash cushions (unless these are very long) compared to longitudinal safety barriers. The reason for this is that the energies which come into play are greater (e.g. higher than those for an H3 barrier, very high containment) and the surface area for stopping the vehicle is much smaller.

10. What happens in head-on collisions with rigid obstacles?
Vehicles currently on the market have a collapsible front section and this will absorb the impact of collisions occurring at up to 40 - 50 km/h. At higher speeds, however, the framework collapses and the rigid parts (engine, gears etc.,) penetrate into the interior and crush the passengers.

11. What happens in head-on collisions with safety barriers?

- Concrete barriers with vertical end act like rigid obstacles and push the engine into the interior of the car
- A metal barrier (guard rail) with ends consisting of a "fan" or a vertical pipe acts like a beam hit at one end: it pierces the car's interior like a spear and comes out at the back
- A metal or concrete barrier with an end which slopes downwards acts like a ramp; the car takes off and lands again on one side or the other of the barrier several metres on, often overturning in the process

12. How does the TAU Crash Cushion work ?
TAU is a modular crash cushion using air compression.
It consists of a metal framework and external 3-wave panels that retract telescopically into the base. Inside each section is a bag made of a plastic-coated high resistance fabric, which, when not in use, remains at atmospheric pressure.
Upon impact, the air inside increases in pressure providing a cushioning effect and continues increasing until a diaphragm gives way and discharges the air to prevent the return effect (spring back).
Because the force is absorbed by means of compressed air - a very gentle method - it is therefore much kinder to the occupants of the car.



There are two very strong metal cables running from one end of the system to the other, and in a lateral collision they will form an arch which send the car back onto the road without violent accelerations.

13. Why is the TAU a restorable system?
The TAU is built in such a way that it can be used more than once, providing the greatest protection possible against injury.
In a direct head-on collision, the metal frame telescopes up without being distorted, the bags inflate and then release the air thanks to the plastic bursting disks.
Because of this, the system can be quickly made available for use again by pulling the framework back into its original position and replacing the bursting disks in the bags.

In actual fact, collisions are not perfectly balanced, so it may be possible that some other section has been distorted or damaged and needs replacing.

14. How is the TAU supplied?
The parallel TAU may be supplied in parts ready to assemble or else with a preassembled frame that reduces installation time and also makes installation easier.
The preassembled frame takes up more room than the single pieces when being transported, even if the frames are packed very tightly one against the other, so making this solution less convenient for shipping over long distances.
The L and XL TAU (triangular in shape) are always sent in parts because the structure takes up a lot of room.
The rear terminal is always packed separately so as to allow it to be positioned and drill holes in the ground, as required during installation. The air bags are also supplied separately in specially designed protective boxes.

15. How can TAU be connected to safety barriers?
TAU system is designed to be attached to any type of crash barrier, guard rail (double or triple corrugation) or concrete New Jersey.
A set of connections for different barriers and heights is available on request.

16. What manpower and equipment are needed to install a TAU?
Not including the roadwork traffic management, the TAU can be installed by 2-3 people, supplied with the usual equipment plus a carrot-boring machine and a light crane (mounted on a lorry).
It is usually set up on a solid bitumen surface with a series of holes carrot-drilled in this to hold the piles, which are then fixed with a resin bond.
If the surface is not sufficiently firm, a foundation of lightly reinforced concrete shall be laid. Should this be the case, the piles can be inserted before casting the concrete to obviate the need for drilling and the time taken by the resin to set.
It usually takes two hours and a team of 3 expert workers to install a TAU.
The assembly instructions explain the entire procedure to follow and specify the equipment needed.

17. What maintenance is required?
When not in use, the TAU is a static system and does not require any maintenance in order to function. However, because it is exposed to the elements and to pollutants in the air and because it must function perfectly when needed, it is a good idea to carry out an annual cleaning, thorough inspection and protection of all the important parts.
The maintenance instructions provide details of these procedures and the necessary equipment.

17. How is the TAU made functional again after a collision?
After a collision when the crash barrier has fulfilled its function, it is usually possible for the device to be restored with just a few replacements necessary.
In the case of a head-on collision, the TAU is crushed in the direction of the rear terminal. Undo the nuts of the sliders and pull the TAU back into its original position. Then thoroughly check all the parts and replace any damaged parts. Parts that usually need replacing are the plastic nose and the bursting disks in the bags if these have indeed burst. Sometimes, in case of offset or angulated frontal impact, one or few of the side panels may be damaged and this can also cause tears in a bag.
The bags themselves are not normally involved in a lateral collision but one or more of the panels may be crushed by contact with the vehicle and they must be replaced.
Finally, tighten the nuts on the sliders and reset the cable tension.
It takes about two hours after a collision of medium severity for 2 people with the necessary equipment to make the device functional again. This does not include the positioning and removal of the roadworks signs.
The procedure and equipment necessary are covered in the instructions for repairing the TAU.

19. How is possible to get spare parts?
Spare parts are available at local distribution or through the manufacturer Snoline s.p.a. and can be shipped within 24 hours upon acceptance of an order.

Solutions for
SAFETY ON THE ROAD

Snoline

a Company of

LINDSAY™

TRANSPORTATION SOLUTIONS

Snoline
Via F. Baracca 19/23
20056 Trezzo sull'Adda (MI) ITALY
Tel. +39 02.909961 Fax +39 02.90996213
e-mail: export@snoline.com
www.snoline.com